

# 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.

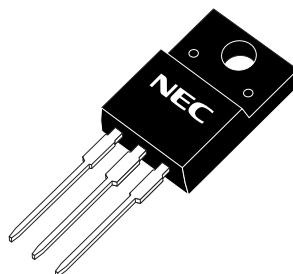
### ORDERING INFORMATION

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

### FEATURES

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

(Isolated TO-220)



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

|                                                      |               |                        |                  |
|------------------------------------------------------|---------------|------------------------|------------------|
| Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )   | $V_{DSS}$     | 500                    | V                |
| Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )    | $V_{GSS(AC)}$ | $\pm 30$               | V                |
| Drain Current (DC)                                   | $I_D(DC)$     | $\pm 5$                | A                |
| Drain Current (pulse) <sup>Note1</sup>               | $I_D(pulse)$  | $\pm 20$               | A                |
| Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) | $P_T$         | 35                     | 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                                  | $T_{stg}$     | $-55 \text{ to } +150$ | $^\circ\text{C}$ |
| Single Avalanche Current <sup>Note2</sup>            | $I_{AS}$      | 5.0                    | A                |
| Single Avalanche Energy <sup>Note2</sup>             | $E_{AS}$      | 125                    | mJ               |

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

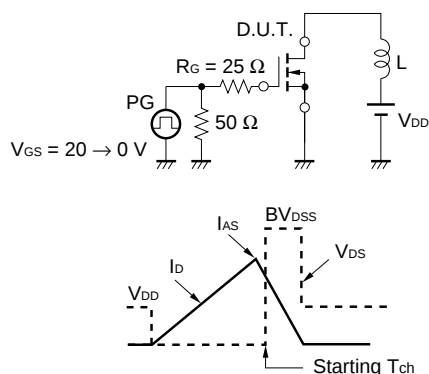
**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 150 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

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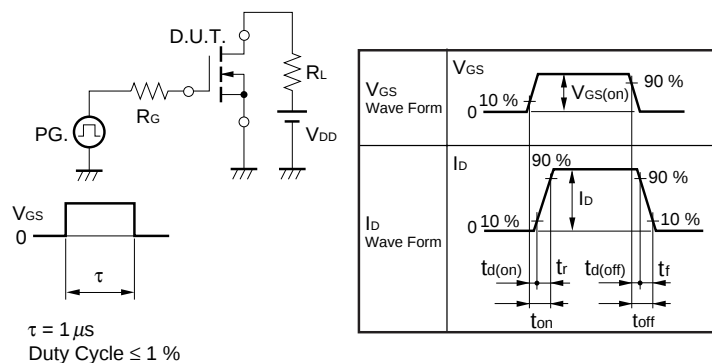
# ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)

