Speciality
Product Guide

www.ttieurope.com

TTI, Inc. - Never Short on Solutions

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TTI, Inc. - Never Short on Solutions

TTI is the largest authorised Passive, Interconnect, Discrete, Relay & Switch specialist.

TTI's European headquarters in Maisach Gernlinden occupies 13,000m^2, with 10,000m^2 of dedicated warehouse space on three levels. We provide local service in 36 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 world wide.

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

TTI is known as a specialist in Passives, beside resistors and capacitors, we also focus on Speciality Passive Products.
We define Speciality Products as passives that require extensive technical and application knowledge and extended design-in support. These products include Varistors, Thermistors, Inductors, Resonators and all kind of Filters plus much more.
Speciality Products are driven by technology and are used in multiple applications such as Automotive, Consumer Electronics, Industrial Systems, Medical Technology, Network Communications and Telecommunications where our Specialties perfectly fit in.

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 I, P&E
- Deepest & 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

Passives

	API DELEVAN	AVX	BOURNS	EPCOS	KEMET	KOA	LELON	LITTELFUSE	MURATA	NICHICON	OHMITE	PANASONIC	SPECTRUM CONTROL	SYFER CMP	TDK	TT ELECTRONICS	TYCO ELECTRONICS	VISHAY	VISHAY PRECISION FOIL	WIMA	YAGEO/PHYCOMP
Potentiometers & Trimmers																					
Precision/Panel Control			●								●	●				●	●	●			
Sensor/Encoder			●						●			●			●	●		●			
Trimmers			●			●			●			●		●		●	●	●			
Magnetics																					
Ferrite Beads	●		●		●	●			●			●			●	●	●	●			●
Ferrite Cores	●			●					●						●						
Chokes	●		●	●	●	●			●			●			●	●	●	●			●
Coils	●		●	●	●	●			●			●			●	●	●	●			●
Inductors	●	●	●	●	●	●			●			●			●	●	●	●			●
Transformers	●		●	●	●							●			●	●	●	●			●
Filters																					
EMI/RFI	●	●		●	●				●			●	●	●	●		●				
RF/Microwave	●	●		●					●			●	●	●	●						●
Circuit Protection																					
ESD Suppression	●	●	●	●		●		●				●					●				
Fuses		●	●			●		●				●					●	●			
Gas Discharge Tube (GDT)			●	●				●									●				
Resettable Fuses (PPTC)			●					●									●				
Thermistors (NTC)		●		●		●			●			●			●			●			
Thermistors (PTC)			●	●		●			●									●			
Thyristors			●					●									●				
TVS Diodes			●					●										●			
TVS Diodes Arrays			●					●										●			
Varistors		●	●	●		●		●				●			●		●	●			●
Timing Devices																					
Resonators		●							●						●						
Crystals		●																●			
Oscillators		●																●			

Discretes

	BOURNS	LITTELFUSE	PANASONIC	TOSHIBA	TT SEMELAB	VISHAY
Diodes						
Arrays	●	●		●	●	●
ESD Protection	●	●		●	●	●
Schottky	●		●	●	●	●
Switching	●		●	●	●	●
TVS	●	●			●	●
Zener	●		●	●	●	●
Rectifiers						
Avalanche	●					●
Bridge	●					●
Fast Recovery	●		●	●		●
General Purpose	●				●	●
Schottky	●		●	●	●	●
Standard Recovery	●			●	●	●
Ultrafast Recovery	●			●	●	●
Transistors						
FETs			●	●	●	●
IGBTs			●	●	●	●
MOSFETs			●	●	●	●
RF			●	●	●	●
Bipolar/Small Signal	●		●	●	●	
Thyristors						
DIAC		●				
SCRs	●	●				●
SIDACs		●				
TRIAC	●	●				
Optoelectronics						
Couplers			●	●		●
LEDs			●	●		●
Infrared Emitters						●
Infrared Receivers						●
IRDA Transceivers						●
Optical Sensors			●	●		●
Photo Detectors			●	●		●
Solid State Relays				●		●
Others						
Modules				●	●	●
Voltage Regulators				●	●	●
Analog Switches				●		●
Motor Control ICs				●		●
Fiber-Optic Devices (TOSLINK™)				●		
General Purpose Logik LMOS/TSSOP				●		

AVX A KYOCERA GROUP COMPANY

BOURNS®

EPCOS

Littelfuse® Expertise Applied | Answers Delivered

muRata

Panasonic ideas for life

SYFER CMP

TDK®

TT electronics

Tyco Electronics Authorized Distributor

VISHAY®

YAGEO

Circuit Protection & Signal Integrity

AVX is a technology leader in circuit protection components. Their capability includes surface mount and leaded transient suppression products, including multi-element arrays and LCT filters. Speciality low capacitance and high speed circuit (USB, CANbus) families are also available. Other products include medium power, load and jump start varistors, NTC thermistors and SMT fuses.

TransGuard - Surface Mount Transient Voltage Suppressors

The AVX TransGuard range of transient voltage suppressors use a multi-layer high energy construction that offers state of the art protection against voltage transients caused by ESD lightning and inductive switching events etc. AVX TransGuard MLVs have both physical and electrical advantages over traditional means of transient protection - such as zener diodes.

Part Numbering System	V	C	1206	18	D	400	R	T

PRODUCT Varistor TransGuard

CASE STYLE Chip Type

CASE SIZE 0201 up to 3220

WORKING VOLTAGE

0.3 = 3.0 VDC	09 = 9.0 VDC	14 = 14.0 VDC
26 = 26.0 VDC	48 = 48.0 VDC	65 = 65.0 VDC
05 = 5.6 VDC	12 = 12.0 VDC	18 = 18.0 VDC
30 = 30.0 VDC	60 = 60.0 VDC	

ENERGY RATING

A = 0.1J	J = 1.5J	F = 0.7J	X = 0.05J
H = 1.2J	D = 0.4J	Y = 0.02J	
C = 0.3J	P = 3.0J	G = 0.9J	

CLAMPING VOLTAGE 10.0V - 65.0V

PACKAGING (Pcs/REEL)
D = 1000 R = 4000 P = 10000

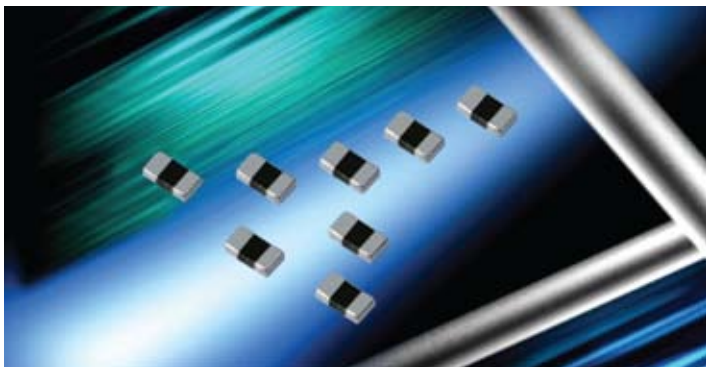
TERMINATION FINISH
P = Ni – Sn Alloy (plated) M = Ni – Sn Pb (plated)

Speciality TransGuard Series

MultiGuard	MG04, MG05, MG06	2, 3 and 4 element arrays
TransFeed	V2F, V3F	Feed-thru version for greater filtering performance
StaticGuard	VC04, VC06, VC08, VC12, VA10	Low capacitance primarily for ESD protection
USB Series	USB	Low capacitance for high-speed data applications
CanBus	Can	Controlled capacitance type for automotive canbus
Medium Power	Automotive, Industrial	Higher voltage applications 12V-500V
Automotive Series		AEC-Q qualified, higher load dump per request
High Temperature Series	150°C	Oil drilling, under the hood applications
Controlled Capacitance Series		Tighter capacitance tolerance +/-20%

Miniature 0201 MLV

AVX 0201 Multi-Layer Varistors are designed for circuits where board space is a premium. 0201 MLV offer bi-directional ESD protection in the smallest package available today. The added advantage is EMI/RFI attenuation. 0201 MLV can replace 2 diodes and the EMC capacitor for a one chip solution.The miniature size and one chip solution team to offer designers the best in ESD protection and EMI filtering in one ultra compact device.



Features

- Capacitance 15pF to 150pF
- Low VB version
- Bi-directional protection
- Fastest response time to ESD strikes
- Multi-strike capability
- Ultra compact 0201 case size

Applications

- Cell phone
- PDA
- Camera modules
- Embedded components
- Hearing aid
- Any circuit with space constraint

AVX Part Number	V_W (DC)	V_W (AC)	V_B	V_C	I_{VC}	I_L	E_T	I_P	Cap
VC020103V101WP	3.5	2.0	4.76 min. - 8.84 max.	14 max.	1	50	0.02	10	100pF±30%
VC020103V121WP	3.5	2.0	4.76 min. - 8.84 max.	14 max.	1	50	0.02	10	125pF±30%
VC020103V151WP	3.5	2.0	4.76 min. - 8.84 max.	14 max.	1	50	0.02	10	150pF±30%
VC020105T150WP	5.6	4.0	10.0 min. - 15.6 max.	35 max.	1	50	0.01	2	15pF±30%
VC020105T330WP	5.6	4.0	10.0 min. - 15.6 max.	35 max.	1	50	0.01	4	33pF±30%
VC020105T500WP	5.6	4.0	10.0 min. - 15.6 max.	35 max.	1	50	0.01	5	50pF±30%
VC020105T101WP	5.6	4.0	10.0 min. - 15.6 max.	35 max.	1	50	0.01	5	100pF±30%
VC020105V101WP	5.6	4.0	6.4 min. - 9.6 max.	17 max.	1	50	0.02	4	100pF±30%
VC020107V101WP	7.0	5.6	9.6 min. - 14.4 max.	20 max.	1	50	0.02	5	100pF±30%

V_W(DC) DC Woking Voltage (V)
V_W(AC) ACWorking Voltage (V @ 1mADC)
V_C Clamping Voltage (V @ IVC)

V_B Breakdown Voltage (V @ IVC)
I_{VC} Test Current for VC(A, 8x20µS)

I_I Maximum leakage current at the working voltage (µA)
E_T Transient Energy Rating (J, 10x1000µS)

I_P Peak Current Rating (A, 8x20µS)
Cap Capacitance (pF) @ 1KHz specified and 0.5VRMS

Single Layer Varistors VC/VJ3220

The VC32 series offers the designer a surface mount solution for high voltage high-energy transient suppression. Think of this series as a surface mount alternative to MOVs.

N.B: Other values available per request.

