2012.01

Renesas Discrete General Catalog

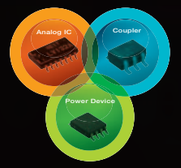
Transistor / Diode / Triac / Thyristor

General Catalog

Discrete

Renesas Electronics
www.renesas.com

What gives rise to this sort of encounter?



◎ **Green Stream Solution**
These solutions control the flow of power (energy) and contribute to reduced power consumption overall.

Power Device		Element power density
		Lower switching loss and high speed
Non-MOS	Low-voltage MOS / High-voltage MOS	Package current capacity and thermal resistance

Diodes		Low capacity, high tolerance
		Linearity and change ratio
		Smaller, composite packages

High Frequency Device		Higher fT
		Efficiency
		Smaller packages

Product category map

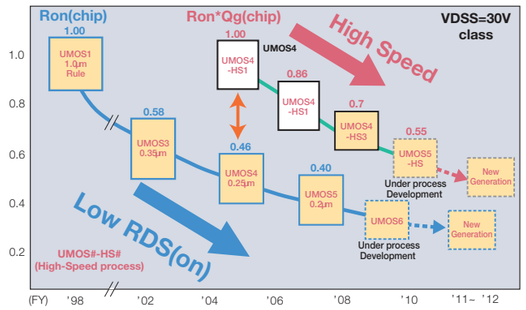
http://japan.renesas.com/transistor http://www.renesas.com/en/transistor

Trends in Low-Voltage Power MOSFET Technology

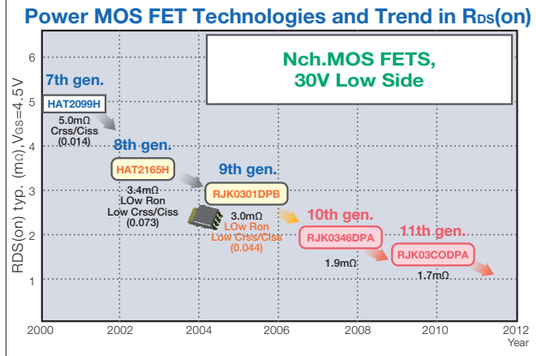
Renesas Electronics is constantly improving the performance of its lineup of low-voltage power MOSFETs to enable more efficient power supplies that use less energy. Trench technology and ultra fine process technology at the top class in the industry contribute to reduced on-resistance, while advanced package technologies such as multi-bonding, copper-clip connection, composite configuration with integrated Schottky diodes, and compact dimensions enable low-voltage characteristics.

In switching power supplies, currently the most widely used type, power loss arises not only from on-resistance but also from switching loss due to the gate load. Renesas Electronics improves performance with process technology that reduces capacitance and on-resistance, combined with package technology designed to lower reactance and on-resistance.

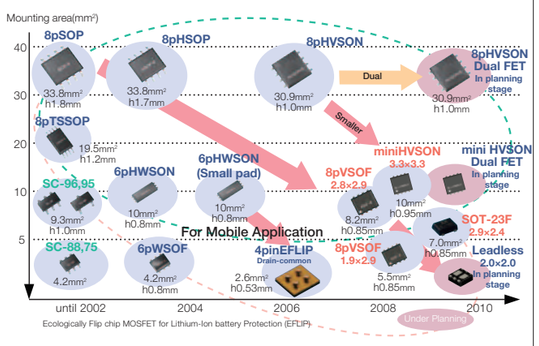
Trend in On-Resistance Performance of Low-Voltage Power MOSFETs



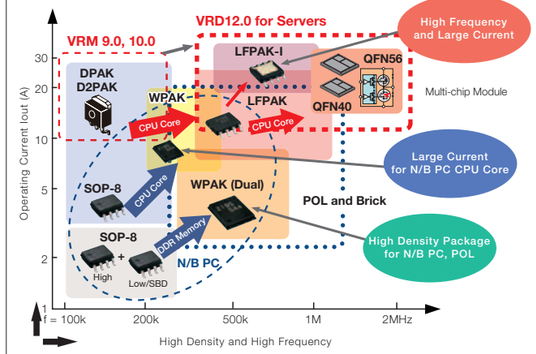
Low-Voltage Power MOSFET On-Resistance Roadmap



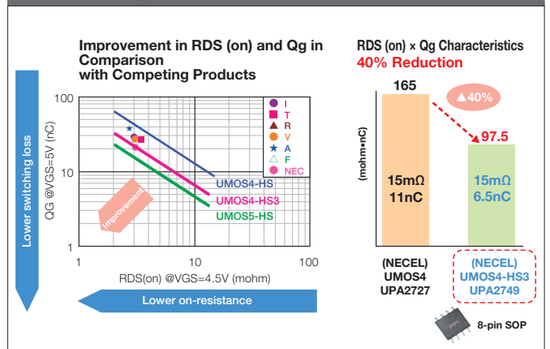
Trend in Low-Voltage Power MOSFET Packages



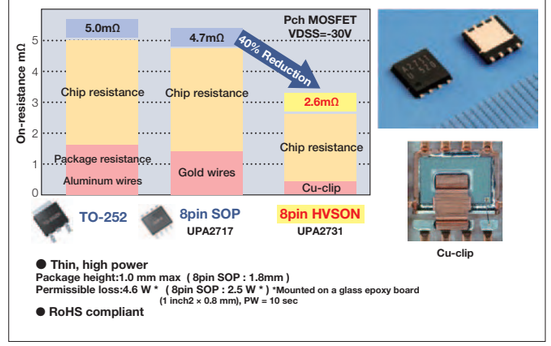
Trend in Low-Voltage Power MOSFET Packages



Further Lower Switching Loss in Low-Voltage UMOS-HS3



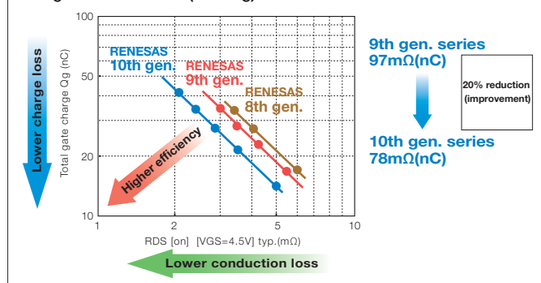
Features of 8-Pin HVSON



Better heat dispersion is another important aspect of improved package performance. Wireless bonding and dual-face heat dispersion help to prevent increased RDS on-resistance due to higher junction temperatures.

10th Generation Power MOSFET Performance (VDSS = 30 V)

● Figure of merit: FOM(Ron•Qg) at VGS=4.5V



10th Generation Package Configuration

To the 9th generation SOP-8, WPAK (Au-wire)	10th generation series	
	SOP-8, WPAK (AL ribbon)	LFPAK (Au Bump)
Lead frame (source, gate) Au wire Die Die pad (drain)	Aluminum ribbon bonding AL ribbon	Lead (source, gate) Die Ag paste Au bump Heat sink (drain)

to 1.0mΩ → to 0.5mΩ

Package wire resistance reduced by half (contributing to lower on-resistance)

Online Design Tool for Power MOSFETs Used in Buck Converters

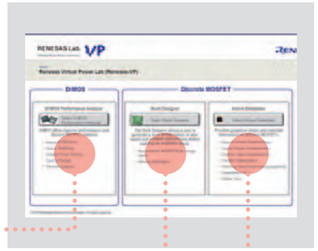
Your Buck Converter MOSFET Sommelier
Renesas VP has been updated!!

From Overseas
Renesas Online MOSFET Design Tool
http://www.renesas.com/vp

Visit this URL to register!

http://japan.renesas.com/vp

NEW



DrMOS Performance Analyzer
Since DrMOS (SiP with integrated driver) products are supported, you can run simulations for DrMOS devices, which are superior to standalone MOSFETs.

Specify conditions similar to those of your application.

▼

First, the DrMOS calculation results for the condition settings are displayed.

▼

When you select a DrMOS, a circuit diagram is displayed. You can change the parameters for parts appearing in blue type. You can also view waveforms, etc., for the various points and run simulations while comparing the efficiency with a design using discrete devices.

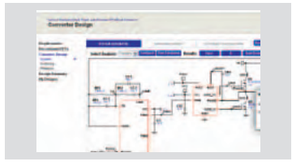
Buck Designer
Simulate power MOSFET operation in a synchronous rectification type step-down DC/DC converter employing a model circuit design.

Specify conditions similar to those of your application.

▼

A recommended combination of devices is displayed. You can use the custom solution function to make changes to the combination of devices.

▼



You can change the parameters for parts appearing in blue type in the circuit diagram. You can also view waveforms, etc., for the various points.

Active Datasheet
Obtain detailed simulations based on standalone power MOSFET characteristics by changing various parameter settings.

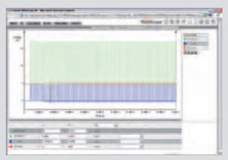
Select a FET.

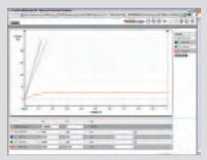
▼

Visual representations of characteristics are displayed. You can also download SPICE data.

▼

You can also change the parameter settings.

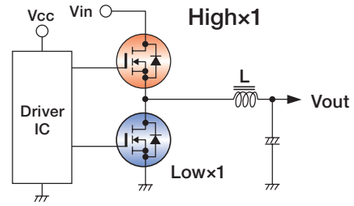




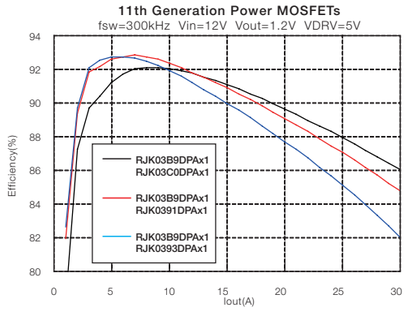
While running a simulation, click on a waveform graph or characteristic curve illustration to display a dedicated graph viewer. The viewer has tools that enable you to check fine details or adjust the appearance of the display.

Buck Converter Efficiency

Application Example



Renesas discrete device evaluation board
Ta = 25°C, no airflow
L = 0.45µH

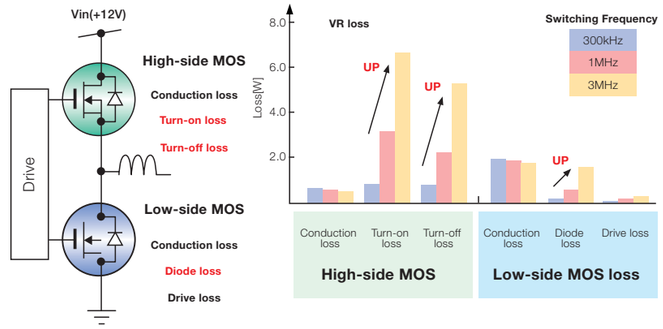


When designing a synchronous rectification step-down DC-DC converter, the high-side and low-side MOS devices selected will differ according on considerations such as the operating conditions, the target efficiency, and the key load range.
Generally, there is a trade-off between the on-resistance and capacitance (Qg, Qgd) of a MOSFET. For example, a comparison of the three low-side products used in the efficiency graph above shows the following relationships.

On-resistance:
RJK03C0DPA < RJK0391DPA < RJK0393DPA
Capacitance (Qg, Qgd):
RJK03C0DPA > RJK0391DPA > RJK0393DPA

In the large-current range, conduction loss accounts for a large portion of the total loss. Therefore, selecting a MOS with low on-resistance will provide increased efficiency by reducing the conduction loss. In the small-current range, conversely, drive loss and switching loss account for more of the total loss, so selecting a MOS with low capacitance (Qg, Qgd) is an effective way to increase efficiency.
Renesas Electronics has created a simulation site called Renesas VP to assist customers in the selection of MOSFET products. It presents recommended pairs of high-side and low-side devices to match particular usage conditions and allows you to select MOS products and run efficiency simulations using them.

Buck converter Loss



In a buck converter, the main types of loss from the power MOSFETs are conduction loss when current flows through the MOSFET and loss during switching associated with capacitance charging and discharging loss. When the ratio of the input to the output voltage approaches 1, the duration of high-side current flow is longer. As the ratio approaches 0, the low-side current flow duration increases. Generally speaking, RdSON is the main cause of loss for the side with the longer current flow duration, and this loss can be reduced by selecting a MOSFET with a low on-resistance for this side. However, MOSFETs with low on-resistance tend to have a correspondingly larger chip size, and they also have slightly higher switching loss due to factors such as higher gate capacitance. Consequently, it is necessary to place more emphasis on characteristics such as gate capacitance than on on-resistance when selecting a MOSFET for the side with the shorter current flow duration. It is also important to pay close attention to characteristics such as gate capacitance when using a higher switching frequency and more compact parts such as coils and transformers.

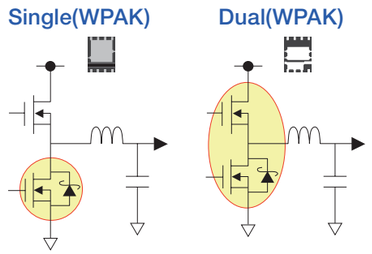
● **Increased Loss at Higher Frequencies**
High-side MOS: Increased turn-on and turn-off loss
Low-side MOS: Increased diode loss

Power MOSFETs

Low-Voltage Power MOSFETs

SBD MOSFET

10th Generation + SBD (Single/Dual)



Features (Single)

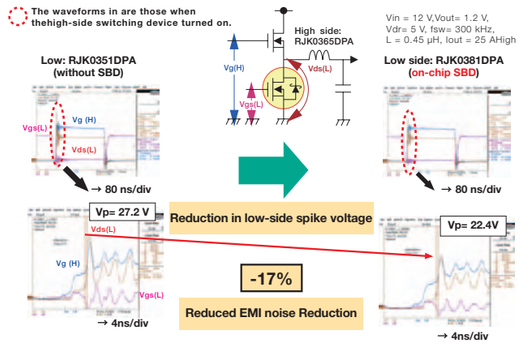
•SBD between source and drain
- Higher efficiency
  Reduced VDF loss during dead time
- Low EMI noise: Reduced low-side D-S spike voltage at high-side turn-on

Features (Dual)

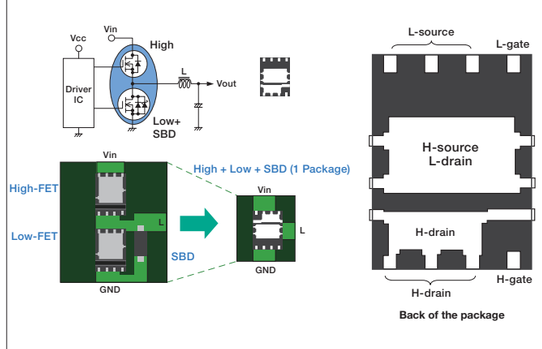
•Two elements (high and low) in a single package
- Smaller package with 50% lower PCB area
  Low-side element with SBD
- Higher efficiency
- Reduced VDF loss during dead time
- Low EMI noise: Reduced low-side D-S spike
- voltage at high-side turn-on

10th Generation WPAK (Dual) – New Product

Reduction of Spike Voltages (Comparison of Operating Frequency)



Reduction of PCB mounting area; more compact



WPAK Single

No.	Part No.	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)
		V_{DSS} (V)	V_{GSS} (V)	I_D (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.		
1	RJK0379DPA	30V	+20/-20	50	55	2.4	3.4	1.8	2.3	10.7	37
2	RJK0380DPA			45	50	3.3	4.7	2.4	3.2	6.7	24
3	RJK03A4DPA			42	45	4.3	6.0	2.9	3.8	5.2	17
4	RJK0381DPA			40	45	4.7	6.6	3.4	4.5	4.3	15

WPAK Dual

No.	Part No.	FET	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)
			V_{DSS} (V)	V_{GSS} (V)	I_D (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.		
1	RJK0389DPA	High	30	+20/-20	15	10	11.8	16.5	8.2	10.7	1.4	6.3
		Low			20	10	10.5	14.7	6.8	8.9	2.2	7.2

BEAM2+SBD series WPAK 5×6mm Note

No.	Part No.	Maximum Rating				RDS (on)				Ciss (pF)
		V_{DSS} (V)	V_{GSS} (V)	I_D (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.	
1	RJK03N0DPA	30	+12/-12	TBD	TBD	2.5	3.1	2.2	2.6	4450
2	RJK03N1DPA			TBD	TBD	3.2	4.0	2.8	3.4	3280
3	RJK03N2DPA			TBD	TBD	4.1	5.1	3.6	4.3	2700
4	RJK03N3DPA			TBD	TBD	4.9	6.1	4.3	5.2	2180
5	RJK03N4DPA	30	+20/-20	TBD	TBD	2.7	3.5	2.2	2.6	3100
6	RJK03N5DPA			TBD	TBD	3.5	4.6	2.8	3.4	2300
7	RJK03N6DPA			TBD	TBD	4.4	5.8	3.6	4.3	1900
8	RJK03N7DPA			TBD	TBD	5.4	7.0	4.3	5.2	1550

BWAM2+SBD series 3.3×3.3mm Package (HWSON3030-8) Note

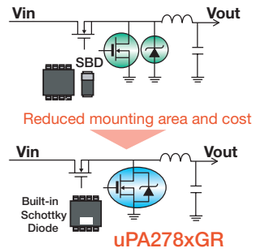
No.	Part No.	Maximum Rating				RDS (on)				Ciss (pF)
		V_{DSS} (V)	V_{GSS} (V)	I_D (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.	
1	RJK03N8DNS	30	+12/-12	TBD	TBD	5.5	6.9	5.0	6.0	2416
2	RJK03N9DNS			TBD	TBD	7.1	8.8	6.3	7.5	1748
3	RJK03L2DNS	30	+20/-20	TBD	TBD	5.9	7.7	5.0	6.0	1700
4	RJK03L3DNS			TBD	TBD	7.7	10.0	6.3	7.5	1250

■ for Lo-Side SW, Synchronous rectification

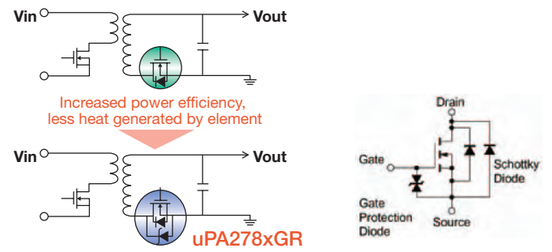
Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

SOP8 Built-in Schottky diode Series

Power Supply Circuit of Notebook PC or Game Console

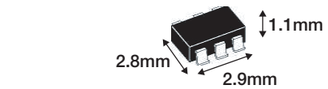


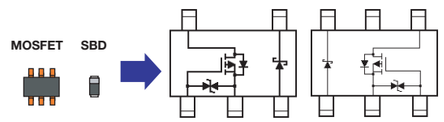
Secondary-Side Rectifier Circuit of Onboard Power Supply



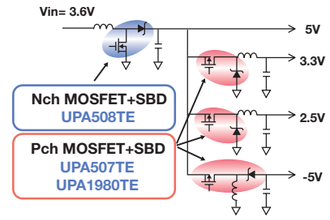
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max	RDS (on) (mΩ) VGS=4.5V typ./max	Clss (pF)	Qg (nC) VGS=5V	VF Max (V) 1F=1A
UPA2780GR	Nch+SBD	30	±20	±14	6.2/7.5	8.7/11.6	1200	12	0.5
UPA2781GR	Nch+SBD	30	±20	±13	7.6/9.5	11.3/15.1	900	9	0.5
UPA2782GR	Nch+SBD	30	±20	±11	11/15	16/22.5	660	7.1	0.5

SC-95 Built-in Schottky diode Series





Application:
DC/DC converter for portable devices

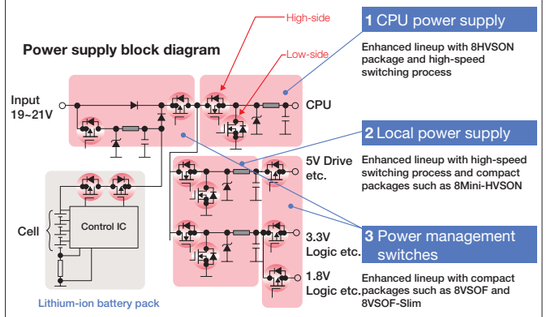


Type No.	MOSFET Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=4.5V typ./max	RDS (on) (mΩ) VGS=2.5V typ./max	RDS (on) (mΩ) VGS=1.8V typ./max	Clss (pF)	Qg (nC) VGS=4V	SBD VRRM (V)	SBD IF(AV) (A)	SBD VF (V)	SBD IR (uA)
UPA507TE	Pch	-20	±8	±2	68/85	84/120	109/180	380	4.7	30	1	0.38 1F=1A	200 VR=10V
UPA508TE	Nch	20	±12	±2	40/51	59/90	-	170	2.7				
UPA1980TE	Pch	-20	±8	±2	116/135	142/183	170/284	272	2.3	40	0.5	0.51 1F=0.5A	20 VR=40V

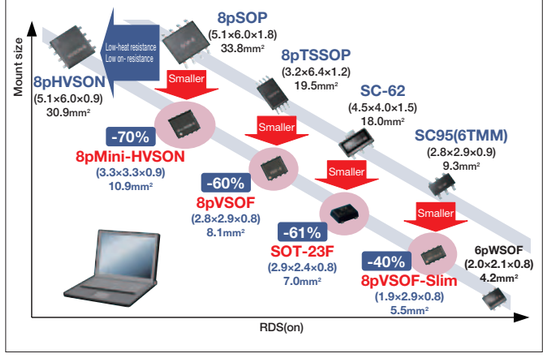
Low-Voltage Power MOSFETs for Notebook PC Power Supplies

MOSFETs for notebook PC applications demand low-loss characteristics and a low mounting profile.
Renesas Electronics offers a large number of products that meet these requirements.

Low-Voltage Power MOSFETs for Power Supplies



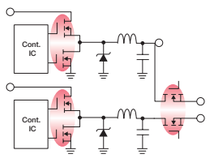
Low-Voltage Power MOSFET Package Options



SOP8 Dual Series

2-in-1 package for smaller mounting area
UPA2750GR, UPA2755AGR, and UPA2757GR for high-speed switching applications such as DC/DC converters
UPA2751GR and UPA2758GR with high-speed switching element and low-on-resistance element
UPA1770G, UPA1772G, and UPA1774G for load switching applications

DC/DC Converter Power line load switch



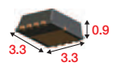
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.	Ciss (pF)	Qg (nC) VGS=10V
UPA1770	Pch Dual	-20	± 12	± 6	-	28/37	44/59	1300	11 VGS=4.5V
UPA1772	Pch Dual	-30	± 20	± 8	17.4/20	23.5/29.5	-	1500	34
UPA1774	Pch Dual	-60	± 20	± 2.8	200/250	230/300	-	420	10

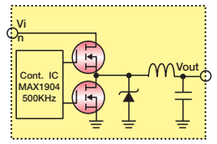
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.	Ciss (pF)	Qg (nC) VGS=10V
UPA1759G	Nch Dual	60	± 20	± 5	110/150	170/240 VGS=4V	-	190	8
UPA1763G	Nch Dual	60	± 20	± 4.5	37/47	45/57	-	870	20
UPA1764G	Nch Dual	60	± 20	± 7	27/35	32/42	-	1300	29
UPA2750GR	Nch Dual	30	± 20	± 9	12.5/15.5	16/21	-	1040	21
UPA2750GR	Nch	30	± 20	± 9	12.5/15.5	16/21	-	1040	21
	Nch	30	± 20	± 8	18.4/23.0	26.3/35.0	-	480	10
UPA2754GR	Nch Dual	30	± 12	± 11	-	11.5/14.5	13.9/18.6	1940	25 VGS=4.5V
UPA2755AGR	Nch Dual	30	± 20	± 8	14/18	21/29	-	650	13
UPA2756GR	Nch Dual	60	± 20	± 4	85/105	106/150	-	260	13
UPA2757GR	Nch Dual	30	± 20	± 5	28.5/36	36/50	-	400	10
UPA3753GR[Note]	Nch Dual	60	± 20	± 4	44/56	49/72	-	640	8

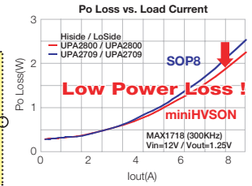
Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

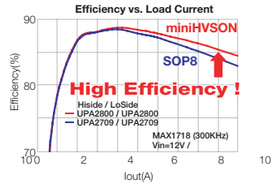
Mini-HVSON Series

- Features: 1) High-speed switching
  2) Thin high-power package
  3) Low on-resistance
  4) Integrated gate protection diode









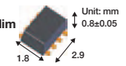
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) @10V	RDS (on) (mΩ) @4.5V	RDS (on) (mΩ) @2.5V	Ciss (pF)	Qg (nC) VGS=5V
UPA2802T1L	Nch	20	±20	±18	6.0	9.7	-	1800	13
UPA2803T1L	Nch	20	±12	±20	-	5.8	8.8	2450	17
UPA2804T1L	Nch	30	±20	±28	6.8	-	-	1850	16
UPA2810T1L	Pch	-30	±20	±13	12	23	-	1860	40(Note2)
UPA2806TIL	Nch	100	±20	±21	47/57	47/70(Note1)	-	780	18(Note2)
UPA2811TIL	Pch	-30	±25	±19	12/15	20/28	-	1360	30(Note2)

(Note1)@VGS=8V (Note2)@VGS=10V

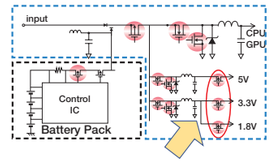
8pin VSOF-Slim Series

- Features: 1) Low-voltage drive
  2) Compact, thin package
  3) Low on-resistance
  4) Integrated gate protection diode

8pVSOF slim



- Application example Power management switch for notebook PC



Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ	RDS (on) (mΩ) VGS=4.5V typ	RDS (on) (mΩ) VGS=2.5V typ	RDS (on) (mΩ) VGS=1.8V typ	Ciss (pF)	Qg (nC) VGS=5V
UPA2200T1M	Nch	30	±20	±8	23	31	-	-	870	9
UPA2201T1M	Nch	20	±12	±9	-	18	27	-	920	13
UPA2210T1M	Pch	-20	±8	±8	-	30	41	81	1350	17
UPA2211T1M	Pch	-12	±8	±8	-	24	34	66	1350	15

Power MOSFETs

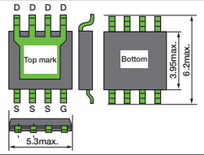
Low-Voltage Power MOSFETs

LFPAK-i and CMFPAK-6

LFPAK-i Package Power MOSFET Series

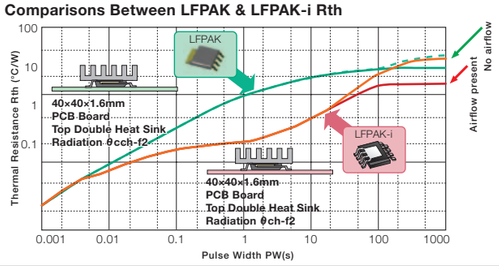
- 40% less heat resistance and 30% better current characteristics when mounted
- SOP-8 and LFPAK packages also available
- Top side cooling function

Package Dimensions
Unit:mm



*[ ]:VGS=8V

Comparisons Between LFPAK & LFPAK-i Rth



Lineup

Part No.	Rating		RDS (on) (mΩ)				Qg	Qgd
	VDSS	ID	VGS=4.5V*		VGS=10V		typ.	typ.
	(V)	(A)	typ.	max.	typ.	max.	(nC)	(nC)
HAT2165N	30	55	3.7	5.6	2.8	3.6	33	7.1
HAT2166N	30	45	4.3	6.4	3.2	4.1	27	5.9
HAT2168N	30	30	9.1	13.8	6.3	8.2	11	2.4
HAT2172N	40	30	(6.9)	(9.5)	6.1	7.8	32	4
HAT2173N	100	25	[13.3]	[17.8]	12.3	15.3	61	14.5
HAT2174N	100	20	[22]	[30]	21	27	33.5	8.4
HAT2175N	100	15	[34]	[46]	33	42	21	4.5

Lineup of 10th Generation Products in LFPAK Package

No.	Part No.	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)
		VDSS (V)	VGSS (V)	ID (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.		
1	RJK0328DPB	30	+20/-20V	60	65	2.1	2.9	1.6	2.1	8.8	42
2	RJK0329DPB			55	60	2.4	3.4	1.8	2.3	7.3	35
3	RJK0330DPB			45	55	2.8	3.9	2.1	2.7	5.8	27
4	RJK0331DPB			40	50	3.5	4.9	2.6	3.4	4.6	21
5	RJK0332DPB			35	45	5.0	7.0	3.6	4.7	3.0	14

for low-side switch and synchronous rectifier
for high-side switch

Lineup of 10th Generation Products in SOP-8 Package

No.	Part No.	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)
		VDSS (V)	VGSS (V)	ID (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.		
1	RJK0348DSP	30	+20/-20V	22	2.5	3.2	4.5	2.6	3.4	7.0	34
2	RJK0349DSP			20	2.5	3.6	5.0	2.9	3.8	5.3	25
3	RJK0351DSP			20	2.5	5.0	6.9	4.0	5.2	3.7	17
4	RJK0352DSP			18	2.0	5.5	7.0	4.3	5.6	3.4	16
5	RJK0353DSP			18	2.0	5.9	8.3	4.5	5.9	3.0	15
6	RJK0354DSP			16	2.0	7.5	10.5	5.4	7.0	2.5	12
7	RJK0355DSP			12	1.8	12.0	16.8	8.5	11.1	1.4	6.0

for low-side switch and synchronous rectifier
for high-side switch

WINFET series

No.	Part No.	Package	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)	Rg (Ω)
			VDSS (V)	VGSS (V)	ID (A)	P-ch (W)	VGS=10V typ.	VGS=10V max.	VGS=4.5V typ.	VGS=4.5V max.			
1	RJK0210DPA	WPAK (5x6)	25	+16/-12	40	45	4.5	5.4	5.7	7.4	11.8	1.2	0.9
2	RJK0211DPA				30	30	6.8	8.2	8.7	11.3	7.5	0.9	1.3
3	RJK0212DPA				25	30	9.0	10.8	12.0	15.6	5.4	0.6	1.5
4	RJK0225DNS	Mini-HVSON (3.3x3.3)			30	30	5.8	7.3	7.4	9.6	8.5	0.9	2.5

for Hi-Side SW, DC-DC

Development of BEAM (11th generation) series

No.	Part No.	Maximum Rating				RDS (on) (mΩ)				Qgd (nC)	Qg (nC)	Rg (Ω)
		VDSS [V]	VGSS [V]	ID [A]	P-ch [W]	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.			
1	RJK03C0DPA	30	+20/-20V	70	65	1.8	2.5	1.5	2.0	13.7	66	0.75
2	RJK0390DPA			65	60	2.1	2.9	1.7	2.2	11.3	54	0.8
3	RJK0391DPA			50	50	2.8	3.9	2.2	2.9	7.4	34	0.95
4	RJK0392DPA			45	45	3.4	4.8	2.7	3.5	5.9	26	0.8
5	RJK0393DPA			40	40	4.2	5.9	3.3	4.3	4.7	21	1.4
6	RJK0394DPA			35	35	5.3	7.4	4.1	5.3	3.7	15.5	1.4
7	RJK0395DPA			30	30	7.6	10.6	5.9	7.7	2.6	11.0	2.2
8	RJK0396DPA			30	28	9.0	12.6	6.9	9.0	2.2	9	2.5
9	RJK0397DPA			30	25	10.4	14.6	7.8	10.1	1.9	7.4	2.5
10	RJK03B7DPA			30	30	7.7	10.7	6.0	7.8	2.6	11.0	1.0
11	RJK03B8DPA			30	28	9.3	12.9	7.0	9.3	2.2	9	1.2
12	RJK03B9DPA			30	25	10.9	15.1	8.3	10.6	1.9	7.4	1.2

for low-side switch and synchronous rectifier
for high-side switch

BEAM2 series WPAK 5×6mm Note

No.	Part No.	Maximum Rating				RDS (on)				Ciss (pF)
		VDSS (V)	VGSS (V)	ID (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.	
1	RJK03M0DPA	30	+20/-20V	TBD	TBD	2.0	2.6	1.7	2.0	4400
2	RJK03M1DPA			TBD	TBD	2.5	3.3	2.1	2.5	3350
3	RJK03M2DPA			TBD	TBD	3.0	3.9	2.5	3.0	2750
4	RJK03M3DPA			TBD	TBD	4.0	5.2	3.4	4.1	2100
5	RJK03M4DPA			TBD	TBD	5.0	6.5	4.1	4.9	1600
6	RJK03M5DPA	30	+20/-20V	TBD	TBD	7.0	9.1	6.0	7.2	1350
7	RJK03M6DPA			TBD	TBD	10.0	13.0	8.5	10.2	850
8	RJK03M7DPA			TBD	TBD	10.0	13.0	8.3	10.0	840

for Lo-Side SW, Synchronous rectification
for Hi-Side SW, DC-DC

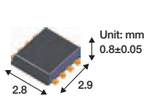
BWAM2 series 3.3×3.3mm Package (HWSON3030-8) Note

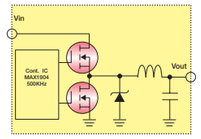
No.	Part No.	Maximum Rating				RDS (on)				Ciss (pF)
		VDSS (V)	VGSS (V)	ID (A)	P-ch (W)	VGS=4.5V typ.	VGS=4.5V max.	VGS=10V typ.	VGS=10V max.	
1	RJK03M8DNS	30	+20/-20V	TBD	TBD	5.5	7.2	4.8	5.8	1850
2	RJK03M5DNS			TBD	TBD	7.0	9.1	6.0	7.2	1350
3	RJK03M6DNS			TBD	TBD	10.2	13.3	8.5	10.2	850
4	RJK03M9DNS			TBD	TBD	12.5	16.3	10.3	12.4	680

Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

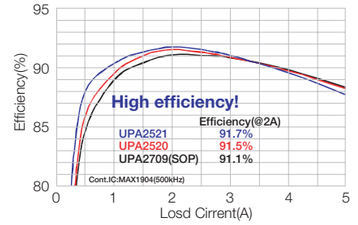
8pin VSOF Nch Single Series

- Features: 1) High-speed switching
  2) Smaller and thinner package than 8-pin SOP
  3) Low on-resistance
  4) Integrated gate protection diode





- Application example
  Losd Current vs. Efficiency (Vin=15V/Vout=3.3V)



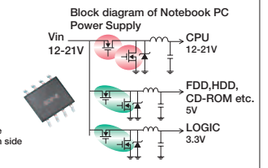
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) @10V	RDS (on) (mΩ) @4.5V	RDS (on) (mΩ) @2.5V	Ciss (pF)	Qg (nC) VGS=5V
UPA2520T1H	Nch	30	±20	±10	13.2	17	–	1000	10.8
UPA2521T1H	Nch	30	±20	±8	16.5	25	–	780	7.6

SOP8 Nch Single Series

- Features:
1) Low-voltage drive
2) Compact, thin package
3) Low on-resistance
4) Integrated gate protection diode

MOSFETs ideal for synchronous rectification power supplies
UPA2709AGR with improved high-speed switching for low side
UPA2707GR with low on-resistance (max. 4.3mΩ@10V) for high side

Block diagram of Notebook PC Power Supply

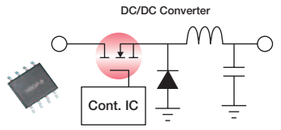


Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.	Ciss (pF)	Ciss (pF)	Qg (nC) VGS=5V	Qgd (nC) VGS=5V
UPA1724G	Nch	20	± 12	± 10	-	8.6/11	11/15	1850	320	18 VGS=4.5V	7.8 VGS=4.5V
UPA1725G	Nch	20	± 12	± 7	-	16.5/21	22/30	950	160	9.6 VGS=4.5V	4.1 VGS=4.5V
UPA1727G	Nch	60	± 20	± 10	14/19	17/22	-	2400	200	45 VGS=10V	13 VGS=10V
UPA1728G	Nch	60	± 20	± 9	19/26	23/29	-	1700	130	31 VGS=10V	9.1 VGS=10V
UPA2709AGR	Nch	30	± 20	± 13	7.9/10.5	10/15	-	1200	110	11	3.3
UPA2720AGR	Nch	30	± 20	± 14	5.5/6.6	7/14 VGS=5V	-	3600	250	28	11
UPA2721AGR	Nch	30	± 20	± 19	3.6/4.3	4.7/10 VGS=5V	-	7100	490	52	20
UPA2728GR	Nch	30	± 20	± 13	8.3/10.5	12/18	-	1020	88	8.8	2.6
UPA2761GR	Nch	30	± 20	± 9	15/18.5	22.5/30	-	550	49	5.2	2.1
UPA2762GR	Nch	30	± 25	± 12	10.6/13.3	16.5/22	-	841	116	7	2.8

SOP8 Pch Single Series

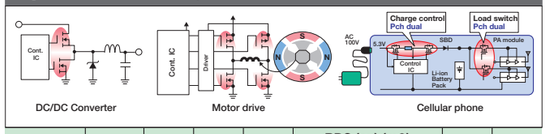
Low on-resistance
UPA2715GR : RDS(on)=3.7mΩ(typ)@10V

High-speed switching
UPA2733GR : Qg=18nC @VGS=10V



Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.	Ciss (pF)	Qg (nC) VGS=10V
UPA2715GR	Pch	-30	20	± 18	3.9/4.6	6.2/9.0	-	3500	118
UPA2716AGR	Pch	-30	± 20	± 14	5.5/7.0	7.3/11.3	-	3000	95
UPA2717AGR	Pch	-30	± 20	± 15	4.7/5.5	6.1/6.9	-	3550	130
UPA2718AGR	Pch	-30	± 20	± 13	7.2/9.0	9.9/14.5	-	2810	67
UPA2719AGR	Pch	-30	± 20	± 10	10/13	14/20.9	-	2010	43
UPA2733GR	Pch	-30	± 20	± 5	30/38	39/53	-	870	18
UPA2734GR	Pch	-30	± 12	± 7	-	30/38	40/72	1050	29.5 VGS=4.5V

8pin VSOF Dual,Pch+Nch Series

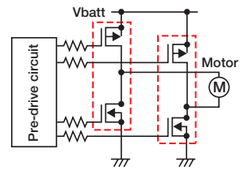


Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) 10V	RDS (on) (mΩ) 4.5V	RDS (on) (mΩ) 2.5V	Ciss (pF)	Qg (nC) VGS=5V
UPA2550T1H	Pch Dual	-12	±8	±5	-	40	60	930	8.7
UPA2560T1H	Nch Dual	30	±20	±4.5	50	83	-	310	6.6
UPA2561T1H	Nch Dual	20	±12	±4.5	-	50	65	415	5.4
UPA2562T1H	Nch Dual	30	±12	±4.5	-	55	70	405	6.1
UPA2590T1H	Nch	30	±20	±4.5	50	83	-	310	6.6
	Pch	-30	±20	±4.5	72	105	-	310	7.5
UPA2591T1H	Nch	30	±12	±4.0	-	55	70	405	6.1
	Pch	-30	±12	±3.0	-	88	150	450	5.2
UPA2592T1H	Nch	20	±12	±4.0	-	50	65	415	5.4
	Pch	-20	±12	±3.0	-	80	140	450	5.2
UPA2593T1H	Nch	40	±20	±4.5	65	125	-	310	6.6
	Pch	-40	±20	±4.5	150	200	-	310	7.5

