# N0601N

## N-channel MOSFET
## 60 V, 100 A, 4.2 mΩ

R07DS0557EJ0200
Rev.2.00
2020.6.10

### Features

- Low on-state resistance : $R_{DS(on)}$ = 4.2 mΩ MAX. ($V_{GS}$ = 10 V, $I_D$ = 50 A)
- Low $C_{iss}$ : $C_{iss}$ = 7730 pF TYP. ($V_{DS}$ = 25 V, $V_{GS}$ = 0 V)
- High current : $I_{D(DC)}$ = ±100 A
- RoHS Compliant
- Quality Grade : Standard
- Applications : For high current switching

### Ordering Information

| Part No. | Package | Packing |
|---|---|---|
| N0601N-ZK-E1-AY | TO-263, Pb-free Note1 | 800 pcs / Tape and Reel |

Note: 1. Pb-free means that this product does not contain lead in the external electrode.

### Absolute Maximum Ratings ($T_A$ = 25°C)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to Source Voltage ($V_{GS}$ = 0 V) | $V_{DSS}$ | 60 | V |
| Gate to Source Voltage ($V_{DS}$ = 0 V) | $V_{GSS}$ | ±20 | V |
| Drain Current (DC) ($T_C$ = 25 °C) | $I_{D(DC)}$ | ±100 | A |
| Drain Current (pulse) Note2 | $I_{D(pulse)}$ | ±400 | A |
| Total Power Dissipation ($T_C$ = 25°C) | $P_{T1}$ | 156 | W |
| Total Power Dissipation ($T_A$ = 25°C) | $P_{T2}$ | 1.5 | W |
| Channel Temperature | $T_{ch}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |
| Single Avalanche Current Note3 | $I_{AS}$ | 55 | A |
| Single Avalanche Energy Note3 | $E_{AS}$ | 300 | mJ |

Note: Continuous heavy condition (e.g. high temperature/voltage/current or high variation of temperature) may affect a reliability even if it is within the absolute maximum ratings. Please consider derating condition for appropriate reliability in reference Renesas Semiconductor Reliability Handbook (Recommendation for Handling and Usage of Semiconductor Devices) and individual reliability data.

Notes: 2. PW ≤ 10 μs, Duty Cycle ≤ 1%

3. Starting $T_{ch}$ = 25°C, $R_G$ = 25 Ω, $V_{DD}$ = 30 V, $V_{GS}$ = 20 → 0 V, L = 100 μH

### Thermal Resistance

| Item | Symbol | Max. Value Note4 | Unit |
|---|---|---|---|
| Channel to Case Thermal Resistance | $R_{th(ch-C)}$ | 0.8 | °C/W |
| Channel to Ambient Thermal Resistance | $R_{th(ch-A)}$ | 83.3 | °C/W |

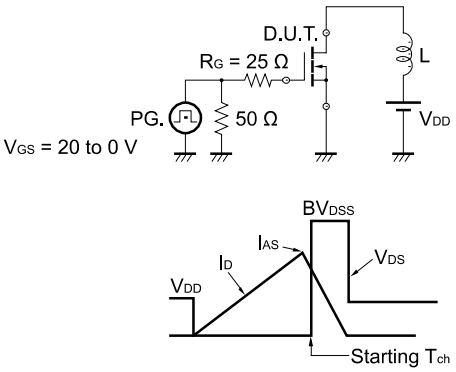
Notes: 4. This data is the designed target maximum value on Renesas's measurement condition. (Not tested)

