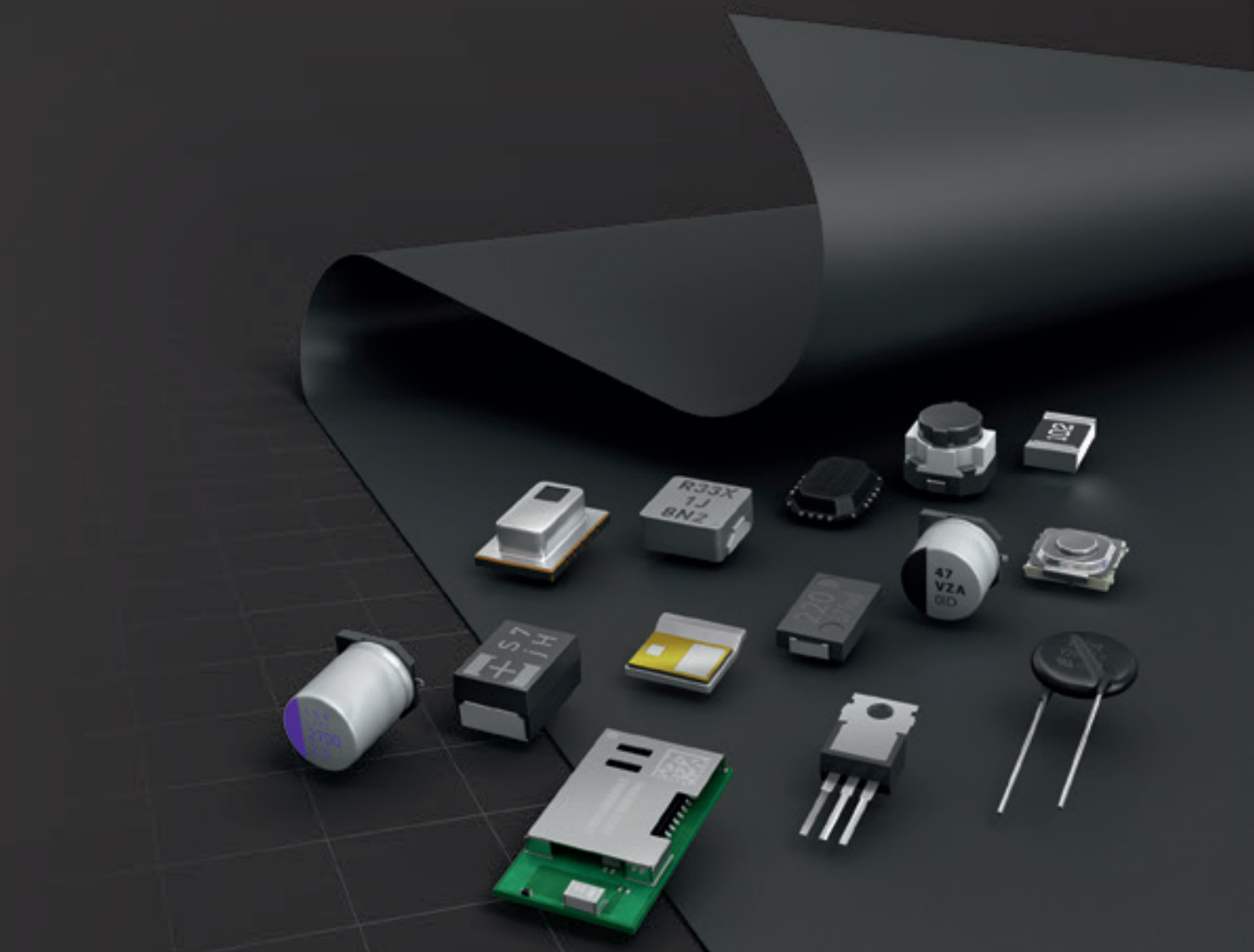
Panasonic

SHORTFORM CATALOGUE

AUTOMOTIVE & INDUSTRIAL COMPONENTS · EUROPE



Sensors · Capacitors · Resistors · Inductors · Circuit Protection
Switches · Encoders · Fuses · Wireless Modules · Semiconductors
Thermal Heat Sink Solution · SD-Cards

SHORTFORM CATALOGUE

AUTOMOTIVE & INDUSTRIAL COMPONENTS · EUROPE

CHAPTER PAGE

AUTOMOTIVE SOLUTIONS

Panasonic offers a wide range of components and devices for various applications in the Automotive Market.

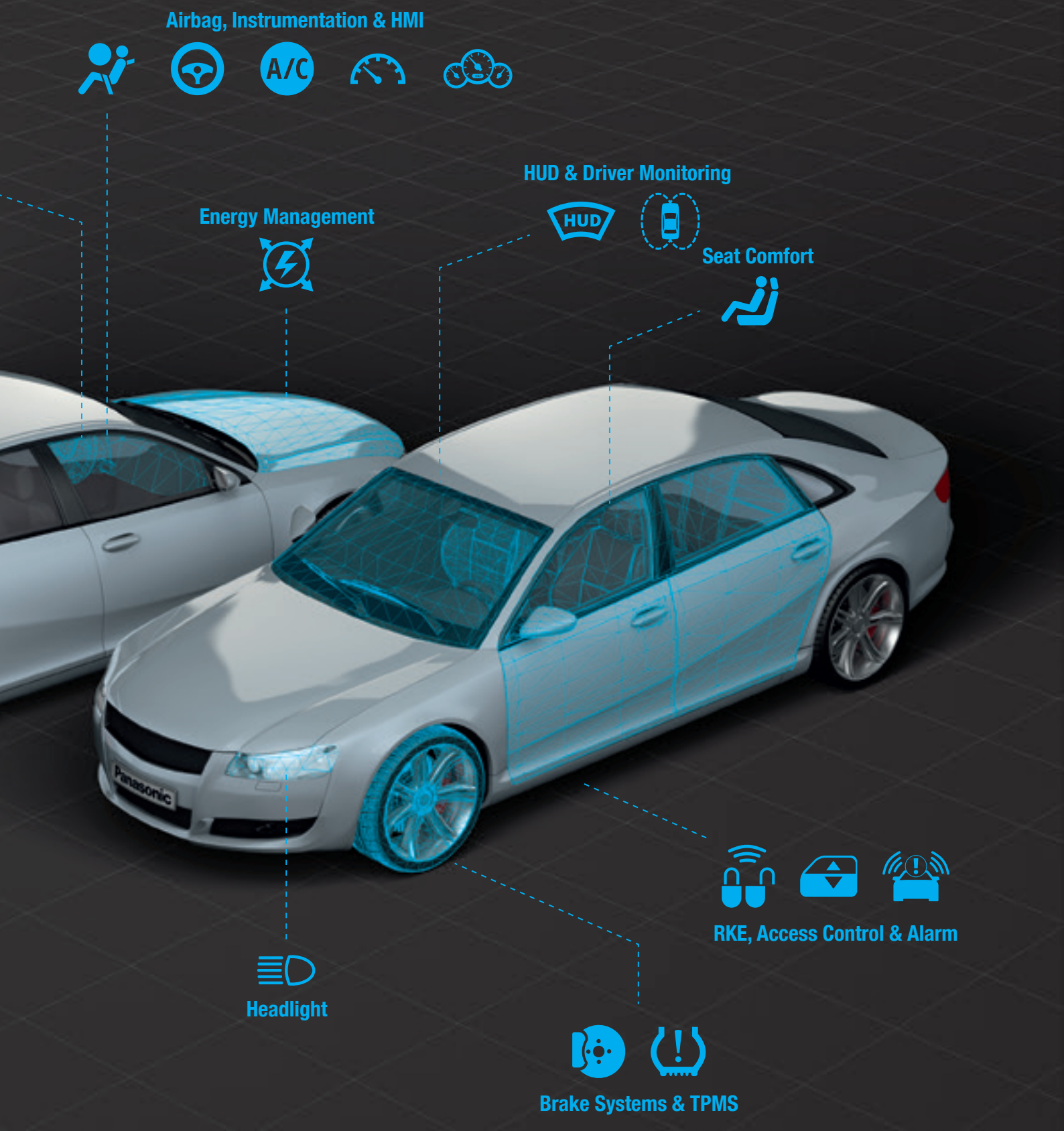
Starting from passive components, like capacitors, resistors and inductors, Panasonic delivers to all in car electrical applications such as airbags, brake systems, lighting systems and control panels. Our sensors are mainly used for monitoring and detecting, whilst semiconductors focus on power electronics and battery management solutions. Pyrolytic Graphite Sheets resolve heat issues experienced in displays or headlight applications. Panasonic's input devices are being used for radio, navigation, steering wheels and where a human-machine-interface is required.

ELECTRIFICATION
> Power Electronics
> Battery Management

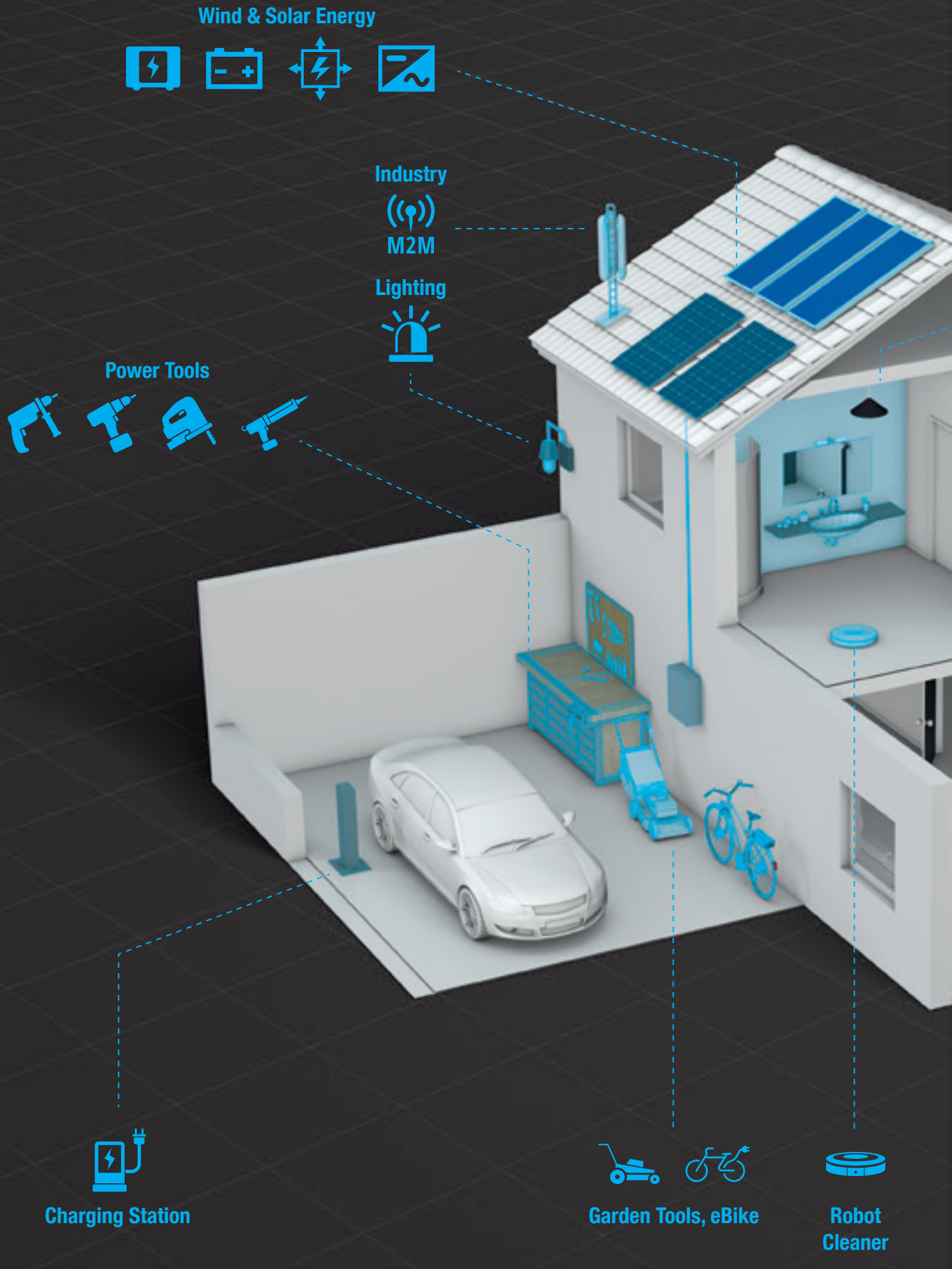
CHASSIS & SAFETY SYSTEMS
> Active & Passive Safety
> ADAS (Advanced Driver Assistance Systems)
> Headlight

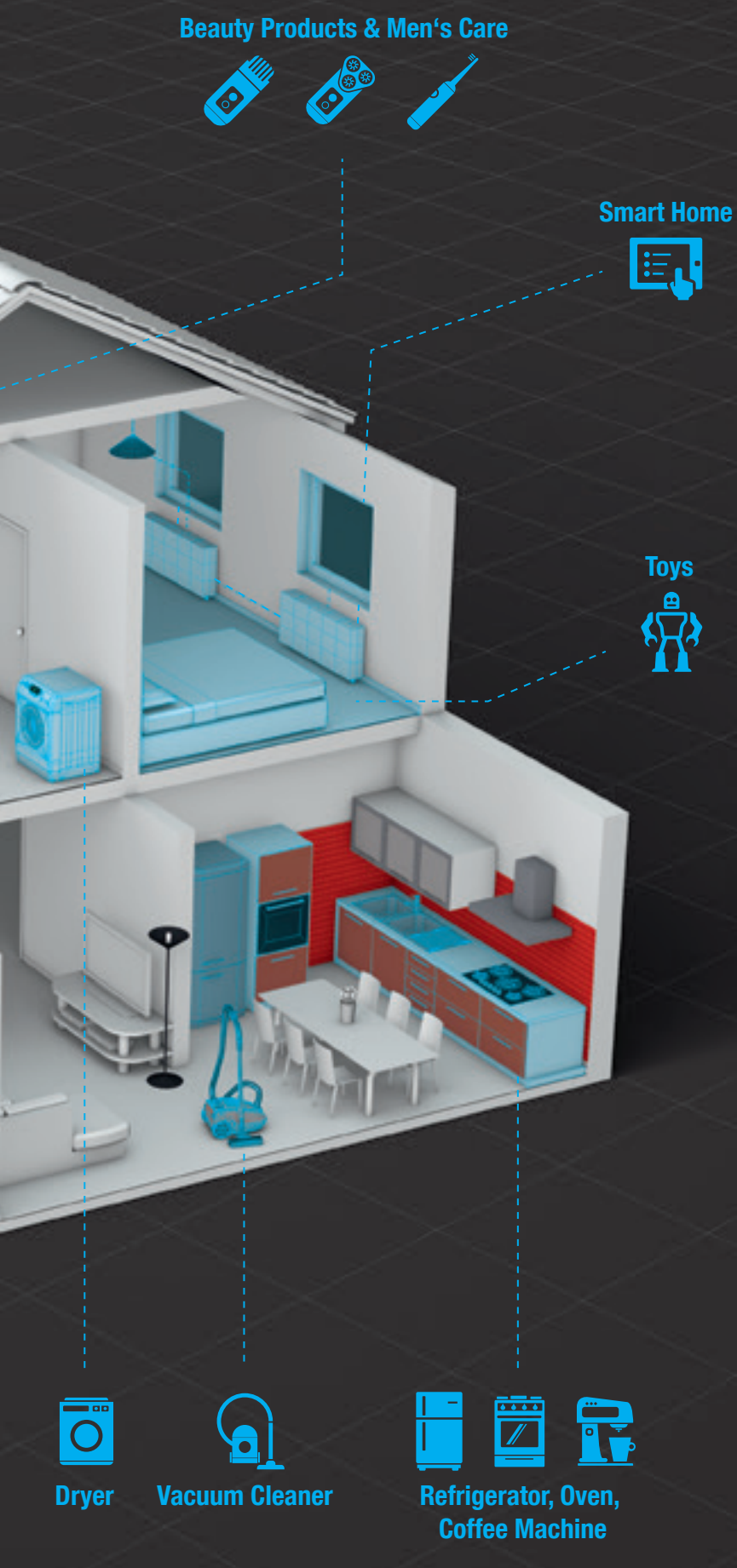
INTERIOR & HMI
> Instrumentation & HMI
> Infotainment & Connectivity
> Body & Security

Details in the matrix on the pages 8/9



Watch the Panasonic
Automotive Solutions Video


Wind & Solar Energy
Industry
M2M
Lighting
Power Tools
Charging Station
Garden Tools, eBike
Robot Cleaner



HOME SOLUTIONS

Looking into the Smart Home, Panasonic contributes to the fields of energy creation, storage and distribution.

Starting from solar and wind energy, we deliver passive components, semiconductors and thermal solutions from the source of creation to the energy storage within the house. Modern Smart Homes use our devices in areas such as home appliances, storage solutions, personal health care and kitchen appliances. Whilst in Power Tools, Electronic Toys and gadgets you can utilize our sensors, input devices and power supplies. Wireless connectivity solutions from Panasonic enables communication between various applications, giving life to the internet of things.

RENEWABLE ENERGY
> Wind, Solar

MOBILITY
> eBike
> Charging Station

APPLIANCE
> Home Appliance
> Personal, Healthcare and Toys
> Power Tools

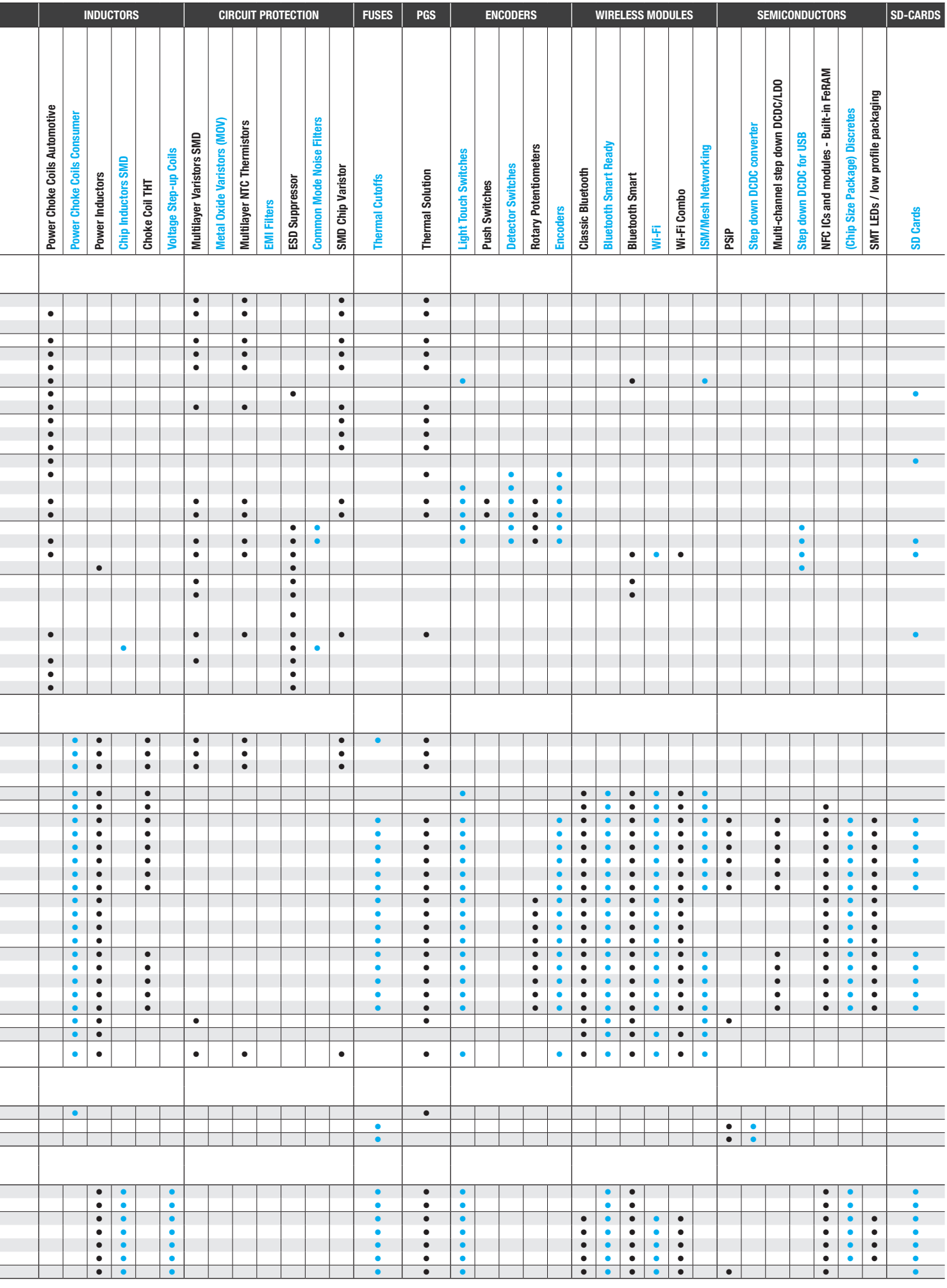
LIGHTING
> Lighting

INTERNET OF THINGS
> Industry 4.0
> Smart Home

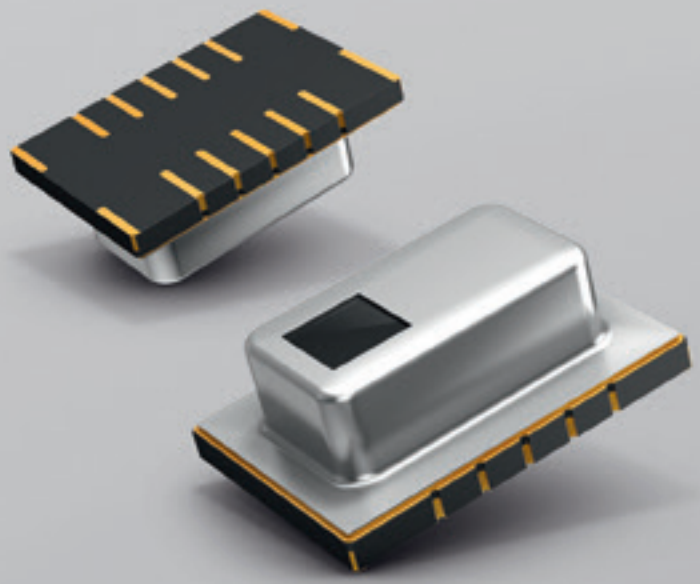
Details in the matrix on the pages 8/9

APPLICATIONS MATRIX

			SENSORS							CAPACITORS							RESISTORS								
			Grid-EYE	MA Motion Proximity Switch	Pressure Sensors	Pressure Sensors w/ built-in amplifier	Ambient Light Sensors (NaPiCa)	Acceleration Sensors	1-axis Accelerometer	Aluminium Electrolytic	Electric Double Layer	Film	Polymer Aluminium SP-CAP	Conductive Polymer Hybrid	Polymer Aluminium OSCON	Polymer Aluminium POSCAP	Shunt Resistors	Thin Film Resistors	High Power & Pulse Proof Resistors	Thick Film Resistors	Anti-Sulfurated Resistors	Network & Array Resistors	Metal (Oxide) Film Resistors Radial	Trimmer Potentiometers SMD	
AUTOMOTIVE																									
Electrification	Power Electronics	Inverter								●		●		●			●	●	●		●	●			
		DCDC Converter								●		●		●			●	●	●		●	●			
		Charger (AC/DC, Bidirectional)								●		●		●											
	Battery Management	Battery Module								●	●			●			●	●	●		●	●			
Chassis & Safety Systems	Active & Passive Safety	Brake Systems, ABS, ESP								●				●			●	●	●		●	●			
		Airbags, Restraint Systems								●				●			●	●	●		●	●			
		Remote Keyless Entry (RKE)											●	●			●			●		●			
	ADAS	Camera System	●							●			●	●	●	●	●	●	●		●	●			
		Radar System								●				●	●	●	●	●	●		●	●			
	Headlight	LED						●	●					●			●		●			●			
		Xenon						●	●					●			●		●			●			
		Laser						●	●					●			●		●			●			
Interior & HMI	Instrumentation & HMI	Displays								●			●	●	●	●	●		●			●			
		Head-Up- Displays								●			●	●	●	●	●		●			●			
		Steering Wheel								●				●								●			
		HVAC	●											●			●		●			●			
		ICP (Integrated Control Panel)								●				●	●	●	●		●			●			
	Infotaiment & Connectivity	Radio								●	●	●	●	●	●	●						●			
		Multimedia								●	●	●	●	●	●	●	●	●	●		●	●			
		Connectivity, Telematics, eCall						●		●	●	●	●	●	●	●	●	●	●		●	●			
		Electric Toll Collection (ETC)								●	●	●	●	●	●	●	●	●	●		●	●			
	Body & Security	Access & Door Control								●	●			●			●	●	●		●	●			
		Seat Comfort								●				●			●	●	●		●	●			
		Tire pressure monitoring systems (TPMS)								●				●			●	●	●		●	●			
		Energy Management								●				●			●	●	●		●	●			
		Antenna Modules								●			●	●	●	●	●	●	●		●	●			
		Driver Monitoring with Camera	●							●			●	●	●	●	●	●	●		●	●			
		Car Alarm						●		●			●	●	●	●	●	●	●		●	●			
		Black Box								●				●			●	●	●		●	●			
HOME																									
Renewable Energy	Wind, Wind Turbine, Solar	Generation						●				●					●		●		●	●	●		
		Storage									●						●		●		●	●	●		
		Distribution										●					●		●		●	●	●		
		Inverter								●		●	●	●	●							●			
Mobility	eBike	eBike								●				●			●		●		●	●			
	Charging Station	Charging Station								●		●		●			●		●		●	●			
Appliance	Home Appliance	Coffee Machine	●		●	●				●	●	●		●			●		●		●	●	●	●	
		Fridge-Freezers	●		●	●				●	●	●		●			●		●		●	●	●	●	
		Oven, Microwaves	●		●	●				●	●	●		●			●		●		●	●	●	●	
		Vacuum & Robot Cleaner	●		●	●				●	●	●		●			●		●		●	●	●	●	
		Dryer	●		●	●				●	●	●		●			●		●		●	●	●	●	
		Laundy & Irons	●		●	●				●	●	●		●			●		●		●	●	●	●	
	Personal, Health Care & Toys	Men's Grooming	●	●	●	●				●	●		●	●	●	●	●		●		●	●		●	
		Beauty Products	●	●	●	●				●	●		●	●	●	●	●		●		●	●		●	
		Oral Care	●	●	●	●				●	●		●	●	●	●	●		●		●	●		●	
		Toys	●	●	●	●				●	●		●	●	●	●	●		●		●	●		●	
	Power Tools	Drilling								●				●	●	●	●		●		●	●		●	
		Screwer								●				●	●	●	●		●		●	●		●	
		Jig saw								●				●	●	●	●		●		●	●		●	
		Garden Tools								●				●	●	●	●		●		●	●		●	
		Sealing gun								●				●	●	●	●		●		●	●		●	
Lighting	Lighting	Emergency Lighting	●	●			●			●	●						●	●	●		●	●	●		
Internet of Things	Industry 4.0	M2M Communication								●	●		●	●	●	●	●	●	●			●			
	Smart Home	Control of Lighting, Heating, Shutter								●			●	●	●	●	●	●	●			●	●		
INFRASTRUCTURE																									
Mobility	Train	Inverter		●								●			●		●	●	●			●	●		
Information	Data Server, Server	Power Supply								●			●	●	●	●						●			
Communication	BTS (Base Tranceiver Station)	Power Supply								●			●	●	●	●						●			
HEALTHCARE																									
Healthcare	Wearables	Sleep Monitor											●			●	●	●		●		●			
		Fitness Tracker											●			●	●	●		●		●			
	Home, Personal MHC Tracking	Scale			●	●							●			●	●	●		●		●		●	
		Thermometer			●	●							●			●	●	●		●		●		●	
		Blood Pressure			●	●							●			●	●	●		●		●		●	
		Blood Sugar			●	●							●			●	●	●		●		●		●	
	Sports Activity	Fitness machines		●									●	●		●	●	●		●		●		●	


