

# RBA160N04AHPF-4UA01

40V – 160A – N-channel Power MOS FET

Application : Automotive

R07DS1344EJ0200

Rev.2.00

Jul. 8, 2020

## Description

The RBA160N04AHPF-4UA01 is N-channel MOS Field Effect Transistor designed for high current switching applications.

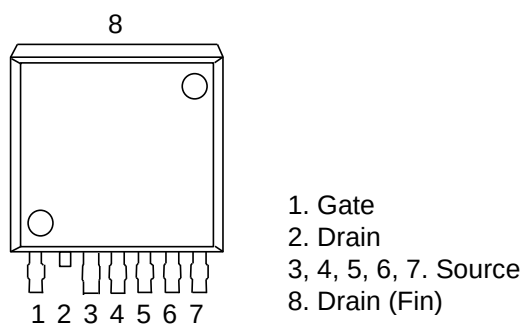
## Features

- Super low on-state resistance  
 $R_{DS(on)} = 1.25 \text{ m}\Omega \text{ MAX. ( } V_{GS} = 10 \text{ V, } I_D = 80 \text{ A )}$
- Low input capacitance  
 $C_{iss} = 8800 \text{ pF TYP. ( } V_{DS} = 25 \text{ V )}$
- Designed for automotive application and AEC-Q101 qualified
- Pb-free (This product does not contain Pb in the external electrode)

## Ordering Information

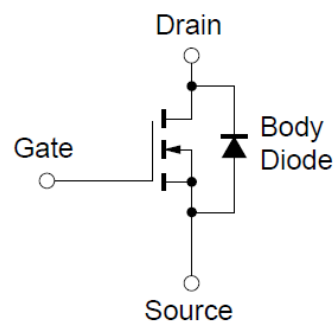
| Part No.                | Quantity    | Shipping container |
|-------------------------|-------------|--------------------|
| RBA160N04AHPF-4UA01#GB0 | 800pcs/reel | Taping             |

## Outline



TO-263-7pin-SHL\* (MP-25ZU)

\* Short Head & Lead



Equivalent circuit

**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

## Absolute Maximum Ratings

(T<sub>A</sub>=25°C)

| Item                                             | Symbol                | Ratings    | Unit |
|--------------------------------------------------|-----------------------|------------|------|
| Drain to Source Voltage (V <sub>GS</sub> = 0 V)  | V <sub>DSS</sub>      | 40         | V    |
| Gate to Source Voltage (V <sub>DS</sub> = 0 V)   | V <sub>GSS</sub>      | ±20        | V    |
| Drain Current (DC) (T <sub>C</sub> = 25 °C)      | I <sub>D(DC)</sub>    | ±160       | A    |
| Drain Current (pulse) <sup>Note1</sup>           | I <sub>D(pulse)</sub> | ±640       | A    |
| Total Power Dissipation (T <sub>C</sub> = 25 °C) | P <sub>T1</sub>       | 250        | W    |
| Total Power Dissipation (T <sub>A</sub> = 25 °C) | P <sub>T2</sub>       | 1.8        | W    |
| Channel Temperature                              | T <sub>ch</sub>       | 175        | °C   |
| Storage Temperature                              | T <sub>stg</sub>      | -55 to 175 | °C   |
| Repetitive Avalanche Current <sup>Note2</sup>    | I <sub>AR</sub>       | 55         | A    |
| Repetitive Avalanche Energy <sup>Note3</sup>     | E <sub>AR</sub>       | 303        | mJ   |

Note 1. P<sub>W</sub> ≤ 10 μs, Duty Cycle ≤ 1%2. V<sub>GS</sub> = 20 → 0V, R<sub>G</sub> = 25 Ω3. L = 100μH, V<sub>DD</sub> = 20V, V<sub>GS</sub> = 20 → 0V, R<sub>G</sub> = 25 Ω

## Thermal Resistance

|                                       |                       |      |      |
|---------------------------------------|-----------------------|------|------|
| Channel to Case Thermal Resistance    | R <sub>th(ch-C)</sub> | 0.60 | °C/W |
| Channel to Ambient Thermal Resistance | R <sub>th(ch-A)</sub> | 83.3 | °C/W |