## Electrical Characteristics ($T_A$ = 25°C)

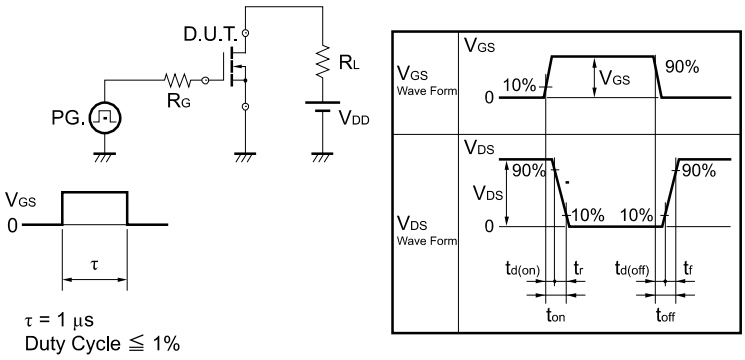
| Item | Symbol | MIN. | TYP. | MAX. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Zero Gate Voltage Drain Current | $I_{DSS}$ | | | 1 | μA | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V |
| Gate Leakage Current | $I_{GSS}$ | | | ±100 | nA | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V |
| Gate to Source Cut-off Voltage | $V_{GS(off)}$ | 2.0 | | 4.0 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| Forward Transfer Admittance Note5 | $\|y_{fs}\|$ | 35 | | | S | $V_{DS}$ = 10 V, $I_D$ = 50 A |
| Drain to Source On-state Resistance Note5 | $R_{DS(on)}$ | | 3.3 | 4.2 | mΩ | $V_{GS}$ = 10 V, $I_D$ = 50 A |
| Input Capacitance | $C_{iss}$ | | 7730 | | pF | $V_{DS}$ = 25 V, |
| Output Capacitance | $C_{oss}$ | | 560 | | pF | $V_{GS}$ = 0 V, |
| Reverse Transfer Capacitance | $C_{rss}$ | | 290 | | pF | f = 1 MHz |
| Turn-on Delay Time | $t_{d(on)}$ | | 35 | | ns | $V_{DD}$ = 30 V, $I_D$ = 50 A, |
| Rise Time | $t_r$ | | 12 | | ns | $V_{GS}$ = 10 V, |
| Turn-off Delay Time | $t_{d(off)}$ | | 76 | | ns | $R_G$ = 0 Ω |
| Fall Time | $t_f$ | | 14 | | ns | |
| Total Gate Charge | $Q_G$ | | 133 | | nC | $V_{DD}$ = 48 V, |
| Gate to Source Charge | $Q_{GS}$ | | 38 | | nC | $V_{GS}$ = 10 V, |
| Gate to Drain Charge | $Q_{GD}$ | | 38 | | nC | $I_D$ = 100 A |
| Body Diode Forward Voltage Note5 | $V_{F(S-D)}$ | | | 1.5 | V | $I_F$ = 100 A, $V_{GS}$ = 0 V |
| Reverse Recovery Time | $t_{rr}$ | | 44 | | ns | $I_F$ = 50 A, $V_{GS}$ = 0 V, |
| Reverse Recovery Charge | $Q_{rr}$ | | 61 | | nC | di/dt = 100 A/μs |

Notes: 5. Pulsed test

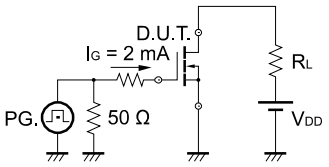
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**




