



13NM90

Power MOSFET

13A, 900V N-CHANNEL SUPER-JUNCTION MOSFET

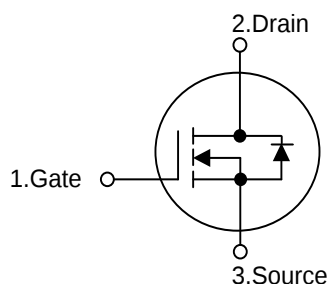
DESCRIPTION

The UTC 13NM90 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

- * $R_{DS(ON)} \leq 0.5 \Omega$ @ $V_{GS}=10V$, $I_D=6.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

SYMBOL

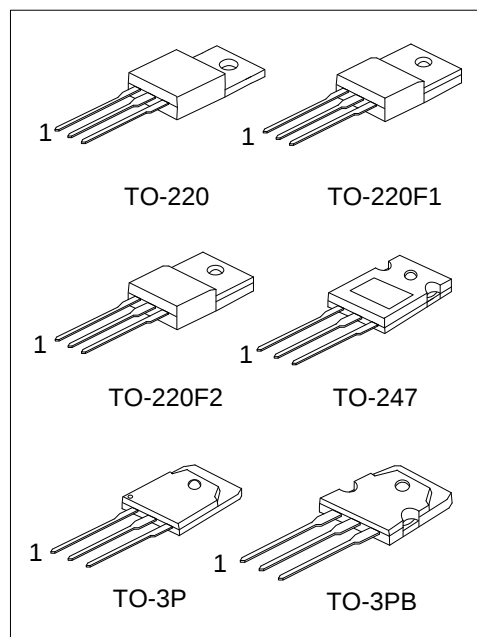


ORDERING INFORMATION

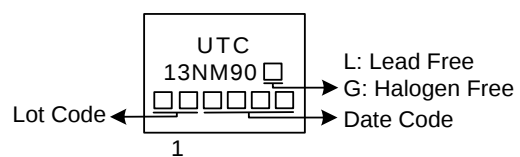
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13NM90L-TA3-T	13NM90G-TA3-T	TO-220	G	D	S	Tube
13NM90L-TF1-T	13NM90G-TF1-T	TO-220F1	G	D	S	Tube
13NM90L-TF2-T	13NM90G-TF2-T	TO-220F2	G	D	S	Tube
13NM90L-T3B-T	13NM90G-T3B-T	TO-3PB	G	D	S	Tube
13NM90L-T3P-T	13NM90G-T3P-T	TO-3P	G	D	S	Tube
13NM90L-T47-T	13NM90G-T47-T	TO-247	G	D	S	Tube

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

13NM90G-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2 T3B: TO-3PB, T3P: TO-3P, T47: TO-247 (3) G: Halogen Free and Lead Free, L: Lead Free
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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}	± 30	V
Continuous Drain Current	Continuous	I_D	13	A
Pulsed Drain Current	Pulsed (Note 2)	I_{DM}	52	A
Avalanche Current (Note 2)		I_{AR}	3.0	A
Single Pulsed Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	180	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.68	V/ns
Power Dissipation	TO-220	P_D	101	W
	TO-220F1/TO-220F2		32	W
	TO-3P/TO-3PB		405	W
	TO-247		370	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. $L = 10\text{mH}$, $I_{AS} = 4.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.

4. $I_{SD} \leq 13\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1 TO-220F2	θ_{JA}	62.5	$^\circ\text{C/W}$
	TO-3P/TO-3PB		30	$^\circ\text{C/W}$
	TO-247		40	$^\circ\text{C/W}$
Junction to Case	TO-220	θ_{JC}	1.24	$^\circ\text{C/W}$
	TO-220F1/TO-220F2		3.91	$^\circ\text{C/W}$
	TO-3P/TO-3PB		0.31	$^\circ\text{C/W}$
	TO-247		0.34	$^\circ\text{C/W}$

