DATA SHEET

NEC

# MOS FIELD EFFECT TRANSISTOR
# 2SK3306

## SWITCHING
## N-CHANNEL POWER MOS FET
## INDUSTRIAL USE

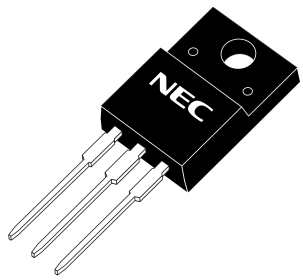
### DESCRIPTION

The 2SK3306 is N-Channel DMOS FET device that features a low gate charge and excellent switching characteristics, and designed for high voltage applications such as switching power supply, AC adapter.

### ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|---|---|
| 2SK3306 | Isolated TO-220 (MP-45F) |

(Isolated TO-220)




### FEATURES

- Low gate charge :
  ★ $Q_G$ = 13 nC TYP. ($V_{DD}$ = 400 V, $V_{GS}$ = 10 V, $I_D$ = 5.0 A)
- Gate voltage rating : ±30 V
- Low on-state resistance :
  $R_{DS(on)}$ = 1.5 Ω MAX. ($V_{GS}$ = 10 V, $I_D$ = 2.5 A)
- Avalanche capability ratings
- Isolated TO-220(MP-45F) package

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

| | | | |
|---|---|---|---|
| Drain to Source Voltage ($V_{GS}$ = 0 V) | $V_{DSS}$ | 500 | V |
| Gate to Source Voltage ($V_{DS}$ = 0 V) | $V_{GSS(AC)}$ | ±30 | V |
| Drain Current (DC) | $I_{D(DC)}$ | ±5 | A |
| Drain Current (pulse) **Note1** | $I_{D(pulse)}$ | ±20 | A |
| Total Power Dissipation ($T_C$ = 25°C) | $P_T$ | 35 | W |
| Total Power Dissipation ($T_A$ = 25°C) | $P_T$ | 2.0 | 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** | $E_{AS}$ | 125 | 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 V → 0 V



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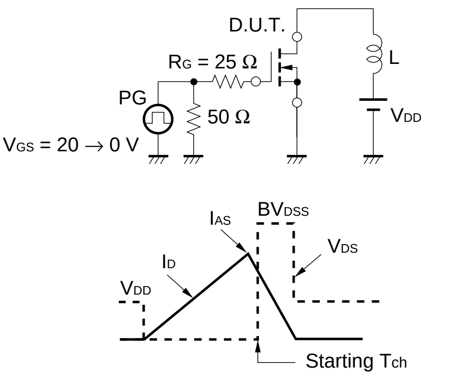
**The mark ★ shows major revised points.**

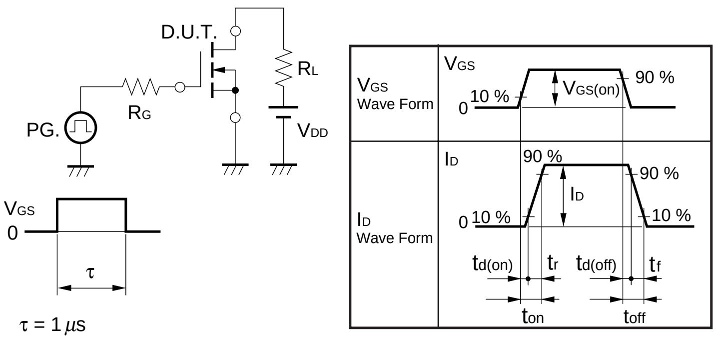
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

