



1N60-KW

Power MOSFET

1A, 600V N-CHANNEL POWER MOSFET

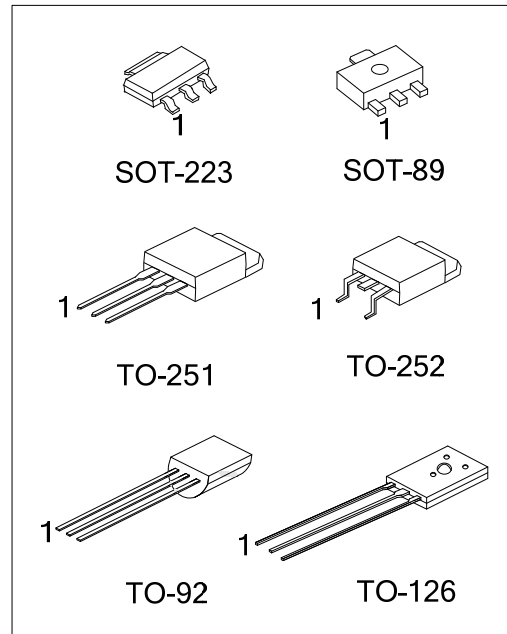
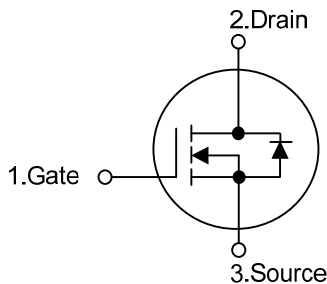
DESCRIPTION

The UTC **1N60-KW** is a high voltage 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 AC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} \leq 15\Omega$ @ $V_{GS}=10V, I_D=0.5A$
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL



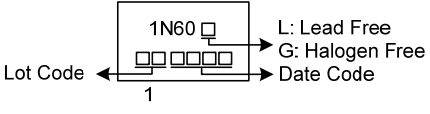
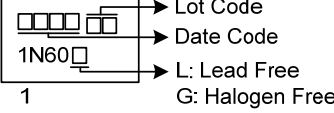
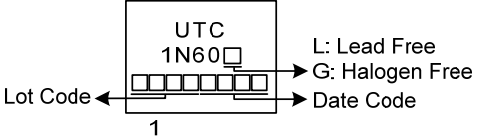
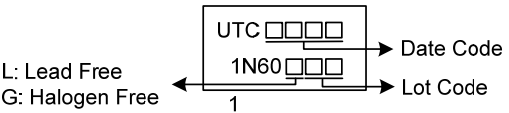
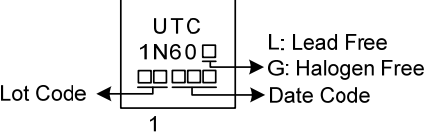
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
1N60L-AA3-R	1N60G-AA3-R	SOT-223	G	D	S	Tape Reel
1N60L-AB3-R	1N60G-AB3-R	SOT-89	G	D	S	Tape Reel
1N60L-TM3-T	1N60G-TM3-T	TO-251	G	D	S	Tube
1N60L-TN3-R	1N60G-TN3-R	TO-252	G	D	S	Tape Reel
1N60L-T60-K	1N60G-T60-K	TO-126	G	D	S	Bulk
1N60L-T92-B	1N60G-T92-B	TO-92	G	D	S	Tape Box
1N60L-T92-K	1N60G-T92-K	TO-92	G	D	S	Bulk

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

<p>1N60G-AA3-R</p>	<p>(1) T: Tube, R: Tape Reel, B: Tape Box, K: Bulk (2) AA3: SOT-223, AB3: SOT-89, TM3: TO-251 TN3: TO-252, T60: TO-126, T92: TO-92 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

