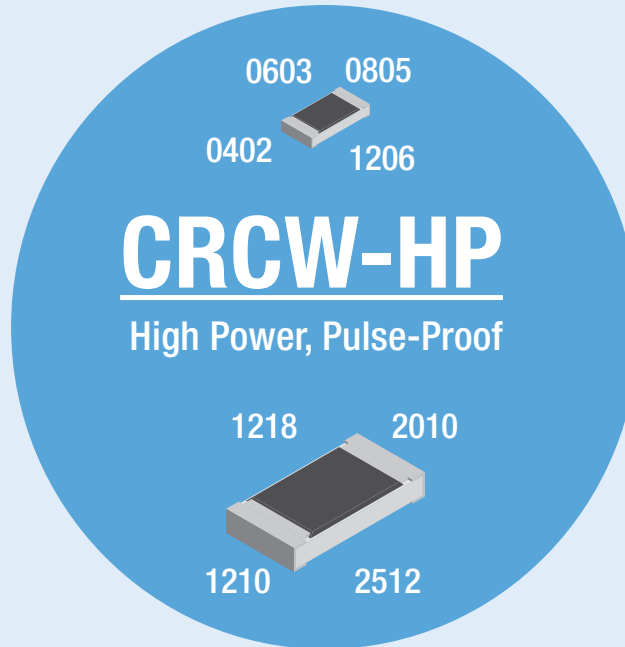
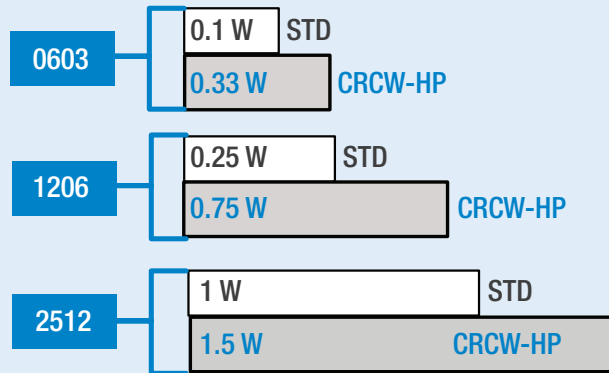




HIGH POWER THICK FILM RESISTORS

HIGH POWER, PULSE-PROOF

HIGH POWER RATING

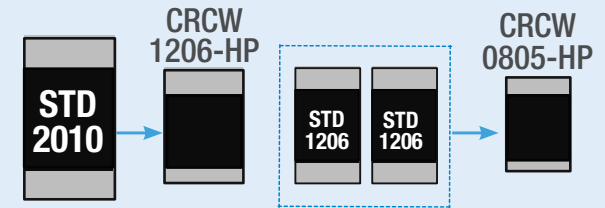


SPACE-SAVING

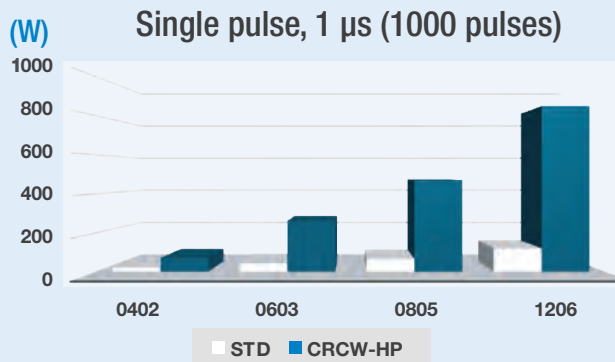
Component count and board space

58 % less

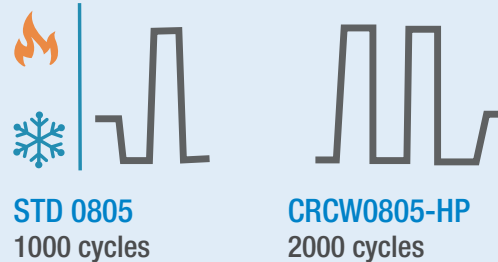
75 % less



EXCELLENT PULSE PERFORMANCE



ADVANCED THERMAL CYCLING



APPLICATIONS



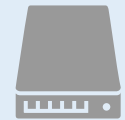
Automotive



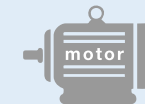
Industrial



Inverters



DC/DC Converters



Drives



Battery Management

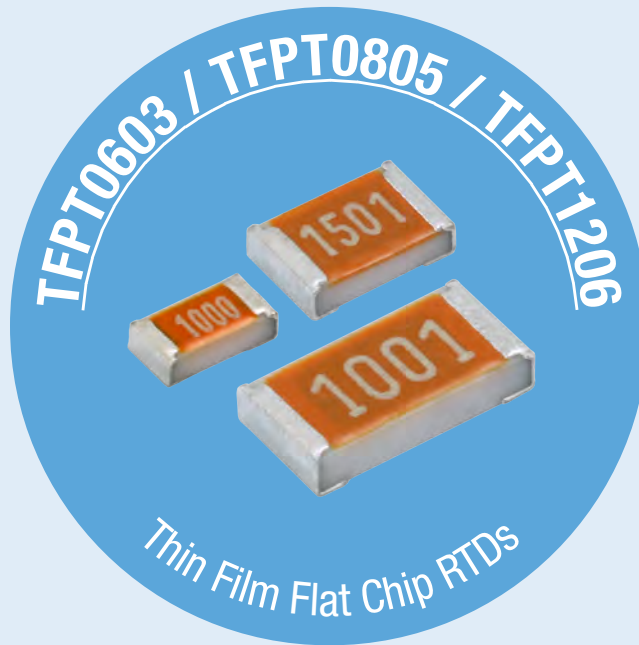


TFPT SURFACE-MOUNT NI THIN FILM RTD

LINEAR POSITIVE TEMPERATURE COEFFICIENT ELEMENT

COMPLIANCE TO STANDARDS

- AEC-Q200 qualification
- ESD HBM 0.5 kV (0603);
1 kV (0805 / 1206)
- RoHS-compliant
- Halogen-free
- Whisker-tested per JEDEC® 22A121.01



TEMPERATURE SENSING / CONTROL / PROTECTION / COMPENSATION

SystemVision® Cloud

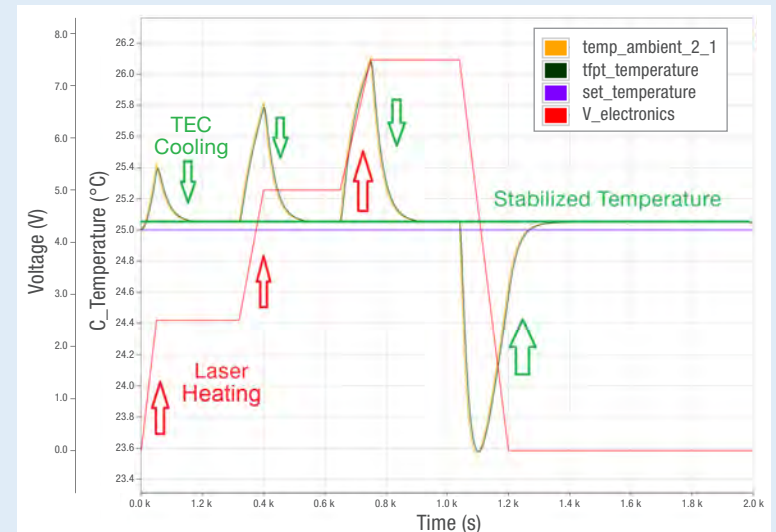
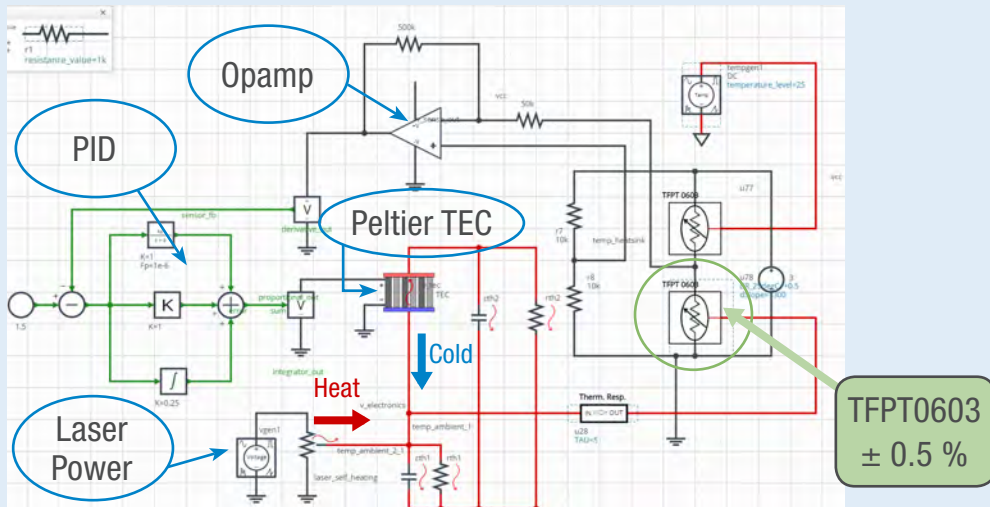
- Laser temperature regulator using Peltier TEC

MULTIPLE DESIGN TOOLS AVAILABLE

- LTSpice® models with Monte Carlo tolerances ([online](#))
- Cadence® PSpice models ([online](#))
- VHDL-AMS models (on [SystemVision® Cloud](#))

APPLICATIONS

- LED current control
- Portable instrumentation systems
- Peltier cooling elements
- CTA flow sensors
- BLDC drivers
- Optoelectronics
- Car infotainment
- Medical equipment



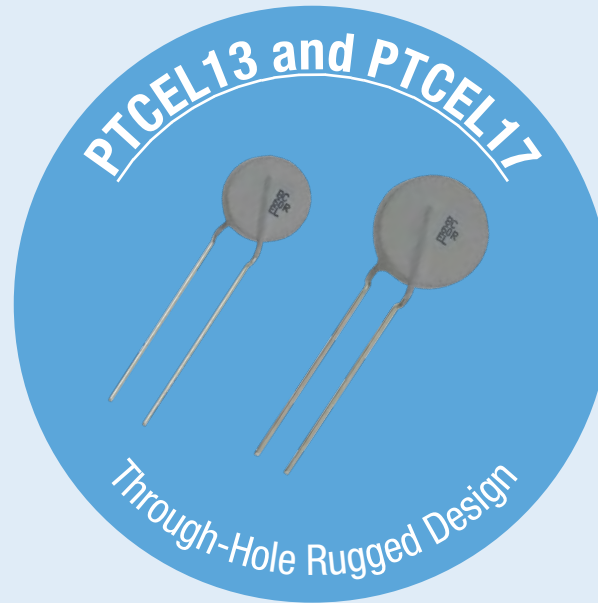
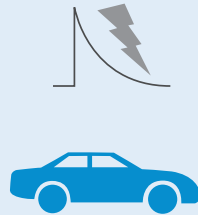


PTCEL INRUSH CURRENT LIMITING THERMISTORS

THROUGH-HOLE HIGH ENERGY CERAMIC DISCS

APPLICATIONS

- AC/DC and DC/DC converters
- Load dump and DC-Link circuits
- Battery charging equipment
- Welding equipment
- Motor drives



SPECIAL FEATURES

- Up to 1000 V withstanding
- Up to 105 °C ambient temperature
- Self-protected against overheating

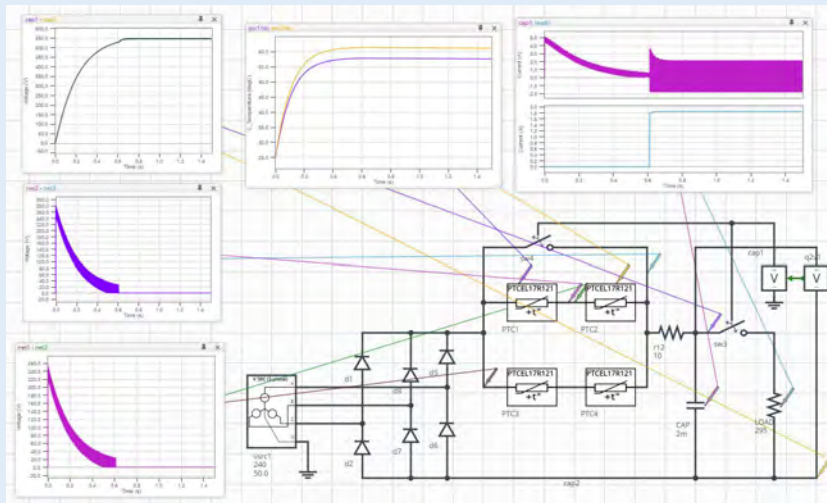


MULTIPLE DESIGN TOOLS AVAILABLE

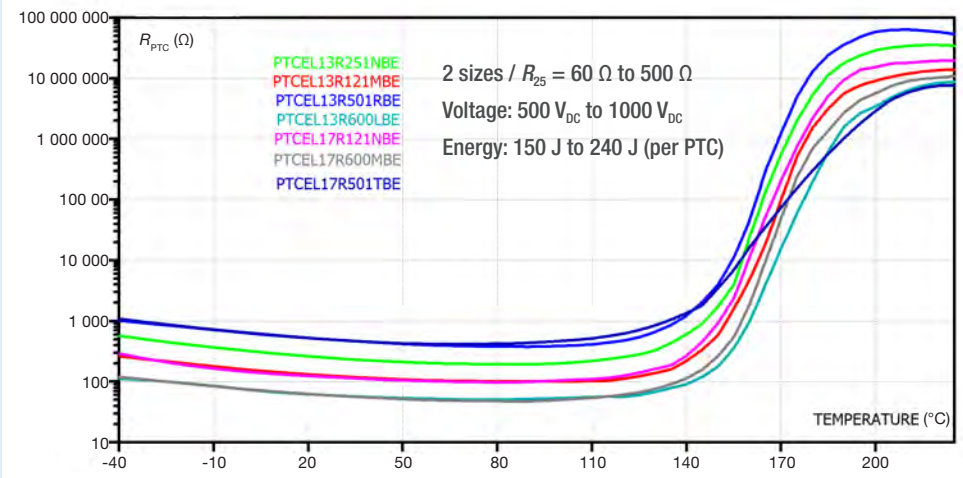
- LTspice® models available with Monte Carlo tolerances ([online](#))
- VHDL-AMS models available (live tunable design [online](#) on SystemVision® Cloud website)
- 3D models available ([online](#))

INRUSH CURRENT LIMIT / LOAD DUMP / SAFE EMERGENCY DISCHARGE / PRE-CHARGE

[Simulation on SystemVision® Cloud](#)



Extended Resistance vs Temperature Capability



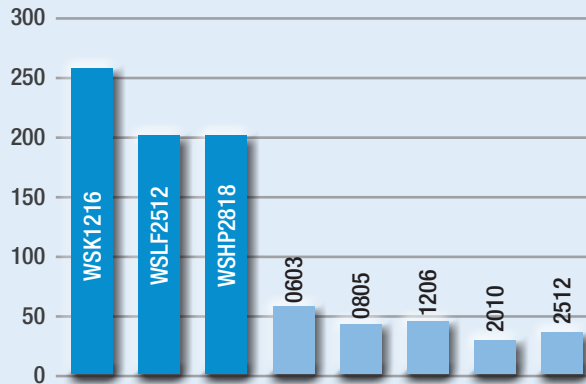


CURRENT SENSE RESISTORS

HIGH POWER DENSITY, LOW RESISTANCE

IN A NUTSHELL

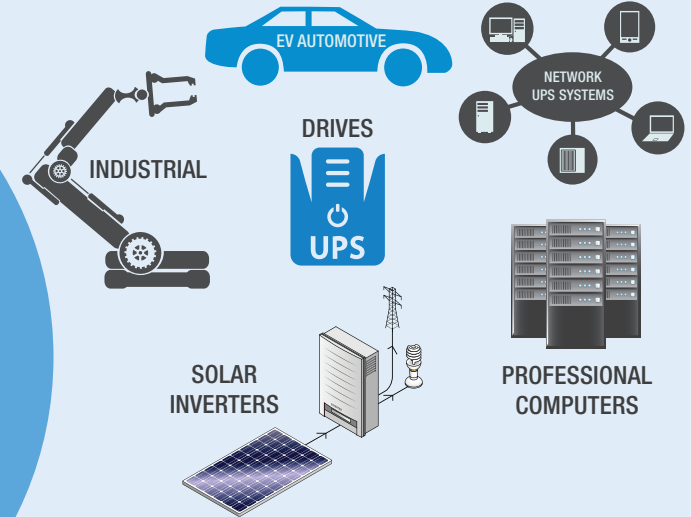
POWER DENSITY (W/in²) vs
STANDARD POWER RATED SIZES



- ### BENEFITS OF POWER METAL STRIP®
- All-metal welded construction provides superior pulse tolerance
 - Extremely low resistance values; minimizes power loss and prevents parallel resistance elements
 - Low TCR; better temperature stability
 - Tight tolerance; improves measurement accuracy
 - Laser trimmed; enables design flexibility



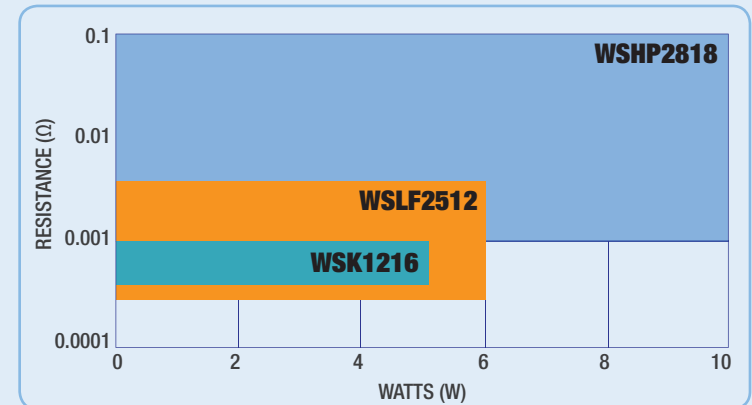
APPLICATIONS



FOOTPRINT	BENEFIT
■ WSLF2512	Replace (2) ■ ■ high power 2512
■ WSK1216	4-Terminal / TCR performance
■ WSHP2818	Flexible resistance range and high power capability

Shown at actual size

POWER RATING vs RESISTANCE RANGE

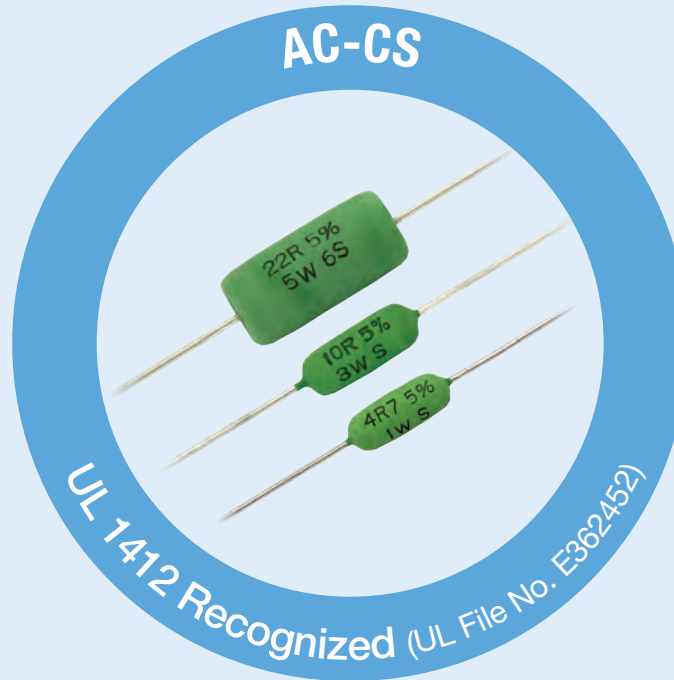
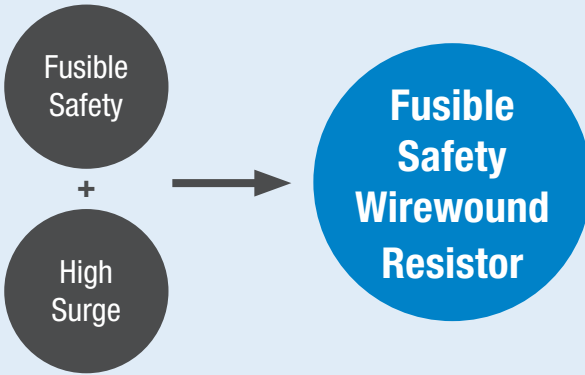