|   | CHARACTERISTICS                     | SYMBOL               | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS                                                                                                              |
|---|-------------------------------------|----------------------|------|------|------|------|------------------------------------------------------------------------------------------------------------------------------|
|   | Drain Leakage Current               | I <sub>DSS</sub>     |      |      | 100  | μA   | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V                                                                               |
| ★ | Gate to Source Leakage Current      | I <sub>GSS</sub>     |      |      | ±100 | nA   | V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V                                                                               |
|   | Gate to Source Cut-off Voltage      | V <sub>GS(off)</sub> | 2.5  |      | 3.5  | V    | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA                                                                                |
| ★ | Forward Transfer Admittance         | y <sub>fs</sub>      | 1.0  | 3.0  |      | S    | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.5 A                                                                               |
| ★ | Drain to Source On-state Resistance | R <sub>DS(on)</sub>  |      | 1.35 | 1.5  | Ω    | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.5 A                                                                               |
| ★ | Input Capacitance                   | C <sub>iss</sub>     |      | 700  |      | pF   | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                     |
|   | Output Capacitance                  | C <sub>oss</sub>     |      | 115  |      | pF   |                                                                                                                              |
|   | Reverse Transfer Capacitance        | C <sub>rss</sub>     |      | 6    |      | pF   |                                                                                                                              |
|   | Turn-on Delay Time                  | t <sub>d(on)</sub>   |      | 16   |      | ns   | V <sub>DD</sub> = 150 V, I <sub>D</sub> = 2.5 A, V <sub>GS(on)</sub> = 10 V,<br>R <sub>G</sub> = 10 Ω, R <sub>L</sub> = 60 Ω |
|   | Rise Time                           | t <sub>r</sub>       |      | 3    |      | ns   |                                                                                                                              |
|   | Turn-off Delay Time                 | t <sub>d(off)</sub>  |      | 33   |      | ns   |                                                                                                                              |
|   | Fall Time                           | t <sub>f</sub>       |      | 5.5  |      | ns   |                                                                                                                              |
| ★ | Total Gate Charge                   | Q <sub>G</sub>       |      | 13   |      | nC   | V <sub>DD</sub> = 400 V, V <sub>GS(on)</sub> = 10 V, I <sub>D</sub> = 5.0 A                                                  |
| ★ | Gate to Source Charge               | Q <sub>GS</sub>      |      | 4    |      | nC   |                                                                                                                              |
| ★ | Gate to Drain Charge                | Q <sub>GD</sub>      |      | 4.5  |      | nC   |                                                                                                                              |
| ★ | Body Diode Forward Voltage          | V <sub>F(S-D)</sub>  |      | 1.0  |      | V    | I <sub>F</sub> = 5.0 A, V <sub>GS</sub> = 0 V                                                                                |
|   | Reverse Recovery Time               | t <sub>rr</sub>      |      | 0.7  |      | μs   | I <sub>F</sub> = 5.0 A, V <sub>GS</sub> = 0 V, di/dt = 50 A/μs                                                               |
| ★ | Reverse Recovery Charge             | Q <sub>rr</sub>      |      | 3.3  |      | μC   |                                                                                                                              |

