



# 3N90

**Power MOSFET**

## 3.0A, 900V N-CHANNEL POWER MOSFET

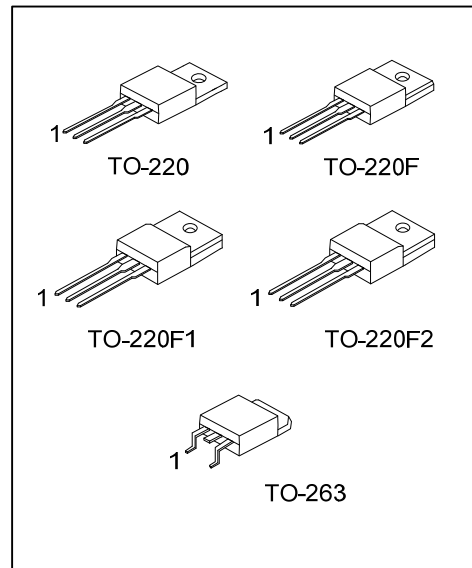
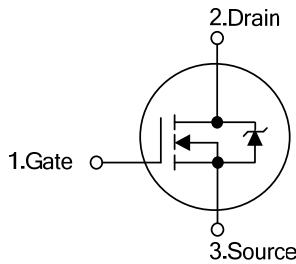
■ DESCRIPTION

The UTC **3N90** provides excellent  $R_{DS(ON)}$ , low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

■ FEATURES

- \*  $R_{DS(ON)} \leq 3.5 \Omega @ V_{GS}=10V, I_D=1.5A$
- \* Fast Switching Capability
- \* Avalanche Energy Specified
- \* Improved dv/dt Capability, High Ruggedness

■ SYMBOL



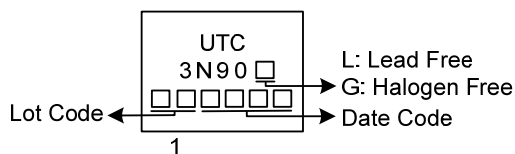
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
3N90L-TA3-T	3N90G-TA3-T	TO-220	G	D	S	Tube
3N90L-TF3-T	3N90G-TF3-T	TO-220F	G	D	S	Tube
3N90L-TF1-T	3N90G-TF1-T	TO-220F1	G	D	S	Tube
3N90L-TF2-T	3N90G-TF2-T	TO-220F2	G	D	S	Tube
3N90L-TQ2-T	3N90G-TQ2-T	TO-263	G	D	S	Tube
3N90L-TQ2-R	3N90G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>3N90G-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1 TF2: TO-220F2, TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	900	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	3	A
	Pulsed (Note 2)	$I_{DM}$	12	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	195	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.85	V/ns
Power Dissipation	TO-220/TO-263	$P_D$	90	W
	TO-220F/TO-220F1		36	W
	TO-220F2		37	W
Junction Temperature		$T_J$	-40 ~ +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.  $L=30\text{mH}$ ,  $I_{AS}=3.6\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 4.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/ TO-263	$\theta_{JC}$	1.38	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	
	TO-220F2		3.37	

