

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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# **Phase-out/Discontinued**

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Phase-out/Discontinued

2SK1756/2SK1757

SWITCHING  
N-CHANNEL POWER MOS FET  
INDUSTRIAL USE

DESCRIPTION

The 2SK1756/2SK1757 is N-channel MOS Field Effect Transistor designed for high voltage switching applications.

FEATURES

- Low On-state Resistance  
 $R_{DS(on)} = 0.5/0.6 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 8 \text{ A)}$
- Low  $C_{iss}$   $C_{iss} = 1\ 500 \text{ pF TYP.}$
- Built-in G-S Gate Protection Diode
- High Avalanche Capability Ratings

QUALITY GRADE

Standard

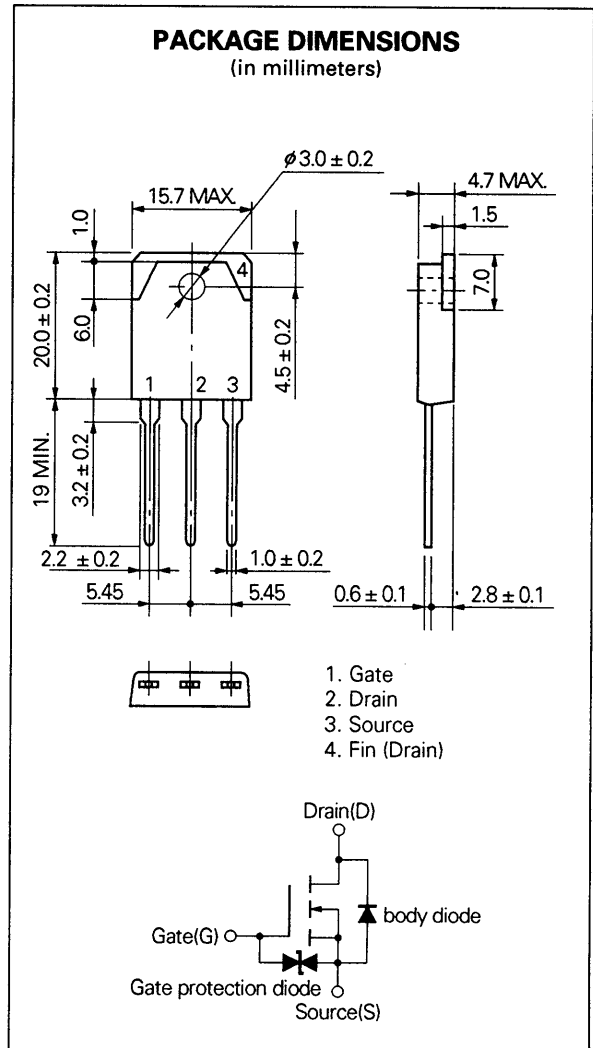
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

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

Drain to Source Voltage	$V_{DSS}$	450/500	V
Gate to Source Voltage	$V_{GSS}$	$\pm 30$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 15$	A
Drain Current (pulse)	$I_{D(pulse)^*}$	$\pm 60$	A
Total Power Dissipation ( $T_c = 25 \text{ }^\circ\text{C}$ )	$P_T$	120	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Avalanche Current	$I_{AS}^{**}$	22.5	A
Single Avalanche Energy	$E_{AS}^{**}$	362	mJ

