

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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MOS FIELD EFFECT TRANSISTOR  
K2355, 2SK2355-Z/2SK2356, 2SK2356-Z

**Phase-out/Discontinued**

SWITCHING  
N-CHANNEL POWER MOS FET  
INDUSTRIAL USE

**DESCRIPTION**

The 2SK2355, 2SK2355-Z/2SK2356, 2SK2356-Z is N-Channel MOS Field Effect Transistor designed for high voltage switching applications.

**FEATURES**

- Low On-Resistance  
2SK2355:  $R_{DS(on)} = 1.4 \Omega$  ( $V_{GS} = 10 V, I_D = 2.5 A$ )  
2SK2356:  $R_{DS(on)} = 1.5 \Omega$  ( $V_{GS} = 10 V, I_D = 2.5 A$ )
- Low  $C_{iss}$   $C_{iss} = 670 pF$  TYP.
- High Avalanche Capability Ratings

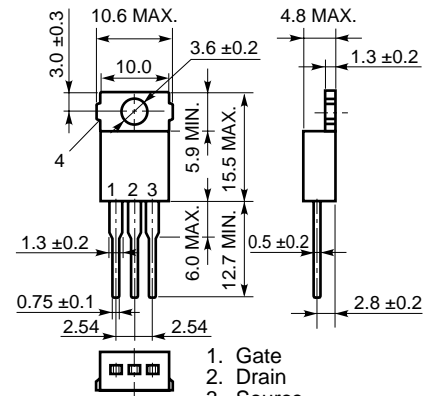
**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ C$ )**

Drain to Source Voltage (2SK2355/2356)	$V_{DSS}$	450/500	V
Gate to Source Voltage	$V_{GSS}$	$\pm 30$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 5.0$	A
Drain Current (pulse)*	$I_{D(pulse)}$	$\pm 20$	A
Total Power Dissipation ( $T_c = 25^\circ C$ )	$P_{T1}$	50	W
Total Power Dissipation ( $T_a = 25^\circ C$ )	$P_{T2}$	1.5	W
Channel Temperature	$T_{ch}$	150	$^\circ C$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ C$
Single Avalanche Current**	$I_{AS}$	5.0	A
Single Avalanche Energy**	$E_{AS}$	17.4	mJ

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

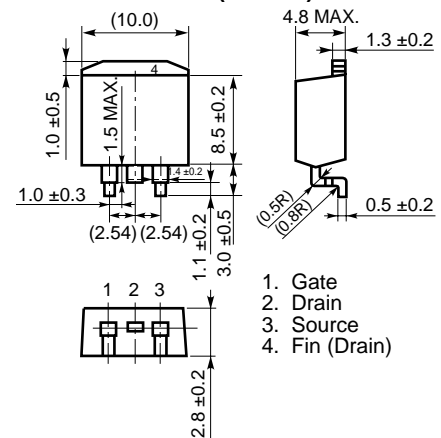
\*\* Starting  $T_{ch} = 25^\circ C$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 V \rightarrow 0$

**PACKAGE DIMENSIONS**  
(in millimeter)



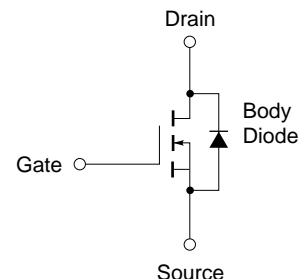
1. Gate
  2. Drain
  3. Source
  4. Fin (Drain)
- JEDEC: TO-220AB

