



# 4N90

## Power MOSFET

### 4A, 900V N-CHANNEL POWER MOSFET

#### DESCRIPTION

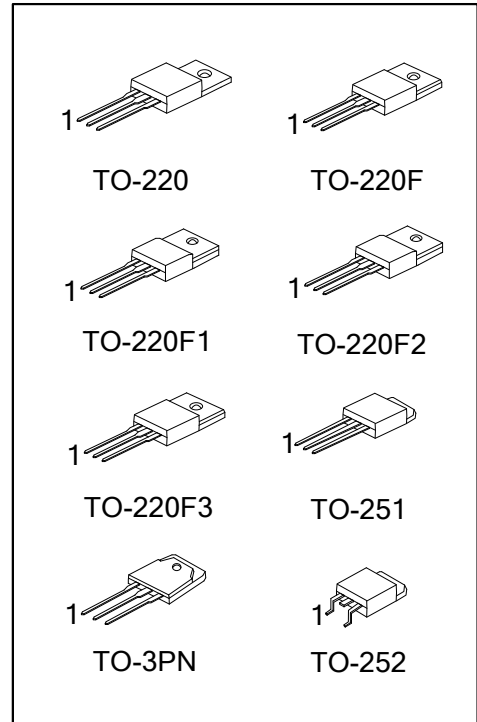
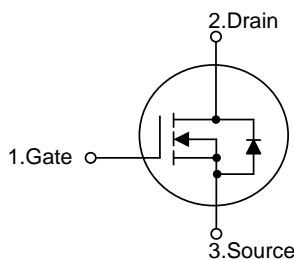
The UTC **4N90** is a N-channel enhancement MOSFET adopting UTC's advanced technology to provide customers with DMOS, planar stripe technology. This technology is designed to meet the requirements of the minimum on-state resistance and perfect switching performance. It also can withstand high energy pulse in the avalanche and communication mode.

The UTC **4N90** is particularly applied in high efficiency switch mode power supplies.

#### FEATURES

- \*  $R_{DS(ON)} \leq 4.2 \Omega$  @  $V_{GS}=10V, I_D=2.0A$
- \* High switching speed
- \* 100% avalanche tested
- \* Improved dv/dt capability

#### SYMBOL



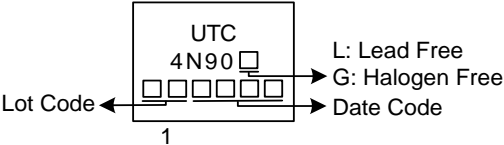
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N90L-TA3-T	4N90G-TA3-T	TO-220	G	D	S	Tube
4N90L-TF3-T	4N90G-TF3-T	TO-220F	G	D	S	Tube
4N90L-TF1-T	4N90G-TF1-T	TO-220F1	G	D	S	Tube
4N90L-TF2-T	4N90G-TF2-T	TO-220F2	G	D	S	Tube
4N90L-TF3T-T	4N90G-TF3T-T	TO-220F3	G	D	S	Tube
4N90L-TM3-T	4N90G-TM3-T	TO-251	G	D	S	Tube
4N90L-TN3-R	4N90G-TN3-R	TO-252	G	D	S	Tape Reel
4N90L-T3N-T	4N90G-T3N-T	TO-3PN	G	D	S	Tube

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

<p>4N90G-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, TF3T: TO-220F3, TM3: TO-251 TN3: TO-252, T3N: TO-3PN (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 to Source Voltage		$V_{DSS}$	900	V
Gate to Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	4	A
Continuous Drain Current	Continuous	$I_D$	4	A
	Pulsed (Note 2)	$I_{DM}$	16	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	570	mJ
	Repetitive (Note 2)	$E_{AR}$	14	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation ( $T_C=25^\circ\text{C}$ )	TO-220	$P_D$	140	W
	TO-220F/TO-220F1		38	W
	TO-220F3			
	TO-220F2		40	W
	TO-251/TO-252		54	W
	TO-3PN		208	W
Derate above $25^\circ\text{C}$	TO-220		1.12	$W/^\circ\text{C}$
	TO-220F/TO-220F1		0.304	$W/^\circ\text{C}$
	TO-220F3			
	TO-220F2		0.322	$W/^\circ\text{C}$
	TO-251/TO-252		0.43	$W/^\circ\text{C}$
	TO-3PN	1.66	$W/^\circ\text{C}$	
Operating 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.  $L=67\text{mH}$ ,  $I_{AS}=4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$

