

# MOS FIELD EFFECT TRANSISTOR

## 2SK3570

### SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3570 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

#### FEATURES

- 4.5V drive available.
- Low on-state resistance,  
 $R_{DS(on)1} = 12 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 24 \text{ A)}$
- Low gate charge  
 $Q_G = 23 \text{ nC TYP. (} V_{DD} = 16 \text{ V, } V_{GS} = 10 \text{ V, } I_D = 48 \text{ A)}$
- Built-in gate protection diode
- Surface mount device available

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

|                                                      |                |             |                  |
|------------------------------------------------------|----------------|-------------|------------------|
| Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )   | $V_{DSS}$      | 20          | V                |
| Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )    | $V_{GSS}$      | $\pm 20$    | V                |
| Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )      | $I_{D(DC)}$    | $\pm 48$    | A                |
| Drain Current (pulse) <sup>Note</sup>                | $I_{D(pulse)}$ | $\pm 160$   | A                |
| Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) | $P_{T1}$       | 1.5         | W                |
| Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) | $P_{T2}$       | 29          | W                |
| Channel Temperature                                  | $T_{ch}$       | 150         | $^\circ\text{C}$ |
| Storage Temperature                                  | $T_{stg}$      | -55 to +150 | $^\circ\text{C}$ |

**Note**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

#### ★ ORDERING INFORMATION

| PART NUMBER | PACKAGE                   |
|-------------|---------------------------|
| 2SK3570     | TO-220AB                  |
| 2SK3570-S   | TO-262                    |
| 2SK3570-ZK  | TO-263                    |
| 2SK3570-Z   | TO-220SMD <sup>Note</sup> |

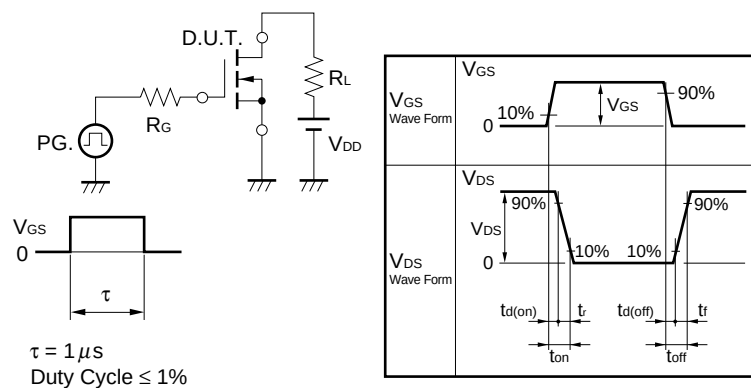
**Note** TO-220SMD package is produced only in Japan.

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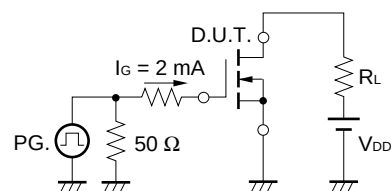
# ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

