



Your Passive Solution

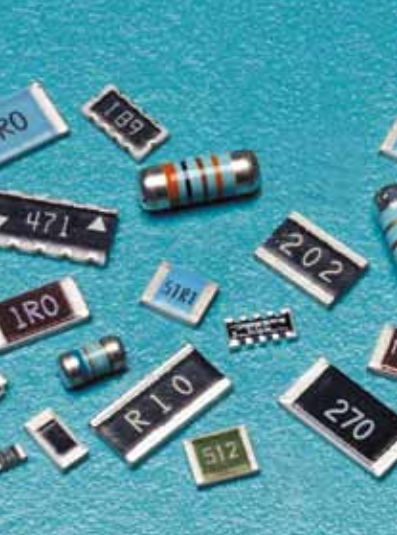
PASSIVE COMPONENTS

Selection Guide

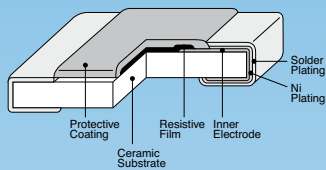


Surface Mount Resistors & Arrays

Flat chip resistors and arrays include general purpose, high precision, pulse and surge, high voltage, high heat, anti sulfuration and zero ohm types for applications ranging from general purpose to ultra precision.



Thick Film



- Sizes available:

01005	0603	1210
0201	0805	2010
0402	1206	2512
- RuO₂ thick film

General Purpose - RK73B

- Tolerance: $\pm 2\%$ and $\pm 5\%$
- Resistance range: $1\Omega \sim 22M\Omega$
- RK73BW3A2 (2512 = 3W)

Precision - RK73H

- Tolerance: $\pm 0.5\%$ and $\pm 1\%$
- Resistance range: $1\Omega \sim 10M\Omega$
- RK73HW3A2 (2512 = 3W)

High Precision - RK73G

- T.C.R.: ± 50 ppm/K
- Resistance range: $10\Omega \sim 1M\Omega$
- Tolerance: $\pm 0.25\%$, $\pm 0.5\%$ and $\pm 1\%$

Zero Ohm - RK73Z

- Maximum resistance of 50m Ω
- Maximum continuous current @70°C: 0.5A ~ 2.0A

Anti Sulfur

NEW RT-Series

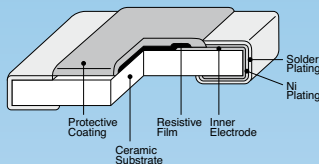
- Excellent anti-sulfuration characteristics due to using high-sulfuration-proof inner top electrode material
- Intended for use under harsh environment
- Available for several standard product series:

RK73B_RT	CN_RT	SG73_RT
RK73H_RT	CN_KRT	SG73S_RT
RK73Z_RT	CNZ_RT	SG73P_RT
RK73G_RT	HV73_RT	WK73_RT
SR73_RT		HV73V_RT

Specialty

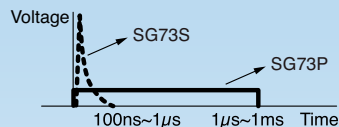
Surge Current - SG73

- 10x pulse power capability
- Resistance range: $1\Omega \sim 1M\Omega$
- Tolerance: $\pm 10\%$, $\pm 20\%$
- Sizes available: 0603, 0805, 1206, 1210, 2010, 2512



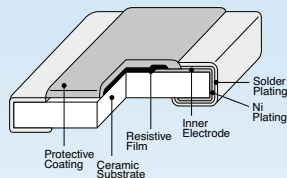
Pulse SG73P and Surge SG73S

- Resistance range: $1\Omega \sim 10M\Omega$
- Tolerance: $\pm 0.5\%$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$
- Sizes available: 0402, 0603, 0805, 1206, 1210
- Increased power rating (e.g.: 0603 = 0.33W)



Wide Terminal - WK73R

- Robust thermal cycle characteristic
- Power rating: 0.75W ~ 3W
- Resistance range: $10\Omega \sim 1M\Omega$
- Tolerance: $\pm 0.5\%$, $\pm 1\%$ or $\pm 5\%$
- T.C.R.: ± 100 and ± 200 ppm/K
- Sizes available: 0612, 1020, 1218, 2512



High Voltage - HV73

- 2.5x to 10x rated working voltage of standard thick film
- Chip size 2512 with 3kV rated voltage
- Sizes available: 0603, 0805, 1206, 2010, 2512
- 350V, 400V, 500V, 2kV, 3kV
- Resistance range: $10k\Omega \sim 51M\Omega$
- Tolerance: $\pm 0.5\%$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$

NEW High Voltage - HV73V-automotive

- Chip sizes: 0603, 0805, 1206
- AEC-Q200 qualified

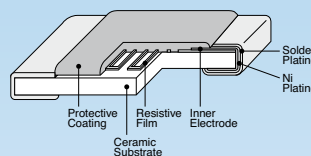
Thin Film

Ultra Precision - RN73

- Tolerance: $\pm 0.05\% \sim \pm 1\%$
- T.C.R.: ± 5 , ± 10 , ± 25 , ± 50 or ± 100 ppm/K
- Resistance range: $10\Omega \sim 1M\Omega$
- Nickel chromium thin film resistor element

Ultra Precision - RN73H

- Higher temperature range up to $+155^\circ\text{C}$
- Higher rated ambient temperature: $+85^\circ\text{C}$
- Improved moisture resistance by special coating
- Resistance range: $10\Omega \sim 1.5M\Omega$
- Tolerance: $\pm 0.05\% \sim \pm 1\%$
- T.C.R.: ± 5 , ± 10 , ± 25 , ± 50 or ± 100 ppm/K
- Sizes available: 0402, 0603, 0805, 1206, 1210



