



# 6N70-P

**Power MOSFET**

## 6A, 700V N-CHANNEL POWER MOSFET

■ DESCRIPTION

The UTC **6N70-P** is a N-channel mode power MOSFET using UTC's advanced technology to provide customers with a minimum on-state resistance, high switching speed, low gate charge and low input capacitance.

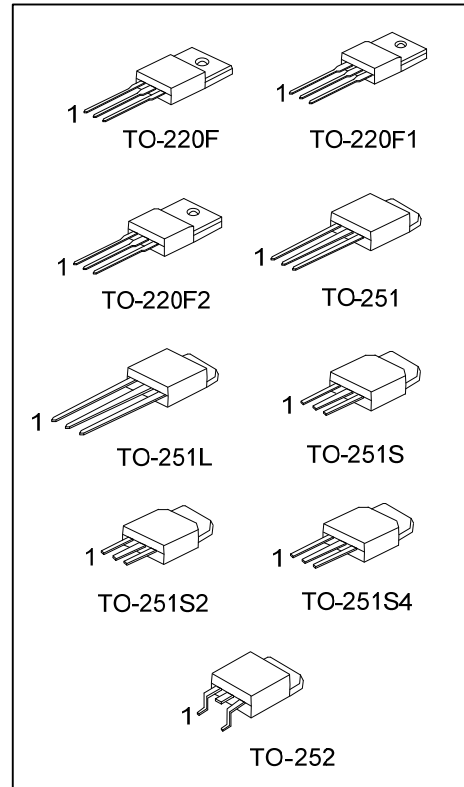
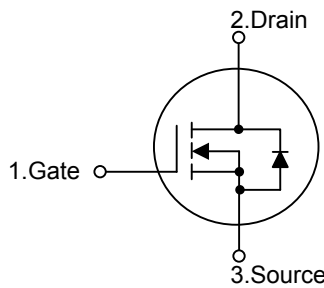
The UTC **6N70-P** is universally applied in high efficiency switch mode power supply.

■ FEATURES

\*  $R_{DS(ON)} < 1.8\Omega$  @  $V_{GS}=10V, I_D=3.0A$

\* High switching speed

■ SYMBOL



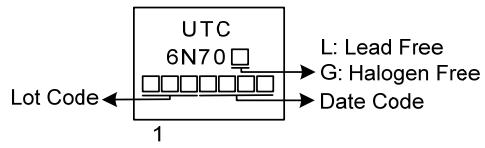
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6N70L-TF1-T	6N70G-TF1-T	TO-220F1	G	D	S	Tube
6N70L-TF2-T	6N70G-TF2-T	TO-220F2	G	D	S	Tube
6N70L-TF3-T	6N70G-TF3-T	TO-220F	G	D	S	Tube
6N70L-TM3-T	6N70G-TM3-T	TO-251	G	D	S	Tube
6N70L-TMA-T	6N70G-TMA-T	TO-251L	G	D	S	Tube
6N70L-TMS-T	6N70G-TMS-T	TO-251S	G	D	S	Tube
6N70L-TMS2-T	6N70G-TMS2-T	TO-251S2	G	D	S	Tube
6N70L-TMS4-T	6N70G-TMS4-T	TO-251S4	G	D	S	Tube
6N70L-TN3-R	6N70G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>6N70G-TF1-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TM3: TO-251, TMA: TO-251L, TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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## MARKING



■ ABSOLUTE MAXIMUM RATINGS (unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		$V_{DSS}$	700	V	
Gate-Source Voltage (Note 2)		$V_{GSS}$	$\pm 30$	V	
Drain Current	Continuous	$I_D$	$T_C=25^\circ\text{C}$	6	A
			$T_C=100^\circ\text{C}$	3.8	A
	Pulsed	$I_{DM}$	24	A	
Avalanche Current (Note 2)		$I_{AR}$	6	A	
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	200	mJ	
	Repetitive (Note 2)	$E_{AR}$	13	mJ	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.5	V/ns	
Power Dissipation	TO-220F/TO-220F1	$P_D$	40	W	
	TO-220F2		42		
	TO-251/TO-252		55		
	TO-251L/TO-251S TO-251S2/TO-251S4				
Junction Temperature		$T_J$	+150	$^\circ\text{C}$	
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$	

