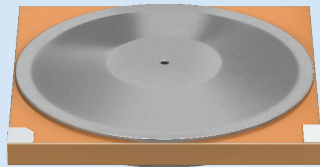
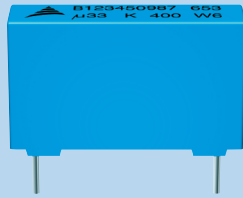


EPCOS Application Guide 2019

Automotive

Electronic Components for Comfort Applications



EPCOS Components for Comfort Applications



Convenience and comfort are key selling points for modern vehicles. A wide range of electronic helpers are leading the way. Automatic seat and mirror settings or multiple-zone air-conditioning systems that can be set individually for each passenger are just a few examples. For all of these systems TDK offers not only standard components, but also application-specific solutions, which are developed together with our customers.

A typical example is the integrating round air duct sensor for air-conditioning systems. This sensor has not only a fast response time and a low weight but also special mounting design which allows a simpler mounting is suitable for different wall thicknesses.

On the following pages you will find further special features that distinguish our products and solutions for use in convenience applications for automobiles.

EPCOS Components for Comfort Applications

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EPCOS Components for Comfort Applications

Special Features



Aluminum Electrolytic Capacitors

- Low ESR
- High reliability
- High ripple current capability
- Compact design
- Capacitors with AEC-Q200 qualification available

Ceramic Transient Voltage Suppressors (CTVS) – Multilayer chip varistors (MLV) and SHCV (combination of capacitor and MLV)

- Bidirectional protection for ESD
- High ESD stability acc. to IEC 61000-4-2 Level 4 and ISO 10605
- Automotive series for jump-start and load-dump protection acc. to ISO 7637
- Nickel barrier series acc. to AEC-Q200
- Wide temperature range from -55 °C to $+150\text{ °C}$

Ferrites

- Recommended materials for automotive applications: N49, N87, N92, N95, N97
- CAN bus choke materials: K1, K10, T65
- Suitability of other materials depends on transformer design
- Wide range of ferrite accessories

Film Capacitors (medium power)

- Long-term stability
- High reliability
- Self-healing capability
- AEC-Q200D compliant

Inductors

- Wide temperature range from -55 °C to $+150\text{ °C}$
- Miniaturized versions
- High mechanical strength
- Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D
- Qualified acc. to AEC-Q200

Piezo Haptic Actuators

- Using as sensor and actuator
- Actuator feedback adjustable
- Low power consumption
- Qualified acc. to AEC-Q200

PTC Thermistors

- Overcurrent protection
- Limit temperature sensors
- Heating elements

EPCOS Components for Comfort Applications

Special Features



Sensors

Temperature sensors (NTC)

- Long-term stability
- High measuring accuracy
- Short response time
- Temperature measurement up to +260 °C
- Heat resistive and highly stable
- Rugged design
- Compact dimensions
- SMD NTCs are qualified acc. to AEC-Q200

Integrated air duct sensors

- Lightweight full plastic version with fast response time

Evaporator fin temperature sensors

- Metal tube sensors to directly measure the evaporator fin temperature

Evaporator air temperature sensors

- NTC directly in the air stream for fast response time
- Overmolded design
- Humidity resistant

Double sensors

- Combined NTC and PTC sensors with wire harness

Outside temperature sensors

- Overmolded package
- Cable-bound or integrated connector versions
- Humidity resistant
- Customer-specific design

Solar sensors

- Mono and dual sun sensors with twilight function

Pressure sensors

- Piezo-resistive pressure dies and transmitters
- Long-term stability
- High media resistance
- Small dimensions

Ultrasonic sensors

- Available with wrap-around metallization
- Customized dimensions
- Production certified to automotive standard (ISO/TS 16949)

Transformers

- Material class –40 °C to +155 °C
- High power density
- Advanced thermal behavior
- Platform designs qualified acc. to AEC-Q200

Varistors

Leaded disk and CU varistors

- Automotive grade ratings (load-dump, jump-start)
- Stable protection level
- Minimum leakage current
- Operating temperature up to +125 °C
- High resistance to cyclic temperature stress
- Qualified acc. to AEC-Q200

