Product Survey 2019

Electronic Components, Modules and Systems

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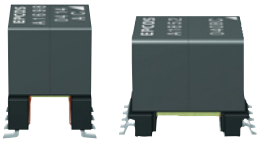
Contents

Magnetics

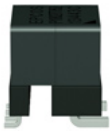
Transformers

TDK EPCOS Micronas InvenSense Tronics

Transformers

				
Series	EP6 shielded – SMD	EHR – SMD	EP7 … EP13 – SMD	ER11 – SMD
Technical data	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
Features	– High turns ratio – Low leakage inductance – High frequencies – Insensitive to external fields – AEC-Q200 approved	– High saturation currents – Low leakage inductance – High frequencies – AEC-Q200 approved	– Low leakage inductance – Compact design – Supplementary/ reinforced insulation levels	– Low stray inductance – High power density – High operating frequencies
Applications	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

				
Series	EF12.6 … EF25	Current-sense transformers – SMD B82801	Current-sense transformers – EP7 / EP10 CTEM series – SMD	Power chokes – PCEM series
Technical data	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_{sense}: up to 30 A RMS Turns ratio: 1:50 … 1:180	L_R: 1 … 3 µH I_R: up to 210 A
Features	– Pin Trough Hole (PTH) – High creepage distance – High dielectric strength – Types with 8 mm creepage and clearance distance available	– Three different sizes available – Very low DC resistance, losses and high reliability – Ruggedness and simple implementation – Customized designs	– Basic insulation – AEC-Q200 approved	– Basic insulation – Low DC resistance – AEC-Q200 approved
Applications	Power supplies	Compact DC/DC converters for midrange power	Electric car applications (xEV) Switch-mode power supplies	Electric car applications (xEV)

Please read *Important notes* on page 93.

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Series	Power transformers PTEM series	Gate-drive transformers EP5 – SMD B82804	Push-pull transformers E6.3 – SMD B82805
Technical data	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
Features	– 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
Applications	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

			
Series	Flyback transformers – SMD B82802, B82806D …	Flyback transformers ECO series	Resonant transformers SRX series
Technical data	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
Features	– 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
Applications	DC/DC converters (isolated buck) Power over Ethernet (PoE)	Switching power supplies	Switching power supplies

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Transformers

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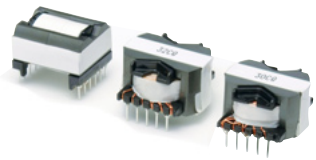
Transformers

			
Series	Resonant transformers SRV series	Flyback transformers SRW series	Choke coils PFC series
Technical data	Power: 160 … 250 W Frequency: 100 kHz Number of outputs: 2	For multiple outputs (vertical type) Power: 51 … 83 W Frequency: 50 … 100 kHz Operating temp: –30 … +120 °C For multiple outputs (horizontal type) 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
Features	– Pin terminal type (resonant type, through-hole) – Low height (15 … 16 mm) – High power in compact dimensions – Supports automatic winding	– Pin terminal type for multiple outputs – High B, low loss PC47 material – Adopts EGG cores developed for power transformers – Ideal for small, multiple output switching power supplies – Perfect balance between core volume	– Pin terminal type – Low height (15.5 … 27 mm) – High current in compact dimensions
Applications	Switching power supplies	Switching power supplies	General purpose isolated AC/DC, DC/DC converters

Transformers

		
Series	Energy management system CCT series	Gate-drive transformers VGT series – SMD
Technical data	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
Features	– Clamp type for easy installation on existing power equipment – Accommodates automatic process from wire wrapping and winding to soldering, ensuring high quality and stable supply – Equipped with a built-in open-circuit protective device	– High flux density cores have been adopted to achieve miniaturization – Dielectric strength voltage is 2.6 kV
Applications	Energy management systems (EMS) for buildings, factories, stores and communities (BEMS, FEMS, SEMS, CEMS)	IPM drive of motor inverters in automotive appications

Please read *Important notes* on page 93.

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Transformers, Power Inductors

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Series	Current-sense transformers VST series – SMD	Balun transformers – SMD ATB series
Technical data	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	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
Features	– High flux density cores have been adopted to achieve miniaturization – Maximum 30 A RMS can be measured	– Small size – Stable charging characteristics – High reliability
Applications	Switching current detection in on-board DC/DC converters and chargers in automotive applications	TVs Mobile devices Set Top Boxes

Transformers

Power Inductors

		
Series	Pulse transformers – SMD ALT series	Power inductors – SMD A and G versions B82471 … B82479
Technical data	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	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
Features	– Compatible with 10BASE-T, 100BASE-TX, and 1000BASE-T – High-quality product with automatic winding	– Shielded and unshielded construction – High rated current – Low DC resistance – Suitable for lead-free reflow soldering
Applications	LAN interface portion of devices like network devices, communication devices and digital home appliances	Filtering of supply voltages Coupling, decoupling DC/DC converters Consumer and industrial electronics

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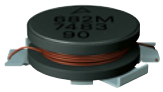
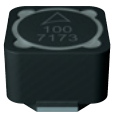
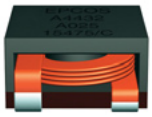
	 	 
Series	Power inductors – SMD A and G versions B82462, B82464	Power inductors – SMD P, R and M versions B82464 … B82477
Technical data	Rated inductance: 0.82 … 1000 µH Rated current: 0.11 … 7.6 A Temperature: up to +150 °C Size: 6 x 6 and 10 x 10 mm Height: 3.0 … 4.8 mm	Rated inductance: 0.82 … 1000 µH Rated current: 0.2 … 12.25 A Temperature: up to +150 °C Size: 7.3 x 7.3 … 12.5 x 12.5 mm Height: 4.5 … 8.5 mm
Features	– Shielded and unshielded construction – High rated current – Low DC resistance – Qualified to AEC-Q200 – Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D	– Shielded and unshielded construction – High mechanical stability – High rated current – Low DC resistance – Qualified to AEC-Q200 – Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D
Applications	Filtering of supply voltages Coupling, decoupling DC/DC converters Automotive and industrial electronics	Filtering of supply voltages Coupling, decoupling DC/DC converters Automotive electronics LED lighting

Power Inductors

	 	
Series	ERU chokes – SMD Helically wound B82559	Buck/Boost choke BCEM series – ERU33
Technical data	Rated inductance: 0.5 … 35 µH 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	Rated inductance: 3.2 … 10 µH Saturation current: 34 … 90 A (+25 °C) Size: 33 x 33 mm Height: 15 mm
Features	– Flat wire winding – Self-leaded construction under body termination – Very high rated current – Extremely low DC resistance – Suitable for pick-and-place process – Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D	– Flat wire winding – Pin Through Hole (PTH) with self-leaded pins – Additional fixation to be considered by customer – High rated current – Low DC resistance – AEC-Q200 under preparation
Applications	Energy storage chokes for DC/DC converters VRM modules POL converters	Buck/Boost choke for 48 V boardnet converters

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Series	Dual inductors – SMD B82464D6 … B82477C …, B82477D …	General use – SMD SLF series
Technical data	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
Features	– Two windings – 1:1 transformer – Shielded construction – Special winding technology for low stray inductance – High coupling factor – Qualified to AEC-Q200 – Suitable for lead-free reflow soldering as referenced in JEDEC J-STD 020D	– Magnetic shield type wound inductor for power circuits – Product line up allows various usages
Applications	SEPIC, CUK and flyback topologies DC/DC converters Automotive electronics LED lighting	Thin-screen TVs, LCDs, AV equipment, gaming equipment

Power Inductors

		
Series	Automotive general use – SMD CLF-NI-D series	General use – SMD VLCF series
Technical data	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
Features	– High rated DC current – High reliability with welding connection – Ferrite shielded component	– General use for portable DC/DC converter line – High magnetic shield construction
Applications	Generic DC/DC converter lines in automotive applications	DC/DC converters for communications Consumer electronics PCs

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Power Inductors

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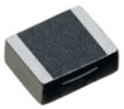
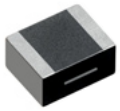
			
Series	General use – SMD SPM series	High current – SMD VLB series	Thin-Film – metal composite core technology – SMD TFM-GHM, TFM-ALM series
Technical data	Size (IEC): 3012 … 12565 Inductance: 0.18 … 10 µH Rated current: 1.3 … 46 A Temperature: –40 … +125 °C	Size (IEC): 7050 … 12065 Inductance: 90 … 360 nH Rated current: 14 … 68 A Temperature: –40 … +125 °C	Size (IEC): 2016 Inductance: 0.47 … 2.2 µH Rated current: 1.9 … 4.5 A
Features	– High power handling capability: Small copper loss – Using large saturation induction of Fe-based metals – High curie temperature of about +550 °C means low inductance temperature variance	– High output processing capacity: Minimal copper loss – High saturation current and low DC resistance – High operating frequency up to 2 MHz	– Low height of 1.0 mm – Superior DC-bias characteristics – Consists of original fine copper pattern with micro-processing technology – Coil pattern coated with metal magnetic material
Applications	Mobile communications, consumer electronics, servers, VRM	Servers Notebooks PCs VRMs VRDs	Generic use for DC/DC converter of mobile communication devices

Power Inductors

			
Series	Thin-Film – metal composite core technology – SMD TFM-ALMA	Semi-shielded – SMD VLS-EX, VLS-E series	Low profile, shielded – SMD VLS-CX series
Technical data	Size (IEC): 2016 … 2520 Inductance: 0.47 … 2.2 µH Rated current: 1.9 … 3.9 A Temperature: –40 °C … +150 °C	Size (IEC): 3010 … 6045 Inductance: 1 … 220 µH Rated current: 0.31 … 13.5 A	Size (IEC): 2016 … 2520 Inductance: 0.24 … 22 µH Rated current: 0.38 … 3.08 A
Features	– Low height of 1.0 and 1.2 mm (size 2520 only) – AEC-Q200 qualified – Excellent DC-bias characteristics – Consists of original fine copper pattern with micro-processing technology – Coil pattern coated with metal magnetic material	– General use for portable DC/DC converter lines	– Magnetic shield type wound inductor for power circuits using ferrite magnetic material – High magnetic shield construction and compatible with high-density mounting
Applications	Automotive (ECM, airbags, headlights, electronic power steering, ABS)	Mobile communications Consumer electronics Notebooks	Mobile communications Consumer electronics LCD displays HDDs

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	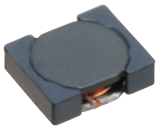	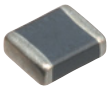
Series	Low profile – SMD VLF-MT series	Multilayer technology – SMD MLP series
Technical data	Size (IEC): 3025 … 4032 Inductance: 0.47 … 22 µH Rated current: 0.38 … 3.01 A	Size (IEC): 1005 … 2520 Inductance: 0.47 … 10 µH Rated current: 0.5 … 2.3 A
Features	– DC/DC converter with top class voltage conversion efficiency – Low profile – Generic use for portable DC/DC converters – High magnetic shield construction	– Most suitable for power lines with low output – Optimized ferrite materials for the reduction of losses – Substantially improved DC superposition characteristics
Applications	Mobile communications LCD displays HDDs DVC DSC	Mobile communications Power supply modules DSC PCs HDDs

Power Inductors

		
Series	Low profile, semi-shielded, metal core – SMD VLS-HBX series	Multilayer technology – SMD MLD series
Technical data	Size (IEC): 2016 … 2520 Inductance: 0.24 … 2.2 µH Rated current: 1.9 … 4.6 A	Size (IEC): 2016 Inductance: 1 … 4.7 µH Rated current: 0.2 … 1.4 A Temperature: –40 … +125 °C
Features	– General use for portable DC/DC converter lines – High magnetic shield construction actualizes high resolution for EMC protection	– For compact DC/DC converters – Most suitable for power lines with low output – Optimized ferrite materials enables the reduction of losses
Applications	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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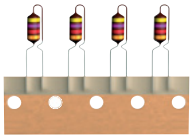
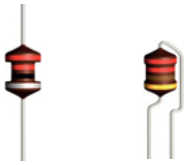
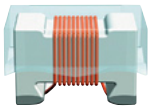
Power Inductors

			
Series	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
Technical data	Rated inductance: 1.0 … 100 000 µH Rated current: 0.02 … 2.5 A	Rated inductance: 0.1 … 470 µH Rated current: 0.6 … 7.3 A	Rated inductance: 1 … 3900 µH Rated current: 0.1 … 10 A
Features	– Wide inductance range – Suitable for wave soldering	– Low inductance, high rated current – Low DC resistance – Suitable for wave soldering	– High resonant frequency – Suitable for wave soldering
Applications	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 supression 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

			
Series	SIMID 0603-C – SMD B82496C …	SIMID 0805-F3 – SMD B82498F3 … 001	SIMID 1210-H – SMD B82422H …
Technical data	Size: 0603 (EIA) or 1608 (IEC) Inductance: 1 … 220 nH Rated current: 110 … 1800 mA Temperature: up to +150 °C	Size: 0805 (EIA) or 2012 (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 µH Rated current: 61 … 1150 mA Temperature: up to +150 °C
Features	– High resonance frequency – Narrow inductance tolerances – High mechanic stability – Qualified to AEC-Q200	– Ceramic core version – High resonance frequency – Narrow inductance tolerance – Qualified to AEC-Q200	– Very high current handling capability – Qualified to AEC-Q200
Applications	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

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Series	SIMID 1210H-900 – SMD B82422H … 900	SIMID 1210-100 – SMD B82422A …100	SIMID 1812-T/C – SMD B82432T …, B82432C …
Technical data	Size: 1210 (EIA) or 3225 (IEC) Inductance: 1 … 100 µH Rated current: 100 … 750 mA Temperature: up to +140 °C	Size: 1210 (EIA) or 3225 (IEC) Inductance: 0.0082 … 100 µH Rated current: 65 … 800 mA Temperature: up to +145 °C	Size: 1812 (EIA) or 4532 (IEC) Inductance: 1 … 1000 µH Rated current: 55 … 1300 mA Temperature: up to +150 °C
Features	– 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
Applications	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

				
Series	Standard circuits – SMD NL(V) series	Standard circuits – SMD NLFV series	Decoupling circuits – SMD NLC(V) series	SIMID 2220-T – SMD B82442T…
Technical data	Size (IEC): 2520 … 3225 Inductance: 0.01 … 1000 µH Rated current: 25 … 530 mA	Size (IEC): 2520, 3225 Inductance: 1 … 1000 µH Rated current: 20 … 750 mA	Size (IEC): 2520 … 4532 Inductance: 0.1 … 330 µH Rated current: 70 … 2850 mA	Size: 2220 (EIA) or 5650 (IEC) Inductance: 1 … 10 000 µH Rated current: 46 … 3510 mA Temperature: up to +150 °C
Features	– 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
Applications	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

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Transponder Coils

		
Series	X/Y Transponder coils – SMD TC1210 B82450A … C	Z Transponder coils – SMD TC1812 B82451A … D
Technical data	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
Features	– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests – High Q and sensitivity in X, Y direction – Qualified to AEC-Q200	– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests – High Q and sensitivity in Z direction – Qualified to AEC-Q200
Applications	Tire Pressure Monitoring System (TPMS) Tire Mounted Sensor Road Condition Sensor	Tire Pressure Monitoring System (TPMS)

Transponder Coils

			
Series	3D Transponder coils – SMD B82453C … A B82453C … A022	X/Y Transponder coils – SMD B82450A …, B82450H …	Z Transponder coils – SMD B82451L …
Technical data	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
Features	– Long receiving distance at 125 kHz and 21.8 kHz – High sensitivity in all orientations (X/Y/Z) – Rugged construction for high mechanical stability when exposed to shock, drop and bending tests – Qualified to AEC-Q200	– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests – High Q version available – Qualified to AEC-Q200	– Rugged construction for high mechanical stability when exposed to shock, drop and bending tests – Qualified to AEC-Q200
Applications	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

Please read *Important notes* on page 93.

