



4N60K-TC

Power MOSFET

4A, 600V N-CHANNEL POWER MOSFET

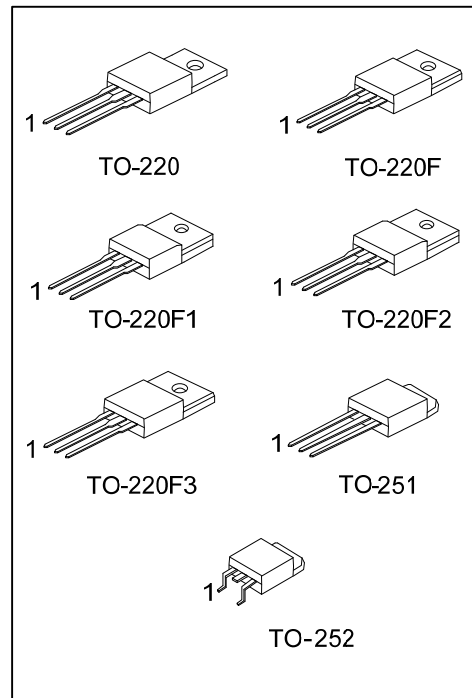
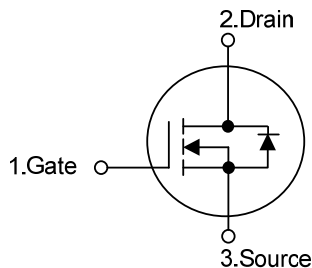
■ DESCRIPTION

The UTC **4N60K-TC** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

- * $R_{DS(ON)} < 2.5\Omega @ V_{GS} = 10V, I_D = 2.0A$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, high Ruggedness

■ SYMBOL



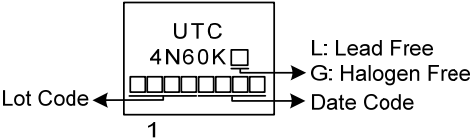
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N60KL-TA3-T	4N60KG-TA3-T	TO-220	G	D	S	Tube
4N60KL-TF3-T	4N60KG-TF3-T	TO-220F	G	D	S	Tube
4N60KL-TF1-T	4N60KG-TF1-T	TO-220F1	G	D	S	Tube
4N60KL-TF2-T	4N60KG-TF2-T	TO-220F2	G	D	S	Tube
4N60KL-TF3T-T	4N60KG-TF3T-T	TO-220F3	G	D	S	Tube
4N60KL-TM3-T	4N60KG-TM3-T	TO-251	G	D	S	Tube
4N60KL-TN3-R	4N60KG-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>4N60KG-TA3-T</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TF3T: TO-220F3, TM3: TO-251, TN3: TO-252 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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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}	600	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	4.0	A
Drain Current	Continuous	I_D	4.0	A
	Pulsed (Note 2)	I_{DM}	16	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	100	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.5	V/ns
Power Dissipation	TO-220	P_D	106	W
	TO-220F/TO-220F1 TO-220F2/TO-220F3		36	W
	TO-251/TO-252		50	W
Derate above 25°C	TO-220		0.85	W/ $^\circ\text{C}$
Derate above 25°C	TO-220F/TO-220F1 TO-220F2/TO-220F3	0.288	W/ $^\circ\text{C}$	
	TO-251/TO-252	0.40	W/ $^\circ\text{C}$	
	Junction Temperature	T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +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. $L = 13\text{mH}$, $I_{AS} = 4.0\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

