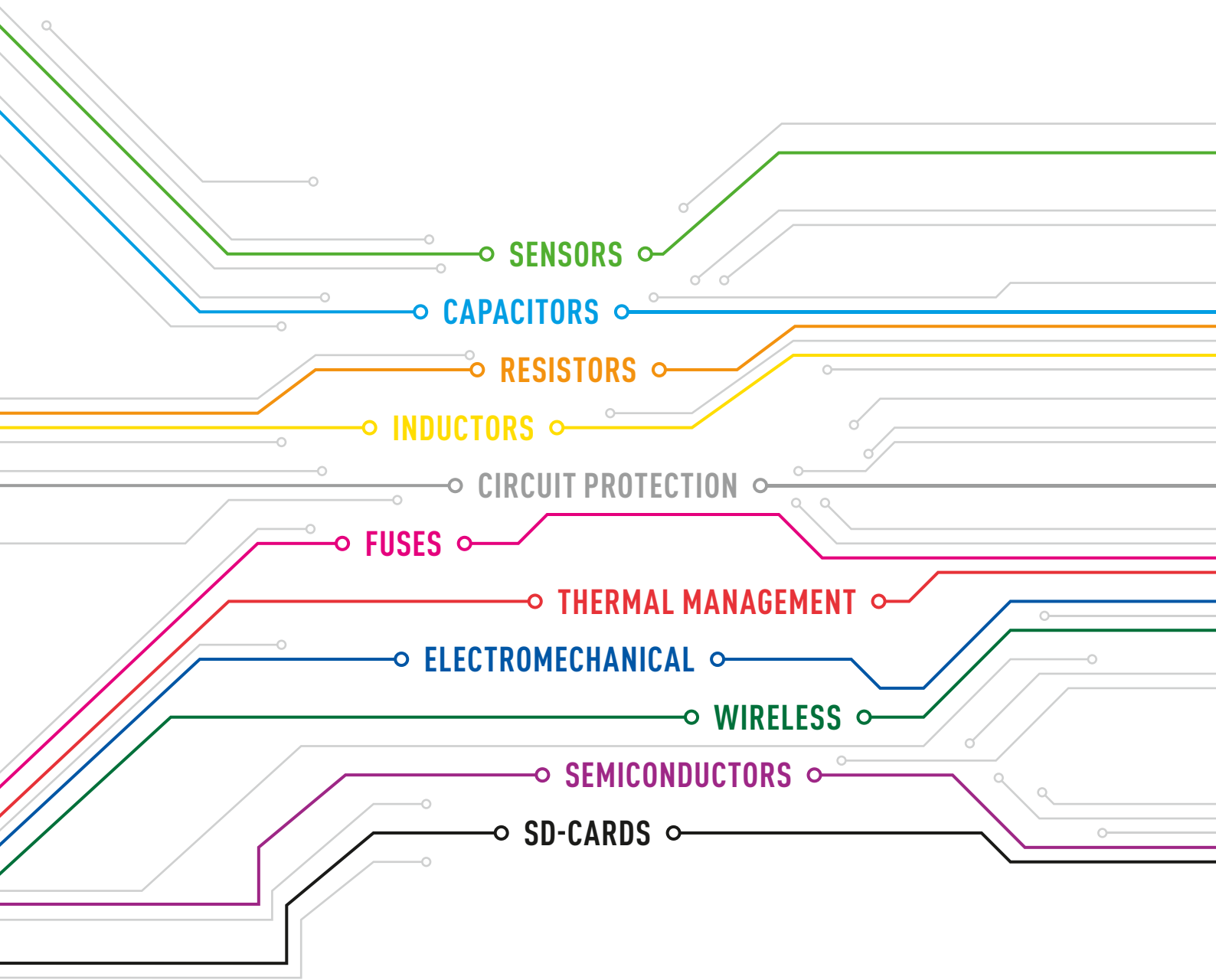
Panasonic



SHORTFORM CATALOGUE

AUTOMOTIVE & INDUSTRIAL SYSTEMS · EUROPE

Dear existing and prospective customers,

Rapidly changing requirements in the industrial sector mean that you need to have a high capacity for innovation and a strong and reliable partner by your side.

In view of development cycles becoming ever shorter and the increasing complexity of many systems, many customers are no longer just interested in finding the right product but the right end-to-end solution. Various different divisions work together at our new site in Ottobrunn and are already developing comprehensive solutions. You therefore have virtually everything under one roof – from electronic components through to finished modules and industrial systems.

The major trends, most notably the Internet of Things, are changing our consumer behaviour and therefore also the entire value chain from supplier to consumer. This means that manufacturers have to be extremely flexible and this is driving the demand for mass customisation which is a challenge in itself. We provide solutions that can meet these new circumstances head on.

Companies can benefit from trends such as Industry 4.0, energy efficiency and the connected car by developing innovative solutions for the industrial and automotive sectors with our help.

This catalogue provides an overview of almost all of our industrial products, systems and solutions. Our portfolio ranges from electronic and electromechanical components as well as semiconductor and sensor components through to motors and actuators, batteries and displays. This gives rise to a depth that is unique on the market and seamless expertise along the entire value chain of industrial applications. With some 1,300 employees spread throughout Europe, we are able to offer regional customer proximity as well as expert pre-sales and after-sales service.

Johannes Spatz, Managing Director Industrial Business,
Panasonic Automotive and Industrial Systems Europe GmbH

PANASONIC AUTOMOTIVE & INDUSTRIAL SYSTEMS EUROPE

The formation of Panasonic Automotive & Industrial Systems Europe (PAISEU) in October 2015 brought together the formerly separate legal entities of Panasonic Automotive Systems Europe, Sanyo Components Europe, Panasonic Industrial Devices Sales Europe and Panasonic Electric Works Europe (PEWEU), which remains a subsidiary and separate legal entity.

The objective as an integrated company is to promote a strong B2B strategy in Europe and expand revenue growth in the automotive and industrial sector with about 1,300 employees.

Panasonic 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. Central to this is to engage with major global industrial markets that demand specialised technologies in order to enhance their production processes.

Panasonic provides unparalleled expertise to car manufacturers, industrial customers and OEMs. With the end consumer in mind, we aim to deliver not only B2B, but ultimately B2B2C solutions to our clients.

Globally, Panasonic's Automotive and Industrial Systems Company is responsible for over one third of Panasonic's overall revenue.

MAIN PRODUCTS AND SOLUTIONS IN EUROPE:

AUTOMOTIVE SAFETY AND SECURITY SOLUTIONS

> break-in detection systems; night view systems; keyless entry systems and rear view cameras

INFOTAINMENT SOLUTIONS

> car navigation systems; audio system; ETC (Electric Toll Collection) in-vehicle units; AV & rear seat entertainment systems and speaker systems

ENERGY SOLUTIONS

> Ni-MH hydride batteries and electric double layer capacitors

INDUSTRIAL DEVICES

> passive and electromechanical components; switches and optics components; printed wiring boards; communication units; sensors; i/o devices; power supplies; materials; semiconductors; storage, supplies, batteries and energy products; motors, fans and compressors

MANUFACTURING SOLUTIONS

> welding and cutting machines; welding related products; industrial robots; laser processing; soldering machines; electronic component mounting-related systems; device-related systems; display-related systems and measurement systems

TABLE OF CONTENTS

AUTOMOTIVE SOLUTIONS

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

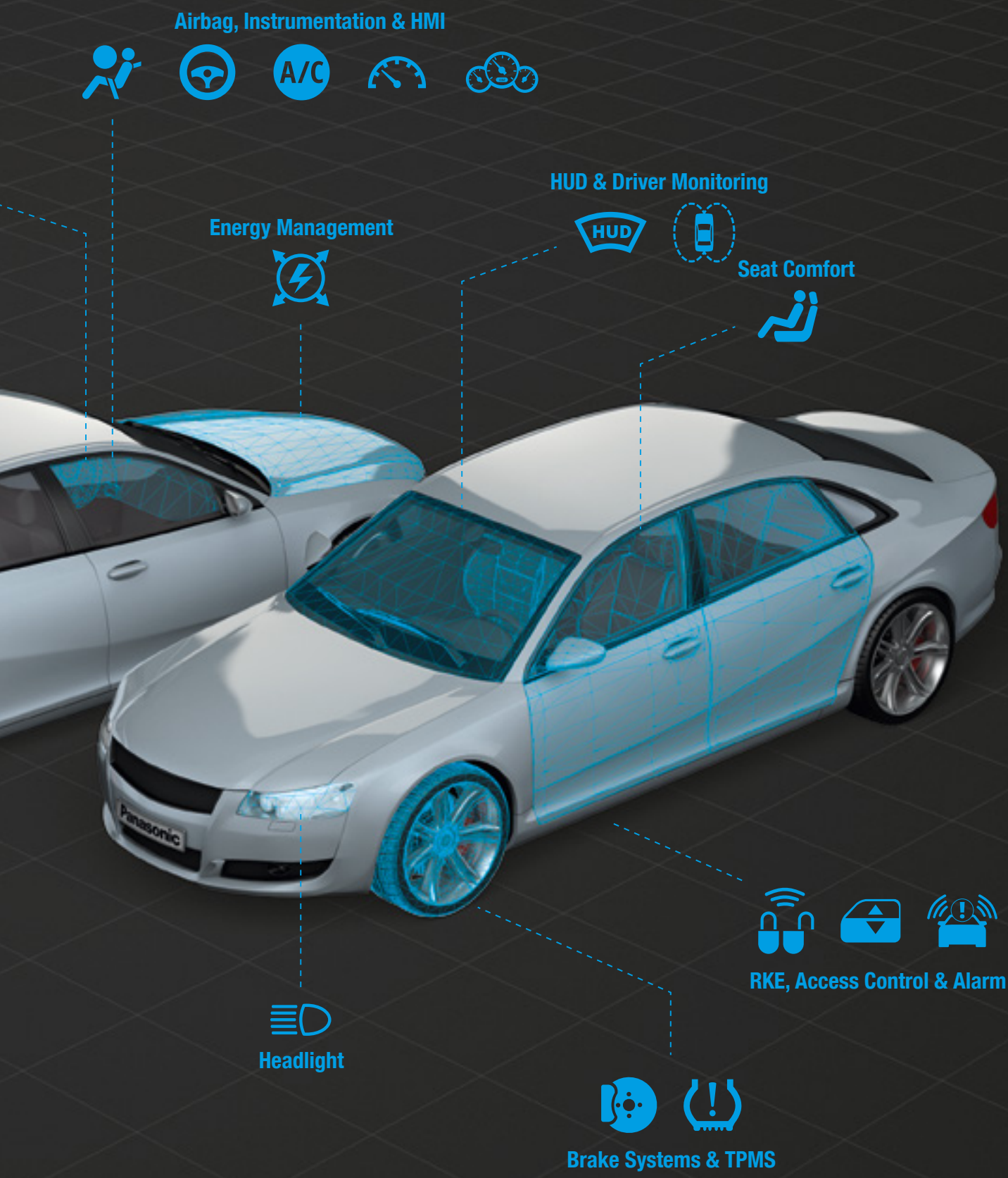
Starting from passive components, like capacitors, resistors and inductors, Panasonic delivers to all in car electrical applications such as airbags, brake systems, lighting systems and control panels. Our sensors are mainly used for monitoring and detecting, whilst semiconductors focus on power electronics 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

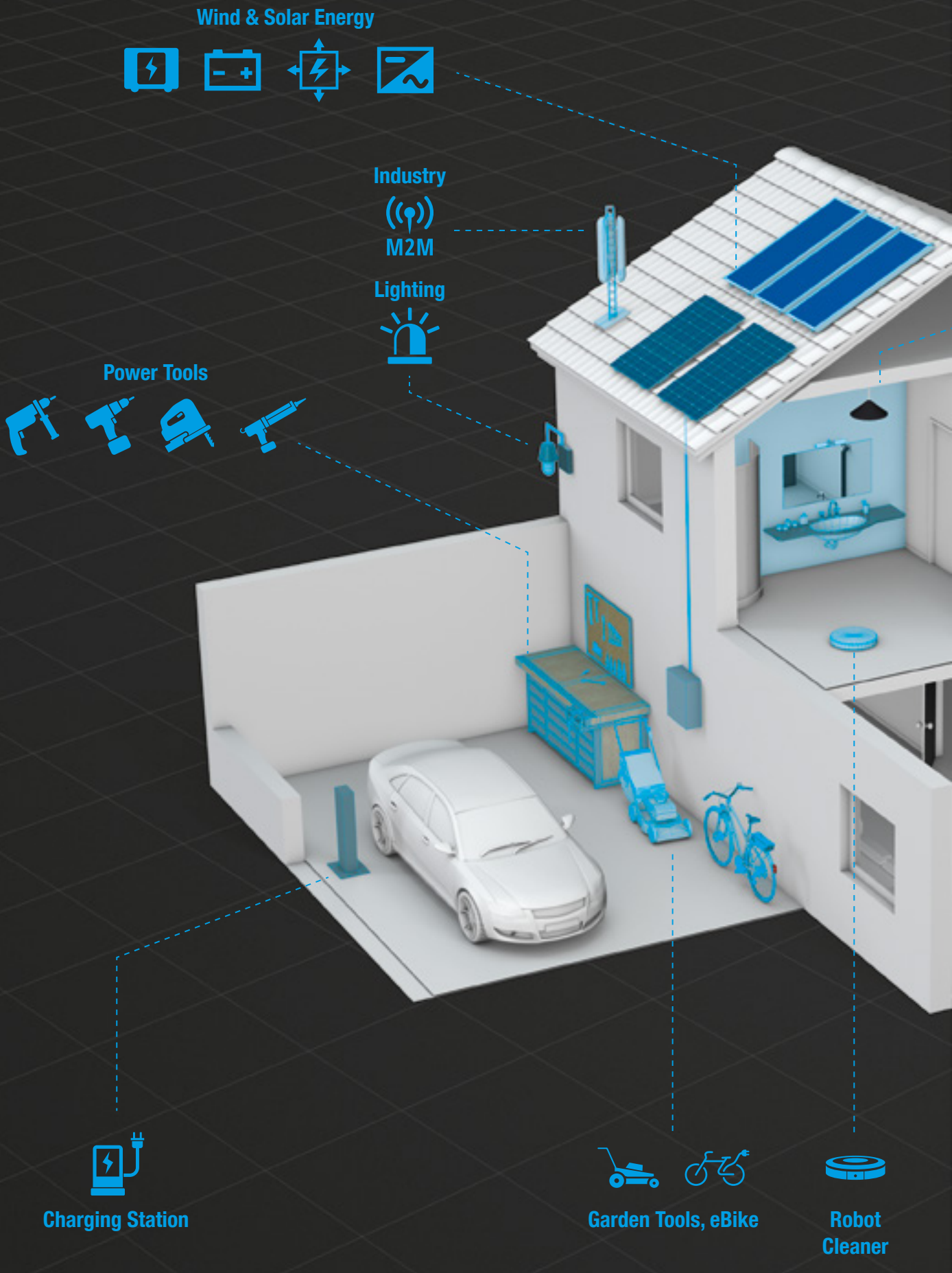
INTERIOR & HMI
> Instrumentation & HMI
> Infotainment & Connectivity
> Body & Security

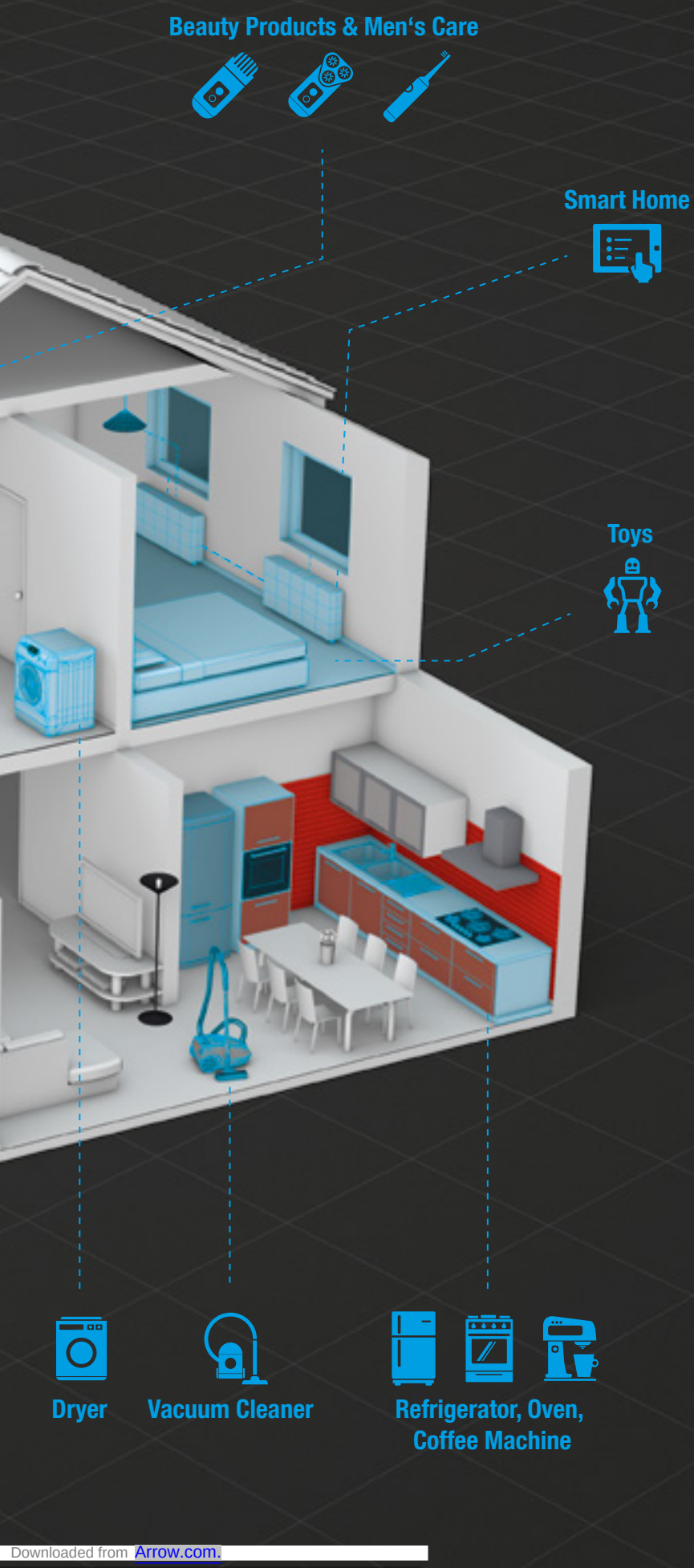
Details in the matrix on the pages 10/11



Watch the Panasonic Automotive Solutions Video

HOME SOLUTIONS





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 10/11

APPLICATIONS MATRIX

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	●		●	●				●	●	●		●	●		●		●	●	●	●	●	●
		Laundry & 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		●								●	●	●		●	●	●		●		●		●

APPLICATIONS MATRIX

	INDUCTORS					CIRCUIT PROTECTION							FUSES	THERMAL SOLUTIONS			ENCODERS					WIRELESS MODULES						SEMICONDUCTORS			SD-CARDS
	Power Choke Coils Automotive	Power Choke Coils Consumer	Power Inductors	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	PGS / SSM Thermal Spreading	Soft PGS Graphite-Pad Thermal Interface TIM	NASBIS Thermal Insulation	Light Touch Switches	Push Switches	Detector Switches	Rotary Potentiometers	Encoders	*Bluetooth®* Classic	*Bluetooth®* Dual Mode	*Bluetooth®* Low Energy	Wi-Fi	Wi-Fi Combo	ISM/Mesh Networking	NFC ICs and Modules - Built-in FeRAM	(Chip Size Package) Discretes	SMT LEDs / Low Profile Packaging	SD Cards
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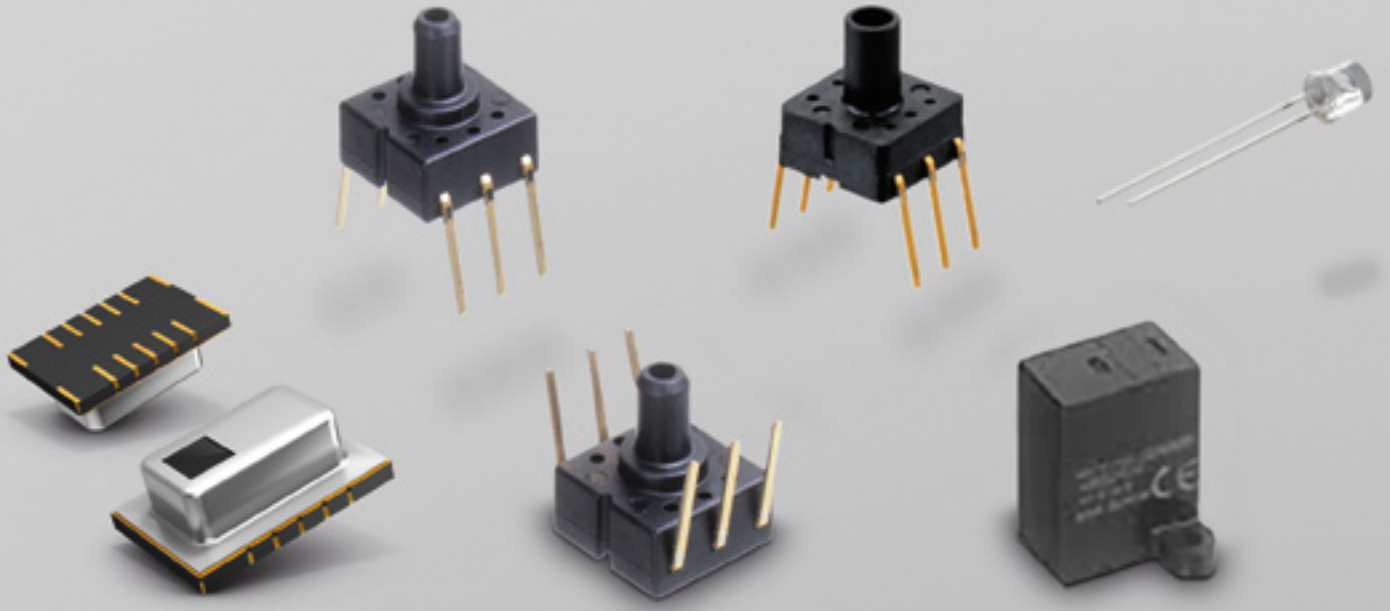
SENSORS

WIDE RANGE OF MEMS AND OPTICAL SENSOR TECHNOLOGIES



SENSORS

> High precision
> High reliability
> Compact size
> Energy saving
> Environmental-friendly

Grid-EYE 2nd Generation
State-of-the-art IR temperature sensor featuring 64 thermopile elements in an 8 x 8 grid

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

MA Motion Proximity Switch
Compact, easy to use proximity switch

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

Acceleration Sensor
Capacitive MEMS acceleration sensors

GRID-EYE 2ND GENERATION

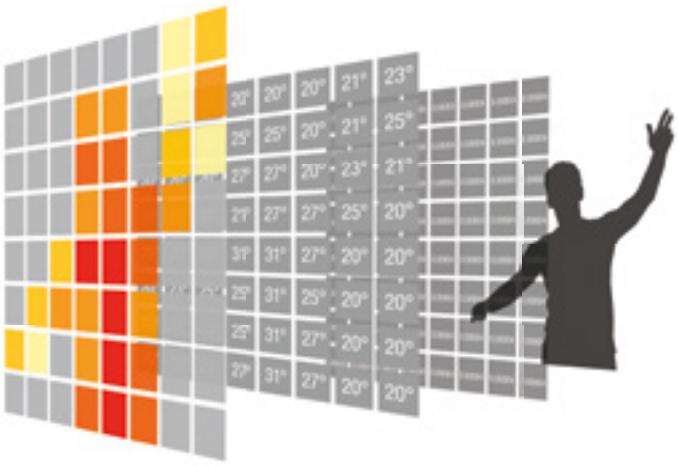
1ST SMD THERMOPILE ARRAY SENSOR

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.