Magnetics

Multilayer Inductors

TDK EPCOS Micronas InvenSense Tronics

Multilayer Inductors

			
Series	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
Technical data	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
Features	– 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; particulary at more than 800 MHz
Applications	High frequency applications such as mobile communications, high-frequency modules (PA, VCO, FEM), Bluetooth, WLAN, UWB and tuners		

Multilayer Inductors

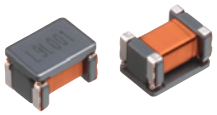
			
Series	High frequency – SMD MLK series	High frequency – Super High Q – SMD MHQ-P, MHQ-PSA series	Signal line – Narrow tolerance – SMD MLF-J series
Technical data	Size (IEC): 0603 … 1005 Inductance: 1 … 330 nH Rated current: 70 … 500 mA	Size (IEC): 0402 …1005 Inductance: 1 … 150 nH Rated current: 400 … 1200 mA	Size (IEC): 1005, 1608 Inductance: 0.16 … 0.56 µH Rated current: 250 … 400 mA
Features	– 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%
Applications	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
			
Series	Signal line standard – SMD MLF series	Decoupling circuits – SMD MLZ series	Noise suppression filter – SMD MAF series
Technical data	Size (IEC): 1005 … 2012 Inductance: 0.047 … 100 µH Rated current: 2 … 300 mA Tolerance: ±5%, ±10% and ±20%	Size (IEC): 1005 … 2012 Inductance: 0.1 … 100 µH Rated current: 30 … 1000 mA	Size (IEC): 1608 Impedance: 60 Ω (100 MHz) Rated current: 1600 mA Temperature: –55 … +125 °C
Features	– 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
Applications	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			
			
Series	Common-mode filters, CAN bus, FlexRay – SMD ACT1210	Common-mode filters, BroadR-Reach / 100Base-T1/A²B – SMD ACT1210L	Common-mode filters, CAN bus, FlexRay – SMD ACT45B, ACT45C, ACT45R series
Technical data	Size: 1210 (EIA) or 3225 (IEC) Rated inductance: 11 … 100 µH Impedance: 300 … 5100 Ω (10 MHz) Rated current: 0.15 … 0.3 A Temperature: –40 … +150 °C	Size: 1210 (EIA) or 3225 (IEC) Inductance: 100 … 200 µH Rated current: 70 … 0.15 mA Temperature: –40 … +125 °C	Size: 1812 (EIA) or 4532 (IEC) Rated inductance: 11 … 100 µH Impedance: 300 … 5800 Ω (10 MHz) Rated current: 0.15 … 0.25 A Temperature: –40 … +150 °C Temperature: –40 … +125 °C (ACT45C)
Features	– 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
Applications	CAN/FlexRay bus on space in critical automotive applications	BroadR-Reach / 100Base-T1/ A²B	CAN/FlexRay bus in automotive applications

Please read *Important notes* on page 93.

Magnetics

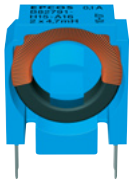
Signal EMC Filters

TDK EPCOS Micronas InvenSense Tronics

Signal EMC Filters

			
Series	Common-mode filters, BroadR-Reach / 100Base-T1 – SMD ACT45L	Data line chokes – SMD SIMDAD 1812 B82789C0…, B82789S0…	Data line chokes – SMD B82793C0…, B82793S0…
Technical data	Size: 1812 (EIA) or 4532 (IEC) Inductance: 200 µH Rated current: 100 mA Temperature: –40 … +105 °C	Size: 1812 (EIA) or 4532 (IEC) Rated inductance: 11 … 100 µH Rated current: up to 300 mA Temperature: up to +150 °C	Size: 9 x 6 x 4.8 mm Rated inductance: 5 µH … 47 mH Rated current: up to 1.2 A Temperature: up to +125 °C
Features	– ACT45L for 100Base-T1 – Provides excellent balance parameter (symmetry) – Qualified to AEC-Q200 – Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D	– Qualified to AEC-Q200 – Suitable for lead-free soldering profiles acc. to JEDEC J-STD 020D	– High inductance range – Qualified to AEC-Q200 – Suitable for lead-free soldering profiles based on JEDEC J-STD 020D
Applications	BroadR-Reach / 100Base-T1/ A²B	CAN/FlexRay bus in automotive applications	CAN/FlexRay bus in automotive applications Industrial electronics xDSL applications

Signal EMC Filters

	 		
Series	Double/quad chokes B82792, B82794, B82791, B82720	Chip beads – SMD MMZ series	Chip beads – High frequency, large impedance – SMD MMZ-E, MMZ-V series
Technical data	Rated inductance: 0.1 … 0.7 A Rated current: 0.47… 68 mH Rated voltage: 42 V	Size (IEC): 1005 … 2012 Impedance: 10 … 2500 Ω (100 MHz) Rated current: 100 … 1500 mA Temperature: –55 … +125 °C	Size (IEC): 0603 … 1005 Impedance: 47… 2200 Ω (100 MHz) Rated current: 150 … 300 mA
Features	– SMD and PTH available – Very low stray inductance – Very good symmetry features	– High reliability – Closed magnetic circuit structure – Low DC resistance structure of electrode	– Broad-band impedance values for higher frequency ranges – High reliability – Closed magnetic circuit structure – Low DC resistance structure of electrode
Applications	Comunications 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

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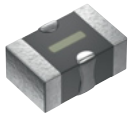
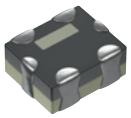
Signal EMC Filters

			
Series	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
Technical data	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
Features	– Best-in-class energy-saving in the low DC resistance range – No crosstalk with closed magnetic circuit structural design	– Compact size, low R DC (0.75 Ω max.) – Capable of removing both common and differential mode noise – Closed magnetic circuit structure allows high-density installation, while preventing crosstalk between circuits	– Multilayer chip EMC filter utilizing a T-type circuit – High reliability – Closed magnetic circuit architecture enables high-density installation and prevents crosstalk – Highly effective noise suppression
Applications	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

			
Series	3-terminal filters – SMD ACF series	3-terminal filter arrays – SMD MEA series	3-terminal feedthrough filters – SMD YFF Series
Technical data	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
Features	– T-type filter circuit is magnetically shielded with ferrite: Superior attenuation characteristics – Offers even greater attenuation characteristics when used in a stable circuit on the ground – Ideal for high-density circuit design space	– Array type: LC filter for 2 or 4 lines – Effective as a sensitivity suppression technique – Post-filter processing, base oval waveform signal – Suited for high-speed signal lines	– Optimized for noise bypass with signal source circuits – Ideal for use at higher frequencies due to low parasitic inductance
Applications	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

Please read *Important notes* on page 93.

Magnetics

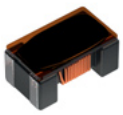
Signal EMC Filters

TDK EPCOS Micronas InvenSense Tronics

Signal EMC Filters

			
Series	3-terminal feedthrough filters – SMD YFF Series	Common-mode filters – SMD TCM-G/S/R series	Common-mode filters – SMD ACM series
Technical data	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
Features	– Optimized for noise bypass with power source circuits – Ideal for use at higher frequencies due to low parasitic inductance	– Thin-film common-mode filter with a large bandwidth – Suppresses radiation noise due to common-mode noise, without affecting the transmission of high-speed differential signals by realizing a higher cut-off frequency	– Miniaturized wire-wound chip-type filter – Extremely effective noise suppression – Minimal effect upon high speed signals, due to low differential mode impedance
Applications	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

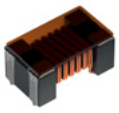
		
Series	Common-mode filters for automotive – SMD ACM series	Common-mode filters – SMD MCZ-AH, MCZ-CH, MCZ-DH series
Technical data	Size (IEC): 2012 Impedance: 90 … 360 Ω (100 MHz) Rated current: 220 … 400 mA Temperature: –40 … +105 °C	Size (IEC): 0605 … 2010 Impedance: 24 … 300 Ω (100 MHz) Rated current: 100 … 200 mA
Features	– High reliability – Impedance variation: 4 types of impedance values are prepared to correspond to the various applications – Suppresses the common mode EMI without waveform distortion	– Minimum effect for high-speed differential signals due to wide bandwidth for differential mode – Suppresses radiated emissions MCZ-CH series: – Differential mode signal transmission band to 3.5 GHz – Differential mode characteristic impedance is 100 Ω
Applications	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

			
Series	Common-mode filters – SMD ACM series	Common-mode filters for automotive power line – SMD ACM-V series	Common-mode filters – SMD ACP3225 series
Technical data	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
Features	– Noise is strongly suppressed – Best-in-class highest current handling up to 10 A – Lightweight choke coil	– High impedance characteristic has achieved superior common mode noise suppression – Products have serialized a large current product up to 8 A corresponding to various DC power lines	– Capable of achieving reduction in power consumption and improvement of noise suppression effect, due to its low DC resistance and high common-mode impedance
Applications	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

		
Series	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
Technical data	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
Features	– Unique plastic case ensures simple, convenient installation and features a self-holding mechanism – Ferrite core provides excellent absorption of high-frequency EMC and is highly effective as countermeasure against common-mode EMC	– Can easily be attached without cutting the cable – Plastic case has a self-sustaining mechanism that prevents slipping on the cable after being clamped – Excellent high-frequency noise absorption effect – Works against common-mode noise, allowing for noise suppression without affecting signal quality
Applications	Communications Consumer electronics PCs	ECUs in automotive

Please read *Important notes* on page 93.

Magnetics

Power EMC Filters, Reactors and Chokes

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes

			
Series	Feedthrough capacitors B85121 Feedthrough filters B85321	IEC inlet filters B8477*, B84103	2-line filters B8411*, B84142, B84742
Technical data	Rated voltage: 250 V AC Rated voltage: 350 … 600 V DC Rated current: 16 … 500 A Feedthrough capacitors Rated capacitance: 0.5 … 4.7 µF Feedthrough filters 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
Features	– MKP technology (dry, self-healing) – Solderless production technology – Terminals as axial leads, screw connectors, soldering tags or tab connectors	– IEC connector – Version with fuse holder – Version with fuse holder and switch – Versions with low leakage current	– For single-phase or DC applications – Modular SIFI filter system – One or multi-stage filters – High-voltage versions – Versions with low leakage current
Applications	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

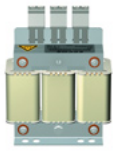
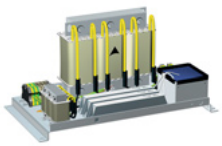
			
Series	3- or 4-line filters B84143, B84144	3-line filters B84243	Converter chokes B86305
Technical data	Rated voltage: 440 … 760 V AC Rated current: 8 … 2500 A	Rated voltage: 530 V AC Rated current: 3 … 280 A	Rated voltage: 520 V AC Rated current: 4 … 390 A
Features	– Filters without/with neutral line – One or multi-stage design – Compact filters	– Typical performance according to EN 61800-3: C1 up to 25 m respectively C2 up to 50 m motor cable length – Low leakage current – Short discharge time up to 44 A types: < 60 V within 1 s	– Line reactors – DC chokes
Applications	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

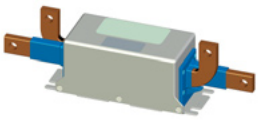
Power EMC Filters, Reactors and Chokes

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes

			
Series	Line reactor for active infeed converters B86306	LCL filters B84143G*R/ S405	Output chokes B86301 Output filters B84143V …
Technical data	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
Features	– Decoupling of powerline to PWM converters – Reduction of THD – Compact design – UL approved insulation system T-EIS-CF1 E320370	– High attenuation of pulse frequency – Reduction of THD – Modifications possible according to customer specific requirements – Optional housing for IP 20 can be ordered separately (B84143Q*R405)	– dv/dt filters or chokes – Sine-wave EMC output filters (SineFormer)
Applications	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

			
Series	3-line filters Sine-wave output filters B84143V*227/229/230	Filters for shielded rooms B84299, B84312, B8426*	Automotive 2-line EMC filters
Technical data	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
Features	– Reduction of motor noise and eddy current losses – Generation of sinusoidal phase-to-phase voltage with low ripple – dv/dt reduction – Optional housing for IP21 can be ordered separately (B84143Q*R229)	– Power line filters – Filters for data, telephone or control lines – HEMP filters acc. to MIL 188-125-1 – UL certified versions – Filters for high DC voltage	– Designed for high voltage DC bus – Fulfills CISPR 25, Class 5 requirements – At least 80 dB insertion loss at 500 kHz – Compact designs – Busbar temperature up to +105°C
Applications	Industrial applications Frequency converters	EMC laboratories Shielded rooms	EMI filtering in on-board chargers, DC/DC converters, inverters or batteries in automotive applications

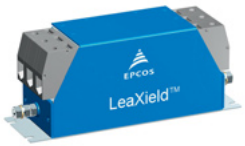
Please read *Important notes* on page 93.

Magnetics

Power EMC Filters, Reactors and Chokes

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes

			
Series	LeaXield Active filter for leakage current compensation	EMC services	Ring core chokes (current compensated) B82720 … B82725, B82791
Technical data	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
Features	– Highest reduction of earth leakage current – Improves RCD compatibility – Integrated power supply – Add-on to reduce common mode conducted emissions – Climatic category (IEC 60068-1: 1992) 25/100/21 – Degree of protection (IEC 60529: 2013) IP 20	– Accredited laboratory – In-house or on-site testing – Measurement of conducted and radiated emissions – EMC design support	– High resonance frequency owing to special winding technique – Approx. 1% stray inductance for symmetrical interference suppression – Potted versions possible – B82720 also available in SMD – Plastic case with terminals – VDE and UL approvals for majority of products
Applications	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

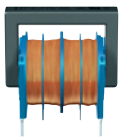
		
Series	Ring core chokes (current compensated) B82724J8*N*	Ring core chokes (current compensated) B82721K2*U*
Technical data	Rated current: 1.6 … 10 A Rated inductance: 0.5 … 47 mH Rated voltage: 250 V AC / 800 V DC	Rated current: 0.4 … 2.8 A Rated inductance: 0.4 … 47 mH Rated voltage: 250 V
Features	– High resonance frequency due to special winding technique – Approx. 0.5% stray inductance for symmetrical interference suppression – Completely potted for local reduction of pollution degree (micro-environment) – Significantly increased nominal inductance and current values at high rated temperature	– High resonance frequency due to special winding technique – Approx. 1% stray inductance for symmetrical interference suppression – Completely potted for local reduction of pollution degree (micro-environment) – Materials with CTI600 and approved to EN 60335-1, clause 30 – VDE and UL approvals
Applications	Frequency converters (DC link), power supplies	Power supplies in polluted, humid environments

Magnetics

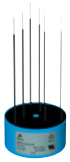
Power EMC Filters, Reactors and Chokes

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes

			
Series	Ring core chokes (current compensated) B82725S … B82726E/S …, B82727E …	Ring core chokes (current compensated) B82724J*U*	D core chokes (current compensated) B82731 … B82734
Technical data	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
Features	– High resonance frequency – Approx. 1% stray inductance for symmetrical interference suppression – On baseplate, winding wire serves as solder terminal	– High resonance frequency due to special winding technique – Approx. 1% stray inductance for symmetrical interference suppression – High rated temperatures – Completely potted for local reduction of pollution degree (micro-environment) – Materials with CTI600 – Construction approved to EN 60335-1 – VDE and UL approvals	– High resonance frequency due to 2-section winding – Approx. 1% stray inductance for symmetrical interference suppression – Low leakage due to closed core shape – High pulse strength – Low whirring noise – Low-height horizontal versions
Applications	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

		 	 
Series	U core chokes (current compensated) B82730	Frame core chokes (FC) (current compensated) B82732F …, B82733F…	Ring core chokes, triple/quad (current compensated) B8274* … B8276*
Technical data	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
Features	– High resonance frequency – Approx. 1.3% stray inductance for symmetrical interference suppression – Low whirring noise – Low saturation effects – Low-height horizontal versions feasible on request – Compact design	– Closed magnetic circuit with frame construction – 4-section winding – High stray inductance, excellent differential mode suppression – High pulse-handling capability – Low height allows usage in lamp ballasts – Optional: magnetic bypass to increase stray inductance	– High power handling – Available in plastic case (fully potted) or on baseplate
Applications	Compact power supplies Ballasts Household appliances	Power supplies Ballasts	Power supplies of high power applications, such as solar inverters, drives

Please read *Important notes* on page 93.

Magnetics

Power EMC Filters, Reactors and Chokes, Ferrites

TDK EPCOS Micronas InvenSense Tronics

Power EMC Filters, Reactors and Chokes		Ferrites
		
Series	Ring core (iron powder) chokes B826*	E, EFD, ETD, EV cores
Technical data	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
Features	– Iron powder core – Single and double chokes – High thermal stability – High differential attenuation at low frequencies	– Wide range of core shapes, sizes and accessories – Cost optimized – Optimum performance ratio at small volume – Small cores available with SMD coil former – Flat transformer design – Large volume design – Distributed air gap
Applications	PFC and reduction of harmonics in power supplies	Power supplies AC/DC converters, DC/DC converters SMD transformers Storage chokes EMI suppressions chokes

Ferrites			
			
Series	QU cores	U cores + I cores	DG cores
Technical data	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
Features	– Combination with large volume E and U cores – Various thicknesses possible (5 to 46.5 mm)	– High saturation flux density – High curie temperature – Low dissipation losses – Various combination possibilities	– Reduce proximity losses by up to 70% – Enable use of larger winding area – Lower winding losses than with a single air gap – Enable downsizing – Offer significantly increased power density
Applications	Wireless applications Solar applications	Power transformers Pulse transformers High voltage transformers	Flyback transformers Chokes

Magnetics

Ferrites

TDK EPCOS Micronas InvenSense Tronics

Ferrites

			
Series	ELP, ER, EQ cores + I cores	PQ cores	PM cores
Technical data	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
Features	– Flat mounting height – Planar solution – Board integrated – Clamps	– Compact design – Ferrite cores for power transformers and chokes – Bobbins available	– Max. transmissible power – Max. magnetic cross section – Large volume cores – Accessories available
Applications	Power supplies AC/DC converters DC/DC converters		

Ferrites

			
Series	RM cores	EP, EPX, EPO cores – SMD + PTH	P cores
Technical data	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
Features	– With/without center hole – Compact design – Accessories available	– Low hysteresis loss coefficient – Low THD – Accessories available	– With/without center hole – With/without threaded sleeve – Optimized shielding – Accessories available
Applications	Power supplies AC/DC converters DC/DC converters	xDSL applications	Signal transformers Proximity switches

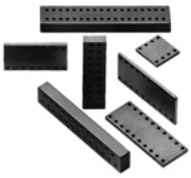
Please read *Important notes* on page 93.

