# N0602N

## N-channel MOSFET
## 60 V, 100 A, 4.6 mΩ

R07DS0558EJ0200
Rev.2.00
2020.6.10

### Features

- Low on-state resistance : $R_{DS(on)}$ = 4.6 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 |
|---|---|---|
| N0602N-S19-AY | TO-220AB, Pb-free Note1 | 50 pcs / Magazine (Tube) |

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 |

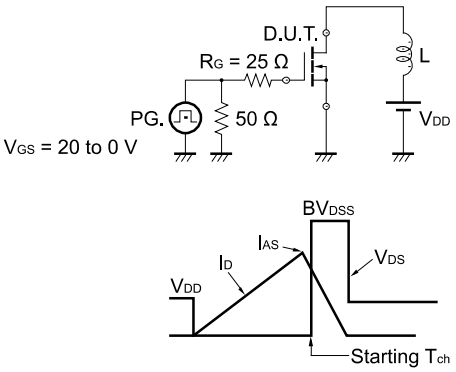
Notes: 4. This data is the designed target maximum value on Renesas's measurement condition. (Not tested)

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

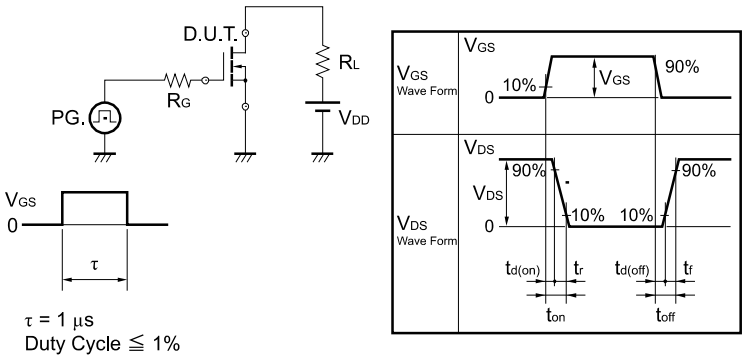
| Item | Symbol | MIN. | TYP. | MAX. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Zero Gate Voltage Drain Current | $I_{DSS}$ | | | 1 | μA | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V |
| Gate Leakage Current | $I_{GSS}$ | | | ±100 | nA | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V |
| Gate to Source Cut-off 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 | $R_{DS(on)}$ | | 3.7 | 4.6 | 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

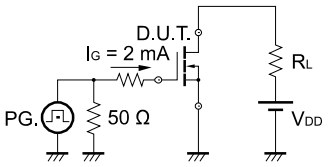
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**




