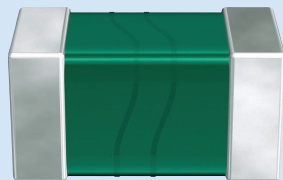
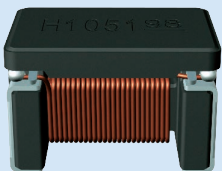


EPCOS Application Guide 2018

Automotive

Electronic Components for e-Mobility Applications



EPCOS Components for e-Mobility Applications



At the core of e-mobility are electric drives in both cars and other motorized vehicles such as electric bikes or scooters. The demands on the drive electronics is raising the requirements on the electronic components, modules and systems used. Its strong technology and product portfolio makes us a competent and innovative partner for manufacturers of hybrid and electric vehicles. We enable the development of technologically superior solutions, especially with our components for use in converters and in the powertrain.

We provide solutions based on EPCOS film capacitors for all applications designed to store electrical energy in the DC link circuit and for suppression of ripple voltages. Key components here are the power capacitor chips, or PCC™ that feature flexible dimensions and form factor as required by the respective application. We also offer a wide range of power inductors and transformers with rated powers of up to 3 kW for use in power conversion systems. As the electric motor dissipates no usable heat to warm the vehicles, EVs require supplementary heating units. Our EPCOS PTC heating elements are very well suited for this purpose and can be connected directly to the high-voltage battery.

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

EPCOS Components for e-Mobility Applications

Contents

Special features	4
Overview	6
Characteristics	8
Aluminum electrolytic capacitors	8
Ceramic transient voltage suppressors (CTVS)	8
EMC filters	8
Ferrites	8
Film capacitors (medium power)	9
High-voltage contactors (HVC)	11
Inductors	11
Power capacitors	13
Surge arresters	13
Thermistors NTC	13
Thermistors PTC	15
Transformers	16
Varistors	16
Important notes	18
Get in contact	19

EPCOS Components for e-Mobility Applications

Special Features



Power Capacitors

- Power capacitor chips (PCC) for DC link function
- High temperature capability (up to +125 °C)
- High peak and RMS current handling capability
- Long-term stability
- High pulse handling capability
- High overvoltage strength up to twice the rated voltage
- Very low inductance (max. 20 nH)
- Standard and customized designs

Surge Arresters

- Very high discharge current
- Excellent protection characteristics
- Stable performance over useful life
- Very high insulation resistance
- EN 61643-11 class III
- Built to automotive standard (ISO TS 16949)
- EHV series is UL 1449 graded

Thermistors NTC

Glass-encapsulated NTCs, leaded NTCs, temperature probes

- High measuring accuracy and long-term stability
- Short response time
- Temperature measurement up to +260 °C
- Heat resistant and highly stable
- Rugged design
- Compact dimensions
- Overmolded package
- Cable-bound or integrated connector versions
- Humidity resistant
- Customer-specific designs

Inrush current limiters

- Long-term stability
- No derating of steady state current necessary at 0 °C and +60 °C
- Usable in series connections up to 265 V RMS

SMD NTCs

- High accuracy ($\Delta R = \pm 1\%$)
- Qualified acc. to AEC-Q200

Thermistors PTC

- Limit temperature sensors qualified acc. to AEC-Q200
- Inrush current limiters (self-protecting resistors)
- Heating elements

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
- Intrinsically safe ThermoFuse varistors
- Qualified acc. to AEC-Q200

EPCOS Components for e-Mobility Applications

Overview											
	Battery disconnect unit (BDU)	Battery management systems	Boost converters	Car and battery climatization	Charging piles	DC/DC converters	Electrical motors	Lithium ion battery – cell management	Motor inverters	On-board chargers	Wall chargers
Aluminum electrolytic capacitors											
Axial-lead, soldering star			•			•			•		
Large-size										•	•
Ceramic transient voltage suppressors (CTVS)											
Automotive series		•				•		•		•	
EMC filters											
EMC input filters				•		•			•	•	
Ferrites											
E, ELP cores		•	•			•		•		•	•
PM, PQ cores		•	•			•		•		•	•
Quader cores			•		•	•					
Ring cores						•			•		
RM, RM LP cores		•	•			•		•		•	•
Film capacitors (medium power)											
MMKP						•			•	•	•
MKP			•	•		•			•	•	•
MKT			•	•		•	•		•	•	•
X1 MKP, Y1 MKP			•	•		•	•		•	•	•
X2 MKP, Y2 MKP			•	•		•	•		•	•	•
High-voltage contactors (HVC)											
HVC200, HVC300, HVC500	•	•			•						
Inductors											
CAN-/ FlexRay bus chokes		•		•		•		•	•	•	
Power inductors		•		•	•	•				•	•
SIMID 0603 ... 2220		•		•		•					
Powerline chokes, common-mode (ring core)					•						

EPCOS Components for e-Mobility Applications

Overview											
	Battery disconnect unit (BDU)	Battery management systems	Boost converters	Car and battery climatization	Charging piles	DC/DC converters	Electrical motors	Lithium ion battery – cell management	Motor inverters	On-board chargers	Wall chargers
Power capacitors											
Power capacitor chips (PCC LP)						•			•	•	
Surge arresters											
EHV series										•	•
Thermistors NTC											
Glass-encapsulated NTCs		•	•	•		•		•	•	•	•
Inrush current limiters										•	•
Leaded NTCs		•	•	•		•		•	•	•	•
SMD NTCs		•	•	•	•	•	•	•	•	•	•
Temperature probes		•	•	•		•	•	•	•	•	•
Thermistors PTC											
Inrush current limiters		•	•			•			•	•	•
SMD PTCs		•				•		•			
Heating elements				•							
Transformers											
Current-sense transformers		•			•	•			•	•	
Boost chokes for 48 V						•					
Power chokes					•	•				•	
Power transformers						•				•	
Varistors											
ThermoFuse T14, T20, ETFV25					•						•
EnergetiQ series Q14, Q20					•						•
Leaded disk varistors S14, S20										•	•
Non flammable varistors SNF14										•	
CU varistors			•			•				•	
Strap varistors, LS40 ... LS41					•						

EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Aluminum electrolytic capacitors				
Axial-lead, soldering star		V_R : 25 ... 250 V DC	High vibration resistance design up to 60 g, available upon request Very low ESR Low thermal resistance High ripple current (29 A/10 kHz/+125 °C) Shelf life up to 15 years Long useful life, 10000 h/+125 °C	B41689/B41789
		C_R : 47 ... 10000 μ F		B41690/B41790
		48 V board net applications: B41692 B41689		B41691/B41791
				B41692/B41792
				B41693/B41793 B43693/B43793
Large-size		V_R : 450 V DC C_R : 120 ... 680 μ F	Compact can size (25 x 30 ... 35 x 55 mm) Different terminal configurations available, e.g. 3 terminals (4.5 mm) High vibration resistance design, available upon request	B43508
Ceramic transient voltage suppressors (CTVS)				SMD
Automotive series		Temperature range up to +150 °C	ESD protection up to 30 kV Low leakage current Controlled capacitance for additional EMI filtering Qualified acc. to AEC-Q200 Protection against transients acc. to ISO 7637-2 Jump-start and load-dump capability	B725**E...
		V_R : 15 ... 34 V DC		B725**G...
		C_R : 10 pF ... 10 μ F		
		V_{RMS} : 14 ... 30 V AC		
		W_{LD} : 1 ... 25 J Case sizes: 0402 ... 2220		
EMC filters				
EMC input filters for high voltage DC bus		V_R : 600, 900 V DC I_R : 150, 350 A	High insertion loss across large bandwidth Standard and customized designs	P100316
Ferrites				
E cores SMD		Material: N27, N30, N49, N87, N95, N97, PC200 A_L : 30 ... 13000 nH	E and ELP cores are available in a wide variety of sizes E and ELP cores are supplied in single units	E 5 ... E 100
ELP cores ELP + I cores		Material: N49, N87, N92, N95, N97, PC200 A_L : 100 ... 15500 nH		ELP 14 ... ELP 102 I 14 ... I 102











EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Ferrites				
PM cores		Material: N27, N87, N97 A_L : 100 ... 16000 nH	PM cores are suitable for high-power transformers and energy storage chokes PM cores are supplied in sets	PM 50 .. PM 114
PQ cores		Material: N49, N87, N95, N97, PC200 A_L : 100 ... 9400 nH	PQ cores are a preferred shape for power conversion PQ cores are supplied in sets	PQ 16 ... PQ 50
Quader cores		Material: K1, N27, N87, N92, N95, N97, PC200	Quader cores can be used for contact-less power transfer applications	B67410
Ring cores		Material: K1, K10, N27, N30, N87, PC200, 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, N95, N97, PC200, T35, T38 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	RM 4 ... RM 14
RM cores Low-profile		Material: N49, N87, N95, PC200 A_L : 40 ... 11500 nH	Low-profile RM cores are specified acc. to IEC 61860 Low-profile RM cores are supplied in sets	RM 4 LP ... RM 14 LP
Film capacitors (medium power)				
MMKP		V_R : 400 ... 2000 V DC V_{RMS} : 250 ... 500 V AC C_R : 2.2 ... 560 μ F	Electronic ballasts (resonant circuits) LLC typology in resonant circuits High frequency applications with high current stress Switched-mode power supply	B32641B ... B32643B
MKP		V_R : 300 ... 875 V DC C_R : 0.47 ... 12 μ F	DC link Overvoltage capability High reliability Long useful life	B32674 ... B32678







EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Film capacitors (medium power)				
MKP		V_R : 160 ... 700 V AC 250 ... 2000 V DC C_R : 1 nF ... 40 μ F	High pulse strength High contact reliability Very low inductance	B32651 ... B32658
				
		V_R : 630 ... 840 V DC C_R : 1 ... 50 μ F	DC link Overvoltage capability High reliability Operating temperature +125 °C	B32774P ... B32778P
		V_R : 200 ... 900 V AC 400 ... 2000 V DC C_R : 1 nF ... 1 μ F	Very high AC voltages for all frequency ranges Very small dimensions High pulse withstand capability	B32671L ... B32672L
		V_R : 160 ... 200 V AC 450 ... 630 V DC C_R : 68 nF ... 2.2 μ F	Operating temperature +125 °C PFC (Power Factor Correction) Very high ripple and peak current	B32671P ... B32673P
		V_R : 220 ... 310 V AC 450 ... 630 V DC C_R : 10 nF ... 2.2 μ F	Operating temperature +125 °C PFC (Power Factor Correction) Very high ripple and peak current	B32671Z ... B32673Z
		V_R : 450 ... 1100 V DC C_R : 1.5 nF ... 120 μ F	DC link Severe ambient conditions High reliability	B32774H ... B32778H
		V_R : 450 ... 800 V AC 850 ... 2000 V DC C_R : 68 nF ... 5.6 μ F	IGBT/snubbing High pulse strength and high contact reliability Very low inductance	B32656S ... B32658S
		V_R : 250 ... 310 V AC C_R : 1 ... 70 μ F	Output AC filtering for power converters, motor drives Optimized AC voltage performance High ripple current/frequency handling capability	B32754 ... B32758
	MKT		V_R : 32 ... 200 V AC 50 ... 400 V DC C_R : 1 nF ... 220 μ F	Operating temperature +125 °C High pulse strength High contact reliability

EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Film capacitors (medium power)				
X1 MKP		V_R : 530 V AC C_R : 4.7 nF ... 1.0 μ F	Across-the-line applications Severe ambient conditions	B32912 ... B32916
Y1 MKP		V_R : 500 V AC C_R : 1 ... 10 nF	Line-to-ground applications High voltage capability	B81123
X2 MKP		V_R : 305 V AC C_R : 47 nF ... 2.2 μ F	For connection in series with the mains High stability of capacitance value Severe ambient conditions	B32932A/B ... B32936A/B
		V_R : 305 V AC C_R : 100 nF ... 15 μ F	Across-the-line applications High stability of capacitance value Severe ambient conditions	B32922H/J ... B32926H/J
Y2 MKP		V_R : 350 V AC C_R : 470 nF ... 10 μ F	Internal series construction "E-meters", "In-series" with mains Across-the-line applications +85 °C/85%RH at 330 V AC, 1000 h	B32924A/B4 ... B32926A/B4
		V_R : 350 V AC C_R : 4.7 nF ... 1.2 μ F	Line-to-ground applications Severe ambient conditions Small dimensions +85 °C/85%RH at 350 V AC, 1000 h	B32032 ... B32036
High-voltage contactors (HVC)				
HVC200 HVC300 HVC500		Maximum operating voltage up to 900 V DC Continuous operating current up to 500 A 1 million nominal switching Contact stuck detection available	Bipolar design Gas-filled and hermetically sealed No EMI, no inrush current phase at start-up UL 60947-4-1	B88269X...
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...






EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Inductors				
Power inductors SMD		L_R : 0.82 ... 1000 μ H I_R : up to 12.5 A Case sizes: 6 x 6 ... 12 x 12 mm	Shielded and unshielded versions Low DC resistance Temperature up to +150 °C Qualified acc. to AEC-Q200	B82462A... B82462G... B82464A... B82464G... B82464P... B82472P... B82473M... B82475M... B82477P...
SIMID 0603-C SMD		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-F3 SMD		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...
SIMID 1210-H SMD		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 SMD		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 SMD		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
Ring core chokes, double, common mode		L_R : 0.19 ... 7.8 mH I_R : 5.4 ... 56 A V_R : 250 ... 600 V AC 250 ... 1000 V DC (DC link)	High resonance frequency owing to special winding technique Approx. 1% stray inductance for symmetrical interference suppression Higher current chokes on baseplate, winding wire serves as solder terminal UL insulation system class 155(F) for open chokes UL and VDE approval for types in plastic case	B8272...


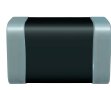




EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Inductors				
Ring core chokes, triple/common mode		L_R : 0.35 ... 6.2 mH I_R : 8 ... 62 A	High power handling UL insulation system class 155(F)	B8274... B8276...
Power capacitors				
Power capacitor chips (PCC LP)		V_R : 100 ... 1000 V DC C_R : 100 ... 3000 μ F Temperature range: -40 ... +105 °C Short time operation: max. +125 °C	Volume fill factor of nearly 1 Low inductance (max. 20 nH) Long useful life (approx. 10000 h) Standard and customized designs Available in flat winding and stacked winding technology	B25655J... B25655M... B25655P... B25655W...
Surge arresters				
EHV		DC breakdown voltage: 2500, 3000, 3600 4000, 4500 V Max. discharge current 8/20 μ s: 5 kA	High discharge current and isolation resistance High voltage types available Application in series with MOV Small size Wide range of lead configurations	B88069X2733... B88069X2553... B88069X3003... B88069X2563... B88069X2573...
Thermistors NTC				
Glass-encapsulated NTCs G1541 G1551 G1561		Temperature range: -55 ... +260 °C (G1541: +250 °C) Rated resistance at +25 °C: 2 ... 100 k Ω Resistance tolerance: \pm 1 ... \pm 3% Insulation resistance: > 100 M Ω 500 V DC (1 s)	High-temperature resistant Insulated wires with high insulation voltage Non-standard wire configurations	B57541G1... B57551G1... B57561G1...
Inrush current limiters S364		Rated resistance at 25 °C: 1 ... 10 Ω I_{max} : up to 16 A V_{RMS} : 265 V	Limiting of inrush current Taped versions for automatic processing UL approval (E69802) High accuracy and easy mounting Lead spacing 5 and 7.5 mm	B57***S***M...







EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Thermistors NTC				
Leaded NTCs S86* S87* S88*		Temperature range: -55 ... +155 °C Rated resistance at +25 °C: 2 ... 100 kΩ Resistance tolerance: ±1 ... ±5%	Nonstandard lead configurations Taped versions for automatic processing Lead spacing 2.5 and 5.0 mm (S87*, S88*) UL approval (S86*)	B5786*S... B5787*S... B5788*S... B579**S...
SMD NTCs SMD		Temperature range: -40 ... +150 °C Rated resistance at 25 °C: 4.7 ... 100 kΩ Case sizes: 0402, 0603, 0805 Resistance tolerance: ±1, ±3, ±5% B-tolerance: ±1, ±3%	Operating temperatures up to +150 °C High accuracy (ΔR = ±1%) Qualified acc. to AEC-Q200	B57***V5...
Temperature probes Outside temperature sensor		Temperature range: -40 ... +85 °C IP6K6, 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	Upon request
Motor temperature sensor		Temperature range: -40 ... +200 °C	Humidity resistant: 500 h test at +40 °C with 93% humidity Thermal cycling: 1000 cycles without voltage Cable-based design	Upon request
Battery fluid sensor		Temperature range: -40 ... +100 °C	Response time: < 20 s in oil Thermal cycling: 21 days without voltage Design allows direct detection of battery fluid Cable based design	Upon request
Screw-on battery sensor		Temperature range: -40 ... +100 °C	Response time: < 20 s in silicone oil Thermal cycling: 240 h with applied voltage Humidity resistance Screw design for fast and reliable mounting Cable based design	Upon request

EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Thermistors NTC				
Clip-on battery sensor		Temperature range: -40 ... +100 °C	Thermal cycling: 240 h with applied voltage 2 hours on/off Response time: < 20 s in water Cable-based design Clip design for fast and reliable mounting at different pipe diameters	Upon request
Busbar temperature sensor		Temperature range: -40 ... +150 °C Short term overload (6 h over lifetime): +200 °C HV insulation acc. LV123 Class H3 Wire acc. LV112-4 (0.13 mm ² CuMg alloy with reduced weight)	Insulation strength: 1000 V DC, R _{iso} > 1 GΩ Voltage strength: 2500 V DC, 60 sec Response time: < 10 s in water	Upon request
Thermistors PTC				
Inrush current limiters (self-protecting resistors)		R _R : 56 Ω, V _{link,max} : 620 V	Small size Self-protecting Customer-specific solutions available	B59451C1130B070
		R _R : 120 Ω, V _{link,max} : 800 V		B59412C1130B070
Inrush current limiters, phenolic resin and PBT plastic case		Max. DC link voltage: 400 ... 800 V DC Rated resistance: 22 ... 100 Ω Operating cycles: 100000	Inrush current limiters are not damaged when directly connected to V _{max} even without additional current limitation	B59213J0130A020 B59215J0130A020 B59217J0130A020 B59219J0130A020
SMD PTCs SMD		V _{max} : 32 V Rated resistance: 470 Ω (0402, 0603) 680 Ω (0805) Temperature tolerance: ±5 °C Case sizes: 0402, 0603, 0805	Qualified acc. to AEC-Q200 UL approval Fast and reliable response	B59721A... B59641A... B59421A...
Heating elements		Max. operating voltage: 30 V DC Reference temperature: +80 ... +120 °C	Silver metallization Other voltage ratings, reference temperatures and geometries upon request	B59060A0...
		Max. operating voltage: 20 V DC Reference temperature: +80 ... +120 °C	Low curvature < 0.05 mm Silver metallization Other voltage ratings, reference temperatures and geometries upon request	B59041R0...




EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Transformers				
Current-sense transformers (CTEM series): EP7, EP10 SMD		I_{sense} : up to 30 A _{RMS}	Basic isolation HV Typ test 2800 V DC	B78417
		Turns ratio: 1:50 ... 1:180		B78419
Boost chokes for 48 V (BCEM series) SMD		I_{sat} : 22 ... 75 A	High rated current, low DC resistance	B78...
		L_R : 3.5 ... 15 µH		
Power chokes (PCEM series): ER51/58/62 SMD		L_R : 1 ... 3 µH	Basic isolation Low DC resistance	B78...
		I_R : up to 210 A		
Power transformers (PTEM series): ER62		Power: 1800 ... 3000 W	Basic isolation Optimized cooling concept	B78...
		$V_{in,typ}$: 170 ... 450 V		
		$V_{out,typ}$: 12 ... 16 V		
Varistors				
ThermoFuse varistors T14 T20 ETFV25		I_{max} 8/20 µs: 6 kA	Disk varistor and fuse in one housing Space saving Monitoring option with 3 rd lead UL approval to UL 1449	B72214T...
		I_{max} 8/20 µs: 10 kA		B72220T...
		I_{max} 8/20 µs: 20 kA		B72225T...
EnergetiQ varistors Q14 Q20		I_{max} 8/20 µs: 8 kA	Maximum load capacity at minimum component Height miniaturization High surge current rating up to 15 kA	B72214Q...
		I_{max} 8/20 µs: 15 kA		B72220Q...
		V_{RMS} : 130 ... 460 V		

EPCOS Components for e-Mobility Applications



Characteristics				
Series		Technical data	Features	Ordering code/ type
Varistors				
Leaded disk varistors S14 S20		I_{max} 8/20 μ s: up to 6 kA	High surge current ratings up to 12 kA High energy ratings (2 ms) up to 440 J For high energy absorption	B72214S...
		I_{max} 8/20 μ s: up to 12 kA		B72220S...
Non flammable varistor SNF14		V_{RMS} : 11 ... 1100 V	IEC 60695-11-5 (needle flame test) Qualified acc. to AEC-Q200	B72214X...
		I_{max} 8/20 μ s: up to 6 kA		B72220X...
CU varistors SMD	 	I_{max} 8/20 μ s: up to 12 kA	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	B72650M...
		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		B72660M...
Strap varistors LS40		I_{max} 8/20 μ s: 40 kA	Operating voltage V_{RMS} 130 ... 750 V High surge current ratings up to 50 kA High energy ratings (2 ms) up to 1200 J Bent or straight terminals possible	B72240L...
LS41		I_{max} 8/20 μ s: 50 kA		B72241L...

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.

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.
5. 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)**.
6. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

Get in Contact

Europe

Austria

TDK Austria GesmbH
T +43 1 25 63 630 56 39
F +43 1 25 63 630 56 44
sales.austria@eu.tdk.com

Bulgaria, Greece, Macedonia

TDK Austria GesmbH
T +43 1 25 63 630 56 30
F +43 1 25 63 630 56 44
sales.csee@eu.tdk.com

Czech Republic

TDK Czech s.r.o.
T +420 2 33 03 22 81
F +420 2 33 03 22 89
sales.czech@eu.tdk.com

Finland, Estonia

TDK Nordic OY
T +358 10 34 90 108
sales.nordic@eu.tdk.com

France, Belgium, Luxembourg, Malta

TDK Electronics France SAS
T +33 1 49 46 67 89
F +33 1 49 46 67 67
sales.france@eu.tdk.com

Germany, Liechtenstein, Netherlands, Switzerland

TDK Europe GmbH
T (D) 0180 500 33 48
(0.14 Euro/min.)
(NL) +31 70 33 10 611
(CH) +49 89 54020 2691
F +49 89 54020 2913
sales.germany@eu.tdk.com

Hungary

TDK Electronics Hungary Ltd.
T +36 1 436 07 20
F +36 1 436 07 21
sales.hungary@eu.tdk.com

Italy

TDK Italy S.r.l.
T +39 02 50 99 54 25
F +39 02 50 99 54 55
sales.italy@eu.tdk.com

Poland, Latvia, Lithuania

TDK Polska Sp. z o.o.
T +48 22 24 60 409
F +48 22 24 60 400
sales.poland@eu.tdk.com

Portugal

TDK Electronics Spain S.L.U.
T +34 93 480 42 92
+34 93 480 42 68
F +34 93 480 42 31
sales.iberia@eu.tdk.com

Romania

TDK Austria GesmbH
T +43 1 25 63 630 56 30
F +43 1 25 63 630 56 44
sales.romania@eu.tdk.com

Russia, Belarus, Kazakhstan, Moldavia, Ukraine

TDK CIS LLC
T +7 495 663 21 00
+7 495 663 21 22
sales.cis@eu.tdk.com

Slovakia

TDK Austria GesmbH
T +43 1 25 63 630 56 30
F +43 1 25 63 630 56 44
sales.slovakia@eu.tdk.com

Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia

TDK Austria GesmbH
T +43 1 25 63 630 56 30
F +43 1 25 63 630 56 44
sales.slovenia@eu.tdk.com

Spain

TDK Electronics Spain S.L.U.
T +34 93 480 42 92
+34 93 480 43 33
F +34 91 514 70 14
sales.iberia@eu.tdk.com

Sweden, Iceland, Denmark, Norway

TDK Nordic AB
T +46 8 4 77 27 00
F +46 8 4 77 27 01
sales.nordic@eu.tdk.com

Turkey

TDK Europe GmbH
T +90 216 5 69 81 01
F +90 216 4 64 07 56
sales.turkey@eu.tdk.com

United Kingdom, Ireland

TDK UK Limited
T +44 13 44 38 15 10
F +44 13 44 38 15 12
sales.uk@eu.tdk.com

Asia

Afghanistan, Iran, Iraq, Jordan, Lebanon, Pakistan, Syria

TDK Europe GmbH
T +90 216 5 69 81 01
F +90 216 4 64 07 56
sales.turkey@eu.tdk.com

China

EPCOS (Shanghai) Ltd.
T +86 21 22 19 15 00
F +86 21 22 19 15 99
sales.cn@epcos.com

Hong Kong

EPCOS Limited
T +852 36 69 82 00
F +852 36 69 82 56
sales.cn@epcos.com

India, Bahrain, Bangladesh, Kuwait, Nepal, Oman, Qatar, Saudi Arabia, Sri Lanka, United Arab Emirates

EPCOS India Private Ltd.
T +91 120 45 05 801
F +91 120 45 05 818
sales.in@epcos.com

Israel

TDK Sales Representative
T +972 73 2676 317
sales.israel@eu.tdk.com

Japan

TDK Corporation
T +81 3 68 52 73 00
inquiry@jp.tdk.com

Malaysia

EPCOS RDC SDN. BHD.
T +60 6 79 98 168
F +60 6 79 98 162
sales.asean@epcos.com

Philippines

c/o TDK Electronics Philippines Corporation
T +63 49 541 31 41 66 30
+63 49 541 31 41 66 31
F +63 49 541 31 40
sales.asean@epcos.com

Singapore, Indonesia, Thailand, Vietnam

EPCOS COMPONENTS PTE. LTD.
T +65 65 97 06 28
F +65 65 97 06 07
sales.asean@epcos.com

Taiwan

EPCOS Taiwan Co. Ltd.
T +886 2 26 55 76 76
F +886 2 27 82 03 89
sales.tw@epcos.com

Americas

USA, Canada, Mexico

EPCOS Inc.
T +1 732 9 06 43 00
F +1 732 9 06 43 95
sales.usa@epcos.com

South America

EPCOS do Brasil Ltda.
T +55 11 32 89 95 99 Ext. 6851
F +55 11 32 89 99 40
sales.br@epcos.com

Australia

Australia, New Zealand

TDK Sales Representative
T +61 3 95 66 72 17
F +61 3 95 66 72 99
sales.au@epcos.com

Africa

Egypt

TDK Europe GmbH
T +90 216 5 69 81 01
F +90 216 4 64 07 56
sales.turkey@eu.tdk.com

Morocco, Tunisia

TDK Electronics France SAS
T +33 1 49 46 67 89
F +33 1 49 46 67 67
sales.france@eu.tdk.com

South Africa

TDK Sales Representative
T +27 11 458 90 00
+27 11 458 90 32
F +27 11 458 90 34
sales.southernafrica@epcos.com

