






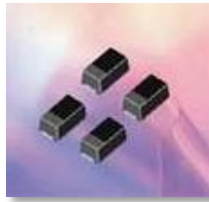


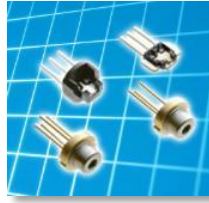
Innovations  
from  
Semiconductor

# Discrete Products

ROHM Co., Ltd.



# Discrete products lineup

|  |   |   |  |
|--|---|---|--|
| <b>SiC</b>  | <ul style="list-style-type: none"> <li>• MOSFET MP started for the first time in the world.</li> <li>• SBD MP has been supplied</li> <li>• All process handled by ROHM group.</li> </ul>                | <b>R</b>     | <ul style="list-style-type: none"> <li>• The smallest PKG(03015) is on developing.</li> <li>• Various shunt resistor's line up. (~5W)</li> </ul>                         |
| <b>TR</b>   | <ul style="list-style-type: none"> <li>• Small signal is the 3<sup>rd</sup> best in the world.</li> <li>• The smallest PKG(0806) has been on MP</li> <li>• Hybrid MOS developed (SJMOS+IGBT)</li> </ul> | <b>TC</b>    | <ul style="list-style-type: none"> <li>• The smallest and biggest capacitance product (1608/100uF) line up.</li> <li>• No. 1share in small portable products.</li> </ul> |
| <b>Di</b>  | <ul style="list-style-type: none"> <li>• Small signal is the best in the world.</li> <li>• The smallest LC SBD started MP.</li> <li>• The smallest PKG(0402) developed.</li> </ul>                      | <b>LED</b>  | <ul style="list-style-type: none"> <li>• The smallest PKG (1006) and RGBPKG (1010) are on MP</li> </ul>  |
|  |   | <b>LD</b>  | <ul style="list-style-type: none"> <li>• No. 1share (for read LD)</li> </ul>   |

# 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

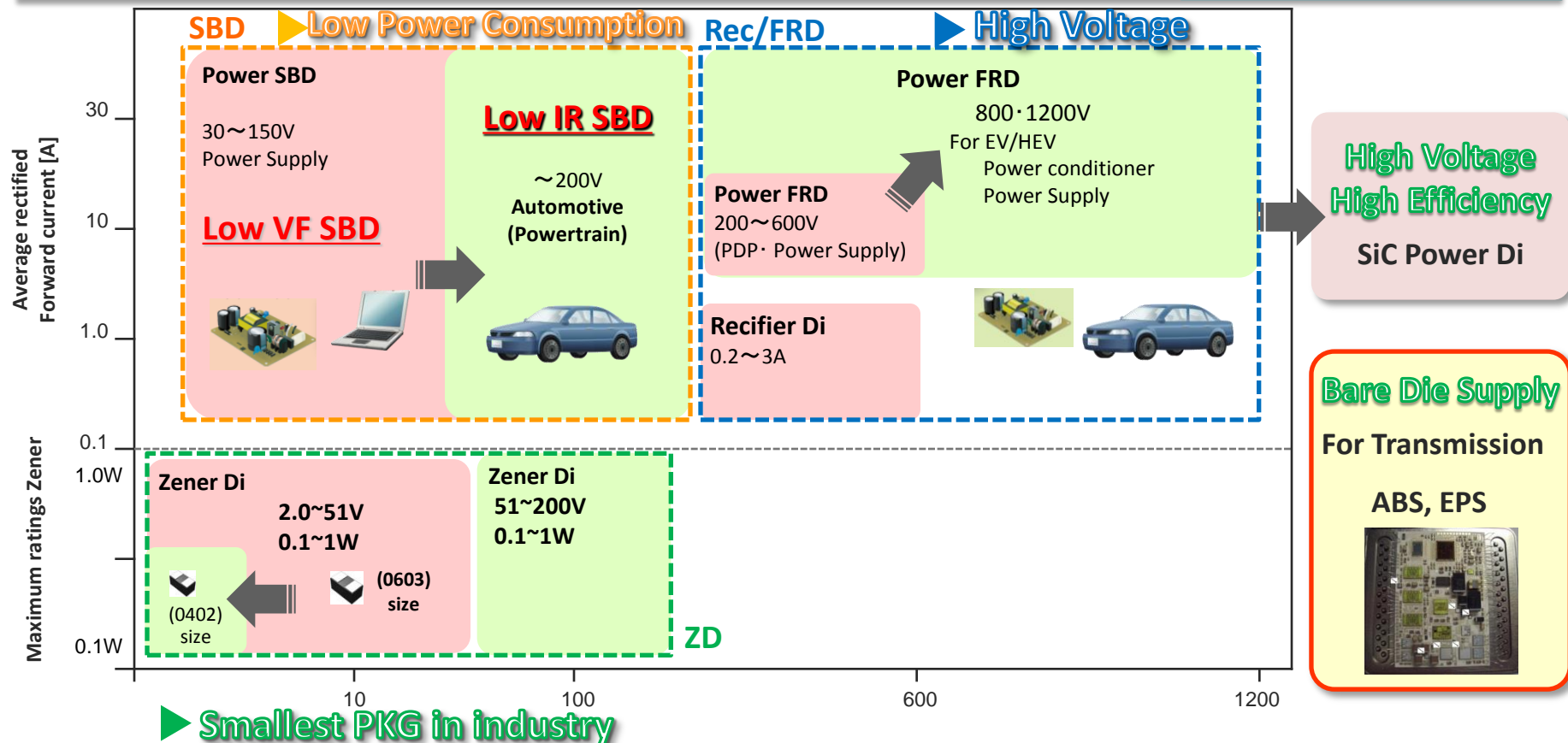
Already in MP

## Development Strategy

High voltage

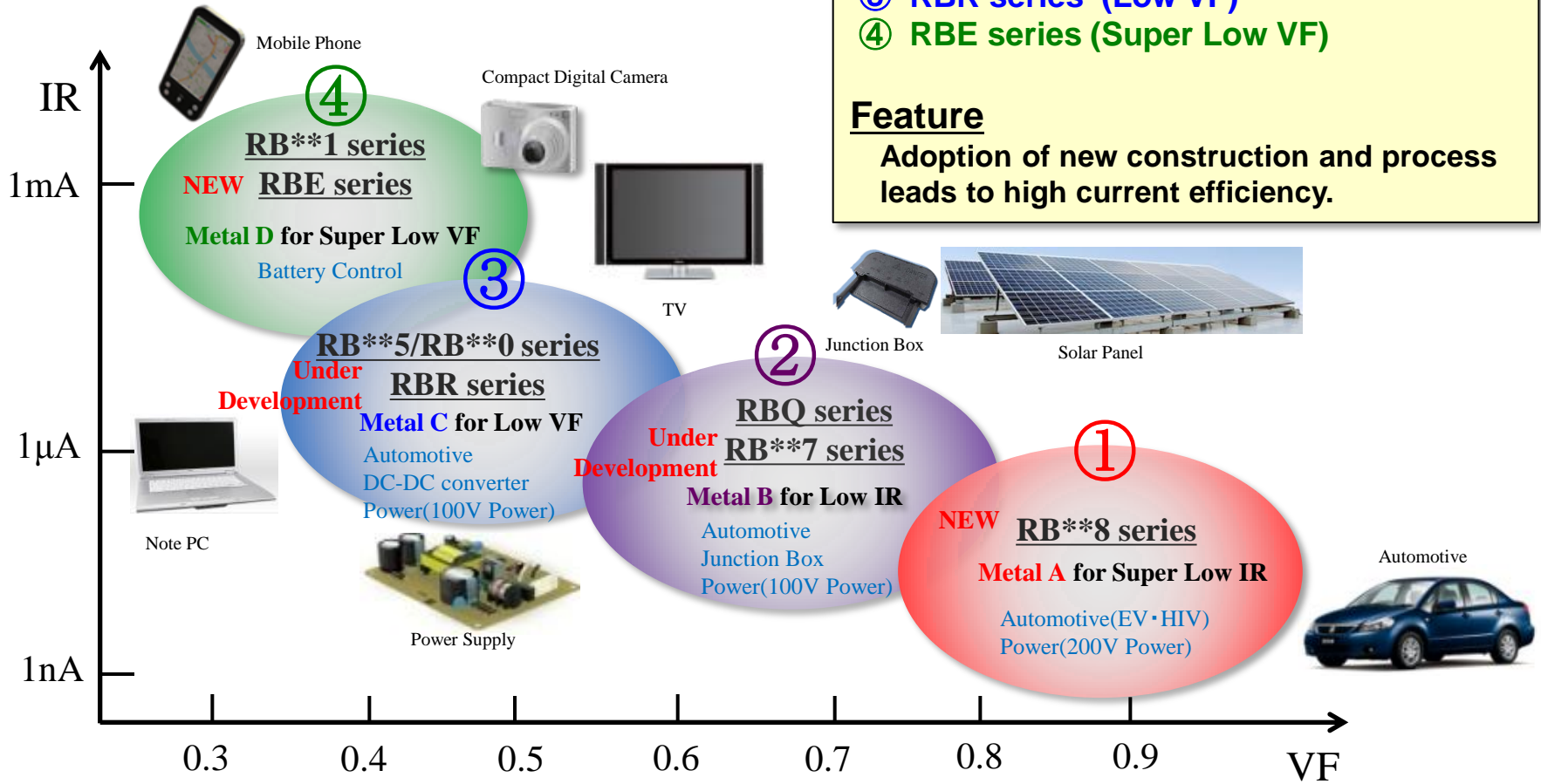
High current

Small / multiple



# Schottky Barrier Diode (SBD) Line Up

## SBD Line Up

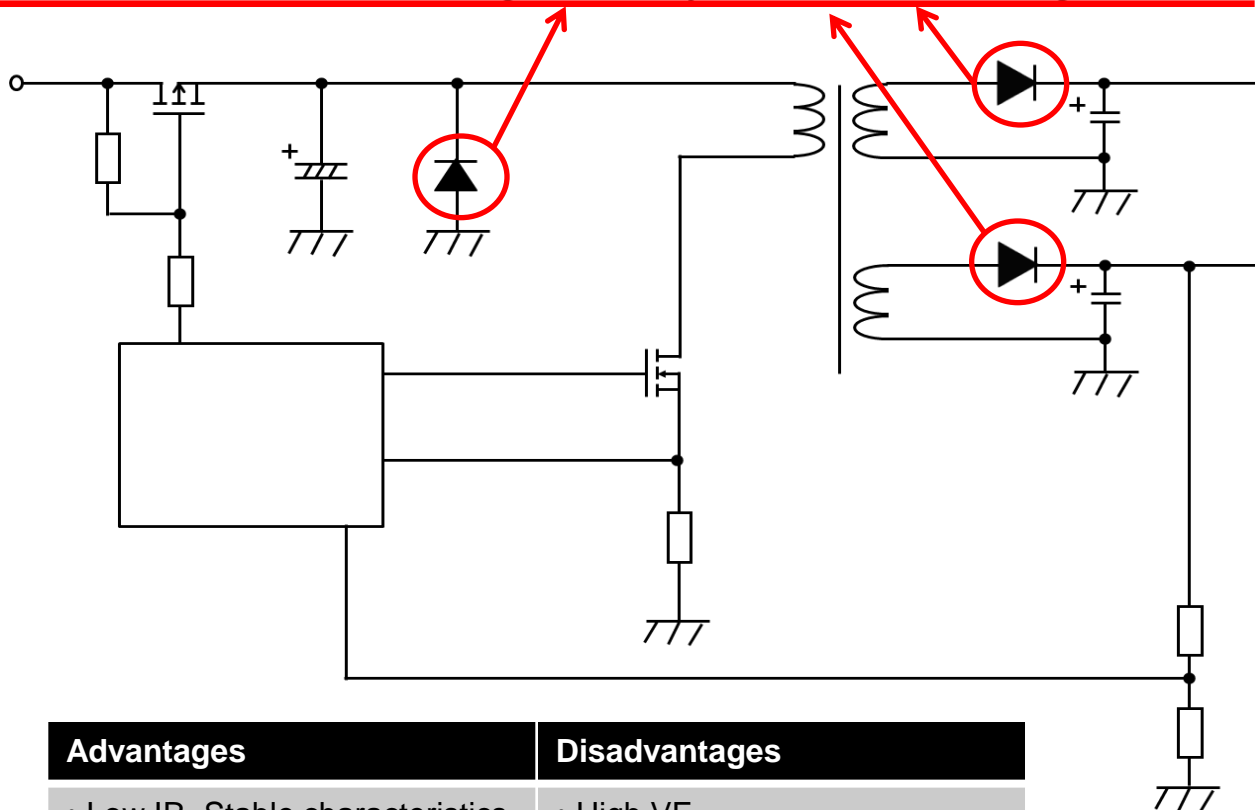




# Low IR SBD Concept

## ■ Typical Circuit

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



### Advantages

- Low IR. Stable characteristics under high temperature environment.

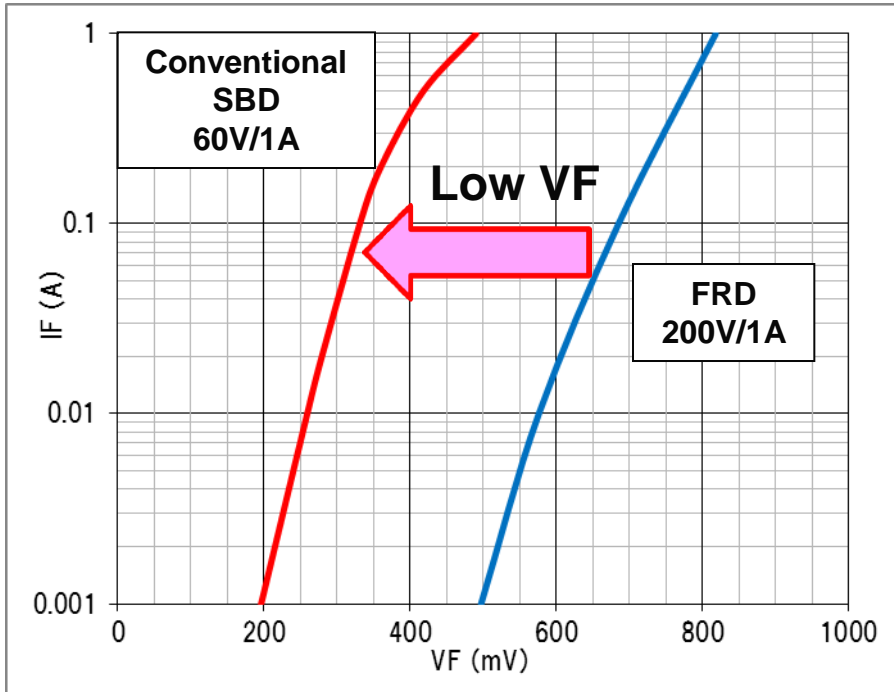
### Disadvantages

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

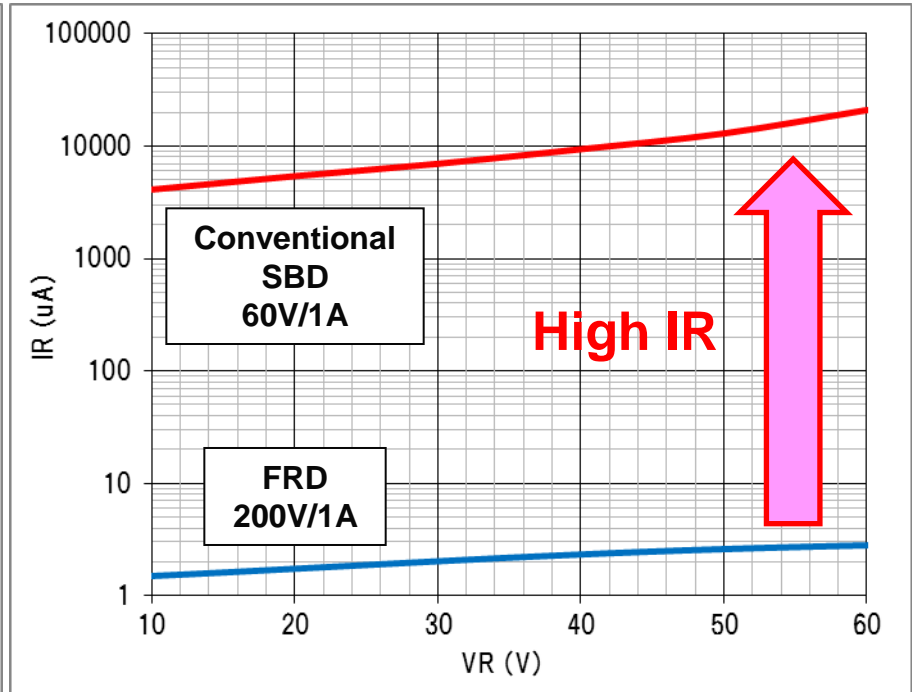
# Concept

## ■ Spec Comparison

●  $T_a=25^\circ\text{C}$  VF-IF



●  $T_a=150^\circ\text{C}$  VR-IR

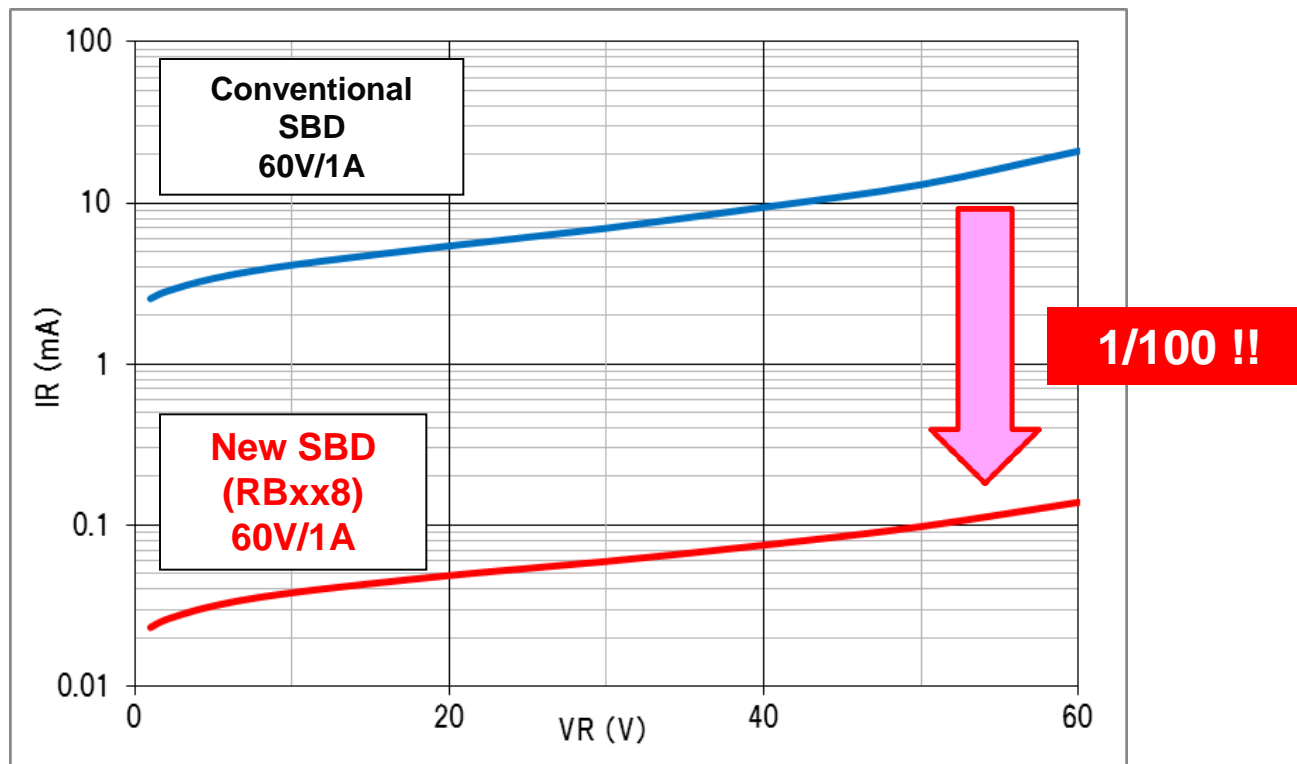


SBD VF is low but there is a concern about Thermal Runaway due to its high IR at high temperature range.

# Concept

## ■ IR Comparison

● Ta=150°C VR-IR



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

# Concept

## ■ Thermal Runaway

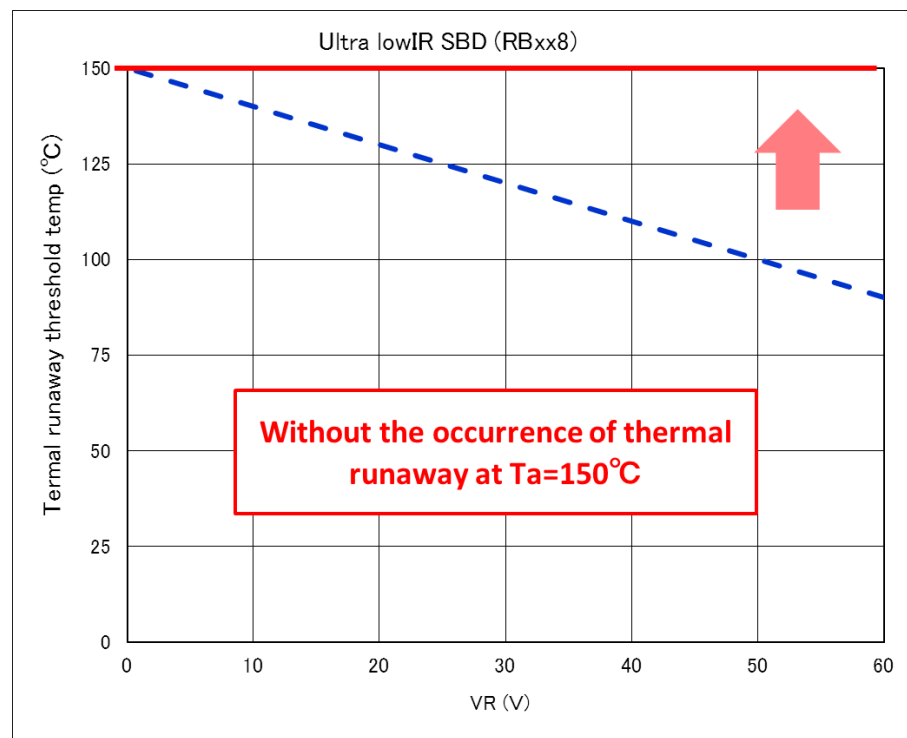
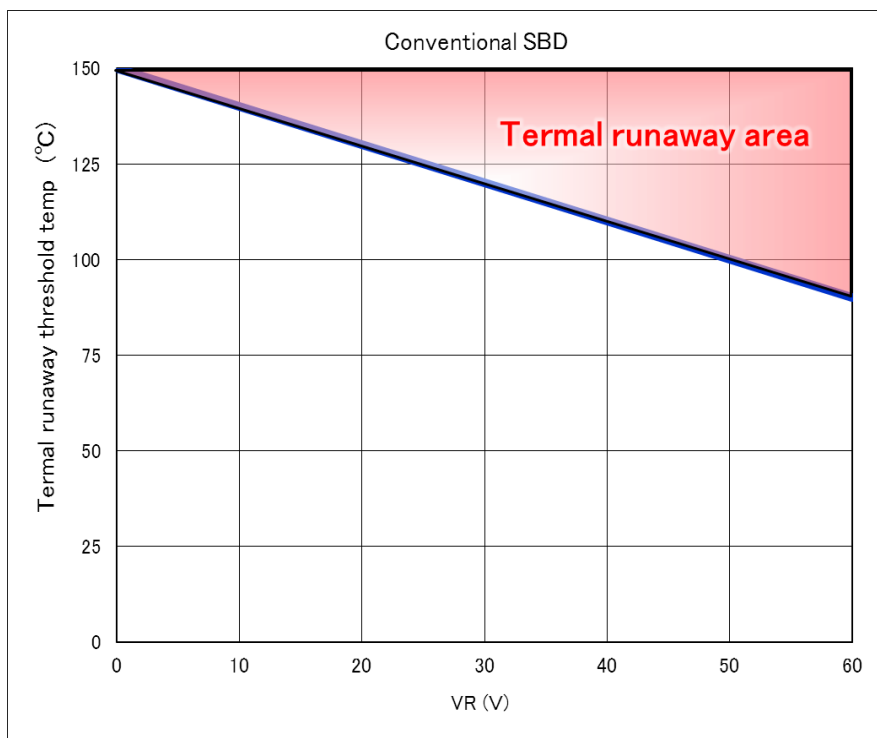
### < Test Conditions >