Part Numbering System VC32 M0 0151 K -

TYPE VC3220

SERIES M = For general application

AC OPERATION VOLTAGE (EIA coding)

SUFFIX See detailed specification for packaging code

TOLERANCE
K - 10% Other: upon request

Part No.	V1mA (nominal)	Vms	Vdc	If (max)	Maximum Clamping Voltage (8/20us)		Maximum Peak Current (8/20us) Ip (A)				Maximum Absorption (10/1000us)	Typical capacitance 1kHz 0.5V
	V	V	V	uA	Vp (V)	Ip (A)	2 Surge	10 Surge	20 Surge	100 Surge	J	pF
VC32M00151K--	240	150	200	200	395	10	200	100	80	50	13.0	150
VC32M01750K--	270	175	225	200	455	10	200	100	80	50	15.0	135
VC32M00231K--	360	230	300	50	595	10	200	100	80	50	20.0	100
VC32M00251K--	390	250	330	50	650	10	200	100	800	50	21.0	90
VC32M02750K--	430	275	368	50	710	10	200	100	80	50	23.0	80
VC32M00.01K--	470	300	385	50	775	10	200	100	80	50	23.0	70

Surface Mount Fuses

The ACCU-Guard series of fuses is based on thin film techniques. This technology provides a level of control over the component electrical and physical characteristics that are generally not possible using standard fuse technologies. This has allowed AVX to design a series of devices that provide fast acting surface mount over current protection.

- **Fast acting**
- **Case sizes 0402 to 1206**
- **Current rating (A): 0.125 to 5.00**

Part Numbering System F 1206 B 0R20 F W TR

PRODUCT Fuse

SIZE Chip Type

FUSE VERSION
B = Accu-Guard
C = Accu-Guard 0603
D = Acc-Guard 0612
E = Accu-Guard 0402, 0603

RATED CURRENT
Current expressed in Amps, letter R denotes decimal point
e.g. 0.20A = OR20, 1.75A = 1R75

PACKAGING
TR = Tape and reel

TERMINATION
S = Nickel/Lead-Free Solder coated (Sn 100)
W = Nickel/Solder Coated (Sn 63, Pb 37)

FUSE SPEED F = Fast

NTCs

Negative temperature coefficient devices (NTCs) are thermally sensitive resistors made from Mn, Ni, Co, Cu and Fe oxides. The resultant semi conducting material acts as an NTC resistor whose resistance decreases with increasing temperature. This negative coefficient effect can result from external ambient temperature change or interal heating due to the joule effect of current flowing through the device.

Applications include temperature measurement, compensation and inrush current protection.
See www.ttieurope.com/avx for further information.

Types	Range of Values (R at 25°C)	Main Applications
SMD 0402-1206	10Ω — 1MΩ	Hybrid Circuit Temperature Compensation
NC 12 / 20		
NB 12 / 20		
NB 21 / 23		
Accuracy Series 1%, 2%, 3%	2kΩ — 100kΩ	Temperature Measurement
NJ 28		
NI 24	150Ω — 330Ω	
NP 30		
NK 20		
Leaded Discs 5%,10%, 20%	330Ω — 1MΩ	Temperature Measurement & Regulation Level Detection Compensation
N.03	150Ω — 330Ω	
N.306	68Ω — 150Ω	
N.09		
Leaded Discs	Custom designed products generally defined at two temperatures	Automotive and Industrial Thermal Control
NR		

KNH21 Series/ Feedthru Filters

Features

- Rated current up to 6A max.
- Effective for filtering noise on power (Vcc) lines

Applications

- PCs, laser printer, cell phones
- Power/signal lines for LCD Display, office equipment
- AV power supply/signal line, VCR, etc.
- High current signal line

AVX Product Selection Guide

AVX PRODUCTS	Fast Blow SMT Fuse	Filter (Feedthru)	SMT (Feedthru array)	SMT (High Current Feedthru)	SMT TransGuard	SMT MultiGuard	SMT StaticGuard	Filter (TransFeed)	AntennaGuard	CAN BUS Series	USB Series	UltraGuard	MLV Medium	Power MLVs (Medium Power Automotive Series)	Medium Power MLVs for Telecom	Leaded NTCs	SMT NTCs
APPLICATIONS																	
ESD						●			●	●	●						
In Rush Current Limit																●	●
Long Wave Transient					●	●		●					●	●	●		
EMI Filtering		●	●	●													
EMI Filtering + Transient					●	●	●	●	●	●	●	●	●	●	●		
Load Dump					●									●			
Automotive		●		●	●	●	●	●	●	●				●		●	●
Mil Std 461-E					●												
ISO 7637					●									●			
IEC 61000					●	●	●	●	●	●	●	●	●				
Telecom Protection					●										●		
Over Current Protection	●																
Diode Replacement					●	●	●		●	●	●	●					
Zener Replacement					●	●	●		●	●	●	●					
Military A-A-55682					●												
Radiation Resistance					●	●											
Industrial		●		●	●	●	●	●		●	●		●			●	
UL 1449																	
UL 1414																	
Medical (EN 60601)		●			●												
High Speed Data Line Protection									●		●						
Optic Transceiver Protection									●		●						
Temperature Sensing																●	●
Low Leakage Circuit												●					

Circuit Protection

Bourns delivers the most comprehensive line of circuit protection technology and solutions in the industry. At Bourns' engineering centers in Riverside, California; Sauerlach, Germany; Auburn Hills, Michigan and Linkou, Taiwan, Bourns designs a full range of overvoltage and overcurrent protection technologies.

Bourns offers world-class technology and applications expertise that is the result of years of circuit protection engineering, design and support. Bourns' global reputation for quality products, innovative protection strategies and a wide range of technologies ensures that Bourns can provide the right circuit protection solution for your needs.

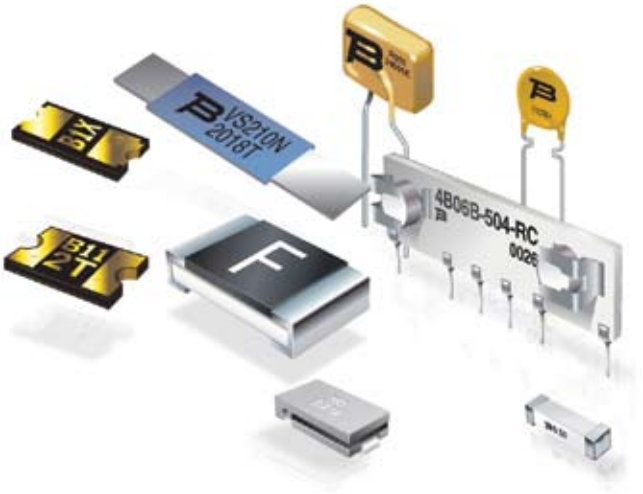
Overcurrent Circuit Protection

Surge Module & Fuse Solutions

Polymer PTC resettable fuses are available in radial leaded, axial leaded, chip, disc and surface mount packages. In addition, thick film surge protection modules, Telecom™ fuses and SinglFuse™ thin film chip fuses are also offered.

Applications

Automotive motor and wire harness protection, security and fire alarm systems, loudspeakers, power transformers and USB port protection.



TVS Diode Solutions

Bourns offers a wide range of TVS diodes with minimal packaging overhead. The small signal 0603, 1005 and 1206 Chip Diodes are lead free with Cu/Ni/Au plated terminations.

Other packages (SMA, SMB, SMC, 1408, 1607, 2010, 2419, 8L NSOIC, 16L NSOIC, SOT23, SOT23-6, 16L WSOIC) use 100% tin terminations. All Bourns® diodes are compatible with lead free manufacturing processes, conforming to many industry and government regulations.

ESD Protection Solutions

Voltage options from 5V to 36VDC and industry standard 0402, 0603, CSP and QSOP24L type packaging, various MLV, thin film on silicon and TVS diode technologies are offered for ESD protection per IEC 61000-4-2 standard.

Bourns® ESD protection products provide general protection in IC power supplies signal lines, and control protection lines; suppression and filtering in one device with low capacitance and low leakage currents for high performance applications requiring low capacitance loading properties.

TBU™

High Speed Protectors

Bourns® TBU™ (Transient Blocking Unit) products protect against faults caused by short circuits, AC power cross, induction and lightning surges. The TBU™ device reacts to an increase in current by current limiting within nanoseconds and then disconnecting the circuit all in less than 1µsec.

Applications

Telecom: POTS, PSTN, FXS/FXO, VOIP, ADSL, VDSL, VDSL2, linecards, ONUs and ONTs, gateways and modems, T1/E1, and other communication equipment.

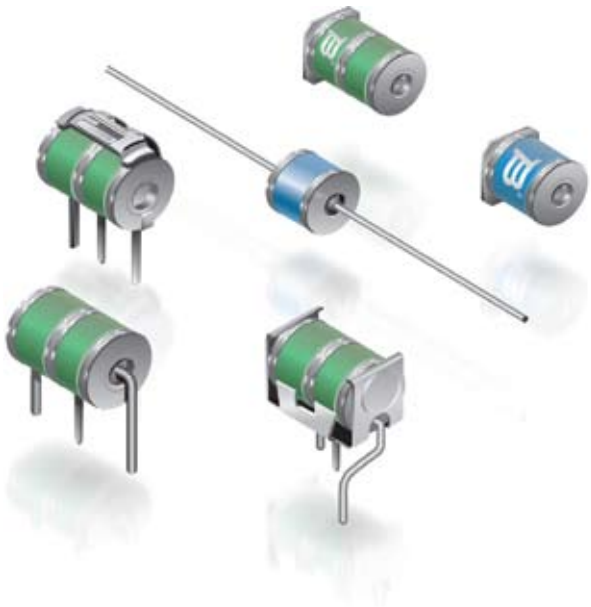
Non-Telecom: Ethernet, LVDS, sensors, test equipment, rail, industrial controls and RS232/RS485 lines.

Gas Discharge Tube Overvoltage Protection

Bourns offers 3-electrode and miniature 3-electrode gas discharge tubes, 2-electrode and miniature 2-electrode gas discharge tubes, multi-stage protector sub-assemblies and surge protector test sets.

Applications

Central office, network interface devices, building entrance, terminals, station protectors, signal & dataline protectors, modems, DSU/CSUs, ISDN NT1s and line interface cards.



Magnetics

Bourns® Inductive Products

Bourns provides a broad array of magnetic components and solutions to meet a variety of application needs. Bourns'® magnetic components product portfolio includes chokes, filters, inductors, transformers and JW Miller® Magnetics products. Bourns continues to be a leading supplier of small high current power inductors that feature higher currents and lower DCRs, and common mode chokes that offer improved core materials for enhanced efficiency.

