

EPCOS Application Guide 2012

Automotive

Electronic Components for Safety Applications



EPCOS Components for Safety Applications



We offer one of the broadest product portfolios of electronic components for the demanding safety applications in vehicles, such as ABS, ESP, SRS, TPMS and many more. Our products range from capacitors and inductors to a wide variety of components for overvoltage protection and EMC, and include complete sensor systems. Just one example of components designed to meet the automotive industry's stiff requirements for quality and long-term stability are EPCOS aluminium electrolytic capacitors that can achieve a useful life of more than 10,000 hours at an operating temperature of 125 °C.

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

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Special Features



Aluminum Electrolytic Capacitors

- High CV product in compact design
- High ripple current capability
- Long useful life
- Capacitors with AEC-Q200 qualification available

Ceramic Transient Voltage Suppressors (CTVS) - MLVs

- Short reponse time < 0.5 ns
- Operating temperatures up to +125 °C for lead-free soldering or +150 °C for hybrid mounting
- Bidirectional clamping
- ESD protection acc. to ISO 10605 and IEC 61000-4-2 Level 4
- Nickel barrier series acc. to AEC-Q200

Ferrites

- Recommended materials for automotive applications: N49, N87, N92, N95, N97
- CAN bus choke materials: K1, K10
- 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
- High contact reliability
- Various lead configurations
- Capacitors with AEC-Q200 qualification available

Inductors

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

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NTC Thermistors

- Wide range of case sizes, resistances and tolerances
- Very good long-term stability in high-temperature environments
- Temperature measurement up to +260 °C
- Short response time
- Compact dimensions
- High measuring accuracy
- SMD NTCs are qualified acc. to AEC-Q200

PTC Thermistors

- Overcurrent protection
- Limit temperature sensors

SAW Components

- Balanced and unbalanced operation possible
- High selectivity especially at image frequency
- Qualified acc. to AEC-Q200

Switching Spark Gaps

- Very low switching losses
- Stable performance over lifetime
- Very short breakdown time
- Very long operating life
- High reliability due to robust design

Transformers

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

Varistors

Leaded disk varistors




- Automotive grade ratings (load-dump, jump-start)
- Stable protection level
- Minimum leakage current
- Qualified acc. to AEC-Q200

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Overview										
	Airbag control units	Blind spot radars	Braking control units (ABS/ESP)	Cruise control systems	Lane departure warning	Light systems		Power steering	Suspension control units	Tire pressure monitoring systems (TPMS)
						HID lamp control units	Light modules incl. front, travelling and LED light control, adaptive headlight control			
Aluminum electrolytic capacitors										
Axial-lead			•					•		
Large size								•		
Single-ended	•		•					•		
Ceramic transient voltage suppressors (CTVS) - MLVs										
Automotive series			•			•		•	•	
Controlled-capacitance series	•	•	•		•		•			•
High-speed series		•	•	•	•		•			•
High-temperature series			•					•	•	
Standard/ low-capacitance series	•	•	•		•		•	•	•	•
Ferrites										
Double-aperture cores				•						
E, EFD, ELP, ER, EQ cores			•			•		•	•	
Ring cores	•		•	•						
RM, RM LP cores			•			•				
Film capacitors (medium power)										
MKN						•				
MKP										•
MKT			•			•		•		
Inductors										
CAN-/ FlexRay bus chokes	•	•	•	•	•	•	•	•	•	•
Cylindrical core chokes								•		
E core chokes			•				•			
Power inductors	•	•	•	•	•	•	•	•	•	
SIMID 0603 ... 2220	•	•	•	•	•	•	•	•	•	•
Transponder coils										•
NTC thermistors										
Glass-encapsulated NTCs								•		
SMD NTCs	•	•	•	•	•	•	•	•	•	•
PTC thermistors										
Limit temperature sensors							•			•
Overcurrent protectors	•									
SAW components										
Resonators										•
RF front-end filters										•
Switching spark gaps										
FS type series						•				
Transformers										
EP series		•			•					
EPT platform (EHP, EHR series)						•	•			
Varistors										
S07 ... S20 AUTO (D1)	•		•	•						