Magnetics

Ferrites

TDK EPCOS Micronas InvenSense Tronics

Ferrites

			
Series	Ring cores	Ferrite cores – EMI suppression	Ferrite cores – switching power supplies
Technical data	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 µi NiZn ferrites	Material: PC47, PC90, PC95, HS72, HS10, HS12, N27, N49, N87, N88, N92, N95, N96, N97, PC200, T46, N30
Features	– Parylene-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
Applications	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

			
Series	Ferrite cores – telecommunication	Large size ferrite cores	Ferrite cores – coils
Technical data	Core shape: P, RM, EP, EPC, ER, EE, EEM, T Initial permeability (typ.): 3300 … 15 000 µi Material: H5A, H5B2, H5C2, H5C3, HP5, DNW45 MnZn ferrites	Core shape: EC, EE, EI, EIC, PQ, SP, T, UU Initial permeability (typ.): 1800 … 2300 µi Material: PE22, PC40, PE90 MnZn ferrites	Initial permeability (typ.): 1 … 1500 µi 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
Features	– Toroidal cores are suitable for pulse transformers and sensors – Epoxy and paraxylylene 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
Applications	Filters Sensors Transformers	Transfomers (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

	
Series	Magnetic sheets for noise suppression Flexield – IFL10M, IFL12, IFL16, IFF08, IFM10M Material
Technical data	High μ / High characteristic 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 μi Resistivity (Ω/square) min: 100 k
Features	– Highly flexible and shock-resistant – Noise suppression across a wide frequency range – Excellent flexibility in fabrication
Applications	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

		
Series	Magnetic sheets for RFID Flexield – IFL04 Material	Magnetic sheets for RFID Flexield – IBF15 Material
Technical data	High performance Dimensions: 300 x 200 mm Thickness: 0.05, 0.1, 0.2 mm Initial permeability at 13.56 MHz: 45 μ' / 1.3 μ" Resistivity (Ω/square) min: 10 k	Ferrite plate High permeability, low dissipation Dimensions: 125 x 125 mm Thickness: 0.1, 0.18 mm Initial permeability at 13.56 MHz: 150 μ' / 5 μ" Resistivity (Ω/square) min: 1 G
Features	– Highly flexible and shock-resistant – Highly effective – Extensive line-up of sizes and dimensions – Excellent permeability – Excellent magnetic convergence	
Applications	For improving reception performance of RFID readers/writers Integrating IC cards with metal Integrating IC tags with metal Improved antenna reception sensitivity	

Please read *Important notes* on page 93.

RF Components

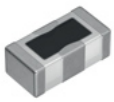
Multilayer and Thin-Film RF Components

TDK EPCOS Micronas InvenSense Tronics

Multilayer and Thin-Film RF Components

		
Series	Multilayer band pass filters – SMD DEA series	Multilayer band pass filters – SMD Balance output DEA series
Technical data	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
Features	– Compact lightweight, and thin type – Low loss in the passband – High attenuation in the attenuated band	– Compact lightweight, and thin type – Low loss in the passband – High attenuation in the attenuated band – IC impedance compatible design available
Applications	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

		
Series	Multilayer low pass filters – SMD DEA series	Multilayer high pass filters – SMD DEA series
Technical data	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
Features	– Compact lightweight and thin type – Low loss in the passband – High attenuation in the attenuated band	– Compact lightweight and thin type – Low loss in the passband – High attenuation in the attenuated band
Applications	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

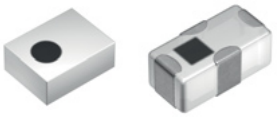
Multilayer and Thin-Film RF Components

TDK EPCOS Micronas InvenSense Tronics

Multilayer and Thin-Film RF Components

		
Series	Multilayer diplexers – SMD DPX series	Multilayer triplexers – SMD TPX series
Technical data	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
Features	– Compact lightweight and thin type – Low loss in the passband – High attenuation in the attenuated band – Combinations of LPF/BPF/HPF design	– Flexible band combinations – Low loss – High isolation – Combinations of LPF/BPF/HPF design
Applications	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

			
Series	Multilayer balun – SMD HHM series	Wound chip baluns – SMD ATB series	Thin-Film balun – SMD TFSZ series
Technical data	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
Features	– Compact lightweight and thin type – Low loss – Available in 50:50 Ω, 75:50 Ω, 100:50 Ω, and 200:50 Ω – Available with conjugate matching to specific chipset	– Chip balun transformer developed for 50, 75 Ω impedance system – Impedance ration 1:1	– Thin-film based design – Extremely compact and low profile – Stable performance – Tight lot-to-lot variation – Suitable for modules
Applications	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

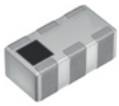
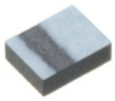
Please read *Important notes* on page 93.

RF Components

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

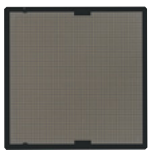
TDK EPCOS Micronas InvenSense Tronics

Multilayer and Thin-Film RF Components

		
Series	Multilayer directional couplers – SMD HHM series	Thin-Film directional couplers – SMD TFSC series
Technical data	Size (l x w x t): 0.65 x 0.5 x 0.3 … 1.6 x 0.8 x 0.7 mm	Size (l x w x t): 0.65 x 0.5 x 0.3 mm
Features	– Compact lightweight and thin type – Low loss – High isolation	– Attenuators included – Thin-film based design – Extremely compact and low profile – Stable performance – Tight lot-to-lot variation – Suitable for modules
Applications	2.4 GHz WLAN/Bluetooth 2.4 GHz WLAN Divider 5 GHz WLAN GSM, UMTS, LTE Band	2.4 GHz WLAN/Bluetooth

Multilayer and Thin-Film RF Components

LTCC Substrates for LED

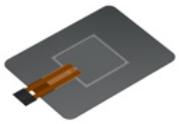
		
Series	Multilayer chip antennas – SMD ANT series	LTCC substrates
Technical data	Size (l x w x t): 1.6 x 0.8 x 0.4 … 2.5 x 2.0 x 0.7 mm	Integrated ESD protection IEC 61000-4-2: level 4 with 8 kV contact Panel format 8 x 8"
Features	– Compact, low profile design – High performance and reliability – Capable of supporting multi-bands – Require small keep-out area – Omni-directional	– Thermal conductivity: > 25 W/mK – Mounting techniques: compatible with most standards – flip mount – wire bond – glue – solder – Surface finishing: Ag, Au, Cu variants available
Applications	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	Bare die LEDs LED components and LED modules

Piezo and Protection Devices

Piezo Haptic Actuators

TDK EPCOS Micronas InvenSense Tronics

PiezoHapt Actuators

		
Series	PHUA8060-35A-33-000	PHUA3015-30A-21-000
Technical data	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
Features	– Clear response by low-voltage drive – Response in an instant – Variegated vibration pattern	– Clear response by low-voltage drive – Response in an instant – Variegated vibration pattern
Applications	Touchpads Displays	Wearables

PowerHap Actuators

			
Series	2626H023V120	1313H018V120	0909H011V060
Technical data	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
Features	– Using as sensor and actuator – Specific actuator feedback adjustable – Supports bipolar driving mode allows lower operating voltage – Low power consumption – Qualified to AEC-Q200		
Applications	Multifunctional automotive HMIs Industrial equipment, household appliances Smartphones and tablets, ATMs and vending machines Medical appliances, game controllers, push buttons and switches		

Please read *Important notes* on page 93.

Piezo and Protection Devices

Piezo Actuators for Automotive, Piezo Receivers, Buzzers

TDK EPCOS Micronas InvenSense Tronics

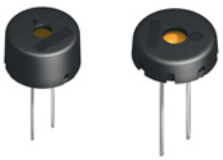
Piezo Actuators for Automotive

			
Series	Cu actuators 30 mm	Injection actuators 30 mm	Injection actuators 45 mm
Technical data	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
Features	– Proprietary piezo technology with copper inner electrodes – Stress release technology	– AgPd technology	– AgPd technology
Applications	Diesel injection systems	Diesel injection systems	Gasoline injection systems

Piezo Actuators for Automotive

Piezo Receivers

Buzzers

			
Series	Piezo actuator in high active stack technology	Piezoelectric receiver RU	Piezoelectric buzzers PS
Technical data	Stack surface temperature: –40 … +160 °C Voltage: –10 … +180 V Current: –30 … +30 A Stroke at 160 V (s): 59 µm ±10 % Charge at 160 V (Q): 1.0 mC ±10 % Useful life: >3E9 cycles	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)
Features	– Dimensions 5.2 x 5.2 x 30 mm – Highly efficient actuator design thanks to smallest insulation zones – Robust design avoids polarization cracks – High melting metal bond – High reliability – Highest cycles stability at high temperatures – Outstanding resistance against humidity	– Compact, thin sounding body using unimorph piezoelectric vibration plate – No leakage flux	– Pin terminal/ lead, without oscillator circuit – High-performance buzzers that employ unimorph piezoelectric elements – Designed for easy incorporation into various circuits – Extremely low power consumption in comparison to electromagnetic units – Can be used as a musical tone oscillator or buzzer
Applications	Injection systems, metering systems, positioning systems	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

			
Series	Electromagnetic buzzers SD	Electromagnetic buzzers SDC	Electromagnetic buzzers – SMD SDR
Technical data	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
Features	– 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
Applications	Clocks, travel watches Keyboards Toys Alarms in automotive electronics	Personal computers Office automation equipment Medical appliances Household appliances	Mobile phones Pagers

Surge Arresters

			
Series	S20, S30, S50, S80 – SMD	LN8 – Arrester stack – SMD	EHV
Technical data	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
Features	– 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
Applications	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)

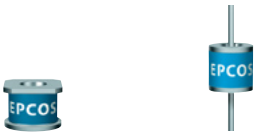
Please read *Important notes* on page 93.

Piezo and Protection Devices

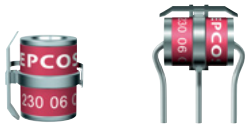
Surge Arresters

TDK EPCOS Micronas InvenSense Tronics

Surge Arresters

			
Series	M5	A8	T8
Technical data	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
Features	– 2-electrode SMD and leaded version – Low capacitance – High insulation resistance	– 2-electrode SMD and leaded version – Very high discharge current – High insulation resistance	– 3-electrode arresters – High discharge current – High insulation resistance
Applications	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

			
Series	T8 – with failsafe	T9 – SMD with and w/o failsafe	TQ90 – SMD
Technical data	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
Features	– 3-electrode arresters with failsafe – High discharge current – High insulation resistance	– 3-electrode arresters in SMD and failsafe option – High insulation resistance	– 3-electrode arresters in SMD – High insulation resistance
Applications	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

			
Series	D06 – SMD	TD08 – SMD	TD12 – SMD
Technical data	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
Features	– 3-electrode arresters – High discharge current – High insulation resistance – Flat design		
Applications	Overvoltage protection in data line applications		

Surge Arresters

				
Series	H38M	L1	V13 and V10	EF
Technical data	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
Features	– High impulse current (10/350 µs) – Temporary overvoltage withstand capability – IEC 61643-11		– High insulation resistance – Temporary overvoltage withstand capability – IEC 61643-11	– High insulation resistance – Temporary overvoltage withstand capability – IEC 61643-11 – UL 1449 (E319264)
Applications	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

Please read *Important notes* on page 93.

Piezo and Protection Devices

High-Voltage Contactors, PTC Thermistors

TDK EPCOS Micronas InvenSense Tronics

High-Voltage Contactors		PTC Thermistors	
			
Series	HVC200, HVC300, HVC500 B88269X …	Overcurrent protection	Overcurrent protection Lead-free series
Technical data	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 … 1 000 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
Features	– Bipolar design – Gas-filled and hermetically sealed – No EMI, no inrush current – UL 60947-4-1, CE, AECQ-200	– High thermal stability – No resistance drift for 100 switching cycles	– High thermal stability – No lead contained in ceramic or solder joint – No resistance drift for 100 switching cycles
Applications	DC fast charging stations Battery storage systems Electrical and commerercial vehicles: – Battery management systems – Battery disconnect units – Power distribution units	Overcurrent protection in automotive electronics, power supplies, entertainment and household electronics	

PTC Thermistors			
			
Series	Overcurrent protection – SMD	Overcurrent protection Telecom	Telecom pair overcurrent protectors – SMD
Technical data	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
Features	– High thermal stability – No resistance drift for 100 switching cycles	– Compliant with ITU standards – No resistance drift after switching	– Compliant with ITU standards – Matched pair in one housing
Applications	Overcurrent protection in automotive electronics, power supplies, entertainment and household electronics	Overcurrent protection in central office linecards, base stations and customer premises equipment	

Please read *Important notes* on page 93.

Piezo and Protection Devices

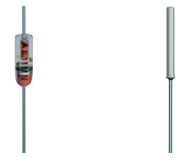
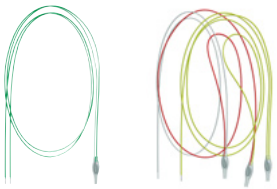
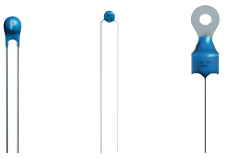
PTC Thermistors

TDK EPCOS Micronas InvenSense Tronics

PTC Thermistors

			
Series	Telecom pair protectors	Switching applications Plastic case	Motor start
Technical data	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
Features	– Compliant with GR1089 central office – Matched pair in one housing	– Useful life up to 100 000 switching cycles	– Useful life >100 000 switching cycles
Applications	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

			
Series	Point level sensors	Motor protection Single or triple sensors	Limit temperature sensors
Technical data	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_{sense}: +60 … +160 °C
Features	– Liquid level detection for oil and water – Hermetically sealed glass case or stainless steel case	– Characteristics for sensing temperatures compliant with DIN 44081/44082 – Customer-specific lead lengths on request	– Available as leaded disks or assembly probes
Applications	Level sensors for indoor and outdoor tanks Industrial and home applications	Industrial motors and machines protection	Power supplies Lighting equipment

Please read *Important notes* on page 93.

Piezo and Protection Devices

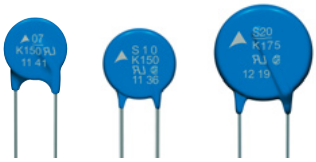
PTC Thermistors, Varistors

TDK EPCOS Micronas InvenSense Tronics

PTC Thermistors

			
Series	Limit temperature sensors – SMD	Heating elements	High voltage heating elements
Technical data	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 $T_{surface}$: +40 … +280 °C	Max. voltage: up to 600 V Customized solutions upon request
Features	– Fast and reliable response – UL approval	– Available in round and rectangular shape – Al or Ag electrode	– Available in rectangular shape – Al electrode
Applications	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

			
Series	Ring varistors VAR-18-P (Plane surface electrode type) VAR-18-S (Side surface electrode type)	S5, S7, S10, S14, S20	S25
Technical data	Varistor voltage (E10 mA): 2.0 ... 38.0 V Rated power: 500 mW Capacitance: 1 … 100 nF (at 1 kHz)	S05: I_{max} 8/20 µs: up to 800 A S07: I_{max} 8/20 µs: up to 1750 A S10: I_{max} 8/20 µs: up to 3.5 kA S14: I_{max} 8/20 µs: up to 6 kA S20: I_{max} 8/20 µs: up to 12 kA Operating voltage V_{RMS}: 11 … 1100 V	I_{max} 8/20 µs: up to 20 kA Operating voltage V_{RMS}: 130 … 750 V
Features	– 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
Applications	Micro-motors	Industrial electronics Power supplies Photovoltaic systems Household appliances Communications	Industrial electronics Power supplies Inverters Photovoltaic systems

Piezo and Protection Devices

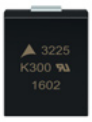
Varistors

TDK EPCOS Micronas InvenSense Tronics

Varistors

			
Series	Q14, Q20	ETFV/T series	NT series
Technical data	Q14: I_{max} 8/20 µs: 8 kA Q20: I_{max} 8/20 µs: 15 kA Operating voltage V_{RMS}: 130 … 680 V	T14: I_{max} 8/20 µs: 6 kA T20: I_{max} 8/20 µs: 10 kA ETFV25: I_{max} 8/20 µs: 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
Features	– Leaded varistors 14 and 20 mm – Max. load capacity vs. height – High surge current ratings up to 15 kA – For high energy absorption – UL 1449, ed.4	– ThermoFuse (varistor and fuse in one housing) – Disk Ø 14, 20 and 25 mm disks – Space saving – Monitoring option with 3rd lead – UL 1449, ed.4	– Compact size – Highly reliable fuse design – Fuse prevents reconnection for high safety – According to UL 1449 – Available with 3rd lead for status display – High surge current capability
Applications	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

		
Series	CU varistors – SMD	SNF10, SNF14, SNF20
Technical data	Size (EIA): 3225, 4032, 4948 Operation voltage V_{RMS}: 14 … 300 V Max. surge current (8/20 µs): 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 µs up to 3.5 kA SNF14: I_{max} 8/20 µs up to 6 kA SNF20: I_{max} 8/20 µs up to 12 kA
Features	– Electrically equivalent to leaded types S05, S07, S10 – Lead-free soldering – UL 1449, ed.4	– Operating temperature +125 °C – No flame or rupture – Heat resistance and flame-retardant to UL 94 V-0 – UL 1449, ed.4
Applications	Surge current protection in SMD package for automotive, industrial and communication electronics	Consumer electronics Power supplies

Please read *Important notes* on page 93.