| Characteristics                     | Symbol               | Test Conditions                                | MIN. | TYP. | MAX. | Unit |
|-------------------------------------|----------------------|------------------------------------------------|------|------|------|------|
| Zero Gate Voltage Drain Current     | I <sub>DSS</sub>     | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V  |      |      | 10   | μA   |
| Gate Leakage Current                | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V |      |      | ±10  | μA   |
| Gate Cut-off Voltage                | V <sub>GS(off)</sub> | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA  | 1.5  |      | 2.5  | V    |
| Forward Transfer Admittance         | y <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 24 A  | 8.0  |      |      | S    |
| Drain to Source On-state Resistance | R <sub>DS(on)1</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 24 A  |      | 8.2  | 12   | mΩ   |
|                                     | R <sub>DS(on)2</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A |      | 12.3 | 22   | mΩ   |
| Input Capacitance                   | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V                         |      | 930  |      | pF   |
| Output Capacitance                  | C <sub>oss</sub>     | V <sub>GS</sub> = 0 V                          |      | 360  |      | pF   |
| Reverse Transfer Capacitance        | C <sub>rss</sub>     | f = 1 MHz                                      |      | 250  |      | pF   |
| Turn-on Delay Time                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 10 V, I <sub>D</sub> = 24 A  |      | 13   |      | ns   |
| Rise Time                           | t <sub>r</sub>       | V <sub>GS</sub> = 10 V                         |      | 20   |      | ns   |
| Turn-off Delay Time                 | t <sub>d(off)</sub>  | R <sub>G</sub> = 10 Ω                          |      | 39   |      | ns   |
| Fall Time                           | t <sub>f</sub>       |                                                |      | 14   |      | ns   |
| Total Gate Charge                   | Q <sub>G</sub>       | V <sub>DD</sub> = 16 V                         |      | 23   |      | nC   |
| Gate to Source Charge               | Q <sub>GS</sub>      | V <sub>GS</sub> = 10 V                         |      | 4    |      | nC   |
| Gate to Drain Charge                | Q <sub>GD</sub>      | I <sub>D</sub> = 48 A                          |      | 7    |      | nC   |
| Body Diode Forward Voltage          | V <sub>F(S-D)</sub>  | I <sub>F</sub> = 48 A, V <sub>GS</sub> = 0 V   |      | 1.1  |      | V    |
| Reverse Recovery Time               | t <sub>rr</sub>      | I <sub>F</sub> = 48 A, V <sub>GS</sub> = 0 V   |      | 33   |      | ns   |
| Reverse Recovery Charge             | Q <sub>rr</sub>      | di/dt = 100 A/μs                               |      | 25   |      | nC   |

