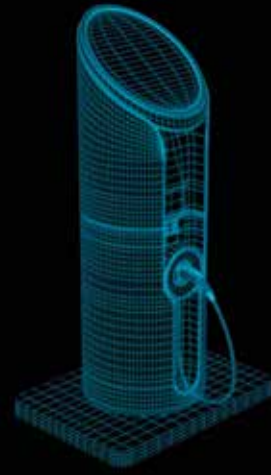
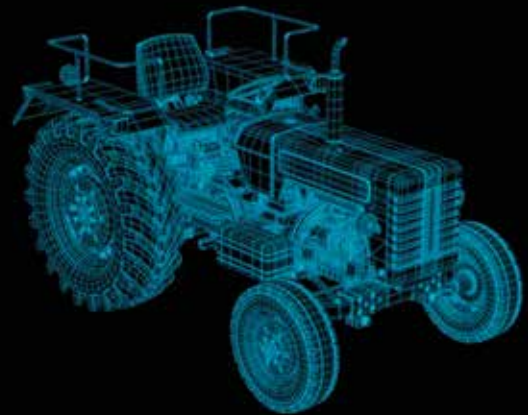
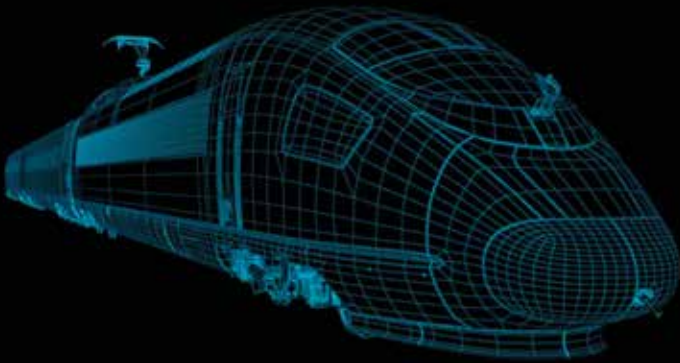




ttieurope.com



Automotive & Transportation





ttieurope.com

The Specialist in Electronic Component Distribution

Why Choose TTI?

TTI is committed to serving the automotive and transportation industry by expanding its vast inventory depth and breadth to include the fullest available range of automotive and commercial vehicle components.

Why Buy from TTI?

Founded in 1971, TTI has steadily grown to become a world leading specialist distributor of electronic components. The company was founded on the premise that passive component purchasing could be made more efficient by offering product specialisation, customer-driven service and proprietary supply chain solutions.

Product Knowledgeable Experts

Our unique specialisation enables us to provide significantly better product knowledge to support manufacturing from design chain to supply chain. TTI's commitment to this specialty and our customers is as dedicated today as always.

Broader and Deeper Inventories

TTI maintains extensive inventories, stocking more than 850,000 part numbers globally - that's more connector, passive, electromechanical, discrete, sensor and power supply inventory available than from any other source.

Leading Edge Technology Products

TTI partners with manufacturers that lead the industry in new component technologies and can help solve any design challenge. We ensure the very latest and most technologically-advanced products are readily available from stock.

Supply Chain Excellence

From technical application advice to customised logistical solutions; TTI can add value throughout the supply chain by reducing acquisition costs, improving material flow through forecast analysis, provide safety stock and reduce receipt handling through consolidated shipments. We provide the BOM coverage necessary to deploy comprehensive supply chain solutions that reduce total cost of ownership and mitigate line down risk.

Global Distribution Centres

Our European headquarters is located just outside of Munich, Germany in Maisach-Gernlinden. In total, we have 22,000m² of dedicated warehouse space and local sales and technical support in over 40 locations across Europe.

TTI has more than 111,000m² of automated warehousing in North America, Europe and Asia. All are linked into a global warehouse management system that provides superior customer service and overall business efficiencies. Wherever you are in the world, TTI can support you.

Quality and Reliability

TTI is the first distributor to have all global warehouse locations ISO registered and currently are certified to ISO 9001:2008 and ISO 14001:2004 Standards. TTI Europe is also certified to EN9120/EN9100, IECQ-CECC and ISO/IEC 27001:2005 Standards. Additionally, all of our European sales branches are certified ISO 9001:2008. TTI has one global documentation system that ensures that every TTI branch and warehouse in the world follows the same processes.

Year after year, customers rate our inventory availability, on-time delivery and accuracy among the very best in the industry - contact us today to find out what a true specialist has to offer.



Global Distribution Centres with more than **111,000m²** of automated warehousing in North America, Europe and Asia.





ttieurope.com

Contents

| | |
|--------------------------|-----|
| Line Card | 04 |
| Connectors | 12 |
| Discretes | 57 |
| Electromechanical | 60 |
| Passives | 70 |
| Capacitors | 70 |
| Circuit Protection | 91 |
| Electromagnetic | 101 |
| Resistors | 108 |
| Power | 117 |
| Sensors | 118 |
| Specialty | 129 |



ttieurope.com

Broadest and Deepest Inventory

3M

Amphenol®

Amphenol FCi

APEM

API Delevan

api technologies corp.

ARTESYN EMBEDDED TECHNOLOGIES

at AMERICAN TECHNICAL CERAMICS

AVX A KYOCERA GROUP COMPANY

BOURNS®

C&K

CARLISLE TRI-STAR

CDE CORNELL DUBILIER

DELPHI

EAT•N Powering Business Worldwide

ebmpapst

ERICSSON CHANNEL PARTNER

Esterline® Connection Technologies SOURIAU

GE GE Critical Power

Glenair INNOVATOR IN ELECTRONICS

HEXTRON

HARWIN INTERCONNECT DESIGN & MANUFACTURE

Honeywell

Cannon BTT Industries

JAE

JST

KEMET Electronic Components CHARGED.

Kingbright Kingbright Electronic Europe GmbH

knowles BIPolaroid®

KOA Your Factory Solution

LeYon

Littelfuse®

MW MEAN WELL

molex one company a world of innovation

muRata INNOVATOR IN ELECTRONICS

N2Power™

Nexans BRINGS ENERGY TO LIFE

nichicon

OHMITE

OMRON

Panasonic

PANDUIT™

PHENIX CONTACT INSPIRING INNOVATIONS

PKC GROUP

precidip

Pulse Electronics

Radiall

SAMSUNG SAMSUNG ELECTRO-MECHANICS

samtec

SCHAFFNER shaping electrical power

SCHURTER

smiths connectors

Standex MEDER ELECTRONICS

TDK

TE AUTHORIZED DISTRIBUTOR

TOSHIBA Leading Innovation >>>

TT Electronics

TUSONIX

VISHAY

VISHAY FOIL RESISTORS A VPG Brand

VITROHM

Weidmüller WE

WIMA

YAGEO Innovative Service Around the Globe

Transportation Line Card

Connectors

Line Card

| Transportation Connectors | 3M | Amphenol | AFCI | AVX/Elco | Delphi | Glenair | Harwin | JST | Molex | Omron | Panduit | Phoenix Contact | PKC Group | Radiall | Smiths Connectors | Souriau | TE Connectivity |
|---------------------------|----|----------|------|----------|--------|---------|--------|-----|-------|-------|---------|-----------------|-----------|---------|-------------------|---------|-----------------|
|---------------------------|----|----------|------|----------|--------|---------|--------|-----|-------|-------|---------|-----------------|-----------|---------|-------------------|---------|-----------------|

By Product Type

| | | | | | | | | | | | | | | | | | |
|-------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Antennas | | | | | | | | | | | | | | | | | |
| Board-to-Board | | | | | | | | | | | | | | | | | |
| Circular - Metal | | | | | | | | | | | | | | | | | |
| Circular - Sealed | | | | | | | | | | | | | | | | | |
| Circular - Unsealed | | | | | | | | | | | | | | | | | |
| Contacts | | | | | | | | | | | | | | | | | |
| EV/HEV - High Power | | | | | | | | | | | | | | | | | |
| EV/HEV - Charging Couplers | | | | | | | | | | | | | | | | | |
| Fibre Optic Products | | | | | | | | | | | | | | | | | |
| FFC/FPC Connectors | | | | | | | | | | | | | | | | | |
| Fuse/Lamp Holders | | | | | | | | | | | | | | | | | |
| Input/Output | | | | | | | | | | | | | | | | | |
| Multimedia/Convenience Port | | | | | | | | | | | | | | | | | |
| Memory Card | | | | | | | | | | | | | | | | | |
| Modular Blocks | | | | | | | | | | | | | | | | | |
| Rail - High Reliability Power | | | | | | | | | | | | | | | | | |
| Relay Holders | | | | | | | | | | | | | | | | | |
| RF - Coax/Microwave | | | | | | | | | | | | | | | | | |
| RF - FAKRA/HSD | | | | | | | | | | | | | | | | | |
| Rectangular - Heavy-Duty | | | | | | | | | | | | | | | | | |
| Rectangular - Sealed | | | | | | | | | | | | | | | | | |
| Rectangular - Unsealed | | | | | | | | | | | | | | | | | |
| Automotive Sensor Interconnects | | | | | | | | | | | | | | | | | |
| Solderless Terminal | | | | | | | | | | | | | | | | | |
| Terminal Blocks | | | | | | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | | | | | | |
| Wire & Cable | | | | | | | | | | | | | | | | | |
| Wire Management - Labels - Cable ID | | | | | | | | | | | | | | | | | |
| Wire-to-Board | | | | | | | | | | | | | | | | | |
| Wire-to-Wire | | | | | | | | | | | | | | | | | |

By Market Segment

| | | | | | | | | | | | | | | | | | |
|--------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Agriculture | | | | | | | | | | | | | | | | | |
| Automotive | | | | | | | | | | | | | | | | | |
| Commercial Vehicles | | | | | | | | | | | | | | | | | |
| Construction & Mining | | | | | | | | | | | | | | | | | |
| Electric/Hybrid Vehicles | | | | | | | | | | | | | | | | | |
| Rail/Mass Transit | | | | | | | | | | | | | | | | | |
| Marine | | | | | | | | | | | | | | | | | |
| Military/Aerospace | | | | | | | | | | | | | | | | | |
| Recreational Vehicles | | | | | | | | | | | | | | | | | |

| RF/Coaxial/Microwave | 3M | Amphenol | Carlisle/Tri-Star | JAE | JST | Molex | Radiall | Smiths Connectors | Souriau | TE Connectivity |
|----------------------|----|----------|-------------------|-----|-----|-------|---------|-------------------|---------|-----------------|
|----------------------|----|----------|-------------------|-----|-----|-------|---------|-------------------|---------|-----------------|

| | | | | | | | | | | |
|------------------------------|--|--|--|--|--|--|--|--|--|--|
| 1.0/2.3 | | | | | | | | | | |
| 1.6/5.6 | | | | | | | | | | |
| 7/16 | | | | | | | | | | |
| BMA | | | | | | | | | | |
| BNC (50/75Ω) | | | | | | | | | | |
| BNC (Miniature) | | | | | | | | | | |
| B to B Blindmate/Compression | | | | | | | | | | |
| BSA | | | | | | | | | | |
| FAKRA | | | | | | | | | | |
| MCX/MMCX | | | | | | | | | | |
| MHV/SHV | | | | | | | | | | |
| Precision1 | | | | | | | | | | |
| QMA | | | | | | | | | | |
| Reverse Polarity2 | | | | | | | | | | |
| Shielded Terminators | | | | | | | | | | |
| SMA | | | | | | | | | | |
| SMB (50/75Ω) | | | | | | | | | | |
| SMB (Miniature) | | | | | | | | | | |
| SMC | | | | | | | | | | |
| SMP | | | | | | | | | | |
| SMT | | | | | | | | | | |
| SSMA | | | | | | | | | | |
| TNC | | | | | | | | | | |
| Triax | | | | | | | | | | |
| Twinax | | | | | | | | | | |
| Type F/G | | | | | | | | | | |
| Type N | | | | | | | | | | |
| UHF/MiniUHF | | | | | | | | | | |

| Wire-To-Board/ Wire-To-Wire | 3M | Amphenol | AFCI | AVX | Delphi | Glenair | Harwin | JAE | JST | Molex | Phoenix Contact | Smiths Connectors | Souriau | TE Connectivity | Weidmüller |
|--------------------------------|----|----------|------|-----|--------|---------|--------|-----|-----|-------|-----------------|-------------------|---------|-----------------|------------|
|--------------------------------|----|----------|------|-----|--------|---------|--------|-----|-----|-------|-----------------|-------------------|---------|-----------------|------------|

| | | | | | | | | | | | | | | | |
|----------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 1.25mm | | | | | | | | | | | | | | | |
| 1.27mm | | | | | | | | | | | | | | | |
| 2.00mm | | | | | | | | | | | | | | | |
| 2.50mm | | | | | | | | | | | | | | | |
| 2.54mm | | | | | | | | | | | | | | | |
| 3.00mm | | | | | | | | | | | | | | | |
| 3.96mm | | | | | | | | | | | | | | | |
| 4.00mm | | | | | | | | | | | | | | | |
| 4.20mm | | | | | | | | | | | | | | | |
| 5.00mm | | | | | | | | | | | | | | | |
| 5.03mm | | | | | | | | | | | | | | | |
| 5.08mm | | | | | | | | | | | | | | | |
| 6.35mm | | | | | | | | | | | | | | | |
| 7.50mm | | | | | | | | | | | | | | | |
| 9.00mm | | | | | | | | | | | | | | | |
| 10.00mm | | | | | | | | | | | | | | | |
| Bus Bar | | | | | | | | | | | | | | | |
| Cable Assemblies | | | | | | | | | | | | | | | |
| Discrete Wire | | | | | | | | | | | | | | | |
| FFC/FPC | | | | | | | | | | | | | | | |
| IDC Discrete Wire | | | | | | | | | | | | | | | |
| IDC/Mass Termination | | | | | | | | | | | | | | | |
| Mini D Ribbon/Champ | | | | | | | | | | | | | | | |
| Power | | | | | | | | | | | | | | | |
| SATA/SAS/Mini SATA | | | | | | | | | | | | | | | |
| SCSI I, II, III | | | | | | | | | | | | | | | |

Transportation Line Card

Connectors

| Wire & Board Management/ Accessories | 3M | Amphenol | AFCI | AVX | Carlisle/Tri-Star | Glennair | Harwin | JAE | JST | Molex | Panduit | Phoenix Contact | Preci-Dip | Souriau | TE Connectivity | Weidmüller |
|--------------------------------------|----|----------|------|-----|-------------------|----------|--------|-----|-----|-------|---------|-----------------|-----------|---------|-----------------|------------|
| Backshells | | | | | | | | | | | | | | | | |
| Cable Clips | | | | | | | | | | | | | | | | |
| Cable Management | | | | | | | | | | | | | | | | |
| Cable Marker Ties | | | | | | | | | | | | | | | | |
| Cable Mounts | | | | | | | | | | | | | | | | |
| Cable Spacers | | | | | | | | | | | | | | | | |
| Cable Terminals | | | | | | | | | | | | | | | | |
| Cable Ties | | | | | | | | | | | | | | | | |
| Heat Shrink Products | | | | | | | | | | | | | | | | |
| Jumper Links | | | | | | | | | | | | | | | | |
| Labelling Systems | | | | | | | | | | | | | | | | |
| Labels | | | | | | | | | | | | | | | | |
| PCB Spacers | | | | | | | | | | | | | | | | |
| PCB Terminals | | | | | | | | | | | | | | | | |
| Printers/Software & Ribbons | | | | | | | | | | | | | | | | |
| RFI Clips & Fingers | | | | | | | | | | | | | | | | |
| Shorting Links | | | | | | | | | | | | | | | | |
| Solderless Terminals | | | | | | | | | | | | | | | | |
| Splices | | | | | | | | | | | | | | | | |
| Stainless Steel Accessories | | | | | | | | | | | | | | | | |
| Test Points | | | | | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | | | | | |
| Wire & Cable | | | | | | | | | | | | | | | | |
| Wire Ducting | | | | | | | | | | | | | | | | |

| Input/Output | 3M | Amphenol | AFCI | API (Spectrum Control) | AVX | Carlisle/Tri-Star | Delphi | Glennair | Harwin | JAE | JST | Molex | Omron | Phoenix Contact | Radiall | Smiths Connectors | Souriau | TE Connectivity | Weidmüller | |
|------------------------------|----|----------|------|------------------------|-----|-------------------|--------|----------|--------|-----|-----|-------|-------|-----------------|---------|-------------------|---------|-----------------|------------|--|
| 1394 & 1394b | | | | | | | | | | | | | | | | | | | | |
| Audio | | | | | | | | | | | | | | | | | | | | |
| Camera Link/Mini Camera Link | | | | | | | | | | | | | | | | | | | | |
| Circular | | | | | | | | | | | | | | | | | | | | |
| Combo I/O | | | | | | | | | | | | | | | | | | | | |
| Display Port | | | | | | | | | | | | | | | | | | | | |
| D-Subminiature | | | | | | | | | | | | | | | | | | | | |
| DVI | | | | | | | | | | | | | | | | | | | | |
| Fiber Channel | | | | | | | | | | | | | | | | | | | | |
| Fiber Optic | | | | | | | | | | | | | | | | | | | | |
| Filtered I/O | | | | | | | | | | | | | | | | | | | | |
| HDMI/Micro HDMI | | | | | | | | | | | | | | | | | | | | |
| Ipass (Mini SAS) | | | | | | | | | | | | | | | | | | | | |
| InfiniBand® | | | | | | | | | | | | | | | | | | | | |
| M12/M12D/M8 | | | | | | | | | | | | | | | | | | | | |
| Micro D | | | | | | | | | | | | | | | | | | | | |
| Mini DIN/Circular DIN | | | | | | | | | | | | | | | | | | | | |
| Mini D-Subminiature | | | | | | | | | | | | | | | | | | | | |
| Mobile Systems | | | | | | | | | | | | | | | | | | | | |
| Modular Plugs & Jacks | | | | | | | | | | | | | | | | | | | | |
| PCI Express | | | | | | | | | | | | | | | | | | | | |
| Power | | | | | | | | | | | | | | | | | | | | |
| Push/Pull | | | | | | | | | | | | | | | | | | | | |
| Rectangular | | | | | | | | | | | | | | | | | | | | |
| RF/Coax/Microwave | | | | | | | | | | | | | | | | | | | | |
| RJ/Industrial Ethernet | | | | | | | | | | | | | | | | | | | | |
| SATA/SAS/Mini SATA | | | | | | | | | | | | | | | | | | | | |
| SCSI | | | | | | | | | | | | | | | | | | | | |
| SFP/XFP | | | | | | | | | | | | | | | | | | | | |
| TDP | | | | | | | | | | | | | | | | | | | | |
| USB/Mini USB/USB OTG | | | | | | | | | | | | | | | | | | | | |

| Military Circular | Amphenol | Glennair | Smiths Connectors | Souriau | TE Connectivity |
|------------------------------------|----------|----------|-------------------|---------|-----------------|
| EN2997/ESC | | | | | |
| EN3645 | | | | | |
| EN4165 | | | | | |
| HE301 | | | | | |
| HE308 | | | | | |
| MIL-22992 | | | | | |
| MIL-DTL-26482 Series 1 Crimp | | | | | |
| MIL-DTL-26482 Series 1 Solder | | | | | |
| MIL-DTL-26482 Series 2 | | | | | |
| MIL-DTL-27599 Solder | | | | | |
| MIL-DTL-28840 Shipboard | | | | | |
| MIL-DTL-38999 Series I & II | | | | | |
| MIL-DTL-38999 Series III Aluminium | | | | | |
| MIL-DTL-38999 Series III Firewall | | | | | |
| MIL-DTL-38999 Series III Lanyard | | | | | |
| AS50151 | | | | | |
| MIL-DTL-55302 | | | | | |
| MIL-C-81511 | | | | | |
| MIL-DTL-83723 | | | | | |
| Hermetics | | | | | |
| VG95234 | | | | | |
| VG95328 | | | | | |
| VG96912 | | | | | |

| Cable & Wire Management | 3M | Amphenol | Delphi | JAE | JST | Molex | Nexans | Panduit | Phoenix Contact | Radiall | Smiths Connectors | Souriau | TE Connectivity | Weidmüller |
|-----------------------------------|----|----------|--------|-----|-----|-------|--------|---------|-----------------|---------|-------------------|---------|-----------------|------------|
| Cable & Wire | | | | | | | | | | | | | | |
| Cable Assemblies | | | | | | | | | | | | | | |
| Coaxial (RF) | | | | | | | | | | | | | | |
| Fibre Optic | | | | | | | | | | | | | | |
| Flat Flex (FFC, FPC) | | | | | | | | | | | | | | |
| Flat Ribbon | | | | | | | | | | | | | | |
| Modular - Flat | | | | | | | | | | | | | | |
| Multiple Conductor | | | | | | | | | | | | | | |
| Single Conductor (Wire) | | | | | | | | | | | | | | |
| Cable & Wire Management | | | | | | | | | | | | | | |
| Accessories | | | | | | | | | | | | | | |
| Bushings, Grommets | | | | | | | | | | | | | | |
| Cable & Cord Grips | | | | | | | | | | | | | | |
| Cable Ties | | | | | | | | | | | | | | |
| Clamps & Clips | | | | | | | | | | | | | | |
| Cold Shrink Tape & Tubing | | | | | | | | | | | | | | |
| Heat Shrink Boots & Tubing | | | | | | | | | | | | | | |
| Labels & Markers | | | | | | | | | | | | | | |
| Solid Tubing & Sleeving | | | | | | | | | | | | | | |
| Spiral Wrap & Expandable Sleeving | | | | | | | | | | | | | | |
| Splice Enclosures & Protection | | | | | | | | | | | | | | |

Transportation Line Card

Discretes

| Discrete Semiconductors | AVX | Bourns | KOA | Littelfuse | Panasonic | Toshiba | TT Electronics (Semelab) | TT Electronics (Optek) | Vishay |
|------------------------------|-----|--------|-----|------------|-----------|---------|--------------------------|------------------------|--------|
| Diodes | | | | | | | | | |
| Arrays | | ■ | | ■ | ■ | ▲ | ■ | ■ | ■ |
| Schottky | | | | ▲ | ■ | ■ | ▲ | ■ | ■ |
| Small Signal | | ■ | | | ■ | ■ | ▲ | ■ | ■ |
| TVS | ■ | ■ | | ■ | ■ | ■ | ▲ | ■ | ■ |
| Zener | | ■ | | ■ | ■ | ■ | ▲ | ■ | ■ |
| Bare Die Products and Wafers | | | | | | | | | ■ |
| TVS Diodes | | ■ | | ■ | | | | | ■ |
| TVS Diodes Arrays | | | ■ | ■ | | | | | ■ |
| Rectifiers | | | | | | | | | |
| Bridge | | | | | | | | | ■ |
| Standard | | ■ | | | ■ | | ▲ | ■ | ■ |
| Fast | | | | | | | ▲ | ■ | ■ |
| Ultrafast | | | | ▲ | | | ▲ | ■ | ■ |
| Schottky | ■ | ■ | | ▲ | ■ | ■ | | | ■ |
| Thyristors | | | | | | | | | |
| Protection | | ■ | | ■ | | | | | ■ |
| Switching | | ■ | | | | | | | ■ |
| SCR | | ■ | | ■ | | | | | ■ |
| Transistors | | | | | | | | | |
| Bipolar | | | | | ■ | ■ | ▲ | | |
| Small Signal | | | | | ■ | ■ | ▲ | | |
| Mosfets | | | | | | | | | |
| Low Voltage | | | | | ■ | ■ | ▲ | ■ | ■ |
| High Voltage | | | | | ■ | ■ | ▲ | ■ | ■ |
| Automotive Qualified | | | | | ■ | ■ | ▲ | ■ | ■ |
| Mil Qualified | | | | | | | ▲ | | ▲ |
| Modules | | | | | | | | | |
| Bridge | | | | | | | | | ■ |
| Diode | | | | | | | | | ■ |
| IGBT | | | | ■ | | | | | ■ |
| Thyristor | | | | ■ | | | | | ■ |
| MOSFET | | | | | | | | | ■ |

- Lead-free only parts available
- Lead & Lead-free compliant parts available
- ▲ Mil-Spec Discretes

Optoelectronics

| Optoelectronics | Kingbright | Panasonic | Toshiba | TT Electronics (Optek) | Vishay |
|----------------------------|------------|-----------|---------|------------------------|--------|
| Optocouplers | | | | | |
| Standard Optocouplers | ■ | | ■ | ■ | ■ |
| IC Couplers | | | ■ | ■ | ■ |
| High Voltage Couplers | | | ■ | ■ | ■ |
| Solid State Relays | | | ■ | ■ | ■ |
| Infrared Components | | | | | |
| Optical Sensors | | ■ | | | ■ |
| Infrared Emitters | | ■ | | | ■ |
| Infrared Receiver Modules | | | | | ■ |
| Visible LEDs | | | | | |
| LEDs - Indication | | ■ | ■ | ■ | ■ |
| LEDs - Illumination <1W | | ■ | ■ | ■ | ■ |
| LEDs - Illumination >1W | | ■ | ■ | ■ | ■ |
| LED Modules | | ■ | | | ■ |
| LED Displays | | ■ | | | ■ |
| OPTO Solutions | | | | | |
| Custom Specific Solutions | | | | ■ | ■ |
| LED Drivers | | | ■ | | ■ |

ICs - Power & Linear

| ICs - Power & Linear | Toshiba | TT Electronics (Semelab) | Vishay |
|---|---------|--------------------------|--------|
| Analogue Switches & Multiplexers | | | |
| Logic ICs | ■ | | ● |
| Motor Control Drivers | | | ■ |
| RF Diodes | | | ■ |
| RF Transistors | | ▲ | ■ |
| Voltage Regulators | | ▲ | ■ |
| LDO Low Dropout Regulators | | | ■ |
| DC/DC Converters | | | ■ |

Transportation Line Card

Electromechanical

Relays & Circuit Breakers

| | KEMET | Omron | Panasonic | Standex Meder | TE Connectivity |
|-----------------------------|-------|-------|-----------|---------------|-----------------|
| Relays | | | | | |
| Automotive | | ■ | ■ | ■ | ■ |
| Communication | ■ | | | | |
| Contactors | | ■ | ■ | ■ | ■ |
| Control | | ■ | ■ | ■ | ■ |
| Counters | | ■ | | | |
| Crystal Can | | | | | ■ |
| Definite Purpose Contactors | | ■ | ■ | ■ | ■ |
| DIN Rail Mounted | | ■ | ■ | ■ | ■ |
| Forcibly-Guided Contact | | ■ | ■ | ■ | ■ |
| General Purpose | | ■ | ■ | ■ | ■ |
| High Voltage | | ■ | ■ | ■ | ■ |
| Industrial DC & AC | | ■ | ■ | ■ | ■ |
| Input/Output Modules | | ■ | ■ | ■ | ■ |
| Magnetic Latching | | ■ | ■ | ■ | ■ |
| Microwave | | ■ | ■ | ■ | ■ |
| Military/Space | | ■ | ■ | ■ | ■ |
| Miniature PCB | | ■ | ■ | ■ | ■ |
| MOSFET | | ■ | ■ | ■ | ■ |
| Panel/Plug-In | | ■ | ■ | ■ | ■ |
| Power | | ■ | ■ | ■ | ■ |
| Reed | | | | ■ | ■ |
| Safety | | ■ | ■ | ■ | ■ |
| Signal | ■ | | | | |
| Sockets | | ■ | ■ | ■ | ■ |
| Solid State | | ■ | ■ | ■ | ■ |
| Time Delay | | ■ | ■ | ■ | ■ |
| Circuit Breakers | | | | | |
| Magnetic Circuit Breakers | | | | | ■ |
| Thermal Circuit Breakers | | | | | ■ |

Switches

| | C&K Components | Honeywell | Omron | Panasonic | Standex Meder | TE Connectivity |
|----------------------------|----------------|-----------|-------|-----------|---------------|-----------------|
| Switches | | | | | | |
| Analog | ■ | ■ | | | | ■ |
| Counters/Hour Meters | ■ | ■ | | ■ | | |
| Detection/Navigation | | | | ■ | | |
| Detector | ■ | | | ■ | | |
| DIP | ■ | | ■ | | | ■ |
| Encoder | | ■ | | | | |
| Fader | | | | ■ | | |
| Industrial | ■ | ■ | ■ | ■ | | ■ |
| Keylock/Switchlock | | | | | | ■ |
| Keypad | ■ | ■ | | | | |
| Knobs | | | ■ | | | ■ |
| Limit | | ■ | ■ | ■ | | |
| Mil/Aero/Space Grade Level | ■ | ■ | ■ | ■ | | |
| Pushbutton | ■ | ■ | ■ | ■ | | ■ |
| Pushwheel/Thumbwheel | ■ | ■ | ■ | ■ | | ■ |
| Rocker | ■ | ■ | ■ | ■ | | ■ |
| Rotary | | ■ | ■ | ■ | | ■ |
| Safety | | ■ | ■ | ■ | | ■ |
| Selector | ■ | | | | | |
| Slide | | | | | | ■ |
| Snap Action | ■ | ■ | ■ | ■ | | |
| Special Purpose | ■ | ■ | ■ | ■ | | ■ |
| Tactile | | | | | | ■ |
| Toggle/Paddle | ■ | ■ | ■ | ■ | | ■ |
| Wireless Limit | | ■ | | | | |

Transportation Line Card

Passives – Capacitors

| Aluminium | | | | | | | | | | |
|------------------------|-----|------------------|-------------------------|-------|-------|--------|----------|-----------|-------------|-----------------------|
| | AVX | Cornell Dubilier | Eaton (Cooper/Bussmann) | KEMET | Lelon | Murata | Nichicon | Panasonic | TDK (Epcos) | Vishay (BCComponents) |
| AC Motor Start | | | | | | | | | | |
| Axial Electrolytic | | ● | | | | | | | | ● |
| EDLC/Supercapacitor | ■ | | | | | | | | | |
| FlatPack Electrolytics | | ▲ | | | | | | | | |
| Polymer | | | | | | | | | | |
| Radial Miniature | | ● | | | | | | | | ● |
| Screw Terminal | | | | | | | | | | |
| Snap-In | | | | | | | | | | |
| Surface Mount | | | | | | | | | | |

| Ceramic | | | | | | | | | | | | | |
|------------------|------------------|-----|------------------|-------|-----------------|--------|---------|-----|----------|---------------------|----------|----------|-------|
| | API Technologies | AVX | Cornell Dubilier | KEMET | Knowles (Syfer) | Murata | Samsung | TDK | Tusontix | Vishay BCComponents | Ceramate | Vitramon | Yageo |
| Arrays | | ■ | ● | | | | | | | | | | ■ |
| Dip 2-Pin | | | ■ | | | | | | | | | | |
| Disc | | | | | | | | | ● | | | | |
| High Cap | | | ● | | ● | | | | | | | | ● |
| High Q | | ■ | | | | | | | | | | | |
| High Temperature | | | ● | | ● | | | | | | | | |
| High Voltage | | ■ | ● | ■ | ■ | | | | | | | | ■ |
| Low Inductance | | | | | | | | | | | | | |
| Multi-Layer | | ■ | ● | | ● | | | | | ● | | | ■ |
| RF/Microwave | | | | | | | | | | | | | ■ |
| Safety | | | | | | | | | | | | | ■ |
| Single Layer | | | | | | | | | | | | | |
| Switch Mode | | ■ | ■ | | | | | | | | | | |
| Tip 'n' Ring | | | | | | | | | | | | | ■ |
| Trimmer | | | | | | | | | | | | | |

- Lead-free only parts available
- Lead & Lead-free compliant parts available
- ▲ Lead-only compliant parts available

| Film & Mica | | | | | | | | | | | | |
|------------------------------|------------------|-----|------------------|-------|----------|-----------|-------------|--------|--------------|----------|-------------|------|
| | API Technologies | AVX | Cornell Dubilier | KEMET | Nichicon | Panasonic | TDK (Epcos) | Vishay | BCComponents | Draloric | Roederstein | WIMA |
| Film | | | | | | | | | | | | |
| Motor Run | | | | | | | | | | | | |
| Polyester | | ■ | ■ | ● | ■ | ■ | ■ | ■ | ● | ■ | ■ | ■ |
| Polypropylene | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Power Film | | | ● | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Snubber | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Suppression X-Y (Safety Cap) | | ■ | | | | | | ■ | ■ | ■ | ■ | ■ |
| Surface Mount | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Mica | | | | | | | | | | | | |
| Metal Clad | | | ● | | | | | | | | | |
| Mica | | | ● | | | | | | | | | |
| Surface Mount | | | ● | | | | | | | | | |

| Tantalum | | | | | | | |
|-------------------------------|-----|------------------|-------|-----------|--------|---------|----------|
| | AVX | Cornell Dubilier | KEMET | Panasonic | Vishay | Sprague | Tansitor |
| Micro-Chip | | | | | | | |
| Conformal Coated Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Dipped Radial | | | ■ | ■ | ■ | ■ | ■ |
| Fail Safe/Fused Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Hermetic Through Hole | | ■ | ■ | ■ | ■ | ■ | ■ |
| High Temperature Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Low ESR Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Low Profile Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Moulded Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Moulded Through Hole | | ■ | ■ | ■ | ■ | ■ | ■ |
| Niobium Chip | | | | | | | |
| Polymer Chip | | ■ | ■ | ■ | ■ | ■ | ■ |
| Solid Metal Case Through Hole | | ■ | ■ | ■ | ■ | ■ | ■ |
| Supertan | | | | | ■ | ■ | ■ |
| Wet Through Hole | | ■ | | | ■ | ■ | ■ |

Transportation Line Card

Passives – Circuit Protection & Electromagnetics

| Protection Devices | AVX | Bourns | Eaton | KOA | Littelfuse | Murata | Panasonic | TDK | EPCOS | Vishay | BCcomponents | Dale |
|---------------------------------------|-----|--------|-------|-----|------------|--------|-----------|-----|-------|--------|--------------|------|
| Overcurrent | | | | | | | | | | | | |
| Axial (PICO) Fuses | | | | | | | | | | | | |
| Automotive (Blade) Fuses | | | | | | | | | | | | |
| Cartridge Fuses | | | | | | | | | | | | |
| NTC Thermistors | ● | | | | | | | | | | | |
| Power (Electrical) Fuses | | | | | | | | | | | | |
| PTC Thermistors | | | | | | | | | | | | |
| Radial Leaded Resettable Fuses (PPTC) | | | | | | | | | | | | |
| Radial Subminiature Fuses | | | | | | | | | | | | |
| SMT Resettable Fuses (PPTC) | | | | | | | | | | | | |
| Surface Mount (125V+) Fuses | | | | | | | | | | | | |
| Telecom Resettable Fuses (PPTC) | | | | | | | | | | | | |
| Thermal Cutoffs (TCO) | | | | | | | | | | | | |
| Thin Film (Chip) Fuses | ● | | | | | | | | | | | |
| Over Voltage | | | | | | | | | | | | |
| Gas Discharge Tube (GDT) | | ● | | | | | | | | | | |
| Line Protection Networks | | | | | | | | | | | | |
| Polymer ESD Suppression | | | | | | | | | | | | |
| Protection Thyristors | | | | | | | | | | | | |
| Surface Mount Varistors (MLV) | | | | | | | | | | | | |
| Thermal (MOV) | | | | | | | | | | | | |
| Through-Hole Varistors (MOV) | | | | | | | | | | | | |
| TVS Diodes | | | | | | | | | | | | |
| TVS Diodes Arrays | | | | | | | | | | | | |

| EMI/RFI & RF | API Technologies (Spectrum Control) | AVX | KEMET | Murata | Panasonic | Pulse | TDK | EPCOS | TE Connectivity | Tusonix (CTS) | Yageo |
|-----------------------|-------------------------------------|-----|-------|--------|-----------|-------|-----|-------|-----------------|---------------|-------|
| EMI/RFI Filters | ● | ● | ● | ● | ● | ● | ● | ● | ▲ | ● | ● |
| Feed-Thru Filters | | | | | | | | | | | |
| RF/Microwave Filters | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SAW Filters | | | | | | | | | | | |
| Surface Mount Filters | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

- Lead-free only parts available
- Lead & Lead-free compliant parts available
- ▲ Lead-only compliant parts available

| Ferrites/ Inductors/ Transformers | API Delevan | AVX | Bourns | Eaton (Colltronics) | KEMET | KOA | Murata | Panasonic | Pulse | Samsung | TDK | EPCOS | TT Electronics (BI Tech) | Vishay | Yageo |
|-----------------------------------|-------------|-----|--------|---------------------|-------|-----|--------|-----------|-------|---------|-----|-------|--------------------------|--------|-------|
| Air Coil Inductors | ● | ■ | | | | | | | | | | | | | ■ |
| Common Mode Chokes | ● | ■ | | | | | | | | | | | | | |
| Custom Inductors | ● | | ● | | | | | | | | | | | | |
| Ferrite Beads | ■ | | ■ | | | | | | | | | | | | |
| Ferrite Cores/Clamp Filters | ■ | | ■ | | | | | | | | | | | | |
| High Current Inductors | ■ | | ■ | | | | | | | | | | | | |
| Leaded Inductors | ● | | | | | | | | | | | | | | |
| Military Inductors | ● | | | | | | | | | | | | | | |
| Multilayer Inductors | | ■ | ■ | | | | | | | | | | | | |
| Power Inductors | ● | ■ | ■ | | | | | | | | | | | | |
| RF Inductors | ● | ■ | ■ | | | | | | | | | | | | |
| Thin Film Inductors | | ■ | ■ | | | | | | | | | | | | |
| Toroid Inductors | | | | | | | | | | | | | | | |
| Transformers | ● | ■ | ■ | | | | | | | | | | | | |
| Wirewound/Coil Inductors | ● | ■ | ■ | | | | | | | | | | | | |

| Sound Devices | AVX | Murata | Panasonic | TDK |
|---------------|-----|--------|-----------|-----|
| Buzzer | | | | |
| Microphone | ● | ● | ● | ● |
| Receiver | | | | |
| Ringer | ● | ● | ● | ● |
| Sensor | | ● | ● | ● |
| Sounder | | ● | ● | ● |
| Speaker | | ● | ● | ● |

| Frequency Control | AVX (Kyocera) | Murata | Panasonic | Samsung | TDK | Vishay Dale |
|---------------------|---------------|--------|-----------|---------|-----|-------------|
| Crystals | ● | ● | ● | ● | ● | ● |
| Oscillators | ● | ● | ● | ● | ● | ● |
| Piezo Sound Devices | ● | ● | ● | ● | ● | ● |
| Resonators | ● | ● | ● | ● | ● | ● |
| Tuning Forks | ● | ● | ● | ● | ● | ● |

Transportation Line Card

Passives – Resistors

Line Card

| Film | Bourns | KOA | OHMITE | Panasonic | TT Electronics | BI Technologies | IRC | Welwyn | Vishay | Angstrom | BCcomponents | Dale | Electro-Films | Huntington/Milwaukee | Sfernice/MCB | Techno | Thin Film | Vishay Precision Group | Yageo |
|------------------|--------|-----|--------|-----------|----------------|-----------------|-----|--------|--------|----------|--------------|------|---------------|----------------------|--------------|--------|-----------|------------------------|-------|
| Chip Array | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | | | | ■ | ■ |
| Discrete Chip | | | ● | | | | | | | | | | ■ | | | | | ● | |
| Flame Proof | | ● | ● | | ● | | ● | ■ | ■ | | | ● | | ■ | | | | | ■ |
| Fusible | ■ | ● | | ■ | ● | | ● | ■ | ■ | | | | | ■ | | | | | ■ |
| High Temp | ■ | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | ■ | | ■ |
| High Voltage | | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | | | ■ |
| Matched Sets | | | ■ | | ■ | | ■ | ■ | ■ | | | | | ■ | | | | ■ | |
| Melf/Cylindrical | | ■ | | ■ | ● | | ● | ■ | ■ | | | | | ■ | | | | | ■ |
| Metal Film | ■ | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | | | ■ |
| Metal Glaze | | | ● | ■ | ● | | ● | ■ | ■ | | | | | ■ | | | | | ■ |
| Metal Oxide | | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | | | ■ |
| Precision | ■ | ● | ● | ■ | ● | | ● | ■ | ■ | | | ■ | | ■ | | | ● | ● | ■ |
| Thick Film Chip | ■ | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | ● | ● | ■ |
| Thin Film Chip | ■ | ● | ● | ■ | ● | | ● | ■ | ■ | | | ● | | ■ | | | ● | ● | ■ |
| Trimmable | | ■ | | | ■ | | ■ | ■ | ■ | | | | | ■ | | | | | ■ |
| Voltage Divider | | | ■ | | ■ | | ■ | ■ | ■ | | | | | ■ | | | | | ■ |

| Network | Bourns | KOA | Panasonic | TT Electronics | BI Technologies | IRC | Welwyn | Vishay | Dale | Electro-Films | Huntington/Milwaukee | Techno | Thin Film | Vishay Precision Group | Yageo |
|--------------------|--------|-----|-----------|----------------|-----------------|-----|--------|--------|------|---------------|----------------------|--------|-----------|------------------------|-------|
| Array | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Conformal Coated | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Custom | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Integrated Passive | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Ladder | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Line Protection | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Moulded | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Resistor/Capacitor | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| SMT | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Surge | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Thick Film DIP | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Thick Film SIP | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Thin Film DIP | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Thin Film SIP | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

