



## 6NM90

Power MOSFET

### 6A, 900V N-CHANNEL SUPER-JUNCTION MOSFET

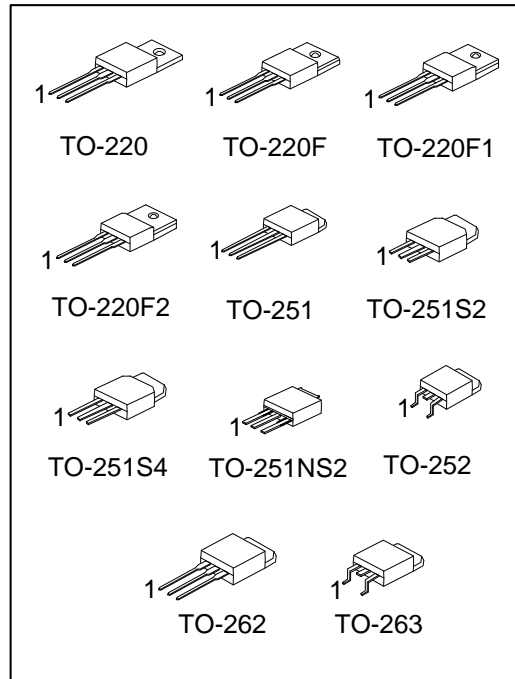
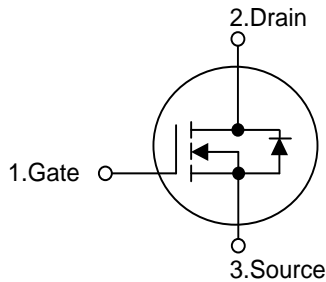
#### DESCRIPTION

The UTC 6NM90 is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

#### FEATURES

- \*  $R_{DS(ON)} \leq 1.9 \Omega @ V_{GS}=10V, I_D=3.0A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



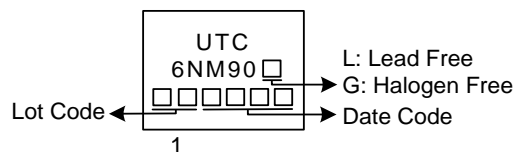
### ■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6NM90L-TA3-T	6NM90G-TA3-T	TO-220	G	D	S	Tube
6NM90L-TF1-T	6NM90G-TF1-T	TO-220F1	G	D	S	Tube
6NM90L-TF2-T	6NM90G-TF2-T	TO-220F2	G	D	S	Tube
6NM90L-TF3-T	6NM90G-TF3-T	TO-220F	G	D	S	Tube
6NM90L-TM3-T	6NM90G-TM3-T	TO-251	G	D	S	Tube
6NM90L-TMS2-T	6NM90G-TMS2-T	TO-251S2	G	D	S	Tube
6NM90L-TMS4-T	6NM90G-TMS4-T	TO-251S4	G	D	S	Tube
6NM90L-TMN2-T	6NM90G-TMN2-T	TO-251NS2	G	D	S	Tube
6NM90L-TN3-R	6NM90G-TN3-R	TO-252	G	D	S	Tape Reel
6NM90L-T2Q-T	6NM90G-T2Q-T	TO-262	G	D	S	Tube
6NM90L-TQ2-T	6NM90G-TQ2-T	TO-263	G	D	S	Tube
6NM90L-TQ2-R	6NM90G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>6NM90G-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, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TM3: TO-251, TMS2: TO-251S2, TMN2: TO-251NS2, TMS4: TO-251S4, TN3: TO-252, T2Q: TO-262, 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
Continuous Drain Current	Continuous	$I_D$	6.0	A
Pulsed Drain Current	Pulsed (Note 2)	$I_{DM}$	24	A
Single Pulsed Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	50.88	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.25	V/ns
Power Dissipation	TO-220/TO-262 TO-263	$P_D$	50	W
	TO-220F/TO-220F1 TO-220F2		26	W
	TO-251/TO-251S2 TO-251S4/TO-251NS2 TO-252		45	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 maximum junction temperature.

