Passive & Discrete Components

Capacitors
- Tantalum
- Ceramic
- Aluminium
- Film
- Polymer

Resistors
- Film
- Foil
- Network
- Power
- Carbon
- Current sense

Speciality
- Pots/trimmers
- Sensors/encoders
- Magnetics
- Filters
- Circuit protection
- Timing devices
- Power supplies

Discretes
- Diodes
- Rectifiers
- Transistors
- Thyristors
- Optoelectronics
- Speciality

www.ttieurope.com
TTI, Inc. – Never Short on Solutions
The World’s Largest Specialist Distributor for Passive, Discrete, Connector & Electromechanical Components

TTI's European headquarters in Maisach-Gernlinden occupies 19,000m², with 16,000m² of dedicated warehouse space on three levels. We provide local service in over 40 sales locations across Europe.

Our suppliers are the most innovative and capable in the electronics industry. Together with them, we put emphasis on product knowledge, inventory and logistics to provide our customers with industry leading service support and value.

Our focused product line and comprehensive supply chain management solutions have made TTI the supplier of choice for our OEM and CEM customers worldwide.

By focusing on new product introductions, high technology products and working with Mouser, we provide our customers and suppliers with unparalleled design-in support, ensuring the best and newest parts are always available.

TTI has built a reputation as a specialist in passive components stretching back over 35 years. The company represents leading brands, stocking wide and deep across each franchise. With many of the world’s leading manufacturers of resistors and capacitors, TTI is at the top of their supply chain network thanks to the company’s commitment to holding inventory and its policy of introducing new products before many other distributors. This ensures that customers get access to the latest technology solutions.

Discrete semiconductor manufacturers are continually developing new diodes, rectifiers, FETs, LEDs etc which offer designers a wealth of performance benefits that they can incorporate into their latest projects. TTI represents a number of leading manufacturers of these products and provides the same level of service and support that buyers of passive and interconnect components have come to expect.

Why buy from TTI?
TTI concentrates on the basic strategy of focusing on our products and striving to be the best at what we do. No other company offers the unique combination of benefits we provide:

- Specialist in Passive, Discrete, Connector & Electromechanical Components
- Deepest and broadest inventory
- Best in class support
- Leading global suppliers
- Focused line card
- Technology leader
- Only distributor with catalogue division – Mouser
- Opportunity to consolidate supplier base
- Reduced lead-times
- Specialist local support
- World class supply chain programs
- Reduced total cost of acquisition

To support your design you can request free of charge samples from TTI.
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AVX Corporation, a recognised leader in the global passive electronic component and interconnect products industry, is at the forefront of technology, design, manufacturing and supply.

AVX offers customers the benefits of global manufacturing and distribution provided by 24 manufacturing facilities in 15 countries. With research and development centres in five locations around the world, AVX and TTI are committed to new product design to meet customer demand for miniaturization, improved performance and reduced cost. AVX’s broad range of components includes capacitors, resistors, timing devices, filters, integrated passive components and circuit protection. Featured below are a selection of exciting products from AVX offered by TTI.
High Capacitance Ceramics

Features & Benefits
- X5R and X7R ceramic
- Up to 100μF offering
- Excellent ESR performance
- FLEXITERM® termination finish available
- Commercial and automotive qualified

High Voltage/High Reliability Ceramics

Features & Benefits
- High voltage/high reliability ceramics
- Outstanding ESR/ESL performance
- Non-polar construction
- Capacitance availability to 1,300μF
- RoHS options available
- Commercial, CECC, MIL, DSCC and ESCC qualified ranges

RF and Microwave Devices

Features & Benefits
- Porcelain (P90) and NPO dielectric
- High current
- Hi-Q
- Low ESR
- High stability

Varistors (MLV & MOV)

Features & Benefits
- TransGuard® – 0402V – 1210V, 3.3V – 60V
- 0405 and 0508 two element array versions
- 0508 and 0612 four element array versions
- Medium power versions
- CANbus, USB and AntennaGuard versions
- Leaded and SMT

Tin/Lead (SnPb) Finish MLCC

Features & Benefits
- NP0, X5R, X7R and X8R dielectrics
- Voltage range from 6.3V – 5,000V
- Low inductance capability
- FLEXITERM® soft termination capability
- Coupling, decoupling, filter and snubber circuits

Filters

Features & Benefits
- EMI, SMT, array cylindrical, bolt and soldering systems
- High current feedthrough
- Feedthrough arrays – 4 element
- SAW
- Leaded and SMT thin film low pass filters

FLEXITERM® & FLEXISAFE™

Features & Benefits
- Increases resistance to cracking
- Thermal/mechanical shock damage resistance
- FLEXITERM® up to 2x standard bend test
- FLEXISAFE™ utilises internal cascade design
- FLEXISAFE™ improved ESD and ESR performance

Timing Devices

Features & Benefits
- Ceramic resonators up to 60MHz
- SAW resonators
- Quartz crystal
- Clock oscillators
- Stable product
- Full range of case sizes

630V Ceramic Capacitors

Features & Benefits
- High capacitance 0.56μF
- Low ESR at high frequency
- Low leakage
- High current handling
- For SMPS, high voltage coupling and DC blocking

NTC Thermistors

Features & Benefits
- Leaded and SMT
- Temperature range: -55°C – 150°C
- Resistance range: up to 1MΩ
- Measuring accuracy: 1 up to 5%
- RoHS part, lead free profile solder compatible

LGA Low Inductance Capacitors

Features & Benefits
- Two terminal simple construction/design
- 0204, 0306, 0508, 0805 case size
- Ultra low ESR (down to 27pH)
- High capacitance (up to 2.2μF)
- Land grid array for improved bond strength

Other AVX Products

Features & Benefits
- Medium and high power film capacitors
- Piezo generators
- Thin film devices
- Fuses 0401 – 0612, up to 4A
- Module devices
- Integrated passive devices
- Diodes
- Multilayer organic devices
- Resistors
- Inductors
Bourns was founded over 60 years ago around a simple philosophy; provide top-quality products, responsive service and high value for customers. Bourns manufactures over 4,000 products and has manufacturing facilities and customer support teams located throughout the world. Bourns continually invests in new products and designs.

Bourns serves a broad range of markets, including telecommunications, computer, industrial, instrumentation, automotive, consumer, non-critical life support medical, audio and various other market segments. Bourns offers high volume commercial panel controls, precision potentiometers, trimming potentiometers, networks, sensors and controls, encoders, specialty resistive products, circuit protection products, diodes, inductors, transformers, switches, integrated circuits, and microelectronic modules as well as custom capabilities for numerous one-of-a-kind applications.

Speciality Resistive Products

**Power Resistors – RF**

**Features & Benefits**
- Powers up to 1,000Wmax
- Thick film on ceramic

**Applications**
- Drop-in isolators
- Combiners
- Duplexers
- Heaters

**Surge Resistors**

**Features & Benefits**
- Thick film in TO220
- Surface mount wirewound

**Applications**
- Central offices
- Networks
- Inverters
- Actuators
- Braking resistors

**Shunt Resistors**

**Features & Benefits**
- Rated current of up to 50A
- TCRs of 20ppm
- Minimum resistance values of less than 1mΩ

**Applications**
- Battery chargers
- OEM power supplies
- Emergency power systems

Circuit Protection Products

**Features & Benefits**
- MOV products
- Multifuse® ceramic PTC resettable fuses
- Gas discharge tubes
- MSP® hybrid protectors
- ChipGuard® ESD protection
- Signal and dataline protectors
- Telefuse™ telecom fuses
- TISP® thyristor surge protectors
- TVS diodes/arrays
- SingiFuse™ thin film chip fuses
- TBU® high-speed protectors
- Multifuse® devices with freeXpansion™ technology provides greater product performance

**Diodes**

**Features & Benefits**
- TVS diodes
- TVS diode arrays
- Rectifier diodes
- Schottky diodes
- Small signal switching diodes
- Steering diode arrays
- Zener diodes

**TBU® High-Speed Protectors**

**Features & Benefits**
- Superior circuit protection
- Overcurrent and overvoltage protection
- Blocks surges up to rated limits
- Operating temperature -40°C – +125°C
- High-speed performance
- Small SMT package

**Inductors & Transformers**

**Features & Benefits**
- Standard inductance values from 1nH to100mH
- Chip inductors from size 0402 – 1812
- 120 SMD power inductors models up to 60A, shielded, semi shielded and non-shielded, ferrite, toroidal and moulded cores
- Common mode chokes and line filters
- Line matching, RF, LAN (POE) and ADSL
- Surface mount and through-hole models
Linear Motion Potentiometers

**Features & Benefits**
- 20mm and 32mm package sizes
- Electrical travel from 2.54mm (0.1”) – 12.7mm (0.5”)
- Long mechanical life
- Essentially infinite resolution

Precision Controls

**Features & Benefits**
- Bushing
- PC mount
- Snap-in
- Servo mount
- Linear
- Audio taper
- Custom taper
- 13mm – 51mm diameter
- AMS 22S: non-contacting, single-turn, sintered bronze servo lid

Industrial Encoders

**Features & Benefits**
- Bushing and snap-in
- PC board mount
- Contacting – 6PPR – 36PPR options
- Optical – 25PPR – 256PPR options
- Magnetic – incremental, absolute, PWM
- 6mm, 12mm, 18mm square and 16mm x 22mm

Industrial Panel Controls

**Features & Benefits**
- Bushing
- PC mount
- Snap-in
- Linear
- Audio taper
- Custom taper
- 9mm – 23mm

Commercial Panel Controls & Encoders

**Encoders**
- Incremental contacting, absolute contacting and rotary optical – all continuous rotation
- Mounting: bushing, PCB pins, PCB bracket and snap-in
- 6mm, 9mm, 12mm, 16mm, 22mm square, 16mm x 21mm sizes

**Panel Controls**
- Slide, rotary and linear motion potentiometers and pot/switches with metal and plastic shafts
- Terminals: solder lugs, PCB pins, L-pattern, J-hooks, leadwire-flexible
- 6mm x 22mm sizes

Resistor & RC Networks

**Features & Benefits**
- Surface mount and through-hole mounting
- SIP and DIP packages
- Moulded and conformal-coat packages
- Standard resistance values from 100 – 10mΩ
- SIP package height as low as 0.195”
- Operating temperature range of -55°C – +125°C

Chip Resistors & Chip Arrays

**Features & Benefits**
- Standard resistance values 0.001Ω – 0.01mΩ
- Chip resistor sizes from 0201 to 2512
- Chip array sizes from 0402 x 2 to 0603 x 8
- Operating temperature range of -55°C – +125°C
- Thick film, thin film, metal plate
- Tolerances of 0.01% – 5%
- TCRs of 5ppm – 600ppm
- Maximum current 17A (current sense resistor model CRA2512)

Trimpot\textsuperscript{®} Trimming Potentiometers

**Multiturn**
- Top and side adjust
- Cermet and wirewound resistance elements
- 3mm – 12.7mm
- Surface mount and through-hole mounting
- Panel mount options
- Available in military approved versions (QPL and Hi-rel)
- Tube, embossed tape carrier, bulk, radial vs. radial tape & reel and ammo pack

**Single-turn**
- Top, bottom, side, front and back adjust
- Cermet, wirewound and carbon resistance elements
- 2mm – 9mm
- Surface mount and through-hole
- Sealed and open-frame
- Tube, embossed tape carrier, bulk, radial vs. radial tape & reel and ammo pack

Switches

**Features & Benefits**
- Surface mount and through-hole mounting
- PC pins, gull wing and J-hook terminal styles
- 3mm, 4mm and 6mm
- Sealed for board wash processes
- Tube and embossed tape carrier
Cooper Bussmann is a global manufacturer offering a broad range of products, including connectors, magnetics, overvoltage and overcurrent circuit protection devices and supercapacitors. Through innovative technology and custom-engineered designs, Cooper Bussmann provides unique solutions for today’s market-driven requirements.

Brand names include Cooper Bussmann fuses and connectors, PolySurg ESD suppressors, Coiltronics magnetics, and PowerStor supercapacitors.

## Circuit Protection

### Resettable PTCs – PTS/PTR Series

**Features & Benefits**
- Fast time to trip
- Low resistance
- Radial and surface mount options

**Applications**
- Medical equipment
- Computers and peripherals
- Rechargeable battery packs
- White goods
- Telecommunications
- Consumer electronics

### Ceramic Tube Fuses – S505H Series

**Features & Benefits**
- Time-delay, high breaking capacity
- 5 x 20mm physical size
- Ceramic tube with plated end cap construction
- Designed to IEC 60127-2, standard, sheet 5
- Optional axial leads available
- 400Vdc/500-600Vac

**Applications**
- Power supplies
- TVs/displays
- Lighting ballasts
- Battery chargers
- Desktops/notebooks

### Surface Mount Fuses – CB61F Series Brick Fuse

**Features & Benefits**
- High interrupting ratings:
  - 50A at 125Vac/300A at 125Vdc
- Wide Selection: 2 – 15A
- CQC approved
- Wire-in-air design
- Solder immersion compatible

**Applications**
- Servers
- LCD/PDP TVs
- White goods
- Power supplies
- Industrial applications

### ESD Suppressors – LTV Series

**Features & Benefits**
- Low trigger voltage and clamping voltage for enhanced protection
- Ultra low capacitance
- Single line, bidirectional
- Low profile
- Low leakage current reduced power consumption

**Applications**
- Satellite/digital radio
- Mobile phones
- HDTV and A/V equipment
- High speed data ports
Magneitics
Power Shielded Drum Inductors – DR/DRQ/DRA Series
Features & Benefits
• Single and dual winding options available
• Automotive grade options available
• 125˚C maximum total operating temperature
• Inductance range from 0.33μH – 1000μH
• Current range up to 56A peak
Applications
• DC/DC converters
• LCDs
• Buck, boost, forward, and resonant converters
• Noise filtering and filter chokes

High Current Ferrite Inductors – FP Series
Features & Benefits
• 125˚C maximum total temperature operation
• Ferrite core material
• High current carrying capacity, low core loses
• Controlled DCR tolerance for sensing circuits
Applications
• Voltage regulator modules (VRMs)
• Power supplies
• Data networking and storage systems
• Point of load modules

High Current Powder Iron Inductors – HCM Series
Features & Benefits
• 125˚C maximum total temperature operation
• Powder iron core material
• Magnetically shielded, low EMI
• High current carrying capacity, low core loses
Applications
• Voltage Regulator Module (VRM)
• Multi-phase regulators
• Base station equipment
• Data networking and storage systems

Supercapacitors
Coin cells – KW Series
Features & Benefits
• High specific capacitance
• Low leakage current
• Long cycle life
• Lowest profile for full industrial temperature range
• Eco-friendly
Applications
• RTC back-up
• Electric utility meters
• Motor control units
• Solar inverters

Cylindrical – X Series
Features & Benefits
• Over 10 year operating life at room temperature
• Ultra low ESR for high power density
• Large capacitance for high energy density
• Long life cycle
• UL recognised
• Eco-friendly package available
Applications
• Hybrid battery or fuel cell systems
• High pulse current applications
• UPS/Hold up power

Cylindrical – PHV/PBH Series
Features & Benefits
• Large capacitance for high energy density
• Ultra low ESR for high power density
• Eco-friendly package available
Applications
• Pulse power
• Bridging or hold-up power
Why Choose KEMET

KEMET applies world-class service and quality to deliver industry-leading, high performance capacitance solutions worldwide. With over 95% of possible dielectric solutions, KEMET offers the world’s most complete line of surface mount and through-hole capacitor technologies across tantalum, ceramic, film, aluminium and paper dielectrics. By offering a wide variety of dielectrics, dimensions, voltages, temperature characteristics and terminations, KEMET capacitors satisfy an expansive range of customer requirements and applications.

Tantalum Capacitors

Tantalum capacitors are the leading choice when high capacitance is needed in the smallest possible size. KEMET has been the foremost manufacturer of tantalum capacitors for over 50 years, and is constantly introducing new innovations to meet changing demands. Offered in a variety of standard sizes, KEMET tantalum capacitors are fully RoHS-compliant and compatible with modern solder processes including multiple Pb-Free reflow passes.

KEMET tantalum capacitors offer many advantages including low ESR, surge current robustness and multiple operating temperature ranges. KEMET also offers a complete line of defence and Commercial-Off-The-Shelf (COTS) products as well as enhanced testing for space applications. While many applications use surface mount technology, a complete line of through-hole tantalum capacitors are available for down-hole, defence and other demanding environments. KEMET offers both traditional MnO2 tantalum as well as a newer variation tantalum polymer which are recommended when very low ESR, increased temperature stability, or benign failure mode is critical.

Ceramic Capacitors

KEMET offers one of the broadest product portfolios of ceramic capacitors in the industry, providing customers the right combination of dielectric, termination system, form factor and screening. KEMET Multilayer Ceramic Capacitors (MLCCs) offer tremendous performance, reliability and cost advantages for circuit designers. Our comprehensive line of surface mount and through-hole devices are utilised in a variety of computer, telecommunications, automotive, defence, medical and consumer electronics. Primary applications include decoupling, filtering, bypassing and smoothing.

Ceramics are non-polar devices which offer unsurpassed volumetric efficiency, delivering the highest capacitance in the smallest package sizes in the market. Available in a wide range of sizes, KEMET MLCCs offer very low equivalent series resistance (ESR), exhibit excellent high frequency characteristics and are extremely reliable. KEMET is driving ceramic technology advancement, resulting in smaller case sizes, better performance and lower cost.

Aluminium Electrolytic Capacitors

Aluminium electrolytics offer some of the smallest sizes for a given capacitance and voltage. Commonly utilised for filtering and bulk energy storage, electrolytics are available in rated voltages exceeding 500 VDC. KEMET offers a broad line of axial, snap-in, screw terminal and miniature electrolytic capacitors with excellent vibration and low thermal resistance for a wide variety of general purpose applications and demanding power electronics such as automotive, power generators and converters, welders, wind turbines, uninterruptible power supplies, and medical imaging.

