



4N60Z

Power MOSFET

4A, 600V N-CHANNEL POWER MOSFET

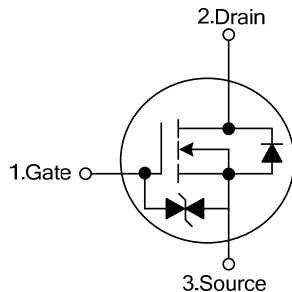
DESCRIPTION

The UTC **4N60Z** 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

- * $R_{DS(ON)} < 2.5\Omega$ @ $V_{GS} = 10V$
- * Ultra Low Gate Charge (typical 15 nC)
- * Low Reverse Transfer Capacitance ($C_{RSS} =$ typical 8.0 pF)
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, high Ruggedness

SYMBOL

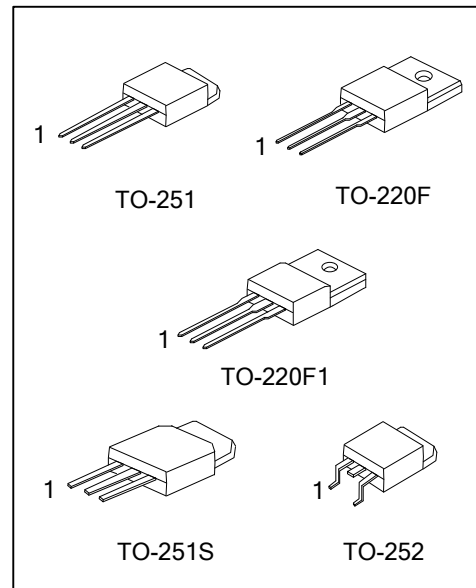


ORDERING INFORMATION

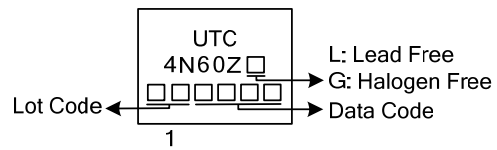
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N60ZL-TF3-T	4N60ZG-TF3-T	TO-220F	G	D	S	Tube
4N60ZL-TF1-T	4N60ZG-TF1-T	TO-220F1	G	D	S	Tube
4N60ZL-TM3-T	4N60ZG-TM3-T	TO-251	G	D	S	Tube
4N60ZL-TMS-T	4N60ZG-TMS-T	TO-251S	G	D	S	Tube
4N60ZL-TN3-T	4N60ZG-TN3-T	TO-252	G	D	S	Tape Reel

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

4N60ZL-TF3-T (1)Packing Type (2)Package Type (3)Lead Free		(1) T: Tube, R: Tape Reel (2) TF3: TO-220F, TF1: TO-220F1, TM3: TO-251, TMS: TO-251S, TN3: TO-252 (3) L: Lead Free, G: Halogen Free
---	--	--



■ 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}	±20	V
Avalanche Current (Note 2)		I _{AR}	4.4	A
Drain Current	Continuous	I _D	4.0	A
	Pulsed (Note 2)	I _{DM}	16	A
Avalanche Energy	Single Pulsed (Note 3)	E _{AS}	260	mJ
	Repetitive (Note 2)	E _{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220F/TO-220F1	P _D	36	W
	TO-251/TO-251S		50	
	TO-252			
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. $L = 30\text{mH}$, $I_{AS} = 4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F/TO-220F1	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-251/TO-251S		110	
	TO-252			
	TO-220F/TO-220F1		3.47	
	TO-251/TO-251S TO-252		2.5	