The new high gain types (AMG8833 and AMG8853) and low gain types (AMG8834 and AMG8854) of Grid-EYE 2nd Generation now benefit from an improved NETD (Noise Equivalent Temperature Difference) of 0.16°C at 10Hz and of 0.05°C at 1Hz.

For all Grid-EYE 2nd Generation models the detection distance has improved from 5m up to 7m. It is important to note that the second generation of Grid-EYE sensors is fully compatible with the existing first generation designs. This means that the engineers can now get improved and accurate results when they use the sensor in their applications.

Based on Panasonic's MEMS (Micro Electro Mechanical Systems) technology the Grid-EYE 2nd Generation infrared array sensors combine a more sensitive MEMS sensor chip, a digital ASIC (I^2C interface) and a silicon lens in the same small package. Unlike conventional sensors, Grid-EYE uses a patented 60° silicon lens etched out of a silicon wafer, which is (with less than 0.3mm height) the smallest available lens in the market. The combination of these technologies allows for a sensor package size of only 11.6mm x 8mm x 4.3mm, which is around 70% smaller in size than competitor products.



Specifications	Parameters
Dimensions (L x H x W):	11.6 x 4.3 x 8.0mm
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: with amplification factor low gain:	 0°C to 80°C, -20°C to 100°C
Field of view:	60° (vertical and horizontal)
Number of pixels:	64 (vertical 8 x horizontal 8)
External interface:	I^2C (fast mode)
Frame rate:	1 or 10 frames/s
Typical absolute temperature accuracy:	Typ. ±2.5°C (depends on P/N)

Grid-EYE 2nd Generation – Infrared Array Sensor

Series / Type		Number of Pixels	Operating Voltage [VDC]	P/N	Part. No.
Infrared Array Sensor Grid-EYE		64 (vertical 8 x horizontal 8)	3.3	High gain	AMG8833
				Low gain	AMG8834
			5.0	High gain	AMG8853
				Low gain	AMG8854

Detection / Type	Moving Object	Motionless Object	Moving Direction	Temperature Measuring	Thermal Image
Pyroelectric	✔	✘	✘	✘	✘
Thermopile (single element)	✔	✘	✘	✔	✘
	⬇	⬇	⬇	⬇	⬇
Grid-EYE	✔	✔	✔	✔	✔

PIEZO-RESISTIVE PRESSURE SENSORS

SOLUTIONS FOR FACTORY AUTOMATION & INDUSTRIAL APPLICATIONS

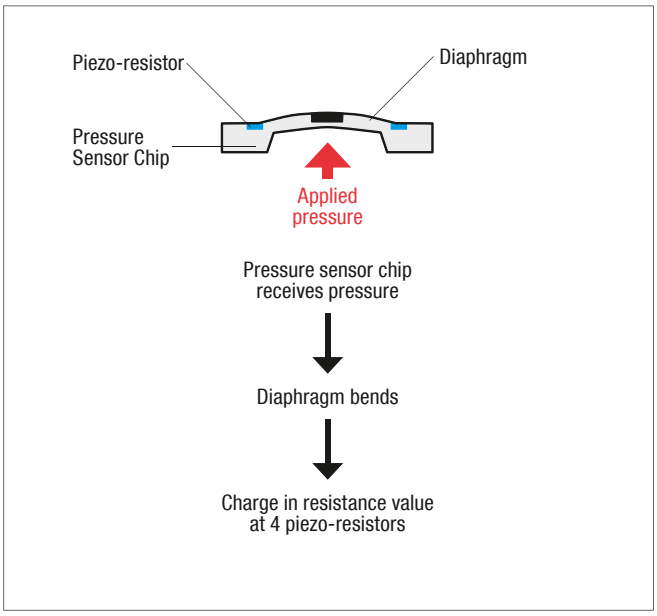
Panasonic highly accurate piezo-resistive pressure sensor product line provides a robust solution for a wide range of applications with main focus on factory automation and medical industry. Possessing engineering expertise in pressure sensor development for more than 20 years, Panasonic MEMS-based pressure sensors come in diverse packaging and porting options – with or without an amplifier.

The company's sensing element design consists of four piezo-resistors on a chemically etched silicon diaphragm. A pressure change will cause a strain in the diaphragm and the buried resistors. The resistor values will change in proportion to the stress applied, which produces an electrical output. Panasonic pressure sensors measure reliably and are proven globally for long-term stability in the field. The small and cost-effective design makes them an ideal match for price-sensitive solutions.

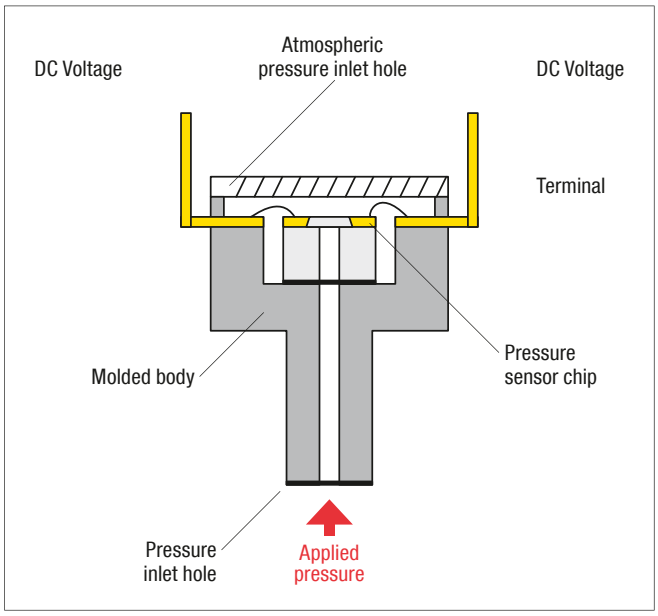
ADDED VALUE

> High overall accuracy (±1.25%)
> High linearity
> Wide pressure range -100kPa to 1,000kPA
> Easy to use amplified analog output (PS-A)
> Open bridge circuit (PS)
> Temperature compensation range up to 70°C

TECHNOLOGY



CROSS SECTION



APPLICATIONS

Factory automation

> Reference pressure control
> Pressure switches
> Vacuum control

Medical

> Blood pressure measurement

PS/PF Gauge Pressure Sensors

Series / Type	Rated Pressure [kPa]	Drive Current [mA]	Bridge Resistance [kΩ]	Temp. Compensation Range [°C]	Offset Voltage [mV]	Output Span Voltage [mV]	Linearity [FS]	Pressure Hysteresis [FS]	Offset Voltage-Temperature Characteristics*2 [FS]	Sensitivity-Temperature Characteristics*2 [FS]	Packaging Size	Part No.
 Gauge Pressure	4.9	1.5	5	0-50	±20	40±20	±0.7%	±0.6%	±15%	±10%	PF/PS	ADPxx01x
	34.3			0-50	±20	100±40	±0.3%	±0.2%	±5.0%	±2.5%	PF/PS	ADPxx21x
	49.0			0-50	±20	100±40	±0.3%	±0.2%	±5.0%	±2.5%	PF/PS	ADPxx31x
	98.1			0-50	±20	100±40	±0.3%	±0.2%	±5.0%	±2.5%	PF/PS	ADPxx41x
	196.1			0-50	±20	100±40	±0.3%	±0.2%	±5.0%	±2.5%	PF/PS	ADPxx51x
	343.2			0-50	±20	100±40	±0.3%	±0.2%	±5.0%	±2.5%	PF/PS	ADPxx61x
	490.3			0-50	±20	100±40	±0.5%	±0.4%	±5.0%	±2.5%	PF/PS	ADPxx71x
	833.6			0-50	±20	100±40	±0.6%	±0.4%	±5.0%	±2.5%	PF/PS	ADPxx71x
	980.7			0-50	±20	100±40	±0.6%	±0.4%	±5.0%	±2.5%	PF/PS	ADPxx91x
	98.1	1.0	3.3	0-60	±20	65±25	±1.0%	±1.0%	±3.5%	±2.5%	PS	ADP4x41x
	980.7	1.0	3.3	0-60	±20	65±25	±1.0%	±1.0%	±3.5%	±2.5%	PS	ADP4x91x
Gauge Pressure (economy type)	40.0	1.5	3.3	5-45	±15	43.5±22.5	±0.3%	±0.7%	±10%	±1.3%	PF/PS	APDxxA23

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

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

Medium: Air*1
Terminal Type: DIP/SMD

*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 +1,000kPa
> Standard / reversed DIP packages
> Economy type for consumer applications

"MA Motion" Proximity Switch

Series / Type	Available Detection Range *2 [cm]	Operating Voltage [V]	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)	5 10 15	4.5 to 5.5	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)	5-10 (1 steps)	4.5 to 5.5	H-Type	NPN open collector output	Built-in oscillator – "Plug and Play"	AMBA1409xx
					External triggering type	AMBA1109xx
		5.5 to 27			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)	20-80 (10 steps)	4.5 to 5.5	H-Type	NPN open collector output	Built-in oscillator – "Plug and Play"	AMBA2409xx
					External triggering type	AMBA2109xx
		5.5 to 27			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	30-200 (10 steps)	4.5 to 5.5	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 27	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

NaPiCa ambient light sensor

Series / Type	Photo current *1 [µA]	Reverse Voltage [V]	Photocurrent [mA]	Power Dissipation [mW]	Operating Temperature [°C]	Dark Current [µA]	Packaging	Part No.
 NaPiCa	260	1.5 to 6	5	40	-30 to +85	max 0.3	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 high output current

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

Series / Type		Operation Power Supply Voltage [VDC]	Current Consumption [mA]	Acceleration Detection Range [g]	Detection Sensitivity [V/g]	Temperature Sensitivity [%]	Offset Voltage [V]	Offset Voltage Temperature Characteristics [mg]	Non-Linearity [%]	Shock [g]	Part No.
	1-axis Acceleration sensor GS1	5	5 (typ.)	±2	1	±4	2.5 ±0.1	±70	±1	max. 5,000	AGS11151
			5 (typ.)	±1.5	1.333	±4	2.5 ±0.1	±70	±1	max. 5,000	AGS11351
	2-axis Acceleration sensor GS2	5	2 (typ.)	±2	1	±2	2.5 ±0.06	±55	±1	max. 5,000	AGS21151
			2 (typ.)	±1.5	1.333	±2	2.5 ±0.08	±55	±1	max. 5,000	AGS21351
		3	1.8 (typ.)	±2	0.6	±2	1.5 ±0.036	±55	±1	max. 5,000	AGS21631
			1.8 (typ.)	±1.5	0.8	±2	1.5 ±0.048	±55	±1	max. 5,000	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) (typ. values)
> High sensitivity: 1 to 1.333V/g (VDD=5V)

1-axis Accelerometer GF1 (Electrostatic Capacitance Detection Sensor)

Series / Type		Operation Power Supply Voltage [VDC]	Acceleration Detection Range [m/s²]	Detection Sensitivity [V/g]	Current Consumption [mA]	Offset Voltage [V]	Offset Voltage Temperature Characteristics [mg]	Non-Linearity [%]	Shock [g]	Installation Type	Part No.
	1-axis accelerometer GF1 Bracket	5	±11.76 (±1.2g)	1.333	10	2.5±0.1	±70	±1	max. 5,000	Bracket	AGF11311
	1-axis accelerometer GF1 Direct Mount	5	±4.9 (±0.5g)	3.0	10	2.5±0.1	±70	±1	max. 5,000	Direct mount	AGF10711
		12	±11.76 (±1.2g)	1.333	15	2.5±0.1	±70	±1	max. 5,000	Direct mount	AGF10321
			±4.9 (±0.5g)	3.0	15	2.5±0.1	±70	±1	max. 5,000	Direct mount	AGF10721
		24	±11.76 (±1.2g)	1.333	15	2.5±0.1	±70	±1	max. 5,000	Direct mount	AGF10331
			±4.9 (±0.5g)	3.0	15	2.5±0.1	±70	±1	max. 5,000	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

- > 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

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

Aluminum Electrolytic Capacitors – Surface Mount Type

Series / Type		Temperature [°C]	Endurance [h]	Rated W.V. [V]	Capacity [µF]	Features	AEC-Q200	Part No.
	Type V - Series S High temp. reflow	-40 to +85	2,000	6.3 to 50	1 to 1,500	5.5mm height Dia. ≤ 6.3mm	qualified*	EEExxAxxxxAx
	Type V - Series S			4 to 100	1 to 1,500			EEExxAxxxNx EEExxAxxxSx EEExxSxxxSx
	Type V - Series HA High temp. reflow	-40 to +105	1,000	6.3 to 50	1 to 1,500	5.5mm height	qualified*	EEEHAxxxxxAx
	Type V - Series HA			6.3 to 100				EEEHAxxxxxP EEEHAxxxxxR
	Type V - Series HB High temp. reflow		2,000	6.3 to 50		6.1mm height Dia. ≤ 6.3mm	qualified*	EEEHBxxxxxAx
	Type V - Series HB			4 to 50	1 to 470			EEEHBxxxxxP EEEHBxxxxxR EEEHBxxxxxSx
	Type V - Series HC		3,000	6.3 to 50	1 to 1,000	Dia. 8-10 / 5,000h	qualified*	EEEHCxxxxxxx
	Type V - Series HD High temp. reflow		5,000	6.3 to 100	1 to 1,000	Long life	qualified*	EEEHDxxxxxx EEEHDxxxxxAx
	Type V - Series HD High temp. reflow Medium-size	-55 to +105		6.3 to 35	680 to 7,500			EEEHDxxxxxAM EEEHDxxxxxAQ
	Type V - Series FC High temp. reflow	-40 to +105	1,000	6.3 to 35	1 to 1,500	Low impedance (50% less than HA series)	qualified*	EEEFCxxxxxAx
	Type V - Series FC			6.3 to 50				EEEFCxxxxxP EEEFCxxxxxR
	Type V - Series FK	-55 to +105	2,000	6.3 to 35	4.7 to 1,500	Low impedance	qualified*	EEEFKxxxxxAP EEEFKxxxxxAR
	Type V - Series FK (G)		5,000	6.3 to 35	4.7 to 1,500	Low impedance	qualified*	
	Type V - Series FK (A) High temp. reflow Medium-size		5,000	6.3 to 100	47 to 6,800	105°C / 5,000h	qualified*	EEEFKxxxxxAM EEEFKxxxxxAQ
	Type V - Series FKS Miniaturisation/ Low ESR		2,000	6.3 to 50	39 to 1,800	One case size smaller than FK	qualified*	EEEFKxxxxxxSP
	Type V - Series FP High temp. reflow		2,000	6.3 to 50	10 to 1,800	Low ESR (30% to 50% less than FK series)	qualified*	EEEFPxxxxxxx
	Type V - Series FT High temp. reflow		2,000 to 5,000	6.3 to 50	10 to 2,200	Low inpendance miniaturized	qualified*	EEEFTxxxxxAP EEEFTxxxxxAR
	Type V - Series FT(G) Increased reliability/ Miniaturisation					Increased lifetime/ Miniaturisation	qualified*	EEEFTxxxxxGP
	Type V - Series TG	-40 to +125	1,000 2,000	10 to 100	10 to 4,700	smaller/higher temperature	qualified*	EEETGxxxxxxx EEVTGxxxxxxx
	Type V - Series TK Medium-size		2,000		47 to 4,700	125°C / 2,000h	qualified*	EEETKxxxxxAx
	Type V - Series TK High temp. reflow		3,000	10 to 35	47 to 470	Low ESR at -40°C (50% lower than TG series)	qualified*	EEETKxxxxxP EEETKxxxxxUP
	Type V - Series TP High temp. reflow		3,000 (D8: 2,000)			Low ESR	qualified*	EEETPxxxxxAx
	Type V - Series TC High ripple perfor- mance					Highest ripple current rating in class	qualified*	EEEFTCxxxxxP
	Type V - Series TC-U High Ripple and Capacitance					Highest ripple current and capacitance in case class	qualified*	EEEFTCxxxxxUP
	Type V - Series TQ High temp. reflow		2,000	35	47 to 100	Low ESR, 1 size smaller than TK-series	qualified*	EEETQxxxxxxxx
	Type V - Series EB	-25 to +105	3,000 to 5,000	160 to 450	2.2 to 100	Dia, 10 to 18mm		EEVEBxxxxxxx

Vibration-proof product is available upon request (≥Ø8mm diameter)
* The series qualify for AEC-Q200, but may have some deviations

Aluminum Electrolytic Capacitors – Radial Lead Type

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

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

Electric Double Layer Capacitors – Radial Lead Type

Series / Type	Temperature [°C]	Endurance [h]	Rated W.V. [V]	Capacity [F]	Features	Part No.
 NEW Series HL	-40 to +65	2,000	2.7	50/100	Large capacitance, high endurance and diminished ESR creep	EECHLxxxxx
Series HZ	-25 to +70	1,000	2.5	3.3 to 10	Miniaturized	EECHZxxxxxx
Series HW	-25 to +60 (+70)		2.1 2.3	22 to 70	Large capacitance	EECHWxxxxxxx

Electric Double Layer Capacitors – Stacked Coin Type

Series / Type	Temperature [°C]	Endurance [h]	Rated W.V. [V]	Capacity [F]	Features	Part No.
 Series SD	-25 to +70	1,000	5.5	0.22 to 0.33	Tabbed lead terminals	EECS0HDxxxxx
	-40 to +70					EECS0HDxxxxxN UPGRADE
Series SG	-25 to +70			0.47 to 1.5		EECS5R5xxxx
	-40 to +70					EECS5R5xxxxN UPGRADE
Series SE	-25 to +70			0.22	5mm pitch lead taping	EECSE0Hxxxxx
	-40 to +70					EECSE0HxxxxxN UPGRADE
Series NF	-25 to +70			0.22 to 1.5	Flat type	EECF5R5Uxxxx
	-40 to +70					EECF5R5UxxxxN UPGRADE
Series F	-25 to +85			0.1 to 1.5	Flat type 85°C	EECF5R5Hxxxx
	-40 to +85					EECF5R5HxxxxN UPGRADE
Series RG	-25 to +85	2,000	3.6	0.22 to 1.0	2,000h at 85°C	EECRGxxxxxx
	-40 to +85					EECRGxxxxxxN UPGRADE
Series RF	-25 to +85		5.5	0.1 to 0.68		EECRFxxxxxx
	-40 to +85					EECRFxxxxxxN UPGRADE
Series LF NEW	-40 to +85	6,000	5.5	1	Extra long life	EECLFxxxxxx NEW
						EECLFxxxxxxN NEW