Film Capacitors

KEMET's complete line of film and paper capacitors, available in both surface mount and through-hole form factors, are designed for use in all types of electronic equipment including power and alternative energy, industrial, telecommunications, automotive, defence, medical and consumer electronics applications. With over 50 years of experience manufacturing plastic film capacitors, KEMET also designs and builds custom equipment for film capacitor production, continuously innovating and improving the production capability, quality, and efficiency. Because films are exceptionally thin – less than 1μm in some cases – extreme precision and process control is required to manufacture quality capacitors for demanding applications.
Low Leakage MnO2
T489 Series

Features & Benefits
• DC leakage current 25% lower than standard MnO2
• Improved reliability: 0.5%/1000 hours, 85°C, rated voltage
• Low ESR options available
• Automotive grade available
• Meets or exceeds EIA standard 535BAAC
• Taped and reeled per EIA 481–1
• Symmetrical, compliant terminations
• Laser-marked case
• Halogen-free epoxy
• RoHS compliance and lead-free terminations

High Reliability Polymer COTS
T540 & T541 Series

Features & Benefits
• First-to-market polymer cathode technology (COTS) capacitors for defence/aerospace applications
• High frequency capacitance retention
• Benign failure mode
• Volumetrically efficient
• 10% derating for part types ≤10V
• 20% derating for part types >10V
• Standard and low ESR levels
• Sn/Pb terminations available
• Surge current testing options
• Single anode (T540) and multiple anode (T541) design
• T541 Series multiple anode design delivers the lowest ESR values in the industry

High Voltage Polymer Tantalum
T521 Series

Features & Benefits
• Voltage ratings to 50V
• Volumetric efficiency
• Stable temperature characteristics
• Up to 330μF capacitance value
• High ripple current capability
• Low ESR
• High reliability
• Low profile design
• Benign failure mode
• Pb Free when ordered with 100% Sn termination
• RoHS compliant and halogen free
• Non-magnetic option available

High Energy Polymer Tantalum
T545 Series

Features & Benefits
• Delivers the highest energy per CC of any tantalum surface mount device
• Extremely low ESR
• High frequency capacitance retention
• Non-ignition failure mode
• Volumetric efficiency and self-healing mechanism
• 100% thermal shock and voltage aging to ensure long term reliability
• Polymer cathode technology
• Excellent solution for designs requiring high energy at relatively low voltages such as hold-up, data hardening or data vaulting for solid state drives and high-end desktop modems

Polymer Hermetic Seal
T550 Series

Features & Benefits
• Polymer cathode technology
• ≤ 0.0075 CV (μA) at rated voltage after 5 minutes
• Extremely low ESR
• High frequency capacitance retention
• Low temperature capacitance retention
• 100% accelerated steady state aging
• 100% surge current tested
• 100% Simulated Breakdown Screening™
• Volumetric efficiency
• Use of up to 80% of rated voltage
• Non-ignition failure mode
• Approximately 25% lighter than equivalent wet tantalum
• Case dimensions equivalent to MIL-PRF-39006/25

Non-Magnetic Capability
Available on Many MnO2 & Polymer Tantalum Surface Mount Series

Features & Benefits
• Developed for applications with known sensitivity to the effects of magnetism such as sonobuoys, digital compasses, gyroscopes and medical imaging equipment
• Exhibits extremely low magnetic permeability
• μ values (measure of permeability) as low as 1.00001–1.00007
• Available with 100% Tin (Sn) or Tin/Lead (SnPb) lead material
• Non-magnetic option can be specified by adding the appropriate lead material code to existing part numbers. Please refer to the ordering information in the desired tantalum surface mount series.
Surface Mount Stacked MLCCs
KEMET Power Solutions (KPS) Series, X7R Dielectric

Features & Benefits
• Higher capacitance in the same footprint
• Potential board space savings
• Single and double chip options available
• Advanced protection against thermal and mechanical stress
• Provides up to 10mm of board flex capability
• Reduces audible, microphonic noise
• Pb-free and RoHS compliant
• Commercial and automotive grade (AEC-Q200) available

High Voltage Surface Mount MLCCs
Commercial, Industrial, Automotive & Military Grades

Features & Benefits
• First-to-market, industry-leading CV values in X7R dielectric, now up to seven times greater than previously available
• Offer optimisation and downsizing opportunities for existing designs
• Rated voltages from 500 – 10,000VDC
• Base metal and precious metal electrodes
• Variety of application-specific options
• Surface mount and through-hole form factors
• Designed for SMPS, high voltage coupling and DC blocking, voltage multiplier and snubber circuits and input/output filtering applications

Flex Crack Mitigation MLCCs
Fail Open, Flexible Termination, Hybrid & Mechanical Isolation Technologies

Features & Benefits
• Lowers risk of catastrophic failure due to board flex
• Reduces low IR or short circuits due to board flex
• Flex stress channelled to end terminations
• Flexible termination allow up to 5mm of board flexitivity
• A full range of flex mitigation options to choose from
• Available in X7R, C0G, X8L and Ultra-Stable X8R dielectrics
• Surface mount and through-hole form factors
• Commercial and automotive grades available
• Well-suited for variety of applications requiring proven, reliable performance

ArcShield™ Technology
for High Voltage Applications
X7R Dielectric

Features & Benefits
• Base metal electrode (BME) dielectric system
• Industry leading CV values
• Exceptional performance at high frequencies
• Pb-free and RoHS compliant
• DC voltage ratings of 500V, 630V and 1KV
• Low ESR and ESL
• 100% pure matte tin-plated termination finish allowing for excellent solderability
• SnPb plated termination finish option available (5% min)
• Available in commercial and automotive grades
• Flexible termination option available upon request

High Power RF & Microwave
HiQ-CBR Series

Features & Benefits
• Ultra high Q
• Base metal (copper) electrode (BME) dielectric system
• Pb-Free and RoHS compliant
• No piezoelectric noise
• Low ESR
• High thermal stability
• No capacitance change with respect to applied rated DC voltage; negligible capacitance change with respect to temperature
• No capacitance decay with time
• Non-polar device, minimising installation concerns
• 100% pure matte tin-plated termination finish allowing for excellent solderability

Automotive Grade SMD MLCCs
C0G, X8L, X7R, X5R, Goldmax, Aximax, Ultra-Stable X8R

Features & Benefits
• Undergo stricter testing protocol and inspection
• Designed for mission and safety-critical automotive circuits for applications requiring proven, reliable performance in harsh environments
• ISO/TS 16949:2002 plant-level certification
• AEC-Q200 part level qualifications
• PPAP availability
• Electric and hybrid vehicle solutions
• High temperature ranges
• More than 50 years experience in the automotive industry
• Custom and optimised designs
• Applications include electronic engine control, drive train and transmission control, multimedia, safety and driver convenience
General Purpose Metallised Polyester Radial Film
F611–F612 Series
Features & Benefits
- Excellent electrical performance
- Smaller sizes
- Good self-healing
- Constructed of metallised wound (F611) or stacked (F612) polyester film
- Encapsulated in self-extinguishing material meeting UL 94V-0 and with halogen-free plastic box
- Typical applications include blocking, coupling, decoupling, and bypassing in applications including consumer, industrial, medical, telecom and automotive
- RoHS compliant and lead-free terminations

DC Link Radial Power Film
C4AE Series
Features & Benefits
- Polypropylene metallised film
- New 600VDC and 105°C ambient temperature ranges
- Smaller case sizes meet the requirements of modern solar microinverters and inverter-driven LED systems.
- Extra long life—100K hours at 85°C and rated voltage
- Self-healing
- Low losses
- High ripple current
- High capacitance density
- High contact reliability
- Suitable for high frequency applications
- RoHS compliant and lead-free terminations

Single Metallised Polypropylene Radial Film
F461–F464 Series
Features & Benefits
- DC or AC applications
- Excellent electrical performance
- Smaller sizes
- Good self-healing
- Offered with up to 4-section construction to meet the high voltage requirements of modern lighting ballasts and other applications such as alternative energy generation, HEV control and charger electronics and industrial power equipment
- Encapsulated in self-extinguishing material meeting UL 94V-0 and with halogen-free plastic box
- Stability and frequency response also ideal for many audio applications
- RoHS compliant and lead-free terminations

Snubbers for IGBT Modules
C4B Series
Features & Benefits
- Self-healing
- Constructed with low-loss polypropylene film
- Voltages to match common IGBTs
- High dV/dt ratings
- High ripple current
- High contact reliability
- Extra long life—100K hours at 85°C and rated voltage
- Suitable for high frequency applications
- Stable temperature characteristics
- Six available tab styles to match various IGBTs
- Compliant and lead-free terminations

Aluminium Electrolytic Screw Terminal Can
ALS30 Series
Features & Benefits
- Compact size
- Long life—up to 40K hours at 85°C and rated voltage
- High ripple current
- Excellent low temperature performance
- Excellent surge voltage capability
- Optimised designs available on request
- Cover a wide range of capacitance and voltage ratings
- Ideally suited for industrial and commercial applications demanding high reliability and long life expectancy such as alternative energy, AC motor drives, welders, UPS systems and switch mode power supplies
- RoHS compliant and lead-free terminations

DC Link Polypropylene Film Screw Terminal Can
C44U Series
Features & Benefits
- Polypropylene segmented film
- Can be used alone or in a bank for medium to high power applications
- High ripple current
- Two life grades available—up to 100K hours at 85°C and rated voltage.
- New larger can sizes to 116mm diameter
- Standard and optimised designs
- Controlled self-healing
- Low losses
- High capacitance density
- Designed for solar power, wind turbine, hybrid/electric vehicles, industrial motor drive and other power generation applications
- RoHS compliant and lead-free terminations
30 years Experience in Quality, Efficiency, Innovation and Service

SMD-LEDs
Features & Benefits
- Wide range of industry-standard SMD packages
- 0402, 0603, 0805, 1206, PLCC-2, PLCC-4 and SOT-23
- Ultra-thin versions of many types also available
- All parts are available in red, green, orange, yellow and blue in standard and high brightness

THT LEDs
Features & Benefits
- THT LEDs available in 3mm, 5mm, 8mm, 10mm and 20mm round package
- 1.9 x 3.1mm, 1.9 x 3.9mm, 2 x 3mm, 2 x 5mm, 2.5 x 5mm rectangular package
- 5 x 5mm square package, 3mm and 5mm cylindrical package
- All parts are available in red, green, orange, yellow and blue in standard and high brightness

PCB Indicators
Features & Benefits
- Extensive range of different PCB indicators assembled with 1, 2, 3 and 4 THT LEDs
- Available in red, green, orange, yellow and blue
- Standard brightness and high brightness types available
- In addition Kingbright offers a small range of SMD PCB indicators

LED Lightbars & Bar Graphs
Features & Benefits
- LED lightbars in various sizes
- Bar graphs with 5, 10, 12 and 20 elements
- Available in red, green, orange, yellow and blue
- Standard brightness and high brightness available

SMD Displays
Features & Benefits
- SMD 7-segment displays in 1 digit and 2 digit versions with digit sizes from 0.2” – 0.8”
- SMD alphanumeric displays in 1 and 2 character versions in 0.4” character size
- Available in red, green, orange, yellow and blue
- Standard brightness and high brightness available

THT Displays
Features & Benefits
- THT displays available in 1, 2, 3 and 4 digits
- Numeric and alphanumeric
- Single colour and bi-colour
- Character sizes from 0.3” – 5.0”
- Available in red, green, orange, yellow and blue
- Standard brightness and high brightness available

Dot matrix
Features & Benefits
- Dot matrix from 0.7” – 4.0”
- 5x7, 5x8 and 8x8 dots
- Round and square dots
- Single colour and bi-colour
- Available in red, green, orange, yellow and blue
- Standard brightness and high brightness available

IR LEDs & Phototransistors
Features & Benefits
- IR LEDs and phototransistors available in various THT and SMD packages
- Available wavelength 850nm – 940nm

Photo-Coupler and Photointerrupter
Features & Benefits
- Kingbright offer a range of industry-standard photocouplers and photointerrupters
- Through hole and pinless types available
Established 1940 in Japan, KOA Corporation is a leading, innovative manufacturer of passive components with more than 3000 employees and 24 manufacturing plants. KOA supplies products to all of the world’s leading electronics manufacturers. KOA Europe GmbH which is located in Dägeling/Itzehoe, Germany offers dedicated customer service together with an experienced sales force and local product and application engineers. Our state-of-the-art logistics operations with our own warehouse ensure the customer production lines to run smoothly.

KOA offers a broad portfolio of high reliability products and technical solutions to fulfill the requirements of various applications. Apart from standard resistors, KOA recommends special SMD parts which are resistant against pulses (SG73 Series), suitable for higher voltages (HV73), have wide terminals for high reliability joints (WK73) or are anti-sulfuration parts (RT-types) for usage in harsh environment. Low ohmic current sensing resistors (SL, TLR, PS) and through hole resistors (CW, PCF, B_R) are also our focus. KOA especially recommends high precision thin film resistors (RN73H) for high reliability applications.

Wide Terminal Chip Resistors – WK73 Series

**Features & Benefits**
- Improved solder joint reliability
- Excellent heat dissipation characteristics
- Superior temperature and power cycling performance
- Low thermal expansion stress
- Higher rated power – less board space
- Tested according to AEC-Q200 requirements

**Applications**
- Several automotive applications
- Power supplies
- Motor control
- Industrial power control
- Battery management EV/HEV

High Precision Resistors – RN73H Series

**Features & Benefits**
- Improved moisture and high heat resistance by special resistive film and protecting coating
- High component and equipment reliability
- Tight tolerances down to ±0.05%
- Stable TCR down to ±5ppm/K
- Operating temperatures up to +155˚C

**Applications**
- Automotive ECU inside the engine room
- Industrial control circuits
- Power meter, power conditioner
- Solar/wind inverter circuits
- DC/DC converter

High-Reliability Power Resistors – BGR, BWR, BSR Series

**Features & Benefits**
- High power ratings up to 40W
- High component and equipment reliability
- Excellent in anti-pulse and inrush current
- Wirewound or metal oxide resistors inside
- Using flame retardant/insulated ceramic case
- Wirewound resistors with ±1% tolerance
- Operating temperatures up to +155˚C

**Applications**
- Pre-charge and discharge resistor in inverter circuits for EV and P(HEV)
- Industrial control circuits
- Power meter, power conditioner
- Solar/wind inverter circuits
- DC/DC converter

Low Ohmic Current Sensing Resistors – SL, TLR, PS Series

**Features & Benefits**
- Resistance values down to 0.5mΩ
- Power ratings up to 6W
- Tolerance of ±1% is standard
- Stable TCR down to ±5ppm/K
- Operating temperatures up to +170˚C

**Applications**
- Automotives
- Inverter power supplies
- Current sensing for CPU
- DC/DC converter
- AC adapters
- Inverter circuits
- Power conditioner/smart meter shunt

Pulse/Surge Protection Resistors – SG73 (S,P) Series

**Features & Benefits**
- Excellent in ESD characteristic
- Outstanding pulse proof property
- High component and equipment reliability
- Tight tolerances down to ±0.5%
- Operating temperatures up to +155˚C

**Applications**
- Car electronics
- Power supplies
- Industrial robots
- Power meter, power conditioner
- Solar/wind inverter circuits
- Snubber circuits in power conditioner/inverter (AC conversion)

Leaded Surge Resistors – CW, RCR, PCF, HPC Series

**Features & Benefits**
- Full ceramic body resistors for HV and surge current (HPC/PCF Series)
- Wirewound for low R-values and good TCR (CW Series)
- Metal glaze resistors for anti-surge and high continuous voltage (RCR Series)

**Applications**
- Power supply circuits for industrial fans, machine tools, etc.
- Inrush current limiting or HV-dividing
- Medical cables
- Circuit breaker
- Snubber circuits in power conditioner/inverter (AC conversion)
Organic Conductive Polymer Aluminium Electrolytic Capacitors (OP-CAP)™

**Features & Benefits**
- 2.5V – 80V, -55˚C – 125˚C
- 6.3mm x 4.5mm – 10mm x 13mm
- 2,000h – 5,000h assured
- Ultra low ESR and high allowable ripple current
- Over 20 years useful life

**SMD Type**

**Features & Benefits**
- 4V – 450V
- -55˚C – 125˚C
- 1,000h – 5,000h assured
- 3mm x 5.3mm – 18mm x 21mm
- Low ESR and high reliability

**Snap-in Type**

**Features & Benefits**
- Up to 500V
- 85˚C – 105˚C
- Up to 7,000h
- 20mm x 25mm – 45mm x 100mm
- Anti-vibration structure available
- Flame-retardant design available
- Terminal type for horizontal mount available

**SMD Type for Automotive Application**

**Features & Benefits**
- Anti-vibration structure
- Peak acceleration up to 50G
- -55˚C – 125˚C
- Up to 5,000h

**Screw Terminal Type**

**Features & Benefits**
- Up to 500V
- 85˚C – 105˚C
- 2,000h – 20,000h assured
- 35mm x 53mm – 90mm x 236mm
- Customised specifications available
**SMD Type**

**VZS Series**

**Features & Benefits**
- 105˚C, 2,000h – 5,000h assured
- Low ESR and high CV in compact size
- Voltage 6.3V – 35V
- Capacitance 22uF – 680uF
- Size 5mm x 5.7mm – 8mm x 10mm

**ORE Series**

**Features & Benefits**
- 105˚C, 5,000h assured
- Radial type, ultra low ESR
- Large permissible ripple current
- ESR 5mΩ

**High CV Items**

**Features & Benefits**
- 105˚C, 2,000h assured
- 2.5V – 63V
- 6.3mm x 5.5mm – 10mm x 13mm
- High CV value in compact size
- Through-hole and SMD types available

**OVK Series**

**Features & Benefits**
- 105˚C, 5,000h assured
- SMD type, ultra low ESR
- Voltage 4V – 63V
- Size 6.3mm x 6mm – 10mm x 8mm

** OVH Series**

**Features & Benefits**
- 105˚C, 2,000h assured
- SMD type, ultra low ESR
- Voltage 2.5V – 16V
- Size 6.3mm x 4.5mm – 10mm x 10mm
- ESR 8mΩ available

**Organic Conductive Polymer Al. E. Capacitor**

**ORE Series**

**Features & Benefits**
- 105˚C, 5,000h assured
- Radial type, ultra low ESR
- Large permissible ripple current
- ESR 5mΩ

**OVK Series**

**Features & Benefits**
- 105˚C, 5,000h assured
- SMD type, ultra low ESR
- Voltage 4V – 63V
- Size 6.3mm x 6mm – 10mm x 8mm