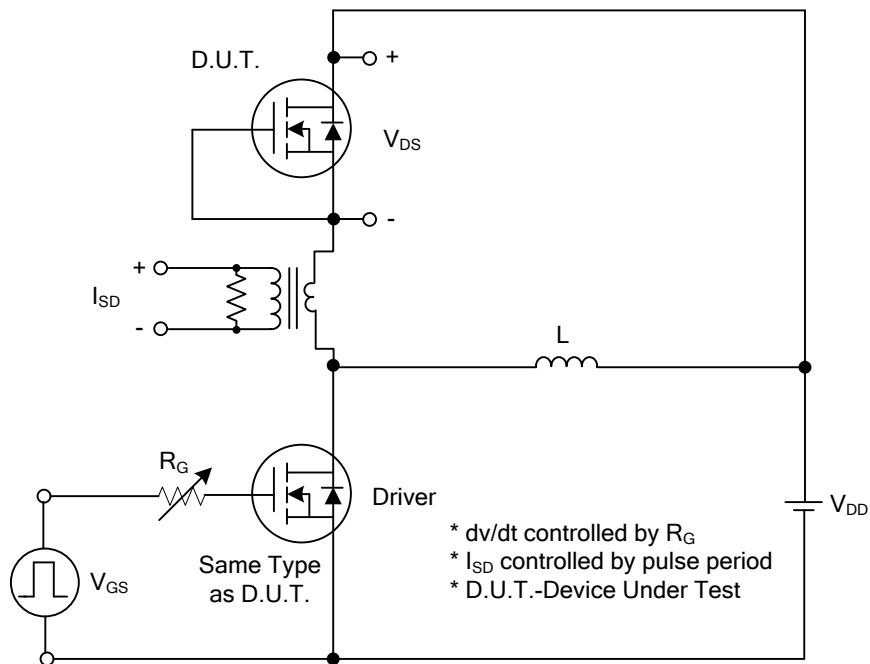
■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	900			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 900V, V _{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			100	nA
	Reverse		V _{GS} = -30V, V _{DS} = 0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.5		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D = 6.5A			0.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		1650		pF
Output Capacitance		C _{OSS}			390		pF
Reverse Transfer Capacitance		C _{RSS}			0.3		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =100V, I _D =13A, I _G =1mA V _{GS} =10V (Note 1,2)		60		nC
Gate to Source Charge		Q _{GS}			11		nC
Gate to Drain Charge		Q _{GD}			22		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DD} =100V, I _D =13A, R _G =25Ω, V _{GS} =10V (Note 1,2)		25		nS
Rise Time		t _R			24		nS
Turn-OFF Delay Time		t _{D(OFF)}			190		nS
Fall-Time		t _F			37		nS
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				13	A
Maximum Body-Diode Pulsed Current		I _{SM}				52	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =13A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =13A, V _{GS} =0V,		640		nS
Body Diode Reverse Recovery Charge		Q _{rr}	dl _F /dt=100A/μs		12.7		μC

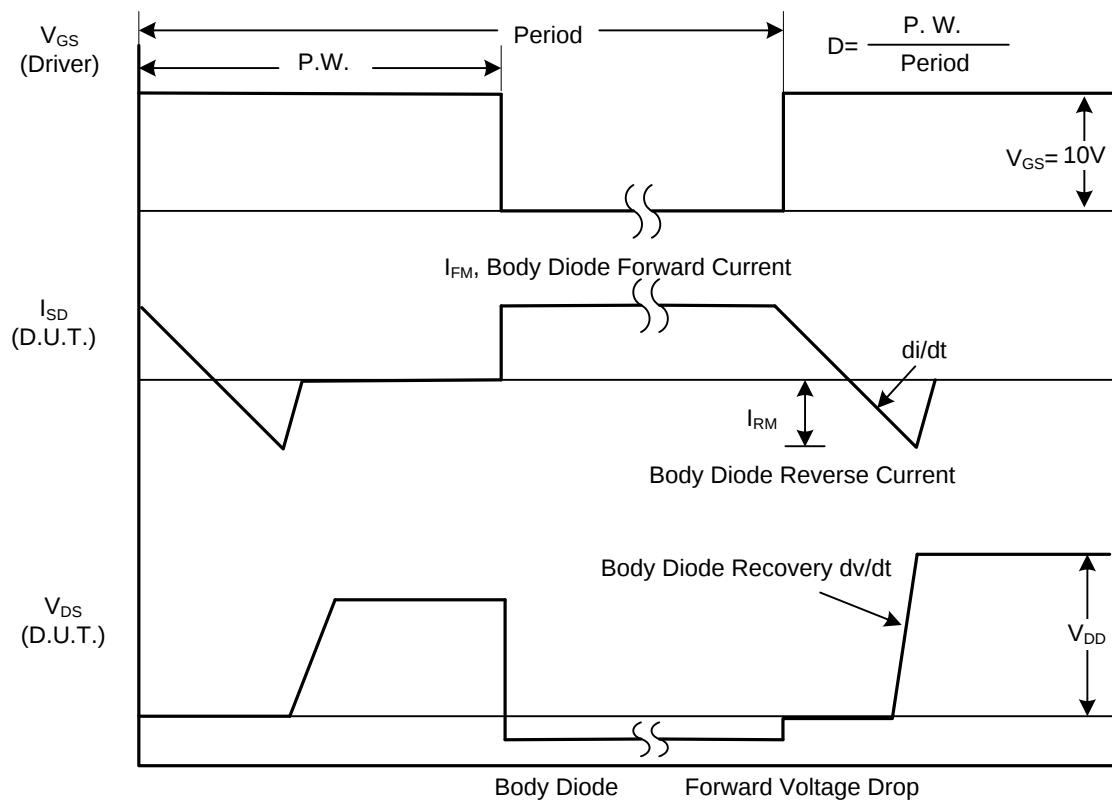
Notes: 1. Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS

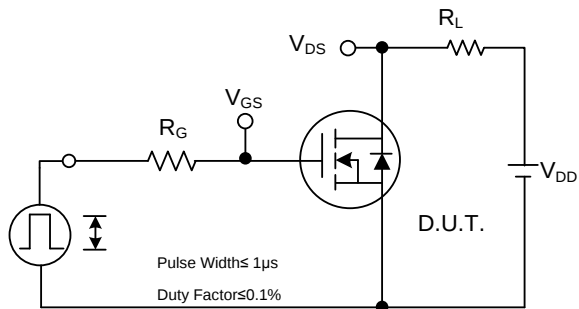


Peak Diode Recovery dv/dt Test Circuit

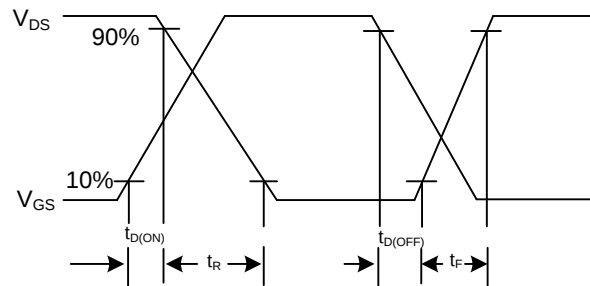


Peak Diode Recovery dv/dt Waveforms

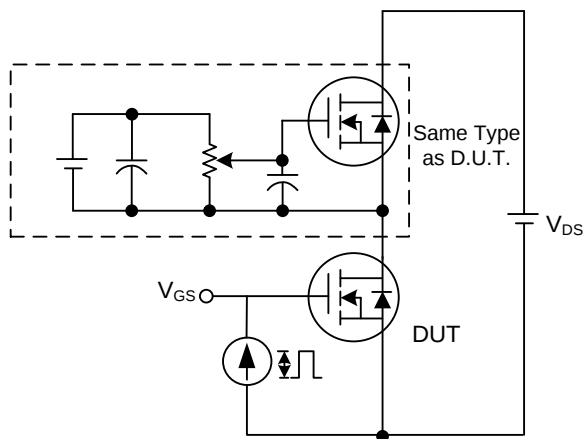
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