FUSIBLE SAFETY WIREWOUND RESISTORS

SILENT + SAFE FUSING, SURGE HANDLING UP TO 6 kV

IN A NUTSHELL



KEY APPLICATIONS IN ALTERNATIVE ENERGY, CONSUMER, AND INDUSTRIAL



Energy Meters



Gas Meters

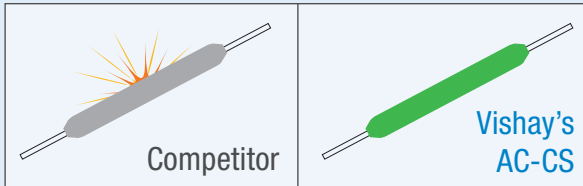


Washing Machines



Power Supplies

SAFE + SILENT FUSING



AC-CS OPTIONS

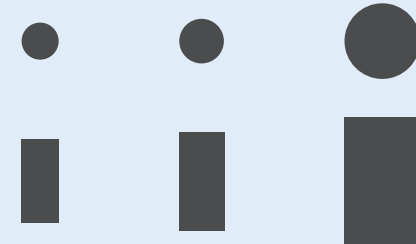
	RATED POWER, P_{40}	SURGE VOLTAGE MAX.	FUSING TIME	OHMIC RANGE	DIAMETER	LENGTH
AC01-CS	1.1 W	0.7 kV to 3.2 kV	< 30 s for 30 W overload	3 Ω to 100 Ω , 5 %	5 mm	11 mm
AC03-CS	3 W	2 kV to 4 kV	< 25 s for 45 W overload	4.7 Ω to 100 Ω , 5 %	6 mm	13 mm
AC05-CS	5 W	4 kV (10 Ω to 20 Ω) 6 kV (22 Ω to 100 Ω)	< 45 s for 100 W overload	10 Ω to 100 Ω , 5 %	10 mm	17 mm

FOOTPRINT

AC01-CS

AC03-CS

AC05-CS



Shown at actual size
(when viewed or printed at 100 %)

Detailed datasheet: www.vishay.com/doc?28909

For Technical Questions: ww1resistors@vishay.com
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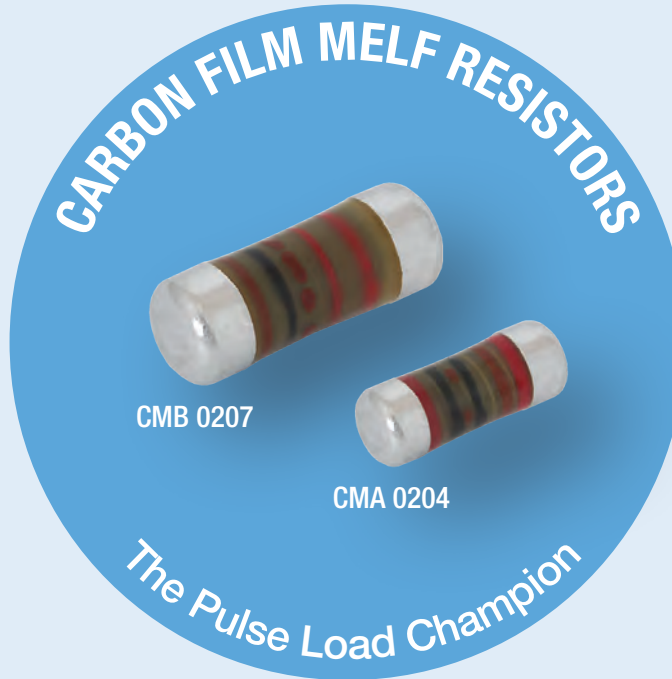
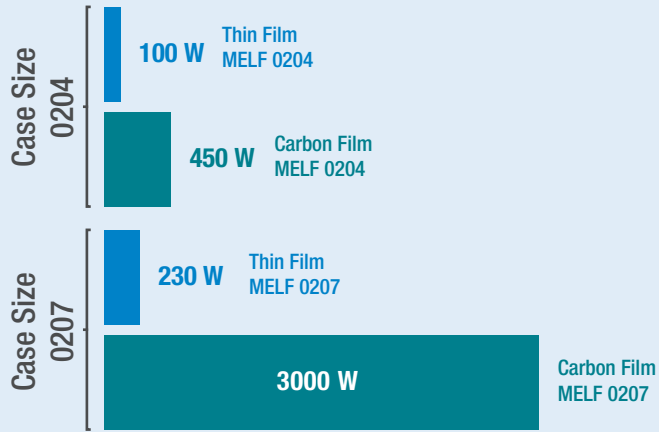


CARBON FILM MELF RESISTORS

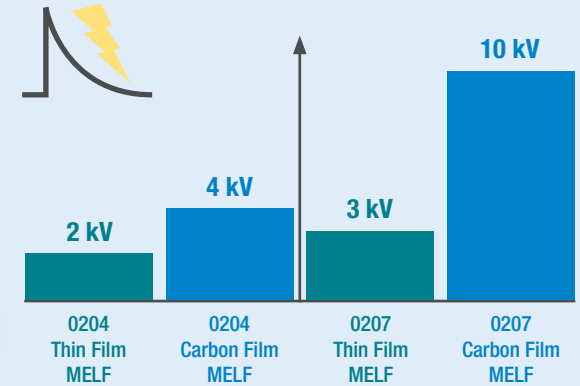
HIGH PULSE LOAD CAPABILITY

IN A NUTSHELL

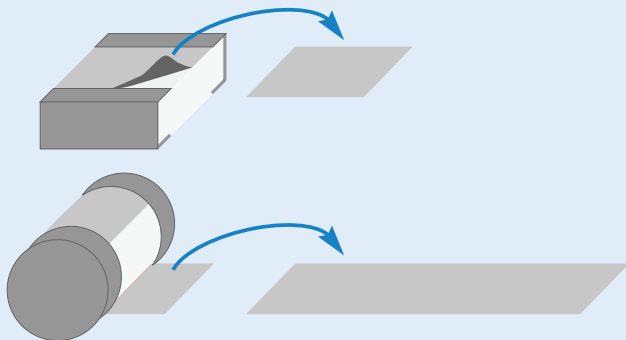
HIGHEST PULSE CAPABILITY FOR SMD FILM RESISTORS



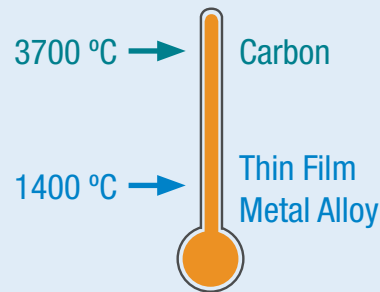
SURGE VOLTAGE CAPABILITY



LARGEST EFFECTIVE RESISTIVE AREA for highest pulse handling capability



CARBON FILM highest melting point of all elements



SIZE COMPARISON

MELF size = Chip size

0204 = ■ = 1206

0207 = ■ = 2512

APPLICATIONS



INVERTERS



I/O PROTECTION



SMART METERS

For Technical Questions: melf@vishay.com

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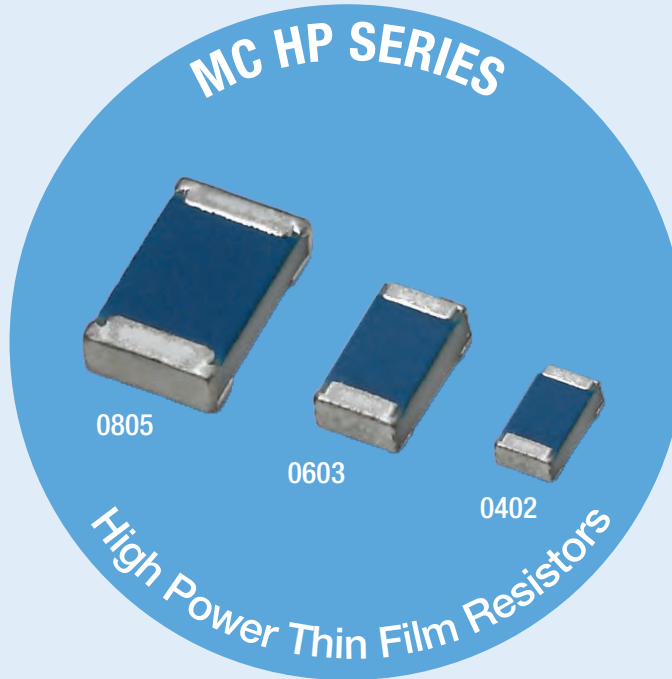
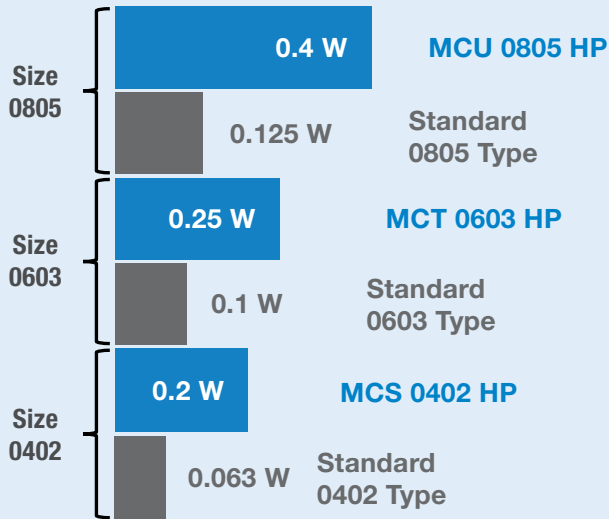


HIGH POWER THIN FILM RESISTORS

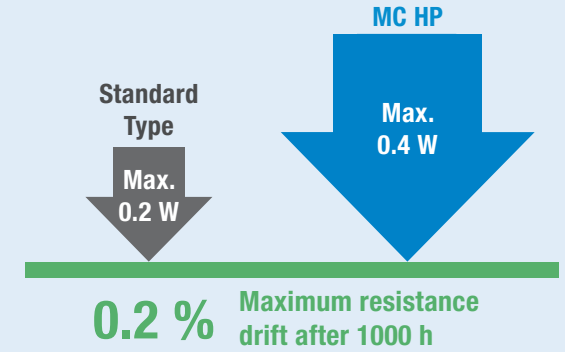
EXCELLENT STABILITY IN HIGH POWER APPLICATIONS

IN A NUTSHELL

SUPERIOR POWER RATING



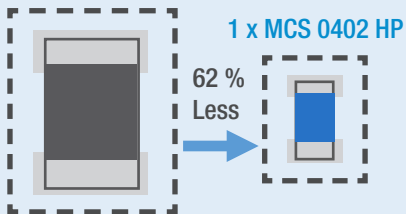
EXCELLENT LONG-TERM STABILITY At Increased Power Rating



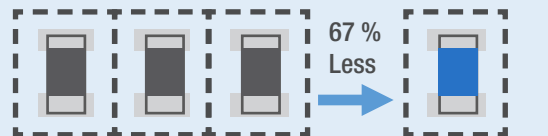
SPACE SAVING

Component Count and Board Space for 0.2 W Rated Power

1 x standard 0805 type



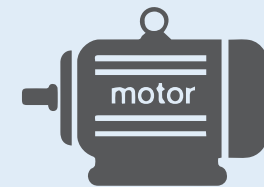
3 x standard 0402 type



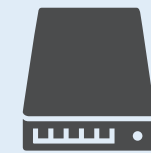
APPLICATIONS



AUTOMOTIVE



DRIVES



DC/DC CONVERTERS



INVERTERS



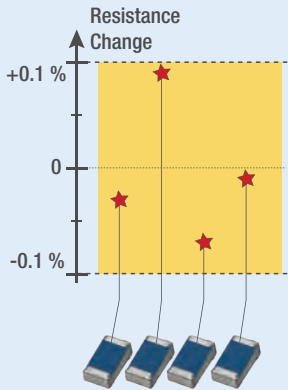
RESISTOR ARRAYS

WHEREVER A STABLE RESISTANCE RATIO IS REQUIRED

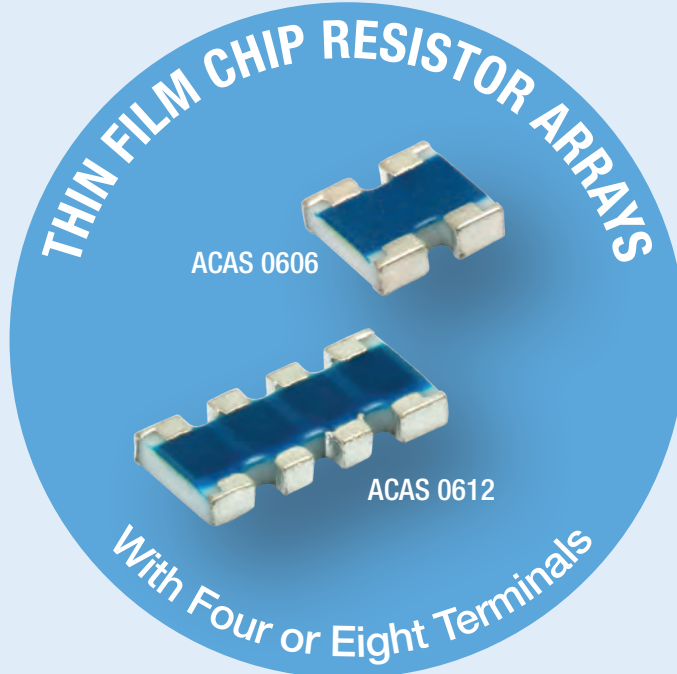
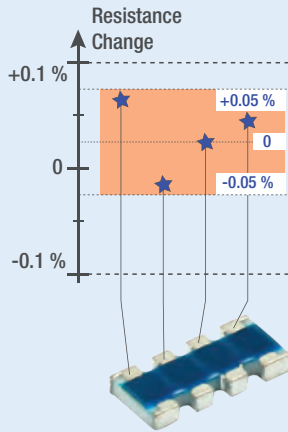
IN A NUTSHELL

TOLERANCE

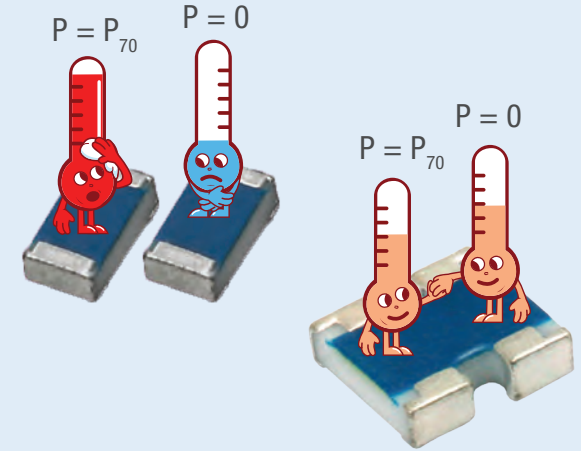
Absolute Tolerance



Relative Tolerance (Matching)

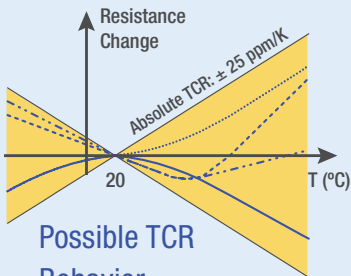


THERMAL COUPLING

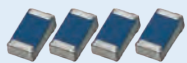


TEMPERATURE COEFFICIENT

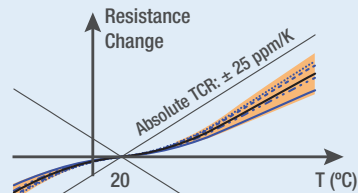
Absolute TCR



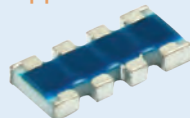
Possible TCR Behavior



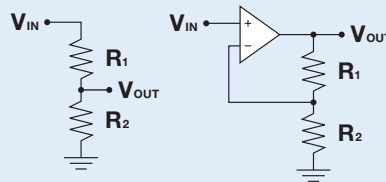
Relative TCR (Tracking)



Relative TCR: ± 5 ppm/K



APPLICATIONS



VOLTAGE DIVIDER

FEEDBACK LOOP



AUTOMOTIVE



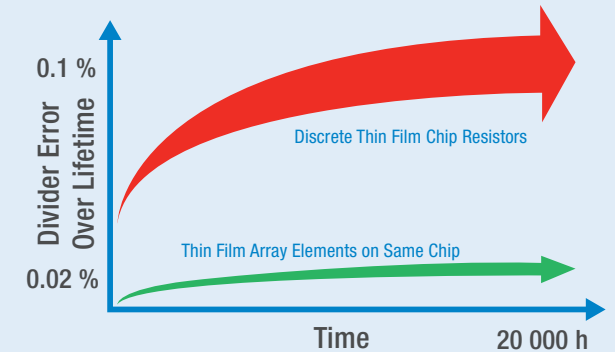
DC/DC CONVERTERS



MEASUREMENT EQUIPMENT

EQUIVALENT AGING DRIFT

Divider Ratio Stability: Aging Over Lifetime



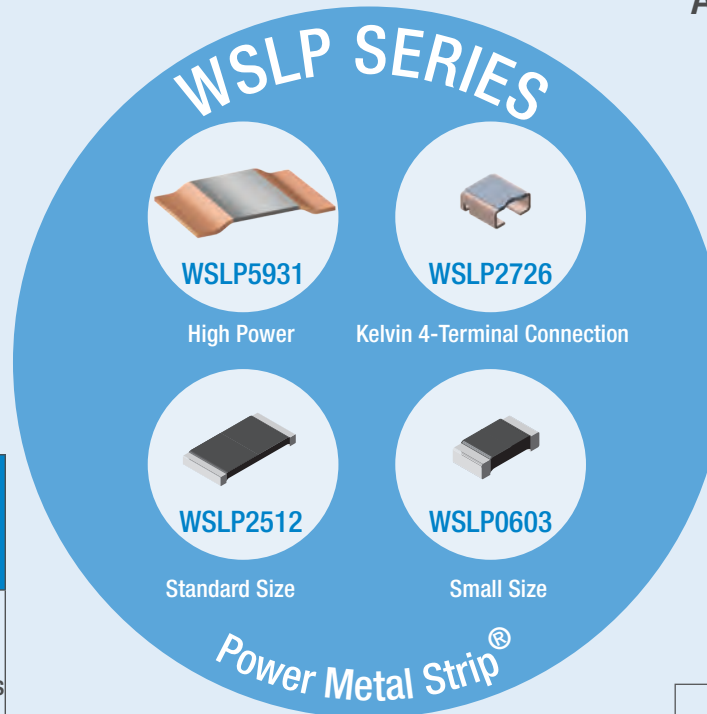
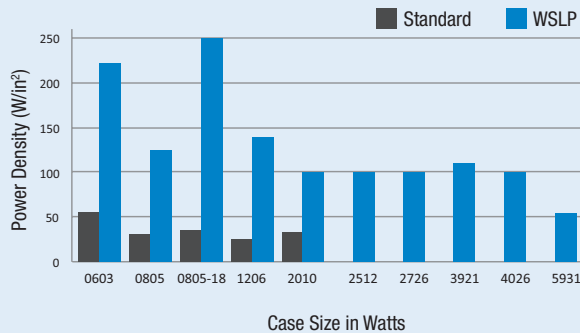