Item: SBD / 60V / 3A / SMA

Bias: VR = 60V DC Supply

Board: FR-4

Land : Rohm Recommended Footprint

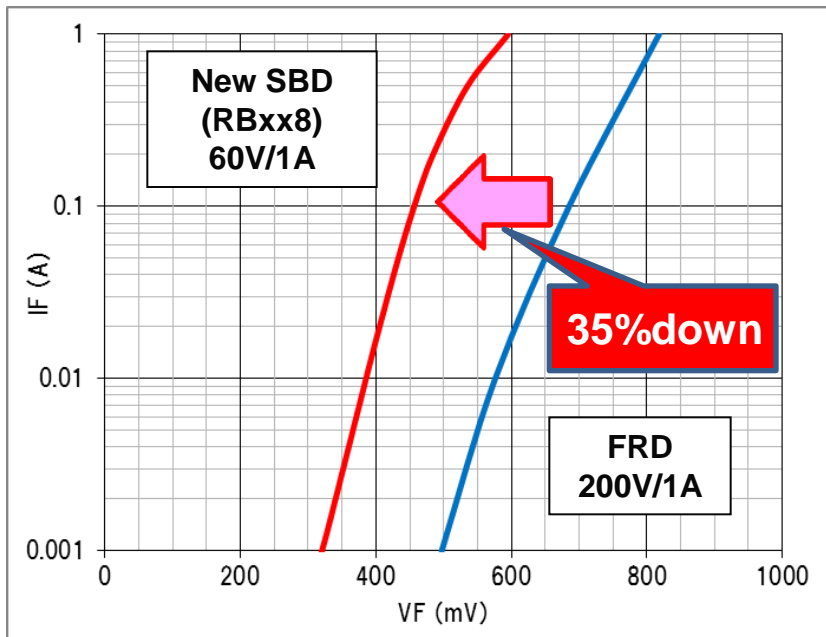




# Replacing Rectifier Diodes

## 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 !**

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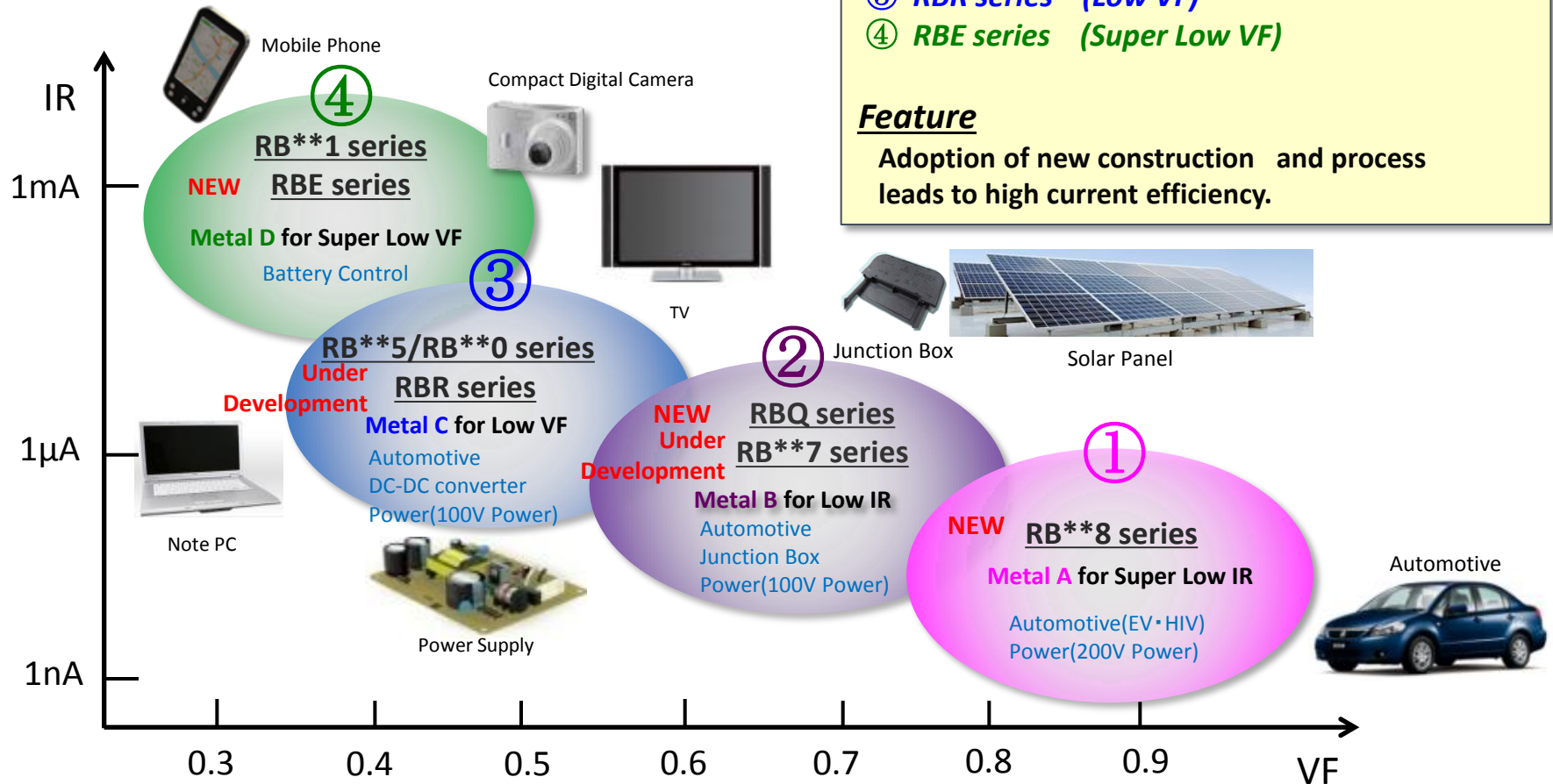
# SBD

## ***Schottky Barrier Diodes Lineup***

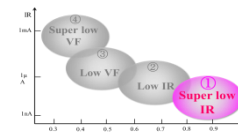
- |   |  |
|---|--|
| ▪ <b><i>RB**8 Series (Ultra low IR)</i></b> | <b><i>..... Automotive</i></b>                   |
| ▪ <b><i>RBQ Series (Low IR)</i></b>         | <b><i>..... Power ▪ Automotive</i></b>           |
| ▪ <b><i>RBR Series (Low VF)</i></b>         | <b><i>..... DC-DC ▪ Battery Control</i></b>      |
| ▪ <b><i>RBE Series (Ultra low VF)</i></b>   | <b><i>..... Smartphone ▪ Battery Control</i></b> |

# Schottky Barrier Diode (SBD) Line Up

## 4 Kinds of SBD Metal Line Up



# ① RB\*\*8 Series ~ Ultra Low IR SBD ~



## ■ Feature

**Ultra Low Reverse Current**  
**No Thermal Runaway**  
**High Reliability**

## ■ Aprication

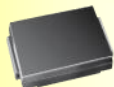
•Power•Automotive•DC-DC  
 (The circuit which is used under high temperature environment)



## ■ approach example

Mounting Area: 72% down

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



64% down

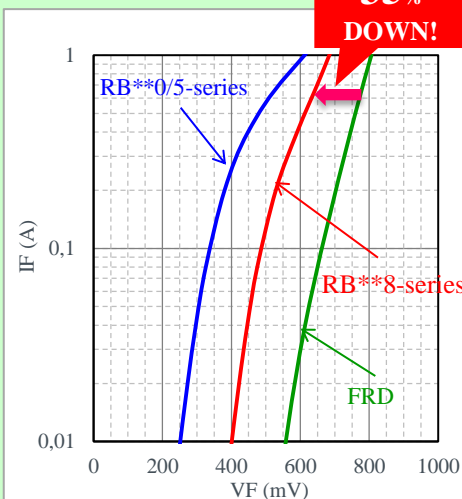
REC (200V / 1A) PMDS  RB168M-60 PMDU



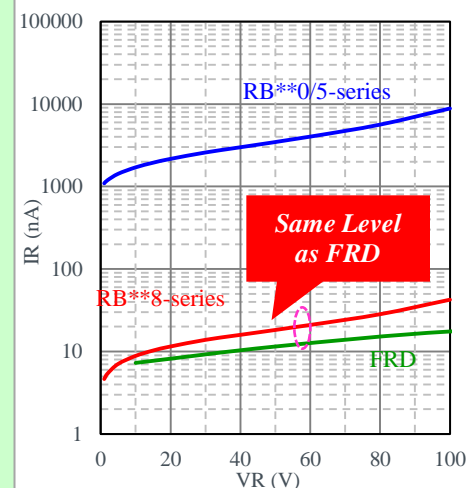
**Lower VF guarantees the equal current to the big package**

## ■ Characteristic data

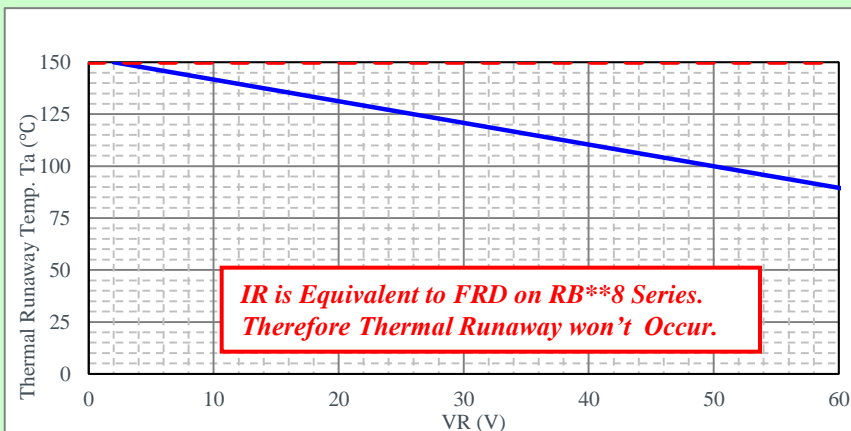
<VF-IF :Tj =25℃>



<VR-IR :Tj =25℃>

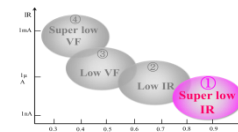


## <Thermal Runaway>



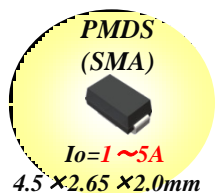
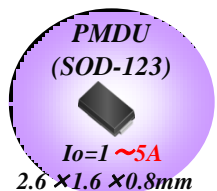
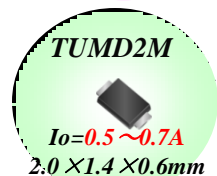
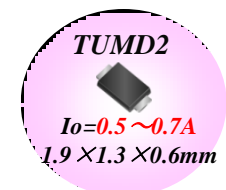


# ① RB\*\*8 Series ~ Ultra Low IR SBD ~



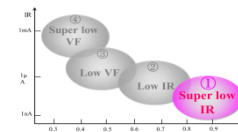
## Line Up

### Middle power

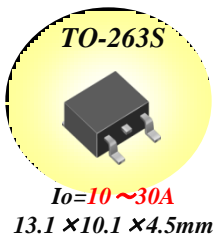
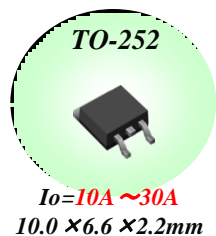


| Package              | Circuit | Part No.        | Absolute Maximum |       | Electrical Characteristic (Tj = 25 °C) |               |        |               |
|----------------------|---------|-----------------|------------------|-------|--|---------------|--------|---------------|
|                      |         |                 | VR(V)            | Io(A) | VF(V)                                  | Max.<br>IF(A) | IR(uA) | Max.<br>VR(V) |
| TUMD2<br>(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<br>(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<br>(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 ~

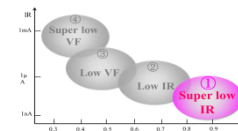


## Power(SMD)



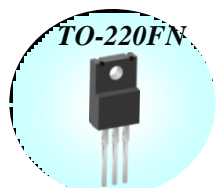
| Package           | Circuit | Part No.       | Absolute Maximum |       | Electrical Characteristic (Tj = 25 °C) |               |        |               |
|-------------------|---------|----------------|------------------|-------|--|---------------|--------|---------------|
|                   |         |                | VR(V)            | Io(A) | VF(V)                                  | Max.<br>IF(A) | IR(uA) | Max.<br>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<br>(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

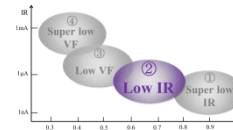
Power(THD)



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

| Package  | Circuit | Part No.      | Absolute Maximum |       | Electrical Characteristic (Tj = 25 °C) |               |        |               |
|----------|---------|---------------|------------------|-------|--|---------------|--------|---------------|
|          |         |               | VR(V)            | Io(A) | VF(V)                                  | Max.<br>IF(A) | IR(uA) | Max.<br>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**

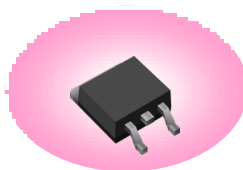
### Package

### Application

- Automotive
- Junction Box
- Power Supply

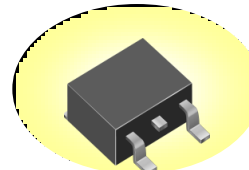
### Line Up

TO-252



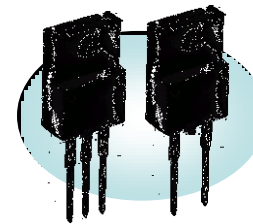
$I_o = 5A \sim 20A$   
10.0 × 6.6 × 2.2mm

TO-263S



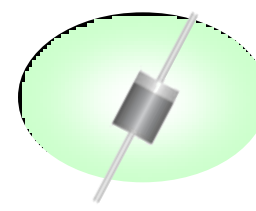
$I_o = 10 \sim 30A$   
13.1 × 10.1 × 4.5mm

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<br> | 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<br>       | 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<br> | 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~

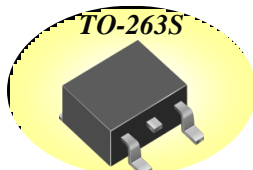
### Feature

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

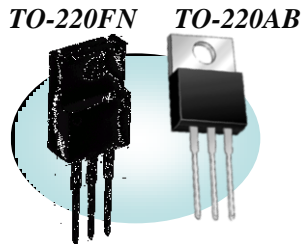
### Package



**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<br>RB087NS100<br>RB087T100<br>RB087TG100 | 10      | 0.86             | TO252M<br>TO263S<br>TO220FND<br>TO220AB |
| RB217BM100<br>RB217NS100<br>RB217T100<br>RB217TG100 | 20      | 0.86             | TO252M<br>TO263S<br>TO220FND<br>TO220AB |
| RB227BM100<br>RB227NS100<br>RB227T100<br>RB227TG100 | 30      | 0.86             | TO252M<br>TO263S<br>TO220FND<br>TO220AB |

### Characteristic data

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



### Voltage Rank

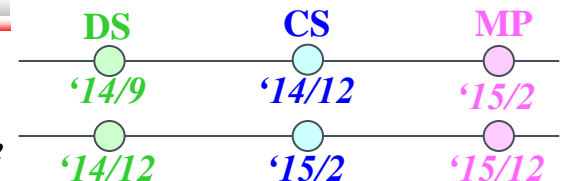
RB\*\*7 series  
(Low IR)



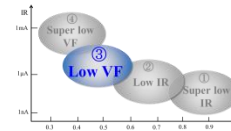
### Schedule

~100V Line

150/200V Line



# ③ RBR series ~ Low VF SBD ~



On MP

## Feature

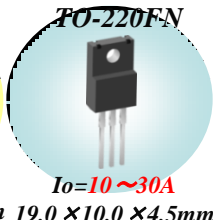
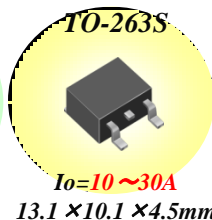
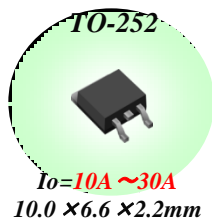
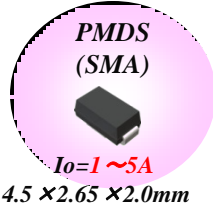
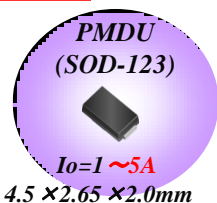
• Installation of new line realize the same characteristics with **Die Shrink!!**



## Application

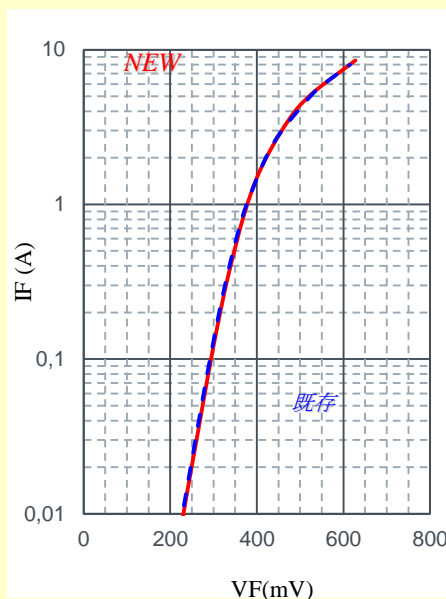
- DC-DC
- Power Supply

## PKG

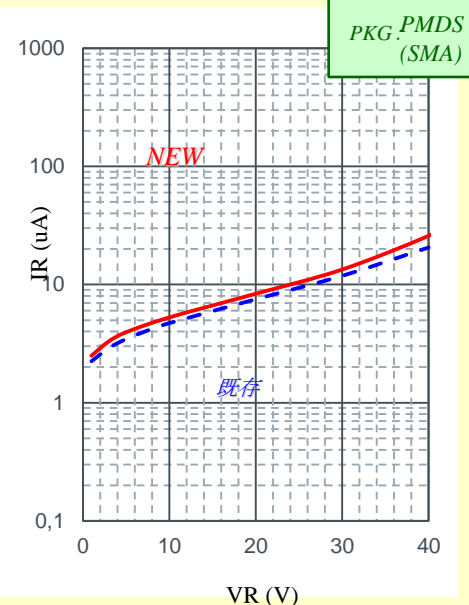


## Electrical Characteristic

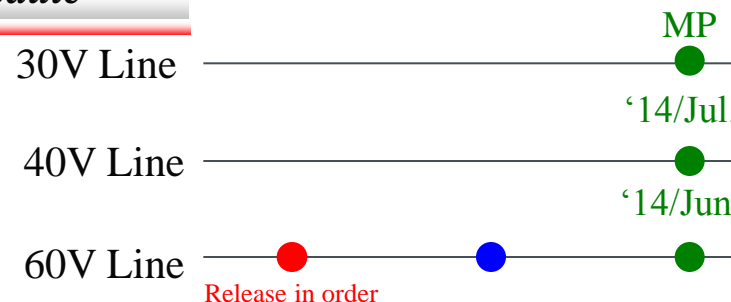
<VF-IF :Tj=25°C>



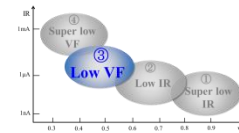
<VR-IR :Tj=25°C>



## Schedule



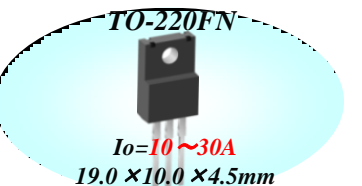
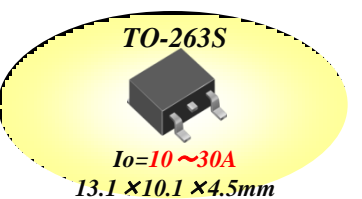
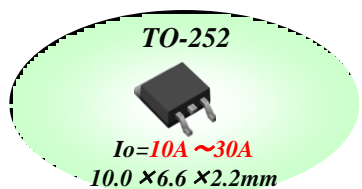
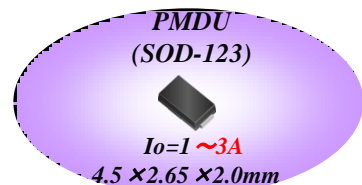
# ③ RBR series ~ Low VF SBD ~



On MP

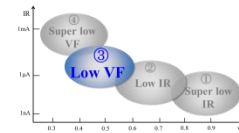
## Line Up

<30V>



| PKG            | Circuit | P/N        | Absolute Maximum Ratings [Tc=25°C] |                    | Electrical Characteristics [Tj=25°C] |                    |                        |                    |
|----------------|---------|------------|------------------------------------|--------------------|--------------------------------------|--------------------|------------------------|--------------------|
|                |         |            | V <sub>R</sub> (V)                 | I <sub>O</sub> (A) | V <sub>Fmax</sub> (V)                | I <sub>F</sub> (A) | I <sub>Rmax</sub> (uA) | V <sub>R</sub> (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                    |                    |

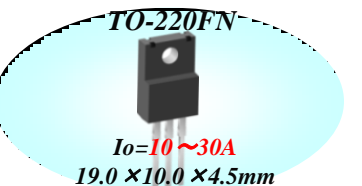
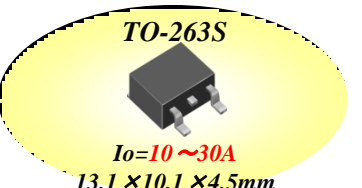
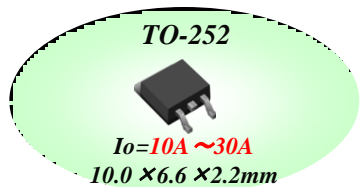
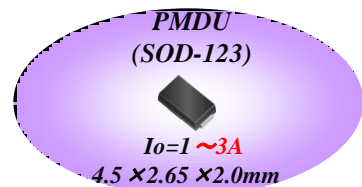
# ③ RBR series ~ Low VF SBD ~



On MP

## Line Up

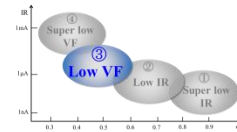
<40V>



| PKG               | Circuit | P/N        | Absolute Maximum Ratings [Tc=25°C] |                       | Electrical Characteristics [Tj=25°C] |                    |                           |                    |
|-------------------|---------|------------|------------------------------------|-----------------------|--------------------------------------|--------------------|---------------------------|--------------------|
|                   |         |            | V <sub>R</sub><br>(V)              | I <sub>O</sub><br>(A) | V <sub>Fmax</sub><br>(V)             | I <sub>F</sub> (A) | I <sub>Rmax</sub><br>(uA) | V <sub>R</sub> (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<br>(TO252)   |         | RBR10BM40A | 40                                 | 10                    | 0.62                                 | 5                  | 120                       | 40                 |
|                   |         | RBR15BM40A |                                    | 15                    | 0.58                                 | 7.5                | 240                       |                    |
|                   |         | RBR20BM40A |                                    | 20                    | 0.58                                 | 10                 | 360                       |                    |
| D2PAK<br>(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                       |                    |



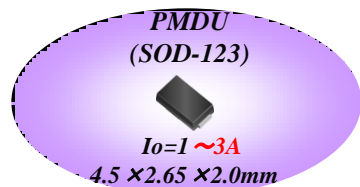
# ③ RBR series ~ Low VF SBD ~



On MP

## Line Up

<60V>



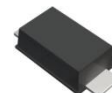
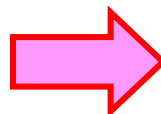
| PKG   | Circuit | P/N       | Absolute Maximum Ratings [Tc=25°C] |                    | Electrical Characteristics [Tj=25°C] |                    |                        |                    |
|-------|---------|-----------|------------------------------------|--------------------|--------------------------------------|--------------------|------------------------|--------------------|
|       |         |           | V <sub>R</sub> (V)                 | I <sub>O</sub> (A) | V <sub>Fmax</sub> (V)                | I <sub>F</sub> (A) | I <sub>Rmax</sub> (uA) | V <sub>R</sub> (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**

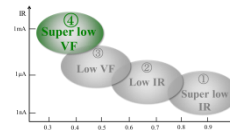


**SOD123**

| PKG                      | Current part | VR (V) | Io (A) | VF (V) | IR (mA)  |  | PKG    | Proposal | VR (V)   | Io (A)   | VF (V) | IR (mA) |
|--------------------------|--------------|--------|--------|--------|----------|--|--------|----------|----------|----------|--------|---------|
| SMA<br>SOD106<br>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   |



# ④RBE series ... High Efficiency SBD



On MP

## Feature

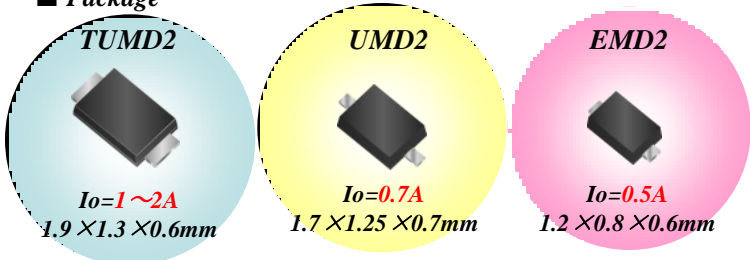
•New construction achieve low VF and High current density.

## Advantage

•Lowering the heat and dissipation by high efficiency.