Film Capacitors – Surface Mount Type

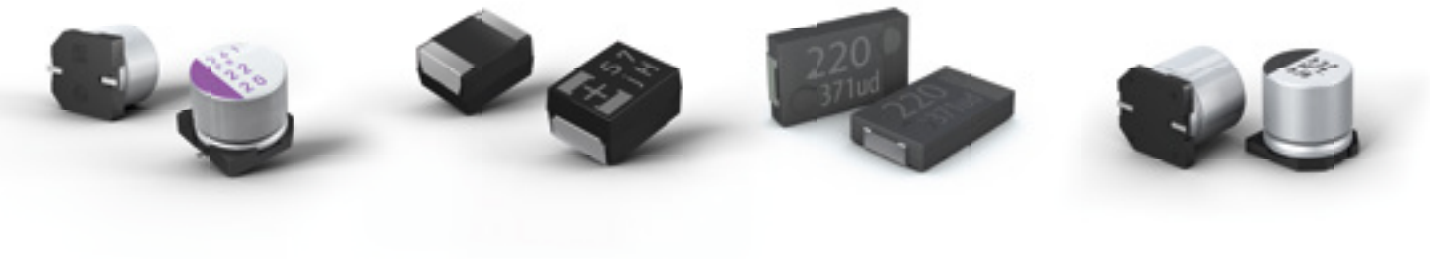
Series / Type	Temperture [°C]	Rated W.V. [VDC]	Capacity [µF]	Features	Dielectric Material	Part No.
 Series ECHU(X)	-55 to +125	16 50	0.00010 to 0.22	Tight capacitance tolerance	PPS	ECHUxxxxxxX5 ECHUxxxxxxX9
Series ECHU(C)	-55 to +105	100	0.010 to 0.22			ECHUxxxxxxC9
Series ECWU(X)			0.0010 to 0.010	Small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

Film Capacitors – Radial Lead Type

Series / Type		Temperature	Rated W.V.	Capacity [µF]	Features	Dielectric Material	Part No.
	Series EZPE	-40 to +85°C	500VDC 800VDC 1,100VDC 1,300VDC	10 to 110	High safety, self-healing, self-protecting	PP	EZPExxxxxxTA
			450VDC 525VDC	66, 29	High safety Self-healing Self-protecting low profile		EZPExxxxxxTx
	Series EZPQ NEW		250VAC	12, 22, 36	Long life 100,000h		EZPQxxxxxxTx
	Series EZWE NEW		450VDC	10-30	Case type, low noise		EZWExxxxxxTx
	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 10	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 4.7	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 10	Wide rated voltage range		ECQExxxxxxT ECQExxxxxT
	Series ECWF(L)	-40 to +105°C	400VDC 450VDC 630VDC	0.010 to 2.4	High frequency	PP	ECWFxxxxxL
	Series ECWF(A)		250VDC 450VDC 630VDC	0.10 to 6.8	Miniaturization of ECWF(L)		ECWFxxxxxxA
	Series ECWFD UPGRADE		450VDC 630VDC	0.47 to 2.2 0.1 to 47	Low hum sound noise		ECWFD2Wxxxx ECWFD2Gxxxx
	Series ECWFE UPDATE		450VDC 630VDC	0.10 to 2.2	Low hum, box type, competitive CV value		ECWFE2Wxxxx ECWFE2Jxxxx
	Series ECWH(V)	-25 to +105°C	1,000VDC to 2,000VDC	0.0010 to 0.10	Low-loss inherent Temperature rise		ECWHxxxxxVx ECWHxxxxxRxV
	Series ECWH(A)	-40 to +105°C	800VDC 1,600VDC	0.010 to 0.047	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 0.33	Low-loss		ECWH6xxxHC ECWH6xxxHCx ECWH6xxxRHC ECWHC3BxxxJA
	Series ECQUA UPGRADE	-40 to 110°C	275VAC	0.1 to 4.7	Safety standard Class X2		ECQUAAFxxxx
	Series ECQUL	-40 to +100°C	275VAC (250VAC)	0.0010 to 2.2	Safety standard Class Y2 / X2	PET	ECQUxxxxxL
	Series ECQUG		300VAC (250VAC)	0.010 to 1.0	Safety standard Class X1		ECQUxxxxxG
	DC-Link Film Capacitor	-40 to 105°C	450VDC	581	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 [°C]	Endurance* [h]	Rated Voltage [V. DC]	Capacitance Range [µF]	ESR Range [mOhm @ 100kHz+]	Case Size Range [LxWxH mm (Code)]	Part No.
	TCE	High temperature	-55 to 125	1,000	2.5 to 10	100 to 1,000	12 to 25	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 3.8 (D4)	xxTCExxxxx
	TCF	High temperature			2.5 to 10	150 to 1,000	5 to 15	7.3 x 4.3 x 2.8 (D3L) to 7.3 x 4.3 x 3.8 (D4)	xxTCFxxxxx
	TV **	High reliability guaranteed at 125°C			6.3 to 10	68 to 150	25	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 2.8 (D3L)	xxTVxxxxx
	TH	Guaranteed at 125°C			2.5 to 10	68 to 470	15 to 40	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	2,000	2.5 to 10	47 to 680	9 to 70	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 2.8 (D3L)	xxTAxxxxx
	TPB	Standard			4 to 10	33 to 470	35 to 70	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 3.8 (D4)	xxTPBxxxxx
	TPC	Low profile			6.3 to 12.5	10 to 330	40 to 80	3.5 x 2.8 x 1.1 (B1) to 7.3 x 4.3 x 1.9 (D2)	xxTPCxxxxx
	TQC UPDATE	High voltage			16 to 35	2.7 to 150	40 to 300	3.5 x 2.8 x 1.4 (B15) to 7.3 x 4.3 x 2.8 (D3L)	xxTQCxxxxx
	TQS NEW	Small size, low profile with low capacitance			16 to 35	6.8 to 33	70 to 150	3.5 x 2.8 x 1.1 (B1)	xxTQSxxxxx
	TPE	Low ESR			2 to 10	47 to 1,500	70 to 150	3.5 x 2.8 x 1.9 (B2) to 7.3 x 4.3 x 3.8 (D4)	xxTPExxxxx
	TPF	Low ESR Large capacitance			2 to 10	150 to 1,000	5 to 15	7.3 x 4.3 x 1.8 (D2E) to 7.3 x 4.3 x 3.8 (D4)	xxTPFxxxxx
	TPSF	Low ESR small size large capacitance			2 to 2.5	200 to 270	6 to 9	3.5 x 2.8 x 1.1 (B1S) to 3.5 x 2.8 x 1.9 (B2S)	xxTPSFxxxxx
	TPG	Small size Large capacitance		1,000	2.5 to 12.5	33 to 220	35 to 70	3.5 x 2.8 x 1.1 (B1G) to 3.5 x 2.8 x 1.4 (B15G)	xxTPGxxxxx
	TPH	Small size low profile			2.5 to 10	33 to 220	7 to 35	3.2 x 1.6 x 0.9 (A09) to 3.2 x 1.6 x 1.4 (A14)	xxTPHxxxxx
	TPU	Small size low profile	-55 to 85	1,000	2.5 to 10	4.7 to 150	100 to 300	2.0 x 1.25 x 0.9 (S09) to 3.5 x 2.8 x 0.9 (B09)	xxTPUxxxxx

* Lifetime calculation: 10times x 20°C (eg. 125°C 1,000h => 105°C 10,000h => 85°C 100,000h)
** Automotive grade

Polymer Aluminum Capacitors

Series / Type		Features	Temperature [°C]	Endurance* [h]	Rated Voltage [V. DC]	Capacitance Range [µF]	ESR Range [mOhm @ 100kHz]	Case Size Range [LxWxH mm]	Part No.
	HX NEW	High temperature Low ESR High voltage	-55 to 125	1,000	2 to 25	15 to 560	4.5 to 40	7.3 x 4.3 x 1.9	EEFHXxxxxxxx
	CX UPDATE	High capacitance Low profile 1.9mm height	-55 to 105	2,000 UPDATE	2 to 6.3	100 to 560	12 to 15	7.3 x 4.3 x 1.9	EEFCXxxxxxxx
		High voltage Low profile 1.9mm height			10 to 35	15 to 100	40		
	CT UPDATE	Low profile 1.4mm height			4 to 6.3	100 to 180	15	7.3 x 4.3 x 1.4	EEFCTxxxxxxx
		High voltage Low profile 1.4mm height			10 to 35	22 to 68	40		
	CS UPDATE	Low profile 1.1mm height			4 to 6.3	68 to 120	15	7.3 x 4.3 x 1.1	EEFCSxxxxxxx
		High voltage Low profile 1.1mm height			10 to 35	10 to 47	40		
	SX	Low ESR Low profile 1.9mm height			2 to 6.3	82 to 560	4.5 to 9	7.3 x 4.3 x 1.9	EEFSXxxxxxxx
	ST	Low ESR Low profile 1.4mm height			2 to 2.5	270 to 330	6	7.3 x 4.3 x 1.4	EEFSTxxxxxxx
	SS	Low ESR Low profile 1.1mm height			2 to 2.5	180 to 220	6	7.3 x 4.3 x 1.1	EEFSSxxxxxxx
	SR	Low ESR Low profile max. 1mm height			2 to 6.3	68 to 220	4.5 to 9	7.3 x 4.3 x 1.0	EEFSRxxxxxxx
	GX	Low ESR Low profile 1.9mm height			2 to 2.5	330 to 560	3	7.3 x 4.3 x 1.9	EEFGXxxxxxxx
		Low ESL Low ESR Low profile 1.9mm height							EEFGXxxxxxxL
	LX	Low ESL Low ESR Low profile 1.9mm height			2 to 2.5	330 to 560	4.5 to 6	7.3 x 4.3 x 1.9	EEFLXxxxxxxx
	LT	Low ESL Low ESR Low profile 1.4mm height			2 to 2.5	270 to 330	6	7.3 x 4.3 x 1.4	EEFLTxxxxxxx
	LS	Low ESL Low ESR Low profile 1.1mm height			2 to 2.5	180 to 220	6	7.3 x 4.3 x 1.1	EEFLSxxxxxxx
	LR	Low ESL Low ESR Low profile max. 1mm height			2 to 6.3	68 to 220	4.5 to 6	7.3 x 4.3 x 1.0	EEFLRxxxxxxx

* Lifetime calculation: 10times x 20°C (eg. 125°C 1,000h => 105°C 10,000h => 85°C 100,000h)

OS-CON – Conductive Polymer Aluminum Solid Capacitors

Series / Type		Features	Temperature [°C]	Endurance* [h]	Rated Voltage [V. DC]	Capacitance Range [µF]	Ripple Current [mArms @ 105°C]	Case Size Range [DxH max (Code)]	Part No.
	SVP	Standard	-55 to 105	2,000	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	2,000	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	1,000	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	2,000	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	5,000	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	5,000	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	2,000	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	5,000	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	1,000	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	2,000	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 UPGRADE	Super high voltage Long life	-55 to 105	5,000	63 to 100	15 to 330	2,350 to 2,950	8 x 12 (E12)	xxSXVxxxxx
	SEPF UPDATE	Long life High voltage Large capacitance	-55 to 105	5,000	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 UPGRADE	Super high voltage Long life	-55 to 105	5,000	63 to 100	15 to 330	2,350 to 2,950	8 x 12 (E12)	xxSXExxxxx

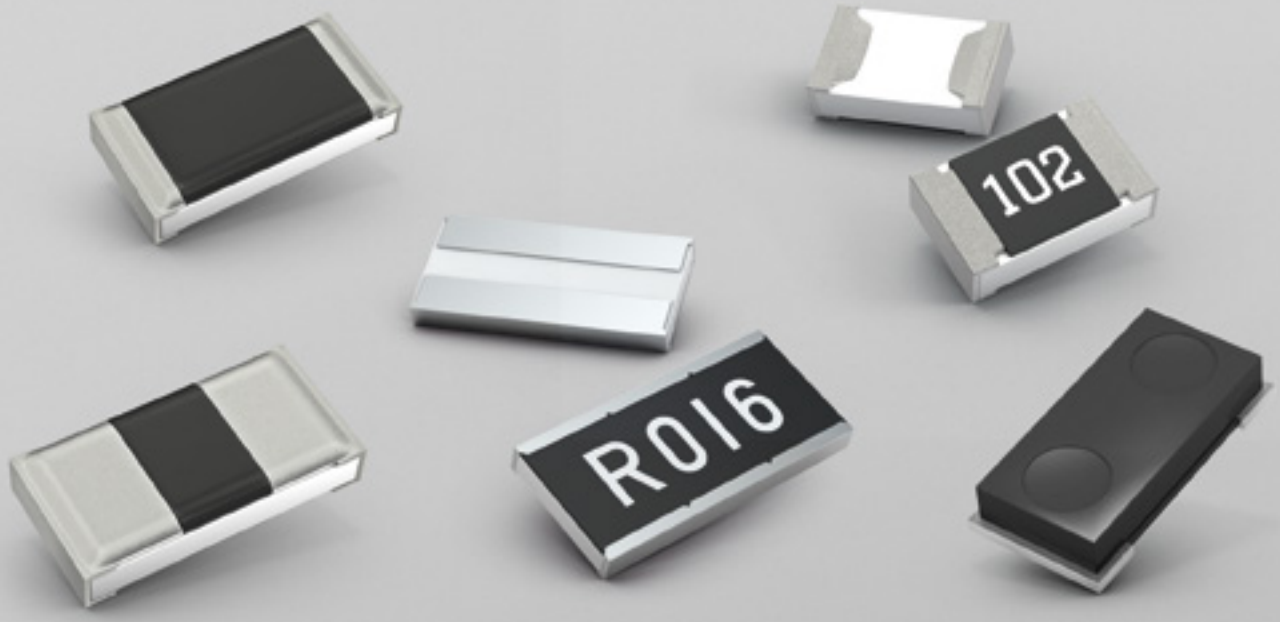
* Lifetime calculation: 10 times x 20°C (eg. 105°C 5,000h => 85°C 50,000h)
** Automotive grade available

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

Series / Type		Features	Temperature [°C]	Endurance* [h]	Rated Voltage [VDC]	Capacitance Range [µF]	Ripple Current [mArms @ 125°C]	AEC-Q200	Part No.
	ZA	High ripple current Long life	-55 to 105	10,000	25 to 80	10 to 470	500 to 2,900	Unconditionally qualified**	EEHZAxxxxxx
	ZC	High ripple current Long life 125°C	-55 to 125	4,000	25 to 80				EEHZCxxxxxx
	ZK	Higher ripple current and capacitance at 125°C	-55 to 125	4,000	25V, 35V				EEHZKxxxxxx

Vibration-proof product is available upon request (≥ Ø 8mm diameter)
* Lifetime calculation: 2times x 10°C (eg. 105°C 10,000h => 85°C 40,000h)
** ACE-Q200 qualified, case specification deviations might exist
ESR down to 20mΩ
Lifetime calculation: 2times x 10°C (eg. 105°C 10,000h => 85°C 40,000h). Achieves 2,000h @ 85°C/85% humidity

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
> Low tolerance, low TCR provide high voltage measurement accuracy

High Power (ERJB Series) & Anti-Surge Resistors (ERJP and ERJT Series) – Soft Termination

> 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

SMD Current Sensing Shunt Resistors

> Current Sensing Resistors are designed for current detection
> Low resistance value (from 0,5mΩ) and high power rating (5W, 3W, 2W, 1W)
> 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 resistor types 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
> Downsizing, cost saving

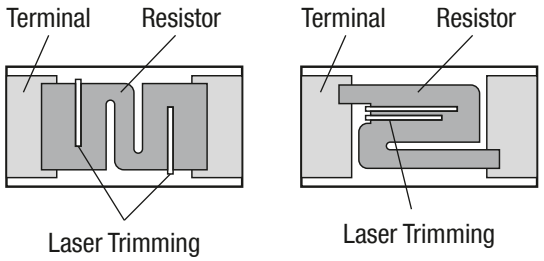
HIGH POWER SMD RESISTORS

DOWNSIZING AND COMPONENT-SAVING PURPOSE

ADDED VALUE

- > Downsizing & high power load
- > Components-saving
- > Cost saving
- > High pulse characteristics
- > High voltage characteristics
- > Heat dissipation

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

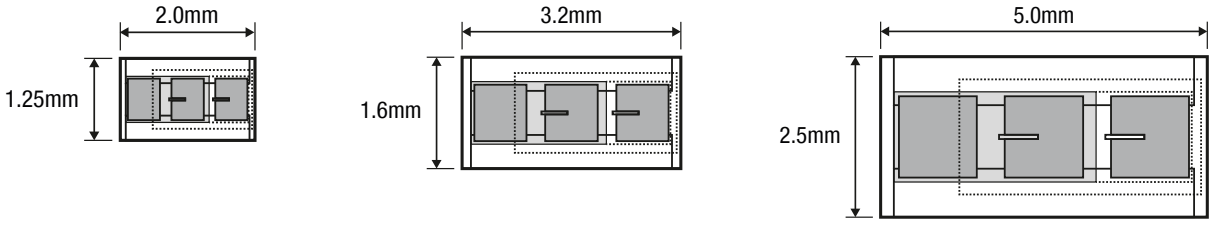
The first two or three digits are significant figures of resistance and the third or fourth one denotes numbers of zeros following.
Three digit type (±5%)
Four digit type (±1.0%, ±0.5%)
Example: 222 -> 2.2kΩ, 1002 -> 10kΩ

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 (70°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
0402 (01005)	±5	0.031	4.7-1M	E24	-55 to +125	General	ERJXGN
0402 (01005)	±1	0.031	10-1M	E24, E96	-55 to +125	Precision	ERJXGN
0603 (0201)	±1	0.05	10-1M	E24, E96	-55 to +125	Precision	ERJ1GN
0603 (0201)	±0.5	0.05	100-1M	E24, E96	-55 to +125	Precision	ERJ1RH/1RK
1005 (0402)	±5	0.1	1-1.2M	E24	-55 to +155	Anti-Sulfurated	ERJS02/U01
1005 (0402)	±1	0.1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS02/U02
1005 (0402)	±5	0.1	1-1M	E24	-55 to +155	General	ERJ2GE
1005 (0402)	±2	(0.25)	0.047-0.1	E24	-55 to +155	Low Resistance	ERJ2BW
1005 (0402)	±5	(0.25)	0.047-0.1	E24	-55 to +155	Low Resistance	ERJ2BW
1005 (0402)	±5	(0.166)	0.1-1	E24	-55 to +125	Low Resistance	ERJ2BS/2BQ
1005 (0402)	±2	(0.166)	0.1-1	E24	-55 to +125	Low Resistance	ERJ2BS/2BQ
1005 (0402)	±1	0.166	0.22-1	E24	-55 to +125	Low Resistance	ERJ2BQ
1005 (0402)	±0.1	0.063	47-100k	E24	-55 to +155	Metal Film, High Reliability	ERA2A
1005 (0402)	±0.5	0.063	10-1M	E24, E96	-55 to +125	Precision	ERJ2RH/2RK
1005 (0402)	±1	0.1	10-1M	E24, E96	-55 to +155	Precision	ERJ2RK
1608 (0603)	±5	0.1	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS03/U03
1608 (0603)	±1	0.1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS03/U03
1608 (0603)	±5	0.2	1-1M	E24	-55 to +155	Anti-Surge	ERJP03
1608 (0603)	±0.5	0.2	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP03
1608 (0603)	±1	0.2	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP03
1608 (0603)	±5	0.1	1-10M	E24	-55 to +155	General	ERJ3GE
1608 (0603)	±1	0.33	0.02-0.1	E24	-55 to +155	Low Resistance	ERJ3BW
1608 (0603)	±5	0.33	0.02-0.1m	E24	-55 to +155	Low Resistance	ERJ3BW
1608 (0603)	±2	0.33	47-100m	E24	-55 to +155	Low Resistance	ERJ3BW
1608 (0603)	±5	0.2	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL03
1608 (0603)	±1	(0.2)	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL03
1608 (0603)	±1	(0.25)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
1608 (0603)	±1	0.1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
1608 (0603)	±2	(0.25)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
1608 (0603)	±2	0.1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
1608 (0603)	±5	(0.25)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3BS/3BQ
1608 (0603)	±5	0.1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ3RS/3RQ
1608 (0603)	±0.05	0.1	1-100k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
1608 (0603)	±0.5	0.1	10-330k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
1608 (0603)	±0.1	0.1	47-330k	E24	-55 to +155	Metal Film, High Reliability	ERA3A
1608 (0603)	±0.5	0.063 (0.1)	10-100k	E24, E96	-55 to +125	Precision	ERJ3RB/3RE
1608 (0603)	±1	0.1	10-1M	E24, E96	-55 to +155	Precision	ERJ3EK
2012 (0508)	±5	0.33 (0.5)	0.02-10	E24	-55 to +155	High Power	ERJB3
2012 (0508)	±1	0.33 (0.5)	0.02-10	E24	-55 to +155	High Power	ERJB3
2012 (0508)	±5	0.33 (0.5)	0.02-10	E24	-55 to +155	High Power	ERJB3
2012 (0805)	±5	0.25	1-1M	E24	-55 to +155	Anti-Pulse	ERJT06
2012 (0805)	±5	0.125	1-10m	E24	-55 to +155	Anti-Sulfurated	ERJS06/U06
2012 (0805)	±1	0.125	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS06/U06