SOP8 Complementary Series

- Features:
1) Small surface mount package
2) Low on-resistance
3) Logic drive type (4.5V drive)
4) Low Ciss
5) Integrated gate protection Zener diode

Application example (DC motor drive)



Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.	Ciss (pF)	Qg (nC) VGS=10V
UPA1792G	Nch	30	± 20	± 6.8	20.5/26	27/36	-	760	14
	Pch	-30	± 20	± 5.8	30/36	43/54	-	900	17
UPA1793G	Nch	20	± 12	± 3	-	55/69	78/107	160	3.1 VGS=4V
	Pch	-20	± 12	± 3	-	75/115	116/190	370	3.4 VGS=4V
UPA2790GR	Nch	30	± 20	± 6.8	21/28	28/40	-	500	12.6
	Pch	-30	± 20	± 6.8	43/60	58/80	-	460	11
UPA2791GR	Nch	30	± 20	± 5	28.5/36	36/50	-	400	10
	Pch	-30	± 20	± 5	63/82	79/110	-	300	8.3
UPA2792AGR	Nch	30	± 20	± 10	10/12.5	14.5/21	-	2200	42
	Pch	-30	± 20	± 10	14/18	17.5/26	-	2200	47
UPA2793AGR	Nch	40	± 20	± 7	12/15	16.5/23	-	2200	40
	Pch	-40	± 20	± 7	21/26	24/36	-	2200	45
UPA2794AGR	Nch	60	± 20	± 5.5	19.5/25	23/33	-	2200	41
	Pch	-60	± 20	± 5.5	33/43	36/54	-	2200	45

Power MOSFETs

Low-Voltage Power MOSFETs

P-Channel MOSFET Series

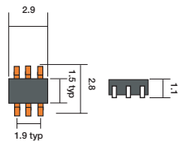
- Features
  - Ultra-low RDS(on),
    HAT1125H RDS(on) = 2.7mΩ
- Applications
  - Li-ion battery protection circuits, load switches, notebook PC chargers

No.	Part No.	Package	V_{DSS} [V]	V_{GSS} [V]	I_D [A]	4.5V R_{DS}(on) typ. (mΩ)	4.5V R_{DS}(on) max. (mΩ)	10V R_{DS}(on) typ. (mΩ)	10V R_{DS}(on) max. (mΩ)	Qg (nC)	Qgd (nC)
1	HAT1125H	LFPAK	30	+10/-20	-45	4.1	5.9	2.7	3.6	165	40
2	HAT1127H	LFPAK	30	+10/-20	-40	6.0	8.6	3.6	4.5	125	28
3	RJJ0315DSP	SOP-8	30	+10/-20	-16	7.2	10.5	5.2	6.5	48	20
4	RJJ0318DSP	SOP-8	30	+10/-20	-12	14.0	22.0	9.5	12.0	22	10
5	RJJ0319DSP	SOP-8	30	+10/-20	-10	19.0	28.0	12.5	15.5	17	5.5
6	RJJ0315DPA	WPAK	30	+10/-20	-35	6.8	10.0	4.8	5.9	48	20

SC-95 Dual Series

- Features
  Low on-resistance, low Qg

6pin type SC-95



Application example (DC motor drive)
Pre-drive circuit

Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max	VGS=4.5V typ./max	VGS=2.5V typ./max	VGS=1.8V typ./max	Ciss (pF)	Qg (nC) VGS=5V
UPA1970	Nch Dual	20	±12	±2.2	-	55/69	80/107	-	160	2.3
UPA1950	Pch Dual	-12	±8	±2.5	-	105/130	160/205	225/375	220	1.9
UPA1951	Pch Dual	-12	±8	±2.5	-	70/88	100/133	140/234	270	2.4
UPA1952	Pch Dual	-20	±8	±2.0	-	108/135	137/183	170/284	272	2.3

SC-95 Single Series

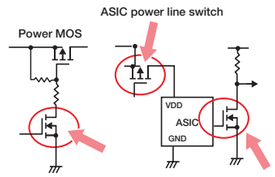
Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max	VGS=4.5V typ./max	VGS=2.5V typ./max	VGS=1.8V typ./max	Ciss (pF)	Qg (nC) VGS=5V
UPA1901	Nch Single	30	±12	±6.5	-	31/39	40/54	-	470	5.4
UPA1902	Nch Single	30	±20	±7.0	17/22	22/30	-	-	780	15
UPA1912	Pch Single	-12	±10	±4.5	-	39/50	53/70		810	5.6
UPA1916	Pch Single	-12	±8	±4.5	-	30/39	41/55	59/98	950	8.0
UPA1917	Pch Single	-20	±8	±6.0	-	42/53	52/70	64/107	835	8.0
UPA1911A	Pch Single	-20	±12	±2.5	-	82/115	122/190	-	370	2.3
UPA1913	Pch Single	-20	±12	±4.5	-	44/55	66/90	-	700	6.0
UPA1915	Pch Single	-20	±12	±4.5	-	45/55	67/90	-	820	5.0
UPA1919	Pch Single	-20	±12	±6.0	-	46/58	63/84	-	680	6.0
UPA1914	Pch Single	-30	±20	±4.5	43/57	58/86	-	-	589	11.0
UPA1930	Pch Single	-30	±20	±4.5	58/77	77/100	-	-	325	7.5
UPA1918	Pch Single	-60	±20	±3.5	114/143	134/179	-	-	666	12
UPA1931	Pch Single	-40	±20	±4.5	44/65	53/100	-	-	115	20
UPA1932	Pch Single	-30	±20	±6.0	30/38	36/59	-	-	950	20

SC-96 Series

Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ./max	VGS=4.5V typ./max	VGS=2.5V typ./max	VGS=1.8V typ./max	Ciss (pF)	Qg (nC) VGS=4V
N0300N	Nch	30	±20	±4.5	38/50	48/83	-	-	350	7.4 VGS=4.5V
N2500N	Nch	250	±12	±0.5	-	4200/5800	4300/6600	-	145	7.4 VGS=4.5V
2SK3408	Nch	43±5	±20	±1.0	155 / 195	185 / 250	-	-	230	4 VGS=10V
2SK3576	Nch	20	±12	±4.0	-	40 / 50	56 / 75	-	250	3.3
2SK3577	Nch	30	±12	±3.5	-	50 / 63	68 / 91	-	260	3
2SK4035	Nch	250	±30	±0.5	3200 /4500	-	-	-	74	4 VGS=10V
2SK4147	Nch	250	±20	±0.5	3600 /4500	3600 / 5200	-	-	120	5.5 VGS=10V
N0300P	Pch	30	±20	±4.5	56/72	75/105	-	-	345	8.3 VGS=10V
2SJ557A	Pch	-30	±20	±2.5	75/100	91/134	-	-	315	3.2
2SJ621	Pch	-12	±8	±3.5	-	35/44	46/62	63/105	630	6.2
2SJ624	Pch	-20	±8	±4.5	-	43/54	53/71	65/108	813	8.1
2SJ625	Pch	-20	±8	±3.0	-	90/113	128/171	188/314	348	2.6
2SJ626	Pch	-60	±20	±1.5	310/388	385/514	-	-	255	8.2 VGS=10V
2SJ690	Pch	-30	±12	±2.5	-	87/119	120/217	-	450	5.2 VGS=4.5V

SOT-23F Series

- Features
  1) Mounting pad compatible with SOT-23
  2) Thin package (t = 0.8mm)
  3) Suitable replacement for SC-62, etc.



Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=10V typ	VGS=4.5V typ	VGS=2.5V typ	VGS=1.8V typ	Ciss (pF)	Qg (nC)
N0100P	Pch	-12	±8	±3.5	-	44	62	105	720	7.4
N0301P	Pch	-30	±12	±4.5	-	75	106	-	780	8.7
N0302P	Pch	-30	±20	±4.4	54	77	-	-	620	6.8
N0301N	Nch	30	±20	±4.5	36	50	-	-	400	4.3

2×2 package series Note

Type No.	Polarity	VDSS (V)	VGSS (V)	ID(DC) (A)	Ron typ./max. VGS=4.5V	VGS=2.5V	VGS=1.8V
uPA2672	Pch-Dual	-12V	10V	-4.0A	48/60mΩ	68/92mΩ	112/179mΩ
uPA2670	Pch-Dual	-20V	10V	-4.0A	61/77mΩ	76/102mΩ	122/196mΩ
uPA2630	Pch-Single	-12V	8V	-7.0A	15/18mΩ	21/28mΩ	35/56mΩ
uPA2631	Pch-Single	-20V	8V	-7.0A	20/24mΩ	24/33mΩ	39/62mΩ
uPA2600	Nch-Single	20V	12V	7.0A	8/10mΩ	12/16mΩ	-
uPA2601	Nch-Single	30V	20V	7.0A	12/16mΩ	-	-

Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

Low-Voltage Drive Low-Power MOSFET Series

Product Concept

While responding to recent market demand for low-voltage controller ICs of various types, Renesas Electronics develops FET products that keep both the voltage tolerance of earlier products and enable low-voltage gate drive.

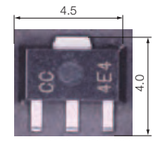
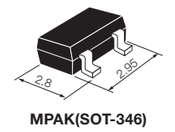
Features

- VDSS of 60V and gate drive voltage of 2.5V
  Voltage tolerance of 60V and lower drive voltage (drive voltage: 4.5V→2.5V)
  - Support for 3.3V MCUs
- Small, general-purpose packages Two packages with long histories
  - UPAK: High-power, Pch: 1.5W
  - MPAK: Smallest package suitable for flow mounting
- Environmentally friendly, completely lead-free Completely lead-free, including die bonding
  - RoHS Directive compliant

Main Applications

Ideal for applications requiring compact, low-loss, high-efficiency devices
- Compact motor drive control switching applications
- Compact DC/DC converter switching applications

Package Dimensions

Package (mm)	UPAK(SOT-89)	MPAK(SOT-346)
		
Mount area(mm²)	18	8
Max.height Max. (mm)	1.6	1.3
Pch(W)	1.5	0.8

UPAK Lineup

No.	Package	Part No.	Maximum Rating V_{DSS} (V)	Maximum Rating V_{GSS} (V)	Maximum Rating I_D (A)	RDS (on) (mΩ) VGS=10V Typ.	VGS=10V Max.	VGS=4.5V Typ.	VGS=4.5V Max.	VGS=2.5V Typ.	VGS=2.5V Max.	Ciss (pF)	mark
1	UPAK	RQK0601AGDQS	60	±20	5.0	56	70	65	91	-	-	540	AG
2	UPAK	RQK0603CGDQS	60	±20	2.8	205	257	240	336	-	-	130	CG
3	UPAK	RQK0609CQDQS	60	±12	4.0	-	-	78	100	90	125	470	CQ
4	UPAK	RQK0608BQDQS	60	±12	3.2	-	-	120	155	140	195	300	BQ
5	UPAK	RQK0607AQDQS	60	±12	2.4	-	-	210	270	250	350	170	AQ
6	UPAK	RQJ0601DGDQS	-60	+10/-20	-2.8	124	155	150	210	-	-	590	DG
7	UPAK	RQJ0602EGDQS	-60	+10/-20	-1.5	485	607	620	868	-	-	135	EG
8	UPAK	RQK0301FGDQS	30	±20	3.0	28	35	35	49	-	-	750	FG
9	UPAK	RQK0302GGDQS	30	±20	3.8	81	102	107	150	-	-	170	GG
10	UPAK	RQJ0301HGDQS	-30	+10/-20	-5.2	38	48	56	79	-	-	845	HG
11	UPAK	RQJ0306FQDQS	-30	+8/-12	-4.0	-	-	75	95	120	165	510	FQ
12	UPAK	RQJ0305EQDQS	-30	+8/-12	-3.4	-	-	110	140	165	230	330	EQ
13	UPAK	RQJ0304DQDQS	-30	+8/-12	-2.6	-	-	195	245	300	420	185	DQ

MPAK Lineup

No.	Package	Part No.	Maximum Rating V_{DSS} (V)	Maximum Rating V_{GSS} (V)	Maximum Rating I_D (A)	RDS (on) (mΩ) VGS=10V Typ.	VGS=10V Max.	VGS=4.5V Typ.	VGS=4.5V Max.	VGS=2.5V Typ.	VGS=2.5V Max.	Ciss (pF)	mark
1	MPAK	RQK2501YGDQA	250	±10	0.4	-	-	(4000)	(5400)	4100	5600	80	YG
2	MPAK	RQK2001HQDQA	200	±30	0.4	5000	6700	-	-	-	-	30	HQ
3	MPAK	RQK0605JGDQA	60	±20	3.1	82	103	93	131	-	-	405	JG
4	MPAK	RQK0603CGDQA	60	±20	2.0	212	265	248	348	-	-	130	CG
5	MPAK	RQK0604IGDQA	60	±12	2.0	-	-	111	144	129	180	320	IG
6	MPAK	RQK0606KGDQA	60	±12	1.5	-	-	173	225	207	290	200	KG
7	MPAK	RQJ0603LGDQA	-60	+10/-20	-1.8	158	198	196	275	-	-	440	LG
8	MPAK	RQJ0602EGDQA	-60	+10/-20	-1.1	490	613	613	854	-	-	145	EG
9	MPAK	RQK0303MGDQA	30	±20	3.7	42	53	50	70	-	-	550	MG
10	MPAK	RQK0302GGDQA	30	±20	2.7	92	115	122	171	-	-	175	GG
11	MPAK	RQJ0303PGDQA	-30	+10/-20	-3.3	54	68	76	107	-	-	625	PG
12	MPAK	RQJ0306FQDQA	-30	+8/-12	-3.0	-	-	75	95	120	165	510	FQ
13	MPAK	RQJ0305EQDQA	-30	+8/-12	-2.4	-	-	110	140	165	230	330	EQ
14	MPAK	RQJ0302NGDQA	-30	+10/-20	-2.2	138	173	216	303	-	-	195	NG
15	MPAK	RQJ0304DQDQA	-30	+8/-12	-1.8	-	-	195	245	300	420	185	DQ
16	MPAK	RQK0201QGDQA	20	±12	4.5	-	-	30	39	38	53	479	QG
17	MPAK	RQK0202RGDQA	20	±12	3.8	-	-	42	55	62	85	293	RG
18	MPAK	RQK0203SGDQA	20	±12	2.9	-	-	68	90	105	150	159	SG
19	MPAK	RQK0204TGDQA	20	±12	2.3	-	-	100	130	146	204	127	TG
20	MPAK	RQJ0201UGDQA	-20	±12	-3.4	-	-	53	69	80	112	597	UG
21	MPAK	RQJ0202VGDQA	-20	±12	-2.7	-	-	83	105	124	170	365	VG
22	MPAK	RQJ0203WGDQA	-20	±12	-2.1	-	-	142	180	216	300	205	WG
23	MPAK	RQJ0204XGDQA	-20	±12	-1.6	-	-	219	280	363	510	153	XG

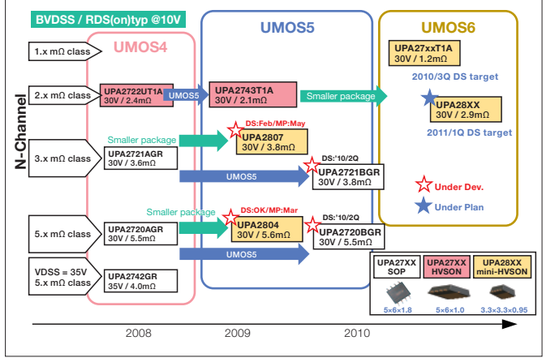
Note: The parentheses represents value of VGS = 4 V.

Power MOSFETs

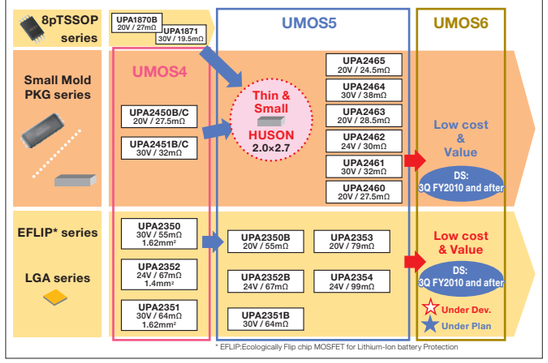
Low-Voltage Power MOSFETs

Power MOSFETs for Lithium-Ion Battery Protection Circuits

Lithium-Ion Battery Product Roadmap (for Notebook PCs)

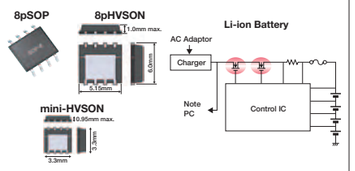


Lithium-Ion Battery Product Roadmap (for Mobile Phones)



N-Channel Series for Charge/Discharge Control

- Feature
  1) VDSS: 30V and 35V
  2) Compact, thin package
  3) Low on-resistance
  4) RoHS compliant, halogen free



Type No.	Package	VDSS (V)	VGSS (V)	ID(DC) (A)	ID (PULES) (A)	RDS (on) (mΩ) VGS=10V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	Ciss (pF)	Qg (nC) VGS=5V
UPA2743T1A	8pHVSON	30	± 20	± 29	± 170	2.1/3.3	3.1/4.6	5080	39
UPA2742GR	8pSOP	35	± 25	± 17	± 150	4.0/4.8	4.7/8.0 VGS=5V	4600	43
UPA2804T1L	mini-HVSON	30	± 20	± 28	± 115	5.6/6.8	8.2/13.9	1850	15
UPA2807T1L	mini-HVSON	30	± 20	± 34	± 150	3.8/4.6	6.0/10	2400	21
UPA2720CGR Note	8pSOP	30	±20	± 12		5/6	8.5/14.5	2450	TBD
UPA2721CGR Note		30	±20	± 16		3.4/4.3	7.5/12.5	3800	TBD
UPA2820T1S Note	HWSON8	30	±20	± 22		4.2/5.3	9/15	2490	TBD
UPA2821T1L Note	Mini-HVSON	30	±20	± 26		3.3/4.2	7/12	2720	TBD
UPA2822T1L Note		30	±20	± 34		2.3/2.8	4.2/7	4780	TBD

Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

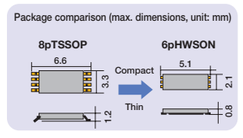
TSSOP,HWSON Series

- Features Compact, thin (HWSON)

	Footprint	Height
8pTSSOP	21.8mm²	1.2mm MAX
6pHWSON	10.7mm²	0.8mm MAX

Heat resistance comparable to earlier 8-pin TSSOP (flat drain contact configuration)
Low on-resistance

High ID (pulse) tolerance



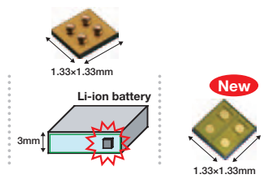
Type No.	Polarity	Drain	VDSS (V)	VGSS (V)	ID(DC) (A)	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=4.5V typ./max.	RDS (on) (mΩ) VGS=2.5V typ./max.
UPA1870B	8pTSSOP	Commom	20	± 12	± 6.0	16.0/20.0	15.5/21.0	20.0/27.0
UPA1871	8pTSSOP	Commom	30	± 12	± 6.0	20.5/26.0	21.5/27.0	27.8/38.0
UPA1872B*1	8pTSSOP	Commom	20	± 12	± 10.0	10.0/13.0	10.5/13.5	13.0/18.0
UPA1873	8pTSSOP	Commom	20	± 12	± 6.0	18.0/23.0	19.0/24.0	24.5/29.0
UPA1874B*1	8pTSSOP	Commom	30	± 12	± 8.0	11.5/14.0	12.0/14.5	15.0/19.5
UPA2450B*1	6pHWSON	Commom	20	± 12	± 8.6	12.5/17.5	13.0/18.5	18.0/27.5
UPA2451B*1	6pHWSON	Commom	30	± 12	± 8.2	15.0/20.0	15.5/21.0	22.0/32.0
UPA2450C*1	6pHWSON	Commom	20	± 12	± 8.6	12.5/17.5	13.0/18.5	18.0/27.5
UPA2451C*1	6pHWSON	Commom	30	± 12	± 8.2	17.5/20.0	18.0/21.0	25.5/32.0
UPA2452*1	6pHWSON	Commom	24	± 12	± 7.8	17.5/21.5	18.5/22.5	25.0/30.0
UPA2454	6pHWSON	Commom	24	± 12	± 15.0	8.0/10.0	8.3/10.5	12.5/15.5
UPA2455	6pHWSON	Commom	30	± 12	± 15.0	9.5/12.0	10.0/13.0	13.0/18.0

*1:Wireless bonding product

EFLIP UMOS5 Series

Ecologically Flip chip MOSFET for Lithium-Ion battery Protection (EFLIP)

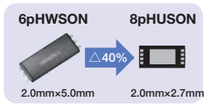
- Features:
  Minimizes the size of the battery protection MOSFET.
  1) Compact: 1.47mm × 1.47mm
     1.33mm × 1.33mm
  2) Internal drain connection (common drain)
  3) Lead-free solder bumps or LGA
  4) On-resistance comparable to 6-pin HWSON



Type No.	Polarity	Outline	VDSS (V)	VGSS (V)	RDS (on) (mΩ) VGS=4.5V typ./max	RDS (on) (mΩ) VGS=3.1V typ./max	RDS (on) (mΩ) VGS=2.5V typ./max	RDS (on) (mΩ) VGS=1.8V typ./max
UPA2350BT1G	1.47mm□	4pEFLIP -BGA	20	±12	27/35	32/44	40/55	-
UPA2352BT1G	1.33mm□		24	±12	35/43	43/55	55/67	-
UPA2353T1G	1.47mm□		20	±8	29/31	31/38	34/43	44/79
UPA2354T1G	1.33mm□		24	±8	35/42	40/49	43/57	57/99
UPA2350BT1P	1.47mm□	4pEFLIP -LGA	20	±12	27/35	32/44	40/55	-
UPA2352BT1P	1.33mm□		24	±12	35/43	43/55	55/67	-
UPA2351BT1P	1.47mm□		30	±12	32/40	37/50	45/64	-
UPA2353T1P	1.47mm□		20	±8	29/31	31/38	34/43	44/79
UPA2354T1P	1.33mm□		24	±8	35/42	40/49	43/57	57/99

8pin HUSON(2720) Series

- Features
  Successor to 6-pin HWSON
  More compact and thin (than 6-pin HWSON)
  CSP package for easy assembly
  Halogen-free
  Common drain



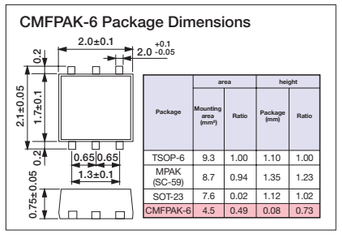
Item	UPA2460	UPA2461	UPA2462	UPA2463	UPA2464	UPA2465
Size	2.0×2.7	2.0×2.7	2.0×2.7	2.0×2.7	2.0×2.7	2.0×2.7
VDSS-V	20	30	24	20	30	20
VGSS-V	+/-12	+/-12	+/-12	+/-12	+/-12	+/-12
Rds(on)-mohm atVGS=4.5V	11.0/14.5/17.5	12.0/17.5/21.5	12.0/16.0/21.5	12.0/16.0/20.0	15.0/20.0/26.0	9.5/13.5/16.5
Rds(on)-mohm atVGS=4.0V	11.5/15.0/18.5	12.5/18.0/22.0	12.5/16.5/22.5	13.0/16.5/21.0	16.0/20.5/27.0	10.5/14/17
Rds(on)-mohm atVGS=3.1V	12.0/16.0/22.0	14.0/19.5/25.0	14.5/18.0/26.5	13.5/18.0/24.0	17.0/22.0/30.0	12/16/22
Rds(on)-mohm atVGS=2.5V	15.3/18.5/27.5	15.5/22.0/32.0	15.5/21.0/30.0	15.0/21.0/28.5	19.0/25.5/38.0	14/18/24.5
	UPA2450B compatible	UPA2451B compatible	UPA2452 compatible	UPA1870B compatible	UPA1871 compatible	

Next-Generation Compact, Low-Loss MOSFET CMFPAK-6 Series

Power MOSFET in a CMFPAK-6 package
- Gate drive voltage: 1.8V to 2.5V available
- Pch/Nch products fabricated using D8 process
- Ideal for voltage step-up/step-down DC/DC converters and power management circuits for mobile devices (compact electronic products)

Main Applications
- Digital Still cameras
- Mobile phones
- Mobile information terminals, etc.

CMFPAK-6 Package Dimensions



Package	area Mounting area (mm²)	area Ratio	height Package (mm)	height Ratio
TSOP-6	9.3	1.00	1.10	1.00
MPAK (SC-59)	8.7	0.94	1.35	1.23
SOT-23	7.6	0.02	1.12	1.02
CMFPAK-6	4.5	0.49	0.08	0.73

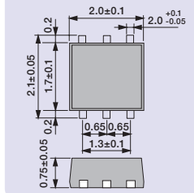
Lineup

Polarity	Part No.	(V) Drive Voltage	Absolute Maximum Rating VDSS (V)	Absolute Maximum Rating VGSS (V)	Absolute Maximum Rating ID (A)	Electrical Characteristics RDS (on) (mΩ) at 10V	Electrical Characteristics RDS (on) (mΩ) at 4.5V	Electrical Characteristics RDS (on) (mΩ) at 2.5V	Electrical Characteristics RDS (on) (mΩ) at 1.8V	Ciss (pF)	Marking
P	HAT1069C	1.8	-12	±8	-4.0	-	38/52	48/70	60/93	1380	VY-
	HAT1093C				3.0	-	41/54	54/76	85/128	940	VM-
	HAT1094C				-2.5	-	67/88	90/126	128/192	530	VN-
	HAT1095C				-2.0	-	108/140	146/205	225/337	290	VP-
	RJJ0102DQM				-1.2	-	265/315	400/535	625/930	123	TBD
	HAT1090C	2.5	-20	±12	-2.5	-	50/65	74/104	-	590	VJ-
	HAT1089C				-2.0	-	79/103	120/168	-	365	VK-
	HAT1091C				-1.5	-	134/175	205/287	-	200	VL-
	HAT1096C				-1.0	-	225/293	380/530	-	155	VQ-
	HAT1108C	4.5	-30	+20/-10	-1.5	155/194	245/356	-	-	160	VZ-
	HAT1142C		-60		-3.0	50/63	75/109	-	-	505	TBD
	HAT1111C				-2.0	245/307	310/450	-	-	290	UA-
	HAT1141C		-80		-0.8	800/1050	1020/1380	-	-	170	UM-
N	HAT2204C	1.8	12	±8	3.5	-	26/34	34/44	45/69	770	VU-
	HAT2205C				3	-	38/50	48/67	65/97	430	VV-
	HAT2206C				2	-	65/85	81/114	113/170	260	VW-
	HAT2202C	2.5	20	±12	3	-	31/40	43/55	-	520	VR-
	HAT2196C				2.5	-	45/58	66/93	-	270	VS-
	HAT2203C				2	-	69/90	107/150	-	165	VT-
	HAT2207C				1.5	-	100/130	140/210	-	135	VX-
	HAT2268C	4.5	30	+20/-10	4.0	27/34	37/54	-	-	440	UN-
	HAT2221C				1.5	120/150	160/235	-	-	110	UC-
	HAT2240C	2.5	60	±12	2.5	-	75/98	85/119	-	590	UK-
	HAT2281C				2.0	-	120/156	140/196	-	350	UH-
	HAT2282C				1.5	-	195/254	240/336	-	210	UJ-
	HAT2217C	4.5		+20/-10	3.0	105/132	126/183	-	-	275	UB-

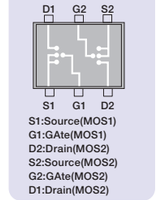
CMFPAK-6 Composite Power MOSFETs

- Features
  - Composite type (N-channel composite, P-channel composite, N-channel + P-channel)
  - Low drive voltage (1.8V, 2.5V)
  - Compact package (CMFPAK-6)
  - High-speed switching
- Applications
  - DC-DC converters
  - Power management switches

Package dimensions



Pin assignments



Polarity	Part No.	Drive Voltage (V)	Maximum Rating VDSS (V)	Maximum Rating VGSS (V)	Maximum Rating ID (A)	Electrical Characteristics RDS (on) (mΩ)(typ./max.) VGS=4.5V	VGS=2.5V	VGS=1.8V	Ciss (pF)
P-ch (Dual)	HAT1146C	1.8	-12	±8	-1.2	265/330	400/565	625/1130	125
	HAT1147C	2.5	-20	±12	-1.0	340/440	575/960	-	85
N-ch (Dual)	HAT2291C	1.8	12	±8	1.8	150/200	200/290	265/440	100
	HAT2292C	2.5	20	±12	1.5	165/215	255/370	-	73
	HAT2286C		60		0.9	460/595	560/770	-	80
N-ch+P-ch	HAT3042C	1.8	12	±8	1.8	150/200	220/290	265/440	100
			-12		-1.2	265/330	400/565	625/1130	125
	HAT3043C	2.5	20	±12	1.5	165/215	255/370	-	73
			-20		-1.0	340/440	575/960	-	85

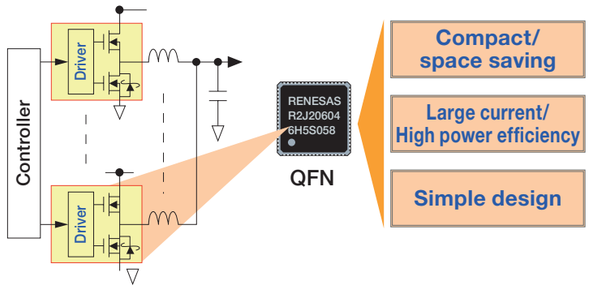
Power MOSFETs

Low-Voltage Power MOSFETs

IC-MOSFET Integrated SiP Product Series

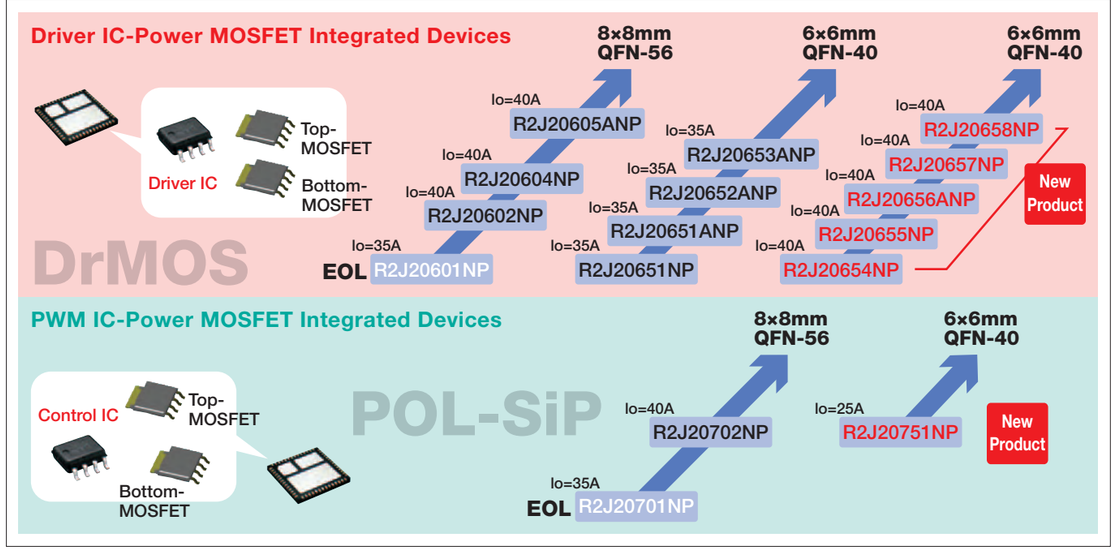
Renesas Electronics offers SiP products with integrated MOSFETs to enable easy configuration of high-performance multi-phase power supplies. They combine in a single package either controller, driver, and MOSFETs or driver and MOSFETs. These products make it easy to build a high-performance DC/DC converter while reducing stray capacitance and inductance, and achieving higher mounting density.

Multi-Phase Power Supply Configuration Example



Wireless package structure for improved performance

Renesas Integrated Power Device Product Families



IC-MOSFET Integrated SiP Products

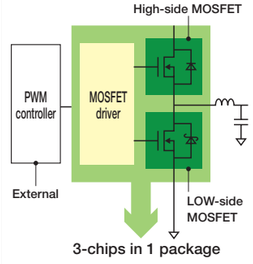
Part No.	Function	Vin(V)	Vout(V)	Iout Max. (A)	PWM Input (V)	Fmax. (MHz)	Tj-opr (°C)	Pin count	Package	Remarks
R2J20702NP	POL-SiP	Up to 16	40	40	-	1.0	-40 to +150	56	QFN-56	Built in PWM controller MOSFETs for Switching
R2J20751NP	POL-SiP	Up to 27	25	25	-	1.0	-40 to +150	40	QFN-40	Built in PWM controller MOSFETs for Switching
R2J20602NP	DrMOS	Up to 16	40	40	5.0	2.0	-40 to +150	56	QFN-56	Built in Driver MOSFETs for Switching
R2J20604NP	DrMOS	Up to 16	40	40	3.3/5.0	2.0	-40 to +150	56	QFN-56	Built in Driver MOSFETs for Switching
R2J20605ANP	DrMOS	Up to 27	40	40	5.0	2.0	-40 to +150	56	QFN-56	Built in Driver MOSFETs for Switching
R2J20651NP	DrMOS	Up to 16	35	35	3.3/5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20651ANP	DrMOS	Up to 16	35	35	5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20653ANP	DrMOS	Up to 27	35	35	5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20654NP	DrMOS	Up to 20	40	40	3.3/5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20655NP	DrMOS	Up to 27	35	35	3.3/5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20656ANP	DrMOS	Up to 27	35	35	5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20657NP	DrMOS	Up to 20	40	40	3.3/5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching
R2J20658NP	DrMOS	Up to 20	40	40	3.3/5.0	2.0	-40 to +150	40	QFN-40	Built in Driver MOSFETs for Switching

SiP Products with Various Types of Integrated MOSFETs

Renesas Integrated Power Device Product Families

Driver IC Power MOSFET Driver IC-integrated devices

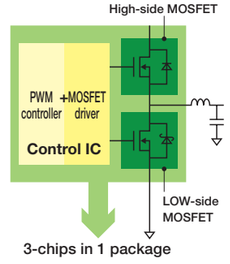
DrMOS



Main applications: CPUs and GPUs (large current, 40A to 200A)

PWM IC Power MOSFET Driver IC-integrated devices

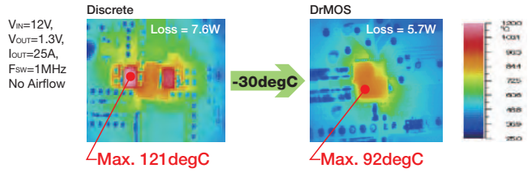
POL-SiP



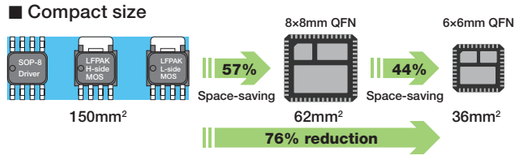
Main applications: DDR Memory and FPGA (medium current, 5A to 40A)

Advantages of DrMOS

■ High efficiency/low heat generation

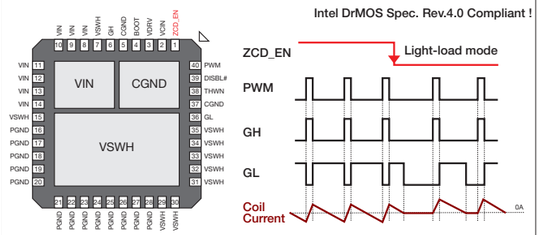


■ Compact size



DrMOS (R2J20656ANP)

Zero Current Detection



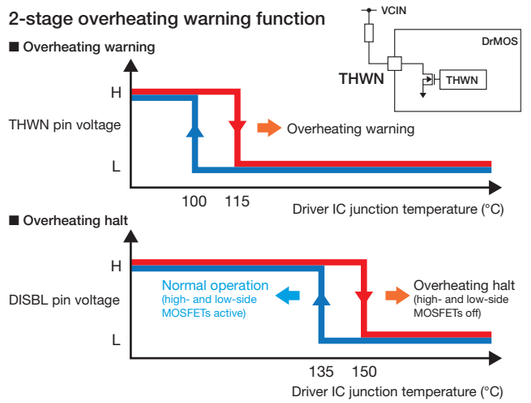
Notes: - ZCD_EN pin low: DCM mode and ZCD enabled
- ZCD_EN pin high: CCM mode and ZCD disabled
- ZCD_EN pin open: CCM mode and ZCD disabled

Light-load mode

Automatically detects when inductor current is zero andturns offlow-side FET.

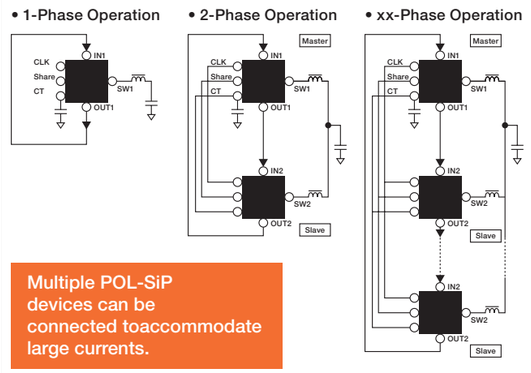
On-Chip Protection Function

2-stage overheating warning function



R2J20751NP(6×6mm□) Concept

■ Scalability concept

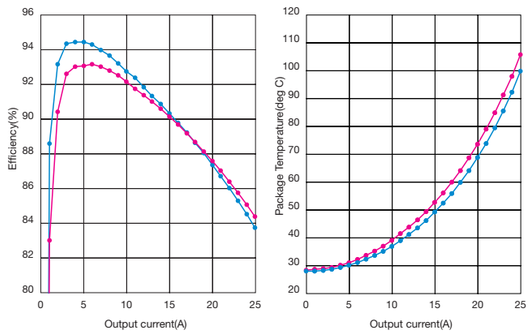


Multiple POL-SiP devices can be connected toaccommodate large currents.

R2J20751NP(6×6mm□) Performance

■ Efficiency curve (single-phase EVB)

Vout=1.5V,Fsw=300kHz , L=0.47uH , Cout=600uF , No air-flow

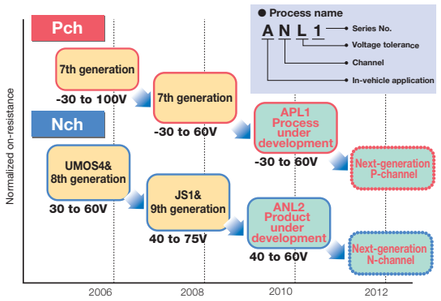


Automotive Power Devices 1

Demand for power devices with superior performance, high efficiency, and excellent functionality is growing among manufacturers of next-generation automobiles and electrical systems striving to achieve advances in environmental performance, energy efficiency, improved safety, enhanced convenience, and reduced space requirements. Aware of these requirements and the demand in this market for trustworthiness and ultrahigh reliability, Renesas Electronics designs, develops, and manufactures products that deliver an exceptionally high level of quality and reliability. Like other electronic devices, products for the automotive field must combine compact size and low on-resistance. Renesas Electronics achieves on-resistance specs among the lowest in the world through the use of ultrafine technology, such as our 0.25µ UMOS4 process employing the latest trench technology, and package technology utilizing a new multi-bonding mount technology. Our extensive lineup of automotive power devices driven by “intelligent technology” delivers performance to match the most demanding specifications.