**TEST CIRCUIT 2 SWITCHING TIME**

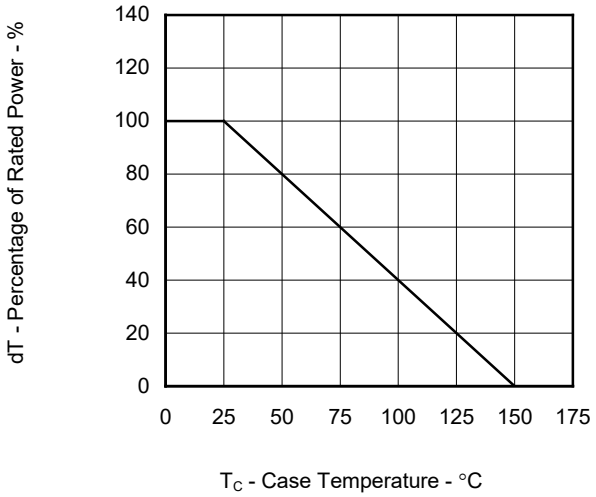



**TEST CIRCUIT 3 GATE CHARGE**

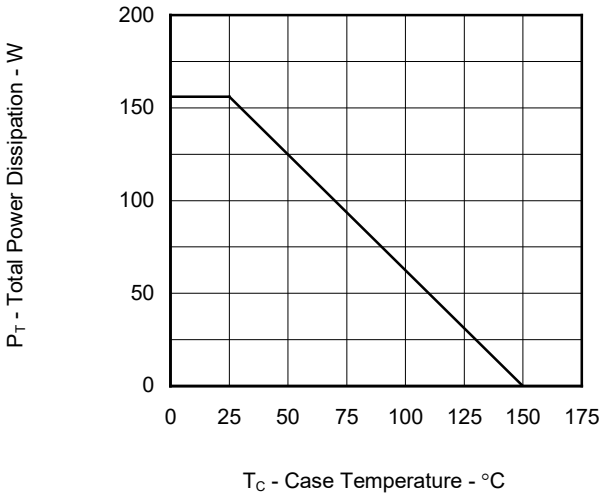


## Typical Characteristics Note6

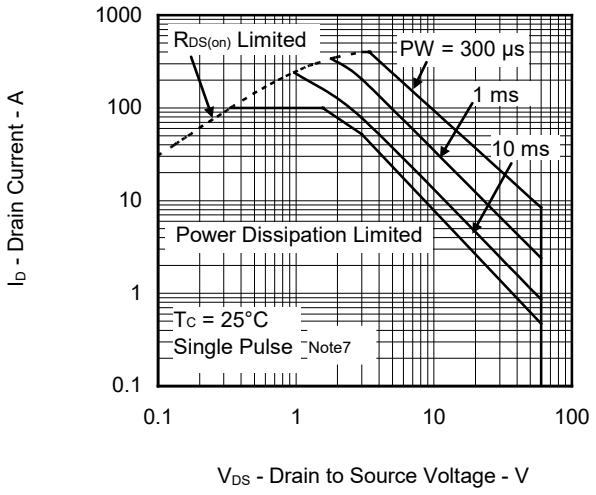
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



