RENESAS

ANALOG AND POWER DEVICES

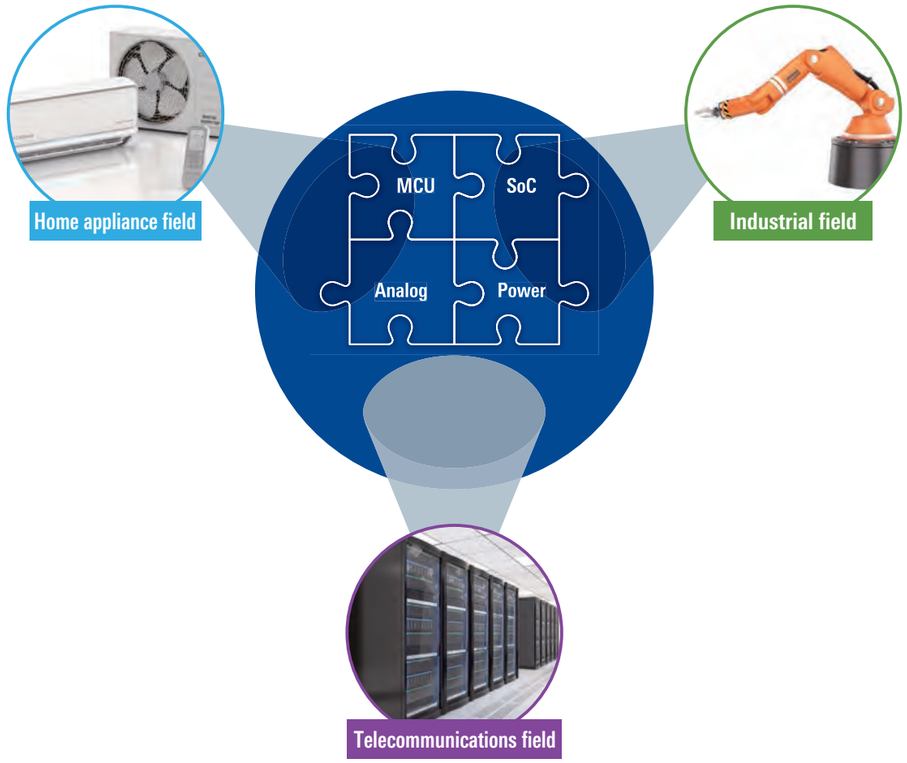
Lineup Catalog

BIG IDEAS
FOR EVERY SPACE

2017.03

Key components that make solutions possible. Analog and power devices that boost added value.

Renesas Electronics offers an extensive lineup of products with a proven track record and superior reliability. Alongside microcontrollers and SoC products, our analog and power devices are key components that make solutions possible in the industrial, home appliance, and OA/ICT fields. Moving forward, Renesas Electronics will continue to deliver products that meet customers' requirements for advanced performance and contribute to solutions with enhanced added value.



CONTENT

Power MOSFETs

Contributing to more efficient and compact systems

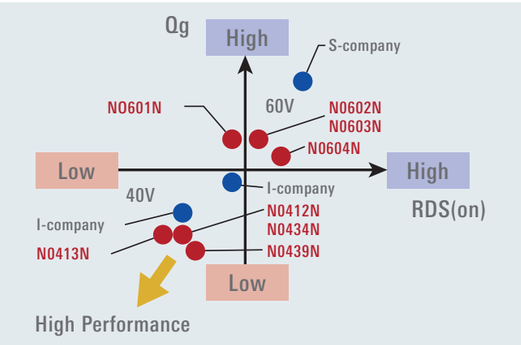
Renesas Strengths and Features

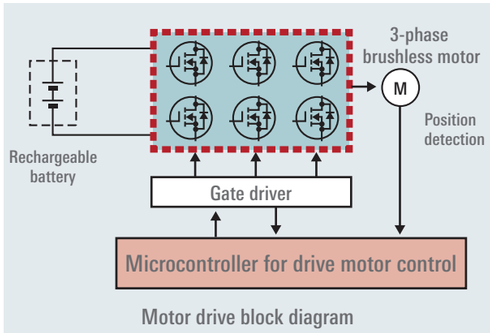
- Extensive product lineup to match a variety of applications
  Low on-resistance, fast switching, highly robust

Product Topics

1. Nch MOSFET for Motor Drive (VDSS=40~60V)

Recommended for applications requiring medium voltage tolerance, Id = 100A (Ta = 25°C)!





Motor drive block diagram

■Features
- Large current support, ID = 100A (Ta=25°C)
- Low on-resistance
- RoHS support

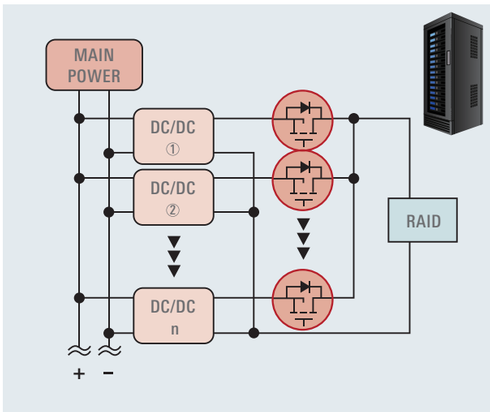
■Applications
- Portable motor driven devices such as electric power tools

2. Introducing the new UPA2764T1A.

Recommended for low-loss load switching applications!

■Features
- RDS(on)=0.72mΩtyp@10V
- VDSS/VGSS 30V/20V
- Package (8pHVSON)

■Applications
- ORing switching in server power supplies
- Battery protection circuits for portable devices

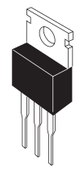


Power MOSFET Product Lineup

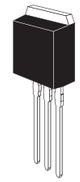
■Nch MOSFET for Motor Drive(VDSS=40~60V) *Products in parentheses ( ) are under development.

Part No.	Package	VDSS (V)	VGSS (V)	ID (A)	RDS (on) [mΩ] @10V		Qg [nC]	Ciss [pF]	WS	MP
					typ.	max.				
N0413N	TO-263	40	+20/-20	100	2.3	3.3	100	5550	OK	OK
N0412N	TO-220AB				2.7	3.7				
N0434N	TO-262									
N0439N	TO-220AB			90	2.75	3.3	68	3900		
(N0531N)	TO-247	55	+20/-20	180	1.5	1.9	220	13000		CY4Q/2017
(N0609N)	TO-220AB	60	+20/-20	120	2.5	3	210	11300	OK	CY4Q/2017
N0601N	TO-263			100	3.3	4.2	133	7730		OK
N0602N	TO-220AB				3.7	4.6				
N0603N	TO-262				3.7	4.6				
N0604N	TO-220AB			82	5.1	6.5	75	4150		
(N0605N)	TO-220AB			80	6.8	8.5	57	3300		CY4Q/2017
(N0607N)	TO-252			56	6.9	8.4		3280		CY4Q/2017
(N0606N)	TO-220AB			60	10.7	12.9	43	2170		CY4Q/2017
(N0608N)	TO-252			52	12.3	14.0	35	1910		CY4Q/2017

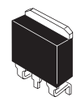
TO-220AB



TO-262



TO-263



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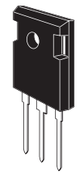


■Nch Road Switch series

Part No.	Package	VDSS (V)	VGSS (V)	ID (A)	RDS (on) [mΩ]				WS	MP
					VGS=10V		VGS=4.5V			
					typ.	max.	typ.	max.		
UPA2766T1A	8pHVSON (5x6)	30	+20/-20	130	0.72	0.88	1.3	1.82	OK	OK
UPA2764T1A				130	0.9	1.1	1.6	2.45		
UPA2765T1A				100	1.05	1.3	1.85	2.9		

8pHVSON

5 × 6 × 1.0(mm)

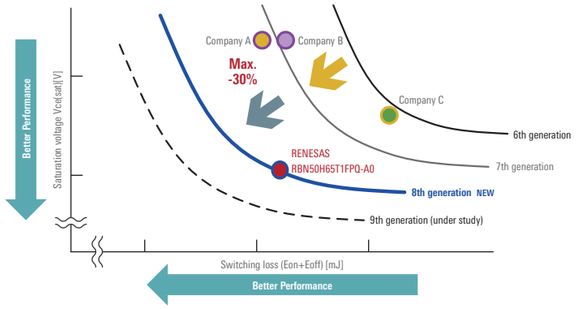
IGBTs

Ultralow-loss devices with improved power efficiency
Contributes to reduced heat generation and greater compactness.

Renesas Strengths and Features

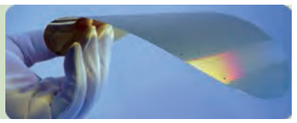
- Exclusive device structure and thin wafer for industry-top performance (low loss, fast switching)
- Extensive product lineup with characteristics to match a variety of applications

■Ultralow-loss IGBTs employing advanced process technology to achieve the lowest power loss levels in the industry



■**Ultrafine processing technology**
New trench field stop structure IGBT*1 technology
⇒ Low loss and fast switching

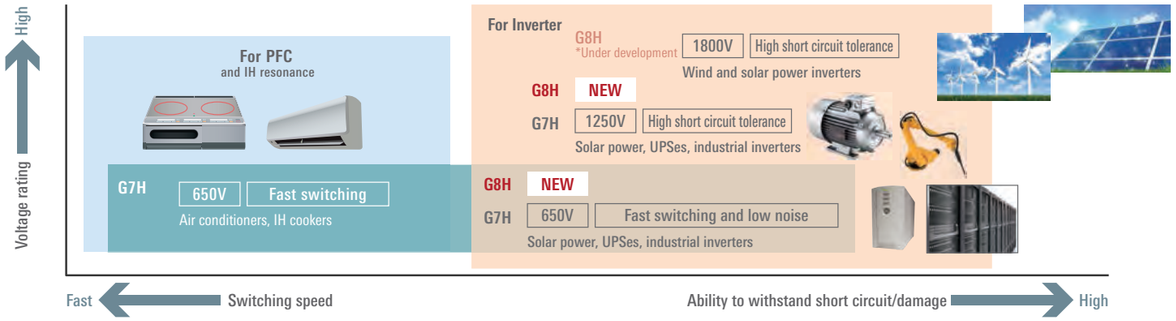
■**Thin wafer processing technology**
65μm ultrathin wafer
⇒ Reduced conduction loss



Note: 1. An IGBT structure in which the gate is shaped like a channel in the wafer surface and an electric field relaxation structure is formed relative to the back side of the thin wafer

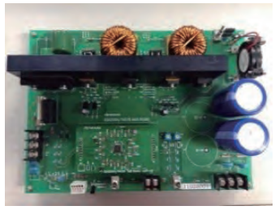
IGBT Roadmap

■Products for various applications



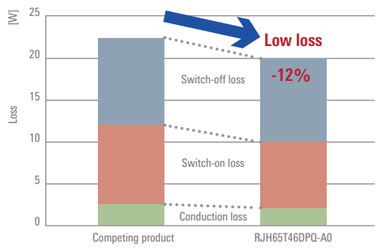
■PFC application example

PFC evaluation board populated with IGBTs



IGBT loss is reduced by fast switching performance.

