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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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SWITCHING N-CHANNEL POWER MOS FET

DESCRIPTION

The 2SK3431 is N-channel MOS Field Effect Transistor designed for high current switching applications.

FEATURES

- Super low on-state resistance:
 $R_{DS(on)1} = 5.6 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 42 \text{ A)}$
 $R_{DS(on)2} = 8.9 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4 \text{ V, } I_D = 42 \text{ A)}$
- Low C_{iss} : $C_{iss} = 6100 \text{ pF TYP.}$
- Built-in gate protection diode

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

| | | | |
|--|----------------|-------------|------------------|
| Drain to Source Voltage ($V_{GS} = 0 \text{ V}$) | V_{DSS} | 40 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | V_{GSS} | ± 20 | V |
| Drain Current (DC) ($T_C = 25^\circ\text{C}$) | $I_{D(DC)}$ | ± 83 | A |
| Drain Current (pulse) ^{Note1} | $I_{D(pulse)}$ | ± 332 | A |
| Total Power Dissipation ($T_C = 25^\circ\text{C}$) | P_T | 100 | W |
| Total Power Dissipation ($T_A = 25^\circ\text{C}$) | P_T | 1.5 | W |
| Channel Temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Single Avalanche Current ^{Note2} | I_{AS} | 65 | A |
| Single Avalanche Energy ^{Note2} | E_{AS} | 423 | mJ |

Notes 1. $PW \leq 10 \mu\text{s}$, Duty cycle $\leq 1\%$

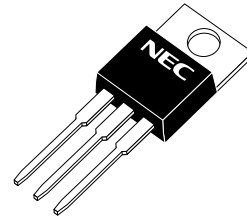
2. Starting $T_{ch} = 25^\circ\text{C}$, $V_{DD} = 20 \text{ V}$, $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$

ORDERING INFORMATION

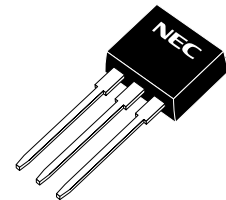
| PART NUMBER | PACKAGE |
|-------------|---------------------------|
| 2SK3431 | TO-220AB |
| 2SK3431-S | TO-262 |
| 2SK3431-ZJ | TO-263 |
| 2SK3431-Z | TO-220SMD ^{Note} |

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

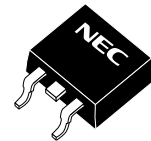
(TO-220AB)



(TO-262)



(TO-263, TO-220SMD)

