



Innovations
from
Semiconductor

Discrete Products

ROHM Co., Ltd.



Diode Development Map

Schottky Barrier Diode

The lowest VF in industry

Fast Recovery Diode

The first trr, High performance, Low loss

Zener Diode

Various lineup

Switching Diode

Stable supply / High quality

SiC Power Device

High voltage / High efficiency

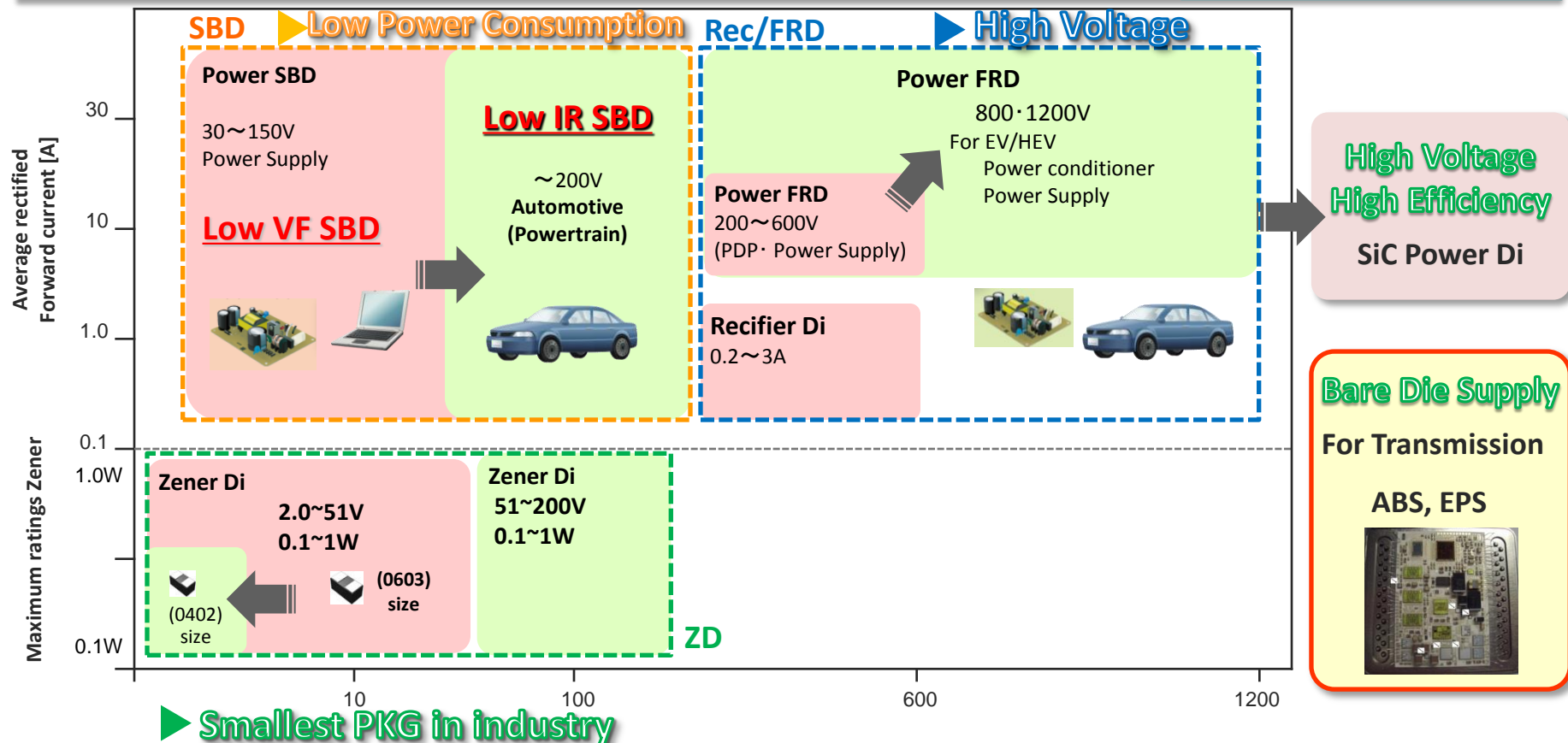
Already in MP

Development Strategy

High voltage

High current

Small / multiple



Automotive Application Example (Diodes)

Vehicle Information System

LAN

ZD:RSB16V
ZD:RSB16F2
ZD:RSB18V
ZD:RSB18F2
ZD:RSB27V
ZD:RSB27F2

Body Control System

Power Sheet

Rec:RR264M-400
ZD:KDZ Series

Air Conditioning

Rec:1SR154-400
Rec:RR264M-400
ZD:UDZV Series
SW:1SS355

Meter

Rec:RR264M-400
SW:1SS355VM
ZD:UDZV Series
ZD:KDZ Series
Rec:RR274EA-400
SBD:RB058L-40
SBD:RB095B-60

Door Control

Rec:RR264M-400
SW:1SS355VM
ZD:UDZV Series
SBD:RB168M-40

Keyless Entry

Rec:RR264M-400
SBD:RB160M-40

Power Window

Rec:RR264M-400
SW:1SS355V
ZD:UDZV Series

Engine Control System

Engine Control Unit

Rec:RR264M-400
Rec:1SR154-400
SW:1SS355VM
FRD:RF201L2S
SBD:RB068L100
ZD:KDZ Series

Air Bag

FRD:RF101L2S
Rec:RR264M-400
Rec:1SR154-400
ZD:KDZ Series
SW:DAN202U

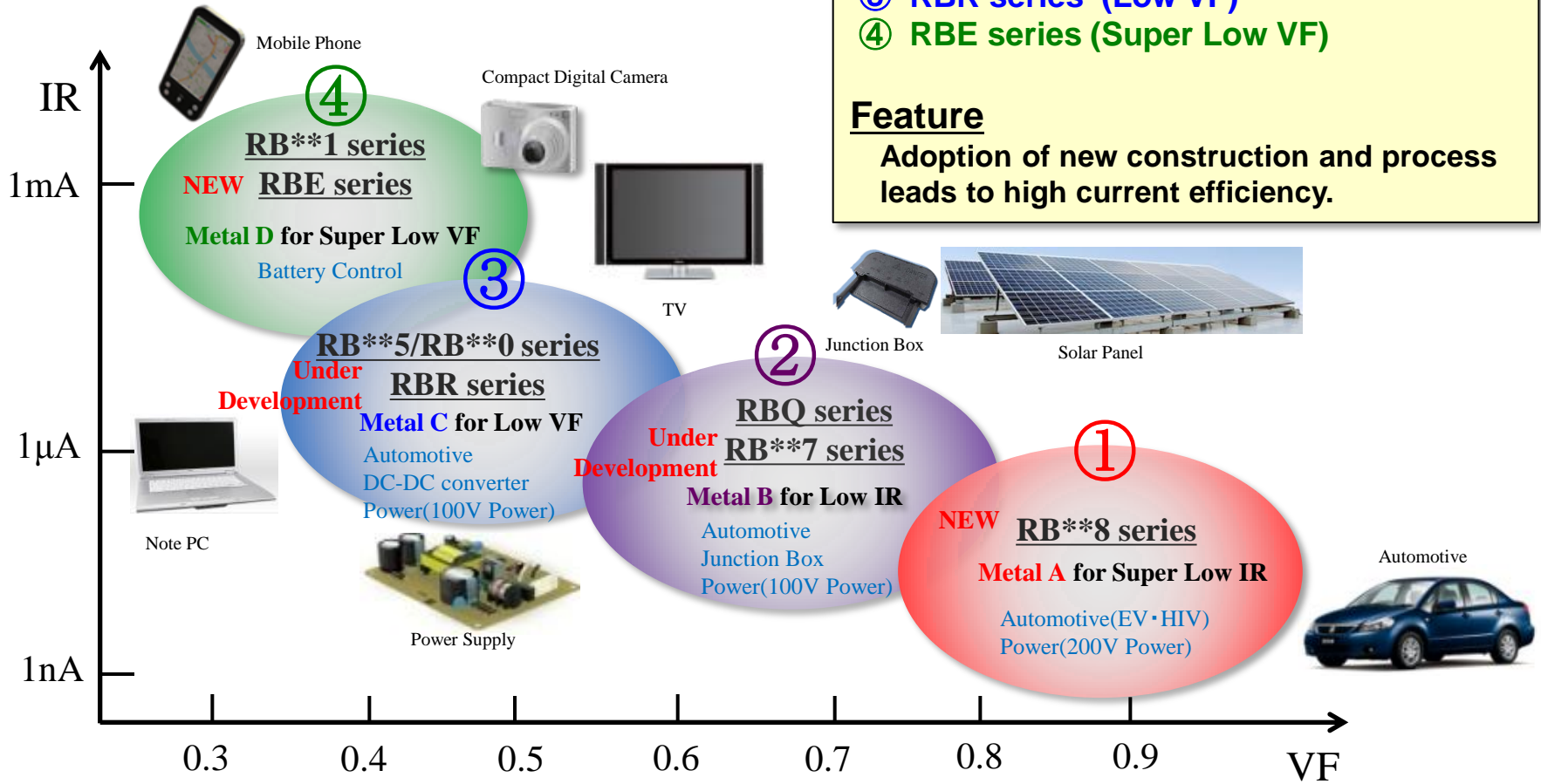
Engine/Powertrain Control System

Vehicle Information System

Body/Chassis Control System

Schottky Barrier Diode (SBD) Line Up

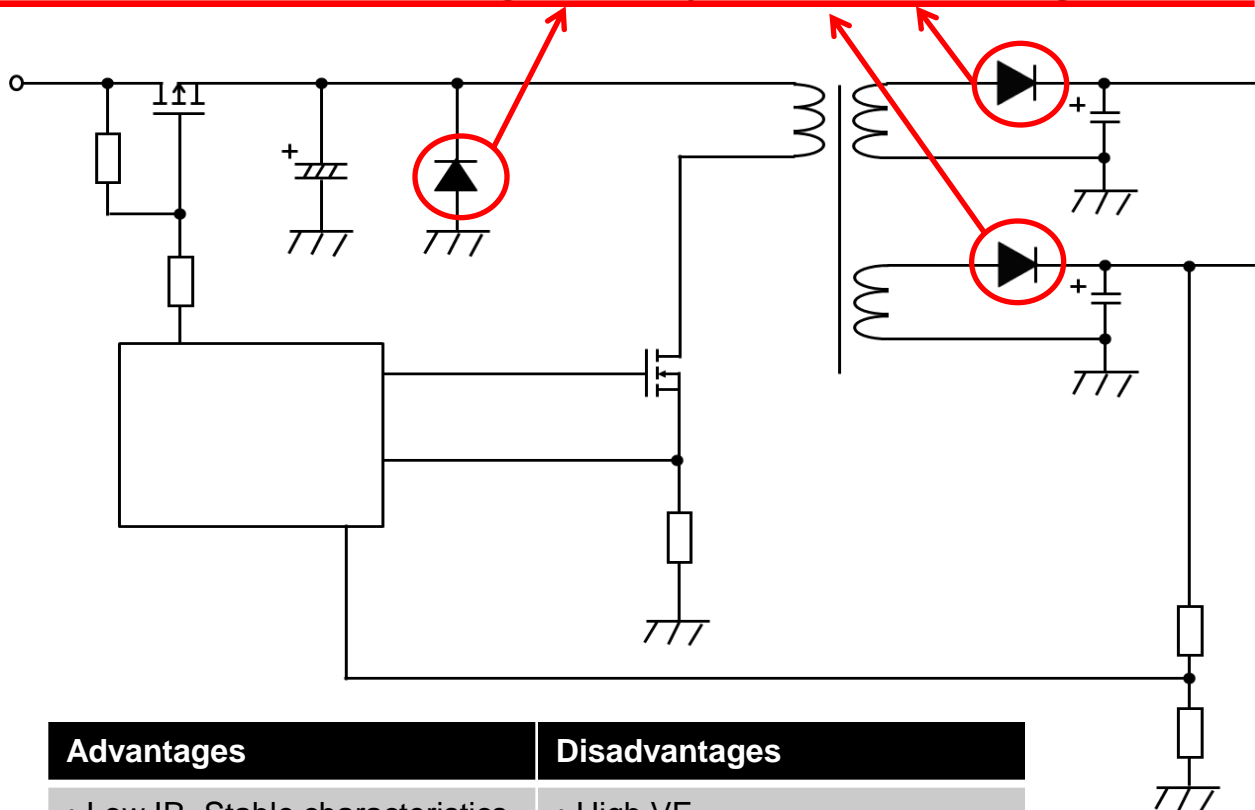
SBD Line Up



Low IR SBD Concept

■ Typical Circuit

REC's or FRD's are generally used under high ambient temp.



Advantages

- Low IR. Stable characteristics under high temperature environment.

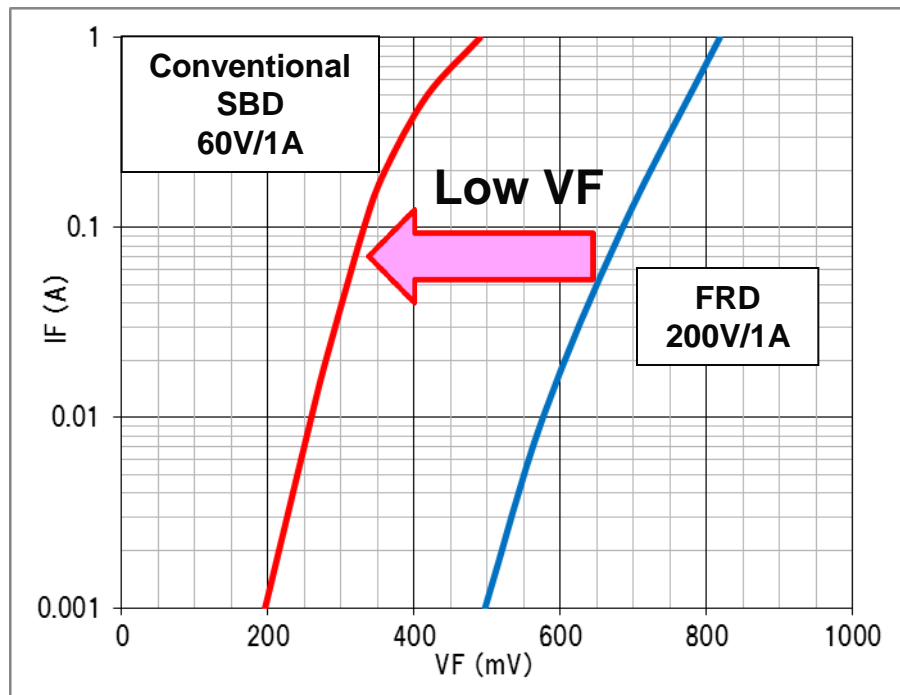
Disadvantages

- High VF
- < 200V line-up not available
- Package Size

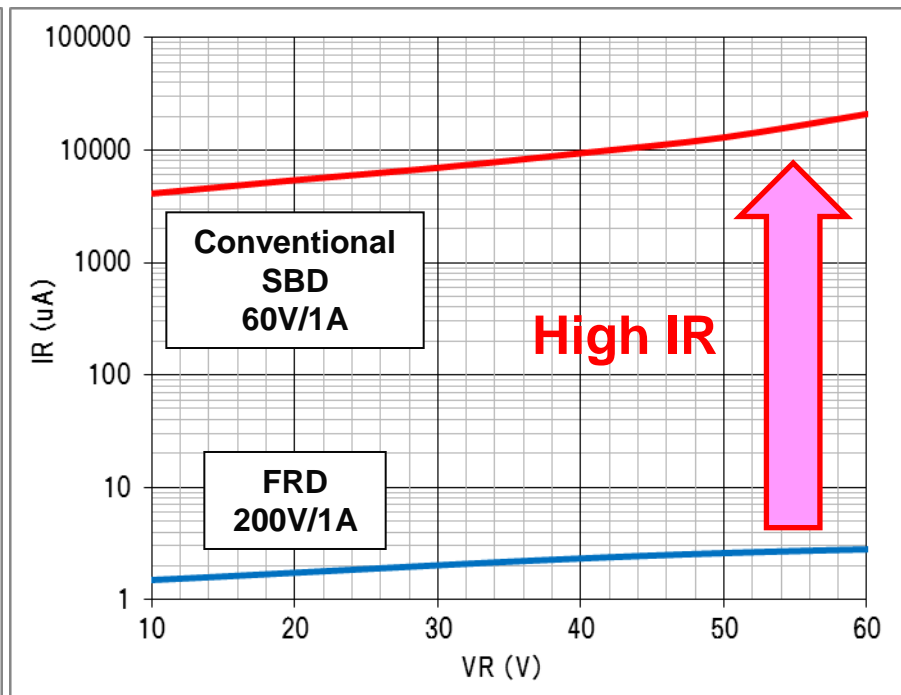
Concept

■ Spec Comparison

● $T_a=25^\circ\text{C}$ VF-IF



● $T_a=150^\circ\text{C}$ VR-IR

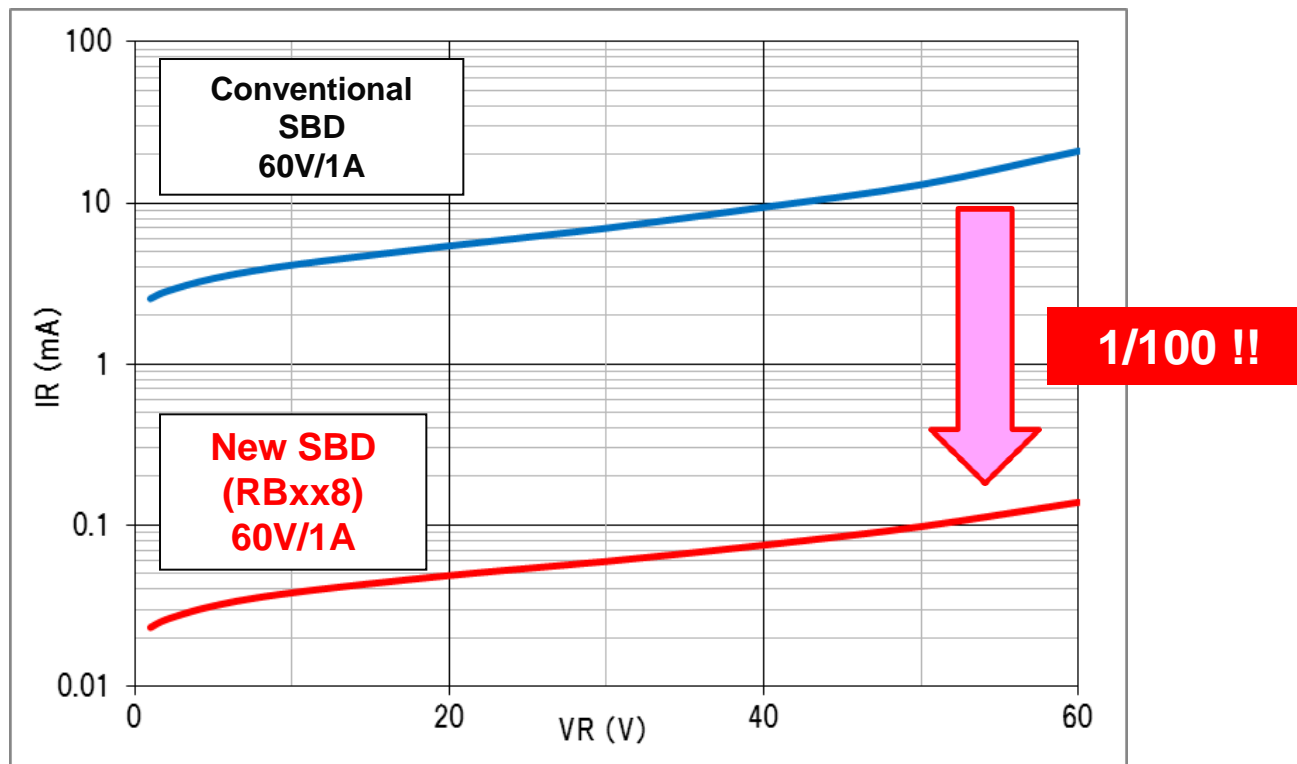


SBD VF is low but there is a concern about Thermal Runaway due to its high IR at high temperature range.