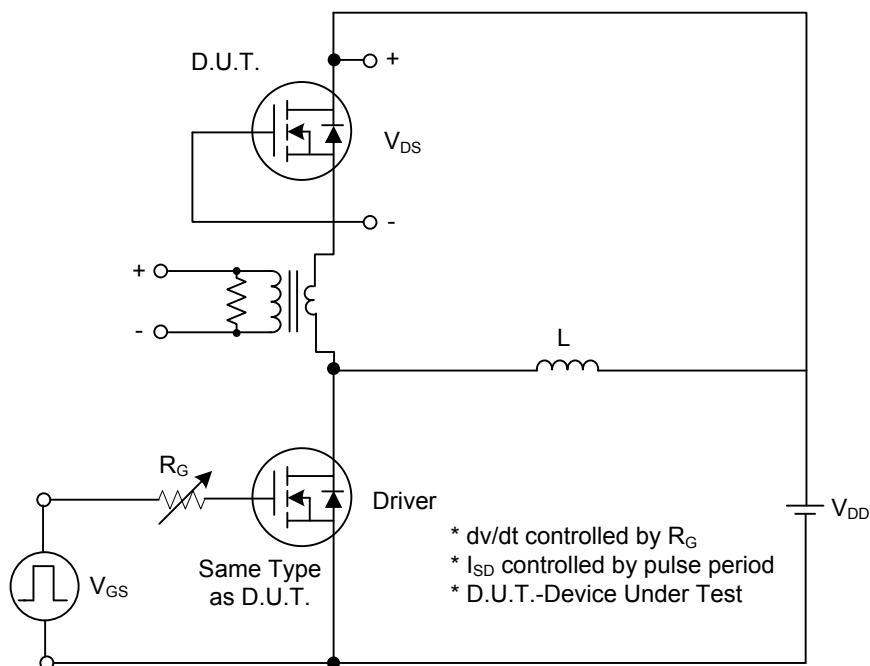
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

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}	V _{GS} = 20V, V _{DS} = 0V			5	μA
	Reverse		V _{GS} = -20V, V _{DS} = 0V			-5	μA
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA,Referenced to 25°C		0.6		V/°C
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 = 2.2A		2.2	2.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} = 25V, V _{GS} = 0V, f = 1MHz		520	670	pF
Output Capacitance		C _{OSS}			70	90	pF
Reverse Transfer Capacitance		C _{RSS}			8	11	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} = 300V, I _D = 4.0A, R _G = 25Ω (Note 1, 2)		13	35	ns
Turn-On Rise Time		t _R			45	100	ns
Turn-Off Delay Time		t _{D(OFF)}			25	60	ns
Turn-Off Fall Time		t _F			35	80	ns
Total Gate Charge		Q _G	V _{DS} = 480V,I _D = 4.0A, V _{GS} = 10V (Note 1, 2)		15	20	nC
Gate-Source Charge		Q _{GS}			3.4		nC
Gate-Drain Charge		Q _{GD}			7.1		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0V, I _S = 4.4A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				17.6	A
Reverse Recovery Time		t _{rr}	V _{GS} = 0 V, I _S = 4.4A,		250		ns
Reverse Recovery Charge		Q _{RR}	dl _F /dt = 100 A/μs (Note 1)		1.5		μC

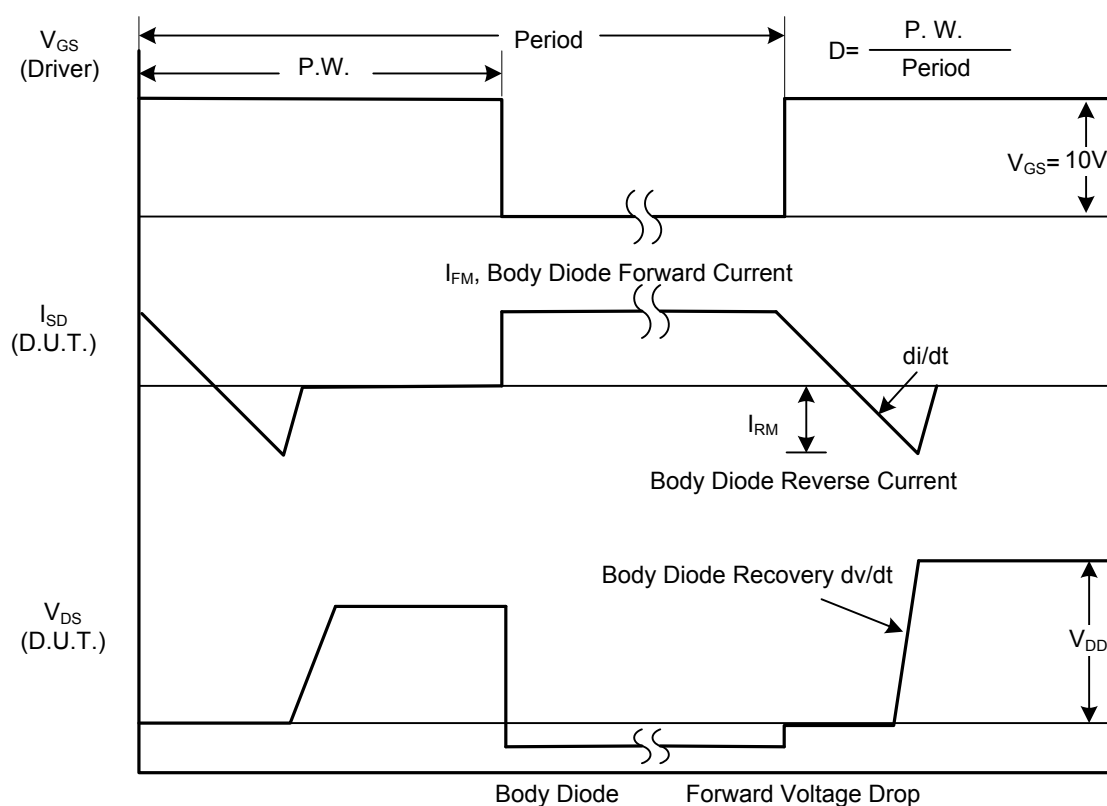
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