- Lead-free only parts available
- Lead & Lead-free compliant parts available
- ▲ Lead-only compliant parts available

| Potentiometers/ Trimmers | Bourns | Honeywell | KOA | Murata | OHMITE | Panasonic | TT Electronics (BI Tech) | Vishay | BCcomponents | Dale | Sfernice/MCB | Spectrol | Vishay Precision Group |
|--------------------------|--------|-----------|-----|--------|--------|-----------|--------------------------|--------|--------------|------|--------------|----------|------------------------|
| Trimming Potentiometers | | | | | | | | | | | | | |
| Adjustment Tools | | | | | | | | | | | | | |
| Carbon | ● | | ■ | | | ■ | ● | | | | | | ■ |
| Cermet | ● | ● | | ■ | | ■ | ● | | | | | | ■ |
| Counters | ■ | | | | | ■ | ● | | | | | | ■ |
| Dials/Knobs | ■ | | | | | ■ | ● | | | | | | ■ |
| Multi-Turn | ● | | | ■ | | ■ | ● | | ● | | | | ■ |
| Open Frame | ● | | | | | ■ | ● | | | | | | ■ |
| Open Frame Slide | ■ | | | | | ■ | ● | | | | | | ■ |
| Sealed Frame | ● | | ■ | | ■ | ■ | ● | | ● | | | ■ | ■ |
| Single-Turn | ● | | | | | ■ | ● | | | | | | ■ |
| Wirewound | ▲ | | | | | ■ | ● | | | | | | ■ |
| Precision Panel Control | | | | | | | | | | | | | |
| Carbon | | ■ | | | | | | | | | | | ■ |
| Cermet | | ■ | | | | | | | | | | | ■ |
| Conductive Plastic | | ■ | | | | | | | | | | | ■ |
| Knobs | | ■ | | | | | | | | | | | ■ |
| Hybrid | | ■ | | | ■ | | | | | | | | ■ |
| Linear | | ■ | | | | | | | | | | | ■ |
| Metal Foil | | | | | | | | | | | | | ■ |
| Modular | | | | | | | | | | | | | ■ |
| Motor Pot | | | | | | ■ | | | | | | | ■ |
| Multi-Turn | ■ | | | | | ■ | ● | | | | | | ■ |
| Non-Linear | | | | | | ■ | ● | | | | | | ■ |
| Rheostat | | | | | ■ | | ■ | | | | | | ■ |
| Rotary | ■ | | | | | ■ | ● | | | | | | ■ |
| Sealed Frame | ■ | | | | | ■ | ● | | | | | | ■ |
| Single-Turn | ■ | | | | | ■ | ● | | | | | | ■ |
| Wirewound | ■ | ■ | | | | ■ | ● | | | | | | ■ |
| Sensor/Encoder | | | | | | | | | | | | | |
| Attenuator | | | | | | | | | | | | | ■ |
| Encoders | | ■ | ● | | | | ■ | | | | | | ■ |
| Linear Motion | | | | | | | ■ | | | | | | ■ |
| Rotary | | | ● | | ■ | | ■ | | | | | | ■ |

| Power/ Wirewound/ Carbon & Foil | Bourns | KOA | OHMITE | Panasonic | TT Electronics | BI Technologies | IRC | Welwyn | Vishay | Dale | Huntington/Milwaukee | Sfernice/Mcb | Thin Film | Vishay Precision Group | Yageo |
|---------------------------------|--------|-----|--------|-----------|----------------|-----------------|-----|--------|--------|------|----------------------|--------------|-----------|------------------------|-------|
| Power/Wirewound | | | | | | | | | | | | | | | |
| Brackets/Hardware | | | ● | | | | | | | | ■ | ■ | | | ■ |
| Ceramic Composition | | ● | ● | | | | | | | | ■ | ■ | | | ■ |
| Commercial | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Current Sense/Low Resistance | ■ | | | ■ | | | | | | | ■ | ■ | | ■ | ■ |
| Industrial | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Precision | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Rheostat | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Special Purpose | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Tubular | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Vitreous Enamel | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Carbon | | | | | | | | | | | | | | | |
| Carbon Composition | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Carbon Film | | ● | ● | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ |
| Foil | | | | | | | | | | | | | | | |
| Bulk Metal Foil | | | | | | | | | | | | | | | ● |

Transportation Line Card

Power

| Power Supplies | Artesyn | Ericsson Power Modules | GE Critical Power | MEAN WELL | Murata Power Solutions | N2Power |
|--|---------|------------------------|-------------------|-----------|------------------------|---------|
| Internal/Embedded - AC/DC | | | | | | |
| Low to Mid Power (1W - 500W) | | | | | | |
| High Power (500 - 10KW) | | | | | | |
| Single Output | | | | | | |
| Multi-Output (Dual, Triple, Quad) | | | | | | |
| PCB Mount | | | | | | |
| Open Frame | | | | | | |
| U-Channel/Enclosed | | | | | | |
| DIN Rail | | | | | | |
| Modular/Configurable | | | | | | |
| ATX | | | | | | |
| Front End, Bulk Power | | | | | | |
| Medical Rated | | | | | | |
| Conduction Cooled | | | | | | |
| Industrial Temperature | | | | | | |
| Extended Temperature | | | | | | |
| I ² C PMBus Control/Interface | | | | | | |
| Power Over Ethernet (PoE) | | | | | | |
| External - AC/DC | | | | | | |
| Wall Mount Adapters | | | | | | |
| Desktop | | | | | | |
| Medical Rated | | | | | | |
| High Power (120W-280W) | | | | | | |
| LED Drivers | | | | | | |
| Power Over Ethernet (PoE) | | | | | | |
| DC/AC | | | | | | |
| UPS | | | | | | |
| Battery Charging | | | | | | |
| Inverter (DC/AC) | | | | | | |
| DC/DC | | | | | | |
| Isolated DC/DC Converters | | | | | | |
| Fractional Brick | | | | | | |
| Digital Control | | | | | | |
| Industrial Pin-Out | | | | | | |
| Intermediate Bus Converter | | | | | | |
| Low Power Unregulated | | | | | | |
| Wide Input Range 4:1 | | | | | | |
| Surface Mount | | | | | | |
| EN50155 DC/DC | | | | | | |
| Non Isolated POL Converters | | | | | | |
| Digital Control | | | | | | |
| Through Hole | | | | | | |
| Single In Line | | | | | | |
| Surface Mount | | | | | | |
| Ancillary Power Products | | | | | | |
| ATCA PIM Modules | | | | | | |
| RF/Power Amplifier | | | | | | |
| PFC Modules | | | | | | |
| 300Vin Modules | | | | | | |
| Embedded DC/DC | | | | | | |
| Open Frame/Enclosed | | | | | | |
| Front End Bulk Power | | | | | | |

Sensors

| Sensors | Amphenol Advanced Sensors | AVX | Bourns | Honeywell | KEMET | KOA | Littelfuse | Molex | Murata | Omron | Panasonic | Standex Meder | TDK (EPCOS) | TE Connectivity Sensor Solutions | TT Electronics | Vishay |
|---|---------------------------|-----|--------|-----------|-------|-----|------------|-------|--------|-------|-----------|---------------|-------------|----------------------------------|----------------|--------|
| Motion/Speed/Position | | | | | | | | | | | | | | | | |
| Accelerometer | | | | | | | | | | | | | | | | |
| Encoder/Rotary | | | | | | | | | | | | | | | | |
| Gyroscope | | | | | | | | | | | | | | | | |
| Inclinometer/Tilt | | | | | | | | | | | | | | | | |
| Inertial Measurement Unit | | | | | | | | | | | | | | | | |
| Liquid Level | | | | | | | | | | | | | | | | |
| Motion/Gesture/Displacement | | | | | | | | | | | | | | | | |
| Proximity | | | | | | | | | | | | | | | | |
| Shock/Vibration | | | | | | | | | | | | | | | | |
| Speed/Position/Magneto Resistive/Resolver | | | | | | | | | | | | | | | | |
| Ultrasonic | | | | | | | | | | | | | | | | |
| Optical | | | | | | | | | | | | | | | | |
| Ambient Light | | | | | | | | | | | | | | | | |
| Fibre Optic | | | | | | | | | | | | | | | | |
| Infrared/Human Presence Detection | | | | | | | | | | | | | | | | |
| Laser | | | | | | | | | | | | | | | | |
| Photodiodes/Phototransistors/Photoelectrics | | | | | | | | | | | | | | | | |
| Solar | | | | | | | | | | | | | | | | |
| Ultra Violet | | | | | | | | | | | | | | | | |
| Pressure/Force/Flow/Gas | | | | | | | | | | | | | | | | |
| Air/Gas/CO ₂ | | | | | | | | | | | | | | | | |
| Altimeter/Barometric | | | | | | | | | | | | | | | | |
| Combination MEMS | | | | | | | | | | | | | | | | |
| Dust/Ionizer | | | | | | | | | | | | | | | | |
| Flow | | | | | | | | | | | | | | | | |
| Force | | | | | | | | | | | | | | | | |
| Fluid Property | | | | | | | | | | | | | | | | |
| Load Cell/Load Pin | | | | | | | | | | | | | | | | |
| Pressure | | | | | | | | | | | | | | | | |
| Torque | | | | | | | | | | | | | | | | |
| Turbidity | | | | | | | | | | | | | | | | |
| Thermal/Humidity | | | | | | | | | | | | | | | | |
| Combination MEMS | | | | | | | | | | | | | | | | |
| Heaters | | | | | | | | | | | | | | | | |
| Humidity | | | | | | | | | | | | | | | | |
| NTC Thermistor | | | | | | | | | | | | | | | | |
| Probes & Assemblies | | | | | | | | | | | | | | | | |
| PTC Thermistors | | | | | | | | | | | | | | | | |
| RTD | | | | | | | | | | | | | | | | |
| Thermocouples | | | | | | | | | | | | | | | | |
| Thermopiles/Human Presence Detection | | | | | | | | | | | | | | | | |
| Other | | | | | | | | | | | | | | | | |
| Capacitive Touch | | | | | | | | | | | | | | | | |
| Colour Sensors - Factory Automation | | | | | | | | | | | | | | | | |
| Current Sensors | | | | | | | | | | | | | | | | |
| Inductive Sensors - Factory Automation | | | | | | | | | | | | | | | | |
| Light Curtain Safety - Factory Automation | | | | | | | | | | | | | | | | |
| Magnets | | | | | | | | | | | | | | | | |
| Medical Sensor Cable Assemblies | | | | | | | | | | | | | | | | |
| Oil Sensors | | | | | | | | | | | | | | | | |
| Piezo Film Sensors | | | | | | | | | | | | | | | | |
| Powder Level Sensors | | | | | | | | | | | | | | | | |
| Pulse Oximetry Probes | | | | | | | | | | | | | | | | |
| Urea, Water (WIF/WIF+WDS/WS), Diesel | | | | | | | | | | | | | | | | |

Connectors

Amphenol Industrial



Circular Connectors

Amphenol LTW's circular connectors are ideal for automation engineering applications with a broad product portfolio available of contact configurations, connector sizes and mating styles.



Features & Benefits

- Screw thread, lock bayonet or push lock types
- Receptacle, receptacle with cable, overmolded with cable, and field installable versions available
- Options from 2 to 31 contacts, 2A to 20A
- Various sizes, over 1000 items, plastic and metal
- UV resistant
- IP66/67/68, mated or unmated waterproof
- Hybrid available

Applications

- EV charging stations and infrastructure
- Agricultural and farm equipment
- Construction and mining equipment
- Marine and shipbuilding
- Material handling equipment
- Motorbikes and scooters
- Rail/MRT
- Trucks and buses

D-Sub Connectors

Amphenol LTW's rugged D-Sub provides a cost-effective option for input/output (I/O) connection systems.



Features & Benefits

- Standard D-Sub (9/15/25/37/50 contacts), High Density D-Sub (15/26/44/62/78 contacts) and mixed options available
- Receptacle, overmolded with cable, and field installable versions available
- Connection types from hand solder, wire wrap, straight and angled PCB, with and without boardlock to flat cables
- IP67/68, mated or unmated
- Special latches instead of thumb screws available
- High reliability for harsh environment

Applications

- EV charging stations and infrastructure
- Agricultural and farm equipment
- Construction and mining equipment
- Marine and shipbuilding
- Material handling equipment
- Motorbikes and scooters
- Rail/MRT
- Trucks and buses

USB

Amphenol LTW's supplies you with a complete USB series, from receptacles, plugs to cable assemblies, satisfying all your needs for data transfer applications.



Features & Benefits

- USB A, USB B, and Mini USB
- Screw threaded or lock bayonet types
- Receptacle, receptacle with cable, overmolded with cable, and field installable versions available
- UV resistant
- IP67/68, mated or unmated waterproof
- Easy and simple connection structure
- Plug and play (PnP)

Applications

- EV charging stations and infrastructure
- Agricultural and farm equipment
- Construction and mining equipment
- Marine and shipbuilding
- Material handling equipment

Connectors

Amphenol Industrial

Amphenol
Industrial

Micro USB

Amphenol LTW's breakthrough innovation allows your wearable devices to enable high speed data transmission in an IPx8 rating environment.



Features & Benefits

- Micro USB A and B
- Panel available
- IP67/68, unmated waterproof
- Operating temperature: -35°C – 85°C

Applications

- Agricultural and farm equipment
- Marine and shipbuilding
- Motorbikes and scooters
- Rail/MRT

Power Connectors

The robust construction of Amphenol LTW's power connector is designed for high power amperage applications such as generators, stationary power sets, battery, alternator and wireless base stations.



Features & Benefits

- Screw thread or lock bayonet types
- Receptacle, overmolded with cable, and field installable versions available
- Options from 2 to 7 contacts, 8A to 30A
- Over 110 plastic connector types
- UV resistant
- IP67/68, mated or unmated waterproof
- Safety locking available (30A)
- Touch Safe (IP2X) available (30A)

Applications

- Electric vehicles
- EV charging stations and infrastructure
- Construction and mining equipment
- Material handling equipment
- Motorbikes and scooters
- Rail/MRT
- Trucks and buses

RJ45 Connectors

Amphenol LTW's RJ45 series connectors meets the Ethernet/IP RJ45 requirements. Rated IP67/68, these performance connectors are suitable for the industrial automation and transportation markets.



Features & Benefits

- Screw thread or lock bayonet types
- Receptacle, overmolded with cable, and field installable versions available
- Shielded versions
- RJ jack in right angle and straight, terminal block and cable terminated
- UV resistant
- IP67/68, mated or unmated waterproof
- Fast connectivity networking in harsh environment

Applications

- EV charging stations and infrastructure
- Agricultural and farm equipment
- Construction and mining equipment
- Marine and shipbuilding
- Material handling equipment
- Motorbikes and scooters
- Rail/MRT
- Trucks and buses

Connectors

Amphenol Industrial

Amphenol
Industrial

POWERLOK™

Utilising Amphenol's latest RADSOK® technology, the POWERLOK™ product is the answer for hybrid and electric vehicles applications, where a custom, reliable, easy to install and cost effective solution is required.



POWERLOK™ is available straight or right angle, 1, 2 or 3 poles in metal or plastic versions.

- Up to 750A and 1000V per pole
- RoHS compliant

Features & Benefits

- High Voltage Interlock (HVIL)
- Full shielding
- IP67 and IP6K9K mated
- Secondary locking
- Multi polarisation and colour coding
- Finger proof (IP2X) unmated

Applications

- Hybrid and electrical vehicles
- Frequency converter
- Inverter
- Battery pack
- Power Distribution Unit (PDU)

RADLOK™

Utilising Amphenol's latest RADSOK® technology, the RADLOK™ product line was designed with compactness and robustness in mind.



Coupling with Amphenol's RADLOK™ PIN, the one finger operated lock feature allows users to connect any power distribution/storage system in a quick and secure manner.

- Field crimpable or overmolded
- RoHS compliant

Features & Benefits

- Quick audible tool – free mechanical locking
- Up to 750A and 1000V per pole
- 3 colour options

Applications

- Hybrid and electrical vehicles
- Battery pack
- Power Distribution Unit (PDU)

SurLok Plus™

The SurLok Plus™ compression lug is a field installable, highly reliable alternative to common compression lugs.



The SurLok Plus™ is environmentally sealed and features a quick lock and press-to-release design. Incorporating our latest RADSOK® Technology, SurLok Plus™ is a compact, quick mating, and robust product line.

- Size 5.7, 8 and 10.3mm up to 400AMP
- Operating voltage up to 1,000V
- Operating temperature -55°C to 125°C

Features & Benefits

- IP67 rated
- Touch proof (IP2X) unmated
- RoHS compliant
- "Keyway" design to prevent incorrect mating

Applications

- Cable to box/PCB
- Electric and hybrid vehicles
- Energy storage/BMS
- Process control and automation

Connectors

Amphenol Industrial

Amphenol
Industrial

MSD (Manual Service Disconnect)

Safe and reliable solution for PHEV servicing. MSD utilises a two-stage lever to open the HVIL circuit prior to separation of HV contacts.



It is a tool-free solution for disconnecting the internal high voltage battery pack and protecting the high voltage battery pack from short circuit. All HV conduction surfaces on receptacle assembly are finger proof touch safe. Available in a scalable design with a variety of fuse ratings.

Features & Benefits

- IP67 and IP6K9K mated
- Touch proof (IP2X) unmated

- RoHS compliant
- High Voltage Interlock (HVIL)
- Tool free locking mechanism
- Current rating up to 150A and 700VDC

Applications

- Electric and hybrid vehicles
- Power supply unit

HVCO (High Voltage Coupler Outlet)

Utilising Amphenol's RADSOK® technology, the HVCO product is the answer for hybrid and electric vehicles charging applications.



HVCO meets national standard GB/T 20234.1/2/3-2011, reference with IEC 62196-2 and it is interchangeable with all supplier interfaces. The option for an electronic lock is available to prevent the connector from being unplugged while charging.

Features & Benefits

- IP55 mated
- Up to 10,000 mating cycles

- RoHS compliant
- Current rating up to 250A and 750VDC
- Operating temperature -30°C to 50°C
- Water drainage design

Applications

- Electric and hybrid vehicles
- Charging stations

ePower Connectors

The ePower series of connectors are designed for the demanding requirements of hybrid, electric vehicles, and utility truck electrical systems, operating at 800VDC – 1,000VDC with a 200A – 500A rating.



Features & Benefits

- Two or three circuit power
- Crimp, lug or bus bar termination
- IP2X on pin and socket
- Environmental IP67 rating
- Two HVIL circuits
- 1,000VDC rating
- 8mm and 11.1mm RADSOK® technology
- 200A at 80°C with 30°C T-rise
- 400A at 80°C with 30°C T-rise

- Strain relief for jacketed cable incorporated into shell
- Integrated EMI shielding
- Excellent vibration resistance
- Cast aluminium shell

Applications

- Power converters
- Hybrid electric vehicles
- Heavy equipment electrification
- Two and three phase motors
- Starter generators

Connectors

Amphenol Industrial



A Series™

The A Series™ connectors contain superior environmental seals, seal retention capabilities and feature Amphenol Sine Systems RockSolid™ Contact technology.



In addition, all of the A Series™ connectors have been developed to be completely compatible with all other existing standard products industry-wide.

- LED feature (optional)
- Available in a wide variety of colours

Features & Benefits

- 12AWG – 20AWG
- 7.5A – 25A
- Stamped, formed and machined contacts
- Strain relief modification

Applications

- Agriculture machines
- Construction vehicles
- Heavy duty equipment
- Transportation
- Marine

AHD Series

Amphenol AHD Series Connectors offer both a smooth, non-sealing option for controlled applications, as well as an environmentally sealed, threaded option for more demanding applications.



Specifically designed for Diagnostic Grade Cable Assemblies, completely compatible with all other existing standard products industry-wide.

Features & Benefits

- 6 position: 10AWG – 14AWG, size #12 contacts
- 9 position: 14AWG – 20AWG, size #16 contacts
- High performance, cost effective
- Ideal for controlled/uncontrolled environmental conditions
- J1939 specifications compliance

Applications

- Agriculture machines
- Construction vehicles
- Heavy duty equipment
- Transportation
- Marine

DuraMate™

The Amphenol DuraMate™ environmentally sealed multi-pin thermoplastic circular connector series provides an economical quick-connect bayonet locking system manufactured to withstand the challenges and complexities of harsh environment off-road applications.



Features & Benefits

- Polarised for proper mating of connector halves
- High density signal and mixed power insert configurations
- Available in size 24 with 5 insert arrangements (7, 19, 23, 29, 31)
- Contacts available in economical reel-mounted high volume machine termination or in machined loose-piece form
- Low insertion force stamped terminals

- IP67 mated
- RoHS compliant

Applications

- Agriculture machines
- Construction vehicles
- Heavy duty equipment
- Transportation

Connectors

Amphenol Infocom

Amphenol®

High Speed Data (HSD) Transport Solutions

For both PCB side and cable assembly. HSD Series connectors, HSD to USB adaptor.



Features & Benefits

- One solution for many digital transmission standards
- Data rate up to 1.6GBPS
- 2 differential pair lines
- Optimised EMI-Shielding according to CISPR25
- Complies with IEEE1394 protocol

Applications

- LVDS camera/video (Vision Control)
- GVIF (Gigabit Video interface) camera links
- IEEE1394 (FireWire) S800 speed over 7m, S400 over 10m
- Other applications running on a 100Ω datalink

FAKRA Coaxial Connectors

FAKRA connectors are designed to perform up to 4GHz and meet the particular mechanical and environmental requirements of the automobile industry.



Features & Benefits

- 12 different mechanical and colour codes
- Plastic housing with locking feature and audible clicking noise
- Available in straight and right angle for cable as well as edge-launch and PCB designs, and includes the Gen. 4.0 and Gen 4c jack and plugs, and Gen 4.0 PCB connectors

Applications

- GPS
- Bluetooth
- Remote start
- Antenna

USB 3.1 Type C Connectors

Amphenol offers its USB 3.1 connector that complies with C-type specification and supports scalable power charging.



Amphenol's USB C-type connectors, designed for emerging product designs, are fully compliant to the newest C-type specifications. The usability for these low-profile connectors is enhanced by offering reversible plug and cable directions. The connectors also support scalable power charging by extending 5A current ranges plus USB power delivery.

Features & Benefits

- Tailored for emerging product designs
- Similar size to USB 2.0 micro-B

- Reversible plug orientation and cable direction
- Extended 5A current ranges plus USB power delivery
- Designed to establish future USB performance needs
- High speed up to 10Gb/s

Applications

- GPS systems/navigation
- Driver assistance systems
- Infotainment systems

Signal and Power Distribution Solutions

For both PCB side and cable assembly.



Pin Header HDR Series, Terminal Block and Header 91X Series, Power Connector CAU Series, Socket and Header T80X Series, D-Sub Series.

Features & Benefits

- Experienced in customisation
- Cost effective
- Single and double row, wire-to-board and board-to-board product family
- Can handle solder temperatures up to 260°C

Connectors

AVX



| Product | Series | Description | Range |
|---------|------------------------------|---|--|
| | Custom Automotive Connectors | Advanced component, process and automation technology provides high pin and component (Mechatronics) count connector and module solutions for emerging automotive systems; engine management, braking, steering, safety, environmental etc. | Designed based on customer requirements |
| | IDC | Provides reliable "Gas Tight" wire-to-board connections for high temperature, shock and vibration applications. | AWG: 12-30 SMT and PTH |
| | Board-to-Board | Fine pitch, vertical board-to-board connectors. | 20-120 pos 3-9mm stacking height |
| | Secure Locking FFC/FPC | FFC/FPC cables connectors with secure locking mechanism. | 8-80 positions right angle and vertical types |
| | High Speed FFC/FPC | FFC/FPC cables connectors for high data speed. | 24-51 positions right angle |
| | SDIO | SDIO connectors for SD memory cards with push-push spring eject mechanism. | Reverse and normal mount type 2.7-2.9mm connector max height |

Delphi



Main Global Terminal Families

Features & Benefits

- OCS 05, 064, 150, 280 ...
- DUOTWIN/ MTS 064
- DCK/ CTS 050, 064, 120, 150, 280, 480/630 ...
- DCS/ DSQ 150, 280, 480/630, 950
- SICMA/ BTS 150, 280
- APEX 064, 120, 150, 280, 635 and 950
- DUCON, GTS, Perf. Pack, HDK, HES, Power Pack, GT, MP
- Ring terminals and grounding systems



High Voltage Metal Pass-Through

Features & Benefits

- High voltage: 1000V DC
- 250A continuous depending cable characteristics and selection
- Sealing protection: IP67, IP6K9K
- 8 Codlings for 50mm²
- 6 Codlings for 35 and 25mm²
- Wire sections: 25, 35 and 50mm²
- Vibration: SAE/USCAR2 5.8.2 severe vibration with -40deg to 150deg environment loading. Volvo truck class 5 and 6 vibrations
- Flange size: 111mm x 52mm
- IP2XB Finger proof/touch safe
- 1 key/index



Applications

- E-motor connections, screw type device connections with heavy duty requirements
- Commercial vehicles: trucks, tractors with high vibration profiles

Connectors

Delphi

DELPHI

APEX® HV280 2 Way Connection System with HVIL

Features & Benefits

- Bundle shielding with external braid
- Panel mount to device with face seal
- HVIL shunted-in harness connector
- Two-stage disconnect for safe un-mating
- ErgoMate™ axial mating assist system on harness connector
- Two HV power circuits (2.8mm terminal)
- IP2xB finger proof/touch safe
- Cable size: 2.5mm² – 4mm² power circuit; 0.5mm² – 0.75mm² HVIL circuit
- Current capacity: 35A at 70°C
- Voltage: 1000V
- Temperature range: -40°C – +125°C
- Sealing protection: IP67, IPx9K



Applications

- High voltage peripheral equipment connection system:
 - Air conditioning
 - PTC
 - Charger

RCS800 High Voltage 2 Way Connection System with HVIL

Features & Benefits

- Bundle shielding with external braid
- Panel mount to device with face seal to module
- HVIL shunted-in harness connector
- Two-stage disconnect for safe un-mating
- ErgoMate™ axial mating assist system on harness connector
- Two HV power circuits (8.0mm round terminal)
- IP2xB finger proof/touch safe
- Cable size: 35mm² to 50mm² power circuit; 0.5mm² – 0.75mm² HVIL circuit
- Current capacity: 230A at 70°C
- Voltage: 1000V
- Temperature range: -40°C – +125°C
- Sealing protection: IP67, IPx9K



Applications

- High voltage/high current modules:
 - Inverter
 - Battery
 - Junction box
 - Power electric box

RCS890 High Voltage 2 Way Right Angle Connection System with HVIL

Features & Benefits

- Bundle shielding with external braid
- Panel mount to device with face seal to module
- HVIL shunted-in harness connector
- Two-stage disconnect for safe un-mating
- Slider mating assist system on harness connector
- Two HV power circuits (8.0mm round terminal)
- IP2xB finger proof/touch safe
- Cable size: 35mm² – 50mm² power circuit; 0.5mm² – 0.75mm² HVIL circuit
- Current capacity: 230A at 70°C
- Voltage: 750V
- Temperature range: -40°C – +125°C
- Sealing protection: IP67, IPx9K



Applications

- High voltage/high current modules:
 - Inverter
 - Battery
 - Junction box
 - Power electric box
 - Electric vehicle

Shield-Pack™ HV280 - 2 Piece Header with Pluggable Inner Connector

Features & Benefits

- Inner Connector with TPA can be plugged into header during device assembly
- Sealed connection system
- Panel mount to device with face seal
- Internal HVIL (shunt in harness connector)
- Two HV power circuits (2.8mm terminal)
- IP2XB finger proof/touch safe
- Cable range: 2mm² to 5mm² power circuit; 0.5mm² HVIL circuit
- Three keys/indexes
- Current capacity: 40A at 85°C
- Voltage: 600V
- Temperature range: -40°C to +125°C
- Sealing protection: IP67, IP6K9K



Applications

- Ideal for internal battery harnesses/high voltage connection system

Connectors

Delphi

DELPHI

Charge Coupler Connector Pigtails

Features & Benefits

- Current capacity: 15A to 32A
- Voltage range: 120V to 480V
- Temperature range: -40°C to +50°C
- Validation: see part number information
- SAE J1772/IEC62196 Type I, IEC62196 Type II, and GB/T 20234 compliant connections
- Wiring crimps sealed from environment
- Rubber overmold and plastic grip options available



Applications

- Cable assemblies for integration into charging stations or portable cordsets per customer requirements

Charge Plug Mode 3 Jumpers

Features & Benefits

- Vehicle interface through three global standards
- UL/CE marking
- SAE J1772/IEC62196 Type I, IEC62196 Type II, and GB/T 20234 vehicle interface
- Call for additional configurations



Applications

- Electric vehicle charging

Charge plug mode 2 assembly (with ICCB)

Features & Benefits

- Vehicle interface through three global standards
- EVSE provides restart in the event of power grid fault
- Programmable for multiple charge currents
- NEMA 4 construction
- UL/CE marking
- 120V/12A
- 240V/10A, 13A, or 16A
- SAE J1772/IEC62196 Type I, IEC62196 Type II, and GB/T 20234 vehicle interface
- Grid cord as required by country of use
- Call for additional configurations



Applications

- Portable Electric Vehicle Supply Equipment (EVSE) for electric vehicle charging

Charge Inlet - Type II Vehicle Charging Inlet

Features & Benefits

- Supports single-phase or three-phase power supply
- Supports: 16A, 230V and 63A, 400V
- Voltage: 400V maximum rating
- Temperature range: -40°C to +50°C
- Electrical protection: IP2XB
- Sealing protection: IP44 (connector/inlet mated)
- Design life: 10,000+ mating cycles
- Interface complies with IEC62196 Type II standard
- Panel mounts to vehicle
- Integrated thermal circuit breaker to prevent abnormal temperature increase inlet connector only
- Cover provides dust protection
- Designed to drain fluid if introduced to inlet
- Holes provided for coupler lock actuator
- Available with cover opening right or left



Applications

- Plug-in hybrid and electric vehicle charge inlet

Connectors

Delphi

DELPHI

APEX® 150 Sealed Connectors – 10, 14, 16 & 24 ways

Features & Benefits

- USCAR "on-engine" performance standard suitable for harsh environments
- Circumferential interface seal
- Mat seal design
- Wire accommodation range – 0.35mm² (22 AWG) to 1.5mm² (16 AWG)
- Mid-sized housings (3.5mm pitch)
- Fully assembled connector for ease of use
- Terminal Position Assurance (TPA) device to detect partially installed terminals
- Connector Position Assurance (CPA) available
- 24 ways version includes FCI's ErgoMate® mate-assist technology
- 14 ways and 24 ways connectors offer shorting bar options



APEX® 2.8 Sealed & Unsealed Connectors – 2, 3, 4, 6, 10 & 14 ways

Features & Benefits

- Circumferential interface seal
- Heavy duty connectors for demanding environments
- Proven record since 1993
- Most compact 2.8mm system in the industry
- Wire accommodation range – sealed 0.75mm² (20 AWG) to 4mm² (10 AWG) – unsealed 0.35mm² (22 AWG) to 5mm² (10 AWG)
- Robust APEX® performance
- Mid-sized housings (5.25mm pitch – 6.40mm rows)
- Mat seal design
- Fully assembled connector for ease of use
- Terminal Position Assurance (TPA) device to detect partially installed terminals
- CPA Available
- Up to 7 mechanical polarisations available
- Meets or exceeds USCAR performance standards



APEX® SensoMate™ 2.8mm Sealed Connectors – 2, 3 & 4 ways

Features & Benefits

- APEX® terminal technology and performance in our smallest package
- Sealing technology: cable seal
- SWS (cable seal) terminal seal design
- SensoMate 2.8 connectors mate to certain Bosch fuel injectors and components
- Heavy duty – for diesel engine vibration and temperature duty cycles
- Compliant with USCAR design guidelines and performance standards
- Superior single-piece housing construction
- Terminal Position Assurance (TPA) device to detect partially installed terminals



APEX® SensoMate™ 1.2mm Sealed Connectors – 2, 3 & 4 ways

Features & Benefits

- APEX® terminal technology and performance in our smallest package
- SWS (Cable seal) terminal seal design
- SensoMate 1.2 connectors mate to AK 1.2 device interface
- Heavy Duty – for diesel engine vibration and temperature duty cycles
- Sealing technology: cable seal
- Compliant with USCAR design guidelines and performance standards
- Superior single-piece housing construction
- Terminal Position Assurance (TPA) device to detect partially installed terminals
- CPA available



Connectors

Delphi

DELPHI

Sicma Sealed Connectors – Mini-Sealed 2, 3, 4, 5, 6 ways & 24 ways

Features & Benefits

- High sealing performance ensured by rear mat-seal and circumferential interface seal
- Optimised size with 3.33mm pitch for 1.5mm terminals
- Reduced size sealed housing
- Easy and quick connection system with Go-No-Go locking principle
- Integrated secondary lock feature (TPA) allowing detection of unlocked terminals
- Terminal Position Assurance (TPA)
- Optional Connector Position Assurance for 2 and 6 ways (CPA)
- Optional 6 ways hybrid with rear latch principle: 17260685A (black coding)
- Suitable for body, engine compartment and harsh environment applications



Sicma Panel Through Sealed Connectors – 14, 16, 24, 26, 34 & 50 ways

Features & Benefits

- High density connectors particularly suitable for door to body or engine to cockpit applications
- Suitable for a combination of low and medium current applications
- Mating assistance system with slider to minimise mating force and allowing blind mating
- Male terminals can be protected from hazardous damage thanks to a front grid protection



Sicma Sealed Full Interconnect – 6, 24, 56 & 90 ways

Features & Benefits

- Female housing connection to male housing for PCB mount
- High sealing performance ensured by rear mat-seal and front interfacial seal
- Slider for mating force reduction and blind mating
- Integrated secondary lock device allowing detection of terminals (TPA)
- Typical applications: electrical parking brake, clutchless gear box controller, liquified petrol gas controller, engine management electronic control unit



Sicma Sealed Relay Sockets – 7, 8 & 11 ways

Features & Benefits

- Single wire seal
- Circumferential interface seal
- 15g vibration performance
- Front terminal position assurance
- Slider for reduced mating assistance



Connectors

Delphi

DELPHI

Harsh Environment Series (HES)

Features & Benefits

- Circular connector size 24 shell
- 19, 21, 23, 29, 31, 47, 50 and 60 way headers
- Various terminal sizes and patterns
- Terminal designed for lower insertion forces
- Size 20 and 16 available
- 3-rib design provides better sealing capability up to 50% compared to existing designs
- Environmentally sealed to IP67
- Male pin and female socket terminal cavity compatible with all industry pin and socket connections
- Rugged construction to withstand harsh environments
- Frontward/backward compatibility
- Sonic welded design provides 360° of contact to withstand high vibration to meet J-2030 standards



Applications

- Commercial vehicles
- Construction vehicles
- Military vehicles
- Marine vehicles

OCS Unsealed Connectors

Features & Benefits

- Female connector
- Male connector
- Secondary locks
- Robust design features for enhanced warranty performance and designed-in durability
 - Connector lock design ensures connection integrity
 - Over-stress feature for handling robustness
 - CPA capability
 - Clear and consistent audible click
- USCAR indexing
- Front mounted spacer (primary lock reinforcement) is delivered pre-staged to the harness manufacturer
- Independent secondary lock (ISL) for certain size terminals
- Multiple terminal sizes available
 - 0.64mm, 1.20mm, 1.50mm, 2.80mm
- Cavity compatible with industry standard terminals
- Validated to USCAR and other customer specifications



Applications

- Automotive
- Transportation

GT Global Terminal Series

Features & Benefits

- 1.50mm and 2.80mm versions
- Headers
- Lever lock
- Mixed
- SlimLine
- Tangless terminals
- Low engagement force
- Pump-handle primary lock
- Secondary lock, Connector Position Assurance (CPA), and Terminal position Assurance (TPA) capabilities
- Mates to ISO, SAE blades
- Optimised content packaging for space efficient terminations
- Pre-staged male blade stabilizer or superior male blade protection
- Mixed terminal capability or design flexibility
- Protected seal interface
- Conforms to USCAR design footprint
- Cam lever/mechanical assist or hand engage/disengage



Applications

- Ergonomic connections for in-line, device, header, and bulkhead applications

OCS Sealed Connectors

Features & Benefits

- Robust design features for enhanced warranty performance and designed-in durability
 - Patented connector lock design
 - Low profile lock with overstress protection
 - Clear and consistent audible click
 - Enhanced strain relief
 - Cavities can be molded fully open, or selectively punched, eliminating the need for loose piece cavity plugs
 - Thumb grip incorporated to aid connector unmating
 - Optional conduit capture
 - Optional CPA
 - USCAR indexing
 - PLR is delivered pre-staged to the harness manufacturer
- Reliable connector seal design
- Multiple terminal sizes available
 - 0.64mm, 1.20mm, 1.50mm, 2.5mm
- Cavity compatible with industry standard terminals
- Validated to USCAR-2 Class III and other customer specifications



Applications

- Automotive
- Transportation

Connectors

JST



AIT 2

Wire-to-Board/Wire-to-Wire Connector

2.54mm Pitch Disconnectable Crimp Style. 0.64 unsealed ultra low-profile connector.



Variations

There are multiple varieties of AIT-II Connectors which can satisfy your needs (colours, single/dual row, front/side load).

Features & Benefits

- Current rating: 5A DC max
- Voltage rating: 14V DC
- Temp: -40°C to +105°C
- Ultra low profile connector: over 30% height reduction as compared to the standard USCAR footprints

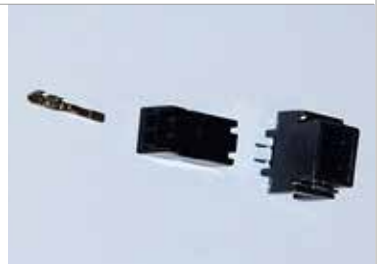
Applications

- Automotive
- Rear view mirror
- Clock spring
- Transmission
- Microphones
- Speakers

CPT

Wire-to-Board Connector

2.0mm Pitch Disconnectable Crimp/SMT type. Developed in pursuit of miniaturisation and low profile as PC board connector for automobile.



CPT connector is surface mounting type, having the spring structure on male terminal disproving the conventional concept.

Features & Benefits

- Current rating: 3A AC DC
- Voltage rating: 50V AC DC
- Temp: -40°C to +100°C

- Compact design: 2.0mm pitch is realised miniaturisation and low profile as the connector for automobile
- Terminal construction: female terminal is designed for simple box structure by having spring structure on male terminal

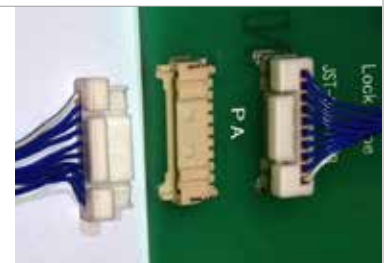
Applications

- Automotive front lamps

PA

Wire-to-Board/Wire-to-Wire Connector

2.0mm Pitch Disconnectable Crimp/SMT type. Wide choice of connection type, IDC/Crimp, THT/SMT wire to wire and wire to board.



Features & Benefits

- Current rating: 3A AC DC
- Voltage rating: 250V AC DC
- Secure locking device prevents accidental disconnection. The box contact supplies stable contact performance
- Retainer mountable type is also available. Highly reliable contact, flanged press pin, insertion guide mechanism

Applications

- Housing lighting
- Steering system
- Door switches
- Lighting modules and shifters
- Great for black box application where connection is not made at OEM

Connectors

JST

JST

XA

Wire-to-Wire/Wire-to-Board Connector

2.5mm Pitch Disconnectable Crimp/SMT type. Large variety of connection type, IDC/Crimp, THT/SMT wire to wire and wire to board.



Secure locking device, low insertion force insertion guide mechanism, solder crack preventive material, applicable to automatic board mounting machine.

Features & Benefits

- Current rating: 3A AC DC
- Voltage rating: 250V AC DC
- Secure locking device prevents accidental disconnection
- Header wafer is made of solder crack preventive material, glass-filled PA66 nylon. Header pins are round and reflow-treated, which provides low insertion force
- Shrouded headers on radial-tape and headers with polarising bosses are also available

Applications

- Rear lamp
- Housing lighting
- Steering system
- Door switches
- Lighting modules and shifters
- Great for black box application where connection is not made at OEM

ZRO

Interface Wire-to-Board Connector

2.55mm Pitch Crimp THT type.



Compact and sealed, this connector has 36 and 48 circuits, and a lever. Easy to develop and adapt it to your specific applications.

Features & Benefits

- Current rating: Power 7A DC Signal 5A DC
- Voltage rating: 50V DC
- Temp: -40°C to +120°C
- Improvement of operability: the lever is adopted to decrease the connector mating force. The fixing part to PC board is snap fit configuration on consideration of the workability when assembling
- Sealed: mat seal is adopted for improving the workability when assembling
- Durability: heat resistant specification corresponding to 120°C
- Reduced waste structure: low cost and low resources are realised by abolishing use of the wire rod pin and the alignment board

- Variations: this connector is available in two kinds of keying codes. If the harness cover of an option is used, the harness can be taken out from the side
- Circuits: lineup of 48 and 36 circuits

Applications

- Automotive
- Rear view mirror
- Clock spring
- Transmission
- Microphones
- Speakers
- Calculator for heat engines
- Embedded telematics solutions

Connectors

Molex

molex
one company > a world of innovation

Imperium™ High Voltage/High Current (HVHC) Connector System

Delivering superior shielding and current density. The Imperium™ Connector System safely operates in extreme shock and vibration conditions found in the hybrid-electric and electrification commercial vehicle markets.



