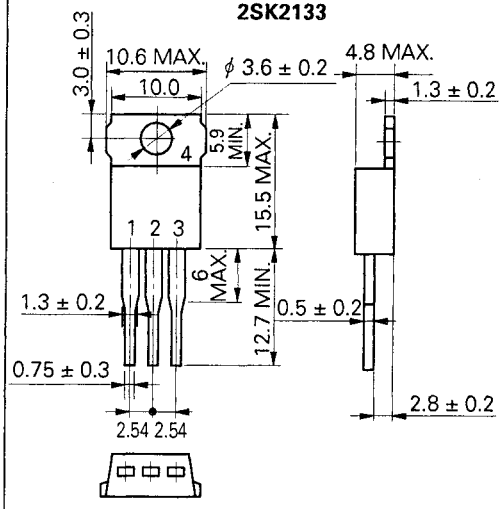
NEC

# MOS FIELD EFFECT POWER TRANSISTORS
# 2SK2133, 2SK2133-Z

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

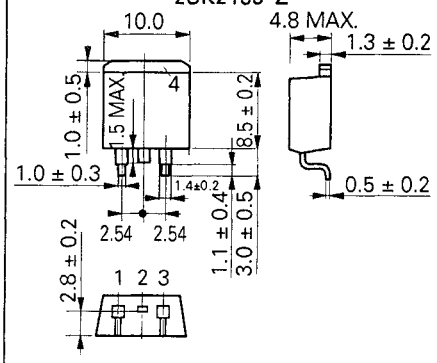
### PACKAGE DIMENSIONS
(Unit : mm)

2SK2133

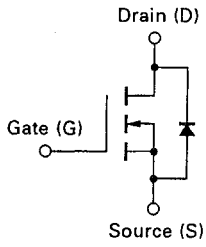



MP-25 (TO-220AB)

2SK2133-Z




1. Gate
2. Drain
3. Source
4. Fin (Drain)




(Diode in the figure is the parasitic diode)

### DESCRIPTION

The 2SK2133, 2SK2133-Z are N-channel Power MOS Field Effect Transistors designed for high voltage switching applications.

### FEATURES

- Low On-state Resistance
  $R_{DS(on)}$ = 0.21 Ω MAX. ($V_{GS}$ = 10 V, $I_D$ = 8.0 A)
- Low $C_{iss}$ $C_{iss}$ = 1 090 pF TYP.
- High Avalanche Capability Ratings

### QUALITY GRADE

Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

### ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|---|---|---|
| Maximum Temperatures | | | |
| Storage Temperature | | −55 to +150 | °C |
| Channel Temperature | | 150 | °C MAX. |
| Maximum Power Dissipation | | | |
| Total Power Dissipation ($T_A$ = 25 °C) | | 1.5 | W |
| Total Power Dissipation ($T_C$ = 25 °C) | | 75 | W |
| Maximum Voltages and Currents ($T_A$ = 25 °C) | | | |
| $V_{DSS}$ | Drain to Source Voltage | 250 | V |
| $V_{GSS}$ | Gate to Source Voltage | ±30 | V |
| $I_{D(DS)}$ | Drain Current (DC) | ±16 | A |
| $I_{D(pulse)}$* | Drain Current (pulse) | ±64 | A |
| Maximum Avalanche Capability Ratings** | | | |
| $I_{AS}$ | Single Avalanche Current | 16 | A |
| $E_{AS}$ | Single Avalanche Energy | 320 | mJ |