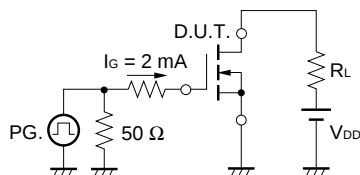
## TEST CIRCUIT 1 AVALANCHE CAPABILITY



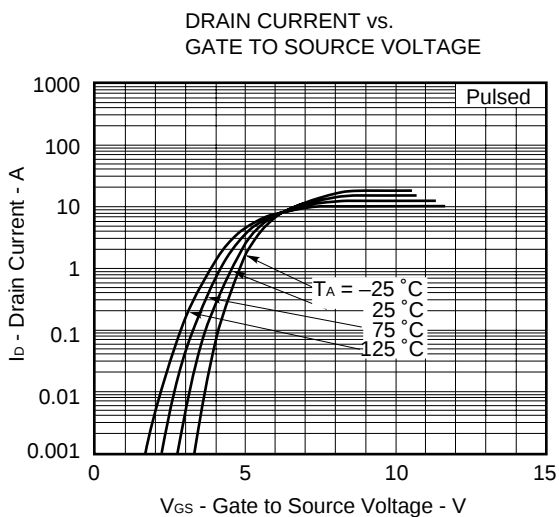
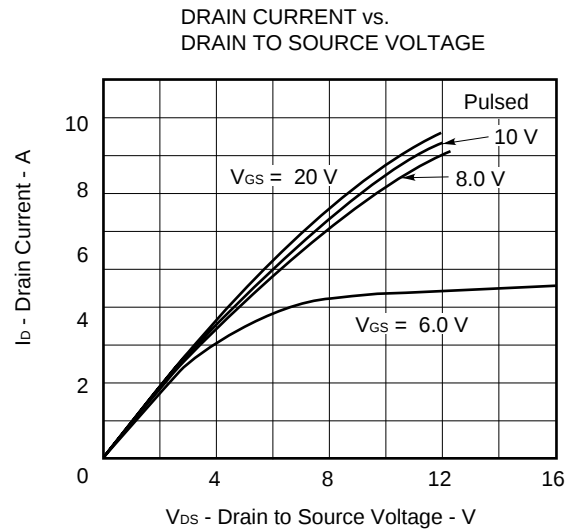
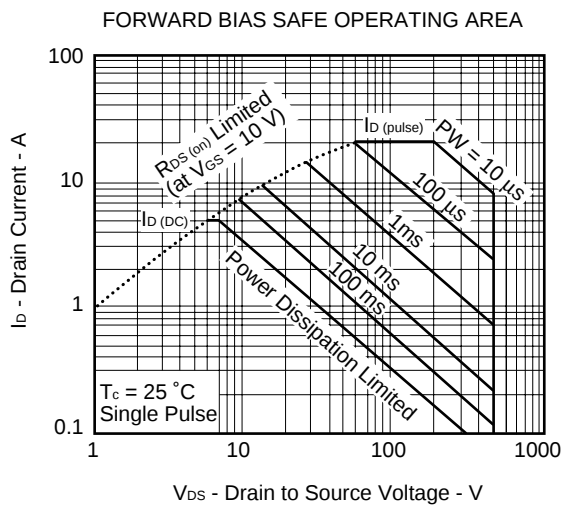
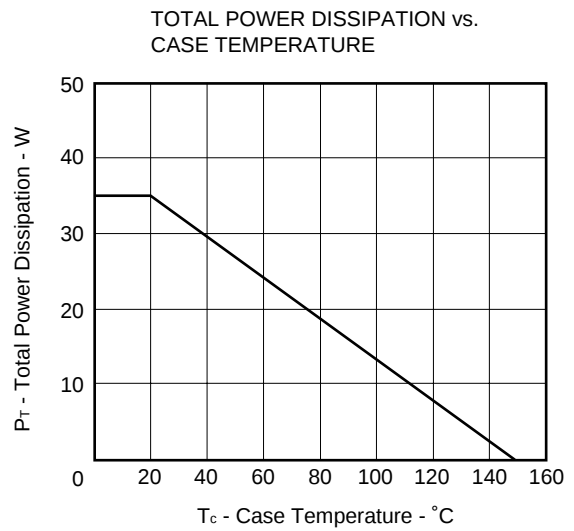
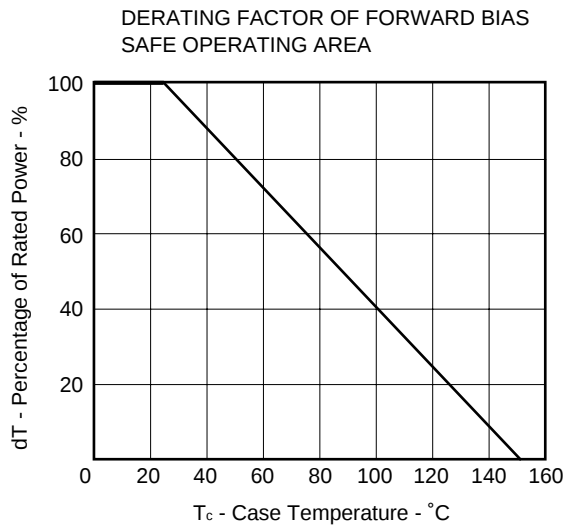
## TEST CIRCUIT 2 SWITCHING TIME



