

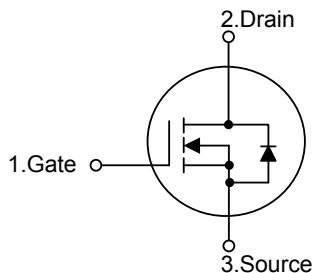
**11NM60****Power MOSFET****11A, 600V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

The UTC **11NM60** is an Super Junction MOSFET Structure. It uses UTC advanced planar stripe, DMOS technology to provide customers perfect switching performance, minimal on-state resistance.

The UTC **11NM60** is universally applied in electronic lamp ballasts based on half bridge topology, high efficiency switched mode power supplies, active power factor correction, etc.

FEATURES

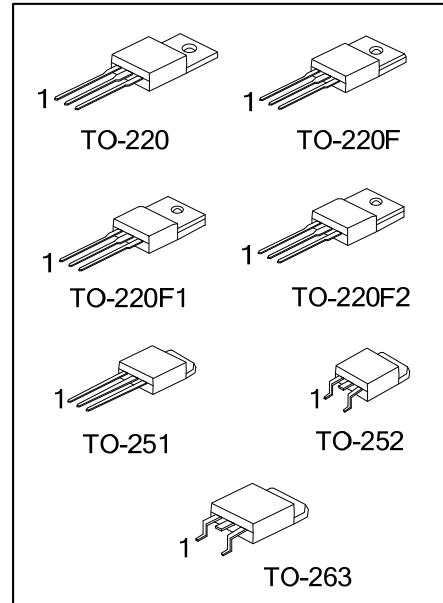
- * $R_{DS(ON)} \leq 0.5 \Omega$ @ $V_{GS}=10V$, $I_D=5.5A$
- * By using Super Junction Structure
- * Fast Switching
- * With 100% Avalanche Tested

SYMBOL**ORDERING INFORMATION**

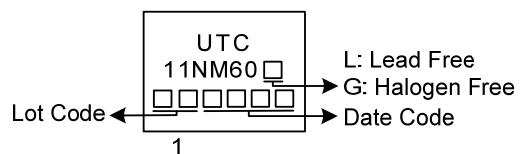
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
11NM60L-TA3-T	11NM60G-TA3-T	TO-220	G	D	S	Tube
11NM60L-TF1-T	11NM60G-TF1-T	TO-220F1	G	D	S	Tube
11NM60L-TF3-T	11NM60G-TF3-T	TO-220F2	G	D	S	Tube
11NM60L-TF3-T	11NM60G-TF3-T	TO-220F	G	D	S	Tube
11NM60L-TM3-T	11NM60G-TM3-T	TO-251	G	D	S	Tube
11NM60L-TN3-R	11NM60G-TN3-R	TO-252	G	D	S	Tape Reel
11NM60L-TQ2-T	11NM60G-TQ2-T	TO-263	G	D	S	Tube
11NM60L-TQ2-R	11NM60G-TQ2-R	TO-263	G	D	S	Tape Reel

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

11NM60G-TA3-T (1)Packing Type (2)Package Type (3)Green Package	(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 TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free
--	---



■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain to Source Voltage		V _{DSS}	600	V
Gate to Source Voltage		V _{GSS}	±30	V
Continuous Drain Current	Continuous	I _D	11 (Note 2)	A
Pulsed Drain Current	Pulsed (Note 3)	I _{DM}	44 (Note 2)	A
Avalanche Current (Note 3)		I _{AR}	2.4	A
Single Pulsed Avalanche Energy (Note 4)		E _{AS}	452	mJ
Peak Diode Recovery dv/dt (Note 5)		dv/dt	5.0	V/ns
Power Dissipation	TO-220/TO-263	P _D	160	W
	TO-220F/TO-220F1		24	W
	TO-220F2		60	W
	TO-251/TO-252		60	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. Drain current limited by maximum junction temperature.

