



12N65-ML

Power MOSFET

12A, 650V N-CHANNEL POWER MOSFET

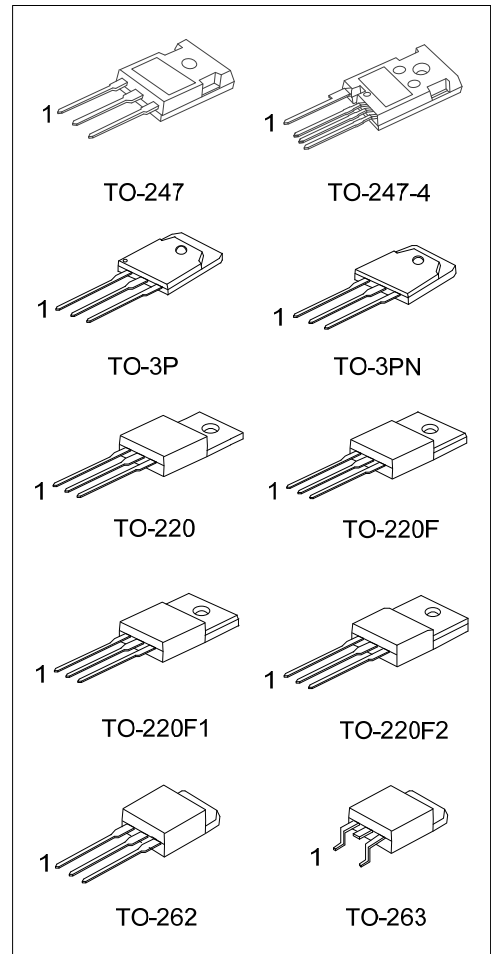
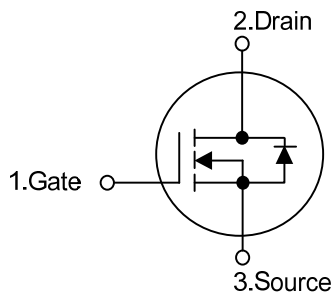
■ DESCRIPTION

The UTC **12N65-ML** is a high voltage power MOSFET combines advanced planar MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

■ FEATURES

- * $R_{DS(ON)} \leq 0.85 \Omega$ @ $V_{GS}=10V$, $I_D=6.0A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

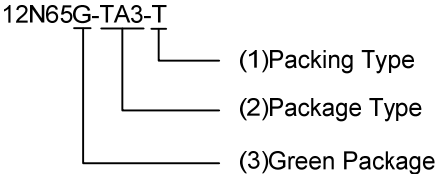
■ SYMBOL



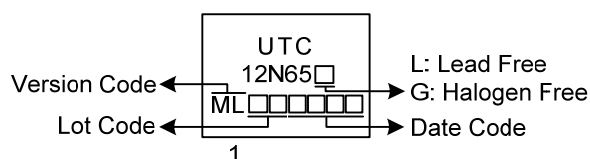
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment				Packing
Lead Free	Halogen Free		1	2	3		
12N65L-TA3-T	12N65G-TA3-T	TO-220	G	D	S		Tube
12N65L-TF1-T	12N65G-TF1-T	TO-220F1	G	D	S		Tube
12N65L-TF2-T	12N65G-TF2-T	TO-220F2	G	D	S		Tube
12N65L-TF3-T	12N65G-TF3-T	TO-220F	G	D	S		Tube
12N65L-T2Q-T	12N65G-T2Q-T	TO-262	G	D	S		Tube
12N65L-TQ2-T	12N65G-TQ2-T	TO-263	G	D	S		Tube
12N65L-TQ2-R	12N65G-TQ2-R	TO-263	G	D	S		Tape Reel
12N65L-T3P-T	12N65G-T3P-T	TO-3P	G	D	S	-	Tube
18N60L-T3N-T	18N60G-T3N-T	TO-3PN	G	D	S	-	Tube
12N65L-T47-T	12N65G-T47-T	TO-247	G	D	S	-	Tube
12N65L-T474-T	12N65G-T474-T	TO-247-4	D	S	S	G	Tube

