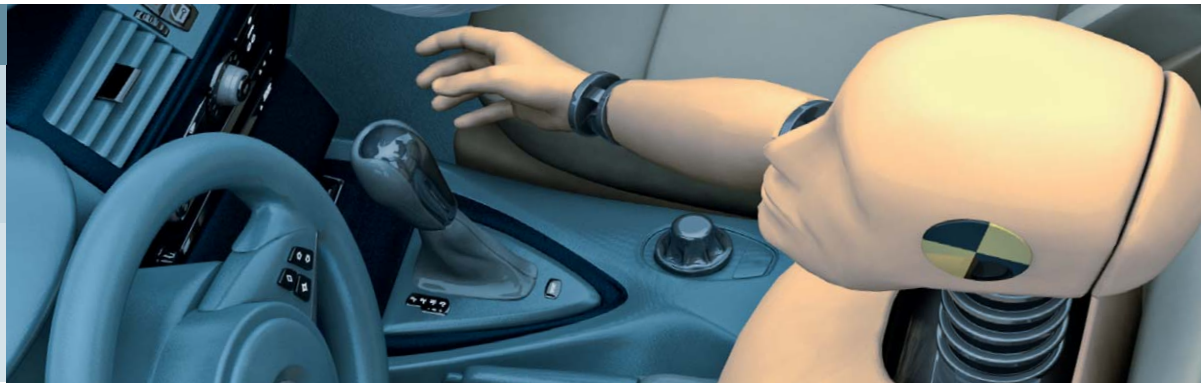
EPCOS

Application Guide 2008



Automotive

Electronic Components for Safety Applications

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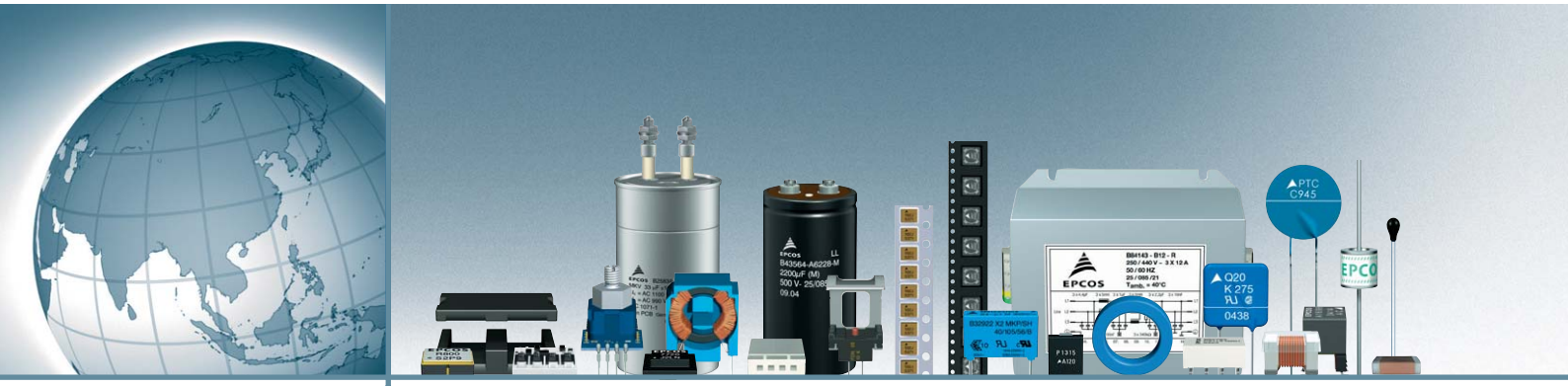
Welcome to the World of Electronic Components and Modules



EPCOS is a leading manufacturer of electronic components, modules and systems. Our broad portfolio includes capacitors, inductors and ferrites, EMC filters, sensors and sensor systems, nonlinear resistors, and arresters, as well as SAW and BAW components and RF modules. As an innovative technology-driven company, EPCOS focuses technologically demanding growth markets in the areas of information and communications technology, automotive, industrial, and consumer electronics. We offer our customers both standard components as well as application-specific solutions.

