



4N60Z

Power MOSFET

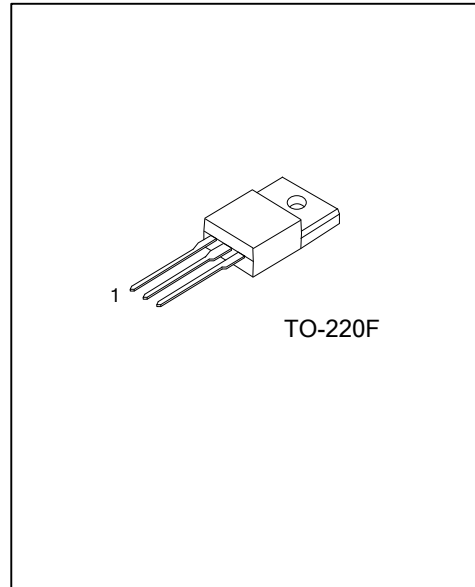
4A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

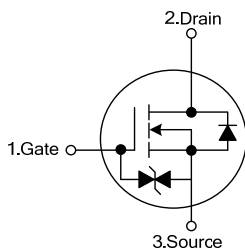
The UTC **4N60Z** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, 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

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

<p>4N60ZL-TF3-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free</p>	<p>(1) T: Tube (2) TF3: TO-22F (3) G: Halogen Free, L: Lead 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}	± 20	V
Avalanche Current (Note 2)		I_{AR}	4.4	A
Drain Current	Continuous I	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		P_D	36	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. 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 SYMBOL		RATINGS	UNIT
Junction to Ambient	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	θ_{Jc}	3.47	$^\circ\text{C}/\text{W}$

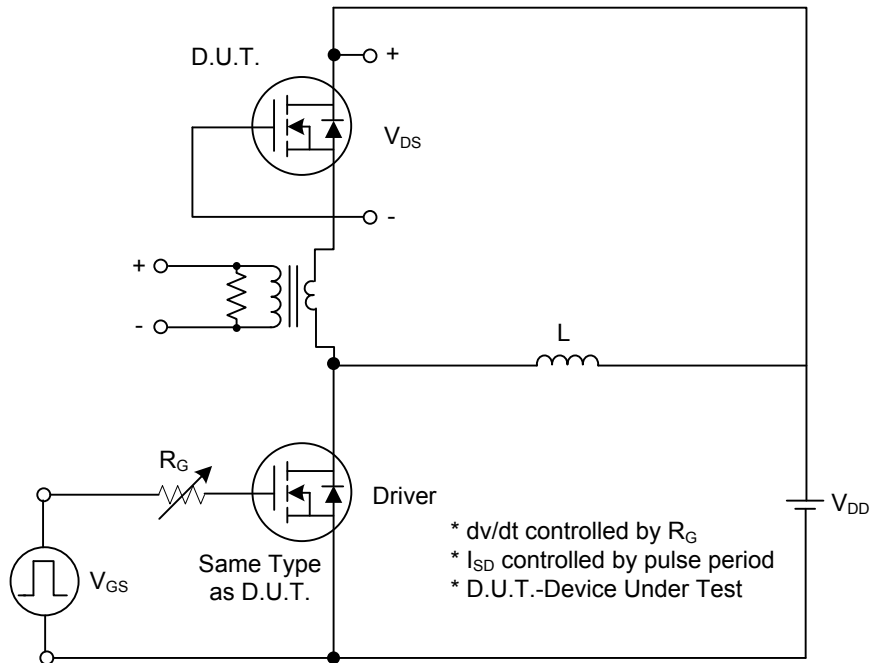
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

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	V _{DS} = 600V, V _{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS} V _{GS} = 20V, V _{DS} = 0V V _{GS} = -20V, V _{DS} = 0V			5	μA
	Reverse V				-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, dI _F /dt = 100 A/μs (Note 1)	250			ns
Reverse Recovery Charge	Q _{RR}			1.5		

