NEC

# MOS FIELD EFFECT TRANSISTOR
# 2SK3457

## SWITCHING
## N-CHANNEL POWER MOS FET

### DESCRIPTION

The 2SK3457 is N-channel DMOS FET device that features a low gate charge and excellent switching characteristics, designed for high voltage applications such as switching power supply.

### ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|---|---|
| 2SK3457 | Isolated TO-220 |

### FEATURES

- Low gate charge
  $Q_G$ = 24 nC TYP. ($V_{DD}$ = 450 V, $V_{GS}$ = 10 V, $I_D$ = 5.0 A)
- Gate voltage rating ±30 V
- Low on-state resistance
  $R_{DS(on)}$ = 2.2 Ω MAX. ($V_{GS}$ = 10 V, $I_D$ = 3.0 A)
- Avalanche capability ratings
- Isolated TO-220 package

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| | | | |
|---|---|---|---|
| Drain to Source Voltage ($V_{GS}$ = 0 V) | $V_{DSS}$ | 800 | V |
| Gate to Source Voltage ($V_{DS}$ = 0 V) | $V_{GSS}$ | ±30 | V |
| Drain Current (DC) ($T_C$ = 25°C) | $I_{D(DC)}$ | ±5.0 | A |
| Drain Current (pulse) Note1 | $I_{D(pulse)}$ | ±20 | A |
| Total Power Dissipation ($T_A$ = 25°C) | $P_{T1}$ | 2.0 | W |
| Total Power Dissipation ($T_C$ = 25°C) | $P_{T2}$ | 50 | W |
| Channel Temperature | $T_{ch}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |
| Single Avalanche Current Note2 | $I_{AS}$ | 5.0 | A |
| Single Avalanche Energy Note2 | $E_{AS}$ | 73.8 | mJ |

**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** Starting $T_{ch}$ = 25°C, $V_{DD}$ = 150 V, $R_G$ = 25 Ω, $V_{GS}$ = 20 → 0 V



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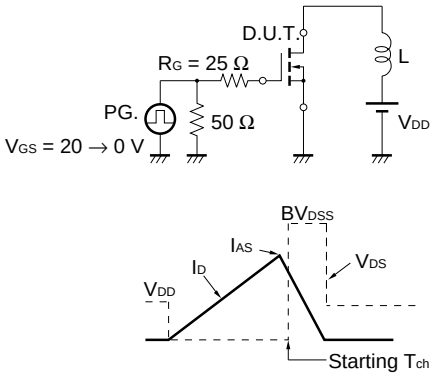
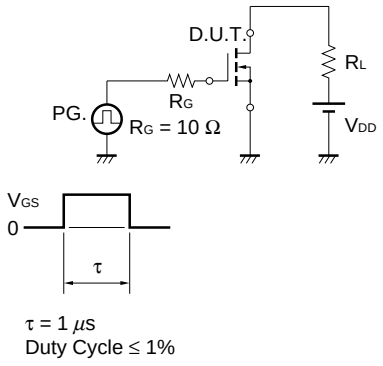
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 800 V, $V_{GS}$ = 0 V | | | 100 | $\mu$A |
| Gate Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V | | | ±100 | nA |
| Gate Cut-off Voltage | $V_{GS(off)}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 2.5 | | 3.5 | V |
| Forward Transfer Admittance | $\|y_{fs}\|$ | $V_{DS}$ = 10 V, $I_D$ = 3.0 A | 2.0 | | | S |
| Drain to Source On-state Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 3.0 A | | 1.8 | 2.2 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 10 V | | 1220 | | pF |
| Output Capacitance | $C_{oss}$ | $V_{GS}$ = 0 V | | 170 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | f = 1 MHz | | 16 | | pF |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = 150 V, $I_D$ = 3.0 A | | 17 | | ns |
| Rise Time | $t_r$ | $V_{GS}$ = 10 V | | 7 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $R_G$ = 10 Ω | | 43 | | ns |
| Fall Time | $t_f$ | | | 11 | | ns |
| Total Gate Charge | $Q_G$ | $V_{DD}$ = 450 V | | 24 | | nC |
| Gate to Source Charge | $Q_{GS}$ | $V_{GS}$ = 10 V | | 5 | | nC |
| Gate to Drain Charge | $Q_{GD}$ | $I_D$ = 5.0 A | | 10 | | nC |
| Body Diode Forward Voltage | $V_{F(S-D)}$ | $I_F$ = 5.0 A, $V_{GS}$ = 0 V | | 1.0 | | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 5.0 A, $V_{GS}$ = 0 V | | 1310 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | di/dt = 50 A/ $\mu$s | | 6.6 | | $\mu$C |

