

NEC

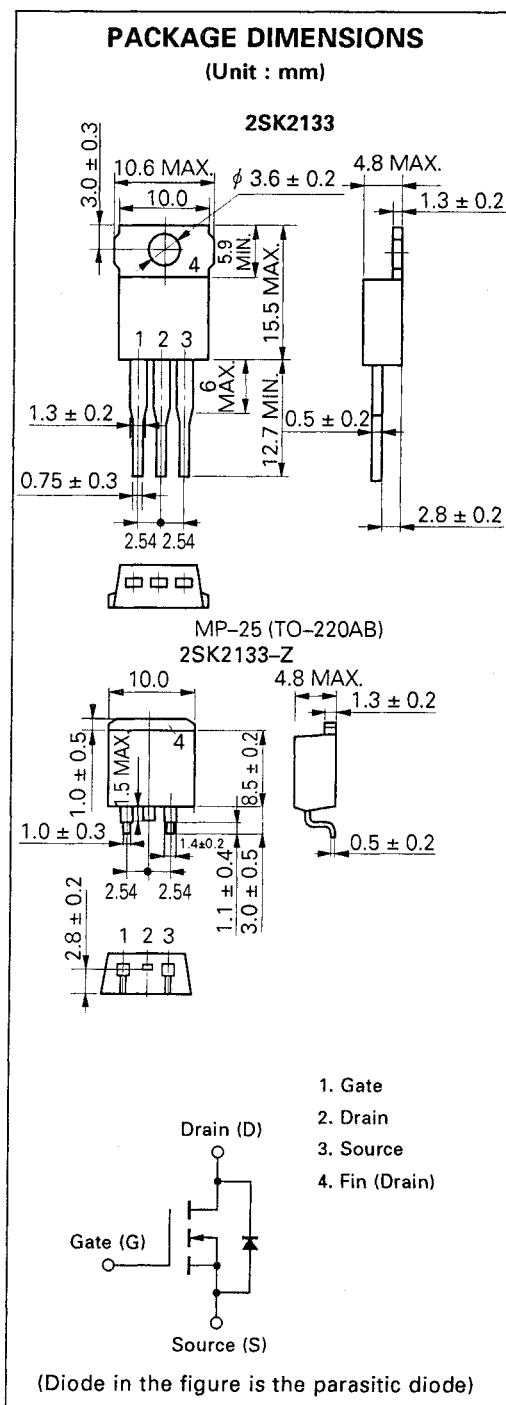
MOS FIELD EFFECT POWER TRANSISTORS

2SK2133, 2SK2133-Z

SWITCHING

N-CHANNEL POWER MOS FET

INDUSTRIAL USE



DESCRIPTION

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

FEATURES

- Low On-state Resistance
 $R_{DS(on)} = 0.21 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 8.0 \text{ A)}$
- Low C_{iss} $C_{iss} = 1090 \text{ pF TYP.}$
- 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 ($T_A = 25^\circ\text{C}$)	1.5	W
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	75	W

Maximum Voltages and Currents ($T_A = 25^\circ\text{C}$)

V_{DS}	Drain to Source Voltage	250	V
V_{GS}	Gate to Source Voltage	± 30	V
$I_{D(S)}$	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

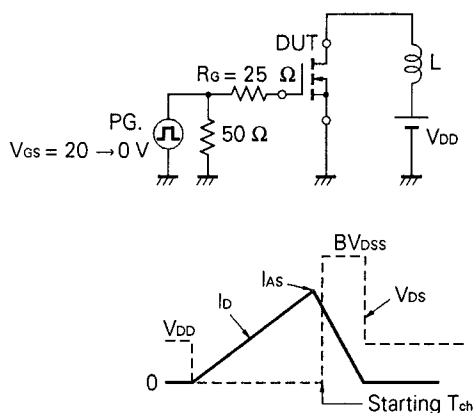
* $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$