**OVH Series**

**Features & Benefits**
- 105˚C, 2,000h assured
- SMD type, ultra low ESR
- Voltage 2.5V – 16V
- Size 6.3mm x 4.5mm – 10mm x 10mm
- ESR 8mΩ available

**Axial Lead E-Cap**

**For Audio/Speaker System Applications**

**Features & Benefits**
- W. voltage 6.3V – 500V
- Temperature -40˚C – 105˚C
- Capacitance 0.1μf – 22,000μf
- Non-polar, low LC, bio-polar

**High Voltage Pen Type**

**Features & Benefits**
- 400V – 450V
- 2,000h – 10,000h assured
- For slim type power supply
- Large RC capability
- Size: 8mm x 30mm, 8mm x 50mm, 10mm x 50mm, 18mm x 50mm

**Low ESR and High Reliability Type**

**Features & Benefits**
- 6.3V – 450V
- -55˚C – 130˚C
- 2,000h – 10,000h assured
- 4mm x 5mm – 18mm x 45mm
- Higher RC, ultra low ESR
Innovator in Circuit Protection

Littelfuse products can be found around the world, with solutions that can protect virtually every application that requires electricity. Our breadth of product offering, combined with extensive application and industry expertise enables a unique ability to evaluate and respond to needs. Littelfuse partners with TTI and customers to deliver the right solution for each unique application requirement.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Key Features and Protection Characteristics</th>
<th>When/Where Typically Used</th>
<th>Surge Energy Rating Range</th>
<th>Typical Voltage Clamping Speeds</th>
<th>Typical Capacitance/Insertion Loss</th>
<th>Mounting/Size/Packaging Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overcurrent Protection Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuses</td>
<td>Completely stop current flow, which helps to identify faults; wide range of options</td>
<td>Ultimate protection for sensitive/expensive/critical components</td>
<td>Low thru very high</td>
<td>Not applicable</td>
<td>Series impedance measured in nH</td>
<td>Very extensive range of options</td>
</tr>
<tr>
<td>PTCs</td>
<td>Resettable; no device replacement after most common overcurrent events</td>
<td>Where overcurrent events may occur often, and continuous uptime desired</td>
<td>Low thru high</td>
<td>Not applicable</td>
<td>Series resistance measured in ohms</td>
<td>Surface mount, radial leaded, axial strap</td>
</tr>
<tr>
<td><strong>Overvoltage Suppression Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDTs</td>
<td>Switches that turn to on state and shunt overvoltage to ground using a contained inert gas as an insulator</td>
<td>Protection of telecom equipment from lightning surges</td>
<td>Medium thru high</td>
<td>Fast</td>
<td>Low</td>
<td>Surface mount, axial leaded, 2/3 lead radial</td>
</tr>
<tr>
<td>Multi-Layer Varistors (MLVs)</td>
<td>Compact and capable of handling significant surges for their size</td>
<td>ESD and high suppression in smaller and portable electronics</td>
<td>Low thru medium</td>
<td>Moderate</td>
<td>High</td>
<td>Miniature surface mount</td>
</tr>
<tr>
<td>Metal-Oxide Varistor (MOVs)</td>
<td>Capable of withstanding very high energy transients; wide range of options</td>
<td>Appliance, industrial and very high energy suppression applications</td>
<td>Medium thru very high</td>
<td>Moderate</td>
<td>High</td>
<td>Radial leaded, industrial terminal</td>
</tr>
<tr>
<td>PLED LED Protectors</td>
<td>Shunt function bypasses open LEDs; ESD and reverse power protection</td>
<td>High brightness outdoor led lighting applications</td>
<td>Low</td>
<td>Very fast</td>
<td>Medium</td>
<td>Miniature surface mount</td>
</tr>
<tr>
<td>PulseGuard® ESD Suppressors</td>
<td>Extremely low capacitance; fast response time; compact size</td>
<td>ESD suppression; ultra fast reaction; low signal distortion</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>Miniature surface mount</td>
</tr>
<tr>
<td>SPA™ Silicon Protection Arrays</td>
<td>Low capacitance/low clamping voltage; compact size</td>
<td>ESD suppression; low distortion; ideal for I/O interfaces and digital and analogue signal lines</td>
<td>Low thru medium</td>
<td>Very fast</td>
<td>Low</td>
<td>Extensive range of surface mount options</td>
</tr>
<tr>
<td>TVs Diodes</td>
<td>Fast response to fast transients; wide range of options</td>
<td>Semiconductor protection; telecom I/O interfaces, electronics, industrial equipment</td>
<td>Medium thru high</td>
<td>Fast</td>
<td>High</td>
<td>Axial leaded, radial leaded</td>
</tr>
<tr>
<td>SIDACtor® Protection Thyristors</td>
<td>Specifically designed to serve stringent telecom/networking standards</td>
<td>Telecom and networking applications</td>
<td>Medium thru high</td>
<td>Very fast</td>
<td>Low</td>
<td>Extensive range of surface mount and thru-hole options</td>
</tr>
<tr>
<td><strong>Switching Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Power Thyristors</td>
<td>Solid state switches that switch to low 'on' state and control the flow of current</td>
<td>Home appliances, power tools, outdoor equipment</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Extensive range of surface mount and thru-hole options</td>
</tr>
</tbody>
</table>
TVS Diode Arrays (SPA™ Devices)

Features & Benefits
- Offering low dynamic resistance for improved clamping performance, SPA devices are offered in a wide range of industry standard discrete and multi-channel SMD packages
- Features include capacitance as low as 0.65pF
- Enhanced ESD capability up to 25kV (contact discharge)

Applications
- Designed to protect analog and digital signal lines (HDMI, USB, eSata, Ethernet) from electrostatic discharge and other transients without causing signal distortion

Protection Thyristors (SIDActor® devices)

Features & Benefits
- Solid state crowbar devices that suppress overvoltage transients such as those resulting from lightning
- SIDActor devices have a patented ion implant technology to ensure protective performance within nanoseconds, up to 5,000A surge current ratings

Applications
- Specifically designed to protect datacom and telecom equipment during hazardous transient conditions

Power Thyristors

Features & Benefits
- Solid state switches normally open circuits (very high impedance)
- Capable of withstanding rated blocking/off-state voltage until triggered to on state
- The Littelfuse line of thyristors include Sidacs, Triacs, Quadrac, and Sensitive Triacs, Sensitive CRs, Rectifiers, Diacs and Sidacs

Applications
- Used to control the flow of electrical currents in applications including many home appliances, electrical tools and outdoor equipment
Features & Benefits

- **Current ranges:** 0.001A–40A
- **Maximum voltage range:** 24V–600V
- **Overcurrent protection:** completely stop the flow of electricity
- **Applications:**
  - Comprehensive line of lead-free and RoHS devices
  - Interrupting ratings from 24A–50,000A
  - Maximum voltage ranges from 5x20 mm to 6.3x32 mm (3AG/3AB)

Applications

- Overcurrent protection that will completely stop the flow of electricity for critical circuits

#### Fuses

<table>
<thead>
<tr>
<th>Name</th>
<th>Series</th>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroTR®</td>
<td>TR5®</td>
<td>125</td>
<td>10,000</td>
<td>50</td>
</tr>
<tr>
<td>TR®</td>
<td>100</td>
<td>24–50,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEP®</td>
<td>100</td>
<td>50–100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PICO®</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceramic Chip</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thin Film</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nano3®</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMNI-BLOK®</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat Pak</td>
<td>100</td>
<td>50</td>
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<tr>
<td>EBK</td>
<td>100</td>
<td>50</td>
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</tr>
</tbody>
</table>

#### Gas Discharge Tubes (GDTs)

#### Features & Benefits

- **Small footprint leaded, surface mount and cartridge configurations**
- **Very high current surges** (up to 40,000A) while effectively suppressing overvoltage transients
- **Low capacitance** (typically 1pF–2pF)
- **High insulation resistance** (greater than 1GΩ)
- **Low leakage** ensure virtually no effect on the protected system during normal (non-surge) operating conditions

Applications

- **Ideal for use in broadband cable, MDF (Main Distribution Frame) and central office**

#### Fuses

<table>
<thead>
<tr>
<th>Name</th>
<th>Series</th>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICO®</td>
<td>100</td>
<td>50</td>
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</tr>
<tr>
<td>EBK</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**PTCs**

**Features & Benefits**
- Miniature surface mount items for use in compact electronics applications
- Radial PTCs rated from 6VDC–600VDC for use in higher voltage applications
- Axial PTCs rated from 6VDC–30VDC for use in battery pack applications that require thermal protection against fault conditions
- Recognised under the Components Program of UL for US and Canada and certified by TÜV

**Applications**
- Resettable protection for applications subject to repetitive overcurrent conditions or where fuse replacement is difficult

---

**Metal Oxide Varistors (MoVs)**

**Features & Benefits**
- Designed to suppress high level transient voltage such as lightning
- Peak current ratings ranging from 40A–70,000A
- Peak energy from 0.1J–10,000J
- Available in radial leaded, axial leaded, surface mount and bare-disk

**Applications**
- Power Supply and AC line protection

---

**PulseGuard® ESD Suppressors**

**Features & Benefits**
- Specified to protect against ESD transients per the IEC 61000-4-2 (Level 4) test method
- Available in small surface mount form factors
- Capacitance value as low as 0.04pF
- Lead-free and RoHS compliant

**Applications**
- ESD protection for high-speed digital I/O lines (HDMI, USB, eSata, Ethernet) without causing signal distortion

---

**Varistors**

**Features & Benefits**
- Available in miniature surface mount options as small as 0201 size
- Low voltage range (5.5VDC–135VDC)
- Peak current ratings range 4A–500A and peak energy 0.02J–2.5J

**Applications**
- Protection from low to medium transients for electronic equipment

---

**PTCs**

<table>
<thead>
<tr>
<th>Series Name</th>
<th>Hold Current (IHOLD)</th>
<th>Maximum Voltage (VMAX)</th>
<th>Maximum fault current (IFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LoRho (Low Resistance)</td>
<td>1.1A–2.0A</td>
<td>6V</td>
<td>50A</td>
</tr>
<tr>
<td>005L</td>
<td>0.10–0.35A</td>
<td>6–15V</td>
<td>40A</td>
</tr>
<tr>
<td>0805L</td>
<td>0.10–1.10A</td>
<td>6–15V</td>
<td>100/400A</td>
</tr>
<tr>
<td>1206L</td>
<td>0.125–1.05A</td>
<td>6–30V</td>
<td>100A</td>
</tr>
<tr>
<td>1210L</td>
<td>0.05–1.05A</td>
<td>6–30V</td>
<td>10/100A</td>
</tr>
<tr>
<td>1812L</td>
<td>0.10–2.0A</td>
<td>6–40V</td>
<td>100/1000A</td>
</tr>
<tr>
<td>2016L</td>
<td>0.30–2.0A</td>
<td>6–60V</td>
<td>20/40A</td>
</tr>
<tr>
<td>2020L</td>
<td>0.30–3.0A</td>
<td>6–60V</td>
<td>10/40A</td>
</tr>
<tr>
<td>250S</td>
<td>0.13A</td>
<td>60V</td>
<td>3A</td>
</tr>
<tr>
<td>Radial Leaded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USBR</td>
<td>0.75–2.0A</td>
<td>6/16V</td>
<td>40A</td>
</tr>
<tr>
<td>16R</td>
<td>2.50–14.00A</td>
<td>16V</td>
<td>100A</td>
</tr>
<tr>
<td>26R</td>
<td>0.90–3.0A</td>
<td>30V</td>
<td>40A</td>
</tr>
<tr>
<td>56R</td>
<td>0.50–3.75A</td>
<td>80V</td>
<td>40A</td>
</tr>
<tr>
<td>72R</td>
<td>0.20–3.75A</td>
<td>12V</td>
<td>40A</td>
</tr>
<tr>
<td>260R</td>
<td>0.08–1.18A</td>
<td>250V</td>
<td>3/10A</td>
</tr>
<tr>
<td>60HR</td>
<td>0.15–0.16A</td>
<td>600V</td>
<td>3A</td>
</tr>
<tr>
<td>Battery Strap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL (Low Resistance)</td>
<td>1.8A</td>
<td>6V</td>
<td>50A</td>
</tr>
<tr>
<td>LE</td>
<td>1.90–7.30A</td>
<td>15/20V</td>
<td>100A</td>
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<tr>
<td>LT</td>
<td>0.70–3.40A</td>
<td>15/24V</td>
<td>100A</td>
</tr>
<tr>
<td>BT</td>
<td>1.20–8.30A</td>
<td>15/30V</td>
<td>100A</td>
</tr>
<tr>
<td>VT</td>
<td>1.70–2.0A</td>
<td>12V</td>
<td>100A</td>
</tr>
</tbody>
</table>

**Varistors**

<table>
<thead>
<tr>
<th>Series Name</th>
<th>Operating AC Voltage Range</th>
<th>Operating DC Voltage Range</th>
<th>Peak Current Range (A)</th>
<th>Peak Energy Range (J)</th>
<th>Lines Protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Mount MLV/MOV</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MRS</td>
<td>9–42</td>
<td>30–130</td>
<td>300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLE</td>
<td>9–42</td>
<td>15–30</td>
<td>22–28</td>
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<tr>
<td>ML</td>
<td>2.7–107</td>
<td>5.5–120</td>
<td>4–500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AULM</td>
<td>16</td>
<td></td>
<td></td>
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<tr>
<td>MLN</td>
<td>16</td>
<td></td>
<td>5.5–18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM7</td>
<td>275–510</td>
<td>369–675</td>
<td>1200</td>
<td>23–40</td>
<td></td>
</tr>
</tbody>
</table>

| Radial Leaded MOV | | | | | |
| TOMV/TMOV® | 115–750 | 600–10000 | 35–480 |
| TMOV®25S | 115–750 | 20000 | 170–670 |
| UltraMOVTM | 130–625 | 170–825 | 125–720 |
| UltraMOVTM 2S | 115–750 | 150–970 | 200–890 |
| C-AI | 130–460 | 350–4000 | 40–530 |
| LA | 130–1000 | 175–1200 | 110–380 |
| ZA | 4–460 | 5.5–615 | 50–6500 |

| Industrial High Energy Terminal MOV | | | | | |
| EAR6 | 130–250 | 175–350 | 5000–10000 | 450–10000 |
| SAT6 | 130–750 | 175–970 | 4000 | 270–1030 |
| HA | 130–750 | 175–970 | 25000–40000 | 200–1030 |
| TMMOV345® | 115–750 | 150–970 | 4000 |
| H534, H53A, HF34 | 130–750 | 175–970 | 270–1030 |

| Specialty Application MOV | | | | | |
| MA | 9–204 | 13–389 | 40–1000 | 0.06–1.7 |
| BA | 6–204 | 5.5–389 | 50–4500 | 0.4–180 |
| High Reliability | 130–510 | 4–675 | 700–4500 | 0.4–180 |

---

**PLED LED Protectors**

**Features & Benefits**
- Specialty silicon devices that enable LED lighting strings to continue to function if any single LED fails as an open circuit
- Provides a switching function that will bypass open LEDs to allow current to other LEDs in the string
- ESD and reverse power protection available in some models

**Applications**
- High brightness outdoor LED lighting such as advertising and traffic control signs, and roadway, pathway and runway lights
About Murata

Established in 1944 in Japan, Murata is a leading manufacturer of electronic components, modules, and devices. The complete range of this technology house includes ceramic capacitors, resistors/thermistors, inductors/chokes, ceramic resonators, buzzers, sensors and EMI suppression filters. Whilst the company supplies the widest line up of ceramic capacitor products in the industry, it is also the world leader in Bluetooth and WiFi Modules, and a key manufacturer of power supplies. Murata also designs and manufactures mobile handset antenna families, piezoelectric actuators for fuel injection systems, short focal length ceramic lenses and speaker products.

