



fine **power**<sup>®</sup>

YOUR INNOVATION HUB



28.10.2021

Webinar Winter Challenge

**Finepower present DELTA  
AC/DC and DC/DC Converter  
by Ralf Feuerstein**

# Delta Standard Power Modules

DC/DC and AC/DC Converter

DCBU  
Delta Electronics, Inc.  
September 2021





- The largest power solution provider worldwide
- More than 25M PSU manufactured per month
- Power range from 1W to 10MW
- High power density
- Providing up to 98,7% efficiency power solution
- Over 9000 R&D engineers worldwide
- 6~7% group sales revenue devoted to R&D

### World's No. 1 in:

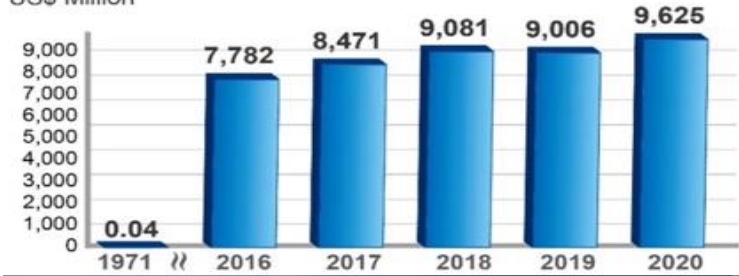
- Switching Power Supplies since 2002
- DC Brushless Fans since 2006

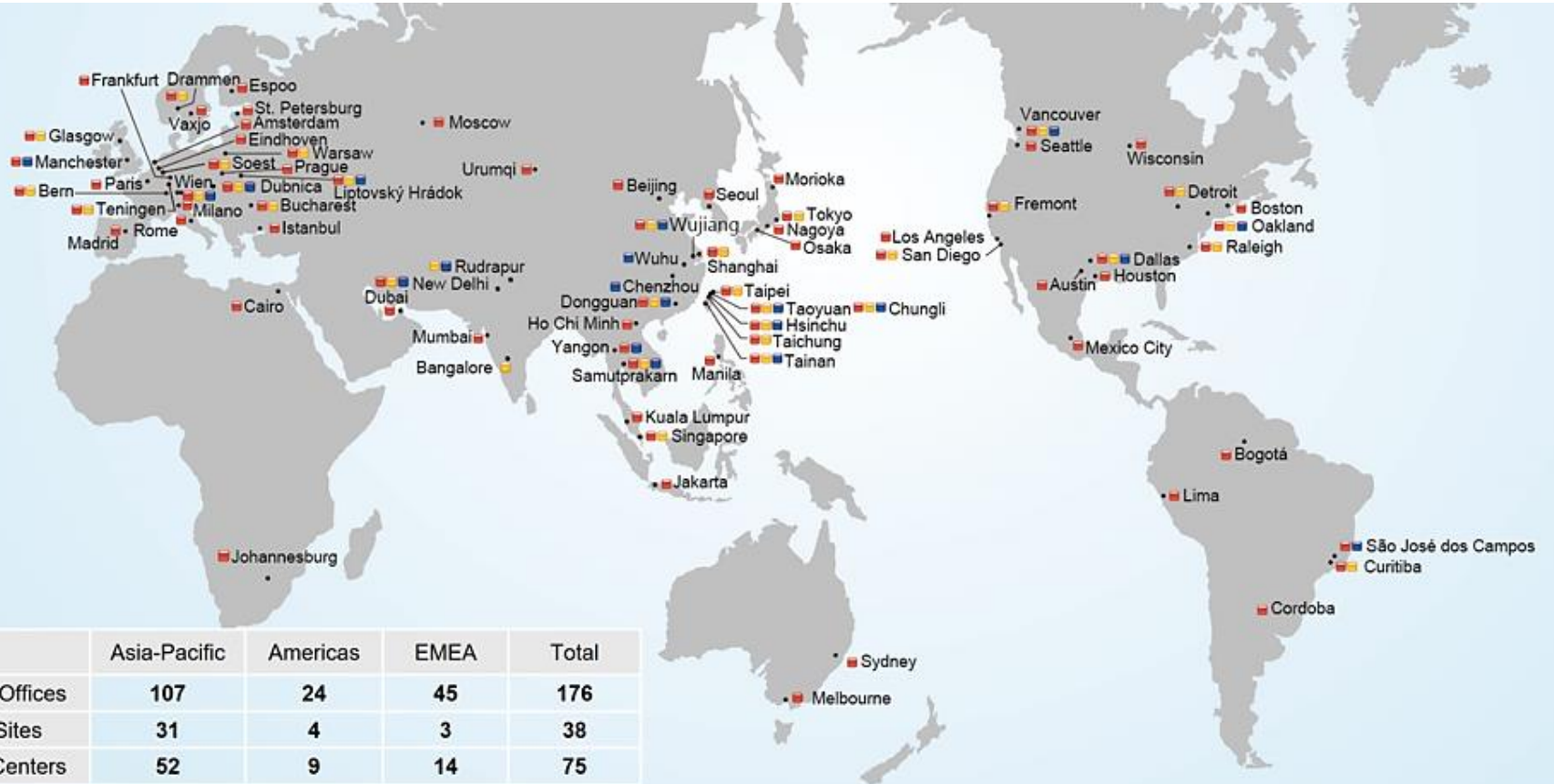
### Leading in:

- Telecom Power Systems
- Industrial Automation
- Renewable Energy Solutions
- Datacenter Infrastructure
- Passive and Magnetic Components
- Networking Products

## Delta Introduction

US\$ Million

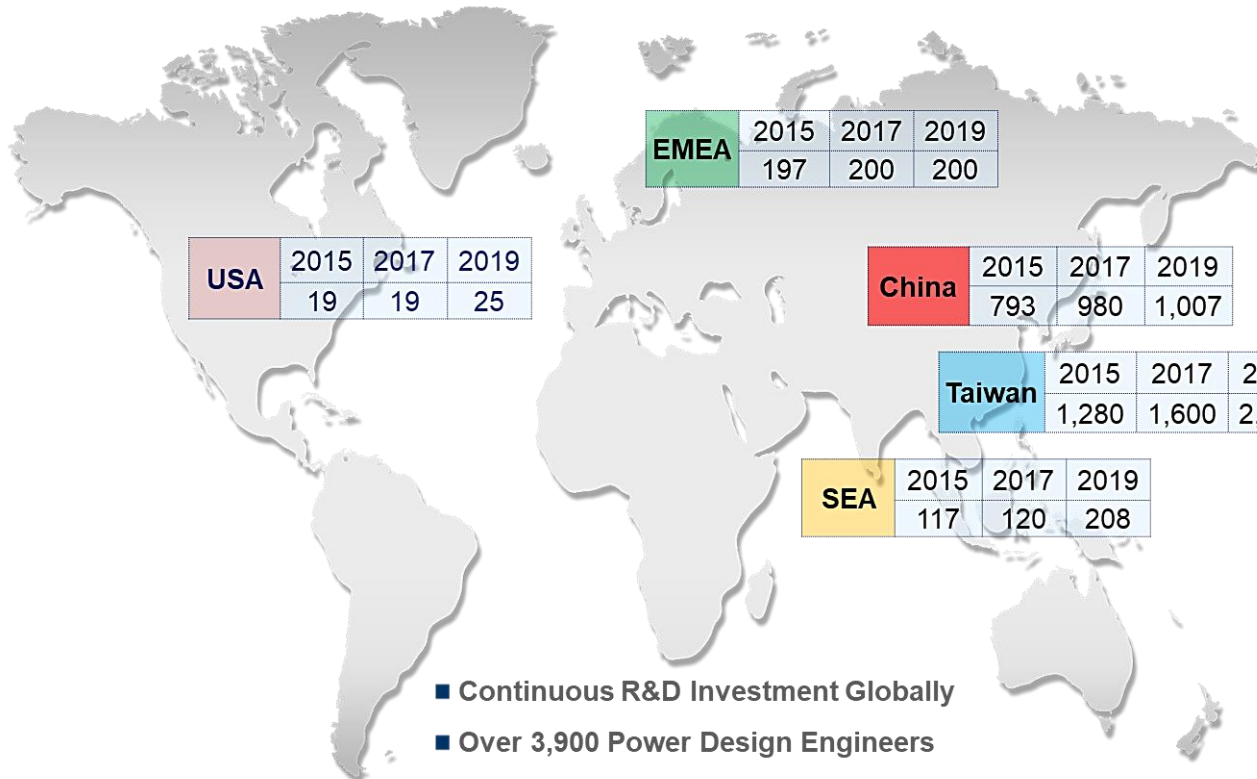




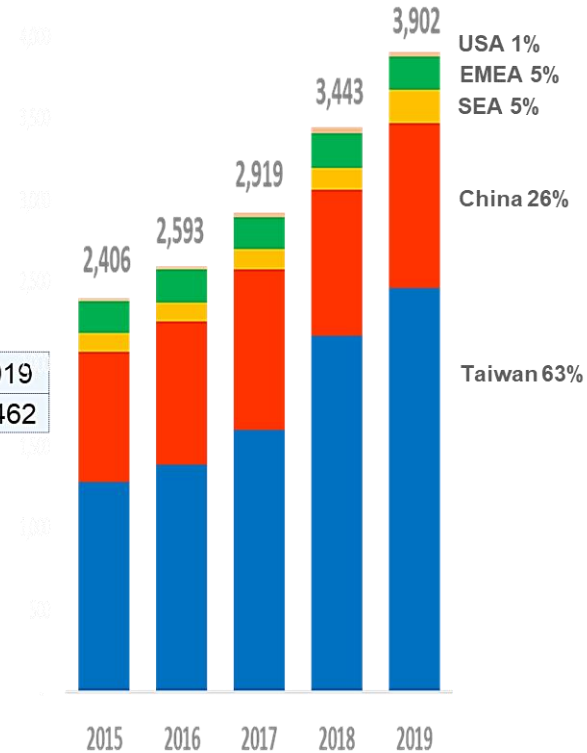




# Delta Power Engineering Resources

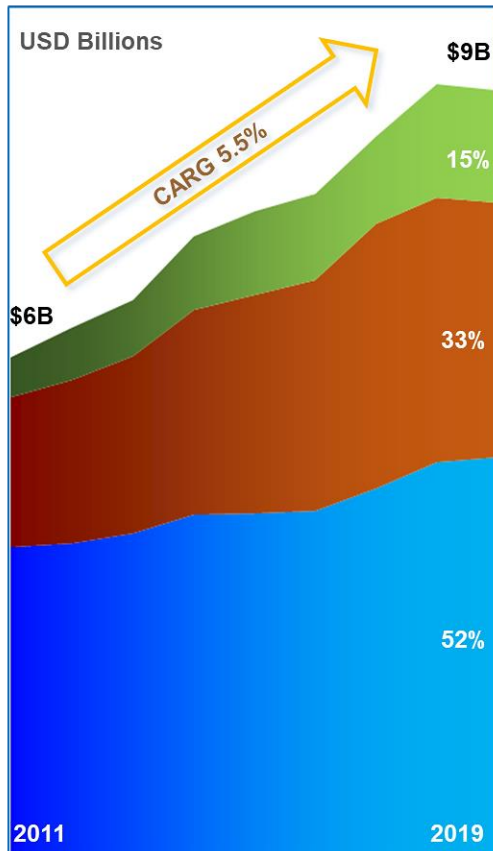


- Continuous R&D Investment Globally
- Over 3,900 Power Design Engineers in 9 Design Centers and 3 Technology Research Labs