PACKAGE	MARKING
SOT-223	 <p>1N60 □ Lot Code ← □ □ □ □ □ → Date Code 1 L: Lead Free G: Halogen Free</p>
SOT-89	 <p>□ □ □ □ □ → Lot Code □ □ □ □ □ → Date Code 1N60 □ 1 L: Lead Free G: Halogen Free</p>
TO-251 / TO-252	 <p>UTC 1N60 □ Lot Code ← □ □ □ □ □ → Date Code 1 L: Lead Free G: Halogen Free</p>
TO-126	 <p>UTC □ □ □ □ □ → Date Code L: Lead Free ← □ □ □ □ □ → Lot Code G: Halogen Free 1N60 □ □ □ □ □ 1</p>
TO-92	 <p>UTC 1N60 □ Lot Code ← □ □ □ □ □ → Date Code 1 L: Lead Free G: Halogen Free</p>

■ **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
Continuous Drain Current		I_D	1	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	7.2	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation ($T_A=25^\circ\text{C}$)	SOT-89	P_D	8	W
	SOT-223		8	W
	TO-251/TO-252		27	W
	TO-126/TO-92		12.5	W
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. $L = 10\text{mH}$, $I_{AS} = 1.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

3. $I_{SD} \leq 1.2\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-89/SOT-223	θ_{JA}	150	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		100	$^\circ\text{C}/\text{W}$
	TO-126/TO-92		132	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-89/SOT-223	θ_{JC}	15.6	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		4.6	$^\circ\text{C}/\text{W}$
	TO-126/TO-92		10	$^\circ\text{C}/\text{W}$

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

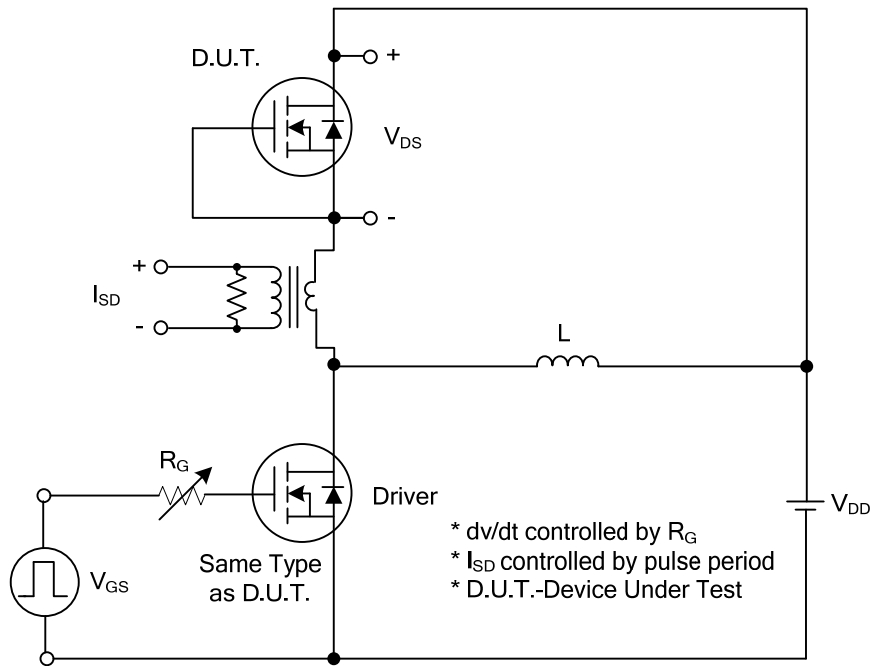
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V	
Drain-Source Leakage Current	I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA	
Gate-Source Leakage Current	Forward	I _{GSS}			100	nA	
	Reverse						V _{GS} =30V, V _{DS} =0V
		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 =0.5A		12	15	Ω	
DYNAMIC CHARACTERISTICS							
Input Capacitance	C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1MHz		115		pF	
Output Capacitance	C _{OSS}				17.5		pF
Reverse Transfer Capacitance	C _{RSS}				2		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =1A (Note 2,3)		7.5		nC	
Gate-Source Charge	Q _{GS}				3.2		nC
Gate-Drain Charge	Q _{GD}				0.6		nC
Turn-On Delay Time	t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =1A, R _G =25Ω, (Note 2,3)		2.4		ns	
Turn-On Rise Time	t _R				15		ns
Turn-Off Delay Time	t _{D(OFF)}				9.6		ns
Turn-Off Fall Time	t _F				35		ns
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current	I _S				1	A	
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				2	A	
Drain-Source Diode Forward Voltage	V _{SD}	I _S =1A, V _{GS} =0V			1.4	V	
Reverse Recovery Time	t _{rr}	I _S =1A, V _{GS} =0V dI _F /dt=100A/μs (Note 1)		280		ns	
Reverse Recovery Charge	Q _{rr}				400		nC

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature.