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

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
	TO-220F1/TO-220F2			
	TO-220F3		110	$^\circ\text{C/W}$
	TO-251/TO-252			
	TO-3PN			
Junction to Case	TO-220	$\theta_{JC}$	0.89	$^\circ\text{C/W}$
	TO-220F/TO-220F1		3.25	$^\circ\text{C/W}$
	TO-220F3			
	TO-220F2		3.1	$^\circ\text{C/W}$
	TO-251/TO-252		2.3	$^\circ\text{C/W}$
	TO-3PN		0.6	$^\circ\text{C/W}$

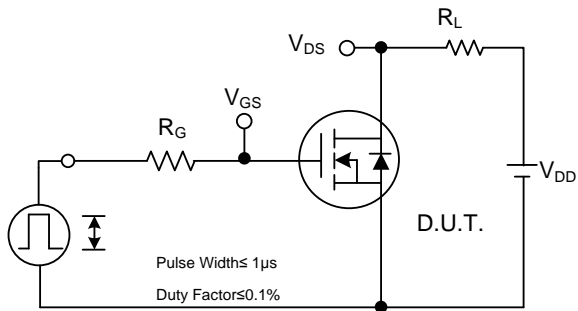
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	900			V
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		1.05		V/°C
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =900V, V <sub>GS</sub> =0V			10	μA
		V <sub>DS</sub> =720V, T <sub>C</sub> =125°C			100	μA
Gate- Source Leakage Current	Forward	I <sub>GSS</sub> V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V			+100	nA
	Reverse	I <sub>GSS</sub> V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	3.0		5.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.0A			4.2	Ω
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =2A	3.5			S
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		1094		pF
Output Capacitance	C <sub>OSS</sub>			101		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			13.3		pF
<b>SWITCHING PARAMETERS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =250V, V <sub>GS</sub> =10V, I <sub>D</sub> =4.0A (Note 1,2)		31		nC
Gate-Source Charge	Q <sub>GS</sub>			9		nC
Gate-Drain Charge	Q <sub>GD</sub>			9.7		nC
Turn-ON Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω (Note 1,2)		70		ns
Turn-ON Rise Time	t <sub>R</sub>			188		ns
Turn-OFF Delay Time	t <sub>D(OFF)</sub>			188		ns
Turn-OFF Fall Time	t <sub>F</sub>			88		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				4	A
Maximum Body-Diode Pulsed Current	I <sub>SM</sub>				16	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V			1.4	V

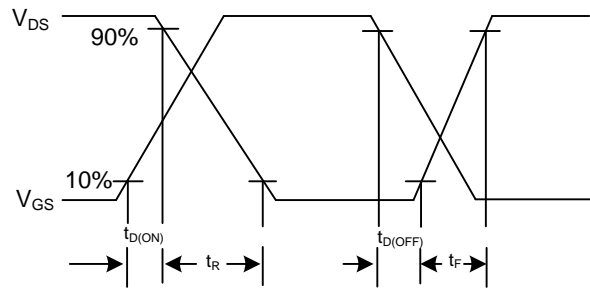
- Notes: 1. Pulse Test : Pulse width≤300μs, Duty cycle≤2%  
2. Essentially independent of operating temperature