EPCOS has design, manufacturing and marketing facilities in Europe, Asia and the Americas. We are continuously strengthening our global research and development network by expanding R&D activities at our production locations, primarily in Eastern Europe, China and India. With our global presence we are able to provide our customers with local development and manufacturing know-how and support in the early phases of their projects.

EPCOS is continually improving its processes and thus the quality of its products and services. The Group is ISO/TS 16949 certified and remains committed to constantly reviewing and systematically improving its quality management system.

EPCOS Components for Safety Applications

EPCOS features one of the broadest product portfolios of electronic components for the demanding safety applications in vehicles, such as ABS, SRS, ESP, TPMS and many more. These products range from capacitors and inductors to a wide variety of components for EMC and overvoltage protection, 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 aluminum electrolytic capacitors that can achieve a useful life of more than 30,000 hours at an operating temperature of 105 °C.

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

EPCOS Components for Safety Applications

Special Features

Aluminum Electrolytic Capacitors

- Wide capacitance range
- High CV product
- Long useful life
- Compact design

Ferrites

- Recommended materials for automotive applications are N49, N87, N92, N95, N97
- CAN bus choke materials K1, K10
- Other materials suitable depending on transformer design
- Wide range of accessories for ferrites

Film Capacitors

- Long-term stability
- High reliability
- Suitable for high frequencies up to 130 kHz
- High pulse strength
- Temperatures up to +170 °C
- Various lead configurations

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 020C
- Qualified acc. to AEC-Q200

Multilayer Ceramic Capacitors Multilayer Serial Capacitors

- Long-term stability
- High ripple current capability
- Low ESR, low ESL
- Operating temperature –55 °C to +125 °C, X8R –55 °C to +150 °C
- Suitable for lead-free soldering
- Termination for glue mounting available
- Qualified acc. to AEC-Q200

NTC Thermistors

- Wide range of case sizes, resistances and tolerances
- Very good aging stability in high-temperature environments

PTC Thermistors

- Short response time
- Overcurrent protection
- Temperature management

EPCOS Components for Safety Applications

Special Features

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

- Suitable for lead-free soldering
- High power efficiency
- Material class from –40 °C to +150 °C

Varistors

Multilayer varistors

- Fast response time < 0.5 ns
- Operating temperature 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
- Ni-barrier termination for lead-free soldering acc. to IEC 60068-2-59 and acc. to JEDEC J-STD 020C
- Nickel-barrier series qualified acc. to AEC-Q200

Leaded disk varistors

- Operating temperature up to +125 °C (D1)
- Various crimp styles available

EPCOS Components for Safety Applications

Portfolio overview

	Airbag control unit	Braking system control unit (ABS/ESP)	Cruise control Distance radar control unit	Dashboard systems	Electronic wedge brake	HID lamps	Light module control unit	Tire pressure monitoring unit
Aluminum electrolytic capacitors								
Single-ended	●				●	●		
Ferrites								
E, EFD, ELP, ER, EQ cores		●		●	●	●		
Ring cores	●	●	●		●			
Double-aperture cores			●					
RM cores		●			●	●		
Film capacitors								
PCC µP						●		
MKT		●				●		
MKP								●
MKN						●		
Inductors								
Transponder coils								●
CAN-/FlexRay bus chokes	●	●	●	●	●	●	●	●
SIMID 0603	●	●	●	●		●	●	●
SIMID 1210 … 2220	●	●	●	●	●	●	●	
Power inductors	●	●		●	●	●	●	
E core chokes		●		●	●	●		
Multilayer ceramic capacitors								
Standard, Advanced and HighCV	●	●	●	●	●	●	●	●
MLSC	●	●	●	●	●	●	●	●
Hybrid		●				●		
Arrays	●	●	●	●	●	●	●	●
Feedthrough	●	●	●	●	●	●	●	●
NTC thermistors								
V*	●	●	●	●	●	●	●	●
PTC thermistors								
Temperature chip sensors							●	●
Overcurrent protectors	●							
SAW components								
Filters, resonators								●
Switching spark gaps								
Axial-lead, SMD						●		
Transformers								
EHP		●		●		●		
Varistors								
Standard / LC[1]	●	●		●			●	●
HS[2]		●	●	●	●		●	●
HT[3]		●						
CC[4]	●	●		●			●	●
AUTO		●				●		
Leaded disk	●	●	●	●	●		●	●