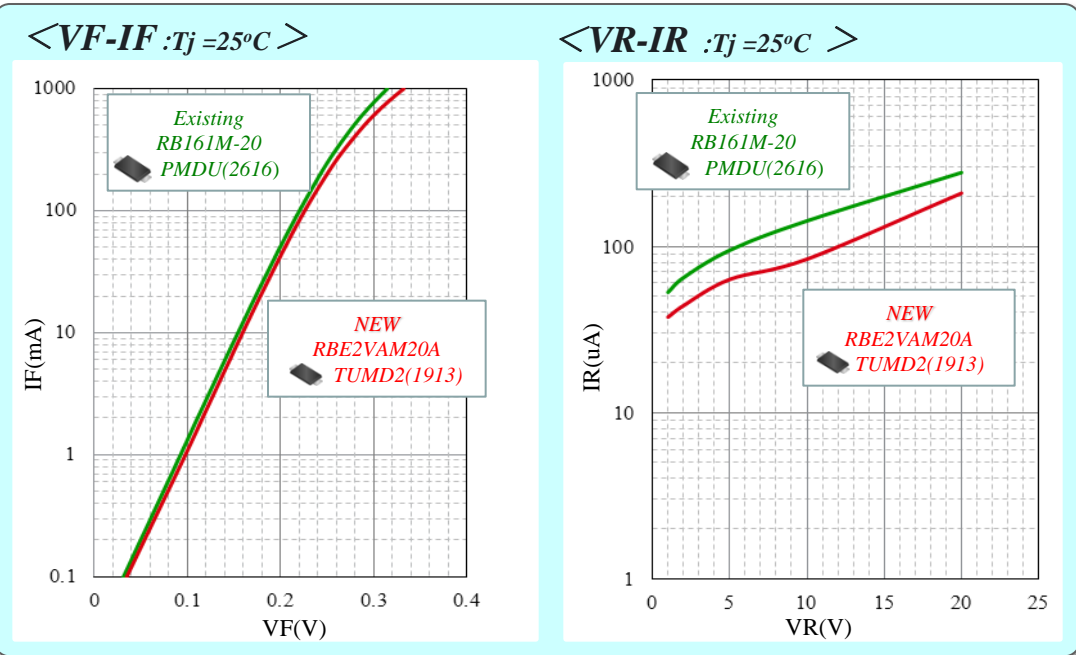
•Die shrink is available by High current density

## Package



## Lineup

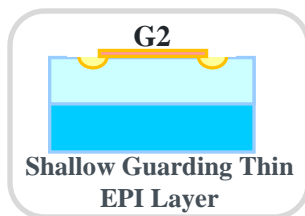
## Characteristic Comparison



| Package | Part No.   | Absolute Maximum Rationgs<br>(Tc=25°C) |       | Electrical Characteristic<br>( Tj = 25°C) |       |             |       | Circuit         |
|---------|------------|--|-------|---|-------|-------------|-------|-----------------|
|         |            | VR(V)                                  | Io(A) | VF(V) Max.                                |       | IR(mA) Max. |       |                 |
|         |            |  |       |   | IF(A) |             | VR(V) |                 |
| VML2    | RBE05AS20A | 20                                     | 0.5   | 0.50                                      | 0.5   | 0.15        | 20    | Single          |
| EMD2    | RBE02SM20A | 20                                     | 0.2   | 0.49                                      | 0.2   | 0.08        | 20    |                 |
|         | RBE05SM20A | 20                                     | 0.5   | 0.53                                      | 0.5   | 0.15        | 20    |                 |
| UMD2    | RBE05VM20A | 20                                     | 0.5   | 0.43                                      | 0.5   | 0.20        | 20    |                 |
|         | RBE07V20A  | 20                                     | 0.7   | 0.49                                      | 0.7   | 0.20        | 20    |                 |
| TUMD2   | RBE1VA20A  | 20                                     | 1.0   | 0.53                                      | 1.0   | 0.20        | 20    |                 |
|         | RBE2VA20A  | 20                                     | 2.0   | 0.46                                      | 2.0   | 0.70        | 20    |                 |
| TUMD2M  | RBE1VAM20A | 20                                     | 1.0   | 0.53                                      | 1.0   | 0.20        | 20    |                 |
|         | RBE2VAM20A | 20                                     | 2.0   | 0.46                                      | 2.0   | 0.70        | 20    |                 |
| TUMD5   | RBE1KA20A  | 20                                     | 0.5   | 0.43                                      | 0.5   | 0.20        | 20    | Parallel 2 chip |
| TSMD5   | RBE2EA20A  | 20                                     | 1.0   | 0.39                                      | 1.0   | 0.70        | 20    |                 |

## Feature

- High power
- Low VF



## PKG



| Package            | Part No.   | Absolute Maximum Ratings |       | Electrical Characteristics (Ta=25°C) |          |                |          |
|--------------------|------------|--------------------------|-------|--------------------------------------|----------|----------------|----------|
|                    |            | VR(V)                    | Io(A) | VF(V)<br>Max.                        | at IF(A) | IR(uA)<br>Max. | at VR(V) |
| DPAK<br>(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<br>(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       |

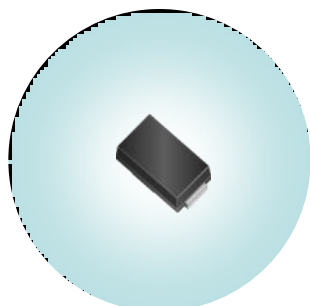
# SBD 90V~150V

| 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    |

# Compact Rectifier Diodes

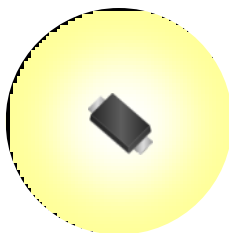
## Feature

Improved performance in the TUMD2S package



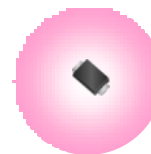
**PMDS (SMA)**  
4526 size

Smaller



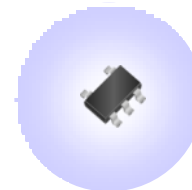
**PMDU (SOD123)**  
2616 size

Smaller



**TUMD2S**  
1913 size

Mixed



**TSMD5 (SOT23-5)**  
2916 size

**NEW**

**NEW**

**NEW**

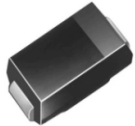
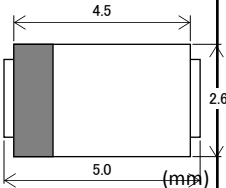

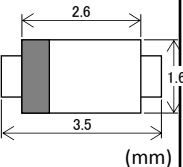
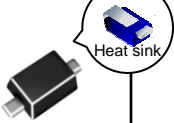
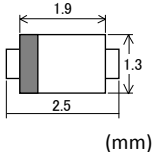

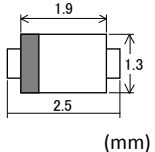

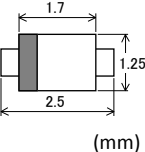

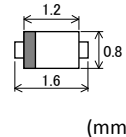

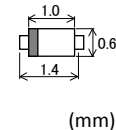

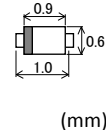

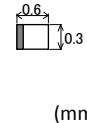

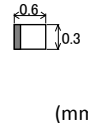

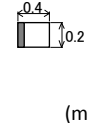
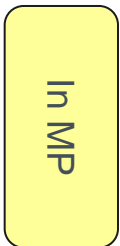

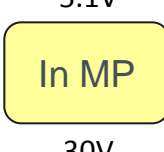

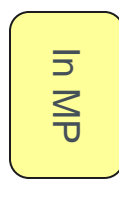
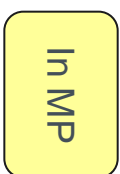

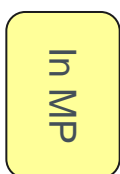
| Part No.                   |        | RR2L4S   | 1SR154-400 | RR264M-400  | RRE07VSM4S | RRE02VSM4S | RRE04EA4D |
|----------------------------|--------|----------|------------|-------------|------------|------------|-----------|
| Absolute maximum ratings   | Io(A)  | 2.0      | 1.0        | 0.7         | 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     |  |

# Zener Diode Line Up

Non automotive grade

| Zener voltage rank | 1W  | 1W   | 0.5W   | 0.5W   | 0.2W   | 0.15W  | 0.1W   | 0.1W   | 0.1W   | 0.1W   | 0.1W   |
|--------------------|---|--|--|--|--|--|--|--|--|--|--|
|                    | PTZ series  | KDZ series   | TDZ series   | TFZ series   | UDZS series<br>UDZV series   | EDZ series<br>EDZV series  | VDZ series   | CDZ Series   | GDZ Series   | SDZ Series   | FDZ Series   |
|                    | <br> | <br> | <br> | <br> | <br> | <br> | <br> | <br> | <br> | <br> | <br> |
|                    | PMDS<br>(4526)  | PMDU<br>(2616)   | TUMD2<br>(1913)  | TUMD2<br>(1913)  | UMD2<br>(1712)   | EMD2<br>(1618)   | VMD2<br>(1416)   | VMN2<br>(1006)   | GMD2<br>(0603)   | SMD0603<br>(0603)  | SMD0402<br>(0402)  |
| 2.0V<br>↑<br>150V  | 2.0V<br><br>51V   | 2.0V<br><br>51V<br>Under Development<br>150V   | 5.1V<br><br>30V   | 2.0V<br><br>39V   | 2.0V<br><br>39V<br>Under development<br>150V   | 2.0V<br><br>36V   | 2.0V<br><br>36V   | 2.0V<br><br>36V   | 3.9V<br>In MP<br>8.2V  | 5.1V<br>8.2V<br>MP: Apr. 2014  | 5.1V<br>8.2V<br>Under development  |

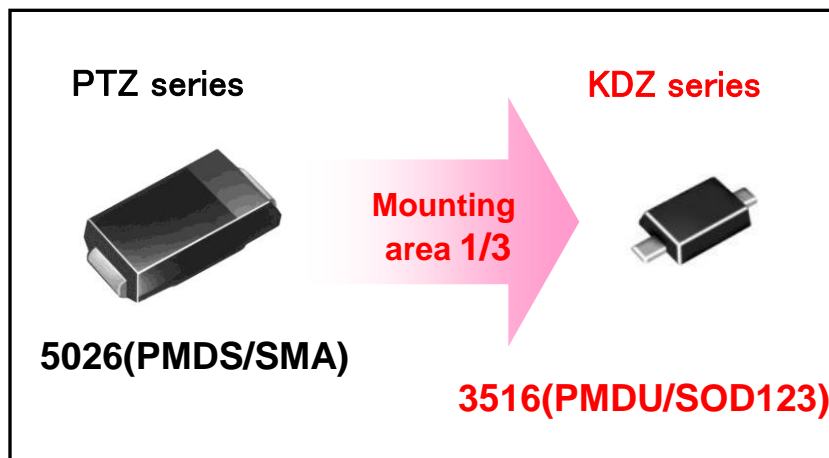




# Compact 1W type Zener Diode

## Feature

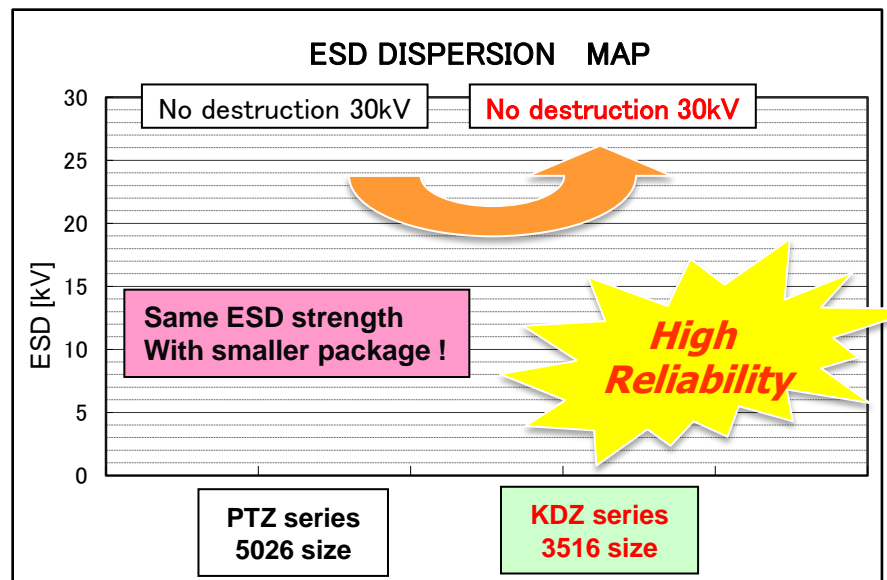
- Guaranteed 1W with the size 3516
- Conventional line-up



## Benefit

- Minimized the size of devices without losing their special characteristics

## Advantage



## Line-up

|         | PTZ series                     | KDZ series                     |
|---------|--------------------------------|--------------------------------|
| Package | PMDS<br>5.0mm × 2.6mm(t=2.0mm) | PMDU<br>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<br><br><b>SOD323F</b><br>(2512size)<br>0.2W | KDZLVseries<br><br><b>SOD123</b><br>(3516size)<br>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       |

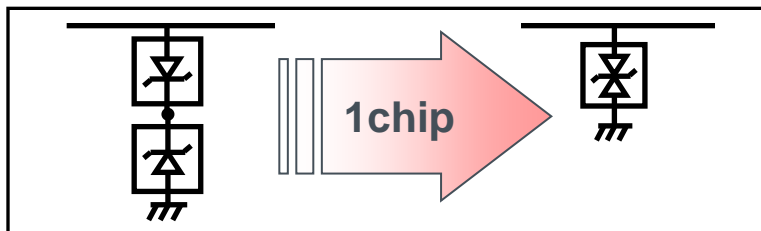


| UDZLV Series<br>PKG : SOD323F (2.5mm x 1.2mm)<br>Power : 0.2W |         |           |         |              | KDZLV Series<br>PKG : SOD123 (3.5mm x 1.6mm)<br>Power : 1.0W |         |          |                             |              |
|---|---------|-----------|---------|--------------|--|---------|----------|-----------------------------|--------------|
| ROHM  | Renesas | VISHAY    | ON SEMI | NXP          | ROHM   | Renesas | VISHAY   | ON Semi                     | NXP          |
| UDZLV51   | RD51S   | BZX384C51 | N/A     | BZX384-B/C51 | KDZLV51  | RD51FS  | BZT52C51 | MMSZ5262BT1G/SZMMSZ5262BT1G | BZT52H-51B/C |
| UDZLV56   | RD56S   | BZX384C56 | N/A     | BZX384-B/C56 | KDZLV56  | RD56FS  | BZT52C56 | MMSZ5263BT1G/SZMMSZ5263BT1G | BZT52H-56B/C |
| UDZLV62   | RD62S   | BZX384C62 | N/A     | BZX384-B/C62 | KDZLV62  | RD62FS  | BZT52C62 | MMSZ5265BT1G/SZMMSZ5265BT1G | BZT52H-62B/C |
| UDZLV68   | RD68S   | BZX384C68 | N/A     | BZX384-B/C68 | KDZLV68  | RD68FS  | BZT52C68 | MMSZ5266BT1G/SZMMSZ5266BT1G | BZT52H-68B/C |
| UDZLV75   | RD75S   | BZX384C75 | N/A     | BZX384-B/C75 | KDZLV75  | RD75FS  | BZT52C75 | MMSZ5267BT1G/SZMMSZ5267BT1G | BZT52H-75B/C |
| UDZLV82   | RD82S   |           | N/A     |              | KDZLV82  | RD82FS  |          | MMSZ5268BT1G/SZMMSZ5268BT1G |              |
| UDZLV91   | RD91S   |           | N/A     |              | KDZLV91  | RD91FS  |          | MMSZ5270BT1G/SZMMSZ5270BT1G |              |
| UDZLV100  | RD100S  |           | N/A     |              | KDZLV100   | RD100FS |          |                             |              |
| UDZLV110  | RD110S  |           | N/A     |              | KDZLV110   | RD110FS |          | MMSZ5272BT1G/SZMMSZ5272BT1G |              |
| UDZLV120  | RD120S  |           | N/A     |              | KDZLV120   | RD120FS |          |                             |              |
| UDZLV130  |         |           | N/A     |              | KDZLV130   |         |          |                             |              |
| UDZLV150  | RD150S  |           | N/A     |              | KDZLV150   |         |          |                             |              |

# Bi-Directional Zener Diode

## Feature

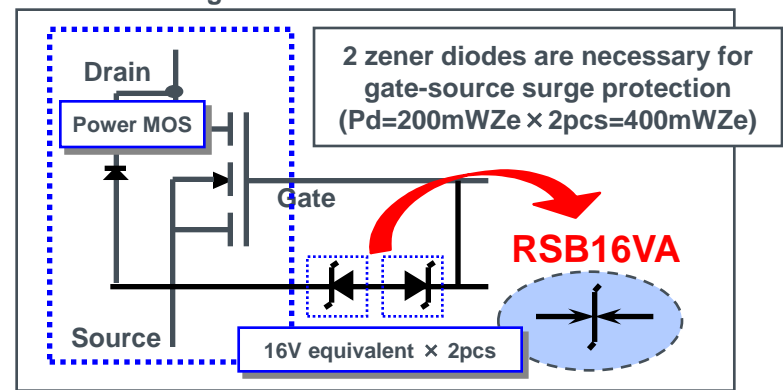
- Deal with bi-directional surge
- Both positive and negative surge protection in 1 chip
- There is  $1.0 \times 0.6$  as a smallest size



## Benefit

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

### Inside of the engine control unit



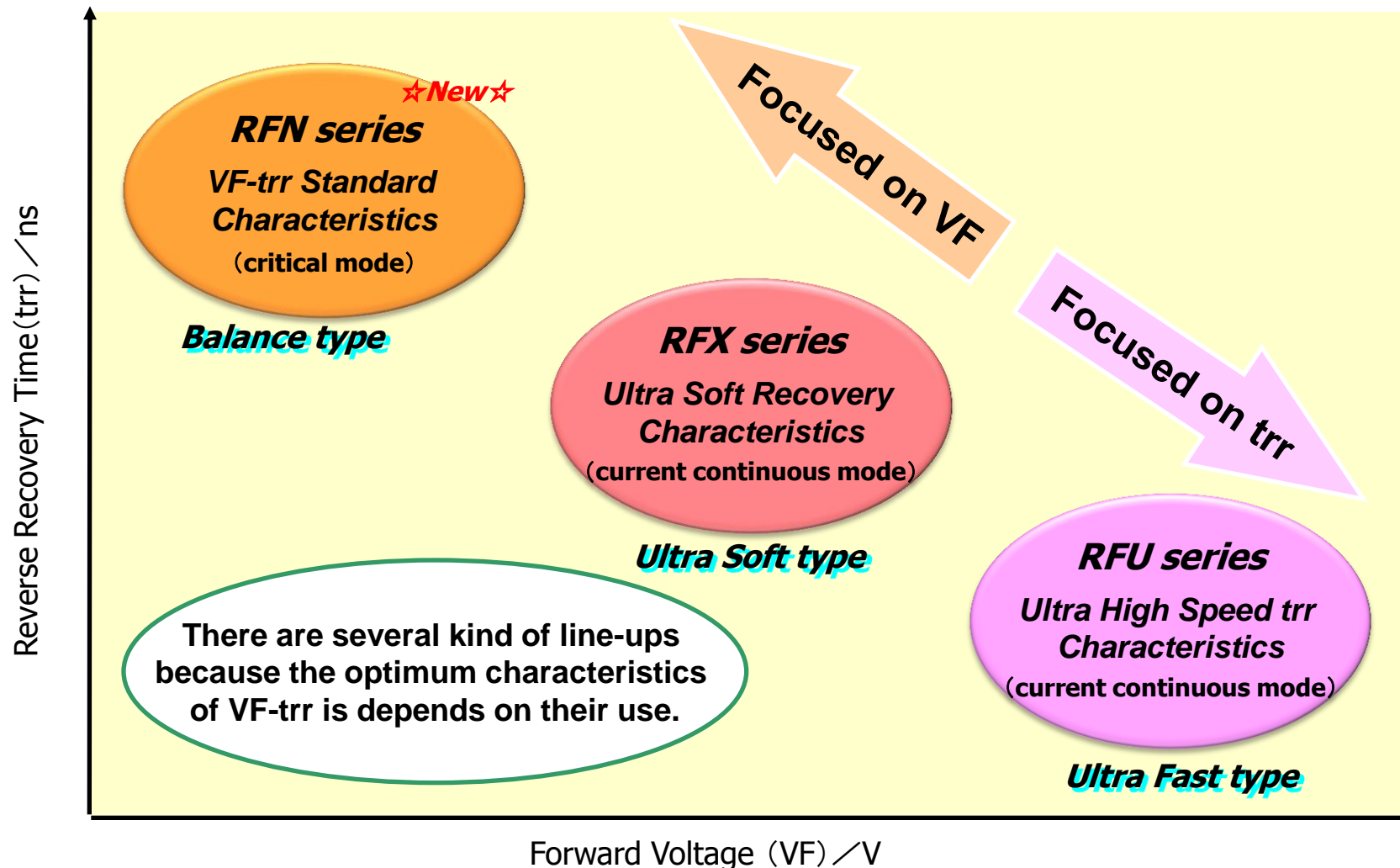
## Evidence

| 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)<br>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)<br>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)<br>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)<br>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)<br>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

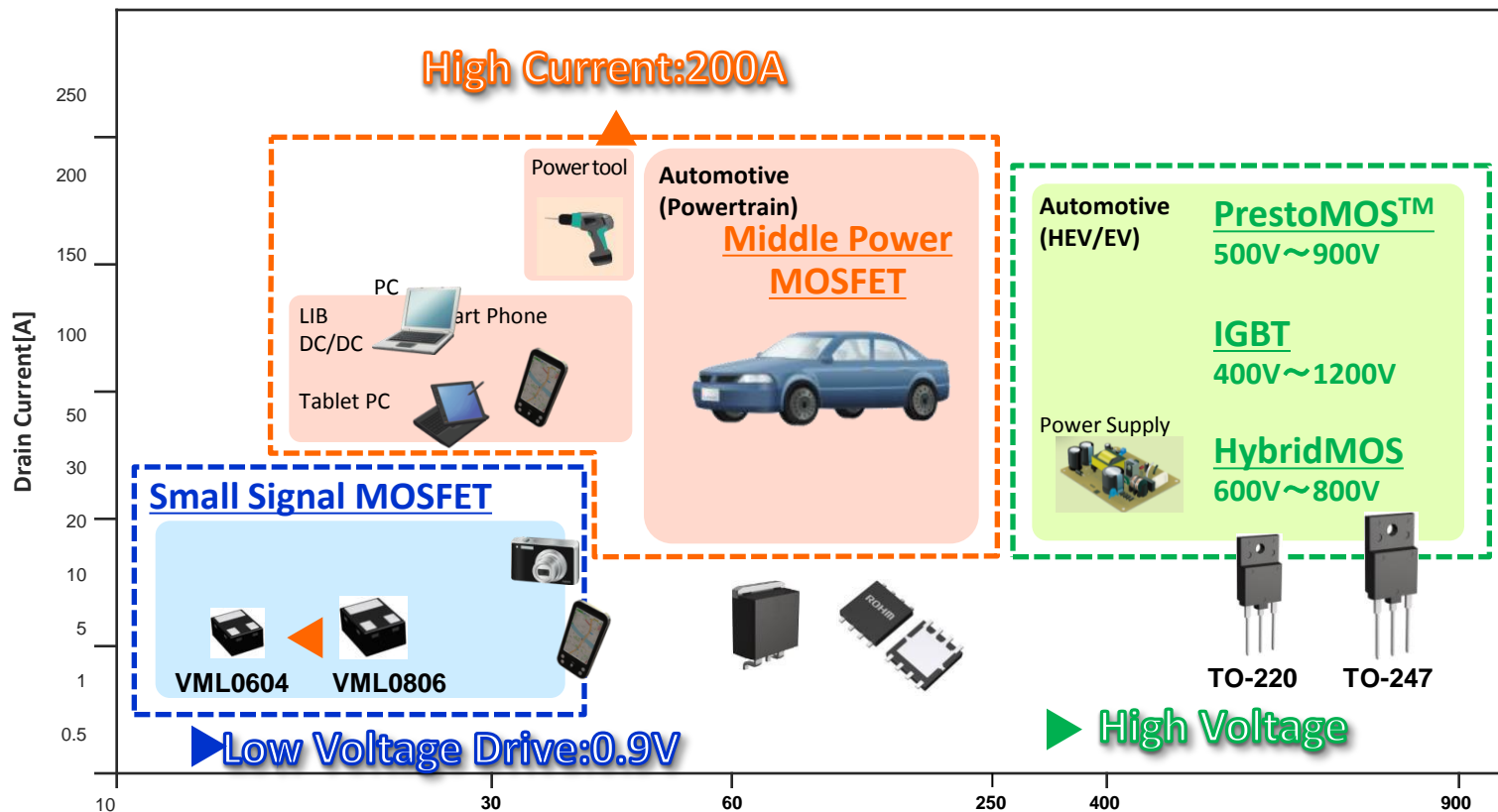
MP started in Dec 2010 that is first in world