## Electrical Characteristics

(T<sub>A</sub>=25°C)

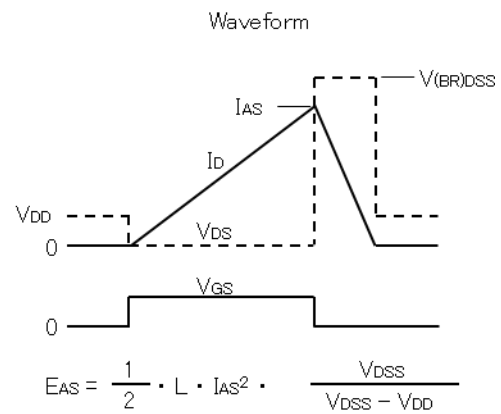
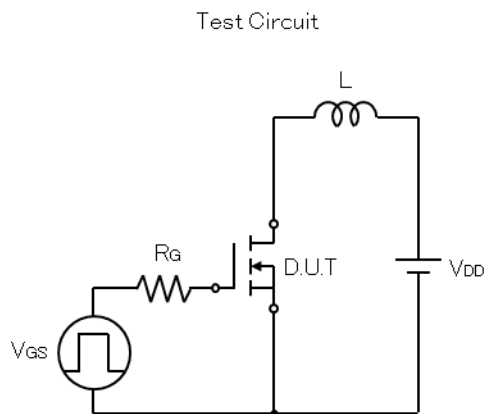
| Item                                | Symbol                               | Min | Typ  | Max   | Unit | Test Conditions                                             |
|-------------------------------------|--------------------------------------|-----|------|-------|------|-------------------------------------------------------------|
| Zero Gate Voltage Drain Current     | I <sub>DSS</sub>                     |     |      | 1     | μA   | V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V               |
| Gate Leakage Current                | I <sub>GSS</sub>                     |     |      | ±100  | nA   | V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> = 0 V             |
| Gate to Source Threshold Voltage    | V <sub>GS(th)</sub>                  | 2.0 | 3.0  | 4.0   | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA |
| Drain to Source On-state Resistance | R <sub>DS(on)</sub> <sup>Note4</sup> |     | 1.05 | 1.25  | mΩ   | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A               |
| Input Capacitance                   | C <sub>iss</sub> <sup>Note5</sup>    |     | 8800 | 13200 | pF   | V <sub>DS</sub> = 25 V                                      |
| Output Capacitance                  | C <sub>oss</sub> <sup>Note5</sup>    |     | 980  | 1470  | pF   | V <sub>GS</sub> = 0 V                                       |
| Reverse Transfer Capacitance        | C <sub>rss</sub> <sup>Note5</sup>    |     | 530  | 960   | pF   | f = 1 MHz                                                   |
| Turn-on Delay Time                  | t <sub>d(on)</sub> <sup>Note5</sup>  |     | 32   | 64    | ns   | V <sub>DD</sub> = 20 V, I <sub>D</sub> = 80 A               |
| Rise Time                           | t <sub>r</sub> <sup>Note5</sup>      |     | 22   | 53    | ns   | V <sub>GS</sub> = 10 V                                      |
| Turn-off Delay Time                 | t <sub>d(off)</sub> <sup>Note5</sup> |     | 97   | 194   | ns   | R <sub>G</sub> = 0 Ω                                        |
| Fall Time                           | t <sub>f</sub> <sup>Note5</sup>      |     | 22   | 53    | ns   |                                                             |
| Total Gate Charge                   | Q <sub>G</sub> <sup>Note5</sup>      |     | 157  | 236   | nC   | V <sub>DD</sub> = 32 V                                      |
| Gate to Source Charge               | Q <sub>GS</sub> <sup>Note5</sup>     |     | 37   |       | nC   | V <sub>GS</sub> = 10 V                                      |
| Gate to Drain Charge                | Q <sub>GD</sub> <sup>Note5</sup>     |     | 40   |       | nC   | I <sub>D</sub> = 160 A                                      |
| Body Diode Forward Voltage          | V <sub>F(S-D)</sub> <sup>Note4</sup> |     | 0.9  | 1.5   | V    | I <sub>F</sub> = 160 A, V <sub>GS</sub> = 0 V               |
| Reverse Recovery Time               | t <sub>rr</sub> <sup>Note5</sup>     |     | 71   |       | ns   | I <sub>F</sub> = 160 A, V <sub>GS</sub> = 0 V               |
| Reverse Recovery Charge             | Q <sub>rr</sub> <sup>Note5</sup>     |     | 92   |       | nC   | di/dt = 100 A/μs                                            |