Notes: 1. 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.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3.  $L = 12\text{mH}$ ,  $I_{AS} = 6\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 27\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 6\text{A}$ ,  $di/dt \leq 140\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT	
Junction to Ambient	TO-220F/TO-220F1 TO-220F2	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$	
	TO-251/TO-252 TO-251L/TO-251S TO-251S2/TO-251S4		110	$^\circ\text{C}/\text{W}$	
	Junction to Case	TO-220F/TO-220F1 TO-220F2	$\theta_{JC}$	3.1	$^\circ\text{C}/\text{W}$
				2.9	$^\circ\text{C}/\text{W}$
TO-251/TO-252 TO-251L/TO-251S TO-251S2/TO-251S4		2.27 (Note)	$^\circ\text{C}/\text{W}$		

Note: The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.

■ ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

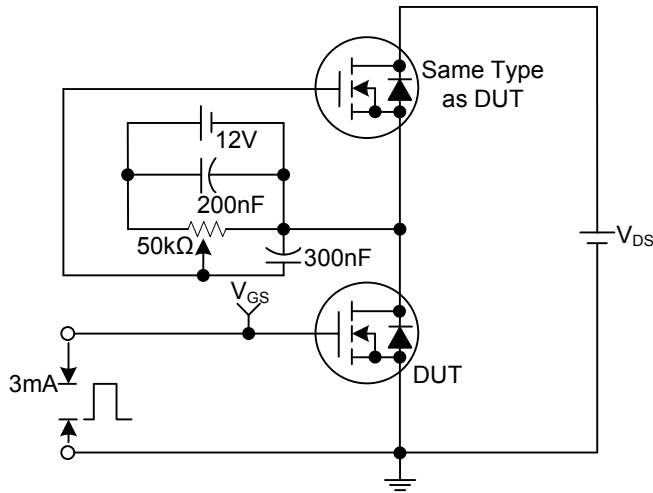
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	700			V
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu\text{A}$		0.79		$\text{V}/^\circ\text{C}$
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS}=700\text{V}$			25	$\mu\text{A}$
			$V_{DS}=560\text{V}$ , $T_C=125^\circ\text{C}$			250	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS}=+30\text{V}$ , $V_{DS}=0\text{V}$			+100	nA
	Reverse		$V_{GS}=-30\text{V}$ , $V_{DS}=0\text{V}$			-100	nA
<b>ON CHARACTERISTICS</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=3.0\text{A}$ (Note 1)		1.6	1.8	$\Omega$
<b>DYNAMIC PARAMETERS</b>							
Input Capacitance		$C_{ISS}$	$V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ , $f=1.0\text{MHz}$ (Note 1, 2)		810	1000	pF
Output Capacitance		$C_{OSS}$			95	135	pF
Reverse Transfer Capacitance		$C_{RSS}$			15	25	pF
<b>SWITCHING PARAMETERS</b>							
Total Gate Charge		$Q_G$	$V_{GS}=10\text{V}$ , $V_{DS}=50\text{V}$ , $I_D=1.3\text{A}$ (Note 1, 2)		25	35	nC
Gate to Source Charge		$Q_{GS}$			6.5		nC
Gate to Drain Charge		$Q_{GD}$			6.0		nC
Turn-ON Delay Time		$t_{D(ON)}$	$V_{DS}=30\text{V}$ , $I_D=0.5\text{A}$ , $R_G=2.5\Omega$		57	84	ns
Rise Time		$t_R$			64	90	ns
Turn-OFF Delay Time		$t_{D(OFF)}$			180	220	ns
Fall-Time		$t_F$			68	100	ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>							
Maximum Body-Diode Continuous Current		$I_S$	Integral reverse pn-diode in the MOSFET			6	A
Maximum Body-Diode Pulsed Current (Note 3)		$I_{SM}$				24	A
Drain-Source Diode Forward Voltage (Note 2)		$V_{SD}$	$I_S=6\text{A}$ , $V_{GS}=0\text{V}$ , $T_J = 25^\circ\text{C}$			1.4	V

Notes: 1. Pulse Test: Pulse width  $\leq 250\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

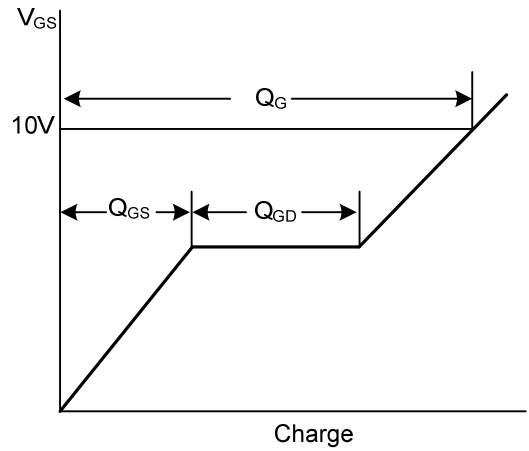
2. Essentially independent of operating temperature.