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (70°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
2012 (0805)	±5	0.25	1-2.2M	E24	-55 to +155	Anti-Surge	ERJP06
2012 (0805)	±0.5	0.25	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP06
2012 (0805)	±1	0.25	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP06
2012 (0805)	±5	0.125	1-10M	E24	-55 to +155	General	ERJ6GE
2012 (0805)	±1, ±2, ±5	0.5	10-100m	Each 1mΩ	-55 to +155	Low Resistance	ERJ6BW
2012 (0805)	±1	0.33	10-100m	E24	-55 to +155	Low Resistance	ERJ6BW
2012 (0805)	±2	0.33	10-100m	E24	-55 to +155	Low Resistance	ERJ6BW
2012 (0805)	±1	(0.25)	20-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL06
2012 (0805)	±5	(0.25)	47-100m	E24	-55 to +125	Low Resistance	ERJL06
2012 (0805)	±2	(0.33)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
2012 (0805)	±2	0.125	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
2012 (0805)	±1	(0.33)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
2012 (0805)	±1	0.125	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
2012 (0805)	±5	(0.33)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6BS/6BQ
2012 (0805)	±5	0.125	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ6RS/6RQ
2012 (0805)	±0.5	0.125	10-1M	E24	-55 to +155	Metal Film, High Reliability	ERA6A
2012 (0805)	±0.1	0.125	47-1M	E24	-55 to +155	Metal Film, High Reliability	ERA6A
2012 (0805)	±0.05	0.125	1k-100k	E24	-55 to +155	Metal Film, High Reliability	ERA6A
2012 (0805)	±0.5	0.1	10-100k	E24, E96	-55 to +125	Precision	ERJ6RB/6RE
2012 (0805)	±1	0.125	10-2.2M	E24, E96	-55 to +155	Precision	ERJ6EN
3216 (0612)	±1, ±2	0.75 (1)	0.01-1M	E24	-55 to +155	High Power	ERJB2
3216 (0612)	±5	0.75 (1)	5m-1M	1mΩ Step/E24	-55 to +155	High Power	ERJB2
3216 (0612)	±2	0.75 (1)	0.005-1M	E24	-55 to +155	Low Resistance	ERJ8BS/8BQ
3216 (1206)	±5	0.33	1-1M	E24	-55 to +155	Anti-Pulse	ERJT08
3216 (1206)	±5	0.25	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS08/U08
3216 (1206)	±1	0.25	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS08/U08
3216 (1206)	±5	0.33	1-10M	E24	-55 to +155	Anti-Surge	ERJP08
3216 (1206)	±0.5	0.33	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP08
3216 (1206)	±1	0.33	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP08
3216 (1206)	±5	0.25	1-10M	E24	-55 to +155	General	ERJ8GE
3216 (1206)	±5	0.5 (1)	10-100m	E24	-55 to +155	Low Resistance	ERJ8BW
3216 (1206)	±1	0.5 (1)	10-100m	E24	-55 to +155	Low Resistance	ERJ8BW
3216 (1206)	±1	(0.33)	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL08
3216 (1206)	±1	(0.5)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ8BS/8RS
3216 (1206)	±1	0.25	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ8RS/8RQ
3216 (1206)	±2	0.33	47-100m	E24	-55 to +125	Low Resistance	ERJL08
3216 (1206)	±2	1	10-100m	E24	-55 to +125	Low Resistance	ERJ8BW
3216 (1206)	±5	(0.5)	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ8BS/8BQ
3216 (1206)	±5	0.25	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ8RS/8RQ
3216 (1206)	±0.5	0.25	10-1M	E24	-55 to +155	Metal Film, High Reliability	ERA8A
3216 (1206)	±0.1	0.25	47-1M	E24	-55 to +155	Metal Film, High Reliability	ERA8A
3216 (1206)	±1	0.25	10-2.2M	E24, E96	-55 to +155	Precision	ERJ8EN
3216 (1206)	±1	0.5	1-500m	E24	-65 to +170	Metal Plate	ERJMP2K

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (70°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
3216 (1206)	±1	1	1-500m	E24	-65 to +170	Metal Plate	ERJMP2M
3225 (1210)	±5	0.5	1-1M	E24	-55 to +155	Anti-Pulse	ERJT14
2550 (1020)	±1	2	1-6m	E24	-65 to +170	Metal Plate Wide Terminal	ERJMB1xxxxU
3225 (1210)	±5	0.5	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS14/U14
3225 (1210)	±1	0.5	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS14/U14
3225 (1210)	±5	0.5	1-1M	E24	-55 to +155	Anti-Surge	ERJP14
3225 (1210)	±0.5	0.5	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP14
3225 (1210)	±1	0.5	10-1M	E24, E96	-55 to +155	Anti-Surge	ERJP14
3225 (1210)	±5	0.5	1-10M	E24	-55 to +155	General	ERJ14Y
3225 (1210)	±1	0.33	20-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL14
3225 (1210)	±5	0.33	20-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL14
3225 (1210)	±1	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
3225 (1210)	±1	0.25	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
3225 (1210)	±2	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
3225 (1210)	±2	0.25	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
3225 (1210)	±5	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14BS/14BQ
3225 (1210)	±5	0.25	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ14RS/14RQ
3225 (1210)	±1	0.5	10-1M	E24, E96	-55 to +155	Precision	ERJ14N
4532 (1812)	±5	0.75	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS12/U12
4532 (1812)	±1	0.75	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS12/U12
4532 (1812)	±5	0.75	1-10M	E24	-55 to +155	General	ERJ12Y
4532 (1812)	±1	0.5	20-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL12
4532 (1812)	±5	0.5	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL12
4532 (1812)	±1	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
4532 (1812)	±2	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
4532 (1812)	±5	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12RS/12RQ
4532 (1812)	±1	0.75	10-1M	E24, E96	-55 to +155	Precision	ERJ12N
5025 (1020)	±1	1 (2)	0.01-10k	E24	-55 to +155	High Power	ERJB1
5025 (1020)	±2, ±5	1 (2)	0.01-10k	E24	-55 to +155	High Power	ERJB1
5025 (1020)	±5	1 (2)	0.01-10k	E24	-55 to +155	High Power	ERJB1
5025 (2010)	±5	0.75	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS1D/U1D
5025 (2010)	±1	0.75	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS1D/U1D
5025 (2010)	±5	0.75	1-10M	E24	-55 to +155	General	ERJ12ZY
5025 (2010)	±1	0.5	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1D
5025 (2010)	±5	0.5	47-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1D
5025 (2010)	±1	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
5025 (2010)	±2	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
5025 (2010)	±5	0.5	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ12ZS/12ZQ
5025 (2010)	±1	0.75	10-1M	E24, E96	-55 to +155	Precision	ERJ12S
603 (0201)	±5	0.05	1-10M	E24	-55 to +125	Anti-Sulfurated	ERJU01
603 (0201)	±1	0.05	10-1M	E24, E96	-55 to +125	Anti-Sulfurated	ERJU01
603 (0201)	±5	0.05	1-10M	E24	-55 to +125	General	ERJ1GN
6432 (1225)	±2, ±5	1.33	0.01-10k	E24	-55 to +155	High Power	ERJA1

SELECTION GUIDE

SURFACE MOUNT RESISTORS

Selection Guide Surface Mount Resistors

Size mm (inch)	Tolerance (%)	Power Rating (70°C)(W)	Resistance Range (Ω)	Standard Resistane Value	Category Temp. Range (°C)	Series	Part. No.
6432 (1225)	±1	1.33	0.1-10k	E24	-55 to +155	High Power	ERJA1
6432 (1225)	±1	1.33	0.1-10k	E24	-55 to +155	High Power	ERJA1
6432 (2512)	±5	1	1-10M	E24	-55 to +155	Anti-Sulfurated	ERJS1T/U1T
5025 (2010)	±1	0.5	1-500m	E24	-65 to +170	Metal Plate	ERJMP3K
5025 (2010)	±1	1	1-500m	E24	-65 to +170	Metal Plate	ERJMP3M
5025 (2010)	±1	2	1-500m	E24	-65 to +170	Metal Plate	ERJMP3P
6432 (2512)	±1	1	10-1M	E24, E96	-55 to +155	Anti-Sulfurated	ERJS1T/U1T
6432 (2512)	±5	1	1-1M	E24	-55 to +155	General	ERJ1TY
6432 (2512)	±1	1	40-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1W
6432 (2512)	±5	1	40-100m	Each 1mΩ	-55 to +125	Low Resistance	ERJL1W
6432 (2512)	±1	1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
6432 (2512)	±2	1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
6432 (2512)	±5	1	0.1-9.1	E24	-55 to +125	Low Resistance	ERJ1TRS/1TRQ
6432 (2512)	±1	1	10-1M	E24, E96	-55 to +155	Precision	ERJ1TN
6432 (2512)	±1	1	1-500m	E24	-65 to +170	Metal Plate	ERJMP4M
6432 (2512)	±1	2	1-500m	E24	-65 to +170	Metal Plate	ERJMP4P
6432 (2512)	±1	3	1-500m	E24	-65 to +170	Metal Plate	ERJMP4P
6468 (2526)	±1; ±5	5	≥0.3m	E24	-65 to +170	Metal Plate	ERJMS6SxxxxU

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

Series / Type		Power Pating [W]	Resistance	Tolerance [%]	T.C.R [ppm]	Features	Size	Part No.
	Metal Plate	3	≥ 0.3mΩ	±1 ±5	≥ ±50	Low resistance values and high power. Operation temperature range -65°C to +170°C	2512	ERJMS4SxxxxU
		2 (3 R≤5mΩ)					2512	ERJMS4HxxxxU
		5					2526	ERJMS6SxxxxU
	Metal Plate	0.5	1 to 500mΩ	±1	≥ ±20	-65°C to +170°C	1206	ERJMP2K
		1						ERJMP2M
		0.5		±1	≥ ±20	-65°C to +170°C	2010	ERJMP3K
		1						ERJMP3M
		2						ERJMP3P
		1		±1	≥ ±20	-65°C to +170°C	2512	ERJMP4M
		2						ERJMP4P
		3						ERJMP4Q
	Metal Plate Wide Terminal	2	1m to 5mΩ	±1 ±5	≥ ±75	Small size and high power	1020	ERJMB1xxxxU
	High Power Wide Terminal	0.33 (0.5 R≤1Ω)	≥ 5mΩ	±1 ±2 ±5	≥ ±50	Superior solder-joint reliability by wide terminal structure	0508	ERJB3xxxxxV
		0.75 (1 R≤10Ω)					0612	ERJB2xxxxxV
		1 (2 R≤10Ω)					1020	ERJB1xxxxxU
		1.33					1225	ERJA1xxxxxU
	Low Thick Film Shunt Wide Terminal	1		±1 ±2 ±5	≥ ±50	Low TCR and high power	0612	ERJD2xxxxxxV*
		2					1020	ERJD1xxxxxxU*
	Thick Film Low Resistance	0.1	100m to 9.1Ω	±1 ±2 ±5	≥ ±100	Thick Film low resistance type	0603	ERJ3RxxxxxV
		0.125					0805	ERJ6RxxxxxV
		0.25					1206	ERJ8RxxxxxV
		0.25					1210	ERJ14RxxxxxU
		0.5					1812	ERJ12RxxxxxU
		0.5					2010	ERJ12ZxxxxxU
		1					2512	ERJ1TRxxxxxU
		0.166	100m to 9.1Ω	±1 ±2 ±5	≥ ±100	Thick Film low resistance type, high power type	0402	ERJ2BxxxxxX
		0.25					0603	ERJ3BxxxxxV
		0.33					0805	ERJ6BxxxxxV
		0.5					1206	ERJ8BxxxxxV
		0.5					1210	ERJ14BxxxxxU
	High Power Double-sided	0.25	10m to 100mΩ	±1 ±2 ±5	≥ ±50	Low resistance type, high power type, double-sided resistive elements structure	0402	ERJ2BWxxxxxX
		0.33					0603	ERJ3BWxxxxxV
		0.5					0805	ERJ6BWxxxxxV
		1					1206	ERJ8BWxxxxxV
		1					1206	ERJ8CWxxxxxV
		0.5					0805	ERJ6CWxxxxxV
		0.5					0805	ERJ6LWxxxxxV
		0.25					0603	ERJ3LW xxxxxV
		0.2					0402	ERJ2LW xxxxxV
		0.2	20m to 100mΩ	±1 ±5	≥ ±100	Low TCR type	0603	ERJL03xxxxxV
		0.25					0805	ERJL06xxxxxV
		0.33					1206	ERJL08xxxxxV
		0.33					1210	ERJL14xxxxxU
		0.5					1812	ERJL12xxxxxU
		0.5					2010	ERJL1DxxxxxU
		1					2512	ERJL1WxxxxxU

* Under development

Thin Film Resistors – Surface Mount Type

Series / Type	Power Rating [W]	Resistance	Tolerance [%]	T.C.R [ppm]	Size	Part No.
 Metal Film High Reliability Suitable at high temperature and humidity (85°C 85%RH rated load, category temperature range: -55 to +155°C)	0.05	10 to 100KΩ	±0.1	±25	0201	ERA1AEB
			±0.25	±25	0201	ERA1AEC
			±0.5	±100	0201	ERA1ARW
	0.063		±0.1	±10	0402	ERA2ARB
			±0.25	±10	0402	ERA2ARC
			±0.1	±15	0402	ERA2APB
			±0.1	±25	0402	ERA2AEB
			±0.25	±25	0402	ERA2AEC
			±0.5	±25	0402	ERA2AED
			±0.1	±50	0402	ERA2AHB
			±0.5	±100	0402	ERA2AKD
	0.1	10 to 330KΩ	±0.05	±10	0603	ERA3ARW
			±0.1	±10	0603	ERA3ARB
			±0.1	±15	0603	ERA3APB
			±0.1	±25	0603	ERA3AEB
			±0.25	±25	0603	ERA3AEC
			±0.5	±25	0603	ERA3AED
			±0.5	±50	0603	ERA3AHD
	0.125	10 to 1MΩ	±0.05	±10	0805	ERA6ARW
			±0.1	±10	0805	ERA6ARB
			±0.1	±15	0805	ERA6APB
			±0.1	±25	0805	ERA6AEB
			±0.25	±25	0805	ERA6AEC
			±0.5	±25	0805	ERA6AED
			±0.5	±50	0805	ERA6AHD
	0.25	10 to 1MΩ	±0.05	±10	1206	ERA8ARW
			±0.1	±10	1206	ERA8ARB
			±0.5	±10	1206	ERA8ARD
			±0.1	±15	1206	ERA8APB
			±0.1	±25	1206	ERA8AEB
			±0.25	±25	1206	ERA8AEC
			±0.5	±25	1206	ERA8AED
			±0.5	±50	1206	ERA8AHD

High Power & Pulse Proof Resistors – Surface Mount Type

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

High Precision Thick Film Chip Resistors

Series / Type	Power Rating at 70°C*3 [W]	Limiting Element Voltage*1 [V]	Maximum Overload Voltage*2 [V]	Resistance Tolerance [%]	Resistance Range	T.C.R. (x10^{-6}/°C)	Category Temperature Range [°C]	Size	Part No.
 Thick Film	0.2	150	200	±0.1 ±0.5	200 to 100kΩ (E24, E96)	±50	-55 to +155	0603	ERJPB3
	0.25	150	200	±0.1 ±0.5	200 to 1MΩ (E24, E96)	±50	-55 to +155	0805	ERJPB6

*1 Rated Continous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating x Resistance Values}}$, or Limiting Element Voltage listed above, whichever less
*2 Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 x RCWV or max. Overload Voltage listed above, whichever les
*3 Use it on the condition that the case temperature is below 155°C

Anti-Sulfurated Resistors – Surface Mount Type

Series / Type	Power Rating [W]	Resistance	Tolerance [%]	Features	Size	Part No.
 Thick Film Anti-Sulfurated Au-based inner electrode	0.1 to 1	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	0.25	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 1	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	2	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 Rating [W]	Resistance [MΩ]	Tolerance [%]	Features	Size	Part No.
 Resistor Array Anti-Sulfurated	0.031 to 0.1 per element	10 to 1	±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 Rating [W]	Resistance [MΩ]	Tolerance [%]	Features	Size	Part No.
 Resistor Array	0.031 to 0.1 per element	10 to 1	±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 0.063 per element	47 to 1	±5	High density placing for digital signal circuits	2512	EXBAxxxxxxxx
					1206	EXBDxxxxxxxx
					1608	EXBExxxxxxxx
					1506	EXBQxxxxxxxx

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 INDUCTORS

METAL COMPOSITE MAGNETICS CORE TYPE

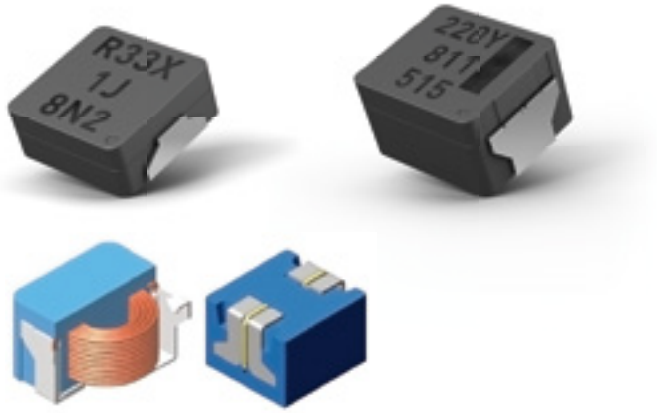
ADDED VALUE

> No-Hard magnetic saturation by high peak current
> Robust design (up to +155C°, 2,000hrs, 30g vibration)
> Solution for downsizing (30-50% less mounting space)

ABSTRACT

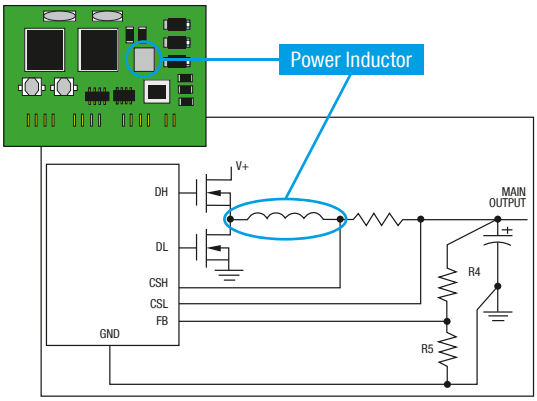
> Lower power loss at high switching frequency and outstanding power efficiency
> Ultra compact size and less mounting space by magnetic shield, molded structure
> Super high reliability and high stability for the requirements of the automotive and industrial market

MONOLITHIC MOLDED BY METAL COMPOSITE MAGNETIC MATERIAL



METAL COMPOSITE INDUCTORS SOLUTION

FOR HIGH PERFORMANCE DC TO DC CONVERTER

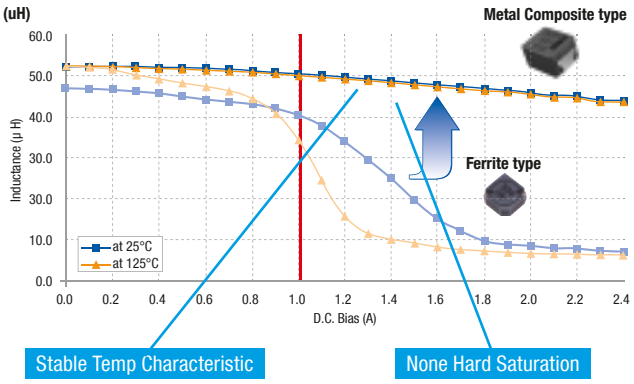


METAL COMPOSITE MAGNETIC MATERIAL

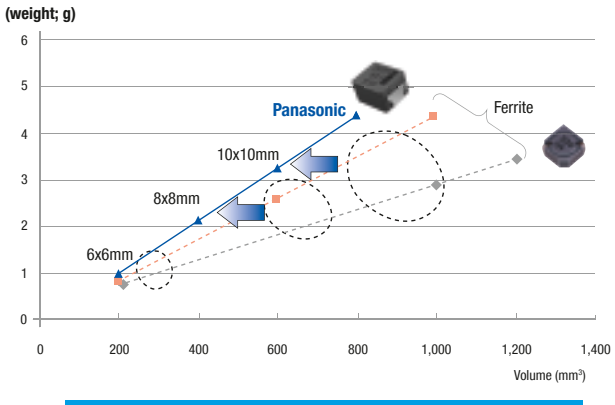
Specifications	Parameters
Size	5x5, 6x6, 7x7, 8x8, 10x10, 12x12mm
Inductance	0.22μH – 100μH
Bias Current	No hard saturation, temp. influence
Robustness	+155°C x 2,000hrs, +180°C short time. Up to 30G vibration proof.

Low DCR, Low Profile , Ultra low loss type available

INDUCTANCE V.S. D.C. BIAS CURRENT



PRODUCT SIZE AND WEIGHT REDUCTION



Same performance of the ferrite type and size down possible.