Power Design Engineers : EE, FW, SW, ME

# Delta Group Business Strategy



**Automation**  
**Industrial Automation**  
 ( IABG )  
**Building Automation**  
 ( BABG )

### Industry Automation



### Building Automation



**Infrastructure**  
**ICT Infrastructure**  
 ( ICTBG )  
**Energy Infrastructure**  
 ( EISBG )

### Telecom Power

### UPS System

### EV Charging Station

### Renewable Energy



**Power Electronics**  
**Power and System**  
 ( PSBG )  
**Fan & Thermal Management**  
 ( FMBG )

**Electric Vehicle Solution**  
 ( EVSBG )  
**Components**  
 ( CPBG )

Automotive Electronics  
 Powertrain, On-Board Charger  
 Traction Motor and Inverter



### Server, Networking

### Desktop

### Notebook, WiFi

### Appliance, Lighting

### E-Mobility Power

### Fan and Thermal



### Power Shelf

### DC-DC Converter

### Power Tools

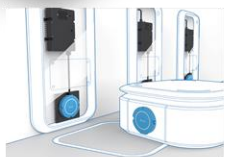
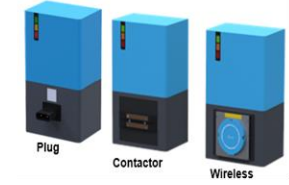
### Industrial, Medical

### Off-Line UPS

### Components



# PSBG Power Solutions E-Mobility



**AGV Docking Charger**   **Wireless Charger**

**Control Unit**

**Battery Charger Power Module**



**Stationary Battery Charger**

**On-Board Charger**

**DC/DC Module**

**Battery Swapping Station**

**Battery Charger**

(12) **United States Patent**  
Huang et al.

(10) Patent No.: **US 6,344,979 B1**  
(45) Date of Patent: **Feb. 5, 2002**

(54) **LLC SERIES RESONANT DC-TO-DC CONVERTER**

Priority to:  
(74) Attor

(75) Inventors: **Gaibong Huang, Alpha J. Zhang, Yibei Gu, all of Shanghai (CN)**

(73) Assignee: **Delta Electronics, Inc.**  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

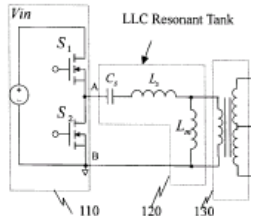
(21) Appl. No.: **09/786,128**  
(22) Filed: **Feb. 9, 2001**

(51) Int. Cl.<sup>7</sup> ..... **H02M 3/335**  
(52) U.S. Cl. .... **363/18, 363/131, 363/132**  
(58) Field of Search ..... **363/15, 14, 17, 363/30, 40, 131, 132**

(50) **References Cited**

U.S. PATENT DOCUMENTS  
4,785,897 A \* 11/1988 Lee et al. .... 363/131  
4,814,962 A \* 3/1989 Magathas et al. .... 363/17  
4,876,658 A \* 10/1989 Park et al. .... 363/132  
5,508,040 A \* 2/1995 Hale ..... 363/18  
5,638,496 A \* 8/1995 Ingrain ..... 363/132  
5,694,678 A \* 11/1997 Blank ..... 363/17  
5,777,659 A \* 7/1998 Bach ..... 363/131  
5,781,418 A \* 7/1999 Zhang et al. .... 363/18  
5,805,432 A \* 9/1988 Zafra et al. .... 363/39  
5,906,205 A \* 11/1999 Stewart et al. .... 363/16  
6,117,234 A \* 09/2000 Willard et al. .... 363/37

\* cited by examiner



LLC Series Resonant DC-to-DC

(12) **United States Patent**  
Huang et al.

(10) Patent No.: **US 6,469,915 B2**  
(45) Date of Patent: **Oct. 22, 2002**

(54) **RESONANT RESET DUAL SWITCH FORWARD DC-TO-DC CONVERTER**

Priority to:  
(74) Attor

(75) Inventors: **Gaibong Huang, Yibei Gu, Zhiheng Liu, Alpha J. Zhang, all of Shanghai (CN)**

(73) Assignee: **Delta Electronics Inc., Taoyuan Shin (TW)**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/845,686**  
(22) Filed: **Apr. 30, 2001**

(50) **Prior Publication Data**

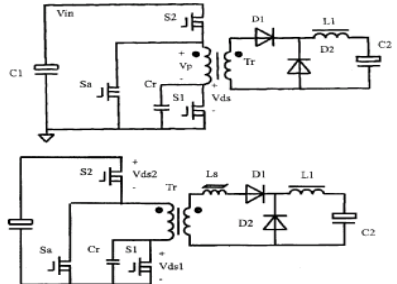
US 2002/0034065 A1 Mar. 21, 2002  
US 2002/0034065 A1 Mar. 21, 2002

(30) **Foreign Application Priority Data**  
Sep. 15, 2000 (TW) ..... 089118884 A

(51) Int. Cl.<sup>7</sup> ..... **H02M 3/335**  
(52) U.S. Cl. .... **363/25, 363/56, 106**  
(58) Field of Search ..... **363/24, 25, 26, 363/56, 58, 106, 89, 134, 133, 22, 23**

(50) **References Cited**

U.S. PATENT DOCUMENTS  
4,736,284 A \* 4/1988 Yamagishi et al. .... 363/16



10 Claims, 10 Drawing Sheets

(12) **United States Patent**  
Zhang et al.

(10) Patent No.: **US 6,466,458 B2**  
(45) Date of Patent: **Oct. 15, 2002**

(54) **ASYMMETRICAL FULL BRIDGE DC-TO-DC CONVERTER**

(75) Inventors: **Alpha J. Zhang, Gaibong Huang, Yibei Gu, all of Shanghai (CN)**

(73) Assignee: **Delta Electronics, Inc., Taipei (TW)**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/782,573**  
(22) Filed: **Feb. 12, 2001**

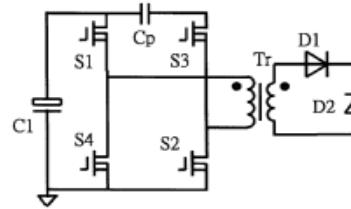
(50) **Prior Publication Data**

US 2002/036652 A2 Sep. 26, 2002

(51) Int. Cl.<sup>7</sup> ..... **H02M 3/335, H02H 7/122**  
(52) U.S. Cl. .... **363/17, 363/58, 363/132, 363/56, 602**  
(58) Field of Search ..... **363/17, 56, 58, 602, 363/58, 132**

(50) **References Cited**

U.S. PATENT DOCUMENTS  
5,245,520 A \* 01/1993 Inthorn ..... 363/17



Asymmetrical full bridge DC-to-DC converter

5,654,880 A \* 8/1997 Bekowic et al. .... 363/17  
5,900,827 A \* 8/1999 Jacobs et al. .... 363/48  
6,208,520 B1 \* 2/2001 Davidson ..... 363/132

\* cited by examiner

Priority Examiner—Bao Q. Wu  
(74) Attorney, Agent, or Firm—Bao-In-Lin

(57)

(12) **United States Patent**  
Zhang et al.

(10) Patent No.: **US 6,370,044 B1**  
(45) Date of Patent: **Apr. 9, 2002**

(54) **SYNCHRONOUS RECTIFIER CIRCUIT**

(75) Inventors: **Alpha J. Zhang, Gaibong Huang, Yibei Gu, all of Nucleo Taipei (TW)**

(73) Assignee: **Delta Electronics, Inc. (TW)**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/855,006**

(22) Filed: **May 14, 2001**

(30) **Foreign Application Priority Data**

Nov. 30, 2000 (TW) ..... 8912522 A

(51) Int. Cl.<sup>7</sup> ..... **H02M 3/335**

(52) U.S. Cl. .... **363/21, 106, 363/89**

(58) Field of Search ..... **363/89, 21, 106, 363/127**

(50) **References Cited**

U.S. PATENT DOCUMENTS  
5,663,877 A \* 01/1997 Dhill et al. .... 363/27



US006370044B1

6,026,065 A 2/2000 Abdoulin  
6,169,875 B1 \* 1/2001 Shimomori et al. .... 363/17  
6,300,463 B1 \* 10/2001 Krugly ..... 363/21, 04

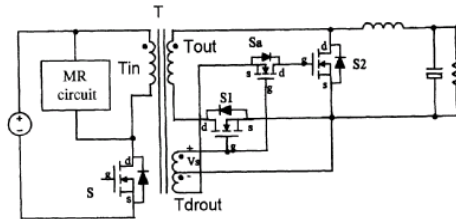
\* cited by examiner

Priority Examiner—Shawn Riley  
(74) Attorney, Agent, or Firm—Alston & Bird LLP

(57) **ABSTRACT**

A self-driven synchronous rectifier circuit applied to a forward converter is provided. The circuit includes a transformer having a primary winding and a secondary winding for converting an input voltage into an output voltage, a first synchronous rectifier switch and a second synchronous rectifier switch connected to the secondary winding for rectifying the output voltage; and an auxiliary switch, wherein the gate terminal thereof is connected to the gate terminal of the first synchronous rectifier switch and the positive end of the secondary winding, the source terminal thereof is connected to the drain terminal of the first synchronous rectifier switch and the negative end of the secondary winding, and the drain terminal thereof is connected to the gate terminal of the second synchronous rectifier switch.