Loss evaluation result



(Loss breakdown when Pout = 2,000W)

Applications

- Power supplies, inverters, air conditioners, IH cookers, power conditioners

IGBT Product Lineup

VCES (V)	IC 100C (A)	tsc (μs)	Product Category and Part Number: IGBT+Diode	Product Category and Part Number: IGBT	Package:	Package: TO-220F	Package: TO-220ABS	Package: TO-247	Package: TO-3P	Package: TO-3PF
600	30	-	RJH60T04	-	-	-	-		-	-
650	15	-	-	RJP65D03	MP	-	-	-	-	-
	20	-	-	RJP65T43	-	-	-	-	-	
	30	-	RJH65T04B	-	-	-	-	-	-	MP
		-	-	RJP65D05	MP	-	-	-	-	-
		10	-	RJP65S03	MP	-	-	-	-	-
	40	-	RJH65T46	-	-	-	-	MP	-	-
		-	RBN40H65T1	-	-	-	-	Dev.	-	-
	45	-	RJH65T47	-	-	-	-	MP	-	-
	50	-	RBN50H65T1	-	-	-	-	Dev.	-	-
		-	RJH65T14	-	-	-	-	MP	-	-
		3	RJH65D27B	-	-	-	-	MP	-	-
		5	-	RJP65M04	MP	-	-	-	-	-
		10	-	RJP65S04	MP	-	-	-	-	-
	75		RBN75H65T1	-	-	-	-	Dev.	-	-
		5	-	RJP65M05	MP	-	-	-	-	-
		10	-	RJP65S05	MP	-	-	-	-	-
	100	5	-	RJP65M06	MP	-	-	-	-	-
		10	-	RJP65S06	MP	-	-	-	-	-
	150		-	RJP65S07	MP	-	-	-	-	-
	200		-	RJP65S08	MP	-	-	-	-	-
1250	15	10	-	RJP1CS01	MP	-	-	-	-	-
	25		RBN25H125S1		-	-	-	Dev.	-	-
	30		-	RJP1CS03	MP	-	-	-	-	-
			-	RJP1CS23	MP	-	-	-	-	-
	40		RBN40H125S1		-	-	-	Dev.	-	-
	50		-	RJP1CS04	MP	-	-	-	-	-
			-	RJP1CS24	MP	-	-	-	-	-
	75		RBN75H125S1		-	-	-	Dev.	*TO-247Plus	
			-	RJP1CS05	MP	-	-	-	-	-
			-	RJP1CS25	MP	-	-	-	-	-
	100		-	RJP1CS06	MP	-	-	-	-	-
			-	RJP1CS26	MP	-	-	-	-	-
	150		-	RJP1CS07	MP	-	-	-	-	-
			-	RJP1CS27	MP	-	-	-	-	-
	200		-	RJP1CS08	MP	-	-	-	-	-
			-	RJP1CS28	MP	-	-	-	-	-

MP: In mass production
Dev.: Under development

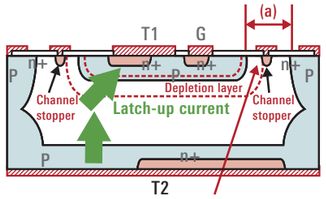
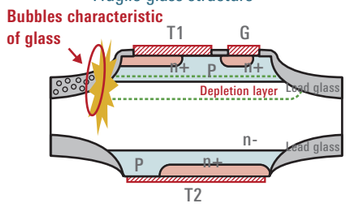
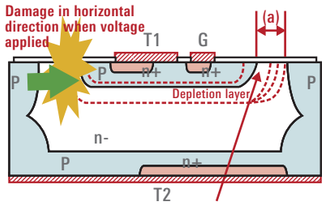
Triacs/Thyristors

High quality, high performance

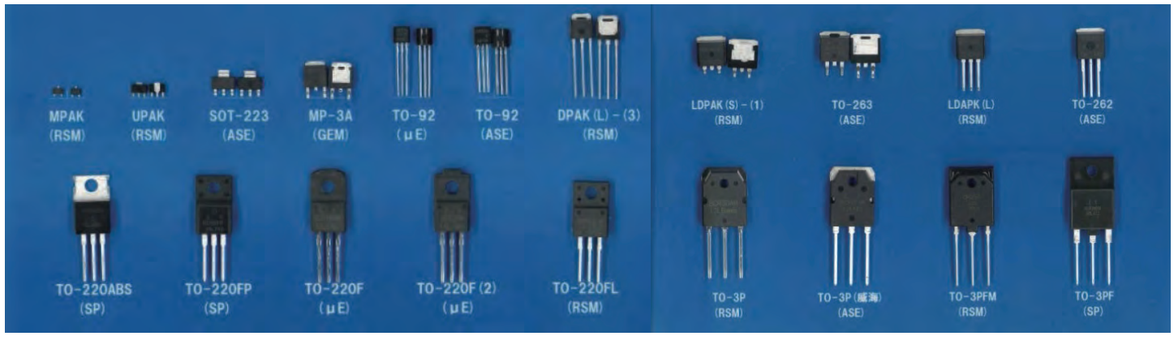
Renesas Strengths and Features

Helping customers achieve higher-quality products with planar technology

- Stable supply
  Employs 6-inch wafers, the industry's largest
- Low failure rate
  Actual failure rate: 0.01ppm or less (long service life)
- Ability to withstand voltage stress
  Channel stopper structure for stable performance and ability to withstand voltage stress

	Renesas New Planar Structure	Old Structure from 1980s	Old Planar Structure
Structural comparison	Planar structure Voltage tolerance to spare	Mesa glass structure	Planar structure Structure with no voltage tolerance to spare
	High quality and able to withstand voltage stress 	Fragile glass structure 	Inability to withstand voltage stress 
Comparison details	• Channel stopper provides stable voltage tolerance (stable under high-temperature, high-voltage testing: high reliability). • Distance (a), which determines voltage tolerance, is long (ability to withstand overvoltage: rugged)	• Application of foreign matter (lead glass) causes high off-current (current leakage) at high temperatures. • The bubbles characteristic of glass reduce tolerance of physical stress and increase fragility (brittleness).	• Unstable voltage tolerance from lack of countermeasures (fails high-temperature, high-voltage testing: low reliability) • Distance (a), which determines voltage tolerance, is short (ability to withstand overvoltage: poor, easily damaged)
Voltage stress	Lightning surge tests (3A version) No damage at 12kV	Lightning surge tests (3A version) No damage at 12kV	Lightning surge tests (3A version) Damage at 8kV

Package Lineup



Triac Product Lineup

Triacs (600V)

Part No.	VDRM (V)	IT (RSM) (A)	ITSM (A)	IGT (mA)	Tj (°C)	Package
BCR08AM-12A	600	0.8	8	5	125	TO-92
BCR08AS-12A	600	0.8	8	5	125	UPAK
BCR1AM-12A	600	1	10	7	125	TO-92
BCR3AS-12B	600	3	30	15	150	MP-3A
BCR5AS-12B	600	5	50	30	150	MP-3A
BCR3PM-12LG	600	3	30	20	150	TO-220F
BCR30AM-12LB	600	30	300	50	150	TO-3P
BCR40RM-12LB	600	40	400	50	150	TO-3PFM

Triacs (700V and high voltage tolerance)

Part No.	VDRM (V)	IT (RSM) (A)	ITSM (A)	IGT (mA)	Tj (°C)	Package
BCR08AM-14A	700	0.8	8	5	125	TO-92
BCR3AS-14B	700	3	30	30	150	MP-3A
BCR3PM-14LG	700	3	30	30	150	TO-220F
BCR5AS-14LJ	700	5	50	30	150	MP-3A
BCR5PM-14LJ BCR5FM-14LJ	700	5	50	30	150	TO-220F TO-220FP
BCR8AS-14LJ	700	8	80	30	150	MP-3A
BCR8PM-14LJ BCR8FM-14LJ	700	8	80	30	150	TO-220F TO-220FP
BCR10PM-14LJ BCR10FM-14LJ	700	10	100	30	150	TO-220F TO-220FP
BCR12PM-14LJ BCR12FM-14LJ	700	12	120	30	150	TO-220F TO-220FP
BCR16PM-14LJ BCR16FM-14LJ	700	16	160	30	150	TO-220F TO-220FP
BCR20PM-14LJ BCR20FM-14LJ	700	20	200	30	150	TO-220F TO-220FP
BCR25PM-14LJ BCR25FM-14LJ	700	25	250	50	150	TO-220F TO-220FP
BCR20RM-30LA	1,500	20	200	50	150	TO-3PFM

Renesas offers an extensive product lineup (packages, PLP coverage) to meet a broad range of customer requirements.
Feel free to contact a Renesas sales representative regarding product specifications other than those listed, estimates, etc.

Operational Amplifiers/Comparators

Renesas general-purpose linear ICs provide comprehensive support for system building by providing the interfaces and power systems required by microcontroller peripherals.

Renesas Strengths and Features

- High market share in fields from automotive and industrial to home appliances. Highly reliable products with solid track record over many years in the automotive business.
- Extensive lineup from low-power CMOS devices to high-voltage-tolerance bipolar devices.

Operational Amplifier Topics

New Product: READ2301G/READ2351J

TSSOP8 (3.0×6.4)

■Features
- Low power
- Full-range input and output
- Suitable for automotive applications

■Electrical Characteristics (TYP)
- Recommended operating voltage: 1.8V to 5.5V
- Circuit current: 40μA/CH
- Gain–bandwidth product: 550kHz
- Slew rate: 0.35V/μs
- Operating temperature
  READ2351J: Ta=-40°C to +125°C
  READ2301G: Ta=-40°C to +85°C
- Channels: 2 circuits

■Package
8pin TSSOP (3.2×6.4)

New Product: READ2302G/READ2352J

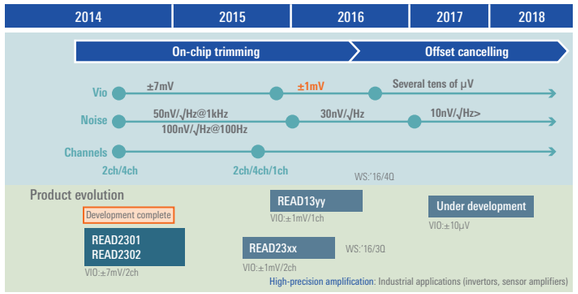
TSSOP8 (3.0×6.4)

■Features
- High slew rate
- Full-range input and output
- Suitable for automotive applications

■Electrical Characteristics (TYP)
- Recommended operating voltage: 2.5V to 5.5V
- Circuit current: 750μA/CH
- Gain–bandwidth product: 6.5MHz
- Slew rate: 8.0V/μs
- Operating temperature
  READ2352J: Ta=-40°C to +125°C
  READ2302G: Ta=-40°C to +85°C
- Channels: 2 circuits

■Package
8pin TSSOP (3.2×6.4)

Operational Amplifier/Comparator Roadmap



Package Lineup

5pin	8pin		14pin
CMPAK (2.0×2.1) 	TSSOP (3.0×6.4) 	TSSOP (3.2×6.4) 	TSSOP (5.0×6.4) 
MPA (2.95×2.8) 	TSSOP (3.0×4.9) 	TSSOP (3.0×4.0) 	KSOP (10.2×6.5) 
	MMPAK (2.95×4.0) 	SOP (5.2×6.5) 	

Operational Amplifier/Comparator Product Lineup

■CMOS Operational Amplifiers

• Industrial: Products with extended temperature tolerances (125°C). • Items in red are new products.

