



## 7N60A

### Power MOSFET

## 7 Amps, 600/650 Volts N-CHANNEL POWER MOSFET

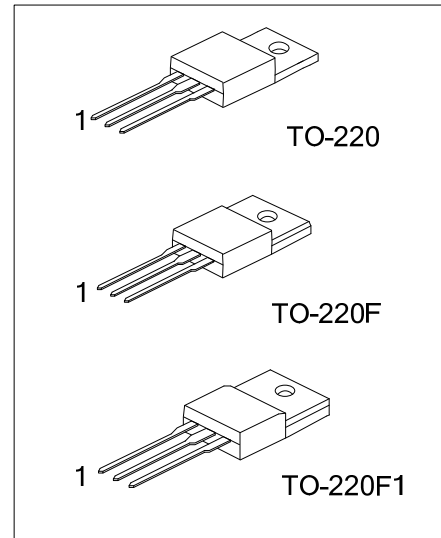
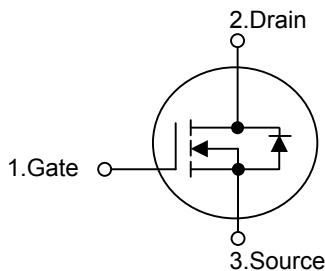
### DESCRIPTION

The UTC **7N60A** is a high voltage N-Channel enhancement mode power field effect transistors and is designed to have minimize on-state resistance , provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. This power MOSFET is well suited for high efficiency switch mode power supply.

### FEATURES

- \*  $R_{DS(ON)} = 1.2\Omega @ V_{GS} = 10 V$
- \* Ultra low gate charge (typical 28 nC )
- \* Low reverse transfer Capacitance ( $C_{RSS}$ = typical 12 pF )
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

### SYMBOL



Lead-free: 7N60AL  
Halogen-free: 7N60AG

### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free Plating	Halogen Free		1	2	3	
7N60AL-x-TA3-T	7N60AG-x-TA3-T	TO-220	G	D	S	Tube
7N60AL-x-TF1-T	7N60AG-x-TF1-T	TO-220F1	G	D	S	Tube
7N60AL-x-TF3-T	7N60AG-x-TF3-T	TO-220F	G	D	S	Tube

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

<p>7N60AL-x-TA3-T</p>	<p>(1) T: Tube (2) TA3: TO-220, TF1: TO220-F1, TF3: TO-220F (3) A: 600V, B: 650V (4) G: Halogen Free, L: Lead Free</p>
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■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	7N60A-A	$V_{DSS}$	600	V
	7N60A-B		650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	7	A
Continuous Drain Current		$I_D$	7	A
Pulsed Drain Current (Note 2)		$I_{DM}$	28	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	330	mJ
	Repetitive (Note 2)	$E_{AR}$	7.5	mJ
Power Dissipation	TO-220	$P_D$	65	W
	TO-220F/TO-220F1		30	W
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  $T_{J(MAX)}$

3.  $L = 12.05\text{mH}$ ,  $I_{AS} = 7.4\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 27\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	$\theta_{JA}$	83.3	$^\circ\text{C/W}$
	TO-220F/TO-220F1	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
Junction to Case	TO-220	$\theta_{JC}$	1.92	$^\circ\text{C/W}$
	TO-220F/TO-220F1	$\theta_{JC}$	4.16	$^\circ\text{C/W}$