MELF

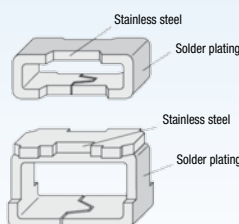
Carbon Film/Metal Film/Zero Ohm

- RD41 Carbon film series
- RN41 Metal film series
- CC Zero ohm series

Checker Chips

Checker Chips – RCU/RCT/RCS/RCW

- Surface mountable test terminals
- Automatic mounting possible
- Standard chip sizes: 0603, 0805, 1206
- Maximum resistance: 50m Ω
- Rated current: 2A

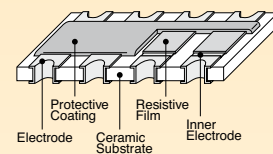


Resistor Arrays

Isolated Resistors

Convex, Square Corners - CN_K

- Resistance range: $10\Omega \sim 1M\Omega$
- Tolerance: $\pm 1\% \sim \pm 5\%$
- Sizes available: 0402, 0603, 1206 x2, x4, x8 elements



Concave, Square Corners - CN

- Resistance range: $10\Omega \sim 1M\Omega$
- Tolerance: $\pm 1\% \sim \pm 5\%$
- Sizes available: 0402, 0603, 0805, 1206 x2, x4, x8 elements

Convex, Scalloped Corners - CN_A

- Resistance range: $1\Omega \sim 1M\Omega$
- Tolerance: $\pm 1\%$ and $\pm 5\%$
- Sizes available: 0603, 1206 x2, x4 elements

Zero Ohm Jumper - CNZ

- Convex or Concave
- Current rating @70°C (per element): 0.5A and 1.0A
- Sizes available: 0402, 0603, 0805, 1206 x2, x4, x8 elements

NEW Anti-Sulfur RT-Series

- Excellent anti-sulfuration characteristics
- High heat and weather resistance
- Series available: CN_RT CN_KRT CNZ_RT

Bussed Resistors

Convex or Concave - CND

- Reverse common electrode and side electrode type circuits available
- Resistance range: $22\Omega \sim 100K\Omega$
- Tolerance: $\pm 5\%$
- Sizes available: 1206, 1608 and 2512

Convex Staggered Terminations - CNB

- Resistance range: $1K\Omega \sim 470K\Omega$
- Tolerance: $\pm 5\%$
- 4 or 8 elements included in one array in 2 sizes

BGA (Ball Grid Array) - BR

- High level of integration
- Low inductance
- 18 integrated resistors
- Isolated or bussed

Current Sense Resistors

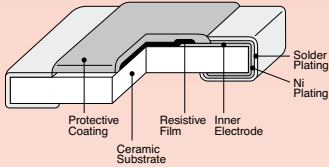
Four basic types of current sensing resistors are available in low-ohm, high precision, 4-terminal Kelvin, high power, low profile, high frequency, high heat, and power shunt chips for a wide range of detecting applications and power applications.



Thick Film

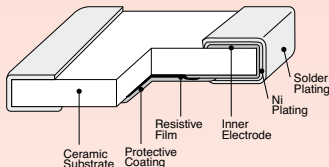
Low-Ohm - SR73 Series

- Resistance range: 24mΩ ~ 10Ω
- Tolerance: ±0.5% ~ ±5%
- Sizes available: 0201 ~ 2512 (2W)
- Best T.C.R.: ±100 ppm/K



Ultra-Low Ohm - UR73(D) Series

- Face-up and face-down types available
- Resistance range: 10mΩ ~ 100mΩ
- Tolerance: ±1%
- Improved T.C.R.: ±100 ~ ±300 ppm/K
- Sizes available: 0402 ~ 2512

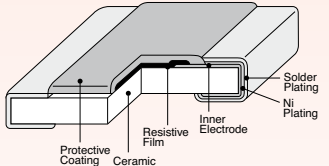


NEW Ultra-Low Ohm - UR73V(D) Series

- Automotive, AEC-Q200 qualified
- Size: 0805 (0.5W), 1206 (0.75W)
- Resistance range: 10mΩ ~ 100mΩ
- T.C.R.: ±75 ~ ±250ppm/K
- Operating temp. up to +155°C

Wide Terminal - WK73S

- Robust thermal cycle characteristic
- Power rating: 0.75W ~ 3W
- Resistance range: 10mΩ ~ 9.1Ω
- Tolerance: ±0.5%, ±1% or ±5%
- T.C.R.: ±100, ±200, ±300 or ±800ppm/K
- Sizes available: 0612, 1020, 1218, 1225



NEW Wide Terminal - WU73 Series

- Improved T.C.R. type
- Resistance range: 10mΩ ~ 100mΩ
- T.C.R.: ±100, ±150ppm/K
- Size 1206, 1W

NEW Anti Sulfur - RT Series

- Excellent anti sulfuration characteristics due to using high-sulfuration-proof inner top electrode material
- Available for several standard product-series:
SR73_RT WK73S_RT

Molded

Robust Leadframe

SL(N)/TSL Series

- Molded with flame retardant resin (UL94 V-0)
- Enhanced thermal shock capability
- Operating temperature: up to +180°C
- Increased power rating e.g.:

SLW07(2010) = 1W

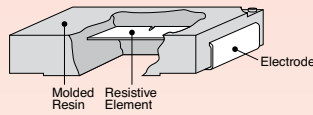
SLW1(2512) = 1.5W

SLN5(4527) = 7W

- Resistance range: 3mΩ ~ 22MΩ
- Tolerance: ±0.5%, ±1%, ±2%, ±5%
- T.C.R.: ±50 ~ ±200 ppm/K

