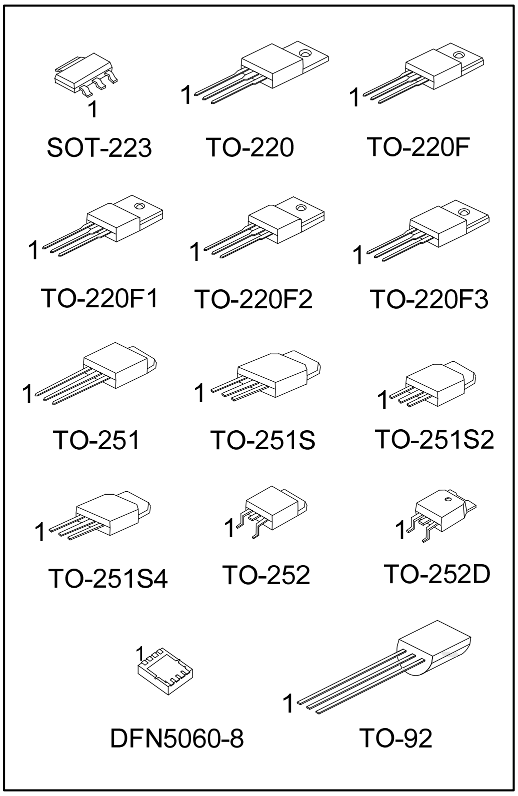
2.0A, 600V N-CHANNEL POWER MOSFET



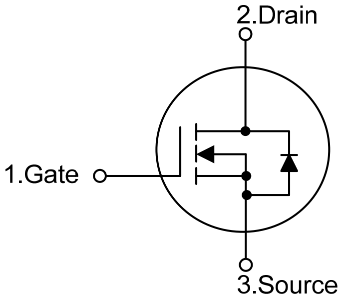
■ DESCRIPTION

The UTC **2N60-CBS** 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 AC to DC converters and bridge circuits.

■ FEATURES

* $R_{DS(ON)}$ ≤ 8.5Ω @ V_{GS}=10V, I_D=1.0A
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL

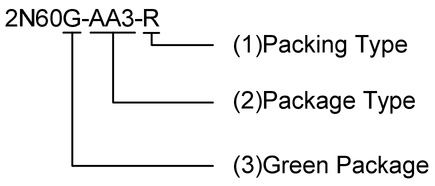


Copyright © 2022 Unisonic Technologies Co., Ltd

ORDERING INFORMATION

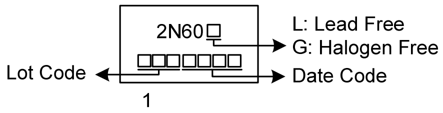
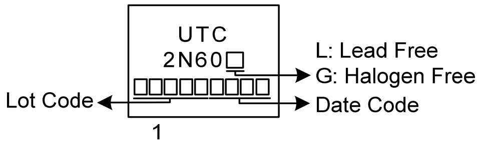
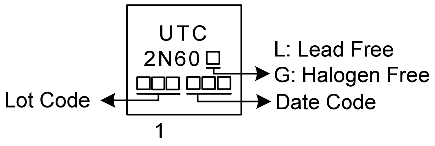
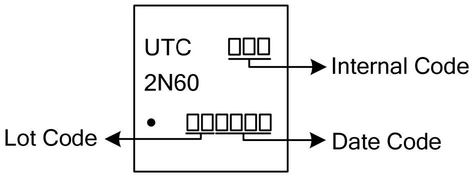
Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
2N60L-AA3-R	2N60G-AA3-R	SOT-223	G	D	S	-	-	-	-	-	Tape Reel
2N60L-TA3-T	2N60G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
2N60L-TF3-T	2N60G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
2N60L-TF1-T	2N60G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
2N60L-TF2-T	2N60G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
2N60L-TF3T-T	2N60G-TF3T-T	TO-220F3	G	D	S	-	-	-	-	-	Tube
2N60L-TM3-T	2N60G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
2N60L-TMS-T	2N60G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	Tube
2N60L-TMS2-T	2N60G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
2N60L-TMS4-T	2N60G-TMS4-T	TO-251S4	G	D	S	-	-	-	-	-	Tube
2N60L-TN3-R	2N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
2N60L-TND-R	2N60G-TND-R	TO-252D	G	D	S	-	-	-	-	-	Tape Reel
2N60L-T92-B	2N60G-T92-B	TO-92	G	D	S	-	-	-	-	-	Tape Box
2N60L-T92-K	2N60G-T92-K	TO-92	G	D	S	-	-	-	-	-	Bulk
2N60L-K08-5060-R	2N60G-K08-5060-R	DFN5060-8	S	S	S	G	D	D	D	D	Tape Reel