INDUCTORS
CIRCUIT PROTECTION
FUSES
PGS
ENCODERS
WIRELESS MODULES
SEMICONDUCTORS
SD-CARDS
Power Choke Coils Automotive
Power Choke Coils Consumer
Power Inductors
Chip Inductors SMD
Choke Coil THT
Voltage Step-up Coils
Multilayer Varistors SMD
Metal Oxide Varistors (MOV)
Multilayer NTC Thermistors
EMI Filters
ESD Suppressor
Common Mode Noise Filters
SMD Chip Varistor
Thermal Cutoffs
Thermal Solution
Light Touch Switches
Push Switches
Detector Switches
Rotary Potentiometers
Encoders
Classic Bluetooth
Bluetooth Smart Ready
Bluetooth Smart
Wi-Fi
Wi-Fi Combo
ISM/Mesh Networking
PSiP
Step down DCDC converter
Multi-channel step down DCDC/LDO
Step down DCDC for USB
NFC ICs and modules - Built-in FeRAM
(Chip Size Package) Discretes
SMT LEDs / low profile packaging
SD Cards

WIDE RANGE OF MEMS AND OPTICAL SENSOR TECHNOLOGIES



SENSORS

> High Precision
> High Reliability
> Compact Size
> Energy Saving
> Environmental Friendly

Grid-Eye
State-of-the-art IR temperature sensor featuring 64 thermopile elements in an 8 x 8 grid

MA Motion Proximity Switch
Compact, easy to use proximity switch

Pressure Sensors
High-precision, miniature sensors that cover low to high pressures

Pressure Sensors with built-in amplifier
Contains built-in amplification and temperature compensation circuit

Ambient Light Sensors (NaPiCa)
Visible light detection with proportional current output

Acceleration Sensor
Capacitive MEMS acceleration sensors

GRID-EYE

1ST SMD THERMOPILE ARRAY SENSOR

Grid-EYE features 64 thermopile elements in an 8x8 grid format that detect absolute temperatures by infrared radiation. Grid-EYE is able to measure actual temperature and temperature gradients, providing thermal images. It is easily possible to detect multiple persons, identify positions and direction of movement, almost independent of ambient light conditions without disturbing privacy as with conventional cameras.
Cost-effective and compact solutions for contactless temperature measurement across the entire specified area can be and with very accurate results. The built-in silicon lens provides a viewing angle of 60°.
The measurement values can be read out via I²C interface in 1 or 10 frames per second. The interrupt signal output delivers a quick response to time-critical events, offering a high degree of flexibility.

Compared to single element thermopile sensors and pyro-electric detectors, Grid-EYE sensors offers extended possibilities for detecting persons and objects, enabling advanced Applications.

Grid-EYE – Infrared Array Sensor

Series / Type		Number of pixels	Operating voltage	P/N	Part. No.
Infrared Array Sensor Grid-EYE		64 (vertical 8 x horizontal 8)	3.3VDC	High gain	AMG8831
				Low gain	AMG8832
			5.0VDC	High gain	AMG8851
				Low gain	AMG8852

Detection / Type	Moving object	Motionless object	Moving direction	Temperature measuring	Thermal image
Pyroelectric	✔	✘	✘	✘	✘
Thermopile (single element)	✔	✔	✘	✔	✘
	⬇	⬇	⬇	⬇	⬇
Grid-EYE	✔	✔	✔	✔	✔

FEATURES

> Dimensions: 11.6 x 4.3 x 8.0mm (L x H x W)
> Operating voltage: 3.3V or 5.0V (depends on P/N)
> Current consumption: Typ. 4.5mA (normal mode); 0.8mA (stand-by mode), 0.2mA (sleep mode)
> Temperature range of measuring object: With amplification factor high gain: 0°C to 80°C, with low gain: -20°C to 100°C
> Field of view: 60° (vertical and horizontal)
> Number of pixels: 64 (vertical 8 x horizontal 8)
> External interface: I²C (fast mode)
> Frame rate: 1 or 10 frames/s
> Typical absolute temperature accuracy: Typ. ±2.5°C (depends on P/N)

„MA Motion“ Proximity Switch

Series / Type	Available Detection Range *2	Operating Voltage	Mounting Holes	Output	Circuit for „Plug and Play“ or adjacent use *1	Part No. *2
 Thin short type (Dimensions excl. mounting holes: W 11m x H 20mm x D 12.7mm)	5cm 10cm 15cm	4.5 to 5.5V	V-Type	NPN open collector output	Built-in oscillator – „Plug and Play“	AMA1459xx
					External triggering type	AMA1159xx
				PNP open collector output	Built-in oscillator – „Plug and Play“	AMA1469xx
					External triggering type	AMA1169xx
 Short type (Dimensions excl. mounting holes: W 11mm x H 20mm x D 19.5mm)	5-10cm (1cm steps)	4.5 to 5.5V	H-Type	NPN open collector output	Built-in oscillator – „Plug and Play“	AMBA1409xx
					External triggering type	AMBA1109xx
		5.5 to 27V			Built-in oscillator – „Plug and Play“	AMBA1402xx
					External triggering type	AMBA1102xx
 Middle type (Dimensions excl. mounting holes: W 14mm x H 31.2mm x D 23.1mm)	20-80cm (10cm steps)	4.5 to 5.5V	H-Type	NPN open collector output	Built-in oscillator – „Plug and Play“	AMBA2409xx
					External triggering type	AMBA2109xx
		5.5 to 27V			Built-in oscillator – „Plug and Play“	AMBA2402xx
					External triggering type	AMBA2102xx
 Long type (Dimensions excl. mounting holes: W 20mm x H 46mm x D 29.7mm) H-Type	30-200cm (10cm steps)	4.5 to 5.5V	H-Type	NPN open collector output	Built-in oscillator – „Plug and Play“	AMBA3409xx
					External triggering type	AMBA3109xx
			V-Type		Built-in oscillator – „Plug and Play“	AMBA3549xx
					External triggering type	AMBA3159xx
 V-Type		5.5 to 27V	H-Type		Built-in oscillator – „Plug and Play“	AMBA3402xx
					External triggering type	AMBA3102xx
			V-Type		Built-in oscillator – „Plug and Play“	AMBA3452xx
					External triggering type	AMBA3152xx

*1: If you plan to use multiple sensors side-by-side, or you wish to keep the current consumption small, inquire for details about external trigger type, which is suitable for such applications.
*2: Please see datasheet for part numbers depending on detection range

FEATURES

> Thin design with only 1.2mm thickness available (AMA type)
> „Plug and Play“ type with built-in oscillator – only connect DC power supply
> „External trigger type“ for adjacent (side –by-side) use without interference or energy saving
> Detection range available from 5cm to 200cm
> Detection almost unaffected by object, color and material
> Good performance even when detection surface is dirty

PS/PF Gauge Pressure Sensors

Series / Type	Rated Pressure	Drive Current	Bridge Resistance	Temp. Compensation Range	Offset Voltage	Output Span Voltage	Linearity	Pressure Hysteresis	Offset Voltage-Temperature Characteristics*2	Sensitivity-Temperature Characteristics*2	Packaging Size	Part No.
 Gauge Pressure	4.9kPa	1.5mA	5kΩ	0-50°C	±20mV	40±20mV	±0.7%FS	±0.6%FS	±15%FS	±10%FS	PF/PS	ADPxx01x
	34.3kPa			0-50°C	±20mV	100±40mV	±0.3%FS	±0.2%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx21x
	49.0kPa			0-50°C	±20mV	100±40mV	±0.3%FS	±0.2%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx31x
	98.1kPa			0-50°C	±20mV	100±40mV	±0.3%FS	±0.2%FS	±5.0%FS	±2.5%FS	PF	ADP1x41
	196.1kPa			0-50°C	±20mV	100±40mV	±0.3%FS	±0.2%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx51x
	343.2kPa			0-50°C	±20mV	100±40mV	±0.3%FS	±0.2%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx61x
	490.3kPa			0-50°C	±20mV	100±40mV	±0.5%FS	±0.4%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx71x
	833.6kPa			0-50°C	±20mV	100±40mV	±0.6%FS	±0.4%FS	±5.0%FS	±2.5%FS	PF/PS	ADPxx71x
	980.7kPa			0-50°C	±20mV	100±40mV	±0.6%FS	±0.4%FS	±5.0%FS	±2.5%FS	PF	ADP1x91
	98.1kPa	1.0mA	5/3.3kΩ	0-60°C	±20mV	65±25mV	±1.0%FS	±1.0%FS	±3.5%FS	±2.5%FS	PS	ADP4x41x
	980.7kPa	1.0mA	5/3.3kΩ	0-60°C	±20mV	65±25mV	±1.0%FS	±1.0%FS	±3.5%FS	±2.5%FS	PS	ADP4x91x
Gauge Pressure (economy type)	40.0kPa	1.5mA	3.3kΩ	5-45°C	±15mV	43.5±22.5mV	±0.3%FS	±0.7%FS	±10%FS	±1.3%FS	PF/PS	APDxxA23

Medium: Air*1
DIP Terminal Type: Standard/Reversed

Unless otherwise specified, measurements were taken with a drive current of ±0.01mA and humidity ranging from 25% to 85%.
*1. Please consult us if a pressure medium other than air is to be used.
*2. This is the regulation which applies within the compensation temperature range.
Please consult us if the intended use involves a negative pressure
Dimensions:
PF Type (W 10mm x L 8.6mm x H 9.9mm)
PS Type (W 7.2mm x L 7.2mm x H 8.5mm)

FEATURES

PS / PF SERIES – HIGH PRECISION GAUGE AIR PRESSURE SENSORS

> High level of accuracy and linearity
> Miniature “PS” package
> Wide lineup
> Pressure ranges from 4.9kPa to 980kPa
> 5kΩ and 3.3kΩ bridge resistance available
> Standard / reversed DIP packages
> Economy type for consumer applications

Gauge Pressure sensors with built-in amplifier

Series / Type	Pressure Sensors with Amplifier	Pressure	Drive Voltage	Current Consumption	Offset Voltage *2,3	Span Voltage *2,3	Overall Accuracy *3,4	Temperature Compensation Range	Port Type*5	Part No. *5
 Gauge pressue	Standard Type	±100kPa	5V±0.25V	max. 10mA	2.5V ± 0.05V	4.0V (Typical)	**±1.25%FS**	0 to 50°C	S/M	ADP510x
		–100kPa			0.5V ± 0.05V					ADP511x
		25kPa								ADP512x
		50kPa								ADP513x
		100kPa								ADP514x
		200kPa								ADP515x
		500kPa								ADP516x
		1,000kPa								ADP517x
	Low Pressure Type	6kPa	5V±0.25V	max. 10mA	0.5V (Typical)	4.0V (Typical)	±2.5%FS	0 to 70°C	M/L/P	APD5B6x
	Economy Type	40kPa	3V±0.15V	max. 3mA	0.3V±0.09V *2,3.1	2.4±0.03V *2,3.1	±4.0%FS (Offset); 1,3% FS (Senitivity)	5 to 45°C	M	ADP51A11

Medium: Air*1
Terminal Type: DIP

*1. Please consult us for pressure media other than air.
*2. Indicates output when temperature is 25°C (77°F).
*3. Indicates output when drive voltage is 5V (3V for economy type).
Although output fluctuates due to fluctuations in the drive voltage, this is not included.
*4. Overall accuracy indicates the accuracy of the offset voltage and rated output voltage at the specified temperature compensation range
*5 Port Types

0: S Package
length: 3mm, diameter: 3mm
1: M Package
length: 5mm, diameter: 3mm
2: L Package (Only low pressure type)
length: 13.5mm diameter: 5.45mm
3: P Package (Only low pressure type)
length: 15.6mm , diameter: 5.45mm

FEATURES

PS-A SERIES – GAUGE AIR PRESSURE SENSORS WITH INTEGRATED CIRCUIT

> Built in Amplifier and temperature compensation circuit
> High accuracy and reliability
> Overall accuracy up to 1.25% of FS (standard type)
> Wide lineup
> Pressure ranges from -100kPa to +1000kPa
> Standard / reversed DIP packages
> Economy type for consumer applications

NaPiCa ambient light sensor

Series / Type	Photo current *1	Reverse Voltage	Photocurrent	Power Dissipation	Operating Temperature	Dark Current	Packaging	Part No.
 NaPiCa	260µA	1.5 to 6V	5mA	40mW	-30 to +85°C	max 0.3µA	Baggage package	AMS302
							Tape and reel	AMS302T

*1 Ev = 100 lx (Ev: Brightness, Fluorescent lamp is used as light source), V = 5V
Tape and reel package Through-hole type: Carton: 2,000pcs.; Case: 2,000pcs.
Baggage package Through-hole type: Carton: 500pcs.; Case: 1,000pcs.

FEATURES

> Linear output: Photocurrent is proportional to illumination
> Easy measurement of ambient light level similar to the human eye
> Cadmium free and RoHS compliant – replacement of CdS cells
> Integrated amplifier for schrieblesque high output current

Acceleration Sensors GS1 / GS2 (High-precision MEMS 2-axis acceleration sensor)

Series / Type		Operation Power Supply Voltage	Current Consumption	Acceleration Detection Range	Detection Sensitivity	Temperature Sensitivity	Offset Voltage	Offset Voltage Temperature Characteristics	Non-Linearity	Shock	Part No.
	1-axis Acceleration sensor GS1	5V DC	5mA (typ.)	±2g	1V/g	±4%	2.5±0.1V	±70mg	±1%	max. 5000g	AGS11151
			5mA (typ.)	±1.5g	1.333V/g	±4%	2.5±0.1V	±70mg	±1%	max. 5000g	AGS11351
	2-axis Acceleration sensor GS2	5V DC	2mA (typ.)	±2g	1V/g	±2%	2.5±0.06V	±55mg	±1%	max. 5000g	AGS21151
			2mA (typ.)	±1.5g	1.333V/g	±2%	2.5±0.08V	±55mg	±1%	max. 5000g	AGS21351
		3V DC	1.8mA (typ.)	±2g	0.6V/g	±2%	1.5±0.036V	±55mg	±1%	max. 5000g	AGS21631
			1.8mA (typ.)	±1.5g	0.8V/g	±2%	1.5±0.048V	±55mg	±1%	max. 5000g	AGS21831

Operating temperature: -40 to 85°C
Cross Axis sensitivity: ±5%

FEATURES

> High precision and high reliability:
  Offset temperature characteristics ±47mg (GS1) and ±38mg (GS2) (Typical values)
> High sensitivity: 1 to 1.333V/g (VDD=5V)

1-axis Accelerometer GF1 (Electrostatic capacitance detection sensor)

Series / Type		Operation Power Supply Voltage	Acceleration Detection Range	Detection Sensitivity	Current Consumption	Offset Voltage	Offset Voltage Temperature Characteristics	Non-Linearity	Shock	Installation Type	Part No.
	1-axis accelerometer GF1 Bracket	5V DC	±11.76m/s2 (±1.2g)	1.333V/g	10mA	2.5±0.1V	±70mg	±1%	max. 5000g	Bracket	AGF11311
	1-axis accelerometer GF1 Direct Mount	5V DC	±4.9m/s2 (±0.5g)	3.0V/g	10mA	2.5±0.1V	±70mg	±1%	max. 5000g	Direct mount	AGF10711
		12V DC	±11.76m/s2 (±1.2g)	1.333V/g	15mA	2.5±0.1V	±70mg	±1%	max. 5000g	Direct mount	AGF10321
			±4.9m/s2 (±0.5g)	3.0V/g	15mA	2.5±0.1V	±70mg	±1%	max. 5000g	Direct mount	AGF10721
		24V DC	±11.76m/s2 (±1.2g)	1.333V/g	15mA	2.5±0.1V	±70mg	±1%	max. 5000g	Direct mount	AGF10331
			±4.9m/s2 (±0.5g)	3.0V/g	15mA	2.5±0.1V	±70mg	±1%	max. 5000g	Direct mount	AGF10731

Operating temperature: -30 to 85°C
Temperature sensitivity: ±3%
Cross Axis sensitivity: ±5%

FEATURES

> IP67 Water and dust protected package
> High reliability: Superior offset voltage temperature characteristics (33mg (typ.))
> Fast response: 15ms (typ.)
> Compact size: 58×36.5×33mm (without bracket)

CAPACITORS FOR DEMANDING APPLICATIONS

Aluminium Electrolytic Capacitor
Capacitors with a liquid electrolyte using an AL oxide film as dielectric – available in Surface Mount and Leaded Radial Technology.

Electric Double Layer Capacitor (Gold Cap)
Unlike batteries, Gold Caps do not rely on a chemical reaction to produce electric current. Rather they are storage cells that utilize the absorption/release reaction of ions.

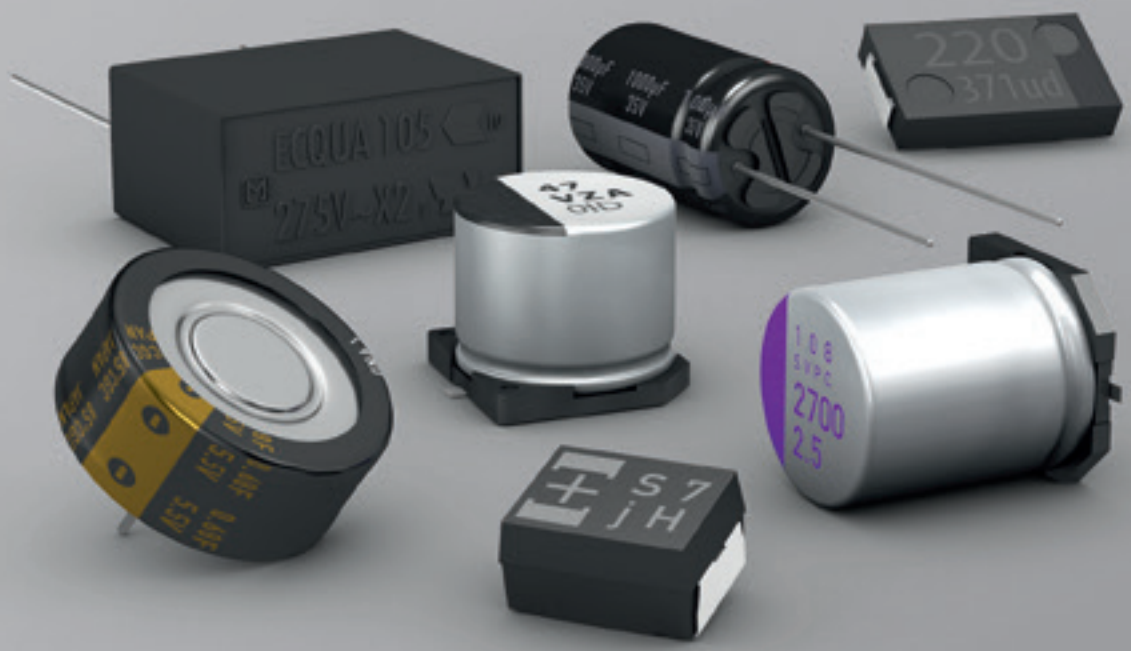
Film Capacitor
Electrical capacitors using a thin insulating plastic film as dielectric.

Polymer Capacitor (SP-CAP, POSCAP, OS-CON)
Using solid polymer electrolyte instead of liquid electrolyte achieving low ESR values and excellent performance over a wide frequency range.

Conductive Polymer Hybrid
Using best of two worlds combining the low leakage of Aluminium Electrolytic and low ESR of the Polymer technology.

CAPACITORS

> Wide range of Capacitance Values
> Very low ESR Types
> High Ripple Currents
> Up to 10,000h endurance
> Temperatures up to +135°C
> Compact Size
> AEC-Q200 qualified Series
> Alternatives to MLCC and Tantalum



Aluminum Electrolytic Capacitors – Surface Mount Type

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	AEC-Q200	Part No.
	Type V - Series S High temp. reflow	-40 to +85°C	2,000h	6.3 to 50V	1 to 1,500µF	5.5mm height Dia. ≤ 6.3mm	qualified*	EEExxAxxxxAx
	Type V - Series S			4 to 100V	1 to 1,500µF			EEExxAxxxNx EEExxAxxxSx EEExxSxxxSx
	Type V - Series HA High temp. reflow	-40 to +105°C	1,000h	6.3 to 50V	1 to 1,500µF	5.5mm height	qualified*	EEEHAxxxxxAx
	Type V - Series HA			6.3 to 100V				EEEHAxxxxxP EEEHAxxxxxR
	Type V - Series HB High temp. reflow		2,000h	6.3 to 50V		6.1mm height Dia. ≤ 6.3mm	qualified*	EEEHBxxxxxAx
	Type V - Series HB			4 to 50V	1 to 470µF			EEEHBxxxxxP EEEHBxxxxxR EEEHBxxxxxSx
	Type V - Series HC		3,000h	6.3 to 50V	1 to 1,000µF	Dia. 8-10 / 5,000h	qualified*	EEEHCxxxxxxx
	Type V - Series HD High temp. reflow		5,000h	6.3 to 100V	1 to 1,000µF	Long life	qualified*	EEEHDxxxxxx EEEHDxxxxxAx
	Type V - Series HD High temp. reflow Medium-size	-55 to +105°C		6.3 to 35V	680 to 7,500µF			EEEHDxxxxxAM EEEHDxxxxxAQ
	Type V - Series FC High temp. reflow	-40 to +105°C	1,000h	6.3 to 35V	1 to 1,500µF	Low impedance (50% less than HA series)	qualified*	EEEFCxxxxxAx
	Type V - Series FC			6.3 to 50V				EEEFCxxxxxP EEEFCxxxxxR
	Type V - Series FK High temp. reflow	-55 to +105°C	2,000h	6.3 to 35V	4.7 to 1,500µF	Low impedance	qualified*	EEEFKxxxxxAP EEEFKxxxxxAR
	Type V - Series FK High temp. reflow Medium-size		5,000h	6.3 to 100V	47 to 6,800µF	105°C / 5,000h	qualified*	EEEFKxxxxxAM EEEFKxxxxxAQ
	Type V - Series FK		2,000 to 5,000h		3.3 to 6,800µF	Low impedance (40% to 60% less than FC series)	qualified*	EEEFKxxxxxxR EEEFKxxxxxxP EEVFKxxxxxM EEVFKxxxxxQ
	Type V - Series FP High temp. reflow		2,000h	6.3 to 50V	10 to 1,800µF	Low ESR (30% to 50% less than FK series)	qualified*	EEEFPxxxxxxx
	Type V - Series FT High temp. reflow			6.3 to 50V	10 to 2,200µF	Low impedance miniaturized	qualified*	EEEFTxxxxxAP EEEFTxxxxxAR
	Type V - Series TG	-40 to +125°C	1,000h 2,000h	10 to 100V	10 to 4,700µF	40% smaller than TA series	qualified*	EEETGxxxxxxx EEVTGxxxxxxx
	Type V - Series TK High temp. reflow Medium-size		2,000h		47 to 4,700µF	125°C / 2,000h	qualified*	EEETKxxxxxAx
	Type V - Series TK		3,000h	10 to 35V	47 to 470µF	Low ESR at -40°C (50% lower than TG series)	qualified*	EEETKxxxxxP EEETKxxxxxUP
	Type V - Series TP High temp. reflow		3,000h (D8: 2,000h)			Low ESR	qualified*	EEETPxxxxxAx
	Type V - Series TQ High temp. reflow		2,000h	35V	47 to 100µF	Low ESR, 1 size smaller than TK-series	qualified*	EEETQxxxxxxxx
	Type V - Series EB	-25 to +105°C	3,000 to 5,000h	160 to 450V	2.2 to 100µF	Dia, 10 to 18mm		EEVEBxxxxxxx

Vibration-proof product is available upon request (≥ Ø 8mm diameter).
* The series qualify for AEC-Q200, but may have some deviations.