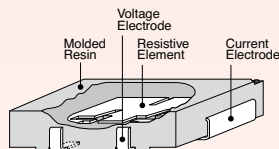
NEW Jumper - SLZ1 Series

- Maximum resistance of 0.5mΩ
- Current rating: 44A



4 Terminal - CSR Series

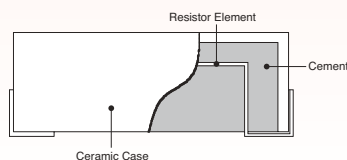
- Suitable for Kelvin applications
- Molded with flame retardant resin
- Power rating: 1W & 2W
- Resistance range: 5mΩ ~ 50mΩ
- Tolerance: ±0.5 or ±1%
- T.C.R.: ±50 ppm/K



Ceramic Case

Ceramic Case - BLR Series

- Flame retardant resistor in ceramic case
- Resistance range: 8mΩ ~ 50mΩ
- Tolerance: ±5%, ±10%
- Power rating: 1W, 2W or 15W



Metal Plate

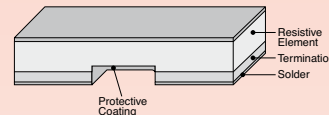
TLR Series

- Resistance range: 0.5mΩ ~ 20mΩ
- Tolerance: ±1%, ±2% or 5%
- Ultra low T.C.R.: ±50, ±75, ±100 ppm/K
- 0402, 0805, 1206, 2010, 2512 chip size
- Ultra low height: 0.25 ~ 0.6mm
- Increased power rating e.g.:

TLR2BP (1206) = 1.5W

TLR2HW (2010) = 2W

TLR3AP (2512) = 3W

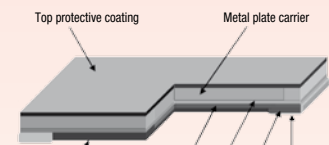


NEW Jumper - TLRZ Series

- Sizes 0402, 0603, 0805, 1206
- Maximum resistance of 0.2mΩ (0.5mΩ)
- Current rating: 10A ~ 40A

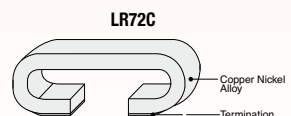
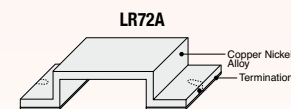
TLR H Series

- Resistance range: 6mΩ - 270mΩ
- Tolerance: ±1%
- T.C.R.: ±50, ±75 ppm/K
- Low height: 0.25, 0.5 mm
- 0805, 2512 chip size
- Power rating 0.25W ~ 5W



LR72 Series

- Power rating: 0.25W, 0.5W, 1W
- Resistance range: 2mΩ ~ 8mΩ
- Tolerance: ±5%
- T.C.R.: ±100, ±350 ppm/K
- Custom configurations available



Power Shunt

NEW Large Current - HS Series

- Power rating: 18W, 36W
- Resistance values: 100μΩ, 200μΩ
- T.C.R.: 50±25 ppm/K
- Size: 40 x 15 x 2(1) mm
- Current detection by voltage pins



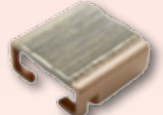
NEW High Power - PSJ2/PSL2 Series

- Power rating: 6W, 8W, 10W, 12W
- Resistance range: 200μΩ ~ 2mΩ
- Tolerance: ±1%
- T.C.R.: ±75 ~ ±200ppm/K
- Sizes: 2512, 3920



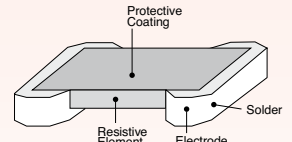
NEW High Power - PSG4/PSF4 Series

- 4 Terminal configuration
- Power rating: 3W, 5W, 8W, 10W
- Resistance values: 0.5mΩ, 1mΩ
- Tolerance: ±1%
- T.C.R.: ±50ppm/K
- Sizes: 1216, 2725



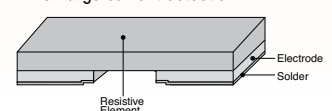
High Power - PSB Series

- Power rating: 6W, 7W
- Resistance range: 0.2mΩ, 0.75mΩ, 1mΩ
- Tolerance: ±1%
- T.C.R.: ±75 ppm/K, ±100 ppm/K
- Special electrode shape ensures excellent temperature cycling characteristics



High Power - PSI/PSE Series

- Power rating: 3W, 5W
- Resistance values: 0.5mΩ ~ 4mΩ
- Tolerance: ±1%, ±5%
- T.C.R.: ±50ppm/K, ±150ppm/K
- Sizes: 2525, 3920
- Smooth current flow, suitable for large current detection



Thermal Sensors and Circuit Protection

In addition to our flat chip resistors we offer a complete line of circuit protection products including thermistors, platinum sensors, chip and ceramic case fuses and metal oxide varistors.

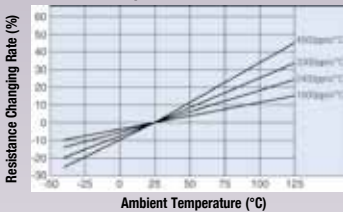


Thermal Sensors

Thin Film Linear PTC - LT73(V)/LP73

- LT73 available in 25 specifiable temperature characteristics
- **LT73V**: 0805 & 1206 for automotive
- **LP73**: narrow T.C.R. tolerance $\pm 5\%$
- Resistance range: $51\Omega \sim 51k\Omega$
- Resistance tolerance: $\pm 1\%$, $\pm 2\%$, $\pm 5\%$
- T.C.R.: $\pm 150 \sim \pm 5000$ ppm/K
- T.C.R. Tolerance: ± 150 ppm/K $\sim \pm 15\%$
- Sizes available: 0603, 0805 & 1206