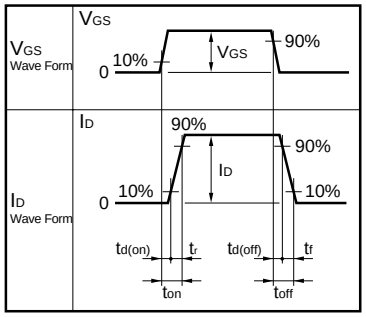
### TEST CIRCUIT 1 AVALANCHE CAPABILITY



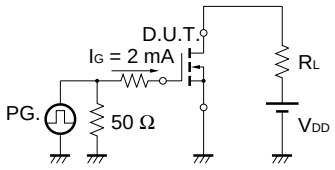

### TEST CIRCUIT 2 SWITCHING TIME




τ = 1 $\mu$s
Duty Cycle ≤ 1%

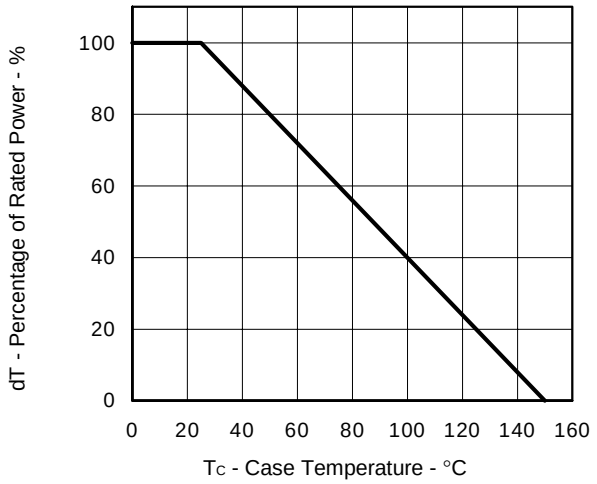



### TEST CIRCUIT 3 GATE CHARGE

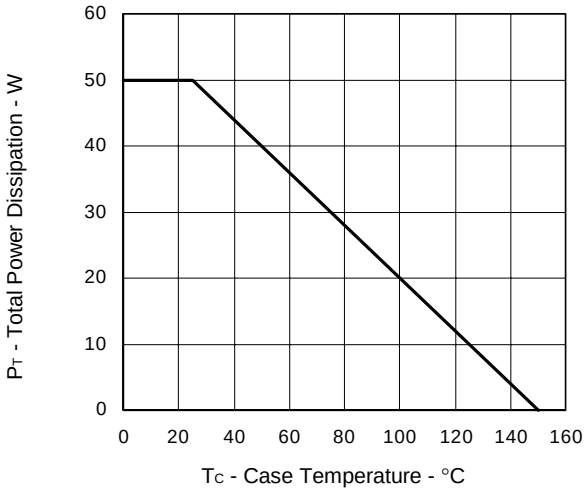


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

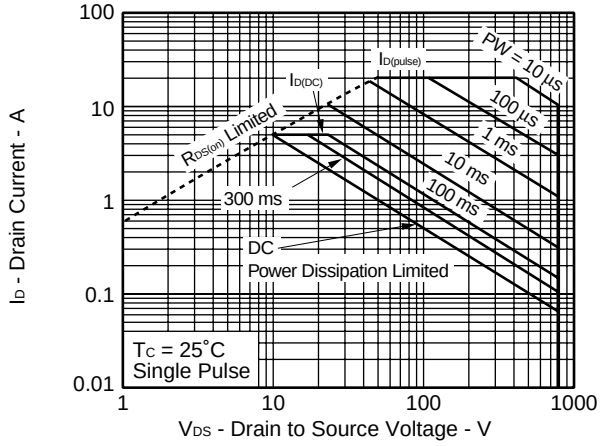
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