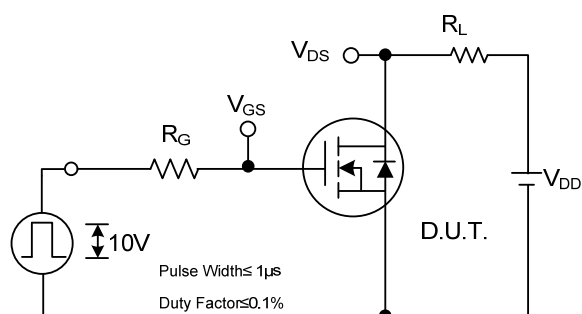


Peak Diode Recovery dv/dt Test Circuit

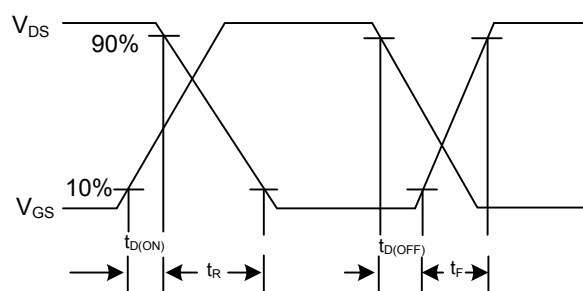


Peak Diode Recovery dv/dt Waveforms

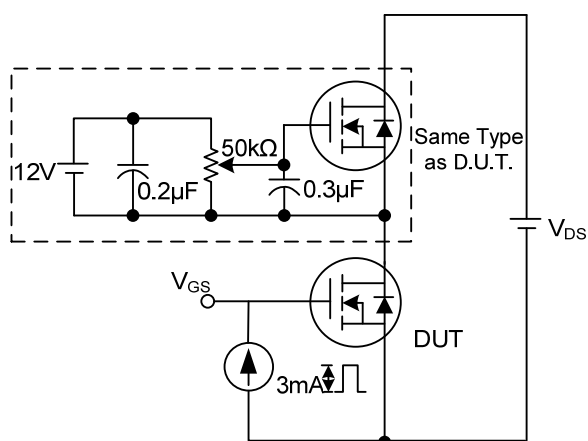
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



