

**NEC****MOS FIELD EFFECT TRANSISTOR  
2SK3404****SWITCHING  
N-CHANNEL POWER MOS FET  
INDUSTRIAL USE****DESCRIPTION**

The 2SK3404 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**

- 4.5-V drive available
- Low on-state resistance  
 $R_{DS(on)1} = 14 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 20 \text{ A)}$
- Low gate charge  
 $Q_G = 25 \text{ nC TYP. (} I_D = 40 \text{ A, } V_{DD} = 24 \text{ V, } V_{GS} = 10 \text{ V)}$
- Built-in gate protection diode
- Surface mount device available

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)**

|   |                       |             |    |
|---|-----------------------|-------------|----|
| Drain to Source Voltage (V <sub>GS</sub> = 0 V) | V <sub>bss</sub>      | 30          | 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>    | ±40         | A  |
| Drain Current (Pulse) <sup>Note</sup>           | I <sub>D(pulse)</sub> | ±160        | A  |
| Total Power Dissipation (T <sub>A</sub> = 25°C) | P <sub>T1</sub>       | 1.5         | W  |
| Total Power Dissipation (T <sub>c</sub> = 25°C) | P <sub>T2</sub>       | 40          | W  |
| Channel Temperature                             | T <sub>ch</sub>       | 150         | °C |
| Storage Temperature                             | T <sub>stg</sub>      | -55 to +150 | °C |

**Note** PW ≤ 10 μs, Duty Cycle ≤ 1%

**ORDERING INFORMATION**

| PART NUMBER | PACKAGE         |
|-------------|-----------------|
| 2SK3404     | TO-220AB        |
| 2SK3404-ZK  | TO-263(MP-25ZK) |
| 2SK3404-ZJ  | TO-263(MP-25ZJ) |

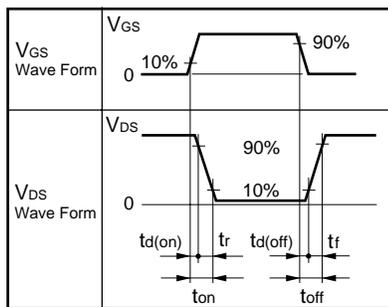
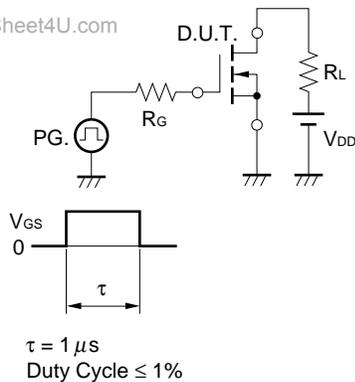
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 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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

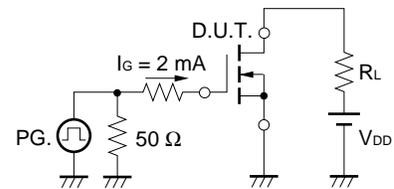
| CHARACTERISTICS                     | SYMBOL               | TEST CONDITIONS                                | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------|----------------------|--|------|------|------|------|
| Drain Leakage Current               | I <sub>DSS</sub>     | V <sub>DS</sub> = 30 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 to Source 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> = 20 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> = 20 A  |      | 11   | 14   | mΩ   |
|                                     | R <sub>DS(on)2</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A |      | 15   | 21   | mΩ   |
| Input Capacitance                   | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V                         |      | 1400 |      | pF   |
| Output Capacitance                  | C <sub>oss</sub>     | V <sub>GS</sub> = 0 V                          |      | 410  |      | pF   |
| Reverse Transfer Capacitance        | C <sub>rss</sub>     | f = 1 MHz                                      |      | 180  |      | pF   |
| Turn-on Delay Time                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 15 V, I <sub>D</sub> = 20 A  |      | 20   |      | ns   |
| Rise Time                           | t <sub>r</sub>       | V <sub>GS(on)</sub> = 10 V                     |      | 9    |      | ns   |
| Turn-off Delay Time                 | t <sub>d(off)</sub>  | R <sub>G</sub> = 10 Ω                          |      | 50   |      | ns   |
| Fall Time                           | t <sub>f</sub>       |  |      | 14   |      | ns   |
| Total Gate Charge                   | Q <sub>G</sub>       | V <sub>DD</sub> = 24 V                         |      | 25   |      | nC   |
| Gate to Source Charge               | Q <sub>GS</sub>      | V <sub>GS</sub> = 10 V                         |      | 5.0  |      | nC   |
| Gate to Drain Charge                | Q <sub>GD</sub>      | I <sub>D</sub> = 40 A                          |      | 7.0  |      | nC   |
| Diode Forward Voltage               | V <sub>F(S-D)</sub>  | I <sub>F</sub> = 40 A, V <sub>GS</sub> = 0 V   |      | 1.0  |      | V    |
| Reverse Recovery Time               | t <sub>rr</sub>      | I <sub>F</sub> = 40 A, V <sub>GS</sub> = 0 V   |      | 31   |      | ns   |
| Reverse Recovery Charge             | Q <sub>rr</sub>      | di/dt = 100 A/μs                               |      | 28   |      | nC   |