3. Repetitive Rating : Pulse width limited by maximum junction temperature.

4. L=157mH, I_{AS}=2.4A, V_{DD}= 50V, R_G=25Ω, Starting T_J=25°C

5. 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	θ _{JA}	62.5	°C/W
	TO-220F1/TO-220F2			
	TO-263			
	TO-251/TO-252		110	°C/W
Junction to Case	TO-220/TO-263	θ _{JC}	0.78	°C/W
	TO-220F/TO-220F1		5.2	°C/W
	TO-220F2			
	TO-251/TO-252		2.08 (Note)	°C/W

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

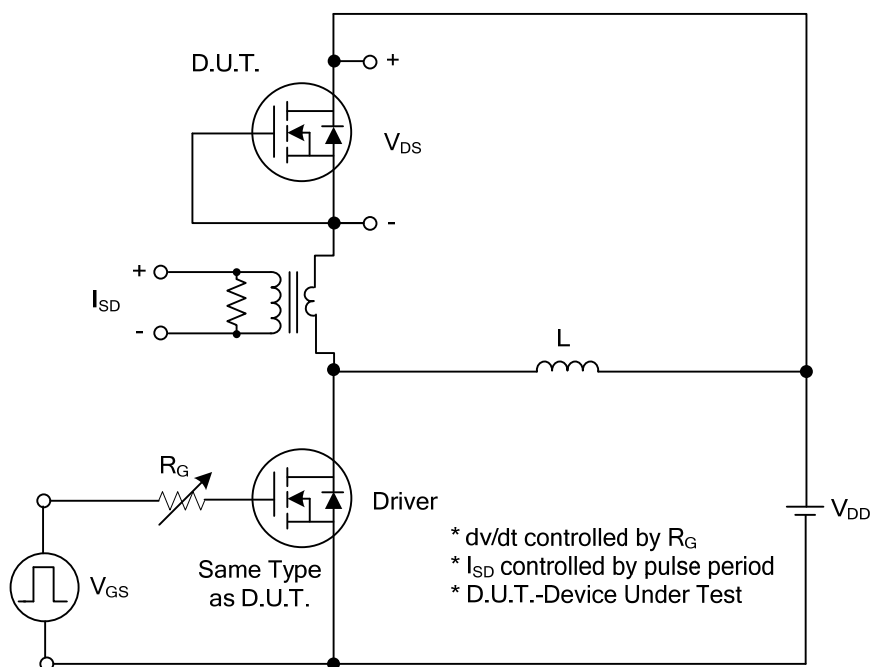
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA
Gate-Source Leakage Current	I _{GSS}	V _{DS} =0V , V _{GS} =±30V			±100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D =250μA	2.5		4.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =5.5A			0.5	Ω
DYNAMIC PARAMETERS						
Input Capacitance	C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		595		pF
Output Capacitance	C _{OSS}			600		pF
Reverse Transfer Capacitance	C _{RSS}			39		pF
SWITCHING PARAMETERS						
Total Gate Charge	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =11A , I _G =1mA (Note 1, 2)		28		nC
Gate-Source Charge	Q _{GS}			4.5		nC
Gate-Drain Charge	Q _{GD}			9		nC
Turn-ON Delay Time	t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =11A, R _G =25Ω (Note 1, 2)		11		ns
Turn-ON Rise Time	t _R			24		ns
Turn-OFF Delay Time	t _{D(OFF)}			130		ns
Turn-OFF Fall Time	t _F			50		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I _S				11	A
Maximum Body-Diode Pulsed Current	I _{SM}				44	A
Drain-Source Diode Forward Voltage	V _{SD}	I _S =11A, V _{GS} =0V			1.4	V
Reverse Recovery Time	t _{rr}	I _S =11A, V _{GS} =0V		350		ns
Reverse Recovery Charge	Q _{rr}	di/dt=200A/μs (Note 1)		5		μC