* PW ≦ 10 μs, Duty Cycle ≦ 1 %

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

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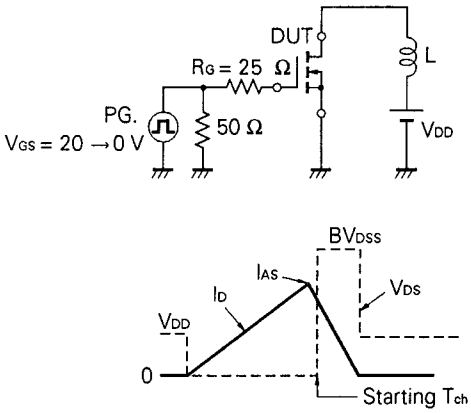
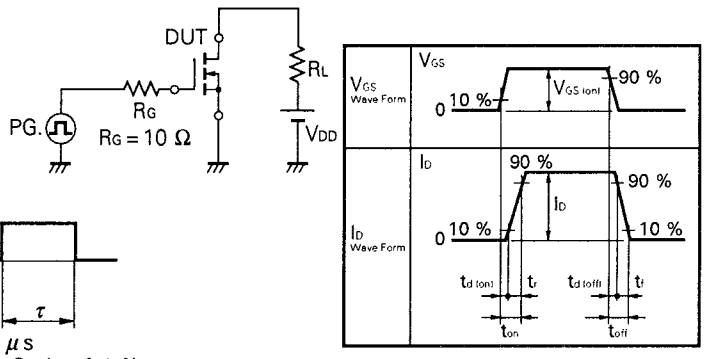
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Drian to Source On-state Resistance | $R_{DS(on)}$ | | 0.21 | 0.26 | Ω | $V_{GS}$ = 10 V, $I_D$ = 8.0 A |
| Gate to Source Cutoff Voltage | $V_{GS(off)}$ | 2.0 | | 4.0 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| Forward Transfer Admittance | $\|y_{fs}\|$ | 4.0 | | | S | $V_{DS}$ = 10 V, $I_D$ = 8.0 A |
| Drain Leakage Current | $I_{DSS}$ | | | 100 | μA | $V_{DS}$ = 250 V, $V_{GS}$ = 0 |
| Gate to Source Leakage Current | $I_{GSS}$ | | | ±10 | μA | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 |
| Input Capacitance | $C_{iss}$ | | 1 090 | | pF | $V_{DS}$ = 10 V<br>$V_{GS}$ = 0<br>f = 1 MHz |
| Output Capacitance | $C_{oss}$ | | 420 | | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | | 80 | | pF | |
| Turn-On Delay Time | $t_{d(on)}$ | | 20 | | ns | $V_{GS}$ = 10 V<br>$V_{DD}$ = 150 V<br>$I_D$ = 8.0 A, $R_G$ = 10 Ω<br>$R_L$ = 18.75 Ω |
| Rise Time | $t_r$ | | 40 | | ns | |
| Turn-Off Delay Time | $t_{d(off)}$ | | 60 | | ns | |
| Fall Time | $t_f$ | | 20 | | ns | |
| Total Gate Charge | $Q_G$ | | 25 | | nC | $V_{GS}$ = 10 V<br>$I_D$ = 16 A<br>$V_{DD}$ = 200 V |
| Gate to Source Charge | $Q_{GS}$ | | 8.0 | | nC | |
| Gate to Drain Charge | $Q_{GD}$ | | 14 | | nC | |
| Diode Forward Voltage | $V_{F(S-D)}$ | | 1.0 | | V | $I_F$ = 16 A, $V_{GS}$ = 0 |
| Reverse Recovery Time | $t_{rr}$ | | 400 | | ns | $I_F$ = 16 A<br>di / dt = 50 A / μs |
| Reverse Recovery Charge | $Q_{rr}$ | | 2.0 | | μC | |