Type	Rail to Rail	Part No.	Power Supply Voltage [V]	VIO (max) [mV]	IDD(typ) [μA/ch]	TPLH/HL [μs]	Channels	Package
Standard	Output	HA1630x01	1.8 to 5.5	±4	15	0.125	1.2.4	D: 8pin TSSOP/MMPAK
	Output	HA1630x02	1.8 to 5.5	±4	50	0.5	1.2.4	
	Output	HA1630x03	1.8 to 5.5	±4	100	1	1.2.4	
High slew rate	Output	HA1630x04	1.8 to 5.5	±4	200	2	1.2.4	D: 8pin TSSOP/MMPAK Q: 14pin TSSOP
	Output	HA1630x05	1.8 to 5.5	±4	400	4	1.2.4	
	Output	HA1630x06	1.8 to 5.5	±4	800	8	1.2.4	
Low power	Input/output	READ2301G (General purpose)	1.8 to 5.5	±5	60	0.5	2	8pin TSSOP
	Input/output	READ2351J (Industrial)	1.8 to 5.5	±5	60	0.5	2	8pin TSSOP
High slew rate	Input/output	READ2302G (General purpose)	2.5 to 5.5	±5	700	8	2	8pin TSSOP
	Input/output	READ2352J (Industrial)	2.5 to 5.5	±5	700	8	2	8pin TSSOP

■Bipolar Operational Amplifiers

Type	Part No.		Power Supply Voltage [V]	VIO (max) [mV]	ICC (max) [mA]	SR (typ) [V/μs]	Channels	Package
	Industrial	General purpose						
Single power supply	μPC451	μPC324	3 to 30	±7	2	0.3	4	14pin SOP/TSSOP
	μPC452	μPC3403	3 to 32	±7	7	0.8	4	14pin SOP
	μPC842	μPC4742	3 to 32	±5	4.5	7	2	8pin SOP/TSSOP
	μPC844	μPC4744	3 to 32	±5	9	7	4	14pin SOP/TSSOP
	μPC1251	μPC358	3 to 30	±7	1.2	0.3	2	8pin SOP/TSSOP
Low noise	μPC258	μPC4558	±4 to ±16	±6	5.7	1	2	8pin SOP
	μPC259	μPC4560	±4 to ±16	±6	5.7	2.8	2	8pin SOP
	μPC458	μPC4741	±4 to ±16	±5	7	1	4	14pin SOP
	-	μPC4570	±4 to ±16	±5	8	7	2	8pin SOP/TSSOP
	-	μPC4572	±2 to ±7	±5	7	6	2	8pin SOP
	-	μPC4574	±4 to ±16	±5	12	6	4	8pin SOP/TSSOP
J-FET	μPC811	-	±5 to ±16	±2.5	3.4	15	1	8pin SOP/TSSOP
	μPC812	μPC4092	±5 to ±16	±3	6.8	15	2	8pin SOP/TSSOP
	μPC813	-	±5 to ±16	±2.5	3.5	25	1	8pin SOP/TSSOP
	μPC814	μPC4094	±5 to ±16	±3	6.8	25	2	8pin SOP/TSSOP
	μPC822	μPC4072	±5 to ±16	±10	5	13	2	8pin SOP/TSSOP
	μPC824	μPC4074	±5 to ±16	±10	10	13	4	14pin SOP/TSSOP
	μPC832	μPC4062	±2 to ±16	±10	0.5	3	2	8pin SOP/TSSOP
	μPC834	μPC4064	±2 to ±16	±10	1	3	4	14pin SOP/TSSOP
	μPC835	-	±5 to ±16	±3	2.2	5.5	2	8pin TSSOP
Low power	μPC802	-	±1 to ±16	±6	to 0.1	to 1.0	1	8pin SOP
General	μPC251	μPC1458	±7.5 to ±16	±6	5.6	0.5	1	8pin SOP

■Bipolar Comparators

Type	Part No.		Power Supply Voltage [V]	VIO (max) [mV]	ICC (max) [mA]	Tr/Tf (typ) [μs]	Channels	Package
	Industrial	General purpose						
General	μPC177	μPC339	2 to 32	±5	2	1.3	4	14pin SOP/TSSOP
	μPC271	-	5 to 32	±7.5	7.5	0.2	1	8pin SOP
	μPC272	μPC319	5 to 16	±8	12.5	0.08	2	14pin SOP
	μPC277	μPC393	2 to 32	±5	1	1.3	2	8pin SOP/TSSOP

Simple DC/DC

Making power supply design simple!

Renesas Strengths and Features

■Simplified power supply design for RZ and R-IN products (LSI with multiple power supplies)

RZ and R-IN reference boards populated with Simple DC/DC devices are available. Simplify the design process and reduce development TAT by utilizing the provided circuit diagrams and recommended parts.

- Simple DC/DC devices are utilized on RZ and R-IN solution boards.

Enables operation checking without modification.
Utilize the provided circuit diagrams, patterns, and recommended parts.

- Connection diagrams are available for use with Renesas devices.

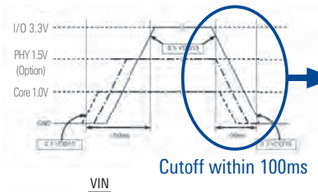
Confirm operation and reuse connection diagrams and recommended parts.

■Simplified R-IN sequence design

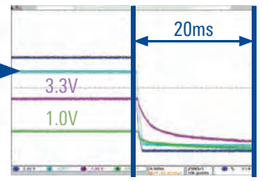
The integrated discharge circuit simplifies R-IN cutoff sequence design. There is no need for an external discharge circuit, reducing the total number of parts.

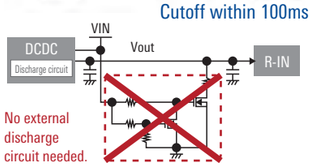
- Integrated discharge circuit for strict cutoff sequence, simplified design, and fewer parts

R-IN power sequence



Simple power supply falling-edge waveform

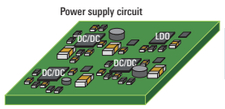




■Reduced board area and power supply circuit part count

The main power supply circuit elements are integrated. This reduces the number of components and mounting area of the power supply block.

□ Conventional Product



Components
51psc ➡ 30psc
Mounting area
418mm² ➡ 276mm²
Component cost
30% reduction

□ Simple DC/DC

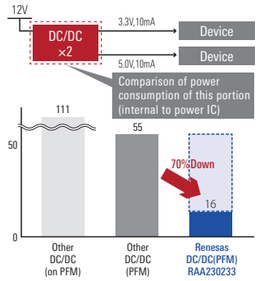
- ○ Many components
- ○ Long design time
- ○ Large board size
- ○ Optimized components: Less tuning required.
- ○ Simple design: Easier to create a platform.
- ○ Compact: Smaller system dimensions.

*RAA230409 (5.5V, DC/DC × 3 + LDO) configured for 5V input and 4 outputs (DC/DC × 3, LDO × 1)

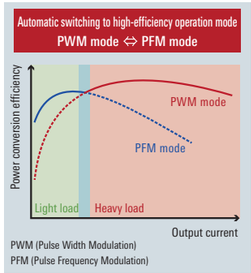
■Reduced system power consumption

Integrated AutoPFM mode. Matches the system's operating current, making it easy to reduce the overall power consumption.

Power consumption comparison with 16V 2CH devices

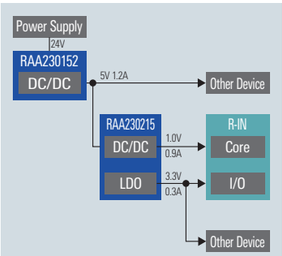


Auto-PFM mode

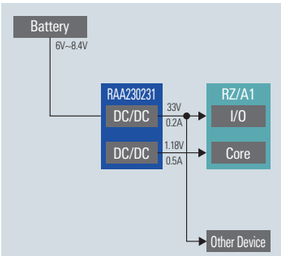


Applications

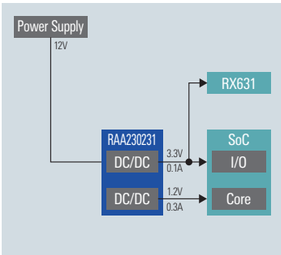
Industrial equipment (PLCs, etc.)



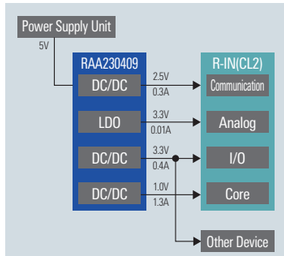
Handheld terminals



Smart grid



Industrial equipment (fast Ethernet communication)



Simple DC/DC Product Lineup

Part No.	Ch	Circuit	VIN (V)	VOUT (V)	IOUT MAX (A)	Package	Sequence	AutoPFM
RAA230231	2	DC/DC x2 (Step-down)	4.5 to 16	ch1=3.3V ch2=Adj.*1 Adj : 0.8V to 6.0V	3A	20pin HTSSOP	Controlled by P-Good	✓
RAA230232				ch1=3.3V ch2=5.0V				
RAA230233				ch1=Adj. ch2=Adj.*1 Adj : 0.8V to 6.0V				
RAA230131	1	DC/DC (Step-down)	4.5 to 16	3.3V	3A	8pin HLSOP	-	✓
RAA230132				5.0V				
RAA230133				Adj.*1 0.8V to 6.0V				
RAA230151	1	DC/DC (Step-down)	7.0 to 28	3.3V	3A	8pin HLSOP	-	✓
RAA230152				5.0V				
RAA230153				Adj.*1 0.8V to 6.0V				
RAA230215	2	ch1: DC/DC (Step-down) ch2: LDO	3.0 to 5.5	Adj.*1 0.9V to VIN × 0.8	ch1:3A ch2:0.5A	20pin HTSSOP	Built-in	-
RAA230409	4	ch1,ch3,ch4: DC/DC (Step-down) ch2: LDO	2.5 to 5.5	Adj.*1 0.9V to VIN × 0.8	ch1: 0.5A ch2:0.1A ch3:1.5A ch4:1.5A	32pin TQFP or 32pin VQFN	Outside*2	-

Notes: 1. Adjustable: Voltage can be set using an external resistor.
2. Each channel is enabled/disabled by an external signal.

Low Power SRAM

Renesas supports the business requirements of customers through long-term stable supply of highly reliable products employing exclusive technologies such as Advanced LPSRAM.

Renesas Strengths and Features

- Highly reliable: Excellent tolerance for soft-errors and operation free of latch-ups (Advanced LPSRAM)
  Note: Advanced LPSRAM is a technology exclusive to Renesas that makes possible low power SRAM combining improved reliability and smaller mounting area.
- Extensive lineup: Includes products with the industry's largest capacity (up to 64Mb) and capacity-compatible packages.
- No. 1 market share worldwide (60% in Japan)

Proven Track Record in the Industrial Equipment Field

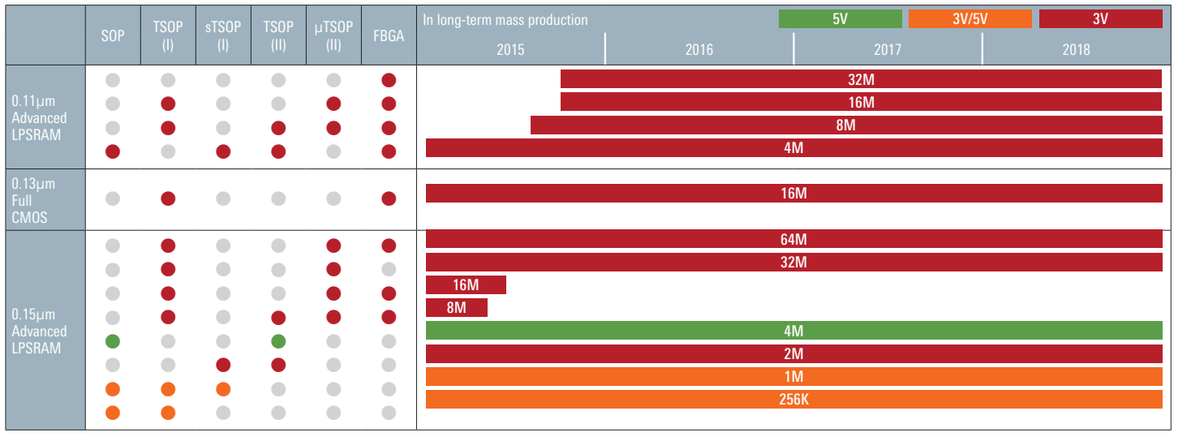
2014 actual figures

Virtually No Soft-Errors

Projected errors over five years of use of 1,000 16Mb low power SRAM chips, based on actual measurement values for soft-errors.