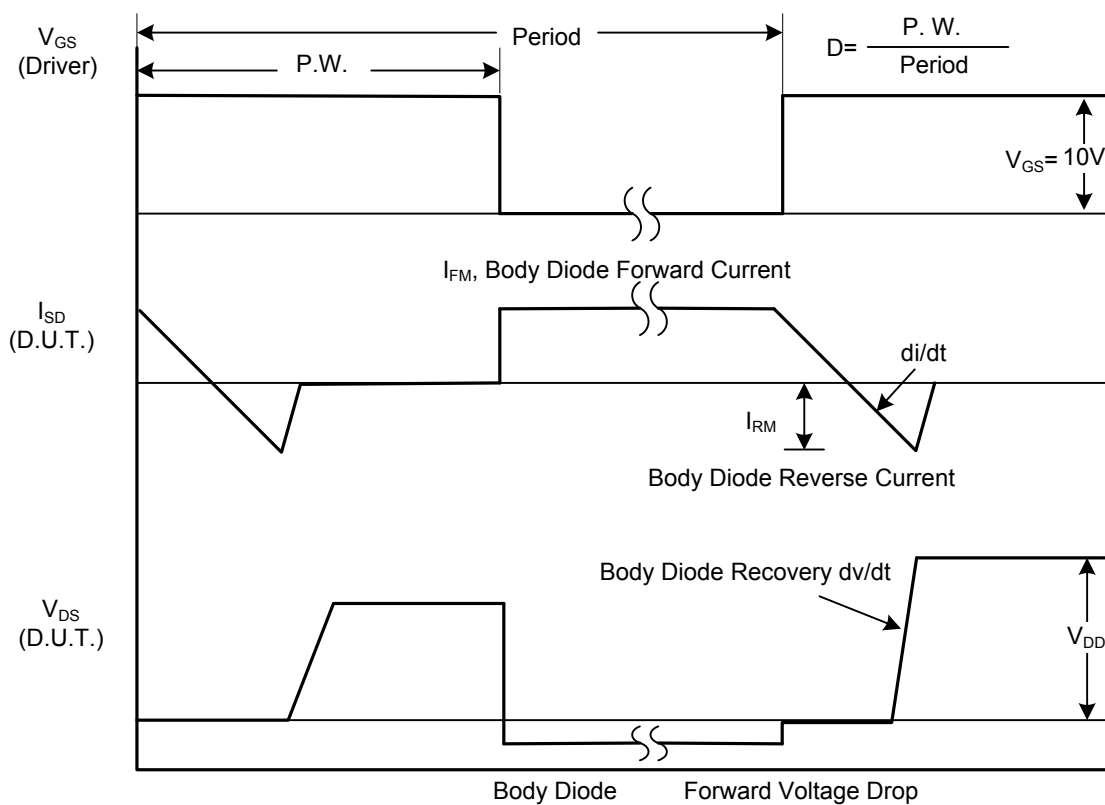
Notes: 1. Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