[1] Low capacitance [2] High speed [3] High temperature [4] Controlled capacitance

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics

Series		Technical data	Features	Ordering code / Type
Aluminum electrolytic capacitors				
Single-ended		Low voltage V_R: 6.3 … 100 V DC C_R: 0.1 … 10000 µF Low voltage V_R: 25 … 50 V DC C_R: 470 … 6800 µF up to 10000 µF upon request	Different lead configurations available, e.g. J lead, crimped lead, bent 90° lead Low ESR For rugged charging and discharging conditions Shelf life up to 15 years	B41851 B41853
Ferrites				
E cores		Material: N27, N30, N41, N45, N72, N87, T38, T46 A_L: 69 ... 9700 nH	E cores are available in a wide variety of sizes E cores are supplied in single units	E5 ... E80
EFD cores		Material: N27, N49, N87, N97 A_L: 100 ... 2150 nH		EFD10 ... EFD30
ELP cores		Material: N49, N87, N92, N97 A_L: 800 ... 12500 nH		ELP14 ... ELP64
ER cores		Material: N27, N49, N72, N87, N92, N97, T38 A_L: 125 ... 6400 nH		ER9.5 ... ER54
EQ cores		Material: N49, N87, N92, N97 A_L: 1320 ... 4800 nH		EQ13 ... EQ30
Ring cores		Material: K10, N30, T35, T37, T38, T46, T57, T65 A_L: 70 ... 21300 nH	Ring cores are primarily used as EMC chokes for suppressing RF interfences	R2.5 ... R202
Double-aperture cores		Material: K1, M13, N30 A_L: 42 ... 10000 nH	For BALUN transformers and frequency diplexers	B62152
RM cores		Material: K1, M33, N30, N41, N45, N48, N49, N87, N97, T35, T38, T66, A_L: 16 ... 16000 nH	RM cores are ideal for low-loss, highly stable filter coils Sizes are specified acc. to IEC 60431 RM cores are supplied in sets	RM4 ... RM14
SMD		Material: N49, N87, N92, T38 A_L: 950 ... 11500 nH	Low-profile cores are acc. to IEC 61860 Low-profile cores are supplied in sets	RM4LP ... RM14LP

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics

Series		Technical data	Features	Ordering code / Type
Film capacitors				
PCC µP SMD		V_R: 250 … 400 V DC C_R: 220 nF … 2.2 µF	High pulse strength Compact design Tested acc. to AEC-Q200	B3255 … Upon request
MKT		V_R: 250 … 400 V DC C_R: 220 nF … 2.2 µF	High pulse strength	B32522 B32523
		V_R: 63 … 400 V DC C_R: 1 nF … 4.7 µF	High pulse strength of +150 °C for 500 h at 0.2 · V_R	B32520 B32521 B32529
MKP		V_R: 250 … 1000 V DC C_R: 1.5 … 100 nF	High reliability Suitable for high frequencies up to 130 kHz	B32620 B32621
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	B32861 B32862
Inductors				SMD
Transponder coils		L_R: 1 … 7 mH Temperature range –40 ... +125 °C	Special molded part for high mechanical strength Low insertion height of only 2.4 mm Optimized for operating frequencies in the range of 125 kHz High sensitivity Qualified acc. to AEC-Q200	B82450A …
CAN-/FlexRay bus chokes	 	L_R: 5 µH … 4.7 mH I_R: up to 1.2 A	Miniaturized types B82789 and B82799 in size 1812 Bifilar and sector winding Temperature up to +150 °C For reflow soldering and gluing	B82789C0/S0 … B82790C0/S0 … B82793C0/S0 … B82799C0/S0 …
SIMID 0603		L_R: 1.0 … 220 nH I_R: up to 1.8 A	Laser-cut technology Narrow L tolerances High resonant frequency Temperature –55 ... +125 °C	B82496C …
SIMID 1210 … 2220		L_R: 8.2 nH … 10 mH I_R: up to 2.5 A	Laser-welded, molded Temperature up to +150 °C	B82422 B82432 B82442

