



CIRCUIT PROTECTION APPLICATION GUIDE

FUSES | INTEGRATED MLV + MLCC | MULTILAYER VARISTORS | NTC THERMISTORS | TVS DIODES

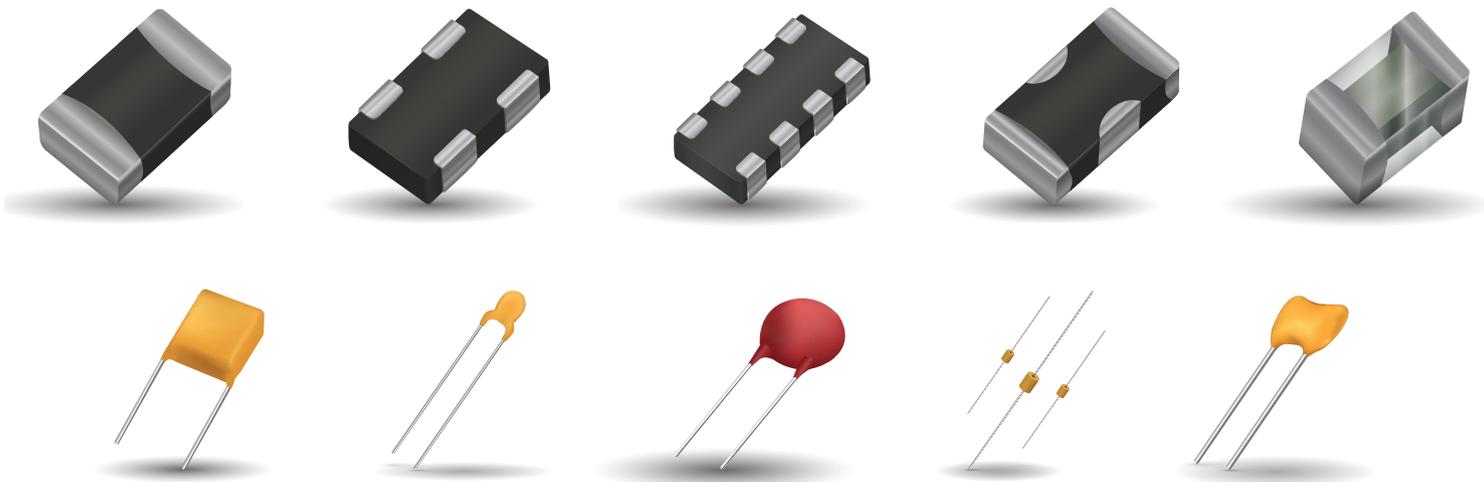


TABLE OF CONTENTS

3 INTRODUCTION

Transguard Multilayer Varistor
Features & Benefits
Applications

4 - 5 MULTILAYER VARISTORS (COMMERCIAL | CONSUMER | INDUSTRIAL | PROFESSIONAL)

TVS + EMI Filtering
TVS + Enhanced EMI Filtering
TVS + Low Signal Distortion/Low Loss (Cap)
TVS + High Temperature (150°C/175°C)

6 - 9 AUTOMOTIVE QUALIFIED (AEC-Q200)

TransGuard MLVs for Automotive Applications
TVS + EMI Filtering (AEC-Q200)
TVS + Enhanced EMI Filtering (AEC-Q200)
TVS + Low Signal Distortion/Low Loss (Low Cap; AEC-Q200)
TVS + High Temperature (150°C/175°C; AEC-Q200)
Application Examples

10 DIODES AND FUSES (CONSUMER | INDUSTRIAL)

GiGuard® TVS Diodes
Thin Film Fuses

11 NTC THERMISTORS (COMMERCIAL | CONSUMER | INDUSTRIAL | PROFESSIONAL)

Overview
SMT Thermistors
High Accuracy Thermistors
Disc Thermistors

TRANSGUARD® MULTILAYER VARISTORS

The KYOCERA AVX TransGuard® Transient Voltage Suppressor (TVS) Multilayer Varistors (MLVs) with unique high-energy multilayer construction, represent state-of-the-art overvoltage circuit protection. Monolithic multilayer construction provides protection from voltage transients caused by ESD (e.g. IEC 61000-4-2), lightning, inductive switching, automotive related transients such as load dump (ISO 7637-2-5), jump start with and other automotive transients (e.g. ISO 7637 Pulse 1-3, AEC-Q200-002, ISO 10605, ISO 16750- 2, CI-220, CI-260, VW 80808), and more.