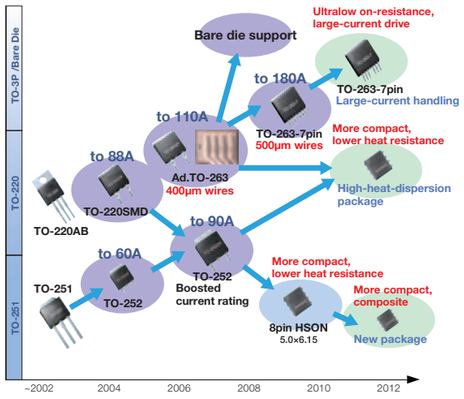
Process Trend of Low-Voltage Power MOSFETs for Automotive Applications

Achieving low on-resistance
by optimizing the trench structure



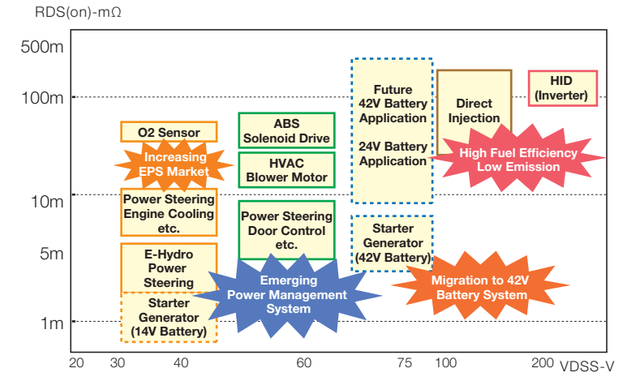
Since automotive power MOSFETs perform large-current drive control in high-temperature environments, low on-resistance is a key performance factor. In recent years, as PWM support and compatibility with a wider range of power supplies become more important, attention has also begun to focus on switching performance. Renesas Electronics is continuously working to develop new high-performance fabrication processes to deliver ultralow on-resistance and low gate capacitance in response to these technical trends. In addition, many years of experience enable us to design products with high breakdown tolerance and high reliability that customers can have confidence in.

Automotive Power Device Package Evolution



Renesas Electronics supplies power MOSFET products for automotive electrical systems in a wide variety of packages to accommodate implementations ranging from large-current applications such as electric power steering to medium-current applications such as engine control. To meet the diverse requirements of our customers, we develop high-performance power devices with power packages employing the latest assembly technology. Multi-wire bonding is used to provide large-current capabilities for applications such as electric power steering. For medium-current applications such as engine control, new packages such as the 8-pin HSON provide smaller size and reduced mounting area.

Map of Automotive Electrical System Applications



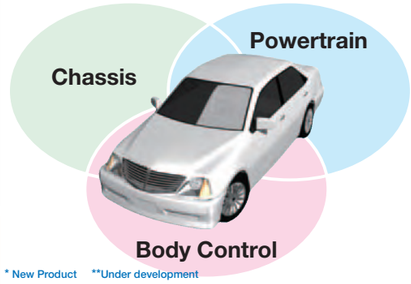
Automotive Electrical System Application Examples

Pump Driver
NP55N04SUG
NP55N055SUG
NP35N04YUG*
NP50N04YUK**

Engine Control
NP23N06YDG*
NP33N06YDG*
NP28N10SDE*
NP20N10YDF**
NP32N055SHE
RJM0404JSC
RJM0603JSC
RJK2061JPE

Fan Motor
NP90N04MUG
NP88N04NUG
NP82N04MUG

Battery Management
Pch Series



* New Product **Under development

EPS, EHPS
NP88N04NUG
NP90N04VUG
NP109N04PUJ
NP160N04TUJ*
NP109N04PUK*
NP160N04TUK*

ABS - F/S SW
NP35N04YUG (F/S)*
NP55N055SDG (F/S)
NP110N04PUJ (pump)

ISG
NP180N04TUJ*
NP180N055TUJ*
NP180N04TUK*
NP180N055TUK*

HVAC
NP90N04MUG
NP82N04MUG
NP80N06MLG

Wiper
NP82N04PUG
NP90N04VUG
NP75N04YUG*

Light
NP55N03SUG
NP70N10KUF
NP36N10SDE*

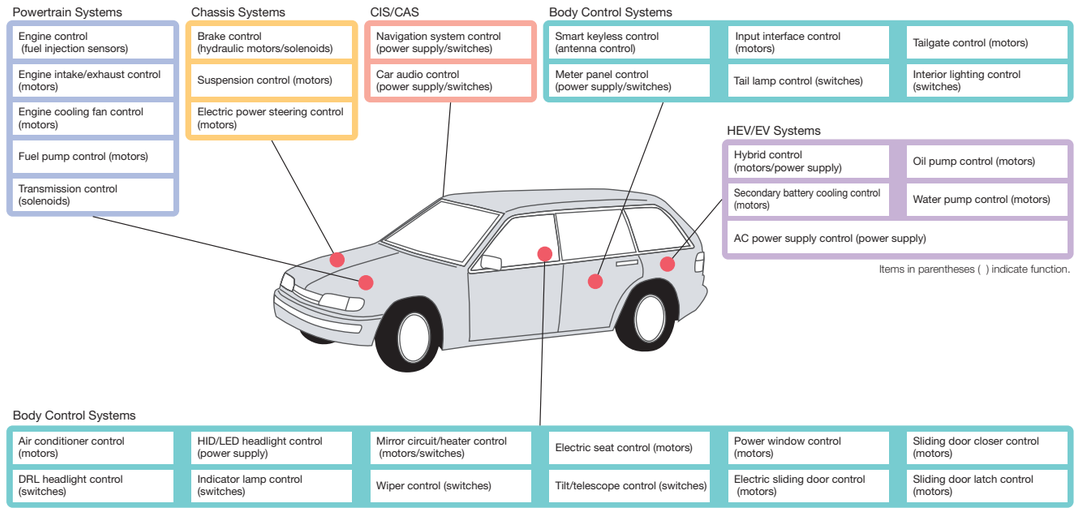
Power Window
NP55N04SUG
NP55N055SUG
NP90N055VDG

Junction Box
NP36N055SHE
NP55N055SUG
NP55N04SUG

Automotive Power Devices 2

Main Applications for Automotive Power Devices

Power devices are used in a variety of applications.



Power MOSFETs

Automotive Power Devices

NP Series

NP Series features
The new NP Series joins the earlier 2SK Series and 2SJ Series for automotive applications and provides guaranteed operation at even higher temperatures.
• Tch = 175°C guaranteed (AEC-Q101 qualified)
• UMOS, super junction technology for ultralow on-resistance and low QG characteristics

NP180N04TUK (ANL2) 1.05mΩ (max.)/198nC(typ.)
• Large-current rating
TO263-7pin package ID(DC)=180A (max)
TO263 package ID(DC)=110A (max)
Adv.TO252 package ID(DC)=90A (max)
8pinHSON Package ID(DC)=75A (max)

N-Channel Large-Current Product Series

Package	Part No.	Polarity	V_{DSS} (V)	V_{GSS} (V)	ID(DC) [A] Tc= 25°C	PT [W] Tc= 25°C	VGS(th) [V]	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Ciss (pF) typ.
TO-263-7pin	NP180N04TUG	Nch	40	±20	180	288	2.0~4.0	1.2	1.5	-	-	16300
	NP180N04TUJ		40	±20	180	348	2.0~4.0	1.2	1.5	-	-	9500
	NP160N04TDG		40	±20	160	220	1.5~2.5	1.6	2.0	2.2	5.4	10500
	NP160N04TUG		40	±20	160	220	2.0~4.0	1.6	2.0	-	-	10500
	NP160N04TUJ		40	±20	160	220	2.0~4.0	1.6	2.0	-	-	6900
	NP161N04TUG		40	±20	160	250	2.0~4.0	1.4	1.8	-	-	13500
	NP180N04TUK		40	±20	180	348	2.0~4.0	0.85	1.05	-	-	10500
	NP160N04TUK		40	±20	160	250	2.0~4.0	1.25	1.5	-	-	7200
	NP180N055TUJ		55	±20	180	348	2.0~4.0	1.7	2.4	-	-	9500
	NP160N055TUJ		55	±20	160	220	2.0~4.0	2.4	3.0	-	-	6900
	NP180N055TUK		55	±20	180	348	2.0~4.0	1.15	1.4	-	-	10700
	NP160N055TUK		55	±20	160	250	2.0~4.0	0.9	2.1	-	-	7500
TO-263 (MP-25ZP)	NP110N03PUG		30	±20	110	288	2.0~4.0	1.1	1.5	-	-	16400
	NP109N04PUG		40	±20	110	220	2.0~4.0	1.7	2.3	-	-	10500
	NP109N04PUJ		40	±20	110	220	2.0~4.0	1.7	2.3	-	-	6900
	NP110N04PDG		40	±20	110	288	1.5~2.5	1.4	1.8	2.1	3.2	14500
	NP110N04PUG		40	±20	110	288	2.0~4.0	1.4	1.8	-	-	17100
	NP110N04PUJ		40	±20	110	288	2.0~4.0	1.4	1.8	-	-	9500
	NP110N04PUK		40	±20	110	348	2.0~4.0	1.15	1.4	-	-	10500
	NP109N04PUK		40	±20	110	250	2.0~4.0	1.4	1.75	-	-	7200
	NP100N04PUK		40	±20	100	176	2.0~4.0	1.9	2.3	-	-	4700
	NP89N04PUK		40	±20	90	147	2.0~4.0	2.45	2.95	-	-	3900
	NP109N055PUJ		55	±20	110	220	2.0~4.0	2.5	3.2	-	-	6900
	NP110N055PUG		55	±20	110	288	2.0~4.0	1.9	2.4	-	-	17100
	NP110N055PUJ		55	±20	110	288	2.0~4.0	1.9	2.4	-	-	9500
	NP110N055PUK		55	±20	110	348	2.0~4.0	1.45	1.75	-	-	10700
	NP109N055PUK		55	±20	110	250	2.0~4.0	1.85	2.2	-	-	7500
	NP100N055PUK		55	±20	100	176	2.0~4.0	2.7	3.25	-	-	4900
	NP89N055PUK		55	±20	90	147	2.0~4.0	3.3	4.0	-	-	4000
TO-262 (MP-25SK)	NP100N04NUJ		40	±20	100	220	2.0~4.0	2.5	3.0	-	-	5600

N-Channel TO-252 Package Series

Package	Part No.	Polarity	V_{DSS} (V)	V_{GSS} (V)	ID(DC) [A] Tc= 25°C	PT [W] Tc= 25°C	VGS(th) [V]	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Ciss (pF) typ.
TO-252 (MP-3ZP)	NP90N03VHG	Nch	30	±20	90	105	2.0~4.0	2.5	3.2	-	-	5000
	NP90N03VLG		30	±20	90	105	1.4~2.5	2.5	3.2	3.8	8	5000
	NP90N03VUG		30	±20	90	105	2.0~4.0	2.5	3.2	-	-	5000
	NP90N04VUG		40	±20	90	105	2.0~4.0	3.2	4.0	-	-	5000
	NP90N04VDG		40	±20	90	105	1.4~2.5	3.2	4.0	4.3	8.6	5000
	NP90N04VLG		40	±20	90	105	1.4~2.5	3.2	4.0	4.3	8.6	5000
	NP90N04VUK		40	±20	90	147	2.0~4.0	2.35	2.8	-	-	3900
	NP60N04VUK		40	±20	60	105	2.0~4.0	3.2	3.85	-	-	2450
	NP90N055VUG		55	±20	90	105	2.0~4.0	4.8	6.0	-	-	5000
	NP90N055VDG		55	±20	90	105	1.4~2.5	4.8	6.0	6	10.5	5000
	NP90N055VUK		55	±20	90	147	2.0~4.0	3.2	3.85	-	-	4000
	NP60N055VUK		55	±20	60	105	2.0~4.0	4.6	5.5	-	-	2500
	NP90N06VLG		60	±20	90	105	1.4~2.5	6.2	7.8	7.5	12.5	5000
TO-252 (MP-3ZK)	NP60N03SUG		30	±20	60	105	2.0~4.0	3.0	3.8	-	-	5000
	NP55N03SUG		30	±20	55	77	2.0~4.0	4.0	5.0	-	-	3500
	NP55N04SUG		40	±20	55	77	2.0~4.0	5.0	6.5	-	-	3400
	NP55N055SDG		55	±20	55	77	1.5~2.5	7.4	9.5	8.9	12	3200
	NP55N055SUG		55	±20	55	77	2.0~4.0	7.7	10.0	-	-	3500
	NP52N055SUG		55	±20	52	56	2.0~4.0	11.0	14.0	-	-	2100
	NP52N06SLG		60	±20	52	56	1.5~2.5	13.6	17.5	17.5	25	2100

8-Pin HSON Package Series (Underside Heat Dispersion)

Package	Part No.	Polarity	V_{DSS} (V)	V_{GSS} (V)	ID(DC) [A] Tc= 25°C	PT [W] Tc= 25°C	VGS(th) [V]	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=5V typ.	RDS (on) (mΩ) VGS=5V max.	Ciss (pF) typ.
8pin HSON	NP40N10YDF	Nch	100	±20	40	120	1.5~2.5	21	25	23	30	2100
	NP20N10YDF**		100	±20	20	73	1.5~-2.5	44	55	49	68	1100
	NP33N075YDF		75	±20	33	92	1.5~2.5	23	28	25	32	1300
	NP33N06YDG		60	±20	33	97	1.4~2.5	11.2	14	12.8	20	2600
	NP23N06YDG		60	±20	23	60	1.4~2.5	22	27	24	37	1200
	NP35N055YUK**		55	±20	35	97	2.0~4.0	5.4	6.7	-	-	2240
	NP75N055YUK**		55	±20	75	138	2.0~4.0	3.6	4.5	-	-	3500
	NP75N04YUG		40	±20	75	138	2.0~4.0	3.8	4.8	-	-	4300
	NP74N04YUG		40	±20	75	120	2.0~4.0	4.2	5.5	-	-	3620
	NP75N04YUK**		40	±20	75	138	2.0~4.0	2.6	3.3	-	-	3400
	NP50N04YUK**		40	±20	50	97	2.0~4.0	3.9	4.8	-	-	2100
	NP35N04YLG		40	±20	35	77	1.4~2.5	7.8	9.7	9.6	15	1900
	NP35N04YUG		40	±20	35	77	2.0~4.0	7.9	10	-	-	1900
	NP16N04YUG		40	±20	16	36	2~4	20	25	-	-	740
	NP75P03YDG	Pch	-30	±20	-75	138	-1.0~-2.5	4.8	6.2	6.2	9.6	3200
	NP50P03YDG		-30	±20	-50	102	-1.0~-2.5	6.7	8.4	8.5	13	2300
	NP75P04YLG		-40	±20	-75	138	-1.0~-2.5	7.7	9.7	9.3	14	3200
	NP20P06YLG**		-60	±20	20	67	-1.0~-2.5	37	49	42	64	1600

★★: Under development

P-Channel Low Ron Series

Package	Part No.	Polarity	V_{DSS} (V)	V_{GSS} (V)	ID(DC) [A] Tc= 25°C	PT [W] Tc= 25°C	VGS(th) [V]	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Ciss (pF) typ.
TO-263 (MP-25ZP)	NP100P06PDG	Pch	-60	±20	-100	200	-1.0~-2.5	4.4	6.0	5.0	7.8	15000
	NP100P06PLG		-60	±20	-100	200	-1.0~-2.5	4.4	6.0	5.0	7.8	15000
	NP83P06PDG		-60	±20	-83	150	-1.0~-2.5	6.9	8.8	8.0	12.0	10100
	NP100P04PDG		-40	±20	-100	200	-1.0~-2.5	2.8	3.5	3.4	5.1	15100
	NP100P04PLG		-40	±20	-100	200	-1.0~-2.5	2.8	3.7	3.4	5.1	15100
	NP83P04PDG		-40	±20	-83	150	-1.0~-2.5	4.1	5.3	5.1	8.0	9820
	NP82P04PLF		-40	±20	-82	150	-1.5~-2.5	6.5	8.0	8.3	12.0	5000
TO-263 (MP-25ZK)	NP50P06KDG		-60	±20	-50	90	-1.0~-2.5	13.5	17.0	15.4	23.0	5000
	NP36P06KDG		-60	±20	-36	56	-1.0~-2.5	23.1	29.5	27.0	37.5	3100
	NP50P04KDG		-40	±20	-50	90	-1.0~-2.5	7.9	10.0	9.8	15.0	5100
	NP36P04KDG		-40	±20	-36	56	-1.0~-2.5	12.8	17.0	16.6	23.5	2800
TO-252 (MP-3ZK)	NP50P06SDG		-60	±20	-50	84	-1.0~-2.5	13.2	16.5	14.9	23.0	5000
	NP36P06SLG		-60	±20	-36	56	-1.0~-2.5	24.0	30.0	27.0	40.0	3200
	NP20P06SLG		-60	±20	-20	38	-1.0~-2.5	36.0	48.0	42.0	64.0	1650
	NP15P06SLG		-60	±20	-15	30	-1.0~-2.5	56.0	70.0	62.0	95.0	1100
	NP50P04SDG		-40	±20	-50	84	-1.0~-2.5	7.7	9.6	9.3	15.0	5100
	NP36P04SDG		-40	±20	-36	56	-1.0~-2.5	12.5	17.0	15.4	23.5	2800
	NP20P04SLG		-40	±20	-20	38	-1.0~-2.5	20.0	25.0	24.0	38.0	1650
	NP15P04SLG		-40	±20	-15	30	-1.0~-2.5	31.0	40.0	38.0	60.0	1100

Power MOSFETs

Automotive Power Devices

N-Channel 100V Series

Package	Part No.	Polarity	V_{DSS} (V)	V_{GSS} (V)	ID(DC) [A] Tc= 25°C	PT [W] Tc= 25°C	VGS(th) [V]	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Ciss (pF) typ.
TO-263 (MP-25ZP)	NP82N10PUF	Nch	100	±20	82	150	1.7~3.3	12	15	-	-	2900
	NP40N10PDF		100	±20	40	120	1.5~2.5	21	27.0	24	38	2100
TO-263 (MP-25ZK)	NP70N10KUF		100	±20	70	120	1.7~3.3	17.0	20.0	-	-	2500
TO-252 (MP-3ZP)	NP40N10VDF		100	±20	40	120	1.5~2.5	21	26.0	24	37.0	2100
TO-252 (MP-3ZK)	NP36N10SDE		100	±20	36	142	1.5~-2.5	27	33	29	39	3500
	NP28N10SDE		100	±20	28	100	1.5~-2.5	41	52	45	59	2200
8pin HSON	NP40N10YDF		100	±20	40	120	1.5~2.5	21.0	25.0	24.0	36.0	2100
	NP20N10YDF**		100	±20	20	73	1.5~-2.5	44	55	TBD	TBD	1100

★★: Under development

Ultralow On-Resistance Process: 9th Generation Power MOSFET Series (40V to 60V Drain Voltage Class)

■ Features

This series of power MOSFET devices delivers the world's best performance, with on-resistance 20% lower and Ciss 50% lower than comparable earlier devices from Renesas Electronics. In particular, our ultralow on-resistance products with wire-less structure and high-heat-dispersion, low-resistance package design are ideal for large-current systems. All have a guaranteed junction temperature (Tch) of 175°C.

■ Suggested applications

Motor control, body control, engine control, etc.

Generation	Package	Part No.	Polarity	Maximum Rating V_{DSS} (V)	Maximum Rating V_{GSS} (V)	Maximum Rating I_D (A)	Maximum Rating P-ch (W)	V_{GS}(off) (V)	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	Ciss (pF)	Remarks
9th	DPAK	RJK0632JPD	Nch	60	±20	20	20	1.0~2.0	29	35	41	55	440	
		RJK0631JPD		60	±20	30	37	1.0~2.0	12	15	15	20	1350	
	LDPAK	RJK0415JPE		40	±20	80	70	2.0~3.5	4.4	5.5	-	-	2100	
		RJK0631JPE		60	±20	30	50	1.0~2.0	12	15	15	20	1350	
		RJK0630JPE		60	±20	75	70	1.0~2.0	6.2	7.5	8.5	11.5	2100	
		RJK0629JPE		60	±20	85	100	1.0~2.0	3.75	4.5	4.9	6.6	4100	
		RJK0406JPE		40	±20	160	125	2.0~3.5	1.65	2	-	-	6300	Wire-less
8th	SOP-8	HAT2210RJ		30	±20	7.5	1.5	1.0~2.5	19	24	27	40	630	
					±20	8		1.0~2.5	17	22	21	29	1330	
		HAT2215RJ		80	±20	3.4	1.5	1.0~2.5	88	115	100	145	400	
	DPAK	RJK0323JPD		30	±20	30	40	1.0~2.5	7	9	9	13	2600	
	LDPAK	RJK1207JPE**		120	±20	(50)	(135)	2.5~3.5	(25)	(35)	-	-	1750	
	SOP-8	RJM0301JSP	Nch	30	±20	5	1.5	1.0~2.5	33	43	46	70	395	N-ch × 1 element
			Pch	-30		-4			58	70	95	140	450	P-ch × 1 element
		RJM0306JSP	Nch	30	±20	3.5	1.5	1.0~2.5	50	65	70	105	290	N-ch × 2 element
			Pch	-30		-3.5			90	120	140	210	320	N-ch × 2 element
	HSOP-20	RJM0404JSC	Nch	40	±20	20	45	1.0~2.5	17	21	24	34	1400	N-ch × 3 element
			Pch	-40		-20			34	42	48	68	1500	P-ch × 3 element
		RJM0603JSC	Nch	60	±20	20	45	1.0~2.5	16	20	21	32	2600	N-ch × 3 element
			Pch	-60		-20			32	40	42	64	2800	P-ch × 3 element

★★: Under development

Automotive Multichip Devices

The area where next-generation automobiles and electrical systems are showing the most notable development is electric "powered" applications employing motors of various types. Renesas Electronics responds to demand in this area with "custom package" products designed specifically with motor control in mind. These devices are developed using multichip technology.

Features

The basic circuit needed for motor control is implemented using N-channel and P-channel power MOSFETs with low on-resistance in a multi-chip configuration.

1. The 6-in-1 configuration integrates six MOSFET elements in a HSOP20 package and is intended for controlling compact three-phase brushless motors. (Size comparison with DPAC × 6: Approx. 40% reduction)
2. The 4-in-1 configuration integrates four elements in a SOP8 package and is intended for controlling ultra-compact brushed DC motors. (Size comparison with SOP8 × 2: Approx. 50% reduction)

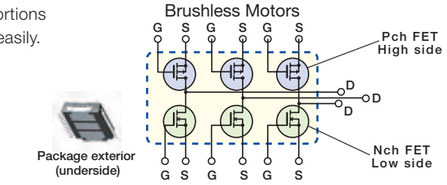
Suggested Applications

Three-phase brushless motors used as engine auxiliary control motors (for exhaust gas circulation, water circulation, oil circulation), etc. (6-in-1 Series), mirror angle adjustment motors (4-in-1 Series)

Advantages for Customers

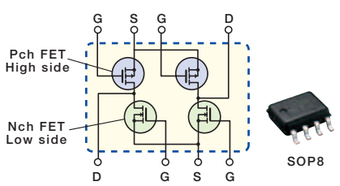
Since a high mounting density is possible, the electrical and mechanical portions of the motor can be integrated easily.

6-in-1 Series for Compact 3-Phase Brushless Motors



Package exterior (underside)

4-in-1 Series for Ultra-Compact Motors



SOP8

6-in-1 Series Power MOSFET Lineup

Package	Type No.	Polarity	Maximum Rating VDSS (V)	Maximum Rating VGSS (V)	Maximum Rating ID (A)	Maximum Rating Pch (W)	VGS(off) (V)	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Remarks
HSOP20 6 in1	RJM0404JSC	Nch	40	±20	20	45	1.0~2.5	17	21	24	34	
		Pch	-40		-20			34	42	48	68	
	RJM0603JSC	Nch	60	±20	20	45	1.0~2.5	16	20	21	32	
		Pch	-60		-20			32	40	42	64	

4-in-1 Series Power MOSFET Lineup

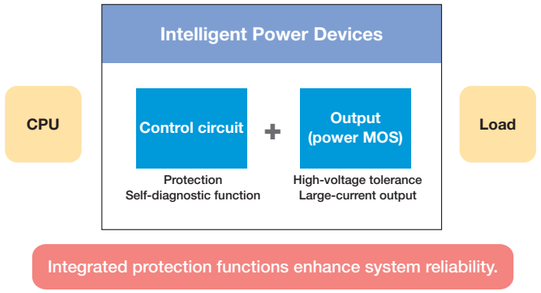
Package	Type No.	Polarity	Maximum Rating V_{DSS} (V)	Maximum Rating V_{GSS} (V)	Maximum Rating I_D (A)	Maximum Rating Pch (W)	VGS(off) (V)	RDS (on) (mΩ) VGS=10V typ.	RDS (on) (mΩ) VGS=10V max.	RDS (on) (mΩ) VGS=4.5V typ.	RDS (on) (mΩ) VGS=4.5V max.	Remarks
SOP-8 4 in1	RJM0306JSP MOS1	Nch	30	±20	3.5	1.5	1.0~2.5	55	70	75	110	
	MOS2	Pch		±20	-3.5		1.0~2.5	75	100	120	180	

Power MOSFETs

Automotive Power Devices

Intelligent Power Devices

Designed for use as automotive power devices, intelligent power devices combine a power MOS, protection circuit, and monitor output in a single package. This enables more compact size, lighter weight, and improved reliability.



Integrated protection functions enhance system reliability.

Engine Control and Body/Safety Control: Accelerated Development of Two Types of Systems

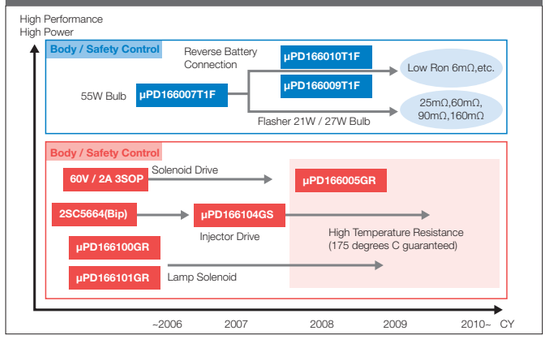
Renesas Electronics develops intelligent power device products with an emphasis on two types of systems: engine control and body/safety control. This enables us to focus on features needed for engine control, such as EUC compactness and direct mounting on the engine housing, as well as features needed for body/safety control, such as unit compactness and lightness, energy efficiency, and use of electronic relays.

In the area of engine control, there is demand for products that provide integration of protection functions in drive elements for solenoids, etc. Renesas Electronics has released fuel injector driver products with a voltage tolerance of 130 V, the highest in the industry. They make possible extremely precise control of the volume of fuel injected into the cylinder, contributing to improved fuel efficiency and reduced emissions.

In the area of body/safety control, there is demand for products with large-current and low on-resistance specs to replace mechanical relays. Renesas Electronics was one of the first in Japan to release multichip package (MCP) products to meet this need. They combine a power chip and control chip in a single package to deliver excellent performance and economy.

As the performance of power MOSFETs has improved in recent years, the use of semiconductor devices has expanded to include a wider range of automotive applications. In the past, partly due to economic reasons, mechanical relays were generally used in automotive applications requiring the ability to handle currents of several tens of amperes. By using intelligent power devices instead, systems can be made more compact and lightweight, and more reliable as well.

Product Lineup



List of Products

Device	VDSS	IL(LIM) Amps.	RDS(ON) mOhm	PD Watts	Channel	Package
μPD166100GR	40	1.0	160	2.0	1ch	8pinSOP
μPD166101GR	40	1.0/ch	160	2.0	2ch	8pinSOP
μPD166104GR	100	1.7/ch	90	2.0	2ch	20pinSOP
μPD166005GR	60	2.0	100	1.8	1ch	8pinSOP
μPD166007T1F	36	5 to 10	10	59	1ch	TO-252 5pin
μPD166009T1F, μPD166010T1F	40	5 to 10	10	59	1ch	TO-252 5pin

http://www2.renesas.com/automotive/ja/ipd/whats_ipd.html http://www2.renesas.com/automotive/ja/ipd/index.html

Thermal FETs

Power MOSFETs with Integrated Overheating Protection Circuit

Features

- Integrated overheating shutoff function (current shutoff when Tch = 150°C or higher)
- Shutoff function either self-holding (latch) or self-recovering (temperature hysteresis)
- Suitable for either low-side or high-side drive

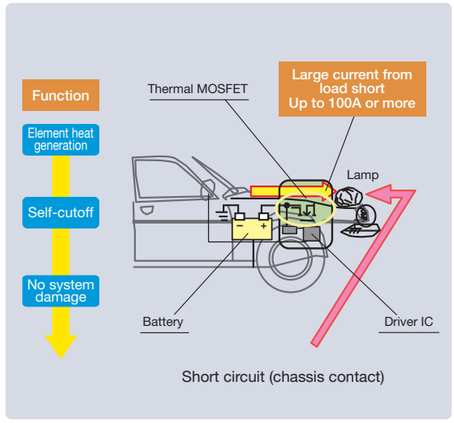
Main Applications

- Automotive electronic equipment (lamp drive, relay replacement, actuator drive)

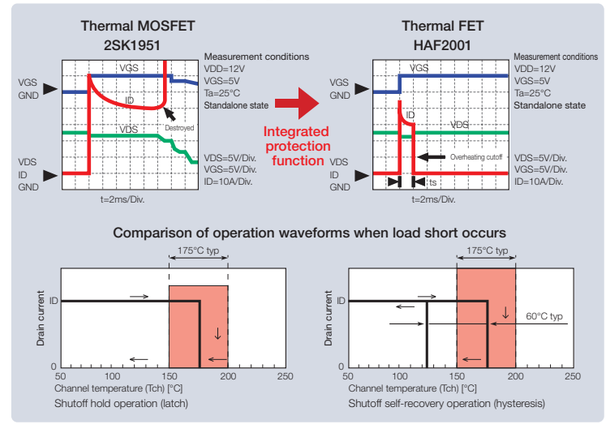
Advantages for Customers

● Protection from element destruction due to load shorts

Thermal FET Function



Thermal FET Overheating Shutoff Characteristics



2nd Generation Thermal FET Series

Package	Part No.	Polarity	Maximum Rating				RDS (on) (mΩ)				Shutoff temp. Typ.	Shutoff hold type	Remarks
			V_{DSS}	V_{GSS}	I_D	Pch	VGS=10V{5V}		VGS=4V(6V)[4.5V]				
			(V)	(V)	(A)	(W)	typ.	max.	typ.	max.			
LDPAK	HAF2017	Nch	60	+16 -2.5	20	50	27	43	[35]	[53]	175°C	Latch	
TO-220FM	HAF2005				40	30	15	20	25	33	175°C	Latch	
LDPAK	HAF2011				40	50	15	20	25	33	175°C	Latch	
TO-220AB	HAF2014				40	50	15	20	25	33	175°C	Latch	
DPAK	HAF2007				5	20	55	75	73	120	175°C	Latch	
LDPAK	HAF2021				50	100	8	12	(9.5)	(15)	175°C	Latch	
SOP-8	HAF2015RJ				2	1.5	110	160	130	200	175°C	Hysteresis	2 elements
	HAF2026RJ				1	1.5	150	210	{200}	{300}	175°C	Latch	2 elements
LDPAK	HAF2027				50	100	7.7	10	10	15	175°C	Latch	
SOP-8	HAF1010RJ	Pch	-60	-16 +2.5	-5	2.5	140	200	200	340	175°C	Latch	
DPAK	HAF1004				-5	20	140	200	200	340	175°C	Latch	
LDPAK	HAF1008				-20	50	42	54	60	80	175°C	Latch	
	HAF1009				-40	50	22	27	33	50	175°C	Latch	

3rd Generation Trench-Type Thermal FET Series

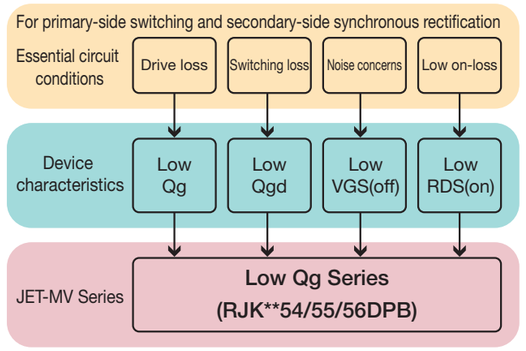
Package	Part No.	Polarity	Maximum Rating				RDS (on) (mΩ)				Shutoff temp. Typ.	Shutoff hold type	Remarks
			V_{DSS}	V_{GSS}	I_D	Pch	VGS=10V{5V}		VGS=6V				
			(V)	(V)	(A)	(W)	typ.	max.	typ.	max.			
LDPAK	RJE0601JPE	Pch	-60	-16 +2.5	-40	50	22	27	27	45	175°C	Latch	
LDPAK	RJE0603JPE				-50	100	12	15	16	30	175°C	Latch	
DPAK	RJE0605JPD				-10	30	58	75	75	110	175°C	Latch	
	RJE0609JPD				-4	30	79	100	102	170	175°C	Latch	
SOP-8	RJE0607JSP				-1.5	1.5	140	260	185	380	175°C	Latch	2 elements
	RJF0615JSP				-10	2.5	53	65	70	95	175°C	Latch	1 elements
	RJE0616JSP				-4	2.5	77	90	102	150	175°C	Latch	1 elements

Power MOSFETs

Medium- and Low-Voltage MOSFETs

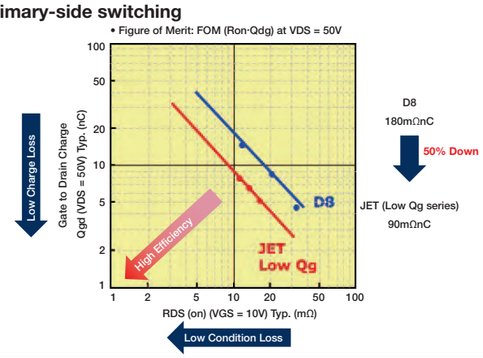
Reducing power loss is a key issue in overcoming problems related to heat generation in high-performance power supplies for computer servers and communication equipment. Renesas Electronics supplies a wide range of low-Qg power MOSFET products in the medium-voltage range (40V to 100V). They provide significantly improved performance (FOM) as well.

Diversification of JET Middle Voltage Series



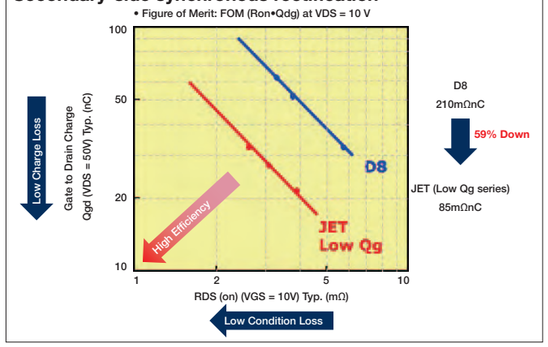
Low-Capacitance (Qg) JET Middle Voltage (VDSS = 100V)

Primary-side switching



Diversification of JET Middle Voltage Series

Secondary-side synchronous rectification



Low-Capacitance (Qg) 11th Generation Middle Voltage Lineup

Main applications: DC/DC power supplies, motor drive, battery control, etc.

- Features: Low Qg and Qdg (low switching loss)

High drive voltage (high noise tolerance)

Type No.	Max. ratings				VGS(off) (V) min-max	RDS (on) (mΩ) VGS=10V		Qdg (nC)	Qg (nC)
	VDSS (V)	VGSS (V)	ID (A)	P-ch (W)		typ.	max.	VGS=10V	
RJK0454DPB	40	±20	40	55	2.0~4.0	3.9	4.9	3.2	22
RJK0455DPB			45	60	2.0~4.0	3.1	3.8	4.1	27
RJK0456DPB			50	65	2.0~4.0	2.6	3.2	4.9	33
RJK0654DPB	60		30	55	2.0~4.0	6.5	8.3	3.3	22
RJK0655DPB			35	60	2.0~4.0	5.3	6.7	4.2	28
RJK0656DPB			40	65	2.0~4.0	4.5	5.6	5.0	34
RJK0854DPB	80		25	55	2.0~4.0	10	13	5.0	30
RJK0855DPB			30	60	2.0~4.0	8.2	11	6.3	37
RJK0856DPB			35	65	2.0~4.0	6.9	8.9	7.6	45
RJK1054DPB	100		20	55	2.0~4.0	17	22	5.1	30
RJK1055DPB			23	60	2.0~4.0	13	17	6.5	38
RJK1056DPB			25	65	2.0~4.0	11	14	7.8	45

Motor drive MOSFETs with low on-voltage and large-current handling for applications such as power tools

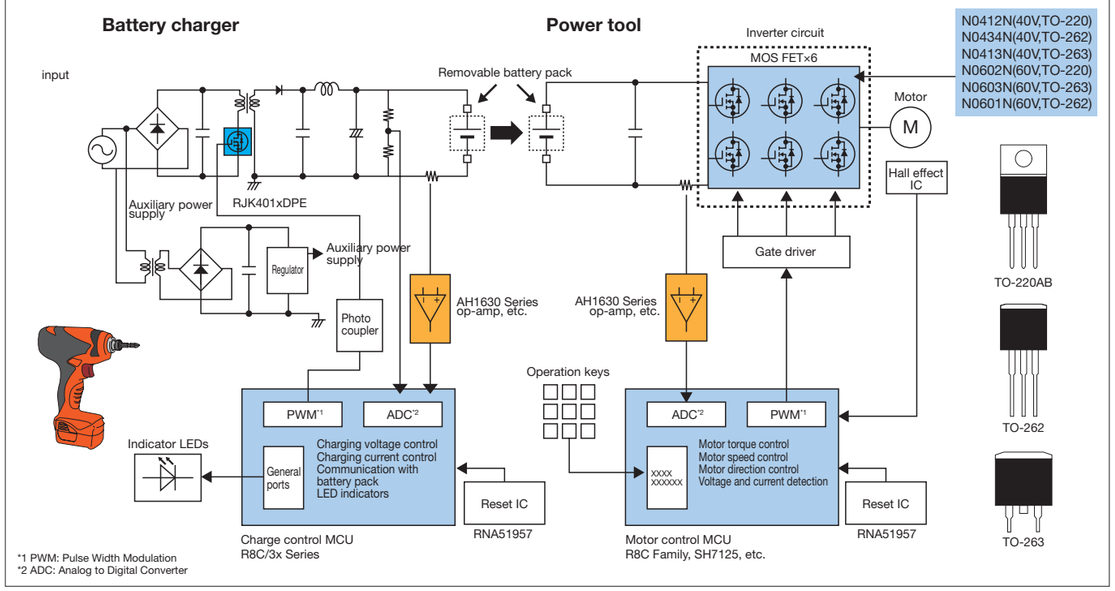
Features

- Large-current handling sufficient for power tools, ID = 100A (DC)
- VDSS = 40V/60V product lineup to accommodate wide range of input voltages
- Standalone (TO-220/TO262) and surface-mount (TO-263) packages available

Target fields

- Brushless motor units
- Power tool switches
- Brushed motor units

Block Diagram of Power Tool System



Product Lineup

Parts No.	PKG	VDSS (V)	VGSS (V)	ID (A)	Rds(on)[mΩ]@10V		Qg [nC]	Ciss [pF]
					Typ.	Max.		
N0412N	TO-220	40	±20	±100	3.0	3.7	97	6000
N0434N	TO-262	40	±20	±100	3.0	3.7	97	6000
N0413N	TO-263	40	±20	±100	2.7	3.3	97	6000
N0602N	TO-220	60	±20	±100	3.6	4.6	148	8000
N0603N	TO-262	60	±20	±100	3.6	4.6	148	8000
N0601N	TO-263	60	±20	±100	3.3	4.2	148	8000

Note: This product is under development. The electrical characteristics or schedule may be subject to change without notice.