Piezo and Protection Devices

Varistors

TDK EPCOS Micronas InvenSense Tronics

Varistors

			
Series	LS40, LS41, LS42	LS40-E7	LS50
Technical data	LS40: I_{max} 8/20 µs: 40 kA LS41: I_{max} 8/20 µs: 50 kA LS42: I_{max} 8/20 µs: 65 kA Operating voltage V_{RMS}: 130 … 750 V	I_{imp} 10/350 µs: 6.5 kA I_{max} 8/20 µs: 40 kA Operating voltage V_{RMS}: 130 … 460 V	I_{max} 8/20 µs: up to 75 kA Operating voltage V_{RMS}: 130 … 550 V
Features	– Strap terminals – High surge current ratings – High energy ratings (2 ms) up to 1200 J – Designed to requirements of IEC 61643-11 – UL 1449, ed.4	– Strap terminals – High surge current ratings at 10/350 µs – Designed to requirements of IEC 61643-11 – UL 1449, ed.4	– Strap terminals – High surge current ratings – High energy ratings (2 ms) up to 1820 J – UL 1449, ed.4
Applications	Power supplies Renewable energies Surge protection devices		

Varistors

			
Series	B32, B40, B60, B80	S-AUTO	Energy varistors E32 … E99
Technical data	B32: I_{max} 8/20 µs: 25 kA B40: I_{max} 8/20 µs: 40 kA B60: I_{max} 8/20 µs: 70 kA B80: I_{max} 8/20 µs: 100 kA Operating voltage V_{RMS}: 75 … 1100 V	S07: I_{max} 8/20 µs: up to 250 A S10: I_{max} 8/20 µs: up to 500 A S14: I_{max} 8/20 µs: up to 1 kA S20: I_{max} 8/20 µs: up to 2 kA Operating voltage: 16 … 48 V DC Operating temperature: +125 °C	E32: I_n 8/20 µs: 5 kA … E99: I_n 8/20 µs: 20 kA Repetitive charge transfer rating, Q_{rs} 8/20 µs: 0.2 … 6 C
Features	– Disk shaped varistor element potted in plastic housing – Screw terminals – Housing and potting flame retardant to UL94 V-0 – UL 1449, ed.4	– Leaded varistors disk Ø 7 to 20 mm – High energy absorption – Coating flame retardant to UL 94 V-0	– Disk Ø 32 to 99 mm – Glass passivated collar – Aluminum termination for pressure contact
Applications	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

			
Series	S153, S235, S236, S237, S238, P11, P13, S364, S464, P27	Plastic case	Leaded disks
Technical data	Operating voltage V_{RMS}: 265 V Rated resistance at +25 °C: 1 … 120 Ω I_{max}: up to 30 A Load capacitance: up to 16 000 pF	Max. voltage: 280 … 560 V AC Rated resistance: 22 … 100 Ω	Max. voltage: 260 … 560 V AC Rated resistance: 25 … 500 Ω
Features	– NTC thermistors – Limiting of inrush current – Wide resistance range – Lead spacing 5 and 7.5 mm – UL 1434	– PTC thermistor – Operating cycles at V_{max} (charging of capacitor): >100 000 – J213, J215, J217, J219 qualification to AEC-Q200, Rev. D	– PTC thermistor – Operating cycles at V_{max} (charging of capacitor): >100 000
Applications	Power supplies Soft-start motors	Power supplies Household appliances Pumps Drives On-board chargers	

Multilayer Varistors, CTVS

		
Series	Multilayer chip protectors – SMD SGNE	SHCV
Technical data	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
Features	– For ESD protection solutions which is using a semiconductor ceramic – Possible replacement of TVS diode for ESD protection – Outstanding ESD absorption and excellent ESD protection characteristic (based on IEC61000-4-2, Contact-8 kV)	– Lead-free soldering – Coating: Flame-retardant to UL94 V0, epoxy resin
Applications	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

Please read *Important notes* on page 93.

Piezo and Protection Devices

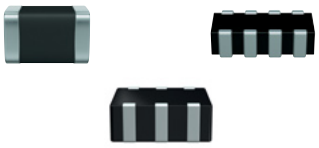
Multilayer Varistors, Ceramic Transient Voltage Suppressors (CTVS)

TDK EPCOS Micronas InvenSense Tronics

Multilayer Varistors, CTVS

		
Series	Multilayer chip varistors – SMD AVRL	Multilayer chip varistors – SMD AVRM
Technical data	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)	Size (IEC): 0402 … 2012 Varistor voltage: 6.8 (4.76 … 8.84) … 39 (35 … 43) V DC (1 mA) Max. continuous voltage: 3.5 … 28 V DC Clamping voltage: 14 (1 A) … 69 (2 A) V (8/20 micro-s) Max. energy: 0.003 … 0.3 J (10/1000 micro-s) Max. peak current: 1 … 100 A (8/20 micro-s) Capacitance: 15 … 1050 pF typ. (1 kHz, 1 V RMS)
Features	– No polarity, due to symmetrical current-voltage characteristics – Excellent electrostatic absorption capability – Adopted inner electrode lamination structure	– No polarity, due to symmetrical current-voltage characteristics – Excellent electrostatic absorption capability – Adopted inner electrode lamination structure
Applications	Countermeasure for surge and static electricity	Countermeasure for surge and static electricity

Multilayer Varistors, CTVS

			
Series	CeraDiodes – SMD Standard, High-speed and LED series	Multilayer chip varistors – SMD Standard and high surge series	Multilayer chip varistors – SMD Automotive E series
Technical data	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
Features	– Bidirectional protection – Lead-free soldering – ESD capability to IEC 6100-4-2, level 4 (8 kV contact discharge, 15 kV air discharge) – Lead-free		
Applications	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

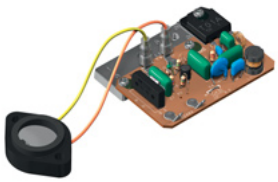
TDK EPCOS Micronas InvenSense Tronics

NTC Thermistors

		
Series	NTC thermistors chip – SMD Standard series	NTC thermistors chip – SMD Automotive series
Technical data	Size (EIA): 0402 … 1206 $B_{25/100}$ values: 3439 K … 4575 K R values: 1 … 680 kΩ R tolerance: ≧ ±0.5% B tolerance: ≧ ±0.5% Operating temperature: –55/+125 °C	Size (EIA): 0402 … 1206 $B_{25/100}$ values: 3439 K … 4575 K R values: 4.7 … 100 kΩ R tolerance: ≧ ±0.5% B tolerance: ≧ ±0.5% Operatingtemperature: –40/+150 °C
Feature	– Ni barrier termination – Lead-free soldering – UL approval	– Ni barrier termination – Lead-free soldering – Qualified to AEC-Q200 Rev. D
Applications	Temperature measurement and compensation in consumer electronics, information technology, industrial and wireless applications	Temperature measurement and compensation in automotive electronics

NTC Thermistors

Nebulizer Units

		
Series	NTCG – SMD	Ultrasonic nebulizer units NB
Technical data	Size (IEC): 0603 … 2012 B constant: 3250 … 4750 K ±3% (+25/+85 °C) Nominal resistance value: 30 Ω … 1.0 MΩ (+25 °C) Operating temperature: –40 … +125°C	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
Features	– 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 that low floating capacitance (using TCXO) in the high frequency region	– Compact, with highly reliable circuitry – Separate transducer and drive circuit sections provide superior layout versatility
Applications	Temperature measurement and compensation	Household appliances Medical appliances

Please read *Important notes* on page 93.

Micro Modules

Bluetooth V4.1 Smart Single Mode Modules

Bluetooth V4.1 Smart Single Mode Modules

	
Series	BLE V4.1 (Bluetooth Low Energy) module – SMD SESUB-PAN-D14580
Technical data	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)
Features	– Ultra small package, ideal for for wearable devices (3.5 x 3.5 x 1.0 mm typ.) – Packaged in 36-pin solder bumped BGA with 0.5 mm pitch – Compatible with Bluetooth Smart Ready products – ARM Cortex-M0 32-bit high performance microcontroller – 32 kB OTP programmable memory, 84 kB ROM for BT stack – 42 kB System SRAM, 8 kB Retention SRAM – Including IC (Dialog Semiconductor : DA14580), Crystal (16 MHz), Inductor, and Capacitor in this module
Applications	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)

			
Series	NTC thermistors with lead spacing	Mini sensors with bendable wires	Glass-encapsulated sensors G1540
Technical data	Operating temperature: –55 … +155 °C Resistance value: 1 … 470 kΩ Accuracy: $\Delta R_N/R_N$ = 1% / ΔB/B = 1% Head size: 2.5 … 4.5 mm Diameter of lead wires: 0.4 … 0.6 mm Lead spacing: 2.5 or 5.0 mm Delivery mode: tape & reel; bulk Coating: epoxy, lacquer	Operating temperature: –55 … +155 °C Resistance value: 2 … 100 kΩ Accuracy: $\Delta R_N/R_N$ = 1% / ΔB/B = 1% Head size: 2.41 … 2.8 mm Diameter of lead wires: 0.25 mm Delivery mode: bulk Coating: epoxy	Operating temperature: –55 … +300 °C (G1540 from 5 kΩ, up to +250 °C) Resistance value: 2 … 230 kΩ Accuracy: $\Delta R_N/R_N$ = 2% / ΔB/B = 1% Head size: 0.8 … 2.3 mm Diameter of lead wires: 0.15 … 0.3 mm Delivery mode: bulk Coating: glass
Features	– Available with insulated leads – High measuring accuracy – Lead spacing – Rugged design – Cost effective	– Available with insulated leads – Special version with improved resistance to humidity available – High measuring accuracy – Tight B value tolerance available – Available with long bendable leads – UL approval (S861, S867)	– Short response time – Heat resistive and highly stable
Applications	Temperature measurement and compensation	Temperature measurement	

Temperature Sensors (NTC)

			
Series	Glass-encapsulated sensors with insulation, G5141	Cable-bound temperature sensors	Water temperature sensors
Technical data	Operating temperature: –55 … +260 °C (G1541 from 5 kΩ, up to +250 °C) Resistance value: 2 … 230 kΩ Accuracy: $\Delta R_N/R_N$ = 2% / ΔB/B = 1% Head size: 1.4 … 3.0 mm, max. Diameter of lead wires: 0.15 … 0.3 mm Delivery mode: bulk Coating: glass Insulation voltage: 500 V/ 1 s	Operating temperature: –40 … +80 °C Resistance value: 2.7 … 10 kΩ Accuracy: $\Delta R_N/R_N$ = 2% / ΔB/B = 1.5% Head size: 5.4, 7, 8, 9 mm Cable length: up to 2800 mm	Operating temperature: –20 … +125 °C Resistance value: 10 kΩ Accuracy: $\Delta R_N/R_N$ = 2% / ΔB/B = 0.8%
Features	– With insulation on head and leads – Short response time – Heat resistive, highly stable and robust	– Highly resistant to water/ moisture – Construction based on DIN EN 60 730-1/VDE protection class 2 (M2020) – UL approved (M2020: file E69802)	– Suitable for use in corrosive environments – Highly resistant to water/ moisture – Short thermal response time in water
Applications	Temperature measurement		

Please read *Important notes* on page 93.

Sensors

Temperature Sensors (NTC)

TDK EPCOS Micronas InvenSense Tronics

Temperature Sensors (NTC)

			 
Series	Screw-on temperature sensors	Pipe mounted temperature sensors	Evaporator sensors
Technical data	Operating temperature: –55 … +200 °C Resistance: 10 … 100 kΩ Accuracy: $\Delta R_N/R_N$ = 3% / ΔB/B = 1%	Operating temperature: +5 … +100 °C Resistance: 10 kΩ Accuracy: $\Delta R_N/R_N$ = 3.6% / ΔB/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% / ΔB/B = 1%
Features	– Maximum temperature at sensor head +300 °C – Good thermal coupling through metal tag – Thermistor encapsulated in metal tag case	– Fast and easy mounting – Short response time – Good thermal coupling to pipes	– Humidity resistant: 2000 h immersion test in water at +80 °C – Clip design for fast and reliable mounting
Applications	Surface temperature measurement	Temperature measurement of fluids in pipes	Temperature measurement in evaporators

Temperature Sensors (NTC)

			
Series	Air duct sensors	Ambient temperature sensors	Solar sensors
Technical data	Operating temperature: –40/+90 °C Resistance value: 2 … 30 kΩ Accuracy: $\Delta R_N/R_N$ = 1% / ΔB/B = 1%	Operating temperature: –40/+85 °C Resistance value: 2 … 30 kΩ Accuracy: $\Delta R_N/R_N$ = 1% / ΔB/B = 1%	Operating temperature: –40/+100 °C Tolerance: ±15%
Features	– Plastic version with clip mounting – Short response time – Reduction of weight – Simplified recycling	– Humidity resistant over-molded design – High resistance to water splashes IPx9k – Cable-based design – Designed for 2000 h water immersion at +80 °C	– Mono and dual-zone sensors – High resolution and sensitivity – Measurement of solar radiation on the passenger compartment for the HVAC system – Angular characteristics – Analog signal
Applications	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)

			
Series	NTC sensors (Assembly) NTCGP series	NTC sensors (Assembly) NTCDP series	NTC sensors (Assembly) – ABS Plastic case NTCDP series
Technical data	Nominal resistance: R_{25} = 15 kΩ ±3% … 50 kΩ ±3% B constant: $B_{25/50}$ = 3950 K ±2, ±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 kΩ ±3, ±5% B constant: $B_{25/85}$ = 4000 K ±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: R3 = 5.6 kΩ ±0.2 kΩ (3 °C) B constant: B3/5 0= 3850 K ±100 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
Features	– Resin DIP type with built-in multilayer element – Good heat responsiveness	– Excellent reliability, high responsiveness, high heat resistance – Three types are available Epoxy (Ø 5.5 mm) type: Priority given to heat responsiveness Epoxy (Ø 6.0 mm) type: Compatible with copper case type of Ø 6.0 mm Epoxy screw fix type: Superior surface temperature detection	– Plastic case compliant to Food Hygiene Act – Highly waterproof – Inexpensive
Applications	Temperature measurement	Temperature measurement Surface temperature detection	Home appliances Consumer electronics

Temperature Sensors (NTC)

			
Series	NTC sensors (Assembly) – Plastic case type, oil temperature sensor NTCDP series	NTC sensors (Assembly) – ATF oil temperature sensor NTCDP	NTC sensors (Assembly) – NTCRP
Technical data	Nominal resistance: R140 = 0.072 kΩ ±5% (+140 °C) B constant: $B_{20/80}$ = 3520 K ±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: R145 = 0.111 kΩ ±2.5% (+145 °C) B constant: $B_{25/85}$ = 3528 K ±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: R25 = 49.12 kΩ ±5% B constant: $B_{25/80}$ = 3992 K ±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)
Features	– 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
Applications	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

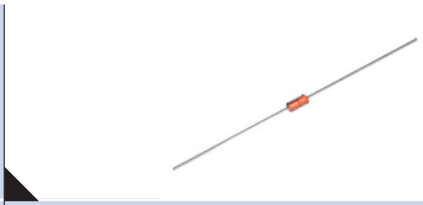
Please read *Important notes* on page 93.

