



12N40-ML

Power MOSFET

12A, 400V N-CHANNEL POWER MOSFET

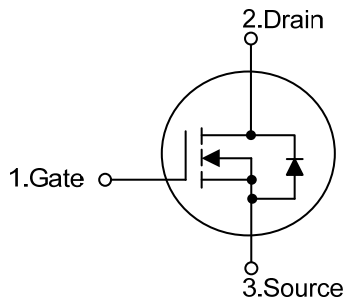
DESCRIPTION

The UTC 12N40-ML provide excellent $R_{DS(ON)}$, low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

FEATURES

- * $R_{DS(ON)} \leq 0.46 \Omega$ @ $V_{GS}=10V$, $I_D=6.0A$
- * Low Reverse Transfer Capacitance
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

SYMBOL

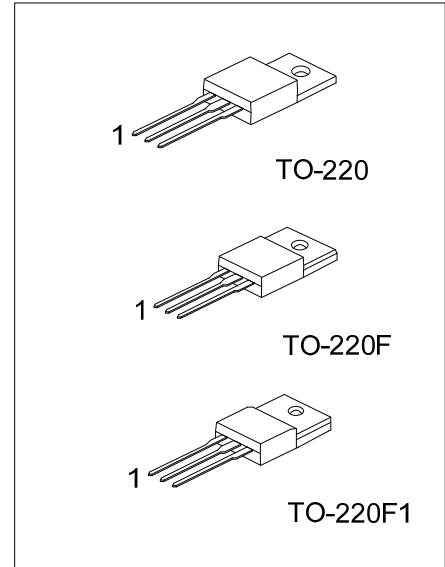


ORDERING INFORMATION

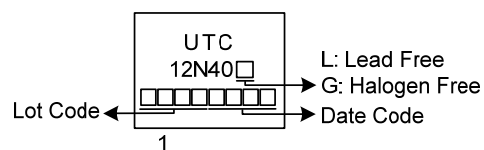
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
12N40L-TA3-T	12N40G-TA3-T	TO-220	G	D	S	Tube
12N40L-TF1-T	12N40G-TF1-T	TO-220F1	G	D	S	Tube
12N40L-TF3-T	12N40G-TF3-T	TO-220F	G	D	S	Tube

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

12N40G-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F (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}	400	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous	I_{D}	12	A
	Pulsed (Note 2)	I_{DM}	24	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	453	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2	V/ns
Power Dissipation	TO-220	P_{D}	150	W
	TO-220F/TO-220F1		36	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. $L=30\text{mH}$, $I_{\text{AS}}=5.5\text{A}$, $V_{\text{DD}}=100\text{V}$, $R_{\text{G}}=25\ \Omega$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$

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

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ_{JA}	62.5	$^{\circ}\text{C/W}$
Junction to Case	TO-220	θ_{JC}	0.83	$^{\circ}\text{C/W}$
	TO-220F/TO-220F1		3.47	$^{\circ}\text{C/W}$