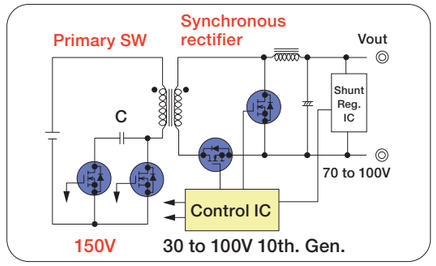
Power MOSFETs

Medium- and Low-Voltage MOSFETs

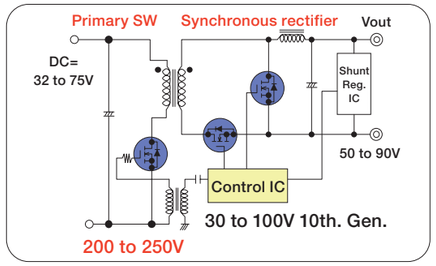
Overview of Medium- and High-Voltage MOSFETs

Our power MOSFETs with a voltage tolerance of 150V or more are classified as medium- and high-voltage MOSFETs. They are used in the primary side of insulated DC/DC converters and in the primary or secondary side of AC/DC converters. In addition to conventional planar MOSFETs, trench MOSFETs are available for even better performance.

Typical Circuit Example



Active clamp circuit

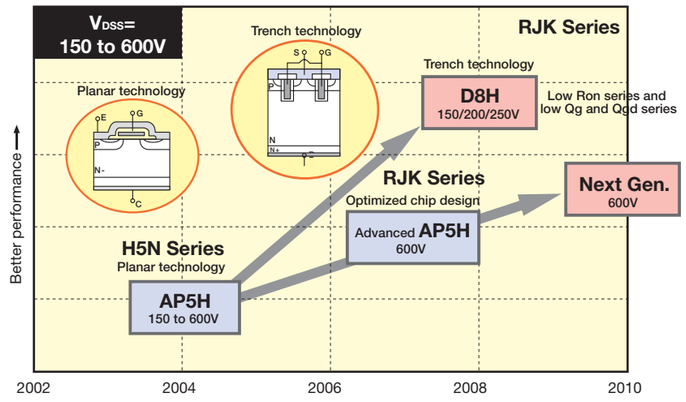


Single-ended forward converter circuit

Features of Medium- and High-Voltage Power MOSFETs

- Ultra-low on-resistance and large-current products available
  - RJK2511DPK: 250V, 65A, 34mΩ, TO-3P
  - RJK4018DPK: 400V, 43A, 100mΩ, TO-3P
  - RJK5020DPK: 500V, 40A, 115mΩ, TO-3P
  - RJK6020DPK: 600V, 32A, 175mΩ, TO-3P
- Low gate charge (low Qg)
- Guaranteed avalanche tolerance
- Integrated diode with high breakdown tolerance

Medium- and High-Voltage Power MOSFET Roadmap



Low on-state Resistance

Package	Part No.	VDSS (V)	ID (A)	RDS (on) Max. (Ω)	Ciss Typ.(pF)	Qg Typ.(nC)	Qgd Typ.(nC)
WPAK	RJK1555DPA	150	25	0.048	2400	38	10.2
	RJK2055DPA	200	20	0.069	2400	38	9.0
	RJK2555DPA	250	17	0.104	2400	39	10.5

High Speed Switching

Package	Part No.	VDSS (V)	ID (A)	RDS (on) Max. (Ω)	Ciss Typ.(pF)	Qg Typ.(nC)	Qgd Typ.(nC)
WPAK	RJK1557DPA	150	25	0.058	1250	20	5
	RJK2057DPA	200	20	0.085	1250	19	5.3
	RJK2557DPA	250	17	0.128	1250	20	5.9

Medium- and High-Voltage MOSFET Lineup

150V to 600V Power MOSFET Lineup (Small Package and Surface-mount type)

Package	Part No.	VDSS [V]	ID [A]	RDS (on) Max. [Ω]	Ciss Typ. [pF]
TO-92	2SK4151	150	1	1.95	98
	2SK4150	250	0.4	5.7	80
	HS54095	600	0.15	25	50
	HS54097		0.2	16.5	66
TO-92MOD	2SK4093	250	1	2.6	140
	RJK6011DJE	600	0.1	52	25
	RJK6022DJE		0.2	15	84
	HS56021		0.2	15	84
MP-3A (SMD)	RJK4006DPD	400	8	0.8	650
	RJK5003DPD	500	5	1.5	550
	RJK5006DPD		7	1.3	650
	RJK6002DPD	600	2	6.8	160
	RJK6023DPD		0.15	25	240
	RJK6024DPD		0.4	42	TBD
	RJK6025DPD		0.8	20	TBD
LDPAK-S (SMD)	RJK2006DPE	200	40	0.059	1800
	RJK4012DPE	400	15	0.41	1120
	RJK4013DPE		17	0.3	1470
	RJK4512DPE	450	14	0.51	1100
	RJK4513DPE		16	0.38	1440
	RJK5012DPE	500	12	0.62	1100
	RJK5013DPE		14	0.465	1470
	RJK6026DPE	600	5	2.4	440
	RJK6012DPE		10	0.92	1100
	RJK6024DPE		0.4	42	TBD
	RJK6025DPE		0.8	20	TBD
	RJK6013DPE		11	0.7	1470

250V to 600V with Integrated High-Speed Diode Lineup

Package	Part No.	VDSS [V]	ID [A]	RDS (on) Max. [Ω]	Ciss [pF]
TO-220FN (Full mold)	H5N2512CF	250	18	0.105	2200
	H5N3007CF	300	15	0.16	2180
TO-220FN (Full mold)	H5N2522FN	250	12	0.21	1300
	RJL5012DPP	500	12	0.7	1050
	RJL5013DPP		14	0.51	1400
	RJL6012DPP	600	10	1.1	1050
	RJL6013DPP		11	0.81	1400
	RJL6014DPP		15	0.635	1680
TO-3P	H5N2507P	250	50	0.055	5000
	H5N3008P	300	40	0.069	5150
	RJL5020DPK	500	38	0.14	TBD
	RJL6020DPK	600	30	0.21	TBD

400V to 600V Lineup (Standalone (3-Pin) Package)

Package	Part No.	VDSS [V]	ID [A]	RDS (on) Max. [Ω]	Ciss [pF]
TO-220FN (Full mold)	RJK4007DPP	400	7.6	0.55	850
	RJK5026DPP	500	6	1.75	450
	RJK5012DPP		12	0.62	1100
	RJK5013DPP		14	0.465	1470
	RJK5014DPP		19	0.38	1800
	RJK5009DPP		20	0.3	2600
	RJK6026DPP	600	5	2.4	440
	RJK6012DPP		10	0.92	1100
	RJK6013DPP		11	0.7	1470
	RJK6014DPP		16	0.575	1800
TO-3PFM	RJK2009DPM	200	40	0.036	2900
	RJK5015DPM	500	25	0.24	2600
	RJK6015DPM	600	21	0.36	2600
TO-3P	RJK2508DPK	250	50	0.064	2600
	RJK2511DPK		65	0.034	4900
	RJK4014DPK	400	24	0.24	1820
	RJK4015DPK		30	0.165	2600
	RJK4018DPK		43	0.1	4100
	RJK4514DPK	450	22	0.3	1820
	RJK4515DPK		27	0.2	2600
	RJK4518DPK		39	0.13	4100
	RJK5013DPK	500	14	0.465	1470
	RJK5014DPK		19	0.38	1800
	RJK5015DPK		25	0.24	2600
	RJK5018DPK		35	0.155	4100
	RJK5020DPK		40	0.118	5150
	RJK6014DPK	600	16	0.575	1800
	RJK6015DPK		21	0.36	2600
	RJK6018DPK		30	0.235	4100
	RJK6020DPK		32	0.175	5150

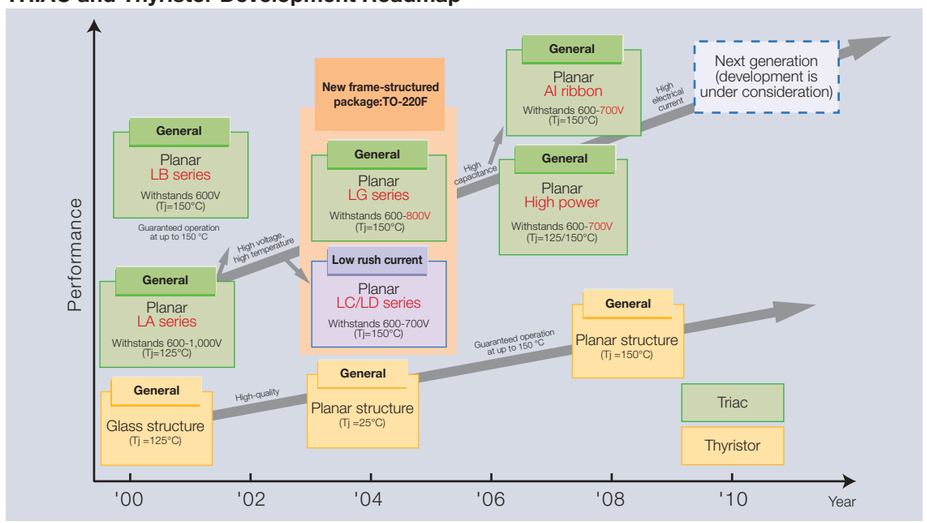
Overview of Thyristors and TRIACs

The basic characteristic of thyristors and TRIACs is a constant voltage drop in the signal passing through them, as with diodes. They provide highly efficient control in applications requiring on/off switching of large currents, and are used in a wide range of fields. Renesas Electronics supplies a variety of thyristor and TRIAC products with distinctive characteristics and maintains a high market share in many application areas.

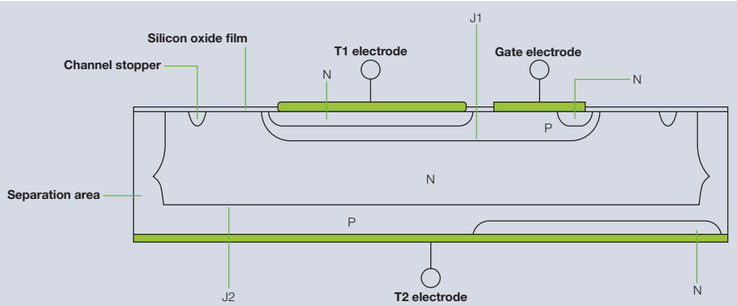
Features of Renesas Electronics Thyristors and TRIACs

- Products available with guaranteed junction temperature of 150°C (600V, 700V, 800V)
  - LB, LC, LD, and LG series
- Extensive lineup
  - TO-220 full molded package, UL approved
  - TO-3P full molded package, large-current specification
  - Many lead forming configurations available
- Products tailored to specific applications
  - For low-rush-current applications: LC and LD series, etc.
- High-current products available
  - 700V, 800V, 1,000V, 1,500V

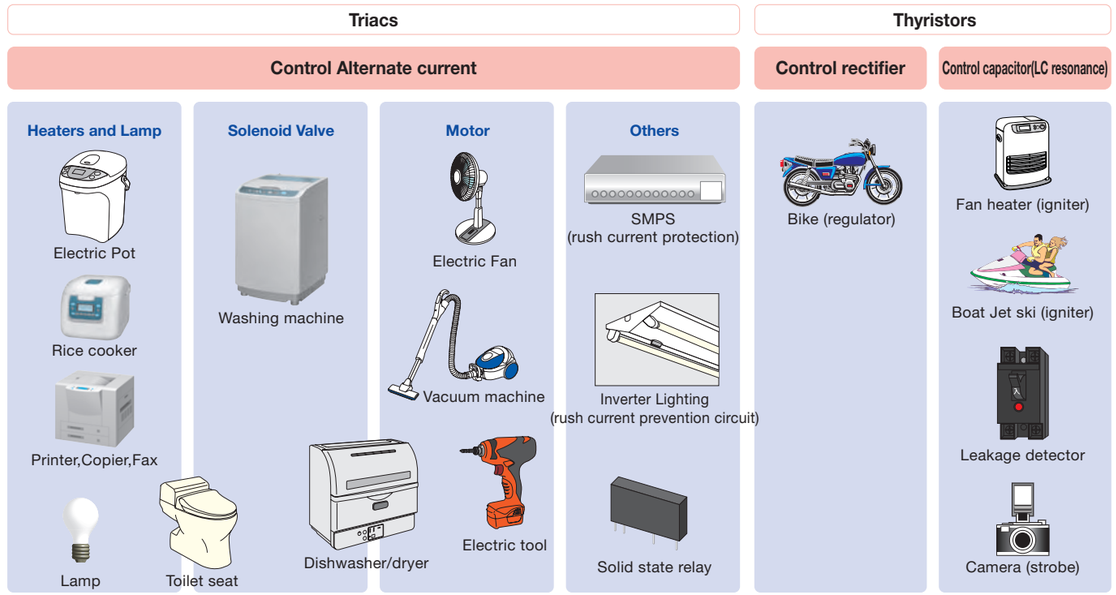
TRIAC and Thyristor Development Roadmap



Planar structure



Applications and Characteristics of Thyristors and TRIACs



Development of 150°C Triac Series

Outline of functions

- Guaranty of rated junction temperature 150°C (conventionally, 125°C warranty)
- Expansion of current-carrying capacity by increase of rated temperature
- Adoption of planar structure

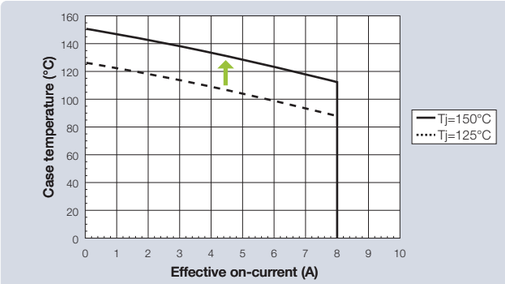
Product line

- LB Series : BCRxxxx-xxLB
- LC Series : BCRxxxx-xxLC
- LD Series : BCRxxPM-xxLD
- LG Series : BCRxxPM-xxLG
- BCR2PM-12RE/14LE
- BCR3KM/5KM-12RB

Selling point

- **Small amount of OFF-current at a high temperature**
  Planar structure enables smaller off-current than glass structure.
- **Expansion of thermal design margin**
  →Increase in easiness of design
  Ex.) At a design margin of 80%, Tj=150×80%=120°C
  (Conventionally, Tj=125×80%=100°C. Therefore, increase by 20°C)

Expansion of current-carrying capacity (ex.BCR8KM-12L)



- **Size-reduction of radiating fin: Footprint is reduced to 1/4.**
  Ex.) At BCR8KM Ta=60°C and IT(RMS)=8A, Rth(f-a)=4.8 °C/W(50cm²)
  (Conventionally, Rth(f-a)=2.3 °C/W(200cm²). Therefore, the footprint is reduced to 1/4.)
- **Radiating fin is not required.**
  Ex.) When the heater is controlled at BCR3KM Ta = 80°C, and AC100V/140W, Tj=1.3W×50°C/W+80°C=145°C.
- **High reliability**
- **Usable at a high temperature**

http://japan.renesas.com/scrbcr http://www.renesas.com/en/scrbcr

Thyristor/TRIAC Lineup

General-Purpose TRIAC LG Series

• Applications
Heater control and motor control in washing machines, vacuum cleaners, rice cookers, etc.
• Features
1) Highly reliable: Planar structure
2) Insulation configuration: TO-220FL, dielectric strength of 1,800V, UL approved
3) Guaranteed operation at high temperatures: Guaranteed up to 150°C
4) Support for lead forming

Product Lineup

Part No.	V_{DRMS} [V]	I_{TRMS} [A]	I_{TSM} [A]	I_{GT} (max.) [mA]	Notes
BCR3LM-12LB	600	3	30	20	-
BCR3LM-12RB		3	30	15	
BCR5LM-12LB		5	50	20	
BCR5LM-12RB		5	50	15	
BCR8LM-12LB		8	80	30	
BCR10LM-12LB		10	100	30	
BCR12LM-12LB		12	120	30	
BCR16LM-12LB		16	160	30	
BCR3LM-14LB	700	3	30	30	Available VDRMS 800 V (@Tj=125°C)
BCR5LM-14LB		5	50	30	
BCR8LM-14LB		8	80	30	
BCR12LM-14LB		12	120	30	
BCR16LM-14LB		16	160	30	

Low-Rush-Current TRIAC LD Series

• Applications
Low-rush-current applications such as ceramic heaters
• Features
1) Highly reliable: Planar structure
2) Insulation configuration: TO-220FL, dielectric strength of 2,000V, UL approved
3) Guaranteed operation at high temperatures: Guaranteed up to 150°C
4) High noise tolerance (IGT ≦ 50mA)
5) Support for lead forming

Product Lineup

Part No.	V_{DRM} [V]	T_j [°C]	I_T (RMS) [A]	I_{TSM} [A]	I_{GT} (max.) [mA]	Notes
BCR8LM-12LD	600	150	8	48	50	TO-220FL
BCR10LM-12LD		150	10	60	50	
BCR12LM-12LD		150	12	72	50	
BCR16LM-12LD		150	16	96	50	
BCR5LM-14LD	700	150	5	30	50	TO-220FL
BCR8LM-14LD		150	8	48	50	
BCR12LM-14LD		150	12	72	50	

General-Purpose High-Voltage/High-Capacity TRIACs

• Applications
Power supply rush-current prevention circuits, heater control, motor control
• Features
1) Highly reliable: Planar structure
2) Insulation configuration: TO-220F, TO-220FN, TO-3P, TO-3PF
3) High voltage tolerance: 1,000V, 1,500V
4) High current: 25A/30A @ TO-220FN
5) Support for lead forming

Product Lineup

Part No.	V_{DRMS} [V]	T_j [°C]	I_{TRMS} [A]	I_{TSM} [A]	I_{GT} (max.) [mA]	Package
BCR30KM-8LB	600	150	30	300	30	TO-220FN
BCR16RM-12LB		150	16	160	30	TO-3PFN
BCR25KM-12LB		150	25	250	50	TO-220FN
BCR25RM-12LB		150	25	250	50	TO-3PFM
BCR30AM-12LA		125	30	300	50	TO-3P
BCR30AM-12LB		150	30	300	50	
BCR8PM-20LA	1000	125	8	80	30	TO-220F
BCR8KM-20LA		125	8	80	30	TO-220FN
BCR20RM-30LA	1500	125	20	200	50	TO-3PFM

General-Purpose New TO-220FL Package TRIACs

• Applications
Motor and heater control in washing machines, vacuum cleaners, rice cookers, etc.
• Features
1) Highly reliable: Planar structure
2) Insulated package: TO-220FL, 1,800V dielectric strength, UL approved
3) High-temperature guarantee: 150°C guaranteed
4) Suitable for lead forming

Product Lineup

Part No.	VDRM (V)	IT(RMS) (A)	ITSM (A)	IGT(MAX.) (mA)	Status ES	Status MP	Note
BCR3LM-12LB	600	3	30	20	OK	OK	–
BCR3LM-12RB		3	30	15	OK		
BCR5LM-12LB		5	50	20	OK		
BCR5LM-12RB		5	50	15	OK		
BCR8LM-12LB		8	80	30	OK		
BCR10LM-12LB		10	100	30	OK		
BCR12LM-12LB		12	120	30	OK		
BCR16LM-12LB		16	160	30	OK		
BCR3LM-14LB	700	3	30	30	OK	OK	Available VDRMS 800V (@Tj=125°C)
BCR5LM-14LB		5	50	30	OK		
BCR8LM-14LB		8	80	30	OK		
BCR12LM-14LB		12	120	30	OK		
BCR16LM-14LB		16	160	30	OK		

General-Purpose Thyristors

• Applications
Heater control, igniters, regulators, motor control, inrush current protection circuits (switching power supplies, inverter lighting fixtures, inverters)
• Features
1) Junction temperature: 110°C, 125°C
2) IGT item support
3) Suitable for lead forming

Product Lineup

Part No.	VDRM (V)	Tj (°C)	IT(AV) (A)	ITSM (A)	IGT(MAX.) (mA)	Status ES	Status MP	Package
CR02AM-8	400	125	0.3	10	0.1	OK	OK	TO-92
CR02AM-8		125	0.3	10	0.1	OK	OK	TO-92(3)
CR05AS-8		125	0.5	10	0.1	OK	OK	UPAK
CR05BS-8		125	0.1	10	0.1	OK	OK	MPAK
CR04AM-12	600	125	0.4	10	0.1	OK	OK	TO-92
CR05AM-12		110	0.3	10	0.1	OK	OK	
CR03AM-12		110	0.3	20	0.1	OK	OK	
CR05BM-12		125	0.5	8	0.1	OK	OK	
CR08AS-12		125	0.8	10	0.1	OK	OK	UPAK
CR5AS-12		125	5	90	0.1	OK	OK	MP-3A
CR5AS-12		125	5	90	0.1	OK	OK	DPAK(L)-(3)
CR3KM-12		125	3	70	0.1	OK	OK	TO-220FN
CR6KM-12A		125	6	90	10	OK	OK	
CR8KM-12A		125	8	120	15	OK	OK	
CR3PM-12		125	3	70	0.1	OK	OK	TO-220F
CR6KM-12A		125	6	90	10	OK	OK	
CR8PM-12A		125	8	120	15	OK	OK	
CR12PM-12A		125	12	360	30	OK	OK	
CR6CM-12A		125	6	90	10	OK	OK	TO-220
CR8CM-12A		125	8	120	15	OK	OK	
CR12CM-12A		125	12	360	30	OK	OK	
CR05AM-16	800	110	0.3	10	0.1	OK	OK	TO-92
CR03AM-16		110	0.3	20	0.1	OK	OK	

150°C Guaranteed Planar Thyristors

• Applications
Heater control, igniters, regulators, motor control, inrush current protection circuits (switching power supplies, inverter lighting fixtures, inverters)
• Features
1) Highly reliable: Planar structure
2) 150°C guaranteed: Greater design margin
3) Suitable for lead forming
• Key points
- Improved reliability
- Larger thermal margin
- Smaller heat sink
- Suitable for use in high-temperature environments

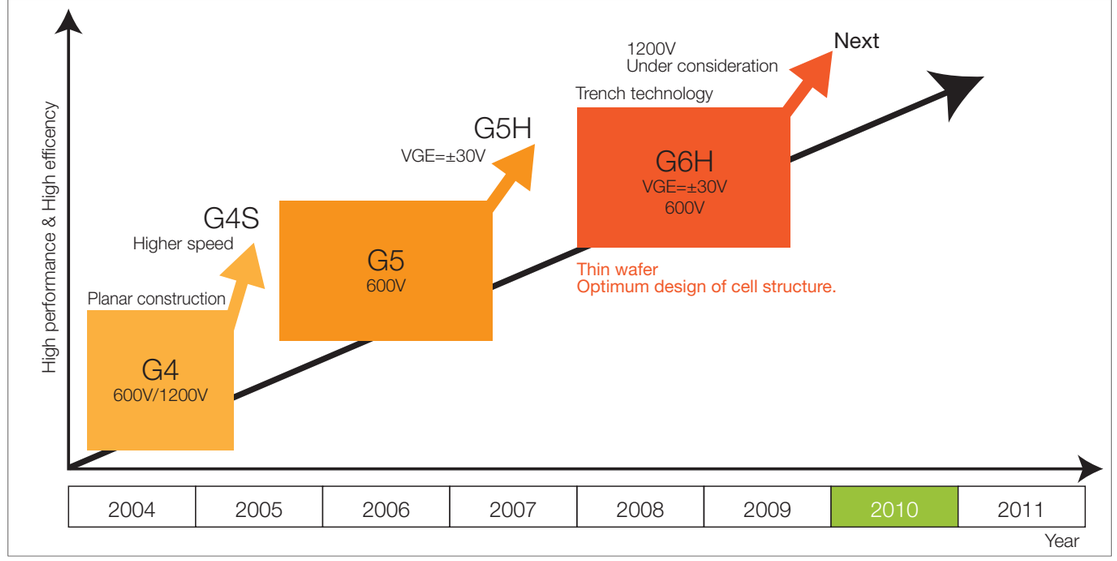
Product Lineup

Part No.	VDRM (V)	Tj (°C)	IT(AV) (A)	ITSM (A)	IGT(MAX.) (mA)	Status ES	Status MP	Package
CR6CM-12B	600	150	6	90	10	OK	OK	TO-220
CR8CM-12B			8	120	15	OK	OK	
CR12CM-12B			12	360	30	OK	OK	
CR6PM-12B			6	90	10	OK	OK	TO-220F
CR8PM-12B			8	120	15	OK	OK	
CR12PM-12B			12	360	30	OK	OK	
CR25RM-12D			25	360	30	OK	OK	TO-3PFM

Overview of Renesas Electronics IGBTs

Renesas Electronics supplies ultracompact, high-performance IGBTs for built-in flash units for digital still cameras and mobile phones, as well as specialized IGBTs for applications such as plasma display panels. Our product lineup also includes large-capacity IGBTs for power supply circuits such as PFCs. Highly efficient power supply circuits can be achieved by combining Renesas Electronics IGBTs and PFC controllers.

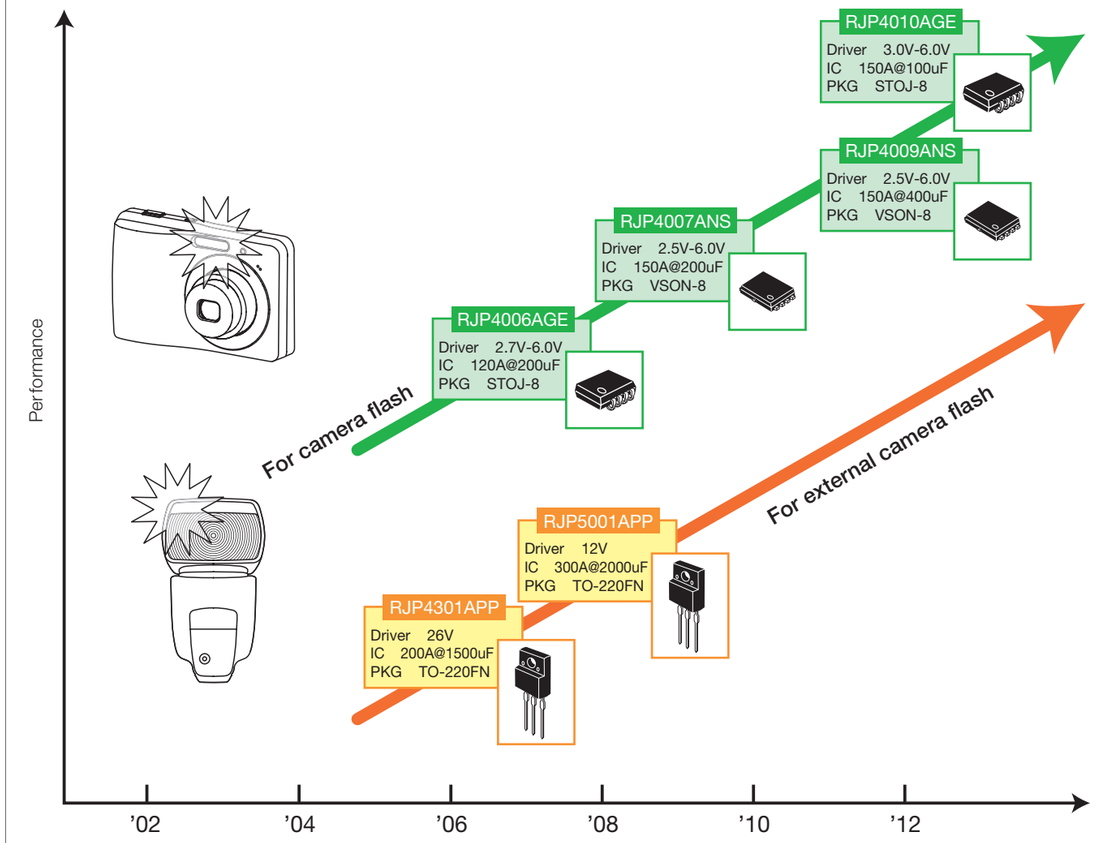
Development Roadmap of IGBTs



IH Kitchen Appliances	High Output, Low Loss, All Metal	High-Speed Trench IGBTs Composite Products with FRD
Inverters	High-Frequency Operation, High Short Circuit Tolerance	HiGT** with High Short Circuit Tolerance Composite Products with High-Speed FRD*
PFC Circuits	Large Current, High Efficiency	Ultra-High-Speed IGBTs Composite Products with High-Speed FRD*
Flat Screen TVs	Increased Panel Brightness, Low Power Consumption	Next-Generation Trench IGBTs Composite Products with FRD*
Camera Flash Units	Large Current, Small Size	Trench IGBTs VSON-8

*Fast recovery diode

Development Roadmap for IGBTs for Camera Flash Applications



Product Lineup of IGBTs for Camera Flash Applications

Part No.	Maximum Ratings			Package
	V_{CES}[V]	I_{CP}[A]	Drive[V]	
CY20AAJ-8H(Note)	400	130	4.0	SOP-8
RJP4301APP ** (Note)	400	200	30.0	TO-220FN
RJP5001APP ** (Note)	400	300	12.0	TO-220FN
RJP4006AGE	400	120	2.7-6.0	TSOJ-8
RJP4007ANS	400	150	2.5-6.0	VSON-8
RJP4009ANS **	400	150	2.5-6.0	VSON-8
RJP4010AGE **	400	150	3.0-6.0	TSOJ-8

** : Under Development Note: High frequency type

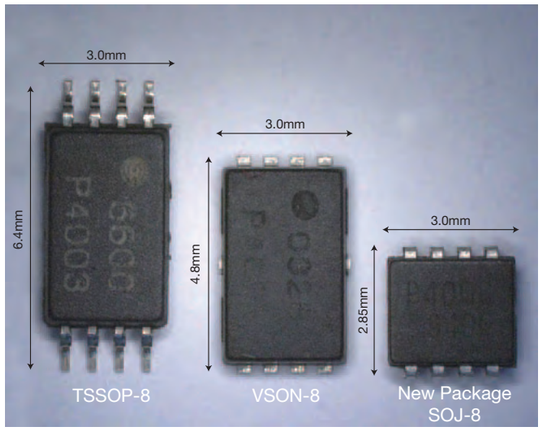
IGBTs for Camera Flash Applications

New IGBT Products for Camera Flash Applications

● Part No.
1. VSON-8 package: RJP4009ANS
2. TSOJ-8 package: RJP4010AGE

● Features
1. Ultra-compact package (TSOJ-8 size: 3.05mm × 2.85mm)
2. Range of drive voltages (2.7V (3.0V) to 6.0V)
3. High electrostatic tolerance (integrated gate Zener diode)
4. Completely lead and halogen free

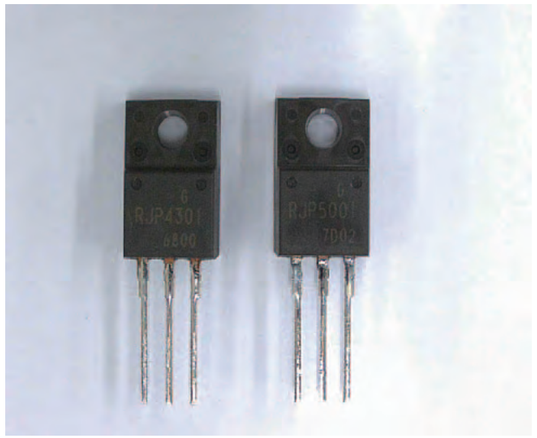
Under development



Part No.	V_{CES}[V]	I_{CP}[A]	Drive[V]	Package
RJP4010AGE	400	150	3.0~6.0	TSOJ-8
RJP4009ANS	400	150	2.5~6.0	VSON-8

Large-Current Control IGBTs for External Camera Flash Units

● Features
1. Large-current control (RJP5001APP: 300A)
2. Low-voltage drive (RJP4301APP: 12V drive)
3. High ESD Imunity (integrated gate Zener diode)
4. Lead free (RoHS compliant)



Part No.	V_{CES}[V]	I_{CP}[A]	Drive[V]	Package
RJP4301APP	430	200	26	TO-220FN
RJP5001APP	500	300	12	TO-220FN

Characteristics Required for Main IGBT Applications and Product Lineup

Characteristics Required for Main IGBT Applications

Application		PFC(1kW and over)			IH cooking heater		Photovoltaic system	Inverter use (UPS, etc.)	PDP		
Characteristics		Active filter (Partial SW)	Active filter (Continuation SW) f=20kHz	Active filter (Continuation SW) f=50kHz	Current resonance type	Voltage resonance type			SUS	ERC	PASS
Output saturation voltage(VCE(sat))		○	◎	○	◎◎	◎	◎	◎	◎	◎◎	◎
High-speed SW	toff	○	◎	◎◎	◎	○	○	○	◎	○	○
	ton	-	-	-	-	-	-	-	◎◎	◎	-
F D R		-	-	○	○	-	○	◎	◎	◎	-
Load short resistance		-	-	-	-	-	○	◎◎	-	-	-
High pulse current		-	-	-	-	-	-	-	◎	-	-
Withstand voltage		600V	600V	600V	600V	900-1200V	600-900V	600-800V	300-400V	300-400V	150-300V
Recommended IGBT		for partial SW	Low VCE (sat)type	High speed SW type	Low VCE (sat)type	-	Low VCE (sat)type	High breakdown resistance type Inverter			

◎◎: high-priority characteristics
◎ : Priority characteristics
○ : Requisite characteristics
- : Non-focused characteristics

Product Lineup

	Application	Motor		Power supply(PFC)			Solar system
		Inverter	DC chopper	Active filter (Partial SW)	Active filter(Full SW)		Inverter
					f=20kHz and near	f=50kHz and near	
Hight-loaded short circuit resistance type	RJH60C9DPD ★	◎	○				
	RJH60D1DPP ★	◎	○				
	RJH60D1DPE ★	◎	○				
	RJH60D2DPP ★	◎	○				
	RJH60D2DPE ★	◎	○				
	RJH60D3DPP ★	◎	○				
	RJH60D3DPE ★	◎	○				
	RJH60D0DPK ★	◎	○				◎
	RJH60D5DPK ★	◎	○				◎
	RJH60D6DPK ★	◎	○				◎
	RJH60D7DPK ★	◎	○				
for Partial SW system	RJP60D0DPK ★			◎			
	RJP60D0DPM ★			◎			
Low VCE(sat)type	RJH60F0DPK ★				◎		○
	RJH60F4DPK ★		◎		◎		○
	RJH60F5DPK ★		◎		◎		○
	RJH60F6DPK ★		◎		◎		
	RJH60F7ADPK ★		◎		◎		
High speed SW type	RJP6085DPN					◎	
	RJP6085DPK					◎	
	RJH6085BDPK ★					◎	
	RJH6086BDPK ★					◎	
	RJH6087BDPK ★					◎	
	RJH6088BDPK ★					◎	

★: New Product

Bipolar Transistors for Switching

Transistors with Integrated Resistors

Small-Signal Transistors (Transistors with Integrated Resistors)

Small-Signal Transistors (Transistors with Integrated Resistors)

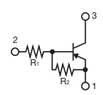
♦ Compact and lightweight
• Small surface mount packages such as USM (SC-75) and SSP (SC-70) for applications such as portable devices requiring compactness, thinness, and lightness.
• Incorporation of different semiconductor element (Zener diode) into a single package, reducing total number of components and allowing more compact size
• Diverse lineup with wide variety of internal resistors to choose from

■ Future improvements

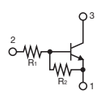
New products with even smaller packages are under development.

