



10N65-ML

Power MOSFET

10A, 650V N-CHANNEL POWER MOSFET

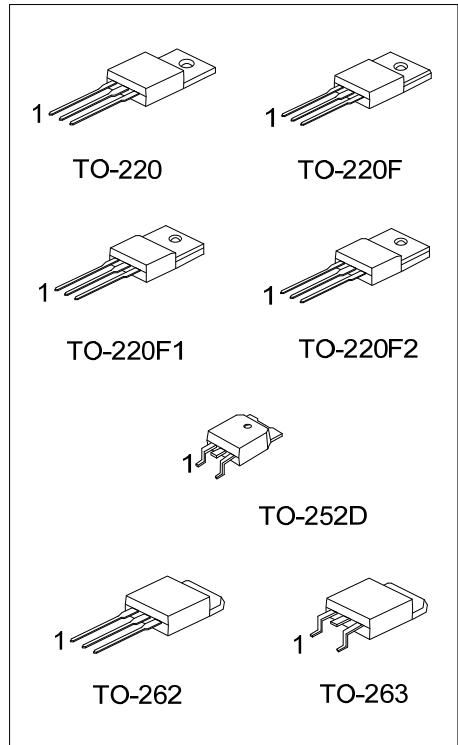
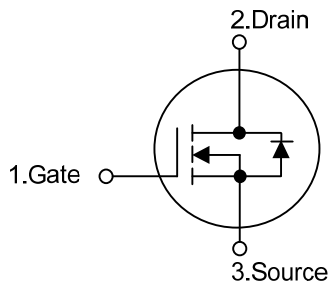
■ DESCRIPTION

The UTC **10N65-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

- * $R_{DS(ON)} \leq 1.0 \Omega$ @ $V_{GS}=10V$, $I_D=5.0A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



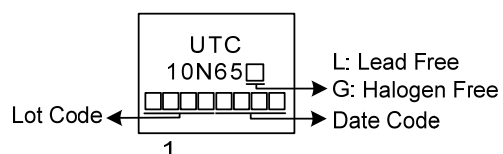
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N65L-TA3-T	10N65G-TA3-T	TO-220	G	D	S	Tube
10N65L-TF1-T	10N65G-TF1-T	TO-220F1	G	D	S	Tube
10N65L-TF2-T	10N65G-TF2-T	TO-220F2	G	D	S	Tube
10N65L-TF3-T	10N65G-TF3-T	TO-220F	G	D	S	Tube
10N65L-TND-R	10N65G-TND-R	TO-252D	G	D	S	Tape Reel
10N65L-T2Q-T	10N65G-T2Q-T	TO-262	G	D	S	Tube
10N65L-T2Q-R	10N65G-T2Q-R	TO-262	G	D	S	Tape Reel
10N65L-TQ2-T	10N65G-TQ2-T	TO-263	G	D	S	Tube
10N65L-TQ2-R	10N65G-TQ2-R	TO-263	G	D	S	Tape Reel

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

10N65G-TA3-T (1)Packing Type (2)Package Type (3)Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2 TF3: TO-220F, TND: TO-252D, T2Q: TO-262 TQ2: TO-263 (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}	10	A
Pulsed Drain Current (Note 2)		I_{DM}	30	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	800	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.1	V/ns
Power Dissipation	TO-220/TO-262 TO-263	P_{D}	135	W
	TO-220F/TO-220F1 TO-220F2		38	W
	TO-252D		55	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. $L = 100\text{mH}$, $I_{\text{AS}} = 4.1\text{A}$, $V_{\text{DD}} = 50\text{V}$, $R_{\text{G}} = 25\ \Omega$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$

4. $I_{\text{SD}} \leq 10\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{\text{DD}} \leq BV_{\text{DSS}}$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-262/TO-263	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-252D		110	$^{\circ}\text{C}/\text{W}$
	TO-220/TO-262 TO-263		0.92	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2		3.29	$^{\circ}\text{C}/\text{W}$
Junction to Case		θ_{JC}	2.27 (Note)	$^{\circ}\text{C}/\text{W}$