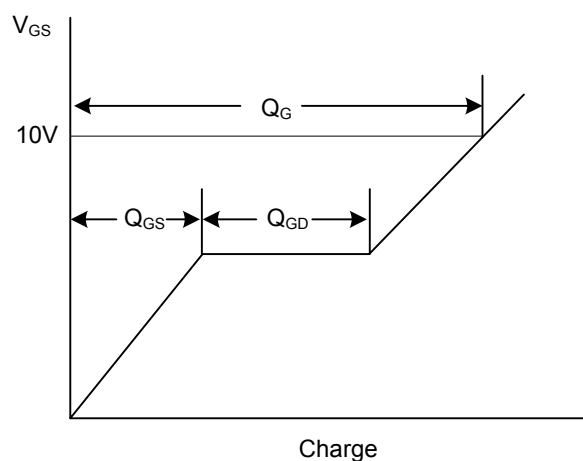
Switching Test Circuit



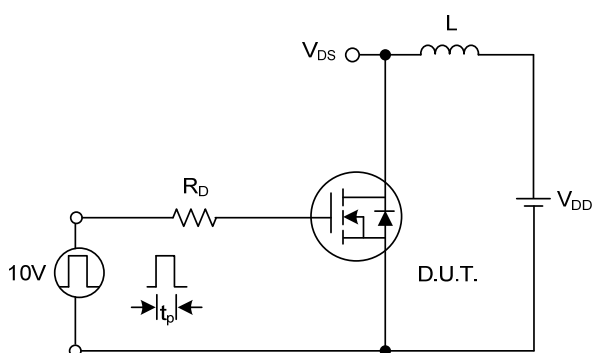
Switching Waveforms



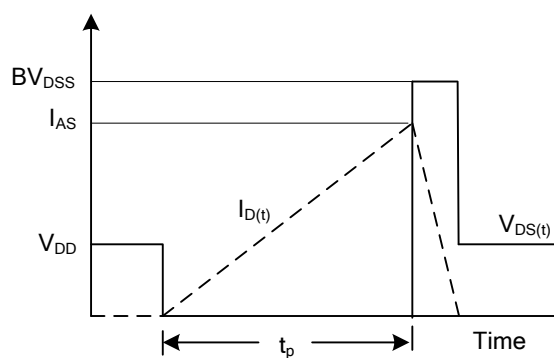
Gate Charge Test Circuit



Gate Charge Waveform