CURRENT SENSE RESISTORS

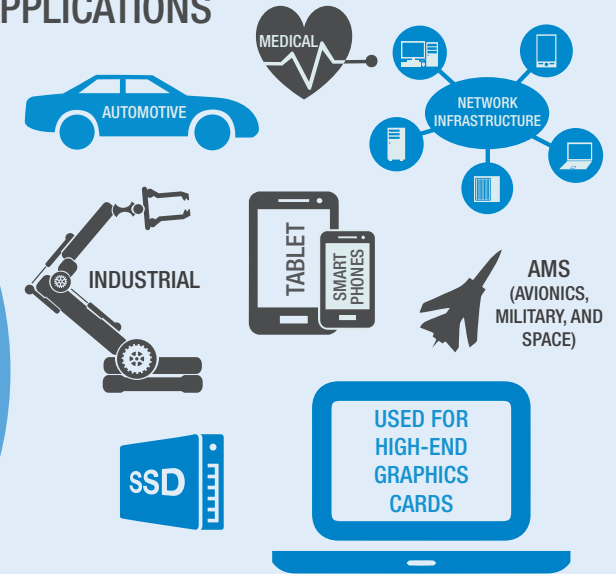
HIGH POWER, LOW RESISTANCE

IN A NUTSHELL

POWER DENSITY



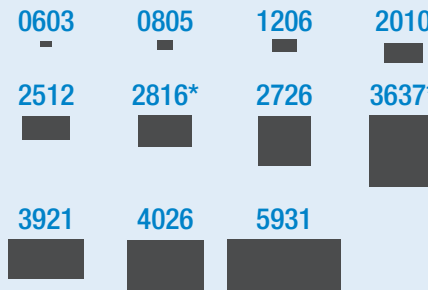
APPLICATIONS



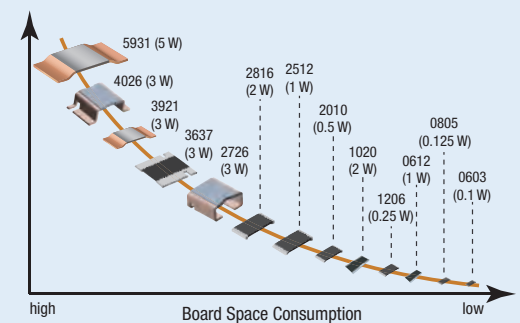
Power Metal Strip® Advantages Over Thick Film	Power Metal Strip® Advantages Over Thin Film
<ul style="list-style-type: none"> Pulse performance Better temperature derating Superior temperature stability (down to 75 ppm) Low thermal EMF (3 $\mu\text{V}/^\circ\text{C}$) RoHS-compliant without exemption 	<ul style="list-style-type: none"> High power (up to 10 W) Not ESD sensitive Lower solder joint stress Pulse performance
Power Metal Strip® Advantages Over Commercial Foil	
<ul style="list-style-type: none"> Pulse performance Low CTE mismatch with PCB Low resistance (down to 0.2 mΩ) 	

FOOTPRINT

Shown at actual size



Multiple Package Sizes (0603 to 5931)



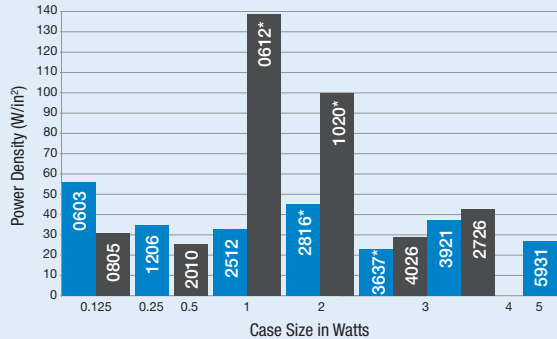


CURRENT SENSE RESISTORS

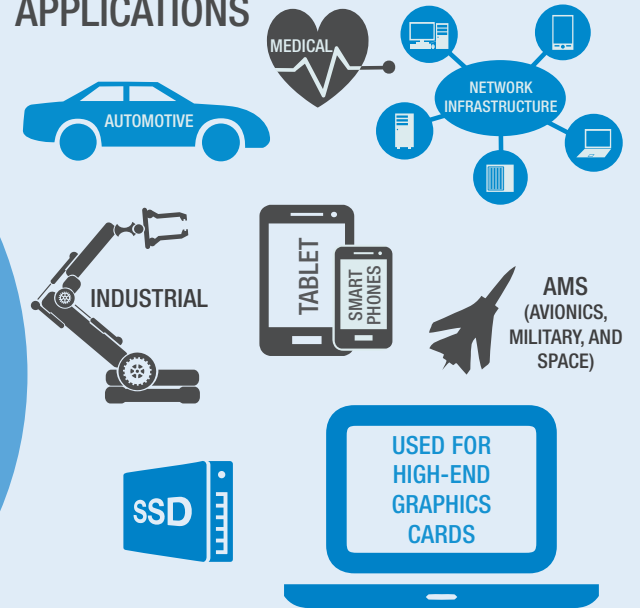
HIGH POWER, LOW RESISTANCE

IN A NUTSHELL

POWER DENSITY



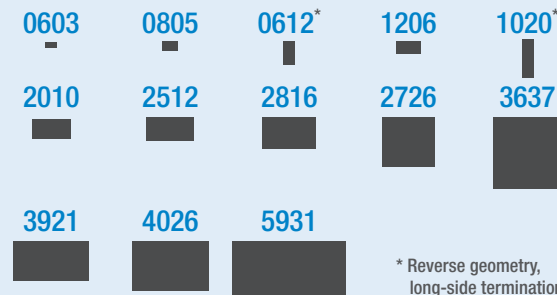
APPLICATIONS



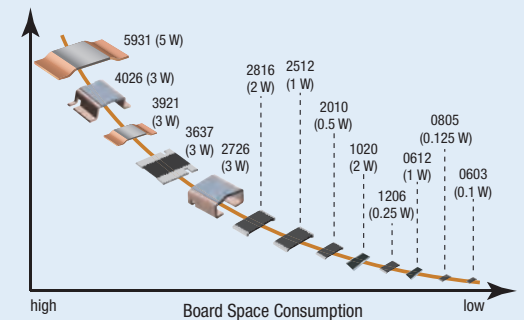
Power Metal Strip® Advantages Over Thick Film	Power Metal Strip® Advantages Over Thin Film
<ul style="list-style-type: none"> Pulse performance Better temperature derating Superior temperature stability (down to 75 ppm) Low thermal EMF (3 μV/°C) RoHS-compliant without exemption 	<ul style="list-style-type: none"> High power (up to 5 W) Not ESD sensitive Lower solder joint stress Pulse performance
Power Metal Strip® Advantages Over Commercial Foil	
<ul style="list-style-type: none"> Pulse performance Low CTE mismatch with PCB Low resistance (down to 0.2 mΩ) 	

FOOTPRINT

Shown at actual size



Multiple Package Sizes (0603 to 5931)





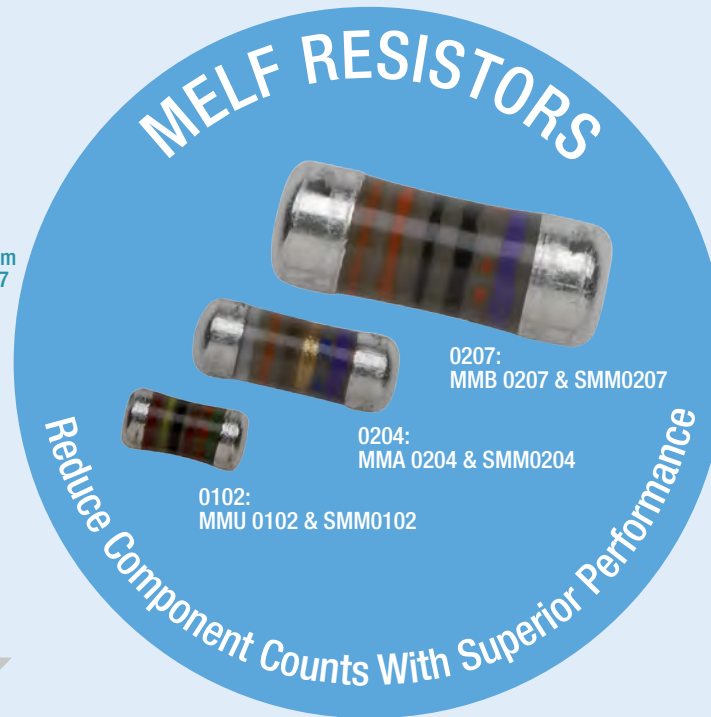
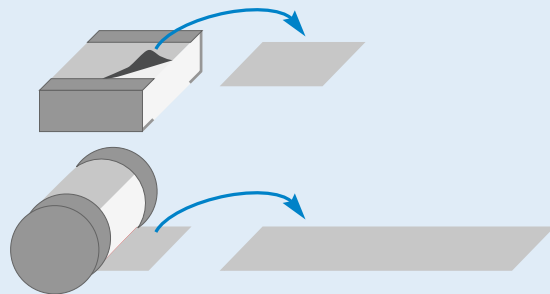
MELF RESISTORS FOR PULSE LOAD APPLICATIONS

IN A NUTSHELL

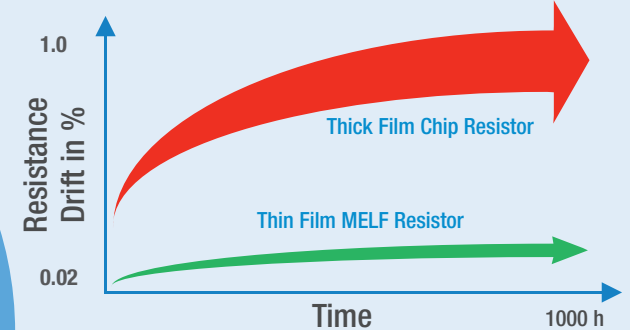
SUPERIOR PULSE CAPABILITY



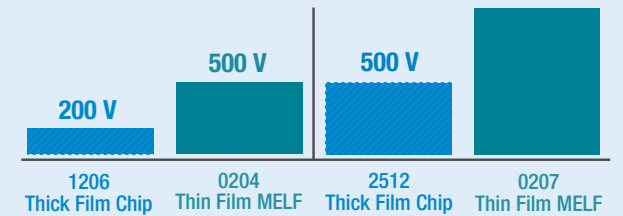
LARGEST EFFECTIVE RESISTIVE AREA for highest pulse handling capability



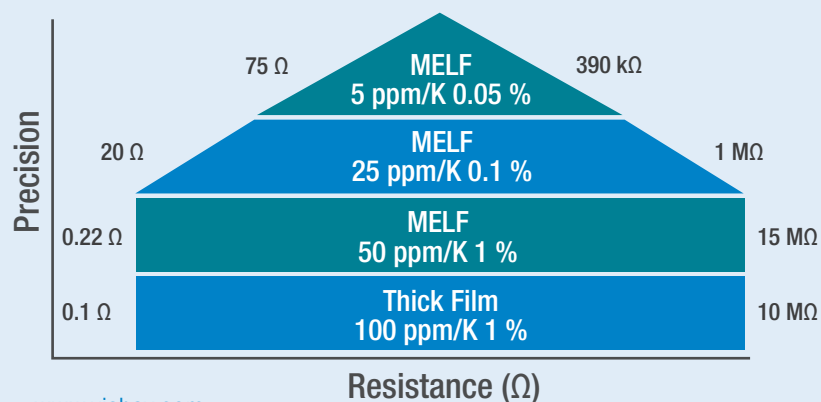
EXCELLENT LONG TERM STABILITY



HIGH VOLTAGE OPERATION



RESISTANCE RANGE AVAILABILITY



SIZE COMPARISON

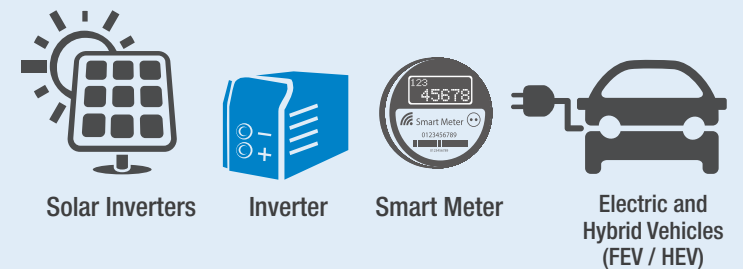
MELF size = Chip size

0102 = = 0805

0204 = = 1206

0207 = = 2512

APPLICATIONS

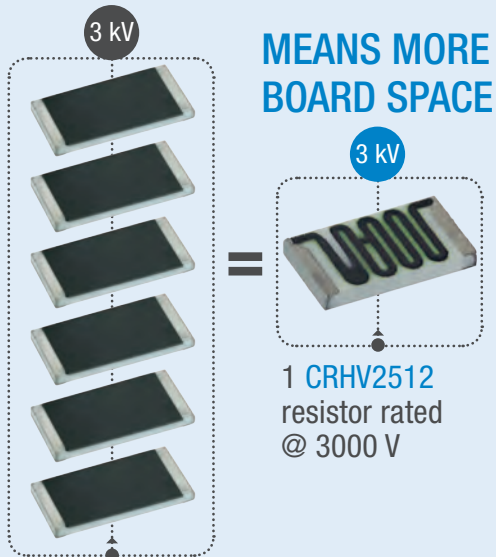




CRHV / CRMV / CRMA* SERIES HIGH VOLTAGE THICK FILM RESISTORS

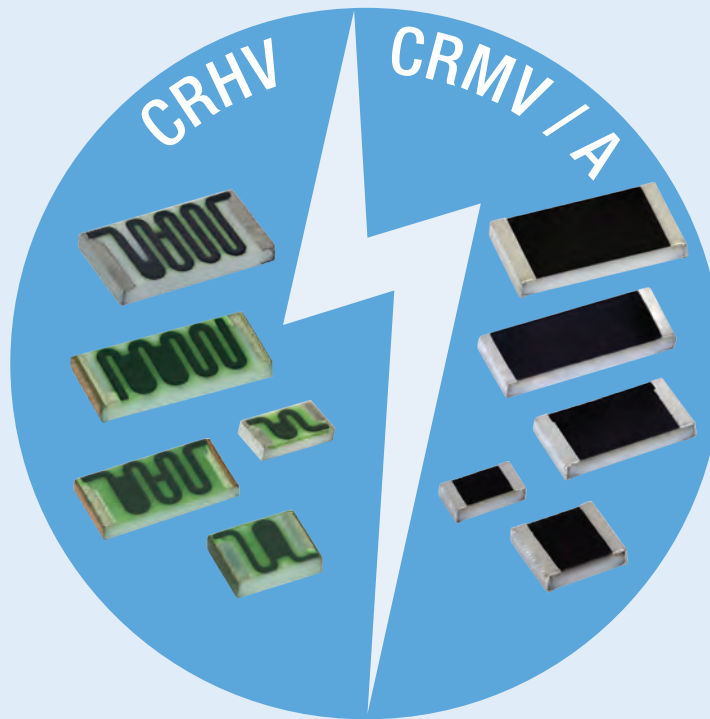
IN A NUTSHELL

6 STANDARD RESISTORS = 1 CRxV

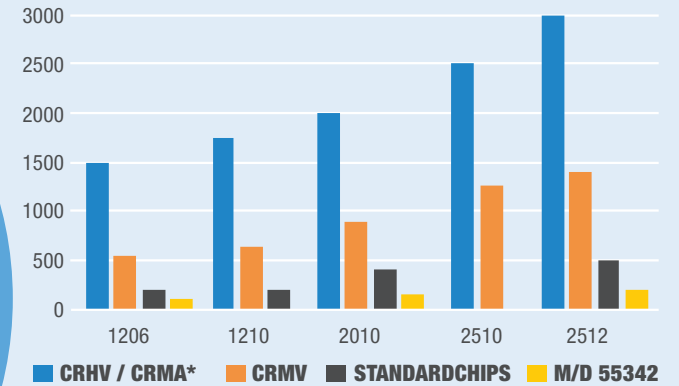


1 CRHV2512 resistor rated @ 3000 V

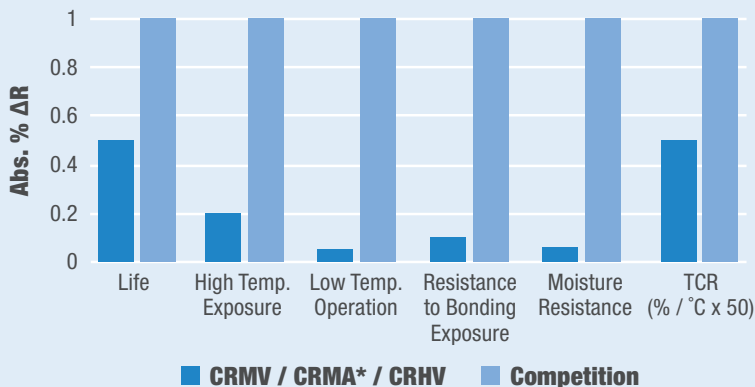
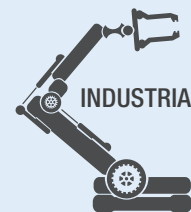
6 STANDARD resistors rated @ 500 V each



VOLTAGE HANDLING



APPLICATIONS



FOOTPRINT

Shown at actual size



- Design flexibility with multiple termination configurations and materials including non-magnetic allow design flexibility
- Available as chip divider also – CDHV and CDMV respectively

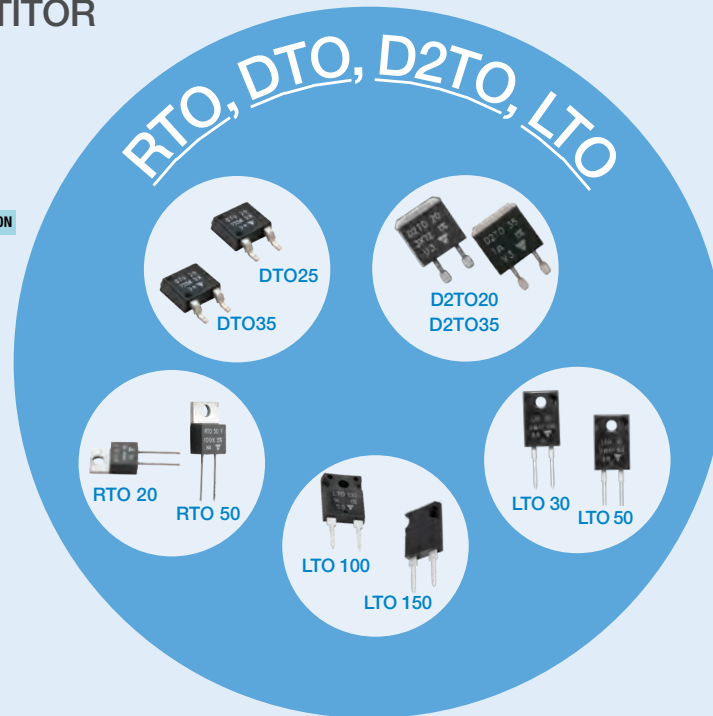
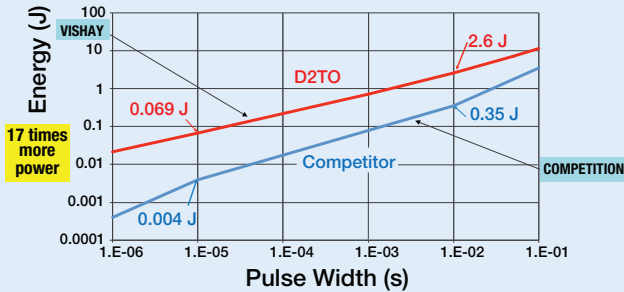
* CRMA is the AEC-Q200 version of CRMV



