



11N40-ML

Power MOSFET

11A, 400V N-CHANNEL POWER MOSFET

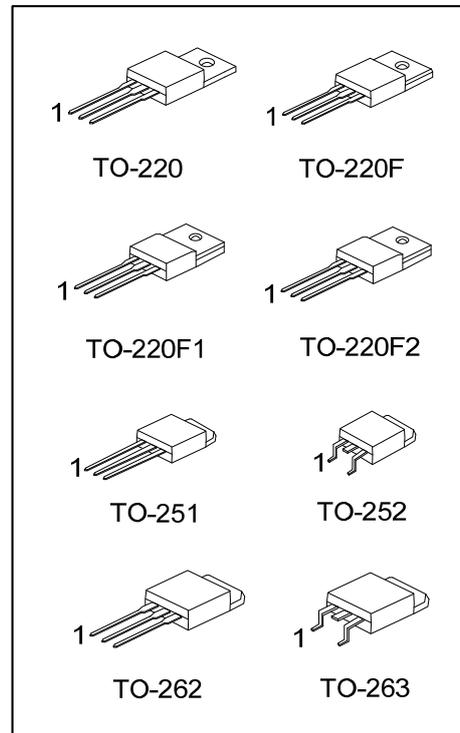
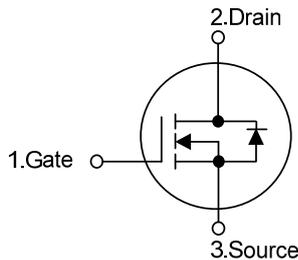
■ DESCRIPTION

The UTC **11N40-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

- * $R_{DS(ON)} \leq 0.55 \Omega @ V_{GS}=10V, I_D=5.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



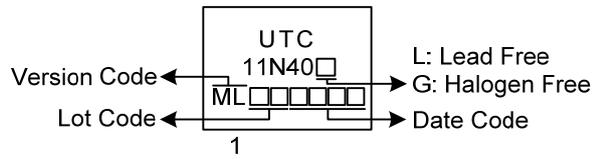
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
11N40L-ML-TA3-T	11N40G-ML-TA3-T	TO-220	G	D	S	Tube
11N40L-ML-TF1-T	11N40G-ML-TF1-T	TO-220F1	G	D	S	Tube
11N40L-ML-TF2-T	11N40G-ML-TF2-T	TO-220F2	G	D	S	Tube
11N40L-ML-TF3-T	11N40G-ML-TF3-T	TO-220F	G	D	S	Tube
11N40L-ML-TM3-T	11N40G-ML-TM3-T	TO-251	G	D	S	Tube
11N40L-ML-TN3-R	11N40G-ML-TN3-R	TO-252	G	D	S	Tape Reel
11N40L-ML-TQ2-T	11N40G-ML-TQ2-T	TO-263	G	D	S	Tube
11N40L-ML-TQ2-R	11N40G-ML-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>11N40G-ML-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Version Code (4)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, TN3: TO-252 T2Q: TO-262, TQ2: TO-263 (3) Version ML (4) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



■ ABSOLUTE MAXIMUM RATINGS (T_c=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V _{DSS}	400	V
Gate-Source Voltage		V _{GSS}	±30	V
Continuous Drain Current	T _C =25°C	I _D	11	A
	T _C =100°C		6.5	A
Pulsed Drain Current (Note 2)		I _{DM}	44	A
Avalanche Energy	Single Pulsed (Note 3)	E _{AS}	437	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.8	V/ns
Power Dissipation	TO-220/TO-262 TO-263	P _D	147	W
	TO-220F/TO-220F1 TO-220F2		35	W
	TO-251/TO-252		56	W
Junction Temperature		T _J	+150	°C
Storage Temperature		T _{STG}	-55 ~ +150	°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 = 30mH, I_{AS} = 5.4A, V_{DD} = 50V, R_G = 25Ω Starting T_J = 25°C
 4. I_{SD} ≤ 11A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°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	°C/W	
	TO-251/TO-252		110	°C/W	
	TO-220/TO-262 TO-263		θ _{JC}	0.85	°C/W
	TO-220F/TO-220F1 TO-220F2			3.57	°C/W
TO-251/TO-252	2.23 (Note)	°C/W			