## Development strategy

High voltage

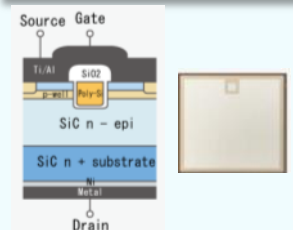
High speed

Low RDS



High Voltage  
High Efficiency

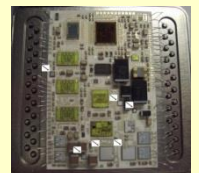
SiC Power Device



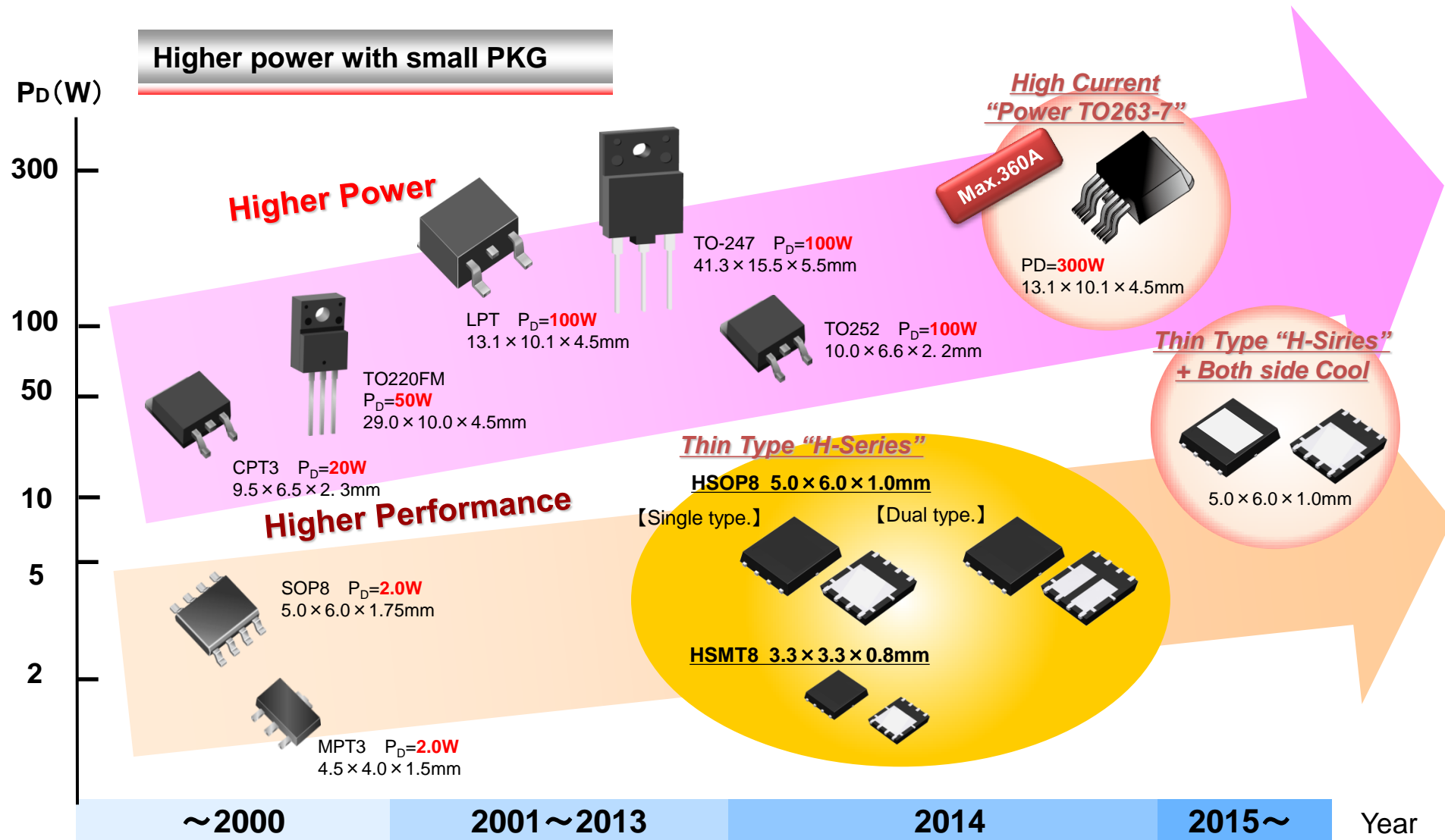
Bare Die Supply

For Transmission

ABS, EPS

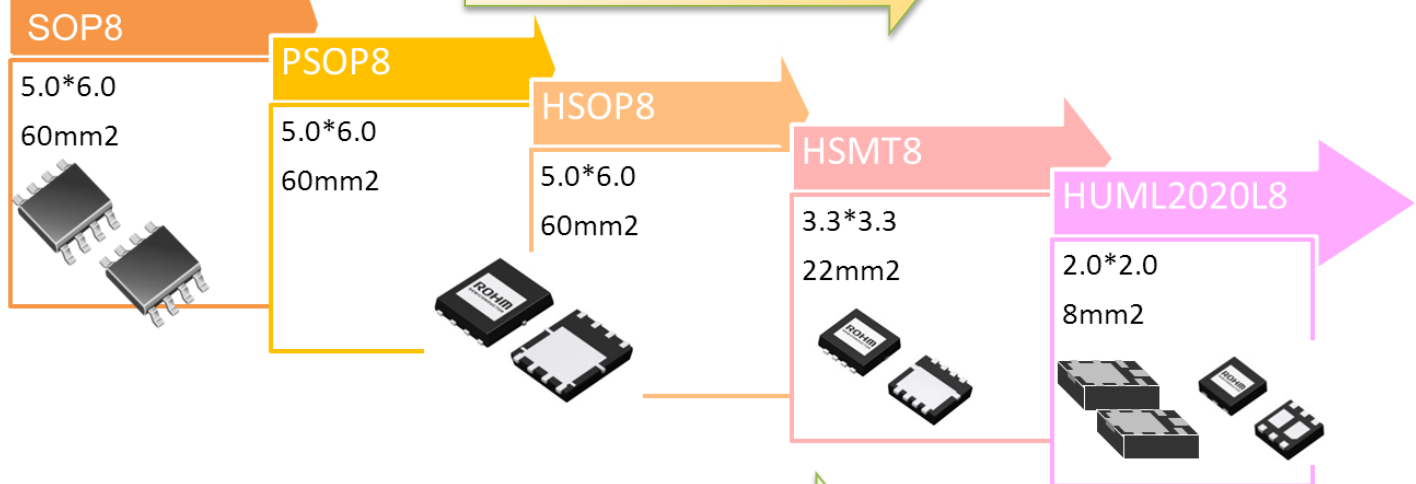


# Transistor Package Trend

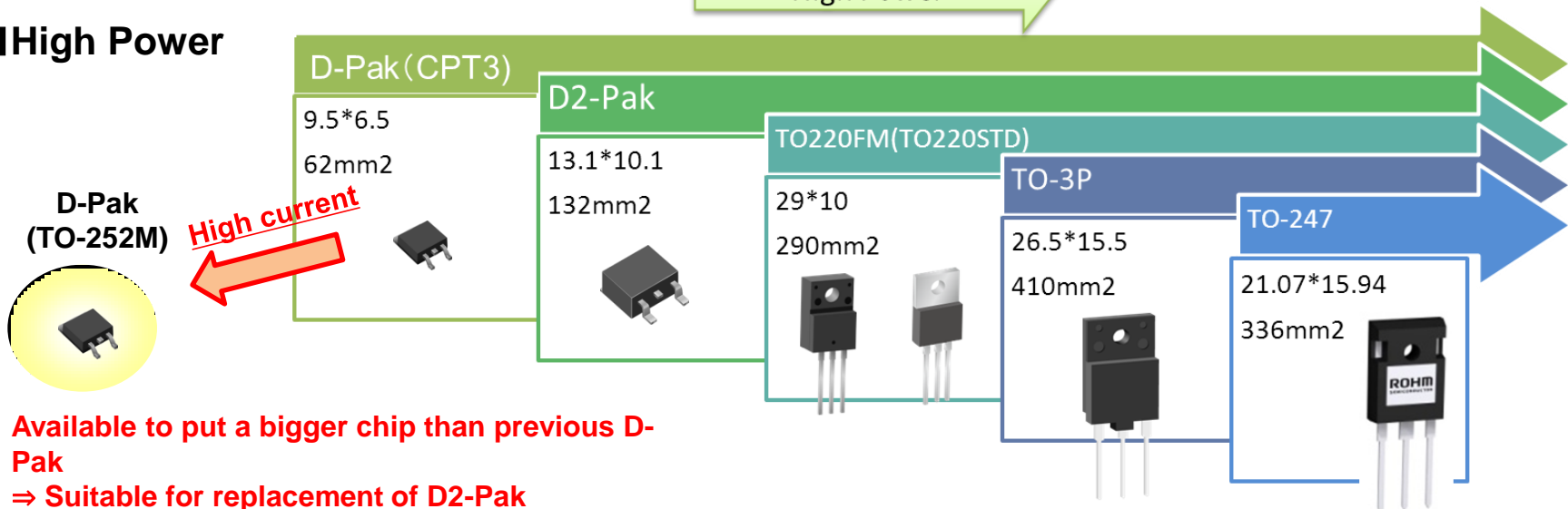


# Package Trend

## ■ Middle power

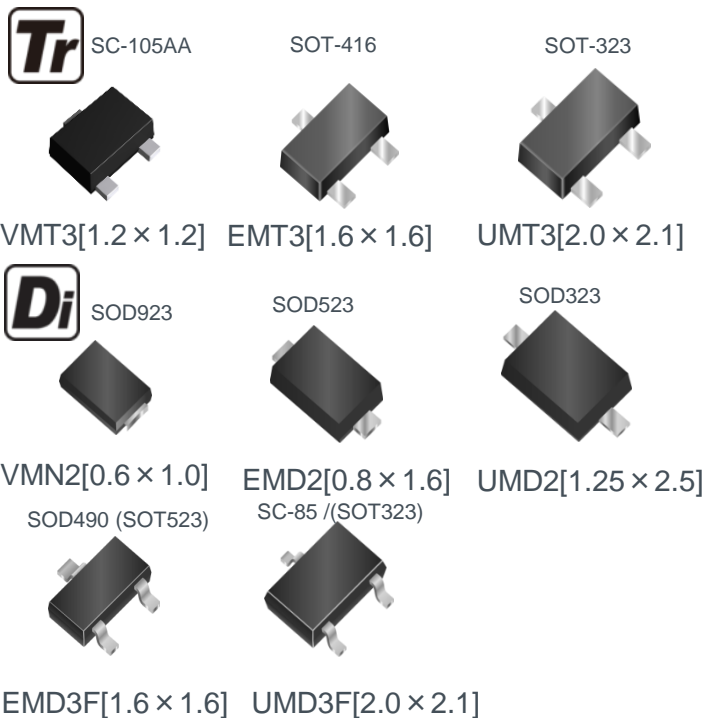


## ■ High Power



# High efficiency production line

## ■ On MP

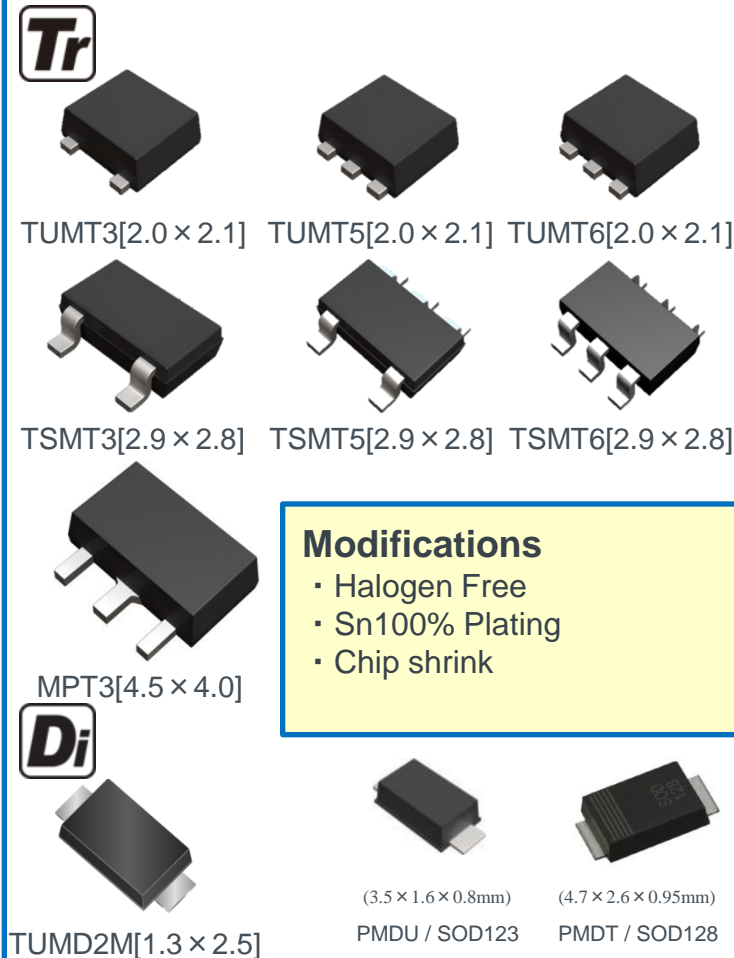


### Modifications

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

**Expand into  
Middle power**

## ■ New Lineup



### Modifications

- Halogen Free
- Sn100% Plating
- Chip shrink



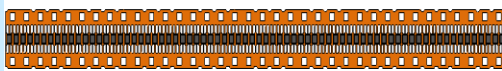
# Small signal flat lead bipolar transistors

# Products to increase competitiveness

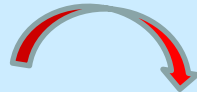
Improvement of productivity , Cost down of materials ...

## ▪ Efficient products line : Wide frame

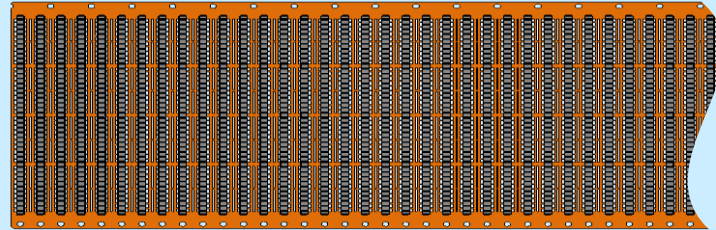
Former single frame



Increase quantitative efficiency  
Decrease scraps

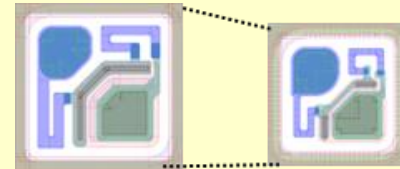


Wide frame



## ▪ 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



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

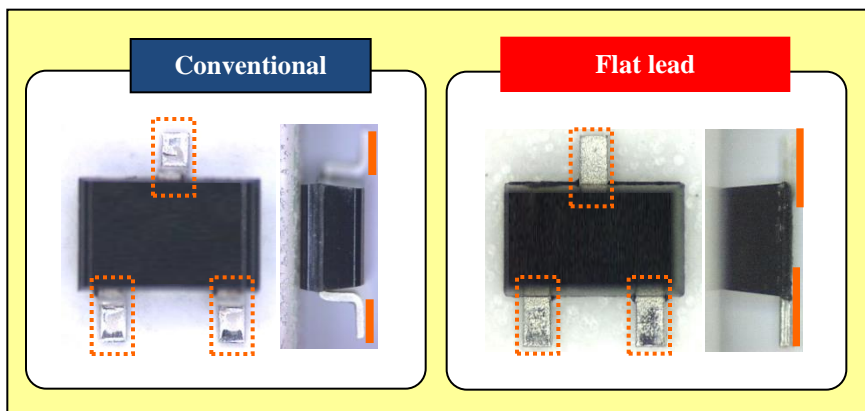
## Feature

- ✓ 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

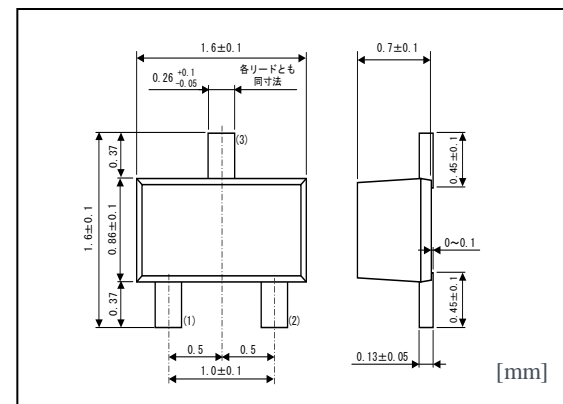
### <Picture>



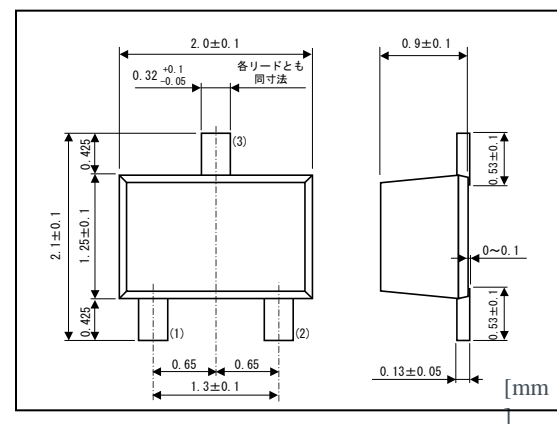
## Benefit

- ✓ Mount efficiency improved

### EMT3F / SC-75A



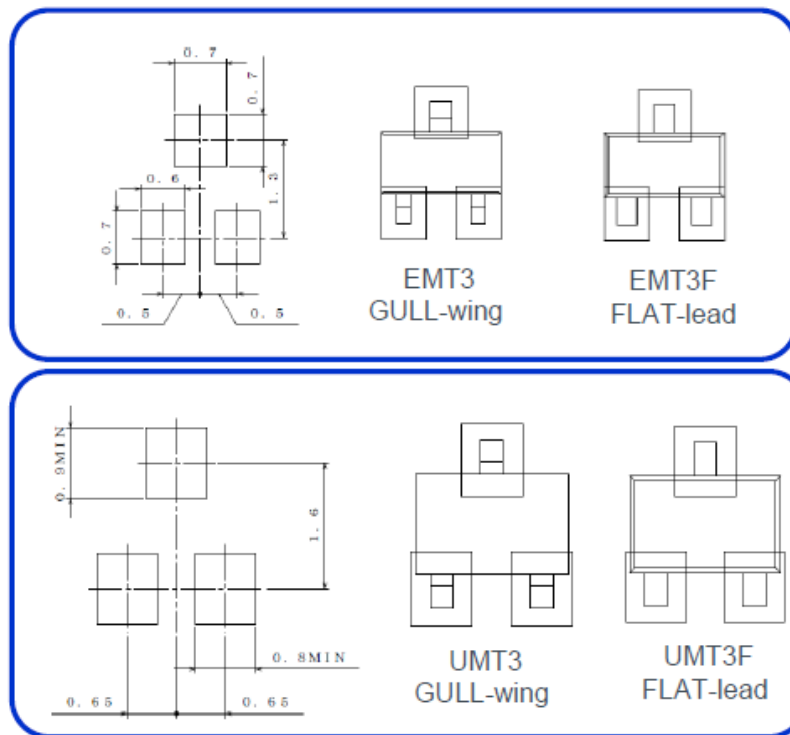
### UMT3F / SOT323



# Small Signal Transistor

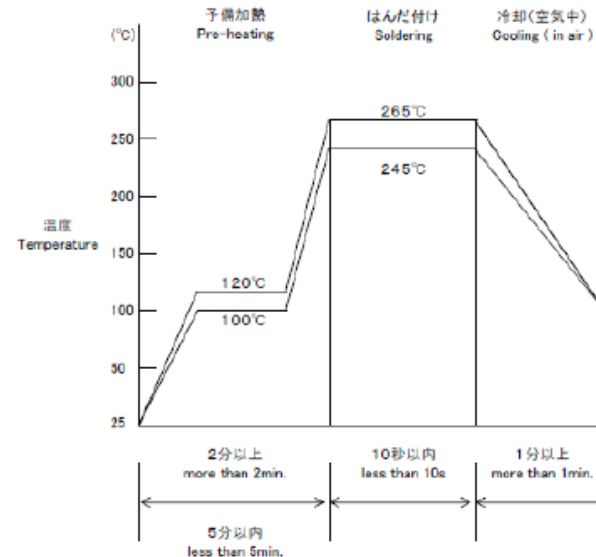
EMT3F, UMT3F FLAT-lead package products are capable of same current GULL-wing package products' mounting process (soldering condition, land pattern etc.).

<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.

# 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  |
|          | —                  | —      |
|          | EMB2               | UMB2N  |
| NPN *2   | EMH10              | UMH10N |
|          | EMH25              | UMH25N |
|          | EMH3               | UMH3N  |
|          | EMH11              | UMH11N |
|          | EMH9               | UMH9N  |
|          | EMH1               | UMH1N  |
|          | EMH2               | UMH2N  |
| NPN+PNP  | 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



# 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

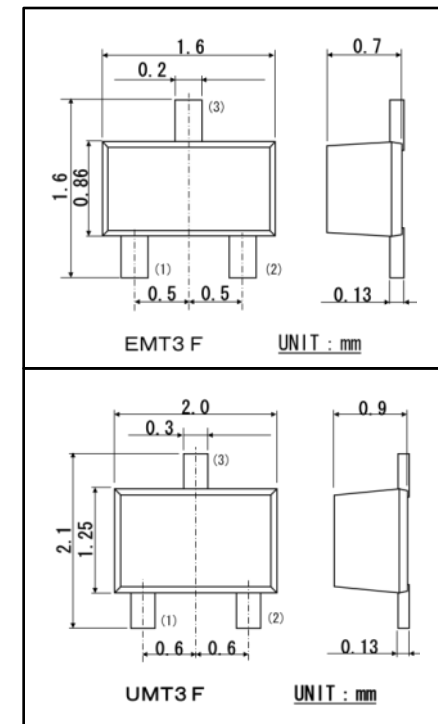
Small Signal  
Bi-polar  
Transistor

| Polarity | UMT3F             | EMT3F             | V <sub>CEO</sub> | I <sub>c</sub> |
|----------|-------------------|-------------------|------------------|----------------|
| 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 <sub>CC</sub> | R <sub>1</sub> /R <sub>2</sub> |
|----------|---------------|---------------|-----------------|--------------------------------|
| 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                    |





# Driver Bipolar transistors

# Bipolar Transistors for driver

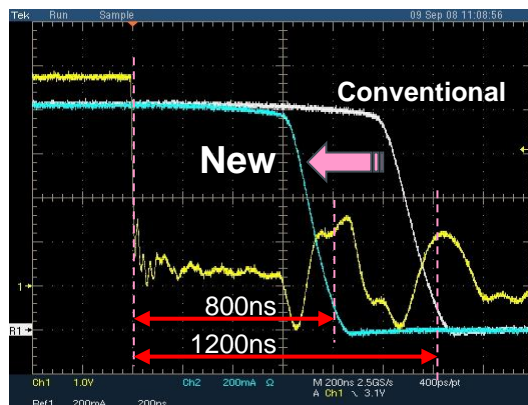
## Features

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

Conventional product : 1,200nsec

→ New product :800nsec

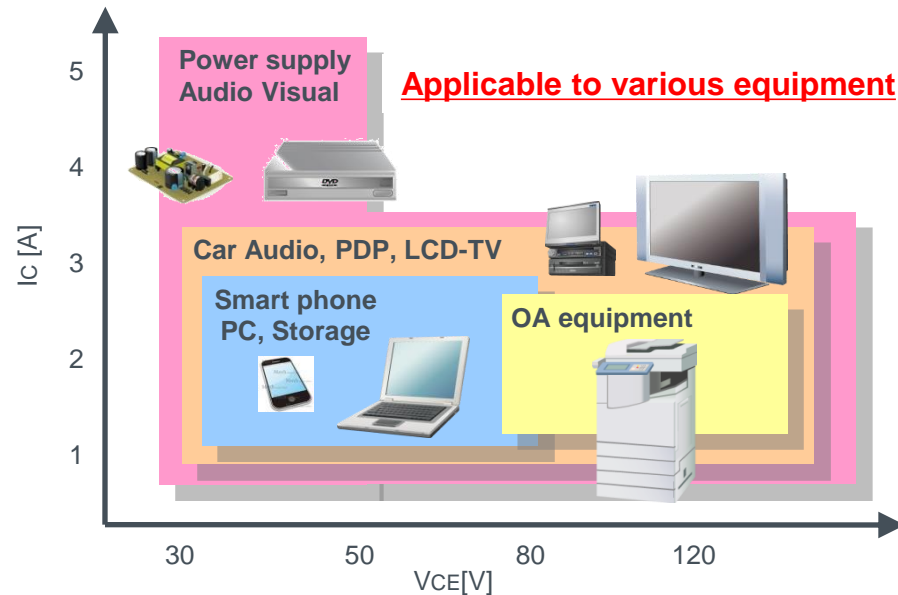
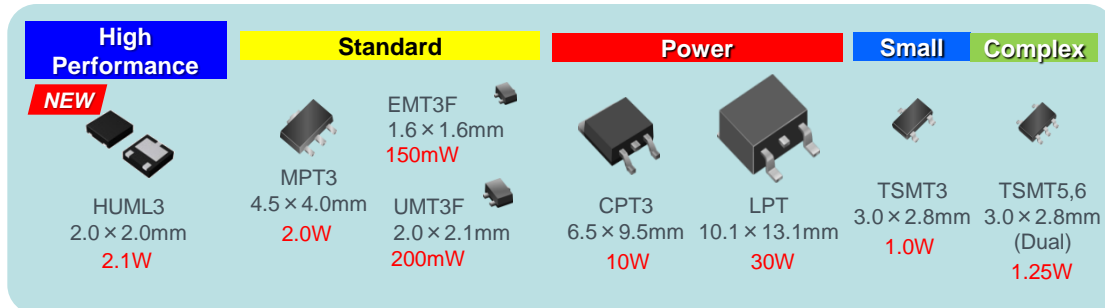
### Switching waveform comparison



**30% faster than conventional products**

4. Reduction of switching loss and thermal radiation.

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

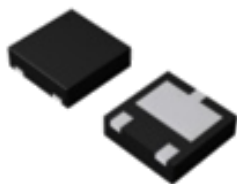




# Bipolar Transistors for driver ① - High performance series -

**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 <sub>CEO</sub> | I <sub>C</sub> | V <sub>CE(sat)</sub> | hFE     |
|----------|----------------------|------------------|----------------|----------------------|---------|
| PNP      | ★2SAR562F3           | −30V             | −6A            | 50mV                 | 200~500 |
|          | <b>NEW</b> 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 -

## Small , Complex series

| Package             | Polarity  | Part No. | V <sub>CEO</sub> | I <sub>C</sub> | hFE     |
|---------------------|-----------|----------|------------------|----------------|---------|
| TSMT3<br>(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<br>(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<br>(SOT-457T) | NPN + PNP | QS6Z5    | 50V              | 1A             | 180~450 |
|                     |           |          | -50V             | -1A            |         |