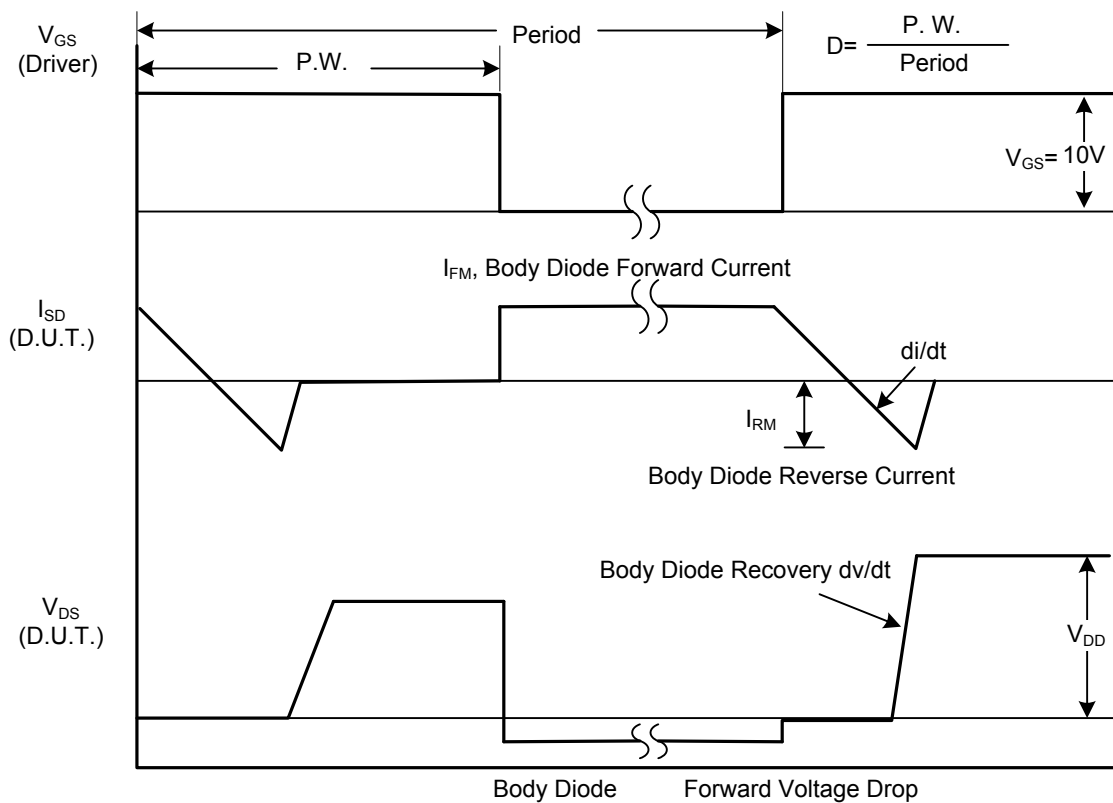
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

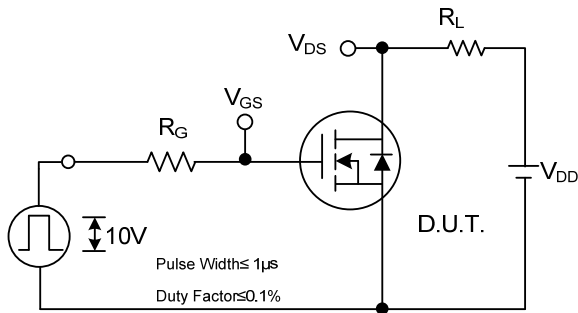


Peak Diode Recovery dv/dt Test Circuit

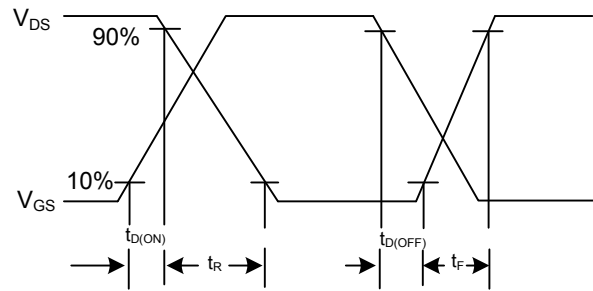


Peak Diode Recovery dv/dt Waveforms

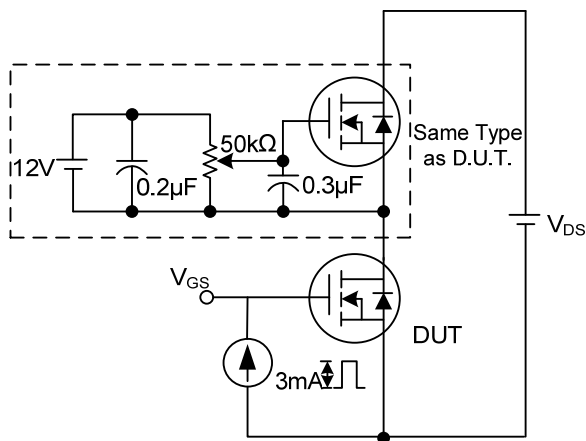
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