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

12N65G-TA3-T  (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, T2Q: TO-262, TQ2: TO-263, T3P: TO-3P, T3N: TO-3PN, T47: TO-247, T474: TO-247-4 (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}	650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Continuous Drain Current		I_D	12	A
Pulsed Drain Current (Note 2)		I_{DM}	24	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	576	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.4	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	140	W
	TO-220F/TO-220F1		40	W
	TO-220F2			
	TO-247/TO-247-4		150	W
	TO-3P/TO-3PN		160	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. $L = 30\text{mH}$, $I_{AS} = 6.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 12\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/ TO-220F	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-262/TO-263			
	TO-247/TO-247-4		40	$^{\circ}\text{C}/\text{W}$
	TO-3P/TO-3PN		30	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220/TO-262/TO-263	θ_{JC}	0.89	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1		3.1	$^{\circ}\text{C}/\text{W}$
	TO-220F2			
	TO-247/TO-247-4		0.83	$^{\circ}\text{C}/\text{W}$
	TO-3P/TO-3PN		0.78	$^{\circ}\text{C}/\text{W}$

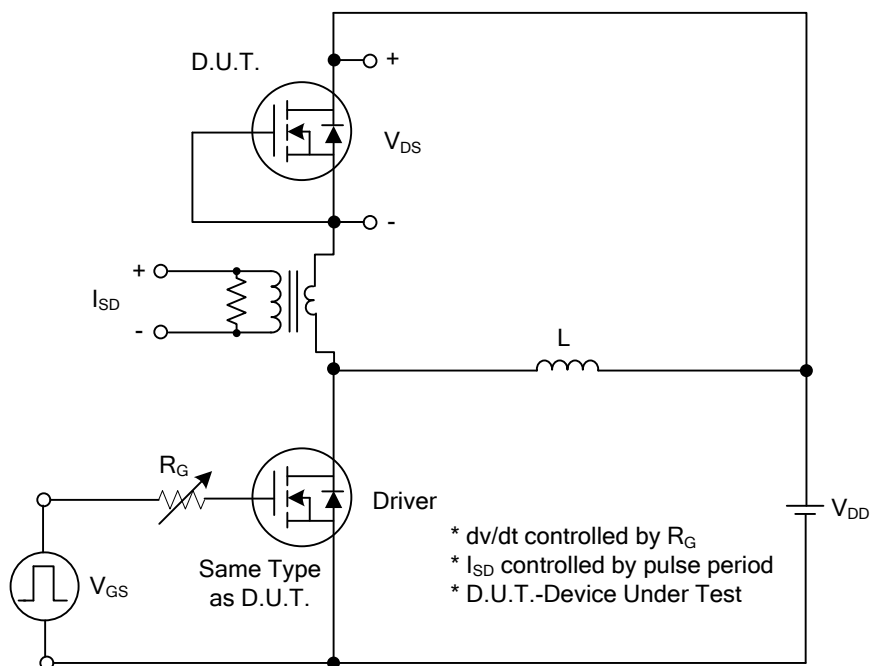
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =650V, 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	2.0		4.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =6.0A			0.85	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		1540		pF
Output Capacitance		C _{OSS}			150		pF
Reverse Transfer Capacitance		C _{RSS}			12		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =520V, V _{GS} =10V, I _D =12A I _G =1mA (Note 1, 2)		36		nC
Gate-Source Charge		Q _{GS}			8.6		nC
Gate-Drain Charge		Q _{GD}			10		nC
Turn-On Delay Time (Note 1)		t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =12A, R _G =25Ω (Note 1, 2)		22		ns
Turn-On Rise Time		t _R			23		ns
Turn-Off Delay Time		t _{D(OFF)}			115		ns
Turn-Off Fall Time		t _F			32		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Body-Diode Continuous Current		I _S				12	A
Maximum Body-Diode Pulsed Current		I _{SM}				24	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =12A , V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)		t _{rr}	I _S =12A , V _{GS} =0V		470		ns
Reverse Recovery Charge		Q _{rr}	di/dt=100A/μs		12		μC