■ Features of internal transistors

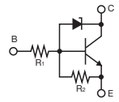
• Diverse lineup with wide variety of internal resistors to choose from
• Extensive product lineup with total loss ratings up to 2.0W
♦ Lineup of transistors with integrated resistors



PNP



NPN



NPN with ZeDi

Package				VCEO(V)	Ic(mA)	hFE	Features
SC-75	SC-70	SC-59	SC-62				
KA4 [ ]	GA4[ ]	FA4[ ]		50	100	35~600	
KN4 [ ]	GN4[ ]	FN4[ ]		-50	-100	35~600	
		FB1[ ]		25	700	300~	
		FP1[ ]		-25	-700	100~	
			HD1[ ]	60	1000	300~	
			HD2[ ]	60±10	1000	300~	Ze between C and B
			HQ1[ ]	-20	-2000	150~	
			HR1[ ]	-60	-1000	100~	

List of Products by Resistance Value

R1 (KΩ)	R2 (KΩ)	SC–75		SC–70		SC–59		SC–59			
		NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
10.0	10.0	KA4A4M	KN4A4M	GA4A4M	GN4A4M	FA4A4M	FN4A4M	-	-	-	-
22.0	22.0	KA4F4M	KN4F4M	GA4F4M	GN4F4M	FA4F4M	FN4F4M	-	-	-	-
47.0	47.0	KA4L4M	KN4L4M	GA4L4M	GN4L4M	FA4L4M	FN4L4M	-	-	-	-
4.7	4.7	KA4L3M	KN4L3M	GA4L3M	GN4L3M	FA4L3M	FN4L3M	-	-	-	-
4.7	10.0	KA4L3N	KN4L3N	GA4L3N	GN4L3N	FA4L3N	FN4L3N	-	-	-	-
4.7	-	KA4L3Z	KN4L3Z	GA4L3Z	GN4L3Z	FA4L3Z	FN4L3Z	-	-	-	-
1.0	10.0	KA4A3Q	KN4A3Q	GA4A3Q	GN4A3Q	FA4A3Q	FN4A3Q	-	-	-	-
10.0	47.0	KA4A4P	KN4A4P	GA4A4P	GN4A4P	FA4A4P	FN4A4P	-	-	-	-
22.0	47.0	KA4F4N	KN4F4N	GA4F4N	GN4F4N	FA4F4N	FN4F4N	-	-	-	-
47.0	22.0	KA4L4L	KN4L4L	GA4L4L	GN4L4L	FA4L4L	FN4L4L	-	-	-	-
10.0	-	KA4A4Z	KN4A4Z	GA4A4Z	GN4A4Z	FA4A4Z	FN4A4Z	-	-	-	-
22.0	-	KA4F4Z	KN4F4Z	GA4F4Z	GN4F4Z	FA4F4Z	FN4F4Z	-	-	-	-
47.0	-	KA4L4Z	KN4L4Z	GA4L4Z	GN4L4Z	FA4L4Z	FN4L4Z	-	-	-	-
2.2	2.2	KA4F3M	KN4F3M	GA4F3M	GN4F3M	FA4F3M	FN4F3M	-	-	-	-
2.2	10.0	KA4F3P	KN4F3P	GA4F3P	GN4F3P	FA4F3P	FN4F3P	-	-	-	-
2.2	47.0	KA4F3R	KN4F3R	GA4F3R	GN4F3R	FA4F3R	FN4F3R	-	-	-	-
10.0	4.7	KA4A4L	KN4A4L	GA4A4L	GN4A4L	FA4A4L	FN4A4L	-	-	-	-
47.0	10.0	KA4L4K	KN4L4K	GA4L4K	GN4L4K	FA4L4K	FN4L4K	-	-	-	-
-	10.0	-	-	-	-	FB1A4A	FP1A4A	HD1A4A	HR1A4A	HQ1A4A	HD2A4A
0.47	4.7	-	-	-	-	FB1L2Q	FP1L2Q	HD1L2Q	HR1L2Q	HQ1L2Q	HD2L2Q
1.0	1.0	-	-	-	-	FB1A3M	FP1A3M	HD1A3M	HR1A3M	HQ1A3M	HD2A3M
2.2	10.0	-	-	-	-	FB1F3P	FP1F3P	HD1F3P	HR1F3P	HQ1F3P	HD2F3P
3.3	10.0	-	-	-	-	FB1J3P	FP1J3P	-	-	-	-
4.7	10.0	-	-	-	-	FB1L3N	FP1L3N	HD1L3N	HR1L3N	-	HD2L3N
10.0	10.0	-	-	-	-	FB1A4M	FP1A4M	HD1L4M	HR1L4M	-	HD2A4M
0.22	2.2	-	-	-	-	-	-	HD1F2Q	HR1F2Q	HQ1F2Q	HD2F2G
0.47	1.0	-	-	-	-	-	-	-	-	HQ1L2N	-
2.2	2.2	-	-	-	-	-	-	-	-	HQ1F3M	-

Under development SOT-23F Series Signal Transistors

[Features]
• SOT23F package with permissible loss comparable to the SC-62 Switching to the new package enables a reduction of about 61% in the mounting area!

SC-62

Permissible loss: 0.52W
Mounting area: 18mm²

SOT-23F

Permissible loss: 0.46W
Mounting area: 6.96mm²

61% reduction

Availability of SC-62 Package Products (Product Numbers) in SOT-23F Package Versions

Target Product Number		VCEO [V]	Ic [A]	hFE	VCE(sat) [V] MAX.
PNP	NPN				
N0201R(2SB798)	N0201S(2SD999)	-25/25	-1.0/1.0	90~400	-0.4/0.4
N0500R(2SB799)	N0500S(2SD1000)	-50/50	-0.7/0.7	90~400	-0.4/0.4
N0800R(2SB800)	N0800S(2SD1001)	-80/80	-0.3/0.3	90~400	-0.6/0.6
N0801R(2SB804)	N0801S(2SD1005)	-80/80	-1.0/1.0	90~400	-0.5/0.5
N0202R(2SB1114)	N0202S(2SD1614)	-20/20	-2.0/2.0	135~600	-0.5/0.5
N0501R(2SB1115)	N0501S(2SD1615)	-50/50	-1.0/1.0	135~600	-0.3/0.3

Amplification Transistors

Amplification Transistors

Transistors for Amplification and High-Output RF MOSFETs

In signal amplification, noise increases and gain becomes more difficult to achieve the higher the frequency. This is why specific types of devices, such as compound transistors, silicon bipolar transistors, and Si-MOSFETs, are used for different applications. Of these, silicon high-frequency transistors have come into wide use due to their suitability for mass production.

High-Frequency MOSFET Market Requirements

Main areas	•Tuners TV and DVD tuners	•Wireless devices FRS, GMRS, RF-ID
Market requirements	•More compact, lower production cost •Eco-friendly (low-voltage/low-current operation)	•High-performance products (high-frequency operation) •Compact, good heat dispersion
Suitable products	•Dual-gate MOSFETs	•High-frequency power MOSFETs
High-frequency MOSFET application guidelines	•Integrated bias circuit •Low operating voltage •High performance(low noise, low distortion)	•Compact and good heat dispersion •High performance (high efficiency, high power)

Ultrafine processing technology for products with lower noise and distortion characteristics!

Dual-Gate MOSFETs

Trend in Dual-Gate MOSFETs

Standalone dual-gate MOS devices
• Four external resistors and four capacitors required.
• Operating voltage up to 9V

▼

BBFET
• Only three external resistors and one capacitor required.
• Low operating voltage (5V)

▼

Twin BBFETs
• One device each for UHF and VHF2 bands is sufficient.
• Mounting area is reduced by half.

Integrated Bias Circuit Product Lineup

Category	UHF	VHF	Package
Frequency (GHz)	0.5~1	0.05~0.5	
BBFET Series	BB502C BB505C BB506C	–	 CMPAK-4
	BB504C		
Twin BBFET Series	TBB1002 TBB1004 TBB1005 TBB1010 TBB1012 TBB1016		 CMPAK-6

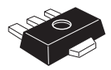
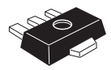
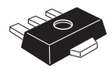
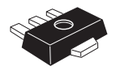
BBFET:Build in Biasing Circuit MOS FET IC
TBBFET:Twin Build in Biasing Circuit MOS FET IC

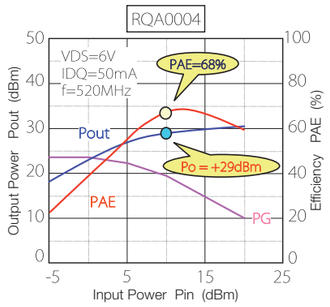
Amplification Transistors

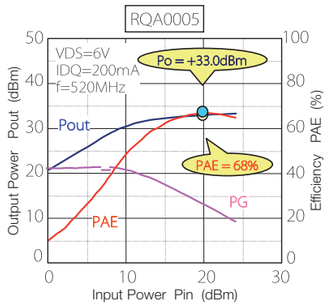
Amplification Transistors

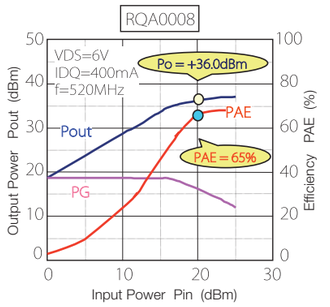
High-Frequency Power MOSFETs

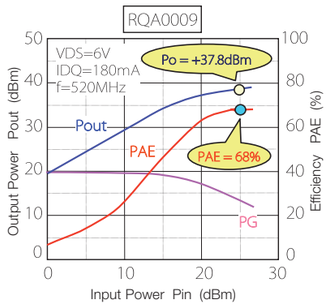
Lineup

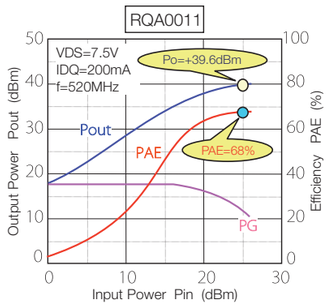
Product Part No.		RQA0004	RQA0005	RQA0008	RQA0009	RQA0011
Max. Rating	VDSS	16V	16V	16V	16V	16V
	ID	0.3A	0.8A	2.4A	3.2A	3.8A
	Pch(max)	3W	9W	10W	15W	15W
Test Conditions	Frequency	520MHz				
	VDS	6V				7.2V
	Pin	13dBm	20dBm			
Main Features	Pout	29.7dBm	33.0dBm	36.0dBm	37.8dBm	39.6dBm
		0.93W	2.0W	3.98W	6.0W	9.12W
	PAE	68%	68%	65%	65%	68%
	Linear Gain	23.0dB	21.0dB	18.5dB	18.0dB	18.5dB
	P1dB	27.0dBm	31.5dBm	35.0dBm	35.5dBm	38.0dBm
	ESD Immunity	level 3	level 3	level 3	level 4	level 4
Package	Name	UPAK	UPAK	UPAK	UPAK	WSON0504-2
	Dimensions (mm)	4.5×2.5×1.5 (including leads: 4.5 × 4.25)	4.5×2.5×1.5 (including leads: 4.5 × 4.25)	4.5×2.5×1.5 (including leads: 4.5 × 4.25)	4.5×2.5×1.5 (including leads: 4.5 × 4.25)	4.5×2.5×1.5 (including leads: 4.5 × 4.25)
	Exterior					











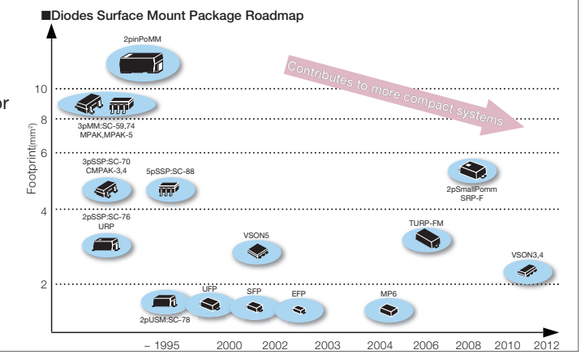
Diodes

Diodes

Overview of Diodes and Zener Diodes

Diodes Packages

Renesas Electronics has a wide-ranging lineup of diode products, including Zener diodes used for surge absorption and in power supplies, general-purpose diodes such as Schottky barrier diodes, varicap diodes used in tuners and VCOs, and high-frequency diodes such as PIN diodes used for switching in high-frequency front ends. The many package options include compact and thin packages, multi-element packages, and high-loss-tolerance packages. Customers can combine the characteristics they require to select the devices that best match their applications.



Zener Diodes (for Surge Absorption)

- Market Requirements
  - Compliance with EMC (Electromagnetic Compatibility) Directive
  - Reduced distortion on high-speed signal lines (USB, etc.)
  - Compact and thin dimensions
  - Environmental considerations
- Goals Moving Forward
  - Guaranteed ESD Immunity complying with IEC 61000-4-2
  - Low capacitance
  - Composite and more compact devices (2 or 4 elements per package), VSON-5 (contains 4 elements)
  - Lead and halogen free

Package	Part No.	Rating	Characteristics			Remarks
		Pd (mW)	Vz (V)	C (pF) (max.)	ESD (kV) (min.)	
MPAK two-devices	HZM3.3WA	200	3.1~3.5	-	30	
	HZM6.2ZMWA	200	5.9~6.5	8.5	13	Low capacitance
	HZM6.8MWA	200	6.47~7.0	130	30	
	HZM6.8ZMWA	200	6.47~7.0	25	20	Low capacitance
	HZM27WA	200	25.1~28.9	(27)	30	
MPAK-5 four-devices	HZM5.6ZFA	200	5.31~5.92	8.5	8	Low capacitance
	HZM6.2ZMFA	200	5.9~6.5	8.5	13	
	HZM6.8MFA	200	6.47~7.0	130	30	
	HZM6.8ZMFA	200	6.47~7.0	25	25	Low capacitance
	HZM27FA	200	25.1~28.9	(27)	30	
CMPAK two-devices	HZB6.8MWA	200	6.47~7.0	130	30	
VSON-5 four-devices	RKZ6.8ZMFAKT	150	6.47~7.0	25	25	Low capacitance

Package	Part No.	Rating	Characteristics			Remarks
		Pd (mW)	Vz (V)	C (pF) (max.)	ESD (kV) (min.)	
EFP*	HZL6.2Z4	100	5.9~6.5	4	8	Low capacitance
	HZL6.8Z4	100	6.47~7.0	4	8	
SFP*	HZD6.2Z4	150	5.9~6.5	4	8	Low capacitance
	HZD6.8Z4	150	6.47~7.0	4	8	
MPAK two-devices	HZM6.2Z4MWA	200	5.9~6.5	4typ.	8	Low capacitance
	HZM6.8Z4MWA	200	6.47~7.0	4typ.	8	
VSON-5 four-devices	RKZ6.2Z4MFAKT	150	5.9~6.5	4typ.	8	Low capacitance
	RKZ6.8Z4MFAKT	150	6.47~7.0	4typ.	8	
MPAK-5 four-devices	HZM6.2Z4MFA	200	5.9~6.5	4typ.	8	Low capacitance
	HZM6.8Z4MFA	200	6.47~7.0	4typ.	8	

*: The package is available for halogen-free diodes.

Package	Part No.	Rating	Characteristics			Remarks
		Pd (mW)	Vz (V)	C (pF) (max.)	ESD (kV) (min.)	
URP	HZU5.1~13G	200	4.84~13.96	-	30	High ESD
	HZU5.6Z	200	5.31~5.92	8.5	8	Low capacitance
	HZU6.2Z	200	5.9~6.5	8.5	-	
	HZU6.8Z	200	6.47~7.0	25	20	
UFP	HZC2.0~30	150	1.90~32.0	-	30	
	HZC33	150	31.0~35.0	-	25	
	HZC36	150	34.0~38.0	-	20	
EFP*	RKZ6.2KL	100	5.86~6.53	-	30	Ultra-small, high ESD resistance
UFP	RKZ6.8TKJ	150	5.80~7.80	-	25	Bi-directional type
SFP*	RKZ6.8TKK	150	5.80~7.80	-	25	

*: The package is available for halogen-free diodes.

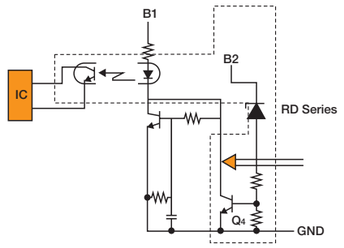
Constant Voltage/Surge Absorber Diodes

A variety of Zener diode products are available for specific applications.
< Constant voltage applications > → Name: RD Series
- Suitable applications include use in combination with transistors to stabilize the power supply voltage in compact power supplies, outputting a reference voltage, and surge absorption.
- The lineup includes small, thin packages such as SMD products for use in compact, lightweight electronic devices, and composite packages.

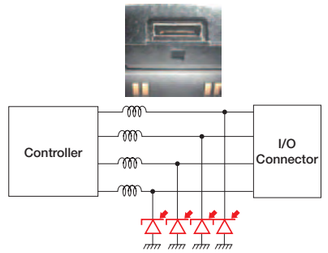
< Surge absorber applications > → Name: NNCD Series
- The Zener diode meets electromagnetic compatibility (EMC) standards for use in electrostatic discharge (EDS) countermeasures and has guaranteed EDS tolerance based on the IEC61000-4 contact discharge test.
- The lineup includes small, thin packages such as SMD products for use in compact, thin, lightweight electronic devices, and composite packages. In addition, low-capacitance products suitable for high-speed interfaces are available.

■ Future improvements
- New halogen-free versions of both constant voltage and surge absorber products.
- New surge absorber products with even smaller packages as well as reduced capacitance and higher ESD are under development.

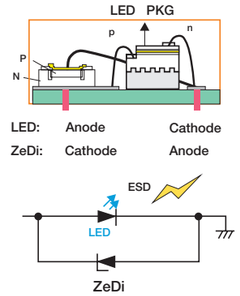
■ Use in constant voltage application
[voltage detection OVP circuit example (RD Series)]



■ Protection against external ESD
in mobile phone interface



■ LED chip protection
(LED package interior simplified)



■ Features of constant voltage diodes (RD Series)
- Versions with three permissible loss ratings (150mW, 200mW, and 1,000mW) are available, and the RD Series comprises eight SMD-type product groups.
- The wide variety of available products includes low-noise versions and versions with Zener voltages from 2.0V to 150V.

■ RD Series Product Lines

Permissible loss		150mW		200mW				1.0W	
Package		SC-78		SC-76		SC-59 (dual, common anode)		2pinPoMM	2-pin compact PoMM
Type		Low noise	General purpose	Low noise	General purpose	General purpose	ESD protection	General purpose	General purpose
Series		**RD[ ]UJ**	**RD[ ]UM**	**RD[ ]SL**	**RD[ ]S**	**RD[ ]MW**	**RD[ ]Z**	**RD[ ]FM**	**RD[ ]FS**
Zener voltage	2.0	-	RD2.0UM	-	RD2.0S	-	RD2.0S	RD2.0FM	RD2.0FS
	2.2	-	RD2.2UM	-	RD2.2S	-	RD2.2S	RD2.2FM	RD2.2FS
	2.4	-	RD2.4UM	-	RD2.4S	-	RD2.4S	RD2.4FM	RD2.4FS
	2.7	-	RD2.7UM	-	RD2.7S	-	RD2.7S	RD2.7FM	RD2.7FS
	3.0	-	RD3.0UM	-	RD3.0S	-	RD3.0S	RD3.0FM	RD3.0FS
	3.3	-	RD3.3UM	-	RD3.3S	-	RD3.3S	RD3.3FM	RD3.3FS
	3.6	-	RD3.6UM	-	RD3.6S	-	RD3.6S	RD3.6FM	RD3.6FS
	3.9	-	RD3.9UM	-	RD3.9S	-	RD3.9S	RD3.9FM	RD3.9FS
	4.3	-	RD4.3UM	-	RD4.3S	-	RD4.3S	RD4.3FM	RD4.3FS
	4.7	RD4.7UJ	RD4.7UM	RD4.7SL	RD4.7S	-	RD4.7S	RD4.7FM	RD4.7FS
	5.1	RD5.1UJ	RD5.1UM	RD5.1SL	RD5.1S	-	RD5.1S	RD5.1FM	RD5.1FS
	5.6	RD5.6UJ	RD5.6UM	RD5.6SL	RD5.6S	-	RD5.6S	RD5.6FM	RD5.6FS
	6.2	RD6.2UJ	RD6.2UM	RD6.2SL	RD6.2S	RD6.2Z	RD6.2S	RD6.2FM	RD6.2FS
	6.8	RD6.8UJ	RD6.8UM	RD6.8SL	RD6.8S	-	RD6.8S	RD6.8FM	RD6.8FS
	7.5	RD7.5UJ	RD7.5UM	RD7.5SL	RD7.5S	-	RD7.5S	RD7.5FM	RD7.5FS
	8.2	RD8.2UJ	RD8.2UM	RD8.2SL	RD8.2S	-	RD8.2S	RD8.2FM	RD8.2FS
	9.1	RD9.1UJ	RD9.1UM	RD9.1SL	RD9.1S	-	RD9.1S	RD9.1FM	RD9.1FS

Features of Surge Absorber Diodes (NNCD Series)

- Versions with two permissible loss ratings (150mW and 200mW) are available, and the NNCD Series comprises 13 SMD-type product groups.
- Products are available with guaranteed minimum ratings of 8kV and 30kV in the IEC61000-4-2 contact discharge test of electromagnetic compatibility. Products with bidirectional functionality as well as many voltage specifications and packages are available for a variety of applications, including reference power sources.

RD Series products (10V and up)

Permissible loss		150mW		200mW				1.0W	
Package		SC-78		SC-76		SC-59 (dual, anode common), general use		2pinPoMM	2-pin compact PoMM
Type		Low noise	General purpose	Low noise	General purpose	General purpose	ESD protection	General purpose	General purpose
Series		**RD[ ]UJ**	**RD[ ]UM**	**RD[ ]SL**	**RD[ ]S**	**RD[ ]MW**	**RD[ ]Z**	**RD[ ]FM**	**RD[ ]FS**
Zener voltage	10	RD10UJ	RD10UM	RD10SL	RD10S	RD10MW	-	RD10FM	RD10FS
	11	RD11UJ	RD11UM	RD11SL	RD11S	RD11MW	-	RD11FM	RD11FS
	12	RD12UJ	RD12UM	RD12SL	RD12S	RD12MW	-	RD12FM	RD12FS
	13	RD13UJ	RD13UM	RD13SL	RD13S	RD13MW	-	RD13FM	RD13FS
	15	RD15UJ	RD15UM	RD15SL	RD15S	RD15MW	-	RD15FM	RD15FS
	16	RD16UJ	RD16UM	RD16SL	RD16S	RD16MW	-	RD16FM	RD16FS
	18	RD18UJ	RD18UM	RD18SL	RD18S	RD18MW	-	RD18FM	RD18FS
	20	RD20UJ	RD20UM	RD20SL	RD20S	RD20MW	-	RD20FM	RD20FS
	22	RD22UJ	RD22UM	RD22SL	RD22S	RD22MW	-	RD22FM	RD22FS
	24	RD24UJ	RD24UM	RD24SL	RD24S	RD24MW	-	RD24FM	RD24FS
	27	RD27UJ	RD27UM	RD27SL	RD27S	RD27MW	-	RD27FM	RD27FS
	30	RD30UJ	RD30UM	RD30SL	RD30S	RD30MW	-	RD30FM	RD30FS
	33	RD33UJ	RD33UM	RD33SL	RD33S	RD33MW	-	RD33FM	RD33FS
	36	RD36UJ	RD36UM	RD36SL	RD36S	RD36MW	-	RD36FM	RD36FS
	39	RD39UJ	RD39UM	RD39DL	RD39S	RD39MW	-	RD39FM	RD39FS
	43	-	-	-	RD43S	-	-	RD43FM	RD43FS
	47	-	-	-	RD47S	-	-	RD47FM	RD47FS
	51	-	-	-	RD51S	-	-	RD51FM	RD51FS
	56	-	-	-	RD56S	-	-	RD56FM	RD56FS
	62	-	-	-	RD62S	-	-	RD62FM	RD62FS
	68	-	-	-	RD68S	-	-	RD68FM	RD68FS
	75	-	-	-	RD75S	-	-	RD75FM	RD75FS
	82	-	-	-	RD82S	-	-	RD82FM	RD82FS
	91	-	-	-	RD91S	-	-	RD91FM	RD91FS
	100	-	-	-	RD100S	-	-	RD100FM	RD100FS
	110	-	-	-	RD110S	-	-	RD110FM	RD110FS
	120	-	-	-	RD120S	-	-	RD120FM	RD120FS
	150	-	-	-	RD150S	-	-	-	-

NNCD Series Product Lines

Category		High-ESD type						Low-capacitance (20pF), high-ESD		Low-capacitance (10pF) type		High-ESD, bidirectional type		
Permissible loss		150mW	200mW					200mW		200mW		200mW		
		SC-78	SC-76	SC-76	SC-59 (double)	SC-74A (quad)	SC-88A (quad)	SC-59 (double)	SC-74A (quad)	SC-74A (quad)	SC-88A (quad)	SC-76	SC-76	SC-70 (double)
Series		**NNCD[ ]C**	**NNCD[ ]D**	**NNCD[ ]DA**	**NNCD[ ]F**	**NNCD[ ]G**	**NNCD[ ]H**	**NNCD[ ]MF**	**NNCD[ ]MG**	**NNCD[ ]LG**	**NNCD[ ]LH**	**NNCD[ ]MDT**	**NNCD[ ]DT**	**NNCD[ ]ST**
Breakdown voltage	2.0V			NNCD2.0DA								-	-	-
	2.2V			NNCD2.2DA								-	-	-
	2.4V			NNCD2.4DA								-	-	-
	2.7V			NNCD2.7DA								-	-	-
	3.0V			NNCD3.0DA								-	-	-
	3.3V	NNCD3.3C	NNCD3.3D	NNCD3.3DA	NNCD3.3F	NNCD3.3G	-	-	-	-	-	-	-	-
	3.6V	NNCD3.6C	NNCD3.6D	NNCD3.6DA	NNCD3.6F	NNCD3.6G	-	-	-	-	-	-	-	-
	3.9V	NNCD3.9C	NNCD3.9D	NNCD3.9DA	NNCD3.9F	NNCD3.9G	-	-	-	-	-	-	-	-
	4.3V	NNCD4.3C	NNCD4.3D	NNCD4.3DA	NNCD4.3F	NNCD4.3G	-	-	-	-	-	-	-	
	4.7V	NNCD4.7C	NNCD4.7D	NNCD4.7DA	NNCD4.7F	NNCD4.7G	-	-	-	-	-		-	-
	5.1V	NNCD5.1C	NNCD5.1D	NNCD5.1DA	NNCD5.1F	NNCD5.1G	-	-	-	-	-	-	-	-
	5.6V	NNCD5.6C	NNCD5.6D	NNCD5.6DA	NNCD5.6F	NNCD5.6G	NNCD5.6H	-	NNCD5.6MG	NNCD5.6LG	NNCD5.6LH	-	-	-
	6.2V	NNCD6.2C	NNCD6.2D	NNCD6.2DA	NNCD6.2F	NNCD6.2G	-	NNCD6.2MF	NNCD6.2MG	NNCD6.2LG	NNCD6.2LH	-	-	-
	6.8V	NNCD6.8C	NNCD6.8D	NNCD6.8DA	NNCD6.8F	NNCD6.8PG	NNCD6.8PH	-	NNCD6.8MG	NNCD6.8RG	NNCD6.8RH	-	-	NNCD6.8ST
	7.5V	NNCD7.5C	NNCD7.5D	NNCD7.5DA	NNCD7.5F	NNCD7.5G	-	-	-	-	-	NNCD7.5MDT	-	-
	8.2V	NNCD8.2C	NNCD8.2D	NNCD8.2DA	NNCD8.2F	-	-	-	-	-	-	-	-	-
	9.1V	NNCD9.1C	NNCD9.1D	NNCD9.1DA	NNCD9.1F	-	-	-	-	-	-	-	-	
	10V	NNCD10C	NNCD10D	NNCD10DA	NNCD10F	-	-	-	-	-	-	-	-	-
	11V	NNCD11C	NNCD11D	NNCD11DA	NNCD11F	-	-	-	-	-	-	-	-	-
	12V	NNCD12C	NNCD12D	NNCD12DA	NNCD12F	-	-	-	-	-	-	-	-	-
	16V	-	-	NNCD16DA	-	-	-	-	-	-	-	-	-	
	18V	-	-	NNCD18DA	-	-	-	-	-	-	-	-	NNCD18DT	NNCD18ST
	20V	-	-	NNCD20DA	-	-	-	-	-	-	-	-	NNCD20DT	-
	22V	-	-	NNCD22DA	-	-	-	-	-	-	-	-	-	-
	24V	-	-	NNCD24DA	-	-	-	-	-	-	-	-	-	-
	27V	-	-	NNCD27DA	-	NNCD27G	-	-	-	-	-	-	NNCD27DT	NNCD27ST
	36V	-	-	NNCD36DA	-	NNCD36G	-	-	-	-	-	-	NNCD36DT	NNCD36ST
	39V	-	-	NNCD39DA	-	-	-	-	-	-	-	-	-	-

Note: High-ESD type is product group with guaranteed tolerance of 30kV. Low-capacitance (10pF) type is product group with guaranteed tolerance of 8kV.

Schottky Barrier Diodes

Schottky Barrier Diodes

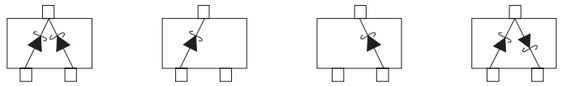
● Market Requirements
- High efficiency and low loss
- Reduced distortion on high-speed signal lines
- Wide-ranging current tolerance
- Environmental considerations

● Goals Moving Forward
- Low VF
- Low leak current
- Low capacitance
- More extensive product lineup
- More compact and composite devices
- Lead and halogen free

Classification	Package	Part No.	Maximum Rating VRRM (V)	Maximum Rating Io (A)	Characteristics VF(V) (max.)	Characteristics IF(A)	Characteristics IR (mA) (max.)	Characteristics VR(V)	Pin Connection
Three-terminal Schottky diodes for use in rectifiers	MPAK	HRW0202A	20	0.2	0.40	0.1	0.05	20	CC
		HRW0202B	20	0.2	0.42	0.1	0.01	20	CC
		HRW0203A	30	0.2	0.50	0.2	0.05	30	SI(1)
		HRW0203B	30	0.2	0.50	0.2	0.05	30	SI(2)
		HRW0302A	20	0.3	0.40	0.3	0.1	20	SI(1)
		HRW0502A	20	0.5	0.40	0.5	0.2	20	SI(1)
		HRW0503A	30	0.5	0.55	0.5	0.05	30	SI(1)
		HRW0702A	20	0.7*	0.43	0.7	0.2	20	SI(1)
	CMPAK	HRB0103A	30	0.1	0.44	0.1	0.05	30	SI(1)
		HRB0103B	30	0.1	0.44	0.1	0.05	30	SE
		HRB0502A	20	0.5*	0.40	0.5	0.2	20	SI(1)
		RKR0202AQE	20	0.2	0.40	0.1	0.05	20	CC

*: IF value

Pin Connection



CC Type　SI(1) Type　SI(2) Type　SE Type

Classification	Package	Part No.	Maximum Rating VRRM (V)	Maximum Rating Io (A)	Characteristics VF(V) (max.)	Characteristics IF(A)	Characteristics IR (mA) (max.)	Characteristics VR(V)
Schottky diodes for use in rectifiers (Two-terminal)	SRP-F	RKR104BKV	40	1	0.55	0.7	0.05	40
	TURP	HRV103A	30	1	0.36	0.7	1	30
		HRV103B	30	1	0.45	0.7	0.1	30
		RKR0505AKH	50	0.5	0.46	0.5	0.4	20
		RKR0505BKH	50	0.5	0.60	0.5	0.04	30
		RKR0703BKH	30	0.7	0.55	0.7	0.05	30
		RKR104BKH	40	1	0.55	0.7	0.05	40
	URP	HRU0103A	30	0.1	0.44	0.1	0.05	30
		HRU0103C	30	0.1	0.60	0.1	0.0001	5
		HRU0203A	30	0.2	0.50	0.2	0.05	30
		HRU0302A	20	0.3	0.40	0.3	0.10	20
	UFP	HRC0103A	30	0.1	0.44	0.1	0.05	30
		HRC0103C	30	0.1	0.60	0.1	0.0001	5
		HRC0201A	15	0.2	0.39	0.2	0.05	6
		HRC0203B	30	0.2	0.52	0.2	0.01	30
		HRC0203C	30	0.2	0.45	0.2	0.03	10
	SFP*	HRD0103C	30	0.1	0.60	0.1	0.0001	5
		HRD0203C	30	0.2	0.45	0.2	0.03	10
	EFP*	HRL0103C	30	0.1	0.60	0.1	0.0001	5

Package	Part No.	Maximum Rating VR(V)	Maximum Rating Io(mA)	Characteristics C(pF)max
URP	HSU276A	5(VRRM)	30	0.85
	HSU227	25(VRRM)	50	3.0
	HSU285	2	5	0.3*2
UFP	HSC88	10	15	0.8
	HSC226	25(VRRM)	50*1	2.8
	HSC276A	5(VRRM)	30	0.85
	HSC278	30	30	1.2
	HSC285	2	5	0.3*2
	RKD700KJ	30	50	2.8
SFP*	HSD88	10	15	0.8
	HSD226	25(VRRM)	50*1	2.8
	HSD276A	5(VRRM)	30	0.85
	HSD278	30	30	1.5
	RKD700KK	30	50	2.8
EFP*	HSL226	25(VRRM)	50*1	2.8
	HSL278	30	30	1.5
	HSL285	2	5	0.3*2
	HSL276A	3	30	0.85
	RKD700KL	30	50	2.8
	RKD702KL	30(VRRM)	50*1	2.5

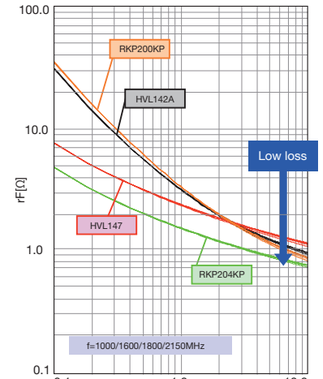
Package	Part No.	Maximum Rating VR(V)	Maximum Rating Io(mA)	Characteristics C(pF)max
MPAK	HSM198S	10	30	1.5
	HSM276AS/ASR	5(VRRM)	30	0.9
	HSM88AS/ASR	10	15	0.85
	HSM88WA	10	15	0.85
	HSM88WK	10	15	0.85
CMPAK	HSB88AS	10	15	0.8
	HSB88WK	10	15	0.8
	HSB226S	25(VRRM)	50*1	2.8
	HSB226WK	25(VRRM)	50*1	2.8
	HSB276AS	5(VRRM)	30	0.9
	HSB285S	2	5	0.3*2
CMPAK-4	HSB226YP	25(VRRM)	50*1	2.8
	HSB88YP	10	15	0.8
	HSB276AYP	5(VRRM)	30	0.85
	HSB0104YP	40	100*1	20.0*2
MP6*	RKD702KP	30(VRRM)	50*1	2.5
	RKD703KP	30(VRRM)	100*1	5
	RKD704KP	30(VRRM)	50*1	5
	RKD750KP	2	5	0.3
	RKD751KP	3	30	1.0

*1: IF value　*2: Typ
*: The package is available for halogen-free diodes.

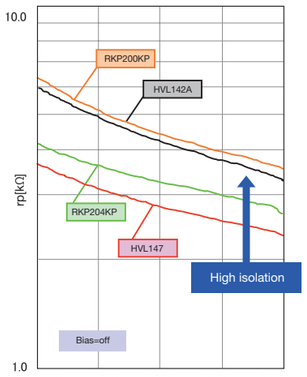
PiN Diodes / Vari-cap Diodes

PiN Diodes

● Low on-resistance for reduced insertion loss
● Low on-resistance in low-current range for reduced power consumption
● Lower capacitance when off for improved isolation
● New fabrication process for lower distortion at high frequencies
● Smaller package (MP6) for reduced secondary harmonics
● Composite package (MFP12) for reduced size and weight
● Less environmental impact through elimination of lead and halogen



On resistance Characteristics

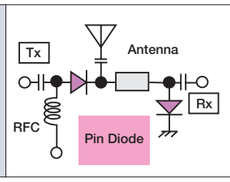


Off resistance characteristics

PiN Diode for High-Frequency Front Ends for Mobile Phones and Wireless LAN Equipment

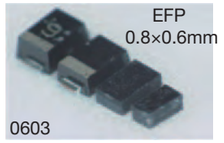
Trench structure process for low capacitance between pins
● Compact Surface-mount flat-lead package versions
1006 (SEP), 0806 (EFP), MP6 (0603), MFP12 (12 pins)

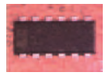
SPDT SW



Insertion Loss of PIN Diode	
Freq. and Loss	Part No.
2.4GHz(6mA) 0.20dB	HVD/L142A RKP200KP
2.4GHz(2mA) 0.20dB	HVD/L144A
5.2GHz(2mA) 0.20dB	HVD/L147 RKP204KP

Package



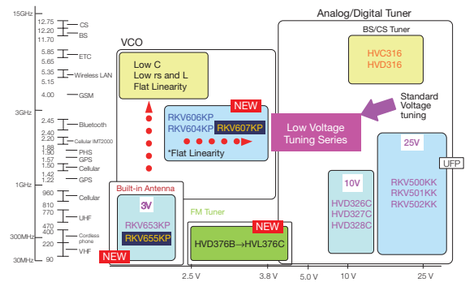


Package	Part No.	Freq. (GHz) up to 2.4	Freq. (GHz) up to 5.8	rf(Ω) max.	rf(Ω) max. IF(mA)	C (pF) max.	2nd HD (dB))	Features
SFP(1006)	HVD131	○		1.0	10	0.8	-36.8	
	HVD132	○		2.0	10	0.5	-36.4	
EFP(0806)	HVD/L142A	○		1.3	10	0.35	-42.0	
	HVD/L144A		○	1.8	2	0.43	-30.2	Low current
	HVD/L147	○	○	1.5 (2.5)	10 (2)	0.31	-46.1	
	HVD191	○	○	2.5	10	0.37	-60.0	High Isolation
EFP(0806)	RKP201KL		○	2.0	2	0.35	-33.3	
	RKP300KL	○	○	3.7	10	0.25	-65.0	Low Harmonic
MP6 (0603)	RKP200KP	○		1.3	10	0.35	-42.0	WS: MP: OK
	RKP204KP		○	1.8	2	0.35	-46.1	
MFP12	RKP400KS	○		6 in 1 (HVD142A ×4, 201 ×2)				Multi-chip /Max. 6 in 1 WS: OK,MP: OK
	RKP401KS	○		5 in 1 (HVD147 ×1, 200 ×4)				
	RKP402KS	○		5 in 1 (RKP200 ×5)				

Vari-cap Diodes

● Less variation in properties to meet narrower tolerances for deviation in C-V characteristics through improved process yields for better capacitance and linearity
● Higher sensitivity (VR = 0.5V to 4.0V)
● Lower capacitance for higher RF
● Smaller, thinner, lighter packages (EFP)
→ Additions to MP6 lineup
● Less environmental impact through elimination of lead and halogen

High Frequency Vari-Cap Diode Products Map



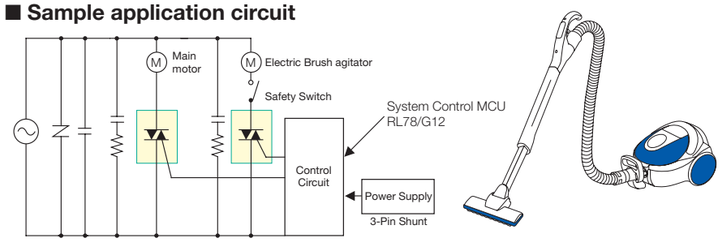
Applications

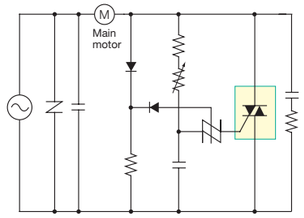
Household Electronics

Vacuum Cleaners, Rice Cookers

Vacuum cleaners

■ **Sample application circuit**





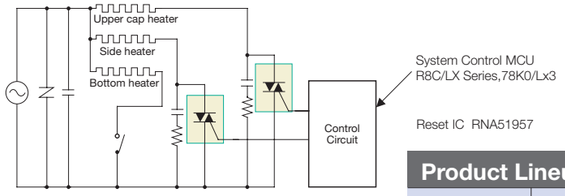
Switching Controllers:
M62213FP,
M62281FP,
M51998FP,
HA178L05UA,
HA17431