Manufacturer	Product	SSER (measured soft-errors) (60% C.L.)	Quantity	Error occurrence over measurement period		
				30 days	1 year	5 years
Renesas	16Mb Advanced LPSRAM	49FIT/device or less (16Mb measured values)	1,000 chips	0	1 or fewer	2 or fewer
Company A	16Mb LPSRAM	9,382FIT/Device	1,000 chips	5	82	411

Low Power SRAM Product Roadmap/Package Lineup



Low Power SRAM Product Lineup

Memory Capacity	Power Supply Voltage	Word Configuration	Package	Part No.	Access Time			Operating Temperature Range*1	
					45ns	55ns	70ns	R	I
256Kbit	4.5V to 5.5V	32K × 8	SOP (28)	R1LP5256ESP		●			●
			TSOP (28)	R1LP5256ESA		●			●
	2.7V to 3.6V		SOP (28)	R1LV5256ESP		●			●
			TSOP (28)	R1LV5256ESA		●			●
1Mbit	4.5V to 5.5V	128K × 8	SOP (32)	R1LP0108ESN		●			●
			TSOP (32)	R1LP0108ESF		●			●
			sTSOP (32)	R1LP0108ESA		●			●
	2.7V to 3.6V		SOP (32)	R1LV0108ESN		●			●
			TSOP (32)	R1LV0108ESF		●			●
			sTSOP (32)	R1LV0108ESA		●			●
2Mbit	2.7V to 3.6V	256K × 8	sTSOP (32)	R1LV0208BSA		●			●
		128K × 16	TSOP (44)	R1LV0216BSB		●			●
4Mbit	4.5V to 5.5V	512K × 8	SOP (32)	R1LP0408DSP		●			●
			TSOP (32)	R1LP0408DSB		●			●
	2.7V to 3.6V		SOP (32)	RMLV0408EGSP	●				●
			TSOP (32)	RMLV0408EGSB	●				●
			sTSOP (32)	RMLV0408EGSA	●				●
		256K × 16	TSOP (44)	RMLV0416EGSB	●				●
				RMLV0414EGSB	●				●
			FBGA (48)	RMLV0416EGBG	●				●
8Mbit	2.7V to 3.6V	1M × 8	TSOP (44)	RMLV0808BGSB	●				●
	2.4V to 3.6V					●			●
	2.7V to 3.6V	512K × 16	TSOP (44)	RMLV0816BGSB	●				●
	2.4V to 3.6V					●			●
	2.7V to 3.6V		FBGA (48)	RMLV0816BGBG	●				●
	2.4V to 3.6V					●			●
	2.7V to 3.6V	1M × 8/ 512K × 16	TSOP (48)	RMLV0816BGSA	●				●
	2.4V to 3.6V					●			●
	2.7V to 3.6V		µTSOP (52)	RMLV0816BGSD	●				●
	2.4V to 3.6V					●			●
16Mbit	2.7V to 3.6V	1M × 16/ 2M × 8	TSOP (48)	RMLV1616AGSA		●			●
				R1LV1616HSA	●	●			●
			µTSOP (52)	RMLV1616AGSD		●			●
		1M × 16	FBGA (48)	RMLV1616AGBG		●			●
				R1LV1616HBG	●	●			●
32Mbit	2.7V to 3.6V	2M × 16/ 4M × 8	TSOP (48)	R1LV3216RSA		●			●
			µTSOP (52)	R1LV3216RSD		●			●
		2M × 16	FBGA (48)	RMWV3216AGBG		●			●
64Mbit	2.7V to 3.6V	4M ×16/ 8M × 8	TSOP (48)	R1WV6416RSA		●			●
			µTSOP (52)	R1WV6416RSD		●			●
		4M × 16	FBGA (48)	R1WV6416RBG		●			●

Note: 1. Operating Temp. (R: 0°C to 70°C/I: -40°C to 85°C)

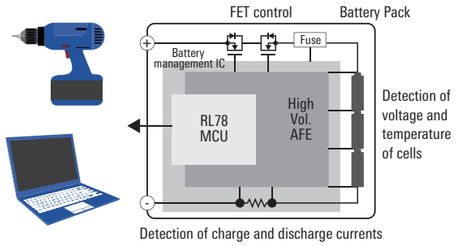
Battery Management ICs

These ICs integrate an MCU core and an analog circuit block specifically designed to control of lithium-ion batteries. They monitors battery status continuously. Renesas provides consumer and industry-leading intelligent battery system with Battery Management ICs.

Renesas Strengths and Features

- Redundant failsafe functions for safety
  Extensive self-diagnostic functions are integrated into the single-chip design combining AFE and MCU. Low-power operation in normal mode and maintain safety control in storage mode.
- Accurate detection of remaining charge under all conditions and environments
  A high-precision delta-sigma A/D converter is integrated to measure the battery's voltage, current, and temperature. Using these data, ICs manage these parameters and can calculate the remaining capacity considering battery degradation.
- Extensive support tools
  Starter kits are available that include support tools such as evaluation boards and sample programs. This simplifies the initial evaluation process for the customer and can reduce their development period substantially.

System Block Diagram



Control Details

Safety control	Remaining capacity management
Overvoltage/undervoltage protection	Current/voltage detection
Charge/discharge current protection	Deterioration detection
Temperature protection	Calculation and learning of battery capacity
FET control when error detected	Current/voltage calibration
Chemical fuse control	Fault detection/history management

Applications and Suitable Products

Application	Number of Cells in Series	Suitable Products	Features
PCs, portable consumer products, digital SLR cameras	2 to 4	RAJ240045	Compact package
	1 to 3	RAJ240500	Integrated charging function
Electric power tools, rechargeable vacuum cleaners, drones, toy robots	2 to 5	RAJ240080	Extensive GPIO
Bicycles with electric motor assist, electric power tools, e-Bikes, electronic switching systems, industrial equipment, rechargeable vacuum cleaners	3 to 8 3 to 10	RAJ240090 RAJ240100	Large-capacity microcontroller and AFE in a single package

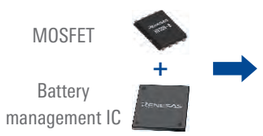
Kit Solutions

Solution details

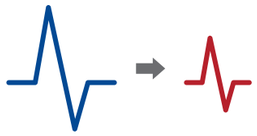
- Charge/discharge switching MOSFET + battery management IC

Advantages

- No need for surge protection element
- Improved safety



On-off control matched to battery MOS characteristics



The battery management IC controls the MOSFET optimally and prevents kickback voltage at turn-off

Block Diagram

Voltage and current measurement by independent A/D converters

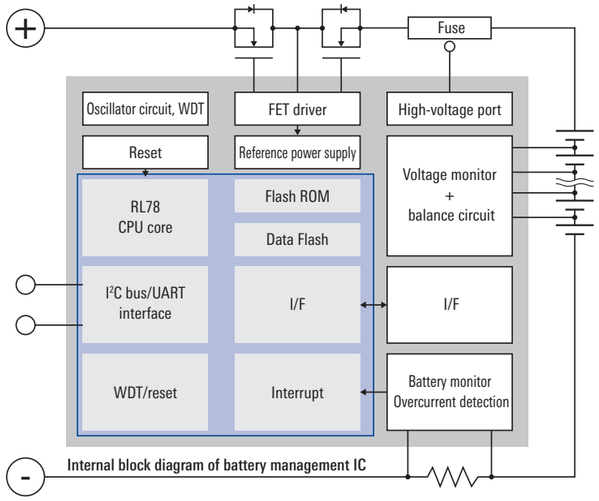
- Current detection: 153μA/LSB resolution (18-bit ΔΣ 5mΩ shunt resistor)
  Support for continuous measurement with no temperature drift
- Voltage/temperature measurement: 15-bit ΔΣ ADC

High reliability and safety system

- FET cutoff in hardware when overcurrent or short circuit detected
- Support for mutual fault detection by MCU and AFE
- Ability to set constants and manage history using data flash guaranteed for 100,000 erase/write cycles for parameters and operating history memory
- Integrated CAN interface and RTC*1 circuit for industrial applications ICs can manage date and time in a single device (RAJ240090 and RAJ240100)

Few parts, low system cost

- Support large-current discharge with Nch FET driver
- Integrated pull-up resistor for thermistor



Internal block diagram of battery management IC

Extended battery life

- Low-power mode with consumption of 25μA or less and balance circuit to maximize battery capacity (RAJ240090 and RAJ240100)

Note: 1. RTC:Real Time Clock

Development Environment

Reference board

- Ability to evaluate device characteristics and performance.
- Supports on-chip debugging using the E1.

Sample programs

- Source code of sample programs implementing basic battery control functionality is available.
- Battery Management ICs monitor current, voltage, and temperature, calculate remaining battery capacity and report these status to host via an SMBus-compatible interface.

Reference firmware

- Object code of reference firmware is available that makes it easy to implement battery control functions such as remaining capacity calculation or safety control simply by setting parameters.

USB/SMBus host adapter

- Battery Management ICs communicate via a USB/SMBus host adapter and customers can monitor battery data on PC.
- Support battery management IC firmware update and readout data via USB/SMBus host adapter.

Reference board

Supports direct connection to product to evaluate charging and discharging.

Battery Management IC Product Lineup

Number of Cells in Series		Power Supply Voltage [V]	Part No.	FlashROM	RAM	ADC	SI/F	I/O	Features	Package
Min	Max									
2	4	4 to 25	RAJ240045	64KB	4.0KB	2ch	I²C, UART	12	Compact package (4mm×4mm)	32QFN
1	3	4 to 25	RAJ240500	128KB	5.5KB	3ch	I²C, UART	9	Charging control by MCU	40QFN
2	5	4 to 28	RAJ240080	64KB	5.5KB	3ch	I²C, UART	22	GPIO: I/O×18, input×2, NOD×2	48LQFP
3	8	4 to 50	RAJ240090	128KB	7KB	4ch	I²C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25μA)	64LQFP
3	10	4 to 50	RAJ240100	128KB	7KB	4ch	I²C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25μA)	64LQFP

Photocouplers

IGBT drive photocouplers, isolation amplifiers, IC output/transistor output photocouplers

Renesas Strengths and Features

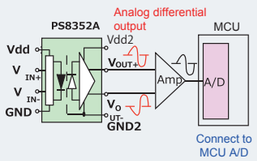
- Extensive lineup
  Renesas offers an extensive lineup of photocouplers for the industrial field, enabling customers to design highly reliable systems.
  - Photocouplers for driving IGBTs that feature integrated protection functions help to reduce the design workload.
  - Isolation amplifiers enable more accurate current and voltage monitoring.
- Small packages exclusive to Renesas contribute to smaller finished products.
  - World's first 14.5mm creepage package
  - Exclusive Renesas packages with half the mounting area of industry-standard SSOP packages

Photocoupler Topics

PS8352A (analog output)

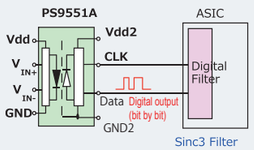
Isolation amplifier produces differential output at eight times the voltage of the input analog voltage.

SDIP



PS9352A (digital output)

Delta-sigma modulator converts the input analog voltage to bit-by-bit digital data.



LSDIP (creepage distance 14.5mm)

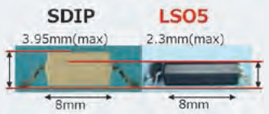
Isolation voltage: 7.5kVr.m.s.

Industry first

- Reduces the power loss of customer systems at higher voltages.
- Substantially reduces the customer's cost in comparison with conventional high-voltage configurations.

LSO5 (height: 2.3mm max.)