| | CHARACTERISTICS | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| | Drain Leakage Current | $I_{DSS}$ | | | 100 | μA | $V_{DS}$ = 500 V, $V_{GS}$ = 0 V |
| ★ | Gate to Source Leakage Current | $I_{GSS}$ | | | ±100 | nA | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V |
| | Gate to Source Cut-off Voltage | $V_{GS(off)}$ | 2.5 | | 3.5 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| ★ | Forward Transfer Admittance | $\vert y_{fs} \vert$ | 1.0 | 3.0 | | S | $V_{DS}$ = 10 V, $I_D$ = 2.5 A |
| ★ | Drain to Source On-state Resistance | $R_{DS(on)}$ | | 1.35 | 1.5 | Ω | $V_{GS}$ = 10 V, $I_D$ = 2.5 A |
| ★ | Input Capacitance | $C_{iss}$ | | 700 | | pF | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 MHz |
| | Output Capacitance | $C_{oss}$ | | 115 | | pF | |
| | Reverse Transfer Capacitance | $C_{rss}$ | | 6 | | pF | |
| | Turn-on Delay Time | $t_{d(on)}$ | | 16 | | ns | $V_{DD}$ = 150 V, $I_D$ = 2.5 A, $V_{GS(on)}$ = 10 V, |
| | Rise Time | $t_r$ | | 3 | | ns | $R_G$ = 10 Ω, $R_L$ = 60 Ω |
| | Turn-off Delay Time | $t_{d(off)}$ | | 33 | | ns | |
| | Fall Time | $t_f$ | | 5.5 | | ns | |
| ★ | Total Gate Charge | $Q_G$ | | 13 | | nC | $V_{DD}$ = 400 V, $V_{GS(on)}$ = 10 V, $I_D$ = 5.0 A |
| ★ | Gate to Source Charge | $Q_{GS}$ | | 4 | | nC | |
| ★ | Gate to Drain Charge | $Q_{GD}$ | | 4.5 | | nC | |
| ★ | Body Diode Forward Voltage | $V_{F(S-D)}$ | | 1.0 | | V | $I_F$ = 5.0 A, $V_{GS}$ = 0 V |
| | Reverse Recovery Time | $t_{rr}$ | | 0.7 | | μs | $I_F$ = 5.0 A, $V_{GS}$ = 0 V, di/dt = 50 A/μs |
| ★ | Reverse Recovery Charge | $Q_{rr}$ | | 3.3 | | μC | |