3. Repetitive Rating: Pulse width limited by maximum junction temperature.

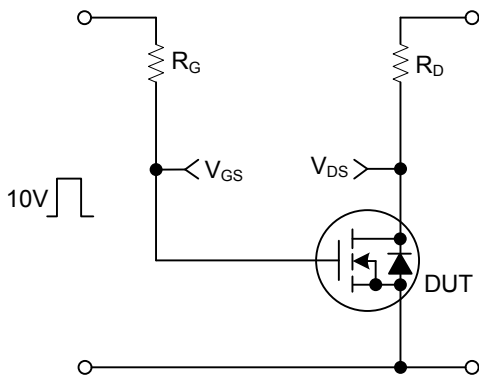
## TEST CIRCUITS AND WAVEFORMS



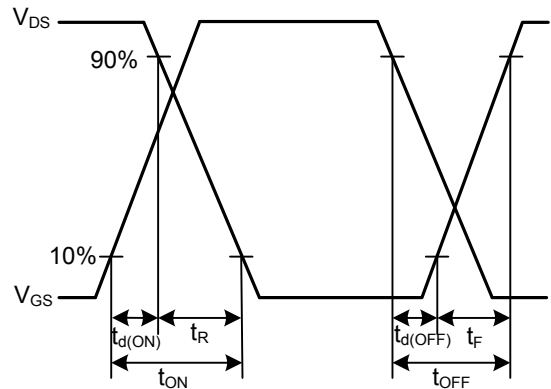
**Gate Charge Test Circuit**



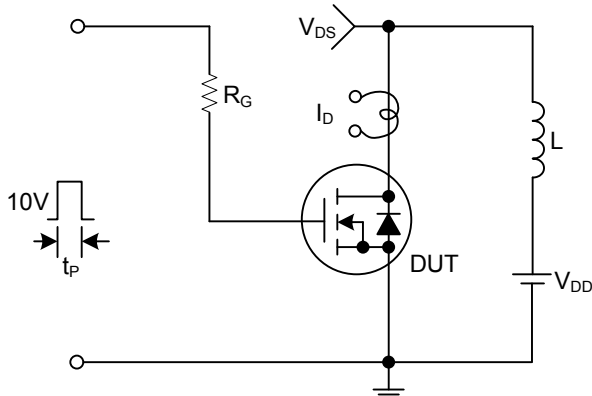