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

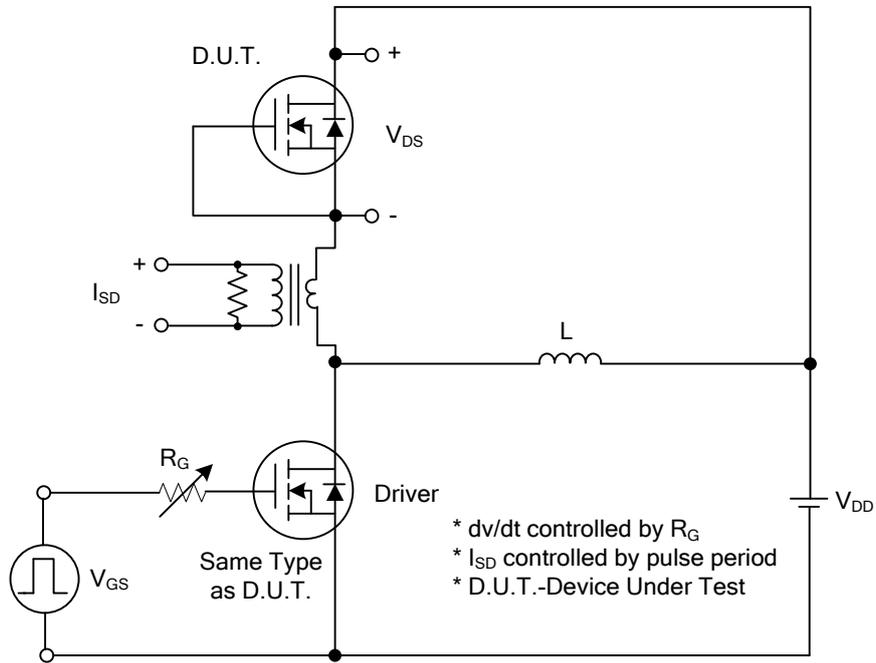
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	400			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =400V, V _{GS} =0V			10	μA
Gate- Source Leakage Current	Forward	I _{GSS}			100	nA
	Reverse					
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 =5.5A			0.55	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		940		pF
Output Capacitance	C _{OSS}			125		pF
Reverse Transfer Capacitance	C _{RSS}			9.5		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =320V, V _{GS} =10V, I _D =11A I _G =1mA (Note 1, 2)		23		nC
Gate-Source Charge	Q _{GS}			5.4		nC
Gate-Drain Charge	Q _{GD}			5		nC
Turn-On Delay Time (Note 1)	t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =11A, R _G =25Ω (Note 1, 2)		10		ns
Turn-On Rise Time	t _R			19		ns
Turn-Off Delay Time	t _{D(OFF)}			70		ns
Turn-Off Fall Time	t _F			27		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Maximum Body-Diode Continuous Current	I _S				11	A
Maximum Body-Diode Pulsed Current	I _{SM}				22	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =11A, V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)	t _{rr}	I _S =11A, V _{GS} =0V di/dt=100A/μs		410		ns
Reverse Recovery Charge	Q _{rr}				7	

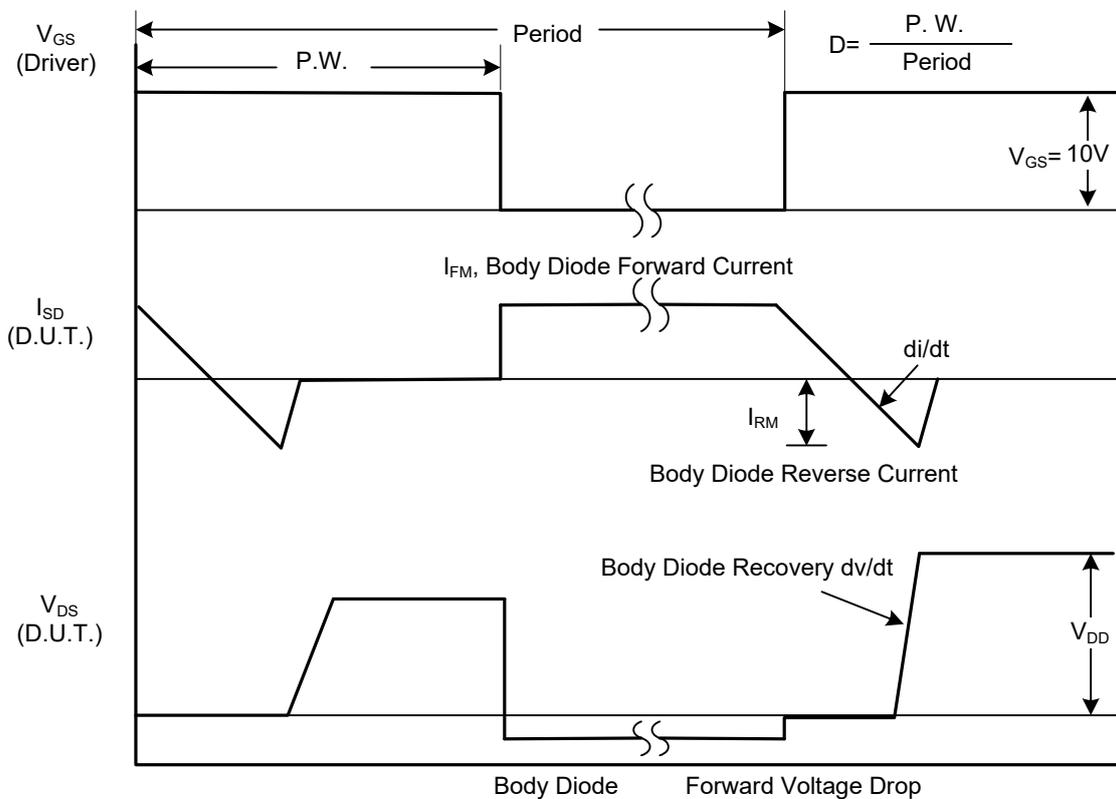
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