MLVs provide bi-directional transient voltage protection in the on-state and EMI/RFI filtering in the off-state, which allows designers to combine the circuit protection and EMI/RFI attenuation function into a single, highly reliable device. Parts are designed for use in temperatures ranging from -55°C to +125°C with no derating (+150°C, 175 °C components available), exhibit very fast response, multiple strikes capability, and high reliability. In addition, KYOCERA AVX automotive series varistors are AEC-Q200 qualified.

Surface mount varistors are available in single-element or multiple-element (array) EIA industry standard packages. RoHS compliant terminations include 100% Sn and FLEXITERM® for enhanced thermo-mechanical stress resistance. SnPb termination (non RoHS) is available as a special option. Thru-hole components are supplied as conformally epoxy coated axial and radial devices and are RoHS compliant.

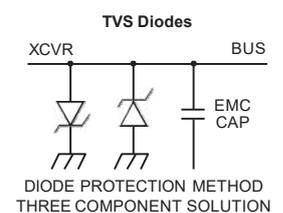
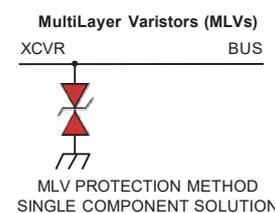


FEATURES & BENEFITS

- RoHS Compliant
- Very fast response (< 1ns)
- EMI filtering in the off-state
- AEC-Q200 qualified automotive series
- Multiple strikes capability; High reliability
- Bi-directional transient voltage protection
- No derating over operating temperature range -55°C to +125°C (+150°C, +175°C available)
- SMT 0201–3220, Axial & Radial configuration
- Available terminations: 100% Sn, FLEXITERM®, SnPb
- Significant space reduction compared to TVS diodes

APPLICATIONS

- Hobby
- Medical
- Defense
- Consumer
- Healthcare
- Automotive
- Automation
- Commercial
- LED Lighting
- Transportation
- Communication
- Safety & Security
- Energy & Smart Grid
- Industrial Applications
- Household Appliances



TVS + EMI FILTERING

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	TransGuard®	VC VG	Case size: 0402 – 3220 Working Voltage: 3.3 – 125Vdc Energy: 0.05 – 12J Peak Current: 20 – 2000A	Wide range MLV for EMI/RFI attenuation & bi-directional ESD protection.	IC Protection; DC Motors; Automation; LED; Alarms; Inductive Switching; Bluetooth; I/O Lines; Portable devices
	Low Clamp TransGuard®	VLAS	Case size: 0603 – 1210 Working Voltage: 16Vdc Energy: 0.1 – 1.6J Peak Current: 50 – 500A	Low clamping to working voltage rating for bi-directional ESD protection & EMI/RFI attenuation.	Displays; ESD Sensitive ICs; Microcontrollers
	Miniature 0201 MLV	VC0201	Case size: 0201 Working Voltage: 3.5 – 16Vdc Energy: 0.01 – 0.02J Peak Current: 1 – 10A	Miniature 0201 varistor for circuits with space constraints or for embedded applications.	Hearing Aid; Portable devices; Embedded designs; Smart cards; Electronic tags
	StaticGuard	VC**LC	Case size: 0402 – 1206 Working Voltage: 18Vdc Energy: 0.02 – 0.1J Capacitance: 40 – 200pF	Lower capacitance varistors for bi-directional ESD protection & EMI/RFI attenuation.	Sensors; CMOS; Switches; Data lines; Bipolar- & SiGe-based systems
	Controlled Capacitance	VCAC	Case size: 0402, 0603 Working Voltage: 9 – 30Vdc Energy: 0.05 – 0.3J Capacitance: 33 – 1000pF	Tight capacitance tolerance for targeted EMI/RFI filtering & transient suppression.	EMI TVS Module Control; High Speed; ASICs; IC; Sensors; Mixed Signal Environment
	MultiGuard®	MG	Case size: 0405 – 0612 Working Voltage: 5.6 – 18Vdc Energy: 0.02 – 0.1J Peak Current: 15 – 30A	2- & 4-element arrays for multiple lines ESD protection & EMI/RFI attenuation. Saves board space, & pick/place costs.	I/O Lines; Portable Equipment; Radios; Programming Ports; Differential Data Lines; ASIC
	UltraGuard®	VCUG MGUG	Case size: 0402 – 0612 Working Voltage: 3.0 – 32Vdc Energy: 0.02 – 0.4J Peak Current: 10 – 150A	Low leakage (<1µA) varistors	Battery Operated Devices; Portable Equipment; High Clock Speed IC; Fingerprint ID; Sensors; Optic Circuits
	Glass Encapsulated	VG VJ	Case size: 1206 – 3220 Working Voltage: 16 – 385Vdc Energy: 0.3 – 15J Peak Current: 120 – 3000A	High energy varistors. Glass encapsulation provides enhanced harsh environment resistance.	Harsh Environment; High Energy Applications; DC Motors; Inductive Loads
	Radial/Axial Varistors	VR**AS VR**AT VA	Case size: Radial, Axial Working Voltage: 3.3 – 60Vdc Energy: 0.1 – 2.0J Peak Current: 30 – 500A	Epoxy coated. For harsh environments where leaded component preferred.	DC Motors; Inductive Loads; Down Hole Drilling; Relays; White Goods; Industrial Equipment; Sensors