### TEST CIRCUIT 1 AVALANCHE CAPABILITY

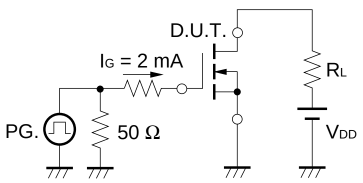



### TEST CIRCUIT 2 SWITCHING TIME



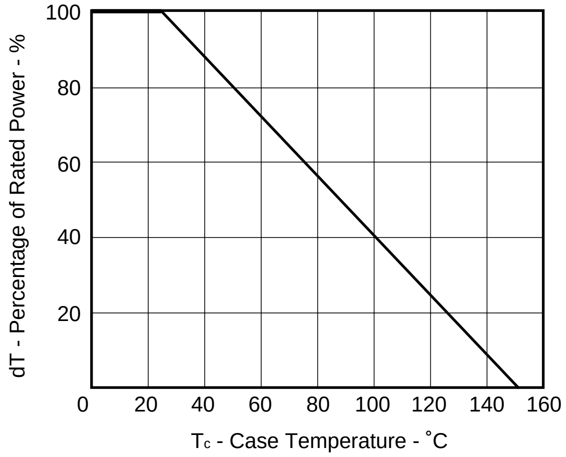

τ = 1 μs
Duty Cycle ≤ 1 %

### TEST CIRCUIT 3 GATE CHARGE

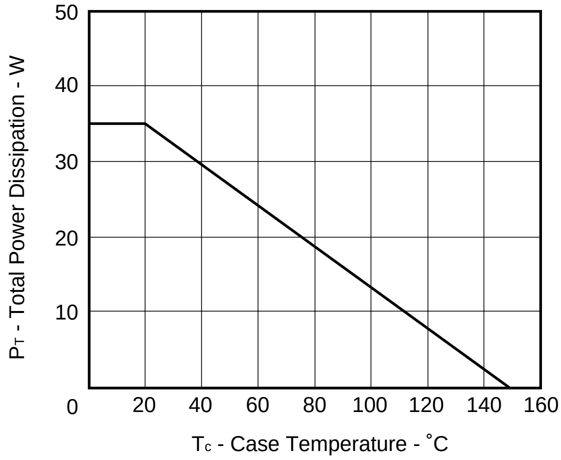


## TYPICAL CHARACTERISTICS($T_A$ = 25 °C)

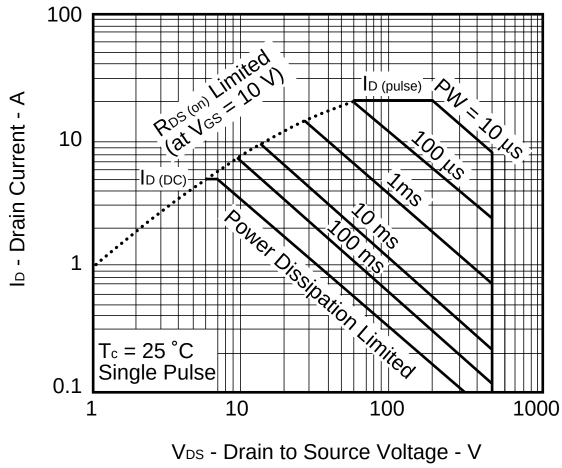
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