Ta = 125°C guaranteed



- 8mm creepage to support 400V-class equipment
- Smaller mounting area than conventional SDIP package
  Contributes to compactness and reduced BOM cost.
- Ta = 125°C for greater heat dispersion design margin

Photocoupler Roadmap

IGBT gate drive — IGBT protection functions, functions supporting low IF load fluctuation

Low IF load fluctuation support
Variable through rate

Current/voltage monitoring — Isolation amplifiers with high detection accuracy and low noise

Output
- Digital: 3V output (RZ direct connection) ▶ Faster internal clock
- Analog: 2V 2 input V output

I/O isolation + data communication — High temperature and high isolation voltage tolerance

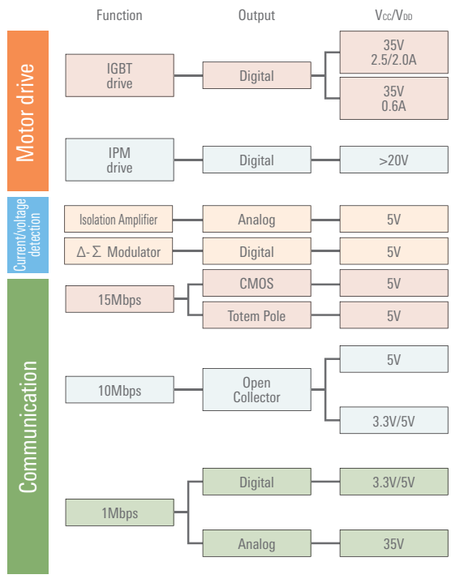
15Mbps low power consumption ▶ 15Mbps for low IF IPM drive
15Mbps low IF, high noise tolerance

2016 2017 2018 2019 2020

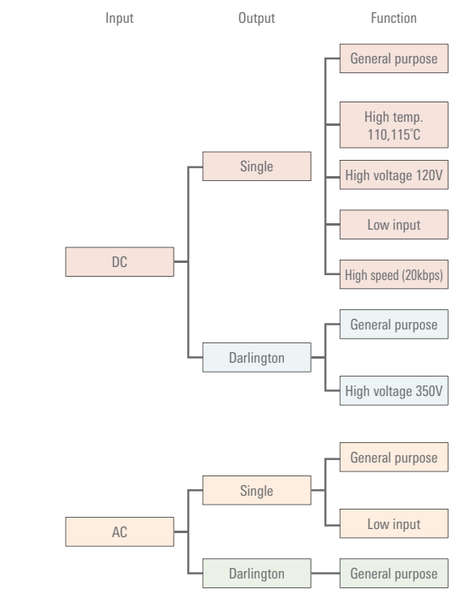
Consumer/home appliances		Industrial			
Power supplies	Home appliances	Communications	Power meters	Solar power	Inverters. servo PLCs
Tr output couplers • 110°C product PS2381 PS2861B • 8mm creepage PS2381	Tr output/IC output couplers • Compact: 8mm PS2381 • IGBT drive PS9307A PS9031	Tr output/IC output couplers • Compact: 8mm PS2381 • 10M PS9117A	Tr output couplers • Compact: 8mm PS2381	Tr output/IC output couplers • IGBT drive (0.6A, 2.5A, protection circuit) PS9031, PS9331, PS9402 • 14mm creepage (IGBT drive, 10M) PS9905, PS9924, PS8902 • Compact PS2701A, PS2801C, PS2805C • Isolation amplifiers PS8352, PS9352A	

Photocoupler Product Lineup

Top row: Package
Bottom row: Creepage distance



DIP8 7mm/8mm	SDIP6/8 7mm/8mm	LSDIP8 14.5mm	LSO5 8mm	SO5 4.2mm	SO16 8mm
PS9531	PS9331 PS9332	PS9905	PS9031		PS9402
PS9506	PS9307A				
PS9513	PS9313 PS9303 PS9309		PS9013 PS9009	PS9113	
PS8551A	PS8352A				SO8 4mm
PS9551A	PS9352A				
	PS9351			PS9151	
				PS9123	
PS9587	PS9317		PS9001	PS9117A	PS9817A-1 PS9817A-2
	PS9324	PS9924		PS9124	PS9821-1 PS9821-2
				PS9122	PS9822-1 PS9822-2
PS8501 PS8502	PS8302	PS8902			



DIP4 7mm	LSOP 8mm	SOP 5mm	SSOP 4mm	SSOP common lead 4mm	Flat lead 4mm
		PS2701A-1	PS2801C-1 PS2801C-4		
PS2561D-1 PS2561F-1	PS2381-1		PS2861B-1		
		PS2703-1			
		PS2711-1	PS2811-1 PS2811-4	PS2841-4A PS2841-4B	PS2911-1 PS2913-1
PS2514-1					
PS2562-1		PS2702-1	PS2802-1 PS2802-4		
PS2533-1 PS2535-1		PS2733-1	PS2833-1 PS2833-4		
PS2565-1		PS2705A-1	PS2805C-1 PS2805C-4		
		PS2715-1	PS2815-1 PS2815-4	PS2845-4A	PS2915-1
PS2506-1		PS2706-1			

General Switching MOSFETs

Suitable for fast-switching and load-switching applications.

General Switching MOSFET Product Lineup

Package	Part No.	VDSS (V)	ID (A)	QG (nC) typ.	RDS (on) (Ω) max.			Ciss (pF) typ.
					10V [8V]	4V [4.5V]	2.5V [1.8V]	
4-pin EFLIP-LGA	UPA2371T1P	24	6	26.5	-	0.02	0.0395	1330
	UPA2373T1P	24	6	22	-	0.024	0.042	1330
	UPA2379T1P	12	8	20	-	0.0119	0.026	1480
	UPA2375T1P	24	10	40	-	0.0114	0.023	2250
6pin HUSON 2020	UPA2660T1R	20	4	4.5	-	0.042	0.062	330
	UPA2690T1R	20	4	4.5	-	0.042	0.062	330
	UPA2600T1R	20	7	7.9	-	0.0138	0.0191	870
	UPA2672T1R	-12	-4	5	-	0.067	0.092	486
	UPA2630T1R	-12	-7	11.3	-	0.028	0.035	1260
	UPA2670T1R	-20	-3	5.1	-	0.079	0.105	473
	UPA2631T1R	-20	-6	12.5	-	0.032	0.041	1240
8pin HVSON -3333	UPA2821T1L	30	26	51	0.0038	0.0105	-	2490
	UPA2822T1L	30	34	12	0.0026	0.0075	-	4660
	UPA2813T1L	-30	-27	80	0.0062	0.013	-	3130
	UPA2812T1L	-30	-30	100	0.0048	0.0099	-	3740
8pin HVSON-6051	UPA2739T1A	-30	-85	153	0.0028	0.0057	-	6050
DPAK(L)-(1) /TO-251	2SK2796L	60	5	-	0.16	0.25	-	180
DPAK(L)-(2) / TO-251	2SK2926L	60	15	-	0.055	0.11	-	500
	2SK3147L	100	5	-	0.13	0.17	-	420
	H5N2508DL	250	7	13	0.63	-	-	450
	2SJ506L	-30	-10	-	0.085	0.18	-	630
	2SJ528L	-60	-7	-	0.22	0.37	-	400
	2SJ529L	-60	-10	-	0.16	0.24	-	580
	2SJ530L	-60	-15	-	0.1	0.16	-	850
DPAK(S) / TO-252	2SK2796S	60	5	-	0.16	0.25	-	180
	2SK2926S	60	15	-	0.055	0.11	-	500
	2SK3147S	100	5	-	0.13	0.17	-	420
	H5N2504DS	250	7	21	0.63	0.67	-	570
	H5N2508DS	250	7	13	0.63	-	-	450
	2SJ506S	-30	-10	-	0.085	0.18	-	630
	2SJ528S	-60	-7	-	0.22	0.37	-	400
	2SJ529S	-60	-10	-	0.16	0.24	-	580
	2SJ530S	-60	-15	-	0.1	0.16	-	850
HSON-8 dual	NP30N04QUK	40	30	27	0.008	-	-	1600
HWSON-8	UPA2826T1S	20	27	37	0.0043	0.0048	0.0099	3610
	UPA2820T1S	30	22	50	0.0053	0.014	-	2330
	UPA2825T1S	30	24	57	0.0046	0.012	-	2600
	RJK03M5DNS	30	25	10.4	0.0063	0.0084	-	1350
	RJK1028DNS	100	4	3.7	0.165	0.18	-	450
	UPA2816T1S	-30	-17	33.4	0.0155	0.045	-	1160
	UPA2815T1S	-30	-21	47	0.011	0.023	-	1760
	UPA2814T1S	-30	-24	74	0.0078	0.0145	-	2800
LDPAK(L) / TO-262	2SK2938L	60	25	-	0.034	0.07	-	740
	2SK3150L	100	20	-	0.06	0.085	-	900
	2SJ549L	-60	-12	-	0.15	0.23	-	580
	2SJ552L	-60	-20	-	0.055	0.095	-	1750
	2SJ553L	-60	-30	-	0.037	0.055	-	2500
	2SJ505L	-60	-50	-	0.022	0.036	-	4100
LDPAK(S)-(1) / TO-263	2SK2938S	60	25	-	0.034	0.07	-	740
	2SK3150S	100	20	-	0.06	0.085	-	900
	RJK1008DPE	100	80	-	0.011	-	-	5200
	RJK1525DPE	150	25	18	0.11	-	-	680
	2SK3211S	200	25	-	0.075	0.085	-	2420
	H5N2522LS	250	20	47	0.18	-	-	1300
	RJK6012DPE	600	10	30	0.92	-	-	1100
	2SJ549S	-60	-12	-	0.15	0.23	-	580
	2SJ552S	-60	-20	-	0.055	0.095	-	1750

Package	Part No.	VDSS (V)	ID (A)	QG (nC) typ.	RDS (on) (Ω) max.			Ciss (pF) typ.
					10V [8V]	4V [4.5V]	2.5V [1.8V]	
LDPAK(S)-(1) / TO-263	2SJ553S	-60	-30	-	0.037	0.055	-	2500
	2SJ505S	-60	-50	-	0.022	0.036	-	4100
LFPAK	HAT2160H	20	60	54	0.0026	0.0041	-	7750
	RJK0305DPB	30	30	8	0.008	0.013	-	1250
	RJK0332DPB-01	30	35	14	0.0047	0.007	-	2180
	RJK0330DPB-01	30	45	27	0.0027	0.0039	-	4300
	RJK0328DPB-01	30	60	42	0.0021	0.0029	-	6380
	RJK0451DPB	40	35	14	0.007	0.0096	-	2010
	RJK0454DPB	40	40	25	0.0049	-	-	2000
	HAT2170H	40	45	62	0.0042	-	-	4650
	RJK0452DPB	40	45	26	0.0035	0.0047	-	4030
	RJK0455DPB	40	45	34	0.0038	-	-	2550
	HAT2169H	40	50	45	0.0035	0.006	-	6650
	RJK0456DPB	40	50	39	0.0032	-	-	3000
	RJK0651DPB	60	25	15	0.014	0.018	-	2030
	HAT2266H	60	30	25	0.012	0.016	-	3600
	RJK0654DPB	60	30	27	0.0083	-	-	2000
	RJK0652DPB	60	35	29	0.007	0.009	-	4100
	RJK0656DPB	60	40	40	0.0056	-	-	3000
	RJK0653DPB	60	45	42	0.0048	0.0061	-	6100
	RJK0851DPB	80	20	14	0.023	0.028	-	2050
	RJK0854DPB	80	25	27	0.013	-	-	2000
	HAT2279H	80	30	60	0.012	0.015	-	3520
	RJK0852DPB	80	30	28	0.012	0.014	-	4150
	RJK0855DPB	80	30	35	0.011	-	-	2550
	RJK1051DPB	100	15	15	0.039	0.046	-	2060
	RJK1054DPB	100	20	27	0.022	-	-	2000
	RJK1055DPB	100	23	35	0.017	-	-	2550
	RJK1053DPB	100	25	43	0.013	0.015	-	6160
	RJK1056DPB	100	25	41	0.014	-	-	3000
MP-25 / TO-220AB	2SK3404	30	40	25	0.014	0.021	-	1400
	2SK3424	30	48	34	0.0115	0.017	-	1900
	2SK3433	60	40	30	0.026	0.041	-	1500
	2SK3480	100	50	74	0.031	0.036	-	3600
	2SK3479	100	83	210	0.011	0.013	-	11000
	2SJ602	-60	-20	26	0.073	0.107	-	1300
	2SJ603	-60	-25	38	0.048	0.075	-	1900
	2SJ605	-60	-65	87	0.02	0.031	-	4600
	2SJ606	-60	-83	120	0.015	0.023	-	4800
MP-25Z / TO-220SMD	2SK3480-Z	100	50	74	0.031	0.036	-	3600
	2SJ602-Z	-60	-20	26	0.073	0.107	-	1300
	2SJ603-Z	-60	-25	38	0.048	0.075	-	1900
	2SJ605-Z	-60	-65	87	0.02	0.031	-	4600
	2SJ606-Z	-60	-83	120	0.015	0.023	-	4800
MP-25ZK / TO-263	2SK3901-ZK	60	60	40	0.013	0.0165	-	1950
	2SK3899-ZK	60	84	96	0.0053	0.0065	-	5500
MP-25ZP / TO-263	NP60N04PDK	40	60	42	0.00395	0.0088	-	2450
	NP89N04PDK	40	90	68	0.00295	0.0062	-	3900
	2SK3811-ZP	40	110	260	0.0018	-	-	17700
	NP60N06PDK	60	60	37	0.0079	0.012	-	2400
	2SK3812-ZP	60	110	250	0.0028	0.0037	-	16800
MP-3 / TO-251	2SK3366	30	20	15	0.021	0.033	-	730
	2SK3365	30	30	25	0.014	0.021	-	1300
	2SK3385	60	30	30	0.028	0.045	-	1500
	2SK3386	60	34	39	0.021	0.036	-	2100
	2SK3484	100	16	20	0.125	0.148	-	900
	2SK3482	100	36	72	0.033	0.039	-	3600