■ 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	7N60A-A	$BV_{DSS}$	$V_{GS} = 0\text{V}$ , $I_D = 250\ \mu\text{A}$	600			V
	7N60A-B			650			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS} = 600\text{V}$ , $V_{GS} = 0\text{V}$			10	$\mu\text{A}$
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
<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		$R_{DS(ON)}$	$V_{GS} = 10\text{V}$ , $I_D = 3.5\text{A}$ (Note 4)		1.0	1.2	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance		$C_{ISS}$	$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1.0\text{MHz}$		950	1430	pF
Output Capacitance		$C_{OSS}$			85	130	pF
Reverse Transfer Capacitance		$C_{RSS}$			12	18	pF
<b>SWITCHING CHARACTERISTICS</b>							
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD} = 300\text{V}$ , $I_D = 7\text{A}$ , $R_G = 25\ \Omega$ (Note 1, 2)		16		ns
Turn-On Rise Time		$t_R$			60		ns
Turn-Off Delay Time		$t_{D(OFF)}$			80		ns
Turn-Off Fall Time		$t_F$			65		ns
Total Gate Charge		$Q_G$	$V_{DS} = 300\text{V}$ , $I_D = 7\text{A}$ , $V_{GS} = 10\text{V}$ (Note 1, 2)		28	42	nC
Gate-Source Charge		$Q_{GS}$			5.5	8.3	nC
Gate-Drain Charge		$Q_{GD}$			11	17	nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_S = 7A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				7	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				28	A
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0V, I_S = 7A,$		365		ns
Reverse Recovery Charge	$Q_{RR}$	$dI_F / dt = 100A/\mu s$ (Note 1)		4.23		$\mu C$

Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

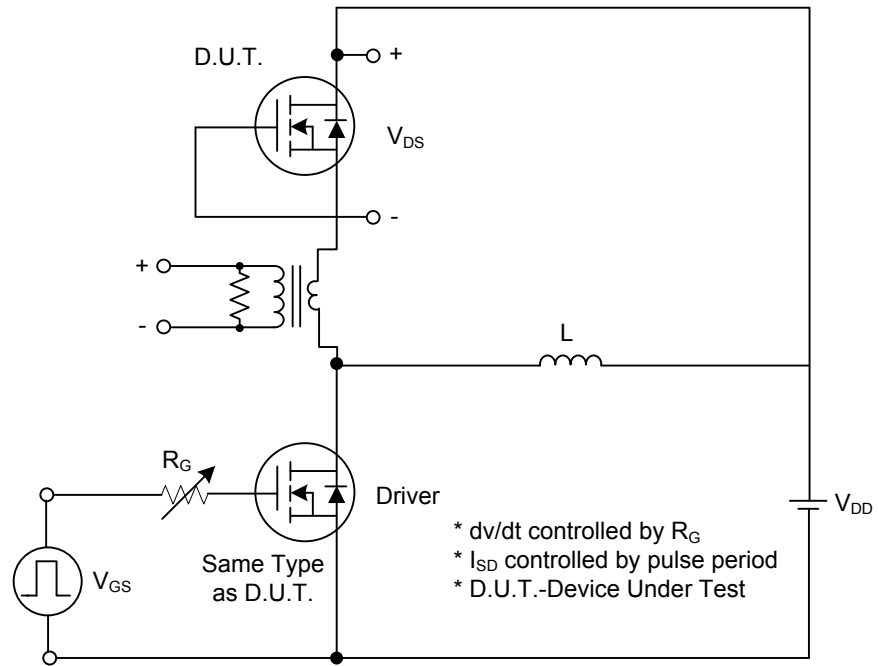


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

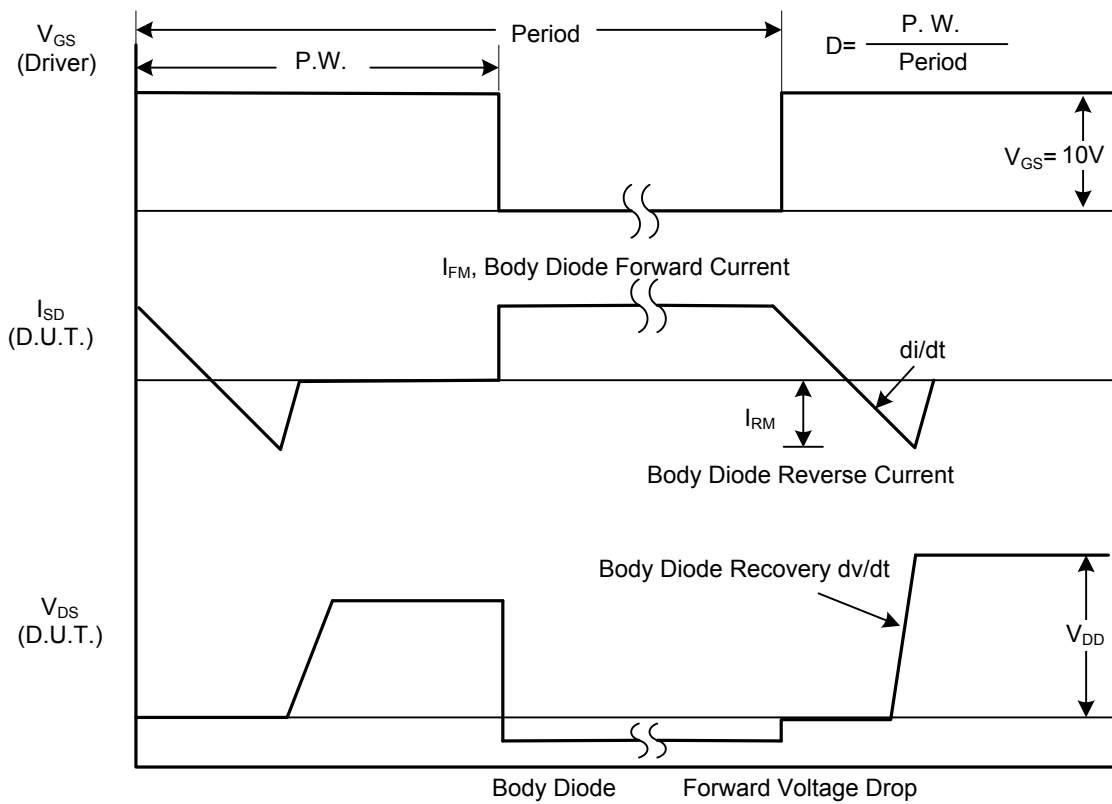


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

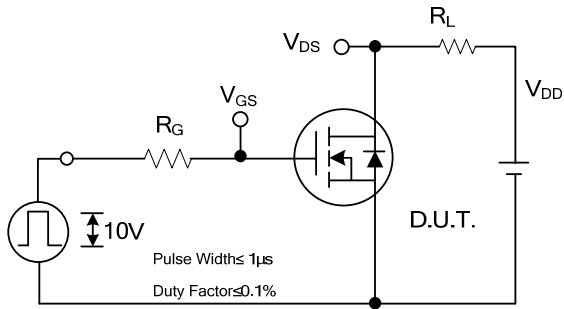