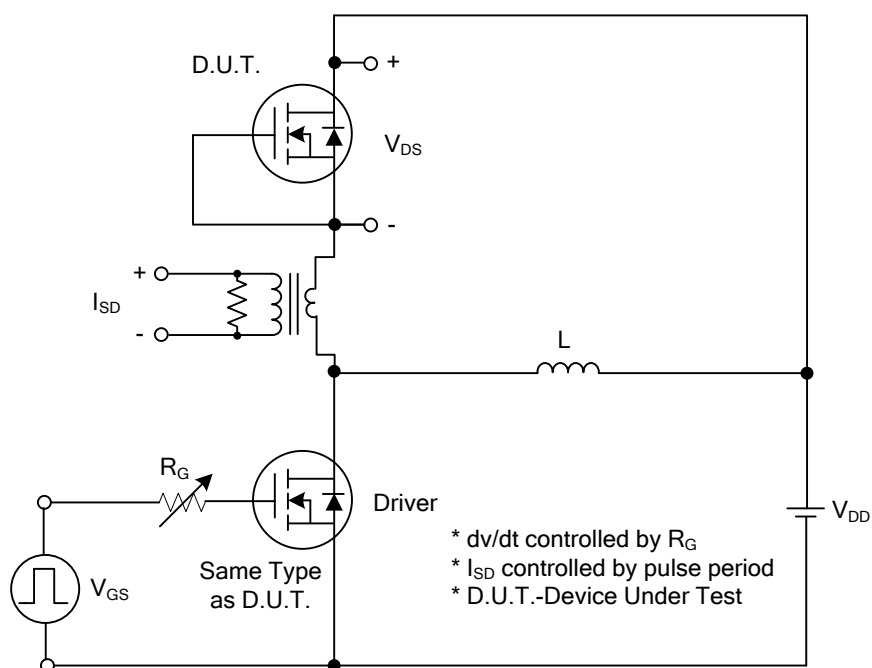
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	400			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=400V, V_{GS}=0V$			10	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 30V, V_{DS}=0V$			± 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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=6.0A$			0.46	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1MHz$		1180		pF
Output Capacitance	C_{OSS}			145		pF
Reverse Transfer Capacitance	C_{RSS}			10.5		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q_G	$V_{DS}=320V, V_{GS}=10V, I_D=12A,$ (Note 1, 2)		40		nC
Gate-Source Charge	Q_{GS}			13		nC
Gate-Drain Charge	Q_{GD}			12		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=100V, V_{GS}=10V, I_D=12A,$ $R_G=25\Omega$ (Note 1, 2)		15		ns
Turn-On Rise Time	t_R			21		ns
Turn-Off Delay Time	$t_{D(OFF)}$			80		ns
Turn-Off Fall Time	t_F			24		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I_S				12	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				24	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	$I_S=12A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t_{rr}	$I_S=12A, V_{GS}=0V,$		265		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$dl_F/dt=100A/\mu s$		2.5		μC

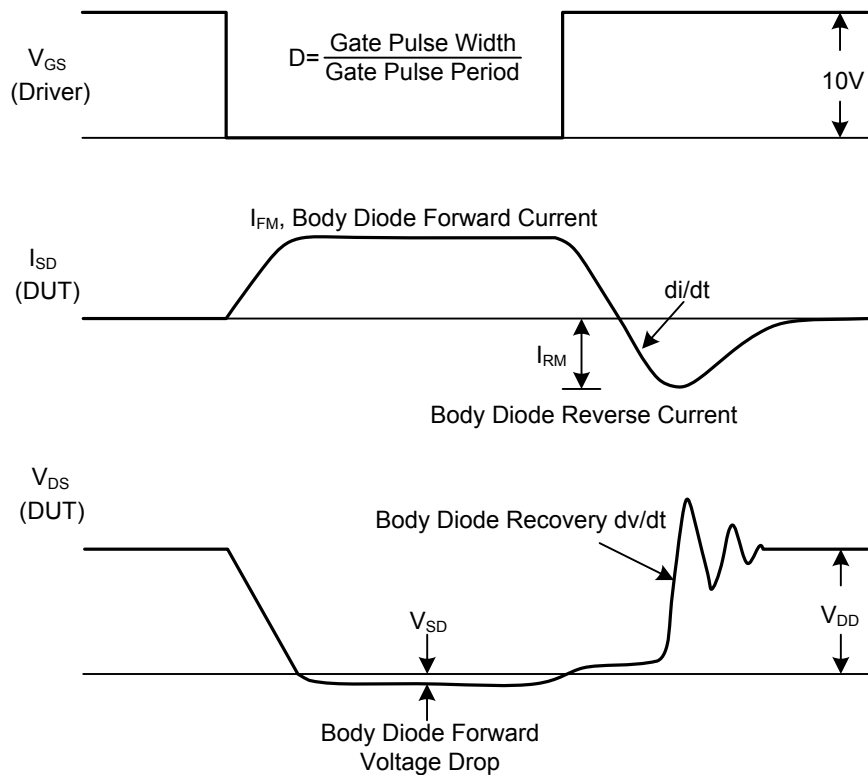
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