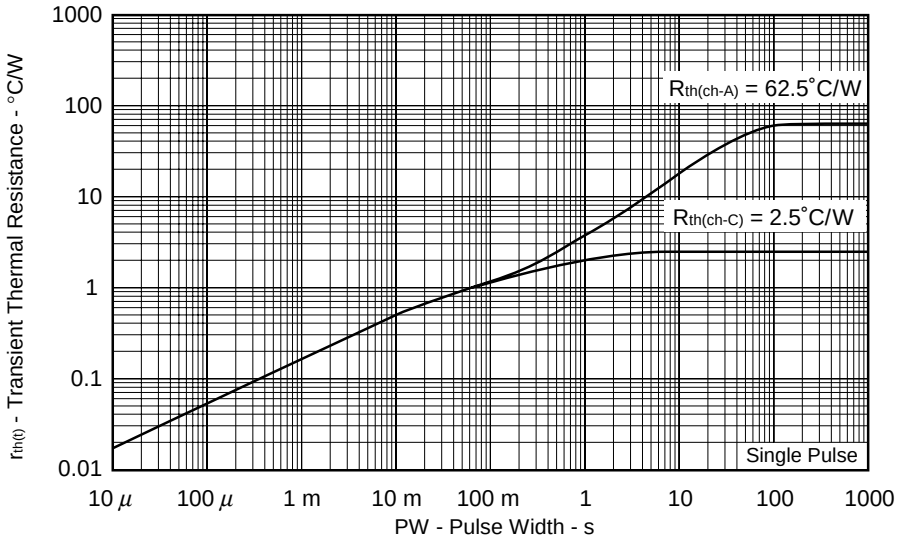

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



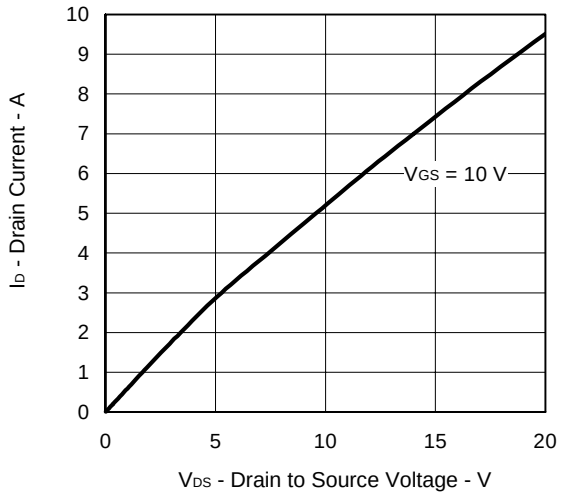

FORWARD BIAS SAFE OPERATING AREA



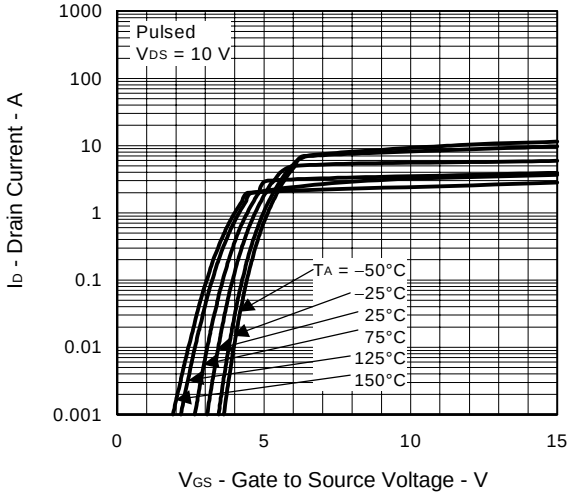

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



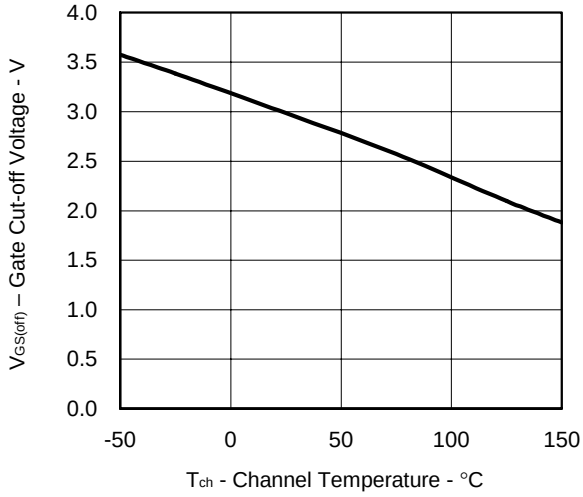
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