THICK FILM MEDIUM POWER RESISTORS

TO-247, TO-220, DPAK, and D²PAK

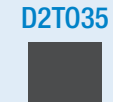
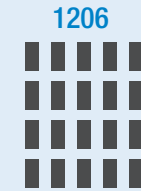
ENERGY CURVE: D2TO VS. COMPETITOR



SPACE SAVING

Fewer components on PCB

Can replace **5 to 20** chip resistors



PROVEN QUALITY



With PPAP available



Driving the main EV / HEV manufacturers

AEC-Q200 RESISTORS

- LTO 100 / LTO 150
- D2TO20 / D2TO35
- DTO25 / DTO35

NON-INDUCTIVE



Widest Ω range

APPLICATIONS

AMS



INDUSTRIAL



AUTOMOTIVE



ADVANTAGES

- High energy ratings for harsh pulses up to 60 J / 0.1 s
AND
- High power for long precharge / discharge up to 150 W at 45 °C
AND
- High dielectric strength for protection up to 3000 V_{RMS}

sferfixedresistors@vishay.com

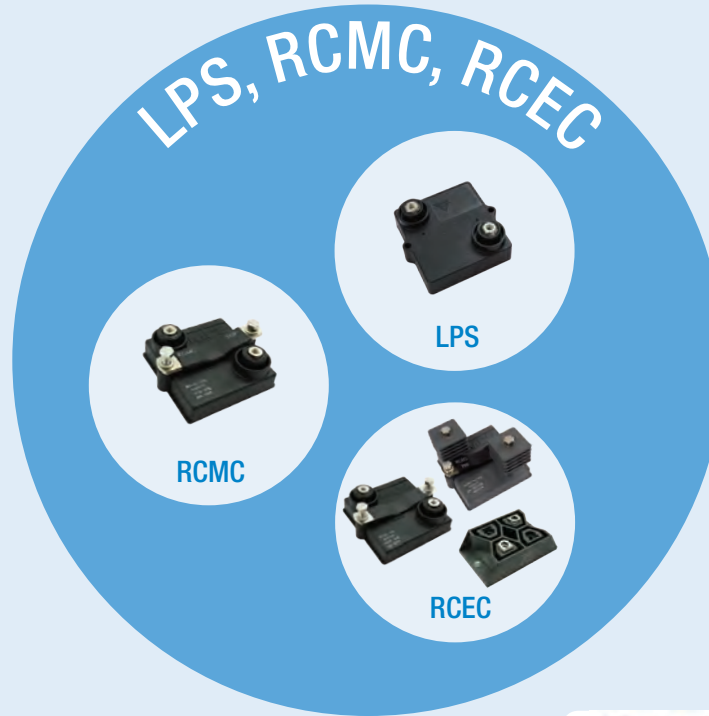


THICK FILM POWER RESISTORS

HIGH POWER, COMPACT THICK FILM RESISTORS

IN A NUTSHELL

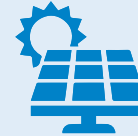
	RCEC 750	WIREWOUND
	750 W	750 W
Size		
Footprint		
Weight	100 g	1400 g
Case Temp	70 °C	450 °C
Inductance	Non-inductive	Inductive
Resistance	0.3 Ω to 1 MΩ	8.2 Ω to 60 kΩ
Dielectric	Up to 12 kV	Not Insulated
Partial Discharge	< 5 pC	> 1000 pC



MEDICAL



SOLAR



INDUSTRY FIRST

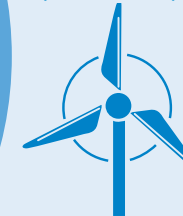


30
Over
30 Years of
Experience

MARINE



WIND ENERGY
(GENERATION)



INDUSTRIAL



RAIL



HVDC
TRANSMISSION

DRIVES

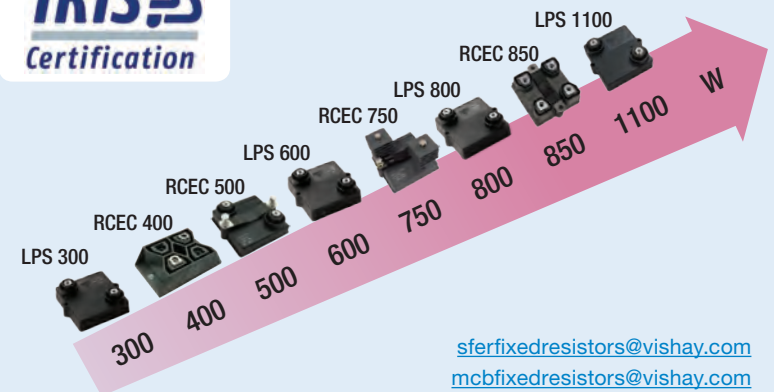


CUSTOM FRIENDLY

- Specific terminals (size and diameter M4 - M5)
- Terminals with leads
- Possibility of two or three resistors in the same case (RCEC 400, RCEC 850)
- Creeping and clearance distances (HV version)
- Assemblies (resistors mounted on heatsink)

KEY APPLICATIONS

- ✓ Snubbers
- ✓ Discharge
- ✓ Balancing
- ✓ Dividers
- ✓ Filters

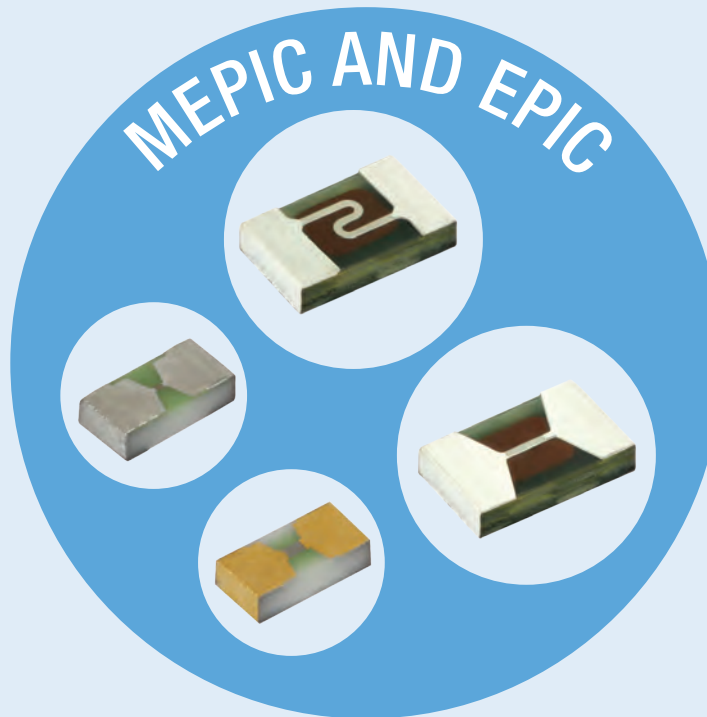
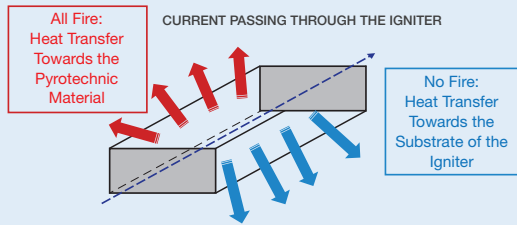




ELECTRO-PYROTECHNIC INITIATOR CHIP RESISTOR | IN A NUTSHELL

SMD IGNITER

The Active Area of an Igniter Is a Volume of Resistive Element to Heat



PERFORMANCE

	EPIC	MEPIC
All Fire Energy	Down to 50 μ J	Down to 1000 μ J
Time	Down to 50 μ s	Down to 250 μ s
No Fire Current	0.3 A to 0.8 A	0.5 A to 1.2 A
No Fire Duration	2 s to 5 s	2 s to 10 s
	Faster and lower energy needed for ignition	Withstands higher energy without ignition

ADVANTAGES OF EPIC / MEPIC OVER WIRE BRIDGE

EASY TO MOUNT

- STD SMD CASES (0603 / 0805)
- TAPE AND REEL PACKING FOR PICK AND PLACE MACHINES
- STD REFLOW PROCESS

CUSTOMIZATION

- ADAPTATION OF OUR ACTIVE AREA TO "ALL FIRE / NO FIRE" CUSTOMER REQUIREMENTS
- CUSTOMIZATION HAS NO IMPACT ON THE FOOTPRINTS
- COMPATIBLE TO ALL EXPLOSIVE MATERIALS

RELIABILITY – REPRODUCTIBILITY

- RELIABILITY & PREDICTABILITY IN THE SOLDERING PROCESS
- DIMENSION OF ACTIVE AREA 100% CONTROLLED
- EACH YEAR WE CONTRIBUTE TO SAVING 5000 LIVES WITH OUR TECHNOLOGY

APPLICATIONS (DOMAIN SPECIFIC)



PYROTECHNICS



DEMOLITION
ROCK FRAGMENTATION



MILITARY

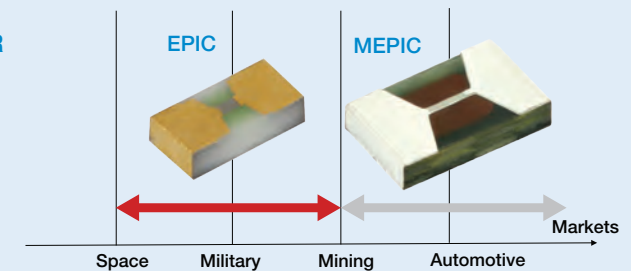


AIRBAGS
SEAT BELTS

MEPIC: MASSIVE ELECTRO-PYROTECHNIC INITIATOR CHIP RESISTOR

EPIC: ELECTRO-PYROTECHNIC INITIATOR THIN FILM CHIP RESISTOR

EPIC 0603 MEPIC 0805

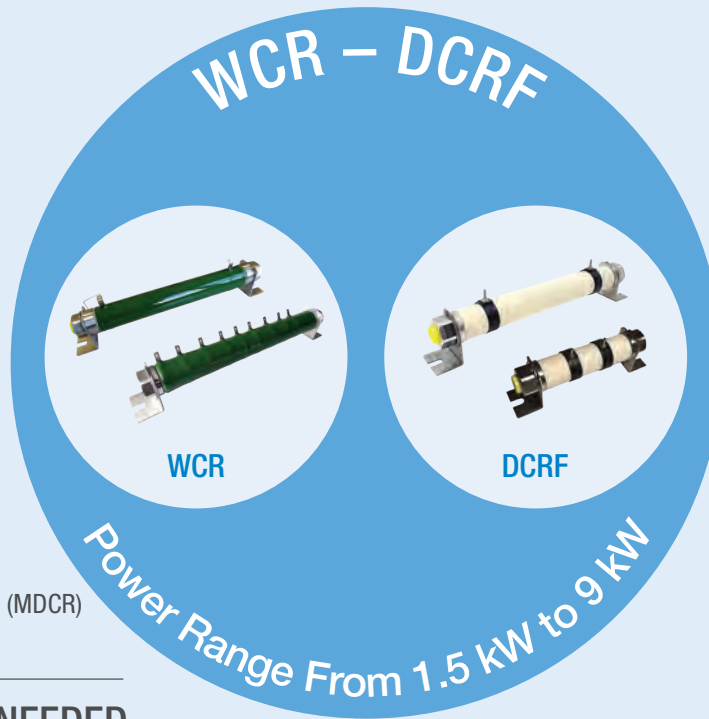
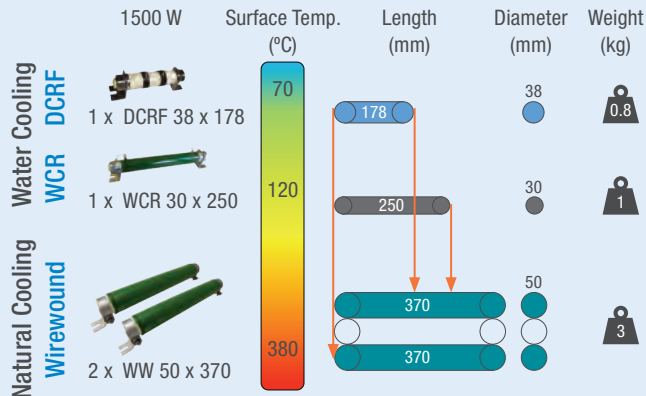




WATER COOLED WIREWOUND RESISTORS

ULTRA HIGH POWER INTEGRATED RESISTORS

IN A NUTSHELL



APPLICATIONS



LARGE DRIVE



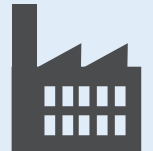
MARINE



WIND POWER



SOLAR



INDUSTRIAL



HVDC-SVC TRANSMISSION

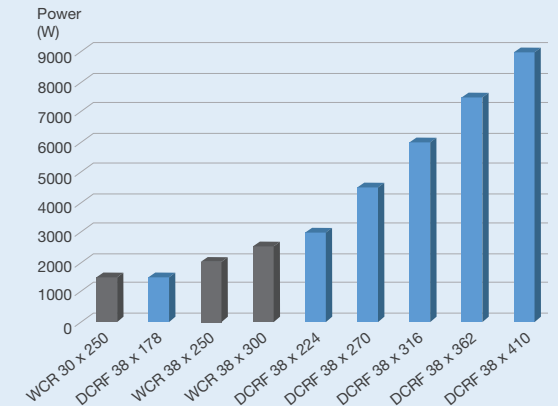
CUSTOMIZATION OPTIONS

- Multiple resistive elements on the same tube (up to 8)
- Combination possible with WCR and DCRF resistive elements (MDCR)
- Custom assemblies (twin tubes)

INTEGRATED SOLUTION, NO HEATSINK NEEDED

WCR and DCRF Advantages Over Thick Film Water Cooled Resistors	WCR and DCRF Advantages Over Plastic Box Water Cooled Resistors
<ul style="list-style-type: none"> • Pulse performance (wirewound technology) • High power dissipation (up to 9 kW) • Overload capability (2 Pn during 60 s) • Multiple resistive element option (low and high ohmic values on the same support) • Safe failure mode (no leakage) 	<ul style="list-style-type: none"> • High power dissipation (up to 9 kW) • Overload capability (2 Pn during 60 s) • Low inductivity option (< 500 nH) • Multiple resistive element option (low and high ohmic values on the same support) • Safe failure mode (no leakage)
WCR and DCRF Advantages Over Standard Wirewound Resistors	
<ul style="list-style-type: none"> • High power dissipation (up to 9 kW) • Limited external radiation (surface temperature < 120 °C) • Helps customers gain competitive advantage by reducing equipment size and cost • Multiple resistive element option (low and high ohmic values on the same support) 	

PRODUCT PORTFOLIO



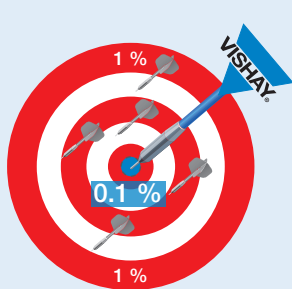
For Technical Questions: mcbsfixedresistors@vishay.com



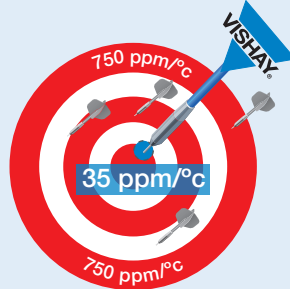
CURRENT SENSE RESISTORS FOR BATTERY MANAGEMENT AND SAFETY

IN A NUTSHELL

PRECISION AND ACCURACY / TCR



What is your tolerance to accuracy and precision?



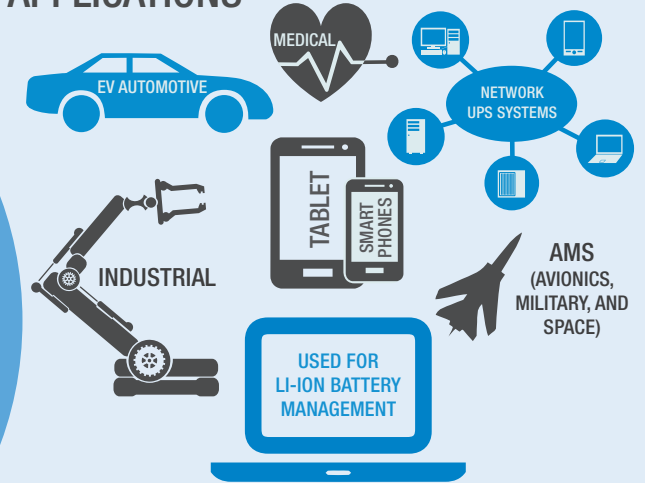
Does TCR ruin your design stability?

POWER METAL STRIP®

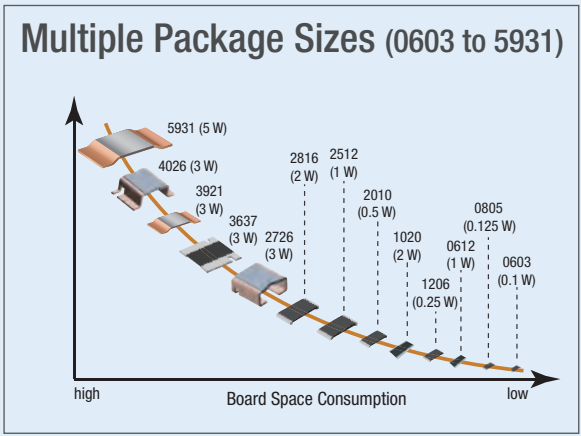
<p>WSLP5931</p> <p>Low Resistance Value</p>	<p>WSHP2818</p> <p>High Power Density</p>	<p>WSK1216</p> <p>Kelvin 4-Terminal Connection</p>
<p>WSLP1206</p> <p>Standard Size</p>	<p>WSL1020</p> <p>Side Terminal</p>	<p>WSBS/WSBM8518</p> <p>Large Shunts</p>

www.vishay.com/doc?49581

APPLICATIONS

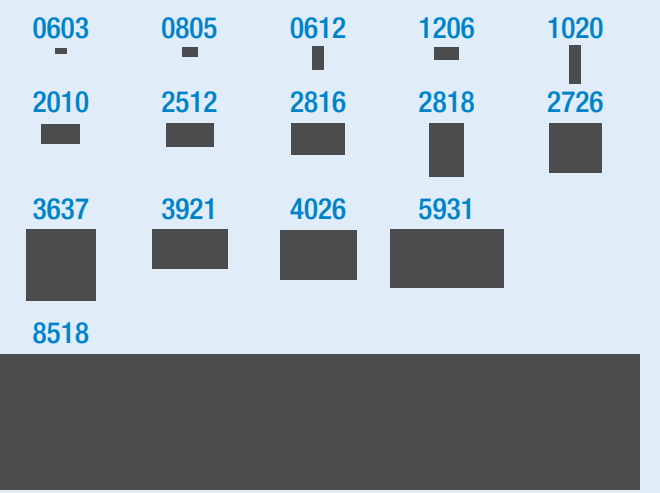


Power Metal Strip Advantages Over Thick Film	Power Metal Strip Advantages Over Thin Film
<ul style="list-style-type: none"> Pulse performance Better temperature derating Superior temperature stability (down to 35 ppm) Low thermal EMF (3 $\mu\text{V}/^\circ\text{C}$) RoHS-compliant without exemption 	<ul style="list-style-type: none"> High power (up to 36 W) Not ESD sensitive Lower solder joint stress Pulse performance
Power Metal Strip Advantages Over Commercial Foil	
<ul style="list-style-type: none"> Pulse performance Low CTE mismatch with PCB Low resistance (down to 0.05 mΩ) 	