**Gate Charge Waveforms**



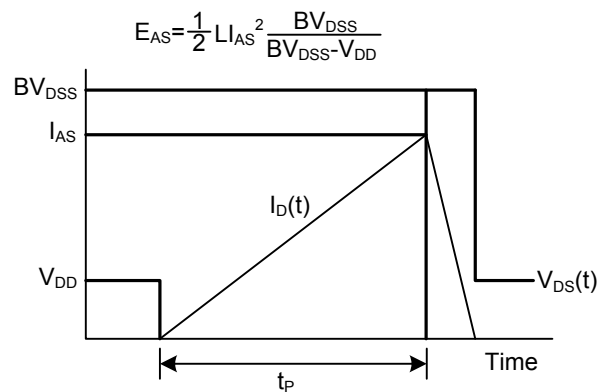
**Resistive Switching Test Circuit**



**Resistive Switching Waveforms**

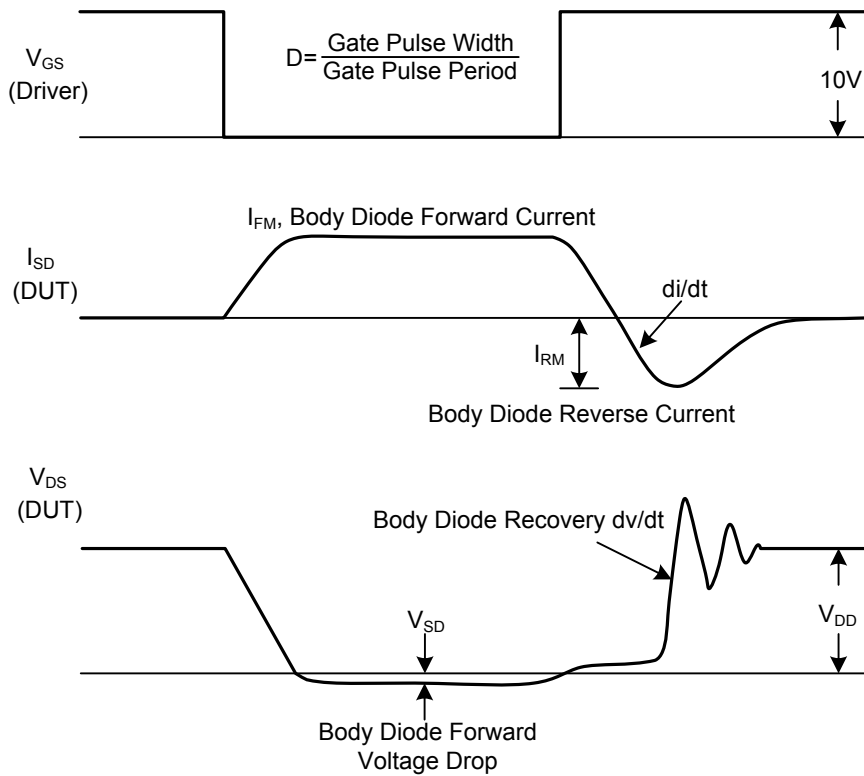
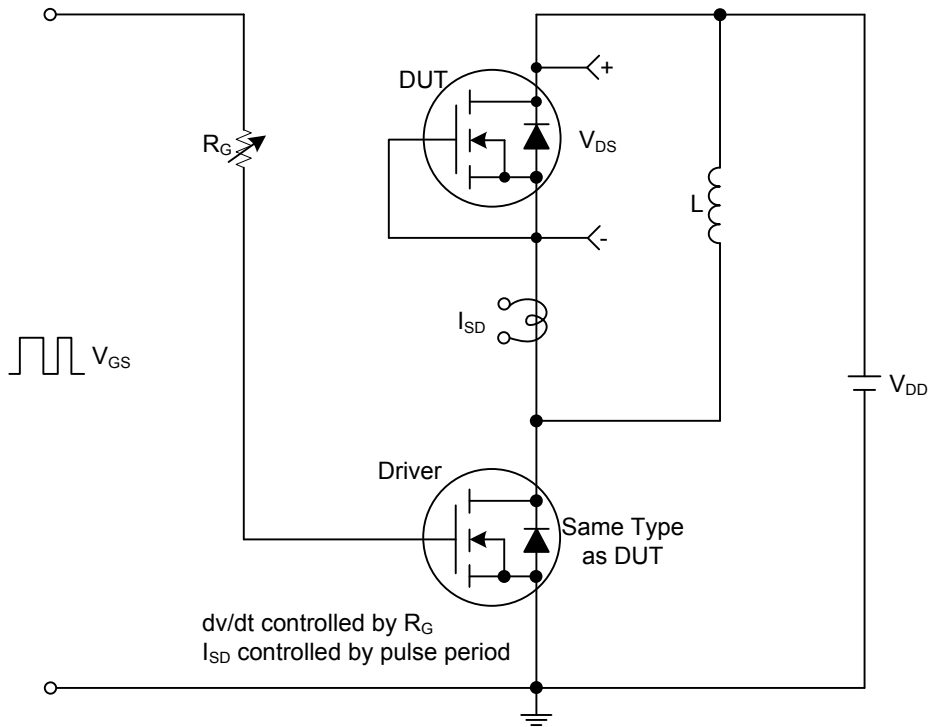


