



**HI - TECH RESISTORS PVT. LTD.**  
AN ISO TS 16949:2009 CERTIFIED COMPANY



**HI - TECH RESISTORS PVT. LTD.**

Office : Buty Compound, Mount Road Extension, Nagpur-440 001 (INDIA)

Tel : +91-712-2531134, 2533269 | Fax : (91-712) 2528334, 2556351.

e-mail : [info@htr-india.com](mailto:info@htr-india.com) (India Sales) | [sales@htr-india.com](mailto:sales@htr-india.com) (International Sales)

[www.htr-india.com](http://www.htr-india.com)

PRODUCT CATALOGUE  
**2015**



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# WIRE WOUND RESISTORS

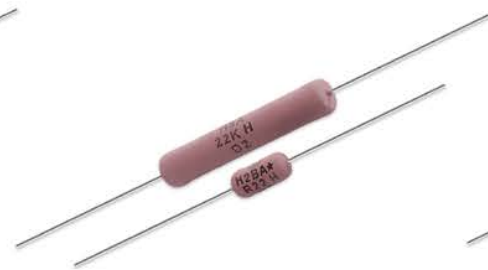
SILICONE / CEMENT COATED



## HIA

**Power rating :** 0.5W to 20W  
**Resistance range :** R01 to 120K  
**Tolerances available :** 1% - 10%  
**Applications :** Industrial, telecommunication and consumer electronics.  
**Features :**

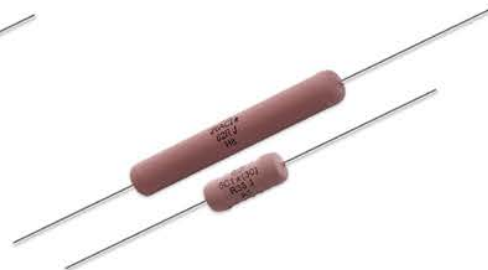
- UL approved flame retardant coating
- Industrial Grade - MIL sizes
- Non-inductive type available.
- Impulse resistors as per IEC 61000-4-5



## HTA

**Power rating :** 0.75W to 12W  
**Resistance range :** R01 to 100K  
**Tolerances available :** 1% - 10%  
**Applications :** Industrial, telecommunication and consumer electronics.  
**Features :**

- UL approved flame retardant coating
- Non-inductive type available
- Impulse resistors as per IEC 61000-4-5
- Industrial grade-JSS/IEC sizes.



## VHIA

**Power rating :** 0.5W to 20W  
**Resistance range :** R01 to 120K  
**Tolerances available :** 1% - 10%  
**Applications :** Industrial, telecommunication and consumer electronics.  
**Features :**

- UL approved flame retardant coating.
- Non-inductive type available.
- Impulse resistors as per IEC 61000-4-5.
- Copper clad steel wire terminations for reduced temperature on PCB.



# WIRE WOUND RESISTORS

SILICONE / CEMENT COATED



## HAA

**Power rating :** 1W to 5W  
**Resistance range :** R01 to 12K  
**Tolerances available :** 1% - 10%  
**Applications :** Miniature sizes for automotive sector.  
**Features :**

- UL approved flame retardant coating
- Industrial grade
- Non-inductive type available
- Impulse resistors as per IEC 61000-4-5



## HFP

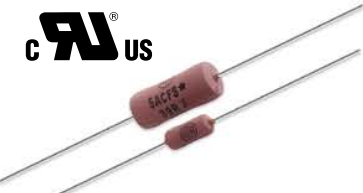
**Power rating :** 2.5W to 8W  
**Resistance range :** R10 to 56K  
**Tolerances available :** 5% - 10%  
**Applications :** Commercial & industrial electronics.  
**Features :**

- Fiber Glass core.
- PCB pluggable style with different terminations and stand off heights available.
- UL approved flame retardant coating.



## HIR

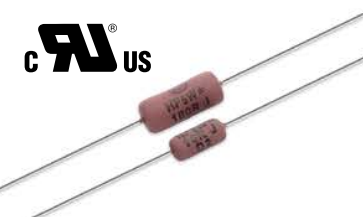
**Power Rating :** 10W to 500W  
**Resistance range :** R22 to 100K  
**Tolerances Available :** 5% - 10%  
**Applications :** High power dissipation & impulse handling capability. High voltage bleeder resistor in power supplies.  
**Features :** UL approved flame retardant coating. Radial terminals for Amp 187 & Amp 250 connectors available. Choice of anti-rust stainless steel terminations.



## FRS

**Power rating :** 1W to 5W  
**Resistance range :** 10R to 100R\*  
**Tolerance available :** 1% - 10%  
**Applications :** Consumer, telecommunication and industrial electronics.  
**Features :**

- UL 1412 approved.
- Safety fusing at 220/240 V.
- Tailor made fusing options available.



## HFW

**Power rating :** 1W to 5W  
**Resistance range :** 10R to 100R\*  
**Tolerance available :** 1% - 10%  
**Applications :** Consumer, telecommunication and industrial electronics.  
**Features :**

- UL 1412 approved.
- Safety fusing at 110/120 V.



**Note \* Higher resistance values available.**  
**Please enquire - info@htr-india.com**



## HFA

**Power Rating :** 1W to 10W  
**Resistance range :** R10 to 51K  
**Tolerances Available :** 5% - 10%  
**Applications :** Low cost solution for consumer electronics.  
**Features :**

- Fiber glass core.
- UL approved flame retardant coating.



## HIP

**Power Rating :** 3W to 10W  
**Resistance range :** R01 to 90K  
**Tolerances Available :** 1% - 10%  
**Applications :** Commercial and industrial electronics.  
**Features :**

- Ceramic core.
- PCB pluggable style.
- UL approved flame retardant coating.



## RSR

**Power Rating :** 40W to 500W  
**Resistance range :** R05 to 18R  
**Tolerances Available :** 5% - 10%  
**Applications :** High power dissipation & impulse handling capability. High voltage bleeder resistor in power supplies. Load bank resistors.  
**Features :** Edge wound resistive strip for reduced surface temperature. High dissipation & very low ohmic values available. UL approved flame retardant coating. Radial terminals for Amp 187 & Amp 250 connectors available. Choice of anti-rust stainless steel terminations.