Product Lineup

	Input Voltage	Capacity	Main Vacuum Motor	Motorized Brush
TRIACs	AC100V to 120V	500 to 1000W	BCR16CM-12LA/LB BCR16KM-12LA/LB BCR16PM-12LA/LG	BCR2PM-14LE BCR3KM-12LA/LB BCR3PM-12LA/LG
		1000 to 1500W	BCR20AM-12LA/LB BCR20KM-12LA/LB BCR30KM-8LB	BCR2PM-14LE BCR3KM-12LA/LB BCR3PM-12LA/LG
	AC200V to 240V	500 to 1000W	BCR8CM-12LA/LB BCR8KM-12LA/LB BCR8PM-12LA/LG	BCR2PM-14LE BCR3KM-12LA/LB BCR3PM-12LA/LG
		1000 to 1500W	BCR12CM-12LA/LB BCR12KM-12LA/LB BCR12PM-12LA/LG	BCR2PM-14LE BCR3KM-12LA/LB BCR3PM-12LA/LG
Diodes	General-Purpose Surge Absorption, Circuit Protection	Zener Diodes	RKZxxKG Series: 2-pin surface-mount package, high ESD ideal for surge absorption HZM*NB Series: 3-pin surface-mount package, high ESD ideal for surge absorption HZ/HZS Series: 2-pin glass insertion package, high ESD ideal for surge absorption	
		Switching Diodes	HSU119, HSC119: 2-pin surface-mount package HSM2838C, HSM123: 3-pin surface-mount package (containing 2 elements) 1S2076, 1SS119: 2-pin glass insertion package	
		Schottky Barrier Diodes	HRC0103C: 2-pin surface-mount package (low Vf, low leak current) HRB0502A: 3-pin surface-mount package (low Vf) HRV103B, RKR104BKH: Compact 2-pin surface-mount package (IO = 1A), low IR ideal for circuit protection	

Rice cookers

■ **Sample application circuit**



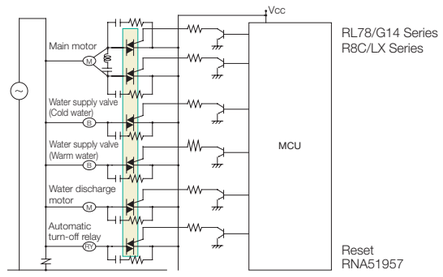
Product Lineup

Input Voltage	Top (Lid) Heater		Side Heater	
AC100V to 120V	~60W	BCR1AM-12A	~60W	BCR1AM-12A
	~120W	BCR2PM-12RE	~120W	BCR2PM-12RE
AC200V to 240V	~80W	BCR08AM-12A	~80W	BCR08AM-12A
	~120W	BCR1AM-12A	~120W	BCR1AM-12A
Diodes	Zener Diodes	RKZxxKG/K Series: High ESD ideal for surge absorption		
	Switching Diodes	HSU119/1SS120		

Washing Machines, Fans

Washing machines

■ **Sample application circuit**

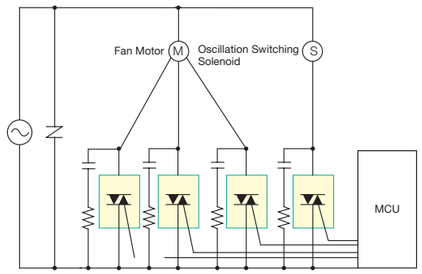


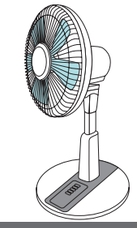
Product Lineup

	Input Voltage	Capacity	Washer Motor	Water Supply Pump	Drain Motor	Auto-Power-Off Relay	Bathwater Pump
TRIACs	AC100V to 120V	~7kg	BCR8PM-12LG	BCR1AM-12A	BCR1AM-12A	BCR1AM-12A	BCR5PM- 12LG
		~10kg	BCR10PM-12LG	BCR1AM-12A	BCR1AM-12A	BCR1AM-12A	BCR5PM-12LG
	AC200V to 240V	~7kg	BCR8PM-14LG BCR8PM-16LG	BCR08AM-14A	BCR08AM-14A	BCR08AM-14A	BCR3PM-14LG
		AC100V/AC200V Aoto-Switching	BCR12PM-14LG	BCR08AM-14A	BCR08AM-14A	BCR08AM-14A	BCR3PM-14LG
Diodes	General-Purpose Surge Absorption, Circuit Protection	Zener Diodes	RKZxxKG Series: 2-pin surface-mount package, high ESD ideal for surge absorption HZM*NB Series: 3-pin surface-mount package, high ESD ideal for surge absorption HZ/HZS Series: 2-pin glass insertion package, high ESD ideal for surge absorption				
		Switching Diodes	HSU119, HSC119: 2-pin surface-mount package HSM2838C, HSM123: 3-pin surface-mount package (containing 2 elements) 1S2076, 1SS119: 2-pin glass insertion package				
		Schottky Barrier Diodes	HRC0103C: 2-pin surface-mount package (low Vf, low leak current) HRB0502A: 3-pin surface-mount package (low Vf) HRV103B, RKR104BKH: Compact 2-pin surface-mount package (IO = 1A), low IR ideal for circuit protection				

Fans

■ **Sample application circuit**





Product Lineup

Input Voltage	Fan Motor	Horizontal Oscillation	Vertical Oscillation
AC100V to 120V	BCR1AM-12A	BCR1AM-12A	BCR1AM-12A
AC200V to 240V	BCR08AM-12A	BCR08AM-12A	BCR08AM-12A

http://japan.renesas.com/consumer_electronics http://www.renesas.com/applications

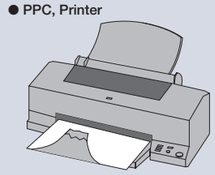
Applications

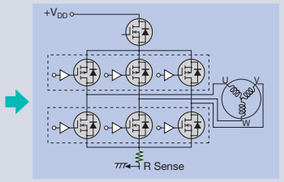
Household Electronics

Compact Motor Drivers, Printers

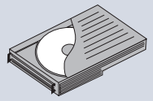
Power MOSFETs for Driving Compact Motors

● PPC, Printer

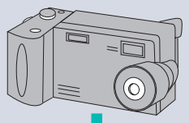


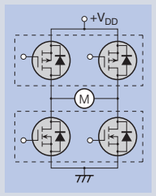


● HDD of Server, etc. (Spindle Motor Drive)



● Camera (H Bridge)



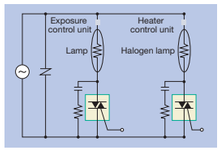


MPAK Lineup

Package	Part No.		Maximum Rating VDSS (V)	Maximum Rating VGss (V)	Maximum Rating ID (A)	RDS (on) (mΩ) VGS=4.5v(8v) typ	RDS (on) (mΩ) VGS=4.5v(8v) max	RDS (on) (mΩ) VGS=10v typ	RDS (on) (mΩ) VGS=10v max	Qgd (nc)	Qg (nC)
SOP-8	HAT2199R	Single (Nch)	30	±20	11	17	25	13	16.5	1.8	7.5
	HAT2208R		30	±20	9	24	35	18	23	1.1	4.4
	HAT2256R		60	±20	8	28	41	24	30	3.2	10
	HAT1131R	Single (Pch)	-30	±20	-9	21.5	31	15	19	5.8	17
	HAT1132R		-30	±20	-7	27.5	40	20	25	5.2	11.5
	HAT2276R	Nch+Nch	30	±20	7.5	27	40	19	24	1.2	4.6
	HAT2280R		30	±20	6	40	58	27	34	1.1	3
	HAT2275R		60	±20	6.6	29	43	25	32	3.2	10
	HAT2215R		80	±20	3.4	100	145	88	115	1.3	7.3
	HAT1126R	Pch+Pch	-60	±20	6	60	85	40	50	8	37
	HAT3029R	Nch+Pch	30	±20	6	40	58	27	34	1.1	3.1
			-30	+10/-20	-6	36	53	25	32	4.4	11.5
	HAT3037R		45	±20	5	55	75	44	55	0.9	3.0
			-45	+10/-20	-3.8	95	130	75	95	1.5	4.9
	HAT3010R		60	±20	6	32	45	25	32	8	18
			-60	±20	-5	90	130	60	76	8	18
	HAT3031R		60	±20	6.6	29	43	25	32	2.8	10
			-60	+10/-20	-3.4	120	175	95	120	2.2	6.0
	HAT3038R		60	±20	5	55	80	48	60	1.4	-
			-60	±20	-3.8	90	130	80	100	2.8	-
	HAT3021R		80	±20	3.4	100	145	90	115	1.3	7.3
			-80	±20	-2.6	200	290	165	210	2.4	16
	HAT3019R		100	±20	3.5	120	160	90	115	3.2	15
			-100	±20	-2.3	300	500	240	300	3.1	16
UPAK	RQK0601DQS	Single (Nch)	60	±20	5.0	65	91	56	70	1	8.9
	RQK0603DQS		60	±20	2.8	240	336	205	257	0.4	2.7
	RQJ0601DQS	Single (Pch)	-60	+10/-20	-2.8	150	210	124	155	1.5	9.6
	RQJ0602DQS		-60	+10/-20	-1.5	620	868	485	607	0.3	2.9
	RQK0301DQS	Single (Nch)	30	±20	6.0	35	49	28	35	2.1	12
	RQK0302DQS		30	±20	3.8	107	150	81	102	1.2	3.2
	RQJ0301DQS	Single(Pch)	-30	+10/-20	-5.2	56	79	38	48	6	18
MPAK	RQK0605DQA	Single (Nch)	60	±20	3.1	93	131	82	103	0.8	6.9
	RQK0603DQA		60	±20	2.0	248	348	212	265	0.4	2.8
	RQJ0603DQA	Single (Pch)	-60		-1.8	196	275	158	198	1.1	7.4
	RQJ0602DQA		-60	+10/-20	-1.1	613	854	490	613	0.6	3
	RQK0303DQA	Single (Nch)	30	±20	3.7	50	70	42	53	1.3	8.9
	RQK0302DQA		30	±20	2.7	122	171	92	115	0.5	3.3
	RQJ0303DQA	Single (Pch)	-30	+10/-20	-3.3	76	107	54	68	2.9	12
	RQJ0302DQA		-30	+10/-20	-2.2	216	303	138	173	1	4.2

Printers

■ Sample application circuit



Exposure Control Units

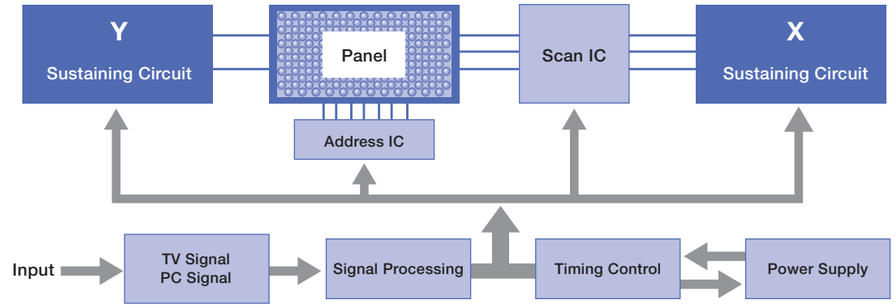
Input Voltage	Capacity	Non-Insulation Package	Uninsulated Package
AC100V to 120V	200W	BCR5AM-12LA/LB	BCR5KM-12LA/LB BCR5PM-12LA/LG
	300W	BCR6AM-12LA/LB	BCR8KM-12LA/LB BCR8PM-12LA/LG
	400W	BCR8CM-12LA/LB	BCR8KM-12LA/LB BCR8PM-12LA/LG
AC200V to 240V	200W	-	BCR3KM-12LA/LB BCR3PM-12LA/LG
	300W	-	BCR3KM-12LA/LB BCR3PM-12LA/LG
	400W	BCR5AM-12LA/LB	BCR5KM-12LA/LB BCR5PM-12LA/LG

Heater Control Units

Input Voltage	Capacity	Non-Insulation Package	Uninsulated Package
AC100V to 120V	400W	BCR8CM-12LA/LB	BCR8KM-12LA BCR5PM-12LA/LG
	600W	BCR12CM-12LA/LB	BCR12KM-12LA BCR12PM-12LA/LG
	800W	BCR16CM-12LA/LB	BCR16KM-12LA BCR16PM-12LA/LG
	1000W	BCR30AM-12LA/LB	-
AC200V to 240V	400W	BCR5AM-12LA/LB	BCR5KM-12LA BCR5PM-12LA/LG
	600W	BCR6AM-12LA/LB	BCR8KM-12LA BCR8PM-12LA/LG
	800W	BCR8CM-12LA/LB	BCR8KM-12LA BCR8PM-12LA/LG
	1000W	BCR10CM-12LA/LB	BCR10KM-12LA BCR10PM-12LA/LG

PDP

PDP System Configuration



IGBTs (High-Speed Type)

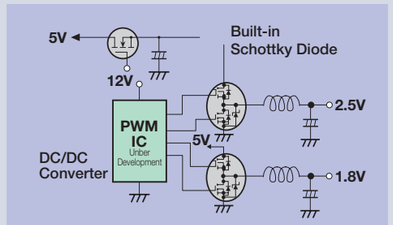
Part No.	Maximum Rating VCES[V]	Maximum Rating IC[A]	Maximum Rating VGE[V]	Electrical Characteristics VCE(sat)[V]typ.	Electrical Characteristics tf[µs]typ.	Package
RJP30E2DPK	360	35	±30	1.7	0.15	TO-3PSG
RJP30E3DPK	360	40	±30	1.6	0.15	TO-3PSG
RJP30E2DPP	360	35	±30	1.7	0.15	TO-220FL
RJP30E3DPP	360	40	±30	1.6	0.15	TO-220FL
RJP30H2DPP	360	35	±30	1.3	0.15	TO-220FL
RJP30H3DPP	360	40	±30	1.2	0.15	TO-220FL
RJP30K3DPP	360	40	±30	1.1	0.25	TO-220FL
RJP63F3DPP	630	40	±30	1.7	0.1	TO-220FL
RJP63K2DPP	630	35	±30	1.9	0.2	TO-220FL
RJP63K3DPP	630	40	±30	1.7	0.2	TO-220FL

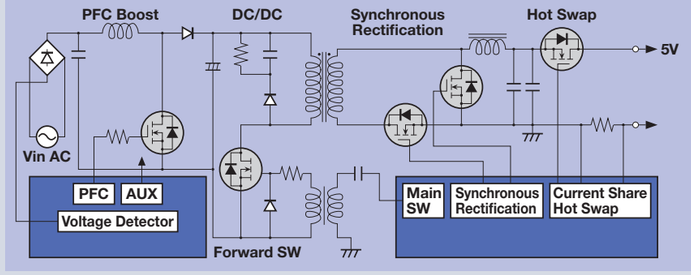
Synchronous Rectifiers for AD/DC Converters

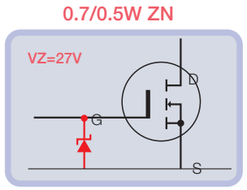
Application Examples

Application Blocks

Application	MOSFET	Control IC
PFC PFC+PWM	500V	HA16174 HA16158
DC/DC	500V	-
Secondary Side Synchronous Rectification	30 to 60V	
Hot Swap	20 to 30V	
VRM	20 to 30V	HA16167







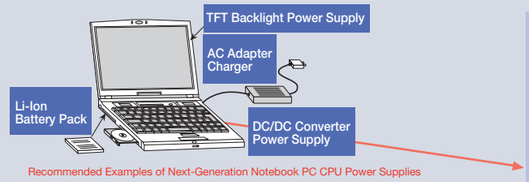
G-S Protection and Overvoltage Protection (OVP)
→ Breakdown mode must be short mode.

Product Lineup

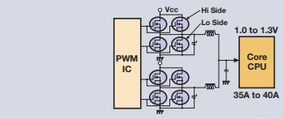
Application	Part No.	Package	VDSS (V)	VGSS (V)	ID (A)	Pch (W)	RDS (on) (mΩ) VGS=10V typ	RDS (on) (mΩ) VGS=10V max
Start SW	RJK6011DJE	TO-92M	600	±30	0.1	0.9	35	52
	RJK6022DJE	TO-92M	600	±30	0.2	0.9	13	15
PFC DC/DC	RJK6015DPK	TO-3P	600	±30	21	150	315	360
	RJK5020DPK	TO-3P	500	±30	40	200	103	115
Secondary Side Synchronous Rectification	HAT2165H	LFPAK	30	±20	55	30	2.5	3.3
	HAT2170H		40	±20	45	30	3.3	4.2
	H7N0308LD	LDPAK	30	±20	70	100	3.8	4.8
	H7N0602LD		30	±20	85	100	4.1	5.2
Hot Swap	H7N0203AB	TO-220AB	20	±20	90	100	2.4	3
	RJK0328DPB	LFPAK	30	±20	60	65	1.6	2.1
DC/DC converters	RJK0354DSP	SOP-8	30	±20	16	2.0	5.4	7.0
	RJK0352DSP		30	±20	18	2.0	4.3	5.6
	RJK0305DPB	LFPAK	30	±20	30	45	6.7	8.0
	RJK0303DPB		30	±20	40	55	3.1	3.7
	RJK0331DPB		30	±20	40	50	2.6	3.4
	RJK0330DPB		30	±20	45	55	2.1	2.7
G-S Protection	**Series**	**Package**	**Pd**	**Notes**				
	RKZ-KV Series	SRP-F	0.7W	IEC 61000-2-4 compliant, 30kV (contact)				
	RKZ-KV Series	TURP-FM	0.5W	IEC 61000-2-4 compliant, 30kV (contact)				

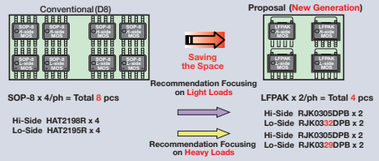
Notebook PCs

Application Example (Notebook PC Lithium-Ion Battery Protection)

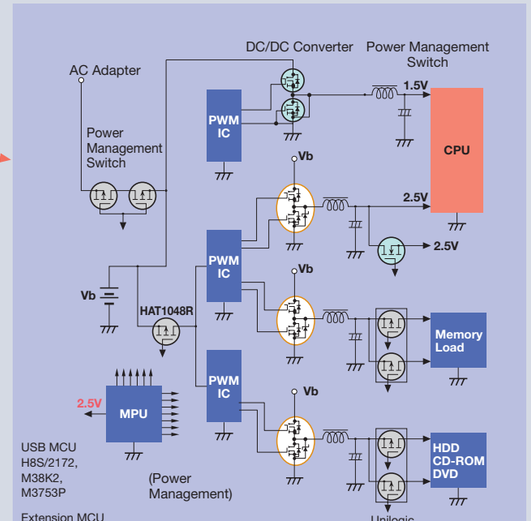


Recommended Examples of Next-Generation Notebook PC CPU Power Supplies





Number of MOSFETs Used	Control IC: LI Ion	DC/DC	Power Management SW	TFT backlight Power Supply	Total
	2 to 4	8 to 10	4 to 6	2 to 4	15 to 22
	2 to 4	8 to 10	4 to 6	2 to 4	15 to 22



Example of Notebook PC Power Supply DC/DC Converter System

Product Lineup

Application		Part No.	Package	VDSS (V)	ID (A)	10V RDS (on) (mΩ) Typ	10V RDS (on) (mΩ) max	Qg(nC) Note1)	MP
Synchronous Rectification DC/DC	CPU Drive	RJK0355DSP	LFPAK	30	12	8.5	11.1	6.0	OK
		RJK0305DPB		30	45	6.7	8.0	8	OK
		RJK0328DPB		30	60	1.6	2.1	42	OK
		RJK0329DPB		30	55	1.8	2.3	35	OK
		RJK0330DPB		30	45	2.1	2.7	27	OK
		RJK0331DPB		30	40	2.6	3.4	21	OK
		RJK0332DPB		30	35	3.6	4.7	14	OK
		RJK0346DPA	WPAK	30	65	1.5	2.0	49	OK
		RJK0348DPA		30	50	1.9	2.5	34	OK
		RJK0349DPA		30	45	2.4	3.1	25	OK
		RJK0351DPA		30	40	3.2	4.2	17	OK
		RJK0353DPA		30	35	4.0	5.2	14	OK
		RJK0355DPA		30	30	8.2	10.7	6.3	OK
		RJK0379DPA	WPAK (Single) +SBD	30	50	1.8	2.3	37.0	OK
		RJK0380DPA		30	45	2.4	3.2	24.0	OK
		RJK03A4DPA		30	42	2.9	3.8	17.0	OK
		RJK0381DPA		30	40	3.4	4.5	15.0	OK
		RJK0383DPA	WPAK (Dual) +SBD	30	15/45	8.5/2.5	11.1/3.3	6.8/20	09/5
		RJK0384DPA		30	15/42	8.5/2.9	11.1/3.8	6.8/17	09/5
		RJK0389DPA		30	15/20	8.2/6.8	10.7/8.9	6.0/7.2	OK
	Memory CD-ROM HDD	HAT2218R[D] (SBD)	SOP-8	30/30	7.5/8	19/17	24/22	4.6/11	OK
		HAT2285WP[D] (SBD)	WPAK	30/30	14/22	19/14	24/18	4.6/18	OK
Power Management SW		HAT1054R[D]	SOP-8	-20	-6	(24)	(30)	-	OK
		HAT1128R		-30	-16	6.0	7.5	-	OK
		HAT1125H	LFPAK	-30	-45	2.7	3.6	165	OK
LED back-light		HAT2114R[D]	SOP-8	60	6	28	32	15	OK
		HAT2215R[D]		80	3.4	88	115	7.3	OK

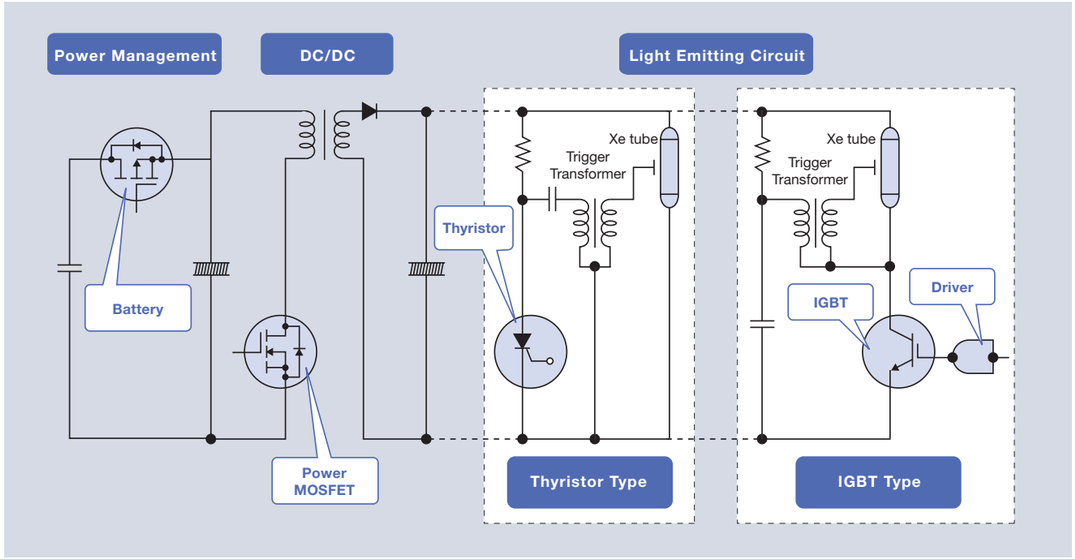
Application	Category	Part No.	Notes
Power supply power management	Schottky barrier diode	HRW0702A HRW0202B	Low Vf, low TR
		HRV103B, RKR104BKH	IO = 1A, small package, low IR ideal for circuit protection
External interface	Zener diode	HZM6.8Z4MFA RKZ6.8Z4MFAKT RKZXXKJ/KK Series	Low capacitance (4pF) ideal for USB pin surge absorption

Applications

AD/DC Converters

Strobe flash

Application Examples (Camera flash)



Product Lineup

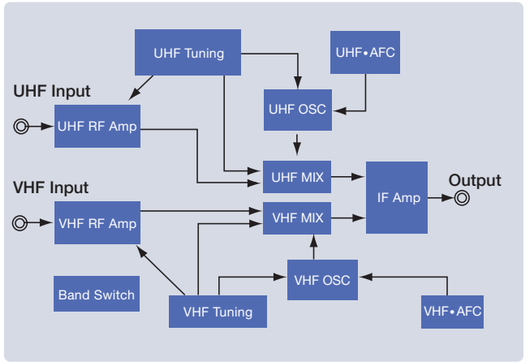
Application	Family	Part No.	Characteristics	Package
Power management	Power MOSFET	HAT1069C	12V, 3A, 70mΩtyp*1, 1.8V drive	CMFPAK-6
		HAT1089C	20V, 2.5A, 103mΩtyp*1, 2.5V drive	
DC/DC		HAT2217C	60V, 3.0A, 126mΩtyp*2, 4.5V drive	
		HAT2240C*	60V, 2.5A, 62mΩtyp*2, 2.5V drive	
Light-emitting circuits	IGBT	RJP4009ANS	400V, 150A, 2.5V drive	VSON-8
		RJP4010AGE	400V, 150A, 3V drive	VSON-8
	Thyristor	CR05BS-8	400V, 0.1A, IGT=100μA	SC-59
		CR05AS-8	400V, 0.5A, IGT=100μA	SOT-89
		CR08AS-12	600V, 0.8A, IGT=100μA	SOT-89
	Driver	RD5CYD08	Vcc=4-6V, IOHshort=-100mA (@Vcc=5.0V)	CMPAK-5
		RD3CYD08	Vcc=2.5-3.6V, IOHshort=-100mA (@Vcc=3.3V)	
		RD5CYDT08	Vcc=4-6V, IOHshort=-100mA (@Vcc=5.0V) Logic level translate function (30V CMOS Logic -> 5V CMOS Logic)	

*: New product *1. When VGS = 2.5V *2. When VGS = 4.5V

High-Frequency

High-Frequency Application Areas**

UHF/VHF Tuners



UHF Tuner Transistor Lineup

Application		Package Code		
		MPAK-4	CMPAK	CMPAK-6
RF	BBFET TBB	BB502M	BB502C	
		BB504M	BB504C	
			BB505C	
			BB506C	TBB1002
				TBB1004
				TBB1005
				TBB1010

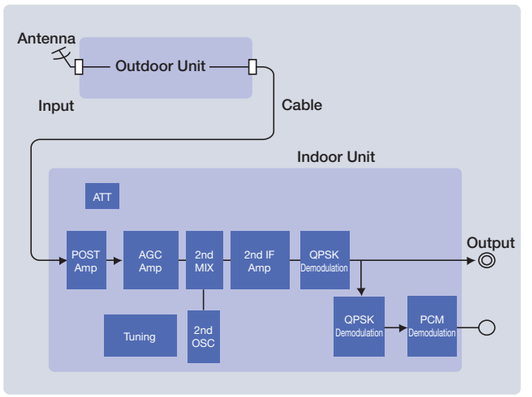
VHF Tuner Transistor Lineup

Application		Package Code		
		MPAK-4	CMPAK-4(T)	CMPAK-6
RF	MOS	3SK297		
			3SK317	
	BBFET	BB305M		
				TBB1002
				TBB1004
				TBB1005
				TBB1010

UHF/VHF Tuner Diode Lineup

Application		Package Code				
		MPAK	URP	UFP	SFP	EFP
UHF	Tuning		HVU202B	HVC202B		
			RKV500KG	RKV500KJ	RKV500KK	
			HVU326C	HVC326C	HVD326C	
	MIX	HSM276AS	HSU276A	HSC276A	HSD276A	HSL276A
VHF	Tuning		HVU306C	HVC306C		
			RKV501KG	RKV501KJ	RKV501KK	
			HVU327C	HVC327C	HVD327C	
			HVU307			
			HVU300C	HVC300C		
			RKV502KG	RKV502KJ	RKV502KK	
			HVU363B	HVC363B		
			HVU328C	HVC328C	HVD328C	
			HSU277	HSC277	RKS150KK	
	Band Switch			RKS151KJ	RKS151KK	
		HSM2694				
UHF/VHF	AFC			HVC308A		

BS/CS Tuners



BS/CS Tuner Transistor Lineup

Application	Package Code			
	MPAK	MPAK-4	CMPAK	CMPAK-4(T)(UPAK)
Post-Amp				2SC5594
		2SC4926		
2nd IF Amp.	2SC5890		2SC4901	
2nd OSC			2SC4901	

BS/CS Tuner Diode Lineup

Application	Package Code					
	MPAK	CMPAK/-4	URP	UFP	SFP	EFP
2nd MIX	HSM276AS	HSB276AS	HSU276A	HSC276A	HSD276A	HSL276A
ATT	HVM14					
	HVM14S/SR	HVB14S				
	HVM187S	HVB187YP	HVU187			
	HVM189S					
	HVM187WK					
		HVB190S				
				HVC190		
					HVD191	
						HVL192
Tuning			HVU316	HVC316		
			HVU417C	HVC417C		
			HVU202B	HVC202B		
			RKV500KG	RKV500KJ	RKV500KK	

Part Numbers

Part Numbers 1 to 2

Part No. Destination

Power Transistor Product No. Designation (Renesas Uniform Product Number)

● Power Transistor

With Some Exceptions

R J K 04 01 J PE - 00 # J 4

- Lead/Halogen-free (1 digit, See table-6.)
- Packing specification (1 alphanumeric, See table-5.)
- Special specification (2-alphanumeric)
- Package code (2-alphanumeric, See table-4.)
- Quality characteristics (1 letter, See table-3.)
- Serial number (2-digit)
- Voltage class (2-digit, See table-2.)
- Product series (1 or 2-letters, See table-1.)
- Power transistor (Fixed)
- Renesas's Semiconductors (Fixed)

▶Table-1. Product series

Symbol	Productseries
E	MOS Pch w/ function
F	MOS Nch w/ function
G	MOS Pch and Nch w/ function
H	IGBT + Diode
J	Power MOS Pch
K	Power MOS Nch
L	Power MOS Nch (Built-in high-speed diode)
M	Power MOS Pch and Nch
P	IGBT
Q	IGBT w/ function
U	Diode (SFD, etc.)

▶Table-2. Voltage class

Symbol	Voltage(V)
01	10 to 19
02	20 to 29
03	30 to 39
:	:
:	:
99	990 to 999
1A	1000 to 1099
1B	1100 to 1199
1C	1200 to 1299
1D	1300 to 1399
1E	1400 to 1499
1F	1500-1599

* Set as necessary.

▶Table-3. Quality characteristics

Symbol	Quality characteristics
J	High reliability 1
P	High reliability 2
D	For industrial use, etc.
A	For consumer use
S	For special and custom use

▶Table-6. Lead/Halogen-free

Full lead-free	0	w/o Bi
	1	w/ Bi
Pin lead-free	2	w/o Bi
	3	w/ Bi
Leaded	4	-
Halogen-free	5	w/o Bi
Full lead-free	6	w/ Bi
Halogen-free	7	w/o Bi
Pin lead-free	8	w/ Bi

▶Table-5. Packing Specification

Symbol	Specification
0	Bulk (Plastic bag)
1	Bulk (Tray)
2	Bulk (Special case)
H	Emboss taping (Left)
J	Emboss taping (Left) Large
Q	Emboss taping (Right) Large
T	Tube
Z	Radial taping (TZ)
W	Wafer
X	Chip

▶Special Specification Code
00 : Standard specification
Others : Special specification

▶Table-4. Package Code

Code	Package
JA	TO-92 (SC-43A)
JE	TO-92M (SC-51)
QS	UPAK (SC-62)
QM	CMFPAK-6
PA	WPAK
PB	LFPAK
PC	LFPAK-i
PD	DPAK-S (MP-3A)
PE	LDPAK-S1 (TO-220S)
PF	LDPAK-S2 (SOT-263)
PH	DPAK-L (MP-3)
PJ	LDPAK-L (TO-220C)
PK	TO-3P
PL	TO-3PL
PM	TO-3PFM
PN	TO-220AB
PP	TO-220FN (However, TO-220FL for PP-M0)
PQ	TO-220F
PR	TO-220FM
PS	TO-220CFM
SA	TSOP-8
SP	SOP-8
SC	HSOP-20
NP	QFN
NS	VSON-8
WA	Wafer
WT	Chip

Power Transistor Product No. Designation (Previous Renesas Products)

● HAT Series, Thermal FET Series

HAT 2 064 R - EL - E

- Lead-free
- Taping direction
- Package abbreviation
- Product number
- N/P
- Series name

▶N/P

1	P ch
2	N ch
3	N ch/P ch

▶Package abbreviation

H	LFPAK
N	LFPAK-I
T	TSSOP-8
R	SOP-8
RP	HSOP-11
M	TSOP-6
C	CMFPAK-6
G	CMPAK-6

HAF 1 001 - 91 - TL - E

- Lead-free
- Taping direction
- Special specification number (2 digits)
- Product number
- N/P
- Thermal FET series

▶N/P

1	P ch
2	N ch

● H5N, H7N, H8N Series

With Some Exceptions

H5 N 50 11 PL - E

- Lead-free
- Package abbreviation
- Product number
- V_{DSS}
- N/P
- Series name

▶Series name

H5
H7
H8

▶N/P

N	N ch
P	P ch

▶Voltage VDSS= x 10

50	500V
02	20V

▶Package abbreviation

PL	TO-3PL
P	TO-P
AB	TO-220AB
FM	TO-220FM
CFM	TO-220CFM
LD	LDPAK-L
DL	DPAK-L(1), (2)
PF	TO-3PFM
LS/LM	LDPAK-S(1)/S(2)
DS	DPAK-S

Thyristor and triac Part No. designation

CR 8 K M -12 A
BCR 8 C M -12 L A

- Version
- Commutation characteristics (Triac only)
  L : For an inductive load
  : For a resistive load
- Standing voltage class
  V_{DRM}=Dielectric resistance class x 50V
- Mount type
  M : Through-hole type
  S : Surface mount type
- Sub-number
  K, P : Insulation type (Full mold type)
  Others : Non-insulation type
- Rated current
- Type
  BCR : Triac
  CR : Thyristor

▶Current ratings (Ex.)

Symbol	Current ratings
05	0.5A
1D5	1.5A
8	8A
0	20A

▶Commutation chara.

Symbol	
L, nothing	Guaranteed
R	Non-guaranteed

▶Package type

Symbol	Package
M	Lead mount
S	Surface mount
R	Lead mount (Aluminum ribbon)

▶Type

Code	Type
BCR	Triac
CR	Thyristor

▶Package

A to C	TO-92, TO-220AB, TO-3P, MP-3A DPAK-L, UPAK, MPAK
K	TO-220FN
P	TO-220F•TO-220F(2) *1
R	TO-3PFM
T	TO-220F(2)

*Note1: LC, LE series and BCR2PM

▶Package

Version	Chips tructure	Shurinked chip	Package	Tj.
Blank	Glass passivation	-	-	125℃
A	Planar	-	-	125℃
B		-	-	150℃
C		○	TO-220F(2)	150℃
D		○	TO-220F	150℃
E		-	TO-220F(2)	125℃
F		-	TO-220F	125℃
G		-	TO-220F	150℃

● Composite type (2-in-1) package products

TBB 1005 AM 01 TR -E

- Pb free
- Taping direction TR, TL
- Special specification code: nothing / 2 digits → standard / special specification
- Stock mark: 2 letters
- Product model name: Serial number from 1001 used
- Series name

▶Special specification code

nothing	Standard
2 digits	Special specification

● Built-in bias type products

BB 1 01 M AU - 01 TR -E

- Pb free
- Taping direction TR, TL
- Special specification code: nothing / 2 digits → standard / special specification
- Stock mark: 2 letters
- Package: M:MPAK-4 / C:CMPAK-4
- Product model name: Serial number from 01
- Use/process: 1 digit * See table below
- Built-in Biasing Circuit MOS FET

▶Special specification code

nothing	Standard
2 digits	Special specification

▶Package

M	MPAK-4
C	CMPAK-4

▶Use/process

1	UHF amplifier
3	VHF amplifier
5	UHF amplifier/VHF amplifier

● Power MOSFET for high frequency

R Q A 0001 xxx D NS H 3

- Pb free
- Packing code
- Package code
- Reliability code
- Stock mark 3 letters (Maximum)
- Unique number (Serial number from 01)
- Power MOSFET for high frequency
- Small signal transistor products
- Renesas products

* Table: BBFET Use/process

1	3	5
UHF amplifier	VHF amplifier	UHF amplifier / VHF amplifier

Above former Part No.
• NPN:2SCxxxx,2SDxxxx • n-ch:2SKxxxx,3SKxxx
• PNP:2SAxxxx,2SBxxxx • p-ch:2SJxxx

▶Table-1. Quality characteristics

Symbol	Quality characteristics
J	High reliability 1
P	High reliability 2
D	For industrial use, etc.
A	For consumer use
S	For special and custom use

▶Table-3. Packing Specification

Symbol	Specification
0	Bulk (Plastic bag)
1	Bulk (Tray)
2	Bulk (Special case)
H	Emboss taping (Left)
J	Emboss taping (Left) Large
Q	Emboss taping (Right) Large
T	Tube
Z	Radial taping (TZ)
W	Wafer
X	Chip

▶Table-4. Lead/Halogen-free

Full lead-free	0	w/o Bi
	1	w/ Bi
Pin lead-free	2	w/o Bi
	3	w/ Bi
Leaded	4	-
Halogen-free	5	w/o Bi
Full lead-free	6	w/ Bi
Halogen-free	7	w/o Bi
Pin lead-free	8	w/ Bi

▶Table-2. Package Code

Code	Package
JA	TO-92 (SC-43A)
JE	TO-92M (SC-51)
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QM	CMFPAK-6
PA	WPAK
PB	LFPAK
PC	LFPAK-i
PD	DPAK-S (MP-3A)
PE	LDPAK-S1 (TO-220S)
PF	LDPAK-S2 (SOT-263)
PH	DPAK-L (MP-3)
PJ	LDPAK-L (TO-220C)
PK	TO-3P
PL	TO-3PL
PM	TO-3PFM
PN	TO-220AB
PP	TO-220FN
PQ	TO-220F
PR	TO-220FM
PS	TO-220CFM
SA	TSOP-8
SP	SOP-8
SC	HSOP-20
NP	QFN
NS	VSON-8
WA	Wafer
WT	Chip

Part Numbers

Part Numbers 3 to 4

Diode Part No. Destination (Renesas Uniform Product Number)

R K Z 6.8Z4 .... KL -1 R 1 Q

- R: Renesas's Semiconductors (FIX)
- K: Diode (FIX)
- Z: Family Name
- 6.8Z4: Unique number and Pin arrangement
- KL: Quality Level (omissible)
- -1: Package
- R: Special Specification Code (omissible)
- 1: Packing
- Q: Lead Free
- Direct import

With Some Exceptions

Packing

Resin Mold		
4mm	TR	P
	TL	H
	UR	Q
	UL	J
2mm	KR	R
	KL	K
	PR	S
	PL	L

Glass		
Bulk		0
52mm	TG	A
	TA	7
	TK	7
26mm	TE	8
	TJ	8
	TD	9
	TN	9
	TDX	B
Radial	RE/RX	6
	RF/RY	5

Family Name and Unique number

V	Vari-Cap	Tuner	500 to 599
		VCO	600 to 699
P	PIN Diodes	Antt.Sw	200 to 299
		Attenuator	300 to 399
S	Switching	Switching	100 to 149
		RF Switch	150 to 199
D	Schottky		700 to 799
R	Rect.Schottky	Depend on Io,VR(*1)	
Z	Zener	Depend on Vz,Cd(*) (*) 4pF : Z4 Low Cd(8 to 25pF): Z others: none	
C(*2)	Compound Chips	more than 6pin	400 to 499

(*1)Refer to the another Table (Rectification schottky) (*2)Depend on Family

Pin Arrangement

S	Series Connect
SR	Rev.Series.Connect
WK	Cathode Common
WA	Anode Common
WS	Series Connect (x2)
FA	Anode Common (x4)
FK	Cathode Common (x4)
YP	Parallel (x2)

Quality Level

J	Q1A/B
(omissible;D)	Q2
A	Q3

Package

KA	DO-35	KP	MP6
KB	DO-41	KQ	(0402)
KC	MHD	KR	MOP
KD	LLD	KS	MFP12
KE	MAP	KT	VSON-5
KF	SRP	QA	MPAK
KG	URP	QC	MPAK5
KH	TURP	QE	CMPAK
KJ	UFP	QF	CMPAK4
KK	SFP	QK	MFPAK
KL	EFP	WA	Wafer-1
KM	TEFP	WB	Wafer-2
KN	MP8	WC	Wafer-3

WD	Wafer-4		
WE	Wafer-5		
WF	Wafer-6		
WT	Chip-1		
WS	Chip-2		
WR	Chip-3		

Lead Free

Full Pb Free	0	without Bi
Full Pb Free	1	with Bi
Terminal Pb Free	2	without Bi
Terminal Pb Free	3	with Bi
Pb	4	-

Diode Part No. Destination (Previous Renesas Products)

● Glass (Inserting) Type [JEITA]

1 S S 270 A TD -E Q

- 1: Indicates semiconductor element
- S: Product category
- 270: Unique number (Serial)
- A: Grade
- TD: Packing specifications
- -E: Pb free
- Q: Direct import

Product category

R	Recitification diode
S	Signal diode
V	Varicap/PIN diode
Z	Zener diode

Unique number

300 to 499	Varicap
10 to 229	Varicap/PIN
Vz center value integer	Zener
0103 to 0703	Rectification schottky (*See table)

Packing specifications

Please refer to Web-site concern to Diode

Rectification schottky (*See table)

HRW 05 03 A

- HRW: Series name
- 05: Rectification current
- 03: Breakdown voltage
- A: Product category

Current(A)	
01	0.1
02	0.2
03	0.3
05	0.5
07	0.7
1	1.0

Breakdown voltage(V)	
02	20
03	30
04	40

● Surface-mount Type

With Some Exceptions

H S M 88 WA TR -E Q

- H: Series name
- S: Abbreviation indicating application
- M: Package abbreviation
- 88: Unique number
- WA: Internal connection or improved products
- TR: Packing specifications
- -E: Pb free
- Q: Direct import

Abbreviation indicating application

S	For signal
V	Varicap/PIN
R	For rectifier
Z	Zener
C	Chip,Wafer

Package abbreviation

B	CMPAK, MQP	N	VSON-5
C	UFP	P	Do-41*
D	SFP	R	SRP
G	Do-35*	S	MHD*
K	LLD	T	(Temp. compen-sation zener) useURP
L	EFP	U	URP
M	MPAK, MPAK5	W	MPAK for rectifier

*: Glass (inserting) type.