Features & Benefits

- Capable of handling up to 1,000V and 250.0A per contact
- Integrated MX150™ High-Voltage Interlock Loop (HVIL) crimp terminal
- Closed-loop 360° shield design with grounding tabs
- Fully sealed to IP6K9K while mated
- Rugged integrated shield design
- Compression-face seal
- Header face shield with redundant grounding tabs
- Robust solid, one-piece contacts (in plug and receptacle)
- Protective, insulated plug and receptacle contact caps

Applications

- Electric vehicle
- Commercial vehicle

SRC (Sealed Rectangular Connector) System

New generation 84-way Sealed Rectangular Connectors, with single-handed blind-mate functionality. Use proven MX150™ (current ratings up to 18.0A) and MX150L™ (current ratings up to 40.0A) terminals to offer a hybrid, high power-and-signal circuit-count system for harsh applications in commercial vehicles.



Features & Benefits

- Rugged, sealed wire-to-panel (bulkhead) and wire-to-wire hybrid connector system
- Pre-assembled connector housing, seals, rear cover and TPA ship in one piece resulting in reduced inventory and applied labour and cost savings
- This simple crimp, poke and plug application using standard MX150™ and MX150L™ terminals require no crimping of individual wire seals

Applications

- Powertrain
- Electronic control module
- Chassis and safety

MAX-LOC® Plus Shielded Cord Grip Assemblies

The combination of the unique grip-body internal cut-away design, nickelplated housing and tapered shielding ring makes this EMI/RFI shielding cord-grip assembly ideal for high-powered switching and harsh-environment applications.



Features & Benefits

- Nickel-plated aluminium housing and shielding ring provide electromagnetic interference (EMI) and radio frequency interference (RFI) protection
- Unique grip-body internal cut-away design ensures a clear pass-through of pre-assembled harnesses and pre-crimped lugs through centre and offset lugs
- Tapered shielding ring provides a robust, reliable connection and ensures low contact resistance and cable grounding
- Two external mounting holes ensure a stable connection in rugged applications
- Sealed O-ring, IP67 and IP69K rated

Applications

- Electric vehicle
- Commercial vehicle

XRC™ (Extra Rugged Circular) Sealed Plugs and Receptacles

Features & Benefits

- IP67 sealed, plastic circular connectors
- Available in 14 and 31 circuits (18 and 24 shell size)
- Rugged design for heavy-duty, in-line or panel-mount applications
- Bayonet-style latch provides quick and easy connections and ensures proper mated depth
- Low insertion force stamped terminals are economical and reduce connector housing mating force



Applications

- Chassis and safety

Connectors

Molex

molex
one company > a world of innovation

ML-XT™ Sealed Connector System

The rugged ML-XT™ connector system with market-leading high-performance seal technology is a cost-competitive solution offering superior reliability for critical vehicle-wiring applications in harsh environments.



Features & Benefits

- Covalently interlocked one-piece plug housing and interfacial seal formed by 2-shot LSR (liquid silicone rubber) molding technology. Prevents fluid ingress; system is IP68-rated and J2030 power-wash test capable. Prevents loss/misalignment of seal; ensures repeatable retention during unmating and mating of plug and receptacle
- Drop in replacement for defacto-standard industry connectors. Achieves superior reliability without the need for costly re-design
- Rear seals made from HCR (high consistency rubber). Provides greater tear-resistance over LSR material; prevents damage to rear seal during terminal insertion/ extraction
- Latched rear covers lock-in rear HCR seals without exceeding the perimeter of the housings. Allows for flexible cable exits and cable movement whilst maintaining optimum seal position to prevent leak paths
- Plug and receptacle housings are supplied pre-assembled with internal HCR rear seals and covers. Reduces inventory, assembly time and costs for harness manufacturers. Prevents loss of rear seals for a cost-competitive mated system
- Utilises Molex proven XRC™ terminals with current ratings up to 13.0A. Supports tooling widely used at harness makers
- High terminal retention force; exceeds 111N. Withstands high axial pull-out forces per J2030 specification
- Wedgeloek/TPA (Terminal Position Assurance) loaded after terminals. Locks terminals in position for secure electrical contact
- Plug housing features integral locking latch with finger grip. Enables easy handling and secure mating of plug and receptacle
- Colour-coded housings available. Facilitates easy visual mating of harnesses to prevent mis-mating

Applications

Commercial Vehicle

- Agricultural machines
- Construction and mining equipment
- Forest and garden equipment generator sets (Gensets)
- Search, detection and navigation equipment
- Trains and rail equipment
- Bus, coach, caravan
- Material handling equipment

Military vehicles

Marine

Aeronautical

- Commercial aviation

Automotive

- Cars
- Motorcycles

Sealed Application Examples

- Sensors – electrical, fluid, velocity, magnetic, moisture, navigation, position angle, optical, pressure, proximity
- Engine Control Units (ECUs)
- Airbag Control Units (ACUs)
- Diagnostics
- Alternators
- Starters
- Air conditioning
- Lights, lamps
- Pumps
- Power steering modules
- Alarms, horns infotainment and telematics
- Electric seats
- Brakes
- Hydraulics

Connectors

Molex

molex
one company > a world of innovation

CMC Sealed Wire-to-Wire and Wire-to-Board Connector Systems

Molex CMC Hybrid Connectors provide a sealed, high-density, modular and cost-effective connection system for heavy-duty, powertrain and body electronics applications in the transportation industry.



Features & Benefits

- Performs in sealed applications where IPx9K rating and 500mbar watertightness are required
- High-density system due to compact-connector design and fine-pitch size of 2.54mm
- Supports low, medium and high-current applications from 2.5 up to 21.0A to perform in harsh-environments and high-conductivity applications
- Matte seal technology used for 0.635mm and 1.50mm terminals and single wire seals used for 2.80mm terminal

- Mechanical and visual (colour coding) polarisation options ease cycle times during harness assembly
- 32 circuit wire-to-wire system designed for either bracket or clip mounting

Applications

- Chassis and safety
- Powertrain
- Electronic control module

CMX Sealed Connectors

Robust, high-density CMX connectors combine mid-range vibration and temperature requirements with sophisticated IP6K9K interfacial-seal protection.



In a compact, cost-effective lean design for electronic control units and other wire-to-board transportation applications.

Features & Benefits

- 5-row connector design with fine pitch of 2.50 (.100) and 3.70mm (.146")
- Requires reduced space on customer printed circuit boards (PCBs) or engine compartments
- Hybrid connection system uses 2 different, high-conductivity, copper-alloy terminal sizes: CTX 064 (0.64mm/.025") and CTX 150 (1.50mm/.060")
- Supports low and medium current applications from 2.5A up to 6.0A copper alloy allows excellent stress relaxation and current-carrying properties
- Connectors feature matte-seal (also known as grommet seal) technology for CTX 064 and CTX 150 terminals
- Ultimate sealing protection for terminals; connectors can perform in sealed applications where IPx9K rating and 500mbar water-tightness are required
- High-density, space-saving system
- Reduces cycle-time during harness assembly due to easy visual installation
- Avoids mis-mating of the headers and connectors

Applications

Wire-to-board applications

- Powertrain
- Electronic Control Unit (ECU)
- Gear box
- Suspension controller
- Electronic parking brake
- Body electronics
- Junction/fuse box
- Lighting control system
- Electric doors

Connectors

Molex

molex[®]
one company > a world of innovation

MX123™ Sealed Connector System

MX123™ is a fully sealed, high-performance connection system optimised for transportation powertrain applications in the most challenging underhood environments.



Features & Benefits

- Receptacle and header housings with six unique mechanical polarisation options and unique colour coding to prevent incorrect cross-mating of harnesses
- Wire dress available in two options: 0° and 180° orientation allows for wirerouting design flexibility
- Anti-scooping features suitable for blind-mate conditions
- Integrated TPA and CPA reduces assembly complexity
- Optional header terminal filtering eliminates cross talk between adjacent circuits

- PCB tail customisation: available with solder-tail or compliant-pin technology
- Lever retention lock on harness connector

Applications

- Powertrain
- Electronic control module

MX150™ Sealed Connector System

The fully-submersible MX150™ is a high-performance connector system. Offering a reduced package size and is ideal for SAE and ISO-style wire in single and dual-row configurations up to 22.0A.



Supporting both signal and power applications for on-engine automotive to off-road construction equipment applications.

Features & Benefits

- Reduced 3.50mm pitch housing design supports single-row configurations for 2 to 6 circuits and dual-row configuration for 4 to 12, 16 (hybrid) and 20 circuits
- Pre-assembled connector housing, seals, rear cover and TPA ship in one piece, allowing simplified assembly processes resulting in applied labour and cost savings

- System meets or exceeds USCAR-2 Class 3 requirements
- Audible and tactile clicks on insertion, extraction and mating facilitate reliable mating and terminal loading and removal

Applications

- Chassis and safety
- Interior
- Electronic control module
- Powertrain

MX150L™ Industrial Sealed Connector System

A pre-assembled, submersible system that exceeds IEC IP67 requirements, designed for commercial-vehicle, marine and other harsh environments.



Features & Benefits

- Rugged 2 to 16 circuit, sealed 5.84 and 7.62mm pitch supporting up to 40.0A per circuit
- Wire-to-wire, wire-to-panel-mount plugs and wire-to-board configurations
- Integral wire and interface seals provide sealing up to IP67
- Sealed panel-mount plugs are equipped with blind-hole boss feature which improves the sealing process during assembly

- Integral terminal position assurance (TPA) ensures that crimped terminal leads are properly locked into connector

Applications

- Chassis and safety
- Interior
- Electronic control module
- Powertrain

Connectors

Molex

molex
one company > a world of innovation

MXP120™ Sealed Connector System

The high-performance, compact MXP120™ Sealed Connector System is designed to perform in harsh environments and can replace common 1.50mm systems in space-constrained in-line harness applications.



Features & Benefits

- 4.00mm pitch connection system based on 1.20mm terminals
- Meets medium-power application requirements up to 13.0A
- Single wire seal (SWS) connection system with robust perimeter seal to withstand high-pressure spray environments
- Reduced package size when compared to existing 1.50mm connection system
- Accommodates wire gauges up to 1.00mm²; limits connector pitch to 4.00mm with SWS
- Compatible with AK or USCAR interface; designed using worldwide AK cavity definition

- Receptacles feature shrouds to ensure all circuit sizes and keying options are scoop proof
- Female receptacles with Independent Secondary Locking (ISL)
- Male blade connectors with Primary Lock Reinforcement (PLR)
- Female receptacles feature integral locking-latch with bridge protection and audible click

Applications

- Chassis and safety

MX64™ Sealed Connectors

MX64™ Single Row Female Connectors meet all USCAR footprint and testing requirements for 0.64mm pitch square pin connector systems.



Features & Benefits

- Circuit sizes 1-by-4, 1-by-5, 1-by-6 and 1-by-8 meet the USCAR
- Z02 optimised footprints. Up to 25% smaller in size as compared to the Z01 footprints
- Matte seal design eliminates secondary operation and costs associated with cable seals
- Available with or without CPA for added locking protection
- Accommodates 18-22 AWG wire and metric wires

- Four polarisation options available to protect against mis-mating

Applications

- Powertrain
- Electronic control module
- Chassis and safety

Mizu-P25™ Miniature Waterproof Connectors

Mizu-P25™ wire-to-wire connector system is the first miniature sealed system in the market to achieve IP67 certification, which provides superior levels of dustproof and waterproof protection along with space savings.



Features & Benefits

- 2, 3 and 4 circuit single row configuration
- Certified for IP67 rating for complete dustproof and waterproof protection
- Compact size achieves space savings for tight-packaging applications
- Positive locks for secure mating retention
- Spring-beam terminal design provides high pressure and small deflection for high-vibration applications

- Raised-body male terminal design provides polarisation to prevent mismating

Applications

- Chassis and safety
- Interior

Connectors

Molex

molex
one company > a world of innovation

Stac64™ Connector System

This stackable connection system provides single and multi-pocket PCB solutions.



Features & Benefits

- The header and female receptacle housings are moulded in standard USCAR colour schemes offering visual polarisation and aiding in connection system assembly
- Pre-assembled, linear Mylar PC tail alignment strip for right-angle headers reduces PCB packaging complexity and provides space savings
- Standard dovetail feature moulded into the modular housings allow headers to be ganged together in large assemblies
- PCB alignment posts ensure all terminals are properly aligned into PCB through-holes during assembly and help to retain

- header to PCB during assembly and solder processing
- PCB stand-offs are moulded into the housings, providing an additional trace-routing area under the headers
- High-temperature thermoplastic housings withstand infrared (IR) and wave lead-free solder processing per ES-40,000-5013 Molex specification, maximum temperature +260°C

Applications

- Chassis and safety
- Interior

Mini50™ Connector System

Achieve 50% space savings over traditional USCAR 0.64mm connectors with Molex's unsealed miniature Mini50™ single-row connection system.



Features & Benefits

- Provides the industry's only USCAR 050 approved interface
- Orientation features moulded into the header allow either vertical or right-angle orientations for wire-routing and module-design flexibility
- Board alignment and retention features simplify header PCB placement and retain header to PCB during soldering operation(s)
- High-temperature thermoplastic housings

- Female terminal wire grips for wires 0.35mm² and smaller
- Three polarisation options
- Independent secondary lock (ISL) terminal-retention
- CTX50 terminal wire grip design
- Connector position assurance (CPA) latch optional prevents accidental un-mating

Applications

- Interior

DuraClik™ Connector System

Molex's DuraClik™ connectors with provides superior electrical contact reliability, mating retention and space savings for high-vibration and high temperature applications.



Features & Benefits

- Available now in 2-15 circuits with both tin and gold plating options
- Inner positive-lock design prevents latch breakage from wire tangling
- Click sound when mated gives audible mating confirmation
- Independent Secondary Lock (ISL) terminal retainer
- Terminal Position Assurance (TPA) terminal retainer
- Enclosed contact design. Protects contact against dust and debris; avoids tangling during harness assembly

- Operating temperatures up to 125°C (ISL and TPA versions)

Applications

- Automotive applications
- Steering wheel wiper/blinker lever
- Shift lever
- Front/back headlights
- Electric bicycle

Connectors

Molex

molex
one company ▶ a world of innovation

MX150™ Unshrouded SMT Headers

MX150™ Unshrouded SMT Headers offer speedier and lower-cost PCB processing for a range of transportation vehicle applications.



Features & Benefits

- 3.50mm pitch unshrouded SMT headers
- High-temperature LCP housing. Withstands high reflow-temperatures (up to 260 degree Celsius) during soldering
- Wide current range (up to 16A) to suit both high and low-current applications
- Choice of 4, 6, 8, 12 and 20-circuit options for flexibility in design configurations

- Eliminates the need for separate male housing for reduced component cost and inventory
- Optional pick-and-place cap to facilitate easy auto-assembly

Applications

- Powertrain
- Comfort, infotainment and driver assist
- Body electronics
- Safety/chassis
- In-Vehicle networking commercial vehicle

MX150™ Unsealed Connector System

The MX150™ Unsealed Connector System for direct connect or in-line applications provides overall reduced package sizes compared to conventional 1.50mm connection systems.



Features & Benefits

- Designed with legacy MX150™ 1.50mm low-insertion-force terminal system
- Reduced package sizes versus USCAR 1.50mm counterparts; receptacles 52% smaller; male in-line connectors 28% smaller
- Integral locking-latch
- Integrated Terminal Position Assurance (TPA) lock moulded into receptacle housing
- Enlarged push surface with ergonomic design

- Custom clip-slots available
- Four polarisation options: black, natural, grey and dark grey
- Utilises existing MX150™ sealed connector field-service tools deployed at numerous harness makers

Applications

- Door locks
- Interior equipment manufacturers
- Interior lighting, consoles, vanity mirrors

Fakra II SMB Connector System

Molex's FAKRA II SMB product offering meets both American USCAR and German FAKRA automotive standards.



Features & Benefits

- Connector rotates 360° inside the plastic shroud
- Secondary plug locking latch
- Numerous keying options and colour codes
- Machined contact versions available
- Stamped-center contact versions available
- Cable-mount jacks and plugs
- Mates with original FAKRA PCB jacks and plugs

Applications

- Audio, navigation
- Infotainment
- Bluetooth
- GPS

Connectors

Molex

molex
one company > a world of innovation

HSAutoLink™ Interconnect System

The HSAutoLink™ Interconnect System is a rugged high-speed cable and connector technology using the automotive industry-standard interface known as USCAR-30.



Features & Benefits

- High speed in-vehicle data bus connector system
- Protocols supported include USB 2.0, LVDS and IEEE 1394
- Vertical and right angle PCB headers
- Rugged assemblies with positive latching and assembly guide rails provide a proven interface offering durability exceeding 5,000 cycles
- Full-length cable shielding provides superior signal performance and reduced EMI

- Multiple header keying options provide assurance of proper mating with side-by-side parts
- Pre-alignment and solder hold down posts for shield assembly and main housing body provide robust PCB mount retainment

Applications

- Telematics
- Interior

HSAutoLink™ II Interconnect System

The robust HSAutoLink™ II Interconnect System. Supports high-speed media protocols including USB 3.0, to meet increasing bandwidth requirements for advanced in-vehicle infotainment, telematics and camera devices.



System uses proven Molex LFH (Low Force Helix) terminal interface to promote high differential-signal bandwidth, extended cycle life and stable contact resistance.

Features & Benefits

- Flexible, expandable product family with data rates up to 5Gbps
- Available in 6 and 12 circuits
- Supports multiple protocols in the same connector (USB 2.0, USB 3.0, LVDS, Ethernet AVB, HDMI, DVI, DisplayPort* etc.)
- Shielded plugs and headers provide robustness and guarantee signal integrity

- System delivers high EMI protection
- System is rated to IP67 and IP69K for use in harsh environments and wet locations
- Compatible with shielded twisted-pair (STP) or jacketed unshielded twisted pair (JUTP) cable construction
- Cost-competitive solution for high-speed differential signalling applications

Applications

- Telematics
- Interior

In-Vehicle Media Modules

Access high-speed audio and video connections through an integrated end-to-end IO module solution for the automotive and non-automotive transportation markets.



The Modules enable state-of-the art in-vehicle audio and video capabilities such as PDAs, laptop computers, video displays, CD players, DVDs or video games.

Features & Benefits

- Flexible design capabilities: full I/O integration, passive and active PCB routing and mechanical enclosure design
- Modules enable the integration of multiple connection types such as HS

- Autolink™, USB, HDMI, 1394, ethernet, SD memory cards, Auxiliary jack inputs and more to meet end system requirements in either passive or active designs

Applications

- Telematics
- Interior

Connectors

Molex

molex
one company > a world of innovation

Brad® mPm® DIN Valve Connectors

The Molex range of field attachable DIN valve connectors provide unsurpassed sealing properties and increased performance.



Features & Benefits

- Ergonomic external-nut design provides greater and consistent torque for more uniform seal between connector and cable
- Achieves 20% greater cable-retention force over internal-nut designs for increased reliability
- IP67-rated when mated
- Each connector accommodates PG9, PG11 cable, up to 9.00mm outer diameter for a 'one size fits all' solution
- Standard circuitry options available include LED and bi-polar LED indicators, blocking diodes and voltage-dependent resistors (VDRs)
- Three packaging options to meet customer requirements, includes 'ready-to-use' un-mounted (disassembled) condition

Applications

- Garbage/refuse and cleaning trucks
- Construction vehicles
- On-vehicle crane and lifting equipment
- Mining machinery
- Farm machinery and tractors
- Forklift trucks
- Power supplies
- HVAC

NMEA 2000® Brad® Micro-Change® (M12) and Brad® Mini-Change® Cables and Connectors

NMEA 2000 (National Marine Electronics Association) cables and connectors are the industry standard for data communications among shipboard electronic devices.



Features & Benefits

- Vibration and water resist connectors ideal for harsh weather environments
- High strength cable crimp survives 35 to 50 pounds of pull-out force
- Epoxy sealed receptacle shells for positive reliability
- Ground circuit mates before other contacts

Applications

- Boats – dock-side charging
- Body electronic modules
- Marine engine controls and navigation equipment

Brad® Micro-Change® (M12) Connectors

Micro-Change® (M12) industry standard connectors are rugged, compact, sealed connectors designed to withstand harsh-industrial and weather environments.



Features & Benefits

- M12 design meets IEC specifications for industry-standard interface compatible with a wide array of sensors and switches
- Rated to 250V AC/DC, up to 4.0A connectors are ideal for Class 2 power and network circuit applications
- Gold over palladium/nickel plating design provides a longer lasting, high-performance electrical contact
- Anti-vibration feature prevents the coupler from loosening even under extreme vibration

- IP67, IP69K compliant waterproof sealed and able to withstand high-pressure wash down

Applications

- Sensors
- Agriculture and construction vehicles
- Commercial vehicles

Connectors

Molex

molex
one company > a world of innovation

Brad® M12 Power F-Coded Cordsets and Receptacles

Delivering four times the power of standard M12 connectors, 300V AC/DC and 16A, IP67-rated Brad® M12 Power F-Coded Connectors provide compact and robust blind-mating.



Features & Benefits

- F-Coding mating interface. Prevents mating with other M12 connectors being used for input, output, signal, or industrial network connections
- Robust blind-mate key design significantly reduces the chance of connectors being mis-mated
- Enhances finger safety by eliminating chance of electrical shock due to exposed pins
- Enhanced heat-dissipating design

- Will be added to IEC Standard 61076-2-111. Submitted for ANSI/EIA acceptance

Applications

Commercial Vehicle (CV)

- Telemetry modules
- Control system power
- On-board lighting power

Brad® Micro-Change® M12 Circular Hybrid Technology (CHT) Connector and Cordsets

The IP67-sealed M12 Circular Hybrid Technology (CHT) connector system



Features & Benefits

- Shielded, twisted-pair cable for Cat5e data performance (patent pending)
- Fully shielded Cat5e, 4-pin array with a wrap-around metal tube shielding
- Cat5e data lines and power lines carrying 6.0A (4+4) or 12.0A (4+2), in one connector
- Cordsets feature M12 overmolded male-to-male
- CHT cable connectors
- Nickel-plated brass cordset coupling nuts and receptacle shells

Applications

Vision systems and surveillance

Transportation

- Railways
- Subways
- Docks/marinas
- Camera systems
- Telematics
- In-vehicle data systems

Brad® Ultra-Lock® Connector System

The Brad® Ultra-Lock® connection system M12 connectors incorporate a mechanical, push-to-lock design and a unique radial-seal that deliver unsurpassed performance with simple and secure operator-independent connections.



Features & Benefits

- Positive-lock, push-to-lock technology for simple, fast and reliable operator-independent connections
- Radial O-ring provides superior protection against water-ingress
- Connections rated to IP67/IP69K – Receptacles accept Ultra-Lock or standard M12 threaded cordsets

- Rated to 250V AC/DC, up to 4.0A
- Ideal for Class 2 power and network circuit applications

Applications

- Sensors
- Material handling equipment
- Commercial vehicle

Connectors

Molex

molex
one company > a world of innovation

Automotive Bulb Sockets

Molex's unparalleled selection of innovative Bulb Socket solutions matches the needs of vehicle makers around the world for safety, performance, variety and robust features.



Features & Benefits

- Bulb is easily "wedged" into housing
- Available in sealed and unsealed versions
- Wide variety of keying and colour options
- Compliant with major automotive specifications
- Separate stainless steel holder assembled with bulb socket
- Durable high-temperature material
- Meets industry standards
- Provides simple one-step assembly
- Meets various customer needs
- Provides design flexibility for combination lamps
- Meets industry-standard requirements
- Provides stable insertion and extraction force
- Withstands high vibration and prevents lamp fogging

Applications

Transportation

- Front indicator
- Brake light
- Reversing light
- Rear fog light
- Rear indicator
- Tail light
- Side indicator
- Parking/marker light

Wedge Bulb Sockets

Features & Benefits

- For W5W, W16W bulbs. Meets industry standards
- Bulb is easily "wedged" into socket. Offers simple one step assembly
- Contact pins positioned onto socket base provides component cost saving versus versions that require bulb base mount
- Short housing option available. Ideal for space constraint requirements
- Silicon seal gasket. Meets industry sealing class requirements (USCAR-155.7 Specification) for high reliability in harsh environments
- Available in single filament with 2 watt options (5W or 16W). Meets various customer needs

S8 Bulb Sockets

Features & Benefits

- For P27W/7W bulbs
- One-piece housing design
- Two different wire seal sizes
- Meets industry sealing class requirements (USCAR -15 5.7 Specification) for high reliability in harsh environments

WT21 Bulb Sockets

Features & Benefits

- For WTY21W, WT21W, WTY21W/7W, WT21W/7W, WTY28/7W
- Each socket has its own type of bulb
- Provides additional keying feature to avoid mis-mating

T20 Bulb Sockets

Features & Benefits

- For W21W and WY21W bulbs

PT Bulb Sockets

Features & Benefits

- For P21W, PY21W, P21/5W, P21/4W bulbs in single and double filament styles meets industry standards and various customer needs
- Push and turn mating style provides easy insertion and secure locking

Connectors

Phoenix Contact



Phoenix Contact offers a reliable product and technology portfolio for E-Mobility that enables you to implement various concepts for your charging infrastructure. The new design line of AC vehicle connectors from Phoenix Contact has been developed in accordance the requirements of the automotive industry. Just as the tried-and-tested handle design line, the new AC vehicle connectors rely on robust and high-quality materials as well as on a uniform plug design.

AC Vehicle Connector Type 2



Features & Benefits

- 5 + 2 poles for 3-phase charging
- Rated voltage up to 480V AC
- Robust, high-quality materials
- Strong strain relief
- Low insertion and withdrawal forces
- Complies with IEC 62196

AC Vehicle Connector Type 1



Features & Benefits

- 3 + 2 poles for 1-phase charging
- Rated voltage up to 250V
- Complies with IEC 62196-2 and SAE J1772
- Locking and unlocking by means of a lever system
- Lockable lever system
- Robust, high-quality materials
- Strong strain relief

AC Charging System GB/T Standard



Features & Benefits

- 5 + 2 poles for 3-phase charging
- Rated voltage up to 440V AC
- Locking and unlocking by means of a lever system
- Lockable lever system
- Robust, high-quality materials
- Strong strain relief
- Low insertion and withdrawal forces
- According to the GB/T standard

Connectors

PKC

PKC GROUP 

Modular Block

The PKC Modular Block family is comprised of individual fuse and relay modules that can be assembled into an infinite selection of customised configurations to meet packaging and power distribution requirements of our customers.



Offering the flexibility of a customised product without the tooling investment, the PKC Modular Block family includes over 200 off the shelf components, including: fuse and relay modules, spacers, brackets, top and bottom covers, and environmental enclosures.

Features & Benefits

- Off the shelf availability
- No tooling cost for standard modules
- Numerous attachment options
- Resistance to most chemical fluids
- Standard electrical, mechanical, and environmental specification validation
- Incorporation of recycling symbol
- Use of high grade resin for Class 3 temperature tolerance
- Optional environmental enclosure for extreme applications
- Custom design option, including surface markings and graphics
- Option for snap-on bracket or screw attachment to vehicle
- Infinite packaging configurations

Specifications

Electrical

- 135% load with no flow or fusing
- Dielectric materials able to withstand 300Vac, 60Hz

Mechanical

- Terminal retention of more than 25lb
- Vibration in 3 planes for 8 hours at 5Hz to 50Hz
- Bottom cover retention that exceeds 50lb
- Top cover retention exceeds 50lb
- Crush test at 100lb
- Drop test at 1.0meter
- Wedge insertion 25lb maximum

Environmental

- Temperature range of -40°C to 135°C
- Operational humidity to 97% RH at 40°C
- Salt spray per ASTM B117
- Dust chamber for 5 hours
- Label retention
- Tested to withstand the following liquids: fuel, kerosene, brake fluid, steering fluid, lubricating oil, battery acid, and anti-freeze

Applications

- Commercial vehicle
- Automotive
- Agricultural
- Construction
- Recreational
- Marine

Ring Terminals

PKC ring terminals are designed with a core conductor grip and depending on the usage, a wire insulation grip.



The applicable wire gauges listed are for the core conductor gauge when using standard or thin-wall insulation.

Features & Benefits

- Multiple configurations
- Simple, robust, field-proven designs
- Validated to the latest OEM and USCAR test standards
- Customised design solutions available for unique customer applications

Applications

- Commercial vehicle
- Automotive
- Agricultural
- Construction
- Recreational
- Industrial

Connectors

PKC

PKC GROUP 

Modular Power Distribution Centre

The PKC modular power distribution centre (mPDC) product series is comprised of existing subcomponents that can be assembled into an infinite number of customised combinations to satisfy the unique requirements of our customers.



PKC's mPDC series also incorporates a printed circuit board (PCB) to route power and signals within the device, enabling the optimisation of the vehicle's electrical architecture.

Features & Benefits

- Availability of infinite combinations of customised assemblies due to modular design
- Multiple selection of component plate designs to support a variety of serviceable content
- Wiring harness efficiencies due to power and ground bussing enabled by PCB incorporation
- Mylar label to reference serviceable device description and location
- Extruded aluminium side rails cut to length per application
- Hybrid 46-way mating connector developed to utilise a pass-through fork terminal
- Application-specific mounting brackets to meet unique packaging requirements
- Operating temperature range of -40°C to 125°C
- Application-specific components developed as needed

Specifications

The mPDC is validated to the following industry specifications:

- IEC 60068, Environmental Testing
- IEC 60529, Degrees of Protection Provided by Enclosures
- SAE/USCAR 2, Performance Specification for Electrical Connection Systems
- ASTM B117, Salt Spray (Fog)

Owing to some customised features the suggested minimum order will be 10,000 units.

Applications

- Commercial vehicle
- Automotive
- Agricultural
- Construction

Smiths Connectors

smiths connectors

HBB Series – Circular High Power

The Smiths Connectors HBB Series is an IP67 rugged metal circular connector that combines high current handling capability with small size and exceptional performance in harsh environments.



Designed for easy mating and quick release, HBB connectors use Hypertac's hyperboloid contact technology to attain current ratings of 300A and 500A (750A available on request) with high reliability and excellent electrical integrity.

Features & Benefits

- Cable and panel mount variants
- Robust aluminium metal shell fully sealed to IP67 and featuring 360° EMI/RFI shielding
- Minimal contact resistance of ~ 0.05mΩ
- Single pole connector
- Quick release latching mechanism for fool proof mating
- Gender reversible and polarised design
- Finger proof IP2X

- Gold contacts surfaces eliminate tarnishing at the contact interface providing consistent resistance and eliminating failures
- Reduced duty maintenance cycle and increased MTFB

Applications

- Converters
- Power/battery supply

Connectors

Smiths Connectors

smiths connectors

M12 Series – Circular Metal

The Smiths Connectors M12 series is an IP67 circular connector specifically developed for applications where space and weight are at a premium. The innovative and user-friendly design incorporates hyperboloid contacts to provide stable electrical performance with up to 500 connector mating cycles and $<7\text{m}\Omega$ resistance.



Features & Benefits

- Insert options from 3 to 8 ways, with both crimp and solder contact terminations
- Robust and compact design allows for up to 10% space saving
- 360° electromagnetic shielding minimises transfer impedance
- Sideway clip insulator design provides a positive contact retention and simplifies cable assembly
- Unique rotating back shell on 90° version, from 0° to 330°
- Over-moulded and free assembled plugs, receptacles and panel mount versions allow flexibility to customers and components optimisation to reduce stocking requirements
- Compliant with gigabit internet network on-board

- RoHS compliant
- Designed according to DIN EN 61076
- Fire and smoke compliant with EN 45545 and UL94 V0/HB standards

Applications

- Passenger information
- Video surveillance
- Electronic displays
- Ethernet networks
- Control/command
- Signalling equipment

REP Series – Rectangular Plastic

The Smiths Connectors REP Series is a multi-pole IP67 sealed rectangular plastic connector.



The Smiths Connectors REP Series is a multi-pole IP66/67 sealed rectangular plastic connector which enables a quick and secure connection of any type of embedded equipment in a wide range of rail applications.

Features & Benefits

- Standard insulators: 2, 6 and 12 ways equipped with Hyperboloid contact technology
- PCB receptacle with straight or bent contact termination
- High performance and reliability: resistance to shock according to EN 61-373 cat.2, NF F 61-030 and EN 50467 standards
- Up to 500 mating cycles and high current rating up to 18A
- Safe solution: finger proof IP2- plug, supporting high withstanding voltage up to 2725V
- Fire and smoke compliant to EN 45545 and UL94 V0 standards

- Cost saving solution: one contact only for different cross section cable from 0.5mm² to 2.5mm² offering reduction of supply chain costs
- Easy cabling with integrated back shell

Applications

- Sensors
- Brakes
- Signalling
- Alarms
- Doors
- Lighting
- Air conditioning
- Seats
- Passenger information
- Driver cabin

Connectors

Smiths Connectors

smiths connectors

Hypermod Series – Heavy Duty Rectangular

The Smiths Connectors Hypermod Series is a heavy duty modular rectangular connector designed for high speed signal interconnections in railway applications.



Features & Benefits

- Available in both modular and monobloc frame version
- Mixed signal, power, coaxial, high speed and fiber optics contacts
- IP66 and IP67 rugged aluminium shell
- Several housing and hoods, single or double locking systems
- Conforms to DIN 43652 standards and NF F61-030 railways approved
- High shock and vibration proof: EMI and RFI protection

- High reliability solution with Hypertac's Hyperboloid contact technology

Applications

- Control boards
- HVAC
- Converters
- Intercoach

F Series – Inter-Car Connection System

The Smiths Connectors F Series is rectangular modular coupler designed to secure signal transmission in critical area located between coaches of all types of rail vehicles, from high speed trains to metros and trams.



Features & Benefits

- Mixed signal, power, data and fiber optic contacts
- IP68 heavy duty aluminium shell
- Fully cabled solution
- Mating safety by guiding and coding pins
- Easy maintenance with removable and interchangeable modules
- Qualified by the rail industry, according to SNCF NF F 61-030 Standards

- Anchoring cable glands: ensure high level of mechanical endurance, up to 1 million swaying cycles
- 3 different shell sizes (FH, FG and mini-FG series)

Applications

- Inter vehicle connection

Transformer Series – High Power Modular

The Smiths Connectors Transformer Series is a comprehensive series of high density, modular connectors for all on-board power applications within the rail market.



This modularity enables customers to design their own solution by supplying the elementary components of the whole connector. It employs a unique do-it-yourself system based on the building block principle. With the Transformer range multiple configurations are possible by using the same piece parts. It allows for cost savings in working capital with local customer assembly and offers the flexibility to integrate local content for components and cabling.

Features & Benefits

- Multi-pole connector (1 to 4 ways)
- High reliable contact technologies
- Current ratings up to 700A
- High voltage up to 3600V, at the highest pollution degree according to EN 50124

- Wide cross section cables supported, from 25mm² to 240mm²
- Easy assembly with no special tooling
- High durability: more than 500 mating/unmating cycles
- Compliant with the main railway standards: NF F 61-030, EN 50647, EN 60373, EN 45545
- High level of mechanical endurance, tested up to 1 million swaying cycles

Applications

- Intercoach
- Bogies
- Power distribution
- Power/battery supply
- Rail traction systems and motors

Connectors

TE Connectivity



Automotive

AMP Power Series Connectors

AMP Power Series connectors provide a durable, quick connect/disconnect means to transmit “power” levels of current and voltage (15-275A, 600V AC/DC).



This product family is primarily comprised of single-pole and 2-pole (battery) connector housings, snap-in contacts and accessories. Housings are offered in various colours. Two pole housings have different polarisation configurations. The different colours identify a different keying configuration and only like colour housings will mate. This feature can be used to help identify different voltage ratings. Contacts are either cold-headed or stamped and formed, depending upon the connector series. AMP Power Series connectors are divided into eight series, based upon approximate current-carrying capability.

Features & Benefits

- Single-pole and 2-pole (battery) quick connect/disconnect connectors
- 8 series based upon approximate current carrying capability: 15A to 275A rated
- Voltage rating: 600V AC/DC
- Hermaphroditic (genderless) housings and contacts reduce inventory

- Modular, single-pole housings are stackable in four directions
- Polarity (+ and -) moulded into 2-pole housings promotes proper wiring
- Mechanical keys help prevent two different colour housings from mating together
- Stamped and formed, open barrel contacts (6AWG – 20AWG) on reels for automatic and semi-automatic termination
- Loose piece, cold-headed contacts (6AWG – 300MCM) for manual termination
- Printed circuit board (pcb) contacts available in the 15/30/45A series

Applications

- AC/DC power supplies and charging systems
- Rechargeable batteries
- Material handling equipment (i.e. forklifts)
- Electric vehicle (i.e. golf carts and sweepers)
- Industrial equipment

AMP MCP Connectors and Contacts

The AMP MCP connectors and contacts are designed for electronic and electrical applications in motor vehicle, including long term use in high vibration, high current and high ambient temperature applications.



Features & Benefits

- CuNiSi with high current capacity
- 3 contact points (1.5mm), 4 contact points (2.8mm/6.3mm), 6 contact points (9.5mm)
- High reliability connector system for long term use
- Integrated secondary locking device delivered in pre-locked position
- Polarisation, several keying options

Applications

- Wire-to-wire
- ECU applications

Connectors

TE Connectivity



AMP SUPERSEAL 1.5mm Connectors

AMP SUPERSEAL 1.5mm connectors are suitable for harsh environments in motor vehicle applications due to its sealing capability.



The connectors are suitable for industry specifications IEC 60529 and DIN 40050-9 I.P 6.7.

Features & Benefits

- Compact system minimises packaging requirements
- Sealing reliability proven under harsh conditions

- Designed for ease of manual harness assembly, engine mounting and under hood environments

Applications

- Wire-to-wire
- ECU applications

AMP Timer Connectors and Contacts

AMP Timer connectors and contacts are extensively used in the automotive and commercial vehicle and occasionally in the appliance industry.



Contact types come in various sealed, unsealed, crimp and IDC versions for wire-to-wire, wire-to-board and wire-to-device applications. Geometry of contacts allows housings to be mated in a pivoting hinged manner. Larger pin count connectors can be mated with reduced force through sequential connection.

Features & Benefits

- Available as receptacle and tab housings or as receptacle housings and multiple tabs
- Receptacle has two or four contact springs

Applications

- Motor vehicle applications
- Underhood and interior applications

Econoseal Connector Series

The Econoseal connector series is used in extreme vehicle conditions where waterproof protection and resistance to moisture, dust and corrosive gasses is needed.



Features & Benefits

- Waterproof
- Rugged construction

Applications

- Wiring of sensors in the interior or motor hoods
- Connections to electrical control systems under extreme temperature conditions

Connectors

TE Connectivity



FASTON Terminals and Splices

FASTON products consist of receptacles, tabs, splices and housings designed for quick connections in motor vehicle applications.



Features & Benefits

- Straight, right-angle and receptacle tab combinations available
- Receptacles available for 6.3mm, 4.8mm and 2.8mm tab size
- Receptacles mate with 0.5mm and 0.8mm thick tabs
- Expanded line of low insertion force receptacles eases assembly
- Housings insulate, withstand high temperatures and improve ergonomics

Applications

- Used for single and multiple connections
- Offers speed of application, uniform reliability and low per line cost
- Automotive applications

Flat Contact Systems

TE's flat contact systems (2.8mm/6.3mm) offer a comprehensive range of products used in motor vehicle applications. The 2.8mm/6.3mm contact systems mate with a variety of receptacle contacts.



Features & Benefits

- Tabs mate with a variety of receptacle contacts
- Tabs can also be applied in both watertight and non-watertight connectors

Applications

- Motor vehicle applications

MQS Connectors

MQS connectors offer one of the most compact connector packages, robust construction and high functional requirements.



Features & Benefits

- High packing density
- Waterproof
- Compact design

Applications

- Electronic and electrical applications
- High vibration and mechanical stress areas

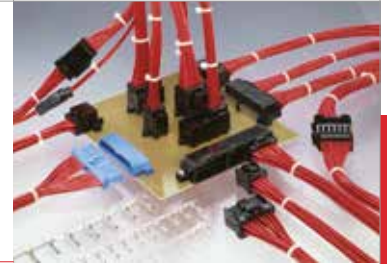
Connectors

TE Connectivity



MULTILOCK Connectors

MULTILOCK connectors are available in .040 (Standard), .040 (Mark II), .070 (Mark I and II), .025 (0.64mm) Series and .040/.070 (Series Hybrid I/O) for use in multiple motor vehicle applications.



Features & Benefits

.040 (Standard):

- Contacts spaced at 2.5mm centerline
- Connectors consist of plug housing
- Receptacle contacts and cap housing assemblies

.040 (Mark II):

- Contacts are spaced at 2.5mm centerline
- Plug housings with two piece double lock plates

.070 (Mark I and II):

- Designed as high density and reliability due to housing lances
- Mark I plug connectors with double-lock plates
- Mark II plug connectors with tow piece type double lock mechanism

.025 (0.64mm) Series:

- High density connectors
- Designed to resist deformation of contacts by scooping at mating/unmating
- Hybrid types of .025, .040 and .090

.040/.070 (Series Hybrid I/O):

- Connectors for use with a mixture of .040 terminals for signal circuits and .070 terminals for power circuits
- Plug connector supplied with hinge lock or side lock
- High range of pin count variants

Applications

.040 (Standard); .040 (Mark II); .070 (Mark I and II):

- Wire-to-wire
- Wire-to-board applications

.025 (0.64mm) Series:

- Engine Control Unit (ECU) and downsized wire harnesses

.040/.070 (Series Hybrid I/O):

- Engine Control Unit (ECU)

Commercial Vehicles

HP/HPSL Sealed Connectors

The family 2 and 3 position high performance (HP) connectors and high performance spring lock (HPSL) have been developed to meet severe OEM's requirements, especially in condition of extreme vibration.



