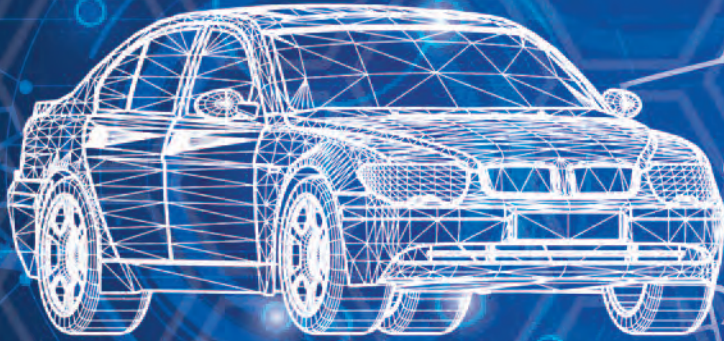




passive  
components  
**SELECTION GUIDE**

**KOA**<sup>®</sup>  
KOA SPEER ELECTRONICS, INC.



# From Concept to Reality

Our wide range of passive component solutions will help you make the leap

Whether you're designing the car of tomorrow or connecting the Internet of Things, you need cutting-edge product solutions to bring your design to fruition. At KOA Speer, we're the ideal partner to help you do just that. Our constantly expanding line of passive components will give you the solution to make your concept a reality!

## Quality 1<sup>st</sup>



You expect product quality from any component that makes it into one of your designs. But in today's competitive global marketplace, much more to the quality equation. At KOA Speer, our Quality 1st initiative reinforces our organization wide focus on serving you at the highest possible level.



Our commitment to quality in everything we do is paying off... in the past two years we've received ten major customer quality awards. We're the industry's most recognized and awarded supplier for achieving the highest product quality, on-time delivery and responsive customer service.

**ISO 9001:2015 IATF16949:2016**

# KOA SPEER... More Than Just Resistors

PAGES **4-7**



## Resistors

Precision • Surge • Wide Terminal  
High Voltage • Thin Film  
High Temperature • Embedded • General Purpose  
Networks • Anti-Sulfur • Fusing • Melf

PAGES **8-9**



## Low Resistance Current Sense/Shunts

Metal Plate • Thick Film • Power Shunt  
Molded • Wide Terminal

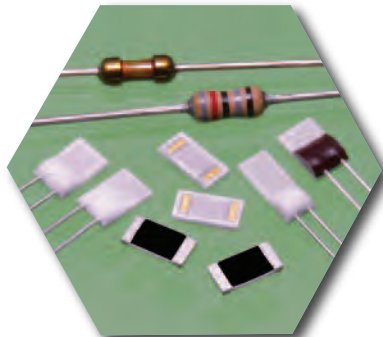
PAGES **10-12**



## Leaded Resistors

General Purpose Carbon Film  
Precision Metal Film • High Voltage • Power  
Wirewound • Current Sense • Networks  
Fusing • Jumpers

PAGES **13-14**



## Thermistors/Thermal Sensors

Platinum Thin Film  
Thin Film Linear PTC  
NTC Thermistors • PTC Thermistors

PAGE **15**



## Fuses

Thin Film • Automotive • Anti-Pulse  
Fast Blow • Anti-Surge

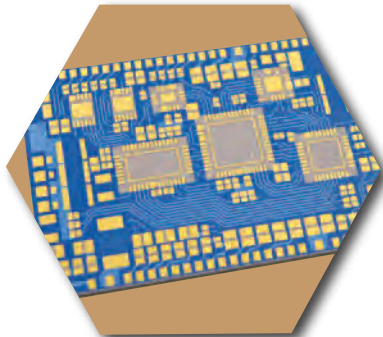
PAGE **15**



## Varistors

Chip Varistors • Automotive Varistors

PAGE **16**



## LTCC Substrates

LTCC Substrates • Hybrid IC

PAGE **16-18**



## Other Products

Check Terminal • Lab Kits

# RESISTORS

## Precision Thick Film

### RS73-Ultra Precision High Reliability Thick Film NEW

- Excellent anti-sulfur characteristics (see page 7)
- Excellent long-term stability with  $\Delta R$  of  $\pm 0.2\%$  0.125W (0402)
- Power rating: 0.2W (0603), 0.25W (0805), 0.33W (1206)
- Low TCR:  $\pm 25\text{ppm}/^\circ\text{C}$ ,  $\pm 50\text{ppm}/^\circ\text{C}$
- Tolerance:  $\pm 0.1\%$ ,  $\pm 0.25\%$ ,  $\pm 0.5\%$ ,  $\pm 1\%$
- Resistance range: 10 ~ 10M $\Omega$

### RK73G High Precision Thick Film

- Excellent anti-sulfur characteristics (see page 7)
- TCR:  $\pm 50\text{ppm}/^\circ\text{C}$
- Resistance range: 10 ~ 1M $\Omega$
- Tolerance:  $\pm 0.25\%$ ,  $\pm 0.5\%$ ,  $\pm 1\%$
- Sizes available: 0201 ~ 1206

## Surge Current Thick Film

### SG73G Endured Pulse Power

- Excellent anti-sulfur characteristics (see page 7)
- Ultra precision grade, high power
- TCR:  $\pm 50\text{ppm}/^\circ\text{C}$
- Resistance range: 10 ~ 1M $\Omega$
- Sizes: 0603 ~ 1206
- Tolerance:  $\pm 0.25\%$ ,  $\pm 0.5\%$

### SG73 Pulse/Surge

- Excellent anti-sulfur characteristics (see page 7)
- Superior to RK73 series in surge/pulse withstanding voltage
- Resistance range: 1 ~ 1M $\Omega$
- Sizes available: 0603 ~ 2512
- Tolerance:  $\pm 10\%$ ,  $\pm 20\%$

### SG73P Precision Pulse

- Excellent anti-sulfur characteristics (see page 7)
- Provides higher pulse ratings than standard RK73
- Resistance range: 1 ~ 10M $\Omega$
- Sizes available: 0402~1210
- Tolerances:  $\pm 0.5\%$ ,  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$

### SG73S Surge Protection

- Excellent anti-sulfur characteristics (see page 7)
- Endures high ESD limiting voltage
- Resistance range: 1 ~ 10M $\Omega$
- Sizes available: 0402~1210
- Tolerances:  $\pm 0.5\%$ ,  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$



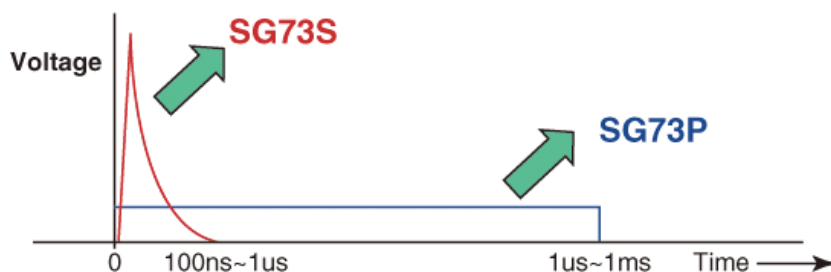
## Excellent Surge & Pulse Withstanding Voltages

### ◆ Surge overload

High peak voltage, short duration  
Ex.: CR discharge, ESD surge

### ◆ Pulse overload

Higher power than rated power, lower voltage than surge is applied for long time.  
Ex.: Gate resistors of FET



## Wide Terminal Thick Film

### WG73 Surge Current Wide Terminal

- Superior to WK73 in pulse withstanding voltage
- Power rating: 1W (0612), 1.5W (1020), 2W (1225)
- Resistance range: 560m ~ 1k $\Omega$
- Tolerance:  $\pm 10\%$ ,  $\pm 20\%$

### WK73R Wide Terminal

- Excellent anti-sulfur characteristics (see page 7)
- Offers excellent heat dissipation & achieves high rated power
- Power rating: 0.33W (0204), 0.5W (0306), 1W (0508)
- Higher power rating: 1.5W (0612), 2W (1020), 3W (1225)
- Sizes available: 0204 ~ 1225
- Resistance range: 10 ~ 1M $\Omega$

Wide Terminal Type (WK73) Heat Dissipation Image



Nominal Terminal Type (RK73) Heat Dissipation Image



## High Voltage

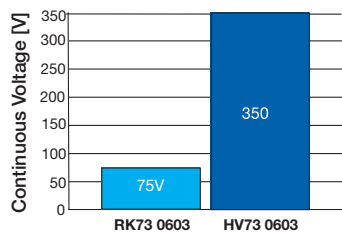
### HV73-High Voltage

- Excellent anti-sulfur characteristics (see page 7)
- Maximum working voltage as high as 800V (1206), 3000V D.C. (2512)
- Superior to RK73 in maximum working voltage
- Resistance range: 10k ~ 100MΩ
- Sizes: 0603 ~ 2512