With the acquisition of JW Miller® Magnetics Division of Bell Industries, Inc., Bourns customers are now supported with a complete line of high-quality coils, chokes, inductors and transformers in both surface mount and through-hole configurations. Bourns' world-class technology and applications expertise is the result of years of magnetic component engineering, design and support. Bourns' global reputation for quality products, extensive magnetics knowledge and range of technologies ensures the right solution for your needs.

J.W.Miller MAGNETICS
A Bourns Company

Power Inductors

Features

- Shielded construction
- Unit height of 3.2mm
- Inductance range: 0.1µH to 10µH
- Current up to 32.5A
- RoHS compliant*

*RoHS Directive 2002/95/EC Jan. 27, 2003 including Annex.

Applications

- Input/output of DC/DC converters
- Power supplies for:
  - Portable communications equipment
  - Camcorders
  - LCD TVs
  - Car audio systems

Circuit Protection

TDK-EPC, a TDK group company, is a leading manufacturer of electronic components, modules and systems. TDK-EPC has emerged from the combination of the electronic components business of TDK and the EPCOS Group and markets its products under the product brands, TDK and EPCOS. The product portfolio includes ceramic, aluminum electrolytic and film capacitors, ferrites and inductors, high-frequency components such as surface acoustic wave (SAW) filter products and modules, piezo and protection components and sensors. With this product spectrum TDK-EPC offers a broad range of products and solutions of outstanding value for the demanding markets in the areas of information and communication technology and automotive, industrial and consumer electronics.

Overvoltage Circuit Protection

Multilayer Varistors (MLVs) Standard Series

Features

- ESD acc. to IEC 61000-4-2 level 4 (8kV contact, 15kV air discharge)
- Surge current up to 1,200A
- Bidirectional protection
- No derating up to 125°C (for case sizes³ 0603)
- Fast response (<0.5ns)
- CT version suitable for lead-free soldering
- PSpice simulation models available
- RoHS compliant

CeraDiodes Standard Series

Features

- ESD protection to IEC 61000-4-2, level 4
- Bidirectional ESD protection in one component
- No change in ESD protection performance at temperatures up to 85°C (temperature derating)
- Use of parasitic capacitance for EMI suppression and high-frequency filtering (replacement of additional MLCC)
- High surge current capability
- Low parasitic inductance
- Low leakage current
- Fast response time <0.5ns
- Lead-free nickel barrier terminations suitable for lead-free soldering
- RoHS compliant

CeraDiodes High-Speed Series

Features

- Very low capacitance values 0.6 up to 10pF
- ESD protection to IEC 61000-4-2, level 4
- Bidirectional ESD protection in one component
- No change in ESD protection performance at temperatures up to 85°C (temperature derating)
- Low parasitic inductance
- Low leakage current
- Fast response time <0.5ns
- Lead-free nickel barrier terminations suitable for lead-free soldering
- RoHS compliant

Surge Arrester 2-Electrode Arrester

Features

- Standard size
- Maximum current rating
- Fast response time
- Stable performance over life
- Very low capacitance
- High insulation resistance
- RoHS compliant

Applications

- AC power lines
- Class I and class II - requirements

Surge Arrester 3-Electrode Arrester

Features

- Extremely small size
- Fast response time
- High current rating
- Stable performance over life
- Very low capacitance
- High insulation resistance
- Excellent SMD handling
- RoHS compliant

Applications

- Branch exchange (MDF)
- Line protection
- Station protection

SMD PTC Thermistors

Features

- Qualification based on AEC-Q200 rev. C
- Suitable for reflow and wave soldering (up to 280°C)
- Fast and reliable response
- UL approval to UL1434 expected 2010
- Lead-free tinned terminations
- RoHS compliant

Circuit Protection

As the global leader in circuit protection, Littelfuse offers the broadcast range of products.

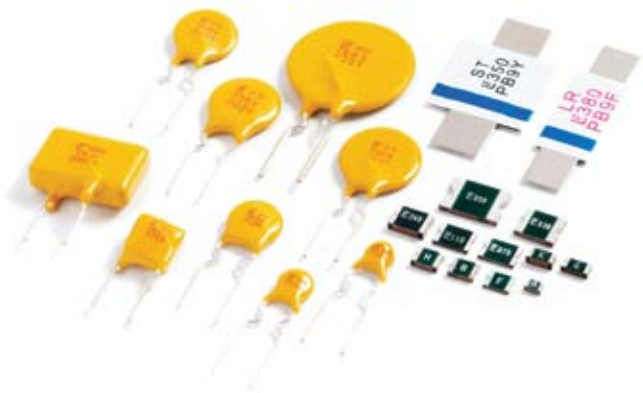
The breadth of Littelfuse's offering, combined with the extensive experience of their product and application experts, gives them the unique ability to comprehensively evaluate Littelfuse customers' needs. This allows for a true partnership with Littelfuse customers, making it possible to deliver the right solution for each application. Solutions from Littelfuse can be found around the world in virtually every product that requires electrical part and every application including: automobiles, computers, consumer electronics, handheld devices, industrial equipment and telecom/datacom circuits.

Overcurrent Circuit Protection

Fuses

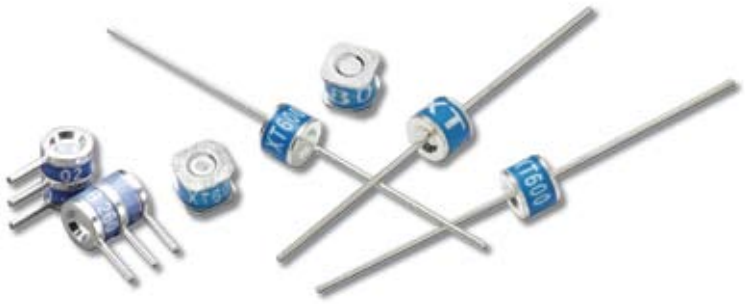
- Surface mount or axial; glass or ceramic; thin-film or Nano$^{2®}$ style; fast acting or Slo-Blo® fuses
- Current ranges: 0.001A-40A
- Maximum voltage ranges from 24V-600V
- Interrupting ratings from 24A-50,000A
- Comprehensive line of lead-free and RoHS devices
- **Applications**: Automotive, industrial, handheld, computer & telecom market

Resettable PTCs



- Radial leaded and axial leaded (battery strap) PTC resettable overcurrent suppression devices
- Radial PTCs are rated from 6VDC to 600VDC
- Designed for use in higher voltage applications requiring minimal maintenance and are subject to repetitive overcurrent conditions
- Axial PTCs are rated from 6VDC to 30VDC designed for use in battery pack applications that require thermal protection against overcurrent fault conditions
- Recognised under the Components Program of Underwriters Laboratory for both the US and Canada and certified by TUV
- Lead-free and RoHS compliant

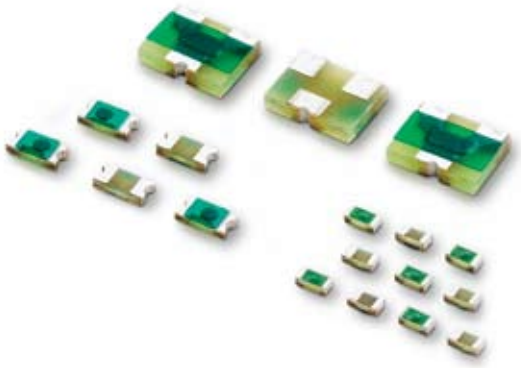
Overvoltage Circuit Protection



Gas Discharge Tubes (GDTs)

- Style: small foot print leaded, surface mount and cartridge configurations
- Very high current surges (up to 40,000A) while effectively suppressing overvoltage transients
- Low capacitance (typically 1-2pF)
- 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

PulseGuard® ESD Suppressors



- With a capacitance value as low as 0.04pF
- Protection for high-speed digital I/O lines (HDMI, USB, eSata, Ethernet) without causing signal distortion
- Specified to protect against ESD transients per the IEC 61000-4-2 (Level 4) test method
- Available in small surface mount form factors
- Lead-free and RoHS compliant

Varistors

- **Metal Oxide Varistors (MOVs)**
  - Designed to suppress transient voltages such as lightning and other high level transients found in industry
  - Peak current rating ranging from 40A to 70,000A
  - Peak energy from 0.1J to 10,000J
  - Available in radial leaded, axial leaded, surface mount and bare-disk options
- **Applications**: Automotive DC line

- **MLVs - Multilayer Varistors (MLVs)**
  - Available in miniature surface mount options as small as 0201 size
  - Low voltage range 5.5VDC-135VDC
  - Peak current ratings range from 4A to 500A and peak energy 0.02J-2.5J
- **Applications**: Designed for requiring protection from low to medium energy transients in the computer, handheld device, industrial automotive markets

Silicon Protection Arrays (SPATM)

- Designed to protect analog and digital signal lines from electrostatic discharge (ESD) and other transients
- 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)

SIDACtor® Devices

- Specifically designed to suppress overvoltage transients such as those resulting from lightning in a wide range of telecom and datacom applications
- Solid state crowbar devices are designed to protect telecom equipment during hazardous transient conditions
- SIDACtor devices have a patented ion implant technology to ensure effective protection within nanoseconds, up to 5,000A surge current ratings

Power Thyristors

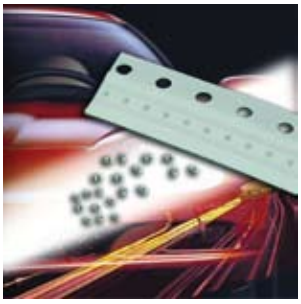
- Solid state switches normally open circuits (very high impedance)
- Capable of withstanding rated blocking/off-state voltage until triggered to on state
- Thyristors are used to control the flow of electrical currents in applications including many home appliances, electrical tools, and outdoor equipment
- The Littelfuse line of thyristors include Sensitive Triacs, Triacs, Quadrac® Devices, Alternistor Triacs, Sensitive SCRs, SCRs, Rectifiers, Diacs and Sidacs