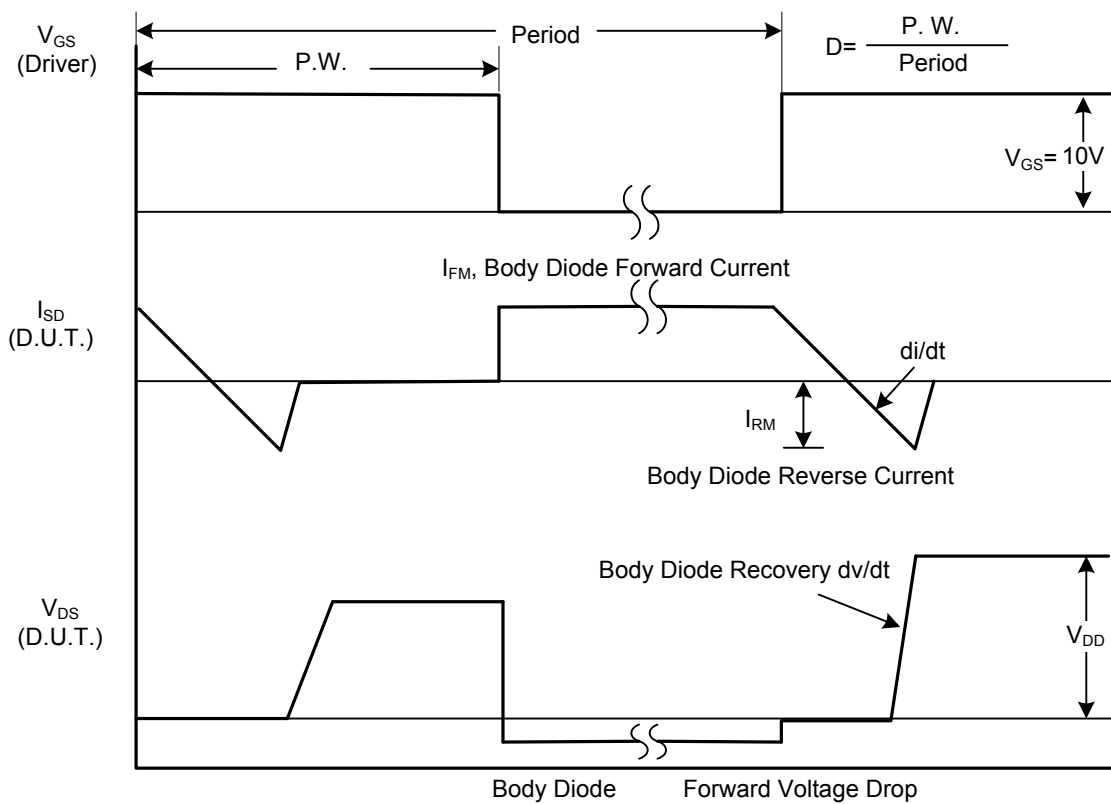
2. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