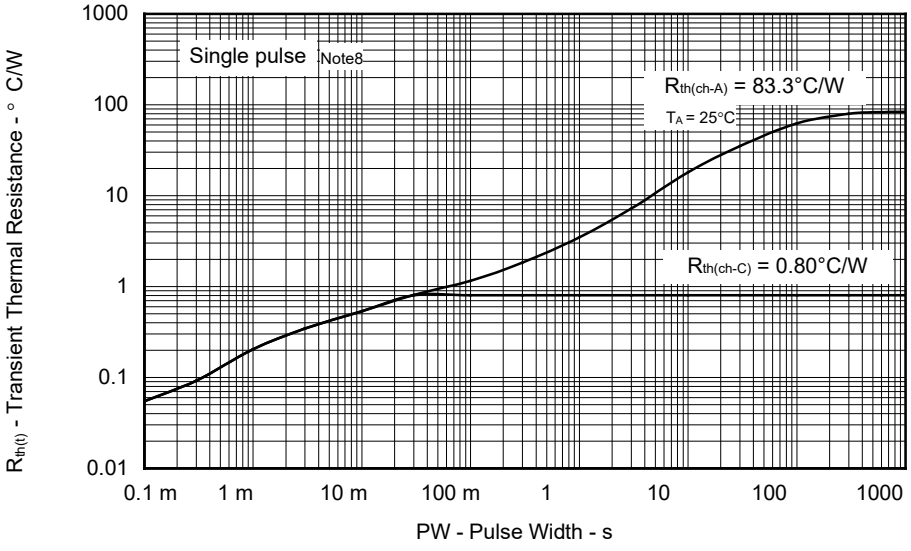

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE




FORWARD BIAS SAFE OPERATING AREA

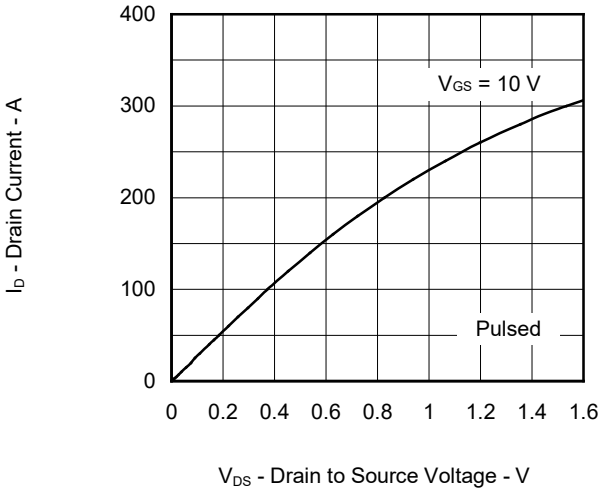



TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

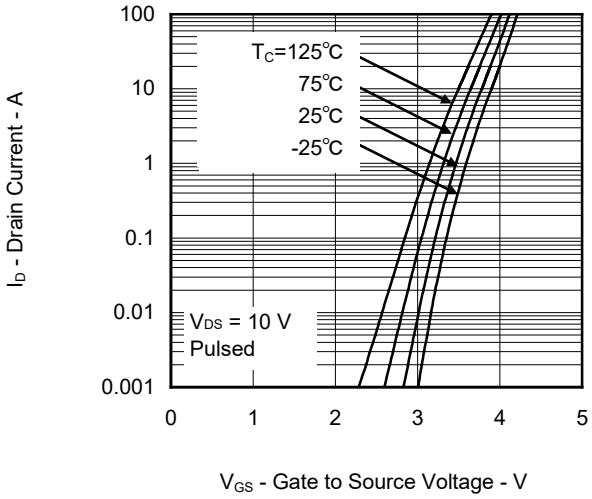



Notes: 6. Designed target value on Renesas measurement condition. ($T_C$ = 25°C, unless otherwise specified)
7. This data is the designed value on Renesas's measurement condition. Renesas recommends that operating conditions are designed according to a document "Power MOSFET/IGBT Attention of Handling Semiconductor Devices (R07ZZ0010)".
8. This data is the designed target maximum value on Renesas's measurement condition.

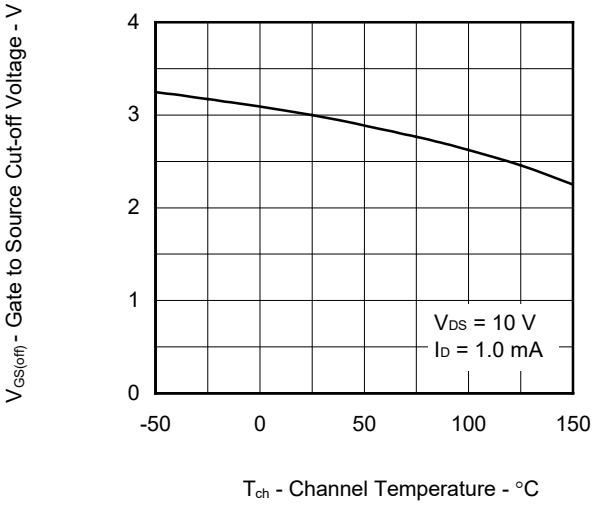
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



