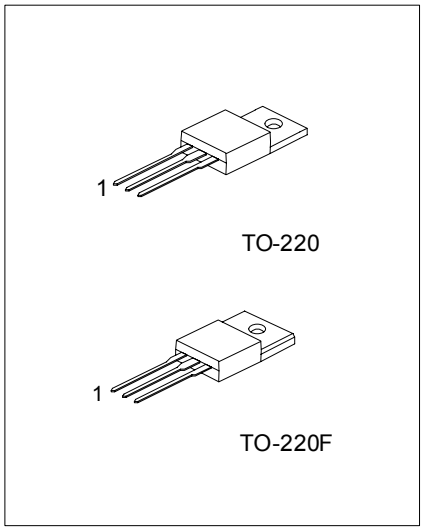
4N60

Power MOSFET

4 Amps, 600 Volts
N-CHANNEL POWER MOSFET



*Pb-free plating product number: 4N60L

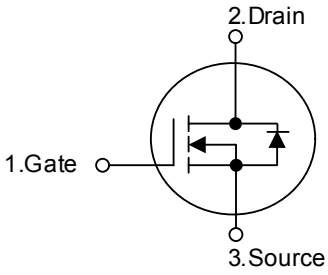
■ DESCRIPTION

The UTC 4N60 is a high voltage 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

* $R_{DS(ON)}$ = 2.5Ω @V_{GS} = 10 V
* 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

Order Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
4N60-TA3-T	4N60L-TA3-T	TO-220	G	D	S	Tube
4N60-TF3-T	4N60L-TF3-T	TO-220F	G	D	S	Tube

4N60L-TA3-T (1)Packing Type (2)Package Type (3)Lead Plating	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F (3) L: Lead Free Plating Blank: Pb/Sn

■ 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 1)		I_{AR}	4.4	A
Continuous Drain Current	T_C = 25°C	I_D	4.0	A
	T_C = 100°C		2.8	A
Pulsed Drain Current, T_P Limited by T_{JMAX} - (Note 1)		I_{DM}	16	A
Avalanche Energy, Single Pulsed (Note 2)		E_{AS}	260	mJ
Avalanche Energy, Repetitive, Limited by T_{JMAX}		E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation (T_C = 25°C)		P_D	106	W
Junction Temperature		T_J	+150	℃
Storage Temperature		T_{STG}	-55 ~ +150	℃

Note 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.

■ THERMAL DATA

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Junction-to-Ambient	θ_{JA}			62.5	°C/W
Junction-to-Case	θ_{JC}			3	°C/W
Case-to-Sink	θ_{CS}		0.5		°C/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} = 0 V, I_D = 250 μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V			10	μA
			V_{DS} = 480 V, T_C = 125°C			100	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30 V, V_{DS} = 0 V			100	nA
	Reverse		V_{GS} = -30 V, V_{DS} = 0 V			-100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D = 250 μA, Referenced to 25°C		0.6		V/℃
On Characteristics							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250 μA	2.0		4.0	V
Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 2.2 A			2.5	Ω
Forward Transconductance		g_{FS}	V_{DS} = 50 V, I_D = 2.2 A (Note 4)		4.0		S
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS} = 25 V, V_{GS} = 0 V, 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 = 4.0 A, R_G = 25Ω (Note 4, 5)		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}= 10 V (Note 4, 5)		15	20	nC
Gate-Source Charge		Q_{GS}			3.4		nC
Gate-Drain Charge		Q_{DD}			7.1		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Source- Drain Diode Ratings and Characteristics						
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS} = 0 V, I_S = 4.4 A			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 = 4.4 A, dI_F/dt = 100 A/μs (Note 4)		250		ns
Reverse Recovery Charge	Q_{RR}			1.5		μC

Notes: 1. Repetitive Rating : Pulse width limited by T_J
2. L = 25mH, I_{AS} = 4.4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 4.4A, di/dt ≤200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

