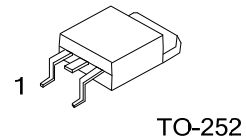
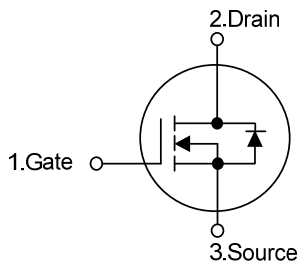


**F4N60-ML1****Power MOSFET****4.0A, 600V N-CHANNEL
POWER MOSFET****DESCRIPTION**

The UTC **F4N60-ML1** is a N-Channel enhancement mode silicon gate power MOSFET with Fast Body Diode, is designed high voltage, high speed power switching applications such, 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**

- * $R_{DS(ON)} \leq 2.7 \Omega$ @ $V_{GS}=10V$, $I_D=2.0A$
- * Fast body diode MOSFET technology
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

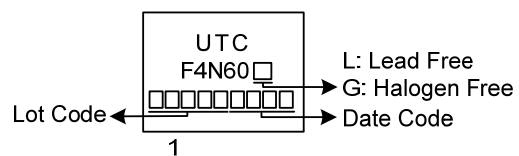
SYMBOL**ORDERING INFORMATION**

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
F4N60L-TN3-R	F4N60G-TN3-R	TO-252	G	D	S	Tape Reel

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

F4N60G-TN3-R		(1)Packing Type	(1) R: Tape Reel
		(2)Package Type	(2) TN3: TO-252
		(3)Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ ABSOLUTE MAXIMUM RATINGS ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	I_D	4	A
Pulsed Drain Current (Note 2)	I_{DM}	8	A
Avalanche Energy	E_{AS}	109	mJ
Single Pulsed (Note 3)			
Peak Diode Recovery dv/dt (Note 4)	dv/dt	7.6	V/ns
Power Dissipation	P_D	50	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. $L = 30\text{mH}$, $I_{AS} = 2.7\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, 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	θ_{JA}	110	$^{\circ}\text{C}/\text{W}$
Junction to Case	θ_{JC}	2.5 (Note)	$^{\circ}\text{C}/\text{W}$

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

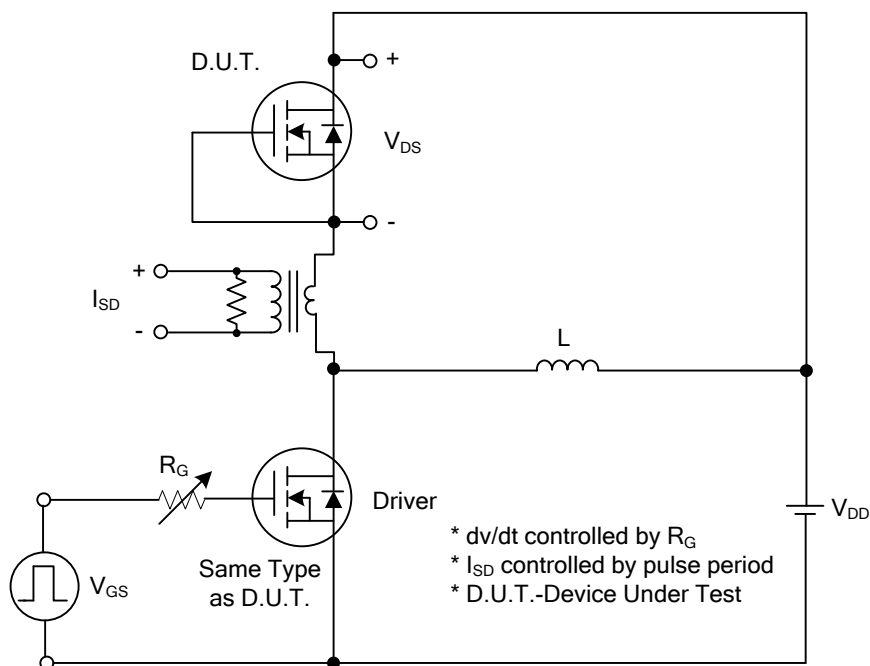
■ ELECTRICAL CHARACTERISTICS ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