Concept

■ IR Comparison

● Ta=150°C VR-IR



Dramatically reduced the Leakage current by using new Barrier Metal Material.

Concept

■ Thermal Runaway

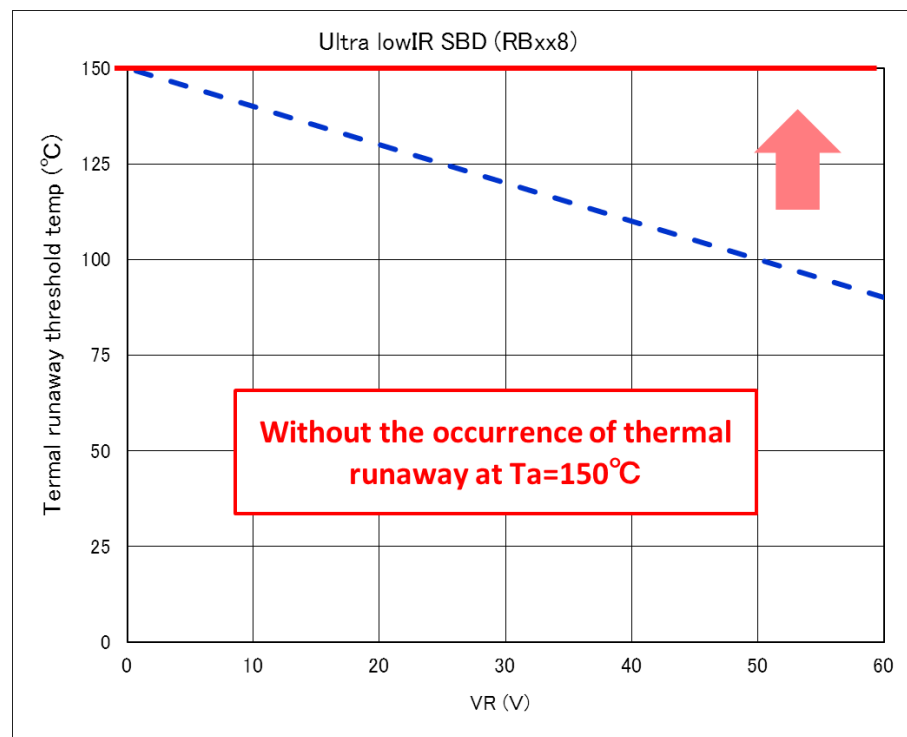
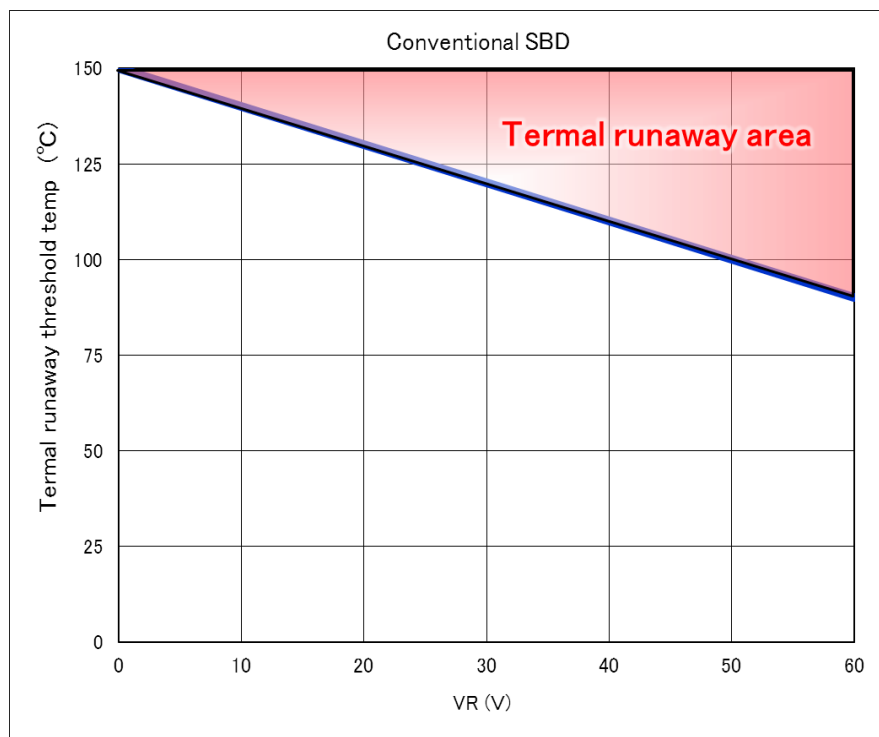
< Test Conditions >

Item: SBD / 60V / 3A / SMA

Bias: VR = 60V DC Supply

Board: FR-4

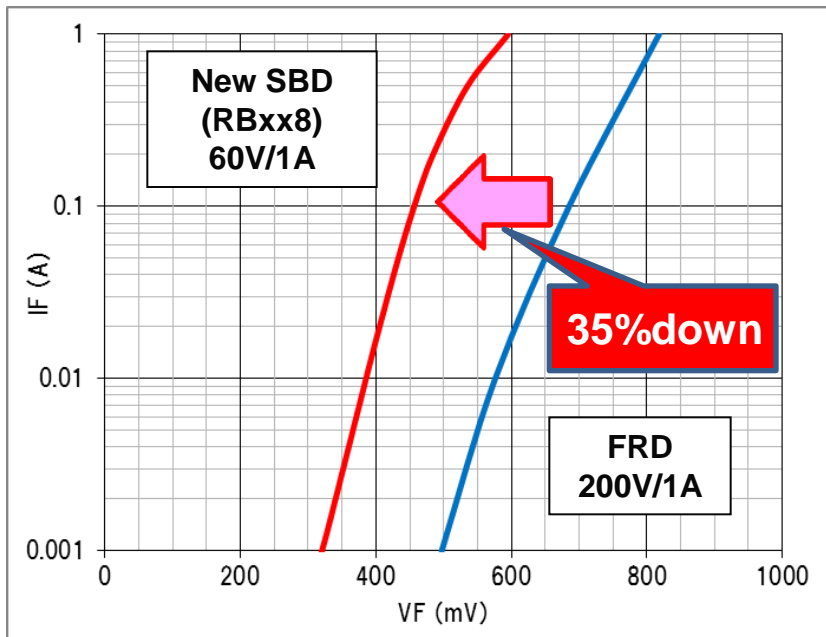
Land : Rohm Recommended Footprint



Replacing Rectifier Diodes

Low VF

● Ta=25°C VF-IF



Downsizing

REC (200V / 3A)
SMC



SBD (150V / 3A)
RB058L150
SMA



72% Less Mounting Area

REC (200V / 1A)
SMA



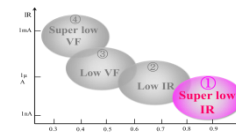
SBD (60V / 1A)
RB168M-60
SOD-123



64% Less Mounting Area

Contribute in Power Consumption Reduction of EV's and HEV's !

① RB**8 Series ~ Ultra Low IR SBD ~



Feature

Ultra Low Reverse Current
No Thermal Runaway
High Reliability

Aprication

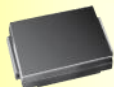
•Power•Automotive•DC-DC
 (The circuit which is used under high temperature environment)



approach example

Mounting Area: 72% down

REC (200V / 3A) SMC  RB058L150 PMDS(SMA)



64% down

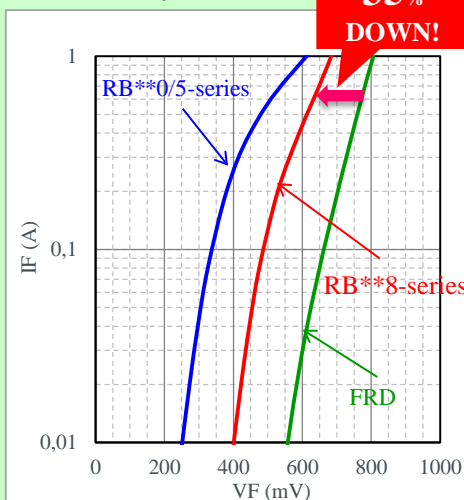
REC (200V / 1A) PMDS  RB168M-60 PMDU



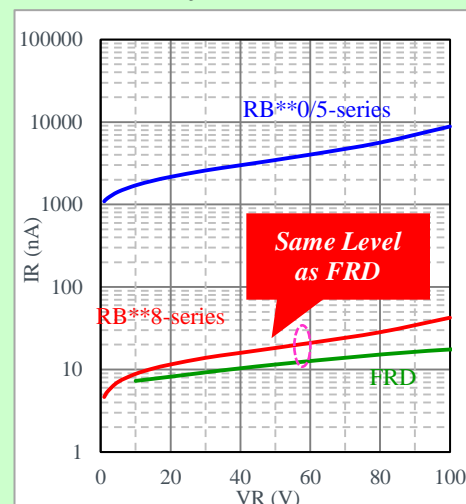
Lower VF guarantees the equal current to the big package

Characteristic data

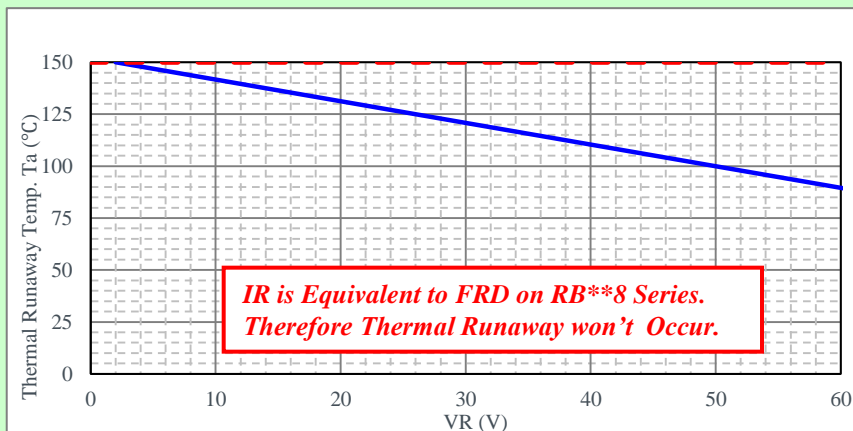
<VF-IF :Tj =25℃>



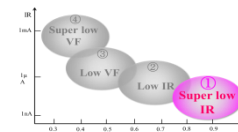
<VR-IR :Tj =25℃>



<Thermal Runaway>

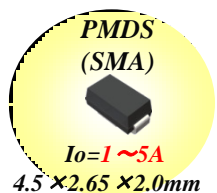
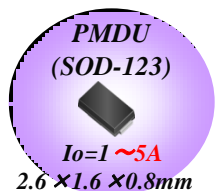
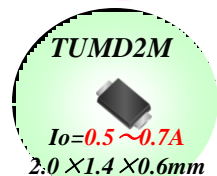
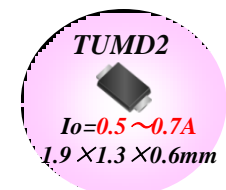


① RB**8 Series ~ Ultra Low IR SBD ~



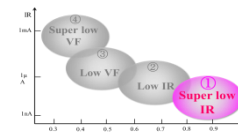
Line Up

Middle power

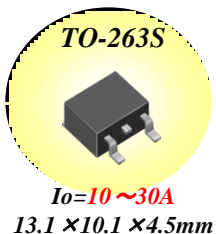
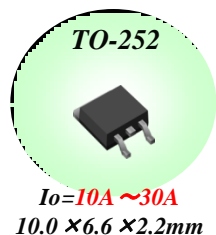


Package	Circuit	Part No.	Absolute Maximum		Electrical Characteristic (Tj = 25 °C)			
			VR(V)	Io(A)	VF(V)	Max. IF(A)	IR(uA)	Max. VR(V)
TUMD2 (SOD-323HE)		RB558VA150	150	0.5	0.95	0.5	0.5	150
TUMD2M		New RB168VAM-30	30	1	0.73	1	0.3	30
		New RB168VAM-40	40	1	0.73	1	0.5	40
		New RB168VAM-60	60	1	0.72	1	1	60
		RB578VAM100	100	0.7	0.85	0.7	0.2	100
		New RB168VAM100		1	0.84	1	0.4	
PMDUM (SOD-123)		New RB168VAM150	150	1	0.88	1	1	150
		New RB168MM-30	30	1	0.69	1	0.4	30
		New RB068MM-30		2	0.69	2	0.7	
		RB168MM-40	40	1	0.65	1	0.55	40
		RB068MM-40		2	0.73	2	0.55	
		RB168MM-60	60	1	0.68	1	1.5	60
		RB068MM-60		2	0.76	2	1.5	
		New RB168MM100	100	1	0.79	1	0.6	100
PMDS (SOD-106)		RB168MM150	150	1	0.84	1	20	150
		New RB168L-30	30	1	0.69	1	0.4	30
		New RB068L-30		2	0.69	2	0.7	
		New RB058L-30		3	0.68	3	1.5	
		New RB168L-40	40	1	0.65	1	0.55	40
		RB068L-40		2	0.69	2	1	
		RB058L-40		3	0.7	3	5	
		New RB168L-60	60	1	0.68	1	1.5	60
		RB068L-60		2	0.7	2	2	
		RB058L-60		3	0.64	3	4	
		New RB168L100	100	1	0.79	1	0.6	100
		RB068L100		2	0.8	2	50	
		New RB168L150	150	1	0.84	1	4	150
		RB068L150		2	0.82	2	5	
		RB058L150		3	0.87	3	5	

① RB**8 Series ~ Ultra Low IR SBD ~

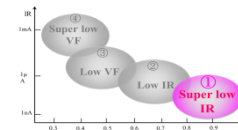


Power(SMD)



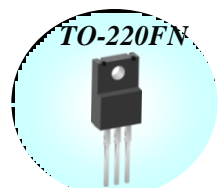
Package	Circuit	Part No.	Absolute Maximum		Electrical Characteristic (Tj = 25 °C)			
			VR(V)	Io(A)	VF(V)	Max. IF(A)	IR(uA)	Max. VR(V)
TO-252M		New RB098BM-30	30	6	0.77	3	1	30
		New RB088BM-30		10	0.77	5	1.5	30
		New RB098BM-40	40	6	0.77	3	1	40
		New RB088BM-40		10	0.77	5	2	40
		New RB098BM-60	60	6	0.78	3	1.5	60
		New RB088BM-60		10	0.78	5	3	60
		New RB098BM100	100	6	0.79	3	4	100
		RB088BM100		10	0.87	5	5	100
		New RB098BM150	150	6	0.88	3	7	150
		RB088BM150		10	0.88	5	15	150
		RB078BM30S	30	5	0.72	5	5	30
		RB075BM40S	40	5	0.75	5	5	40
LPDS (TO-263S)		New RB088NS-30	30	10	0.77	5	1.5	30
		New RB218NS-30		20	0.77	10	3	
		New RB228NS-30		30	0.77	15	3.5	
		New RB238NS-30		40	0.77	20	5	
		New RB088NS-40	40	10	0.77	5	2	40
		New RB218NS-40		20	0.77	10	4	
		New RB228NS-40		30	0.77	15	5	
		New RB238NS-40		40	0.77	20	7	
		New RB088NS-60	60	10	0.78	5	3	60
		New RB218NS-60		20	0.78	10	6	
		New RB228NS-60		30	0.78	15	9	
		New RB238NS-60		40	0.78	20	12	
		New RB088NS100	100	10	0.87	5	5	100
		New RB218NS100		20	0.87	10	7	
		RB228NS100		30	0.87	5	5	
		New RB298NS100		30	0.87	15	10	
		New RB238NS100	150	40	0.86	20	20	150
		RB088NS150		10	0.88	5	15	
		New RB218NS150		20	0.88	10	20	
		New RB228NS150		30	0.92	15	25	
		RB238NS150		40	0.92	20	30	

① RB**8 Series ~ Ultra Low IR SBD ~



On MP

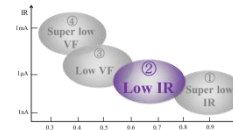
Power(THD)



$I_o = 10 \sim 30A$
19.0 × 10.0 × 4.5mm

Package	Circuit	Part No.	Absolute Maximum		Electrical Characteristic (Tj = 25 °C)			
			VR(V)	Io(A)	VF(V)	Max. IF(A)	IR(uA)	Max. VR(V)
TO-220FN		New RB088T-30	30	10	0.77	5	1.5	30
		New RB218T-30		20	0.77	10	3	
		New RB228T-30		30	0.77	15	3.5	
		New RB238T-30		40	0.77	20	5	
		New RB088T-40	40	10	0.77	5	2	40
		New RB218T-40		20	0.77	10	4	
		New RB228T-40		30	0.77	15	5	
		New RB238T-40		40	0.77	20	7	
		New RB088T-60	60	10	0.78	5	3	60
		New RB218T-60		20	0.78	10	6	
		New RB228T-60		30	0.78	15	9	
		New RB238T-60		40	0.78	20	12	
		New RB088T100	100	10	0.87	5	5	100
		New RB218T100		20	0.87	10	7	
		RB228T100		30	0.87	5	5	
		New RB298T100		30	0.87	15	10	
		New RB238T100	150	40	0.86	20	20	150
		RB088T150		10	0.88	5	15	
		New RB218T150		20	0.88	10	20	
		New RB228T150		30	0.92	15	25	
		New RB238T150		40	0.92	20	30	

② RBQ series ~Low IR SBD~



Feature

- Low IR
- High efficiency by using a highly precise process

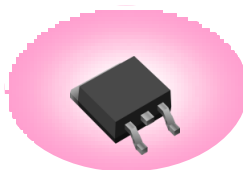
Application

- Automotive
- Junction Box
- Power Supply

Line Up

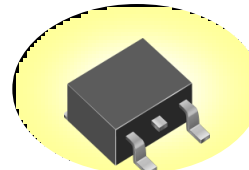
Package

TO-252



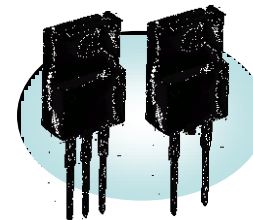
$I_o = 5A \sim 20A$
10.0 × 6.6 × 2.2mm

TO-263S



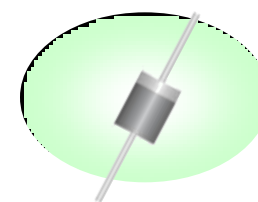
$I_o = 10 \sim 30A$
13.1 × 10.1 × 4.5mm

TO-220FN





$I_o = 10 \sim 30A$
19.0 × 10.0 × 4.5mm

P-600




$I_o = 10 \sim 30A$

<45V>

Circuit	PKG	Part No.	Absolute Maximum Ratings (Tc=25 °C)		Electrical Characteristic (Tj = 25 °C)			
			VF(V)	Io(A)	VF(V)	Max.	IR(uA)	Max.
						IF(A)		VR(V)
Cathode common 	TO-252	RBQ10BM45A	45	10	0.65	5	150	45
		RBQ15BM45A		15		7.5	300	
		RBQ20BM45A		20		10	450	
	TO-263S	RBQ10NS45A	45	10	0.65	5	150	45
		RBQ20NS45A		20		10	300	
		RBQ30NS45A		30		15	450	
	TO-220FN	RBQ10T45A	45	10	0.65	5	150	45
		RBQ20T45A		20		10	300	
		RBQ30T45A		30		15	450	
Single 	TO-263S	RBQ30NS45B	45	30	0.59	30	700	45
	TO-220FN	RBQ30TB45B	45	30	0.59	30	700	45
	P-600	RBQ15AP45A	45	15	0.58	10	500	45