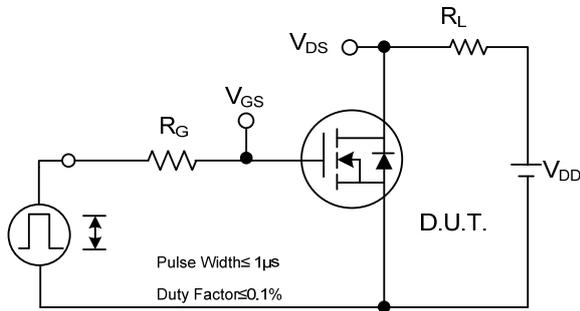


Peak Diode Recovery dv/dt Test Circuit

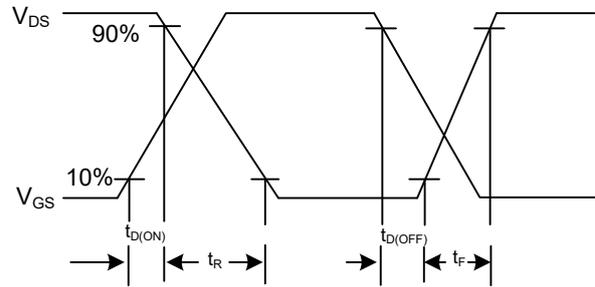


Peak Diode Recovery dv/dt Waveforms

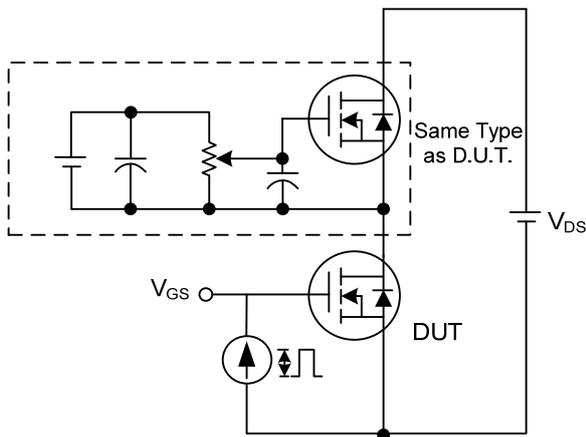
TEST CIRCUITS AND WAVEFORMS



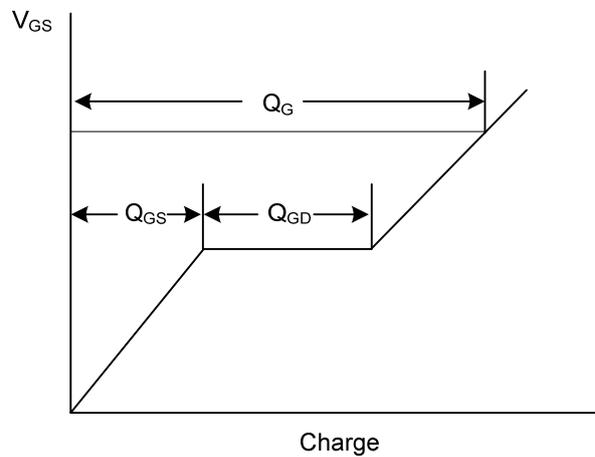
Switching Test Circuit



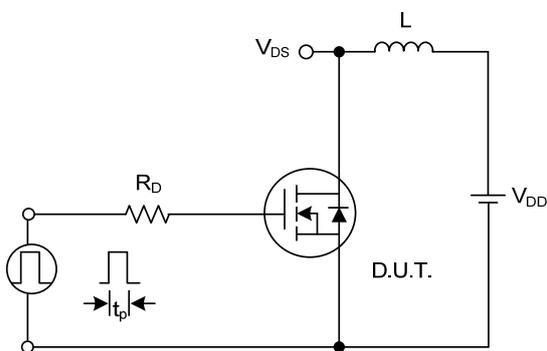