TVS + ENHANCED EMI FILTERING

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	Radial CapGuard®	CG	Case size: Radial Working Voltage: 26 – 45Vdc Energy: 0.6 – 1.2J Capacitance: 0.47 – 4.7µF	Varistor & ceramic capacitor in single component for EMI/RFI attenuation over wide frequency & bi-directional ESD protection.	Inductive Loads; DC Motor Relays; TVS, Radiated & Conducted Noise Filtering
	TransFeed®	V2F	Case size: 0805 Working Voltage: 5.6 – 26Vdc Energy: 0.1 – 0.3J Peak Current: 20 – 120A	Varistor with FeedThru filter construction, enhanced noise reduction (notch filter), & low parallel inductance.	Imaging; GPS; Bar Code Scanners; Instrumentation; I/O Lines; Power Line

MULTILAYER VARISTORS

COMMERCIAL | CONSUMER | INDUSTRIAL | PROFESSIONAL



TVS + LOW SIGNAL DISTORTION/LOW LOSS (LOW CAP)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	Sub pF AG Series	VCH4**AG	Case size: 0201 – 0402 Working Voltage: 10 – 18Vdc Capacitance: 0.47 – 0.8pF	Ultra-low capacitance (<1pF) for protection in RF circuits, antennas, sensors, high-speed data lines, optic circuits, & capacitance sensitive applications.	RF Circuits; Antennas; WLAN; Sensors; Datalines; USB; HDMI; Touch Controls
	AntennaGuard® Antenna PowerGuard	VC**AG VC**AP	Case size: 0402 – 0603 Working Voltage: 18 – 70Vdc Capacitance: 1.5 – 12pF	Low capacitance for RF circuits, antennas, high-speed data lines, optic circuits & capacitance sensitive applications.	RF Circuits; Antennas; WLAN; Ethernet; Sensor; Datalines; USB
	USB Series	USB	Case size: 0402 – 0612 Working Voltage: 18Vdc Peak Current: 4A Capacitance: 3 – 10pF	Low capacitance for high-speed data lines & other capacitance sensitive applications.	Sensors; Data Lines; USB/Firewire; Ethernet; Computers; LCD
	Miniature MAV Series	MAV	Case size: 0402 – 0603 Working Voltage: 70Vdc Peak Current: 1 – 3A Capacitance: 6 – 22pF	Low capacitance for low power AC circuits (110V p-to-p capability at 125kHz.) & higher voltage data lines.	Keyless Entry; Data Lines; LC Resonant Circuits; AC Sampling; Transformer Secondaries
	Communication Bus Varistors	CAN FLX	Case size: 0402 – 0612 Working Voltage: 18 – 32Vdc Peak Current: 4 – 15A Capacitance: 15 – 50pF	Low capacitance for data lines, communication bus, & capacitance sensitive applications	Data Lines; General I/O Protocols; CMOS; CAN Bus; Module Interfaces; Switches; Sensors

TVS + HIGH TEMP (150°C, 175°C)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	150°C Glass Encapsulated TransGuard®	VGAH	Case size: 1206 – 3220 Working Voltage: 16 – 31Vdc Energy: 0.6 – 13J Peak Current: 200 – 1800A	High temperature, 150°C. Glass encapsulation provides enhanced resistance against harsh environment.	High Temperature Applications; Downhole Drilling; Industrial
	150°C/175°C High Temp Varistors	VTA	Case size: 0603 – 1210 Working Voltage: 14 – 31Vdc Energy: 0.1 – 1.6J Peak Current: 30 – 500A	High temperature 150°C (VTA3) & 175°C (VTA7). No derating over specified operating temperature.	High Temperature Applications; Downhole Drilling; Industrial
	150°C Low Capacitance Varistors	CANAT VCAT CANATL	Case size: 0603 – 0612 Working Voltage: 18 – 32Vdc Capacitance: 10 – 22pF	High temperature, low capacitance varistors with low loss. Specified to +150°C.	Data Lines; Communication Bus; RF Circuits; Sensors; High temperature
	150°C Radial Varistors	VR**AT	Case size: Radial Working Voltage: 14 – 48Vdc Energy: 0.1 – 2J Capacitance: 30 – 250A	Radial epoxy coated varistors. Specified to 150°C for high temperature applications.	High Temperature Applications; Downhole Drilling; Industrial