### Test Circuit 1 : Avalanche Capability



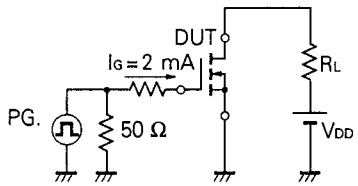

### Test Circuit 2 : Switching Time





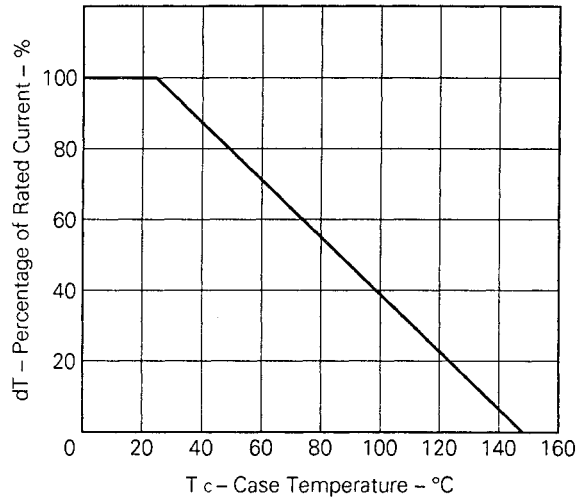


### Test Circuit 3 : Gate Charge

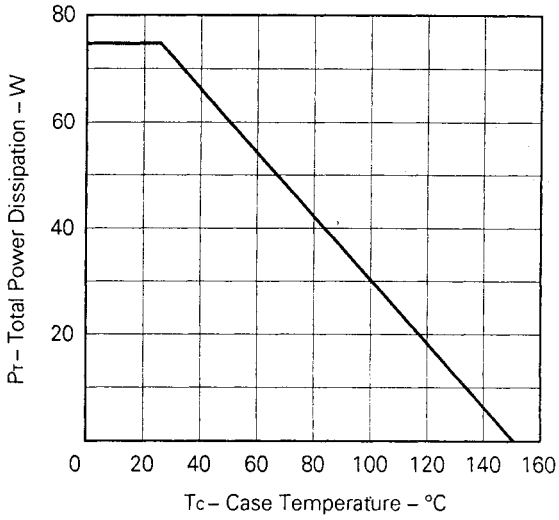


## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C)

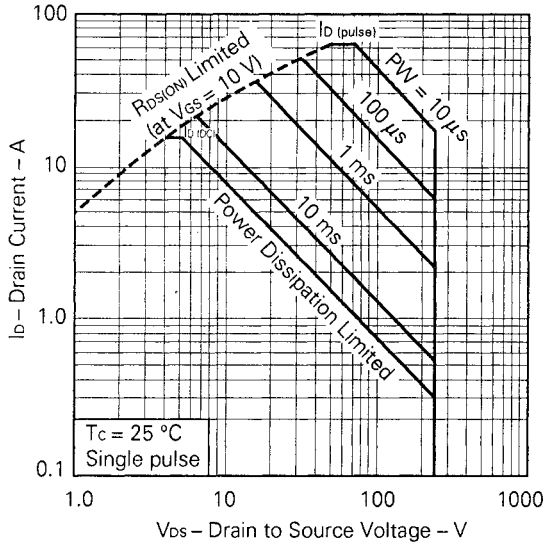
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