General Switching MOSFET Product Lineup

Package	Part No.	VDSS (V)	ID (A)	QG (nC) typ.	RDS (on) (Ω) max.			Ciss (pF) typ.
					10V [8V]	4V [4.5V]	2.5V [1.8V]	
MP-3 / TO-251	2SJ598	-60	-12	15	0.13	0.19	-	720
	2SJ599	-60	-20	26	0.075	0.111	-	1300
	2SJ601	-60	-36	63	0.031	0.046	-	3300
MP-3A / TO-252	RJK4532DPD	450	4	9	2.3	-	-	280
	RJK5033DPD	500	6	-	1.3	-	-	600
MP-3Z / TO-252	2SK3366-Z	30	20	15	0.021	0.033	-	730
	2SK3365-Z	30	30	25	0.014	0.021	-	1300
	2SK3367-Z	30	36	49	0.009	0.012	-	2800
	2SK3385-Z	60	30	30	0.028	0.045	-	1500
	2SK3386-Z	60	34	39	0.021	0.036	-	2100
	2SK3814-Z	60	60	95	0.0087	0.0105	-	5450
	2SK3484-Z	100	16	20	0.125	0.148	-	900
	2SK3482-Z	100	36	72	0.033	0.039	-	3600
	2SJ598-Z	-60	-12	15	0.13	0.19	-	720
	2SJ599-Z	-60	-20	26	0.075	0.111	-	1300
	2SJ601-Z	-60	-36	63	0.031	0.046	-	3300
MP-3ZK / TO-252	2SK3484-ZK	100	16	20	0.125	0.148	-	900
	2SJ687-ZK	-20	-20	57	-	0.007	0.02	4400
	N0400P	-40	-15	16	-	0.04	0.073	1400
	2SJ598-ZK	-60	-12	15	0.13	0.19	-	720
	2SJ599-ZK	-60	-20	26	0.075	0.111	-	1300
	2SJ601-ZK	-60	-36	63	0.031	0.046	-	3300
MP-3ZP / TO-252	NP60N04VDK	40	60	42	0.00385	0.0086	-	2450
	NP75N04VDK	40	75	27	0.0057	0.0126	-	1630
	NP90N04VLK	40	90	68	0.0028	0.006	-	3800
	NP45N06VDK	60	45	25	0.0116	0.0196	-	1530
	NP90N06VDK	60	90	63	0.0053	0.0082	-	4000
MP-45F / TO-220	2SK3715	60	75	145	0.006	0.0095	-	8400
	2SK3793	100	12	21	0.125	0.148	-	900
	2SJ649	-60	-20	38	0.048	0.075	-	1900
MP-88 / TO-3P	2SK3307	60	70	90	0.0095	0.014	-	4650
	2SK3357	60	75	170	0.0058	0.0088	-	9800
Power SOP8	UPA1760G	30	8	14	0.026	0.036	-	760
	UPA2752GR	30	8	10	0.023	0.035	-	480
	UPA2792GR	30	10	42	0.0125	0.021	-	2200
	UPA2782GR	30	11	7.1	0.015	0.0225	-	660
	UPA3753GR	60	5	13.4	0.056	0.072	-	640
	UPA2738GR	-30	-10	37	0.015	0.029	-	1450
	UPA2737GR	-30	-11	45	0.013	0.025	-	1750
	UPA2736GR	-30	-14	80	0.007	0.0135	-	3400
	UPA2735GR	-30	-16	195	0.005	0.0078	-	6250
SOP8	HAT3029R	30	6	3.1	0.034	0.058	-	410
	HAT2280R	30	6.6	3	0.034	0.057	-	410
	RJK0354DSP	30	16	12	0.007	0.0105	-	1740
	HAT2275R	60	6.6	10	0.032	0.043	-	1210
	HAT2256R	60	8	-	0.03	-	-	1210
	HAT1024R	-30	-3.5	-	0.16	0.34	-	350
SOT-223	RJK1590DP3-A0	150	1	-	-	1.95	2.5	98
TO-220	N0439N	40	90	68	0.0033	-	-	3900
	N0412N	40	100	100	0.0037	-	-	5550
	N0604N	60	82	75	0.0065	-	-	4150
	N0602N	60	100	133	0.0046	-	-	7730
TO-220AB	2SK2928	60	15	-	0.052	0.105	-	500
	RJK0603DPN-E0	60	80	57	0.0052	-	-	4150
	2SK3149	100	20	-	0.06	0.085	-	900
	RJK1008DPN	100	80	-	0.011	-	-	5200
	RJK1536DPN	150	50	-	0.03	-	-	5000

Package	Part No.	VDSS (V)	ID (A)	QG (nC) typ.	RDS (on) (Ω) max.			Ciss (pF) typ.
					10V [8V]	4V [4.5V]	2.5V [1.8V]	
TO-220AB	2SJ539	-60	-10	-	0.21	0.36	-	400
	2SJ541	-60	-15	-	0.095	0.155	-	850
	2SJ543	-60	-20	-	0.055	0.095	-	1750
	2SJ544	-60	-30	-	0.037	0.055	-	2500
TO-220FL	RJK1525DPP-M0	150	17	18	0.00011	-	-	680
	RJK5030DPP-M0	500	5	13	1.6	-	-	550
	RJK5033DPP-M0	500	6	-	1.3	-	-	600
TO-220FM	2SK3148	100	20	-	0.06	0.085	-	900
	2SK3155	150	15	-	0.13	0.15	-	850
	2SK3160	200	10	-	0.17	0.19	-	1100
	2SK3177	200	15	-	0.115	0.125	-	1600
	2SK3162	200	20	-	0.075	0.085	-	2420
	2SJ526	-60	-12	-	0.15	0.23	-	580
	2SJ548	-60	-15	-	0.095	0.155	-	850
TO-220FM	2SJ504	-60	-20	-	0.055	0.095	-	1750
	2SJ535	-60	-30	-	0.037	0.055	-	2500
TO-220FP	RJK0703DPP-E0	75	70	56	0.0067	-	-	4150
	RJK1003DPP-E0	100	50	59	0.011	-	-	4150
	RJK1002DPP-E0	100	70	94	0.0076	-	-	6450
	RJK1001DPP-E0	100	80	147	0.0055	-	-	10000
	RJK1008DPP-E0	100	80	-	0.011	-	-	5200
	RJK5035DPP-E0	500	10	23	0.85	-	-	10
	RJK6006DPP-E0	600	5	19	1.6	-	-	600
	RJK6035DPP-E0	600	6	20	1.37	-	-	765
	RJK6012DPP-E0	600	10	30	0.92	-	-	1100
TO-251	RJK6002DPH-E0	600	2	9.2	6.8	-	-	165
TO-262	N0434N	40	100	100	0.0037	-	-	5550
	N0603N	60	100	133	0.0046	-	-	7730
TO-263	N0413N	40	100	100	0.0033	-	-	5550
	N0601N	60	100	133	0.0042	-	-	7730
TO-264S	H5N5004PL-E0-E	500	50	-	0.00011	-	-	7630
TO-3P	RJK1529DPK	150	70	74	0.025	-	-	2900
	RJK2508DPK	250	50	60	0.064	-	-	2600
	RJK5015DPK	500	25	66	0.24	-	-	2600
	2SJ554	-60	-45	-	0.037	0.055	-	2500
	2SJ555	-60	-60	-	0.022	0.036	-	4100
TO-3PFM	RJK5015DPM	500	25	66	0.24	-	-	2600
TO-92 MOD	2SK3446	150	1	-	-	1.95	2.5	98
TSSOP8	UPA1855GR	20	6	8.8	-	0.023	0.029	980
	UPA1870BGR	20	6	8	-	0.02	0.027	720
	UPA1873GR	20	6	9	-	0.023	0.029	705
	UPA1890GR	30	6	14	0.027	0.037	-	748
	UPA1803GR	30	8	36	0.012	0.016	-	1880
	UPA1804GR	30	8	13.5	0.023	0.032	-	761
	UPA1809GR	30	8	10	0.021	0.029	-	520
	UPA1857GR	60	3.8	12	0.067	0.086	-	580
	UPA1815GR	-20	-7	25	-	0.015	0.023	3000
	UPA1814GR	-30	-7	38	0.016	0.024	-	2180
WPAK	RJK03M5DPA	30	30	10.4	0.0065	0.0086	-	1350
	RJK0353DPA	30	35	14	0.0052	0.0076	-	2180
	RJK03M2DPA	30	45	21.2	0.0028	0.0037	-	2750
	RJK03M1DPA	30	50	25	0.0023	0.0031	-	3370
	RJK0346DPA	30	65	49	0.002	0.0027	-	7650
	RJK0658DPA	60	25	19.4	0.0111	-	-	1580
	RJK1555DPA	150	25	38	0.048	-	-	2400
	RJK1557DPA	150	25	20	0.058	-	-	1250
WPAK(3F)	RJK2075DPA	200	20	38	0.069	-	-	2200

Small-Signal MOSFETs

A range of products is available for applications such as power supplies, motor drive, high-frequency amplification, and load switching. Products are classified by reliability level, such as consumer or automotive.