<65V>

Circuit	PKG	Part No.	Absolute Maximum Ratings (Tc=25 °C)		Electrical Characteristic (Tj = 25 °C)			
			VR(V)	Io(A)	VF(V)	Max.	IR(uA)	Max.
						IF(A)		VR(V)
Cathode common 	TO-252	RBQ10BM65A	65	10	0.69	5	150	65
		RBQ15BM65A		15		7.5	300	
		RBQ20BM65A		20		10	450	
	TO-263S	RBQ10NS65A	62	10	0.69	5	150	65
		RBQ20NS65A		20		10	300	
		RBQ30NS65A		30		15	450	
	TO-220FN	RBQ10T65A	65	10	0.69	5	150	65
		RBQ20T65A		20		10	300	
		RBQ30T65A		30		15	450	

② RB**7 series ~Low IR SBD~

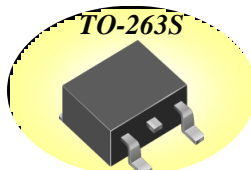
Feature

- **Low leak**
- **High reliability**

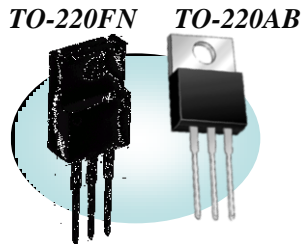
Package



TO-252
 $I_o = 5A \sim 30A$
 $10.0 \times 6.6 \times 2.2mm$



TO-263S
 $I_o = 10 \sim 30A$
 $13.1 \times 10.1 \times 4.5mm$



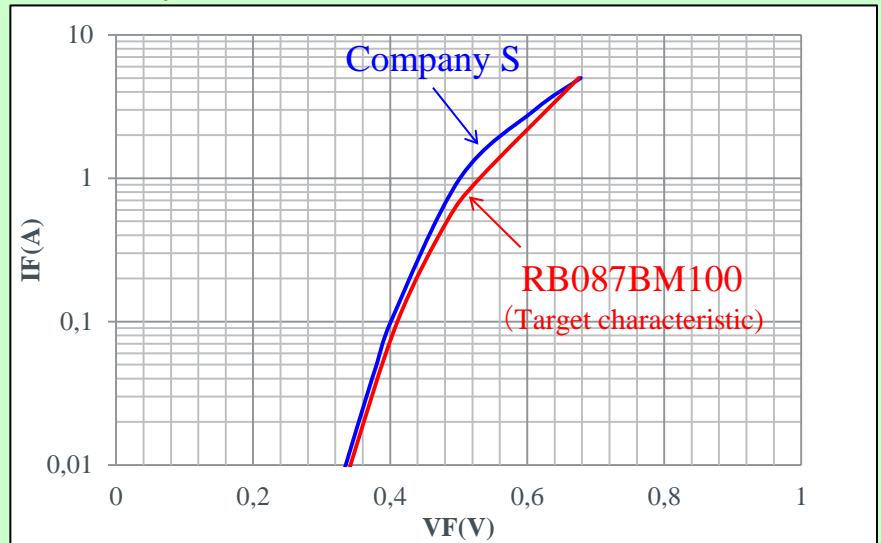
TO-220FN TO-220AB
 $I_o = 10 \sim 30A$
 $19.0 \times 10.0 \times 4.5mm$

Lineup

Type	I_o/A	VF/V (at I_o)	Package
RB087BM100 RB087NS100 RB087T100 RB087TG100	10	0.86	TO252M TO263S TO220FND TO220AB
RB217BM100 RB217NS100 RB217T100 RB217TG100	20	0.86	TO252M TO263S TO220FND TO220AB
RB227BM100 RB227NS100 RB227T100 RB227TG100	30	0.86	TO252M TO263S TO220FND TO220AB

Characteristic data

<VF-IF : $T_j = 25^\circ C$ > ... 100V/10A



Voltage Lank

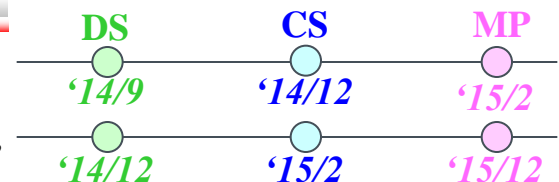
RB**7 series
(Low IR)



Schedule

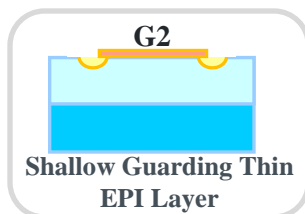
~100V Line

150/200V Line



Feature

- High power
- Low VF



PKG

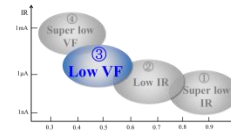


Package	Part No.	Absolute Maximum Ratings		Electrical Characteristics (Ta=25°C)			
		VR(V)	Io(A)	VF(V) Max.	at IF(A)	IR(uA) Max.	at VR(V)
DPAK (TO-252M)	RBQ10BM45A	45	10	0.65	5	0.15	45
	RBQ10BM65A	65	10	0.69	5	0.15	65
	RBQ15BM65A	65	15	0.63	7.5	0.3	65
	RBQ20BM65A	65	20	0.63	10	0.45	65
D2PAK (TO-263S)	RBQ10NS45A	45	10	0.65	5	0.15	45
	RBQ20NS45A	45	20	0.65	10	0.3	45
	RBQ30NS45B	45	30	0.59	30	0.7	45
	RBQ10NS65A	65	10	0.69	5	0.15	65
	RBQ20NS65A	65	20	0.69	10	0.3	65
	RBQ30NS65A	65	30	0.69	15	0.45	65

SBD 90V~150V

Package	Part No	Absolute Max Rating		Electrical Characteristics (Ta=25°C)			
		VR(V)	Io(A)	VF(V) Max	@IF(A)	IR(uA) Max	@VR(V)
TO-220FN(3PIN)	RB095T-90FH	90	6	0.75	3	0.15	90
	RB085T-90FH	90	10	0.83	5	0.15	90
	RB205T-90FH	90	15	0.78		0.3	90
	RB215T-90FH	90	20	0.75	10	0.4	90
	RB228T100FH	100	30	0.87	5	0.15	100
	RB088T150FH	150	10	0.88	5	0.015	150
PMDU / SOD-123	RB160M-90TF	90	1	0.73	1	0.1	90
	RB168M150TF	150	1	0.84	1	0.02	150
PMDS / SMA	RB160L-90TF	90	1	0.73	1	0.1	90
	RB068L100TF	100	2	0.8	2	0.05	100
LPDS / D2-Pak	RB228NS100FH	100	30	0.87	5	0.15	100
	RB088NS150FH	150	10	0.88	5	0.015	150
CPD / D-Pak	RB095B-90FH	90	6	0.75	3	0.15	90
	RB085B-90FH	90	10	0.83	5	0.15	90
	RB088B150FH	150	10	0.88	5	0.015	150

③ RBR series ~ Low VF SBD ~



On MP

Feature

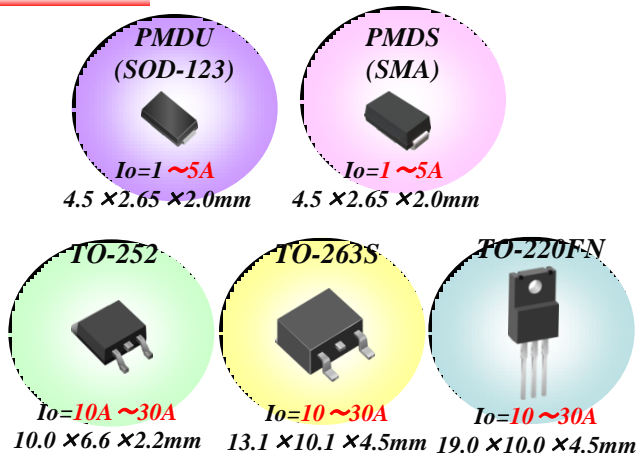
• Installation of new line realize the same characteristics with **Die Shrink!!**



Application

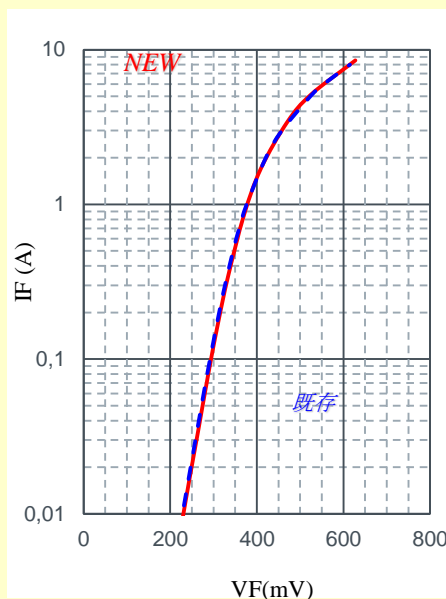
- DC-DC
- Power Supply

PKG

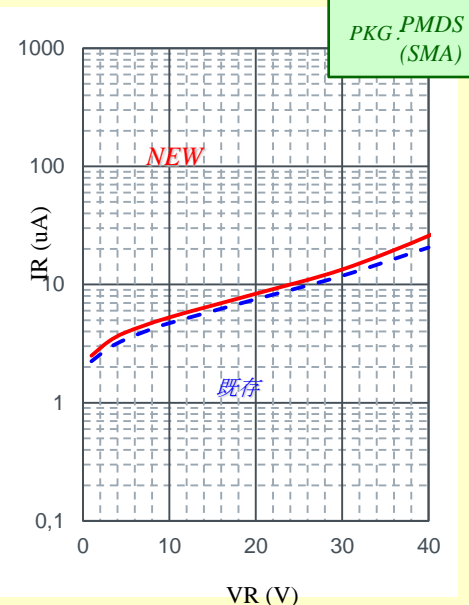


Electrical Characteristic

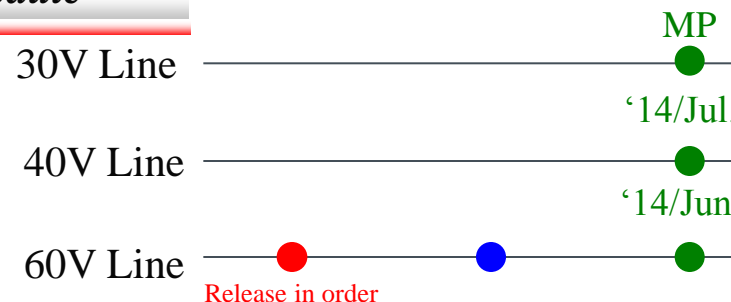
<VF-IF : $T_j = 25^\circ C$ >



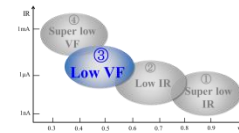
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Schedule



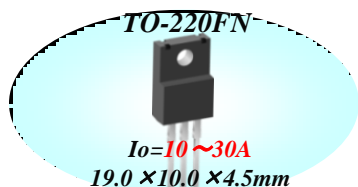
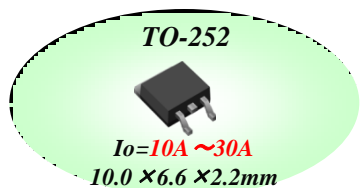
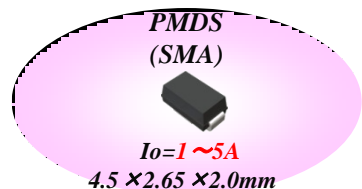
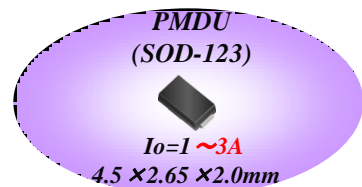
③ RBR series ~ Low VF SBD ~



On MP

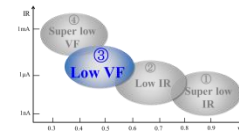
Line Up

<30V>



PKG	Circuit	P/N	Absolute Maximum Ratings [Tc=25°C]		Electrical Characteristics [Tj=25°C]			
			V _R (V)	I _O (A)	V _{Fmax} (V)	I _F (A)	I _{Rmax} (uA)	V _R (V)
PMDU		RBR1MM30A	30	1	0.48	1	50	30
		RBR2MM30A		2	0.53	2	50	
		RBR2MM30B			0.49		80	
		RBR3MM30A		3	0.51	3	100	
PMDS		RBR1L30A	30	1	0.48	1	50	30
		RBR2L30A		2	0.49	2	80	
		RBR3L30A		3	0.58	3	50	
		RBR3L30B			0.53		80	
		RBR5L30A		5	0.54	5	100	
		RBR5L30B			0.49		150	
DPAK (TO252)		RBR10BM30A	30	10	0.55	5	100	30
		RBR15BM30A		15	0.51	7.5	200	
		RBR20BM30A		20	0.51	10	300	
D2PAK (TO263S)		RBR10NS30A	30	10	0.55	5	100	30
		RBR20NS30A		20	0.55	10	200	
		RBR30NS30A		30	0.55	15	300	
TO220FN		RBR10T30A	30	10	0.55	5	100	30
		RBR20T30A		20	0.55	10	200	
		RBR30T30A		30	0.55	15	300	

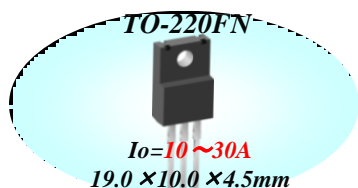
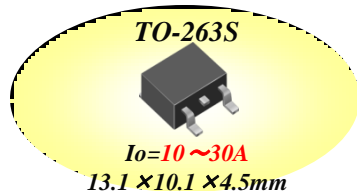
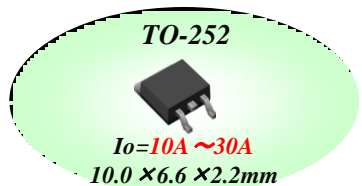
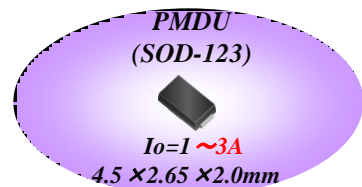
③ RBR series ~ Low VF SBD ~



On MP

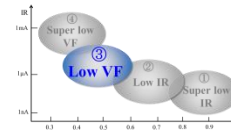
Line Up

<40V>



PKG	Circuit	P/N	Absolute Maximum Ratings [Tc=25°C]		Electrical Characteristics [Tj=25°C]			
			V _R (V)	I _O (A)	V _{Fmax} (V)	I _F (A)	I _{Rmax} (uA)	V _R (V)
PMDUM		RBR1MM40A	40	1	0.53	1	50	40
		RBR2MM40A			0.62		50	
		RBR2MM40B		2	0.56	2	80	
		RBR2MM40C			0.54		100	
		RBR3MM40A		3	0.62	3	80	
		RBR3MM40B			0.58		100	
PMDS		RBR1L40A	40	1	0.52	1	50	40
		RBR2L40A		2	0.55	2	80	
		RBR3L40A			0.69		50	
		RBR3L40B		3	0.62	3	80	
		RBR3L40C			0.55		100	
		RBR5L40A		5	0.53	5	200	
DPAK (TO252)		RBR10BM40A	40	10	0.62	5	120	40
		RBR15BM40A		15	0.58	7.5	240	
		RBR20BM40A		20	0.58	10	360	
D2PAK (TO263S)		RBR10NS40A	40	10	0.62	5	120	40
		RBR20NS40A		20	0.62	10	240	
		RBR30NS40A		30	0.62	15	360	
TO220FN		RBR10T40A	40	10	0.62	5	120	40
		RBR20T40A		20	0.62	10	240	
		RBR30T40A		30	0.62	15	360	

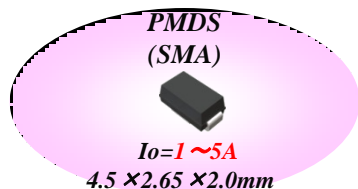
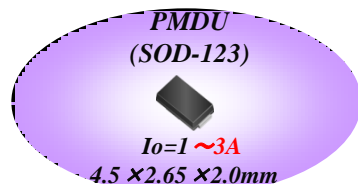
③ RBR series ~ Low VF SBD ~



On MP

Line Up

<60V>



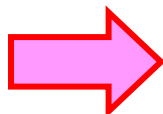
PKG	Circuit	P/N	Absolute Maximum Ratings [Tc=25°C]		Electrical Characteristics [Tj=25°C]			
			V _R (V)	I _O (A)	V _{Fmax} (V)	I _F (A)	I _{Rmax} (uA)	V _R (V)
PMDUM		RBR1MM60A	60	1	0.53	1	75	60
		RBR2MM60A		2	0.65	2	75	
		RBR2MM60B			0.58		100	
		RBR2MM60C			0.55		120	
		RBR3MM60A		3	0.66	3	100	
		RBR3MM60B			0.6		120	
PMDS		RBR1L60A	60	1	0.53	1	75	60
		RBR2L60A		2	0.65	2	75	
		RBR2L60B			0.52		150	
		RBR3L60A		3	0.66	3	100	
		RBR3L60B			0.56		150	
		RBR5L60A		5	0.53	5	250	

Di Downsizing Proposal


SMA



57%down



SOD123

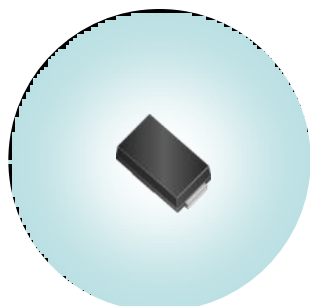
PKG	Current part	VR (V)	Io (A)	VF (V)	IR (mA)		PKG	Proposal	VR (V)	Io (A)	VF (V)	IR (mA)		
SMA SOD106 DO214AC	RB161L-40	20	1	0,40	1,00		SOD123	RBR1M30A	30	1	0,48	0,050		
	RSX205L-30	30	2	0,49	0,20			RBR2M30A		2	0,53	0,050		
	RB055L-30		3	0,55	0,05			RBR2M30B		2	0,49	0,080		
	RB162L-40	40	1	0,55	0,10			RBR3M30A		3	0,51	0,100		
	RB160L-40			0,55	1,00			RBR1M40A	40	1	0,53	0,050		
	RB060L-40		2	0,50	1,00			RBR2M40A		2	0,62	0,050		
	RB055L-40							RBR2M40B			0,56	0,080		
	RB050L-40		3	0,65	0,50			RBR2M40C			0,54	0,100		
	RB162L-60			1	0,65			0,10	RBR3M40A	3	0,62	0,080		
	RB160L-60		0,58		1,00			RBR3M40B	0,58		0,100			
	-	60	2	-	-			RBR1M60A	60	1	0,53	0,075		
	RB055L-60							2		0,65	0,075			
	RB050L-60		0,58	0,100										
			0,55	0,120										
		3	0,68	0,07	RBR3M60A			3	0,62	0,100				
					0,52				0,10	RBR3M60C	0,56	0,120		



Compact Rectifier Diodes

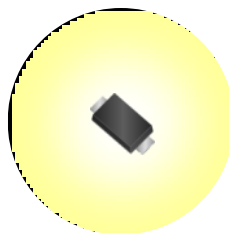
Feature

Improved performance in the TUMD2S package



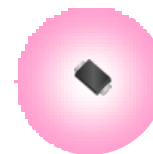
PMDS (SMA)
4526 size

Smaller



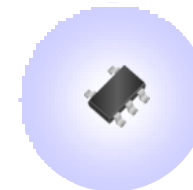
PMDU (SOD123)
2616 size

Smaller



TUMD2S
1913 size

Mixed



TSMD5 (SOT23-5)
2916 size

NEW

NEW

NEW










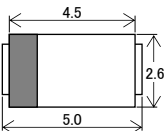
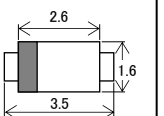
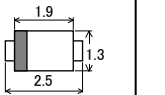
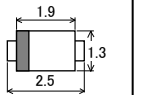
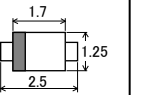
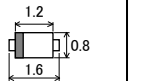
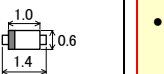
Part No.		RR2L4S	1SR154-400	RR264M-400	RRE07VSM4S	RRE02VSM4S	RRE04EA4D
Absolute maximum ratings	Io(A)	2.0	1.0	0.7	0.7	0.2	0.4 (*1)
	VR(V)	400	400	400	400	400	400
Electrical characteristics	VF(V)	1.1	1.1	1.1	1.1	1.1	1.1
	IR(μA)	10	10	10	1.0	1.0	1.0
PKG		PMDS/SMA	PMDS/SMA	PMDU/SOD123	TUMD2S	TUMD2S	TSMD5