Aluminum Electrolytic Capacitors – Radial Lead Type

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	AEC-Q200	Part No.
	Type A - Series FC	-55 to +105°C	1,000 to 5,000h	6.3 to 100V	2.2 to 15,000µF	Low impedance	qualified*	EEAFCxxxxxxx EEUFCxxxxxxx
	Type A - Series FK		3,000 to 5,000h	6.3 to 35V	180 to 12,000µF	Low impedance (10 to 30% less than FC series)	qualified*	EEUFKxxxxxxx
	Type A - Series FM	-40 to +105°C	2,000 to 7,000h	6.3 to 50V	22 to 6,800µF	Low Impedance		EEUFMxxxxxxx
	Type A - Series FR		5,000 to 10,000h	6.3 to 63V	4.7 to 8,200µF	Low ESR		EEUFRxxxxxx
	Type A - Series ED	-25 to +105°C	8,000 to 10,000h	160 to 450V	10 to 330µF	High ripple current (at high frequency)		EEUEDxxxxxxx
	Type A - Series EB	-40 to +105°C	5,000 to 10,000h	10 to 63V	0,47 to 3,300µF	Long life Low profile		EEUEBxxxxxxx
	Type A - Series EE	-25 to +105°C	8,000 to 10,000h	160 to 450V	10 to 330µF	High ripple		EEUEExxxxxxx
	Type A - Series TA	-40 to +125°C	2,000h	10 to 63V	2.2 to 4,700µF	High ripple	qualified*	EEUTAxxxxxxx
	Type A - Series TP	-40 to +135°C	1,000 to 5,000h	25 to 35V	100 to 5,100µF	High Ripple (20 to 40% higher than TA series)	qualified*	EEUTPxxxxxxx
	Type A - Series NHG	-55 (-25) to +105°C	1,000 to 2,000h	6.3 to 450V	1 to 22,000µF	+105°C 1000h; 2000h	qualified*	ECAxxHGxxxxx
	Type A - Series HD	-55 to +105°C	1,000 to 2,000h	10 to 50V	2.2 to 22,000µF	miniaturized (1 case smaller to NHG series)	qualified*	EEUHDxxxxxxx
	Type A - Series GA	-55 to +105°C	1,000h	10 to 50V	1.5 to 220µF	7mm height		EEAGAxxxxxxx
	Type A - Series GA Bi-polar	-40 to +105°C	1,000 to 2,000h	6.3 to 50V	1.5 to 330µF	Bi-polar		ECAxxENxxxxx
	Type A - Series M	-40 (-25) to +85°C	2,000h	6.3 to 450V	1 to 22,000µF	Smaller than SU series		ECAxxMxxxxx
	Type A - Series SU Bi-polar	-40 to +85°C		6.3 to 50V	2.2 to 6,800µF	Bi-polar		ECEAxxNxxxxx
	Type A - Series KA		1,000h	4 to 50V	2.2 to 470µF	7mm height		ECEAxxKAxxxx
	Type A - Series KA Bi-polar				2.2 to 100µF			ECEAxxKNxxxx
	Type A - Series KS				2.2 to 330µF	5mm height		ECEAxxKSxxxx
	Type A - Series KS Bi-polar			6.3 to 50V	2.2 to 47µF			ECEAxxSNxxxx

* The series qualify for AEC-Q200, but may have some deviations.

Electric Double Layer Capacitors – Radial Lead Type

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	Part No.
	Series HZ	-25 to +70°C	1,000h	2.5V	3.3 to 10F	Miniaturized	EECHZxxxxxx
	Series HW	-25 to +60 (+70)°C		2.1V 2.3V	22 to 70F	Large Capacitance	EECHWxxxxxxx

Electric Double Layer Capacitors – Stacked Coin Type

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	Part No.
	Series SD	-25 to +70°C	1,000h	5.5V	0.22 to 0.33F	Tabbed lead terminals	EECS0HDxxxxx
		-40 to +70°C					EECS0HDxxxxxN UPGRADE
	Series SG	-25 to +70°C			0.47 to 1.5F		EECS5R5xxxx
		-40 to +70°C					EECS5R5xxxxN UPGRADE
	Series SE	-25 to +70°C			0.22F	5mm pitch lead taping	EECSE0Hxxxxx
		-40 to +70°C					EECSE0HxxxxxN UPGRADE
	Series NF	-25 to +70°C			0.22 to 1.5F	Flat type	EECF5R5Uxxxx
		-40 to +70°C					EECF5R5UxxxxN UPGRADE
	Series F	-25 to +85°C			0.1 to 1.5F	85°C Flat type	EECF5R5Hxxxx
		-40 to +85°C					EECF5R5HxxxxN UPGRADE
	Series RG	-25 to +85°C	2,000h	3.6V	0.22 to 1.0F	2,000h at 85°C	EECRGxxxxxx
		-40 to +85°C					EECRGxxxxxxN UPGRADE
	Series RF	-25 to +85°C		5.5V	0.1 to 0.68F		EECRFxxxxxx
		-40 to +85°C					EECRFxxxxxxN UPGRADE

Film Capacitors – Surface Mount Type

Series / Type		Temperture	Rated W.V.	Capacity	Features	Dielectric material	Part No.
	Series ECHU(X)	-55 to +125°C	16VDC 50VDC	0.00010 to 0.22µF	Tight capacitance tolerance	PPS	ECHUxxxxxxX5 ECHUxxxxxxX9
	Series ECHU(C)	-55 to +105°C	100VDC	0.010 to 0.22µF			ECHUxxxxxxC9
	Series ECWU(X)			0.0010 to 0.010µF	Small type	PEN	ECWUxxxxxX5
	Series ECWU(C)	-55 to +125°C	100VDC 250VDC 630VDC	0.0010 to 1.0µF	Wide rated voltage range		ECWUxxxxxCx
	Series ECWU(V16)	-55 to +85°C	250VDC	0.001 to 0.12µF	For xDSL DC-blocking		ECWU2xxxV16
	Series ECPU(A)	-40 to +85°C	16VDC	0.10 to 1.0µF	High volumetric efficiency	Plastic resin	ECPUxxxxxMA5

Film Capacitors – Radial Lead Type

Series / Type	Temperature	Rated W.V.	Capacity	Features	Dielectric material	Part No.
 Series EZPE UPGRADE	-40 to +85°C	500VDC 800VDC 1,100VDC 1,300VDC	10 to 110μF	High safety Self-healing Self-protecting	PP	EZPExxxxxxTA
		450VDC 525VDC	66uF, 29uF	High safety Self-healing Self-protecting low profile		EZPExxxxxxTx
 Series ECQE(F)	-40 to +105°C 100 to 1250VDC -40 to +85°C 125, 250VAC	100 to 1,250VDC 125, 250VAC	0.0010 to 10μF	Wide rated voltage range	PET	ECQExxxxxxF ECQExxxxxF
 Series ECQE(B)	-40 to +105°C 250VDC -40 to +85°C 125VAC	250VDC 125VAC	0.010 to 4.7μF	Small type		ECQExxxxxxB ECQExxxxxB
Series ECQE(T)	-40 to +105°C 250 to 630VDC -40 to +85°C 125, 250VAC	250 to 630VDC 125VAC 250VAC	0.010 to 10μF	Wide rated voltage range		ECQExxxxxxT ECQExxxxxT
Series ECWF(L)	-40 to +105°C	400VDC 450VDC 630VDC	0.010 to 2.4μF	High frequency	PP	ECWFxxxxxL
Series ECWF(A)		250VDC 450VDC 630VDC	0.10 to 6.8μF	Miniaturization of ECWF(L)		ECWFxxxxxxA
Series ECWFD		450VDC	0.47 to 2.2μF	Low Hum Sound Noise		ECWFD2Wxxxx
Series ECWFE NEW SERIES		450VDC	0.1 to 4.7μF	Low Hum Sound Noise box type		ECWFE2Wxxxx
Series ECWH(V)	-25 to +105°C	1000 to 2,000VDC	0.0010 to 0.10μF	Low-loss Inherent Temperature rise		ECWHxxxxxxVx ECWHxxxxxRxV
Series ECWH(A)	-40 to +105°C	800VDC 1,600VDC	0.010 to 0.047μF	High voltage and high frequency		ECWHxxxxHAx ECWHxxxxRHA ECWHA3Cxxxxx
Series ECWH(C)	-40 to +105°C General resonance circuit -40 to +85°C Air cooling	630VDC, 1,250VDC	0.10 to 0.33μF	Low-loss		ECWH6xxxHC ECWH6xxxHCx ECWH6xxxRHC ECWHC3BxxxJA
Series ECQUA	-40 to 110°C	275VAC	0.1 to 2.2μF	Safety standard Class X2		ECQUAAFxxxx
Series ECQUL	-40 to +100°C	275VAC (250VAC)	0.0010 to 2.2μF	Safety standard Class Y2 / X2	PET	ECQUxxxxxL
Series ECQUG		300VAC (250VAC)	0.010 to 1.0μF	Safety standard Class X1		ECQUxxxxxG
 DC-Link Film Capacitor	-40 to 105°C	450VDC	581μF	Automotive, high safety, self healing, low ESR	PP	EZTVKCTYP1HA

POLYMER CAPACITORS

SPEED UP YOUR DESIGN – THE NEXT STAGE OF LOW ESR

OS-CON™
OS-CON™ is an aluminium solid capacitor with high conductive polymer electrolyte material. OS-CON™ acquires high ripple currents, low ESR, excellent noise reduction capability and frequency characteristics. In addition, OS-CON™ has a long life span and its ESR has little change even at low temperatures since the electrolyte is solid.

POSCAP™
POSCAP™ is a solid electrolytic chip capacitor. The anode is sintered tantalum and the cathode is a highly conductive polymer. POSCAP™ has a low ESR (Equivalent Series Resistance) level and excellent performance for high frequency while maintaining a low profile and high capacitance. In addition, it has high reliability and high heat resistance.

SP-CAP – CONDUCTIVE POLYMER ALUMINIUM CAPACITORS
Based on common aluminium electrolytic capacitor technology SP cap uses solid polymer electrolyte instead of liquid electrolyte. It has been continuously developed since 1990 and offers very stable capacitance characteristics over the complete operating temperature and frequency range, especially compared to ceramic and low ESR tantalum capacitors. And in terms of safety SP Cap does not easily ignite or “smoke” at over-voltage conditions or in case of short circuit. If a defect occurs, the polymer will become self-insulating and shuts off the current flow.

CONDUCTIVE POLYMER HYBRID ALUMINIUM ELECTROLYTIC CAPACITORS
Lytic meets Polymer. It brings together low ESR characteristics of specialty polymer capacitor and the low leakage current of aluminium electrolytic capacitor. The series shows a compact design, high reliability in high temperatures with the safety of the aluminum electrolytic capacitor.

FEATURES

> High Reliability, long lifetime
> High Efficiency in Small Case Sizes
> Low ESR – High Ripple Current
> High Miniaturization Potential
> The Smart Alternatives to Tantalum Capacitors

POSCAP – Conductive Polymer Tantalum Solid Capacitors

Series / Type		Features	Temperature	Endurance*	Rated range [V. DC]	Capacitance range [µF]	ESR range [Ohm @ 100kHz+]	Case size range [LxWxH (Code)]	Part No.
	TPB	Standard	-55 to 105°C	2,000h	4 to 10	33 to 470	0.035 to 0.070	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 3.8 (D4)	xxTPBxxxxx
	TPC	Low profile	-55 to 105°C	2,000h	6.3 to 12.5	10 to 330	0.040 to 0.080	3.5 x 2.8 x 1.1 (B1) to 7.3 x 4.3 x 1.9 (D2)	xxTPCxxxxx
	TPG UPDATE	Small size Large capacitance	-55 to 105°C	1,000h	2.5 to 12.5	33 to 220	0.035 to 0.070	3.5 x 2.8 x 1.1 (B1G) to 3.5 x 2.8 x 1.4 (B15G)	xxTPGxxxxx
	TPE UPDATE	Low ESR	-55 to 105°C	2,000h	2 to 10	47 to 1.500	0.070 to 0.150	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 3.8 (D4)	xxTPExxxxx
	TPF UPDATE	Low ESR Large Capacitance	-55 to 105°C	2,000h	2 to 10	150 to 1.000	0.005 to 0.015	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 3.8 (D4)	xxTPFxxxxx
	TPSF UPDATE	Low ESR Small size Large Capacitance	-55 to 105°C	2,000h	2 to 2.5	200 to 270	0.006 to 0.009	3.5 x 2.8 x 1.1 (B1S) to 3.5 x 2.8 x 1.9 (B2S)	xxTPSFxxxxx
	TPU	Small size Low profile	-55 to 85°C	1,000h	2.5 to 10	4.7 to 150	0.100 to 0.300	2.0 x 1.25 x 0.9 (S09) to 3.5 x 2.8 x 0.9 (B09)	xxTPUxxxxx
	TPH	Small size Low profile	-55 to 105°C	1,000h	2.5 to 10	33 to 220	0.007 to 0.035	3.2 x 1.6 x 0.9 (A09) to 3.2 x 1.6 x 1.4 (A14)	xxTPHxxxxx
	TH	Guaranteed at 125°C	-55 to 125°C	1,000h	2.5 to 10	68 to 470	0.015 to 0.040	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 3.8 (D4)	xxTHxxxxx
	TA **	High reliability	-55 to 105°C	2,000h	2.5 to 10	47 to 680	0.009 to 0.070	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 2.8 (D3L)	xxTAxxxxx
	TV **	High reliability Guaranteed at 125°C	-55 to 125°C	1,000h	6.3 to 10	68 to 150	0.025	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 2.8 (D3L)	xxTVxxxxx
	TQC UPDATE	High voltage	-55 to 105°C	2,000h	16 to 35	2.7 to 150	0.040 to 0.300	3.5 x 2.8 x 1.4 (B15) to 7.3 x 4.3 x 2.8 (D3L)	xxTQCxxxxx

TCE (icon NEW), high temeprature, -55 to 125°C, 1000h, 2.5-10V, 100-1000, 0.012 to 0.025, 7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 3.8 (D4), xxTCExxxxx
TCF (icon NEW), high temperature, low ESR, -55 to 125°C, 1000h, 2.5-10V, 150-1000, 0.005 to 0.015, 7.3 x 4.3 x 2.8 (D3L) to 7.3 x 4.3 x 3.8 (D4), xxTCFxxxxx
* Lifetime calculation: 10times x 20°C (eg. 105°C 2,000h => 85°C 20,000h)
** Automotive grade

Polymer Aluminum Capacitors

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	number of terminals	Part No.
	Series HX NEW	-40 to +125°C	1,000h	2 to 25V	15 to 560µF	high temperature, low ESR, high voltage	2	EEFHXxxxxxxx
	Series CX UPGRADE	-40 to +105°C	2,000h UPGRADE	2 to 6.3V	100 to 560µF	high capacitance low profile 1.9mm height**	2	EEFCXxxxxxxx
				10 to 35V	15 to 100µF	high voltage, low profile 1.9mm height**		
	Series CT UPGRADE			4 to 6.3V	100 to 180µF	low profile 1.4mm height		EEFCTxxxxxxx
				10 to 35V	22 to 68µF	high voltage, low profile 1.4mm height		
	Series CS UPGRADE			4 to 6.3V	68 to 120µF	low profile 1.1mm height		EEFCSxxxxxxx
				10 to 35V	10 to 47µF	high voltage, low profile 1.1mm height		
	Series SX			2 to 6.3V	82 to 560µF	low ESR (4.5mΩ to 9mΩ), low profile 1.9mm height**		EEFSXxxxxxxx
	Series ST			2 to 2.5V	270 to 330µF	low ESR (6mΩ), low profile 1.4mm height		EEFSTxxxxxxx
	Series SS			2 to 2.5V	180 to 220µF	low ESR (6mΩ), low profile 1.1mm height		EEFSSxxxxxxx
	Series SR			2 to 6.3V	68 to 220µF	low ESR (4.5mΩ to 9mΩ), low profile 0.9mm height*		EEFSRxxxxxxx
	Series GX			2 to 2.5V	330 to 560µF	low ESR (3mΩ), low profile 1.9mm height**		EEFGXxxxxxxx
						low ESL, low ESR (3mΩ), low profile 1.9mm height**	3	EEFGXxxxxxxL
	Series LX			2 to 2.5V	330 to 560µF	low ESL, low ESR (4.5mΩ to 6mΩ), low profile 1.9mm height**		EEFLXxxxxxxx
	Series LT			2 to 2.5V	270 to 330µF	low ESL, low ESR (6mΩ), low profile 1.4mm height		EEFLTxxxxxxx
	Series LS			2 to 2.5V	180 to 220µF	low ESL, low ESR (6mΩ), low profile 1.1mm height		EEFLSxxxxxxx
	Series LR			2 to 6.3V	68 to 220µF	low ESL, low ESR (4.5mΩ to 9mΩ), low profile 0.9mm height*		EEFLRxxxxxxx

* height 0.9±0.1mm, maximum height 1mm
** height 1.9±0.2mm, maximum height 2.1mm
*** please contact Panasonic in case of new design

OS-CON – Conductive Polymer Aluminum Solid Capacitors

Series / Type		Features	Temperature	Endurance*	Rated V. DC	Capacity [µF]	Ripple Current [mArms @ 105°C]	Case size range [DxHmax (Code)]	Part No.
	SVP	Standard	-55 to 105°C	2,000h	2.5 to 20	3.3 to 1,500	670 to 5,440	5.0 x 4.5 (B45) to 6.3 x 10.0 (C10)	xxSVPxxxxx xxASVPxxx (**)
	SVPA	Low ESR High ripple current	-55 to 105°C	2,000h	2.5 to 20	10 to 820	1,700 to 4,240	5 x 6 (B6) to 10 x 8 (F8)	xxSVPAxxxxx
	SVPB	Low profile	-55 to 105°C	1,000h	2.5 to 20	15 to 120	1,670 to 2,000	6.3 x 5 (C5) to 6.3 x 5.5 (C55)	xxSVPBxxxxx
	SVPC UPDATE	Large capacitance Low ESR	-55 to 105°C	2,000h	2.5 to 16	39 to 2,700	1,820 to 5,150	5 x 6 (B6) to 10 x 12.7 (F12)	xxSVPCxxxxx
	SVPF	Long life High voltage Large capacitance	-55 to 105°C	5,000h	16 to 50	10 to 1,000	2,450 to 5,400	5 x 6 (B6) to 10 x 12.7 (F12)	xxSVPFxxxxx
	SVPG UPDATE	Low ESR High ripple current	-55 to 105°C	5,000h	16 to 25	15 to 270	2,800 to 5,800	5.0 x 4.5 (B45) to 6.3 x 10.0 (C10)	xxSVPGxxxxx
	SVPE	Super low ESR Large capacitance	-55 to 105°C	2,000h	2 to 16	150 to 1,200	2,700 to 6,100	5 x 6 (B6) to 10 x 12.7 (F12)	xxSVPExxxxx
	SVPS	Long life	-55 to 105°C	5,000h	4 to 25	10 to 680	700 to 4,130	4 x 5.5 (A5) to 10 x 8 (F8)	xxSVPSxxxxx
	SVQP	Guaranteed @ 125°C	-55 to 125°C	1,000h	4 to 20	22 to 220	1,450 to 2,560	6.3 x 6 (C6) to 8 x 7 (E7)	xxSVQPxxxxx xxASVQPxxx (**)
	SVPD	Guaranteed @ 125°C High voltage	-55 to 125°C	2,000h	10 to 35	8.2 to 82	1,300 to 3,800	6.3 x 6 (C6) to 10 x 12.7 (F12)	xxSVPDxxxxx xxASVPDxxx (**)
	SXV NEW	Super high voltage Long life	-55 to 105°C	5,000h	63 to 100	15 to 33	2,350 to 2,950	8 x 12 (E12)	xxSXVxxxxx
	SEPF UPDATE	Long life High voltage Large capacitance	-55 to 105°C	5,000h	16 to 35	22 to 1,000	2,400 to 5,400	6.3 x 5.5 (C55) to 10 x 13 (F13)	xxSEPFxxxxx
	SXE NEW	Super high voltage Long life	-55 to 105°C	5,000h	63 to 100	15 to 33	2,350 to 2,950	8 x 12 (E12)	xxSXExxxxx

* Lifetime calculation: 10 times x 20°C (eg. 105°C 5,000h => 85°C 50,000h)
** Automotive grade available

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

Series / Type		Temperature	Endurance	Rated W.V.	Capacity	Features	AEC-Q200	Part No.
	Type V - Series ZA	-55 to +105°C	10,000h	25 to 80V	10 to 330µF	low ESR (lower as FT/TP) high ripple current (>70% higher as FP/TP) stable temp. characteristcs long lifetime low L.C.	qualified*	EEHZAxxxxxx
	Type V - Series ZC	-55 to +125°C	4,000h	25 to 63V				EEHZCxxxxxx

Vibration-proof product is available upon request (≥ Ø 8mm diameter).
* The series qualify for AEC-Q200, but may have some deviations.

FOR AUTOMOTIVE AND HIGH RELIABILITY APPLICATIONS

ERA Series – High Reliability Thin Film Resistors

> High reliability, high heat resistance and high moisture resistance make ERA-series perfectly suited to harsh environment applications, such as automotive, medical, transportation and any measurement industry

High power & Anti-Surge Resistors (ERJP and ERJT Series)

> Electronic surge can occur anywhere in a vehicle's electronic circuitry, industrial, measurement and telecom applications
> Panasonic ERJP series have great Anti-Surge characteristics and excellent heat dissipation characteristics due to 'Serpentine Resistor Pattern Structure' which helps to decrease electric field strength per unit length
> Combined with a variety of small case size Panasonic Anti-Surge Resistors are suitable to replace MELF in plenty of cases

SMD Current Sensing Shunt Resistors – Soft Termination

> Current Sensing Resistors are designed for low resistance so as to minimize power consumption
> In order to meet the requirements of the market Panasonic offers a wide range of Current Sensing Resistors in many case sizes (0402 to 2526) and many resistance values in different technologies
> Metal plate technology (ERJM-series) and special constructions makes them suitable for the harsh environment while maintaining their high reliability and high power
> Double sided resistor element technology (ERJxBW-series) & wide terminal technology (ERJA, ERJB-series) for high power purpose

RESISTORS

> Corresponding to AEC-Q200
> High power in small package
> High performance and reliability
> Stability over life time
> Wide Resistance Value
> Excellent TCR
> Down Sizing
> Cost Saving

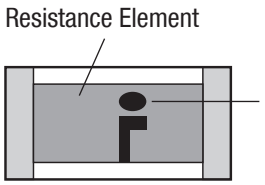
HIGH POWER SMD RESISTORS

DOWNSIZING AND COMPONENT-SAVING PURPOSE

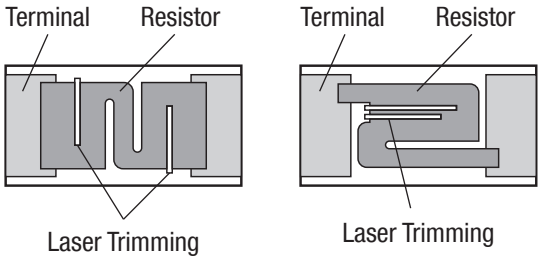
ADDED VALUE

> Downsizing & High Power Load
> Components-Saving
> Cost Saving

STANDARD TYPE STRUCTURE



ANTI-SURGE TYPE STRUCTURE



1	2	3	4	5	6	7	8	9	10	11	12	Digit
E	R	J	P	0	6	D	1	0	0	2	V	Part Number

Product Code

Thick Film Chip Resistors

Size, Power, Rating

Type	Inch	Power R.
P03	0603	0.20W
PA3	0603	0.25W
P06	0805	0.50W
P08	1206	0.66W
P14	1210	0.50W

Resistance Tolerance

Code	Tolerance
D	±0.5%
F	±1.0%
J	±5.0%

Resistance Value

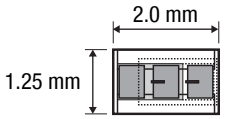
The first two or three digits are significant figures of resistance and the third or fourth one denotes number of zeros folowing.
Three digit type (±5%)
Four digit type (±1.0%, ±0.5%)
Example: 222 -> 2.2kΩ, 1002 -> 10kΩ

Packaging Methods

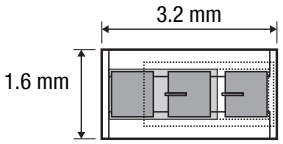
Code	Packaging	Type
V	Punched Carrier Taping 4mm pitch, 5,000 pcs.	ERJP03 ERJPA3 ERJP06 ERJP08
U	Embossed Carrier Taping 4mm pitch, 5,000 pcs.	ERJP14

WIDE TERMINAL TYPE STRUCTURE

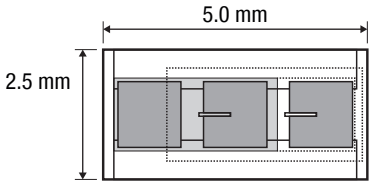
> ERJB3 Series (Size 0508)



> ERJB2 Series (Size 0612)



> ERJB1 Series (Size 1020)



1	2	3	4	5	6	7	8	9	10	11	Digit
E	R	J	A	1	A	J	1	0	2	U	Part Number

Product Code

Thick Film Chip Resistors

Size, Power, Rating

Type	Inch	Power R.
A1	2512	1.33W
B1	2010	1W (2W; R≤10Ω)
B2	1206	0.75W (1W; R≤10Ω)
B3	0805	0.33W (0.5W; R≤10Ω)

Resistance Value Region

A	10Ω	≤ R
B	0.22Ω	≤ R < 10Ω
C	0.01Ω	≤ R < 0.22Ω
D	0.005Ω	≤ R < 0.01Ω

Resistance Tolerance

F	±1.0%
G	±2.0%
J	±5.0%

Resistance Value

Shown by three digits or letters.
Only when it is possible, shown by four digits or letters.
Ex.: 102: 1.0kΩ R01: 0.01 Ω = 10mΩ
4R7: 4.7Ω R015: 0.015Ω = 15mΩ

Packaging Methods

Code	Packaging	Type
V	Punched Carrier Taping 4mm pitch, 5,000 pcs.	ERJB2 ERJB3
U	Embossed Carrier Taping 4mm pitch, 5,000 pcs.	ERJB1
	Embossed Carrier Taping 4mm pitch, 4,000 pcs.	ERJA1