3. Essentially Independent of Operating Temperature.

■ TEST CIRCUITS AND WAVEFORMS

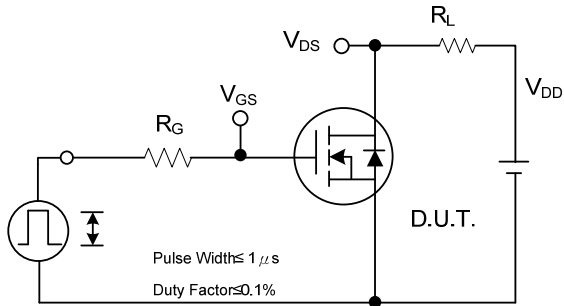


Peak Diode Recovery dv/dt Test Circuit

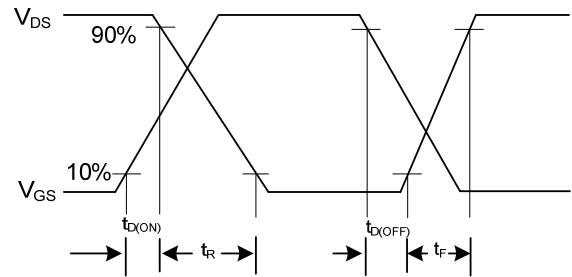


Peak Diode Recovery dv/dt Waveforms

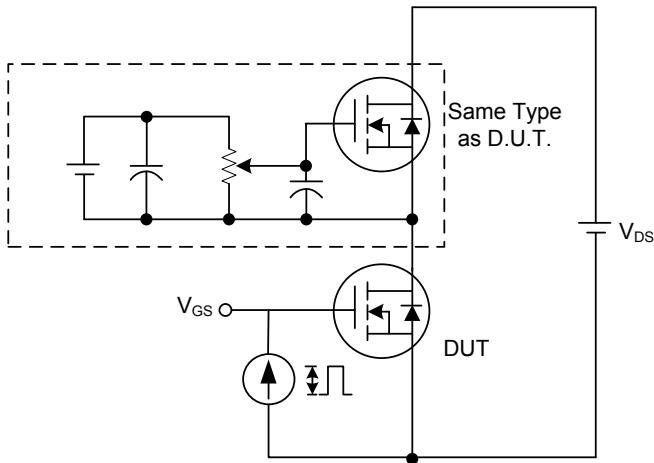
■ TEST CIRCUITS AND WAVEFORMS



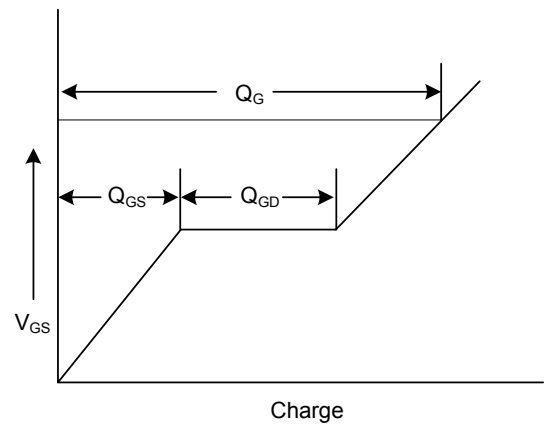
Switching Test Circuit



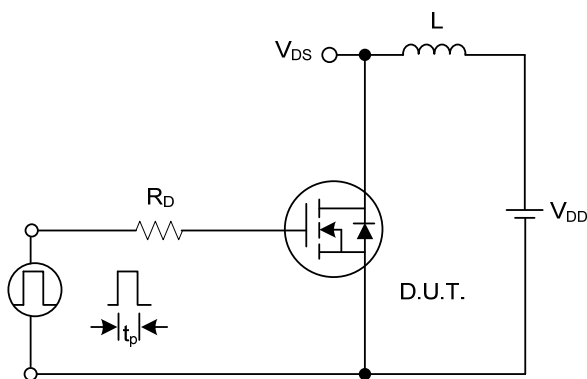
Switching Waveforms



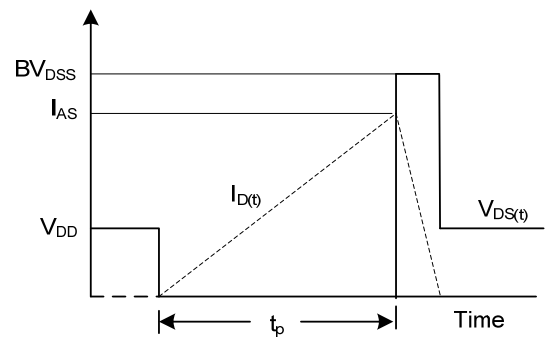
Gate Charge Test Circuit



Gate Charge Waveform

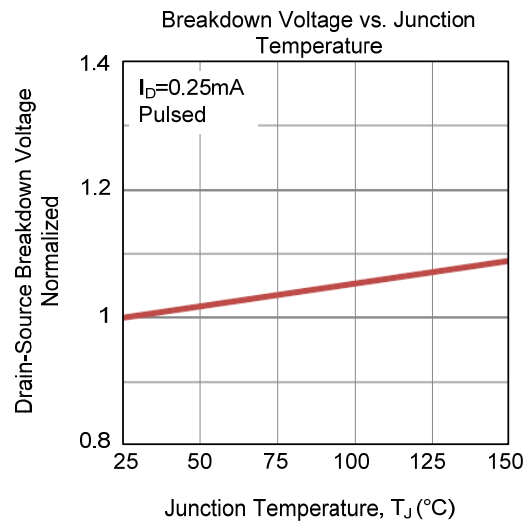
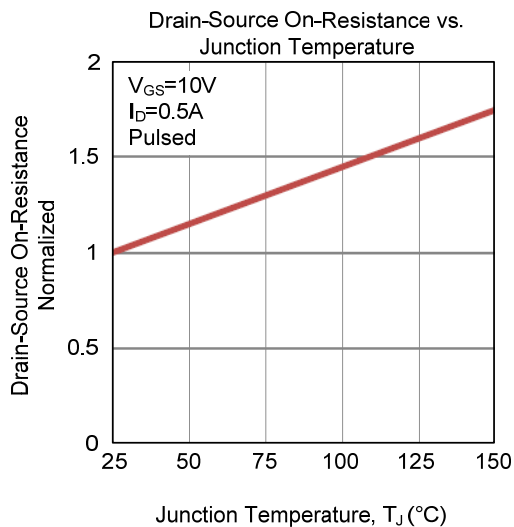
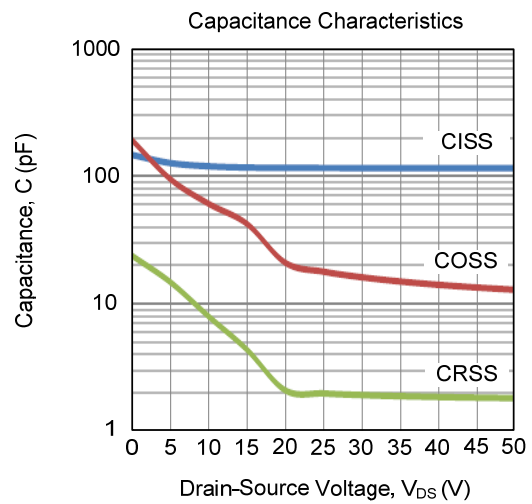
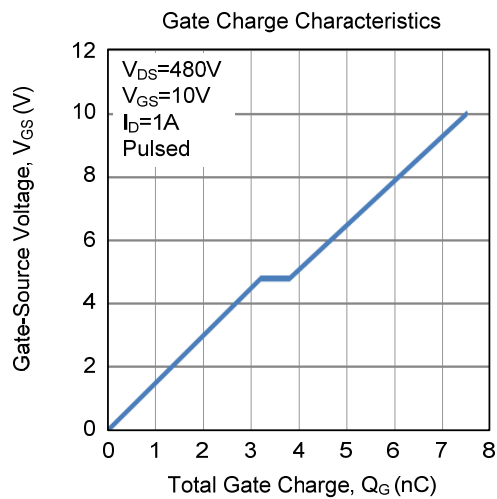
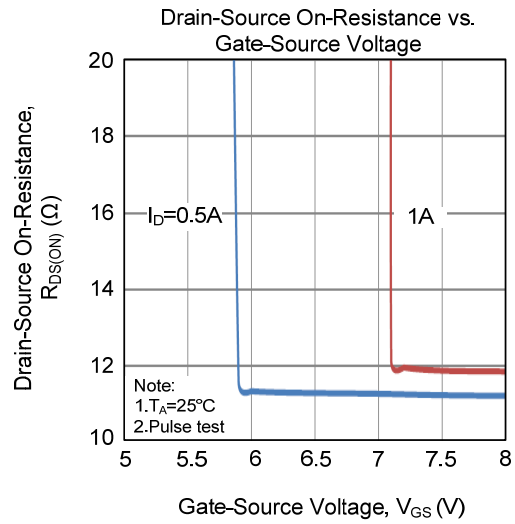
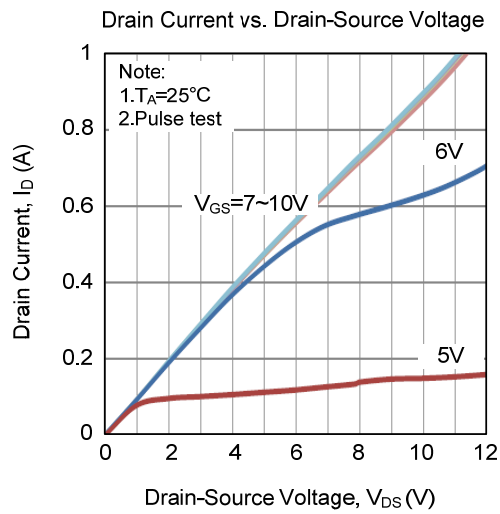