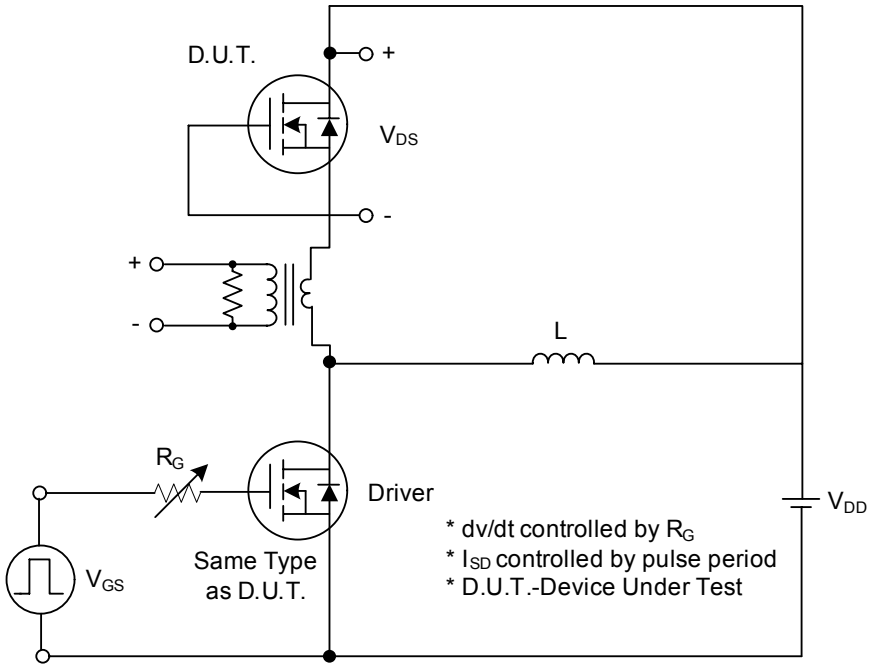


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

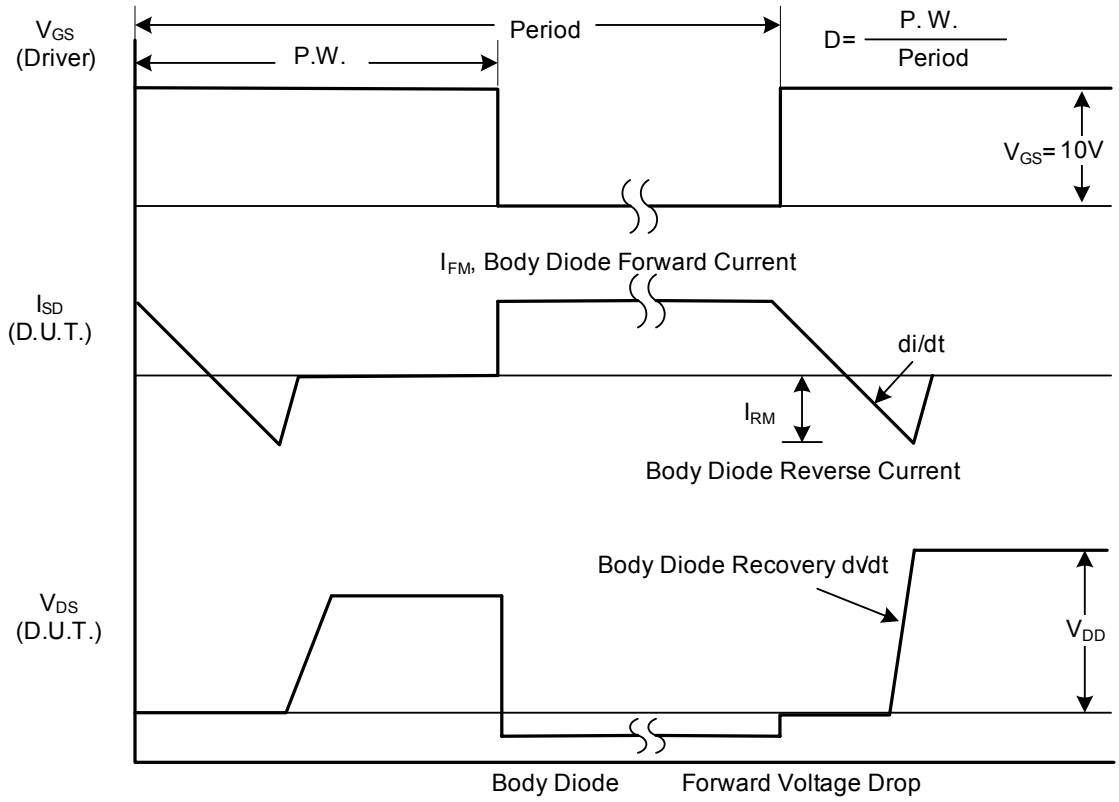


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

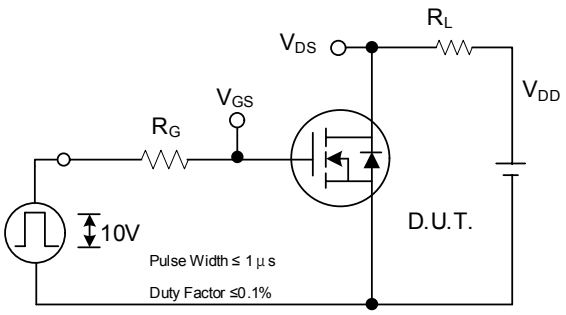


Fig. 2A Switching Test Circuit

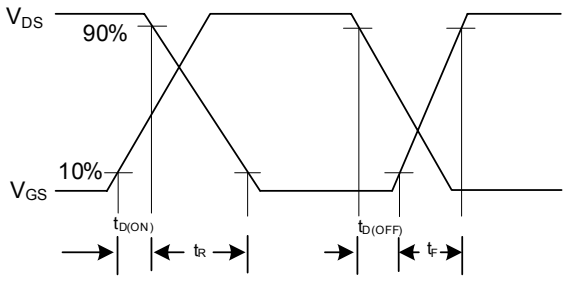


Fig. 2B Switching Waveforms