Fig. 2A Switching Test Circuit

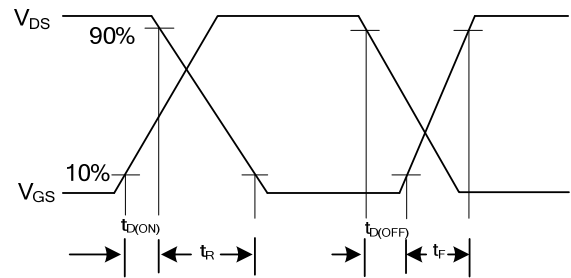


Fig. 2B Switching Waveforms

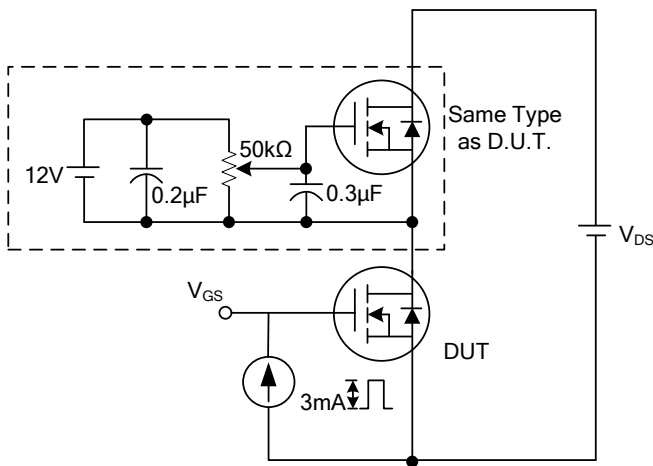


Fig. 3A Gate Charge Test Circuit

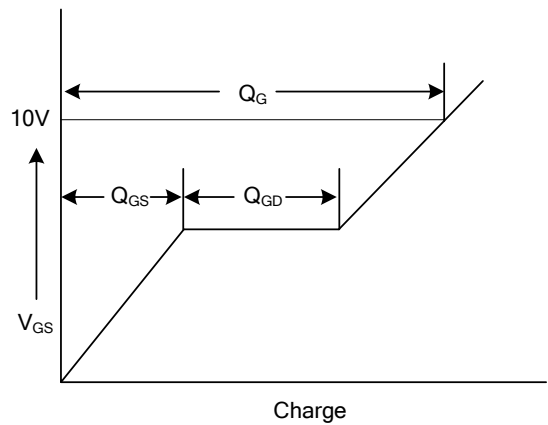


Fig. 3B Gate Charge Waveform

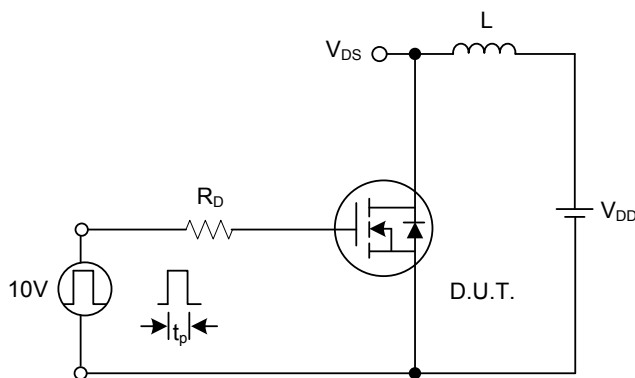