**TEST CIRCUIT 1 SWITCHING TIME**

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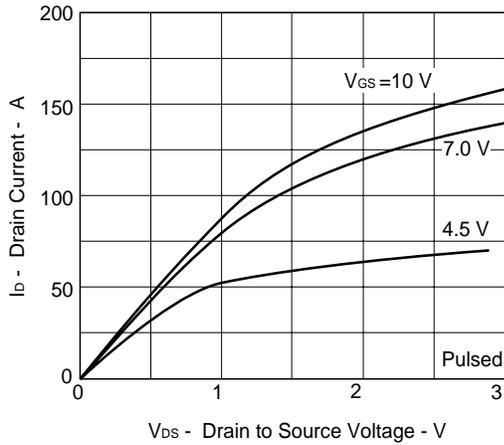


**TEST CIRCUIT 2 GATE CHARGE**

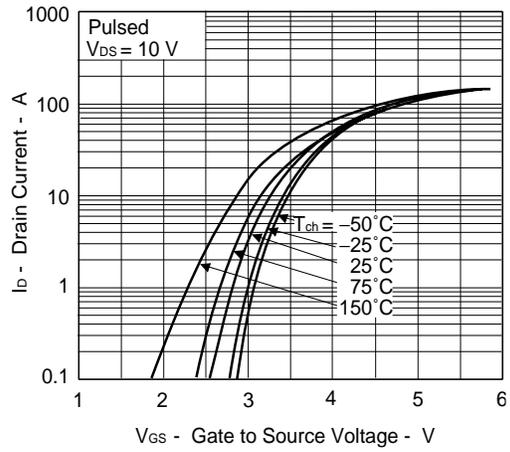


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

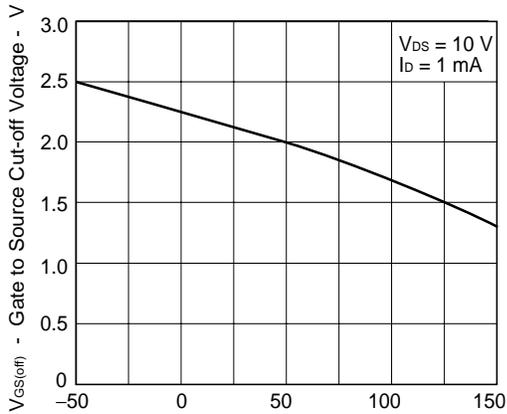
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