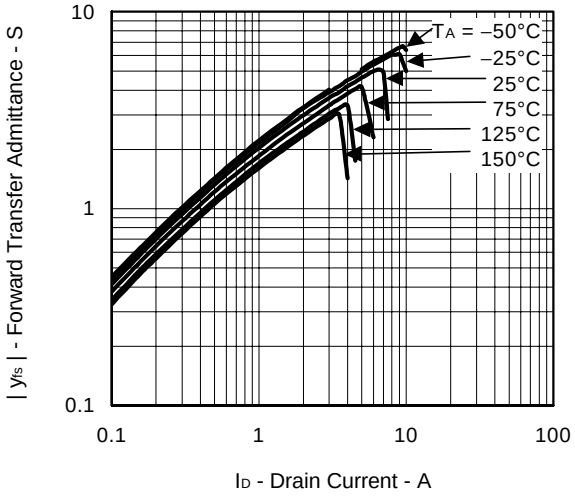

FORWARD TRANSFER CHARACTERISTICS



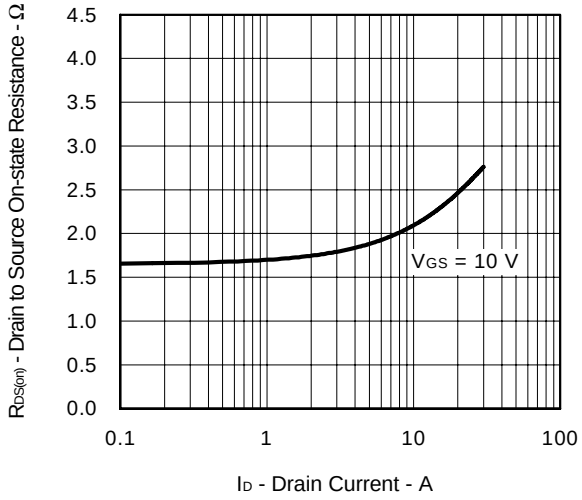

GATE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



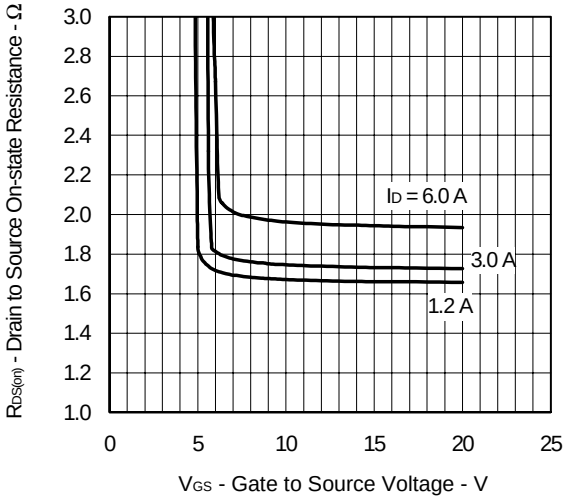

FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



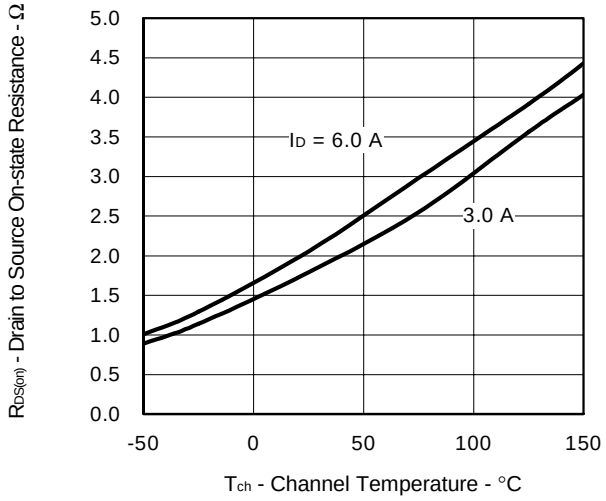

DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



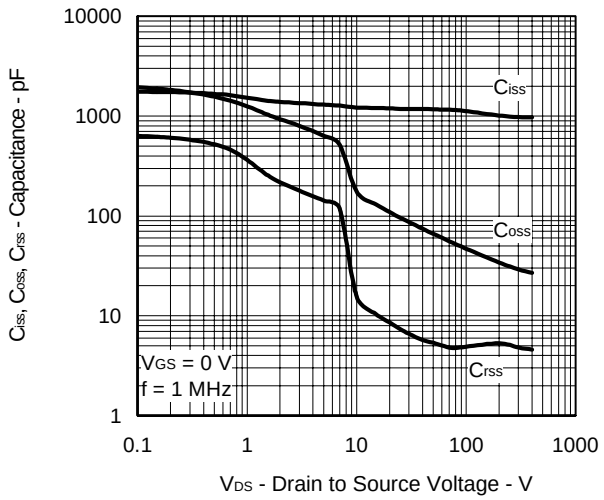

DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



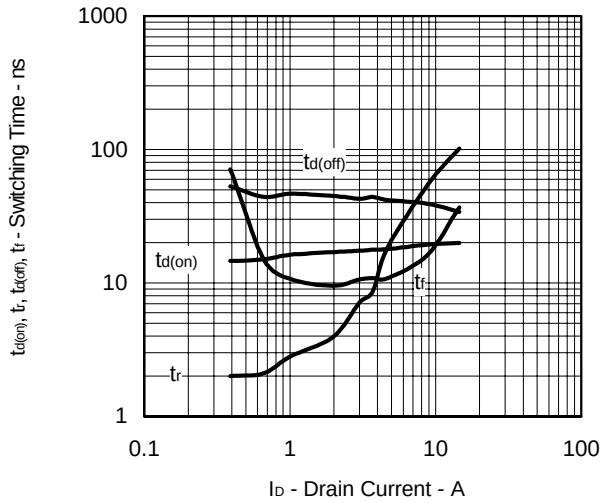
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



