

MOS FIELD EFFECT TRANSISTOR

2SK3059

SWITCHING

N-CHANNEL POWER MOS FET

INDUSTRIAL USE

DESCRIPTION

The 2SK3059 is N-Channel MOS Field Effect Transistor designed for high current switching applications.

FEATURES

- Low on-state resistance
 $R_{DS(on)1} = 13 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 25 \text{ A)}$
 $R_{DS(on)2} = 20 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.0 \text{ V, } I_D = 25 \text{ A)}$
- Low C_{iss} : $C_{iss} = 2400 \text{ pF TYP.}$
- Built-in gate protection diode
- Isolated TO-220 package

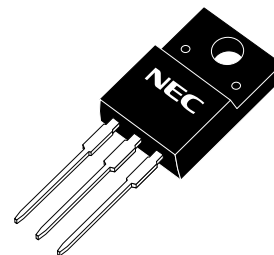
ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|-------------|-----------------|
| 2SK3059 | Isolated TO-220 |

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

| | | | |
|--|----------------|-------------|------------------|
| Drain to Source Voltage ($V_{GS} = 0 \text{ V}$) | V_{DSS} | 60 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | $V_{GSS(AC)}$ | ± 20 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | $V_{GSS(DC)}$ | +20, -10 | V |
| Drain Current (DC) ($T_C = 25^\circ\text{C}$) | $I_{D(DC)}$ | ± 50 | A |
| Drain Current (Pulse) ^{Note1} | $I_{D(pulse)}$ | ± 200 | A |
| Total Power Dissipation ($T_C = 25^\circ\text{C}$) | P_T | 30 | W |
| Total Power Dissipation ($T_A = 25^\circ\text{C}$) | P_T | 2.0 | 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} | 25 | A |
| Single Avalanche Energy ^{Note2} | E_{AS} | 62.5 | mJ |

(Isolated TO-220)



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

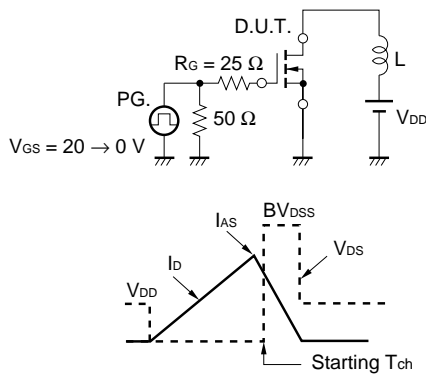
2. Starting $T_{ch} = 25^\circ\text{C}$, $V_{DD} = 30 \text{ V}$, $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$

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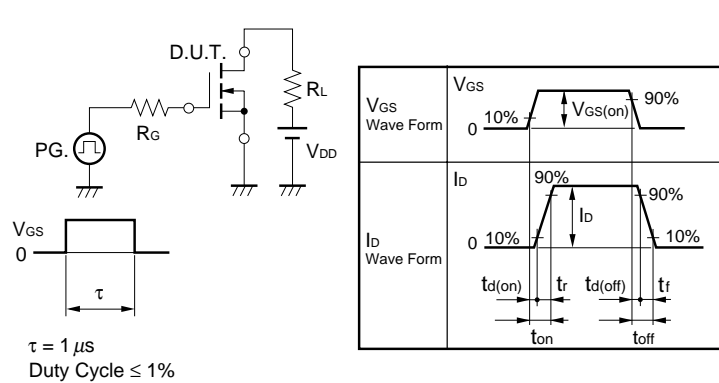
ELECTRICAL CHARACTERISTICS (TA = 25°C)

| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------|---------------|---|------|------|----------|------------------|
| Zero Gate Drain Current | I_{DSS} | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ | | | 10 | μA |
| Gate Leakage Current | I_{GSS} | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ | | | ± 10 | μA |
| Gate Cut-off Voltage | $V_{GS(off)}$ | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 1.0 | 1.5 | 2.0 | V |
| Forward Transfer Admittance | $ y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 25\text{ A}$ | 15 | 45 | | S |
| Drain to Source On-state Resistance | $R_{DS(on)1}$ | $V_{GS} = 10\text{ V}, I_D = 25\text{ A}$ | | 11 | 13 | $\text{m}\Omega$ |
| | $R_{DS(on)2}$ | $V_{GS} = 4.0\text{ V}, I_D = 25\text{ A}$ | | 16 | 20 | $\text{m}\Omega$ |
| Input Capacitance | C_{iss} | $V_{DS} = 10\text{ V}$ | | 2400 | | pF |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | | 700 | | pF |
| Reverse Transfer Capacitance | C_{rss} | $f = 1\text{ MHz}$ | | 280 | | pF |
| Turn-on Delay Time | $t_{d(on)}$ | $I_D = 25\text{ A}$ | | 30 | | ns |
| Rise Time | t_r | $V_{GS(on)} = 10\text{ V}$ | | 420 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $V_{DD} = 30\text{ V}$ | | 140 | | ns |
| Fall Time | t_f | $R_G = 10\ \Omega$ | | 380 | | ns |
| Total Gate Charge | Q_G | $I_D = 50\text{ A}$ | | 50 | | nC |
| Gate to Source Charge | Q_{GS} | $V_{DD} = 48\text{ V}$ | | 7.5 | | nC |
| Gate to Drain Charge | Q_{GD} | $V_{GS} = 10\text{ V}$ | | 17 | | nC |
| Body Diode Forward Voltage | $V_{F(S-D)}$ | $I_F = 50\text{ A}, V_{GS} = 0\text{ V}$ | | 1.0 | | V |
| Reverse Recovery Time | t_{rr} | $I_F = 50\text{ A}, V_{GS} = 0\text{ V}$ | | 55 | | ns |
| Reverse Recovery Charge | Q_{rr} | $di/dt = 100\text{ A}/\mu\text{s}$ | | 75 | | nC |

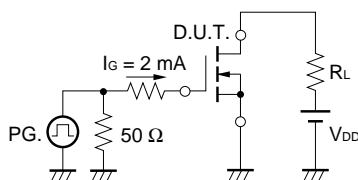
TEST CIRCUIT 1 AVALANCHE CAPABILITY



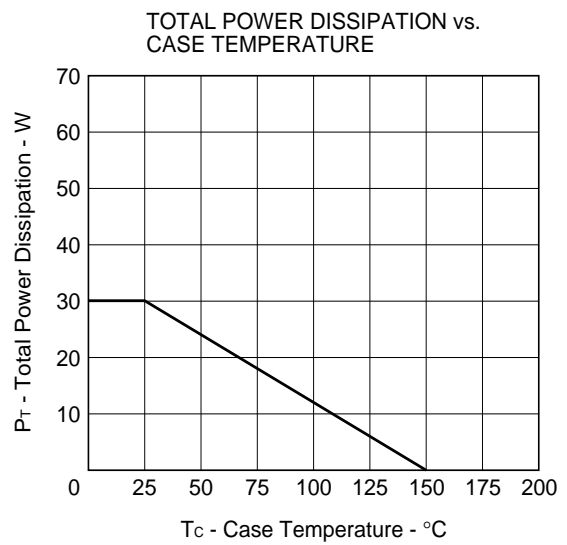
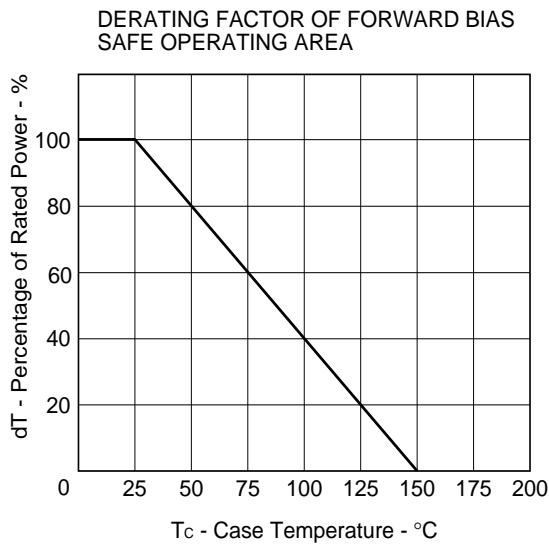
TEST CIRCUIT 2 SWITCHING TIME