(*1)Per one CHIP

Part No.		RR2L6S	1SR154-600	RR268M-600	RRE07VSM6S	RRE02VSM6S	
Absolute maximum ratings	Io(A)	3.0	1.0	1.0	0.7	0.2	
	VR(V)	600	600	600	600	600	
Electrical characteristics	VF(V)	1.2	1.1	1.1	1.1	1.1	
	IR(μA)	10	10	10	1.0	1.0	
PKG		PMDS/SMA	PMDS/SMA	PMDU/SOD123	TUMD2S	TUMD2S	

ROHM Zener Diode

<PKG Lineup>

Zener power voltage rank	1W	1W	0.5W	0.5W	0.2W	0.15W	0.1W
	PTZ series	KDZ series	TDZ series	TFZ series TFZV series	UDZS series UDZV series	EDZ series EDZV series	VDZ series
			 	 			
							
	PMDS(5026)	PMDU(3516)	TUMD2(2513)	TUMD2(2513)	UMD2(2512)	EMD2(1618)	VMD2(1416)
2.0V	2.0V	2.0V	5.1V	2.0V	2.0V	2.0V	2.0V
	MP	MP	MP	MP	MP	MP	MP
	51V	51V	30V	39V	39V	36V	36V
51V							
	SMA	SOD123		SOD323F	SOD523	SOD723	

Vz 60V~70V Underdevelopment

<Rohm recommendation package>

PTZ series

KDZ series



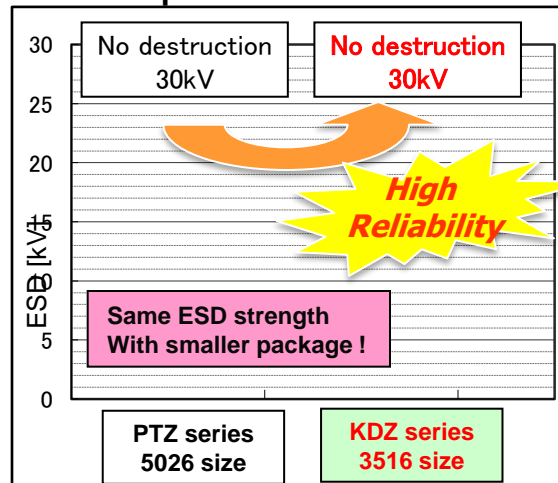
Mounting
area 1/3



5026(PMDS/SMA) 3516(PMDU/SOD123)

- Guaranteed 1W with the size 3516
- Voltage lineup equivalent to conventional products
- Minimized the size of devices without losing their special characteristics

<ESD Dispersion MAP>

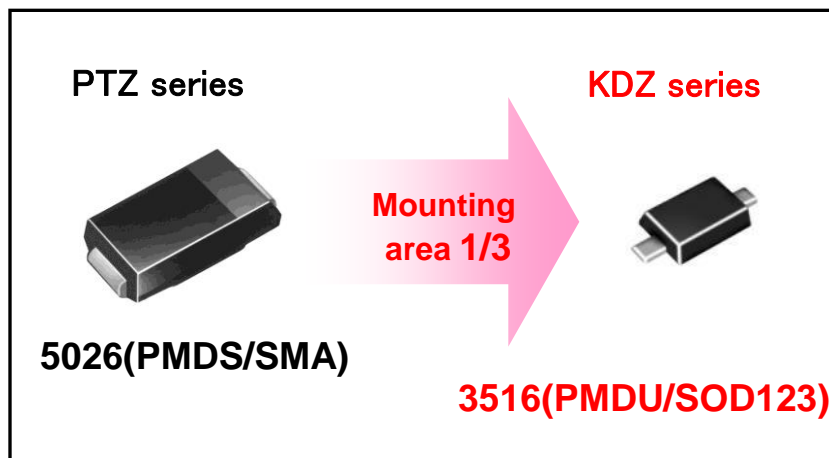




Compact 1W type Zener Diode

Feature

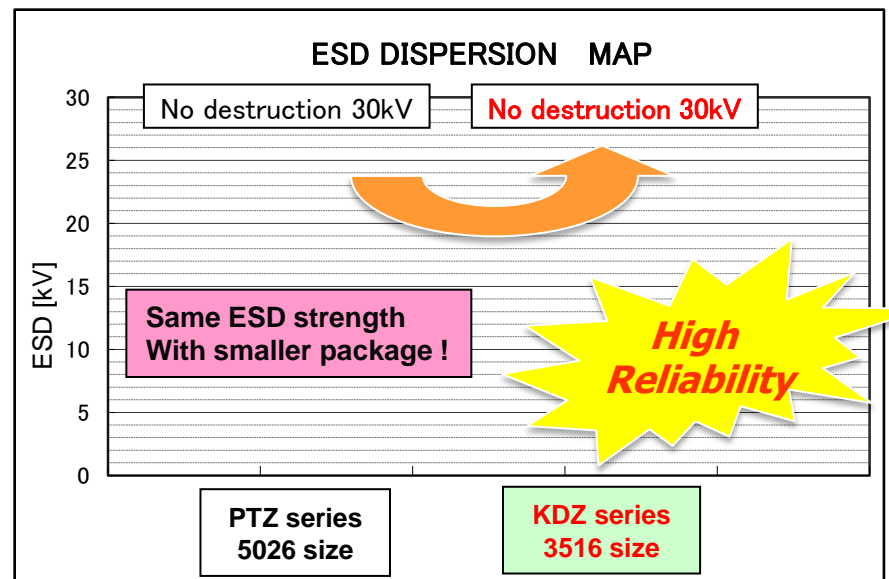
- Guaranteed 1W with the size 3516
- Conventional line-up



Benefit

- Minimized the size of devices without losing their special characteristics

Advantage



Line-up

	PTZ series	KDZ series
Package	PMDS 5.0mm × 2.6mm(t=2.0mm)	PMDU 3.5mm × 1.6mm(t=0.8mm)
Pd	1W	1W
Vz rank	3.6~51V	3.6~51V

■ High Vz 90V Under development

High Voltage ZenerDiodes (Under development)

Feature

- LineUp to 150V
- 0.2W UDZLVseries (2512size)
- 1.0W KDZLVseries (3516size)

Application

- voltage regulation
- surge protection



Schedule

- UDZLV series
DS: Jun/'14
MP: Oct/'14
- KDZLV series
DS: Oct/'14
MP: Dec/'14

※June,2014 investigation

Line up

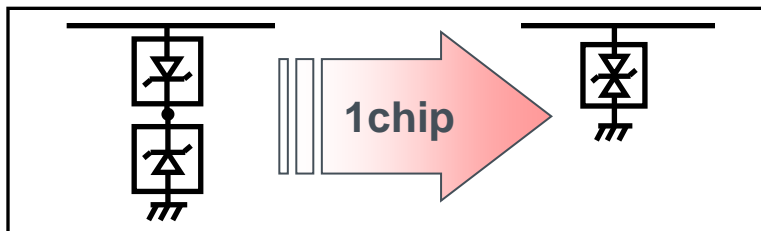
★:under development

Status	Vz(V)	UDZLVseries  SOD323F (2512size) 0.2W	KDZLVseries  SOD123 (3516size) 1.0W	Vz min(V)	Vz max(V)
★	43	UDZLV43	KDZLV43	40	47
★	47	UDZLV47	KDZLV47	44	50
★	51	UDZLV51	KDZLV51	48	54
★	56	UDZLV56	KDZLV56	53	60
★	62	UDZLV62	KDZLV62	58	66
★	68	UDZLV68	KDZLV68	64	72
★	75	UDZLV75	KDZLV75	70	79
★	82	UDZLV82	KDZLV82	77	87
★	91	UDZLV91	KDZLV91	85	96
★	100	UDZLV100	KDZLV100	94	106
★	110	UDZLV110	KDZLV110	104	116
★	120	UDZLV120	KDZLV120	114	126
★	130	UDZLV130	KDZLV130	124	136
★	150	UDZLV150	KDZLV150	140	160

Bi-Directional Zener Diode

Feature

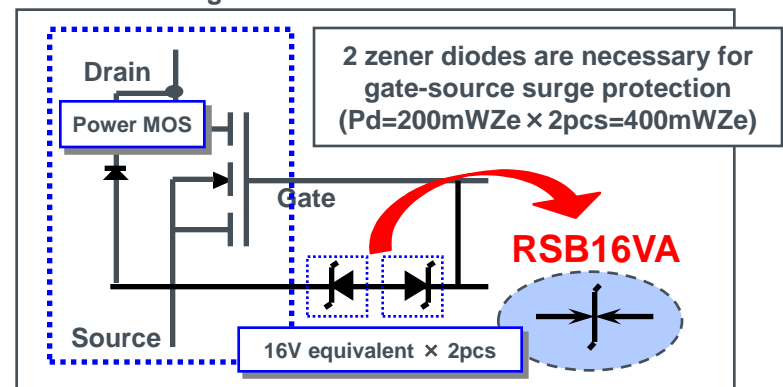
- Deal with bi-directional surge
- Both positive and negative surge protection in 1 chip
- There is 1.0×0.6 as a smallest size



Benefit

- Cut down the mounting count and area to 1/2 than conventional type

Inside of the engine control unit



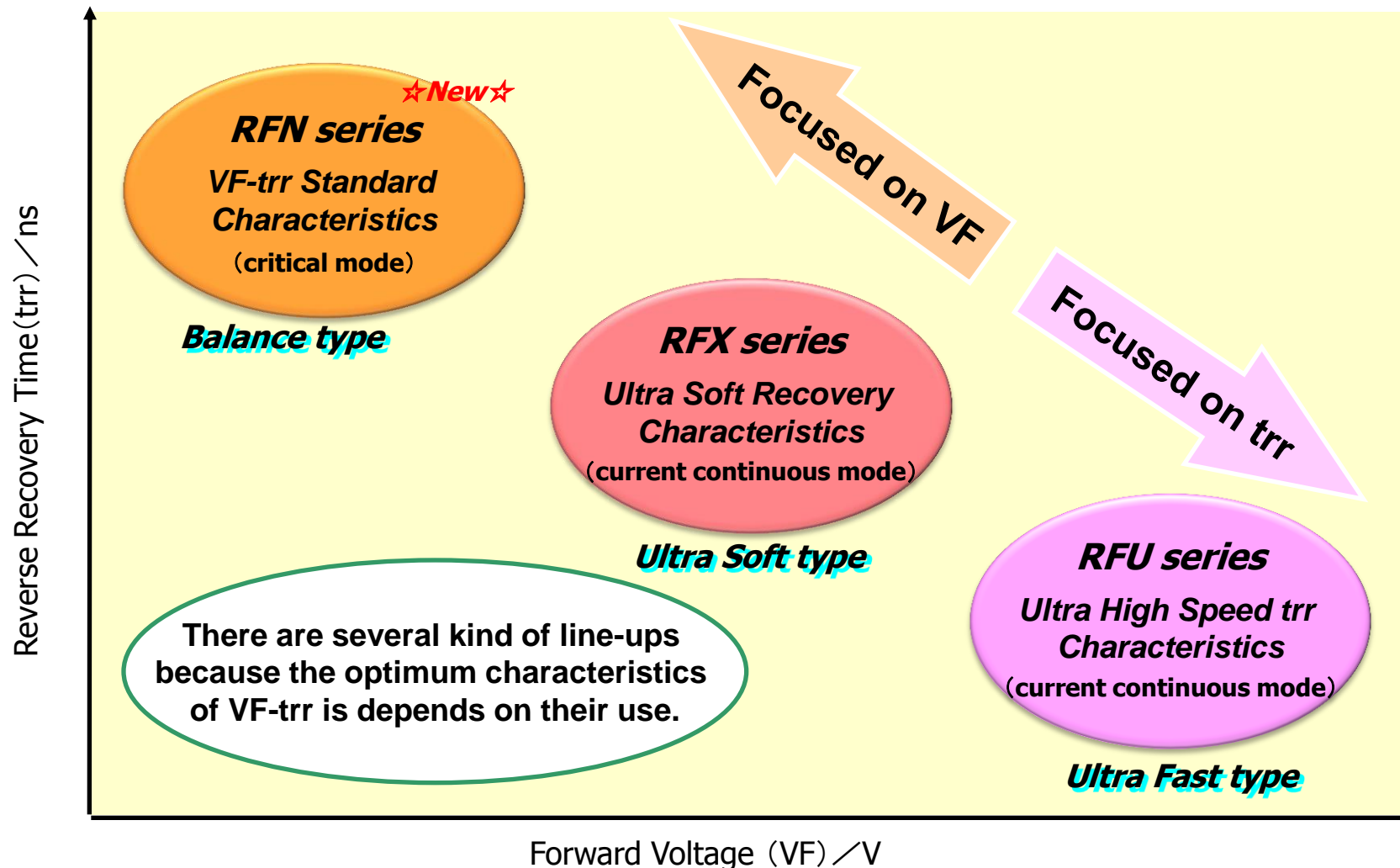
Evidence

形名	Pd(mW)	Vz (V)	PKG	等価回路
RSB6.8ZS	100	5.78~7.82	GMD2(0603)	
RSB6.8CM	100	5.78~7.82	VMN2M(1006)	
RSB6.8CS	100	5.78~7.82	VMN2(SOD-923)	
RSB6.8G	100	5.78~7.82	VMD2(SOD-723)	
RSB6.8S	150	5.78~7.82	EMD2(SOD-523)	
RSB16V	200	14.4~17.6	UMD2(SOD-323)	
RSB18V	200	16.2~19.8	UMD2(SOD-323)	
RSB27V	200	26.2~32.0	UMD2(SOD-323)	
RSB33V	200	29.7~36.3	UMD2(SOD-323)	
RSB36V	200	32.4~39.6	UMD2(SOD-323)	
RSB39V	200	35.1~42.9	UMD2(SOD-323)	
RSB6.8F2	200	5.78~7.82	UMD3(SOT-323)	
RSB16F2	200	14.4~17.6	UMD3(SOT-323)	
RSB18F2	200	16.2~19.8	UMD3(SOT-323)	
RSB27F2	200	26.2~32.0	UMD3(SOT-323)	
RSB33F2	200	29.7~36.3	UMD3(SOT-323)	
RSB36F2	200	32.4~39.6	UMD3(SOT-323)	
RSB39F2	200	35.1~42.9	UMD3(SOT-323)	
RSB27K2	200	26.2~32.0	UMD4(SOT-343)	
RSB16X3N	200	14.4~17.6	UMD6(SOT-363)	



Fast Recovery Diodes series table

Lineup





Introduction new FRD ~Surface mount~

■ ~200V

Part No.	Package	VR(V)	Io(A)	VF(V)		trr(ns) max.	Internal circuit
				max.	at.IF(A)		
RF05VA1S	TUMD2	100	0.5	0.98	0.5	25	Single
RF05VA2S	TUMD2	200	0.5	0.98	0.5	25	Single
RF04UA2D	TSMD6	200	0.4	0.98	0.2	25	Parallel
RF071M2S	PMDU	200	0.7	0.85	0.7	25	Single
RF081M2S	PMDU	200	0.8	0.95	0.8	25	Single
RF101L2S	PMDS	200	1	0.87	1	25	Single
RF081L2S	PMDS	200	1.1	0.98	1.1	25	Single
RF201L2S	PMDS	200	2	0.87	2	25	Single
RFN3B2S	D-pack	200	3	0.98	3	25	Single
RFN5B2S	D-pack	200	5	0.98	5	25	Single
RFN6B2D	D-pack	200	6	0.98	3	25	Cathode Common

■ 300/350V

Part No.	Package	VR(V)	Io(A)	VF(V)		trr(ns) max.	Internal circuit
				max.	at.IF(A)		
RFN5B3S	D-pack	350	5	1.50	5	30	Single
RFN10B3S	D-pack	350	10	1.50	10	30	Single
RF2001NS3D	D2-pack	300	20	1.30	10	25	Cathode Common
RF1501NS3S	D2-pack	300	20	1.50	20	30	Single
RFXH8NS3S	D2-pack	350	8	1.50	8	30	Single
RFN10NS3S	D2-pack	350	10	1.50	10	30	Single
RFN20NS3S	D2-pack	350	20	1.35	20	35	Single
RFUH25NS3S	D2-pack	350	20	1.45	20	30	Single
RFUH20NS3S	D2-pack	350	20	1.50	20	25	Single



Introduction new FRD ~Surface mount~

■400/430V

Part No.	Package	VR(V)	Io(A)	VF(V)		trr(ns) max.	Internal circuit
				max.	at.IF(A)		
RF071L4S	PMDS	400	0.7	1.25	0.7	25	Single
RF101L4S	PMDS	400	1	1.25	1	25	Single
RFN2L4S	PMDS	400	1.5	1.20	1.5	30	Single
RFN10NS4S	D2-pack	430	10	1.55	10	30	Single
RFUH10NS4S	D2-pack	430	10	1.70	10	25	Single
RFN20NS4S	D2-pack	430	20	1.55	20	30	Single
RFUH20NS4S	D2-pack	430	20	1.70	20	25	Single

■600/700V

Part No.	Package	VR(V)	Io(A)	VF(V)		trr(ns) max.	Internal circuit
				max.	at.IF(A)		
RFU02VS6S	TUMD2S	600	0.2	2.20	0.2	35	Single
RFN1L6S	PMDS	600	0.8	1.45	0.8	35	Single
RFN2L6S	PMDS	600	1.5	1.55	1.5	35	Single
RFN1L7S	PMDS	700	1	1.50	1	80	Single
RF305B6S	D-pack	600	3	1.70	3	30	Single
RFN3B6S	D-pack	600	3	1.55	3	30	Single
RF505B6S	D-pack	600	5	1.70	5	30	Single
RFN5B6S	D-pack	600	5	1.55	5	50	Single
RFUH10NS6S	D2-pack	600	10	2.80	10	25	Single
RFN10NS6S	D2-pack	600	10	1.55	10	50	Single
RFUH20NS6S	D2-pack	600	20	2.80	20	35	Single
RFN20NS6S	D2-pack	600	20	1.55	20	60	Single