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

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

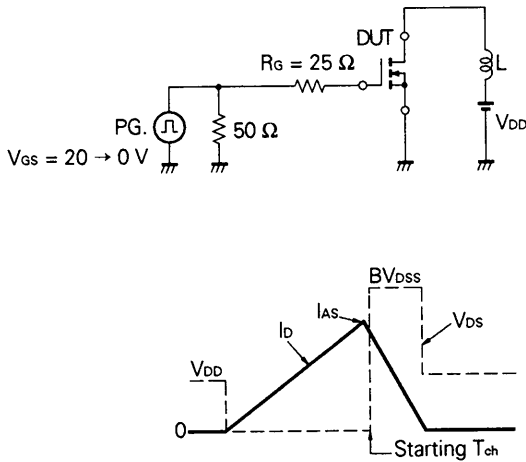


**Phase-out/Discontinued**

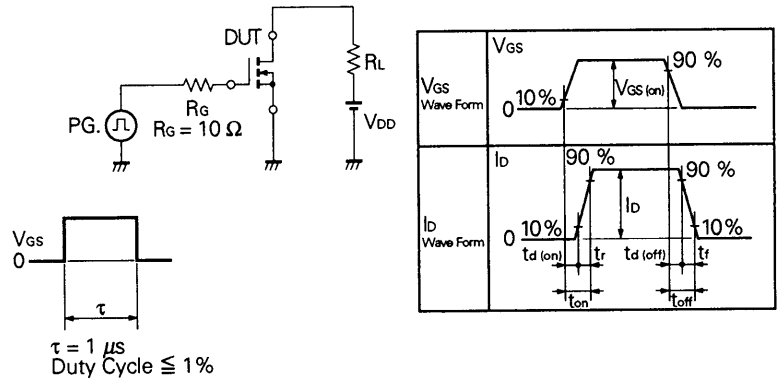
**ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C)**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Drain to Source On-state Resistance (2SK1756)	R <sub>DS(on)</sub>		0.4	0.5	Ω	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 8 A
Drain to Source On-state Resistance (2SK1757)	R <sub>DS(on)</sub>		0.5	0.6	Ω	
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>	5.0	6.8		S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 8 A
Drain Leakage Current (2SK1756/1757)	I <sub>DSS</sub>			100	μA	V <sub>DS</sub> = 450/500 V, V <sub>GS</sub> = 0
Gate to Source Leakage Current	I <sub>GSS</sub>			±10	μA	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0
Input Capacitance	C <sub>iss</sub>		1 500		pF	V <sub>DS</sub> = 10 V V <sub>GS</sub> = 0 f = 1 MHz
Output Capacitance	C <sub>oss</sub>		480		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		200		pF	
Turn-On Delay Time	t <sub>d(on)</sub>		25		ns	V <sub>GS</sub> = 10 V V <sub>DD</sub> = 150 V I <sub>D</sub> = 8 A, R <sub>G</sub> = 10 Ω R <sub>L</sub> = 18.8 Ω
Rise Time	t <sub>r</sub>		55		ns	
Turn-Off Delay Time	t <sub>d(off)</sub>		90		ns	
Fall Time	t <sub>f</sub>		30		ns	
Total Gate Charge	Q <sub>G</sub>		50		nC	
Gate to Source Charge	Q <sub>GS</sub>		10		nC	V <sub>GS</sub> = 10 V I <sub>D</sub> = 15 A V <sub>DD</sub> = 400 V
Gate to Drain Charge	Q <sub>GD</sub>		30		nC	
Diode Forward Voltage	V <sub>F(I<sub>D</sub>)</sub>		1.0		V	
Reverse Recovery Time	t <sub>rr</sub>		520		ns	I <sub>D</sub> = 15 A, V <sub>GS</sub> = 0 di/dt = 50 A/μs
Reverse Recovery Charge	Q <sub>rr</sub>		8.3		μC	

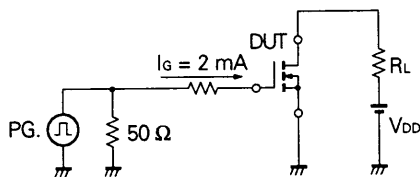
**Test Circuit 1: Avalanche Capability**