HIGH POWER SMD RESISTORS

DOWNSIZING AND COMPONENT-SAVING PURPOSE

DOWNSIZING & COMPONENT SAVING MATRIX

Power \ Size	0402 (1005mm)	0603 (1608mm)	0805 / 0508	1206/0612 (3216/1632mm)	1210 (3225mm)	2010/1020 (5025/2550mm)
2W						ERJB1
1W				ERJB2		
0.66W (2/3W)				ERJP08		
0.5W (1/2W)			ERJB3 / ERJP06		ERJP14	ERJ12 (0.75W)
0.33W (1/3W)					ERJ14	
0.25W (1/4W)		ERJPA3		ERJ8ENF		
0.2W (1/5W)	ERJPA2					
0.125W (1/8W)			ERJ6ENF			
0.1W (1/10W)		ERJ3EKF				
0.063W (1/16W)	ERJ2RKF					

Higher Power in Smaller Size

DOWNSIZING SOLUTION

> Reducing PCB Area
> Reducing Large Size Resistor (1206) by high power series

1W	0612 Wide-terminal (B2)
0.66W	1206 High Power (P08 up-grade enable)
0.5W	0508 Wide-terminal (B3)
	0805 High Power (P06 up-grade enable)
0.25W	0603 High Power (PA3)
0.20W	0402 High Power (PA2)

HIGH POWER TYPE
(ERJP03, P06, P08, P14)

NEW HIGH POWER TYPE
(ERJPA2, PA3)

WIDE TERMINAL TYPE
(ERJB3, B2, B1, A1)

STANDARD TYPE
(ERJ2, 3, 6, 8, 14, 12, 1T)

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (79°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
0402 (01005)	±1	0.031	10-1M	E24, E96	-55 to +125	Precision	ERJXGN
	±5	0.031	4.7-1M	E24	-55 to +125	General	ERJXGN
0603 (0201)	±0.5	0.05	100-1M	E24, E96	-55 to +125	Precision	ERJ1RH/1RK
	±1	0.05	10-1M	E24, E96	-55 to +125	Precision	ERJ1GN
		0.05	10-1M	E24, E96	-55 to +125	Anti-Sulfurated	ERJU01
	±5	0.05	1-10M	E24	-55 to +125	General	ERJ1GN
		0.05	1-10M	E24	-55 to +125	Anti-Sulfurated	ERJU01
1005 (0402)	±0.1	0.063	10.5-100k	E24	-55 to +155	Metal Film, High Reliability	ERA2A
	±0.5	0.063	10-1M	E24, E96	-55 to +125	Precision	ERJ2RH/2RK
	±1	0.063	10-100k	E24	-55 to +155	Metal Film, High Reliability	ERA2A
		0.125 (0.166)	0.3-1m	E24	-55 to +125	Low Resistance	ERJ2BQ
		0.1	10-1M	E24, E96	-55 to +155	Precision	ERJ2RK
		0.1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS02/U02
	±2	0.125 (0.25)	0.03-0.1m	E24	-55 to +155	Low Resistance	ERJ2BW
		0.125 (0.166)	0.1-1m	E24	-55 to +125	Low Resistance	ERJ2BS/2BQ
	±5	0.125 (0.25)	0.03-0.1m	E24	-55 to +155	Low Resistance	ERJ2BW
		0.125 (0.166)	0.1-1	E24	-55 to +125	Low Resistance	ERJ2BS/2BQ
		0.1	1-1M	E24	-55 to +155	General	ERJ2GE
		0.1	1-1.2M	E24	-55 to +155	Anti-Sulfurated	ERJS02/U01
1608 (0603)	±0.05	0.1	1-100k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
	±0.1	0.1	10.5-105k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
	±0.5	0.1	10-105k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
		0.063 (0.1)	10-1M	E24, E96	-55 to +125	Precision	ERJ3RB/3RE
		0.2	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP03
	±1	0.1 (0.2)	0.05-1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL03
		0.25	0.02-1m	E24	-55 to +155	Low Resistance	ERJ3BW
		0.2 (0.25)	0.1-0.9m	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
		0.1	0.1-0.9m	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
		0.25	0.01-0.03	10mΩ	-55 to +155	Metal Plate	ERJM03
		0.1	10-1M	E24, E96	-55 to +155	Precision	ERJ3EK
		0.2	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP03
		0.1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS03/U03
	±2	0.25	0.03-01m	E24	-55 to +155	Low Resistance	ERJ3BW
		0.2 (0.25)	0.1-9.9m	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
		0.1	0.1-9.9m	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
	±5	0.1 (0.2)	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL03
		0.25	0.03-0.1m	E24	-55 to +155	Low Resistance	ERJ3BW
		0.2 (0.25)	0.1-9.9m	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
		0.1	0.1-9.9m	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
		0.25	0.01-0.05	10mΩ	-55 to +155	Metal Plate	ERJM03
		0.1	1-10M	E24	-55 to +155	General	ERJ3GE
		0.2	1-1M	E24	-55 to +155	Anti-Surge	ERJP03
		0.1	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS03/U03

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (79°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
2012 (0805)	±0.05	0.125	1k-100k	E24	-55 to +155	Metal Film, High Reliability	ERA6A
	±0.1	0.125	150-1M	E24	-55 to +155	Metal Film, High Reliability	ERA6A
	±0.5	0.125	10-1M	E24	-55 to +155	Metal Film, High Reliability	ERA6A
		0.1	10-1M	E24, E96	-55 to +125	Precision	ERJ6RB/6RE
		0.25	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP06
	±1	0.125 (0.25)	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL06
		0.33	0.01-0.1m	E24	-55 to +155	Low Resistance	ERJ6BW
		0.25 (0.33)	0.1-9m	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
		0.125	0.1-9m	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
		0.125	10-2.2M	E24, E96	-55 to +155	Precision	ERJ6EN
		0.25	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP06
		0.33 (0.5)	0.05-10m	E24	-55 to +155	High Power	ERJB3
		0.125	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS06/U06
	±2	0.33	0.01-0.1m	E24	-55 to +155	Low Resistance	ERJ6BW
		0.25 (0.33)	0.1-8m	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
		0.125	0.1-8m	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
		0.33 (0.5)	0.02-1m	E24	-55 to +155	High Power	ERJB3
	±5	0.125 (0.25)	0.050-0.1m	E24	-55 to +125	Low Resistance	ERJL06
		0.33	0.01-0.1	Each 1mΩ	-55 to +155	Low Resistance	ERJ6BW
		0.25 (0.33)	0.1-9m	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
		0.125	0.1-9m	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
		0.125	1-10M	E24	-55 to +155	General	ERJ6GE
		0.25	1-2.2M	E24	-55 to +155	Anti-Surge	ERJP06
		0.25	1-1M	E24	-55 to +155	Anti-Pulse	ERJT06
		0.33 (0.5)	0.05-1M	E24	-55 to +155	High Power	ERJB3
		0.125	1-10m	E24	-55 to +155	Anti-Sulfurated	ERJS06/U06
3216 (1206)	±0.1	0.25	50-1M	E24	-55 to +155	Metal Film, High Reliability	ERA8A
	±0.5	0.25	10-1M	E24	-55 to +155	Metal Film, High Reliability	ERA8A
		0.33	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP08
	±1	0.25 (0.33)	0.050-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL08
		0.5 (1)	0.01-0.1m	E24	-55 to +155	Low Resistance	ERJ8BW
		0.33 (0.5)	0.1-9m	E24	-55 to +125	Low Resistance	ERJ8BS/8RS
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ8RS/8RQ
		0.25	10-2.2M	E24, E96	-55 to +155	Precision	ERJ8EN
		0.33	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP08
		0.75 (1)	0.01-1M	E24	-55 to +155	High Power	ERJB2
		0.25	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS08/U08
	±2	0.5 (1)	0.01-0.1m	E24	-55 to +155	Low Resistance	ERJB2
		0.33 (0.5)	0.1-9m	E24	-55 to +125	Low Resistance	ERJL08
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ8BW
		0.75 (1)	0.01-1M	E24	-55 to +155	High Power	ERJ8BS/8BQ

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (79°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
3216 (1206)	±5	0.25 (0.33)	0.050-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJ08
		0.5 (1)	0.01-0.1	E24	-55 to +155	Low Resistance	ERJ8BW
		0.33 (0.5)	0.1-9m	E24	-55 to +125	Low Resistance	ERJ8BS/8BQ
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ8RS/8RQ
		0.25	1-10M	E24	-55 to +155	General	ERJ8GE
		0.33	1-10M	E24	-55 to +155	Anti-Surge	ERJP08
		0.33	1-1M	E24	-55 to +155	Anti-Pulse	ERJT08
		0.75 (1)	5m-1M	1mΩ Step/E24	-55 to +155	High Power	ERJB2
		0.25	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS08/U08
3225 (1210)	±0.5	0.5	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP14
	±1	0.33	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL14
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
		0.5	10-1M	E24, E96	-55 to +155	Precision	ERJ14N
		0.5	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP14
		0.5	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS14/U14
	±2	0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
	±5	0.33	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL14
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
		0.25	0.1-9m	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
		0.5	1-10M	E24	-55 to +155	General	ERJ14Y
		0.5	1-1M	E24	-55 to +155	Anti-Surge	ERJP14
		0.5	1-1M	E24	-55 to +155	Anti-Pulse	ERJT14
		0.5	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS14/U14
4532 (1812)	±1	0.5	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL12
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
		0.75	10-1M	E24, E96	-55 to +155	Precision	ERJ12N
		0.75	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS12/U12
	±2	0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
	±5	0.5	0.05-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL12
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
		0.75	1-10M	E24	-55 to +155	General	ERJ12Y
		0.75	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS12/U12
5025 (2010)	±1	0.5	0.050-0.1	Each 1mΩ	-55 to +125	Low Resistance	ERJL1D
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
		0.75	10-1M	E24, E96	-55 to +155	Precision	ERJ12S
		1 (2)	0.01-10k	E24	-55 to +155	High Power	ERJB1
		0.75	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS1D/U1D
	±2	0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
		1 (2)	0.01-10k	E24	-55 to +155	High Power	ERJB1

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (79°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
5025 (2010)	±5	0.5	0.050-0.1	Each 1mΩ	-55 to +125	Low Resistance	ERJL1D
		0.5	0.1-9m	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
		0.75	1-10M	E24	-55 to +155	General	ERJ12ZY
		1(2)	0.01-10k	E24	-55 to +155	High Power	ERJB1
		0.75	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS1D/U1D
6432 (2512)	±1	1	0.050-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1W
		1	0.1-9m	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
		1	10-1M	E24, E96	-55 to +155	Precision	ERJ1TN
		1	1m-20m	1, 1.5, 2, 3, 4, 5, 6, 10, 15, 20mΩ	-55 to +170	Metal Plate	ERJM1W
		1.33	0.1-10k	E24	-55 to +155	High Power	ERJA1
		1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS1T/U1T
	±2	1	0.1-9m	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
		1.33	0.01-10k	E24	-55 to +155	High Power	ERJA1
	±5	1	0.050-0.1m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1W
		1	0.1-9m	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
		1	1-1M	E24	-55 to +155	General	ERJ1TY
		1	1m-20m	1, 1.5, 2, 3, 4, 5, 6, 10, 15, 20mΩ	-55 to +170	Metal Plate	ERJM1W
		1.33	0.01-10k	E24	-55 to +155	High Power	ERJA1
		1	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS1T/U1T

Shunt Resistors (Low ohmic Current Sensing Resistor) – Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	T.C.R	Features	Size	Part No.
	Metal Plate Type	1W (2W R≤10mΩ)	≥ 0.3mΩ	±1% ±5%	≥ ±50ppm	Low resistance values and high precision	2512	ERJM1WSxxxxU
		1W (2W R≤10mΩ)					2512	ERJM1WTxxxxU
		3W				Low resistance values and high power. Operation temperature Range -65°C to +170°C	2512	ERJMS4SxxxxU
		2W (3W R≤5mΩ)					2512	ERJMS4HxxxxU
		5W					2526	ERJMS6SxxxxU
	Metal Plate Wide Terminal Type	2W	1m to 5mΩ	±1% ±5%	≥ ±75ppm	Small size and high power	1020	ERJMB1xxxxU
	High Power Wide Terminal Type	0.33W (0.5W R≤1Ω)	≥ 5mΩ	±1% ±2% ±5%	≥ ±50ppm	Superior solder-joint reliability by wide terminal structure	0508	ERJB3xxxxxV
		0.75W (1W R≤10Ω)					0612	ERJB2xxxxxV
		1W (2W R≤10Ω)					1020	ERJB1xxxxxU
		1.33W					1225	ERJA1xxxxxU
		1W					0612	ERJD2xxxxxxV*
		2W					1020	ERJD1xxxxxxU*
	Thick Film Low Resistance	0.1W	100m to 9.1Ω	±1% ±2% ±5%	≥ ±100ppm	Thick Film Low Resistance Type	0603	ERJ3RxxxxxV
		0.125W					0805	ERJ6RxxxxxV
		0.25W					1206	ERJ8RxxxxxV
		0.25W					1210	ERJ14RxxxxxU
		0.5W					1812	ERJ12RxxxxxU
		0.5W					2010	ERJ12ZxxxxxU
		1W					2512	ERJ1TRxxxxxU
		0.166W	100m to 9.1Ω	±1% ±2% ±5%	≥ ±100ppm	Thick Film Low Resistance Type High power Type	0402	ERJ2BxxxxxX
		0.25W					0603	ERJ3BxxxxxV
		0.33W					0805	ERJ6BxxxxxV
		0.5W					1206	ERJ8BxxxxxV
		0.5W					1210	ERJ14BxxxxxU
		0.25W	10m to 100mΩ	±1% ±2% ±5%	≥ ±50ppm	Low Resistance Type High power Type Double-sided resistive elements structure	0402	ERJ2BWxxxxxX
		0.33W					0603	ERJ3BWxxxxxV
		0.5W					0805	ERJ6BWxxxxxV
		1W					1206	ERJ8BWxxxxxV
		1W					1206	ERJ8CWxxxxxV
		0.2W	20m to 100mΩ	±1% ±5%	≥ ±100ppm	Low TCR Type	0603	ERJL03xxxxxV
		0.25W					0805	ERJL06xxxxxV
		0.33W					1206	ERJL08xxxxxV
		0.33W					1210	ERJL14xxxxxU
		0.5W					1812	ERJL12xxxxxU
		0.5W					2010	ERJL1DxxxxxU
		1W					2512	ERJL1WxxxxxU

* Under development

Thin Film Resistors – Surface Mount Type

Series / Type	Power Pating	Resistance	Tolerance	T.C.R	Size	Part No.
 Metal Film High Reliability Type Suitable at high temperature and humidity (85°C 85%RH rated load, Category temperature range: -55 to +155°C)	0.05W	10 to 100KΩ	±0.1%	±25ppm	0201	ERA1AEB
			±0.25%	±25ppm	0201	ERA1AEC
	0.063W		±0.1%	±10ppm	0402	ERA2ARB
			±0.25%	±10ppm	0402	ERA2ARC
			±0.1%	±15ppm	0402	ERA2APB
			±0.1%	±25ppm	0402	ERA2AEB
			±0.25%	±25ppm	0402	ERA2AEC
			±0.5%	±25ppm	0402	ERA2AED
			±0.1%	±50ppm	0402	ERA2AHB
			±0.5%	±100ppm	0402	ERA2AKD
	0.1W	10 to 330KΩ	±0.05%	±10ppm	0603	ERA3ARW
			±0.1%	±10ppm	0603	ERA3ARB
			±0.1%	±15ppm	0603	ERA3APB
			±0.1%	±25ppm	0603	ERA3AEB
			±0.25%	±25ppm	0603	ERA3AEC
			±0.5%	±25ppm	0603	ERA3AED
			±0.5%	±50ppm	0603	ERA3AHD
	0.125W	10 to 1MΩ	±0.05%	±10ppm	0805	ERA6ARW
			±0.1%	±10ppm	0805	ERA6ARB
			±0.1%	±15ppm	0805	ERA6APB
			±0.1%	±25ppm	0805	ERA6AEB
			±0.25%	±25ppm	0805	ERA6AEC
			±0.5%	±25ppm	0805	ERA6AED
			±0.5%	±50ppm	0805	ERA6AHD
	0.25W	10 to 1MΩ	±0.05%	±10ppm	1206	ERA8ARW
			±0.1%	±10ppm	1206	ERA8ARB
			±0.5%	±10ppm	1206	ERA8ARD
			±0.1%	±15ppm	1206	ERA8APB
			±0.1%	±25ppm	1206	ERA8AEB
			±0.25%	±25ppm	1206	ERA8AEC
			±0.5%	±25ppm	1206	ERA8AED
			±0.5%	±50ppm	1206	ERA8AHD

High Power & Pulse Proof Resistors – Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size	Part No.
	High Power Wide Terminal Type	0.33W (0.5W R≤1Ω)	5m to 1MΩ	±1% ±2% ±5%	Superior solder-joint reliability by wide terminal structure	0508	ERJB3xxxxxV
		0.75W (1W R≤10Ω)				612	ERJB2xxxxxV
		1W (2W R≤10Ω)				1020	ERJB1xxxxxU
		1.33W				1225	ERJA1xxxxxU
	Anti-Surge Type	0.2W	1 to 3,3MΩ	±0.5% ±1% ±5%	Anti-Surge & High voltage Characteristic	0603	ERJP03xxxxxV
		0.25W				0603	ERJPA3xxxxxV
		0.5W				0805	ERJP06xxxxxV
		0.66W				1206	ERJP08xxxxxV
		0.5W				1210	ERJP14xxxxxU
		0.5W	1 to 10MΩ	±1% ±5%	Double-sided resistive elements structure	0805	ERJP6WxxxxxV
	Anti-Pulse Type	0.25W	1 to 1MΩ	±5%	Anti-Pulse Characteristic	0805	ERJT06xxxxV
		0.33W				1206	ERJT08xxxxV
		0.5W				1210	ERJT14xxxxU

Thick Film Resistors – Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size	Part No.
	Thick Film	0.031 to 1W	1 to 10MΩ	±5% Jumper	Size: 01005 to 2512	01005	ERJXGNJxxxY
						0201	ERJ1GNJxxxC
						0402	ERJ2GEJxxxX
						0603	ERJ3GEYJxxxV
						0805	ERJ6GEYJxxxV
						1206	ERJ8GEYJxxxV
						1210	ERJ14YJxxxU
						1812	ERJ12YJxxxU
						2010	ERJ12ZYJxxxU
						2512	ERJ1TYJxxxU
	Precision Thick Film	0.05 to 1W	10 to 2.2MΩ	±0.5% ±1%	Precision Type	01005	ERJXGNFxxxx(U/Y)
						0201	ERJ1GNFxxxxC
						0201	ERJ1RxDxxxxC
						0402	ERJ2RxxxxxxX
						0603	ERJ3EKFxxxxV
						0603	ERJ3RxDxxxxV
						0805	ERJ6ENFxxxxV
						0805	ERJ6RxDxxxxV
						1206	ERJ8ENFxxxxV
						1210	ERJ14NFxxxxU
						1812	ERJ12NFxxxxU
						2010	ERJ12SFxxxxU
						2512	ERJ1TNFxxxxU

Anti-Sulfurated Resistors – Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size	Part No.
	Thick Film Anti-Sulfurated Au-based inner electrode	0.1 to 1W	1 to 1MΩ	±1% ±5%	Special construction to avoid open failure due to the presence of sulfur	0402	ERJS02xxxxxX
						0603	ERJS03xxxxxV
						0805	ERJS06xxxxxV
						1206	ERJS08xxxxxV
						1812	ERJS12xxxxxU
						1210	ERJS14xxxxxU
						2010	ERJS1DxxxxxU
						2512	ERJS1TxxxxxU
	Thick Film Anti-Sulfurated Ag-Pd-based inner electrode	0.25W	0.1 to 0.2Ω	±1% ±2% ±5%	Special construction to avoid open failure due to the presence of sulfur. Low resistance type.	0805	ERJS6SxxxxV
			0.22 to 1Ω				ERJS6QxxxxV
		0.05 to 1W	1 to 1MΩ	±1% ±5%	Special construction to avoid open failure due to the presence of sulfur	0201	ERJU01xxxxxC
						0402	ERJU02xxxxxX
						0603	ERJU03xxxxxV
						0805	ERJU06xxxxxV
						1206	ERJU08xxxxxV
						1812	ERJU12xxxxxU
						1210	ERJU14xxxxxU
						2010	ERJU1DxxxxxU
						2512	ERJU1TxxxxxU
	Thick Film Anti-Sulfurated Wide Terminal Type	2W	10m to 1Ω	±1% ±5%	High power and high solder-joint reliability by wide terminal construction	1020	ERJC1CxxxxU

Anti-Sulfurated Network & Array Resistors - Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size	Part No.
	Resistor Array Anti-Sulfurated	0.031 to 0.1W per element	10 to 1MΩ	±5%	High resistance to sulfurization achived by adopting an Ag-Pb-based inner electrode.	0402 × 2R	EXBU24xxxxX
						0402 × 4R	EXBU28xxxxX
						0402 × 8R	EXBU2HxxxxV
						0603 × 2R	EXBU34xxxxV
						0603 × 4R	EXBU38xxxxV

Network & Array Resistors - Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size	Part No.
	Resistor Array	0.031 to 0.1W per element	10 to 1MΩ	±5%	Placement efficiency of chip resistor array is 2 / 4 / 8 times of the flat type chip resistor	0201 x 2R	EXB14VxxxJX
						0201 x 4R	EXB18VxxxJX
						0402 x 2R	EXB24VxxxJX
						0402 x 4R	EXB28VxxxJX
						0402 x 8R	EXB2HVxxxJV
						0603 x 2R	EXB34VxxxJV
						0603 x 4R	EXB38VxxxJV
						0402 x 4R	EXBN8VxxxJX
						0805 x 4R	EXBS8VxxxJ
						0603 x 2R	EXBV4VxxxJV
						0603 x 4R	EXBV8VxxxJV
	Resistor Networks	0.025 to 0.063W per element	47 to 1MΩ	±5%	High density placing for digital signal circuits	2512	EXBAxxxxxxxx
						1206	EXBDxxxxxxxx
						1608	EXBExxxxxxxx
						1506	EXBQxxxxxxxx

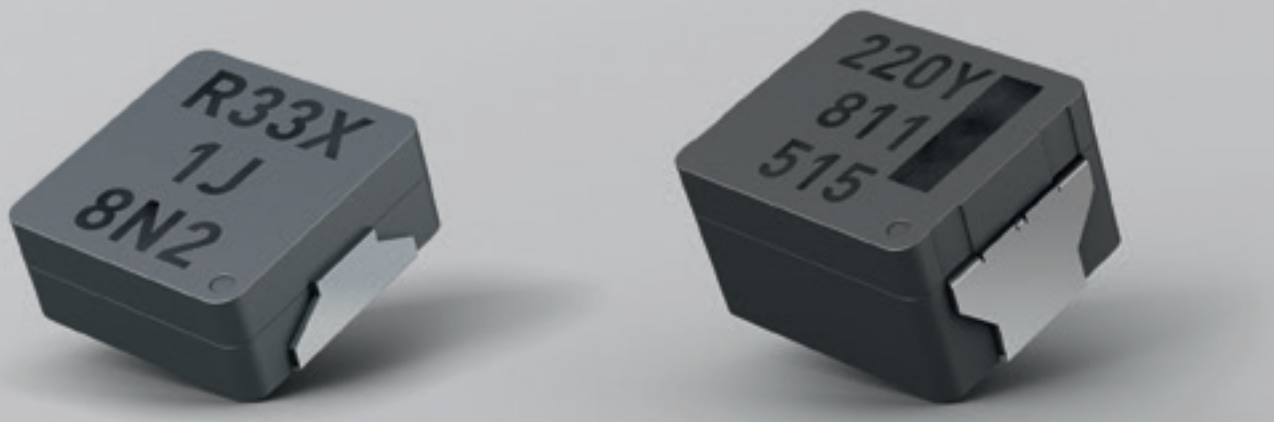
Metal (Oxide) Film Resistors – Radial Lead Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Size (mm)	Part No.
	Small size	0.5 to 5W	0.1 to 9.1Ω	±2% ±5%	Non flammable coating Small size	6.35 x 2.3	ERX12Sxxxxxx
						9 x 2.8	ERX1Sxxxxxxx
						12 x 4	ERX2Sxxxxxxx
						15 x 5.5	ERX3Sxxxxxxx
						24 x 8	ERX5Sxxxxxxx
			9.1 < R ≤ 100kΩ			6.35 x 2.3	ERG12Sxxxxxx
						9 x 2.8	ERG1Sxxxxxxx
						12 x 4	ERG2Sxxxxxxx
						15 x 5.5	ERG3Sxxxxxxx
						24 x 8	ERG5Sxxxxxxx
	Small size Anti-heat conducing Type (Fe lead wire)	1 to 5W	0.1 to 9.1Ω	±2% ±5%		9 x 2.8	ERX1Fxxxxxxx
						12 x 4	ERX2Fxxxxxxx
						15 x 5.5	ERX3Fxxxxxxx
						24 x 8	ERX5Fxxxxxxx
			9.1 < R ≤ 100kΩ			9 x 2.8	ERG1Fxxxxxxx
						12 x 4	ERG2Fxxxxxxx
						15 x 5.5	ERG3Fxxxxxxx
						24 x 8	ERG5Fxxxxxxx

Trimmer Potentiometers - Surface Mount Type

Series / Type		Power Pating	Resistance	Tolerance	Features	Part No.
	Cermet 2mm Square Open	0.15W	100 to 1MΩ	±25%	Low-profile 0.7mm (EVM2T) 0.81mm (EVM2N) 1.05mm (EVM2W)	EVM2GSX80Bxx
						EVM2NSX80Bxx
						EVM2WSX80Bxx
	Cermet 3mm Square Open				Auto,Adjust (EVM3Y) Both Sides Adjust (EVM3S) Back Sides Adjust (EVM3R)	EVM3ESX50Bxx
						EVM3GSX50Bxx
						EVM3RSX50Bxx
						EVM3SSX50Bxx
						EVM3YSX50Bxx
	Cermet 3mm Square Open				Low-profile 0.95mm	EVM3WSX80Bxx
	Cermet 3mm Square Open				Rotation stopper Automatic adjustment type	EVM3VSX50Bxx
	Cermet 4mm Square Open	0.2W			4mm square series for reflow soldering	EVM1DSX30Bxx
						EVM1ESX30Bxx
						EVM1USX30Bxx
	Cermet 4mm Square Dustproof	0.3 to 0.5W			Radial Taping	EVMAAGA00Bxx
						EVMAASA0xBxx
						EVMAEGA00Bxx
						EVMAESA0xBxx
						EVMAHGA00Bxx
						EVMAJGA00Bxx
						EVMASGA00Bxx

WINDING AND METAL COMPOSITE TECHNOLOGIES



Surface Mount high **Power Inductors (ETQ-series)** in Metal Composite technology have excellent „non-hard"-saturation characteristics and reduce power loss at high switching frequencies.