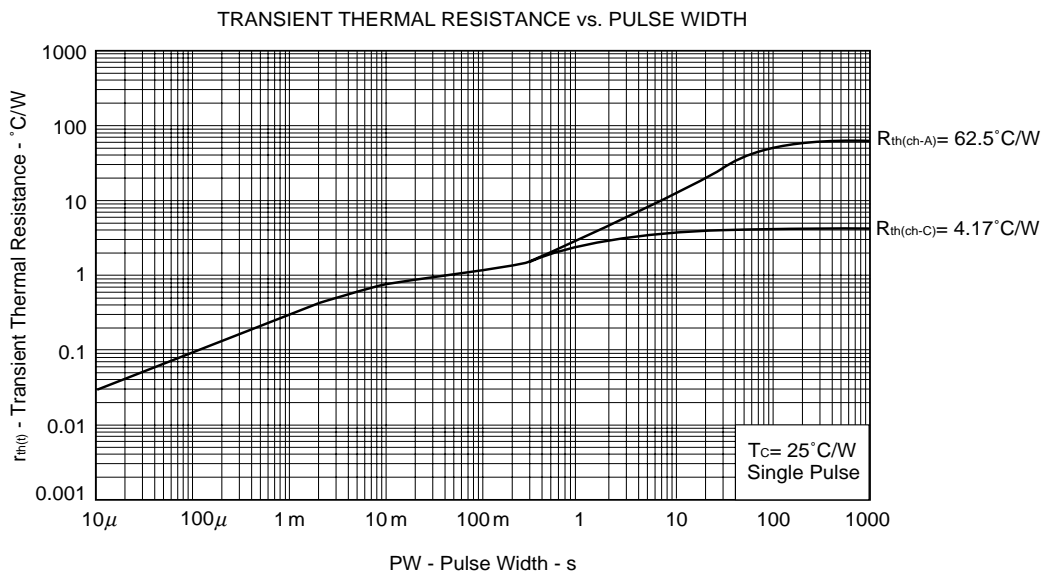
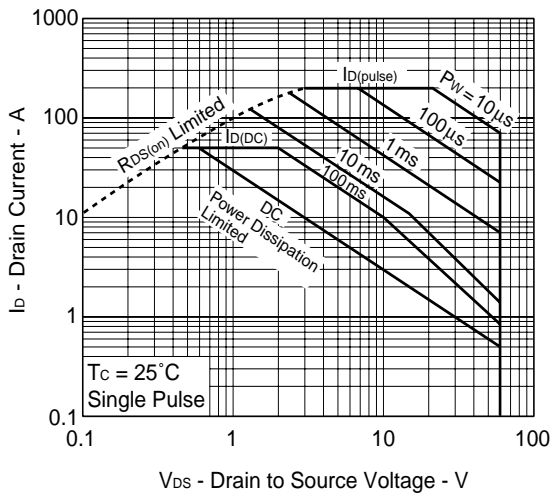
TEST CIRCUIT 3 GATE CHARGE