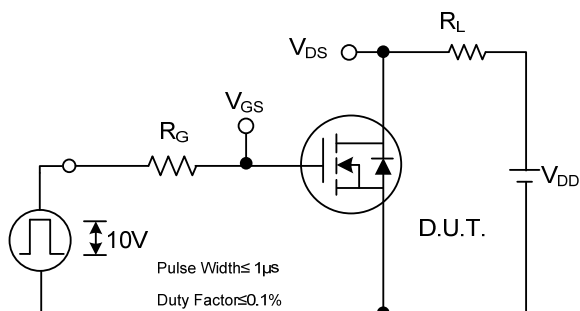


Peak Diode Recovery dv/dt Test Circuit

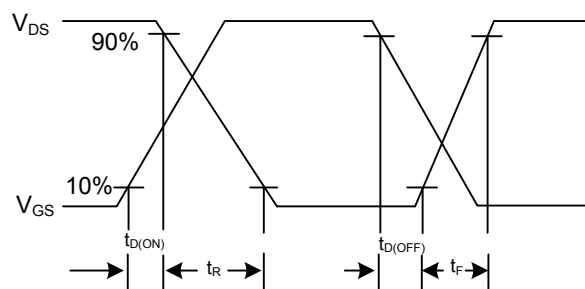


Peak Diode Recovery dv/dt Waveforms

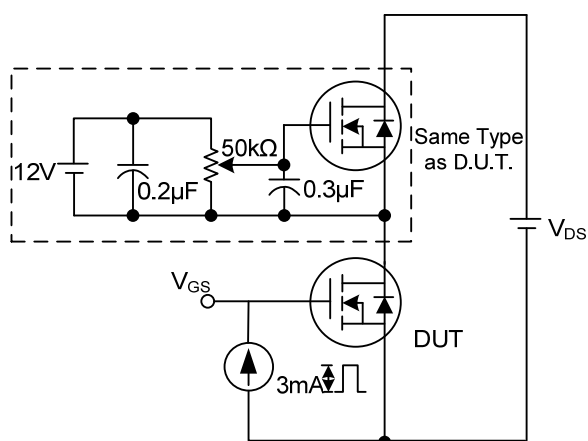
■ TEST CIRCUITS AND WAVEFORMS



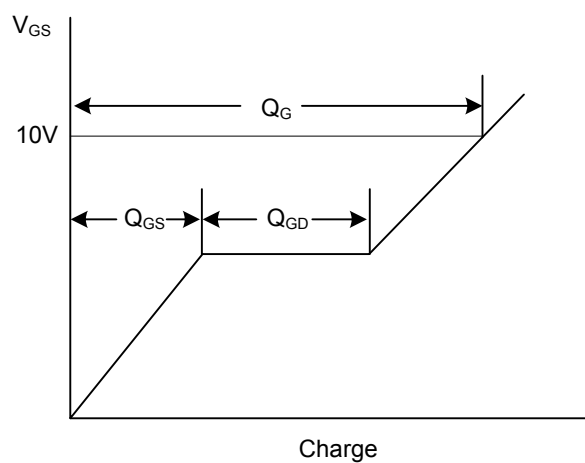
Switching Test Circuit



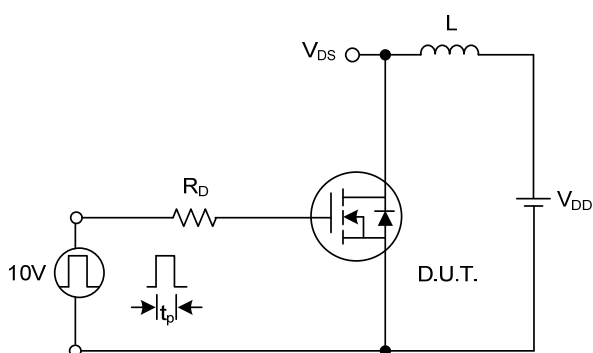
