



## 1N60A

Power MOSFET

### 0.5 Amps, 600 Volts N-CHANNEL MOSFET

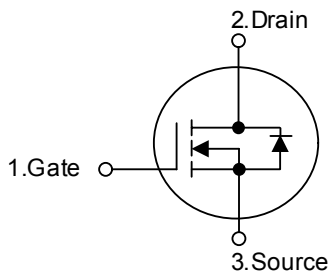
#### DESCRIPTION

The UTC 1N60A is a high voltage MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} = 11\Omega @ V_{GS} = 10V$ .
- \* Ultra Low gate charge (typical 8.0nC)
- \* Low reverse transfer capacitance ( $C_{RSS} = 3.0 \text{ pF(max)}$ )
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL

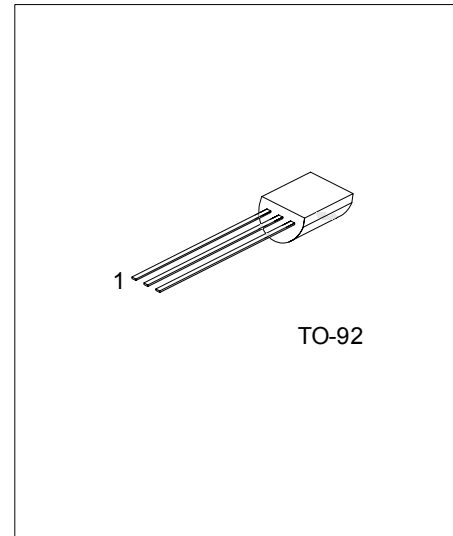


#### ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
1N60A-T92-B	1N60AL-T92-B	TO-92	G	D	S	Tape Box
1N60A-T92-K	1N60AL-T92-K	TO-92	G	D	S	Bulk
1N60A-T92-R	1N60AL-T92-R	TO-92	G	D	S	Tape Reel

Note: Pin Assignment: G: Gate D: Drain S: Source

<p>1N60AL-T92-B</p> <p>(1) Packing Type (2) Package Type (3) Lead Plating</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel (2) T92: TO-92 (3) L: Lead Free Plating Blank: Pb/Sn</p>
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\*Pb-free plating product number: 1N60AL

■ ABSOLUTE MAXIMUM RATINGS( $T_C = 25$  , unless otherwise specified.)

PARAMETER		SYMBOL	RATINGS		UNIT
Drain-Source Voltage		$V_{DSS}$	600		V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$		V
Continuous Drain Current	$T_C = 25$	$I_D$	0.5		A
	$T_C = 100$		0.4		
Drain Current-Pulsed (Note 2)		$I_{DP}$	2		A
Avalanche Energy	Repetitive(Note 1)	$E_{AR}$	3.6	4.0	mJ
	Single Pulse(Note 2)	$E_{AS}$	50		mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5		V/ns
Total Power Dissipation	$T_C=25$	$P_D$	3		W
	Derate above 25°C		25		mW/
Operation Junction Temperature		$T_J$	-55 ~ +150		
Storage Temperature		$T_{STG}$	-55 ~ +150		

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Thermal Resistance Junction-Ambient	$\theta_{JA}$			120	/W
Thermal Resistance Case-Sink	$\theta_{CS}$		0.5		

■ ELECTRICAL CHARACTERISTICS ( $T_J=25$  , Unless Otherwise Specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Off Characteristics</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Breakdown Voltage Temperature Coefficient		$BV_{DSS}/T_J$	$I_D = 250\mu A$ , referenced to 25		0.4		V/
Zero Gate Voltage Drain Current		$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			1	$\mu A$
			$V_{DS} = 480V, T_C = 125$				
Gate-Body Leakage Current	Forward	$I_{GSS}$	$V_{GS} = 20V, V_{DS} = 0V$			10	$\mu A$
	Reverse		$V_{GS} = -20V, V_{DS} = 0V$			-10	$\mu A$
<b>On Characteristics</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 0.5A$		11	15	$\Omega$
<b>Dynamic Characteristics</b>							
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1MHz$				100	pF
Output Capacitance	$C_{OSS}$					20	pF
Reverse Transfer Capacitance	$C_{RSS}$					3	pF
<b>Switching Characteristics</b>							
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300V, I_D=0.5A, R_G=5\Omega$ (Note 4,5)			12	34	ns
Rise Time	$t_R$				11	32	ns
Turn-Off Delay Time	$t_{D(OFF)}$				40	90	ns
Fall Time	$t_F$				18	46	ns
Total Gate Charge	$Q_G$				8	10	nC
Gate-Source Charge	$Q_{GS}$	$V_{DS}=480V, V_{GS}=10V, I_D=0.8A$ (Note 4,5)			1.8		nC
Gate-Drain Charge	$Q_{GD}$				4.0		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Drain-Source Diode Characteristics</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S = 0.8A,$			1.6	V
Continuous Drain-Source Current	$I_{SD}$				1.2	A
Pulsed Drain-Source Current	$I_{SM}$				4.8	A
Reverse Recovery Time	$t_{RR}$	$V_{GS}=0V, I_S = 0.8A$		136		ns
Reverse Recovery Charge	$Q_{RR}$	$di/dt = 100A/\mu s$		0.3		$\mu C$