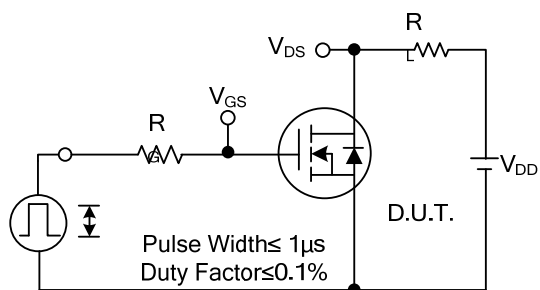


Peak Diode Recovery dv/dt Test Circuit

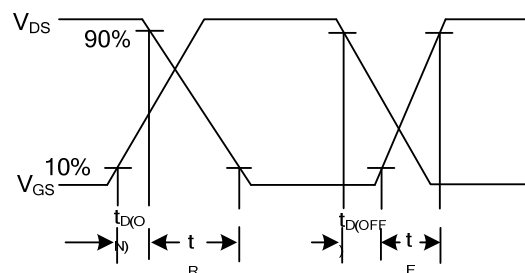


Peak Diode Recovery dv/dt Waveforms

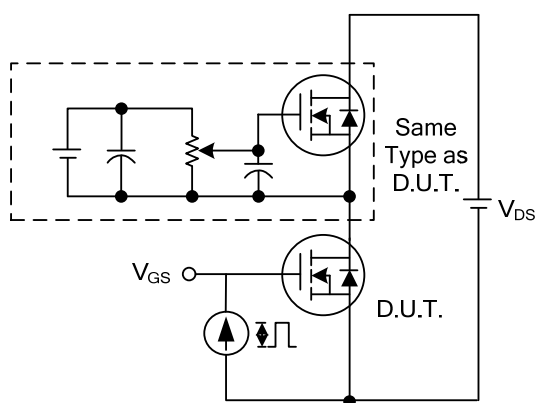
■ TEST CIRCUITS AND WAVEFORMS



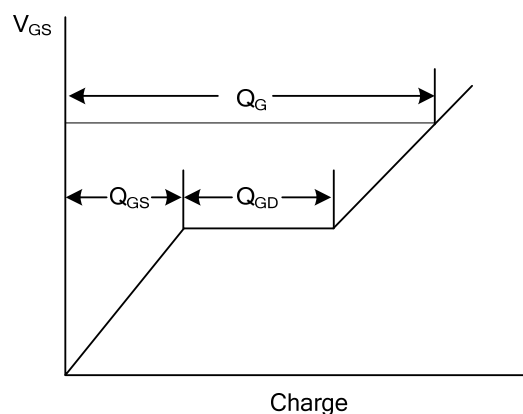
Switching Test Circuit



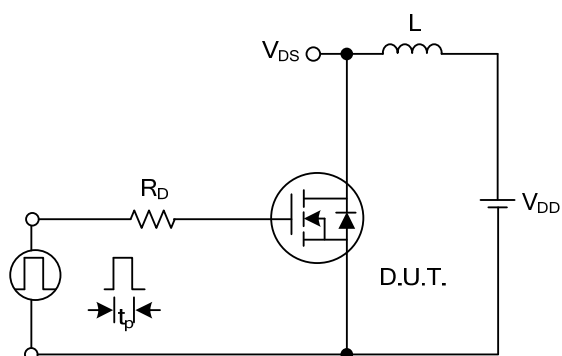