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	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 =2.0A			2.7	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		550		pF
Output Capacitance		C _{OSS}			60		pF
Reverse Transfer Capacitance		C _{RSS}			5		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =480V, V _{GS} =10V, I _D =4A I _G =1mA (Note 1, 2)		18		nC
Gate-Source Charge		Q _{GS}			6		nC
Gate-Drain Charge		Q _{GD}			4.2		nC
Turn-On Delay Time (Note 1)		t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =4A, R _G =25Ω (Note 1, 2)		10		ns
Turn-On Rise Time		t _R			18		ns
Turn-Off Delay Time		t _{D(OFF)}			37		ns
Turn-Off Fall Time		t _F			26		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Body-Diode Continuous Current		I _S				4	A
Maximum Body-Diode Pulsed Current		I _{SM}				8	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =4A , V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)		t _{rr}	I _S =4A , V _{GS} =0V		80		ns
Reverse Recovery Charge		Q _{rr}	di/dt=100A/μs		141		nC

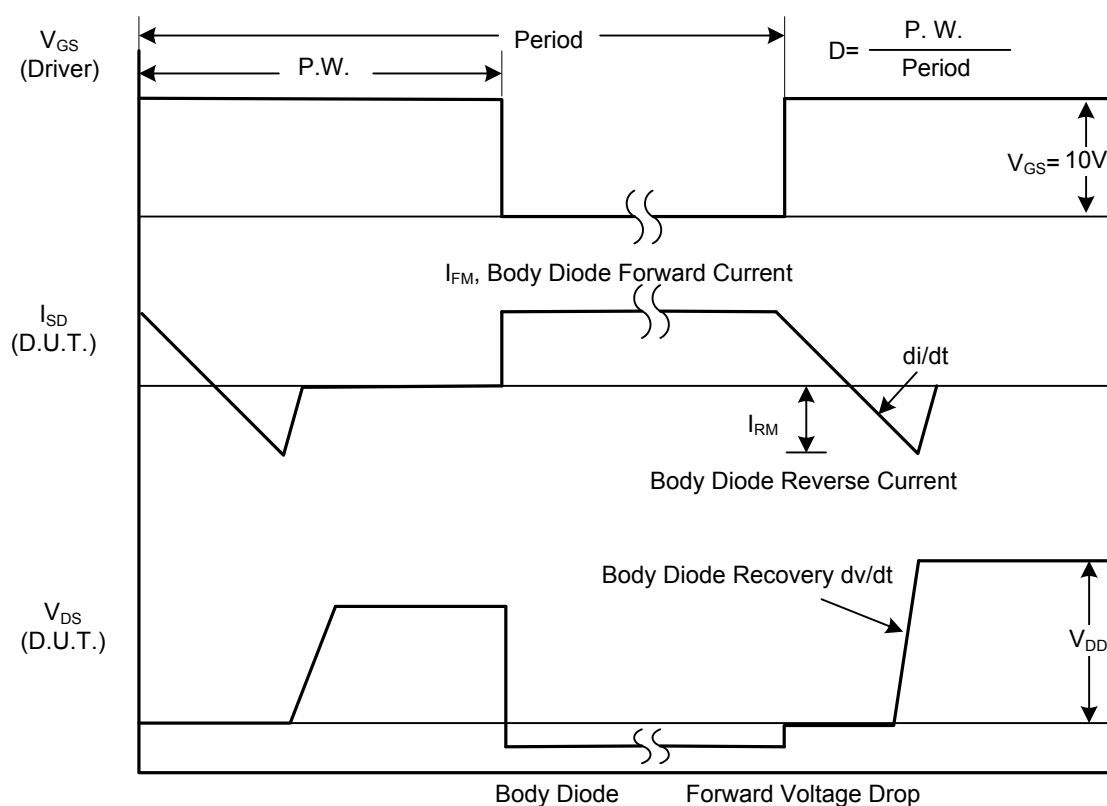
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