Note: 1. Repeatability rating: pulse width limited by junction temperature

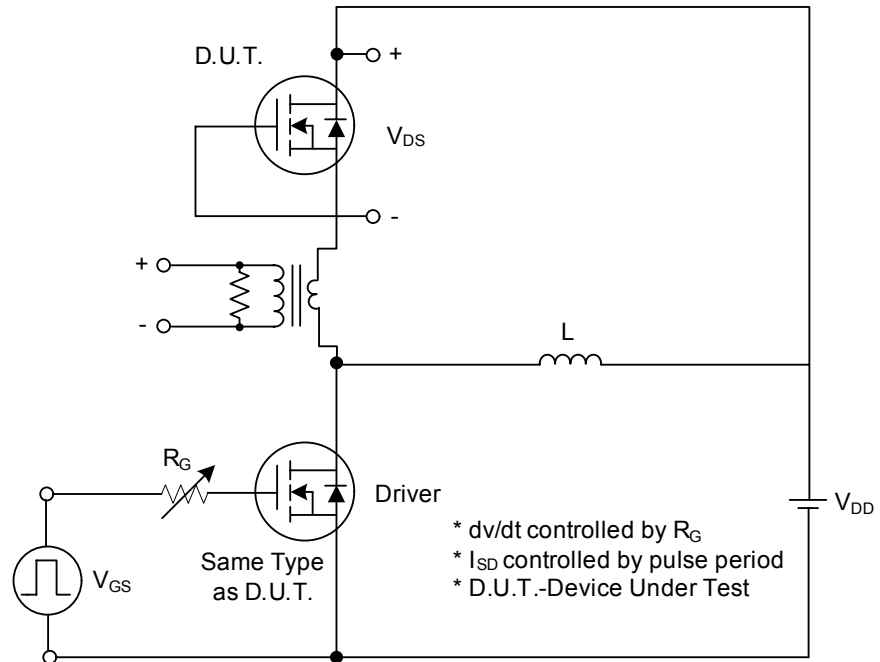
2.  $L=92mH, I_{AS}=1.0A, V_{DD}=50V, R_G=0\Omega,$  Starting  $T_J=25$

3.  $I_{SD}\leq 1.0A, di/dt\leq 100A/\mu s, V_{DD}\leq BV_{DSS},$  Starting  $T_J=25$