**Test Circuit 2: Switching Time**

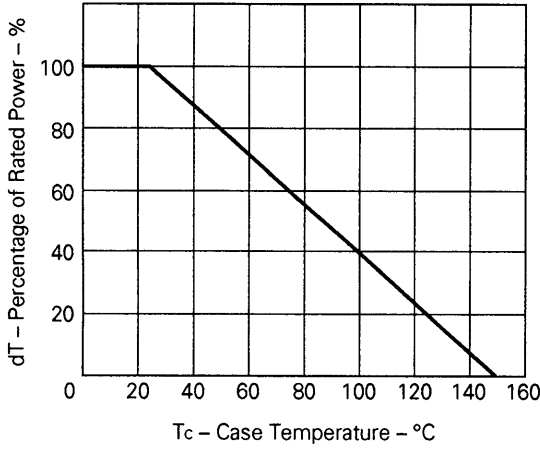


**Test Circuit 3: Gate Charge**

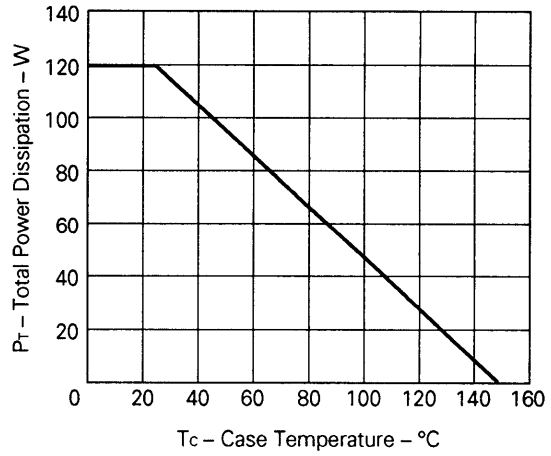


**TYPICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C)**

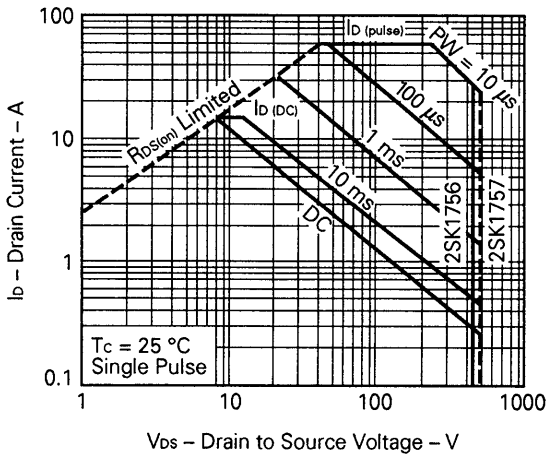
**DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA**



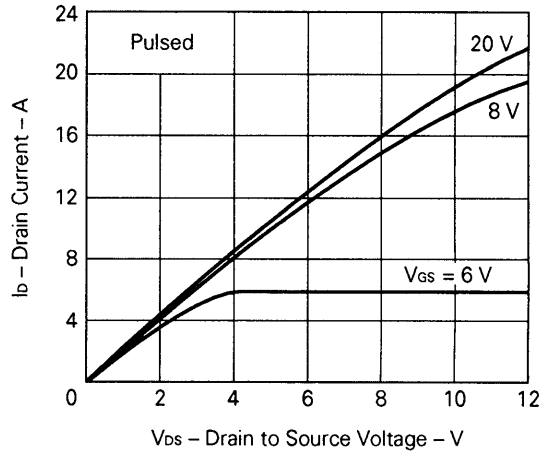
**TOTAL POWER DISSIPATION vs. CASE TEMPERATURE**