1CH (Nch MOSFET) Lineup

Nch (SC-75,SC-70,SC-59)

Part No.	GATE Drive Voltage	VDSS (V)	VGSS (V)	ID (DC) (A)	Package	VGS (off) (V)		RDS (on) (Ω)						Ciss (pF) typ.
								at VGS=10V		at VGS=4V or 4.5V		at VGS=2.5V		
						min.	max.	typ.	max.	typ.	max.	typ.	max.	
2SK1581C	2.5 V	20	± 12	± 0.5	SC-59	0.5	1.5			0.41	0.6	0.6	0.88	28
2SK3663	2.5 V	20	± 12	± 0.5	SC-70	0.5	1.5			0.41	0.6	0.6	0.88	28
2SK3664	2.5 V	20	± 12	± 0.5	SC-75	0.5	1.5			0.41	0.6	0.6	0.88	28
2SK3107C	2.5 V	60	± 20	± 0.2	SC-75	1.0	2.5	2.1	2.7	2.4	3.2			20
2SK1590C	4.5 V	60	± 20	± 0.2	SC-59	1.0	2.5	2.1	2.7	2.4	3.2			20
2SK3054C	4.5 V	60	± 20	± 0.2	SC-70	1.0	2.5	2.1	2.7	2.4	3.2			20

Nch (SC-96,SC-62,SC-84)

Part No.	GATE Drive Voltage	VDSS (V)	VGSS (V)	ID (DC) (A)	Package	VGS (off) (V)		RDS (on) (Ω)						Ciss (pF) typ.
								at VGS=10V		at VGS= 4V or 4.5V		at VGS=2.5V		
						min.	max.	typ.	max.	typ.	max.	typ.	max.	
2SK3576	2.5 V	20	± 12	± 4	SC-96	0.5	1.5			0.042	0.053	0.056	0.075	250
2SK3577	2.5 V	20	± 12	± 3.5	SC-96	0.5	1.5			0.052	0.065	0.068	0.091	260
2SK1483C	2.5 V	30	± 12	± 3.5	SC-62	0.5	1.5			0.052	0.065	0.068	0.091	260
2SK2054C	4.0 V	60	± 20	± 4	SC-84	1.5	2.5	0.085	0.105	0.106	0.15			260
2SK2857C	4.0 V	60	± 20	± 4	SC-62	1.5	2.5	0.085	0.105	0.106	0.15			260
2SK3408	4.0 V	43±5	± 20	± 1	SC-96	1.5	2.5	0.155	0.195	0.195	0.26			230
N0300N	4.5 V	30	± 20	± 4.5	SC-96	1.0	2.5	38	50	48	83			350

1CH (Pch MOSFET) Lineup

Pch (SC-75,SC-70,SC-59)

Part No.	GATE Drive Voltage	VDSS (V)	VGSS (V)	ID (DC) (A)	Package	VGS (off) (V)		RDS (on) (Ω)						Ciss (pF) typ.
								at VGS=-10V		at VGS=-4V or 4.5V		at VGS=-2.5V		
						min.	max.	typ.	max.	typ.	max.	typ.	max.	
2SJ203C	-2.5 V	-20	± 12	± 0.2	SC-59	-0.8	-1.8			1.25	1.55	2.25	2.98	29
2SJ210C	-4.5 V	-60	± 20	± 0.2	SC-59	-1.0	-2.5	2.1	2.7	2.4	3.2			20
2SJ647	-2.5V	-20	± 12	± 0.4	SC-70	-0.8	-1.8			1.25	1.55	2.25	2.98	29
2SJ648	-2.5V	-20	± 12	± 0.4	SC-75	-0.8	-1.8			1.25	1.55	2.25	2.98	29

Pch (SC-96,SC-62,SC-84)

Part No.	GATE Drive Voltage	VDSS (V)	VGSS (V)	ID (DC) (A)	Package	VGS (off) (V)		RDS (on) (Ω)								Ciss (pF) typ.
								at VGS=-10V		at VGS=-4V or 4.5V		at VGS=-2.5V		at VGS=-1.8V		
						min.	max.	typ.	max.	typ.	max.	typ.	max.	typ.	max.	
2SJ690	-1.5 V	-30	± 12	± 2.5	SC-96	-0.5	-1.5			0.087	0.119	0.120	0.217			450
2SJ624	-1.8 V	-20	± 8	± 4.5	SC-96	-0.45	-1.5			0.043	0.054	0.053	0.071	0.065	0.108	813
2SJ625	-1.8 V	-20	± 8	± 3	SC-96	-0.45	-1.5			0.09	0.113	0.128	0.171	0.188	0.314	348
2SJ621	-1.8 V	-12	± 8	± 3.5	SC-96	-0.45	-1.5			0.035	0.044	0.046	0.062	0.063	0.105	660
2SJ557A	-4.0 V	-30	± 20	± 2.5	SC-96	-1.5	-2.5	0.114	0.155	0.212	0.29					312
2SJ356C	-4.0 V	-60	± 20	± 2	SC-62	-1.5	-2.5	0.31	0.388	0.417	0.556					255
2SJ358C	-4.0 V	-60	± 20	± 3.5	SC-84	-1.5	-2.5	0.114	0.143	0.142	0.19					666
2SJ626	-4.0 V	-60	± 20	± 1.5	SC-96	-1.5	-2.5	0.31	0.388	0.417	0.556					255
N0300P	-4.5 V	-30	± 20	± 4.5	SC-96	-1.0	-2.5	0.056	0.072	0.075	0.105					345

SC-95 (Nch MOSFET) Lineup

SC-95

Part No.	Config.	VDSS (V)	VGSS (V)	ID (DC) (A)	RDS (on) (mΩ) typ./max.			Ciss (pF) typ.	QG (nC) typ.
					at 10V	at 4.5V	at 2.5V		
UPA1970	Dual	20	±12	±2.2	-	55 / 69	80 / 107	160	2.3
UPA1901	Single	30	±12	±6.5	-	31 / 39	40 / 54	470	5.4
UPA1902	Single	30	±20	±7.0	17 / 22	22 / 30	-	780	15

SC-95 (Pch MOSFET) Lineup

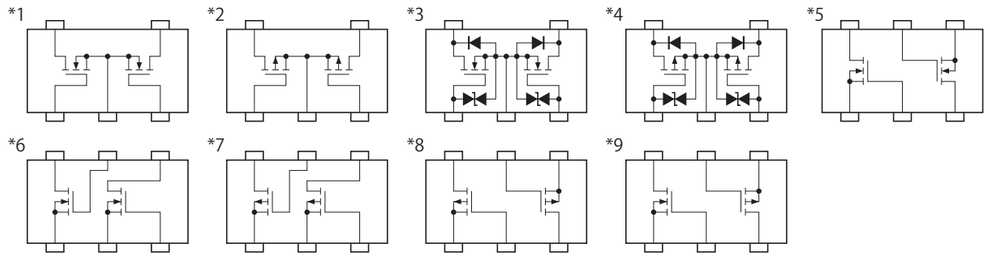
SC-95

Part No.	Config.	VDSS (V)	VGSS (V)	ID (DC) (A)	RDS (on) (mΩ) typ./max.				Ciss (pF) typ.	QG (nC) typ.
					at 10V	at 4.5V	at 2.5V	at 1.8V		
UPA1912	Single	-12	±10	±4.5	-	39/50	53/70	-	810	5.6
UPA1916	Single	-12	±8	±4.5	-	30/39	41/55	59/98	950	8
UPA1950	Dual	-12	±8	±2.5	-	105/130	160/205	225/375	220	1.9
UPA1951	Dual	-12	±8	±2.5	-	70/88	100/133	140/234	270	2.4
UPA1917	Single	-20	±8	±6.0	-	42/53	52/70	64/107	835	8
UPA1952	Dual	-20	±8	±2.0	-	108/135	137/183	170/284	272	2.3
UPA1911A	Single	-20	±12	±2.5	-	82/115	122/190	-	370	2.3
UPA1913	Single	-20	±12	±4.5	-	44/55	66/90	-	700	6
UPA1915	Single	-20	±12	±4.5	-	45/55	67/90	-	820	5
UPA1919	Single	-20	±12	±6.0	-	46/58	63/84	-	682	6
UPA1914	Single	-30	±20	±4.5	43/57	58/86	-	-	589	11
UPA1930	Single	-30	±20	±4.5	58/77	77/100	-	-	325	7.5
UPA1931	Single	-40	±20	±4.5	50/65	70/100	-	-	880	20
UPA1932	Single	-30	±20	±6.0	30/38	36/59	-	-	950	20
UPA1918	Single	-60	±20	±3.5	114/143	134/179	-	-	666	12

2CH Lineup

Part No.	Package	VDSS (V)	VGSS (V)	ID (DC) (A)	VGS (off) (V)		RDS (on) (Ω)						Ciss (pF) typ.	Config.
							at VGS=10V		at VGS=4V or 4.5V		at VGS=2.5V			
					min.	max.	typ.	max.	typ.	max.	typ.	max.		
UPA502CT	5pin mini-mold SC-74A	60	± 20	± 0.1	1.0	2.5	2.1	2.7	2.4	3.2			20	*1
UPA503CT		-60	± 20	± 0.1	-1.0	-2.5	1.8	2.7	2	3.2			20	*2
UPA572CT	5pin super-mini-mold SC-88A	60	± 20	± 0.1	1.0	2.5	2.1	2.7	2.4	3.2			20	*3
UPA573CT		-60	± 20	± 0.1	-1.0	-2.5	1.8	2.7	2	3.2			29	*4
UPA606CT	6pin mini-mold SC-74	60	± 20	± 0.1	1.0	2.5	2.1	2.7	2.4	3.2			20	*5
UPA602CT		60	± 20	± 0.1	1.0	2.5	2.1	2.7	2.4	3.2			20	*6
UPA603CT		-60	± 20	± 0.1	-1.0	-2.5	1.8	2.7	2	3.2			20	*7
UPA677TB	6pin super-mini-mold SC-88	20	± 12	± 0.35	0.5	1.5			0.41	0.60	0.60	0.88	28	*5
UPA672CT		60	± 20	± 0.1	1.0	2.5	2.1	2.7	2.4	3.2			20	*5
UPA678TB		-20	± 12	± 0.25	-0.8	-1.8			1.25	1.55	2.25	2.98	29	*8
UPA679TB		20	± 12	± 0.35	0.5	1.5			0.41	0.60	0.60	0.88	28	*9
		-20	± 12	± 0.25	-0.8	-1.8			1.25	1.55	2.25	2.98	29	

Configurations:



IGBT

A range of products is available for applications such as industrial inverters and home appliances (IH cookers, air conditioners).

General IGBT Product Lineup

Package	Part No.	VCES [V]	IC [A]	VCE (sat) [V] typ.	tf [μs] typ.	tsc [μs]
TO-3P	RJH60F7ADPK	600	50	1.35	0.074	-
TO-3PFM	RJP65T43DPM	650	20	1.8	0.045	-
TO-3PFP	RJH65T04BDPM-A0	650	30	1.5	0.045	-
	RJP65T54DPM-A0	650	30	1.35	0.13	-
TO-247A	RJH60T04DPQ-A1	600	30	1.5	0.045	-
	RJP65T43DPQ-A0	650	30	1.8	0.045	-
	RJH65T46DPQ-A0	650	40	2.4	0.045	-
	RJH65T47DPQ-A0	650	45	2.4	0.045	-
	RJH65T14DPQ-A0	650	50	1.45	0.115	-
	RJH65D27BDPQ-A0	650	50	1.3	0.12	3
	RBN40H65T1FPQ-A0	650	40	1.5	0.045	-
	RBN50H65T1FPQ-A0	650	50	1.5	0.04	-
	RBN75H65T1FPQ-A0	650	75	1.5	0.035	-
	RBN25H125S1FPQ-A0	1250	25	1.8	0.067	10
	RBN40H125S1FPQ-A0	1250	40	1.8	0.192	10
TO-247plus	RBN75H125S1FP4-A0	1250	75	1.8	0.148	10

General Bare-die IGBT Product Lineup

Package	Part No.	VCES [V]	IC [A]	VCE (sat) [V] typ.	tf [μs] typ.	tsc [μs]
Wafer*1	RJP65D03DWA	650	15	1.45	0.19	3
	RJP65D05DWA	650	30	1.45	0.10	3
	RJP65S03DWA	650	30	1.5	0.1	10
	RJP65S04DWA	650	50	1.5	0.1	10
	RJP65S05DWA	650	75	1.5	0.075	10
	RJP65S06DWA	650	100	1.5	0.06	10
	RJP65S07DWA	650	150	1.5	0.07	10
	RJP65S08DWA	650	200	1.5	0.08	10
	RJP65M04DWA	650	50	1.55	0.095	5
	RJP65M05DWA	650	75	1.55	0.08	5
	RJP65M06DWA	650	100	1.5	0.07	5
	RJP1CS23DWA	1250	30	1.55	0.31	10
	RJP1CS24DWA	1250	50	1.55	0.31	10
	RJP1CS25DWA	1250	75	1.55	0.33	10
	RJP1CS26DWA	1250	100	1.55	0.28	10
	RJP1CS27DWA	1250	150	1.55	0.32	10
	RJP1CS28DWA	1250	200	1.55	0.30	10
	RJP1CS10DWA	1250	10	1.8	0.23	10
	RJP1CS01DWA	1250	15	1.8	0.21	10
	RJP1CS03DWA	1250	30	1.8	0.16	10
	RJP1CS04DWA	1250	50	1.8	0.16	10
	RJP1CS05DWA	1250	75	1.8	0.17	10
	RJP1CS06DWA	1250	100	1.8	0.16	10
	RJP1CS07DWA	1250	150	1.8	0.15	10
	RJP1CS08DWA	1250	200	1.8	0.14	10

Note: 1. Bare-die products are available in the following two shipping configurations:
- Un-Sawn Wafer:RJP*****DWA
- Sawn Wafer:RJP*****DWS

Diodes

Renesas supplies diodes that help make possible compact and lightweight mobile and information devices that deliver high performance.