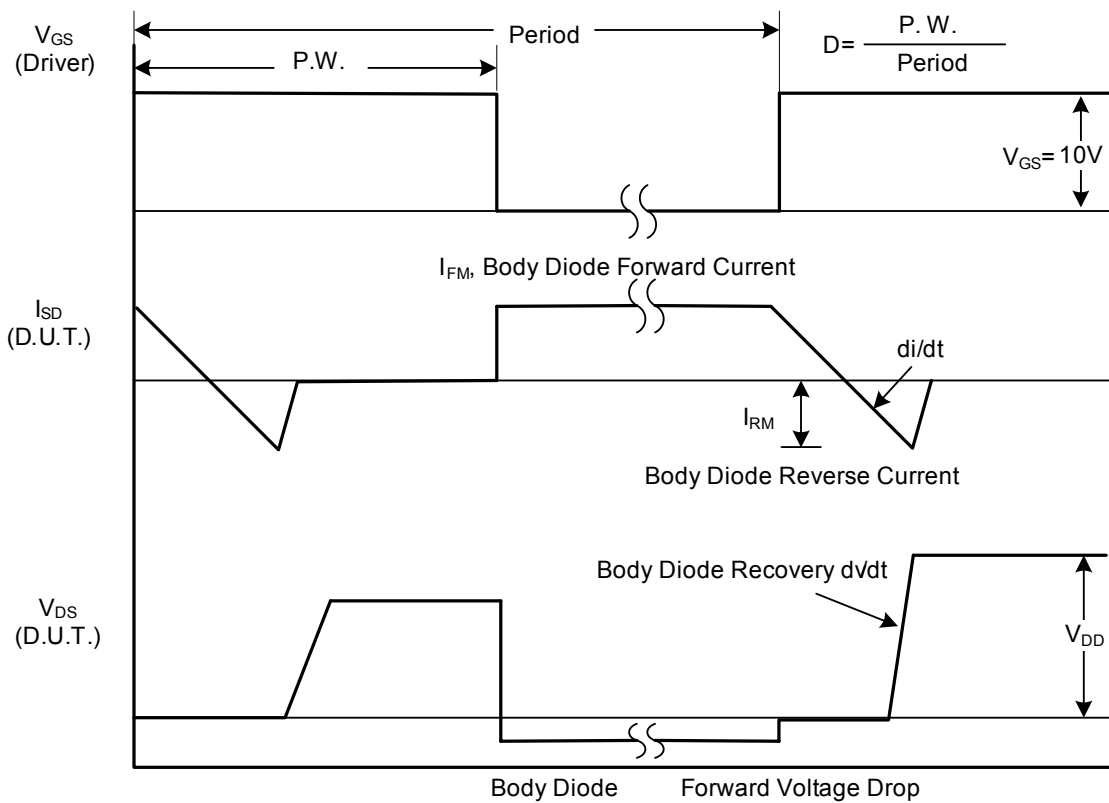
4. Pulse Test: Pulse Width $\leq 300\mu s,$  Duty Cycle $\leq 2\%$

5. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS



**Fig. 1A Peak Diode Recovery dv/dt Test Circuit**



**Fig. 1B Peak Diode Recovery dv/dt Waveforms**

### TEST CIRCUITS AND WAVEFORMS (Cont.)

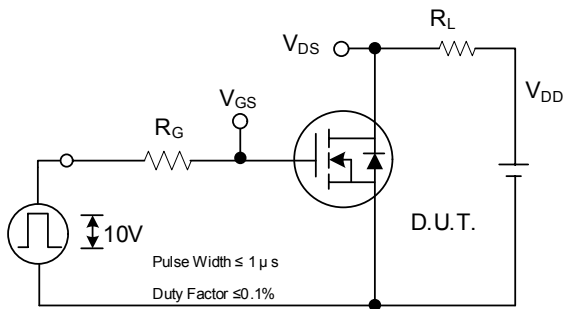


Fig. 2A Switching Test Circuit

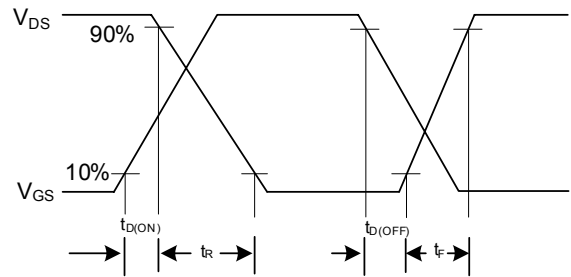


Fig. 2B Switching Waveforms

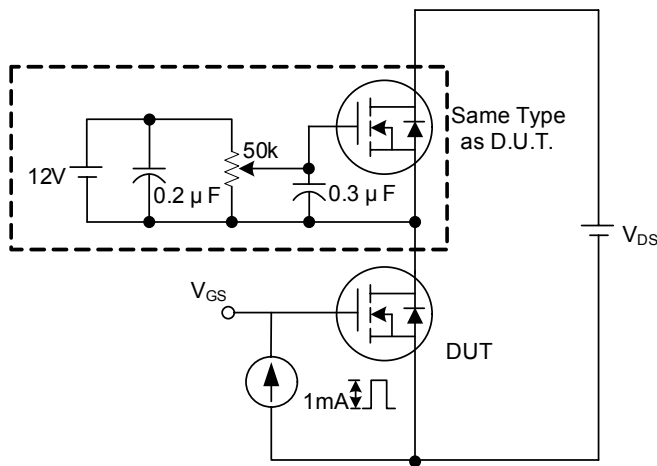


Fig. 3A Gate Charge Test Circuit

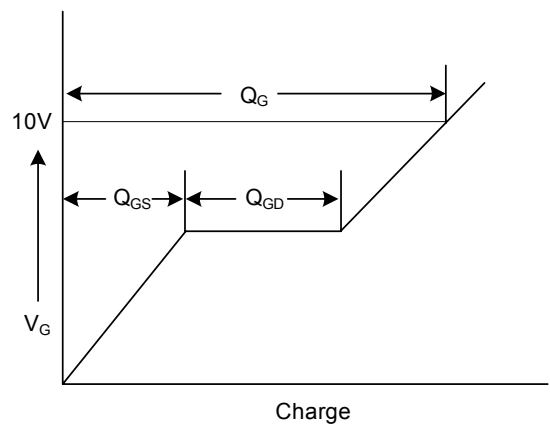


Fig. 3B Gate Charge Waveform

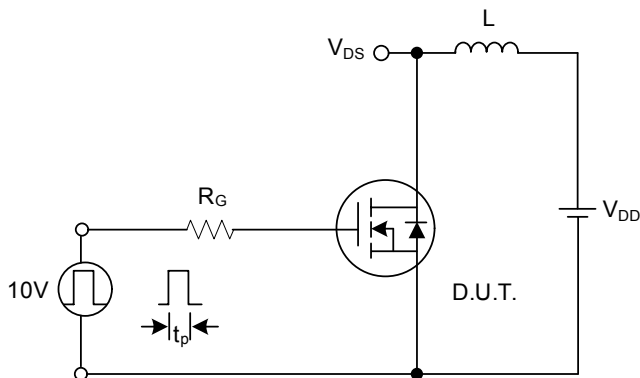


Fig. 4A Unclamped Inductive Switching Test Circuit

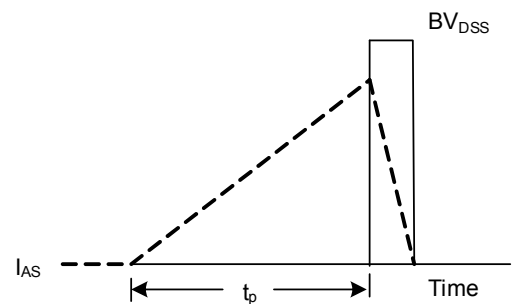
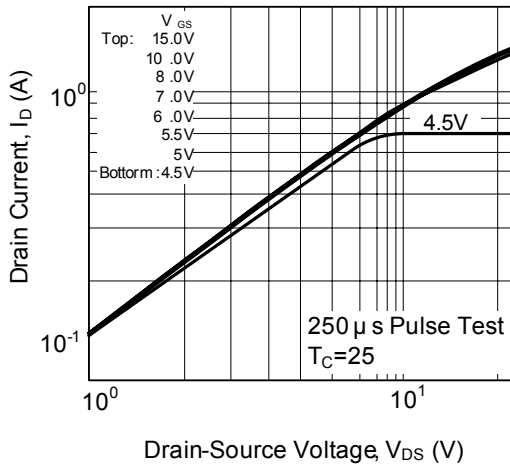


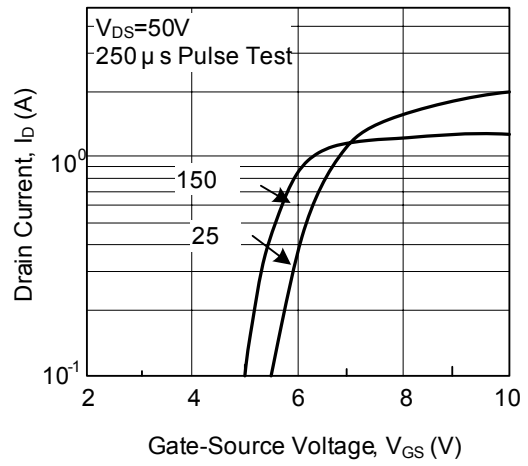
Fig. 4B Unclamped Inductive Switching Waveforms