**Unclamped Inductive Switching Test Circuit**



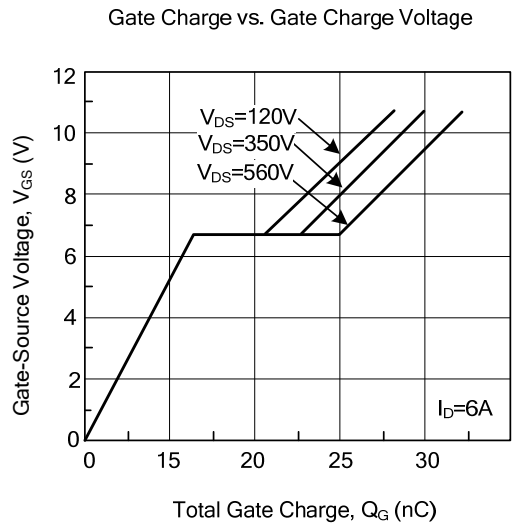
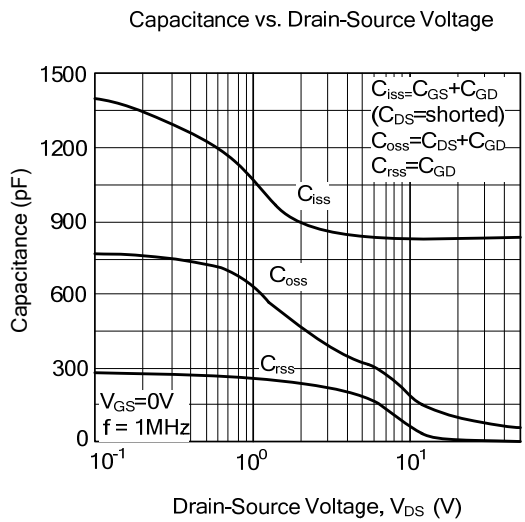
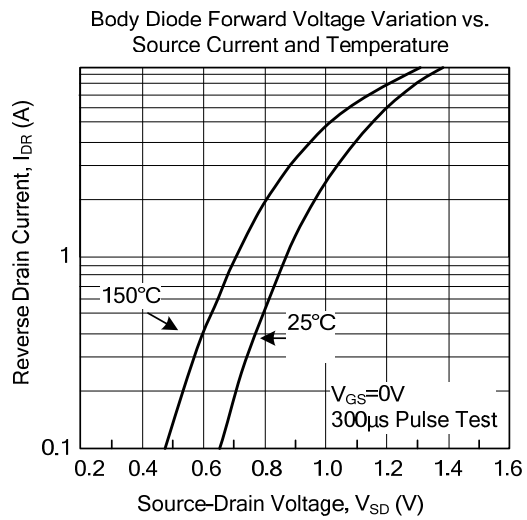
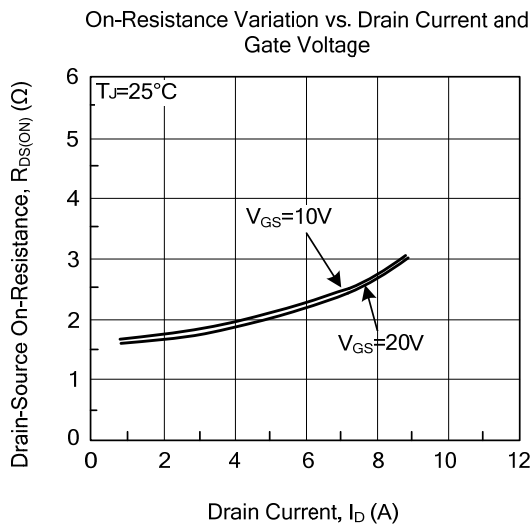
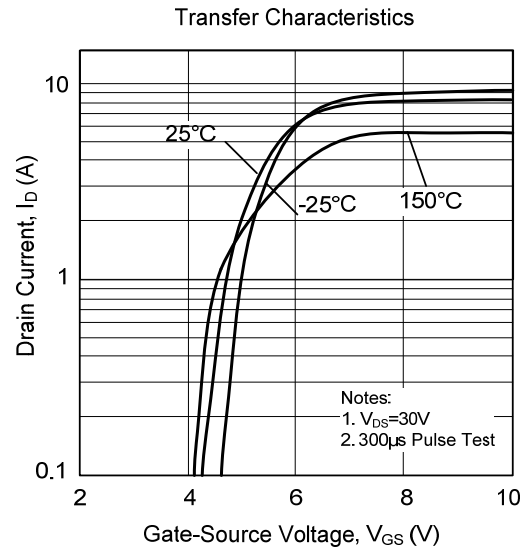
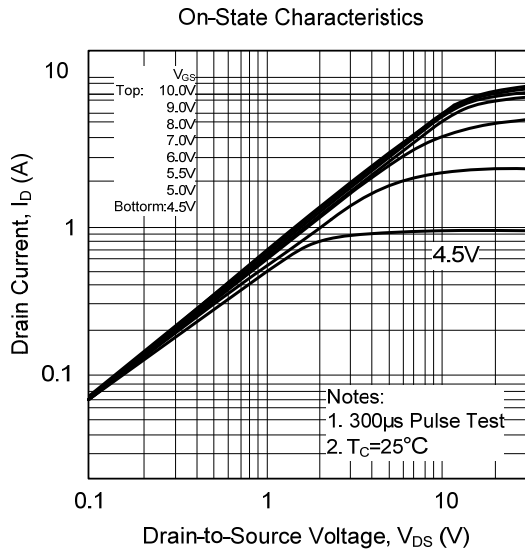
**Unclamped Inductive Switching Waveforms**