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



(1) T: Tube, R: Tape Reel
(2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F,
TF1: TO-220F1, TF1: TO-220F2, TF3T: TO-220F3,
TM3: TO-251, TMS: TO-251S, TMS2: TO-251S2,
TMS4: TO-251S4, TN3: TO-252, TND: TO-252D
T92: TO-92, K08-5060: DFN5060-8
(3) G: Halogen Free and Lead Free, L: Lead Free

MARKING

PACKAGE	MARKING
SOT-223	
TO-220 / TO-220F TO-220F1 / TO-220F2 TO-220F3 / TO-251 TO-251S / TO-251S2 TO-251S4 / TO-252 TO-252D	
TO-92	
DFN5060-8	

■ ABSOLUTE MAXIMUM RATINGS (T_C=25°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}	0.77	A
Drain Current	Continuous	I_D	2	A
	Pulsed (Note 2)	I_{DM}	4	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	21.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.0	V/ns
Power Dissipation	SOT-223	P_D	8	W
	TO-220		44	W
	TO-220F/TO-220F1 TO-220F3		23	W
	TO-220F2		24	W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		30	W
	TO-92		1.5	W
	DFN5060-8		22	W
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-55 ~ +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}=1.8A, V_{DD}=50V, R_G=25 Ω, Starting T_J = 25°C
4. I_{SD}≤2.0A, di/dt≤100A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	°C/W
	TO-220/TO-220F TO-220F1/ TO-220F2 TO-220F3		62.5	°C/W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		100	°C/W
	TO-92		180	°C/W
	DFN5060-8		75	°C/W
Junction to Case	SOT-223 (Note)	θ_{JC}	14	°C/W
	TO-220		2.84	°C/W
	TO-220F/TO-220F1 TO-220F3		5.4	°C/W
	TO-220F2		5.3	°C/W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D (Note)		4.16	°C/W
	TO-92		80	°C/W
	DFN5060-8 (Note)		5.6	°C/W

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

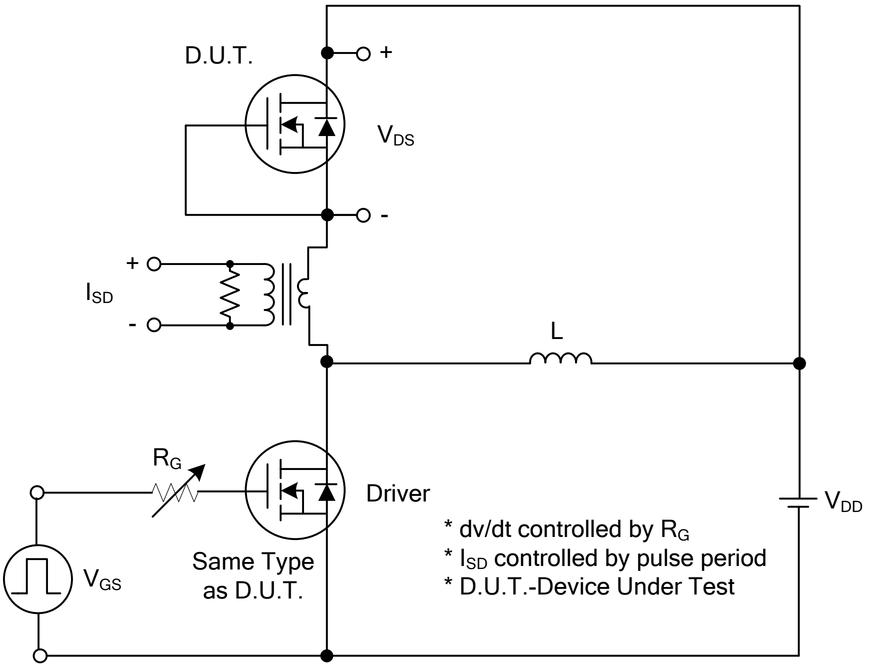
■ ELECTRICAL CHARACTERISTICS (T_C =25°C, unless otherwise specified)