## TYPICAL PERFORMANCE CHARACTERISTICS

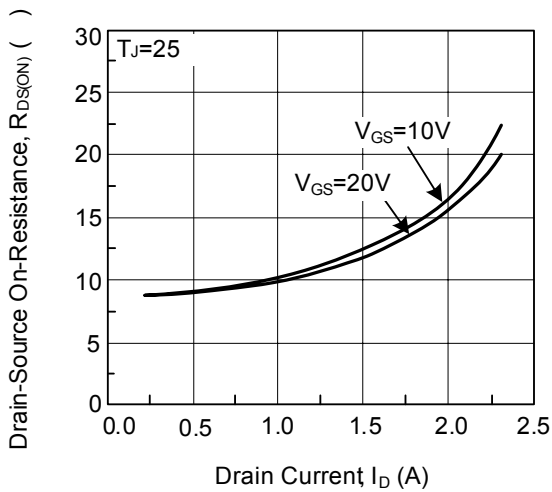
Output Characteristics



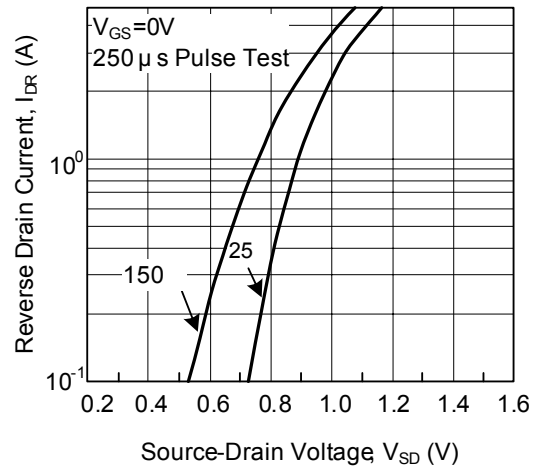
Transfer Characteristics



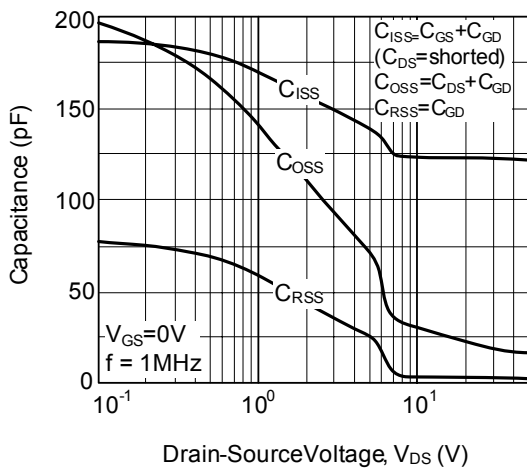
On-Resistance vs. Drain Current



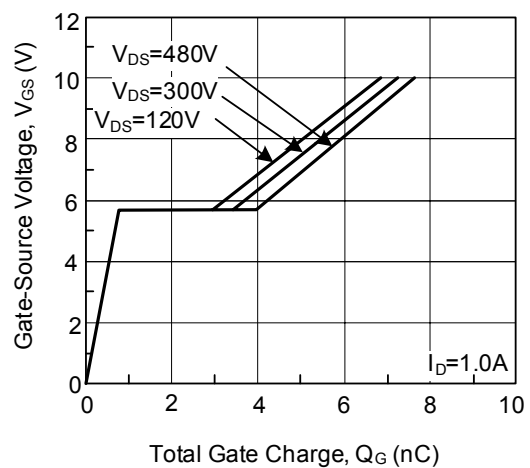
Source- Drain Diode Forward Voltage



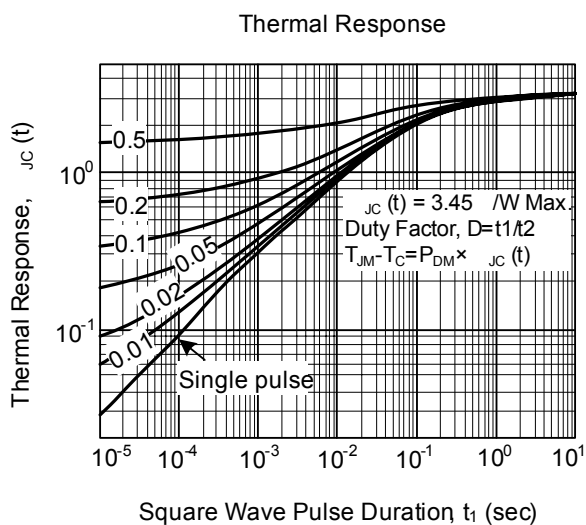