SMD **ferrite Choke Coils** with plenty of series make it easy for design engineers to select the most suitable surface-mount choke for various applications such as DC/DC converters in portable equipment.

Chip Inductors with very good electrical performance characteristics in laser-cut technology and a wide range of inductance values and case sizes from 0402 to 0603.

THT Choke Coils with inductance values up to 10mH for conventional mounting completes the inductor product portfolio.

INDUCTORS

> Wide range of inductive products in both SMD and THT

> Automotive Type Metal Composite Power Choke Coil is applicable 150°C/2,000h, 30G

> AEC-Q200 Qualified Series available

Power Choke Coil – Automotive Type

Series / Type	Size (LxWxH mm)	Inductivity (µH)	Rated Current (A) +40°C High Heat Dissipation	Satulation Current (A) L=–30%	R dc (mOhms)	Part No.
 Power Choke Coil Automotive Type	5x5x3	2.20	5.80	10.90	22.60	ETQP3M2R2YFP
	5x5x3	3.30	4.90	8.60	32.30	ETQP3M3R3YFP
	5x5x4	22.00	2.30	3.10	163.00	ETQP4M220YFP
	5x5x4	4.70	4.80	7.70	36.00	ETQP4M4R7YFP
	5x5x4	10.00	3.10	6.00	84.60	PCC-M0540M-100Y*
	5x5x4	15.00	2.40	3.20	139.00	PCC-M0540M-150Y*
	5x5x4	6.80	3.80	7.40	58.00	PCC-M0540M-6R8Y*
	6x6x3	10.00	3.30	6.40	81.40	ETQP3M100YFN
	6x6x3	1.00	10.70	20.00	7.90	ETQP3M1R0YFN
	6x6x3	1.50	9.10	16.00	11.00	ETQP3M1R5YFN
	6x6x3	2.20	7.20	13.00	17.50	ETQP3M2R2YFN
	6x6x3	3.30	5.60	11.20	29.00	ETQP3M3R3YFN
	6x6x3	4.70	4.40	8.80	43.00	ETQP3M4R7YFN
	6x6x3	6.80	4.10	7.20	55.20	ETQP3M6R8YFN
	6x6x3	0.68	12.00	24.00	6.30	ETQP3MR68YFN
	6x6x4.5	10.00	4.40	8.30	54.20	ETQP4M100YFN
	6x6x4.5	15.00	3.20	6.20	105.00	ETQP4M150YFN
	6x6x4.5	22.00	3.00	6.00	124.00	ETQP4M220YFN
	6x6x4.5	2.20	10.20	14.40	10.40	ETQP4M2R5YFN
	6x6x4.5	33.00	2.50	4.10	172.00	ETQP4M330YFN
	6x6x4.5	3.30	8.40	13.20	15.40	ETQP4M3R3YFN
	6x6x4.5	47.00	2.20	3.70	210.00	ETQP4M470YFN
	6x6x4.5	4.70	7.00	11.70	21.80	ETQP4M4R7YFN
	6x6x4.5	6.80	5.30	10.00	39.30	ETQP4M6R8YJN
	7x7x5	93.00	1.80	3.10	348.00	ETQP5M101YGM
	7x7x5.4	10.00	5.60	8.70	40.80	ETQP5M100YFM
	7x7x5.4	15.00	4.20	8.40	74.00	ETQP5M150YFM
	7x7x5.4	22.00	3.70	5.80	92.00	ETQP5M220YFM
	7x7x5.4	2.20	11.80	17.20	9.20	ETQP5M2R2YFM
	7x7x5.4	33.00	3.30	4.80	120.00	ETQP5M330YFM
	7x7x5.4	3.30	10.40	13.70	11.90	ETQP5M3R3YFM
	7x7x5.4	47.00	2.90	4.10	156.00	ETQP5M470YFM
	7x7x5.4	4.70	8.00	13.10	20.00	ETQP5M4R7YFM
	7x7x5.4	6.80	6.90	11.10	26.70	ETQP5M6R8YFM
	8x8x4	1.00	15.60	29.30	4.58	ETQP4M1R0YVK
	8x8x5	100.00	2.10	3.00	302.00	ETQP5M101YGK
	8x8x5	68.00	2.60	4.40	200.00	ETQP5M680YGK
	8x8x5.4	10.00	6.70	13.00	33.70	ETQP5M100YFK
	8x8x5.4	15.00	5.30	7.60	48.20	ETQP5M150YFK
	8x8x5.4	22.00	4.80	6.90	63.00	ETQP5M220YFK
	8x8x5.4	2.50	14.00	20.10	7.60	ETQP5M2R5YFK
	8x8x5.4	33.00	3.80	5.70	100.00	ETQP5M330YFK
	8x8x5.4	3.30	13.20	17.80	8.50	ETQP5M3R3YFK
	8x8x5.4	48.00	3.40	5.40	125.00	ETQP5M470YFK
	8x8x5.4	4.70	9.40	16.20	16.80	ETQP5M4R7YFK
	8x8x5.4	6.80	8.50	13.30	20.40	ETQP5M6R8YFK
	10x10x5	97.00	2.70	3.80	208.00	ETQP5M101YGC
	10x10x5	1.00	27.50	38.40	2.30	ETQP5M1R0YLC
	10x10x5	3.30	13.90	23.50	7.10	ETQP5M3R3YGC

Power Choke Coil – Automotive Type

Series / Type	Size (LxWxH mm)	Inductivity (µH)	Rated Current (A) +40°C High Heat Dissipation	Satulation Current (A) L=–30%	R dc (mOhms)	Part No.
 Power Choke Coil Automotive Type	10x10x5	0.33	39.80	59.40	1.10	ETQP5MR33YLC
	10x10x5	0.68	31.50	40.60	1.75	ETQP5MR68YLC
	10x10x5.4	10.00	8.50	12.00	23.80	ETQP5M100YFC
	10x10x5.4	15.00	6.90	10.60	36.50	ETQP5M150YFC
	10x10x5.4	1.50	21.40	36.20	3.80	ETQP5M1R5YFC
	10x10x5.4	22.00	6.20	7.20	45.00	ETQP5M220YFC
	10x10x5.4	2.50	18.10	27.20	5.30	ETQP5M2R5YFC
	10x10x5.4	33.00	5.00	7.00	68.50	ETQP5M330YFC
	10x10x5.4	3.30	15.70	22.70	7.10	ETQP5M3R3YFC
	10x10x5.4	47.00	4.30	6.80	96.20	ETQP5M470YFC
	10x10x5.4	4.70	13.10	20.00	10.20	ETQP5M4R7YFC
	10x10x5.4	68.00	3.50	5.20	140.00	ETQP5M680YFC
	10x10x5.4	6.80	9.60	16.00	18.80	ETQP5M6R8YFC
	10x10x6	1.50	23.40	31.90	3.20	ETQP5M1R5YLC
	10x10x6	2.50	19.70	28.00	4.50	ETQP6M2R5YLC
	10x10x6	3.30	17.00	27.80	6.00	ETQP6M3R3YLC
	10x10x6	4.70	14.10	26.00	8.70	ETQP6M4R7YLC
	12x12x7	0.33	-	-	0.70	PCC-M1270MF-R33Y*
	12x12x7	0.68	-	-	1.10	PCC-M1270MF-R68Y*
	12x12x8	1.00	-	-	1.36	PCC-M1270MF-1R0Y*
	12x12x8	1.50	-	-	1.60	PCC-M1270MF-1R5Y*
	12x12x8	2.50	-	-	2.60	PCC-M1270MF-2R5Y*
	12x12x8	3.30	-	-	3.50	PCC-M1270MF-3R3Y*
	12x12x8	4.70	-	-	4.63	PCC-M1270MF-4R7Y*
	13.2x14.7x13.1	24.00	-	-	25.80	ETQPDH240DTV

*Under development

Power Choke Coil – Consumer Type

Series / Type	Size (LxWxHmm)	Inductance	Rated Current	Product Part No.
 Power Choke Coil Consumer Type	5.15x5.4x1.2	0.47 to 4.7µH	5.5 to 2.2A	ETQP1Wxxx
	7.5x6.5x 3	0.33µH	17A	ETQP3Lxxx
	7x6.6x3	1 to 4.7µH	8.1 to 3.8A	ETQP3Wxxx
	8.7x7.0x4 to 11.5x10x4	0.20 to 0.68µH	17 to 21A	ETQP4Lxxxx
	10x11x4	1.5µH	13 A	ETQP4Wxxx
	12.5x12.5x3 to 12.5x12.5x6	0.58 to 12.5µH	25.2 to 12A	ETQP6Fxxx
	12.9x13x3.9	0.36 to 1.43uH	32 to 17A	ETQP3Hxxx
	12.9x13x4.9	0.29 to 2.61µH	36 to 12A	ETQP2Hxxx
	14.5x12.5x5	0.5 to 0.6µH	30 to 27 A	ETQP5Lxxx

Power Inductors (Multilayer Type, Wire Wound Type)

Series	External Dimension (typ.)	Appearance	max. Height	Inductance [L]	Rated Current I dc (A)	Part No.
	2.0x1.25	Magnetic Shielded Type	1.0	0.47-4.7µH	0.80-1.20	ELGTEA
	3.0		1.0	0.68-22µH	0.33-1.80	ELLVEG
			1.2	1-33µH	0.28-1.50	ELLVFG-C
			1.5	1-47µH	0.27-1.80	ELLVGG
			1.5	1-100µH	0.18-1.40	ELVGG-C
	3.8		1.2	1-47µH	0.29-1.90	ELL4FG-A
			1.4	1.2-100µH	0.25-1.90	ELL4GG
			1.8	1-150µH	0.22-1.90	ELL4LG-A
	6.0		1.6	1-100µH	0.30-2.50	ELL6GG
			2.0	0.8-100µH	0.38-2.80	ELL6PG
	6.0x6.4		2.8	1-220µH	0.20-3.00	ELL6RH
			3.3	1-680µH	0.16-3.40	ELL6SH
			5.0	10-1,000µH	0.18-1.80	ELL6UH
	8.0		5.0	0.8-1,000µH	0.25-9.00	ELL8TP
	10.0		4.5	1-1,000µH	0.31-8.00	ELLATP
			4.5	1.5-1,000µH	0.32-6.70	ELLATV
	12.0		4.5	1.2-1,000µH	0.40-7.00	ELLCTP
			4.5	1.2-1,000µH	0.41-6.50	ELLCTV

Chip Inductors – Surface Mount Type

Series / Type		Inductance	DC current	Size	Part No.
	High Frequency use (Non Magnetic core type) RF/RE	1 to 100µH	400 to 90mA	0402 (1005)	ELJRFxxxxFB
		1 to 220µH	500 to 70mA	0603 (1608)	ELJRExxxxFA
	High Frequency use High-Q (Non Magnetic core type) QF,QE	1 to 39µH	400 to 150mA	0402 (1005)	ELJQFxxxxF
		2.2 to 56µH	970 to 180mA	0603 (1608)	ELJQExxxxFA
	High Power (High power type) PF/PE	1 to 39µH	400 to 150mA	0402 (1005)	ELJPFxxxxFB
		2.2 to 56µH	970 to 180mA	0603 (1608)	ELJPExxxxFA

Choke Coils

Series / Type	External Dimensions DxH (mm)	Inductance	Current IDC (A)	Part No.
 Regular	Ø9.5x8.9 (with case)	2.2-10,000µF	0.08-3.5	ECL09D*
 Regular	Ø11.5x13.9 (with case)	2.2-10,000µF	0.16-5.3	ECL11D*
 Regular	Ø12.5x16.5	100-10,000µF	0.27-1.9	ECL12D
 Regular	Ø16.0x23.0	3.3-10,000µF	0.26-8.5	ECL16B
 Regular	Ø20.0x27.0	3.3-10,000µF	0.36-8.5	ECL18B
 Shield	Ø10.0x13.0	3.9-8,200µF	0.10-2.9	ECL10E-L
 Shield	Ø13.0x18.5	4.7-10,000µF	0.13-4.4	ECL12E-L
 Shield	Ø16.0x22.0 (3 pin terminal)	5.6-10,000µF	0.30-5.4	ECL15E-L
 Shield	Ø19.0x25.1 (4 oin terminal)	5.6-10,000µF	0.33-5.9	ECL18E-L

*Taping available

Voltage Step-up Coils – Surface Mount Type

Type / Series	Inductance	Saturation Rated Current	Magnetic Composition	Size (DxH)	Part No.
 3KN	0.33 to 7.5mH	60 to 10mA	Brass ring	3.3x1.1mm to 3.3x2.0mm	ELT3KNxxxx
	10 to 50mH	10 to 1.5mA	Permalloy ring		
	1.1mH	25mA	Ring less		

OUR PROTECTION FOR YOUR CIRCUIT

CIRCUIT PROTECTION

- > SMD and leaded Types
- > Compact sizes
- > Wide range of peak current/energy handling
- > UL certified Types

Multilayer Varistors
Multilayer structure to achieve small case size.

Metal Oxide Varistors (MOV)
Large withstanding surge current capability in compact sizes. Large Energy Handling Capability absorbing transient overvoltages in compact sizes. Wide rage of varistor voltages.

SMT Multilayer NTC Thermistors
Highly reliable multilayer monolythic structure and a wide range of operating temperature.

EMI Filters
Highly effective in noise suppression, good signal integrity for high bit rate data transmission and a simple multi-layer structure.

ESD Suppressor
Excellent electrostatic-noise suppression and ESD withstanding characteristics and ultra low capacitance.

Common Mode Noise Filters
Used for signal integrity enhancement and in differential signal system.

Fuses – Thermal Cutoffs
Featuring quick temperature response and are mountable in a small space without insulation or protection.

Metal Oxide Varistors (MOV) / Transient Surge Absorbers

Series / Type	Varistor Voltage	Maximum Peak Current	Features	Part No.
 Varistor Type: D Series: E	200 to 1,100V	600 to 10,000	Large withstanding surge current capability in compact sizes Large Energy Handling Capability absorbing transient overvoltages in compact sizes Wide range of varistor voltages	ERZE05Axxx
				ERZE07Axxx
				ERZE08Axxx
				ERZE10Axxx
				ERZE11Axxx
				ERZE14Axxx
 Varistor Type: D Series: V	18 to 1,800V	125 to 10,000	Standard type with radial leads for general surge protect applications For Surge Pulse	ERZV05Dxxxxx
				ERZV07Dxxxxx
				ERZV09Dxxxxx
				ERZV10Dxxxxx
				ERZV14Dxxxxx
				ERZV20Dxxxxx
 Varistor SMD Type Series: VF	22 to 470V	125 to 600 (@8/20us)	Surface mount type with protective coating so as to high level; reliability For Surge Pulse	ERZVF1Mxxx
				ERZVF2Mxxx
Varistor Type: SC	200 to 950V	In 20kA Imax. 40kA (@8/20us)	For incorporation in a surge protective device corresponding to the IEC61643-1	ERZVS34Cxxx
 Varistor Type: E	200 to 1,100V	5,000 to 20,000	Very large surge withstanding capability with a compact size Direct mounting on boards like a power distribution board available Fast response to steep impulse voltage	ERZC20EKxxx
				ERZC32EKxxx
 Varistor UL and CSA Recognized with Tab, Type:CK		20 to 25	UL and CSA recognized components High energy handling capability (210 to 750 joules), Large withstanding peak current (25 to 30kA) Common terminals for electrical connection and mounting	ERZC32CKxxxW
				ERZC40CKxxxW
 Varistor Type: J	560 to 1,250V		Stack-type for heavy surge energy application (High power induced load etc)	ERZA80JK112
				ERZA80JK122
				ERZA80JK561
 Varistor Type: P	250 to 1,000V	5,000 (@8/20us)	Plug-in type with deterioration indicator For application to industrial equipment	ERZA20PK102
				ERZA20PK251
				ERZA20PK501
 Varistor Type: G	5 to 17kV	21kA to 5,000	For protection to switching surge of high voltage (3.3, 6.6kV) equipment	ERZA20GS173H
				ERZA20GS852H
				ERZA48GK502
Varistor For Thyristor Protection	510 to 2,500V		Thristor protection against switching surge transformer	ERZC20EKxxxP
				ERZC32EKxxxP
				ERZUxxJPxxx
Varistor Unit	22 to 1,000V	5,000 to 50,000	Surge absorber with connected ZNRs and circuit breaker in box	ERZAxxxxxxx

Multilayer NTC Thermistors – Surface Mount Type

Series / Type	Zero-Power Resistance @25Cel	B Value	Heat Dissipation Constant	Features	Size	Part No.
 NTC Thermistor (Chip Type)	22Ω to 470Ω	3,375 to 4,700K	1 or 2 or 3mW/°C	Highly reliable multilayer/ monolithic structure Wide ranges of operating temperature (-40 to 125cel)	0201	ERTJZxxxxxxxx
					0402	ERTJ0xxxxxxxx
					0603	ERTJ1xxxxxxxx

EMI Filters

Series / Type	Operating temperature	Rated Voltage	Rated Current	Features	Part No.
 Coil Type (Digital Noise Filter)	-40 to +85°C	DC 50V, 25V Applicable normal voltage for varistor (Type ELKEV)	DC 6A (Type ELKEA) DC 2A	3218 case size, 6A rated current. (Type ELKEA) 3218 case size, 2A rated current. (Type ELKE) High ESD suppression with varistor and included coils. (Type ELKEV) No variation in attenuation characteristics as current changes. The stable P/N marking using laser technology makes the part number check easier.	ELKExxxFA
					ELKEAxxxFA
					ELKEVxxxFx

ESD Suppressor – Surface Mount Type

Series / Type	Rated Voltage	Capacitance	Peak Voltage	Clamping Volt.	Size	Part No.
 ESD Suppressor	30V	0.04pF	500V max. (350V typ.)	100V max.	0201	EZAEG1A50AC
		0.05pF			0402	EZAEG2A50AX
		0.10pF			0603	EZAEG3A50AV
ESD Suppressor, 15kV Type		0.04pF			0201	EZAEG1N50AC
		0.05pF			0402	EZAEG2N50AX
 ESD Suppressor Array	15V	0.25pF			0805	EZAEGCA50AV

Common Mode Noise Filters – Surface Mount Type

Series / Type		Components	Impedance	Rated Current	DC Resistance	Part No.
	Noise Filters (0302 small size)	1 lines	43Ω ±25% 65Ω ±20% 90Ω ±20%	100mA 130mA 130mA	2.7Ω 2.5Ω 2.5Ω	EXC14CG430U EXC14CE650U EXC14CE900U
	Noise Filters (for Gbps)		50Ω ±25% 90Ω ±20%	160mA 130mA	1.5Ω 2.5Ω	EXC24CH500U EXC24CH900U
	Noise Filters (for Gbps)		24Ω ±25% 90Ω ±25%	160mA 100mA	1.5Ω 3.0Ω	EXC24CG240U EXC24CG900U
	Noise Filters (for Mbps)		36Ω ±25% 90Ω ±25% 120Ω ±25% 200Ω ±25% 90Ω ±25%	200mA 160mA 140mA 130mA 130mA	1.00Ω 1.75Ω 2.20Ω 2.70Ω 2.50Ω	EXC24CE360UP EXC24CE900U EXC24CE121U EXC24CE201U EXC24CF900U
	Noise Filters (0805 small size)		67Ω ±25% 90Ω ±25% 120Ω ±25% 200Ω ±25% 90Ω ±25%	250mA 250mA 200mA 200mA 100mA	0.8Ω 0.8Ω 1.0Ω 1.0Ω 3.0Ω	EXC34CE670P EXC34CE900U EXC34CE121U EXC34CE201U EXC34CG900U
	Noise Filter Array (0603 small size)	2 lines	43Ω ±20% 65Ω ±20% 90Ω ±20% 200Ω ±20%	100mA 140mA 130mA 100mA	2.7Ω 1.8Ω 2.0Ω 3.5Ω	EXC18CG430U EXC18CE650U EXC18CE900U EXC18CE201U
	Noise Filter Array (for Gbps)		50Ω ±25% 90Ω ±20%	160mA 130mA	1.5Ω 2.5Ω	EXC28CH500U EXC28CH900U
	Noise Filter Array (for Gbps)		24Ω ±25% 90Ω ±25%	160mA 100mA	1.5Ω 3.0Ω	EXC28CG240U EXC28CG900U
	Noise Filter Array (for Mbps)		90Ω ±25% 120Ω ±25% 200Ω ±25% 300Ω ±25%	160mA 140mA 130mA 80mA	1.5Ω 2.0Ω 2.5Ω 5.0Ω	EXC28CE900U EXC28CE121U EXC28CE201U EXC28CE301U
	2 mode Noise Filters	1 lines	120Ω ±25% 220Ω ±25% 220Ω ±25% 1.000Ω ±25% 600Ω ±25%	500mA 350mA 100mA 50mA 200mA	0.3Ω 0.4Ω 0.7Ω 1.5Ω 0.9Ω	EXC24CP121U EXC24CP221U EXC24CB221U EXC24CB102U EXC24CN601X
	Chip Bead Array	4 lines	120Ω ±25% 220Ω ±25% 120Ω ±25% 220Ω ±25%	100mA	0.5Ω 0.7Ω 0.5Ω 0.7Ω	EXC28BA121U EXC28BA221U EXC28BB121U EXC28BB221U

SMD Chip Varistor - Automotive Type

Series / Type		Circuit Voltage DC(V)	Maximum Allowable Voltage DC(V)	Normal Varistor Voltage at 1mA (V)	Capacitance at 1MHz	Application	Features	Size	Part No.
	Multilayer Chip Varistor Automotive Type	DC3~5V	11V	18V	150pF max.	Sensor I/O data Line (ECU-ECU) Communication Line (CAN/LIN)	Replacement of 0.5W Zener Diode (2.5x1.25mm)	0402	EZJZ0V180HM
		DC3~12V	13V	22V	150pF max.				EZJZ0V220HM
		DC3~12V	18V	27V	47pF max.				EZJZ0V270EM
		DC3~12V	18V	27V	20pF max.				EZJZ0V270RM
		DC3~24V	30V	42V	56pF max.				EZJZ0V420WM
		DC3~24V	40V	65V	27pF max.				EZJZ0V650DM
		DC3~12V	18V	27V	47pF max.			0504 (2 Array)	EZJZSV270EM
		DC3~12V	18V	27V	20pF max.				EZJZSV270RM
		DC3~24V	30V	42V	56pF max.				EZJZSV420WM
		DC3~5V	11V	18V	220pF max.	Actuator	Replacement of 1W Zener Diode (3.5x1.6mm)	0603	EZJZ1V180JM
		DC3~12V	13V	22V	220pF max.				EZJZ1V220JM
		DC3~12V	18V	27V	100pF max.				EZJZ1V270GM
		DC3~12V	18V	27V	47pF max.				EZJZ1V270EM
		DC3~12V	18V	27V	20pF max.				EZJZ1V270RM
		DC3~24V	30V	42V	68pF max.				EZJZ1V420FM
		DC3~24V	40V	65V	27pF max.				EZJZ1V650DM
	High Energy Type	DC12V	16V	20 to 23.2V		LED Lamp Electronic shifter Car air con, Power window	Replacement of 5W Zener Diode (>15.5x10x5mm) Meet for Load Damp Surge Maximum Surge: JASO A-1 70V 1time	3225	ERZHF2M220D
			16V	27V ± 20% (21.6 to 32.4V)				3225	ERZHF2M270

Multilayer Varistors – Surface Mount Type

Series / Type		Varistor Voltage	Maximum Peak Current	Part No.
	Multilayer Chip Varistor [Voltage/Signal lines]	6.8 to 170V	1 to 20A Contact discharge: 8kV	EZJPxxxxxx EZJZxxxxxx
	Multilayer Chip Varistor [2 Array Type for Signal lines]	12 to 170V	3 to 5A Contact discharge: 8kV	EZJZSxxxxx
	Multilayer Chip Varistor for ESD pulse	12 to 50V	Contact discharge: 30kV	EZJSxxxxxx

Thermal Cutoffs – Radial Lead Type

Series / Type	Rated Temp.	Functioning Temp.	Electrical Rating			Maximum Operating Temp.	Holding Temp.	Maximum Temp. Limit : Tm	Part No.
			AC/DC	Volt	Amp.				
 Series N	86°C	82°C	AC	250	2	60°C	60°C	200°C	EYP2BN082
			AC	125	3	52°C	56°C		
			DC	50	4	45°C	50°C		
	102°C	98°C	AC	250	2	65°C	75°C	200°C	EYP2BN099
			AC	125	3	60°C	70°C		
			DC	50	4	55°C	65°C		
	114°C	110°C	AC	250	2	80°C	90°C	200°C	EYP2BN109
			AC	125	3	76°C	86°C		
			DC	50	5	65°C	74°C		
	115°C	110°C	AC	250	2	80°C	90°C	200°C	EYP2BN110
			AC	125	3	76°C	86°C		
			DC	50	5	65°C	74°C		
	134°C	129°C	AC	250	2	90°C	100°C	200°C	EYP2BN127
			AC	125	3	75°C	90°C		
			DC	50	4	65°C	80°C		
	139°C	135°C	AC	250	2	100°C	110°C	200°C	EYP2BN134
			AC	125	3	85°C	100°C		
			DC	50	6	60°C	70°C		
	145°C	141°C	AC	250	2	110°C	120°C	200°C	EYP2BN143
			AC	125	3	105°C	115°C		
			DC	50	6	80°C	90°C		
 Series F	102°C	98°C	AC	250	1	65°C	75°C	200°C	EYP1BF101
			AC	125	2	60°C	70°C		
			DC	50	35	55°C	65°C		
	115°C	110°C	AC	250	1	80°C	90°C	200°C	EYP1BF115
			AC	125	2	76°C	90°C		
			DC	50	4	70°C	80°C		
	134°C	129°C	AC	250	1	90°C	105°C	200°C	EYP1BF134
			AC	125	2	85°C	100°C		
			DC	50	4	65°C	80°C		
	139°C	135°C	AC	250	1	100°C	110°C	200°C	EYP1BF138
			AC	125	2	90°C	105°C		
			DC	50	5	65°C	70°C		
	145°C	141°C	AC	250	1	110°C	125°C	200°C	EYP1BF145
			AC	125	2	110°C	125°C		
			DC	50	5	80°C	95°C		