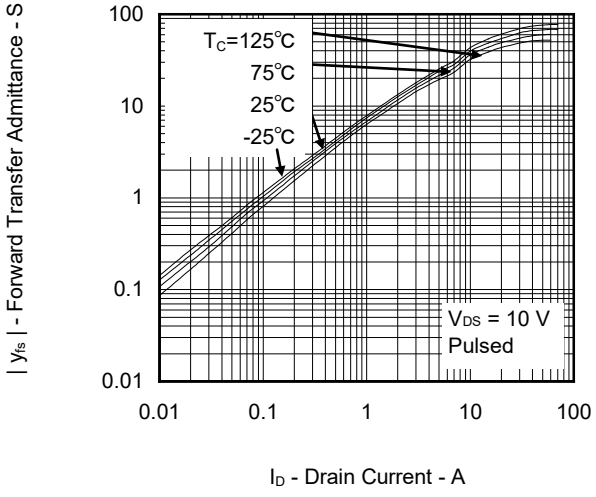

FORWARD TRANSFER
CHARACTERISTICS



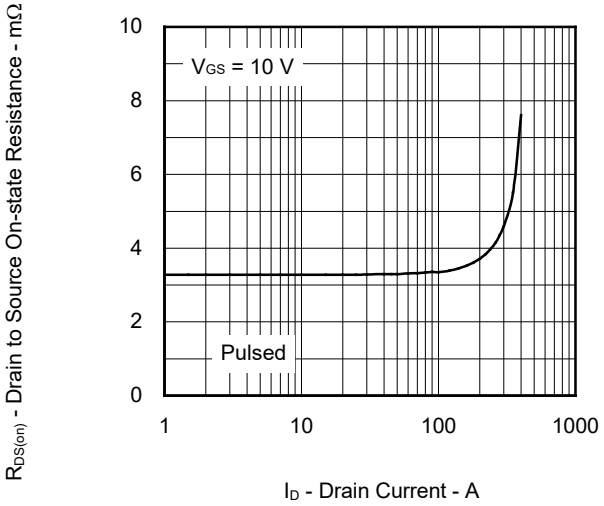

GATE TO SOURCE CUT-OFF VOLTAGE
vs. CHANNEL TEMPERATURE



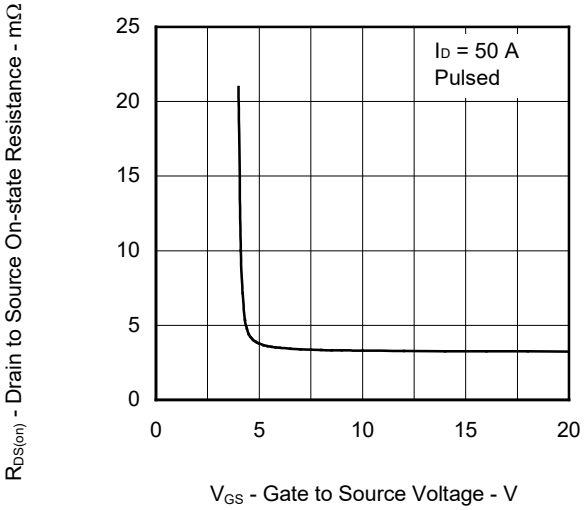

FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



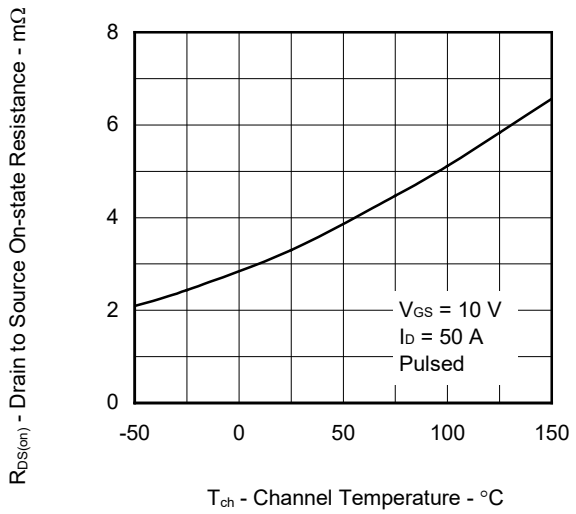

DRAIN TO SOURCE ON-STATE RESISTANCE
vs. DRAIN CURRENT



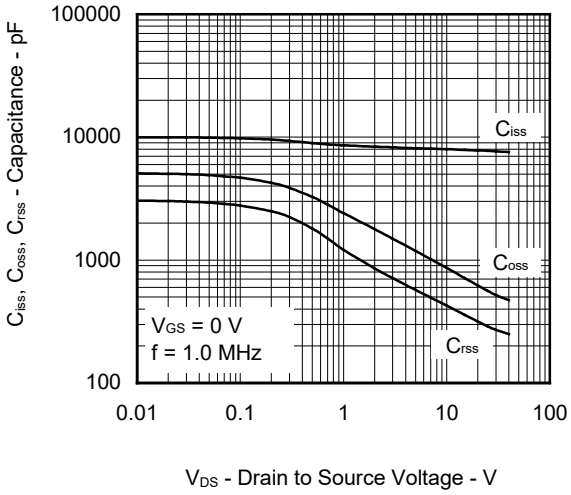

DRAIN TO SOURCE ON-STATE RESISTANCE
vs. GATE TO SOURCE VOLTAGE



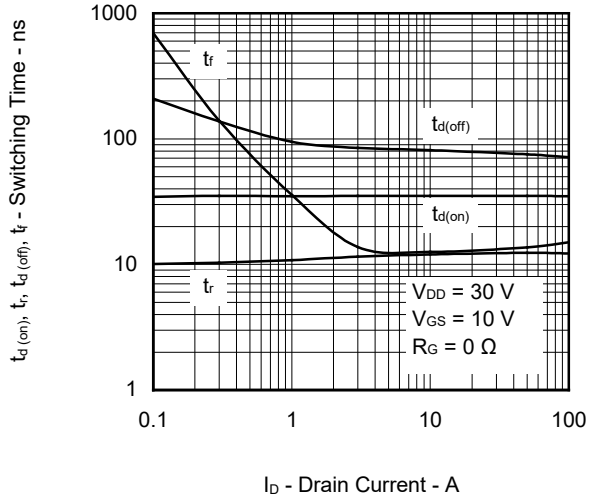
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