TRANSGUARD® MLVs FOR AUTOMOTIVE APPLICATIONS

KYOCERA AVX MLVs IN AUTOMOTIVE APPLICATIONS

The EMC requirements of today's automotive electronics are a natural fit for the use of Multilayer Varistors (MLVs).

KYOCERA AVX Automotive Series MLVs provide reliable protection against automotive related transients, such as Load Dump, Jump Start and ESD, to protect the growing number of electronics systems used in automotive applications.

AUTOMOTIVE TRANSIENTS

Today's automobiles are using new technologies based on electronics systems connected by wide variety of networks to provide increased safety, convenience and comfort, reduce emissions, increase fuel efficiency, etc. During their lifetime, these systems are subjected to many overvoltage transient surges. To ensure safe and reliable function, it is necessary to protect these sensitive systems against overvoltage surges.

AUTOMOTIVE POWER RAIL TRANSIENTS

The transients on automotive power rails are usually medium to high energy transients and are caused by engine start such as Jump start (connecting other cars battery to jump start the engine), Load Dump (sudden load disconnect from alternator) or inductive switching (caused by DC motors on/off switching - e.g. window lifter, wipers, adaptive headlights). These transients are typically bi-directional.

AUTOMOTIVE DATA LINE TRANSIENTS

Data lines connecting the automotive systems need to be protected against various ESD pulses to ensure protection. These transients are mainly caused by human interaction with the electronics systems (controls, buttons and ports) or by interaction between systems due to different charge build up. These transients are typically bidirectional and very fast.

When used in communication bus designs, MLVs can save approximately 90% of the board area involved with diode/EMC cap solutions. In addition, MLVs offer a FIT rate <0.1, an ability to be used at temperatures up to 150°C and a fast turn on time.

MLVs have traditionally been used in inductively generated automotive transient suppression applications such as motors, relays and latches. MLVs offer a large in-rush current capability in a small package, high-energy transient suppression, and a broad and definable off state bulk EMC capacitance.

Coupled with an extremely low FIT rate and excellent process capability, this makes MLVs commonplace in today's intermediate to high power automotive circuit protection.

TRANSIENT EXAMPLES

- Load dump (ISO 7637-2-5)
- Jump Start
- ISO 7637 Pulse 1-3
- IEC 61000-4-2, etc.
- AEC-Q200-002
- ISO 10605
- ISO 16750-2
- CI-220
- CI-260
- VW 80808

The parts offer fast turn on time, bi-directional protection, excellent multiple strikes capability and in addition also EMI/RFI filtering in the off-state that can improve overall system EMC performance. High power MLV designs have been revised and miniaturized to allow efficient protection of today's most widely used communication bus designs.

Suitable KYOCERA AVX Series Based on Data Speed & Line Type:

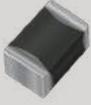
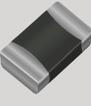
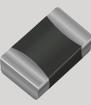
SERIES	BUS	DATA SPEED	
Sub pF AG Antenna PowerGuard	HDMI T1 Ethernet	High Speed	3.2 Gbps 1 Gbps
Sub pF AG Antenna PowerGuard AntennaGuard® Miniature MAV	1394a MOST TTP		400 Mbps 45 Mbps 25 Mbps
FlexRay	FlexRay	Data	10 Mbps
CAN FlexRay AG MAV	TTCAN CAN	Low Speed	1 Mbps 1Mbps – 50 Kbps
TransGuard® Low Clamp TG StaticGuard® Radial Varistors	Safe-by-Wire LIN		150 Kbps <20 Kbps
TransGuard® Low Clamp TG StaticGuard® Radial Varistors TransFeed® CapGuard®	ALL		Power Line
TransFeed® Controlled Capacitance	10 – 100 Mbps		Cutoff Frequency

AUTOMOTIVE QUALIFIED

(AEC-Q200)