FRD Line up

■600/700/800V

形名	PKG	VR(V)	Io(A)	VF(V)		trr(ns) max.	内部回路
				max.	at.IF(A)		
RFU02VS6S	TUMD2S	600	0.2	2.2	0.2	35	Single
RFN1L6S	PMDS	600	0.8	1.45	0.8	35	Single
RFN2L6S	PMDS	600	1.5	1.55	1.5	35	Single
RFN1L7S	PMDS	700	1	1.5	1	80	Single
RF305B6S	D-pack	600	3	1.7	3	30	Single
RFN3B6S	D-pack	600	3	1.55	3	30	Single
RF505B6S	D-pack	600	5	1.7	5	30	Single
RFN5B6S	D-pack	600	5	1.55	5	50	Single
RFUH10NS6S	D2-pack	600	10	2.8	10	25	Single
RFN10NS6S	D2-pack	600	10	1.55	10	50	Single
RFUH20NS6S	D2-pack	600	20	2.8	20	35	Single
RFN20NS6S	D2-pack	600	20	1.55	20	60	Single
RFN5TF6S	TO-220NFM (2pin)	600	5	1.55	5	50	Single
RFU5TF6S	TO-220NFM (2pin)	600	5	2.8	5	25	Single
RFN10TF6S	TO-220NFM (2pin)	600	10	1.55	10	50	Single
RFX10TF6S	TO-220NFM (2pin)	600	10	2.5	10	30	Single
RFUH10TF6S	TO-220NFM (2pin)	600	10	2.8	10	25	Single
RFN20TF6S	TO-220NFM (2pin)	600	20	1.55	20	60	Single
RFUH20TF6S	TO-220NFM (2pin)	600	20	2.8	20	35	Single
RFUS20TM6S	TO-220NFM (3pin)	600	20	2.8	20	35	Single (3pin)
RFN30TS6S	TO-247	600	30	1.55	30	55	Single
RFN30TS6D	TO-247	600	30	1.55	15	50	Dual
RFUH30TS6S	TO-247	600	30	2.8	30	35	Single
RFUH30TS6D	TO-247	600	30	2.8	15	30	Dual
RFN60TS6D	TO-247	600	60	1.55	30	55	Dual
RFUH60TS6D	TO-247	600	60	2.8	30	35	Dual
RFN5TF8S	TO-220NFM (2pin)	800	5	2.1	5	40	Single

Transistor Development MAP

MOSFET (Presto-MOS/Hybrid-MOS)

High efficiency / High power

Bipolar Transistor / Digital Transistor

Stable supply / High quality

IGBT

High voltage

SiC Power Device

High voltage / High efficiency

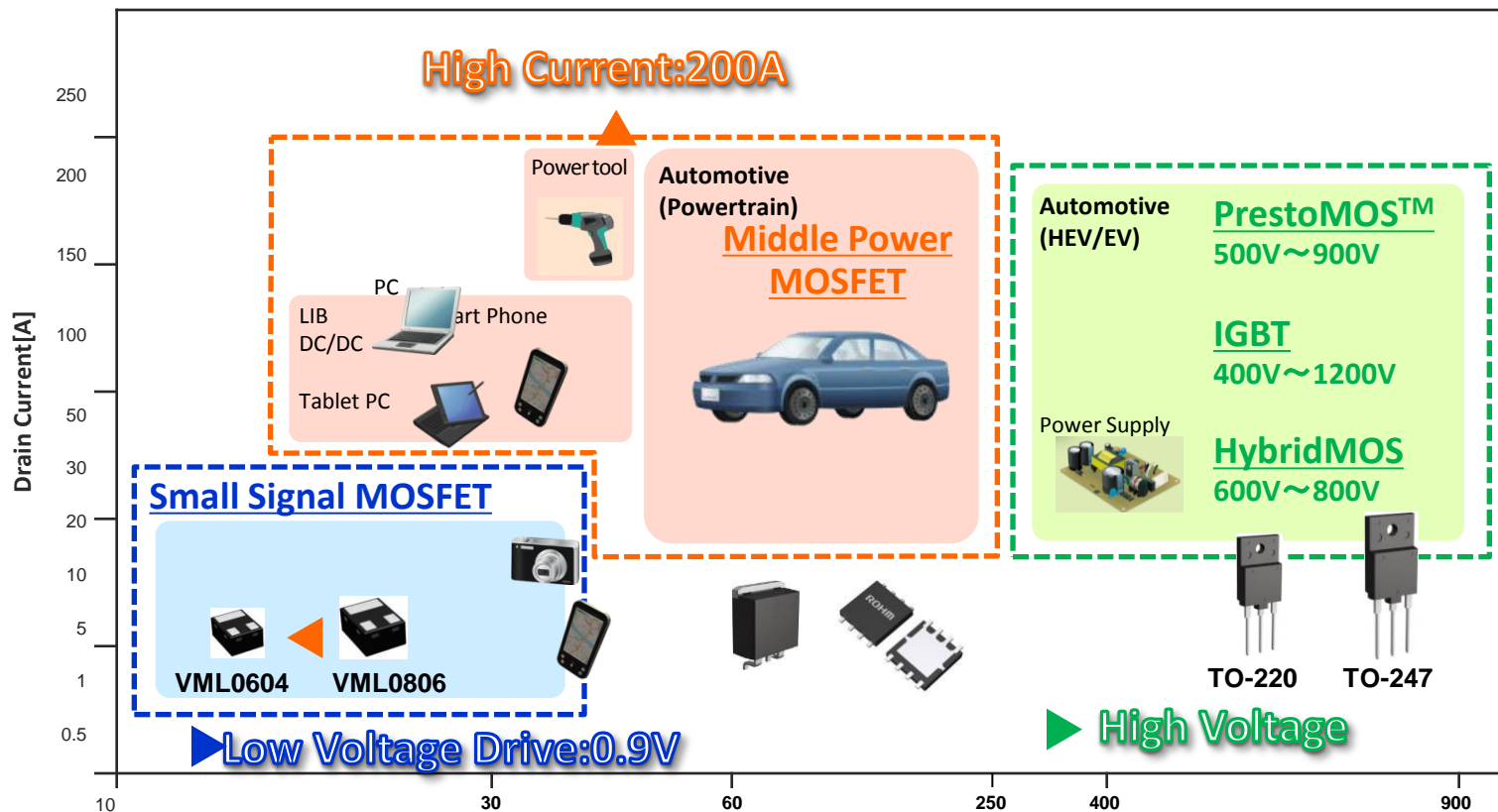
MP started in Dec 2010 that is first in world

Development strategy

High voltage

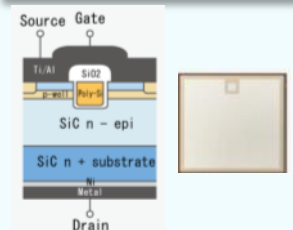
High speed

Low RDS



High Voltage
High Efficiency

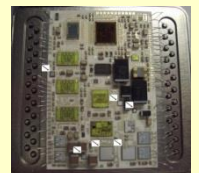
SiC Power Device



Bare Die Supply

For Transmission

ABS, EPS



Automotive Application Example (Transistors)

Vehicle Information System

LAN

2SB1260(MPT3)
2SB1198K(SMT3)
2SC2412K(SMT3)
DTA143EKA(SMT3)
DTC114EKA(SMT3)

ETC

DTA114EE(EMT3)
DTA114EUA(UMT3)
DTC114EUA(UMT3)
DTA144EUA(UMT3)
DTC143TUA(UMT3)

Vehicle Information System

Engine/Powertrain Control System

Engine Control System

Engine Control Unit

2SB1189 (MPT3)
2SB1198K (SMT3)
2SC2412K (SMT3)
2SD1782K (SMT3)
2SC4081 (UMT3)
DTA114EUA (UMT3)
DTC114EUA (UMT3)

Air Bag

2SB1260 (MPT3)
DTA114EUA (UMT3)
DTC114EUA (UMT3)

Engine Control Unit

RSS090P03 (SOP8)
RSD220N06 (CPT3)

Power Window

DTDG14GP(MPT3)
2SB1189K /
2SD1782K (SMT3)
DTB113ZK /
DTD1132K (SMT3)

Body Control System

Sonar

FMG2A(SMT5)

Shift Lock

2SA1037AK(SMT3)
2SC2412K(SMT3)

Air Conditioning

DTDG14GP(MPT3)
2SB1260(MPT3)
2SC2412K(SMT3)
DTA143EKA(SMT3)
DTC114EKA(SMT3)

Security

DTDG14GP(MPT3)
2SB1260(MPT3)
2SB1198K(SMT3)
2SD1782K(SMT3)

Body/Chassis Control System

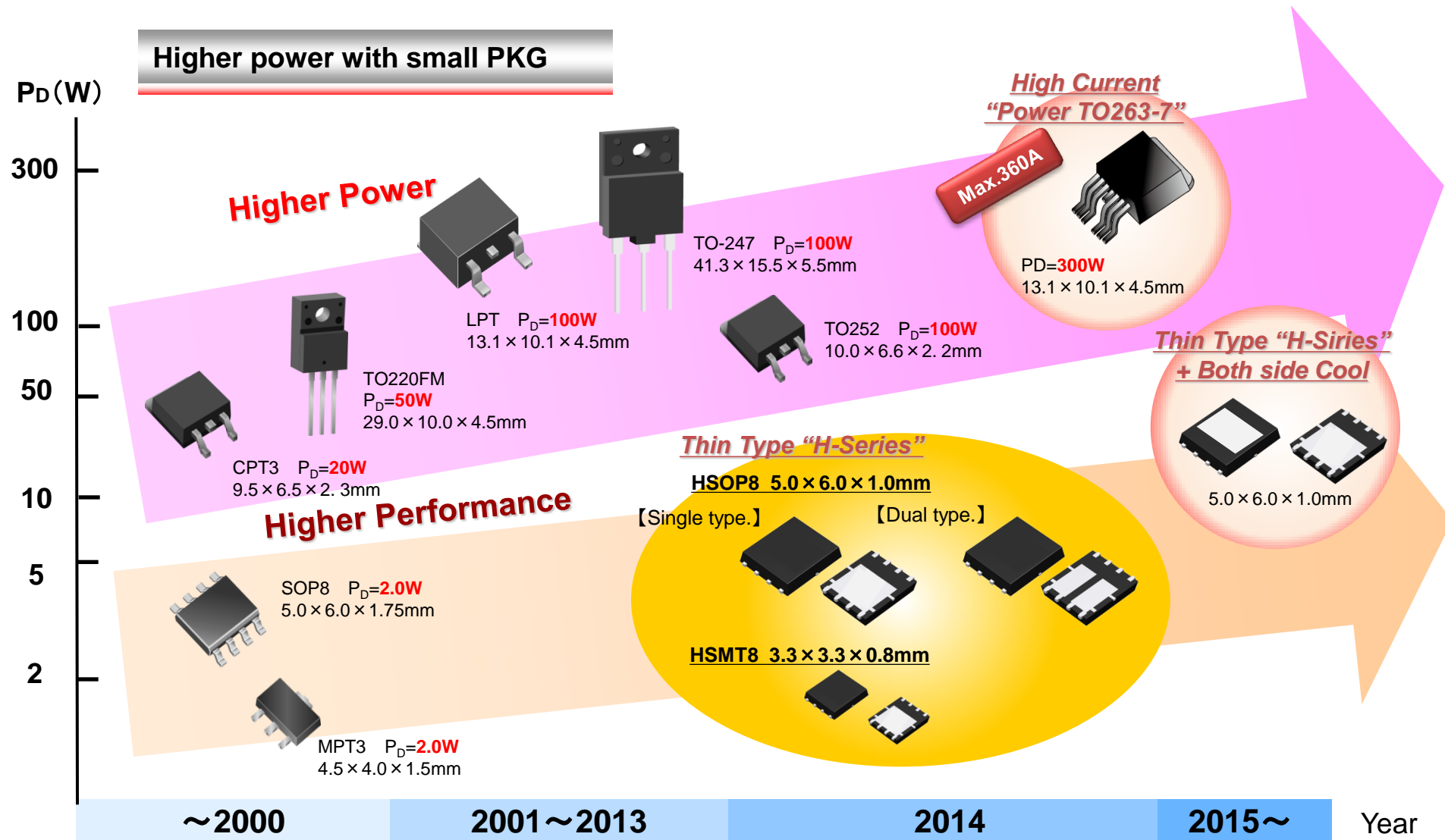
Meter

DTDG14GP(MPT3)
2SD1989(MPT3)
2SD2318(CPT3)
2SA1037AK(SMT3)
2SB1198K(SMT3)
2SC2412K(SMT3)
UMH11N(UMT6)

Door Control

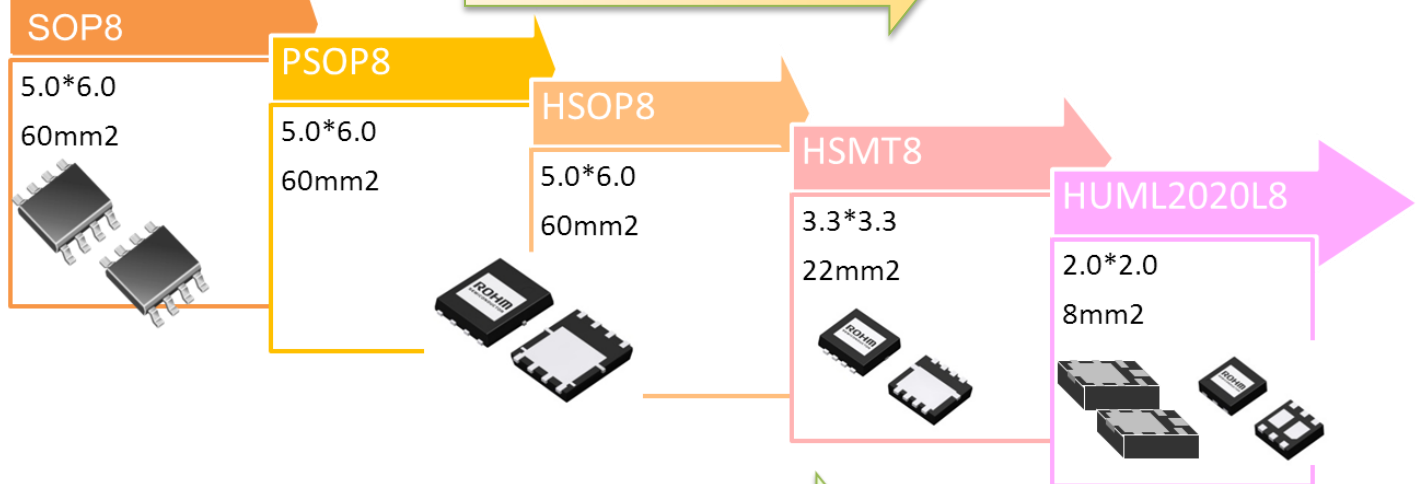
DTDG14GP(MPT3)
2SC2412K(SMT3)
2SA1797(MPT3)
2SB1198K(SMT3)
2SB1260(MPT3)
2SD1898(MPT3)

Transistor Package Trend

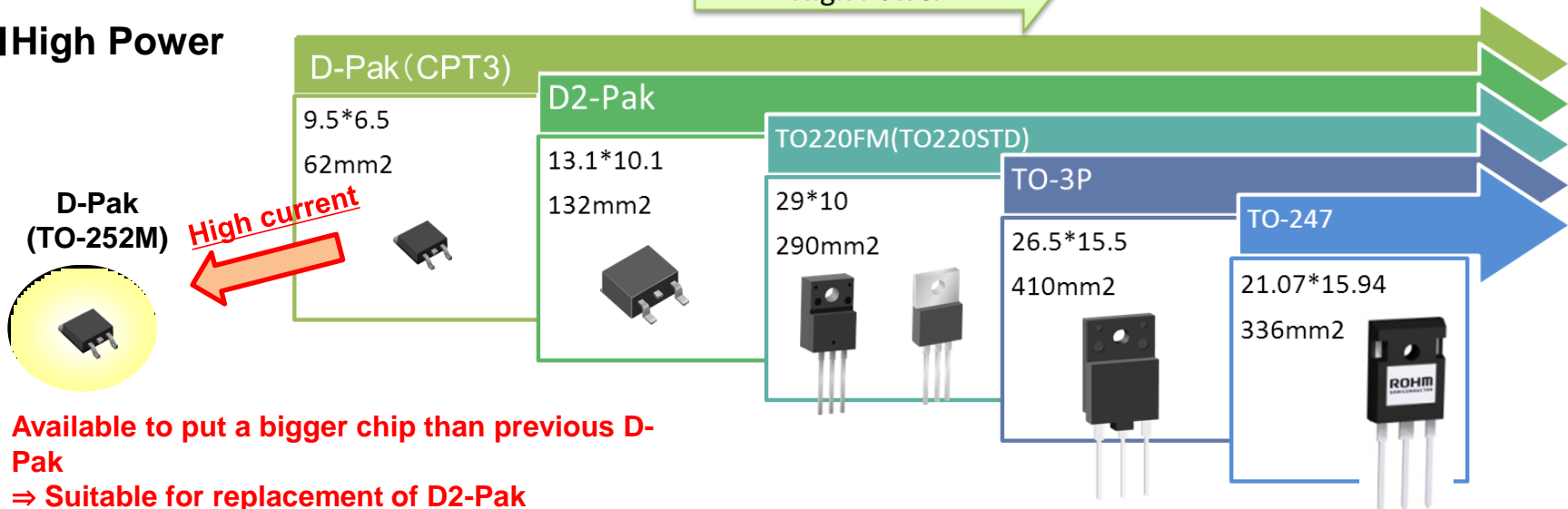


Package Trend

■ Middle power

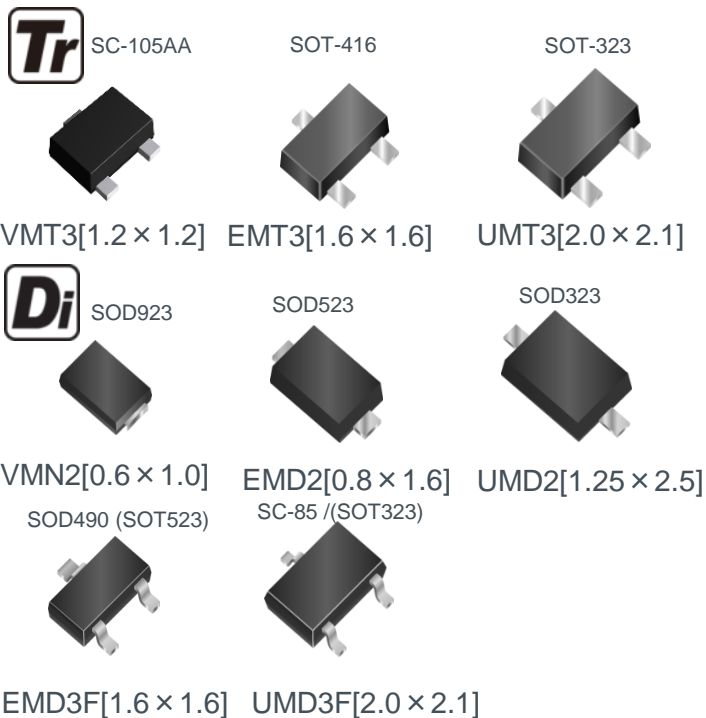


■ High Power



High efficiency production line

■ On MP

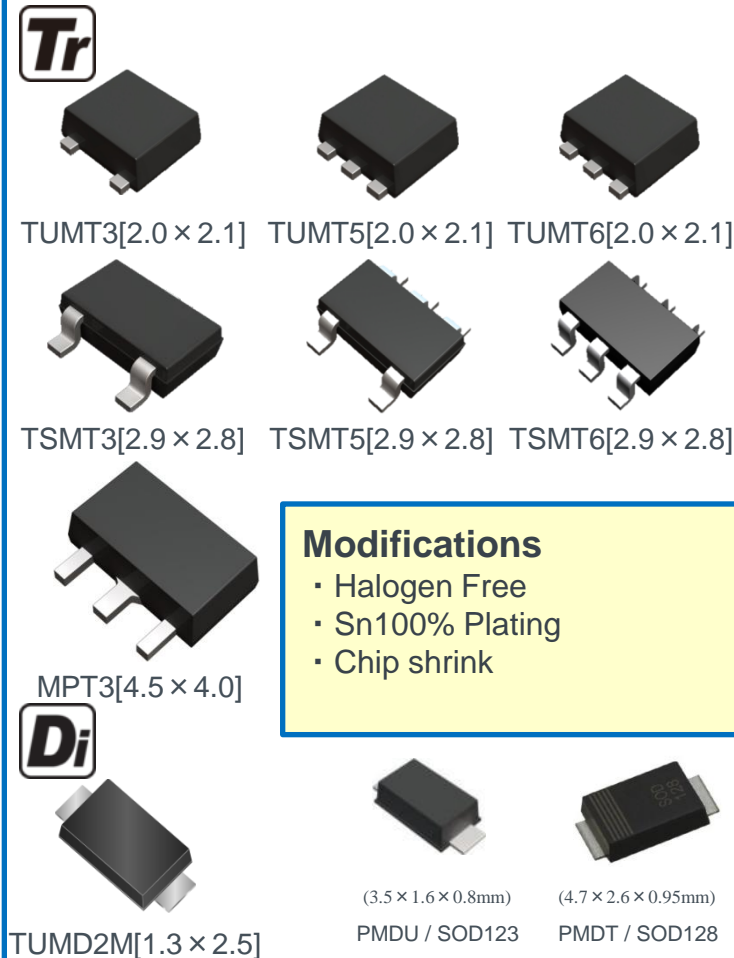


Modifications

- Halogen Free
- Sn100% Plating
- Flat lead PKG
- Chip shrink

**Expand into
Middle power**

■ New Lineup



Modifications

- Halogen Free
- Sn100% Plating
- Chip shrink



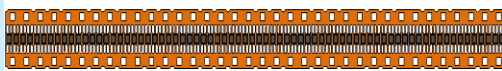
Small signal flat lead bipolar transistors

Products to increase competitiveness

Improvement of productivity , Cost down of materials ...