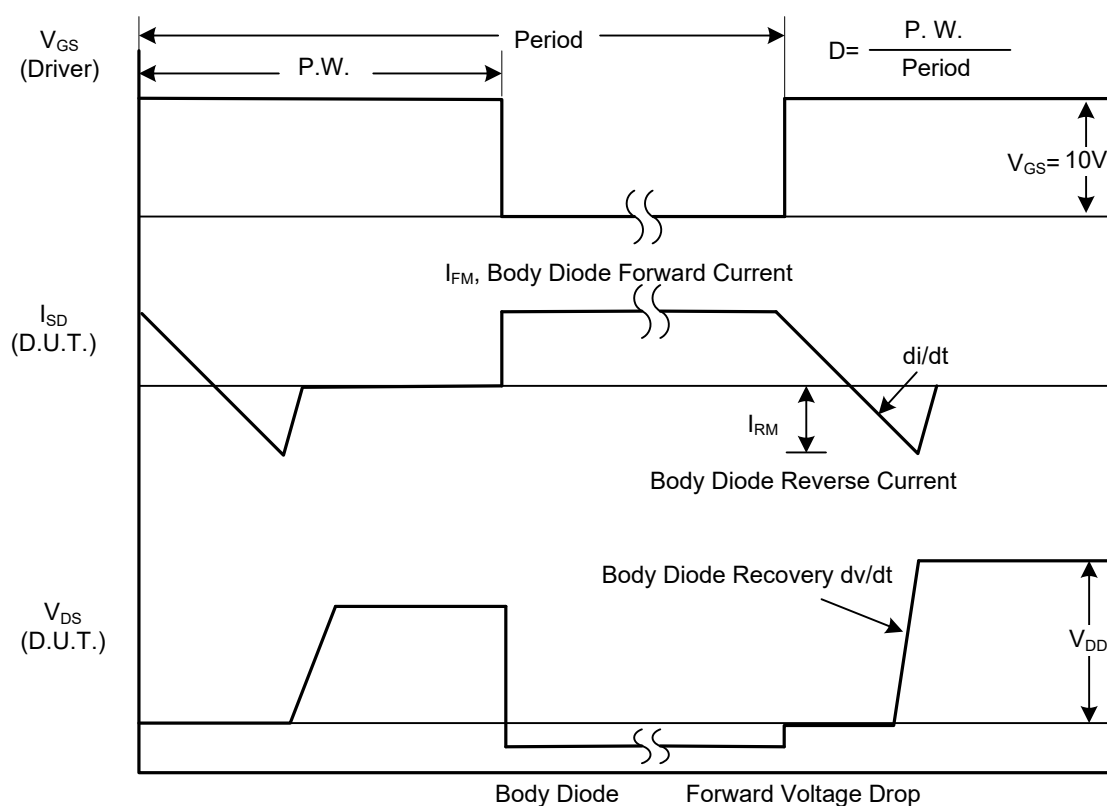
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