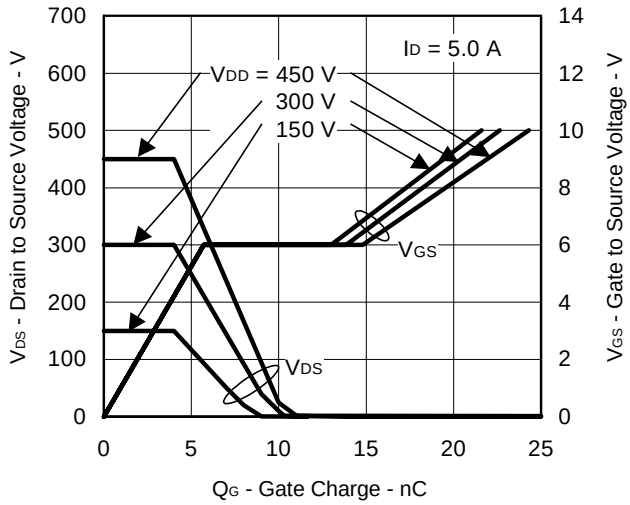

CAPACITANCE vs.
DRAIN TO SOURCE VOLTAGE



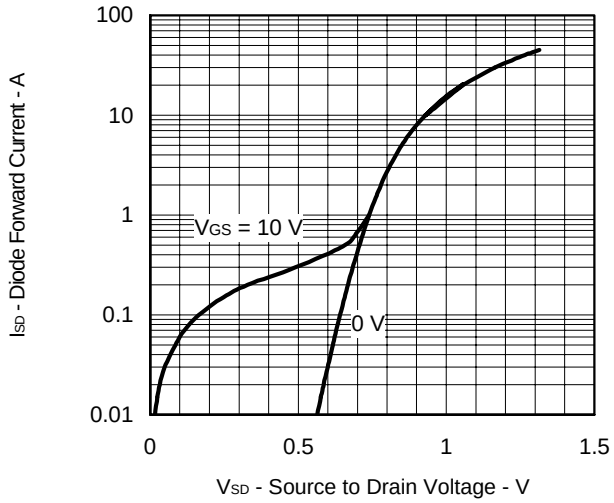

SWITCHING CHARACTERISTICS



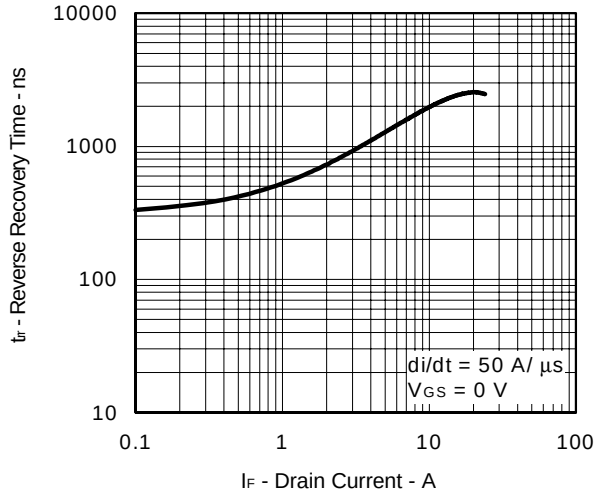

DYNAMIC INPUT/OUTPUT CHARACTERISTICS



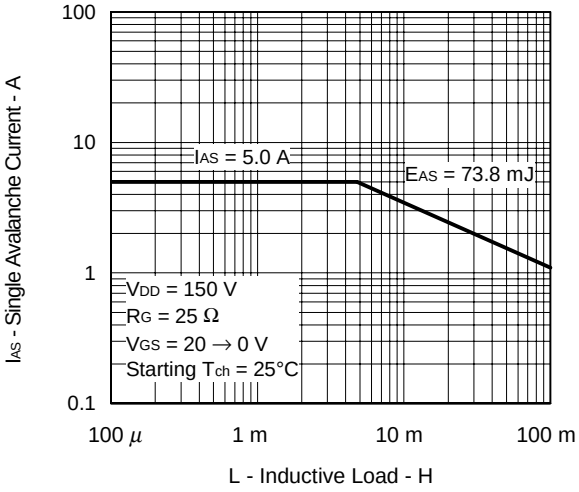

SOURCE TO DRAIN DIODE
FORWARD VOLTAGE



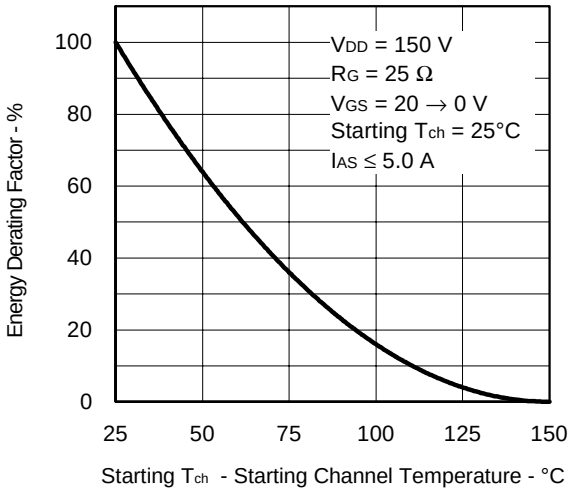

REVERSE RECOVERY TIME vs. DRAIN CURRENT



SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD

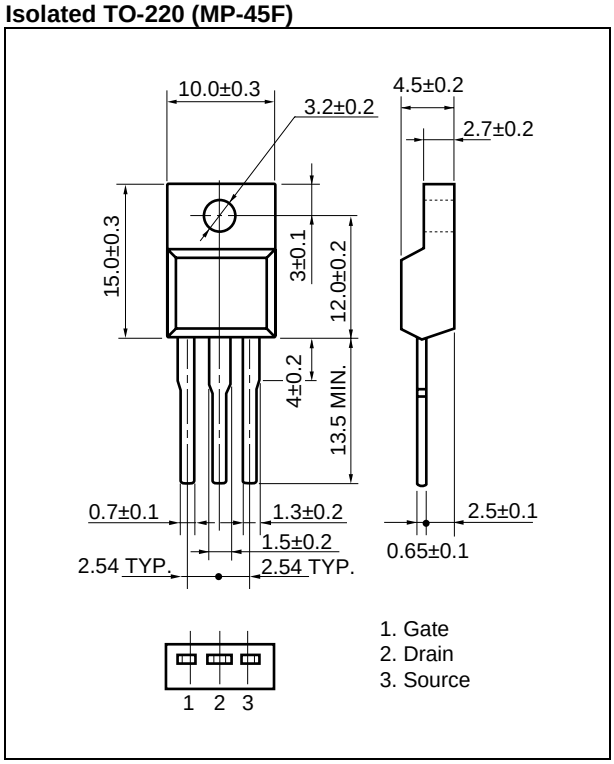



SINGLE AVALANCHE ENERGY
DERATING FACTOR

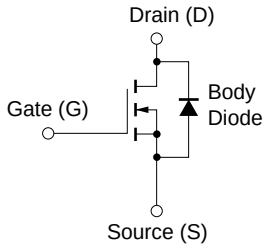


**PACKAGE DRAWING (Unit: mm)**

**Isolated TO-220 (MP-45F)**




**EQUIVALENT CIRCUIT**




**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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