Note 4. Pulse test

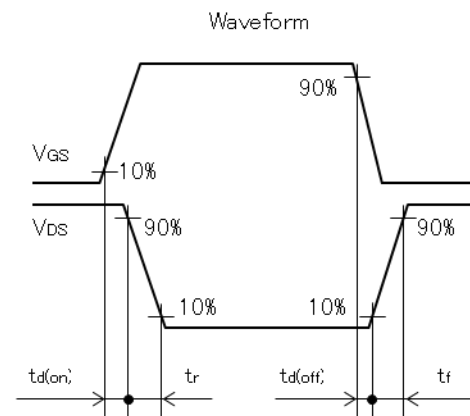
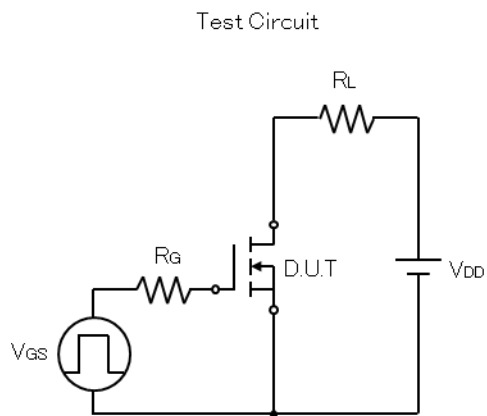
Note 5. Refer value

## Test Circuit

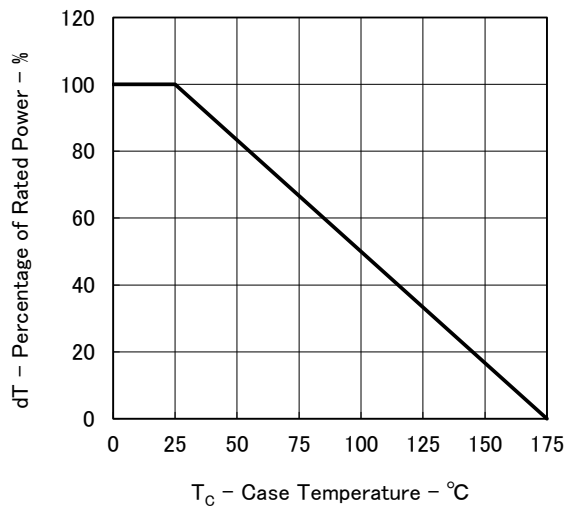
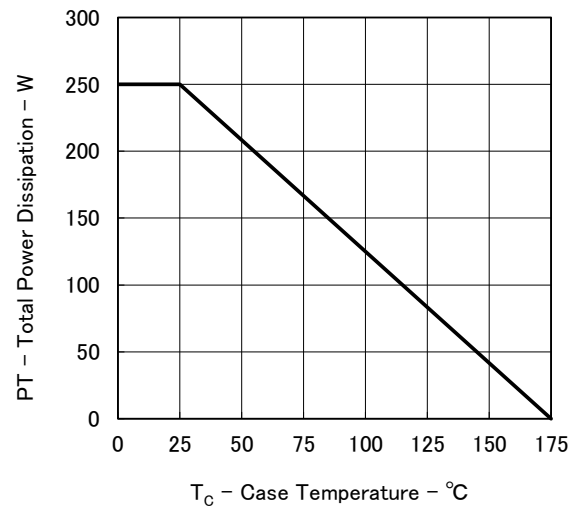
### Avalanche