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} = 480V, T_C =125°C			100	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} = 10V, I_D =1.0A			8.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} =25V, V_{GS} =0V, f =1MHz		158		pF
Output Capacitance		C_{OSS}			21		pF
Reverse Transfer Capacitance		C_{RSS}			3		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}=480V, V_{GS}=1.0V, I_D=2.0A (Note 1, 2)		9		nC
Gate-Source Charge		Q_{GS}			4.5		nC
Gate-Drain Charge		Q_{GD}			1.5		nC
Turn-On Delay Time		$t_{D\ (ON)}$	V_{DD} =100V, I_D =2.0A, R_G=25Ω (Note 1, 2)		4.8		ns
Turn-On Rise Time		t_R			15		ns
Turn-Off Delay Time		$t_{D(OFF)}$			42		ns
Turn-Off Fall Time		t_F			32		ns
DRAIN-SOURCE DIODE CHARACTERISTICS							
Continuous Drain-Source Current		I_S				2	A
Pulsed Drain-Source Current		I_{SM}				4	A
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_{SD} = 2.0 A			1.4	V
Body Diode Reverse Recovery Time		t_{rr}	I_F=2.0A,V_{DD}=400V, dI/dt=100A/μs		210		ns
Body Diode Reverse Recovery Charge		Q_{rr}			656		nC

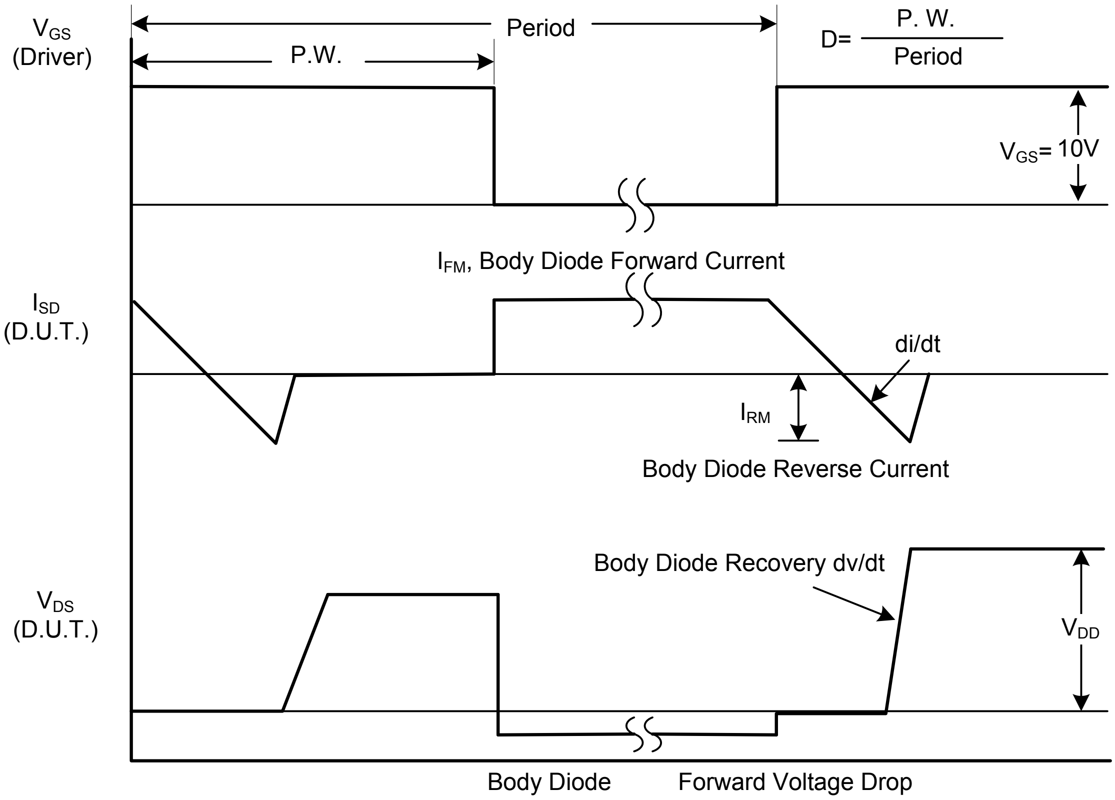
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle≤2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