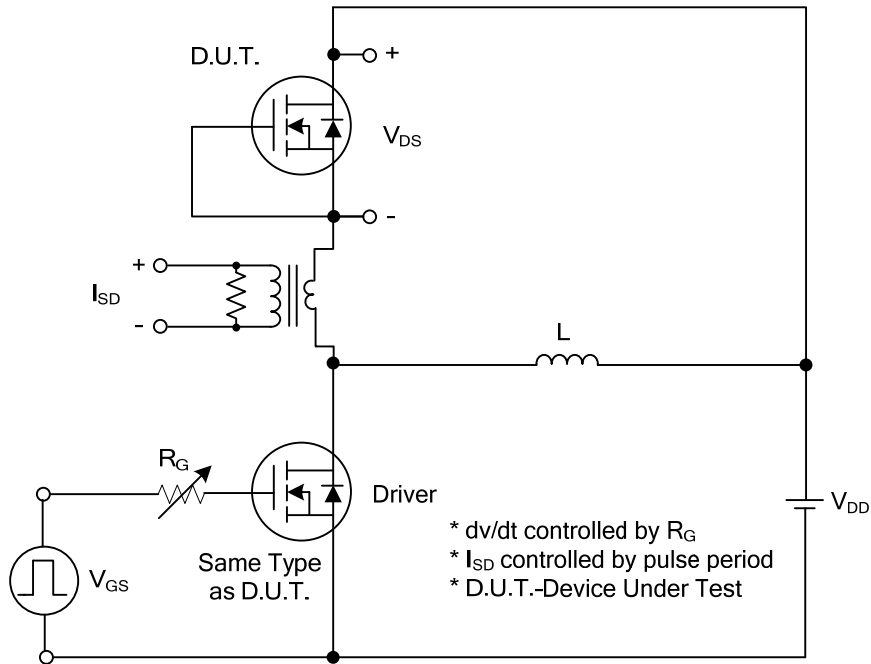
■ ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	900			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=900V, V_{GS}=0V$			10	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 30V, V_{DS}=0V$			$\pm 10$	$\mu A$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	3.0		5.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=1.5A$			3.5	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$		850		pF
Output Capacitance	$C_{OSS}$			95		pF
Reverse Transfer Capacitance	$C_{RSS}$			10		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=100V, V_{GS}=10V, I_D=4A$ $I_G=1\text{mA}$ (Note 1, 2)		27		nC
Gate-Source Charge	$Q_{GS}$			10		nC
Gate-Drain Charge	$Q_{GD}$			7.8		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=100V, V_{GS}=10V, I_D=4A,$ $R_G=25\Omega$ (Note 1, 2)		14		ns
Turn-On Rise Time	$t_R$			17		ns
Turn-Off Delay Time	$t_{D(OFF)}$			70		ns
Turn-Off Fall Time	$t_F$			48		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				3	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				12	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_S=3.0A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	$t_{rr}$	$I_S=4.0A, V_{GS}=0V,$ $di_F/dt=100A/\mu s$		461		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$				9.2	

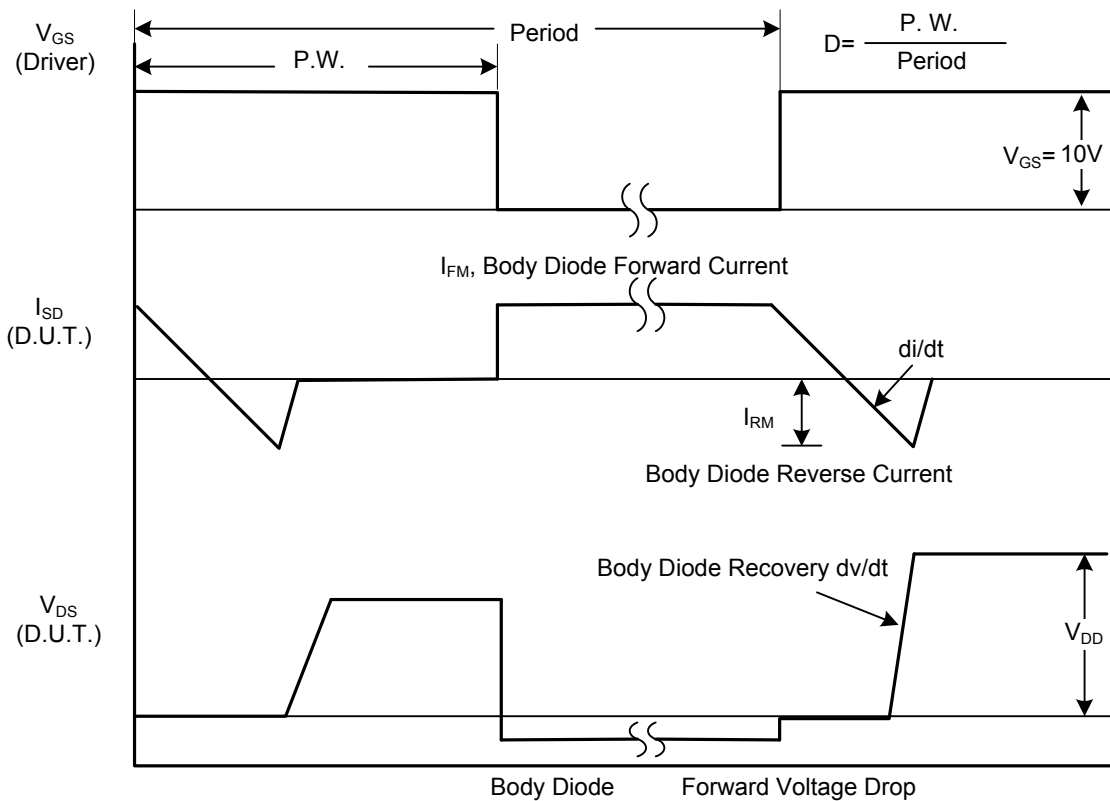
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