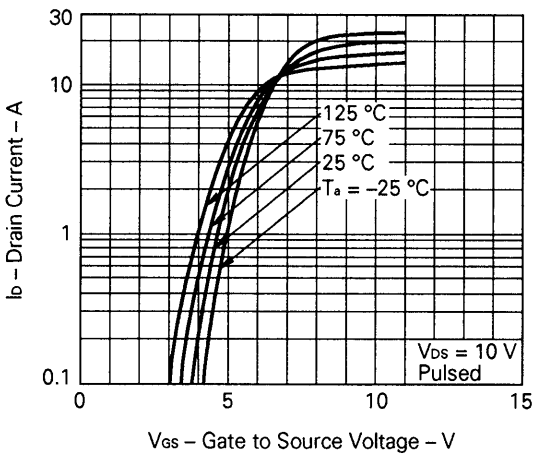
**FORWARD BIAS SAFE OPERATING AREA**



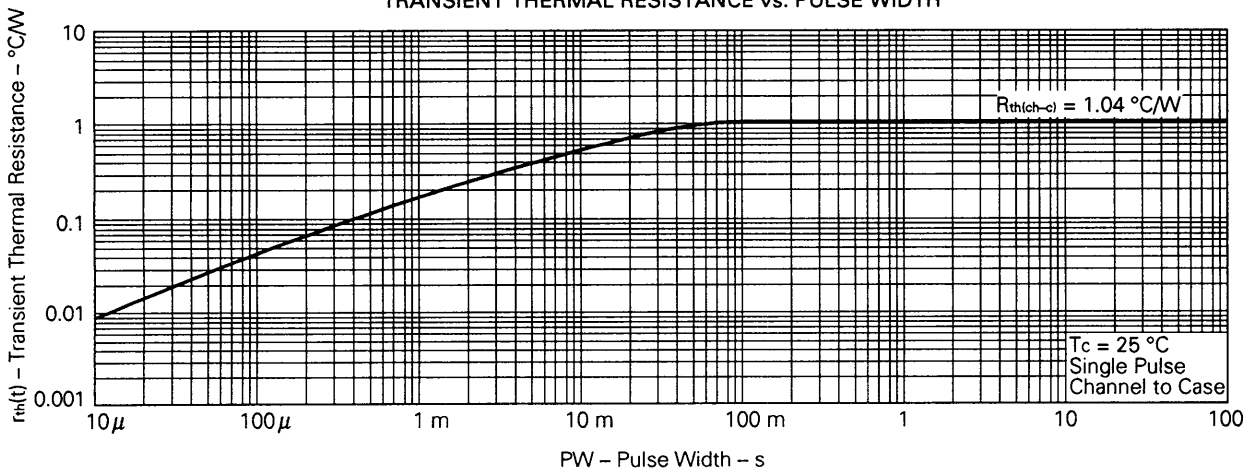
**DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE**



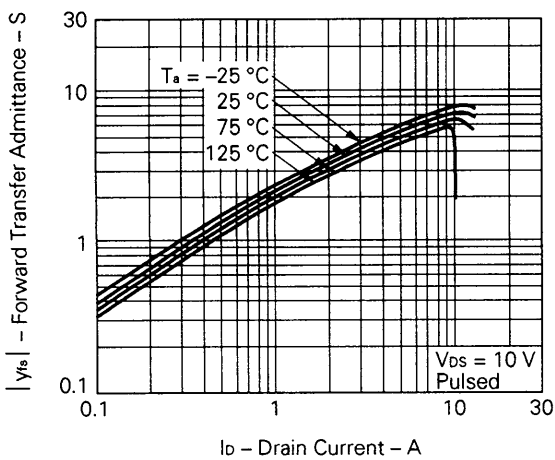
**TRANSFER CHARACTERISTICS**



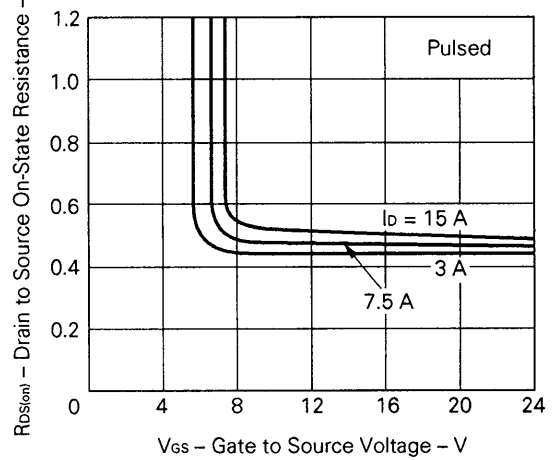
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



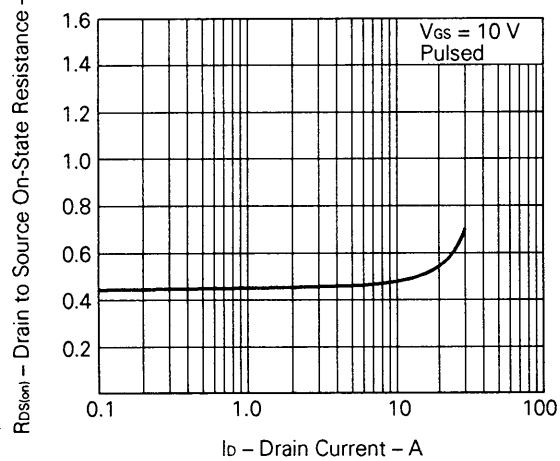
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