**MP-25 (TO-220)**



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

**MP-25Z (TO-220 SURFACE MOUNT TYPE)**

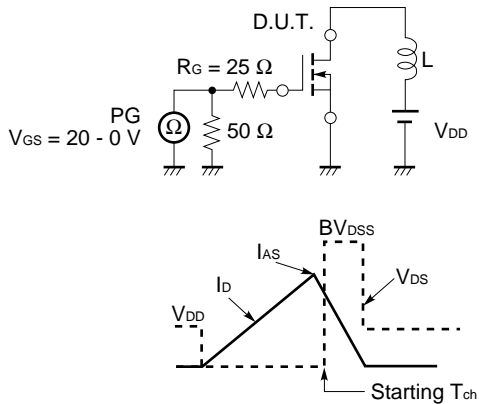


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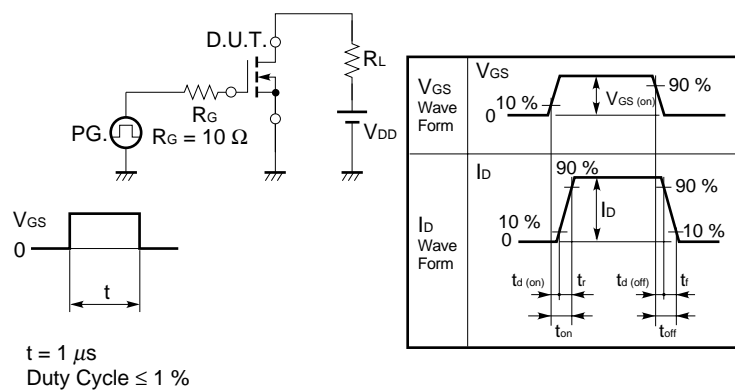
ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain to Source On-Resistance	R <sub>DS(on)</sub>		0.9	1.4	mΩ	V <sub>GS</sub> = 10 V 2SK2355
			1.0	1.5		I <sub>D</sub> = 2.5 A 2SK2356
Gate to Source Cutoff 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			S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.5 A
Drain Leakage Current	I <sub>DSS</sub>			100	μA	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0
Gate to Source Leakage Current	I <sub>GSS</sub>			±100	nA	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0
Input Capacitance	C <sub>iss</sub>		670		pF	V <sub>DS</sub> = 10 V
Output Capacitance	C <sub>oss</sub>		140		pF	V <sub>GS</sub> = 0
Reverse Transfer Capacitance	C <sub>rss</sub>		18		pF	f = 1 MHz
Turn-On Delay Time	t <sub>d(on)</sub>		11		ns	I <sub>D</sub> = 2.5 A
Rise Time	t <sub>r</sub>		8		ns	V <sub>GS</sub> = 10 V
Turn-Off Delay Time	t <sub>d(off)</sub>		40		ns	V <sub>DD</sub> = 150 V
Fall Time	t <sub>f</sub>		8		ns	R <sub>G</sub> = 10 Ω R <sub>L</sub> = 60 Ω
Total Gate Charge	Q <sub>G</sub>		20		nC	I <sub>D</sub> = 5.0 A
Gate to Source Charge	Q <sub>GS</sub>		4.5		nC	V <sub>DD</sub> = 400 V
Gate to Drain Charge	Q <sub>GD</sub>		9		nC	V <sub>GS</sub> = 10 V
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
Reverse Recovery Time	t <sub>rr</sub>		270		ns	I <sub>F</sub> = 5.0 A, V <sub>GS</sub> = 0
Reverse Recovery Charge	Q <sub>rr</sub>		1.0		nC	di/dt = 50 A/μs

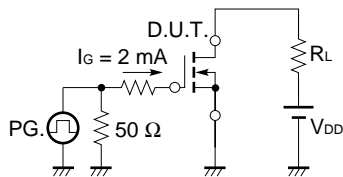
Test Circuit 1 Avalanche Capability



Test Circuit 2 Switching Time



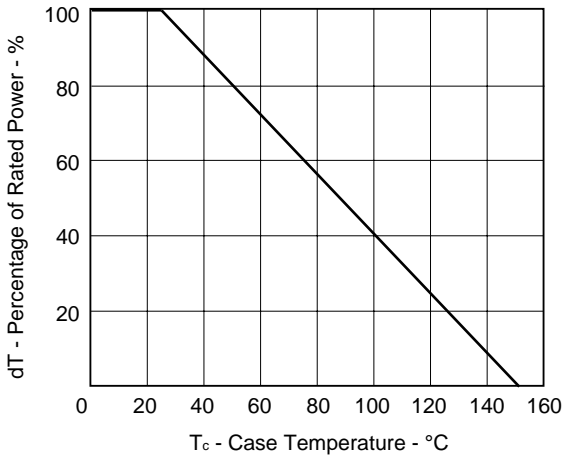
Test Circuit 3 Gate Charge



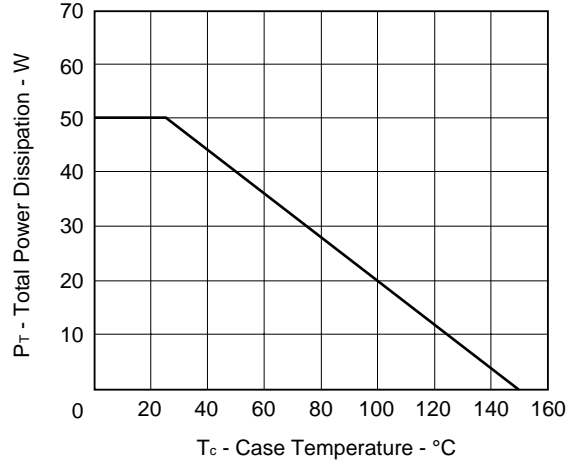
The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

TYPICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C)

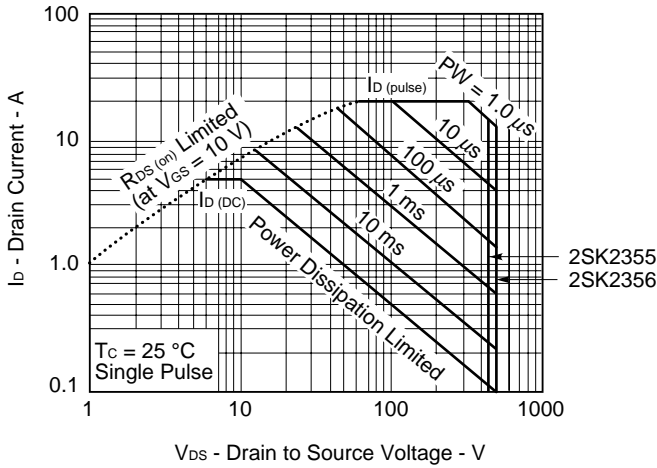
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



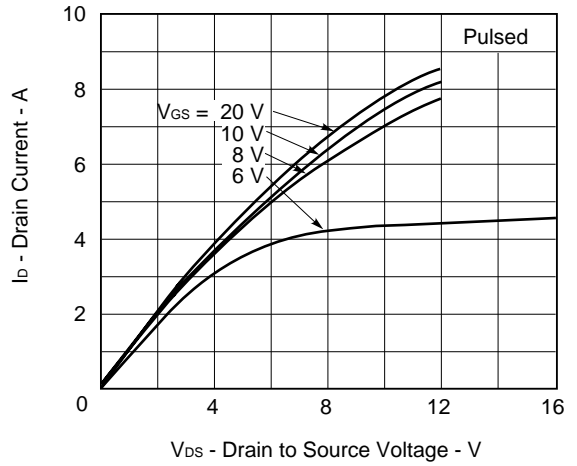
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