3.  $L = 159\text{mH}$ ,  $I_{AS} = 0.8\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .

4.  $I_{SD} \leq 6.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .

### ■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-262/TO-263	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S2 TO-251S4/TO-251NS2 TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-262 TO-263	$\theta_{JC}$	2.5	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2		4.81	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S2 TO-251S4/TO-251NS2 TO-252		2.78 (Note)	$^\circ\text{C}/\text{W}$

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

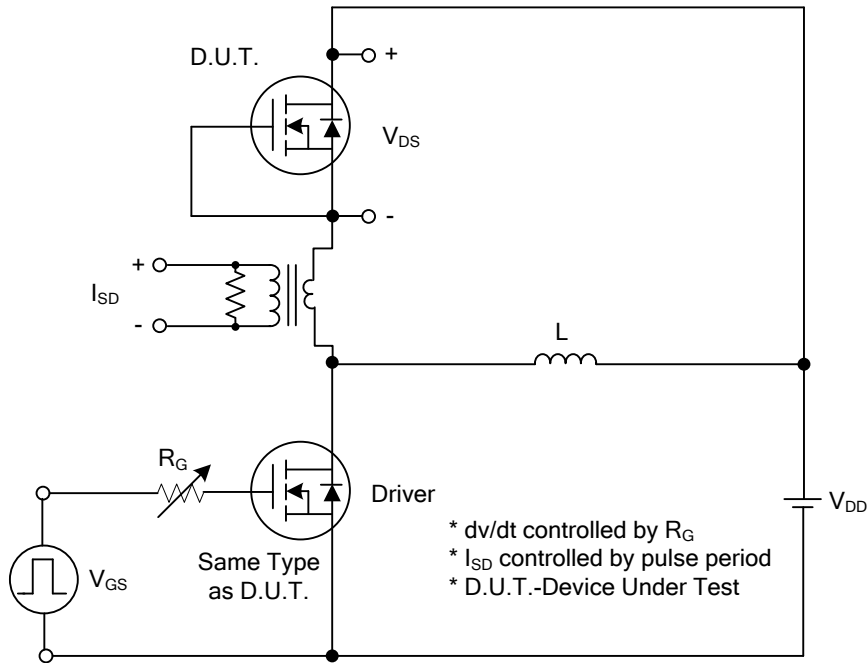
■ **ELECTRICAL CHARACTERISTICS** ( $T_J=25^\circ\text{C}$ , unless otherwise specified)

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	Forward	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$		-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 3.0A$			1.9	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$		500		pF
Output Capacitance	$C_{OSS}$			165		pF
Reverse Transfer Capacitance	$C_{RSS}$			4		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=100V, V_{GS}=10V, I_D=6A,$ $I_G=1mA$ (Note 1,2)		19.6		nC
Gate to Source Charge	$Q_{GS}$			4.2		nC
Gate to Drain Charge	$Q_{GD}$			6.6		nC
Turn-ON Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD} = 100V, V_{GS}=10V, I_D = 6A,$ $R_G = 25\Omega, (Note 1,2)$		8		nS
Rise Time	$t_R$			18.5		nS
Turn-OFF Delay Time	$t_{D(OFF)}$			60		nS
Fall-Time	$t_F$			45		nS
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	$I_S$				6.0	A
Maximum Body-Diode Pulsed Current	$I_{SM}$				12	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_S=6.0A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	$t_{rr}$	$I_S=6.0A, V_{GS}=0V,$ $V_R=200V, di_F/dt=100A/\mu s$		500		nS
Body Diode Reverse Recovery Charge	$Q_{rr}$			5.6		$\mu C$