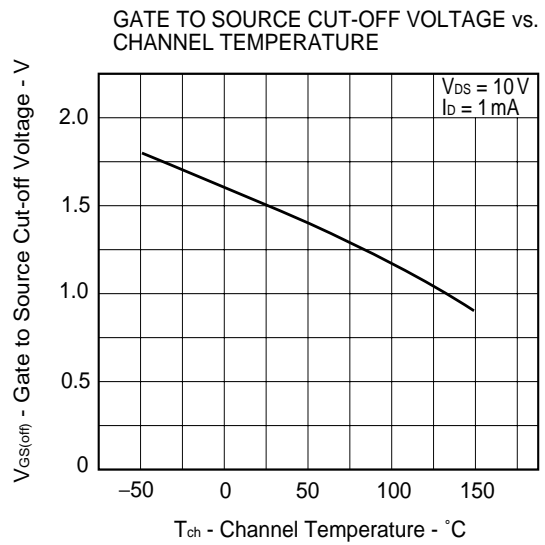
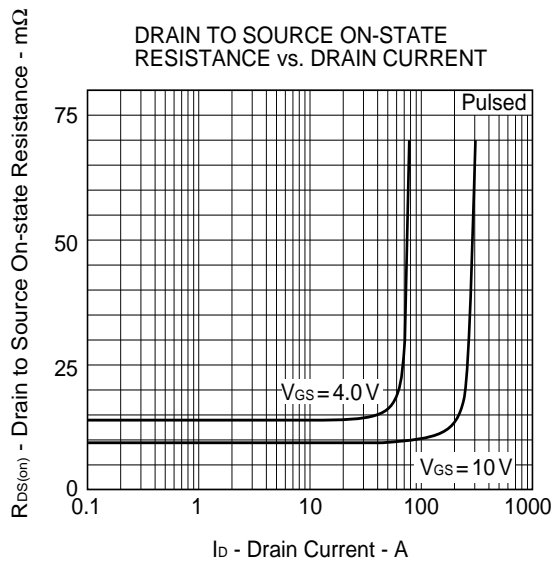
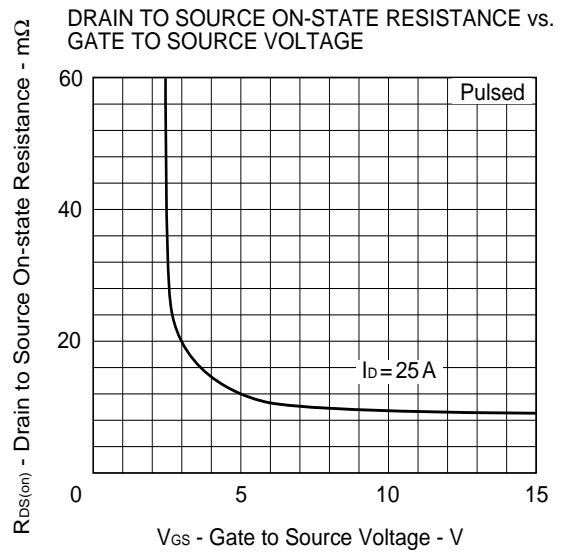
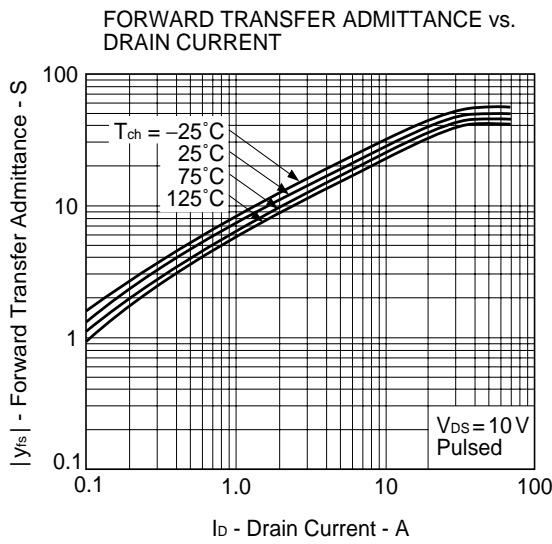
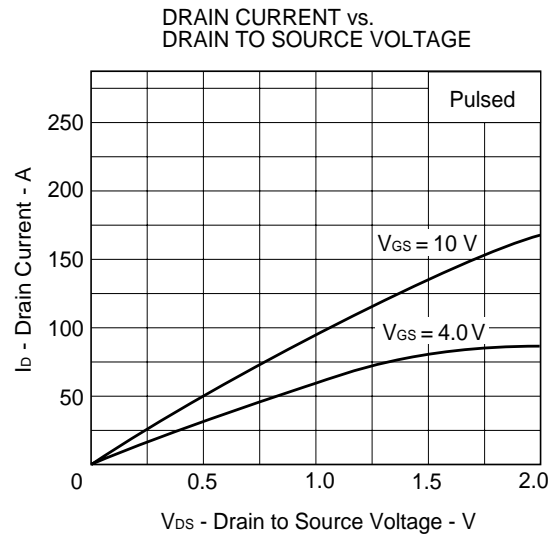
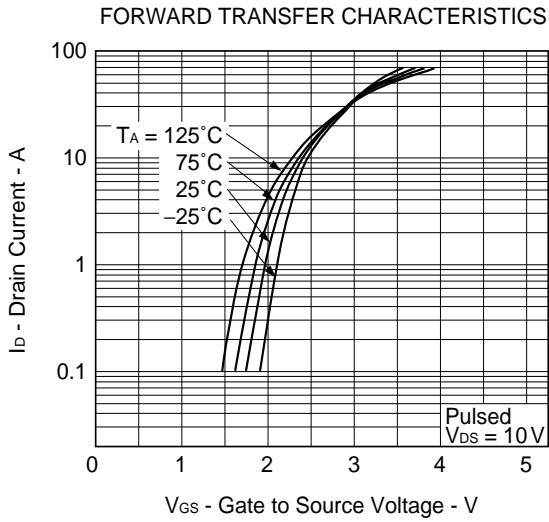


TYPICAL CHARACTERISTICS (T_A = 25°C)