POWER INDUCTORS

LARGE CURRENT 12.8X12.6X8.0MM TYPE

ADDED VALUE

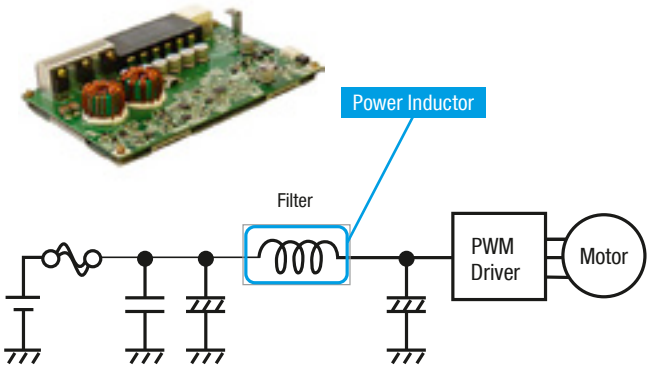
> No-hard magnetic saturation by high peak current (up to 50A)
> High robust design (up to +160°C*2,000hrs, 30g vibration)
> SMD solution for downsizing (50 – 70% miniaturize)

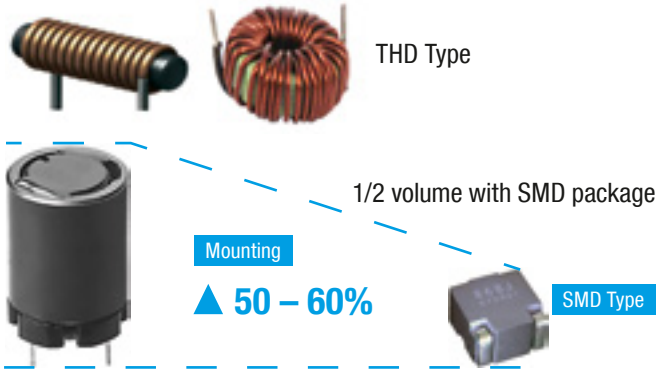
ABSTRACT

> Lowest DC resistance in market & excellent heat resistance for high current filter application
> High reliable molding structure and integral terminal structure for vibration resistance up to 30g (5-2kHz)
> Ultra compact SMD package enable by high magnetic permeability and low eddy-current loss of metal core

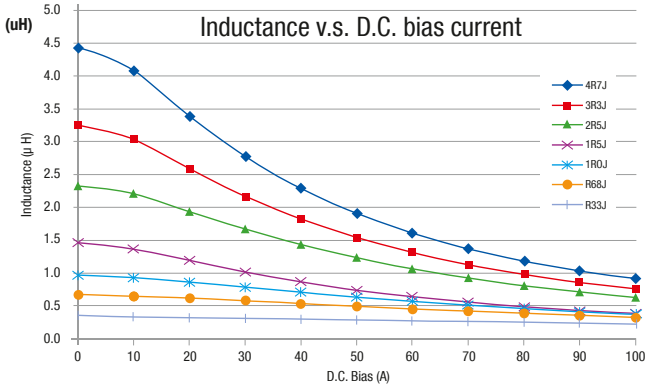
DIRECT LEADING WIRE & METAL COMPOSITE MAGNETIC MATERIAL

SMD SOLUTION FOR HIGH CURRENT DC-DC, MOTORS

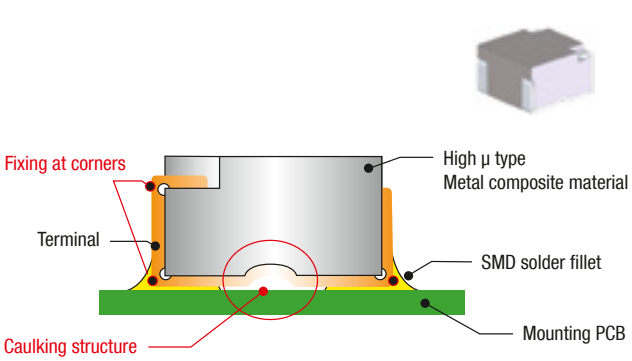




HIGH POWER CURRENT STABILITY CHARACTERISTICS



NEW DESIGN FOR VIBRATION STRESS



Power Inductors – Metal Composite Technology Automotive Type (AEC-Q200 Qualified)

Series / Type	Case Size L×W [mm]	Case Height H [mm]	Inductance [uH]	Rated Current*2) [A]	DCR [mΩ]	Recommended Application	Part No.
 High Performance Series	5.5×5.0	3	1	-6,6	-12	1. Noise filter for various drive circuitry requiring high temp. and peak current handling capability 2. Boost-converter, Buck-converter DC/DC	ETQP3M1R0YFP*1)
			1,5	-5,6	-16,7		ETQP3M1R5YFP*1)
			2,2	4,8	22,6		ETQP3M2R2YFP
			3,3	4,1	32,3		ETQP3M3R3YFP
		4	4,7	4	36		ETQP4M4R7YFP
			6,8	-3,1	-58		ETQP4M6R8YFP*1)
			10	-2,5	-90		ETQP4M100YFP*1)
			15	-2,1	-127		ETQP4M150YFP*1)
			22	1,9	163		ETQP4M220YFP
	6.5×6.0	3	0,68	9,8	6,3		ETQP3MR68YFN
			1	8,8	7,9		ETQP3M1R0YFN
			1,5	-7,4	-11		ETQP3M1R5YFN*1)
		4,5	2,2	-8	-10,4		ETQP4M2R2YFN*1)
			3,3	-6,6	-15,4		ETQP4M3R3YFN*1)
			4,7	-5,5	-22		ETQP4M4R7YFN*1)
			6,8	4,1	39,3		ETQP4M6R8YFN
			10	3,5	54,2		ETQP4M100YFN
			15	-2,5	-105		ETQP4M150YFN*1)
			22	-2,3	-126		ETQP4M220YFN*1)
			33	-2	-172		ETQP4M330YFN*1)
			47	1,8	210		ETQP4M470YFN
	7.5×7.0	5	95	-1,4	-348		ETQP5M101YGM*1)
		5,4	2,2	-9,4	-9,2		ETQP5M2R2YFM*1)
			3,3	-8,3	-11,9		ETQP5M3R3YFM*1)
			4,7	6,3	20,4		ETQP5M4R7YFM
			6,8	-5,5	-26,7		ETQP5M6R8YFM*1)
			10	4,7	37,6		ETQP5M100YFM
			15	-3,2	-78		ETQP5M150YFM*1)
			22	3	92		ETQP5M220YFM
			33	2,6	120		ETQP5M330YFM
			48	2,3	156		ETQP5M470YFM
			64	-1,9	-237		ETQP5M680YFM
	8.5×8.0	5	100	1,7	302		ETQP5M101YGK
		5,4	2,5	11,9	7,6		ETQP5M2R5YFK
			3,3	-10,7	-9,5		ETQP5M3R3YFK*1)
			4,7	-8	-16,8		ETQP5M4R7YFK*1)
			6,8	-6,8	-23,5		ETQP5M6R8YFK*1)
			10	5,7	33,4		ETQP5M100YFK
			15	-4,7	-48,2		ETQP5M150YFK*1)
			22	4,1	63		ETQP5M220YFK
			33	-3,3	-100		ETQP5M330YFK*1)
			48	2,9	125		ETQP5M470YFK
			68	-2,4	-192		ETQP5M680YFK*1)

Power Inductors – Metal Composite Technology Automotive Type (AEC-Q200 Qualified)

Series / Type	Case Size L×W [mm]	Case Height H [mm]	Inductance [uH]	Rated Current*2) [A]	DCR [mΩ]	Recommended Application	Part No.
 High Performance Series	10.7×10.0	5	3,3	-13,1	-7,1	1. Noise filter for various drive circuitry requiring high temp. and peak current handling capability 2. Boost-converter, Buck-converter DC/DC	ETQP5M3R3YGC*1)
			97	2,2	208		ETQP5M101YGC
		5,4	1,5	17,9	3,8		ETQP5M1R5YFC
			2,5	15,1	5,3		ETQP5M2R5YFC
			3,3	13,1	7,1		ETQP5M3R3YFC
			4,7	10,9	10,2		ETQP5M4R7YFC
			6,8	-8	-18,8		ETQP5M6R8YFC*1)
			10	7,1	23,8		ETQP5M100YFC
			15	-6,1	-32,5		ETQP5M150YFC*1)
			22	5,2	45		ETQP5M220YFC
			33	4,2	68,5		ETQP5M330YFC
			47	-3,5	-99		ETQP5M470YFC*1)
			68	-3	-136		ETQP5M680YFC*1)
	10.9×10.0	5	0,33	-33,2	-1,1		ETQP5MR33YLC*1)
			0,68	26,3	1,75		ETQP5MR68YLC
			1	23	2,3		ETQP5M1R0YLC
		6	1,5	-19,8	-3,1		ETQP6M1R5YLC*1)
			2,5	16,3	4,55		ETQP6M2R5YLC
			3,3	14,2	6		ETQP6M3R3YLC
			4,7	-11,8	-8,7		ETQP6M4R7YLC*1)
 Low Profile Series (LP Series)	5.5×5.0	3	10	2,4	96	1. Noise filter for various drive circuitry requiring high temp. and peak current handling capability 2. Boost-converter, Buck-converter DC/DC	ETQP3M100KVP
			6,8	-2,9	-65,7		ETQP3M6R8KVP*1)
			4,7	-3,4	-45,6		ETQP3M4R7KVP*1)
			3,3	-4,4	-27,3		ETQP3M3R3KVP*1)
			2,2	-5,2	-20		ETQP3M2E2KVP*1)
			1,5	-6,7	-12		ETQP3M1R5KVP*1)
			1	7,5	9,6		ETQP3M1R0KVP
			0,68	-8,4	-7,6		ETQP3MR68KVP*1)
	6.5×6.0	3	22	-2,2	-128		ETQP3M220KVN*1)
			15	-2,5	-99,2		ETQP3M150KVN*1)
			10	2,9	71		ETQP3M100KVN
			6,8	3,6	45,6		ETQP3M6R8KVN
			4,7	-4,6	-29		ETQP3M4R7KVN*1)
			3,3	-5	-24,1		ETQP3M3R3KVN*1)
			2,2	-6,5	-14,5		ETQP3M2R2KVN*1)
			1,5	-7,4	-11		ETQP3M1R5KVN*1)
			1	-9,9	-6,2		ETQP3M1R0KVN*1)
			0,68	-10,8	-5,2		ETQP3MR68KVN
	8.5×8.0	4	22	-3,3	-76,3		ETQP4M220KVK*1)
			15	-3,8	-55		ETQP4M150KVK*1)
			10	-4,4	-41,6		ETQP4M100KVK*1)
			6,8	-5,9	-23,5		ETQP4M6R8KVK*1)
			4,7	7,1	16,1		ETQP4M4R7KVK
			3,3	-7,6	-14		ETQP4M3R3KVK*1)
			2,2	-9,8	-8,5		ETQP4M2R2KVK*1)
			1,5	-12,8	-4,9		ETQP4M1R5KVK*1)
			1	-14,8	-3,7		ETQP4M1R0KVK*1)
			0,68	-16,7	-2,9		ETQP4MR68KVK*1)

Power Inductors – Metal Composite Technology Automotive Type (AEC-Q200 Qualified)

Series / Type	Case Size L×W [mm]	Case Height H [mm]	Inductance [uH]	Rated Current*2) [A]	DCR [mΩ]	Recommended Application	Part No.
 Low Profile Series (LP Series)	10.7×10.0	4	47	-2,8	-132	1. Noise filter for various drive circuitry requiring high temp. and peak current handling capability 2. Boost-converter, Buck-converter DC/DC	ETQP4M470KVC*1)
			33	-3,4	-84,6		ETQP4M330KVC*1)
			22	-4,1	-60		ETQP4M220KVC*1)
			15	-5,2	-37		ETQP4M150KVC*1)
			10	-6,3	-25,4		ETQP4M100KVC*1)
			6,8	-7,4	-18,5		ETQP4M6R8KVC*1)
			4,7	-9,2	-11,8		ETQP4M4R7KVC*1)
			3,3	-10,3	-9,4		ETQP4M3R3KVC*1)
			2,2	-12,1	-6,8		ETQP4M2R2KVC*1)
			1,5	-14,3	-4,9		ETQP4M1R5KVC*1)
			1	-19,6	-2,6		ETQP4M1R0KVC*1)
 Large Current Series	12.6×13.2	8	0,33	-44,4	-0,7	1. Noise filter for various drive circuitry requiring high temp. and peak current handling capability 2. Boost-converter, Buck-converter DC/DC	ETQP8MR33JFA*1)
			0,68	35,4	1,1		ETQP8MR68JFA
			1	-31,8	-1,36		ETQP8M1R0JFA*1)
			1,5	-27,7	-1,8		ETQP8M1R5JFA*1)
			2,5	-23	-2,6		ETQP8M2R5JFA*1)
			3,3	-19,6	-3,5		ETQP8M3R3JFA*1)
			4,7	16,8	4,9		ETQP8M4R7JFA
 Dust Core Series	13.2×14.7	13,1	36	6,9	25,8	1. Driver circuits of fuel injection systems in automotive 2. Driver circuits of diesel common rail injection 3. Step-up power supplies for motor driver-circuits	ETQPDH240DTV

*1) Under development – please contact us for product details and samples
*2) DC current which causes temperature rise of 40K. Parts are soldered by reflow on four-layer PWB (1.6 mm FR4) and measured at room temperature

Power Inductors – Metal Composite Technology Consumer Type

Series / Type	Size (LxWxH) [mm]	Inductannce range [microH]	Rated Current [A]	Recommended Application	Part No.
 Consumer Type	5.4x5.15x1.2max.	0.47, 1.00, 2.20, 3.30, 4.70	≤ 5.5	1. HDD, tablet PC power supply modules 2. Servers, routers, DC/DC converters for driving CPUs	ETQP1WxxxWFP
	7.5x6.5x3.0max.	0.33, 1.50	≤ 17	1. Servers, routers, DC/DC converters for driving CPUs 2. Laptop and desktop PC power supply 3. Power supply modules	ETQP3LxxxXFN
	7.3x6.6x3.0max.	0.33, 0.47, 0.68, 0.82, 1.0, 1.5, 2.2, 3.3, 4.7	≤ 21	1. Notebook PC power supply modules 2. Servers, routers, DC/DC converters for driving CPUs	ETQP3WxxxWFN
	8.7x7.0x3.0max.	0.24	≤ 22		ETQP3LxxxCFM
	8.7x7.0x4.0max.	0.24, 0.36, 0.42	≤ 24		ETQP4LxxxAFM
	11.0x10.0x4.0max.	1.5	≤ 13		ETQP4WxxxEFC
	11.5x10.0x4.0max.	0.19, 0.36, 0.56	≤ 38		ETQP4LXXXWFC/XFC
	11.7x10.0x4.0max.	0.36, 0.68	≤ 40		ETQP4LxxxAFC/XFC
	14.5x12.5x5.0max.	0.50, 0.60	≤ 30		ETQP5LxxxXFA
	12.5x12.5x6.0max.	0.58, 1.06, 1.71, 2.45, 3.32	≤ 19	1. DC-DC converter for CPU in PCs 2. Thin on-board power supply modules for servers	ETQP6FxxxBFA
	12.5x12.5x5.7max	2.3 to 12.5	≤ 20		ETQP6FxxxHFA/SFA/LFA
	13.0x12.9x6.0max.	0.60, 1.00	≤ 26		ETQP1HxxxBFA
	13.0x12.9x4.9max.	0.29, 0.69, 1.22, 1.83, 2.61	≤ 23		ETQP2HxxxBFA
	13.0x12.90x3.9max.	0.36, 0.80, 1.43	≤ 23		ETQP3HxxxBFA

Power Inductors – Magnetic Shielded Ferrite Technology Consumer Type

Series / Type	Size [mm]	Inductannce range [microH]	Rated Current [A]	Recommended Application	Part No.
 Wire Wound Type	3.0x3.0x1.0max.	0.68 to 68.0	≤ 1.8	DSC, tablet terminal, portable game device, DC-DC converter circuit for cellular phone	ELLVEGxxxxx
	3.0x3.0x1.2max.		≤ 1.5		ELLVFGxxxxx
	3.0x3.0x1.5max.		≤ 1.8		ELLVGGxxxxx
	3.8x3.8x1.2max.	1.0 to 150.0	≤ 1.9		ELL4FGxxxxx
	3.8x3.8x1.4max.		≤ 1.9		ELL4GGxxxxx
	3.8x3.8x1.8max.		≤ 1.9		ELL4LGxxxxx
	6.0x6.0x1.6 max.	0.8 to 100.00	≤ 2.5		ELL6GGxxxxx
	6.0x6.0x2.0 max.		≤ 2.8		ELL6PGxxxxx
	6.0x6.0x2.8max.	1.0 to 1000.0	≤ 3	Audiovisual equipment, small portable device, DC-DC converter circuit for amusement machine	ELL6RHxxxxx
	6.0x6.0x3.3max.		≤ 3.4		ELL6SHxxxxx
	6.0x6.0x5.0max.		≤ 1.8		ELL6UHxxxxx
	8.0x8.0x5.0max.	0.8 to 1,000.0	≤ 9	Audiovisual equipment, appliance, office automation equipment, amusement machine, power circuit	ELL8TPxxxxx
	10.0x10.0x4.5max.	1.0 to 1,000.0	≤ 8		ELLATPxxxxx
	12.0x12.0x4.5max.	1.2 to 1,000.0	≤ 7		ELLCTPxxxxx
	10.0x10.0x4.5max.	1.5 to 1,000.0	≤ 6.7		ELLATVxxxxx
	12.0x12.0xH4.5max	1.2 to 1,000.0	≤ 6.5		ELLCTVxxxxx

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.
AEC-Q200 Series available

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. AEC-Q200 series available

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 [V]	Maximum Peak Current [A]	Features	Part No.
 Varistor Type: D Series: E	200 to 1,100	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 1,800	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 470	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 950	In 20kA Imax. 40kA (@8/20us)	For incorporation in a surge protective device corresponding to the IEC61643-1	ERZVS34Cxxx
 Varistor Type: E	200 to 1,100	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 1,250		Stack-type for heavy surge energy application (High power induced load etc)	ERZA80JK112 ERZA80JK122 ERZA80JK561
 Varistor Type: P	250 to 1,000	5,000 (@8/20us)	Plug-in type with deterioration indicator for application to industrial equipment	ERZA20PK102 ERZA20PK251 ERZA20PK501
 Varistor Type: G	5 to 17	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 2,500		Thyristor protection against switching surge transformer	ERZC20EKxxxP ERZC32EKxxxP ERZUxxJPxxx
Varistor Unit	22 to 1,000	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 [Ω]	B Value	Heat Dissipation Constant [mW/°C]	Features	Size [inch]	Part No.
	NTC Thermistor (Chip Type)	22 to 470	3,375 to 4,700K	1 or 2 or 3	Highly reliable multilayer/ monolithic structure Wide ranges of operating temperature (-40 to 125°C)	0201	ERTJZxxxxxxxx
						0402	ERTJ0xxxxxxxx
						0603	ERTJ1xxxxxxxx
	NTC Thermistor (Automotive Series)	10k, 47k, 100k	3,380 to 4,700K	3 or 2	Highly reliable multilayer/monolithic structure Wide ranges of operating temperatures (-40 to +150°C)	0402	ERTJ0xxxxxxM
						0603	ERTJ1xxxxxxM

EMI Filters

Series / Type		Operating temperature [°C]	Rated Voltage	Rated Current	Features	Part No.
	Coil Type (Digital Noise Filter)	-40 to +85	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 [V]	Capacitance [pF]	Peak Voltage [V]	Clamping Voltage [V]	Size [inch]	Part No.
	ESD Suppressor	30	0.04	500 max. (350 typ.)	100 max.	0201	EZAEG1A50AC
			0.05			0402	EZAEG2A50AX
			0.10			0603	EZAEG3A50AV
	ESD Suppressor, 15kV Type		0.04			0201	EZAEG1N50AC
			0.05			0402	EZAEG2N50AX
	ESD Suppressor Array	15	0.25			0805	EZAEGCA50AV