Switching Waveforms



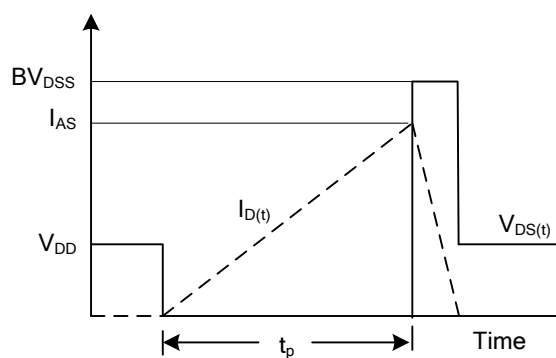
Gate Charge Test Circuit



Gate Charge Waveform

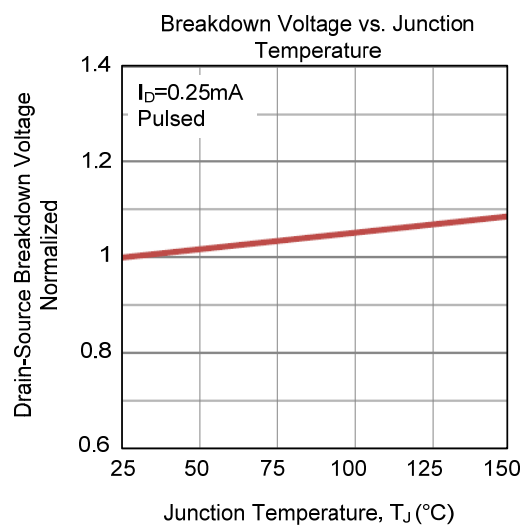
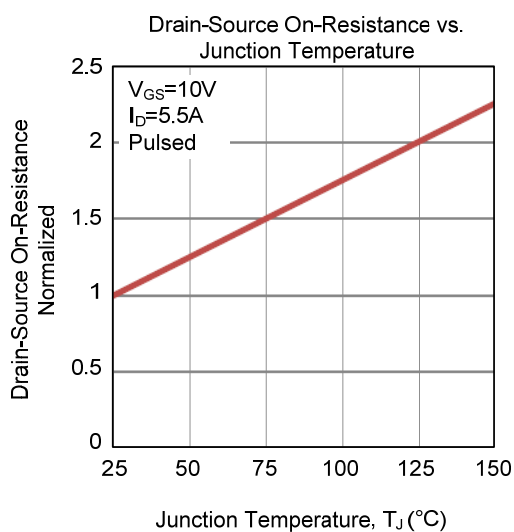
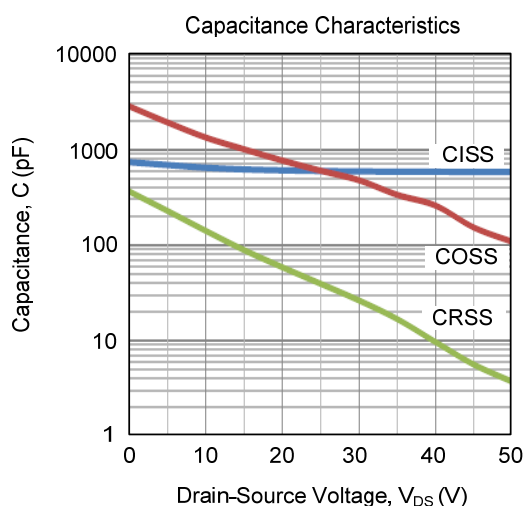
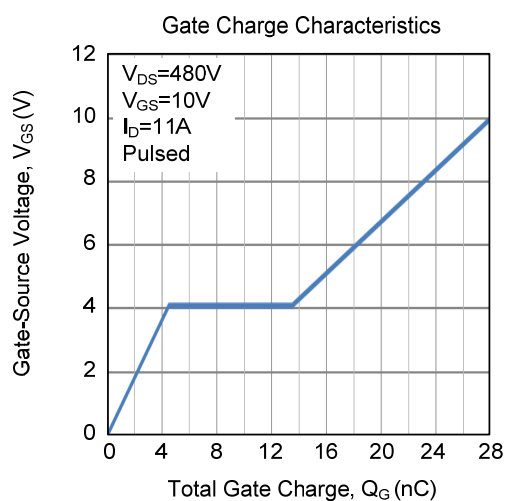
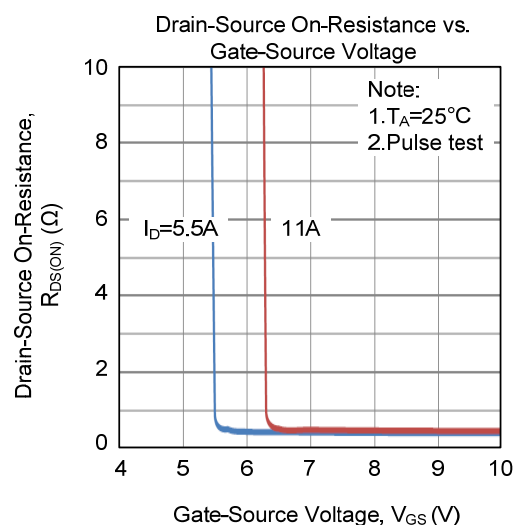
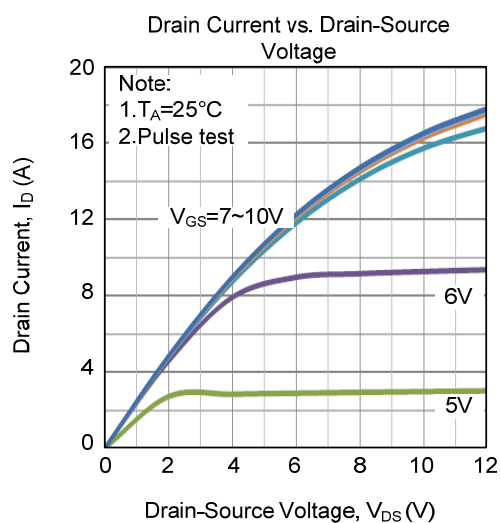