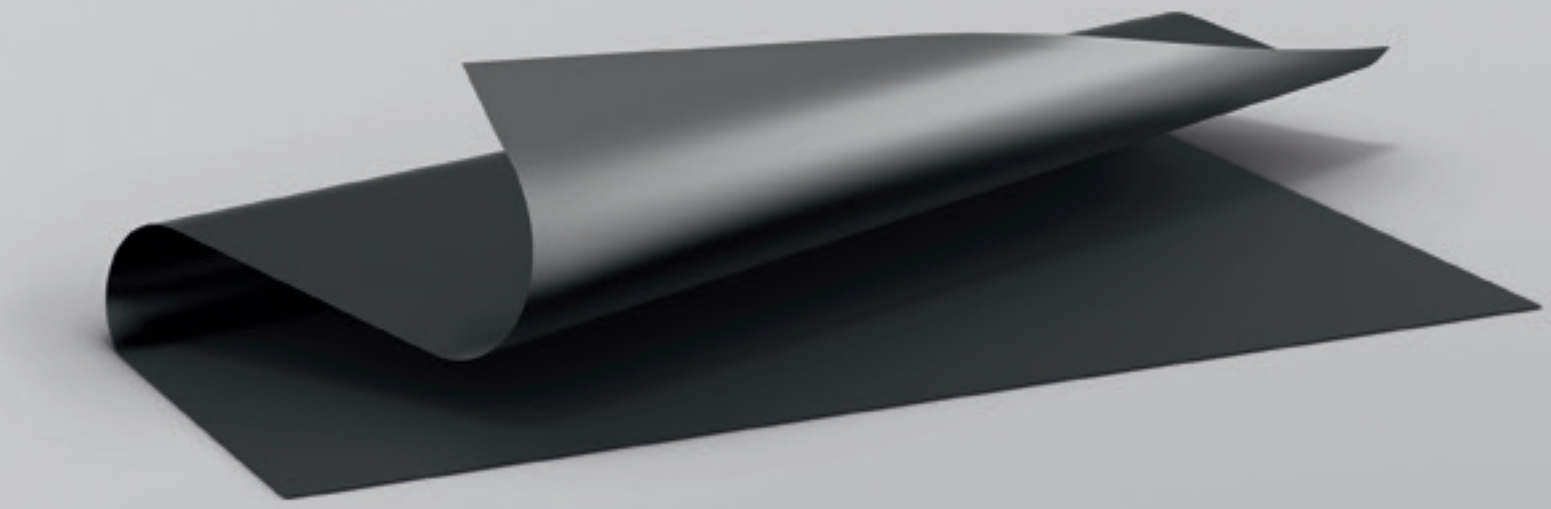
Thermal Cutoffs – Radial Lead Type

Series / Type	Rated Temp.	Functioning Temp.	Electrical Rating			Maximum Operating Temp.	Holding Temp.	Maximum Temp. Limit : Tm	Part No.
			AC/DC	Volt	Amp.				
 Series E	102°C	98°C	AC	250	05	65°C	75°C	200°C	EYP05BE101
			AC	125	15	60°C	70°C		
			DC	50	3	55°C	65°C		
	115°C	110°C	AC	250	05	80°C	95°C	200°C	EYP05BE115
			AC	125	15	76°C	93°C		
			DC	50	3	70°C	84°C		
	134°C	129°C	AC	250	05	90°C	105°C	200°C	EYP05BE134
			AC	125	15	85°C	100°C		
			DC	50	3	70°C	85°C		
	139°C	135°C	AC	250	05	100°C	115°C	200°C	EYP05BE138
			AC	125	15	95°C	110°C		
			DC	50	4	65°C	80°C		
	145°C	141°C	AC	250	05	110°C	125°C	200°C	EYP05BE145
			AC	125	15	105°C	125°C		
			DC	50	5	80°C	95°C		
 Series H	102°C	98°C	AC	250	2	65°C	75°C	200°C	EYP2BH101
			AC	125	3	60°C	70°C		
			DC	50	35	55°C	65°C		
	115°C	110°C	AC	250	2	80°C	90°C	200°C	EYP2BH115
			AC	125	3	76°C	86°C		
			DC	50	35	74°C	84°C		
	134°C	129°C	AC	250	2	90°C	95°C	200°C	EYP2BH134
			AC	125	3	70°C	85°C		
			DC	50	35	65°C	80°C		
	139°C	135°C	AC	250	2	100°C	105°C	200°C	EYP2BH138
			AC	125	3	80°C	95°C		
			DC	50	35	75°C	90°C		
	145°C	141°C	AC	250	2	110°C	125°C	200°C	EYP2BH145
			AC	125	3	100°C	115°C		
			DC	50	45	85°C	100°C		
 Series MP	92°C	88°C	DC	32	2	55°C	60°C	135°C	EYP2MP092AFT
	98°C	94°C	DC	32	2	60°C	65°C	135°C	EYP2MP098AFT
Series MU	92°C	89°C	DC	32	4	55°C	55°C	135°C	EYP4MU092GFD

Micro Chip Fuse – Surface Mount Type

Series / Type	Rated Current	Rated Voltage	Size	Part No.
Micro Chip Fuse	0.315A - 3.0A	32VDC	0402	ERBRDxRxxX
	0.5A - 5.0A		0603	ERBRExRxxV
	0.5A - 4.0A	63VDC (0.5A to 2.0A) 32VDC (2.5A to 4.0A)	1206	ERBRGxRxxV

THE FUTURE OF THERMAL MANAGEMENT



THERMAL HEAT SINK SOLUTION

- Thermal Conductivity: 700 to 1950 W/(m-K)
- Offers thermal conductivity five times greater than copper, ten times greater than aluminium
- Density: 0.85 to 2.13g/cm
- Flexible and easy to cut or trim
- Withstands repeated bending
- Low thermal resistance
- RoHS directive compliant

Our products efficiently diffuse heat in today's world of compact electronic devices. Enter with us the next dimension of thermal management.

Pyrolytic Graphite Sheet (PGS) is an ultra-thin, lightweight, graphite film with a thermal conductivity high enough to release and diffuse the heat generated by heat sources such as CPUs, processors, power amplifiers, cameras and mobile phones.
This material is flexible and can be cut into customized shapes.

PYROLYTIC GRAPHITE SHEET (PGS)

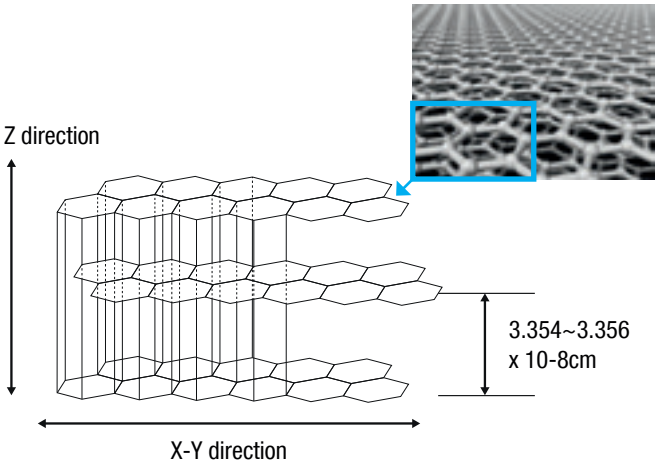
HIGH THERMAL CONDUCTIVITY FOR HEAT PROBLEMS

ADDED VALUE

> High thermal conductivity
> Flexible Material
> Shielding (Electromagnetic wave)

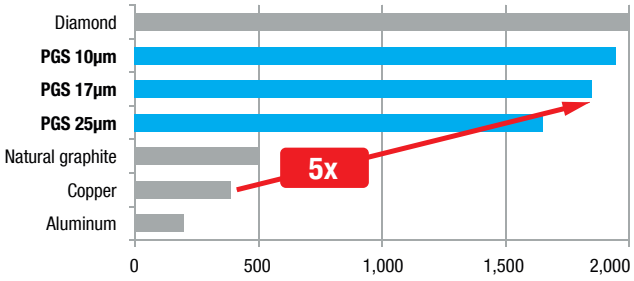
FLEXIBLE MATERIAL

CRYSTALLIZED STRUCTURE



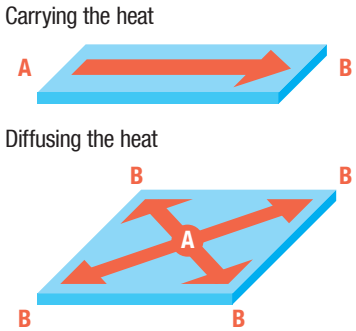
HIGH THERMAL CONDUCTIVITY

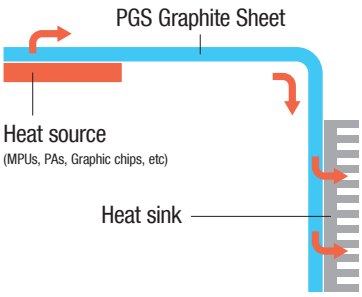
> Best thermal conductivity in the industry
> 5 times higher, in a range from 700 to 1950W/mK

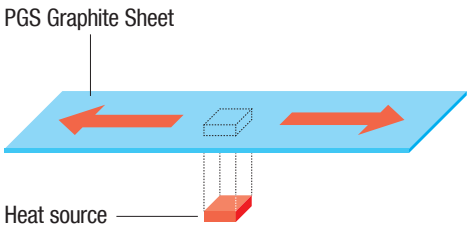


FUNCTION OF PGS GRAPHITE SHEET

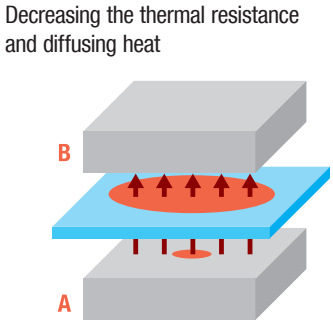
1.) Thermal Transfer

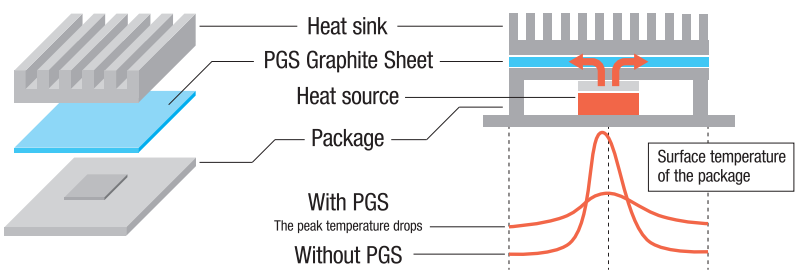




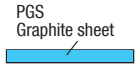
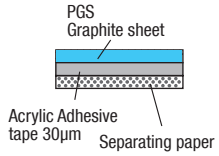
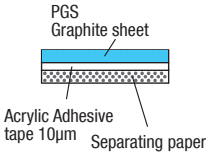
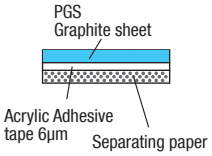


2.) Thermal Interface



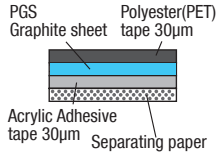
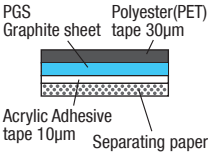
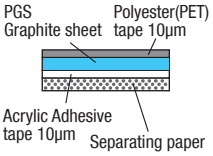
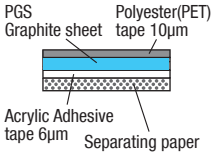


"PGS" Graphite Sheets Standard Series

Type		PGS only	Adhesive Tape		
		S Type	A-A Type	A-M Type	A-F Type
Front Face		-	-	-	-
Rear Face		-	Insulative adhesion type 30 µm	Insulative thin adhesion type 10µm	Insulative thin adhesion type 6µm
Structure					
Features		> High Thermal Conductivity > High Flexibility > Low Thermal Resistance > Available up to 400°C > Conductive Material	> With insulation material on one side > With strong adhesive tape for putting chassis > Withstanding voltage: 2kV	> With insulation material on one side > Low thermal resistance comparison with A-A type > Withstanding voltage: 1kV	> With insulation material on one side > Low thermal resistance comparison with A-A type
Withstanding temperature		400°C	100°C	100°C	100°C
Standard Size		115x180mm	90x115mm	90x115mm	90x115mm
Maximum Size		180x230mm (25µm to)	115x180mm	115x180mm	115x180mm
100µm	Part No.	EYGS121810	EYGA091210A	EYGA091210M	EYGA091210F
	Thickness	100µm	130µm	110µm	106µm
70µm	Part No.	EYGS121807	EYGA091207A	EYGA091207M	EYGA091207F
	Thickness	70µm	100µm	80µm	76µm
50µm	Part No.	EYGS121805	EYGA091205A	EYGA091205M	EYGA091205F
	Thickness	50µm	80µm	60µm	56µm
40µm	Part No.	EYGS121804	EYGA091204A	EYGA091204M	EYGA091204F
	Thickness	40µm	70µm	50µm	46µm
25µm	Part No.	EYGS121803	EYGA091203A	EYGA091203M	EYGA091203F
	Thickness	25µm	55µm	35µm	31µm
17µm	Part No.	-	EYGA091202A	EYGA091202M	EYGA091202F
	Thickness	-	47µm	27µm	23µm
10µm	Part No.	-	EYGA091201A	EYGA091201M	EYGA091201F
	Thickness	-	40µm	20µm	16µm

Please contact our engineering section or factory about special applications.
Withstanding voltages are for reference, not guarenteed.

"PGS" Graphite Sheets Standard Series

Type		Laminated Type (Insulation & Adhesive)			
		A-PA Type	A-PM Type	A-DM Type	A-DF Type
Front Face		Polyester tape standard type 30μm	Polyester tape standard type 30μm	Polyester tape thin type 10μm	Polyester tape thin type 10μm
Rear Face		Insulative adhesion type 30μm	Insulative thin adhesion type 10μm	Insulative thin adhesion type 10μm	Insulative thin adhesion type 6μm
Structure					
Features		> With insulation material on both side > Withstanding voltage: > PET tape: 4kV > Adhesive tape: 2kV	> With insulation material on both side > Withstanding voltage: > PET tape: 4kV > Adhesive tape: 1kV	> With insulation material on both side > Withstanding voltage: > PET tape: 1kV > Adhesive tape: 1kV	> With insulation material on both side > Withstanding voltage: > PET tape: 1kV
Withstanding temperature		100°C	100°C	100°C	100°C
Standard Size		90x115mm	90x115mm	90x115mm	90x115mm
Maximum Size		115x180mm	115x180mm	115x180mm	115x180mm
100μm	Part No.	EYGA091210PA	EYGA091210PM	EYGA091210DM	EYGA091210DF
	Thickness	160μm	140μm	120μm	116μm
70μm	Part No.	EYGA091207PA	EYGA091207PM	EYGA091207DM	EYGA091207DF
	Thickness	130μm	110μm	90μm	86μm
50μm	Part No.	EYGA091205PA	EYGA091205PM	EYGA091205DM	EYGA091205DF
	Thickness	110μm	90μm	70μm	66μm
40μm	Part No.	EYGA091204PA	EYGA091204PM	EYGA091204DM	EYGA091204DF
	Thickness	100μm	80μm	60μm	56μm
25μm	Part No.	EYGA091203PA	EYGA091203PM	EYGA091203DM	EYGA091203DF
	Thickness	85μm	65μm	45μm	41μm
17μm	Part No.	EYGA091202PA	EYGA091202PM	EYGA091202DM	EYGA091202DF
	Thickness	77μm	57μm	37μm	33μm
10μm	Part No.	EYGA091201PA	EYGA091201PM	EYGA091201DM	EYGA091201DF
	Thickness	70μm	50μm	30μm	26μm

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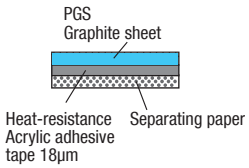
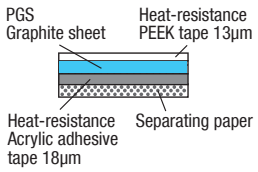
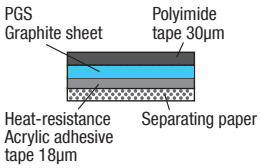
"PGS" Graphite Sheets High Heat Resistance Series

Type		High Heat Resistance Type		
		A-V Type	A-RV Type	A-KV Type
Front Face		-	High heat resistance and insulation type 13μm	High heat resistance and insulation type 30μm
Rear Face		High heat resistance and insulation adhesion type 18μm	High heat resistance and insulation adhesion type 18μm	High heat resistance and insulation adhesion type 18μm
Structure				
Features		> With high heat resistance and insulation tape on one side > Withstanding voltage adhesive tape: 2kV	> With high heat resistance and insulation tape on both side > Withstanding voltage: > PEEK tape: 2kV > adhesive tape: 2kV	> With high heat resistance and more insulated tape on both side > Withstanding voltage: > PI tape: 5kV > adhesive tape: 2kV
Withstanding temperature		150°C	150°C	150°C (Polyimide: 180°C)
Standard Size		90x115mm	90x115mm	90x115mm
Maximum Size		115x180mm	115x180mm	115x180mm
100μm	Part No.	EYGA091210V	EYGA091210RV	EYGA091210KV
	Thickness	118μm	131μm	148μm
70μm	Part No.	EYGA091207V	EYGA091207RV	EYGA091207KV
	Thickness	88μm	101μm	118μm
50μm	Part No.	EYGA091205V	EYGA091205RV	EYGA091205KV
	Thickness	68μm	81μm	98μm
40μm	Part No.	EYGA091204V	EYGA091204RV	EYGA091204KV
	Thickness	58μm	71μm	88μm
25μm	Part No.	EYGA091203V	EYGA091203RV	EYGA091203KV
	Thickness	43μm	56μm	73μm
17μm	Part No.	EYGA091202V	EYGA091202RV	EYGA091202KV
	Thickness	35μm	48μm	65μm
10μm	Part No.	EYGA091201V	EYGA091201RV	EYGA091201KV
	Thickness	28μm	41μm	58μm

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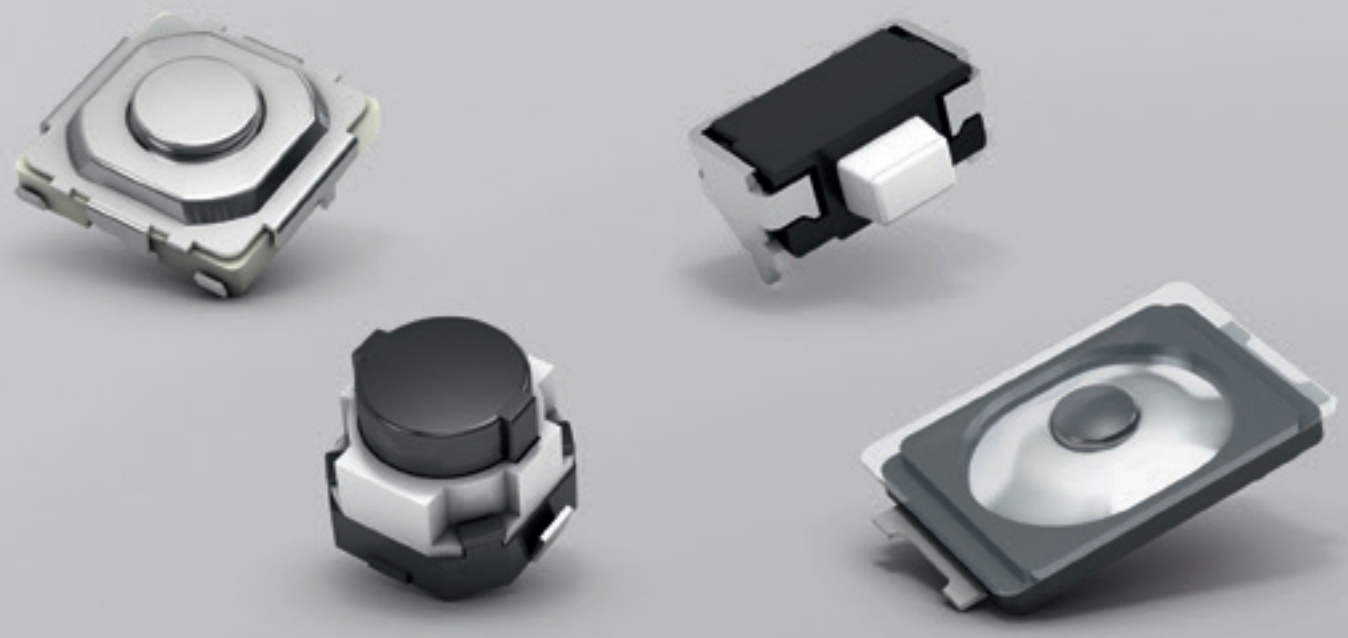
TOUCH AND FEEL THE DIFFERENCE



SWITCHES

- > Wide range of size and operating forces
- > Very low contact resistance
- > High contact reliability
- > Temperature range from -40 up to +85°C
- > Excellent tactile behaviour
- > Long life type up to 1Mio cycles
- > Variety of IP67 switches

Light Touch Switches provide a unique, sharp tactile feel, have low contact resistance, minimal bounce noise, high contact reliability and are available in a wide selection of operating forces.

Detector Switches are used to detect mechanical, such as the closing of a flip-phone or detecting end positions of rotaries. Detector Switches can also be used as an Encoder function enabling lower cost solutions.

Encoders convert the manual rotary operation of an actuator or knob into coded signal outputs and offer options such as excellent haptics with various detents, high torque, push-on switch, long life, and center space.

Carbon-Type Potentiometers are used for analog Input systems. These devices are available with or without detents as well as center space and high torque capability. Excellent output linearity combined with long life capability provides added value.

Light Touch Switches – Surface Mount Type

Series / Type	Dimensions LxWxH (mm)	Operating Force	Operating Cycles	Travel	Part No.
 4mm Square	4.1x4.1x0.35 4.1x4.1x0.43 4.1x4.1x0.58	1.0N 1.6N 2.4N	200,000 500,000 1,000,000	0.25mm	EVQ6P6xxx EVQ7P6xxx EVQ9P6xxx EVQP6xxxx
 4.5mm Square	4.5x4.5x0.55	1.6N 2.4N	200,000	0.20mm	EVQPQxxxx
 4.9mm Square	4.9x4.9x0.8 4.9x4.9x1.5	1.0N 1.6N 2.6N	200,000 500,000	0.25mm	EVQPLxxxx
 6mm Square Thin Type	6.5x6.0x2.0 6.5x6.0x2.5 6.5x6.0x3.1	0.5N 0.6N 1.0N 1.3N 1.6N 2.6N 3.5N	100,000 200,000 1,000,000 2,000,000	0.25mm 0.35mm	EVQP0xxxx EVQQ2xxxx
 2.6x1.6mm IP67	2.6x1.6x0.53	1.6N	500,000	0.11mm	EVPBBxxxx NEW
 3.0x2.0mm IP67	3.0x2.0x0.6	1.6N 2.4N 3.3N	300,000	0.13mm 0.15mm	EVPAWxxxx NEW
 3.0x2.6mm	3.0x2.6x0.65	1.6N	100,000	0.15mm	EVPAFxxxx
 3.0x2.6mm Double-action	3.0x2.6x0.7	1st: 0.7N 2nd: 2.0N	100,000	1st: 0.07mm 2nd: 0.16mm	EVPAXxxxx NEW
 3.4x2.9mm IP67	3.4x2.9x1.7	1.6N	500,000	0.15mm	EVPAYxxxx NEW
 3.5x2.9mm	3.5x2.9x1.7	1.0N 1.6N 2.4N 3.5N 5.0N	200,000 1,000,000	0.15mm	EVPAAxxxx
 4.7x3.5mm	4.7x3.5x2.1 4.7x3.5x2.5	1.0N 1.6N 2.4N 2.5N 3.5N 5.0N	200,000 500,000 1,000,000	0.25mm 0.70mm	EVQ3P2xxx EVQP2xxxx EVQP9xxxx
 3.5x2.9mm Side-operation Type	3.5x2.9x1.35	1.6N 2.2N	100,000	0.20mm	EVQ9P7xxx EVQP3xxxx EVQP7xxxx
 3.8x1.9mm Side-operation Type IP67	3.8x1.9x1.6	1.6N	200,000	0.12mm	EVPAKxxxx NEW
 4.7x3.5mm Side-operation Type	4.7x3.5x1.65			0.30mm	EVQPUxxxx
 2.8x2.3mm Side-operation Type Edge Mount	2.8x2.3x1.95	1.6N	300,000	0.13mm	EVPAVxxxx NEW
 4.5x2.2mm Side-operation Type Edge Mount	4.5x2.2x2.9	1.6N	200,000	0.15mm	EVPAExxxx
 6.2x2.5mm Side-operation Type Edge Mount	6.2x2.55x3.5	1.0N 1.6N 2.4N 2.5N 3.5N 5.0N	200,000 500,000 1,000,000	0.25mm 0.70mm	EVQP4xxxx EVQP8xxxx