Fig. 4A Unclamped Inductive Switching Test Circuit

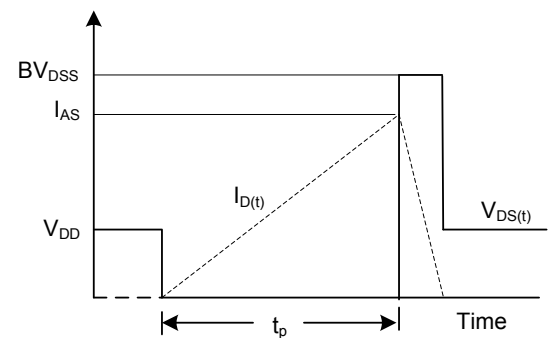
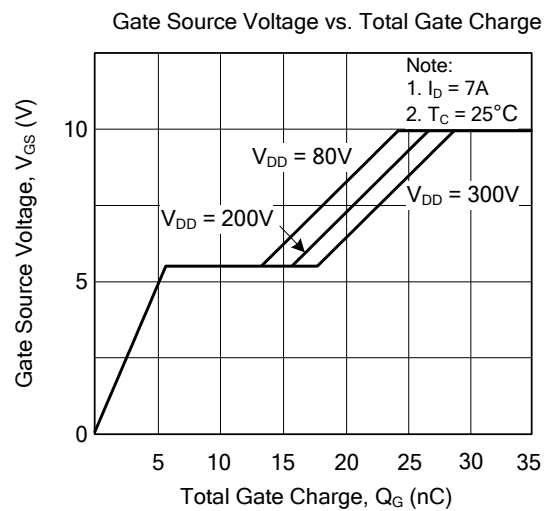
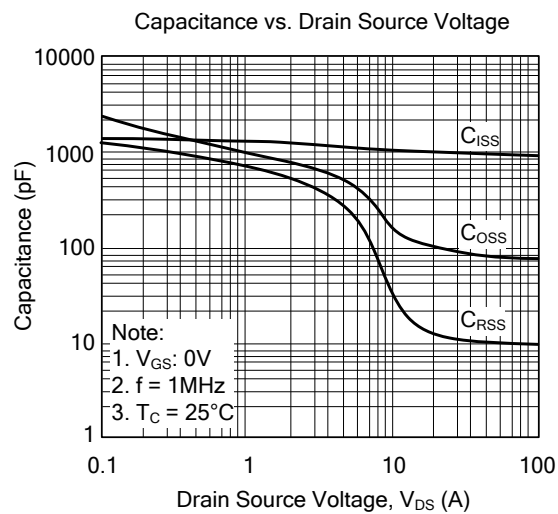
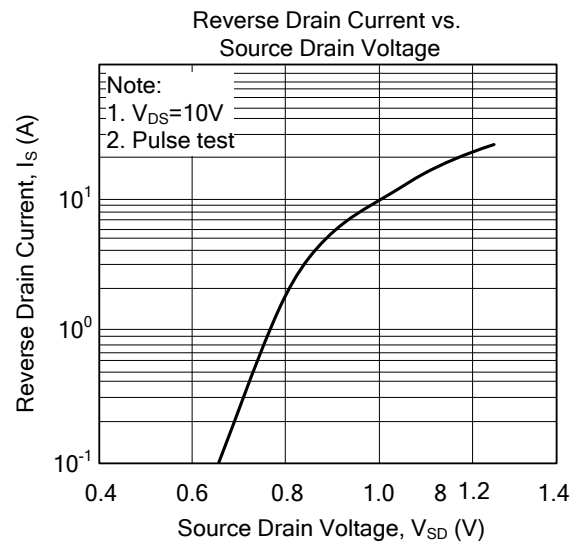
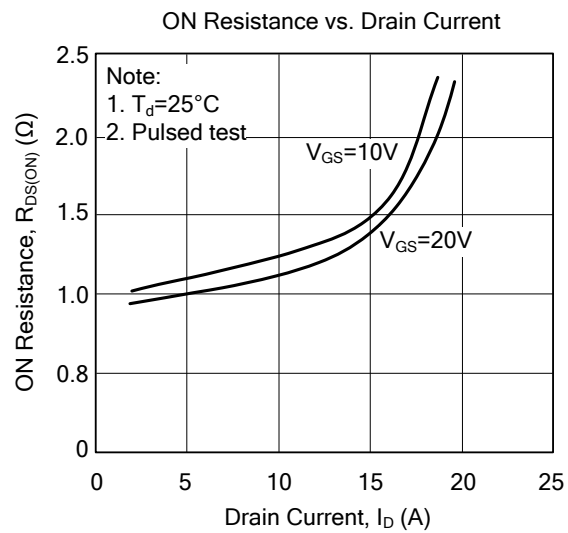
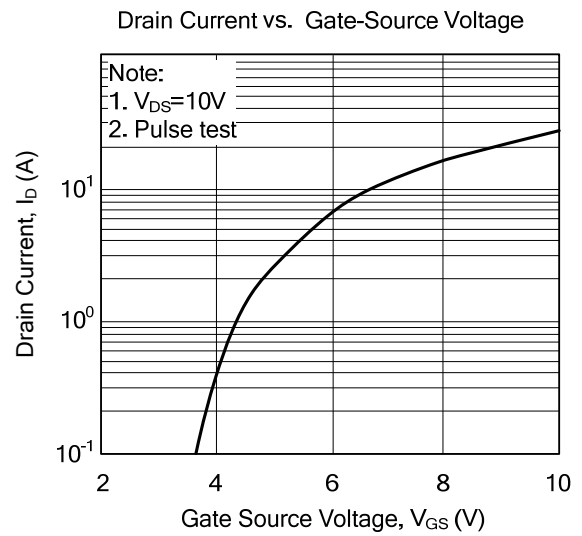