▪ Efficient products line : Wide frame

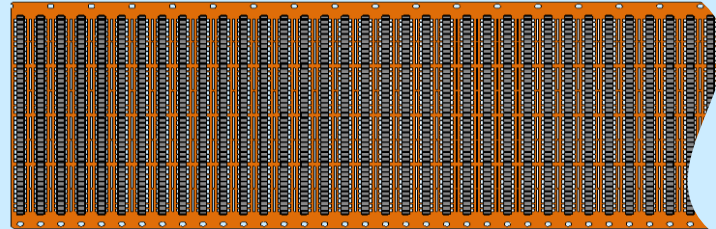
Former single frame



Increase quantitative efficiency
Decrease scraps

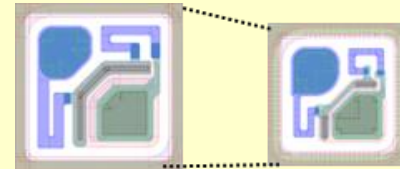


Wide frame



▪ Reduction of Chip size

- The number of chips on a wafer are increase.
- It's possible to product more continuously and higher speed.



▪ Cost down trend of products

Packages

Single types

SMT3
UMT3
EMT3
VMT3



UMT3F
EMT3F
VMT3

Complex types

SMT5/6
UMT5/6
EMT5/6



EMT6

types

Digital Tr.

DTA0xx series
DTC0xx series

General purpose bip. Tr.

2SAR52x series
2SCR52x series

Complex types

EMB51~75 series
EMH51~75 series
EMD51~75 series
EMT51~52 series
EMX51~52 series
EMZ51~52 series

Recommended Products : Small signal transistors (1)

Reduction of chip size

Flat lead frame

Concentrate in 3 packages

Single Types

Small signal bipolar transistors

PNP	NPN	VCEO (V)	Ic (mA)	package
2SA2029	2SC5658	50	150	VMT3
2SA1774	2SC4617			EMT3
2SA1774EB	2SC4617EB			EMT3F
2SA1576A	2SC4081			UMT3
2SA1576UB	2SC4081UB			UMT3F
2SA1037K	2SC2412K			SMT3



PNP	NPN	VCEO (V)	Ic (mA)	package
2SAR523M	2SCR523M	50	100	VMT3
2SAR523EB	2SCR523EB			EMT3F
2SAR523UB	2SCR523UB			UMT3F

50V/100mA Digital transistors

PNP	NPN	R1	R2	VMT3	EMT3	UMT3	SMT3	EMT3F	UMT3F
DTA123E	DTC123E	2.2	2.2	○	○	○	○	—	—
DTA143E	DTC143E	4.7	4.7	○	○	○	○	○	○
DTA114E	DTC114E	10	10	○	○	○	○	○	○
DTA124E	DTC124E	22	22	○	○	○	○	○	○
DTA144E	DTC144E	47	47	○	○	○	○	○	○
DTA115E	DTC115E	100	100	○	○	○	○	○	○
DTA113Z	DTC113Z	1	10	—	△	○	○	—	—
DTA123Y	DTC123Y	2.2	10	—	○	○	○	—	—
DTA123J	DTC123J	2.2	47	○	○	○	○	○	○
DTA143X	DTC143X	4.7	10	○	○	○	○	○	○
DTA143Z	DTC143Z	4.7	47	○	○	○	○	○	○
DTA114Y	DTC114Y	10	47	○	○	○	○	○	○
DTA124X	DTC124X	22	47	○	○	○	○	—	—
DTA143T	DTC143T	4.7	—	○	○	○	○	○	○
DTA114T	DTC114T	10	—	○	○	○	○	○	○
DTA144T	DTC144T	47	—	○	○	○	○	—	—
DTA115T	DTC115T	100	—	○	○	○	○	—	—



PNP	NPN	R1	R2	VMT3	EMT3F	UMT3F
DTA023E	DTC023E	2.2	2.2	○	○	○
DTA043E	DTC043E	4.7	4.7	○	○	○
DTA014E	DTC014E	10	10	○	○	○
DTA024E	DTC024E	22	22	○	○	○
DTA044E	DTC044E	47	47	○	○	○
DTA015E	DTC015E	100	100	○	○	○
DTA013Z	DTC013Z	1	10	○	○	○
DTA023Y	DTC023Y	2.2	10	○	○	○
DTA023J	DTC023J	2.2	47	○	○	○
DTA043X	DTC043X	4.7	10	○	○	○
DTA043Z	DTC043Z	4.7	47	○	○	○
DTA014Y	DTC014Y	10	47	○	○	○
DTA024X	DTC024X	22	47	○	○	○
DTA043T	DTC043T	4.7	—	○	○	○
DTA014T	DTC014T	10	—	○	○	○
DTA044T	DTC044T	47	—	○	○	○
DTA015T	DTC015T	100	—	○	○	○

Recommended Products : Small signal transistors (2) - Complex Types -

Complex Types

Small signal Bipolar Transistors

Polarity	Former Type (EMT6)	(UMT6)
PNP *2	—	—
	EMT1	UMT1N
NPN *2	—	—
	EMX1	UMX1N
NPN+PNP	—	—
	EMZ1	EMZ1N

NEW

Package	Package	Equivalent		VCEO (V)	Ic (mA)
		Tr1	Tr2		
EMT51	EMT6	2SAR522EB	2SAR522EB	-20	-200
EMT52		2SAR523EB	2SAR523EB	-50	-100
EMX51		2SCR522EB	2SCR522EB	20	200
EMX52		2SCR523EB	2SCR523EB	50	100
EMZ51		2SCR522EB	2SAR522EB	(-) 20	(-) 200
EMZ52		2SCR523EB	2SAR523EB	(-) 50	(-) 100

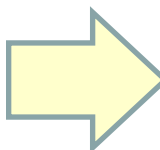


50V/100mA Digital Transistors

Polarity	Former type (EMT6)	(UMT6)
PNP *2	EMB10	UMB10N
	—	—
	EMB3	UMB3N
	EMB61	UMB61N
	EMB9	UMB9N
	—	—
NPN *2	EMB2	UMB2N
	EMH10	UMH10N
	EMH25	UMH25N
	EMH3	UMH3N
	EMH11	UMH11N
	EMH9	UMH9N
	EMH1	UMH1N
NPN+PNP	EMH2	UMH2N
	EMD22	UMD22N
	EMD3	UMD3N
	EMD9	UMD9N
	EMD2	UMD2N
	EMD12	UMD12N

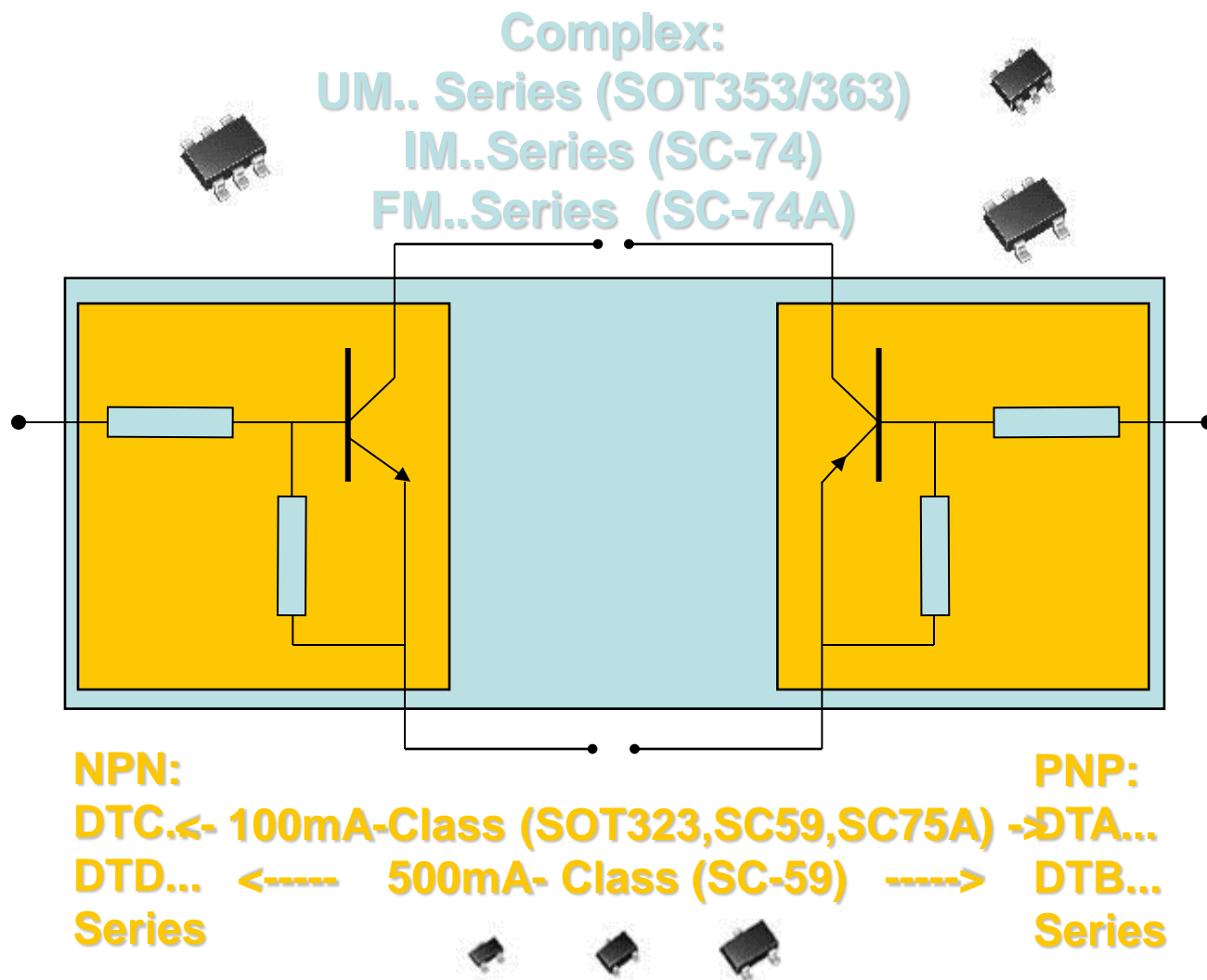
NEW

Package	Package	Equivalent		R1 (kΩ)	R2 (kΩ)
		Tr1	Tr2		
EMB60	EMT6	DTA023JEB	DTA023JEB	2.2	47
EMB75		DTA043ZEB	DTA043ZEB	4.7	47
EMB53		DTA043TEB	DTA043TEB	4.7	—
EMB61		DTA014EEB	DTA014EEB	10	10
EMB59		DTA014YEB	DTA014YEB	10	47
EMB51		DTA024EEB	DTA024EEB	22	22
EMB52		DTA044EEB	DTA044EEB	47	47
EMH60		DTC023JEB	DTC023JEB	2.2	47
EMH75	EMT6	DTC043ZEB	DTC043ZEB	4.7	47
EMH53		DTC043TEB	DTC043TEB	4.7	—
EMH61		DTC014EEB	DTC014EEB	10	10
EMH59		DTC014YEB	DTC014YEB	10	47
EMH51		DTC024EEB	DTC024EEB	22	22
EMH52		DTC044EEB	DTC044EEB	47	47
EMD72	EMT6	DTC043ZEB	DTA043ZEB	4.7	47
EMD53		DTC014EEB	DTA014EEB	10	10
EMD59		DTC014YEB	DTA014YEB	10	47
EMD52		DTC024EEB	DTA024EEB	22	22
EMD62		DTC044EEB	DTA044EEB	47	47



MP: OK

Digital Transistor





Small Signal Transistor

- Development to the automotive flat package (EMT3F, UMT3F)
- to conduct all number high temperature measurement
- Halogen free, Terminal plating Sn 100%
- Mounting solder pattern is shareable with gull wing type



Under
Development

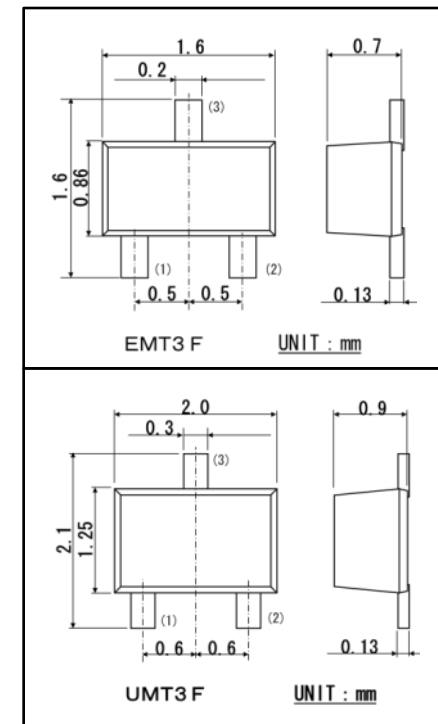
Small Signal
Bi-polar
Transistor

Polarity	UMT3F	EMT3F	V _{CEO}	I _c
PNP	2SA1576UB HZG Q/R	2SA1774EB HZG Q/R	50V	0.15A
NPN	2SC4081UB HZG Q/R	2SC4617EB HZG Q/R		

Under
Development

50V/100mA
Digital
Transistor

polarity	UMT3F	EMT3F	V _{CC}	R ₁ /R ₂
PNP	DTA143EUB HZG	DTA143EEB HZG	50V	4.7kΩ / 4.7kΩ
	DTA114EUB HZG	DTA114EEB HZG		10kΩ / 10kΩ
	DTA124EUB HZG	DTA124EEB HZG		22kΩ / 22kΩ
	DTA144EUB HZG	DTA144EEB HZG		47kΩ / 47kΩ
	DTA123JUB HZG	DTA123JEB HZG		2.2kΩ / 47kΩ
	DTA143XUB HZG	DTA143XEB HZG		4.7kΩ / 10kΩ
	DTA143ZUB HZG	DTA143ZEB HZG		4.7kΩ / 47kΩ
	DTA114YUB HZG	DTA114YEB HZG		10kΩ / 47kΩ
NPN	DTC143EUB HZG	DTC143EEB HZG	50V	4.7kΩ / 4.7kΩ
	DTC114EUB HZG	DTC114EEB HZG		10kΩ / 10kΩ
	DTC124EUB HZG	DTC124EEB HZG		22kΩ / 22kΩ
	DTC144EUB HZG	DTC144EEB HZG		47kΩ / 47kΩ
	DTC123JUB HZG	DTC123JEB HZG		2.2kΩ / 47kΩ
	DTC143XUB HZG	DTC143XEB HZG		4.7kΩ / 10kΩ
	DTC143ZUB HZG	DTC143ZEB HZG		4.7kΩ / 47kΩ
	DTC114YUB HZG	DTC114YEB HZG		10kΩ / 47kΩ



EMT3F (SC-75A)/UMT3F(SOT323) Flat lead package

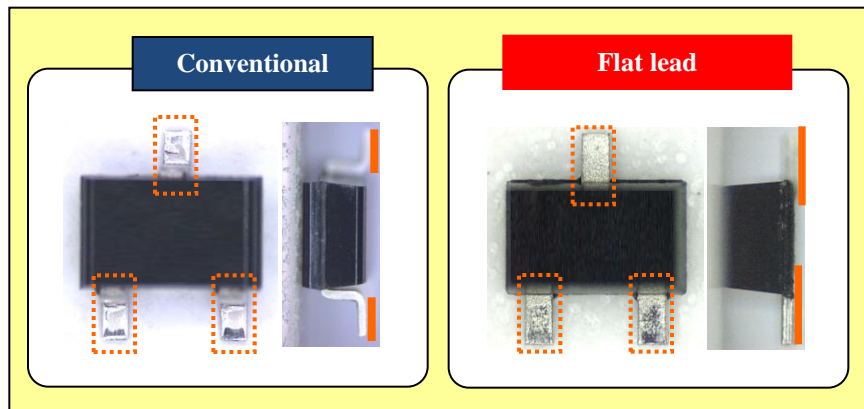
■ Feature

- ✓ Same land-pattern as conventional UMT3/EMT3 with flat lead
- ✓ World standard Pure Tin plating
- ✓ Conventional die is in package

■ Advantage

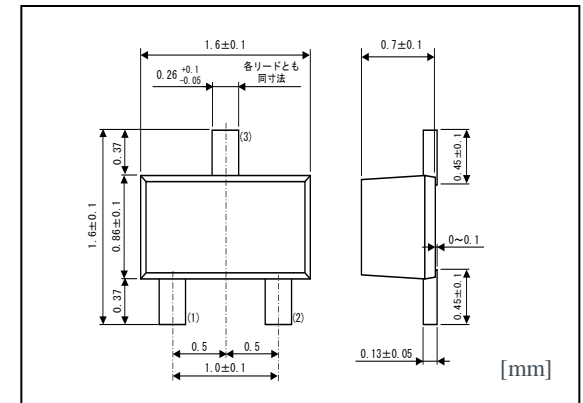
- ✓ **Self –alignment** because of the flat lead
- ✓ **Better adhesive strength**

<Picture>

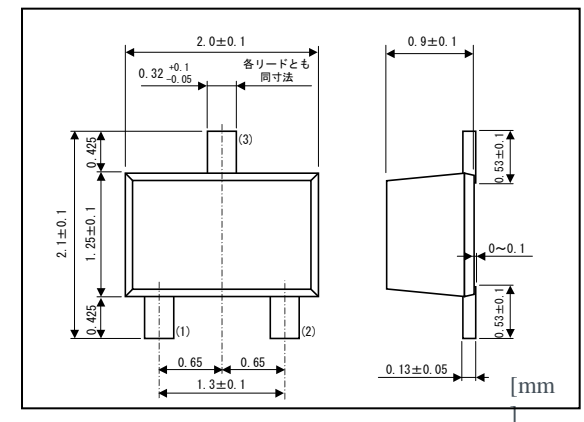


■ Benefit

- ✓ Mount efficiency improved

EMT3F / SC-75A

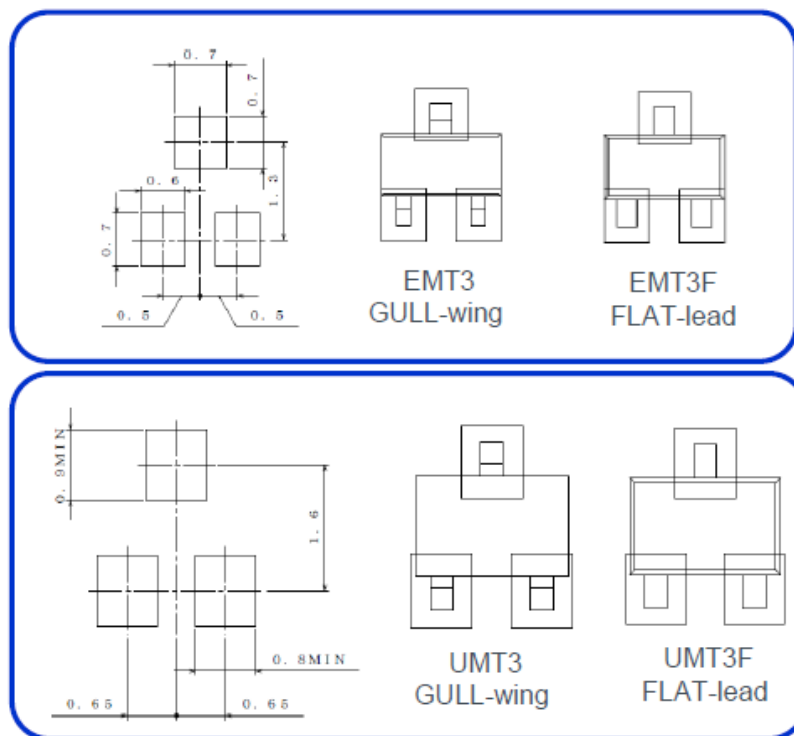
UMT3F / SOT323



Small Signal Transistor

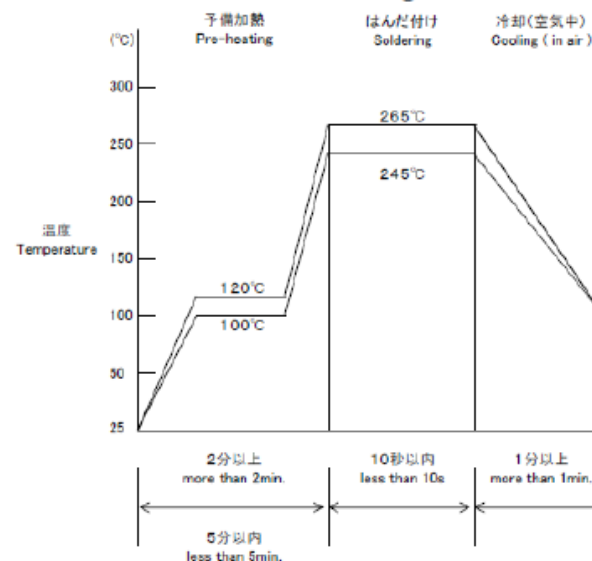
EMT3F, UMT3F FLAT-lead package products are capable of same current GULL-wing package products' mounting process (soldering condition, land pattern etc.).