### HV73V-High Voltage for Automotive

- Excellent anti-sulfur characteristics (see page 7)
- AEC-Q200 Tested
- Maximum working voltage as high as 800V (1206)
- Superior to RK73 in maximum working voltage
- Resistance range: 10k ~ 51MΩ
- Sizes: 0603 ~ 1206

Use Fewer Resistors for High-Voltage



- Anti-Sulfuration Version - HV73RT - Only company to offer High Voltage resistor with sulfur proof terminations

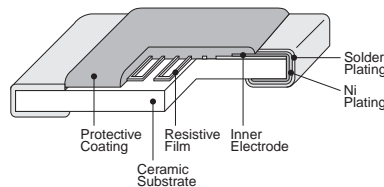
## Thin Film

### RN73R-High Reliability Thin Film

- Improved moisture resistance with high humidity coating
- High precision tolerance:  $\pm 0.05\% \sim \pm 1\%$
- High performance TCR:  $\pm 5 \sim \pm 100\text{ppm}/^\circ\text{C}$
- Resistance range: 10 ~ 1.5MΩ
- Sizes: 0402 ~ 1210
- AEC-Q200 Tested

### RN73H-Thin Film for Automotive

- Improved moisture resistance by special gloss protective coating
- High stability  $\Delta R = 0.1\%$  after 3,000 hrs
- High precision tolerance:  $\pm 0.05\% \sim \pm 1\%$
- High performance TCR:  $\pm 5 \sim \pm 100\text{ppm}/^\circ\text{C}$
- Resistance range: 10 ~ 1.5MΩ
- Sizes: 0402 ~ 1210
- AEC-Q200 Tested



### RTX-Thin Film Network

- Resistance range: 51 ~ 40kΩ
- Power rating: 50mW ~ 200mW
- TCR:  $\pm 25, \pm 50, \pm 100\text{ppm}/^\circ\text{C}$

### RTY-Precision Voltage Divider Thin Film

- Ratio matching
- TCR:  $\pm 10, \pm 25, \pm 50, \pm 100\text{ppm}/^\circ\text{C}$
- TCR tracking: 5, 10, 25, 50ppm/°C
- Package power rating: 0.2W



### CNN-Thin Film Chip Network

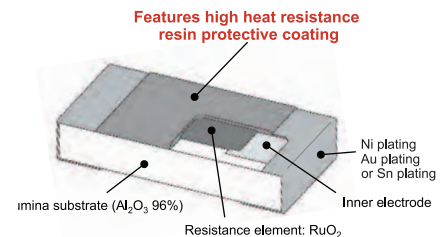
- Excellent relative TCR (5ppm/°C)
- Pair resistors for high precision OP-amplifiers
- Custom products: any pairs between 1K ~ 100kΩ available upon request

## High Temperature



### HSG73P-High Temperature Gold Terminations

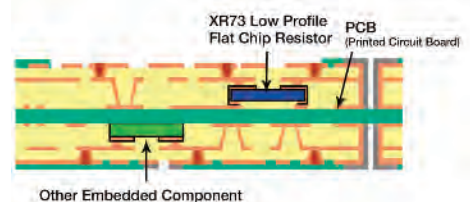
- High heat resistance that can be used even at high temperatures of 155°C or higher. The maximum operating temperature of Sn plating products compatible with solder mounting is 175°C, and Au plating products compatible with conductive glue mounting is 200°C.
- Metal glaze thick film ensures excellent heat and weather resistance
- Resistance range: 1 ~ 10MΩ
- Sizes available: 0402 ~ 1206
- AEC-Q200 Tested



## Embedded

### XR73-Embedded Flat Chip Resistor

- Interlayer embedding in the multilayer substrates applicable from the height of 0.13 to 0.14mm
- Cu via hole connection is applicable
- Resistance range: 1 ~ 10MΩ, zero ohm offered
- Sizes available: 0201, 0402



## General Purpose

### RK73B-General Purpose 2%, 5% Tolerance Thick Film Chip Resistor

- Excellent anti-sulfur characteristics (see page 7)
- Passes ASTM-809 anti-sulfuration testing

### RK73G-Ultra Precision 0.25%, 0.5%, 1% Tolerance Thick Chip Resistor

- Excellent anti-sulfur characteristics (see page 7)

### RK73H-Precision 0.5%, 1% Tolerance Thick Film Chip Resistor

- Excellent anti-sulfur characteristics (see page 7)
- Passes ASTM-809 anti-sulfuration testing

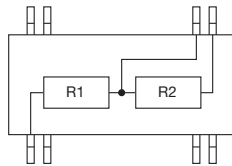
### RK73Z-Zero ohm Jumper Thick Film Chip Resistor

- Excellent anti-sulfur characteristics (see page 7)
- Zero ohm with max. resistance of 50m $\Omega$ , 100m $\Omega$

## Networks

### HVD-High Voltage Divider-Precision Type

- Max. resistance value 51M $\Omega$
- Max. working voltage 1000V
- Max. resistance Ratio 1:1000
- Relative tolerance: 0.1%, 0.25%, 0.5%
- TCR tracking: 10, 25ppm/ $^{\circ}$ C
- TCR:  $\pm$ 10,  $\pm$ 25,  $\pm$ 50ppm/ $^{\circ}$ C
- Absolute resistance tolerance:  $\pm$ 0.1% ~  $\pm$ 1%



### RBA, RBB-Bussed Resistor Network

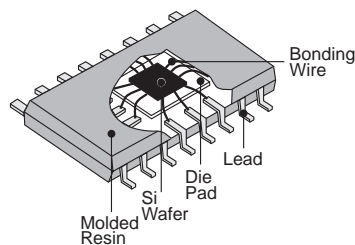
- TCR:  $\pm$ 25,  $\pm$ 50,  $\pm$ 100ppm/ $^{\circ}$ C
- Resistance range: 10 ~ 100k $\Omega$
- Absolute tolerance:  $\pm$ 1% ~  $\pm$ 5%

### RNX-High Precision Custom Resistor Network

- Number of pins: 8, 14, 16, 20, 24
- Resistance range: 10 ~ 510k $\Omega$
- TCR tracking: 5, 10, 25, 50ppm/ $^{\circ}$ C

### RIA-Isolated Resistor Network

- Number of pins: 8, 14, 16, 20, 24
- Absolute tolerance:  $\pm$ 0.1% ~  $\pm$ 5%
- TCR tracking: 5, 10, 25, 50ppm/ $^{\circ}$ C



## Fusing Resistors

### RF73-Fusing Resistor Performs Like RK73 under normal conditions

- Fuses when overloaded
- Fusing Power: 1.75W ~ 6.5W
- Fusing Time: 60 seconds, maximum
- Sizes available: 0603 ~ 2512

## Melf Resistors

### CC, RD41-Fixed Carbon Film MELF Resistor

- Metal plated terminals
- Power Rating: 0.25W (RD41)
- Current rating: 5A (CC)

### RN41-Fixed Metal Film MELF Resistors

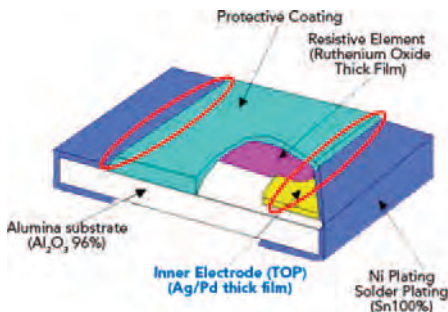
- Higher stability in short and long term tests
- TCR:  $\pm$ 25 ~  $\pm$ 50ppm/ $^{\circ}$ C
- Power Rating: 0.4W (1406/0204), 1W (2309/0207)
- Resistance range: 0.22 ~ 5.11M $\Omega$

## Anti-Sulfuration Chip Resistors

### Why Choose Anti-Sulfuration?

Sulfuration is a phenomenon that occurs in most thick film resistors, with silver-based inner electrodes. When a resistor is used in a high-sulfur atmosphere, the sulfur molecules can migrate between the protective film and the outer electrode to the inner electrode, where they react to form silver sulfide. Silver sulfide is an insulator, and the resistance of the device increases toward an open circuit. KOA's product line includes resistors with sulfuration-resistant inner electrodes.