Switching Waveforms



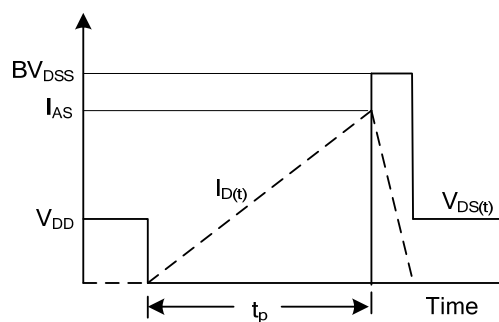
Gate Charge Test Circuit



Gate Charge Waveform

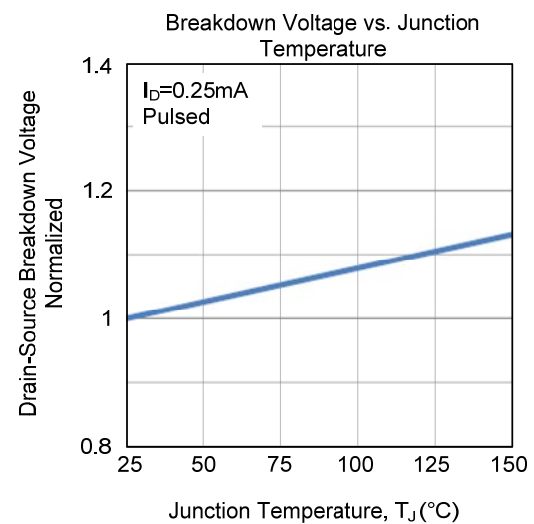
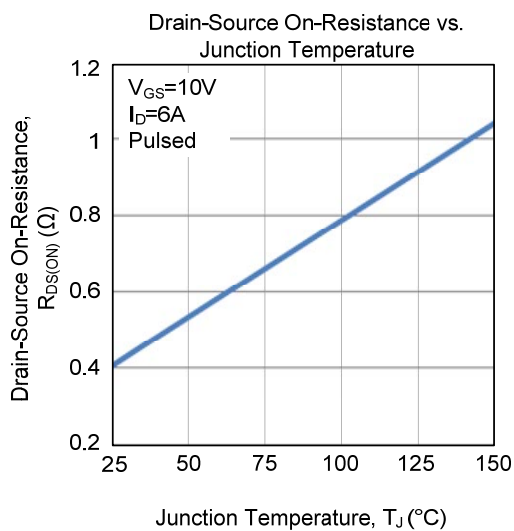
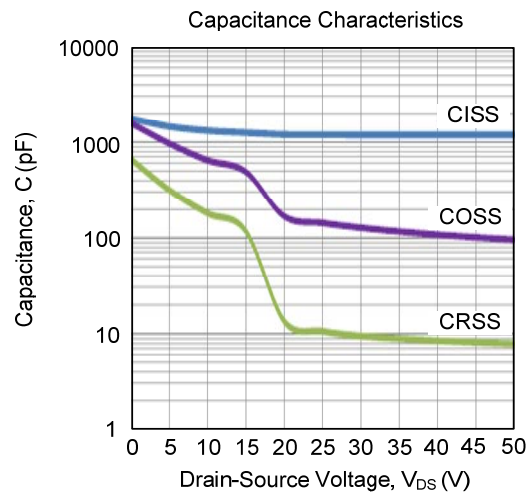
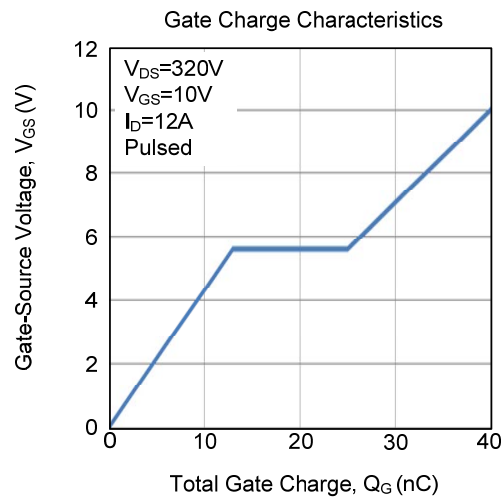
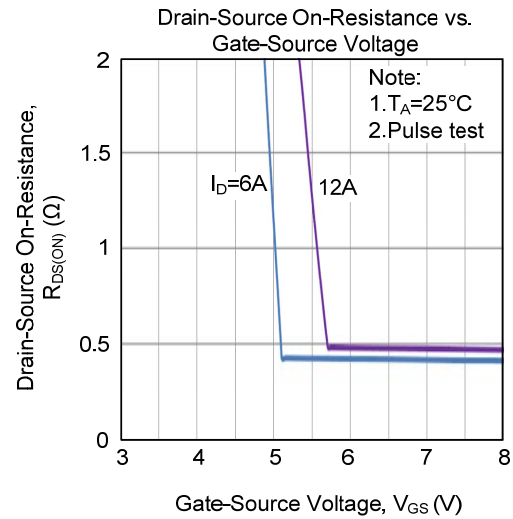
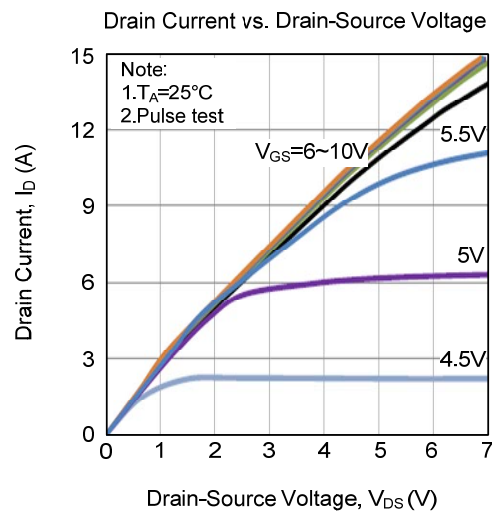