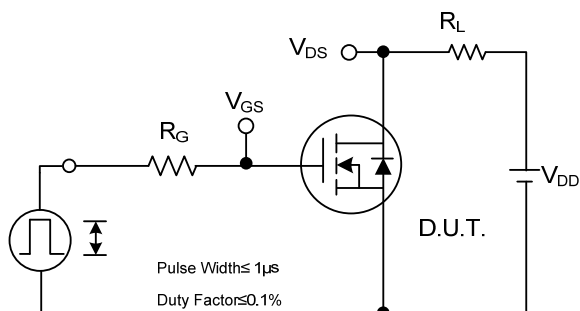


Peak Diode Recovery dv/dt Test Circuit

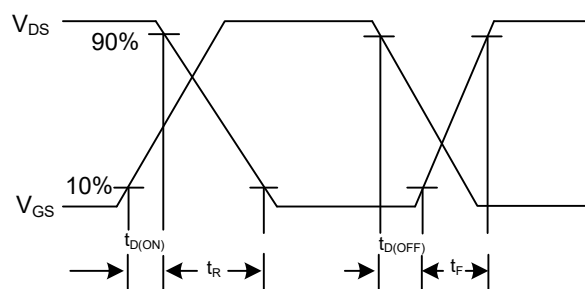


Peak Diode Recovery dv/dt Waveforms

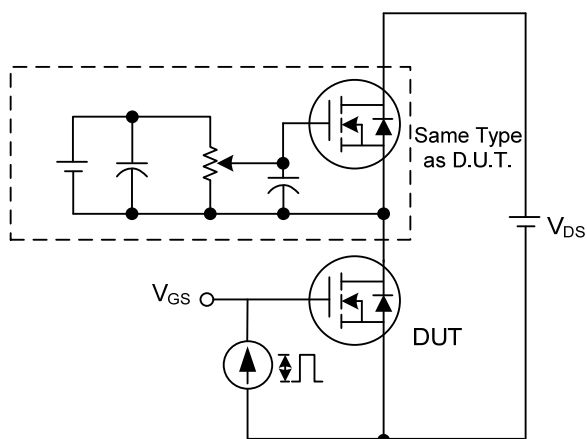
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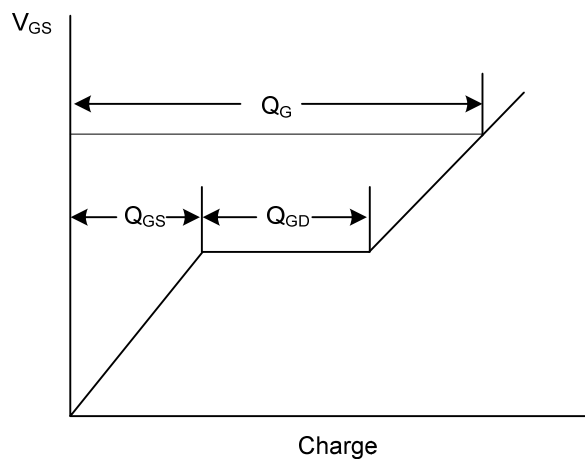
Switching Test Circuit