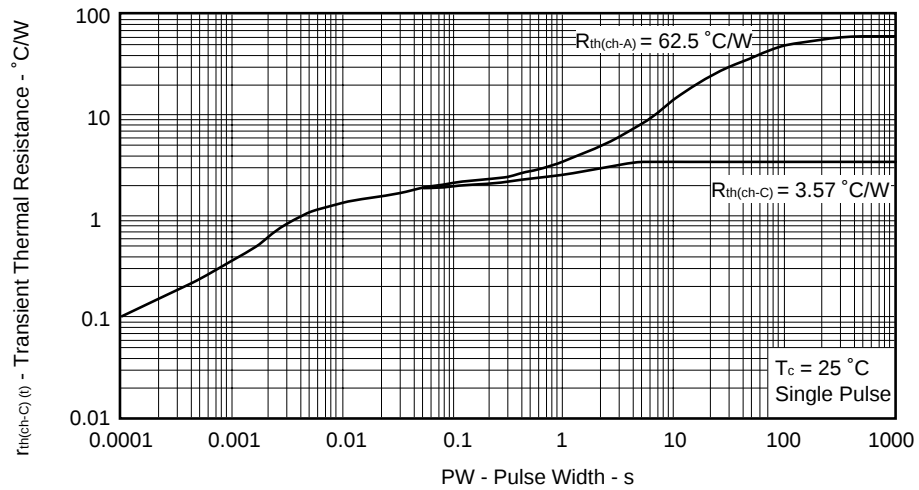
## TEST CIRCUIT 3 GATE CHARGE



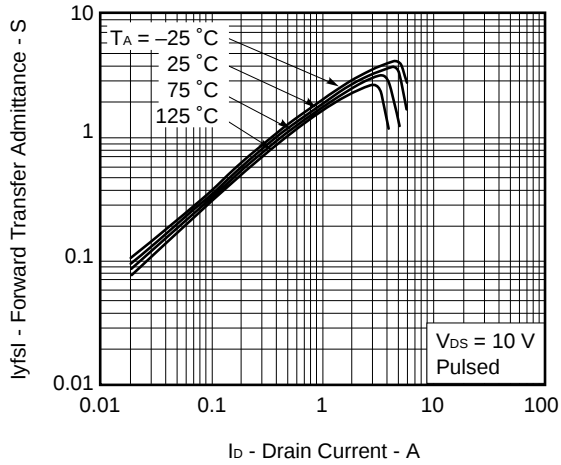
TYPICAL CHARACTERISTICS( $T_A = 25\text{ }^{\circ}\text{C}$ )



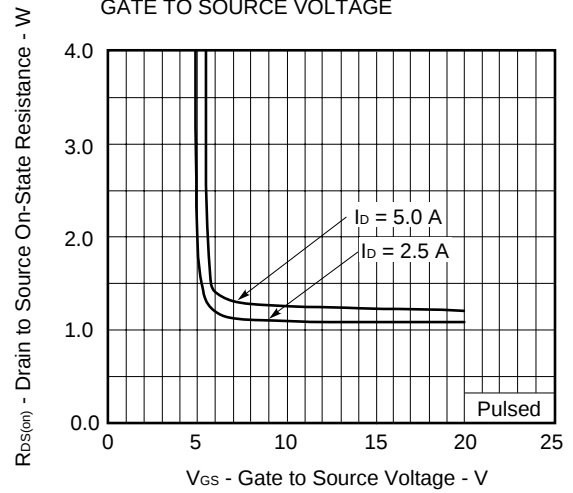
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



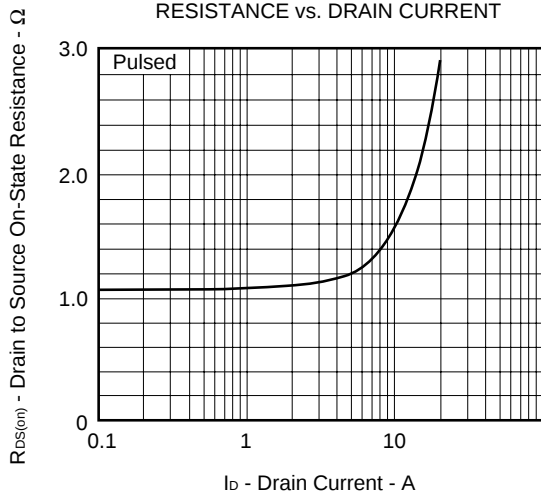
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



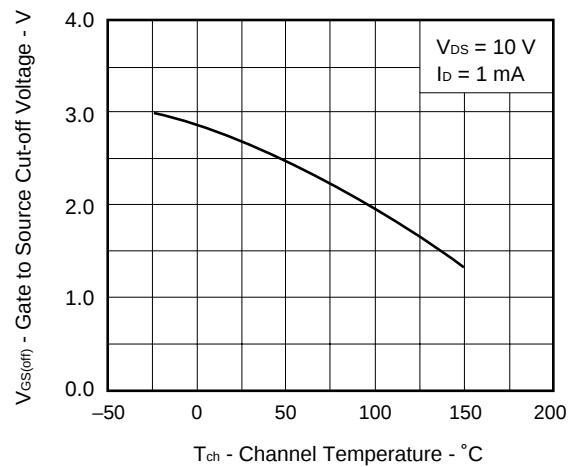
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