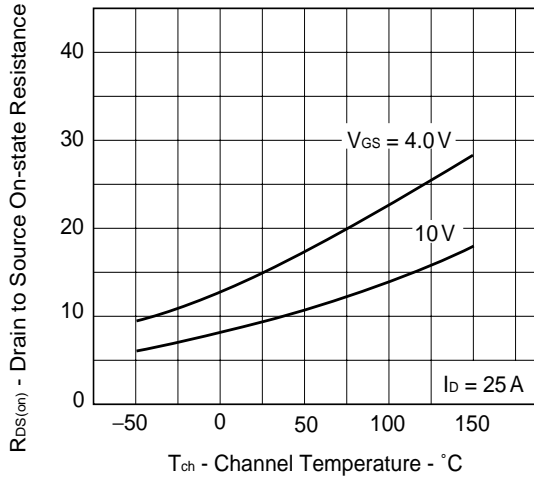


★ FORWARD BIAS SAFE OPERATING AREA

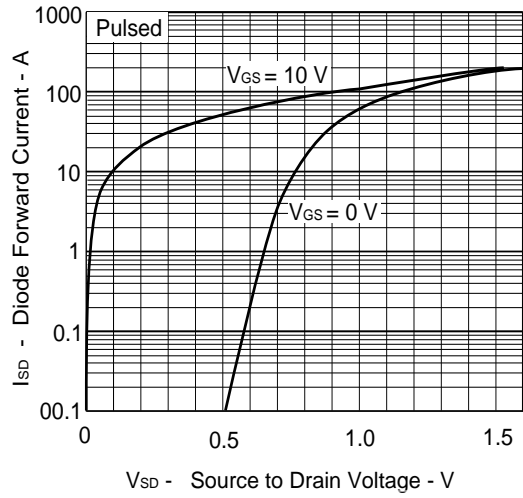




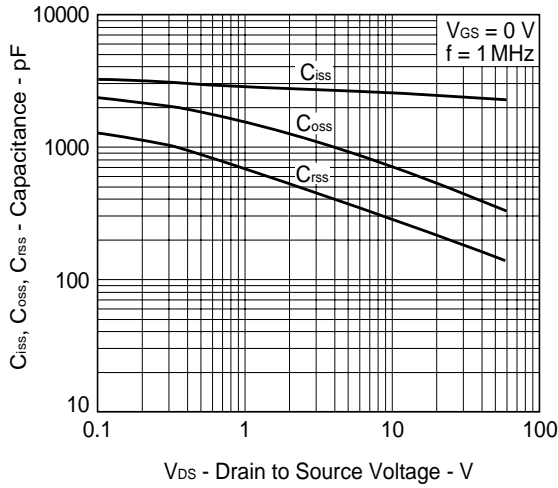
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



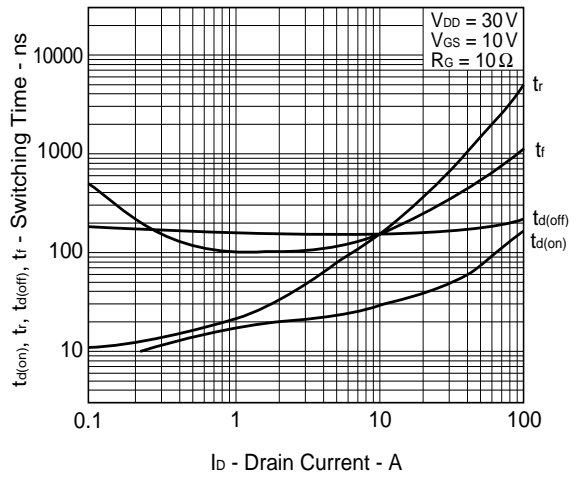
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



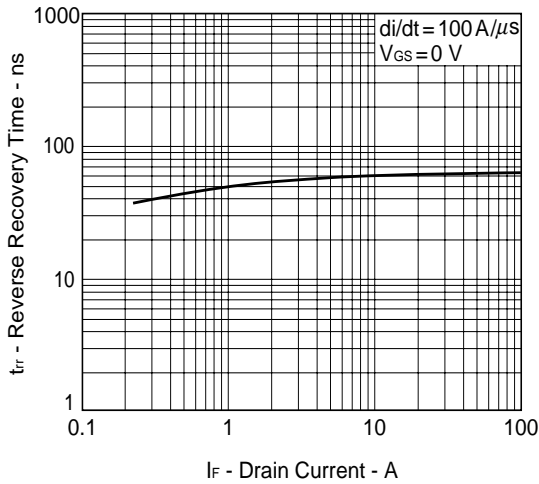
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