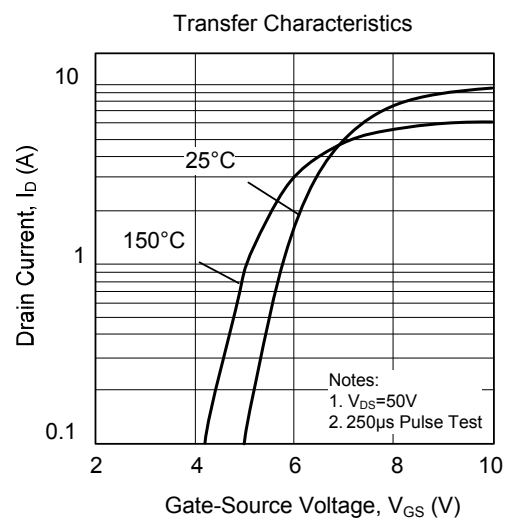
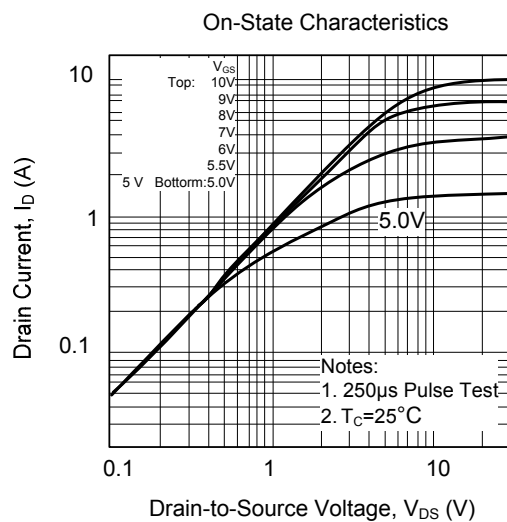
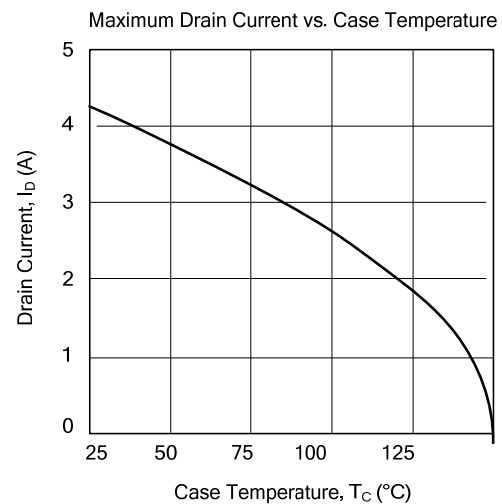
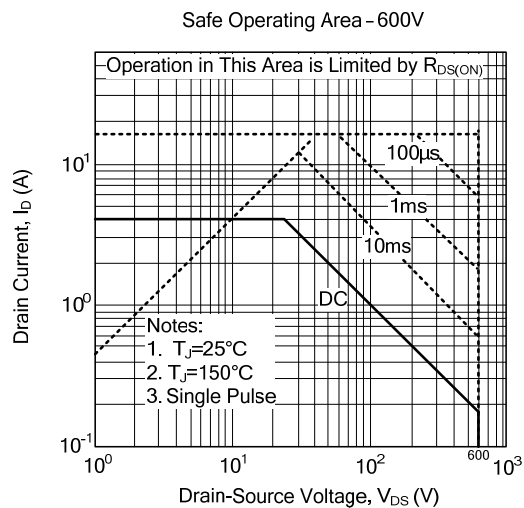
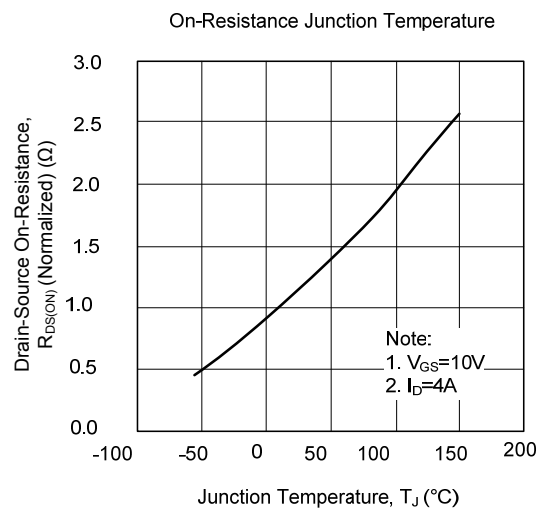
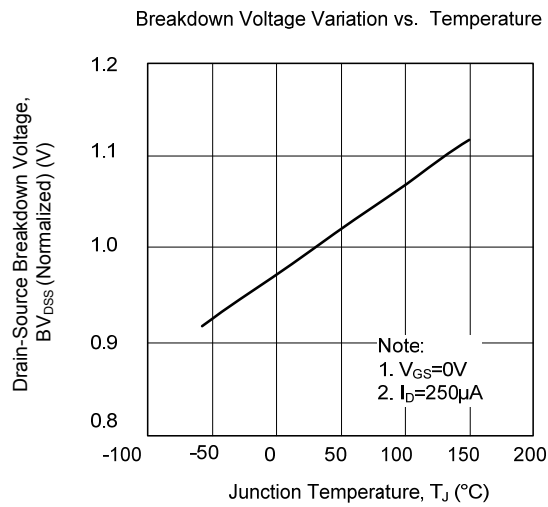