Unclamped Inductive Switching Test Circuit

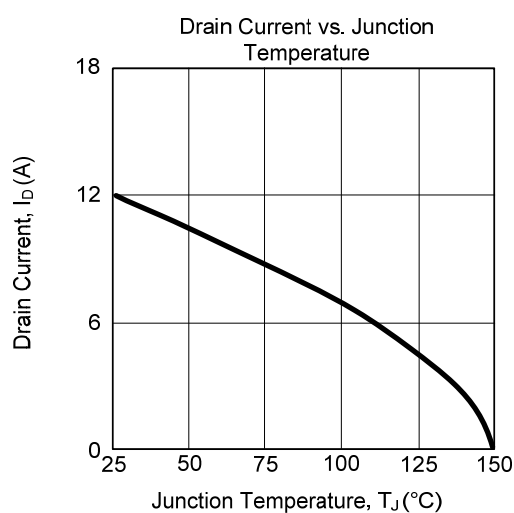
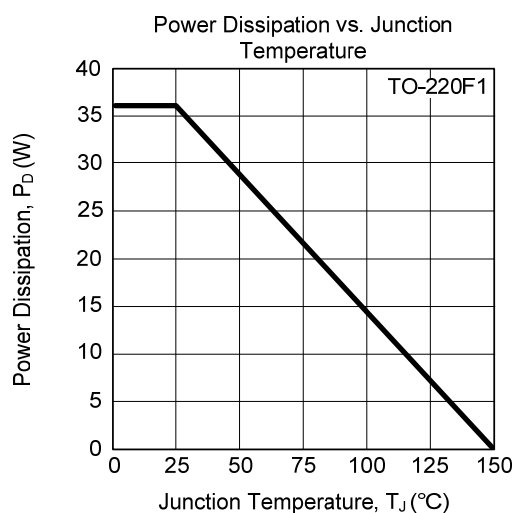
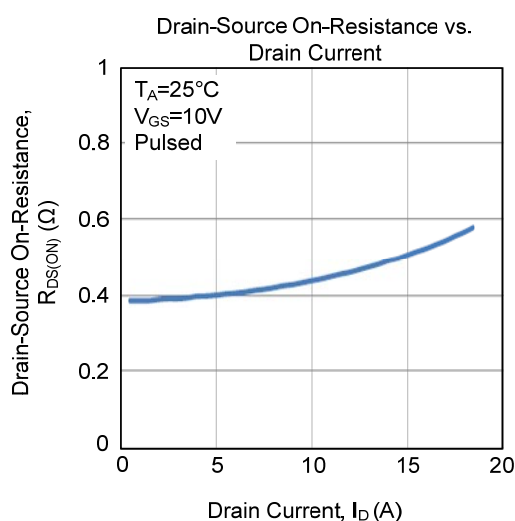
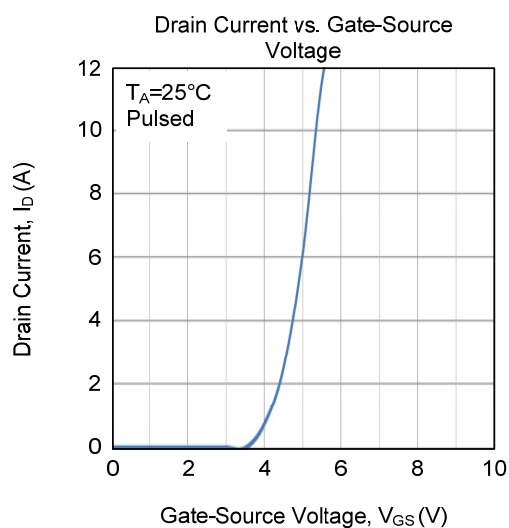
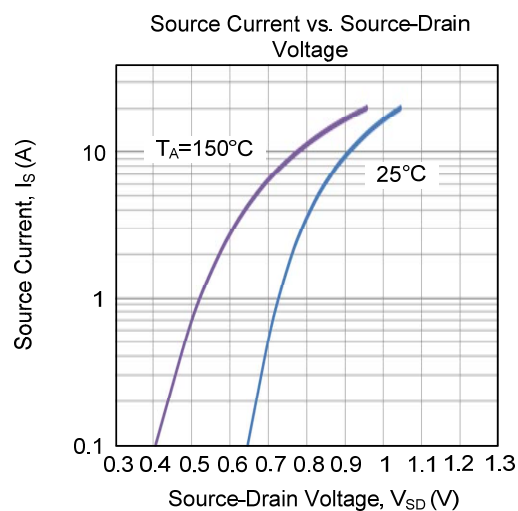