## SYMMETRY RESISTORS



## HSR

**Power Rating :** 8.25W, 11W & 20W  
**Resistance range :** 10K to 120K  
**Tolerances Available :** 1% - 10%  
**Applications :** Capacitor charging and discharging resistors.  
**Features :**

- Wire wound symmetry resistors.
- UL approved flame retardant coating.
- Stainless steel terminals for direct mounting on capacitors.



## HSRC

**Power rating :** 11W, 20W & 25W  
**Resistance range :** 10K to 110K  
**Tolerance available :** 1% - 10%  
**Applications :** Capacitor charging & discharging resistors.  
**Features :** Wire wound symmetry resistors. Ceramic encased resistors for greater heat dissipation. Stainless steel terminals for direct mounting on capacitors. Customised solutions available upto 40W.



### HCA

**Power rating :** 1W to 20W  
**Resistance range :** R05 to 56K  
**Tolerance available :** 1% - 10%  
**Applications :** Industrial and consumer electronics.  
**Features :**

- Fibre glass and ceramic core available.
- Ceramic encased for high degree of insulation and low surface temperature.
- Impulse types available.
- Non inductive type available.



### HCV

With bracket  
**Power rating :** 7W to 20W  
**Resistance range :** R05 to 56K  
**Tolerance available :** 1% - 10%  
**Applications :** Industrial & consumer electronics.  
**Features :**

- High stability vertical mounting bracket available.
- Fibre glass and ceramic core available.
- Ceramic encased for high degree of insulation and low surface temperature.
- Impulse types available.
- Non inductive type available.



### HCW

**Power rating :** 1W to 20W  
**Resistance range :** R05 to 56K  
**Tolerance available :** 1% - 10%  
**Applications :** Industrial and consumer electronics.  
**Features :**

- Ceramic core.
- Ceramic encased for high degree of insulation and low surface temperature.
- Impulse types available.
- Non inductive type available.
- Copper clad steel wire terminations for reduced temperature on PCB.
- Low TCR options available.



### HSV

**Power rating :** 4W to 17W  
**Resistance range :** R04 to 82K  
**Tolerance available :** 1% - 10%  
**Applications :**

- Space saving, vertical mounting resistors.
- Consumer and industrial applications.

**Features :**

- Choice of fibre glass or ceramic core.
- Choice of mounting pillars for additional stability.
- Non inductive type available.



### HSVA/HSVAU

**Power rating :** 4W to 17W  
**Resistance range :** R04 to 82K  
**Tolerance available :** 1% - 10%  
**Applications :**

- Both axial and space saving vertical mounting resistors.
- Consumer and industrial applications.

**Features :**

- Choice of fibre glass or ceramic core.
- Dual purpose mounting in HSVAU series is an useful inventory reducer for broad line distributor.



### HCP

**Power rating :** 3W to 20W  
**Resistance range :** R10 to 56K  
**Tolerance available :** 5% & 10%  
**Applications :** Commercial and industrial electronics.  
**Features :**

- Fibre glass and ceramic core available.
- Ceramic encased for high power dissipation.
- PCB pluggable style with different terminations and stand off heights available.



### FRC

**Power rating :** 1W to 3W  
**Resistance range :** 10R to 750R  
**Tolerance available :** 3% - 10%  
**Applications :** Industrial & consumer electronics.  
**Features :**

- Safety fusing at 110/120V & 220/240V.
- Tailor made fusing options available.
- Fibre glass and ceramic core available.
- Ceramic encased for high degree of insulation and low surface temperature.



### HEA

**Power rating :** 1W to 17W  
**Resistance range :** R025 to 82K  
**Tolerance available :** 1% - 10%  
**Applications :** Industrial and consumer electronics.  
**Features :**

- Fibre glass and ceramic core available.
- Ceramic encased for high degree of insulation & low surface temperature.
- Impulse types available.
- Non inductive type available.



### HCL

**Power rating :** 10W to 40W  
**Resistance range :** R10 to 68K  
**Tolerance available :** 5% & 10%  
**Applications :** Commercial and industrial electronics.  
**Features :**

- Fibre glass & ceramic core available.
- Ceramic encased for high power dissipation.
- Radial terminations for Amp 187 & Amp 250 connectors available.
- Available with mounting bracket which also serves as heat sink.



### HMW

**Power rating :** 5W & 9W  
**Resistance range :** R18 to 18K  
**Tolerance available :** 1% - 10%  
**Applications :** Commercial and industrial electronics.  
**Features :**

- Flat vertical mounting type
- Ceramic and fibre glass core available.
- Impulse types available.
- Non inductive types available.
- PCB space saving resistor.



### HMV

**Power rating :** 2.5W to 15W  
**Resistance range :** R04 to 36K  
**Tolerance available :** 1% - 10%  
**Applications :** Industrial and consumer electronics.  
**Features :**

- Flat vertical mounting type
- Ceramic and fibre glass core available.
- Ceramic legs for greater stability also act as heat sink.
- Impulse types available.
- Non inductive types available.
- PCB space saving resistor.





## LOW OHM/CURRENT SENSE SHUNT RESISTORS CERAMIC ENCASED



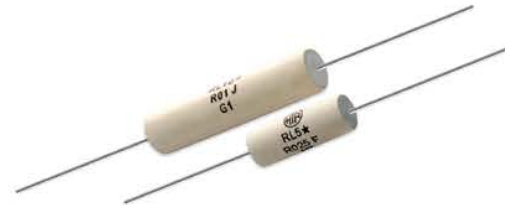
### HMVL

- Alloy Ribbon Element/  
Flat Vertical Mounting  
**Power rating** : 2.5W to 15W  
**Resistance range** : R004 to R20  
**Tolerance available** : 0.5% - 10%  
**Applications** : • Current sensing.  
• Industrial and consumer electronics.  
**Features** :  
• Flat vertical mounting type.  
• Negligible inductance.  
• Ceramic legs for greater stability also act as heat sink.  
• PCB space saving resistor.