TVS + EMI FILTERING (AEC-Q200)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	TransGuard® Automotive	VCAS VGAS	Case size: 0402 – 3220 Working Voltage: 3.3 – 85Vdc Energy: 0.05 – 13J Peak Current: 20 – 2000A	Wide range for bi-directional ESD protection and EMI/RFI attenuation. Specified with load dump and jump start rating where applicable	Automotive Applications; Safety; Body Electronics; Drivetrain; Load Dump Protection; Comfort & Convenience
	Low Clamp TransGuard®	VLAS	Case size: 0603 – 1210 Working Voltage: 16Vdc Energy: 0.1 – 0.6J Peak Current: 50 – 500A	Low clamping to working voltage ration for bi-directional ESD protection and EMI/RFI attenuation.	Infotainment; Displays; Microcontrollers; ESD Sensitive ICs
	Miniature 0201 MLV	VCAS 0201	Case size: 0201 Working Voltage: 9Vdc Energy: 0.02J Peak Current: 5A	Miniature 0201 varistor for any circuits with space constraints or for embedded applications.	Manifold Absolute Pressure Sensor; Applications with Space Constraint
	StaticGuard Automotive	VCAS**LC	Case size: 0402 – 0805 Working Voltage: 18Vdc Peak Current: 0.02 – 0.1J Capacitance: 40 – 80pF	Lower capacitance varistors for bi-directional ESD protection as well as EMI/RFI attenuation.	Sensors; CMOS; Switches; Data Lines; General purpose Logic; Module Interfaces
	Controlled Capacitance	VCAC	Case size: 0402, 0603 Working Voltage: 9 – 30Vdc Peak Current: 0.05 – 0.3J Capacitance: 33 – 1000pF	Tight capacitance tolerance for targeted EMI/RFI filtering and transient suppression.	EMI TVS Module Control; High Speed ASICs; IC; Sensors; Mixed Signal Environment
	Glass Encapsulated Varistors	VGAS VJ	Case size: 1206 – 3220 Working Voltage: 16 – 385Vdc Energy: 0.3 – 15J Peak Current: 120 – 3000A	High energy. Glass encapsulation provides enhanced resistance against harsh environment.	Harsh Environment; High Energy Applications; DC Motors; Inductive Loads; Power Steering; Load Dump
	Radial Varistors	VR**AS VA**AS VR**AT	Case size: Radial Working Voltage: 3.3 – 60Vdc Energy: 0.1 – 2.0J Peak Current: 30 – 500A	Radial and axial epoxy. For harsh environments or applications where leaded component preferred.	DC Motors; Inductive Loads; Relays; Turbocharger

TVS + ENHANCED EMI FILTERING (AEC-Q200)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	Radial CapGuard®	CG	Case size: Radial Working Voltage: 26 – 45Vdc Energy: 0.6 – 1.2J Peak Current: 0.47 – 4.7μF	Bi-directional ESD protection and EMI/RFI attenuation over wide frequency.	Inductive loads: DC Motors; Relays, TVS, Radiated, and Conducted Noise Filtering
	TransFeed®	V2AF	Case size: 0805 Working Voltage: 5.6 – 26Vdc Energy: 0.1 – 0.3J Peak Current: 20 – 120A	FeedThru filter construction with enhanced noise reduction (notch filter) and low parallel inductance.	Drive-by-Wire; Electric Mirror; LCD Dashboard; GPS; I/O Ports; Power Line

TVS + LOW SIGNAL DISTORTION/LOW LOSS (LOW CAP; AEC-Q200)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	Sub pF AG Series	VCH4**AG	Case size: 0402 Working Voltage: 16Vdc Capacitance: 0.8pF	Ultra-low capacitance (<1pF) for protection in RF circuits, antennas, sensors, high-speed data lines, optic circuits, & capacitance sensitive applications.	RF Circuits; Antennas; WLAN; Sensors; Datalines; USB; HDMI; Touch Controls
	AntennaGuard® Antenna PowerGuard	VCAS**AG VCAS**AP	Case size: 0402 – 0603 Working Voltage: 18 – 70Vdc Capacitance: 1.5 – 12pF	Low capacitance for RF circuits, antennas, high-speed data lines, optic circuits & capacitance sensitive applications.	RF Circuits; Antennas; WLAN; Ethernet; Sensor; Datalines; USB
	Miniature MAV Series	MAV	Case size: 0402 – 0603 Working Voltage: 70Vdc Peak Current: 1 – 3A Capacitance: 6 – 22pF	Low capacitance for low power AC circuits (110V p-to-p capability at 125kHz.) & higher voltage data lines.	Keyless Entry; Data Lines; LC Resonant Circuits; Immobilizers
	Communication Bus Varistors	CAN FLX	Case size: 0402 – 0612 Working Voltage: 18 – 32Vdc Peak Current: 4 – 15A Capacitance: 15 – 50pF	Low capacitance for data lines, communication bus, & capacitance sensitive applications	Data Lines; General I/O Protocols; CAN Bus; Body Control Modules; FlexRay; Sensors