19 Claims, 9 Drawing Sheets

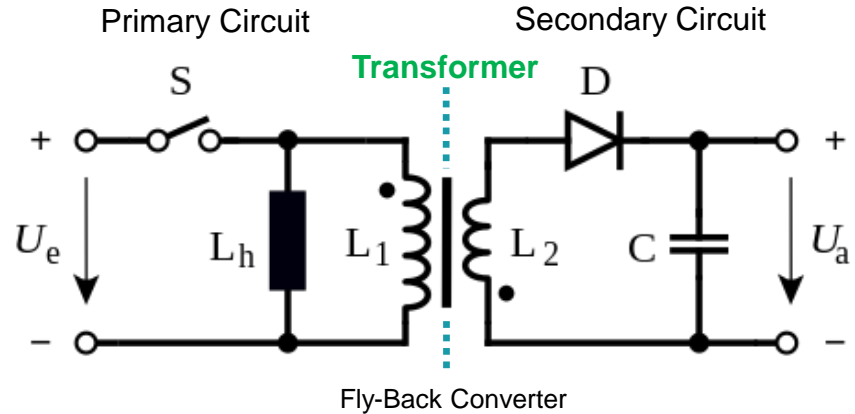




## Isolated DC-DC converters

### Isolated DC-DC Converter

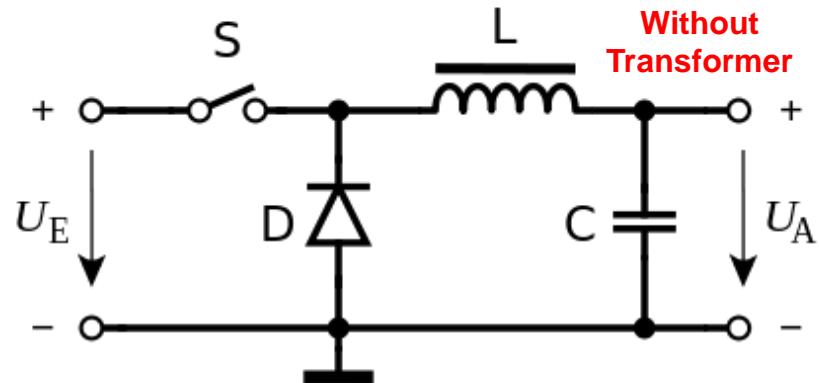
- Transformer for galvanic Isolation
- $U_a$  independent from  $U_i$



## Non-Isolated DC-DC converters

### Buck Converter (Step-Down, POL)

- No galvanic Isolation
- $U_a < U_i$





# Switching Power Technology Innovation

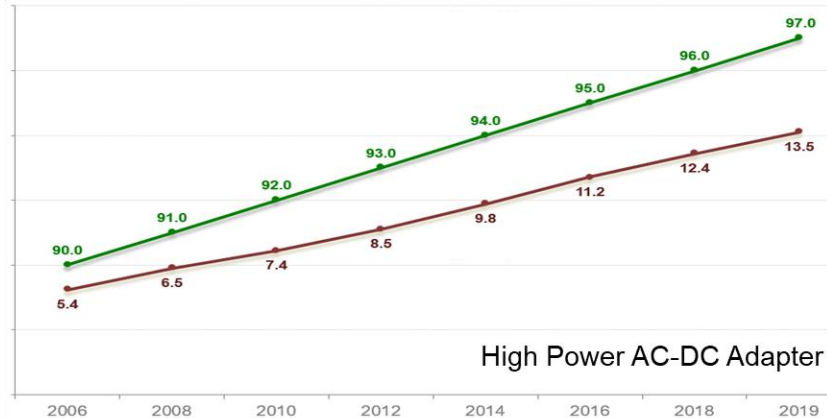
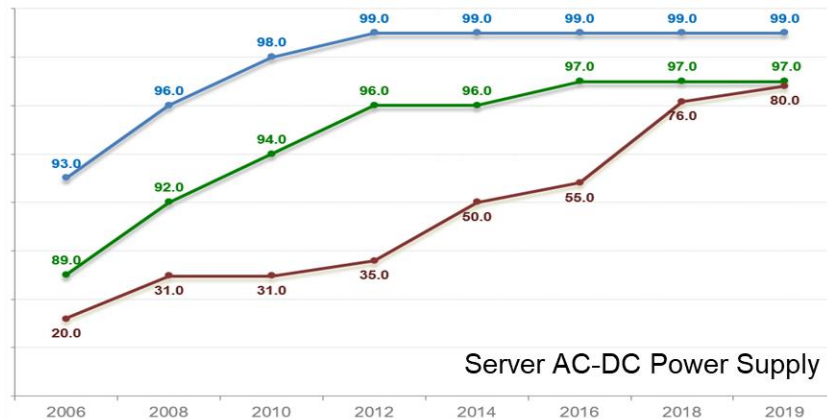
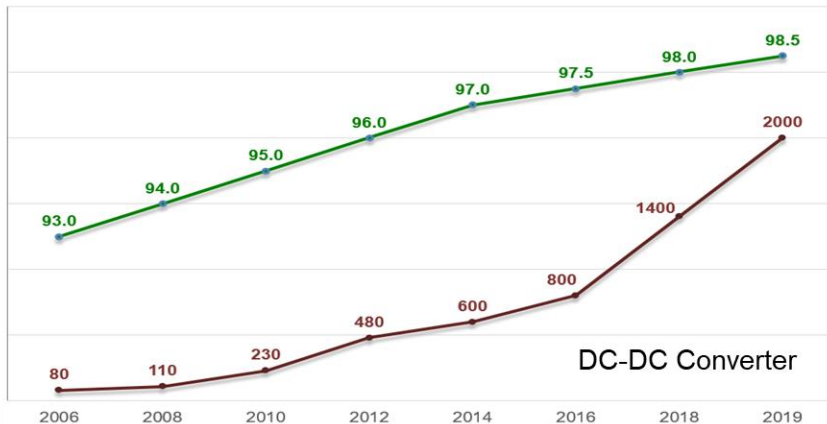
## Advanced Technology :

- ✓ Flyback, LLC, Interleave, PFC Topologies
- ✓ Integrated Magnetics, Planar Transformer
- ✓ Digital PWM, DPS Control, PMBus
- ✓ MHz Switching Frequency, SiC, GaN

**Power Efficiency**  
 ( % )

**Power Density**  
 ( Watt / In<sup>3</sup> )

**Power Factor**  
 ( % )

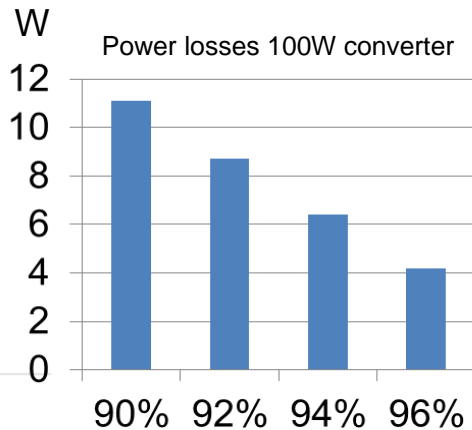
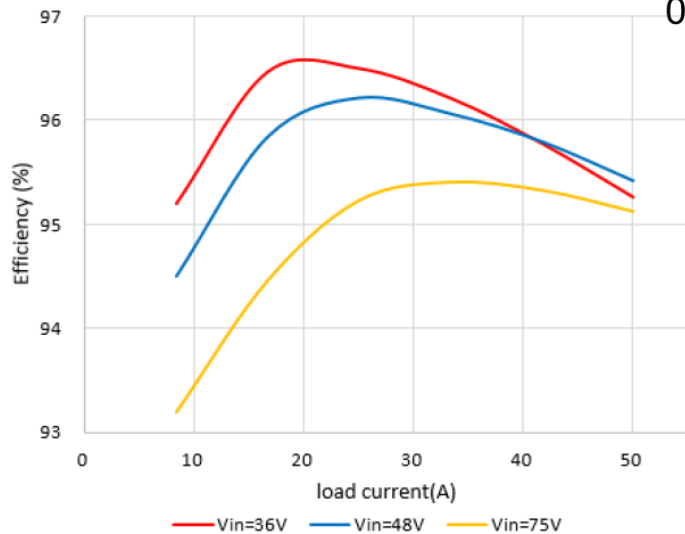




# Efficiency

High efficiency is one of the most important selection criteria:

- Save energy
- Reduce cost (TCO)
- Minimize power losses
- Reduce heat dissipation
- Extend lifetime
- Increase system reliability



100W with different efficiency:

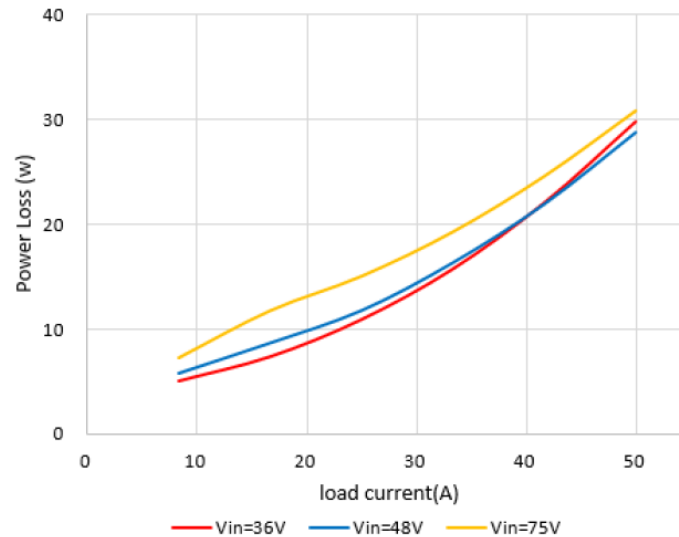
- 94% = 6,4W power losses
- 96% = 4,2W power losses

---

35% less power losses  
with only 2% better efficiency

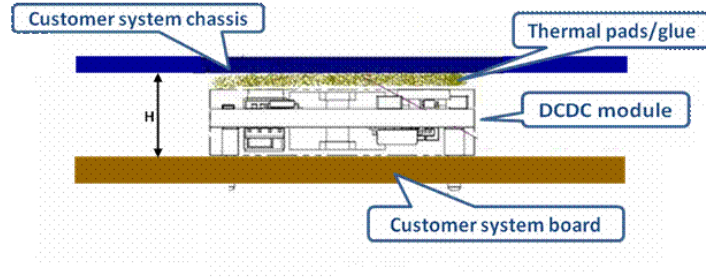


Delta Q48SK  
Quarter Brick  
600W  
12V 50A

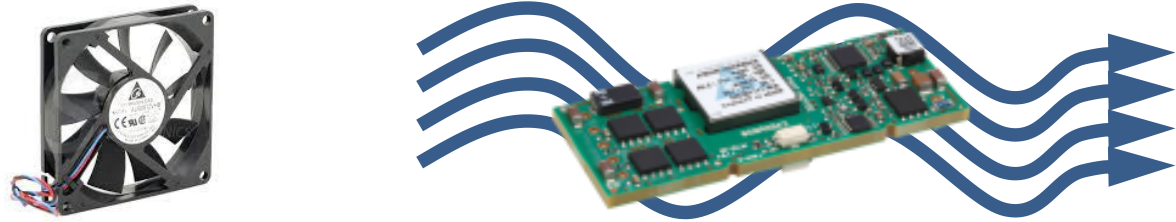


# Cooling Methods

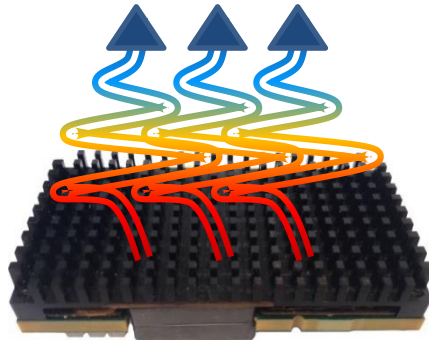
Conduction Cooling:



Forced Cooling:



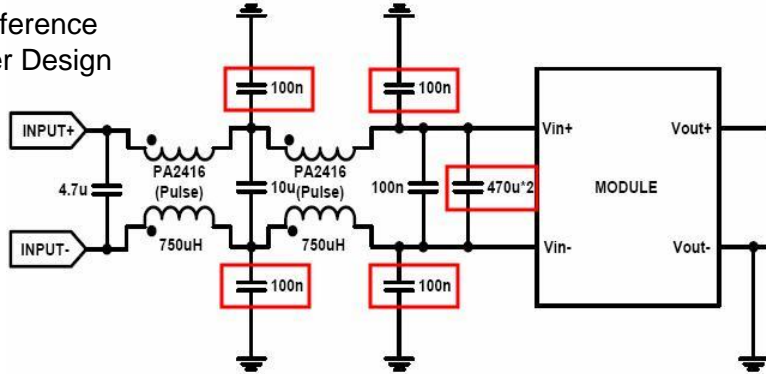
Convection Cooling:





# EMI Input Filter

Reference Filter Design

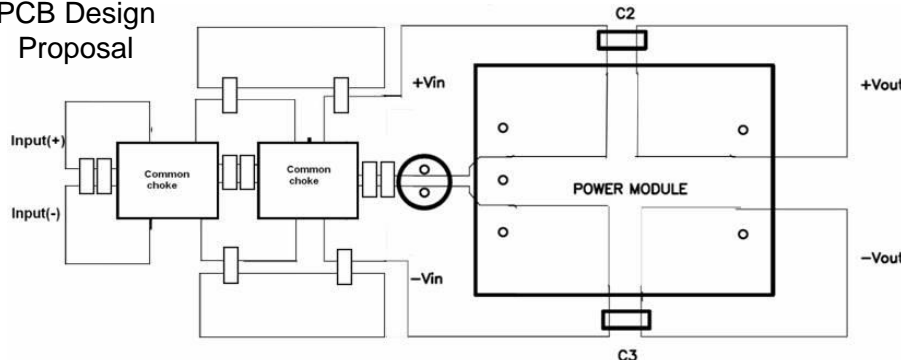


or



5A FL75L05 A  
 7A FL75L07 A  
 10A FL75L10 A  
 20A FL75L20 A

PCB Design Proposal



- Please reserve more Y-cap and X-cap locations if space allows. It's helpful for debug during EMI test.
- Ensure all connections are low impedance. Low ESR capacitors should be used.

## DELTA STANDARD POWER MODULES

- Introduction DC/DC Converters
- Product Overview Delta Power Modules
- Applications
  - Railway
  - Non-Automotive Transportation
  - Industrial
  - Medical
  - Telecom
- Product Selection Guide
- Benefits
- Sales Channels and Support



Standard Power Module

DC/DC Converters & AC/DC Modules

Product Catalog 2020



# DCBU Global Operations



● Amsterdam, the Netherlands



● Taipei, Taiwan  
Sales / Marketing



● Shanghai, China  
R & D



● Fremont, USA



● Bangpoo, Thailand  
Manufacturing site



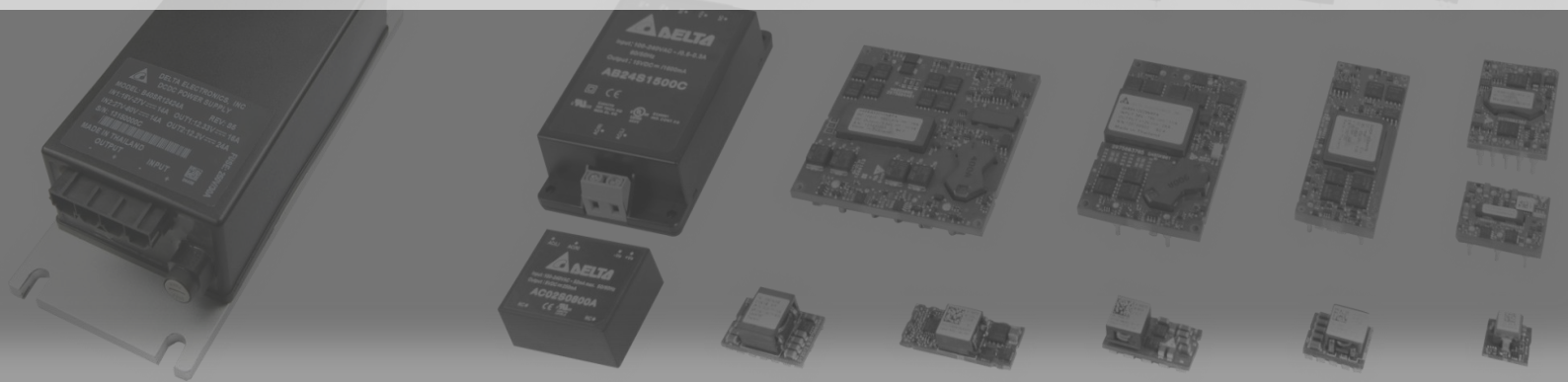
● Tokyo, Japan



# Product Overview



PRODUCTS





## STANDARD POWER MODULES AC/DC



### AC/DC On-Board

Power: 300-500W  
Vout: 12V, 24V, 28V, 48V  
PACSR series



### AC/DC On-Board

Power: 800W  
Vout: 12V, 28V, 48V  
FACS series



### AC/DC On-Board

Power: 4-60W  
Vout: 3,3V, 5V, 9V, 12V  
15V, 24V, 36V, 48V  
Dual and Triple outputs  
AA series



### AC/DC On-Board

Power: 24-60W  
Vout: 5V, 9V, 12V, 15V  
24V, 48V,  $\pm 12V$ ,  $\pm 15V$   
EN 60601 Medical approval  
AB series

## STANDARD POWER MODULES Off-Board



### DC/DC Panel Mount

**Power:** 60W  
**Vin:** 9-36V  
**Vout:** 12V  
**PM24S** series



### DC/DC DIN Rail

**Power:** 60W  
**Vin:** 9-36V  
**Vout:** 12V  
**DR24S** series



### DC/DC Box Type IP67

**Power:** 300-360W  
**Vin:** 18-60V, 18-106V, 36-106V  
**Vout:** 12V, 13,7V, 24V  
**B40SR** series **B62SR** series **B70SR** series



### DC/DC Box Type IP67

**Power:** 500W  
**Vin:** 32-96V  
**Vout:** 12V, 13,7V, 24V  
**B70SP** series

## STANDARD ON-BOARD DC/DC MODULES ENCAPSULATED



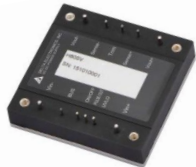
### DC/DC High-Voltage Full-Brick

**Power:** 1200W  
**Vin:** 200-400V, 400-800V  
**Vout:** 14V, 28V, 54V  
**FB7SR** series **FG5SR** series



### DC/DC Half-Brick (non-isolated)

**Power:** 3000Wmax (50A)  
**Vin:** 9-60V  
**Vout:** 0-60V trim range  
**H60SB** series



### DC/DC Half-Brick

**Power:** 100-200W  
**Vin:** 16,8-137,5V  
**Vout:** 12V, 15V, 24V, 48V, 54V  
**H80SV** series



### DC/DC Half-Brick

**Power:** 300W  
**Vin:** 40-160V  
**Vout:** 12V, 13,8V, 15V  
**HA0SP** series



### DC/DC HV Quarter-Brick

**Power:** 750W  
**Vin:** 360-400V  
**Vout:** 12V  
**QC8SC** series



### DC/DC Quarter-Brick

**Power:** 150W  
**Vin:** 14,4-170V  
**Vout:** 5V, 12V, 15V, 24V, 54V  
**Q80SV** series



### DC/DC Quarter-Brick

**Power:** 200W  
**Vin:** 40-170V  
**Vout:** 5V, 12V, 15V, 24V, 54V  
**QA1SV** series



### DC/DC Eighth-Brick

**Power:** 150W  
**Vin:** 9-60V  
**Vout:** 5V, 12V, 24V, 48V  
**E35SE** series

## STANDARD ON-BOARD DC/DC MODULES ENCAPSULATED



### DC/DC 2"x1"

**Power:** 40-60W

**Vin:** 9-36V

**Vout:** 5V, 12V, 15V, 24V

**S24SP** series



### DC/DC 1"x1"

**Power:** 10-30W

**Vin:** 9-36V, 18-75V

**Vout:** 3,3V, 5V, 12V, 15V,  $\pm 12V$ ,  $\pm 15V$

**S24SE** series **S24DE** series **S36SE** series



### DC/DC DIP and SMD

**Power:** 1-6W

**Vin:** 5V, 9-36V, 18-75V

**Vout:** 3,3V, 5V, 9V, 12V, 15V, 24V  
 $\pm 5V$ ,  $\pm 9V$ ,  $\pm 12V$ ,  $\pm 15V$

**D** series **S** series



### DC/DC SIP

**Power:** 1-3W

**Vin:** 3,3V, 4,5-18V, 9-36V, 18-75V

**Vout:** 3,3V, 5V, 9V, 12V, 15V  
 $\pm 5V$ ,  $\pm 9V$ ,  $\pm 12V$ ,  $\pm 15V$

**P** series



## STANDARD ON-BOARD DC/DC MODULES OPEN FRAME



### DC/DC Half-Brick

**Power:** 80-1650W  
**Vin:** 18-75V, 36-75V, 38-60V  
**Vout:** 3,3V, 12V, 15V, 24V, 28V, 48V, 54V  
**H36S / H48S** series



### DC/DC Quarter-Brick

**Power:** 60-1600W  
**Vin:** 9-36V, 18-75V, 36-75V, 40-60V  
**Vout:** 1V, 1,2V, 1,5V, 1,8V, 2,5V, 3,3V, 5V, 7V, 12V, 24V, 28V, 48V, 54V  
**Q24S / Q36S / Q48S / Q54S / Q55S** series



### DC/DC Eighth-Brick

**Power:** 50-480W  
**Vin:** 9-36V, 18-36V, 18-75V, 36-75V, 40-60V  
**Vout:** 1V, 1,2V, 1,5V, 1,8V, 2,5V, 3,3V, 5V, 7V, 12V, 24V, 28V, 48V, 50V  
**E24S / E36S / E48S / E54S** series



### DC/DC 1/16-Brick

**Power:** 40-200W  
**Vin:** 18-75V, 36-75V, 42-60V  
**Vout:** 1V, 1,2V, 1,5V, 1,8V, 2,5V, 3,3V, 5V, 7V, 12V, 15V  
**V36S / V48S / V48D** series