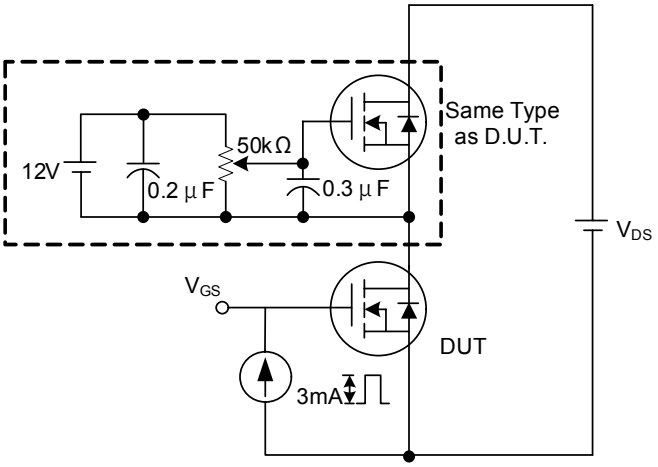


Fig. 3A Gate Charge Test Circuit

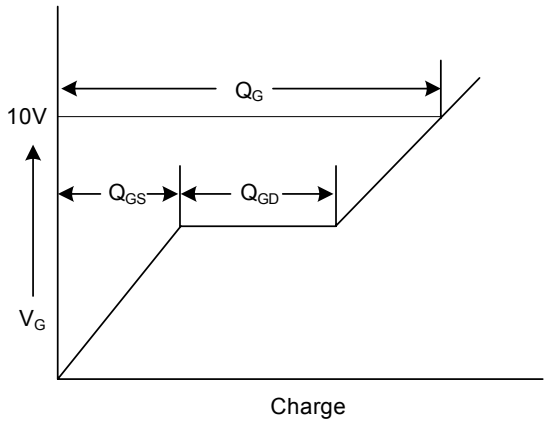


Fig. 3B Gate Charge Waveform

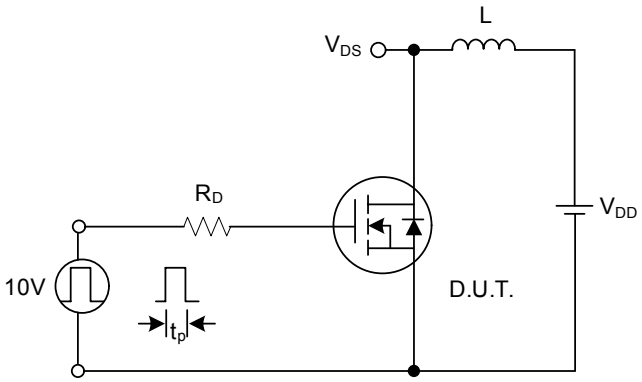


Fig. 4A Unclamped Inductive Switching Test Circuit

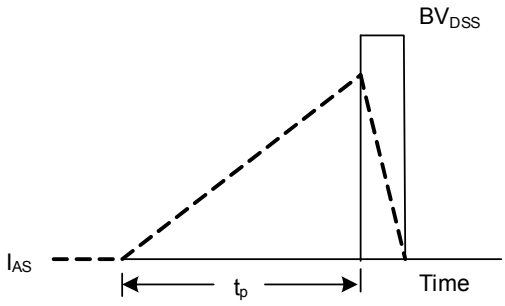
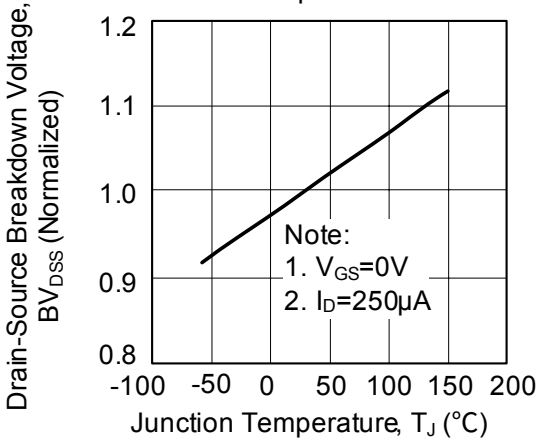


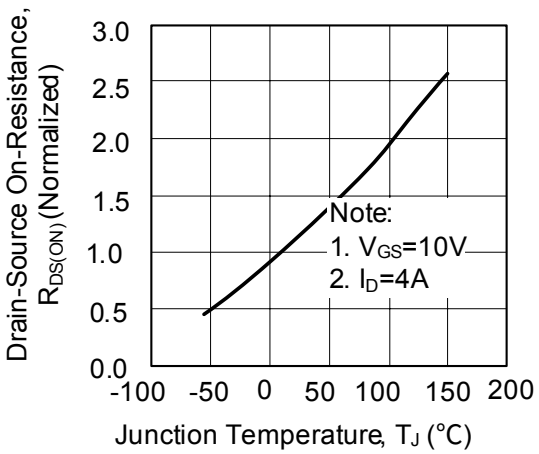