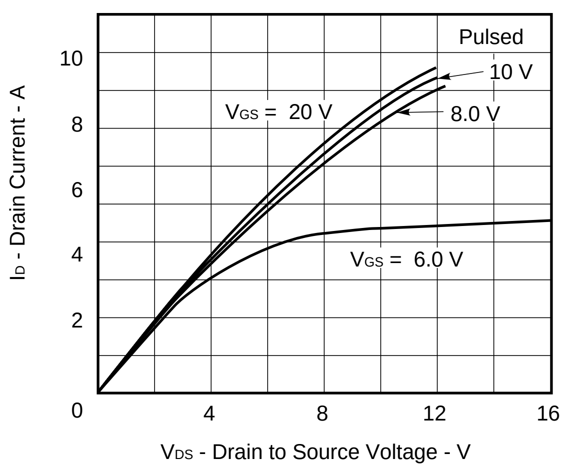

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



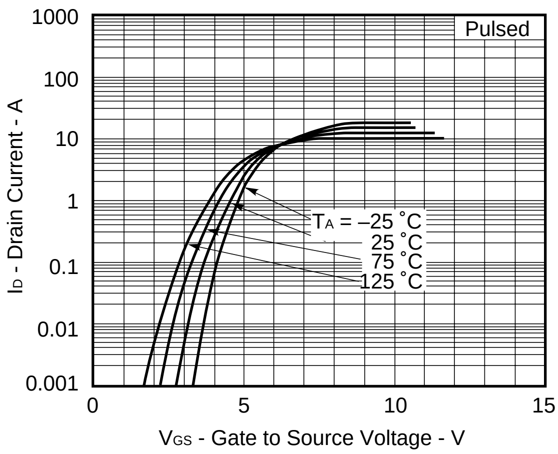

FORWARD BIAS SAFE OPERATING AREA



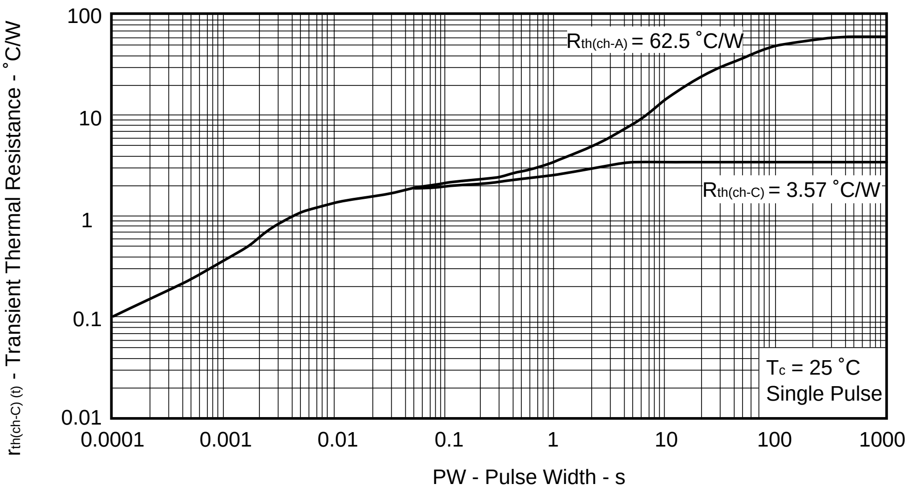

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



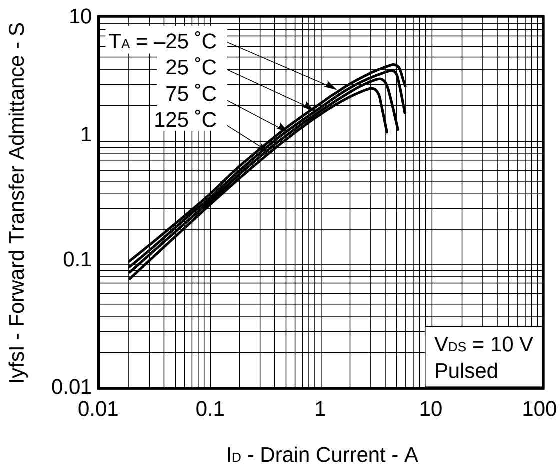

DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



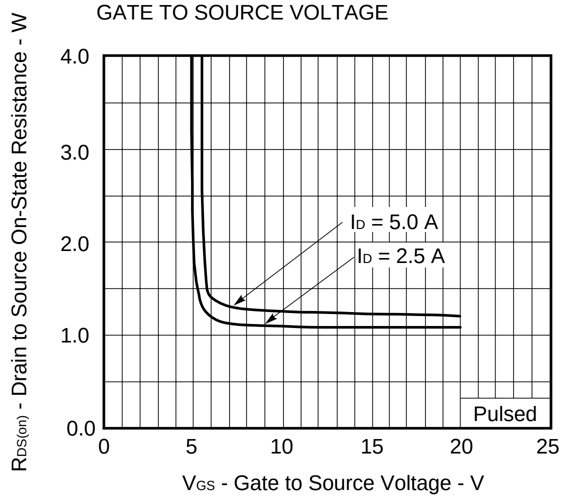
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