Internal connection

S	Series
SR	Reverse series
WK	Cathode common
WA	Anode common
WS	2 series connections
FA	4 elements anode common
YP	2 elements parallel

Part No. designation

● JEITA Part No.

Example.

2 S C 945 A

- 2: Three of effective electrode
- S: Semiconductor
- C: NPN high frequency TR
- 945: Registration number
- A: Improved product first

Single digit	S	1 digit alphabetic	2 to 4 digits	1 digit alphabetic
*a	*b	*c	*d	*e

*a: The number of effective electrodes–1

*b: Semiconductors (Semiconductors) show.

*c: Features of the device type

*d: Registration number(11–)

*e: Represents improvement. (And in alphabetical order.)

Symbol	Device type	Symbol	Device type
A	PNP high frequency TR	K	Nch FET
B	NPN low frequency TR		
C	NPN high frequency TR		
D	NPN low frequency TR		

● Transistor with Internal Resistor

1 digit alphabetic	1 digit alphabetic + Single digit	1 digit alphabetic	Single digit	1 digit alphabetic	(1 to 2 digits or 1 digit alphabetic) –	1 to 2 digit alphanumeric	–	Environmental
*a	*b	*c	*d	*e	*f	*g		*h

*a: Shows the outside.

*b: Indicate the polarity and electrical characteristics. Polarity with a letter, a number that represents the electrical characteristics. The meaning of letters is as follows.

Alphanumeric	NPN transistor	Alphanumeric	PNP transistor	Alphanumeric	NPN+PNP transistor
A 1	Small signal type	N 1	Small signal type	Y 5	Small signal type
A 2	Small signal high hFE type	N 2	Small signal high hFE type		
A 3	Small-signal with internal diode	N 3	Small-signal with internal diode		
A 4	Small-signal type (Flat chip shrink version)	N 4	Small-signal type (Flat chip shrink version)		
A 5	Small signal (Ic=0.05A class)	N 5	Small-signal (Ic=0.05A class)		
B 1	Semi-power type 1 (Ic=0.7A class)	P 1	Semi-power type 1 (Ic=0.7A class)		
C 1	Semi-power type 2 (Ic=2A class)	Q 1	Semi-power type 2 (Ic=2A class)		
C 2	Semi-power type 3 (Ic=3A class)	Q 2	Semi-power type 3 (Ic=3A class)		
D 1	Semi-power type 4 (Ic=1A class)	R 1	Semi-power type 4 (Ic=1A class)		
D 2	Semi-power type 5 (ZeDi internal)				
E 1	Semi-power type 6 (High hFE)				
E 2	Semi-power type 7 (High hFE , ZeDi internal)				

*c: R1 significant figures of resistance. *d be used in conjunction with the index.

*d: R1 resistance index. The squares represent 10 n. N the number.

*e: R2 / R1 ratio of the resistance. However, R1-free configurations *c , *d is that the value of the resistor R2.

*f: A section of special support. Serial number starting with # 1.

*g: Packing (view taping)
1. Insert type ..... T
2. Surface mount

*h: Environmental

Part Numbers

Part Numbers 5 to 6

Part No. designation

● Power MOSFET (NP Series)

NP	2 to 3 digits	1 digit alphabetic	2 to 3 digits	1 digit alphabetic	1 digit alphabetic	1 digit alphabetic	(	1 to 2 digits	)	1 digit alphabetic-1 digit alphabetic Single digit	–	1 to 3 digit alphanumeric
*a	*b	*c	*d	*e	*f	*g		*h		*i		*j

–	1 to 3 digit alphanumeric	–	Sample form	–	Order Form	–	Environmental
	*k		*l		*m		*n

*a: Indicate the Power MOSFET.

*b: Represents the ID(DC) rating. Example) 50:50A rating, 110:110A rating

*c: Represents the polarity. N : Nch P : Pch

*d: Represents the VDSS rating. Example) 60:60V rating, 10:100V rating, 055:55V rating, 50:500V rating, 100:1000V rating

*e: Represents the package types.

Sign	Name	Sign	Name
A	TOP-3 (MP-88)	K	TO-263AB (MP-25ZK)
B	TO-220 Isolated (MP-45F)	M	TO-220AB (MP25, JEDEC version.)
C	TO-220AB (MP25, JEITA version.)	N	TO-262AA (MP-25fins cut, JEDEC version.)
D	TO-262AA (MP-25fins cut, JEITA version.)	P	TO-263 (MP-25ZP)
E	TO-220SMD (MP-25ZJ)	R	TO-251 (MP-3, JEDEC version.)
F	MP-10	S	TO-252 (MP-3Z, JEDEC version.)
G	TO-126	T	TO-263-7pin
H	TO-251 (MP-3, JEITA version.)	V	TO-252 (MP-3ZP)
I	TO-252 (MP-3Z, JEITA version.)	Y	8pinHSON
J	SOT-89 (Power mini mold.)	Z	Wafer, Pellet

*f: Gate-represents the presence of protection diodes and voltage source drive.
B: Built in Gate to Source protection diode drive voltage 2.5V
L: Built in Gate to Source protection diode drive voltage 4, 4.5V
H: Built in Gate to Source protection diode drive voltage 10V
D: No protection diode between Gate and Source drive voltage 4, 4.5V
U: No protection diode between Gate and Source drive voltage 10V

*g: Represents the series name.
A: Generation 3 Series D: Generation 6 Series G: Generation 9 Series K: Generation 11 Series
B: Generation 4 Series E: Generation 7 Series H: Generation 7 Series
C: Generation 5 Series F: Generation 8 Series J: Generation 10 Series

*h: Represents the special specification. Serial number starting with # 1.

*i: Represents the packing wafer or pellets.
W–S .....Wafer(diced)
W–U .....Wafer(no diced)
P–T.....Pellet(tray packed)
P–S .....Pellet(Surf tape)
Pellet (Embossed taping) is divided into the following chip in the direction of the tape pack.
P–E 1.....Look left from the position of the gate pad tape drawerIf you have a embossed carrier taping of which gate pad is faced to feed direction to reel direction.
P–E 2.....Look right from the position of the gate pad tape drawerIf you have a embossed carrier taping of which gate pad is faced to feed direction to reel direction.
P–E 3.....In the case of a square chip which Gate pad is positioned middle of the side is face to reef direction.
P–E 4.....In the case of a square chip which Gate pad is positioned middle of the side is face to reef direction.

*j: Product packing package.
Numbers that begin with S: Stick Magazine
Surface mount

*k: OEM code *m: Order form

*l: Sample form *n: Environmental

Example.
NP 110 N 04 P U G (1)
- *a Power MOSFET
- *b ID(DC) rating: 110A rating
- *c Polarity: Nch
- *d VDSS rating: 40V rating
- *e Package: TO-263(MP-25ZP)
- *f Gate-no protection diode between the source and drive voltage 10V
- *g Series name: Generation 9 series
- *h Special specifications

● Transistor. MOSFET, J–FET (House)

N	Double-digit number	Double-digit alphanumeric	1 digit alphabetic	1 digit alphabetic	(	1 to 3 digit alphanumeric	)–	1 to 2 digit alphanumeric	–	1 to 3 digit alphanumeric	–	Sample form	–	Environmental
*a	*b	*c	*d	*e		*f		*g		*h		*i		*j

*a: Indicate the Transistor, MOSFET or J-FET.

*b: Represents the voltage rating (Vceo, VDSS). 01 to 99 table of code.

Code	Vceo / Vdss	Code	Vceo / Vdss	Code	Vceo / Vdss
01	10 to 19V	07	70 to 79V	13	130 to 139V
02	20 to 29V	08	80 to 89V	…	…
03	30 to 39V	09	90 to 99V	…	…
04	40 to 49V	10	100 to 109V	88	880 to 889V
05	50 to 59V	11	110 to 119V	89	890 to 899V
06	60 to 69V	12	120 to 129V	90	900 to Over

*c: Part number (a set sequential breakdown by voltage rating) 00 to 99, AD to ZZ

*d: Represents the polarity. R : PNP-Tr, S : NPN-Tr
N : Nch-FET, P : Pch-FET

*e: Represents the improvement. (And in alphabetical order.)

*f: Represents the special specification. Serial number starting with # 1.

*g: Special specification Lead
S: TO-262
Z: TO-252, TO-220SMD
ZJ: TO-263
ZK: TO-252(MP-3ZK), TO-263AB
ZP: TO-252(MP-3ZP), TO-263

*h: Packing (view taping)
Insert type .....T: Radial
Numbers that begin with S: Stick magazine .....L: Stick magazine (magazine packed horizontal)
Surface mount .....VM: magazine (magazine packed height)

*i: Sample form *n: Environmental

Technical e to j can be omitted.

Example.
N 06 00 P A (1) – ZK – E1 – AY
- *a Transistor, MOSFET or J-FET
- *b VDSS60–69V
- *c Part number
- *d Polarity: Pch-FET
- *e Improved product first
- *f Special specifications
- *g Package: TO-252(MP-3ZK), TO-263AB
- *h Surface mount type
- *j Environmental

Part No. designation

● Zener Diodes

RD	2 to 3 digits	1 to 2 digit alphabetic	(	1 to 2 digits	) –	2 to 3 digit alphanumeric	–	Order Form	–	Environmental
*a	*b	*c		*d		*e		*f		*g

*a: Indicate the constant voltage display.

*b: Represents the zener voltage display.
The figures represent the number of digits including a decimal point.

*c: Indicate the series.
The distinction beyween shape and function to classify and power.

*d: A section of special suppoet. Serial number starting with # 1.

*e: Packing (view taping)
1. Surface mount
2. Glass type

*f: Order form

*g: Environmental

Example.
RD 5.1 S (50) – T 1
- Zener voltage: 5.1V
- 2Pin SSP / 200mW type
- Special support
- Axial taping segment boxed

● ESD Noise-Clipping Diodes

NNCD	2 to 3 digits	0 to 1 digit alphabetic	1 digit alphabetic	1 digit alphabetic	(	1 to 2 digits	) –	2 to 3 digit alphanumeric	–	1 to 3 digit alphanumeric	–	Order Form	–	Environmental
*a	*b	*c	*d	*e		*f		*g		*h		*i		*j

*a: Indicate the Noise-Clipping diode.

*b: Represents the breakdown voltage. Usable point.
Example) 3.3V → 3.3 12V → 12

*c: Indicate the series. Symbol product series

Symbol	Type	Symbol	Type
None	High ESD type (Multi-chip)	R	Low capacitance (monolithic chip)
L	Low capacitance type (Multi-chip)	S	Low capacitance high ESD type (monolithic chip)
M	High-low capacitance ESD type (Multi-chip)		
P	High ESD type (monolithic chip)		

*d: Represents the package type.
Package Symbol (alphabet 1 taken in sequential order and character development.)

Symbol	Package	Symbol	Package
A	-	K	3pin XSOF
B	-	L	5pin XSOF
C	SC-78 (2pinUSM(G))	M	2pinSSP (F)
D	SC-76 (2pinSSP(G))	N	1008LLP Single-type
E	-	P	Missing number
F	SC-59 (3pinMM) Dual-type	R	1611LLP Quad-type
G	SC-74A (5pinMM) Quad-type	S	SC-70 (3pinSSP(G))
H	SC-88A (5pinssp) Quad-type	T	1008LLP Dual-type
J	2pin XSOF		

*e: Additional symbols

Symbol	Package	Symbol	Package
A	Characteristic improvement additional symbol	T	Internal connection symbol (two-way connection)
B			
C			
D			

*f: Special specification section numbers

*g: Packing (view taping)

*h: OEM code

*i: Order form

*h: Environmental

Technical e to j can be omitted.

Example.
NNCD 5. 6 D A (1) – T1 – AT
- *a Indicate the NNCD
- *b Breakdown voltage: 5.6V
- *c None: High ESD type
- *d SC-76 (2pinSSP)
- *e Characteristic improvement
- *f Special specification section numbers
- *g Embossed Taping division
- *j Environmental classification

- Name catalog: abcdef
- Name specification sheet: abcdefghi
- Key A4 Name: abcdefghij

● Surge Absorber Device

NSAD	2 to 3 digit alphanumeric	0 to 1 digit alphabetic	1 digit alphabetic	(	1 to 2 digit alphanumeric	) –	2 to 3 digit alphanumeric	–	1 to 3 digits	–	Order Form	–	Environmental
*a	*b	*c	*d		*e		*f		*g		*h		*i

*a: Indicate the of surge protection devices.

*b: Represents the max. signal frequency.
Example) 500MHz → 500 1GHz → 1G

*c: Indicate the series.
Under development products: None
The folloeing……(2) Noise-Clipping diode equivalent

*d: Represents the package types.

*e: Special specification section numbers.

*f: Packing (view taping)

*g: OEM code

*h: Order form

*i: Environmental

Technical e to j can be omitted.

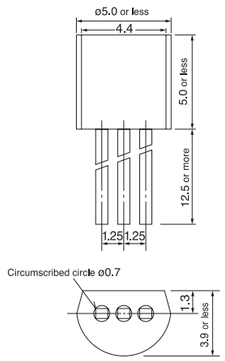
Note: Name (example)
NSAD500H-T1
NSAD500F-T1

Package Drawings

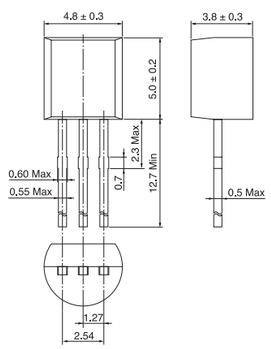
Package Drawings 1

Package Name / Package Code (Units: mm)

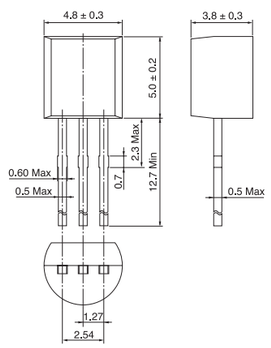
TO-92*
PRSS0003EA-A



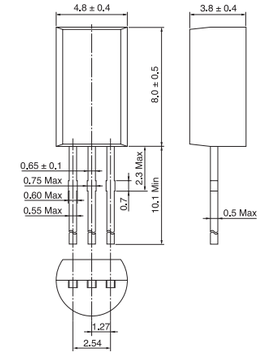
TO-92(1)
PRSS0003DA-A/PRSS0003DB-A



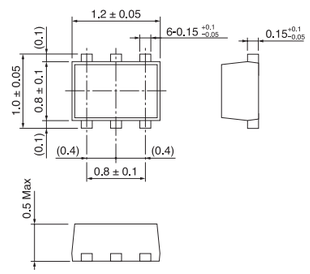
TO-92(2)
PRSS0003DA-C/PRSS0003DB-C



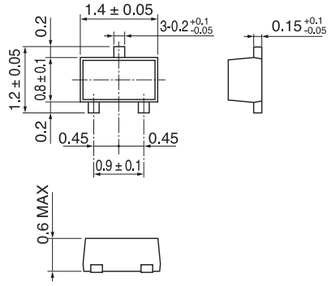
TO-92MOD
PRSS0003DC-A



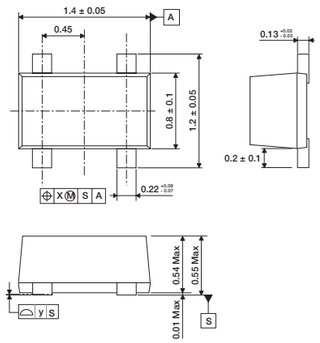
EMFPAK-6
PXSF0006LA-A



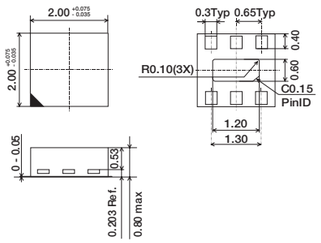
MFPAK
PUSF0003ZA-A



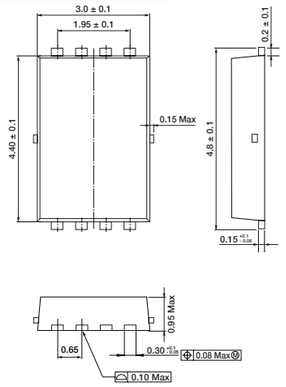
MFPAK-4
PUSF0004ZA-A



TNP-6DTV
PWSN0006JA-A

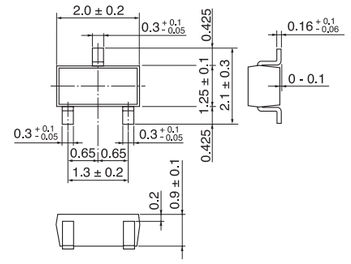


VSON-8
PVSN0008JA-A

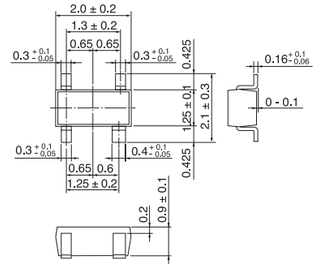


Package Name / Package Code (Units: mm)

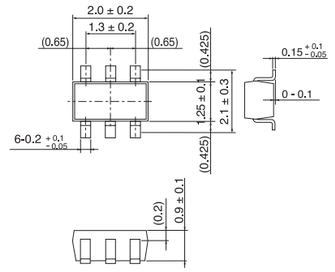
CMPAK
PTSP0003ZA-A



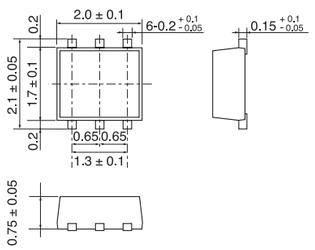
CMPAK-4
PTSP0004ZA-A



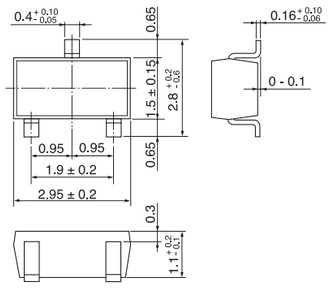
CMPAK-6
PTSP0006JA-A



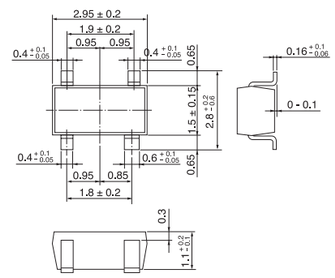
CMFPAK-6
PWSF0006JA-A



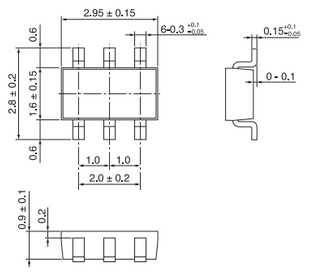
MPAK
PLSP0003ZB-A



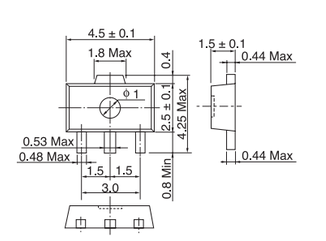
MPAK-4
PLSP0004ZA-A



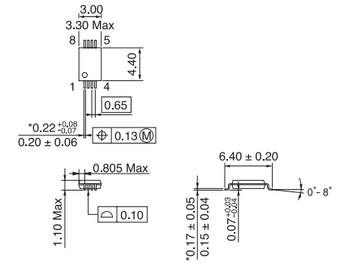
TSOP-6
PTSP0006FA-A



UPAK
PLZZ0004CA-A



TTP-8D
PTSP0008JB-A

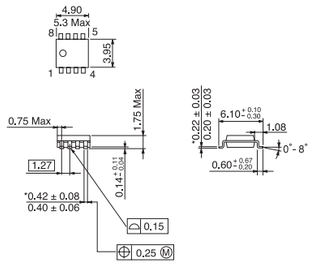


Package Drawings

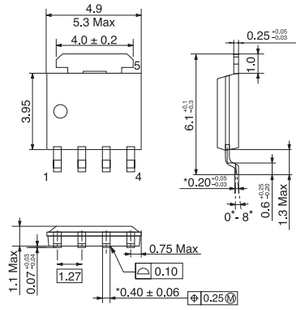
Package Drawings 2

Package Name / Package Code (Units: mm)

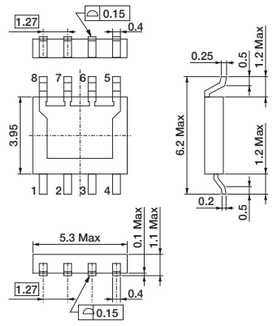
FP-8DA
PRSP0008DD-A



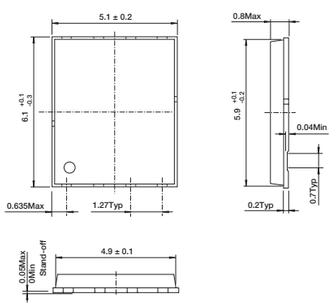
LFPAK
PTZZ0005DA-A



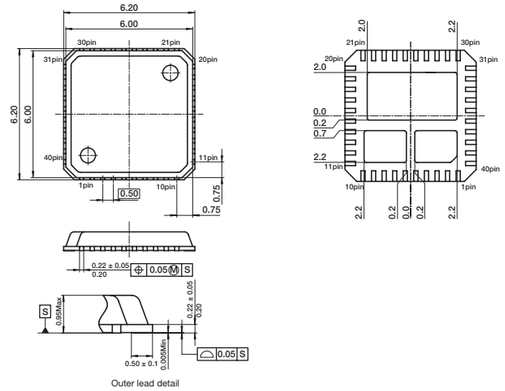
LFPAK-i
PTSP0008DC-A



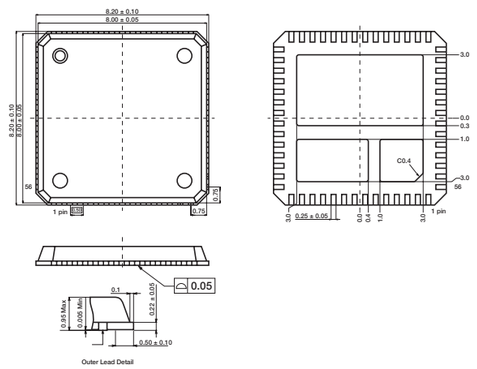
WPAK
PWSN0008DA-A



QFN40
PVQN0040KC-A

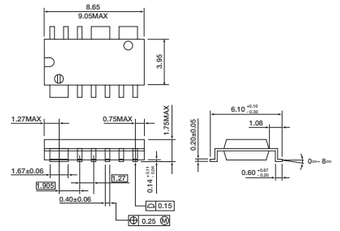


QFN56(2)
PVQN0056KA-A

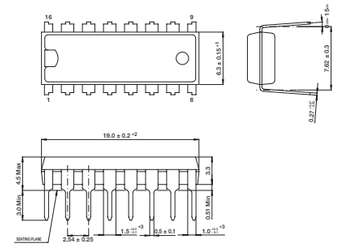


Package Name / Package Code (Units: mm)

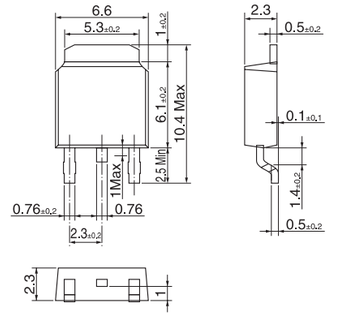
FP-11DTV
PRSP0014DE-B



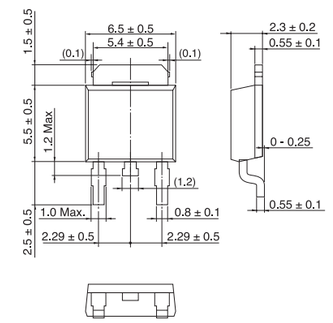
16P4
PRDP0016AA-A



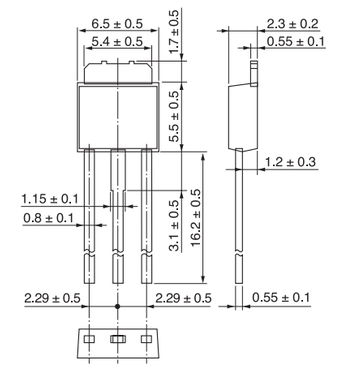
MP-3A
PRSS0004ZA-A



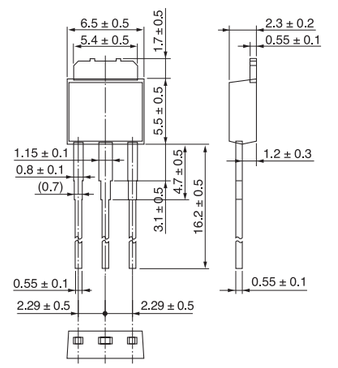
DPAK(S)
PRSS0004ZD-C



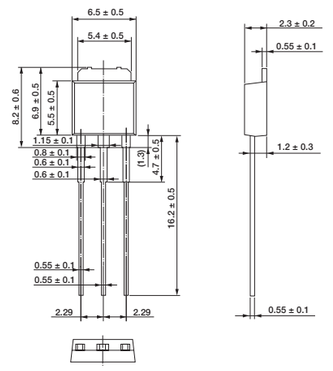
DPAK(L)-(1)
PRSS0004ZD-A



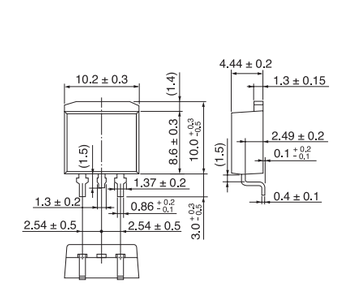
DPAK(L)-(2)
PRSS0004ZD-B



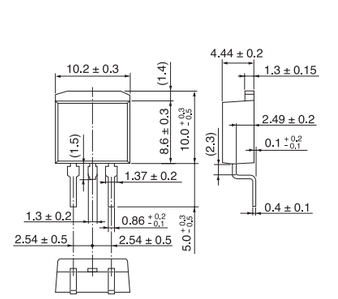
DPAK(L)-(3)
PRSS0004ZD-D



LDPAK(S)-(1)
PRSS0004AE-B



LDPAK(S)-(2)
PRSS0004AE-C



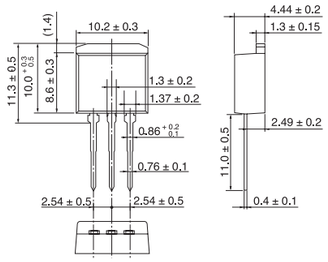
Package Drawings

Package Drawings 3

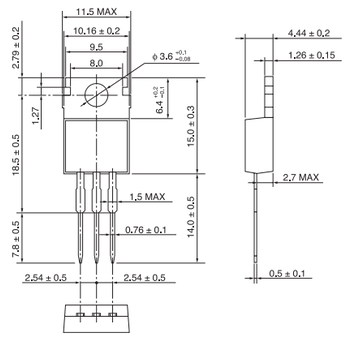
Package Name / Package Code

(Units: mm)

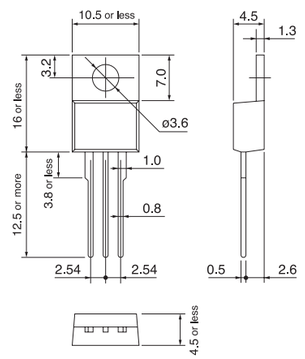
LDPAK(L)
PRSS0004AE-A



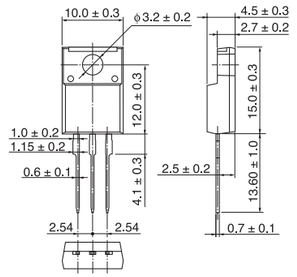
TO-220AB
PRSS0004AC-A



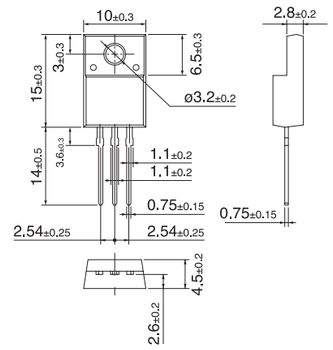
TO-220
PRSS0004AA-A



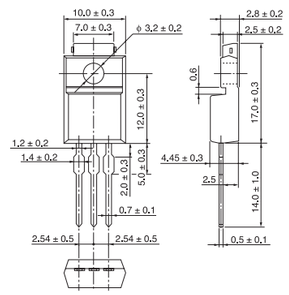
TO-220CFM
PRSS0003AE-A



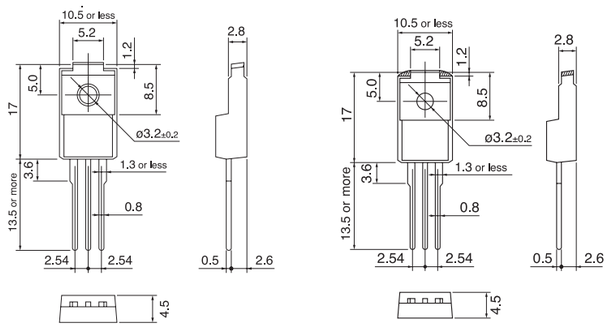
TO-220FN
PRSS0003AB-A



TO-220FM
PRSS0003AD-A



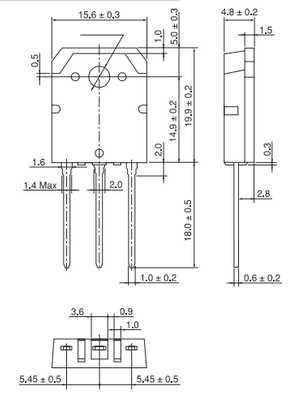
TO-220F*/TO-220F**
PRSS0003AA-A



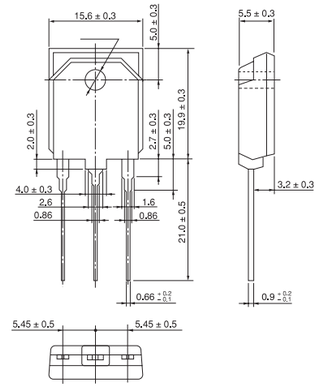
Package Name / Package Code

(Units: mm)

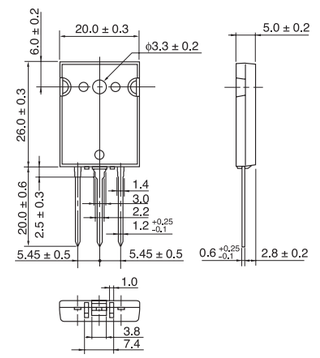
TO-3P
PRSS0004ZE-A



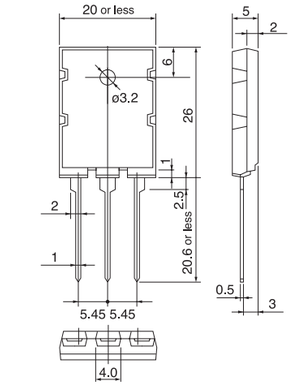
TO-3PFM
PRSS0003ZA-A



TO-3PL
PRSS0004ZF-A



TO-3PL*
PRSS0004ZC-A



RF-K-8
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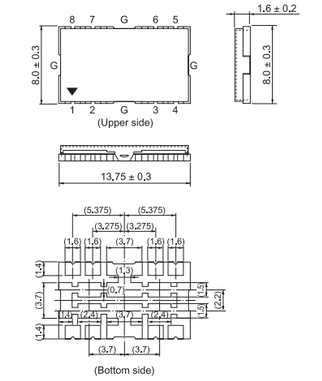
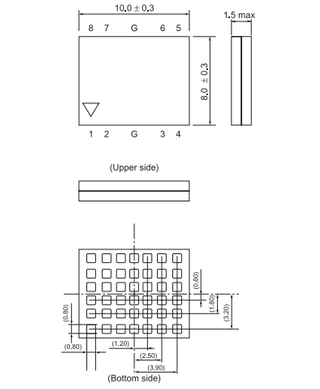


RF-Q-8
CLMR0022ZQ-A



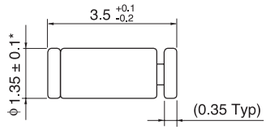
Package Drawings

Package Drawings 4

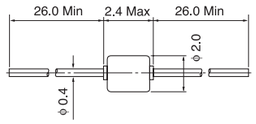
Package Name / Package Code

(Units: mm)

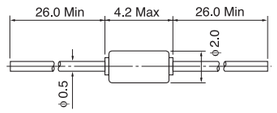
LLD
GLZZ0002ZA-A/GLZZ0002ZA-B



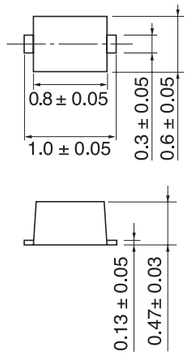
MHD
GRZZ0002ZC-A



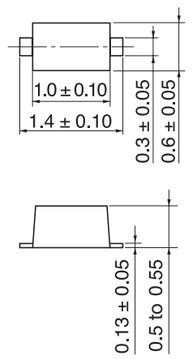
DO-35
GRZZ0002ZB-A



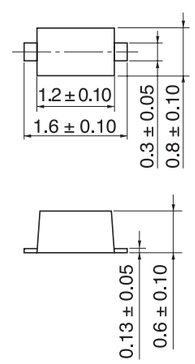
EFP
PXSF0002ZA-A



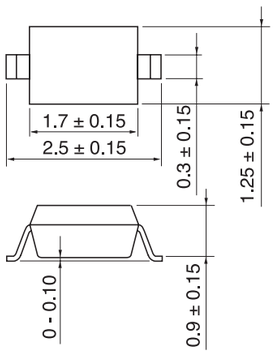
SFP
PUSF0002ZB-A



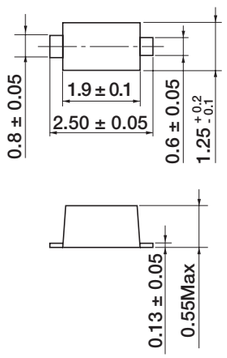
UFP
PWSF0002ZA-A



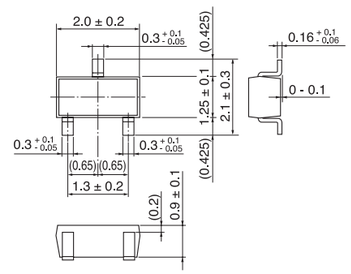
URP
PTSP0002ZA-A



TURP
PUSF0002ZC-A



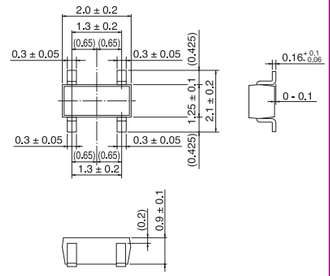
CMPAK
PTSP0003ZB-A



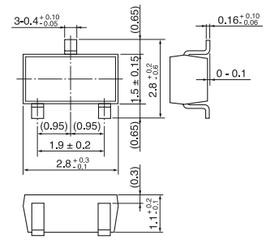
Package Name / Package Code

(Units: mm)

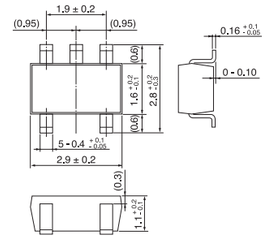
CMPAK-4
PTSP0004ZB-A



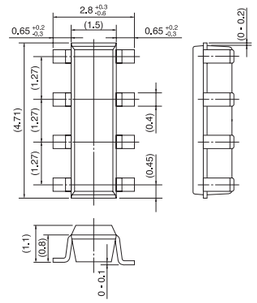
MPAK
PLSP0003ZC-A



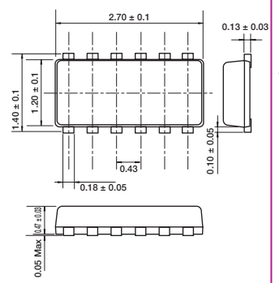
MPAK-5
PLSP0005ZC-A



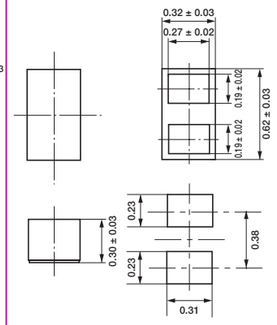
MOP
PTSP0008DB-A



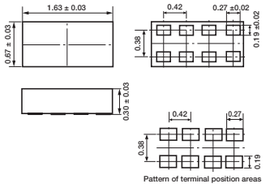
MFP12
PUSF0012ZA-A



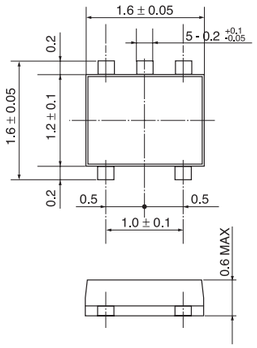
MP6
PXSN0002ZB-A



MP6-8
PXSN0008ZA-A



VSON-5
PUSN0005KA-A



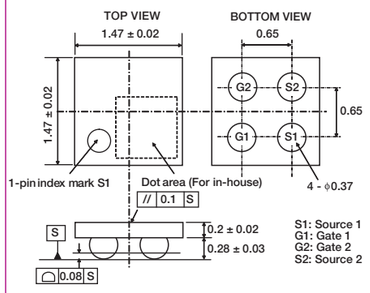
Package Drawings

Package Drawings 5

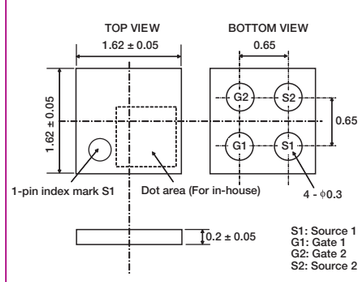
Package Name / Package Code

(Units: mm)