### BR

- Slim Type, Metal Plate/  
Preformed resistance strip  
**Power rating** : 2W to 10W  
**Resistance range** : R01 to 1R2  
**Tolerance available** : 3% - 10%  
**Applications** : • Reduces switching distortion at high frequency.  
• Audio amplifier.  
**Features** :  
• PCB pluggable with option of various pitch and stand off heights.  
• Negligible inductance.  
• Twin style available.



### RL

- Power rating** : 0.5W to 10W  
**Resistance range** : R0015 to R80  
**Tolerance available** : 0.5% - 10%  
**Applications** : • Current sensing in applications which include switching and linear power supplies, instruments and power amplifiers.  
**Features** :  
• Alloy ribbon element in cylindrical ceramic body.  
• **Superior alternative to replace moulded device of identical size.**  
• Negligible inductance.  
• Highly thermal efficient power to size ratio.  
• Low TCR.



## LOW OHM/CURRENT SENSE RESISTORS OPEN FRAME



### OA

- Power rating** : 1W to 3W  
**Resistance range** : R003 to R10  
**Tolerance available** : 1% to 10%  
**Applications** : Usage in switching, linear power supplies, instruments, regulators and other modern current sensing circuits.  
**Features** :  
• Open frame axial type.  
• Negligible inductance.  
• Low TCR.



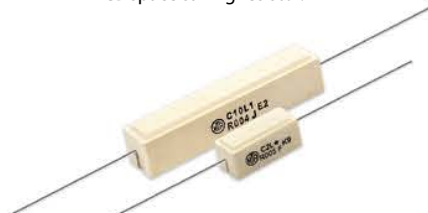
### OP

- Power rating** : 0.5W to 5W  
**Resistance range** : R0015 to R10  
**Tolerance available** : 1% to 10%  
**Applications** : Usage in switching, linear power supplies, instruments, regulators and other modern current sensing circuits.  
**Features** :  
• Open frame PCB mounting radial type.  
• Negligible inductance.  
• Low TCR.



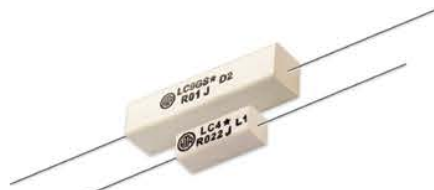
### HEW

- Power rating** : 1W to 5W  
**Resistance range** : R003 to R10  
**Tolerance available** : 1% to 10%  
**Applications** : Usage in switching, linear power supplies, instruments, regulators and other modern current sensing circuits.  
**Features** :  
• Open frame PCB mounting radial type.  
• Edge welding for reduced PCB footprint.  
• Negligible inductance.  
• Very low TCR available.



### HCAL

- Power rating** : 1W to 20W  
**Resistance range** : R002 to R20  
**Tolerance available** : 0.5% - 10%  
**Applications** :  
• Current sensing for industrial and power conditioning applications.  
**Features** : • Alloy ribbon element  
• Ceramic encased for greater heat dissipation and thermal stability. • Low TCR.  
• Negligible inductance.



### HEAL

- Power rating** : 2.5W to 12W  
**Resistance range** : R0025 to R20  
**Tolerance available** : 0.5% - 10%  
**Applications** :  
• Current sensing for industrial and power conditioning applications.  
**Features** :  
• Alloy ribbon element in square profile ceramic tube.  
• Ceramic encased for greater heat dissipation and thermal stability. • Low TCR.  
• Negligible inductance.



### OF

- Power rating** : 1W to 10W  
**Resistance range** : R001 to R10  
**Tolerance available** : 1% to 10%  
**Applications** : Usage in switching, linear power supplies, instruments, regulators and other modern current sensing circuits.  
**Features** :  
• Open frame PCB mounting radial type.  
• Monolithic construction for superior stability.  
• Negligible inductance. • Very low TCR available.



### OFSC

- Power rating** : 5W & 10W  
**Resistance range** :  
For 5W - R00012 to R002, For 10W - R0004 to R003  
**Tolerance available** : 1% to 10%  
**Applications** : Highly accurate current sensing applications in automotive & industrial electronics.  
**Features** :  
• Four terminals for highly accurate current sensing applications. • UL approved flame retardant coating. • Increased lead diameter for high current handling capability.





# LOW OHM / CURRENT SENSE RESISTORS

ELECTRON BEAM WELDED



# LOW OHM / CURRENT SENSE RESISTORS

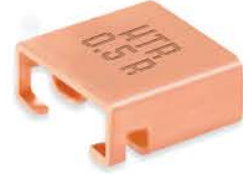
ELECTRON BEAM WELDED



## HRE

**Power rating :** 3W, 4W and 5W  
**Resistance range :** R0002 to R003  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

- Applications:**
- Current sensor for power hybrid applications
  - High current applications for automotive market
  - Frequency convertors • Power modules
- Features:** • 5W constant power possible in R0002  
 • Constant current carrying capability upto 160 amp (R0002) • Sturdy copper connectors  
 • Maximum solder temperature upto 350°C for 30 seconds.



## HBE

**Power rating :** 2W to 5W  
**Resistance range :** R0005 to R005  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

- Applications:**
- Current sensing for power hybrid applications
  - Automotive applications that require high current capability
  - Frequency convertors • Power modules
- Features:** • 5W constant power in R0005  
 • 4 terminal connections for exceptionally accurate measurement • Excellent long term stability due to nature of construction.



## HSE

**Power rating :** 2W to 5W  
**Resistance range :** R0002 to R005  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

- Applications:**
- Accurate current sensing for power hybrid applications • Automotive applications that require high current capability
  - Frequency convertors • Power modules
- Features:** • 5W constant power  
 • Capable of carrying current upto 160 amp (R0002) on continuous basis • Sturdy copper connectors  
 • Excellent long term stability.



## HEB

**Power rating :** 36W  
**Resistance range :** R0001, R000125, R000218 R000250  
**Tolerances available :** ±5% (Available upto ±1%)

- Applications:** • Current sensor for EBM (Electronic Battery Management) in motorcars, trucks, forklifts, hybrid & electric vehicles. • Current sensing in bus bars • Current sensing in welding equipments.
- Features:** • Upto 15W permanent power in free air.  
 • Continuous current load upto 350 A (0.1 mΩ)  
 • High pulse power rating.  
 • Max. fastening torque 10 Nm.