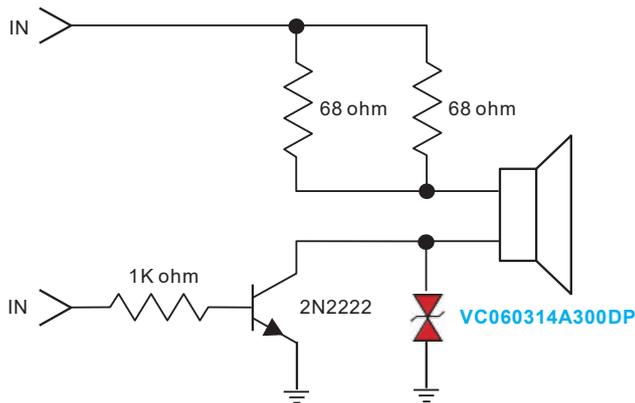
TVS + HIGH TEMP (150°C / 175°C; AEC-Q200)

PRODUCT	SERIES	PN	SPECS	FEATURES	APPLICATIONS
	150°C Glass Encapsulated TransGuard®	VGAH	Case size: 1206 – 3220 Working Voltage: 16 – 31Vdc Energy: 0.6 – 13J Peak Current: 200 – 1800A	High temperature, 150°C. Glass encapsulation provides enhanced resistance against harsh environment.	High Temperature Applications; Underhood; Load Dump; DC Motors
	150°C/175°C High Temp Varistors	VTA	Case size: 0603 – 1210 Working Voltage: 14 – 31Vdc Energy: 0.1 – 1.6J Peak Current: 30 – 500A	High temperature 150°C (VTA3) & 175°C (VTA7). No derating over specified operating temperature.	High Temperature Applications; Underhood; Turbocharger
	150°C Low Capacitance Varistors	CANAT VCAT CANATL	Case size: 0603 – 0612 Working Voltage: 18 – 32Vdc Capacitance: 10 – 22pF	High temperature, low capacitance varistors with low loss. Specified to +150°C.	Data Lines; Communication Bus; RF Circuits; Sensors; High temperature
	150°C Radial Varistors	VR**AT	Case size: Radial Working Voltage: 14 – 48Vdc Energy: 0.1 – 2J Capacitance: 30 – 250A	Radial epoxy coated varistors. Specified to 150°C for high temperature applications.	High Temperature Applications; Underhood; Turbocharger, DC Motors