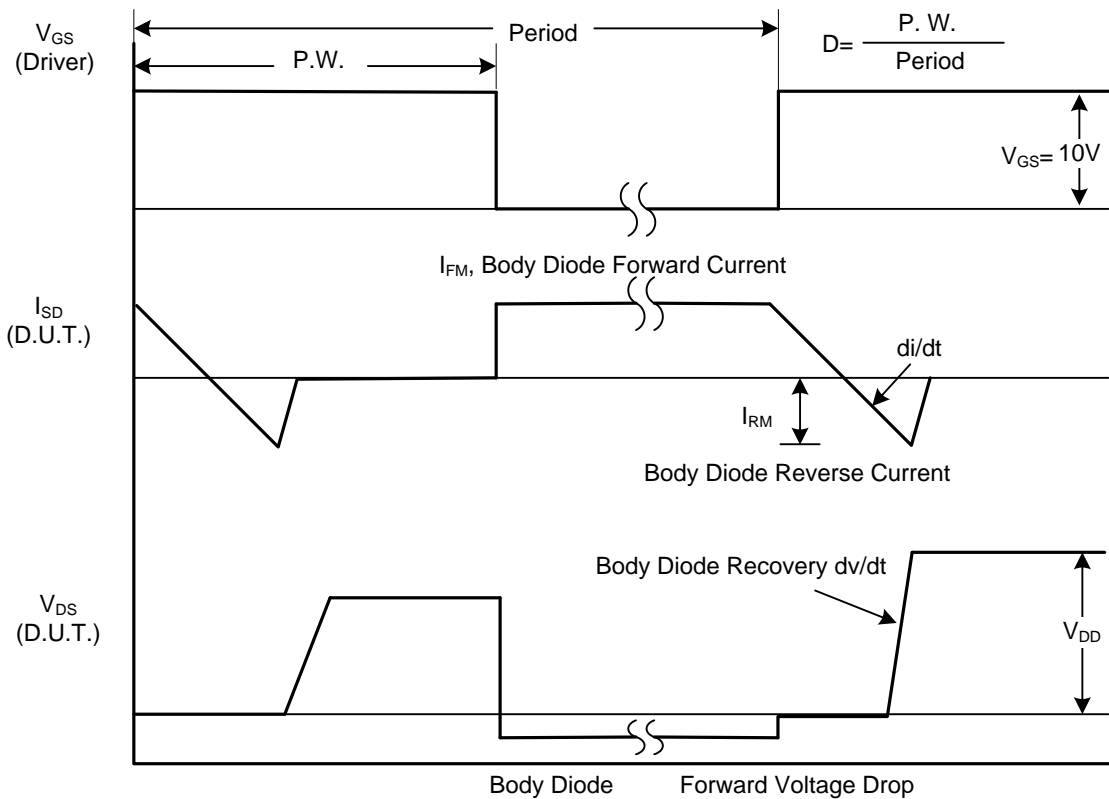
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS

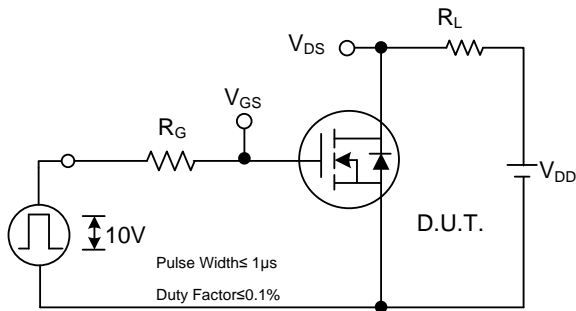


Peak Diode Recovery  $dv/dt$  Test Circuit

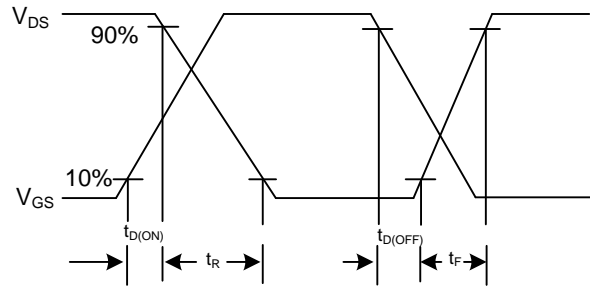


Peak Diode Recovery  $dv/dt$  Waveforms

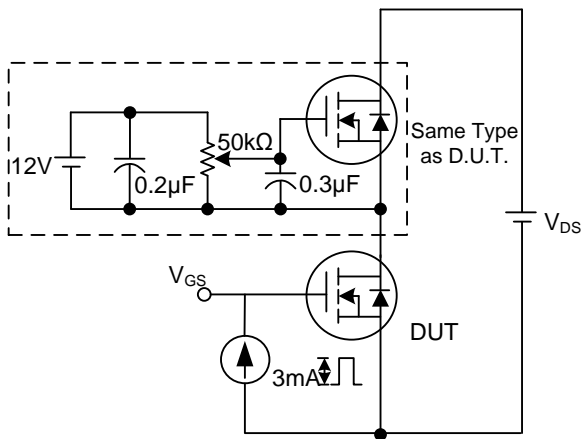
## TEST CIRCUITS AND WAVEFORMS



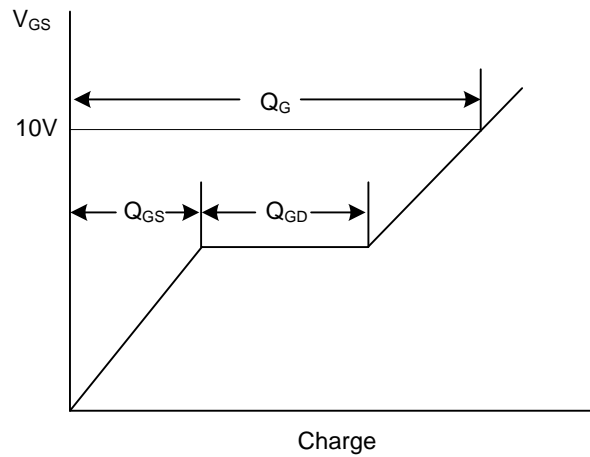
Switching Test Circuit



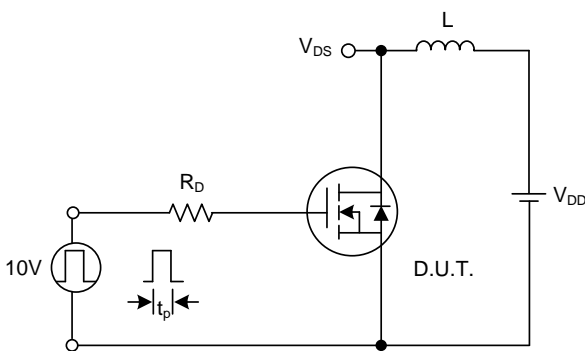