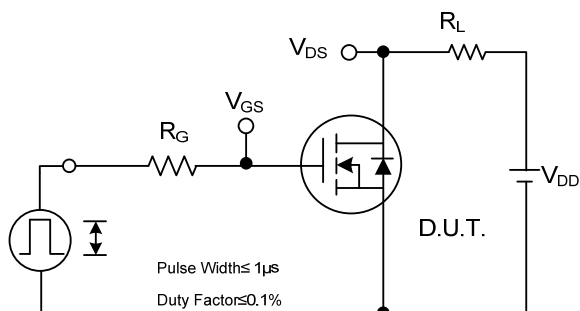


Peak Diode Recovery dv/dt Test Circuit

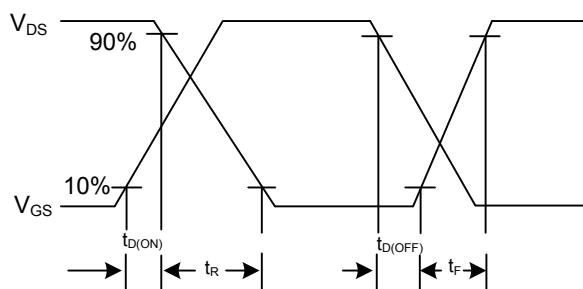


Peak Diode Recovery dv/dt Waveforms

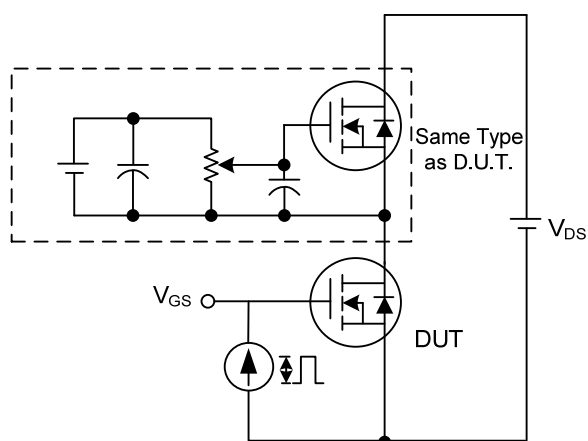
■ TEST CIRCUITS AND WAVEFORMS



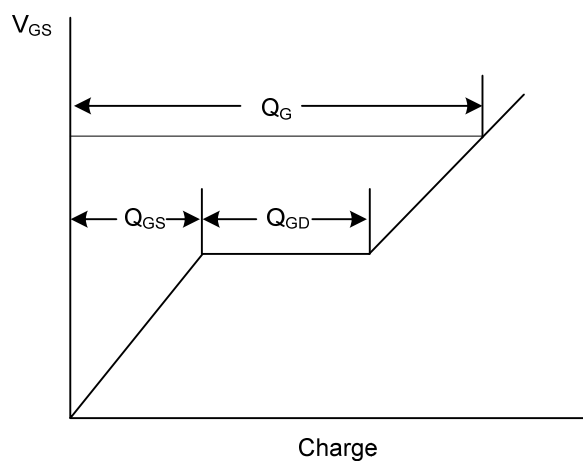
Switching Test Circuit



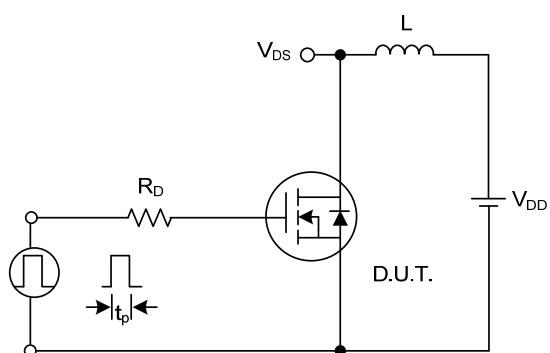