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Characteristics			
Series	Technical data	Features	Ordering code/ type
Aluminum electrolytic capacitors			
Axial-lead and soldering star	 <p>V_R: 25 ... 63 V DC C_R: 100 ... 10000 μF</p>	<p>High ripple current capability Useful life up to 10000 h at +125 °C Different mechanical constructions available Soldering star for horizontal and vertical mounting RoHS-compatible versions available Whisker mitigation solutions available High vibration resistance up to 40 g Shelf life up to 15 years</p>	<p>B41690/B41790 B41691/B41791 B41692/B4192 B41694/B41794</p>
Large size	 <p>V_R: 25 ... 63 V DC C_R: 900 ... 27000 μF</p>	<p>Wide capacitance range Useful life up to 10000 h at +125 °C 1.2 mm copper leads for soldering and welding High vibration resistance up to 40 g Shelf life up to 15 years</p>	<p>B41605 B41607</p>
Single-ended	 <p>V_R: 10 ... 75 V DC C_R: 10 ... 10000 μF</p>	<p>High CV product Different lead configurations available, e.g. J-leads, crimped leads, bent 90° leads Useful life up to, 10000 h at +105 °C 7000 h at +125 °C RoHS-compatible versions available Whisker mitigation solutions available Shelf life up to 15 years</p>	<p>B41863 B41888 B41866 B41896</p>

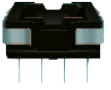


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Characteristics				
Series		Technical data	Features	Ordering code/ type
Ceramic transient voltage suppressors (CTVS) - MLVs				
Automotive series		Temperature range up to +125 °C V_R : 15 ... 34 V DC C_R : 10 pF ... 10 µF V_{RMS} : 14 ... 30 V AC W_{LD} : 1 ... 25 J Case sizes: 0603, 0805, 1206, 1210, 1812, 2220	Load-dump and/ or jump-start pulse protection	B72500T...
		Temperature range up to +150 °C V_R : 16 ... 56 V DC C_R : 10 pF ... 10 µF V_{RMS} : 14 ... 40 V AC W_{LD} : 1.2 ... 12 J Case sizes: 0402, 0603, 0805, 1206, 1812, 2220		B72510T...
Controlled-capacitance series		V_R : 22 ... 31 V DC C_R : 33 ... 1200 pF V_{RMS} : 17 ... 25 V AC Case sizes: 0508, 0603, 0805, 1206	Application-specific capacitance tolerances	B72520T...
				B72714A...
High-speed series		V_R : 16 ... 32 V DC C_R : 3 ... 30 pF V_{RMS} : 14 ... 25 V AC Case sizes: 0402, 0504, 0508, 0603, 0612	Low capacitance value to avoid signal distortion at high-speed data rates	B72500T...
				B72590T...
High-temperature series		Temperature range up to +150 °C V_R : 16 ... 31 V DC C_R : 32 ... 120 pF V_{RMS} : 14 ... 25 V AC Case sizes: 0603, 0805, 1210	Conductive gluing series	B72714A...
				B72724A...
Standard/ low-capacitance series		V_R : 22 ... 31 V DC C_R : 50 ... 100 pF V_{RMS} : 17 ... 25 V AC Case sizes: 0603, 0805, 1206, 1210, 1812, 2220	Highly stable ESD protection Very low inductance	B72762A...
				B72500H...
				B72510H...
				B72530H...
				B72540V...
				B72542V...
				B72580V...
				B72582V...