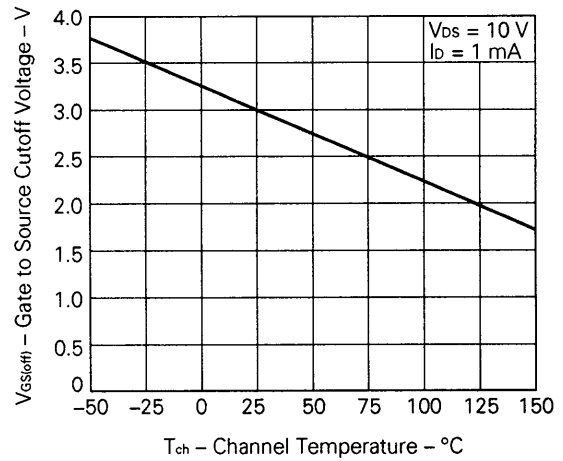
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

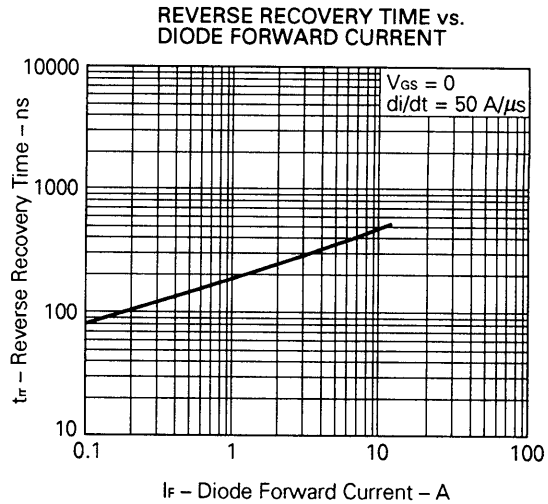
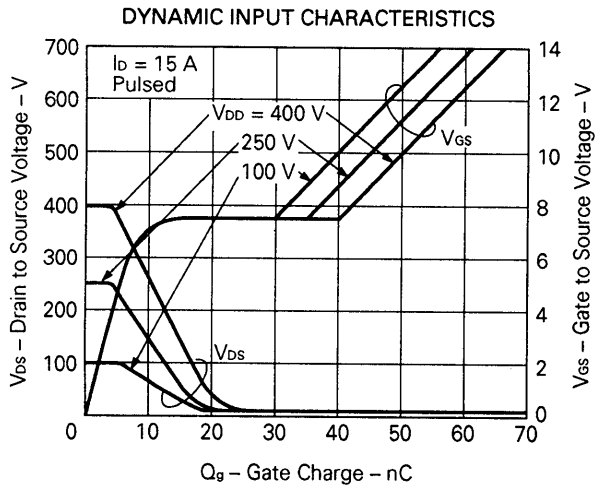
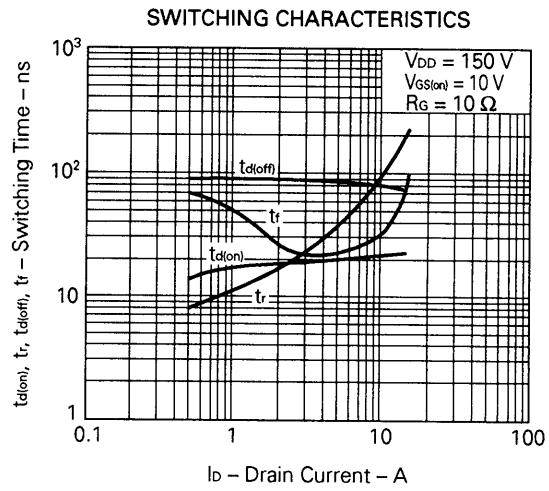
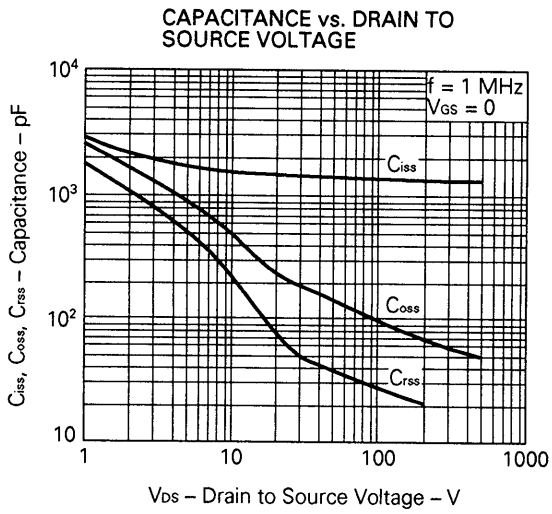
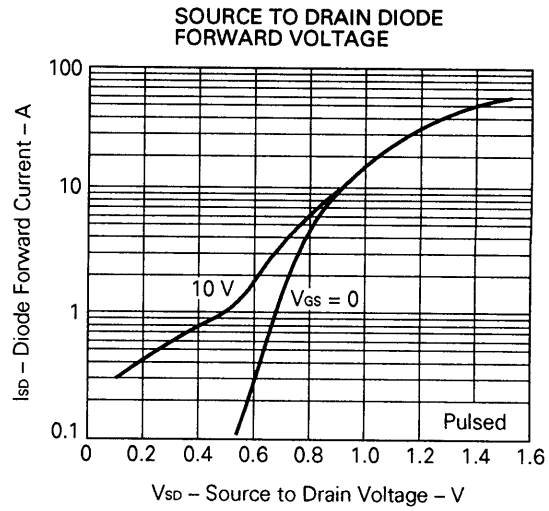
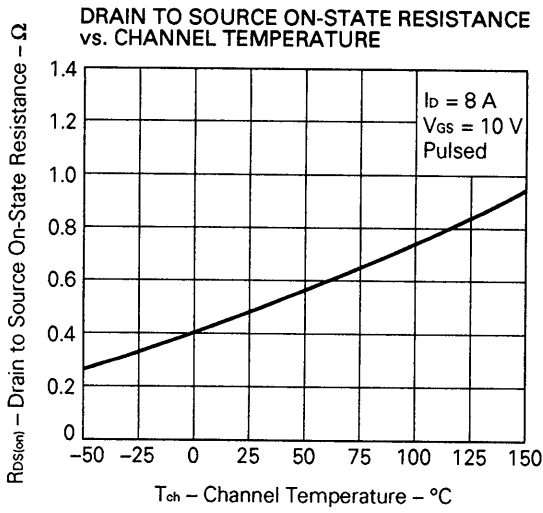