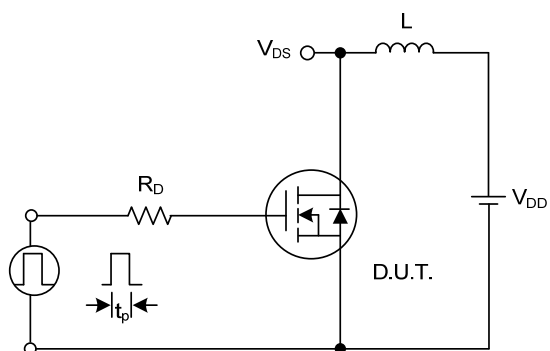
Switching Waveforms



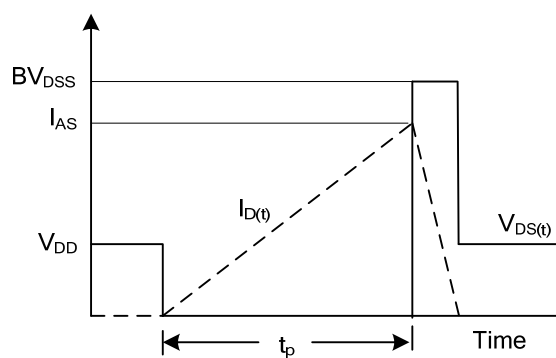
Gate Charge Test Circuit



Gate Charge Waveform

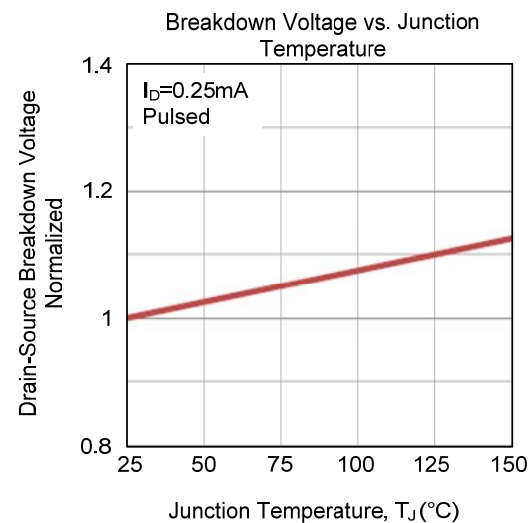
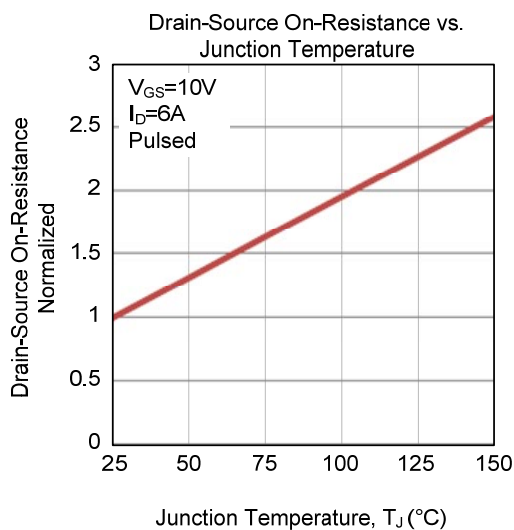
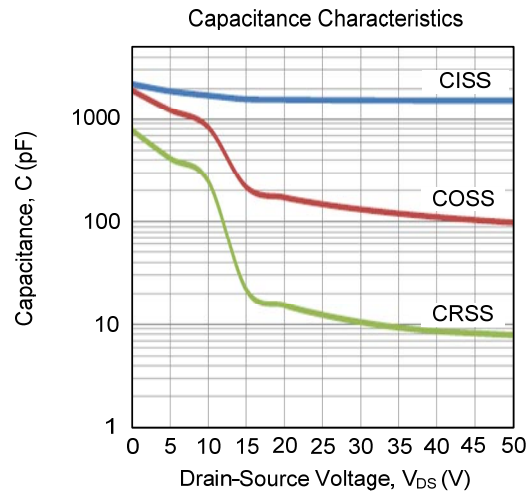
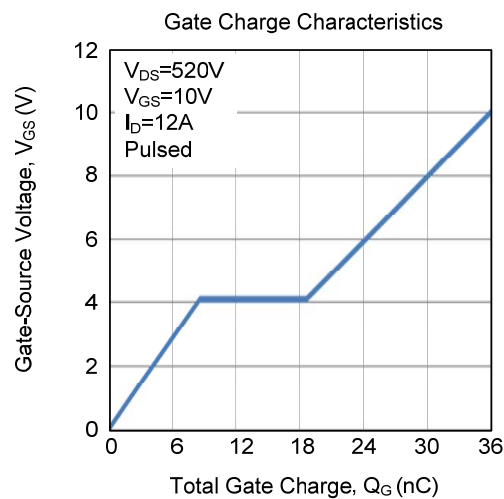
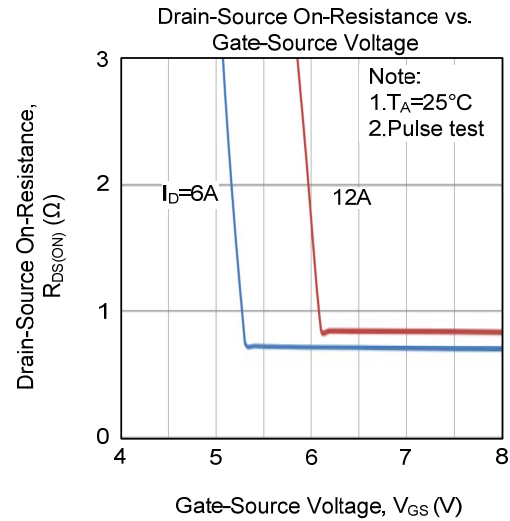
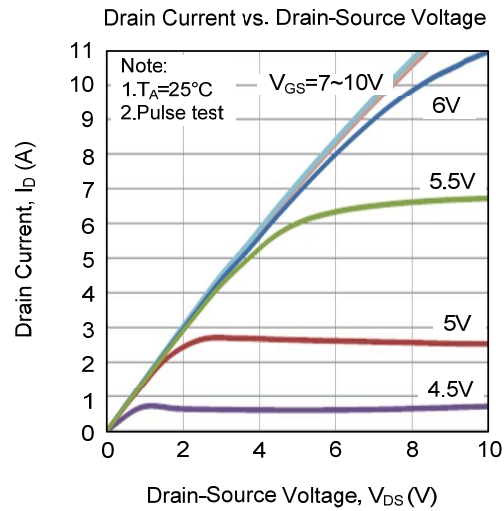