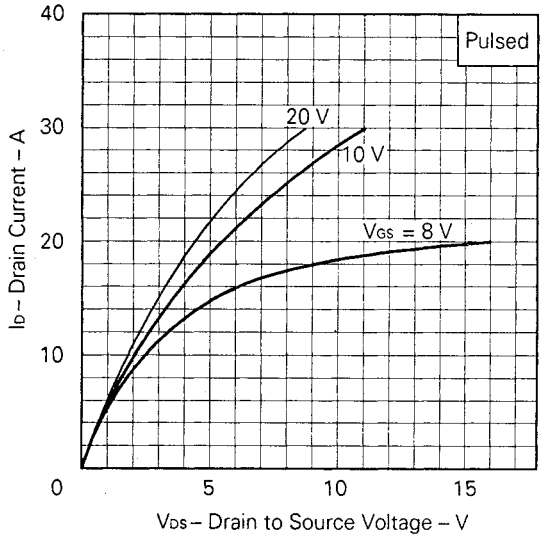

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



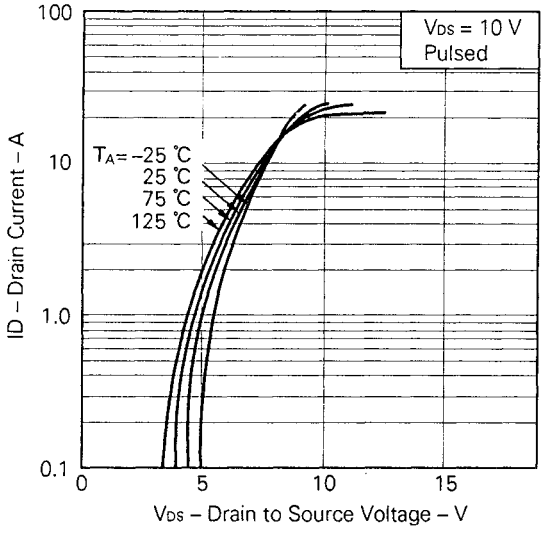

FORWARD BIAS SAFE OPERATING AREA



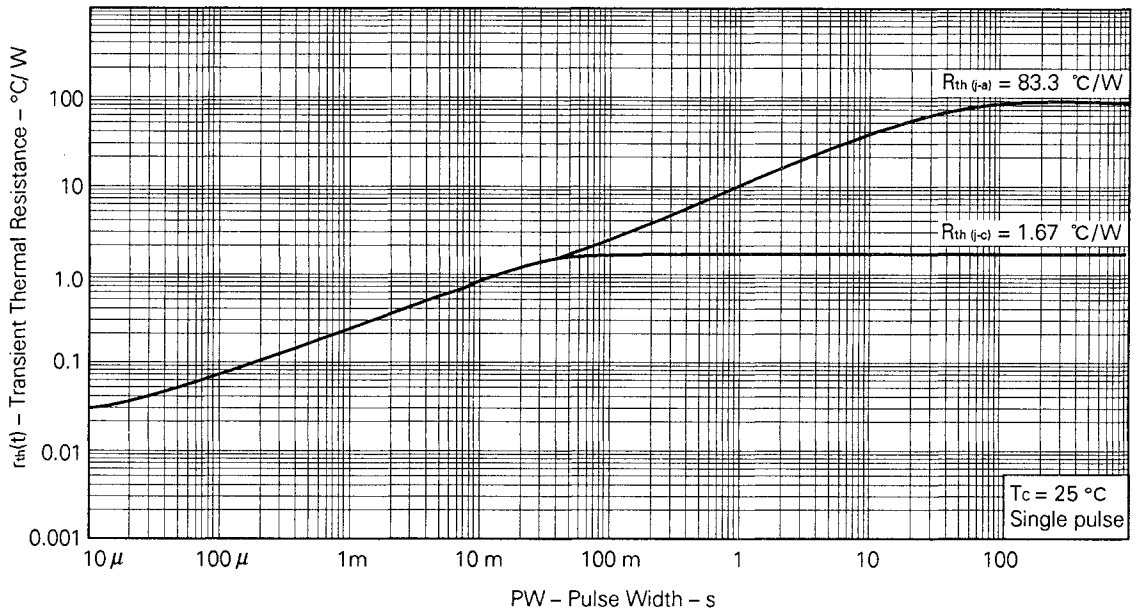