### DC/DC 1/32 Brick

**Power:** 25W  
**Vin:** 36-75V  
**Vout:** 3,3V, 5V  
**T48SR** series



### DC/DC 2"x1"

**Power:** 25-33W  
**Vin:** 18-60V, 36-75V  
**Vout:** 3,3V, 5V, 12V  
**S36SA** series **S48SA** series



### DC/DC 1"x1"

**Power:** 15-35W  
**Vin:** 18-75V, 36-75V  
**Vout:** 3,3V, 5V, 7V, 12V, 15V  
**S36SE** series **S48SP** series



### DC/DC (fixed ratio & bi-directional)

**Power:** 62A / 15,5A  
**Vin:** 38-60V **Vout:** Vin/4  
**Vin:** 9,5-15V **Vout:** Vin\*4  
**U50SU** series

COMING  
SOON

## STANDARD ON-BOARD DC/DC MODULES NON-ISOLATED



### DC/DC Switching Regulator

**Power:** 0,5A  
**Vin:** 4,75-32V, 11-32V, 18-32V  
**Vout:** 1,5-V, 1,8V, 2,5V, 3,3V, 5V, 6,5V, 9V, 12V, 15V

**PM05** series



### DC/DC POL DOSA I

**Power:** 3-30A  
**Vin:** 2,4-5,5V, 6-14V, 8,3-14V  
**Vout:** 0,75-5V trim range

**DNx** series



### DC/DC POL DOSA II

**Power:** 12-30A  
**Vin:** 4,5-14V  
**Vout:** 0,69-5V trim range

**DCx** series



### DC/DC POL

**Power:** 3-60A  
**Vin:** 3-13,8V, 10,2-13,8V  
**Vout:** 0,59-5V trim range

**NE** series **NC** series



### DC/DC POL

**Power:** 10-80A  
**Vin:** 4,5-13,8V, 10,8-13,2V  
**Vout:** 0,6-5V trim range  
**D12** series



### DC/DC Power Block

**Power:** 30-140A  
**Vin:** 7-13,2V  
**Vout:** 0,6-3,3V trim range  
**D12S1R8** series



### DC/DC 1/32 Brick

**Power:** 100W  
**Vin:** 9-53V  
**Vout:** 3,3-16,5V trim range 8A (6A)  
**Vout:** 5-30V trim range 4,5A  
**T31SN** series



### DC/DC POL (transformer coupled)

**Power:** 100W  
**Vin:** 45-60V  
**Vout:** 1,2V, 1,8V, 3,3V  
**TCP54** series

## STANDARD ON-BOARD DC/DC EMI FILTER MODULES



### EMI Filter 1''x1'' Encapsulated THT

Current: 5A max  
Vin: 75V max  
**FL75L5 A**



### EMI Filter 1''x1'' Open Frame SMD / THT

Current: 7A max  
Vin: 75V max  
**FL75L7 A / FL75L7 B**



### EMI Filter 2''x1'' Encapsulated THT

Current: 10A max  
Vin: 75V max  
**FL75L10 A**

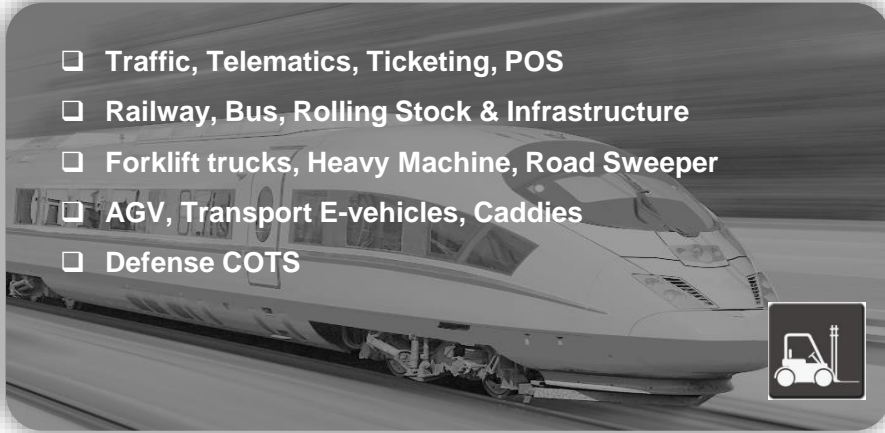


### EMI Filter 2''x1,6'' Encapsulated THT

Current: 20A max  
Vin: 75V max  
**FL75L20 A / FL75L20 B**



- ❑ Traffic, Telematics, Ticketing, POS
- ❑ Railway, Bus, Rolling Stock & Infrastructure
- ❑ Forklift trucks, Heavy Machine, Road Sweeper
- ❑ AGV, Transport E-vehicles, Caddies
- ❑ Defense COTS



- ❑ Base stations, Small Cells, Radio Communication
- ❑ Optical Networks, Switches, Routers, Gateways
- ❑ Broadband, Cable TV, Broadcast
- ❑ Satellite Communications, Radio Heads, Wireless
- ❑ PABX, Access, Ethernet, IP Phones, Modems, PoE
- ❑ Data Center, Computing, Cloud



- ❑ Building Automation, Security Systems, CATV
- ❑ Controls, Interfaces, Industrial Ethernet Switch
- ❑ Test & Measurement Systems, ATE, Balances
- ❑ Robotics, Manufacturing, Pumps, Drives
- ❑ Infotainment, Video Walls, LED Signage
- ❑ Laser Systems, Plasma, Welding, Machine Tools
- ❑ Gaming, Audio/Video, Printers

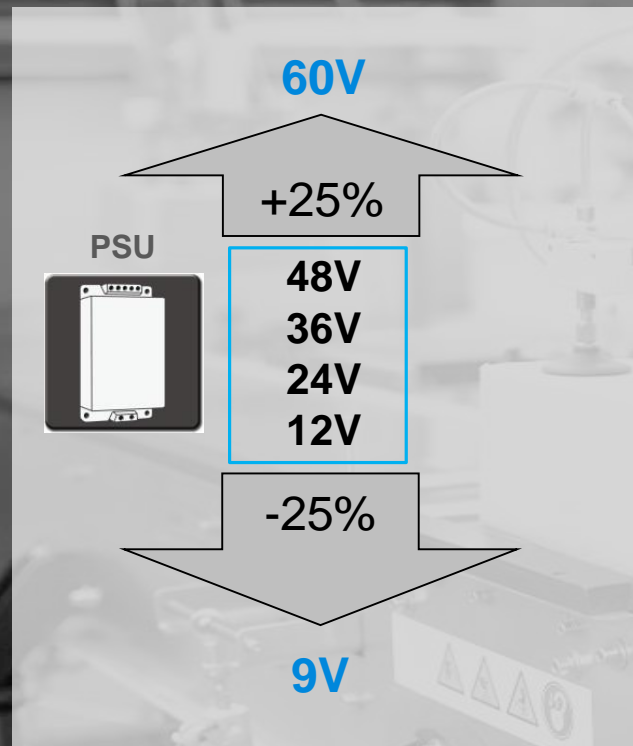


- ❑ Analysis, Diagnostics, Dialysis, Ventilation
- ❑ MRT, Scanners, X-ray, Ultrasound, Microscopy
- ❑ Patient Monitoring, Treatment, Dental
- ❑ Surgery, Laser, Trolleys, Pumps, Lighting





## VOLTAGE VARIATIONS IN INDUSTRIAL DEVICES





## ENCAPSULATED ON-BOARD CONVERTERS

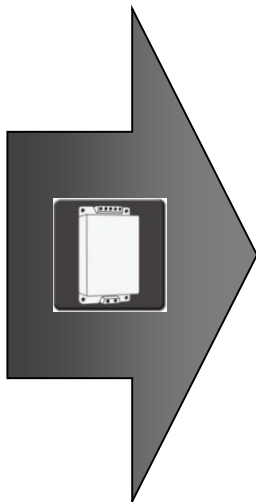
### WIDE INPUT VOLTAGE 9-36V



+50%

**24V**  
**12V**

-25%



1"x1"

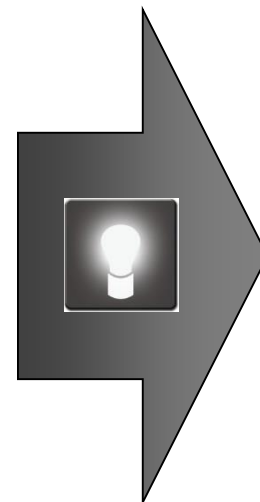


30W  
20W  
15W  
10W

2"x1"



60W  
40W



24V  
15V  
12V  
5V  
3,3V  
±15V  
±12V

Motor  
Pump  
Valve  
Relay  
Fans  
Display  
Lights  
Cameras  
Interface  
Sensors  
Modem  
MCU  
FPGA  
Memory

#### DC/DC 1"x1"

Power: 10-30W

Vin: 9-36V

Vout: 3,3V, 5V, 12V, 15V, ±12V, ±15V

**S24SE** series **S24DE** series

#### DC/DC 2"x1"

Power: 40-60W

Vin: 9-36V

Vout: 5V, 12V, 15V, 24V

**S24SP** series

Efficiency: 87-93%

Isolation: 1600/1500Vdc

Natural Convection: -40~85°C ambient temp.