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics

Series		Technical data	Features	Ordering code / Type
Inductors				SMD
Power inductors		L_R: 0.82 … 1000 µH I_R: up to 11 A	Shielded and unshielded versions Low DC resistance Temperature up to +150 °C	B82462 B82464 B8247 …
E core chokes		L_R: 0.1 … 1000 µH I_R: up to 80 A	High saturation current High frequencies Low DC resistance High ripple currents Low losses	B78336 B78337 B78343 B78345 Upon request

Characteristics

Series		Ceramic	Size	Technical data	Features	Ordering code / Type
Multilayer ceramic capacitors, Multilayer serial capacitors (MLSC)						SMD
Standard, Advanced and HighCV		X7R	0603 … 1206	V_R: 16 … 50 V DC C_R: 220 pF … 2.2 µF	Qualified acc. to AEC-Q200	B37931 B37941 B37872
		C0G	0402 … 1206	V_R: 50 … 100 V DC C_R: 1 pF … 5.6 nF		B37920 B37930 B37940 B37871
MLSC		X7R	0603	V_R: 50 V DC C_R: 1 … 10 nF	High functional reliability with savings in placement cost, due to the integrated serial connection of two capacitors in one component Qualified acc. to AEC-Q200	B37931
		X7R	0805	V_R: 50 … 100 V DC C_R: 10 … 220 nF		B37941
Hybrid[1]		X7R	0603 … 1206	V_R: 25 … 100 V DC C_R: 1 … 100 nF	Termination suitable for glue mounting Qualified acc. to AEC-Q200	B37931J … B37941J … B37872J …
		X8R	0603 … 1206	V_R: 50 V DC C_R: 100 pF … 100 nF		B37540 B37541 B37472
		C0G	0402 … 1206	V_R: 50 … 100 V DC C_R: 1 pF … 5.6 nF		B37920J … B37930J … B37940J … B37871J …
Arrays		X7R	0405/0508/0612 2-fold, 4-fold	V_R: 16 … 50 V DC C_R: 1 … 22 nF	Space-saving EMI protection Qualified acc. to AEC-Q200	B37831R … B37941R … B37872R …
		C0G	0405/0508/0612 2-fold, 4-fold	V_R: 25 … 50 V DC C_R: 10 pF … 1 nF		B37830R … B37940R … B37871R …
Feedthrough		X7R	1206	V_R: 50 V DC C_R: 2.2 … 10 nF	Outstanding performance for signal filtering and EMI suppression up to the GHz frequency spectrum Qualified acc. to AEC-Q200	B37872U …

[1] With silver-palladium terminations for conductive adhesion

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics

Series		Technical data	Features	Ordering code / Type
NTC thermistors				SMD
V2 V3 V4		Temperature range –55 … +125 °C (+150 °C) Rated resistance at 25 °C 47 Ω … 470 kΩ Resistance tolerance ±3%, ±5%; ±1% on request Case sizes 0402/0603/0805	Wide range of resistances and tolerances Multilayer SMD NTC with inner electrodes Very good long-term aging stability in high-temperature environment Very good resistance stability during soldering (change < 1%) Range of automotive series acc. to AEC-Q200-Rev. C	B572**V ... B573**V ... B574**V ...
PTC thermistors				SMD
Temperature chip sensors A601		Sensing temperature 75 … 135 °C in steps of 10 °C Rated resistance 470 Ω	EIA 0603 Lead-free tinned terminations Temperature tolerance ±5 °C	B59601A0075A062 B59601A0085A062 B59601A0095A062 B59601A0105A062 B59601A0115A062 B59601A0125A062 B59601A0135A062
Overcurrent protectors A606 A607 A707		Rated current: 90 mA 70 mA 50 mA Rated resistance: 27 Ω 55 Ω 125 Ω	EIA 1210 Lead-free tinned terminations Short response time	B59606A0110A062 B59607A0120A062 B59707A0120A062
SAW components				SMD
Frontend filters		Useable bandwidth approx. 360 kHz Operating temperature –40 … +125 °C Package 3 x 3 mm² (DCC6E)	Quartz substrate ELPAS passivation for particle protection and against aging Improved shock and vibration strength thanks to stress-free cold seam-welding of the metal lid Filter curve with steep skirts avoids interference with adjacent radio frequencies e.g. Tetra systems Qualified acc. to AEC-Q200	B39321B3731H110 B39431B3732H110 B39431B3736H110 B39871B3734H110
Resonators		Center frequency tolerance ±50 kHz Insertion loss < 1.5 dB (typ.) Operating temperature –40 … +125 °C Package 3 x 3 mm² (DCC6E)	Quartz substrate ELPAS passivation for particle protection and against aging Improved shock and vibration strength thanks to stress-free cold seam-welding of the metal lid Provides reliable fundamental-mode quartz stabilization Frequency pre-offset to compensate frequency drift over temperature Qualified acc. to AEC-Q200	B39321R0961H110 B39321R0963H110 B39431R0960H110 B39431R0962H110