FOOTPRINT

Shown at actual size



For Technical Questions: ww2bresistors@vishay.com

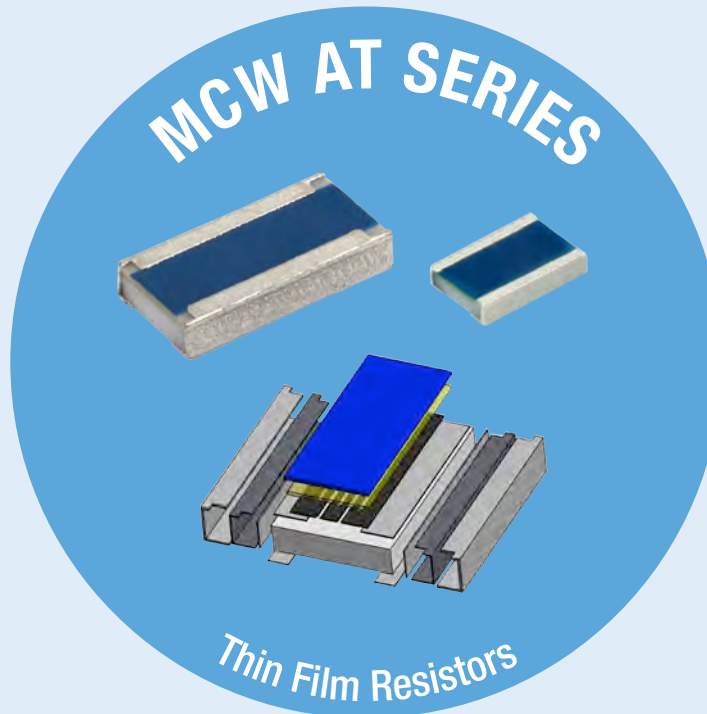
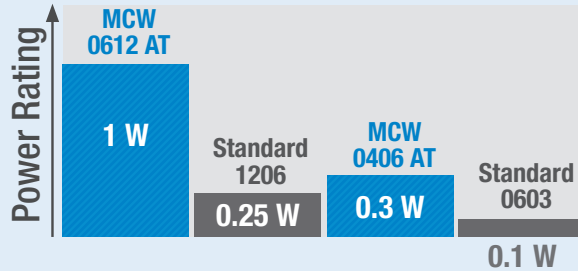


WIDE TERMINAL THIN FILM RESISTORS

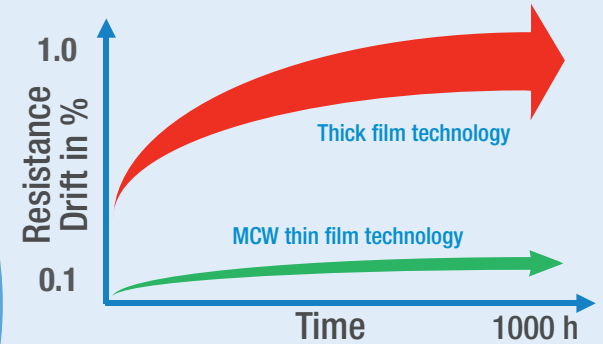
HIGH POWER, SPACE SAVING

IN A NUTSHELL

SUPERIOR POWER RATING



EXCELLENT LONG-TERM STABILITY

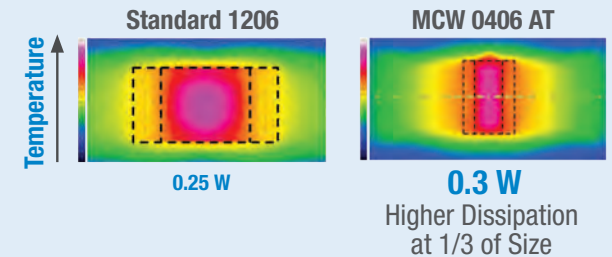


ADVANCED THERMAL CYCLING



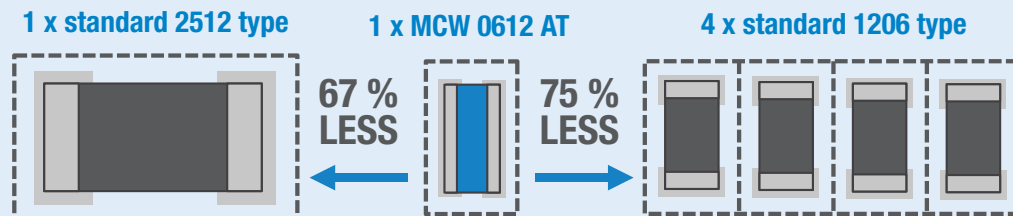
MCW 0406 AT - **3000** cycles
 MCW 0612 AT - **2000** cycles
 Standard 1206 case size - **1000** cycles

HIGHER POWER DISSIPATION

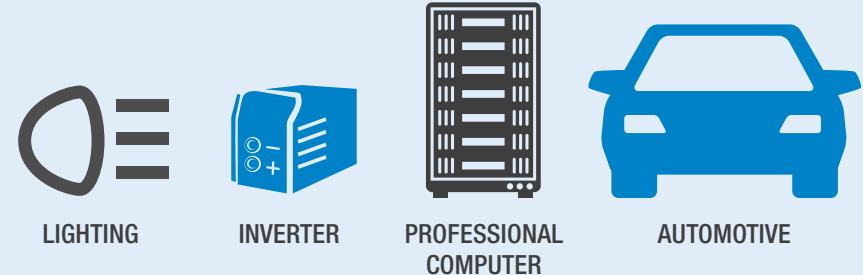


SPACE SAVING

Component Count and Board Space for 1 W Rated Power



APPLICATIONS



thinfilmchip@vishay.com

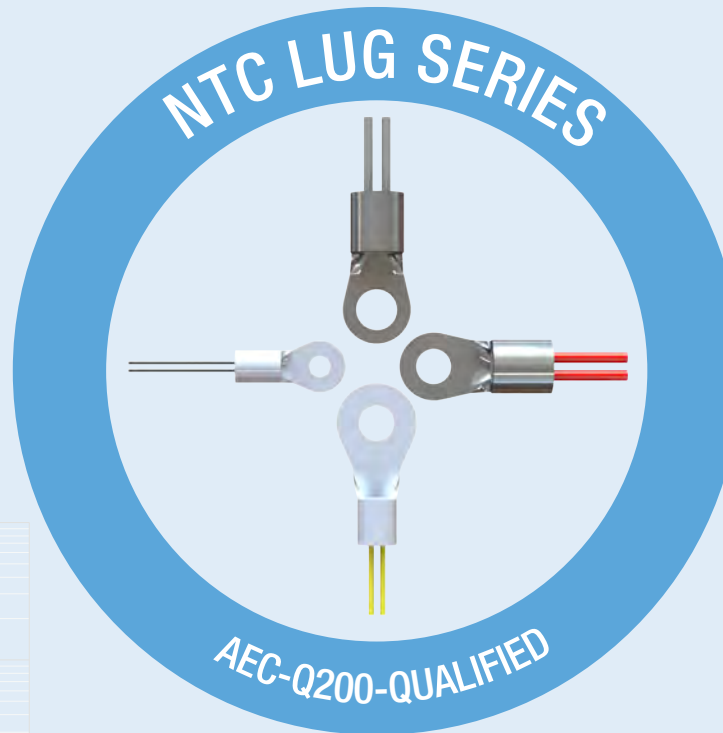
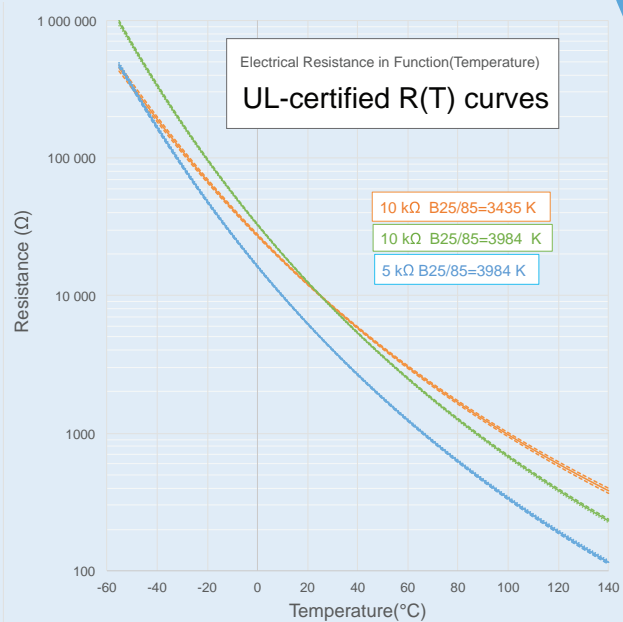
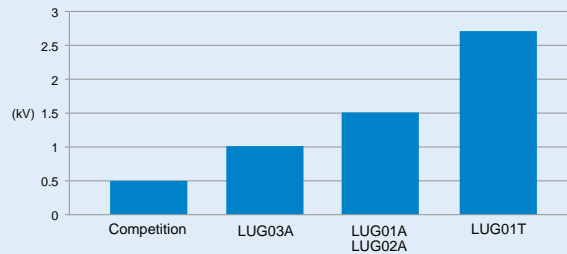


NTC LUG THERMISTORS

SURFACE TEMPERATURE SENSORS

IN A NUTSHELL

HIGH INSULATION VOLTAGE FOR EV HIGH POWER INVERTERS



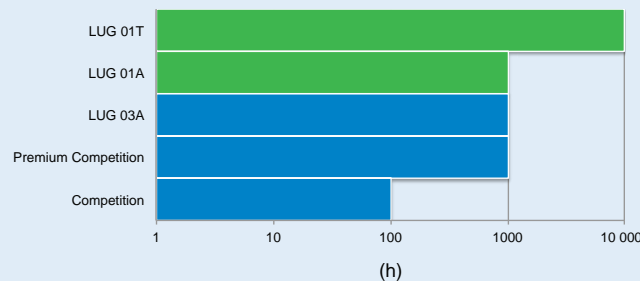
EASY MOUNTING MECHANICAL OPTIONS

Mounting screw ->	○	○	○	○	○	○	○
Metric screw ->	M2	M3	M3,5	M4	M5	M6	M8
Stud screw ->	#1-2	#3-4	#5-6	#8	#10	#1/4	#5/16
CABLE AWG24			■	■	■	■	■
CABLE AWG26		■	■	■	■	■	
CABLE AWG28	■	■	■	■	■	■	
CABLE AWG30	■	■	■	■			
CABLE AWG32	■	■					

KEY APPLICATIONS IN AUTOMOTIVE / INDUSTRIAL

- Inverters
- DC/DC Converters
- Battery Management
- On-Board Chargers
- Charging Plugs
- Robotics

RELIABLE OPERATING TEMP. OVER TIME

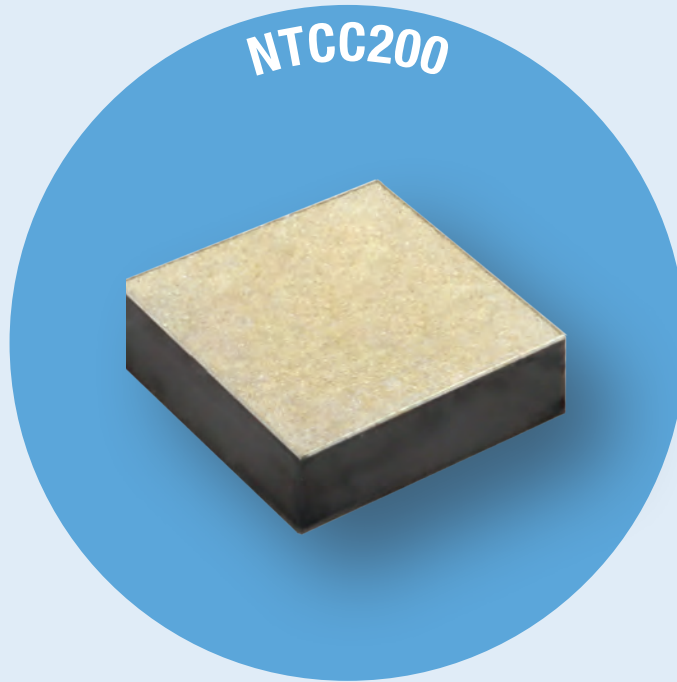
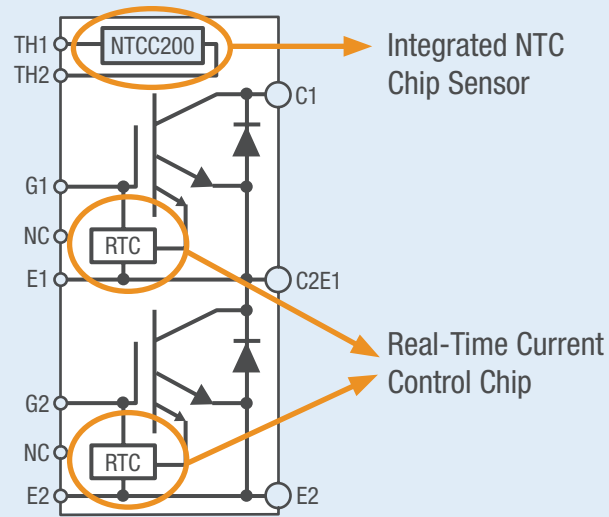




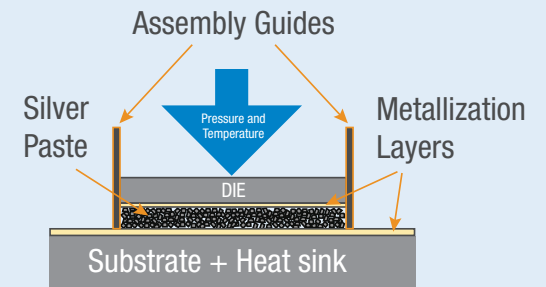
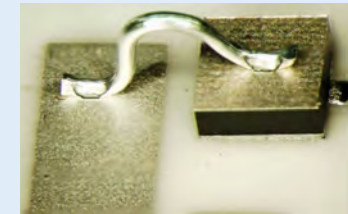
WIRE BONDABLE NTC THERMISTOR DIE

IN A NUTSHELL

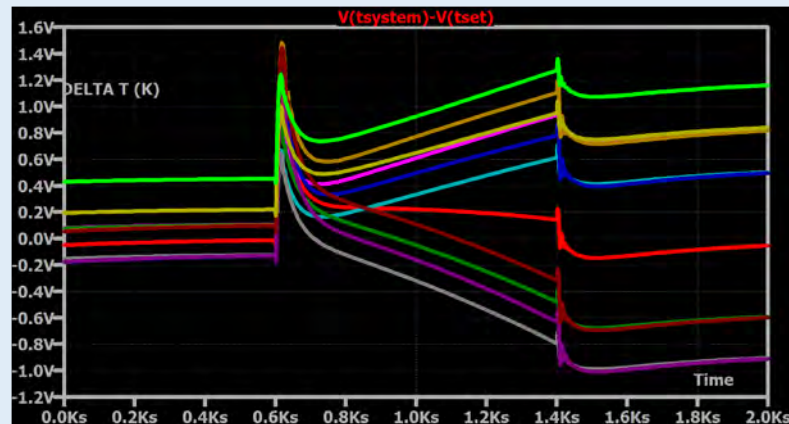
DESIGNED FOR IGBT MODULES



SUITABLE FOR WIRE BONDING AND NANO-SILVER PASTE SINTERING



TEMPERATURE SENSING AND REGULATION

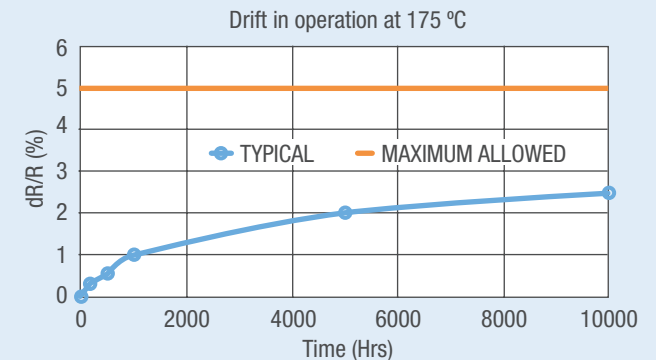


INDUSTRIES

Power modules for EVs and hybrid vehicles

Inverters for windmills and solar panels

ACCURATE / STABLE AT HIGH TEMPERATURE (175 °C)



For Technical Questions: nlr@vishay.com

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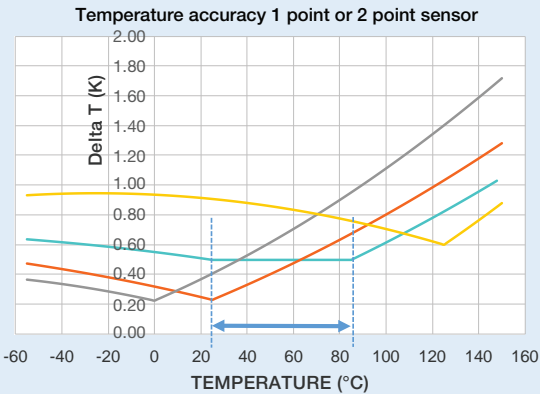


NTCLE LEADED-EPOXY COATED NTC THERMISTORS

RADIAL LEADS-SAWING TECHNOLOGY

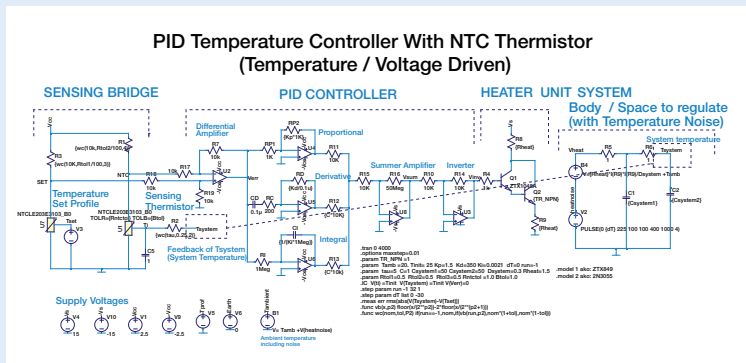
IN A NUTSHELL

ACCURACY IN TEMPERATURE MEASUREMENT



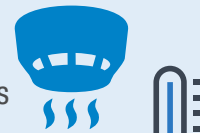
TEMPERATURE SENSING / CONTROL / PROTECTION

NTCLE203...SB0 10 KΩ



APPLICATIONS

- EV battery sensor
- Charging plug
- Ambient thermostats
- Fire detectors
- Inlet Air Temp (IAT)
- Engine Coolant (ECT)
- Air conditioning



MULTIPLE DESIGN TOOLS AVAILABLE

- Resistance /temperature curve in “My Vishay NTC Curve” (©Excel)
- 3D models available (online)
- LT and PSpice models (online)
- SPICE multi-simulator models on request (adapted to most other SPICE simulators like Multisim / TINA...)