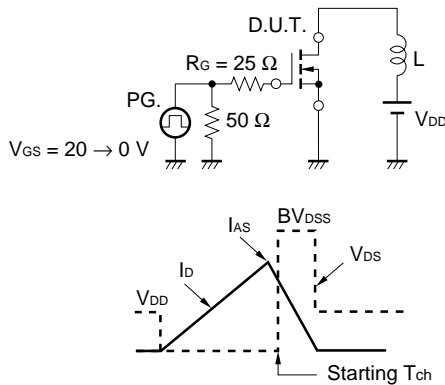


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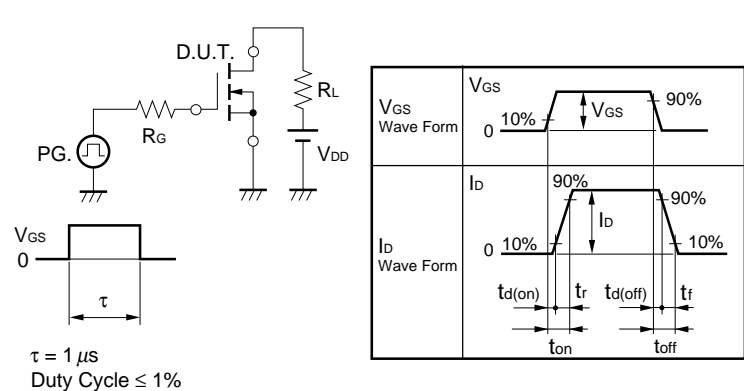
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------|----------------------|---|------|------|------|------|
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 40 V, V _{GS} = 0 V | | | 10 | μA |
| Gate Leakage Current | I _{GSS} | V _{GS} = ±20 V, V _{DS} = 0V | | | ±10 | μA |
| Gate Cut-off Voltage | V _{GS(off)} | V _{DS} = 10 V, I _D = 1 mA | 1.5 | 2.0 | 2.5 | V |
| Forward Transfer Admittance | y _{fs} | V _{DS} = 10 V, I _D = 42 A | 30 | 60 | | S |
| Drain to Source On-state Resistance | R _{DS(on)1} | V _{GS} = 10 V, I _D = 42 A | | 4.5 | 5.6 | mΩ |
| | R _{DS(on)2} | V _{GS} = 4 V, I _D = 42 A | | 6.2 | 8.9 | mΩ |
| Input Capacitance | C _{iss} | V _{DS} = 10 V | | 6100 | | pF |
| Output Capacitance | C _{oss} | V _{GS} = 0 V | | 1400 | | pF |
| Reverse Transfer Capacitance | C _{rss} | f = 1 MHz | | 700 | | pF |
| Turn-on Delay Time | t _{d(on)} | V _{DD} = 20 V, I _D = 42 A | | 120 | | ns |
| Rise Time | t _r | V _{GS} = 10 V | | 1800 | | ns |
| Turn-off Delay Time | t _{d(off)} | R _G = 10 Ω | | 350 | | ns |
| Fall Time | t _f | | | 440 | | ns |
| Total Gate Charge | Q _G | V _{DD} = 32 V | | 110 | | nC |
| Gate to Source Charge | Q _{GS} | V _{GS} = 10 V | | 18 | | nC |
| Gate to Drain Charge | Q _{GD} | I _D = 83 A | | 31 | | nC |
| Body Diode Forward Voltage | V _{F(S-D)} | I _F = 83 A, V _{GS} = 0 V | | 1.0 | | V |
| Reverse Recovery Time | t _{rr} | I _F = 83 A, V _{GS} = 0 V | | 65 | | ns |
| Reverse Recovery Charge | Q _{rr} | di/dt = 100 A/μs | | 110 | | nC |