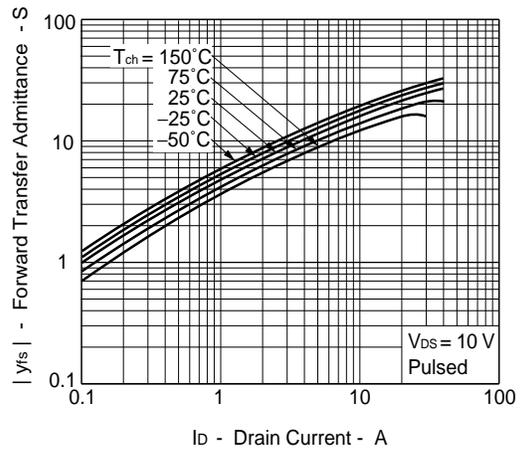
FORWARD TRANSFER CHARACTERISTICS



GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

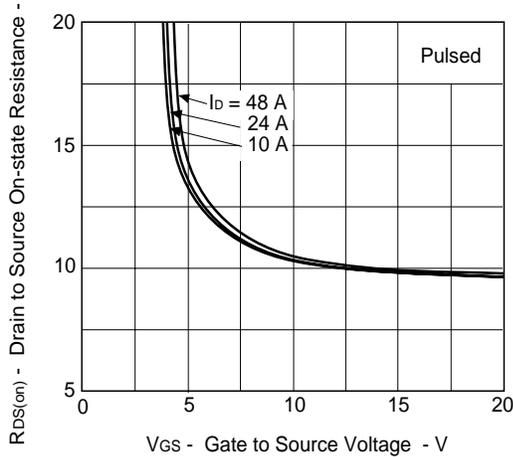


FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

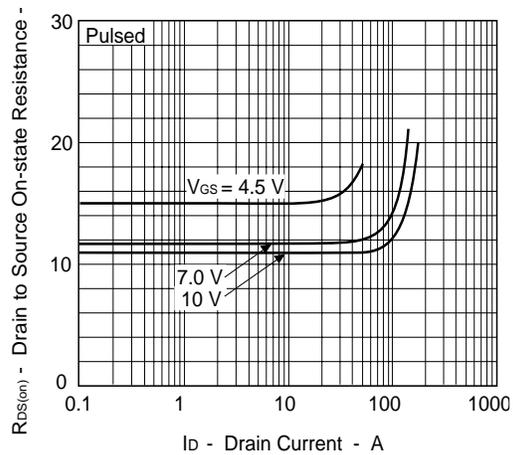


www.DataSheet4U.com T<sub>ch</sub> - Channel Temperature - °C

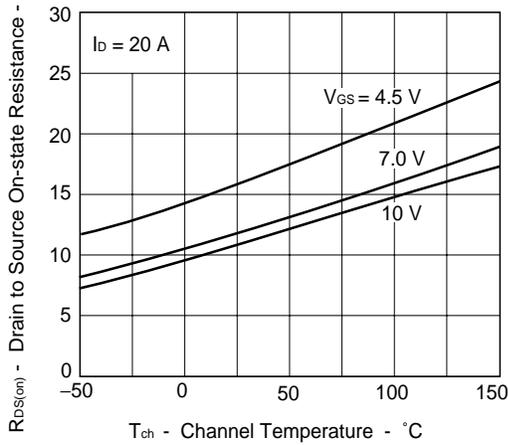
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



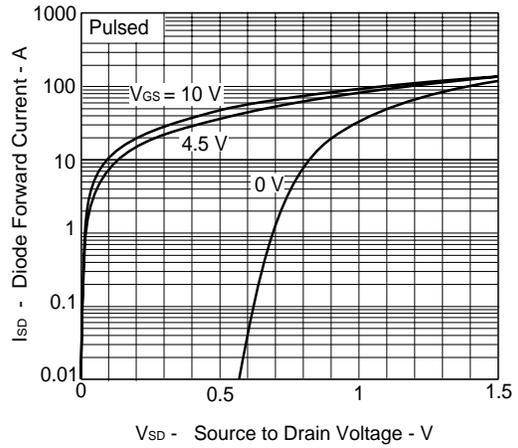
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



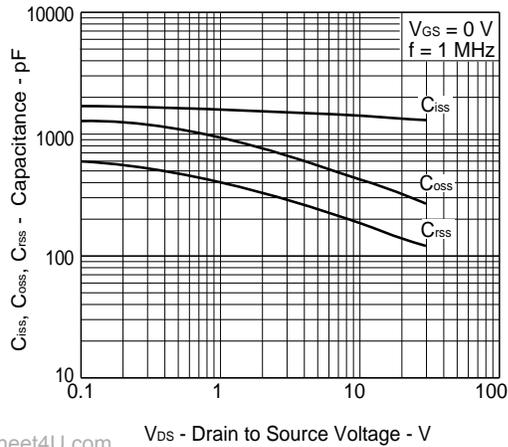
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



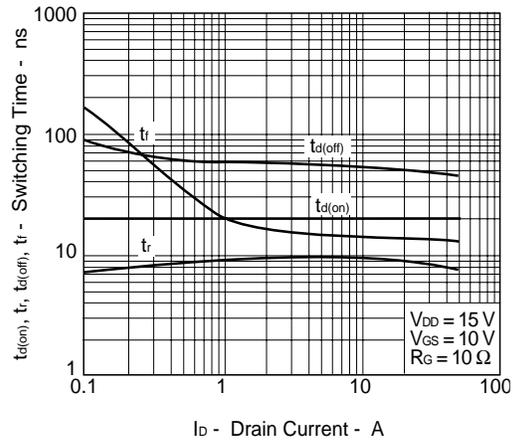
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