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

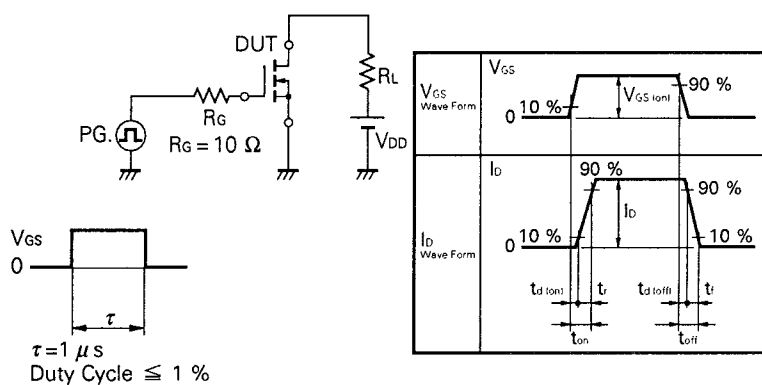
ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain to Source On-state Resistance	$R_{DS(on)}$		0.21	0.26	Ω	$V_{GS} = 10\text{ V}$, $I_D = 8.0\text{ A}$
Gate to Source Cutoff Voltage	$V_{GS(off)}$	2.0		4.0	V	$V_{DS} = 10\text{ V}$, $I_D = 1\text{ mA}$
Forward Transfer Admittance	$ y_{fs} $	4.0			S	$V_{DS} = 10\text{ V}$, $I_D = 8.0\text{ A}$
Drain Leakage Current	I_{DSS}			100	μA	$V_{DS} = 250\text{ V}$, $V_{GS} = 0$
Gate to Source Leakage Current	I_{GSS}			± 10	μA	$V_{GS} = \pm 30\text{ V}$, $V_{DS} = 0$
Input Capacitance	C_{iss}		1 090		pF	$V_{DS} = 10\text{ V}$ $V_{GS} = 0$ $f = 1\text{ MHz}$
Output Capacitance	C_{oss}		420		pF	
Reverse Transfer Capacitance	C_{rss}		80		pF	
Turn-On Delay Time	$t_d(on)$		20		ns	$V_{GS} = 10\text{ V}$ $V_{DD} = 150\text{ V}$ $I_D = 8.0\text{ A}$, $R_G = 10\text{ }\Omega$ $R_L = 18.75\text{ }\Omega$
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	$V_{GS} = 10\text{ V}$ $I_D = 16\text{ A}$ $V_{DD} = 200\text{ V}$
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	$I_F = 16\text{ A}$, $V_{GS} = 0$
Reverse Recovery Time	t_{rr}		400		ns	$I_F = 16\text{ A}$ $di/dt = 50\text{ A}/\mu\text{s}$
Reverse Recovery Charge	Q_{rr}		2.0		μC	