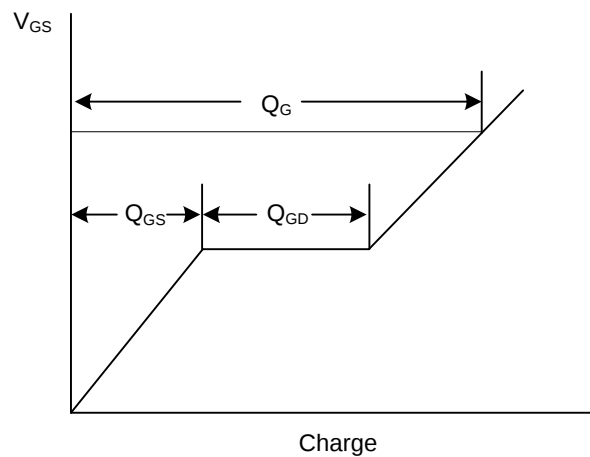
Switching Test Circuit



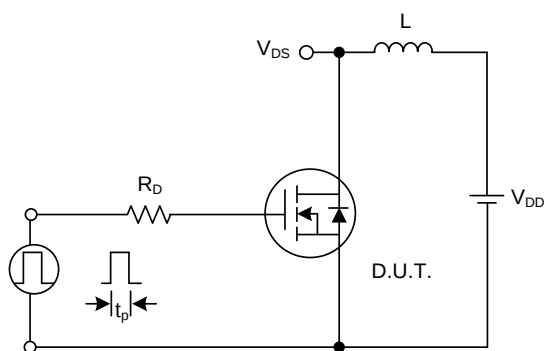
Switching Waveforms



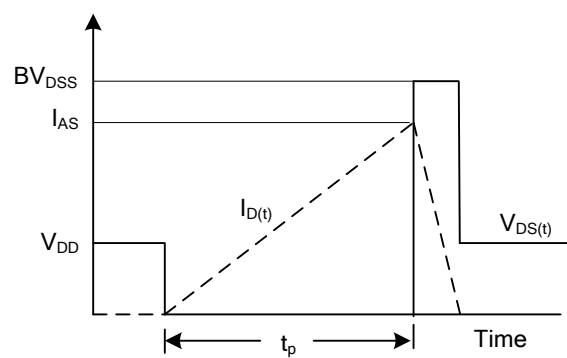
Gate Charge Test Circuit



Gate Charge Waveform