Light Touch Switches – Surface Mount Type

Series / Type	Dimensions LxWxH (mm)	Operating Force	Operating Cycles	Travel	Part No.
 6.1x4.0mm Side-operation Type	6.1x4.0x1.8	1.6N 2.2N	100,000	0.30mm	EVQPSxxxx
 3.5x2.9mm Side-operation Type Half Dive	3.5x2.9x1.2			0.20mm	EVPANxxxx
 6.0x3.5mm	6.0x3.5x4.3 6.0x3.5x5.0	1.0N 1.6N 2.4N	30,000 50,000	0.25mm	EVQ5Pxxxx EVQPE1xxx EVQPNxxxx
 4mm Square Double-action	4.0x4.1x0.59	0.8N / 1.6N 0.9N / 2.0N 1.0N / 2.6N	30,000 100,000	0.15 / 0.3mm	EVPAHxxxx
 6mm Square Double-action Thin Type	6.0x6.0x0.9 6.0x6.0x0.95	0.7N / 2.6N 1.0N / 2.6N	30,000	0.4mm / 0.5mm	EVQ3PRxxx EVQPRxxxx EVQQ0xxxx
 7x3.5mm Double-action Side-operational	4.7x3.5x1.2	1.6N / 2.6N	100,000	0.15mm / 0.4mm	EVPAJxxxx
 6mm Square Long Travel	6.0x6.1x5.0	1.6N 2.0N 2.2N 2.5N 3.5N	30,000 100,000	1.0mm 1.3mm	EVQ9Pxxxx EVQP19xxx EVQP1Bxxx EVQP1Dxxx EVQP1Fxxx EVQP1Kxxx
 6mm Square Long Travel 2 terminal type	6.0x6.1x5.0	1.6N 2.0N 2.2N 2.5N 3.0N 3.5N	30,000 100,000	1.0mm 1.3mm	EVPASxxxx
 8mm Square Long Travel	8.5x8.5x6.5	4.0N 5.0N	100,000	1.0mm	EVQQ1xxxx
 10mm Square Center Space Long Travel	9.8x9.8x4.6	4.0N			EVPADxxxx

Light Touch Switches – Radial Lead Type

Series / Type	Dimensions LxWxH (mm)	Operating Force	Operating Cycles	Travel	Part No.
 5N	6.0x6.0x4.3 6.0x6.0x5.0 6.0x6.0x7.0 6.0x6.0x9.5	1.0N 1.3N 1.6N 2.6N	50,000 100,000	0.25mm	EVQPAxxxx EVQPBxxxx
 5N Side-operation Type	7.5x7.1x7.15 7.5x7.1x7.85 7.5x7.1x9.85 7.5x7.1x12.35				EVQPFxxxx
 5N Type 2R	6.0x6.0x4.3 6.0x6.0x5.0 6.0x6.0x7.0 6.0x6.0x9.5				EVQ2xxxx
 5N Type 4R Side-operation Type	7.5x7.1x9.25				EVQPCxxxx
 Type 2R Round Type	6.0x6.0x4.3 6.0x6.0x5.0 6.0x6.0x7.0 6.0x6.0x9.5				EVQ11xxxx
 6.0x3.5mm	6.0x3.5x4.3 6.0x3.5x5.0	1.0N 1.6N 2.4N	30,000 50,000		EVQPExxxx
 Over Travel	6.2x6.2x7.45	0.74N 1.3N	1,000,000 5,000,000	0.2mm	EVQP0xxxx
 6mm Square 2R Long Travel	6.0x6.1x5.0	1.6N 2.0N 2.2N 2.5N 3.5N	30,000 100,000	1.0mm 1.3mm	EVQPVxxxx

Push Switches – Surface Mount Type

Series / Type	Dimensions LxWxH (mm)	Lock Travel	Full Travel	Operating Force	Part No.
	8.9x10.0x20.5	1.5mm 2.5mm	2.5mm 3.5mm	2.0N 3.5N	ESB30xxxx

Push Switches – Radial Lead Type

Series / Type	Dimensions LxWxH (mm)	Lock Travel	Full Travel	Operating Force	Part No.
	8.5x8.5x13.5	1.5mm	2.5mm	2.94N	ESB64xx
	10.0x7.75x12.5		2.3mm	3.0N	ESB33xxx
	8.9x10.0x20.5	1.5mm 2.5mm	2.5mm 3.5mm	2.0N 3.5N	ESB30xxxxx
	7.8x7.9x17.5	–	2.5mm	2.0N 4.0N	ESE20C4xx ESE20D4xx
	7.8x7.9x12.5				ESE20C3xx ESE20D3xx

Detector Switches

Series / Type	Dimensions LxWxH (mm)	Travel	Operating Force	Rating	Part No.
 09HL	3.0x3.5x0.9	1.4mm 2.1mm	300mN	50µA 3VDC to 10µA 5VDC	ESE58xxxx
 1VR	2.2x3.35x1.5	1.5mm	250mN		ESE16xxxx
 1VL	4.2x3.6x1.2	2.15mm 3.05mm	300mN		ESE13xxxx
 1HL	4.0x4.4x1.2	1.4mm 2.1mm			ESE18xxxx
 2HL	5.4x5.75x1.7	3.2mm	390mN		ESE31xxxx
 2N	Wide Variation	0.6mm 1.2mm 1.45mm 2.20mm 4.25mm	300mN		ESE22xxxx
 5N		Wide Variation	350mN		ESE11xxxx
 1HW	5.0x4.4x1.5	1.0mm 2.2mm	300mN		ESE23xxxx
 2W	7.5x3.0x5.6 7.5x4.65x5.6	Wide Variation	350mN		ESE24xxxx

Rotary Potentiometers – Vertical Type – Surface Mount Type

Series / Type	Pulse	Detents	Rotation Torque	Height of body	Endurance (Cycles)	Part No.
 10mm GS	333.3°	—	3mNm	2.0mm	100,000	EVWAE4001B14

Encoders – Horizontal Type – Radial Lead Type

Series / Type	Pulse	Detents	Rotation Torque	Height from PCB to shaft	Endurance (Cycles)	Part No.
 10mm GS	12	24	5mNm	7.0mm	100,000	EVQVXM00112B
				9.0mm		EVQVXD00112B
				11.0mm		EVQVXC00112B

Encoders – Surface Mount Type

Series / Type	Bushing	Pulse	Detents	Rotation Torque	Switch Push Force / Stroke	Height (mm)	Endurance (Cycles)	Part No.
 11mm Square GS serration-shaft Komuso Junior (shaft wobble reduced), with Switch Push Function	-	8	16	14mNm	6N / 0.4mm	17.5	30,000	EVEUPCAH508B
		16	32	14mNm				EVEUPCAH516B
		8	16	14mNm	4N / 1.5mm			EVEUBCAH508B
		16	32	14mNm				EVEUBCAH516B

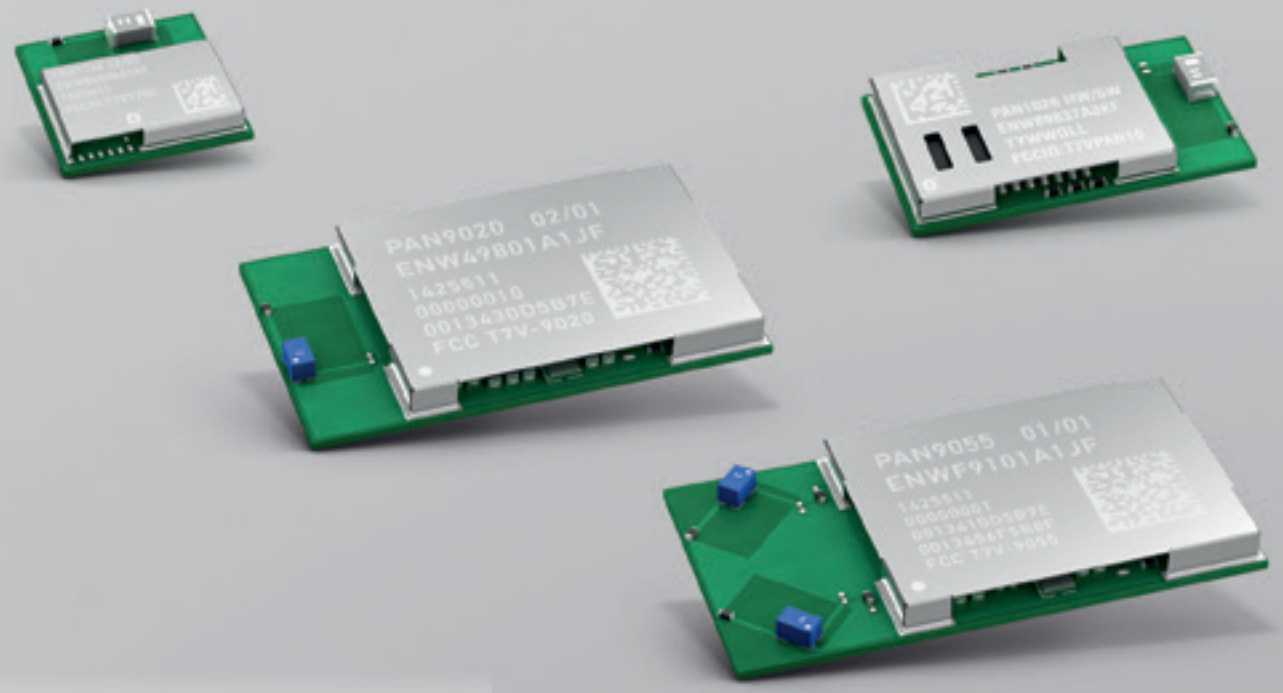
Encoders – Radial Lead Type

Series / Type	Bushing	Pulse	Detents	Rotation Torque	Switch Push Force / Stroke	Height (mm)	Endurance (Cycles)	Part No.
 11mm Square GS serration-shaft Komuso Junior (shaft wobble reduced), with Switch Push Funct.	-	8	16	14mNm	6N / 0.4mm	18.0	30,000	EVEYPCAJ008B
		16	32	14mNm				EVEYPCAJ016B
		8	16	14mNm	4N / 1.5mm			EVEYBCAJ008B
		16	32	14mNm				EVEYBCAJ016B
 12mm Square GS with Switch Push D-shaft	Die-cast (7 & 9mm)	20	20	3~20mNm	3N / 0.4mm	20	30,000	EVEJBBF2020B
		20	20			25		EVEJBBF2520B
 16mm Square GS Komuso Senior High torque with switch push func.	-	16	32	25mNm	6N / 0.5mm	21.5		EVEQDBRG516B
		8	16	25mNm				EVEPDBRG508B

Center Space Encoders – Radial Lead Type

Series / Type	Pulse	Detents	Rotation Torque	Endurance	Part No.
 20/12mm	9	18	6mNm	30,000	EVQV6B00909B
	9	18	7mNm		EVQV6A00609B
	9	18	9mNm		EVQV5A00109B
 27/18mm	9	18	9mNm		EVQV5N00409B
	9	18	13.5mNm		EVQV5D00309B
	9	18	18mNm		EVQV5G00209B
	15	30	9mNm		EVQV5L00415B
	15	30	13.5mNm		EVQV5C00315B
	15	30	18mNm		EVQV5B00215B
	15	30	25mNm		EVQV5K00715B

MODULES FOR A WIRELESS WORLD



WIRELESS CONNECTIVITY

One major trend in the wireless connected world is the **Internet of Everything (IoE)** – connect the unconnected.

Application in the IoE are divided towards what shall be connected.

> Person to Machine

> Machine to Machine

> Person to Person

In a connected world all these will interact together.

Panasonic is manufacturing modules in the field of **Wireless Personal Area Network** (WPAN: *Bluetooth®*, ISM and Mesh Networking), **Wireless Body Area Network** (WBAN) and expanding its portfolio to **Wireless Local Area Network** (WLAN: Wi-Fi).
The modules are engineered in Germany and produced in Europe under the premise of TS16949.

All products are qualified according to CE, FCC, IC, and *Bluetooth®* QDID if applicable. Different software/profile options are available.

With short project deadlines, a module design enables you to be the first in the market, quickly. Panasonic evaluation kits provide an easy to use and low-cost platform for evaluating and prototyping your design.

Classic *Bluetooth*® Modules

Series	PAN13x0 Series	PAN1322 Series	PAN1555 Series	PAN13x5B Series
				
Status	Mass Production	Mass Production	Mass Production	Mass Production
Part Number*	ENW89814C2MF	ENW89841A3KF	ENW89815AxKF	ENW89829x3KF
RF Category	**Classic *Bluetooth*® *Bluetooth*® v2.1 + EDR class 2**	**Classic *Bluetooth*® *Bluetooth*® v2.1 + EDR class 2**	**Classic *Bluetooth*® *Bluetooth*® v3.0 + EDR class 2**	**Classic *Bluetooth*® *Bluetooth*® v2.1 + EDR class 1.5**
Software/Profile	HCI	SPP	SPP/HDP+SPP/HID/…	HCI
Used ICs	PMB8763	PMB8754	BC6 + STM32F103	CC2560B
Size [mm] w/o antenna w/ antenna	11.6x8.7x1.8	15.6x8.7x1.8	22.8x13.5x2.7	9.0x6.5x1.8 9.0x9.5x1.8
Rx Sensitivity [dBm]	-86 @ BER 10^{-3}	-86 @ BER 10^{-3}	-86 @ BER 10^{-3}	-93 @ BER 10^{-3}
Tx Power (max.) [dBm]	+4	+4	+4	+10
Power Supply [V]	2.9 to 4.1	2.9 to 4.1	2.7 to 3.6	1.8 to 4.8
Current Consumption	Tx, EDR: 40mA Sleep Mode: 80µA	Tx, EDR: 40mA Sleep Mode: 80µA	ACL, DH1: 47mA Sleep Mode: <100µA	Tx, EDR: 40mA Sleep Mode: 135µA
Interfaces	GPIO, PCM, UART, JTAG	GPIO, UART, JTAG	GPIO, UART, I²C, SPI, ADC	GPIO, PCM, UART
Footprint-compatible to	PAN13x0/PAN1322/PAN172x Series			All CC256x based *Bluetooth*® modules are footprint- and pin-compatible
Operating Temp. [°C]	-40 to +85	-40 to +85	-40 to +85	-40 to +85
Evaluation Kit*	n/a	ENW89841AYKF (KIT)	n/a	EVAL_PAN1323 (EMK)

* x is a parameter to be defined.

Classic *Bluetooth*® technology is best suited to high data rate applications (up to 3Mbits), where the network size is under eight nodes. This is a piconet of one master device and up to seven slaves. Role switching is supported. Larger networks can be formed with Scatternets. Connections are robust, even in noisy environments, by using 79 channels, each 1MHz wide, adaptive frequency hopping, and multiple modulation schemes. Range can be adjusted using hardware and software from under a meter to over two hundred meters. There are several types of profiles which describe a variety of use cases. For example, SPP or Serial Port Profile is a standard profile for wirelessly connecting devices in place of a serial cable.

Bluetooth® Smart Ready and *Bluetooth*® Smart Modules

Series	PAN13x6B Series	PAN1026 Series	PAN1760 Series	PAN172x Series	PAN1740 Series
					
Status	Mass Production	Mass Production	Engineering Sample	Mass Production	Mass Production
Part Number*	ENW89823x3KF	ENW89837A3KF	ENW89847A1KF	ENW898xxxxKF	ENW89846A1KF
RF Category	***Bluetooth*® Smart Ready *Bluetooth*® v4.0 class 1.5**	***Bluetooth*® Smart Ready *Bluetooth*® v4.0 class 2**	***Bluetooth*® Smart *Bluetooth*® v4.1**	***Bluetooth*® Smart *Bluetooth*® v4.0**	***Bluetooth*® Smart *Bluetooth*® v4.1**
Software/Profile	HCI	SPP + GATT	Embedded Profiles	nBlue™ by BlueRadios Inc./ TI SW stack	Embedded Profiles
Used ICs	CC2564B	TC35661-501	TC35667	CC2540/CC2541	DA14580
Size [mm] w/o antenna w/ antenna	9.0x 6.5x1.8 9.0x9.5x1.8	15.6x8.7x1.8	15.6x8.7x1.8	11.6x8.7x1.8 15.6x8.7x1.8	9.0x9.5x1.8
Rx Sensitivity [dBm]	-93 @ BER 10^{-3}	-88 @ BER 10^{-3}	-91	-94 @ BER 1%	-93 @ BER 1%
Tx Power (max.) [dBm]	+10	+4	+0	+4/0	+0
Power Supply [V]	1.8 to 4.8	1.8 or 3.3	1.8 to 3.6	2.0 to 3.6	2.35 to 3.3
Current Consumption	Tx, EDR: 40mA Sleep Mode: 135µA	ACL, DH1: 46mA Sleep Mode: <100µA	Tx: 8.7mA Rx: 8.4mA LPM: 0.7/5/8/10µA	Tx: 23mA @ -6dBm Rx: 18mA Sleep Mode: <1µA	Tx: 4.9mA Rx: 4.9mA Sleep Mode: <1µA
Interfaces	GPIO, PCM, UART	GPIO, UART	GPIO, UART, SPI, I²C, ADC	GPIO, UART, USB only PAN17x0 Series	GPIO, UART, SPI, I²C, 3-axis QD, ADC
Memory			32kB on chip RAM 512kb EEPROM	256kb	32kb OTP
Specialty		Same *Bluetooth*® Low Energy Software Platform		2 internal crystal	2 internal crystal
Footprint-compatible to	All CC256x based *Bluetooth*® modules are footprint- and pin-compatible	PAN1760 Series	PAN1026 Series	PAN13x0/PAN1322/ PAN172x Series	
Operating Temp. [°C]	-40 to +85	-40 to +85	-40 to +85	-40 to +85	-40 to +85
Evaluation Kit*	EVAL_PAN1323 (EMK)	ENW89837AYKF (KIT)	ENW89847AYKF (KIT)	ENW898xxAY2F (BR KIT) ENW898xxAY1F (TI KIT)	ENW89846AYKF (KIT) ENW89846AVKF (EMK)

* x is a parameter to be defined.

***Bluetooth*® Smart Ready** technology builds the centre of the *Bluetooth*® ecosystem in combining Classic *Bluetooth*® technology and *Bluetooth*® Smart technology in one device. These so called dual-mode modules combine both communication stacks and permit a shared antenna. It can communicate with other devices implementing both technologies as well as devices implementing either technology and therefore can easily be added to 'hub' devices, e.g. for industrial, automation, medical and fitness products. Single-mode and dual-mode devices are respectively designated as *Bluetooth*® Smart and Bluetooth® Smart Ready. Some profiles and use cases will be supported by only one of the technologies. Therefore, devices implementing both technologies have the ability to support the most use cases.

***Bluetooth*® Smart** technology achieves its low power consumption primarily by keeping its radio turned off most of the time. It scans only three advertising channels, and its radio awakens only to send or receive short bursts of data, with small packet sizes from 8 to 27 octets. *Bluetooth*® Smart technology can transmit authenticated data in as little as 3ms, versus the 1000ms typical for Classic *Bluetooth*® technology. All this relates in a maximum practical data rate well under 100kbps typically. In *Bluetooth*® Smart technology each use case is allocated to one *Bluetooth*® Smart profile. For transmitting temperature the temperature profile and service are used. Profile and services are using the GATT-based architecture.

Wi-Fi and Wi-Fi Combo Modules

Series	PAN90x0**	PAN93x0	PAN90x5**
			
Status	Engineering Sample	ES Q2/2015	Under Development
Part Number*	ENW49801x1JF (USB) ENW49802x1JF (SDIO)	ENW49A01x3JF	ENWF9101x1JF (commercial grade) ENWF9101x1EF (extended grade)
RF Category	**Wi-Fi Radio 802.11 b/g/n**	**Wi-Fi Embedded 802.11 b/g/n**	**Combo Radio Wi-Fi 802.11 b/g/n (MIMO 2x2) + *Bluetooth*® Smart Ready *Bluetooth*® v4.0 class 1.5**
Software/Profile	Linux / Android Driver	Full Embedded	Linux / Android Driver
Used ICs	88W8782	88MC200 + 88W8782	88W8797
Size [mm]	22.75x13.5x2.42	29.0x13.5x2.66	26.0x13.5x2.40
Antenna Options	w/ antenna / w/ 50Ω bottom pad	w/ antenna	w/o antenna / w/ 2 antenna
Rx Sensitivity [dBm]	-98 @ 1M-DSSS -88 @ 11M-CCK -93 @ 6M-BPSK -76 @ 54M-OFDM -74 @ 65M-MCS7	-98 @ 1M-DSSS -88 @ 11M-CCK -93 @ 6M-BPSK -76 @ 54M-OFDM -74 @ 65M-MCS7	-98 @ 1M-DSSS -88 @ 11M-CCK -93 @ 6M-BPSK -76 @ 54M-OFDM -74 @ 65M-MCS7
Tx Power (max.) [dBm]	+18 @ 11b	+18 @ 11b	+18 @ 11b
Power Supply [V]	3.0 to 3.6	3.0 to 3.6	3.0 to 3.6
Current Consumption	430mA @ 11Mbps	~450mA	tbd
Centre Frequency [GHz]	2.4	2.4	2.4
Interfaces	USB2.0 or SDIO	GPIO, QSPI, I²C, UART, JTAG	USB2.0, SDIO3.0, HS UART
Specialty	Coexistence Interface for external co-located 2.4GHz radios		Coexistence with cellular and other 2.4GHz on-chip radios
Operating Temp. [°C]	0 to +70	0 to +70	0 to +70 (commercial grade) -30 to +85 (extended grade)
Evaluation Kit*	ENW49802AYJF (KIT)	ENW49A01AZJF (ETU)	ENWF9101AYEF (KIT)

* x is a parameter to be defined.

** Annual Volume Requirement of 100k. Please engage with Panasonic sales team and wireless team to determine if this module is suitable for your applications. Panasonic reserves the right to support or to not support requests based on corporate policy that includes export control and application restrictions or other requirements.

Based on the IEEE 802.11 standard, **Wi-Fi** is part of the Wireless Local Area Network (WLAN). Wi-Fi enables devices to exchange data or connect to the internet using 2.4GHz and 5GHz. Therefore Wi-Fi is the technology working anywhere in the world. The range of Wi-Fi technology varies by Wi-Fi standard (a/b/g/n/ac etc.) and frequency band. The 802.11n standard uses high throughput data rates, double the radio spectrum/bandwidth (40MHz) compared to 802.11a or 802.11g (20MHz) and introduces MIMO technology for RF multipath data propagation.

The latest 802.11ac standard, which uses the 5GHz band, uses radio spectrum/bandwith of up to 160MHz and enhanced MIMO technology. The term “Wi-Fi” is used in general English as a synonym for “WLAN”. Radio modules offer easy hardware integration with flexible software part whereas embedded modules cover the full package on hardware and software side. **Combo modules** of Wi-Fi and other wireless technology allow interaction of those technolgies. NFC for example can act as enabling technology for Bluetooth and Wi-Fi connection set-up.

ISM and Mesh Networking Modules

Series	PAN235x Series	PAN237x Series	PAN4561H Series	PAN4580x Series
				
Status	Mass Production	Engineering Sample	Mass Production	Mass Production
Part Number*	ENW5961xN3xx	ENW59637C1xF	ENWC9A22xxEF	ENWC9A31xxEF
RF Category	**ISM Transceiver**	**ISM Transceiver**	**Mesh Networking (ZigBee® ready)**	**Mesh Networking (ZigBee® ready)**
Software/Profile	n/a	n/a	SNAP® by Synapse Wireless Inc.	SNAP® by Synapse Wireless Inc.
Used ICs	CC1101	CC1200	MC13213 + CC2591	ATmega128RFA1
Size [mm]	8.0x8.2x1.9	13.8x11.8x1.9	35.0x15.0x3.8	29.8x19.0x2.6
Antenna Options	w/o antenna	w/o antenna	w/ ceramic antenna / U.FL connector / bottom pad	
Rx Sensitivity [dBm]	-112 @ 1.2k GFSK -104 @ 38.4k GFSK -95 @ 250k GFSK -89 @ 500k 4FSK	-123 @ 1.2k-2FSK -110 @ 50k-2GFSK -97 @ 500k-2GFSK -97 @ 1M-4GFSK	-98 @ 250 kbps	-100 @ 250kbps -96 @ 500kbps -94 @ 1Mbps -86 @ 2Mbps
Tx Power (max.) [dBm]	+10	+15	+18.5	+3.5
Power Supply [V]	1.8 to 3.6	2.0 to 3.6	2.7 to 3.4	1.9 to 3.6
Current Consumption	Tx: 36mA Rx: 18mA Sleep Mode: <1µA	Tx: 54mA Rx: 2mA to 23mA Sleep Mode: <1µA	Tx: 210mA Rx: 48mA Off Mode: 2µA	Tx: 20mA Rx: 17mA Sleep Mode: 1.5µA
Centre Frequency [MHz]	433/868/915	169/433/868/915/955	2,400	2,400
Interfaces	GPIO, SPI	GPIO, SPI	GPIO, UART, I²C	GPIO, 2x UART, SPI, ADC, I²C
Operating Temp. [°C]	-40 to +85	-40 to +85	-40 to +85	-40 to +85
Evaluation Kit*	n/a	n/a	ENWC9A30x4EF + RF Module USB Adapter	ENWC9A33xxEF + RF Module USB Adapter

* x is a parameter to be defined.

Industrial, Scientific and Medical (ISM radio band) solutions benefits of reduced cost, proprietary network, low power and various speeds of data transmission. Many ISM Modules work outside of the crowded 2.4GHz spectrum to provide high RF performance and data integrity. These modules allow the highest flexibility for realising your wireless connection. If a system does not need to be open, this might be an economical way to transmit/receive data.

Based on the IEEE 802.15.4 standard, **Mesh Networking** was developed for the purpose of sending small amounts of data short distances, using very little power. The key feature of this technology is the ability to create a self-healing mesh network where nodes “talk” to each other in a way that gets a message to a desired end point using the best path. When not in use, nodes will “sleep” using extremely little power. The ecosystem of IEEE 802.15.4 comprises different standards like ZigBee, KNX, Wireless HART, 6LoWPAN/IPv6 and many more. If a system does not need to be open, SNAP® (Synapse Network Application Protocol) might be an efficient and easy way to realise a Mesh Network.

ORIGINAL SOLUTIONS FOR POWER, LIGHTING AND COMMUNICATION

SEMI-CONDUCTORS

> The quick and easy way to improve and differentiate your green electronic designs
> Original design solutions
> Advanced materials, beyond silicon
> Reduce power waste
> Integration and miniaturization

POWER

> High efficiency, fast transient response DCDC converters and modules for point of load. Reduce development time, bill of material and power waste.
> Fast switching, low on-resistance, normally off GaN power transistors.

NFC

> Easily add cloud connectivity to your products with Panasonic NFC modules and interface ICs. Worldwide standards supported.