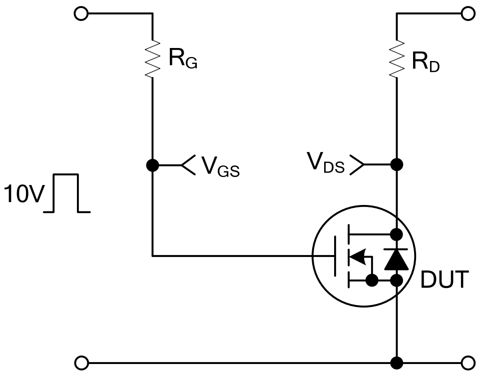


Peak Diode Recovery dv/dt Test Circuit

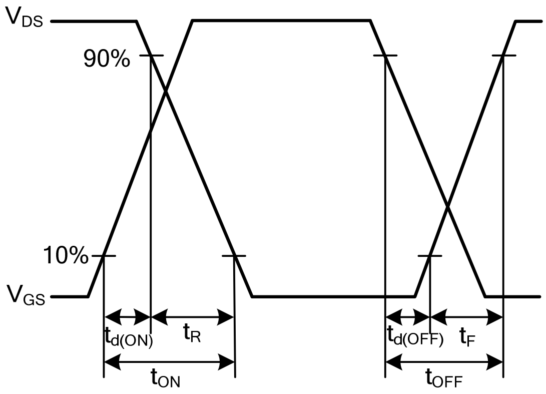


Peak Diode Recovery dv/dt Waveforms

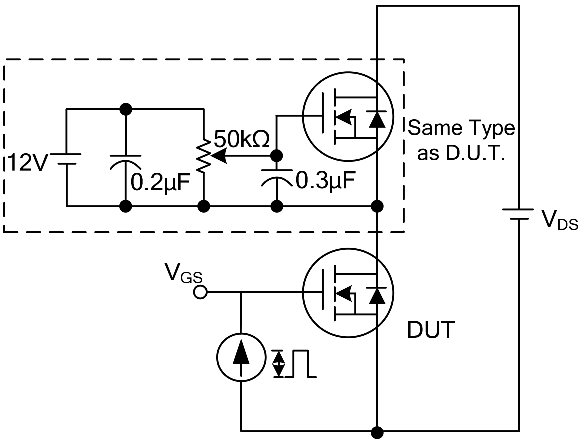
TEST CIRCUITS AND WAVEFORMS



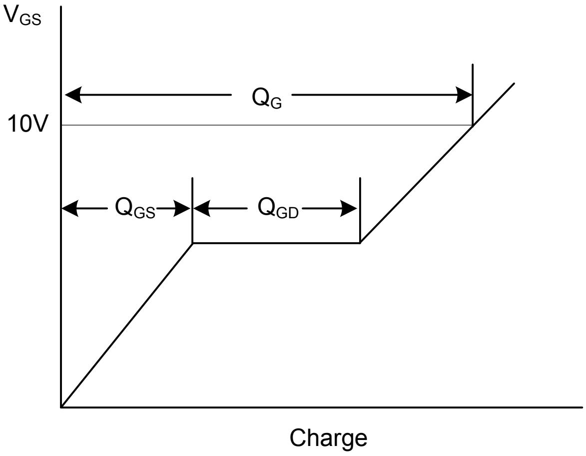
itching Test Circuit



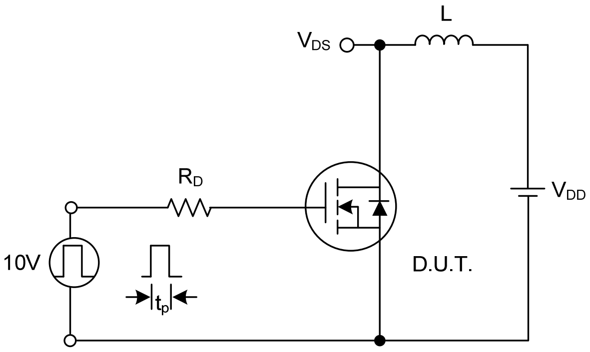
Switching Waveforms



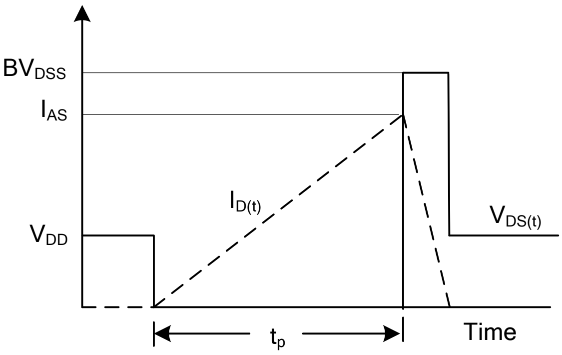