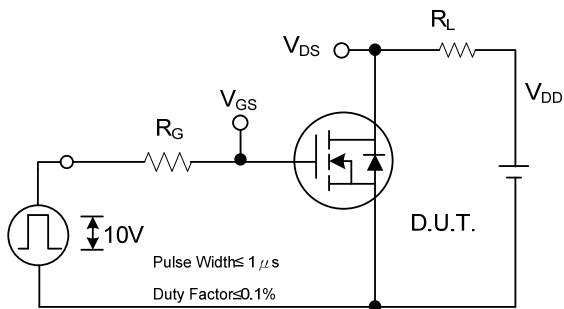


Peak Diode Recovery  $dv/dt$  Test Circuit

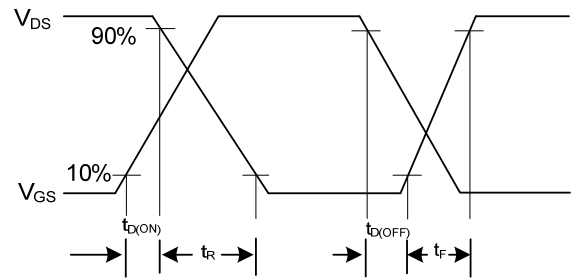


Peak Diode Recovery  $dv/dt$  Waveforms

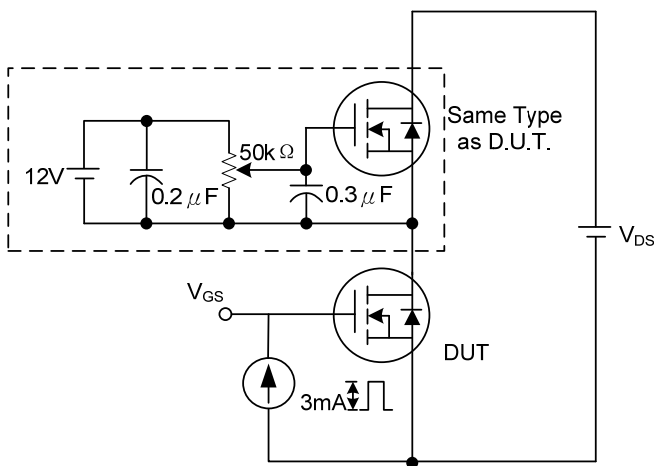
## TEST CIRCUITS AND WAVEFORMS



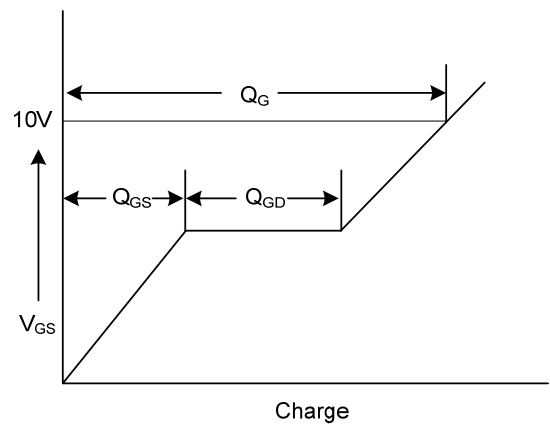
**Fig. 2A Switching Test Circuit**



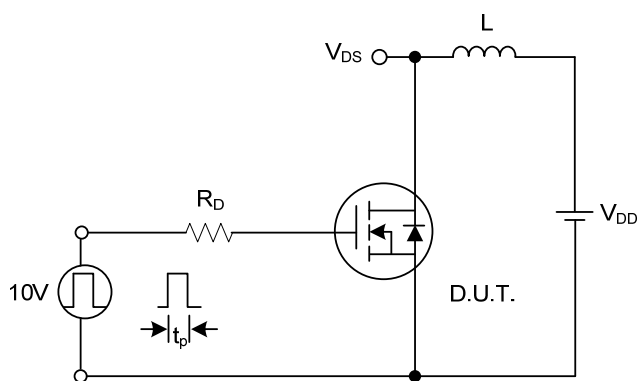
