

MOS FIELD EFFECT TRANSISTOR 2SK2138, 2SK2138-Z

SWITCHING N-CHANNEL POWER MOS FET INDUSTRIAL USE

DESCRIPTION

The 2SK2138, 2SK2138-Z is N-channel Power MOS Field Effect Transistor designed for high voltage switching applications.

FEATURES

- Low On-state Resistance
 $R_{DS(on)} = 2.4 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 2.5 \text{ A)}$
- Low C_{iss} $C_{iss} = 550 \text{ pF TYP.}$
- High Avalanche Capability Ratings

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

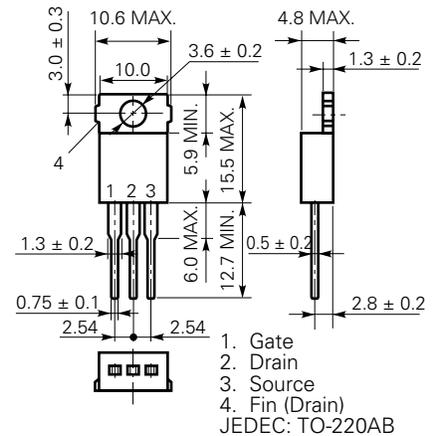
| | | | |
|---|----------------|-------------|------------------|
| Drain to Source Voltage | V_{DSS} | 600 | V |
| Gate to Source Voltage | V_{GSS} | ± 30 | V |
| Drain Current (DC) | $I_{D(DC)}$ | ± 5.0 | A |
| Drain Current (pulse)* | $I_{D(pulse)}$ | ± 20 | A |
| Total Power Dissipation ($T_c = 25 \text{ }^\circ\text{C}$) | P_{T1} | 70 | W |
| Total Power Dissipation ($T_A = 25 \text{ }^\circ\text{C}$) | P_{T2} | 1.5 | W |
| Storage Temperature | T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Channel Temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Single Avalanche Current** | I_{AS} | 14 | A |
| Single Avalanche Energy** | E_{AS} | 8.3 | mJ |

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

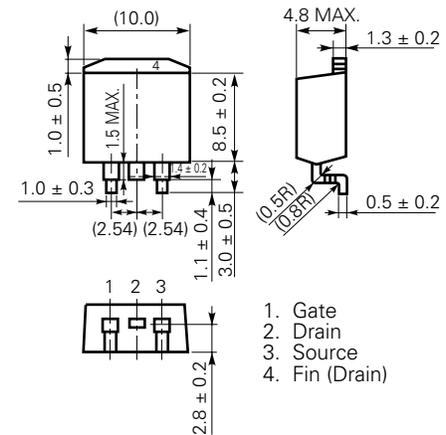
** Starting $T_{ch} = 25 \text{ }^\circ\text{C}$, $R_G = 25 \Omega$, $V_{GS} = 20 \text{ V} \rightarrow 0$

PACKAGE DIMENSIONS

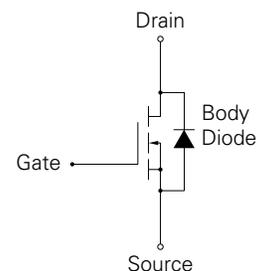
(in millimeters)



MP-25 (TO-220)



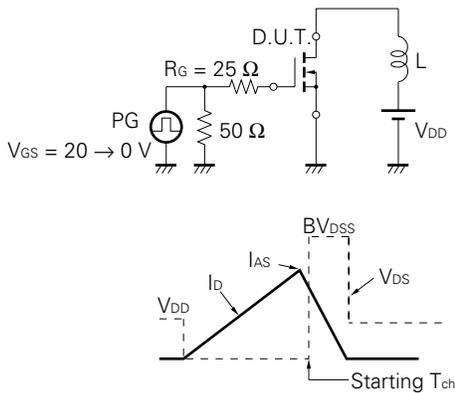
MP-25Z (SURFACE MOUNT TYPE)