Switching Waveforms



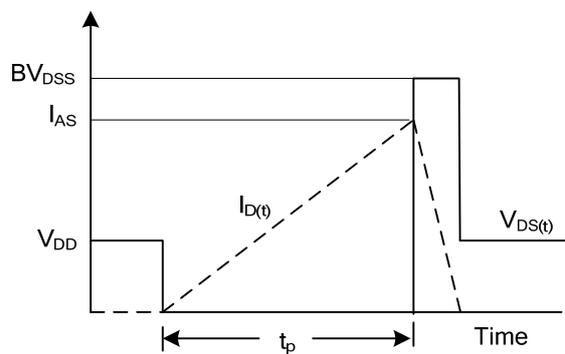
Gate Charge Test Circuit



Gate Charge Waveform

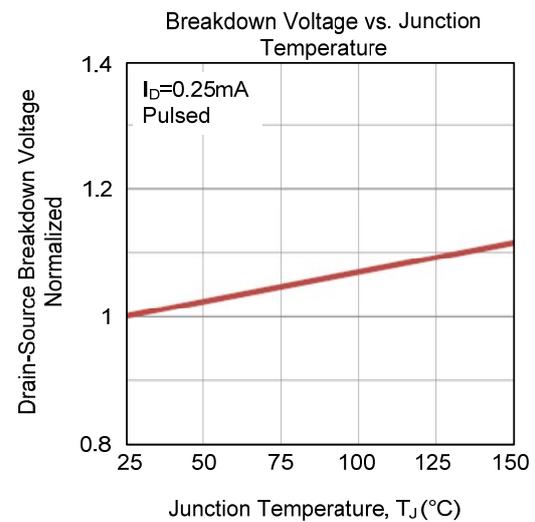
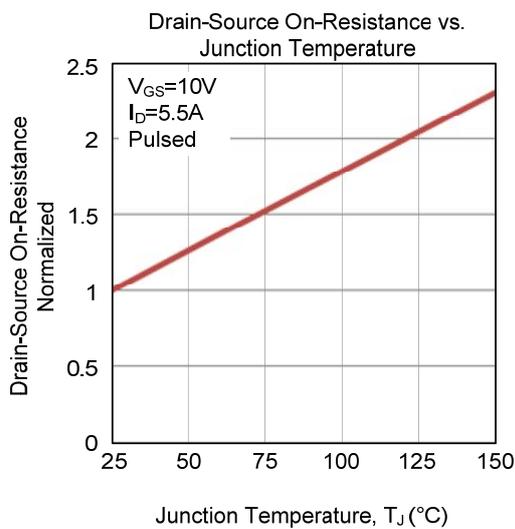
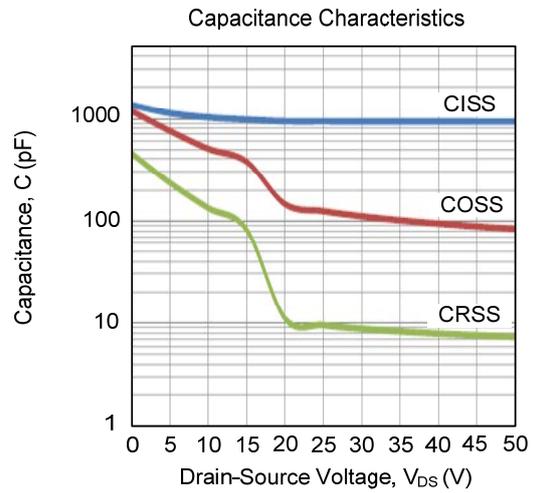
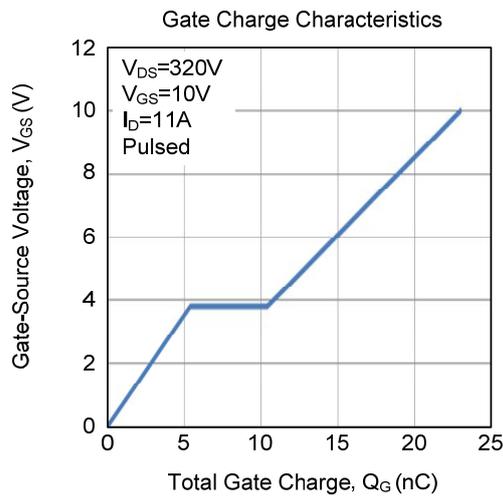
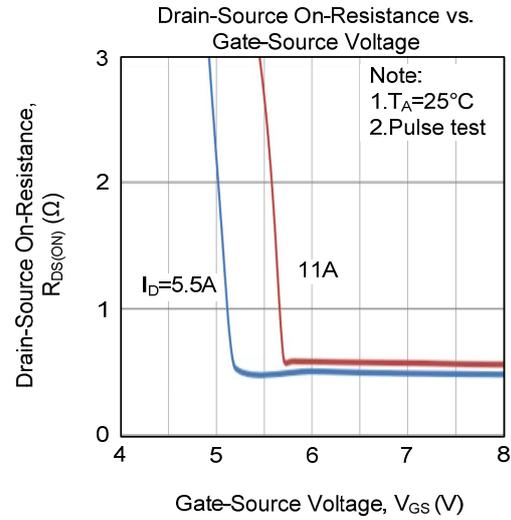
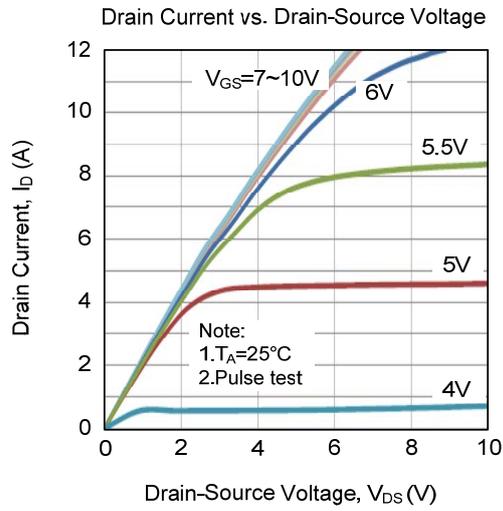