Features: Trim, OVP, OCP, OTP

Options: Remote ON/OFF, Heatsink





## ENCAPSULATED ON-BOARD CONVERTERS

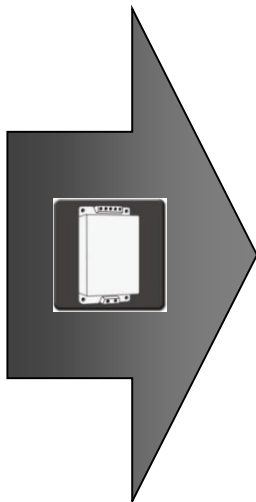
WIDE INPUT VOLTAGE  
9-60V



+25%

48V  
36V  
24V  
12V

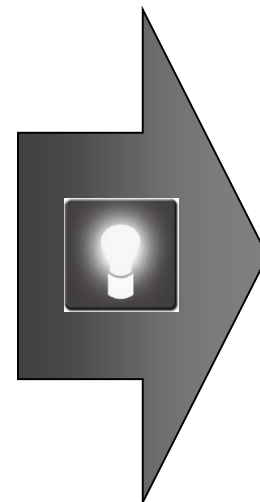
-25%



1/8  
Brick



150W



(Trim Range)

(54V)  
48V  
24V  
12V  
5V

- Power Distr.
- Router
- Printer
- Amplifier
- Motor
- Pump
- Valve
- Relay
- Fans
- Display
- Lights
- Cameras
- Interface
- Sensors
- Modem
- MCU
- Electronics

### DC/DC 1/8 Brick

Power: 150W

Vin: 9-60V

Vout: 5V, 12V, 24V, 48V

E35SE series

Efficiency: 92,2%

Isolation: 4242V

Natural Convection: -40~85°C ambient temperature

Features: Wide Trim Range +/-20%, OVP, OCP, OTP

Options: Remote ON/OFF, Heatsink

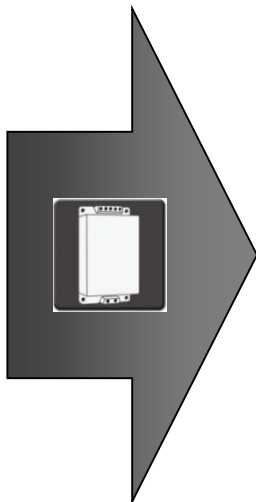
## ENCAPSULATED ON-BOARD CONVERTERS

WIDE INPUT VOLTAGE  
18-75V

+50%

48V  
24V

-25%



1"x1"



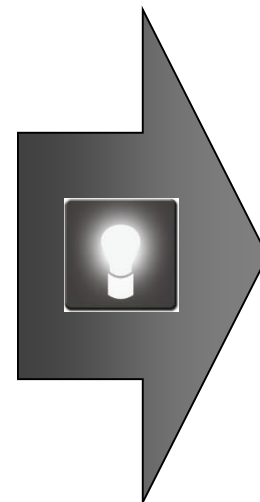
Encapsulated

15W

1"x1"



Open-Frame



12V  
7V  
5V  
3,3V

Relay  
Fans  
Display  
Cameras  
Interface  
Sensors  
Modem  
MCU  
Memory

### DC/DC 1"x1"

Power: 15-17W

Vin: 18-75V

Vout: 3,3V, 5V, 7V, 12V

S36SE series

Efficiency: 83,5-87%

Isolation: 2250Vdc

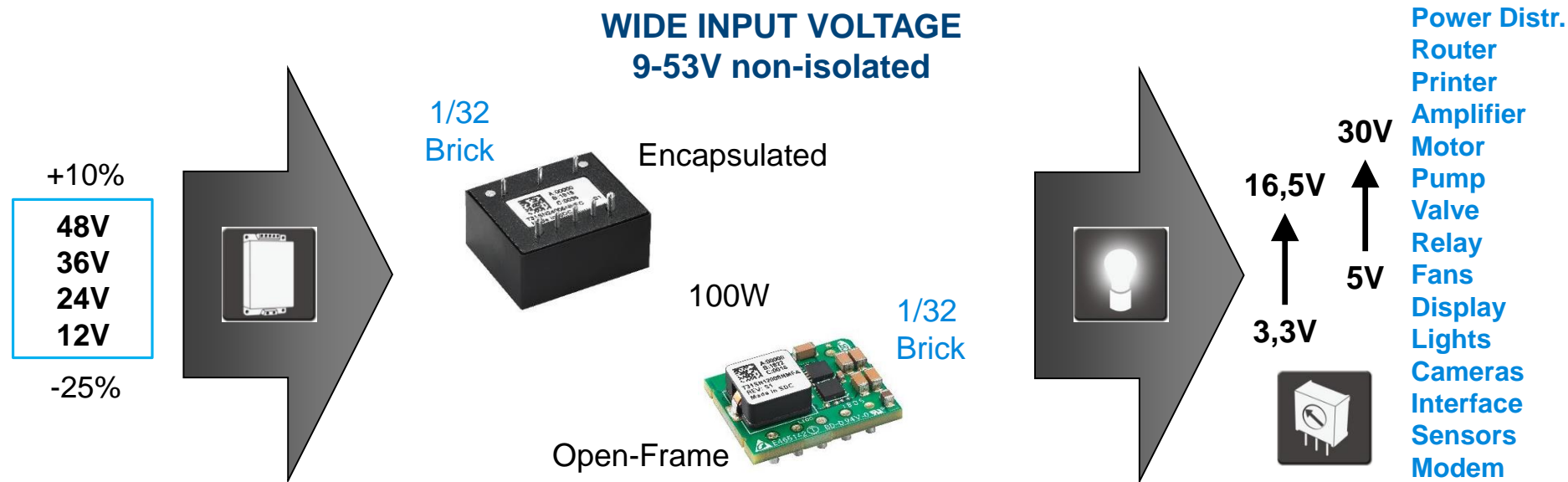
Natural Convection: -40~85°C ambient temperature

Features: Trim, OVP, OCP, OTP

Options: THT/SMD, Remote ON/OFF



## ENCAPSULATED ON-BOARD CONVERTERS



### DC/DC 1/32 Brick (non-isolated)

**Power:** 100W max.

**Vin:** 9-53V

**Vout:** 3,3-16,5V and 5-30V

**T31SN** series

**Efficiency:** 86,5%

**Isolation:** No

**Natural Convection:** -40~85°C ambient temperature

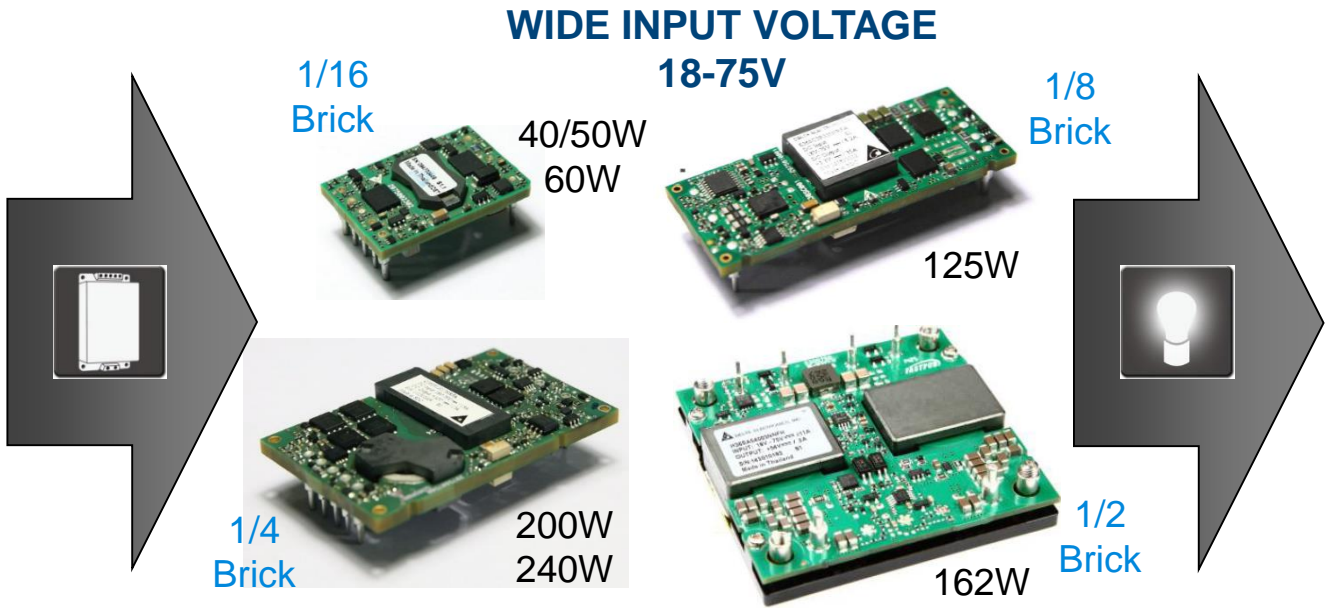
**Features:** Wide Trim Range, OVP, OCP, OTP

**Options:** THT/SMD, Remote ON/OFF



## OPEN-FRAME ON-BOARD CONVERTERS

### WIDE INPUT VOLTAGE



1/16  
Brick



40/50W  
60W

18-75V



125W

1/8  
Brick

1/4  
Brick



200W  
240W

1/2  
Brick



162W

- PoE
- Motor
- Pump
- Valve
- Relay
- Fans
- Display
- Lights
- Cameras
- Interface
- Sensors
- Modem
- MCU
- FPGA
- Memory

- 54V
- 12V
- 5V
- 3,3V

#### DC/DC 1/16 Brick

Power: 40-60W  
Vin: 18-75V  
Vout: 3,3V, 5V, 12V  
V36SE series

#### DC/DC 1/8 Brick

Power: 108-125W  
Vin: 18-75V  
Vout: 3,3V, 5V, 12V  
E36SC series

#### DC/DC 1/4 Brick

Power: 200-240W  
Vin: 18-75V  
Vout: 12V  
Q36SR series

#### DC/DC 1/2 Brick

Power: 162W  
Vin: 18-75V  
Vout: 54V  
H36SA series

Efficiency: 88-93%  
Isolation: 2250V/1500Vdc  
Natural Convection: -40~85°C T<sub>A</sub>  
Features: Trim, Sense, OVP, OCP, OTP  
Options: Remote, THT/SMD, Heatsink



## STANDARD ON-BOARD DC/DC MODULES 1-6W

SIP



Power	Input	Output	Series
1W	3,3V	3,3V, 5V	<a href="#">PA01S</a>
	5V	3,3V, 5V, 9V 12V, 15V ±5V, ±9V ±12V, ±15V	<a href="#">PA01S</a> <a href="#">PB01S/D</a> <a href="#">PD01S/D</a> <a href="#">PE01S/D</a> <a href="#">PF01S</a> <a href="#">PI01S/D</a> <a href="#">PL01S/D</a>
2W	5V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">PC02S/D</a> <a href="#">PG02S</a>
3W	4,5-18V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">PJ03S/D</a>
2W	9-36V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">PH02S/D</a>
3W			<a href="#">PJ03S/D</a>
2W			<a href="#">PH02S/D</a>
3W	18-75V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">PJ03S/D</a>

DIP



Power	Input	Output	Series
1W	5V	5V, 9V, 12V, 15V	<a href="#">DA01S</a>
2W		5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">DC02S/D</a> <a href="#">DK02S/D</a>
3W	4,5-9V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">DB02S/D</a>
		3,3V, 5V 12V, 15V, 24V ±5V, ±12V, ±15V	<a href="#">DD03S/D</a> <a href="#">DM03S/D</a> <a href="#">DN03S/D</a>
4W	9-36V	3,3V, 5V 12V, 15V, 24V ±5V, ±12V, ±15V	<a href="#">DL03S/D</a>
6W			<a href="#">DF04S/D</a>
3W	18-75V	3,3V, 5V 12V, 15V, 24V ±5V, ±12V, ±15V	<a href="#">DL03S/D</a>
4W			<a href="#">DF04S/D</a>
6W			<a href="#">DJ06S/D</a>