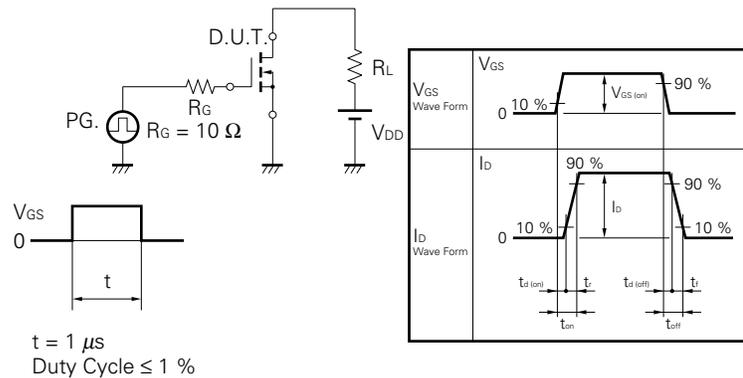
ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|-------------------------------------|----------------------|------|------|------|------|--|
| Drain to Source On-state Resistance | R _{DS(on)} | | 2.0 | 2.4 | Ω | V _{GS} = 10 V, I _D = 2.5 A |
| Gate to Source Cutoff Voltage | V _{GS(off)} | 2.5 | | 3.5 | V | V _{DS} = 10 V, I _D = 1 mA |
| Forward Transfer Admittance | y _{fs} | 1.0 | | | S | V _{DS} = 10 V, I _D = 2.5 A |
| Drain Leakage Current | I _{DSS} | | | 100 | μA | V _{DS} = 600 V, V _{GS} = 0 |
| Gate to Source Leakage Current | I _{GSS} | | | ±100 | nA | V _{GS} = ±30 V, V _{DS} = 0 |
| Input Capacitance | C _{iss} | | 550 | | pF | V _{DS} = 10 V |
| Output Capacitance | C _{oss} | | 130 | | pF | V _{GS} = 0 |
| Reverse Transfer Capacitance | C _{rss} | | 25 | | pF | f = 1 MHz |
| Turn-On Delay Time | t _{d(on)} | | 11 | | ns | V _{GS} = 10 V |
| Rise Time | t _r | | 6.0 | | ns | V _{DD} = 150 V |
| Turn-Off Delay Time | t _{d(off)} | | 40 | | ns | I _D = 2.5 A, R _G = 10 Ω |
| Fall Time | t _f | | 8 | | ns | R _L = 60 Ω |
| Total Gate Charge | Q _G | | 20 | | nC | V _{GS} = 10 V |
| Gate to Source Charge | Q _{GS} | | 4.0 | | nC | I _D = 5.0 V |
| Gate to Drain Charge | Q _{GD} | | 10 | | nC | V _{DD} = 450 V |
| Diode Forward Voltage | V _{F(S-D)} | | 1.0 | | V | I _F = 5.0 A, V _{GS} = 0 |
| Reverse Recovery Time | t _{rr} | | 320 | | ns | I _F = 5.0 A |
| Reverse Recovery Charge | Q _{rr} | | 2.4 | | μC | di/dt = 50 A/μs |