Murata and TTI, trusted partners for all your component needs:

**Capacitors**
- Electrical double layer capacitors (EDLC)
- Metal terminal capacitors
- Polymer electrolytic capacitors
- Hi-Q capacitors
- Hi-capacitance capacitors

**RFID Modules**
- RFID device MAGICSTRAP®

**Sensors**
- SMD PIR sensors
- AMR sensors/magnetic switch

**Noise/EMI suppression products**
- Power inductors
- ESD protection devices
- Murata Power Solutions magnetics

**Power Converters**
- DC/DC converters
- AC/DC converters

**Piezo Components**
- Piezo speakers
- Piezo buzzers

**Product Group**
- Monolithic ceramic capacitors (capacitors for general purpose and automotive, medium voltage capacitors, safety standard certified capacitors and lead type capacitors)
- Disc ceramic capacitors (medium voltage capacitors and safety standard certified capacitors)
- High frequency single layer microchip capacitors
- Ceramic trimmer capacitors
- Polymer electrolytic capacitors
- High voltage capacitors
- Metal terminal capacitors

**Inductors (Coils)**
- Inductors for power circuits (power inductors and choke inductors)
- Chip inductors (for general purpose, RF circuits and automotive)
- Murata Power Solutions inductors

**Power Supplies**
- DC/DC converters
- Switching power supplies
- High voltage power supplies
- Ionizer modules
- Micro DC/DC converter

**Murata Power Solution Products**
- DC/DC converters
- AC/DC converters
Resonators

**Product Group**
- Ceramic resonators CERALOCK® for MHz and kHz
- Hybrid crystal resonators
- SAW resonators

Filters for Communication Equipment

**Product Group**
- Duplexers (SAW duplexers and dielectric duplexers GIGAFIL®)
- Filters for RF/local (SAW filters, dielectric filters GIGAFIL® and LC filters)
- Filters for IF (ceramic filters CERAFIL® and SAW filters)

Sensors

**Product Group**
- Ultrasonic sensors
- Shock sensors
- SMD infrared sensors
- Gyro sensors
- Angular velocity sensors
- Magnetic pattern recognition sensors
- Rotary sensors
- Rotary position sensors
- AMR sensors/magnetic switch

Thermistors

**Product Group**
- PTC thermistors POSISTOR® (for heaters, motor starters, overcurrent protection, overheat sensing and automotive)
- NTC thermistors (for inrush current suppression, temperature sensor/compensation and automotive)

Noise Suppression Products/EMI Suppression Filters

**Product Group**
- Noise suppression filters EMIFIL® (chip and lead type)
- Common mode chokes (chip and lead type)
- AC line filters
- Noise suppression products for automotive
- Microwave absorbers
- Ferrite cores
- ESD protection devices

Filters for Audio Visual Equipment

**Product Group**
- Ceramic filters CERAFIL® (filters, traps and discriminators)
- SAW filters (for TV, VCR and digital equipment)

RF Components

**Product Group**
- Antennas
- Isolators
- RF diode switches
- Baluns (chip multilayer and wirewound/film type)
- Couplers (chip multilayer and film type)
- Chip multilayer components (hybrid dividers and diplexers)
- High-frequency coaxial connectors
- Thin film circuit substrate RUSUB®
- High-frequency single layer microchip capacitors

Sound Component

**Product Group**
- Piezoelectric speakers
- Piezoelectric diaphragms
- Piezoelectric sounders
- Piezoelectric ringers
- Piezoelectric buzzers
Polymer Electrolytic Capacitors – ECAS Series

Features & Benefits
- EIA 7343, in 1.9mm, 2.8mm and 4.2mm thickness
- Capacitance range: 6.8μF – 470μF
- Rated voltage: 2VDC – 16VDC
- ESR: 6mΩ – 70mΩ
- Operating temperature: -40˚C – 105˚C

ESD Protection Devices – LXES Series
Ceramic ESD protection device

Features & Benefits
- Size reduction
- Ultra low capacitance: 0.05pF(typ.), small insertion loss
- Low IMD level: under -100dBm at 800MHz, capable for antenna port
- IEC61000-4-2 ±15kV air/contact

Silicon ESD protection device

Features & Benefits
- Size reduction
- Quick turn on, better protection performance
- Low peak voltage, better protection performance
- Low clamp voltage, better protection performance
- Low capacitance (0.25pF~), suitable for high speed line

RFID Modules – LXMS Series
Magicstrap without external antenna/booster antenna (Bare Magicstrap, Antennaless) for near field applications, read range up to 10mm

Applications
- Brand protection
- Anti-counterfeiting
- Process control
- Direct part marking (DPM)
- Digital ID

Applications
- Traceability
- Process control
- Anti-counterfeit
- Asset management

Power Inductors LQM-P, LQH-P Series

Features & Benefits
- Excellent electrical performance
  - Inductance
  - RDC
  - Rated current
- Wide variety of selection in size and height

SMD PIR Sensors – IRS-B Series

Features & Benefits
- Only SMD PIR sensor in the industry
- Ultra small
- Low price
- High sensitivity and S/N ratio
- High stability against temperature change
- High stability against white light
- Enhanced RFI immunity
- Low current consumption

Micro DC/DC Converter – LXDC Series

Features & Benefits
- Buck-converter (LXDC44A is boost-converter)
- Maximum load current: 300-3000mA
- Switching frequency available: 3-6MHz
- Low EMI noise by using an inductor-embedded ferrite substrate.

Electrical Double Layer Capacitors – DME, DMD, DMG Series

Features & Benefits
- Small, slim, robust package suitable for portable devices
- Ultra-low ESR
- Single and double cell packages available
- Excellent low temperature characteristics
- Maintenance-free operation – exceeding 100K cycles
- High peak pulse output; may be used for load leveling
Power Supplies (Murata Power Solution Products)

The newest offering of products across our portfolio of power electronics that continue to be perfect solutions for a broad spectrum of applications. Innovation. New solutions. Just what you expect from the market-leading supplier of power electronics.

Products in focus

MTU 1D series DC/DC

Features & Benefits
- Reduced footprint by 50%
- 40% reduction load regulation
- Power density 1.71W/cm³
- 50% less power dissipation
- Lower running temperatures than its predecessor

New Okami OKX-T/3 & OKX-T/5 Series

Features & Benefits
- DOSA standard pinout
- Programmable output voltage from 0.75V – 5.5V
- Drives 1000µF ceramic capacitive loads
- High power conversion efficiency typically 94.5% at 3.3Vout
- Outstanding thermal derating performance

UWQ series DC/DC

Features & Benefits
- Isolated open-frame 204W DC/DC converters
- Through-hole mount
- Industry standard quarter-brick format
- Measuring just 2.3” (58.4) X 1.45” (36.) X 0.46” (11.68)
- Efficiency 92%
- Ultra-wide 4:1 input voltage range of 18VDC – 75VDC, ideal for 24V or 48V systems
- Single output voltage of 12VDC up to 17A of current
- Protection features include over current, over temperature, input under voltage and output short circuit

MEE1 series DC/DC

Features & Benefits
- Min 6% efficiency improvement over comparable models
- Higher efficiency performance across the full load range
- 50% load regulation reduction, reducing the need for pre- or post-regulation
- 1kVDC Isolation
- Wide temperature performance at full load

ULT series DC/DC

Features & Benefits
- Miniature 1/32 brick
- DOSA compatible, open frame package
- Takes up significantly less board space than other 30W products on the market
- Wide (2:1) input voltage range of 36VDC – 75 VDC
- 12Vout, 5Vout, and 3.3Vout models. Lower voltages to come in the near future
- Maximum output power of 30W is available from the 12Vout model, with the 5V and 3.3V models producing 25W

AC/DC Power Supply Systems

Front Ends for Distributed Power Architectures

Features & Benefits
- AC to 12VDC or 48VDC ultra compact front end supplies for distributed power architectures with active power factor correction
- 400W – 5kW
- Industry leading efficiency and density

Open Frame

Features & Benefits
- High-efficiency, single output solutions in 1U chassis
- 75W – 400W

Compact PCI

Features & Benefits
- High-efficiency 3Ux8HP solutions from 200W – 300W

Applications
- Industrial factory automation
- Medical and dental
- Test and measurement
- Light industry systems
- Visual solution
- Data process and communications

DC/DC Power Conversion

Isolated Board Mount Power

Features & Benefits
- Single, dual, triple and quad output
- 0.25W – 680W, 0.02A – 80A, 1.2V – 48V
- 1/32, 1/16, 1/8, 1/4, 1/2 bricks, 1x1", 1x2", SIP, DIP, SMT
- DOSA compatible

Isolated Board Mount Power

Non-Isolated (Point of Load)

Features & Benefits
- 0.59V – 5.0V output, 0.5A – 50A
- ILGA
- DOSA and POLA compatible
Since its founding in 1950, Nichicon has constantly been involved in the development, production and sales of capacitors, circuit products and other kinds of electronic components that are essential for many types of electronics. Nowadays, the need for electronic components is becoming increasingly advanced and caters to the needs of their customers in four market segments that are experiencing particularly striking growth: “Digital home appliances”, “Automotive and railway car-related appliances”, “Ecology-related appliances” and “Information and communications appliances”.

Aluminium Electrolytic Capacitors

Nichicon is working toward production of dielectric materials with larger capacitance.

The performance of an aluminium electrolytic capacitor is determined by the properties of its electrode foil and electrolyte solutions. Nichicon possesses the leading technological prowess in the industry in the area of “etching”. This is a technique used to enlarge the surface area of electrode foils, “chemical treatment” for generating dielectrics and “electrolyte development.” Nichicon is constantly studying the development of new materials for electrode foils and methods to enlarge the surface area to achieve larger capacitance.

Conductive Polymer Aluminium Solid Electrolytic Capacitors

Nichicon is continuing to add to its polymer offering by introducing new series with lower and lower ESR while retaining the small sizes with large capacitances! Nichicon have been targeting low ESR and high reliability product through improved element design by developing conductive polymer materials as well as other component materials for Conductive Polymer Aluminium Solid Electrolytic Capacitors. By using its specific technology cultivated with extensive history with aluminium electrolytic capacitors, Nichicon can meet the future market demands.

Tantalum Electrolytic Capacitors

Nichicon is pushing the utmost limits in ESR reduction with their tightly engineered electrolyte formation.

The characteristics of tantalum electrolytic capacitors, which use tantalum oxide film as the dielectric, depend on tantalum powder forming and sintering technologies as well as dielectric film and electrolyte forming technologies. In addition to conducting research on basic technologies, Nichicon utilises semiconductor component assembly technologies and is actively pushing the limits in terms of size reduction, thickness, and lowering ESR (equivalent series resistance).

Electric Double Layer Capacitors

Nichicon is promoting the commercialisation and application development of high-capacity products. They engage in various research and development activities to further optimise the characteristics of these high-capacity and high-output products. At the same time, they are working on application development and making active efforts toward expanding the range of applications for which these products are used, all the time ensuring that the user maintains complete freedom at mounting.

Plastic Film Capacitors

Nichicon is committed to size reduction as well as improving safety and reliability. In order to support higher density electronic circuits, they are working toward the development of thinner dielectric films that substantiate size reduction. They have been developing film capacitors with long life, high reliability and high safety used in inverter units for driving the motors for EV and HEV.
### Aluminium Electrolytic Capacitor SMD

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZD</td>
<td>*-40˚C – +85˚C</td>
<td>4V – 25V</td>
<td>2.2µF – 100µF</td>
<td>Ultra small size – 3mm profile</td>
<td>Space critical applications</td>
<td></td>
</tr>
<tr>
<td>UBI/UH</td>
<td>*-55˚C – +125˚C</td>
<td>10V – 50V</td>
<td>10µF – 3,300µF</td>
<td>High temperature range – 125˚C</td>
<td>Automotive equipment, engine management systems</td>
<td></td>
</tr>
<tr>
<td>CZ</td>
<td>*-40˚C – +125˚C</td>
<td>10V – 35V</td>
<td>47µF – 470µF</td>
<td>High reliability, low temperature ESR specification</td>
<td>Automotive equipment, safety critical applications</td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>*-55˚C – +150˚C</td>
<td>10V – 50V</td>
<td>100µF – 3,300µF</td>
<td>150˚C – vibration resistance</td>
<td>Automotive equipment, Exhaust gas treatment</td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td>*-55˚C – +105˚C</td>
<td>6.3V – 35V</td>
<td>10µF – 2,200µF</td>
<td>Low impedance</td>
<td>Automotive equipment</td>
<td></td>
</tr>
<tr>
<td>CW</td>
<td>*-25˚C – +105˚C</td>
<td>6.3V – 50V</td>
<td>10µF – 470µF</td>
<td>Long life (7,000h), low impedance</td>
<td>High reliability</td>
<td></td>
</tr>
</tbody>
</table>

### Aluminium Electrolytic Capacitor Radial

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>BX</td>
<td>*-55˚C – +150˚C</td>
<td>10V – 400V</td>
<td>1µF – 1,000µF</td>
<td>High temperature range – 150˚C</td>
<td>Automotive (heavy duty service) exhaust gas treatment</td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td>*-55˚C – 135˚C</td>
<td>10V – 100V</td>
<td>1µF – 1,000µF</td>
<td>High temperature range – 135˚C</td>
<td>Automotive (heavy duty service)</td>
<td></td>
</tr>
<tr>
<td>BT</td>
<td>*-40˚C – +125˚C</td>
<td>10V – 450V</td>
<td>1µF – 4,700µF</td>
<td>High temperature range – 125˚C</td>
<td>Automotive (heavy duty service)</td>
<td></td>
</tr>
<tr>
<td>PW</td>
<td>*-55˚C – +105˚C</td>
<td>6.3V – 450V</td>
<td>0.47µF – 15,000µF</td>
<td>Miniature sized, low impedance, high reliability</td>
<td>Switching power supply, automotive applications</td>
<td></td>
</tr>
<tr>
<td>CY</td>
<td>*-40˚C – +105˚C</td>
<td>160V – 400V</td>
<td>6.8µF – 560µF</td>
<td>Miniature sized, high ripple current, high reliability</td>
<td>Ballast, input filtering</td>
<td></td>
</tr>
<tr>
<td>PX</td>
<td>*-55˚C – +105˚C</td>
<td>10V – 35V</td>
<td>1µF – 4,700µF</td>
<td>Long life assurance, high reliability</td>
<td>Switching power supply, automotive applications</td>
<td></td>
</tr>
</tbody>
</table>

### Aluminium Electrolytic Capacitor Large Can

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>*-40˚C – +85˚C</td>
<td>350V – 450V</td>
<td>820µF – 22,000µF</td>
<td>High voltage, smaller sized screw terminal</td>
<td>General inverter, welding machine, UPS</td>
<td></td>
</tr>
<tr>
<td>GW</td>
<td>*-40˚C(-25˚C) – +105˚C</td>
<td>200V – 450V</td>
<td>82µF – 2,200µF</td>
<td>High ripple current</td>
<td>Inverter, power supply</td>
<td></td>
</tr>
<tr>
<td>GX</td>
<td>*-25˚C – +105˚C</td>
<td>200V – 450V</td>
<td>82µF – 2,200µF</td>
<td>Long life, smaller-sized</td>
<td>Rectifier circuit of general inverter, power supply, solar inverter</td>
<td></td>
</tr>
<tr>
<td>FY</td>
<td>*-40˚C – +105˚C</td>
<td>16V – 100V</td>
<td>560µF – 47,000µF</td>
<td>Long life</td>
<td>Industrial power supply</td>
<td></td>
</tr>
</tbody>
</table>

### Polymer

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>*-55˚C – +105˚C</td>
<td>16V – 63V</td>
<td>5.6µF – 470µF</td>
<td>High voltage, low ESR, high ripple current, long life</td>
<td>Automotive, decoupling, power supply</td>
<td></td>
</tr>
<tr>
<td>LV</td>
<td>*-55˚C – +105˚C</td>
<td>16V – 63V</td>
<td>22µF – 470µF</td>
<td>High voltage, low ESR, high ripple current, long life</td>
<td>Automotive, decoupling, power supply</td>
<td></td>
</tr>
</tbody>
</table>

### FPCAP (Polymer)

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>F8</td>
<td>*-55˚C – +105˚C</td>
<td>2.5V – 6.3V</td>
<td>100µF – 560µF</td>
<td>Low ESR/ESL, high ripple, long life, low profile</td>
<td>Power supply, decoupling</td>
<td></td>
</tr>
<tr>
<td>NE</td>
<td>*-55˚C – +105˚C</td>
<td>2.5V – 16V</td>
<td>100µF – 1,200µF</td>
<td>Large capacitance</td>
<td>Power supply, decoupling</td>
<td></td>
</tr>
<tr>
<td>SS/SA/SB</td>
<td>*-55˚C – +105˚C</td>
<td>2.5V – 16V</td>
<td>100µF – 560µF</td>
<td>Large capacitance</td>
<td>Power supply, DC/DC converter, decoupling</td>
<td></td>
</tr>
<tr>
<td>HS/HA</td>
<td>*-55˚C – +105˚C</td>
<td>2.5V – 16V</td>
<td>100µF – 1,200µF</td>
<td>Large capacitance</td>
<td>Power supply, DC/DC converter, decoupling</td>
<td></td>
</tr>
<tr>
<td>SL/SH</td>
<td>*-55˚C – +105˚C</td>
<td>2.5V – 16V</td>
<td>22µF – 470µF</td>
<td>Low profile</td>
<td>Power supply, DC/DC converter, decoupling</td>
<td></td>
</tr>
</tbody>
</table>

### Conformal Coated Tantalum

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>F95</td>
<td>*-55˚C – +125˚C</td>
<td>4V – 35V</td>
<td>1µF – 330µF</td>
<td>Small and compact construction, enables higher density PCB population than standard moulded type tantalum capacitors, high capacitance, very low ESR and ESL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F72</td>
<td>*-55˚C – +125˚C</td>
<td>4V – 16V</td>
<td>33µF – 330µF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F75</td>
<td>*-55˚C – +125˚C</td>
<td>4V – 16V</td>
<td>68µF – 2,200µF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Conformal Coated Tantalum

<table>
<thead>
<tr>
<th>Type</th>
<th>Series</th>
<th>Temperature Range</th>
<th>Voltage</th>
<th>Capacitance</th>
<th>Features &amp; Benefits</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>UW</td>
<td>*-25˚C – +70˚C</td>
<td>2.7V</td>
<td>1F – 82F</td>
<td>Radial type, high voltage, smaller sized</td>
<td>CPU/memory and small device backup</td>
<td></td>
</tr>
<tr>
<td>JC</td>
<td>*-25˚C – +60˚C</td>
<td>2.5V</td>
<td>15F – 150F</td>
<td>Snap in type capacitor (excellent voltage holding property)</td>
<td>Suitable for quick charge and discharge</td>
<td></td>
</tr>
<tr>
<td>JL</td>
<td>*-25˚C – +60˚C</td>
<td>2.5V</td>
<td>400F – 2,600F</td>
<td>Screw terminal type, high power density type</td>
<td>Suitable for regeneration and UPS application</td>
<td></td>
</tr>
</tbody>
</table>

* Please note that for some series, temperature and endurance life depend on voltage and case size.
Ohmite is part of Heico Companies LLC, a multinational, U.S.-based holding company. Ohmite Manufacturing Company has been the leading provider of resistive products for high current, high voltage and high energy applications for over 80 years.

The company's full complement of resistor construction includes wirewound, wire element, thick film and ceramic composition. Ohmite offers a broad selection of Power Resistors to worldwide customers in the industrial, medical, military and aerospace industries.

Through ongoing product development, they provide the latest in resistor technology required by today’s sophisticated high voltage, high current and high energy circuit designs. Strengthened by the backing of Heico Companies LLC, Ohmite strives to maintain the flexibility needed to handle both large and small requirements. Custom built parts are always considered and new technologies are always being evaluated.

They have recently launched a range of heatsinks designed to complement their surface mount resistors. Product availability in today’s market is critical to the success of their customers. The products include: Power Resistors-Surface Mount-High Voltage-Current Sense-Heatsinkable (and heatsinks)-Surge Handling-Wirewound Resistors and Rheostats.