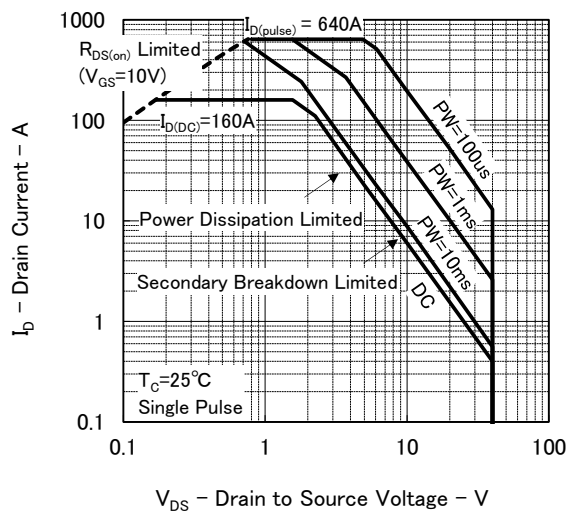
### Switching Time



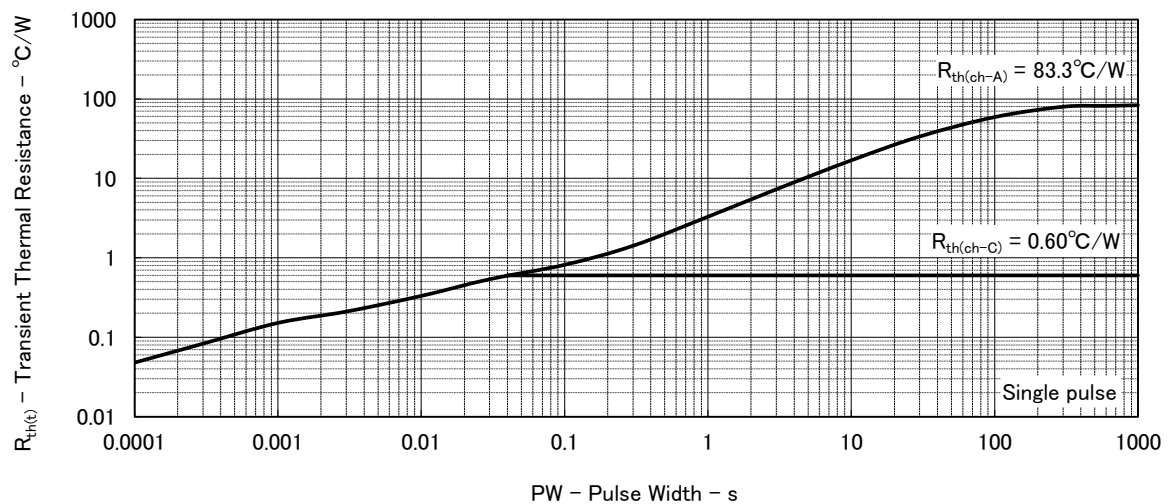
## Typical Characteristics (TA = 25°C)

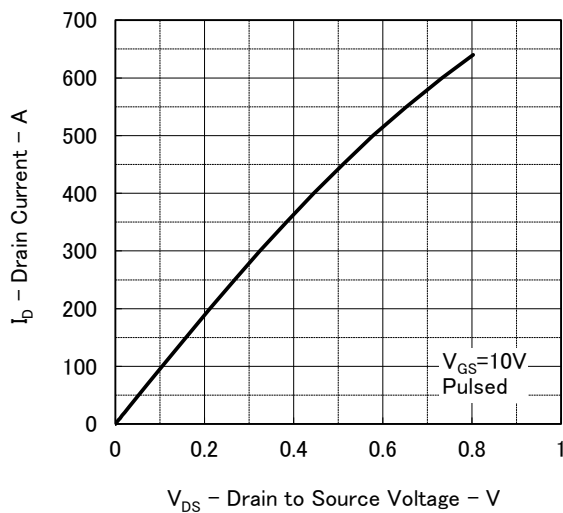
DERATING FACTOR OF FORWARD BIAS  
SAFE OPERATING AREATOTAL POWER DISSIPATION vs.  
CASE TEMPERATURE