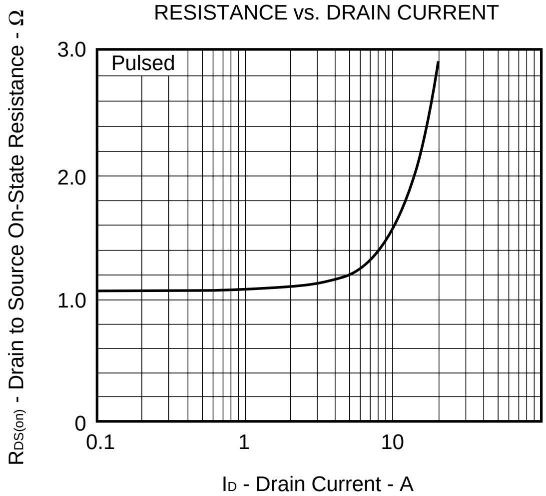

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



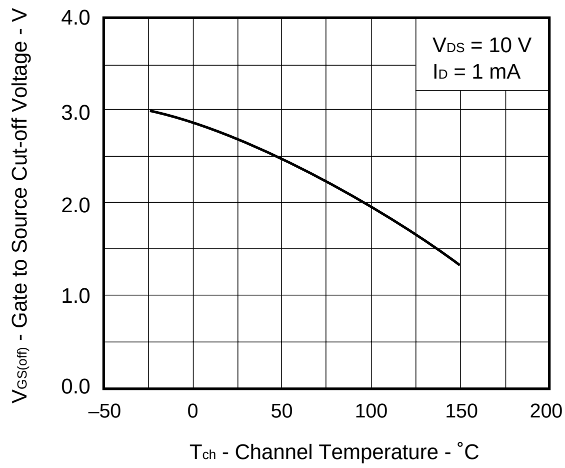

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



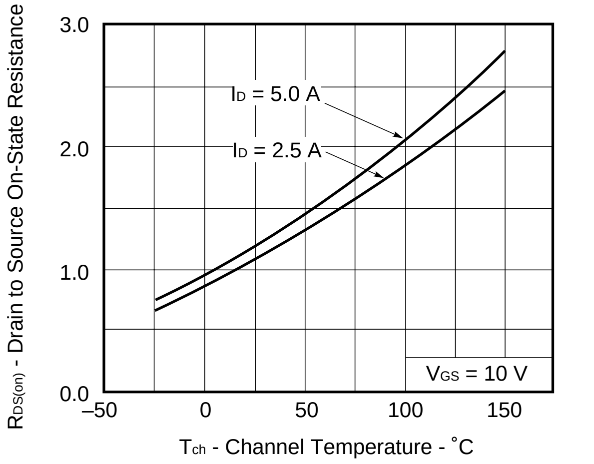

DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



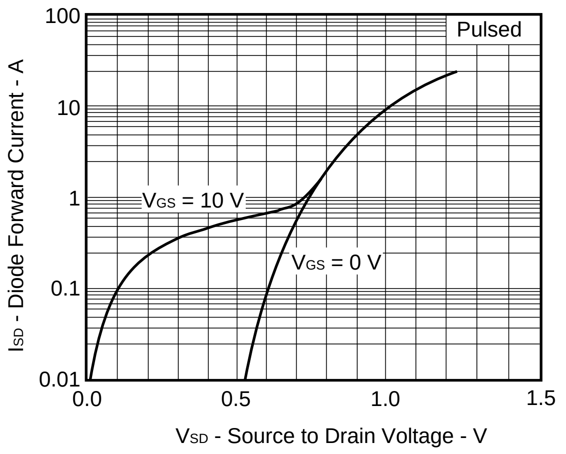

GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



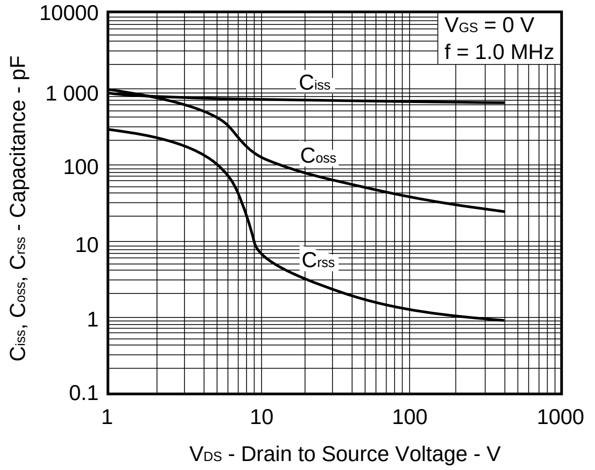
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