Gate Charge Test Circuit



Gate Charge Waveform



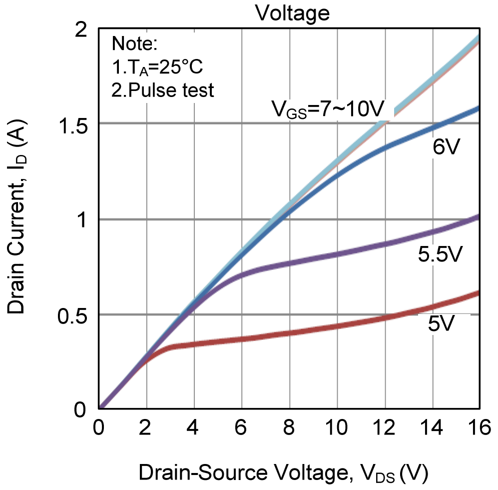
Unclamped Inductive Switching Test Circuit



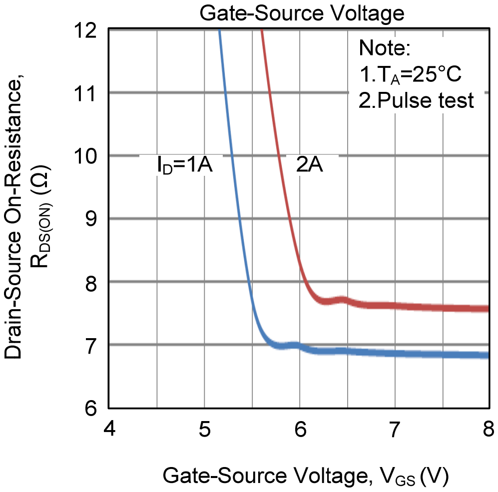
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

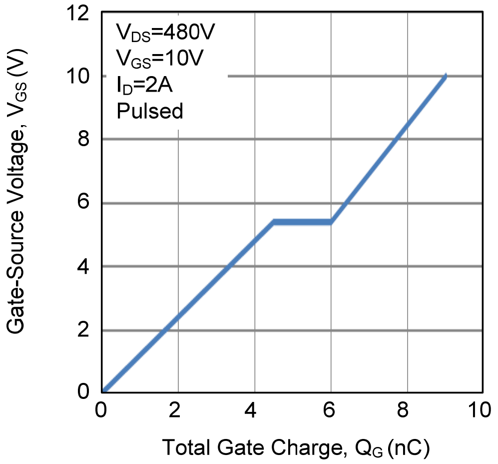
Drain Current vs. Drain-Source Voltage



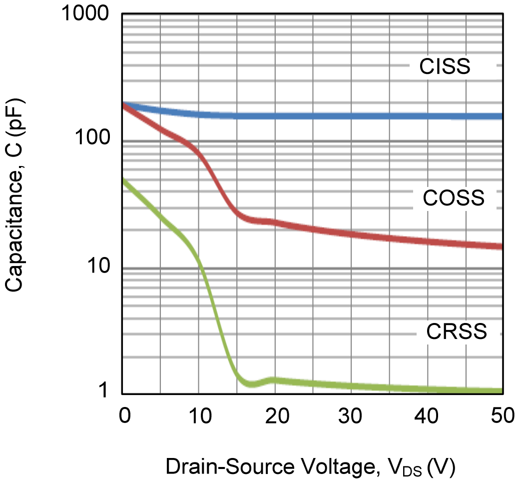
Drain-Source On-Resistance vs. Gate-Source Voltage