The connectors can be used in the body car, with wire to wire applications as well as in the engine area on sensors or actuators. The HP family offers solutions to customer for electronic and electrical applications which require a high level of performance:

- Watertightness (IPX9K and 500mb immersion, with an included family seal)
- Temperature (150°C)
- Resistance to extreme vibrations conditions(40G, with TE Connectivity's Sensor Flat Contact 2 terminal)

The housing design is based on the 1.5 x 0.8mm receptacle and tab terminals in the centerline 3.33mm. A positive mate (Go-Nogo) locking feature is integrated in the housing and is improved with a spring system in the HPSL version.

Features & Benefits

- Wire to wire applications or wire to sensors/actuators
- Spring lock version available (HPSL)
- Optional CPA for HP version
- Positive locking device
- Primary and secondary (integrated TPA) receptacle lock
- Covers compatible
- Full shroud (seal is protected all around the connector)
- High vibration level

Applications

- Engine or body car harness

Connectors

TE Connectivity



AMPSEAL Headers

AMPSEAL connectors provide rugged reliability and environmental sealing. They are available in cable plugs and PCB mount headers that are designed to stand up to high-temperature underhood applications.



The pre-assembled receptacle housing connector features built-in contact sealing and an integral interfacial seal that protects mated connectors.

AMPSEAL connectors provide rugged reliability and environmental sealing. They are available in cable plugs and PCB mount headers that are designed to stand up to high-temperature underhood applications.

The pre-assembled receptacle housing connector features built-in contact sealing and an integral interfacial seal that protects mated connectors.

Features & Benefits

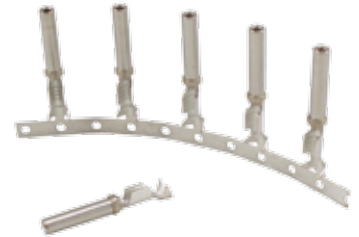
- Accepts contact size 1.3mm (up to 17 amps gold, up to 8 amps tin)
- 16-20 AWG (1.25-0.50mm²)
- 8, 14, 23, and 35 cavity arrangements
- PCB mount
- Rectangular, thermoplastic housing
- Product specification documents: 108-1329 and 114-16016

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine
- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

AMPSEAL 16 Terminals

AMPSEAL 16 connectors commonly use the HDSF size 16 contact system. The contacts are round, stamped and formed contacts with dual beam sockets.



Features & Benefits

- Accepts contact size HDSF 16 (up to 13 amps)

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine

- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

AMPSEAL 16 Wire-to-Wire Connectors

The AMPSEAL 16 connector system is targeted for off-road, heavy duty industrial, recreational and agricultural applications.



This wire-to-wire and wire-to-device connector line was designed to meet the rigorous demands of an industry that requires the highest standards in performance. AMPSEAL 16 receptacle and pin housings offer a one-piece approach and come fully assembled.

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine

- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

Connectors

TE Connectivity



HDSCS Connectors

The heavy duty sealed connector series (HDSCS) is designed for high vibration and extreme temperature and with inflammable materials in motor vehicle applications.



The Heavy Duty Sealed Connector Series (HDSCS) offers several cavity arrangements and mixed wire sizes. The rugged, thermoplastic connectors have a secondary lock with poke-yoke feature and can be used for in-line or flange mount applications. HDSCS connectors are available in five housing sizes and four keying options.

- In-line or flange mount
- Rectangular, thermoplastic housing
- Slide lock for mating
- Integrated secondary lock confirms contact alignment and retention
- Product specification documents: 108-94020 and 114-18756

Features & Benefits

- Accepts contact sizes 6.3 (up to 40 amps), 2.8 (up to 40 amps), and 1.5K (up to 20 amps)
- 6.00-0.20mm²
- 2, 3, 4, 6, 7, 8, 10, 12, 15, 16, and 18 cavity arrangements

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine
- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

LEAVYSEAL Headers

The LEAVYSEAL connectors have been developed to meet the tough requirements of the truck industry.



This fully sealed series combines the advantages of proven AMP MCP terminals with a robust design and easy mating of multi-position connectors.

This fully sealed series combines the advantages of proven AMP MCP terminals with a robust design and easy mating of multi position connectors. It gives a choice of 7 groups, 15 to 120 positions with terminals of 3 different sizes. The lever-slide mechanism reduces the force required to close the system. Due to high vibration resistance, perfect temperature behaviour and the size, LEAVYSEAL connectors are the product of choice for major commercial vehicles ECU manufacturers.

Features & Benefits

- High vibration level supported
- Integrated secondary locking device delivered in pre-locked position
- Polarisation, several keyings
- Lever-slide mechanism
- Easy handling
- Mixed terminal sizes in one housing

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine
- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

Connectors

TE Connectivity



LEAVYSEAL Connectors

LEAVYSEAL multi-position connectors, based on AMP MCP terminals, have proven themselves in truck applications where they withstand vibration and temperature exposure.



The rugged LEAVYSEAL connectors are multi-pin and accept multiple wire sizes. LEAVYSEAL products utilise a lever lock system for mating and are available in several mounting styles and keying options. The housings come in six sizes and feature an integrated cable attachment.

Features & Benefits

- Accepts contact sizes 6.3 (up to 40 amps), 2.8 (up to 40 amps), and 1.5K (up to 20 amps)
- 6.00-0.20mm²
- 15, 18, 21, 22, 26, 29, 31, 39, 46, 62, and 92 cavity arrangements
- In-line, flange, or PCB mount

- Rectangular, thermoplastic housing
- Lever for mating
- Integrated secondary lock confirms contact alignment and retention
- Product specification documents: 108-18696 and 114-18376

Applications

- Agriculture
- Construction
- Emergency vehicles
- Forestry
- Marine
- Material handling/lifts
- Military
- Mining
- Off-highway
- Recreation
- Truck/bus

Rail – Connectors

NGC - Compact Plastic Wire-to-Wire Connectors

Compact plastic connector compliant with railway standards.



The NGC Series is a compact and cost effective solution for all non-secure connections for wire to wire applications. From 4 to 28 poles, it will answer your fast connection needs with high level protection (IP66) and up to 500 volts (EN 50124-1/A2) applications. NGC offers cable capacity of up to 2.85mm² for AWG16 contacts.

Features & Benefits

- Compact and cost-effective solutions
- High level of performance
- Halogen free
- Field-proven

Applications

- Train control
- PIS and safety
- Sub systems

Connectors

TE Connectivity



Heavy Duty Connectors

TE's Heavy Duty Connectors offer high-reliability performance in rugged and industrial environments with a variety of inserts, contacts, hoods and housings that offer customers options for wire termination, mounting, cable exit, latching and environmental protection.



The modular HMN range enables engineers to quickly design and prototype application specific connectors, utilising more than 25 different module types for maximum flexibility and reliability with minimum installation or maintenance effort.

Features & Benefits

Housings

- Thermoplastic, aluminium and zinc die cast alloy
- Protection class: IP20 – IP69K
- Locking systems
 - Locking clip
 - Screw locking
- Powder coated surface-corrosion resistant hard coating

Contact Inserts

- Thermoplastic, glass-fiber reinforced according to UL 94 V-0
- Rated current: up to 200A
- Rated voltage: up to 1000V
- Types of wire connections
 - Screw terminal
 - Spring clamp terminal
 - Crimp terminal

- Contact material
 - Copper alloy
- Contact surfaces
 - Silver-plated
 - Gold-plated
- UL, CSA, VDE approved

Applications

- Industrial
 - Production equipment
 - Material handling
 - Forklifts
 - Robots
 - Motors
 - Control cabinets
 - Monitoring (HMI)
- Rail
- Renewable energies

EKO Series

Composite and shielded connectors for power application.



EKO Series is dedicated for all main rolling stock power systems applications, and specially designed for harsh environment applications.

Field Proven Solution from metros to very high speed trains, EKO Composite Series is designed in accordance with EN 50467 (2012) and NFF 61030 standards.

It will answer to all of your static applications for inline or panel connections. The EKO solution ranges from 1 to 4 poles and up to 240mm² cable size for 3000 volt applications.

The EKO family is completed by EKO S (shielded and high resistance for mechanical constraints), EKO D (derivation) and EKO A (inter-vehicle).

Features & Benefits

- Compact and weight saving
- Straight and 90 degree connection
- Shielded and unshielded version
- 3 or 4 pole configurations
- Cable from 10 to 240mm²
- Halogen-free
- Field proven

Applications:

- Traction power
- Inter-vehicle connection

Connectors

TE Connectivity



SRC Series

The SRC Series is the solution for signal static connectivity with flexible modular designs, various shell sizes with a bayonet locking system.



SRC connector is derived from MIL-DTL-5015 Standard and adapted to be compliant with NFF 61030 railway standard with hard thermoplastic insert which is self-extinguishing and halogen free.

Adapted for outdoor applications in panel versions, it offers a choice up to 9 size shells, 11 arrangements and many angled or straight backshells for integrating in different configurations of cables for cable sizes from 0.5mm² to 6mm². SRC provides also a choice of removable and interchangeable inserts (plug and receptacle can be male or female).

Features & Benefits

- Quick positive lock system
- NF F 61-030 standard compliant
- Broad range of accessories
- Field-proven
- From 6 to 60 crimp contacts over 9 shells and 11 configurations
- Connector design based on MIL-DTL-5015 and VG95234 specifications

Applications

- Train control
- Passenger information and safety
- Train sub-systems (e.g. doors, train control, air conditioning)

UIC552 Series

The UIC552 Series is a railway standard power connector used for international service.



The UIC552 Series is long field proven solution for junction and derivation box, jumpers and dummy plugs for applications where the UIC 552 standard is requested.

The UIC552 connectors have to assure the power supply between locomotives and all coaches for trains able to do international trips.

Features & Benefits

- Compliant to UIC552 standard
- Rail networks approved
- Low maintenance costs
- Field proven
- Full UIC package available ICT DIN Connectors

Applications

- Inter-vehicle connection

Connectors

TE Connectivity



Circular Plastic Connectors

TE's Circular Plastic Connectors (CPC) can be used practically anywhere signal and/or power need to enter/exit a system.



These come in a versatile range of power and signal options. Versatile and rugged, cost effective design. CPC comes in six different series to allow you to choose the product best suited to your design requirements. Mounting options include panel mount, free-hanging and wire-to-board. The receptacle and plug housings accept Type III+ or Size 20 signal contacts, Type XII power contacts or AMP POWERBAND contacts. The housings come in configurations designed to handle signal, power or combinations of signal and power in the same housing. Sealing to IP67 is also available.

Features & Benefits

- Lightweight, all-plastic and metal-shell connectors
- UL 94V-0 rated and made of stabilised, heat resistant, self-extinguishing thermoplastic material
- Quick connect/disconnect capability with thread assist, positive detent coupling
- Built-in pin and socket protection
- Polarised for proper mating of connector halves
- Removable contacts and replaceable coupling ring make field repair easy HDSCS - Connectors

Applications

- Industrial machinery, factory automation, material handling equipment
- Rail and transit vehicles and systems
- Medical instrumentation and equipment
- Communication equipment, networking, data storage, computers and peripherals
- HVAC, commercial and building equipment
- Lighting and signage
- Motor vehicles - auto/bus/truck, off-road and recreational vehicles, agricultural machinery, construction equipment
- Aerospace and defence equipment and systems

M12 Rail Cable Connectors

The newly expanded M12 connector system, designed for railway (EN45545) and automation industry applications.



M12 Cable Connectors for field assembly provides a solution that safely and reliably helps ensure communication in harsh environments. Our crimp flange technology and machined crimp contacts providing 360° EMI/RFI shielding, torsion and vibration proof cable strain relief.

Features & Benefits

- Reduced installation times when compared with gland sealed connectors
- Reduced service time and cost with easier access to thread grip

Applications

- CCTV
- Door controls
- Passenger information systems
- Inverter/converter control
- Train management
- Wayside control

Connectors

TE Connectivity



Rail – Cables

100G Series Light Power and Instrumentation Wire



Features & Benefits

- Small size, lightweight
- Zero-halogen
- 19/37/56 strand conductors depending on size
- Excellent handling and flexibility
- Outstanding resistance to oils
- Excellent scrape abrasion and cut through
- Voltage rating: 750V
- Conductor cores 0.15mm² to 4.0mm²
- Temperature rating: -30°C – 125°C
- Flexible (does not wrinkle on bending)
- Dual wall construction (notch and abrasion resistant)

ZHPCG Power Cable



Features & Benefits

- Radiation cross-linked insulation system
- Zero-halogen
- Low smoke
- Flame retardant
- Fluid resistant jacket
- Excellent handling and flexibility
- Full range of sizes 1.5mm² – 240mm²
- Available in IEC 60228 Class 5 and 6 conductor stranding
- Tin plated copper conductors
- Temperature rating: -30°C – 105°C

Railway Cables Multicore



Features & Benefits

- Small size, lightweight
- Limited fire hazard
- Custom designed to application requirements
- Greater flexibility in the choice of routings
- Mixed sizes, component types and functionality
- Excellent handling and flexibility
- Optional shielding internal and external
- Segregation of cabling
- Easy to install and maintain
- Wide range of temperatures
- Wide range of jacket materials to suit application requirements

Connectors

TE Connectivity



Rail Cat 7 Data Cables



Rail approved zero halogen, high speed data cables. TE Connectivity introduces the new high performance, networking cables for railway ethernet applications. The new cable reads rates of 1Gbps, expanding design capabilities into broader bandwidth Ethernet applications.

Features & Benefits

- Obtain data rates of 1Gbps
- Expand design capabilities for broader bandwidth
- Ethernet connections with increased speed
- Stranded conductors for flexible cable application use

- Zero Halogen jacket
- High performance rail approved to EN45545-2

Applications

- Railway CCTV/passenger information
- Trackside control cabinets
- Entertainment systems
- Industrial switches, routers, servers, hubs
- Sensor systems
- Video link

Industrial Rail Low Fire Hazard Wire 100E Wire and Cable



To complement its existing 100G product line TE is launching 100E 300 volt signal wire. This rail-approved wire and cable is fully compliant to all of the clauses specified in EN50306-2, EN50306-3, EN50306-4. The wire meets all of the thin walled EN rail approvals, and is suitable for all new rail builds within the EU.

Features & Benefits

- Lightweight, thin walled leading to reduce bundle volume and weight
- Approximately 30% lighter than conventional thick walled wire, giving significant energy savings to the end user

- Approximately 50% saving in bulk of wire giving more room for the train designer, builder and passengers
- Compliant to EN50306-2,-3,-4 thin wall rail standard, meaning it is suitable to be used in passengers

Applications

- Rail market rolling stock
- Underground metro tunnels
- All signal and power applications for rolling stock and tunnels

Connectors

TE Connectivity



Cable ID/Labels

TMS-SCE Military Grade Heat-shrinkable Wire Identification Sleeves

TMS-SCE marker sleeves are designed to meet the wire and cable marking needs of manufacturers with high performance requirements.



Made from durable, flame retardant, radiation cross linked heat-shrinkable polyolefin, TMS-SCE can be used in a wide variety of applications including aerospace, military, motor sports and oil & gas. TMS-SCE meets the performance requirements of SAE-ASM-DTL-23053/5 class 1. The marks are permanent immediately after printing and remain legible even when exposed to abrasion, aggressive cleaning solvents, and military fuels and oils. TMS-SCE meets the mark permanence requirements of SAE AS81531 4.6.2 and MIL-STD-202. TMS-SCE is supplied with a 3:1 shrink ratio. The lightweight 3:1 products provide extremely fast shrinking and cover a wider range of wire diameters, thus simplifying inventory

- Military specification material and print performance
- 2:1 shrink ratio
- CSA certified
- UL recognised
- VW all flame tubing test rated
- Quick for heat sensitive areas

Applications

- Rail
- Military
- Aerospace
- Marine

Features & Benefits

- Permanent identification sleeves
- Computer-printable
- Lightweight for aerospace applications

ZHD-SCE Heat-shrinkable Wire Identification Sleeves

ZHD-SCE Low Fire Hazard, fluid resistant heat shrinkable wire identification sleeves.



ZHD-SCE is designed specifically for applications requiring the highest performance from an identification sleeve, without compromising on safety or capability. ZHD is designed to bridge the gap between D-SCE and HX-SCE, by being both zero halogen and diesel resistant. ZHD-SCE can be used in a wide variety of applications including rail, mass transit, motorsports and industrial.

Features & Benefits

- Meets industry standards, including EN45545-2
- Zero halogen
- Diesel resistant
- Resistant to key rail and industrial fluids including diesel (defined by RW-2536)

- Low toxic fumes
- Non-flame propagating
- Shrink ratio 2:1
- Single product enables inventory reduction
- Decreases set-up and change-over frequency

Applications

- Rail
- Industrial
- Military
- Aerospace

Connectors

TE Connectivity



HX-SCE Low Fire Hazard Heat-shrinkable Wire Identification Sleeves



HX-SCE is a thin walled, zero-halogen, low smoke, low toxicity, radiation crosslinked, polyolefin heat-shrinkable tubing, assembled as cut sleeves organized in a ladder format. Ideal for applications where limited fire hazard characteristics are necessary. The zero halogen material coupled with low smoke and low toxic fume emissions make this product best used in enclosed spaces such as mass transit, marine and industrial applications. This product is not recommended where strain relief properties are required. Supplied in a "ladder format", sleeves are held horizontally between two polyester strips and offers ease of printing and kitting.

Features & Benefits

- Zero halogen
- Low toxic fumes
- Low smoke

- Self-extinguishing, non-flame propagating
- Low heat release rate
- Resistant to key industrial and rail fluids (defined by RW2072)
- Excellent resistance to burning (typical LOI 39%)
- Sleeve diameters from 2.4
- 2:1 shrink ratio

Applications

- Pre-termination cable identification
- Particularly suitable for locations with a fire risk to human life or equipment
- Mass transit – rail, aerospace, marine and industrial

D-SCE Fluid Resistant Heat-shrinkable Wire Identification Sleeves

D-SCE markers are used to identify wires and cables where exposure to organic fluids, especially oils, is required.



D-SCE markers are designed to operate in elevated temperatures for extended periods of time, they are suitable for use in environments with temperatures of -55°C to +135°C (-67°F to +275°F), and will provide strain relief, insulation and protection from mechanical abuse.

Features & Benefits

- Supplied with side scoring
- Resistance to organic fluids, common fuels, lubricants and solvents
- 3:1 shrink ratio

- Wide range of sizes for several wire and bundle diameters
- Formulated for use in harsh environments
- Dot matrix and thermal printable - both print technologies meet all specifications and approvals list

Applications

- Rail
- Industrial
- Military
- Aerospace

Connectors

TE Connectivity



HLX-NEL Narrow Edge Leading Low Fire Hazard Tie-On Printable Cable Marker Tags



HLX-NEL Cable Markers are designed to offer flexibility when it comes to wire and cable identification. Manufactured from the same low fire hazard, UV stabilised material as HLX, with the difference being that it is assembled in a Narrow Edge Leading (NEL) format. Ideal for applications where low fire hazard characteristics (low smoke, low toxicity and low flammability) and UV protection are critical. Applied using cable ties, HLX-NEL Cable Markers give the ability to identify large diameter wire and cable, as well as post connector installation.

Features & Benefits

- Excellent resistance to burning – typical LOI 39%
- Zero halogen
- Low toxic fumes
- Low smoke
- Self-extinguishing
- Recommended for use where combustion of products may endanger personnel or delicate electronics at risk
- Resistant to key industrial and rail fluids
- Ideal for low volume applications
- Cost effective identification solution
- Ideal for pre or post termination assembly

AMP, AMP MPC, AMP SUPERSEAL 1.5, AMPOWER, AMPSEAL, AMPSEAL 16, DEUTSCH, Econoseal, FASTON, LEAVYSEAL, MQS, MULTILOCK, TE Connectivity and TE connectivity (logo) are trademarks.

Diode Arrays



Features & Benefits

- Multiple configurations in single channel, and multichannel arrays, spanning 0201 through MSOP-10 package
- Signal Integrity-friendly solutions from 0.1pF - 400pF
- Offers at least +/-8kV ESD protection, and in some instances +/-30kV
- Operating voltages through 36V, unidirectional and bidirectional
- Surpasses surge expectations
- All products AEC-Q101 qualified, MSL Level 1

Applications

- In vehicle communications interfaces including CAN, LIN
- Safety interfaces including tire pressure and airbag deployment
- Antenna protection Radio, GPS, Bluetooth, Wifi, and LTE
- Driver convenience interfaces including USB, HDMI
- Charging port interfaces

| Series name | Package | Capacitance (pF) | Clamping voltage (VDC) | Working voltage | Number of channels | ESD rating (contact discharge, IEC61000-4-2) | Maximum surge rating (tp=8/20s) | AEC-Q101 qualified |
|---|--|------------------|------------------------|-----------------|--------------------|--|---------------------------------|--------------------|
| General Purpose ESD Protection (Discretes and Array) | | | | | | | | |
| SP1001 | SC70-3 | 8 | 8.0V at 1A | 5.5 | 2/4/5 | 15kV | 2A | • |
| SP1003 and AQ1003 | SOD882 | 30 | 12.0V at 7A | 5.0 | 1 | 30kV | 7A | • |
| SP1005 and AQ1005 | 0402 (SOD882) | 30 | 9.3V at 1A | 6.0 | 1 | 30kV | 10A | • |
| SDxx | SOD323 | 50-350 | 9.8-50V at 1A | 5-36 | 1 | 30kV | 5-30A | • |
| SDxx-C | SOD323 | 30-260 | 10-52V at 1A | 5-36 | 1 | 30kV | 5-30A | • |
| SM24CANA | SOT23-3 | 11 | 36V at 1A | 24.0 | 2 | 24kV | 3A | • |
| SM24CANB | SOT23-3 | 30 | 34V at 1A | 24.0 | 2 | 30kV | 10A | • |
| SM712 | SOT23-3 | 75 | 11V at 1A | -7-12 | 2 2 | 4kV | 19A | • |
| SPHVxx | SOD882, SOD882 with side lead exposure | 25-60 | 19-52V at 1A | 12-36 | 1 | 30/30/24/15 kV | 2-8A | • |
| SPHVxx-C | SOD882, SOD882 with side lead exposure | 13-30 | 19-52V at 1A | 12-36 | 1 | 30/24/17/13kV | 2-8A | • |
| SMxx | SOT23-3 | 65-400 | 9.8-36V at 1A | 5.0 | 2 | 30kV | 7-24A | • |
| Low Capacitance ESD Protection (Discretes and Array) | | | | | | | | |
| SP1255P | µDFN-6 | 0.5 | 6.6V at 1A | 12.0 | 3 | 30kV | 4A | • |
| SP3014 | µDFN6L | 1.0 | 6.6V at 1A | 5.0 | 2 | 15kV | 8A | • |
| SP3022 | 0402 (SOD882) | 0.35 | 12V at 1A | 5.3 | 1 | 20kV | 3A | • |
| SP0524P | µDFN10 | 0.5 | 6.6V at 1A | 5.0 | 4 | 12kV | 4A | • |
| SP3012 | µDFN14, µDFN10 | 0.5 | 6.6V at 1A | 5.0 | 4/6 | 12kV | 4A | • |
| AQ3118 | 0402 (SOD882) | 0.3 | 31V at 1A | 8.0 | 1 | 10kV | 2A | • |
| AQ3130 | 0402 (SOD882) | 0.3 | 39V at 1A | 28.0 | 1 | 10kV | 2A | • |
| SP3030 | 0402 (SOD882) | 0.5 | 9.2V at 1A | 5.0 | 1 | 20kV | 3A | • |
| SP3003 | µDFN6L | 0.65 | 10V at 1A | 6.0 | 2/4/8 | 8kV | 2.5A | • |
| SP5001 | TDFN10 | 0.8 | - | - | 5.0 | 4 15kV | - | • |
| SP5002 | TDFN16 | 0.8 | - | - | 5.0 | 6 15kV | - | • |
| SP5003 | TDFN10 | 0.8 | - | - | 5.0 | 4 15kV | - | • |
| SESD Ultra Low Cap. Discrete TVS | 0201 µDFN, 0402 µDFN | 0.1-0.2 | 9.2-10V at 2A | 9-9.8 | 1 | 20kV | 2A | • |
| SESD Ultra Low Cap. Diode Arrays | 0402 µDFN, 0802 µDFN, 1004 µDFN, 1103 µDFN | 0.2 | 9.2V at 2A | 9.0 | 2/4/6 | 20kV | 2A | • |
| SESD Enhanced ESD. Discrete TVS | 0201 µDFN, 0402 µDFN | 0.15-0.3 | 13-14V at 2.5A | 7.0 | 1 | 22kV | 2.5A | • |
| SESD Enhanced ESD. Diode Arrays | 0402 µDFN, 1004 µDFN | 0.3 | 13V at 2.2A | 7.0 | 2/4 | 22kV | 2.2A | • |
| Lightning Surge Protection (Discretes and Array) | | | | | | | | |
| SP3051 | SOT23-6 | 3.8 | 9V at 1A | 6 | 4 | 30kV | 20A | • |
| SP3312T | µDFN08 | 1.3 | 6V at 1A | 3.3 | 1 | 30kV | 15A | • |
| SP4022 | SOD323 | 1.3 | 19V at 1A | 12 | 1 | 30kV | 15A | • |
| SP4023 | SOD323 | 1.3 | 23V at 1A | 15 | 1 | 30kV | 12A | • |
| SP4024 | SOD323 | 1.3 | 34V at 1A | 24 | 1 | 30kV | 7A | • |
| SP2574N | µDFN10 | 3.8 | 4.5V at 1A | 2.5 | - | 30kV | 40A | • |
| SLVU2.8-8 | SOIC | 2.6 | 17V at 24A | 2.8 | 8 | 30kV | 30A | • |

Discretetes

Littelfuse



Automotive TVS Diodes

Littelfuse AEC-Q101 qualified components TVS Diodes helps to protect the growing number of electronic applications in modern vehicles.



From high power surge protection to automotive load protection, Littelfuse semiconductors have the solutions and expertise to match your technical and application challenges.

AEC-Q101 qualified components TVS Diodes Meets ISO7637-2 and ISO 16750-2.

Features & Benefits

- Wide standoff voltage range fulfils all design requirements for automotive applications
- Peak pulse power rating from 400W to 5000W and 2200W load dump
- Helps the power system pass the different surge tests operationally as specified by ISO7637-2
- Automotive-grade products are well-suited for high reliability applications
- Standard package and compact footprint allow quick and easy layout in high reliability applications

Applications

- Auto chassis and safety systems such as active suspension, ABS and etc.
- Network systems and body application such as dashboard control and power window control
- Advanced driver assistance systems (ADAS)
- Power train system applications such as turbocharger, transmission control unit and many others
- New energy car applications such as Battery Management System (BMS) and fuel cell electric

AEC-Q101 Qualified TVS Diode (Meets ISO7637-2 and ISO16750-2)

| Series name | Package type | Power rating (10/1000s) | Polarity | Reverse standoff voltage V_R | 12V system | | | | | | | | | | | | | | | 24V system | | | | | | | | | | | | | | |
|---|--------------|-------------------------|--------------------|--------------------------------|------------|------|------|-------|------|------|-------|------|------|-------|------|------|-------|------|------|------------|------|------|------|------|------|-------|------|------|------|------|------|------|------|--|
| | | | | | 1 | 2a | 2b | 3a | 3b | 5a | 1 | 2a | 2b | 3a | 3b | 5a | 1 | 2a | 2b | 3a | 3b | 5a | 1 | 2a | 2b | 3a | 3b | 5a | | | | | | |
| | | | | | -75v | 37v | 10v | -112v | 75v | 65v | -100v | 112v | 10v | -220v | 150v | 87v | -300v | 37v | 20v | -150v | 150v | 123v | 600v | 112v | 20v | -300v | 300v | 173v | | | | | | |
| Automotive Transient Surge Including Load Dump Protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TPSMF4L | SOD-123FL | 400W | Unidirectional | 5-85 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TPSMA6L | DO-221AC | 600W | Unidirectional | 5-85 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TPSMB | DO-214AA | 600W | Uni/ Bidirectional | 6.4-77.8 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TPSMC | DO-214AB | 1500W | Uni/ Bidirectional | 10.2-77.8 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TPSMD | DO-214AB | 3000W | Uni/ Bidirectional | 10-43 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TP6KE | DO-15 | 600W | Uni/ Bidirectional | 11.1-77.8 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TP1.5KE | DO-201 | 1500W | Uni/ Bidirectional | 10.2-40.2 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| TP5KP | R6/P600 | 5000W | Uni/ Bidirectional | 10-60 | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | | Pass | Pass | Pass | Pass | Pass | |
| SLD (or Load Dump) | P600 | 2200W Load Dump | Uni/ Bidirectional | 10-60 | | | | | | Pass | | | | | | Pass | | | | | | Pass | | | | | | | | | | | Pass | |

Discretes

Vishay



DIODES - TVS (Transient Voltage Suppressors)

| Series | Product | Product line | Package outline | Power rating (W) | TVS polarity | V _{BR} min. (V) | V _{WM} min. (V) | V _{WM} max. (V) | T _J max. (°C) |
|------------------------|---------|--------------|-----------------|------------------|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
| TPSMA6.8 thru TPSMA43A | | PAR* TVS | DO-214AC (SMA) | 400 | Uni-directional | 6.12 | 5.5 | 36.8 | 185 |
| TPSMP6.8 thru TPSMP43A | | PAR* TVS | DO-220AA (SMP) | 400 | Uni-directional | 6.12 | 5.5 | 36.8 | 185 |
| TPSMB6.8 thru TPSMB43A | | PAR* TVS | DO-214AA (SMBJ) | 600 | Uni-directional | 6.12 | 5.5 | 36.8 | 185 |
| TPSMC6.8 thru TPSMC47A | | PAR* TVS | DO-214AB (SMCJ) | 1500 | Uni-directional | 6.12 | 5.5 | 40.2 | 185 |

MOSFETs

| Series | Package | Channel | Configuration | V _{DS} (V) | V _{GS} (V) | R _{DS(on)} (max.) at 10 V _{GS} (Ω) | R _{DS(on)} (max.) at 4.5 V _{GS} (Ω) | R _{DS(on)} (max.) at 2.5 V _{GS} (Ω) | R _{DS(on)} (max.) at 1.8 V _{GS} (Ω) | Q _g (typ.) at 10 V _{GS} (nC) | Q _g (typ.) at 4.5 V _{GS} (nC) | I _D (A) | P _D (W) | |
|------------------------------|------------------|-----------------|---------------|---------------------|---------------------|--|---|---|---|--|---|--------------------|--------------------|----|
| SINGLE N-CHANNEL | | | | | | | | | | | | | | |
| SQJ402E | PowerPAK® 8 x 8L | N | Single | 40 | 20 | 0.0017 | 0.002 | 0.0017 | 0.002 | 169 | – | 200 | 150 | |
| SQJ410EP | PowerPAK® SO-8L | N | Single | 30 | 20 | 0.0039 | 0.0042 | – | – | 73.5 | – | 32 | 83 | |
| SQJ840EP | | N | Single | 30 | 20 | 0.0093 | 0.0138 | – | – | 25.3 | – | 30 | 46 | |
| SQJ422EP | | N | Single | 40 | 20 | 0.0034 | 0.0043 | – | – | 67 | – | 75 | 83 | |
| SQJ412EP | | N | Single | 40 | 20 | 0.0041 | – | – | – | 80 | – | 32 | 83 | |
| SQJ886EP | | N | Single | 40 | 20 | 0.0045 | 0.0055 | – | – | 43 | – | 60 | 55 | |
| SQJ858AEP | | N | Single | 40 | 20 | 0.0063 | 0.0075 | – | – | 36 | – | 58 | 48 | |
| SQJ460AEP | | N | Single | 60 | 20 | 0.0087 | 0.0094 | – | – | 71 | – | 64 | 83 | |
| SQJ850EP | | N | Single | 60 | 20 | 0.023 | 0.032 | – | – | 20 | – | 24 | 45 | |
| SQJ486EP | | N | Single | 75 | 20 | 0.026 | 0.032 | – | – | 22 | – | 30 | 56 | |
| SQJ402EP | | N | Single | 100 | 20 | 0.011 | 0.014 | – | – | 37 | – | 32 | 83 | |
| SQJ488EP | | N | Single | 100 | 20 | 0.021 | 0.0258 | – | – | 18 | – | 42 | 83 | |
| SQJ456EP | | N | Single | 100 | 20 | 0.026 | – | – | – | 42 | – | 32 | 83 | |
| DUAL N-CHANNEL | | | | | | | | | | | | | | |
| SQJ910AEP | | PowerPAK® SO-8L | N | Dual | 30 | 20 | 0.007 | 0.0086 | – | – | 25.8 | – | 30 | 48 |
| SQJ844AEP | N | | Dual | 30 | 20 | 0.0166 | 0.0276 | – | – | 17 | – | 8 | 48 | |
| SQJ912AEP | N | | Dual | 40 | 20 | 0.0093 | 0.0111 | – | – | 25.6 | – | 30 | 48 | |
| SQJ952EP | N | | Dual | 60 | 20 | 0.02 | 0.024 | – | – | 24 | – | 23 | 25 | |
| SQJ968EP | N | | Dual | 60 | 20 | 0.0336 | 0.0444 | – | – | 12.3 | – | 18 | 25 | |
| SQJ992EP | N | | Dual | 60 | 20 | 0.0562 | 0.0745 | – | – | 8.1 | – | 15 | 34 | |
| SQJ980AEP | N | | Dual | 75 | 20 | 0.05 | 0.066 | – | – | 14 | – | 17 | 34 | |
| SINGLE P-CHANNEL | | | | | | | | | | | | | | |
| SQJ401EP | PowerPAK® SO-8L | P | Single | -12 | 8 | – | 0.006 | 0.008 | – | – | 109 | 32 | 83 | |
| SQJ403EEP | | P | Single | -30 | 20 | 0.0085 | 0.02 | – | – | 75 | – | 30 | 68 | |
| SQJ463EP | | P | Single | -40 | 20 | 0.01 | 0.015 | – | – | 98 | – | 30 | 83 | |
| SQJ443EP | | P | Single | -40 | 20 | 0.029 | 0.047 | – | – | 38 | – | 40 | 83 | |
| SQJ461EP | | P | Single | -60 | 20 | 0.016 | 0.021 | – | – | 90 | – | 30 | 83 | |
| SQJ465EP | | P | Single | -60 | 20 | 0.085 | 0.115 | – | – | 26.5 | – | 8 | 45 | |
| SQJ469EP | | P | Single | -80 | 20 | 0.025 | 0.029 | – | – | 101 | – | 32 | 100 | |
| SQJ431EP | | P | Single | -200 | 20 | 0.213 | – | – | – | 71 | – | 12 | 83 | |
| DUAL P-CHANNEL | | | | | | | | | | | | | | |
| SQJ951EP | PowerPAK® SO-8L | P | Dual | -30 | 20 | 0.017 | 0.036 | – | – | 33 | – | 30 | 56 | |
| SQJ963EP | | P | Dual | -60 | 20 | 0.085 | – | – | – | 26.5 | – | 8 | 27 | |
| N-CHANNEL AND P-CHANNEL PAIR | | | | | | | | | | | | | | |
| SQJ500AEP | PowerPAK® SO-8L | P | N&P pair | -40 | 20 | 0.027 | 0.0435 | – | – | 30.2 | – | 30 | 48 | |
| | | N | N&P pair | 40 | 20 | 0.0092 | 0.0112 | – | – | 25.5 | – | 30 | 48 | |

Electromechanical

C&K Components



Switch Solutions for Automotive Applications

| | Tactile | Key | Detect | Snap | Push button | Multi functions | Haptic system | Integrated switches | Park break switch |
|------------------------|---------|-----|--------|------|-------------|-----------------|---------------|---------------------|-------------------|
| | | | | | | | | | |
| Interior controls | • | • | • | | • | • | • | • | • |
| Steering wheel | • | • | | | | • | • | • | |
| Interior lighting | • | • | • | | | | | • | |
| Shifter/gearbox | • | | • | • | • | | | • | |
| Seat belt | | | • | | | | | • | |
| Electronic park brake | | | | | | | | | • |
| Door panels & seats | • | • | • | • | • | • | • | • | |
| Column switches | • | | • | | | • | | • | |
| Auto dimming mirrors | • | • | • | | | | • | | |
| Tactile surface | | | | | | | • | | |
| Mechatronics detection | • | • | • | • | | | | • | |
| Keyfobs | • | | | | | | | | |
| Door & trunk handles | • | | • | | • | | | • | |
| Latches | • | | • | • | | | | • | |

K12 Series

High performance key switches.



Features & Benefits

- Excellent tactile feel
- Wide choice of LED colours, travel and actuator forces
- Sealed version available
- Designed for low-level switching
- Double stroke version available

Applications

- Interior controls
- Door panels and seat control
- Steering wheel
- Interior lighting
- Mechatronics detection
- Door and trunk handles
- Gear box

K12S Series

High performance SMT key switches.



Features & Benefits

- IP67
- Compatible with SMT lead free soldering process
- Available in tape and reel packaging
- Illuminated
- Excellent tactile feel
- High reliability/long life
- DPST and detect versions available

Applications

- Interior controls
- Door panels and seat control
- Steering wheel
- Interior lighting
- Mechatronics detection
- Door and trunk handles
- Gear box

Electromechanical

C&K Components



K6 Series

Short stroke key switches.



Features & Benefits

- Excellent tactile feel
- Wide variety of LEDs, travel and actuation forces
- Designed for low-level switching
- Detector version available

Applications

- Interior controls
- Door panels and seat control
- Steering wheel
- Interior lighting
- Mechatronics detection

KMR Series Tactile Switch

Microminiature SMT top actuated Tactile Switch.



Features & Benefits

- Compact design
- Short stroke to latch
- Wide variety of actuator heights and styles
- Adapted for medium power applications

Applications

- Interior controls
- Door panels and seat control
- Steering wheel
- Interior lighting
- Mechatronics detection
- HVAC controls

KSR Series Tactile Switch

Microminiature SMT top actuated.



Features & Benefits

- IP50 sealed
- Saves PCB space
- Range of actuation forces
- Detect type available
- Rubber actuator
- Normally closed version available

Applications

- Keyfobs
- Door and trunk handles
- Interior controls
- Door panels and seat control
- Steering wheel
- Column switches
- Interior lighting
- Gear box
- Mechatronics detection

KSC Series

Sealed tactile switches for SMT.



Features & Benefits

- IP67 sealed
- Positive tactile feeling
- Range of 6 actuation forces
- Gullwing option available for each part number

Applications

- Keyfobs
- Door and trunk handles
- Interior controls
- Door panels and seat control
- Steering wheel
- Column switches
- Interior lighting
- Gear box
- Mechatronics detection

KSJ Series

Sealed detect switch for SMT.



Features & Benefits

- Straight or vertical detect
- Spherical actuator allows actuation +/- 30°
- High travel
- Adapted for cam actuation

Applications

- Door and trunk handles
- Interior controls
- Door panels and seat control
- Column switches
- Interior lighting
- Seat belt
- Gear box
- Mechatronics detection

PVA Series

Short stroke key switches.



Features & Benefits

- Compact design
- Short stroke to latch
- Wide variety of actuator heights and styles
- Adapted for medium power applications

Applications

- Interior controls
- Door panels and seat control
- Steering wheel
- Interior lighting
- Mechatronics detection
- HVAC controls

Electromechanical

Honeywell

Honeywell

Wireless Technology

Honeywell Sensing and Control's wireless technology is a cutting edge, cost-saving solution.



That innovation starts whether you're retrofitting into an existing transportation application, or starting a new design. Now you have the freedom to push your designs and applications further and expand your vision.

Applications

- Retrofit systems
- Attachment detection

Operator Controls

Often used on control panels or machinery in harsh environments.



Honeywell key and rotary switches use o-rings to help keep dirt and moisture out of the contact chamber and prolong the switch's life. Custom switches and controls are "standard" for Honeywell S&C.

Applications

- Shifter and turnsignals
- Key switches and push button
- Hour meters and toggles

Electromechanical Switches

Simple or precision on/off, end of limit, presence/absence, pressure, temperature, and manual operator interface application needs.



Watertight/dust-tight series provide IP67 protection to operate under difficult environmental conditions. Premium series delivers a broad range of ratings, operating actions, and terminations.

Applications

- Door position
- Brake light switch
- Clutch pedal position

Limit Switches

Meet IEC standards for world-wide acceptance.



Often used in lifts and elevators, electronic assembly, construction and agriculture equipment, material handling, and rail. EN50041 and EN50047 mounting pattern options. Global approvals, support, and sourcing.

Applications

- Suspension systems
- Vehicle/tilt position
- Overload detection

Electromechanical

Panasonic

Panasonic

EVPAS Series – Long Stroke

Car electronic equipment and devices must be designed with rigorous standards to function in environments where users safety and product reliability are critical.



Today, there is great demand for innovative, feature-rich, electronic equipment to be used in car control units operating the automotive specific communication buses of the future. Panasonic EVPAS Series is a new “rubber dome type” with the advantage of its 6.0mm x 6.1mm (square) x 5mm size with only 2 terminals. This SMD Light Touch Switch convinces due to its dust proof structure with a silent superior snap and extra soft feeling thanks to rubber dome feature. The high quality integration of a metal leaf spring convinces users with its steady and low contact resistance.