**TEST CIRCUIT 2 SWITCHING TIME**

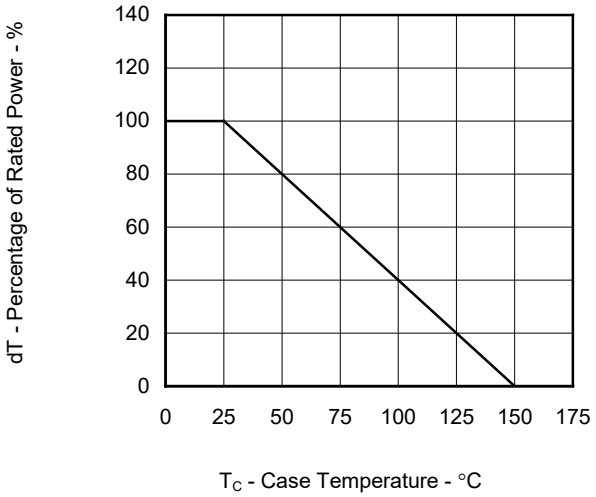



**TEST CIRCUIT 3 GATE CHARGE**

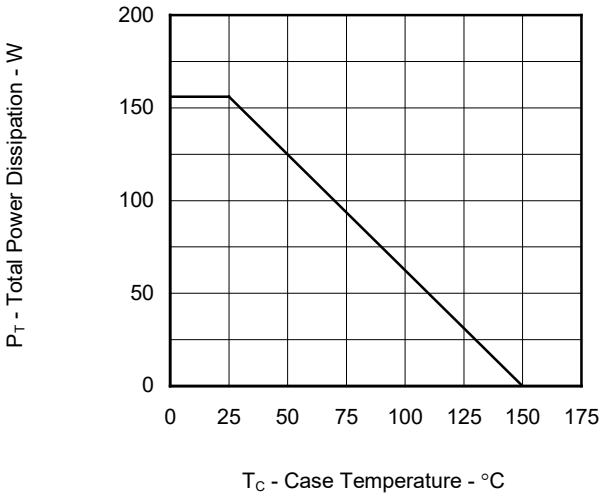


## Typical Characteristics Note6

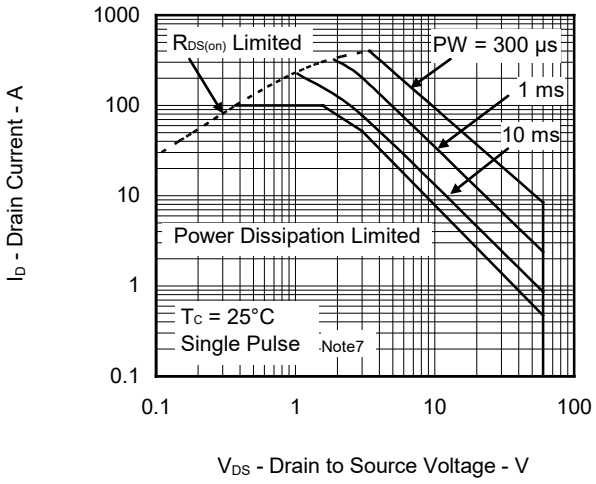
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