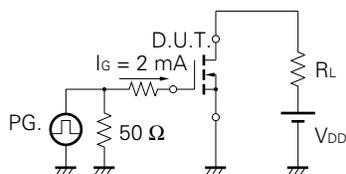
Test Circuit 1 Avalanche Capability



Test Circuit 2 Switching Time

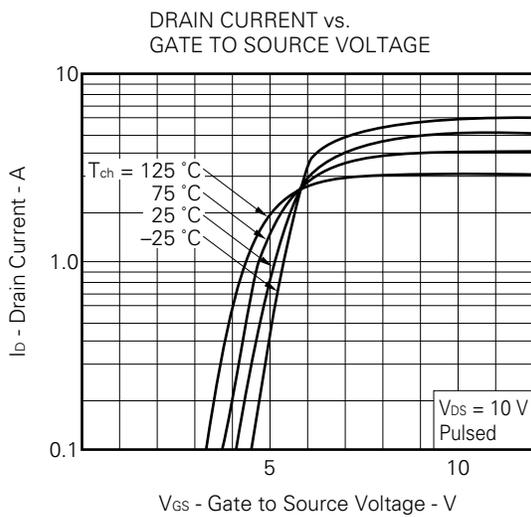
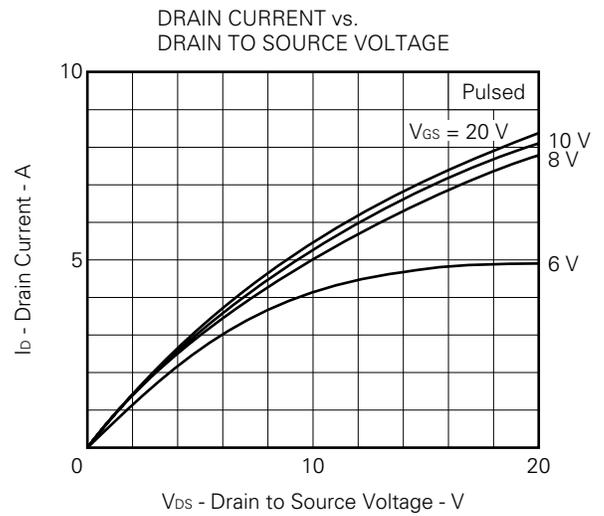
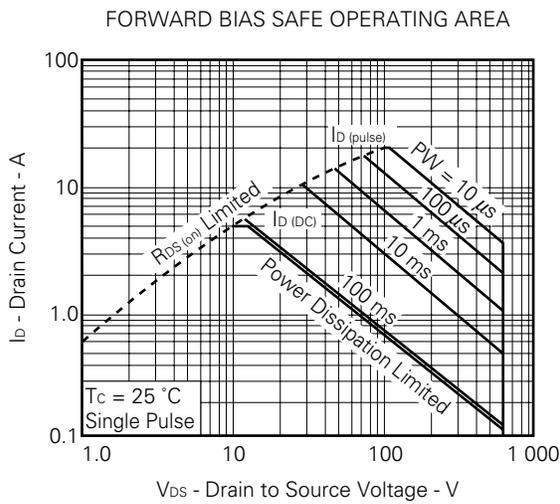
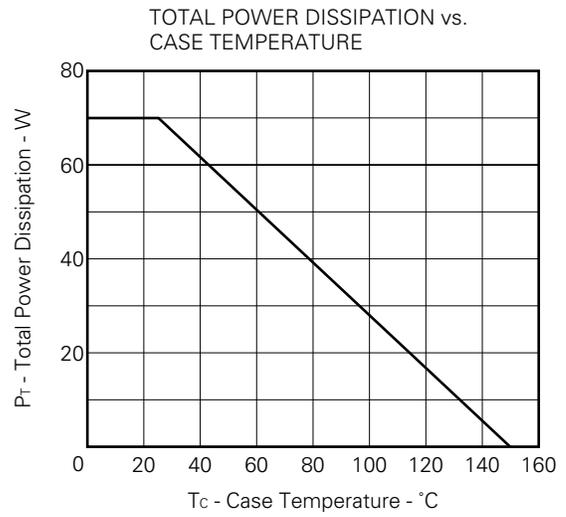
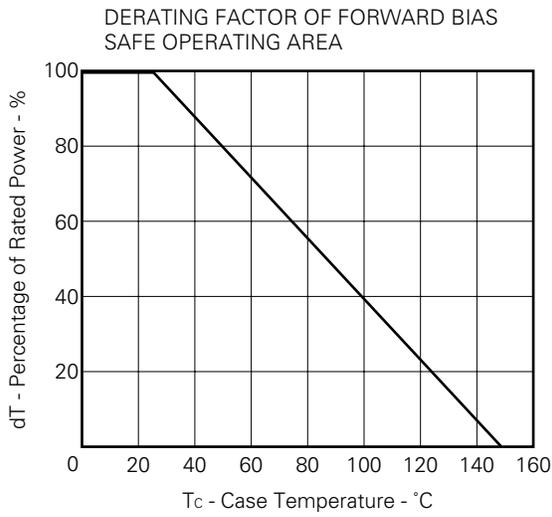