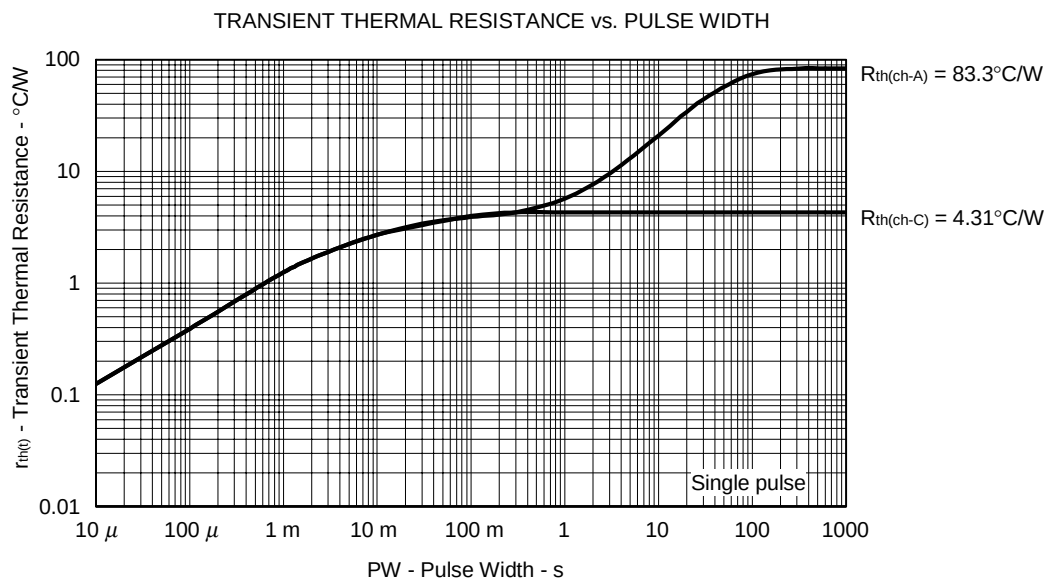
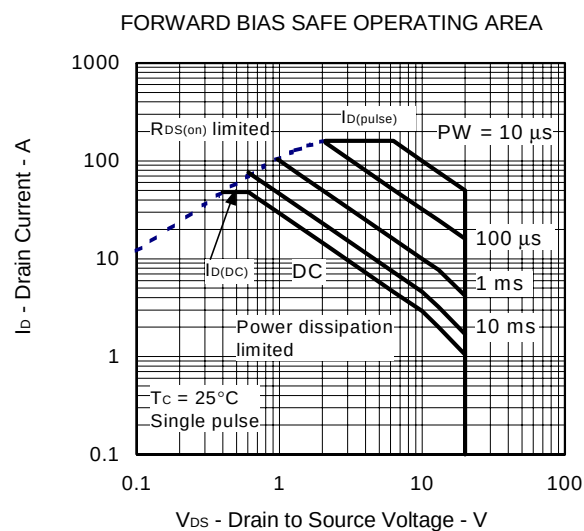
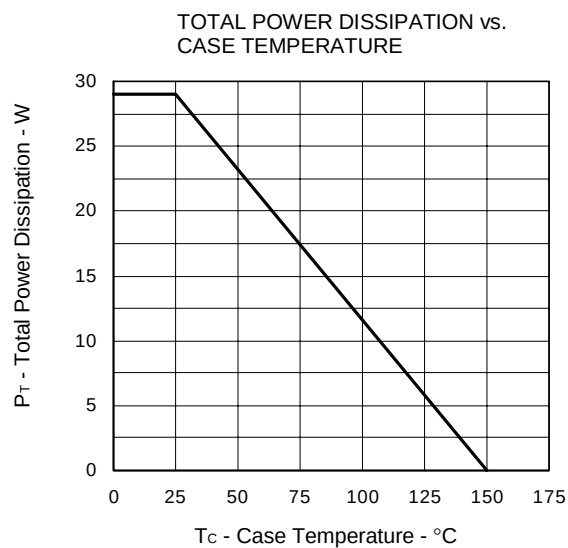
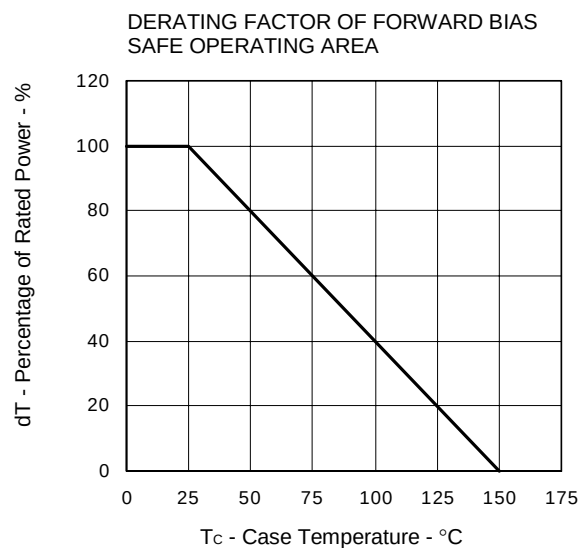
## ★ TEST CIRCUIT 1 SWITCHING TIME