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

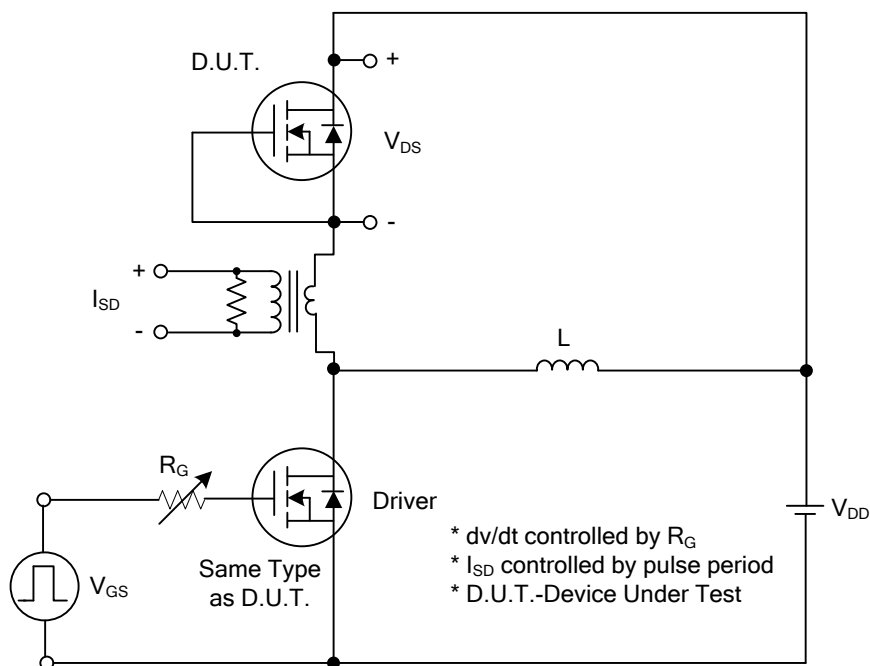
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	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		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=5.0A$			1.0	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1.0MHz$		1300		pF
Output Capacitance		C_{OSS}			124		pF
Reverse Transfer Capacitance		C_{RSS}			9.3		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	$V_{DS}=520V, V_{GS}=10V, I_D=10A$ $I_G=1mA$ (Note 1, 2)		31		nC
Gate-Source Charge		Q_{GS}			7.6		nC
Gate-Drain Charge		Q_{GD}			5.8		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	$V_{DS}=100V, V_{GS}=10V, I_D=10A,$ $R_G=25\Omega$ (Note 1, 2)		20		ns
Turn-On Rise Time		t_R			21		ns
Turn-Off Delay Time		$t_{D(OFF)}$			98		ns
Turn-Off Fall Time		t_F			35		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	$I_S=10A, V_{GS}=0V$			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	$I_S=10A, V_{GS}=0V$ $di/dt=100A/\mu s$		376		ns
Reverse Recovery Charge		Q_{rr}			8.5		μC

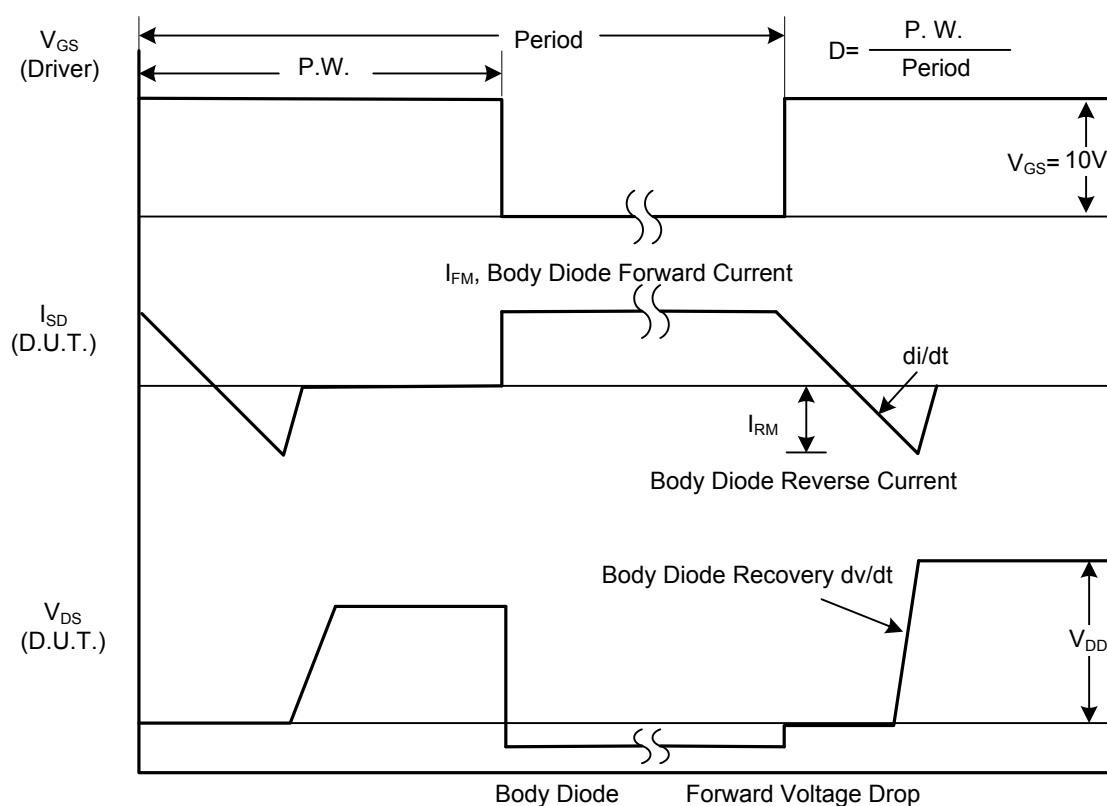
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