## HOS

**Power rating :** 2W, 3W & 5W  
**Resistance range :** R001 to R05  
**Tolerances available :** ±5%, ±3%, ±2%, ±1%

- Applications:**
- Current sensor for Power hybrid applications.
  - In the automotive sector for high current applications. • Where reduced temperature is required on the PCB.
- Features:**
- Reduced PCB heating due to open air flow design.
  - Flexible nature of termination design for thermal expansion.



## HTE

**Power rating :** 1W, 1.5W, 2W & 3W  
**Resistance range :** R0001 to R01  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

- Applications:**
- Sensor of current for Power hybrid applications.
  - Automotive sector for high current applications.
  - Frequency convertor/Power modules.
- Features :**
- Excellent long term stability.
  - Ideal for mounting on DCB/IMS substrates.
  - High temperature application due to nature of design.



## HEE

**Power rating :** 4W to 10W  
**Resistance range :** R0002 to R002  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

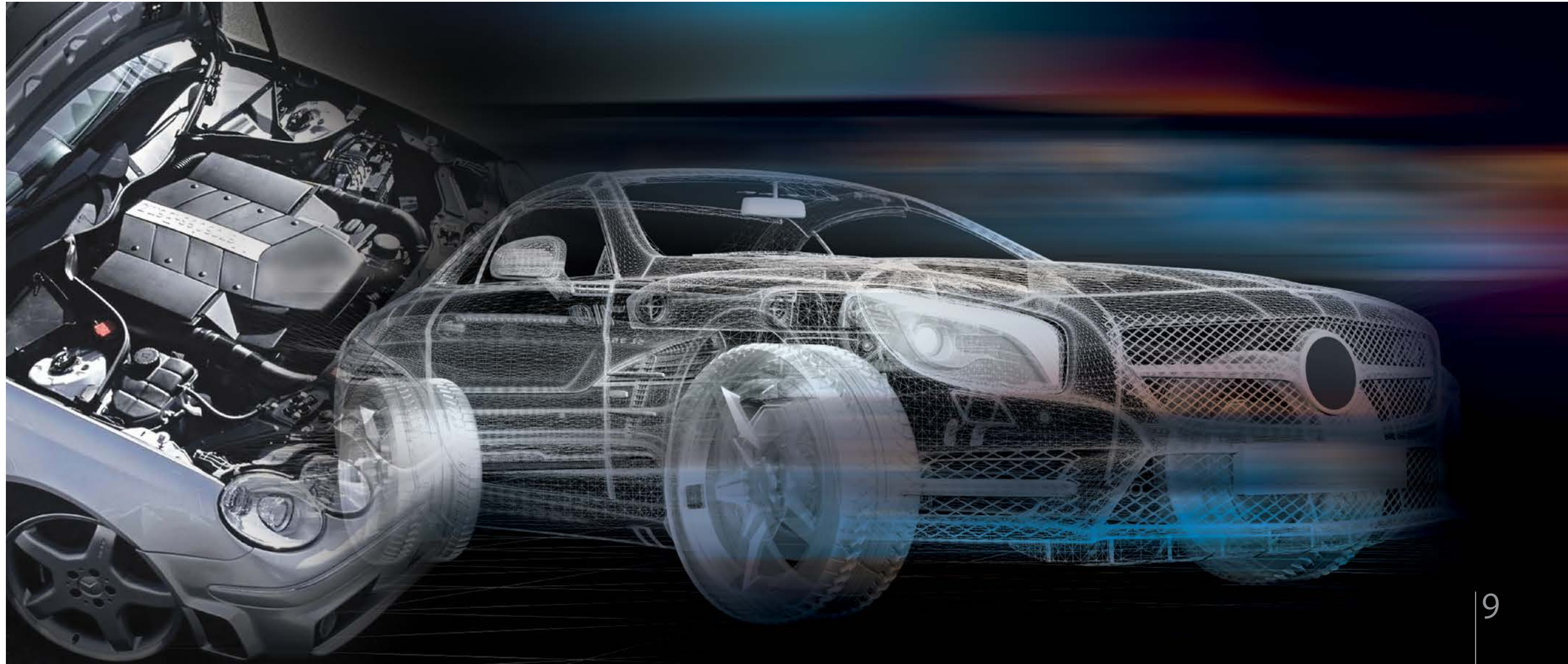
- Applications:** • Accurate current sensing for power hybrid applications • Suitable for welding on bus bars
- High current applications for automotive market
  - Frequency convertors • Power Modules
- Features:** • 10W constant power possible in R0002  
 • Capable of carrying current upto 225 amp (R0002) on continuous basis • Sturdy copper connectors  
 • Excellent long term stability • Maximum solder temperature upto 350°C for 30 seconds.



## HHE

**Power rating :** 5W  
**Resistance range :** R0003 to R002  
**Tolerances available :** ± 1% (0.5% and other tolerance available on request)

- Applications:**
- Power tools due to nature of physical construction
  - High current applications for the automotive sector
  - Frequency convertors • Power modules
- Features :**
- 5W constant power possible in R0003
  - Constant current carrying capability upto 120 amp (R0003) • Sturdy copper connectors
  - Excellent long term stability.





## SURFACE MOUNT (SMD) RESISTORS



### HIAS

- Power rating :** 1W to 5W  
**Resistance range :** R01 to 22K  
**Tolerances available :** 1% - 10%  
**Applications :** Fills the gap for melf and surface mount resistors in applications which are too severe for film resistors.  
**Features :**
- Wire wound with multiple SMD mounting configurations.
  - UL approved flame retardant coating.
  - Non inductive types available.
  - Impulse resistors as per IEC 61000-4-5.
  - 1W and 2W – MELF type.
  - Tape & reel packing for pick & place machine.