<Mounting on same land pattern.>



<Mutual condition for soldering>

(Recommendation of flow soldering condition is shown below.)



<Specialties>

- Capable of same current GULL-wing package land pattern.
- Capable of flow soldering.
- Compared to current specification, 100%Sn100 plating has better wettability (molten solder method).
- Defect on mounting process does not occur because electronic terminal bending procedure is extracted in new specification.
- Satisfies JEITA Standard package strength.



Driver Bipolar transistors

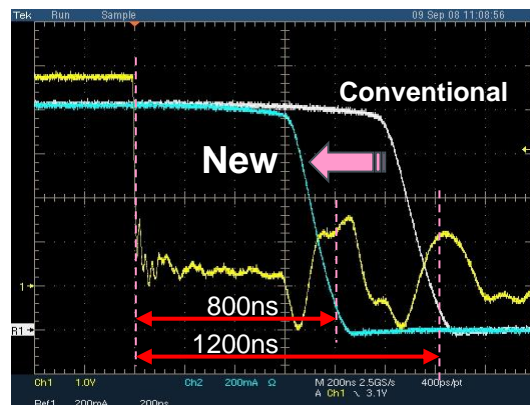
Features

1. Suitable for motor driver, Relay driver and power supply etc. .
2. Low VCE(sat)
3. Fast switching speed
e.g.) SW off time

Conventional product : 1,200nsec

→ New product :800nsec

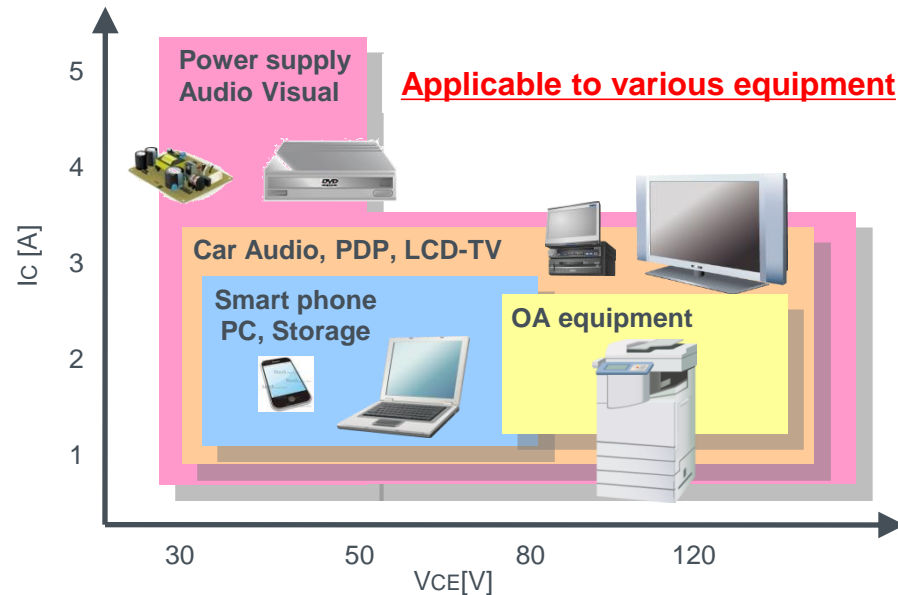
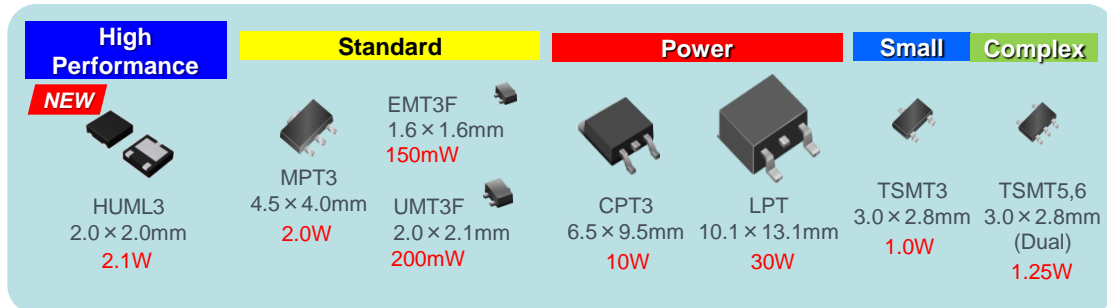
Switching waveform comparison

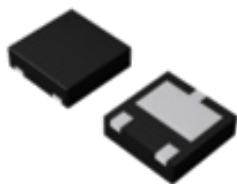


30% faster than conventional products

4. Reduction of switching loss and thermal radiation.

5. Various packages line up : small , complex, and power.



NEW
High performance series


HUML2020L3
(DFN2020-3S)
2.0 × 2.0 × 0.6mm

2.1W


●Features

1. Leadless small SMD package “HUML2020L3”.
Excellent thermal and electrical conductivity.
2. Suitable for Middle Power Driver.
3. Ultra Low VCE(sat)

●Applications

Load switch, Battery-driven devices, Power management
Charging circuits, Power switches (e.g. motors, fans)

Polarity	Part No.	V _{CEO}	I _C	V _{CE(sat)}	hFE
PNP	★2SAR562F3	−30V	−6A	50mV	200~500
	NEW 2SAR542F3	−30V	−3A	90mV	200~500
NPN	★2SCR562F3	30V	6A	40mV	200~500
	★2SCR542F3	30V	3A	70mV	200~500

★ DS: OK
MP: NOV./2014

Bipolar Transistors for driver ② - Small, Complex series -

47

Small , Complex series

Package	Polarity	Part No.	V _{CEO}	I _C	hFE
TSMT3 (SOT-346T)	PNP	2SAR513R	-50V	-1A	180~450
		2SAR553R		-2A	
		2SAR543R		-3A	
		2SAR514R	-80V	-0.7A	120~390
		2SAR554R		-1.5A	
		2SAR544R		-2.5A	
	NPN	2SCR513R	50V	1A	180~450
		2SCR553R		2A	
		2SCR543R		3A	
		2SAR514R	80V	0.7A	120~390
		2SAR554R		1.5A	
		2SCR544R		2.5A	
TSMT5 (SOT-25)	NPN x2	QS5W1	30V	3A	200~500
		QS5W2	50V	3A	180~450
	PNP + NPN	QS5Y1	-30V	-3A	200~500
			30V	3A	
		QS5Y2	-50V	-3A	180~450
			50V	3A	
TSMT6 (SOT-457T)	NPN + PNP	QS6Z5	50V	1A	180~450
			-50V	-1A	

Small



1.0W

TSMT3
(SOT-346T)
3.0 × 2.8 × 0.85mm

Complex

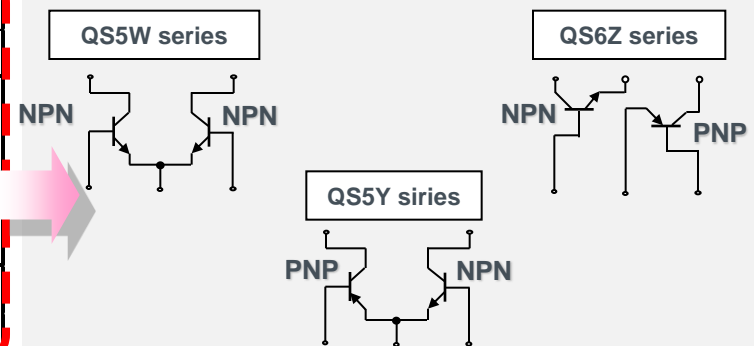


1.25W

TSMT5,6
(SOT-25, SOT-457T)
3.0 × 2.8 × 0.85mm

1. Same specifications, although smaller than “MPT3”.
2. Reduction the number of parts and mounted area.

Pin. arrangement



Higher cost performance series

PNP

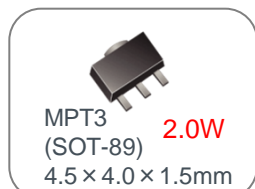
class		Conventional	V _{CEO} (V)	I _C (A)	hFE
(V)	(A)				
30	1	2SB1132	-30	-1	120~390
	2	2SB1188	-32	-2	120~390
	3				
50	1	2SA1900	-50	-1	120~270
	2	2SB1561	-60	-2	120~270
	3	2SA1797	-50	-3	120~270
80	0.7(1)	2SB1260	-80	-1	120~390
	1.5				
	2.5	2SA2109	-90	-2	120~270

	New Product (Cu Wire)	V _{CEO} (V)	I _C (A)	hFE
NEW	2SAR293P5	-30	-1	270~680
	★2SAR512P5		-2	200~500
	★2SAR552P5		-3	
NEW	2SAR513P5	-50	-1	180~450
	2SAR553P5		-1	
	★2SAR533P5		-3	
NEW	★2SAR514P5	-80	-0.7	120~390
	★2SAR554P5		-1.5	
	★2SAR544P5		-2.5	

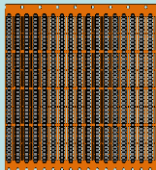
NPN

class		Conventional	V _{CEO} (V)	I _C (A)	hFE
(V)	(A)				
30	1	2SD1664	30	1	120~390
	2	2SD1766	32	2	120~390
	3				
50	1	2SC5053	50	1	120~390
	2	2SD2391	60	2	120~270
	3	2SC4672	50	3	120~390
80	1	2SD1898	80	1	120~390
	1.5				
	2.5	2SC5918	90	2	120~390
120					
	2	2SC4132	120	2	82~390

	New Product (Cu Wire)	V _{CEO} (V)	I _C (A)	hFE
NEW	2SCR293P5	30	1	270~680
	★2SCR512P5		2	200~500
	★2SCR552P5		3	
NEW	★2SCR513P5	50	1	180~450
	2SCR553P5		2	
	★2SCR533P5		3	
NEW	★2SCR514P5	80	0.7	120~390
	★2SCR554P5		1.5	
	★2SCR544P5		2.5	
NEW	★2SCR372P5	120	0.7	120~390
	★2SCR375P5		1.5	

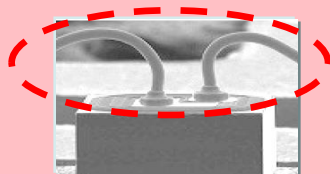


Improving productivity by wider-frame



- higher productivity
- reduction of material losses

Reduction of material cost



Cost reduction by changing wire materials "Au" to "Copper"

★: 開発中
(DS OK)

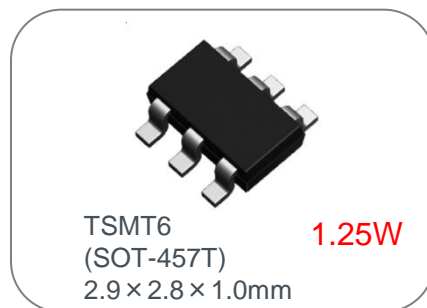
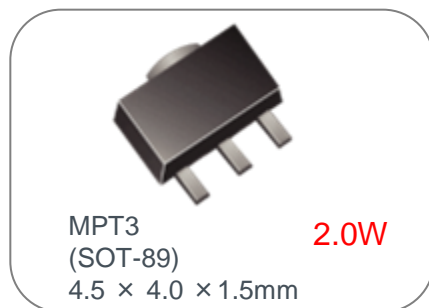
High voltage series

●Features

1. High break down voltage.
2. Ultra Low $V_{CE(sat)}$.
3. Broad package line-up for small package“TSMT6” and middle power package “MPT3”

●Applications

Camera strobes, Ligting, Power supply



class		Conventional	V_{CEO} (V)	I_C (A)	hFE
(V)	(A)				
400	0.1	2SA1759	-400	-0.1	82~180
		2SC4505	400	0.1	56~270



NEW				
Package	New Product	V_{CEO} (V)	I_C (A)	hFE
TSMT6 (SOT-457T)	2SAR340Q	-400	-0.1	82~270
	2SCR341Q	400	0.1	82~270

NEW				
Package	New Product	V_{CEO} (V)	I_C (A)	hFE
MPT3 (SOT-89)	2SAR340P	-400	-0.1	82~270
	2SCR346P	400	0.1	

Bipolar Transistors for driver ⑤ - Power series -

50

Power series

1. High power dissipation : 10W~30W

2. Applicable for “Automotives”.



PNP

class		Conventional	V _{CEO} (V)	I _C (A)	hFE
(V)	(A)				
30V	5A	2SB1412	-30	-5	120~390
50V	3A	2SB1184	-50	-3	120~390
60V	5A	2SA1952	-60	-5	120~270
80V	2A	2SB1181	-80	-1	120~390

NEW

New Product	V _{CEO} (V)	I _C (A)	hFE
2SAR572D	-30	-5	200~500
2SAR573D	-50	-3	180~450
2SAR574D	-80	-2	120~390
★2SAR586D	-80	-5	120~390

★:DS 2015/2

NPN

class		Conventional	V _{CEO} (V)	I _C (A)	hFE
(V)	(A)				
30V	5A	2SD2118	20	5	120~390
50V	3A	2SD1760	50	3	120~390
60V	5A	2SC5103	60	5	120~270
80V	1A	2SD1733	80	1	120~390

NEW

New Product	V _{CEO} (V)	I _C (A)	hFE
2SCR572D	30	5	200~500
2SCR573D	50	3	180~450
2SCR574D	80	2	120~390
★2SCR586D	80	5	120~390

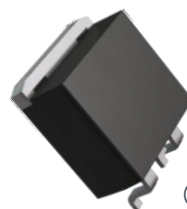
★:DS 2015/2



CPT3
(SOT-428)

(6.5 × 9.5 × 2.3mm)

10W



LPTS
(TO-263, D2PAK)
(10.1 × 13.1 × 4.5mm)

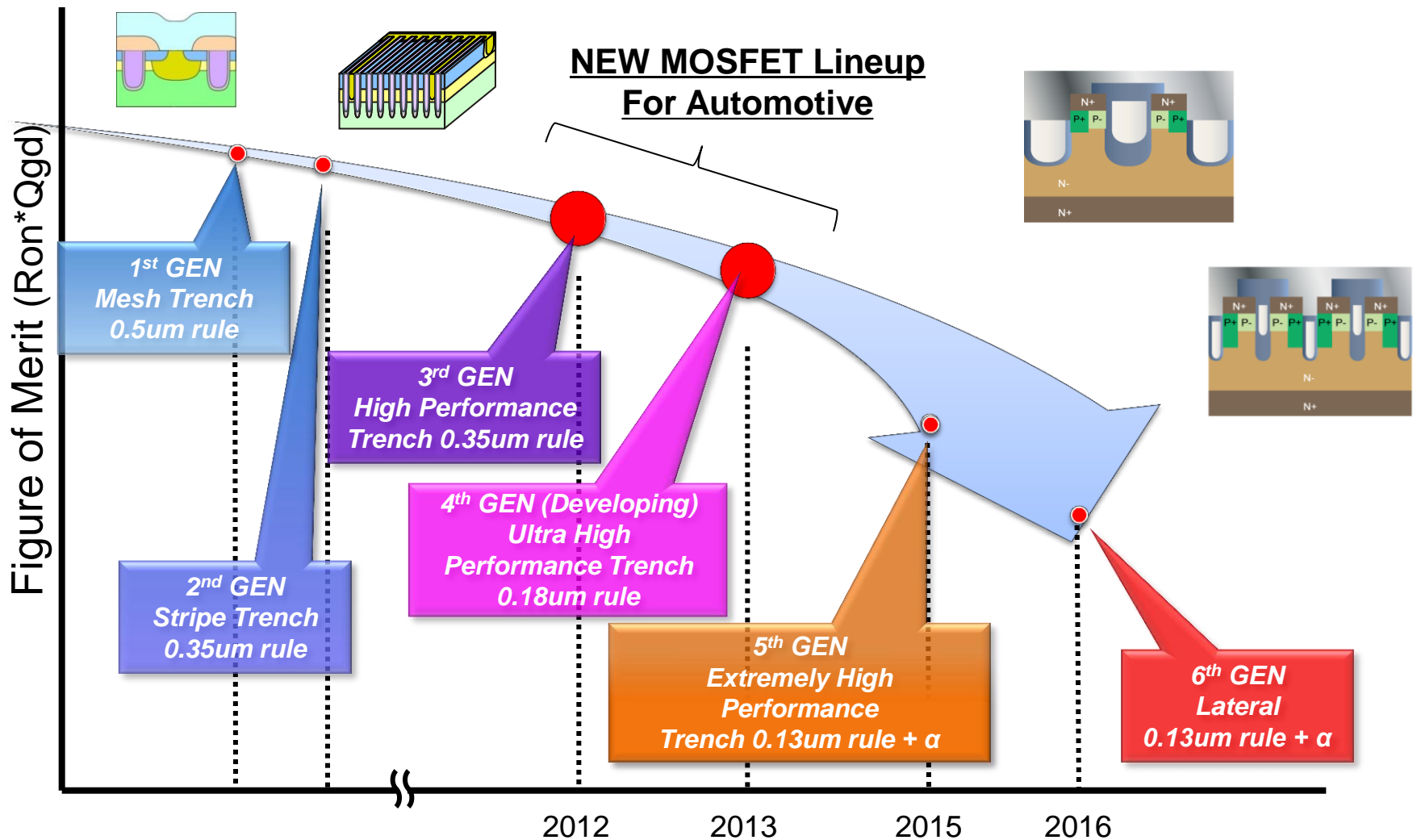
30W

NEW

New Product	V _{CEO} (V)	I _C (A)	hFE
2SB1644J	-80	-4	100~320

Process trend

NEW MOSFET Lineup For Automotive





Small signal MOSFET

UMT3/
SOT323



(2.0×2.1×0.9mm)

SMT3/
SOT346



(2.9×2.8×1.0mm)

MPT3/
SOT89



(4.5×4.0×1.5mm)

	Product	SPEC	Driving Vol	PKG	Status
30V	RJU003N03	Nch : 30V/ 0.3A / 0.8Ω	2.5V	UMT3	On MP
	RJK005N03	Nch : 30V/ 0.5A / 0.4Ω		SMT3	On MP
	RHU003N03	Nch : 30V/ 0.3A / 0.8Ω	4V	UMT3	On MP
	RHK005N03	Nch : 30V/ 0.5A / 0.35Ω		SMT3	On MP
	RHP030N03	Nch : 30V/ 3.0A / 0.09Ω		MPT3	On MP
60V	RJU002N06	Nch : 60V/ 0.2A / 1.6Ω	2.5V	UMT3	On MP
	RJP020N06	Nch : 60V/ 2.0A / 0.17Ω		MPT3	On MP
	RHU002N06	Nch : 60V/ 0.2A / 1.7Ω	4V	SMT3	On MP
	RHK003N06	Nch : 60V/ 0.3A / 0.7Ω		SMT3	On MP
	RHP020N06	Nch : 60V/ 2.0A / 0.15Ω		MPT3	On MP

TUMT (VDSS=30V Type.)