**Fig. 2B Switching Waveforms**



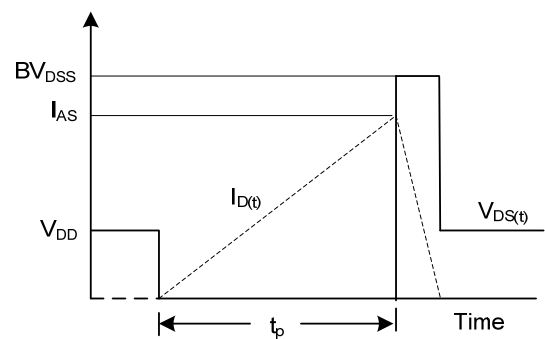
**Fig. 3A Gate Charge Test Circuit**



**Fig. 3B Gate Charge Waveform**

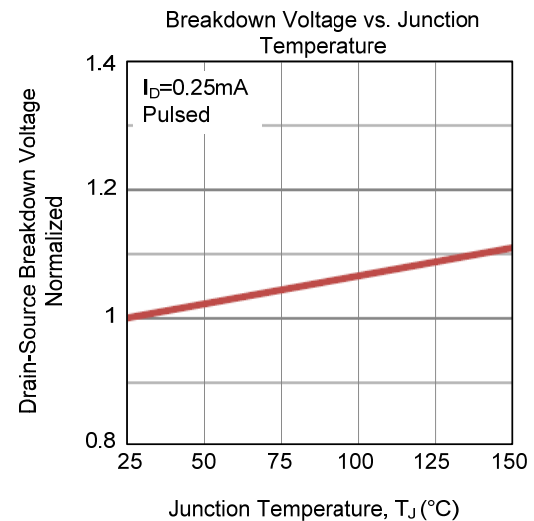
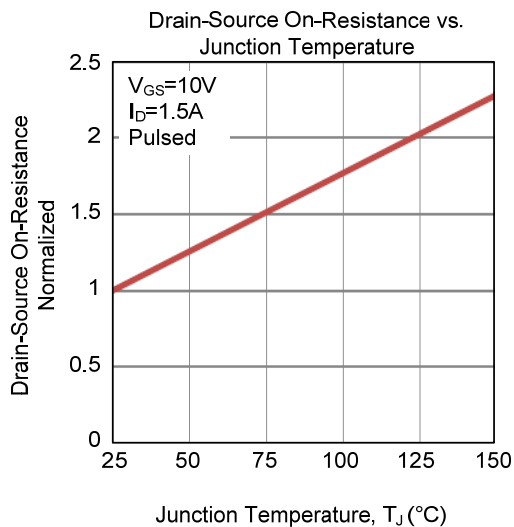
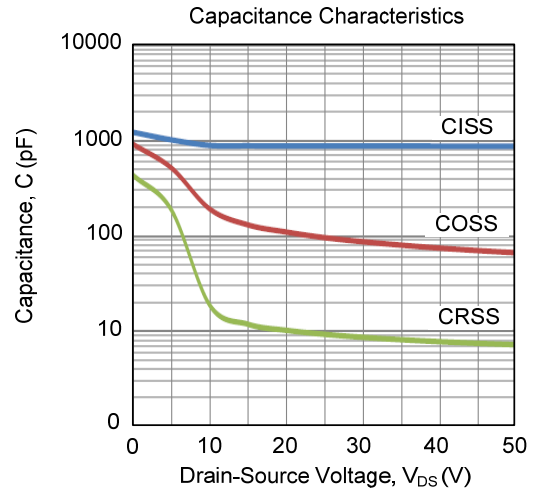
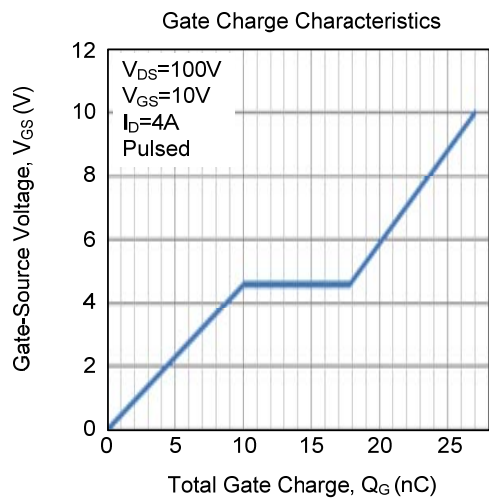
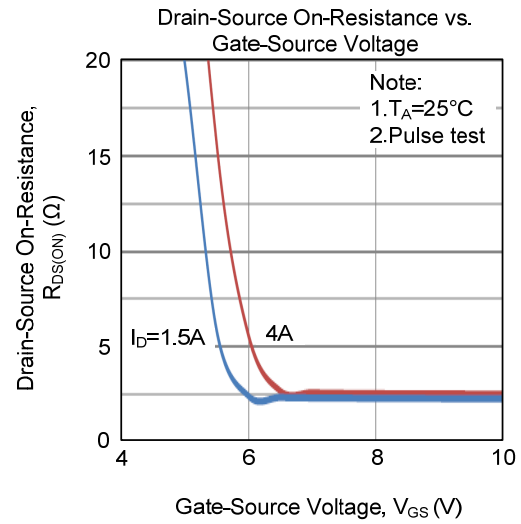
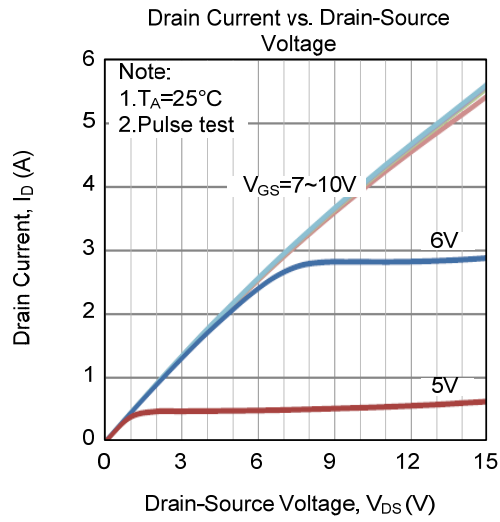