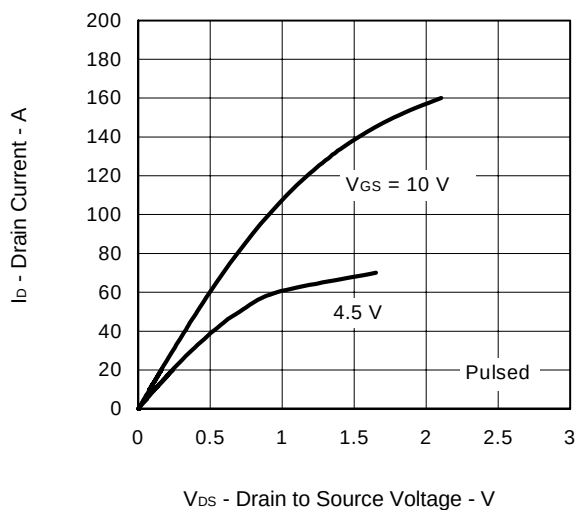
## TEST CIRCUIT 2 GATE CHARGE



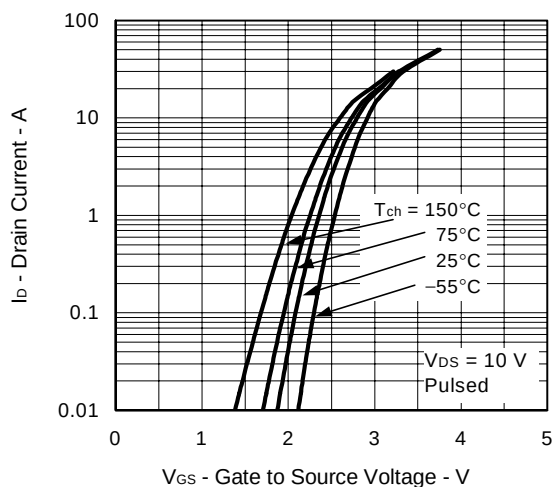
★ TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



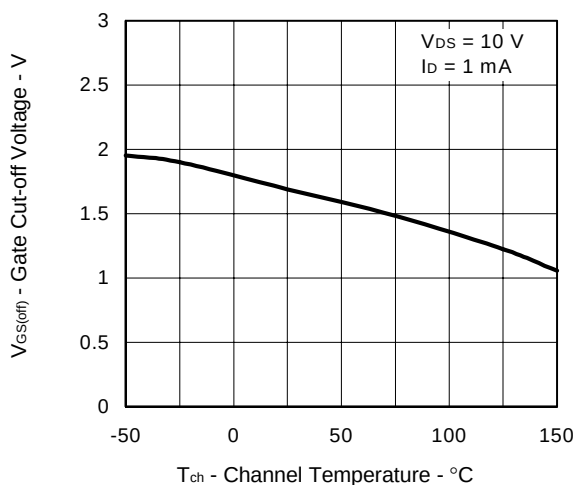
DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE



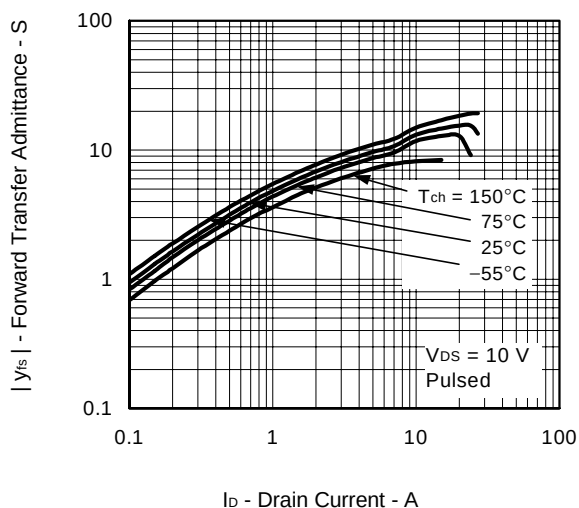
FORWARD TRANSFER CHARACTERISTICS



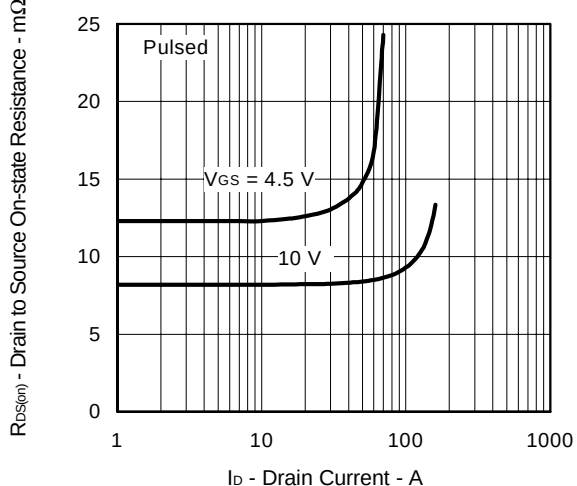
GATE CUT-OFF VOLTAGE vs.  
CHANNEL TEMPERATURE