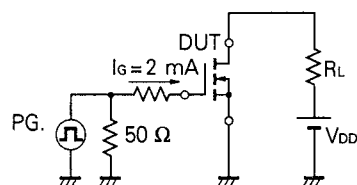
Test Circuit 1 : Avalanche Capability



Test Circuit 2 : Switching Time

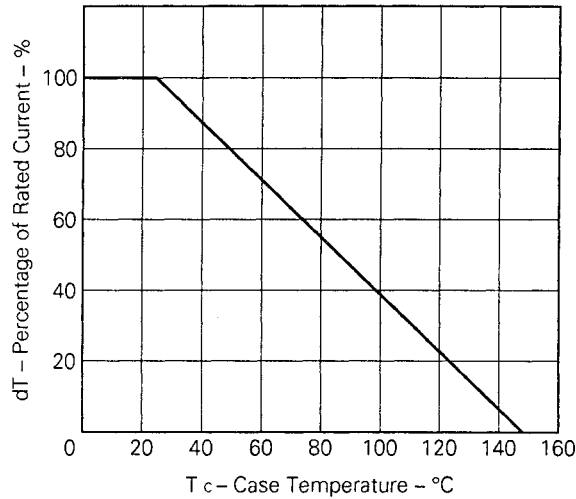


Test Circuit 3 : Gate Charge

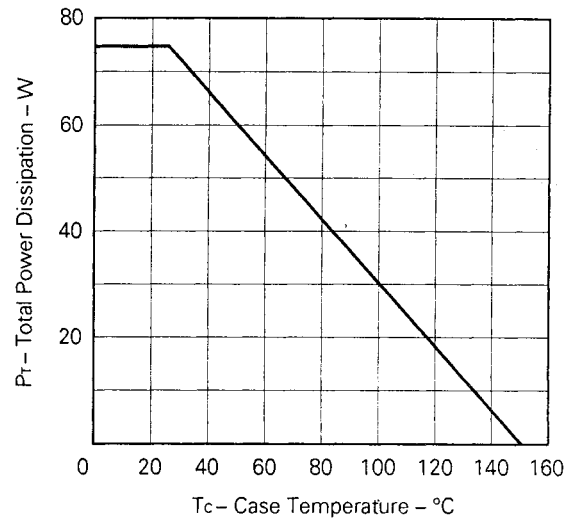


TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

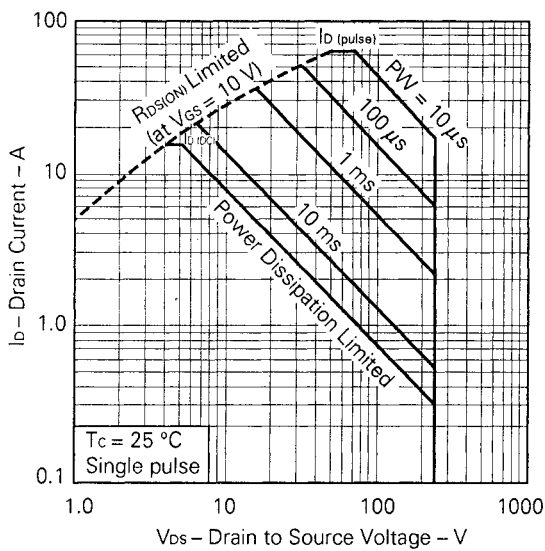
DERATING FACTOR OF FORWARD BIAS
SAFE OPERATING AREA



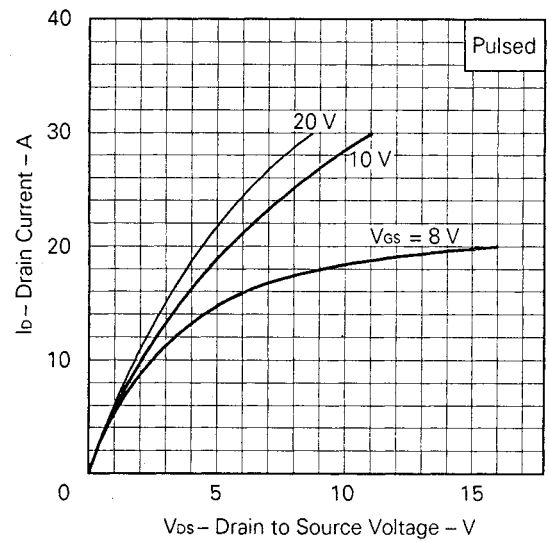
TOTAL POWER DISSIPATION vs.
CASE TEMPERATURE



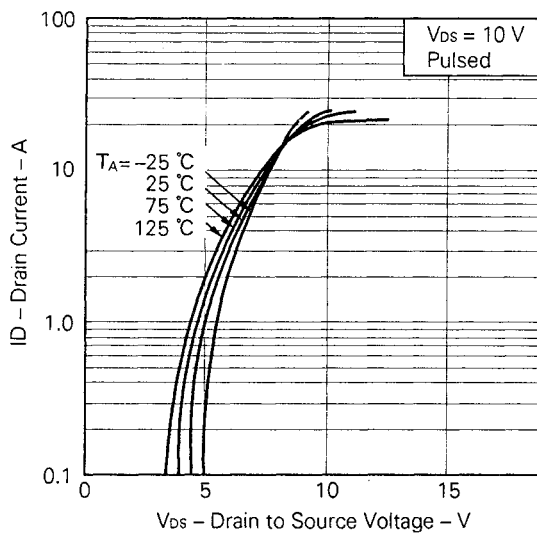
FORWARD BIAS SAFE OPERATING AREA



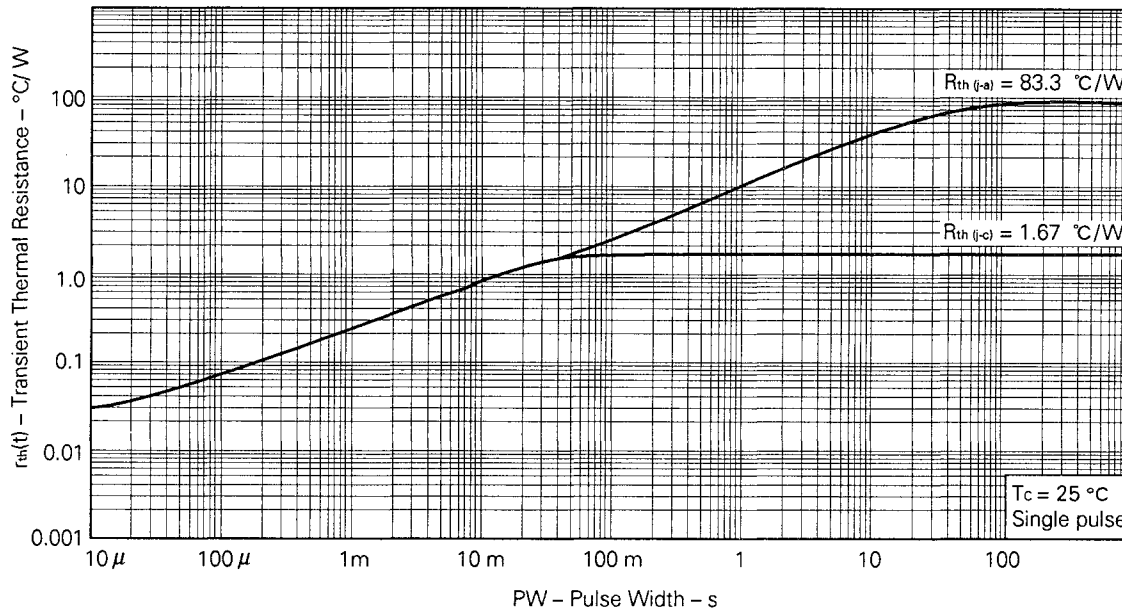
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