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics				
Series		**Technical data**	**Features**	**Ordering code / Type**
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 Operating temperature –40 … +150 °C	B88069X3560T502 B88069X5980T502
FS08XJMSMD SMD		Nominal breakdown voltage 800 V Breakdown voltage during lifetime (ionized mode) 680 … 920 V	Switching operations up to 380000 Operating temperature –40 … +175 °C	B88069X4151T602
Transformers				SMD
EHP16		Power: 20 … 35 W Dimensions l x w x h (mm): 23 x 16 x 11	High frequencies up to 700 kHz High saturation currents up to 30 A Low leakage inductance, typical 50 nH	B78343 Upon request
EHP19		Power: 35 … 50 W Dimensions l x w x h (mm): 25 x 20.5 x 12		B78345 Upon request

Please read *Important notes* on page 13.

EPCOS Components for Safety Applications

Characteristics

Series		Technical data	Features	Ordering code / Type
Varistors				SMD
Standard / LC		V_R: 22 … 31 V DC V_{RMS}: 17 … 25 V AC C_R: 50 … 100 pF	Highly stable ESD protection Very low inductance Very good solderability in reflow processes	B72500T0 … B72500T2 … B72510T2 …
HS		V_R: 16 … 32 V DC V_{RMS}: 14 … 25 V AC C_R: 3 … 30 pF	Low capacitance values to avoid signal distortion at high-speed data rates	B72500T8 … B72590T8 …
HT		V_R: 16 … 31 V DC V_{RMS}: 14 … 25 V AC C_R: 32 … 120 pF	High performance at temperatures up to +150 °C	B72500H … B72510H … B72530H …
CC		V_R: 22 … 31 V DC V_{RMS}: 17 … 25 V AC C_R 1500 pF: C (1 MHz); ±20 % $\Delta C_{R\%}$ = 20%, 30%, etc.	Application-specific capacitance tolerances Nickel-barrier series qualified acc. to AEC-Q200	B72500T5 … B72510T5 …
AUTO		V_R: 16 … 34 V DC V_{RMS}: 14 … 30 V AC Load Dump W_{LD}: 0.3 … 25 J	Very good load dump and/or jump start pulse protection capability	B72500T1 … B72510T1 … B72520T1 … B72530T1 … B72540V1 … B72540V3 … B72580V1 … B72580V3 …
S07K … AUTO (D1)		V_R: 16 V DC V_{RMS}: 14 V AC $C_{R\,typ.}$ (1 kHz): up to 2.3 nF	High energy absorption, particularly in case of load dump Jump start strength Operating temperature up to +125 °C (D1)	B72207S1 …
S10K … AUTO (D1)		V_R: 16 … 20 V DC V_{RMS}: 14 … 17 V AC $C_{R\,typ.}$ (1 kHz): up to 5.2 nF		B72210S1 …
S14K … AUTO (D1)		V_R: 16 … 34 V DC V_{RMS}: 14 … 30 V AC $C_{R\,typ.}$ (1 kHz): up to 10 nF		B72214S1 …
S20K … AUTO (D1)		V_R: 16 … 34 V DC V_{RMS}: 14 … 30 V AC $C_{R\,typ.}$ (1 kHz): up to 19 nF		B72220S1 …

Please read *Important notes* on page 13.

Important Notes

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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.
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