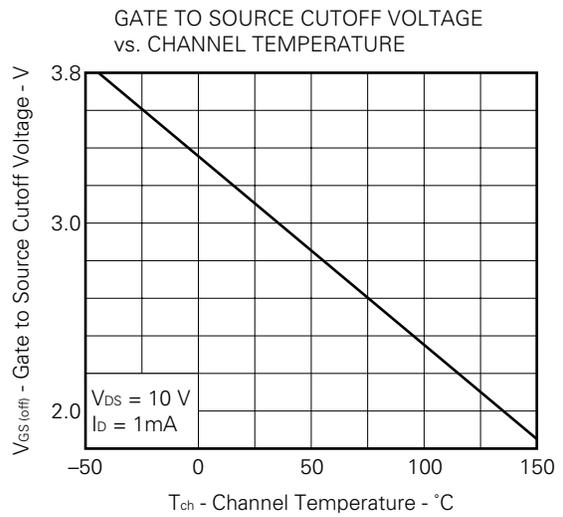
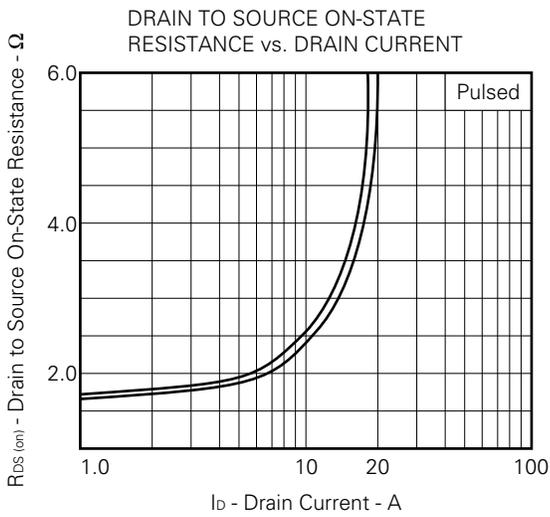
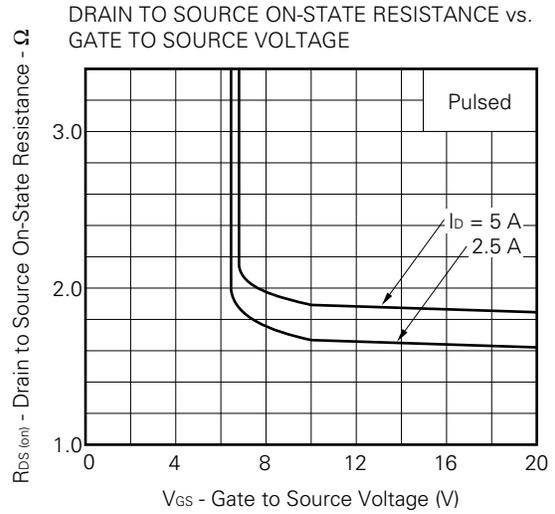
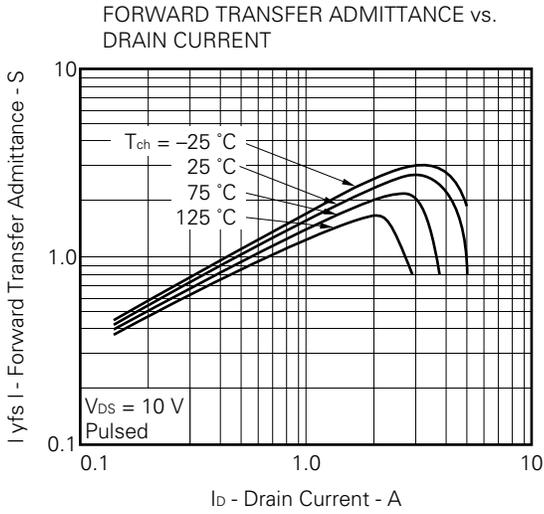
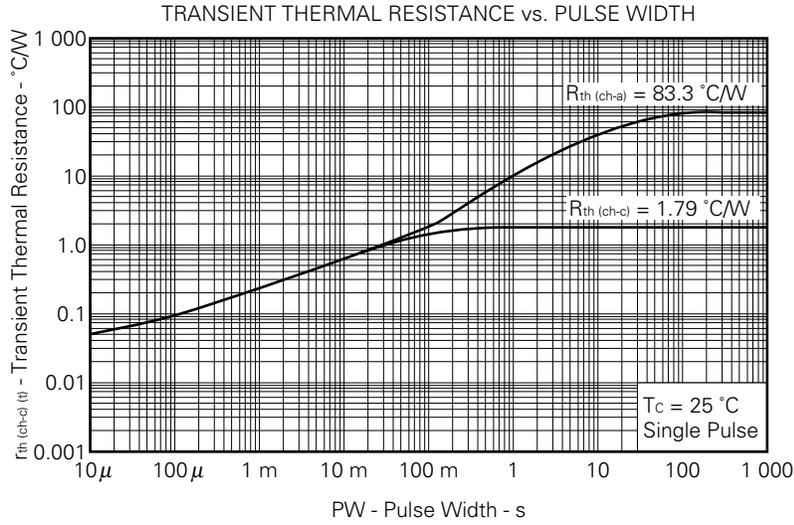
Test Circuit 3 Gate Charge