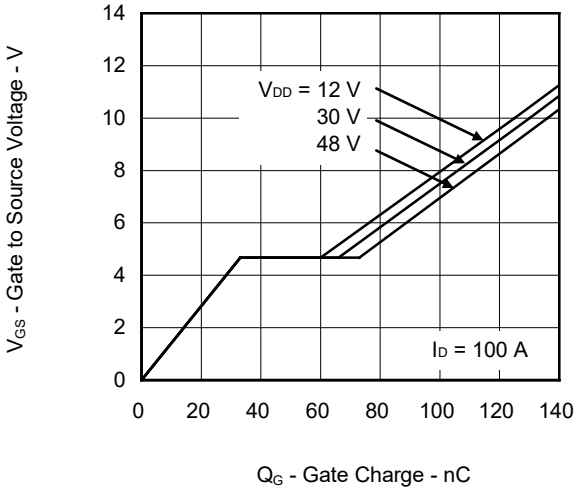

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



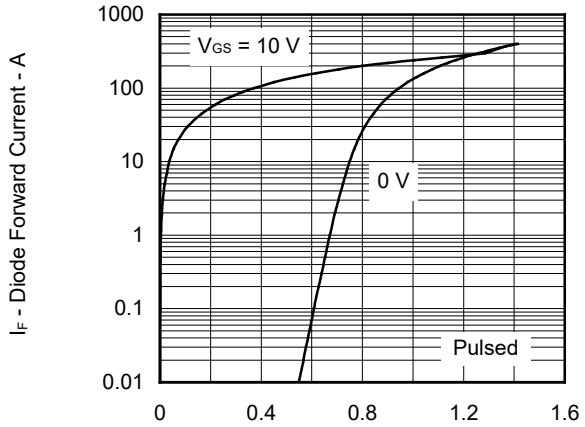

SWITCHING CHARACTERISTICS



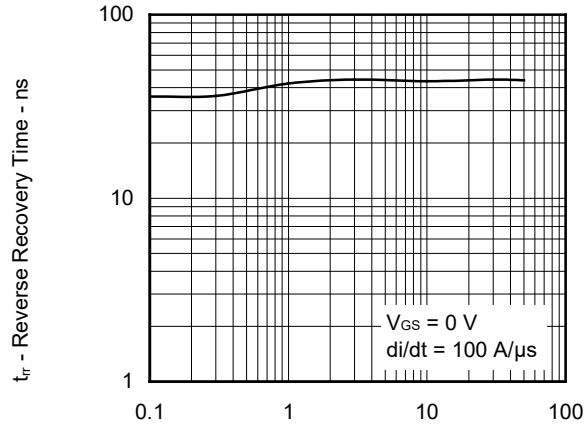

DYNAMIC INPUT CHARACTERISTICS




SOURCE TO DRAIN DIODE FORWARD VOLTAGE



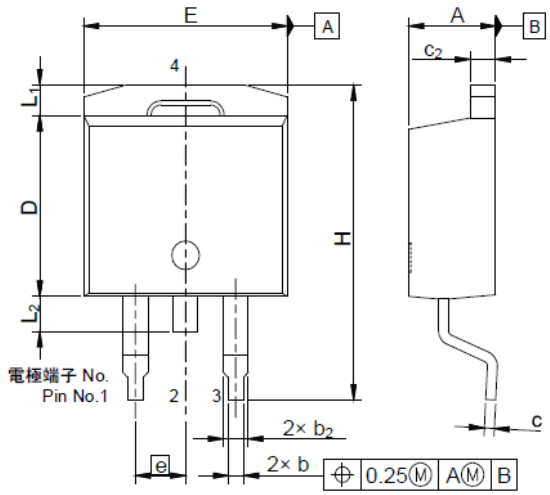

REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

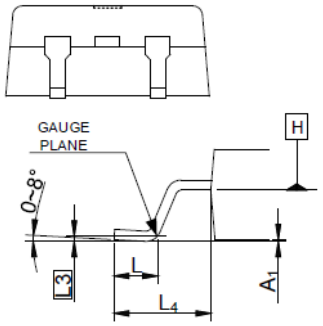


## Package Drawing (Unit: mm)

| Package Name | JEITA Package Code | RENESAS Code | Previous Code | MASS (Typ) [g] |
|---|---|---|---|---|
| TO-263 | — | PRSS0004AS-A | TO-263A | 1.4 |