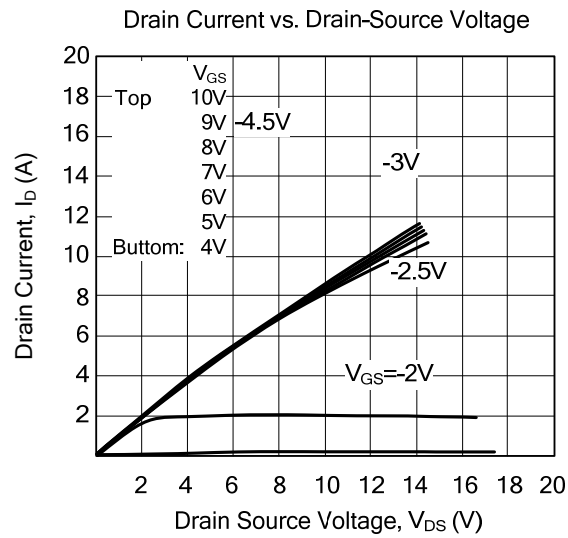
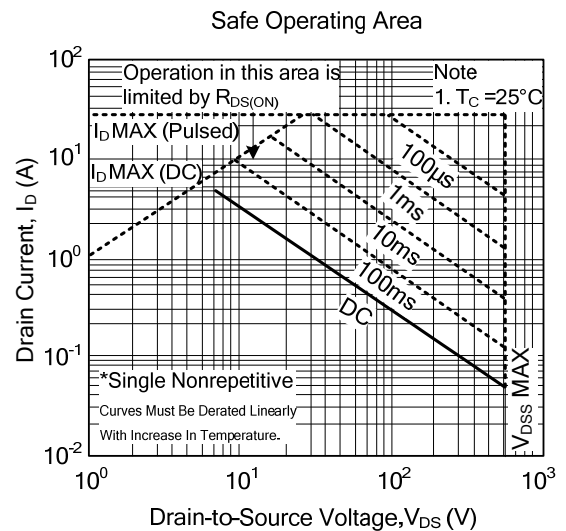
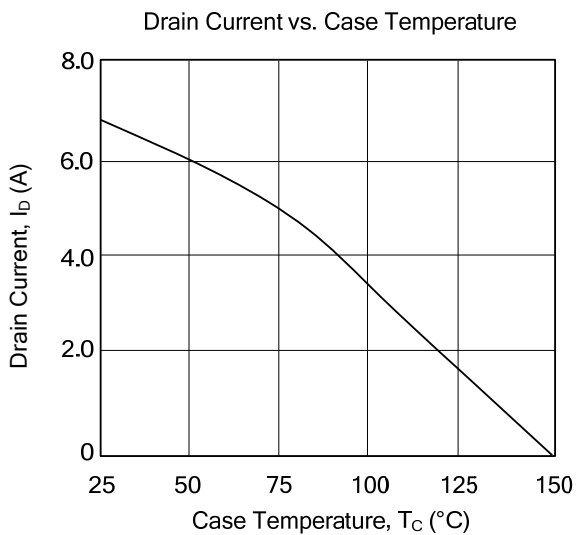
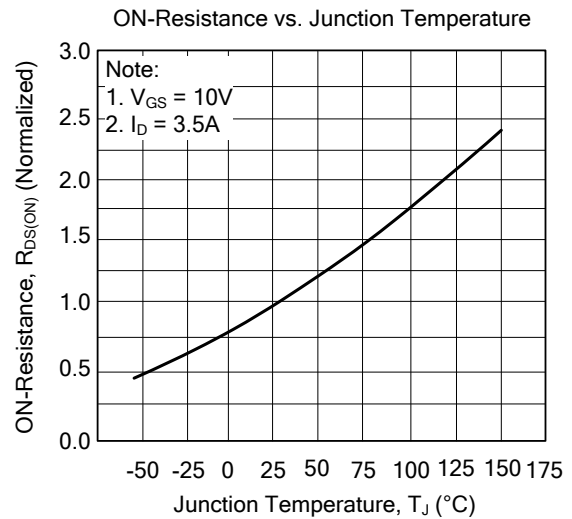
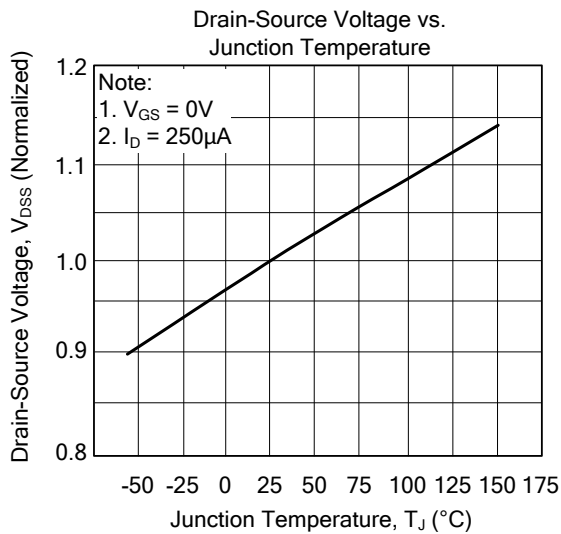


Fig. 4B Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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