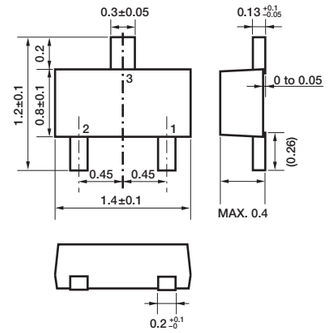
4PIN EFLIP
PKG4Q1-411-0000



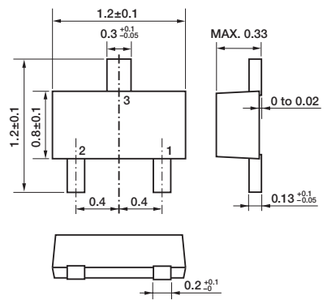
4PIN EFLIP-LGA
PKG4Q1-221-0001



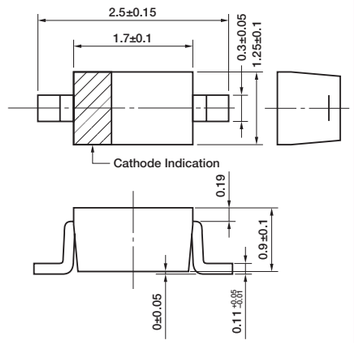
3pin XSOF(0814)
PKG3D1-323-0412



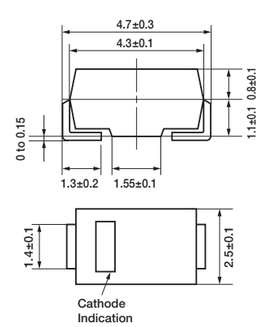
3pin XSOF03(0812)
PKG3D1-212-0412



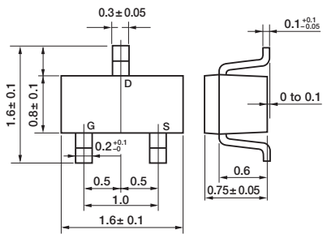
2pin SSP
PKG2C1-111-0412



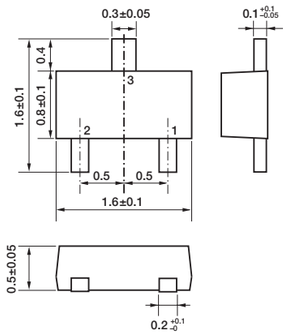
2pin PoMM
PKG2C4-121-0432



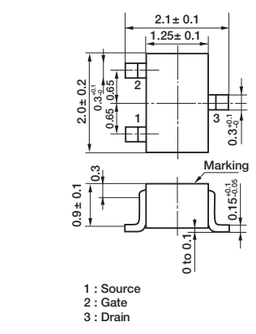
3pin USM(SC-75)
PKG3C2-222-0412



3pinTUSM(SC-89)
PKG3C2-212-0412



3pinSSP(SC-70)
PKG3C1-212-0412

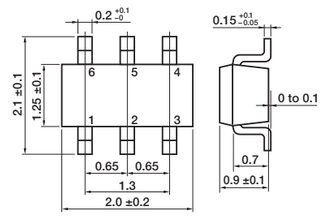


1 : Source
2 : Gate
3 : Drain

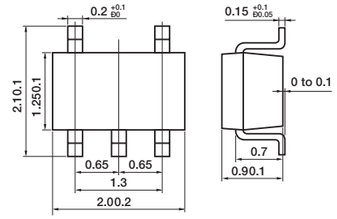
Package Name / Package Code

(Units: mm)

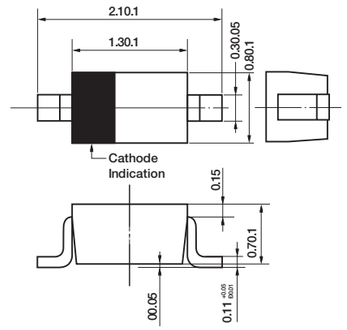
6pin SSP(SC-88)
PKG6C1-212-0412



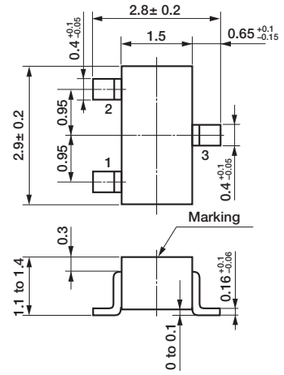
5pinSSP(SC-88A)
PKG5C1-212-0412



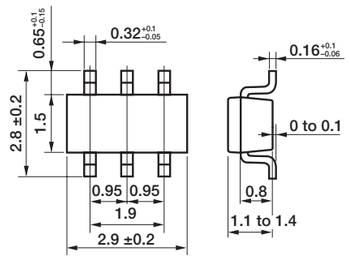
2pinUSM(SC-78)
PKG2C2-212-0412



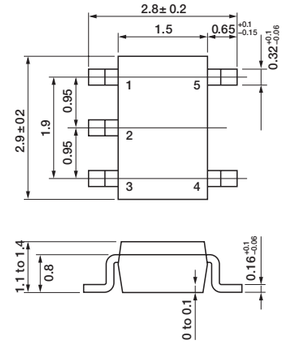
3pinMM(SC-59)
PKG3C3-121-0212



6pinMM(SC-74)
PKG6C3-121-0412

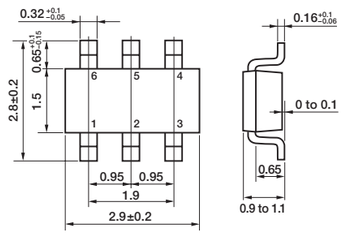


5pinMM(SC-74A)
PKG5C3-121-0412



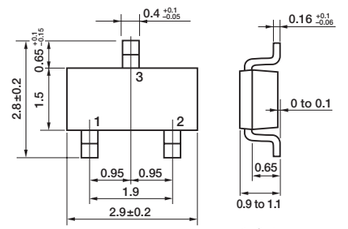
(SC-74A)

6pinTMM(SC-95)
PKG6C3-111-0422



1: Anode
2: Source
3: Gate
4: Drain
5: N/C
6: Cathode

3pinTMM(SC-96)
PKG3C3-111-0422



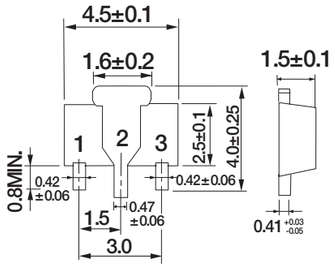
1. Gate
2. Source
3. Drain

Package Drawings

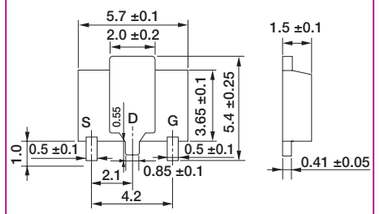
Package Drawings 6

Package Name / Package Code (Units: mm)

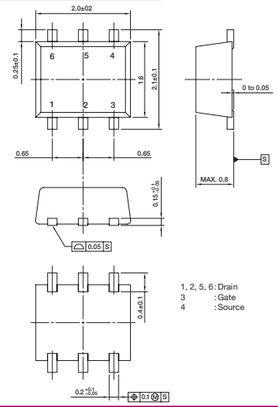
3pin PoMM(SC-62)
PKG3C4-212-0432



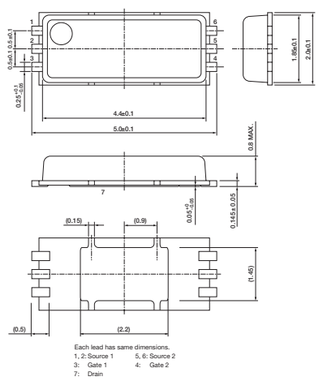
MP-2(SC-84)
PKG3J4-111-0432



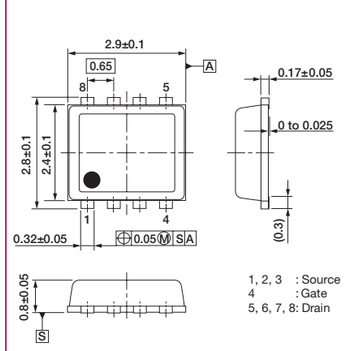
6pinWSOF(1620)
PKG6D1-545-0422



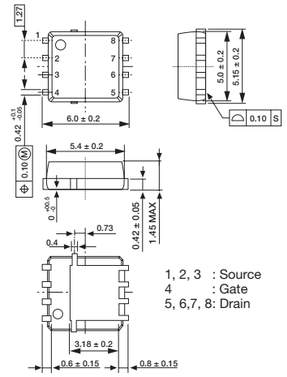
6pinHWSON(4521)
PKG6E1-111-0424



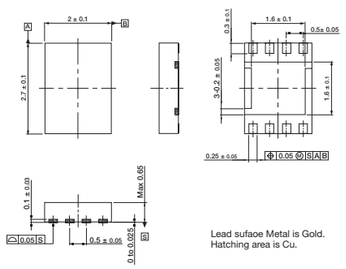
8pinVSOF(2429)
PKG8D1-655-0422



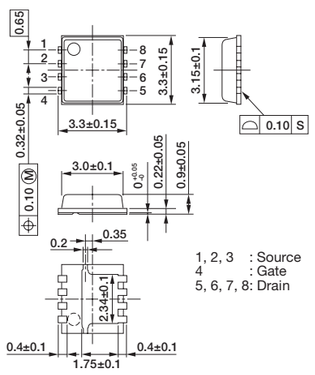
8PIN HSON
PKG8E1-343-0431



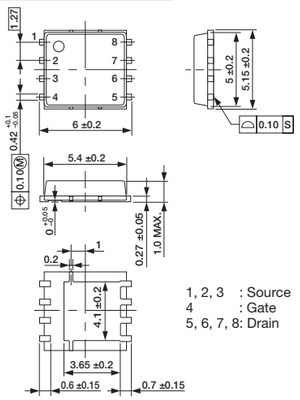
8pin HUSON(2027)
PKG8E1-551-0422



8pin HVSON(3333)
PKG8E1-432-0432

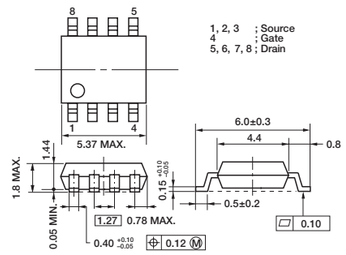


8pinHVSON(6051)
PKG8E1-323-0432

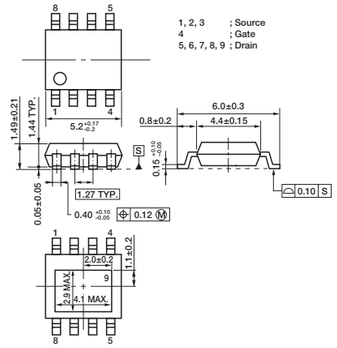


Package Name / Package Code (Units: mm)

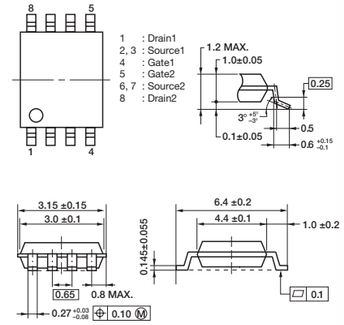
8pin SOP
PKG8GR-0403



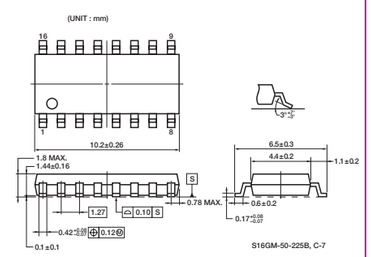
8pin HSOP
PKG8U1-111-0432



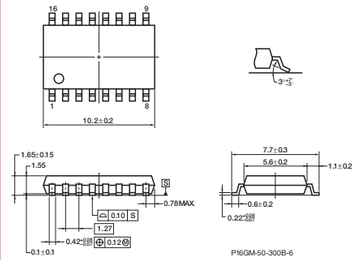
8pin TSSOP
PKG8GR-9JG-0405



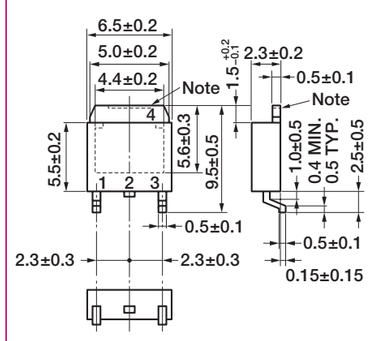
16pin SOP(225ml)
PKG16GR-0103



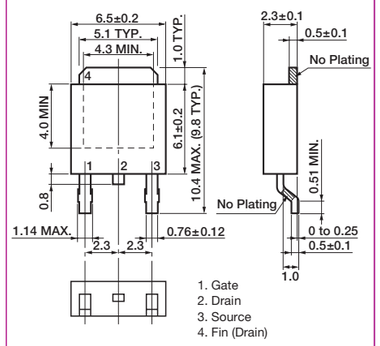
16pin SOP(300ml)
PKG16GS-0403



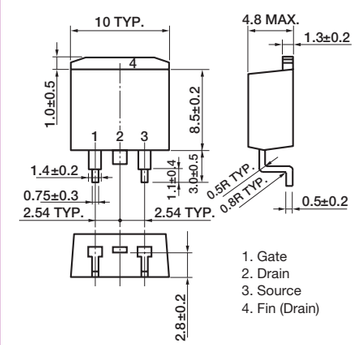
MP-3Z(TO-252)
PKG3J5-212-0431



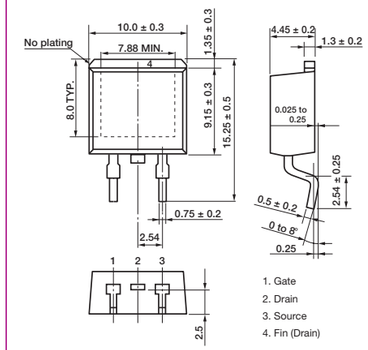
MP-3ZK(TO-252)
PKG3J5-312-0431



MP-25Z(TO-220SMD)
PKG3J9-323-0431



MP-25ZK(TO-263)
PKG3J9-513-0431

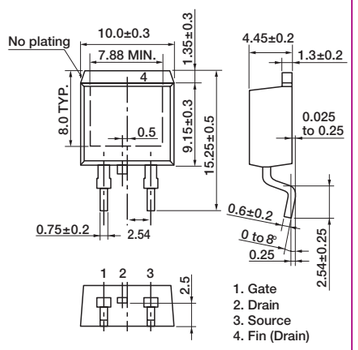


Package Drawings

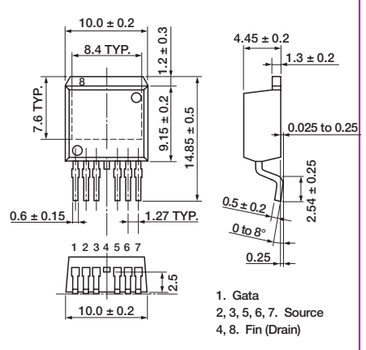
Package Drawings 7

Package Name / Package Code (Units: mm)

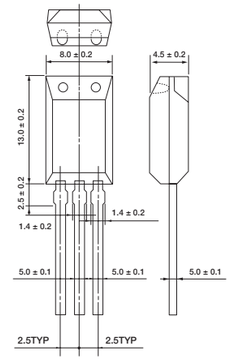
MP-25ZP(TO-263)
PKG3J9-713-0431



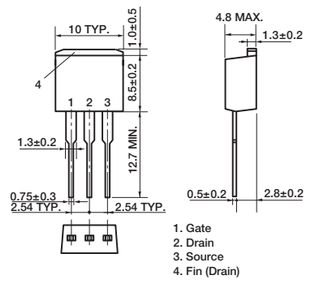
MP-25ZT(TO-263-7pin)
PKG7J9-321-0431



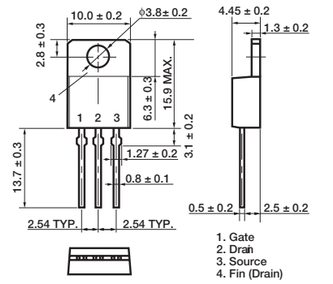
MP-10
PKG3J8-111-0431



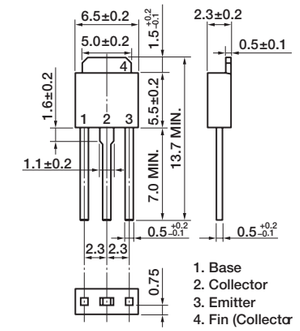
MP-25Fincut(TO-262)
PKG3J9-223-0431



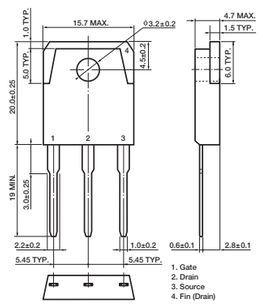
MP-25K(TO-220)
PKG3J9-913-0431



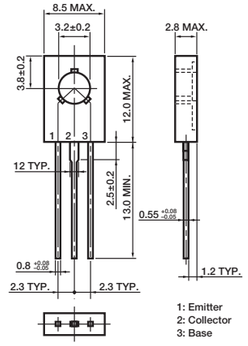
MP-3(TO-251)
PKG3J5-112-0431



MP-88(TO-3P)
PKG3JC-111-0441

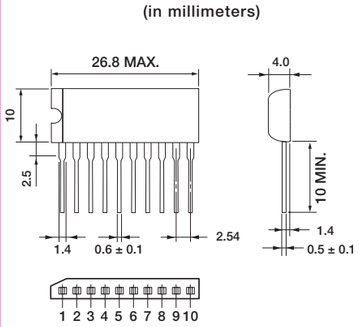


MP-5(TO-126)
PKG3J6-113-0432

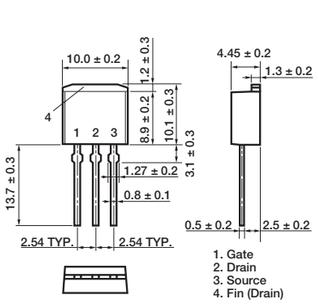


SIP10
PKG10H2-111-0432

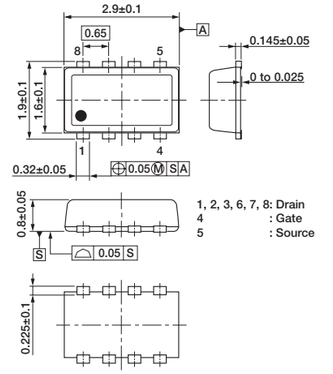
(in millimeters)



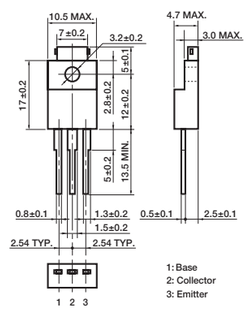
MP-25SK(TO-262)
PKG3J9-813-0431



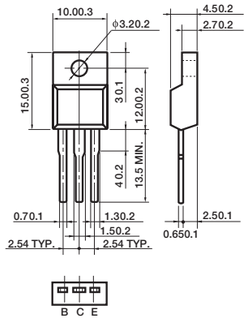
8pin VSOF(1629)
PKG8D1-755-0422



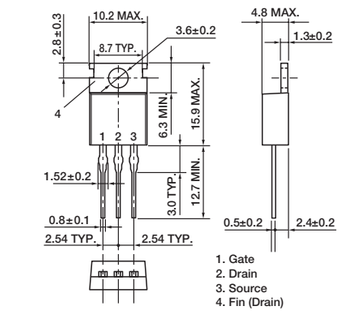
MP-45(Isolated TO-220)
PKG3JB-111-0431



MP-45F(Isolated TO-220)
PKG3JB-212-0431



MP-25(TO-220)
PKG3J9-123-0431

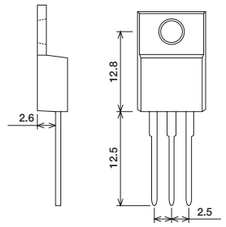


Lead Forming and Taping

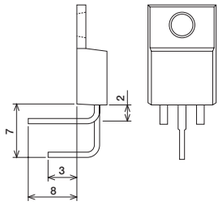
Lead Forming

(Units: mm)

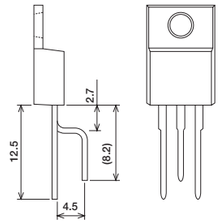
TO-220 Standard package



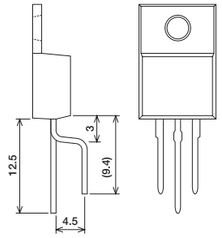
TO-220-A6



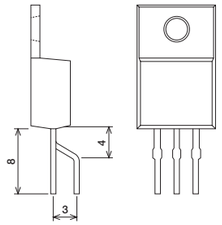
TO-220-A8



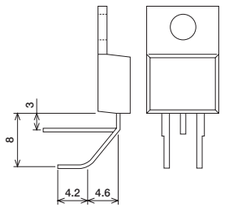
TO-220-AA



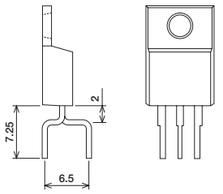
TO-220-AN



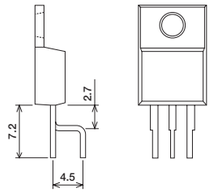
TO-220-AP



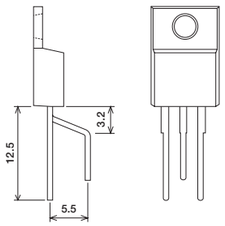
TO-220-AR



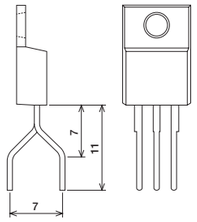
TO-220-AS



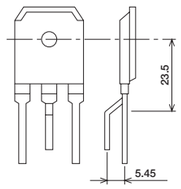
TO-220-AT



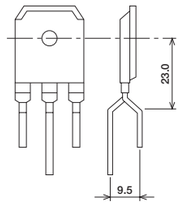
TO-220-AV



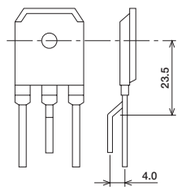
TO-3P-A8



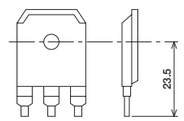
TO-3P-AB



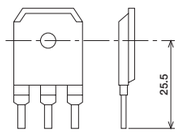
TO-3P-AN



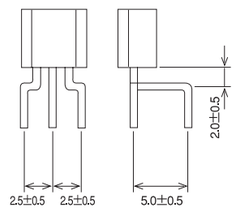
TO-3P-AV



TO-3P-AW

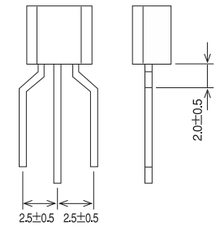


TO-92-A6 Standard Forming package

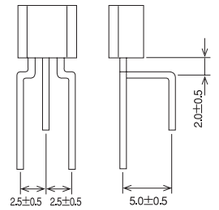


(Units: mm)

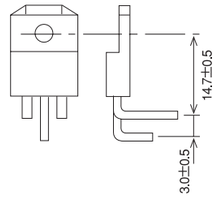
TO-92-A8 Standard Forming package



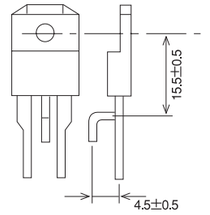
TO-92-AB Standard Forming package



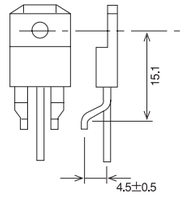
TO-220F-A5 Standard Forming package



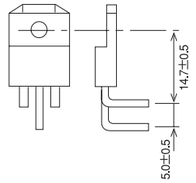
TO-220F-A8 Standard Forming package



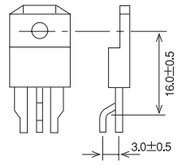
TO-220F-AA Standard Forming package



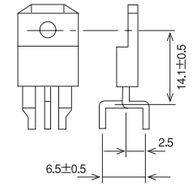
TO-220F-AK Standard Forming package



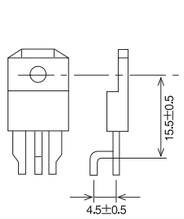
TO-220F-AN Standard Forming package



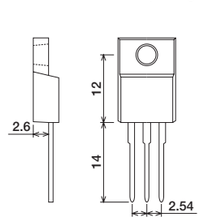
TO-220F-AR Standard Forming package



TO-220F-AS Standard Forming package



TO-220FN Standard package



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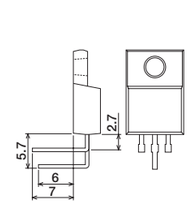

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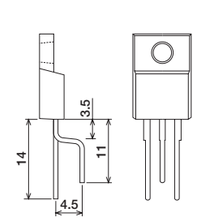

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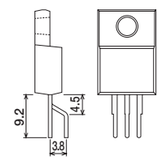

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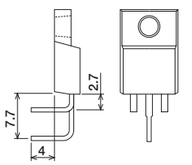

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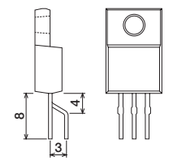

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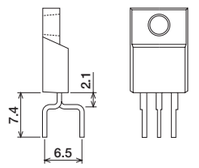

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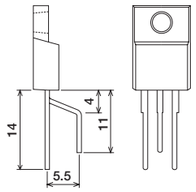

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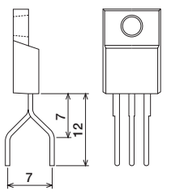

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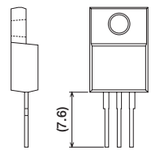

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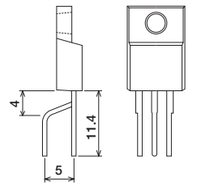
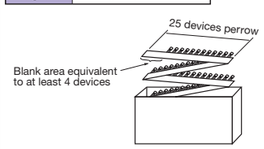


Lead Forming and Taping

Taping

Designation	Part No. + **TZ**



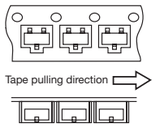
Package	Packing Unit	
TO-92 TO-92MOD	Zigzag box	2,500 Pcs/ Box
SPAK	Zigzag box	2,500 Pcs/ Box

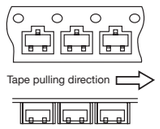
"R" of TR and UR is applied to those items which are packed face up with the marking surface positioned in the direction in which the tape can be pulled out so that the center terminal of CMPAK turns on the right side.

CMPAK / MPAK standard taping and packing specifications (Comform to JEITA standard RC-1009A)

Designation	Part No. + Mark + **TR**	3000 Pcs / Reel
	Part No. + Mark + **UR**	12000 Pcs / Reel

Designation	Part No. + Mark + **TL**	3000 Pcs / Reel
	Part No. + Mark + **UL**	12000 Pcs / Reel

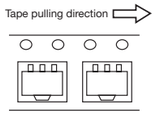


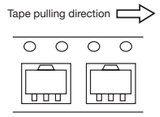


UPAK taping and packing specifications (Comform to JEITA standard RC-1009A)

Designation	Part No. + Mark + **TR**	1000 Pcs / Reel
	Part No. + Mark + **UR**	4000 Pcs / Reel

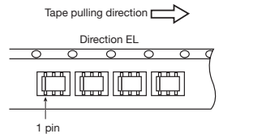
Designation	Part No. + Mark + **TL**	1000 Pcs / Reel
	Part No. + Mark + **UL**	4000 Pcs / Reel





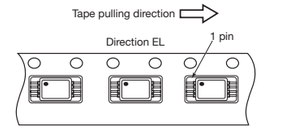
TSOP-6 taping and packing specifications

Designation	Part No. + **EL**	3000 Pcs / Reel



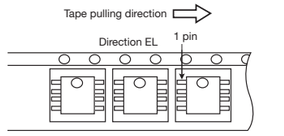
TSSOP-8 taping and packing specifications (Comform to JIS standard C0806)

Designation	Part No. + **EL**	3000 Pcs / Reel

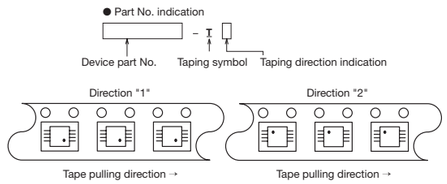


SOP-8 taping and packing specifications (Comform to JIS standard C0806)

Designation	Part No. + **EL**	2500 Pcs / Reel



VSON-8 (Packing Unit: 3000 Pcs/ Reel)



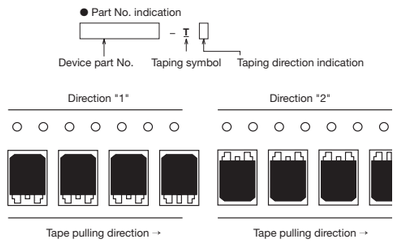
DPAK / LDPAK taping and packing specifications (Comfprm to JEITA standard RC-1009B)

Designation	Part No. + **TL**	DPAK : 3000 Pcs / Reel DPAK : 1000 Pcs / Reel

Designation	Part No. + **TR**	LDPAK : 3000 Pcs / Reel LDPAK : 1000 Pcs / Reel

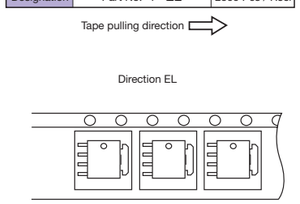
TL is the standard spec. For TR, we will support individually if there is any request.

TO-220S (Packing Unit: 1000 Pcs/ Reel)



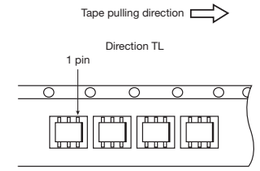
LFPAK taping and packing specifications

Designation	Part No. + **EL**	2500 Pcs / Reel

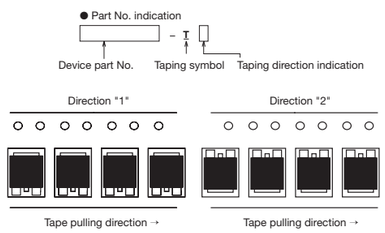


CMPAK-6 taping and packing specifications

Designation	Part No. + **TL(CMPAK-6)** Part No. + **EL(CMFPAK-6)**	3000 Pcs / Reel



MP-3A (Packing Unit: 3000 Pcs/ Reel)



Emboss Taping Reel Pack

Package	Packing Unit	Name	Packing Configurations
URP	3,000	Part No.+TL[H]/TR[P]	Emboss TAPING REEL PACK (Conforming to JEITA standard RC-1009B) 8mm emboss tape (Tape equivalent to JEITA type TE84F)
MPAK CMPAK CMPAK-4	3,000	Part No.+TL[H]/TR[P]	
MPAK-5 VSON-5	3,000	Part No.+TL[H]/TR[P]	
LLD	2,500	Part No.+TL[H]/TR[P]	
UFP (TURP)	4mm pitch 4,000	Part No.+TR(TRF)[P]	
	2mm pitch 8,000	Part No.+KR(KRF)[R]	
SFP	2mm pitch 8,000	Part No.+KR[R]	
EFP MP6	2mm pitch 10,000	Part No.+KR[R]	
MFP12	4mm pitch 4,000	Part No.+TR[P]	
MOP	3,000	Part No.+TL[H]/TR[P]	12mm emboss tape

Note) TR is recommended for emboss taping and reel specification.

Characters in [ ] in Name column are new codes.

Taping Pulling Direction

Package	Taping Code	Appearance
URP LLD MOP	TR[P] (Taping to Right)	TR Pulling direction
UFP (TURP)	TR[P] (Taping to Right) (TRF)	TR Pulling direction
	KR[R] (KRF)	KR Pulling direction
SFP EFP MP6	KR[R]	KR Pulling direction SFP/EFP MP6
MPAK CMPAK CMPAK-4 MPAK-5 MFPAK VSON-5	TR[P] (Taping to Right)	TR Pulling direction MPAK/CMPAK/MFPAK CMPAK-4 MPAK-5/CMPAK-5/VSON-5
MFP12	TR[P] (Taping to Right)	TR Pulling direction

Characters in [ ] in Taping Code column are new codes.

Taping of URP package takes the following symbols according to quantity in 1 reel, group, and other items.

Taping Code	TRF[P]	TRU[P]	TRV[P]
Taping direction	TR[P]	TR[P]	TR[P]
Quantity of maximum category in 1 reel	-	4	
Quantity in 1 reel	3000 pcs		
Grouping	-	10 pcs or more	
End of group	-	4 spaces	Non-reflection tape on 1 space
Note	-	C.C system*	

*. Continuous Connected taping system of variable capacitance diode.
**. Please contact our sales office if you need the TL type.

Taping of UFP/SFP package takes the following symbols according to quantity in 1 reel, group, and other items. (SFP Package only KR taping)

Taping Code	TRF[P]	TRU[P]	TRV[P]	KRF[R]	KRU[R]	KRV[R]
Taping direction	TR[P]			KR[R]		
Quantity of maximum category in 1 reel	-	5 max.		-	10 max.	
Quantity in 1 reel	4000 pcs			8000 pcs		
Grouping	-	10 pcs or more		-	10 pcs or more	
End of group	-	9 spaces	1space+ Non-reflection tape on 1space+1space	-	4 spaces	Non-reflection tape on 1 space
Note	-	C.C system*		-		C.C system*

* Continuous Connected taping system of variable capacitance diode

Home Page

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The selection of application examples on the Renesas Electronics website has been further enhanced. You can search for product examples among the following categories.

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- PCs and PC peripherals
- Consumer electronics
- Healthcare
- Automotive
- Industrial/building management
- Elemental technologies

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From the discrete devices top page you can search for content arranged by product series from among categories such as power MOSFETs, diodes, IGBTs, TRIACs and thyristors, RF and microwave devices, and optoelectronic devices. In addition, you can use the navigation panel on the left to locate documentation related to discrete devices.

Searching by Product Name

By using the search function on the top page you can go directly to the content that interests you.

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You can search the contents of the website by entering keywords or enter a part number to view a listing of product specifications. On the results page you can switch to the information you need by clicking the corresponding tab. (Click on the tabs in the back to display the product pages from which datasheets, etc., can be obtained.)

❷ Parametric Search

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❹ Obsolete/Discontinued Product Search

You can search for information on products that have been discontinued or are no longer being actively promoted.

Support Information

We aim to offer a total support package to meet customers' needs through the provision of simulation data, FAQ, seminars, inquiries via the Web, and so on.

Renesas VP

The Buck Designer section of Renesas VP enables you to enter your usage conditions to obtain a listing of the optimal power MOSFETs for your buck converter and a graphical display of its simulated characteristics.

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http://www.renesas.com

Overseas http://www.renesas.com/en/discrete

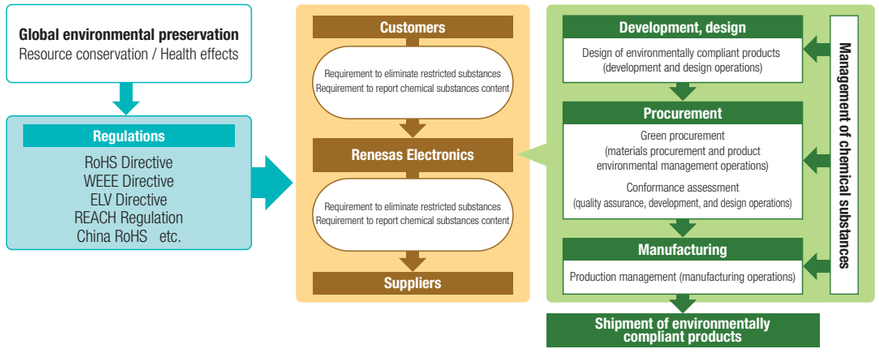
Environmental Considerations for Renesas Electronics Products

Renesas Electronics is working actively to improve product environmental quality in all aspects of its business operations, including product design, materials procurement, manufacturing, and shipping.

Design

- **Development of environmentally compliant products through product environmental assessment**
  Making products more resource and energy efficient (more compact, higher integration, reduced power consumption, extended service life)
  Reducing environmental load due to chemicals (management of chemical content of products)
- **Compliance with domestic and international product environmental regulations**
  EU RoHS Directive, China RoHS, ELV Directive, REACH Regulation

< Renesas Product Environmental Quality Management Sequence >



Procurement

- **Thoroughgoing green procurement activities**
- **Investigation and confirmation of chemical content of procured parts and materials**

Manufacturing

- **Prevention of inclusion or contamination by prohibited chemicals in products (process management)**
- **Reduction of CO_2 emissions (reduction of PFC output and energy usage), reduction of environmental load from chemicals used in manufacturing, reduction of waste materials**

Shipping

- **Reduction of volume of packing materials (expanding reuse of plastic packaging materials)**
- **Reduction of energy consumption in transport (improving overall efficiency of distribution)**

Compliance with customer requirements — **Transmission of information such as chemical content of products**

RoHS : Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
WEEE : Waste Electrical and Electronic Equipment
ELV : End of Life Vehicles
REACH : Registration, Evaluation, Authorisation and Restriction of Chemicals

Renesas Green Device Accreditation System

Renesas green device definitions:
Renesas Electronics defines green devices as products that reduce environmental impact by more than a specified amount over their life cycle, which includes procurement, production, distribution, use, and disposal, as determined at the R&D and design stage according to the company's internal environmental standards. Renesas Electronics recognizes three green device ranks for each fiscal year.

a) Green devices:
Products having a "FactorX" score of 1 or higher after completion of a product environmental assessment (at completion of development) and an improvement ratio of 10% or greater.

b) Supergreen devices:
Products that have been assigned a "FactorX" score after completion of a product environmental assessment (at completion of development) and an improvement ratio that place them among the top 20 products.

c) Ultragreen devices:
Products selected from among the supergreen devices as having environmental performance that is No. 1 in the industry or extremely high, or products that combine high environmental performance with excellence in another aspect such that they are considered to contribute substantially to boosting the presence of Renesas Electronics.

RoHS : Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
WEEE : Waste Electrical and Electronic Equipment
ELV : End of Life Vehicles
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RENESAS

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