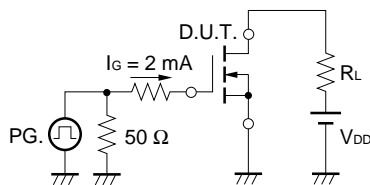
TEST CIRCUIT 1 AVALANCHE CAPABILITY



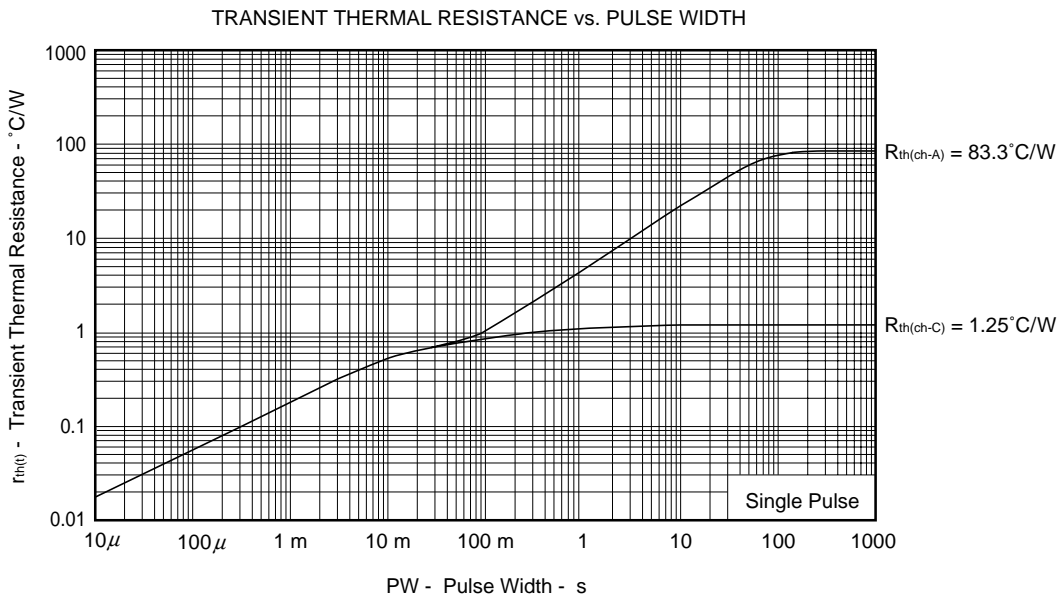
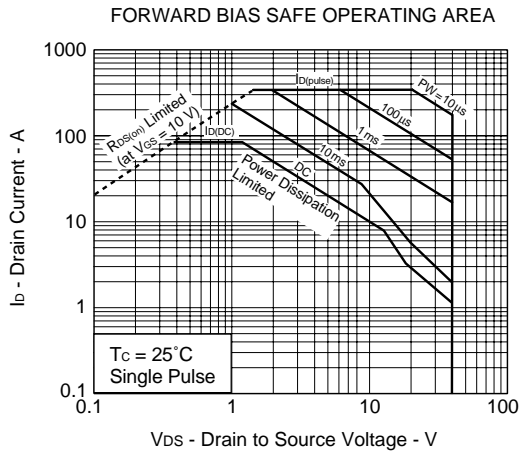
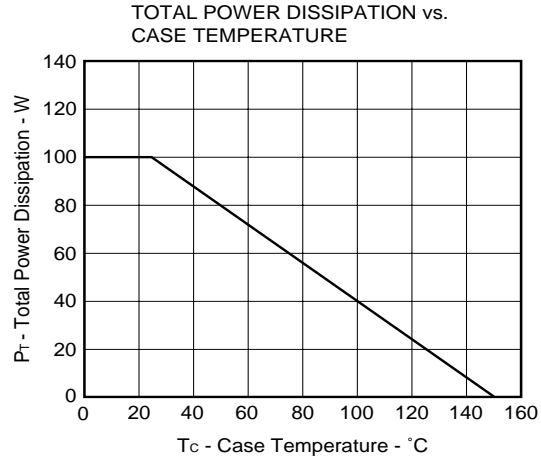
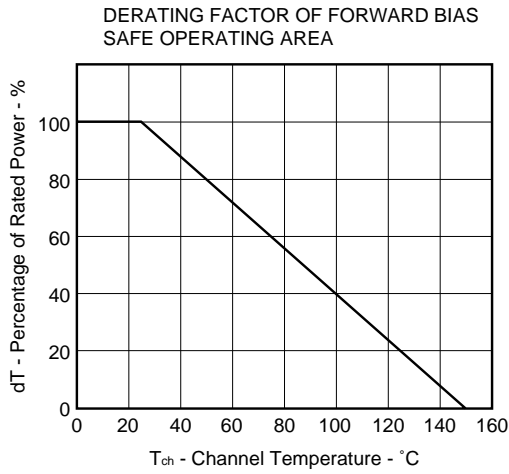
TEST CIRCUIT 2 SWITCHING TIME