Positive Temperature Characteristics



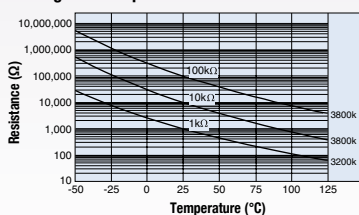
Thick Film Linear PTC - LA73

- Available in 13 specifiable temperature characteristics
- T.C.R. Tolerance: ± 200 ppm/K or $\pm 10\%$
- Resistance range: $22\Omega \sim 10k\Omega$, $\pm 5\%$
- Sizes available: 0603, 0805 & 1206

NTC Thermistor- NT73

- Resistance range: $1k\Omega \sim 150k\Omega$
- Resistance tolerance: $\pm 5\% \sim \pm 15\%$
- B constant: $3200K \sim 4100K$
- B constant tolerance: $\pm 3\% \sim \pm 10\%$
- Sizes available: 0603, 0805, 1206

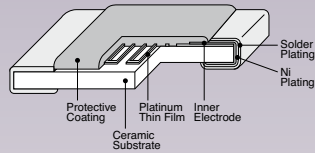
Negative Temperature Characteristics



Platinum Thermal Sensors

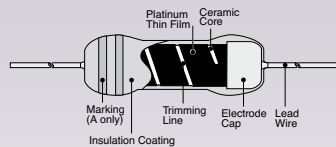
Chip Type Sensor - SDT73H/V/S

- T.C.R.: 3850 ± 50 ppm/K in accordance with IEC 60751⁻¹⁹⁹⁵
- **SDT73H**: Temperature up to $+155^\circ C$
- **SDT73V**: AEC-Q200 qualified, $+155^\circ C$
- **SDT73S**: Temperature up to $+250^\circ C$
- Resistances: 100Ω or 500Ω
- Resistance tolerance: $\pm 0.2\%$, $\pm 1\%$



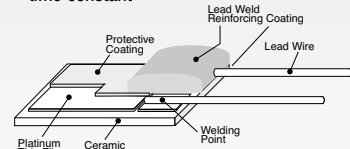
Axial Type - SDT101A/SDT101B

- -55 to $+300^\circ C$ operating temperature
- Resistances: 10Ω , 100Ω , 500Ω
- Resistance tolerance: $\pm 0.5\%$ or $\pm 1\%$
- T.C.R.: ± 3500 ppm/K $\pm 1\%$ or $\pm 2\%$



Small Type - SDT310

- T.C.R.: 3850 ppm/K in accordance with IEC 60751, JIS C 1604
- Radial and axial styles
- Stability classes A, B or C available
- Class A: $\pm(0.15+0.002|t|)^\circ C$
- **SDT310VASP**: Axial, ultra small heater element, $(2 \times 0.4 \times 0.65 \text{ mm})$, 20Ω at $0^\circ C$, $+600^\circ C$, 3.2 sec thermal time constant
- **SDT310AP**: Axial, $(3 \times 0.8 \times 1.2 \text{ mm})$, 10Ω at $0^\circ C$
- **SDT310HCTP**: Radial, $(3 \times 1.2 \times 1.1 \text{ mm})$, 100Ω
- **SDT310LTC**: Radial, temp. up to $+155^\circ C$
- **SDT310P**: Radial, temp. up to $+400^\circ C$
- **SDT310MTM**: Radial, temp. up to $+650^\circ C$, 100Ω
- **SDT310HLTC**: Radial, 2.8 sec thermal time constant



Custom Configurations - ST Series/AFS Units

- Customer configurations based on use of SDT101 and SDT310 products

Applications for Temperature Compensation

- Flow sensor (automobiles, industrial equipment, home appliances)
- Measuring equipment (electric scale, load cell, flow sensors, automobiles)
- Cold junction compensation of thermocouple temperature controllers

Fuses

Fusing Flat Chip Resistors - RF73

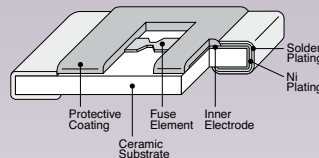
- Resistance range: $0.2\Omega \sim 510\Omega$
- Resistance Tolerance: $\pm 5\%$
- Sizes available: 0603 \sim 2512

Chip Current Fuses - TF

- Rated current: $0.2A \sim 5A$
- Rated voltage: $24V$ & $32V$
- Sizes available: 0402 & 0603
- TF16AT: Anti pulse

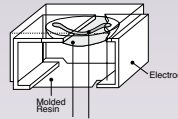
NEW TF16VN: 0603 for Automotive

- Rated current: $0.8A \sim 3.15A$
- Rated voltage: $32V$



Micro-Fuse - CCP

- UL 248.14 approved, File #131375
- Fusing Current: $1A \sim 10A$
- Rated Voltage: $24V \sim 76V$
- Sizes available: 1206 & 1210



Chip Fuse - CCF1N

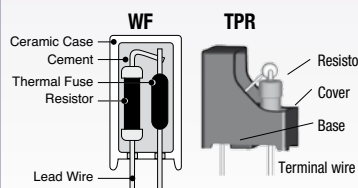
- Square ceramic body
- Size: $6.0 \times 2.5 \times 2.5$ mm
- Up to AC125V and DC160V
- UL248.14, c-UL(CSA)C22.2
- Rated current: $0.4A \sim 15A$

Chip Fuse - CCF1F

- Fast acting
- Meets IEC60127-4 specifications (Universal modular fuse-links standard sheet 2)

Thermal Fuse & Power Resistor - WF

- Rated current: $2A$ & $10A$
- Rated voltage: $250V$ AC
- Resistance range: $1\Omega \sim 10k\Omega$



Temperature Protection Resistor - TPR

- Quickly fusing to overcurrent
- Circuit is completely interrupted after fusing
- Lightning surge test (IEC61000-4-5) effective
- UL1412 (File E344400) approval awarded
- Power rating: 1Watt
- Resistance range: $2\Omega \sim 10k\Omega$