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

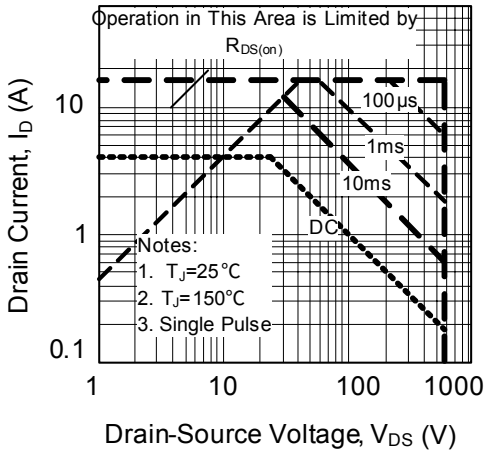
Breakdown Voltage Variation vs Temperature



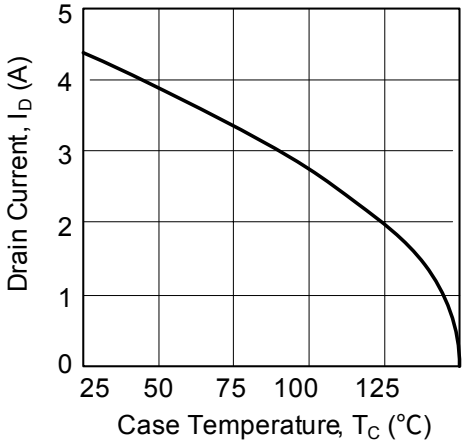
On-Resistance Junction Temperature



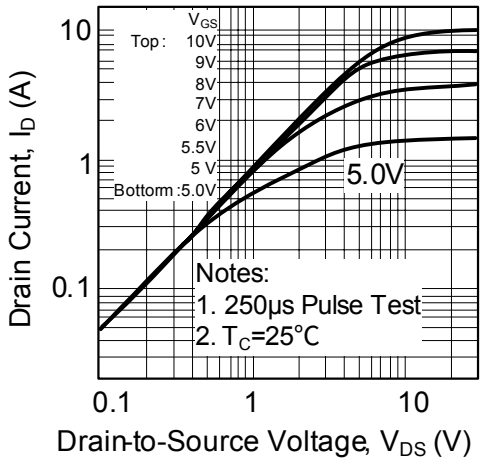
Maximum Safe Operating Area



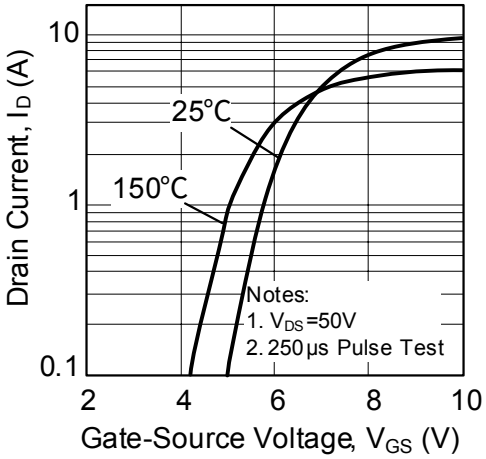
Maximum Drain Current vs. Case Temperature