Unclamped Inductive Switching Test Circuit

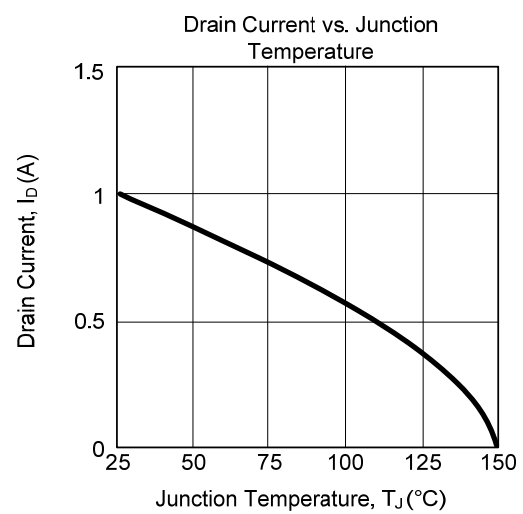
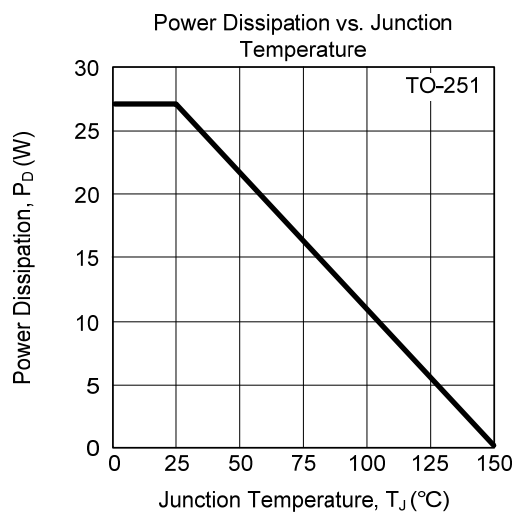
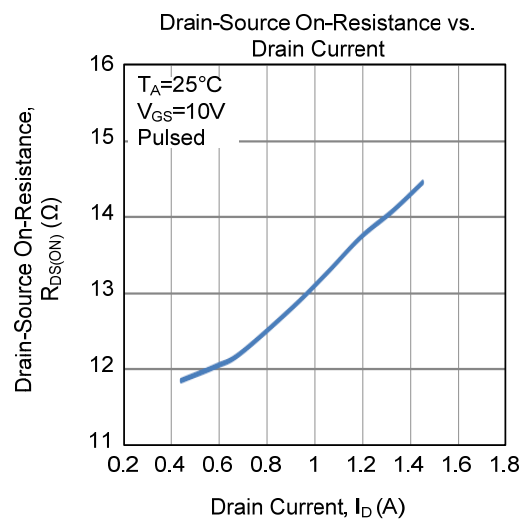
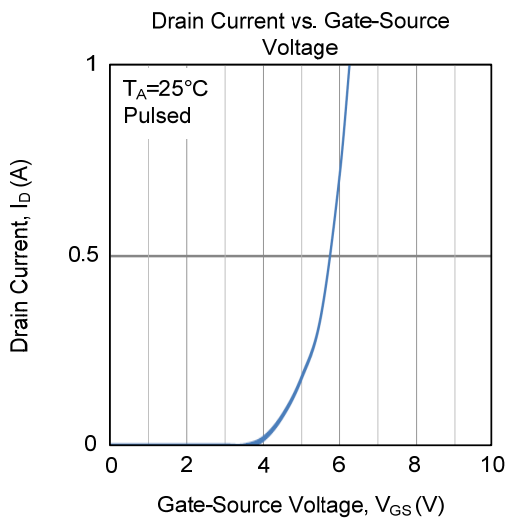
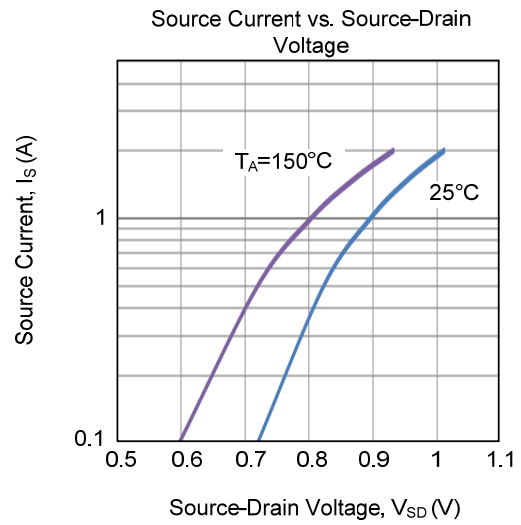