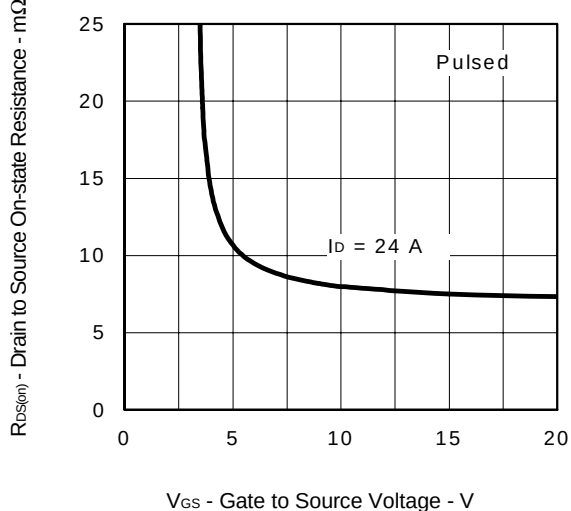
FORWARD TRANSFER ADMITTANCE vs.  
DRAIN CURRENT



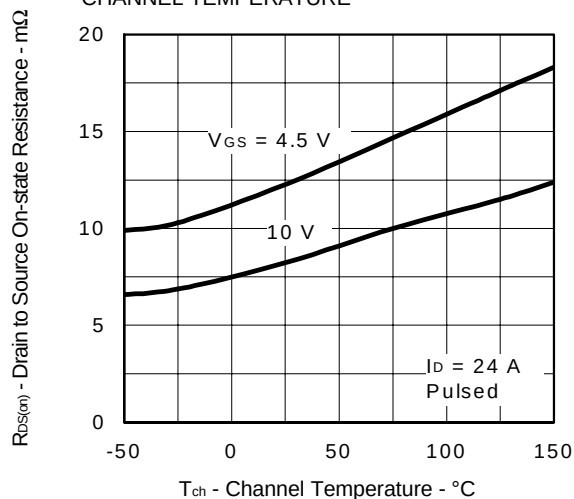
DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
DRAIN CURRENT



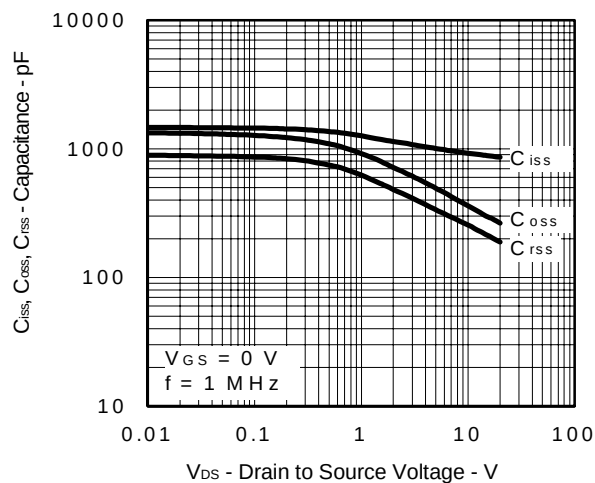
DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
GATE TO SOURCE VOLTAGE



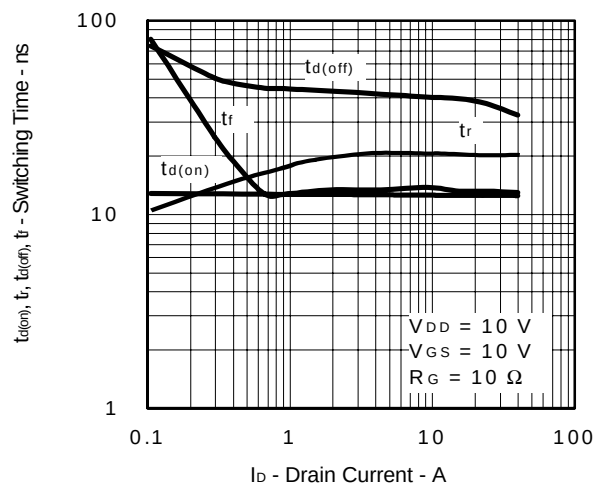
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