### Structural Chart of Flat Chip Resistor (Standard)



All KOA Speer anti-sulfuration components (-RT) pass EIA-977 Anti-Sulfuration Testing

### Chip Resistor Disconnected by Sulfuration

Needle Crystals of Silver Sulfide ( $Ag_2S$ )



### General Purpose

#### RK73B-RT

- $\pm 2\%$ ,  $\pm 5\%$  General Purpose Flat Chip Resistor
- Power rating: 0.03W (01005), 0.05W (0201), 0.1W (0402), 0.125W (0603), 0.25W (0805), 0.25W (1206), 0.5W (1210), 0.75W (2010), 2W (2512)

#### RK73H-RT

- $\pm 0.5\%$ ,  $\pm 1\%$  High Precision Flat Chip Resistor
- Power rating: 0.03W (01005), 0.05W (0201), 0.1W (0402), 0.125W (0603), 0.25W (0805), 0.25W (1206), 0.5W (1210), 0.75W (2010), 2W (2512)

#### RK73Z-RT

- Zero ohm with max. resistance of 50m $\Omega$

### High Precision

#### RS73-RT

- High reliability with  $\Delta R$  of  $\pm 0.2\%$ ,
- Low TCR:  $\pm 25$ ppm/ $^{\circ}C$
- Power rating: 0.125W (0402), 0.2W (0603), 0.25W (0805), 0.33W (1206)

#### RK73G-RT

- $\pm 0.25\%$  Ultra Precision Flat Chip Resistor
- Low TCR:  $\pm 50$ ppm/ $^{\circ}C$
- Power rating: 0.1W (0402/0603), 0.125W (0805), 0.25W (1206)

### Wide Terminal

#### WK73R-RT/WK73S-RT

- Power rating: 0.75W (0508, 0612), 1W (0508, 0612, 1020, 1218), 1.5W (1225), 2W (1225)

#### WK73R-RT/WK73S-RT

- Higher power rating: 1.5W (0612), 2W (1020), 3W (1225)

### High Voltage

#### HV73-RT

- High Voltage Flat Chip Resistor
- Max working voltage as high as 3000V DC (2512)

#### HV73V-RT

- High Voltage Flat Chip Resistor for Automotive
- AEC-Q200 Tested

### Anti-Surge

#### SG73-RT

- Superior to RK73 series in surge withstanding voltage and pulse withstanding power
- Power rating: 0.1W (0603), 0.125W (0805), 0.33W (1206), 0.5W (1210), 0.75W (2010), 1W (2512)

#### SG73P-RT

- Able to select resistance tolerance from  $+0.5\%$
- Pulse withstanding power
- Power rating: 0.2W (0402), 0.33W (0603), 0.5W (0805), 0.75W (1206), 1W (1210)

#### SG73S-RT

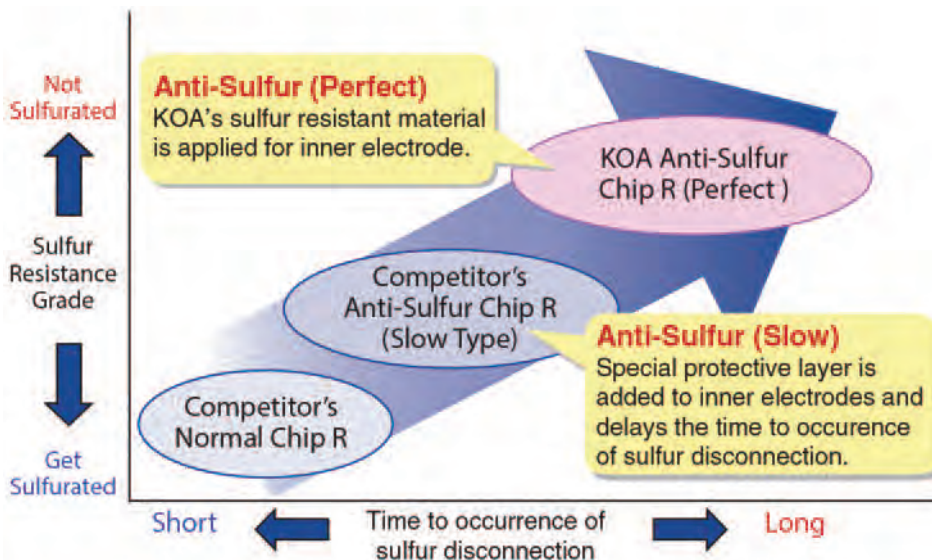
- Surge Precision
- Power rating: 0.2W (0402), 0.33W (0603), 0.5W (0805), 0.75W (1206), 1W (1210)

### Current Sense

#### SR73-RT

- Low Resistance (0.1~10 $\Omega$ )
- Power rating: 0.166W (0402), 0.2W (0603), 0.5W (0805, 1206), 0.66W (1210)

### Anti-Sulfur Performance Comparison



## Metal Plate

### TLR-Current Sensing, Low Resistance

- Power rating: 1W (0805), 2W (2010), 3W (1206), 5W (2512)
- Resistance range: 0.5 ~ 20mΩ
- Ultra-low TCR (+50ppm/°C) available
- Tolerance: ±1%

### TLRH-Current Sensing, Extended Resistance Range, Low Resistance

- Power rating: 0.5W (0805) to 5W (2512)
- Resistance range: 6 ~ 270mΩ
- TCR: ±50, ±75ppm/°C
- Tolerance: ±1%

### TLRZ-Current Sensing, Zero Ohm Jumper

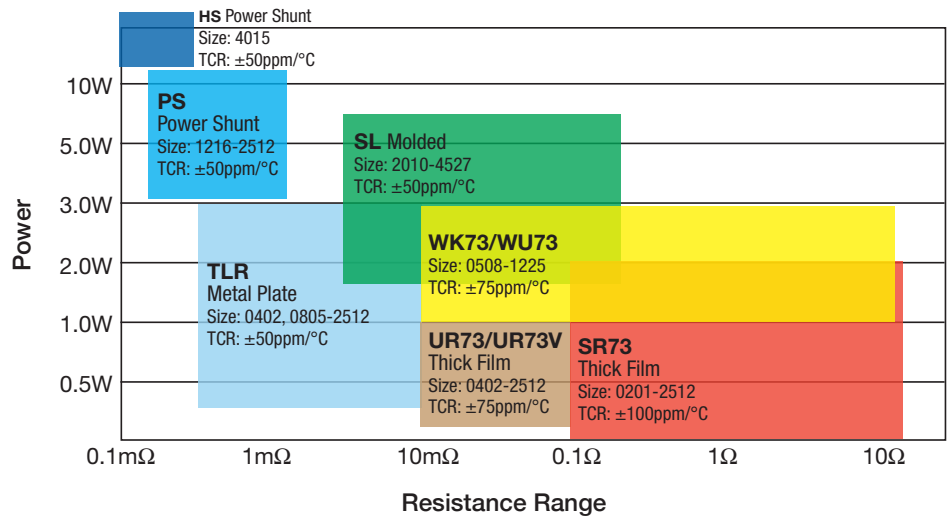
- Current Ratings: 10A (0402), 26A (0603), 31.6A (0805), 50A (1206)
- Ultra low resistance not to exceed 0.5mΩ
- Operating temperature: -65 ~ +170°C

### LR72-Custom Milliohm

- Flexible leads allow for thermal expansion
- Unique open-center shapes for cooler operation
- Resistance values: 2 ~ 8mΩ

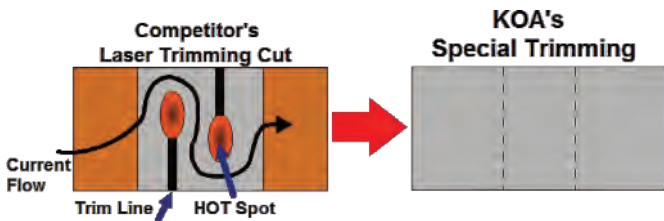


KOA Current Sense Resistor Lineup



## KOA's Metal Plate

LARGE Pulse Capability Due to NO Trim Lines



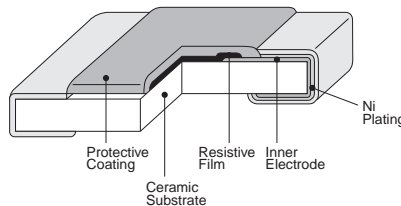
## Thick Film Current Sense

### SR73-Low Resistance

- Excellent anti-sulfur characteristics (see page 7)
- Resistance range: 24m ~ 10Ω
- Power rating: 0.1W (0201), 0.166W (0402), 0.25W (0603), 0.5W (0805, 1206), 0.66W (1210), 0.75W (2010), 2W (2512)
- TCR: Down to 1000ppm/°C
- Tolerance: ±0.5%, ±1%, ±2%, ±5%

### UR73-Low Resistance, Low TCR

- Resistance range: 10m ~ 100mΩ
- TCR: ±100 ~ ±500ppm/°C
- Power rating: 0.125W (0402), 0.25W (0603), 0.33W (0805), 0.5W (1206), 0.75W (2010), 1W (2512)



### UR73V-High Heat, Low Resistance, Low TCR

- Operating temp range: -55°C ~ +155°C
- Resistance range: 10m ~ 100mΩ
- TCR: ±75 available
- Power rating: 0.5W (0805), 1W(1206)
- AEC-Q200 Tested