### HCAS/HCALS

- Power rating :** 2W & 3W  
**Resistance range :** R001 to 5K6  
**Tolerances available :** 1% - 10%  
**Features :**
- Wire Wound and Alloy Ribbon element options.
  - Ceramic encased for greater heat dissipation & thermal stability.
  - Package size 2W - 4527, 3W - 6927.
  - Tape and reel packing for pick & place machine.
  - Fusible type available.
  - Non inductive type available.
  - Impulse resistors as per IEC 61000-4-5



### HSVAS/HSVALS

- Power rating :** 4W & 5W  
**Resistance range :** R003 to 16K  
**Tolerances available :** 1% - 10%  
**Features :**
- Wire wound and alloy ribbon element options.
  - Ceramic encased for greater heat dissipation and thermal stability.
  - Fusible type available.
  - Non inductive type available.
  - Impulse resistors as per IEC 61000-4-5.



### RLS

- Power rating :** 1.5W to 5W  
**Resistance range :** R0015 to R39  
**Tolerances available :** 1% - 10%  
**Applications :** Current sensing in applications which include switching and linear power supplies, instruments and power amplifiers.  
**Features :**
- Alloy ribbon element in cylindrical ceramic body
  - Superior alternative to replace moulded device of identical size.
  - Negligible inductance
  - Highly thermal efficient power to size ratio.
  - Any resistance value possible within resistance range given
  - Low TCR.



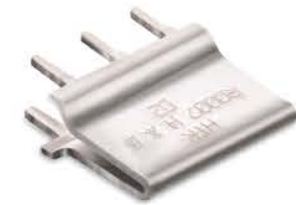
## AUTOMOTIVE RESISTIVE DEVICES



Noise suppressor resistor. Please refer HANS series in [www.htr-india.com](http://www.htr-india.com)



For power window applications.



For electronic braking and steering applications.



Customised resistive devices for engine cooling systems.





**CUSTOMISED AUTOMOTIVE RESISTIVE DEVICES**  
HVAC APPLICATIONS



**CUSTOMISED RESISTIVE DEVICES**  
INDUSTRIAL APPLICATIONS



For windpower applications.



Ceramic type resistors for HVAC application.



Coil type resistor for HVAC application.



Resistor fitted with cables for Bimetallic switch



For Power tools  
HTR can customise resistive devices for applications in various industries. Currently devices are being supplied to a large number of customers across the industrial, automotive & consumer electronics sector. Please enquire - [info@htr-india.com](mailto:info@htr-india.com)





DNV BUSINESS ASSURANCE MANAGEMENT SYSTEM CERTIFICATE

Certificate No.: 22919-2008-AQ-IND- IATF IATF Certificate No.: 0178985 Page 1 of 1

This is to certify that the Management System of: HI-TECH RESISTORS PVT. LTD.

Plot No. EL-1, MIDC, Hingna Road, Nagpur - 440 016, Maharashtra, India

Supporting Site Extensions: None

Remote Supporting Functions included in the certification:

Table with 6 columns: Site Name, Site Address, Site City, Site State, Certification Body, Site Main Activities. Row 1: Hi-Tech Resistors Pvt. Ltd., Buty Compound, Mount Road Extension, Sadar, Nagpur 440 001, Maharashtra, India, DNV, Marketing.

has been found to conform to Technical Specification:

ISO/TS 16949:2009

having been audited in accordance with the: Rules for the registration scheme for ISO/TS 16949:2009 - 3rd Edition. This Certificate is valid for the following products/service ranges

DESIGN, MANUFACTURE OF WIRE WOUND AND LOW OHM / CURRENT SENSE, HVAC AND ENGINE COOLING RESISTOR. EXCLUSIONS: NONE

Initial Certification date: 12 March 2008

This Certificate is valid until: 02 February 2017

Nitin Joshi Nitin Joshi Lead Auditor



Place and Validity Start date: Katy, Texas, 03 February 2014 for the Accredited Unit: DET NORSKE VERITAS CERTIFICATION INC., KATY, TX, USA

Robert Kozak Management Representative

Audit Conducted by DNV Office located in Pune, India.

ACCREDITED UNIT: DET NORSKE VERITAS CERTIFICATION, INC 1400 RAVELLO DRIVE, 77449, KATY, TX, USA. TEL: 281-396-1000, WWW.DNVCERT.COM

GUJARAT

Electrodeal 202, 203, Fatehsagar Complex, Opp. Convent School, Fatehganj, Vadodara - 390 002. Tel : (0265) 3013099, 2793344. Fax : (0265) 2786677 e-mail : respond@electrodeal.com sanjayvelani@electrodeal.com

DELHI AREA

Vam Electronics Shop No. 1 & 2, 1690, Sunder Bhawan, Bhagirath Palace, Delhi - 110 006 Tel : (011) 23868159, Fax : (011) 23868459 e-mail : vam.electronics@yahoo.co.in | enquiry@vamelectronics.com

MAHARASHTRA

Electromark Technologies 12A, Hanuman Terrace Building, 1st Floor, Behind Bombay Biscuits, Tara Temple Lane, Grant Road, Mumbai - 400 007 Tel : (022) 23820454 / 455 / 456. e-mail : mahavir@electromarkindia.com

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Multitek Electro Devices

167, Above Apeksha Palace, Pune-Saswad Road, Phursungi Fata, Pune - 412 308 Tel / Fax : (020) 26860032. Cell : 09923391582 e-mail : shahkumar@vsnl.net | multitekdevices@gmail.com

KERALA

Roni Electronics # 40/5884 C & D, AVS Building, M. G. Road, Ernakulam, Kochi - 682 035. Tel : (0484) 2355029, 2369926. Fax : (0484) 2352928. e-mail : roni@sify.com | roy@ronielelectronics.com

KARNATAKA

Swift Electrocomp Solutions (P) Ltd. # 681/99, 6th Main Road, Vijayanagar, Bengaluru - 560 040 Tel : +9180-23406770 / 23406774 (M) : +91-9886017544 e-mail : sales@swiftelectrocomp.in vishwanath@swiftelectrocomp.in

WEST BENGAL

Indian Electronics 6, Madan Street, Kolkata - 700 072. Tel : (P) (033) 22127548 (F) (033) 22126385 (M) 09831232412. e-mail : indianelec1974@gmail.com wasimul2006@yahoo.co.in