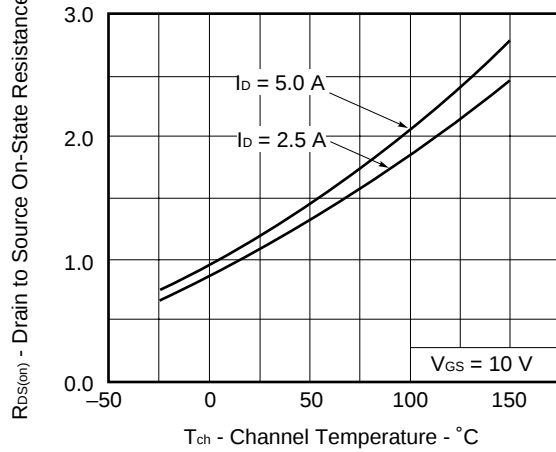
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



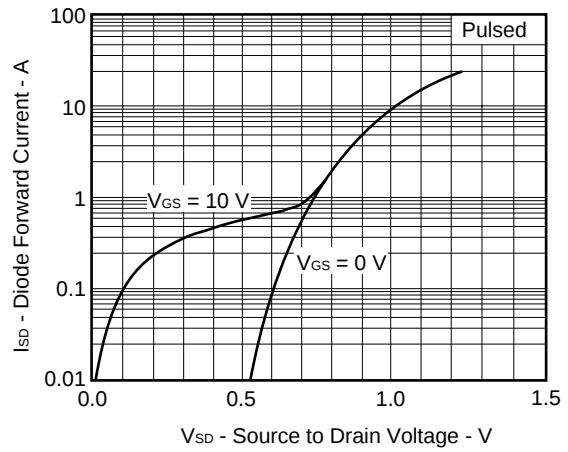
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



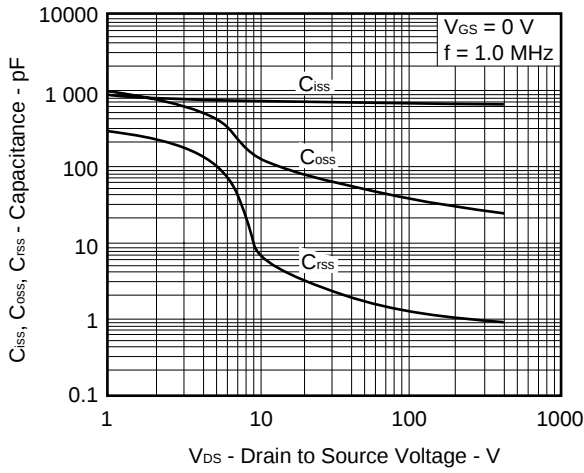
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



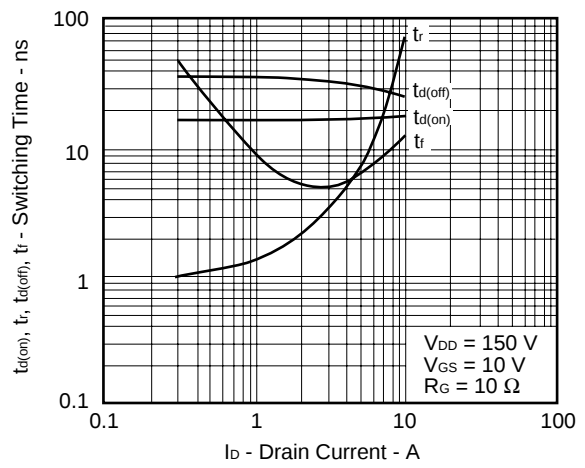
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



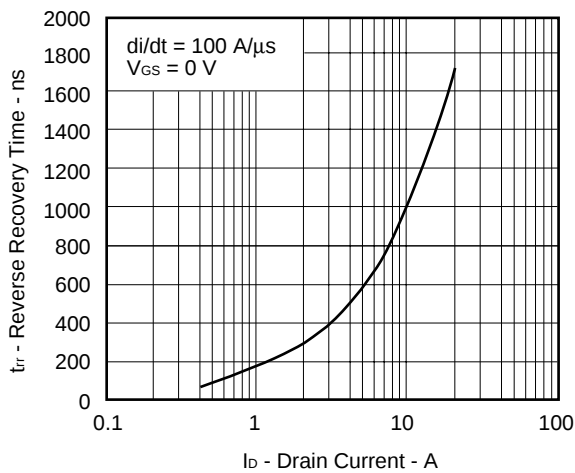
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