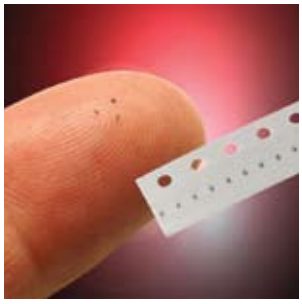
TVS Diodes

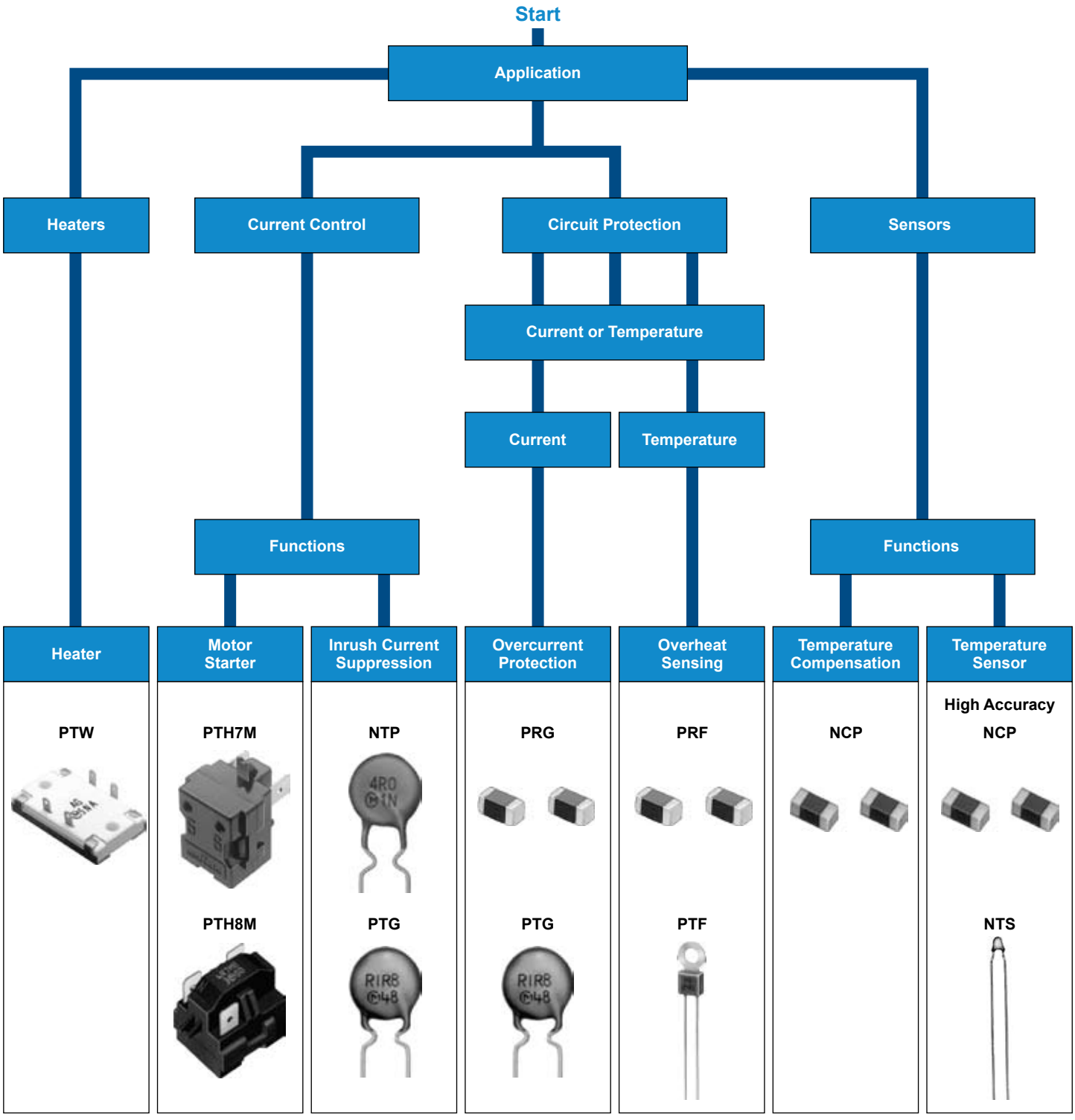
- Designed to suppress overvoltage transients such as EFT, lighting and inductive load switching
- Offer Peak Pulse Power (10/1,000µs) ratings from 400W to 30,000W
- Reverse Standoff Voltages from 5V to 512V
- **Applications**: Computer, industrial, telecom and automotive markets

Murata Circuit protection

Murata Thermistors are used to detect overheating in electronic equipment, protect circuits in the event of drawing too much current and for temperature compensation. Murata's semi-conductive ceramics and electrode printing technologies allow us to produce both PTC as well as NTC Thermistors.







EMI Filter Selection by Circuits and Noise Frequency

Chip Ferrite Bead / Chip EMIFIL®

Noise Frequency?

Circuit Type?

Noise Frequency: Under 1GHz

Inductor Type (Suppression Effect: Normal)

Power Line	General Signal Line Under 10MHz	High Speed Signal Line Over 10MHz
BLM03P 0201/0.75-0.9A/Imp.22-33Ω	BLM02A 01005/Imp.10-120Ω	BLM03B 0201/Imp.10-600Ω
BLM15P 0402/1-2.2A/Imp.10-120Ω	BLM03A 0201/Imp.10-1000Ω	BLM15B 0402/Imp.5-1800Ω
BLM18P 0603/0.5-3A/Imp.30-470Ω	BLM15A 0402/Imp.10-1000Ω	BLM18B 0603/Imp.5-2500Ω
BLM21P 0805/1.5-6A/Imp.22-330Ω	BLM18A 0603/Imp.120-1000Ω	BLM21B 0805/Imp.5-2700Ω
BLM31P 1206/1.5-6A/Imp.33-600Ω	BLM18T 0603/Imp.120-1000Ω	**Array Type**
BLM41P 1806/1.5-6A/Imp.60-1000Ω	BLM18R 0603/Imp.120-1000Ω	BLA2AB 0804/Imp.10-1000Ω
Low DC Resistance Type	BLM21A 0805/Imp.120-1000Ω	BLA31B 1206/Imp.120-1000Ω
BLM18K 0603/1.3-6A/Imp.26-600Ω	BLM21R 0805/Imp.120-1000Ω	
BLM18S 0603/1.5-6A/Imp.26-330Ω	**Array Type**	
	BLA2AA 0804/Imp.120-1000Ω	
	BLA31A 1206/Imp.30-1000Ω	

Capacitor Type (Suppression Effect: High)

Power Line	General Signal Line Under 10MHz	High Speed Signal Line Over 10MHz
NFM18PC 0603/2-4A/Cap.0.1-2.2μF	NFM18C 0603/Cap.22-22000pF	**LC Combined**
NFM21P 0805/2-6A/Cap.0.1-4.7μF	NFM21C 0805/Cap.22-22000pF	NFL18ST 0603/Cut off 200-500MHz
NFM3DP 1205/2A/Cap.0.022μF	NFM3DC 1205/Cap.22-22000pF	NFL18SP 0603/Cut off 150-500MHz
NFM31P 1206/6A/Cap.27μF	NFM41C 1806/Cap.22-22000pF	NFL21S 0805/Cut off 10-500MHz
NFM41P 1806/2-6A/Cap.0.2-1.5μF	**Array Type**	NFW31S 1206/Cut off 10-500MHz
NFM55P 2220/6A/Cap.1.5μF	NFA31C 1206/Cap.22-22000pF	**RC Combined**
T Circuit Filter Feed Through Type	**T Circuit Filter Feed Through Type**	NFR21G 0805/22-100Ω/Cap.10-100pF
NFE31P 1206/6A/Cap.22-2200pF	NFE31P 1206/Cap.22-22000pF	**Array Type (RC/LC Combined)**
NFE61P 2706/2A/Cap.33-4700pF	NFE61P 2706/Cap.33-4700pF	NFA31G 1206/6.8-100Ω/Cap.10-100pF
Block Type		NFA18S 0603/Cut off 50-480MHz
BNX022/023 10-15A/Range1MHz-2GHz		NFA21S 0805/Cut off 50-330MHz

Noise Frequency: GHz Band

Inductor Type (Suppression Effect: Normal)

Power Line	General Signal Line Under 10MHz	High Speed Signal Line Over 10MHz
BLM15EG 0402/0.7-1.5A/Imp.120-220Ω	BLM15HG 0402/Imp.600-1000Ω	BLM15HD 0402/Imp.600-1800Ω
BLM18HE 0603/0.5-0.8A/Imp.600-1500Ω	BLM15EG 0402/Imp.120-220Ω	BLM15HB 0402/Imp.120-220Ω
BLM18EG 0603/0.5-2A/Imp.100-600Ω	BLM18HG 0603/Imp.470-1000Ω	BLM18HD 0603/Imp.470-1000Ω
	BLM18HK 0603/Imp.330-1000Ω	BLM18HB 0603/Imp.120-330Ω
	BLM18EG 0603/Imp.100-600Ω	BLM18HE 0603/Imp.600-1500Ω

Capacitor Type (Suppression Effect: High)

Power Line	General Signal Line Under 10MHz	High Speed Signal Line Over 10MHz
NFM18PS 0603/2A/Cap.0.47-1.0μF		**LC Combined**
		NFL18ST 0603/Cut off 200-500MHz
		Array Type (LC Combined)
		NFA18S 0603/Cut off 50-480MHz
		NFA21S 0805/Cut off 50-330MHz

Noise Frequency: High-GHz Band

Inductor Type

General Signal Line Under 10MHz	High Speed Signal Line Over 10MHz
BLM15GG 0402/Imp.220-470Ω	BLM15GA 0402/Imp.75Ω
BLM18GG 0603/Imp.470Ω	

EMI Filter Selection by Circuits and Noise Frequency

Chip Common Mode Choke Coil

Circuit Type?

DC Power Line	High Speed Differential Signal Line		Audio Line
	High Speed Signal Line (USB/LVDS/IEEE1394 etc.)	Ultra High Speed Signal Line (HDMI/DVI/Display Port etc.)	
DLW5AH 2014/0.2A/Imp.4000Ω	**DLP0NS** 03025/Imp.67-120Ω	**DLP11SA** 0504/Imp.35-90Ω	**DLM11G** 0504/Imp.600Ω
DLW5BS 2020/0.5-5A/Imp.190-3000Ω	**DLP11SN** 0504/Imp.35-330Ω	**DLW21S_HQ** 0805/Imp.67-120Ω	**DLM2HG** 1008/Imp.600Ω
DLW5BT 2020/1.5-6A/Imp.100-1400Ω	**DLW21H** 0805/Imp.67-180Ω		
	DLW21S_SQ 0805/Imp.67-370Ω		
	DLP31S 1206/Imp.120-550Ω		
	DLW31S 1206/Imp.90-2200Ω		
	Array Type		
	DLP2AD 0804/Imp.67-280Ω		
	DLP31D 1206/Imp.90-440Ω		

Selection Guide of Chip Inductors (Chip Coils)

Construction?

Circuit Type?