Features & Benefits

- Common size of 6.0mm square x 5.0mm (with push plate)
- Travel 1.0mm or 1.3mm
- Excellent solderability with 2 terminals
- Reflow soldering available
- Excellent light-touch operation feeling
- Usage temperature range: -40°C – +90°C
- 30k – 100k Life Cycles with a variety of push forces 1.6N, 2.0N, 2.5N, 3.0N and 3.5N

Applications

- Operating switches for car electronic equipment

EVPAA Series – Short Stroke

As one of the industry's smallest size solution for Light Touch Switches (outer dimensions 3.5mm x 2.9mm, height 1.7mm), the EVPAA Series offers a wide variety of available operating forces up to 5.0N.



Features include a sharp, clear click, low contact resistance, minimal bouncing noise, and high contact reliability. Panasonic offers with this super-thin, standard J-bent (4 terminals) solution optional ground terminal that highlights this Light Touch Switch solution especially for keyless automotive entry systems.

Features & Benefits

- Common size of 3.5mm x 2.9mm
- Travel 0.15mm
- Excellent light-touch operation feeling

- Long operating life
 - 1.0N: 1 million cycles or more
 - 1.6N, 2.4N, 3.5N, 5.0N: 100K cycles or more
- Reflow soldering available
- Ground terminal available (Option)
- 100k – 1 mil Life Cycles with a variety of push forces 1.0N, 1.6N, 2.4N, 3.5N and 5.0N

Applications

- Keyless automotive entry systems

Electromechanical

Panasonic

Panasonic

ESE24 Series

Panasonic Electronic Components' detector switches are used to detect internal mechanical movements and convert those or human manual operations to electronic signals.



These switches are used for detecting the position or presence of objects, and are installed in many applications within automobiles appliances. Panasonic provides a wide variety of detector switches with high reliability by original contact technology. The most outstanding features of this detector switch is its high reliability. Detector switches use a mechanical sliding spring design to ensure consistent signal output. They also have features that include long travel, thin profile, compact size, light weight, highly flexible actuation angles and surface mount.

Features & Benefits

- Actuator type: angled toggle (detector)
- Circuit: SPDT
- Rating: 50 μ A 3VDC – 10m A 5VDC
- Electrical life: 50.000 up to 1 million cycles
- Operating force, torque: 0.35mNm
- Poles and throws: 1-pole 2 throw (OFF at midpoint)
- Voltage rating–DC: 5V

Applications

- Car CD player
- ETC
- Car air conditioner

EVEU & EVEY Series

Encoders convert the manual rotary operation of an actuator or knob into coded signal outputs.

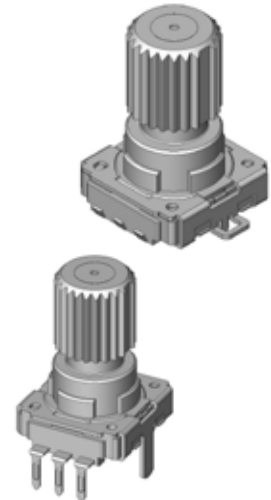
Their outstanding characteristics are various detents, high torque, push-on switch, long life which are all indispensable features for creating a high quality, haptic operating experience – especially within automotive applications. Panasonic EVEU and EVEY encoder series have a very small shaft wobble – in fact the peak to peak distance measures only 0.13mm. All these qualities highlight the EVEU and EVEY Series as encoders which offer comfort of full control and mediate a feeling of full awareness throughout their entire operation.

Features & Benefits

- Superior shaft wobble performance
- Small torque reduction after reflow soldering and life cycle test
- Silent acoustic image
- High soldering strength and good robustness
- Stable electrical contact
- Small rotational shaft wobble

Applications

- Car-RNS (Radio Navigational System)
- Head-up-display adjustment



Electromechanical

Standex-Meder Electronics



E-Car – Isolation Measurement

Hybrid and electric drivetrains in cars, trucks and two wheelers are introducing new, previously unknown challenges in the transportation industry.



The 12 V or 24 V board net is now complemented with a 400 V or higher battery and power system, which introduces a completely new set of requirements for the car OEMs and system module providers.

Operating with such high voltages and current in a harsh automotive environmental drives the need for more robust, but also long term stable solutions for isolating these high voltages levels from the other electronic functions, but most important, also for the passengers. This isolation need is present in all

functions of hybrid and electric vehicles like the high voltage battery, the DC/DC converter, the inverter for driving the electric motor, but also for the charger module connected to the 230 V/380 V power grid. Therefore, electronic vehicles contain an internal measurement system. This system checks all electrical parameters like isolation and dielectrical strength (Isolation resistance between active and electronic components and the frame). To switch or cut such a measurement system to the power system a high isolation is required.

KT Reed Relays

The KT Series Reed Relays integrate high technology packed into a small footprint.



Available in either surface mount or through hole mounting, the KT relay measures just L30 x W8.6 x H10.6 mm. Additionally, the KT Relay series offer excellent isolation resistance at $\geq 10^{13}\Omega$ and an isolation voltage between the coil and contact of ≥ 7 kVDC.

Both its high isolation characteristics and very small size make these KT relays highly suitable for green applications such as solar photovoltaic technology. They are particularly helpful in measuring isolation resistance across several components within a solar system prior to grid connection preventing injury or further current leakages.

Specifications

- Coil voltage 5 VDC, 12 VDC, 24 VDC
- Coil resistance 150 Ω
- Contact form 1 A
- Rated power 100 W
- Switching voltage 1000 VDC
- Switching current 1 A
- Carry current 0 A – 2.5 A
- Breakdown voltage 2 kVDC to 5 kVDC

Features & Benefits

- High isolation characteristic
- Small dimensions
- High isolation voltage
- PCB through hole mounting
- Hermetically sealed thermoset
- Moulded encapsulation
- Dynamically tested contacts
- Millions of reliable operations
- SMT and THT available

Applications

- E-vehicles
- Hybrid cars
- Solar collectors
- Photovoltaic

Electromechanical

TE Connectivity



Automotive, Truck, Bus and Off-Road Relays

Relays & Contactors

From passenger comfort and infotainment to higher DC voltages and power levels to harsh environments, TE's relays and contactors provide critical switching functions in multiple vehicle applications.



Features & Benefits

- Broad portfolio offering
- Performance classes from 1A up to 6,000A
- System voltages from conventional 12/24V vehicles to hybrid and electric vehicles up to 800V
- Plug-in and PCB mount, as well as screw terminals
- Monostable and latching (bistable) versions
- High resistance to shock, vibration and temperature extremes

Applications

- Automotive
- Truck
- Bus
- Off-road
- Construction and agriculture equipment
- Hybrid and electric vehicles

High Current HCR 150 and HCR 200 Relays

TE's high-current relays provide increased safety connections and disconnections for system voltages up to 48V.



They are compact and provide high-current switching capabilities.

The High Current Relay 150 (HCR 150) and High Current Relay 200 (HCR 200), provide two ideal solutions for all automotive applications, where particularly high load currents must be handled. HCR 150 and HCR 200 meet the demand for relays in increasing electric and electronic driver assistance systems that can not only carry and switch such high loads, but also ensure a reliable function at temperatures up to 110°C.

Features & Benefits

- Compact relays for power applications
- High current switching capabilities
- Suitable for system voltages up to 48V

Applications

- Energy/battery management
- Start-stop systems
- Electric power steering
- Engine control
- Glow plug
- Heated front screen
- Preheating systems (e.g. for diesel engines, catalytic converters)
- Switches for loading ramps

High Voltage Mini K HV Relays

TE's high voltage Mini K HV pre-charge relays are a cost-effective, safe, light-weight and reliable solution for pre-charging the DC high voltage power system.



An innovative contact design enables switching loads at a system voltage of up to 450V. The Mini K HV supports the connection and disconnection of the traction battery in switching assemblies for hybrid and battery electric vehicles. Even under fault conditions, the Mini K HV reliably disconnects the pre-charge circuit from the traction battery for excellent safety. TE's high voltage pre-charge relays, Mini K HV, operate safely with two arc extinguishing magnets. Its small package and PCB mount or plug-in terminals make it an easy choice for voltage levels up to 450VDC and pre-charge currents and limiting break currents up to 20 Amps.

Features & Benefits

- Safe-magnetic arc suppression
- Prevents contact welds
- Form X (NO DM) contact arrangement
- Suitable for voltage level up to 450VDC
- Pre-charge current up to 20A
- Limiting break current up to 20A
- Small package size – low profile
- Lightweight
- Available with PCB mount and plug-in terminals

Applications

- Hybrid Electric Vehicles (HEV, PHEV)
- Full Battery Electric Vehicles (BEV)
- Fuel Cell Vehicles (FCV)

High Voltage EVC 135, EVC 175, EVC 250, EVC 500 Contactors

TE Connectivity's high-voltage contactors provide safe disconnection and connection of the traction battery in hybrid, electric and fuel cell vehicles, as well as charging systems.



TE's high-voltage contactors and relays use proven technology in an innovative manner and are suited for use in hybrid, full electric and fuel cell vehicles, as well as vehicle charging systems.

Features & Benefits

- Designed for automotive requirements
- Suitable for hybrid, full electric and fuel cell vehicles as well as vehicle charging systems
- Compact relays and contactors for high voltage applications

Applications

- Hybrid vehicles
- Full battery electric vehicles, fuel-cell cars
- DC battery charging systems
- Main power contactor for traction batteries
- Accessory relays for high voltage loads
- Pre-charge circuits

Electromechanical

TE Connectivity



Plug-In Micro Relays

TE's automotive plug-in micro ISO relays include latching versions, modules and sockets in 12V and 24V power supply systems.



TE Connectivity offers high-performing plug-in micro ISO relays that are available in a variety of contact arrangements. A wide range of options includes, silent, customised and special footprints, and serial as well as parallel components.

Features & Benefits

- Design, production, support locations and application engineering around the globe
- Limiting continuous current up to 35A
- Flexible contact arrangements (make, changeover)
- Customised versions available (colour, mounting and release features, parallel or serial components)
- Compact size

Applications

Cross carline up to 35A for example:

- ABS control
- Blower fans
- Cooling fan
- Door control
- Door lock
- Fuel pump
- Heated front screen
- Immobiliser
- Seat belt pretensioner
- Trunk lock
- Valves window lifter, wiper control

Plug-In Mini and Maxi Relays

TE's automotive plug-in mini and maxi ISO relays include latching versions, modules, and sockets in 12V, 24V, and 48V power supply systems.



TE's high-performing plug-in mini and maxi ISO relays that are available in a variety of contact arrangements. A wide range of options includes, latching, customised and special footprints, serial and parallel components as well as shrouded waterproof versions.

Features & Benefits

- Design, production, support locations and application engineering around the globe
- Limiting continuous current 40A up to 70A
- Flexible pin assignment (ISO, Non ISO)
- Flexible contact arrangements (make, changeover, double make, double contact, 2*87...)
- Customised versions available (colour, mounting features, parallel or serial components, latching, shrouded...)
- 24V versions with contact gap >0.8mm
- Plug-in or PCB terminals

Applications

Cross carline up to 70A for example:

- ABS control
- Cooling fan
- Energy management
- Engine control
- Glow plug
- Heated front screen
- Ignition
- Main switch/supply relay

Electromechanical

TE Connectivity



PCB Micro K Relays

TE's range of automotive PCB Micro K relays are suitable for wave solder and reflow processing. They are available as single and double versions for the full performance range of vehicle applications.



Features & Benefits

- Small power relay
- Limiting continuous current 20A at 85°C
- Low weight
- Low noise operation
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

Applications

- Door lock
- Heated front/rear screen
- Lamps front/rear/fog light
- Interior lights
- Seat control
- Sun roof
- Window lifter
- Wiper control

PCB Power Relay PK2 HE (Monostable)

TE's range of automotive PCB PK2 relays are suitable for wave solder and reflow processing. They are available as single and latching versions for the full performance range of vehicle applications.



Features & Benefits

- High endurance performance up to 125°C
- High shock and vibration resistance
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions
- For latching (bistable) version refer to Power Relay PK2 HE Latching
- Limiting continuous current 40A at 85°C
- Maximum switch on current 250A

Applications

- Clamp switch (power distribution box)
- Blower fan
- Cooling fan
- Fuel pump
- Glow plug
- Starter (start stop)
- Heated screens

PCB Power Relay PK2 HE Latching

TE's latching version of the Power Relay PK2 HE is especially designed to have no continuous coil power consumption resulting in reduced emissions and heat dissipation.



Power Relays PK2 HE Latching operate on not permanently energized high endurance performance levels.

Features & Benefits

- High endurance performance up to 125°C
- Minimised coil power consumption
- Limiting continuous current 45A at 85°C
- Maximum switch on current 200A
- High shock and vibration resistance

- No change of switching state at breakdown of battery voltage
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions
- For monostable version refer to Power Relay PK2 HE (THT – THR)

Applications

- Clamp switch (power distribution box)
- Switched power supply
- Quiescent current management

Capacitors

AVX



SMT Ceramic Capacitors

| Product | Description | Dielectric | Operating temperature | Range |
|------------------------|--|------------------|-----------------------|-------------------------------|
| Tin Termination | | | | |
| | AVX Ceramic Capacitors exhibit low parasitics and excellent EMI filtering capabilities. AVX MLC Capacitors are available in wide range of values, styles, voltage ratings and dielectrics. Ultra Low ESR NPO - "U" dielectric parts are designed for RF applications requiring ultra-low ESR. NPO parts are suitable for use in MHz range with very stable characteristics. X7R parts are suitable for use in general kHz range. X8R/X8L parts are designed for high temperature applications up to +150°C. (*Contact AVX for +150°C X7R option). | Ultra Low ESR | +125°C | 50V - 200V 0.2pF - 1.0nF |
| | | NPO | +125°C | 25V - 100V 1pF - 4.7nF |
| | | NPO | +125°C | 16V - 500V 220pF - 22μF |
| | | X7R High Voltage | +125°C | 600V - 3000V 100pF - 0.15μF |
| | | X8R/X8L/X7R* | +150°C | 25V - 100V 330pF - 4.7μF |
| FLEXITERM® | | | | |
| | MLC Capacitors equipped with an AVX flexible termination system - FLEXITERM®. Capacitors have superior resistance to both - mechanical stress (board flexure - 5mm bend test guaranteed) and thermal stress (increased temperature cycling performance, 3000 cycles and beyond). (*Contact AVX for +150°C X7R option). | X7R | +125°C | 16V - 200V 270pF - 22μF |
| | | X7R High Voltage | +125°C | 600V - 3000V 100pF - 0.15μF |
| | | X8R/X8L/X7R* | +150°C | 25V - 100V 330pF - 4.7μF |
| FLEXISAFE | | | | |
| | Specifically designed with an industry leading set of safety features for safety critical applications. Combines FLEXITERM™ layer in conjunction with the cascade design. | X7R | +125°C | 16V - 100V 1nF - 470nF |
| ESDSafe | | | | |
| | Enhanced MLC capacitor designed specifically for general ESD protection. | X7R | +125°C | 25V - 100V 4.7nF - 2.2μF |
| IPC Array | | | | |
| | Capacitor array is an Integrated Passive Component (IPC) and associates up to four capacitance elements in a single case and is ideal for use in modern integrated circuits in automotive applications. It offers PCB space saving, increased assembly line output and better electrical performance thanks to small dimensions. Available also with FLEXITERM® for X7R and X8R range. | NPO | +125°C | 16V - 100V 1pF - 470pF |
| | | X7R | +125°C | 10V - 100V 220pF - 100nF |
| | | X8R | +150°C | 16V 220pF - 680pF |
| EMI Filter | | | | |
| | Capacitor with excellent filtering capability thanks to the feedthrough L-C-T like filter design. | NPO and X7R | +125°C | 50V - 100V 22pF - 47nF |

Leaded Ceramic Capacitors


| Product | Description | Dielectric | Operating temperature | Range |
|---------------|--|------------------|-----------------------|------------------------------|
| Radial | | | | |
| | AVX leaded MLCCs offer excellent mechanical shock and vibration resistance in harsh environment applications. With a wide range of dielectric materials, capacitance values, voltage ratings and lead styles, leaded capacitors offer robust mechanical shock and vibration characteristics, exceptional thermal resistance and proven reliability and quality. Both dipped and molded configurations available. | NPO | +125°C | 50V - 200V 1pF - 8200pF |
| | | X7R | +125°C | 50V - 100V 470pF - 10μF |
| | | X7R High Voltage | +125°C | 1000V - 3000V 470pF - 10nF |
| | | X8R | +150°C | 50V 1nF - 330nF |
| Axial | | | | |
| | Axial version of the leaded epoxy coated capacitors. Both dipped and molded configurations available. | X7R | +125°C | 50V 10nF - 4.7μF |

Capacitors


AVX





Tantalum Capacitors

| Product | Description | Dielectric | Operating temperature | Range |
|--|---|----------------------------|-----------------------|-----------------------------|
| Tantalum Capacitors | | | | |
|  | AVX automotive tantalum capacitors offer high ripple and surge current capability and resistance against thermo-mechanical stresses. Parts are available in standard and low ESR options and also in high temperature series up to +175°C while respecting the requirements for high reliability which make them suitable for a wide range of automotive control circuits in applications such as engine control units, ABS systems, MDPS, electronic gearboxes, TPMS, etc. | TAJ | +125°C | 6.3V - 50V 0.22µF - 680µF |
| | | F93-AJ6 | +125°C | 4V - 35V 1µF - 680µF |
| | | TPS | +125°C | 6.3V - 50V 0.22µF - 680µF |
| | | F91-AJ6 | +125°C | 10V - 16V 22µF - 47µF |
| | | TRJ | +125°C | 4V - 50V 0.1µF - 680µF |
| | | F97 | +125°C | 6.3V - 35V 0.47µF - 100µF |
| | | TRM | +125°C | 2.5V - 50V 4.7µF - 1500µF |
| | | TMJ | +125°C | 6.3V - 50V 0.22µF - 680µF |
| THJ | +175°C | 6.3V - 50V 0.1µF - 220µF | | |

Niobium Oxide Capacitors

| Product | Description | Dielectric | Operating temperature | Range |
|---|---|------------|-----------------------|------------------------------|
| Niobium Oxide Capacitor – Oxicap® | | | | |
|  | AVX NbO Oxicap. capacitors offer unique features - high reliability, non-burn and non smoke technology, more resistance to overvoltage breakdown, lower recommended derating, high resistance failure mode. NbO Oxicap. capacitors suits well application where reliability and safety is of primary focus, such as automotive. | NOJ | +105°C | 1.8V - 10V 4.7µF - 1000µF |
| | | NOS | +125°C | 1.8V - 6.3V 4.7µF - 1000µF |
| | | NOM | +125°C | 1.8V - 6.3V 220µF - 680µF |

Film Capacitors

| Product | Description | Dielectric | Operating temperature | Range |
|--|---|----------------------|-----------------------|------------------------------|
| Film Chip Capacitors | | | | |
|  | The self-healing property of film dielectric provides an open failure mode capacitor with excellent reliability. The intrinsic characteristic of film provides a capacitor that exhibits low DC bias, excellent thermal behavior and thermal shock resistance, no piezo effect and low ESR, ESL and dissipation factor. | PPS | +125°C | 16V - 50V 1nF - 180nF |
| | | PEN | +125°C | 25V - 630V 0.01µF - 4.7µF |
| | | PEN-HT | +125°C | 63V - 630V 0.01µF - 4.7µF |
| Medium Power Film | | | | |
|  | FFV, FFLI and custom parts are medium power film capacitors for DC filtering, high rms current and high temperature automotive applications. FAV series are high reactive energy tuning capacitors for HEV/EV battery charging applications. | FFV Series (PET/PPY) | +125°C | 300V - 1900V 22µF - 400µF |
| | | FFLI (PPY) | +95°C | 800V - 1400V 105µF - 3mF |
| | | Custom Parts (PPY) | +105°C | 75V - 1400V 300µF - 1.5mF |
| | | FAV (PPY) | +85°C | 300 - 650Vrms 80nF - 1.2mF |

Capacitors

Eaton



Supercapacitors

| Family | Capacitance (F) | Maximum working voltage (V) | Surge voltage (V) | Operating temperature |
|----------------------|-----------------|-----------------------------|-------------------|--|
| HV Cylindrical Cells | 1.0 - 100 | 2.7 | 3 | -40°C to +65°C with linear voltage derating to 2.3V at +85°C |
| XVM Module | 65 | 16.2 | 17 | -40°C to +65°C |
| XLR Module | 166 | 48.6 | 51.3 | -40°C to +65°C, extended to +85°C at 410V |

HV Cylindrical Cells



Features & Benefits

- Ultra low ESR for high power density
- UL recognised

XVM 16V Module



Features & Benefits

- Compact size for easy mounting
- Series or parallel connections for easy integration
- High reliability, green solution for pulse or backup power
- Maintenance free

XLR 48V Module



Features & Benefits

- Ultra low ESR provides high efficiency, high power
- Industry standard form factor for easy integration
- High power density for low operating costs
- Millions of charge/discharge cycles
- No heavy metals, non-hazardous energy storage
- Heavy duty metal housing
- Meets IP65 environmental rating

Applications

- Door locks
- Emergency backup energy
- Cold engine start
- Hybrid or electric vehicle
- Commercial vehicles: trucks, mining, construction
- Trolley, subway
- Marine

KEMET



T591/T598 High Humidity/High Temperature Automotive Grade Polymer Electrolytic, 2.5VDC to 50VDC



The KEMET Organic Capacitor (KO-CAP®) is a solid electrolytic capacitor with a conductive polymer cathode capable of delivering very low ESR and improved capacitance retention at high frequencies.

Features & Benefits

- Ultra-low ESR
- Full compliance with AEC-Q200 Qualification Test Plan (T598)
- Qualification plan based on AEC-Q200 with 85°C/85% RH load specification limited to 500 hours (T591)
- TS 16949 certified plant

- Subject to PPAP/PSW and change control
- Meets or exceeds EIA standard 535BAAC
- Taped and reeled per EIA 481
- Halogen-free epoxy/RoHS compliant

Applications

- Decoupling and filtering in a variety of market segments
- Special emphasis in automotive applications such as infotainment and input/output in DC/DC converters where hard conditions, such as high humidity and temperature are a concern

Capacitors

KEMET



KEMET X7R Dielectric Ceramic SMD High Capacitance Values

KEMET's Automotive Grade Series surface mount capacitors in X7R dielectric are suited for a variety of applications requiring proven, reliable performance in harsh environments.



Features & Benefits

- AEC Q200 automotive qualified
- Pb-Free and RoHS compliant
- Temperature stable dielectric
- Non-polar device, minimising installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression in engine, body, and transmission control modules.

Performance Characteristics

- -55°C to +125°C operating temperature range
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- EIA 0402, 0603, 0805, 1206, 1210, 1812, and 2220 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 250V
- Capacitance offerings ranging from 10pF to 22 μ F

KEMET SMD X8L Dielectric MLCC

KEMET's X8L dielectric features a 150°C maximum operating temperature.



These components are fixed, ceramic dielectric capacitors suited for high temperature bypass and decoupling applications or frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X8L exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature up to 125°C. Beyond 125°C X8L displays a wider variation in capacitance. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C and +15, -40% from 125°C to 150°C.

Features & Benefits

- Available in standard and flexible terminations
- Commercial and AEC Q200 automotive qualified
- Pb-Free and RoHS compliant
- Non-polar device, minimising installation concerns
- SnPb termination finish option available upon request (5% Pb minimum)
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include use in extreme environments such as down-hole oil exploration, under-hood automotive, military and aerospace.

Performance characteristics

- -55°C to +150°C operating temperature range
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$, and $\pm 20\%$
- EIA 0402, 0603, 0805, 1206 and 1210 case sizes
- Voltage is from 6V to 50V
- Capacitance offerings ranging from 0.012 μ F to 10 μ F

Capacitors

KEMET



KEMET Flexible Termination MLCC

KEMET's flexible termination surface mount capacitors incorporate a unique, flexible termination system that is integrated with KEMET's standard termination materials.



This technology was developed in order to address the primary failure mode of MLCCs – flex cracks, which are typically the result of excessive tensile and shear stresses produced during board flexure and thermal cycling. Flexible termination technology inhibits the transfer of board stress to the rigid ceramic body, therefore mitigating flex cracks which can result in low IR or short circuit failures.

Features & Benefits

- Superior flex performance (up to 5mm)
- AEC-Q200 automotive qualified
- Pb-Free and RoHS compliant
- Non-polar device, minimising installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression in engine, body, and transmission control modules.

Performance Characteristics

- -55°C to +150°C operating temperature range
- Available capacitance tolerances of $\pm 0.10\text{pF}$, $\pm 0.25\text{pF}$, $\pm 0.5\text{pF}$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$, and $\pm 20\%$
- EIA 0603, 0805, 1206, 1210, 1812, and 2220 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 250V
- Capacitance offerings ranging from 0.5pF to 22 μF

Surface Mount Multilayer Ceramic Capacitors

KPS HT Series

High Temperature 150°C X8L Dielectric

Features & Benefits

- Operating temperature range -55°C to +150°C
- Reliable and robust termination system
- Provides up to 10mm of board flex capability
- Reduces audible, microphonic noise
- Extremely low ESR and ESL
- Pb-Free and RoHS compliant



Applications

Typical applications include smoothing circuits, DC/DC converters, power supplies (input/output filters), noise reduction (piezoelectric/mechanical), circuits with a direct battery or power source connection, critical and safety relevant circuits without (integrated) current limitation and any application that is subject to high levels of board flexure or temperature cycling.

KPS Series

Commercial and Automotive Grade X7R Dielectric

Features & Benefits

- Higher capacitance in the same footprint
- Provides up to 10mm of board flex capability
- Reduces audible, microphonic noise
- Extremely low ESR and ESL
- Pb-free and RoHS compliant



Applications

Typical applications include smoothing circuits, DC/DC converters, power supplies (input/output filters), noise reduction (piezoelectric/mechanical), circuits with a direct battery or power source connection, critical and safety relevant circuits without (integrated) current limitation and any application that is subject to high levels of board flexure or temperature cycling.

Capacitors

KEMET



Tantalum Surface Mount Capacitors

KEMET T499 Series

High Temperature Tantalum SMT Capacitor



KEMET T499 High Temperature Tantalum SMT Capacitor has solid-state structures capable of 125°C applications with a maximum temperature rating of +175°C. KEMET's T499 SMT Capacitor features include capacitance values of 0.15µF to 220µF, AEC-Q200 compliance, voltage rating of 6V to 50V, five standard EIA case sizes with RoHS compliant terminations, 100% surge current testing, and a self-healing mechanism.

Features & Benefits

- Taped and reeled per EIA 481-D
- Symmetrical, compliant terminations
- Optional gold-plated terminations

- Laser-marked case
- 100% surge current testing
- Tolerances of ±10% and ±20%
- 100% steady-state accelerated aging
- Voltage derating is 1/2 at 175°C
- RoHS compliance and lead-free terminations standards

Applications

- DC/DC converters
- Portable electronics
- Telecommunications
- Control units

T498 150°C Rated MnO₂ Series

Features & Benefits

- Capacitance values of 0.47µF to 220µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6VDC to 50VDC
- 100% steady-state accelerated aging
- Temperature/voltage de-rating is 2/3 at 150°C
- RoHS compliant and lead-free terminations standard
- Operating temperature range of -55°C to +150°C

Applications

Typical applications include decoupling and filtering in automotive end applications such as DC/DC converters, high temperature sensors and control units operating at temperatures up to 150°C.

T499 175°C Rated MnO₂ Series

Features & Benefits

- Capacitance values of 0.15µF to 220µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6VDC to 50VDC
- 100% steady-state accelerated aging
- Voltage de-rating is 1/2 at 175°C
- RoHS compliant and lead-free terminations standard
- Operating temperature range of -55°C to +175°C

Applications

Typical applications include decoupling and filtering in automotive end applications such as DC/DC converters, high temperature sensors and control units operating at temperatures up to 175°C.

Capacitors

KEMET



Film Capacitors

KEMET Film Selection for Filtering – F61

KEMET F161 Series Automotive Grade SMD capacitors in polyester dielectric.



KEMET's F161 Series polyester (PET) film surface mount capacitor is encapsulated in a self-extinguishing material meeting the requirements of UL 94 V-0. This series meets IEC 60384-19 standards, as well as the demanding Automotive Electronics Council's AEC-Q200 qualification.

Features & Benefits

- Rated voltage: 50 to 630VDC
- Rated voltage: 30 to 250VAC
- Capacitance range: 0.01 to 12 μ F
- EIA size: 2220 to 6560
- Capacitance tolerance: \pm 5%, \pm 10%, \pm 20%, other tolerances available on request

- Climatic category: 55/125/56
- RoHS compliant and lead-free terminations
- Operating temperature range of -55°C to +125°C
- Automotive grade options available

Applications

- Bypassing and signal coupling
- F161 is a general purpose series designed for the highest reliability

KEMET Film Selection for Filtering – LDE

KEMET LDE Series Automotive Grade SMD capacitors in Polyethylene Naphthalate (PEN) dielectric.



Features & Benefits

- Rated voltage: 50 to 1,000VDC
- Rated voltage: 40 to 250VAC
- Capacitance range: 0.001 to 4.7 μ F
- EIA size: 1206 to 6054
- Capacitance tolerance: \pm 10%, \pm 20%, \pm 5% on request
- Climatic category: 55/125/56
- RoHS Compliant and lead-free terminations
- Operating temperature range of -55°C to +125°C
- Automotive (AEC-Q200) grades available

Applications

- Bypassing and signal coupling
- LDE is a general purpose series designed for the highest reliability and high temperature service
- Not suitable for across-the-line application

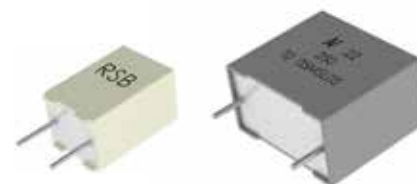
Capacitors

KEMET

Electronic Components
KEMET
CHARGED™

KEMET Film Selection for Filtering – RSB/R60

KEMET RSB/R60 Series Automotive Grade THT capacitors in polyester dielectric.



RSB Series

The RSB Series is constructed of metallised polyester film (stacked technology) with radial leads of tinned wire. Radial leads are electrically welded to the contact metal layer on the ends of the capacitor winding. The capacitor is encapsulated with thermosetting resin in a box of material meeting the UL 94V-0 requirements.

Features & Benefits

- Voltage range: 50VDC to 630VDC
- Capacitance range: 0.001 μ F to 2.2 μ F
- Lead spacing: 5mm
- Capacitance tolerance: \pm 20%, \pm 10% standard, \pm 5% on request
- Climatic category: 55/125/56
- Operating temperature range of -55°C to +125°C
- RoHS Compliant and lead-free terminations
- Tape and reel packaging in accordance with IEC 60286-2
- Self-healing
- Automotive (AEC-Q200) grades available

Applications

- High performance
- High temperature, blocking, coupling, decoupling for a signal from DC to high frequency, pulse, logic and timing circuit, lamp capacitor for electronic compact lamps, inverter for LCD monitors, automotive DC motor suppression
- Not suitable for across-the-line application

R60 Series

The R60 Series is constructed of metallised polyester film (wound or stacked technology) with radial leads of tinned wire. Radial leads are electrically welded to the contact metal layer on the ends of the capacitor winding. The capacitor is encapsulated in a self-extinguishing solvent resistant plastic case with thermosetting resin material meeting the UL 94V-0 requirements.

Features & Benefits

- Voltage range: 50VDC to 1000VDC
- Capacitance range: 0.001 μ F to 150.0 μ F
- Lead spacing: 10.0mm to 37.5mm
- Capacitance tolerance: \pm 5%, \pm 10%, \pm 20%
- Climatic category: 55/105/56
- Operating temperature range of -55°C to +105°C
- RoHS compliance and lead-free terminations
- Tape and reel packaging in accordance with IEC 60286-2
- Self-healing
- Automotive (AEC-Q200) grades available up to pitch 22.5mm

Applications

- Blocking, coupling, decoupling, bypassing and interference suppression in low voltage applications such as automotive
- Not suitable for across-the-line application

Capacitors

KEMET



Radial Crown and Axial Electrolytic Capacitors for Automotive Applications – PEG Series

KEMET's Axial Aluminium Electrolytic Capacitors are designed specifically for demanding applications requiring very long life, high vibration resistance and high ripple current. Operating temperatures up to 150°C are available without voltage de-rating.

Applications

- Fans
- Water pumps
- Power steering
- Hydraulic clutch
- Automatic transmission
- Start-stop systems
- Energy recuperation
- Capacitor batteries
- Super chargers

Competitive Advantages

- Excellent thermal Dissipation
- Heavy load designs
- High vibration performance

PEG127 Series

Features & Benefits

- High ripple current up to 6.6A-ripple (RMS, continuous load)
- High vibration resistance
- Rated temperature 150°C
- Voltage range 25VDC to 63VDC
- Capacitance range 33µF to 1300µF
- Diameter range 10mm to 13mm
- 1,600 hours operational life at +150°C for all case sizes



PEG126 Series

Features & Benefits

- Low ESR
- High ripple current intermittent specification
- Resistance to vibrations
- Rated temperature 150°C
- Voltage range 25VDC to 63VDC
- Capacitance range 250µF to 4,000µF
- Diameter range 16mm to 20mm
- Available as Radial Crown Version PEH126
- 2,000 hours at +150°C (D20 Case Size)



PEG220 Series

Features & Benefits

- Very high ripple current up to 21A-ripple (RMS, continuous load)
- High vibration resistance
- Rated temperature 150°C
- Voltage range 25VDC to 63VDC
- Capacitance range 250µF to 4700µF
- Diameter range 16, 18, 20mm
- Available as Radial Crown Version PEH220
- 18mm diameter is available 2,000 hours at +150°C



PEG225 Series

Features & Benefits

- Extremely high ripple current up to 28A-ripple (RMS, continuous load)
- High vibration resistance
- Rated temperature: -40°C to +125°C (at UR), -40°C to +150°C (at reduced voltage)
- Voltage range 25VDC to 63VDC
- Capacitance range 470µF to 6300µF
- Diameter range 16mm to 20mm
- Available as Radial Crown Version PEH226
- 18mm diameter is available



PEG226 Series

Features & Benefits

- Extremely high ripple current up to 28A-ripple (RMS, continuous load)
- High vibration resistance
- Rated temperature 150°C
- Voltage range 25VDC to 63VDC
- Capacitance range 250µF to 4700µF
- Diameter range 16mm to 20mm
- Available as Radial Crown Version PEH226
- 18mm diameter is available 2,000 hours at +150°C



Capacitors

Knowles



Knowles Capacitors, comprising Syfer, DLI, Novacap and Voltronics, has many years of experience providing products and solutions for a variety of transportation applications.

The automotive sector in particular requires consistent quality and performance, and to help meet this demand Knowles offers a range of AEC-Q200 automotive qualified components including:

- MLCCs featuring FlexiCap™ terminations
- Panel Mount Feedthrough EMI filters
- SMD EMI chip filters
- X2Y EMI filters
- Safety certified capacitors
- Open mode and tandem capacitors
- High temperature capacitors

As a leader in ceramic capacitor technology and EMI filtering, Knowles is well positioned to satisfy the need for high performance, high reliability components.

FlexiCap™ MLCCs

Features & Benefits

- World's first flexible termination on MLCCs
- Proven technology reduces stress damage in MLCCs, caused during PCB assembly process, by shock or vibration, or by temperature cycling
- Suitable for a wide range of automotive applications
- Qualified to AEC-Q200



StackiCap™ MLCCs

Features & Benefits

- Ground breaking product designed to provide high CV in compact packages
- Offers the greatest volumetric efficiency and CV per unit mass of any high voltage X7R ceramic capacitor
- Suitable replacement for film and tantalum capacitors
- Suitable for applications in power supplies, filtering, DC-DC converters

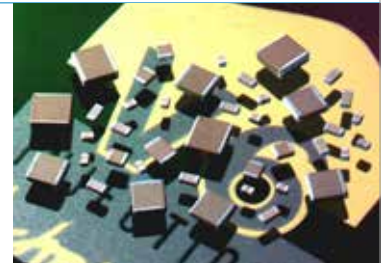


- Available in 1812, 2220 and 3640 case sizes
- AEC-Q200 qualified

High Temperature Capacitors

Features & Benefits

- The broadest range of high temperature MLCCs available
- From X8R performance (150°C) up to 230°C
- Features FlexiCap™ termination for reduced mechanical cracking
- Applications include under-the-hood sensors and ignition coils
- Products can be in SMD/ radial forms or custom shaped



High Voltage Capacitors

Features & Benefits

- Up to 12kV working voltage
- Smallest case sizes for highest voltage/ capacitance combinations
- FlexiCap™ termination option, and AEC-Q200 qualification
- Safety capacitors/250Vac non-safety
- For DC-DC converters, in vehicles or charging stations

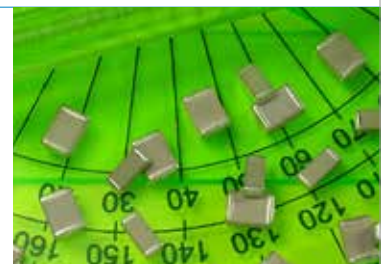


- Radial leaded options for space saving and isolation from the board

Open Mode & Tandem Capacitors

Features & Benefits

- Open Mode and Tandem capacitors are designed to dramatically reduce the chance of short circuit
- FlexiCap terminations to enhance reliability
- Case sizes from 0603 to 2225
- Qualified to AEC-Q200



Capacitors

Lelon



Brand New “Hybrid” Polymer Capacitors

Super low ESR, stable on low leakage current and long life.

Features & Benefits

HBV – extra long life design (SMD)

- 105°C, 10,000hrs
- 10uF – 390uF
- 25V – 63V

HBR – high temperature usage

- 105°C, 10,000hrs
- 10uF – 470uF
- 16V – 80V

HBW – high temperature usage (SMD)

- 125°C, 4,000hrs
- 10uF – 390uF
- 25V – 63V

HBS – high temperature usage

- 125°C, 4,000hrs
- 10uF – 470uF
- 16V – 63V

Applications

- Fuel injection
- Heat turbo control
- Exhaust treatment
- Self-driving system
- Outdoor security camera



V-Chip (SMD) Lines

Global leading on quality/quantity.

Features & Benefits

VEU – long life of full range

- 105°C, 5,000hrs, 1μF – 1,500μF, 6.3V – 100V

VUK – Extreme high reliability and large capacitance

- 125°C, 5,000hrs, 100μF – 3,300μF, 10V – 63V

VZH – Low ESR with large capacitance

- 105°C, 5,000hrs, 1μF – 8,200μF, 6.3V – 100V

VZS – Ultra LESR with high CVs

- 105°C, 2,000hrs, 22μF – 680μF, 6.3V – 35V

VZT – Super Ultra “LOW” ESR and 30% up w/ miniature size with VZS

- 105°C, 5,000hrs, 10μF – 2200μF, 6.3V – 50V

Applications

- Infotainment
- Window lifting control system
- Mirror control system
- Fuel injection system
- AE audio system
- Industrial process control

Note: VLV/VLW-50G anti-vibration 105°C and 125°C versions are available.



Axial Aluminium Electronics Capacitors (New Development)

Features & Benefits

TUK special for AE business

- Wide operating temperature range -55 – +125
- High reliability and long useful life: 10,000 – 500,000hrs
- Vibration resistance up to 30G
- Low ESR and high ripple current capability

Applications

- Automotive safety system
- Engine control unit
- Electromechanical tools



Snap-In Power Capacitors

LSR – new innovation for power electronics application.

Features & Benefits

- Less ESR 30% – 40%, higher ripple 30% – 60%
- Reduced temperature rise for 0.5°C – 1.0°C

Applications

- DC power bank
- High power inverter
- HVAC

Note: 85°C/105°C, 2,000/5,000/7,000hrs versions are all available.