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



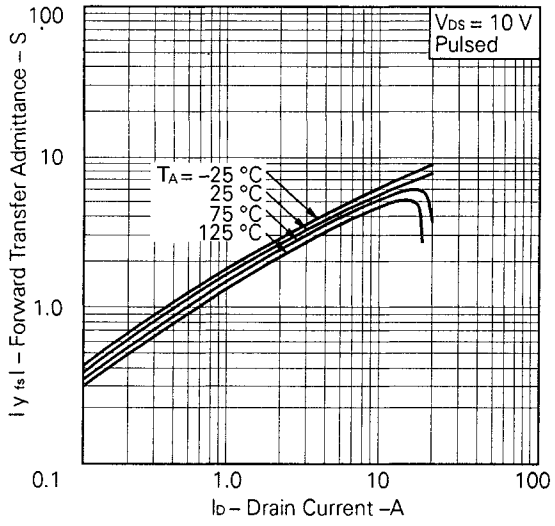

TRANSFER CHARACTERISTICS



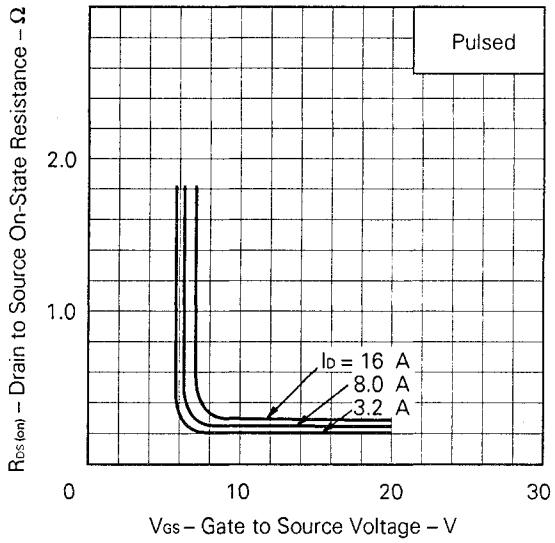
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