SWITCHING CHARACTERISTICS

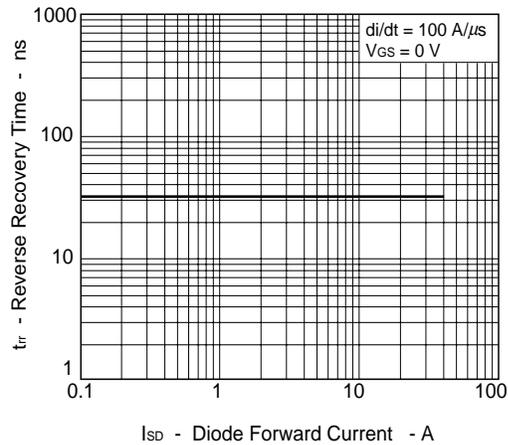


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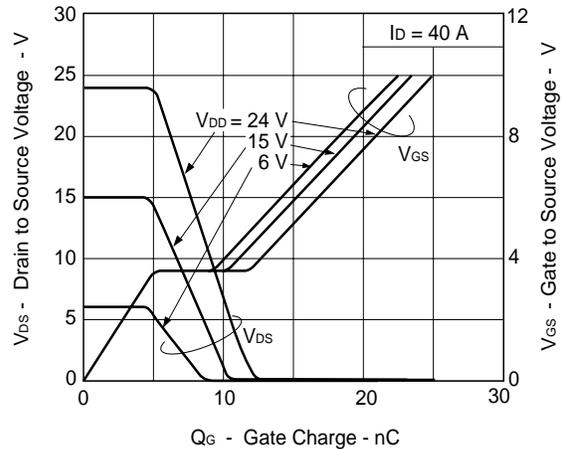
$V_{DS}$  - Drain to Source Voltage - V

$I_D$  - Drain Current - A

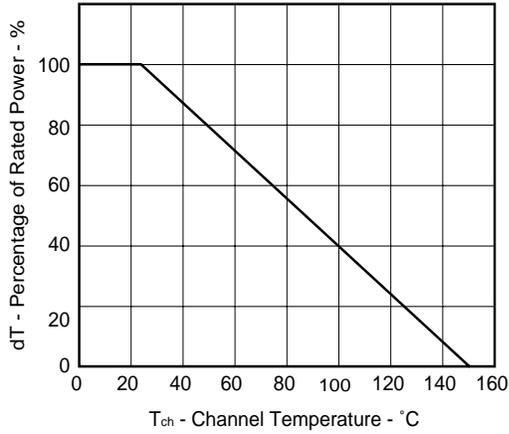
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



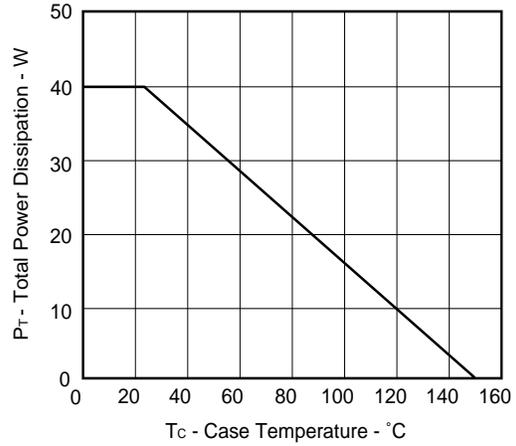
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