Unclamped Inductive Switching Test Circuit

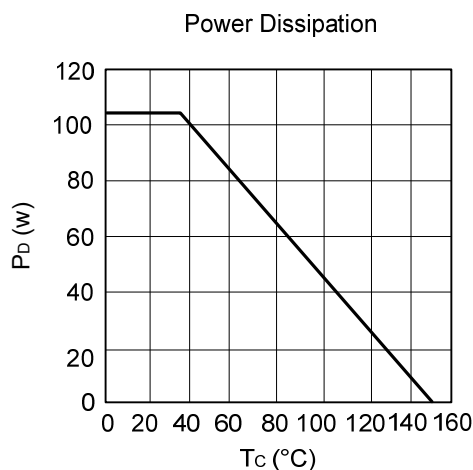
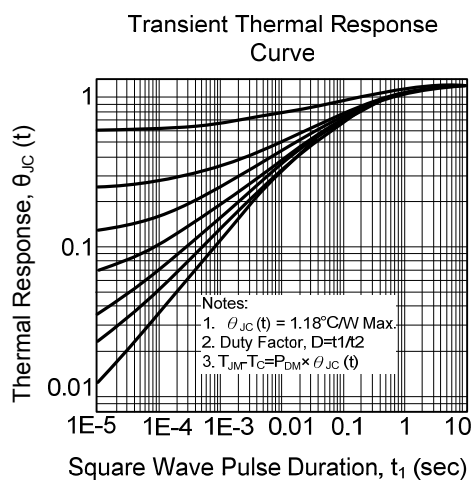
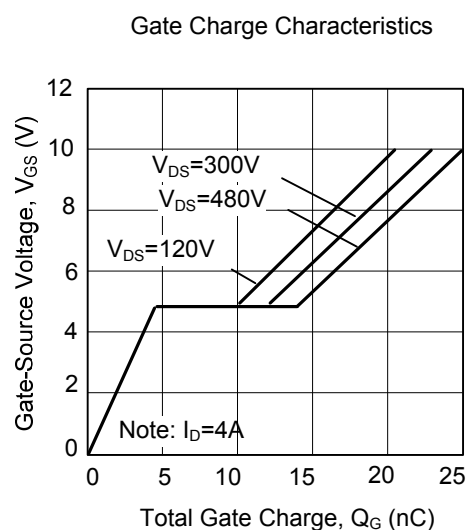
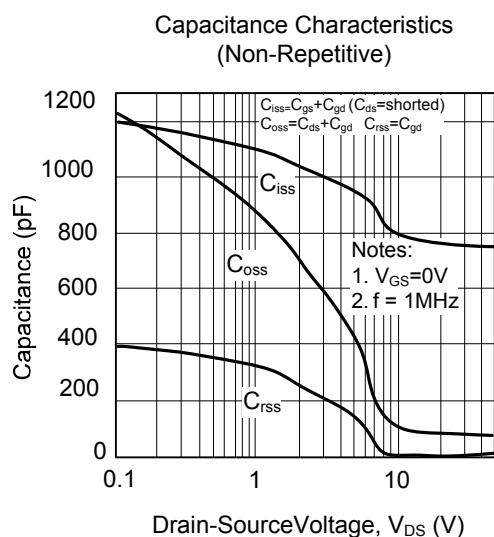
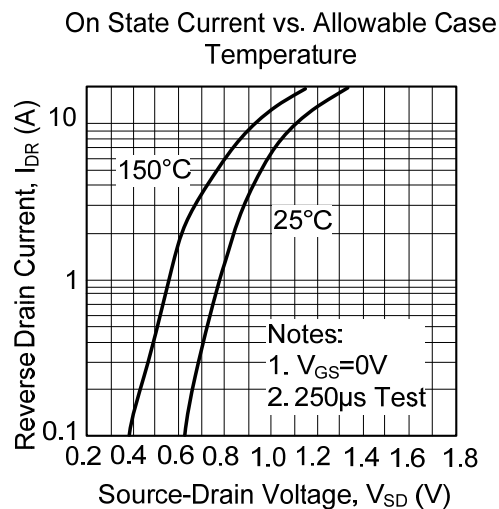
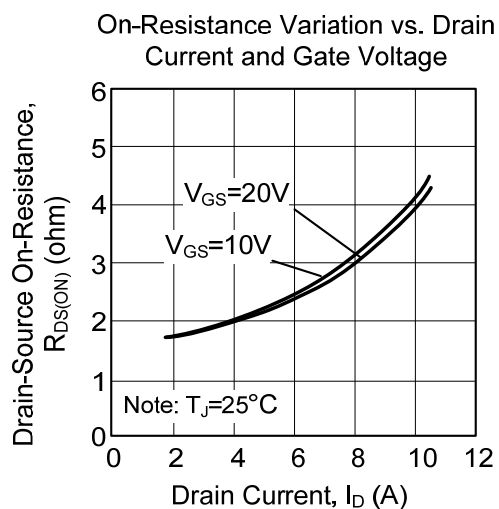


Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS(Cont.)



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. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.