Varistors

Metal Oxide Chip - NV73

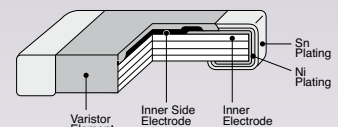
- Protects against static electricity, switching and incoming surges
- Varistor voltage: $8Vc \sim 165Vc$
- Sizes available: 0201 \sim 2220
- Maximum energy: $0.005J \sim 14.0J$

Automotive Metal Oxide Chip - NV73DL

- Conforming to AEC-Q200
- Low leakage current
- Operating temperature: up to $+125^\circ C$
- Varistors voltage: $10 \sim 90 V_{1mA}$
- Sizes available: 0603, 0805 & 1206

NEW Chip Varistor for Load Dump Surge - NV73DS

- Meets load dump surge test of JASO
- High energy power - comparable to power zener diodes
- Size: $6.1 \times 5.1 \times 3.7$ mm (2420 inch)
- Varistor voltage: $20 \sim 25V$; $40 \sim 45V_{1mA}$
- Max. load dump surge energy: $63J \sim 70J$

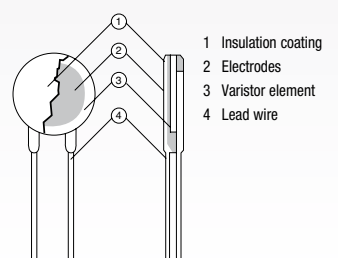


NEW Metal Oxide - Nonflammable Coated - NVF

- Flame retardant silicone (UL94V-0) is applied for outer coating
- UL1449 (File No. E328032)
- Disc diameter: $15 \sim 16$ mm
- Varistor voltage: $198 \sim 740V_{1mA}$
- Max. Energy: $27.5J \sim 67J$

Metal Oxide Disc Type - NVD

- Higher surge current
- Absorbs positive and negative surges
- Varistor voltage: $16V \sim 1980V$
- Disc diameters of 05, 07, 10, 14 & 20mm
- Maximum energy: $0.3J \sim 360J$



Inductors

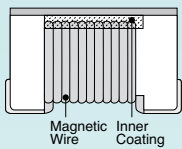
Coil solutions on different cores cover an application range from RF to power by using ferrite, ceramic, thin film and choke coil technologies.



Wirewound

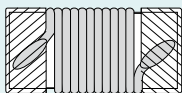
High Q Air Core - KQ/KQT

- High self resonant frequency
- Ideal for low loss, high output power consumption
- Q Factor min.: 16 ~ 65
- Inductance range: 1.0nH ~ 10 μ H
- Inductance tolerance: ± 0.1 nH ~ $\pm 20\%$
- Sizes available: 0402, 0603, 0805 & 1008



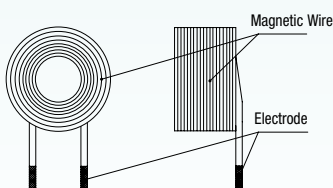
High Current Air Core - KQC

- Low DC resistance, high allowable DC current
- Nominal inductance: 1.4nH ~ 27nH
- Allowable currents up to 2.25A
- Inductance tolerance: ± 0.1 nH ~ $\pm 5\%$
- Sizes available: 0402, 0603



Custom Wirewound Coil - LWA

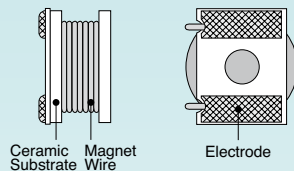
- Custom product which keeps its shape even if no core nor bobbin are used
- Different shapes, dimensions, inductances on request
- Coils for wire-less power supply, actuator, etc.
- Inductance range: approx. 10 μ H ~ 1mH
- Inductance tolerance: $\pm 5\%$



Choke Coils

Power - LPC

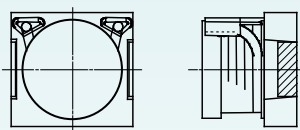
- Non-shielded construction with bottom terminations in sizes: 4045, 9040, 10065, 12065
- DC current max.: 0.12A ~ 10A
- Inductance range: 0.68 μ H ~ 6.8mH
- Inductance tolerance: $\pm 10\%$ ~ $\pm 30\%$



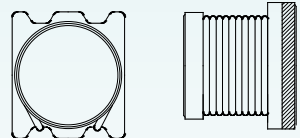
Power - LPC 4235/LPC 4545

- 4 mm size with bottom and side terminations
- AEC-Q200 qualified
- DC current max.: 0.07A ~ 3.66A
- Inductance range: 0.82 μ H ~ 2200 μ H
- Inductance tolerance: $\pm 10\%$ or $\pm 20\%$

LPC4235 (3.5mm height)



LPC4545 (4.6mm height)



Choke Coils

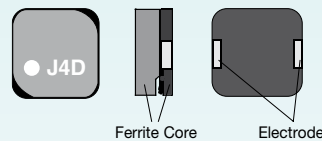
NEW Magnetic Shielded Power - LCM1060

- Extremely low leakage magnetic flux
- High rated current in 10 x 10mm size
- AEC-Q200 qualified
- DC current max.: 0.6A ~ 6.8A
- Inductance range: 1.5 μ H ~ 470 μ H
- Inductance tolerance: $\pm 20\%$, $\pm 30\%$
- E-I core construction