製品名	PAKG	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RTL035N03	TUMT6	30V	3.5 A	40 mΩ *	4.6 nC *	Nch	2.5V駆動
RSL020P03	TUMT6	-30V	2.0 A	50 mΩ	8.0 nC	Pch	4V駆動
RTL020P02			2.0 A	100 mΩ *	4.9 nC *		2.5V駆動
RTF025N03	TUMT3	30V	2.5 A	48 mΩ *	3.7 nC *	Nch	2.5V駆動
RTF015P02	TUMT3	-30V	1.5 A	100 mΩ *	5.2 nC *	Pch	2.5V駆動

* : VGS = 4.5V * : VGS = 4.5V

TSMT (VDSS=45V Type.)

製品名	PAKG	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RTR020N05	TSMT3	45V	2.0 A	130 mΩ *	2.9 nC *	Nch	2.5V駆動
QS6K21	TSMT6	45V	1.0 A	300 mΩ *	1.5 nC *	Nch(Dual)	

* : VGS = 4.5V * : VGS = 4.5V

TUMT3,5,6



(2.0 × 2.1 × 0.85mm)

TSMT3,5,6



(2.9 × 2.8 × 1.0mm)

SOP8



(5.0 × 6.0 × 1.75mm)

TSMT (VDSS=30V Type.)

製品名	PAKG	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RSQ045N03	TSMT6	30V	4.5 A	27 mΩ	6.8 nC	Nch	4V駆動
RSQ035N03			3.5 A	44 mΩ	5.3 nC		
RSQ020N03			2.0 A	96 mΩ	2.2 nC		
RTQ045N03			4.5 A	30 mΩ *	7.6 nC *		2.5V駆動
RTQ035N03			3.5 A	38 mΩ *	4.6 nC *		
RTQ020N03			2.0 A	89 mΩ *	2.4 nC *		
RSQ035P03	TSMT6	-30V	-3.5 A	45 mΩ	9.2 nC	Pch	4V駆動
RSQ030P03			-3.0 A	60 mΩ	6.0 nC		
RSQ025P03			-2.5 A	80 mΩ	4.4 nC		
RTQ035P02			-3.5 A	50 mΩ *	10.5 nC *		2.5V駆動
RTQ030P02			-3.0 A	60 mΩ *	9.0 nC *		
RTQ025P02			-2.5 A	72 mΩ *	6.4 nC *		
RSR025N03	TSMT3	30V	4.0 A	100 mΩ	4.9 nC	Nch	4V駆動
RTR040N03			4.0 A	34 mΩ *	5.9 nC *		2.5V駆動
RTR025N03			2.5 A	66 mΩ *	3.3 nC *		
RSR025P02	TSMT3	-30V	-2.5 A	70 mΩ	5.4 nC	Pch	4V駆動
RSR020P02			-2.0 A	85 mΩ	4.3 nC		
RTR030P02			-3.0 A	55 mΩ *	9.3 nC *		2.5V駆動
RTR025P02			-2.5 A	70 mΩ *	7.0 nC *		
RTR020P02			-2.0 A	100 mΩ *	4.9 nC *		
QS6K1	TSMT6	30V	1.0 A	170 mΩ *	1.7 nC *	Nch (Dual)	2.5V駆動
QS5K2	TSMT5		1.5 A	71 mΩ *	2.8 nC *		

* : VGS = 4.5V * : VGS = 4.5V



SOP8 PKG

SOP8 (VDSS=30V Type.)

製品名	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RSS130N03	30V	13.0 A	5.9 mΩ	25 nC	NCh	4V駆動
RSS125N03		12.5 A	6.5 mΩ	25 nC		
RSS110N03		11.0 A	7.6 mΩ	17 nC		
RSS100N03		10.0 A	9.5 mΩ	14 nC		
RSS090N03		9.0 A	11 mΩ	11 nC		
RSS065N03		6.5 A	19 mΩ	6.1 nC		
RSS090P03	-30V	-9.0 A	10 mΩ	39 nC	PCh	4V駆動
RSS075P03		-7.5 A	15 mΩ	30 nC		
RSS050P03		-5.0 A	30 mΩ	13 nC		
RSS040P03		-4.0 A	42 mΩ	8 nC		
SP8K4	30V	9.0 A	12 mΩ	15 nC	NCh (Dual)	4V駆動
SP8K3		7.0 A	17 mΩ	8.4 nC		
SP8K2		6.0 A	21 mΩ	7.2 nC		
SP8K1		5.0 A	36 mΩ	3.9 nC		
SP8K5		3.5 A	59 mΩ	2.5 nC		
SP8J5	-30V	7.0 A	20 mΩ	25 nC	PCh (Dual)	4V駆動
SP8J1		5.0 A	30 mΩ	16 nC		
SP8J2		4.5 A	40 mΩ	8.5 nC		
SP8M2	30V/-30V	3.5 / -3.5 A	59 / 65 mΩ	2.5 / 5.5 nC	PCh + NCh	4V駆動
SP8M3		5.0 / -4.5 A	36 / 40 mΩ	3.9 / 8.5 nC		
SP8M4		9.0 / -7.0 A	12 / 20 mΩ	15 / 25 nC		
SP8M5		6.0 / -7.0 A	21 / 20 mΩ	7.2 / 25 nC		
SP8M6		5.0 / -3.5 A	36 / 65 mΩ	3.9 / 5.5 nC		
SP8M8		6.0 / -4.5 A	21 / 40 mΩ	7.2 / 8.5 nC		
SP8M10		7.0 / -4.5 A	17 / 40 mΩ	8.4 / 8.5 nC		

SOP8 (VDSS=45V Type.)

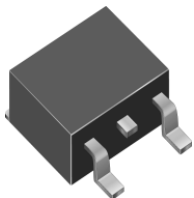
製品名	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RSS095N05	45V	9.5 A	11 mΩ	19 nC	NCh	4V駆動
RSS085N05		8.5 A	13 mΩ	15 nC		
RSS070N05		7.0 A	18 mΩ	12 nC		
RSS070P05	-45V	-7.0 A	19 mΩ	34 nC	PCh	4V駆動
RSS060P05		-6.0 A	26 mΩ	23 nC		
SP8K24	45V	6.0 A	18 mΩ	15 nC	NCh (Dual)	4V駆動
SP8K22		4.5 A	33 mΩ	6.8 nC		
SP8M21	45V/-45V	6.0A / -4.0A	18 / 33 mΩ	15 / 20 nC	PCh + NCh	4V駆動
SP8M24		4.5A / -3.5A	33 / 45 mΩ	6.8 / 13 nC		

SOP8 (VDSS=60V Type.)

製品名	BVDSS	ID	RDS(on) at 10V (Typ.)	Qg at 5V (Typ.)	極性	仕様
RSS065N06	60V	6.5 A	24 mΩ	11 nC	NCh	4V駆動
SP8K33	60V	5.0 A	34 mΩ	8.0 nC	NCh (Dual)	4V駆動
SP8K32		4.5 A	46 mΩ	7.0 nC		
SP8K31		3.5 A	85 mΩ	3.7 nC		

Tr Pch MOSFET

D-PACK



(13.1 × 10.1 × 4.5mm)

D-PACK



(9.5 × 6.5 × 2.3mm)

SOP8



(5.0 × 6.0 × 1.75mm)

TSMT3,6



(2.9 × 2.8 × 1.0mm)

Part Number	Package	Maximum Rating						Q _G typ. (nC)	V _{GS} (v)
		V _{DS} (V)	I _D (A)	R _{DS(on)} mΩ					
				V _{GS} = 2.5V	V _{GS} = 4V	V _{GS} = 4.5V	V _{GS} = 10V		
RSJ250P10	LPT(D2-Pack)	-100	-25	-	50	48	48	60	5
RSJ151P10		-100	-15	-	100	95	85	64	10
RSD160P05	CPT3 (D-Pack)	-45	-16	-	50	45	35	16	5
RSD080P05		-45	-8	-	105	95	65	9	5
RSD046P05		-45	-4.5	-	185	160	110	6	4.5
RSD140P06		-60	-14	-	77	73	60	27	4.5
RSD131P10		-100	-13	-	155	150	135	18	4.5
RSS090P03		-30	-9	-	17	15	10	39	5
RSS075P03	SOP8	-30	-7.5	-	25	22	15	30	5
RSS050P03		-30	-5	-	55	47	30	13	5
RSS040P03		-30	-4	-	78	68	42	8	5
RSS070P05		-45	-7	-	28	25	19	34	5
RSS060P05		-45	-6	-	38	35	26	23	5
SP8J5		SOP8 (P+P/Dual)	-30	-7	-	30	25	20	25
SP8J1	-30		-5	-	45	40	30	16	5
SP8J2	-30		-4.5	-	65	57	40	8.5	5
RTR030P02	TSMT3 (SC96)	-20	-3	90	60	55	-	9.3	4.5
RTR025P02		-20	-2.5	115	75	70	-	7	4.5
RTR020P02		-20	-2	180	110	100	-	4.9	4.5
RSR025P03		-30	-2.5	-	115	100	70	5.4	5
RSR020P05		-45	-2	-	200	180	130	9.5	10
RTQ035P02	TSMT6 (SC95)	-20	-3.5	80	55	50	-	10.5	4.5
RTQ030P02		-20	-3	110	65	60	-	9	4.5
RTQ025P02		-20	-2.5	140	80	72	-	6.4	4.5
RSQ035P03		-30	-3.5	-	70	65	45	9.2	5
RSQ030P03		-30	-3	-	100	90	60	6	5
RSQ025P03		-30	-2.5	-	145	120	80	4.4	5

Middle Power MOSFET(40V~100V) for Motor /Power Supply

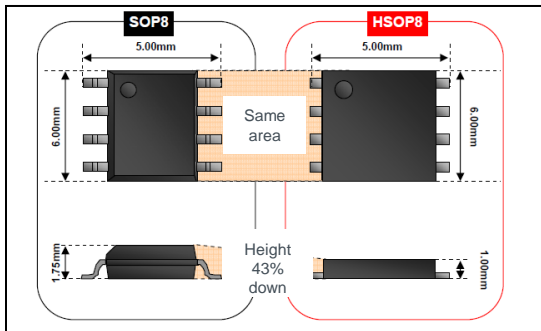
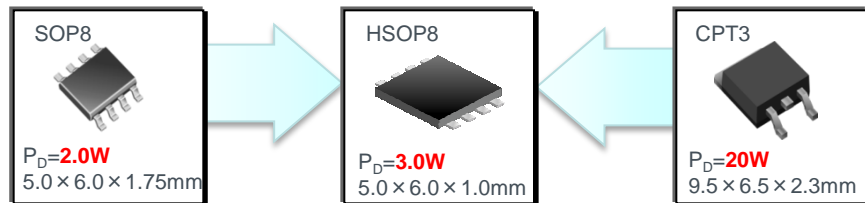


Feature

- Low On resistance
- High current product lineup : 3A to 100A

Advantage

- Adoption of small size / thin package

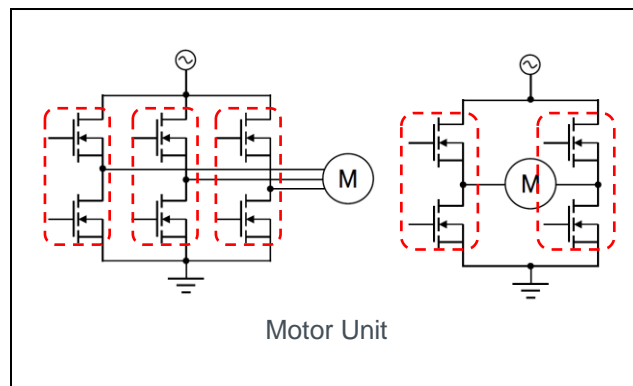


Benefit

- Reduction of generation of heat by Low ON resistance
- Contributes to smaller, thinner sets and high efficiency operation

Application Circuit Examples

Motor drive circuit



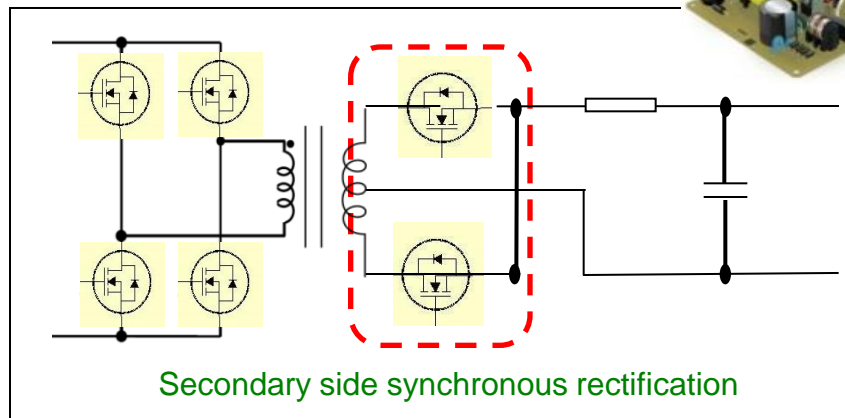
Power tools



FUN motor




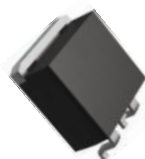
Power supply circuit





MOSFET ~40V/45V Line Up~

VDSS=40~45V , VGSS=20V

Package	Part No.	Polarity	VDSS [V]	ID [A]	RDS (on) typ [mohm]		Qg typ [nC]	Ciss typ [pF]
					VGS=10V	VGS=4.5V	VGS=10V	VDS=20V
CPT3 (DPAK) 	RSD200N05	Nch	45	20	20	25	12 ※1	950 ※2
	RSD046P05	Pch	45	5	110	185	12 ※1	550 ※2
	RSD080P05	Pch	45	8	65	95	9 ※1	1000 ※2
	RSD160P05	Pch	45	16	35	45	16 ※1	2000 ※2
	AG008DGD3 ☆	Nch	40	40	5,2	6,5	28,9	1711
	AG007DGD3 ☆	Nch	40	45	4,4	5,5	34,7	2054
	AG006DGD3 ☆	Nch	40	50	3,5	4,3	46,7	2762
	AG005DGD3 ☆	Nch	40	60	2,5	3,1	69,9	4131
	AG004DGD3 ☆	Nch	40	80	2	2,4	97,5	5765
LPTS (D2PAK) 	RSJ451N04	Nch	40	45	9,5	-	43,0	2400 ※3
	AG007DGJ1 ☆	Nch	40	45	4,6	5,6	34,7	2054
	AG006DGJ1 ☆	Nch	40	80	3,6	4,4	46,7	2762
	AG004DGJ1 ☆	Nch	40	80	2,1	2,5	97,5	5765
	AG003DGJ1 ☆	Nch	40	100	1,5	1,8	149,9	8864
	AG002DGJ1 ☆	Nch	40	110	1,4	1,5	190,9	11286
	AG001DGJ1 ☆	Nch	40	120	1,2	1,4	241,7	14289

☆ Developing

※1 : VGS=5V ※2 : VGS=10V
※3 : VGS=25V

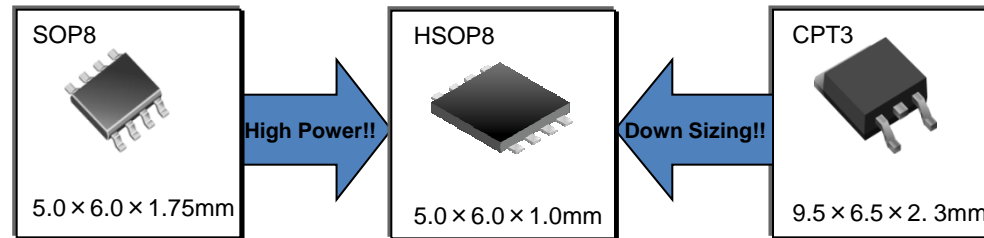
Design and specification is supposed to change.

HSOP8 MOSFET

Under development

■ Feature

- Compact PKG
- High power



■ Line-up

Package	Part No.	Polarity	Type	VDSS [V]	ID [A]	RDS (on) typ [mohm]		Qg typ [nC]	Ciss typ [pF]
						VGS=10V	VGS=4.5V	VGS=10V	VDS=20V
CPT3 (DPAK)	AG022DGS4 ☆	Nch	Single	40	70	2,3	2,8	73,8	4364
	AG021DGS4 ☆	Nch	Single	40	80	2,0	2,4	87,1	5148
	AG020DGS5 ☆	Nch	Dual	40	20	10,0	11,4	27,1	1601
	AG019DGS5 ☆	Nch	Dual	40	20	9,2	10,3	33,3	1967

☆ Developing

* Design and specification is subject to change.

Tr MOSFET ~60V Line Up~

VDSS=60V , VGSS=20V



Package	Part No.	VDSS [V]	ID [A]	RDS(on)typ [mΩ]			Qg [nC]
				VGS=10V	VGS=4.5V	VGS=4.0V	VGS=10V
TSMT3	☆RGR035N06	60	3.5	43	66	-	7
SOP8(S)	☆RGH100N06	60	10	8.2	11.9	-	47
	☆RGH130N06	60	13	5.5	7.9	-	70
SOP8(D)	☆SP8K61	60	5	43	66	-	7
HSOP8(S)	☆RS1L110GN	60	11	11	16	-	30.5
	☆RS1L140GN	60	14	6.9	10.5	-	30
	☆RS1L220GN	60	22	4.2	5.0	-	112
HSOP8(D)	☆HP8K62	60	20	15	23	-	17
	☆HP8K61	60	20	10	18	-	32
CPT3 (DPAK)	RSD050N06	60	5	78	-	100	8
	RSD080N06	60	8	57	-	78	9.5
	RSD150N06	60	15	28	-	36	18
	RSD221N06	60	22	18	-	23	30
	RSD140P06	-60	-14	60	-	77	27
TO252 (DPAK)	☆RD3L150GN	60	15	35	52	-	8.5
	☆RD3L230GN	60	23	18	26	-	19
	☆RD3L300GN	60	30	11	16	-	30.5
	☆RD3L400GN	60	40	7	11	-	59
	☆RD3L500GN	60	50	4.0	5.8	-	84
LPTS (D2PAK)	RSJ400N06	60	40	11	-	-	52
	☆RJ1L450GN	60	45	12	17.4	-	28
	☆RSJ700N06	60	70	4.5	-	-	75
	☆RJ1L750GN	60	75	4.0	5.8	-	84
	☆RJ1L10HGN	60	100	3.5	5.0	-	96
	☆RJ1L11HGN	60	110	1.9	2.8	-	177

☆ : Under development. Design and specification is supposed to change.

Thank you very much