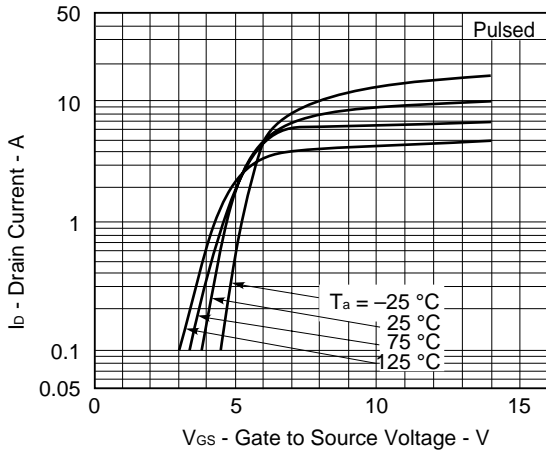
FORWARD BIAS SAFE OPERATING AREA

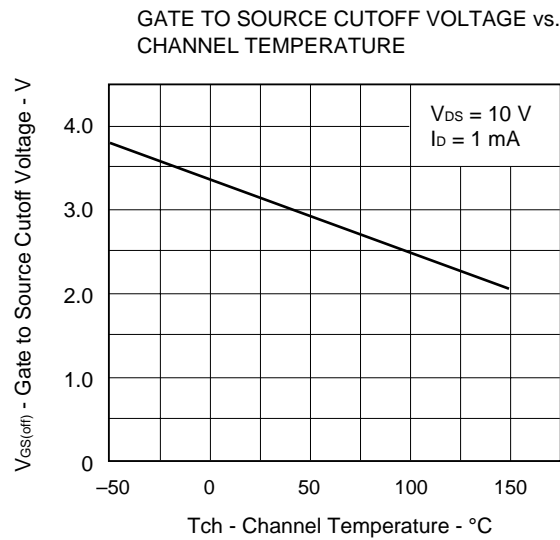
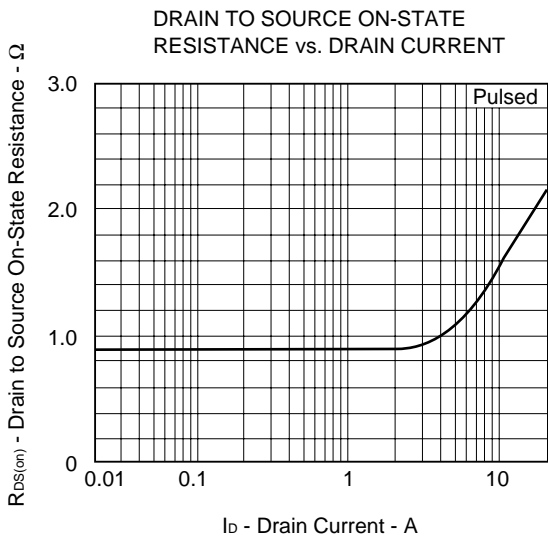
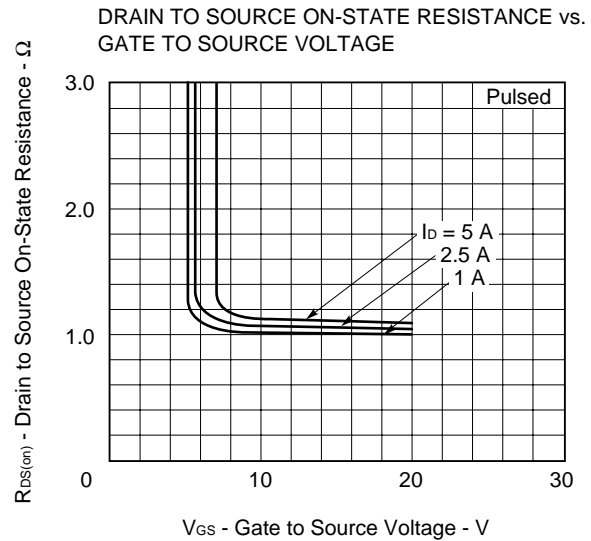
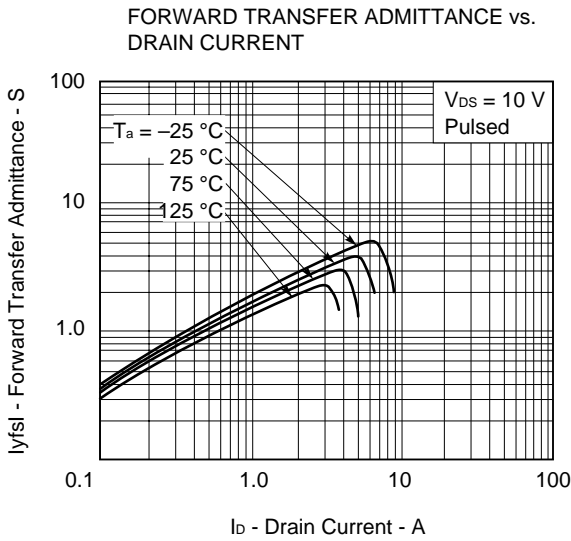
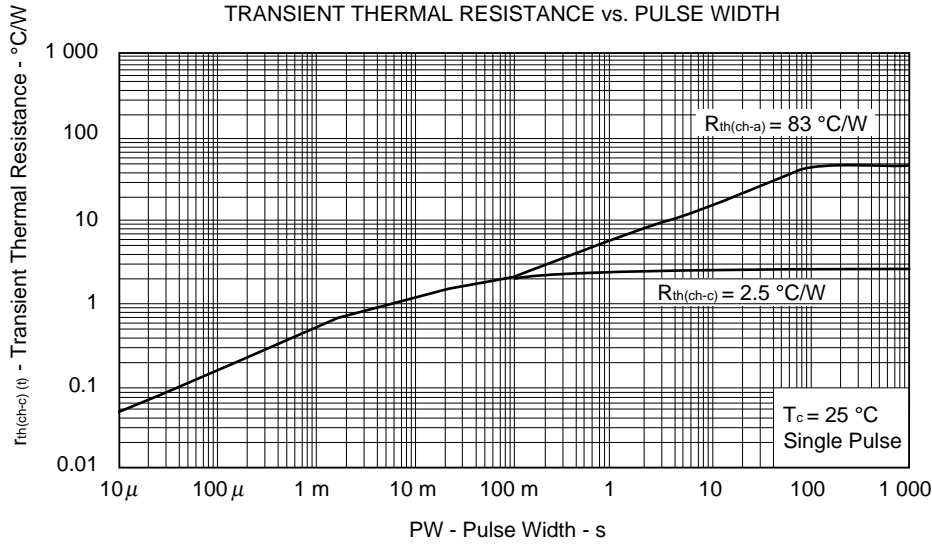


DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

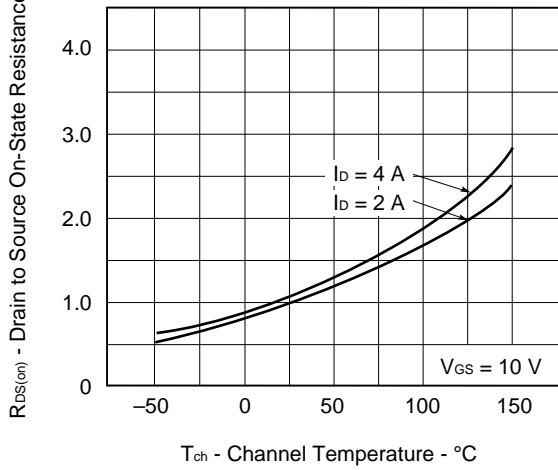


DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE

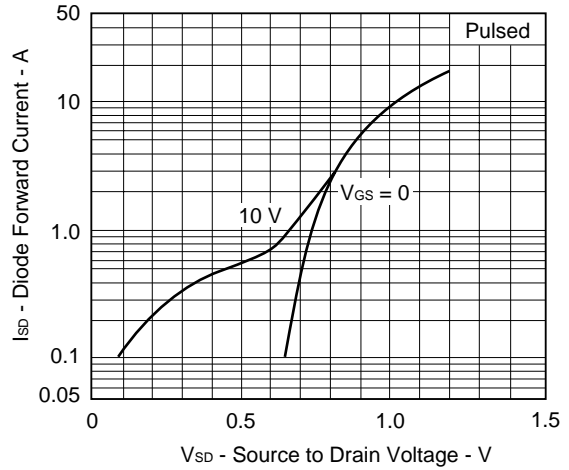




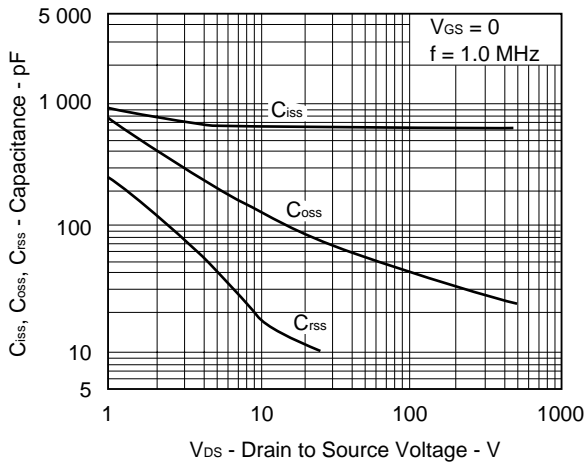
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



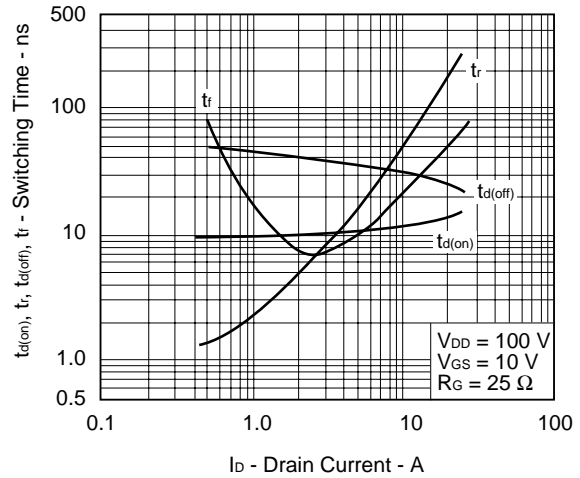
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