Unclamped Inductive Switching Test Circuit

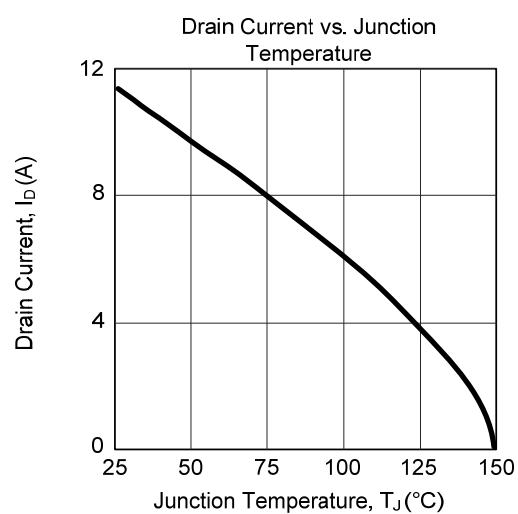
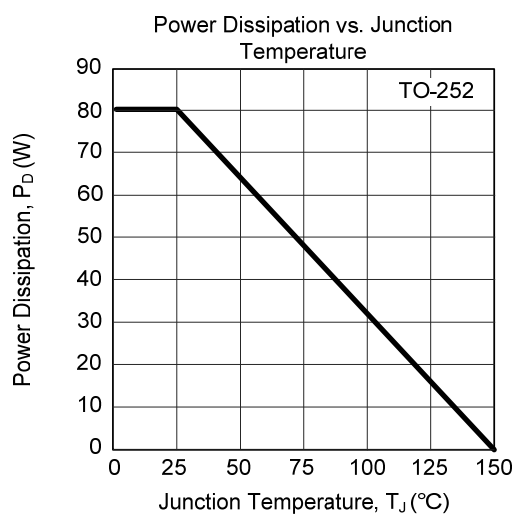
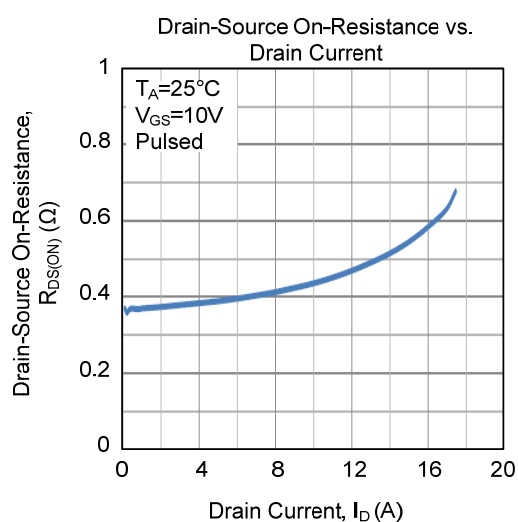
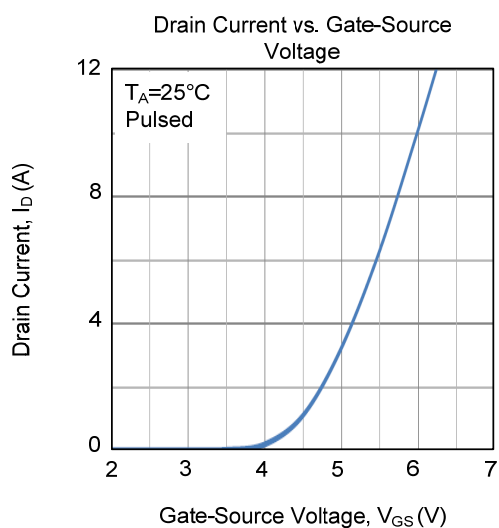
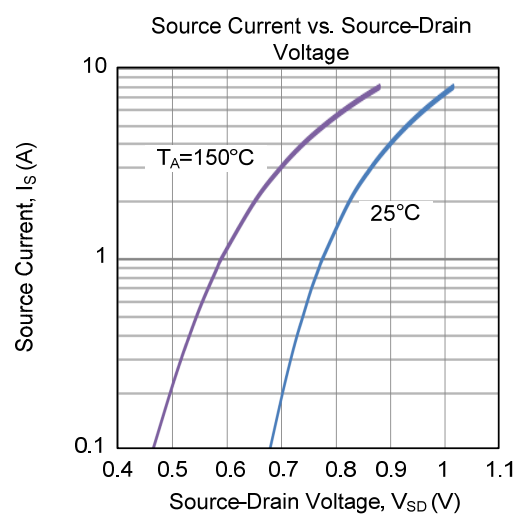