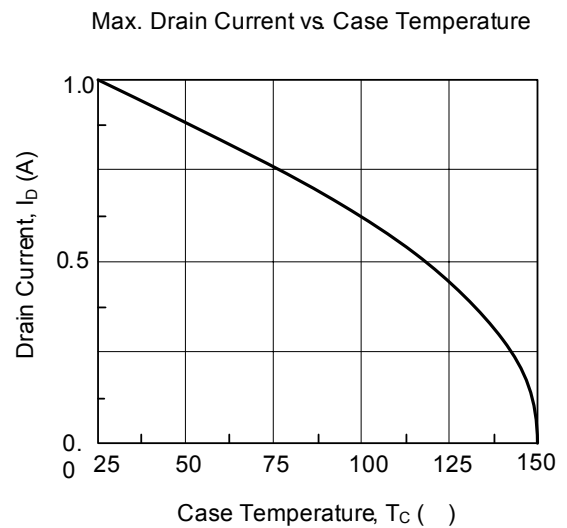
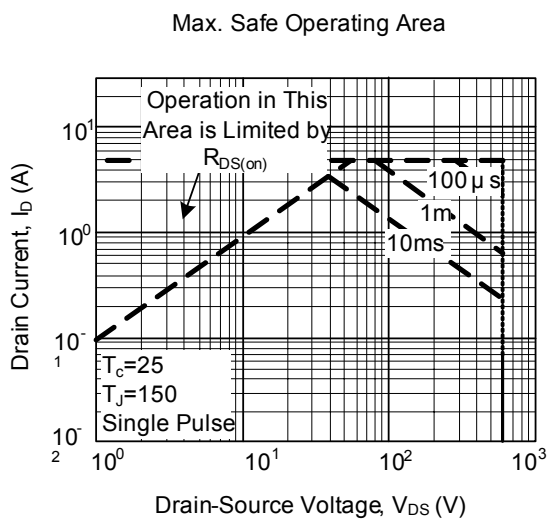
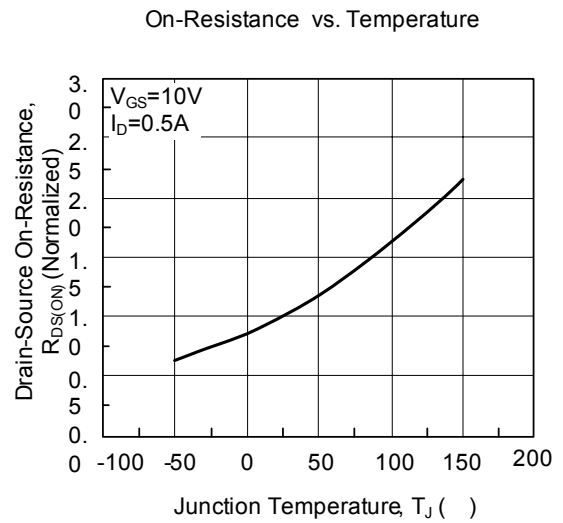
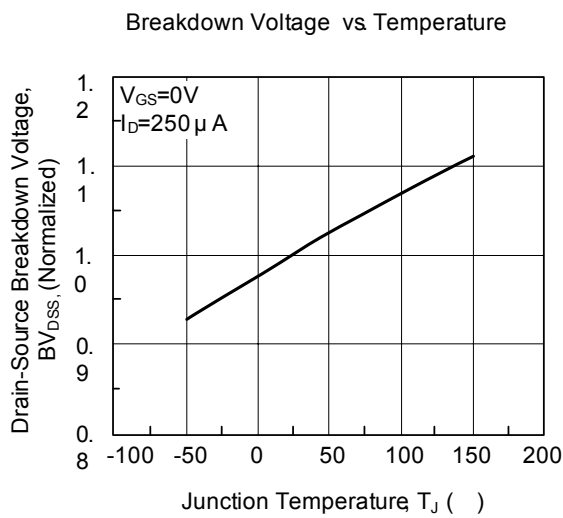
Capacitance vs. Drain-Source Voltage



Gate Charge vs. Gate-Source Voltage



## TYPICAL PERFORMANCE CHARACTERISTICS(Cont.)



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