Capacitors

Murata



Chip Monolithic Ceramic Capacitors/Lead Type Ceramic Capacitors

Powertrain/Safety













| Series | Series name | Characteristics | Rated voltage | | Capacitance | | | | | |
|--------|---|---|------------------|-----|-----------------|---|-----|---|--|-----|
| | | | V | kV | pF | | μF | | | |
| | | | 1 | 100 | 10 | 1 | 0.1 | 1 | 10 | 100 |
| GCM |  | General purpose products for automotive | 6.3Vdc – 1000Vdc | | 0.10pF – 47μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product | |
| GCD |  | Specially designed product to reduce shorts | 16Vdc – 100Vdc | | 1000pF – 0.50μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Fail safe product • Product resistant to deflection cracking | |
| GCE |  | Specially designed product to reduce shorts and resin electrode products | 25Vdc – 100Vdc | | 220pF – 0.10μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Fail safe product • Product resistant to deflection cracking | |
| GCG |  | Conductivity adhesive compatible type | 6.3Vdc – 100Vdc | | 1.0pF – 47μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Product resistant to deflection cracking • Product with solder cracking suppression | |
| G CJ |  | Resin external electrode products | 6.3Vdc – 1000Vdc | | 220pF – 47μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Fail safe product • Product resistant to deflection cracking | |
| GC3 |  | High effective capacitance and high allowable ripple current | 250Vdc – 630Vdc | | 10000pF – 1.0μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Product suitable for acoustic noise reduction and low distortion | |
| KCM |  | Metal terminal type for automotive | 25Vdc – 100Vdc | | 4.7μF – 68μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Product suitable for acoustic noise reduction and low distortion • Product resistant to deflection cracking • Product with solder cracking suppression | |
| KC3 |  | Metal terminal type/high effective capacitance and high allowable ripple current for automotive | 250Vdc – 630Vdc | | 0.10μF – 2.2μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Product suitable for acoustic noise reduction and low distortion • Product resistant to deflection cracking • Product with solder cracking suppression | |
| DE6 |  | Safety standard certified (IEC60384-14 Class X1/Y2 for automotive) | 300Vac (r.m.s.) | | 100pF – 4700pF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product • Certified by safety standard | |
| RCE |  | 125°C compatible type for automotive | 25Vdc – 1000Vdc | | 1.0pF – 22μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product | |
| RH |  | 150°C compatible type for automotive | 25Vdc – 100Vdc | | 100pF – 22μF | | | | <ul style="list-style-type: none"> • AEC-Q200 compliant product | |

Capacitors

Murata




Infotainment/Comfort

| Series | Series name | Characteristics | Rated voltage | | | | | Capacitance | | | | | | | | | |
|--------|---|--|------------------|----|-----|----|---|-----------------|---|----|-----|------|-------|-----|---|----|-----|
| | | | V | | kV | | | pF | | | | | μF | | | | |
| | | | 1 | 10 | 100 | 10 | 1 | 0.1 | 1 | 10 | 100 | 1000 | 10000 | 0.1 | 1 | 10 | 100 |
| GRM |  For general purpose (infotainment/comfort) | | 2.5Vdc – 3150Vdc | | | | | 0.10pF – 330μF | | | | | | | | | |
| GA2 |  Products based on the electrical appliance and material safety law of Japan | | 250Vac | | | | | 470pF – 0.10μF | | | | | | | | | |
| GA3 |  Safety standard certified type | | 250Vac | | | | | 10pF – 56000pF | | | | | | | | | |
| GJM |  High frequency high Q type 1005 (in mm)/0402 (in inch) Size Max. | <ul style="list-style-type: none"> Low dissipation for high frequency | 6.3Vdc – 50Vdc | | | | | 0.10pF – 47pF | | | | | | | | | |
| GMA |  Top and bottom electrode type for bonding | | 6.3Vdc – 100Vdc | | | | | 100pF – 0.47μF | | | | | | | | | |
| GMD |  Compatible to bonding/AuSn soldering | | 6.3Vdc – 50Vdc | | | | | 100pF – 1.0μF | | | | | | | | | |
| GQM |  High frequency high Q type 1608 (in mm)/0603 (in inch) Size Min. | <ul style="list-style-type: none"> Low dissipation for high frequency | 50Vdc – 500Vdc | | | | | 0.10pF – 200pF | | | | | | | | | |
| GR3 |  High effective capacitance and high allowable ripple current | <ul style="list-style-type: none"> Product suitable for acoustic noise reduction and low distortion | 250Vdc – 630Vdc | | | | | 10000pF – 1.0μF | | | | | | | | | |
| GR4 |  For ethernet LAN and primary-secondary coupling of DC-DC converters | | 2000Vdc | | | | | 100pF – 10000pF | | | | | | | | | |
| GRJ |  Resin external electrode type | <ul style="list-style-type: none"> Product resistant to deflection cracking | 6.3Vdc – 1000Vdc | | | | | 220pF – 47μF | | | | | | | | | |
| KR3 |  Metal terminal type, high effective capacitance and high allowable ripple current for general purpose | <ul style="list-style-type: none"> Low dissipation for high frequency Product resistant to deflection cracking Product with solder cracking suppression | 250Vdc – 630Vdc | | | | | 0.10μF – 2.2μF | | | | | | | | | |
| KRM |  Metal terminal type for general purpose (Infotainment/comfort) | <ul style="list-style-type: none"> Low dissipation for high frequency Product resistant to deflection cracking Product with solder cracking suppression | 16Vdc – 1000Vdc | | | | | 68000pF – 68μF | | | | | | | | | |

Polymer Aluminium Electrolytic Capacitors

Infotainment/Comfort

| Series | Series name | Characteristics | Rated voltage | | | | | Capacitance | | | | | | | | | |
|--------|---|--|---------------|----|-----|----|---|-------------|---|----|-----|------|-------|-----|---|----|-----|
| | | | V | | kV | | | pF | | | | | μF | | | | |
| | | | 1 | 10 | 100 | 10 | 1 | 0.1 | 1 | 10 | 100 | 1000 | 10000 | 0.1 | 1 | 10 | 100 |
| ECAS |  7.3x4.3mm | <ul style="list-style-type: none"> Over 220μF No DC bias characteristics | 2Vdc-16Vdc | | | | | 6.8μF-560μF | | | | | | | | | |

Capacitors

Nichicon

nichicon

BC Series



Features & Benefits

- Category temperature range:
 - 40°C – +150°C (Ø 8mm – 10mm)
 - 55°C – +150°C (Ø 12.5mm – 18mm)
- Rated voltage range: 10V – 50V
- Rated capacitance range: 33µF – 3,300µF
- Endurance: 1,000 hours
- Case size: 8mm x 10mm – 18mm x 21.5mm

Applications

- Motor control
- Exhaust system

CZ Series



Features & Benefits

- Low temperature ESR specification
- Category temperature range: -40°C – +125°C
- Rated voltage range: 10V – 100V
- Rated capacitance range: 10µF – 470µF
- Endurance: 1,000 hours – 3,000 hours
- Case size: 6.3mm x 5.8mm – 10mm x 10mm

Applications

- Engine control
- Motor control
- Climate control

UBY Series



Ratings & Specifications

- Temperature range: -40°C – +135°C
- Rated voltage: 25V – 50V
- Rated capacitance: 620µF – 12,000µF
- Endurance: 3,000 hours at 125°C/135°C

Applications

- Engine control unit
- Electric power
- Electric power steering
- Motor control unit

Comparison to UBT Series, 25V/12.5mm x 25mm:

- UBT Series: 1,000µF
1,750mA at 125°C, 120Hz
- UBY Series: 3,000µF
3,480mA at 125°C, 120Hz

Capacitors

Panasonic

Panasonic

Hybrid Capacitors

Driven by miniaturisation of electrical components and higher switching frequencies of many electrical devices, hybrid capacitors have started to get more traction.



Panasonic Conductive Polymer Hybrid Aluminium Electrolytic Capacitors take the benefits of electrolytic and polymer capacitor technologies and combine them, producing a capacitor with low ESR, low leakage current, high ripple current and smaller case sizes. These advantages are in particular important in automotive applications, which tend to experience fluctuations in operating temperatures. Panasonic Hybrid Capacitors meet automotive requirements and comply with AEC-Q200 standards.

Features & Benefits

- Long life and high reliability
- Low ESR and high ripple current

- High ripple current
- Wide temperature range
- High voltage
- High capacitance
- Small case size

Applications

- Automotive ECU
- Motor drives
- DC/DC converter

Capacitors

Samsung Electro-Mechanics



Samsung Electro-Mechanics (SEM) was established in 1973 as a manufacturer of key electronic components and the company has grown from an A/V components manufacturer into one of the industry leaders in manufacturing passive chip components, multi-layer circuit boards and optical components. As second biggest MLCC manufacturer worldwide SEM is able to manufacture several billion pieces of MLCCs a month, on the highest level of quality and is moreover spending around 8% of its revenues for R&D, to exceed the market requirements.

Automotive MLCC

Quality design concept for automotive applications.



Features & Benefits

- The "P" series of the AEC-Q-200 compliant product have better quality based on fine material, inner design and specific inspections
- To reduce initial/wear-out failure rate, X7R dielectric components of "P" series have robust design margin for anti-deflecting crack, thermal strength, ESD, anti-soldering crack and life time by using fine ceramic material, metal-epoxy termination and robust safety margin size
- The metal-epoxy external electrodes decrease cracks by board deflection, which releases the stress

Applications

- Electric vehicle: battery management system
- Power train: ECU (Engine Control Unit), TCU
- Safety: ABS, airbag, TMPS
- Chassis: electric steering power
- Lighting: LED
- Body and convenience: BCM, cluster, keyless entry, junction box
- Infotainment: GPS/navigation, car multi system

Automotive MLCC for ESD Protection, PE Series

Features & Benefits

- Compliance with the IEC 61000-4-2 standard for ESD immunity
- Meet AEC-Q200 requirements
- Pb-free and ROHS compliant
- Available in package size 0603 (1608mm)
- Capacitance range from 1nF to 10nF (E6)
- Input and output sections (CAN BUS) of a wide range of automotive applications

Applications

- Input and output sections (CAN BUS) of a wide range of automotive applications

Standard X7R and C0G, PN Series

Features & Benefits

- Manufactured in state of the art facilities recommended for registration to ISO/TS 16949
- Meet AEC-Q200 requirements
- Packaged by tape and reel for surface mount assembly
- Pb-free and ROHS compliant
- X7R dielectric components have BME and metal-epoxy terminations with a Ni/Sn plated overcoat
- C0G dielectric components have BME and copper terminations with a Ni/Sn plated overcoat
- Size 0603/0805/1206 is suitable for flow and reflow soldering
- Size 0402 and smaller (≤ 0402) and 1210 and bigger (≥ 1210) is suitable for reflow soldering

Capacitors

TDK



High voltage automotive MLCCs with world's widest capacitance range

TDK Corporation has expanded its CGA lineup of high-voltage MLCCs for automotive applications.



The new CGA6 and CGA9 series of MLCCs, which have a rated voltage of 1000V, feature types with capacitances ranging from 1nF to 33nF, the world's widest range. The MLCCs are available with both C0G and NP0 temperature characteristics. They thus feature a temperature coefficient of $0 \pm 30 \text{ ppm}/^\circ\text{C}$ max. and temperature ranges of 55°C to $+125^\circ\text{C}$ and -55°C to $+150^\circ\text{C}$, respectively. As a result, their capacitance drift over temperature is negligible. Moreover, the new capacitors exhibit nearly no drift over voltage and time, making them suitable for applications where high capacitance stability of the components is essential. The CGA6 and CGA9 MLCCs measure in with footprints of $3.2\text{mm} \times 2.5\text{mm}$ (EIA 1210) and $5.7\text{mm} \times 5.0\text{mm}$ (EIA 2220), respectively.

Not only do the new MLCCs deliver an extremely constant capacitance under all conditions, their AC energy losses and heat generation are also extremely low. They are suited for use in the wireless charging units, DC-DC converters and onboard chargers in electric and plug-in hybrid vehicles, and wherever space savings and high performance are required.

Features & Benefits

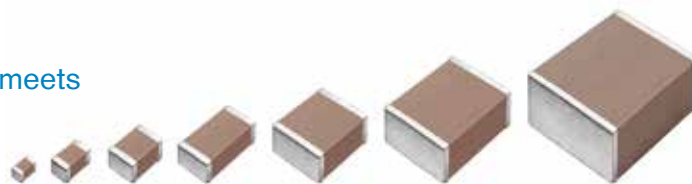
- Capacitance range of 1nF to 33nF with a rated voltage of 1000V
- Available in both C0G and NP0 temperature characteristics to ensure smallest temperature-dependent capacitance drift
- Qualified according to AEC-Q200

Applications

- Use in the engine compartments of automobiles and other automotive applications
- Circuits in industrial equipment where high reliability is essential, for example in timer circuits, filter circuits, resonance and oscillation circuits, and snubber circuits

CGA3EA Series for ESD Protection

The CGA3EA series of automotive grade MLCCs meets the ESD immunity requirements according to the IEC 61000-4-2 standard.



The new components are available in package size 1608 (EIA 0603) and offer rated capacitances ranging from 1nF to 10nF and a rated voltage of 100V. The series comprises two lineups of MLCCs with different thermal characteristics: C0G components with a temperature range of -55°C to $+125^\circ\text{C}$ and a temperature coefficient of $0 \pm 30 \text{ ppm}/^\circ\text{C}$ max., and NP0 components with a temperature range of -55°C to $+150^\circ\text{C}$ and the same temperature coefficient. The material used in the CGA3EA series features a low dielectric constant and thus maintains stable performance even when load conditions such as temperature or voltage change. The new components are therefore able to withstand ESD events of up to 8kV and higher, as proven by the contact discharge test according to IEC 61000-4-2 (level 4).

Features & Benefits

- Compliant with IEC 61000-4-2 level 4 or higher
- Series offers both C0G and NP0 components with a temperature range of -55°C to $+125^\circ\text{C}$ and -55°C to $+150^\circ\text{C}$, respectively, and a capacitance temperature coefficient of $0 \pm 30 \text{ ppm}/^\circ\text{C}$ max.
- Stable capacitance values regardless of DC bias, temperature or aging effects
- Capacitance range from 1nF to 10nF (E6)
- Qualified to AEC-Q200

Applications

- Airbag controllers
- Remote keyless entry systems
- Navigation systems

Capacitors

TDK



Aluminium Electrolytic Capacitors






| Series | Product | Technical data | Features & benefits | Ordering code/type |
|--|---------|---|--|--|
| Capacitors with 4-pin snap-in terminals/solder pins | | 385 – 500 V DC 220 – 3300 µF | • Compact can size | B43512, B43522 |
| | | 350 – 450 V DC 270 – 2700 µF | • Long useful life | B43513, B43523 |
| | | 350 – 450 V DC 270 – 2700 µF | • Compact can size, 105°C | B43516, B43526 |
| Snap-in capacitors | | 200 – 450 V 56 – 2200 µF 200 – 450 V 82 – 2700 µF 200 – 600 V 47 – 2200 µF | • Long useful life | B43624 |
| | | 200 – 450 V DC 82 – 3300 µF | • Ultra-compact can size • Outstanding ripple current capability, high voltage | B43634 B43541 |
| | | 200 – 450 V DC 82 – 3300 µF | • Ultra-compact can size • High ripple current capability, 105°C | B43508 |
| | | 200 – 450 V 56 – 2700 µF 200 – 450 V | • Compact can size, 105°C | B43509 |
| | | 82 – 3300 µF 200 – 500 V | • Ultra-compact can size, 105°C | B43640 |
| | | 35 – 2700 µF | • Ultra-compact can size, 105°C | B43644 |
| | | 200 – 550 V 47 – 2700 µF | • Outstanding ripple current capability | B43544 |
| | | 400 – 450 V 82 – 820 µF 200 – 450 V 82 – 2200 µF | • Compact can size, 105°C, outstanding ripple current capability • Very long useful life, 105°C, outstanding ripple current capability | B43545 B43547 |
| Large-size capacitors Low-voltage series | | 25 - 63 V DC 900 - 4700 µF 125 °C - > 10,000 h | • Very high ripple current capability optimised for high frequencies • Outstanding reliability • Long useful life | B41607 |
| | | 25 - 63 V DC 2000 – 27,000 µF 125 °C - > 5000 h | • Compact design • Very high ripple current capability optimised for high frequencies • High vibration stability (up to 40g available) • Up to 150°C | B41605 |
| Large-size and snap-in capacitors High-voltage series | | 450 V DC 100 – 470 µF 105 °C – 3000 h | • Design for On Board Charger • High ripple current capability • High vibration stability (up to 40g available) | B43504 |
| | | 450 V DC 120 – 680 µF 105 °C - 3000 h | • Design for On Board Charger • High ripple current capability • Compact can size | B43508 |
| Axial-lead and soldering star capacitors | | 25 - 63 V DC 270 – 4500 µF 125 °C - > 10,000 h 150 °C - > 2000 h | • Very high ripple current capability • Long useful life • Low ESR also at 63V • High vibration stability (up to 45 g available) • Different constructions available | B41689/B41789 |
| | | 25 - 100 V DC 300 – 10,000 µF 125 °C - > 10,000 h 150 °C - > 2000 h | • Each series is optimised to meet certain customer requirements (according to data book) • Different constructions available | B41690/ B41790 B41691/ B41791 B41692/ B41792 B41693/ B41793 B31695/ B41795 B41696/ B41796 |
| | | 160 - 250 V DC 22 – 130 µF 125 °C - > 2500 h 105 °C - > 10,000 h | • High voltage design • High ripple current capability | B43696/ B43793 |
| Single-ended capacitors | | 10 - 100 V DC 22 – 10,000 µF 105 °C - > 10,000 h | • Design for automotive applications • Each series is optimised to meet certain customer requirements (according to data book) • Various taping, packaging and lead configurations available | B41863 B41858 B41859 B41887 B41888 |
| | | 10 - 75 V DC 47 – 10,000 µF 125 °C - > 7000 h 135 °C - > 3000 h | • Design for automotive applications • High voltage design • Low ESR • Various taping, packaging and lead configurations available | B41866 B41895 B41896 |
| | | 160 - 250 V DC 33 – 270 µF 125 °C - > 4000 h | • Design for automotive applications • High voltage design • Low ESR • Various taping, packaging and lead configurations available | B43896 |

Capacitors

TDK



Film Capacitors (Medium Power)

| Series | | Technical data | Features & benefits | Ordering code/type |
|--|---|-------------------------------------|---|--------------------------------|
| EMI capacitors |  | 305VAC 10 μ F – 30 μ F | • General purpose across the line UL/ENEC | B329221C/D – B32928C/D (X2) |
| | | 250VAC 1nF – 10nF | • Reinforced insulation line to ground UL/ENEC | B81123 (Y1) |
| | | 300VAC 1nF – 1 μ F | • Basic insulation line to ground UL/ENEC • AEC-Q200 with restrictions | B32021 – B32026 (Y2) |
| EMI capacitors (humidity resistant) |  | 305VAC 0.1 μ F – 15 μ F | • For severe ambient conditions: +85°C/85% RH/240VAC/1000h +60°C/95% RH/240VAC/1000h • Between the lines and series applications • AEC-Q200 | B32922H/J – B32926H/J (X2) |
| MFP capacitors |  | 400 – 2000VDC 0.47nF – 1500nF | • Very high dV/dt | B32682 – B32686 |
| MKP capacitors |  | 250 – 2000VDC 1nF – 8.2 μ F | • General purpose • AEC-Q200 | B32651 – B32656 |
| | | 850 – 2000VDC 68nF – 5.6 μ F | • 17 versions of strap terminals | B32656S |
| | | 250 – 2000VDC 0.68nF – 1 μ F | • High VAC • AEC-Q200 | B32671L – B32672L |
| | | 450 – 1050VDC 0.47 – 270 μ F | • Highpower, high ripple current • AEC-Q200 | B32674 – B32678 |
| | | 450 – 1300VDC 1.5 – 480 μ F | • High density, small size | B32774 – B32778 |
| MKT capacitors |  | 63 – 630VDC 1nF – 220 μ F | • Up to +125°C • AEC-Q200 | B32520 – B32529 |
| | | 305VAC 47nF – 2.2 μ F | • +85°C/85% RH/240VAC/1000h UL/ENEC • Connection in series with the mains • AEC-Q200 | B32932 – B32936 |

Capacitors

Vishay



| Series | Product | Type | Technology | Description | Mounting | Voltage (V) | Capacitance | |
|-----------------|---------|-------------------|----------------------------|---|---------------|-------------|-------------|--------|
| | | | | | | | (min.) | (max.) |
| 146 CTI | | Capacitors, fixed | Aluminium | Aluminium capacitors SMD (chip), high temperature, low impedance | Surface mount | 16 | 220 µF | 4.7 mF |
| | | | | | | 25 | 100 µF | 2.7 mF |
| | | | | | | 35 | 33 µF | 1.8 mF |
| | | | | | | 50 | 47 µF | 1.2 mF |
| | | | | | | 63 | 22 µF | 1 mF |
| | | | | | | 80 | 10 µF | 470 µF |
| | | | | | | 100 | 10 µF | 330 µF |
| 150 CRZ | | Capacitors, fixed | Aluminium | Aluminium capacitors SMD (chip), very low Z | Surface mount | 6.3 | 470 µF | 10 mF |
| | | | | | | 10 | 330 µF | 6.8 mF |
| | | | | | | 16 | 220 µF | 4.7 mF |
| | | | | | | 25 | 150 µF | 3.3 mF |
| | | | | | | 35 | 100 µF | 2.2 mF |
| | | | | | | 50 | 68 µF | 1.5 mF |
| | | | | | | 63 | 33 µF | 680 µF |
| | | | | | | 80 | 47 µF | 680 µF |
| 160 CLA | | Capacitors, fixed | Aluminium | Aluminium capacitors SMD (chip), high temperature, low impedance | Surface mount | 16 | 470 µF | 3.3 mF |
| | | | | | | 25 | 330 µF | 2.2 mF |
| | | | | | | 35 | 220 µF | 1.5 mF |
| | | | | | | 50 | 100 µF | 1 mF |
| | | | | | | 63 | 47 µF | 680 µF |
| K...V Series | | Capacitors, fixed | Ceramic, multilayer leaded | Radial leaded multilayer ceramic capacitors for automotive applications class 1 and class 2, 50 V _{DC} , 100 V _{DC} , 200 V _{DC} | Through hole | 50 | 100 pF | 1 µF |
| | | | | | | 100 | 100 pF | 470 nF |
| | | | | | | 200 | 100 pF | 100 nF |
| AY2 Series | | Capacitors, fixed | Ceramic, single layer | Automotive Grade AC line rated ceramic disc capacitors class X1, 440 V _{AC} , class Y2, 300 V _{AC} | Radial | 300 | 10 pF | 4.7 nF |
| | | | | | | 440 | 10 pF | 4.7 nF |
| MKP1848 DC-Link | | Capacitors, fixed | Film | Metallised polypropylene film capacitors, DC-link capacitor | Radial | 450 | 1 µF | 400 µF |
| | | | | | | 700 | 1 µF | 320 µF |
| | | | | | | 800 | 1 µF | 240 µF |
| | | | | | | 900 | 1 µF | 200 µF |
| | | | | | | 1100 | 1 µF | 140 µF |
| | | | | | | 1200 | 1 µF | 120 µF |
| TH4 | | Capacitors, fixed | Tantalum, solid | Solid Tantalum surface mount chip capacitors TANTAMOUNT® molded case, high temperature 175 °C, Automotive Grade | SMD, molded | 6.3 | 10 µF | 47 µF |
| | | | | | | 10 | 10 µF | 47 µF |
| | | | | | | 16 | 10 µF | 47 µF |
| | | | | | | 35 | 22 µF | 22 µF |
| TP3 | | Capacitors, fixed | Tantalum, solid | Solid Tantalum surface mount chip capacitors TANTAMOUNT® molded case, high performance, Automotive Grade | SMD, molded | 4 | 4.7 µF | 68 µF |
| | | | | | | 6.3 | 2.2 µF | 470 µF |
| | | | | | | 10 | 1.5 µF | 220 µF |
| | | | | | | 16 | 1 µF | 220 µF |
| | | | | | | 20 | 680 nF | 100 µF |
| | | | | | | 25 | 470 nF | 47 µF |
| | | | | | | 35 | 100 nF | 22 µF |
| | | | | | | 50 | 100 nF | 10 µF |

Capacitors

WIMA



Film Capacitors

| WIMA Products | | Fields of Application | | | | | | | | | Features |
|---|--|-----------------------|---------------------------------------|-------------------------------|------------------------|--|---------------------------|----------------------|---|---------------------------------------|--|
| | | Safety | | | | Auxiliaries | | | Powertrain | | |
| | | Airbag control unit | Braking system control unit (ABS/ESC) | Tire pressure monitoring unit | HID lamps | Small motor drives (e.g. seats, mirrors, windows etc.) | Electrical power steering | Remote keyless entry | DC/DC converter and inverter. Electric drives | Fuel pump, diesel filter control unit | |
| SMD 0.01µF - 6.8µF 63-1000 VDC 1812 - 6054 | | SMD-PPS | SMD-PPS | SMD-PET SMD-PEN SMD-PPS | | SMD-PET SMD-PEN | SMD-PET SMD-PEN | SMD-PET SMD-PEN | | SMD-PET SMD-PEN | <ul style="list-style-type: none"> Operating temp. up to 140°C Operating life >300.000h Suitable for lead-free soldering at T≤250°C |
| Film 1000pF - 680µF 50 - 2000 VDC PCM 2.5 - 52.5 | | | MKS FKS | MKS FKS | | MKP | MKS MKP FKS | MKP | | MKS | <ul style="list-style-type: none"> Operating temp. up to 125°C Operating life >300.000h Smallest PCM 2.5mm |
| Pulse Duty 100µF - 47µF 100 - 6000 VDC PCM 7.5 - 52.5 | | | | | MKP 10 FKP 1 MKP | | | | MKP 10 FKP 1 MKP | | <ul style="list-style-type: none"> Operating temp. up to 100°C Operating life >300.000h Highest du/dt |
| Snubber 0.01µF - 8µF 630 - 4000 VDC Variable contacts | | | | | | | | | Snubber MKP/FKP | | <ul style="list-style-type: none"> Operating temp. up to 100°C Operating life >300.000h Various contact configurations |
| DC-LINK 1µF - 8250µF 400 - 1500 VDC Variable contacts | | | | | | | | | DC-LINK | | <ul style="list-style-type: none"> Operating temp. up to 100°C Operating life >200.000h 2-pin, 4-pin, screwable plate or screw connections |

YAGEO

YAGEO
Innovative Service Around the Globe

Automotive Grade MLCC – AC Series



Features & Benefits

- AEC-Q200 qualified and PPAP ready
- Board flex 2mm
- 100% AOI
- ISO/TS16949 certified
- TC:X7R, NPO(-55°C – 125°C)

Applications

- All general purpose applications
- Entertainment applications
- Comfort/security applications
- Information applications

Circuit Protection

AVX



Multilayer Varistors and NTC Thermistors

| Product | Series | Description | Operating temp | Range |
|--|--------------------------------|---|------------------|-------------------------------|
| Automotive Series Multilayer Varistors | | | | |
|  | Automotive TransGuard | Wide range of varistors for overvoltage protection with EMI/RFI filtering function in the off state. | +125°C | 5.6Vdc - 85Vdc 0.05J - 12J |
| | Automotive StaticGuard | Lower capacitance version of TransGuard. for general ESD and CMOS protection. | +125°C | 18Vdc 40 - 80pF |
| | Communication Bus Varistors | Low capacitance varistors for protection of CANBus, FlexRay, data lines etc. | +125°C | 18, 32Vdc 15 - 37pF |
|  | Automotive AntennaGuard | Low capacitance varistors for applications such as Antennas, RF, high-speed data links etc. | +125°C | 18Vdc 2 - 12pF |
| | Automotive Sub pF AntennaGuard | UltraLow capacitance varistors for applications such as sensors, RF, HDMI, high speed data links. | +125°C | 16Vdc 0.8pF |
| | Controlled Capacitance | Varistors with controlled capacitance for circuit protection and targeted EMI filtering. | +125°C | 22, 26Vdc 47, 82pF |
| | Miniature AC Varistor | Varistors designed for low power AC, LC resonant circuits, and higher DC data lines protection. | +125°C | 70Vdc/52Vac 6 - 22pF |
|  | Automotive High Temperature | Varistors designed for use in high temperature environment, under-hood applications etc | +150°C | 18, 32Vdc 12 - 22pF |
|  | Radial Automotive Varistors | Radial epoxy coated part for radial mounting, harsh environment, available also in high-temp series. | +125°C +150°C | 14 - 48Vdc 0.1 - 2.0J |
| | CapGuard™ | Combines advantages of varistor and high capacitance MLC capacitor in single component for overvoltage protection and enhanced EMI/RFI filtering. | +125°C | 26, 45Vdc 0.47, 1.0µF |
|  | Automotive TransFeed | Varistor with Feedthru construction for ESD suppression and enhanced EMI filtering. | +125°C | 5.6 - 26Vdc 0.05 - 0.3J |
| | Glass Encapsulated | Glass encapsulated varistors designed for high energy or harsh environment applications. | +125°C | 16 - 65Vdc 0.6 - 13.8J |
| NTC Thermistors | | | | |
|  | SMT Series | SMT thermistors for temperature measurement and temperature compensation. | +150°C | R: 10Ω - 1MΩ |
| | Disc Thermistors | Disc thermistors for temperature measurement and temperature compensation. | +150°C | R: 68Ω - 1MΩ |
| | High Accurate Series | Highly accurate thermistors for temperature sensing with tolerances from +/-1%. | +150°C | R: 2kΩ - 0.1MΩ |

Circuit Protection

Bourns

BOURNS®

ESD Protectors

Automotive electronics circuits may also be damaged by electrostatic discharge either through human contact on the assembly line or in the application itself.



Bourns provides a range of ESD protectors in 0402 and 0603 case size surface mount chips, which are ideal for providing protection where needed on communication ports such as CANbus, FlexRay or USB.

Applications

- Passenger comfort – navigation systems, instrument clusters
- Passenger safety – front and rear view cameras, airbag controls

Features & Benefits

- AEC-Q200 approval
- Operating voltages from 5V – 24V
- Low capacitance

| | Part number | Operating voltage (V) | ESD strength | Capacitance (pF) | Clamping voltage (V) |
|---|----------------|-----------------------|-----------------------|------------------|----------------------|
|  | CG0603MLC-05E | 5 | 8KV Contact, 15KV Air | 0.5 | 25 |
| | CG0603MLC-12E | 12 | 8KV Contact, 15KV Air | 0.5 | 25 |
|  | CGA0402MLC-05E | 5 | 8KV Contact, 15KV Air | 0.2 | 30 |
| | CGA0402MLC-12E | 12 | 8KV Contact, 15KV Air | 0.2 | 30 |
| | CGA0402MLC-24E | 24 | 8KV Contact, 15KV Air | 0.2 | 30 |
|  | CGA0603MLC-05E | 5 | 8KV Contact, 15KV Air | 0.2 | 30 |
| | CGA0603MLC-12E | 12 | 8KV Contact, 15KV Air | 0.2 | 30 |
| | CGA0603MLC-24E | 24 | 8KV Contact, 15KV Air | 0.05 | 30 |

Circuit Protection

Bourns

BOURNS®

ChipGuard® MLC Series ESD Protectors

The CGA-MLC Series is a family designed to protect sensitive automotive electronics from the threat of ESD up to IEC 61000-4-2 Level 4 in the ultra-small 0402 and 0603 type packages.



These very fast bidirectional protectors have low capacitance, minimal insertion loss and low leakage over a wide temperature range. High performance and reliability make the series a good choice in protecting antenna circuits, camera links, sensors, touch screen interfaces, GPS, USB 3.0 and high-speed communication buses, just to name a few. The new models are AEC-Q200 qualified and RoHS compliant.

Features & Benefits

- AEC-Q200 qualified
- ESD protection to IEC 61000-4-2 Level 4
- <1ns response time to ESD strike
- Low leakage current
- Extremely low capacitance (0.05pF typ.)
- Bidirectional
- Multi-strike capability
- RoHS compliant

Applications

- Camera links
- Sensors
- Touchscreen interfaces
- GPS
- Antennas
- USB 3.0
- High-speed communications buses

ChipGuard® MLA Series Varistor ESD Clamp Protectors

The Bourns® Model CGA-MLA Series is designed to protect sensitive automotive electronics from the threat of ESD up to IEC 61000-4-2 Level 4.



Available in 0603, 0805 and 1206 type packages, these very fast bidirectional devices provide robust over voltage protection and stable low leakage performance over a wide temperature range. High performance and reliability make the series a good choice in electrical protection of sunroofs and control units as well as engine management systems, just to name a few. The new models are AEC-Q200 and RoHS compliant.

Features & Benefits

- AEC-Q200 qualified
- Meets IEC 61000-4-2 standard
- Multi-layered varistor technology
- Proprietary insulating overcoat provides low and stable leakage current
- Quick response time (<0.5ns)
- High transient current capability
- High reliability
- RoHS compliant

Applications

- HDMI
- CANbus
- Ethernet
- GPS
- Camera links
- Sensors
- Touchscreen interfaces
- Circuits sensitive to ESD

Circuit Protection

Bourns

BOURNS®

Multifuse® PPTC Resettable Fuses

Bourns® Multifuse® Polymer Positive Temperature Coefficient (PPTC) Resettable Fuses are used in a wide variety of circuit protection automotive applications.










PPTCs provide both overcurrent and overtemperature protection by transitioning from a low resistive to a high resistive state in response to fault events, such as a short circuit, an overcurrent surge or high temperature event. Bourns has developed a range of high temperature devices that have been specifically designed for the elevated temperature ranges experienced in the automotive industry. They have also been vigorously tested to both AEC and customer specific tests to protect applications such as DC motors, comfort, safety and entertainment systems.

Features & Benefits

- Resettable overcurrent protection
- ISO/TS 16949 certified
- AEC approvals
- High temperature options
- High voltage options for 42V and electric vehicle systems

Applications

- Powertrain – engine cooling fan control
- Passenger comfort – seat and sunroof controls, electric windows, car alarms
- Passenger safety – front and rear view cameras
- Infotainment – GPS systems, on-board entertainment systems
- USB protection

| | Series | Max operating temperature (°C) | Max voltage (V) | Current range (A) |
|---|---------|--------------------------------|-----------------|-------------------|
|  | MF-RHT | 125 | 16 | 0.7 – 13 |
|  | MF-SMHT | 125 | 16 | 1.36 – 1.6 |
|  | MF-PSHT | 125 | 16 | 0.1 |
|  | MF-RG | 85 | 16 | 3 – 5 |
|  | MF-R | 85 | 60 | 0.05 – 11 |
|  | MF-SM | 85 | 6 – 60 | 0.3 – 3 |
|  | MF-LSMF | 85 | 6 – 33 | 1.85 – 3.0 |
|  | MF-MSMF | 85 | 6 – 60 | 0.1 – 2.6 |
|  | MF-NSMF | 85 | 6 – 30 | 0.12 – 2 |

Circuit Protection

Eaton



CC12H Surface Mount Fuses



Features & Benefits

- AEC-Q200 qualified
- High inrush withstand capability
- Excellent temperature and cycling characteristics

Applications

- Automotive infotainment
- Electronic control units
- Electronic spark igniters
- Wireless chargers
- Battery management

| | Current rating (A) | | Voltage rating (Vdc) | | Breaking capacity (A) | | Resistance (mΩ) typical | | Typical melt (I ² T) DC | | Typical voltage drop (mV) | |
|-------|--------------------|------|----------------------|------|-----------------------|------|-------------------------|------|------------------------------------|------|---------------------------|------|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| CC12H | 0.25 | 30 | 32 | 63 | 50 | 200 | 2.1 | 3500 | 0.00038 | 100 | 90 | 1400 |

PS04LTVA1 ESD Suppressor



Features & Benefits

- AEC-Q200 qualified
- Ultra-low capacitance
- Small footprint
- Low trigger and clamping voltages

Applications

- Automotive infotainment
- High speed data ports

| | Rated voltage (Vdc) | Clamping voltage (V) | Trigger voltage (V) | Capacitance (pF) |
|-----------|---------------------|----------------------|---------------------|------------------|
| PS04LTVA1 | 5 | 25 | 150 | 0.05 |

Knowles



Surface Mount EMI Filters

Features & Benefits

- Surface mount EMI filters from 0805 to 1812
- Feedthrough filter capacitors with capacitance up to 1.8μF
- AEC-Q200 qualified
- For crankshaft sensors, pedal position sensors and other applications



X2Y EMI Filter

Features & Benefits

- Suitable for a variety of automotive applications
- Efficient low pass SMD EMI filter, for balanced or unbalanced lines
- Suppresses EMI on dc motors – e.g. car seat, windows, HVAC, movable grilles
- Up to 500Vdc working
- AEC-Q200 qualified



Panel Mount EMI Filters

Features & Benefits

- Low pass EMI suppression filters
- Available in C, L-C, T and Pi-section
- Voltage ratings up to 2kVdc
- Suitable for EMI filtering in electronic circuits in railway applications



Circuit Protection

Littelfuse



MICRO2™ Blade Fuse 32V

The MICRO2™ Fuse is the new standard for vehicle circuit protection.



Its sub-miniature design meets the need for more circuits to be protected while utilising less space and its ability to cope with high temperatures in adverse environments makes the MICRO2™ Fuse the recommended choice for protection.

Features & Benefits

- Voltage rating: 32VDC
- Interrupting ratings: 1,000A at 32VDC
- Operating temperature range: -40°C – +125°C
- Terminals: Ag plated zinc alloy
- Housing material: PA66

| Part number | Current rating | Colour code | Typical voltage drop | Cold resistance | I ² t |
|-------------|----------------|-------------|----------------------|-----------------|-----------------------|
| 0327005_ | 5A | | 116mV | 17.4mΩ | 17 A ² s |
| 0327075_ | 7.5A | | 106mV | 10.8mΩ | 47 A ² s |
| 0327010_ | 10A | | 102mV | 7.7mΩ | 89 A ² s |
| 0327015_ | 15A | | 94mV | 4.8mΩ | 189 A ² s |
| 0327020_ | 20A | | 91mV | 3.4mΩ | 397 A ² s |
| 0327025_ | 25A | | 90mV | 2.6mΩ | 585 A ² s |
| 0327030_ | 30A | | 88mV | 2.1mΩ | 1028 A ² s |

Ordering Information

| Part number | Package size |
|--------------|--------------|
| 0327xxx.YX2S | 4000 |
| 0327xxx.UXS | 500 |
| 0327xxx.LXS | 50 |

LC HEV FUSE

The LC HEV fuse is designed for protection of high-voltage accessory circuits in electric and hybrid electric vehicles.



Features & Benefits

- Interrupting rating (10A, 15A, 20A, 30A): 10kA at 450VDC
- Interrupting rating (40A): 10kA at 425VDC
- Voltage rating (10A, 15A, 20A, 30A): 450VDC
- Voltage rating (40A): 425VDC
- Operating temperature range: -40°C to +125°C

Time-Current Characteristics

| % of rating | Opening time min/max (s) 10A | Opening time min/max (s) 15A, 20A, 30A | Opening time min/max (s) 40A |
|-------------|------------------------------|--|------------------------------|
| 100 | 100 hrs/- | 100 hrs/- | 100 hrs/- |
| 110 | 4 hrs/- | 4 hrs/- | - |
| 135 | 100/3600 | 150/3600 | 150/3600 |
| 150 | 10/1,000 | 10/1,000 | 10/1,000 |
| 200 | 0.5/100 | 0.5/100 | 0.5/100 |
| 300 | 0.1/15 | 0.1/15 | 0.1/15 |
| 500 | 0.05/1 | 0.05/1 | 0.05/1 |

| Part number | Current rating | Colour code | Typical voltage drop at 70% IR | Maximum voltage drop spec at 100% IR | Cold resistance | Minimum melting I ² t |
|-------------|----------------|-------------|--------------------------------|--------------------------------------|-----------------|----------------------------------|
| 0HEV010.xxx | 10A | | 114mV | 300mV | 13.3mΩ | 255 A ² s |
| 0HEV015.xxx | 15A | | 96mV | 200mV | 7.9mΩ | 133 A ² s |
| 0HEV020.xxx | 20A | | 79mV | 200mV | 6.4mΩ | 268 A ² s |
| 0HEV030.xxx | 30A | | 67mV | 200mV | 2.7mΩ | 993 A ² s |
| 0HEV040.xxx | 40A | | 69mV | 200mV | 1.3mΩ | 1495 A ² s |

Circuit Protection

Littelfuse



PolySwitch Surface-Mount Devices

PolySwitch SMD devices help protect computer and consumer electronics against temporary overcurrent faults.



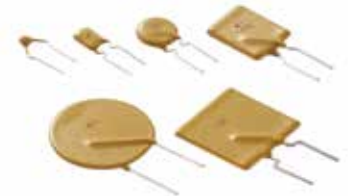
The PolySwitch surface mount product family has been extended to include a range of devices, which are qualified to rigorous automotive standards (following the AEC-Q200 specification). As a result, they are suitable for protecting Electronic Control Units (ECUs) against damage from faults that would otherwise require costly, complete module replacement

Features & Benefits

- Current ratings up to 3A
- Voltage ratings up to 60VDC
- A wide range of current ratings available
- Small size down to 1608mm (0603mils)
- Temperature range -40°C/+85°C or +125°C
- Suitable for ECU I/O and trace protection
- Devices available for both current and future vehicle electrical systems (12V, 24V, 42V systems)
- Maximum design flexibility
- Minimises circuit-board space, weight and cost
- Can be designed in cabin or under-hood applications

PolySwitch Radial-Leaded Devices

PolySwitch through-hole devices represent a comprehensive and complete range of PPTC overcurrent protection for the car, truck and bus industries.



Littelfuse offers a wide range of devices all qualified to rigorous automotive standards (following the AEC-Q200 specification).

Features & Benefits

- Current ratings up to 15A
- Voltage ratings up to 72VDC
- Compatible with high-volume, automatic insertion, electronic assembly processes
- Very low electrical resistance
- Broad range of through-hole polymeric PTC devices available with small current increments
- Temperature range -40°C/+85°C or +125°C
- Can be used in applications that require fuse values up to 30A
- Devices available for both existing and future vehicle electrical systems (12V, 24V, 42V systems)
- Low installation cost
- Low voltage drop
- Many available electrical and physical sizes facilitate the most precise protection design
- Can be designed in cabin or under-hood applications

Circuit Protection

Littelfuse



MLA Auto Varistor Series

Multi Layer Varistor

The MLA Auto Series Varistor devices protect integrated circuits and other components at the circuit board level.



The MLA Automotive Series of transient voltage surge suppression devices is based on the Littelfuse Multilayer fabrication technology. These components are designed to suppress a variety of transient events, including those specified in IEC 61000-4-2 or other standards used for Electromagnetic Compliance (EMC).