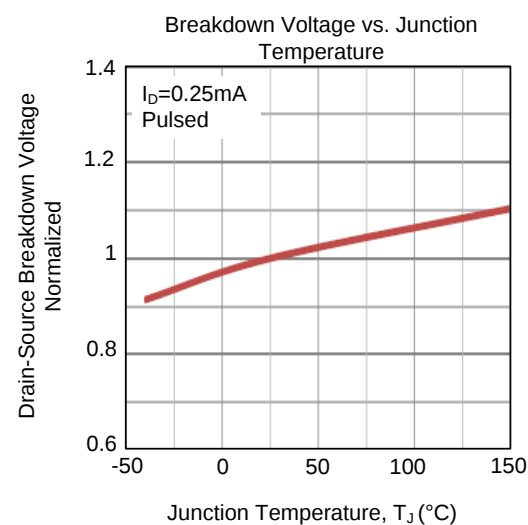
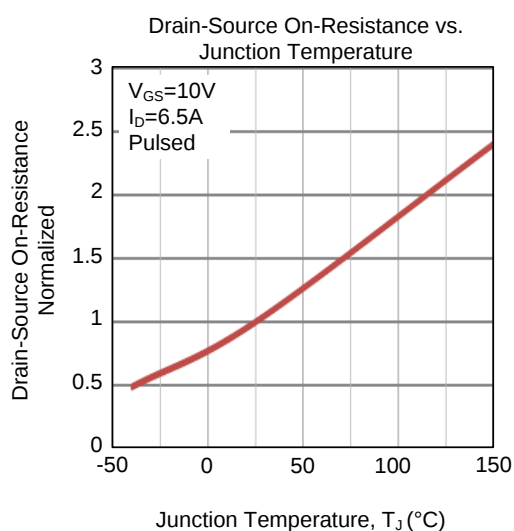
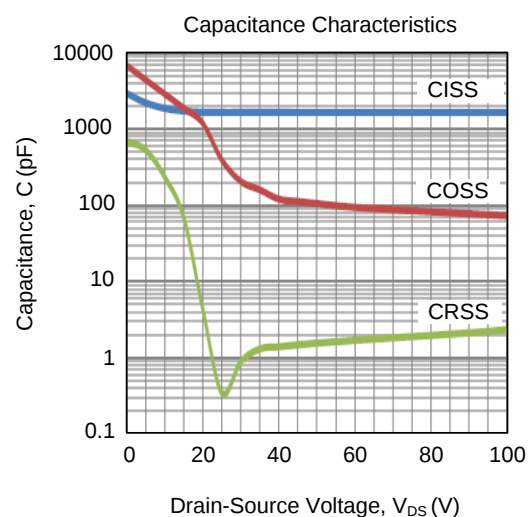
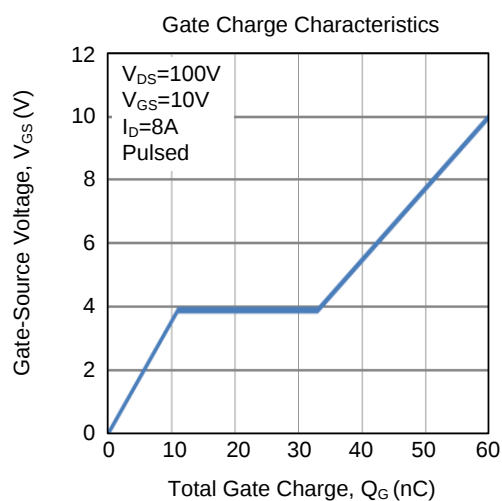
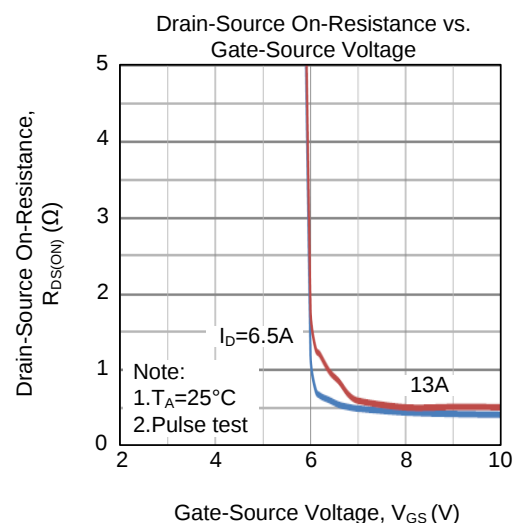
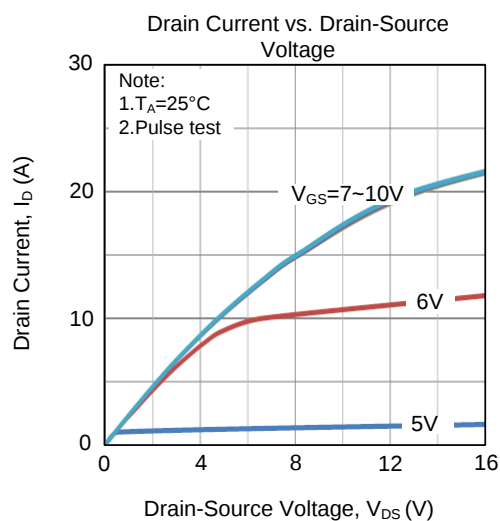