Sensors

Temperature Sensors (NTC)

TDK EPCOS Micronas InvenSense Tronics

Temperature Sensors (NTC)

		
Series	NTC sensors (Element) NTCDS series	NTC sensors (Element) NTCGF series
Technical data	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)	Size: 6.0 x Ø 3.5 mm, resin DIP type Operating temperature: –40 … +125 °C Heat dissipation constant: 4 mW/°C (in still air) Thermal time constant: 30 s max. (in still air) Insulation resistance between lead and thermistor: 5 MΩ min. DC 500 V
Features	– Glass-sealed construction identical to DHDs (Double Heatsink Diodes) – Highly reliable and resistant to high relative humidity – Tight tolerances are maintained in resistance vs. temperature characteristics – Size reduction	
Applications	Automotive electronics, home appliances, consumer electronics	

Temperature Sensors (NTC)

			
Series	E-Motor temperature sensor	Battery temperature sensor	Screw-on temperature sensor
Technical data	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
Features	– Measurement directly in the winding of the motor – Mechanically protected by plastic housing – High insulation voltage up to 2000 V – Available with different connectors, RT curves and cable lengths	– Screw-on sensor for battery temperature measurement – Clip-on sensor for measurement of battery cooling fluid temperature – Available with different connectors, RT curves, cable lengths and for different pipe diameters	– High voltage insulation of 2.5 kV – Validated according LV123/124 – Screw design for fast and reliable mounting
Applications	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

		
Series	HAL® 8xy Programmable linear Hall-effect sensor	HAC 830 Robust multi-purpose linear Hall-effect sensor with integrated capacitors
Technical data	Package: TO92UT Operating temp.: TJ = –40 … +170 °C Operating voltage: 4.5 … 14 V Magnetic range: ±30 … ±150 mT	Package: TO92UP Operating temp.: TA = –40 … +150 °C Operating voltage: 4.5 … 5.5 V Magnetic range: ±30 … ±100 mT
Features	– High-precision sensor with 12-bit analog output – Programmable temperature compensation – Open-circuit, over- and undervoltage detection – Programmable output clamping function – High immunity against ESD – Overvoltage and reverse-voltage protection at all pins, short-circuit protected push-pull output – Flexible analog / PWM output – Offset drift over temperature less than ±0.2% of VSUP	– High-precision sensor with 12-bit analog output – Integrated capacitors for improved electromagnetic compatibility (EMC) and PCB-less applications – Programmable temperature compensation – Open-circuit, over- and undervoltage detection – Programmable output clamping function – High immunity against HBM ESD – Overvoltage and reverse-voltage protection at all pins, short-circuit protected push-pull output
Applications	Accelerator pedal Throttle position Steering torque Exhaust gas recirculation Turbo charger	

Single-Axis Hall-Effect Sensors

		
Series	HAL® 188y Linear Hall-effect sensor – Programmable or with fixed sensitivity	HAL® 28xy Programmable linear Hall-effect sensor with SENT or PWM output
Technical data	Package: TO92UA Operating temp.: TJ = –40 … +170 °C Operating voltage: 4.5 … 5.5 V Magnetic range: ±20 … ±160 mT	Package: TO92UT Operating temp.: TJ = –40 … +170 °C Operating voltage: 4.5 … 17 V Magnetic range: ±20 … ±160 mT
Features	– Ratiometric analog output – Digital signal processing – Temperature characteristics programmable for matching all common magnetic materials – Operates with static and dynamic magnetic fields up to 5 kHz – Over-/reverse-voltage protection on VDD pin – Magnetic characteristics extremely robust against mechanical stress – Short-circuit protected output	– High-precision linear Hall-effect sensor – Spinning-current offset compensation – Built-in temperature sensor – Built-in RISC processor – Digital signal processing – Up to 16 bit resolution – Customer-programmable temperature compensation – SENT or PWM output up to 2 kHz (HAL 2850) – Magnetic characteristics extremely robust against mechanical stress
Applications	Current measurements Gear position sensor	Steering torque Turbo charger

Please read *Important notes* on page 93.

Sensors

Linear Hall Sensors

TDK EPCOS Micronas InvenSense Tronics

Single-Axis Hall-Effect Sensors

		
Series	HAL® 24xy Precise and robust programmable linear Hall-effect sensor	HAR 24xy Precise and robust programmable linear Hall-effect sensor with redundancy functionality
Technical data	Package: TO92UT or SOIC8 Operating temp.: TJ = –40 … +170 °C Operating voltage: 4.5 … 5.5 V Magnetic range: ±25 … ±200 mT	Package: TSSOP14 Operating temp.: TJ = –40 … +170 °C Operating voltage: 4.5 … 5.5 V Magnetic range: ±25 … ±200 mT
Features	– Ratiometric 12-bit analog output – 16 setpoints for various output characteristics – High immunity against ESD (8 kV) – Programmable temperature compensation – Low output voltage drifts over temperature – Open-circuit, over- and undervoltage detection – Programmable output clamping function – Digital readout of temperature and magnetic field information in calibration mode – Operates with dynamic magnetic fields up to 2 kHz – Overvoltage and reverse-voltage protection (all pins) – Short-circuit protected push-pull output	– Ratiometric 12-bit analog output or PWM output – Dual-die Hall-effect sensors for true redundancy – 16 setpoints for various output characteristics – High immunity against HBM ESD (8 kV) – Programmable temperature compensation – Low output voltage drifts over temperature – Open-circuit, over- and undervoltage detection – Programmable output clamping function – Digital readout of temperature and magnetic field information in calibration mode – Operates with dynamic magnetic fields up to 2 kHz – Overvoltage and reverse-voltage protection (all pins) – Short-circuit protected push-pull output
Applications	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

Please read *Important notes* on page 93.

Sensors

Multi-Axis Hall Sensors

TDK EPCOS Micronas InvenSense Tronics

2D Position Hall Sensors

			
Series	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
Technical data	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
Features	– Measurement extremely robust against temperature and stress influence – Angular accuracy of ±0.5% FS – 12 bit ratiometric linear analog output for HAL 372x – HAL 371x with modulo 90°/120° for chassis systems – 0.2 kHz to 2 kHz PWM (up to 12 bit) or 12 bit SENT output for HAL 3711/ HAL 373x – Programmable arbitrary output characteristic with up to 33 setpoints – Temperature-dependent offset programmable for X/Y- or Z-channel – On-board diagnostics – Short-circuit protected push-pull output – Over-/reverse-voltage & under- and overvoltage protection at VSUP – Wire-break detection	– Measurement extremely robust against temperature and stress influence – Integrated capacitors for improved electromagnetic compatibility (EMC) and PCB-less applications – Angular accuracy of ±0.5% FS – 12 bit ratiometric linear analog output for HAC 372x – HAC 371x with modulo 90°/120° for chassis systems – 0.2 kHz to 2 kHz PWM (up to 12 bit) or 12 bit SENT output for HAC 3711/ HAL 373x – SENT SAE J2716 rev. 2016 protocol – Programmable arbitrary output characteristic with up to 33 setpoints – Temperature-dependent offset programmable for X/Y- or Z-channel – On-board diagnostics – Wire-break detection	– Measurement extremely robust against temperature and stress influence – Angular accuracy of 0.5% FS – 0.2 to 2 kHz PWM (up to 12 bit) or 12 bit SENT output – SENT SAE J2716 rev. 2016 protocol: – H.1 Format: Transmission of position and temperature or magnetic field amplitude on fast and slow channel – H.2 Format: Three data nibbles – H.4 Format: Secure channel format – Programmable arbitrary output characteristic with up to 33 setpoints – Temperature-dependent offset programmable for X/Y- or Z-channel – On-board diagnostics – Short-circuit protected push-pull output – Over-/reverse-voltage & under- and overvoltage protection at VSUP
Applications	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

Please read *Important notes* on page 93.

Sensors

Multi-Axis Hall Sensors

TDK EPCOS Micronas InvenSense Tronics

3D Position Hall Sensors

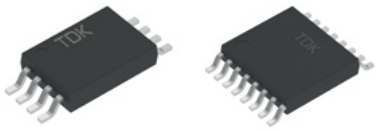
			
Series	HAL® 3900 – Programmable Hall-effect sensor for 3D position detection with SPI interface	HAC 3930 – Programmable Hall-effect sensor for 3D position detection with PWM/SENT interface	HAR 3980 – Programmable Hall-effect sensor for 2D position detection with PSI5 interface
Technical data	Package: SOIC8 Operating temp.: T_J = –40 … +170 °C Operating voltage: 3.0 … 5.5 V Magnetic range: ±10 … 130 mT	Package: SOIC8 Operating temp.: T_J = –40 … +170 °C Operating voltage: 3.0 … 16 V Magnetic range: ±10 … 130 mT	Package: SOIC8 Operating temp.: T_J = –40 … +170 °C Operating voltage: 3.0 …11 V Magnetic range: ±10 … 130 mT
Features	– 3D position detection supporting transmission of two angles out of B_X, B_Y, B_Z – Temperature compensated raw values of BX, BY, BZ – Stray field robust linear and rotary position detection up to 360° – SEooC according to ISO 26262 to support functional safety applications – SPI interface with 10 MHz clock – 16 bit data transmission with CRC and rolling counter – Programmable via SPI interface – Sleep mode (wake-up pin) – Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc.	– 3D position detection supporting transmission of two angles out of B_X, B_Y, B_Z – Compensation of magnetic stray fields for linear and rotary position detection up to 360° – SEooC according to ISO 26262 to support functional safety applications – Customer configurable PWM or SENT output – PWM frequencies between 0.1 kHz and 2 kHz (Up to 13 bit) – SENT according to SAEJ 2716 rev.4 with three different frame formats (H1, H2 and H4) – Enhanced 12-bit serial message format including temperature information – Additional switch output – Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc. – Programmable via output pin with min. supply voltage – 17 variable or 33 fix setpoints for output linearization	– 2D position detection out of B_X, B_Y, B_Z – Compensation of magnetic stray fields for linear and rotary position detection up to 360° – SEooC according to ISO 26262 to support functional safety applications – PSI5 interface supporting version 2.1 and 2.2 – Programming via 2-wire interface by supply voltage modulation. No additional programming pin required – Various configurable signal processing parameter, like output gain and offset, reference position, temperature-dependent offset, etc. – 17 variable or 33 fix setpoints for output linearization
Applications	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

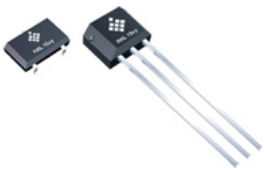
Angle Sensors, Hall Switches

TDK EPCOS Micronas InvenSense Tronics

Angle Sensors

	
Series	Angle sensors TAS
Technical data	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°
Features	– Magnetic angle sensor including TMR (Tunnel Magneto-Resistance) based on magnetic record sensing technology in HDD head – High-output, high-accuracy, and high-stability with low aging deterioration. – Innovative TMR sensors are available in a compact package – Low temperature drifts – Low power consumption
Applications	Steering angles Pedal opening, throttle valve opening Brushless motors Motors for wipers

Hall Switches

		
Series	HAL® 1002 In-System programmable hall switch	HAL® 15xy ISO 26262 compliant low-power hall switch
Technical data	Package: TO92UT Operating temp.: TJ = –40 ... +170 °C Operating voltage: 4.5 … 8.5 V Magnetic range: –30 … to 150 mT	Package: TO92UA or SOT23 Operating temp.: TJ = –40 … +170 °C Operating voltage: 2.7 … 24 V Magnetic range: ±0.4 … ±24 mT
Features	– Programmable switching points and behavior – Switching points programmable in steps of 0.5% of the magnetic field range – Multiple programmable magnetic characteristics – Temperature characteristics are programmable for matching all common magnetic materials – Operates with dynamic magnetic fields up to 2 kHz – Magnetic characteristics are extremely robust against mechanical stress effects – Over-, and reverse-voltage protection (all pins) – Short-circuit protected push-pull output – High ESD performance 8 kV – EMC optimized design	– 3-wire version with short-circuit protected open-drain output or 2-wire version with current output – Very low current consumption of typ. 1.6 mA – Overvoltage protection capability up to 40 V – Highest ESD performance up to ±8 kV – Reverse-voltage protection at supply pin – Sampling and output refresh time of 2 ms – 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 – AEC-Q 100 qualification – ISO 26262 compliant with additional functional safety features like power-on self-test – Magnetic characteristics are robust against mechanical stress
Applications	Endposition detection, electronic fuse Bending lights, pedal kick-down	Endposition detection, brushless DC motor commutation Revolutions per minute (RPM) or other rotary measurements

Please read *Important notes* on page 93.

Sensors

Embedded Motor Controllers

TDK EPCOS Micronas InvenSense Tronics

Embedded Motor Controllers

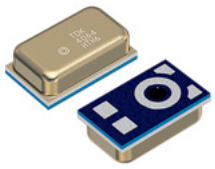
	
Series	HVC 4223F Embedded motor controller for smart actuators
Technical data	Package: QFN40, 6 x 6 mm Operating temp.: TJ = –40 … +150 °C Operating voltage: 4.5 … 18 V
Features	– Six integrated half-bridges up to 6 x 500 mA or 1000 mA (depending on configuration) – Load dump up to 40 V – High-performance 32-bit ARM® Cortex®-M3, running at up to 20 MHz – Memory: – 2 kbyte RAM, 32 kbyte Flash – On-chip NVRAM with wear leveling – Logic modules dedicated for controlling BLDC or BDC motors – Comparators with integrated virtual star point and reference currents – Digital and window watchdog timers with different, independent clocks – 12-bit multi-channel ADC – Programmable gain amplifier – 16-bit free-running counter with three capture/compare-modules – Two 16-bit timers – Enhanced PWMs (EPWMs), providing edge/center-aligned signals with non-overlapping capability – SPI and enhanced LIN 2.x UART – LIN 2.x transceiver – Integrated temperature sensor – Active EMI suppression hardware – Several diagnosis and protection functions such as: – Integrated H-bridge diagnostic features – Internal protection for non-overlapping bridge activation – Clock/temperature/supply supervision – Overvoltage/Overcurrent protection – Power saving modes
Applications	Drive of stepper, BDC, or BLDC motors in smart actuators for automotive applications such as: Grille shutter HVAC flaps LED headlight and fan

Sensors

Geartooth Sensors, Ultrasonic Sensors
MEMS Microphones

TDK EPCOS Micronas InvenSense Tronics

Geartooth Sensors		Ultrasonic Sensors	
		 	
Series	PS-HR series	Ultrasonic sensors	
Technical data	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	Radial oscillation type: Frequency: 200 … 400 kHz Thickness: 0.2 … 4 mm Diameter: 4 … 8 mm	Thickness oscillation type: Frequency: 500 … 4000 kHz Thickness: 0.5 … 4 mm Diameter: 4 … 12 mm
Features	– Low cost sensor – Measures the rotation angle of the cam crank – Highly precise digital output due to integration of components into an IC package – Designed to tolerate extreme temperatures (–30 … +150 °C) – Probe distance can be varied over a wide range – Built-in surge voltage suppression circuit	– Available with wrap-around metallization – Customized dimensions upon request – Production certified to automotive standard (ISO/TS 16949)	
Applications	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		
		
Series	T4064 – analog output	T4070 – analog output
Technical data	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	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
Features	– Very small size of 2.7 × 1.6 mm – Very low height of 0.89 mm – High signal to noise ratio	– SiMic MEMS Microphone – Reflow soldering up to +260 °C – Ni/Au-plated terminals suited for lead free soldering – Approximate weight of 20 mg – High long-term temperature stability – High signal to noise ratio – Positive polarity: Sound pressure increase will increase output voltage
Applications	Mobile phones, tablets Wearables Headsets Internet of Things	Smartphones and feature phones, microphone arrays Tablets, teleconferencing systems, digital still and video Cameras, Headsets, Notebooks, Security and surveillance

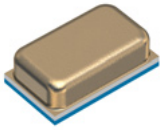
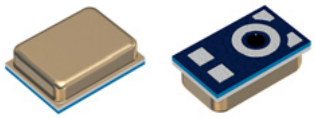
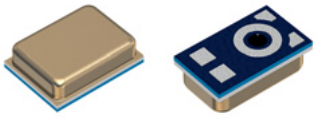
Please read *Important notes* on page 93.

Sensors

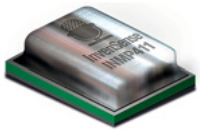
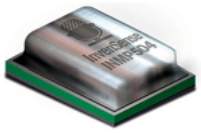
MEMS Microphones

TDK EPCOS Micronas InvenSense Tronics

MEMS Microphones

			
Series	T4076 – analog output	T4078 – analog output	T4081 – analog output
Technical data	Size: 2.75 x 1.85 x 0.9 mm Sensitivity: –38 ±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 … +85 °C	Size: 3.35 x 2.5 x 0.95 mm Sensitivity: –38 ± 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 … +105 °C Current consumption I_{CC}: 85 µA (LM), 250 µA (HM)	Size: 3.35 x 2.5 x 0.95 mm Sensitivity: –38 ± 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 … +85 °C Current consumption I_{CC}: 135 µA
Features	– Small size of 2.75 × 1.85 mm – Very low height of 0.9 mm – High signal to noise ratio	– High signal to noise ratio of 66 dB (A) typ. – Analog balanced output – Multi mode: High performance mode (HM) and low power mode (LM)	– High signal to noise ratio of 66 dB (A) typ. – Analog balanced output
Applications	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

		
Series	INMP411 – analog output	INMP504 – analog output
Technical data	Size: 4.72 x 3.76 x 1 mm Sensitivity: –46 dBV ±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 ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 65 Acoustic overload point / dB SPL: 120 at 10% THD
Features	– Surface Mounted Technology (SMT) – Balanced operation – High performance mode (HM) and low power mode (LM) – Wide dynamic range – Positive polarity	– Surface Mounted Technology (SMT) – Flat frequency response from 100 to 16 kHz – Low current consumption – Single-ended analog output – Omnidirectional response
Applications	Mobile phones, headsets, PDAs, notebooks, cameras	Smartphones, tablets, teleconferencing systems Digital still and video cameras, headsets, notebook Security and surveillance

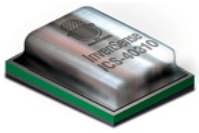
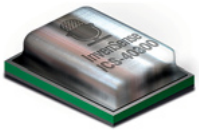
Please read *Important notes* on page 93.