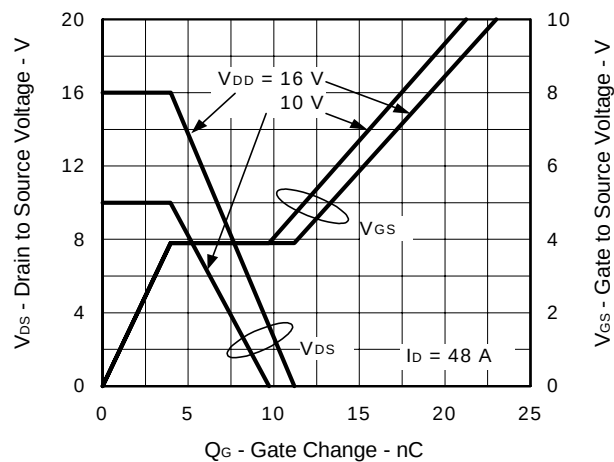
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



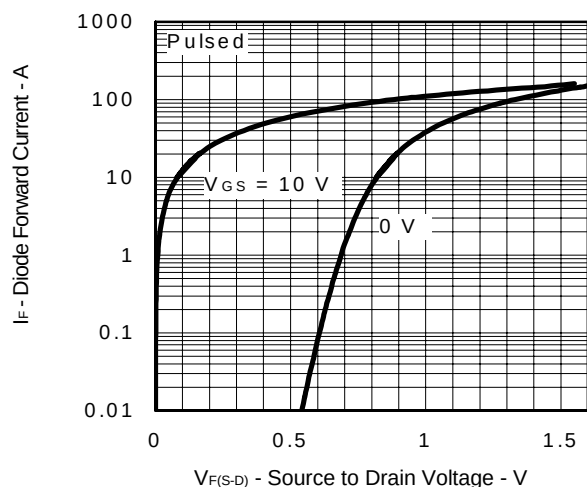
SWITCHING CHARACTERISTICS



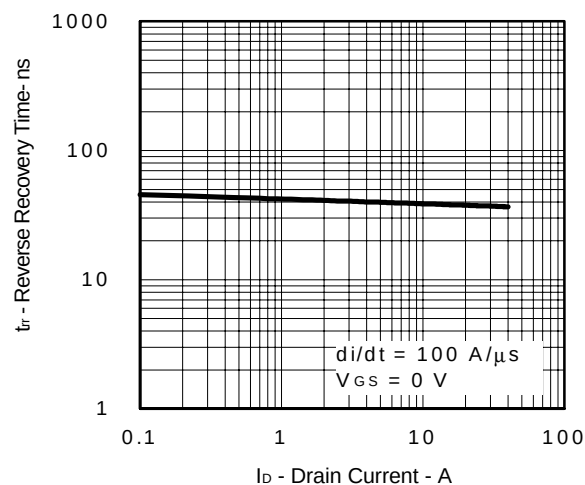
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