## Wide Terminal Thick Film

### WK73S-Low Resistance, Wide Terminal

- Excellent anti-sulfur characteristics (see page 7)
- Power rating: 1W (0508, 1218), 1.5W (0612), 2W (1020), 3W (1225)
- Resistance range: 10m ~ 9.76Ω
- Tolerance: ±0.5%, ±1%, ±5%

### WU73-Low Resistance, Wide Terminal

- Power rating: 1.5W (0612)
- Resistance range: 10m ~ 100mΩ
- Tolerance: ±1%
- Low TCR: ±75, ±100ppm/°C

## Power Shunts

### PSL2-Large Current Sensing, Ultra Low Resistance, 2-Terminal

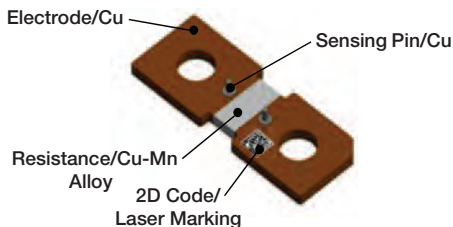
- Resistance range: 0.2, 0.3, 0.5mΩ
- Power rating: 8W, 9W (2512)
- TCR: Down to ±115ppm/°C
- Tolerance: ±1%

### PSF4-Large Current Sensing, Ultra Low Resistance, 4-Terminal, Low TCR

- Resistance range: 0.5, 1mΩ
- Power rating: 3W, 5W (1206)
- TCR: ±50ppm/°C
- Tolerance: ±1%

### HS-Large Current Sensing, Ultra Low Resistance

- Resistance Range: 50μΩ, 100μΩ, 200μΩ
- Power Rating: Up to 50W (1,000A)
- Size: 4015, 4022, 8018, 8022
- Tolerance: ±5%
- TCR: 50±25, 75±50ppm/°C



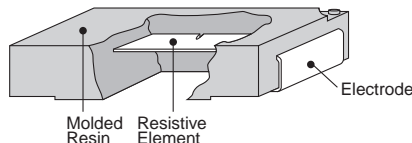
## Molded Plate

### SLR1-High Temperature Resistance **NEW**

- Power rating: 1W (2512)
- Resistance range: 301m ~ 1MΩ
- Tolerance: ±0.5%, ±1%, ±5%
- TCR: ±100ppm/°C

### SL-Current Sensing, Low Resistance

- Power rating: 0.75W (2010), 1W (2512), 2W (4527), 3W (4527)
- Resistance range: 3m ~ 360mΩ
- Tolerance: ±0.5%, ±1%, ±2%, ±5%
- TCR as low as: ±50ppm/°C



### SLN-SLW-Higher Power Current Sensing

- Power rating: 1W (2010), 1.5W (2512), 7W (4527)
- TCR: As low as ±50ppm/°C
- Resistance range: 3 ~ 200mΩ
- Tolerance: ±0.5%, ±1%, ±5%

### TSL-Low Profile Current Sensing

- Power rating: 1W (2512)
- Resistance range: 5 - 100mΩ
- Operating temperature: -55 ~ +180°C
- Tolerance: ±0.5%, ±1%, ±5%

### CSR-Current Sensing, 4-Terminal, Molded

- Power rating: 1W, 2W
- TCR: ±50ppm/°C
- Resistance values: 5 ~ 50mΩ
- Tolerance: ±0.5%, ±1%

### BLR-Ceramic, Custom

- Power rating: 1W, 2W, 15W
- Resistance range: 8m ~ 50mΩ
- Tolerance: ±5%, ±10%



## MWS-Power Type, Wirewound **NEW**

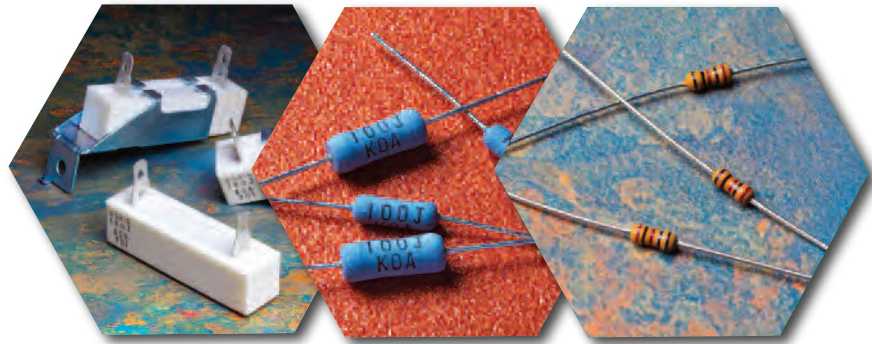
- Power rating: 5W
- Resistance range: 1 ~ 470Ω
- TCR: ±200ppm/°C
- Tolerance: ±5%
- AEC-Q200 Tested

# LEADED RESISTORS

## General Purpose Leaded

### CF-Carbon Film

- Flameproof coating available (CFP)
- Reduced body size offered (CFS, CFPS)
- Resistance range: 1 ~ 5.1M $\Omega$
- Power rating: 0.25W, 0.5W
- Tolerance:  $\pm 2\%$ ,  $\pm 5\%$



## Precision Leaded

### MF-Precision Metal Film

- Meets requirements of MIL-R-22684
- MFS two times the power rating of the standard body type
- Resistance range: 0.51 ~ 5.11M $\Omega$
- Power rating: 0.25W, 0.5W
- Low tolerance:  $\sim \pm 0.5\%$

### MRS-Plate Shaped High Precision Metal Film

- Ultra precision TCR as low as  $\pm 2.5\text{ppm}/^\circ\text{C}$
- Low tolerance:  $\pm 0.01\%$ ,  $\sim \pm 0.5\%$
- Wide resistance range: 10 ~ 1M $\Omega$

### RNS-High Precision Metal Film

- Excellent long term stability in resistance value
- Resistance range: 0.2 ~ 6.8M $\Omega$
- High precision resistance:  $+0.1\% \sim 1\%$
- Power rating: 0.125W, 0.25W, 0.5W, 1W

### SN3A/3D- High Precision

- TCR: As low as  $\pm 50\%$
- Wide resistance range: 10 ~ 1.5M $\Omega$
- Power rating: 1W, 2W

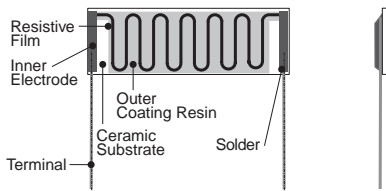
### SNF- Flame Retardant, Fixed Resistor

- TCR:  $+350 \sim -450\text{ppm}/^\circ\text{C}$
- Wide resistance range: 0.47 ~ 100 $\Omega$
- Power rating: 0.25W, 0.5W

## High Voltage Circuit Leaded

### RK92-L-High Voltage SIP Discharge Resistor

- Excellent overload capability and high stability life and aging even in insulating oil
- Thin SIP shape suitable for space saving mounting
- Power rating: 4W
- Resistance range: 1.2 - 16M $\Omega$



### RK92-High Voltage SIP Resistor

- High resistance resistor for high voltage circuits
- Flame retardant coatings corresponding to UL94V-0 are used
- Thick film resistors (Ru02) ensure high stability in life and aging
- Resistance range: 1M ~ 1G $\Omega$
- Up to 15kV

### RK-Metal Glaze Discharge Path Resistors

- TCR as low as  $\pm 100\text{ppm}/^\circ\text{C}$
- Highly stable against environmental conditions and overload
- Power rating: 0.25W, 0.5W, 1W
- RK1/2G: Discharge path resistor UL1676 available

### RCR-Anti-Surge Resistor

- Excellent anti-surge characteristics
- Stable characteristics of moisture resistance up to 100M $\Omega$  resistance range
- RCR50+, RCR50EN (1M ~ 12M $\Omega$ ), RCR60 are conductive-path and discharge path resistors recognized by UL1676 and c-UL (CSA-C22.2 No. 1-M94)
- RCR25EN, RCR50EN (100k ~ 33M $\Omega$ ), RCR60 (100k ~ 56M $\Omega$ ) are approved by EN6268-1 G.10 safety

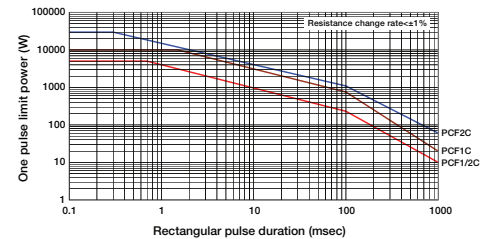
### GS-High Voltage, High Resistance Thick Film

- Miniature construction can endure to high power voltage (up to 40kV)
- High power rating up to 12W
- Excellent anti-surge characteristics
- Wide resistance range: 500k ~ 10G $\Omega$