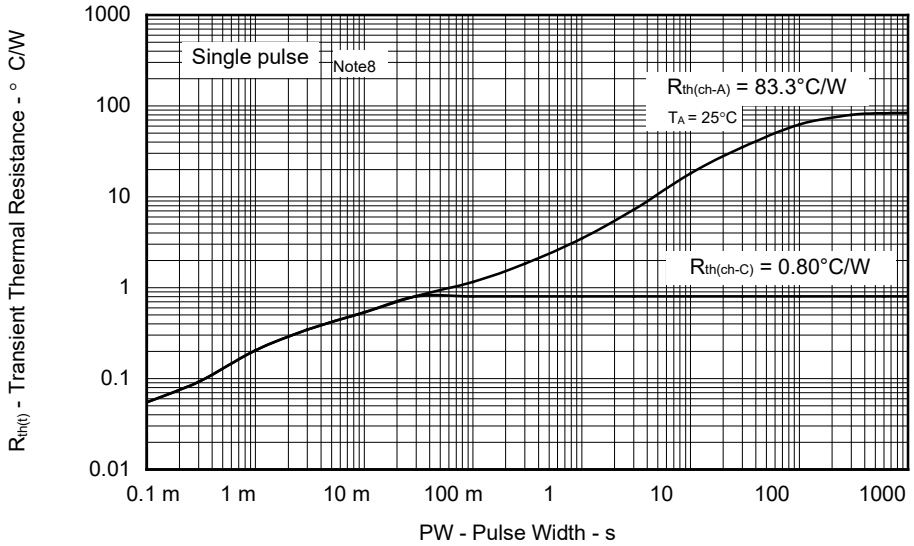

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE




FORWARD BIAS SAFE OPERATING AREA

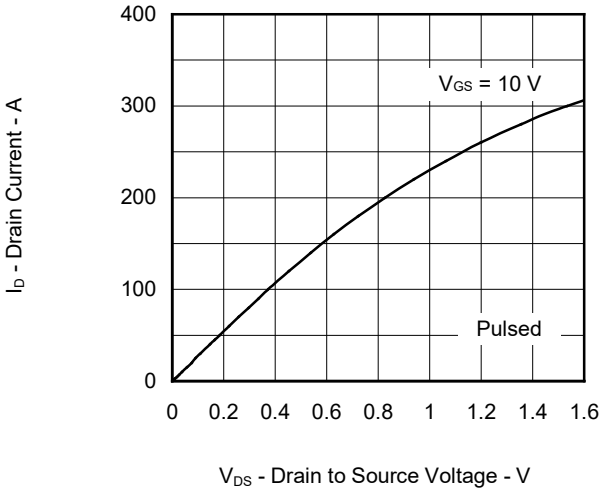



TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

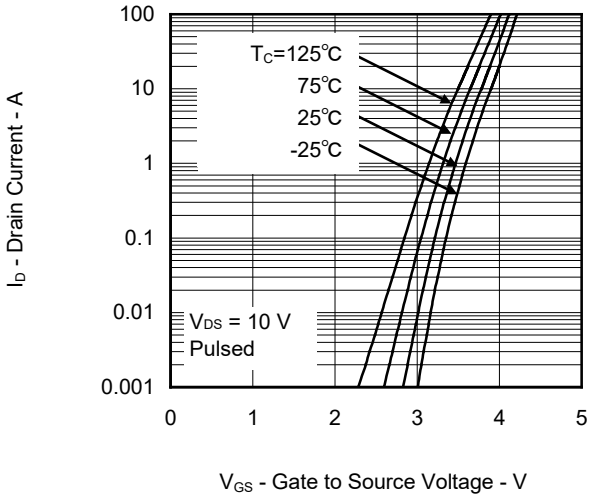



Notes: 6. Designed target value on Renesas measurement condition. ($T_C$ = 25°C, unless otherwise specified)
7. This data is the designed value on Renesas's measurement condition. Renesas recommends that operating conditions are designed according to a document "Power MOSFET/IGBT Attention of Handling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

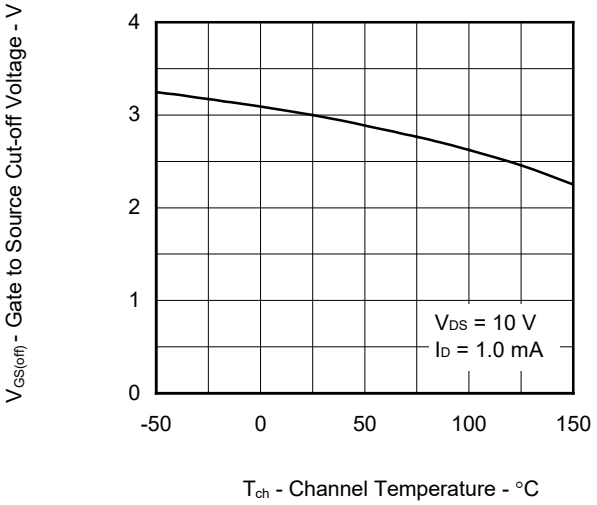
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