Power Line

Application? — Voltage Conversion

Wire Wound	Multilayer	Film
LQH2MC_02 0806/1.0-82µH/90-485mA	**LQM21P** 0805/0.47-2.2µH/600-1300mA	
LQH2MC_52 (Low profile type) 0806/1.0-22µH/130-595mA	**LQM2MP** 0806/0.47-4.7µH/1100-1600mA	
LQH3NP_M0 1212/1.0-100µH/200-1400mA	**LQM2HP_J0** 1008/1.0-3.3µH/1000-1500mA	
LQH3NP_J0 1212/1.0-47µH/200-1620mA	**LQM2HP_G0** 1008/0.47-4.7µH/1100-1800mA	
LQH3NP_G0 1212/1.0-250µH/80-1525mA	**LQM2HP_E0** 1008/0.56µH/1500mA	
LQH32P 1210/0.47-22µH/450-2550mA	**LQM31P_00** (Standard type) 1206/0.47-4.7µH/700-1400mA	
LQH44P_P0 1515/1.0-22µH/790-2450mA	**LQM31P_C0** (Low profile type) 1206/0.47-2.2µH/900-1300mA	
LQH44P_J0 1515/1.0-47µH/300-1530mA		
LQH55P 2220/1.2-22µH/670-2600mA		
LQH6PP 2424/1.0-100µH/0.8-4.3A		
LQH88P 3131/1.0–100µH/1.0–8.0A		

Application? — Choke

Wire Wound	Multilayer	Film
LQH31C 1206/0.12-100µH/80-970mA	**LQM18F** 0603/1.0–10µH/50–150mA	
LQH32C (Standard type) 1210/0.15-560µH/60-1450mA	**LQM21D** 0805/1.0–47µH/7–60mA	
LQH32C_53 (Low profile type) 1210/1.0-100µH/100-1000mA	**LQM21F** 0805/1.0–47µH/7–220mA	
LQH43C 1812/1.0-470µH/90-1080mA	**LQM31F** 1206/10µH/70mA	
LQH55D 2220/0.12-10000µH/0.05-6.0A		
LQH66S 2525/0.27-10000µH/0.05-6.0A		

Signal Line

Operating Frequency? — Less than 100MHz General

Wire Wound	Multilayer	Film
LQH31M 1206/0.15–100µH	**LQM18N** 0603/47–2200nH	
LQH32M 1210/1.0–560µH	**LQM21N** 0805/0.1–4.7µH	
LQH43M(N) 1812/1.0–2200µH		

Operating Frequency? — Greater than 100MHz High Frequency

Wire Wound	Multilayer	Film
LQW04A 03015/1.1–33nH	**LQG15H** 0402/1.0–270nH	**LQP02T** 01005/0.4–18nH
LQW15A 0402/1.3–120nH	**LQG18H** 0603/1.2–100nH	**LQP03T** 0201/0.6–120nH
LQW18A 0603/2.2–470nH		**LQP15T** 0402/1.0–18nH
LQW2BH 0805/2.7–470nH		**LQP15M** 0402/1.0–33nH
LQW31H 1206/8.8–100nH		**LQP18M** 0603/1.3–100nH
LQW21H 0805/0.47–2.2µH		
LQH31H 1206/54–880nH		

Circuit Protection

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.

Through continuous improvement in its worldwide production sites, Panasonic is able to manufacture billions of resistors on the highest level of quality. Furthermore Panasonic invests a lot in research and development to achieve or exceed the market requirements.

Panasonic ESD Suppressor Array

ESD Protection of High-Speed Data Lines

ESD Suppressors protect Electronic Components and Systems from Electrostatic Discharge (ESD).

By clamping voltages to levels which circuits can withstand, ESD Suppressors protect static-dissipative equipment from overvoltage transients.

Due to the fact that data lines of digital home appliances and personal computer peripherals become faster and faster year by year, the necessity of miniaturised ESD Suppression components in high-speed signal lines (GHz-band) is getting more and more important.

Applications like HDMI, USB2.0 and IEEE1394 will benefit from the features Panasonic has created in its latest ESD Suppressors.

These features include:

- Excellent transmission quality with ultra low capacitance values
- Superior electrostatic-noise protection and
- Static-electricity suppression for circuit protection

Additionaly the newly developed ESD Suppressors do not have the impedance drop caused by super low capacitance that is normally associated with Zener Diodes.

Features & Benefits

- Excellent Transmission Characteristic
- Ultra Low Capacitance Value
- Superior Electrostatic-Noise and Static-Electricity Suppression
- Low Impedance Drop Rate

Type	Case Size	Cap. Value	Peak Voltage	Clump Voltage (after 30ns)	Rated Voltage
EZAEG-1A50AC	0201	$0.04^{+0.04}_{-0.03}$ pF	500V max. (350V typ.)	100V max.	30V
EZAEG-2A50AX	0402	$0.05^{+0.05}_{-0.04}$ pF			
EZAEG-3A50AV	0603	$0.10^{+0.10}_{-0.08}$ pF			
EZAEGCA	0805	$0.25^{+0.05}_{-0.10}$ pF			15V max.

Multilayer Varistor for ESD pulse

Features

- Excellent ESD suppression due to advanced material technology
- Meets IEC61000-4-2, Level 4 standard
- Can replace 2 Zener Diodes and 1 Capacitor
- Low capacitance versions for DC voltage lines of high speed busses
- Ultra low capacitance for signal lines of high speed busses
- RoHS compliant

Applications

- Digital Still Camera
- Digital TV
- Notebook PC
- Wireless LAN
- Control Area Network (CAN-BUS)

(PGS) Graphite Sheets
Pyrolytic Highly Orientated Graphite Sheet

Features

- Excellent thermal conductivity (2 to 4 times higher as copper, 3 to 6 times higher as aluminium)
- Lightweight: Speciality gravity: 0.85 to 21g/cm^2 (1/4 to 1/10 of copper, 1/1.3 to 1/3 of aluminium in density)
- Flexible and easy to be cut or trimmed (withstands repeated bending)
- Low thermal resistance
- RoHS compliant

Magnetics

Chip Inductors (0402-1812)

Panasonic Chip Inductors have very good electrical performance characteristics and are available in photolithography, laser-cut or wirewound technologies, with a wide range of inductance values and case sizes.

To meet design engineers requirements and market needs the line up of 0402 to 1812 size Chip Inductors consists of:

- Ultra small Chip Inductor series
- High Q-factor series
- High power types for high current loads
- Wide inductance range (1nH up to 1mH)
- High SRF series
- Excellent for high frequency applications
- RoHS compliant

Application

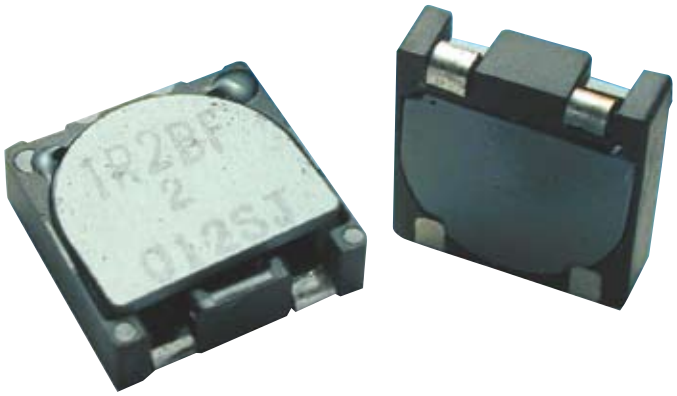
Wireless Communication equipment (W-Lan, BT), PDA, Camcorder, DSC, Various module, HIC; TV, VTR, PC peripherals

SMD Power Choke Coils

Plenty of series make it easy for customer's design engineers to select the most suitable surface-mount choke for various applications such as DC/DC converters in portable equipment.

The smallest SMD Choke Coils features values from 1uH to 33mH at a footprint of 3mm x 3mm and a minimum height of 1mm.

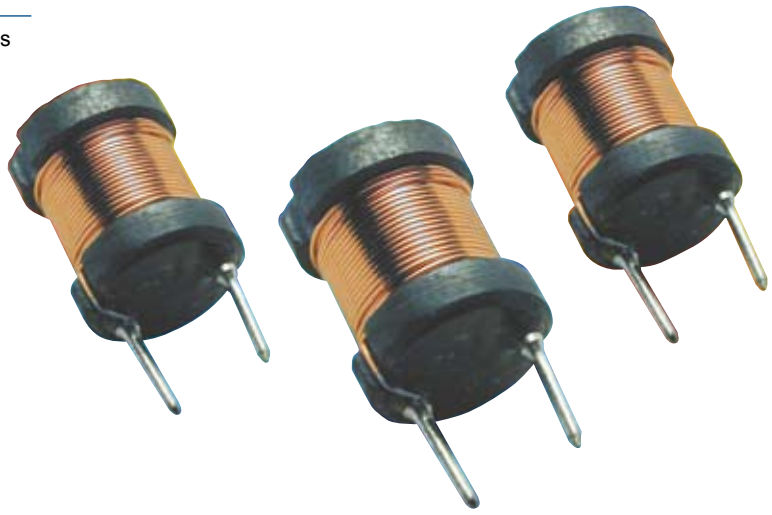
- Wide range of inductance values up to 1mH
- Low DC resistance and large current capability
- Minimised case sizes available by adhesive shield technology
- Shock resistance series available
- Saturation currents up to 50A
- High peak currents without saturation
- Low AC resistance over 500kHz
- RoHS compliant



Leaded Choke Coils

An impressive diversity of choke coils for conventional mounting completes the inductor product portfolio.

- High inductance values up to 10mH
- Low leakage magnetic flux
- High current capability
- Perfectly suited for switching power supply
- RoHS compliant



Syfer Technology

Syfer Technology offers a wide range of EMI filter products, from 0603 surface mount EMI chips to 100A panel mount power line filters. As a UK manufacturer Syfer Technology offers short lead-times, together with an emphasis on quality and flexible service.

Products

- SMD pi-filters - high capacitance and high voltage
- Feedthrough EMI chips
- X2Y filter chips
- Panel mount EMI filters

Filtering

Surface Mount EMI Filters

Three families of SMD filters ensure a wide range of filtering options is available, combined with the benefits of being surface mount.