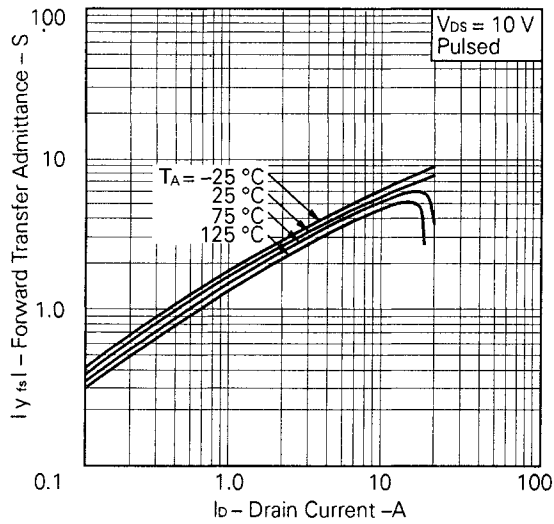
TRANSFER CHARACTERISTICS



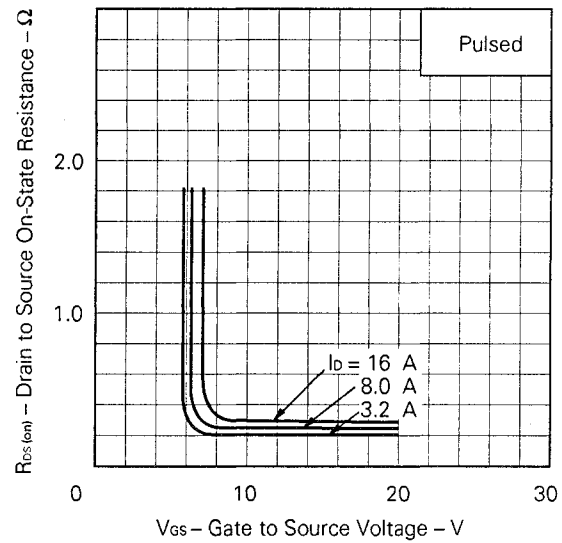
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



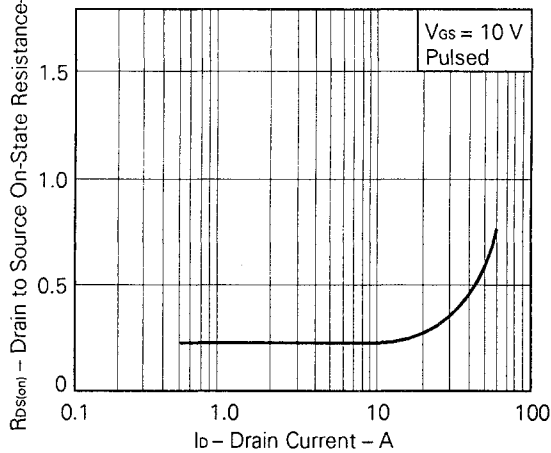
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