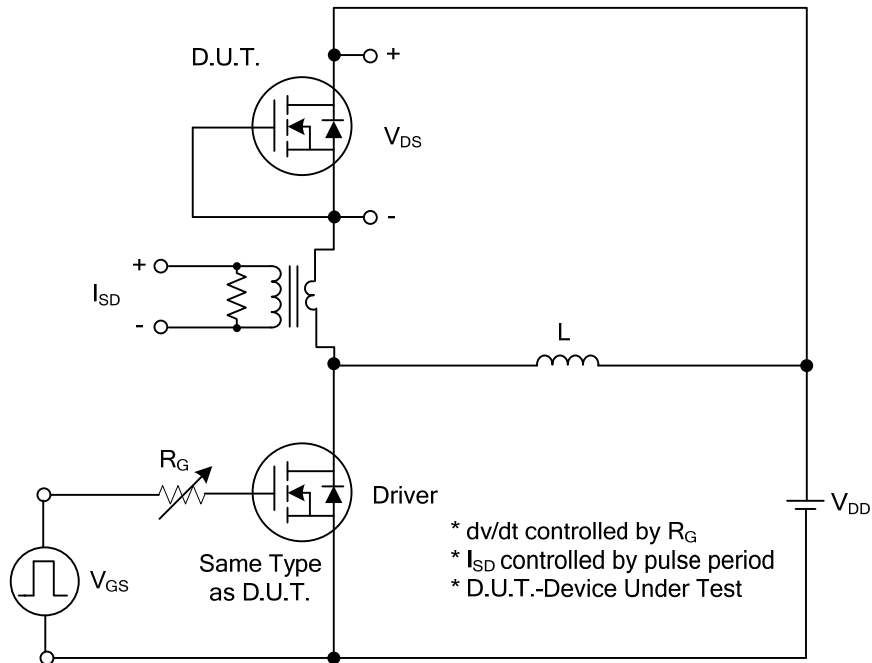
PARAMETER		SYMBOL	RATINGS	UNIT
Junction-to-Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220F3	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
Junction-to-Case	TO-220	θ_{JC}	1.18	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		3.47	$^\circ\text{C}/\text{W}$
	TO-220F2		3.4	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		2.5	$^\circ\text{C}/\text{W}$

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

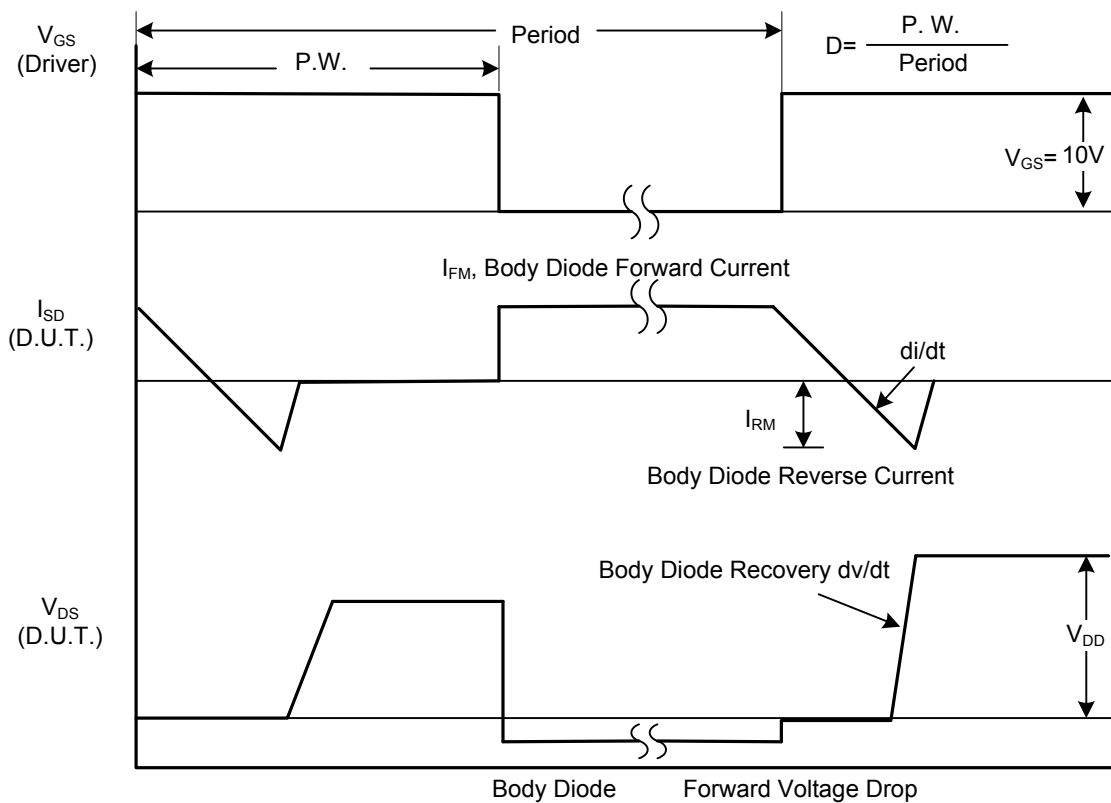
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V	
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA	
			V _{DS} =600V, V _{GS} =0V, T _C =125°C			10	μA	
Gate-Source Leakage 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} =10 V, I _D =2.0A			2.5	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1MHz		510		pF	
Output Capacitance		C _{OSS}				58		pF
Reverse Transfer Capacitance		C _{RSS}				5.6		pF
SWITCHING CHARACTERISTICS								
Total Gate Charge		Q _G	V _{DS} =200V, V _{GS} =10V, I _D =2.0A I _G = 10mA (Note1, 2)		17.4		nC	
Gate-Source Charge		Q _{GS}				5		nC
Gate-Drain Charge		Q _{GD}				4.6		nC
Turn-On Delay Time		t _{D(ON)}	V _{DS} =30V, V _{GS} =10V, I _D =0.5A, R _G =25Ω (Note1, 2)		36		ns	
Turn-On Rise Time		t _R				29		ns
Turn-Off Delay Time		t _{D(OFF)}				146		ns
Turn-Off Fall Time		t _F				34		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS								
Maximum Continuous Drain-Source Diode Forward Current		I _S				4.0	A	
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				16	A	
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0V, I _S = 4.0A			1.4	V	
Reverse Recovery Time		t _{rr}	V _{GS} = 0V, I _S = 4.0A, dI _F / dt =100A/μs (Note 1)		248		nS	
Reverse Recovery Charge		Q _{rr}				0.15		μC