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Characteristics				
Series		Technical data	Features	Ordering code/ type
Ferrites				
Double aperture		Material: K1, N30 A_L : 42 ... 10000 nH	For BALUN transformers and frequency diplexers	B62152...
E cores		Material: N27, N30, N87, N97 A_L : 30 ... 12100 nH	E, EFD, ELP, EQ and ER cores are available in a wide variety of sizes E, EFD, ELP, EQ and ER cores are supplied in single units	E 5 ... E 80
EFD cores		Material: N27, N87, N97 A_L : 40 ... 2150 nH		EFD 10 ... EFD 30
ELP cores		Material: N49, N87, N92, N97 A_L : 160 ... 12500 nH		ELP 14 ... ELP 64
EQ cores		Material: N49, N87, N92, N97 A_L : 1320 ... 4800 nH		EQ 13 ... EQ 30
ER cores		Material: N27, N49, N87, N92, N97, T38 A_L : 56 ... 6400 nH		ER 9.5 ... ER 54
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 LP cores		Material: N49, N87, N95 A_L : 160 ... 11500 nH	Low-profile cores are specified according to IEC 61860 Low-profile cores are supplied in sets	RM 4 LP ... RM 14 LP
Film capacitors (medium power)				
MKN		V_R : 1000 V DC C_R : 70 ... 120 nF	Very high pulse strength (up to 6 kV/μs) Operating temperature up to +150 °C Peak temperature up to +170 °C	B32681 ... B32682
MKP		V_R : 160 ... 1000 V DC C_R : 0.47 ... 220 nF	High reliability Suitable for high frequencies up to 130 kHz	B32620 ... B32621
		V_R : 400 ... 2000 V DC C_R : 1.0 nF ... 1.0 μF		B32671L ... B32672L
MKT		V_R : 63 ... 630 V DC C_R : 1 nF ... 220 μF	High pulse strength	B32520 ... B32529

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Characteristics				
Series		Technical data	Features	Ordering code/ type
Inductors				
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	ACT45B (B82787...) B82789C0... B82789S0... B82793C0... B82793S0...
				
				
				
Cylindrical core chokes		L_R : 3 ... 4 μ H I_{peak} : > 80 A	High saturation currents Differential-mode choke	B82116...
E core chokes		L_R : 0.5 ... 10 μ H I_{peak} : > 25 A	High saturation currents High ripple currents Low losses	B78366...
Power inductors		L_R : 0.82 ... 1000 μ H I_R : up to 11 A Case sizes: 6 x 6 ... 12 x 12 mm	Shielded and unshielded versions Low DC resistance Temperatures up to +150 °C Qualified according to AEC-Q200	B82462A... B82462G... B82464A... B82464G... B82464P... B82472P... B82473M... B82475M... B82477P...
				
				
				
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	B82498F...
SIMID 1210-H		L_R : 0.1 ... 680 μ H I_R : 61 ... 2050 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 : 25 ... 3510 mA Case size: 2220	Ferrite drum core Laser welded winding Flame retardant molding	B82442...