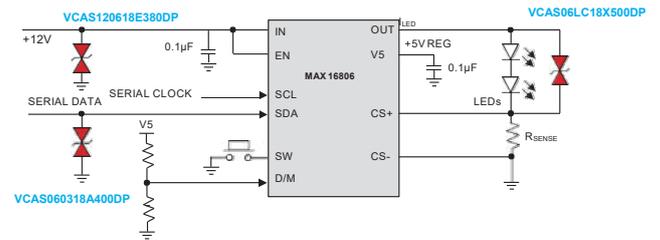


APPLICATION EXAMPLES

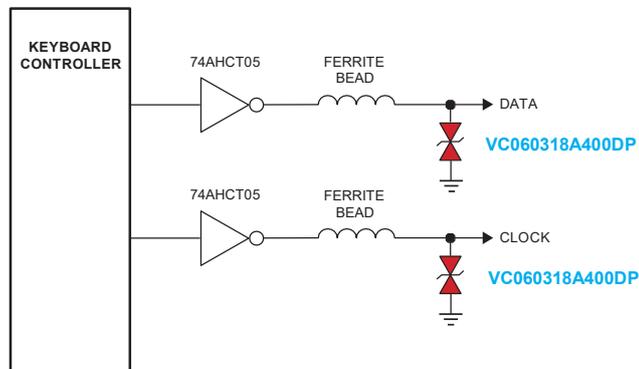
AUDIO PROTECTION



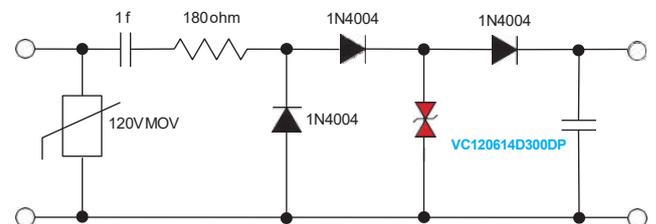
IN VEHICLE LED DRIVER PROTECTION



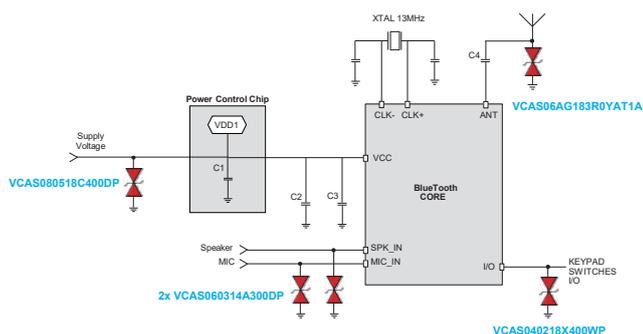
KEYBOARD PROTECTION



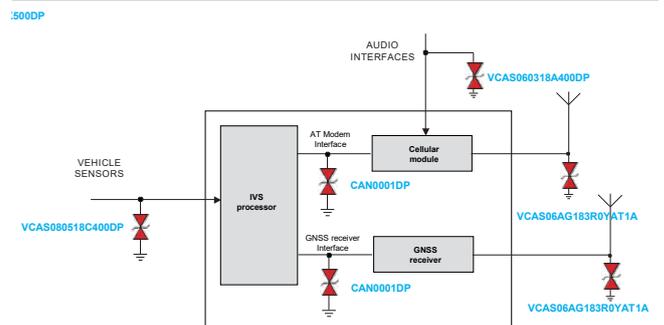
SENSOR PROTECTION



IN VEHICLE BLUETOOTH



IN VEHICLE E-CALL SYSTEM

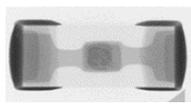
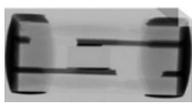
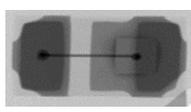
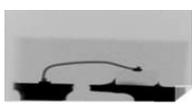


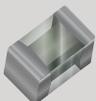
GIGUARD® TVS DIODES

Utilizing the latest in TVS Technology combined with a unique leadless package, the new GiGuard® series of ESD Suppression Diodes offers Tight Clamping to working Voltages and cap values as low as 0.3 pF.

This combination of excellence both protects sensitive ICs during ESD events and preserves the integrity of the protected high speed signals. The KYOCERA AVX GG series fits perfectly onto the same PCB solder pads as standard EIA 0201/0402 components. The GG series complies with IEC 61000-4-2(ESD), Level 4+ ($\pm 20\text{kV}$ air, $\pm 20\text{kV}$ contact discharge), IEC 61000-4-4 (electrical fast transient - EFT) (20A, 5/50 ns), very fast charged device model (CDM) ESD and cable discharge event (CDE).

CONSTRUCTION

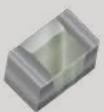
PRODUCT	X-RAY TOP	X-RAY SIDE
 GiGuard®		
 Standard		

PRODUCT	SERIES	PIN	SPECS	FEATURES	APPLICATIONS
	GiGuard®	GG	Case size: 0201 - 0603 Working Voltage: 3.3 - 12Vdc Peak Power: 46 - 300W Capacitance: 0.3 - 32pF	Tight clamping to working voltages, low capacitance, and low leakage	Touch Screens; HDMI; Gigabyte Ethernet; Network Communications; USB 2.0/3.0



THIN FILM FUSES

The Accu-Guard® series of fuses is based on thin-film technology and provides a level of control on the component electrical and physical characteristics that is generally not possible with standard fuse technologies. This has allowed KYOCERA AVX to offer a series of devices which are designed for modern surface mount circuit boards which require protection. Approvals : UL, cUL, RoHS, IATF.

PRODUCT	SERIES	PIN	SPECS	FEATURES	APPLICATIONS
	Accu-Guard® Accu-Guard® II	F	Case size: 0402 - 1206 Current: 28mA - 3A Voltage: 32V, 63V	Fast Acting High Reliability SMD & LGA Types Low Current Rating	Computers; Cell Phones; LCD Screens; SCSI Interface; Cameras; Battery Chargers; Hard Disk Drives; Two-Way Radios; Home Appliances; Rechargeable Battery Packs; Battery Management Systems; IP/Software Access Protection for ICs

NTC THERMISTORS

AUTOMOTIVE | CONSUMER | INDUSTRIAL



OVERVIEW

KYOCERA AVX offers reliable NTC thermistor solutions for a wide range of automotive, industrial and commercial applications. Available in SMT, leaded, or leadless form, NTC thermistors provide multiple stability options and a wide resistance range with the option to offer customized solutions. Thermistors are widely used in temperature sensing or temperature compensation applications.