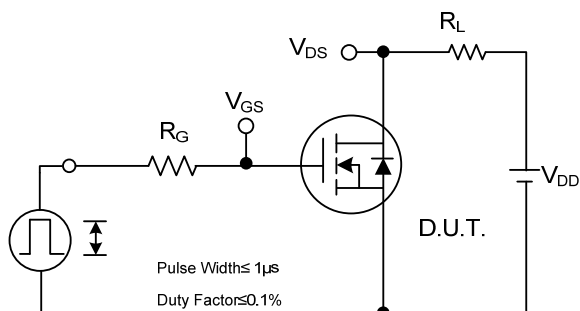


Peak Diode Recovery dv/dt Test Circuit

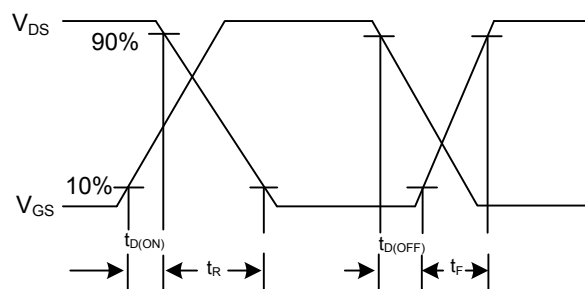


Peak Diode Recovery dv/dt Waveforms

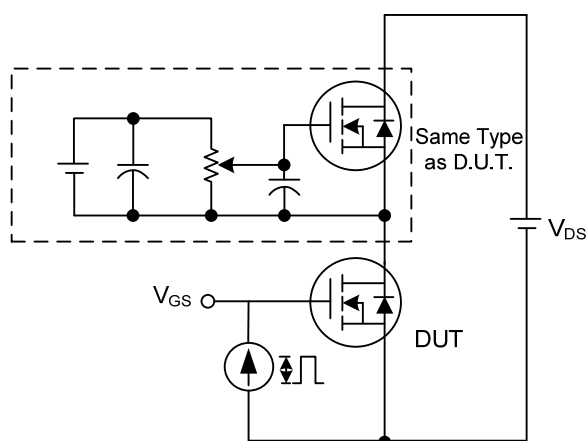
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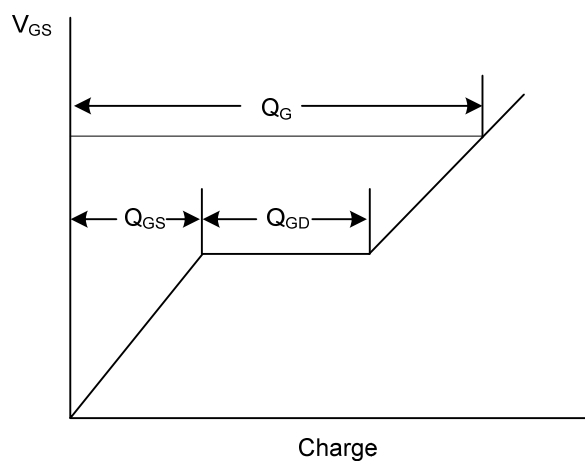
Switching Test Circuit