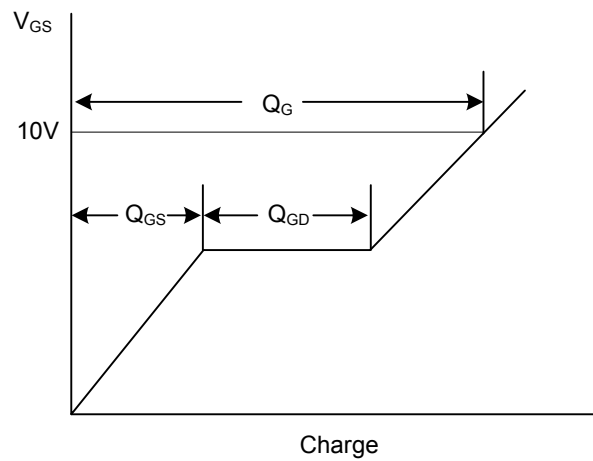
Switching Test Circuit



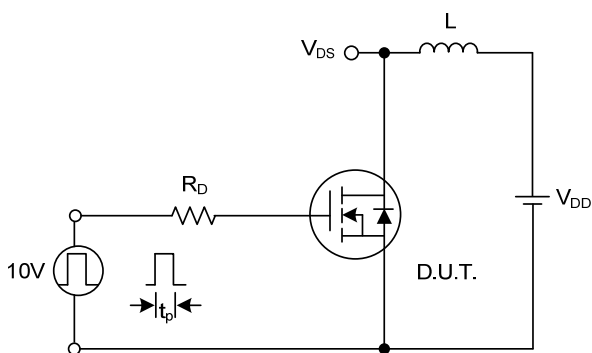
Switching Waveforms



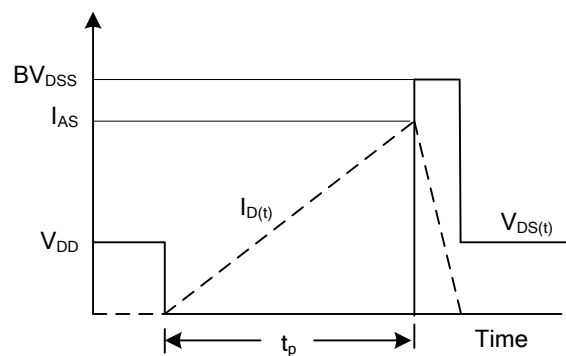
Gate Charge Test Circuit



Gate Charge Waveform



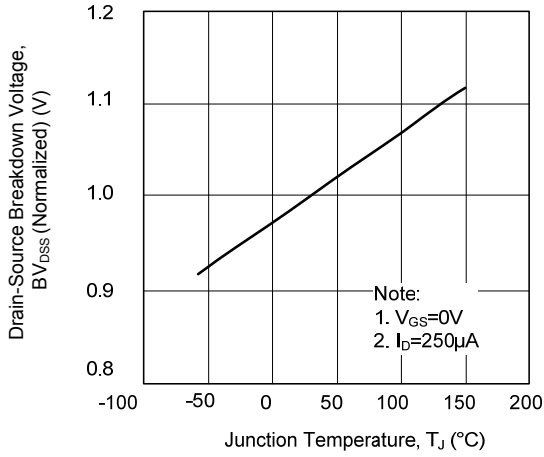
Unclamped Inductive Switching Test Circuit