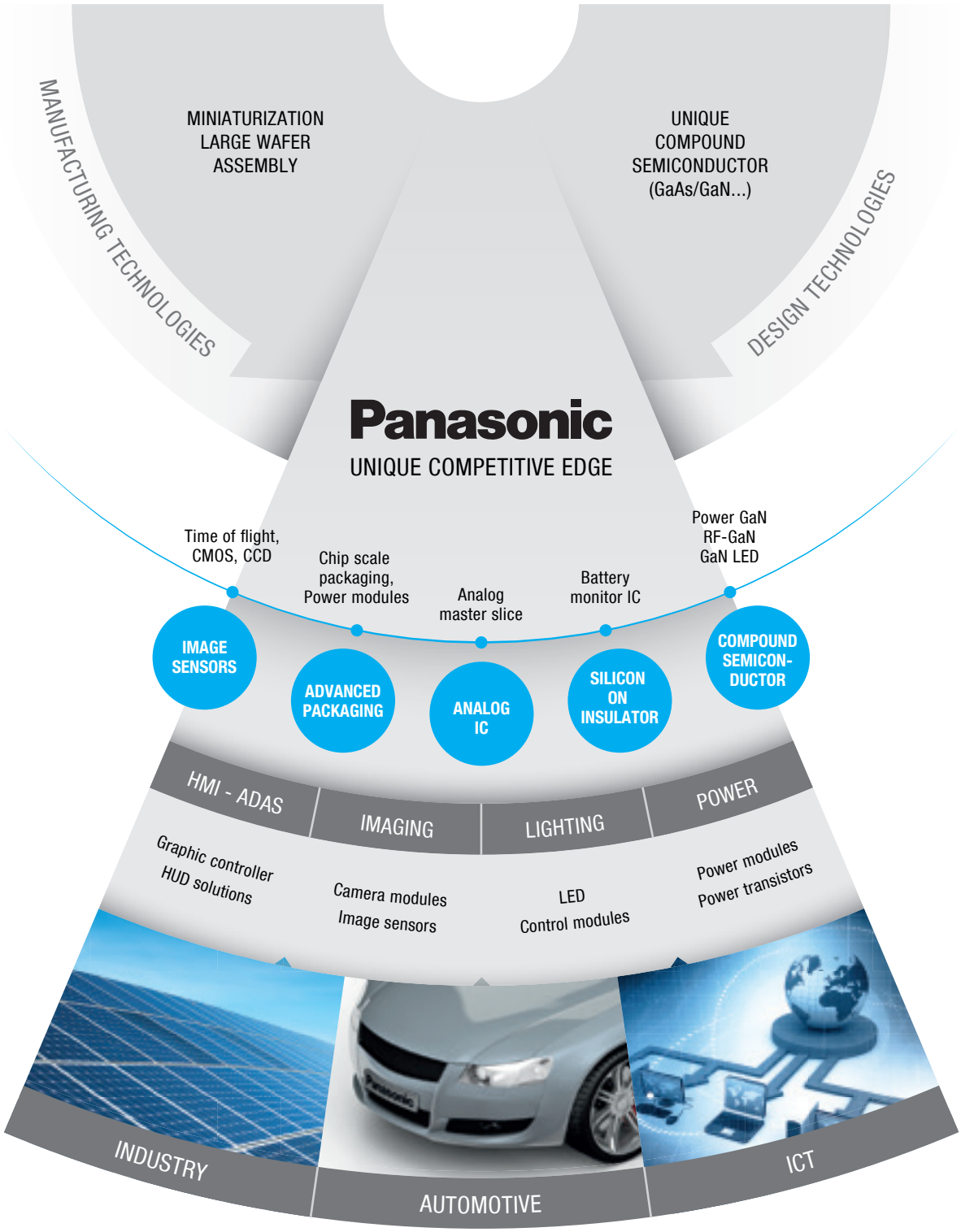
DISCRETES

> Thin-wafer trench MOSFETs and diodes in innovative chip-scale packages exhibit superior efficiency and heat extraction characteristics while reducing the PCB footprint. For load switching and switched power supplies.

LEDs

> Wide range of mono- dual- and tri-colour top-firing LEDs in SMT, including 0.2mm ultra thin 0402/0603 packaging.
> High brightness white GaN on GaN LED for automotive front lighting.

COMPETITIVE EDGE AND FOCUS MARKETS



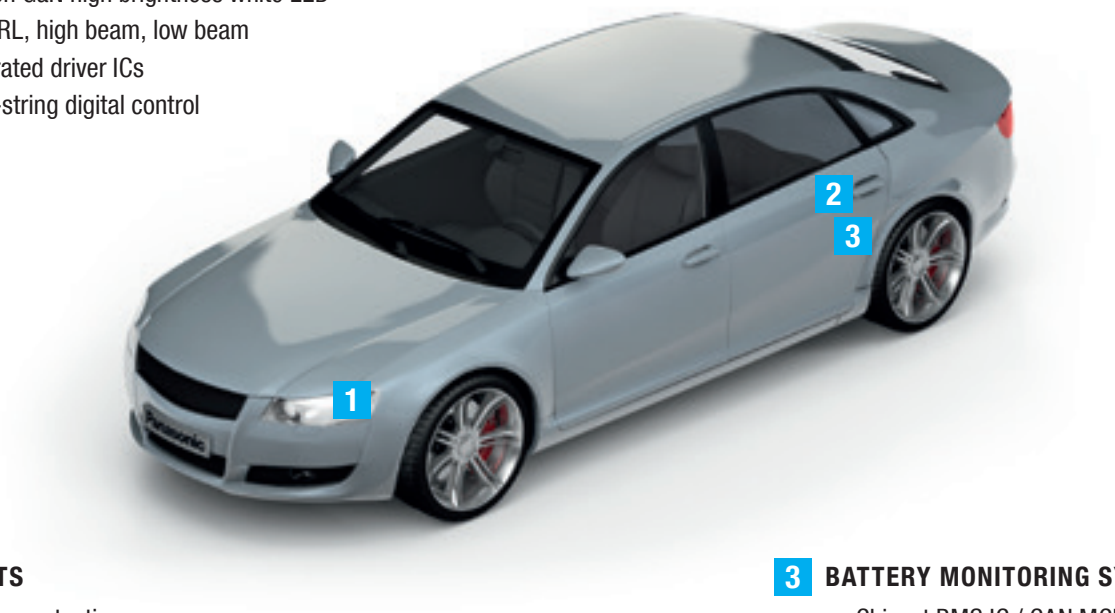
LEVERAGING PANASONIC EXPERTISE IN SEMICONDUCTOR MATERIALS AND MANUFACTURING METHODS TO DELIVER ADVANCED SOLUTIONS AND PRODUCTS TO THE AUTOMOTIVE, INDUSTRIAL AND ICT MARKETS.

ADVANCED AUTOMOTIVE SOLUTIONS

SOLUTION FOR LIGHTING AND BATTERY MONITORING

1 LIGHTING SOLUTIONS*

> GaN on GaN high brightness white LED
> For DRL, high beam, low beam
> Integrated driver ICs
> Multi-string digital control



2 MOSFETS

> Battery protection
> Thin trench technology
> Flip-chip packages
> Superior heat extraction
> High efficiency

3 BATTERY MONITORING SYSTEMS*

> Chipset BMS IC / CAN MCU / SBC
> Silicon On Insulator technology
> High precision
> Wide temperature range
> High robustness

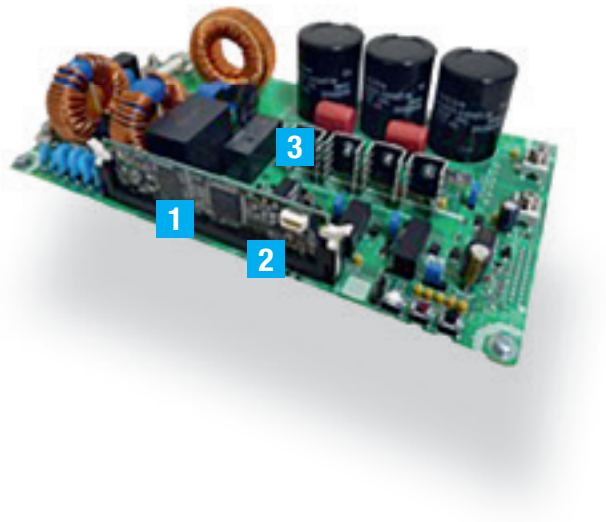
*Advanced product, please contact your nearest Panasonic sales representative for more information

ADVANCED POWER SOLUTIONS

EFFICIENT POWER DEVICES AND POWERFUL DIGITAL CONTROL

1 INVERTER MCU*

> Dual motor control
> Sub-nanosecond resolution PWM
> HW acceleration for Field Oriented Control
> Control software



2 PSIP

> Embedded power / POL
> Fast and easy design
> Simplified procurement
> High power density

3 GaN / SiC*

> High power converters
> AC-DC / DC-DC
> Fast switching
> Low losses

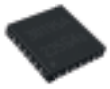
*Advanced product, please contact your nearest Panasonic sales representative for more information

Non-isolated DCDC step down power modules - „Power Supply in Package“ (PSiP)

Series / Type	V_{in} min/max (V)	V_{out} min / max (V)	I_{out} max (A)	Package (mm^3)	Part number
 PSiP NEW	4.5 / 28	0.6 / 5.5	10	QFN (8.5x7.5x4.7)	NN31000A
	4.5 / 28	0.6 / 5.5	7		NN31001A
	4.5 / 28	0.6 / 5.5	4		NN31002A

Built-in safety: under voltage lock out, over voltage detection, under voltage detection, over current protection, short circuit protection, thermal shut down

Step down DCDC converter with built in MOSFET - „MCP DCDC“

Series / Type	V_{in} min/max (V)	V_{out} min / max (V)	I_{out} max (A)	Package (mm^2)	Part number
 5V V_{in} (*)I2C interface	4.5 / 5.6	0.6 / 3.5	6	HQFN24 (4x4)	NN30195A
	4.5 / 5.6	0.6 / 3.5	9	HQFN40 (6x6)	NN30196A
	4.5 / 5.6	0.6 / 3.5	6	HQFN24 (4x4)	NN30295A(*)
	4.0 / 5.6	0.6 / 3.5	6	HQFN24 (4x4)	NN30297A(*)
Extended V_{in} / V_{out} range	4.5 / 28	0.75 / 5.5	3	HQFN24 (4x4)	NN30320A
	4.5 / 28	0.75 / 5.5	6	HQFN24 (4x4)	NN30321A
	4.5 / 30	0.75 / 5.5	10	HQFN40 (6x6)	NN30312A
Extended V_{in} range, for secondary power rail (external 5V supply required)	4.75 / 24	0.75 / 3.6	8	HQFN24 (4x4)	NN30421A
	4.5 / 24	0.75 / 3.6	8	HQFN24 (4x4)	NN30331A
	4.5 / 24	0.75 / 3.6	10	HQFN24 (4x4)	NN30332A

Built-in safety: under voltage lock out, over voltage detection, under voltage detection, over current protection, short circuit protection, thermal shut down

Integrated multi-channel synchronous step down DCDC and LDO

Series / Type	Channels (buck /LDO)	V_{in} min/max (V)	V_{out} (V)	I_{out} max (A)	Package (mm^2)	Part number
 Step down DCDC	(1 / -)	2.5/5.5	1.15/1.3/1.8/2.8	1.2	WLCSP (1.5x1.5)	AN30180A
	(1 / -)	2.5/5.5	1.2/1.35/1.85/3.3	1.2	WLCSP (1.5x1.5)	AN30180AA
	(2 / -)	2.9/5.5	1.2/1.8	0.8	HQFN24 (4x4)	AN30181A
	(2 / -)	2.9/5.5	1.0/1.8	0.8	HQFN24 (4x4)	AN30185A
Multi-channel DCDC/LDO	(1 / 4)	2.5/5.5	(DCDC) 0.8 to 2.4 (LDO) 1 to 3.3	(DCDC) 0.6 (LDO) 0.3	WLCSP (1.6x2.1)	AN30183A
	(2 / 6)	2.5/5.5			WLCSP (2.2x2.2)	AN30182A

Built-in safety: under voltage lock out, over current protection, short circuit protection, thermal shut down

Step down DCDC converter for USB and car radio

Series / Type	Output	V_{in} min/max (V)	V_{out} min / max (V)	I_{out} max (A)	Package	Part number
 Baseline (*) USB current sense	2	5 / 25	1.2 / 0.88*Vcc	Ext. FET	SSOP24	AN33012UA
	1	5 / 25	1.2 / 0.88*Vcc	1.5	SSOP24	AN33013UA
	1	5 / 25	1.2 / 9	1.5	SSOP24	AN33014UA(*)
Extended V_{in} range (*) USB current sense	1	5 / 39	1.2 / 0.88*Vcc	1.5	SSOP24	AN33016UA
	1	5 / 39	1.2 / 9	2.1	HQFP48	AN33017UA(*)

Built-in safety: under voltage lock out, over voltage protection, over current protection, short circuit protection, thermal shut down

Near field communication ICs and modules - Built-in FeRAM

Series / Type	V_{in} min/max (V)	FeRAM	NFC forum	Safety	Digital I/Fs	Dimensions (mm)	Part number
 NFC ICs	1.8 / 3.6 or 4.5 / 5.5	4Kbit	Type 3	-	UART/sync serial	SSOP16 (5x6.4x1.3)	MN63Y1210A
	1.7 / 3.6	4Kbit	Type 3/4B	AES128	I2C (100kbps)	QFN16 (3.2x4.2x0.77)	MN63Y1208
	-	4Kbit	Type 3/4B	AES128	IRQ	SON8 (2x2x0.45)	MN63Y1212
	1.7 / 3.6	4Kbit	Type 3/4B	AES128	I2C (100kbps)		MN63Y1213
	1.7 / 3.6	8Kbit	Type 3/4A/4B	Password	I2C (400kbps)		MN63Y1214
	1.7 / 3.6	8Kbit	Type 4A/4B	Password	I2C (400kbps)		MN63Y1217
 NFC modules (including antenna)	3.3 ±5%	4Kbit	Type 3/4B	AES128	I2C (100kbps)	40x30	MN63Y3208N1
	-	4Kbit	Type 3/4B	AES128	IRQ	11.5x25	MN63Y3212N1
	-	4Kbit	Type 3/4B	AES128	-	Ø30 (round)	MN63Y3212N4
	1.7 / 3.6	4Kbit	Type 3/4B	AES128	I2C (100kbps)	9x30	MN63Y3213N1

Power supply (V_{in}) is optional for use as NFC tag - energy is harvested from the magnetic coupling

(Chip Size Package) Discrete semiconductors

Series / Type	Vsss (V)	Is (A)	Rsson (mΩ)	Package	Part number
 MOS FET Dual N channel	12	11	3	CSP (1.77x3.54mm)	FCAB2126
	12	1.5	95	CSP (0.6x0.6mm)	FC4B2130

Series / Type	VDSS (V)	ID (A)	Rdson (mΩ)	Package	Part number
 MOS FET N channel	60	3.3	62	CSP (1.2x1.2mm)	FK4B0613
MOS FET N channel	40	4.6	32	CSP (1.2x1.2mm)	FK4B0416
MOS FET N channel	12	3.1	17	CSP (1.0x1.0mm)	FK4B0112
 MOS FET P channel	-60	-1.8	197	CSP (1.2x1.2mm)	FJ4B0618
MOS FET P channel	-40	-3	74	CSP (1.2x1.2mm)	FJ4B0421
MOS FET P channel	-12	-2	40	CSP (1.0x1.0mm)	FJ4B0112

Series / Type	VR (V)	IF (A)	VF (V)	Package	Part number
 Schottky Barrier Diode	40	1	0.37	CSP (1.0x0.6mm)	DB4G429
Schottky Barrier Diode	30	0.5	0.4	CSP (0.6x0.3mm)	DB2L324
Schottky Barrier Diode	30	0.1	0.35	CSP (0.6x0.3mm)	DB2L335

Series / Type	VRWM (V)	ESD (V)	Ct (pF)	Package	Part number
 Bi-directional TVS diode	5	+/-15kV	6	CSP (0.6x0.3mm)	DY2L5A0C

(Power Mount Chip Size Package) Discrete semiconductors

Series / Type	VDSS (V)	ID (A)	Rdson (mΩ)	Package	Part number
 MOS FET N channel	24	6	20	PMCP (1.8x1.6mm)	FK3P0211
MOS FET P channel	-20	-7.5	16.5	PMCP (2.0x2.0mm)	FJ3P0210
MOS FET P channel	-12	-7.5	13.5	PMCP (2.0x2.0mm)	FJ3P0113

SMT LEDs in low profile packaging

Series / Type	Colour	Forward Voltage Vf(V) Typ.	Dominant Colour λd (nm) / (Typ)	Io (mcd) Typ.	IF (mA)	Part number
 0603 1.6x0.8mm 0.2mm height	White	2.9	x 0.2635 / y 0.2645	60	5	LNJ037X8ARA
	RED	1.95	630	16	5	LNJ237W82RA
	YG	1.95	572	7.5	5	LNJ337W83RA
	Amber	1.95	590	25	5	LNJ437W84RA
	Orange	1.95	620	17.5	5	LNJ837W83RA
	Soft Orange	1.95	605	27.5	5	LNJ837W86RA
	Blue	2.9	472	17	5	LNJ937W8CRA
 0603 1.6x0.8mm 0.35mm height	White	2.9	x 0.2655 / y 0.2630	40	5	LNJ026X8ARA1
	White	2.95	x 0.2900 / y 0.3005	150	5	LNJ026X8BRA4
	YG	2.05	572	18	10	LNJ326W83RA1
	Amber	2.05	589	35	10	LNJ426W83RA1
	Pure Green	2.9	527	40	5	LNJ626W8CRA
	Orange	1.9	620	19	5	LNJ826W83RA
	Soft Orange	1.92	605	16.9	10	LNJ826W86RA
	Blue	2.9	470	11.5	5	LNJ926W8CRA
 0402 1.0x0.5mm 0.2mm height	White	2.9	x 0.247 / y 0.234	50	5	LNJ047X8ARA
	RED	1.95	630	16	5	LNJ247W82RA
	YG	1.95	572	13	5	LNJ347W83RA
	Amber	1.95	590	30	5	LNJ447W84RA1
	Pure Green	3.1	527	90	5	LNJ647W8CRA
	Orange	1.95	620	30	5	LNJ847W83RA
	Soft Orange	1.95	605	30	5	LNJ847W86RA
	Blue	2.9	472	18	5	LNJ947W8CRA
 Dual-colour LED 1.3x1.05mm 0.25mm height	Green	1.95	572	7.5	5	LNJ167W8RRA
	RED	1.95	628	15	5	
	Pure Green	3.00	525	90	5	LNJ167W87RA
	RED	1.95	628	15	5	
	Blue	2.95	470	15	5	LNJ167W85RA
	RED	1.95	628	15	5	
 Tri-colour LED 1.3x1.05mm 0.25mm height	Pure Green	3.00	525	90	5	LNJ757W86RA
	Blue	2.95	470	15	5	
	RED	1.90	628	30	5	

INDUSTRIAL GRADE SD MEMORY CARD

As equipment and devices become increasingly advanced in performance and functions, SD Memory Cards require larger capacity and higher speed performance.
Since the release of its first SD Card in 2000, Panasonic has been a leader in its development. Today's Industrial SD Cards have achieved new levels of performance and reliability.
We also offer customisation services to meet specific user needs, and a technical support system including failure analysis, thus delivering flexible SD card solutions to all.

- > Flexible customisation and technical support
- > Industrial Grade NAND Flash Memory
- > Power Failure Recovery minimises data damage
- > Double Bit Error Correction improves data retention
- > Static Wear Levelling to maximise the lifetime

CUSTOMISATION, TECHNICAL SUPPORT AND HIGH RELIABILITY FOR INDUSTRIAL USE

SLC FX Series – High grade series with superb rewriting durability suitable for long-term data storage

MADE IN JAPAN

Model	RP-SDFC51	RP-SDF02G	RP-SDF04G	RP-SDF08G	RP-SDF16G
Capacity*1	512MB	2GB	4GB	8GB	16GB
Flash Memory/Type	Single-Level Cell (SLC) NAND Flash Memory				
SD Physical Specification	Ver. 3.01 (No UHS-I Compliant)		Ver. 3.01 (UHS-I Compliant)		
Speed Class	Speed Class 6		Speed Class10, UHS Speed Class 1		
Operating Temperature	-40 to +85°C				
Controller	Designed by Panasonic				
Functions	Double Power Failure Recovery, Error Correction Code, Refresh Function, Static Wear Levelling, Intelligent Data Writing				
Write/Read Tests for All Memory Areas	Completed				
Size (HxWxD)	32.0x24.0x2.1mm				

*1: SD Card utilises a portion of the memory for copy protection and other purposes. Therefore the usable capacity will be less.

MLC JD Series – Industry's first*1 bit-error-free SD card*2 with RAID technology

MADE IN JAPAN

Model	RP-SDJD32	RP-SDJD64
Capacity*3	32GB	64GB
Flash Memory/Type	Multi-Level Cell (MLC) NAND Flash Memory	
SD Physical Specification	Ver. 4.10 (UHS-II Compliant)	
Speed Class	UHS Speed Class 1	Speed Class 10, UHS Speed Class 1
Operating Temperature	-25 to +85°C	
Controller	Designed by Panasonic	
Functions	RAID Technology, Power Failure Recovery, Error Correction Code, Refresh Function, Static Wear Levelling, Intelligent Data Writing	
Write/Read Tests for All Memory Areas	Completed	
Size (HxWxD)	32.0x24.0x2.1mm	

*1 For Industrial SD Cards. As of April 1st, 2014.
*2 All bit error correction cannot be guaranteed.
*3 SD Card utilises a portion of the memory for copy protection and other purposes. Therefore the usable capacity will be less.

MLC GD Series – Ideal for recording large-volume image data

MADE IN JAPAN

Model	RP-SDGD04	RP-SDGD08	RP-SDGD16	RP-SDGD32	RP-SDGD64
Capacity*1	4GB	8GB	16GB	32GB	64GB
Flash Memory/Type	Multi-Level Cell (MLC) NAND Flash Memory				
SD Physical Specification	Ver. 3.01 (UHS-I Compliant)				
Speed Class	Speed Class 10, UHS Speed Class 1				
Operating Temperature	-25 to +85°C				
Controller	Designed by Panasonic				
Functions	Power Failure Recovery, Error Correction Code, Refresh Function, Static Wear Levelling, Intelligent Data Writing				
Write/Read Tests for All Memory Areas	Completed				
Size (HxWxD)	32.0x24.0x2.1mm				

*1: SD Card utilises a portion of the memory for copy protection and other purposes. Therefore the usable capacity will be less.

MLC P Series – Basic series suitable for various industrial equipment

MADE IN JAPAN

Model	RP-SDPC04	RP-SDPC08	RP-SDPC16
Capacity*1	4GB	8GB	16GB
Flash Memory/Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification	Ver. 3.01 (No UHS-I Compliant)		
Speed Class	Speed Class 4		
Operating Temperature	-40 to +85°C		
Controller	Designed by Panasonic		
Functions	Power Failure Recovery*2, Error Correction Code, Refresh Function, Static Wear Levelling, Intelligent Data Writing		
Write/Read Tests for All Memory Areas	Completed		
Size (HxWxD)	32.0x24.0x2.1mm		

*1: SD Card utilises a portion of the memory for copy protection and other purposes. Therefore the usable capacity will be less.
*2: Customisable.

MLC KC Series – MicroSD series with power failure recovery suitable for embedded use

MADE IN JAPAN



Model	RP-SMKC04	RP-SMKC08	RP-SMKC16
Capacity*1	4GB	8GB	16GB
Flash Memory/Type	Multi-Level Cell (MLC) NAND Flash Memory		
SD Physical Specification	Ver. 3.01 (UHS-I Compliant)		
Speed Class	Speed Class 2 (No UHS Speed Class Compliant)		
Operating Temperature	-40 to +85°C		
Controller	Designed by Panasonic		
Functions	Double Power Failure Recovery, Error Correction Code, Refresh Function, Static Wear Levelling, Intelligent Data Writing		
Write/Read Tests for All Memory Areas	Completed		
Size (HxWxD)	15.0x11.0x1.1mm		

*1: SD Card utilises a portion of the memory for copy protection and other purposes. Therefore the usable capacity will be less.

FEATURES

> **Temperature Resistance**
Operation is assured even under harsh temperature conditions

> **Electrostatic Resistance**
IEC 61000-4-2 compliance: Clears Electrostatic Discharge Immunity Tests of 150pF energy storage capacitance, 15kV aerial discharge and 330Ω discharge resistance

> **Impact Resistance**
Bending load resistance: 20N (Newton) min., (SD standard: 10N)
Twisting torque resistance: 0.3N~m (Newton meter) min.
(SD standard: 0.15N~m) – for a full size SD card only

> **Magnetic Resistance**
Operable after being set onto a 1,000-gauss DC magnetic field for approx. 1 minute

> **X-Ray Resistance**
ISO 7816-1 compliance: Operable after 0.1Gy (gray) of X-ray irradiation

> **Water Resistance**
JIS IPX7 compliance: Operable after submerging the product in water (tap water, 1m depth) for 30 minutes – microSD only

> **Durability against Insertion / Removal**
Tested for 10,000 cycles of card insertion/removal using a card reader

> **Built-in Fuse**
The internal card fuse protects against excess current and abnormal heating

GUIDELINES AND CAUTIONS FOR USING THE PRODUCT TECHNICAL INFORMATION AND THE PRODUCTS DISPLAYED ON THIS MATERIAL

- The products described on this material were designed and manufactured for standard applications such as general electronics devices, office equipment, data and communications equipment, measuring instruments, household appliances and audio-video equipment. For special applications in which quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please use only after your company has sufficiently tested the suitability of our products for that application.
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ABOUT PAISEU

Panasonic Automotive & Industrial Systems Europe (PAISEU) is a company that provides unparalleled expertise to leading car manufacturers, industrial customers and OEMs. It researches, develops, manufactures and supplies key electronic components, devices and modules up to complete solutions across a broad range of industries; and provides production equipment which builds the manufacturing lines of global corporations. Globally, Panasonic’s Automotive and Industrial Systems company is responsible for over one third of Panasonic’s overall revenue.

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