Common Mode Noise Filters – Surface Mount Type

Series / Type		Components	Impedance [Ω]	Rated Current [mA]	DC Resistance [Ω]	Part No.
	Noise Filters (0302 small size)	1 lines	43 ±25% 65 ±20% 90 ±20%	100 130 130	2.7 2.5 2.5	EXC14CG430U EXC14CE650U EXC14CE900U
	Noise Filters (for Gbps)		50 ±25% 90 ±20%	160 130	1.5 2.5	EXC24CH500U EXC24CH900U
	Noise Filters (for Gbps)		24 ±25% 90 ±25%	160 100	1.5 3.0	EXC24CG240U EXC24CG900U
	Noise Filters (for Mbps)		36 ±25% 90 ±25% 120 ±25% 200 ±25% 90 ±25%	200 160 140 130 130	1.00 1.75 2.20 2.70 2.50	EXC24CE360UP EXC24CE900U EXC24CE121U EXC24CE201U EXC24CF900U
	Noise Filters (0805 small size)		67 ±25% 90 ±25% 120 ±25% 200 ±25% 90 ±25%	250 250 200 200 100	0.8 0.8 1.0 1.0 3.0	EXC34CE670P EXC34CE900U EXC34CE121U EXC34CE201U EXC34CG900U
	Noise Filter Array (0603 small size)	2 lines	43 ±20% 65 ±20% 90 ±20% 200 ±20%	100 140 130 100	2.7 1.8 2.0 3.5	EXC18CG430U EXC18CE650U EXC18CE900U EXC18CE201U
	Noise Filter Array (for Gbps)		50 ±25% 90 ±20%	160 130	1.5 2.5	EXC28CH500U EXC28CH900U
	Noise Filter Array (for Gbps)		24 ±25% 90 ±25%	160 100	1.5 3.0	EXC28CG240U EXC28CG900U
	Noise Filter Array (for Mbps)		90 ±25% 120 ±25% 200 ±25% 300 ±25%	160 140 130 80	1.5 2.0 2.5 5.0	EXC28CE900U EXC28CE121U EXC28CE201U EXC28CE301U
	2 mode Noise Filters	1 lines	120 ±25% 220 ±25% 220 ±25% 1.000 ±25% 600 ±25%	500 350 100 50 200	0.3 0.4 0.7 1.5 0.9	EXC24CP121U EXC24CP221U EXC24CB221U EXC24CB102U EXC24CN601X
	Chip Bead Array	4 lines	120 ±25% 220 ±25% 120 ±25% 220 ±25%	100	0.5 0.7 0.5 0.7	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 [pF]	Application	Features	Size [inch]	Part No.
	Multilayer chip varistor Automotive type	DC3~5	11	18	150 max.	Sensor I/O data Line (ECU-ECU) Communication Line (CAN/LIN)	Replacement of 0.5W Zener Diode (2.5x1.25mm)	0402	EZJZ0V180HM
		DC3~12	13	22	150 max.				EZJZ0V220HM
		DC3~12	18	27	47 max.				EZJZ0V270EM
		DC3~12	18	27	20 max.				EZJZ0V270RM
		DC3~24	30	42	56 max.				EZJZ0V420WM
		DC3~24	40	65	27 max.				EZJZ0V650DM
		DC3~12	18	27	47 max.			0504 (2 Array)	EZJZSV270EM
		DC3~12	18	27	20 max.				EZJZSV270RM
		DC3~24	30	42	56 max.				EZJZSV420WM
		DC3~5	11	18	220 max.	Actuator	Replacement of 1W Zener Diode (3.5x1.6mm)	0603	EZJZ1V180JM
		DC3~12	13	22	220 max.				EZJZ1V220JM
		DC3~12	18	27	100 max.				EZJZ1V270GM
		DC3~12	18	27	47 max.				EZJZ1V270EM
		DC3~12	18	27	20 max.				EZJZ1V270RM
		DC3~24	30	42	68 max.				EZJZ1V420FM
		DC3~24	40	65	27 max.				EZJZ1V650DM
	High energy type	DC12	16	20 to 23.2		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
			16	27 ± 20% (21.6 to 32.4)				3225	ERZHF2M270

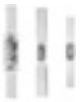
Multilayer Varistors – Surface Mount Type

Series / Type		Varistor Voltage [V]	Maximum Peak Current [A]	Part No.
	Multilayer chip varistor [Voltage/Signal lines]	6.8 to 170	1 to 20 Contact discharge: 8kV	EZJPxxxxxx EZJZxxxxxx
	Multilayer chip varistor [2 Array Type for Signal lines]	12 to 170	3 to 5 Contact discharge: 8kV	EZJZSxxxxx
	Multilayer chip varistor for ESD pulse	12 to 50	Contact discharge: 30kV	EZJSxxxxxx
	Multilayer chip varistor automotive type	27 to 65	1 to 10	EZJPxxxxxxM

Thermal Cutoffs – Radial Lead Type

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

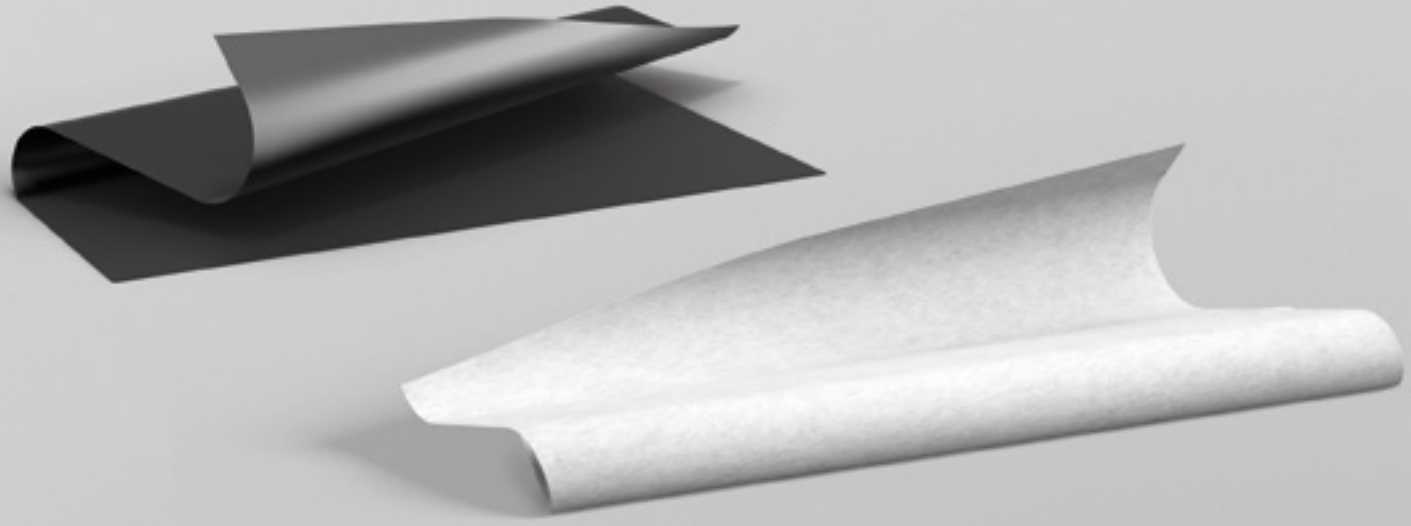
Thermal Cutoffs – Radial Lead Type

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

Micro Chip Fuse – Surface Mount Type

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

THE FUTURE OF THERMAL MANAGEMENT



THERMAL HEAT SINK AND HEAT INSULATION SOLUTIONS

> Flexible and easy to cut or trim
> Withstands repeated bending
> RoHS directive compliant

Pyrolytic Graphite Sheet (PGS) is an ultra-thin, flexible, 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

SSM (Semi-Sealing Material) compounds PGS and high thermal conductive elastomer resin. It has a function to absorb heat by resin and release the heat by utilizing high thermal conductivity of PGS

Soft-PGS is a graphite sheet that is dedicated for use as a thermal interface material **(TIM).** High compressibility property helps to reduce contact thermal resistance due to better fitting to uneven surface compared with regular PGS. The properties are greater than that of existing TIMs

Graphite-PAD is a thermal interface material **(TIM)** that compatibly obtained excellent thermal conductivity in thickness direction (Z-axis direction) and high flexibility (deformable with a low load).
The properties are greater than that of existing TIMs

NASBIS (Nano Silica Balloon Insulation Sheet) sheet which is the thinnest insulation solution currently available on the market. As a high-performance thermal insulation sheet it comes with different thickness and an ultra low thermal conductivity of 0.018 to 0.024 W/mK. The flexibility and fantastic heat insulation performance of the ultra thin NASBIS thermal insulation sheet makes it the ideal solution for applications where it is important to cancel a heat spot in a narrow space

PYROLYTIC GRAPHITE SHEET (PGS)

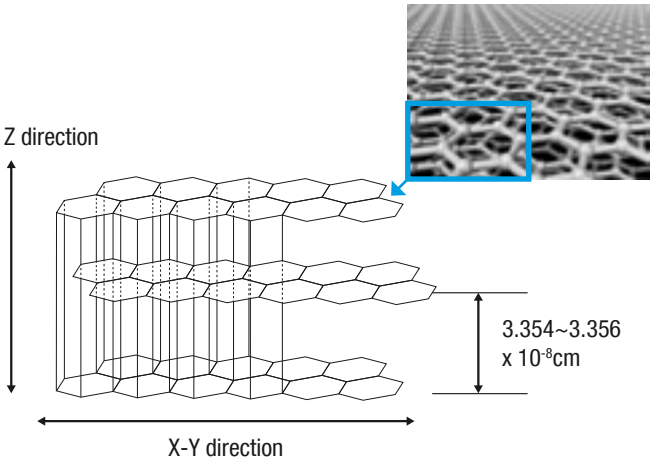
HIGH THERMAL CONDUCTIVITY FOR HEAT PROBLEMS

ADDED VALUE

> High thermal conductivity
> Flexible material
> Shielding (electromagnetic wave)

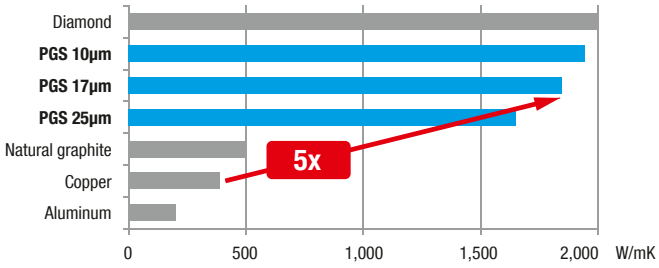
FLEXIBLE MATERIAL

CRYSTALLIZED STRUCTURE



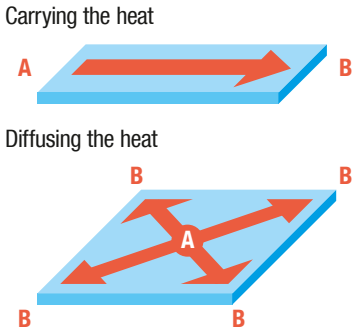
HIGH THERMAL CONDUCTIVITY

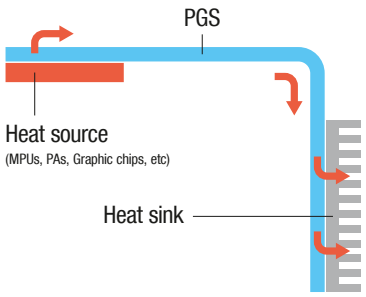
> Best thermal conductivity in the industry
> 5 times higher, in a range from 700 to 1950W/mK

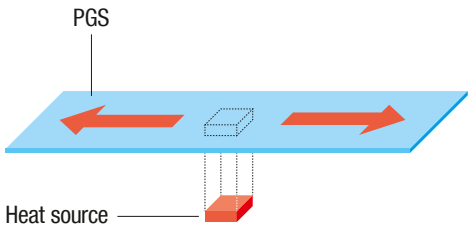


FUNCTION OF PGS

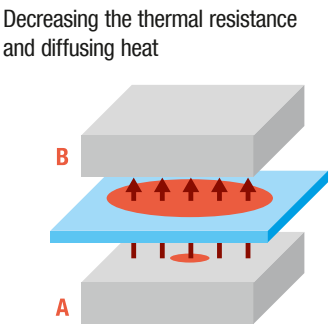
1.) Thermal Transfer

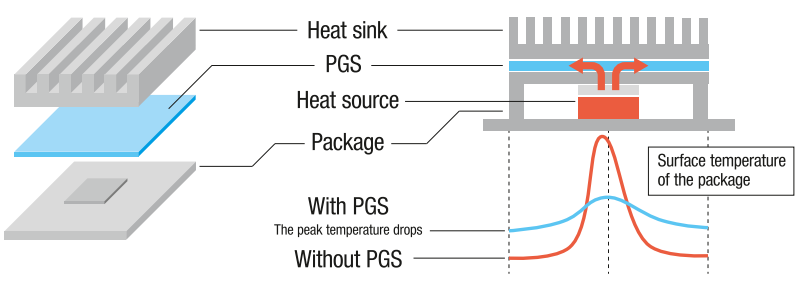




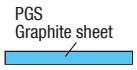
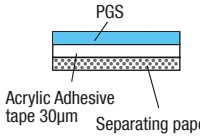
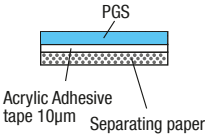
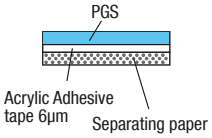


2.) Thermal interface



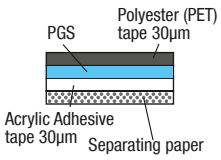
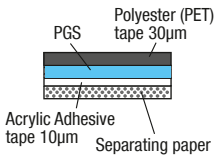
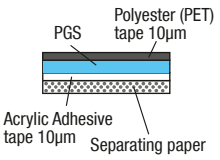
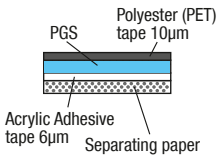


PGS

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*1	115x180mm	90x115mm	90x115mm	90x115mm
Thickness	PGS thickness + Front Face thickness + Rear Face thickness			
PGS thickness available	25µm, 40µm, 50µm, 70µm, 100µm	10µm, 17µm, 25µm, 40µm, 50µm, 70µm, 100µm		
Part No.*2	EYGS1218☐☐	EYGA0912☐☐A	EYGA0912☐☐M	EYGA0912☐☐F

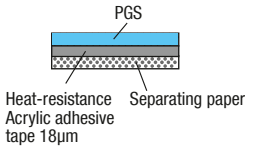
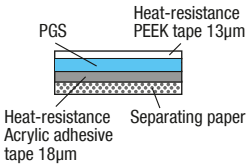
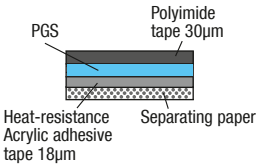
*1: Please contact us for other dimension
*2: Please see datasheet for part numbers depending on PGS thickness
Please contact us for other lamination type product. Withstanding voltages are for reference, not guaranteed

PGS

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*1	90x115mm	90x115mm	90x115mm	90x115mm
Thickness	PGS thickness + Front Face thickness + Rear Face thickness			
PGS thickness available	10µm, 17µm, 25µm, 40µm, 50µm, 70µm, 100µm			
Part No.*2	EYGA0912☐☐PA	EYGA0912☐☐PM	EYGA0912☐☐DM	EYGA0912☐☐DF

*1: Please contact us for other dimension
*2: Please see datasheet for part numbers depending on PGS thickness
Please contact us for other lamination type product. Withstanding voltages are for reference, not guaranteed

PGS

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*1	90x115mm	90x115mm	90x115mm
Thickness	PGS thickness + Front Face thickness + Rear Face thickness		
PGS thickness available	10µm, 17µm, 25µm, 40µm, 50µm, 70µm, 100µm		
Part No.*2	EYGA0912☐☐V	EYGA0912☐☐RV	EYGA0912☐☐KV

*1: Please contact us for other dimension
*2: Please see datasheet for part numbers depending on PGS thickness
Please contact us for other lamination type product. Withstanding voltages are for reference, not guaranteed

SEMI-SEALING MATERIAL (SSM)

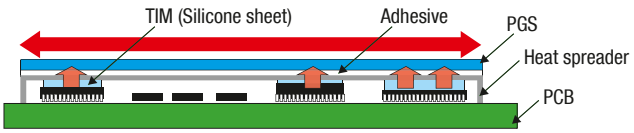
ADDED VALUE

> Low heat resistance with flexible graphite sheet
> Low repulsion and easy to keep the product's shape after attaching
> Siloxane free
> High dielectric voltage : 17kVac/mm

FUNCTION OF SSM

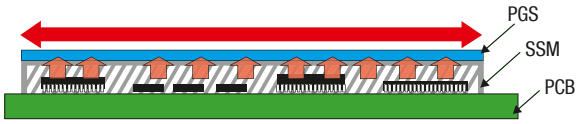
EXAMPLE OF CURRENT HEAT SOLUTION

TIM's (Thermal Interface Material) are put just on the semi-conductors. PGS spreads out the heat

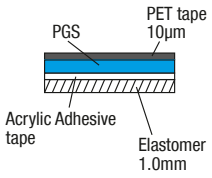
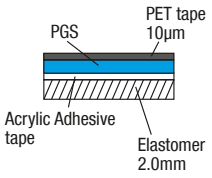
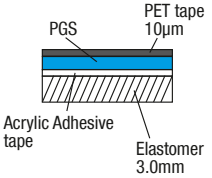


NEW HEAT SOLUTION WITH SSM

SSM can cover whole PCB and transport the heat from ICs to PGS effectively



Semi-Sealing Material (SSM)

Type	SSM		
	E-6 Type	E-8 Type	E-9 Type
Elastomer thickness*1	1.0mm	2.0mm	3.0mm
Tape thickness*1	PET tape 10µm	PET tape 10µm	PET tape 10µm
Structure			
Features	> Soft and low thermal resistance (Elastomer) > Low repulsion > Withstanding voltage: 1.7kV	> Soft and low thermal resistance (Elastomer) > Low repulsion > Withstanding voltage: 1.7kV	> Soft and low thermal resistance (Elastomer) > Low repulsion > Withstanding voltage: 1.7kV
Withstanding temperature	100°C	100°C	100°C
Standard size*2	90x115mm	90x115mm	90x115mm
Thickness	PGS thickness + Elastomer thickness + Tape thickness		
PGS thickness available	10µm, 17µm, 25µm, 40µm, 50µm, 70µm, 100µm		
Part No.*3	EYGE0912X☐6D	EYGE0912X☐8D	EYGE0912X☐9D

*1: Please see datasheet for other elastomer thickness and tape type/thickness
*2: Please contact us for other dimension
*3: Please see datasheet for part numbers depending on PGS thickness, elastomer thickness and tape thickness

SOFT PYROLYTIC GRAPHITE SHEET (SOFT PGS)

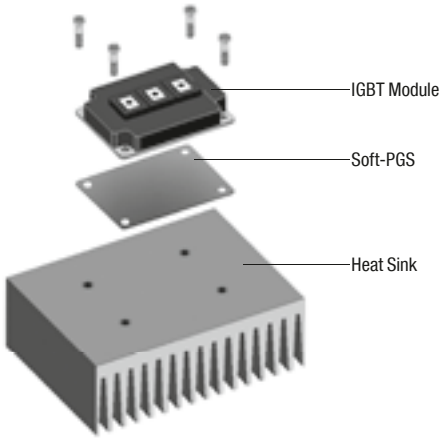
THERMAL INTERFACE MATERIAL

ADDED VALUE

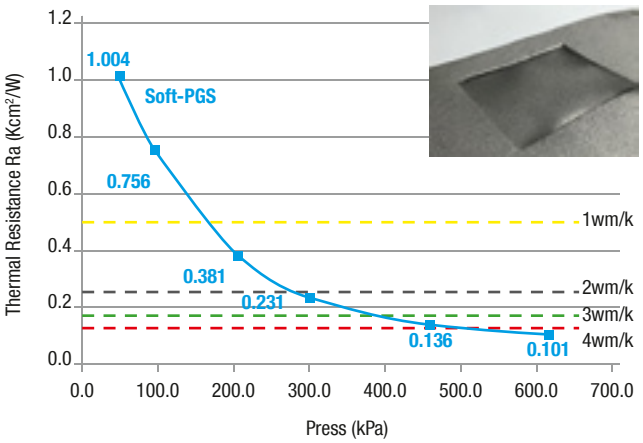
> Soft PGS is designed exclusively for TIM (Thermal Interface Material)
> High compressibility property helps to reduce contact thermal resistance due to better fitting to uneven surface compared with regular PGS
> Excellent TIM material with high workability, reliability and thermo stability compared to thermal grease and PCM

PRACTICABILITY

Soft PGS for IGBT module



A close adherence would make the product fit into the uneven part and enhance the performance



*measurement with thermal grease thickness 50µm

SOFT PGS COMPARISON CHARACTERISTICS TABLE

Spec	Sub		PGS 70µm	PGS 100µm	Soft-PGS
Compressibility	%	ASTM D5470 0.5MPa	9	12	50
Density	K · cm²/W		1.21	0.85	0.43
Thermal conductivity	W/mK	X-Y	1000 (900 to 1100)	700 (600 to 800)	400 (300 to 600)
		Z	(20)	(26)	30
Operating temperature	°C		-55 to +400	-55 to +400	-55 to +400
Certificate	UL 94		V-0	V-0	V-0
Thickness	µm		70+/-15	100+/-30	200 +50/-30