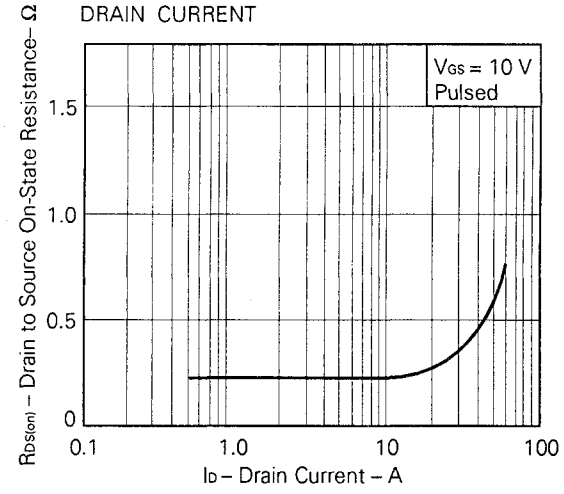

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



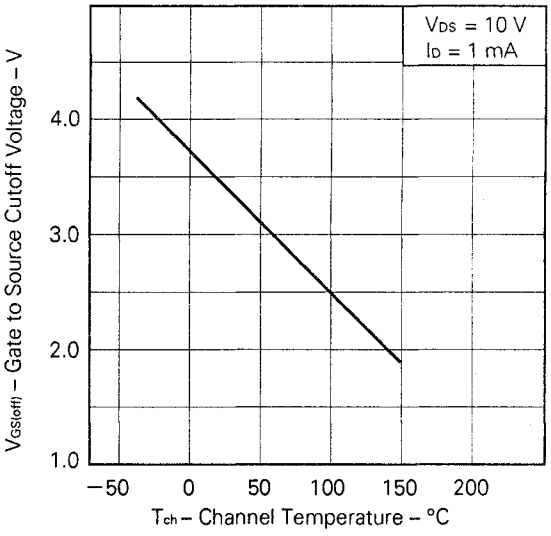

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



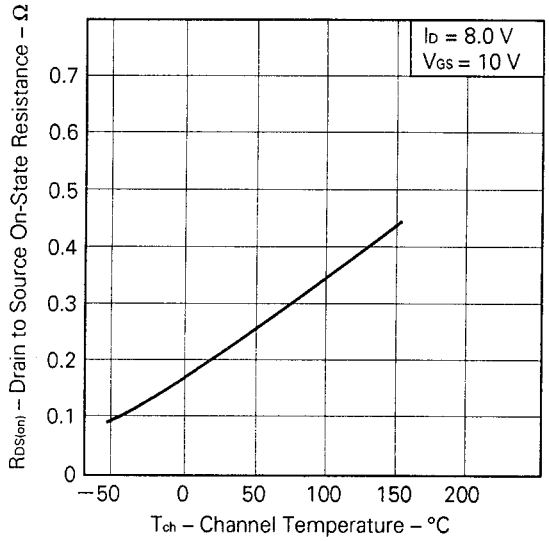

DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



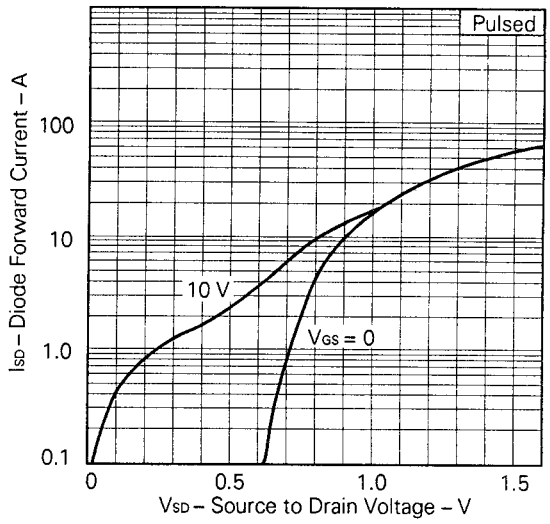

GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



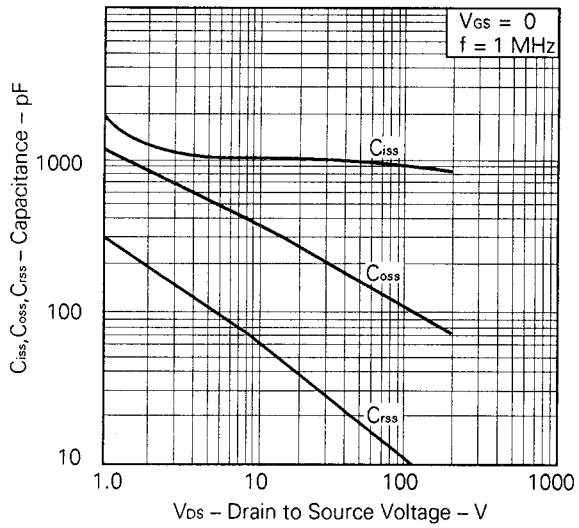
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