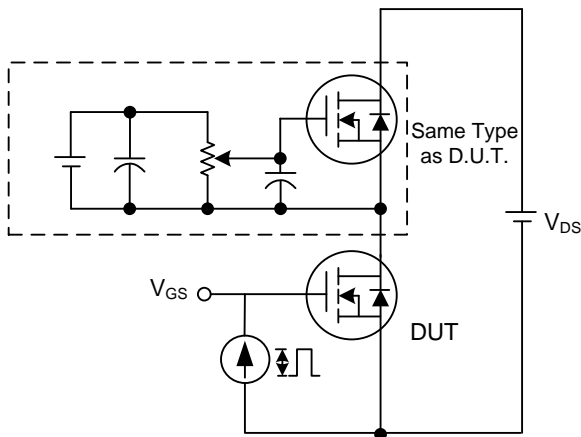
■ TEST CIRCUITS AND WAVEFORMS



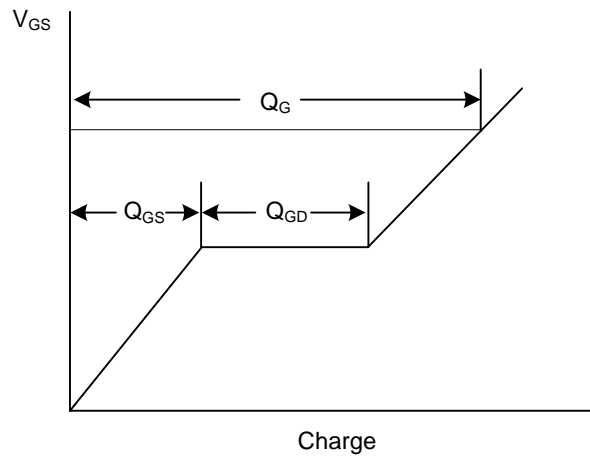
Switching Test Circuit



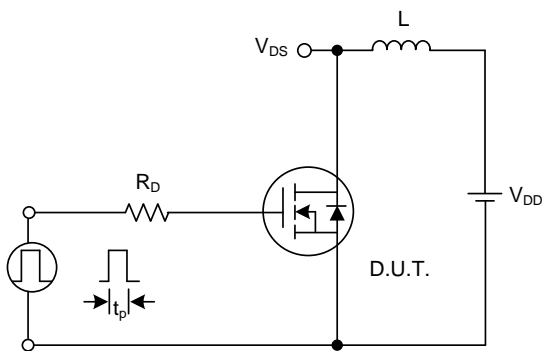
Switching Waveforms



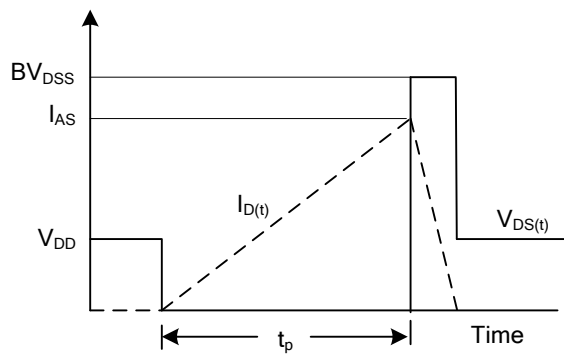
Gate Charge Test Circuit