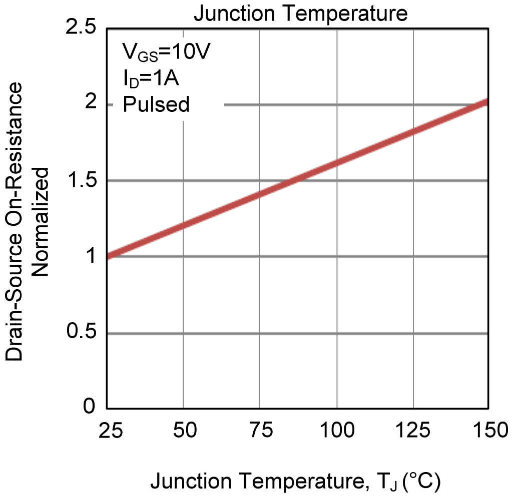
Gate Charge Characteristics



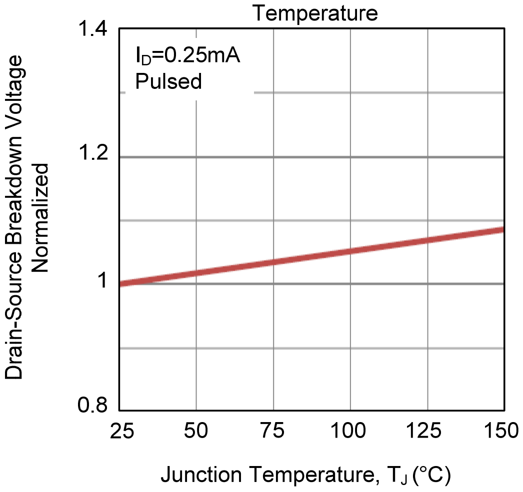
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

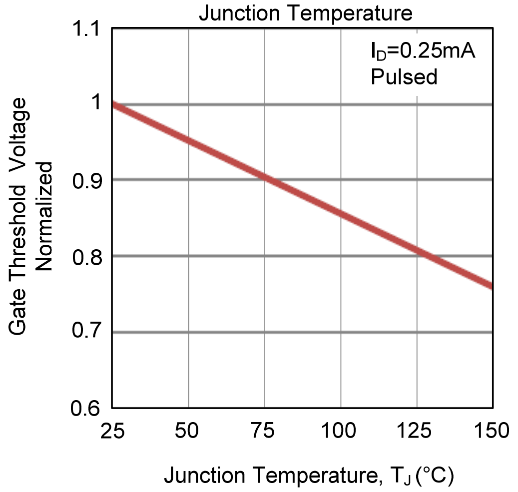


Breakdown Voltage vs. Junction Temperature

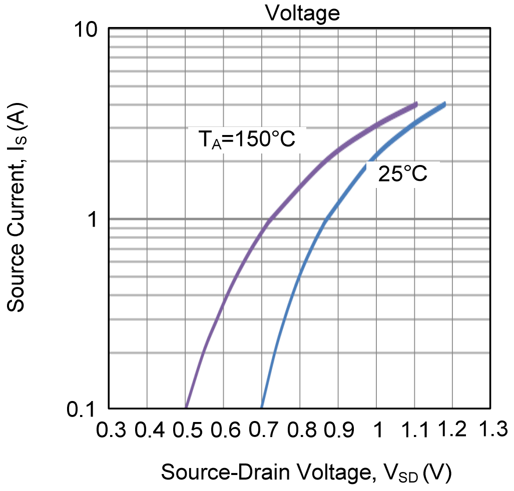


■ TYPICAL CHARACTERISTICS (Cont.)