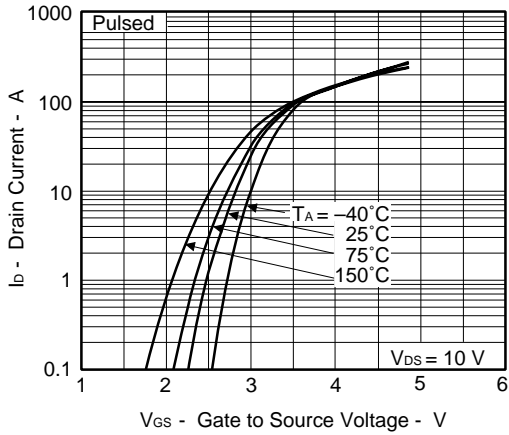
TEST CIRCUIT 3 GATE CHARGE



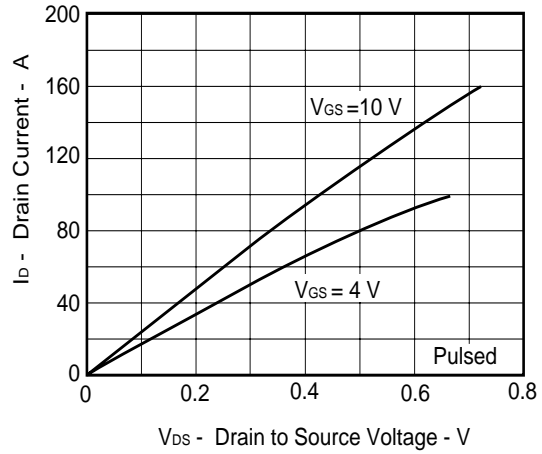
TYPICAL CHARACTERISTICS (T_A = 25°C)



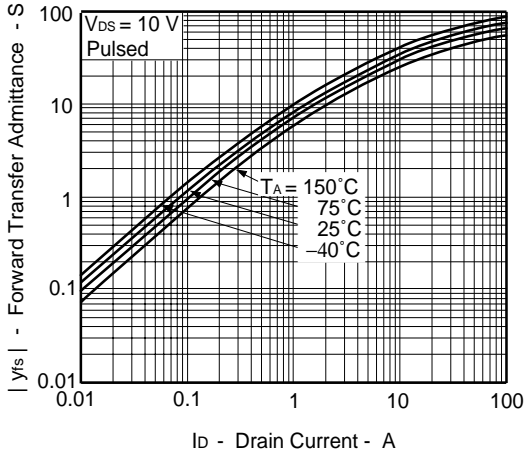
FORWARD TRANSFER CHARACTERISTICS



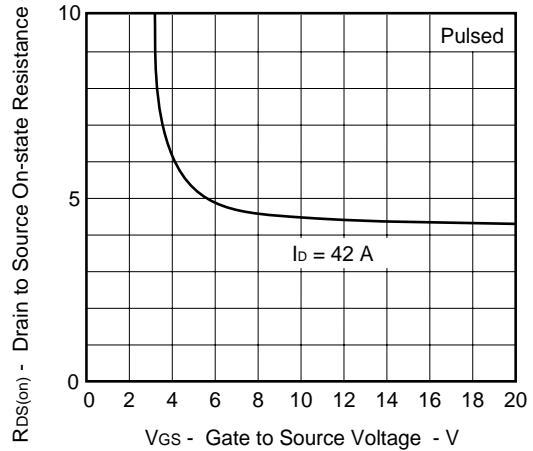
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



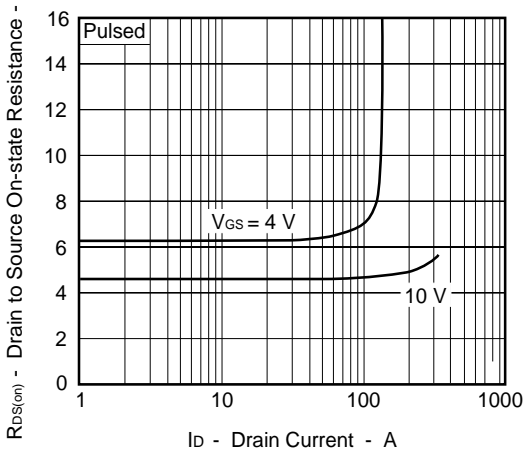
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