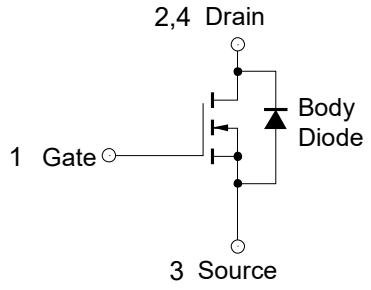
Unit: mm




| Reference Symbol | Dimensions in mm | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.20 | - | 4.60 |
| $A_1$ | 0.00 | - | 0.255 |
| b | 0.65 | - | 0.95 |
| $b_2$ | 1.12 | - | 1.42 |
| c | 0.381 | - | 0.737 |
| $c_2$ | 1.15 | - | 1.40 |
| D | 8.50 | - | 9.10 |
| $D_1$ | 6.90 | - | 7.50 |
| E | 10.05 | - | 10.65 |
| $E_1$ | 8.00 | - | 8.80 |
| e | 2.54 BSC | | |
| H | 15.00 | - | 15.60 |
| L | 1.90 | - | 2.50 |
| $L_1$ | - | - | 1.70 |
| $L_2$ | - | - | 1.78 |
| $L_3$ | 0.25 BSC | | |
| $L_4$ | 4.78 | - | 5.28 |

## Equivalent Circuit



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7. 虽然瑞萨电子一直致力于提高瑞萨电子产品的质量和可靠性，但是，半导体产品有其自身的具体特性，如一定的故障发生率以及在某些使用条件下会发生故障等。除非是瑞萨电子数据表或其他瑞萨电子文档中指定为高可靠性产品或用于恶劣环境的产品，否则瑞萨电子产品未进行防辐射设计。用户负责执行安全保护措施，以避免因瑞萨电子产品失效或发生故障而造成身体伤害、火灾导致伤害或损害和/或其他对公众构成危险的事故。例如进行软硬件安全设计（包括但不限于冗余设计、防火控制以及故障预防等）、适当的老化处理或其他适当的措施等。由于对微机软件单独进行评估非常困难且不实际，所以请用户自行负责对最终产品或系统进行安全评估。
8. 关于环境保护方面的详细内容，例如每种瑞萨电子产品的环境兼容性等，请与瑞萨电子的营业部门联系。用户负责仔细并充分查阅对管制物质的使用或含量进行管理的所有适用法律法规（包括但不限于《欧盟RoHS指令》），并在使用瑞萨电子产品时遵守所有适用法律法规。对于因用户未遵守相应法律法规而导致的损害或损失，瑞萨电子概不承担任何责任。
9. 不可将瑞萨电子产品和技术用于或者嵌入日本国内或海外相应的法律法规所禁止生产、使用及销售的任何产品或系统中。也不可将瑞萨电子产品或技术用于(1)与大规模杀伤性武器（例如核武器、化学武器、生物武器或运送此等武器的导弹，包括无人机(UAV)）的开发、设计、制造、使用、存储等相关的任何目的；(2)与常规武器的开发、设计、制造或使用相关的任何目的；(3)扰乱国际和平与安全的任何其他目的，并且不可向任何第三方销售、出口、租赁、转让、或让与瑞萨电子产品或技术，无论直接或间接知悉或者有理由知悉该第三方或任何其他方将从事上述活动。用户必须遵守对各方或交易行使司法管辖权的任意国家/地区政府所公布和管理的任何适用出口管制法律法规。
10. 瑞萨电子产品的买方或分销商，或者分销、处置产品、或以其他方式向第三方出售或转让产品的任何其他方有责任事先向所述第三方通知本文档规定的内容和条件。
11. 在事先未得到瑞萨电子书面认可的情况下，不得以任何形式部分或全部再版、转载或复制本文档。
12. 如果对本文档所记载的信息或瑞萨电子产品有任何疑问，请向瑞萨电子的营业部门咨询。

（注1） 瑞萨电子：在本文档中指瑞萨电子株式会社及其控股子公司。
（注2） 瑞萨电子产品：指瑞萨电子开发或生产的任何产品。

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