Switching Waveforms



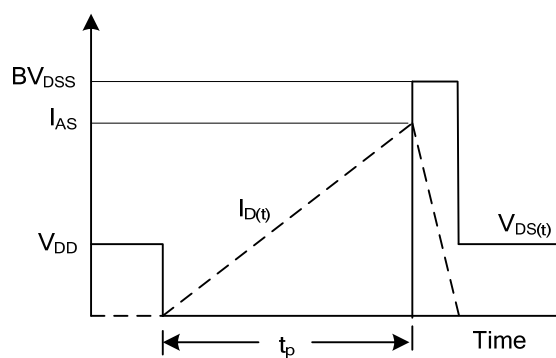
Gate Charge Test Circuit



Gate Charge Waveform

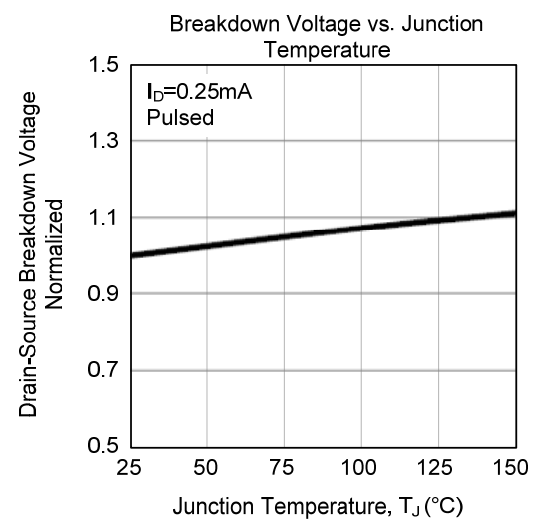
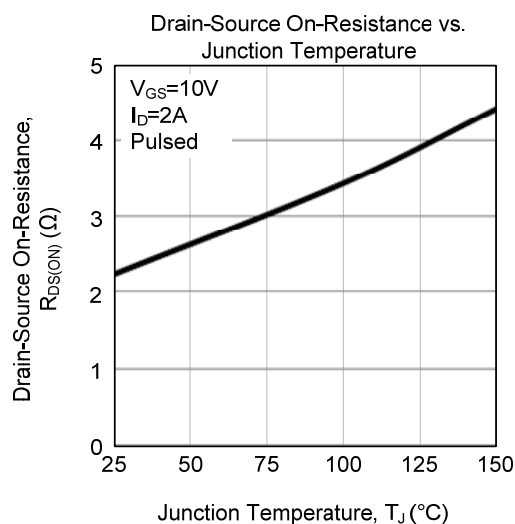
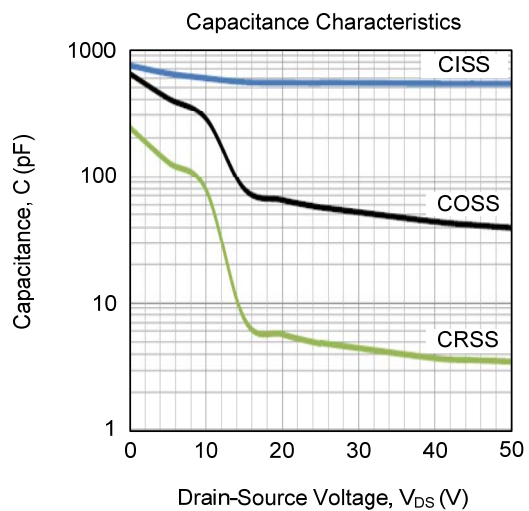
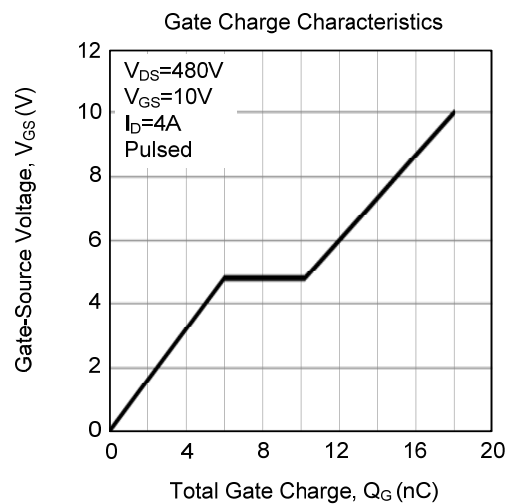
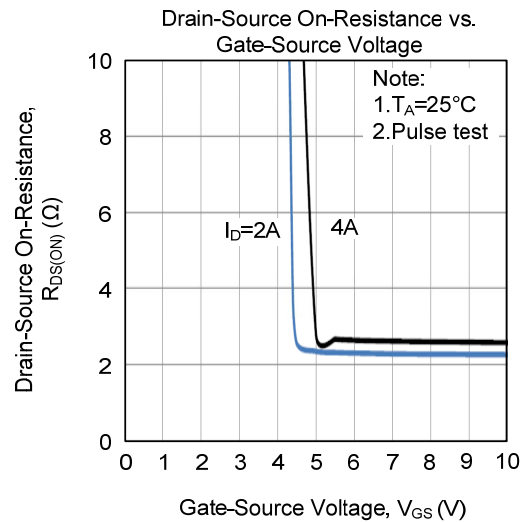
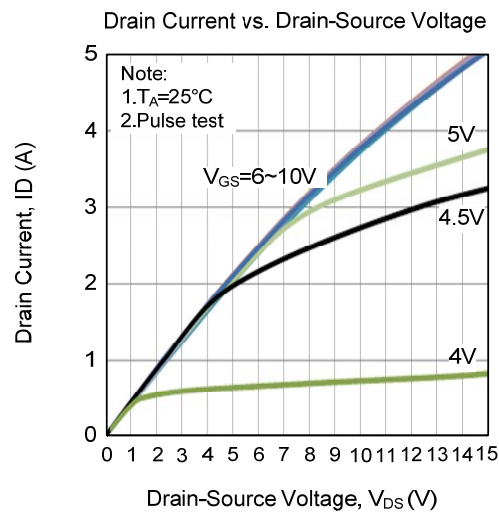