Notes: 1. Pulse Test: Pulse width≤300μs, Duty cycle≤2%
2. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

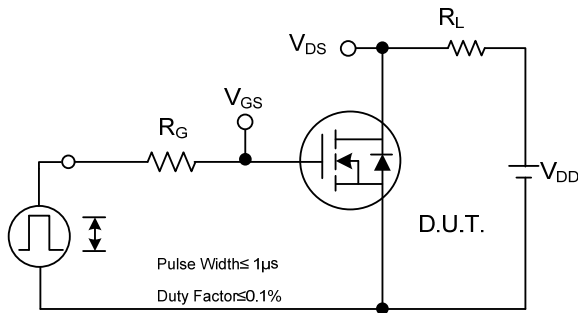


Peak Diode Recovery dv/dt Test Circuit

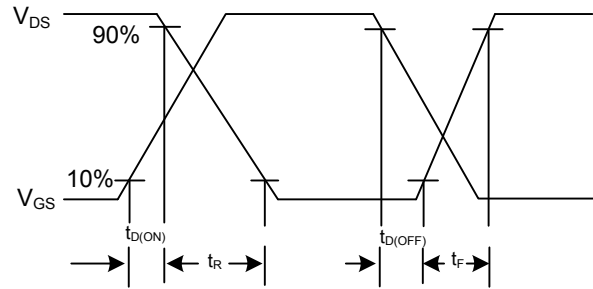


Peak Diode Recovery dv/dt Waveforms

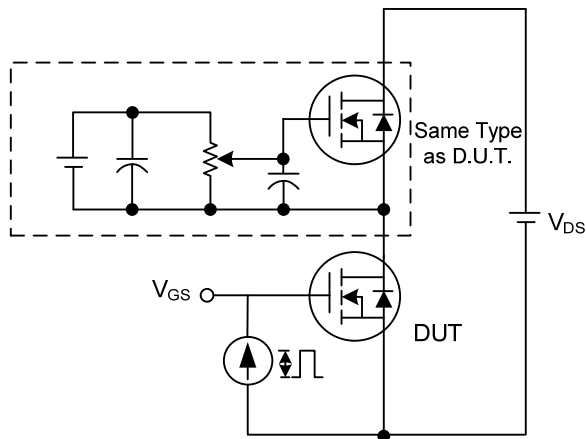
TEST CIRCUITS AND WAVEFORMS



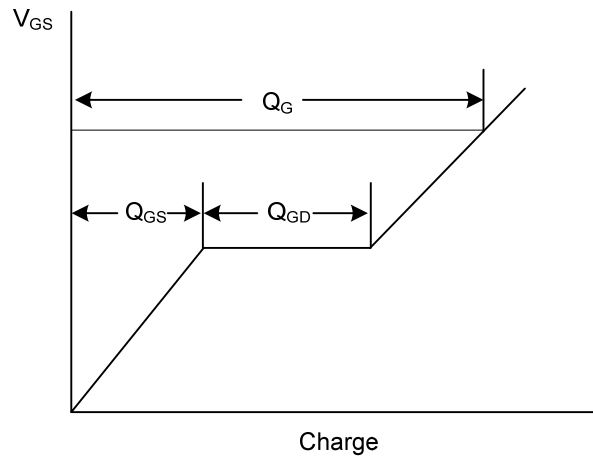
Switching Test Circuit