**Small**



TSMT3  
(SOT-346T)  
3.0 × 2.8 × 0.85mm

1.0W

**Complex**

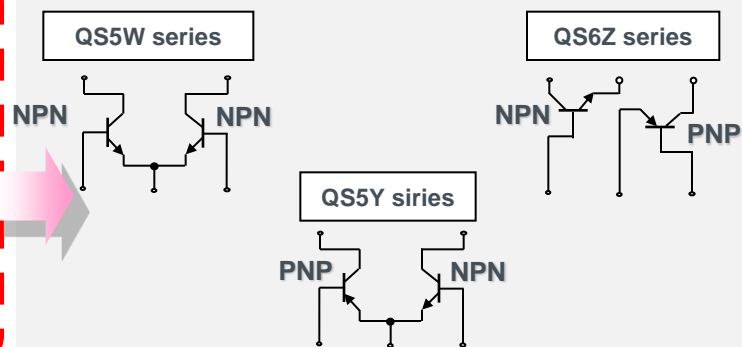


TSMT5,6  
(SOT-25, SOT-457T)  
3.0 × 2.8 × 0.85mm

1.25W

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

## Pin. arrangement



# Bipolar Transistors for driver ③ - Higher cost performance series -

## Higher cost performance series

### PNP

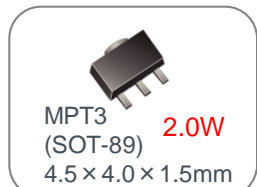
| class |        | Conventional | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-------|--------|--------------|-------------------------|-----------------------|---------|
| (V)   | (A)    |              |                         |                       |         |
| 30    | 1      | 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 |

### NPN

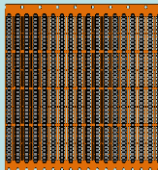
| class |     | Conventional | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-------|-----|--------------|-------------------------|-----------------------|---------|
| (V)   | (A) |              |                         |                       |         |
| 30    | 1   | 2SD1664      | 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<br>(Cu Wire) | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-----|--------------------------|-------------------------|-----------------------|---------|
| NEW | 2SAR293P5                | -30                     | -1                    | 270~680 |
|     | ★2SAR512P5               |                         | -2                    | 200~500 |
|     | ★2SAR552P5               |                         | -3                    |         |
|     | ★2SAR513P5               | -50                     | -1                    | 180~450 |
| NEW | 2SAR553P5                |                         | -1                    |         |
|     | ★2SAR533P5               |                         | -3                    |         |
|     | ★2SAR514P5               | -80                     | -0.7                  | 120~390 |
| NEW | ★2SAR554P5               |                         | -1.5                  |         |
|     | ★2SAR544P5               |                         | -2.5                  |         |

|     | New Product<br>(Cu Wire) | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-----|--------------------------|-------------------------|-----------------------|---------|
| NEW | 2SCR293P5                | 30                      | 1                     | 270~680 |
|     | ★2SCR512P5               |                         | 2                     | 200~500 |
|     | ★2SCR552P5               |                         | 3                     |         |
|     | ★2SCR513P5               | 50                      | 1                     | 180~450 |
| NEW | 2SCR553P5                |                         | 2                     |         |
|     | ★2SCR533P5               |                         | 3                     |         |
|     | ★2SCR514P5               | 80                      | 0.7                   | 120~390 |
|     | ★2SCR554P5               |                         | 1.5                   |         |
|     | ★2SCR544P5               |                         | 2.5                   |         |
|     | ★2SCR372P5               | 120                     | 0.7                   | 120~390 |
|     | ★2SCR375P5               |                         | 1.5                   |         |

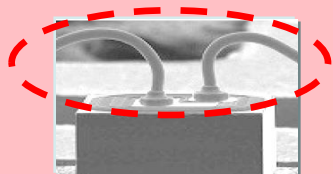


Improving productivity by wider-frame



- higher productivity
- reduction of material losses

Reduction of material cost



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

★: 開発中  
(DS OK)

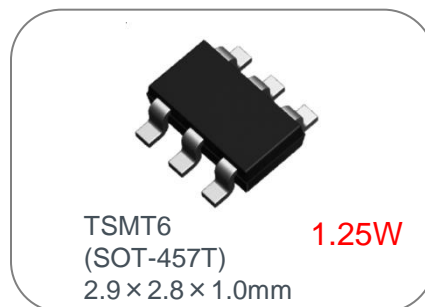
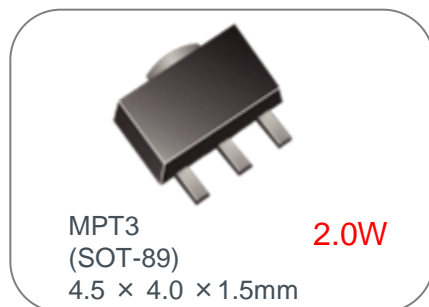
## High voltage series

### ●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 | $V_{CEO}$<br>(V) | $I_C$<br>(A) | hFE    |
|-------|-----|--------------|------------------|--------------|--------|
| (V)   | (A) |              |                  |              |        |
| 400   | 0.1 | 2SA1759      | -400             | -0.1         | 82~180 |
|       |     | 2SC4505      | 400              | 0.1          | 56~270 |



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

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

# Bipolar Transistors for driver ⑤ - Power series -

## Power series

1. High power dissipation : 10W~30W

2. Applicable for “Automotives”.



### PNP

| class |     | Conventional   | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-------|-----|----------------|-------------------------|-----------------------|---------|
| (V)   | (A) |                |                         |                       |         |
| 30V   | 5A  | <b>2SB1412</b> | -30                     | -5                    | 120~390 |
| 50V   | 3A  | <b>2SB1184</b> | -50                     | -3                    | 120~390 |
| 60V   | 5A  | <b>2SA1952</b> | -60                     | -5                    | 120~270 |
| 80V   | 2A  | <b>2SB1181</b> | -80                     | -1                    | 120~390 |

**NEW**

| New Product      | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|------------------|-------------------------|-----------------------|---------|
| <b>2SAR572D</b>  | -30                     | -5                    | 200~500 |
| <b>2SAR573D</b>  | -50                     | -3                    | 180~450 |
| <b>2SAR574D</b>  | -80                     | -2                    | 120~390 |
| <b>★2SAR586D</b> | -80                     | -5                    | 120~390 |

★:DS 2015/2

### NPN

| class |     | Conventional   | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-------|-----|----------------|-------------------------|-----------------------|---------|
| (V)   | (A) |                |                         |                       |         |
| 30V   | 5A  | <b>2SD2118</b> | 20                      | 5                     | 120~390 |
| 50V   | 3A  | <b>2SD1760</b> | 50                      | 3                     | 120~390 |
| 60V   | 5A  | <b>2SC5103</b> | 60                      | 5                     | 120~270 |
| 80V   | 1A  | <b>2SD1733</b> | 80                      | 1                     | 120~390 |

**NEW**

| New Product      | V <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|------------------|-------------------------|-----------------------|---------|
| <b>2SCR572D</b>  | 30                      | 5                     | 200~500 |
| <b>2SCR573D</b>  | 50                      | 3                     | 180~450 |
| <b>2SCR574D</b>  | 80                      | 2                     | 120~390 |
| <b>★2SCR586D</b> | 80                      | 5                     | 120~390 |

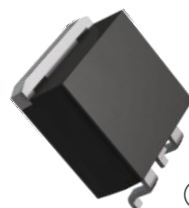
★:DS 2015/2



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 <sub>CEO</sub><br>(V) | I <sub>C</sub><br>(A) | hFE     |
|-----------------|-------------------------|-----------------------|---------|
| <b>2SB1644J</b> | -80                     | -4                    | 100~320 |



# 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  |

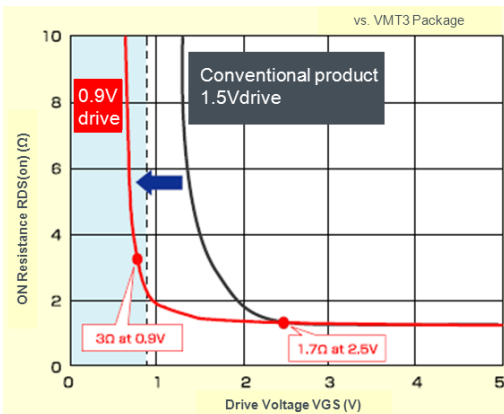
# ECOMOS™ Series

## ■ Features

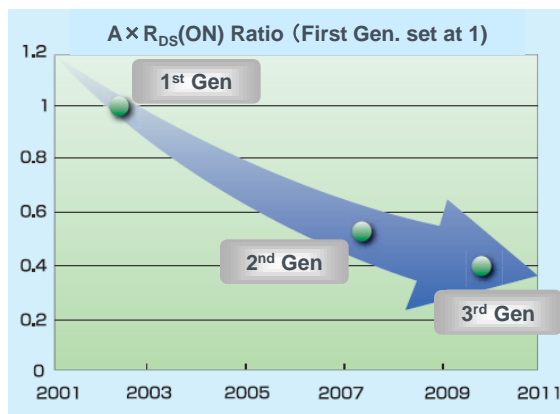
- Low voltage drive (0.9V, 1.2V, 1.5V, 1.8V)
- Drive loss reduced 90%
- Low ON resistance
- Wide voltage lineup : 12V to 60V
- Abundant package lineup : VMT3(1.2 × 1.2mm) to TSMT8(2.8 × 3.0mm)



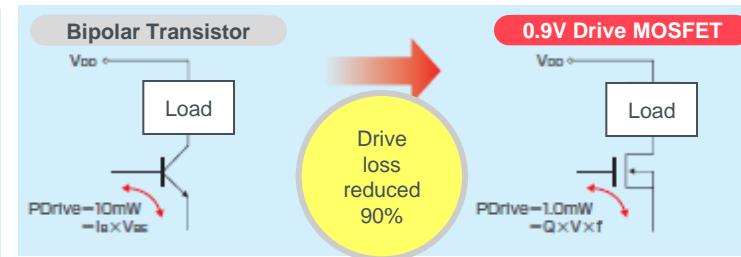
## ■ R<sub>DS(on)</sub> Comparison



## ■ Process Trend



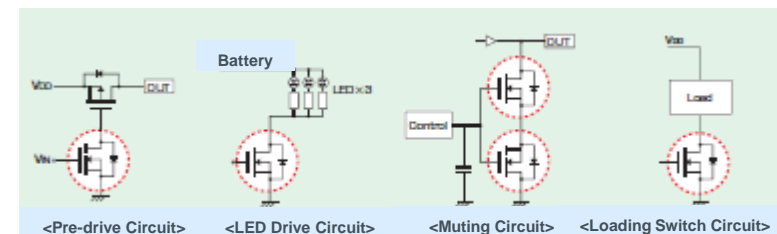
## ■ 0.9V Drive loss comparison



## ■ Application

- Mobile phones, Smart phones
- Digital SLRs, Digital Cameras
- Digital Book, Portable Audio

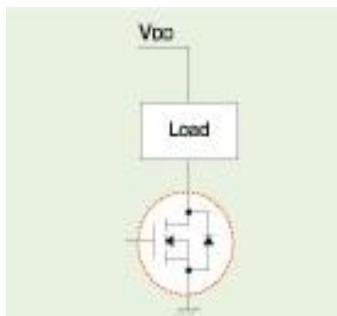
## ■ The example of an application circuit



# ECOMOS™ Series (1)

## ROHM PKG Trend

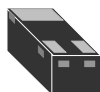
### Loading switch



VML1006

1.0\*0.6\*0.37mm

$P_D = 0.1W$



VML0806

0.8\*0.6\*0.37mm

$P_D = 0.1W$



VML0604

0.6\*0.4\*0.35mm

$P_D = 0.1W$



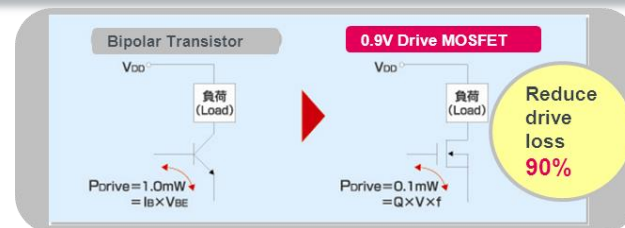
| Package | Part.No    | Polarity (ch) | VDSS(V) | ID(A) | PD(W) | RDS(on) Typ.(Ω) |      |      |       |     |      | Drive Voltage (V) |
|---------|------------|---------------|---------|-------|-------|-----------------|------|------|-------|-----|------|-------------------|
|         |            |               |         |       |       | VGS(V)          |      |      |       |     |      |                   |
|         |            |               |         |       |       | 0.9             | 1.2  | 1.5  | 2.5   | 4   | 4.5  |                   |
| VML0604 | ☆RV3J001YN | N             | 50      | 0.1   | 0.1   | 11.3            | 8.25 | 7.5  | 6.375 | —   | 5.6  | 0.9               |
|         | ☆RV3C002UN | N             | 20      | 0.15  | 0.1   | —               | 3.8  | 2.7  | 2.2   | 1.7 | 1.4  | 1.2               |
|         | ☆RV3C001ZP | P             | -20     | -0.1  | 0.1   | —               | 10   | 6    | 4.8   | 3.4 | 2.5  | 1.2               |
| VML0806 | ☆RV1J001YN | N             | 50      | 0.1   | 0.1   | 11.3            | 8.3  | 7.5  | 6.4   | —   | 5.6  | 0.9               |
|         | RV1C002UN  | N             | 20      | 0.15  | 0.1   | —               | 4    | 2.5  | 1.5   | —   | 1.2  | 1.2               |
|         | RV1C001ZP  | P             | -20     | -0.1  | 0.1   | —               | 10   | 6    | 4.8   | 3.4 | 2.5  | 1.2               |
| VML1006 | ☆RV2J002YN | N             | 50      | 0.2   | 0.1   | 3               | 2.2  | 2    | 1.7   | —   | 1.6  | 0.9               |
|         | ☆RV2C010UN | N             | 20      | 1     | 0.1   | —               | 0.75 | 0.53 | 0.34  | —   | 0.28 | 1.2               |
|         | ☆RV2C003UN | N             | 20      | 0.2   | 0.1   | —               | 1.6  | —    | 0.8   | —   | —    | 1.2               |
|         | ☆RV2C002UN | N             | 20      | 0.18  | 0.1   | —               | 3.8  | 2.7  | 2.2   | 1.7 | 1.4  | 1.2               |
|         | ☆RV2C007ZP | P             | -20     | -0.7  | 0.1   | —               | 1.7  | —    | 0.7   | —   | 0.6  | 1.2               |
|         | ☆RV2C002ZP | P             | -20     | -0.2  | 0.1   | —               | 2.4  | —    | 1     | —   | 0.8  | 1.2               |
|         | ☆RV2C001ZP | P             | -20     | -0.1  | 0.1   | —               | 10   | 6    | 4.8   | 3.4 | 2.5  | 1.2               |
| VMT3    | RYM002N05  | N             | 50      | 0.2   | 0.15  | 3               | 2.2  | 2    | 1.7   | —   | 1.6  | 0.9               |
|         | RUM001L02  | N             | 20      | 0.1   | 0.15  | —               | 6    | 4.5  | 3.8   | 3   | 2.5  | 1.2               |
|         | RUM002N02  | N             | 20      | 0.2   | 0.15  | —               | 1.6  | —    | 0.8   | —   | —    | 1.2               |
|         | RUM002N05  | N             | 50      | 0.2   | 0.15  | —               | 2.4  | —    | 1.7   | —   | 1.6  | 1.2               |
|         | RZM001P02  | P             | -20     | -0.1  | 0.15  | —               | 10   | 6    | 4.8   | 3.4 | 2.5  | 1.2               |
|         | RZM002P02  | P             | -20     | -0.2  | 0.15  | —               | 2.4  | —    | 1     | —   | 0.8  | 1.2               |

☆開発中



# ECOMOS™ Series (2)

## Advantage



| Package | Part.No   | Polarity<br>(ch) | VDSS(V) | ID(A) | PD(W) | RDS(on) Typ.(Ω) |     |     |     |     |     | Drive<br>Voltage<br>(V) |
|---------|-----------|------------------|---------|-------|-------|-----------------|-----|-----|-----|-----|-----|-------------------------|
|         |           |                  |         |       |       | VGS(V)          |     |     |     |     |     |                         |
|         |           |                  |         |       |       | 0.9             | 1.2 | 1.5 | 2.5 | 4   | 4.5 |                         |
| EMT3F   | RE1C002UN | N                | 20      | 0.2   | 0.15  | —               | 1.6 | —   | 0.8 | —   | —   | 1.2                     |
|         | RE1C001UN | N                | 20      | 0.1   | 0.15  | —               | 6   | 4.5 | 3.8 | 3   | 2.5 | 1.2                     |
|         | RE1C002ZP | P                | -20     | -0.2  | 0.15  | —               | 2.4 | —   | 1   | —   | 0.8 | 1.2                     |
|         | RE1C001ZP | P                | -20     | -0.1  | 0.15  | —               | 10  | 6   | 4.8 | 3.4 | 2.5 | 1.2                     |
| UMT3F   | RU1C002UN | N                | 20      | 0.2   | 0.2   | —               | 1.6 | —   | 0.8 | —   | —   | 1.2                     |
|         | RU1C001UN | N                | 20      | 0.1   | 0.2   | —               | 6   | 4.5 | 3.8 | 3   | 2.5 | 1.2                     |
|         | RU1C001ZP | P                | -20     | -0.1  | 0.15  | —               | 10  | 6   | 4.8 | 3.4 | 2.5 | 1.2                     |
|         | RU1C002ZP | P                | -20     | -0.2  | 0.15  | —               | 2.4 | —   | 1   | —   | 0.8 | 1.2                     |
|         | RE1J002YN | N                | 50      | 0.2   | 0.15  | 3               | 2.2 | 2   | 1.7 | —   | 1.6 | 0.9                     |
|         | RU1J002YN | N                | 50      | 0.2   | 0.2   | 3               | 2.2 | 2   | 1.7 | —   | 1.6 | 0.9                     |
| SST3    | RUC002N05 | N                | 50      | 0.2   | 0.2   | —               | 2.4 | —   | 1.7 | —   | 1.6 | 1.2                     |
|         | RYC002N05 | N                | 50      | 0.2   | 0.2   | 3               | 2.2 | 2   | 1.7 | —   | 1.6 | 0.9                     |
| VMT6    | VT6K1     | N+N              | 20      | 0.1   | 0.15  | —               | 6   | 4.5 | 3.8 | 3   | 2.5 | 1.2                     |
|         | VT6J1     | P+P              | -20     | -0.1  | 0.15  | —               | 10  | 6   | 4.8 | 3.4 | 2.5 | 1.2                     |
|         | VT6M1     | N                | 20      | 0.1   | 0.15  | —               | 6   | 4.5 | 3.8 | 3   | 2.5 | 1.2                     |
|         |           | P                | -20     | -0.1  | 0.15  | —               | 10  | 6   | 4.8 | 3.4 | 2.5 | 1.2                     |
| EMT6    | EM6K7     | N                | 20      | 0.2   | 0.15  | —               | 1.6 | —   | 0.8 | —   | —   | 1.2                     |
|         | EM6K33    | N                | 50      | 0.2   | 0.15  | —               | 2.4 | —   | 1.7 | —   | 1.6 | 1.2                     |
|         | EM6J1     | P+P              | -20     | -0.2  | 0.15  | —               | 2.4 | —   | 1   | —   | 0.8 | 1.2                     |
|         | EM6M2     | N                | 20      | 0.2   | 0.15  | —               | 1.6 | —   | 0.8 | 0.7 | —   | 1.2                     |
|         |           | P                | -20     | -0.2  | 0.15  | —               | 2.4 | —   | 1   | —   | 0.8 | 1.2                     |
|         | EM6K34    | N+N              | 50      | 0.2   | 0.15  | 3               | 2.2 | 2   | 1.7 | —   | 1.6 | 0.9                     |
| UMT6    | UM6K33N   | N                | 50      | 0.2   | 0.15  | —               | 2.4 | —   | 1.7 | —   | 1.6 | 1.2                     |
|         | UM6K34N   | N+N              | 50      | 0.2   | 0.15  | 3               | 2.2 | 2   | 1.7 | —   | 1.6 | 0.9                     |

# ECOMOS™ Series (3)

| Package    | Part. No   | Polarity<br>(ch) | VDSS (V) | ID (A) | PD (W) | RDS(on) Typ. (Ω) |     |    |     |    | Drive<br>Voltage<br>(V) |
|------------|------------|------------------|----------|--------|--------|------------------|-----|----|-----|----|-------------------------|
|            |            |                  |          |        |        | VGS (V)          |     |    |     |    |                         |
|            |            |                  |          |        |        | 1.5              | 2.5 | 4  | 4.5 | 10 |                         |
| WEMT6      | RW1C015UN  | N                | 20       | 1.5    | 0.7    | 300              | 170 | —  | 130 | —  | 1.5                     |
|            | RW1A030AP  | P                | −12      | −3     | 0.7    | 75               | 40  | —  | 30  | —  | 1.5                     |
|            | RW1A025AP  | P                | −12      | −2.5   | 0.7    | 90               | 55  | —  | 44  | —  | 1.5                     |
|            | RW1A020ZP  | P                | −12      | −2     | 0.7    | 200              | 105 | —  | 75  | —  | 1.5                     |
|            | RW1A013ZP  | P                | −12      | −1.3   | 0.7    | 530              | 280 | —  | 190 | —  | 1.5                     |
|            | RW1C025ZP  | P                | −20      | −2.5   | 0.7    | 120              | 65  | —  | 48  | —  | 1.5                     |
|            | RW1C026ZP  | P                | −20      | −2.5   | 0.7    | 100              | 65  | —  | 50  | —  | 1.5                     |
|            | ES6U2      | N+SBD (0.5A)     | 20       | 1.5    | 0.8    | 300              | 170 | —  | 130 | —  | 1.5                     |
|            | ES6U1      | P+SBD (0.5A)     | −12      | −1.3   | 0.8    | 530              | 280 | —  | 190 | —  | 1.5                     |
| HUML2020L8 | RF4C050AP  | P                | −20      | −5     | 2      | 32               | 22  | 18 | —   | —  | 1.5                     |
|            | ☆RF4C030AP | P                | −20      | −3     | 2      | 75               | 55  | 45 | —   | —  | 1.5                     |
|            | ☆RF4A060AP | P                | −12      | −6     | 2      | 23               | 19  | 15 | —   | —  | 1.5                     |
|            | ☆RF4A035AP | P                | −12      | −3.5   | 2      | 50               | 41  | 31 | —   | —  | 1.5                     |
|            | ☆UT6J3     | P+P              | −20      | −3     | 2      | 85               | 70  | 60 | —   | —  | 1.5                     |
| TUMT3      | RUF025N02  | N                | 20       | 2.5    | 0.8    | 80               | 49  | —  | 39  | —  | 1.5                     |
|            | RUF020N02  | N                | 20       | 2      | 0.8    | 170              | 95  | —  | 75  | —  | 1.5                     |
|            | RAF040P01  | P                | −12      | −4     | 0.8    | 40               | 27  | —  | 22  | —  | 1.5                     |
|            | RZF030P01  | P                | −12      | −3     | 0.8    | 72               | 39  | —  | 28  | —  | 1.5                     |
|            | RZF020P01  | P                | −12      | −2     | 0.8    | 200              | 105 | —  | 75  | —  | 1.5                     |
|            | RZF013P01  | P                | −12      | −1.3   | 0.8    | 530              | 280 | —  | 190 | —  | 1.5                     |
|            | RUF015N02  | N                | 20       | 1.5    | 0.8    | 220*1            | 170 | —  | 130 | —  | 1.8                     |
| TUMT6      | RUL035N02  | N                | 20       | 3.5    | 1      | 66               | 38  | —  | 31  | —  | 1.5                     |
|            | RAL045P01  | P                | −12      | −4.5   | 1      | 50               | 28  | —  | 22  | —  | 1.5                     |
|            | RAL035P01  | P                | −12      | −3.5   | 1      | 75               | 40  | —  | 30  | —  | 1.5                     |
|            | RAL025P01  | P                | −12      | −2.5   | 1      | 90               | 55  | —  | 44  | —  | 1.5                     |
|            | US6J12     | P+P              | −12      | −2     | 1      | 200              | 105 | —  | 75  | —  | 1.5                     |
|            | US6J11     | P+P              | −12      | −1.3   | 1      | 530              | 280 | —  | 190 | —  | 1.5                     |
|            | US6K4      | N+N              | 20       | 1.5    | 1      | 220*1            | 170 | —  | 130 | —  | 1.8                     |
|            | US6M11     | N                | 20       | 1.5    | 1      | 300              | 170 | —  | 130 | —  | 1.5                     |