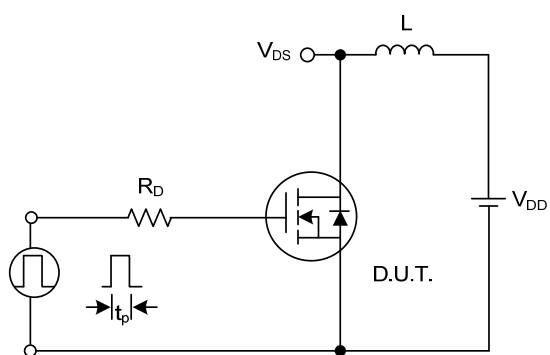
Switching Waveforms



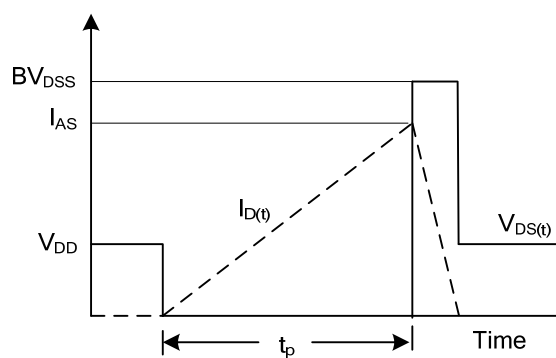
Gate Charge Test Circuit



Gate Charge Waveform

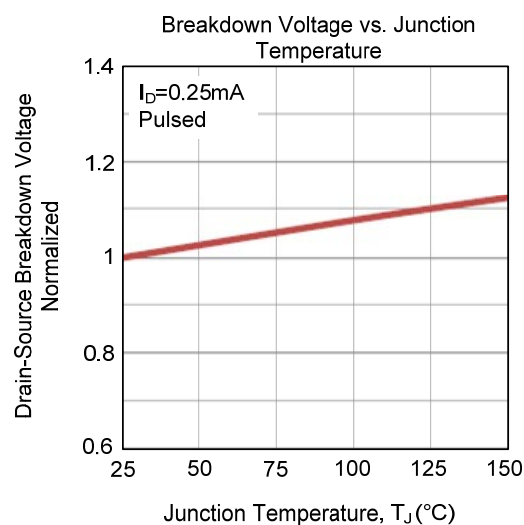