EPCOS Components for Comfort Applications




Overview													
	Additional heating systems (e.g. steering wheel and seat climatization)	Air conditioning, climate control units, ventilation, fan control	Body control modules (e.g. door, roof, seat control)	Car alarm systems	Car navigation systems / telematics	Communication and reception systems	Dashboard systems (incl. board computers, LED and LCD control systems and head-up displays)	Entry systems, immobilizer systems (incl. remote keyless, passive entry)	Interior monitoring, anti-theft systems	Park assist systems, blind spot assist systems, distance control	Rear camera systems	Small motor drives (incl. mirrors, seats, windows, doors, massage car seats)	Wiper control systems (e.g. rain sensor, spray nozzles heating)
Aluminum electrolytic capacitors													
Axial-lead, soldering star													•
Single-ended													•
Ceramic transient voltage suppressors (CTVS) – multilayer chip varistors (MLV) and SHCV (combination of capacitor and MLV)													
High-speed series					•	•	•						
Automotive E series	•	•	•	•	•	•	•	•		•	•	•	•
Automotive G series	•	•	•	•	•	•	•	•		•	•	•	•
SHCV series												•	•
Ferrites													
E, EFD, ETD cores	•	•										•	•
ELP, EQ, ER cores	•	•		•	•		•			•		•	•
EP cores			•							•			
Ring cores			•			•							
RM, RM LP	•	•		•	•					•		•	•
Film capacitors (medium power)													
MKP								•					
MKT								•				•	•
MMKP								•					
Inductors													
CAN-/ FlexRay bus chokes	•	•	•		•	•	•	•		•	•		•
E core chokes		•	•				•						
Power inductors		•	•	•	•	•	•	•			•		
SIMID 0603 ... 2220	•	•	•	•	•	•	•	•		•	•		•
Transponder coils								•					

EPCOS Components for Comfort Applications

Overview													
	Additional heating systems (e.g. steering wheel and seat climatization)	Air conditioning, climate control units, ventilation, fan control	Body control modules (e.g. door, roof, seat control)	Car alarm systems	Car navigation systems / telematics	Communication and reception systems	Dashboard systems (incl. board computers, LED and LCD control systems and head-up displays)	Entry systems, immobilizer systems (incl. remote keyless, passive entry)	Interior monitoring, anti-theft systems	Park assist systems, blind spot assist systems, distance control	Rear camera systems	Small motor drives (incl. mirrors, seats, windows, doors, massage car seats)	Wiper control systems (e.g. rain sensor, spray nozzles heating)
Piezo haptic actuators													
PowerHap			•		•		•						
PTC thermistors													
Heating elements		•											•
Overcurrent protectors, leaded												•	•
Overcurrent protectors, SMD				•	•	•							
Limit temperature sensors, SMD		•					•				•		
Sensors – temperature sensors (NTC), pressure sensors, ultrasonic sensors													
Glass-encapsulated NTCs	•	•									•		•
Leaded NTCs	•	•									•		•
SMD NTCs	•	•	•	•	•	•	•	•		•	•	•	•
Temperature probes, solar sensors	•	•											
Pressure transmitter ASx					•							•	
Pressure dies C32		•											
Ultrasonic sensors									•	•			
Transformers													
EHR series		•	•	•			•						
EP6 series										•			
E10 EM		•	•									•	
Varistors													
S07 ... S20 AUTO (D1)		•	•	•	•		•			•		•	
CU varistors		•	•	•	•		•			•		•	