### PCF-Ceramic Resistor for Anti-Pulse Surge

- KOA original bulk ceramic resistor
- Coated with UL94V0 flameproof material
- Excellent in anti-pulse characteristics
- Power rating: 0.5W, 1W, 2W
- Resistance range: 3.3 ~ 390k $\Omega$

### PCF Series One Pulse Limit Power Curve



### HPC-Ceramic Resistor for Anti-Pulse Surge

- KOA original bulk ceramic resistor
- Higher reliability against disconnection compared to wirewound resistors and film resistors
- Power rating: 0.5W ~ 5W
- Resistance range: 3.3 ~ 330k $\Omega$

### CPCN-Fixed Ceramic Resistor

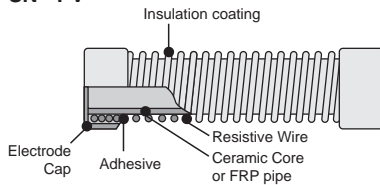
- Suitable for noise suppression of engine ignition systems
- Reliable in pulse/transient applications
- Power rating: 0.5W, 1W, 1.5W, 2W
- TCR:  $-1200 \pm 300\text{ppm}/^\circ\text{C}$



### P-High Voltage Power Resistor

- PSN is higher power (up to 250W) and for high voltage surge (up to 400kV)
- PSO is a completely moisture resistant version of PSN
- PN is non-inductive type and can be used for high frequency
- PWV are non-inductive wirewound resistors for high voltage with resistance wires wound on insulation pipes
- PAP are non-inductive wirewound resistors with inductance less than PWV, can be used for pulse wave measurement
- Wide power rating: 1.5 - 250W

#### PSN • PV



### Power Leaded

#### BGR, BWR, BSR-High Power Resistors

- BGR - rectangular type wirewound resistor with glass core
- BWR - rectangular type wirewound resistor with ceramic core
- BSR - rectangular type metal oxide film resistor
- Uses flame retardant insulated ceramic case
- Power rating: BWR - 1W ~ 20W, BGR-5W ~ 40W, BSR - 2W ~ 20W
- Various styles available

### BGRV, BWRV, BSRV-High Power Resistors for Automotive NEW

- BGRV - rectangular type wirewound resistor with glass core
- BWRV - rectangular type wirewound resistor with ceramic core
- BSRV - rectangular type metal oxide film resistor
- Uses flame retardant insulated ceramic case
- Excellent in anti-pulse and in rush current
- Power rating: BGRV-5W ~ 40W\*, BSRV-3W ~ 20W, BWRV-3W ~ 40W
- \*BWRV-40W- when used at a rated power of 60W, the surface temperature of the product will reach approximately 300°C
- Resistance range: BGRV-5.1 ~ 390Ω, BSRV-430 ~ 75kΩ, BWRV-1 ~ 390Ω



#### MOS/MOSX-Reduced Size Metal Oxide Power Type

- MOS/MOSX Small size power type resistor
- Coated with UL94V0 equivalent flameproof material
- Power rating: 0.5W - 5W
- Resistance range: MOS- 10 ~ 100kΩ, MOSX - low resistance range: 0.1 ~ 9.1Ω
- TCR: ±300ppm/°C

#### SPR-Power Carbon Film

- Coated with UL94V0 equivalent flameproof material
- High reliability performance
- SPRX- fixed metal film resistor available
- Power rating: 0.25W - 5W

### Wirewound Leaded

#### CWFS-Coat Insulated Wirewound Resistor with Fusing Function

- Fail-safe fusing at AC 250V
- Flameproof coating
- Power rating: 3W, 5W
- Fusing power: 90W, 150W
- Fusing time: 30 S. Max

#### CW-Coat Insulated Wirewound Resistor

- Flameproof silicone coating equivalent (UL94V0)
- CW1SS- UL1412 approval (file No. E320246)
- CW\_X - power type & CW\_S - small type available
- Power rating: 0.25W - 5W
- Resistance range: 0.01 ~ 390Ω

#### CWH-Miniature Wirewound Leaded Resistor

- Meets MIL-PRF-26 (U characteristics)
- High precision resistor with TCR ±20, ±50ppm/°C
- Power rating: 1W, 2W, 3W
- Resistance range: 0.1 ~ 3kΩ
- Tolerance: ±0.5% ~ ±1%

#### CWP-Precision Coat Insulated Wirewound Resistor

- Flameproof silicone coating equivalent (UL94V0)
- Power rating: 1W, 2W, 3W
- Resistance range: 0.1 ~ 430Ω
- TCR: ±50, ±90ppm/°C
- Tolerance: ±0.25%, ±1%

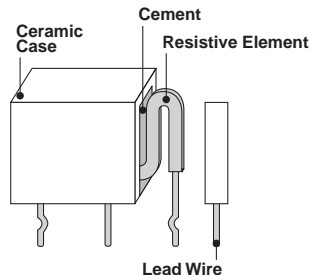
#### RW-Coat-Insulated Miniature Precision Power Wirewound Resistor

- Meets MIL-R-26E (U and V characteristics) and surface temperature (hot spot) 350°C max.
- Wide resistance range: 0.1 ~ 62kΩ
- RW\_N are non-inductive wound and can be used in high frequency applications
- Operating temperature range: U: -55°C ~ +275°C, V: -55°C ~ +350°C
- Tolerance: ±0.5%, ±1%, ±3%, ±5%

## Current Sense Leaded

### BPR-Rectangular Metal Plate Resistor

- Power type current detecting resistor with flame retardant ceramic case
- Automatic insertion for a 5mm pitch between terminals is applicable (26 type, 58 type)
- Low resistance range: 0.01 ~ 1Ω
- TCR: ±350ppm/°C
- Low inductance



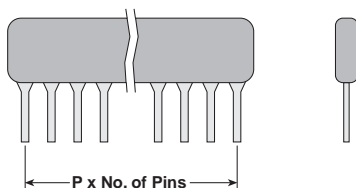
### LR-Custom Milliohm Resistor

- The super low resistance (3m ~ 100mΩ) is suitable for high power current detection
- Pitches and heights are adjustable according to mounting conditions
- All custom made parts
- Max. current rating: 3A ~ 21A

## Leaded Resistor Networks/ Resistor Arrays

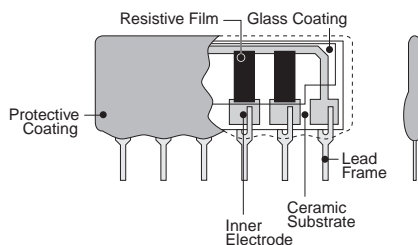
### MRP-Precision Metal Film SIP Network

- Custom design network
- Ultra-precision performance for precision analog circuits
- Absolute TCR: ±25, ±50ppm/°C
- Tracking TCR: 2, 5, 10ppm/°C
- Power rating: (mW): element-100, package-200



### RKC, RKH, RKL-Thick Film SIP Resistor Network

- Various type of standard circuits in different sizes and power (seated height 0.20", 0.26", 0.42")
- Higher temperature soldering of the leads prevents terminals from loosening during board assembly
- Number of pins: 3 ~ 16
- Tolerance: ±0.5%, ±1%, ±2%, ±5%
- Resistance range: 10 ~ 10MΩ



### RK92D-Thick Film Resistor for High Voltage

- High-precision high voltage divider for high voltage circuits
- Higher relative accuracy of resistance value is possible with one package
- Thin SIP shape
- Tolerance: ±1%
- TCR: ±50, ±100
- Power rating: 0.2W, 0.5W
- Maximum working voltage: 4kV

## Fusing Leaded

### RF-Coat Insulated Fusing Resistor

- Functions as a resistor in normal conditions
- Quick fusing protects circuit from excessive overload at an abnormal time
- Fusing time: 30s max, 60s max
- Flame-retardant coating equivalent to UL94V0
- Fusing power: 2.5W ~ 36W

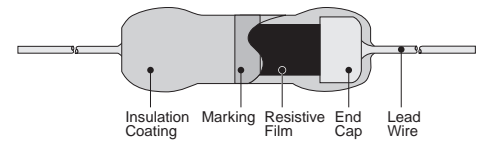
### RF25CC-Coat-Insulated Fusing Resistor

- Constant current fuse type
- Fuse with 60 sec in case of over-current
- Fuse in low magnification at 5 times or 10 times the power rating
- Flame retardant coating equivalent to UL94V-0
- Fusing power: 2.5W, 1.25W

## Jumper Leaded

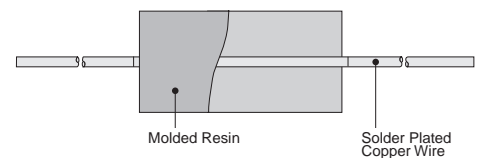
### Z-Jumper (Coating Type)