SiC Schottky Barrier Diode Product Lineup

Package	Part No.	VR [V]	IR [μA] max.	IF [A]	VF [V] typ.	trr [ns] typ.	Channels
TO-220FP-2L	RJS6004TDPP-EJ	600	10	10	1.5	15	1
	RJS6005TDPP-EJ	600	10	15	1.5	15	1
TO-3P	RJS6004WDPK-00	600	10/20	10/20	1.5	15	2
	RJS6005WDPK-00	600	10/20	15/30	1.5	15	2

Bare-die Fast Recovery Diode Product Lineup

Package	Part No.	VR [V]	IR [μA] max.	IF [A]	Tj [˚C]	VF [V] max.	trr [ns] typ.
Wafer*1	RJU65E03DWA	650	1	30	175	2.2	150
	RJU65E04DWA	650	1	50	175	2.2	180
	RJU65E05DWA	650	1	75	175	2.2	200
	RJU65E06DWA	650	1	100	175	2.2	200
	RJU65E07DWA	650	1	150	175	2.2	300
	RJU65E08DWA	650	1	200	175	2.2	350
	RJU1CE03DWA	1250	150	30	175	2.5	200
	RJU1CE04DWA	1250	150	50	175	2.5	220
	RJU1CE05DWA	1250	150	75	175	2.5	250
	RJU1CE06DWA	1250	150	100	175	2.5	300
	RJU1CE07DWA	1250	150	150	175	2.5	330
	RJU1CE08DWA	1250	150	200	175	2.5	360

Note: 1. Bare-die products are available in the following two shipping configurations:
- Un-Sawn Wafer:RJU*****DWA
- Sawn Wafer:RJU*****DWS

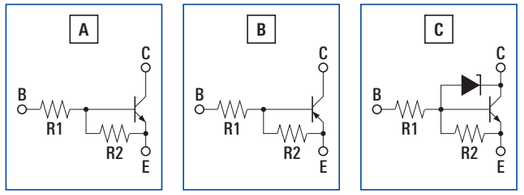
Transistors with Integrated Resistors

Renesas' transistors have a built-in resistor in the base or between the base and the emitter, enabling a reduction in the mounting area and the number of parts.

Transistor with Integrated Resistor Product Lineup

Package	Part No.	VCBO (V)	VCEO (V)	VEBO (V)	IC(A)	hfe min.	PT (mW)	R1 (kΩ)	R2 (kΩ)	Equivalent Circuit
3pin MM	FB1A3M	30	25	10	700	80	200	1	1	A
	FB1A4A					300	200	-	10	
	FB1A4M					300	200	10	10	
	FB1F3P					300	200	2.2	10	
	FB1J3P					300	200	3.3	10	
	FB1L2Q					150	200	0.47	4.7	
	FB1L3N					300	200	4.7	10	
	FP1A3M	-25	-25	-10	-700	100	200	1	1	B
	FP1A4A					100	200	-	10	
	FP1A4M					100	200	10	10	
	FP1F3P					100	200	2.2	10	
	FP1J3P					100	200	3.3	10	
	FP1L2Q					100	200	0.47	4.7	
	FP1L3N					100	200	4.7	10	
3pin PoMM	HD1A3M	80	60	10	1000	200	2000	1	1	A
	HD1A4A					300	2000	-	10	
	HD1A4M					300	2000	10	10	
	HD1F3P					300	2000	2.2	10	
	HD1L2Q					300	2000	0.47	4.7	
	HD1L3N					300	2000	4.7	10	
	HD2A3M	60	60	10	1000	200	2000	1	1	C
	HD2A4A					300	2000	-	10	
	HD2A4M					300	2000	10	10	
	HD2F2Q					300	2000	0.22	2.2	
	HD2F3P					300	2000	2.2	10	
	HD2L3N					300	2000	4.7	10	
	HQ1A3M	-20	-20	-10	-2000	100	2000	1	1	B
	HQ1F2Q					150	2000	0.22	2.2	
	HQ1F3P					150	2000	2.2	10	
	HQ1L2N					150	2000	0.47	1	
	HQ1L2Q					150	2000	0.47	4.7	
	HR1A3M	-60	-60	-10	-1000	100	2000	1	1	
	HR1A4A					100	2000	-	10	
	HR1A4M					100	2000	10	10	
	HR1F3P					100	2000	2.2	10	
	HR1L3N					100	2000	4.7	10	

Equivalent Circuit



Bipolar Small-Signal Transistors

An extensive lineup of packages is available, from small and thin packages to high-power packages.

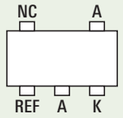
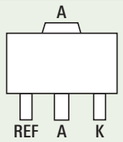
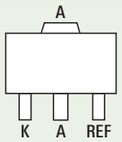
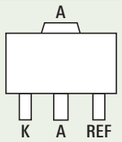
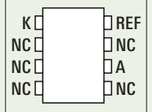
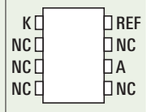
Bipolar Small Signal Transistor Product Lineup

Package	Part No.	VCEO (V)	IC(A)	hfe1		PT (W)
				min.	max.	
3pin MM	2SA1226	-40	-0.03	40	180	0.2
	2SA1330	-200	-0.1	90	450	0.2
	2SA1464	-40	-0.5	75	300	0.2
	2SA811A	-120	-0.05	135	900	0.2
	2SB736	-60	-0.3	110	400	0.2
	2SB736A	-80	-0.3	110	400	0.2
	2SC1009A	30	0.05	60	180	0.2
	2SC1622A	120	0.05	135	900	0.2
	2SC2223	20	0.02	40	180	0.15
	2SC3360	200	0.1	90	400	0.2
	2SC3624	50	0.15	1000	3200	0.2
	2SC3624A	50	0.15	1000	3200	0.2
	2SC3739	40	0.5	75	300	0.2
	2SD780	60	0.3	110	400	0.2
	2SD780A	80	0.3	110	400	0.2
3pin PoMM	2SB1114	-20	-2	135	600	2
	2SB1115	-50	-1	135	600	2
	2SB1115A	-60	-1	135	600	2
	2SB1301	-16	-3	135	600	2
	2SB1571	-30	-5	100	400	2
	2SB1572	-60	-3	100	400	2
	2SB1628	-15	-3	140	560	2
	2SB799	-50	-0.7	90	400	2
	2SB800	-80	-0.3	90	400	2
	2SB804	-80	-1	90	400	2
	2SB805	-100	-0.7	90	400	2
	2SB806	-120	-0.7	90	400	2
	2SC3554	300	0.2	60	250	2
	2SC3617	50	0.3	800	3200	2
	2SD1000	50	0.7	90	400	2
	2SD1001	80	0.3	90	400	2
	2SD1005	80	1	90	400	2
	2SD1006	100	0.7	90	400	2
	2SD1007	120	0.7	90	400	2
	2SD1615	50	1	135	600	2
	2SD1615A	60	1	135	600	2
	2SD1699	80	0.8	4000	50000	2
	2SD1702	60	0.8	4000	50000	2
	2SD1950	25	2	800	3200	2
	2SD2402	30	5	100	400	2
	2SD2403	60	3	100	400	2

Shunt Regulators

These are the standard reference voltage source widely used in the feedback circuits of switching power supplies and similar devices. Compared to the Zener diode, which is a discrete product, a shunt regulator has much better voltage precision because voltage control is carried out by an IC.

Shunt Regulator Product Lineup

Item		Low-Voltage (1.25V) Type			Standard-Voltage (2.5V) Type		
		UPC1943T	UPC1944T	UPC1944GR	UPC1093TA	UPC1093T	UPC1093G
Reference voltage	VREF(V)	1.23(min.) to 1.26(typ.) to 1.29(max.)			2.440(min.) to 2.495(typ.) to 2.550(max.)		
Cathode voltage	VKA(V)	24(max.)			36(max.)		
Cathode current	IK(mA)	30(max.)			100(max.)		
Operating temperature range	TA(°C)	-30 to +85			-20 to +85		
Package	5-pin mini mold (SC-74A)						
	3-pin power mini mold (SC-62)						
	8-pin SOP						

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https://www.renesas.com

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■Improvements

1. Private portal function

   Now you can store the information you need for your own use later. Check back whenever you want to view the stored information. Log in to MyRenesas to get started.

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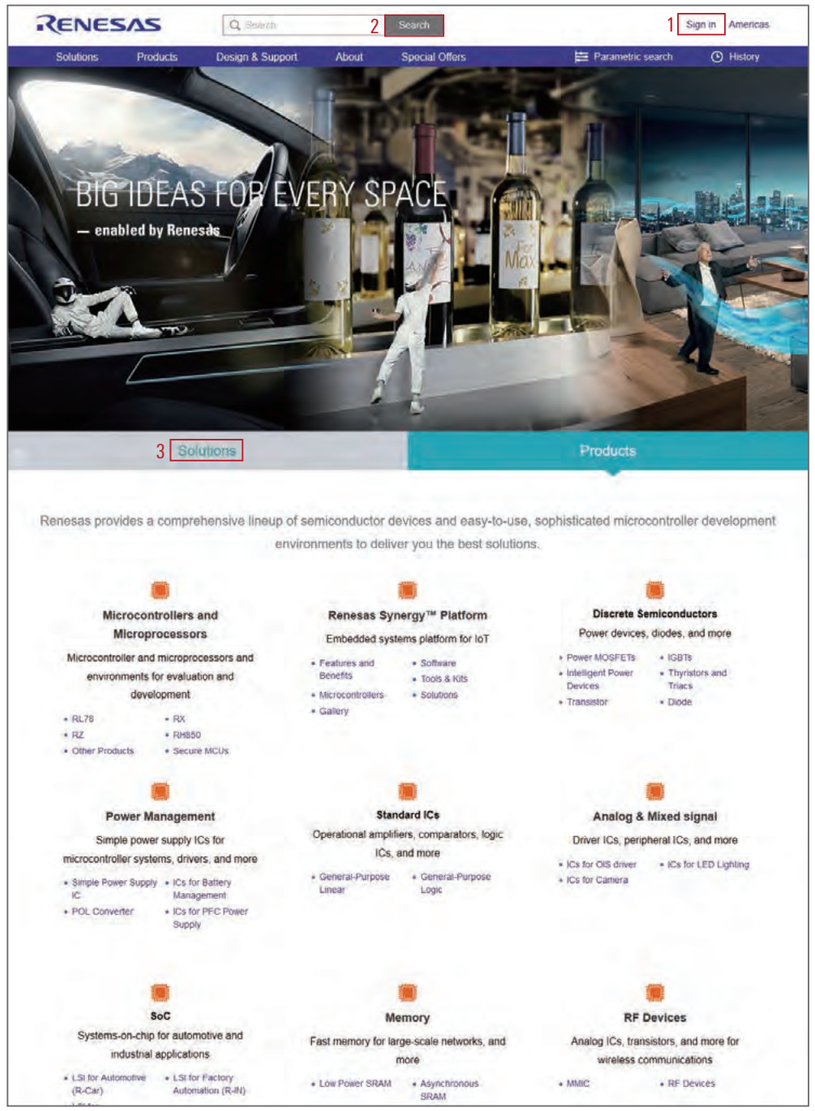
   Search functions that were previously separated into categories have been unified so you can now search everything by keyword. A single search will return matching results covering tools, documents, and product specifications.

3. Information on solutions

   Now you can access a single page to find information on the solutions offered by Renesas. You can also check related information on products, documents, and tools from this page.



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