☆開発中

# ECOMOS™ Series (4)

| Package | Part.No    | Polarity (ch) | VDSS(V) | ID(A) | PD(W) | RDS(on) Typ.(Ω) |     |    |     |     | Drive Voltage (V) |
|---------|------------|---------------|---------|-------|-------|-----------------|-----|----|-----|-----|-------------------|
|         |            |               |         |       |       | VGS(V)          |     |    |     |     |                   |
|         |            |               |         |       |       | 1.5             | 2.5 | 4  | 4.5 | 10  |                   |
| TSST8   | RT1C060UN  | N             | 20      | 6     | 1.25  | 33              | 24  | —  | 20  | —   | 1.5               |
|         | TT8K1      | N+N           | 20      | 2.5   | 1.25  | 100             | 65  | —  | 52  | —   | 1.5               |
|         | RT1A060AP  | P             | -12     | -6    | 1.25  | 27              | 17  | —  | 14  | —   | 1.5               |
|         | RT1A050ZP  | P             | -12     | -5    | 1.25  | 48              | 26  | —  | 19  | —   | 1.5               |
|         | RT1A045AP  | P             | -12     | -4.5  | 1.25  | 50              | 28  | —  | 22  | —   | 1.5               |
|         | TT8J11     | P+P           | -12     | -3.5  | 1.25  | 75              | 41  | —  | 31  | —   | 1.5               |
|         | TT8J13     | P+P           | -12     | -2.5  | 1.25  | 90              | 55  | —  | 44  | —   | 1.5               |
|         | TT8J21     | P+P           | -20     | -2.5  | 1.25  | 140             | 68  | —  | 49  | —   | 1.5               |
|         | TT8M1      | N             | 20      | 2.5   | 1.25  | 100             | 65  | —  | 52  | —   | 1.5               |
|         |            | P             | -20     | -2.5  | 1.25  | 140             | 68  | —  | 49  | —   | 1.5               |
| TT8M3   | N          | 20            | 2.5     | 1.25  | 100   | 65              | —   | 52 | —   | 1.5 |                   |
|         | P          | -20           | -2.4    | 1.25  | 180   | 105             | —   | 80 | —   | 1.5 |                   |
| TSMT3   | RUR040N02  | N             | 20      | 4     | 1     | 55              | 33  | —  | 25  | —   | 1.5               |
|         | RUR020N02  | N             | 20      | 2     | 1     | 170             | 95  | —  | 75  | —   | 1.5               |
|         | RZR040P01  | P             | -12     | -4    | 1     | 55              | 30  | —  | 22  | —   | 1.5               |
|         | RZR025P01  | P             | -12     | -2.5  | 1     | 110             | 60  | —  | 44  | —   | 1.5               |
|         | RZR020P01  | P             | -12     | -2    | 1     | 200             | 105 | —  | 75  | —   | 1.5               |
| TSMT5   | QS5U36     | N+SBD (0.7A)  | 20      | 2.5   | 1.25  | 120             | 74  | —  | 58  | —   | 1.5               |
|         | QS5U34     | N+SBD (0.5A)  | 20      | 1.5   | 1.25  | 220*5           | 170 | —  | 130 | —   | 1.8               |
| TSMT6   | RUQ050N02  | N             | 20      | 5     | 1.25  | 40              | 27  | —  | 22  | —   | 1.5               |
|         | RZQ050P01  | P             | -12     | -5    | 1.25  | 44              | 26  | —  | 19  | —   | 1.5               |
|         | RAQ045P01  | P             | -12     | -4.5  | 1.25  | 50              | 28  | —  | 22  | —   | 1.5               |
|         | QS6J11     | P+P           | -12     | -2    | 1.25  | 200             | 105 | —  | 75  | —   | 1.5               |
| TSMT8   | RQ1C075UN  | N             | 20      | 7.5   | 1.5   | 20              | 14  | —  | 11  | —   | 1.5               |
|         | RQ1C065UN  | N             | 20      | 6.5   | 1.5   | 29              | 19  | —  | 16  | —   | 1.5               |
|         | RQ1A070ZP  | P             | -12     | -7    | 1.5   | 19              | 11  | —  | 8   | —   | 1.5               |
|         | RQ1A060ZP  | P             | -12     | -6    | 1.5   | 39              | 22  | —  | 16  | —   | 1.5               |
|         | QS8J13     | P+P           | -12     | -5.5  | 1.5   | 29              | 19  | —  | 15  | —   | 1.5               |
|         | QS8J12     | P+P           | -12     | -4.5  | 1.5   | 49              | 27  | —  | 21  | —   | 1.5               |
|         | QS8J11     | P+P           | -12     | -3.5  | 1.5   | 75              | 41  | —  | 31  | —   | 1.5               |
|         | QS8J2      | P+P           | -12     | -4    | 1.5   | 66              | 36  | —  | 26  | —   | 1.5               |
|         | RQ1A070AP  | P             | -12     | -7    | 1.5   | 24              | 13  | —  | 10  | —   | 1.5               |
|         | TT8U1      | P+SBD (1A)    | -20     | -2.4  | 1.25  | 180             | 105 | —  | 80  | —   | 1.5               |
| TT8U2   | P+SBD (1A) | -20           | -2.4    | 1.25  | 180   | 105             | —   | 80 | —   | 1.5 |                   |

## TUMT (VDSS=30V Type.)

| 製品名       | PAKG  | BVDSS | ID    | RDS(on)<br>at 10V (Typ.) | Qg<br>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)<br>at 10V (Typ.) | Qg<br>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)

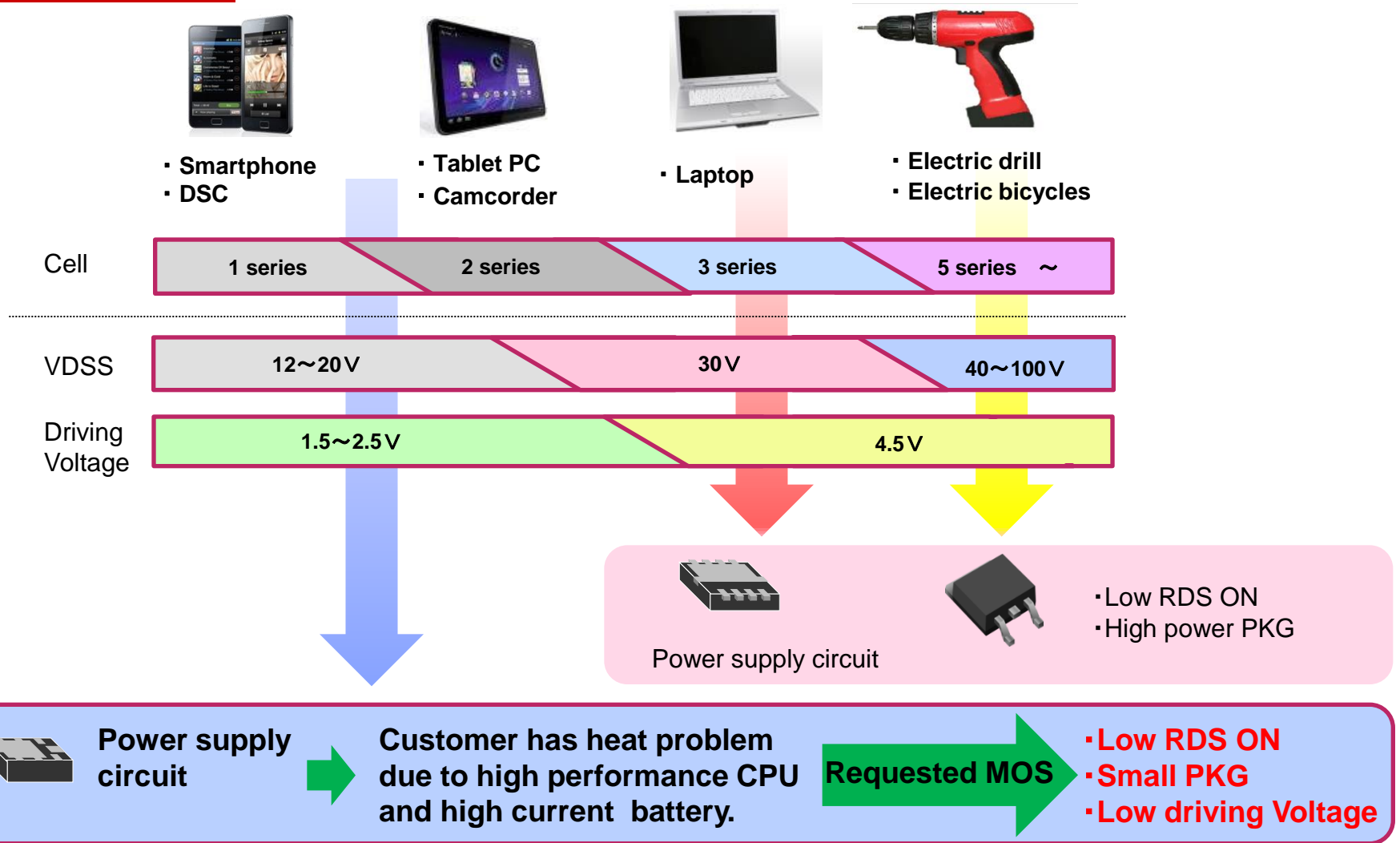
## TSMT (VDSS=30V Type.)

| 製品名       | PAKG  | BVDSS | ID     | RDS(on)<br>at 10V (Typ.) | Qg<br>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<br>(Dual) | 2.5V駆動 |
| QS5K2     | TSMT5 |       | 1.5 A  | 71 mΩ *                  | 2.8 nC *           |               |        |

\* : VGS = 4.5V      \* : VGS = 4.5V

# MOSFET for Power supply circuit

## LiB application



# 30V Power MOSFET

## ■ Feature

- Broad PKG lineup (HSOP8,HSMT8,HUML,Each Dual)
- Compact, low profile high power package types
- Low ON resistance, High efficiency
- High current Line Up (up to  $I_d=35A$ )

## ■ Application

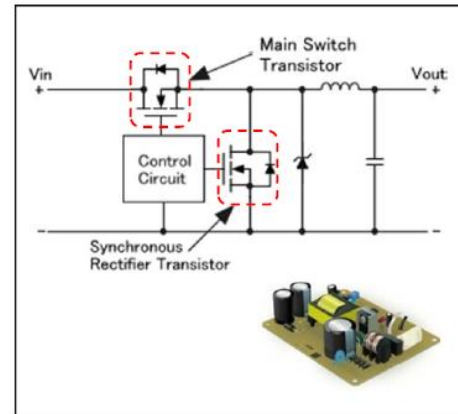
- DC/DC converter
- Li-ion Battery pack
- DC motor

## ■ Benefit

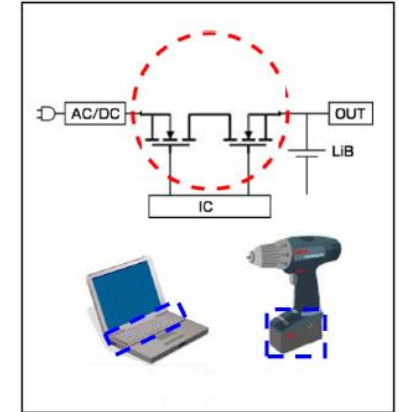
- Complex designs reduce the number of external parts
- Contributes to smaller, thinner sets and high efficiency operation

## ■ Application Circuit Examples

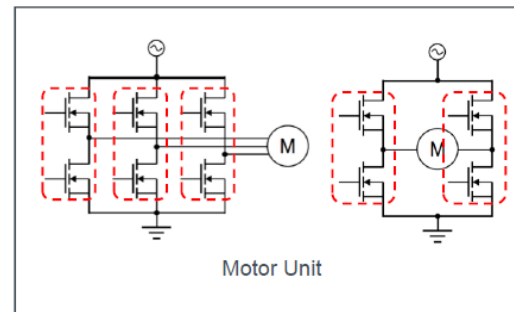
### ● DC/DC converter



### ● Li-ion Battery pack



### ● DC motor



# 30V MOSFET

## Line UP

## Line Up of HSOP8(5.0\*6.0)



### 〈Gen4 : Low Ron〉

| Package | PD (W) | Process | Part No.  | VDSS (V) | VGSS (V) | ID (A) | RON Typ (mΩ)         |                       | RON Max               | Qg(nC)                | Qgd (nC) |
|---------|--------|---------|-----------|----------|----------|--------|----------------------|-----------------------|-----------------------|-----------------------|----------|
|         |        |         |           |          |          |        | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =4.5V |          |
| HSOP8   | 3.0    | Gen4LR  | RS1E350BN | 30       | 20       | 35     | 1.2                  | 1.8                   | 2.5                   | 95                    | 40       |
|         |        |         | RS1E280BN | 30       | 20       | 28     | 1.7                  | 2.3                   | 3.2                   | 50                    | 20       |
|         |        |         | RS1E240BN | 30       | 20       | 24     | 2.3                  | 3.3                   | 4.6                   | 35                    | 14       |
|         |        |         | RS1E200BN | 30       | 20       | 20     | 2.8                  | 3.8                   | 5.3                   | 29                    | 11       |
|         |        |         | RS1E180BN | 30       | 20       | 18     | 3.5                  | 4.9                   | 6.9                   | 23                    | 9        |

### 〈Gen4 : High Performance for DCDC〉

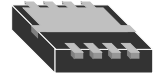
| Package | PD (W) | Process | Part No.  | VDSS (V) | VGSS (V) | ID (A) | RON Typ (mΩ)         |                       | RON Max               | Qg(nC)                | Qgd (nC) |
|---------|--------|---------|-----------|----------|----------|--------|----------------------|-----------------------|-----------------------|-----------------------|----------|
|         |        |         |           |          |          |        | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =4.5V |          |
| HSOP8   | 3.0    | Gen4HP  | RS1E350GN | 30       | 20       | 35     | 1.2                  | 1.5                   | 2.0                   | 35.3                  | 7.7      |
|         |        |         | RS1E320GN | 30       | 20       | 32     | 1.4                  | 1.8                   | 2.4                   | 28.2                  | 6.8      |
|         |        |         | RS1E300GN | 30       | 20       | 30     | 1.7                  | 2.2                   | 2.8                   | 23.3                  | 6.5      |
|         |        |         | RS1E280GN | 30       | 20       | 28     | 2.0                  | 2.6                   | 3.3                   | 19.1                  | 5.4      |
|         |        |         | RS1E240GN | 30       | 20       | 24     | 2.6                  | 3.3                   | 4.4                   | 14.2                  | 3.2      |
|         |        |         | RS1E200GN | 30       | 20       | 20     | 3.6                  | 4.6                   | 6.1                   | 9.8                   | 2.2      |
|         |        |         | RS1E170GN | 30       | 20       | 17     | 5.1                  | 6.7                   | 8.7                   | 7.1                   | 1.6      |
|         |        |         | RS1E150GN | 30       | 20       | 15     | 6.7                  | 8.8                   | 11.4                  | 5.4                   | 1.1      |
|         |        |         | RS1E130GN | 30       | 20       | 13     | 8.9                  | 11.7                  | 15.2                  | 4.1                   | 0.8      |

- High Efficiency
- Low Capacity

# 30V MOSFET

■ Line UP

Line Up of HSMT8(3.3\*3.3)



〈Gen4 : Low Ron〉

| Package | PD (W) | Process | Part No.  | VDSS (V) | VGSS (V) | ID (A) | RON Typ (mΩ)         |                       | RON Max | Qg(nC) | Qgd (nC) |
|---------|--------|---------|-----------|----------|----------|--------|----------------------|-----------------------|---------|--------|----------|
|         |        |         |           |          |          |        | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V |         |        |          |
| HSMT8   | 2.0    | Gen4LR  | RQ3E180BN | 30       | 20       | 18     | 2.8                  | 3.7                   | 5.2     | 37     | 16.0     |
|         |        |         | RQ3E150BN | 30       | 20       | 15     | 3.8                  | 5.3                   | 7.4     | 23     | 7.0      |
|         |        |         | RQ3E130BN | 30       | 20       | 13     | 4.4                  | 6.7                   | 9.4     | 16.0   | 6.0      |
|         |        |         | RQ3E120BN | 30       | 20       | 12     | 6.6                  | 8.6                   | 11.9    | 14.0   | 4.7      |
|         |        |         | RQ3E100BN | 30       | 20       | 10     | 7.7                  | 11.0                  | 15.3    | 10.5   | 4.2      |
|         |        |         | RQ3E080BN | 30       | 20       | 8      | 11                   | 16                    | 22      | 7.2    | 3.0      |
|         |        |         | RQ3E070BN | 30       | 20       | 7      | 20                   | 29                    | 39      | 4.6    | 1.4      |

〈 Gen4 : High Performance for DCDC 〉

| Package | PD (W) | Process | Part No.  | VDSS (V) | VGSS (V) | ID (A) | RON Typ (mΩ)         |                       | RON Max | Qg(nC) | Qgd (nC) |
|---------|--------|---------|-----------|----------|----------|--------|----------------------|-----------------------|---------|--------|----------|
|         |        |         |           |          |          |        | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V |         |        |          |
| HSMT8   | 2.0    | Gen4HP  | RQ3E180GN | 30       | 20       | 18     | 3.3                  | 4.3                   | 5.5     | 13.8   | 3.9      |
|         |        |         | RQ3E150GN | 30       | 20       | 15     | 4.6                  | 6.2                   | 8.1     | 8.0    | 2.3      |
|         |        |         | RQ3E120GN | 30       | 20       | 12     | 6.7                  | 9.1                   | 11.8    | 5.4    | 1.1      |
|         |        |         | RQ3E100GN | 30       | 20       | 10     | 8.9                  | 12.0                  | 15.7    | 4.1    | 0.8      |
|         |        |         | RQ3E080GN | 30       | 20       | 8      | 12.9                 | 17.5                  | 22.8    | 2.7    | 0.6      |



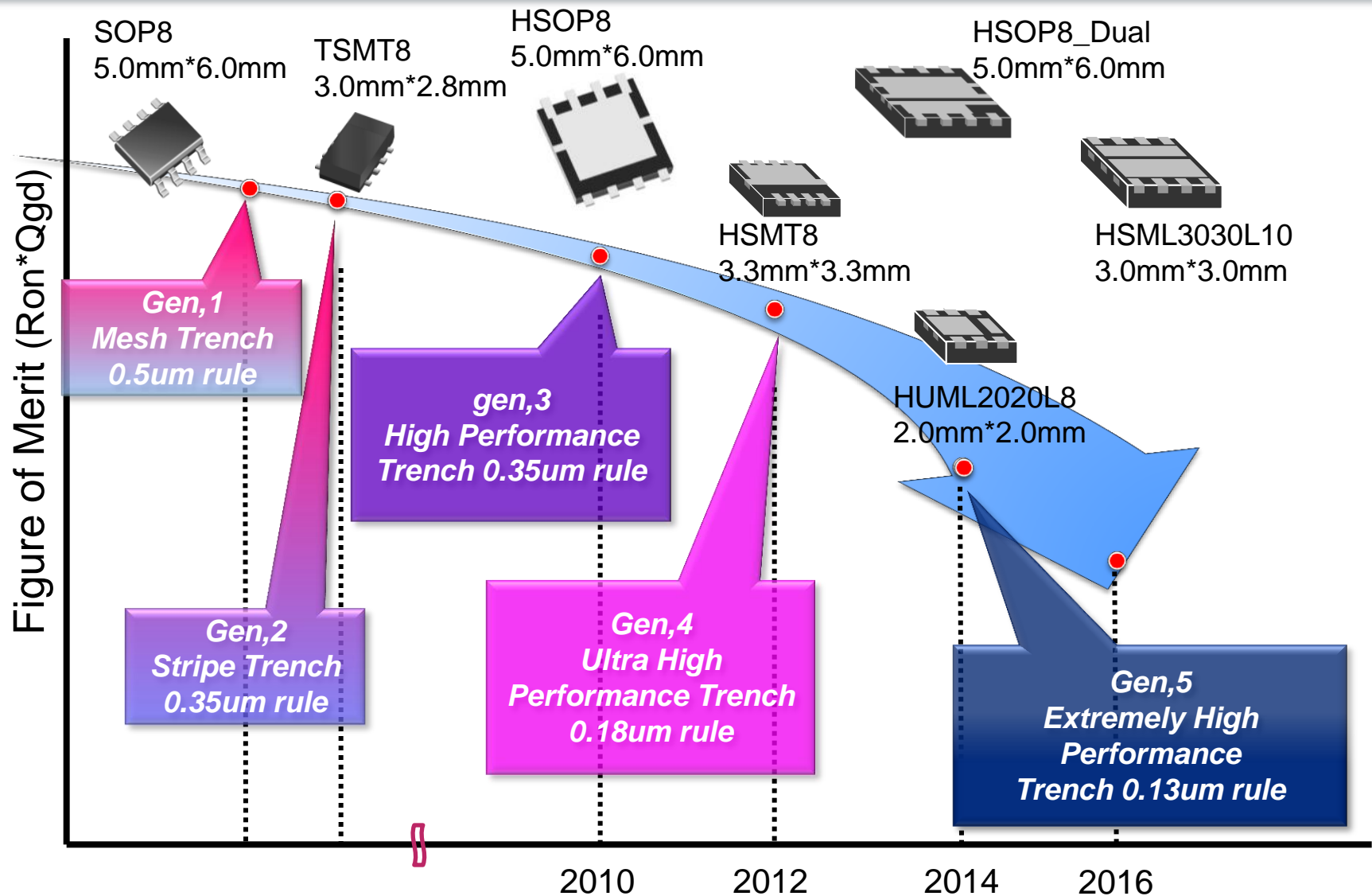
# 40V Line Up

| Package               | PD<br>(W)      | Part No.  | VDSS<br>(V) | VGSS<br>(V) | ID<br>(A) | RON Typ (mΩ)         |                       | Qg(nC)               | Qgd(nC) |
|-----------------------|----------------|-----------|-------------|-------------|-----------|----------------------|-----------------------|----------------------|---------|
|                       |                |           |             |             |           | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =10V |         |
| HSMT8<br>(3.3 x 3.3)  | 2              | RQ3G150GN | 40          | 20          | 15        | 4.8                  | 6.0                   | 19.0                 | 3.1     |
|                       |                | RQ3G130MN |             |             | 13        | 6.0                  | 7.9                   | 17.0                 | 2.0     |
|                       |                | RQ3G100GN |             |             | 10        | 9.0                  | 12.0                  | 11.2                 | 1.8     |
|                       |                | RQ3G080GN |             |             | 8         | 15.0                 | 20.0                  | 6.7                  | 1.1     |
| HSML<br>Dual (3 x 3)  |                | HS8K21    |             |             | 8         | 17.3                 | 22.1                  | 6.4                  | 0.8     |
|                       |                | HS8K22    |             |             | 9         | 14.1                 | 18.0                  | 8.0                  | 1.0     |
|                       |                |           |             |             | 6         | 27.3                 | 35.1                  | 4.0                  | 0.5     |
|                       |                |           |             |             | 9         | 14.1                 | 18.0                  | 8.0                  | 1.0     |
| SOP8<br>(5 x 6)       |                |           |             |             | RGH200N04 | 20                   | 3.0                   | 3.7                  | 36.0    |
|                       |                | RMH170N04 |             |             | 17        | 4.0                  | 5.1                   | 31.9                 | 3.6     |
|                       |                | RMH110N04 |             |             | 11        | 8.4                  | 11.0                  | 15.3                 | 2.1     |
|                       |                | RMH090N04 |             |             | 9         | 12.5                 | 16.5                  | 10.4                 | 1.4     |
| HSOP8<br>(5 x 6)      |                | RS1G300GN |             |             | 30        | 2.1                  | 2.7                   | 52.0                 | 7.6     |
|                       |                | RS1G260MN |             |             | 26        | 2.4                  | 3.2                   | 44.0                 | 5.2     |
|                       |                | RS1G240GN |             |             | 24        | 3.1                  | 3.9                   | 33.0                 | 4.7     |
|                       |                | RS1G180MN |             |             | 18        | 5.0                  | 6.7                   | 19.5                 | 2.5     |
|                       | RS1G150MN      | 15        |             |             | 7.6       | 10.2                 | 15.0                  | 2.0                  |         |
|                       | RS1G120MN      | 12        |             |             | 11.6      | 15.6                 | 9.4                   | 1.1                  |         |
| HSOP8<br>Dual (5 x 6) | HP8K31         | 14        |             |             | 8.4       | 10.8                 | 13.2                  | 1.7                  |         |
|                       | HP8K32         | 14        |             |             | 8.9       | 11.3                 | 13.2                  | 1.7                  |         |
|                       |                | 25        |             |             | 2.9       | 3.6                  | 42.4                  | 5.3                  |         |
|                       | HP8K33         | 14        |             |             | 8.9       | 11.3                 | 13.2                  | 1.7                  |         |
|                       |                | 20        |             |             | 4.4       | 5.6                  | 54.4                  | 13.1                 |         |
|                       |                | 14        |             |             | 8.9       | 11.3                 | 13.2                  | 1.7                  |         |
| D-PAK                 | 20             | RD3G800GN |             |             | 80        | 1.9                  | 2.5                   | 55.0                 | 8.5     |
|                       |                | RD3G600GN |             |             | 60        | 3.0                  | 3.9                   | 34.8                 | 5.4     |
|                       |                | RD3G500GN |             |             | 50        | 4.0                  | 5.2                   | 26.1                 | 4.0     |
|                       |                | RD3G450GN |             |             | 45        | 5.0                  | 6.6                   | 20.9                 | 3.2     |
|                       |                | RD3G400GN |             |             | 40        | 7.0                  | 9.2                   | 14.9                 | 2.3     |
|                       |                | D2-PAK    |             |             | 50        | RGJ12HN04            | 120                   | 1.1                  | 1.3     |
| RMJ10HN04             | 100            |           |             |             |           | 1.5                  | 2.0                   | 120.0                | 15.0    |
| RMJ800N04             | 80             |           |             |             |           | 2.5                  | 3.5                   | 60.0                 | 7.5     |
| RMJ700N04             | 70             |           |             |             |           | 4.5                  | 6.0                   | 26.0                 | 3.5     |
| RGJ650N04             | 65             |           |             |             |           | 5.0                  | 6.6                   | 24.2                 | 5.0     |
| TO220                 | RX1G18BGN(12H) |           |             |             |           | 180                  | 1.1                   | 1.4                  | 125.0   |
|                       | RX1G12BGN(800) | 120       |             |             |           | 2.5                  | 3.3                   | 48.0                 | 10.0    |
|                       | RX1G11BGN(750) | 110       |             |             |           | 3.5                  | 4.6                   | 35.0                 | 7.0     |
|                       | RX1G09BGN(650) | 90        |             |             |           | 5.0                  | 6.5                   | 24.2                 | 5.0     |