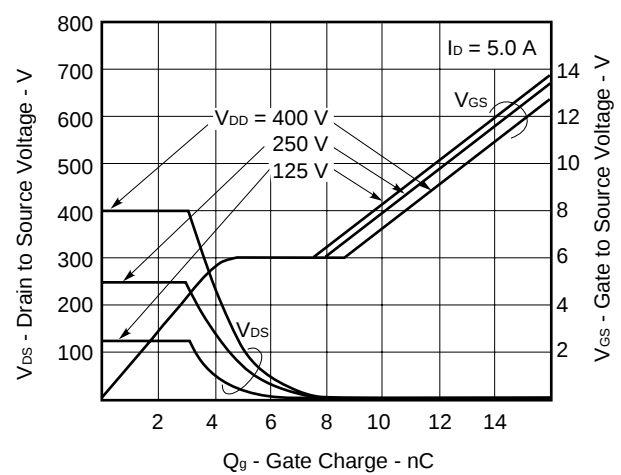
SWITCHING CHARACTERISTICS

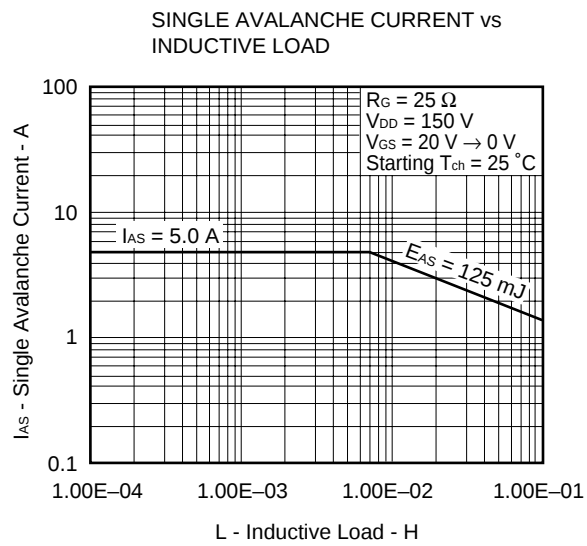
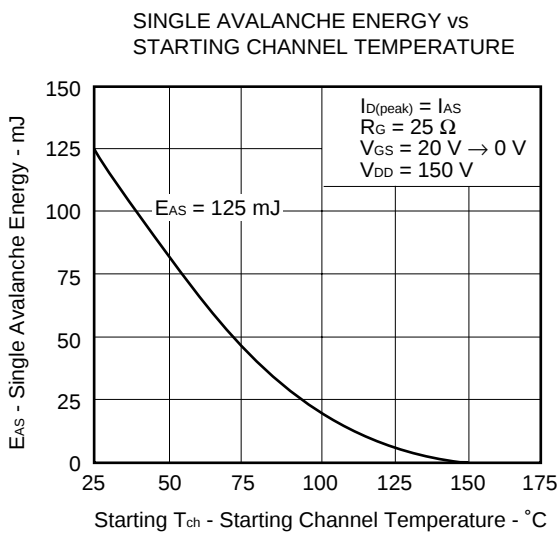


REVERSE RECOVERY TIME vs. DRAIN CURRENT



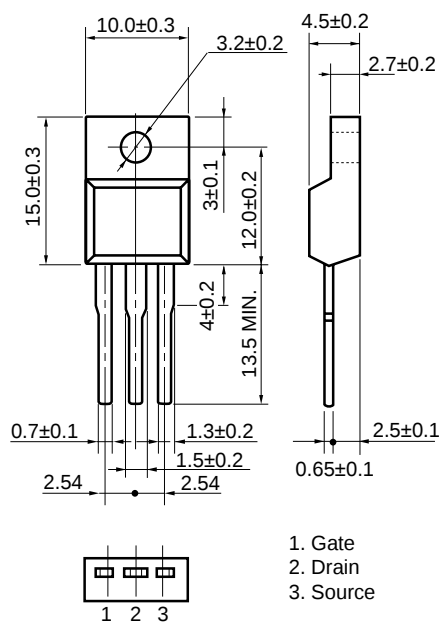
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



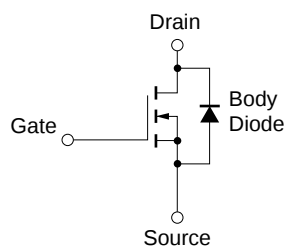


PACKAGE DRAWING (Unit: mm)

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.

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