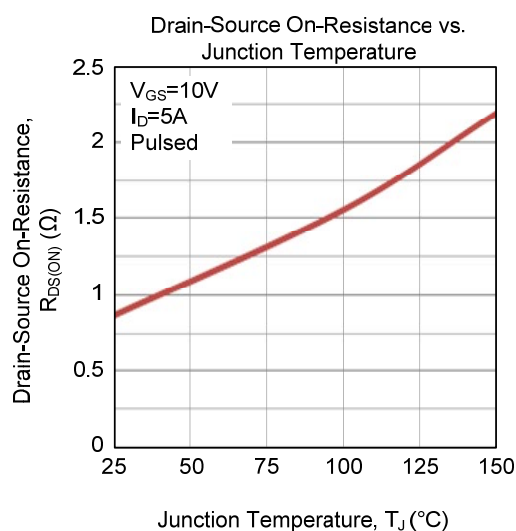
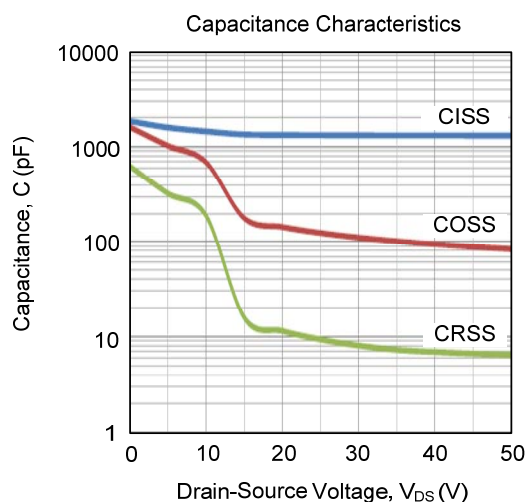
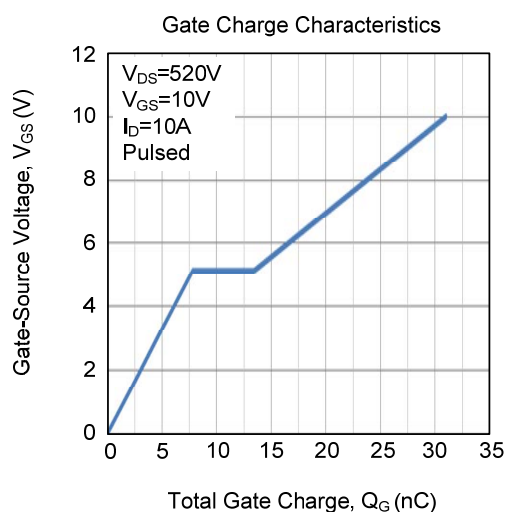
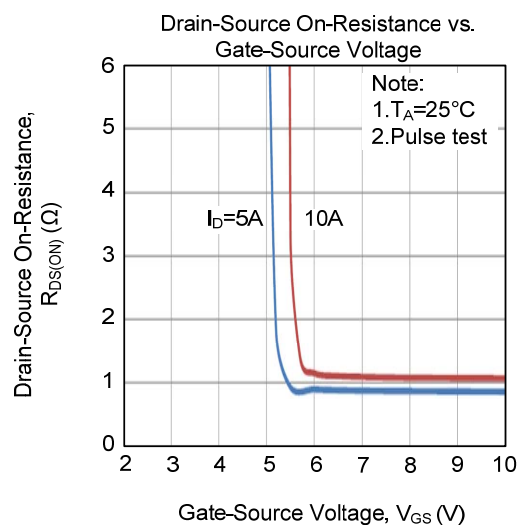
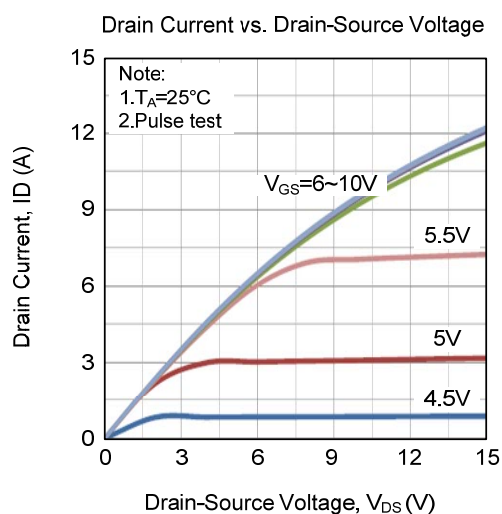