- Size compatible with 1/8, 1/4 watt resistors
- Max. Amperage: 15A
- Resistance: 20mΩ or less



### J-Molded Jumper

- Max. allowable current: 8A, 10A
- Operating temperature range: -55°C ~ +125°C



### JL-Jumper Wire

- Suitable for automatic machine insertion
- Max. current rating: 8A, 10A, 12A
- 20, 22, 24 gauge wire

# THERMAL SENSORS

## Platinum Thin Film Thermal Sensors

### SDT310VSP2-Small Type Platinum Thin Film Thermal Sensor, Fast Response NEW

- Achieves a thermal time constant of 2.3 seconds due to volume reduction
- Excellent heat-resistance
- Applies axial lead type suitable to use as a heater element
- TCR:  $+3850 \pm 40 \text{ ppm}/^\circ\text{C}$

### SDT101-Axial Platinum Thin Film Thermal Series

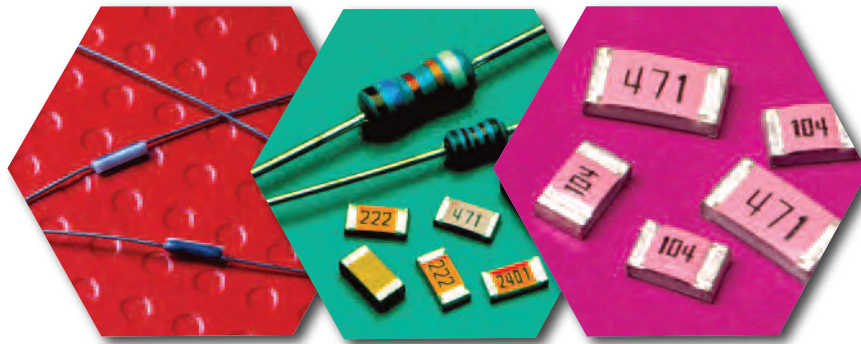
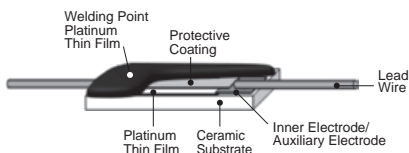
- Stable characteristics even in use for a long time with an excellent environment resistance
- Resistance:  $10\Omega \sim 1\text{k}\Omega$
- TCR:  $+3500 \text{ ppm}/^\circ\text{C}$

### SDT310HCTP-Small Type Platinum Thin Film Thermal Sensor

- Characteristics are equivalent with IEC 60751-2008, JISC 1604-2013
- Small package of  $1.2\text{mm} \times 3\text{mm}$  with  $100\Omega$  resistance
- Operating temperature range:  $-55^\circ\text{C} \sim +300^\circ\text{C}$ ,  $-55^\circ\text{C} \sim +400^\circ\text{C}$
- Specified current: 1mA Max.

### SDT310-Small Type Platinum Thin Film Thermal Sensor

- TCR:  $+3850 \text{ ppm}/^\circ\text{C}$  is in accordance with JIS-DIN standards IEC
- Small package with a real ability of  $1\text{k}\Omega$  resistance
- Thermal time constant is improved with the small package
- Operating temperature range:  $-55^\circ\text{C} \sim 155^\circ\text{C}$ ,  $-55^\circ\text{C} \sim 400^\circ\text{C}$ ,  $-55^\circ\text{C} \sim +650^\circ\text{C}$



### ST-Custom Thermal Sensor

- All ST-series thermal sensors are custom designed in various shapes in accordance with your application
- TCR:  $+3500 \text{ ppm}/^\circ\text{C}$ ,  $+3850 \text{ ppm}/^\circ\text{C}$
- Resistance values at  $0^\circ\text{C}$ : 100, 500,  $1\text{k}\Omega$
- Utilize SDT310 or SDT101

### AFS-Air Flow Sensors

- Realized high and long-term stability
- Small platinum thin film thermal sensor and an even temperature differential operating circuit ensure a quick response
- Built-in temperature compensation circuit assures correct values regardless of air temperature
- Products have no rotating mechanism and are resistant to vibration



## Platinum Thin Film Surface Mount Thermal Sensors

### SDT73H-General Purpose Chip Series

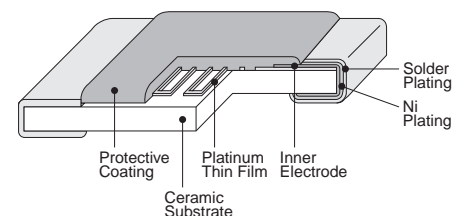
- SMD platinum thin film thermal sensor
- TCR:  $+3850 \text{ ppm}/^\circ\text{C}$  is in accordance with JIS-DIN standards IEC
- 1206 Size
- Operating temperature range:  $-55^\circ\text{C} \sim +155^\circ\text{C}$
- Thermal dissipation constant:  $2.4 \text{ mW}/^\circ\text{C}$
- Resistance values at  $0^\circ\text{C}$ :  $100\Omega$ ,  $500\Omega$

### SDT73S-Heat Resistant Chip Series

- SMD platinum thin film thermal sensor
- TCR:  $+3850 \text{ ppm}/^\circ\text{C}$  is in accordance with JIS-DIN standards IEC
- Operating temperature range:  $-55^\circ\text{C} \sim +250^\circ\text{C}$
- Thermal time constant 6.5 seconds
- Resistance values at  $0^\circ\text{C}$ :  $100\Omega$

### SDT73V-Automotive Platinum Thin Film Chip Series

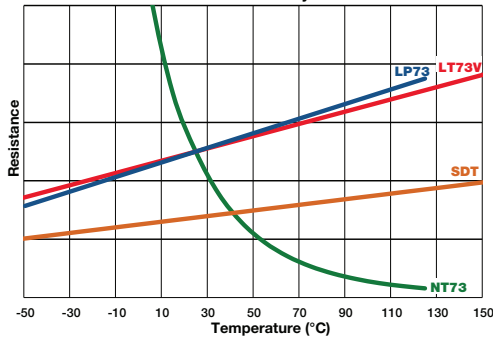
- AEC-Q200 Tested
- SMD platinum thin film thermal sensor
- TCR:  $+3850 \text{ ppm}/^\circ\text{C}$  is in accordance with JIS-DIN standards IEC
- Operating temperature range:  $-55^\circ\text{C} \sim +155^\circ\text{C}$
- Thermal dissipation constant:  $2.4 \text{ mW}/^\circ\text{C}$
- Resistance values at  $0^\circ\text{C}$ :  $100\Omega$ ,  $500\Omega$



# THERMAL SENSORS

## Linear PTC Resistors Thin Film Linear PTC Thermistors

### Thermistor Styles



### LP73-Thin Film Thermal Sensors of SMD Type

- Resistance tolerance  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$
- Wide range of TCR's:  $+3000 \sim +5000\text{ppm}/^\circ\text{C}$
- Suitable for control of temperatures in various industrial equipment
- Sizes: 0603, 0805, 1206
- TCR tolerance:  $\pm 5\%$
- Resistance:  $100\Omega \sim 1\text{k}\Omega$

### LT73-Linear Positive Tempco Thermistor

- TCR:  $\pm 150 \sim \pm 4500\text{ppm}/^\circ\text{C}$
- Sizes: 0805, 1206
- Thermal time constant: 1 second, 1.5 seconds
- Resistance:  $51\Omega \sim 51\text{k}\Omega$

### LT73V-Linear Positive Tempco Flat Chip for Automotive

- AEC-Q200 Tested
- Various TCR:  $+150 \sim +4500\text{ppm}/^\circ\text{C}$  are available
- Operating temperature range:  $-55^\circ\text{C} \sim +155^\circ\text{C}$
- Sizes: 0805, 1206
- Rated ambient temperature:  $+85^\circ\text{C}$
- Resistance:  $51\Omega \sim 22\text{k}\Omega$

### LP-Thin Film Resistance Thermal Sensor

- TCR:  $+150 \sim \pm 5000\text{ppm}/^\circ\text{C}$
- Accommodates resistance tolerance  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$
- Power rating: 0.063W, 0.125W
- Resistance range:  $1 \sim 100\text{k}\Omega$

## Negative Tempco Thermistors

### NT73-Temperature Compensation Thick Film

- Twelve standard resistance values;  $1\text{k}\Omega \sim 150\text{k}\Omega$
- Sizes: 0603, 0805, 1206
- B constant @  $25^\circ\text{C}/75^\circ\text{C}$ :  $3200\text{K} \sim 4100\text{K}$
- B constant tolerance:  $\pm 3\%$ ,  $\pm 5\%$ ,  $\pm 10\%$