Unclamped Inductive Switching Test Circuit

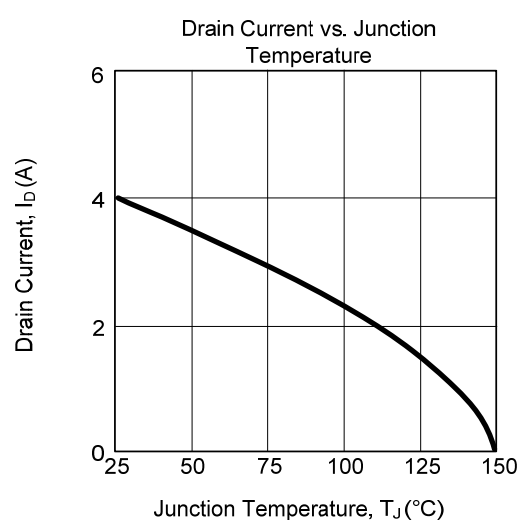
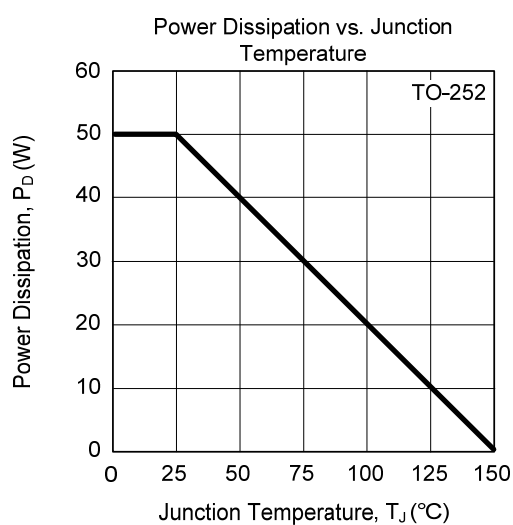
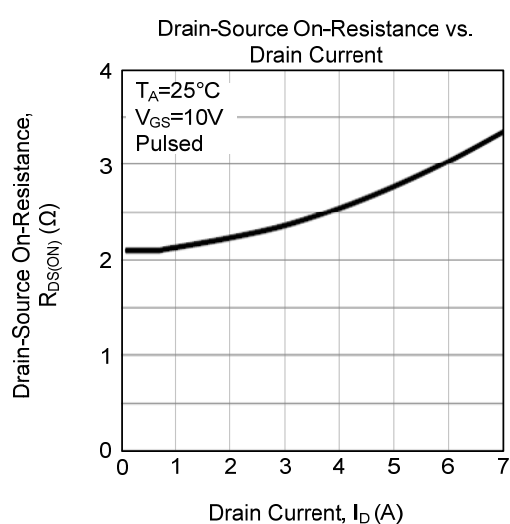
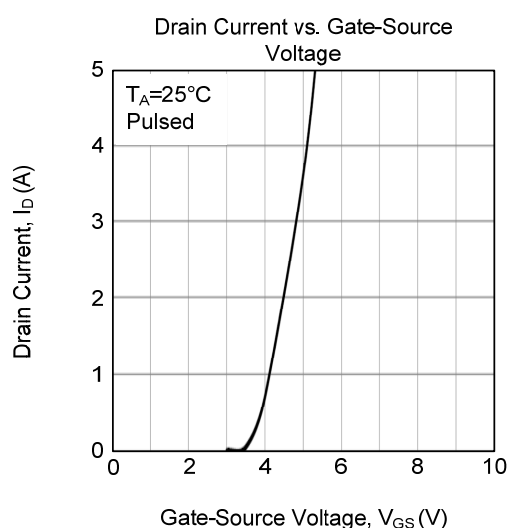