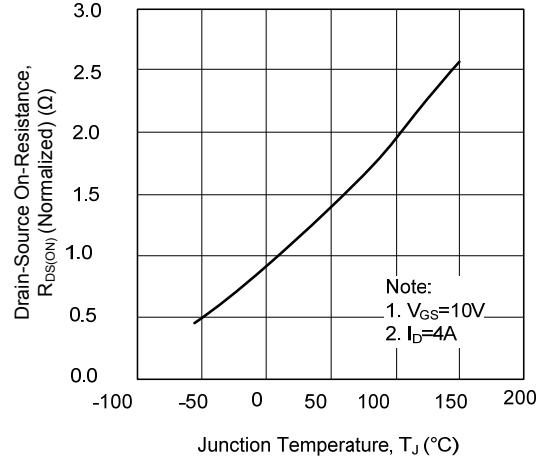
Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

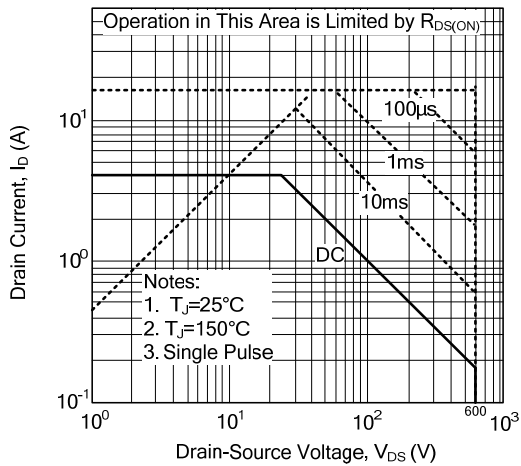
Breakdown Voltage Variation vs. Temperature



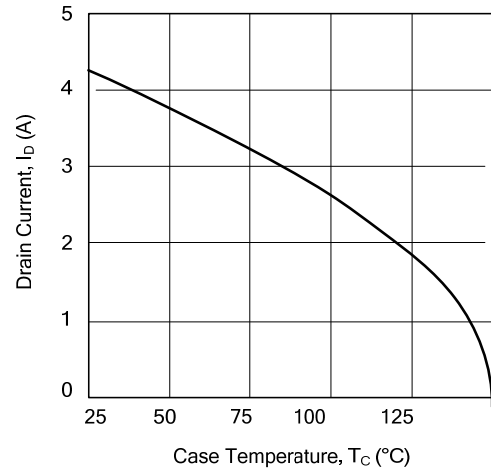
On-Resistance Junction Temperature



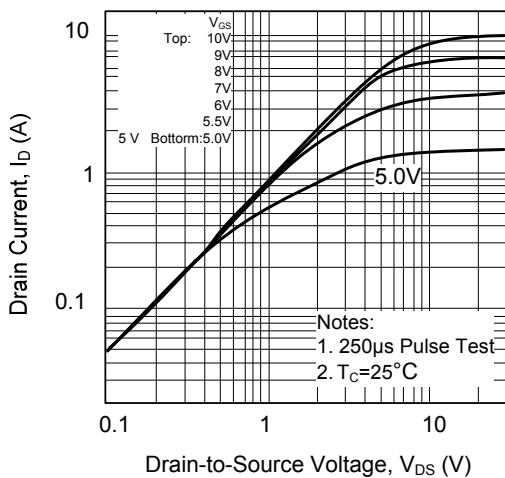
Safe Operating Area - 600V



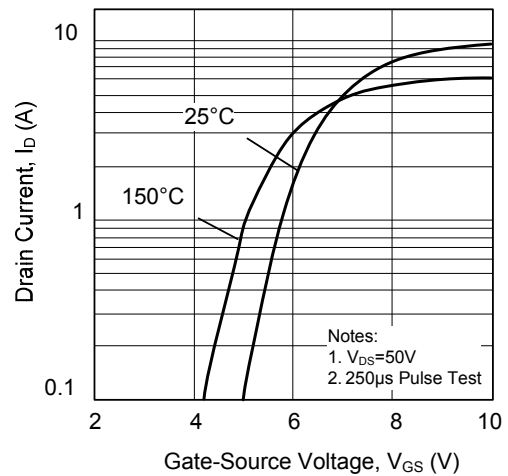
Maximum Drain Current vs. Case Temperature