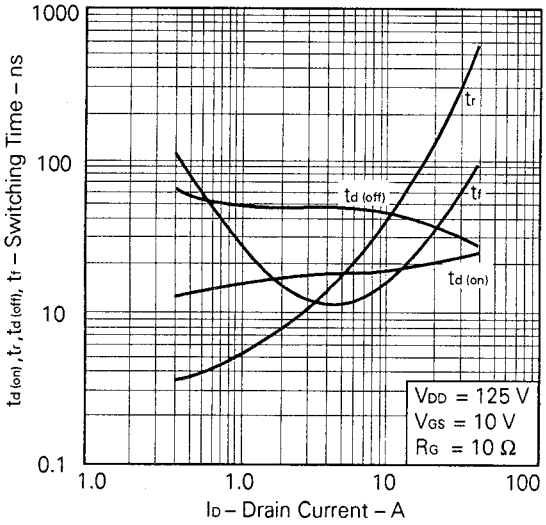

SOURCE TO DRAIN DIODE FORWARD VOLTAGE



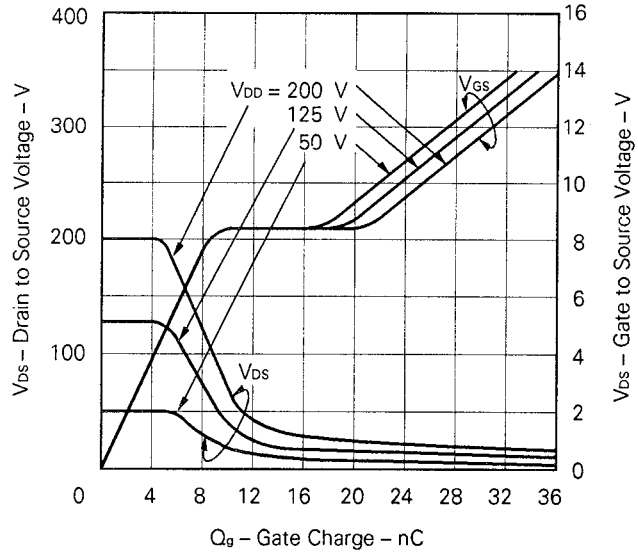

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



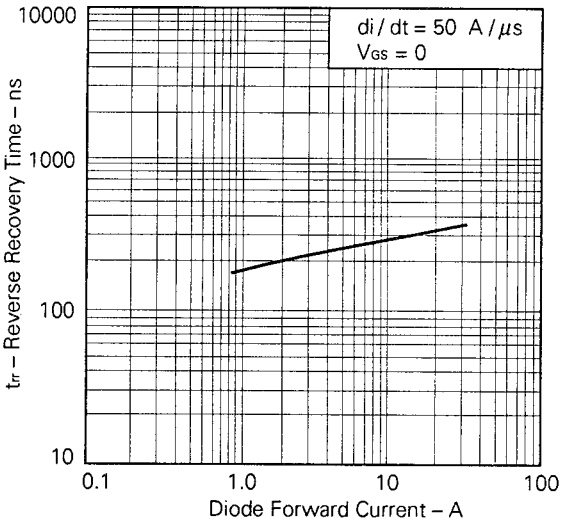

SWITCHING CHARACTERISTICS



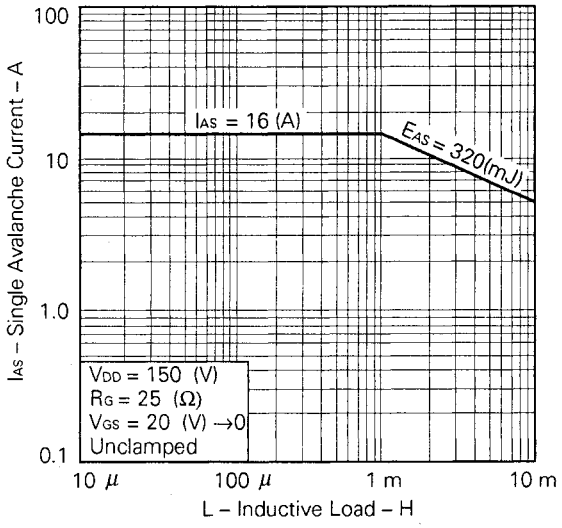

DYNAMIC INPUT/ OUTPUT CHARACTERISTICS



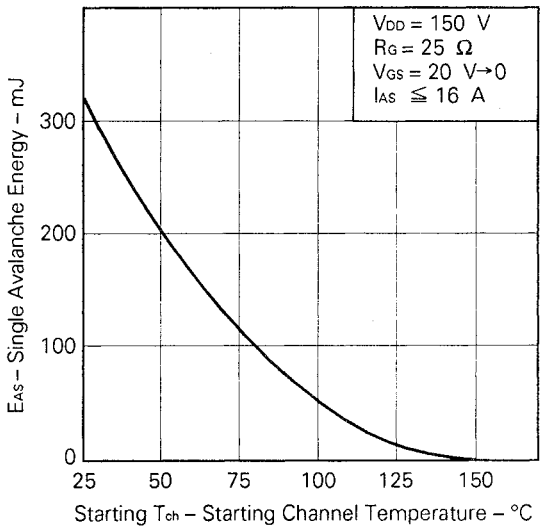

REVERSE RECOVERY TIME vs. REVERSE DRAIN CURRENT



SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD




SINGLE AVALANCHE ENERGY vs.
STARTING CHENNEL TEMPERATURE



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