**Features & Benefits**
- Designed specifically with high current applications in mind and for the European market
- Ohmite’s new wirewound tubular lug resistor range, the E Series, is available with three durable coating options; lead-free vitreous enamel, silicone-ceramic and the patented, flameproof Centohm cement which is designed to withstand temperatures as high as 2,000°C
- Initially available in ratings of 72W, 160W, 280W and 700W, the E-Series has both adjustable and fixed options, with live and isolated integrated mounting terminals
- Enhancing Ohmite’s existing lug offering by adding sizes commonly used by the European electronics market, their rugged construction and choice of coatings makes the E Series resistors ideal for applications requiring high wattage ratings

Ohmite extends its FCSL Series with this 4-terminal Kelvin type FC4L derivative in 2 watt and 5 watt package sizes. Employing the same Ni-Cu-Mn resistive element this product affords the user and added advantage of a built in 4-terminal design with 2 larger electrodes for current management and 2 smaller electrodes for current measurement.

**Features & Benefits**
- Foil construction ensures a very stable TCR (Temperature Coefficient of Resistance)
- Designed for automatic insertion
- Industry standard sizes
- High heat resistant use

---

**Ohmite – New Wirewound Tubular Lug Resistor Range – E Series**

**FC4L**
Ohmite introduces Thermal Management Solutions

In order to create exactly the right heatsink to suit their products and applications, Ohmite have developed a range of thermal management components which provide a fast, secure and economic solution to temperature problems.

These patented heatsinks provide designers with an opportunity to plan for future applications and power requirements by selecting a resistor which simply clips into the heatsink without the need for reworking the board and which has the potential to endure several design changes if required. Ohmite’s growing heatsink range, some of which are offered in black to provide even greater thermal dissipation.

**W Series (includes the WV, WA and DT2)**

**Features & Benefits**

- **Reduced assembly cost:**
  - spring clip and auto-align feature makes fasteners and fixtures obsolete, along with stray metal filings from tapped holes.
- **Maximum repeatability:**
  - clamping force of the spring clip is not degraded by repeated loading and unloading.
- **Maximum heat transfer per unit space:**
  - maximum surface area per unit volume and consistent mounting force reduces thermal resistance.
- **Maximum resistance to shock and vibration:**
  - light weight, resilient spring clip locks the component in place and is highly resistant to shock and vibration.

**M Series**

**Features & Benefits**

- Ohmite has also developed multi component packages capable of mounting more than one of each type of device.
- The M Series can accommodate up to four TO-264 or TO-247 packages.
- Secured by circuit board mounting, the devices are held in place by a clever ASTM A228 spring clip, making mounting holes and fasteners unnecessary.
- Constant, resilient spring force locks components into place and assures maximum repeatability even after repeated assembly and disassembly.
- The product offers superior thermal efficiencies while reducing labour and assembly cost.
- Standard parts are 55mm in length by 38.66mm high, but the extrusion can be supplied longer or shorter to accommodate custom designs involving more or fewer resistors or semiconductors as required.

**D Series**

**Features & Benefits**

- Increased thermal performance up to 30% over bright copper heat sinks from improved radiation of the black finish.
- Increased surface areas by 3 times therefore thermal performance up to 300% over the aluminium stamped heat sinks on markets.
- Unique aluminium extrusion design reduces the heat sink cost versus similar designs utilising copper.
- Light weight aluminium construction allows faster pick and place assembly reducing the manufacturing cycle time.
- Radius mounted “Rollers” are designed for maximising heat transfer from the component and avoiding the thermal “bottle-neck” seen in stamped and staked heatsinks.

**C Series**

**Features & Benefits**

- Maximum reliability resilient spring action locks electronic component in place. Fewer parts in assembly and no fasteners and washers required.
- Prevent short circuit by eliminating metal particles generated from hardware or thread tapping.
- Design flexibility maximum flexibility for dynamic device locations and power upgrading. “Configure-to-Fit” gives designers total freedom to configure heat sink needed to fit into a multitude design environments.
- Maximum thermal transfer maximum surface area per unit volume, efficient cooling fins and consistent mounting force reduces thermal resistance.
- Maximum repeatability constant spring force over repeated assembly/disassembly.
Panasonic is one of the industry’s leading suppliers of standard and customised electronic components. With a wide product portfolio coupled with global manufacturing and sales capabilities, as well as the commitment to customer service Panasonic meets today’s market needs in terms of design support, single sourcing and global presence.

**Low ESR Aluminium Electrolytic Capacitors**

**ZA Series**

**Features & Benefits**
- Voltage range: 25VDC – 80VDC
- Capacitance range: 10uF – 330uF
- Temperature range: -55°C – +105°C
- Endurance: 5000h at 105°C
- Ripple current: up to 2500mA
- High ripple current up to 2500mA
- Low leakage current

**Applications**
- Switching Power Supplies
- DC/DC converter
- Automotive equipment
- Industrial electronics
- Digital devices
- Telecommunication, e.g. base stations
- Smart meter
- New designs for high efficiency and miniaturization

**ZC Series**

**Features & Benefits**
- Voltage range: 25VDC – 63VDC
- Capacitance range: 10uF – 330uF
- Temperature range: -55°C – +125°C
- Endurance: 4000h at 125°C
- Down-sizing by up to 60%
- ESR reduction down to 50%
- Ripple current increase up to 1.4 times compared to ZA series
- Endurance: 2000h at 105°C
- High temperature lead-free reflow soldering

**Applications**
- Switching power supplies
- DC/DC converter
- Automotive equipment
- Industrial electronics
- Digital devices
- Telecommunication, e.g. base stations
- Smart meter
- New designs for high efficiency and miniaturization

**ZA Series**

**Features & Benefits**
- Voltage range: 6.3VDC – 100VDC
- Capacitance range: 3.3uF – 6800uF
- Temperature range: -55°C – +105°C
- Endurance: 2000h – 5000h at 105°C
- Excellent low impedance down to 33mΩ

**Applications**
- Switching Power Supplies
- DC/DC converter
- Automotive equipment
- Industrial electronics
- Digital devices
- Telecommunication, e.g. base stations
- Smart meter
- New designs for high efficiency and miniaturization

**Speciality Polymer Aluminium Capacitors**

Speciality Polymer Aluminium Capacitors (SP Caps) have been continuously developed by Panasonic ever since 1990 and offer very stable capacitance characteristics over complete operating temperature and frequency range, especially compared with ceramic and low ESR tantalum capacitors. SP Caps are based on common aluminium electrolytic capacitor technology and use a solid polymer electrolyte instead of liquid electrolyte. Voltage range is from 2VDC to 16VDC and capacitance range is from 2.2uF to 560uF.

**ZC Series**

**Features & Benefits**
- Voltage range: 6.3VDC – 63VDC
- Capacitance range: 4.7uF – 8200uF
- Temperature range: 5000– 10000h at 105°C
- Ripple current: up to 3820mA
- ESR Down to 12mΩ (20°C/100kHz)

**Applications**
- Switching mode power supply
- Switching mode Adapter
- Line noise removal
- LCD backlight
- LED applications
- Applications with long lifetime requirements

**Conductive Polymer Hybrid Aluminium Electrolytic Capacitors**

It brings together low ESR characteristics of speciality polymer capacitor and the low leakage current of aluminium electrolytic capacitor. The series show a compact design, high reliability of the speciality polymer capacitor and the safety of the aluminium electrolytic capacitor.

**FK Series**

**Features & Benefits**
- Voltage range: 6.3VDC – 100VDC
- Capacitance range: 10uF – 2200uF
- Temperature range: -55°C – +105°C
- Endurance: 2000h at 105°C
- Down-sizing by up to 60%
- ESR reduction down to 50%
- New designs for high efficiency and miniaturization

**Applications**
- Switching power supplies
- DC/DC converter
- Automotive equipment
- Industrial electronics
- Digital devices
- Telecommunication, e.g. base stations
- Smart meter
- New designs for high efficiency and miniaturization

**FT Series**

**Features & Benefits**
- Voltage range: 6.3VDC – 50VDC
- Capacitance range: 10uF – 2200uF
- Temperature range: -55°C – +105°C
- Endurance: 2000h at 105°C
- Down-sizing by up to 60%
- ESR reduction down to 50%
- New designs for high efficiency and miniaturization

**Applications**
- Switching power supplies
- DC/DC converter
- Automotive equipment
- Industrial electronics
- Digital devices
- Telecommunication, e.g. base stations
- Smart meter
- New designs for high efficiency and miniaturization

**FR Series**

**Features & Benefits**
- Voltage range: 6.3VDC – 63VDC
- Capacitance range: 4.7uF – 8200uF
- Endurance: 5000 – 10000h at 105°C
- Ripple current: up to 3820mA
- ESR Down to 12mΩ (20°C/100kHz)

**Applications**
- Switching mode power supply
- Switching mode Adapter
- Line noise removal
- LCD backlight
- LED applications
- Applications with long lifetime requirements
Panasonic Film Capacitors for DC-link and DC Filter Applications

Panasonic EZPE Series is produced with metallised Polypropylene film and a patterned metallisation technology (100% Panasonic black box technology). The special fuse function of the patterned metallisation enables high capacitance, high withstand voltage and a built-in protection function.

**Features & Benefits**
- Rated voltage: 500VDC – 1300VDC down to 5.6 mΩ
- Capacitance range: 10uF – 110uF
- Capacitance tolerance ±10%
- Temperature range: -40˚C – 85˚C
- Typical ESR (20˚C/10kHz) up to 17 Arms
- Permissible RMS current (70˚C/10kHz)**

**Applications**
- DC link
- DC filtering
- IGBT protection/snubber capacitor
- Photovoltaic inverter
- Wind power generation
- Industrial power supplies
- Inverter circuit for appliances

* Please refer to “DC voltage derating at ≥70˚C”
** For permissible peak current Ao-p please refer to datasheet.

Metal Thin Film Chip Resistors

**ERA High Reliability Series**

**Features & Benefits**
- Case size: 0402 – 1206
- T.C.R: 10ppm, 15ppm, 25ppm, 50ppm
- Tolerance: 0.05%, 0.1%, 0.5%
- New material offers superior characteristics over harsh environment (85˚C; 85% RH; 1000h, ≤0.1%)
- Various sizes, tolerance (up to 0.05%) and Temperature coefficient (up to 10ppm) available
- AEC-Q200 compatible

**Low Ohmic Chip Resistors**

**Features & Benefits**
- Wide range of resistance values starting from 1mΩ
- Case size: 0402 – 2512
- Large power range, especially ERJ*BW Series: 0.16W in 0402 case size to 0.5W in 1206 case size
- Wide selection is available from metal plate technology (ERJM) to single and double sided thick film technology (ERJ), suitable for current sensing application (Shunt)

**Metallised Polypropylene Film Capacitors (Class X2)**

ECQUA is a new X2 Safety capacitor and offers a guaranteed moisture resistance of 85˚C, 85%, 500h under loaded conditions. The special fuse function of the patterned metallisation leads to a very stable capacitance level over the capacitor lifetime and thus guarantees a high reliability of your application. ECQUA is accredited in accordance with UL/CSA and European safety regulation class X2.

**Features & Benefits**
- Rated voltage: 275VAC/310*VAC
- Capacitance range: 0.1uF – 2.2uF
- Temperature range: -40˚C – 110˚C
- Flame-retardant plastic case and non-combustible resin

**Applications**
- Interference suppressors
- Power supplies
- Solar applications
- Lighting applications
- Metering applications
- Home appliance

*310V = Maximum AC Voltage, not nominal continuous applied voltage

**Chip Choke Coils**

**Features & Benefits**
- Shielded structure by either terminal attached ring cores or metal composite shield in order to achieve improved saturation characteristics, down sizing and cost advantages
- Inductance values from 1.0μH – 1,000μH
- Low DCR Series
- Available with a wide variety of specifications, including, magnetically shielded, low profile, thin, low DC resistance, large current capability and vibration resistant
Samsung Electro-Mechanics (SEM) was established in 1973 as a manufacturer of key electronic components and the company has grown from an A/V components manufacturer into one of the industry leaders in manufacturing passive chip components, multi-layer circuit boards and optical component. As second biggest MLCC manufacturer worldwide SEM is able to manufacture several billion pieces of MLCCs a month, on the highest level of quality and is moreover spending around 8% of its revenues for R&D, to exceed the market requirements.

MLCC

Standard & High Cap X5R Lineup

Features & Benefits
• Rated up to 85°C
• Highest capacity up to 220µF
• Excellent DC bias
• High ripple current
• High reliability

Applications
• Set top box
• Hi-fi and audio equipment
• Mobile applications
• Brown goods
• DC/DC output

Industrial Grade X7R & C0G Lineup

Features & Benefits
• Rated up to 125°C
• Excellent DC bias
• High ripple current
• High reliability

Applications
• Industrial
• Automation
• Control unit
• Lighting/LED
• Drive control
• Embedded PC
• Welding

Automotive X7R & C0G Lineup

Features & Benefits
• Soft termination for all X7R
• Improved bending strength
• Specified after JEDEC J-STD-020-D

Applications
• Industrial
• Automation
• Control unit
• Lighting/LED
• Drive control
• Embedded PC
• Welding

X7R Soft Termination Lineup

Features & Benefits
• Soft termination type
• Typical bending strength 2mm
• Rated up to 125°C
• Excellent DC bias
• High ripple current
• High reliability

Applications
• Industrial
• Automation
• Control unit
• Lighting/LED
• Drive control
• Embedded PC
• Welding

Medium ~ High Voltage X7R Lineup

Features & Benefits
• Rated up to 125°C
• Open mode for all X7R with Vr 630V~3kV
• High reliability
• Excellent ESD resistance

Applications
• Industrial
• Automation
• Control unit
• Lighting/LED
• Residual-current device (RCD)
• Solar
• Power supply/SMPS
• Smart metering

Chip Resistors

Standard & Low Ohm

Features & Benefits
• Precision thick film
• Metal foil
• Excellent TCR down to 75ppm
• Low Ohm down to 1Ω

Applications
• General purpose
• Home appliances
• For computers and communication devices
• Current sensing

Tantalum Capacitors

Polymer Tantalum

Features & Benefits
• Ultra low ESR
• High reliability
• Excellent voltage withstanding

Applications
• DC/DC output
• Set top boxes
• Audio/video
EMC – Inductors & Beads

### Ferrite Beads

**Features & Benefits**
- Impedances 8Ω – 2500Ω
- Up to 6A
- Sizes 0201 – 1806
- Low profile max. 0.3mm – 1.5mm
- High reliability and robust design
- Audio/video
- Easy handling

**Applications**
- Modems/power lines
- Mobile applications
- Set top boxes
- Industrial

### Power Inductor Line-up

**Features & Benefits**
- Up to 10µH
- Up to 3A at 1µH (Type: H)
- Slow saturation – see graph below
- Magnetically shielded
- Low profile maximum 0.5mm
- High reliability and robust design
- Easy handling

**Applications**
- DC/DC converter
- Mobile application
- Set top box
- Audio/video

### High Frequency Inductor Line-up

**Features & Benefits**
- Small size
- Robust design
- Cost efficient

**Applications**
- Mobile application
- Noise suppression
- Impedance matching

### Ferrite Inductor Line-up

**Features & Benefits**
- Magnetic shielding eliminates cross talk
- Monolithic structure for high reliability
- Excellent Q characteristic

**Applications**
- Filtering/signal improvement
- Resonance circuits
- PLL circuits

### Timing Devices

#### Crystals

**Features & Benefits**
- Suitable for reflow and wave soldering
- Meets EU-RoHS
- 12MHz up to 52MHz
- Low ESR
- Small sizes
- Frequency tolerance: ±10ppm – ±50ppm

**Applications**
- Audio and video equipment
- Mobile applications
- Wireless, e.g. Bluetooth, W-Lan

#### Oscillators

**Features & Benefits**
- Suitable for reflow and wave soldering
- Meets EU-RoHS
- 4MHz up to 125MHz
- Small Sizes
- Frequency tolerance: ±20 ppm – ±100 ppm
- C-MOS voltages

**Applications**
- Industrial PC
- Mobile applications
- WiFi
- Modem
Spectrum Control, Inc. is established as one of the world’s leading manufacturers and total solutions providers in the suppression or elimination of electromagnetic interference.