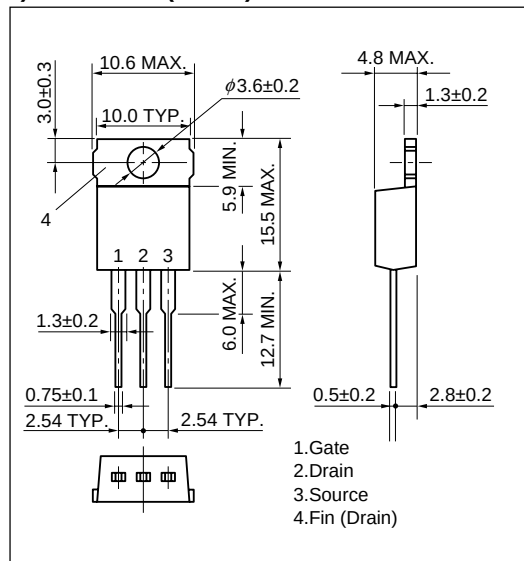


REVERSE RECOVERY TIME vs. DRAIN CURRENT

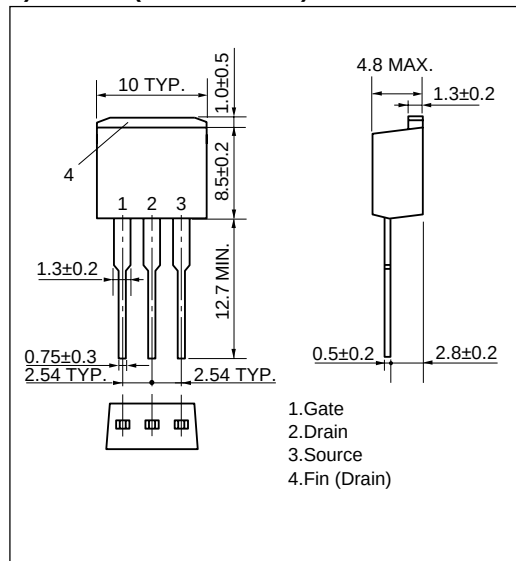


★ PACKAGE DRAWINGS (Unit: mm)

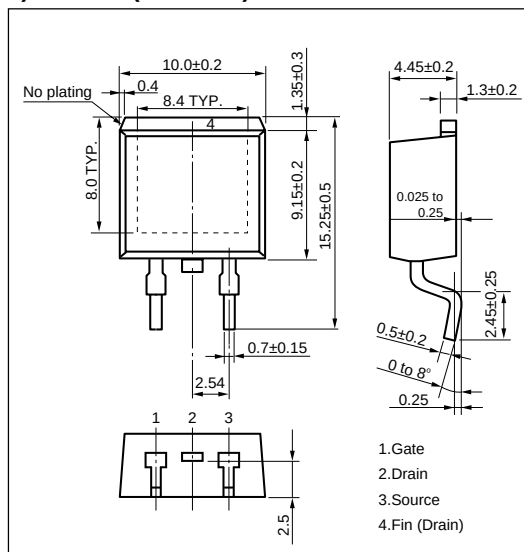
1) TO-220AB (MP-25)



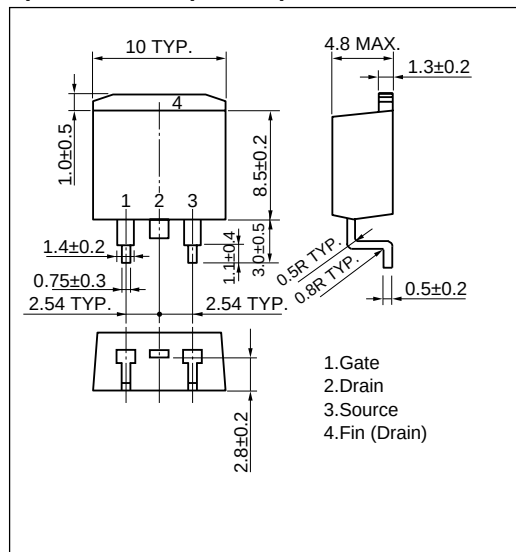
2) TO-262 (MP-25 Fin Cut)



3) TO-263 (MP-25ZK)

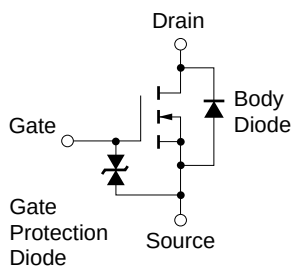


4) TO-220SMD (MP-25Z) **Note**



**Note** This package is produced only in Japan.

EQUIVALENT CIRCUIT



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

[MEMO]

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