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



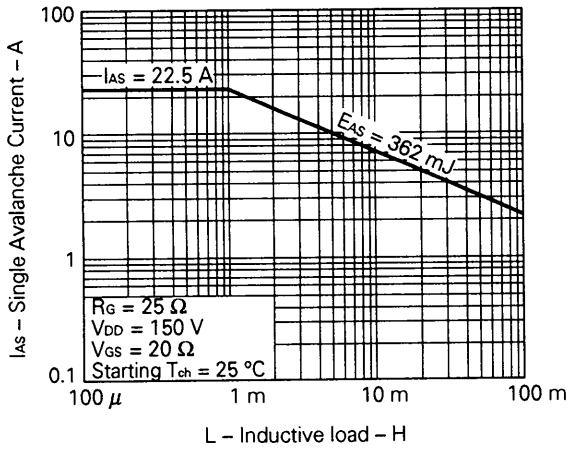
GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



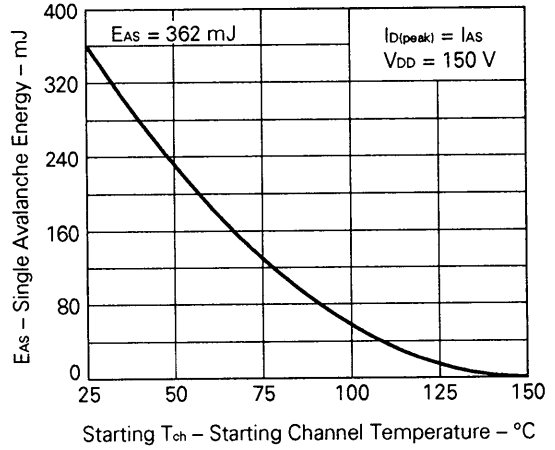




SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



SINGLE AVALANCHE ENERGY vs. STARTING CHANNEL TEMPERATURE



**Reference**

Application note name	No.
Safe operating area of Power MOS FET.	TEA-1034
Application circuit using Power MOS FET.	TEA-1035
Quality control of NEC semiconductors devices.	TEI-1202
Quality control guide of semiconductors devices.	MEI-1202
Assembly manual of semiconductors devices.	IEI-1207

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