Shielded - LKS

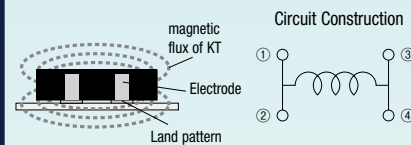
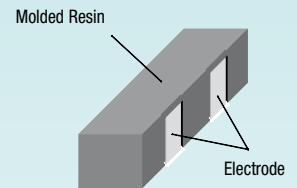
- Sizes 0745, 1045, 1260
- DC Current max.: 0.15A ~ 6.6A
- Inductance range: 3.3 μ H ~ 10000 μ H
- Inductance tolerance: $\pm 20\%$ or $\pm 30\%$



Transponder Coil

Rx-Receiver - KT 11835

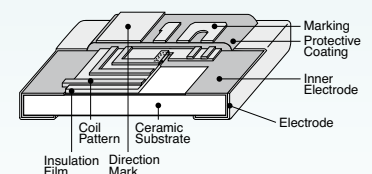
- Single-axis LF antenna (for receiving)
- High Q and high sensitivity
- Strong to vibration, shock and substrate bending
- 4 element terminal structure
- DC current max: 12mA ~ 30mA
- Inductance range: 2.4mH ~ 12mH
- Inductance tolerance: $\pm 2\%$, $\pm 3\%$, $\pm 5\%$



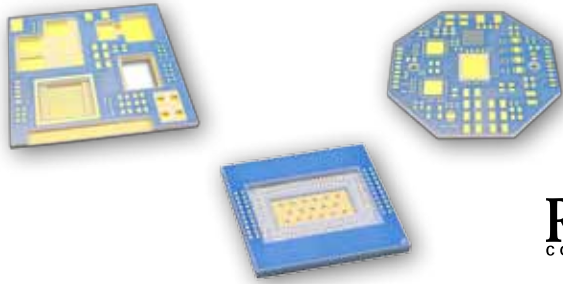
Thin Film

Thin Film Inductor - KL73

- High self resonant frequency
- Low DC resistance
- Inductance range: 0.56nH ~ 100nH
- Inductance tolerance: ± 0.1 nH ~ $\pm 5\%$
- Sizes available: 0402, 0603, 0805, 1206



LTCC Substrates



Low Temperature Co-Fired Ceramic LTCC-KLC

Technology
Low Temperature Co-fired Ceramic is a multilayer ceramic technology that allows for moderate firing temperatures. The LTCC process is similar to the thick film hybrid process employed for multilayer ceramic capacitor and chip inductors. The moderate firing temperature level below 900 °C is achieved by mixing alumina and glass as main ingredients of the ceramic tape, the so-called green sheets. This permits the co-firing with highly conductive material (silver) for the electrodes. LTCC also support the creation of buried components and thus contribute to miniaturization.

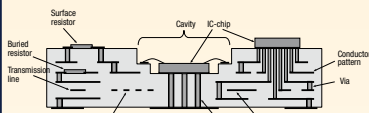
Shrinkage Control
The LTCCs are fired under free shrinkage conditions: The material is allowed to shrink in all three dimensions. The highly homogeneous structure of the green sheets and precise process control ensures high reproducibility of the dimensional accuracy. Relative accuracies of 0.05 % can be achieved. This high accuracy allows for the realization of dimensionally accurate cavities for the mounting of bare die semiconductor chips.

- Features**
- Excellent dimensional accuracy by KOA's original shrinkage control technology
 - Multi layer technology up to 20 layers (more than 20 layers available on request)
 - Surface Flatness down to $\pm 5 \mu\text{m}$ on request
 - High-density wiring by fine line patterning
 - Miniaturization by buried R, L, C and strip-lines
 - Back volumes and channels
 - Excellent high frequency performance up to 60 GHz by the use of low loss ceramics and conductors
 - Thermal expansion coefficient similar to Si and GaAs
 - Precision cavities enable bare chip mounting with short bond wires
 - Thermal vias under bare chips enhance heat transport
 - Superior heat and humidity resistance

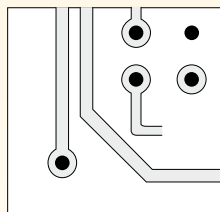
Low Temperature Co-Fired Ceramic LTCC-KLC

- Stack accuracy: 20 μm max.
- Line width as low as 60 μm
- Line-to-line spacing as low as 60 μm
- Substrate flatness: 30 μm max.
- Via diameter: 100 μm , 150 μm , 200 μm
- Through-via pad diameter: Via diameter +50 μm min.
- Cavity width: 600 μm min.
- Cavity depth: 100 μm min.
- Cavity wall thickness: 500 μm min
- Flexural/bending strength: 250MPa
- Coefficient of Thermal Expansion: 5.5ppm/K
- Thermal conductivity: 3W/m • K
- Minimum insulation resistance: $1 \times 10^{13} \Omega \cdot \text{cm}$
- Dielectric constant at 1MHz: 7
- Dielectric loss at 1MHz: <0.003
- Density: 2.8g/cm³
- Max. surface roughness (Ra): 0.4 μm
- Min. withstanding voltage: 15kV/mm
- Fired layer thickness: 40 μm ~ 125 μm

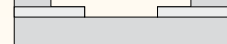
Cross-sectional structure



Inner layer



Cavity



Applications:

- High density sensor interconnect
- MEMS Packages
- High frequency: Microwave, Milliwave
- Harsh environment: High Temperature, High humidity
- Mobile Communications
- Multi Chip Modules
- Interposer substrates



Integrated Components

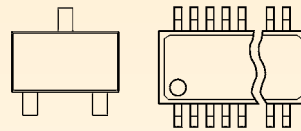
Improve performance, save space and lower costs by combining components using our thin film, silicon based, multi-element technology.