# 60V Line Up

| Package              | PD<br>(W) | Part No.       | VDSS<br>(V) | VGSS<br>(V) | ID<br>(A) | RON Typ (mΩ)         |                       | Qg(nC)<br>V <sub>GS</sub> =10V | Qgd(nC) |
|----------------------|-----------|----------------|-------------|-------------|-----------|----------------------|-----------------------|--------------------------------|---------|
|                      |           |                |             |             |           | V <sub>GS</sub> =10V | V <sub>GS</sub> =4.5V |                                |         |
| HSMT8<br>(3.3 x 3.3) | 2         | RQ3L090GN      | 60          | 20          | 9         | 11.6                 | 16.9                  | 29                             | 3.9     |
|                      |           | RQ3L070GN      |             |             | 7         | 17.0                 | 24.7                  | 20                             | 2.6     |
|                      |           | RQ3L050GN      |             |             | 4         | 43.0                 | 66.0                  | 8                              | 1.0     |
| HSML<br>Dual (3 x 3) |           | HS8K31         |             |             | 5         | 34.0                 | 49.3                  | 10                             | 1.3     |
|                      |           |                |             |             | 5         | 34.0                 | 49.3                  | 10                             | 1.3     |
| SOP8 (5 x 6)         |           | RGH130N06      |             |             | 13        | 5.5                  | 7.9                   | 61                             | 8.2     |
|                      |           | RGH100N06      |             |             | 10        | 8.2                  | 11.9                  | 41                             | 5.5     |
| HSOP8<br>(5 x 6)     | 3         | RS1L200GN      |             |             | 20        | 4.0                  | 5.8                   | 84                             | 11.3    |
|                      |           | RS1L180GN      |             |             | 18        | 4.9                  | 7.1                   | 69                             | 9.2     |
|                      |           | RS1L160GN      |             |             | 16        | 5.5                  | 8.0                   | 61                             | 8.2     |
|                      |           | RS1L140GN      |             |             | 14        | 6.9                  | 10.5                  | 49                             | 6.5     |
|                      |           | RS1L110GN      |             |             | 11        | 11.0                 | 16.0                  | 31                             | 4.1     |
|                      |           |                |             |             |           |                      |                       |                                |         |
| D-PAK                | 20        | RD3L500GN      |             |             | 50        | 4.0                  | 5.8                   | 84                             | 11.3    |
|                      |           | RD3L400GN      |             |             | 40        | 5.0                  | 7.3                   | 67                             | 9.0     |
|                      |           | RD3L350GN      |             |             | 35        | 7.0                  | 11.0                  | 48                             | 6.4     |
|                      |           | RD3L300GN      |             |             | 30        | 11.0                 | 16.0                  | 31                             | 4.1     |
|                      |           | RD3L200GN      |             |             | 20        | 18.0                 | 26.1                  | 19                             | 2.5     |
|                      |           | RD3L150GN      |             |             | 15        | 35.0                 | 52.0                  | 10                             | 1.3     |
|                      |           | RD3L100GN      |             |             | 10        | 55.0                 | 79.8                  | 6                              | 0.8     |
| D2-PAK               | 50        | RGJ12HN06      |             |             | 120       | 1.9                  | 2.8                   | 177                            | 23.7    |
|                      |           | RGJ11HN06      |             |             | 110       | 2.5                  | 3.6                   | 134                            | 18.0    |
|                      |           | RGJ10HN06      |             |             | 100       | 3.5                  | 5.0                   | 96                             | 12.9    |
|                      |           | RGJ750N06      |             |             | 75        | 4.0                  | 5.8                   | 84                             | 11.3    |
|                      |           | RGJ700N06      |             |             | 70        | 5.0                  | 7.3                   | 67                             | 9.0     |
|                      |           | RGJ550N06      |             |             | 55        | 8.0                  | 11.6                  | 42                             | 5.6     |
|                      |           | RGJ450N06      |             |             | 45        | 10.0                 | 14.5                  | 34                             | 4.5     |
|                      |           |                |             |             |           |                      |                       |                                |         |
| TO220                |           | RX1L18CGN(12H) |             |             | 180       | 1.8                  | 2.6                   | 187                            | 25.0    |
|                      |           | RX1L18BGN(11H) |             |             | 180       | 2.5                  | 3.6                   | 134                            | 18.0    |
|                      |           | RX1L14BGN(800) |             |             | 140       | 3.5                  | 5.1                   | 96                             | 12.9    |
|                      |           | RX1L09BGN(700) |             |             | 90        | 5.0                  | 7.3                   | 67                             | 9.0     |
|                      |           | RX1L06BGN(550) |             |             | 60        | 8.0                  | 11.6                  | 42                             | 5.6     |
|                      |           | RX1L05BGN(450) |             |             | 50        | 10.0                 | 14.5                  | 34                             | 4.5     |
|                      |           | RX1L03BGN(350) |             |             | 30        | 20.0                 | 29.0                  | 17                             | 2.3     |
| TO220FM              |           | RX2L800GN      |             |             | 80        | 1.8                  | 2.6                   | 187                            | 25.0    |
|                      |           | RX2L750GN      |             |             | 75        | 3.5                  | 5.1                   | 96                             | 12.9    |
|                      |           | RX2L600GN      | 60          | 6.0         | 8.7       | 56                   | 7.5                   |                                |         |

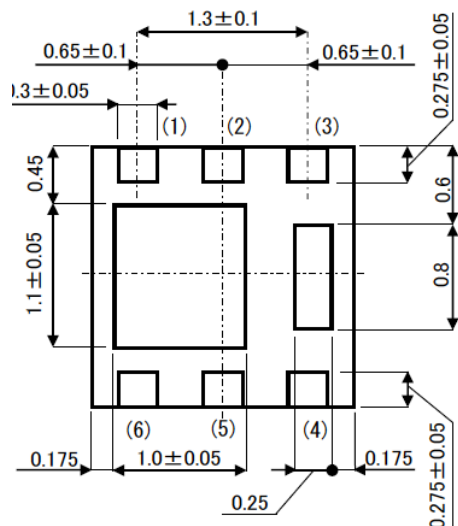
# MOSFET ROAD MAP



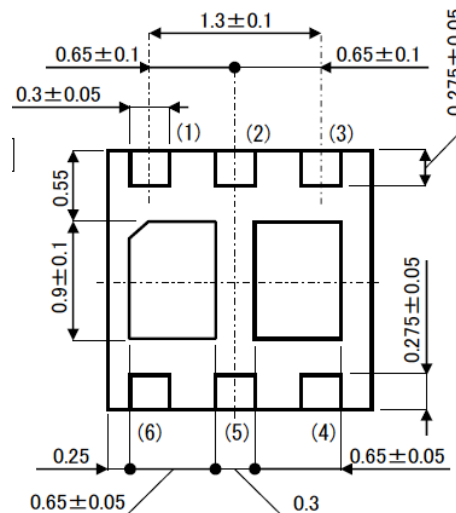
# Package Trend (Middle Power type)

## HUML6 : 2.0 × 2.0 × 0.60mm

Single



Dual



SOP8

5.0\*6.0\*1.75

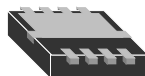
Pd=2W



HSMT8

3.3\*3.3\*1.0

Pd=2W



TSMT8

2.8\*3.0\*0.8

Pd=1.5W



HUML6

2.0\*2.0\*0.6

Pd=2W



# Low Voltage Operation MOSFET Line Up (Nch)

## ■ Single

| Packag<br>e      | Size<br>(mm) | Polarit<br>y | PD<br>(W) | Part No.  | V <sub>DSS</sub><br>(V) | ID<br>(A) | RDS(on) Typ(mΩ)       |                       | Sample   | MP       |
|------------------|--------------|--------------|-----------|-----------|-------------------------|-----------|-----------------------|-----------------------|----------|----------|
|                  |              |              |           |           |                         |           | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =2.5V |          |          |
| HSMT8            | 3.3*3.3*0.8  | Nch          | 2,0       | RQ3E180AJ | 30                      | 18        | 3,5                   | 6,0                   | OK       | Sep 2014 |
| HUML6            | 2.0*2.0*0.6  |              | 2,0       | RF4E100AJ | 30                      | 10        | 10,4                  | 13,4                  | Sep 2014 | Dec 2014 |
| TSMT6            | 2.8*2.9*0.85 |              | 1,25      | RQ6E055AJ | 30                      | 5,5       | 15                    | 21                    | Planning | Dec 2014 |
| TSMT3<br>(SC-96) |              |              | 1,0       | RQ5E040AJ | 30                      | 4         | 27                    | 39                    | Sep 2014 | Dec 2014 |
|                  |              |              |           | RQ5E030AJ | 30                      | 3         | 59                    | 77                    | Sep 2014 | Dec 2014 |
| TUMT6            | 2.1*2.0*0.77 |              | 1,0       | RF6E045AJ | 30                      | 3         | 15                    | 21                    | OK       | Sep 2014 |
| TUMT3            |              |              | 0,8       | RF1E015AJ | 30                      | 1,5       | 40                    | 55                    | Aug 2014 | Sep 2014 |

# Low Voltage Operation MOSFET Line Up (Pch)

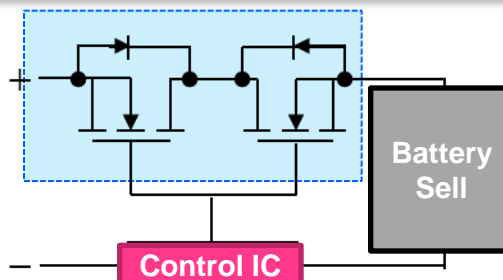
## ■ Single

| Package | Size<br>(mm) | Polarity | PD<br>(W) | Part No.  | V <sub>DSS</sub><br>(V) | ID<br>(A) | RDS(on) Typ(mΩ)       |                       | Sample   | MP       |
|---------|--------------|----------|-----------|-----------|-------------------------|-----------|-----------------------|-----------------------|----------|----------|
|         |              |          |           |           |                         |           | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =2.5V |          |          |
| HUML6   | 2.0*2.0*0.6  | Pch      | 2.0       | RF4C100BC | -20                     | -10       | 10                    | 13                    | Planning | Dec 2014 |
|         |              |          |           | RF4C050AP | -20                     | -5        | 18                    | 20                    | OK       | OK       |
| HSMT8   | 3.3*3.3*0.8  |          | 2.0       | RQ3A085AP | -12                     | -8.5      | 10                    | 13                    | OK       | OK       |
|         |              |          |           | RQ3A070AP | -12                     | -7        | 15                    | 19                    | OK       | OK       |
| TSMT8   | 2.8*3.0*0.8  |          | 1.5       | RQ1A070AP | -12                     | -7        | 10                    | 13                    | OK       | OK       |
| TSMT6   | 2.8*2.9*0.85 |          | 1.25      | RAQ045P01 | -12                     | -4.5      | 22                    | 28                    | OK       | OK       |
| TSMT3   |              |          | 1.0       | RQ5C035BC | -20                     | -3.5      | 40                    | 70                    | Planning | Dec 2014 |
| TUMT6   | 2.1*2.0*0.77 |          | 1.0       | RAL045P01 | -12                     | -4.5      | 22                    | 28                    | OK       | OK       |
|         |              |          |           | RAL035P01 | -12                     | -3.5      | 30                    | 40                    | OK       | OK       |
|         |              |          |           | RAL025P01 | -12                     | -2.5      | 44                    | 55                    | OK       | OK       |
| TUMT3   | 2.1*2.0*0.77 |          | 0.8       | RAF040P01 | -12                     | -4        | 22                    | 27                    | OK       | OK       |

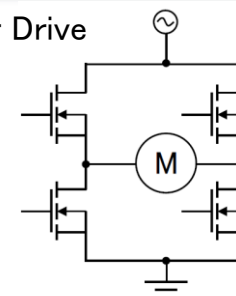
# Low Voltage Operation MOSFET Line Up

## ■ Dual

For protection Lib



For Motor Drive



## One package MOSFET

| Package | Size (mm)    | Polarity | PD (W) | Part No. | V <sub>DSS</sub> (V) | ID (A) | RDS(on) Typ(mΩ)       |                       | Sample   | MP       |
|---------|--------------|----------|--------|----------|----------------------|--------|-----------------------|-----------------------|----------|----------|
|         |              |          |        |          |                      |        | V <sub>GS</sub> =4.5V | V <sub>GS</sub> =2.5V |          |          |
| HUML6   | 2.0*2.0*0.6  | Nch+Nch  | 2.0    | UT6K3    | 20                   | 5.5    | 32                    | 45                    | OK       | OK       |
|         |              |          | 2.0    | UT6K1    | 20                   | 4      | 60                    | 85                    | OK       | Dec 2014 |
| TSMT8   | 2.8*3.0*0.85 |          | 1.5    | QH8KA4   | 20                   | 8      | 13                    | 17                    | OK       | Dec 2014 |
| TUMT6   | 2.0*2.1*0.85 |          | 1.0    | US6K4    | 20                   | 1.5    | 130                   | 170                   | OK       | OK       |
| HUML6   | 2.0*2.0*0.6  | Pch+Pch  | 2.0    | UT6J3    | -20                  | -3     | 50                    | 70                    | OK       | Dec 2014 |
|         |              |          | 1.5    | QS8J11   | -12                  | -3.5   | 31                    | 41                    | OK       | OK       |
| TSMT8   | 2.8*3.0*0.85 |          | 1.5    | QS8J12   | -12                  | -4.5   | 21                    | 27                    | OK       | OK       |
|         |              |          | 1.5    | QS8J13   | -12                  | -5.5   | 15                    | 19                    | OK       | OK       |
| TUMT6   | 2.0*2.1*0.85 |          | 1.0    | US6J11   | -12                  | -1.3   | 190                   | 280                   | OK       | OK       |
| TUMT6   | 2.0*2.1*0.85 |          | 1.0    | US6J12   | -12                  | -2     | 75                    | 105                   | OK       | OK       |
| HUML6   | 2.0*2.0*0.6  | Pch+Nch  | 2.0    | UT6MA3   | 20                   | 4      | 60                    | 85                    | Planning | Dec 2014 |
|         |              |          |        |          | -20                  | -3     | 60                    | 70                    |          |          |
| TSMT6   | 2.8*3.0*0.85 |          | 1.25   | QS6M4    | 30                   | 1.5    | 170                   | 260                   | OK       | OK       |
|         |              |          |        |          | -20                  | -1.5   | 155                   | 310                   |          |          |
| TUMT6   | 2.0*2.1*0.85 |          | 1.0    | US6M11   | 20                   | 1.5    | 130                   | 170                   | OK       | OK       |
|         |              |          |        |          | -12                  | -1.3   | 190                   | 280                   |          |          |



# SOP8 PKG

## SOP8 (VDSS=30V Type.)

| 製品名       | BVDSS    | ID           | RDS(on)<br>at 10V (Typ.) | Qg<br>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<br>(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<br>(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<br>+<br>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)<br>at 10V (Typ.) | Qg<br>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<br>(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<br>+<br>NCh | 4V駆動 |
| SP8M24    |          | 4.5A / -3.5A | 33 / 45 mΩ               | 6.8 / 13 nC        |                 |      |

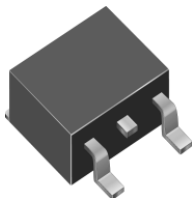
## SOP8 (VDSS=60V Type.)

| 製品名       | BVDSS | ID    | RDS(on)<br>at 10V (Typ.) | Qg<br>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<br>(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 <sub>G</sub> typ.<br>(nC) | V <sub>GS</sub><br>(v) |
|-------------|----------------|------------------------|-----------------------|------------------------|----------------------|------------------------|-----------------------|-----------------------------|------------------------|
|             |                | V <sub>DS</sub><br>(V) | I <sub>D</sub><br>(A) | R <sub>DS(on)</sub> mΩ |                      |                        |                       |                             |                        |
|             |                |                        |                       | V <sub>GS</sub> = 2.5V | V <sub>GS</sub> = 4V | V <sub>GS</sub> = 4.5V | V <sub>GS</sub> = 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

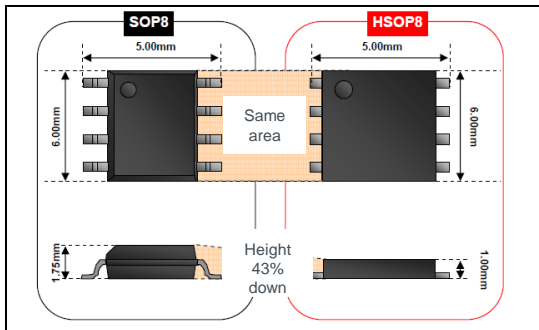


## Feature

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

## Advantage

- Adoption of small size / thin package

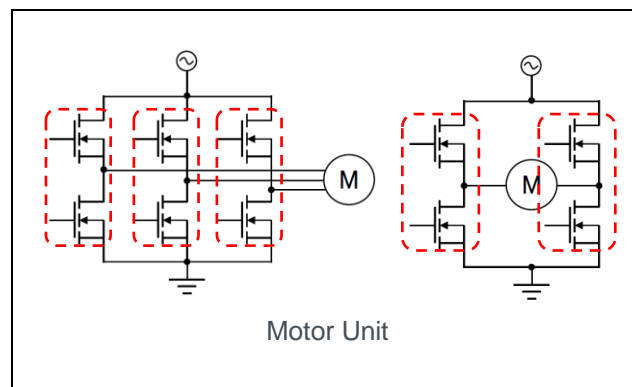


## Benefit

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

## Application Circuit Examples

### ● Motor drive circuit



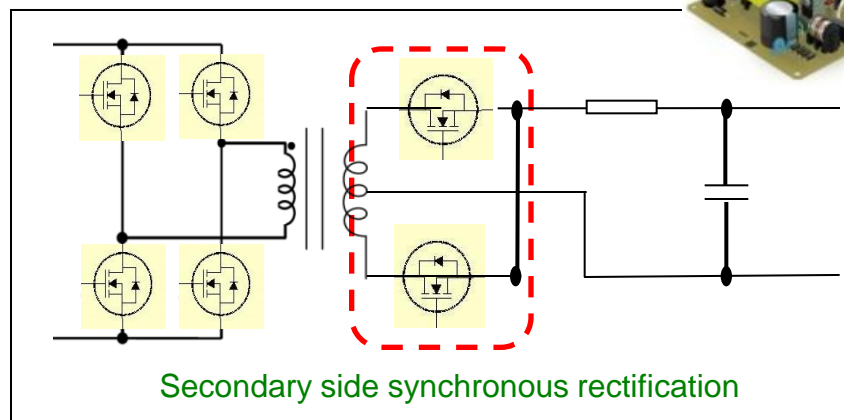
Power tools



FUN motor




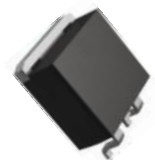
### ● Power supply circuit





# MOSFET ~40V/45V Line Up~

VDSS=40~45V , VGSS=20V

| Package   | Part No.   | VDSS [V] | ID [A] | RDS(on)typ [mΩ] |          |          | Qg [nC] |
|---|------------|----------|--------|-----------------|----------|----------|---------|
|   |            |          |        | VGS=10V         | VGS=4.5V | VGS=4.0V | VGS=10V |
| CPT3*<br>TO252<br>(DPAK)<br> | RSD200N05* | 45       | 20     | 20              | 25       | 28       | 12 ※1   |
|   | ☆RMD600N04 | 40       | 60     | 3.0             | 4.0      | -        | 65      |
|   | RSD046P05* | -45      | -4.5   | 110             | 160      | 185      | 12 ※1   |
|   | RSD080P05* | -45      | -8     | 65              | 95       | 105      | 9 ※1    |
|   | RSD160P05* | -45      | -16    | 35              | 45       | 50       | 16 ※1   |
| LPTS<br>(D2PAK)<br>         | RSJ450N04  | 40       | 45     | 9.5             | -        | -        | 43      |
|   | ☆RMJ700N04 | 40       | 70     | 4.0             | 5.5      | -        | 50      |
|   | RSJ800N04  | 40       | 80     | 3.5             | -        | -        | 80      |
|   | ☆RMJ800N04 | 40       | 80     | 3.0             | 4.0      | -        | 65      |
|   | ☆RMJ10HN04 | 40       | 100    | 1.5             | 2.0      | -        | 130     |
|   | RSJ400P05  | -45      | -40    | 10              | -        | -        | 110     |

☆ : Under development. Design and specification is supposed to change. ※1 : V<sub>GS</sub>=5V

# 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.



# High voltage (500~800V) MOSFET

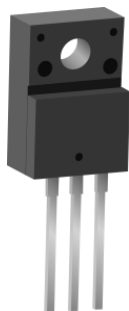
# Package Line up - High Voltage MOSFET -

## □ THD

### TO220FM

29\*10

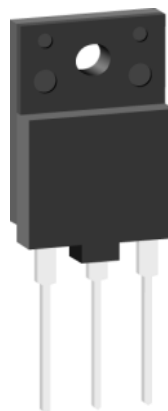
290mm<sup>2</sup>



### TO3PF

26.5\*15.5

410mm<sup>2</sup>



### TO247

21.07\*15.94

336mm<sup>2</sup>

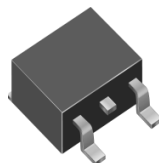


## □ SMD

### D2-Pak(LPT)

13.1\*10.1

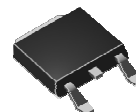
132mm<sup>2</sup>



### D-Pak(CPT3)

9.5\*6.5

62mm<sup>2</sup>



### D-Pak(TO252E)

10.0\*6.6

66mm<sup>2</sup>



# Recommended Application for using ROHM's Power MOSFETs

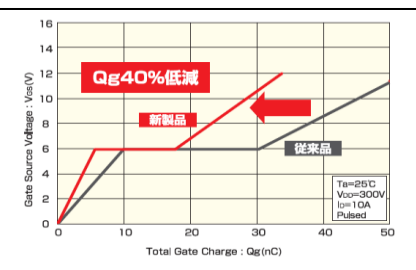
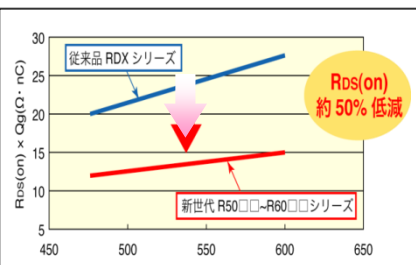
| 500V                            | 600V     |          |                        |                                 | 650V                            | 800V     |
|---------------------------------|----------|----------|------------------------|---------------------------------|---------------------------------|----------|
| Planer                          | SJ-MOS   | Planer   | SJ-MOS                 | Hybrid MOS                      | SJ-MOS                          | SJ-MOS   |
| High Speed trr                  |          |          | High Speed trr         | High Speed trr                  |                                 |          |
| D3EB                            | gen.2    | DMOS3    | gen.1                  | gen.1                           | gen.2                           | gen.1    |
| RxxWxxxAT<br>(500V only)        | R60xxENx | Rx-xAB/C | R60xxFNx<br>Presto MOS | R65xxGNx                        | R65xxLNx                        | R80xxANx |
| Under development<br>DS Q3/2013 | MP       | MP       | MP                     | Under development<br>DS Q3/2013 | Under development<br>DS Q4/2013 | MP       |

|                                      |                     |                                  |                            |                     |                    |                                  |   |
|--------------------------------------|---------------------|----------------------------------|----------------------------|---------------------|--------------------|----------------------------------|---|
| <u>White goods</u>                   | Compressor / Motor  | PFC                              | Compressor / Motor         | PFC                 | Compressor / Motor |                                  |   |
| <u>Lighting</u>                      |                     | Compact Lamp<br>PFC / ITTF & TTF |                            |                     |                    | LED<br>Quasi Resonant<br>Flyback | Lamp Ballast<br>Sepic pre converter<br>3 phase supply<br>/ Single switch res. |
| <u>PC Power</u>                      |                     | PFC                              | TTF 80+ / LLC<br>90+       |                     |                    |                                  |   |
| <u>Telecom<br/>(server)</u>          |                     | PFC /<br>ITTF & TTF              | ZVS Full-<br>bridge / LLC  | PFC                 |                    |                                  |   |
| <u>UPS (, FA)</u>                    |                     |                                  | ZVS Full-<br>bridge        | Replace from IGBT   |                    |                                  |   |
| <u>Adapter</u>                       |                     | LLC Half-<br>bridge              | Flyback/<br>Quasi resonant | LLC Half-<br>bridge |                    | Flyback / PFC + Flyback          |   |
| <u>Consumer<br/>(TV, Game, SMPS)</u> | LLC Half-<br>bridge | PFC / LLC Half-bridge            | LLC Half-<br>bridge        | Replace from IGBT   |                    | PFC +<br>Quasi Resonant Flyback  |   |
| <u>Solar</u>                         |                     | Booster                          |                            | Booster             | DC/AC              | Booster                          | DC / AC   |
| <u>EV/HEV</u>                        |                     |                                  | Resonant<br>Full-bridge    |                     |                    |                                  |   |

# Super Junction MOSFET - Multi Epi 1<sup>st</sup> gen. AN series -

## Feature

- > Super Junction structure
- > Line-up of V<sub>ds</sub> 500V-600V
- > Low A\*Ron x Qg
- > Various Package line-up



### 500Vシリーズ\*

| Part No. | Package       | V <sub>DSS</sub> [V] | I <sub>D</sub> [A] | R <sub>DS(on)</sub> [Ω]<br>at 10V<br>Typ. |
|----------|---------------|----------------------|--------------------|---|
| R5021ANX | TO220FM       | 500                  | 21                 | 0.16                                      |
| R5019ANX |               |                      | 19                 | 0.18                                      |
| R5016ANX |               |                      | 16                 | 0.21                                      |
| R5013ANX |               |                      | 13                 | 0.29                                      |
| R5011ANX |               |                      | 11                 | 0.38                                      |
| R5009ANX |               |                      | 9                  | 0.55                                      |
| R5007ANX |               |                      | 7                  | 0.75                                      |
| R5005CNX |               |                      | 6                  | 0.9                                       |
| R5021ANJ | LPTS / D2-Pak | 500                  | 21                 | 0.16                                      |
| R5016ANJ |               |                      | 16                 | 0.21                                      |
| R5013ANJ |               |                      | 13                 | 0.29                                      |
| R5011ANJ |               |                      | 11                 | 0.38                                      |
| R5009ANJ |               |                      | 9                  | 0.55                                      |
| R5007ANJ |               |                      | 7                  | 0.78                                      |
| R5005CNJ |               |                      | 5                  | 1.2                                       |
| R5207AND | CPT3/D-Pak    | 525                  | 7                  | 0.78                                      |
| R5205CND | CPT3/D-Pak    | 525                  | 5                  | 1.2                                       |
| SP8K80   | SOP8 (Dual)   | 500                  | 0.5                | 9   |

### 600Vシリーズ\*

| Part No.  | Package         | V <sub>DSS</sub> [V] | I <sub>D</sub> [A] | R <sub>DS(on)</sub> [Ω]<br>at 10V<br>Typ. |
|-----------|-----------------|----------------------|--------------------|---|
| R6046ANZ1 | TO247           | 600                  | 46                 | 0.069                                     |
| R6046ANZ  | TO3PF           |                      | 46                 | 0.065                                     |
| R6025ANZ  |                 |                      | 25                 | 0.12                                      |
| R6020ANZ  |                 |                      | 20                 | 0.17                                      |
| R6015ANZ  |                 |                      | 15                 | 0.23                                      |
| R6020ANX  | TO220FM         |                      | 20                 | 0.17                                      |
| R6015ANX  |                 |                      | 15                 | 0.23                                      |
| R6012ANX  |                 |                      | 12                 | 0.32                                      |
| R6010ANX  |                 |                      | 10                 | 0.43                                      |
| R6008ANX  |                 |                      | 8                  | 0.6                                       |
| R6006ANX  | 6               |                      | 0.85               |   |
| R6020ANJ  | LPTS/<br>D2-Pak |                      | 20                 | 0.19                                      |
| R6015ANJ  |                 |                      | 15                 | 0.23                                      |
| R6012ANJ  |                 |                      | 12                 | 0.32                                      |
| R6010ANJ  |                 |                      | 10                 | 0.43                                      |
| R6008ANJ  |                 |                      | 8                  | 0.6                                       |
| R6006AND  | CPT3/D-Pak      |                      | 6                  | 0.9                                       |
| R6004CND  |                 |                      | 4                  | 1.4                                       |

### 小型PKG.

### High power PKG.



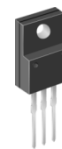
SOP8



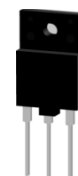
CPT3/D-Pak



LPTS/D2-Pak



TO220FM



TO3PF



TO247



# High Voltage Resistance and High Speed Switching Power MOSFET (EN series)

## Planar MOS

<cross section>

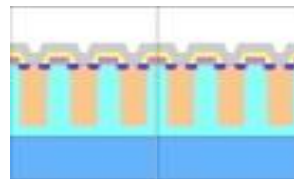


### Feature

- Low noise

## SJ MOS (AN series)

<cross section>



### Feature

- Low RON
- High speed SW

## New Generation Super Junction MOS

### ■ EN series

#### Feature

An advantage of planar and that of SJ-MOS are united.