Unclamped Inductive Switching Test Circuit

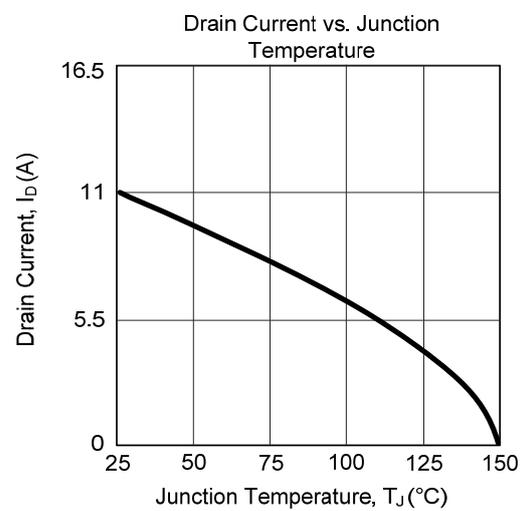
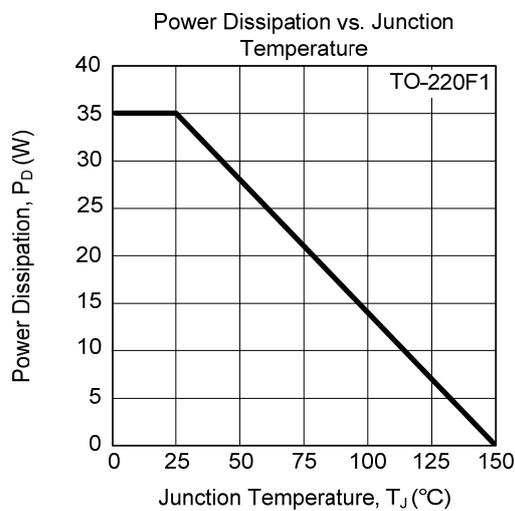
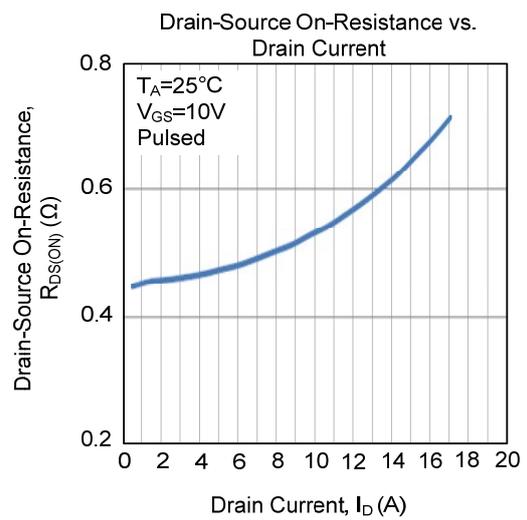
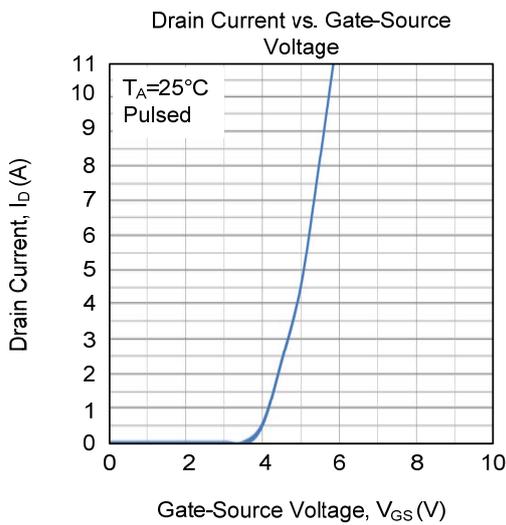
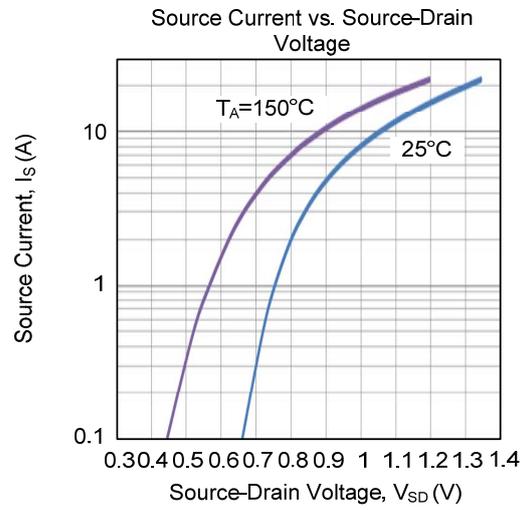