Features & Benefits

- AEC-Q200 compliant
- RoHS compliant
- Leadless 0603, 0805, 1206 and 1210 chip sizes
- Multilayer ceramic construction technology
- -55°C to +125°C operating temp. range
- Operating voltage range $V_M(DC) = 3.5V$ to 48V
- Rated for surge current ($8 \times 20\mu s$); rated for energy ($10 \times 1000\mu s$)

- No plastic or epoxy packaging assures better than UL94V-0 flammability rating
- Meets automotive industry requirements
- Suitable for harsh automotive environments
- Eliminating lead inductance and assuring fast speed of response to transient surges

Applications

- Body electronics systems
- Powertrain systems
- Infotainment systems
- Automotive control module protection
- Motor or inductive load transient suppression

AUMOV[®] Varistor Series

Metal Oxide Varistor

AUMOV[®] Varistor Series protects sensitive automotive systems from voltage transients induced by load dump, jump starts and other transient events.



The AUMOV Series Varistor offers 50 percent greater surge withstanding capability than existing technologies on the market for low DC voltage automotive electronics applications. The maximum peak surge current is rated up to 5kA (8/20 μ s pulse) to protect sensitive automotive systems from voltage transients induced by load dump and other transient events.

Features & Benefits

- UL recognised
- -40°C to +85°C operating temp. range (epoxy coating), optional phenolic coating for operating temps up to 125°C
- High peak surge current rating and energy absorption capability
- Reduced footprint and volume required for voltage surge protection

- High resistance to thermal cycles for phenolic coating
- Lead free, halogen free and RoHS compliant
- Meets automotive industry requirements
- Suitable for harsh automotive environments
- Helps meet UL1449 requirements
- Up to 3x higher surge handling capability than similar sized varistors

Applications

- Body electronics systems
- Powertrain systems
- Infotainment systems
- Automotive control module protection
- Motor or inductive load transient suppression

Circuit Protection

Murata



EMI Suppression Filters

Powertrain/Safety

| BLM Inductor Type | | Series | Size code in inch (in mm) | Impedance (Ω) at 100MHz | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|------------------------|---|-----------|---------------------------|-------------------------|--|--------|------|-------|--------|------|-------|
| | | | | | 10kHz | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz |
| For General Band Noise | For General Signal Lines | BLM_AG | | 0402-0805 (1005-2012) | 10-1000 | | | | | | |
| | For High Speed Signal Lines | BLM_B | | 0402-0805 (1005-2012) | 5-2700 | | | | | | |
| | Power Lines Type | BLM_PG* | | 0603-1806 (1608-4516) | 22(6A)-1000(1.5A) | | | | | | |
| For GHz Band Noise | Universal Type [Power Lines/Signal Lines] | BLM18EG* | 0603 (1608) | 100(2A)-600(0.5A) | | | | | | | |
| | Signal Lines Type | BLM_HG+HD | 0402-0603 (1005-1608) | 470-1800 | | | | | | | |

| NFM Capacitor Type | | Series | Size code in inch (in mm) | Capacitance (F) | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|---|--|----------|---------------------------|-----------------|--|--------|------|-------|--------|------|-------|
| | | | | | 10kHz | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz |
| Universal Type [Power Lines/Signal Lines] | | NFM21HC | | 0805 (2012) | 22p-1μ | | | | | | |
| | | NFM31HK* | | 1206 (3216) | 10000p-0.1μ | | | | | | |

| NFE LC Combined Type | | Series | Size code in inch (in mm) | Impedance (Ω) at 100MHz | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|---|--|---------|---------------------------|-------------------------|--|--------|------|-------|--------|------|-------|
| | | | | | 10kHz | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz |
| Universal Type [Power Lines/Signal Lines] | | NFE61HT | | 2706 (6816) | 33p-3300p | | | | | | |

| DLW Common Mode Choke Coils | | Series | Size code in inch (in mm) | Impedance (Ω) at 100MHz | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|-----------------------------|-------------------------------|--------|---------------------------|-------------------------|--|------|-------|--------|------|-------|--|
| | | | | | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz | |
| Signal Lines Type | For Differential Signal Lines | DLW31S | | 1206 (3216) | 2200 | | | | | | |

| DLW Common Mode Choke Coils | | Series | Size code in inch (in mm) | Impedance (Ω) at 100MHz | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|-----------------------------|-------------------------------|--------|---------------------------|-------------------------|--|------|-------|--------|------|-------|--|
| | | | | | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz | |
| Signal Lines Type | For Differential Signal Lines | DLW43S | | 1812 (4532) | 11-100 | | | | | | |

| PLT Large Current Common Mode Choke Coils for Automotive Available | | Series | Size code in inch (in mm) | Impedance (Ω) at 100MHz | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|--|--|---------|---------------------------|-------------------------|--|------|-------|--------|------|-------|--|
| | | | | | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz | |
| Power Lines Type | | PLT10H* | | - | 45-1000 | | | | | | |

| BNX Block EMIFIL* | | Series | Height (mm) | Rated voltage (Vdc) | Rated current (A) | Effective frequency range (Applicable frequency ranges are only for reference) | | | | | | |
|-------------------|-----------|------------|-------------|---------------------|-------------------|--|--------|------|-------|--------|------|-------|
| | | | | | | 10kHz | 100kHz | 1MHz | 10MHz | 100MHz | 1GHz | 10GHz |
| Power Lines Type | SMD Type | BNX024H01* | | 3.5 | 50 | 15 | | | | | | |
| | | BNX025H01* | | 3.5 | 25 | 15 | | | | | | |
| | | BNX026H01* | | 3.5 | 50 | 15 | | | | | | |
| | | BNX027H01* | | 3.5 | 16 | 15 | | | | | | |
| | Lead Type | BNX012H01* | | 8.5 max. | 50 | 15 | | | | | | |

| VFC Lead Type Capacitors with Varistor Function | | Series | Height (mm) | Capacitance (F) | Varistor voltage (V) | |
|---|--|--------|-------------|-----------------|----------------------|----|
| Power Lines Type | | VFC2 | | 6.0 max. | 1.0μ | 27 |

* The derating of rated current is required for some items according to the operating temperature.

Circuit Protection

TDK



Multilayer Varistors: E Series for Automotive Electronics

TDK has extended its product range of EPCOS multilayer varistors with the E Series, which is designed to assure protection from current surge pulses in automotive electronics. Thanks to their innovative glass passivation, the SMD protection components that are qualified to AEC-Q200 with an extended stress test are even more rugged and reliable than before.







Features & Benefits

- Reliable ESD protection up to 30kV acc. to IEC 61000-4-2, level 4 (8kV contact, 15kV air)
- High energy absorption capability
- Bidirectional protection
- No temperature derating up to 150°C
- Qualification based on AEC-Q200
- RoHS-compatible, lead-free

Applications

- Transient overvoltage protection in automotive applications: engine management, airbag, control units, electrohydraulic brake, ABS/ESP, sunroof
- Load-dump protection
- Jump-start protection

Leaded Varistors

| Series | | Technical data | Features & benefits | Ordering code/type |
|--|---|--|---|---|
| Disk varistors AUTO types for 12-V supply systems |  | V_{RMS} : 14 and 17 V I_{max} : 0.25 – 2 kA | <ul style="list-style-type: none"> • High energy absorption, particularly for load dump • Jump-start strength • Stable protection level, minimum leakage current • High resistance to cyclic temperature stress | B72210S1... B72214S1... B72220S1... |
| Disk varistors AUTOD1 types for 12-V supply systems |  | V_{RMS} : 14 V I_{max} : 0.25 – 1 kA | <ul style="list-style-type: none"> • High operating temperature range up to 125°C • Qualified to AEC-Q200 | B72207S1... B72210S1... B72214S1... |
| Disk varistors AUTO types for 24-V systems |  | V_{RMS} : 25 and 30 V I_{max} : 1 and 2 kA | <ul style="list-style-type: none"> • High energy absorption, particularly for load dump • Jump-start strength • Stable protection level, minimum leakage current • High resistance to cyclic temperature stress | B72214S1... B72220S1... |
| Disk varistors SNF 14E2 and 20E2 for on-board chargers |  | V_{RMS} SNF 14E2: 275 - 625 V V_{RMS} SNF 20E2: 275 - 420 V | <ul style="list-style-type: none"> • Qualified to AEC-Q200 • High operating temperature range up to 125°C | B722*X* |

Electromagnetic

Bourns

BOURNS®

The continuing replacement of mechanical couplings in vehicles with electronics and communications has brought tremendous growth and opportunities for electronic components. Electronics are appearing in a broad range of systems such as engine controllers, safety systems, chassis control, diagnostic systems and infotainment. All of these systems are connected to each other over networks using CANbus, FlexRay, LINbus or Ethernet. The use of sensors coupled with electronics is enabling car manufacturers to reduce cost, improve energy efficiency and ultimately meet tough CO₂ emissions targets.

Magnetics













Inductors in automotive electronics are used on different types of switch mode power supplies, as well as inverters acting as energy storage devices during the voltage conversion or as part of differential or common mode filters for EMI suppression.

Features & Benefits

- AEC-Q200 qualified inductors
- Designed for DC/DC converters
- Inductance values up to 1mH
- Up to 17.6A DC current
- Ferrite core for high frequency switching

Applications

- Convenience – keyless entry, rain sensors, headlamp control
- Passenger comfort – navigation, entertainment systems, instrument clusters, ethernet gateway

| | Series | Inductance range (µH) | DC current range (A) | Saturation current range (A) | Core |
|---|----------|-----------------------|----------------------|------------------------------|----------------|
|  | SDE1006A | 1.2 – 820 | 7.2 – 0.45 | 7.2 – 0.45 | Ferrite |
|  | SDR1307A | 1.5 – 1,000 | 9.5 – 0.65 | 20 – 1.0 | Ferrite |
|  | SRR0735A | 10 – 680 | 2.1 – 0.21 | 1.85 – 0.22 | Ferrite |
| | SRR1260A | 1 – 1,000 | 9.4 – 0.68 | 10 – 0.6 | Ferrite |
|  | SRR1280A | 4.7 – 1,000 | 8.2 – 0.68 | 8.8 – 0.8 | Ferrite |
|  | SRU1028A | 1-150 | 7 – 0.7 | 8.0 – 0.65 | Ferrite |
|  | SRU1038A | 1.5 – 330 | 7.2 – 0.55 | 7.0 – 0.55 | Ferrite |
|  | SRU1048A | 1.5 – 330 | 7 – 0.65 | 7.2 – 0.52 | Ferrite |
|  | SRU3028A | 10 – 33 | 0.72 – 0.47 | 0.86 – 0.48 | Ferrite |
|  | SRU5028A | 1.2 – 100 | 3.5 – 0.47 | 3.4 – 0.42 | Ferrite (Drum) |
|  | SRU6025A | 1.2 – 220 | 4.0 – 0.42 | 3.2 – 0.24 | Ferrite (Drum) |
|  | SRU8028A | 2.5 – 100 | 4.5 – 0.75 | 4.2 – 0.7 | Ferrite (Drum) |
|  | SRF1260A | 0.47 – 1,000 | 17.6 – 0.57 | 33 – 0.7 | Ferrite (Drum) |

Electromagnetic

Eaton



Magnetics

DRA



Features & Benefits

- AEC-Q200 qualified
- 165°C max operating temperature
- Ferrite core material
- 5 size options available

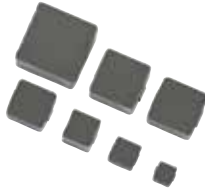
HCMA



Features & Benefits

- AEC-Q200 qualified
- 125°C max operating temperature
- Iron powder core material
- 5 size options available

HCM1A



Features & Benefits

- AEC-Q200 qualified, Grade 1
- 155°C max operating temperature
- Iron powder core material

HC31A



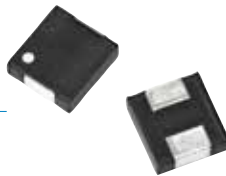
Features & Benefits

- AEC-Q200 qualified, Grade 1
- 165°C max operating temperature
- 33 x 27.2 x 21mm

Applications

- Body electronics
- Advanced drive assistance systems
- Infotainment and cluster electronics
- Automotive lighting
- Engine cooling pumps
- Engine control units
- Turbochargers

MPIA4040



Features & Benefits

- AEC-Q200 Grade 3 qualified
- Handles high transient inrush current spikes
- Magnetically shielded
- 4.7 x 4.31 footprint SMD in 1.2, 1.5, 1.85 or 2.0mm heights
- Rugged construction
- Halogen free, lead free, RoHS compliant

DRAQ



Features & Benefits

- AEC-Q200 qualified
- 165°C max operating temperature
- Dual winding inductors that can be used as single inductor or coupled inductor/transformers
- Ferrite core material

| Family | Inductance (μH) | | Isat current (A) | | I _{rms} current (A) | | DCR maximum (Ω) | |
|--------|-----------------|------|------------------|------|------------------------------|------|-----------------|------|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| DRA | 0.29 | 1002 | 0.24 | 56 | 0.24 | 15.9 | 0.003 | 6.18 |
| DRAQ | 9.63 | 192 | 2.54 | 11.2 | 1.31 | 6.02 | 0.022 | 0.44 |
| HCM1A | 0.1 | 100 | 2.1 | 80 | 1.2 | 53 | 0.6 | 265 |
| HCMA | 0.1 | 68 | 1.9 | 118 | 1.8 | 55 | 0.59 | 270 |
| HC31A | 3.2 | 10 | 46 | 68 | 30.7 | 60.4 | 0.89 | 3.1 |
| MPIA | 0.1 | 22 | 1.8 | 32 | 1.1 | 10.1 | 5.3 | 408 |

Electromagnetic

Murata



DLW Series Common Mode Choke Coils

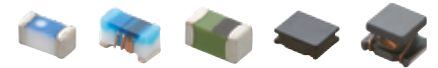
Murata DLW Common Mode Choke Coils are part of the EMI suppression filter product line.



The DLW Common Mode Choke Coils from Murata offer wound, low-profile construction in multiple case sizes and ultra-high self resonance frequency that enables high cut-off frequency for high-speed differential lines. The DLW Series also offers large current (6A maximum) suitable for an input connector from an AC adaptor.

Features & Benefits

- High cut-off frequency for high speed differential signal lines
- Low profile
- Wound structure
- Large current (6A maximum) suitable for input connector from an AC adaptor



| Application Matrix | | | | | |
|---|--------|------------|--------|---------|--------------|
| Product name | Series | Powertrain | Safety | Comfort | Infotainment |
| RF Inductors Film Type | LQP | | | • | • |
| RF Inductors Multilayer Type | LQG | • | • | • | • |
| RF Inductors/Power Lines Wire Wound Type | LQW | | | • | • |
| Power Lines/General Circuit Multilayer Type | LQM | • | • | • | • |
| Power Lines/General Circuit Wire Wound Type | LQH | • | • | • | • |

Powertrain/Safety

| Series | Type | Size code in inch (in mm) | Thickness (mm/max.) | Inductance range (H) | | | | | | | Rated current |
|--------|---|---------------------------|---------------------|----------------------|-----|------|-------------|-----|------|----|---------------|
| | | | | 1n | 10n | 100n | 1μ | 10μ | 100μ | 1m | |
| LQG | RF Inductors Multilayer Type | 0402 (1005) | – | 1.0nH-270nH | | | | | | | 110mA-300mA |
| | | 0603 (1608) | – | 1.2nH-270nH | | | | | | | 200mA-500mA |
| LQM | Power Lines/General Circuit Multilayer Type | 0805 (2012) | 1.2 ≥ Size T ≥ 1 | | | | 2.2μH | | | | 800mA |
| LQH | Power Lines/General Circuit Wire Wound Type | 1210 (3225) | Size T > 1.2 | | | | 0.15μH-22μH | | | | 250mA-1.45A |

Infotainment/Comfort

| Series | Type | Size code in inch (in mm) | Thickness (mm/max.) | Inductance range (H) | | | | | | | Rated current |
|------------------|---|---------------------------|---------------------|----------------------|--------------|------|----------------|-----|------------|----|---------------|
| | | | | 1n | 10n | 100n | 1μ | 10μ | 100μ | 1m | |
| LQP | RF Inductors Film Type | 0201 (0603) | – | 0.6nH-120nH | | | | | | | 80mA-850mA |
| LQG | RF Inductors Multilayer Type | 0402 (1005) | – | 1.0nH-270nH | | | | | | | 110mA-300mA |
| LQW | RF Inductors/Power Lines Wire Wound Type | 0402 (1005) | – | 1.3nH-120nH | | | | | | | 110mA-1.2A |
| | | 0603 (1608) | – | 2.2nH-470nH | | | | | | | 75mA-1.4A |
| LQM | Power Lines/General Circuit Multilayer Type | 0805 (2012) | 1 > Size T | | | | 0.47μH-2.2μH | | | | 600mA-1.1A |
| | | | 1.2 ≥ Size T ≥ 1 | | | | 0.47μH-4.7μH | | | | 800mA-1.3A |
| | | 0806 (2016) | 1.2 ≥ Size T ≥ 1 | | | | 0.47μH-4.7μH | | | | 1.1A-1.6A |
| | | 1008 (2520) | 1 > Size T | | | | 0.56μH | | | | 1.5A |
| 1.2 ≥ Size T ≥ 1 | | | | | 0.24μH-4.7μH | | | | 800mA-1.8A | | |
| LQH | Power Lines/General Circuit Wire Wound Type | 1008 (2520) | 1.2 ≥ Size T ≥ 1 | | | | 0.47μH-22μH | | | | 430mA-2.75A |
| | | 1206 (3216) | Size T > 1.2 | | | | 0.054μH-0.88μH | | | | 180mA-920mA |
| | | 1210 (3225) | Size T > 1.2 | | | | 0.47μH-330μH | | | | 60mA-2.9A |
| | | 1212 (3030) | 1.2 ≥ Size T ≥ 1 | | | | 0.47μH-47μH | | | | 460mA-2.86A |
| | | 1515 (4040) | 1.2 ≥ Size T ≥ 1 | | | | 0.68μH-47μH | | | | 410mA-2.5A |
| | | 1812 (4532) | Size T > 1.2 | | | | 1.0μH-2200μH | | | | 30mA-3.3A |
| | | 2020 (5050) | Size T > 1.2 | | | | 0.47μH-22μH | | | | 1.05A-4.0A |

Electromagnetic

Panasonic

Panasonic

Power Choke Coil – ETQP Series

In order to achieve the high requirements for the environment and low fuel consumption, the number of functions implemented in ECUs is growing while at the same time mounting space becomes smaller and smaller.



In addition, as the number of ECUs in non-engine applications rises, there is a growing requirement for smaller, lighter and integrated ECUs. This has led to the central processing units (CPUs) of ECUs having a higher clock speed and lower voltage, and the power supply circuits to drive CPUs incorporating high efficiency DC/DC converters are becoming more common. Against this background, the power choke coils mounted on DC/DC converters are required to be small in size and capable of supporting a high current, while being resistant to heat and vibrations. To meet the market demand, Panasonic has succeeded in commercialising a metal composite power choke coil suitable for in-vehicle power supply circuits, DC/DC converters and filter circuits.

Features & Benefits

- Low DC-resistance, low AC-resistance
- Compact size and large current, saving space in power supply circuits used in ECUs
 - Dimensions: L 10mm x W 10mm x H 4/5/6mm – L 12mm x W 12mm x H 8mm
 - Approx. 40% reduction in volume
 - Current value: 4.0A – 35A depending on inductance value and size
- Low loss, improving the efficiency of the power supply and enabling an increase of the ECU functionality
- Excellent heat and vibration resistance properties, suitable for high vibration up to 30G
- Heat-resistance: 150°C/2000h

Applications

- Engine ECUs for HEVs
- Gasoline cars
- Power supply circuits of a variety of ECUs

Electromagnetic

TDK



Common Mode Chokes for Automobile Signal Lines – ACT Series



Features & Benefits

- Compatible with an operating temperature range of -40 – +150°C, the chokes can be used for vehicle devices requiring compatibility with high temperatures (ACT45B, ACT45R)
- ACT45R for FlexRay is a product that can achieve DC resistance < 2Ω at 125°C by reducing the DC resistance while maintaining a high inductance value of 100μH
- ACT45L for Ethernet is a product that can realise higher-level Scd21 mode conversion characteristics while maintaining a high inductance value of 200μH

Applications

- ACT45B: CAN bus systems as well as fax, modem and ISDN equipment
- ACT45R: FlexRay bus systems
- ACT45L: 2-wire automotive Ethernet systems such as BroadR-Reach networks

Inductors

| Series | | Technical data | Features & benefits | Ordering code/type |
|---------------------------------------|--|--|---|--|
| SIMID 0603 – 2220 | | L_R : 1 nH – 10,000 μH I_R : up to 3.51 A | <ul style="list-style-type: none"> • Wide temperature range from -55 °C – +150 °C • Miniaturised versions • High mechanical strength • Suitable for lead-free soldering profiles to JEDEC J-STD 020C • Qualified to AEC-Q200 | B82496-C B82498-F B82422 B82432 B82442 |
| Data and signal line chokes SIMDAD | | L_R : 11 - 100 μH I_R : 150 - 300 mA | <ul style="list-style-type: none"> • Temperature range up to 150 °C • Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020C • Qualified to AEC-Q200 • RoHS-compatible • Cost-optimised I-core solution | B82789 |
| Data and signal line chokes ACT45B | | L_R : 51 and 100 μH I_R : 200 and 150 mA | <ul style="list-style-type: none"> • Temperature range up to 150 °C • Qualified to AEC-Q200 • Suitable for lead-free soldering as referenced in JEDEC J-STD 020D • RoHS-compatible • Cost-optimised I-core solution | B82787 |
| Data and signal line chokes ACT45R | | L_R : 5 – 100 μH I_R : 2 – 200 mA | | ACT45R-101-2P-TL* |
| Data and signal line chokes ACT45L | | L_R : 200 μH I_{max} : 200 mA | | ACT45L-201-2P-TL* |
| Data and signal line chokes | | L_R : 0.005 μH – 4.7 mH I_R : 0.4 – 1.2 A | <ul style="list-style-type: none"> • High rated current • Qualified to AEC-Q200 • RoHS-compatible • Reduced component height • Cost-optimised open construction | B82793 |
| Current compensated ring core chokes | | L_R : 0.2 – 82 mH I_R : 0.3 – 16 A | <ul style="list-style-type: none"> • High resonance frequency • Approximately 1% stray inductance • UL and/or VDE Approvals | B82721A/J/K B82722A/J B82723A/J B82724A/J B82725A/J B82726S |
| ERU Helical wound chokes | | L_R : 0.5 – 35 μH I_R : 12 – 71 A | <ul style="list-style-type: none"> • Very low profile • High rated current • Low DC resistance • Magnetically shielded | B82559A |

Electromagnetic

TT Electronics



HA78 Series – SMD Power Inductor

The HA78 series power inductors is a ferrite based inductor designed with wide range of inductances and package sizes.



Features & Benefits

- 125°C operation
- AEC-Q200 certified
- 10 amps max. rated current
- Temperature rise, maximum 40°C
- Operating frequency up to 3MHz
- Magnetically shielded

Applications

- Transportation – powertrain
- Transportation – engine control
- Transportation – transmission control
- Transportation – led driver
- Industrial – automation system
- Industrial – DC/DC converters

HA72E/T Series – Molded Inductor

The HA72E/T series has been designed as a high temperature rated molded inductor for high stress environments that require high current saturation levels. It is ideal for high power density applications where size is critical.



Features & Benefits

- High saturation current per unit volume
- Operating temperature: -40°C to +155°C (HA72E)
- Operating temperature: -55°C to +180°C (HA72T)
- No thermal ageing issues
- Rust resistant
- Low DCR
- Low core loss
- Magnetically shielded
- Robust construction
- High operating temperature allows for higher ambient or higher temperature rise in circuit design

- Moisture resistant
- High power density can save board space and reduce weight for fuel cost savings
- AEC-Q200 certified

Applications

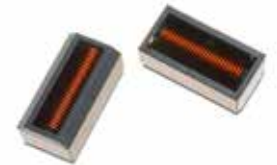
- DC/DC converters
- Point-of-Load modules
- Low pass ripple current Filters
- EMI filters

Markets

- Automotive
- High-end industrial
- Medical

HA55 Series – Power Inductors

The HA55 series power inductors are designed with the special composite Iron Powder core materials to maximise inductance, temperature performance and saturation current while minimising DC resistance and physical size.



Features & Benefits

- 155°C operation
- AEC-Q200 certified
- 40 amps max. rated current
- Low core loss
- Low skin effect
- Magnetically shielded

Applications

- Transportation – hybrid engine
- Transportation – engine control
- Transportation – transmission control
- Transportation – navigation system
- Industrial – automation system
- Industrial – switch mode power supply
- Alternate energy – solar panel

HA65A Series – High Current Surface Mount Power Inductors

The HA65A series is a ferrite based inductor designed for high frequency and high temperature applications up to 155°C. It is AEC-Q200 certified for robust and reliable operation.



Features & Benefits

- High operating temperature allows for higher ambient and higher power operation
- High operating frequency with low power losses
- Automotive ready
- High saturation current per unit volume
- Operating temperature -40°C to 155°C
- AEC-Q200 automotive certification

Applications

- DC/DC converters
- Low pass ripple current Filters
- EMI filters

Markets

- Automotive
- Industrial
- Medical
- IT and communications
- Military/aerospace

Electromagnetic

Vishay



Inductors

| Series | Product image | Description | Inductance range (μH) | Size class | Rating current (A) |
|------------------|---------------|---|-----------------------|------------|--------------------|
| IHLE-4040DC-5A | | Low profile, high current inductors with e-field shield | 0.47 to 47 | 4040 | 2.5 to 30 |
| IHLD-3232HB-5A | | Low profile, high current dual inductors | 10 to 33 | 3232 | 3.1 to 5.6 |
| IHLD-4032KB-5A | | | | 4032 | |
| IHLP-8787MZ-5A | | Low profile IHLP® power inductors – high temperature, automotive, 22.0 x 22.1 x 13.0 | 0.47 to 100 | 8787 | 9.1 to 80 |
| IHLP-6767 Series | | Low Profile IHLP® power inductors – automotive, 17.9 x 17.1 x 7.0 | 0.22 to 100 | 6767 | 5 to 80 |
| IHLP-5050 Series | | Low Profile IHLP® power inductors – high temperature (+155 °C/+180 °C), automotive, 13.6 x 12.9 x 3.5 /13.6 x 12.9 x 5.0/13.6 x 12.9 x 6.5 | 0.1 to 22 | 5050 | 7.0 to 66 |
| IHLP-4040 Series | | Low Profile IHLP® power inductors – high temperature (+155 °C/+180 °C), automotive, 11.5 x 10.3 x 4.0 | 0.19 to 47 | 4040 | 2.5 to 40 |
| IHLP-3232 Series | | Low Profile IHLP® power inductors – automotive, 8.0 x 8.0 x 3.0/8.0 x 8.0 x 4.0 | 0.22 to 33 | 3232 | 3.1 to 36 |
| IHLP-2525 Series | | Low Profile IHLP® power inductors – low DCR, high temperature (+155 °C/+180 °C), automotive, 7.2 x 6.7 x 1.8/7.2 x 6.7 x 2.4 /7.2 x 6.7 x 3.0 | 0.1 to 22 | 2525 | 2.5 to 32.5 |
| IHLP-2020 Series | | Low Profile IHLP® power inductors – low DCR, high temperature (+155 °C), automotive, 5.7 x 5.4 x 2.0/5.7 x 5.4 x 3.0 | 0.1 to 15 | 2020 | 2.4 to 23 |
| IHLP-1616 Series | | Low Profile IHLP® power inductors – automotive, 4.7 x 4.3 x 1.2 | 0.047 to 4.7 | 1616 | 1.7 to 13 |

Resistors

Bourns

BOURNS®

High Power Resistors – PWR Series

High Power Resistors are used as part of clamping and snubber circuits designed to dampen ringing in high voltage MOSFETs operating in inverters or DC-DC converters within hybrid and full electric vehicles.



Bourns® products can achieve very high power densities in the PWR range of power resistors by utilising a combination of proprietary ceramic and thick film technology developed over many years. This technology provides stable resistors with low TCRs.

Features & Benefits

- High power in surface mount package
- Wide resistance range
- Standard tested to 2,000hrs under full load
- Low TCRs
- AEC approvals
- TS 16949 plant

Applications

- Electric vehicles
- Power supplies
- Motor drives
- Test and measurement
- Rectifiers

| Product | Series | Rated power (W) | Resistance range (Ω) | Operating temperature (°C) |
|---|--------|-----------------|----------------------|----------------------------|
|  | PWR163 | 25 | 0.02 – 130K | -55 – 155 |
|  | PWR263 | 35 | 0.02 – 130K | -55 – 155 |

Resistors

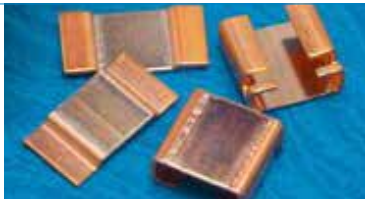
KOA



High Current Metal Plate SHUNT Resistors: PSJ2 (3920) and PSG4 (2725) Series

Features & Benefits

- High current measurements up to 140 A
- Low resistance values available: 0.5 mΩ and 1 mΩ
- High power (0.5 mΩ: 10W and 1 mΩ: 8 W) metal plate resistor
- Standard resistance tolerance $\pm 1\%$
- Operating temperature range is $-65\text{ }^{\circ}\text{C}$ to $+175\text{ }^{\circ}\text{C}$
- Stable detecting with T.C.R.: $\pm 50\text{ ppm/K}$ / $\pm 75\text{ ppm/K}$
- Metal alloy resistive element
- Excellent pulse resistance and very low inductance
- Superior corrosion and heat resistance
- AEC-Q200 qualified



Application

- High current sensing in modules for automotive
 - ECUs 'under the hood'
 - EPS
 - Motor control
 - Electric brake
- Intelligent power modules
- Power inverter
- DC/DC converter

High Precision & High Reliability Thin Film SMD Chips: RN73H Series

Features & Benefits

- Improved moisture and high heat resistance by special resistive film and special inner protecting coating
- High component and equipment reliability
- Sizes 0402 to 1210
- Tight tolerances down to $\pm 0.05\%$
- Stable T.C.R. down to $\pm 5\text{ ppm/K}$
- Rated ambient temperature: $+85\text{ }^{\circ}\text{C}$
- Rated terminal part temperature up to $+110\text{ }^{\circ}\text{C}$
- Operating temperatures up to $+155\text{ }^{\circ}\text{C}$
- AEC-Q200 qualified



Applications

- Automotive electronics
 - Engine ECU, HEV/BMS, EPB, EPS
- Industrial equipment
 - Control circuits, diagnostic devices
- Power grid
 - Power meter, power conditioner
- Medical equipment
- Scale, test and measuring equipment
- Automatic equipment controller
- Converters
- High precision voltage divider circuits

Metal Plate SHUNT Resistors: TLR and SL Series

Features & Benefits

- Ultra-low resistance values 0.5 mΩ for large current sensing
- High power ratings in small sizes (e.g. 0805 = 1 W; 2512 = 3 W; 4527 = 5 W)
- Best T.C.R. of $\pm 50\text{ ppm/K}$
- Molded construction (SL series) for high mechanical stress is also available
- Resistance tolerance $\pm 1\%$ is standard
- AEC-Q200 qualified



Applications

- Automotive electronics
- Current motor control units
- Power steering (EPS)
- Power supplies, battery packs
- DC-DC converters
- AC adapters
- Metering
- CPU current sensing
- Power conditioner/inverter
- Industrial equipment

Low Resistance Flat Chip: UR73V Series

Features & Benefits

- Current detecting thick film resistor for power supplies, motor circuits, etc.
- R-range from 10 mΩ to 100 mΩ
- Power rating: 0.5 W, 1206 size
- Standard or face-down version
- T.C.R.: $\pm 100\text{ ppm/K}$ (12 mΩ to 100 mΩ)
- Resistance tolerance $\pm 1\%$ is standard
- Competitive alternative to metal plate parts
- AEC-Q200 qualified



Applications

- Automotive, including 'under the hood' applications such as ECUs
- Power supplies
- DC-DC converters
- Motor controls
- Industrial automation
- Meter
- LED lighting
- Consumer electronics

Resistors

Ohmite



TAP600/800

Up to 800 watts of power when used with a liquid or air-cooled heat-sink system.



TAP600/800 is designed for low inductance and capacitance, and provides stable performance in addition to high wattage and pulse loading capability. The high alumina content ceramic metalised base plate is ideal for heat transfer and optimum discharge into a heat sink.

Features & Benefits

- High alumina ceramic bottom
- Connections made with M4 or M5 screws (not included)
- Materials meet the requirements of UL94-V0
- Resin filled epoxy casing with a large creepage distance
- High insulation resistance (CTI 600)

PFE and PFR Series

Constructed of a heavy-resistance alloy mounted on ceramic insulators and supported by a metal mounting bracket.



Metal parts, except for the resistance element, are heavily plated to prevent oxidation at high operating temperatures and to prevent corrosion. The mounting bar is slotted on each end to facilitate installation. Edge wound units provide clamp-type terminals, permitting a reliable connection which can be moved along the resistive element to obtain intermediate values.

Features & Benefits

- 700-1000 watts of power dissipation
- Heavily plated to prevent oxidation and corrosion
- Slotted mounting bar for easy installation
- Clamp-type terminals used to obtain intermediate values

270/280 Series

The 270/280 type resistors are equipped with lug terminals suitable for soldering or sturdy bolt connection.



When secure mounting is required, the hollow core of these resistors permit fastening with spring-type brackets, thru bolts or thru bolts with slotted-steel brackets.

Rugged design with wattage rating up to 1KW and high overload ratings up to 10 times rated wattage for 5 seconds. Vitreous coating doesn't outgas and provides protection.

Features & Benefits

- Terminals suitable for soldering or bolt connection
- High wattage applications
- Rugged lead free vitreous enamel coating
- Flame resistant coating
- All-welded construction
- RoHS compliant available

Resistors

Ohmite



ARCOL HS Series/89 Series

A robust wire wound resistor is sealed in an aluminium extrusion.



These molded-construction metal-housed resistors are available in higher power ratings than standard axial resistors and are better suited to withstanding vibration, shock and harsh environmental conditions. Wattage range from 5 watts to 600 with proper heatsink.

The resistor is isolated electrically from the aluminium casing and provides chassis mounting capabilities. The internal element is also protected from the outside elements.

This design also enables heat sinking capabilities to extend wattage range. Standard parts can be customised using wired connections or heatsink mounting and assembly.

Features & Benefits

- High stability: $\pm 0.5\% \Delta R$
- High power to size ratio
- Metal housing allows chassis mounting and provides heat sink capability
- Custom variations welcome

Metalohm Series

Cold-rolled steel-encased wirewound heatsinkable radial terminal.



The metal encased wirewound resistor is heatsinkable up to 150W and resistance values to 100K ohms. Dielectric strength of the Metalohm series starts at 1500V and goes as high as 4250V. The Metalohm series offers great connectivity with multiple terminal options and the ability to be tapped at most values. Non inductive versions are available in all sizes for specific customer needs.

Features & Benefits

- Flameproof and inorganic
- Higher power rating due to heat sink capacity
- All welded construction

- Non-hygroscopic
- High surge construction
- Non-inductive versions (Aryton-Perry windings)
- Terminal sleeves to increase dielectric strength and maximise creepage distance
- Variety of terminal choices
- Potted or soldered wire terminals including quick connect, ring, spade terminals
- Tapped models

Rheostats

Ohmite offers multiple sizes ranging from 7.5 watts up to 1000 watts.



All models are built using metal and ceramic with all welded construction. This robust design uses vitreous enamel to lock in the resistance wire. Metal-graphite contacts are used to minimise wear on the wire providing maximum reliability and long term usability.

Features & Benefits

- Large wattage range
- Enclosed types available
- Rugged construction
- UL listed File no. E10946 for certain models
- Custom designs welcome

Resistors

Panasonic

Panasonic

Shunt Resistors

Although current sense resistors have been widely adopted in the automotive sector, the recent trend towards greater sophistication and computerisation has increased current requirements, leading to a need for high power components.



This includes a demand for high accuracy resistors with low temperature coefficient of resistance (TCR) for stable operation in extreme temperature environment and that feature ultra-low resistance values in order to minimise power consumption.

Metal plate technology (ERJM-Series) and special constructions make them suitable for application with high current measurement accuracy and high reliability.

Double sided resistor element technology (ERJxBW-Series) and wide terminal technology (ERJA, ERJB-Series) as thick film shunt technology. Suitable for current measurement with high accuracy requirements.

Furthermore Panasonic current sensing resistors are AEC-Q200 qualified and therefore are ideal solution for all different kind of automotive applications. Such as brushless DC motors, automotive lithium-ion batteries, and utility power meters.

Features & Benefits

- Wide range of resistance values starting from 0,001mΩ
- Case size: 0402 to 2526
- AEC-Q200 qualified
- Large operating temperature (-65°C to 170°C)
- Linear temperature coefficient characteristics easy to compensate for metal plate shunt
- TCR ppm rate from 20°C to 120°C
- High power rating up to 5W for 2526 for metal plate technology
- Shunt case size

Applications

- Ignition control modules
- Gear control
- Engine management modules
- Door lifter
- Cycled actuator
- Measuring resistors for power hybrids
- Control devices in automotive technology
- Power modules
- Frequency converter
- Switching mains adapters

Resistors

TE Connectivity



Surface Mount Moulded Power Resistor



Features & Benefits

- Suited to meet today's circuit design needs
- Available in 2W, 3W and 5W power ratings
- Value range from R10 – 2M0
- 1% or 5% tolerances available
- Each size offers low profile case design with flexible tinned copper terminations for reliable solder joints
- All styles utilise a fully welded construction technique, unlike other designs that rely solely on tinned termination connections
- These features allow the SM Series to withstand the higher temperatures associated with reflow, vapour phase, or infrared (IR) manufacturing processes without degradation
- Suitable for use in all types of power circuitry

Aluminium Housed High Power Resistors HS Series



Features & Benefits

- A range of extremely stable, high quality wirewound resistors
- Capable of dissipating high power in a limited space with relatively low surface temperature
- Power is rapidly dissipated as heat through the aluminium housing to a specified heatsink
- Largest range of wirewound resistors on the market today
- HS Series resistors feature 5 up to 300W with 500 and 1,000W versions available upon request
- Versatile range of resistors offers wide ohmic values from R01 up to 100K
- Customer specific solutions available

TE Connectivity and TE connectivity (logo) are trademarks.

OARS

Raised element low value SMT resistor.



Features & Benefits

- AEC-Q200 qualified
- Ratings from 2W to 5W
- Value range 1mΩ to 50mΩ
- Raised element reduces PCB heating
- Flexible terminals reduce thermal stress
- Metal alloy gives high surge performance
- High temperature operation up to 160°C

Applications

- Power supplies
- Small motor control
- Process control
- Battery monitoring

WMHP & WSMHP Series Power Resistors

WMHP series offers power resistors in the TO220 and the larger TO147 industry standard packages, which may be attached to heatsinks to give power ratings up to 100W.



complete requalification of in-circuit performance in the event of a revision of the ohmic value

Features & Benefits

- TO-263 SMD to 35W
- TO220/TO147 through hole to 100W
- Very low thermal resistance
- Non-inductive
- Thick film with good surge performance
- WSMHP is AEC-Q200 qualified
- Heatsink mounting enables space saving designs to be realised by using standard thermal management techniques
- Thick film technology across the entire ohmic value range gives consistent reliability under surge conditions which reduces field failure costs
- The single technology also avoids the need for

- Planar design gives low inductance and good high frequency performance so that fast switching circuits avoid distortion such as ringing without the use of additional components
- Low on resistance (low contact resistance)

Applications

- Snubbers
- Current sense
- Automotive actuator drive
- PSU current limit
- Rapid capacitor bleed

Markets

- Automotive
- Industrial
- Medical

LRMAP3920 – Low Resistance Metal Alloy Power Resistors

LRMAP3920 is a high power, low value SMT shunt resistor.



Features & Benefits

- 5W rating on FR4 PCB
- 10W rating on thermal substrate
- AEC-Q200 qualified
- Values 200μΩ to 2mΩ
- High surge energy up to 14J
- Low thermal impedance minimises the temperature rise and enhances the reliability of the assembly
- High surge tolerance gives reliable product performance under inrush and momentary short circuit conditions
- Good long term stability of value, low TCR and low thermal EMF all mean that a small part of the designer's

error budget is consumed, enabling more design freedom elsewhere in the circuit

Applications

- PSU
- Motor drive
- Process control
- Battery monitoring

Markets

- Automotive
- Industrial
- Medical

WIN – Water Insoluble Nitride Thin Film Precision Resistors

WIN series thin film chip resistors use an advanced metal film technology to provide high levels of reliability and stability for precision applications.