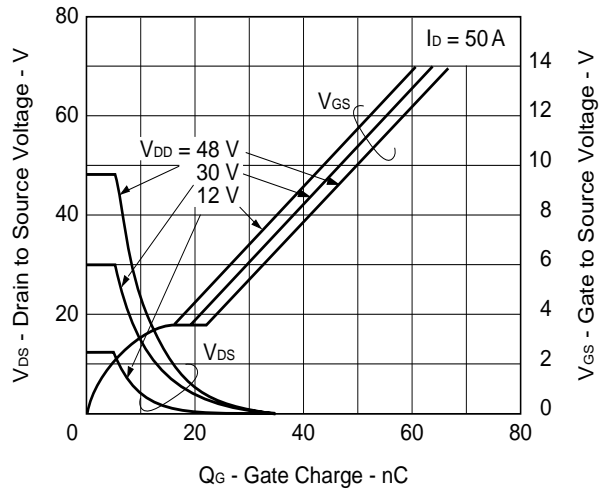
SWITCHING CHARACTERISTICS

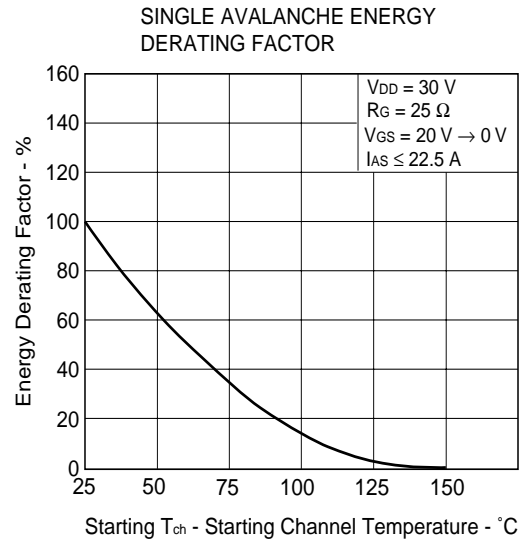
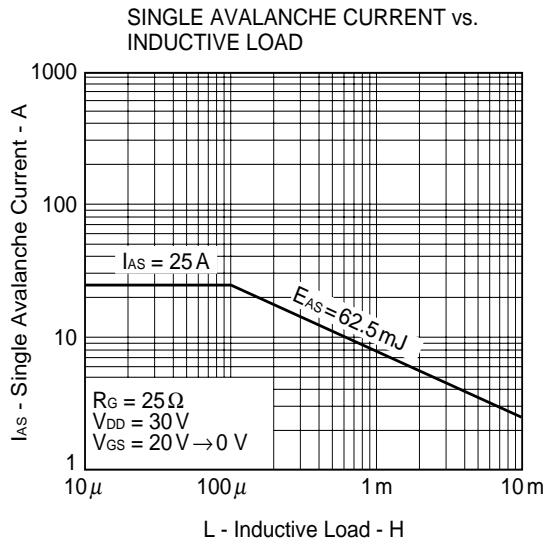


REVERSE RECOVERY TIME vs. DRAIN CURRENT



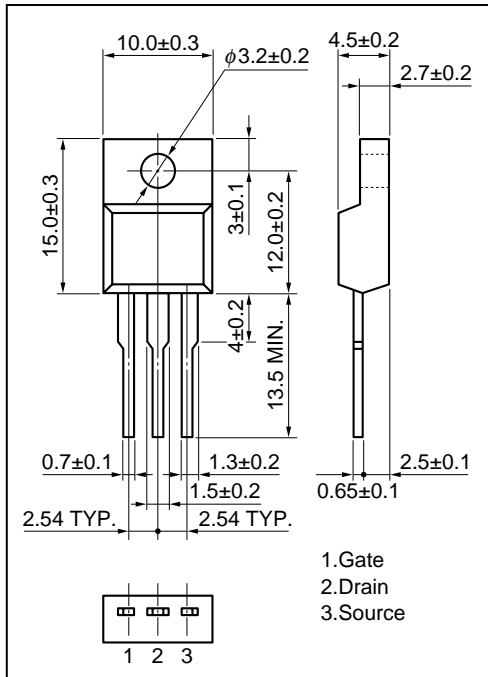
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



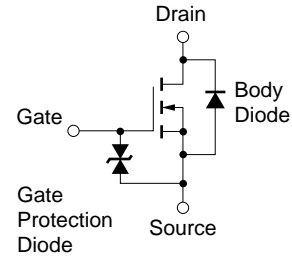


PACKAGE DRAWING (Unit : mm)

Isolated TO-220AB (MP-45F)



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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