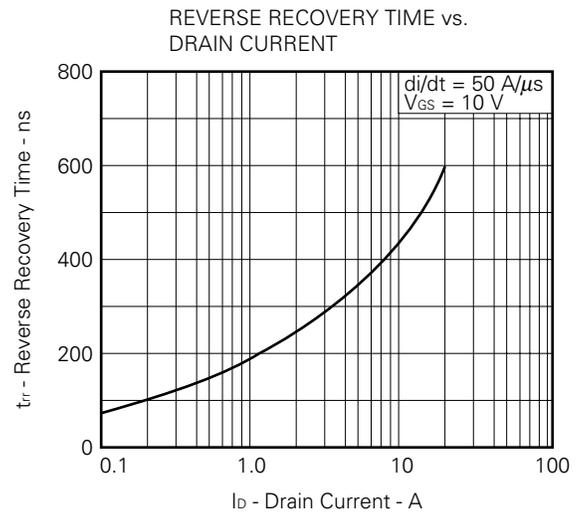
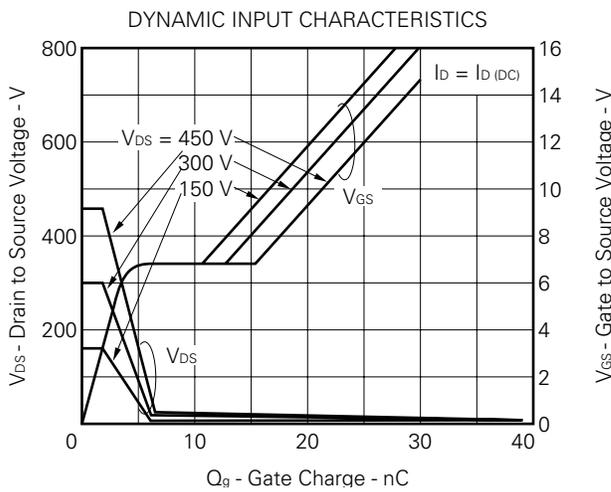
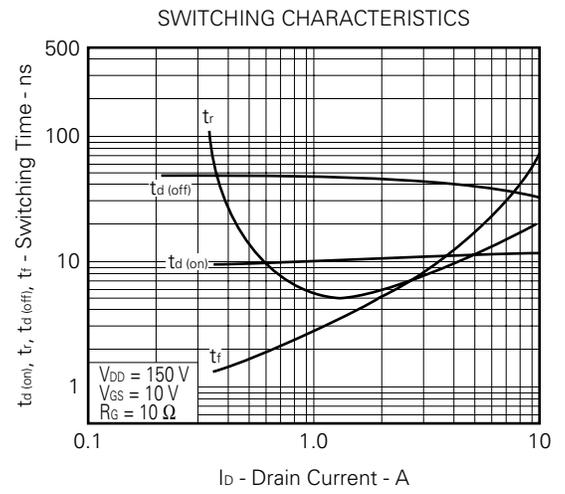
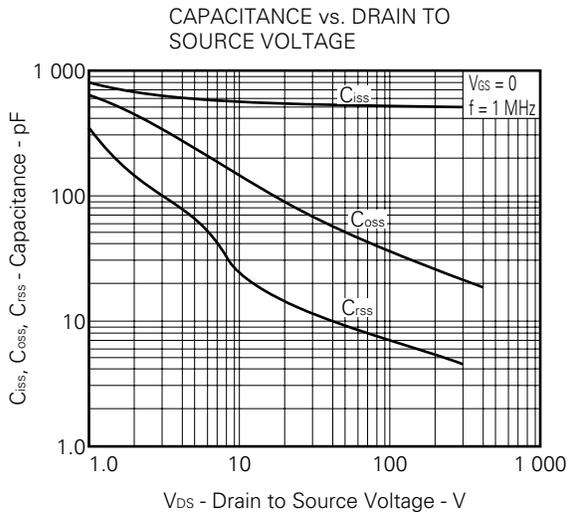
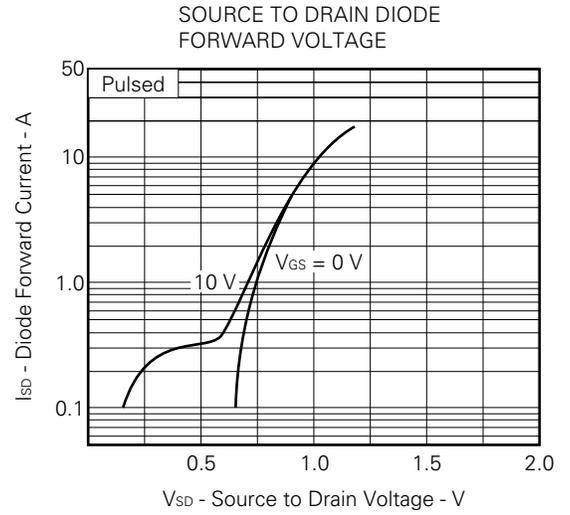
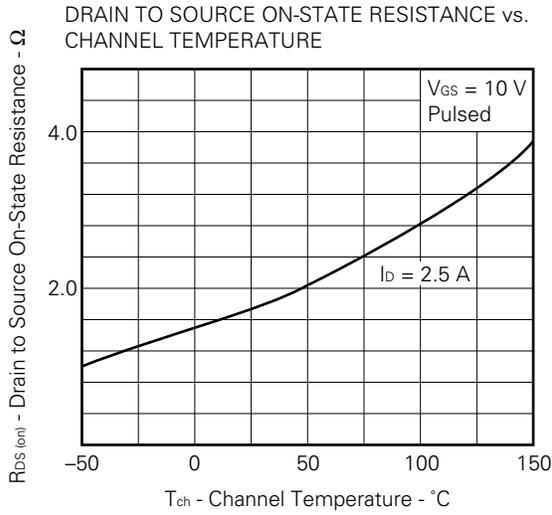