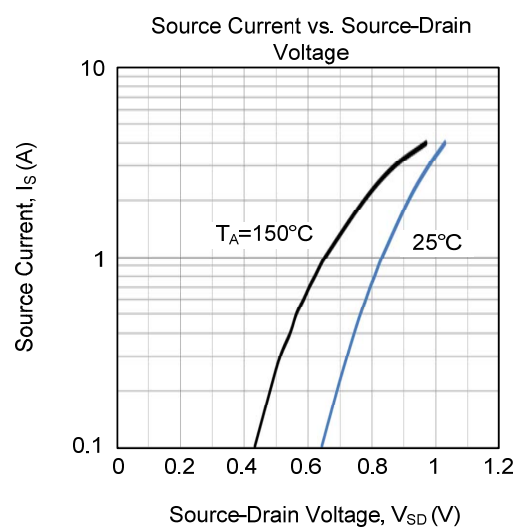
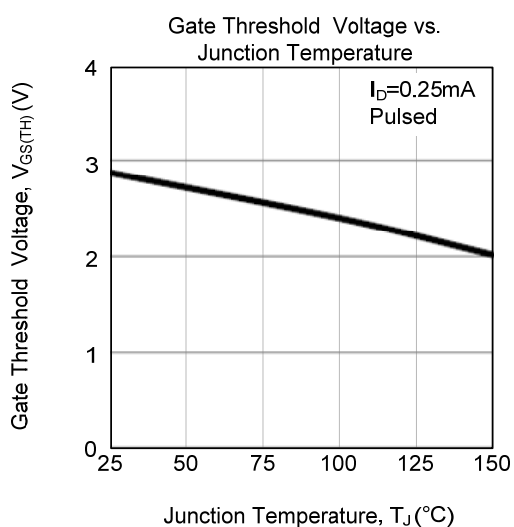


Unclamped Inductive Switching Waveforms

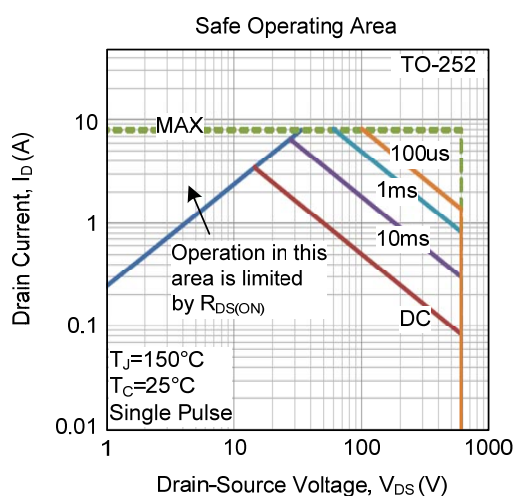
TYPICAL CHARACTERISTICS



■ 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.