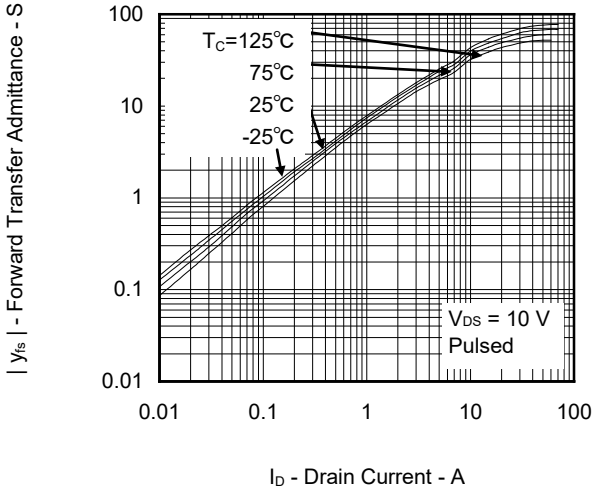

FORWARD TRANSFER
CHARACTERISTICS



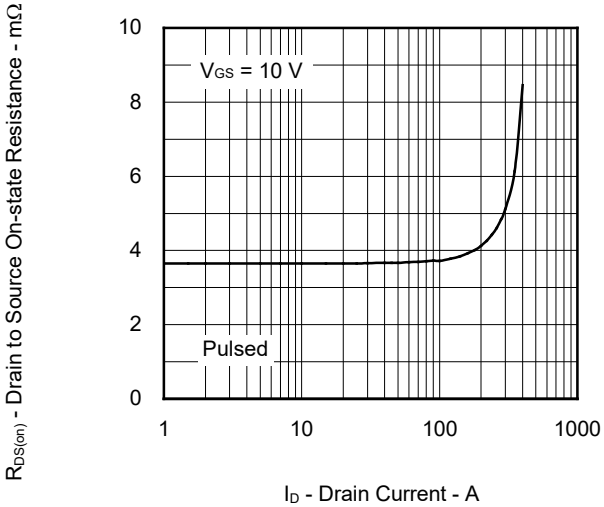

GATE TO SOURCE CUT-OFF VOLTAGE
vs. CHANNEL TEMPERATURE



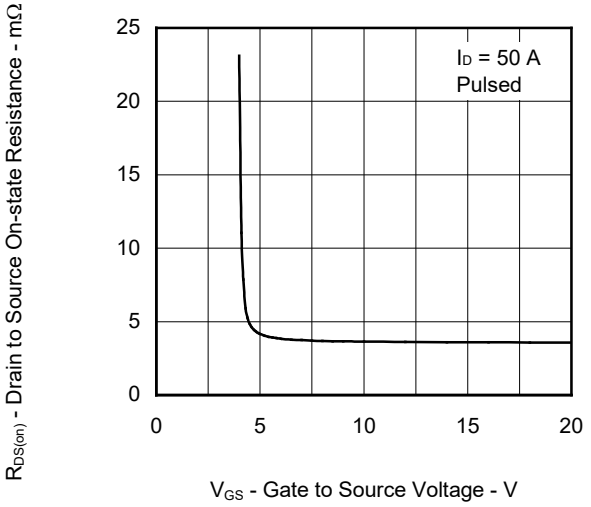

FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



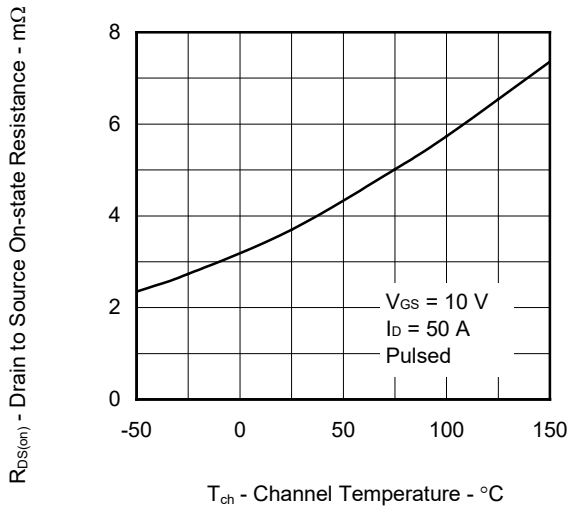

DRAIN TO SOURCE ON-STATE RESISTANCE
vs. DRAIN CURRENT



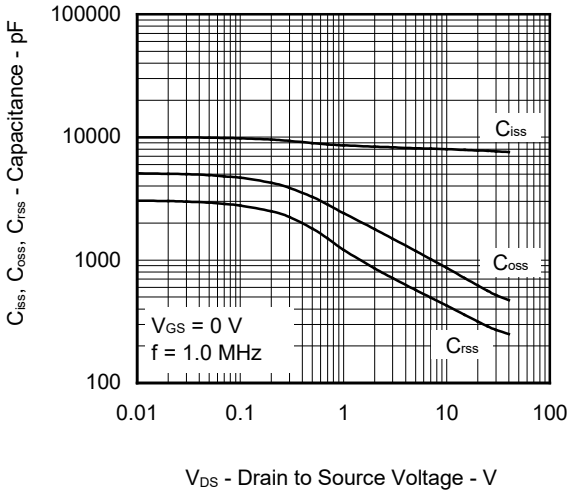

DRAIN TO SOURCE ON-STATE RESISTANCE
vs. GATE TO SOURCE VOLTAGE



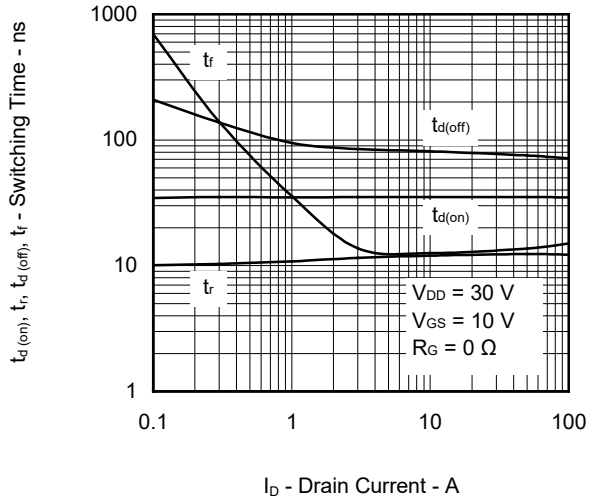
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