Features & Benefits

- Reliable tantalum nitride film
- Low typical 2000 hour life drift of ±0.08%
- Low typical moisture resistance drift of ±100ppm (±0.01%)
- Good pulse performance up to 3kV peak on 1.2/50μs
- Precision to ±0.05% and ±15ppm/°C
- Inherent moisture resistance removes reliance on expensive assembly-level sealing or encapsulation processes
- Low, predictable life drift, tighter tolerance and lower TCR frees up error budget to enable precision requirements to be relaxed elsewhere in the design

- Biased moisture stability (+85°C/85%RH with dc bias) at 2000 hours is better than ±0.1% giving high reliability and so reducing field failure costs

Applications

- Server power supplies
- Process control
- Safety critical systems
- Exposed telecom systems
- Portable medical products
- COTS mil/aerospace

Markets

- Automotive
- Industrial
- Medical
- IT and communications
- Military/aerospace

Resistors

Vishay



| Series | Product | Description | Power (W) | Case (EIA, MIL) | Typical TCR (ppm/°C) | Minimum tolerance (%) | Resistance range |
|---------------------|---------|---|--------------------------------|-----------------|------------------------------------|-----------------------|-------------------|
| WSL | | Very high power (to 3 W), low value (down to 0.0005 Ω), surface mount | 0.1 to 2 | 0603 to 2512 | Element with low TCR (< 20 ppm/°C) | 0.50 | 0.003 Ω to 0.5 Ω |
| WSP | | | 0.4 to 3 | 0603 to 2512 | Element with low TCR (< 20 ppm/°C) | 0.50 | 0.5 mΩ to 50 mΩ |
| WSHM2818 | | High power (7 W), low value (down to 0.001 Ω), surface mount | 7 | 2818 | Element with low TCR (< 20 ppm/°C) | 0.50 | 1 mΩ to 100 mΩ |
| CRCW-HP e3 | | Pulse proof, high power thick film chip resistors | 0.125 to 1.5 | 0402 to 2512 | 100 | 1.00 | 1 Ω to 1 MΩ |
| RCA e3 | | Automotive, sulfur resistant, lead (Pb)-free thick film, rectangular chip resistors | 0.063 to 1 | 0402 to 2512 | 50 | 0.50 | 1 Ω to 10 MΩ |
| RCL e3 | | Long side termination thick film chip resistors | 0.25 to 2 | 0406 to 1225 | 100 | 1.00 | 1 Ω to 2.2 MΩ |
| MELF | | Thin film MELF resistors | 0.3 to 1 | 0102 to 0207 | 15 | 0.10 | 0.22 Ω to 15 MΩ |
| MCx AT Precision | | Thin film chip resistors | 0.1 to 0.4 | 0402 to 1206 | 25 | 0.10 | 1 Ω to 1 MΩ |
| MCx AT Professional | | | | | | | |
| TNPW e3 | | High stability thin film flat chip resistors | 0.063 to 0.33 | 0402 to 1210 | 10 | 0.10 | 4.7 Ω to 3.01 MΩ |
| TNPV e3 | | High voltage thin film flat chip resistors | 0.25 (700 V), 0.33 (1000 V) | 1206, 1210 | 10 | 0.10 | 121 kΩ to 3.01 MΩ |
| ACAS AT Precision | | Precision thin film chip resistor array superior moisture resistivity | 0.2, 0.4 | 0606, 0612 | Relative TCR: 15, 10, 5 | Relative tol.: 0.05 | 47 Ω to 150 kΩ |
| ACAS ATAU Precision | | | | | | | |
| PAT | | Precision automotive thin film chip resistors, AEC-Q200 qualified, 2 kV ESD rating | 0.05 to 1 | 0402 to 2512 | 25 | 0.10 | 2.5 Ω to 3 MΩ |

Resistors

YAGEO

YAGEO
Innovative Service Around the Globe

Automotive Grade Thin Film Chip Resistors – AT Series

Features & Benefits

- Superior resistance against sulfur-containing environments
- High precision and stability
- Low TCR, low electrical noise
- Advanced sputtering technology
- Tolerance : $\pm 0.1\%$, $\pm 0.25\%$, $\pm 0.5\%$, $\pm 1\%$



Applications

- Automotive electronics
- Industrial and medical equipments
- Test and measuring equipments
- Telecommunications

Automotive Grade Thick Film Chip Resistors – AC Series

Features & Benefits

- AEC-Q200 qualified
- EIA case size : 0201 to 2512
- Tolerance : $\pm 0.5\%$, $\pm 1\%$, $\pm 5\%$
- Highly reliable electrode construction
- Highly stable in auto-placement surface mounting applications



Applications

- All general purpose applications
- Automotive electronics
- Industrial application

Low TCR Metal Current Sensor – PA/PE Series

Features & Benefits

- Excellent current sensing performance
- High power rating for large current detection
- Reduce power consumption
- Low thermal EMF ($< 0.3 \mu\text{V}/^\circ\text{C}$)
- Low TCR



Applications

- Consumer goods, computers
- Telecom/datacom
- Industrial/power supply
- Alternative energy
- Automotive electronics

Surge Chip Resistors – SR Series

Features & Benefits

- Excellent performance at pulse loading
- EIA 0402 to 2512 case sizes
- Outstanding anti-surge characteristics
- High power rating and ESD resistance
- Handle high transient current spikes without saturation



Applications

- Telecommunications
- Power supplies
- Industrial control
- Automotive electronics

Power

Artesyn



ERM Series Isolated DC/DC Converters

Artesyn's ERM family of high performance DC/DC converter modules are designed to meet the power demands and safety standard requirements of railway rolling stock applications.



Artesyn's ERM family complies with the railway industry specifications EN 50155 and 50121-3-2 and has been tested to the vibration and thermal shock requirements of EN 61373.

Features & Benefits

- 75W and 50W maximum power output models
- Up to 92% efficiency
- Compact quarter-brick form factor with metal base-plate
- Reinforced insulation rated at 3000 Vac rms
- High EMI immunity
- Railway industry specifications EN 50155 & 50121-3-2
- Tested to vibration & thermal shock requirements of EN 61373
- Each series includes eight models with 5V, 12V, 15V, or 24V outputs
- Input ranges 43Vdc to 101Vdc (72 Vdc nominal) or 66Vdc to 160Vdc (110Vdc nominal)
- Wide operating temperature range of -40°C to 85°C with derating

Applications

- Engine management
- Traction control
- Door control
- Video surveillance
- Communications
- Entertainment
- Lighting
- Other on-board electrical equipment

Murata



RUW15 Series DC/DC Converters

Murata RUW15 Series DC/DC Converters are suitable for use in applications in railway, industry or telecommunication where variable input voltages or high transient voltages are present.



With an ultra-wide input voltage range of 16VDC – 160VDC, RUW15 Series DC/DC Converters are capable of withstanding surges from 24V, 36V, 48V, 72V, 90V and 110V systems, largely eliminating the requirement for input protection circuitry. Optional features include a Power Fail/DC OK signal and circuitry to facilitate long hold-up times with a small external capacitor across \pm Vint pins.

Features & Benefits

- UL 60950 recognised for reinforced insulation
- High transient voltage withstand capability
- Ultra wide input voltage range of 16VDC – 160VDC
- Externally settable hold up time with additional capacitor
- DC OK/power fail signal

- Short circuit protection
- Over temperature protection
- Over voltage protection

Applications

- Railway
- Industrial
- Telecommunication

Temperature

Amphenol Advanced Sensors temperature sensors are suitable for numerous applications from automotive, on and off road heavy duty truck, agriculture, Marine, EV/HEV and bike applications. AAS readily custom packages our industry proven stable thermistors to fit your specific applications. The thermometrics ambient sensor measures temperature outside the passenger compartment. It provides input to automatic HVAC systems for cabin temperature control and temperature readings to vehicle occupants.

Pressure

With our own MEMS fabrication for piezoresistive pressure dies and our expertise in high-volume sensor packaging, we can meet all of your pressure needs. The NPR-101 silicon-based MEMS pressure sensor using "Backside Absolute Pressure" technology designed for harsh media exposure, which eliminates the direct contact of the sensing circuitry with the applied media; enabling ability to measure pressure in harsh media environments with technology that enables smaller and lighter packaging, potentially integrated into customers systems. The NPX2 adds motion sensing in a similar package. The NPP-301, with a 10-year track record and more than 30 million on the road, provides a smaller, non-calibrated package.

The NPA product series is provided in a miniature size as a cost effective solution for applications that require calibrated performance. Packaged in a SOIC14 pin surface mount, the NPA Series is available in gauge, absolute or differential pressure ranges with either mV, amplified analog or digital outputs in pressure ranges from 2-inch of H₂O to 30 psi. The sensor is intended for printed circuit board mounting and delivered in tape and reel form to simplify manufacturing handling.

Humidity

Our resistive, capacitive and silicon-based humidity sensing elements are used in sensors for such applications as air intake and cabin comfort. The Thermometrics active in car and humidity sensor indicates both the temperature and humidity within the cabin to help provide cabin comfort and reduce window fogging.

Gas

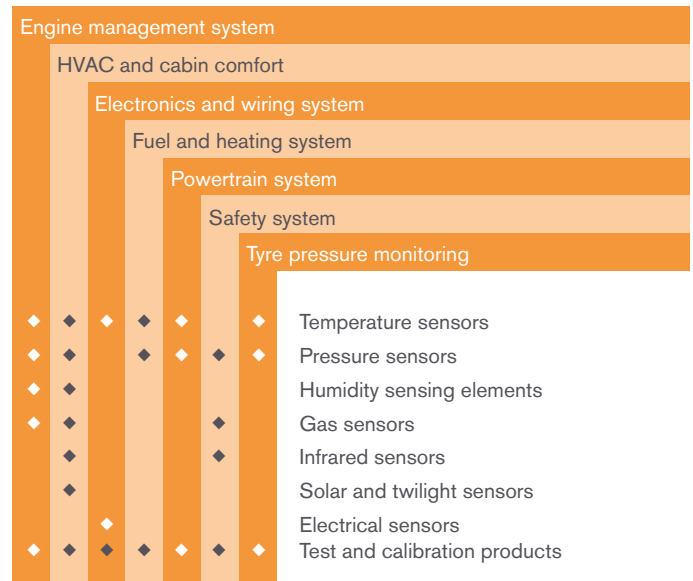
We offer cabin air quality and exhaust gas sensors to provide a comfortable cabin while reducing the emissions level of the exhaust. Our Telaire CO₂ module provides a gas sensing solution for CO₂ based HVAC systems.

Infrared

Our state-of-the-art silicon MEMS facility manufactures the IR thermopiles used in applications involving non-contacting temperature sensing. From driver and passenger temperature sensing for in-cabin comfort control to rotating part temperature measurement, we have small-to dual-sensor packages that meet your application requirements. The ZTP range of products can also be used in conjunction with special filters for gas detection, meeting your requirements in the small TO-41, TO-46 or TO-5 packages.

Solar and Twilight

With the increased number of automatic climate control systems seen in vehicles today, we supply solar and twilight sensors for use with both HVAC and lighting systems. The thermometrics dual solar sensor provides solar readings that help control the HVAC system internal cabin temperature. Twilight sensors provide readings of the light level, allowing for automatic headlight activation.



Sensors

Honeywell

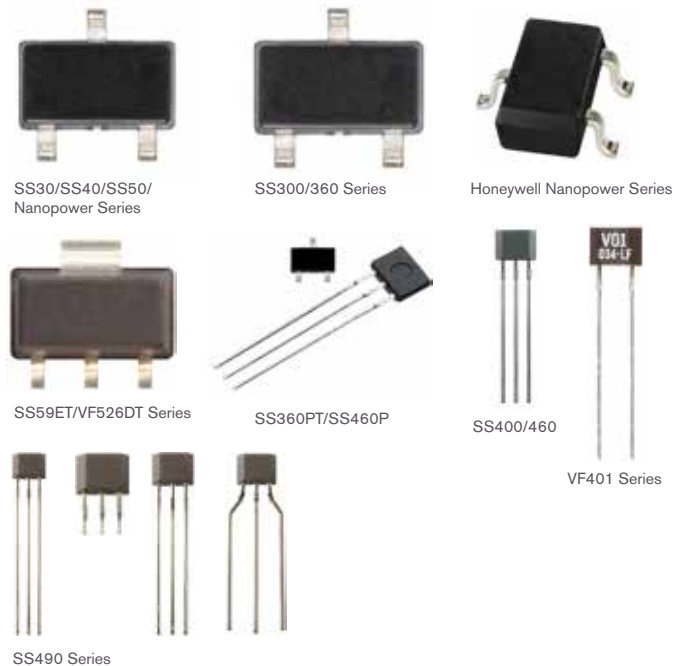
Honeywell

Magnetic Sensors (Analogue and Digital)

Digital magnetic sensor ICs generate a high or low voltage output in response to a magnetic flux perpendicular to the surface of the sheet. Linear magnetic sensor ICs generate an analog voltage output proportional to the magnetic flux, perpendicular to the surface of the sheet. Quad Hall-elements design minimises effects of mechanical or thermal stress on output and provide a stable output.

Applications

- BLDC motor control
- Cylinder and steering-position
- Current measurement



Pressure Sensors

Honeywell TruStability® Board Mount Pressure Sensors.



HSC Series: ($\pm 1\%$ Total Error Band)

SSC Series: ($\pm 2\%$ Total Error Band)

Fully calibrated and temperature compensated using ASIC. Both series have pressure ranges from ultra-low ($\pm 2.5\text{mbar} - \pm 40\text{mbar}$) through low to mid ($60\text{mbar} - 10\text{bar}$).

NSC Series: Uncalibrated, unamplified, uncompensated with a low to mid ($\pm 2.5\text{mbar} - 10\text{bar}$) pressure range.

Features & Benefits

- Configurability (pressure, housing, output)
- Stability over time and thermal shock
- Accuracy

Applications

- HVAC pressure
- Air-based comfort systems

Speed and Direction Sensors



Provides true zero speed capability, direction sensing, and precise switch point measurement. Speed sensor diagnostics provide information on air gap and sensor failure for increased reliability and functionality. A comprehensive line-up of Hall-effect, magnetoresistive, and variable reluctance sensor.

Applications

- Engine speed
- Transmission
- Hydraulic pumps and motors
- Wheel speed

Sensors

Honeywell

Honeywell

Position Sensors

(Linear, Rotary, Arc)



Honeywell's SMART Position Sensors are some of the most durable and adaptable position devices available in the industry today. Their simple, non-contact design eliminates mechanical failure mechanisms, reduces wear and tear, improves reliability and durability and enhances operator efficiency and safety, while minimising downtime.

Applications

- Boom angle
- Shift and gear position
- Suspension systems

Temperature Sensors

Compact, lightweight. Operate with enhanced sensitivity, reliability, and stability under diverse conditions of shock, vibration, humidity, and corrosion.



ES110 Series ES120 Series LTP Temperature Probes

Variety of custom packages available for air, liquid, and solid temperature sensing applications.

Applications

- HVAC
- Engine
- Transmission

Liquid Level Sensors

Complete amplified and compensated pressure measurement. With a choice of ports, connectors, outputs and pressure ranges, transducers can be configured. Heavy-duty pressure.



LLN Series

Heavy-duty pressure sensors are engineered to be resistant to aggressive media in most harsh environments.

Applications

- Brake systems
- Lubrication
- Compressors

Sensors

Honeywell

Honeywell

Heavy Duty Pressure Sensor – PX3 Series



Features & Benefits

- Pressure range: 1 bar to 46 bar | 15 psi to 667 psi (absolute and sealed gage)
- Ratiometric output: 0.5Vdc to 4.5Vdc
- Fully calibrated and temperature compensated
- Total Error Band: ± 1.0 %FSS from -20°C to 85°C [-4°F to 185°F]
- External freeze/thaw resistance: 6 cycles from -30°C to 50°C [-22°F to 122°F]
- High insulation resistance: $>100\text{M}\Omega$, 1500Vdc
- Dielectric strength: AC1500V, 1 min. or AC1800, 1s
- Current consumption: 3.5mA max.
- EMC Radiated Immunity: 200V/m per ISO 11452-2
- Ingress protection up to IP67
- Response time: $<2\text{ms}$
- RoHS, REACH, and CE compliant
- Total Error Band provides the most comprehensive, clear and meaningful indication of the sensor's true measurement performance over a specified temperature range; small error promotes system uptime and efficiency
- Survives exposure to frost, commonly found in refrigeration systems

- Protects the user and sensor in high over-voltage situations, and ensures that the device is compliant with industry standards
- Operates reliably in the presence of electro-magnetic fields, such as near wireless signals, RF communication, and electrical devices. Helps to reduce energy costs, and enhances product life if used in battery driven systems
- Compatible with common HFC (hydrofluorocarbon) refrigerants, next generation low global warming potential (GWP) refrigerants such as R32 and R1234ZE, petroleum oils, lubricants, hydraulic fluids, brake fluids, air and water. (For ammonia and other corrosive media, see Honeywell's MLH Series and SPT Series)

Applications

- Air system monitoring and hydraulic oil
- Pressure monitoring
- Refrigerant pressure
- Monitoring in HVAC/R systems
- Air compressor system pressure

Pressure Switches



Features & Benefits

- Life cycle rating: up to 2 million
- IP67 sealing rating
- Operating temperature range: -40°C to 120°C [-40°F to 248°F]
- Proof pressure: 10000psi [689bar] (High Pressure), 500 psi [34,47bar] (Low Pressure)
- Burst pressure: 20000psi [1379 bar] (High Pressure), 750psi for 3.5psi to 22psi, 1250psi $> 22\text{psi}$ (Low Pressure)
- Hysteresis option (HP, HE, and LP Series only)
- Variety of pressure ports and electrical terminations
- Pressure switching set point range: Factory set 150 psi to 4500 psi [10,34 bar to 310,26 bar] (High Pressure) or factory set or field adjustable 3.5 psi to 150 psi [0,24 bar to 10,34 bar] (Low Pressure)
- Switching point accuracy: up to $\pm 2\%$

Applications

Transportation

- Agricultural machinery
- Heavy duty construction machinery
- Heavy duty trucks
- Lawn and garden
- Marine vessels
- Material handling machinery
- Railway

Industrial

- CNC machines
- Compressors, boilers
- Fracking equipment
- Food and beverage equipment
- Generators
- HVAC/R equipment
- Mud pumps
- Pneumatic equipment
- Presses and punches
- Pressure washers
- Trash compactors
- Water jet cutting machines
- Water pumps

MACD-14

Reed Switch

MACD-14 close-differential reed switch is ideally suited for proximity and level sensing in short range sensing applications.

MACD-14 is an axial leaded, sub-miniature reed switch containing normally open contacts within a 14mm long x 2.28mm diameter glass envelope. The contacts are capable of switching up to 200VDC at 10W. The reed switch features a close-differential characteristic where there is a low hysteresis between close and open operations. Available sensitivity range is 10AT to 30AT. The reed switch has a high insulation resistance of at least 1010Ω and has a low contact resistance of less than 100mΩ.

Features & Benefits

- Capable of switching 200VDC at up to 10W
- Normally open switch contacts
- Low close/open hysteresis (close-differential)
- Hermetically sealed switch contacts are not affected by and have no effect on their external environment

- Zero operating power required for contact closure
- Excellent for switching micro-controller logic level loads
- Well suited for short range sensing applications

Applications

- Proximity/position sensing
- Liquid level sensing (e.g. brake fluid reservoir)

MASM-14

Reed Switch

MASM-14 close-differential reed switch is ideally suited for proximity and level sensing in short range sensing applications.

MASM-14 is a surface mount, sub-miniature reed switch containing normally open contacts within a 14mm long x 2.28mm diameter glass envelope. The contacts are capable of switching up to 200VDC at 10W. The reed switch features a close-differential characteristic where there is a low hysteresis between close and open operations. Available sensitivity range is 10AT to 30AT. The reed switch has a high insulation resistance of at least 1010Ω and has a low contact resistance of less than 100mΩ.

Features & Benefits

- Capable of switching 200VDC at up to 10W
- Normally open switch contacts
- Low close/open hysteresis (close-differential)

- Hermetically sealed switch contacts are not affected by and have no effect on their external environment
- Zero operating power required for contact closure
- Excellent for switching micro-controller logic level loads
- Well suited for short range sensing applications

Applications

- Proximity/position sensing
- Liquid level sensing (e.g. brake fluid reservoir)

Sensors

Murata



MEMS Sensors

Murata's accelerometers, inclinometers, gyroscopes and gyro accelerometer combo sensors are an optimum choice for transportation industries.

Based on the company's proprietary 3D MEMS technology in accordance with the automotive quality requirements (TS16949 and ISO 14100 certified), Murata's sensors offer high stability, robustness, accuracy and excellent performance.

Combined with a state-of-the-art ASIC and highly reliable packaging solution, they perfectly meet the requirements of the most demanding applications from vehicle stability control (ESC), electronic parking brake (EPB) and hill start assistance (HSA) to autonomous driving (ADAS) and various machine control applications.

SCA103T Series Analogue High Performance Differential 1 Axis Inclinometer



Features & Benefits

- Murata's most accurate and stable inclinometer
- Size 11.31mm x 15.58mm x 5.08mm (W x L x H)
- Best in class noise performance $7\mu\text{g}/\sqrt{\text{Hz}}$ noise density
- 0.001° resolution (10Hz BW, analogue output)
- Offset temperature dependency ($-25^\circ\text{C} - 85^\circ\text{C}$) $\pm 0.002^\circ/\text{C}$

Applications

- Heavy duty vehicles, instruments
- Platform levelling and stabilisation
- Avionics
- Machine control

SCA100T Series Analogue 2 Axis Inclinometer



Features & Benefits

- High performance
- Robust design with high shock durability (20,000g)
- Excellent stability over temperature and time
- Size 11.31mm x 5.08mm x 15.58mm (W x H x L)
- $14\mu\text{g}/\sqrt{\text{Hz}}$ noise density
- 0.0025° resolution (10Hz BW, analogue output)
- Offset temperature dependency ($-25^\circ\text{C} - 85^\circ\text{C}$) $\pm 0.008^\circ/\text{C}$

Applications

- Heavy duty vehicles, instruments
- Platform levelling and stabilisation
- 360° vertical orientation measurement
- Machine control
- Avionics and navigation

SCA830 Series Digital 1 Axis Accelerometer



Features & Benefits

- Competitive price with high performance
- Lower integration cost with good digital output
- Extremely stable output over wide range of temperature, humidity and vibrations
- Size 7.0mm x 3.3mm x 8.6mm (W x H x L)
- Advanced self-diagnostic features

Applications

- Automotive
- Inclination measurement
- Heavy-duty vehicles
- Platform levelling and stabilisation
- Electronic Stability Control (ESC)
- Hill Start Assist (HSA)
- Electric Parking Brake (EPB)

Sensors

Murata



Thermistors

| Application Matrix | | | | | | |
|-----------------------------|-----------|--------|------------|--------|---------|--------------|
| Product name | | Series | Powertrain | Safety | Comfort | Infotainment |
| PTC Thermistors (POSISTOR®) | Chip Type | PRF | • | • | • | • |
| | | PRG | • | • | • | • |
| | Lead Type | PTGL | • | • | • | • |

PTC Thermistors (POSISTOR®) Chip Type

Optimal for overheat detection at heat generation areas including power transistors, power diodes and LED lamp.



| Series | Sensing temperature (°C) | Max. voltage (V) | Operating temperature range (°C) |
|--------|--------------------------|------------------|----------------------------------|
| PRF | +65 to +145* | 32 | -40 to +150 |

Optimal for over-current protection for various circuits including those for car navigation and LED lamp.

| Series | Hold current (mA) | Max. voltage (V) | Operating temperature range (°C) |
|--------|-------------------|------------------|----------------------------------|
| PRG | 54 to 205 at 25°C | 16 to 30V | -40 to 105 |

* The line-up contains nine models in 10°C increments. Detection precision: ±5°C (±3°C models are also available.)

PTC Thermistors (POSISTOR®) Lead Type

Optimal for over-current protection for various circuits including those for car navigation and LED lamp.



| Series | Resistance tolerance (%) | Operating temperature range (°C) | Max. voltage (V) |
|--------|--------------------------|----------------------------------|------------------|
| PTGL | ±10 | -40 to +125 | 16 to 140 |
| | ±20 | -30 to +85 | |

Safety

Ultrasonic Sensors

Measures the distance between the car and the object behind it when backing up to park. Has a flat orientation, being wide horizontally and narrow vertically.



| Series | Type | Using method | Nominal frequency (kHz) | Capacitance (pF) | Overall sensitivity (Vop) | Directivity (deg.) | Size (mm) |
|-------------|-----------------|--------------|-------------------------|------------------|---------------------------|--------------------|-----------|
| MA58MF14-7N | Drip Proof Type | Dual Use | 58 | 1400 typ. | 2.0 typ. | 80x35° typ. | ø14 |

The detection distance and resolution vary according to the circuit to be used.

Shock Sensors

Used to detect tire revolutions to save battery power in TPMS.



| Series | Inclination angle of primary axis (degree) | Electric charge sensitivity | Insulation resistance (MΩ) | Resonant frequency (kHz) | Capacitance (pF) | Operating temperature range (°C) | Size (mm) |
|---------------|--|-----------------------------|----------------------------|--------------------------|------------------|----------------------------------|-------------|
| PKGS-25TA-R | 25° | 0.205pC/G | 500 min. | 39 typ. | 240 | -40 to +125 | 4.8×2.3×1.3 |
| PKGS-00TAV-R | 0° | 0.80mV/G | 500 min. | 39 typ. | 245 | | |
| PKGS-45TAV-R1 | 45° | 0.77mV/G | 500 min. | 37 typ. | 195 | | |

Planes, trains, automobiles and more... providing quality components for diverse applications

Standex-Meder reed switches, reed sensors, reed relays, and magnetics are present in millions of operations daily within the transportation industry. With the growth in the number of on-board systems, the increasing number of "smart" features, and the importance of safety and security, convenience, and energy, these sensors are becoming an even more integral feature of next generation vehicles.

The importance of reed switch-based sensors in transportation sensor applications is abundant. From fluid level management, to magnetics for heavy construction vehicle satellite systems, to fuel injector coils, reed switch-based sensors have long played a key role in cars, trucks, and recreational vehicles.

Reed Sensors Ideal for Transportation Applications

Reed switch-based sensors are ideal for transportation applications because, unlike other sensors, they draw no power, leading to significant energy savings. This is particularly important in the electrical vehicle market, which wants to reduce battery power consumption. Also, the contacts of the reed switch are sealed away from the environment, protecting them from dirt, water, and other fluids. High quality/high reliability

reed switch-based sensors can be found in thousands of transportation applications, including fluid level sensors as well as automotive navigation, entertainment, communication, convenience systems. Here are a few of the more recent interesting and innovative transportation sensors on the market.

MK23 Reed Sensors for Automotive Applications

SMD Reed Switches are a non-moulded cost-efficient version of our surface mount sensors.



Offering a more economic and compact design as compared to our over-moulded sensors. The SMD series are sold in Tape and Reel packing and are suitable for pick and place automation. SMD Reed Switches are magnetically actuated and are ideal in applications that require little or no external power to operate. The SMD Series offers versatility in that it can be designed into any application where single or multi-point position or liquid level sensing is required.

Specifications

- Contact form 1 A, 1 B, 1 C
- Rated power 0 W – 100 W
- Switching voltage 0 VDC – 1000 VDC
- Switching current 1 A
- Carry current 0 A – 3.0 A
- Breakdown voltage 210 kVDC – 2500 kVDC
- Available operation range 6 AT – 70 AT

Features & Benefits

- Flat or round bent leads
- Surface mounted
- Very small
- Tape and reel packaging
- Designed for ease in pick and place machines
- Hermetically sealed
- Long life expectancy
- Fast switching
- No external circuit requirements
- No power consumption
- Low on resistance (low contact resistance)

Applications

- Brake pedal position
- Convertible roof position
- Door lock
- Emission control
- End position control
- Gas tank monitoring
- Hood position
- Power windows
- Seat belt sensor
- Battery control
- Gearshift sensor
- Ignition sensor
- Speedometer

Sensors

Standex-Meder Electronics



Fluid Level Sensors

Brake, washer fluid, and coolant level sensors are one key area of use for transportation applications. Washer fluid sensors and safety standards vary in different areas of the world, and switch makers can tailor the sensor design to meet the unique requirements of the particular application.



Standex-Meder makes an all-inclusive electronic liquid level reed sensor that contains the sensing element (reed switch), float, and magnet all as one component.

The hermetically sealed reed switches are then further sealed in rugged plastic with epoxy seals.

R12431/ R12449/ R12456 Series Fluid Level Sensors

Standex-Meder Electronics manufactures fluid level sensors using magnetic and conductive sensing technology to best suit customer requirements. Our unique designs are helping companies to gain competitive market advantages.



Our conductive fluid level sensors have false full protection and current level shift to indicate fluid level. Custom moulding capabilities allow us to design and build float and sensors to suit any fluid level sensing application.

Features & Benefits

- For blow or injection moulded bottles
- Side mount design uses separate seal grommet
- Form A (normally open) and Form B (normally closed) operation
- Switch rated 0.5A/100V/10VA maximum
- Internal snubber resistor

Applications

- Fuel
- Oil
- Brake fluid
- Radiator
- Windshield washer level
- Other fluids

Markets

- Automotive
- Heavy truck
- Recreational vehicles
- Planes
- Railway
- Marine
- Transportation

Sensors

TDK



PTC thermistors: SMD Series with AEC-Q200 Qualification

TDK presents the Superior Series of EPCOS SMD PTC thermistors for limit temperature measurement.



The types of the B59721A Series in case size 0805 have response temperatures from 70°C to 130°C in steps of 10K. Their rated resistance is 680Ω.

The response temperatures of the B59641A (0603) and B59421A (0402) series are from 75°C to 145°C and from 75°C to 135°C, respectively – also in steps of 10K. The rated resistance of these components is 470Ω.

Features & Benefits

- High operating temperature of up to 150°C
- Operating voltage range: 14V DC – 40V DC
- Very short response time of 0.5ns
- Qualification based on AEC-Q200 rev. D
- RoHS-compatible

PTC Thermistors

| Series | | Technical data | Features & benefits | Ordering code/type |
|------------------------------------|--|---|---|---|
| ICL in phenolic resin plastic case | | V_{max} : 260 – 560 VAC R_{25} : 22 ... 100 Ω C_{th} : 2.3 J/K | <ul style="list-style-type: none"> • Self-protection in case of malfunction of short-circuit relay or internal short circuit of capacitor • For high pulse currents and a high number of operation cycles • Inrush current limiters are not damaged when directly connected to V_{max} even without additional current limitation | B5910*J0130A020 |
| ICL leaded disks, coated | | V_{max} : 440 VAC R_{25} : 120 Ω C_{th} : 2.1 J/K | <ul style="list-style-type: none"> • Self-protection in case of malfunction of short-circuit relay or internal short circuit of capacitor • For high pulse currents and a high number of operation cycles • Inrush current limiters are not damaged when directly connected to V_{max} even without additional current limitation | B59412C1130B070 B59451C1130B070 |
| Temperature sensor probes | | Sensing temperature: 60 – 130°C R_{25} : <100 Ω Tolerances: ±5°C | <ul style="list-style-type: none"> • Sensor with epoxy coating and metal tag for easy mounting • Good thermal contact • Short response time | B59901D0... |
| Overcurrent protection leaded | | V_{max} : 20 – 1,000 V R_{25} : 0.3 – 7500 Ω | <ul style="list-style-type: none"> • Broad product range • Partially UL approval • Partially VDE approval | B599*5C0***A070 B599*0C0***A070 B598*0C0***A070 B5988*C0120A070 B5975*B01*0A070 B5977*B01*0A070 B5940*B0060A040 |

NTC Inrush Current Limiters

| Series | | Technical data | Features & benefits | Ordering code/type |
|----------------------------|--|---|---|--------------------|
| ICLs for on-board chargers | | R_{25} at 25°C: 1.5 or 10 I_{max} : up to 16 A V_{RMS} : 110 or 230 V | <ul style="list-style-type: none"> • Qualified to AEC-Q200 | B57364S1* |

Sensors

Vishay



Optical Sensors – Fully integrated proximity, ambient light and emitter



| Series | Product | Integrated modules | Dimensions L x W x H (mm) | Maximum detection distance (mm) | ADC Resolution proximity / ambient light sensor | Ambient light resolution (lx) | Operating temperature range (°C) |
|--|---|--------------------|---------------------------------|---------------------------------------|---|-------------------------------------|--|
| Fully integrated proximity, ambient light, and emitter | | | | | | | |
| VCNL3020X01 |  | – | 4.90 x 2.40 x 0.80 | 200 | – | – | – |
| VCNL4020X01 |  | IRED, ALS-PD, PD | 4.90 x 2.40 x 0.80 | 200 | 16 bit/16 bit | 0.25 | -40 to +105 |
| VCNL4030X01 | | – | 4.00 x 2.30 x 0.75 | 200 | – | – | – |
| VCNL4035X01 | | – | 4.00 x 2.30 x 0.75 | – | – | – | – |

Photo Detectors - Pin Photodiode

| Series | Product | Device type | Package type | Package form | Package dimensions L x W x H (mm) | λ_p (nm) | $\lambda_{0.1} / \lambda_{0.5}$ (nm) | Output current (μ A) | ϕ (\pm °) | Photo sensitive area (mm ²) |
|----------------------|---|---------------------------|--------------|--------------|---|---------------------|---|---------------------------------|----------------------|--|
| Pin photodiode | | | | | | | | | | |
| VEMD10940FX01 |  | Silicon PIN photodiode | Surfacemount | Sideview | 3 x 2 x 1 | 950 | 780 to 1050 | 3 | 75 | – |
| Ambient light sensor | | | | | | | | | | |
| TEMD6200FX01 |  | Ambient light sensor | Surfacemount | 0805 | 2 x 1.25 x 0.85 | 540 | 430 to 610 | 0.04 | 60 | 0.27 |

Speciality

AVX



Timing Devices

| Product | Series | Description | Operating temp | Range |
|---------|-------------|---|-----------------------------------|-----------------|
| | Crystals | Crystal units for automotive applications, enclosed in a sealed package and oscillate when connected to an oscillation circuit. | +85°C +125°C +150°C | 4MHz - 54MHz |
| | Oscillators | Clock oscillators combine semiconductor and quartz crystal units, and emit an oscillation signal when power is switched on. | +85°C +105°C +125°C | 1.5MHz - 160MHz |
| | TCXO | Temperature compensated crystal oscillator (TCXO) to provide highly stable output frequency. | +70°C +75°C +85°C +105°C | 13MHz - 52MHz |
| | Resonators | Miniaturised, high-performance ceramic resonators are used as standard clocks for microprocessors. | +85°C +125°C +150°C | 4MHz - 20MHz |

Murata

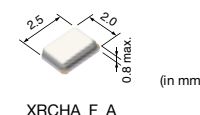


Timing Devices

| Application Matrix | | | | | |
|------------------------------|-------------|------------|--------|---------|--------------|
| Product name | Series | Powertrain | Safety | Comfort | Infotainment |
| Crystal Units | XRC | • | • | • | • |
| Ceramic Resonators CERALOCK® | CSTCR/CSTCE | • | • | • | • |

Crystal Units

Murata offers a wide lineup of small crystal units based on the original excellent package technology and high grade quartz crystal elements. Suitable for powertrain, ADAS, chassis and safety applications, etc.



| Series | Frequency range (MHz) | | | | | | | | | | | Frequency shift by temperature (ppm) | Operating temperature range (°C) | | | | | | |
|-----------|-----------------------|---|---|---|---|---|---|---|---|----|--------------|--------------------------------------|----------------------------------|----|----|----|----|------|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 20 | | | 30 | 40 | 50 | 70 | 100 | |
| XRCHA_F_A | | | | | | | | | | | 16.0000±0.1% | 24.0000±0.1% | | | | | | ±100 | -40 to +125 |

Speciality

Murata



Sound Components

Piezoelectric Sounders

Sound components to generate acknowledgment tone in instrumental panel, power slide door alarm, ultrasonic sonar operation alert and other alarm sounds.



| Series | Type | Features |
|------------|----------|---|
| PKLCS | SMD Type | Super-compact and low-profiled, workable with automatic mounting and reflow soldering |
| PKM_EPP(H) | Pin Type | General-purpose products, low frequency (2kHz) products and high sound pressure products are in the line-up |
| PKM13EPYH | Pin Type | Small and low-profiled, workable with automatic insertion |

YAGEO



GPS/Glonass Antenna

Features & Benefits

- Support GPS and GLONASS system
- High radiation efficiency
- Pin or SMD soldering
- Frequency: 1575/1602 MHz



Applications

- Navigation device
- Telematics box
- Fleet management

2.4 GHz Bluetooth/WiFi Antenna

Features & Benefits

- Compact size
- Omni-directional radiation
- Tape and reel automatic mounting
- Reflow process compatible



Applications

- 2.4 GHz WiFi device
- Bluetooth gadget
- ZigBee device
- ISM band equipment



ttieurope.com

Local Sales and Technical Support in over 40 Sales Locations Across EMEA



European HQ, Munich
22,000m² of dedicated
warehouse space



ttieurope.com

Contact TTI today to see what a true specialist can offer.

Corporate Headquarters

TTI, Inc.

2441 Northeast Parkway
Fort Worth, Texas 76106
U.S.A.

T: +1 817 740 9000
F: +1 817 740 9898
E: information@ttiinc.com

European Headquarters

TTI, Inc.

Ganghoferstr. 34
82216 Maisach-Gernlinden
Germany

T: +49 (0) 81 42 66 80 0
F: +49 (0) 81 42 66 80 490
E: sales@de.ttiinc.com

TTI, Inc. Sales

Austria

Vienna
T: +43 (0) 18 79 85 90
E: sales.vienna@at.ttiinc.com

Benelux

Eindhoven
T: +31 (0) 40 290 1616
E: sales.benelux@nl.ttiinc.com

Bulgaria

T: +359 52 51 10 59
E: sales.varna@bg.ttiinc.com

Czech/Slovak Republic

Brno
T: +420 541 126 714
E: sales.brno@cz.ttiinc.com

Denmark

Copenhagen
T: +45 (0) 43 29 35 35
E: sales.copenhagen@dk.ttiinc.com

Hammel

T: +45 (0) 38 41 31 00
E: sales.copenhagen@dk.ttiinc.com

Finland & Baltic Region

Espoo
T: +358 98 94 65 200
E: sales.finland@fi.ttiinc.com

France

Brive
T: +33 (0) 5 55 92 92 93
E: sales.france@fr.ttiinc.com

Bron

T: +33 (0) 472 81 2030
E: sales.lyon@fr.ttiinc.com

Bruz

T: +33 (0) 2 99 77 60 84
E: sales.rennes@fr.ttiinc.com

La Ciotat

T: +33 (0) 442 84 4142
E: sales.marseille@fr.ttiinc.com

Montigny Le Bretonneux

T: +33 (0) 130 13 7380
E: sales.paris@fr.ttiinc.com

Germany

Berlin
T: +49 (0) 30 8877 40 200
E: sales.berlin@de.ttiinc.com

Dortmund

T: +49 (0) 2301 91 304 0
E: sales.dortmund@de.ttiinc.com

Frankfurt

T: +49 (0) 6102 5999 100
E: sales.frankfurt@de.ttiinc.com

Hanover

T: +49 (0) 5 11 7 80 59 0
E: sales.hannover@de.ttiinc.com

Munich

T: +49 (0) 81 42 66 80 110
E: sales.munich@de.ttiinc.com

Pforzheim

T: +49 (0) 7231 14788 0
E: sales.stuttgart@de.ttiinc.com

Hungary

Budapest
T: +36 1 40 22 111
E: sales.budapest@hu.ttiinc.com

Ireland

T: +353 (0) 21 480 8070
E: sales.ireland@ie.ttiinc.com

Israel/Net-Aye

Airport City
T: +972 3 975 3333
E: sales@ray-q.com

Hod-Hasharon

T: +972 73 2471100
E: sales@ray-q.com

Italy

Bologna
T: +39 051 632 1863
E: sales.milan@it.ttiinc.com

Civitanova Marche

T: +39 0733 81 8655
E: sales.milan@it.ttiinc.com

Florence

T: +39 (0) 55 094 63 76
E: sales.milan@it.ttiinc.com

Milan

T: +39 02 822 521
E: sales.milan@it.ttiinc.com

Naples

T: +39 (0) 81 7148661
E: sales.milan@it.ttiinc.com

Padova

T: +39 049 774 683
E: sales.milan@it.ttiinc.com

Rome

T: +39 0774 57 1302
E: sales.milan@it.ttiinc.com

Norway

Drammen
T: +47 (0) 92 66 87 66
E: sales.norway@no.ttiinc.com

Poland

Kwidzyn
T: +48 (0) 55 279 67 57
E: sales.poland@pl.ttiinc.com

Portugal

T: +351 252 493084
E: sales.barcelona@es.ttiinc.com

Romania

Cluj Napoca
T: +40 (0) 264 439 103
E: sales.romania@ro.ttiinc.com

Russia

Saint Petersburg
T: +7 (0) 812 4962053
E: sales.russia@ru.ttiinc.com

South Africa

Johannesburg
T: +27 (0) 11 795 2691
E: sales.southafrica@za.ttiinc.com

Spain

Barcelona
T: +34 (0) 93 645 25 75
E: sales.barcelona@es.ttiinc.com

Madrid

T: +34 (0) 91 416 11 90
E: sales.madrid@es.ttiinc.com

Vizcaya

T: +34 (0) 94 623 25 80
E: sales.bilbao@es.ttiinc.com

Sweden

Gothenburg
T: +46 (0) 31 741 12 90
E: sales.gothenburg@se.ttiinc.com
Stockholm
T: +46 (0) 8 594 11 800
E: sales.stockholm@se.ttiinc.com

Switzerland

Baar
T: +41 (0) 41 76741 90
E: sales.swiss@ch.ttiinc.com

Tunisia

T: +216 (0) 71 862 693
E: sales.tunis@fr.ttiinc.com

Turkey

Istanbul
T: +90 (0) 216 688 91 75 76
E: sales.turkey@tr.ttiinc.com

United Kingdom

Basildon
T: +44 (0)1268 889520
E: sales.essex@uk.ttiinc.com
High Wycombe
T: +44 (0)1494 460000
E: sales.london@uk.ttiinc.com

Stevenage

T: +44 (0)1438 794170
E: power@uk.ttiinc.com

Resellers or Distributors

TTI Connect - Europe
T: +49 8142 6680 168
E: service@tticonnect.com



EN 9100:2009
EN 9120:2009
Registered