Gate Charge Waveform

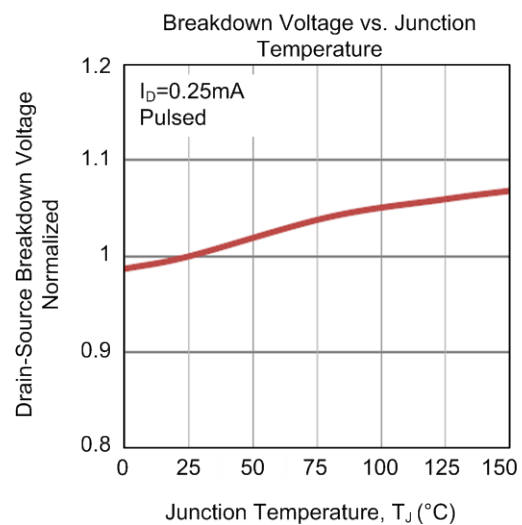
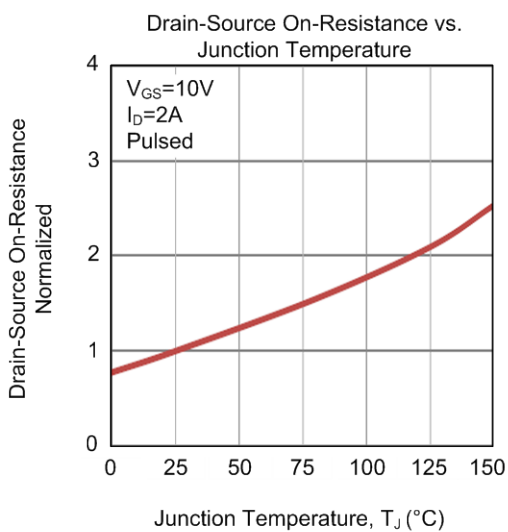
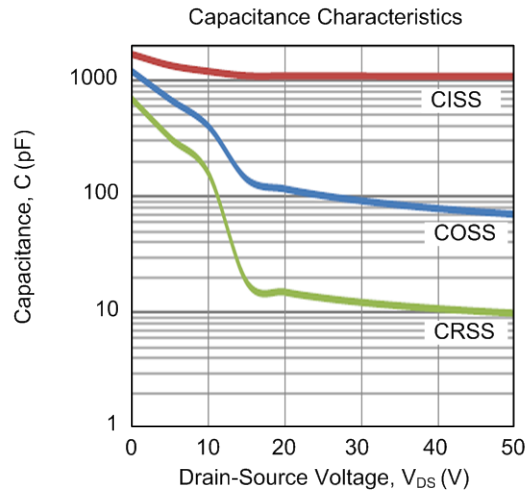
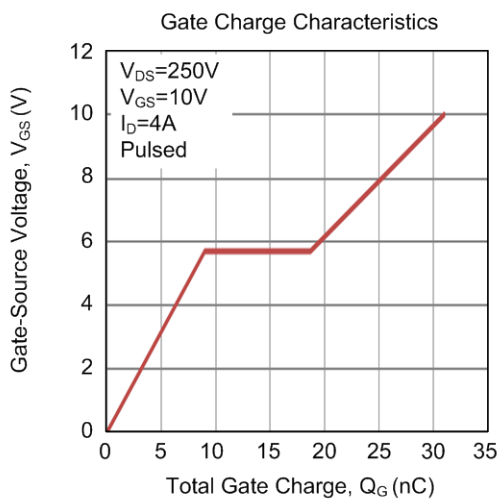
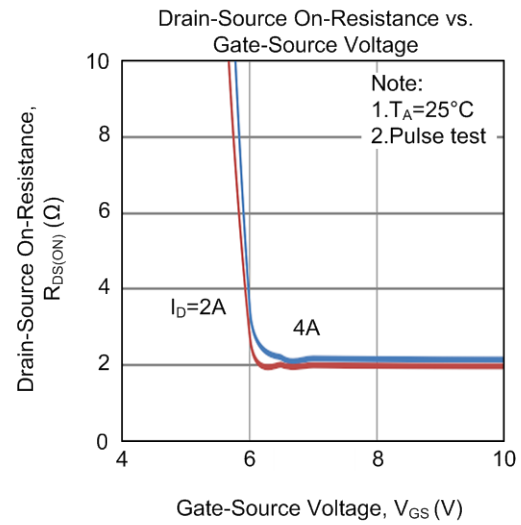
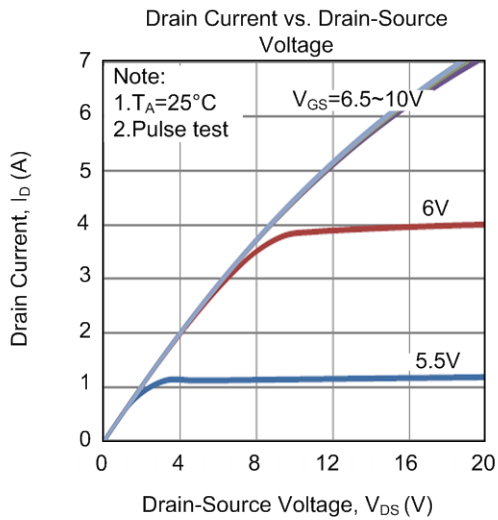