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Characteristics				
Series		Technical data	Features	Ordering code/ type
Inductors				
Transponder coils		L_R : 1 ... 7 mH Sensitivity 10 ... 51 mV/ μ T	Ferrite core Enamel copper wire welded to terminals Flame retardant molding	B82450...
NTC thermistors				
Glass-encapsulated NTCs		Temperature range: -55 ... +260 °C (G1541: +250 °C)	High-temperature resistant	G57541G1...
G1541		Rated resistance at 25 °C: 2 ... 100 k Ω	Insulated wires with high insulation voltage	G57551G1...
G1551		Resistance tolerance: \pm 1... \pm 3%	Non-standard wire configurations	G57561G1...
G1561		Insulation resistance: > 100 M Ω 500 V DC (1 s)		
SMD NTCs		Temperature range: -40 ... +150 °C Rated resistance at 25 °C: 4.7 ... 100 k Ω Case sizes: 0402, 0603, 0805 Resistance tolerance: \pm 3%, \pm 5% (\pm 1% for selected types) B-tolerance: \pm 3% (\pm 1% for selected types)	Qualified according to AEC-Q200 Operating temperatures up to +150 °C	B57***V5...
PTC thermistors SMD				
Limit temperature sensors		V_{max} : 32V Rated resistance: 470 Ω Case sizes: 0402, 0603, 0805 Temperature tolerance: \pm 5 °C	Qualified according to AEC-Q200 Lead-free tinned terminations	B59421A... B59641A... B59721A...
Overcurrent protectors		Rated current: 90 mA 70 mA 50 mA Rated resistance: 27 Ω 55 Ω 125 Ω Case size: 1210	Lead-free tinned terminations Short response time	B59606A0110A062 B59607A0120A062 B59707A0120A062
SAW components SMD				
Resonators	 	Insertion loss < 1.5 dB (typ.) Operating temperature range: -40 ... +125 °C Package sizes: 2 x 2.5 mm ² (DCC4B) 3 x 3 mm ² (DCC6E) 3 x 3 mm ² (DCC6G) Center frequencies/tolerances: 315.00 MHz \pm 25 kHz 315.00 MHz \pm 50 kHz 315.02 MHz \pm 25 kHz 315.04 MHz \pm 50 kHz 433.92 MHz \pm 25 kHz 433.92 MHz \pm 50 kHz 433.94 MHz \pm 25 kHz	Quartz substrate Patented passivation technologies for enhanced reliability Provides reliable fundamental mode quartz stabilization Frequency pre-offset to compensate frequency drift overtemperature Qualified according to AEC-Q200	B39321R1801B910 B39321R0961H110 B39321R0991H110 B39321R0993H110 B39321R0963H110 B39431R1900A310 B39431R0990H110 B39431R0992H110

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Characteristics				
Series		Technical data	Features	Ordering code/ type
SAW components				SMD
RF front-end filters		Usable bandwidth approx. 350 kHz Operating temperature range: -40 ... +125 °C Package sizes: 2 × 2.5 mm ² (DCC6F) 3 × 3 mm ² (DCC6E) Center frequencies: 315.00, 433.92, 868.30 MHz Usable bandwidths: 340, 360, 600 kHz	Quartz substrate, i.e. high frequency stability overtemperature, strong nearby rejection Patented passivation technologies for enhanced reliability Filter curve with steep skirts helps to avoid interference with adjacent radio frequencies, e.g. tetra systems Qualified according to AEC-Q200	B39321B3741H110 B39431B3743H110 B39871B3734H110 B39871B3744H110 B39321B3961B210 B39431B3960B210
Switching spark gaps				
FS08X-1JG FS08X-1JGS		Nominal breakdown voltage: 800, 850 V Breakdown voltage during lifetime (ionized mode): 680 ... 920 V 720 ... 980 V	Switching operations: up to 200000 ignitions Operating temperature: -40 ... +150 °C	B88069X3560T502 B88069X5980T502
FS08XJMSMD		Nominal breakdown voltage: 800 V Breakdown voltage during lifetime (ionized mode): 680 ... 920 V	Switching operations: up to 380000 ignitions Operating temperature: -40 ... +175 °C	B88069X4151T602
Transformers				
EHP 16 EHP 19		Power: 20 ... 40 W	High frequencies: up to 700 kHz High saturation currents: up to 30 A	B78343 B78345
EHR 15 EHR 16 EHR 18		Power: 20 ... 50 W	Low leakage inductance: 50 nH typ.	B78342 B78343 B78344
EP 6		V _{out} : 80 ... 140 V	High turns ratio: 1:20 typ. Insensitive against external fields	B78416
Varistors				
S07... AUTO (D1)		V _{DC} : 16 V V _{RMS} : 14 V C _{typ} : 2.3 nF I _{max} 8/20 μs: 250 A	High energy absorption, particularly in case of load dump Jump start strength Operating 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 μs: 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 μs: 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 μs: 2000 A		B72220S1...

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, EPCOS is 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 an EPCOS 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.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also reserve the right to **discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.

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 the current version of the “General Terms of Delivery for Products and Services in the Electrical Industry” published by the German Electrical and Electronics Industry Association (ZVEI)**.
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