Switching Waveforms



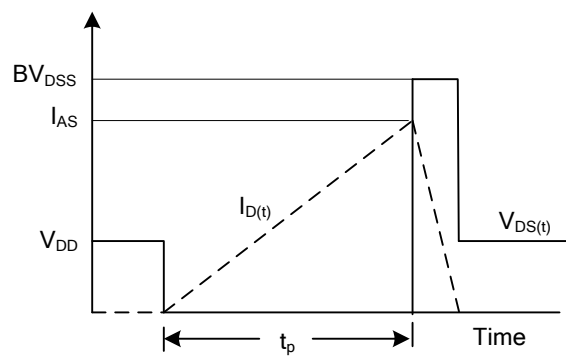
Gate Charge Test Circuit



Gate Charge Waveform

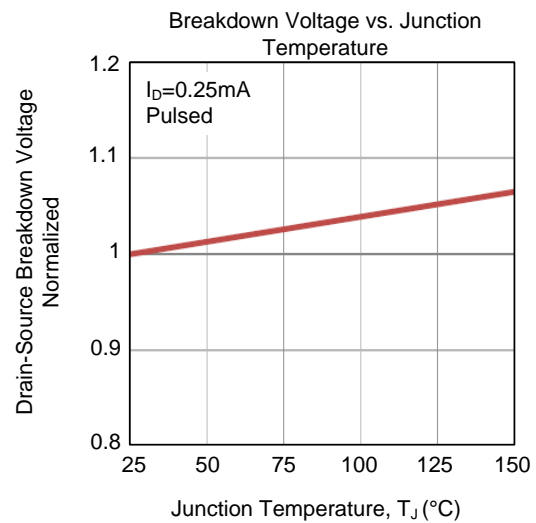
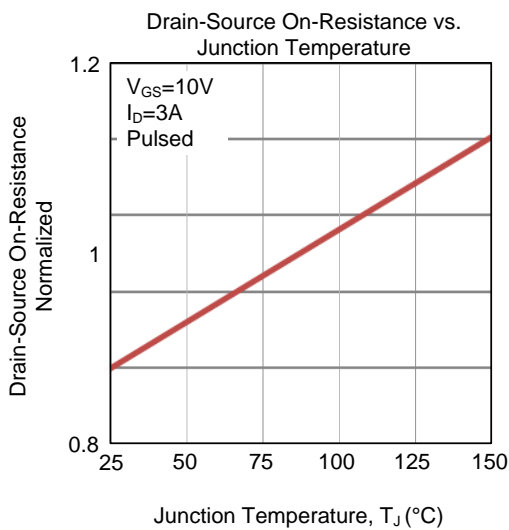
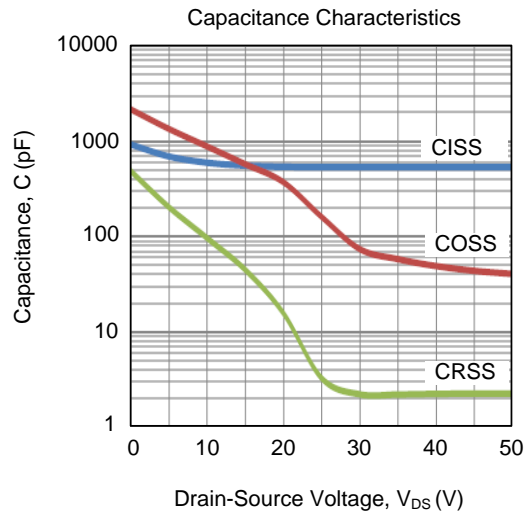
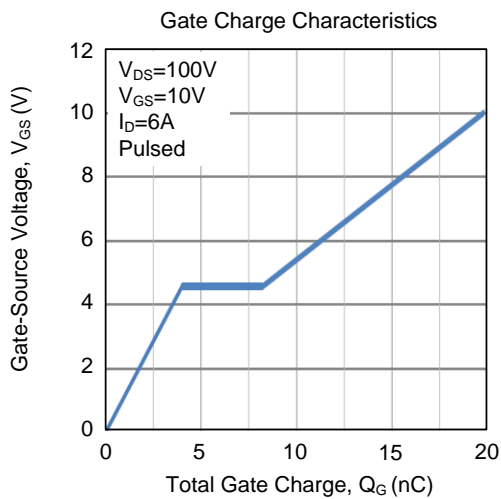
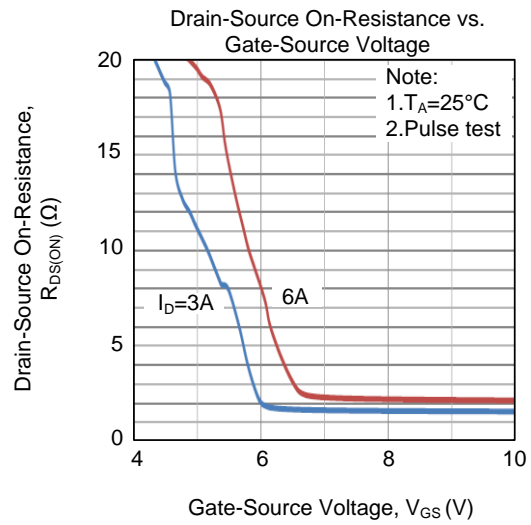
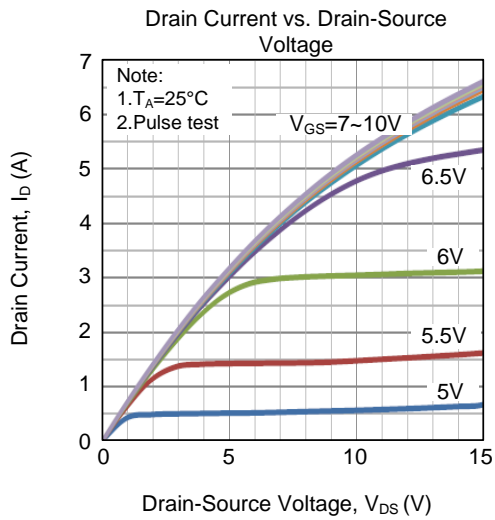