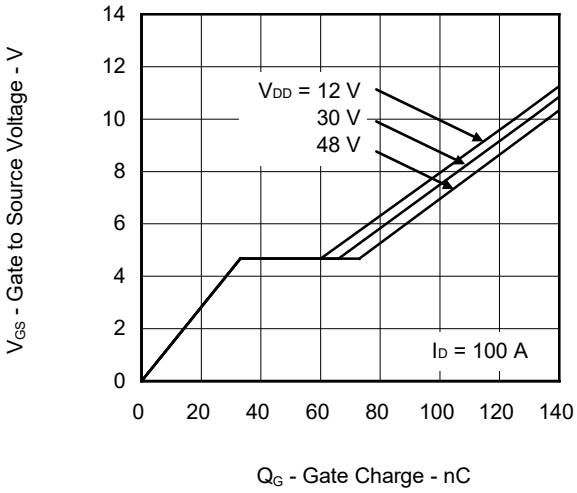

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



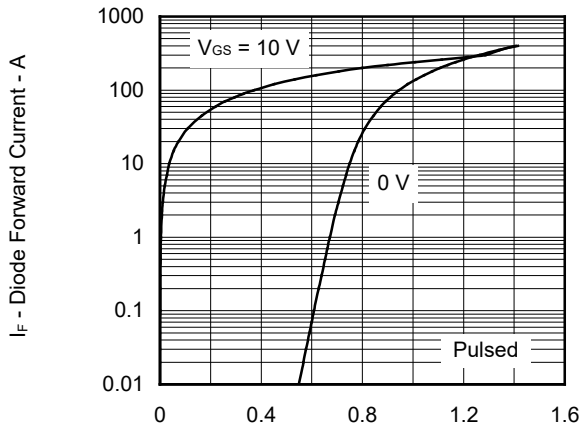

SWITCHING CHARACTERISTICS



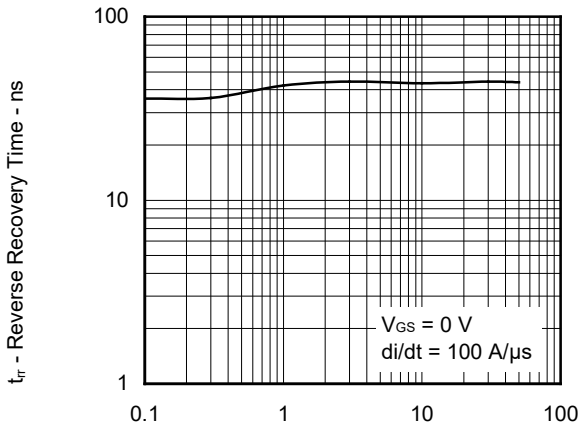

DYNAMIC INPUT CHARACTERISTICS




SOURCE TO DRAIN DIODE FORWARD VOLTAGE



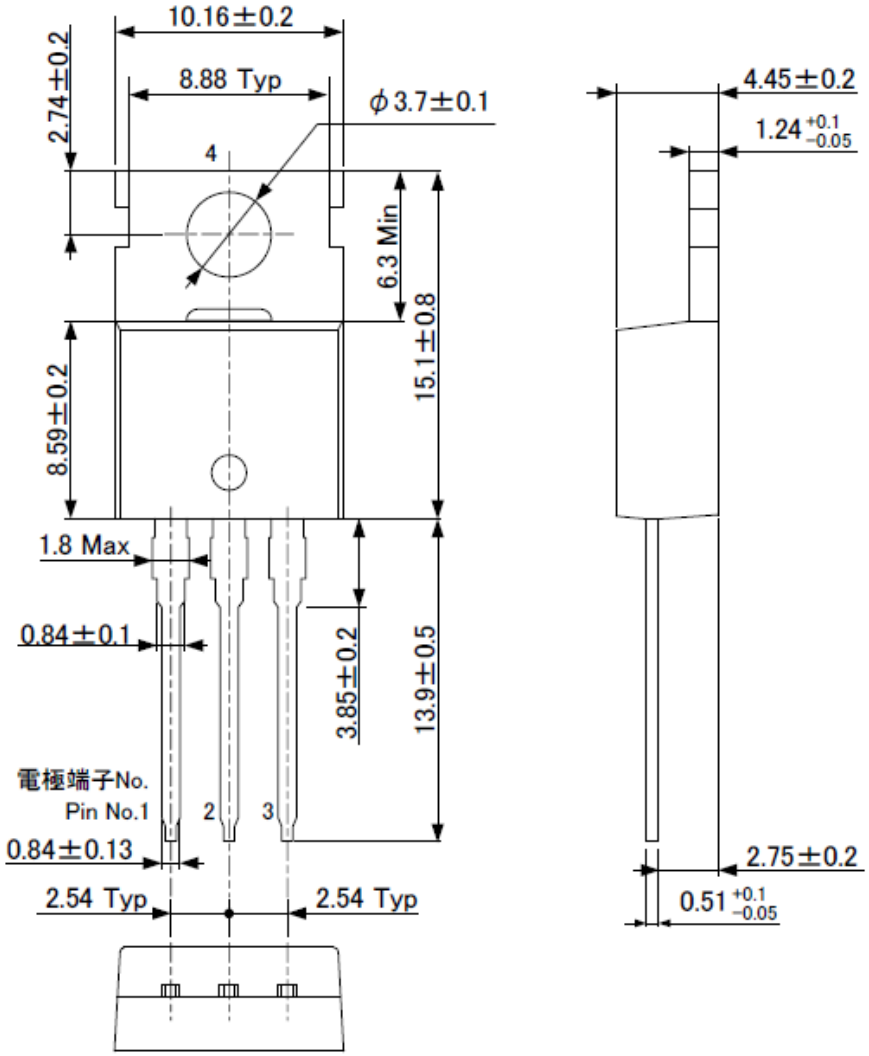

REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



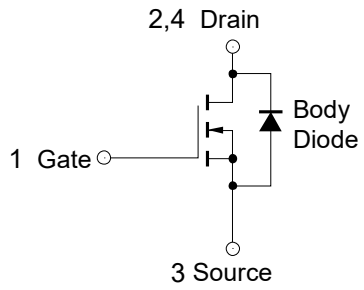
## Package Drawing (Unit: mm)

| JEDEC Package Code | RENESAS Code | Previous Code | MASS (Typ) [g] |
|---|---|---|---|
| TO-220AB | PRSS0004AU-A | TO-220ABB | 2.1 |

Unit: mm




## Equivalent Circuit



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