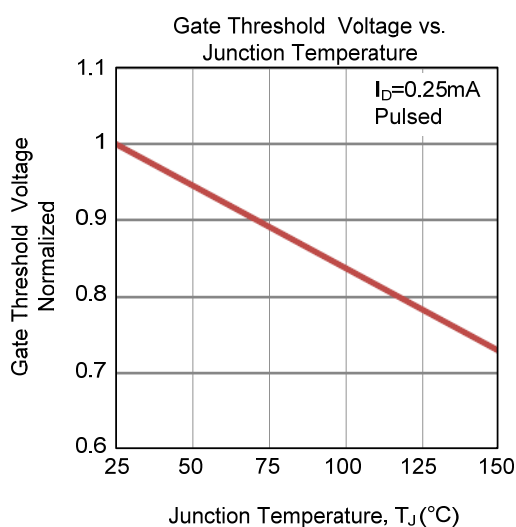


Unclamped Inductive Switching Waveforms

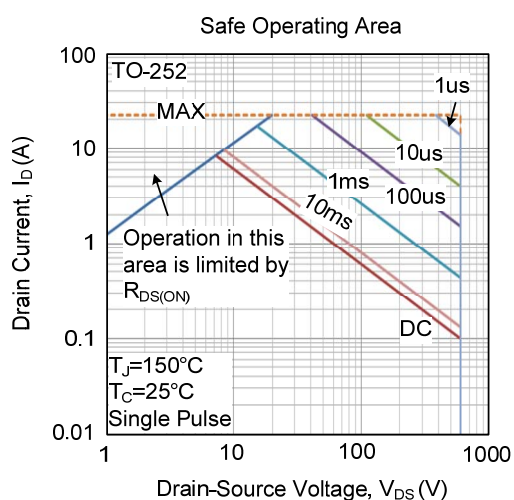
TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (Cont.)



TYPICAL CHARACTERISTICS (Cont.)



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.