Sensors

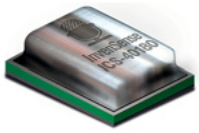
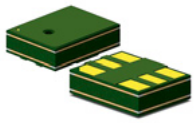
MEMS Microphones

TDK EPCOS Micronas InvenSense Tronics

MEMS Microphones

		
Series	ICS-40310 – analog output	ICS-40300 – analog output
Technical data	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
Features	– Low current consumption – Small Surface-Mount Package – Single-ended analog output	– Extended frequency response from 6 to 20 kHz – Acoustic overload point 130 dB SPL – Sensitivity of –45 dBV – Sensitivity tolerance ±2 dB – Omnidirectional response – High SNR of 63 dBA – Omnidirectional response – Low current consumption
Applications	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

		
Series	ICS-40180/ICS-40181	ICS-40618/ICS-40619
Technical data	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
Features	– Non-inverted signal output – Omnidirectional response (ICS-40181) – Extended frequency response from 60 Hz to 20 kHz – Enhanced RF immunity – Low current consumption – Single-ended analog output	– Differential non-inverting analog output – Top/bottom port pair
Applications	Smartphones, tablets, wearables, still and video cameras, headsets, notebooks, security and surveillance	Smartphones “AlwaysOn” listening Wearable devices Still and video cameras IoT devices

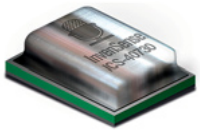
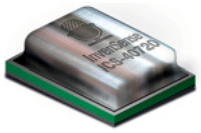
Please read *Important notes* on page 93.

Sensors

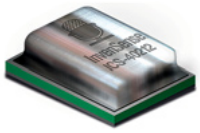
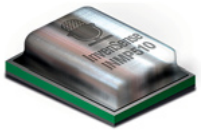
MEMS Microphones

TDK EPCOS Micronas InvenSense Tronics

MEMS Microphones

		
Series	ICS-40730 – analog output	ICS-40720– analog output
Technical data	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
Features	– Ultra-high 74 dBA SNR – Non-inverted signal output – Enhanced RF performance	– Ultra-high 70 dBA SNR – Non-inverted signal output – Enhanced RF performance
Applications	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

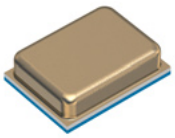
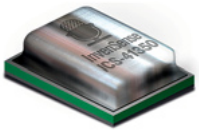
		
Series	ICS-40212– analog output	INMP510– analog output
Technical data	Size: 3.50 x 2.65 x 0.98 mm Sensitivity: –38 dBV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 66 to 66 Acoustic overload point / dB SPL: 128 to 123 dB SPLat 10% THD	Size: 3.35 x 2.5 x 0.98 mm Sensitivity: –38d BV ±1 dBV at 1 kHz, 94 dB SPL S/N Ratio (Nom.) / dBA: 65 Acoustic overload point / dB SPL: 124 at 10% THD
Features	– Surface Mounted Technology (SMT) – Balanced operation – High performance mode (HM) and low power mode (LM) – Wide dynamic range – Positive polarity	– Acoustic overload point of 124 dB SPL – Omnidirectional response – Enhanced radio frequency (RF) performance – Single-ended analog output
Applications	Smartphones, wearables, still and video cameras, Internet of Things	Smartphones, tablets, teleconferencing systems, digital still and video cameras, headsets, notebooks, security and surveillance

Sensors

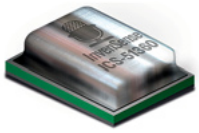
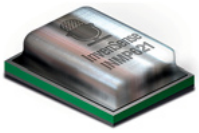
MEMS Microphones

TDK EPCOS Micronas InvenSense Tronics

MEMS Microphones

		
Series	T4075 – digital output	ICS-41350/ICS-41351
Technical data	Size: 3.5 x 2.65 x 0.98 mm Sensitivity (HM): –43 ± 1 dBFS/Pa at 1 kHz Sensitivity (LM): –23 ± 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 … +85 °C Current consumption I_{CC}: 480 µA (LM), 750–900 µA (HM)	Size: 3.2 x 2.65 x 0.98 mm Standard mode sensitivity: –26 db FS ± 1 dB Standard mode SNR: 64 dBA Standard mode AOP: 120 dB SPL
Features	– High signal to noise ratio of 65 dB (A) typ. – High AOP – PDM Digital output – Multi mode: High performance mode (HM) and low power mode (LM)	– Low-power (“AlwaysOn”), standard, high performance, and sleep modes – Extended frequency response from 50 Hz to >20 kHz – Ultrasound support up to 40 kHz
Applications	Mobile phones, tablets Wearables Headsets Internet of Things	Smartphones, microphone arrays, tablets, cameras, headsets, notebooks, security and surveillance

MEMS Microphones

		
Series	ICS-51360 – digital output	INMP621 – digital output
Technical data	Size: 3.5 x 2.65 x 0.98 mm Standard mode sensitivity: –36 db FS ± 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 ± 1 dB SNR: 65 dBA AOP: 133 dB SPL
Features	– Low-power (“AlwaysOn”), standard, and sleep modes – Extended frequency response from 50 Hz to >20 kHz	– Extended frequency response from 45 Hz to >20 kHz
Applications	Smartphones, microphone arrays, tablets, cameras	Tablets, notebooks, smartphones, microphone arrays Teleconferencing systems, digital still and video cameras Headsets, security and surveillance

Please read *Important notes* on page 93.

Sensors

MEMS Intertial Sensors

TDK EPCOS Micronas InvenSense Tronics

MEMS Intertial Sensors

			
Series	GYPRO2300LD	GYPRO3300	AXO215
Technical data	Z-axis angular rate sensor: ±300 °/s Data rate: 1700 Hz Latency: 2 ms Noise density: 0.02 °/s/√Hz	Z-axis angular rate sensor: up to ±800 °/s Data rate: 1800 Hz Latency: 1 ms Noise density: 0.04 °/s/√Hz	In-plane linear accelerometer: ±15 g In-run bias stability: 3 µg Noise density: 15 µg/√Hz Non-linearity: 100 ppm
Features	– 24-bit SPI digital output – Hermetic ceramic package – Closed-loop operation – Embedded temperature sensor – Built-in self-test – Industrial temperature –40 up to +85 °C – Evaluation kit compatible with Arduino platform		
Applications	Motion tracking Platform stabilization GNSS assistance AHRS & IMU Flight control Guidance Precision instrumentation		

Sensors

Motion Sensors

TDK EPCOS Micronas InvenSense Tronics

Motion Sensor 6-Axis

		
Series	ICM-20600	ICM-20602
Technical data	Size: 2.5 x 3 x 0.91 mm Host interface: 10 MHz SPI or 400 kHz Fast Mode I²C	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 I²C
Features	– 1 kB FIFO buffer enables the applications processor to read the data in bursts – Programmable filters	– 1 kB FIFO buffer enables the applications processor to read the data in bursts – Programmable filters
Applications	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

		
Series	ICM-20608-/ICM-20608-G	ICM-20648
Technical data	Size: 3 x 3 x 0.75 mm Host interface: 8 MHz SPI or 400 kHz I²C	Size: 3 x 3 x 0.9 mm Host interface: 7 MHz SPI, 100 kHz standard I²C, or 400 kHz Fast Mode I²C
Features	– Digital-programmable low-pass filter – 512B FIFO buffer enables the applications processor to read the data in bursts – DMP based (ICM-20608-D) – Pedometer (ICM-20608-D)	– DMP based 6- and 9-axis Cal/Fusion – Android support – 512B FIFO buffer enables the applications processor to read the data in bursts
Applications	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

Please read *Important notes* on page 93.

Sensors

Motion Sensors

TDK EPCOS Micronas InvenSense Tronics

Motion Sensor 6-Axis

		
Series	ICM-20689	ICG-20660L
Technical data	Size: 4 x 4 x 0.9 mm Host interface: 8 MHz SPI or 400 kHz Fast Mode I²C	Size: 3 x 3 x 0.75 mm Host interface: 7 MHz SPI or 400 KHz Fast Mode I²C
Features	– 4 kB FIFO buffer enables the applications processor to read the data in bursts – Digital motion processor	– Minimal cross-axis sensitivity between the accelerometer and gyroscope axes – 512B FIFO buffer enables the applications processor to read the data in bursts
Applications	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

		
Series	ICM-30630	ICM-30631
Technical data	Size: 3 x 3 x 0.98 mm Host interface: 8 MHz SPI or 3.4 MHz I²C	Size: 3 x 3 x 0.98 mm Host interface: 6.4 MHz SPI or 1.7 MHz I²C
Features	– 64 kB SRAM and 64 kB flash – Configurable FIFO – SensorStudio	– 64 kB SRAM and 64kB flash – Configurable FIFO – Complete SW stack – Wrist-worn design
Applications	Smartphones, tablets, wearables	Wearables

Please read *Important notes* on page 93.

Sensors

Motion Sensors

TDK EPCOS Micronas InvenSense Tronics

Motion Sensor 6-Axis

		
Series	MPU-6000/MPU-6050	MPU-6500
Technical data	Size: 3 x 3 x 0.98 mm Host interface: 400 kHz Fast Mode I²C, 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 I²C serial interface for communicating with all registers; 20 MHz SPI serial interface for reading sensor and interrupt registers
Features	– 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 – DMP based 9-axis – Cal/Fusion	– 512B FIFO buffer enables the applications processor to read the data in bursts
Applications	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

		
Series	IAM-20680	MPU-9250
Technical data	Size: 3 x 3 x 0.75 mm Host interface: 8 MHz SPI or 400 kHz Fast Mode I²C	Size: 3 x 3 x 1 mm Host interface: 1 MHz SPI or 400 kHz Fast Mode I²C for communicating with all registers; 20 MHz SPI for reading sensor and interrupt registers
Features	– 512B FIFO buffer enables the application processor to read the data in bursts	– 512B FIFO buffer enables the application processor to read the data in bursts – DMP based 9-axis – Cal/Fusion
Applications	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

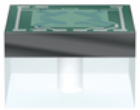
Please read *Important notes* on page 93.

Sensors

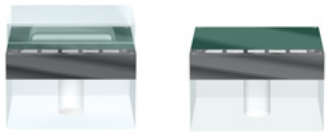
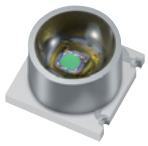
Pressure Sensors

TDK EPCOS Micronas InvenSense Tronics

Pressure Sensors

			
Series	Sensor dies C32	MiniCell	Sensor dies C35
Technical data	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
Features	– Available for absolute, gauge and back side absolute measurements – Various features on request as gold bond pads and backside metallization for soldering	– Differential pressure measurement – Pressure transmitter with high media resistance for both pressure ports with stainless steel diaphragms	– Gauge pressure measurement – Various wire bond options (surrounded wire bonding and direct die to ASIC) – Narrow tolerance of sensitivity
Applications	Automotive and industrial applications	Industrial and automotive applications	Industrial and automotive applications

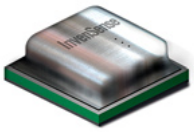
Pressure Sensors

			
Series	Sensor dies C38	Sensor dies C39	ASB/ASA/ASR – SMD
Technical data	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
Features	– For backside applications (gauge and absolute) – Single side bond pads for direct die to ASIC wire bonding – High burst pressure – Gold bond pads available – Various features on request as gold bond pads and backside metallization for soldering	– Miniaturized design for portable devices – High signal stability – Automotive validation acc. AEC-Q101	– Analog V1 or VR voltage output – Minimized pressure transmitter
Applications	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
	
Series	Transmitters AK	ICP-10100, ICP-10101, ICP-10110, ICP-10111
Technical data	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
Features	– Tube or thread connection – Packaged pressure sensor die for low pressure ranges – For gauge measurement	– IPx8: Waterproof to 1.5 m depth (ICP-10100 & ICP10110) – Industry's lowest noise and lowest power barometric pressure and temperature sensor
Applications	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

Series	ICM-20789
Technical data	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
Features	– Minimal cross-axis sensitivity between the accelerometer and gyroscope axes – 4 kB FIFO buffer enables the applications processor to read the data in bursts – 10 000 *g* shock tolerant – 400 kHz Fast Mode I2C for communicating with all registers
Applications	Drones and flying toys,motion-based gaming controllers, VR headsets and controller, navigation

Please read *Important notes* on page 93.

Sensors

Humidity Sensors

TDK EPCOS Micronas InvenSense Tronics

Humidity Sensors

	  	
Series	Humidity sensor units (Assembly) CHS-U	Humidity sensor units (Assembly) CHS-MSS
Technical data	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
Features	– Sensor units with built-in circuits – Highly accurate – Characteristics are stable over a wide temperature range – Dry and wet characteristics exhibit virtually no hysteresis – Highly cost-effective and compact, requiring extremely little mounting space – Low current consumption	
Applications	Refrigerators Air conditioners PPCs, LBP printers Industrial electronic humidity sensors, air conditioners for factories	

Humidity Sensors

		
Series	Humidity sensor units (Assembly) CHS-C	Humidity sensor units (Element) CHS-ESS
Technical data	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)
Features	– Sensor units with built-in circuits – Highly accurate – Characteristics are stable over a wide temperature range – Dry and wet characteristics exhibit virtually no hysteresis – Highly cost-effective and compact, requiring extremely little mounting space – Low current consumption	– Variable resistance humidity sensor with superior water and gas resistance – Large impedance change in response to humidity changes and exhibits excellent responsiveness and sensitivity – Measurement accuracy of ±5% RH at a humidity of 50% RH – Hysteresis of dry and wet characteristics is suppressed at about 1% RH
Applications	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

		
Series	Toner density/quantity sensors TS-A, TS-K, TS-Z	Powder level sensors TSP
Technical data	Rated voltage: 24 V ±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 ±5% Input current: 20 mA max. Sensor level: 5 mm ± 3 mm Output voltage: high 4.5 V min./low 0.5 V max.
Features	– Use a high performance ferrite core differential transformer with an adjustable control lead wires – Sensor adjustment point can be installed at any location – Operating point can be reset easily – Microprocessor in the printer or copier can vary the control lead voltage for automatic adjustment	– 2-terminal type separate excitation oscillation formula – Piezoelectric ceramic sensor element – Die cast finish – Highly resistant to external vibrations – Stable detection characteristics – Can detect both magnetic and non-magnetic powders
Applications	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

		
Series	Surface potential sensors Feed-back type EFS	
Technical data	Measured voltage V_e: –1000 … 0 V / 0 V … +1000 V Power supply voltage V_{cc}: 24 V ±10% Output voltage (measured voltage) V0: 0 (0), 2.5 (–500), 4.5 (–900) V Output variation ΔV0: ±0.05 Response time: 20 ms max. Operating temp.: 0 … +50 °C	
Features	– Stable output performance is maintained for long periods – Quick responsiveness of high speed 11 ms (typ.) realized – Range of detector output (0 to 4.5 V range) fluctuations is limited to less than ±0.05 V	
Applications	Surface electrical potential measurements in various equipment, including the drum or paper in a copier, laser printer	

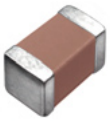
Please read *Important notes* on page 93.

Ceramic Capacitors

Multilayer Ceramic Chip Capacitors

TDK EPCOS Micronas InvenSense Tronics

Multilayer Ceramic Chip Capacitors

			
Series	General use – SMD C, CGA series	Mid voltage – SMD C, CGA series	High voltage – SMD C, CGA series
Technical data	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
Features	– Wide range of case size and superior dimension precision – Available rating up to 50 V	– Unique design allows for higher voltage in smaller case size – Available ratings in 100, 250, 450 and 630 V	– Advance design provides improved withstanding voltage – Available rating up to 3000 V
Applications	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

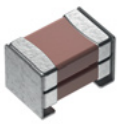
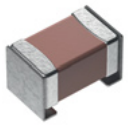
		
Series	High temperature – SMD C, CGA series	Serial design – SMD CEU series
Technical data	Size (IEC): 1005 … 5750 Temp. characteristic: NP0, X8R, X8L Rated voltage: 6.3 … 630 V Capacitance: 1 pF … 22 µF	Size (IEC): 1608, 2012 Temp. characteristic: X7R Rated voltage: 50, 100 V Capacitance: 1 … 100 nF
Features	– Stable temperature characteristics up to +150 °C – Highly precise temperature performance (±7.5%) up to +125 °C	– 2 series-connected capacitors in one component – Improved bending resistance and temperature cycle performance – Ultra high reliability design for automotive battery line applications
Applications	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

		 
Series	Soft termination – SMD C, CGA series	MEGACAP series – SMD CKG series
Technical data	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
Features	– Improved bending resistance and temperature cycle performance – Termination technology available for most case sizes including arrays	– Advance design for twice the capacitance on single footprint – Improved vibration and thermal/mechanical stress performance – Lower ESR and ESL than ALU and TA capacitors
Applications	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies	Automotive electronics Communications Consumer electronics Industrial applications Renewable energies

Multilayer Ceramic Chip Capacitors

		
Series	Soft termination/low resistance – SMD CNC, CNA series	MEGACAP/low resistance, inline – SMD CA series
Technical data	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
Features	– Lower electric resistance has been realized because the current can pass through low resistive layers by covering only soldering positions with conductive resin layers	– Higher mechanical endurance is realized by metal frame structure – 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
Applications	Automotive electronics Industrial applications Renewable energies	Automotive electronics Industrial applications Renewable energies

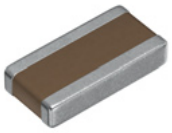
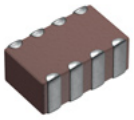
Please read *Important notes* on page 93.