1. EMI filter chips. Available in case sizes from 0805 to 1806, these feedthrough chips are suitable for applications including automotive, sensors and general signal line filtering.
2. X2Y. These super low inductance filter chips filter 2 lines simultaneously and in case sizes from 0603 to 2220, they are suitable for DC motor filtering, for automotive dc motor applications, balanced or unbalanced lines, audio amplifiers

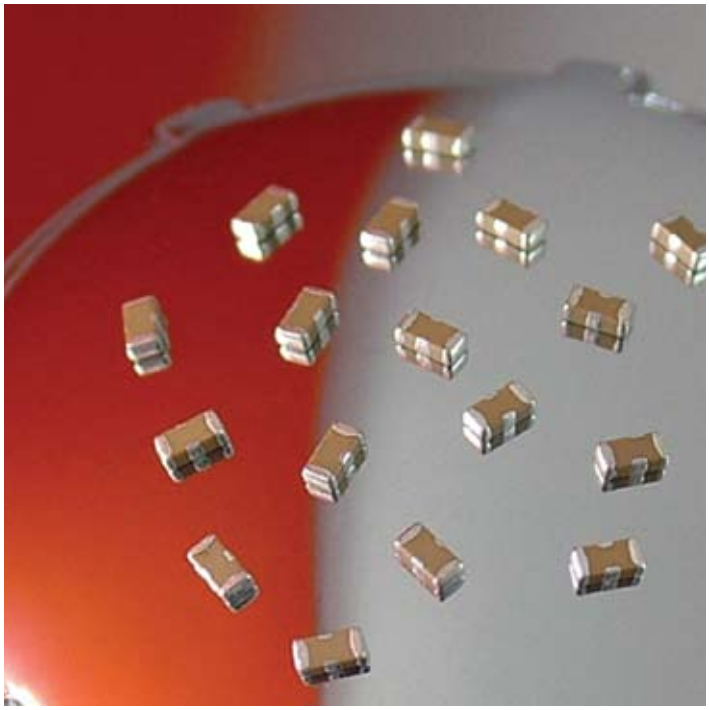
Both above ranges have the option of FlexiCap™ termination to reduce the risk mechanical cracking, and are also available qualified to AEC-Q200.

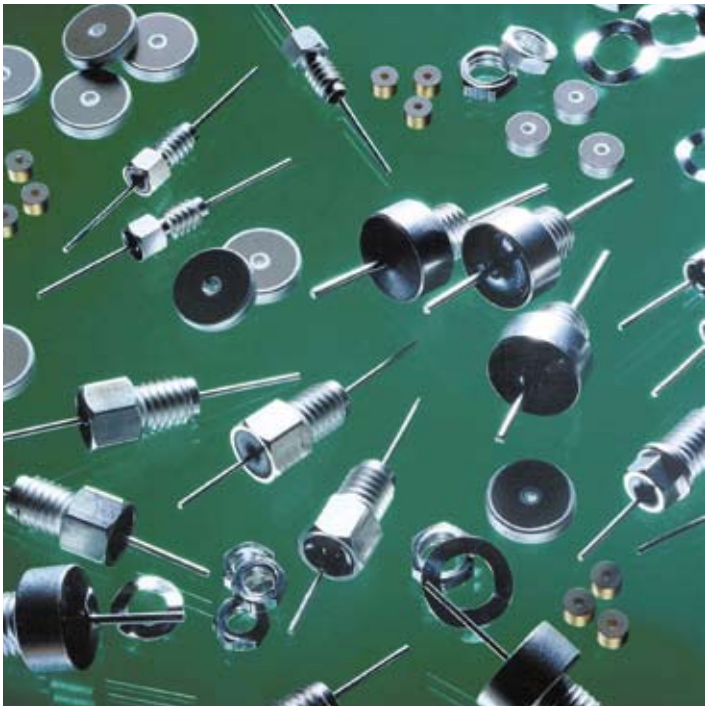
3. SMD pi-filters. Syfer offers the highest voltage and highest capacitance SMD pi-filters available. Offered with current ratings of 1A, 5A or 10A they are ideal for dc line filtering in applications from telecoms to mil/aero.

Panel Mount EMI Filters

Panel mount EMI filters offer excellent feedthrough EMI filtering to 1GHz and higher. C, T, L-C and Pi-filters are available in metric and imperial threads. With working voltages up to 3kVDC and capacitance values up to 40µF, versions are available to suit applications from microwave modules to mil/aero applications.

1. Filters incorporating multilayer ceramic discoidals can be supplied for solder or thread mounting. With threads from M2.5 and larger, or diameters from 2.3mm they offer high performance in a small package.
2. Larger power filters are available in two formats. The hermetically sealed versions utilise ceramic discoidals which can be combined internally with either wound coil inductors or iron powder cores for improved high current performance. Alternatively, filters with film capacitors offer capacitance values up to 40µF and current ratings up to 100A, and are suitable for applications from servers and base stations to military.





TDK-EPC, a TDK group company, is a leading manufacturer of electronic components, modules and systems. TDK-EPC has emerged from the combination of the electronic components business of TDK and the EPCOS Group and markets its products under the product brands, TDK and EPCOS. The product portfolio includes ceramic, aluminum electrolytic and film capacitors, ferrites and inductors, high-frequency components such as surface acoustic wave (SAW) filter products and modules, piezo and protection components, and sensors. With this product spectrum TDK-EPC offers a broad range of products and solutions of outstanding value for the demanding markets in the areas of information and communication technology and automotive, industrial and consumer electronics.

Filtering

Common Mode Filters: ACM Series

Type	Applications	Features
ACM2012	For Signal Line	• Common-mode impedance surpasses 300Ω to 1000Ω [at 100MHz]
ACM2520		• Noise is greatly suppressed
ACM3225		• Capable of handling the highest current (up to 10A)
ACM4532		• Operating temperature from -40 to +85°C
ACM3225	For Power Line	• Common-mode impedance surpasses 300Ω to 1000Ω [at 100MHz]
ACM4532		• Capable of handling the highest current (up to 10A)
ACM7060		• Operating temperature from -40 to +85°C
ACM9070		
ACM1211		
ACM1513		

Inductive Products

Common Mode Filters: ACM Series

Type	Applications	Features
MMZ0402	For Signal Line	• High reliability due to an entirely monolithic structure
MMZ0603		• Closed magnetic circuit structure allows high density installation
MMZ1005		while preventing crosstalk between circuits
MMZ1608		• Low DC resistance structure of electrode prevents wasteful
MMZ2012		electric power consumption
		• Operating temperature range: -55°C to +125°C
MPZ1005	For Power Line	• Supports energy-saving in low DC-resistance
MPZ1608		• No cross-talk with closed magnetic circuit structural design
MPZ2012		• Operating temperature range: -40°C to +125°C

SMD Inductors (Coils): SLF Series

Type	Applications	Features
SLF6020-PF	For Power Line	• Low profile, low R_{dc}
SLF6025-PF		• High current handling capacities
SLF6028-PF		• Excellent in high-density mounting configurations
SLF6045-PF		• Operating temperature range: -20°C to up to +125°C
SLF7028-PF		
SLF7030-PF		
SLF7032-PF		
SLF7045-PF		
SLF7055-PF		
SLF10145-PF		
SLF10165-PF		
SLF12555-PF		
SLF12565-PF		

TT electronics is a world leader in component technologies, supplying the world's leading manufacturers in the defence and aerospace, medical, transportation and industrial electronics markets.

Supported by a global network of application sales engineers, the components division is continually investing in technology development to provide engineered component solutions to meet their customers' needs.

Magnetics

TT electronics BI Technologies supplies miniature surface mount power inductors and transformers with high current ratings, signal transformers, common mode chokes and toroidal inductors, as well as innovative design solutions to meet custom inductor and transformer needs.

Their engineers have developed components that deliver high frequency, high temperature and high current performance for applications including medical, specialty lighting, alternative energy power conversion and energy efficient instrumentation.

HM66

The HM66 Series was developed as a series of miniature shielded inductors which provide protection against emissions on densely populated boards. These surface mount inductors provide design engineers with a low-profile device with an operating temperature range of -40°C to +125°C.

The devices are space saving inductors which feature a magnetically shielded design to facilitate the high density board assembly required in many wireless and handheld devices.

HM78

The HM78 Series of high-performance, shielded, surface mount inductors meet today's demand for a cost-effective, space-saving SMD inductor with high-current capability and EMI protection. Operating temperature range for the HM 78 Series is -40°C to +125°C with operating frequency up to 3MHz.

HM78 Surface Mount Inductors are ideal for DC/DC converter applications, PDAs and applications requiring a high-current inductor with a small physical size.

HM78D

The HM78D Series is an inductor that is housed in a rugged, cost-efficient package and exhibits excellent current handling characteristics. The HM78D can be configured as an inductor, common mode choke or DC/DC converter, and functions as a high inductance, high efficiency part in all configurations.

The rugged, low profile, current handling capabilities, versatility and cost make it ideal for consumer electronics which includes GPS systems, battery-operated handheld devices and cell phones.

HM72B

The HM72B Series is a highly efficient, compact inductor measuring just 6.8mm x 7.23mm, with a maximum board height of 3.0mm, and is designed for use in harsh environments. The HM72B surface mount power inductor features an extremely robust design, including a pressed powdered iron alloy core construction, allowing it to withstand environmental elements. The robust design and small size make the inductor ideal for a variety of applications, including those in the telecom, industrial and automotive markets.

Overcurrent | **Overvoltage** | **Hybrid**

PolySwitch Resettable Devices

Single Use Surface-mount Fuses

Gas Discharge Tubes

ESD Protection Devices

AC 2Pro Devices

PolyZen Devices

Leader in Circuit Protection Innovation

RoHS Compliant

Tyco Electronics is a global leader in PPTC resettable device technology. Their mission is to be the unquestioned Leader in innovative Circuit Protection Solutions and to design and manufacture circuit protection devices to help maximise the performance and reliability of your products. From your cell phone battery to your car's steering wheel control module, Tyco Electronics circuit protection products are helping to make your world safer and your electronics more reliable.

Overcurrent Circuit Protection Devices

RoHS Compliant

PolySwitch™ Resettable Devices are the world's leading PPTC (Polymeric Positive Temperature Coefficient) devices for circuit protection. PolySwitch devices are commonly called resettable devices to distinguish them from traditional single use fuses that work only once and then must be replaced. While the generic term - resettable fuses - is sometimes used for these devices, technically they are not fuses. They are non-linear thermistors that allow a circuit to return to normal operation after a fault has been cleared and power to the circuit has been removed. Used to help protect against damage from harmful overcurrent surges and overtemperature faults in electronic equipment, they help reduce the need for product service and repair. This means improved customer satisfaction and reduced warranty costs.

Single Use Surface-Mount Fuses are available for addressing a broad range of overcurrent protection applications. Helping to prevent costly damage and promote a safe environment for electronic and electrical equipment, surface-mount chip fuses provide performance stability to support applications with current ratings from 0.5A up to 20A. Tyco Electronics also offers the Raychem telecom FT600 fuse for telecommunications applications. This telecom fuse helps comply with North American overcurrent protection requirements, including Telcordia, GR-1089, TIA-968-A (formerly FCC part 68) and UL60950 3rd editions.