### Filter Expertise to Board Level Components

#### Applications
- Telecommunication
- Amplifiers
- Motor controls
- Military avionics and secure communications
- Microwave
- Attenuators
- Oscillators
- Industrial control
- Medical equipment
- Rocket ignitors
- Aerospace

#### Resin Sealed Bolt-In Filters
**Features & Benefits**
- Wide range of sizes: 4 – 40 thread through 5/16 – 24, metric threads M3 and M4
- UL/CSA and MIL-F-15733 approved filters
- Current ratings up to 100A
- Voltage ratings up to 1,250VDC/240VAC (400Hz)
- Custom lead options available: hooked, turret, flattened, notch
- Multiple circuit configurations – C, L, Pi
- High temperature construction
- Rated voltage up to 1,250VDC/240VAC (400Hz)
- Ideal for filtering signal/data lines and DC power lines

#### Solder-In Filters
**Features & Benefits**
- Small size options
- Multiple circuit configurations C, L, Pi
- Voltage ratings to 750VDC
- High temperature construction
- MIL-F-15733 QPL versions available
- Custom lead options available: hooked, turret, flattened, notch
- Many lead length options offered
- Ideal for filtering signal/data lines and DC power lines

#### Hermetically Sealed Bolt-In Filters
**Features & Benefits**
- Popular 0.375/0.410" and 0.690" case diameters
- Voltage ratings from 50VDC – 400VDC/240VAC
- Filter configurations available in C, L, Pi, T and double T
- Largest selection of MIL-F-15733, MIL-F-28861, Mil-PRF-28861 and DSCC 84084 filters
- Provides broadband high performance from 10KHz to over 10GHz
- Excellent for critical applications demanding high reliability in harsh environments

#### Miniature Solder-In, Press-In and Spec Spin Filters
**Features & Benefits**
- Miniature size
- C & L Circuit
- Capacitance values from 5pF – .030pF
- Voltage ratings to 200VDC/115VAC 0Hz-400Hz
- Gold plating compatible with gold bonding techniques
- High temperature construction
- Available in Mil-C-11015 versions
- Ideal for microwave and RF applications

#### SF Series – Three Terminal Chips
**Features & Benefits**
- Standard EIA chip sizes from 0603 – 1806
- Excellent performance in high current applications
- Non-polar, surface mountable
- Capacitance range of 22pF – 220,000pF
- Room temperature up to 100VDC
- Current rating up to 2A
- Applications: telecom equipment, industrial electronic interface, programmable controllers, electronic automotive equipment, computer and peripheral equipment

#### PSM Series – Power Surface Mount Filters
**Features & Benefits**
- Optimum cost savings compared to through-hole filters
- Current ratings up to 20A in P3 circuit, 10A for P1 circuit
- 200VDC, 125VAC
- Capacitance range from 68pF – 10,000pF
- Tape & reel or bulk packaging
- Applications: power amplifiers, power supplies, temperature and motor controls, high current bus-lines and driver circuits, medical equipment
SA Series – SM Filter Arrays

**Features & Benefits**

- Structure minimises residual inductance with a high self resonant frequency ensuring large insertion loss in a wide band
- Designed to control cross talk
- Solder platted nickel barrier terminations
- 25VDC – 50VDC, 0.3A, IR 10,000MO Min, DCR 0.3Ω Max, -55°C – -125°C, 22pF to 22,000pF
- Applications: noise reduction for DC lines and computers, computer peripheral equipment, digital TV and VTR, automotive electronics

**Ceramic Capacitors**

**Features & Benefits**

- Tubular, Planar and discoidal capacitors
- High design flexibility
- Operating temperature range of -55°C – 125°C
- Dielectric: NPO, BX, X7R, Z5U and others
- Capacity values up to 40pF for arrays
- Working Voltage 50 – 1500VDC
- Various cost effective manufacturing processes in use
- Applications: medical implantable devices, EMI/RF suppression filters, commercial and military applications

**Switch Mode Power Supply (SMPS) Capacitors**

**Features & Benefits**

- MIL-PRF-49470 approved
- Style/Size: SMP-3, SMP-4 and SMP-5
- Operating temperature range of -55°C – 125°C
- Dielectric: NPO, BX, X7R, Z5U and Y5U
- Capacity up to 47µF
- Working Voltage 50 – 1500VDC
- Lead configuration: Straight (N), J and L for surface mount
- Applications: high reliability power supplies and high capacitance discharge units

**MSM Series – Miniature Surface Mount Filters**

**Features & Benefits**

- Miniature footprint (0.078”x0.049”)
- 50VDC, 10A, 47pF – 1,000F, Ft circuit
- Superior solderability and heat resistance due to multilayer electrode construction
- Tape & reel or bulk packaging
- Applications: automotive electronics, computer and peripheral equipment, microwave transmissions, test equipment, DC power supply lines and medical equipment

**SSM Series Square Surface Mount Filters**

**Features & Benefits**

- Square mechanical geometry enhances soldering to PCB
- Compact footprint for densely populated PCBs
- 100VDC, 10A, 100pF – 4,000pF, Ft circuit
- Tape & reel or bulk packaging
- Applications: power amplifiers, power supplies, temperature and motor controls, high current bus lines and driver circuits and medical equipment

**Filtered Connectors**

**Features & Benefits**

- Filtered D-Sub connectors with ferrites, multi-layer capacitors or tubes
- Wide range of capacitance values and insertion loss range
- Temperature ranges from -55°C – +125°C
- Pin and socket contact, range of contact layouts
- High-density series available
- Designed to meet NEBS and safety agency approvals
- Available to meet MIL-PRF-15733 and MIL-STD-461 verification
- Rugged construction to withstand MIL-STD environmental conditions
- Design flexibility (transient protection, circuit breakers, voltage cut-off)
- Custom filtering
- High performance optimised through EMC
- Available to meet MIL-PRF-15733 and MIL-STD-461
- Military testing IAW MIL-STD-202, MIL-STD-105
- Designed to meet NEBS and safety agency approvals
- In-house test lab
- Custom voltage ratings available
- Voltage ratings 400VDC and 250VAC standard; custom voltage ratings available
- Insertion loss range effective filtering from 10KHz – 10GHz
- Temperature range -55°C – +125°C
- Standard and low leakage current designs available
- Applications: commercial and military avionics, satellites, secure communications, rugged computers, radars, electronic warfare and weapon systems, medical equipment

**Antennas & Antenna Assemblies**

**Features & Benefits**

- Product spectrum from frequencies of -300MHz – 6GHz
- Patch antenna elements 13mm – 78mm square
- Low profile down to 4mm without ground plane
- Designed and tested for optimal performance
- Dual frequency patches in 45mm square available
- Quick “tuned” prototype capabilities
- Various assembly stages offered (patch element, ground plane, cables, connectors, protective radomes – all variable to customer requirements)
- Wearable antennas in small design (<45mm square incl. radome) for various standard frequencies available (a.e. GPS, Globalstar, aso.)
- Customised antenna solutions can be designed
- Low VSWR
- High efficiency
- High gain/low return loss
- Applications: asset tracking, satellite communication, race monitoring, directional finders, targeting systems, portable defibrillators, survey and toll meter equipment, down-hole drilling

**Multisection Filters**

**Features & Benefits**

- Rugged construction to withstand MIL-STD environmental conditions
- Design flexibility (transient protection, circuit breakers, voltage cut-off)
- Custom filtering
- High performance optimised through EMC
- Available to meet MIL-PRF-15733 and MIL-STD-461
- Military testing IAW MIL-STD-202, MIL-STD-105
- Designed to meet NEBS and safety agency approvals
- In-house test lab
- Current ratings up to 250A
- Voltage ratings 400VDC and 250VAC standard; custom voltage ratings available
- Insertion loss range effective filtering from 10KHz – 10GHz
- Temperature range -55°C – +125°C
- Standard and low leakage current designs available
- Applications: commercial and military avionics, satellites, secure communications, rugged computers, radars, electronic warfare and weapon systems, medical equipment
ProtectiCap™ High Voltage MLCCs

MLCCs are particularly suitable for high voltage applications where small size is required. For standard high voltage capacitors a coating may be required to be applied post-soldering, to minimise the risk of flashover from one termination on the chip to the other. By contrast, the new ProtectiCap™ high voltage range has been introduced to specifically address this issue. The integral coating minimises the risk of flashover without any requirement for the customer to apply conformal coating after soldering. This range is fully compliant with the RoHS and WEEE directives and parts are compatible with lead-free solders.

Features & Benefits
- High working voltage in small case sizes
- Minimises the risk of flashover
- No coating required
- Up to 3kV in 1206 size, 5kV in 2220
- Uses FlexiCap™ flexible termination
- Application Note contains further technical details
- Sample kits available

Applications
- Power supplies
- Inverters
- Lighting ballasts
- Voltage multipliers
- General high voltage circuits

High Voltage MLCCs

Features & Benefits
- MLCCs capability up to 30kV
- Safety certified MLCCs with UL and TÜV approvals
- FlexiCap™ and tin-lead termination options
- Ranges with defined capacitance variation under voltage
- Highest voltage/capacitance combinations available in the world

250Vac Rated MLCCs

Features & Benefits
- Suitable for use in non safety-critical mains AC circuits
- Lower cost than safety approved versions
- From 0805 to 2220, with COG up to 10nF and X7R up to 120nF
- Defined capacitance change across the full rated voltage
- For power supplies and AC/DC converters

High Voltage Low ESR MLCCs

Features & Benefits
- High frequency, high Q capacitors
- Sizes from 0101 in SLC and 0402 in MLC
- From 0.1pF, with voltage up to 3kVdc
- For telecoms, defence, aerospace and satellite applications
- Sample kits and tuning rods available
- Capacitor modelling software to assist in capacitor selection

IECQ-CECC & AEC-Q200 Qualified Products

Features & Benefits
- Approved products available to international standards
- For military, aerospace and automotive applications
- Standard MLCCs, feedthrough EMI chips and X2Y filters
- X7R parts all feature FlexiCap™ termination to reduce mechanical cracking
Feedthrough EMI capacitors

Syfer feedthrough chip ‘C’ filters are 3 terminal chip devices designed to offer reduced inductance compared to conventional MLCCs when used in signal line filtering. The filtered signal passes through the chip internal electrodes and the noise is filtered to the grounded side contacts, resulting in reduced length noise transmission paths. Available in C0G/NP0 and X7R dielectrics, with current ratings of 300mA, 1A, 2A and voltage ratings of 25Vdc – 200Vdc. Also available with FlexiCap™ termination which is recommended for new designs. Commonly used in automotive applications, a range qualified to AECQ-200 is also available.

Features & Benefits
• Surface mount EMI filters from 0603 – 1806
• C0G and X7R dielectrics, with capacitance values up to 200nF
• Recent range extensions
• Available qualified to AEC-Q200
• FlexiCap™ termination option
• Available on short lead-time

Applications
• Automotive, including pedal and crankshaft sensors
• Telecoms
• RF applications
• General signal line filtering
• High rel and space grade versions available

X2Y Filter Chips

Features & Benefits
• Proven X2Y EMI filtering technology
• Simultaneous line-to-line and line-to-ground filtering
• Case sizes from 0603 – 2220, offering up to 500Vdc working
• FlexiCap™ termination option
• Applications include DC motors, automotive, medical, telecoms

EMI Power Filters

Features & Benefits
• Up to 100A current rating
• Self-healing high quality film capacitors for high voltage, high current applications
• Resin sealed
• Hermetically sealed versions with ceramic discoidal capacitors
• For military vehicles, MRI room equipment, base stations

Panel Mount EMI Filters

Features & Benefits
• Resin sealed, panel mount EMI filters
• High capacitance discoidal elements enable superior insertion loss performance in any size
• Eg 4 – 40 UNC range offers 150nF in 50VDC or up to 33nF in 500VDC
• From M2.5 – M6 and up to 3kVDC
• Applications
  • military, aerospace and microwave modules

Surface Mount Pi-Filters

Features & Benefits
• High performance SMD filters for DC lines, up to 10A rated
• Highest working voltage in the market: 500VDC
• Sizes 1206, 1812 and 2220 with maximum capacitance 470nF
• Suitable for military, aerospace and telecoms applications
TDK Corporation is one of the largest manufacturers of electronic components, modules, systems and devices in the world. The broad range of passive electronic components includes multilayer ceramic capacitors as well as aluminium electrolytic and film capacitors, ferrites and inductors, high-frequency components and modules, piezo and protection devices, and sensors. These components are marketed under the product brands TDK and EPCOS. With its product spectrum TDK focuses on demanding markets in the areas of information and communication technology and consumer, automotive and industrial electronics.

### EPCOS Brand Products

#### Inductors

<table>
<thead>
<tr>
<th>Types</th>
<th>Applications</th>
</tr>
</thead>
</table>

#### DC Film Capacitors

<table>
<thead>
<tr>
<th>Types</th>
<th>Applications</th>
</tr>
</thead>
</table>

#### Varistors

<table>
<thead>
<tr>
<th>Types</th>
<th>Applications</th>
</tr>
</thead>
</table>

#### Nonlinear Resistors

<table>
<thead>
<tr>
<th>Types</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inrush current limiters, SMD and leaded PTC thermistors, capacitor charging resistors, SMD NTC thermistors, Leaded NTC thermistors – elements and probes.</td>
<td>Industrial: overcurrent protection in ballasts, SMPS, small and medium-sized drives, UPS, and control units; temperature measurement in medical equipment. Automotive: limit temperature detection and temperature measurement in engine management, LED current regulation, exhaust gas recirculation. IT and telecommunications: temperature measurement in printers, HDD, notebook PCs, mobile handsets, chargers. Consumer: overcurrent protection and limit temperature detection in home appliances, security systems, chargers, LCD displays, SMPS, control units, home appliances, heating.</td>
</tr>
</tbody>
</table>

#### Surge Arresters

<table>
<thead>
<tr>
<th>Applications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial: overvoltage protection for power lines. IT and telecommunications: overvoltage protection in main distribution frames, shelters, base stations, modems set-top boxes, routers.</td>
<td></td>
</tr>
</tbody>
</table>

#### Aluminium Electrolytic Capacitors

<table>
<thead>
<tr>
<th>Types</th>
<th>Applications</th>
</tr>
</thead>
</table>
**TDK Brand Products**

### Signal Line Inductors (NLV)

**Features & Benefits**
- Size: 2010 – 4012
- Inductance: 0.47μH – 47μH
- Rated current: 0.31A – 2.75A
- High magnetic shield construction should actualise high resolution for EMC protection

**Applications**
- Mobile communication, Consumer, Automotive

### Power Line Inductors: Miniature size (VLS)

**Features & Benefits**
- Sizes: 2010 – 4012
- Inductance: 0.47μH – 47μH
- Rated current: 0.31A – 2.75A
- High magnetic shield construction should actualise high resolution for EMC protection

**Applications**
- Mobile communication, Consumer, Automotive

### Common-mode Filters for Signal Line (ZJYS)

**Features & Benefits**
- Size: 5.5mm x 5.8mm, 10.5mm x 5.8mm, 9.5mm x 6.0mm
- Impedance: 100 – 300 (6MHz – 300MHz), 1000 – 2000Ω (1 MHz)
- Rated current: 0.5A – 2A
- Temperature: -25˚C – +85˚C , -25˚C – +125˚C

**Applications**
- ZJYS51: Communication, Office, PCs, Consumer
- ZJYS81: Automotive (CAN-Bus systems)

### Power Line Inductors (SLF)

**Features & Benefits**
- Size: 6025 -12575
- Inductance: 1.2μH – 1500μH
- Rated current: 130mA – 8.2A
- Temperature: -20˚C – +85˚C
- Low profile, low DC resistance, and high current handling capacities

**Applications**
- Mobile communication, Consumer, PC

### Multilayer Inductors: High-Frequency (MLG)

**Features & Benefits**
- Size: 0603 – 1608
- Inductance: 0.3μH – 1000μH
- Rated current: 50mA – 1000mA
- High Q characteristic

**Applications**
- Mobile communication, high-frequency modules (PA, VCO, FEM etc.), Bluetooth, WLAN, UWB

### MLCCs for Automotive Application (CGA)

**Features & Benefits**
- Size: 0402 – 5750
- Temperature characteristics: CH, C0G, JB, X7R, X5R, F, Y5V, X6S, X7T
- Rated voltage: 4V – 630V
- Capacitance: 0.5pF – 100μF

**Applications**
- Automotive

### Power Line Inductors: High-Frequency (MLG)

**Features & Benefits**
- Size: 0603 – 1608
- Inductance: 0.3μH – 1000μH
- Rated current: 50mA – 1000mA
- High Q characteristic

**Applications**
- Mobile communication, high-frequency modules (PA, VCO, FEM etc.), Bluetooth, WLAN, UWB

### Common-mode Filters for Power Line (ACM)

**Features & Benefits**
- Impedance range:
  - 20Ω – 80Ω (10MHz – 100MHz)
  - 50Ω – 150Ω (100MHz – 500MHz)
  - 30Ω – 35Ω (500MHz – 1000MHz)
- Temperature: -40˚C – +85˚C
- Easy installation – no post moulding required
- Built in strain relief prevents slippage on cable

**Applications**
- PCs, Communication, Consumer

### Chip Beads for Signal Line (MMZ)

**Features & Benefits**
- Size: 4520 – 1513
- Impedance: 230Ω – 1000Ω (100MHz)
- Rated current: 1.7A – 10A
- Best-in-class highest current handling (up to 10A)

**Applications**
- Mobile communication, Consumer, etc
TE Connectivity’s product portfolio now includes a comprehensive range of passive components. Specific areas of focus are in precision resistors, high frequency inductors and high power resistors. The range of precision resistors meets the requirement for economically priced components for both industrial and military applications. With tolerances down to 0.01% and TCRs as low as 5ppm/˚C, the range from TE delivers the “Complete Precision Portfolio”. Noise suppression and protection inductor chips from TE can help protect circuits in a variety of ways. The range offers solutions for high power and high speed applications. TE Connectivity’s high power and high voltage resistors can offer up to 2,500W with voltage proof to 50kV. High power and pulse resistors are capable of withstanding pulses up to 25,000W for applications such as regenerative braking and power supplies, these are available in a wide variety of package styles with customisation our speciality.

Customisation & Development Program

As a leading manufacturer of resistive products, TE Connectivity serves a wide range of sectors with both standard and custom-designed solutions. Core markets include industrial machinery, transportation, electrical appliances and commercial.

Manufacturing processes include thick film, thin film, wirewound and foil technology. These core processes can be adapted to achieve solutions specific to a customers design requirements. TE’s capability includes bespoke product developments and product modifications.

The experienced design team works closely with our customers’ engineering personnel to design advanced products meeting their exact requirements. 3D visualisation of the product gives TE’s engineers an understanding of what the product will look like from the start of the project.

The customisation and development program includes in-house product testing in TE’s own R&D laboratory. Tests can be designed in conjunction with customer specifications to include cyclic rated power and overload testing, adiabatic (single shot and frequency) testing, environmental, mechanical and repetitive pulse testing. Qualification testing is carried out to a proven procedure and the product development stages are well documented and approved by a design approval team.