Ceramic Capacitors

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

TDK EPCOS Micronas InvenSense Tronics

Multilayer Ceramic Chip Capacitors

			
Series	Conductive epoxy – SMD CGA series	Flip type – SMD C, CGA series	Ultra low inductance – SMD CLL series
Technical data	Size (IEC): 1005 … 3225 Temp. characteristic: C0G, X7R, X8R Rated voltage: 6.3 … 100 V Capacitance: 1 pF … 10 µF	Size (IEC): 0510 … 0816 Temp. characteristic: X5R, X6S, X7R, X7S Rated voltage: 2.5 … 50 V Capacitance: 47 nF … 4.7 µF	Size (IEC): 1608 Temp. characteristic: X6S, X7R, X7S Rated voltage: 4 V Capacitance: 47 nF … 4.7 µF
Features	– 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
Applications	Automotive electronics	Automotive electronics Communications Consumer electronics	Communications Consumer electronics

Leaded Multilayer Ceramic Chip Capacitors

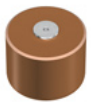
Leaded High Voltage Ceramic Capacitors

		
Series	Dipped radial FG, FA series	High voltage CK45, CK45-RR, CC45 series
Technical data	Temp. characteristic: C0G, NP0, X5R, X7R, X7S, X7T, X8R Rated voltage: 6.3 … 630 V Capacitance: 1 pF … 100 µF	Temp. characteristic: SL, B, E, R Rated voltage: 1 … 6 kV Capacitance: 3 pF … 10 nF
Features	– 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 archieve 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
Applications	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

TDK EPCOS Micronas InvenSense Tronics

Leaded High Voltage Ceramic Capacitors		Ultra-High Voltage Ceramic Capacitors
		
Series	Safety standard approved CD45, CS45 series	Ultra-high voltage FD, MD, TSF, H, GA, FHV, UHV series
Technical data	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
Features	– Compliant with safety standards – Flame-resistant, reinforced outer insulation prevents fires, electrical shock, and other potential hazards – Halogen-free external resin coating	– Low dissipation and excellent voltage/capacitance characteristics – Epoxy-encapsulated to meet requirements of high voltage applications
Applications	Y capacitor in AC lines	High voltage power supplies Laser equipment Industrial applications Renewable energies

CeraLink Capacitors			
			
Series	LP series J leads, L leads	SP series	FA2, FA3, FA10
Technical data	Nom. capacitance: 0.25 … 1 µF 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 µF Rated voltage: 500, 700, 900 V I_{op} (100 kHz, +85 °C): 19 … 31 A RMS ESL = 4 nH	Nom. capacitance: 0.5 … 10 µF Rated voltage: 500, 700, 900 V I_{op} (100 kHz, +85 °C): 7.9 … 46.6 A RMS ESL = 2 … 3 nH
Features	– High operating and peak temperatures – Low ESL, low ESR – High capacitance density and small size – Low losses at high frequencies and high temperatures – Supports further miniaturization of power electronics at system level		
Applications	DC Link and snubber capacitors for: – HV DC/DC converters and OBC (as filter or snubber capacitor) – DC link in local HV inverters/converters and auxiliaries (e.g. HV heater, HV water pump) – Wireless charging systems – High efficiency inverters in DC/AC converters for solar/wind power supplies		

Please read *Important notes* on page 93.

Film Capacitors

Medium Power Film Capacitors

TDK EPCOS Micronas InvenSense Tronics

Medium Power Film Capacitors

		
Series	MKT boxed B32520 … B32529	MKP boxed B32652 …, B32658 …
Technical data	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
Features	Dielectric polyester (PET) offers: – Higher density of capacitance/mm³ and +125 °C operating temperature vs polypropylene (PP) dielectric – Lower dissipation factor, higher current capability (RMS and peak), long useful life and parameter stability – Plastic case and epoxy resin sealing (UL94V-0) – Mechanical and environmental strength	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 – Mechanical stability – High RMS and peak current capability – Good self-healing properties
Applications	General purpose, blocking, coupling, decoupling, bypassing, electronic, ignition in industrial (SMPS, converter), lighting, automotive and household appliances	General purpose, snubbering, resonance, ignition, AC and DC filtering in industrial, lighting, automotive and household appliances

Medium Power Film Capacitors

		
Series	MMKP B32641 … B32643	MKP AC filtering B32754 … B32758
Technical data	Rated capacitance: 2.2 … 560 nF Rated voltage: 400 … 2000 V DC	Rated capacitance: 1.0 … 70 µF Rated voltage: 250 … 400 V AC
Features	– Lead spacing 10 … 22.5 mm – Operating temperature up to +110 °C – Double sided metallization for snubbering, resonant or switching – High dv/dt	– Operating temperature up to +105 °C – Output AC filtering – Optimized AC voltage performance with small dimensions – High ripple current/frequency capability – +60 °C/95 % RH/V RMS/1000 h
Applications	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

Please read *Important notes* on page 93.

Film Capacitors

Medium Power Film Capacitors

TDK EPCOS Micronas InvenSense Tronics

Medium Power Film Capacitors

			
Series	MKP boxed (PFC) B32671Z…, B32676Z…	B32671P… B32673P	MKP boxed (high V AC-temp.) B32671L…, B32672L…
Technical data	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
Features	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		
	– Very compact design – High frequency		– Very small dimensions – For high frequency AC loads and pulses – High pulse withstand capability
Applications	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

			
Series	MKP DC link High Density B32774 … B32778	MKP DC link High Density THB B32774H … B32778H	MKP DC link High Temperature B32774P … B32778P
Technical data	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
Features	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 density of capacitance per volume – Low losses with high current capability	– High density, compact for severe ambient conditions – Operating temperature up to +105 °C – +60 °C/95 % RH/V_R/1000 h – AEC-Q200	– Operating temperature up to +125 °C – +40 °C/93 % RH/V_R/1000 h – +50 °C/95 % RH/V_R/500 h – AEC-Q200
Applications	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

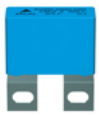
Please read *Important notes* on page 93.

Film Capacitors

Medium Power Film Capacitors

TDK EPCOS Micronas InvenSense Tronics

Medium Power Film Capacitors

			
Series	MKP DC link High Power B32674 … B32678	MKP snubber B32656S… B32658S	MFP boxed B32682 … B32686
Technical data	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
Features	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_{RMS} current per capacitance – High frequency ripple current	– Very low ESL, ESR – Thermal, mechanical stability – 17 terminal options	– 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
Applications	DC link, DC filtering, decoupling in industrial, lighting, automotive and household appliances	Snubbering IGBT module in industrial appliances	Smothing, snubbering, high frequency AC loads in industrial, lighting and medical electronics with very high pulse, frequency and current demand

Medium Power Film Capacitors

			
Series	MFP snubber B32686S…	X2 standard B32921 … B32928	X1 EMI suppression B32911 … B32918
Technical data	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
Features	– Polypropylene (PP) film dielectric metalized 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
Applications	Snubbering 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

TDK EPCOS Micronas InvenSense Tronics

Medium Power Film Capacitors

			
Series	Y2 EMI suppression B32021 … B32026	Y2 Humidity B32032 … B32036	Y1 EMI suppression B81123
Technical data	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
Features	– Standard EMI suppression capacitor for EMC filtering – Good self-healing properties – High voltage capability – Very small dimensions	– Grade III THB – +85 °C/85 % RH/1000 h/350 V AC – Y2 safety class per UL/IEC – High stability of capacitance value	– Standard EMI suppression capacitor for EMC filtering – Good self-healing properties – High voltage capability – Very small dimensions
Applications	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

			
Series	X2 Heavy Duty B32932 … B32936	X2 Humidity B32922H/J … B32926H/J	X2 industrial series B32924A/B4 … B32928A/B4
Technical data	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
Features	– +85 °C/85% RH/1000 h/240 V AC – X2 safety class per UL/IEC (C ≤ 2.2 µF) – High stability on capacitance value – Internal series connection – +40 °C/93% RH/2000 h/305 V AC	– +85 °C/85% RH/1000 h/240 V AC – X2 safety class per UL/IEC – High stability of capacitance value – +60 °C/95% RH/1000 h/240 V AC	– X2 safety class per UL/IEC – Very high stability of capacitance value – +85 °C/85% RH/1000 h/330 V AC – Internal series construction
Applications	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

Please read *Important notes* on page 93.

Film Capacitors

AC Output/Input Filters, AC Film Capacitors

TDK EPCOS Micronas InvenSense Tronics

AC Output/Input Filters		AC Film Capacitors
		
Series	Box type B32354S …	MotorCap S0 plastic B3232 …
Technical data	Rated capacitance: 10 … 40 µF Rated voltage: 350 V AC	Rated voltage: 250 … 480 V AC Rated capacitance: 1 … 60 µF Plastic can
Features	– Plastic can – Terminals: 4 pin, 2 pin as option – Optimized for PCB mounting – Segmented film safety function – +85 °C, 85% rel. humidity, 1000 h, V_R compatible – UL 810 Components level approval as option – 10 000 AFC to UL 810 compliant	– Useful life: Up to 10 000 h/class B – Terminals: Fast-on (single/double) Insulated wire Twin core cable – Safety class: S0 – Approvals: UL, VDE, IS
Applications	Designed for AC input and AC output filters e.g. UPS	General sine wave applications, mainly as motor run capacitor

AC Film Capacitors			
			
Series	MotorCap S3 compact B3235 …	Super MotorCap S2 Alu B3233 …	MotorCap S2 Alu B3333 …
Technical data	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
Features	– Useful life: Up to 30 000 h/class A – Temperature up to +100 °C – Terminals: Fast-on (single/double) Insulated wire Twin core cable – Safety class: S3 – Approvals: UL, VDE	– Useful life: Up to 30 000 h/class A – Terminals: Fast-on (single/double) Twin core cable – Safety class: S2 – Approvals: UL, VDE, TÜV	– Useful life: Up to 30 000 h/class A – Terminals: Fast-on (single/double) Twin core cable – Safety class: S2 – Approvals: UL, VDE, CQC
Applications	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

TDK EPCOS Micronas InvenSense Tronics

PFC Capacitors and Key Components for Power Quality Solutions

				
Series	PhaseCap Energy B25674/B25675	PhaseCap Compact B25673	PhaseCap Premium B25667	PhaseCap HD B25669
Technical data	Power: 5.0 … 33 kvar Rated voltage: 230 … 690 V AC Inrush current: up to 500 • I_R	Power: 5.0 … 33 kvar Rated voltage: 230 … 1000 V AC Inrush current: up to 400 • I_R	Power: 5.0 … 33 kvar Rated voltage: 230 … 800 V AC Inrush current: up to 300 • I_R	Power: 40 … 60 kvar Rated voltage: 400 … 525 V AC Inrush current: up to 300 • I_R
Features	– 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
Applications	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

				
Series	DeltaCap B32300, B32301, B32303, B32304	PhiCap B32340C…A…, B32343C, B32344E	HomeCap B32340C…J…	PoleCap B25671
Technical data	Power: 0.5 … 33 kvar Rated voltage: 230 … 525 V AC Inrush current: up to 200 • I_R	Power: 0.5 … 30 kvar Rated voltage: 230 … 525 V AC Inrush current: up to 200 • I_R	Power: 0.02 … 1.99 kvar Rated voltage: 400 V AC (Application voltage: 127 … 400 V AC) Inrush current: up to 100 • I_R	Power: 0.5 … 30 kvar Rated voltage: 400 … 525 V AC Inrush current: up to 200 • I_R
Features	– 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
Applications	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 surroundings with high dust or moisture concentration

Please read *Important notes* on page 93.

Film Capacitors

PFC Capacitors and Key Components for Power Quality Solutions

PFC Capacitors and Key Components for Power Quality Solutions

Series	PF controllers B44066R …
Technical data	Supply voltage: BR604: 230 V AC BR6000 (from V5.0 onwards), BR7000-series: 110 … 440 V AC Measuring voltage: 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)
Features	Output stages: 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 Menu languages: 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
Applications	Controlling of actual power factor Connecting/disconnecting capacitor steps

PFC Capacitors and Key Components for Power Quality Solutions

Series	Measuring devices B44066M …
Technical data	Supply voltage: MMI6000: 230 V AC MMI7000: 110 … 440 V AC MMI8003: 24 V DC (via external terminal) Measuring voltage: 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)
Features	– Compact dimensions – Panel mounting instrument – LCD display, MMI8003 no display – Menu languages: MMI6000: EN/GER MMI7000: EN/GER/ES/RU/TR MMI8003: n/a
Applications	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

Please read *Important notes* on page 93.

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

			
Series	Grid analysis tool B44066M7777E230	Contactors B44066S … J …	TSM modules B44066T …
Technical data	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
Features	– Comfortable measuring tool – 4 GB memory card included – PC software for evaluation of measured values included	– For usage in PFC systems with and without reactors – cUL approval – CCC approval	– Fast electronically controlled thyristor switch – Easy installation – Very short switching times
Applications	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

			
Series	Reactors B44066D …	PQSine S series – Active harmonic filter and power optimizer B44066F…S…	PQvar series – Static Var Generator (SVG) B44066F…V…
Technical data	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
Features	– High harmonic loading capability – Very low losses – Low noise emission – Temperature protection by microswitch (NC)	– Modules and wall mounted units – Higher ratings available in floor mounting variant – Harmonic mitigation up to the 50th order – Active load balancing – Ultra-fast reactive power factor compensation (inductive and capacitive) – Compact design – Advanced digital control – Modular system	– Modules and wall mounted units – Higher ratings available in floor mounting variant – Ultra-fast reactive power factor compensation (inductive and capacitive) – Active load balancing – Modular and compact design – Advanced digital control – High performance and reliability – Simple installation and commissioning
Applications	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	

Please read *Important notes* on page 93.

Film Capacitors

Power Capacitors

TDK EPCOS Micronas InvenSense Tronics

Power Capacitors

		
Series	MKK DC/DCi/DCi-H, DCi-R/DC-R B25650 (gas), B25640 (resin), B25750 (oil)	PCC LP B25655J …, B25655M …, B25655P …
Technical data	Rated capacitance: 100 µF … 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 µF Rated voltage: 200 … 900 V DC Operating temperature: –40 … +110 °C
Features	– High peak current handling capability – Low losses – Long useful life – Very high reliability – Rectangular case – Flat windings – Overpressure switch possible, self-healing	– Low self-inductivity – High volume fill factor – Very good self-healing – Compact size – Flexible dimensions – Customer specific designs
Applications	DC link Resonant filters Power modules for HVDC	DC link for LV inverters, especially xEV powertrain applications

Power Capacitors

		
Series	MKP DC B2562*	MKP DC LSI B2563*
Technical data	Rated capacitance: 40 … 4000 µF Rated voltage: 700 … 2000 V DC Operating temperature: –55 … +85 °C	Rated capacitance: 50 … 400 µF Rating voltage: 500 … 1200 V DC Operating temperature: –55 … +85 °C
Features	– High RMS current handling capability – Self-healing – Aluminum can – Customized configurations – IEC 61071, UL 810 compliant	– Different terminal types – High peak current capability – Customized configurations – Self-healing – Low self-inductance – Plastic can – IEC 61071, UL 810 compliant
Applications	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

TDK EPCOS Micronas InvenSense Tronics

Power Capacitors

			
Series	Filtercap MKD AC B32370, B32371, B32373, B32374	Filtercap MKD AC B32377	Filtercap MKP AC B33331V…
Technical data	Rated capacitance: 5 … 600 µF Rated voltage: 250 … 850 V RMS Operating temperature: –55 … +85 °C 1-phase capacitor	Rated capacitance: 3x 10 … 3x 600 µF Rated voltage: 250 … 850 V RMS (phase voltage) Operating temperature: –55 … +85 °C 3-phases capacitor	Rated capacitance: 2 … 50 µF Rated voltage: 460 V AC, others upon request
Features	– Different terminal types – High peak current capability – Customized configurations – Overpressure disconnector – Self-healing – IEC 61071, GB/T17702, IEC 60831 and UL 810 compliant	– Different terminal types – High peak current capability – Customized configurations – Overpressure disconnector – Self-healing – IEC 61071, GB/T17702, IEC 60831 and UL 810 compliant	– Robust design – Compact dimensions – 85%/85%/VR/1000 h compatible – UL approved ratings – IEC 61071 compliant
Applications	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

			
Series	Ultra-compact DC link B32320I…	MKK HP B25610	MKK DCR B25640
Technical data	Rated capacitance: 65 µF Rated voltage: 350 V DC, others upon request	Rated capacitance: from 3 x 50 µF 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
Features	– Compact dimensions of (d x l) 40 x 58 mm – Very high capacity density of 0.9 µF/cm³ – Low ESR of 10 mΩ – Integrated thermal fuse	– Low ESR – Self-healing – Reduces high THD – Delta or star connected – Rectangular case – Customer specific design – Aluminum or stainless steel case – Compact size	– Very low ESL – Self-healing – Open capacitors – Rectangular case – Customer specific design – Compact size (flat winding) – Resin filled – Cost optimized
Applications	HF filtering in inverters General DC link applications	High performance output filtering, especially in wind power applications	DC link, industrial and renewable energies

Please read *Important notes* on page 93.