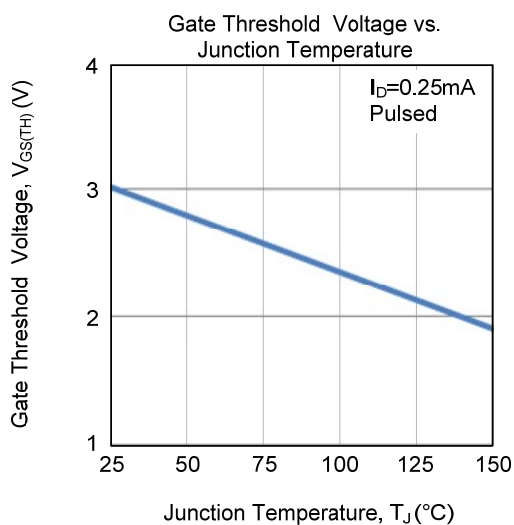


Unclamped Inductive Switching Waveforms

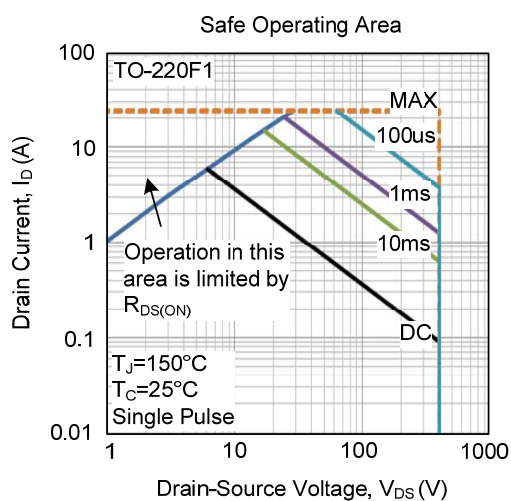
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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