FORWARD BIAS SAFE OPERATING AREA

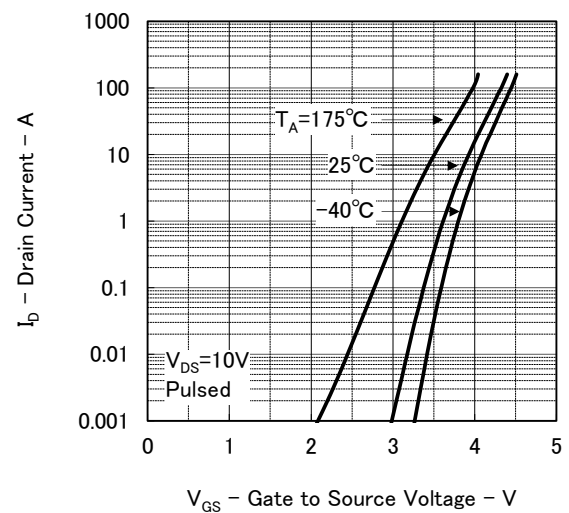
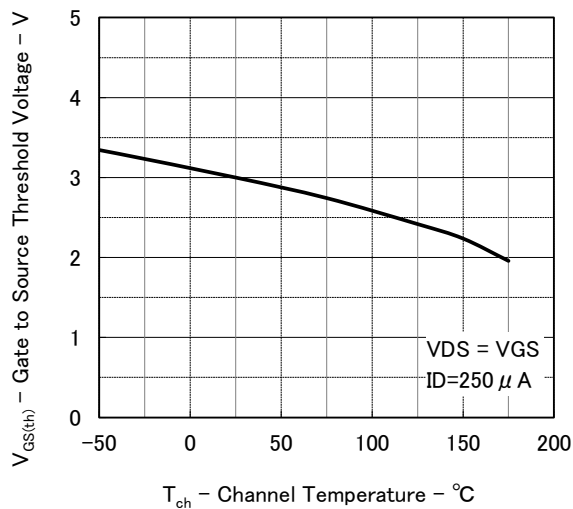
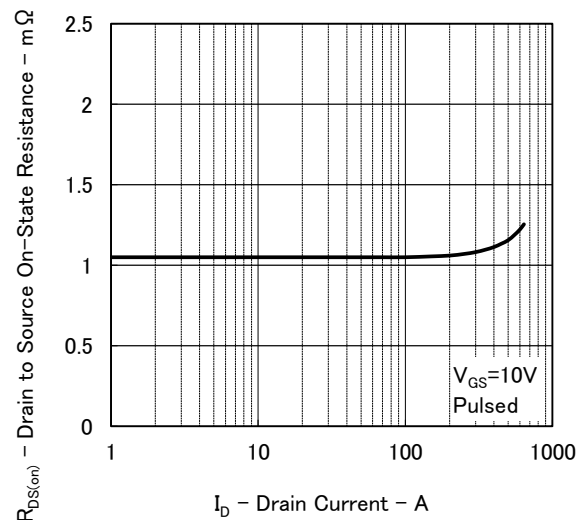
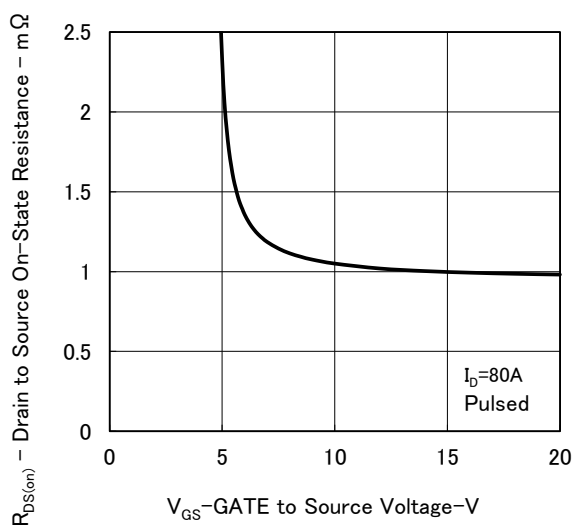
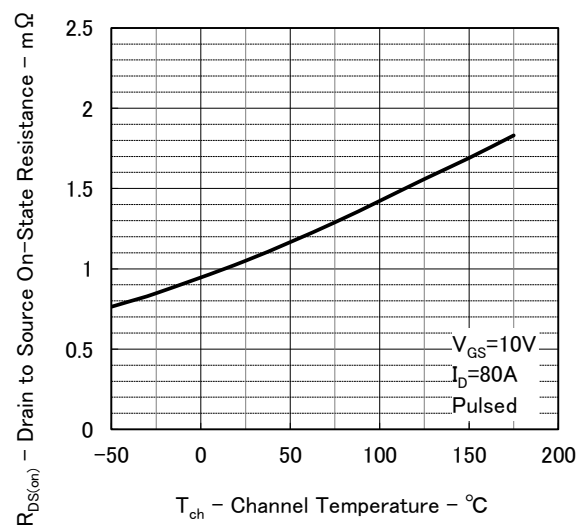