Aluminum Electrolytic Capacitors

TDK EPCOS Micronas InvenSense Tronics

Aluminum Electrolytic Capacitors

			
Series	Screw terminals	4-/5-pin snap-in terminals and solder pins	Snap-in terminals
Technical data	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
Features	– High ripple current capability – Long operational useful life (up to >20 years) – Self-extinguishing electrolyte upon request – Special designs for base cooling – With PET insulation – Compact can size	– High ripple current capability – Long operational useful life (up to >20 years) – With PET insulation – Optional PET insulation cap on terminal side – Compact can size	– High ripple current capability – Long operational useful life (up to >20 years) – With PET insulation – Optional PET insulation cap on terminal side – Compact can size
Applications	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

			
Series	Capacitors for pulse applications	Large-size	Axial-lead
Technical data	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
Features	– Compact design – Outstanding reliability – High charge/discharge proof, polar – Low leakage current – Low dissipation factor	– High vibration stability up to 40 *g* – High ripple current capability – Low ESR – Useful life up to 5000 h at +125 °C up to 63 V – Useful life up to 3000 h at +105 °C up to 500 V	– High vibration stability up to 60 *g* – High ripple current capability – Low ESR at high temperatures – Long useful life up to 10 000 h at +125 °C – High temperature range up to +150 °C
Applications	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

TDK EPCOS Micronas InvenSense Tronics

Aluminum Electrolytic Capacitors

		
Series	Soldering star	Hybrid polymer axial-lead / soldering star *)
Technical data	Rated voltage: 25 … 250 V Rated capacitance: 22 … 10 000 µF Dimensions (d x h): 12 x 30 … 21 x 49 mm	Rated voltage: 25 … 63 V Rated capacitance: 390 … 2100 µF Dimensions (d x h): 14 x 25 … 16 x 30 mm
Features	– High vibration stability up to 60 *g* – Low inductance – High ripple current capability – Long useful life up to 10 000 h at +125 °C – High temperature range up to +150 °C – Low ESR at high temperatures	– Ultra low ESR, e.g. typical 2 ... 3 mΩ – Very high ripple current – High temperature up to +150 °C – Useful life 4000 h at +125 °C – Qualification based on AEC-Q200
Applications	High energy efficiency in automotive applications e.g. motor management, power steering, fan control, water pumps, transmission control, 48 V boardnet, DC/DC converters	48 V bordnet Power steering Fan control Transmission control Electronics pumps Air chargers DC/DC converters

*) upon request

Aluminum Electrolytic Capacitors

		
Series	Hybrid polymer – SMD **)	Single-ended
Technical data	Rated voltage: 25 … 35 V Rated capacitance: 150 … 330 µF Dimensions (d x h): 10 x 10.5 mm	Rated voltage: 10 … 450 V Rated capacitance: 2.2 … 10 000 µF Dimensions (d x h): 8 x 11.5 … 18 x 40 mm
Features	– Low ESR – High ripple current – High temperature up to +125 °C – Useful life 4000 h – Qualification based on AEC-Q200	– High temperature range up to +135 °C – Low impedance at high frequency – Different terminal configurations – Compact designs
Applications	Power steering Fan control Electronic pumps Wiper systems e-brake DC/DC converters ADAS	Automotive e.g. motor management, power steering, fan control

**) Product available in Q1/2019

Please read *Important notes* on page 93.

Electric Double Layer Capacitors

TDK EPCOS Micronas InvenSense Tronics

Electric Double Layer Capacitors

			
Series	Thin type EDLC041720	Low profile type EDLC212520	Low profile type EDLC262520
Technical data	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)
Features	– High capacitance and low impedance – Very thin small size – High bending strength – Long-life – Green materials – High safety – Conformable to ISO card-bending/torsion test	– High capacitance and low impedance – Very thin small size – Long-life – Green materials – High safety	
Applications	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

		
Series	FB series – FB12B, FB12H material	FB series – FB9N, FB9B, FB9H material
Technical data	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/m³, 41.4 ±1.6 kJ/m³	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/m³, 38.6 ±1.6 kJ/m³, 35.0 ±1.6 kJ/m³
Features	– Wet-molded anisotropic ferrite magnet – Further improved coercive force H_{CJ} temperature coefficient	– Wet-molded anisotropic ferrite magnets – Energy product with a substantially improved coercive force H_{CJ} temperature coefficient
Applications	Automotive electronics Home appliances: electrical motors, actuators, appliance motors	Automotive electronics Home appliances: electrical motors, actuators, appliance motors

Ferrite Magnets

		
Series	FB series – FB5D, FB5DH material	
Technical data	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/m³, 30.3 ±1.6 kJ/m³	
Features	– Deliver high B_r and a relatively high level of H_{CJ} – Suitable for a diverse range of small, high-performance motors	
Applications	Automotive electronics Home appliances: electrical motors, actuators, appliance motors, sensors	

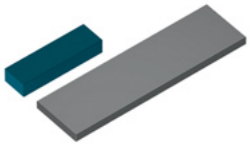
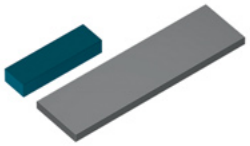
Please read *Important notes* on page 93.

Magnets

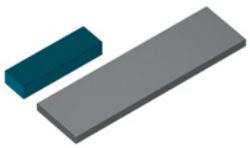
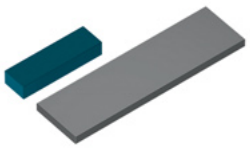
Rare Earth Magnets – Nd-Fe-B Magnets

TDK EPCOS Micronas InvenSense Tronics

Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC51DSX material Heavy Rare Earth diffusion type (HAL)	NEOREC series – NEOREC48DUH material Heavy Rare Earth diffusion type (HAL)
Technical data	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/m³	Residual flux density: 1380 ±30 mT Coercive force: 1058 ±56 kA/m Intrinsic coercive force: ≧1990 kA/m Maximum energy product (BH) max: 366 ±16 kJ/m³
Features	– Heavy Rare Earth diffusion type (HAL) – Reduction of heavy rare earth element (such as Dy, Tb) compared to conventional same H_{CJ} magnet – Improvement of B_r compared to conventional same H_{CJ} magnet (7 to 8 % up)	– Heavy Rare Earth diffusion type (HAL) – Reduction of heavy rare earth element (such as Dy, Tb) compared to conventional same H_{CJ} magnet – Improvement of B_r compared to conventional same H_{CJ} magnet (7 to 8 % up)
Applications	Automotive traction motors, electronics Home appliances	Automotive traction motors, electronics

Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC44DUX material Heavy Rare Earth diffusion type (HAL)	NEOREC series – NEOREC50BF material Dy free (Heavy Rare free)
Technical data	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/m³	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/m³
Features	– Heavy Rare Earth diffusion type (HAL) – Reduction of heavy rare earth element (such as Dy, Tb) compared to conventional same H_{CJ} magnet – Improvement of B_r compared to conventional same H_{CJ} magnet (7 to 8 % up)	– Heavy Rare Earth free
Applications	Automotive traction motors, electronics	VCM for HDD

Magnets

Rare Earth Magnets – Nd-Fe-B Magnets

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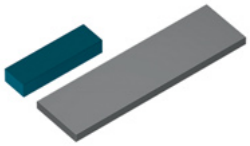
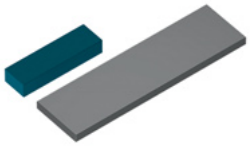
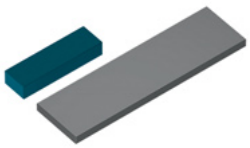
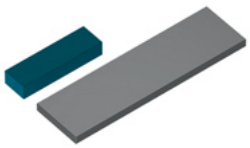
Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC47HF material Dy free (Heavy Rare Earth free)	NEOREC series – NEOREC45MHF material
Technical data	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/m³	Residual flux density: 1370 ±30 mT Coercive force: 1051 ±56 kA/m Intrinsic coercive force: ≧1512 kA/m Maximum energy product (BH) max: 360 ±20 kJ/m³
Features	– Heavy Rare Earth free	– Heavy Rare Earth free
Applications	Renewable energy (Wind power) Home appliances Industrial applications	Home appliances Industrial applications Automotive electronics

Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC45SH material	NEOREC series – NEOREC43SX material
Technical data	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/m³	Residual flux density: 1310 ±30 mT Coercive force: 1012 ±56 kA/m Intrinsic coercive force: ≧1830 kA/m Maximum energy product (BH) max: 331 ±16 kJ/m³
Features	– General type	– General type
Applications	Home appliances Industrial applications Automotive electronics	Automotive electronics

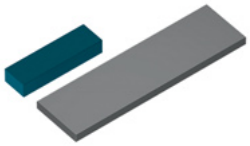
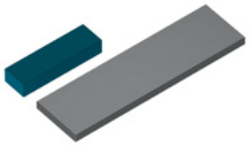
Please read *Important notes* on page 93.

Magnets

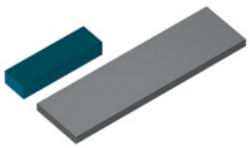
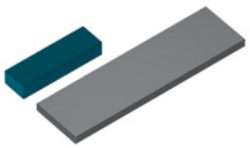
Rare Earth Magnets – Nd-Fe-B Magnets

TDK EPCOS Micronas InvenSense Tronics

Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC40UH material	NEOREC series – NEOREC40TH material
Technical data	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/m³	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/m³
Features	– General type	– General type
Applications	Automotive electronics	Automotive electronics

Rare Earth Magnets – Nd-Fe-B Magnets

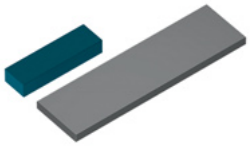
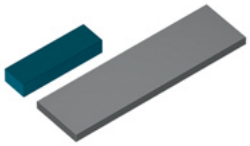
		
Series	NEOREC series – NEOREC38UX material	NEOREC series – NEOREC35NX material
Technical data	Residual flux density: 1250 ±30 mT Coercive force: 966 ±56 kA/m Intrinsic coercive force: ≧2387 kA/m Maximum energy product (BH) max: 294 ±16 kJ/m³	Residual flux density: 1200 ±30 mT Coercive force: 920 ±56 kA/m Intrinsic coercive force: ≧2626 kA/m Maximum energy product (BH) max: 278 ±16 kJ/m³
Features	– General type	– General type
Applications	Automotive electronics	Automotive electronics

Magnets

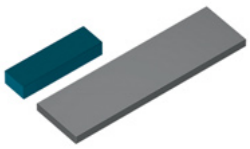
Rare Earth Magnets – Nd-Fe-B Magnets

TDK EPCOS Micronas InvenSense Tronics

Rare Earth Magnets – Nd-Fe-B Magnets

		
Series	NEOREC series – NEOREC46HF material	NEOREC series – NEOREC46HG material
Technical data	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/m³	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/m³
Features	– General type	– General type
Applications	VCM for HDD	Renewable energy (Wind power) Home appliances

Rare Earth Magnets – Nd-Fe-B Magnets

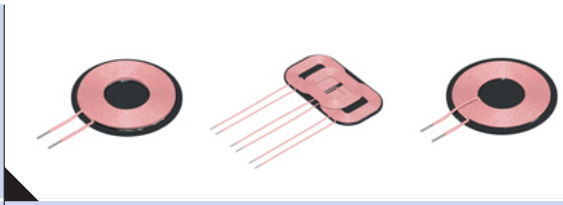
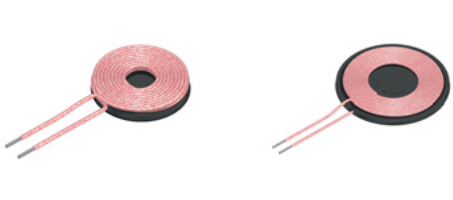
	
Series	NEOREC series – NEOREC42SH material
Technical data	Residual flux density: 1300 ±30 mT Coercive force: 979 ±56 kA/m Intrinsic coercive force: ≧1671 kA/m Maximum energy product (BH) max: 326 ±16 kJ/m³
Features	– General type
Applications	Home appliances Industrial applications Automotive electronics

Please read *Important notes* on page 93.

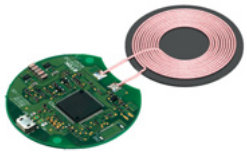
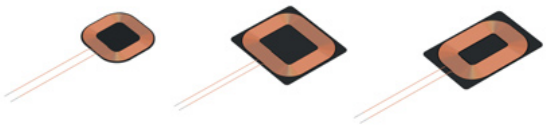
Wireless Charging

TDK EPCOS Micronas InvenSense Tronics

Wireless Charging

		
Series	Tx Coil units (WPC Compliant) WT505090-20K2-A10-G, WT505090-10K2-A11-G, WT525225-20K2-A1-G, WT1005690-12K2-A6-G	Small Tx Coil units WT151512-22F2-ID, WT202012-15F2-ID, WT303012-12F2-ID
Technical data	Size: ⌀ 50 mm 52.0 x 52.0/100.0 x 56.0 mm Inductance: 6.3 … 24.0 µH DC resistance: 0.06 … 0.10 Ω	Size: ⌀ 15.3 … 30.0 mm Inductance: 6.2 … 6.8 µH DC resistance: 0.095 … 0.18 Ω
Features	– Tx coil units for WPC low-power (5W) specification – Got WPC approval for ferrite sheet – Thinner flexible ferrite sheet type is available for durable construction – Performance had been confirmed based on WPC equipment	– Flexible sheet type is used – Custom design is available based on each design requirements
Applications	Various types of battery chargers (WPC compliant)	Smartphones, cellular phones, handheld mobile terminals, DSCs and wearable products

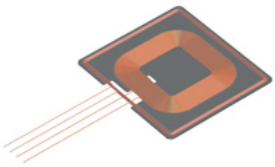
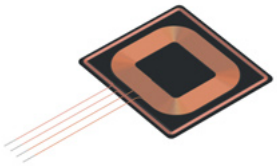
Wireless Charging

		
Series	Tx Coil modules WTM505090-10K2-5V-G1	Rx Coil units WR303050-15F5-G, WR444025-17M6-G, WR444030-16F3-G WR483245-15F5-G, WR483265-15F5-G
Technical data	Size: ⌀ 50 mm Inductance: 6.3 µH DC resistance: 0.06 Ω	Size: 29.6 x 30.0/32.2 x 48.2/43.5 x 39.5 mm Inductance: 12.3 … 19.0 µH DC resistance: 0.2 … 0.7 Ω
Features	– This is Tx turnkey solution including transmitter coil – Fully WPC compliant, including foreign object detection (FOD) method – 5V operation with wireless power consortium (WPC1.1) type A11 transmitter system – Pre cracked ferrite is available for durable construction	– Pre cracked ferrite is available for durable construction – Flexible sheet type is available – Custom design is available based on each design requirements
Applications	Smartphones, cellular phones, handheld mobile terminals, and DSCs	Smartphones, cellular phones, handheld mobile terminals, and DSCs

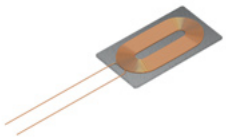
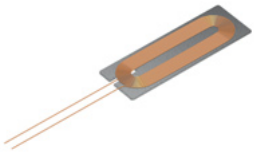
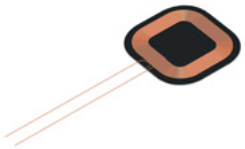
Wireless Charging

TDK EPCOS Micronas InvenSense Tronics

Wireless Charging

	 
Series	NFC Antenna combo Rx coil units WR524830-16F3-NF-G WR524825-17M6-NF-G
Technical data	Size: 52.0 x 48.0 mm Inductance: 16.8 … 19.5 µH DC resistance: 0.75 … 0.8 Ω
Features	– Receiving coils with wireless charging and NFC (Near Field Communication) antenna – Pre cracked ferrite is available for durable construction – Flexible sheet type is available – Custom design is available based on each design requirements
Applications	Smartphones, cellular phones, handheld mobile terminals, and DSCs

Wireless Charging

	  
Series	Small Rx coil units WR121210-27M8-ID, WR202010-18M8-ID, WR222230-26M8-G, WR221230-36M8-G, WR301025-19M8-G, WR303050-12F5-ID
Technical data	Size: ⌀ 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 µH DC resistance: 0.28 … 1.27 Ω
Features	– Flexible sheet type is used – Custom design is available based on each design requirements
Applications	Smartphones, cellular phones, handheld mobile terminals, DSCs and wearable products

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