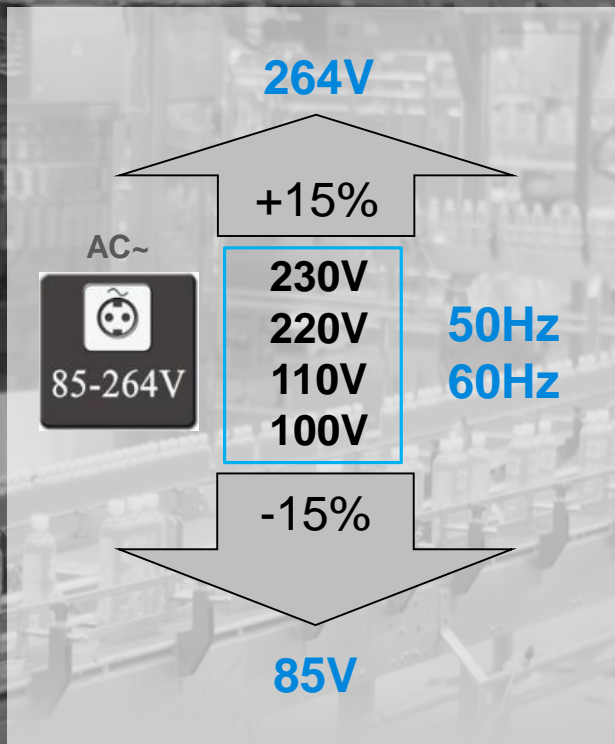
SMD



Power	Input	Output	Series
1W	5V	3,3V, 5V, 9V 12V, 15V ±5V, ±9V ±12V, ±15V	<a href="#">SA01S/D</a> <a href="#">SB01S/D</a> <a href="#">SH01S/D</a> <a href="#">SK01S/D</a>
		5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">SC02S/D</a> <a href="#">SG02S/D</a>
2W	4,5-9V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">SD02S/D</a>
	9-18V		<a href="#">SE03S/D</a>
5W	18-36V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">SF05S/D</a>
2W			<a href="#">SD02S/D</a>
3W			<a href="#">SE03S/D</a>
5W	36-75V	3,3V, 5V, 12V, 15V ±5V, ±12V, ±15V	<a href="#">SF05S/D</a>
2W			<a href="#">SD02S/D</a>
3W			<a href="#">SE03S/D</a>
5W			<a href="#">SF05S/D</a>



## VOLTAGE VARIATIONS IN INDUSTRIAL DEVICES

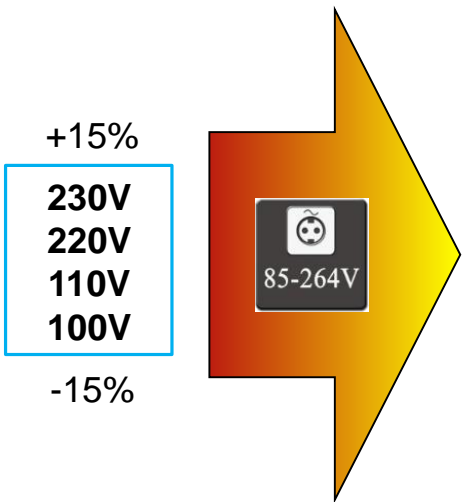






## AC/DC ON-BOARD CONVERTERS

**WIDE INPUT VOLTAGE**  
85-264Vac



+15%  
230V  
220V  
110V  
100V  
-15%

3/4 Brick

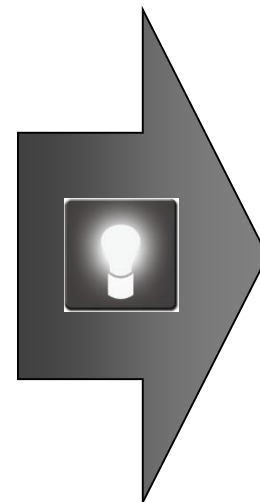


500W

Full Brick



800W



(Trim Range)

(54V)  
48V  
(36V)  
28V  
24V  
(15V)  
12V

- PoE
- Modem
- Router
- Printer
- Amplifier
- Audio/Video
- Motor
- Pump
- Valves
- Relays
- Fans
- Display
- Lights
- Cameras
- Interface
- Sensors
- Computer
- Hard Drives

### AC/DC 3/4 Brick

Power: 300-500W  
Vin: 85-264Vac  
Vout: 12V, 24V, 28V, 48V  
PACSR series

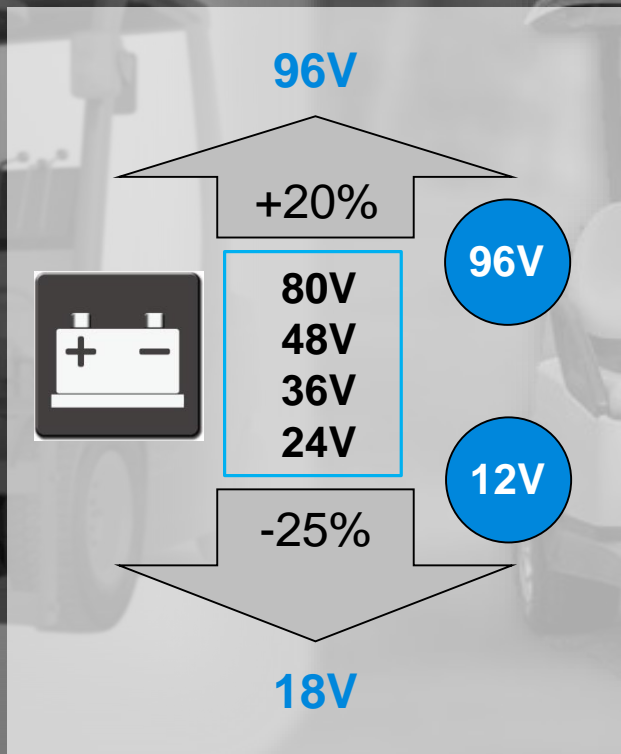
### AC/DC Full Brick

Power: 800W  
Vin: 85-288Vac  
Vout: 12V, 28V, 48V  
FACSR series

Efficiency: 90-94%  
Isolation: 3000Vac  
Conducted Cooling: -40~90°C ambient temperature  
Features: Trim, Sense, UVP, OVP, OCP, OTP, PG, 12V stand-by, Current Sharing  
Options: Remote ON/OFF, PMBus communication



## BATTERY VOLTAGE VARIATIONS IN ELECTRIC VEHICLES Standard EN12895





## BOX TYPE IP67

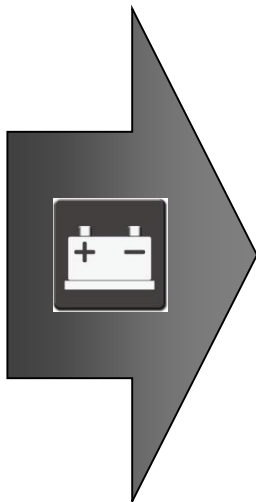
### ULTRA-WIDE INPUT VOLTAGE 18-106V



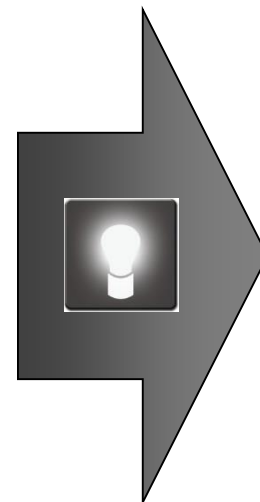
+30%

80V  
48V  
36V  
24V

-25%



360W  
300W



Lights  
Wipers  
Computer  
Display  
Scanner  
Printer  
Cameras  
HVAC  
Radio

24V  
13,7  
12V

### DC/DC Box Type IP67

Power: 300-360W

Vin: 18-60V, 18-106V, 36-106V

Vout: 12V, 13,7V, 24V

**B40SR** series **B62SR** series **B70SR** series

Efficiency: 88-92,5%

Isolation: 2250Vdc

Conducted Cooling: -40~75°C ambient temperature

Features: Parallel Connection, Input Reverse Polarity Protection, OVP, OCP, OTP

Options: External Fuse, Remote ON/OFF, Sealed Connector



## BOX TYPE IP67

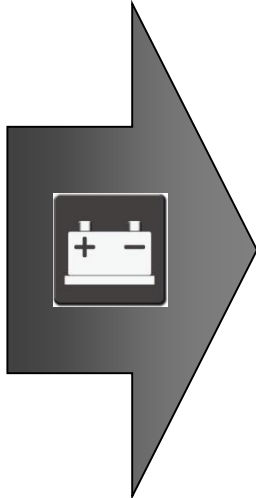
WIDE INPUT VOLTAGE  
32-96V



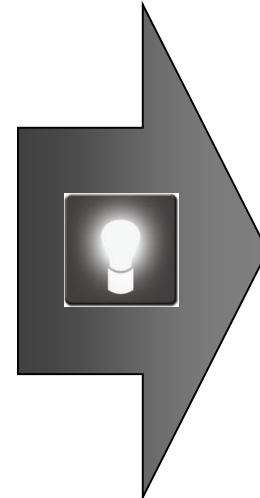
+20%

80V  
48V

-30%



500W



Lights  
Wipers  
Computer  
Display  
Scanner  
Printer  
Cameras  
HVAC  
Radio

24V  
13,7  
12V

### DC/DC Box Type IP67

Power: 500W

Vin: 32-96V

Vout: 12V, 13,7V, 24V

B70SP series

Efficiency: 91,5%

Isolation: 2250Vdc

Conducted Cooling: -40~75°C ambient temperature

Features: Remote ON/OFF, Sealed Connector, Input Reverse Polarity Protection, OVP, OCP, OTP

Options: Parallel Connection



## ON-BOARD BUCK/BOOST CONVERTER

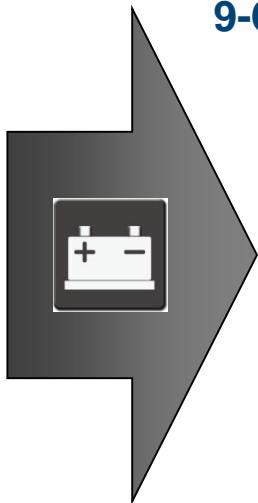
### WIDE INPUT VOLTAGE

9-60V

+25%

48V  
36V  
24V  
12V

-25%



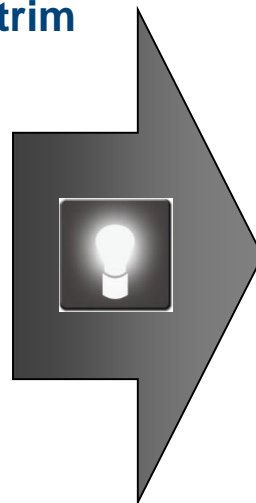
Half  
Brick



3000W

### WIDE OUTPUT VOLTAGE

0-60V trim



60V



0V



Motor  
Pump  
Valves  
HVAC  
RF Amplifier  
Broadcast  
Audio/Video  
Server  
Display  
Lights  
Scanner  
Cameras  
Printer  
Radio  
Battery Charge