Resistor Networks

KOA's Integrated Passive Components - KPC

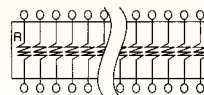
- Thin film (metal film) resistor array on Silicon wafer
- Excellent resistance matching, TCR tracking and stability
- Custom circuits are available with flexible layout (Different resistance combinations possible)
- Higher Integration saves board space and overall assembly costs
- Excellent reliability with standard molded IC package
- Suitable for reflow soldering
- Standard packagings:
SOT-23
QSOP 16, QSOP 20, QSOP 24
SOIC-N08, SOIC-N14, SOIC-N16



- Typical applications
 - Highly accurate peripheral resistors for analog operational amplifiers
 - Automotives, Analog instrumentations, IC-testers
 - Computers, Data communications, Network systems
 - Operational amplifiers, Terminations, Pull-up/Pull-down
 - Meets or exceeds IEC 60115-1, JIS C 5201-1, JIS C 5101-1

Isolated Resistors – RIA

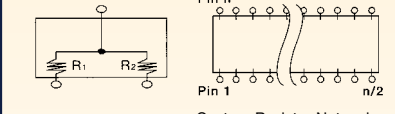
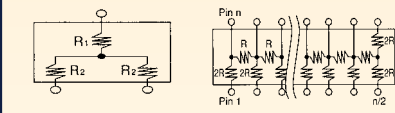
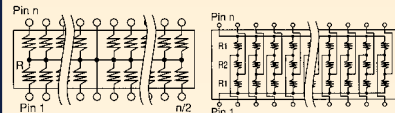
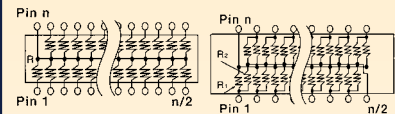
- Precision value matching
- Absolute resistance tolerances: $\pm 0.1\%$, $\pm 0.25\%$, $\pm 0.5\%$, $\pm 1\%$, $\pm 5\%$
- Relative resistance tolerances: 0.05% ~ 2%
- T.C.R.: ± 10 , ± 25 , ± 50 , $\pm 100\text{ppm/K}$
- T.C.R. tracking: 5ppm/K ~ 50 ppm/K
- Resistance range: 10 Ω ~ 510k Ω



Resistor Networks

Bussed Resistors

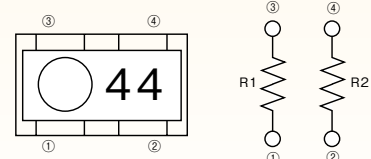
- Standard Combinations
 - Bussed – RBA
 - High speed bussed – RBB
 - Dual terminator – RDA
 - Differential terminator – RDB
 - R2R network – RLA
 - SOT-23 network – RTX, RTY
 - Custom – RNX
- T.C.R.: $\pm 10\text{ppm/K}$ ~ $\pm 100\text{ppm/K}$
- Resistance range: 10 Ω ~ 100k Ω



Custom Resistor Networks

Precision Pair Resistors – CNN

- Thin film on ceramic
- Pair resistors for high precision ratio
- Resistance tolerance
 - absolute: $\pm 0.1\%$, $\pm 0.25\%$
 - relative: 0.05%, 0.1%
- T.C.R. absolute: $\pm 25\text{ppm/K}$
- T.C.R. relative: 5ppm/K





Leaded Resistors

The industry's broadest line of leaded resistors and networks include designs with various material composition and structure for use in general purpose, precision, anti-surge, high voltage, high resistance, PTC and fusing applications.



Carbon film

General Purpose - Reduced Size and Flame Proof CF/CFB/CFS/CFP Series

- Power rating: 0.25W ~ 0.5W
- Resistance range: 2.2Ω ~ 5.1MΩ
- Tolerance: ±2% or ±5%

High Power Resistor - SPR and SPRX

- Power rating: 0.25W ~ 5W
- Resistance range: 0.1Ω ~ 110kΩ
- Tolerance: ±1%, ±2% or ±5%

Metal film

General purpose - Reduced Size MF/MFP/MFS/SN Series

- Power rating: 0.25W ~ 2W
- Resistance range: 0.51Ω ~ 5.11MΩ
- Tolerance: ±0.1% ~ ±5%
- T.C.R.: ±50 ~ ±200 ppm/K

Precision - RNS/SF Series

- Power rating: 0.125W ~ 1W
- Resistance range: 0.2Ω ~ 6.8MΩ
- Tolerance: ±0.01% ~ ±1%
- T.C.R.: 5 ~ 50 ppm/K

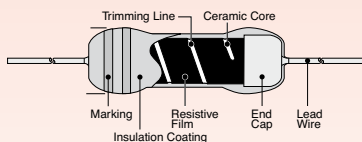
Metal Oxide

General Purpose - MO/MOX Series

- Power rating: 0.5W ~ 3W
- Resistance range: 5.1Ω ~ 150kΩ
- Tolerance: ±2%, ±5%
- T.C.R.: ±200 ppm/K

Reduced Size - MOS/MOSX Series

- Power rating: 0.5W ~ 5W
- Resistance range: 0.1Ω ~ 100kΩ
- Tolerance: ±1%, ±2% or ±5%
- T.C.R.: ±300 ppm/K



Power Type - BSR Series

- Rectangular ceramic case
- Power rating: 2W ~ 20W
- Resistance range: 430Ω ~ 75kΩ
- Tolerance: ±5%
- T.C.R.: ±300 ppm/K

Wirewound

Miniature Type - CW/CWP/CWH/CWS/CWX Series

- Power rating: 0.25W ~ 5W
- Resistance range: 0.1Ω ~ 3kΩ
- Tolerance: ±0.25% ~ ±10%

NEW Fusing Function - CWFS23 Series

- Fail-safe mains fusing at AC 250V (10Ω ~ 100Ω); AC 200V (4.7Ω ~ 9.1Ω)
- UL1412 recognized (File No. E134679)
- Power rating: 3W
- T.C.R.: ±100ppm/K
- Size: 12 x 4mm