Overvoltage Circuit Protection Devices

RoHS Compliant

Gas Discharge Tubes (GDTs) are placed in front of, and in parallel with, sensitive telecom equipment such as central office main distribution frames (MDF) and Customer Premice Equipment (CPE), e.g. phone, fax, modem, etc. They help protect equipment on power lines, communication lines, signal lines and data transmission lines from damage caused by transient surge voltages that may result from lightning strikes and equipment switching operations. These devices do not influence the signal in normal operation. However, in the event of an overvoltage surge, such as a lightning strike, the GDT switches to a low impedance state and diverts the energy away from the sensitive equipment.

ESD Protection Devices

RoHS Compliant

PESD Electrostatic Discharge (ESD) Protection Devices help protect I/O ports on HDMI 1.3, portable video players, LCD & plasma TVs, USB 2.0, digital visual interface (DVI), and antenna switches. PESD devices shunt ESD away from sensitive circuitry in HDTV equipment, printers, laptops, cellular phones and other portable devices. Available in EIA sizes 0402, 0603 and 1206.

Silicon ESD (SESD) Protection Devices help protect electronic circuits against damage from electrostatic discharge (ESD) events. The 0201-sized SESD device's miniature footprint - measuring 0.6mmx0.3mmx0.3mm - is approximately 70% smaller than prior-generation devices, offering designers flexibility in space-constrained applications.

Hybrid Protection Devices

RoHS Compliant

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.

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.

PolySwitch Resettable Devices

Features
- Remotely resettable
- Testable
- Solid state
- Variety of form factors
- Low-resistance devices available
- RoHS compliant

Benefits
- Reduced warranty and service costs
- Increased reliability
- Shock and vibration resistant
- Wide variety of applications

Applications
- Automotive
- Battery protection
- Computers and peripherals
- Consumer
- Industrial/appliance
- Telecommunications and networking

Part Numbering System	RUEF	250	U	2

Product Series
(RXEF, RKEF, RTEF, RUEF, RGEF, RHEF, RUSBF)
An "F" at the end of product series indicates
Pb-free version of product

Hold Current Indicator

Packaging
Blank = Packaged in bags
-1 = 25.4mm (1.0 inch) minimum lead length
-2 = Tape and reel
-AP = Ammo pack
-X.X = Special lead cut length (inch)

Modifier
K = Standard kinked lead B = Special kinked lead
S = Straight lead U = Uncoated device

Single Use Surface-mount Fuses

Features
- Monolithic multilayer design
- High temperature performance
- -55°C to +125°C operating temperature range
- RoHS compliant and halogen free

Benefits
- Small size with high-current ratings
- Excellent temperature stability
- High reliability and resilience
- Strong arc suppression characteristics

Applications
- Laptops
- Digital cameras
- Portable electronics
- Game systems
- DVD players
- LCD monitors
- Power supplies
- Communications equipment
- Voltage regulator modules
- Small motor systems
- Printers
- Scanners
- Cell phones

Part Numbering System	1206	SF	F	400	F	24	-2

Size (1206, 0603, 0402)

SF = Surface Mount Fuse

Fuse Blow Type
F = Fast Acting S = Slow Blow H = High Current

Rated Current
050 = 0.50A
400 = 4A

Special Code
F = RoHS Compliant M = Marked

Voltage Rating (V)

Packaging -2 = Tape and reel

Gas Discharge Tubes

Features
- Wide range of voltages (75V-600V)
- Wide range of form factors
- Low capacitance and insertion loss
- Crowbar device with low arc voltage
- High accuracy spark-over voltage for high precision designs
- Devices tested per ITU K.12 recommendations
- Optional fail-short mechanism
- RoHS compliant and halogen free

Benefits
- Helps provide overvoltage fault protection against damage caused by high energy surges
- Suitable for sensitive equipment due to impulse sparkover response
- Suitable for high-frequency applications
- Highly reliable performance
- New surface-mount devices for automated manufacturing

Applications
- MDF modules
- xDSL equipment
- RF systems
- Antenna
- Base stations
- Power supplies
- Surge protectors
- Alarm systems
- Irrigation systems

Part Numbering System	GT	C	R	3	8	231	M	R	10	FS	-2

Gas Tube

Ceramic

Lead Configuration A = Axial leads
N = No leads R = Radial leads
S = Surface-mount T = T-shape leads

3 Electrode Device

Diameter
5 = 5mm 6 = 6mm 7 = 7mm 8 = 8mm

DC Switch Voltage of 230V (at 100V/s)

Tolerance of 20% on DC Switch Voltage

Product Family Designator
R = R series

Surge Rating
05 = 8x20µs 5kA, 10hits 10 = 8x20µs 10kA, 10hits

FS = solder pellet fail short mechanism on top
FS2 = solder pellet fail short mechanism on bottom
FT = plastic fail short mechanism on top

Packaging
-2 = Tape and reel
Nothing = Tray packaging

Silicon ESD Protection Devices

Features
- Low-leakage current - 1.0µA (max)
- Low-breakdown voltage <5.8V
- Capable of withstanding numerous ESD strikes
- Low capacitance and insertion loss
- SESD0402S devices meet MSL-1 requirements
- SOD-923 case epoxy material meets UL 94 V-O
- RoHS compliant and halogen free

Benefits
- Small size SESD protection diodes for high speed signals
- ESD protection in space-constrained portable electronics and mobile handsets
- Help protect electronic circuits against damage from ESD
- Assist equipment to pass IEC61000-4-2, level 4 testing

Applications
- High-speed data lines
- Low-voltage antenna ports
- USB 2.0/3.0
- HDMI 1.3/1.4
- Display Port
- Cell phones and portable electronics

Part Numbering System	SESD	0402	S	005	054
Series Silicon ESD					**Breakdown Voltage (min)** 054 = 5.4V 058 = 5.8V
EIA Size 0201 0402					**Input Capacitance (typ)** 005 = 0.5pF 006 = 0.6pF 120 = 12.0pF
Package C = Chip Scale S = SOD-923					

AC 2Pro Device

Benefits
- 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

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

Part Numbering System	LVM	2P-	015	R10	431
Module					**Varistor Voltage Indicator**
2Pro Series					
Hold Current (A)					**Typical PPTC Resistance (Ω)**

PolyZen Devices

Benefits
- Helps shield downstream electronics from overvoltage transients and reverse bias
- Helps reduce design costs with single component replacement
- Analog nature of trip events miminises upstream inductive spikes
- Power handling on the order of 30W
- Available hold currents up to 2.3A

Applications
- Portable equipments
- Global positioning systems
- Hard disk drives 5V & 12V bus
- Solid state drives (SSD) 5V bus
- USB powered equipments
- Automotive peripheral input power
- DC power port protection
- Industrial handheld POS
- Rechargeable bar code readers
- Portable medical equipments

Part Numbering System	ZEN	056V	130A	24	LS/M & GS
PolyZen Series					**Labeling** LS or M = Module Height of 2.0mm GS = Module Height of 1.25mm
Zener Voltage Group (056 = 5.6V)					
PPTC Hold Current Group (130 = 1.3A)					**V_{INT} Max Rating (24 = 24V)**

Circuit Protection

Vishay's diode portfolio includes both high-voltage and small-signal devices and addresses the full spectrum of electronic systems from industrial applications to the smallest handheld personal multimedia devices. Vishay diode products include Schottky and switching diodes, high-voltage rectifiers, transient voltage suppressors for automotive applications, and ESD and EMI protection arrays for low-voltage applications.

Overcurrent Circuit Protection

PTC Thermistors

30V to 60V PTC Thermistors for Overload Protection

Features & Benefits

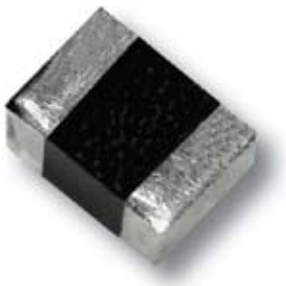
- Wide range of trip and non-trip currents: From 94mA up to 2A for the trip current
- Small ratio between trip and non-trip currents (It/Int = 1.5 at 25°C)
- High maximum overload current (up to 23A)
- Leaded parts withstand mechanical stresses and vibration
- UL file E148885 according to XGPU standard UL1434
- UL approved PTCs are guaranteed to withstand severe test programs
- Long-life cycle tests (over 5,000 trip cycles)
- Long-life storage tests (3,000h at 250°C)
- Electrical cycle tests at low ambient temperatures (-40°C or 0°C)
- Damp-heat and water immersion tests
- Overvoltage tests at up to 200% of rated voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

SMD PTC Thermistors for Overload Protection

Features & Benefits

- Ideal for pick-and-place circuit assembly
- Low mounting height
- Suitable for reflow soldering
- Small ceramic diameter for faster response
- Low heat transfer to substrate
- Flat terminations for stable positioning and good solderability
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

SMD 0805, PTC Thermistors for Over-Temperature Protection



Features

- Well-defined protection temperature levels
- Very fast reaction time
- Accurate resistance for ease of circuit design
- Excellent long term behavior
- Small size and rugged
- UL approved according standard UL1434 (file: E148885)
- PTC thermistor with lead (Pb)-free terminations
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Magnetics

Low Profile, High Current IHLP® Inductors IHLP-2525CZ-01

Features
- Lowest height (3.0mm) in this package footprint
- Shielded construction
- Frequency range up to 5.0MHz
- Lowest DCR/µH, in this package size

Applications
- High current POL converters
- Low profile, high current power supplies
- Battery powered devices
- DC/DC converters in distributed power systems
- DC/DC converter for Field Programmable Gate Array

TVS Diodes

1500W" Low Profile High Power Density TVS

Features & Benefits
- Smallest 1,500W (10/1,000us) TVS
- Low profile 1.1mm height & small footprint compare to traditional SMC package
- Patented PAR® chip with 185°C Tj (TPC)
- AECQ101 qualified (TPC)
- Lead free and halogen free

Applications
- Telecom base station /LNB
- Automotive (TPC)
- Sensitive industrial equipment protection

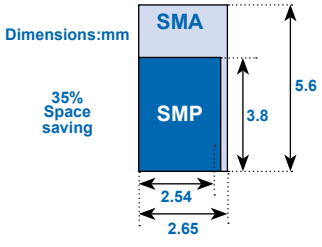
Product	Voltage Range (BVR)	Power Rating	Tj
SMPC5.0A thru SMPC36A	5.0~36V (Standoff)	1500W	150°C
TPCP6.8 thru 43A	6.8~43V (BVR)	1500W	185°C