**Fig. 4A Unclamped Inductive Switching Test Circuit**

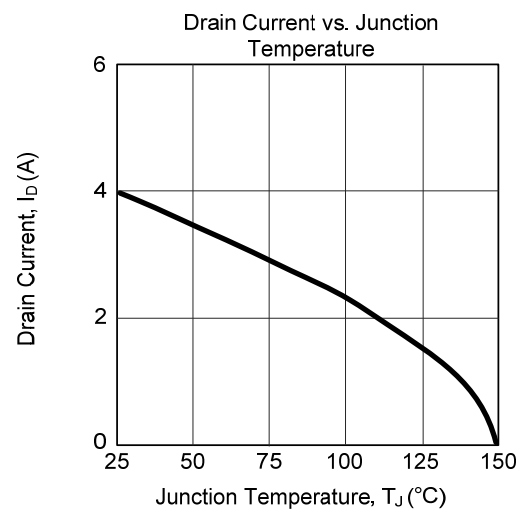
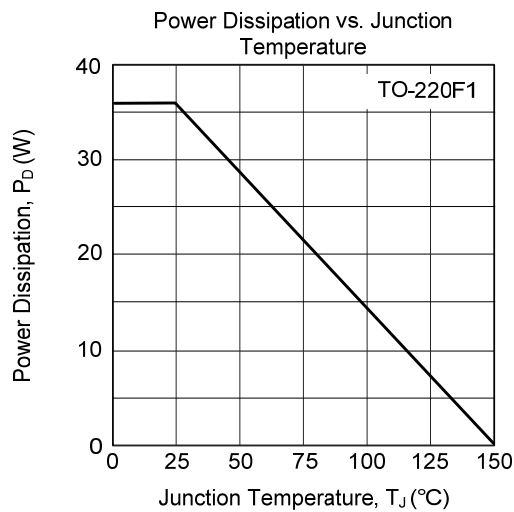
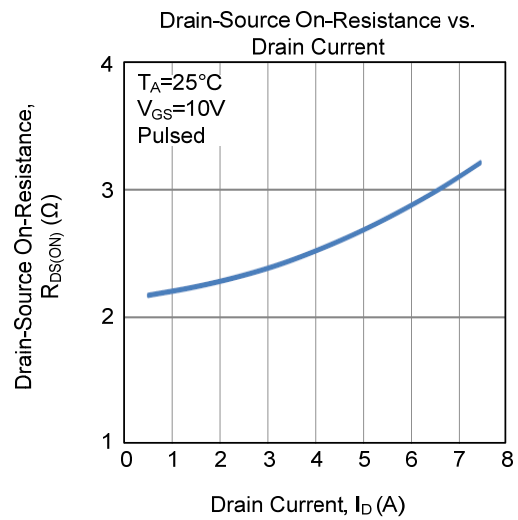
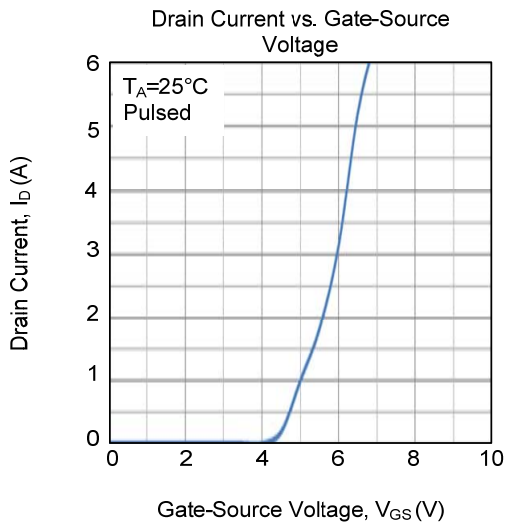
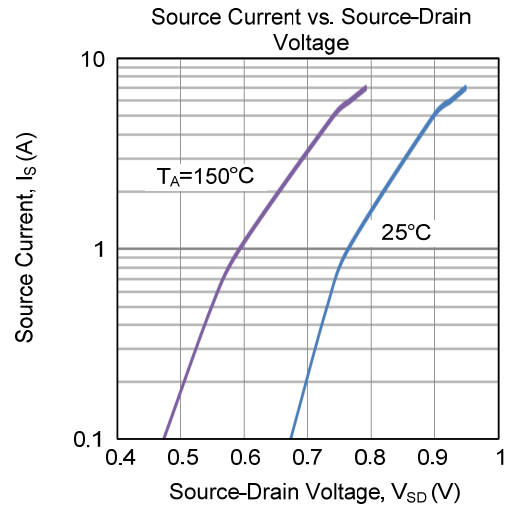