Power - RW/RWN Series

- RWN: Non-inductive winding
- Power rating: 0.5W ~ 14W
- Resistance range: 0.1Ω ~ 62kΩ
- Tolerance: ±0.5% ~ ±5%

Power Rectangular Type - BGR, BWR Series

- Rectangular ceramic case
- BGR with glass core
- BWR with ceramic core
- Power rating: 1W ~ 40W
- Resistance range: 0.1Ω ~ 390Ω
- Tolerance: ±1% ~ ±10%

High Voltage/High Power - P Series

- Special shape parts
- Power rating: up to 250W
- Working voltage: up to 300 kV

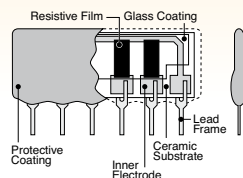
Leaded SIP networks

Thick Film - RKC/RKH/RKL Series

- Number of pins: 3 ~ 16
- Resistance range: 10Ω ~ 2.2MΩ
- Tolerance: ±1% ~ ±5%
- Various circuit and custom parts available

Precision Metal film - MRP

- Resistance range: 50Ω ~ 100kΩ
- Absolute tolerance: ±0.1% ~ ±1%
- Ratio tolerance: 0.025% ~ 0.5%



Zero Ohm/Jumper

Conformal coated - Z Series

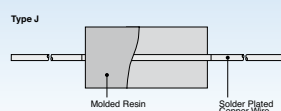
- Max. allowable current: 1.5A, 2.5A
- Resistance: less than 20mΩ

Molded - J Series

- Max. allowable current: 8A, 10A
- Sizes: 3.4 x 1.7mm, 6.5 x 2.3 mm

Jumper Wire - JL Series

- Max. allowable current: 8A, 10A
- Wire diameter: 0.5 or 0.6mm



Specialty

Anti-Surge, Metal Glaze - RCR Series

- Awarded UL1676, EN60065 & c-UL approvals
- Max. working voltage: 500V ~ 5000V
- Power rating: 0.25W ~ 3W
- Resistance range: 3.3Ω ~ 100MΩ
- Tolerance: ±1% or ±5%

High Voltage, Metal Glaze - GS Series

- Max. working voltage: 0.5kV ~ 40kV
- Power rating: 0.25W ~ 12W
- Resistance range: 0.5MΩ ~ 10GΩ
- Tolerance: ±0.5% ~ ±10%

NEW High Voltage, Thick Film - RK92-L Series

- Excellent overload capability
- Charge and discharge res. for power supply
- Power rating: 4W
- Resistance range: 1.2MΩ ~ 16MΩ
- SIP shape, Pitch: 45mm

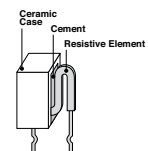


Ceramic Composition - PCF/HPC/CPCN Series

- KOA original ceramic resistor
- Excellent characteristic against high voltage surge current
- Available as PTH or without leads (CPCN)
- CPCN is suitable as noise suppressor of engine ignition circuit systems
- Power rating: 0.5W ~ 5W
- Resistance range: 3.3Ω ~ 390kΩ
- Tolerance: ±10% or ±20%

Current Sensing Rectangular Type - BPR Series

- Power rating: 2W ~ 14W
- Resistance range: 0.01Ω ~ 1Ω
- Tolerance: ±5% or ±10%
- Twin type with 3 leads available



Linear Thin Film PTC - LT/LP Series

- Resistance range: 1Ω ~ 100kΩ
- Tolerance: ±1%, ±2%, ±5%
- T.C.R.: 150ppm/K ~ 5000ppm/K
- T.C.R.: Tolerance: ±50ppm/K, ±5% ~ ±15%

Fusing Resistors - RF/BMF Series

- Power rating: 0.17W ~ 5W
- Resistance range: 0.1Ω ~ 15kΩ
- Tolerance: ±5%, ±10%
- RF25CC: constant current fusing type
- RF26: Radial type, L-style
- BMF: Rectangular type
- WF: Thermal fuse built-in
- TPR1: Temperature protection resistor

For an Innovative Partnership

KOA Europe... In Dägeling, Product and Application Engineers, together with an experienced Sales Force and a dedicated Customer Service Team, share one focus: our mutual growth and success.

Such aspirations necessitate all-round competence including continuous efforts in:

- A wide programme of passive components
- Product innovations
- Superior Customer Support
- Total Quality Management
- Custom-built logistic packages
- Competitive prices

Logistics is the key to efficiency and worldwide success.

KOA Europe runs a warehouse with approx. 2 billion pieces stock on hand to support customers within 24 hours with the most common parts. Our experts are pleased to share their experience with you:

- JIT shipments
- Customer specific labelling
- Full range of EDI possibilities
- Electronic incoming and dispatch control
- Consignment Stock

Continuous improvement is a "must" for today's global business

- We achieved ISO 9001 certification the year following our foundation
- Moreover, KOA's production plants are ISO/TS 16949 and ISO 14001 approved

Technical Support plays a critical role in helping customers to improve product quality.

KOA's technical staff is highly trained in:

- Development of new products
- Design-In
- Application Engineering
- Product Performance Characteristics

Even with all this expertise, a company can only be as good as its Customer Service Team. At KOA you will find:

- Competent and reliable partners for your enquiries
- A multi-lingual team
- Automated order and sample processing
- Prompt, efficient responses

And yet continuous improvement is our goal. Constant staff training is one means by which we are aiming to achieve it, good communication with you is another.

Let's work together for...

Your Passive Solution

Your KOA Europe Team

The KOA logo consists of the letters 'KOA' in a bold, sans-serif font. The 'K' is blue, and the 'O' and 'A' are dark blue. The 'O' has a stylized shape with a gap on the right side.

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