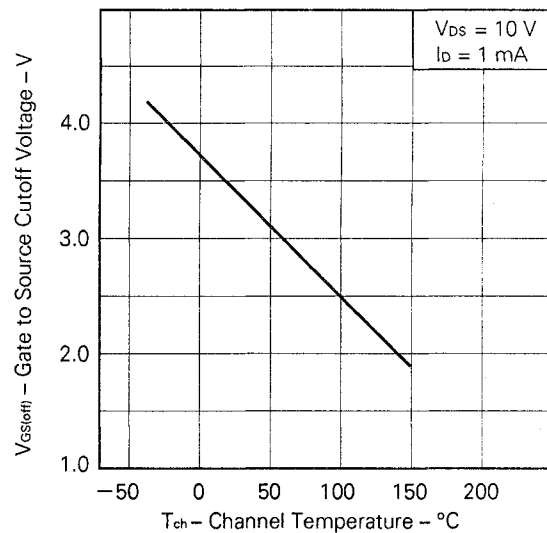
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



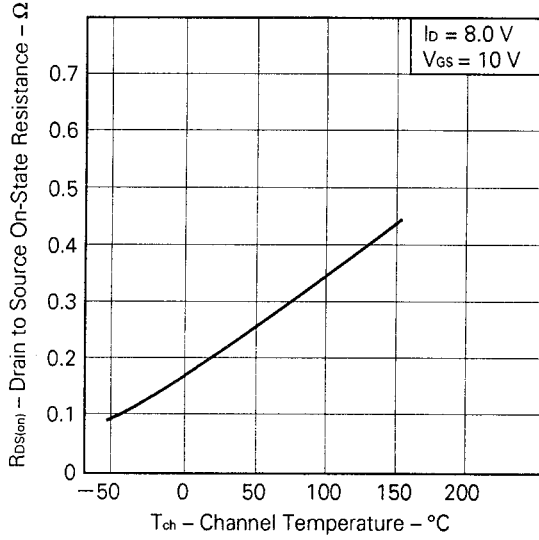
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



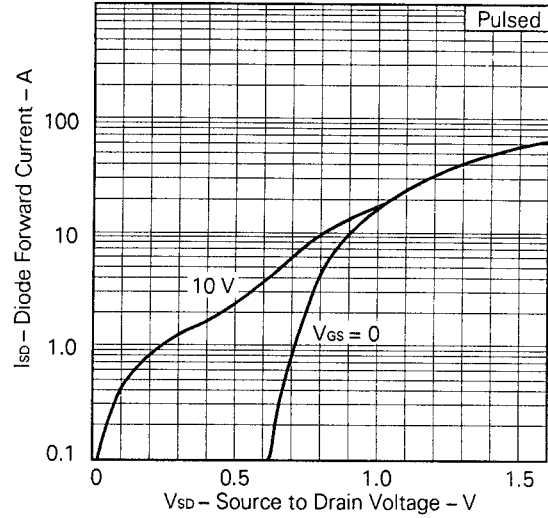
GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



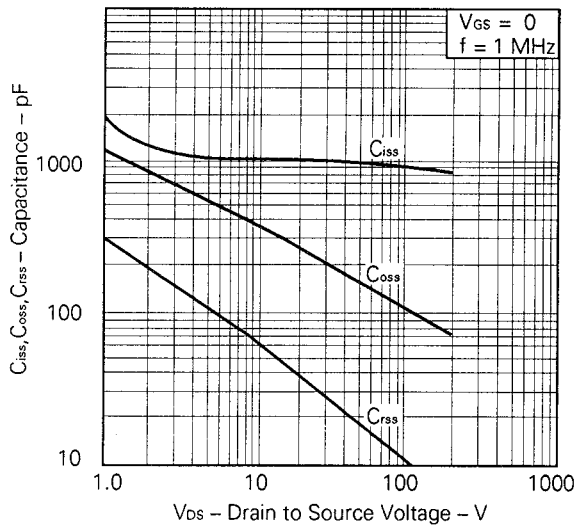
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



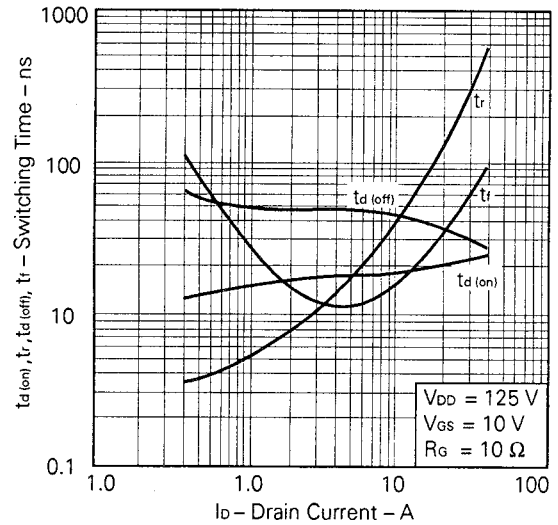
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