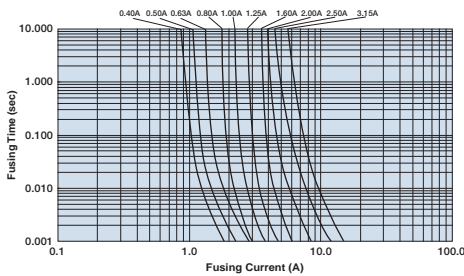
# FUSES & VARISTORS

## Fuses – Flat Chip

### TF16VN - Chip Current Fuse for Automotive

- Small and light for the secondary circuit
- Current rating: .40 - 3.15A
- Temperature cycle (-55°C ~ 125°C), 1000 cycle
- Anti-pulse type in 0603 size
- AEC-Q200 Tested

### Fusing Characteristics

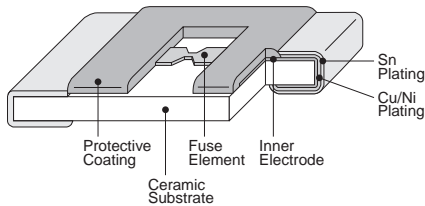


### RF73-Fusing Flat Chip Resistor

- Fuses when overloaded
- Resistance range: 0.2 ~ 510Ω
- Tolerance: ±5%
- Sizes available: 0603 ~ 2512
- UL1412 Approved (0805 ~ 2512 sizes)

### TF-Thin Film Chip Fuse

- Special manufacturing method stabilizes fusing characteristics
- Low power consumption and less voltage drop due to low internal resistance
- Rated current from 0.20 ~ 5A
- Sizes available: 0402, 0603
- TF16AT is Anti-Pulse

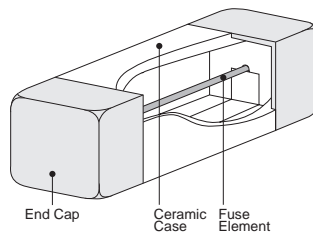


### CCF1N-Anti-Surge Chip Fuse

- Ceramic case provides excellent mechanical strength
- Current rating: 400mA ~ 30A
- UL248, 14, c-UL(CAS)C22.2 approved
- Up to 125V AC and 160V DC
- Standard size: 2410

### CCF1F-Anti Surge, Anti-Sulfuration Chip Fuse

- Meets IEC60127-4 specifications (7A or less)
- Stable fusing characteristics due to proprietary technology
- Current rating: 0.4 ~ 15A
- Standard size: 2410
- Fast-acting type



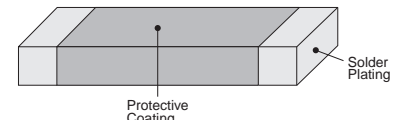
## Varistors

### NV73-Metal Oxide Varistor

- Multilayer structure with high surge current
- Protect against static electricity, switching and incoming surges
- Varistor voltage: 6.8 ~ 165 VA
- Clamping voltage: 18V ~ 350V
- Sizes available: 0201 ~ 2220
- Max. energy: 0.01J ~ 14J
- Max. current: 4,500A

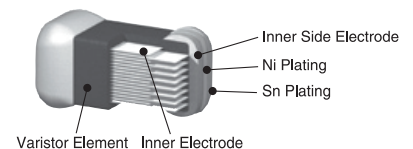
### NV73DL-Metal Oxide Varistor for Automotive

- Ideal for countermeasures against ESD (conforming to IEC61000-4-2)
- Max. energy type up to 1.5J
- High resistance to cyclic temperature stress
- Varistor voltage: 10 ~ 90VA
- Clamping voltage: 24V ~ 135V
- Sizes available: 0603 ~ 1206
- AEC-Q200 Tested



### NV73DS - Load Dump Surge Metal Oxide Varistor

- Symmetrical non-linearity V-I characteristics absorb positive and negative surge
- Meets JASO load dump surge test requirements
- Max. load dump surge energy: 63 ~ 70J
- Operating temperature: up to +125°C
- Varistor voltage: 20 ~ 45VA
- Size available: 2420
- AEC-Q200 Tested



# LTCC SUBSTRATES & OTHER PRODUCTS

## LTCC Substrates

### KLC-LTCC Multilayer Substrates

- Stack accuracy <math> < 20\mu\text{m}</math>
- Line width as low as  $60\mu\text{m}</math>$
- Special shapes of substrates and cavity (circle, polygonal, concave or convex shape available)
- Line-to-line spacing as low as  $60\mu\text{m}</math>$
- Cavity flatness:  $< 25\mu\text{m}</math>$
- Cavity width:  $600\mu\text{m}</math> min.$
- Cavity depth:  $100\mu\text{m}</math> min.$
- Cavity wall thickness:  $500\mu\text{m}</math> min$
- Flexural/bending strength:  $250\text{MPa}</math>$
- (TCE):  $5.5 \times 10^{-6}/\text{K}</math>$
- Thermal conductivity:  $3\text{W}/\text{m}\cdot\text{K}</math>$
- Min. insulation resistance:  $1 \times 10^{13}\Omega\cdot\text{cm}</math>$
- Density:  $2.8\text{g}/\text{cm}^3</math>$
- Fired layer thickness:  $80\mu\text{m}, 100\mu\text{m}, 125\mu\text{m}</math>$
- Via diameter:  $100\mu\text{m}, 150\mu\text{m}, 200\mu\text{m}</math>$

## Hybrid IC

### KA-Hybrid IC

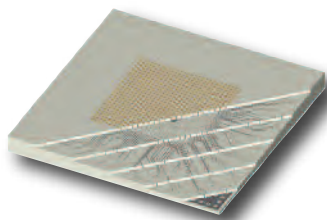
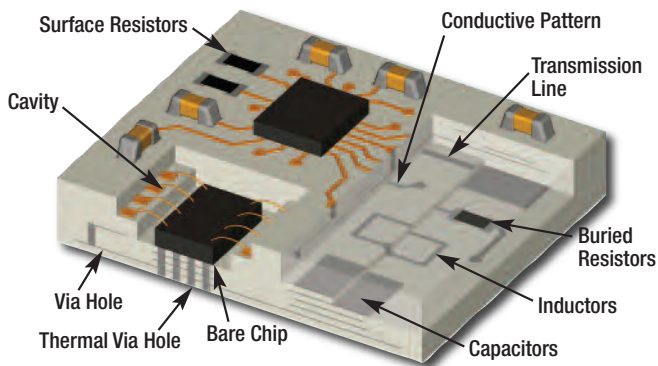
- High density mounting by bonding (COB)
- Adjustment processes are decreased by function and ratio trimmings
- Substrate materials:  $\text{Al}_2\text{O}_3</math> alumina and glass epoxy$
- Conductor: Ag-Pd, Ag-Pt,  $\text{RuO}_2</math>$
- Printed resistor:  $5\Omega \sim 10\text{M}\Omega \pm 100 \times 10^{-6}/\text{K}</math>$



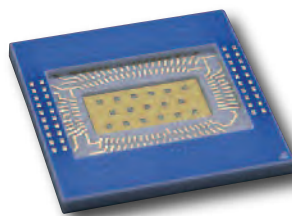
## Other Products

### RC-Test Point Chip

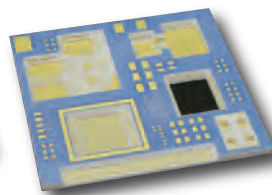
- Surface-mountable chip type test terminal
- Rated Current: 2A
- Standard resistance:  $50\text{m}\Omega</math> or less$
- Sizes available: 0603, 0805, 1206
- AEC-Q200 Tested