● Strength of Planar

Low noise

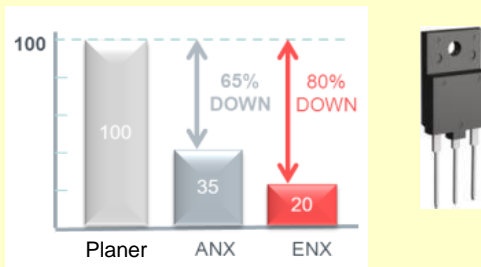
● Strength of SJ—MOS

High speed SW, Low RON

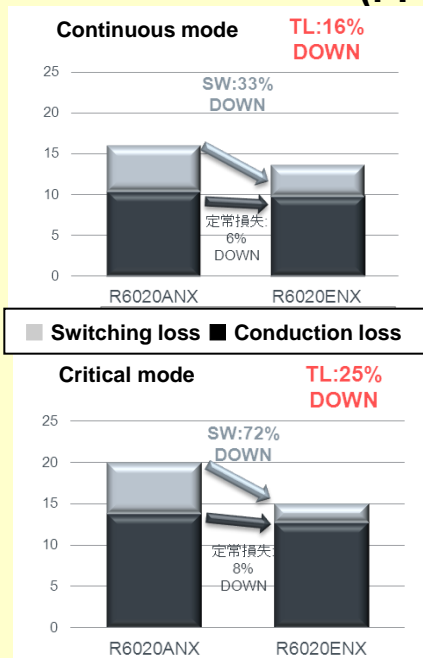
Compared to conventional AN series,  
A-RON was decreased by around 40%.

# High Voltage Resistance and High Speed Switching Power MOSFET (EN series)

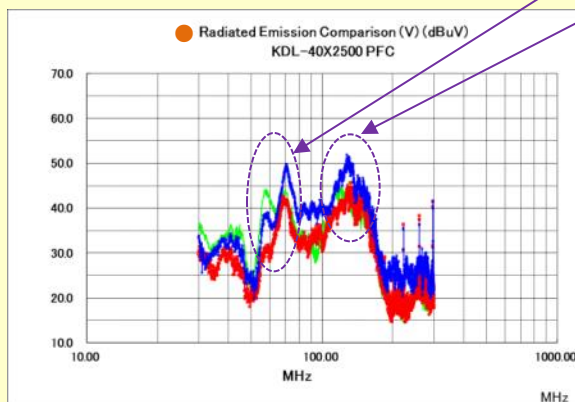
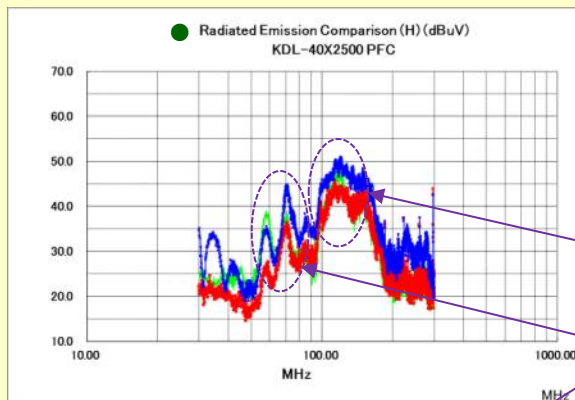
## ■ Ron comparison (TO220)



## ■ Power attenuation comparison (PFC circuit)



## ■ Noise comparison



■ The other company Planar

■ AN series

■ EN series

● EN series vs AN series :

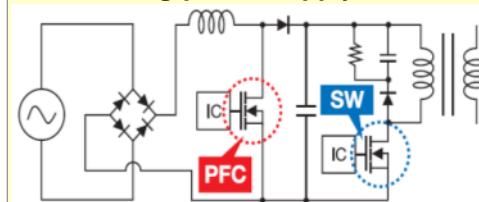
- The peak value of the noise of EN series decreases 6 -10dB.

● The other company Planar vs EN series :

- The noise of the EN series is a low noise even if it compares with Planar .

## ■ Evaluation circuit

Switching-power-supply circuit



Reference : About dB notation

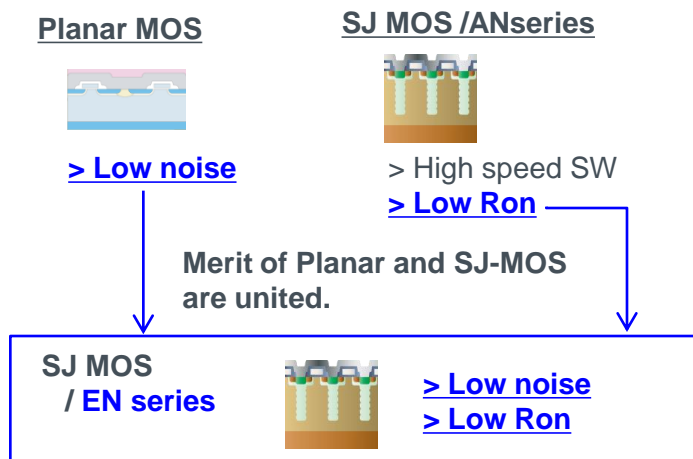
dB notation :  $20 \log_{10}(\text{Gain})$  [dB]

6dB≒twice, 10dB≒3.2 times

The EN series reduces a noise below in half as compared with the AN series.

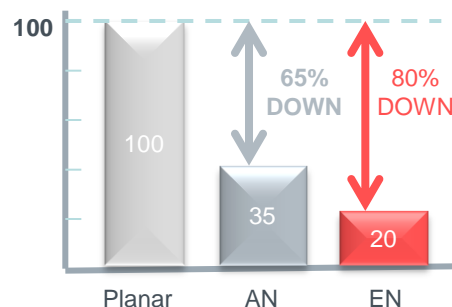
# Low Noise Super Junction MOSFET - Multi Epi 2<sup>nd</sup> gen. EN series -

## Feature

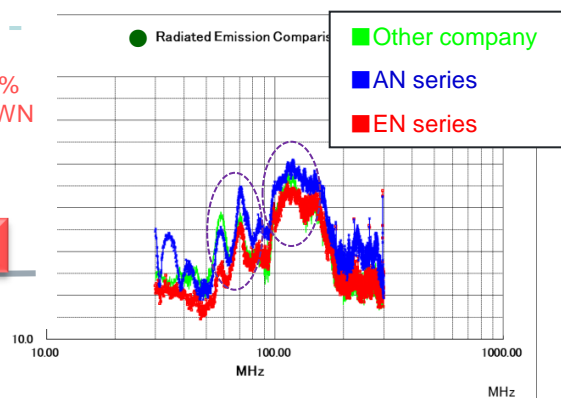


## Advantage

■ A<sup>\*</sup>Ron Comparison (TO220)



■ Noise Comparison



We are developing Vds 650V(DS Q3/2014) and 800V(DS Q2/2015) gen2 MOSFET line-up.

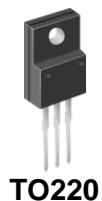
| PKG          | Part.No    | VDSS (V) | ID (A) | RDS(on) Typ.(Ω) Vgs=10V | Qg Typ.(nC) Vgs=10V |
|--------------|------------|----------|--------|-------------------------|---------------------|
| CPT3 D-pak   | R6002END   | 600      | 1.7    | 2.8                     | 6.5                 |
|              | R6004END   |          | 4      | 0.9                     | 15                  |
| TO252E D-pak | ★R6007END3 | 600      | 7      | 0.57                    | 20                  |
|              | ★R6009END3 |          | 9      | 0.5                     | 23                  |
|              | ★R6011END3 |          | 11     | 0.34                    | 32                  |
| LPT D2-pak   | R6004ENJ   | 600      | 4      | 0.9                     | 15                  |
|              | R6007ENJ   |          | 7      | 0.57                    | 20                  |
|              | R6009ENJ   |          | 9      | 0.5                     | 23                  |
|              | R6011ENJ   |          | 11     | 0.34                    | 32                  |
|              | R6015ENJ   |          | 15     | 0.26                    | 40                  |
|              | R6020ENJ   |          | 20     | 0.17                    | 60                  |
| TO220FM      | R6024ENJ   | 600      | 24     | 0.15                    | 70                  |
|              | R6004ENX   |          | 4      | 0.9                     | 15                  |
|              | R6007ENX   |          | 7      | 0.57                    | 20                  |
|              | R6009ENX   |          | 9      | 0.5                     | 23                  |
|              | R6011ENX   |          | 11     | 0.34                    | 32                  |
|              | R6015ENX   |          | 15     | 0.26                    | 40                  |
|              | R6020ENX   |          | 20     | 0.17                    | 60                  |
|              | R6024ENX   |          | 24     | 0.15                    | 70                  |
|              | R6030ENX   |          | 30     | 0.115                   | 85                  |
| TO3PF        | R6015ENZ   | 600      | 15     | 0.26                    | 40                  |
|              | R6020ENZ   |          | 20     | 0.17                    | 60                  |
|              | R6024ENZ   |          | 24     | 0.15                    | 70                  |
|              | R6030ENZ   |          | 30     | 0.115                   | 85                  |
| TO247        | R6035ENZ   | 600      | 35     | 0.095                   | 110                 |
|              | R6020ENZ1  |          | 20     | 0.17                    | 60                  |
|              | R6024ENZ1  |          | 24     | 0.15                    | 70                  |
|              | R6030ENZ1  |          | 30     | 0.115                   | 85                  |
|              | R6035ENZ1  |          | 35     | 0.095                   | 110                 |
|              | R6047ENZ1  |          | 47     | 0.07                    | 145                 |
|              | R6076ENZ1  |          | 76     | 0.04                    | 260                 |

★ Under development: DS Q2/2014 : The development plan may be changed without notice.

# High Voltage Resistance and High Speed Switching Power MOSFET (EN series)

## ■ Feature

- **Low noise**
- Low ON resistance
- High-speed switching
- High-power package etc...



TO220

| Type     | $BV_{DSS}$<br>(V) | $I_D$<br>(A) | $R_{DS(on)}$<br>( $\Omega$ ) | Qg<br>(nC) | Ciss<br>(pF) |
|----------|-------------------|--------------|------------------------------|------------|--------------|
| R6004ENX | 600               | 4            | 0.90                         | 15         | 250          |
| R6007ENX | 600               | 7            | 0.57                         | 20         | 390          |
| R6009ENX | 600               | 9            | 0.50                         | 23         | 430          |
| R6011ENX | 600               | 11           | 0.34                         | 32         | 670          |
| R6015ENX | 600               | 15           | 0.26                         | 40         | 910          |
| R6020ENX | 600               | 20           | 0.17                         | 58         | 1400         |
| R6024ENX | 600               | 24           | 0.15                         | 70         | 1650         |
| R6030ENX | 600               | 30           | 0.115                        | 85         | 2100         |

| Type       | $BV_{DSS}$<br>(V) | $I_D$<br>(A) | $R_{DS(on)}$<br>( $\Omega$ ) | Qg<br>(nC) | Ciss |
|------------|-------------------|--------------|------------------------------|------------|------|
| R6004END   | 600               | 4            | 0.90                         | 15         | 250  |
| ★R6007END3 | 600               | 7            | 0.57                         | 20         | 390  |
| ★R6009END3 | 600               | 9            | 0.50                         | 23         | 430  |
| ★R6011END3 | 600               | 11           | 0.34                         | 32         | 670  |



TO252/  
D-Pack

## ■ Lineup

※Under Development

★DS Not Available

※ Specification may be changed for a development schedule article.

| Type     | $BV_{DSS}$<br>(V) | $I_D$<br>(A) | $R_{DS(on)}$<br>( $\Omega$ ) | Qg<br>(nC) | Ciss |
|----------|-------------------|--------------|------------------------------|------------|------|
| R6004ENJ | 600               | 4            | 0.90                         | 15         | 250  |
| R6007ENJ | 600               | 7            | 0.57                         | 20         | 390  |
| R6009ENJ | 600               | 9            | 0.50                         | 23         | 430  |
| R6011ENJ | 600               | 11           | 0.34                         | 32         | 670  |
| R6015ENJ | 600               | 15           | 0.26                         | 40         | 910  |
| R6020ENJ | 600               | 20           | 0.17                         | 58         | 1400 |
| R6024ENJ | 600               | 24           | 0.15                         | 70         | 1650 |



LPTS /  
D2-Pack

| Type      | $BV_{DSS}$<br>(V) | $I_D$<br>(A) | $R_{DS(on)}$<br>( $\Omega$ ) | Qg<br>(nC) | Ciss |
|-----------|-------------------|--------------|------------------------------|------------|------|
| R6020ENZ1 | 600               | 20           | 0.17                         | 58         | 1400 |
| R6024ENZ1 | 600               | 24           | 0.15                         | 70         | 1650 |
| R6030ENZ1 | 600               | 30           | 0.115                        | 85         | 2100 |
| R6035ENZ1 | 600               | 35           | 0.095                        | 110        | 2750 |
| R6047ENZ1 | 600               | 47           | 0.070                        | 150        | 3600 |
| R6076ENZ1 | 600               | 76           | 0.040                        | 250        | 6500 |



TO247

# 650V Super Junction MOSFET - Multi Epi 2<sup>nd</sup> gen. EN series -

CONFIDENTIAL

## Feature

R60xxENx

> **600V**-SJ MOS

> Low A\*Ron

> Low Noise

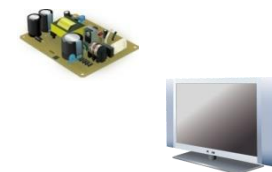
2014/3Q ~ DS

R65xxENx

> **650V**-SJ MOS

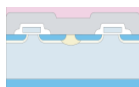
> Low A\*Ron

> Low Noise



## Low Noise

### Planar MOS



> Low noise

### SJ MOS /ANseries



> High speed SW

> Low Ron

Merit of Planar and  
SJ-MOS are united.

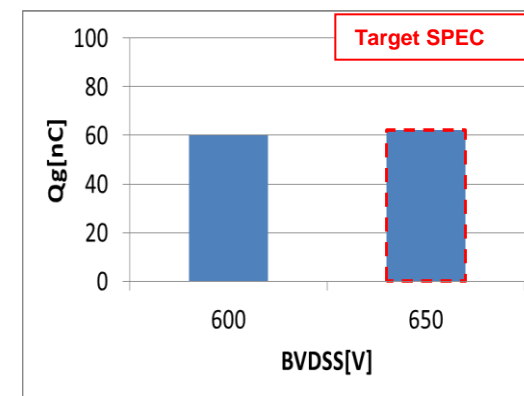
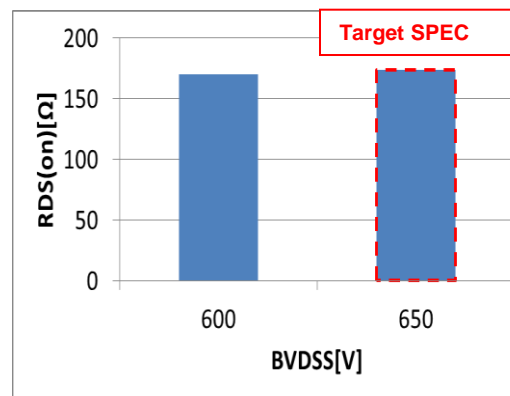
SJ MOS  
/ EN series



> Low noise  
> Low Ron

## Characteristics Comparison

R6020ENX vs. 650V/20A target



Target Ron and Qg of 650V type is same as 600V type.

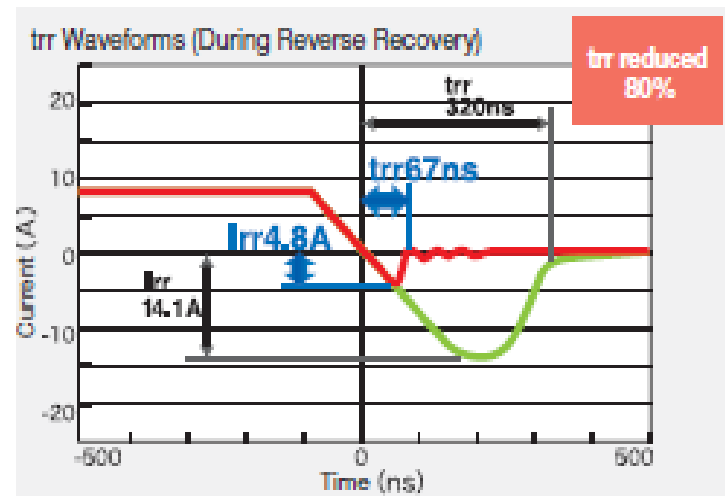
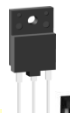
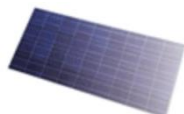
# High speed trr Super Junction MOSFET - Multi Epi 1<sup>st</sup> gen. FN series -

## Feature

- > High speed trr
- > Improves inverter efficiency
- > Compact package and low ON-resistance reduces set size (no FRDs connected in parallel required)

## Application

- > LCD TV power supplies (with integrated inverter)
- > Solar battery power conditioners
- > Motor drives
- > Home appliances



| PKG            | Part.No   | VDSS (V) | ID (A) | RDS(on) Typ.(Ω)<br>Vgs=10V | Qg Typ.(nC)<br>Vgs=10V | trr Typ. (ns) |
|----------------|-----------|----------|--------|----------------------------|------------------------|---------------|
| LPT<br>D2-pack | R6008FNJ  | 600      | 8      | 0.73                       | 20                     | 67            |
|                | R6012FNJ  |          | 12     | 0.39                       | 35                     | 75            |
| TO220FM        | R5009FNX  | 500      | 9      | 0.65                       | 18                     | 78            |
|                | R5011FNX  |          | 11     | 0.4                        | 30                     | 85            |
|                | R5016FNX  | 600      | 16     | 0.22                       | 45                     | 100           |
|                | R6008FNX  |          | 8      | 0.73                       | 20                     | 67            |
|                | R6012FNX  |          | 12     | 0.39                       | 35                     | 75            |
|                | R6015FNX  |          | 15     | 0.27                       | 42                     | 90            |
|                | R6020FNX  |          | 20     | 0.2                        | 65                     | 105           |
|                | R6025FNZ  | 600      | 25     | 0.14                       | 85                     | 120           |
| TO3PF          | R6046FNZ  |          | 46     | 0.075                      | 150                    | 145           |
| TO247          | R6025FNZ1 | 600      | 25     | 0.14                       | 85                     | 120           |
|                | R6046FNZ1 |          | 46     | 0.075                      | 150                    | 143           |



We are developing 2<sup>nd</sup> gen. JN series.  
This item's schedule is DS Q4/2014.

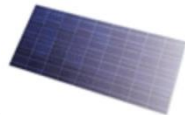
# Super Junction MOSFET - Multi Epi 1<sup>st</sup> gen. **AN series** -

## Feature





- > Super Junction structure
- > Line-up of Vds 800V
- > Low A\*Ron x Qg
- > Various Package line-up  
(D-pak, D2-pak, TO220FM, TO247, TO3PF)

## Application

- > LCD TV power supplies
- > Lighting (Lamp, LED lamp)
- > Solar battery power conditioners
- > Adapter
- > Game
- > Home appliances
- > SMPS



## Line-up

| PKG   | Part.No    | VDSS (V) | ID (A) | RDS(on) Typ.(Ω)<br>Vgs=10V | Qg Typ.(nC)<br>Vgs=10V |
|---|------------|----------|--------|----------------------------|------------------------|
| <b>CPT3</b><br>D-pack  | R8001CND   | 800      | 1      | 6.7                        | 7.2                    |
|   | ★R8002CND  |          | 2      | 3.3                        | 12.7                   |
| <b>LPT</b><br>D2-pack  | ★R8002ANJ  | 800      | 2      | 3.3                        | 12.7                   |
|   | ★R8005ANJ  |          | 5      | 1.6                        | 21                     |
|   | ★R8008ANJ  |          | 8      | 0.79                       | 39                     |
| <b>TO220FM</b><br>     | R8002ANX   | 800      | 2      | 3.3                        | 12.7                   |
|   | R8005ANX   |          | 5      | 1.6                        | 21                     |
|   | R8008ANX   |          | 8      | 0.79                       | 39                     |
|   | R8010ANX   |          | 10     | 0.43                       | 62                     |
| <b>TO247</b><br>       | ★R8012ANZ1 | 800      | 12     | 0.35                       | 78                     |
|   | ★R8016ANZ1 |          | 16     | 0.23                       | 115                    |

★Under development: DS :OK

The development plan may be changed without notice.

This is reference data. If you design circuit, please refer specification sheet.



We are developing Vds 800V(DS Q2/2015) **gen2** SJ-MOSFET line-up.

# ROHM's IGBT Lineup

\*Under development

|                              |  |                               |   |                        |                    |                            |   |
|------------------------------|--|-------------------------------|---|------------------------|--------------------|----------------------------|---|
| Item                         | Low VCE(sat) and High speed SW type (tf 50ns typ.) |                               | Low VCE(sat) and SCSSOA guaranteed type |                        | Low VCE(sat) type  | SCIS guaranteed type       | Low VCE(sat) and SCSSOA guaranteed type |
| Application                  | Converter  |                               | Inverter                                |                        | Home Appliance     | Igniter                    | EV / HEV                                |
| Series Name                  | <b>RGTH</b> series                                 | <b>RGW</b> series (Next Gen.) | <b>RGT</b> series                       | RGS series (Next Gen.) | <b>RGCL</b> series | <b>RGPx</b> series         | -                                       |
| Breakdown Voltage            | <b>650V</b>  | <b>650V</b> *<br>1200V *      | <b>650V</b>                             | 650V *<br>1200V *      | <b>600V</b> *      | <b>430V</b><br><b>560V</b> | 600V *<br>1200V *                       |
| Short Circuit Withstand Time | -  | -                             | 5μsec                                   | 8~10μsec               | -                  | -                          | 8~10μsec                                |
| VCE(sat) typ.                | 1.6V   | -                             | 1.65V                                   | -                      | 1.4V               | 1.3V                       | -                                       |
| Status                       | CS OK  | Under Development             | CS OK                                   | Under Development      | Under Development  | DS OK                      | Under Development                       |

The table shows a product development plan as of today and is subject to change without notice. As of Feb 24, 2014



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Thank you very much