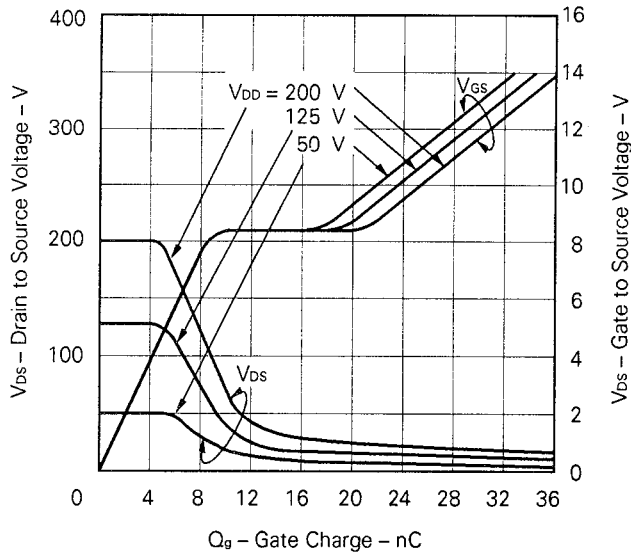
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



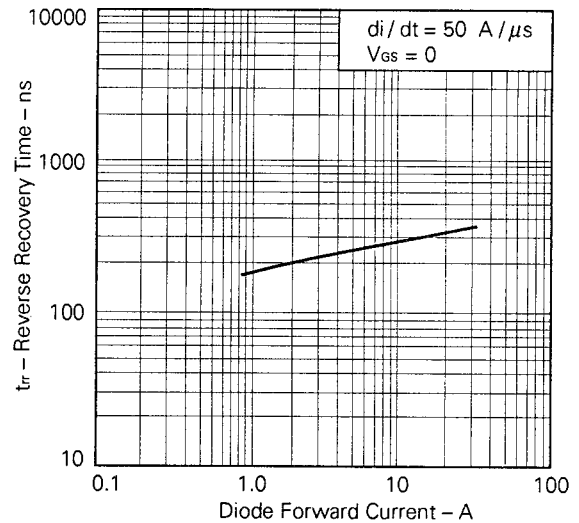
SWITCHING CHARACTERISTICS



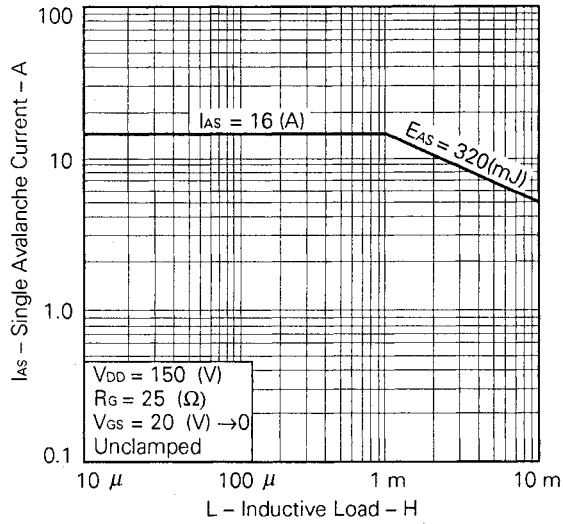
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



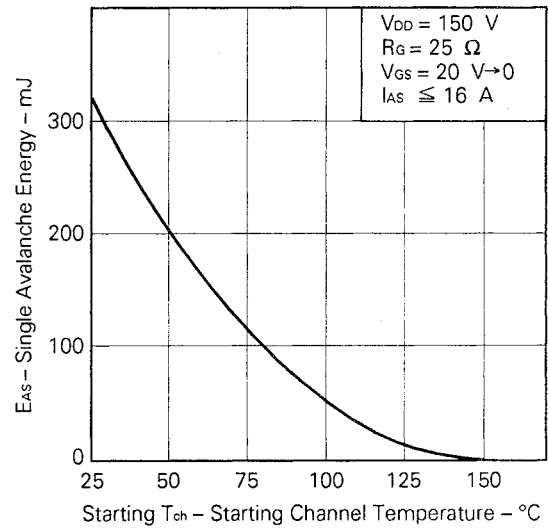
REVERSE RECOVERY TIME vs. REVERSE DRAIN CURRENT



SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD



SINGLE AVALANCHE ENERGY vs.
STARTING CHANNEL TEMPERATURE



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NEC devices are classified into the following three quality grades:

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.