Soft PGS

IGBT Module Manufacturer	IGBT Module Name	Part No.
Fuji Electric	V Series M726	EYGS0304ZLWL
	V Series M728	
	X Series M730	
	X Series M732	
	U Series M262	EYGS0309ZLMF
	V Series M262	
	V Series M263	
	X Series M263	
	V Series M723	EYGS0404ZLMP
	V Series M727	EYGS0405ZLWK
	V Series M729	
	X Series M731	
	X Series M733	
	High speed M233	EYGS0409ZLMG
	V Series M274	
	X Series M274	
	V Series M636	EYGS0411ZLWJ
	V Series M647	
	V Series M711	
	V Series M719	
	V Series M721	
	X Series M719	
	X Series M721	
	V Series M724	EYGS0506ZLMM
	V Series P629	EYGS0507ZLML
	V Series P626	EYGS0508ZLMJ
	V Series P636	EYGS0509ZLMH
	V Series M664	EYGS0608ZLMK
	V Series M725	
	High speed M249	EYGS0611ZLWH
	High speed M276	
	U Series M259	
	V Series M153	
	V Series M275	
	X Series M275	
	X Series M276	
	U Series M633	EYGS0612ZLWF
	V Series M1202	
	V Series M1203	
	V Series M260	
	V Series M633	
	V Series M712	
	X Series M254, M285	
	X Series M282, M286	
	X Series M648	
Fuji Electric	X Series M668	EYGS0612ZLWF
	X Series M720	
	X Series M722	
	V Series M403	EYGS0811ZLWG
	X Series M277	
	V Series P630	EYGS0813ZLMD
	X Series M271	EYGS0917ZLWC
	V Series M404	EYGS0925ZLWA
	X Series M272	
	P401	EYGS1010ZLME
	V Series P631	EYGS1113ZLMB
	M653	EYGS1116ZLMA
	V Series M629	EYGS1216ZLWD
	V Series M639	
	X Series M629	
	U Series M151, M155	EYGS1314ZLWE
	V Series M151, M155	
	V Series M256,M278	
	U Series M156	EYGS1419ZLWB
	V Series M152, M156	
Infineon	34mm	EYGS0309ZLAK
	62mm	EYGS0610ZLAH
	EconoDUAL™ 2	EYGS0410ZLAJ
	EconoDUAL™ 3	EYGS0612ZLWF
	EconoPACK™ + B	EYGS1216ZLWD
	EconoPACK™ + D	EYGS1316ZLAC
	EconoPACK™ 2	EYGS0411ZLWJ
	EconoPACK™ 3	EYGS0612ZLWF
	EconoPACK™ 4	EYGS0713ZLAG
	EconoPIM™ 2	EYGS0411ZLWJ
	EconoPIM™ 3	EYGS0612ZLWF
	HybridPACK™ 1	EYGS0714ZLAE
	IHM 130mm/ IHM B 130mm/ IHV 130mm/ IHV B 130mm	EYGS1314ZLWE
	IHM 190mm/ IHM B 190mm/ IHV 190mm/ IHV B 190mm	EYGS1419ZLWB
	IHV 73mm	EYGS0714ZLAF
	PrimePACK™ 2	EYGS0917ZLWC
	PrimePACK™ 3/ PrimePACK™ 3+	EYGS0925ZLWA
	SmartPACK 1/ SmartPIM 1	EYGS0407ZLAL
	XHP™ 3	EYGS1014ZLAD

Modules and part no. listed above are for reference only. Please consult Panasonic sales office for more information on fitting part no.
Trade marks and trade names are those of their respective owners

Soft PGS

IGBT Module Manufacturer	IGBT Module Name	Part No.
Mitsubishi	A Series	EYGS1313ZLGB
		EYGS0811ZLWG
		EYGS0611ZLWH
		EYGS0509ZLGK
	F Series	EYGS0811ZLWG
		EYGS0611ZLWH
	NF Series	EYGS1315ZLGA
		EYGS1313ZLGB
		EYGS0912ZLGD
		EYGS0512ZLGE
		EYGS0811ZLWG
		EYGS0611ZLWH
		EYGS0509ZLGK
	NFH Series	EYGS0811ZLWG
		EYGS0611ZLWH
		EYGS0509ZLGK
	NX Series	EYGS0612ZLWF
	S Series	EYGS1431ZLAA
		EYGS1315ZLGA
		EYGS1313ZLGB
		EYGS1212ZLGC
		EYGS0612ZLWF
		EYGS0811ZLWG
		EYGS0611ZLWH
		EYGS0607ZLGL
	S1 Series	EYGS0612ZLWF
		EYGS0811ZLGH

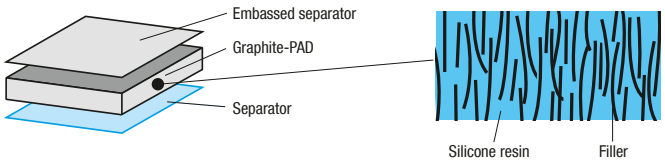
IGBT Module Manufacturer	IGBT Module Name	Part No.
Semikron	MiniSKiiP II 0	EYGS0303ZLSP
	MiniSKiiP II 1	EYGS0404ZLMP
	MiniSKiiP II 2	EYGS0506ZLMM
	MiniSKiiP II 3	EYGS0608ZLMK
	SEMITOP 2	EYGS0204ZLSN
	SEMITOP 3/ SEMITOP 3 Press-Fit	EYGS0305ZLSM
	SEMITOP 4/ SEMITOP 4 Press-Fit	EYGS0506ZLMM
	SEMITRANS 2/ SEMITRANS 2N	EYGS0309ZLMF
	SEMITRANS 3/ SEMITRANS 4/ SEMITRANS 5	EYGS0610ZLAH
	SEMITRANS 6	EYGS0410ZLSJ
	SEMITRANS 20	EYGS1014ZLAD
	SEMiX 1s	EYGS0606ZLSL
	SEMiX 2s	EYGS0609ZLSK
	SEMiX 3s	EYGS0612ZLSG
	SEMiX 3p/ SEMiX 3p shunt	EYGS0612ZLWF
	SEMiX 4s	EYGS0715ZLSD
	SEMiX 5p	EYGS0613ZLSE
	SEMiX 13	EYGS0612ZLSF
	SEMiX 33c	EYGS1216ZLWD
	SKiM 4	EYGS1012ZLSH
	SKiM 5	EYGS1018ZLSA
	SKIM 63	EYGS1116ZLSC
	SKIM 93	EYGS1516ZLSB

Modules and part no. listed above are for reference only. Please consult Panasonic sales office for more information on fitting part no.
Trade marks and trade names are those of their respective owners

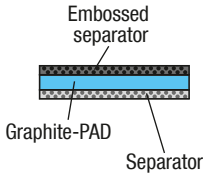
GRAPHITE-PAD

HIGH THERMAL CONDUCTIVITY IN Z-DIRECTION

GRAPHITE-PAD STRUCTURE



Graphite-PAD – High Thermal Conductivity in Z-Direction

Type		Graphite-PAD	
Structure			
Operating temperature		-40°C to 150°C	
Standard size*1		35x35mm	70x70mm
0.5mm	Part No.	EYGT3535A05A	EYGT7070A05A
1.0mm	Part No.	EYGT3535A10A	EYGT7070A10A
1.5mm	Part No.	EYGT3535A15A	EYGT7070A15A
2.0mm	Part No.	EYGT3535A20A	EYGT7070A20A
2.5mm	Part No.	EYGT3535A25A	EYGT7070A25A
3.0mm	Part No.	EYGT3535A30A	EYGT7070A30A

*1: Please contact us for other dimension.

FEATURES

> Thermal conductivity in thickness direction is obtained by having PGS oriented in vertical direction filled into silicone resin
> Thermal conductivity of the material: 13W/mK
> Excellent compressibility to fit into uneven parts and provide excellent thermal resistance with a low load – compressibility: 50% (t=2mm, pressure 300kPa)

NANO SILICA BALLOON INSULATION SHEET (NASBIS)

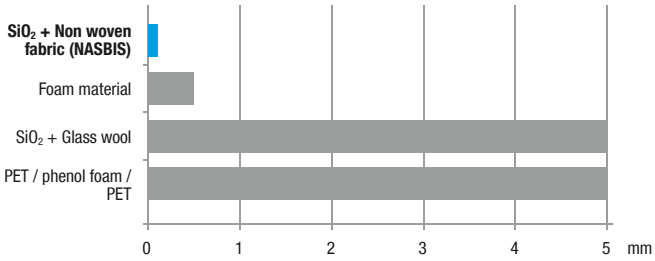
THINNEST INSULATION SOLUTION CURRENTLY AVAILABLE ON THE MARKET

ADDED VALUE

> Low thermal conductivity:
0.020W/m · K typ.
> Created thin-film sheet;
thickness: 100µm to 1,000µm
> Various proposals are available when combined with PGS
> RoHS compliant

FLEXIBLE MATERIAL

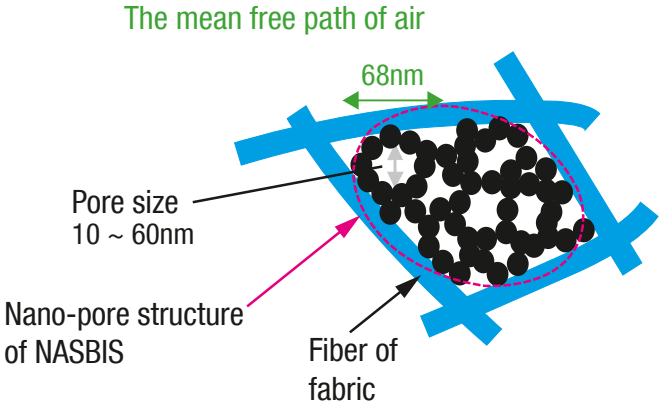
THINNEST INSULATION SOLUTION*



*NASBIS with thickness of 100µm to 1,000µm

INSULATION PRINCPLE OF NASBIS

> An image of nano-pore structure of NASBIS

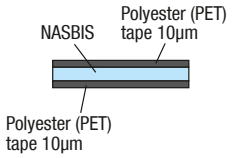
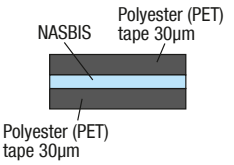
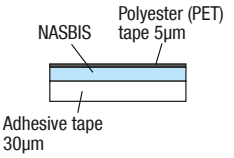
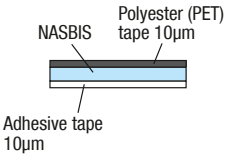


NANO-PORE STRUCTURE STOPS COLLISION OF AIR MOLECULES, AND THUS RESTRAIN THERMAL CONDUCTION

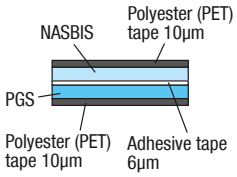
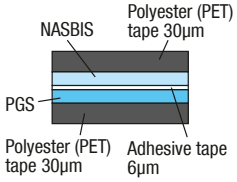
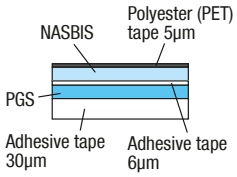
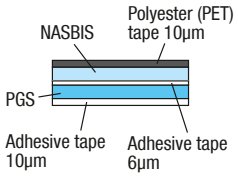
Confine heat by creating smaller space than the mean free path of air (68nm)

> **Restrain the heat conduction** ➜ Insulator
> **Restrain the air-borne sound** ➜ Sound insulator
Exploring new use

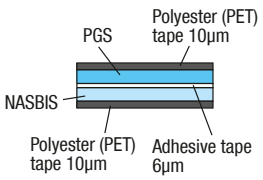
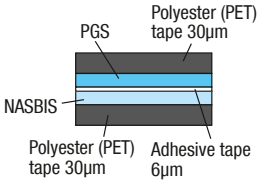
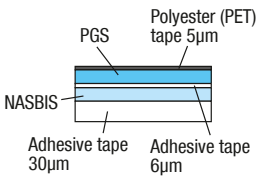
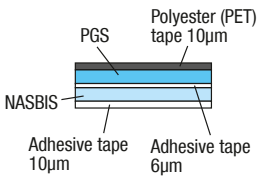
NASBIS Pouch Type

Type		Y – X Type	Y – W Type	Y – T Type	Y – S Type
Structure					
Withstanding temperature		100°C	100°C	100°C	100°C
100µm	Part No.*1	EYGY0912QN6X	EYGY0912QN6W	EYGY0912QN6T	EYGY0912QN6S
	Thickness	120µm	160µm	135µm	120µm
500µm	Part No.*1	EYGY0912QN4X	EYGY0912QN4W	EYGY0912QN4T	EYGY0912QN4S
	Thickness	520µm	560µm	535µm	520µm
1000µm	Part No.*1	EYGY0912QN3X	EYGY0912QN3W	EYGY0912QN3T	EYGY0912QN3S
	Thickness	1020µm	1060µm	1035µm	1020µm

NASBIS and PGS Composit Type – Normal Type

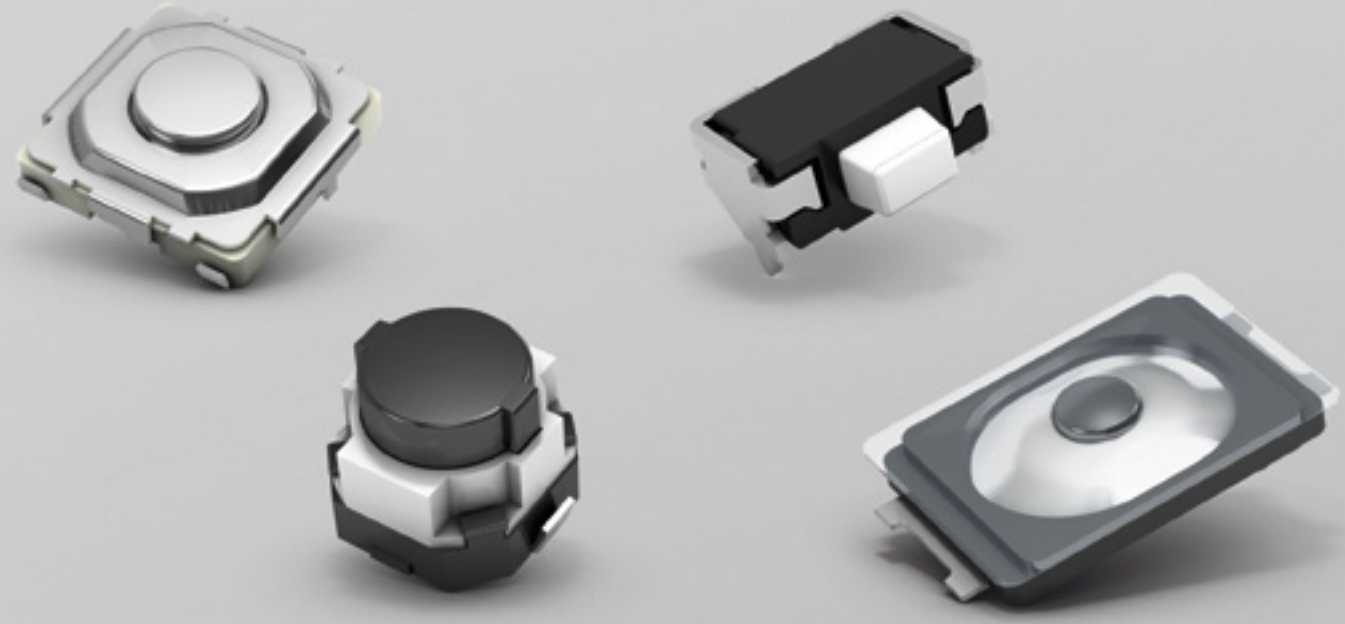
Type		N – X Type	N – W Type	N – T Type	N – S Type
Structure					
Withstanding temperature		100°C	100°C	100°C	100°C
100µm	Part No.*1	EYGN0912Q☐6X	EYGN0912Q☐6W	EYGN0912Q☐6T	EYGN0912Q☐6S
500µm	Part No.*1	EYGN0912Q☐4X	EYGN0912Q☐4W	EYGN0912Q☐4T	EYGN0912Q☐4S
1000µm	Part No.*1	EYGN0912Q☐3X	EYGN0912Q☐3W	EYGN0912Q☐3T	EYGN0912Q☐3S

NASBIS and PGS Composit Type – Reversal Type

Type		N – X Type	N – W Type	N – T Type	N – S Type
Structure					
Withstanding temperature		100°C	100°C	100°C	100°C
100µm	Part No.*1	EYGN0912G☐6X	EYGN0912G☐6W	EYGN0912G☐6T	EYGN0912G☐6S
500µm	Part No.*1	EYGN0912G☐4X	EYGN0912G☐4W	EYGN0912G☐4T	EYGN0912G☐4S
1000µm	Part No.*1	EYGN0912G☐3X	EYGN0912G☐3W	EYGN0912G☐3T	EYGN0912G☐3S

*1: Please see datasheet for part numbers depending on PGS thickness

TOUCH AND FEEL THE DIFFERENCE



SWITCHES, POTENTIO-METERS & ENCODERS

- > 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 types up to 2 Mio. 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 movement, 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 [N]	Operating Cycles	Travel [mm]	Part No.
 2.6x1.6mm IP67	2.6x1.6x0.53	1.6	500,000	0.11	EVPBBxxxx NEW
 2.9x2.6mm	2.9x2.6x1.4	2.5 3.5 4.0 5.0	200,000	0.13	EVPALxxxx
 3.0x2.0mm IP67	3.0x2.0x0.6	1.6 2.4 3.3	300,000	0.13 0.15	EVPAWxxxx
 3.0x2.6mm	3.0x2.6x0.65	1.6	100,000	0.15	EVPAFxxxx
 3.0x2.6mm Double-action	3.0x2.6x0.7	1st: 0.7 2d: 2.0	100,000	1st: 0.07 2nd: 0.16	EVPAXxxxx
 3.0x2.6mm	3.0x2.6x0.58	1.8	100,000	0.13	EVPBA NEW
 3.4x2.9mm IP67	3.4x2.9x1.7	1.6	500,000	0.15	EVPAYxxxx
 3.5x2.9mm	3.5x2.9x1.7	1.0 1.6 2.4 3.5 5.0	200,000 1,000,000	0.15	EVPAAxxxx
 4mm Square	4.1x4.1x0.35 4.1x4.1x0.43 4.1x4.1x0.58	1.0 1.6 2.4	200,000 500,000 1,000,000	0.25	EVQ6P6xxx EVQ7P6xxx EVQ9P6xxx EVQP6xxxx
 4.7x3.5mm	4.7x3.5x2.1 4.7x3.5x2.5	1.0 1.6 2.4 2.5 3.5 5.0	200,000 500,000 1,000,000	0.25 0.70	EVQ3P2xxx EVQP2xxxx EVQP9xxxx
 4.9mm Square	4.9x4.9x0.8 4.9x4.9x1.5	1.0 1.6 2.6	200,000 500,000	0.25	EVQPLxxxx
 6.0x3.5mm	6.0x3.5x4.3 6.0x3.5x5.0	1.0 1.6 2.4	30,000 50,000	0.25	EVQ5Pxxxx EVQPE1xxx EVQPNxxxx
 6mm Square Thin Type	6.5x6.0x2.0 6.5x6.0x2.5 6.5x6.0x3.1	0.5 0.6 1.0 1.3 1.6 2.6 3.5	100,000 200,000 1,000,000 2,000,000	0.25 0.35	EVQP0xxxx EVQQ2xxxx

Light Touch Switches – Surface Mount Type

Series / Type	Dimensions LxWxH [mm]	Operating Force [N]	Operating Cycles	Travel [mm]	Part No.
 2.8x2.3mm Side-operation type Edge Mount	2.8x2.3x1.95	1.6	300,000	0.13	EVPAVxxxx NEW
 3.4x1.7mm Side-operation type	3.4x1.7x1.6	1.6	500,000	0.11	EVPATxxx
 3.5x2.9mm Side-operation type	3.5x2.9x1.35	1.6 2.2	100,000	0.20	EVQ9P7xxx EVQP3xxxx EVQP7xxxx
 3.5x2.9mm Side-operation type Half Dive	3.5x2.9x1.2	1.6 2.2	100,000	0.20	EVPANxxxx
 3.8x1.9mm Side-operation type IP67	3.8x1.9x1.6	1.6	200,000	0.12	EVPAKxxxx
 4.5x2.2mm Side-operation type Edge mount	4.5x2.2x2.9	1.6	200,000	0.15	EVPAExxxx
 4.7x3.5mm Side-operation type	4.7x3.5x1.65	1.6 2.2	100,000	0.30	EVQPUxxxx
 6.0x6.0mm	6.0x6.0x4.0	3.5	100,000	0.75	EVPBDxxxx
 6mm Square Long travel	6.0x6.1x5.0	1.6 2.0 2.2 2.5 3.5	30,000 100,000	1.0 1.3	EVQ9Pxxxx EVQP19xxx EVQP1Bxxx EVQP1Dxxx EVQP1Fxxx EVQP1Kxxx
 6mm Square Long travel 2 Terminal type	6.0x6.1x5.0	1.6 2.0 2.2 2.5 3.0 3.5	30,000 100,000	1.0 1.3	EVPASxxxx
 6.2x2.5mm Side-operation type Edge mount	6.2x2.55x3.5	1.0 1.6 2.4 2.5 3.5 5.0	200,000 500,000 1,000,000	0.25 0.70	EVQP4xxxx EVQP8xxxx
 8mm Square Long travel	8.5x8.5x6.5	4.0 5.0	100,000	1.0	EVQQ1xxxx
 10mm Square Center Space long travel	9.8x9.8x4.6	4.0			EVPADxxxx

Light Touch Switches – Radial Lead Type

Series / Type	Dimensions LxWxH [mm]	Operating Force	Operating Cycles	Travel [mm]	Part No.
 5N	6.0x6.0x4.3 6.0x6.0x5.0 6.0x6.0x7.0 6.0x6.0x9.5	1.0 1.3 1.6 2.6	50,000 100,000	0.25	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	1.0 1.6 2.4	30,000 50,000		EVQPExxxx
 Over travel	6.2x6.2x7.45	0.74 1.3	1,000,000 5,000,000	0.2	EVQP0xxxx
 6mm Square 2R Long travel	6.0x6.1x5.0	1.6 2.0 2.2 2.5 3.5	30,000 100,000	1.0 1.3	EVQPVxxxx