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

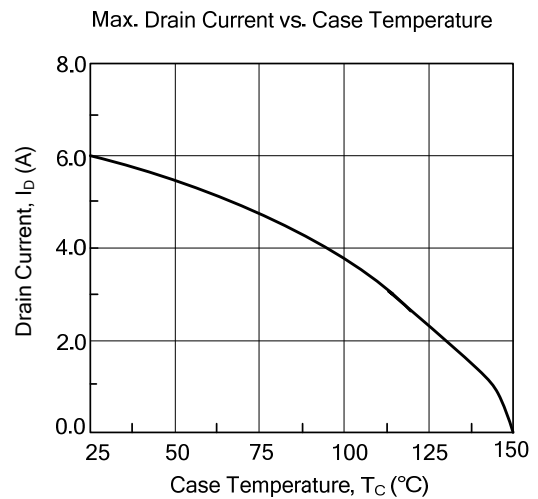
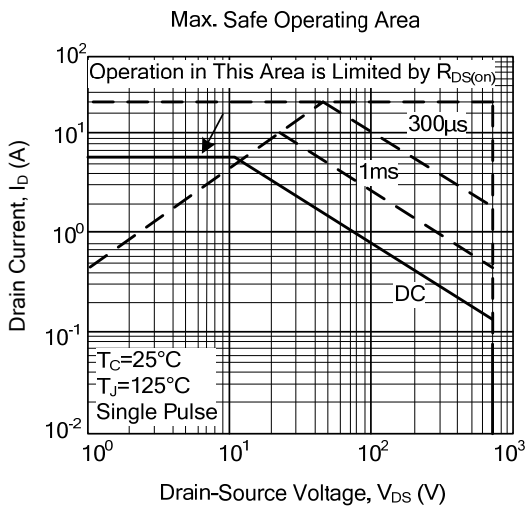
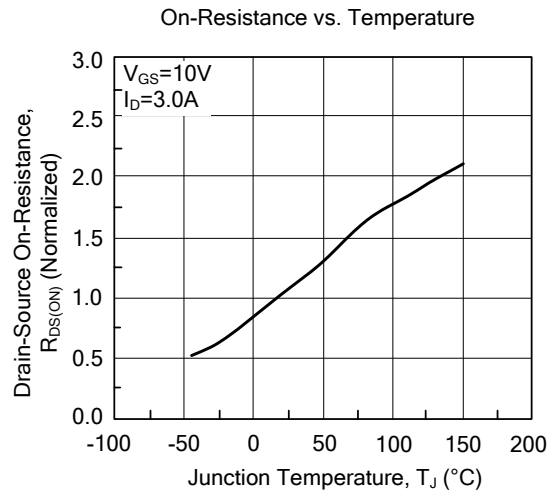
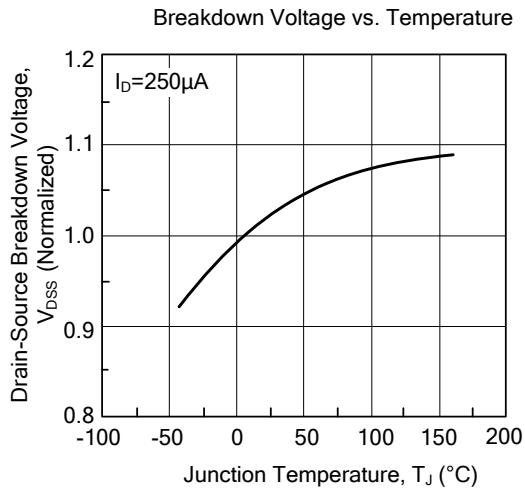


Peak Diode Recovery dv/dt Test Circuit and Waveforms

## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS (Cont.)



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