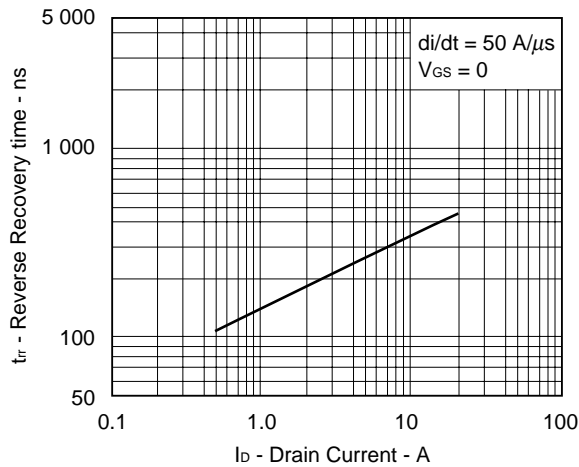
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



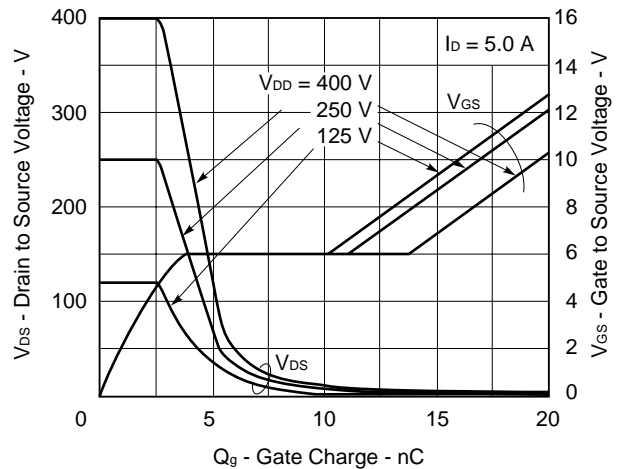
SWITCHING CHARACTERISTICS



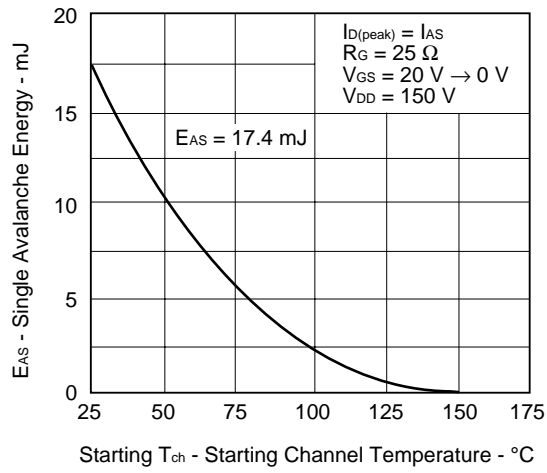
REVERSE RECOVERY TIME vs. DRAIN CURRENT



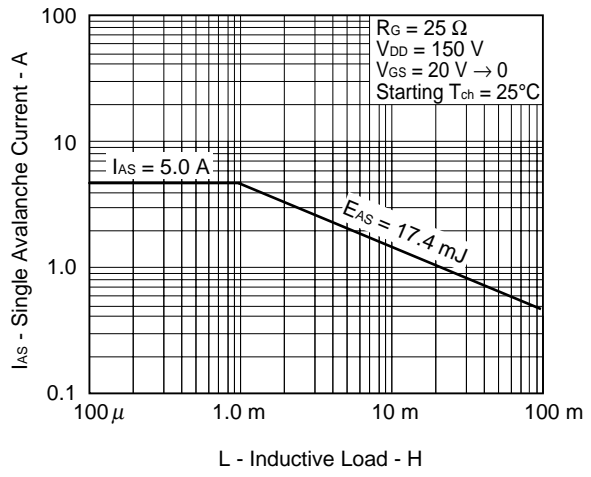
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SINGLE AVALANCHE ENERGY vs  
STARTING CHANNEL TEMPERATURE



SINGLE AVALANCHE CURRENT vs  
INDUCTIVE LOAD





**REFERENCE**

Document Name	Document No.
NEC semiconductor device reliability/quality control system.	C11745E
Quality grades on NEC semiconductor devices.	C11531E
Semiconductor device mounting technology manual.	C10535E
Semiconductor device package manual.	C10943X
Guide to quality assurance for semiconductor devices.	MEI-1202
Semiconductor selection guide.	X10679E
Power MOS FET features and application switching to power supply.	D12971E
Application circuits using Power MOS FET.	D12972E
Safe operating area of Power MOS FET.	D13085E

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.

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