Unclamped Inductive Switching Test Circuit

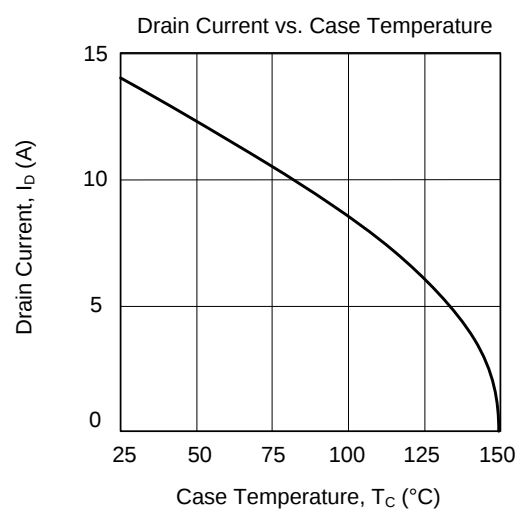
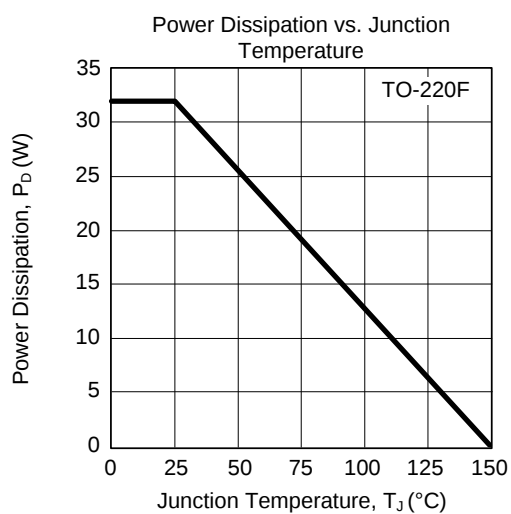
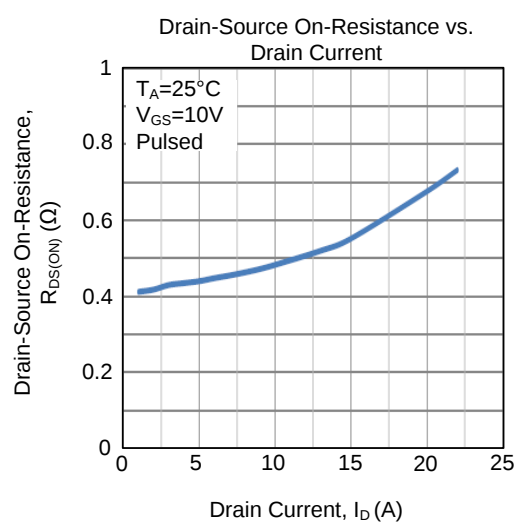
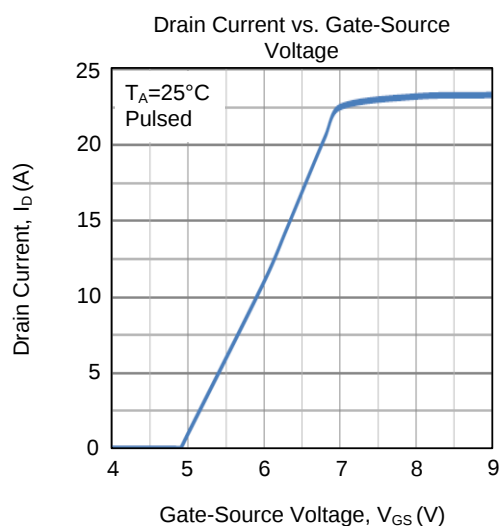
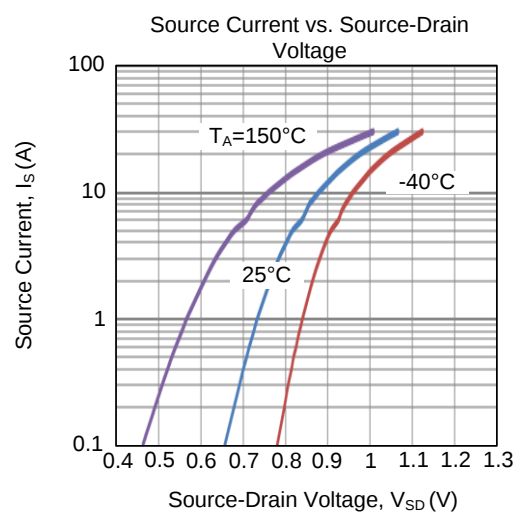
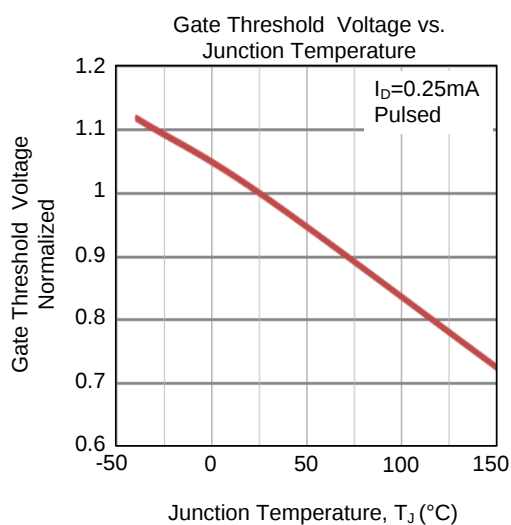


Unclamped Inductive Switching Waveforms

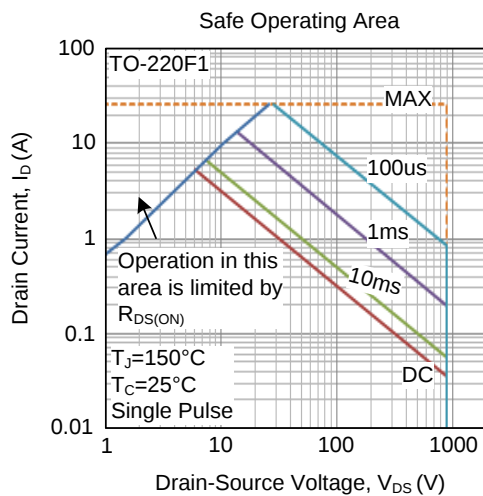
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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