Features & Benefits

Bespoke Solution
• Can be treated as a component not an assembly
• Engineered from a specification to completion
• TE Connectivity turns your specification into a drop-in solution

Complete Flexibility
• A wide range of resistors, heatsinks, terminal posts, fixings, wiring harnesses and connectors to suit every application

Convection or Water Cooling
• Designed to meet your performance and cost requirements

Helps reduce Cabinet Temperature for End-User
• Helps to increase component life and system reliability

Applications
• Rail
• Capacitor Charging and Discharging
• Marine
• Power Transmission and Distribution
• Electrical Machinery
• Crowbar
• Filter
• Braking

Precision Resistors RN73 Series

<table>
<thead>
<tr>
<th>Series</th>
<th>Size</th>
<th>Power</th>
<th>TCR</th>
<th>Tolerance</th>
<th>Range</th>
<th>Pack Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN73</td>
<td>0402</td>
<td>0.063W</td>
<td>10ppm</td>
<td>0.1% and less</td>
<td>49R9 ~ 15K</td>
<td>250, 1000, 5000</td>
</tr>
<tr>
<td></td>
<td>0603</td>
<td>0.063W</td>
<td></td>
<td></td>
<td>4R7 ~ 332K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0805</td>
<td>0.1W</td>
<td></td>
<td></td>
<td>4R3 ~ 511K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1206</td>
<td>0.125W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0.25W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2512</td>
<td>0.5W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td>RP73</td>
<td>0402</td>
<td>0.063W</td>
<td>5ppm</td>
<td>0.05% and greater</td>
<td>10R ~ 255K</td>
<td>250, 1000, 5000</td>
</tr>
<tr>
<td></td>
<td>0603</td>
<td>0.1W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0805</td>
<td>0.125W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1206</td>
<td>0.25W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1210</td>
<td>0.3W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
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<td></td>
<td>2010</td>
<td>0.3W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2512</td>
<td>1.0W</td>
<td></td>
<td></td>
<td>4R7 ~ 1M0</td>
<td></td>
</tr>
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<td>RP73P</td>
<td>0603</td>
<td>0.166W</td>
<td>25ppm</td>
<td>0.1% and greater</td>
<td>10R ~ 332K</td>
<td>1000, 5000</td>
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<tr>
<td></td>
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<td>0.25W</td>
<td></td>
<td></td>
<td>10R ~ 500K</td>
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<tr>
<td>CPF</td>
<td>0201</td>
<td>0.031W</td>
<td>25ppm</td>
<td>0.5% and greater</td>
<td>49R9 ~ 33K</td>
<td>1000, 5000</td>
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<td>0402</td>
<td>0.063W</td>
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<td>1R0 ~ 205K</td>
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<td></td>
<td>0603</td>
<td>0.063W</td>
<td></td>
<td></td>
<td>1R0 ~ 2M0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0805</td>
<td>0.1W</td>
<td></td>
<td></td>
<td>1R0 ~ 2M5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1206</td>
<td>0.125W</td>
<td></td>
<td></td>
<td>1R0 ~ 3M0</td>
<td></td>
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<tr>
<td></td>
<td>1210</td>
<td>0.2W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0.25W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2512</td>
<td>0.5W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Features & Benefits
• Temperature coefficient of resistance (TCR) values down to 5ppm/˚C
• Resistor tolerances to 0.01%
• The RN73 Series in case sizes 0603, 0805 and 1206 are also available with Increased Power ratings
• Wide range of pack quantities (250 piece cut strip (stocked by TTI), 1,000 piece reels, 5,000 piece reels, 10,000 piece reels)
• Thin film resistors with higher tolerances and TCRs are available as the CPF Series

Bluetooth, 2Pro, PolySwitch, PolyZen, TE Connectivity and TE connectivity (logo) are trademarks. Telcordia is a trademark of Telcordia Technologies, Inc.
**Surface Mount Moulded Power Resistor**

**Features & Benefits**
- Available in 2W, 3W and 5W power ratings
- Value range from R10 – 2MΩ
- 1% or 5% Tolerances available
- TE Connectivity (TE) introduces a surface mount power resistor suited to meet today’s circuit design needs
- Each size offers low profile case design with flexible tinned copper terminations for reliable solder joints
- All styles utilise a fully welded construction technique, unlike other designs that rely solely on tinned termination connections
- These features allow the SM Series to withstand the higher temperatures associated with reflow, vapour phase, or infrared (IR) manufacturing processes without degradation
- Suitable for use in all types of power circuitry

---

**Wirewound Anti Surge Resistors**

TE Connectivity is pleased to offer this wirewound axial leaded resistor. Robustly manufactured with high quality materials this resistor offers flame proof coating, and is designed and tested to withstand power surges of up to 12KV.

**Features & Benefits**
- Power ratings from 0.5W – 10W
- Surge ratings tested in accordance with IEC 61000-4-5
- 5% Tolerance as standard
- Custom designs available

---

**High Frequency Chip Inductor 3650 Series**

**Features & Benefits**
- Wide range of inductance values from 1.0nH up to 4.7mH
- Demanding high frequency applications
- Four package sizes: 0402, 0603, 0805, 1008
- Designed for automatic placement
- Wirewound construction and standard tolerances of 2.5% and 10%
- High self resonant frequency realises a high Q factor and stable inductance at high frequency
- Smooth casings of the devices facilitate accurate placement
- A low-DC-resistance design of the devices provides low loss, high output and low power consumption
- Operating temperature range from -40°C – +125°C
- RoHS compliant
- Available in quantities of either 1,000 or 5,000 piece reels
- Laboratory design kits are available

---

**Aluminium Housed High Power Resistors HS Series**

**Features & Benefits**
- A range of extremely stable, high quality wirewound resistors
- Capable of dissipating high power in a limited space with relatively low surface temperature
- Power is rapidly dissipated as heat through the aluminium housing to a specified heatsink
- Largest range of wire wound resistors on the market today
- HS Series resistors feature 5 up to 300W with 500 and 1,000W versions available upon request
- Versatile range of resistors offers wide ohmic values from R01 up to 100K
- Customer specific solutions available
**Circuit Protection**

TE Connectivity’s circuit protection products are a part of your everyday life...

From your cell phone battery to your car’s steering wheel, they are helping to make your world safer and your electronics more reliable. TE develops, manufactures, and markets a complete line of overcurrent, hybrid, and overvoltage circuit protection products. All products are developed in RoHS compliant version.

### PolySwitch Devices

**Features & Benefits**
- Variety of form factors: surface-mount, radial-leaded, axial-leaded
- Hold currents ranging from 0.05A – 15A
- Voltage ratings from 6V – 240V
- Product range includes: radial-leaded devices, surface-mount devices (0603,0805,1206,1210,1812,2018,2920,3425 and 4420 sizes), Line-Voltage-Rated (LVR) devices, automotive devices, strap battery devices and telecommunications and networking devices
- Remotely resettable

### Gas Discharge Tubes

**Features & Benefits**
- Crowbar device with low arc-voltage
- Low capacitance and insertion loss
- High accuracy sparkover voltages for high precision designs
- Wide range of voltages and form factors
- Many devices tested per ITU K.12 recommendations
- Optional fail-short mechanism
- Various lead configurations
- Non radioactive materials

### Telecom Fuses

**Features & Benefits**
- High density placement in multi-port systems
- Low profile and small footprint
- Comply with applicable telecom spec: UL60950, TIA-968-A and Telcordia GR-1089

### Silicon ESD Protection Devices

**Features & Benefits**
- 0.10pF bi-directional 0201 and 0402 devices
- 0.20pF uni-directional 0201, 0402
- 0.20pF flow-through arrays
- Low leakage current ~50nA at 5V(typ)
- Low clamping voltage ~+10.0/-10.0V (typ, bi-di), +9.20/0.80V(typ, uni-di)
- ESD ~20kV contact/air discharge

### Chip Fuses

**High current**

**Features & Benefits**
- Highest current ratings available in 1206 size
- Monolithic multi-layer design
- High-temperature performance
- -55°C – +125°C operating temperature range
- Halogen free

**Fast-Acting**

**Features & Benefits**
- Available in industry standard 0402, 0603 and 1206 chip sizes
- Small size with high-current ratings
- Monolithic, multi-layer design
- High-temperature performance
- -55°C – +125°C operating temperature range
- Halogen free

### Slow-Blow

**Features & Benefits**
- Available in industry standard 1206 and 0603 chip sizes
- Small size with high-current ratings
- Monolithic, multi-layer design
- High-temperature performance
- -55°C – +125°C operating temperature range
- Halogen free

### PESD Protection Devices

**Features & Benefits**
- Thick film technology
- 0.25pF (typical) capacitance
- Low leakage current, low clamping voltage
- Fast response time (<1ns)
- Capable of withstanding numerous ESD strikes
- Compatible with standard reflow installation procedures
- Bi-directional protection
- Halogen free

### PolyZen Devices

**Features & Benefits**
- Overvoltage transient suppression
- Hold currents up to 2.3A
- Time delayed, overvoltage trip
- Time delayed, reverse bias trip
- Power handling on the order of 30W
- Integrated device construction

### 2Pro Devices

**Features & Benefits**
- Single overcurrent, overvoltage and ESD protection device
- Resettable overcurrent protection
- UL 497A listed protector (#E258475)
- Halogen free
Hybrid Protection Devices

TE Connectivity’s AC 2Pro LVM2P device is an integrated overcurrent/overvoltage/overtemperature circuit protection device that helps protect a wide variety of low-power systems against damage caused by overvoltage faults, including lightning strikes, ESD surges, loss of neutral, incorrect input voltage and power induction.

TE Connectivity’s PolyZen devices are polymer enhanced precision Zener diode micro-assemblies that help protect sensitive electronics from damage caused by inductive voltage spikes, voltage transients, incorrect power supplies and reverse bias. The PolyZen micro-assembly incorporates a stable Zener diode for precise voltage clamping and a resistively non-linear, polymeric positive temperature coefficient (PPTC) layer that responds to either diode heating or overcurrent events by transitioning from a low to high resistance state.

AC 2Pro Device

- Single overcurrent, overvoltage, overtemperature and ESD protection device
- Resettable overcurrent protection
- Max input current at 20°C: 150mA
- Power range: up to 30VA for 230VAC input voltage at 20°C
- High safe interrupt power: 415VAC/40ARMS
- RoHS compliant
- Single device helps reduce component count and footprint
- Helps reduce warranty returns
- Helps equipment comply with UL/IEC60950/IEC60335
- Reduces cost by eliminating need for additional fuse or power resistor in the power line

PolyZen Device

- Overvoltage transient suppression
- Hold currents up to 2.3A
- Time delayed, overvoltage trip
- Time delayed, reverse bias trip
- Power handling on the order of 30W
- Integrated device construction
- Inductive spike suppression
- RoHS compliant
- Helps shield downstream electronics from overvoltage and reverse bias
- Trip events shut out overvoltage and reverse bias sources
- Analog nature of trip events minimise upstream inductive spikes
- Helps reduce design costs with single component placement and minimal heat sinking requirements

Applications

- Main LED lighting systems
- PLC network adapters
- Cell phone chargers
- AC/DC power supplies
- Modem power supply
- AC panel protection modules
- AC line power supplies
- AC power meters
- White goods, appliances, industrial controls

Applications

- Portable media players
- Global positioning systems
- Hard disk drives 5V and 12V bus
- Solid state drives (SSD) 5V bus
- Cell phone charger port and USB power
- Automotive peripheral input power
- DC power port protection
- Industrial handheld POS
- Rechargeable bar code readers
- Portable medical equipments
No1 for Discrete Semiconductors

Toshiba Electronics Europe offers a comprehensive portfolio of power, small signal discrete, optoelectronic, logic and motor control driver technologies.

Products available from TTI in Europe include power and small signal MOSFETs, photocouplers, diodes and a wide variety of discrete components ranging from single gate logic to bus switches and voltage regulator ICs. Motor control solutions include optimised MOSFETs, couplers and highly integrated single-chip inverters.

Key Product Families:

**Power Semiconductors**
- Features & Benefits:
  - Power MOSFETs 20V~900V
  - 20V – 120V U-MOS Trench technology for fast switching and low loss operation
  - 400V – 650V PIMOS VII std low Qg MOSFETs
  - 600V – 650V DTMOS IV in Super Junction technology for high efficiency switching (low Qg+Rds(on))
  - Various surface mount and long lead packages

**Logic ICs**
- Features & Benefits:
  - Wide line-up of levelshifter and bus switches
    - Up to USB2.0 speed
    - Down to WL-CSP package size
  - Leading supplier of single gate logic devices
  - Wide standard Logic line-up
    - Focus on high-speed and low voltage logic series
    - Focus on TSSOP package

**Transistors**
- Features & Benefits:
  - Wide line-up of small signal MOSFET (SMOS)
    - New 1W LGA type package
    - Up to 10A (max) rating
    - Down to SOT883 (CST3) size
  - Wide line-up of bipolar transistors
    - Low Vce(sat) transistors
    - Package size as small as SOT883 and SOT923 (1.0mm x 0.6mm)
  - RF transistors
    - Si and SiGe line-up

**Photocouplers & Photorelays**
- Features & Benefits:
  - Wide line-up of high speed IC couplers, many new products in SO6 and SO8 package
  - Wide line-up of IGBT/MOSFET gate driver couplers and IPM-Drive Photocouplers
  - Wide line-up of MOSFET-output photorelays
  - Wide package variety
  - Extended temperature range -40˚C – +125˚C for many new items
  - Low power consumption
  - All relevant safety standard approvals

**Diodes**
- Features & Benefits:
  - Schottky Diodes down to SC2 package size (0.6mm x 0.3mm)
    - Low Vf, Ir performance
  - Wide line-up of ESD protection diodes
    - High speed (USB2.0, HDMI)
    - Small size (0.6mm x 0.3mm)
  - RF Diodes
    - Pin Diodes
    - Varicap Diodes
TT electronics is a focused, global electronics group supplying products to leading manufacturers in the defence and aerospace, medical, transportation, energy and industrial electronics markets.

The TT electronics technology portfolio is one of the most comprehensive in the industry, supplying passive components (fixed and variable resistors, magnetics) and discrete semiconductors (optoelectronics, diodes, MOSFETs) from brands including BI Technologies, IRC, Optek, Semelab and Welwyn Components.

TT electronics is continually investing in new product development, supported by world class application engineering teams committed to understanding and fulfilling customer needs with innovative technology solutions.

**Moulded SMD High Current Power Inductor**

TT electronics BI Technologies’ moulded power inductor has an extremely high energy storage ability of 2000μJ/cm³ and can improve circuit efficiency with minimal power losses up to 3MHz switching frequencies.

Designated the HM72B Series, the power inductor features an extremely low profile package with a pressed powdered iron core construction that will maximise power density and minimise power losses. The inductor features an overmoulded core construction that will saturate at currents ranging from 3.5ADC – 60ADC. The moulded package is extremely robust and will operate in high temperature environments.

**Features & Benefits**
- Low profile package 6.8mm x 7.2mm x 3mm maximum
- Inductance range of 0.10μH – 33μH
- Saturation current to 60A
- Wide operating temperature range, -40˚C – 130˚C
- Low power losses to 3MHz
- Low acoustic noise emissions

**Applications**
- Server and computer voltage regulators
- Point-of-load modules
- Telecom and datacom DC/DC converters
- Automotive DC/DC converters
- LED lighting drivers

**Precision/Ultra Precision Resistors**

**Features & Benefits**
- Metal film 15ppm, 0.1%
- Ultra precision metal film with tolerances down to 5ppm, 0.01%
- Moulded ultra precision with rugged protection, 2ppm
- Custom matched sets
- Bulk metal film, 5ppm, low inductance, low noise
- Available in RC and CAR Series

**Fusible Resistors**

**Features & Benefits**
- Wirewound, metal film, carbon film and nickel film
- Full fusing characteristics available
- UL1412 recognised
- UL94-V0 flameproof
- 240V fusing
- Available in EMC and ULW Series

**Specialist Chip Resistors**

**Features & Benefits**
- Approved to CECC 40401-003, 004 and 008
- Resistance up to 50Ω and down to 0.5mΩ
- Rated up to 3W, Voltage to 3kV
- High reliability tantalum nitride film for maximum protection, also available in military versions
- Military screening available
- Available in CR, HR, SC3, LR, HVC and PFC Series

**Pulse Chip Resistors**

**Features & Benefits**
- High pulse capability for telecoms and power supply applications
- Field proven with millions of units in use
- Standard and custom chip sizes (0805 – 2512)
- Thick film technology putting protection where its needed
- Available in PWC and DSC Series
**UL-Recognised Mains Input Resistor Provides Safe and Silent Fusing**

TT electronics Welwyn Components has introduced a new series of mains input resistors that uses an advanced coating and production process to ensure safe, silent operation in overload conditions, whilst matching the thermal and electrical insulating properties of standard silicone cement. This allows designers to more easily meet the requirements of UL approval, whilst eliminating the need to put additional fuses in series with the input resistor.

Welwyn’s new coating material and process delivers silent fusing performance without adversely affecting either safety or cost. The new multi-layer coating has a flammability rating of UL94V-0 and shares the same high temperature and insulating properties as standard silicone cement. However, it is more compliant so can absorb thermal and mechanical stresses without fragmenting. The resistor coating does not burn or emit incandescent particles under any condition of applied temperature or power overload.

These UL-certified resistors are available in standard values from 4R7 – 100Ω and ratings to 2W – 5W.

The devices are designed to withstand inrush and surge conditions. For example the ULW4-10RJ has an energy limit of 4.3J and a 1.2/50µs peak voltage limit of 1.1kV. Fusing performance is characterised by typical fusing times of 8s at 45W initial power (ULW2), although rapid fusing in a fraction of a second is achieved under mains short circuit conditions.

All the ULW Series operate in ambient temperatures from -55 – +155˚C. They are RoHS compliant and available in optional surface-mount as well as standard through-hole leadforms.

**Power**

- UL recognised fusible resistor
- Failsafe mains fusing at 120/240V
- Inrush and surge withstanding
- UL 94-V0 flameproof coating
- SMD lead form option

**Applications**

- Consumer
- Power supply
- Industrial
- Alternative energy

**Features & Benefits**

- **High Voltage/High Value Resistors**

- Precision high voltage up to 500Ω, 100kV
- High resistance up to 150Ω
- Ultra high resistance up to 100kΩ
- Planar/planar divider types available with full custom design service
- Available in T40, 3810 and HVP Series

- **Precision Resistor Networks**

- Silicon networks in QSOP
- Ceramic or silicon networks in SOIC
- High frequency networks
- T filter networks
- RC networks to IEEE1284 and line termination networks
- Precision networks to 0.1% tolerance
- Available in QSOP, SOIC and 8900 Series

- **Wirewound Resistors**

- Vitreous enamel to CECC 40201-002
- Cement coated: low cost and flameproof
- Aluminium housed to CECC 40203-006
- Low Ohmic down to 5mΩ
- UL version
- Open air low Ohmic, high current
- Tubular: vitreous and cement versions
- Available in W20, W30, WP-S, ULW and 1600-1900 Series

- **Trimming & Precision Potentiometers**

- Single turn
- Multi-turn
- Surface mount
- Through-hole
- Sealed
- Available in variable BU products Series

- **Current Sense**

- High precision, low value axial and chip resistive technologies
- High power, 2 and 4 terminal current shunts
- Custom design service
- Open air, wire bondable, thick film precision and metal glaze (up to 2W) versions
- TCRs to ±20ppm/˚C
- Available in LR, OARS, ULR and LRMA Series
TT electronics OPTEK Technology provides standard and custom designed optoelectronic technology solutions in applications for sensing, isolation/protection, communications, and illumination. OPTEK has the technical expertise to provide total optoelectronics integrated solutions including wiring harness, connectorisation, board assembly, and custom packaging.