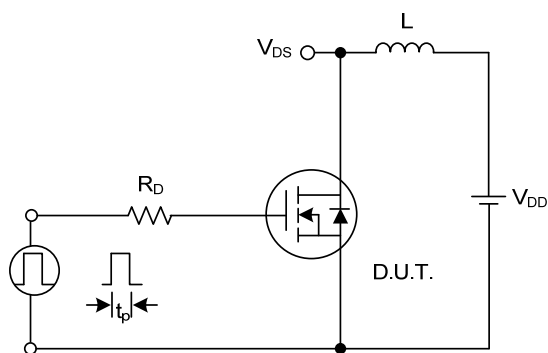
Switching Waveforms



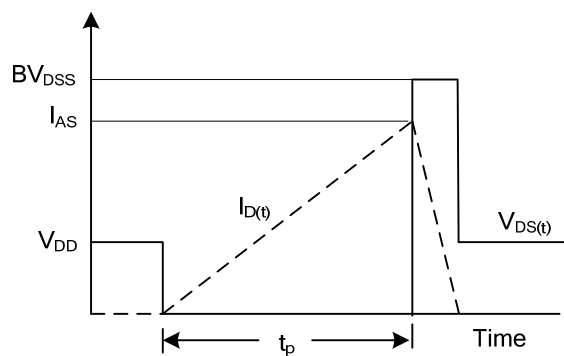
Gate Charge Test Circuit



Gate Charge Waveform

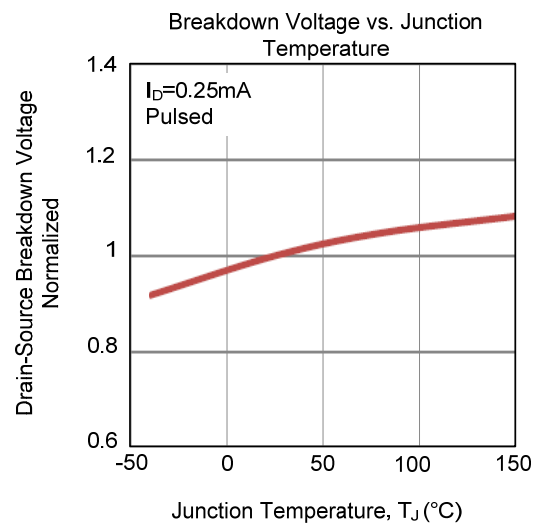
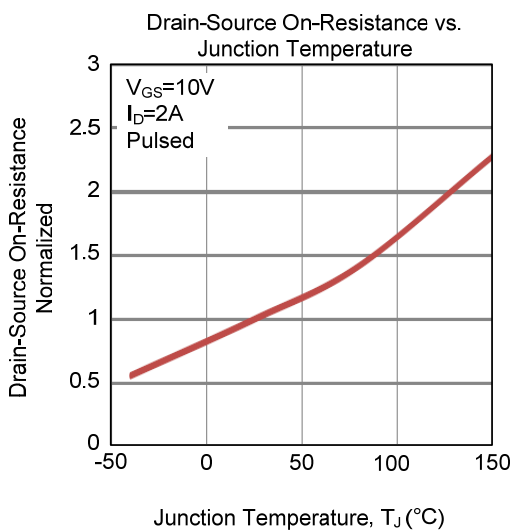
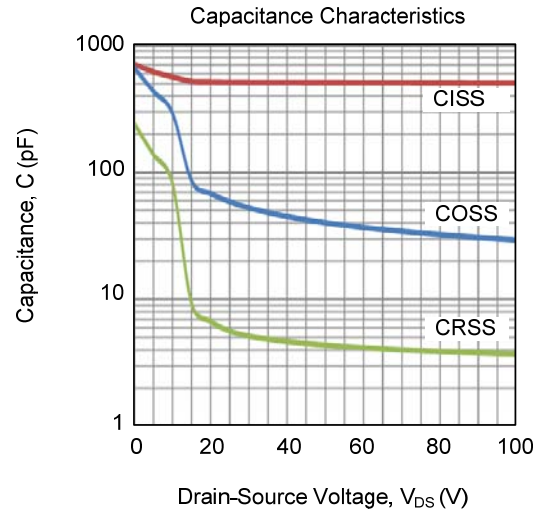
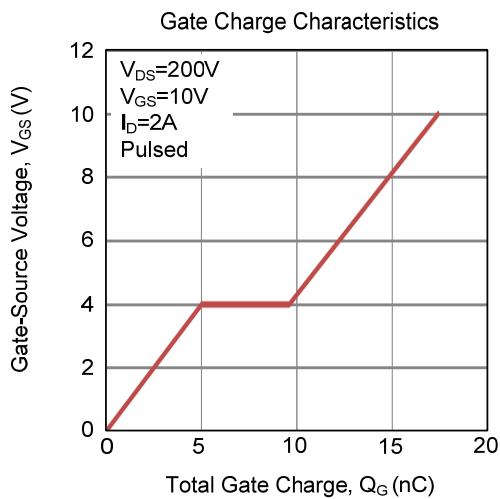
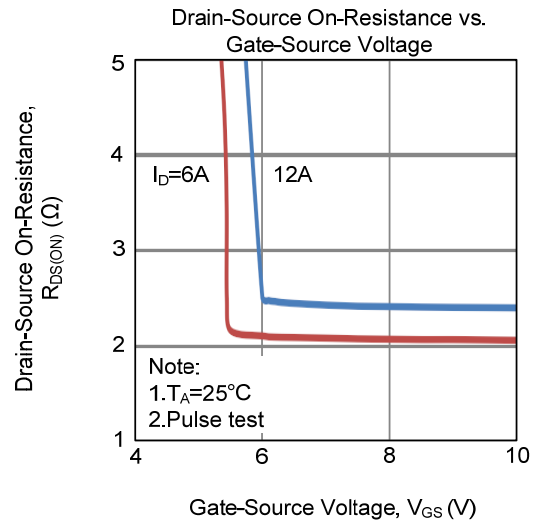
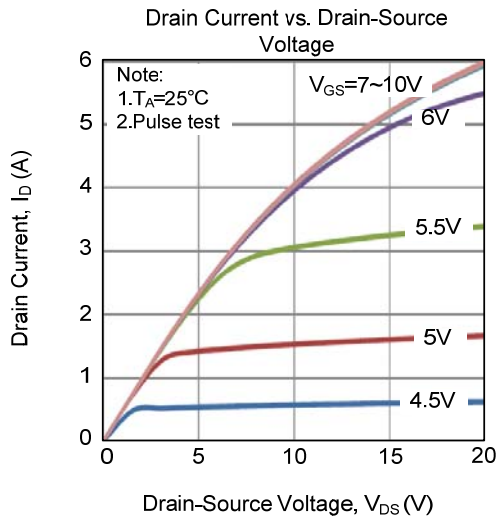