On-State Characteristics

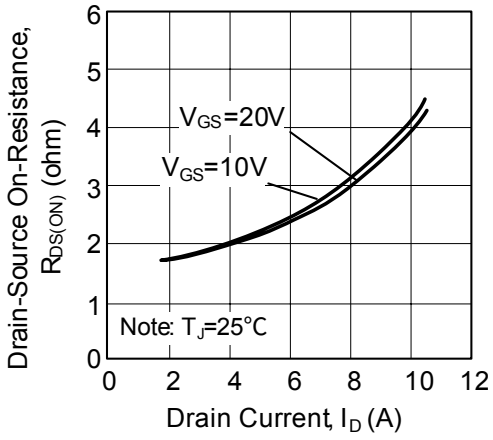


Transfer Characteristics

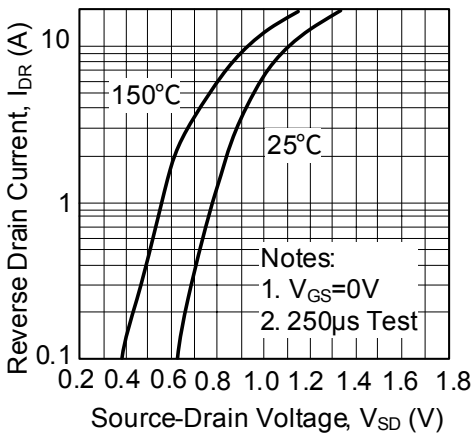


■ TYPICAL CHARACTERISTICS(Cont.)

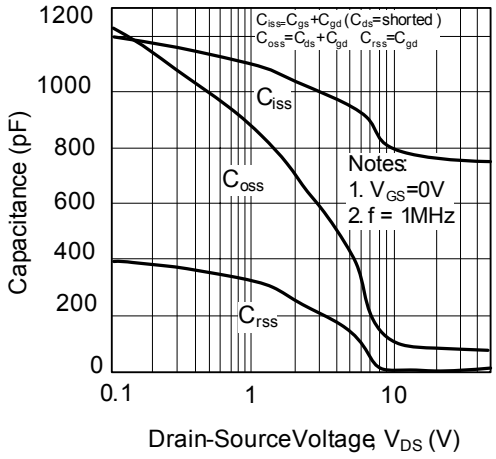
On-Resistance Variation vs Drain Current and Gate Voltage



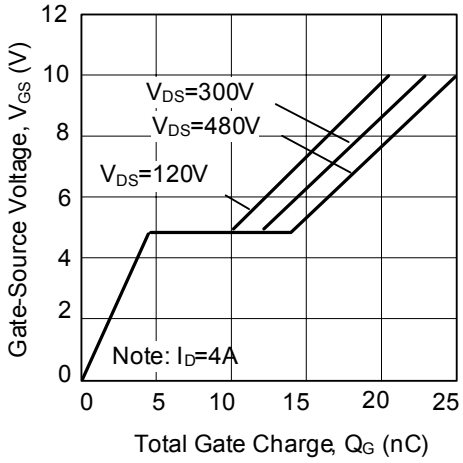
On State Current vs. Allowable Case Temperature



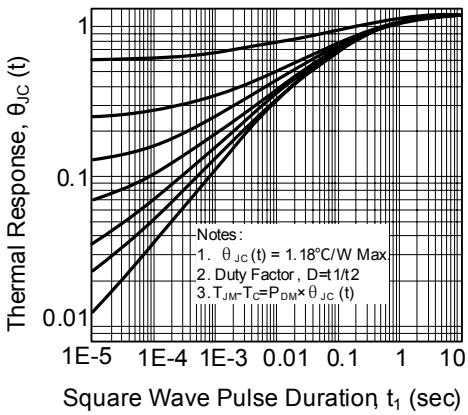
Capacitance Characteristics (Non-Repetitive)



Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation