

Product Survey 2019

# Electronic Components, Modules and Systems





**TDK Technology  
Superior Solutions  
for a Smart World.**





# Contents





<b>Magnetics</b>		<b>4</b>	
• Transformers	4	• Signal EMC Filters	16
• Power Inductors	7	• Power EMC Filters, Reactors and Chokes	21
• Signal Use Inductors	12	• Ferrites	25
• Transponder Coils	14	• Noise Suppressing Sheets	28
• Multilayer Inductors	15		
<b>RF Components</b>		<b>29</b>	
• Multilayer and Thin-Film RF Components	29	• LTCC Substrates for LED	31
<b>Piezo and Protection Devices</b>		<b>32</b>	
• Piezo Haptic Actuators	32	• Inrush Current Limiters	42
• Piezo Actuators for Automotive	33	• Multilayer Varistors, Ceramic Transient Voltage Suppressors (CTVS)	42
• Piezo Receivers, Buzzers	33	• NTC Thermistors	44
• Surge Arresters, High Voltage Contactors (HVC)	34	• Nebulizer Units	44
• PTC Thermistors	37		
• Varistors	39		
<b>Micro Modules</b>		<b>45</b>	
• Bluetooth V4.1 Smart Single Mode Modules	45		
<b>Sensors</b>		<b>46</b>	
• Temperature Sensors (NTC)	46	• MEMS Microphones	56
• Linear Hall Sensors	50	• MEMS Inertial Sensors	61
• Multi-Axis Hall Sensors	52	• Motion Sensors	62
• Angle Sensors	54	• Pressure Sensors	65
• Hall Switches	54	• Humidity Sensors	67
• Embedded Motor Controllers	55	• Level Sensors	68
• Geartooth Sensors	56	• Surface Potential Sensors	68
• Ultrasonic Sensors	56		
<b>Ceramic Capacitors</b>		<b>69</b>	
• Multilayer Ceramic Chip Capacitors	69	• Ultra-High Voltage Ceramic Capacitors	72
• Leaded Multilayer Ceramic Chip Capacitors	71	• CeraLink Capacitors	72
• Leaded High Voltage Ceramic Chip Capacitors	71		
<b>Film Capacitors</b>		<b>73</b>	
• Medium Power Film Capacitors	73	• PFC Capacitors and Key Components for Power Quality Solutions	78
• AC Output/Input Filters	77	• Power Capacitors	81
• AC Film Capacitors	77		
<b>Aluminum Electrolytic Capacitors</b>		<b>83</b>	
<b>Electric Double Layer Capacitors</b>		<b>85</b>	
<b>Magnets</b>		<b>86</b>	
• Ferrite Magnets	86	• Rare Earth Magnets	87
<b>Wireless Charging</b>		<b>91</b>	
• Important Notes			93

# Magnetics

## Transformers

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Transformers				
				
<b>Series</b>	EP6 shielded – SMD	EHR – SMD	EP7 ... EP13 – SMD	ER11 – SMD
<b>Technical data</b>	Output voltage (typ.): 80 ... 140 V Size (l x w x h): 9 x 7.6 x 7.4 mm	Power: 20 ... 50 W	Size (l x w x h): EP7: 10 x 8.0 x 10.9 mm EP10: 12.6 x 14.4 x 13.6 mm EP13: 13.6 x 18.3 x 13.2 mm	Power: up to 1 W Size (l x w x h): 12 x 13 x 6 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– High turns ratio</li> <li>– Low leakage inductance</li> <li>– High frequencies</li> <li>– Insensitive to external fields</li> <li>– AEC-Q200 approved</li> </ul>	<ul style="list-style-type: none"> <li>– High saturation currents</li> <li>– Low leakage inductance</li> <li>– High frequencies</li> <li>– AEC-Q200 approved</li> </ul>	<ul style="list-style-type: none"> <li>– Low leakage inductance</li> <li>– Compact design</li> <li>– Supplementary/reinforced insulation levels</li> </ul>	<ul style="list-style-type: none"> <li>– Low stray inductance</li> <li>– High power density</li> <li>– High operating frequencies</li> </ul>
<b>Applications</b>	Park Distance Control units (PDC)	Xenon lights LED headlights Piezo fuel injection systems	Power supplies Power over Ethernet (PoE)	Power supplies DC/DC converters




Transformers				
				
<b>Series</b>	EF12.6 ... EF25	Current-sense transformers – SMD B82801	Current-sense transformers – SMD EP7 / EP10 CTEM series – SMD	Power chokes – PCEM series
<b>Technical data</b>	Power: up to 20 W Size (l x w x h): 15.5 x 14.5 x 12.5 ... 28.5 x 28.9 x 21 mm	Sensed current 7 ... 40 A Turns ratio: 1:20 ... 1:200	I <sub>sense</sub> : up to 30 A RMS Turns ratio: 1:50 ... 1:180	L <sub>R</sub> : 1 ... 3 µH I <sub>R</sub> : up to 210 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Pin Trough Hole (PTH)</li> <li>– High creepage distance</li> <li>– High dielectric strength</li> <li>– Types with 8 mm creepage and clearance distance available</li> </ul>	<ul style="list-style-type: none"> <li>– Three different sizes available</li> <li>– Very low DC resistance, losses and high reliability</li> <li>– Ruggedness and simple implementation</li> <li>– Customized designs</li> </ul>	<ul style="list-style-type: none"> <li>– Basic insulation</li> <li>– AEC-Q200 approved</li> </ul>	<ul style="list-style-type: none"> <li>– Basic insulation</li> <li>– Low DC resistance</li> <li>– AEC-Q200 approved</li> </ul>
<b>Applications</b>	Power supplies	Compact DC/DC converters for midrange power	Electric car applications (xEV) Switch-mode power supplies	Electric car applications (xEV)

# Magnetics

## Transformers

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Transformers			
			
<b>Series</b>	Power transformers PTEM series	Gate-drive transformers EP5 – SMD B82804	Push-pull transformers E6.3 – SMD B82805
<b>Technical data</b>	Power: 1800 ... 3000 W $V_{in, typ}$ : 240 ... 420 V $V_{out, typ}$ : 14 ... 18 V	Isolation voltage: 1500 V DC Height: max. 5.4 mm Footprint: max. 8.1 x 6.7 mm	– 5 off-the-shelf types with different transformation ratios – Typical voltage ratios of 5 to 5 V or 3.3 to 12 V – High voltage test: Np/Ns: V = 500 V AC – Typical switching frequency < 500 kHz
<b>Features</b>	– Basic insulation – Innovative cooling concept – AEC-Q200 approved	– Standard designs in small SMD package – Low leakage inductance – Low inter-winding capacitance – High SRF value – High isolation between primary and secondary	– Different turns ratios – Small SMD package – Center tap on primary and secondary windings
<b>Applications</b>	Electric car applications (xEV)	General purpose isolated AC/DC, DC/DC converters	Switch-mode power supplies Isolated interface power supplies Industrial automation Process control



Transformers			
			
<b>Series</b>	Flyback transformers – SMD B82802, B82806D ...	Flyback transformers ECO series	Resonant transformers SRX series
<b>Technical data</b>	Power: 12 ... 60 W Input voltage: 36 ... 72 V DC Frequency: 100 kHz Output voltage: 5, 12 or 3.3, 5, 12, 24 V Isolation voltage: 1500 V AC Suitable for ambient temperature: up to +85 °C Operating temperature: up to +125 °C	<u>Vertical type</u> Power: 12 ... 68 W Frequency: 50 kHz  <u>Horizontal type</u> Power: 5 ... 59 W Frequency: 50 ... 100 kHz Operating temp: –30 ... +120 °C	<u>Horizontal type</u> Power: 100 ... 300 W Frequency: 60, 80, 100 kHz Number of outputs: 2, 3
<b>Features</b>	– Low profile SMT packages – Industry standard footprints – Customized designs – B82806D: UL 1446 class 155 (F) EIS	– Pin terminal type (for multiple outputs) – Downsized – Compliant with worldwide safety standards – Supports automatic winding – Reduced characteristic variations – Halogen-free	– Pin terminal type (resonant type, through-hole) – Low height (15 ... 31.5 mm) – High power in compact dimensions – Supports automatic winding
<b>Applications</b>	DC/DC converters (isolated buck) Power over Ethernet (PoE)	Switching power supplies	Switching power supplies

# Magnetics

## Transformers

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Transformers			
			
<b>Series</b>	Resonant transformers SRV series	Flyback transformers SRW series	Choke coils PFC series
<b>Technical data</b>	Power: 160 ... 250 W Frequency: 100 kHz Number of outputs: 2	<u>For multiple outputs (vertical type)</u> Power: 51 ... 83 W Frequency: 50 ... 100 kHz Operating temp: -30 ... +120 °C  <u>For multiple outputs (horizontal type)</u> Power: 58 ... 72 W Frequency: 50 ... 100 kHz Operating temp: -30 ... +120 °C	Power: 75 ... 300 W Frequency: 50, 65 kHz Inductance: 150 ... 600 µH Rated peak current: 2.4 ... 11.1 A Turns ratio: 9.0 ... 10.8 Np/Npd Operating temp.: -30 ... +120 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Pin terminal type (resonant type, through-hole)</li> <li>- Low height (15 ... 16 mm)</li> <li>- High power in compact dimensions</li> <li>- Supports automatic winding</li> </ul>	<ul style="list-style-type: none"> <li>- Pin terminal type for multiple outputs</li> <li>- High B, low loss PC47 material</li> <li>- Adopts EGG cores developed for power transformers</li> <li>- Ideal for small, multiple output switching power supplies</li> <li>- Perfect balance between core volume</li> </ul>	<ul style="list-style-type: none"> <li>- Pin terminal type</li> <li>- Low height (15.5 ... 27 mm)</li> <li>- High current in compact dimensions</li> </ul>
<b>Applications</b>	Switching power supplies	Switching power supplies	General purpose isolated AC/DC, DC/DC converters



Transformers		
		
<b>Series</b>	Energy management system CCT series	Gate-drive transformers VGT series – SMD
<b>Technical data</b>	Size (IEC): 261631, 272440, 323047, 354571, 406393 Inner diameter: 6 ... 36 mm Operating temperature: -20 ... +60 °C Current transformation ratio: 3000:1 Maximum AC current: 30 ... 600 A Max. output current ±1%: 10 ... 200 mA Secondary winding resistance: 64 ... 492 Ω	Inductance: 10 µH ± 20% (100 kHz, 1 V) Leakage inductance: 0.2 µH max. (100 kHz, 1 V, NF, NS shorted) Withstanding voltage: NP, NF – NS: 2.6 kV RMS Operating temperature: -40 ... +130 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Clamp type for easy installation on existing power equipment</li> <li>- Accommodates automatic process from wire wrapping and winding to soldering, ensuring high quality and stable supply</li> <li>- Equipped with a built-in open-circuit protective device</li> </ul>	<ul style="list-style-type: none"> <li>- High flux density cores have been adopted to achieve miniaturization</li> <li>- Dielectric strength voltage is 2.6 kV</li> </ul>
<b>Applications</b>	Energy management systems (EMS) for buildings, factories, stores and communities (BEMS, FEMS, SEMS, CEMS)	IPM drive of motor inverters in automotive applications

# Magnetics

Transformers, Power Inductors

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Transformers	
	 
<b>Series</b>	Current-sense transformers VST series – SMD
<b>Technical data</b>	Inductance NS: 4.0 mH DC resistance: NP 0.5 max mΩ NS 3.2 ± 30% Rated current NP: 30 max A RMS Withstanding voltage: 2.0 kV RMS/1 min. Maximum ET constant: 120 V-μS Operating temperature: –40 ... +125 °C
<b>Features</b>	– High flux density cores have been adopted to achieve miniaturization – Maximum 30 A RMS can be measured
<b>Applications</b>	Switching current detection in on-board DC/DC converters and chargers in automotive applications
	Balun transformers – SMD ATB series  Size: 2012 ... 3225 DC resistance: 0.5 ... 1.0 Ω Rated current: 0.15 ... 0.28 A Withstanding voltage: 125 V Operating temperature: –40 ... +85 °C  – Small size – Stable charging characteristics – High reliability  TVs Mobile devices Set Top Boxes


Transformers	Power Inductors
	 
<b>Series</b>	Pulse transformers – SMD ALT series
<b>Technical data</b>	Size (IEC): 3232, 4532 Inductance (at 100 kHz/DC bias = 8 mA) 170 ... 200 μH min. Insertion loss (0.1 ... 100 MHz): 1.5 ... 2.5 db max. Interwinding stray capacitance (100 kHz): 35 pF max. Operating temperature: –40 ... +85 °C
<b>Features</b>	– Compatible with 10BASE-T, 100BASE-TX, and 1000BASE-T – High-quality product with automatic winding
<b>Applications</b>	LAN interface portion of devices like network devices, communication devices and digital home appliances
	Power inductors – SMD A and G versions B82471 ... B82479  Rated inductance: 1 ... 1000 μH Rated current: 0.18 ... 9.8 A Temperature: up to +125 °C Size: 6.1 x 5.6 ... 18.5 x 15.24 mm Height: 3.5 ... 8 mm  – Shielded and unshielded construction – High rated current – Low DC resistance – Suitable for lead-free reflow soldering  Filtering of supply voltages Coupling, decoupling DC/DC converters Consumer and industrial electronics

# Magnetics

## Power Inductors

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Power Inductors	
	
<b>Series</b>	Power inductors – SMD A and G versions B82462, B82464
<b>Technical data</b>	Rated inductance: 0.82 ... 1000 $\mu$ H Rated current: 0.11 ... 7.6 A Temperature: up to +150 °C Size: 6 x 6 and 10 x 10 mm Height: 3.0 ... 4.8 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Shielded and unshielded construction</li> <li>– High rated current</li> <li>– Low DC resistance</li> <li>– Qualified to AEC-Q200</li> <li>– Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D</li> </ul>
<b>Applications</b>	Filtering of supply voltages Coupling, decoupling DC/DC converters Automotive and industrial electronics

Power Inductors	
	
<b>Series</b>	ERU chokes – SMD Helically wound B82559
<b>Technical data</b>	Rated inductance: 0.5 ... 35 $\mu$ H Saturation current: 9.3 ... 71 A Size: 13.2 x 11, 17.3 x 18.7, 19.9 x 20.5, 22.3 x 22 and 25.3 x 23.5 mm Height: 4.95 ... 15 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Flat wire winding</li> <li>– Self-leaded construction under body termination</li> <li>– Very high rated current</li> <li>– Extremely low DC resistance</li> <li>– Suitable for pick-and-place process</li> <li>– Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D</li> </ul>
<b>Applications</b>	Energy storage chokes for DC/DC converters VRM modules POL converters





# Magnetics

## Power Inductors

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### Power Inductors

		
<b>Series</b>	Dual inductors – SMD B82464D6 ... B82477C ..., B82477D ...	General use – SMD SLF series
<b>Technical data</b>	Rated inductance: 2.0 ... 100 µH (inductance per winding) Rated current: 1.0 ... 7.05 A Temperature: up to +150 °C Size: 10 x 10 ... 12.5 x 12.5 mm Height: 6 ... 10.5 mm	Size (IEC): 6025 ... 12575 Inductance: 1.2 ... 150 µH Rated current: 0.13 ... 8.2 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Two windings</li> <li>– 1:1 transformer</li> <li>– Shielded construction</li> <li>– Special winding technology for low stray inductance</li> <li>– High coupling factor</li> <li>– Qualified to AEC-Q200</li> <li>– Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D</li> </ul>	<ul style="list-style-type: none"> <li>– Magnetic shield type wound inductor for power circuits</li> <li>– Product line up allows various usages</li> </ul>
<b>Applications</b>	SEPIC, CUK and flyback topologies DC/DC converters Automotive electronics LED lighting	Thin-screen TVs, LCDs, AV equipment, gaming equipment




### Power Inductors



		
<b>Series</b>	Automotive general use – SMD CLF-NI-D series	General use – SMD VLCF series
<b>Technical data</b>	Size (IEC): 6045, 7045, 10060, 12577 Inductance: 1 ... 470 µH Rated current: 280 mA ... 8.5 A Temperature: up to +150 °C	Size (IEC): 4018 ... 5028 Inductance: 1.2 ... 470 µH Rated current: 140 ... 2710 mA
<b>Features</b>	<ul style="list-style-type: none"> <li>– High rated DC current</li> <li>– High reliability with welding connection</li> <li>– Ferrite shielded component</li> </ul>	<ul style="list-style-type: none"> <li>– General use for portable DC/DC converter line</li> <li>– High magnetic shield construction</li> </ul>
<b>Applications</b>	Generic DC/DC converter lines in automotive applications	DC/DC converters for communications Consumer electronics PCs

# Magnetics

## Power Inductors

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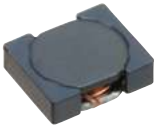
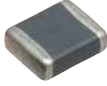
Power Inductors			
			
<b>Series</b>	General use – SMD SPM series	High current – SMD VLB series	Thin-Film – metal composite core technology – SMD TFM-GHM, TFM-ALM series
<b>Technical data</b>	Size (IEC): 3012 ... 12565 Inductance: 0.18 ... 10 $\mu$ H Rated current: 1.3 ... 46 A Temperature: -40 ... +125 °C	Size (IEC): 7050 ... 12065 Inductance: 90 ... 360 nH Rated current: 14 ... 68 A Temperature: -40 ... +125 °C	Size (IEC): 2016 Inductance: 0.47 ... 2.2 $\mu$ H Rated current: 1.9 ... 4.5 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– High power handling capability: Small copper loss</li> <li>– Using large saturation induction of Fe-based metals</li> <li>– High curie temperature of about +550 °C means low inductance temperature variance</li> </ul>	<ul style="list-style-type: none"> <li>– High output processing capacity: Minimal copper loss</li> <li>– High saturation current and low DC resistance</li> <li>– High operating frequency up to 2 MHz</li> </ul>	<ul style="list-style-type: none"> <li>– Low height of 1.0 mm</li> <li>– Superior DC-bias characteristics</li> <li>– Consists of original fine copper pattern with micro-processing technology</li> <li>– Coil pattern coated with metal magnetic material</li> </ul>
<b>Applications</b>	Mobile communications, consumer electronics, servers, VRM	Servers Notebooks PCs VRMs VRDs	Generic use for DC/DC converter of mobile communication devices



Power Inductors			
			
<b>Series</b>	Thin-Film – metal composite core technology – SMD TFM-ALMA	Semi-shielded – SMD VLS-EX, VLS-E series	Low profile, shielded – SMD VLS-CX series
<b>Technical data</b>	Size (IEC): 2016 ... 2520 Inductance: 0.47 ... 2.2 $\mu$ H Rated current: 1.9 ... 3.9 A Temperature: -40 °C ... +150 °C	Size (IEC): 3010 ... 6045 Inductance: 1 ... 220 $\mu$ H Rated current: 0.31 ... 13.5 A	Size (IEC): 2016 ... 2520 Inductance: 0.24 ... 22 $\mu$ H Rated current: 0.38 ... 3.08 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Low height of 1.0 and 1.2 mm (size 2520 only)</li> <li>– AEC-Q200 qualified</li> <li>– Excellent DC-bias characteristics</li> <li>– Consists of original fine copper pattern with micro-processing technology</li> <li>– Coil pattern coated with metal magnetic material</li> </ul>	<ul style="list-style-type: none"> <li>– General use for portable DC/DC converter lines</li> </ul>	<ul style="list-style-type: none"> <li>– Magnetic shield type wound inductor for power circuits using ferrite magnetic material</li> <li>– High magnetic shield construction and compatible with high-density mounting</li> </ul>
<b>Applications</b>	Automotive (ECM, airbags, headlights, electronic power steering, ABS)	Mobile communications Consumer electronics Notebooks	Mobile communications Consumer electronics LCD displays HDDs

# Magnetics

## Power Inductors

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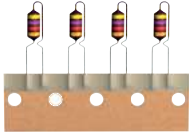
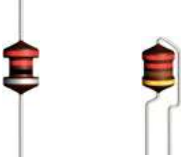

Power Inductors		
		
<b>Series</b>	Low profile – SMD VLF-MT series	Multilayer technology – SMD MLP series
<b>Technical data</b>	Size (IEC): 3025 ... 4032 Inductance: 0.47 ... 22 $\mu$ H Rated current: 0.38 ... 3.01 A	Size (IEC): 1005 ... 2520 Inductance: 0.47 ... 10 $\mu$ H Rated current: 0.5 ... 2.3 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– DC/DC converter with top class voltage conversion efficiency</li> <li>– Low profile</li> <li>– Generic use for portable DC/DC converters</li> <li>– High magnetic shield construction</li> </ul>	<ul style="list-style-type: none"> <li>– Most suitable for power lines with low output</li> <li>– Optimized ferrite materials for the reduction of losses</li> <li>– Substantially improved DC superposition characteristics</li> </ul>
<b>Applications</b>	Mobile communications LCD displays HDDs DVC DSC	Mobile communications Power supply modules DSC PCs HDDs


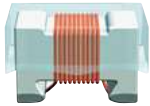

Power Inductors		
		
<b>Series</b>	Low profile, semi-shielded, metal core – SMD VLS-HBX series	Multilayer technology – SMD MLD series
<b>Technical data</b>	Size (IEC): 2016 ... 2520 Inductance: 0.24 ... 2.2 $\mu$ H Rated current: 1.9 ... 4.6 A	Size (IEC): 2016 Inductance: 1 ... 4.7 $\mu$ H Rated current: 0.2 ... 1.4 A Temperature: –40 ... +125 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– General use for portable DC/DC converter lines</li> <li>– High magnetic shield construction actualizes high resolution for EMC protection</li> </ul>	<ul style="list-style-type: none"> <li>– For compact DC/DC converters</li> <li>– Most suitable for power lines with low output</li> <li>– Optimized ferrite materials enables the reduction of losses</li> </ul>
<b>Applications</b>	Mobile communications Consumer electronics LCD displays HDDs	Automotive applications Camera modules Car multimedia Car accessories Connectivity

# Magnetics

Power Inductors, Signal Use Inductors

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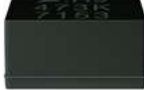
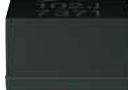
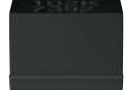
Power Inductors			
			
<b>Series</b>	Leaded RF chokes Axial and radial versions B781 ..., B821 ...	Leaded RF chokes PLUS series, axial and radial versions B781x8E, B82144F2/B2	Leaded VHF chokes Axial version B821 ..., B82500
<b>Technical data</b>	Rated inductance: 1.0 ... 100 000 $\mu$ H Rated current: 0.02 ... 2.5 A	Rated inductance: 0.1 ... 470 $\mu$ H Rated current: 0.6 ... 7.3 A	Rated inductance: 1 ... 3900 $\mu$ H Rated current: 0.1 ... 10 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Wide inductance range</li> <li>– Suitable for wave soldering</li> </ul>	<ul style="list-style-type: none"> <li>– Low inductance, high rated current</li> <li>– Low DC resistance</li> <li>– Suitable for wave soldering</li> </ul>	<ul style="list-style-type: none"> <li>– High resonant frequency</li> <li>– Suitable for wave soldering</li> </ul>
<b>Applications</b>	LF and HF decoupling of signal and control units Lighting technology Industrial, automotive, entertainment electronics Household appliances	DC/DC converters Filtering of supply voltages RF blocking and filtering Decoupling and interference suppression LED and energy-saving lamps Entertainment electronics	RF blocking and filtering Interference suppression in small appliances Decoupling in communication and entertainment electronics




Signal Use Inductors			
			
<b>Series</b>	SIMID 0603-C – SMD B82496C ...	SIMID 0805-F3 – SMD B82498F3 ... 001	SIMID 1210-H – SMD B82422H ...
<b>Technical data</b>	Size: 0603 (EIA) or 1608 (IEC) Inductance: 1 ... 220 nH Rated current: 110 ... 1800 mA Temperature: up to +150 °C	Size: 0805 (EIA) or 1212 (IEC) Inductance: 2.7 ... 820 nH Rated current: 180 ... 1000 mA Temperature: up to +125 °C	Size: 1210 (EIA) or 3225 (IEC) Inductance: 1.0 ... 680 $\mu$ H Rated current: 61 ... 1150 mA Temperature: up to +150 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– High resonance frequency</li> <li>– Narrow inductance tolerances</li> <li>– High mechanic stability</li> <li>– Qualified to AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>– Ceramic core version</li> <li>– High resonance frequency</li> <li>– Narrow inductance tolerance</li> <li>– Qualified to AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>– Very high current handling capability</li> <li>– Qualified to AEC-Q200</li> </ul>
<b>Applications</b>	Multimedia appliances Wireless communication systems Car access systems Tire Pressure Monitoring System (TPMS) GPS Digital cameras	Multimedia appliances Antenna amplifiers Wireless communication systems Car access systems GPS Low pass filters for data lines, e.g 100 Base-T1	Filtering of supply voltages, coupling, decoupling DC/DC converters, power supplies Automotive electronics Communications Consumer and information technology Industrial electronics

# Magnetics

## Signal Use Inductors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics



Signal Use Inductors			
			
<b>Series</b>	SIMID 1210H-900 – SMD B82422H ... 900	SIMID 1210-100 – SMD B82422A ... 100	SIMID 1812-T/C – SMD B82432T ..., B82432C ...
<b>Technical data</b>	Size: 1210 (EIA) or 3225 (IEC) Inductance: 1 ... 100 $\mu$ H Rated current: 100 ... 750 mA Temperature: up to +140 °C	Size: 1210 (EIA) or 3225 (IEC) Inductance: 0.0082 ... 100 $\mu$ H Rated current: 65 ... 800 mA Temperature: up to +145 °C	Size: 1812 (EIA) or 4532 (IEC) Inductance: 1 ... 1000 $\mu$ H Rated current: 55 ... 1300 mA Temperature: up to +150 °C
<b>Features</b>	– Very high current capability – Qualified to AEC-Q200	– High resonance frequency – High Q factor – Qualified to AEC-Q200	– High current handling capability (1812-T) – High Q factor (1812-C) – Qualified to AEC-Q200
<b>Applications</b>	Filtering of supply voltages, coupling, decoupling DC/DC converters SMPS Multiple phase power management	Filtering of supply voltages, coupling, decoupling Antenna systems Automotive electronics Communications Consumer and information technology Industrial electronics	Filtering of supply voltages, coupling, decoupling DC/DC converters Antenna systems Automotive electronics Communications Industrial electronics




Signal Use Inductors			
			
<b>Series</b>	Standard circuits – SMD NL(V) series	Standard circuits – SMD NLFV series	Decoupling circuits – SMD NLC(V) series
<b>Technical data</b>	Size (IEC): 2520 ... 3225 Inductance: 0.01 ... 1000 $\mu$ H Rated current: 25 ... 530 mA	Size (IEC): 2520, 3225 Inductance: 1 ... 1000 $\mu$ H Rated current: 20 ... 750 mA	Size (IEC): 2520 ... 4532 Inductance: 0.1 ... 330 $\mu$ H Rated current: 70 ... 2850 mA
<b>Features</b>	– Good heat durability that withstands lead-free compatible reflow soldering conditions – Lead-free material is used for the plating on the terminal – Metal terminals provide excellent connection reliability – Highly heat-resistant thermoplastic resin		– Very high current handling capability – High inductance values – Qualified to AEC-Q200
<b>Applications</b>	Consumer electronics Automotive (car audio and ECU systems) HDDs and ODDs	Consumer electronics Communications Automotive (car audio and ECU systems) HDDs and ODDs	Filtering of supply voltages, coupling, decoupling DC/DC converters/power supplies Automotive electronics Communications Consumer electronics Industrial electronics

# Magnetics

## Transponder Coils

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Transponder Coils		
		
<b>Series</b>	X/Y Transponder coils – SMD TC1210 B82450A ... C	Z Transponder coils – SMD TC1812 B82451A ... D
<b>Technical data</b>	Size: 1210 (EIA) or 3225 (IEC) Inductance: 1.08 ... 1.34 mH Sensitivity: 3.4 ... 3.71 mV/μT	Size: 1812 (EIA) or 4532 (IEC) Inductance: 2.38 mH Sensitivity: 7.6 mV/μT
<b>Features</b>	<ul style="list-style-type: none"> <li>– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests</li> <li>– High Q and sensitivity in X, Y direction</li> <li>– Qualified to AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests</li> <li>– High Q and sensitivity in Z direction</li> <li>– Qualified to AEC-Q200</li> </ul>
<b>Applications</b>	Tire Pressure Monitoring System (TPMS) Tire Mounted Sensor Road Condition Sensor	Tire Pressure Monitoring System (TPMS)




Transponder Coils			
			
<b>Series</b>	3D Transponder coils – SMD B82453C ... A B82453C ... A022	X/Y Transponder coils – SMD B82450A ..., B82450H ...	Z Transponder coils – SMD B82451L ...
<b>Technical data</b>	Size: 11.5 x 12.5 x 3.6 mm Inductance range 125 kHz: 4.75 ... 13.2 mH Inductance range 21.8 kHz: 30 ... 55 mH Sensitivity range 125 kHz: 45 ... 83 mV/μT Sensitivity range 21.8 kHz: 23.5 ... 25.5 mV/μT	Size 8 mm: B82450A ... E ... Size 11 mm: B82450A ... A ... High Q 11 mm: B82450H ... A ... Inductance: 1 ... 18.52 mH Sensitivity: 10 ... 52 mV/μT	Size: 7.7 x 7.4 x 2.65 mm Inductance: 1 ... 10 mH Sensitivity: 7 ... 23 mV/μT
<b>Features</b>	<ul style="list-style-type: none"> <li>– Long receiving distance at 125 kHz and 21.8 kHz</li> <li>– High sensitivity in all orientations (X/Y/Z)</li> <li>– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests</li> <li>– Qualified to AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests</li> <li>– High Q version available</li> <li>– Qualified to AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests</li> <li>– Qualified to AEC-Q200</li> </ul>
<b>Applications</b>	Passive Entry Passive Start (PEPS) Wake-up and immobilizer LF antenna coil	Car access systems Immobilisers Passive Entry Passive Start (PEPS) Heart rate monitoring devices Goods tracking systems	Passive Entry Passive Start (PEPS) RFID (radio-frequency identification) systems at 125 kHz

# Magnetics

## Multilayer Inductors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Multilayer Inductors			
			
<b>Series</b>	High frequency standard – SMD MLG-S series	High frequency – High Q – SMD MLG-Q series	High frequency – High Q – SMD MLG-P, MLG-PPA series
<b>Technical data</b>	Size (IEC): 0603 ... 1005 Inductance: 0.3 ... 390 nH Rated current: 50 ... 1000 mA	Size (IEC): 0402 Inductance: 0.2 ... 33 nH Rated current: 120 ... 350 mA Temperature: -55 ... +125 °C	Size (IEC): 0402, 0603 Inductance: 0.2 ... 120 nH Rated current: 80 ... 1000 mA Temperature: -55 ... +125 °C
<b>Features</b>	– Advanced monolithic structure is formed using multilayering and sintering process with ceramic and conductive materials for high frequency	– Optimal product for fine-pitch circuits	– Q is higher than in a conventional product; particularly at more than 800 MHz
<b>Applications</b>	High frequency applications such as mobile communications, high-frequency modules (PA, VCO, FEM), Bluetooth, WLAN, UWB and tuners		



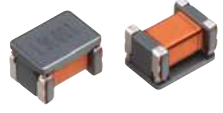
Multilayer Inductors			
			
<b>Series</b>	High frequency – SMD MLK series	High frequency – Super High Q – SMD MHQ-P, MHQ-PSA series	Signal line – Narrow tolerance – SMD MLF-J series
<b>Technical data</b>	Size (IEC): 0603 ... 1005 Inductance: 1 ... 330 nH Rated current: 70 ... 500 mA	Size (IEC): 0402 ... 1005 Inductance: 1 ... 150 nH Rated current: 400 ... 1200 mA	Size (IEC): 1005, 1608 Inductance: 0.16 ... 0.56 µH Rated current: 250 ... 400 mA
<b>Features</b>	– Giga-spiral laminated structure – High self-resonant frequency – Limited decrease of Q in the GHz band	– Achieves high Q characteristics equivalent to an air-core wire wound inductor – Inductance is provided in small increments, taking advantage of the multilayer technique	– Inductance tolerance ±5 or ±10% (J-tolerance and K-tolerance respectively) – Temperature stress (drift variance percentage) for soldering ±3%
<b>Applications</b>	High frequency applications such as mobile communications, high-frequency modules (PA, VCO, FEM), Bluetooth, WLAN, UWB and tuners		NFC circuit for smart phones and PCs, power supply lines for electronic devices

# Magnetics

## Multilayer Inductors, Signal EMC Filters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Multilayer Inductors		Signal EMC Filters	
			
<b>Series</b>	Signal line standard – SMD MLF series	Decoupling circuits – SMD MLZ series	Noise suppression filter – SMD MAF series
<b>Technical data</b>	Size (IEC): 1005 ... 2012 Inductance: 0.047 ... 100 $\mu$ H Rated current: 2 ... 300 mA Tolerance: $\pm$ 5%, $\pm$ 10% and $\pm$ 20%	Size (IEC): 1005 ... 2012 Inductance: 0.1 ... 100 $\mu$ H Rated current: 30 ... 1000 mA	Size (IEC): 1608 Impedance: 60 $\Omega$ (100 MHz) Rated current: 1600 mA Temperature: $-55$ ... $+125$ $^{\circ}$ C
<b>Features</b>	– Magnetically shielded configuration suitable for high-density mounting	– Best DC superimposition characteristics – Lowest DC resistance – Excellent effect mainly on the decoupling of power circuits – Suitable for audio lines, due to its low DC resistance	– Accomodates high currents – Distortions are greatly reduced insertion with the adoption of newly-developed low distortion ferrite materials – Small reductions in volume due to its low resistance, and optimal for devices which requires high sound quality – Excellent effects in measures against the deterioration of the of the receiving sensitivity of wireless devices due to high attenuation characteristics in the cellular band
<b>Applications</b>	Signal processing modules for mobile communications and tuners Automotive electronics	Modules for mobile communications and consumer electronics Automotive electronics	Sound lines for smartphones and tablets (earphones, microphones and speakers) Sound lines for portable game machines




Signal EMC Filters			
			
<b>Series</b>	Common-mode filters, CAN bus, FlexRay – SMD ACT1210	Common-mode filters, BroadR-Reach / 100Base-T1/A <sup>2</sup> B – SMD ACT1210L	Common-mode filters, CAN bus, FlexRay – SMD ACT45B, ACT45C, ACT45R series
<b>Technical data</b>	Size: 1210 (EIA) or 3225 (IEC) Rated inductance: 11 ... 100 $\mu$ H Impedance: 300 ... 5100 $\Omega$ (10 MHz) Rated current: 0.15 ... 0.3 A Temperature: $-40$ ... $+150$ $^{\circ}$ C	Size: 1210 (EIA) or 3225 (IEC) Inductance: 100 ... 200 $\mu$ H Rated current: 70 ... 0.15 mA Temperature: $-40$ ... $+125$ $^{\circ}$ C	Size: 1812 (EIA) or 4532 (IEC) Rated inductance: 11 ... 100 $\mu$ H Impedance: 300 ... 5800 $\Omega$ (10 MHz) Rated current: 0.15 ... 0.25 A Temperature: $-40$ ... $+150$ $^{\circ}$ C Temperature: $-40$ ... $+125$ $^{\circ}$ C (ACT45C)
<b>Features</b>	– ACT1210 for CAN and FlexRay – Non-soldered internal construction provides excellent heat resistance to ensure effective circuit board mounting – Robust lead frame termination – Qualified to AEC-Q200 – Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D	– ACT1210L for 100Base-T1 – Provides excellent balance parameter (symmetry) – Non-soldered internal construction provides excellent heat resistance to ensure effective circuit board mounting – Robust lead frame termination – Qualified to AEC-Q200 – Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D	– ACT45B/C for CAN-Bus – ACT45R for FlexRay – Non-soldered internal construction provides excellent heat resistance to ensure effective circuit board mounting – Robust lead frame termination – Qualified to AEC-Q200 – Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D
<b>Applications</b>	CAN/FlexRay bus on space in critical automotive applications	BroadR-Reach / 100Base-T1/ A <sup>2</sup> B	CAN/FlexRay bus in automotive applications






# Magnetics

## Signal EMC Filters

▲TDK ▲EPCOS ▲Micronas ▲InvenSense ▲Tronics




Signal EMC Filters			
			
<b>Series</b>	Common-mode filters, BroadR-Reach / 100Base-T1 – SMD ACT45L	Data line chokes – SMD SIMDAD 1812 B82789C0..., B82789S0...	Data line chokes – SMD B82793C0..., B82793S0...
<b>Technical data</b>	Size: 1812 (EIA) or 4532 (IEC) Inductance: 200 $\mu$ H Rated current: 100 mA Temperature: –40 ... +105 °C	Size: 1812 (EIA) or 4532 (IEC) Rated inductance: 11 ... 100 $\mu$ H Rated current: up to 300 mA Temperature: up to +150 °C	Size: 9 x 6 x 4.8 mm Rated inductance: 5 $\mu$ H ... 47 mH Rated current: up to 1.2 A Temperature: up to +125 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– ACT45L for 100Base-T1</li> <li>– Provides excellent balance parameter (symmetry)</li> <li>– Qualified to AEC-Q200</li> <li>– Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D</li> </ul>	<ul style="list-style-type: none"> <li>– Qualified to AEC-Q200</li> <li>– Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D</li> </ul>	<ul style="list-style-type: none"> <li>– High inductance range</li> <li>– Qualified to AEC-Q200</li> <li>– Suitable for lead-free soldering profiles based on JEDEC J-STD 020D</li> </ul>
<b>Applications</b>	BroadR-Reach / 100Base-T1/ A <sup>o</sup> B	CAN/FlexRay bus in automotive applications	CAN/FlexRay bus in automotive applications Industrial electronics xDSL applications


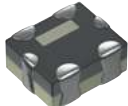

Signal EMC Filters			
			
<b>Series</b>	Double/quad chokes B82792, B82794, B82791, B82720	Chip beads – SMD MMZ series	Chip beads – High frequency, large impedance – SMD MMZ-E, MMZ-V series
<b>Technical data</b>	Rated inductance: 0.1 ... 0.7 A Rated current: 0.47... 68 mH Rated voltage: 42 V	Size (IEC): 1005 ... 2012 Impedance: 10 ... 2500 $\Omega$ (100 MHz) Rated current: 100 ... 1500 mA Temperature: –55 ... +125 °C	Size (IEC): 0603 ... 1005 Impedance: 47... 2200 $\Omega$ (100 MHz) Rated current: 150 ... 300 mA
<b>Features</b>	<ul style="list-style-type: none"> <li>– SMD and PTH available</li> <li>– Very low stray inductance</li> <li>– Very good symmetry features</li> </ul>	<ul style="list-style-type: none"> <li>– High reliability</li> <li>– Closed magnetic circuit structure</li> <li>– Low DC resistance structure of electrode</li> </ul>	<ul style="list-style-type: none"> <li>– Broad-band impedance values for higher frequency ranges</li> <li>– High reliability</li> <li>– Closed magnetic circuit structure</li> <li>– Low DC resistance structure of electrode</li> </ul>
<b>Applications</b>	Communications and automatization applications	Elimination of signal line noises for mobile communications, consumer electronics, automotive electronics	Elimination of signal line noises for mobile communications, consumer electronics

# Magnetics

## Signal EMC Filters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Signal EMC Filters			
			
<b>Series</b>	Chip beads – SMD MPZ-E, MPZ-V, MPZ-N series	Common beads – SMD MCZ1210-D series	3-terminal filters for signal line – SMD MEM-S/SC/P, MEM-D/V/F series
<b>Technical data</b>	Size (IEC): 0603 ... 2012 Impedance: 10 ... 1000 Ω (100 MHz) Rated current: 0.5 ... 6 A	Size (IEC): 1210 Impedance: 90 ... 1000 Ω (100 MHz) Rated current: 50 mA ... 0.5 A	Size (IEC): 1608 ... 2012 Insertion loss: 20 dB (70 ... 2000 MHz) 30 dB (70 ... 2500 MHz) Rated current: 100 ... 250 mA
<b>Features</b>	<ul style="list-style-type: none"> <li>– Best-in-class energy-saving in the low DC resistance range</li> <li>– No crosstalk with closed magnetic circuit structural design</li> </ul>	<ul style="list-style-type: none"> <li>– Compact size, low R DC (0.75 Ω max.)</li> <li>– Capable of removing both common and differential mode noise</li> <li>– Closed magnetic circuit structure allows high-density installation, while preventing crosstalk between circuits</li> </ul>	<ul style="list-style-type: none"> <li>– Multilayer chip EMC filter utilizing a T-type circuit</li> <li>– High reliability</li> <li>– Closed magnetic circuit architecture enables high-density installation and prevents crosstalk</li> <li>– Highly effective noise suppression</li> </ul>
<b>Applications</b>	Elimination of power line noise for mobile communications, consumer electronics, automotive electronics	Elimination of power line noise for mobile communications and consumer electronics Audio/USB1.1 signal lines	MEM-S/P series: general signal lines (consumer, office applications)  MEM-D series: high-speed signal lines (consumer, office applications)

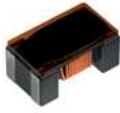

Signal EMC Filters			
			
<b>Series</b>	3-terminal filters – SMD ACF series	3-terminal filter arrays – SMD MEA series	3-terminal feedthrough filters – SMD YFF Series
<b>Technical data</b>	Size (IEC): 3225 Insertion loss: 25 dB (11 ... 700 MHz) Rated current: 300 mA Temperature: –25 ... +85 °C	Size (IEC): 1210 ... 2010 Cut-off frequency: 50 ... 500 MHz Capacitance: 4 ... 36 pF Rated current: 100 mA	Size (IEC): 0402 ... 0805 Temperature: up to +125 °C Rated voltage: 16 ... 50 V Capacitance: 22 pF ... 470 μF
<b>Features</b>	<ul style="list-style-type: none"> <li>– T-type filter circuit is magnetically shielded with ferrite: Superior attenuation characteristics</li> <li>– Offers even greater attenuation characteristics when used in a stable circuit on the ground</li> <li>– Ideal for high-density circuit design space</li> </ul>	<ul style="list-style-type: none"> <li>– Array type: LC filter for 2 or 4 lines</li> <li>– Effective as a sensitivity suppression technique</li> <li>– Post-filter processing, base oval waveform signal</li> <li>– Suited for high-speed signal lines</li> </ul>	<ul style="list-style-type: none"> <li>– Optimized for noise bypass with signal source circuits</li> <li>– Ideal for use at higher frequencies due to low parasitic inductance</li> </ul>
<b>Applications</b>	Consumer electronics Office automation equipment Factory automation equipment Automotive electronics	Mobile communications Consumer electronics General signal line (Cellular Band, DVB-H Band): MEA-L, MEA-LC, MEA-PE High-Speed signal line, RGB and signal lines (Cellular Band, DVB-H Band): MEA-D, MEA-PH, MEA-LD, MEA-LE	Communications Consumer electronics Automotive electronics

# Magnetics

## Signal EMC Filters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Signal EMC Filters			
			
<b>Series</b>	3-terminal feedthrough filters – SMD YFF Series	Common-mode filters – SMD TCM-G/S/R series	Common-mode filters – SMD ACM series
<b>Technical data</b>	Size (IEC): 0402 ... 1206 Temperature: up to +125 °C Rated voltage: 4 ... 100 V Capacitance: 10 nF ... 22 µF	Size (IEC): 0403 ... 1608 Impedance: 12 ... 200 Ω (100 MHz) Rated current: 0.1 A	Size (IEC): 2012 ... 2520 Impedance: 90 ... 1000 Ω (100 MHz) Rated current: 150 ... 400 mA
<b>Features</b>	<ul style="list-style-type: none"> <li>– Optimized for noise bypass with power source circuits</li> <li>– Ideal for use at higher frequencies due to low parasitic inductance</li> </ul>	<ul style="list-style-type: none"> <li>– Thin-film common-mode filter with a large bandwidth</li> <li>– Suppresses radiation noise due to common-mode noise, without affecting the transmission of high-speed differential signals by realizing a higher cut-off frequency</li> </ul>	<ul style="list-style-type: none"> <li>– Miniaturized wire-wound chip-type filter</li> <li>– Extremely effective noise suppression</li> <li>– Minimal effect upon high speed signals, due to low differential mode impedance</li> </ul>
<b>Applications</b>	Communications Consumer electronics Automotive electronics	High-speed differential signal lines (USB 2.0, LVDS)	High-speed differential signal lines (USB 2.0, LVDS)



Signal EMC Filters			
			
<b>Series</b>	Common-mode filters for automotive – SMD ACM series	Common-mode filters – SMD MCZ-AH, MCZ-CH, MCZ-DH series	
<b>Technical data</b>	Size (IEC): 2012 Impedance: 90 ... 360 Ω (100 MHz) Rated current: 220 ... 400 mA Temperature: –40 ... +105 °C	Size (IEC): 0605 ... 2010 Impedance: 24 ... 300 Ω (100 MHz) Rated current: 100 ... 200 mA	
<b>Features</b>	<ul style="list-style-type: none"> <li>– High reliability</li> <li>– Impedance variation: 4 types of impedance values are prepared to correspond to the various applications</li> <li>– Suppresses the common mode EMI without waveform distortion</li> </ul>	<ul style="list-style-type: none"> <li>– Minimum effect for high-speed differential signals due to wide bandwidth for differential mode</li> <li>– Suppresses radiated emissions</li> </ul> <p>MCZ-CH series:</p> <ul style="list-style-type: none"> <li>– Differential mode signal transmission band to 3.5 GHz</li> <li>– Differential mode characteristic impedance is 100 Ω</li> </ul>	
<b>Applications</b>	Radiation noise suppression for car multimedia interfaces (MOST, USB 2.0, IDB-1394)	MCZ-AH series: High-speed differential signal lines (USB 2.0, LVDS) MCZ-CH/DH series: Ultra high-speed differential signal lines (HDMI, DVI, Display port, USB 3.0)	

# Magnetics

## Signal EMC Filters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Signal EMC Filters			
			
<b>Series</b>	Common-mode filters – SMD ACM series	Common-mode filters for automotive power line – SMD ACM-V series	Common-mode filters – SMD ACP3225 series
<b>Technical data</b>	Size (IEC): 4520 ... 1513 Impedance: 180 ... 1400 Ω (100 MHz) Rated current: 1.0 ... 10 A	Size (IEC): 4520 ... 1211 Impedance: 180 ... 1400 Ω (100 MHz) Rated current: 1 ... 8 A Temperature: -40 ... +125 °C	Size (IEC): 3225 Impedance: 500, 1000 Ω (100 MHz) Rated current: 1.2 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Noise is strongly suppressed</li> <li>– Best-in-class highest current handling up to 10 A</li> <li>– Lightweight choke coil</li> </ul>	<ul style="list-style-type: none"> <li>– High impedance characteristic has achieved superior common mode noise suppression</li> <li>– Products have serialized a large current product up to 8 A corresponding to various DC power lines</li> </ul>	<ul style="list-style-type: none"> <li>– Capable of achieving reduction in power consumption and improvement of noise suppression effect, due to its low DC resistance and high common-mode impedance</li> </ul>
<b>Applications</b>	Used for power line noise suppression for electronic devices Suitable for portable devices	Automotive: Common-mode noise countermeasures for DC power lines of electronic control equipment Multimedia equipment in automotive applications	Power line noise suppression of electronic devices Noise suppression of adapter lines or battery lines of PCs




Signal EMC Filters		
		
<b>Series</b>	Clamp filters (Ferrite cores with case) ZCAT, ZCAT-A, ZCAT-B, ZCAT-D/DT series	Clamp filters (Ferrite cores with case) for ECU in automotive ZCAT-V-BK series
<b>Technical data</b>	Impedance range: 20 ... 80 Ω (10 ... 100 MHz) 50 ... 150 Ω (100 ... 500 MHz) 30 ... 35 Ω (50 ... 500 MHz) Temperature: -40 ... +85 °C	Impedance range: 120 ... 140 Ω (100 MHz) Temperature: -40 ... +125 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– Unique plastic case ensures simple, convenient installation and features a self-holding mechanism</li> <li>– Ferrite core provides excellent absorption of high-frequency EMC and is highly effective as countermeasure against common-mode EMC</li> </ul>	<ul style="list-style-type: none"> <li>– Can easily be attached without cutting the cable</li> <li>– Plastic case has a self-sustaining mechanism that prevents slipping on the cable after being clamped</li> <li>– Excellent high-frequency noise absorption effect</li> <li>– Works against common-mode noise, allowing for noise suppression without affecting signal quality</li> </ul>
<b>Applications</b>	Communications Consumer electronics PCs	ECUs in automotive

# Magnetics




## Power EMC Filters, Reactors and Chokes

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Power EMC Filters, Reactors and Chokes

			
<b>Series</b>	Feedthrough capacitors B85121 Feedthrough filters B85321	IEC inlet filters B8477*, B84103	2-line filters B8411*, B84142, B84742
<b>Technical data</b>	Rated voltage: 250 V AC Rated voltage: 350 ... 600 V DC Rated current: 16 ... 500 A  <u>Feedthrough capacitors</u> Rated capacitance: 0.5 ... 4.7 µF  <u>Feedthrough filters</u> Rated capacitance: 2x 0.0025 ... 2x 4.7 µF	Rated voltage: 250 V AC/DC Rated current: 1 ... 20 A	Rated voltage: 250 ... 520 V AC Rated voltage: 250 ... 1500 V DC Rated current: 0.5 ... 1600 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– MKP technology (dry, self-healing)</li> <li>– Solderless production technology</li> <li>– Terminals as axial leads, screw connectors, soldering tags or tab connectors</li> </ul>	<ul style="list-style-type: none"> <li>– IEC connector</li> <li>– Version with fuse holder</li> <li>– Version with fuse holder and switch</li> <li>– Versions with low leakage current</li> </ul>	<ul style="list-style-type: none"> <li>– For single-phase or DC applications</li> <li>– Modular SIFI filter system</li> <li>– One or multi-stage filters</li> <li>– High-voltage versions</li> <li>– Versions with low leakage current</li> </ul>
<b>Applications</b>	Communications Shielded rooms Power supplies Medical appliances	Communications Industrial Medical appliances Power supplies	Communications Industrial, solar inverters Medical appliances Power supplies




### Power EMC Filters, Reactors and Chokes




			
<b>Series</b>	3- or 4-line filters B84143, B84144	3-line filters B84243	Converter chokes B86305
<b>Technical data</b>	Rated voltage: 440 ... 760 V AC Rated current: 8 ... 2500 A	Rated voltage: 530 V AC Rated current: 3 ... 280 A	Rated voltage: 520 V AC Rated current: 4 ... 390 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Filters without/with neutral line</li> <li>– One or multi-stage design</li> <li>– Compact filters</li> </ul>	<ul style="list-style-type: none"> <li>– Typical performance according to EN 61800-3: C1 up to 25 m respectively C2 up to 50 m motor cable length</li> <li>– Low leakage current</li> <li>– Short discharge time up to 44 A types: &lt; 60 V within 1 s</li> </ul>	<ul style="list-style-type: none"> <li>– Line reactors</li> <li>– DC chokes</li> </ul>
<b>Applications</b>	Industrial applications Renewable energies Medical appliances Frequency converters and power supplies	Industrial applications Frequency converters and power supplies Medical appliances	Industrial applications Frequency converters Renewable energies

# Magnetics

## Power EMC Filters, Reactors and Chokes

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes			
			
<b>Series</b>	Line reactor for active infeed converters B86306	LCL filters B84143G*R/ S405	Output chokes B86301 Output filters B84143V ...
<b>Technical data</b>	Rated voltage: 520 V AC Rated current: 14 ... 418 A	Rated voltage: 520 V AC Rated current: 16 ... 400 A	Rated voltage: 440 ... 760 V AC Rated current: 4 ... 1500 A Clock frequency: 2.4 ... 16 kHz
<b>Features</b>	<ul style="list-style-type: none"> <li>- Decoupling of powerline to PWM converters</li> <li>- Reduction of THD</li> <li>- Compact design</li> <li>- UL approved insulation system T-EIS-CF1 E320370</li> </ul>	<ul style="list-style-type: none"> <li>- High attenuation of pulse frequency</li> <li>- Reduction of THD</li> <li>- Modifications possible according to customer specific requirements</li> <li>- Optional housing for IP 20 can be ordered separately (B84143Q*R405)</li> </ul>	<ul style="list-style-type: none"> <li>- dv/dt filters or chokes</li> <li>- Sine-wave EMC output filters (SineFormer)</li> </ul>
<b>Applications</b>	Industrial applications Active infeed converters, e.g. in tooling machines, pumps, conveyor systems, elevators Renewable energies LCL filters	Industrial applications Active infeed converters, e.g. in tooling machines, pumps, conveyor systems, elevators Renewable energies	Industrial applications Frequency converters




Power EMC Filters, Reactors and Chokes			
			
<b>Series</b>	3-line filters Sine-wave output filters B84143V*227/229/230	Filters for shielded rooms B84299, B84312, B8426*	Automotive 2-line EMC filters
<b>Technical data</b>	Rated voltage: 520 ... 690 V AC Rated current: 4 ... 390 A	Rated voltage: 100 ... 690 V AC Rated voltage: 100 ... 1000 V DC Rated current: 0.1 ... 4000 A Insertion loss: >100 dB from 14 kHz ... 40 GHz	Rated voltage: 600/900 V DC Rated current: 150/350 A Ambient temp.: -40 ... +85 °C Climatic category (IEC 60068-1: 1992): 40/100/21
<b>Features</b>	<ul style="list-style-type: none"> <li>- Reduction of motor noise and eddy current losses</li> <li>- Generation of sinusoidal phase-to-phase voltage with low ripple</li> <li>- dv/dt reduction</li> <li>- Optional housing for IP21 can be ordered separately (B84143Q*R229)</li> </ul>	<ul style="list-style-type: none"> <li>- Power line filters</li> <li>- Filters for data, telephone or control lines</li> <li>- HEMP filters acc. to MIL 188-125-1</li> <li>- UL certified versions</li> <li>- Filters for high DC voltage</li> </ul>	<ul style="list-style-type: none"> <li>- Designed for high voltage DC bus</li> <li>- Fulfills CISPR 25, Class 5 requirements</li> <li>- At least 80 dB insertion loss at 500 kHz</li> <li>- Compact designs</li> <li>- Busbar temperature up to +105°C</li> </ul>
<b>Applications</b>	Industrial applications Frequency converters	EMC laboratories Shielded rooms	EMI filtering in on-board chargers, DC/DC converters, inverters or batteries in automotive applications

# Magnetics


## Power EMC Filters, Reactors and Chokes

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Power EMC Filters, Reactors and Chokes

			
<b>Series</b>	LeaXield Active filter for leakage current compensation	EMC services	Ring core chokes (current compensated) B82720 ... B82725, B82791
<b>Technical data</b>	Peak load-side leakage current: up to 1 A Rated voltage: 305/530 V AC (50/60 Hz) Rated current: up to 150A	EMC laboratory offers comprehensive consulting, pre-compliance investigations and conformity testing	Rated current: 0.25 ... 16 A Rated inductance: 0.2 ... 100 mH Rated voltage: 250 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– Highest reduction of earth leakage current</li> <li>– Improves RCD compatibility</li> <li>– Integrated power supply</li> <li>– Add-on to reduce common mode conducted emissions</li> <li>– Climatic category (IEC 60068-1: 1992) 25/100/21</li> <li>– Degree of protection (IEC 60529: 2013) IP 20</li> </ul>	<ul style="list-style-type: none"> <li>– Accredited laboratory</li> <li>– In-house or on-site testing</li> <li>– Measurement of conducted and radiated emissions</li> <li>– EMC design support</li> </ul>	<ul style="list-style-type: none"> <li>– High resonance frequency owing to special winding technique</li> <li>– Approx. 1% stray inductance for symmetrical interference suppression</li> <li>– Potted versions possible</li> <li>– B82720 also available in SMD</li> <li>– Plastic case with terminals</li> <li>– VDE and UL approvals for majority of products</li> </ul>
<b>Applications</b>	Improves RCD compatibility in industrial applications e.g. drives, tooling machines, pumps, compressors, conveyer systems	Industrial applications Converters Renewable energies EV chargers	Power supplies



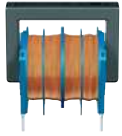
### Power EMC Filters, Reactors and Chokes




		
<b>Series</b>	Ring core chokes (current compensated) B82724J8*N*	Ring core chokes (current compensated) B82721K2*U*
<b>Technical data</b>	Rated current: 1.6 ... 10 A Rated inductance: 0.5 ... 47 mH Rated voltage: 250 V AC / 800 V DC	Rated current: 0.4 ... 2.8 A Rated inductance: 0.4 ... 47 mH Rated voltage: 250 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– High resonance frequency due to special winding technique</li> <li>– Approx. 0.5% stray inductance for symmetrical interference suppression</li> <li>– Completely potted for local reduction of pollution degree (micro-environment)</li> <li>– Significantly increased nominal inductance and current values at high rated temperature</li> </ul>	<ul style="list-style-type: none"> <li>– High resonance frequency due to special winding technique</li> <li>– Approx. 1% stray inductance for symmetrical interference suppression</li> <li>– Completely potted for local reduction of pollution degree (micro-environment)</li> <li>– Materials with CT1600 and approved to EN 60335-1, clause 30</li> <li>– VDE and UL approvals</li> </ul>
<b>Applications</b>	Frequency converters (DC link), power supplies	Power supplies in polluted, humid environments

# Magnetics

## Power EMC Filters, Reactors and Chokes

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Power EMC Filters, Reactors and Chokes			
			
<b>Series</b>	Ring core chokes (current compensated) B82725S ... B82726E/S ..., B82727E ...	Ring core chokes (current compensated) B82724J*U*	D core chokes (current compensated) B82731 ... B82734
<b>Technical data</b>	Rated current: 5.4 ... 56 A Rated inductance: 0.19 ... 7.8 mH Rated voltage: 250 ... 300 V AC 300 ... 1000 V DC (DC link)	Rated current: 4.3 ... 10 A Rated inductance: 0.5 ... 6.8 mH Rated voltage: 250 V	Rated inductance: 3.3 ... 100 mH Rated current: 0.35 ... 4.6 A Rated voltage: 250 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– High resonance frequency</li> <li>– Approx. 1% stray inductance for symmetrical interference suppression</li> <li>– On baseplate, winding wire serves as solder terminal</li> </ul>	<ul style="list-style-type: none"> <li>– High resonance frequency due to special winding technique</li> <li>– Approx. 1% stray inductance for symmetrical interference suppression</li> <li>– High rated temperatures</li> <li>– Completely potted for local reduction of pollution degree (micro-environment)</li> <li>– Materials with CTI600</li> <li>– Construction approved to EN 60335-1</li> <li>– VDE and UL approvals</li> </ul>	<ul style="list-style-type: none"> <li>– High resonance frequency due to 2-section winding</li> <li>– Approx. 1% stray inductance for symmetrical interference suppression</li> <li>– Low leakage due to closed core shape</li> <li>– High pulse strength</li> <li>– Low whirring noise</li> <li>– Low-height horizontal versions</li> </ul>
<b>Applications</b>	Power supplies of high power applications, such as solar inverters, drives, household appliances	Inverter applications in home appliance, e.g. washing machines, dryers	Power supplies Ballasts



Power EMC Filters, Reactors and Chokes			
			
<b>Series</b>	U core chokes (current compensated) B82730	Frame core chokes (FC) (current compensated) B82732F ..., B82733F...	Ring core chokes, triple/quad (current compensated) B8274* ... B8276*
<b>Technical data</b>	Rated inductance: 0.33 ... 15 mH Rated current: 0.4 ... 2.6 A Rated voltage: 300 V	Rated inductance: 10 ... 100 mH Rated current: 0.45 ... 2.3 A Rated voltage: 250 V	Rated inductance: 0.35 ... 6.2 mH Rated current: 6 ... 62 A Rated voltage: 440 ... 690 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– High resonance frequency</li> <li>– Approx. 1.3% stray inductance for symmetrical interference suppression</li> <li>– Low whirring noise</li> <li>– Low saturation effects</li> <li>– Low-height horizontal versions feasible on request</li> <li>– Compact design</li> </ul>	<ul style="list-style-type: none"> <li>– Closed magnetic circuit with frame construction</li> <li>– 4-section winding</li> <li>– High stray inductance, excellent differential mode suppression</li> <li>– High pulse-handling capability</li> <li>– Low height allows usage in lamp ballasts</li> <li>– Optional: magnetic bypass to increase stray inductance</li> </ul>	<ul style="list-style-type: none"> <li>– High power handling</li> <li>– Available in plastic case (fully potted) or on baseplate</li> </ul>
<b>Applications</b>	Compact power supplies Ballasts Household appliances	Power supplies Ballasts	Power supplies of high power applications, such as solar inverters, drives






# Magnetics

Power EMC Filters, Reactors and Chokes, Ferrites

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Power EMC Filters, Reactors and Chokes		Ferrites
		
<b>Series</b>	Ring core (iron powder) chokes B826*	E, EFD, ETD, EV cores
<b>Technical data</b>	Rated inductance: 0.033 ... 20 mH Rated current: 0.3 ... 6 A Rated voltage: 250 V	Core shape: E 5 ... E 100 ETD 29 ... ETD 59 EFD 10 ... EFD 30 EV 15 ... EV 36 Material: N49, N87, N92, N95, N97, PC200
<b>Features</b>	<ul style="list-style-type: none"> <li>– Iron powder core</li> <li>– Single and double chokes</li> <li>– High thermal stability</li> <li>– High differential attenuation at low frequencies</li> </ul>	<ul style="list-style-type: none"> <li>– Wide range of core shapes, sizes and accessories</li> <li>– Cost optimized</li> <li>– Optimum performance ratio at small volume</li> <li>– Small cores available with SMD coil former</li> <li>– Flat transformer design</li> <li>– Large volume design</li> <li>– Distributed air gap</li> </ul>
<b>Applications</b>	PFC and reduction of harmonics in power supplies	Power supplies AC/DC converters, DC/DC converters SMD transformers Storage chokes EMI suppressions chokes

Ferrites			
			
<b>Series</b>	QU cores	U cores + I cores	DG cores
<b>Technical data</b>	Core shape: QU 30 ... QU 155 Material: N27, N49, N87, N95, N97	Core shape: U 26 ... U 141 I 93 ... I 126 Material: N27, N87, N95, N97	Core shape: E 42DG ... E 100DG ETD 29DG ... ETD 59DG ER 28DG ... ER 54DG EQ 25DG ... EQ 30DG PQ 32DG ... PQ 50DG PM 50DG ... PM 114DG Material: N27, N87, N95, N97
<b>Features</b>	<ul style="list-style-type: none"> <li>– Combination with large volume E and U cores</li> <li>– Various thicknesses possible (5 to 46.5 mm)</li> </ul>	<ul style="list-style-type: none"> <li>– High saturation flux density</li> <li>– High curie temperature</li> <li>– Low dissipation losses</li> <li>– Various combination possibilities</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce proximity losses by up to 70%</li> <li>– Enable use of larger winding area</li> <li>– Lower winding losses than with a single air gap</li> <li>– Enable downsizing</li> <li>– Offer significantly increased power density</li> </ul>
<b>Applications</b>	Wireless applications Solar applications	Power transformers Pulse transformers High voltage transformers	Flyback transformers Chokes

# Magnetics

## Ferrites

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Ferrites			
			
<b>Series</b>	ELP, ER, EQ cores + I cores	PQ cores	PM cores
<b>Technical data</b>	Core shape: ELP 14 ... ELP 102 I 14 ... I 102 ER 9.5 ... ER 32 I 23 ... I 25 EQ 13 ... EQ 30 I 13 ... I 30 Material: N49, N87, N92, N95, N97, PC200	Core shape: PQ 16 ... PQ 50 Material: N49, N87, N92, N95, N97	Core shape: PM 50 ... PM 114 Material: N27, N87, N97
<b>Features</b>	<ul style="list-style-type: none"> <li>- Flat mounting height</li> <li>- Planar solution</li> <li>- Board integrated</li> <li>- Clamps</li> </ul>	<ul style="list-style-type: none"> <li>- Compact design</li> <li>- Ferrite cores for power transformers and chokes</li> <li>- Bobbins available</li> </ul>	<ul style="list-style-type: none"> <li>- Max. transmissible power</li> <li>- Max. magnetic cross section</li> <li>- Large volume cores</li> <li>- Accessories available</li> </ul>
<b>Applications</b>	Power supplies AC/DC converters DC/DC converters		




Ferrites			
			
<b>Series</b>	RM cores	EP, EPX, EPO cores – SMD + PTH	P cores
<b>Technical data</b>	Core shape: RM 4 ... RM 14 Material: N49, N87, N97, PC200, K1, M33, N48	Core shape: EP 5 ... EP 20 EPX 7 ... EXP 10 EPO 13 Material: T38, T57, T65, N30, N87, N92	Core shape: P 3.3 ... P 59 PS 7.35 ... PS 68 PCH 14 ... PCH 150 Material: K1, M33, N48, N30, N87, T38
<b>Features</b>	<ul style="list-style-type: none"> <li>- With/without center hole</li> <li>- Compact design</li> <li>- Accessories available</li> </ul>	<ul style="list-style-type: none"> <li>- Low hysteresis loss coefficient</li> <li>- Low THD</li> <li>- Accessories available</li> </ul>	<ul style="list-style-type: none"> <li>- With/without center hole</li> <li>- With/without threaded sleeve</li> <li>- Optimized shielding</li> <li>- Accessories available</li> </ul>
<b>Applications</b>	Power supplies AC/DC converters DC/DC converters	xDSL applications	Signal transformers Proximity switches

# Magnetics

## Ferrites

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics


Ferrites			
			
<b>Series</b>	Ring cores	Ferrite cores – EMI suppression	Ferrite cores – switching power supplies
<b>Technical data</b>	Core shape: R 2.5 ... R 202 Material: K10, T57, N30, N87, T35, T37, T38, T65	Core shape: BB, MH, RID, RH, RU, SH, SP, SU Initial permeability (typ.): 45 ... 50 000 $\mu$ i NiZn ferrites	Material: PC47, PC90, PC95, HS72, HS10, HS12, N27, N49, N87, N88, N92, N95, N96, N97, PC200, T46, N30
<b>Features</b>	– Polyene-coated – Epoxy-coated	– Suitable for one-hole ferrite beads – Various materials, shapes and packaging styles available	– Suitable for various transformers of general-purpose DC/DC converters
<b>Applications</b>	Power supplies AC/DC converters DC/DC converters Common-mode chokes	Noise suppression for video, acoustic, office automation and communication equipment, automotive electronics	Main transformers Drive transformers Choke coils



Ferrites			
			
<b>Series</b>	Ferrite cores – telecommunication	Large size ferrite cores	Ferrite cores – coils
<b>Technical data</b>	Core shape: P, RM, EP, EPC, ER, EE, EEM, T Initial permeability (typ.): 3300 ... 15 000 $\mu$ i Material: H5A, H5B2, H5C2, H5C3, HP5, DNW45 MnZn ferrites	Core shape: EC, EE, EI, EIC, PQ, SP, T, UU Initial permeability (typ.): 1800 ... 2300 $\mu$ i Material: PE22, PC40, PE90 MnZn ferrites	Initial permeability (typ.): 1 ... 1500 $\mu$ i Material: GT1, GT2, GT3, GT4, GT5, GT6, GT7, GT8, GT9, GT10, L2H, L5, L6, L6N, L7H, L8F, L9H, L11H, L17H, L18H, L20H, T2F, T6F, T7F, T9F, Sy20, SY22 NiZn ferrites
<b>Features</b>	– Toroidal cores are suitable for pulse transformers and sensors – Epoxy and paraxylene insulation coating	– Large size ferrite cores developed for reactors and transformers used in high power units	– Mountable with lead-free soldering (+260 °C max.) – Excellent common-mode noise suppression – High-quality and wide-band ferrite cores for LAN
<b>Applications</b>	Filters Sensors Transformers	Transformers (high frequency inductive heater, UPS, EV) Reactor chokes (general purpose inverters, trains)	Inductors, transformers, antennas, and other coil products

# Magnetics

## Noise Suppressing Sheets

TDK EPCOS Micronas InvenSense Tronics

Noise Suppressing Sheets	
	
<b>Series</b>	Magnetic sheets for noise suppression Flexield – IFL10M, IFL12, IFL16, IFF08, IFM10M Material
<b>Technical data</b>	<u>High <math>\mu</math> / High characteristic</u> Dimensions: 300 x 200 mm Thickness: 0.025, 0.03, 0.05, 0.1, 0.2 mm Recommended frequency range: 5 MHz ... 3 GHz Initial permeability at 1 MHz typ: 180 $\mu$ i Resistivity ( $\Omega$ /square) min: 100 k
<b>Features</b>	<ul style="list-style-type: none"> <li>– Highly flexible and shock-resistant</li> <li>– Noise suppression across a wide frequency range</li> <li>– Excellent flexibility in fabrication</li> </ul>
<b>Applications</b>	Noise reduction for flexible cables used in mobile devices Reduction of noise emitted from a wide variety of electronic devices (including noise from CPU) Reduction of specific absorbed radiation (SAR) from cellular phones Reduction of internal EMI (resonance, crosstalk) inside a shielded casing

Noise Suppressing Sheets		
		
<b>Series</b>	Magnetic sheets for RFID Flexield – IFL04 Material	Magnetic sheets for RFID Flexield – IBF15 Material
<b>Technical data</b>	<u>High performance</u> Dimensions: 300 x 200 mm Thickness: 0.05, 0.1, 0.2 mm Initial permeability at 13.56 MHz: 45 $\mu$ ' / 1.3 $\mu$ " Resistivity ( $\Omega$ /square) min: 10 k	<u>Ferrite plate</u> <u>High permeability, low dissipation</u> Dimensions: 125 x 125 mm Thickness: 0.1, 0.18 mm Initial permeability at 13.56 MHz: 150 $\mu$ ' / 5 $\mu$ " Resistivity ( $\Omega$ /square) min: 1 G
<b>Features</b>	<ul style="list-style-type: none"> <li>– Highly flexible and shock-resistant</li> <li>– Highly effective</li> <li>– Extensive line-up of sizes and dimensions</li> <li>– Excellent permeability</li> <li>– Excellent magnetic convergence</li> </ul>	
<b>Applications</b>	For improving reception performance of RFID readers/writers Integrating IC cards with metal Integrating IC tags with metal Improved antenna reception sensitivity	

# RF Components

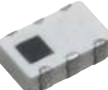
## Multilayer and Thin-Film RF Components

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Multilayer and Thin-Film RF Components

		
<b>Series</b>	Multilayer band pass filters – SMD DEA series	Multilayer band pass filters – SMD Balance output DEA series
<b>Technical data</b>	Size (l x w x t): 1.0 x 0.5 x 0.4 ... 2.5 x 2.0 x 1.5 mm	Size (l x w x t): 2.0 x 1.25 x 0.8 ... 2.5 x 2.0 x 1.0 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact lightweight, and thin type</li> <li>– Low loss in the passband</li> <li>– High attenuation in the attenuated band</li> </ul>	<ul style="list-style-type: none"> <li>– Compact lightweight, and thin type</li> <li>– Low loss in the passband</li> <li>– High attenuation in the attenuated band</li> <li>– IC impedance compatible design available</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth 5.0 GHz WLAN 5.0 GHz Digital cordless WiMAX up to 3.6 GHz GSM, UMTS, LTE Band	2.4 GHz WLAN/Bluetooth 5.0 GHz WLAN 2.5 GHz WiMAX 3.5 GHz WiMAX ZigBee



### Multilayer and Thin-Film RF Components




		
<b>Series</b>	Multilayer low pass filters – SMD DEA series	Multilayer high pass filters – SMD DEA series
<b>Technical data</b>	Size (l x w x t): 0.65 x 0.5 x 0.3 ... 2.0 x 1.25 x 0.7 mm	Size (l x w x t): 1.6 x 0.8 x 0.65 ... 2.0 x 1.25 x 1.1 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact lightweight and thin type</li> <li>– Low loss in the passband</li> <li>– High attenuation in the attenuated band</li> </ul>	<ul style="list-style-type: none"> <li>– Compact lightweight and thin type</li> <li>– Low loss in the passband</li> <li>– High attenuation in the attenuated band</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth 5.0 GHz WLAN DVB-H/ISDB-T GSM900 GSM850/GSM900 Tx DCS DCS/PCS GSM/DCS/PCS Tx & Rx PCS Tx & Rx WiMAX GSM, UMTS, LTE Band	2.4 GHz WLAN/Bluetooth

# RF Components

## Multilayer and Thin-Film RF Components

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Multilayer and Thin-Film RF Components		
		
<b>Series</b>	Multilayer diplexers – SMD DPX series	Multilayer triplexers – SMD TPX series
<b>Technical data</b>	Size (l x w x t): 1.0 x 0.5 x 0.33 ... 2.5 x 2.0 x 1.0 mm	Size (l x w x t): 2.0 x 1.25 x 0.9 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact lightweight and thin type</li> <li>– Low loss in the passband</li> <li>– High attenuation in the attenuated band</li> <li>– Combinations of LPF/BPF/HPF design</li> </ul>	<ul style="list-style-type: none"> <li>– Flexible band combinations</li> <li>– Low loss</li> <li>– High isolation</li> <li>– Combinations of LPF/BPF/HPF design</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth 2.4/5.0 GHz WLAN WiMAX GSM850/900/DCS/DPS – GPS Tx & Rx WCDMA800/WCDMA2000 – WCDMA1900 GPS & 2.4 GHz/Bluetooth	GPS and 2.4, 5 GHz

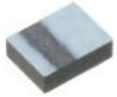
Multilayer and Thin-Film RF Components			
			
<b>Series</b>	Multilayer balun – SMD HHM series	Wound chip baluns – SMD ATB series	Thin-Film balun – SMD TFSZ series
<b>Technical data</b>	Size (l x w x t): 0.65 x 0.5 x 0.3 ... 2.0 x 1.25 x 1.05 mm	Size (l x w x t): 2.0 x 1.2 x 1.0 ... 3.2 x 2.5 x 2.3 mm	Size (l x w x t): 0.65 x 0.5 x 0.3 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact lightweight and thin type</li> <li>– Low loss</li> <li>– Available in 50:50 Ω, 75:50 Ω, 100:50 Ω, and 200:50 Ω</li> <li>– Available with conjugate matching to specific chipset</li> </ul>	<ul style="list-style-type: none"> <li>– Chip balun transformer developed for 50, 75 Ω impedance system</li> <li>– Impedance ration 1:1</li> </ul>	<ul style="list-style-type: none"> <li>– Thin-film based design</li> <li>– Extremely compact and low profile</li> <li>– Stable performance</li> <li>– Tight lot-to-lot variation</li> <li>– Suitable for modules</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth 5.0 GHz WLAN WiMAX GSM, UMTS, LTE Band	Tuner for TV, mobile devices (e.g. DVB-T/H, ISDB-T) Power divider for STB and tuners	W-LAN WiMAX Bluetooth LTE


# RF Components


Multilayer and Thin-Film RF Components, LTCC Substrates for LED

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Multilayer and Thin-Film RF Components	
	
<b>Series</b>	Multilayer directional couplers – SMD HHM series
<b>Technical data</b>	Size (l x w x t): 0.65 x 0.5 x 0.3 ... 1.6 x 0.8 x 0.7 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact lightweight and thin type</li> <li>– Low loss</li> <li>– High isolation</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth 2.4 GHz WLAN Divider 5 GHz WLAN GSM, UMTS, LTE Band

	
<b>Series</b>	Thin-Film directional couplers – SMD TFSC series
<b>Technical data</b>	Size (l x w x t): 0.65 x 0.5 x 0.3 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Attenuators included</li> <li>– Thin-film based design</li> <li>– Extremely compact and low profile</li> <li>– Stable performance</li> <li>– Tight lot-to-lot variation</li> <li>– Suitable for modules</li> </ul>
<b>Applications</b>	2.4 GHz WLAN/Bluetooth


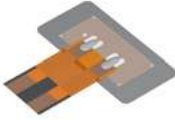
Multilayer and Thin-Film RF Components	LTCC Substrates for LED
	
<b>Series</b>	Multilayer chip antennas – SMD ANT series
<b>Technical data</b>	Size (l x w x t): 1.6 x 0.8 x 0.4 ... 2.5 x 2.0 x 0.7 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact, low profile design</li> <li>– High performance and reliability</li> <li>– Capable of supporting multi-bands</li> <li>– Require small keep-out area</li> <li>– Omni-directional</li> </ul>
<b>Applications</b>	Sub-GHz: Single Band GNSS: Single Band 2.4 GHz WLAN/Bluetooth : Single Band 5GHz WLAN: Single Band GNSS & 2.4 GHz: Dual Band 2.4 GHz & 5 GHz: Dual Band GNSS & 2.4 GHz & 5 GHz: Triple Band




	
<b>Series</b>	LTCC substrates
<b>Technical data</b>	Integrated ESD protection IEC 61000-4-2: level 4 with 8 kV contact Panel format 8 x 8"
<b>Features</b>	<ul style="list-style-type: none"> <li>– Thermal conductivity: &gt; 25 W/mK</li> <li>– Mounting techniques: compatible with most standards                             <ul style="list-style-type: none"> <li>– flip mount</li> <li>– wire bond</li> <li>– glue</li> <li>– solder</li> </ul> </li> <li>– Surface finishing: Ag, Au, Cu variants available</li> </ul>
<b>Applications</b>	Bare die LEDs LED components and LED modules

# Piezo and Protection Devices

## Piezo Haptic Actuators

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

PiezoHapt Actuators		
		
<b>Series</b>	PHUA8060-35A-33-000	PHUA3015-30A-21-000
<b>Technical data</b>	Vibration plate: 80 x 60 x 0.25 mm Element: 30 x 30 x 0.1 mm Vibration plate specification: 42 Ni-Fe Electrode specification: FPC Operation voltage: 24 V P-P (±12 V) max. Operating temperature: -10 ... +60 °C	Vibration plate: 30 x 15 x 0.1 mm Element: 20 x 10 x 0.2 mm Vibration plate specification: 42 Ni-Fe Electrode specification: FPC Operation voltage: 12 V P-P (±6 V) max. Operating temperature: -10 ... +60 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Clear response by low-voltage drive</li> <li>- Response in an instant</li> <li>- Variegated vibration pattern</li> </ul>	<ul style="list-style-type: none"> <li>- Clear response by low-voltage drive</li> <li>- Response in an instant</li> <li>- Variegated vibration pattern</li> </ul>
<b>Applications</b>	Touchpads Displays	Wearables




PowerHap Actuators			
			
<b>Series</b>	2626H023V120	1313H018V120	0909H011V060
<b>Technical data</b>	Acceleration (100 g mass): 35G peak Dimensions: 26 x 26 x 2.4 mm Operating voltage: -20 ... 120 V Max. displacement: 230 µm Operating temperature: -40 ... +85 °C	Acceleration (100 g mass): 7G peak Dimensions: 13 x 13 x 1.8 mm Operating voltage: -20 ... 120 V Max. displacement: 65 µm Operating temperature: -40 ... +85 °C	Acceleration (100 g mass): 2.5G peak Dimensions: 9 x 9 x 1.1 mm Operating voltage: -10 ... 60 V Max. displacement: 32 µm Operating temperature: -40 ... +85 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Using as sensor and actuator</li> <li>- Specific actuator feedback adjustable</li> <li>- Supports bipolar driving mode allows lower operating voltage</li> <li>- Low power consumption</li> <li>- Qualified to AEC-Q200</li> </ul>		
<b>Applications</b>	Multifunctional automotive HMIs Industrial equipment, household appliances Smartphones and tablets, ATMs and vending machines Medical appliances, game controllers, push buttons and switches		






# Piezo and Protection Devices

Piezo Actuators for Automotive, Piezo Receivers, Buzzers

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Piezo Actuators for Automotive			
			
<b>Series</b>	Cu actuators 30 mm	Injection actuators 30 mm	Injection actuators 45 mm
<b>Technical data</b>	Displacement: 40 µm Driving voltage: 160 V Useful life: > 3E9 cycles	Displacement: 40 µm Driving voltage: 160 V Useful life: > 1E9 cycles	Displacement: 60 µm Driving voltage: 160 V Useful life: > 1E9 cycles
<b>Features</b>	<ul style="list-style-type: none"> <li>– Proprietary piezo technology with copper inner electrodes</li> <li>– Stress release technology</li> </ul>	<ul style="list-style-type: none"> <li>– AgPd technology</li> </ul>	<ul style="list-style-type: none"> <li>– AgPd technology</li> </ul>
<b>Applications</b>	Diesel injection systems	Diesel injection systems	Gasoline injection systems




Piezo Actuators for Automotive	Piezo Receivers	Buzzers
		
<b>Series</b>	Piezoelectric receiver RU	Piezoelectric buzzers PS
<b>Technical data</b>	Sound pressure: 108 ± 3 dB Maximum input voltage $E_{RMS}$ : 5 V (Ep-p: 14 V) Operating temperature: -20 ... +70 °C	Sound pressure: 60 ... 90 dBA/10 cm min. (2 ... 4 kHz)
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact, thin sounding body using unimorph piezoelectric vibration plate</li> <li>– No leakage flux</li> </ul>	<ul style="list-style-type: none"> <li>– Pin terminal/ lead, without oscillator circuit</li> <li>– High-performance buzzers that employ unimorph piezoelectric elements</li> <li>– Designed for easy incorporation into various circuits</li> <li>– Extremely low power consumption in comparison to electromagnetic units</li> <li>– Can be used as a musical tone oscillator or buzzer</li> </ul>
<b>Applications</b>	Cordless phones	Washing machines, computer terminals, devices that require speech synthesis output

# Piezo and Protection Devices

## Buzzers, Surge Arresters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics


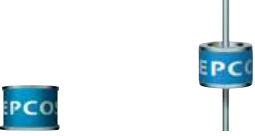

Buzzers			
			
<b>Series</b>	Electromagnetic buzzers SD	Electromagnetic buzzers SDC	Electromagnetic buzzers – SMD SDR
<b>Technical data</b>	Rated voltage: 3 ... 12 V (Eo-p) Sound pressure: 80 ... 85 dBA/10 cm min. (2048 ... 4096 Hz) Operating temperature: -40 ... +85/-10 ... +70 °C	Rated voltage: 5 ... 12 V DC Sound pressure: 85 dBA/10 cm min. (1900 ... 2400 Hz) Operating temperature: -10 ... +70 °C	Rated voltage: 3 V (Eo-p) Sound pressure: 97 dBA/10 cm typ. (2670 Hz) Operating temperature: -40 ... +85 °C
<b>Features</b>	– Pin-type terminal construction enables direct mounting onto printed circuit boards	– Built-in oscillator circuits: output can be produced by merely connecting to a DC power supply – Circuitry utilizes chip-type components for significantly reduced size and high reliability	– Without oscillator circuit – High output level of sound pressure due to high quality parts (yoke and magnets) – Good frequency response and high quality sound
<b>Applications</b>	Clocks, travel watches Keyboards Toys Alarms in automotive electronics	Personal computers Office automation equipment Medical appliances Household appliances	Mobile phones Pagers




Surge Arresters			
			
<b>Series</b>	S20, S30, S50, S80 – SMD	LN8 – Arrester stack – SMD	EHV
<b>Technical data</b>	DC spark-over voltage: 90 ... 500 V Size and footprint (l x w x h): S20: 3.2 x 1.6 x 1.6 mm S30: 4.5 x 3.2 x 2.7 mm S50: 5.7 x 5 x 5 mm S80: 6 x 8.4 x 8.4 mm Nom. discharge current 8/20 µs: 0.5; 2; 5; 20 kA	Max. DC operating voltage: 60 V Nom. discharge current 8/20 µs: 20 kA Nom. discharge current 10/350 µs: 4 kA Size and footprint (l x w x h): 16.3 x 8.4 x 9.5 mm	DC spark-over voltage: 2500 ... 4500 V Max. discharge current 8/20 µs: 5 kA Size: Ø 6 x 7 mm
<b>Features</b>	– 2-electrode square design – Low capacitance – High insulation resistance	– 2-electrode stacked surge arrester – Excellent follow current limiting characteristic	– High voltage surge arrester – High insulation resistance – Very small size
<b>Applications</b>	Overvoltage protection in communication appliances, xDSL modems, cable modems, electronic circuits	Protection of DC power supply circuits in communication systems	AC power supply units Photovoltaic systems Automotive (electric and hybrid vehicles)

# Piezo and Protection Devices

## Surge Arresters

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Surge Arresters			
			
<b>Series</b>	M5	A8	T8
<b>Technical data</b>	DC spark-over voltage: 75 ... 1400 V DC Nom. discharge current: 5 kA Size: Ø 5 x 5 mm	DC spark-over voltage: 75 ... 600 V DC Nom. discharge current: 20 kA Size: Ø 8 x 6 mm	DC spark-over voltage: 90 ... 600 V DC Nom. discharge current: 10 kA Size: Ø 8 x 10 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- 2-electrode SMD and leaded version</li> <li>- Low capacitance</li> <li>- High insulation resistance</li> </ul>	<ul style="list-style-type: none"> <li>- 2-electrode SMD and leaded version</li> <li>- Very high discharge current</li> <li>- High insulation resistance</li> </ul>	<ul style="list-style-type: none"> <li>- 3-electrode arresters</li> <li>- High discharge current</li> <li>- High insulation resistance</li> </ul>
<b>Applications</b>	Overvoltage protection in communication appliances, xDSL- and cable modems, wireless networks, electronic circuits and industrial applications	Overvoltage protection in communication appliances, fixed line network, wireless networks, electronic circuits and industrial applications	Overvoltage protection in communication appliances, fixed line network, wireless networks and electronic circuits

Surge Arresters			
			
<b>Series</b>	T8 – with failsafe	T9 – SMD with and w/o failsafe	TQ90 – SMD
<b>Technical data</b>	DC spark-over voltage: 90 ... 600 V DC Nom. discharge current: 10 kA Size: Ø 8 x 10 mm	DC spark-over voltage: 75 ... 420 V DC Nom. discharge current: 10 kA Size: Ø 5 x 7.6 mm	DC spark-over voltage: 90 V DC Nom. discharge current: 10 kA Size: 5 x 5 x 7.6 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- 3-electrode arresters with failsafe</li> <li>- High discharge current</li> <li>- High insulation resistance</li> </ul>	<ul style="list-style-type: none"> <li>- 3-electrode arresters in SMD and failsafe option</li> <li>- High insulation resistance</li> </ul>	<ul style="list-style-type: none"> <li>- 3-electrode arresters in SMD</li> <li>- High insulation resistance</li> </ul>
<b>Applications</b>	Overvoltage protection in communication appliances, fixed line networks, wireless networks and electronic circuits		

# Piezo and Protection Devices

## Surge Arresters

TDK EPCOS Micronas InvenSense Tronics




Surge Arresters			
			
<b>Series</b>	D06 – SMD	TD08 – SMD	TD12 – SMD
<b>Technical data</b>	DC spark-over voltage: 90 ... 230 V DC Nom. discharge current: 10 kA Size: Ø 6 mm	DC spark-over voltage: 90 ... 230 V DC Nom. discharge current: 10 kA Size: Ø 8mm	DC spark-over voltage: 90 ... 230 V DC Nom. discharge current: 20 kA Size: 12 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– 3-electrode arresters</li> <li>– High discharge current</li> <li>– High insulation resistance</li> <li>– Flat design</li> </ul>		
<b>Applications</b>	Overvoltage protection in data line applications		




Surge Arresters				
				
<b>Series</b>	H38M	L1	V13 and V10	EF
<b>Technical data</b>	DC spark-over voltage: > 600 V DC Protection level at 1.2/50 µs, 6 kV: < 1500 V Impulse current (10/350 µs): 100 kA Size: Ø 30 x 30 mm	DC spark-over voltage: > 600 V DC Protection level at 1.2/50 µs, 6 kV: < 1500 V Impulse current (10/350 µs): 50 kA Size: Ø 30 x 12 mm	DC spark-over voltage: > 600 V DC, > 1100 V DC Protection level at 1.2/50 µs, 6 kV: < 1500 V, < 2500 V Max. discharge current: 60 kA Impulse current (10/350 µs): 12 kA Size: Ø 12 x 17 mm	DC breakdown voltage: 270 ... 3300 V Max. discharge current: 10 kA Size: Ø 8 x 6 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– High impulse current (10/350 µs)</li> <li>– Temporary overvoltage withstand capability</li> <li>– IEC 61643-11</li> </ul>		<ul style="list-style-type: none"> <li>– High insulation resistance</li> <li>– Temporary overvoltage withstand capability</li> <li>– IEC 61643-11</li> </ul>	<ul style="list-style-type: none"> <li>– High insulation resistance</li> <li>– Temporary overvoltage withstand capability</li> <li>– IEC 61643-11</li> <li>– UL 1449 (E319264)</li> </ul>
<b>Applications</b>	AC line protection 230/400 V AC, class I, N-PE		AC line protection 230/400 V AC, class I & II, N-PE Power supplies Photovoltaic systems	AC line protection 230/400 V AC Device protection Power supplies Photovoltaic systems

# Piezo and Protection Devices

High-Voltage Contactors, PTC Thermistors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




High-Voltage Contactors		PTC Thermistors	
			
<b>Series</b>	HVC200, HVC300, HVC500 B88269X ...	Overcurrent protection	Overcurrent protection Lead-free series
<b>Technical data</b>	Max. operating voltage: up to 1200 V DC Continuous operating current: up to 500 A 1 million nominal switching cycles Contactless stuck detection available	Max. voltage: 20 ... 1000 V Rated resistance: 0.3 ... 7500 Ω Rated current: 8 ... 2100 mA	Max. voltage: 265 V Rated resistance: 10 ... 120 Ω Rated current: 50 ... 220 mA
<b>Features</b>	<ul style="list-style-type: none"> <li>– Bipolar design</li> <li>– Gas-filled and hermetically sealed</li> <li>– No EMI, no inrush current</li> <li>– UL 60947-4-1, CE, AECQ-200</li> </ul>	<ul style="list-style-type: none"> <li>– High thermal stability</li> <li>– No resistance drift for 100 switching cycles</li> </ul>	<ul style="list-style-type: none"> <li>– High thermal stability</li> <li>– No lead contained in ceramic or solder joint</li> <li>– No resistance drift for 100 switching cycles</li> </ul>
<b>Applications</b>	DC fast charging stations Battery storage systems Electrical and commercial vehicles: <ul style="list-style-type: none"> <li>– Battery management systems</li> <li>– Battery disconnect units</li> <li>– Power distribution units</li> </ul>	Overcurrent protection in automotive electronics, power supplies, entertainment and household electronics	


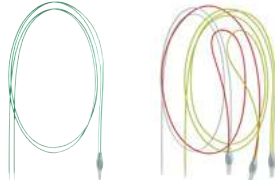

PTC Thermistors			
			
<b>Series</b>	Overcurrent protection – SMD	Overcurrent protection Telecom	Telecom pair overcurrent protectors – SMD
<b>Technical data</b>	Max. voltage: 30 ... 400 V Rated current: 12 ... 310 mA Size (EIA): 0402 ... 4032	Max. fault voltage: 245 V Rated resistance: 6 ... 55 Ω Matching: 1 ... 3 Ω	Max. fault voltage: 245 V Rated resistance: 9 ... 50 Ω
<b>Features</b>	<ul style="list-style-type: none"> <li>– High thermal stability</li> <li>– No resistance drift for 100 switching cycles</li> </ul>	<ul style="list-style-type: none"> <li>– Compliant with ITU standards</li> <li>– No resistance drift after switching</li> </ul>	<ul style="list-style-type: none"> <li>– Compliant with ITU standards</li> <li>– Matched pair in one housing</li> </ul>
<b>Applications</b>	Overcurrent protection in automotive electronics, power supplies, entertainment and household electronics	Overcurrent protection in central office linecards, base stations and customer premises equipment	

# Piezo and Protection Devices

## PTC Thermistors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

PTC Thermistors			
			
<b>Series</b>	Telecom pair protectors	Switching applications Plastic case	Motor start
<b>Technical data</b>	Max. fault voltage: 600 V Rated resistance: 70 Ω	Max. voltage: 265 V Rated resistance: 500 ... 5000 Ω	Rated voltage: 120 ... 230 V AC Max. current.: 5 ... 12 A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compliant with GR1089 central office</li> <li>– Matched pair in one housing</li> </ul>	<ul style="list-style-type: none"> <li>– Useful life up to 100 000 switching cycles</li> </ul>	<ul style="list-style-type: none"> <li>– Useful life &gt;100 000 switching cycles</li> </ul>
<b>Applications</b>	Overcurrent protection in central office linecards	General purpose delayed switching in entertainment, household and industrial electronics	Delayed switch-off of the starter auxiliary winding in single-phase induction motors (e.g. in refrigerators and air conditioners)




PTC Thermistors			
			
<b>Series</b>	Point level sensors	Motor protection Single or triple sensors	Limit temperature sensors
<b>Technical data</b>	Max. voltage: 18 ... 25 V N = 5000 switching cycles	Max. voltage: 30 V Rated resistance: <100 ... ≤300 Ω	Max. voltage: 30 V Rated resistance: <100 ... ≤330 Ω T <sub>sense</sub> : +60 ... +160 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– Liquid level detection for oil and water</li> <li>– Hermetically sealed glass case or stainless steel case</li> </ul>	<ul style="list-style-type: none"> <li>– Characteristics for sensing temperatures compliant with DIN 44081/44082</li> <li>– Customer-specific lead lengths on request</li> </ul>	<ul style="list-style-type: none"> <li>– Available as leaded disks or assembly probes</li> </ul>
<b>Applications</b>	Level sensors for indoor and outdoor tanks Industrial and home applications	Industrial motors and machines protection	Power supplies Lighting equipment

# Piezo and Protection Devices


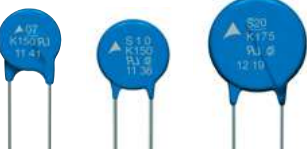

## PTC Thermistors, Varistors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### PTC Thermistors

			
<b>Series</b>	Limit temperature sensors – SMD	Heating elements	High voltage heating elements
<b>Technical data</b>	Max. voltage: 32 V Rated resistance: 470 ... 10 000 Ω Temperature tolerance: ±3 ... ±5 °C Sensing temperature: +70 ... +140 °C Size (EIA): 0402 ... 0805	Max. voltage: 24 ... 265 V T <sub>surface</sub> : +40 ... +280 °C	Max. voltage: up to 600 V Customized solutions upon request
<b>Features</b>	– Fast and reliable response – UL approval	– Available in round and rectangular shape – Al or Ag electrode	– Available in rectangular shape – Al electrode
<b>Applications</b>	Automotive electronics Entertainment and household electronics Battery packs LED lighting	Automotive air heating systems Electrothermal actuators Cabinet heating	Automotive air or water heating systems Hybrid and electric vehicles




### Varistors



			
<b>Series</b>	Ring varistors VAR-18-P (Plane surface electrode type) VAR-18-S (Side surface electrode type)	S5, S7, S10, S14, S20	S25
<b>Technical data</b>	Varistor voltage (E10 mA): 2.0 ... 38.0 V Rated power: 500 mW Capacitance: 1 ... 100 nF (at 1 kHz)	S05: I <sub>max</sub> 8/20 μs: up to 800 A S07: I <sub>max</sub> 8/20 μs: up to 1750 A S10: I <sub>max</sub> 8/20 μs: up to 3.5 kA S14: I <sub>max</sub> 8/20 μs: up to 6 kA S20: I <sub>max</sub> 8/20 μs: up to 12 kA Operating voltage V <sub>RMS</sub> : 11 ... 1100 V	I <sub>max</sub> 8/20 μs: up to 20 kA Operating voltage V <sub>RMS</sub> : 130 ... 750 V
<b>Features</b>	– Positive temperature characteristics of the varistor voltage (E10 value): prevents the varistor voltage from decreasing at high temperatures and large currents flowing through the varistor	– Leaded varistors 5 to 20 mm – High surge current ratings – High energy ratings (2 ms) up to 595 J – For high energy absorption – UL 1449, ed.4	– Leaded varistors 25 mm – High surge current ratings up to 20 kA – High energy ratings (2 ms) up to 1025 J – For high energy absorption – UL 1449, ed.4
<b>Applications</b>	Micro-motors	Industrial electronics Power supplies Photovoltaic systems Household appliances Communications	Industrial electronics Power supplies Inverters Photovoltaic systems

# Piezo and Protection Devices

## Varistors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Varistors			
			
<b>Series</b>	Q14, Q20	ETFV/T series	NT series
<b>Technical data</b>	Q14: $I_{max}$ 8/20 $\mu$ s: 8 kA Q20: $I_{max}$ 8/20 $\mu$ s: 15 kA Operating voltage $V_{RMS}$ : 130 ... 680 V	T14: $I_{max}$ 8/20 $\mu$ s: 6 kA T20: $I_{max}$ 8/20 $\mu$ s: 10 kA ETFV25: $I_{max}$ 8/20 $\mu$ s: 20 kA Operating voltage $V_{RMS}$ : T14: 130 ... 420 V, T20: 130 ... 1000 V ETFV25: 115 ... 420 V	Surge current: 6000, 10000 A Operating voltage: 130 ... 680 V AC 170 ... 895 V DC
<b>Features</b>	<ul style="list-style-type: none"> <li>– Leded varistors 14 and 20 mm</li> <li>– Max. load capacity vs. height</li> <li>– High surge current ratings up to 15 kA</li> <li>– For high energy absorption</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– ThermoFuse (varistor and fuse in one housing)</li> <li>– Disk <math>\varnothing</math> 14, 20 and 25 mm disks</li> <li>– Space saving</li> <li>– Monitoring option with 3<sup>rd</sup> lead</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– Compact size</li> <li>– Highly reliable fuse design</li> <li>– Fuse prevents reconnection for high safety</li> <li>– According to UL 1449</li> <li>– Available with 3<sup>rd</sup> lead for status display</li> <li>– High surge current capability</li> </ul>
<b>Applications</b>	Industrial electronics Power supplies Inverters Photovoltaic systems	Industrial electronics Power supplies Inverters Power meters	Home appliances Power supplies Inverters, Photovoltaic inverters Drives Lighting applications Communication and data systems Smart meters




Varistors		
		
<b>Series</b>	CU varistors – SMD	SNF10, SNF14, SNF20
<b>Technical data</b>	Size (EIA): 3225, 4032, 4948 Operation voltage $V_{RMS}$ : 14 ... 300 V Max. surge current (8/20 $\mu$ s): 3500 A Max. energy absorption: 82 J (2 ms) Max. power dissipation: 400 mW	Operating voltage $V_{RMS}$ : 130 ... 625 V SNF10: $I_{max}$ 8/20 $\mu$ s up to 3.5 kA SNF14: $I_{max}$ 8/20 $\mu$ s up to 6 kA SNF20: $I_{max}$ 8/20 $\mu$ s up to 12 kA
<b>Features</b>	<ul style="list-style-type: none"> <li>– Electrically equivalent to leaded types S05, S07, S10</li> <li>– Lead-free soldering</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– Operating temperature +125 °C</li> <li>– No flame or rupture</li> <li>– Heat resistance and flame-retardant to UL 94 V-0</li> <li>– UL 1449, ed.4</li> </ul>
<b>Applications</b>	Surge current protection in SMD package for automotive, industrial and communication electronics	Consumer electronics Power supplies






# Piezo and Protection Devices

## Varistors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Varistors			
			
<b>Series</b>	LS40, LS41, LS42	LS40-E7	LS50
<b>Technical data</b>	LS40: $I_{max}$ 8/20 $\mu$ s: 40 kA LS41: $I_{max}$ 8/20 $\mu$ s: 50 kA LS42: $I_{max}$ 8/20 $\mu$ s: 65 kA Operating voltage $V_{RMS}$ : 130 ... 750 V	$I_{imp}$ 10/350 $\mu$ s: 6.5 kA $I_{max}$ 8/20 $\mu$ s: 40 kA Operating voltage $V_{RMS}$ : 130 ... 460 V	$I_{max}$ 8/20 $\mu$ s: up to 75 kA Operating voltage $V_{RMS}$ : 130 ... 550 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– Strap terminals</li> <li>– High surge current ratings</li> <li>– High energy ratings (2 ms) up to 1200 J</li> <li>– Designed to requirements of IEC 61643-11</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– Strap terminals</li> <li>– High surge current ratings at 10/350 <math>\mu</math>s</li> <li>– Designed to requirements of IEC 61643-11</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– Strap terminals</li> <li>– High surge current ratings</li> <li>– High energy ratings (2 ms) up to 1820 J</li> <li>– UL 1449, ed.4</li> </ul>
<b>Applications</b>	Power supplies Renewable energies Surge protection devices		



Varistors			
			
<b>Series</b>	B32, B40, B60, B80	S-AUTO	Energy varistors E32 ... E99
<b>Technical data</b>	B32: $I_{max}$ 8/20 $\mu$ s: 25 kA B40: $I_{max}$ 8/20 $\mu$ s: 40 kA B60: $I_{max}$ 8/20 $\mu$ s: 70 kA B80: $I_{max}$ 8/20 $\mu$ s: 100 kA Operating voltage $V_{RMS}$ : 75 ... 1100 V	S07: $I_{max}$ 8/20 $\mu$ s: up to 250 A S10: $I_{max}$ 8/20 $\mu$ s: up to 500 A S14: $I_{max}$ 8/20 $\mu$ s: up to 1 kA S20: $I_{max}$ 8/20 $\mu$ s: up to 2 kA Operating voltage: 16 ... 48 V DC Operating temperature: +125 °C	E32: $I_n$ 8/20 $\mu$ s: 5 kA ... E99: $I_n$ 8/20 $\mu$ s: 20 kA  Repetitive charge transfer rating, $Q_{rs}$ 8/20 $\mu$ s: 0.2 ... 6 C
<b>Features</b>	<ul style="list-style-type: none"> <li>– Disk shaped varistor element potted in plastic housing</li> <li>– Screw terminals</li> <li>– Housing and potting flame retardant to UL94 V-0</li> <li>– UL 1449, ed.4</li> </ul>	<ul style="list-style-type: none"> <li>– Leaded varistors disk <math>\varnothing</math> 7 to 20 mm</li> <li>– High energy absorption</li> <li>– Coating flame retardant to UL 94 V-0</li> </ul>	<ul style="list-style-type: none"> <li>– Disk <math>\varnothing</math> 32 to 99 mm</li> <li>– Glass passivated collar</li> <li>– Aluminum termination for pressure contact</li> </ul>
<b>Applications</b>	Power supplies Renewable energies Inverters	Automotive electronics Jump-start Load dumps	Gapless arresters Distribution class, station class

# Piezo and Protection Devices

Inrush Current Limiters, Multilayer Varistors, Ceramic Transient Voltage Suppressors (CTVS)

TDK EPCOS Micronas InvenSense Tronics

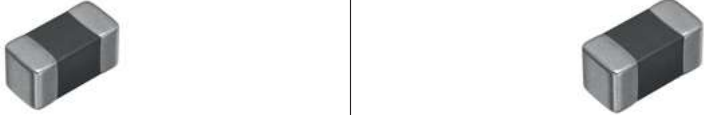
Inrush Current Limiters			
			
<b>Series</b>	S153, S235, S236, S237, S238, P11, P13, S364, S464, P27	Plastic case	Leaded disks
<b>Technical data</b>	Operating voltage $V_{RMS}$ : 265 V Rated resistance at +25 °C: 1 ... 120 $\Omega$ $I_{max}$ : up to 30 A Load capacitance: up to 16 000 pF	Max. voltage: 280 ... 560 V AC Rated resistance: 22 ... 100 $\Omega$	Max. voltage: 260 ... 560 V AC Rated resistance: 25 ... 500 $\Omega$
<b>Features</b>	<ul style="list-style-type: none"> <li>- NTC thermistors</li> <li>- Limiting of inrush current</li> <li>- Wide resistance range</li> <li>- Lead spacing 5 and 7.5 mm</li> <li>- UL 1434</li> </ul>	<ul style="list-style-type: none"> <li>- PTC thermistor</li> <li>- Operating cycles at <math>V_{max}</math> (charging of capacitor): &gt;100 000</li> <li>- J213, J215, J217, J219 qualification to AEC-Q200, Rev. D</li> </ul>	<ul style="list-style-type: none"> <li>- PTC thermistor</li> <li>- Operating cycles at <math>V_{max}</math> (charging of capacitor): &gt;100 000</li> </ul>
<b>Applications</b>	Power supplies Soft-start motors	Power supplies Household appliances Pumps Drives On-board chargers	




Multilayer Varistors, CTVS		
		
<b>Series</b>	Multilayer chip protectors – SMD SGNE	SHCV
<b>Technical data</b>	Size: (IEC) 0402, 0603 or (EIA) 01005, 0201 Max. continuous voltage: 4.3/4.3, 15 V DC Breakdown voltage (1 mA): 8 (6.4 ... 9.6) V/8 (6.4 ... 9.6), 27 (21.6 ... 32.4) V Capacitance (1 MHz): 15 (10.5 ... 19.5) pF/15 (10.5 ... 19.5), 6.8 (4.8 ... 8.8) pF Leakage current: 20 micro-A max. V DC ESD clamp voltage: 25/25, 60 max. V average voltage (IEC61000-4-2, 8 kV)	Size (EIA): 1206 ... 2220 Operating voltage: 16 ... 45 V DC Surge current: up to 1200 A Load dump energy: up to 12 J Nominal capacitance: up to 4700 nF Operating temperature: up to +125 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- For ESD protection solutions which is using a semiconductor ceramic</li> <li>- Possible replacement of TVS diode for ESD protection</li> <li>- Outstanding ESD absorption and excellent ESD protection characteristic (based on IEC61000-4-2, Contact-8 kV)</li> </ul>	<ul style="list-style-type: none"> <li>- Lead-free soldering</li> <li>- Coating: Flame-retardant to UL94 V0, epoxy resin</li> </ul>
<b>Applications</b>	ESD protection such as signal lines, audio lines Filter for EMI protection Smart phones, tablets, portable music players, notebooks	Combined protection against transient and RFI suppression in a single component for brushed DC motors

# Piezo and Protection Devices

## Multilayer Varistors, Ceramic Transient Voltage Suppressors (CTVS)

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics


Multilayer Varistors, CTVS	
	
<b>Series</b>	Multilayer chip varistors – SMD AVRL
<b>Technical data</b>	Size (IEC): 0402 ... 1608 Varistor voltage: 27 ... 90 V typ. (DC 1 mA) Max. continuous voltage: 10 ... 25 V DC Capacitance: 1.1 (0.8 ... 1.4) ... 6.8 (4.8 ... 8.8) pF (1 MHz, 1 V RMS) Insulation resistance: 10 MΩ min. (3 V RMS)
<b>Features</b>	<ul style="list-style-type: none"> <li>– No polarity, due to symmetrical current-voltage characteristics</li> <li>– Excellent electrostatic absorption capability</li> <li>– Adopted inner electrode lamination structure</li> </ul>
<b>Applications</b>	Countermeasure for surge and static electricity



Multilayer Varistors, CTVS			
			
<b>Series</b>	CeraDiodes – SMD Standard, High-speed and LED series	Multilayer chip varistors – SMD Standard and high surge series	Multilayer chip varistors – SMD Automotive E series
<b>Technical data</b>	Size (EIA): 0201 ... 1003 (single) 0506 ... 1012 (array) Operating voltage: 5.5 ... 200 V DC Typical capacitance: 0.6 ... 470 pF No derating up to +85 °C	Size (EIA): 0201 ... 2220 Operating voltage: 5.5 ... 170 V DC Surge current: up to 6000 A Energy absorption: up to 12 J High surge load capability acc. to IEC 61000-4-5 UL approval No derating up to +125 °C	Size (EIA): 0402 ... 2220 Operating voltage: 16 ... 56 V DC Load dump energy: 1 ... 25 J Qualified to AEC-Q200, Rev. C ISO 7637-2 ISO 16750-2 No derating up to +150 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>– Bidirectional protection</li> <li>– Lead-free soldering</li> <li>– ESD capability to IEC 6100-4-2, level 4 (8 kV contact discharge, 15 kV air discharge)</li> <li>– Lead-free</li> </ul>		
<b>Applications</b>	ESD protection of high-speed data lines (e.g. USB, Ethernet, video), industrial, lighting and wireless applications	Protection against ESD, surge, burst, switching inductive load and temporary overvoltage for industrial and communication applications	ESD protection of bus lines (e.g. LIN, CAN, Flexray, Ethernet) Protection against automotive transients in battery lines

# Piezo and Protection Devices

NTC Thermistors, Nebulizer Units

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

NTC Thermistors	
	
<b>Series</b>	NTC thermistors chip – SMD Standard series
<b>Technical data</b>	Size (EIA): 0402 ... 1206 B <sub>25/100</sub> values: 3439 K ... 4575 K R values: 1 ... 680 kΩ R tolerance: $\geq \pm 0.5\%$ B tolerance: $\geq \pm 0.5\%$ Operating temperature: -55/+125 °C
<b>Feature</b>	- Ni barrier termination - Lead-free soldering - UL approval
<b>Applications</b>	Temperature measurement and compensation in consumer electronics, information technology, industrial and wireless applications

NTC Thermistors	Nebulizer Units
	
<b>Series</b>	NTCG – SMD
<b>Technical data</b>	Size (IEC): 0603 ... 2012 B constant: 3250 ... 4750 K $\pm 3\%$ (+25/+85 °C) Nominal resistance value: 30 Ω ... 1.0 MΩ (+25 °C) Operating temperature: -40 ... +125 °C
<b>Features</b>	- Lead-less terminal electrodes and electroplating (Ni-Sn), excellent solderability and soldering heat resistance - Product series provides a wide range of resistances and B constants - Good stability of resistance value after soldering - Attains less than low floating capacitance (using TCXO) in the high frequency region
<b>Applications</b>	Temperature measurement and compensation

<b>Series</b>	Ultrasonic nebulizer units NB
<b>Technical data</b>	Rated input voltage: 48 V AC/ 12 V DC DC Power consumption: 13.2 max./ 30 W Mist output ratio: 150 ... 450 ml/h Ultrasonic frequency: 1600 ... 1750 kHz 2350 ... 2600 kHz
<b>Features</b>	- Compact, with highly reliable circuitry - Separate transducer and drive circuit sections provide superior layout versatility
<b>Applications</b>	Household appliances Medical appliances

# Micro Modules

## Bluetooth V4.1 Smart Single Mode Modules

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Bluetooth V4.1 Smart Single Mode Modules









<b>Series</b>	BLE V4.1 (Bluetooth Low Energy) module – SMD SESUB-PAN-D14580
<b>Technical data</b>	Communication standards: 2.4 GHz Bluetooth V4.1 low energy Transmitter output power: 0 dBm typ. Receiver sensitivity level: -94 dBm Host interface: UART (2ch) / SPI+ / I2C (100 k/400 kHz) Peripheral Interface: 10 bits ADC (4ch) / Pin-configurable GPIO Current consumption: 5.0 mA (Tx), 5.4 mA (Rx), 0.8 µA (Deep Sleep mode)
<b>Features</b>	<ul style="list-style-type: none"> <li>- Ultra small package, ideal for for wearable devices (3.5 x 3.5 x 1.0 mm typ.)</li> <li>- Packaged in 36-pin solder bumped BGA with 0.5 mm pitch</li> <li>- Compatible with Bluetooth Smart Ready products</li> <li>- ARM Cortex-M0 32-bit high performance microcontroller</li> <li>- 32 kB OTP programmable memory, 84 kB ROM for BT stack</li> <li>- 42 kB System SRAM, 8 kB Retention SRAM</li> <li>- Including IC (Dialog Semiconductor : DA14580), Crystal (16 MHz), Inductor, and Capacitor in this module</li> </ul>
<b>Applications</b>	Health care, sports and fitness devices Wearables Home and entertainment devices PC accessories

# Sensors

## Temperature Sensors (NTC)

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Temperature Sensors (NTC)			
			
<b>Series</b>	NTC thermistors with lead spacing	Mini sensors with bendable wires	Glass-encapsulated sensors G1540
<b>Technical data</b>	<p>Operating temperature: -55 ... +155 °C</p> <p>Resistance value: 1 ... 470 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 1\%</math> / <math>\Delta B/B = 1\%</math></p> <p>Head size: 2.5 ... 4.5 mm</p> <p>Diameter of lead wires: 0.4 ... 0.6 mm</p> <p>Lead spacing: 2.5 or 5.0 mm</p> <p>Delivery mode: tape &amp; reel; bulk</p> <p>Coating: epoxy, lacquer</p>	<p>Operating temperature: -55 ... +155 °C</p> <p>Resistance value: 2 ... 100 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 1\%</math> / <math>\Delta B/B = 1\%</math></p> <p>Head size: 2.41 ... 2.8 mm</p> <p>Diameter of lead wires: 0.25 mm</p> <p>Delivery mode: bulk</p> <p>Coating: epoxy</p>	<p>Operating temperature: -55 ... +300 °C (G1540 from 5 kΩ, up to +250 °C)</p> <p>Resistance value: 2 ... 230 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 2\%</math> / <math>\Delta B/B = 1\%</math></p> <p>Head size: 0.8 ... 2.3 mm</p> <p>Diameter of lead wires: 0.15 ... 0.3 mm</p> <p>Delivery mode: bulk</p> <p>Coating: glass</p>
<b>Features</b>	<ul style="list-style-type: none"> <li>- Available with insulated leads</li> <li>- High measuring accuracy</li> <li>- Lead spacing</li> <li>- Rugged design</li> <li>- Cost effective</li> </ul>	<ul style="list-style-type: none"> <li>- Available with insulated leads</li> <li>- Special version with improved resistance to humidity available</li> <li>- High measuring accuracy</li> <li>- Tight B value tolerance available</li> <li>- Available with long bendable leads</li> <li>- UL approval (S861, S867)</li> </ul>	<ul style="list-style-type: none"> <li>- Short response time</li> <li>- Heat resistive and highly stable</li> </ul>
<b>Applications</b>	Temperature measurement and compensation	Temperature measurement	




Temperature Sensors (NTC)			
			
<b>Series</b>	Glass-encapsulated sensors with insulation, G5141	Cable-bound temperature sensors	Water temperature sensors
<b>Technical data</b>	<p>Operating temperature: -55 ... +260 °C (G1541 from 5 kΩ, up to +250 °C)</p> <p>Resistance value: 2 ... 230 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 2\%</math> / <math>\Delta B/B = 1\%</math></p> <p>Head size: 1.4 ... 3.0 mm, max.</p> <p>Diameter of lead wires: 0.15 ... 0.3 mm</p> <p>Delivery mode: bulk</p> <p>Coating: glass</p> <p>Insulation voltage: 500 V/ 1 s</p>	<p>Operating temperature: -40 ... +80 °C</p> <p>Resistance value: 2.7 ... 10 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 2\%</math> / <math>\Delta B/B = 1.5\%</math></p> <p>Head size: 5.4, 7, 8, 9 mm</p> <p>Cable length: up to 2800 mm</p>	<p>Operating temperature: -20 ... +125 °C</p> <p>Resistance value: 10 kΩ</p> <p>Accuracy: <math>\Delta R_N/R_N = 2\%</math> / <math>\Delta B/B = 0.8\%</math></p>
<b>Features</b>	<ul style="list-style-type: none"> <li>- With insulation on head and leads</li> <li>- Short response time</li> <li>- Heat resistive, highly stable and robust</li> </ul>	<ul style="list-style-type: none"> <li>- Highly resistant to water/ moisture</li> <li>- Construction based on DIN EN 60 730-1/VDE protection class 2 (M2020)</li> <li>- UL approved (M2020: file E69802)</li> </ul>	<ul style="list-style-type: none"> <li>- Suitable for use in corrosive environments</li> <li>- Highly resistant to water/ moisture</li> <li>- Short thermal response time in water</li> </ul>
<b>Applications</b>	Temperature measurement		

# Sensors

## Temperature Sensors (NTC)

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Trionics




Temperature Sensors (NTC)			
			
<b>Series</b>	Screw-on temperature sensors	Pipe mounted temperature sensors	Evaporator sensors
<b>Technical data</b>	Operating temperature: -55 ... +200 °C Resistance: 10 ... 100 kΩ Accuracy: $\Delta R_N/R_N = 3\%$ / $\Delta B/B = 1\%$	Operating temperature: +5 ... +100 °C Resistance: 10 kΩ Accuracy: $\Delta R_N/R_N = 3.6\%$ / $\Delta B/B = 1\%$ For pipe diameter: 13.5 ... 22 mm Insulation voltage: 500 V AC	Operating temperature: -40 ... +90 °C Resistance: 2 ... 10 kΩ Accuracy: $\Delta R_N/R_N = 1\%$ / $\Delta B/B = 1\%$
<b>Features</b>	<ul style="list-style-type: none"> <li>- Maximum temperature at sensor head +300 °C</li> <li>- Good thermal coupling through metal tag</li> <li>- Thermistor encapsulated in metal tag case</li> </ul>	<ul style="list-style-type: none"> <li>- Fast and easy mounting</li> <li>- Short response time</li> <li>- Good thermal coupling to pipes</li> </ul>	<ul style="list-style-type: none"> <li>- Humidity resistant: 2000 h immersion test in water at +80 °C</li> <li>- Clip design for fast and reliable mounting</li> </ul>
<b>Applications</b>	Surface temperature measurement	Temperature measurement of fluids in pipes	Temperature measurement in evaporators




Temperature Sensors (NTC)			
			
<b>Series</b>	Air duct sensors	Ambient temperature sensors	Solar sensors
<b>Technical data</b>	Operating temperature: -40/+90 °C Resistance value: 2 ... 30 kΩ Accuracy: $\Delta R_N/R_N = 1\%$ / $\Delta B/B = 1\%$	Operating temperature: -40/+85 °C Resistance value: 2 ... 30 kΩ Accuracy: $\Delta R_N/R_N = 1\%$ / $\Delta B/B = 1\%$	Operating temperature: -40/+100 °C Tolerance: $\pm 15\%$
<b>Features</b>	<ul style="list-style-type: none"> <li>- Plastic version with clip mounting</li> <li>- Short response time</li> <li>- Reduction of weight</li> <li>- Simplified recycling</li> </ul>	<ul style="list-style-type: none"> <li>- Humidity resistant over-molded design</li> <li>- High resistance to water splashes IPx9k</li> <li>- Cable-based design</li> <li>- Designed for 2000 h water immersion at +80 °C</li> </ul>	<ul style="list-style-type: none"> <li>- Mono and dual-zone sensors</li> <li>- High resolution and sensitivity</li> <li>- Measurement of solar radiation on the passenger compartment for the HVAC system</li> <li>- Angular characteristics</li> <li>- Analog signal</li> </ul>
<b>Applications</b>	Measurement of average air temperature	Outside temperature measurement	Measurement of solar radiation and direction

# Sensors

## Temperature Sensors (NTC)

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Temperature Sensors (NTC)			
			
<b>Series</b>	NTC sensors (Assembly) NTCGP series	NTC sensors (Assembly) NTCDP series	NTC sensors (Assembly) – ABS Plastic case NTCDP series
<b>Technical data</b>	Nominal resistance: $R_{25} = 15 \text{ k}\Omega \pm 3\% \dots 50 \text{ k}\Omega \pm 3\%$ B constant: $B_{25/50} = 3950 \text{ K} \pm 2, \pm 3\%$ Operating temperature: –20 ... +80 °C (resin dip) –40 ... +125 °C (lug terminal) Thermal time constant: 6 s max. in still water. Heat dissipation constant: 2.8 ... 3 mW/°C (in still air)	Nominal resistance: $R_{25} = 10 \text{ k}\Omega \pm 3, \pm 5\%$ B constant: $B_{25/85} = 4000 \text{ K} \pm 2\%$ Operating temperature: –40 ... +150 °C Thermal time constant: 15 s max. in still water Heat dissipation constant: 3.3 mW/°C in still air	Nominal resistance: $R_3 = 5.6 \text{ k}\Omega \pm 0.2 \text{ k}\Omega (3 \text{ }^\circ\text{C})$ B constant: $B_{3/50} = 3850 \text{ K} \pm 100 \text{ K}$ Operating temperature: –40 ... +85 °C Thermal time constant: 30 s max. in still water Heat dissipation constant: 2.5 mW/°C in still air
<b>Features</b>	– Resin DIP type with built-in multilayer element – Good heat responsiveness	– Excellent reliability, high responsiveness, high heat resistance – Three types are available <u>Epoxy (Ø 5.5 mm) type</u> : Priority given to heat responsiveness <u>Epoxy (Ø 6.0 mm) type</u> : Compatible with copper case type of Ø 6.0 mm <u>Epoxy screw fix type</u> : Superior surface temperature detection	– Plastic case compliant to Food Hygiene Act – Highly waterproof – Inexpensive
<b>Applications</b>	Temperature measurement	Temperature measurement Surface temperature detection	Home appliances Consumer electronics


Temperature Sensors (NTC)			
			
<b>Series</b>	NTC sensors (Assembly) – Plastic case type, oil temperature sensor NTCDP series	NTC sensors (Assembly) – ATF oil temperature sensor NTCDP	NTC sensors (Assembly) – NTCRP
<b>Technical data</b>	Nominal resistance: $R_{140} = 0.072 \text{ k}\Omega \pm 5\% (+140 \text{ }^\circ\text{C})$ B constant: $B_{20/80} = 3520 \text{ K} \pm 2\%$ Operating temperature: –40 ... +150 °C Thermal time constant: 60 s max. in still oil Heat dissipation constant: 5 mW/°C in still air	Nominal resistance: $R_{145} = 0.111 \text{ k}\Omega \pm 2.5\% (+145 \text{ }^\circ\text{C})$ B constant: $B_{25/85} = 3528 \text{ K} \pm 2\%$ Operating temperature: –40 ... +150 °C Thermal time constant: 15 s max. in still oil Heat dissipation constant: 3.5 mW/°C in still air	Nominal resistance: $R_{25} = 49.12 \text{ k}\Omega \pm 5\%$ B constant: $B_{25/80} = 3992 \text{ K} \pm 2\%$ Operating temperature: –40 ... +200 °C Thermal time constant: 10 s max. in still oil Heat dissipation constant: 1.9 mW/°C (+25 °C in still air) Heating time constant: 3.3 seconds (+25 °C ... +85 °C/1 in oil)
<b>Features</b>	– High heat resistance – Excellent oil resistance	– High heat resistance – Excellent oil resistance and ATF resistance – Detection portion is sealed by an O-ring allowing for direct detection of oil temperature	– Excellent ATF resistance – Fast heat responsiveness
<b>Applications</b>	Oil temperature detection for e.g. ATF transmission oil, oil heaters	Oil temperature detection for e.g. ATF, transmission oil, oil heaters	Coil temperature detection for EV, HEV and PHEV drive motor Inner temperature detection for the servomotor






# Sensors

## Temperature Sensors (NTC)

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics


Temperature Sensors (NTC)	
	
<b>Series</b>	NTC sensors (Element) NTCDS series
<b>Technical data</b>	Size: 3.0 x Ø 1.8 ... 4.0 x Ø 2.0 mm Operating temperature: -40 ... +250 °C (Lead wire Ni plating), -40 ... +160 °C (Lead wire Sn plating) Heat dissipation constant: 1 ... 2 mW/°C in still air Thermal time constant: 10 ... 20 s max. in still air Insulation resistance between lead and glass: 50 MΩ min. (DC 500 V)
<b>Features</b>	<ul style="list-style-type: none"> <li>- Glass-sealed construction identical to DHDs (Double Heatsink Diodes)</li> <li>- Highly reliable and resistant to high relative humidity</li> <li>- Tight tolerances are maintained in resistance vs. temperature characteristics</li> <li>- Size reduction</li> </ul>
<b>Applications</b>	Automotive electronics, home appliances, consumer electronics


Temperature Sensors (NTC)			
			
<b>Series</b>	E-Motor temperature sensor	Battery temperature sensor	Screw-on temperature sensor
<b>Technical data</b>	Operating temperature: -40 ... +200 °C Resistance value: 10 kV/ +25 °C	Operating temperature: -40 ... +90 °C Resistance value: 10 kV/ +25 °C	Operating temperature: -40 ... +150 °C Short temperature overload: +200 °C Resistance value: 10 kV/ +25 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Measurement directly in the winding of the motor</li> <li>- Mechanically protected by plastic housing</li> <li>- High insulation voltage up to 2000 V</li> <li>- Available with different connectors, RT curves and cable lengths</li> </ul>	<ul style="list-style-type: none"> <li>- Screw-on sensor for battery temperature measurement</li> <li>- Clip-on sensor for measurement of battery cooling fluid temperature</li> <li>- Available with different connectors, RT curves, cable lengths and for different pipe diameters</li> </ul>	<ul style="list-style-type: none"> <li>- High voltage insulation of 2.5 kV</li> <li>- Validated according LV123/124</li> <li>- Screw design for fast and reliable mounting</li> </ul>
<b>Applications</b>	Temperature measurement in stator of electric motors	Temperature measurement of batteries in electric cars	Busbar temperature measurement


# Sensors

## Linear Hall Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Single-Axis Hall-Effect Sensors	
	
<b>Series</b>	HAL® 8xy Programmable linear Hall-effect sensor
<b>Technical data</b>	Package: TO92UT Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 14 V Magnetic range: ±30 ... ±150 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>- High-precision sensor with 12-bit analog output</li> <li>- Programmable temperature compensation</li> <li>- Open-circuit, over- and undervoltage detection</li> <li>- Programmable output clamping function</li> <li>- High immunity against ESD</li> <li>- Overvoltage and reverse-voltage protection at all pins, short-circuit protected push-pull output</li> <li>- Flexible analog / PWM output</li> <li>- Offset drift over temperature less than ±0.2% of VSUP</li> </ul>
<b>Applications</b>	Accelerator pedal Throttle position Steering torque Exhaust gas recirculation Turbo charger

Single-Axis Hall-Effect Sensors	
	
<b>Series</b>	HAL® 188y Linear Hall-effect sensor – Programmable or with fixed sensitivity
<b>Technical data</b>	Package: TO92UA Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±20 ... ±160 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>- Ratiometric analog output</li> <li>- Digital signal processing</li> <li>- Temperature characteristics programmable for matching all common magnetic materials</li> <li>- Operates with static and dynamic magnetic fields up to 5 kHz</li> <li>- Over-/reverse-voltage protection on VDD pin</li> <li>- Magnetic characteristics extremely robust against mechanical stress</li> <li>- Short-circuit protected output</li> </ul>
<b>Applications</b>	Current measurements Gear position sensor



	
<b>Series</b>	HAL® 28xy Programmable linear Hall-effect sensor with SENT or PWM output
<b>Technical data</b>	Package: TO92UT Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 17 V Magnetic range: ±20 ... ±160 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>- High-precision linear Hall-effect sensor</li> <li>- Spinning-current offset compensation</li> <li>- Built-in temperature sensor</li> <li>- Built-in RISC processor</li> <li>- Digital signal processing</li> <li>- Up to 16 bit resolution</li> <li>- Customer-programmable temperature compensation</li> <li>- SENT or PWM output up to 2 kHz (HAL 2850)</li> <li>- Magnetic characteristics extremely robust against mechanical stress</li> </ul>
<b>Applications</b>	Steering torque Turbo charger

# Sensors

## Linear Hall Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




### Single-Axis Hall-Effect Sensors

		
<b>Series</b>	HAL <sup>®</sup> 24xy Precise and robust programmable linear Hall-effect sensor	HAR 24xy Precise and robust programmable linear Hall-effect sensor with redundancy functionality
<b>Technical data</b>	Package: TO92UT or SOIC8 Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±25 ... ±200 mT	Package: TSSOP14 Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±25 ... ±200 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>- Ratiometric 12-bit analog output</li> <li>- 16 setpoints for various output characteristics</li> <li>- High immunity against ESD (8 kV)</li> <li>- Programmable temperature compensation</li> <li>- Low output voltage drifts over temperature</li> <li>- Open-circuit, over- and undervoltage detection</li> <li>- Programmable output clamping function</li> <li>- Digital readout of temperature and magnetic field information in calibration mode</li> <li>- Operates with dynamic magnetic fields up to 2 kHz</li> <li>- Overvoltage and reverse-voltage protection (all pins)</li> <li>- Short-circuit protected push-pull output</li> </ul>	<ul style="list-style-type: none"> <li>- Ratiometric 12-bit analog output or PWM output</li> <li>- Dual-die Hall-effect sensors for true redundancy</li> <li>- 16 setpoints for various output characteristics</li> <li>- High immunity against HBM ESD (8 kV)</li> <li>- Programmable temperature compensation</li> <li>- Low output voltage drifts over temperature</li> <li>- Open-circuit, over- and undervoltage detection</li> <li>- Programmable output clamping function</li> <li>- Digital readout of temperature and magnetic field information in calibration mode</li> <li>- Operates with dynamic magnetic fields up to 2 kHz</li> <li>- Overvoltage and reverse-voltage protection (all pins)</li> <li>- Short-circuit protected push-pull output</li> </ul>
<b>Applications</b>	Throttle position, pedal position, steering torque EGR applications	Throttle position, pedal position, steering torque EGR applications, distance and linear movement measurements in safety critical applications

# Sensors

## Multi-Axis Hall Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




2D Position Hall Sensors			
			
<b>Series</b>	HAL® 37xy Programmable Hall-effect sensor for rotational or linear position detection	HAC 37xy Programmable Hall-effect sensor with integrated capacitors	HAR 37xy Programmable Hall-effect sensor with redundancy functionality
<b>Technical data</b>	Package: TO92UP or SOIC8 Operating temp.: TJ = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±20 ... ±100 mT	Package: TO92UF Operating temp.: TJ = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±20 ... ±100 mT	Package: SOIC8 Operating temp.: TJ = -40 ... +170 °C Operating voltage: 4.5 ... 5.5 V Magnetic range: ±20 ... ±100 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>- Measurement extremely robust against temperature and stress influence</li> <li>- Angular accuracy of ±0.5% FS</li> <li>- 12 bit ratiometric linear analog output for HAL 372x</li> <li>- HAL 371x with modulo 90°/120° for chassis systems</li> <li>- 0.2 kHz to 2 kHz PWM (up to 12 bit) or 12 bit SENT output for HAL 3711/ HAL 373x</li> <li>- Programmable arbitrary output characteristic with up to 33 setpoints</li> <li>- Temperature-dependent offset programmable for X/Y- or Z-channel</li> <li>- On-board diagnostics</li> <li>- Short-circuit protected push-pull output</li> <li>- Over-/reverse-voltage &amp; under- and overvoltage protection at VSUP</li> <li>- Wire-break detection</li> </ul>	<ul style="list-style-type: none"> <li>- Measurement extremely robust against temperature and stress influence</li> <li>- Integrated capacitors for improved electromagnetic compatibility (EMC) and PCB-less applications</li> <li>- Angular accuracy of ±0.5% FS</li> <li>- 12 bit ratiometric linear analog output for HAC 372x</li> <li>- HAC 371x with modulo 90°/120° for chassis systems</li> <li>- 0.2 kHz to 2 kHz PWM (up to 12 bit) or 12 bit SENT output for HAC 3711/ HAL 373x</li> <li>- SENT SAE J2716 rev. 2016 protocol</li> <li>- Programmable arbitrary output characteristic with up to 33 setpoints</li> <li>- Temperature-dependent offset programmable for X/Y- or Z-channel</li> <li>- On-board diagnostics</li> <li>- Wire-break detection</li> </ul>	<ul style="list-style-type: none"> <li>- Measurement extremely robust against temperature and stress influence</li> <li>- Angular accuracy of 0.5% FS</li> <li>- 0.2 to 2 kHz PWM (up to 12 bit) or 12 bit SENT output</li> <li>- SENT SAE J2716 rev. 2016 protocol:               <ul style="list-style-type: none"> <li>- H.1 Format: Transmission of position and temperature or magnetic field amplitude on fast and slow channel</li> <li>- H.2 Format: Three data nibbles</li> <li>- H.4 Format: Secure channel format</li> </ul> </li> <li>- Programmable arbitrary output characteristic with up to 33 setpoints</li> <li>- Temperature-dependent offset programmable for X/Y- or Z-channel</li> <li>- On-board diagnostics</li> <li>- Short-circuit protected push-pull output</li> <li>- Over-/reverse-voltage &amp; under- and overvoltage protection at VSUP</li> </ul>
<b>Applications</b>	EGR valve position Clutch pedal position Gear selector Cylinder and valve position sensing Non-contact potentiometer	EGR valve position Turbocharger actuator position Position detection in transmission systems Cylinder and valve position sensing Non-contact potentiometer	EGR valve position Clutch pedal position Gear selector Cylinder and valve position sensing Non-contact potentiometer

# Sensors

## Multi-Axis Hall Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics


### 3D Position Hall Sensors



			
<b>Series</b>	HAL <sup>®</sup> 3900 – Programmable Hall-effect sensor for 3D position detection with SPI interface	HAC 3930 – Programmable Hall-effect sensor for 3D position detection with PWM/SENT interface	HAR 3980 – Programmable Hall-effect sensor for 2D position detection with PSI5 interface
<b>Technical data</b>	Package: SOIC8 Operating temp.: $T_J = -40 \dots +170 \text{ °C}$ Operating voltage: 3.0 ... 5.5 V Magnetic range: $\pm 10 \dots 130 \text{ mT}$	Package: SOIC8 Operating temp.: $T_J = -40 \dots +170 \text{ °C}$ Operating voltage: 3.0 ... 16 V Magnetic range: $\pm 10 \dots 130 \text{ mT}$	Package: SOIC8 Operating temp.: $T_J = -40 \dots +170 \text{ °C}$ Operating voltage: 3.0 ... 11 V Magnetic range: $\pm 10 \dots 130 \text{ mT}$
<b>Features</b>	<ul style="list-style-type: none"> <li>– 3D position detection supporting transmission of two angles out of <math>B_x, B_y, B_z</math></li> <li>– Temperature compensated raw values of <math>B_x, B_y, B_z</math></li> <li>– Stray field robust linear and rotary position detection up to <math>360^\circ</math></li> <li>– SEooC according to ISO 26262 to support functional safety applications</li> <li>– SPI interface with 10 MHz clock</li> <li>– 16 bit data transmission with CRC and rolling counter</li> <li>– Programmable via SPI interface</li> <li>– Sleep mode (wake-up pin)</li> <li>– Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc.</li> </ul>	<ul style="list-style-type: none"> <li>– 3D position detection supporting transmission of two angles out of <math>B_x, B_y, B_z</math></li> <li>– Compensation of magnetic stray fields for linear and rotary position detection up to <math>360^\circ</math></li> <li>– SEooC according to ISO 26262 to support functional safety applications</li> <li>– Customer configurable PWM or SENT output</li> <li>– PWM frequencies between 0.1 kHz and 2 kHz (Up to 13 bit)</li> <li>– SENT according to SAEJ 2716 rev.4 with three different frame formats (H1, H2 and H4)</li> <li>– Enhanced 12-bit serial message format including temperature information</li> <li>– Additional switch output</li> <li>– Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc.</li> <li>– Programmable via output pin with min. supply voltage</li> <li>– 17 variable or 33 fix setpoints for output linearization</li> </ul>	<ul style="list-style-type: none"> <li>– 2D position detection out of <math>B_x, B_y, B_z</math></li> <li>– Compensation of magnetic stray fields for linear and rotary position detection up to <math>360^\circ</math></li> <li>– SEooC according to ISO 26262 to support functional safety applications</li> <li>– PSI5 interface supporting version 2.1 and 2.2</li> <li>– Programming via 2-wire interface by supply voltage modulation. No additional programming pin required</li> <li>– Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc.</li> <li>– 17 variable or 33 fix setpoints for output linearization</li> </ul>
<b>Applications</b>	Shifter position Wiper position Gear selector Joystick position Selector position	Chassis position Turbocharger position EGR valves Gear selector position Steering angle Clutch position Transmission position	Chassis position Brake pedal position Transmission position

# Sensors

## Angle Sensors, Hall Switches

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Angle Sensors	
	
<b>Series</b>	Angle sensors TAS
<b>Technical data</b>	Output: 1.5 ... 3.0 Vp-p (5 V) Angular accuracy: ±0.6 deg. (1.5 Vp-p differential output at 5 V) ±0.8 deg. (3.0 Vp-p differential output at 5 V) Detections can be made from 0 to 360°
<b>Features</b>	<ul style="list-style-type: none"> <li>– Magnetic angle sensor including TMR (Tunnel Magneto-Resistance) based on magnetic record sensing technology in HDD head</li> <li>– High-output, high-accuracy, and high-stability with low aging deterioration.</li> <li>– Innovative TMR sensors are available in a compact package</li> <li>– Low temperature drifts</li> <li>– Low power consumption</li> </ul>
<b>Applications</b>	Steering angles Pedal opening, throttle valve opening Brushless motors Motors for wipers

Hall Switches		
		
<b>Series</b>	HAL® 1002 In-System programmable hall switch	HAL® 15xy ISO 26262 compliant low-power hall switch
<b>Technical data</b>	Package: TO92UT Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 4.5 ... 8.5 V Magnetic range: -30 ... to 150 mT	Package: TO92UA or SOT23 Operating temp.: T <sub>J</sub> = -40 ... +170 °C Operating voltage: 2.7 ... 24 V Magnetic range: ±0.4 ... ±24 mT
<b>Features</b>	<ul style="list-style-type: none"> <li>– Programmable switching points and behavior</li> <li>– Switching points programmable in steps of 0.5% of the magnetic field range</li> <li>– Multiple programmable magnetic characteristics</li> <li>– Temperature characteristics are programmable for matching all common magnetic materials</li> <li>– Operates with dynamic magnetic fields up to 2 kHz</li> <li>– Magnetic characteristics are extremely robust against mechanical stress effects</li> <li>– Over-, and reverse-voltage protection (all pins)</li> <li>– Short-circuit protected push-pull output</li> <li>– High ESD performance 8 kV</li> <li>– EMC optimized design</li> </ul>	<ul style="list-style-type: none"> <li>– 3-wire version with short-circuit protected open-drain output or 2-wire version with current output</li> <li>– Very low current consumption of typ. 1.6 mA</li> <li>– Overvoltage protection capability up to 40 V</li> <li>– Highest ESD performance up to ±8 kV</li> <li>– Reverse-voltage protection at supply pin</li> <li>– Sampling and output refresh time of 2 ms</li> <li>– Operating with dynamic magnetic fields up to 12 kHz at lowest output jitter of max. 0.72 ms (RMS), customized versions are possible up to 93 kHz</li> <li>– AEC-Q 100 qualification</li> <li>– ISO 26262 compliant with additional functional safety features like power-on self-test</li> <li>– Magnetic characteristics are robust against mechanical stress</li> </ul>
<b>Applications</b>	Endposition detection, electronic fuse Bending lights, pedal kick-down	Endposition detection, brushless DC motor commutation Revolutions per minute (RPM) or other rotary measurements

# Sensors

## Embedded Motor Controllers

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Embedded Motor Controllers







<b>Series</b>	HVC 4223F Embedded motor controller for smart actuators
<b>Technical data</b>	Package: QFN40, 6 x 6 mm Operating temp.: T <sub>J</sub> = -40 ... +150 °C Operating voltage: 4.5 ... 18 V
<b>Features</b>	<ul style="list-style-type: none"> <li>- Six integrated half-bridges up to 6 x 500 mA or 1000 mA (depending on configuration)</li> <li>- Load dump up to 40 V</li> <li>- High-performance 32-bit ARM® Cortex®-M3, running at up to 20 MHz</li> <li>- Memory:             <ul style="list-style-type: none"> <li>- 2 kbyte RAM, 32 kbyte Flash</li> <li>- On-chip NVRAM with wear leveling</li> </ul> </li> <li>- Logic modules dedicated for controlling BLDC or BDC motors</li> <li>- Comparators with integrated virtual star point and reference currents</li> <li>- Digital and window watchdog timers with different, independent clocks</li> <li>- 12-bit multi-channel ADC</li> <li>- Programmable gain amplifier</li> <li>- 16-bit free-running counter with three capture/compare-modules</li> <li>- Two 16-bit timers</li> <li>- Enhanced PWMs (EPWMs), providing edge/center-aligned signals with non-overlapping capability</li> <li>- SPI and enhanced LIN 2.x UART</li> <li>- LIN 2.x transceiver</li> <li>- Integrated temperature sensor</li> <li>- Active EMI suppression hardware</li> <li>- Several diagnosis and protection functions such as:             <ul style="list-style-type: none"> <li>- Integrated H-bridge diagnostic features</li> <li>- Internal protection for non-overlapping bridge activation</li> <li>- Clock/temperature/supply supervision</li> <li>- Overvoltage/Overcurrent protection</li> </ul> </li> <li>- Power saving modes</li> </ul>
<b>Applications</b>	Drive of stepper, BDC, or BLDC motors in smart actuators for automotive applications such as: Grille shutter HVAC flaps LED headlight and fan

# Sensors

Gear Tooth Sensors, Ultrasonic Sensors  
MEMS Microphones

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Gear Tooth Sensors		Ultrasonic Sensors	
			
<b>Series</b>	PS-HR series	Ultrasonic sensors	
<b>Technical data</b>	Operating temperature: -30 ... +150 °C Operating power source voltage: 4.75 ... 16 V Output voltage: VHIGH-VCC -0.5 V/VLOW 0.4 V Response frequency: 0 ... 12 kHz	<u>Radial oscillation type:</u> Frequency: 200 ... 400 kHz Thickness: 0.2 ... 4 mm Diameter: 4 ... 8 mm	<u>Thickness oscillation type:</u> Frequency: 500 ... 4000 kHz Thickness: 0.5 ... 4 mm Diameter: 4 ... 12 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- Low cost sensor</li> <li>- Measures the rotation angle of the cam crank</li> <li>- Highly precise digital output due to integration of components into an IC package</li> <li>- Designed to tolerate extreme temperatures (-30 ... +150 °C)</li> <li>- Probe distance can be varied over a wide range</li> <li>- Built-in surge voltage suppression circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Available with wrap-around metallization</li> <li>- Customized dimensions upon request</li> <li>- Production certified to automotive standard (ISO/TS 16949)</li> </ul>	
<b>Applications</b>	Angle, speed sensing in automotive applications	Automotive: Ultrasonic park assist systems Blind spot assist systems Level sensing for fuel or selective catalytic reduction (SCR) tanks Interior monitoring and anti-theft systems	Industrial: Flow meters for fluids or gases Level sensing for fluids or bulk materials Collision avoidance systems Mixture metering systems

MEMS Microphones	
	
<b>Series</b>	T4064 – analog output
<b>Technical data</b>	Size: 2.7 x 1.6 x 0.89 mm Sensitivity: -38 ±3 dBV/Pa at 1 kHz S/N Ratio (typ.): 61.5 dB (A) Acoustic overload point: 124 dB SPL Port location: Bottom Operating temp.: -40 ... +85 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Very small size of 2.7 x 1.6 mm</li> <li>- Very low height of 0.89 mm</li> <li>- High signal to noise ratio</li> </ul>
<b>Applications</b>	Mobile phones, tablets Wearables Headsets Internet of Things
	
<b>Series</b>	T4070 – analog output
<b>Technical data</b>	Size: 3.35 x 2.5 x 0.98 mm Sensitivity: -40 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio(Nom.) / 65 dBA Sound Pressure Level / dB: 131 dB at THD 1% typ., 1 kHz Acoustic overload point: 136 dB SPL Port location: Bottom Operating temp.: -40 ... +85 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- SiMic MEMS Microphone</li> <li>- Reflow soldering up to +260 °C</li> <li>- Ni/Au-plated terminals suited for lead free soldering</li> <li>- Approximate weight of 20 mg</li> <li>- High long-term temperature stability</li> <li>- High signal to noise ratio</li> <li>- Positive polarity: Sound pressure increase will increase output voltage</li> </ul>
<b>Applications</b>	Smartphones and feature phones, microphone arrays Tablets, teleconferencing systems, digital still and video Cameras, Headsets, Notebooks, Security and surveillance

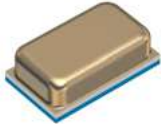
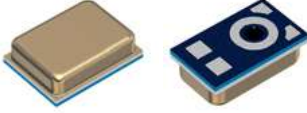
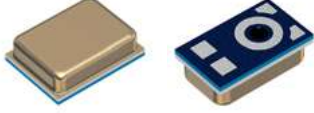


# Sensors

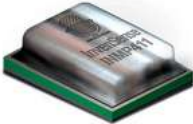
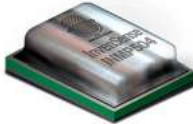
## MEMS Microphones

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### MEMS Microphones

			
<b>Series</b>	T4076 – analog output	T4078 – analog output	T4081 – analog output
<b>Technical data</b>	Size: 2.75 x 1.85 x 0.9 mm Sensitivity: $-38 \pm 1$ dBV/Pa at 1 kHz S/N Ratio (typ.): 62.0 dB (A) Acoustic overload point: 124 dB SPL Port location: Bottom Operating temp.: $-40 \dots +85$ °C	Size: 3.35 x 2.5 x 0.95 mm Sensitivity: $-38 \pm 1$ dBV/Pa at 1 kHz S/N Ratio (typ.): 64.5 (LM), 66 (HM) dB (A) Acoustic overload point: 128 (LM), 135 (HM) dB SPL Port location: Bottom Operating temp.: $-40 \dots +105$ °C Current consumption $I_{CC}$ : 85 $\mu$ A (LM), 250 $\mu$ A (HM)	Size: 3.35 x 2.5 x 0.95 mm Sensitivity: $-38 \pm 1$ dBV/Pa at 1 kHz S/N Ratio (typ.): 66 dB (A) Acoustic overload point: 136 dB SPL Port location: Bottom Operating temp.: $-40 \dots +85$ °C Current consumption $I_{CC}$ : 135 $\mu$ A
<b>Features</b>	<ul style="list-style-type: none"> <li>– Small size of 2.75 x 1.85 mm</li> <li>– Very low height of 0.9 mm</li> <li>– High signal to noise ratio</li> </ul>	<ul style="list-style-type: none"> <li>– High signal to noise ratio of 66 dB (A) typ.</li> <li>– Analog balanced output</li> <li>– Multi mode: High performance mode (HM) and low power mode (LM)</li> </ul>	<ul style="list-style-type: none"> <li>– High signal to noise ratio of 66 dB (A) typ.</li> <li>– Analog balanced output</li> </ul>
<b>Applications</b>	Mobile phones, tablets Wearables Headsets Internet of Things	Mobile phones, tablets Wearables Headsets Internet of Things	Mobile phones, tablets Wearables Headsets Internet of Things

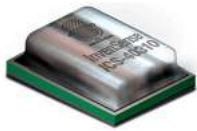
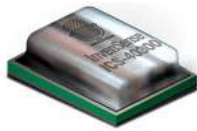
### MEMS Microphones

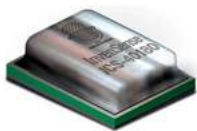

		
<b>Series</b>	INMP411 – analog output	INMP504 – analog output
<b>Technical data</b>	Size: 4.72 x 3.76 x 1 mm Sensitivity: $-46$ dBV $\pm 1$ dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 62 Acoustic overload point / dB SPL: 131 at 10% THD	Size: 3.35 x 2.5 x 0.88 mm Sensitivity: $-38$ dBV $\pm 1$ dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 65 Acoustic overload point / dB SPL: 120 at 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>– Surface Mounted Technology (SMT)</li> <li>– Balanced operation</li> <li>– High performance mode (HM) and low power mode (LM)</li> <li>– Wide dynamic range</li> <li>– Positive polarity</li> </ul>	<ul style="list-style-type: none"> <li>– Surface Mounted Technology (SMT)</li> <li>– Flat frequency response from 100 to 16 kHz</li> <li>– Low current consumption</li> <li>– Single-ended analog output</li> <li>– Omnidirectional response</li> </ul>
<b>Applications</b>	Mobile phones, headsets, PDAs, notebooks, cameras	Smartphones, tablets, teleconferencing systems Digital still and video cameras, headsets, notebook Security and surveillance

# Sensors

## MEMS Microphones

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

MEMS Microphones		
		
<b>Series</b>	ICS-40310 – analog output	ICS-40300 – analog output
<b>Technical data</b>	Size: 3.35 x 2.5 x 0.98 mm Sensitivity: -37 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 64 Acoustic overload point / dB SPL: 112 at 10% THD	Size: 4.72 x 3.76 x 3.5 mm Sensitivity: -45 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 63 Acoustic overload point / dB SPL: 130 at 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>- Low current consumption</li> <li>- Small Surface-Mount Package</li> <li>- Single-ended analog output</li> </ul>	<ul style="list-style-type: none"> <li>- Extended frequency response from 6 to 20 kHz</li> <li>- Acoustic overload point 130 dB SPL</li> <li>- Sensitivity of -45 dBV</li> <li>- Sensitivity tolerance ±2 dB</li> <li>- Omnidirectional response</li> <li>- High SNR of 63 dBA</li> <li>- Omnidirectional response</li> <li>- Low current consumption</li> </ul>
<b>Applications</b>	Dedicated “AlwaysOn” microphones, smartphones Wearables, tablets, headsets	Active noise-cancelling headsets, teleconferencing systems, studio microphones, live microphones Security and surveillance, photoacoustic gas sensing

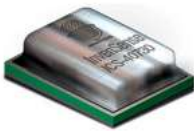
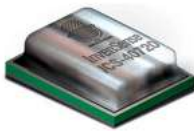
MEMS Microphones		
		
<b>Series</b>	ICS-40180/ICS-40181	ICS-40618/ICS-40619
<b>Technical data</b>	Size: 3.5 x 2.65 x 0.98 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 65 Acoustic overload point / dB SPL: 124 to 135 at 10% THD	Size: 3.35 x 2.5 x 0.95 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 67 to 67 Acoustic overload point / dB SPL: 129 to 132 at 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>- Non-inverted signal output</li> <li>- Omnidirectional response (ICS-40181)</li> <li>- Extended frequency response from 60 Hz to 20 kHz</li> <li>- Enhanced RF immunity</li> <li>- Low current consumption</li> <li>- Single-ended analog output</li> </ul>	<ul style="list-style-type: none"> <li>- Differential non-inverting analog output</li> <li>- Top/bottom port pair</li> </ul>
<b>Applications</b>	Smartphones, tablets, wearables, still and video cameras, headsets, notebooks, security and surveillance	Smartphones “AlwaysOn” listening Wearable devices Still and video cameras IoT devices

# Sensors

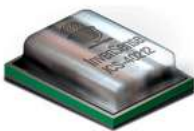
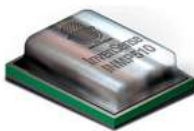
## MEMS Microphones

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Trionics

### MEMS Microphones

		
<b>Series</b>	ICS-40730 – analog output	ICS-40720– analog output
<b>Technical data</b>	Size: 4.72 x 3.76 x 3.5 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 74 Acoustic overload point / dB SPL: 124 at 10% THD	Size: 4 x 3 x 1.2 mm Sensitivity: -34 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 70 dBA Sound pressure level / 160 dB Acoustic overload point / dB SPL: 124 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>– Ultra-high 74 dBA SNR</li> <li>– Non-inverted signal output</li> <li>– Enhanced RF performance</li> </ul>	<ul style="list-style-type: none"> <li>– Ultra-high 70 dBA SNR</li> <li>– Non-inverted signal output</li> <li>– Enhanced RF performance</li> </ul>
<b>Applications</b>	Smart home devices Smartphones Teleconferencing systems Security and surveillance Microphone arrays Voice control and activation	Smartphones, tablets, teleconferencing systems Digital still and video cameras, headsets, security and surveillance, microphone arrays, voice control and activation

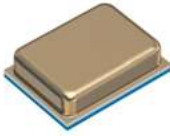
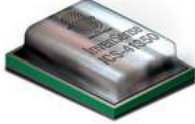
### MEMS Microphones

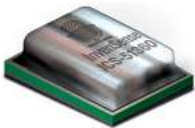
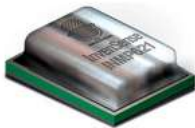
		
<b>Series</b>	ICS-40212– analog output	INMP510– analog output
<b>Technical data</b>	Size: 3.50 x 2.65 x 0.98 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 66 to 66 Acoustic overload point / dB SPL: 128 to 123 dB SPL at 10% THD	Size: 3.35 x 2.5 x 0.98 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 65 Acoustic overload point / dB SPL: 124 at 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>– Surface Mounted Technology (SMT)</li> <li>– Balanced operation</li> <li>– High performance mode (HM) and low power mode (LM)</li> <li>– Wide dynamic range</li> <li>– Positive polarity</li> </ul>	<ul style="list-style-type: none"> <li>– Acoustic overload point of 124 dB SPL</li> <li>– Omnidirectional response</li> <li>– Enhanced radio frequency (RF) performance</li> <li>– Single-ended analog output</li> </ul>
<b>Applications</b>	Smartphones, wearables, still and video cameras, Internet of Things	Smartphones, tablets, teleconferencing systems, digital still and video cameras, headsets, notebooks, security and surveillance

# Sensors

## MEMS Microphones

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




MEMS Microphones		
		
<b>Series</b>	T4075 – digital output	ICS-41350/ICS-41351
<b>Technical data</b>	Size: 3.5 x 2.65 x 0.98 mm Sensitivity (HM): $-43 \pm 1$ dBFS/Pa at 1 kHz Sensitivity (LM): $-23 \pm 1$ dBFS/Pa at 1 kHz S/N Ratio (typ.): 65 (HM), 64.5 (LM) dB (A) Acoustic overload point: 135 (HM), 117 (LM) dB SPL Port location: Bottom Operating temp.: $-40 \dots +85$ °C Current consumption $I_{CC}$ : 480 $\mu$ A (LM), 750–900 $\mu$ A (HM)	Size: 3.2 x 2.65 x 0.98 mm Standard mode sensitivity: $-26$ db FS $\pm 1$ dB Standard mode SNR: 64 dBA Standard mode AOP: 120 dB SPL
<b>Features</b>	<ul style="list-style-type: none"> <li>– High signal to noise ratio of 65 dB (A) typ.</li> <li>– High AOP</li> <li>– PDM Digital output</li> <li>– Multi mode: High performance mode (HM) and low power mode (LM)</li> </ul>	<ul style="list-style-type: none"> <li>– Low-power (“AlwaysOn”), standard, high performance, and sleep modes</li> <li>– Extended frequency response from 50 Hz to &gt;20 kHz</li> <li>– Ultrasound support up to 40 kHz</li> </ul>
<b>Applications</b>	Mobile phones, tablets Wearables Headsets Internet of Things	Smartphones, microphone arrays, tablets, cameras, headsets, notebooks, security and surveillance

MEMS Microphones		
		
<b>Series</b>	ICS-51360 – digital output	INMP621 – digital output
<b>Technical data</b>	Size: 3.5 x 2.65 x 0.98 mm Standard mode sensitivity: $-36$ db FS $\pm 1$ dB Standard mode SNR: 62 W dBA Standard mode AOP: 130 dB SPL	Size: 4 x 3 x 1 mm Standard mode sensitivity: $-26$ db FS $\pm 1$ dB SNR: 65 dBA AOP: 133 dB SPL
<b>Features</b>	<ul style="list-style-type: none"> <li>– Low-power (“AlwaysOn”), standard, and sleep modes</li> <li>– Extended frequency response from 50 Hz to &gt;20 kHz</li> </ul>	<ul style="list-style-type: none"> <li>– Extended frequency response from 45 Hz to &gt;20 kHz</li> </ul>
<b>Applications</b>	Smartphones, microphone arrays, tablets, cameras	Tablets, notebooks, smartphones, microphone arrays Teleconferencing systems, digital still and video cameras Headsets, security and surveillance

# Sensors

## MEMS Inertial Sensors



▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics



MEMS Inertial Sensors			
			
<b>Series</b>	GYPRO2300LD	GYPRO3300	AXO215
<b>Technical data</b>	Z-axis angular rate sensor: $\pm 300$ °/s Data rate: 1700 Hz Latency: 2 ms Noise density: 0.02 °/s/√Hz	Z-axis angular rate sensor: up to $\pm 800$ °/s Data rate: 1800 Hz Latency: 1 ms Noise density: 0.04 °/s/√Hz	In-plane linear accelerometer: $\pm 15$ g In-run bias stability: 3 $\mu$ g Noise density: 15 $\mu$ g/√Hz Non-linearity: 100 ppm
<b>Features</b>	<ul style="list-style-type: none"> <li>– 24-bit SPI digital output</li> <li>– Hermetic ceramic package</li> <li>– Closed-loop operation</li> <li>– Embedded temperature sensor</li> <li>– Built-in self-test</li> <li>– Industrial temperature <math>-40</math> up to <math>+85</math> °C</li> <li>– Evaluation kit compatible with Arduino platform</li> </ul>		
<b>Applications</b>	<ul style="list-style-type: none"> <li>Motion tracking</li> <li>Platform stabilization</li> <li>GNSS assistance</li> <li>AHRS &amp; IMU</li> <li>Flight control</li> <li>Guidance</li> <li>Precision instrumentation</li> </ul>		

# Sensors

## Motion Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Motion Sensor 6-Axis		
		
<b>Series</b>	ICM-20600	ICM-20602
<b>Technical data</b>	Size: 2.5 x 3 x 0.91 mm Host interface: 10 MHz SPI or 400 kHz Fast Mode I <sup>2</sup> C	Size: 3 x 3 x 0.75 mm Gyroscope sensitivity error: ±1% Gyroscope noise: ±4 mdps/√Hz Accelerometer noise: 100 µg/√Hz Host interface: 10 MHz SPI or 400 kHz Fast Mode I <sup>2</sup> C
<b>Features</b>	<ul style="list-style-type: none"> <li>– 1 kB FIFO buffer enables the applications processor to read the data in bursts</li> <li>– Programmable filters</li> </ul>	<ul style="list-style-type: none"> <li>– 1 kB FIFO buffer enables the applications processor to read the data in bursts</li> <li>– Programmable filters</li> </ul>
<b>Applications</b>	Smartphones, tablets, wearables, Internet of Things, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxes, 3D mice	



Motion Sensor 6-Axis		
		
<b>Series</b>	ICM-20608-/ICM-20608-G	ICM-20648
<b>Technical data</b>	Size: 3 x 3 x 0.75 mm Host interface: 8 MHz SPI or 400 kHz I <sup>2</sup> C	Size: 3 x 3 x 0.9 mm Host interface: 7 MHz SPI, 100 kHz standard I <sup>2</sup> C, or 400 kHz Fast Mode I <sup>2</sup> C
<b>Features</b>	<ul style="list-style-type: none"> <li>– Digital-programmable low-pass filter</li> <li>– 512B FIFO buffer enables the applications processor to read the data in bursts</li> <li>– DMP based (ICM-20608-D)</li> <li>– Pedometer (ICM-20608-D)</li> </ul>	<ul style="list-style-type: none"> <li>– DMP based 6- and 9-axis Cal/Fusion</li> <li>– Android support</li> <li>– 512B FIFO buffer enables the applications processor to read the data in bursts</li> </ul>
<b>Applications</b>	Mobile phones, tablets, handset and portable gaming, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxes, 3D mice, wearables	Wearables, smartphones, tablets, Internet of Things, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxes, 3D mice

# Sensors

## Motion Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Trionics

### Motion Sensor 6-Axis

		
<b>Series</b>	ICM-20689	ICG-20660L
<b>Technical data</b>	Size: 4 x 4 x 0.9 mm Host interface: 8 MHz SPI or 400 kHz Fast Mode I <sup>2</sup> C	Size: 3 x 3 x 0.75 mm Host interface: 7 MHz SPI or 400 KHz Fast Mode I <sup>2</sup> C
<b>Features</b>	<ul style="list-style-type: none"> <li>- 4 kB FIFO buffer enables the applications processor to read the data in bursts</li> <li>- Digital motion processor</li> </ul>	<ul style="list-style-type: none"> <li>- Minimal cross-axis sensitivity between the accelerometer and gyroscope axes</li> <li>- 512B FIFO buffer enables the applications processor to read the data in bursts</li> </ul>
<b>Applications</b>	Smartphones, tablets, handset and portable gaming, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxes, 3D mice, wearables	Optical image stabilization camera modules, DSLR, electronic image stabilization, phone camera modules



### Motion Sensor 6-Axis



		
<b>Series</b>	ICM-30630	ICM-30631
<b>Technical data</b>	Size: 3 x 3 x 0.98 mm Host interface: 8 MHz SPI or 3.4 MHz I <sup>2</sup> C	Size: 3 x 3 x 0.98 mm Host interface: 6.4 MHz SPI or 1.7 MHz I <sup>2</sup> C
<b>Features</b>	<ul style="list-style-type: none"> <li>- 64 kB SRAM and 64 kB flash</li> <li>- Configurable FIFO</li> <li>- SensorStudio</li> </ul>	<ul style="list-style-type: none"> <li>- 64 kB SRAM and 64kB flash</li> <li>- Configurable FIFO</li> <li>- Complete SW stack</li> <li>- Wrist-worn design</li> </ul>
<b>Applications</b>	Smartphones, tablets, wearables	Wearables

# Sensors

## Motion Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Motion Sensor 6-Axis		
		
<b>Series</b>	MPU-6000/MPU-6050	MPU-6500
<b>Technical data</b>	Size: 3 x 3 x 0.98 mm Host interface: 400 kHz Fast Mode I <sup>2</sup> C, 1 MHz SPI serial interface for communicating with all registers, or 20 MHz SPI serial interface for reading sensor and interrupt registers	Size: 3 x 3 x 0.90 mm Host interface: 1 MHz SPI or 400 kHz I <sup>2</sup> C serial interface for communicating with all registers; 20 MHz SPI serial interface for reading sensor and interrupt registers
<b>Features</b>	<ul style="list-style-type: none"> <li>- 1024B FIFO buffer reduces power consumption by allowing the host processor to read the data in bursts and then go into low-power mode as the MPU collects more data</li> <li>- DMP based 9-axis</li> <li>- Cal/Fusion</li> </ul>	<ul style="list-style-type: none"> <li>- 512B FIFO buffer enables the applications processor to read the data in bursts</li> </ul>
<b>Applications</b>	Video/still image stabilization, security/authentication, UI application control, gesture recognition, handsets, portable gaming, motion-based game controllers, 3D remote controls for Internet connected DTVs, set top boxes, 3D mice, wearable, toys	UI application control/navigation, motion-enabled game and application framework, handsets, portable gaming, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxes, 3D mice, wearables

Motion Sensor 6-Axis		Motion Sensor 9-Axis	
			
<b>Series</b>	IAM-20680		MPU-9250
<b>Technical data</b>	Size: 3 x 3 x 0.75 mm Host interface: 8 MHz SPI or 400 kHz Fast Mode I <sup>2</sup> C		Size: 3 x 3 x 1 mm Host interface: 1 MHz SPI or 400 kHz Fast Mode I <sup>2</sup> C for communicating with all registers; 20 MHz SPI for reading sensor and interrupt registers
<b>Features</b>	<ul style="list-style-type: none"> <li>- 512B FIFO buffer enables the application processor to read the data in bursts</li> </ul>		<ul style="list-style-type: none"> <li>- 512B FIFO buffer enables the application processor to read the data in bursts</li> <li>- DMP based 9-axis</li> <li>- Cal/Fusion</li> </ul>
<b>Applications</b>	Navigation system, lift gate motion detections, location for vehicle to vehicle infrastructure, 360° view camera stabilization, car alarm, telematics, vehicle tracking		Handsets, portable gaming, motion-based game controllers, 3D remote controls for Internet connected DTVs and set top boxed, 3D mice, wearables






# Sensors



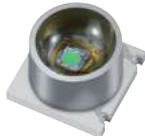
## Pressure Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Trionics

### Pressure Sensors

			
<b>Series</b>	Sensor dies C32	MiniCell	Sensor dies C35
<b>Technical data</b>	Pressure: 400 mbar ... 40 bar Operating temp.: -40 ... +135 °C Non-linearity: typ. 0.2% FS Output span: typ. 120 mV Size: 1.65 x 1.65 mm	Pressure: 0.5 ... 10 bar Operating temp.: -40 ... +140 °C Non-linearity: typ. ±1.5% FS Analog ratiometric output or digital signal	Pressure: 0 ... 0.1 bar Operating temp.: -40 ... +150 °C Non-linearity: typ. 0.5% FS Output span: typ. 50 mV Size: 2.05 x 2.05 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- Available for absolute, gauge and back side absolute measurements</li> <li>- Various features on request as gold bond pads and backside metallization for soldering</li> </ul>	<ul style="list-style-type: none"> <li>- Differential pressure measurement</li> <li>- Pressure transmitter with high media resistance for both pressure ports with stainless steel diaphragms</li> </ul>	<ul style="list-style-type: none"> <li>- Gauge pressure measurement</li> <li>- Various wire bond options (surrounded wire bonding and direct die to ASIC)</li> <li>- Narrow tolerance of sensitivity</li> </ul>
<b>Applications</b>	Automotive and industrial applications	Industrial and automotive applications	Industrial and automotive applications


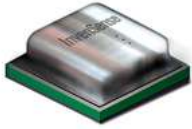
### Pressure Sensors


			
<b>Series</b>	Sensor dies C38	Sensor dies C39	ASB/ASA/ASR - SMD
<b>Technical data</b>	Pressure: 10 ... 40 bar Operating temp.: -40 ... +135 °C Non-linearity: typ. 0.2% FS Output span: typ. 100 mV Size: 1.65 x 1.65 mm	Pressure: 1.2 bar Operating temp.: -40 ... +135 °C Non-linearity: typ. 0.2% FS Output span: typ. 80 mV Size: 0.65 x 0.65 mm	Pressure: 1.2 ... 2.5 bar Operating temp.: -40 ... +125 °C Non-linearity: typ. 0.1% FS Supply voltage: 2.7... 5.5 V Size: 4.3 x 4.3 x 2.4 mm for absolute and 4.3 x 7.9 x 3.0 mm for gauge measurement
<b>Features</b>	<ul style="list-style-type: none"> <li>- For backside applications (gauge and absolute)</li> <li>- Single side bond pads for direct die to ASIC wire bonding</li> <li>- High burst pressure</li> <li>- Gold bond pads available</li> <li>- Various features on request as gold bond pads and backside metallization for soldering</li> </ul>	<ul style="list-style-type: none"> <li>- Miniaturized design for portable devices</li> <li>- High signal stability</li> <li>- Automotive validation acc. AEC-Q101</li> </ul>	<ul style="list-style-type: none"> <li>- Analog V1 or VR voltage output</li> <li>- Minimized pressure transmitter</li> </ul>
<b>Applications</b>	Automotive and industrial applications	Consumer and automotive applications	Industrial, medical and automotive applications

# Sensors

## Pressure Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

Pressure Sensors		Pressure Sensors 1-Axis	
			
<b>Series</b>	Transmitters AK		ICP-10100, ICP-10101, ICP-10110, ICP-10111
<b>Technical data</b>	Pressure: 25 mbar ... 25 bar Operating temp.: -30 ... +85 °C Non-linearity: typ. 0.5% FS		Size: 2 x 2 x 0.72 mm : 10100, 10101 2 x 2.5 x 0.92 mm : 10110, 10111 LGA-10L S/N Ratio(Nom.) / dBA: 64.5 to 66
<b>Features</b>	<ul style="list-style-type: none"> <li>- Tube or thread connection</li> <li>- Packaged pressure sensor die for low pressure ranges</li> <li>- For gauge measurement</li> </ul>		<ul style="list-style-type: none"> <li>- IPx8: Waterproof to 1.5 m depth (ICP-10100 &amp; ICP10110)</li> <li>- Industry's lowest noise and lowest power barometric pressure and temperature sensor</li> </ul>
<b>Applications</b>	Industrial, medical and automotive applications		Drones and flying toys, mobile phones, fitness activity, identification, navigation, vertical velocity monitoring, VR and gaming equipment, weather forecasting



Pressure Sensors 7-Axis	
	
<b>Series</b>	ICM-20789
<b>Technical data</b>	Size: 4 x 4 x 1.365 mm Sensitivity: -38 dBV ±1 dBV at 1 kHz, 9 4dB SPL S/N Ratio (Nom.) / dBA: 64.5 to 66 Acoustic overload point / dB SPL: 128 to 135 at 10% THD
<b>Features</b>	<ul style="list-style-type: none"> <li>- Minimal cross-axis sensitivity between the accelerometer and gyroscope axes</li> <li>- 4 kB FIFO buffer enables the applications processor to read the data in bursts</li> <li>- 10 000 g shock tolerant</li> <li>- 400 kHz Fast Mode I2C for communicating with all registers</li> </ul>
<b>Applications</b>	Drones and flying toys, motion-based gaming controllers, VR headsets and controller, navigation

# Sensors



## Humidity Sensors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Humidity Sensors

		
<b>Series</b>	Humidity sensor units (Assembly) CHS-U	Humidity sensor units (Assembly) CHS-MSS
<b>Technical data</b>	Operating: 5 ... 95% RH (0 ... +50 °C) Accuracy assurance: 5 ... 95% RH at +25 °C Nominal accuracy: ±3, ±5% RH Operating voltage: 5 V DC Output voltage: 0 ... 1 V	Operating: 5 ... 95% RH (0 ... +50 °C) Accuracy assurance: 20 ... 85% RH at +25 °C Nominal accuracy: ±5% RH Operating voltage: 5 V DC Output voltage: 0 ... 1 V
<b>Features</b>	<ul style="list-style-type: none"> <li>– Sensor units with built-in circuits</li> <li>– Highly accurate</li> <li>– Characteristics are stable over a wide temperature range</li> <li>– Dry and wet characteristics exhibit virtually no hysteresis</li> <li>– Highly cost-effective and compact, requiring extremely little mounting space</li> <li>– Low current consumption</li> </ul>	
<b>Applications</b>	Refrigerators Air conditioners PPCs, LBP printers Industrial electronic humidity sensors, air conditioners for factories	

### Humidity Sensors



		
<b>Series</b>	Humidity sensor units (Assembly) CHS-C	Humidity sensor units (Element) CHS-ESS
<b>Technical data</b>	Operating: 5 ... 95% RH (0 ... +50 °C) Accuracy assurance: 50% RH at +25 °C Nominal accuracy: ±7% RH Operating voltage: 5 V DC Output voltage: 0 ... 2 V	Operating: 5 ... 95% RH (0 ... +50 °C) Accuracy assurance: 50% RH at +25 °C Nominal accuracy: ±5% RH Operating voltage: 5 V AC RMS Impedance: 1 ... 80 000 kΩ (AC 1 V/1 kHz)
<b>Features</b>	<ul style="list-style-type: none"> <li>– Sensor units with built-in circuits</li> <li>– Highly accurate</li> <li>– Characteristics are stable over a wide temperature range</li> <li>– Dry and wet characteristics exhibit virtually no hysteresis</li> <li>– Highly cost-effective and compact, requiring extremely little mounting space</li> <li>– Low current consumption</li> </ul>	<ul style="list-style-type: none"> <li>– Variable resistance humidity sensor with superior water and gas resistance</li> <li>– Large impedance change in response to humidity changes and exhibits excellent responsiveness and sensitivity</li> <li>– Measurement accuracy of ±5% RH at a humidity of 50% RH</li> <li>– Hysteresis of dry and wet characteristics is suppressed at about 1% RH</li> </ul>
<b>Applications</b>	Refrigerators Air conditioners PPCs, LBP printers Industrial electronic humidity sensors, air conditioners for factories	


# Sensors

Level Sensors

Surface Potential Sensors

TDK EPCOS Micronas InvenSense Tronics

Level Sensors		
		
<b>Series</b>	Toner density/quantity sensors TS-A, TS-K, TS-Z	Powder level sensors TSP
<b>Technical data</b>	Rated voltage: 24 V $\pm$ 5% Power supply current: 20 mA max. Rated control voltage: 7 V Control current: 10 mA max. Analog output voltage: 0 ... 5.0 V Digital output voltage: 0.5 ... 4.5 V	Operating voltage: 5 V $\pm$ 5% Input current: 20 mA max. Sensor level: 5 mm $\pm$ 3 mm Output voltage: high 4.5 V min./low 0.5 V max.
<b>Features</b>	<ul style="list-style-type: none"> <li>– Use a high performance ferrite core differential transformer with an adjustable control lead wires</li> <li>– Sensor adjustment point can be installed at any location</li> <li>– Operating point can be reset easily</li> <li>– Microprocessor in the printer or copier can vary the control lead voltage for automatic adjustment</li> </ul>	<ul style="list-style-type: none"> <li>– 2-terminal type separate excitation oscillation formula</li> <li>– Piezoelectric ceramic sensor element</li> <li>– Die cast finish</li> <li>– Highly resistant to external vibrations</li> <li>– Stable detection characteristics</li> <li>– Can detect both magnetic and non-magnetic powders</li> </ul>
<b>Applications</b>	Color copiers or color laser printers, toner quantity sensors for one component system magnetic developers, proximity switches/counters or minute displacement measuring devices for various magnetic bodies and conductors	Toner detectors for e.g. copiers, laser printers Detectors for coffee and other powders in automatic beverage vending machines, detectors for powders




Surface Potential Sensors		
		
<b>Series</b>	Surface potential sensors Feed-back type EFS	
<b>Technical data</b>	Measured voltage $V_e$ : -1000 ... 0 V / 0 V ... +1000 V Power supply voltage $V_{cc}$ : 24 V $\pm$ 10% Output voltage (measured voltage) $V_0$ : 0 (0), 2.5 (-500), 4.5 (-900) V Output variation $\Delta V_0$ : $\pm$ 0.05 Response time: 20 ms max. Operating temp.: 0 ... +50 °C	
<b>Features</b>	<ul style="list-style-type: none"> <li>– Stable output performance is maintained for long periods</li> <li>– Quick responsiveness of high speed 11 ms (typ.) realized</li> <li>– Range of detector output (0 to 4.5 V range) fluctuations is limited to less than <math>\pm</math>0.05 V</li> </ul>	
<b>Applications</b>	Surface electrical potential measurements in various equipment, including the drum or paper in a copier, laser printer	

# Ceramic Capacitors



## Multilayer Ceramic Chip Capacitors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### Multilayer Ceramic Chip Capacitors

			
<b>Series</b>	General use – SMD C, CGA series	Mid voltage – SMD C, CGA series	High voltage – SMD C, CGA series
<b>Technical data</b>	Size (IEC): 0402 ... 5750 Temp. characteristic: C0G, X5R, X6S, X7R, X7S Rated voltage: 4 ... 50 V Capacitance: 0.5 pF ... 100 μF	Size (IEC): 1005 ... 5750 Temp. characteristic: C0G, X7R, X7S, X7T Rated voltage: 100 ... 630 V Capacitance: 1 pF ... 15 μF	Size (IEC): 3225 ... 5750 Temp. characteristic: C0G, X7R Rated voltage: 1 ... 3 kV Capacitance: 10 pF ... 33 nF
<b>Features</b>	<ul style="list-style-type: none"> <li>– Wide range of case size and superior dimension precision</li> <li>– Available rating up to 50 V</li> </ul>	<ul style="list-style-type: none"> <li>– Unique design allows for higher voltage in smaller case size</li> <li>– Available ratings in 100, 250, 450 and 630 V</li> </ul>	<ul style="list-style-type: none"> <li>– Advance design provides improved withstanding voltage</li> <li>– Available rating up to 3000 V</li> </ul>
<b>Applications</b>	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies	Automotive electronics Industrial applications Renewable energies



### Multilayer Ceramic Chip Capacitors



		
<b>Series</b>	High temperature – SMD C, CGA series	Serial design – SMD CEU series
<b>Technical data</b>	Size (IEC): 1005 ... 5750 Temp. characteristic: NP0, X8R, X8L Rated voltage: 6.3 ... 630 V Capacitance: 1 pF ... 22 μF	Size (IEC): 1608, 2012 Temp. characteristic: X7R Rated voltage: 50, 100 V Capacitance: 1 ... 100 nF
<b>Features</b>	<ul style="list-style-type: none"> <li>– Stable temperature characteristics up to +150 °C</li> <li>– Highly precise temperature performance (±7.5%) up to +125 °C</li> </ul>	<ul style="list-style-type: none"> <li>– 2 series-connected capacitors in one component</li> <li>– Improved bending resistance and temperature cycle performance</li> <li>– Ultra high reliability design for automotive battery line applications</li> </ul>
<b>Applications</b>	Automotive electronics Industrial applications Renewable energies	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies

# Ceramic Capacitors

## Multilayer Ceramic Chip Capacitors

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics




Multilayer Ceramic Chip Capacitors		
		
<b>Series</b>	Soft termination – SMD C, CGA series	MEGACAP series – SMD CKG series
<b>Technical data</b>	Size (IEC): 1608 ... 7563 Temp. characteristic: C0G, X5R, X7R, X7S, X7T, X8R Rated voltage: 6.3 ... 3 kV Capacitance: 100 pF ... 100 µF	Size (IEC): 3225 ... 7563 Temp. characteristic: C0G, X7R, X7S, X7T Rated voltage: 16 ... 1 kV Capacitance: 1 nF ... 100 µF
<b>Features</b>	<ul style="list-style-type: none"> <li>– Improved bending resistance and temperature cycle performance</li> <li>– Termination technology available for most case sizes including arrays</li> </ul>	<ul style="list-style-type: none"> <li>– Advance design for twice the capacitance on single footprint</li> <li>– Improved vibration and thermal/mechanical stress performance</li> <li>– Lower ESR and ESL than ALU and TA capacitors</li> </ul>
<b>Applications</b>	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies



Multilayer Ceramic Chip Capacitors		
		
<b>Series</b>	Soft termination/low resistance – SMD CNC, CNA series	MEGACAP/low resistance, inline – SMD CA series
<b>Technical data</b>	Size (IEC): 3216 ... 3225 Temp. characteristic: X7R Rated voltage: 16 ... 100 V Capacitance: 2.2 ... 10 µF	Size (IEC): 5750 Temp. characteristic: C0G Rated voltage: 630 ... 1 kV Capacitance: 20 ... 300 nF
<b>Features</b>	<ul style="list-style-type: none"> <li>– Lower electric resistance has been realized because the current can pass through low resistive layers by covering only soldering positions with conductive resin layers</li> </ul>	<ul style="list-style-type: none"> <li>– Higher mechanical endurance is realized by metal frame structure</li> <li>– Low height and low electric resistance with high capacitance have been realized by the inline structure which MLCCs are stacked side by side and optimization of metal frame composition</li> </ul>
<b>Applications</b>	Automotive electronics Industrial applications Renewable energies	Automotive electronics Industrial applications Renewable energies

# Ceramic Capacitors

Multilayer Ceramic Chip Capacitors, Leaded Multilayer Ceramic Chip Capacitors  
 Leaded High Voltage Ceramic Capacitors

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Multilayer Ceramic Chip Capacitors			
			
<b>Series</b>	Conductive epoxy – SMD CGA series	Flip type – SMD C, CGA series	Ultra low inductance – SMD CLL series
<b>Technical data</b>	Size (IEC): 1005 ... 3225 Temp. characteristic: C0G, X7R, X8R Rated voltage: 6.3 ... 100 V Capacitance: 1 pF ... 10 $\mu$ F	Size (IEC): 0510 ... 0816 Temp. characteristic: X5R, X6S, X7R, X7S Rated voltage: 2.5 ... 50 V Capacitance: 47 nF ... 4.7 $\mu$ F	Size (IEC): 1608 Temp. characteristic: X6S, X7R, X7S Rated voltage: 4 V Capacitance: 47 nF ... 4.7 $\mu$ F
<b>Features</b>	– Unique design allows increased resistance to mechanical bending	– Flipped geometry permits lower inductance than standard capacitor – Special design allows for adequate high frequency current to IC	– Reduction of PCB space and mounting time – Unique electrode design reduces crosstalk – Available in soft termination for higher reliability performance
<b>Applications</b>	Automotive electronics	Automotive electronics Communications Consumer electronics	Communications Consumer electronics




Leaded Multilayer Ceramic Chip Capacitors		Leaded High Voltage Ceramic Capacitors	
			
<b>Series</b>	Dipped radial FG, FA series		High voltage CK45, CK45-RR, CC45 series
<b>Technical data</b>	Temp. characteristic: C0G, NP0, X5R, X7R, X7S, X7T, X8R Rated voltage: 6.3 ... 630 V Capacitance: 1 pF ... 100 $\mu$ F		Temp. characteristic: SL, B, E, R Rated voltage: 1 ... 6 kV Capacitance: 3 pF ... 10 nF
<b>Features</b>	– Multilayer ceramic capacitors with solder coated wire leads and dipped with UL94V-0 approved resin – Large electrostatic capacitance – Leads are formed with a “kink” to achieve consistent insertion heights and to facilitate the release of gases during soldering for dramatically improved solderability – Taping specifications for automatic insertions can be met		– High reliability – Low dissipation factor, and decreased self-heating temperature in high frequency and high voltage applications – Halogen-free external resin coating
<b>Applications</b>	Automotive electronics Consumer electronics Micro-motors		Y capacitor in AC lines

# Ceramic Capacitors

Leaded High Voltage Ceramic Capacitors, Ultra-High Voltage Ceramic Capacitors  
CeraLink Capacitors

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Leaded High Voltage Ceramic Capacitors		Ultra-High Voltage Ceramic Capacitors	
			
<b>Series</b>	Safety standard approved CD45, CS45 series		Ultra-high voltage FD, MD, TSF, H, GA, FHV, UHV series
<b>Technical data</b>	Temp. characteristic: SL, B, E, F Rated voltage $E_{ac}$ : X1: 440 V Y1: 400 V/300 V Capacitance: 10 pF ... 10 nF		Temp. characteristic: C0H, Y5P, Y5S, Z5T Rated voltage: 8 ... 50 kV Capacitance: 50 pF ... 7 nF
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compliant with safety standards</li> <li>– Flame-resistant, reinforced outer insulation prevents fires, electrical shock, and other potential hazards</li> <li>– Halogen-free external resin coating</li> </ul>		<ul style="list-style-type: none"> <li>– Low dissipation and excellent voltage/capacitance characteristics</li> <li>– Epoxy-encapsulated to meet requirements of high voltage applications</li> </ul>
<b>Applications</b>	Y capacitor in AC lines		High voltage power supplies Laser equipment Industrial applications Renewable energies

CeraLink Capacitors			
			
<b>Series</b>	LP series J leads, L leads	SP series	FA2, FA3, FA10
<b>Technical data</b>	Nom. capacitance: 0.25 ... 1 $\mu$ F Rated voltage: 500, 700, 900 V $I_{op}$ (100 kHz, +85 °C): 3.6 ... 7.5 A RMS ESL = 3 nH	Nom. capacitance: 5 ... 20 $\mu$ F Rated voltage: 500, 700, 900 V $I_{op}$ (100 kHz, +85 °C): 19 ... 31 A RMS ESL = 4 nH	Nom. capacitance: 0.5 ... 10 $\mu$ F Rated voltage: 500, 700, 900 V $I_{op}$ (100 kHz, +85 °C): 7.9 ... 46.6 A RMS ESL = 2 ... 3 nH
<b>Features</b>	<ul style="list-style-type: none"> <li>– High operating and peak temperatures</li> <li>– Low ESL, low ESR</li> <li>– High capacitance density and small size</li> <li>– Low losses at high frequencies and high temperatures</li> <li>– Supports further miniaturization of power electronics at system level</li> </ul>		
<b>Applications</b>	DC Link and snubber capacitors for: <ul style="list-style-type: none"> <li>– HV DC/DC converters and OBC (as filter or snubber capacitor)</li> <li>– DC link in local HV inverters/converters and auxiliaries (e.g. HV heater, HV water pump)</li> <li>– Wireless charging systems</li> <li>– High efficiency inverters in DC/AC converters for solar/wind power supplies</li> </ul>		





# Film Capacitors



## Medium Power Film Capacitors

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### Medium Power Film Capacitors

		
<b>Series</b>	MKT boxed B32520 ... B32529	MKP boxed B32652 ..., B32658 ...
<b>Technical data</b>	Rated capacitance: 1.0 nF ... 220 µF Rated voltage: 63 ... 630 V DC	Rated capacitance: 1.0 nF ... 40 µF Rated voltage: 250 ... 2000 V DC 160 ... 1000 V AC
<b>Features</b>	Dielectric polyester (PET) offers: <ul style="list-style-type: none"> <li>– Higher density of capacitance/mm<sup>3</sup> and +125 °C operating temperature vs polypropylene (PP) dielectric</li> <li>– Lower dissipation factor, higher current capability (RMS and peak), long useful life and parameter stability</li> <li>– Plastic case and epoxy resin sealing (UL94V-0)</li> <li>– Mechanical and environmental strength</li> </ul>	Dielectric: Polypropylene (PP) offers: <ul style="list-style-type: none"> <li>– Higher dielectric strength vs. polyester (PET) dielectric</li> <li>– Lower dissipation factor, higher current capability (RMS and peak) and parameter stability vs. polyester dielectric</li> <li>– Epoxy resin sealing and plastic box case are UL94V-0 flame retardant materials</li> <li>– Mechanical stability</li> <li>– High RMS and peak current capability</li> <li>– Good self-healing properties</li> </ul>
<b>Applications</b>	General purpose, blocking, coupling, decoupling, bypassing, electronic, ignition in industrial (SMPS, converter), lighting, automotive and household appliances	General purpose, snubbing, resonance, ignition, AC and DC filtering in industrial, lighting, automotive and household appliances



### Medium Power Film Capacitors




		
<b>Series</b>	MMKP B32641 ... B32643	MKP AC filtering B32754 ... B32758
<b>Technical data</b>	Rated capacitance: 2.2 ... 560 nF Rated voltage: 400 ... 2000 V DC	Rated capacitance: 1.0 ... 70 µF Rated voltage: 250 ... 400 V AC
<b>Features</b>	<ul style="list-style-type: none"> <li>– Lead spacing 10 ... 22.5 mm</li> <li>– Operating temperature up to +110 °C</li> <li>– Double sided metallization for snubbing, resonant or switching</li> <li>– High dv/dt</li> </ul>	<ul style="list-style-type: none"> <li>– Operating temperature up to +105 °C</li> <li>– Output AC filtering</li> <li>– Optimized AC voltage performance with small dimensions</li> <li>– High ripple current/frequency capability</li> <li>– +60 °C/95 % RH/V RMS/1000 h</li> </ul>
<b>Applications</b>	Electronic ballasts (resonant circuits) LLC typology in resonant circuits High frequency and high current applications Switch-mode power supplies (SMPS)	Output AC filtering for power converters, UPS, motor drives

# Film Capacitors

## Medium Power Film Capacitors

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Medium Power Film Capacitors			
			
<b>Series</b>	MKP boxed (PFC) B32671Z..., B32676Z...	B32671P... B32673P	MKP boxed (high V AC-temp.) B32671L..., B32672L...
<b>Technical data</b>	Rated capacitance: 10 nF ... 20 µF Rated voltage: 220 ... 310 V AC	Rated capacitance: 0.068 ... 2.2 µF Rated voltage: 450 ... 630 V DC	Rated capacitance: 1 nF ... 1 µF Rated voltage: 250 ... 2000 V DC 160 ... 900 V AC
<b>Features</b>	Dielectric: Polypropylene (PP) offers: <ul style="list-style-type: none"> <li>- Higher dielectric strength vs. polyester (PET) dielectric</li> <li>- Lower dissipation factor, higher current capability (RMS and peak) and parameter stability vs. polyester dielectric</li> <li>- Epoxy resin sealing and plastic box case are UL94V-0 flame retardant materials</li> </ul>		
	<ul style="list-style-type: none"> <li>- Very compact design</li> <li>- High frequency</li> </ul>	<ul style="list-style-type: none"> <li>- Very small dimensions</li> <li>- For high frequency AC loads and pulses</li> <li>- High pulse withstand capability</li> </ul>	
<b>Applications</b>	Power factor correction, decoupling, coupling, switching in industrial (power supplies, converter), lighting (LED ballasts), automotive and household appliances		SMPS, electronic ballasts, pulse circuits




Medium Power Film Capacitors			
			
<b>Series</b>	MKP DC link High Density B32774 ... B32778	MKP DC link High Density THB B32774H ... B32778H	MKP DC link High Temperature B32774P ... B32778P
<b>Technical data</b>	Rated capacitance: 1.5 ... 480 µF Rated voltage: 450 ... 1300 V DC	Rated capacitance: 1.5 ... 120 µF Rated voltage: 450 ... 1700 V DC	Rated capacitance: 1.5 ... 50 µF Rated voltage: 630 ... 840 V DC
<b>Features</b>	Dielectric: Polypropylene (PP) offers: <ul style="list-style-type: none"> <li>- Higher dielectric strength vs. polyester (PET) dielectric</li> <li>- Lower dissipation factor, higher current capability (RMS and peak) and parameter stability vs. polyester dielectric</li> <li>- Epoxy resin sealing and plastic box case are UL94V-0 flame retardant materials</li> <li>- High density of capacitance per volume</li> <li>- Low losses with high current capability</li> </ul>		
		<ul style="list-style-type: none"> <li>- High density, compact for severe ambient conditions</li> <li>- Operating temperature up to +105 °C</li> <li>- +60 °C/95 % RH/V<sub>R</sub>/1000 h</li> <li>- AEC-Q200</li> </ul>	<ul style="list-style-type: none"> <li>- Operating temperature up to +125 °C</li> <li>- +40 °C/93 % RH/V<sub>R</sub>/1000 h</li> <li>- +50 °C/95 % RH/V<sub>R</sub>/500 h</li> <li>- AEC-Q200</li> </ul>
<b>Applications</b>	DC link, DC filtering, decoupling in industrial, lighting, automotive and household appliances	DC link, DC filtering, decoupling in industrial, lighting, automotive and household appliances, for severe ambient conditions	DC link for frequency converters, industrial and high end power supplies, automotive DC/DC and compressors, high temperature applications

# Film Capacitors

## Medium Power Film Capacitors

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Medium Power Film Capacitors			
			
<b>Series</b>	MKP DC link High Power B32674 ... B32678	MKP snubber B32656S... B32658S	MFP boxed B32682 ... B32686
<b>Technical data</b>	Rated capacitance: 470 nF ... 270 µF Rated voltage: 300 ... 875 V DC	Rated capacitance: 68 nF ... 5.6 µF Rated voltage: 850 ... 2000 V DC 450 ... 800 V AC	Rated capacitance: 0.47 nF ... 1.5 µF Rated voltage: 400 ... 2500 V DC 250 ... 750 V AC
<b>Features</b>	Dielectric: Polypropylene (PP) offers: – Higher dielectric strength vs. polyester (PET) dielectric – Lower dissipation factor, higher current capability (RMS and peak) and parameter stability vs. polyester dielectric – Epoxy resin sealing and plastic box case are UL94V-0 flame retardant materials  – High power: density of I <sub>RMS</sub> current per capacitance – High frequency ripple current		– Polypropylene (PP) film dielectric metallized on one side and metal foil electrodes – It allows maximum pulse handling capability together with maximum ripple current and frequency – Very high dv/dt
<b>Applications</b>	DC link, DC filtering, decoupling in industrial, lighting, automotive and household appliances	Snubbing IGBT module in industrial appliances	Smoothing, snubbing, high frequency AC loads in industrial, lighting and medical electronics with very high pulse, frequency and current demand




Medium Power Film Capacitors			
			
<b>Series</b>	MFP snubber B32686S...	X2 standard B32921 ... B32928	X1 EMI suppression B32911 ... B32918
<b>Technical data</b>	Rated capacitance: 22 nF ... 0.68 µF Rated voltage: 1000 ... 2000 V DC 400 ... 500 V AC	Rated capacitance: 10 nF ... 30 µF Rated voltage: 305 V AC	X1 330 V: Rated capacitance: 10 nF ... 6.8 µF Rated voltage: 330 V AC  X1 530 V: Rated capacitance: 6.8 nF ... 5.6 µF Rated voltage: 530 V AC
<b>Features</b>	– Polypropylene (PP) film dielectric metallized on one side and metal foil electrodes – Provides maximum pulse handling capability together with the maximum ripple current and frequency – Very low ESL, ESR – Thermal, mechanical stability	– Standard EMI suppression capacitor for EMC filtering – Good self-healing properties – High voltage capability – Very small dimensions	– Standard EMI suppression capacitor for EMC filtering – Good self-healing properties – High voltage capability – Very small dimensions
<b>Applications</b>	Snubbing IGBT module in industrial, medical electronics with very high pulse, frequency and current demand	Across-the-line applications in industrial, lighting, medical, household appliances	

# Film Capacitors

## Medium Power Film Capacitors

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Medium Power Film Capacitors			
			
<b>Series</b>	Y2 EMI suppression B32021 ... B32026	Y2 Humidity B32032 ... B32036	Y1 EMI suppression B81123
<b>Technical data</b>	Rated capacitance: 1 nF ... 1 µF Rated voltage: 300 V AC	Rated capacitance: 4.7 nF ... 1.2 µF Rated voltage: 350 V AC	Rated capacitance: 1 ... 10 nF Rated voltage: 500 V AC
<b>Features</b>	<ul style="list-style-type: none"> <li>– Standard EMI suppression capacitor for EMC filtering</li> <li>– Good self-healing properties</li> <li>– High voltage capability</li> <li>– Very small dimensions</li> </ul>	<ul style="list-style-type: none"> <li>– Grade III THB</li> <li>– +85 °C/85 % RH/1000 h/350 V AC</li> <li>– Y2 safety class per UL/IEC</li> <li>– High stability of capacitance value</li> </ul>	<ul style="list-style-type: none"> <li>– Standard EMI suppression capacitor for EMC filtering</li> <li>– Good self-healing properties</li> <li>– High voltage capability</li> <li>– Very small dimensions</li> </ul>
<b>Applications</b>	Line-to-ground applications in industrial, lighting, medical, household appliances	Line-to-ground applications in industrial and automotive applications	Line-to-ground applications in industrial, lighting, medical, household appliances




Medium Power Film Capacitors			
			
<b>Series</b>	X2 Heavy Duty B32932 ... B32936	X2 Humidity B32922H/J ... B32926H/J	X2 industrial series B32924A/B4 ... B32928A/B4
<b>Technical data</b>	Rated capacitance: 47 nF ... 2.2 µF Rated voltage: 305 V AC	Rated capacitance: 0.1 ... 15 µF Rated voltage: 305 V AC	Rated capacitance: 0.47 ... 20 µF Rated voltage: 350 V AC
<b>Features</b>	<ul style="list-style-type: none"> <li>– +85 °C/85% RH/1000 h/240 V AC</li> <li>– X2 safety class per UL/IEC (C ≤ 2.2 µF)</li> <li>– High stability on capacitance value</li> <li>– Internal series connection</li> <li>– +40 °C/93% RH/2000 h/305 V AC</li> </ul>	<ul style="list-style-type: none"> <li>– +85 °C/85% RH/1000 h/240 V AC</li> <li>– X2 safety class per UL/IEC</li> <li>– High stability of capacitance value</li> <li>– +60 °C/95% RH/1000 h/240 V AC</li> </ul>	<ul style="list-style-type: none"> <li>– X2 safety class per UL/IEC</li> <li>– Very high stability of capacitance value</li> <li>– +85 °C/85% RH/1000 h/330 V AC</li> <li>– Internal series construction</li> </ul>
<b>Applications</b>	Capacitive power supplies AC voltage dividers Serial connection with mains For severe ambient conditions	Across-the-line applications in industrial, medical, household appliances For severe ambient conditions Also for serial connection with mains	For severe ambient conditions Across the line and series applications

# Film Capacitors

AC Output/Input Filters, AC Film Capacitors

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AC Output/Input Filters		AC Film Capacitors	
			
<b>Series</b>	Box type B32354S ...		MotorCap S0 plastic B3232 ...
<b>Technical data</b>	Rated capacitance: 10 ... 40 µF Rated voltage: 350 V AC		Rated voltage: 250 ... 480 V AC Rated capacitance: 1 ... 60 µF Plastic can
<b>Features</b>	<ul style="list-style-type: none"> <li>– Plastic can</li> <li>– Terminals: 4 pin, 2 pin as option</li> <li>– Optimized for PCB mounting</li> <li>– Segmented film safety function</li> <li>– +85 °C, 85% rel. humidity, 1000 h, V<sub>R</sub> compatible</li> <li>– UL 810 Components level approval as option</li> <li>– 10 000 AFC to UL 810 compliant</li> </ul>		<ul style="list-style-type: none"> <li>– Useful life: Up to 10 000 h/class B</li> <li>– Terminals: Fast-on (single/double) Insulated wire Twin core cable</li> <li>– Safety class: S0</li> <li>– Approvals: UL, VDE, IS</li> </ul>
<b>Applications</b>	Designed for AC input and AC output filters e.g. UPS		General sine wave applications, mainly as motor run capacitor





AC Film Capacitors			
			
<b>Series</b>	MotorCap S3 compact B3235 ...	Super MotorCap S2 Alu B3233 ...	MotorCap S2 Alu B3333 ...
<b>Technical data</b>	Rated voltage: 400, 450 V AC Rated capacitance: 1.5 ... 20 µF Plastic can	Rated voltage: 450 V AC Rated capacitance (single): 1 ... 60 µF Rated capacitance (double): 10+1 ... 60+10 µF Aluminum can	Rated voltage: 450 V AC Rated capacitance: 1 ... 80 µF Rated capacitance (single): 2 ... 50 µF Rated capacitance (dual): 12+1.5 ... 60+8 µF Aluminum can
<b>Features</b>	<ul style="list-style-type: none"> <li>– Useful life: Up to 30 000 h/class A</li> <li>– Temperature up to +100 °C</li> <li>– Terminals: Fast-on (single/double) Insulated wire Twin core cable</li> <li>– Safety class: S3</li> <li>– Approvals: UL, VDE</li> </ul>	<ul style="list-style-type: none"> <li>– Useful life: Up to 30 000 h/class A</li> <li>– Terminals: Fast-on (single/double) Twin core cable</li> <li>– Safety class: S2</li> <li>– Approvals: UL, VDE, TÜV</li> </ul>	<ul style="list-style-type: none"> <li>– Useful life: Up to 30 000 h/class A</li> <li>– Terminals: Fast-on (single/double) Twin core cable</li> <li>– Safety class: S2</li> <li>– Approvals: UL, VDE, CQC</li> </ul>
<b>Applications</b>	Mainly as motor run capacitor, e.g. for refrigeration units, pumps, home convenience drives	Mainly as motor run capacitor, e.g. for household appliances, heat pumps	Mainly as motor run capacitor, e.g. for household appliances, heat pumps Version for general AC purpose

# Film Capacitors

## PFC Capacitors and Key Components for Power Quality Solutions

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PFC Capacitors and Key Components for Power Quality Solutions				
				
<b>Series</b>	PhaseCap Energy B25674/B25675	PhaseCap Compact B25673	PhaseCap Premium B25667	PhaseCap HD B25669
<b>Technical data</b>	Power: 5.0 ... 33 kvar Rated voltage: 230 ... 690 V AC Inrush current: up to $500 \cdot I_R$	Power: 5.0 ... 33 kvar Rated voltage: 230 ... 1000 V AC Inrush current: up to $400 \cdot I_R$	Power: 5.0 ... 33 kvar Rated voltage: 230 ... 800 V AC Inrush current: up to $300 \cdot I_R$	Power: 40 ... 60 kvar Rated voltage: 400 ... 525 V AC Inrush current: up to $300 \cdot I_R$
<b>Features</b>	– Useful life: Up to 180 000 to 200 000 h at temp. class –40/D, depending on the type	– Useful life: Up to 200 000 h at temp. class –40/C Up to 150 000 h at temp. class –40/D	– Useful life: Up to 180 000 h at temp. class –40/C Up to 130 000 h at temp. class –40/D	– Useful life: Up to 180 000 h at temp. class –40/C Up to 130 000 h at temp. class –40/D
<b>Applications</b>	Automatic PFC equipment Individual fixed PFC Group fixed PFC Tuned and detuned capacitor banks Dynamic PFC	Automatic PFC equipment Individual fixed PFC Fixed PFC Tuned and detuned capacitor banks Types from 690 to 1000 V for usage in wind turbine and industrial applications with heavy harmonic loads	Automatic PFC equipment Individual fixed PFC Fixed PFC Tuned and detuned capacitor banks 690 and 800 V series for usage in harsh applications with heavy harmonic loads	Automatic PFC equipment Individual fixed PFC Fixed PFC Detuned capacitor banks


PFC Capacitors and Key Components for Power Quality Solutions				
				
<b>Series</b>	DeltaCap B32300, B32301, B32303, B32304	PhiCap B32340C...A..., B32343C, B32344E	HomeCap B32340C...J...	PoleCap B25671
<b>Technical data</b>	Power: 0.5 ... 33 kvar Rated voltage: 230 ... 525 V AC Inrush current: up to $200 \cdot I_R$	Power: 0.5 ... 30 kvar Rated voltage: 230 ... 525 V AC Inrush current: up to $200 \cdot I_R$	Power: 0.02 ... 1.99 kvar Rated voltage: 400 V AC (Application voltage: 127 ... 400 V AC) Inrush current: up to $100 \cdot I_R$	Power: 0.5 ... 30 kvar Rated voltage: 400 ... 525 V AC Inrush current: up to $200 \cdot I_R$
<b>Features</b>	– Useful life: Up to 150 000 h at temp. class –40/C Up to 115 000 h at temp. class –40/D	– Useful life: Up to 135 000 h at temp. class –40/C Up to 100 000 h at temp. class –40/D	– Useful life: Up to 100 000 h at temp. class –40/D	– Useful life: Up to 100 000 h at temp. class –40/C
<b>Applications</b>	Automatic capacitor banks Fixed PFC Detuned PFC systems	Automatic capacitor banks Fixed PFC Detuned PFC systems	Residential PFC	Outdoor low voltage applications For installation in surround- ings with high dust or moisture concentration

# Film Capacitors


## PFC Capacitors and Key Components for Power Quality Solutions

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

### PFC Capacitors and Key Components for Power Quality Solutions

		
<b>Series</b>	PF controllers B44066R ...	
<b>Technical data</b>	<u>Supply voltage:</u> BR604: 230 V AC BR6000 (from V5.0 onwards), BR7000-series: 110 ... 440 V AC <u>Measuring voltage:</u> BR604 = supply voltage 230 V AC BR6000: 30 ... 525 V AC (L-N) or (L-L) BR7000/BR7000-T: 3 x 30 ... 440 V AC (L-N); 3 x 50 ... 760 V AC (L-L) BR7000-I: 30 ... 440 V AC (L-N); 50 ... 760 V AC (L-L) BR7000-I-TH/BR7000-I-TH/S: 30 ... 440 V AC (L-N) / 50 ... 760 V AC (L-L)	
<b>Features</b>	<u>Output stages:</u> BR604: 4 relay outputs BR6000: depending on the type 6 to 12 relay outputs BR6000-T6: 6 transistor outputs BR7000: 15 relay outputs BR7000-T: 15 transistor outputs BR7000-I: 12/13 relay outputs BR7000-I-TH/BR7000-I-TH/S: 12 relay and 12 transistor outputs	<u>Menu languages:</u> BR604: EN/ES/GER/PT BR6000-series/BR7000-I-series: CZ/EN/ES/GER/NL/PL/PT/RU/TR BR7000-series: EN/ES/GER/RU/TR
<b>Applications</b>	Controlling of actual power factor Connecting/disconnecting capacitor steps	




### PFC Capacitors and Key Components for Power Quality Solutions




		
<b>Series</b>	Measuring devices B44066M ...	
<b>Technical data</b>	<u>Supply voltage:</u> MMI6000: 230 V AC MMI7000: 110 ... 440 V AC MMI8003: 24 V DC (via external terminal) <u>Measuring voltage:</u> MMI6000: 230 V AC MMI7000: 3 x 30 ... 440 V AC (L-N) 3 x 50 ... 760 V AC (L-L) MMI8003: 3 x 30 ... 440 V AC (L-N) 3 x 50 ... 690 V AC (L-L)	
<b>Features</b>	<ul style="list-style-type: none"> <li>- Compact dimensions</li> <li>- Panel mounting instrument</li> <li>- LCD display, MMI8003 no display</li> <li>- Menu languages:                MMI6000: EN/GER                MMI7000: EN/GER/ES/RU/TR                MMI8003: n/a             </li> </ul>	
<b>Applications</b>	Accessory for PF controller BR-series with interface MMI6000: 1-phase measuring and display of grid parameters MMI7000: 3-phase measuring and display of grid parameters MMI8003: 3-phase measuring, display via PC or external control device	

# Film Capacitors

## PFC Capacitors and Key Components for Power Quality Solutions

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PFC Capacitors and Key Components for Power Quality Solutions			
			
<b>Series</b>	Grid analysis tool B44066M7777E230	Contactors B44066S ... J ...	TSM modules B44066T ...
<b>Technical data</b>	Operating voltage: 110 ... 230 V AC Measuring current: 30, 300, 3000 A Measuring voltage: 3x 30 ... 440 V AC 3x 50 ... 760 V AC	Voltage: 400 ... 690 V Output range: 12.5 ... 100 kvar	Voltage range: TSM-LC(X): 230 ... 690 V, depending on type  Output range: TSM-LC(X): 10 ... 200 kvar, depending on type
<b>Features</b>	<ul style="list-style-type: none"> <li>– Comfortable measuring tool</li> <li>– 4 GB memory card included</li> <li>– PC software for evaluation of measured values included</li> </ul>	<ul style="list-style-type: none"> <li>– For usage in PFC systems with and without reactors</li> <li>– cUL approval</li> <li>– CCC approval</li> </ul>	<ul style="list-style-type: none"> <li>– Fast electronically controlled thyristor switch</li> <li>– Easy installation</li> <li>– Very short switching times</li> </ul>
<b>Applications</b>	Three-phase measuring, display and storage of electric parameters in LV grids	Damping of inrush current in low voltage PFC systems For PFC systems with/without reactors	Main supply networks with high load fluctuations for dynamic PFC systems, e.g. presses, welding machines, elevators, cranes, wind turbines

PFC Capacitors and Key Components for Power Quality Solutions			
			
<b>Series</b>	Reactors B44066D ...	PQSine S series – Active harmonic filter and power optimizer B44066F...S...	PQvar series – Static Var Generator (SVG) B44066F...V...
<b>Technical data</b>	Voltage: 220 ... 690 V Output range: 10 ... 100 kvar Detuning factor: 5.67, 7, 14% Frequency: 50 or 60 Hz	Rated voltage: 400 V (228...456 V); 480 V (384...552 V); 690 V (480...790 V) Rated filter current: 25, 35, 50, 60, 75, 90, 100, 150 A	Rated voltage: 400 V (240...480 V); 690 V (483...794 V) Rated output: 30, 50, 75, 95, 100, 110 kvar
<b>Features</b>	<ul style="list-style-type: none"> <li>– High harmonic loading capability</li> <li>– Very low losses</li> <li>– Low noise emission</li> <li>– Temperature protection by microswitch (NC)</li> </ul>	<ul style="list-style-type: none"> <li>– Modules and wall mounted units</li> <li>– Higher ratings available in floor mounting variant</li> <li>– Harmonic mitigation up to the 50<sup>th</sup> order</li> <li>– Active load balancing</li> <li>– Ultra-fast reactive power factor compensation (inductive and capacitive)</li> <li>– Compact design</li> <li>– Advanced digital control</li> <li>– Modular system</li> </ul>	<ul style="list-style-type: none"> <li>– Modules and wall mounted units</li> <li>– Higher ratings available in floor mounting variant</li> <li>– Ultra-fast reactive power factor compensation (inductive and capacitive)</li> <li>– Active load balancing</li> <li>– Modular and compact design</li> <li>– Advanced digital control</li> <li>– High performance and reliability</li> <li>– Simple installation and commissioning</li> </ul>
<b>Applications</b>	Avoiding of resonance conditions Tuned and detuned harmonic filters Reduction of power losses	Datacenters, UPS systems, renewable energies, industrial production facilities, office buildings and shopping centres	





# Film Capacitors

## Power Capacitors

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### Power Capacitors

		
<b>Series</b>	MKK DC/DCi/DCi-H, DCi-R/DC-R B25650 (gas), B25640 (resin), B25750 (oil)	PCC LP B25655J ..., B25655M ..., B25655P ...
<b>Technical data</b>	Rated capacitance: 100 $\mu$ F ... 20 mF Nominal voltage: 800 ... 6500 V Operating temperature: -55 ... +80 °C Gas impregnation (DC) Oil impregnation (DCi/DCi-H) Resin impregnation (DCi-R, DC-R)	Rated capacitance: 50 ... 3000 $\mu$ F Rated voltage: 200 ... 900 V DC Operating temperature: -40 ... +110 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- High peak current handling capability</li> <li>- Low losses</li> <li>- Long useful life</li> <li>- Very high reliability</li> <li>- Rectangular case</li> <li>- Flat windings</li> <li>- Overpressure switch possible, self-healing</li> </ul>	<ul style="list-style-type: none"> <li>- Low self-inductivity</li> <li>- High volume fill factor</li> <li>- Very good self-healing</li> <li>- Compact size</li> <li>- Flexible dimensions</li> <li>- Customer specific designs</li> </ul>
<b>Applications</b>	DC link Resonant filters Power modules for HVDC	DC link for LV inverters, especially xEV powertrain applications




### Power Capacitors




		
<b>Series</b>	MKP DC B2562*	MKP DC LSI B2563*
<b>Technical data</b>	Rated capacitance: 40 ... 4000 $\mu$ F Rated voltage: 700 ... 2000 V DC Operating temperature: -55 ... +85 °C	Rated capacitance: 50 ... 400 $\mu$ F Rating voltage: 500 ... 1200 V DC Operating temperature: -55 ... +85 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- High RMS current handling capability</li> <li>- Self-healing</li> <li>- Aluminum can</li> <li>- Customized configurations</li> <li>- IEC 61071, UL 810 compliant</li> </ul>	<ul style="list-style-type: none"> <li>- Different terminal types</li> <li>- High peak current capability</li> <li>- Customized configurations</li> <li>- Self-healing</li> <li>- Low self-inductance</li> <li>- Plastic can</li> <li>- IEC 61071, UL 810 compliant</li> </ul>
<b>Applications</b>	DC link for renewable energy inverters, industrial drives, UPS, E-mobility, medical appliances and traction	Compact DC link applications, E-mobility

# Film Capacitors

## Power Capacitors




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Power Capacitors			
			
<b>Series</b>	Filtercap MKD AC B32370, B32371, B32373, B32374	Filtercap MKD AC B32377	Filtercap MKP AC B33331V...
<b>Technical data</b>	Rated capacitance: 5 ... 600 $\mu$ F Rated voltage: 250 ... 850 V RMS Operating temperature: -55 ... +85 °C 1-phase capacitor	Rated capacitance: 3x 10 ... 3x 600 $\mu$ F Rated voltage: 250 ... 850 V RMS (phase voltage) Operating temperature: -55 ... +85 °C 3-phases capacitor	Rated capacitance: 2 ... 50 $\mu$ F Rated voltage: 460 V AC, others upon request
<b>Features</b>	<ul style="list-style-type: none"> <li>- Different terminal types</li> <li>- High peak current capability</li> <li>- Customized configurations</li> <li>- Overpressure disconnecter</li> <li>- Self-healing</li> <li>- IEC 61071, GB/T17702, IEC 60831 and UL 810 compliant</li> </ul>	<ul style="list-style-type: none"> <li>- Different terminal types</li> <li>- High peak current capability</li> <li>- Customized configurations</li> <li>- Overpressure disconnecter</li> <li>- Self-healing</li> <li>- IEC 61071, GB/T17702, IEC 60831 and UL 810 compliant</li> </ul>	<ul style="list-style-type: none"> <li>- Robust design</li> <li>- Compact dimensions</li> <li>- 85%/85%/VR/1000 h compatible</li> <li>- UL approved ratings</li> <li>- IEC 61071 compliant</li> </ul>
<b>Applications</b>	Capacitors for AC input/output filtering for industrial applications, converters, UPS, drives and wind/solar inverters		Industrial and general applications AC filter applications Renewable energies

Power Capacitors			
			
<b>Series</b>	Ultra-compact DC link B32320l...	MKK HP B25610	MKK DCR B25640
<b>Technical data</b>	Rated capacitance: 65 $\mu$ F Rated voltage: 350 V DC, others upon request	Rated capacitance: from 3 x 50 $\mu$ F on wards Rated voltage: up to 690 V AC Operating temp.: -55 ... +80 °C	Rated capacitance: up to 20 mF Rated voltage: up to 1500 V DC Operating temperature: -25 ... +80 °C
<b>Features</b>	<ul style="list-style-type: none"> <li>- Compact dimensions of (d x l) 40 x 58 mm</li> <li>- Very high capacity density of 0.9 <math>\mu</math>F/cm<sup>3</sup></li> <li>- Low ESR of 10 m<math>\Omega</math></li> <li>- Integrated thermal fuse</li> </ul>	<ul style="list-style-type: none"> <li>- Low ESR</li> <li>- Self-healing</li> <li>- Reduces high THD</li> <li>- Delta or star connected</li> <li>- Rectangular case</li> <li>- Customer specific design</li> <li>- Aluminum or stainless steel case</li> <li>- Compact size</li> </ul>	<ul style="list-style-type: none"> <li>- Very low ESL</li> <li>- Self-healing</li> <li>- Open capacitors</li> <li>- Rectangular case</li> <li>- Customer specific design</li> <li>- Compact size (flat winding)</li> <li>- Resin filled</li> <li>- Cost optimized</li> </ul>
<b>Applications</b>	HF filtering in inverters General DC link applications	High performance output filtering, especially in wind power applications	DC link, industrial and renewable energies

# Aluminum Electrolytic Capacitors


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Aluminum Electrolytic Capacitors			
			
<b>Series</b>	Screw terminals	4-/5-pin snap-in terminals and solder pins	Snap-in terminals
<b>Technical data</b>	Rated voltage: 16 ... 600 V Rated capacitance: 820 ... 680 000 µF Dimensions (d x h): 51.6 x 80.7 ... 90 x 221 mm	Rated voltage: 350 ... 500 V Rated capacitance: 220 ... 3300 µF Dimensions (d x h): 35 x 40 ... 50 x 100 mm	Rated voltage: 10 ... 600 V Rated capacitance: 47 ... 68 000 µF Dimensions (d x h): 22 x 25 ... 35 x 55 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– High ripple current capability</li> <li>– Long operational useful life (up to &gt;20 years)</li> <li>– Self-extinguishing electrolyte upon request</li> <li>– Special designs for base cooling</li> <li>– With PET insulation</li> <li>– Compact can size</li> </ul>	<ul style="list-style-type: none"> <li>– High ripple current capability</li> <li>– Long operational useful life (up to &gt;20 years)</li> <li>– With PET insulation</li> <li>– Optional PET insulation cap on terminal side</li> <li>– Compact can size</li> </ul>	<ul style="list-style-type: none"> <li>– High ripple current capability</li> <li>– Long operational useful life (up to &gt;20 years)</li> <li>– With PET insulation</li> <li>– Optional PET insulation cap on terminal side</li> <li>– Compact can size</li> </ul>
<b>Applications</b>	Frequency converters DC link for wind energy and solar inverters Uninterruptible power supplies Professional power supplies	Frequency converters DC link for solar inverters Uninterruptible power supplies Professional power supplies	Frequency converters DC link for solar inverters Uninterruptible power supplies Professional power supplies

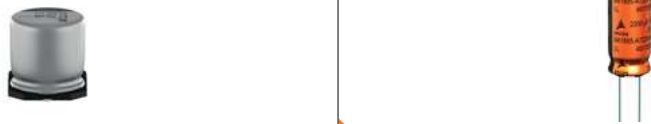
Aluminum Electrolytic Capacitors			
			
<b>Series</b>	Capacitors for pulse applications	Large-size	Axial-lead
<b>Technical data</b>	Rated voltage: 300 ... 500 V Rated capacitance: 200 ... 6600 µF Dimensions (d x h): 25 x 45 ... 50 x 100 mm	Rated voltage: 25 ... 63 V; 400 ... 500 V Rated capacitance: 150 ... 27 000 µF Dimensions (d x h): 22 x 25 ... 35 x 60 mm	Rated voltage: 25 ... 250 V Rated capacitance: 22 ... 10 000 µF Dimensions (d x h): 12 x 30 ... 21 x 49 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>– Compact design</li> <li>– Outstanding reliability</li> <li>– High charge/discharge proof, polar</li> <li>– Low leakage current</li> <li>– Low dissipation factor</li> </ul>	<ul style="list-style-type: none"> <li>– High vibration stability up to 40 g</li> <li>– High ripple current capability</li> <li>– Low ESR</li> <li>– Useful life up to 5000 h at +125 °C up to 63 V</li> <li>– Useful life up to 3000 h at +105 °C up to 500 V</li> </ul>	<ul style="list-style-type: none"> <li>– High vibration stability up to 60 g</li> <li>– High ripple current capability</li> <li>– Low ESR at high temperatures</li> <li>– Long useful life up to 10 000 h at +125 °C</li> <li>– High temperature range up to +150 °C</li> </ul>
<b>Applications</b>	Medical appliances Professional photoflash generators	High energy efficiency in automotive applications e.g. up to 63 V power steering, motor management and for 400 ... 500 V on-board chargers	High energy efficiency in automotive applications e.g. motor management, power steering, fan control, water pumps, transmission control, 48 V boardnet, DC/DC converters

# Aluminum Electrolytic Capacitors

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Aluminum Electrolytic Capacitors	
	
<b>Series</b>	Soldering star
<b>Technical data</b>	Rated voltage: 25 ... 250 V Rated capacitance: 22 ... 10 000 µF Dimensions (d x h): 12 x 30 ... 21 x 49 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- High vibration stability up to 60 g</li> <li>- Low inductance</li> <li>- High ripple current capability</li> <li>- Long useful life up to 10 000 h at +125 °C</li> <li>- High temperature range up to +150 °C</li> <li>- Low ESR at high temperatures</li> </ul>
<b>Applications</b>	High energy efficiency in automotive applications e.g. motor management, power steering, fan control, water pumps, transmission control, 48 V boardnet, DC/DC converters

\*) upon request



Aluminum Electrolytic Capacitors	
	
<b>Series</b>	Hybrid polymer – SMD **)
<b>Technical data</b>	Rated voltage: 25 ... 35 V Rated capacitance: 150 ... 330 µF Dimensions (d x h): 10 x 10.5 mm
<b>Features</b>	<ul style="list-style-type: none"> <li>- Low ESR</li> <li>- High ripple current</li> <li>- High temperature up to +125 °C</li> <li>- Useful life 4000 h</li> <li>- Qualification based on AEC-Q200</li> </ul>
<b>Applications</b>	Power steering Fan control Electronic pumps Wiper systems e-brake DC/DC converters ADAS

\*\*) Product available in Q1/2019

# Electric Double Layer Capacitors

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## Electric Double Layer Capacitors

			
<b>Series</b>	Thin type EDLC041720	Low profile type EDLC212520	Low profile type EDLC262520
<b>Technical data</b>	Size (l x w x h): 20 x 17 x 0.4 mm Capacitance: 5, 10, 15 mF typ. Rated voltage: 3.2 V (continuous), 5 V (peak) Impedance: 7 Ω typ. (AC 1 kHz)	Size (l x w x h): 20 x 25 x 2.1 mm, without lead Capacitance: 350 mF typ. Rated voltage: 4.2 V (continuous), 5.5 V (peak) Impedance: 55 mΩ typ. (AC 1 kHz)	Size (l x w x h): 20 x 25 x 2.6 mm, without lead Capacitance: 500 mF typ. Rated voltage: 4.2 V (continuous), 5.5 V (peak) Impedance: 35 mΩ typ. (AC 1 kHz)
<b>Features</b>	<ul style="list-style-type: none"> <li>- High capacitance and low impedance</li> <li>- Very thin small size</li> <li>- High bending strength</li> <li>- Long-life</li> <li>- Green materials</li> <li>- High safety</li> <li>- Conformable to ISO card-bending/torsion test</li> </ul>	<ul style="list-style-type: none"> <li>- High capacitance and low impedance</li> <li>- Very thin small size</li> <li>- Long-life</li> <li>- Green materials</li> <li>- High safety</li> </ul>	
<b>Applications</b>	Secondary power source for smartcard devices Storage element of energy harvesting	Battery assistance Storage element of energy harvesting Backup application for instantaneous power failures Strong LED flash	

# Magnets

## Ferrite Magnets

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

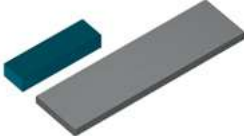
Ferrite Magnets	
<b>Series</b>	<p>FB series – FB12B, FB12H material</p> <p>FB series – FB9N, FB9B, FB9H material</p>
<b>Technical data</b>	<p>Residual flux density: 470 ±10mT, 460 ±10 mT            Coercive force: 340 ±12kA/m, 345 ±15 kA/m            Intrinsic coercive force: 380 ±12 kA/m, 430 ±15 kA/m            Maximum energy product (BH) max: 43.1 ±1.6 kJ/m<sup>3</sup>, 41.4 ±1.6 kJ/m<sup>3</sup></p> <p>Residual flux density: 460 ±10mT, 450±10 mT, 430 ±10 mT            Coercive force: 278.5 ±12kA/m, 342.2 ±12 kA/m, 330.2 ±12 kA/m            Intrinsic coercive force: 286.5 ±12 kA/m, 358.1 ±12 kA/m, 397.1 ±12 kA/m            Maximum energy product (BH) max: 40.4 ±1.6 kJ/m<sup>3</sup>, 38.6 ±1.6 kJ/m<sup>3</sup>, 35.0 ±1.6 kJ/m<sup>3</sup></p>
<b>Features</b>	<p>– Wet-molded anisotropic ferrite magnet            – Further improved coercive force H<sub>CJ</sub> temperature coefficient</p> <p>– Wet-molded anisotropic ferrite magnets            – Energy product with a substantially improved coercive force H<sub>CJ</sub> temperature coefficient</p>
<b>Applications</b>	<p>Automotive electronics            Home appliances: electrical motors, actuators, appliance motors</p> <p>Automotive electronics            Home appliances: electrical motors, actuators, appliance motors</p>

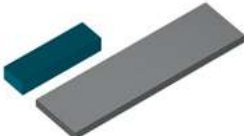
Ferrite Magnets	
<b>Series</b>	<p>FB series – FB5D, FB5DH material</p>
<b>Technical data</b>	<p>Residual flux density: 415 ±10 mT, 400 ±10 mT            Coercive force: 254.6 ±12 kA/m, 278.6 ±12 kA/m            Intrinsic coercive force: 262.6 ±16 kA/m, 318.3 ±16 kA/m            Maximum energy product (BH) max: 32.6 ±1.6 kJ/m<sup>3</sup>, 30.3 ±1.6 kJ/m<sup>3</sup></p>
<b>Features</b>	<p>– Deliver high B<sub>r</sub> and a relatively high level of H<sub>CJ</sub>            – Suitable for a diverse range of small, high-performance motors</p>
<b>Applications</b>	<p>Automotive electronics            Home appliances: electrical motors, actuators, appliance motors, sensors</p>

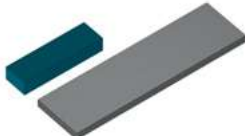
# Magnets

## Rare Earth Magnets – Nd-Fe-B Magnets

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Rare Earth Magnets – Nd-Fe-B Magnets	
	
<b>Series</b>	NEOREC series – NEOREC51DSX material Heavy Rare Earth diffusion type (HAL)
<b>Technical data</b>	Residual flux density: 1430 ±30 mT Coercive force: 1095 ±56 kA/m Intrinsic coercive force: ≥1830 kA/m Maximum energy product (BH) max: 390 ±16 kJ/m <sup>3</sup>
<b>Features</b>	<ul style="list-style-type: none"> <li>– Heavy Rare Earth diffusion type (HAL)</li> <li>– Reduction of heavy rare earth element (such as Dy, Tb) compared to conventional same H<sub>CJ</sub> magnet</li> <li>– Improvement of B<sub>r</sub> compared to conventional same H<sub>CJ</sub> magnet (7 to 8 % up)</li> </ul>
<b>Applications</b>	Automotive traction motors, electronics Home appliances

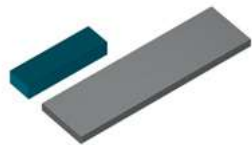
Rare Earth Magnets – Nd-Fe-B Magnets	
	
<b>Series</b>	NEOREC series – NEOREC44DUX material Heavy Rare Earth diffusion type (HAL)
<b>Technical data</b>	Residual flux density: 1330 ±30 mT Coercive force: 1023 ±56 kA/m Intrinsic coercive force: ≥2387 kA/m Maximum energy product (BH) max: 340 ±16 kJ/m <sup>3</sup>
<b>Features</b>	<ul style="list-style-type: none"> <li>– Heavy Rare Earth diffusion type (HAL)</li> <li>– Reduction of heavy rare earth element (such as Dy, Tb) compared to conventional same H<sub>CJ</sub> magnet</li> <li>– Improvement of B<sub>r</sub> compared to conventional same H<sub>CJ</sub> magnet (7 to 8 % up)</li> </ul>
<b>Applications</b>	Automotive traction motors, electronics

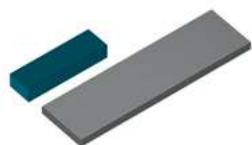
	
<b>Series</b>	NEOREC series – NEOREC50BF material Dy free (Heavy Rare free)
<b>Technical data</b>	Residual flux density: 1420 ±20 mT Coercive force: 1090 ±48 kA/m Intrinsic coercive force: ≥1114 kA/m Maximum energy product (BH) max: 390 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– Heavy Rare Earth free
<b>Applications</b>	VCM for HDD

# Magnets

## Rare Earth Magnets – Nd-Fe-B Magnets

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Rare Earth Magnets – Nd-Fe-B Magnets	
	
<b>Series</b>	NEOREC series – NEOREC47HF material Dy free (Heavy Rare Earth free)
<b>Technical data</b>	Residual flux density: 1390 ±20 mT Coercive force: 1058 ±48 kA/m Intrinsic coercive force: ≥1273 kA/m Maximum energy product (BH) max: 366 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– Heavy Rare Earth free
<b>Applications</b>	Renewable energy (Wind power) Home appliances Industrial applications

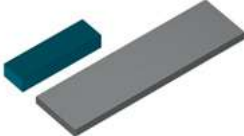
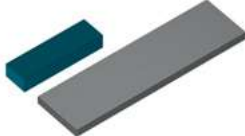
Rare Earth Magnets – Nd-Fe-B Magnets	
	
<b>Series</b>	NEOREC series – NEOREC45SH material
<b>Technical data</b>	Residual flux density: 1360 ±30 mT Coercive force: 1051 ±56 kA/m Intrinsic coercive force: ≥1671 kA/m Maximum energy product (BH) max: 357 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– General type
<b>Applications</b>	Home appliances Industrial applications Automotive electronics

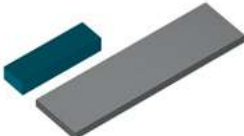
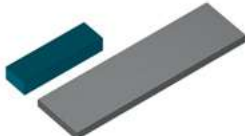


# Magnets

## Rare Earth Magnets – Nd-Fe-B Magnets

▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Tronics

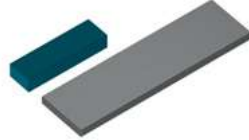
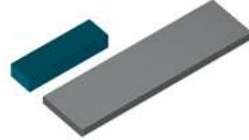
Rare Earth Magnets – Nd-Fe-B Magnets		
		
<b>Series</b>	NEOREC series – NEOREC40UH material	NEOREC series – NEOREC40TH material
<b>Technical data</b>	Residual flux density: 1290 ±30 mT Coercive force: 995 ±56 kA/m Intrinsic coercive force: ≥1990 kA/m Maximum energy product (BH) max: 310 ±16 kJ/m <sup>3</sup>	Residual flux density: 1285 ±30 mT Coercive force: 993 ±56 kA/m Intrinsic coercive force: ≥2109 kA/m Maximum energy product (BH) max: 319 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– General type	– General type
<b>Applications</b>	Automotive electronics	Automotive electronics

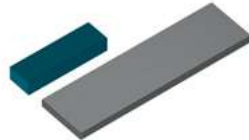
Rare Earth Magnets – Nd-Fe-B Magnets		
		
<b>Series</b>	NEOREC series – NEOREC38UX material	NEOREC series – NEOREC35NX material
<b>Technical data</b>	Residual flux density: 1250 ±30 mT Coercive force: 966 ±56 kA/m Intrinsic coercive force: ≥2387 kA/m Maximum energy product (BH) max: 294 ±16 kJ/m <sup>3</sup>	Residual flux density: 1200 ±30 mT Coercive force: 920 ±56 kA/m Intrinsic coercive force: ≥2626 kA/m Maximum energy product (BH) max: 278 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– General type	– General type
<b>Applications</b>	Automotive electronics	Automotive electronics

# Magnets

## Rare Earth Magnets – Nd-Fe-B Magnets


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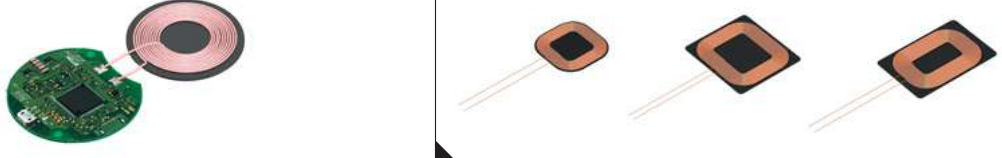
Rare Earth Magnets – Nd-Fe-B Magnets		
		
<b>Series</b>	NEOREC series – NEOREC46HF material	NEOREC series – NEOREC46HG material
<b>Technical data</b>	Residual flux density: 1380 ±30 mT Coercive force: 1066 ±56 kA/m Intrinsic coercive force: ≥1273 kA/m Maximum energy product (BH) max: 368 ±16 kJ/m <sup>3</sup>	Residual flux density: 1350 ±30 mT Coercive force: 1043 ±48 kA/m Intrinsic coercive force: ≥1432 kA/m Maximum energy product (BH) max: 352 ±16 kJ/m <sup>3</sup>
<b>Features</b>	– General type	– General type
<b>Applications</b>	VCM for HDD	Renewable energy (Wind power) Home appliances

Rare Earth Magnets – Nd-Fe-B Magnets		
		
<b>Series</b>	NEOREC series – NEOREC42SH material	
<b>Technical data</b>	Residual flux density: 1300 ±30 mT Coercive force: 979 ±56 kA/m Intrinsic coercive force: ≥1671 kA/m Maximum energy product (BH) max: 326 ±16 kJ/m <sup>3</sup>	
<b>Features</b>	– General type	
<b>Applications</b>	Home appliances Industrial applications Automotive electronics	

# Wireless Charging


▲ TDK ▲ EPCOS ▲ Micronas ▲ InvenSense ▲ Trionics


Wireless Charging	
	
<b>Series</b>	<p>Tx Coil units (WPC Compliant) WT505090-20K2-A10-G, WT505090-10K2-A11-G, WT525225-20K2-A1-G, WT1005690-12K2-A6-G</p> <p>Small Tx Coil units WT151512-22F2-ID, WT202012-15F2-ID, WT303012-12F2-ID</p>
<b>Technical data</b>	<p>Size: <math>\varnothing</math> 50 mm 52.0 x 52.0/100.0 x 56.0 mm Inductance: 6.3 ... 24.0 <math>\mu</math>H DC resistance: 0.06 ... 0.10 <math>\Omega</math></p> <p>Size: <math>\varnothing</math> 15.3 ... 30.0 mm Inductance: 6.2 ... 6.8 <math>\mu</math>H DC resistance: 0.095 ... 0.18 <math>\Omega</math></p>
<b>Features</b>	<ul style="list-style-type: none"> <li>- Tx coil units for WPC low-power (5W) specification</li> <li>- Got WPC approval for ferrite sheet</li> <li>- Thinner flexible ferrite sheet type is available for durable construction</li> <li>- Performance had been confirmed based on WPC equipment</li> </ul> <ul style="list-style-type: none"> <li>- Flexible sheet type is used</li> <li>- Custom design is available based on each design requirements</li> </ul>
<b>Applications</b>	<p>Various types of battery chargers (WPC compliant)</p> <p>Smartphones, cellular phones, handheld mobile terminals, DSCs and wearable products</p>

Wireless Charging	
	
<b>Series</b>	<p>Tx Coil modules WTM505090-10K2-5V-G1</p> <p>Rx Coil units WR303050-15F5-G, WR444025-17M6-G, WR444030-16F3-G WR483245-15F5-G, WR483265-15F5-G</p>
<b>Technical data</b>	<p>Size: <math>\varnothing</math> 50 mm Inductance: 6.3 <math>\mu</math>H DC resistance: 0.06 <math>\Omega</math></p> <p>Size: 29.6 x 30.0/32.2 x 48.2/43.5 x 39.5 mm Inductance: 12.3 ... 19.0 <math>\mu</math>H DC resistance: 0.2 ... 0.7 <math>\Omega</math></p>
<b>Features</b>	<ul style="list-style-type: none"> <li>- This is Tx turnkey solution including transmitter coil</li> <li>- Fully WPC compliant, including foreign object detection (FOD) method</li> <li>- 5V operation with wireless power consortium (WPC1.1) type A11 transmitter system</li> <li>- Pre cracked ferrite is available for durable construction</li> </ul> <ul style="list-style-type: none"> <li>- Pre cracked ferrite is available for durable construction</li> <li>- Flexible sheet type is available</li> <li>- Custom design is available based on each design requirements</li> </ul>
<b>Applications</b>	<p>Smartphones, cellular phones, handheld mobile terminals, and DSCs</p> <p>Smartphones, cellular phones, handheld mobile terminals, and DSCs</p>

# Wireless Charging

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Wireless Charging	
	
<b>Series</b>	NFC Antenna combo Rx coil units WR524830-16F3-NF-G WR524825-17M6-NF-G
<b>Technical data</b>	Size: 52.0 x 48.0 mm Inductance: 16.8 ... 19.5 $\mu$ H DC resistance: 0.75 ... 0.8 $\Omega$
<b>Features</b>	<ul style="list-style-type: none"> <li>- Receiving coils with wireless charging and NFC (Near Field Communication) antenna</li> <li>- Pre cracked ferrite is available for durable construction</li> <li>- Flexible sheet type is available</li> <li>- Custom design is available based on each design requirements</li> </ul>
<b>Applications</b>	Smartphones, cellular phones, handheld mobile terminals, and DSCs

Wireless Charging	
	
<b>Series</b>	Small Rx coil units WR121210-27M8-ID, WR202010-18M8-ID, WR222230-26M8-G, WR221230-36M8-G, WR301025-19M8-G, WR303050-12F5-ID
<b>Technical data</b>	Size: $\phi$ 12.0 ... 22.0 mm 22.0 x 12.0/30.0 x 10.0/30.0 x 29.6 mm Inductance: 8.23 ... 27.9 $\mu$ H DC resistance: 0.28 ... 1.27 $\Omega$
<b>Features</b>	<ul style="list-style-type: none"> <li>- Flexible sheet type is used</li> <li>- Custom design is available based on each design requirements</li> </ul>
<b>Applications</b>	Smartphones, cellular phones, handheld mobile terminals, DSCs and wearable products

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