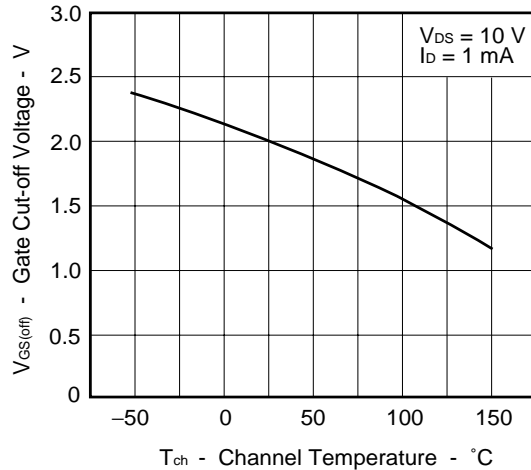
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



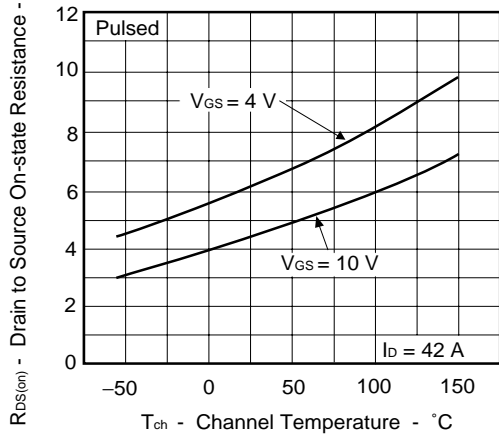
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



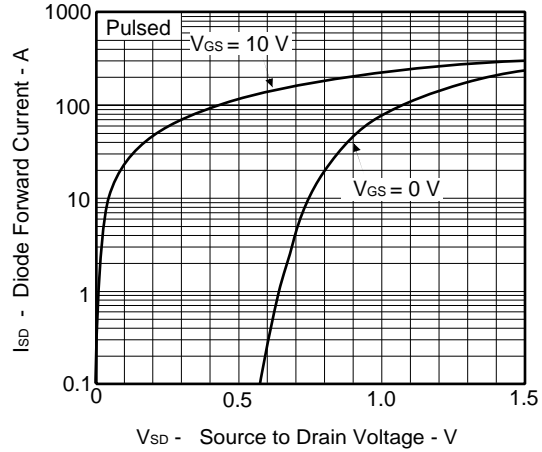
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



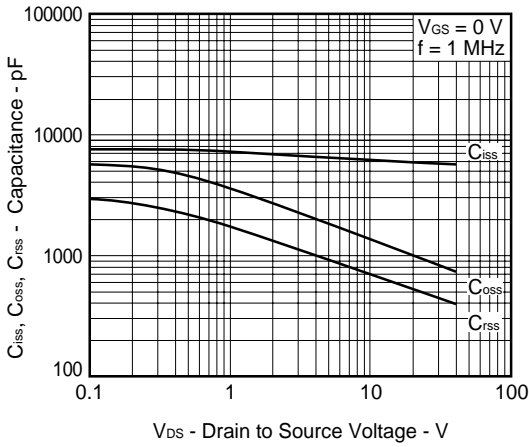
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



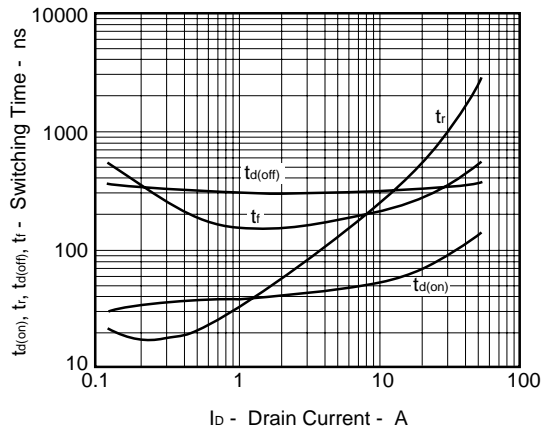
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