National Electronics Corporation

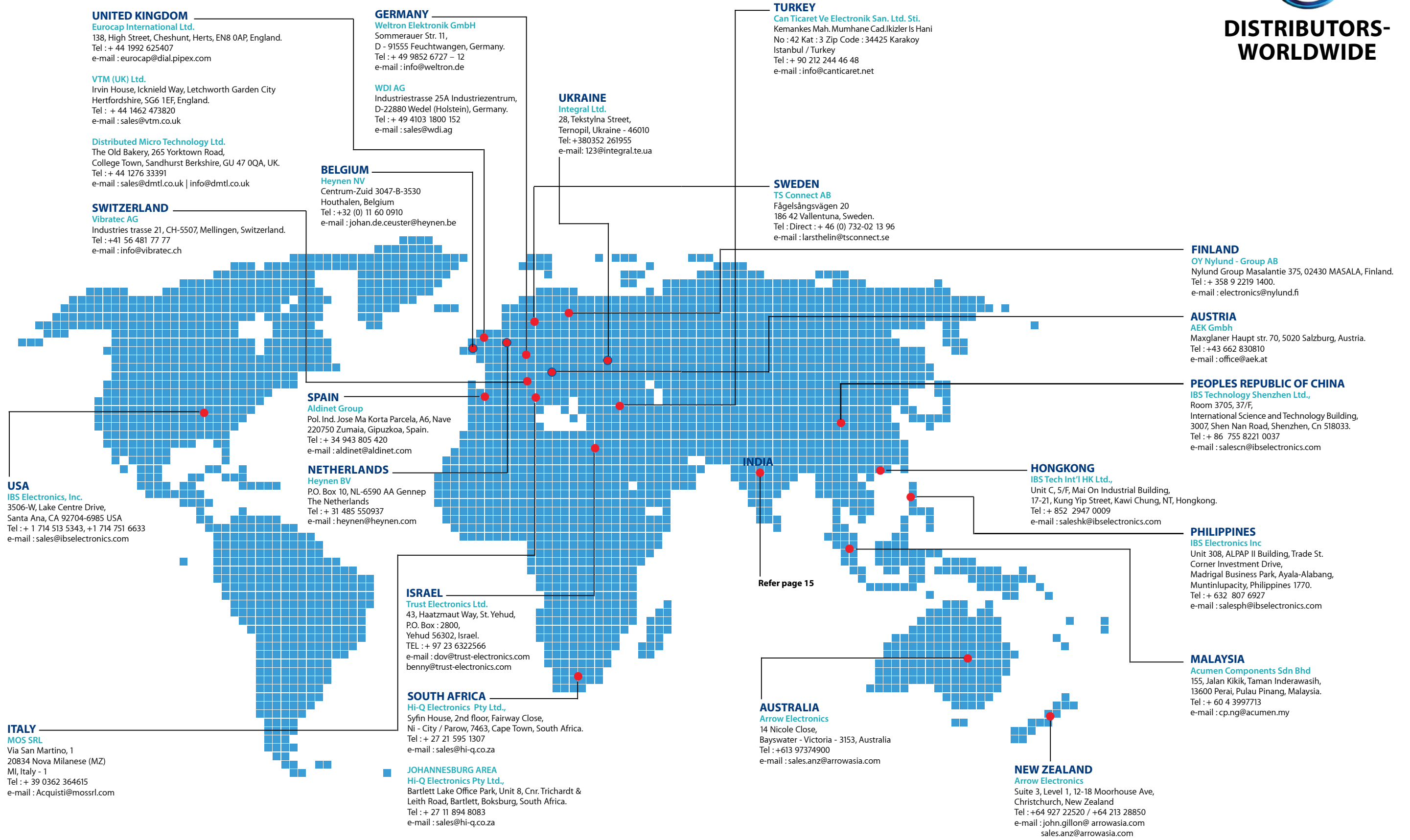
3, Chandni Approach, 1st Floor, Room No - 2 & 3, Kolkata - 700 072. Tel : (033) 2212 4066 | Telefax : (033) 2212 4062 (M) 09831003907. e-mail : necorpn@yahoo.com nec\_cal\_haque@vsnl.net;

TAMILNADU

Elektronika Sales Private Ltd. 16, Narsingapuram Street, Mount Road, Chennai - 600 002 Tel : (044) 2858-7165/2858-7765. Fax : (044) 2841 9833 e-mail : info@elektronikasales.com



# DISTRIBUTORS- WORLDWIDE





## BASICS

Simply put, a resistor is an electronic component connected into an electrical circuit to insert a specific resistance. Resistance is measured in ohms and as per ohms law, the current through the resistor will be directly proportional to the voltage across it and inversely proportional to the resistance. As the current flows through the resistor, heat is produced which makes the temperature of the resistor to rise above the ambient temperature.

Now whether a particular resistor can be used in a specific electrical circuit is its ability to dissipate the heat generated without physical deterioration and within the temperature limits of that particular circuit.

Resistors are rated to dissipate a given wattage without exceeding the declared "hot spot" temperature. This is largely determined by the size and materials used in the construction of the resistor and this is called "Free Air Watt Rating" or "Full Rating" or "Maximum Power Rating".

In some cases the conditions actually encountered deviate from the standard conditions and affect the temperature rise which determines whether that particular resistor can be used or not in a particular application.

## SELECTION PROCESS – Stepwise Guide

### 1. Decide the resistance value required

The following formulae derived from Ohms law can be used for this purpose –

$$R = V/I \text{ or } I = V/R \text{ or } V = I \times R \text{ where,}$$

(R is resistance in ohms, V is voltage in volts and I is current in Amperes)

### 2. Decide the watts (Power) to be dissipated by the resistor

$$W = I^2 \times R \text{ or } W = V \times I \text{ or } W = V^2/R \text{ where,}$$

(W is Power Rating / Wattage in watts, I is current in Amperes, R is resistance in ohms and V is Voltage in volts.)