Push Switches – Surface Mount Type

Series / Type	Dimensions LxWxH [mm]	Lock Travel [mm]	Full Travel [mm]	Operating Force [N]	Part No.
	8.9x10.0x20.5	1.5 2.5	2.5 3.5	2.0 3.5	ESB33xxxx

Push Switches – Radial Lead Type

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

Detector Switches

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

Rotary Potentiometers – Vertical Type – Surface Mount Type

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

Encoders – Horizontal Type – Radial Lead Type

Series / Type	Pulse	Detents	Rotation Torque [mNm]	Height from PCB to shaft [mm]	Endurance [Cycles]	Part No.
 10mm GS	12	24	5	7.0	100,000	EVQVXM00112B
				9.0		EVQVXD00112B
				11.0		EVQVXC00112B
7mm GS	12	24	5	7.0	100,000	EVQVUXXX

Encoders – Surface Mount Type

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

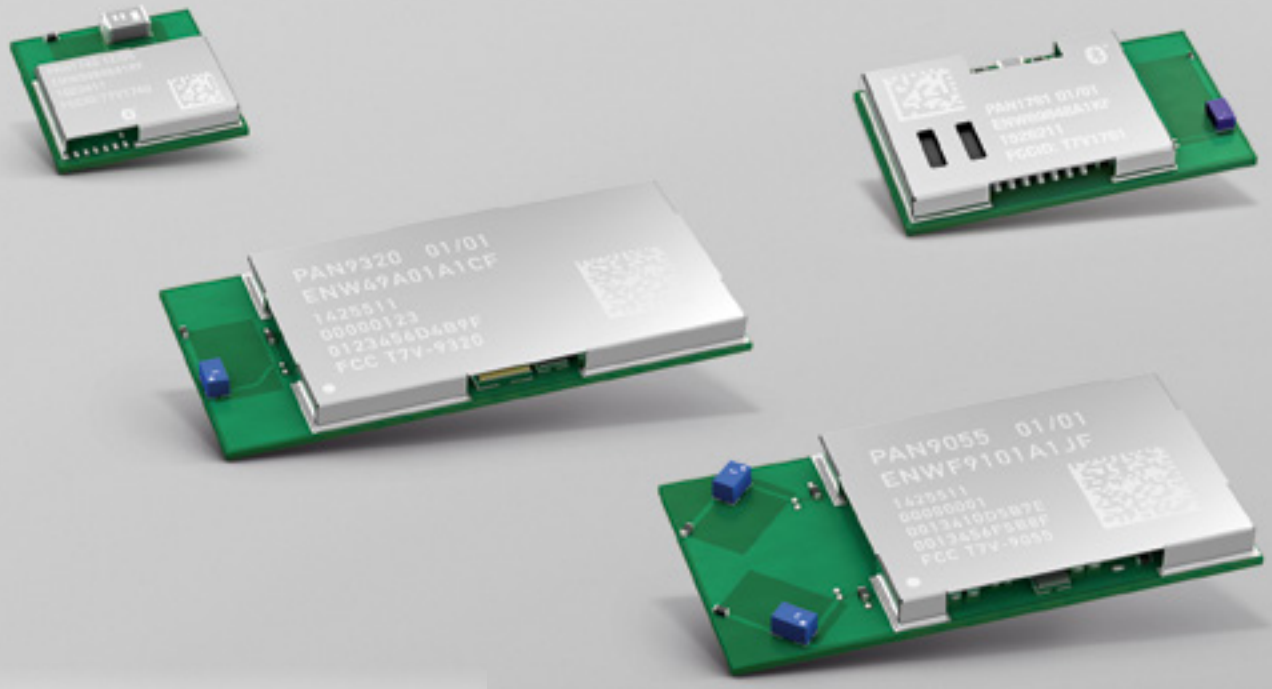
Encoders – Radial Lead Type

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

Center Space Encoders – Radial Lead Type

Series / Type	Pulse	Detents	Rotation Torque [mNm]	Endurance	Part No.
 20/12mm	9	18	6	50,000	EVQV6B00909B
	9	18	7		EVQV6A00609B
	9	18	9		EVQV5A00109B
	15	30	16		EVQV6C01215B NEW
			12		EVQV6G02115B NEW
	9	18	12		EVQV6F02009B NEW
 27/18mm	9	18	9		EVQV5N00409B
	9	18	13.5		EVQV5D00309B
	9	18	18		EVQV5G00209B
	15	30	9		EVQV5L00415B
	15	30	13.5		EVQV5C00315B
	15	30	18		EVQV5B00215B
	15	30	25		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

Products are FCC/IC/CE compliant and have *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

Bluetooth® BR/EDR Functionality Modules

Series		PAN13x0	PAN1322	PAN1555	PAN13x5B
					
Status		Mass production	Mass production	Mass production	Mass production
Part number*		ENW89814C2MF	ENW89841A3KF	ENW89815AxKF	ENW89829x3KF
RF category		***Bluetooth®* BR/EDR Functionality *Bluetooth®* v2.1 + EDR class 2**	***Bluetooth®* BR/EDR Functionality *Bluetooth®* v2.1 + EDR class 2**	***Bluetooth®* BR/EDR Functionality *Bluetooth®* v3.0 + EDR class 2**	***Bluetooth®* BR/EDR Functionality *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	11.6x8.7x1.8			9.0x6.5x1.8
	w/ antenna		15.6x8.7x1.8	22.8x13.5x2.7	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 (max.)		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
Microcontroller and memory			ARM7TDMI, RAM and patchable ROM, 32KB EEPROM	Cortex M3 ST32F103 (256KB Flash, 48KB RAM), CSR BlueCore6-ROM, 256KB EEPROM	
Compatibility		PAN13x0/PAN1322/PAN172x Series are footprint-compatible			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

***Bluetooth®* BR/EDR functionality** 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® Dual Mode Functionality and *Bluetooth®* Low Energy Functionality Modules

Series	PAN13x6B	PAN1026	PAN1760	PAN1761	PAN172x	PAN1740
						
Status	Mass production	Mass production	Mass production	Pre-production	Mass production	Mass production
Part number*	ENW89823x3KF	ENW89837A3KF	ENW89847A1KF	ENW89848A1KF	ENW898xxxxKF	ENW89846A1KF
RF category	***Bluetooth®* Dual Mode Functionality *Bluetooth®* v4.1 class 1.5**	***Bluetooth®* Dual Mode Functionality *Bluetooth®* v4.0 class 2**	***Bluetooth®* Low Energy Functionality *Bluetooth®* v4.1**	***Bluetooth®* Low Energy Functionality Bluetooth v4.1 + NFC Tag type 3**	***Bluetooth®* Low Energy Functionality *Bluetooth®* v4.0**	***Bluetooth®* Low Energy Functionality Bluetooth v4.2**
Software/profile	HCI	SPP + GATT	Embedded profiles	Embedded profiles	nBlue™ by BlueRadios Inc./ TI SW stack	Embedded profiles
Used ICs	CC2564B	TC35661-501	TC35667-006	TC35670-006	CC2540/CC2541	DA14580
Size [mm] w/o antenna w/ antenna	9.0x6.5x1.8 9.0x9.5x1.8	15.6x8.7x1.8	15.6x8.7x1.8	15.6x8.7x1.8 (NFC antenna pin)	11.6x8.7x1.8 15.6x8.7x1.8	9.0x9.5x1.8
Rx sensitivity [dBm]	-93 @ BER 10^{-3}	-88 @ BER 10^{-3}	-91	-90	-94 @ BER 1%	-93 @ BER 1%
Tx power (max.) [dBm]	+10	+4	+0	+0	+4/0	+0
Power supply [V]	1.8 to 4.8	1.8 or 3.3	1.8 to 3.6	1.8 to 3.6	2.0 to 3.6	2.35 to 3.3
Current consumption (max.)	Tx, EDR: 40mA Sleep Mode: 135µA	ACL, DH1: 46mA Sleep Mode: <100µA	Tx: 8.7mA Rx: 8.4mA Sleep Mode: <1µA	Tx: 5.5mA (tbc) Rx: 5.5mA (tbc) Sleep Mode: <1µA (tbc)	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, I²C, NFC Wake-Up, etc.	GPIO, UART, USB only PAN17x0 Series	GPIO, UART, SPI, I²C, 3-axis QD, ADC
Microcontroller and memory		ARM7	ARM 7, 32KB on-chip RAM, 512KB EEPROM	ARM 7, 32KB on-chip RAM, 512KB EEPROM, 1.5KB EEPROM NFC memory	8051 µC, 8KB RAM, 256KB Flash	ARM Cortex M0, 32KB OTP, 84KB ROM, 42KB SRAM / external non-volatile memory
Specialty		Compatible to Toshiba *Bluetooth®* SDK for BLE-GATT			2 internal crystal	2 internal crystal
Compatibility	All CC256x based *Bluetooth®* modules are footprint- and pin-compatible	All TC365xx based modules are footprint- and pin-compatible			PAN13x0/PAN1322/ PAN172x Series are footprint -compatible	
Operating temp. [°C]	-40 to +85	-40 to +85	-40 to +85	-40 to +85	-40 to +85	-40 to +85
Evaluation kit*	EVAL_PAN1323 (EMK)	ENW89837AYKF (EMK)	ENW89847AVKF (EMK) or ENW89847AUKF (Morpheus Board)	ENW89848AVKF (EMK)	ENW898xxAY2F (BR KIT) ENW898xxAY1F (TI KIT)	ENW89846AYKF (KIT) ENW89846AVKF (EMK)

* x is a parameter to be defined
Planned enhancements of Bluetooth technology on several products

***Bluetooth®* with dual mode functionality** builds the centre of the *Bluetooth®* ecosystem in combining *Bluetooth®* BR/EDR functionality and *Bluetooth®* low energy functionality in one device. These modules combine both communication stacks and permit a shared antenna. It can communicate with other devices implementing both functionalities as well as devices implementing either functionality and therefore can easily be added to 'hub' devices, e.g. for industrial, automation, medical and fitness products. Some profiles and use cases will be supported by only one of the functionalities. Therefore, devices implementing both functionalities have the ability to support the most use cases.

***Bluetooth®* with low energy functionality** 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®* low energy can transmit authenticated data in as little as 3ms, versus the 1000ms typical for *Bluetooth®* BR/EDR. All this relates in a maximum practical data rate well under 100kbps typically. In *Bluetooth®* low energy each use case is allocated to one 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*1	PAN93x0	PAN90x5*1
			
Status	Mass production	Mass production	Pre-production
Part number*	ENW49801x1JF (USB) ENW49802x1JF (SDIO)	ENW49A02x3EF (EU) ENW49A01x3EF (FCC/IC)	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/ 50Ω bottom pad	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	Tx: 400mA @ 11Mbps Rx: 105mA @ 11Mbps Sleep Mode: 200µA	Tx: 430mA @ 11Mbps Rx: 150mA @ 11Mbps Off Mode: 27mA	Tx: 580mA @ 300Mbps Rx: 310mA @ 300Mbps Sleep Mode: tbd
Centre frequency [GHz]	2.4	2.4	2.4
Interfaces	USB2.0 or SDIO	GPIO, QSPI, 2 x UART, JTAG	USB2.0, SDIO3.0, HS UART
Microcontroller and memory		ARM Cortex M3 1MB Flash	
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	-30 to +70 (extended grade)	0 to +70 (commercial grade) -30 to +85 (extended grade)
Evaluation kit*	ENW49802AYJF (KIT)	ENW49A01AYEF (EMK)	ENWF9101AYEF (KIT)

* x is a parameter to be defined

*1 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	PAN237x	PAN4561H
			
Status	Mass production	Engineering sample	Mass production
Part number*	ENW5961xN3xx	ENW59637C1xF	ENWC9A22xxEF
RF Category	**ISM Transceiver**	**ISM Transceiver**	**Mesh networking (ZigBee® ready)**
Software/profile	n/a	n/a	SNAP® by Synapse Wireless Inc.
Used ICs	CC1101	CC1200	MC13213 + CC2591
Size [mm]	8.0x8.2x1.9	13.8x11.8x1.9	35.0x15.0x3.8
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
Tx power (max.) [dBm]	+10	+15	+18.5
Power supply [V]	1.8 to 3.6	2.0 to 3.6	2.7 to 3.4
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
Centre frequency [MHz]	433/868/915	169/433/868/915/955	2,400
Interfaces	GPIO, SPI	GPIO, SPI	GPIO, UART, I²C
Operating temp. [°C]	-40 to +85	-40 to +85	-40 to +85
Evaluation kit*	n/a	n/a	ENWC9A30x4EF + 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.

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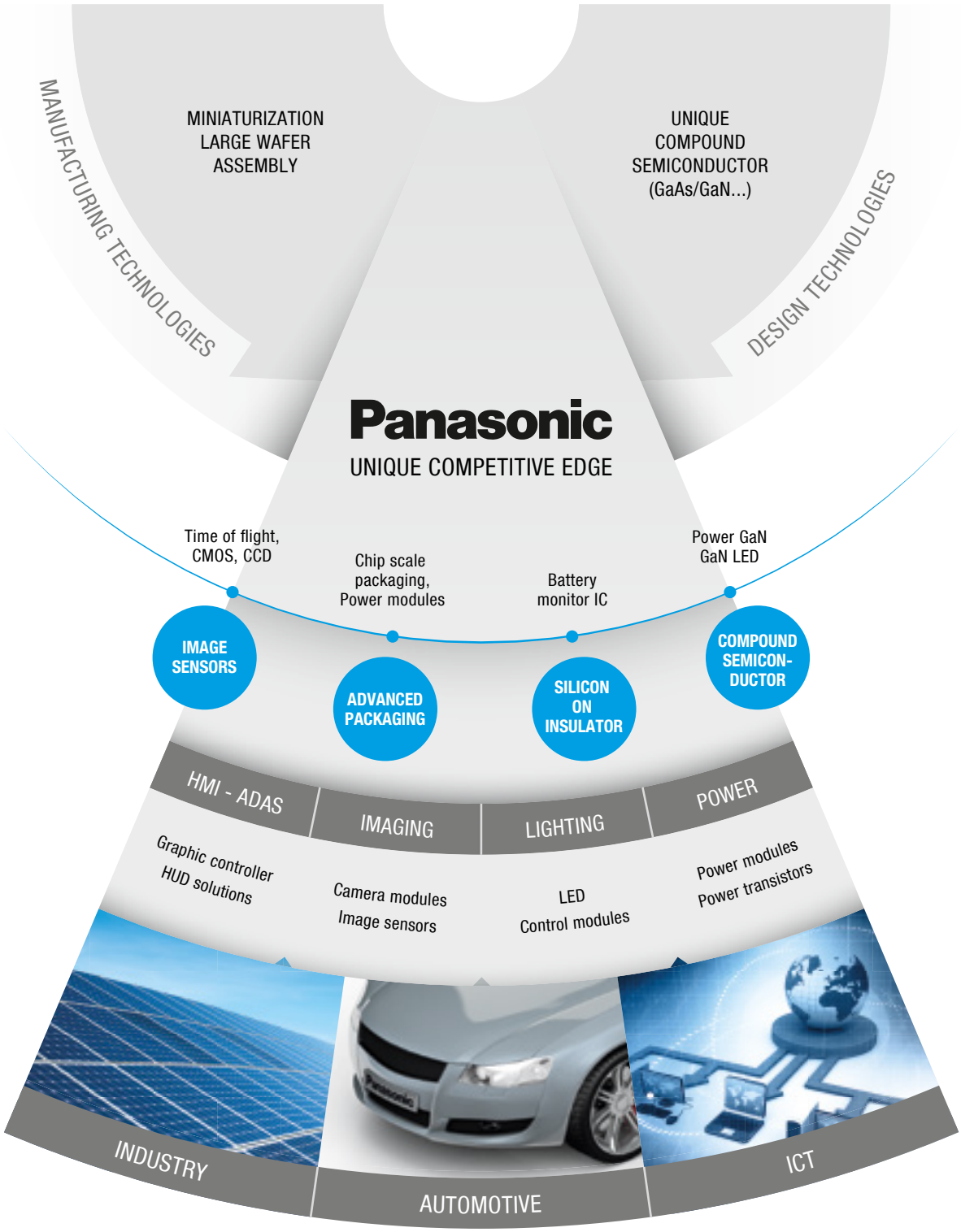

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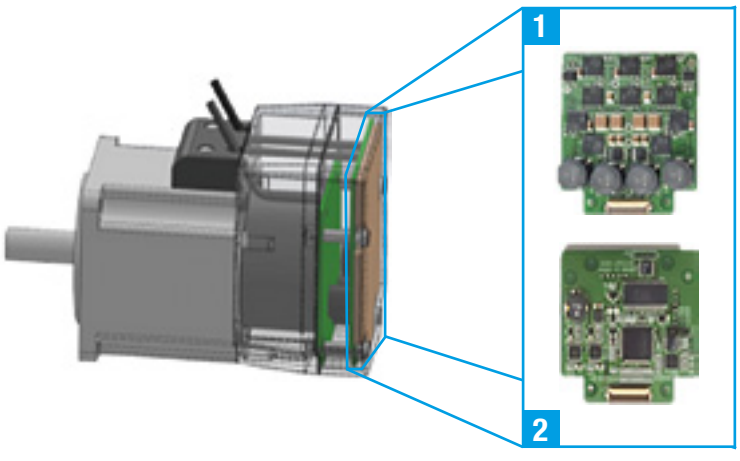
> Fast switching
> Low losses



Laser Diodes

Series / Type		Wavelength [nm]	Output Power [mW]	Built-in Photo Diode	Operating temperature	Package	Part number
	Red laser diodes	661	100 (CW)	No	-10 to 70	Ø5.6 CAN package	LNCQ28PS01WW
		661	100 (CW)	Yes	-10 to 70	Ø5.6 CAN package	LNCQ28MS01WW
	Infrared laser diodes	783	200 (CW)	No	-10 to 70	Ø5.6 CAN package	LNC728PS01WW
		783	200 (CW)	Yes	-10 to 70	Ø5.6 CAN package	LNC728MS01WW
	Dual wavelength laser diodes	661/783	100/200 (CW)	No	-10 to 70	Ø5.6 CAN package	LNCT28PS01WW
		661/783	100/200 (CW) 300/380 (pulse)	No	-10 to 85	Flat package (1.65x3.75x5.15mm)	LNCT28PF01WW
		661/785	100/200 (CW) 280/380 (pulse)	No	-10 to 85	Flat package (1.2x3.75x3.55mm)	LNCT22PK01WW

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 tag ICs	1.7 / 3.6	4 kbit	Type 3/4B	AES128	I2C (100kbps)	QFN (3.2x4.2x0.77)	MN63Y1208-E1
		1.8 / 3.6 or 4.5 / 5.5	4 kbit	Type 3	-	UART/Sync serial	SSOP16 (5x6.4x1.3)	MN63Y1210AF
		-	4 kbit	Type 3/4B	AES128	IRQ	SON8 (2x2x0.45)	MN63Y1212-E1
		1.7 / 3.6	4 kbit	Type 3/4B	AES128	I2C (100kbps)	SON8 (2x2x0.45)	MN63Y1213-E1
		1.7 / 3.6	8 kbit	Type 3/4A/4B	Password	I2C (400kbps)	SON8 (2x2x0.45)	MN63Y1214-E1
	NFC tag modules (including antenna)	-	4 kbit	Type 3/4B	AES128	IRQ	11.5x25	MN63Y3212N1
		-	4 kbit	Type 3/4B	AES128	-	Ø30 (round)	MN63Y3212N4
		-	4 kbit	Type 3/4B	AES128	-	30x15	MN63Y3212N5
		1.7 / 3.6	4 kbit	Type 3/4B	AES128	I2C (100kbps)	9x30	MN63Y3213N1
		1.7 / 3.6	8 kbit	Type 3/4A/4B	Password	I2C (400kbps)	40x30	MN63Y3214N1

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 [mm]	Part number
	MOS FET Dual N channel	12	11	3	CSP (1.77x3.54)	FCAB2126
		12	1.5	95	CSP (0.6x0.6)	FC4B2130

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

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

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

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	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

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

INDUSTRIAL GRADE SD MEMORY CARD

- > 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-SDFC04	RP-SDFC08	RP-SDFC16
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 rests 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

SLC SC Series – High-grade microSD Series with Superb Rewriting Durability and Reliable UHS Speed Class 3 - Ideal for 4K Video Shooting*1

MADE IN JAPAN

Model	RP-SMSC02	RP-SMSC04	RP-SMSC08
Capacity*2	2GB	4GB	8GB
Flash memory/type	Single-Level Cell (SLC) NAND Flash Memory		
SD physical specification	Ver. 3.01 (Not UHS-I Compliant)	Ver. 4.20 (UHS-I Compliant)	
Speed class	Speed Class 6 (Not UHS Speed Class Compliant)	Speed Class10 UHS Speed Class 3	
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)	15.0x11.0x1.0mm		

*1 UHS Speed Class 3 applies only to 4GB and 8GB models
*2 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	RP-SDPC32
Capacity*1	4GB	8GB	16GB	32GB
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

SD-CARDS

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

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

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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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