COMPONENTS AVAILABLE IN DIFFERENT WIRE GAGES, LENGTHS, WITH(OUT) INSULATION

Insulator	None	ETFE	PEEK	PTFE	PVC
AWG32		Ag-plated Ni or NiFe			
AWG30	Sn-plated Ni	Sn-plated Ni	Ag-plated Ni	Ag-plated Ni	Sn-plated Cu
AWG28	Sn-plated Ni	Sn-plated Cu		Ag-plated Cu	
AWG26	Sn-plated Ni	Sn-plated Cu		Ag-plated Cu	
AWG24	Sn-plated Ni				Sn-plated Cu
AWG23	Sn-plated Cu				

- **Monostranded Length**
 0.4 in up to 2 in
 10 mm up to 50 mm
- **Multistranded Length**
 1.5 in up to 9 in
 38 mm up to 228 mm
- **Monostranded Length**
 1.5 in up to 9 in
 38 mm up to 228 mm
- **Multistranded Length**
 2 in up to 150 in
 50 mm up to 3810 mm

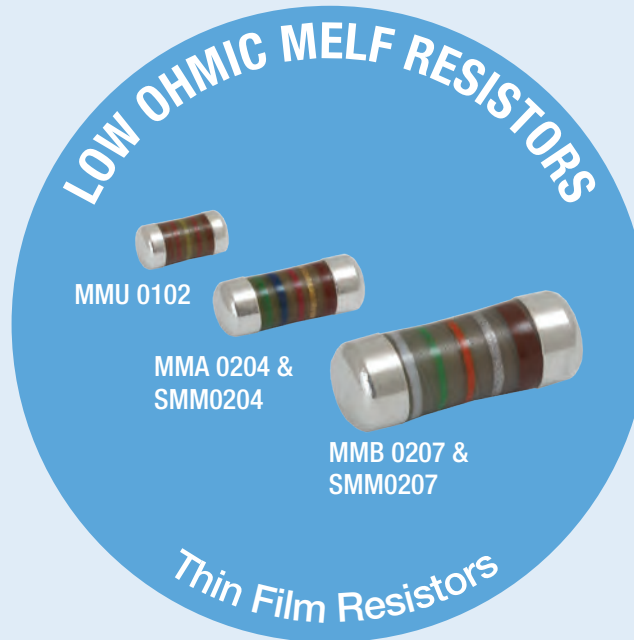
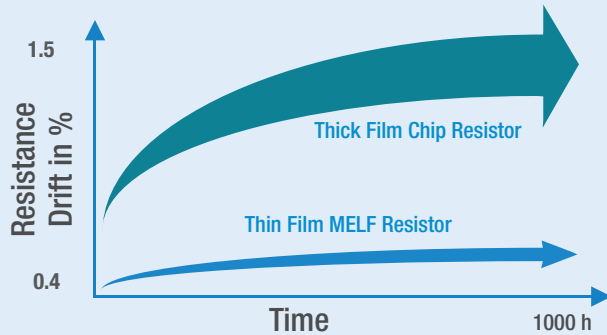


LOW OHMIC MELF RESISTORS

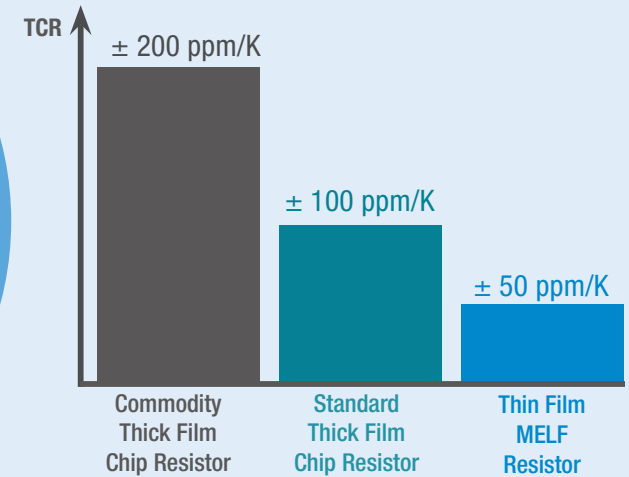
FOR PRECISE CURRENT MEASUREMENT AND EFFICIENT MOSFET GATE DRIVING

IN A NUTSHELL

EXCELLENT LONG TERM STABILITY



LOW TEMPERATURE COEFFICIENT



APPLICATIONS

Current Measurement in:



LED Drivers



DC/DC Converters



Battery Management

IGBT / MOSFET Gate Resistor in:



Electric Vehicles



Motor Drivers



Power Amplifiers

SIZE COMPARISON

MELF Size = Chip Size

0102 = ■ = 0805

0204 = ■ = 1206

0207 = ■ = 2512

RESISTANCE VALUES

0.1 Ω TO > 10 Ω
FOR 0207

0.22 Ω TO > 10 Ω
FOR 0102
AND 0204



PANEL POTENTIOMETERS: MODEL P11

THE MOST VERSATILE MODULAR PANEL POTENTIOMETER

IN A NUTSHELL

MODULAR PANEL POTENTIOMETER

Various Shaft Designs
Up to 21 available designs
Lengths, diameters, machining, and custom models

Various Bushing Types
Up to 10 different bushing options
Various diameters and lengths

Resistive Module
20 Ω up to 10 M Ω
Up to 7 resistive modules in one P11

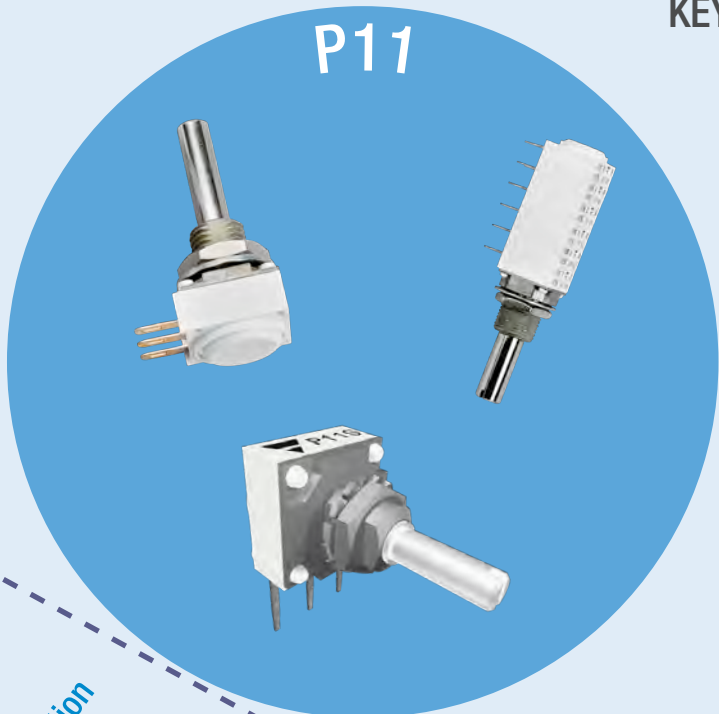
Electrical Laws (Tapers)
Up to 6 different tapers
Most common: linear, log, and reverse log

Sealing Level
IP64
Optional: additional panel and shaft sealing

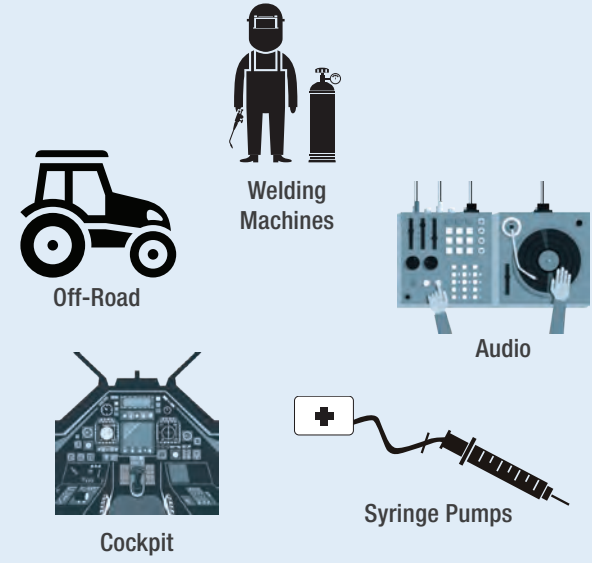
Detent Modules
Higher rotating torque
CW / CCW / Central / up to 21 detents

Mr. Versatile

- Option
- Description
- Comments



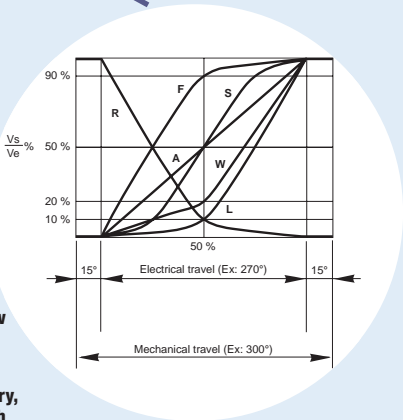
KEY APPLICATIONS



Custom Friendly

- * Resistive module 5 k Ω linear law
- ** Resistive module 10 k Ω logarithmic law
- *** Various switches available: rotary, push-push, and momentary push

Variation Curves



MULTIPLE MODELS

MODEL	SPECIFICITY	MARKETS
P11A*	Low noise and CRV	Audio
P11S & upon request	Genuine model	Avionics
	High torque	Heavy duty vibration
P11P	High dielectric strength	High voltages
P11L	Long life cycles	Heavy duty life
T11	No shaft, knob actuated	PCB mounting

For Technical Questions: sferpottrimmers@vishay.com



UIPMA-UIPMA SERIES

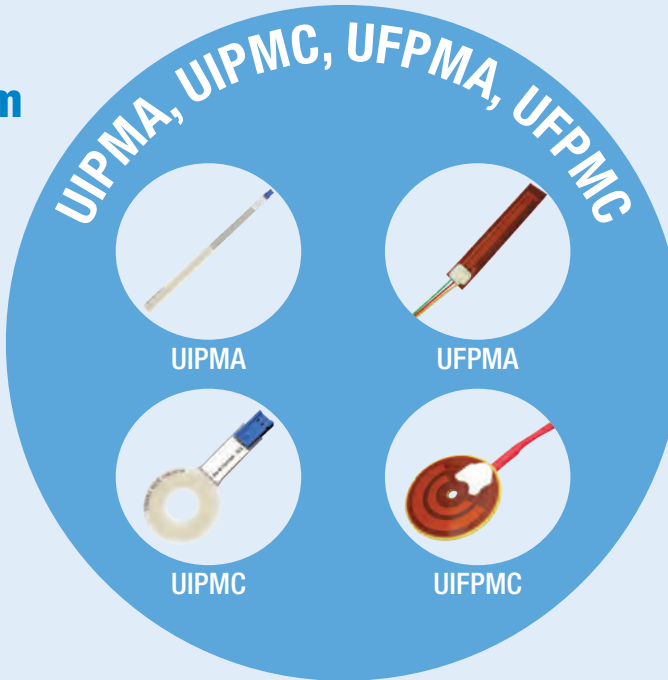
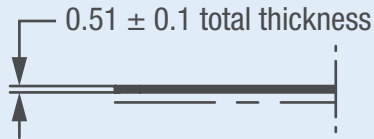
ULTRA THIN, WATERPROOF, EASY TO MOUNT LINEAR AND ANGULAR POSITION SENSORS

IN A NUTSHELL

SPACE SAVING



Thickness of about **0.5 mm**



WATERPROOF



Totally **sealed**

IP66

EASY TO MOUNT

High integration **capacity** by adhesive layer
“**stick and play**”



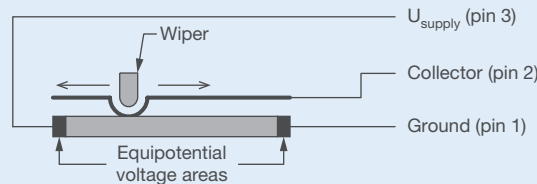
PROVEN RELIABILITY, HIGH DURABILITY



UIPMA **3 M** cycles

UFPMA **25 M** cycles

No direct contact of wiper so **no wearing of the track**



APPLICATIONS



OFF-ROAD



MEDICAL



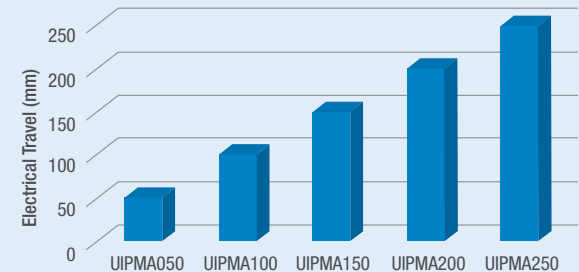
INDUSTRIAL

CUSTOMIZATION

- Output by leads or contacts
- Outdoor version
- Redundant functions
- Version to support pressure variations



PRODUCT PORTFOLIO





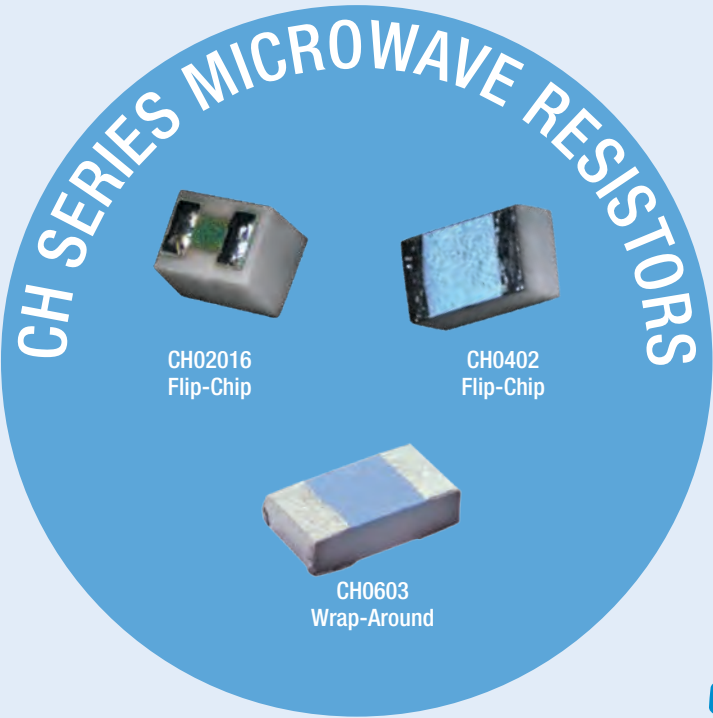
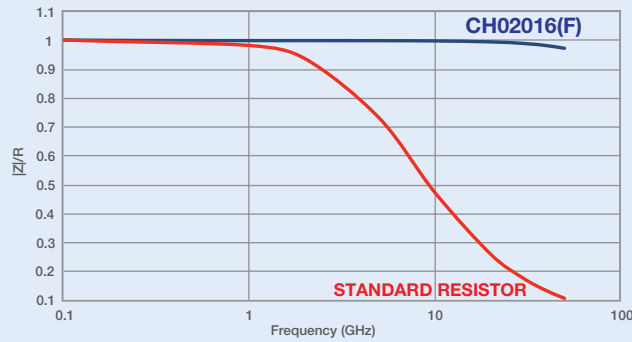
MICROWAVE RESISTORS

WHEREVER A VERY HIGH FREQUENCY IS REQUIRED

IN A NUTSHELL

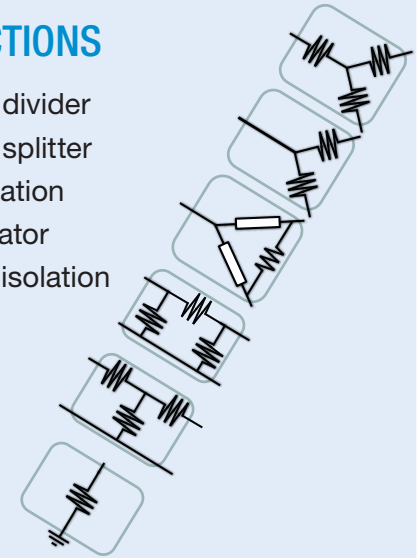
BEST-IN-CLASS FREQUENCY BEHAVIOR

Low internal reactance allows these devices to keep a very good resistor behavior in high frequencies



MAIN FUNCTIONS

- Power divider
- Power splitter
- Termination
- Attenuator
- Signal isolation
- Load



COMPETITIVE ADVANTAGES

- HIGH FREQUENCY PERFORMANCE UP TO 50 GHZ**
- 02016, 0402, AND 0603 SIZES AVAILABLE**
- ALL SIZES AVAILABLE IN TAPE AND REEL PACKAGING**
- SINGLE-SIDE TERMINATION (FLIP-CHIP) AVAILABLE**
- LARGE RESISTANCE RANGE FROM 10 Ω TO 500 Ω**

FOOTPRINT

Shown at 5x Size (mm)	Actual Size
CH02016	·
CH0402	·
CH0603	·

APPLICATIONS



Connected Car



5G Base Stations and Small Cells



Internet of Things (IoT)



RF and Microwave Test Systems



ULTRA PRECISION THIN FILM RESISTORS

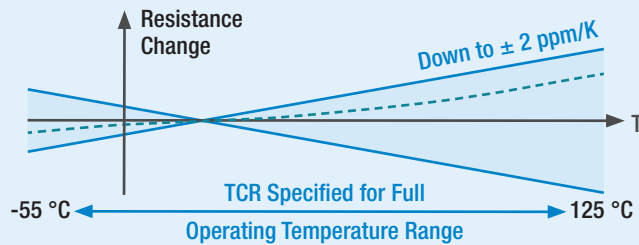
FOR HIGH ACCURACY OVER LIFETIME

ULTRA PRECISION

Tight Tolerance
down to

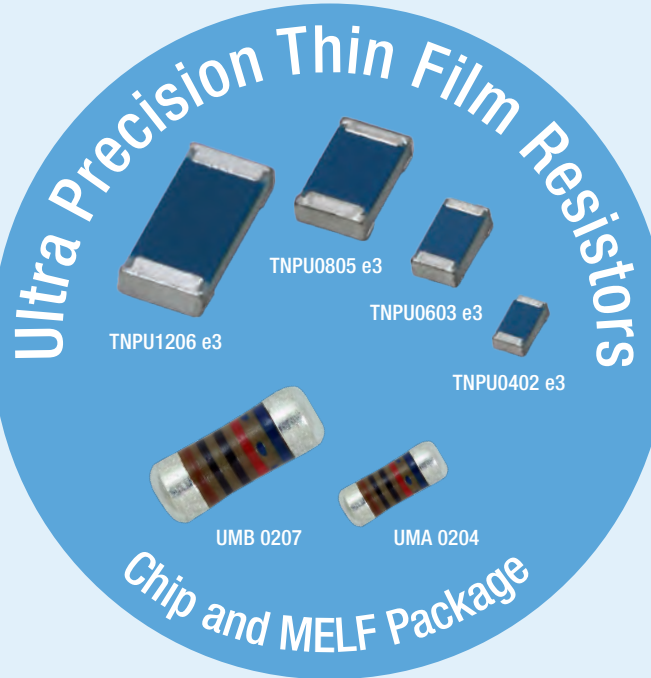
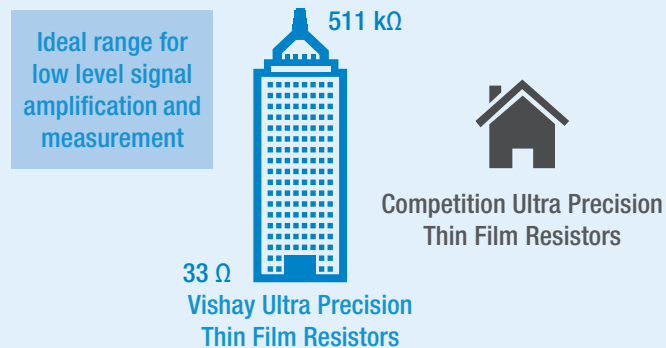