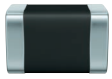



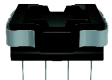


EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Aluminum electrolytic capacitors				
Axial-lead and soldering star		V_R : 25 ... 63 V DC C_R : 270 ... 6800 μ F	Low ESR High ripple current Useful life: up to 10000 h at +125 °C up to 2000 h at +150 °C Different lead configurations available, e.g. J lead, cut lead Whisker mitigation solution available Shelf life up to 15 years	B41689/B41789
Single-ended		V_R : 10 ... 100 V DC C_R : 22 ... 10000 μ F	Different lead configurations available, e.g. J lead, crimped lead, bent 90° lead Useful life: up to 10000 h at +105 °C up to 7000 h at +125 °C up to 3000 h at +135 °C Whisker mitigation solution available Shelf life up to 15 years	B41858 B41859 B41866 B41888 B41895 B41896
Ceramic transient voltage suppressors (CTVS) – multilayer chip varistors (MLV) and SHCV (combination of capacitor and MLV)				
High-speed series SMD		V_R : 14 ... 32 V DC C_R : 0.6 ... 15 pF Case sizes: 0402, 0603 (single line) 0508 (2-fold array for 2 lines)	Low leakage current Controlled capacitance for additional EMI filtering Qualified acc. to AEC-Q200 ESD protection Low capacitance to avoid signal distortion at high-speed data rates	Single lines: B72500E... B72590E... 2-lines: B72812Q...

EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Ceramic transient voltage suppressors (CTVS) – multilayer chip varistors (MLV) and SHCV (combination of capacitor and MLV)				
Automotive E series		Temperature range up to +150 °C V_R : 16 ... 56 V DC C_R : 10 pF ... 10 μ F V_{RMS} : 14 ... 40 V AC W_{LD} : 1 ... 25 J Case sizes: 0402, 0603, 0805, 1206, 1210, 1812, 2220	ESD protection up to 30 kV Low leakage current Qualified acc. to AEC-Q200 <u>E series:</u> Controlled capacitance for additional EMI filtering <u>G series:</u> High energy absorption capability Jump-start and load-dump capability	B72500E... B72500G... B72510E... B72510G... B72520E... B72520G... B72530E... B72530G... B72540E... B72540G... B72580E... B72590E...
Automotive G series				
SMD				
SHCV series		V_R : 16 ... 45 V DC C_R : 220 ... 4700 pF V_{RMS} : 14 ... 35 V AC W_{LD} : 1.5 ... 12 J Lead space: 5 mm	Interference suppression for brushed DC motors Combined component for surge, load-dump protection and RFI suppression Leaded component can be applied directly on the motor winding/coils	B72527 B72547 B72587
Ferrites				
E cores		Material: N27, N30, N87, N97 A_L : 30 ... 12100 nH	E and EFD cores are available in a wide variety of sizes. E and EFD cores are supplied in single units.	E 5 ... E 100
EFD cores		Material: N27, N87, N97 A_L : 40 ... 2150 nH		
ETD cores		Material: N27, N87, N97 A_L : 204 ... 5500 nH	ETD cores are available in a wide variety of sizes. ETD cores are supplied in single units.	ETD 29 ... ETD 59
ELP cores		Material: N49, N87, N92, N97 A_L : 160 ... 12500 nH	ELP cores are available in a wide variety of sizes. ELP cores are supplied in single units.	ELP 14 ... ELP 102







EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Ferrites				
EQ cores		Material: N49, N87, N92, N97 A_L : 1320 ... 4800 nH	EQ and ER cores are available in a wide variety of sizes EQ and ER cores are supplied in single units	EQ 13 ... EQ 30
ER cores		Material: N27, N49, N87, N92, N97, T38 A_L : 56 ... 6400 nH		ER 9.5 ... ER 54
EP cores SMD		Material: N30, N45, N87, T38, T65 A_L : 28 ... 18700 nH	EP cores are recommended for space saving onboard solutions EP cores are delivered as sets	EP 5 ... EP 20
Ring cores		Material: K1, K10, N27, N30, N87, T35, T37, T38, T65 A_L : 70 ... 21300 nH	Ring cores are primarily used as EMC chokes for suppressing RF interference	R 2.5 ... R 202
RM cores		Material: K1, M33, N30, N41, N48, N49, N87, N92, N97, T35, T38 A_L : 16 ... 16000 nH	RM cores are ideal for low-loss / highly stable filter coils. Sizes are specified according to IEC 60431 RM cores are supplied in sets	RM 4 ... RM 14
RM cores Low-profile		Material: N49, N87, N95 A_L : 160 ... 11500 nH	Low-profile RM core sizes are specified according to IEC 61860 Low-profile RM cores are supplied in sets	RM 4 LP ... RM 14 LP

EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Film capacitors (medium power)				
MKP		V_R : 250 ... 2000 V DC C_R : 1 nF ... 8.2 μ F	Suitable for high frequencies High pulse strength High contact reliability	B32651 ... B32656 B32671L ... B32672L
MKT		V_R : 63 ... 630 V DC C_R : 1 nF ... 220 μ F	Different lead configurations available High pulse strength	B32520 ... B32529
MMKP		V_R : 400 ... 2000 V DC C_R : 2.2 ... 560 nF	High current withstand capability Halogen free upon request	B32641B... B32643B...
Inductors SMD				
CAN-/ FlexRay bus chokes		L_R : 5 μ H ... 4.7 mH I_R : up to 1.2 A	Miniaturized types ACT45B, B82789 in size 1812 Bifilar and sector winding Temperatures up to +150 °C For reflow soldering and gluing	B82787 (ACT45B) B82789C0... B82789S0... B82793C0... B82793S0...
E core chokes		L_R : 0.5 ... 35 μ H I_R : > 50 A	High saturation currents High ripple currents Low losses	B82559
Power inductors		L_R : 0.82 ... 1000 μ H I_R : up to 12.25 A Case sizes: 6 x 6 ... 12 x 12 mm	Shielded and unshielded versions Low DC resistance Temperatures up to +150 °C Qualified acc. to AEC-Q200	B8246...A... B8246...G... B8246...P... B8247...P B82476B...M100 B82477R...M100





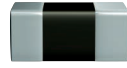
EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Inductors				
SIMID 0603-C		L_R : 1 ... 220 nH I_R : 110 ... 1800 mA Case size: 0603	Copper plated ceramic core Laser cut winding Epoxy coated	B82496C...
SIMID 0805-F		L_R : 2.7 ... 820 nH I_R : 180 ... 1000 mA Case size: 0805	Cubic coil with ceramic core Epoxy molded flat top for vacuum pickup Winding ends welded to the terminals	B82498F3 ... 001
SIMID 1210-H		L_R : 1 ... 680 μ H I_R : 61 ... 1150 mA Case size: 1210	Ferrite drum core Laser welded winding Flame retardant molding	B82422H...
SIMID 1812-T/C		L_R : 1 ... 1000 μ H I_R : 55 ... 1300 mA Case size: 1812	Ferrite drum core Laser welded winding Flame retardant molding	B82432C... B82432T...
SIMID 2220		L_R : 1 μ H ... 10 mH I_R : 46 ... 3510 mA Case size: 2220	Ferrite drum core Laser welded winding Flame retardant molding	B82442T...
Transponder coils X/Y or Z		L_R : 1 ... 18.52 mH Sensitivity: 7 ... 52 mV/ μ T	Ferrite core Enamel copper wire welded to terminals Flame retardant molding	B82450A...
				B82450H... B82451L...
3D transponder coils		L_R : 4.75 ... 13.20 mH (125 kHz) Sensitivity: 45 ... 83 mV/ μ T	X/Y/Z coils in one component Ferrite core with special geometry Laser welded	B82453C...A...





EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Piezo haptic actuators				
PowerHap		Acceleration (100 g mass): 2.5 ... 36 g Operating voltage: -20 ... 120 V Max. displacement: 15 ... 230 μm Operating temp.: -40 ... +85 °C	Small size Enables crisp haptic feedback Using as sensor and actuator Actuator feedback adjustable Low power consumption Qualified based on AEC-Q200	B54101H1020A001
				B54102H1020A001
				B54103H2020A001
				Upon request
PTC thermistors				
Heating elements		Operating voltage: 12 V / 400 V Reference temperature: 0 ... +200 °C Surface temperature: +40 ... +190 °C	Silver or aluminum metallization Other voltage ratings, reference temperatures and geometries upon request Round and rectangular elements available Customer-specific solutions available	B59060AxxxxA010
				B59041RxxxxA010
				B59249R0155B010
Overcurrent protectors, leaded		Rated current: 120 ... 1300 mA Max. voltage: 12, 24 V Rated resistance: 0.45 ... 13 Ω	Broad product range UL approval VDE approval IECQ approval AEC-Q200, Rev. D	B59945C0160A070
				B59955C0160A070
				B59965C0160A070
				B59975C0160A070
				B59985C0160A070
				B59945C0120A070
				B59955C0120A070
				B59965C0120A070
				B59975C0120A070
				B59985C0120A070
Overcurrent protectors SMD		Rated current: 90 mA 70 mA 50 mA 13 mA 12 mA Rated resistance: 27 Ω 55 Ω 125 Ω 470 Ω 1500 Ω Case size: 0402, 1210	Lead-free tinned terminations Short response time UL approval Qualified acc. AEC-Q200 rev. D	B59407A0115A062
				B59606A0110A062
				B59607A0120A062
				B59707A0120A062
Limit temperature sensors SMD		Sensing temperature: +70 ... +145 °C in steps of +10 °C Temperature tolerance: ±5 °C V _{max} : 32 V Rated resistance: 470 Ω (0402 and 0603) 680 Ω (0805) Case sizes: 0402, 0603, 0805	Fast and reliable response UL approval Qualified acc. to AEC-Q200 rev. D	B59421A0***A062
				B59641A0***A062
				B59721A0***A062

EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Sensors – temperature sensors (NTC)				
Glass-encapsulated NTCs G1541 G1551 G1561		Temperature range: $-55 \dots +260 \text{ }^\circ\text{C}$ (G1541: $+250 \text{ }^\circ\text{C}$) Rated resistance at $+25 \text{ }^\circ\text{C}$: $2 \dots 230 \text{ k}\Omega$ Resistance tolerance: $+2 \dots +3\%$ Insulation resistance: $> 100 \text{ M}\Omega$ 500 V DC (1s)	High-temperature resistant Insulated wires with high insulation voltage Nonstandard wire configurations Small dimensions, highly stable	B57541G1... B57551G1... B57561G1...
Leaded NTCs S86* S87* S88*		Temperature range: $-55 \dots +155 \text{ }^\circ\text{C}$ Rated resistance at $+25 \text{ }^\circ\text{C}$: $2 \dots 100 \text{ k}\Omega$ Resistance tolerance: $\pm 1\% \dots \pm 5\%$;	Nonstandard lead configurations Length of wire up to 500 mm Taped versions for automatic processing Lead spacing 2.5 and 5.0 mm (S87*, S88*) UL approval (S86*)	B5786*S... B5787*S... B5788*S...
SMD NTCs SMD		Temperature range: $-40 \dots +150 \text{ }^\circ\text{C}$ Rated resistance at $+25 \text{ }^\circ\text{C}$: $1 \dots 100 \text{ k}\Omega$ Resistance tolerance: $\pm 1\%, \pm 3\%, \pm 5\%$ Case sizes: 0402, 0603, 0805, 1206 B-tolerance: $\pm 1\%, \pm 3\%$	Operating temperatures up to $+150 \text{ }^\circ\text{C}$ Qualified acc. to AEC-Q200 High reliability Excellent long-term aging stability in high temperature and high humidity environment	B57***V5...
Temperature probes Evaporator fin temperature sensors		Temperature range: $-40 \dots +85 \text{ }^\circ\text{C}$ Humidity resistant: 2000 h immersion test at $+80 \text{ }^\circ\text{C}$	Short response time Cable-based design Insulated wires with high insulation voltage Customer-specific solutions	B58...

EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Sensors – temperature sensors (NTC)				
Evaporator air temperature sensors		Temperature range: –40 ... +100 °C Water immersion test: 2000 h / +80 °C Thermal cycling: 1000 cycles in liquid –30 °C / +90 °C with transition time < 30 s	Customer-specific solutions	B58...
Integrating air duct sensors		Temperature range: –40 ... +90 °C Response time: < 15 s in air at 5 m/s	Clip design for fast and reliable mounting Customer-specific solutions	B58...
Integrated round air duct sensors		Temperature range: –40 ... +90 °C Response time: < 12 s in air at 5 m/s	Connector molded directly on the sensor Anti rational features Christmas tree push-in design Simple attachment strategy One design for different wall thicknesses Customer-specific solutions	B58...
Outside temperature sensors		Temperature range: –40 ... 85 °C Compliant to IP6K6 and IPX9K for 30 s Humidity resistant: 2000 h immersion test at +80 °C Thermal cycling: 480 cycles with applied voltage 120000 cycles on/off Thermal shock: 200 cycles in air transition time < 30 s	Customer-specific solutions	B58...







EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Sensors – solar sensors				
Solar sensors with twilight function		Temperature range: -40 ... +100 °C	Mono and dual zone High resolution and sensitivity Adapted angular characteristics Analog signal Twilight function Customer-specific solutions	B58...
Sensors – pressure sensors				
Pressure transmitters ASx SMD		Rated pressure: 200 mbar ... 2.5 bar Pressure measurement: absolute front side (barometric), gauge Sizes: down to 4 x 4 mm	Small SMD package, low profile Various pressure ranges and output signals Customized signal characteristics High accuracy ±2% full scale Humidity resistance: 1000 h at 85 °C/ 85% relative humidity	B5862*S***B***
Pressure dies C32		Rated pressure: 400 mbar ... 40 bar Pressure measurement: absolute front side (barometric), absolute back side (barometric), gauge back side Size: 1.65 x 1.65 mm	Media resistant absolute back side pressure measurement Long-term stability Increased burst pressure upon request Solderable back side upon request Gold bond pads available	Absolute back side (barometric): B58600H8400A037 ... B58600H8400A040 Absolute front side (barometric): B58600H8000A001 ... B58600H8000A004 Gauge back side: B58601H8000A033 ... B58601H8000A036
Sensors – ultrasonic sensors				
Ultrasonic sensors		Radial oscillation types: Frequency: 200 ... 400 kHz Thickness: 0.2 ... 4 mm Diameter: 4 ... 8 mm Thickness oscillation types: Frequency: 500 ... 4000 kHz Thickness: 0.5 ... 4 mm Diameter: 4 ... 12 mm	Available with wrap-around metallization Customized dimensions upon request Production certified to automotive standard (ISO/TS 16949)	Upon request
Transformers				
EHR 16LP EHR 16 EHR 18		Power: 20 ... 50 W	Switching frequencies up to 700 kHz Saturation currents up to 30 A Leakage inductance 50 nH typ. Flyback or buck boost	B78362 B78363 B78364

EPCOS Components for Comfort Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Transformers				
EP 6		V_{out} : 80 ... 140 V	Insensitive against external fields Low inductance drift overtemperature	B78416
E10 EM		V_{op} : up to 500 V	Insulation distances for basic insulation, e.g. IEC 60664-1, PU2, OVC II Isolated DC/DC converter (full bridge and flyback topology) Push-Pull driver for isolated power supply circuits (full bridge topology)	B78307
Varistors				
S07... AUTO (D1)		V_{DC} : 16 V V_{RMS} : 14 V C_{typ} : 2.3 nF I_{max} 8/20 μ s: 250 A	High energy absorption, particularly in case of load dump Jump start strength Operation temperature up to +125 °C (D1)	B72207S1...
S10... AUTO (D1)		V_{DC} : 16 ... 20 V V_{RMS} : 14 ... 17 V C_{typ} : up to 5.2 nF I_{max} 8/20 μ s: 500 A		B72210S1...
S14... AUTO (D1)		V_{DC} : 16 ... 34 V V_{RMS} : 14 ... 30 V C_{typ} : up to 10 nF I_{max} 8/20 μ s: 1000 A		B72214S1...
S20... AUTO (D1)		V_{DC} : 16 ... 34 V V_{RMS} : 14 ... 30 V C_{typ} : up to 19 nF I_{max} 8/20 μ s: 2000 A		B72220S1...
CU varistors SMD	 	V_R : 16 ... 34 V DC C_R : 600 ... 2300 pF V_{RMS} : 14 ... 30 V AC W_{LD} : 6 ... 12 J Case sizes: 3225, 4032		Jump-start and load-dump protection acc. to ISO 7637, pulse 5 Overvoltage protection in SMT version of standard disk varistors (5 and 7 mm diameter) Qualified acc. to AEC-Q200

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of TDK Electronics, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products. Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Important Notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
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The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.
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