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

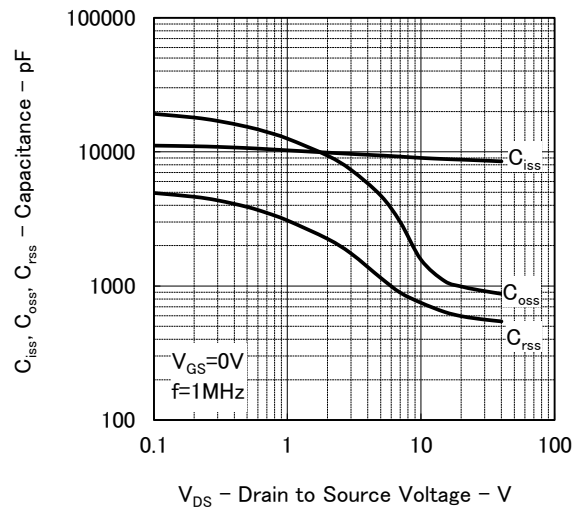


DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE

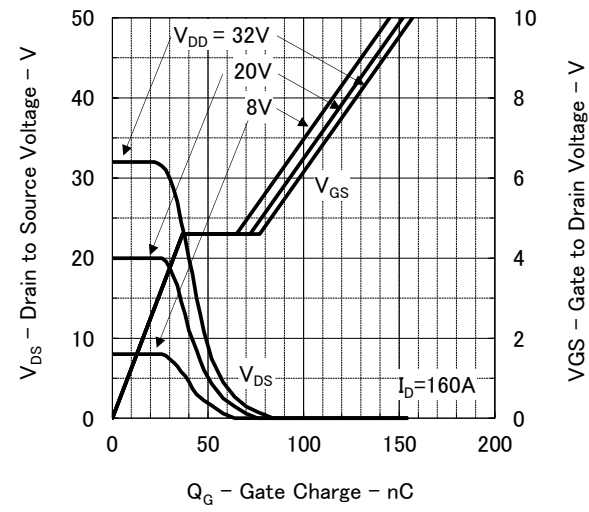
FORWARD TRANSFER CHARACTERISTICS

GATE TO SOURCE THRESHOLD VOLTAGE vs.  
CHANNEL TEMPERATUREDRAIN TO SOURCE ON-STATE  
RESISTANCE vs. DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.  
GATE TO SOURCE VOLTAGEDRAIN TO SOURCE ON-STATE RESISTANCE vs.  
CHANNEL TEMPERATURE