Low Temperature Coefficient

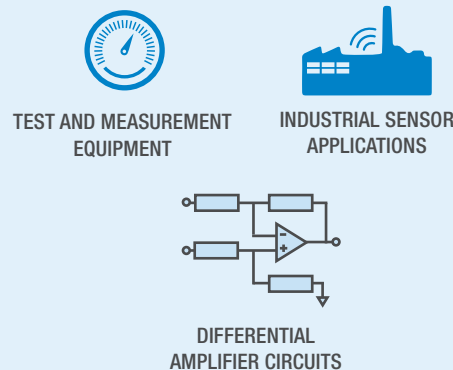


BROAD RESISTANCE RANGE

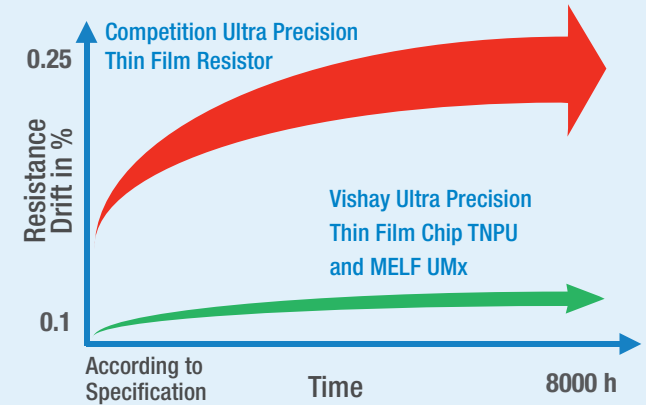
for TCR ± 5 ppm/K



APPLICATIONS

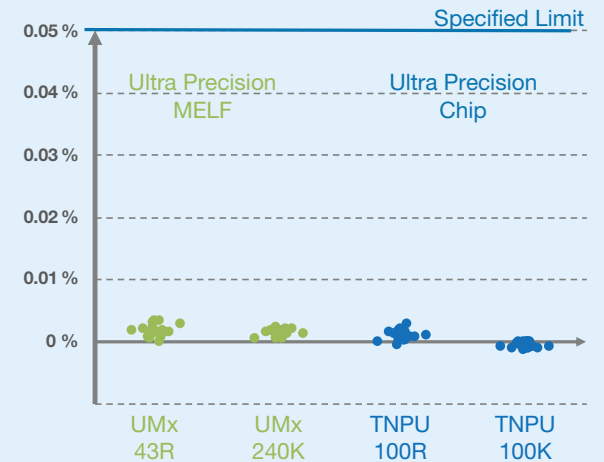


EXCELLENT LONG TERM STABILITY



TYPICAL CHANGE OF RESISTANCE

after 1000 h at rated dissipation P_{70}



melf@vishay.com
thinfilmchip@vishay.com



ROTATIONAL ABSOLUTE MAGNETIC ENCODERS

VERY HIGH ACCURACY, RESOLUTION, AND ROBUSTNESS

Not sensitive to moisture and pollution



Not sensitive to external magnetic fields and offer a large temperature range

From -40 °C up to 105 °C

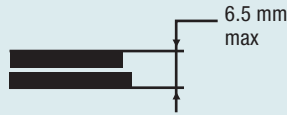


SAVE SPACE, SAVE WEIGHT

THICKNESS



about 6.5 mm



DIAMETER

from 27 mm to 90 mm

WEIGHT

RAMK060 < 55 g

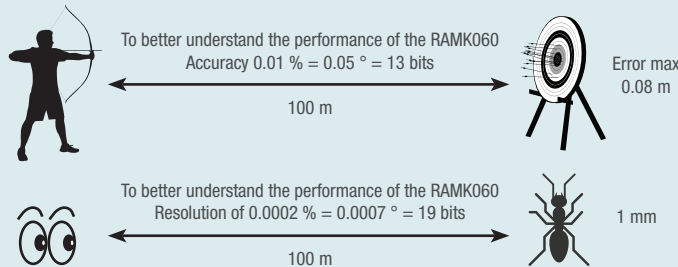
TOTALLY PLUG AND PLAY

No calibration needed



HIGH ACCURACY, HIGH REPEATABILITY, HIGH RESOLUTION

REAL / PHYSICAL RESOLUTION



For Technical Questions: mcbsprecisionpot@vishay.com

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IN A NUTSHELL

APPLICATIONS

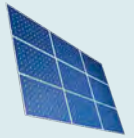
ROBOTIC / AGV



AERONAUTIC MILITARY



WINDMILLS / SOLAR PANELS

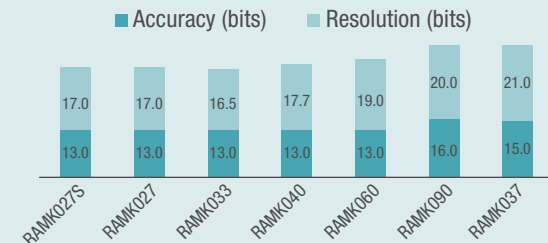


CUSTOMIZATION



- Output SPI, SSI, Biss-C single turn or multi-turns
- Kit variant (RAMK) and body variant (RAME)
- Redundant functions
- Reinforced design for harsh conditions (EMC, ESD protection...)

PRODUCT PORTFOLIO



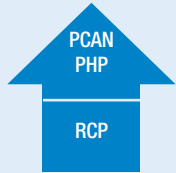


HIGH POWER RESISTORS

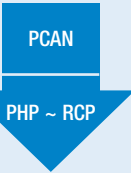
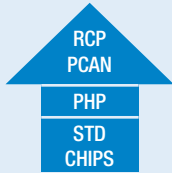
RCP / PHP / PCAN

IN A NUTSHELL

HIGH PRECISION



POWER RATING

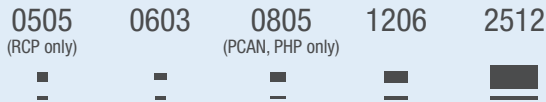


COST

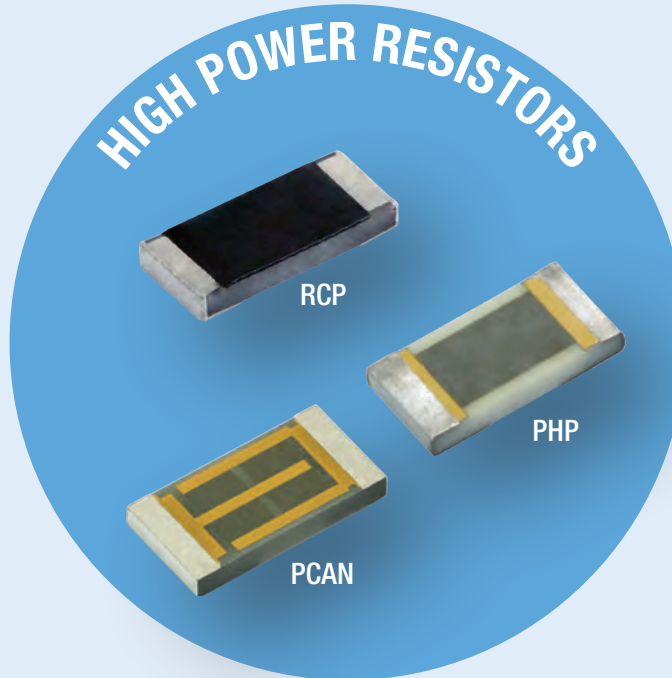
REDUCES COMPONENT COUNT AND PCB AREA



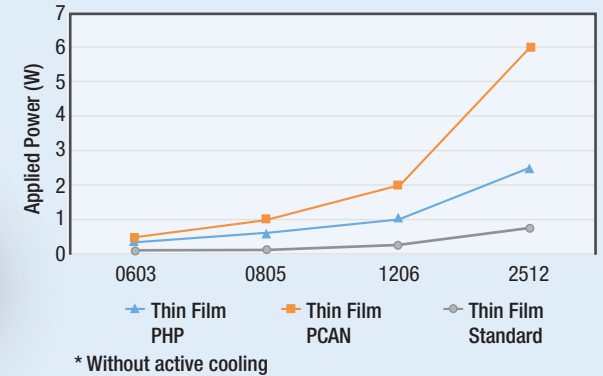
FOOTPRINT AND PROFILE CAPABILITY



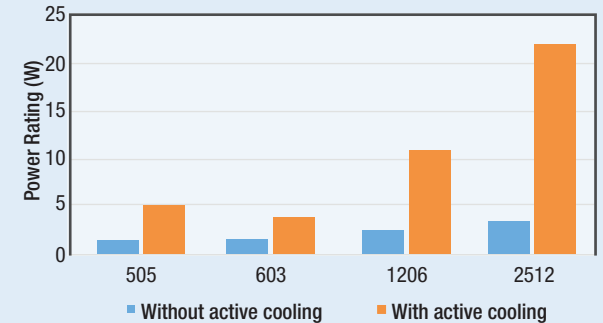
Shown at actual size (when viewed or printed at 100 %)



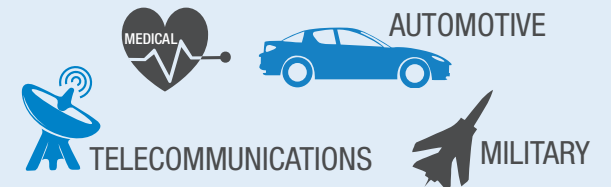
PHP AND PCAN THIN FILM RESISTORS RATED POWER AT 70 °C



RCP (AlN) THICK FILM CHIP RESISTOR POWER RATING



APPLICATIONS



	TECHNOLOGY	SUBSTRATE	RESISTANCE	ADVANTAGE
RCP	Thick Film	Aluminum Nitride	10 Ω to 2 kΩ	• High frequency
PCAN	Thin Film	Aluminum Nitride	2 Ω to 30 kΩ	• Tighter TCR • Tighter tolerance
PHP	Thin Film	Alumina	10 Ω to 30 kΩ	• Tighter TCR • Tighter tolerance

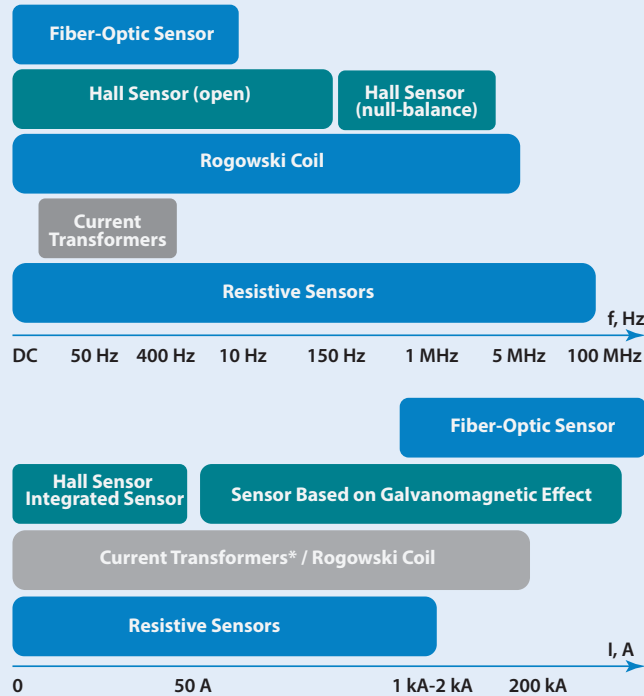


POWER SHUNTS

BATTERY AND METER CURRENT SENSE RESISTORS

IN A NUTSHELL

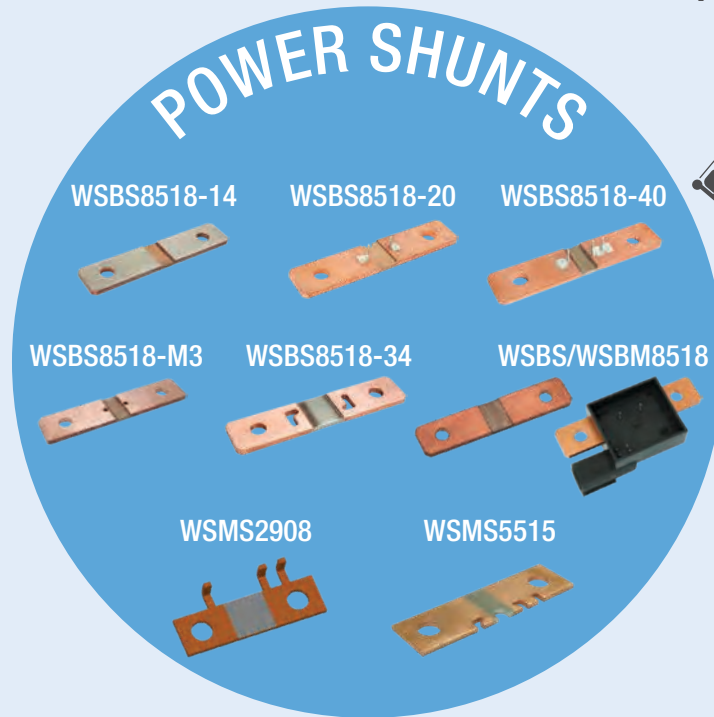
THE GENERAL APPLICATION AREAS OF THE VARIOUS CURRENT SENSORS



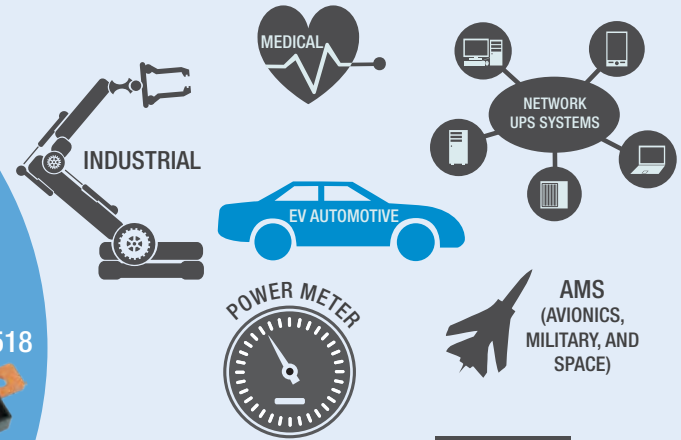
* For alternative current only

- #### Features
- High power (up to 36 W)
 - Pulse performance (> 1 kA)
 - Stabilization available for low ΔR
 - Not ESD-sensitive

- #### Custom Options
- Plated terminals
 - Sense pins
 - Shapes / sizes
 - Molded body / connectors
 - Improved RTC / thermal EMF alloys available

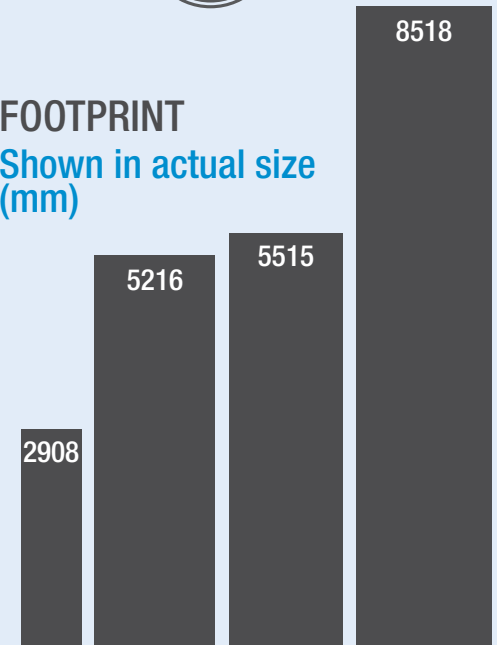


APPLICATIONS



FOOTPRINT

Shown in actual size (mm)



For Technical Questions: ww2cresistors@vishay.com

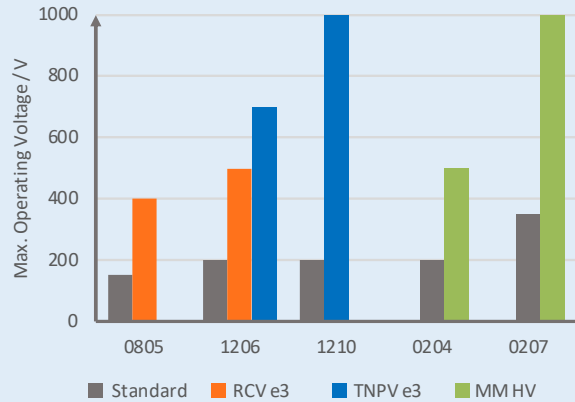


HIGH VOLTAGE SMD RESISTORS

FOR VOLTAGE SENSING CIRCUITS

IN A NUTSHELL

VOLTAGE HANDLING



High Voltage Film Resistors

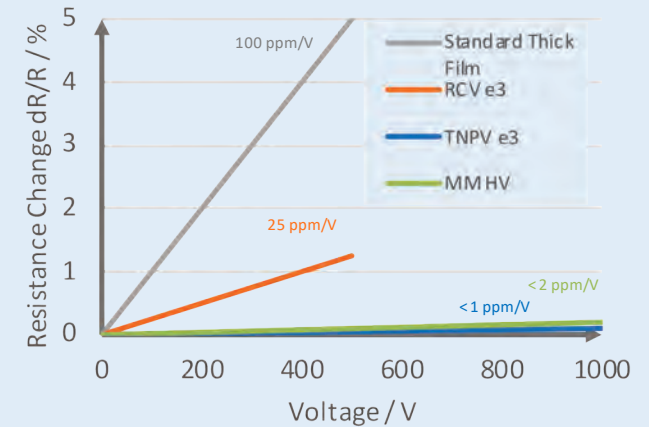
INDUSTRY FIRST

AUTOMOTIVE GRADE

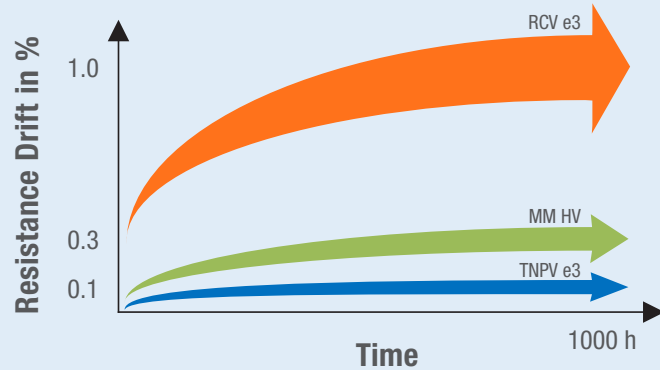
Chip and MELF Packages

LOW VOLTAGE COEFFICIENT OF RESISTANCE

VCR < 2 ppm/V for thin film technology



EXCELLENT LONG TERM STABILITY



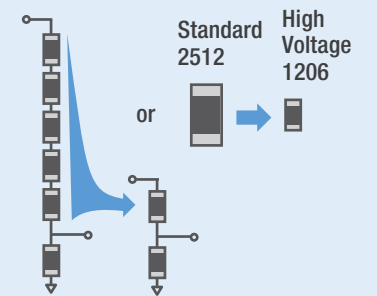
WIDE APPLICATION RANGE

- RCV e3** Standard Applications
- MM HV** High Power and Pulse, Precision Applications
- TNPV e3** High Precision Applications

APPLICATIONS

- EV / HEV Battery Management
- Power / Frequency Inverters
- Test and Measurement Equipment

Cost Savings in High Voltage Dividers

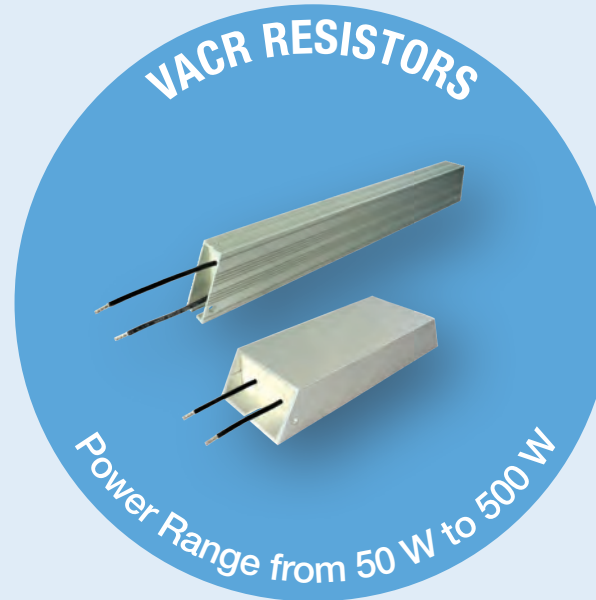




ALUMINUM-HOUSED COMPACT POWER RESISTORS FOR HIGH POWER AND PULSE LOAD APPLICATIONS

IN A NUTSHELL

	VACR	WIREWOUND	POWER THICK FILM
Power	500 W	500 W	500 W
Size			
Energy	++	+++	+
TCR	+++	+++	++
Short Time Overload	+++	+++	++
Dielectric Strength	++	+	+++
Cooling	No cooling needed	No cooling needed	Liquid cooling