400W" Miniature Low Profile TVS

Features & Benefits
- Smallest 400W (10/1,000us) TVS in the world
- Low profile 1mm height and small footprint
- 3.3V thru 36V uni-directional
- Lead free & halogen free
- Patented PAR® chip with 185°C Tj (TPSMP AECQ101 qualified (TPSMP)

Applications
- Hard disk driver power rail production
- Portable entertainment device (Portable audio/video device…)
- Automotive (TPSMP)

Product	Voltage Range (BVR)	Power Rating	Tj
SMP3V3A thru SMP36A	3.3~36V (Standoff)	400W	150°C
TPSMP6.8 thru 43A	6.8~43V (BVR)	250W ~ 400W	185°C



3KASMC10 thru 43A Patented PAR® High Reliability 3000W SMC TVS

Features & Benefits
- 3KW(10/1000us) in SMC package
- Patented PAR® chip with 185°C Tj capability and excellent reliability
- AECQ101 qualified

Applications
- Automotive secondary protection for load dump
- LNB lighting protection comply to IEC61000-4-5

ESD Protection Diodes

New VBUS053BZ-HNH-G-08 USB-OTG ESD Protection Bus Port Array

Features & Benefits

- Low load capacitance: CD = 0.7pF
- Low maximum leakage current of 0.085µA at 3.3V and 1µA at 5.5V
- Low maximum clamping voltage of 14V at 2A
- 3-line USB ESD protection with 5.5V working range
- 1-line VBUS protection with 12V working range in LLP1713-9L
- Compact LLP package with ultra-low profile of 0.6mm

Applications

- ESD protection in high-speed data applications, such as USB 2.0
- HDMI in HDTVs
- Mobile electronics

VBUS05L1-DD1-G-08 Bidirectional Symmetrical (BiSy) Single-Line ESD Protection Diode

Features & Benefits

- Provides a very low capacitance of 0.3pF
- Ultra-compact LLP1006 package
- 0.6mm by 1.0mm footprint with a very low package height of <0.4mm
- Working voltage of 5.5V
- Low leakage current of <0.1µA

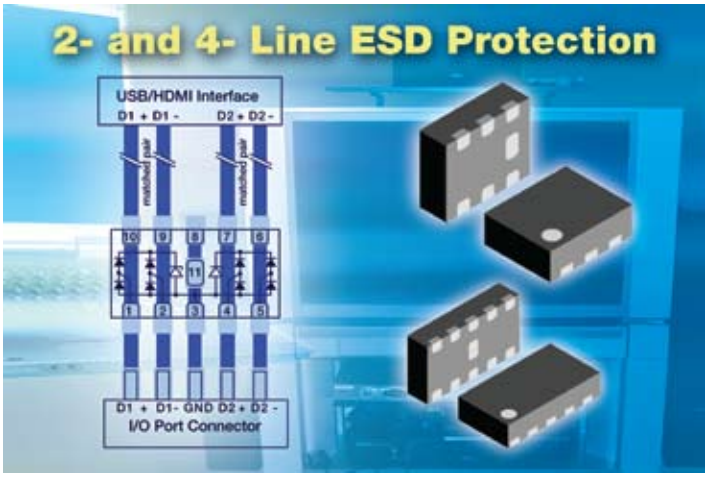
Applications

- ESD protection of antennas
- USB 3.0
- HDMI ports in portable electronics

VBUS052CD-FAH and VBUS054CD-FHI Bus Port Protection Arrays

Features & Benefits

- Offered in LLP2513 and LLP1713 leadless packages
- Feature an ultra-low profile of 0.6mm for board space savings
- "Flow through" design supports the surge resitance requirements for high-speed data lines
- Low load capacitance of 0.8pF
- Low maximum leakage current of <0.1µA at working voltage of 5V



Yageo's one-stop-shop mega store ships over 200,000 types of resistors, capacitors, inductors and HF solutions. A very broad range of High Frequency products meet the diverse requirements of today's wireless systems and EMI/EMC standards. The combination of Yageo global R&D centers and strong core technologies, make these the best cost-effective solutions around the globe.

X2Y® Products

Yageo X2Y® products are comprised of two identical Y-capacitors, and one X-capacitor integrated into a 4 terminal device. Thanks to the unique multilayer construction the X2Y® products offer superior filtering and decoupling. Yageo X2Y® products are available in the size of:

- 0603/0805: suitable for high speed data lines, connector filtering and power supply decoupling.
- 1206/1210: used for filtering on DC motor compliant with the EMC/EMI standards.

GPS Antennas

Yageo various GPS antennas consist of:

Small Linear Polarized chip antennas:

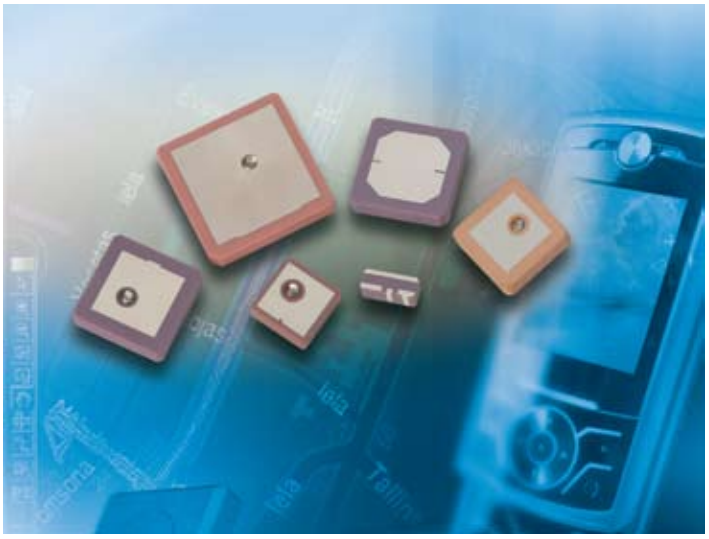
- from 5.3x2.0mm to 12x6.6mm
- extremely suitable for small and lightweight applications e.g. animal tracking devices

Circular Polarized patch antennas:

- from 10x10mm to 25x25mm
- available in through hole and SMD types

Circular Polarized antennas:

- extremely suitable for car navigation



Chip Antennas

Yageo's broad range of chip antennas can be applied in all possible wireless applications covering frequencies from 88MHz to 6GHz:

- FM antenna for mobile radio reception.
- 433/870MHz antennas for ISM systems for remote control and wireless communication.
- DECT/GSM/DCS/GPRS antenna for phone systems.
- Bluetooth/WLAN antennas for PDA, USB dongle, wireless earphones and remote control devices.

TTI

Europe's largest inventory of Passive, Interconnect and Discrete Components.

- 36 Sales locations across Europe
- Connector assembly & 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
10,000m² of dedicated warehouse space

Global Visibility
on a centralised inventory system

SPECIALITY APPLICATION GUIDE

EMI FILTERS

AVX • EPCOS • Murata • Panasonic
Syfer • TT electronics • TDK • Yageo

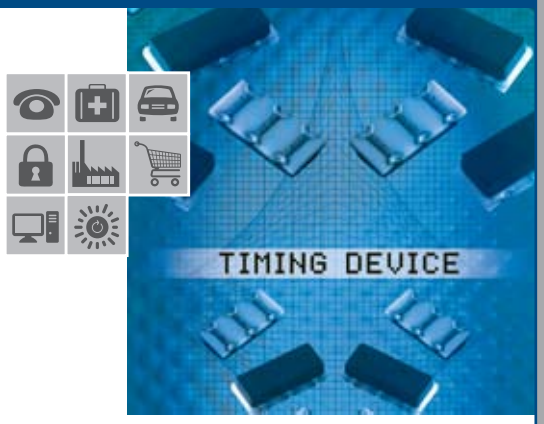
RFI FILTERS

AVX • Murata • Syfer • Vishay • Yageo

VARISTORS

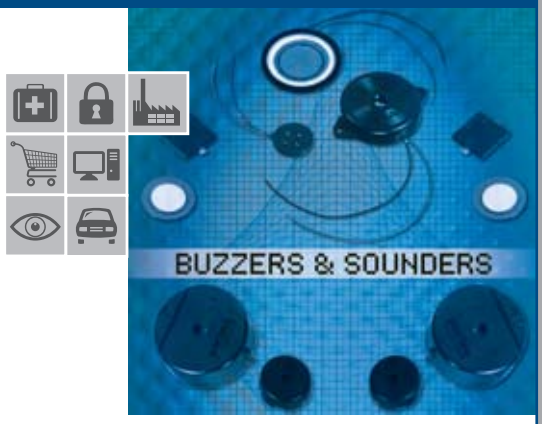
AVX • Bourns • EPCOS
Panasonic •

TIMING DEVICE



AVX • Murata • TDK • Vishay

BUZZERS & SOUNDERS

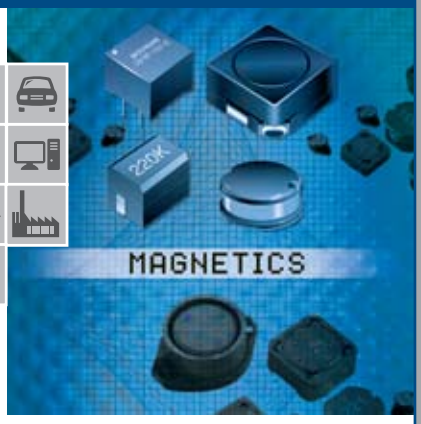


AVX • Murata

KEY

- COMMUNICATION
- MEDICAL
- TRANSPORTATION
- SECURITY
- MILITARY

MAGNETICS



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TDK • TT electronics • Tyco Electronics • Vishay • Yageo

MICROWAVE

AVX • EPCOS • Murata • Panasonic • TDK • Yageo

• Littelfuse • Murata
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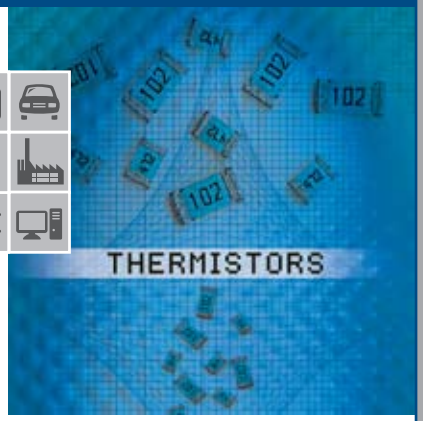
THERMISTORS



AVX • EPCOS • Murata • Panasonic • TDK • Vishay

RESETTABLE DEVICES

Bourns • Littelfuse • Tyco Electronics

INDUSTRIAL

CONSUMER

COMPUTER

RENEWABLE RESOURCES

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