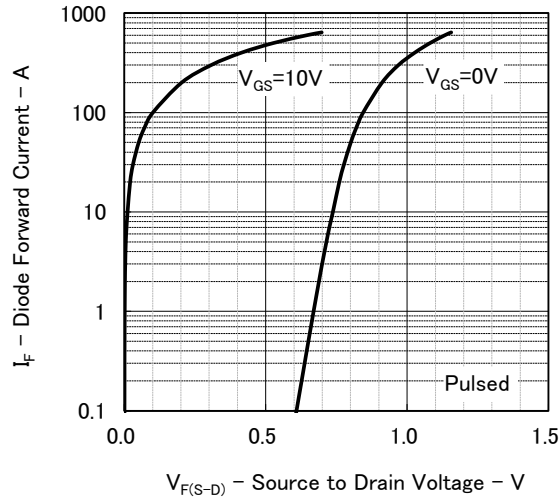
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



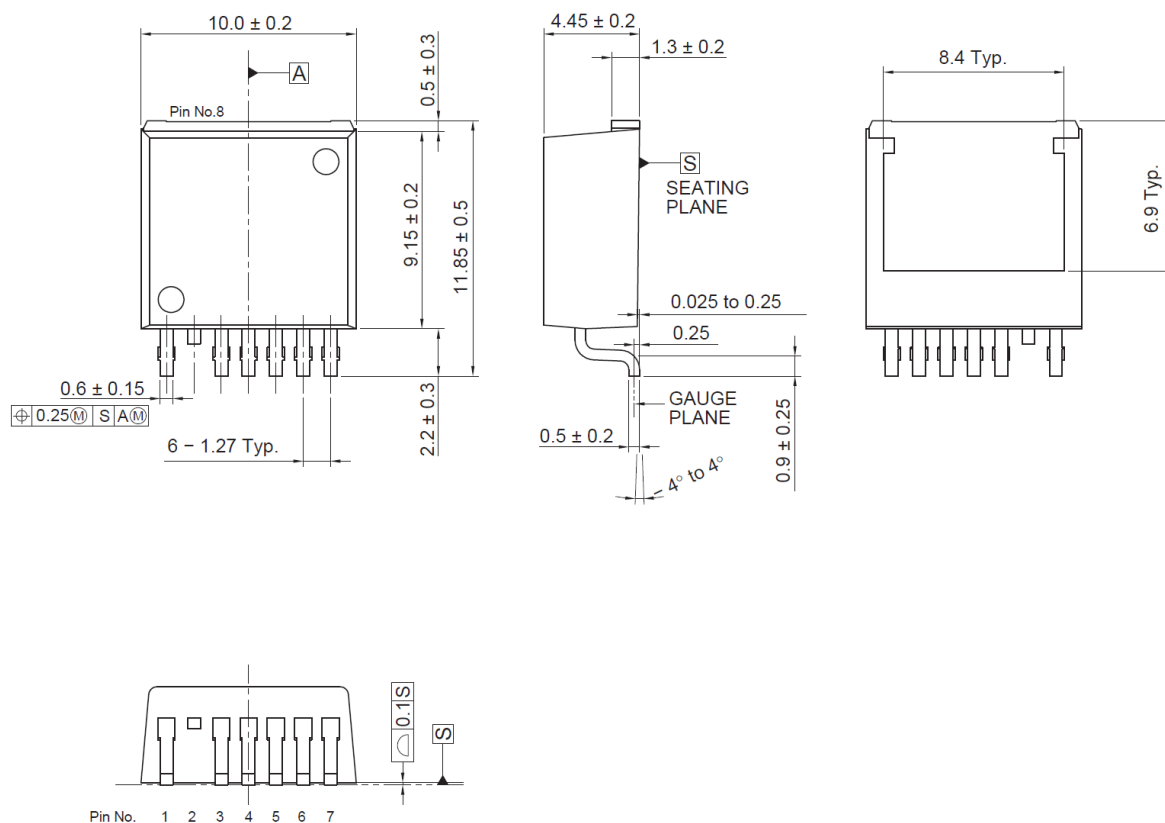
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



## Package Dimensions

| JEITA Package Code | RENESAS Code | Previous Code | MASS (Typ) [g] | Package Name |
|--------------------|--------------|---------------|----------------|--------------|
| —                  | PRSS0008DC-A | —             | 1.39           | MP-25ZU      |

Unit: mm



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