Unclamped Inductive Switching Test Circuit

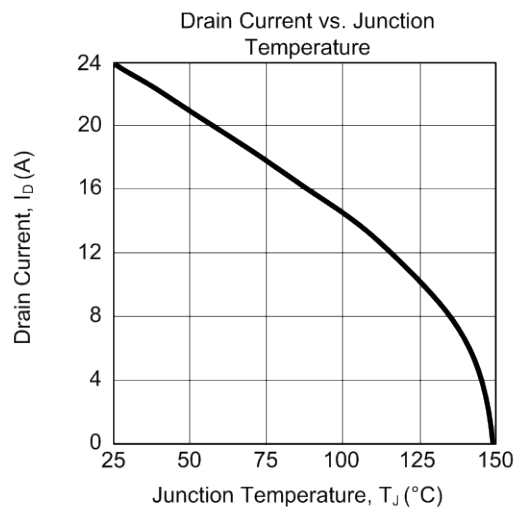
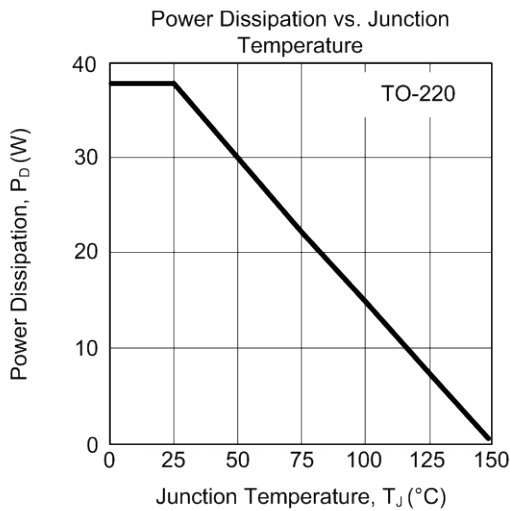
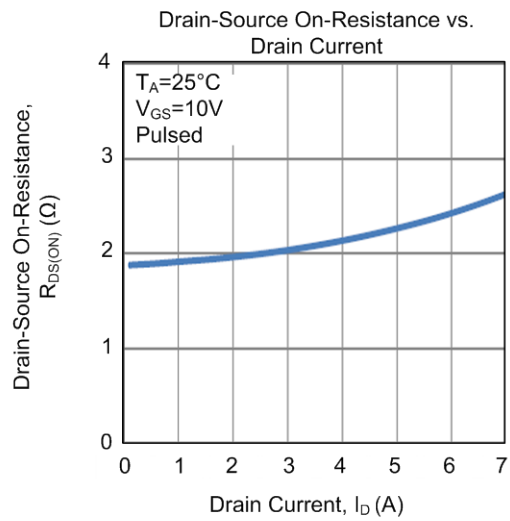
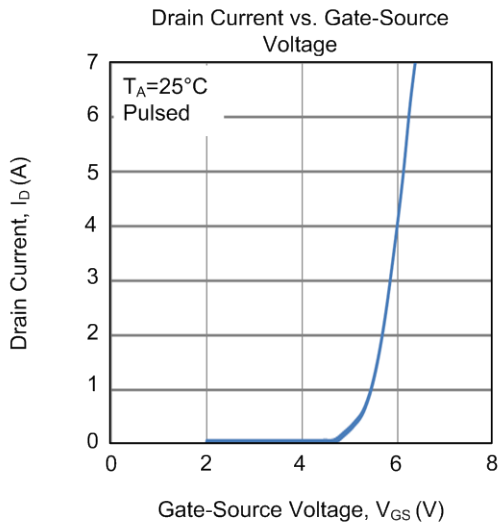
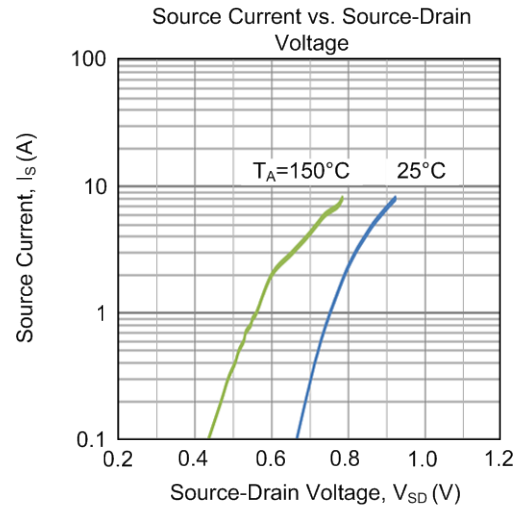
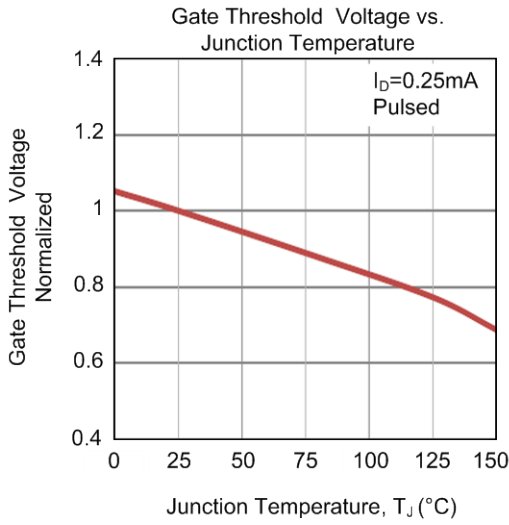


Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS

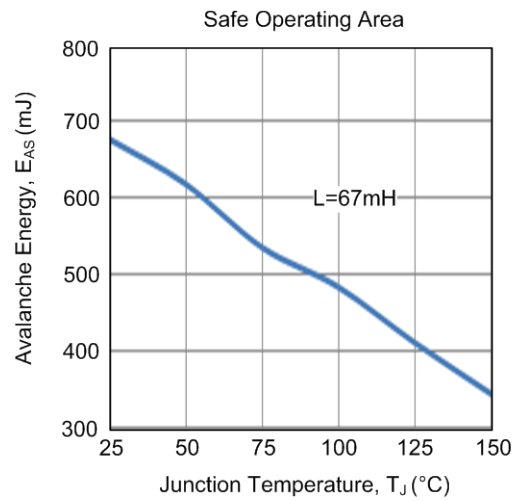
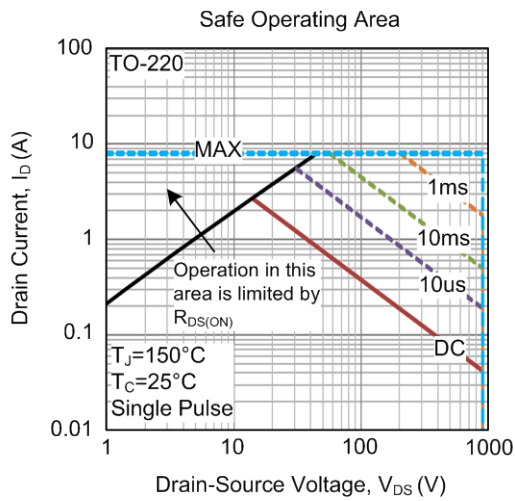


■ TYPICAL CHARACTERISTICS (Cont.)





■ TYPICAL CHARACTERISTICS (Cont.)



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