Unclamped Inductive Switching Test Circuit

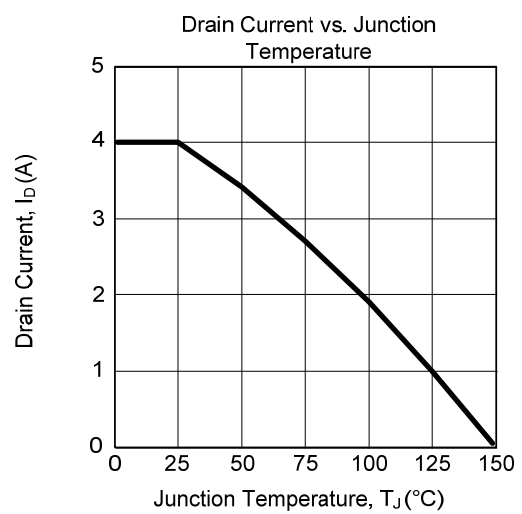
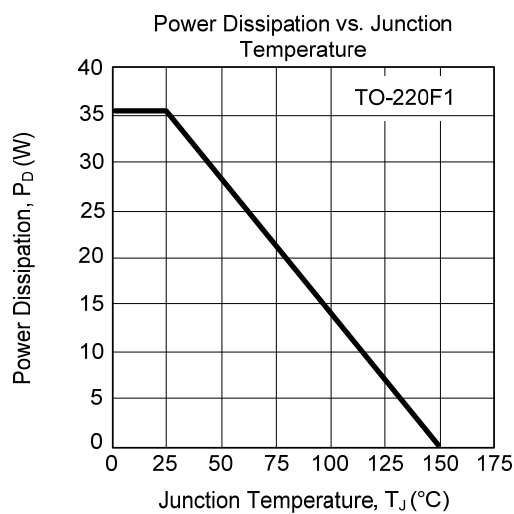
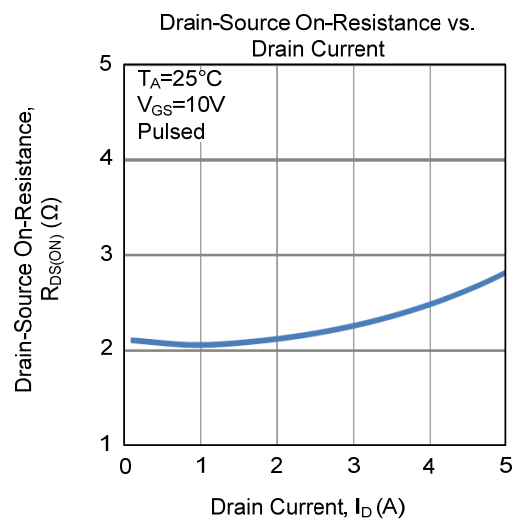
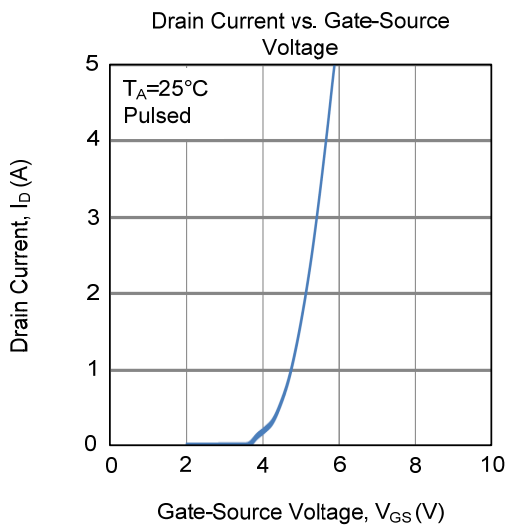
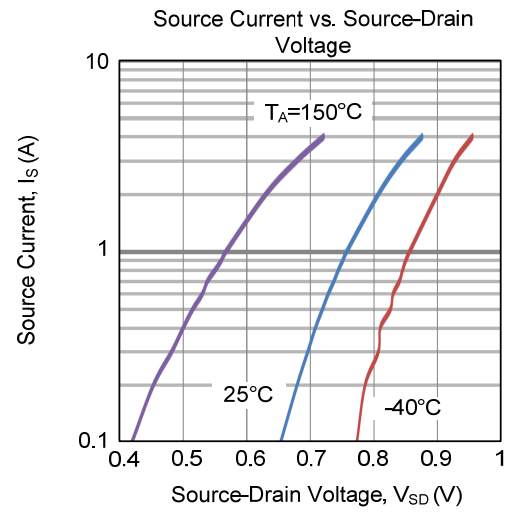
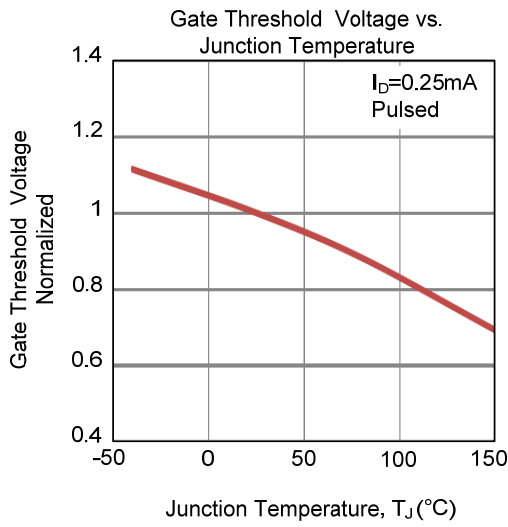


Unclamped Inductive Switching Waveforms

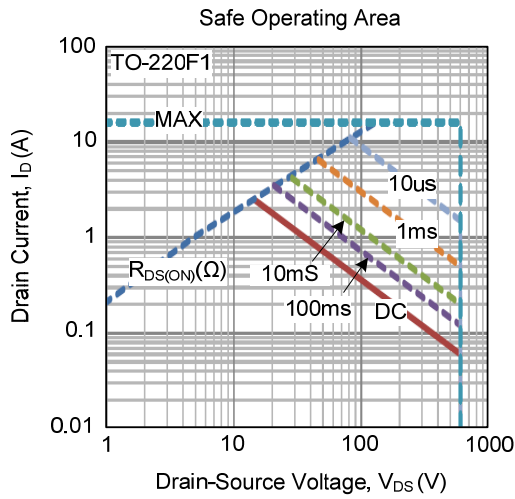
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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