Interposer



Semiconductor Package



Multi-Cavity



## Surface Mount Resistors

### Anti-Sulfur Precision Flat Chip Resistors

**RK73H1 ERT-Kit1 (0402 chip size)** **NEW**  
122 values, 100 pcs each

**RK73H1 JRT-Kit1 (0603 chip size)** **NEW**  
122 values, 100 pcs each

### Precision Flat Chip Resistors

**RK73H1 FTK001Kit (01005 chip size)**  
38 values, Lead-free, 25 pcs each  
(10R0 ~ 620K =  $\pm 1\%$ )

**RK73H1 HTK001Kit (0201 chip size)**  
217 values, Lead-free, 50 pcs each  
(0, 10R0 ~ 1M00 =  $\pm 1\%$ )

**RK73H1ETKit1 (0402 chip size)**  
122 values, Lead-free, 100 pcs each  
(0, 10R0 ~ 1M00 =  $\pm 1\%$ ) E-24

**RK73H1JTKit1 (0603 chip size)**  
122 values, Lead-free, 100 pcs each  
(0, 10R0 ~ 1M00 =  $\pm 1\%$ ) E-24

**RK73H2ATKit1 (0805 chip size)**  
122 values, Lead-free, 100 pcs each  
(0, 10R0 ~ 1M00 =  $\pm 1\%$ )

**RK73H2BTKit1 (1206 chip size)**  
122 values, Lead-free, 100 pcs each  
(0, 10R0 ~ 1M00 =  $\pm 1\%$ )

### General Purpose Flat Chip Resistors

**RK73B1FTK001Kit (01005 chip size)**  
51 values, Lead-free, 25 pcs each (0, 10 ~ 1M =  $\pm 5\%$ )

**RK73B1HTK001Kit (0201 chip size)**  
139 values, Lead-free, 50 pcs each (0, 2R2 ~ 2M2 =  $\pm 5\%$ )

### High Voltage Flat Chip Resistors

**HV73TK001Kit (0603, 0805, 1206, 2010 chip sizes)**  
156 values, Lead-free, 25 pcs each (10k ~ 10M =  $+1\%$ )

### Varistors

**NV73TK001Kit (0201, 0402, 0603, 0805, 1206, 1210, 1812, 2220 chip sizes)**  
Lead-free, 122 values, 10 pcs each size

**NV73DLTK001Kit (0603, 0805, 1206 chip sizes)**  
17 values, Lead-free, 10 pcs each size



### Surge Current Flat Chip Resistors

**SG73TK001Kit (0603, 0805, 1206, 1210, 2010, 2512 chip sizes)**

204 values,  $\pm 10\%$ , Lead-free, 25 pcs each

**SG73STK001Kit (0603, 0805, 1206, 1210 chip sizes)**  
101 values,  $\pm 1\%$ , Lead-free, 25 pcs each

**SG73PTK001Kit (0603, 0805, 1206, 1210 chip sizes)**  
97 values,  $\pm 1\%$ , Lead-free, 25 pcs each

### Wide Terminal Flat Chip Resistors

**WK73TK001Kit (0612, 1020, 1218 & 1225 chip sizes)**  
79 values, Lead-free, 25 pcs each ( $\pm 1\%$ ,  $\pm 5\%$ )

**WU73TK001Kit (0612 chip sizes)**  
27 values, 20 pcs each ( $\pm 1\%$ )

### Circuit Protection - Thermal Sensors

**NT73TK001Kit (0603, 0805, 1206 chip sizes)**  
Lead-free, 53 values (1J, 2A, 2B), 10 pcs each size

### Circuit Protection - Fuses

**CCFTK001Kit (2410 chip size)**  
18 values, Lead-free, 20 pcs each

**FuseKit-TF10BN (0402 chip size)**  
12 values, Lead-free, 100 pcs each

**FuseKit-TF16SN (0603 chip size)**  
14 values, Lead-free, 100 pcs each

**FuseKit-TF16AT (0603 chip size)**  
13 values, Lead-free, 100 pcs each

NOTE: Reference product data pages for available values.

## Surface Mount Resistors (continued)

### Ultra Precision Flat Chip Resistor

#### RN73H1ET-Kit (0402 chip size)

49 values, Lead-free, 50 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73H1JT-Kit (0603 chip size)

67 values, Lead-free, 50 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73H2AT-Kit (0805 chip size)

73 values, Lead-free, 50 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73R1ET-Kit1 (0402 chip size)

49 values, Lead-free, 100 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73R1JT-Kit1 (0603 chip size)

67 values, Lead-free, 100 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73R2AT-Kit1 (0805 chip size)

73 values, Lead-free, 100 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RN73R2BT-Kit1 (1206 chip size)

74 values, Lead-free, 100 pcs each ( $\pm 0.1\%$ , 25ppm°C)

#### RS73F1JT-Kit1 (0603 chip size)

97 values, Lead-free, 100 pcs each ( $\pm 0.1\%$ , 25ppm°C)

NOTE: Reference product data pages for available values.

## Current Sense Resistors

### Surface Mount Molded

#### SLW07TK001Kit (2010, 1W size)

27 values, 20 pcs each ( $\pm 1\%$ )

#### SLW1TK001Kit (2512, 1.5W size)

25 values, 20 pcs each ( $\pm 0.5\%$ )

#### SL1TK001Kit (2512, 1W size)

33 values, 20 pcs each ( $\pm 1\%$ )

#### SL2TK001Kit (4528, 2W size)

45 values, 20 pcs each ( $\pm 1\%$ )

#### SL3TK001Kit (4528, 3W size)

33 values, 20 pcs each ( $\pm 1\%$ )

#### SLN3TK001Kit (4528, 3W size)

32 values, 20 pcs each ( $\pm 0.5\%$ )

#### SLN5TK001Kit (4528, 5W size)

21 values, 10 pcs each ( $\pm 0.5\%$ )

#### TSL1TK001Kit (2512, 1W size)

33 values, Lead-free, 20 pcs each ( $\pm 1\%$ )

#### SLRTK001Kit (2513, 1W size)

40 values, 15 pcs each ( $\pm 1\%$ )

### Metal Plate

#### TLR2ATK001Kit (0805 chip size)

6 values, complete range, 20 pcs each ( $\pm 1\%$ )

#### TLR2BWD-Kit (1206 chip size)

17 values, 15 pcs each ( $\pm 1\%$ )

#### TLR2HWD-Kit (2010 chip size)

10 values, 15 pcs each ( $\pm 1\%$ )

#### TLR3APD-Kit (2512 chip size)

10 values, 20 pcs each ( $\pm 1\%$ )

#### TLRDK001Kit (1206, 1210, 2512 chip sizes)

36 values, Lead-free, complete range, 20 pcs each ( $\pm 1\%$ )

#### TLR2BP-Kit (1206 chip size)

17 values, 15 pcs each ( $\pm 1\%$ )

### Chip Resistors

#### UR73TK001Kit (0402, 0603, 0805, 1206, 2512 chip sizes)

144 values, Lead-free, 20 pcs each ( $\pm 1\%$ )

#### UR73VTK001Kit (1206 chip sizes)

8 values, 20 pcs each ( $\pm 1\%$ )

### Thick Film

#### SR731HTK001Kit (0201 chip size)

29 values, Lead-free, 50 pcs each (R47 ~ 10R0,  $\pm 1\%$ ,  $\pm 5\%$ )

#### SR731ETK001Kit (0402 chip size)

25 values, Lead-free, 50 pcs each (R100 ~ 1R00,  $\pm 1\%$ )

#### SR731JTK001Kit (0603 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

#### SR732ATK001Kit (0805 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

#### SR732BTK001Kit (1206 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

#### SR732ETK001Kit (1210 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

#### SR732HTK001Kit (2010 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

#### SR733ATK001Kit (2512 chip size)

49 values, Lead-free, 50 pcs each (R100 ~ 10R0,  $\pm 1\%$ )

### Power Shunt

#### PSF4-Kit (1216 chip size)

2 values, Lead-free, 10 pcs each ( $\pm 1\%$ )

#### PSL2-Kit (2512 chip size)

3 values, Lead-free, 10 pcs each ( $\pm 1\%$ )

NOTE: Reference product data pages for available values.

# STANDARD VALUES

## Significant Figures of Nominal Resistance

E-12 Decade Values					
10	12	15	18	22	27
33	39	47	56	68	82

E-24 Decade Values					
10	11	12	13	15	16
18	20	22	24	27	30
33	36	39	43	47	51
56	62	68	75	82	91

E-96 Decade Values					
100	102	105	107	110	113
115	118	121	124	127	130
133	137	140	143	147	150
154	158	162	165	169	174
178	182	187	191	196	200
205	210	215	221	226	232
237	243	249	255	261	267
274	280	287	294	301	309
316	324	332	340	348	357
365	374	383	392	402	412
422	432	442	453	464	475
487	499	511	523	536	549
562	576	590	604	619	634
649	665	681	698	715	732
750	768	787	806	825	845
866	887	909	931	953	976

E-192 Decade Values					
100	101	102	104	105	106
107	109	110	111	113	114
115	117	118	120	121	123
124	126	127	129	130	132
133	135	137	138	140	142
143	145	147	149	150	152
154	156	158	160	162	164
165	167	169	172	174	176
178	180	182	184	187	189
191	193	196	198	200	203
205	208	210	213	215	218
221	223	226	229	232	234
237	240	243	246	249	252
255	258	261	264	267	271
274	277	280	284	287	291
294	298	301	305	309	312
316	320	324	328	332	336
340	344	348	352	357	361
365	370	374	379	383	388
392	397	402	407	412	417
422	427	432	437	442	448
453	459	464	470	475	481
487	493	499	505	511	517
523	530	536	542	549	556
562	569	576	583	590	597
604	612	619	626	634	642
649	657	665	673	681	690
698	706	715	723	732	741
750	759	768	777	787	796
806	816	825	835	845	856
866	876	887	898	909	920
931	942	953	965	976	988



**KOA SPEER ELECTRONICS, INC.**

199 Bolivar Drive  
Bradford, PA 16701  
Phone: 814-362-5536  
Fax: 814-362-8883  
[www.koaspeer.com](http://www.koaspeer.com)