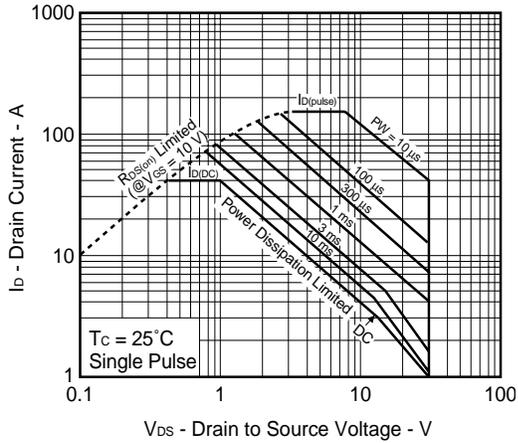


TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



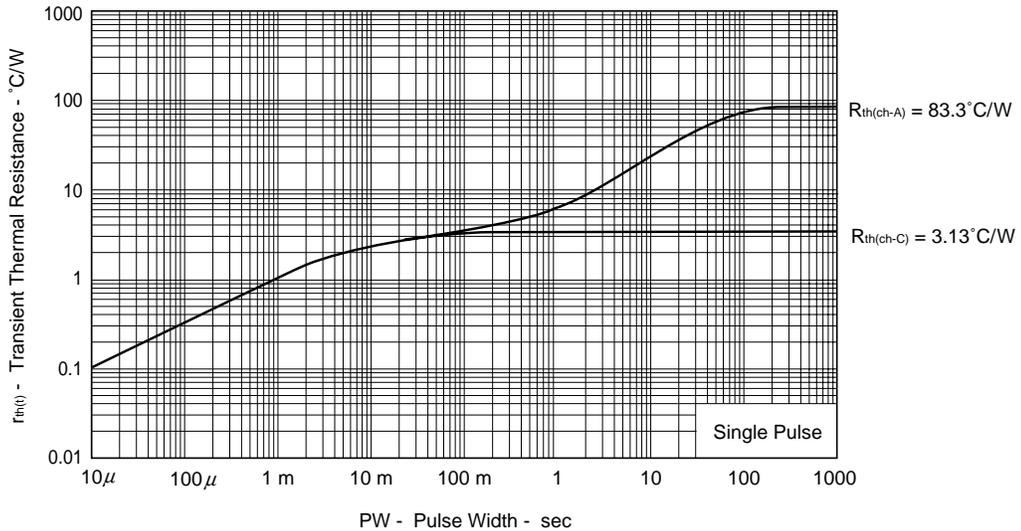
★

FORWARD BIAS SAFE OPERATING AREA



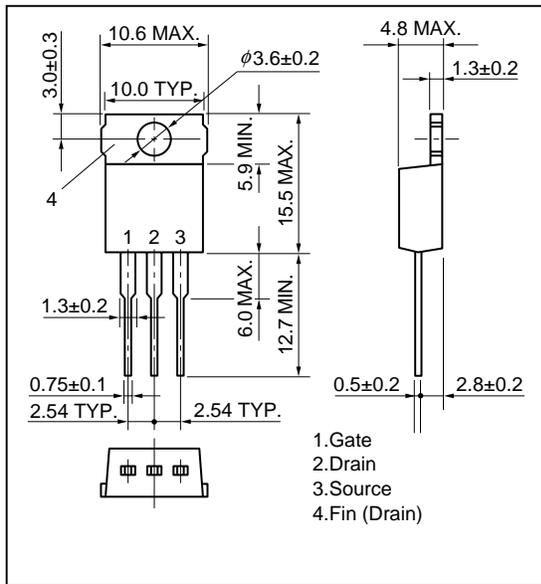
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TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

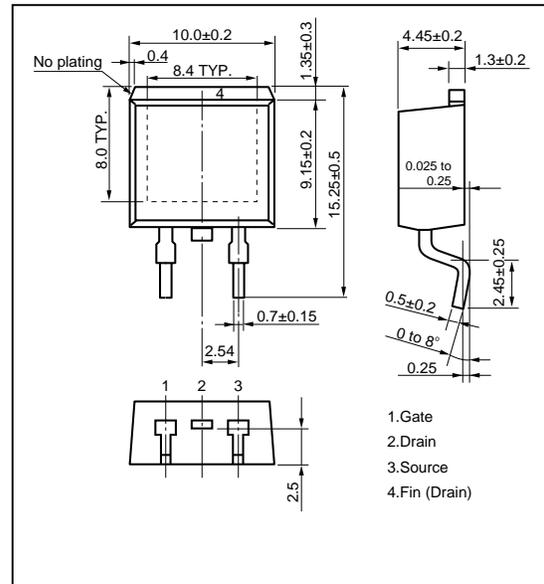


PACKAGE DRAWINGS (Unit : mm)

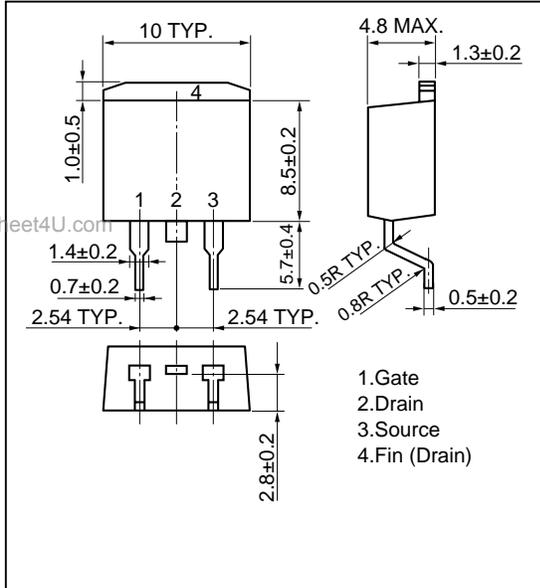
★ 1)TO-220AB (MP-25)



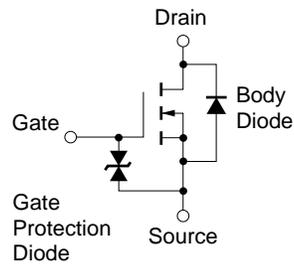
2)TO-263 (MP-25ZK)



★ 3)TO-263 (MP-25ZJ)



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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