SMT THERMISTORS

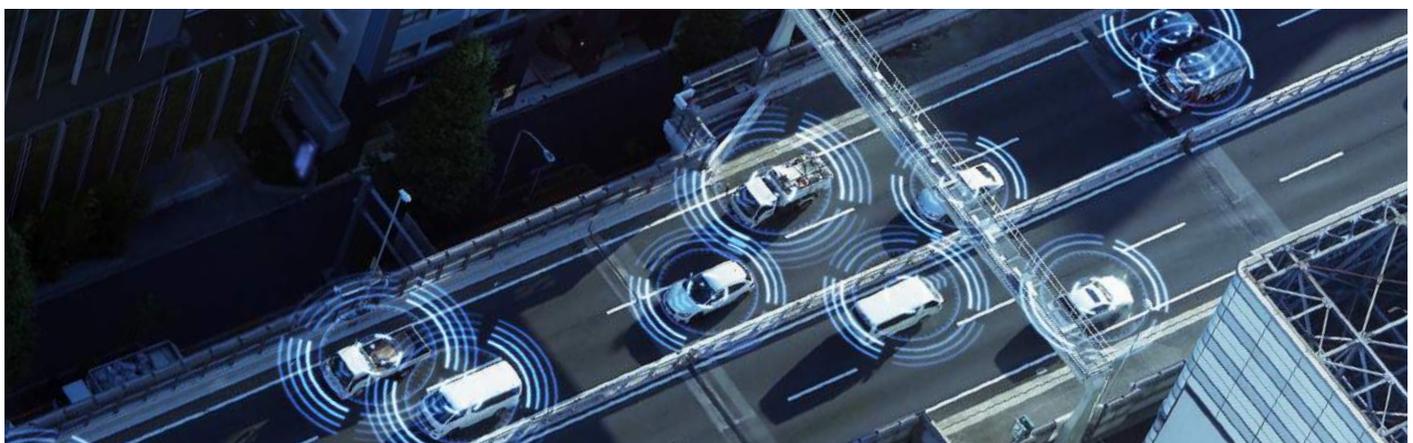
PRODUCT	PIN	SPECS	FEATURES	APPLICATIONS
	NB NC	Case size: 0603 – 1206 Resistance: 10Ω – 1MΩ Tolerance: ±5%, ±10%, ±20% Temperature: -55 to +150°C	Widely used for temperature compensation & temperature control of printed circuits. Available with Ni barrier/100% Sn termination for lead-free soldering or with PdAg termination for hybrid assembly.	Smart meter; ECU; IoT; Home Appliances; Wearables; Lighting; Battery Sensor; Alarm; Industrial Equipment; Refrigeration

HIGH ACCURACY THERMISTORS

PRODUCT	PIN	SPECS	FEATURES	APPLICATIONS
	NI / NJ NP / NK	Size: 2.4 – 3.0mm Resistance: 500Ω – 200kΩ Tolerance: ±1%, ±2%, ±3% Temperature: -55 to +150°C	Ideal for temperature measurement. High precision resistance & ability to reproduce the sensitivity index B. Small head size thermistors with rapid response times & able to meet the most accurate requirements.	Electric Pump; Water and Oil Temperature; Fire Detector; HVAC; Fan; Battery Charger; Industrial Equipment; Liquid Level Detection; Refrigeration; Home Appliances

DISC THERMISTORS

PRODUCT	PIN	SPECS	FEATURES	APPLICATIONS
	ND / NE NV / NR	Size: 3 - 9mm Resistance: 68Ω – 1MΩ Tolerance: ±5% ±10% ±20% Temperature: -55 to +150°C	Excellent thermal & electrical stability, resistance to mechanical and thermal shock with a wide range of resistance values for applications such as temperature measurement or thermal compensation.	Temperature Detection and Compensation; Fan; Industrial Equipment; Home Appliances; Liquid Level Detection



NORTH AMERICA
Tel: +1 864-967-2150

CENTRAL AMERICA
Tel: +55 11-46881960

EUROPE
Tel: +44 1276-697000

ASEAN/INDIA/TAIWAN
Tel: +65-6271-0500

CHINA
Tel: +86-21-5877-5366*511

JAPAN
Tel: +81-75-604-3640

KOREA
Tel: +82-2-3463-3538

▶ WWW.KYOCERA-AVX.COM