Unclamped Inductive Switching Test Circuit

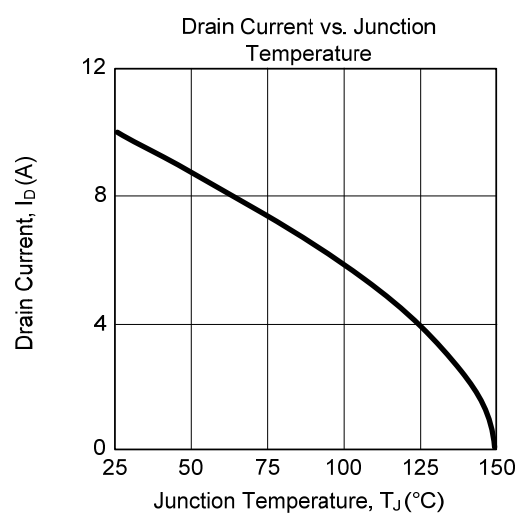
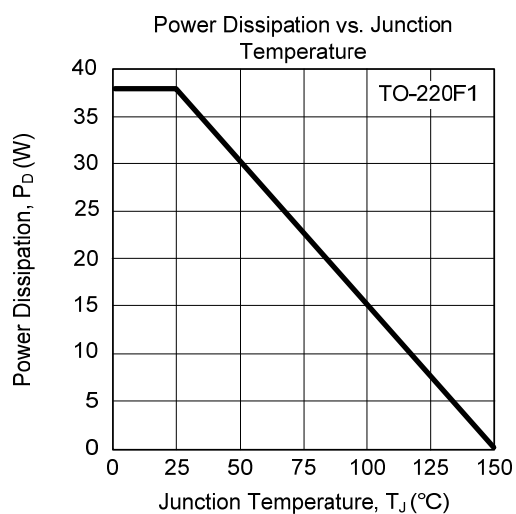
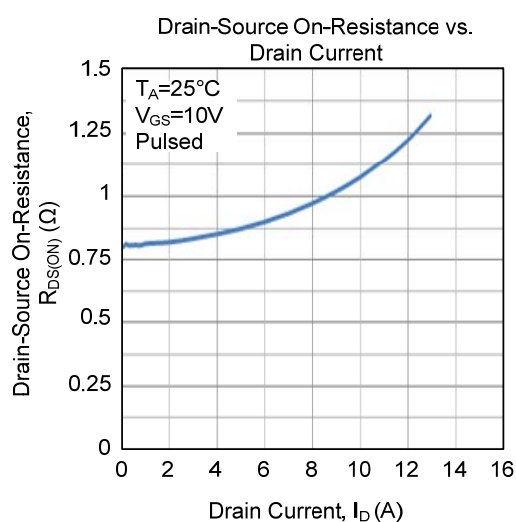
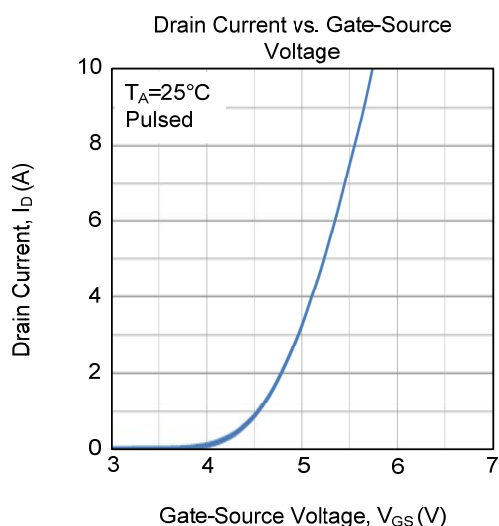
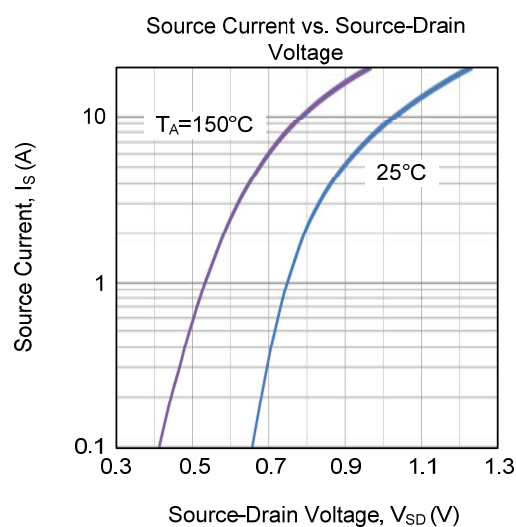
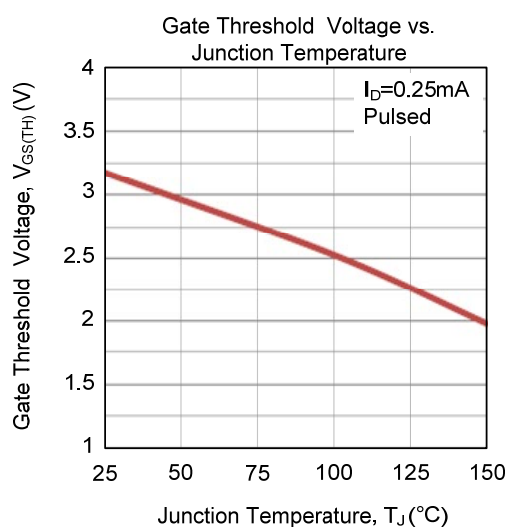


Unclamped Inductive Switching Waveforms

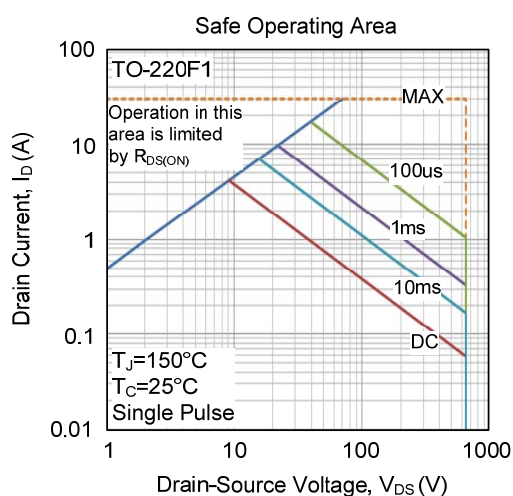
TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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