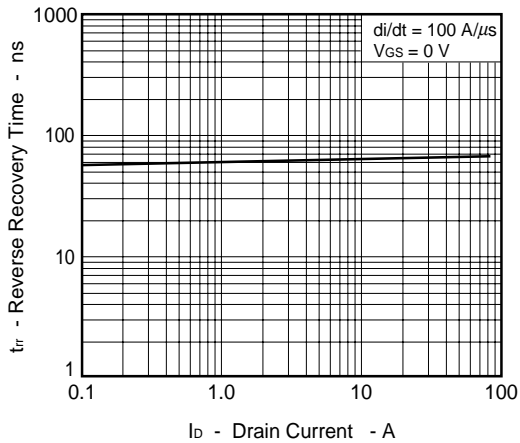
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



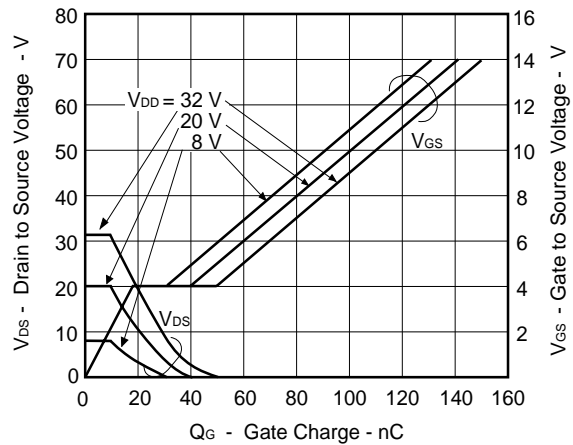
SWITCHING CHARACTERISTICS

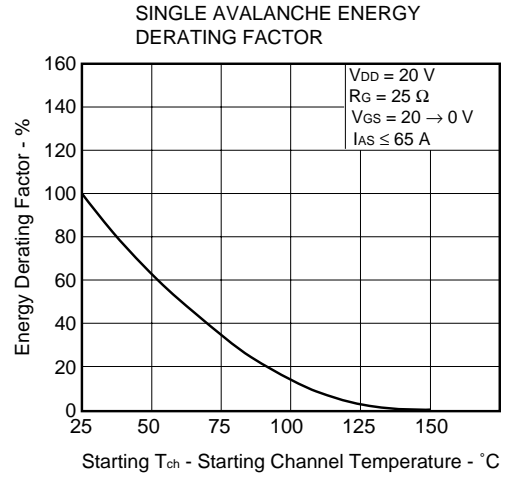
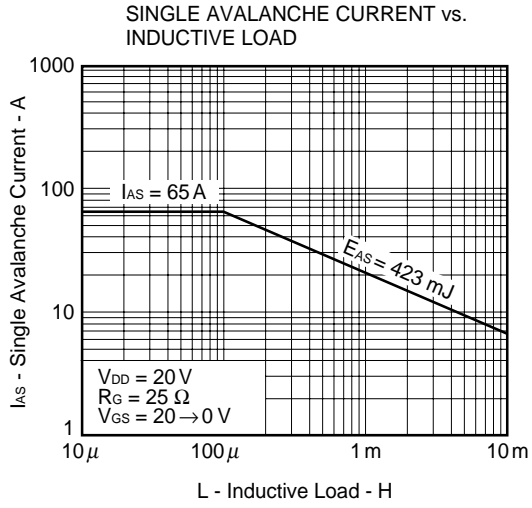


REVERSE RECOVERY TIME vs. DRAIN CURRENT



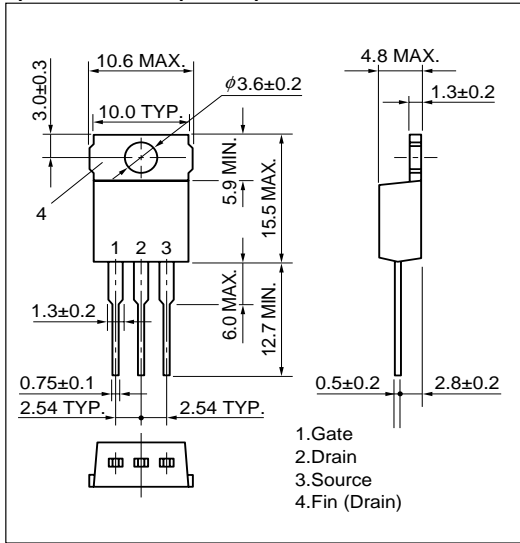
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