**Reflective Sensors**

Typical reflective distances range from 0.04 inches (1mm) to over 30 inches (762mm).

**Applications:**
- Non-contact reflective object sensing
- Assembly line automation
- Machine control
- Machine automation
- Machine safety
- End of travel sensing
- Door/window closure

**Slotted Switches**

Typical slotted switches range in gap width (distance between the LED and Photosensor towers) from 0.08 inches (2mm) to over 1.25 inches (32mm).

**Applications:**
- Non-contact object sensing
- Assembly line automation
- Edge sensing
- Machine automation
- Machine safety
- Printer/copy machines
- Door/window sensing

**Hybrids/Encoder Solutions**

Hybrid products offer flexibility of multiple die in a single package as well as the ability to handle die with industry-standard surface mount equipment.

**Applications:**
- Encoders
- Linear position sensors
- Blood oximetry
- Reflective sensing
- Ambient light detection

**Isolators**

The optoisolator line is designed with special package configurations to enhance voltage isolation up to 50,000 volts.

**Applications:**
- High voltage isolation
- Power supplies
- Industrial equipment
- Medical equipment
- Office equipment
Vishay Intertechnology Inc. has grown through R&D and acquisitions to become a leader in the global electronics industry that sells into all geographic markets and all relevant market segments.

**TNPU e3 High-Precision Thin Film Chip Resistors**
- **Features & Benefits**
  - Low temperature coefficient (±5ppm/K) and tight tolerances (±0.05%)
  - Superior moisture resistivity (56 days/85°C/85% relative humidity)
  - AEC-Q200 qualified
  - Waste gas resistant

**LPS Series High Power Resistors**
- **Features & Benefits**
  - High Power dissipation: 300W, 600W, 800W, and 1100W mounted on heatsink
  - Small size of 57mmx60mm for low weight of 83g
  - High dielectric strength: up to 12kVrms
  - Non-inductive: <1μH
  - Cost-competitive

**Non-Linear Resistors – PTC Thermistors**
- **Features & Benefits**
  - Nickel thin film PTC element with TCR = 4110ppm/K
  - High stability over the entire temperature range
  - Resistance range: 100Ω – 10kΩ
  - Standard Rₚₐₜ tolerances: ±0.5%, ±1%, ±5%
  - Operation range: -55°C – +150°C
  - TFPT package sizes: 0603, 0805, and 1206
  - TFPTL leaded version with 2.5mm and 5.0mm pitch
  - UL and CSA recognized

**Power Metal Strip® Resistors**
- **Features & Benefits**
  - Range of package sizes from 0603 – 5931
  - Resistance range: 0.0002Ω – 1Ω
  - Temperature performance: up to +275°C
  - Tolerances: down to ±0.5%
  - Low temperature coefficient: down to ±30 ppm/°C
  - Excellent overload capability

**Moulded Surface Mount Resistors**
- **Features & Benefits**
  - Package sizes from 2012 – 6927
  - Resistance range: 0.1Ω – 100kΩ
  - High temperature performance: up to +275°C
  - Tight tolerances: down to ±0.5%
  - Low temperature coefficient: down to ±20ppm/°C
  - Excellent overload capability

**ACAS/C Thin Film Chip Resistor Arrays**
- **Features & Benefits**
  - Different resistance values in one substrate
  - Relative tolerance down to ±0.05% (matching)
  - Relative temperature coefficient down to ±5ppm/K (tracking)
  - Two or four resistors per array
  - ACAS AT Series AEC-Q200 qualified

**Non-Linear Resistors – Varistors**
- **Features & Benefits**
  - Varistor VDRS and VDRH Series
    - Overvoltage surge protection ranging from 14Vₑ – 680Vₑ
    - High current surge/size ratio capability up to 10kA
    - UL and CSA recognized according UL 1449 edition 3 for ambient temperatures up to 105°C
  - Multilayer Varistor MLV Series
    - Surface mount multilayer surge suppressor for ESD and overvoltage protection
    - Inherent bidirectional clamping for surge currents up to 1200Aₑ
    - Excellent energy/volume ratio, 7 sizes available from 0402 to 2220

**MCW 0406 AT Wide Terminal Thin Film Chip Resistors**
- **Features & Benefits**
  - Replacement for larger case sizes

**Magnetics**
- **Features & Benefits**
  - Surface mount and leaded transformers
  - Surface mount and leaded power inductors and RF inductors
  - High-frequency chip inductors
  - Chip impedance beads

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One of the World’s Largest Manufacturers of Discrete Semiconductors and Passive Electronic Components
**Film Capacitors**

**Features & Benefits**
- Metallised film: MKT, MKP and MKN
- Excellent electrical parameters
- Low losses, high current, not polarised
- Self-healing properties
- Customised designs

**Multi-Layer Ceramic Capacitors**

**Features & Benefits**
- Large portfolio of EIA industry-standard sizes
- Wide capacitance and voltage range
- Specialty MLCCs incl. Non-magnetic Series
- MIL, DSCC and Hi-Rel products
- Chip arrays and miniature 0201 sizes
- COG(NP0), X5R, X7R, X8R, and Y5V dielectrics
- Hi-Q, Ultra High-Q and Ultra Low ESR MLCCs
- Various terminations incl. Polymer, AgPd

**Conformal-Coated Tantalum Chip Capacitors**

**Features & Benefits**
- Hi-Rel COTS chip capacitors
- T95 conformal-coated chip capacitor
- Customer-definable termination plating, Weibull grading, surge-current screening and ESR level
- Designed for safety-critical avionics and military applications

**RFI Capacitors**

**Features & Benefits**
- Metallised film MKP and MKT
- 0.001µF up to 10µF
- Class X and Y, small physical dimensions
- Approvals: IEC384-14/2, EN 132400 UL, CSA, CQC

**Moulded Tantalum Chip Capacitors**

**Features & Benefits**
- 298D lead-frameless moulded chip capacitor
- 0603 and 0805 case sizes
- Face-down terminations, 100% tin
- Signal processing and power management in cell phones, digital cameras and MP3 devices
- Very low ESR high ripple-current handling

**Leaded Tantalum Capacitors**

**Features & Benefits**
- SuperTan® Extended-Range (STE) Wet Tantalum Capacitors
- Highest capacitance per unit volume available
- Capacitance ranges from 750µF – 10,000µF
- Hermetic seal enables the STE to withstand high stress and hazardous environments
- Avionics, aerospace, smart munitions, petroleum down-hole exploration and data logging

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**Single-Layer Ceramic Disc Capacitors**

**Features & Benefits**
- Class 1 (SL, C0G, N750) and Class 2 (X5F, X7R, Y5F, Z5U, Y5U) dielectrics
- Broad high-voltage and low-voltage ranges
- General-purpose, low-dissipation and narrow-tolerance series
- EMI RFI Y1 and Y2 Series comply with IEC 60384-14 3rd edition
- ENEC, UL and CSA approved

**MKP 1848S Film Capacitors**

**Features & Benefits**
- Slim design – low profile
- Voltage range: 500V to 1000V
- Capacitance: 2µF – 100µF
- Designed to handle high RMS and peak currents
- Long life: > 100,000h at U_{pedc} and 70°C
- Operating temperature: Up to 105°C

**“Hockey Puck” High Voltage Ceramic Disc DC Capacitors – 715C**

**Features & Benefits**
- Symmetric
- Low inductance
- Electrodes on face sides
- Epoxy potted
- Screw terminals
- Class 1 and class 2 ceramics
- Voltages: U\text{max}. = 10kV_{dc} – 40kV_{dc}
- Frequency: f = 50Hz, 60Hz
- High insulation resistance: R_{ins} = 200GΩ
- Capacitance: C_{max}. = 10 nF

**Aluminium Electrolytic Capacitors**

**Features & Benefits**
- Radial, Axial, SMD, large can, energy storage and solid aluminium
- SMD versions: industrial, standard, high-temperature, low-ESR
- Large can, snap in, printed wiring board, screw terminal versions

**Multi-Layer Ceramic Capacitors**

**Features & Benefits**
- Large portfolio of EIA industry-standard sizes
- Wide capacitance and voltage range
- Specialty MLCCs incl. Non-magnetic Series
- MIL, DSCC and Hi-Rel products
- Chip arrays and miniature 0201 sizes
- COG(NP0), X5R, X7R, X8R, and Y5V dielectrics
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- Designed for safety-critical avionics and military applications
Vishay’s Discrete Semiconductor Portfolio

**WSMS and WSBS High Current Shunts** 
*(Current Sense)*

**Features & Benefits**
- Resistance: 0.00002Ω – 0.001Ω
- Current capability: up to 1,000A
- Low-TCR metal resistive element: <20ppm/°C
- Low thermal EMF: <0.3µV/°C
- Operating temperature range: -65°C → +170°C
- Very low inductance: <5nH
- Non-standard package sizes available

**Applications**
- Industrial and commercial power meters (smart grid digital meters)
- Automotive/industrial hybrid and electric battery management
- Alternative energy metering

**IHLP® 3232 Series Low-Profile, High-CURRENT Inductors**

**Features & Benefits**
- New size fits gap in the IHLP footprint line-up
- Available in two standard height profiles: 3mm and 4mm
- Shielded construction
- Applications up to 5MHz

**Applications**
- PDA/notebook/desktop/server applications, high-current POL converters, low-profile, high-current power supplies, battery-powered devices, DC/DC converters in distributed power systems
- Automotive grade series available upon request

**CNY6 Series**

**CAT IV Optocouplers**

**Features & Benefits**
- Certified for CAT IV installations per DIN EN 60747-5-2 (VDE 0884)
- Recurring peak voltage ($V_{on}^{peak}$) of 1450V
- Transient overvoltage ($V_{off}^{peak}$) of 12,000V
- Creepage options of 9.5mm, 14mm, and 17mm
- Distance from emitter to detector through insulation ≥ 3mm
- Available in surface-mount and through-hole packages

**SiHG73N60E E Series 600V**

**High-Voltage MOSFET**

**Features & Benefits**
- Minimum 600V breakdown voltage
- TO-247 package provides the lowest on-resistance
- Super junction technology
  - Low $R_{on}$, high $Q_g$ figure of merit (FOM)
  - Reduce switching and conduction losses
  - Ultra-low gate charge ($Q_g$)
  - Low input capacitance ($C_{iss}$)

**Optoelectronics**

**Features & Benefits**
- Couplers and isolators
- Infrared detectors and emitters
- Infrared receiver modules
- IrDA modules
- LEDs

**DIcs**

**Features & Benefits**
- Analog switches and multiplexers
- Power ICs
- Integrated power products including MicroBuck and DrMOS
- Smart load switches
- Non-isolated DC/DC switching regulators

**MOSFETs**

**Features & Benefits**
- Low-Voltage MOSFETs (up to $V_{DS} =$ 250V)
  - TrenchFET Gen IV
  - ThunderFET medium voltage technology
  - Leading Edge Gen III P-ch
  - Fully AEC-Q qualified LV MOSFETs
- High-Voltage MOSFETs (up to $V_{DS} =$ 1,000V)
  - New E series super junction technology
  - New D series planar technology

**Diodes**

**Features & Benefits**
- Small-Signal diodes
- Zener diodes
- Rectifiers and bridges
- TVS and ESD protection diodes

**Modules**

**Features & Benefits**
- Bridge modules
- Diode modules
- IGBT modules
- MOSFET modules
- Thyristor modules
WIMA has a long tradition in the field of passive electronic components and is one of the leading specialists in capacitor production. WIMA is a privately owned company located in Germany and has four sites there: The Sales Department and Central Lab are in Mannheim, most modern production facilities are situated in Aurich, Berlin and Unna. Continual technical progress and expansion have made WIMA the first address for high-quality film capacitors worldwide. WIMA Group is specialised in three global business areas: Plastic film capacitors, Paper capacitors and Supercapacitors. WIMA’s strength lies in the design and production of customised products requiring experience and highly developed expertise. Solutions can therefore be offered to all customer needs.

**Plastic Film SMD Capacitors**

**Features & Benefits**
- Encapsulated plastic film capacitors with PET or PPS dielectric
- Size codes 1812, 2220, 2824, 4030, 5040 and 6054
- Capacitance values from 0.01μF – 6.8μF
- Rated voltages from 63VDC – 1000VDC

**Subminiature Capacitors in PCM 2.5mm**

**Features & Benefits**
- Smallest plastic film capacitors with PET or PP dielectric
- Available in metallised, self-healing version or in pulse duty film/foil version
- Capacitance values from 1000pF – 1μF
- Rated voltages from 50VDC – 400VDC

**Film Capacitors in PCM 5 – 37.5mm**

**Features & Benefits**
- Plastic film capacitors with PET or PP dielectric
- Available in metallised, self-healing version or in pulse duty film/foil version
- Capacitance values from 27pF – 220μF
- Rated voltages from 50VDC – 2000VDC

**Pulse Duty Capacitors**

**Features & Benefits**
- Pulse duty, self-healing capacitors in PCM 7.5mm – 37.5mm with Polypropylene dielectric
- Internal series connection
- High current carrying capability
- Capacitance values from 100pF – 15μF
- Rated voltages from 100VDC – 6000VDC

**RFI Capacitors**

**Features & Benefits**
- RFI capacitors with Polypropylene or Metallised Paper dielectric in PCM 7.5mm – 48.5mm
- Outstanding self-healing capability
- Classes X1, X2, Y2
- Capacitance values from 1000pF – 10μF
- Rated voltages from 250VAC – 500VAC

**Snubber Capacitors**

**Features & Benefits**
- Snubber capacitors with Polypropylene dielectric
- Particularly reliable contact configuration as 4-pin version or with screwable plate connections
- Capacitance values from 0.01μF – 25μF
- Rated voltages from 250VDC – 4000VDC

**GTO Capacitors**

**Features & Benefits**
- GTO capacitors with Polypropylene dielectric
- Cylindrical capacitor body with axial screw and thread connections
- Self-healing capability
- Capacitance values from 1μF – 100μF
- Rated voltages from 400VDC – 1500VDC

**DC-LINK Capacitors**

**Features & Benefits**
- DC-Link capacitors with Polypropylene dielectric and very high capacitance/volume ratio
- In rectangular or cylindrical version with manifold connecting options
- Capacitance values from 2μF – 4500μF
- Rated voltages from 500VDC – 1500VDC

**SuperCap Double-Layer Capacitors and Modules**

**Features & Benefits**
- Double-Layer capacitors with very high capacitance values
- Single cells in cost-effective cylindrical or in space-saving rectangular metal case
- Series connection possible
- Actively or passively balanced, serial or parallel cascaded modules
- Maintenance-free
- Customised solutions on request
Innovative Services Around the Globe

Yageo is a world-class passive component service provider with capabilities on a global scale, including production and sales facilities in Asia, Europe and the Americas. The corporation is uniquely positioned to provide one-stop-shopping, offering its complete product portfolio of resistors, capacitors and inductors in both commodity and specialty versions to meet the diverse requirements of customers.

Yageo currently ranks as the world No.1 in chip-resistors, No. 3 in MLCCs and No. 3 in ferrite products, with 23 sales/service offices in 18 countries, 8 production sites, 5 JIT logistic outfits and 3 R&D centres worldwide. With the trend toward miniaturization and shorter product cycles for consumer electronics and telecommunication applications, it became clear that future growth would demand globalization, and the ability to become part of customer supply chains through enhanced service. Yageo’s global deployment strategy has thus always been based on providing customers with comprehensive passive component solutions.

Automotive Grade Chip Resistor

**Features & Benefits**
- AEC-Q200 compliant
- Anti-sulfuration (ASTM-B809-95 Standard)
- EAI 0402 to 2512 case sizes
- 100 AOI for patterning
- Stable process control including narrow specification and CPK monitor
- 100% pulse load screening to eliminate early failures during final testing
- ESD withstand voltage of maximum 2KV
- Humidity resistance of 1% (1,000h at +85˚C, 85% RH)
- 8,000h operational life test

**Applications**
- Infotainment, comfort and security, power management

Multilayer Ceramic Capacitors (MLCC)

**Features & Benefits**
- Wide capacitance range (0.22nF ~ 100μF)
- NP0, X5R, X6S, X7R and Y5V dielectrics
- High voltage, high capacitance, high frequency, low inductance, MLV (multi-layer varistor), unique X2Y® filtering and arrays
- Suitable for tantalum replacement

Inductors & Coils

**Features & Benefits**
- Chip beads, multi-layer chip inductors, wirewound inductors and power inductors
- Minimised DC resistance
- Excellent Q factor and SRF characteristic
- Monolithic structure for high reliability
- Applicable to either flow or reflow soldering

Electrolytic Capacitors

**Features & Benefits**
- Miniature, screw type, surface mount, large can and polymer
- High volumetric efficiency
- Long life, high temperature
- High voltage with compact size
- Low ESR and high ripple current

Chip Resistors

**Features & Benefits**
- Surface mount package down to 01005
- Thick film low ohmic, current sensing and anti-sulfurated resistors
- Thin film precision resistors
- High voltage and surge resistors
- Thick film arrays and networks

Leaded Resistors

**Features & Benefits**
- Wide product range of carbon film, metal film, metal oxide, wirewound fusible and aluminium housed
- Highly stable performance and highly reliable
- Higher power rating and working voltage
- Miniature size and narrow tolerance
- Anti-electrical arc and Anti-explosion safeguarding

High Frequency Products

**Features & Benefits**
- Metal antenna, chip/patch/active antenna, and RF components
- Based on low temperature co-fired ceramic (LTCC) technology
- Meets wide range wireless communication protocols, including Bluetooth and IEEE 802.11b/g, WPAN, WLAN, WMAN, WWAN and LTE.
- Customisation services for metal antennas on request

Applications
- Infotainment, comfort and security, power management
Europe’s Largest Inventory of Passive, Discrete, Connector & Electromechanical Components

- Over 40 Sales locations across Europe
- Connector assembly and value added services
- Mechanised distribution centres
- Inventory profile over 500,000 part numbers
- Ship over 3.5 million line items annually
- Only distributor with catalogue division – Mouser
- Industry leading service, support and value

European HQ, Munich
16,000m² of dedicated warehouse space

Global Visibility on a centralised inventory system