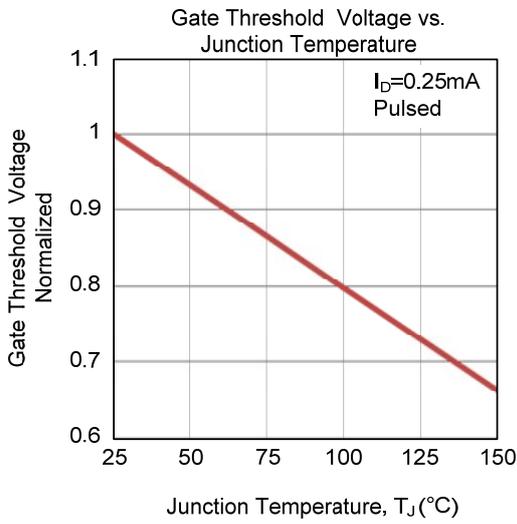


Unclamped Inductive Switching Waveforms

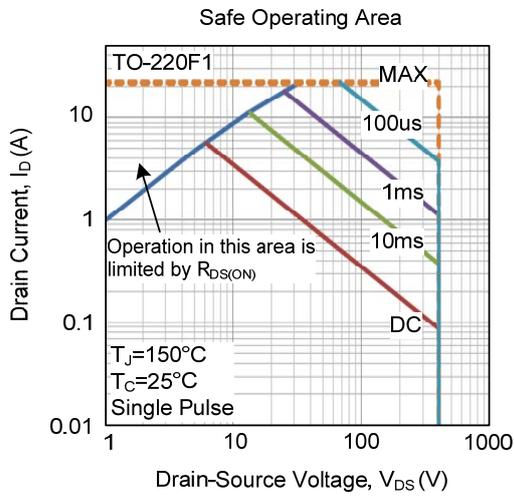
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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