Unclamped Inductive Switching Test Circuit

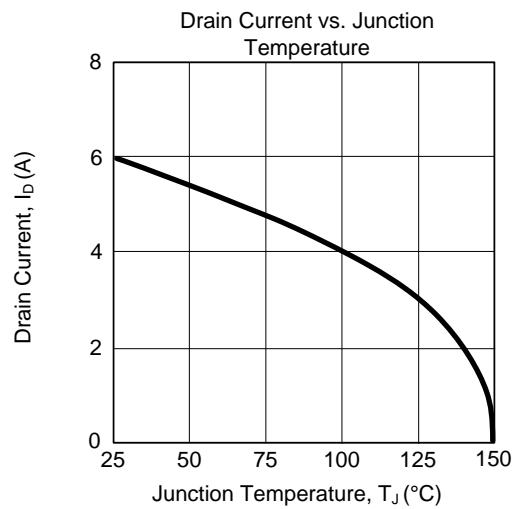
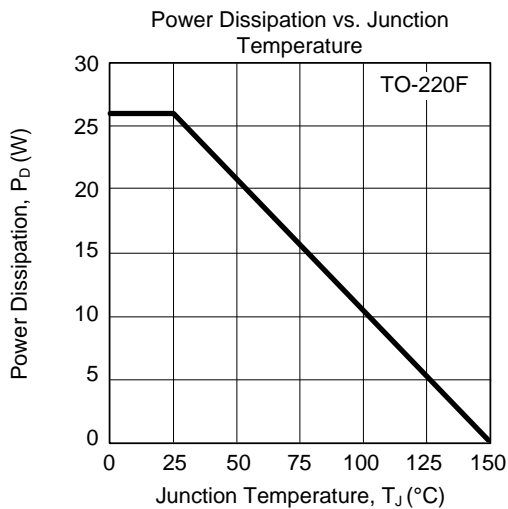
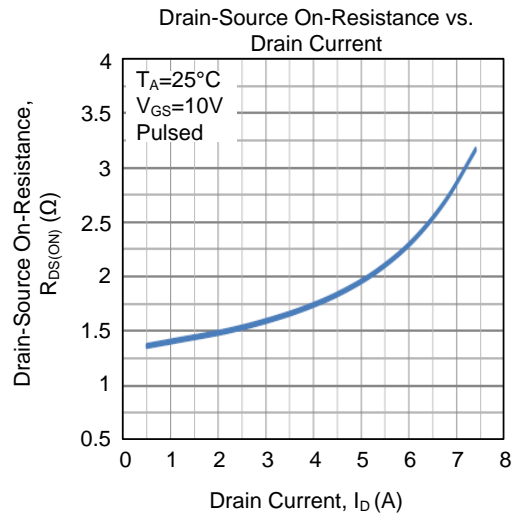
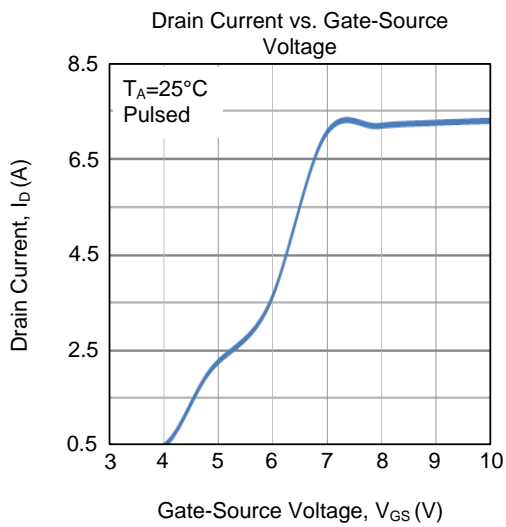
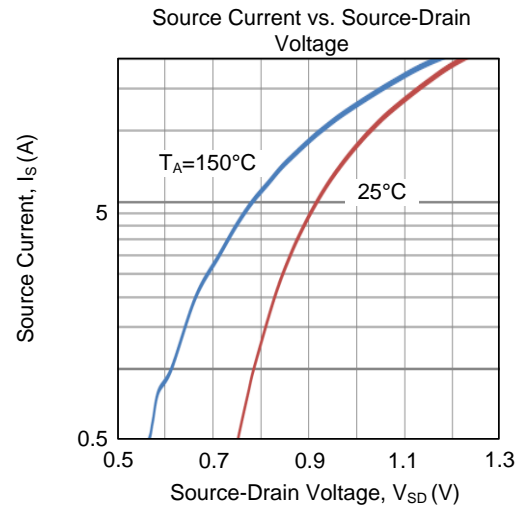
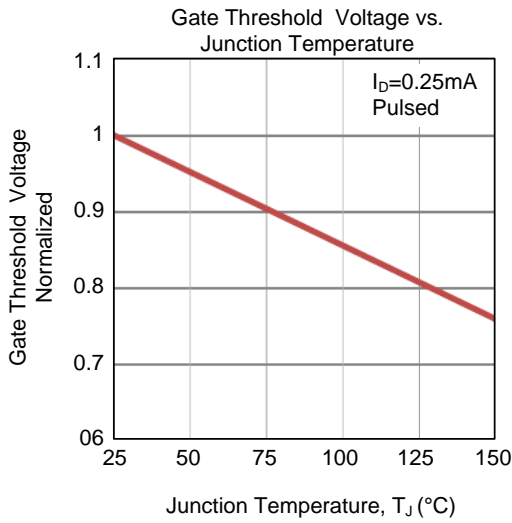


Unclamped Inductive Switching Waveforms

## ■ TYPICAL CHARACTERISTICS

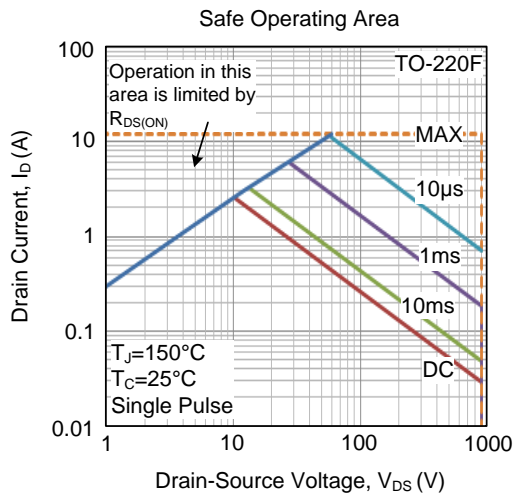


## ■ TYPICAL CHARACTERISTICS (Cont.)





■ **TYPICAL CHARACTERISTICS (Cont.)**



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