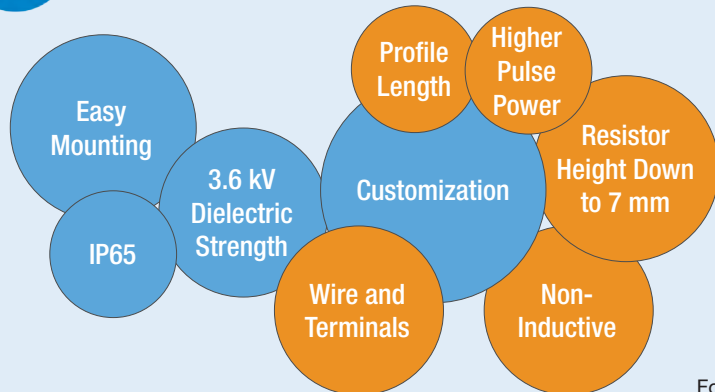


APPLICATIONS

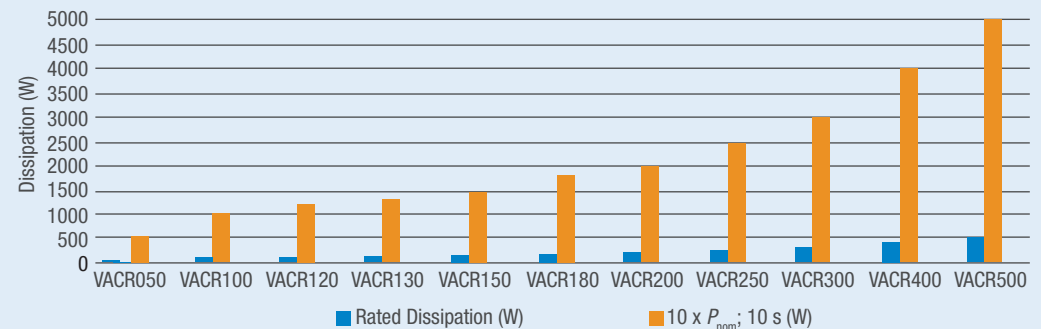


- ✓ Industrial motor drives
- ✓ Frequency inverters
- ✓ Solar inverters
- ✓ Industrial robots
- ✓ UPS

HIGHLY CUSTOMIZABLE



RATED DISSIPATION AND OVERLOAD





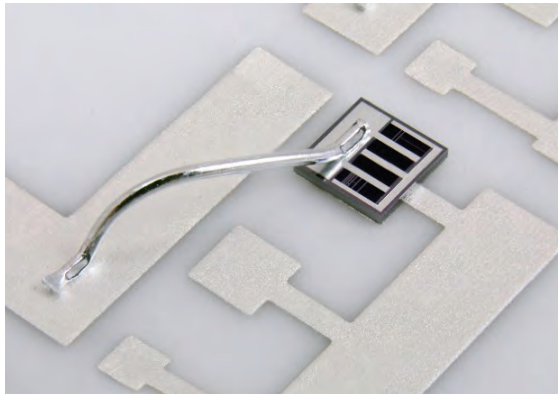
HIGH POWER, BACK-CONTACT, THIN FILM RESISTOR

WIRE BONDABLE SILICON CHIP RESISTOR

SNAPSHOT

APPLICATIONS

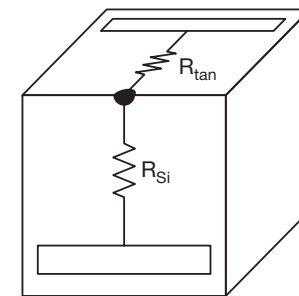
- Gate resistor for IGBT-based power converters
- Current limiting for LED lighting
- High power
- Alternative energy
- Hybrid assemblies



FEATURES

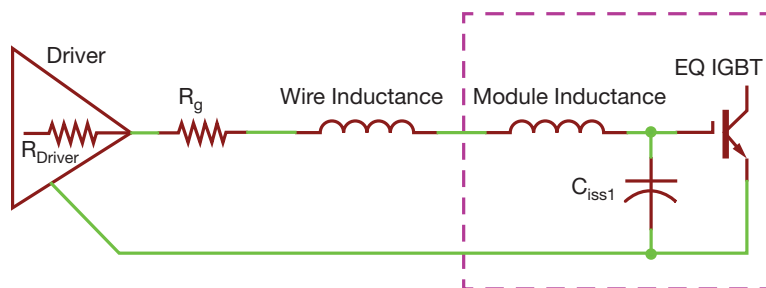
- Low inductance
- Only one wire bond required – up to 6 mils diameter
- Moisture-resistant
- Small size

BACK CONTACT SCHEMATIC



$$R_{total} = R_{tan} + R_{Si}$$

SIMPLIFIED ELECTRICAL MODEL OF THE CIRCUIT



POWER RATING COMPARISONS

Part Type	Case Size	Power Rating
Thin film wire bondable, back-contact resistor on silicon	0808	Up to 4 W
Thin film surface-mount resistor on AlN	2512	Up to 6 W
Thick film chip resistor on AlN	2512	3.5 W



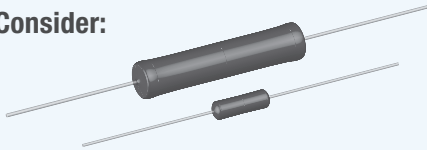
WIREWOUND RESISTORS | SNAPSHOT

Wirewound resistors perform exceptionally well in current sensing and high pulse applications. Vishay Dale has a long history of manufacturing onboard through-hole wirewound resistors. This single-page snapshot highlights various options and features of Vishay Dale onboard through-hole resistors.

COMMERCIAL

- Wide resistance range
- 5 % and 10 % tolerance
- Lowest cost option

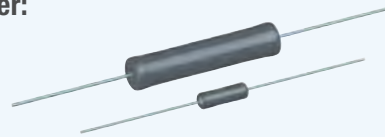
Model to Consider:
CW



INDUSTRIAL

- Wide resistance range
- High power in a small package
- Wide tolerances, including precision
- Non-inductive versions available
- Fully customizable to meet customer drawing requirements

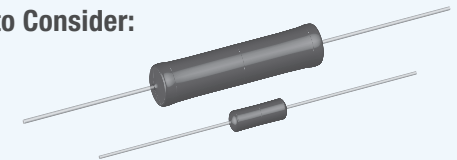
Models to Consider:
G / GN
RS / NS



MILITARY

- Established reliability and non-established reliability options available
- Precision tolerance
- Usually high cost

Models to Consider:
RWR
RW



VISHAY DALE WIREWOUND RESISTOR ADVANTAGES:

- High pulse performance
- Wide resistance values
- High temperature coating (to 350 °C)
- Tolerance as low as 0.05 %
- Customizable to meet customer application requirements
- High reliability options available
- Non-inductive options available
- RoHS-complaint without exemption
- Not ESD sensitive

RS / CW

G SERIES

Miniature series is up to 50 % smaller and > 50 % lighter than the RS / CW series

APPLICATIONS



INDUSTRIAL



CONSUMER



AUTOMOTIVE



MILITARY



TELECOMMUNICATIONS



MEDICAL

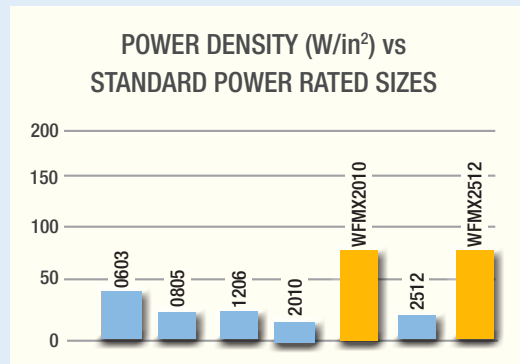


CURRENT SENSE RESISTORS

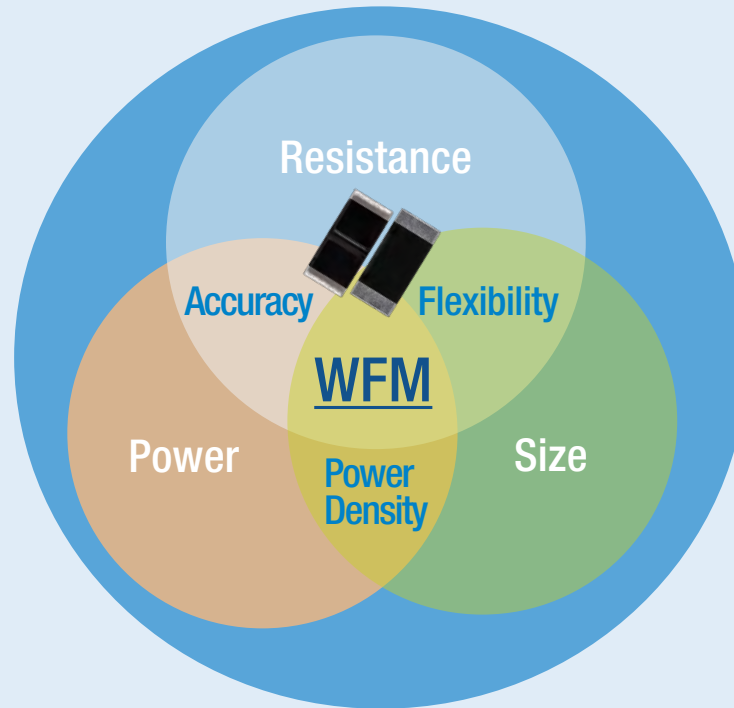
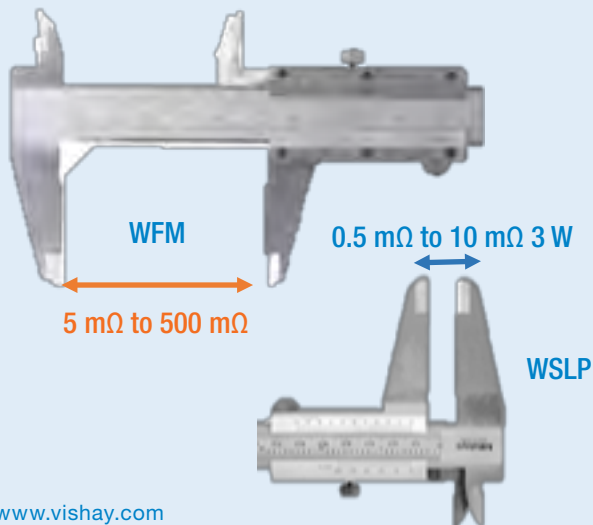
HIGH POWER AND WIDE RESISTANCE RANGE

HIGHER POWER DENSITY

Higher resistance values (up to 0.5 Ω) enables a single high power resistor to replace multiple devices in series. Saves PCB board space and reduces measurement errors.



WIDER RANGE



ADVANTAGE

All metal construction provides lower CTE mismatch with PCB as compared to ceramic.

- Lowers solder joint stress
- Improves reliability

Higher resistance values in a single high power resistor can replace multiple series devices at lower ohmic values.

- Reduces measurement errors
- Saves PCB space
- Reduces solder joint reliability issues



POWER METAL PLATE™ CURRENT SENSE RESISTOR

- Power Metal Plate™ current sense element provides superior pulse performance and superior pulse tolerance
- Low resistance values; minimizes power loss and prevents parallel resistance elements
- Low TCR; better temperature stability
- Tight tolerance; improves measurement accuracy

FOOTPRINT

Shown at actual size



APPLICATIONS



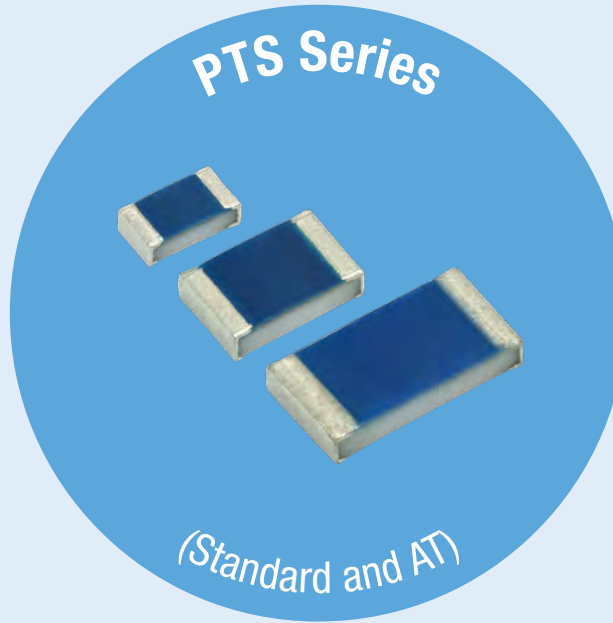


PTS SURFACE-MOUNT PT THIN FILM RTD

LINEAR POSITIVE TEMPERATURE COEFFICIENT ELEMENT

COMPLIANCE TO STANDARDS

- AEC-Q200 qualification
- ESD HBM 0.5 kV (0603);
1 kV (0805 / 1206)
- RoHS-compliant
- Halogen-free
- Whisker-tested per JEDEC 22A121.01

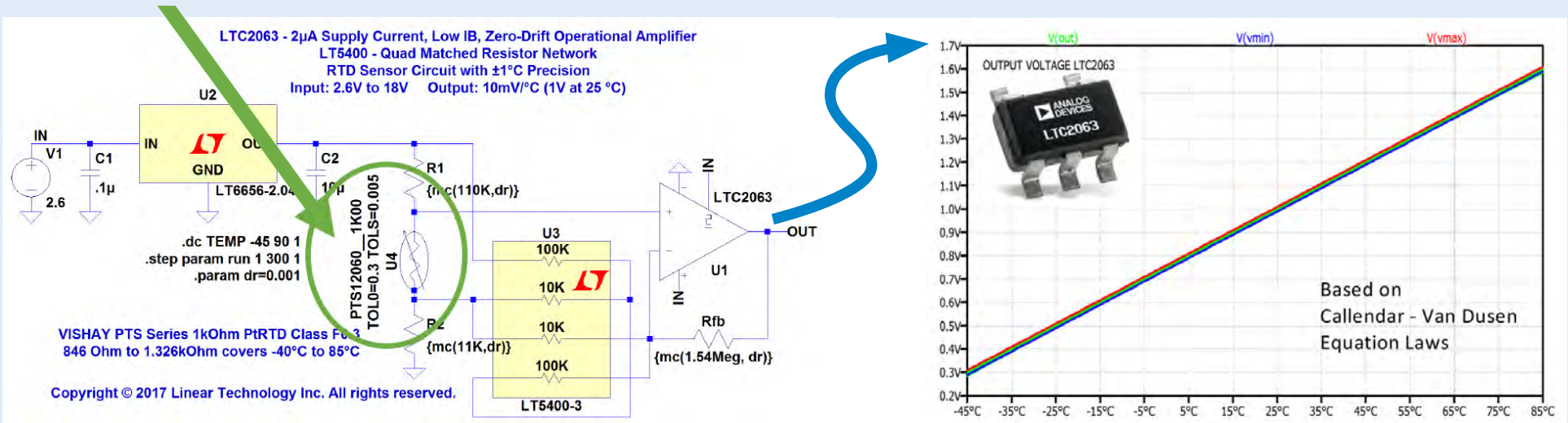


MULTIPLE DESIGN TOOLS AVAILABLE

- LTspice® models with Monte Carlo tolerances available (online)
- PSpice® models available (online)
- VHDL-AMS models available (on SystemVision® Cloud website)

TEMPERATURE SENSING / CONTROL / PROTECTION / COMPENSATION

PTS1206 Class F0.3





COMPACT PANEL POTENTIOMETER

WITH INTEGRATED KNOB

IN A NUTSHELL

ADVANTAGE 1: INTEGRATION

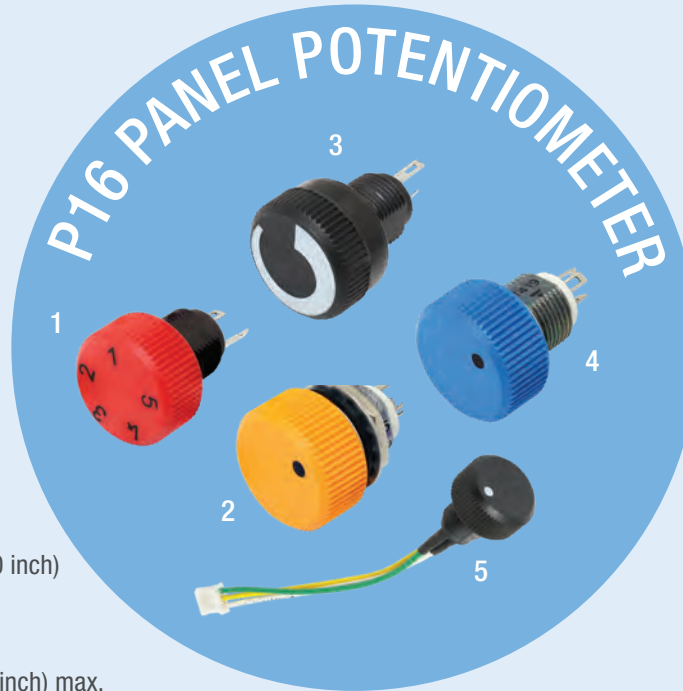
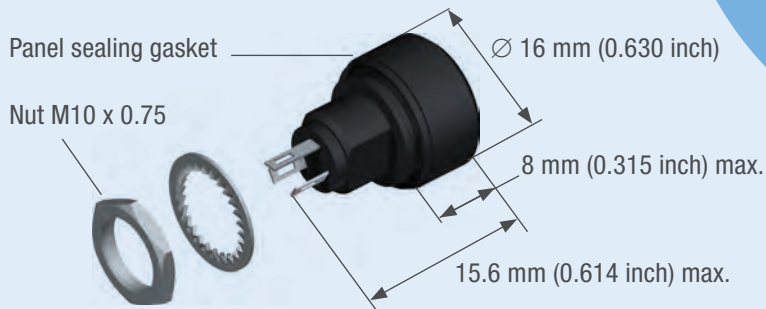
Integrated knob avoids need to assemble two parts and improves ergonomics

2 in 1



ADVANTAGE 2: SPACE OPTIMIZATION

Very small overall dimensions



APPLICATIONS

- Network communication systems
- Night vision goggles



- Audio headset communication



- Remote controls
- Hot air blowers
- Spotlights for scenes
- Air fan controls
- Industrial dashboards



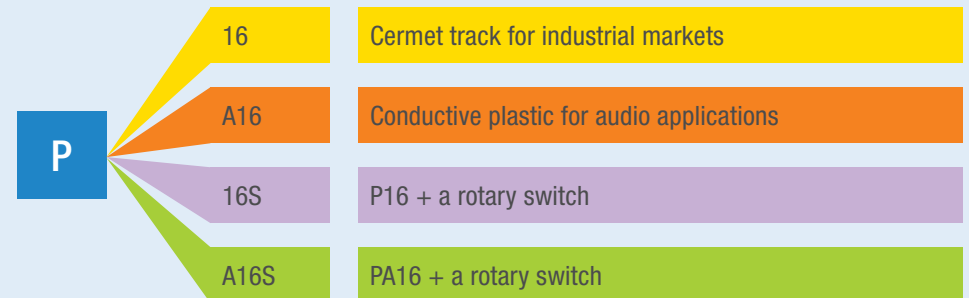
- Variable frequency drives



- Electric wheelchairs



ALL DESIGNS AVAILABLE



AVAILABLE CUSTOM FEATURES

- Custom knob upon request: color, marking, etc. (1, 2, 3, 4)
- Available taper: linear, logarithmic, and reverse log
- Clearance required behind panel is extremely limited
- Model sealed per IP67
- Cable harness and connector upon request (5)
- Knob material: metallic or plastic (3, 5)