Unclamped Inductive Switching Test Circuit

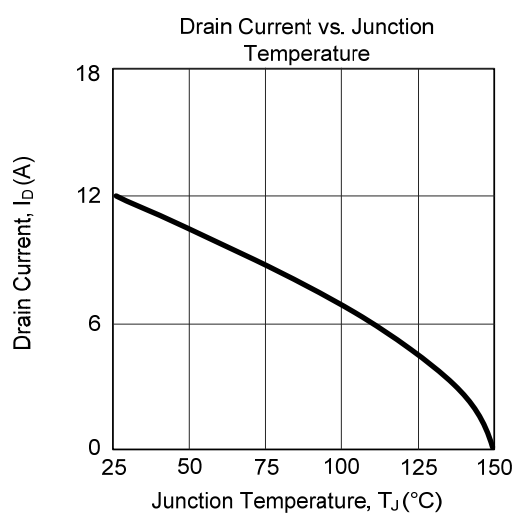
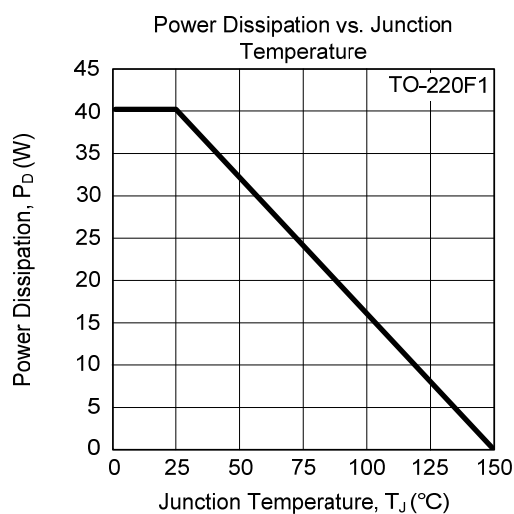
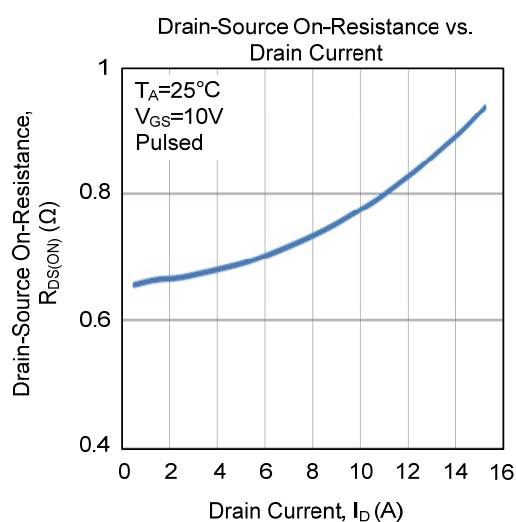
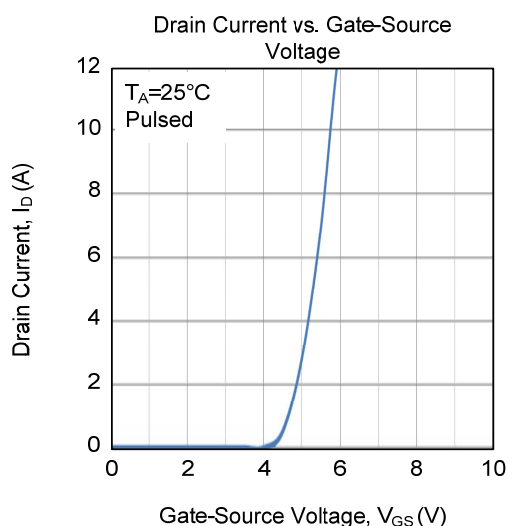
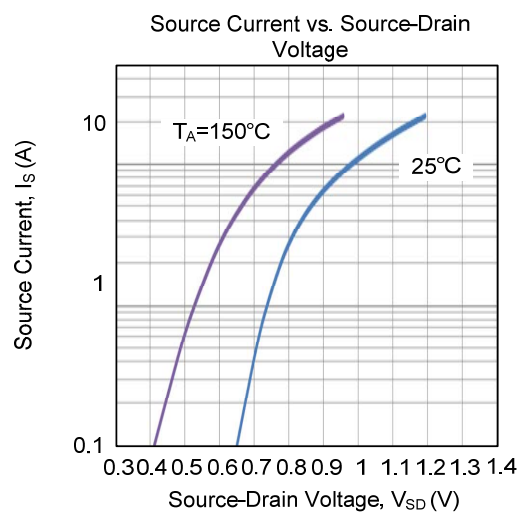
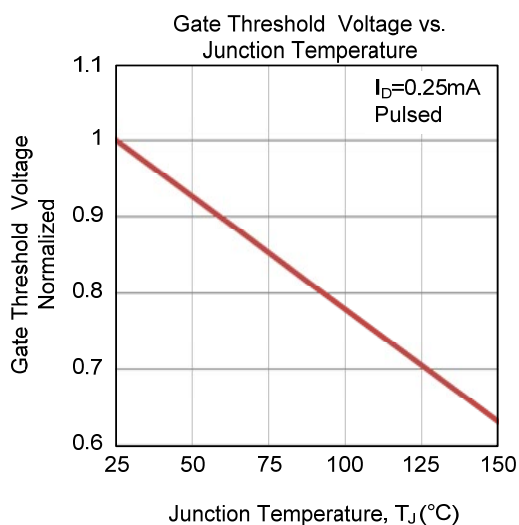