On-State Characteristics

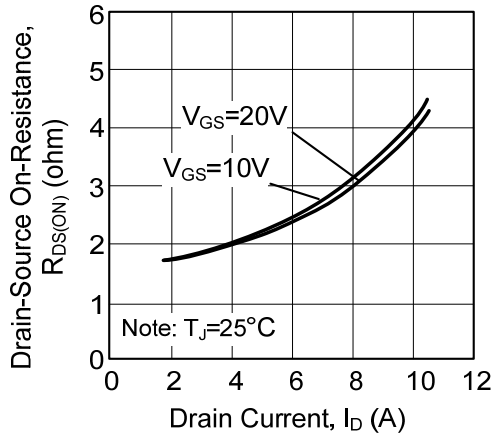


Transfer Characteristics

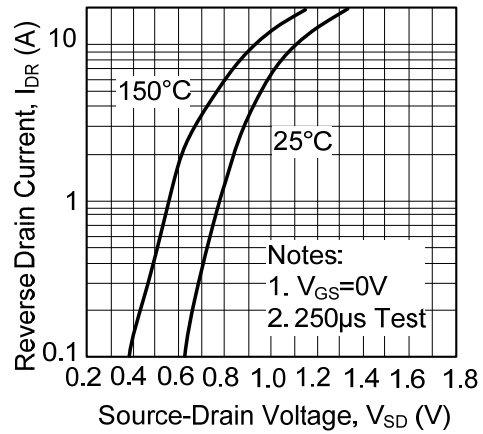


■ TYPICAL CHARACTERISTICS(Cont.)

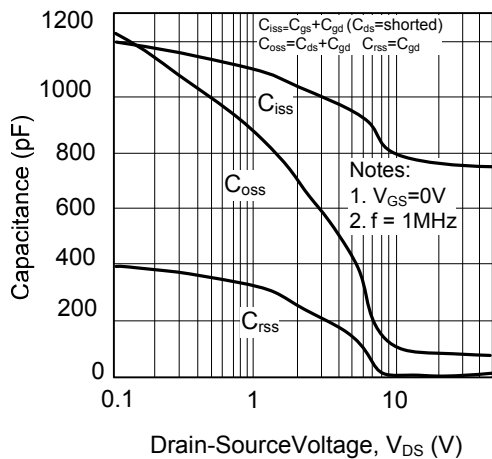
On-Resistance Variation vs. Drain Current and Gate Voltage



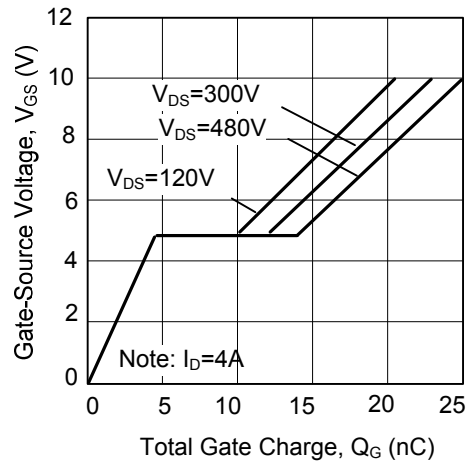
On State Current vs. Allowable Case Temperature



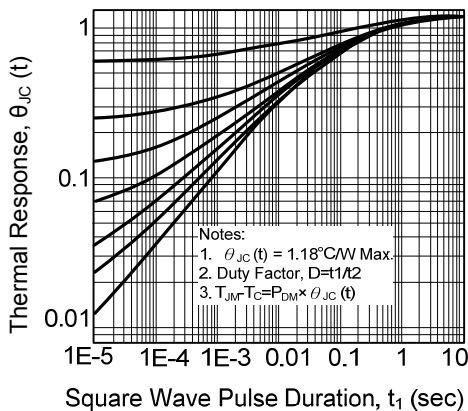
Capacitance Characteristics (Non-Repetitive)



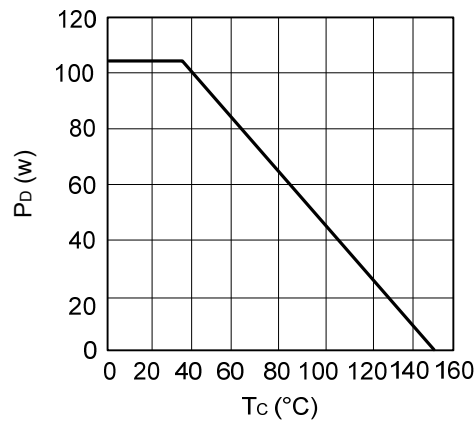
Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation



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.