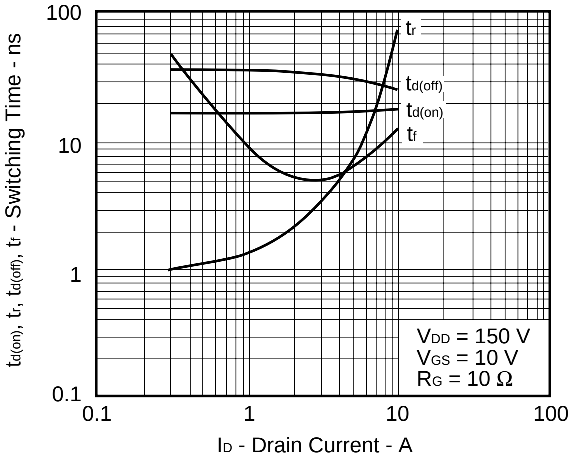

SOURCE TO DRAIN DIODE
FORWARD VOLTAGE



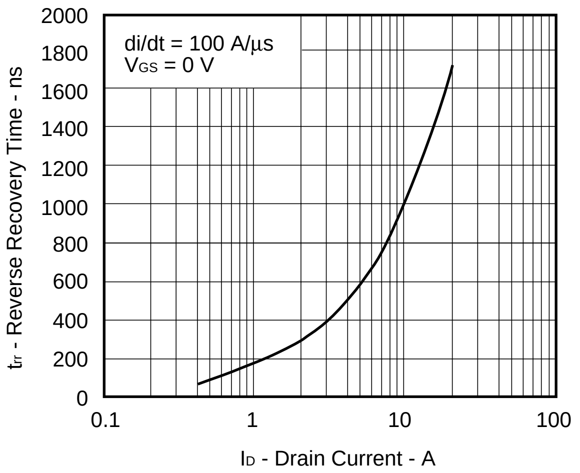

CAPACITANCE vs. DRAIN TO
SOURCE VOLTAGE



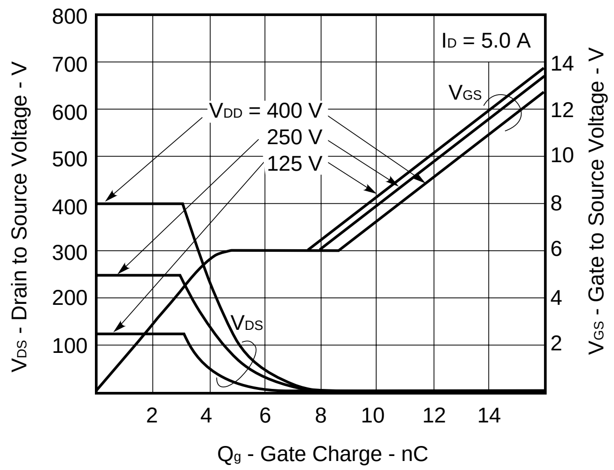

SWITCHING CHARACTERISTICS



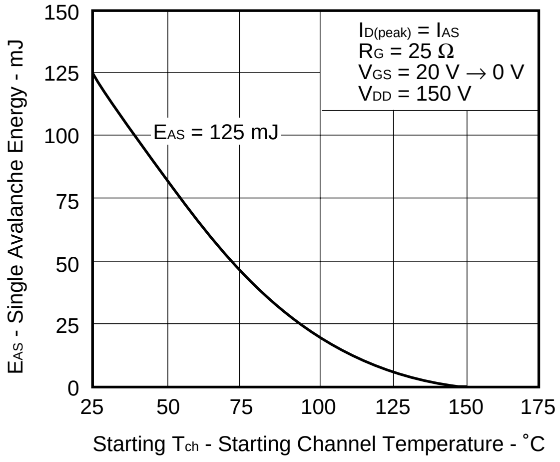

REVERSE RECOVERY TIME vs.
DRAIN CURRENT



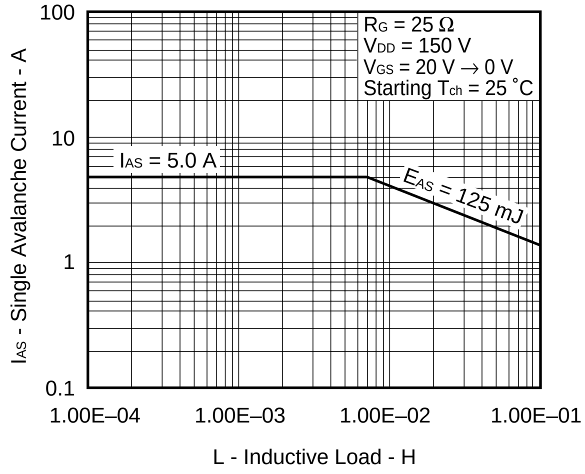

DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SINGLE AVALANCHE ENERGY vs
STARTING CHANNEL TEMPERATURE

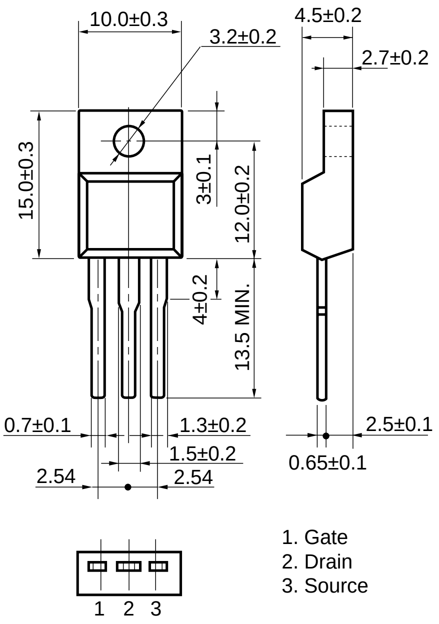



SINGLE AVALANCHE CURRENT vs
INDUCTIVE LOAD

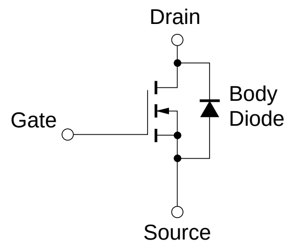


## PACKAGE DRAWING (Unit: mm)

Isolated TO-220(MP-45F)




## EQUIVALENT CIRCUIT




★ **Remark** Strong electric field, when exposed to this device, 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.