Unclamped Inductive Switching Waveforms

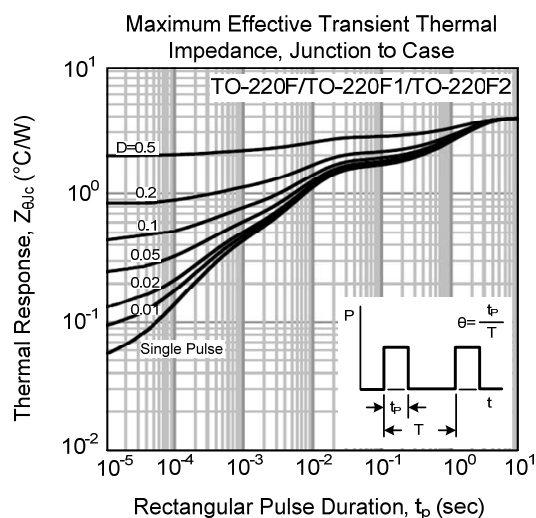
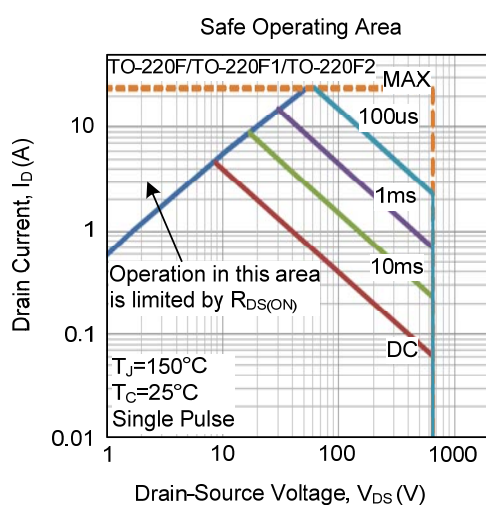
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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