### DC/DC Half-Brick (non-isolated)

Power: 3000Wmax (50A)

Vin: 9-60V

Vout: 0-60V trim range

H60SB series

Efficiency: 98% peak

Conducted Cooling: -40~100°C baseplate temperature

Features: Parallel Connection (Active CS), OVP, OCP, OTP

Options: Remote ON/OFF, PMBus communication

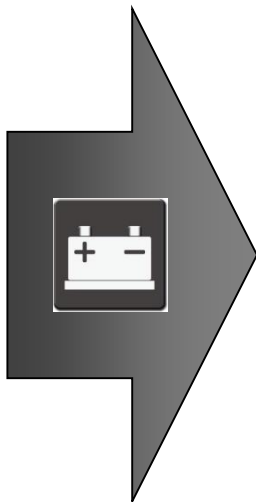


## HIGH VOLTAGE DC/DC ON-BOARD CONVERTERS

UP TO 10 UNITS IN  
PARALLEL CONNECTION

FG5SR

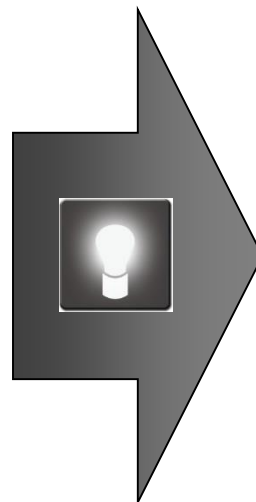
800V  
400V



Full  
Brick



1200W



Motor  
Pump  
Valves  
HVAC  
Lights  
RF Amplifier  
Broadcast  
Audio/Video  
Printer  
Radio  
Router  
Server  
Storage  
Cloud  
Power Distrib.

54V  
(48V)  
28V  
(24V)  
14V  
(12V)  
(Trim  
Range)

### DC/DC High-Voltage Full-Brick

Power: 1200W

Vin: 200-400V, 400-800V

Vout: 14V, 28V, 54V

FB7SR series FG5SR series

Efficiency: 94-96,5%

Isolation: 4242Vdc

Conducted Cooling: -40~100°C baseplate temperature

Features: Parallel Connection (Active CS), Trim, Sense, OVP, OCP, OTP

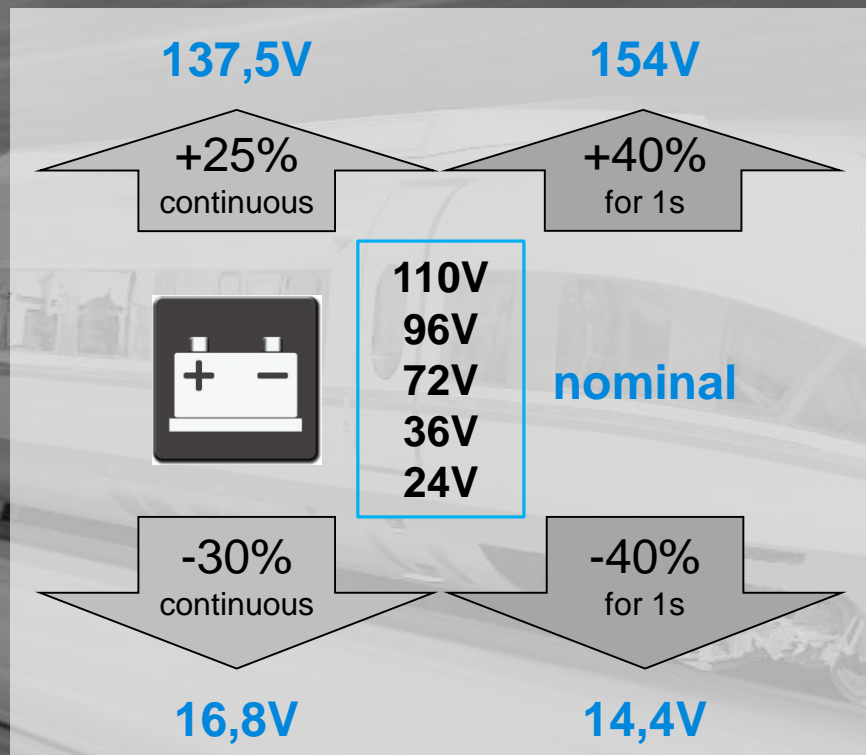
Options: Remote ON/OFF, PMBus communication





## BATTERY VOLTAGE VARIATIONS IN TRAINS

Railway Standard EN50155





# DC/DC Modules for Railway

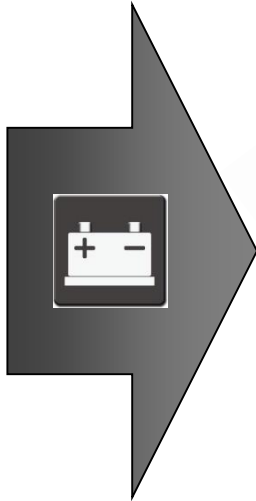


## ULTRA-WIDE INPUT VOLTAGE 16,8-137,5V

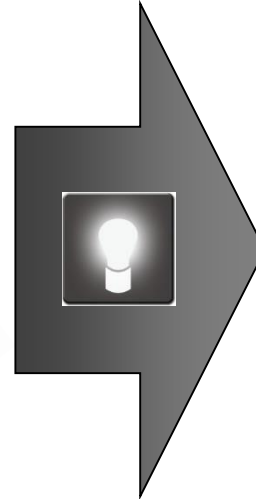
+80%  
for 1s

110V  
96V  
72V  
36V  
24V

-40%  
for 1s



200W  
100W



54V



Video Surveillance  
PoE, Wi-Fi

48V



Signaling  
Communication  
Event Recorder

24V



Cabin Equipment  
Air Conditioning  
Audio Amplifier

24V



Door Control  
Board Computer

24V



Internal & External  
Lighting

15V



Motor Drive &  
Brake Controller

12V



Passenger  
Information  
Displays

### DC/DC Half-Brick

Power: 100-200W

Vin: 16,8-137,5V (14,4V-200V 1s)

Vout: 12V, 15V, 24V, 48V, 54V

H80SV series

Efficiency: 85-90%

Isolation: 4242Vdc

Conducted Cooling: -40~100°C baseplate temp.

Features: Trim, Sense, OVP, OCP, OTP

Options: Remote ON/OFF, M3 Screw Threads



# DC/DC Modules for Railway

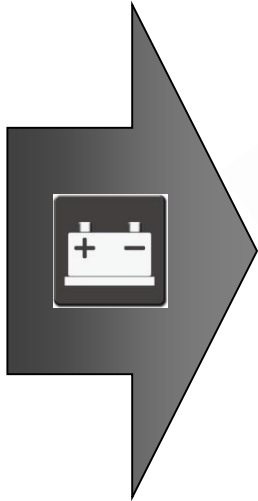


## WIDE INPUT VOLTAGE 40-160V

+40%

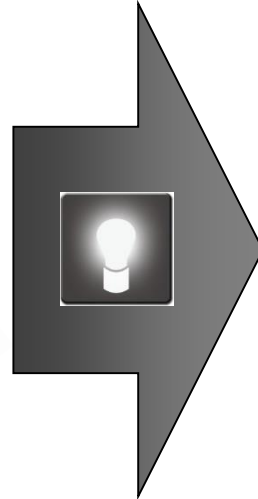
110V  
96V  
72V

-80%



300W

ultra low power loss  
no load 2W



15V



Motor Drive & Brake Controller

13,8V



Passenger Information Displays

12V



Passenger Information Displays

### DC/DC Half-Brick

Power: 300W

Vin: 40-160V (200V 1s)

Vout: 12V, 13,8V, 15V

HA0SP series

Efficiency: 84-90%

Isolation: 4242Vdc

Conducted Cooling: -40~100°C baseplate temp.

Features: Trim, Sense, OVP, OCP, OTP

Options: Remote ON/OFF, M3 Screw Threads, Parallel connection with active current sharing



# DC/DC Modules for Railway

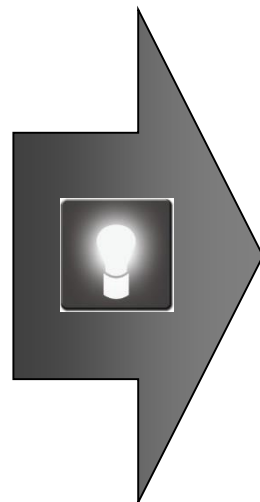
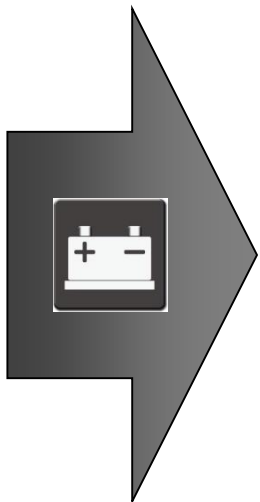


## ULTRA-WIDE INPUT VOLTAGE 14,4-170V

+50%

110V  
96V  
72V  
36V  
24V

-40%



(Trim Range)

54V  
(48V)  
24V  
15V  
12V  
5V

- Video Surveillance
- PoE, Wi-Fi
- Power Distribution
- Signaling
- Communication
- Event Recorder
- Router
- Amplifier
- Cabin Equipment
- Lights
- Door Control
- Board Computer
- Fans
- Server
- Hard Drives
- Displays
- Electronics


### DC/DC Quarter-Brick

**Power:** 150W  
**Vin:** 14,4-170V (12V-200V 1s)  
**Vout:** 5V, 12V, 15V, 24V, 54V  
**Q80SV** series

### DC/DC Quarter-Brick

**Power:** 200W  
**Vin:** 40-170V (170V-200V 1s)  
**Vout:** 5V, 12V, 15V, 24V, 54V  
**QA1SV** series

**Efficiency:** 89%  
**Isolation:** 3000Vdc  
**Conducted Cooling:** -40~100°C baseplate temp.  
**Features:** Trim -20/+10%, Sense, OVP, OCP, OTP  
**Options:** Remote ON/OFF, M3 Screw Threads

A collection of various Delta electronic components, including power supplies, converters, and modules, arranged on a light gray background. The components are shown in various orientations and sizes, some with labels and technical specifications visible. The text 'PRODUCT SELECTION GUIDE' is overlaid in a large, semi-transparent, light gray font across the center of the image.

# PRODUCT SELECTION GUIDE

## Product Search

Search products by parameters    Datasheet download by part number

| By Category     DC/DC     AC/DC

| Input Voltage     Nominal Voltage  V    | Output Voltage     1     2  
 Min  V Max  V    Nominal Voltage  V

| Output Power     W    | Features    All

Submit

# Product Finder

## Product Catalog



### Standard Power Module

DC/DC Converters & AC/DC Modules

Product Catalog 2020



# Smarter. Greener. Together.

To learn more about Delta, please visit [www.deltaww.com](http://www.deltaww.com)