The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

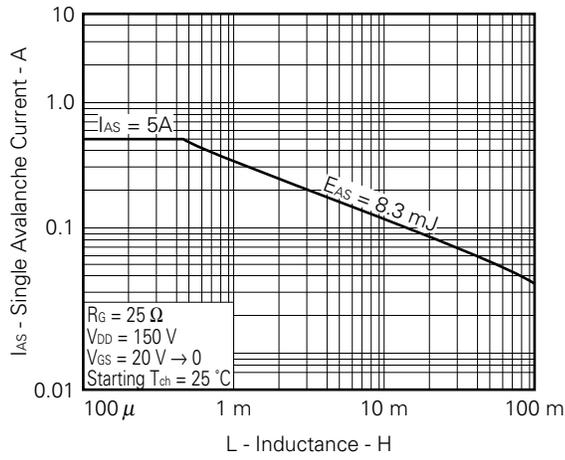
TYPICAL CHARACTERISTICS (T_A = 25 °C)



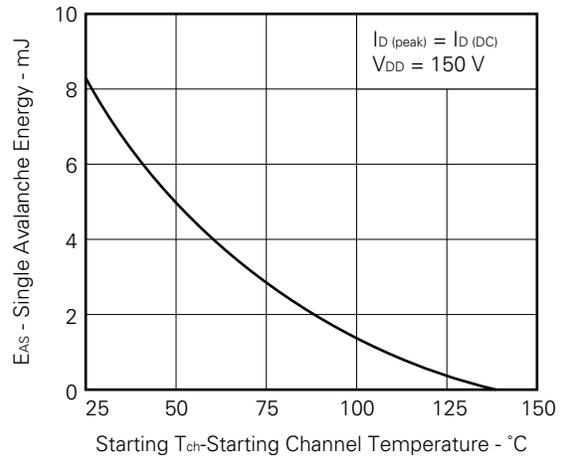




SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



SINGLE AVALANCHE ENERGY vs. STARTING CHANNEL TEMPERATURE



REFERENCE

| Document Name | Document No. |
|--|--------------|
| NEC semiconductor device reliability/quality control system. | TEI-1202 |
| Quality grade on NEC semiconductor devices. | IEI-1209 |
| Semiconductor device mounting technology manual. | IEI-1207 |
| Semiconductor device package manual. | IEI-1213 |
| Guide to quality assurance for semiconductor devices. | MEI-1202 |
| Semiconductor selection guide. | MF-1134 |
| Power MOS FET features and application switching power supply. | TEA-1034 |
| Application circuits using Power MOS FET. | TEA-1035 |
| Safe operating area of Power MOS FET. | TEA-1037 |

The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device is actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

[MEMO]

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Anti-radioactive design is not implemented in this product.