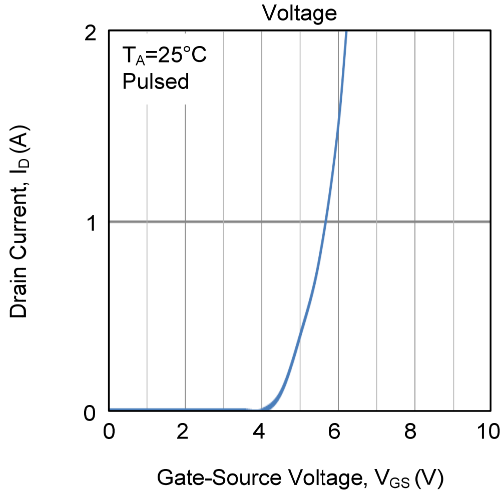
Gate Threshold Voltage vs. Junction Temperature



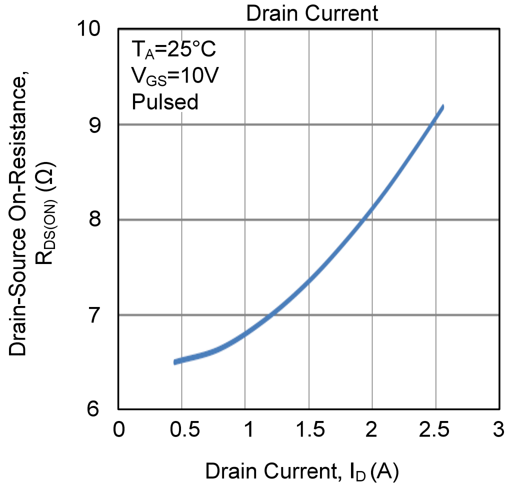
Source Current vs. Source-Drain Voltage



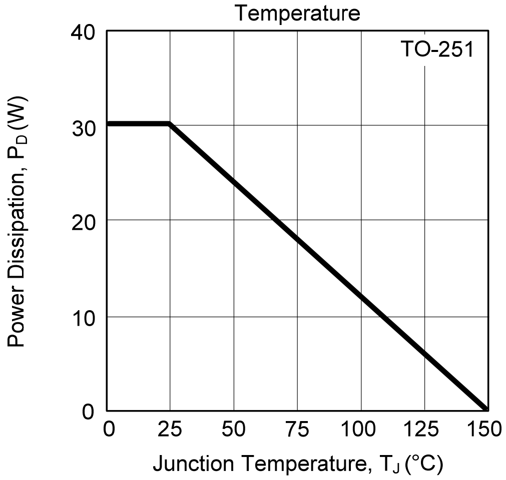
Drain Current vs. Gate-Source Voltage



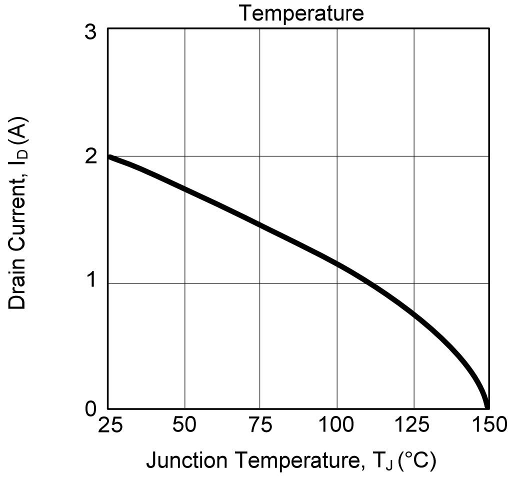
Drain-Source On-Resistance vs. Drain Current



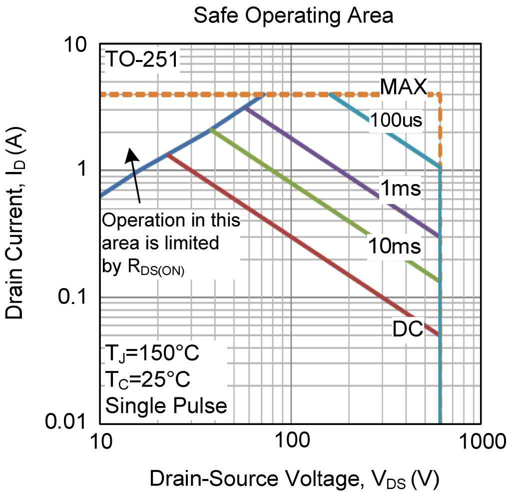
Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.