**Note:** Whilst the power rating in watts can be theoretically determined as above, a note of caution is now introduced – It is important that the actual current that will be drawn is used in the determination of the power rating / wattage of the resistor. Small increases in current or voltage e.g. 20% translate into 44% increase in the power rating / wattage required to dissipate the increased current / voltage within temperature rise limitations. At this point it is also worth mentioning that the designer should also make allowance for the maximum possible line voltage.

### 3. Decide the correct physical size ("watt size") based on the following parameters – watts, volts, temperature that can be permitted in the particular circuit and mounting consideration.

The wattage rating of a resistor as established under specified standard conditions is defined as "Free Air Watt Rating" (Maximum Power Rating).

The following method is broadly used to determine "Free Air Watt Rating" based on the methods followed by "National Electrical Manufacturers Association" – USA (NEMA), "Underwriters Laboratories Inc." (UL) and US MIL – R26 – US Military Specification for wirewound resistors.

In US MIL – R26, there are mainly 2 broad characteristics of resistor types – characteristic 'V' and characteristic 'U'. Characteristic 'V' resistors are required not to exceed a maximum operating temperature of 350°C, which corresponds to a maximum temperature rise of 325°C at ambient temperature 25°C.

Characteristic 'U' resistors are required not to exceed a maximum operating temperature of 275°C, which corresponds to a maximum temperature rise of 250°C with ambient temperature 25°C. The temperature is normally measured on the body of the resistor, suspended in free still air space with unrestricted circulation of air.

When current passes through a resistor, heat is generated and the temperature stabilizes when the sum of heat loss (by termination conduction, radiation and convection) equals the heat input rate (created by passing current proportional to wattage).

By rule of thumb, the larger the resistor, hence greater the area for heat dissipation, the lower the temperature rise. Having said this, it must be admitted that certain other factors such as thermal conductivity of the ceramic core, type and gauge of resistance wire selected and the heat-sink effect of the type of mounting all influence the selection of a resistor to be considered having "acceptable service life".

Further consideration must be given in case the resistor will be operated in elevated ambient temperatures higher than 25°C or 30°C, the power rating must be derated as per the derating curve provided with each HTR series data sheet..



For the design engineer's general guidance, we give below the temperature rise that is generally observed on silicon coated axial resistors (ambient temperature of 30°C) at Maximum Power Rating / Free Air Rating.

Maximum Power Rating (30°C ambient)	▲ Temperature Rise on Body of Resistor	▲ Temperature Rise on Termination of Resistor
1 W	50°C to 80°C	35°C
2 W	60°C to 90°C	37°C
3 W	65°C to 95°C	42°C
4 W	80°C to 110°C	45°C
5 W	100°C to 130°C	45°C
6 W	105°C to 135°C	46°C
7 W	125°C to 155°C	50°C
10 W	140°C to 170°C	50°C
15 W	155°C to 185°C	52°C

▲ **Absolute temperature can be arrived at after adding the prevalent ambient temperature at time of test to the temperature rise figures provided above.**  
These figures merely serve as a guide to a design engineer and must be verified in actual practical conditions by the design engineer before selection and use of a particular resistor.

### 4. Decide the actual resistor to be used - based on actual practical considerations.

Having determined the Wattage / Free Air watt rating on theoretical basis, the designer must now take the following factors into account when deciding on the actual resistor to be used in the application, as all these factors will influence the temperature rise :

**a. The influence of Ambient Temperature** - All the components of an electronic circuit have their own limitations as to the maximum temperature at which they can reliably function.

The temperature that the component rises to in service is the sum of the ambient temperature plus the temperature rise due to heat dissipated by each component during operation. Some devices can tolerate elevated temperatures whilst others cannot.

Wire wound resistors can operate fairly reliably at reasonably elevated temperatures, so in order to ensure that the heat generated by the resistor is minimized, the designer may move to a higher power rating from the theoretical calculation to minimize the temperature rise and minimize the effects of heating on other devices which are heat sensitive in the circuit.

**b. The design of the Enclosure** - The walls of the enclosure form a thermal barrier, preventing heat from escaping and preventing the outside air from entering and providing cooling. Hence, due care must be given to the optimum design / orientation of the ventilation openings of the enclosure.

**c. Spacing** - In case due to design limitations, if heat generating components are bunched together, they will show a higher temperature rise due to heat received by radiation from each other. Therefore it is prudent if at all possible that the designer tries to prevent bunching of heat generating components and if this is not possible, moves to a higher power rating to minimize temperature rise.

**d. Surges** - In certain applications for e.g. typically motor controllers, the resistors do encounter surge conditions which if not properly managed and taken into account at the time of designing the resistor, will lead to resistor failure.

A "Surge" occurs over such a short period of time, in the case of capacitor charge / discharge < 1 msec and in the case of motor start-up < 0.5 sec, that the substrate plays no role in heat dissipation and the energy must be completely absorbed by the resistive element itself. Please refer to the section "Pulse/Surge Capability of Resistors" on our website in the design notes section.

Hence surge conditions, if any must be taken into consideration at this stage to determine the correct resistor for that application.

**e. Forced Air Circulation** - In cases where the apparatus in which the resistor is mounted is heat sensitive or for certain reasons resistor used is of a lower than optimum wattage for that particular application, forced air circulation removes more heat in a shorter time than natural convection and is advised in the circumstances enumerated above.

**f. Derating** - It is always advisable that a resistor should be derated and not operated at its actual power rating for long term reliability. Suitable derating also contributes greatly to the minimization of "Drift Underload" phenomena observed in change in resistance value when a resistor is in operation.

**g. Higher Resistance Value** - In order to achieve higher resistance values, the diameter of the resistance wire wound on the substrate is a very fine gauge, sometimes as little as 0.016mm, hence for maximum reliability it is suggested that the designer opts for a higher power rating if size is not a constraint in order to reduce the temperature rise.

**h. High Frequency Circuit** - Wire wound resistors may be effectively used in circuits with frequency upto 50KHz when non inductively wound by the 'Aryton-Perry' method of winding.

For further details on this subject, please refer to the section "Wire wounds and their limitations when used in a high frequency circuit" in the "Design notes" section of the website under "Guide to optimum utilization & mounting of resistors".