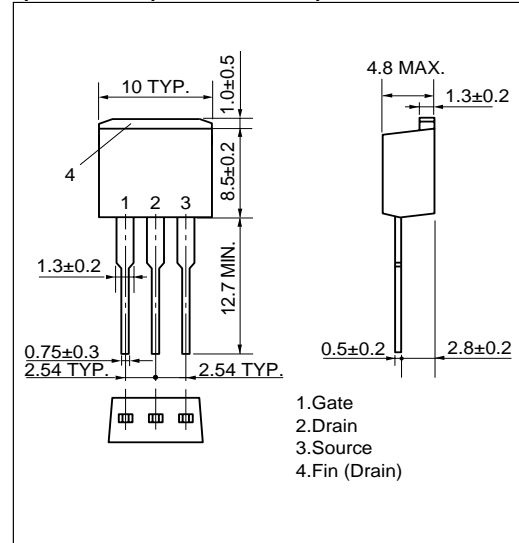


★ PACKAGE DRAWINGS (Unit: mm)

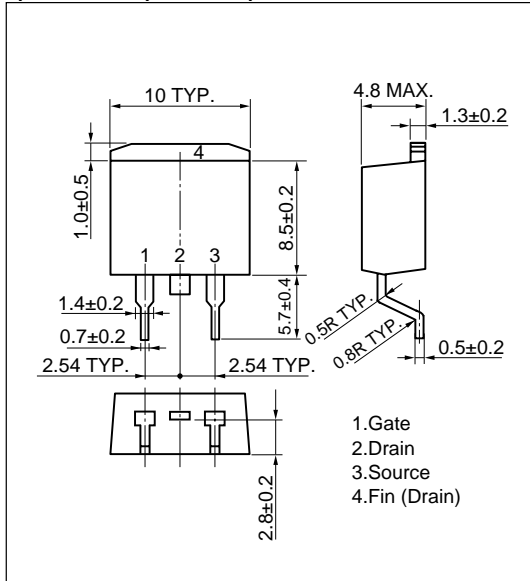
1) TO-220AB (MP-25)



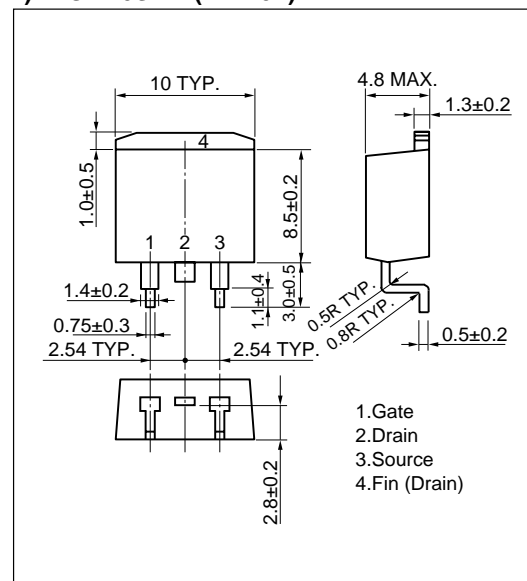
2) TO-262 (MP-25 Fin Cut)



3) TO-263 (MP-25ZJ)

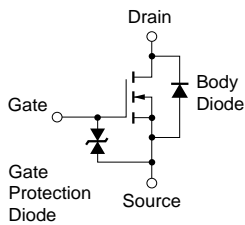


4) TO-220SMD (MP-25Z) ^{Note}



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.

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