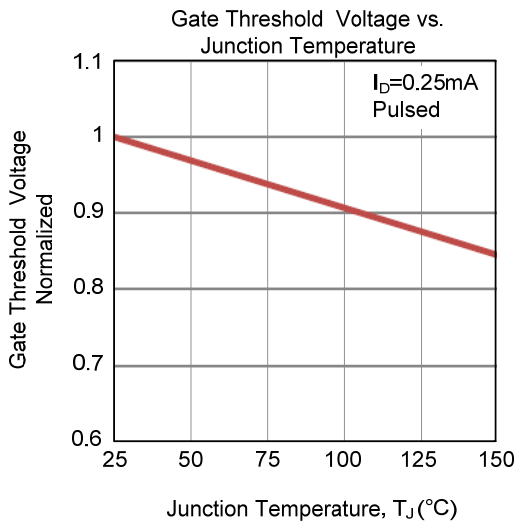


Unclamped Inductive Switching Waveforms

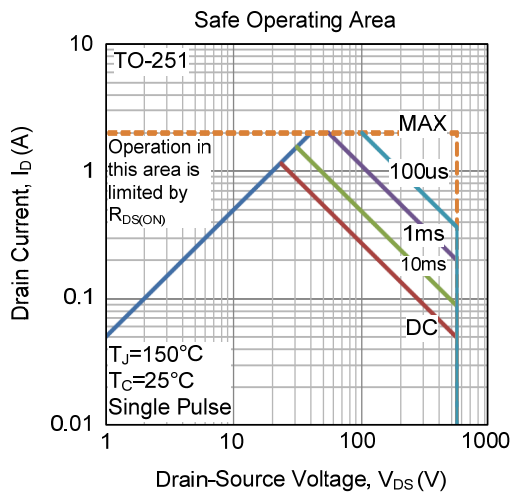
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ **TYPICAL CHARACTERISTICS (Cont.)**



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