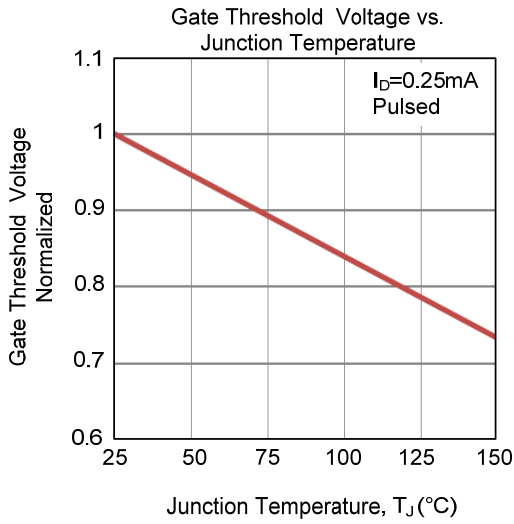


**Fig. 4B Unclamped Inductive Switching Waveforms**

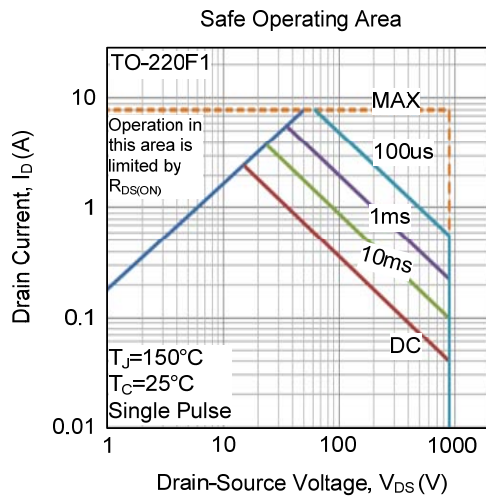
## TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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