# HTR RESISTOR FINDER (MOBILE APP & DESKTOP)

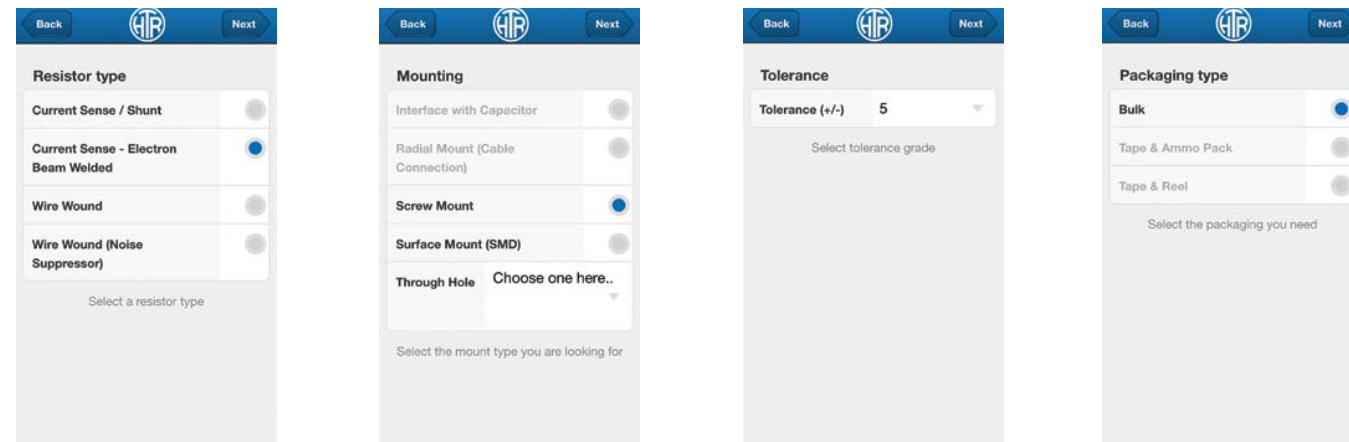
HTR Resistor Finder is a pioneering handy tool from HTR for design engineers and purchase executives in various industries that use Power Resistors. It is a quick fix tool for teachers/students searching for standard resistive devices. It is also a window to newly introduced cutting edge resistive devices.

The application eases your search for resistors by categorizing search specifications into two kinds:

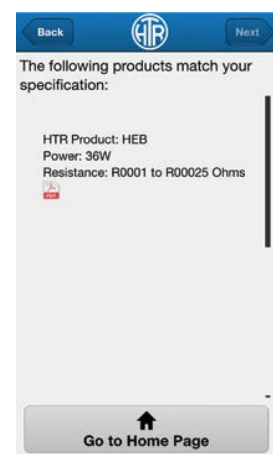
- 1. Find resistor by parameters
- 2. Find a replacement resistor

## 1. Find resistor by parameter:

The search for an appropriate resistor is facilitated by choice of resistor type, mount type, the required tolerance grade and the packaging type in subsequent screens.



Once the parameters are selected on subsequent screens, the required resistor type, its datasheet summary and web link are displayed on the screen.

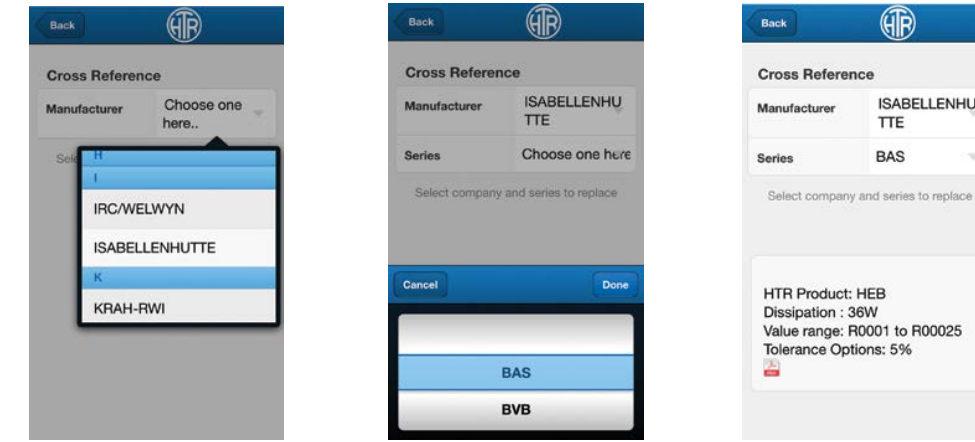


## 2. Find a replacement resistor:

The application also caters to the need for finding an HTR equivalent of a product by another manufacturer. It assists you by offering a wide range of world's leading manufacturers to choose from.

The subsequent screens prompts for selection of a resistor series for which the replacement is needed.

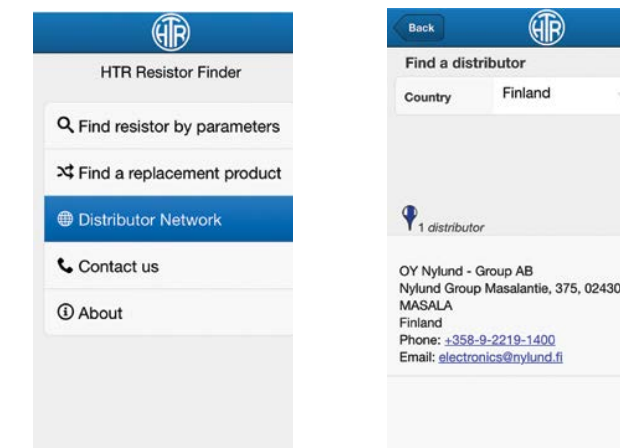
The equivalent HTR series, its datasheet summary and web link appear immediately thereafter.



## 3. Distributor Network:

Apart from these effortless methods to find the required product, the application also helps to find HTR distributors from across the globe.

Categorized on the basis of countries, it gives you options of all countries where HTR distributors are located. Upon selection, it presents a list of distributors in that country.



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