



3N60

Power MOSFET

3 Amps, 600/650 Volts
N-CHANNEL POWER MOSFET

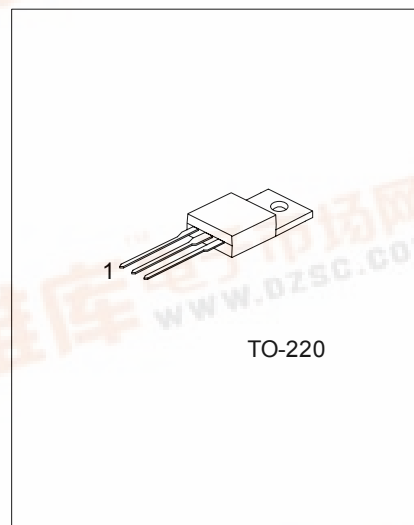
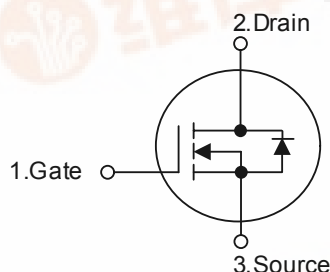
■ DESCRIPTION

The UTC 3N60 is a high voltage and high current power MOSFET, 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

- * $R_{DS(ON)} = 3.6\Omega$ @ $V_{GS} = 10V$
- * Ultra low gate charge (typical 10 nC)
- * Low reverse transfer capacitance ($C_{RSS} =$ typical 5.5 pF)
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



*Pb-free plating product number: 3N60L

■ ORDERING INFORMATION

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

3N60L-x-TA3-T	(1)Packing Type (2)Package Type (3)Drain-Source Voltage (4)Lead Plating	(1) T: Tube (2) TA3: TO-220 (3) A: 600V, B: 650V (4) L: Lead Free Plating Blank: Pb/Sn
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■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	3N60-A	V_{DSS}	600	V
	3N60-B		650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current - (Note 1)		I_{AR}	3.0	A
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	3.0	A
	$T_C = 100^\circ\text{C}$		1.9	A
Pulsed Drain Current, T_P Limited by T_{JMAX} - (Note 1)		I_{DM}	12	A
Avalanche Energy, Single Pulsed (Note 2)		E_{AS}	200	mJ
Avalanche Energy, Repetitive, Limited by T_{JMAX}		E_{AR}	7.5	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation		P_D	75	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

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	TYP	MAX	UNIT
Junction-to-Case	θ_{JC}		1.67	$^\circ\text{C/W}$
Junction-to-Ambient	θ_{JA}		62.5	$^\circ\text{C/W}$

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Off Characteristics							
Drain-Source Breakdown Voltage	3N60-A	BV _{DSS}	V _{GS} = 0 V, I _D = 250 μA	600			V
	3N60-B			650		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		ΔBV _{DSS} /ΔT _J	I _D = 250 μA, Referenced to 25°C		0.6		V/°C
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 = 1.5A		2.8	3.6	Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1MHz		350	450	pF
Output Capacitance		C _{OSS}			50	65	pF
Reverse Transfer Capacitance		C _{RSS}			5.5	7.5	pF
Switching Characteristics							
Turn-On Delay Time		t _{D(ON)}	V _{DD} = 300V, I _D = 3.0 A, R _G = 25Ω (Note 4, 5)		10	30	ns
Turn-On Rise Time		t _R			30	70	ns
Turn-Off Delay Time		t _{D(OFF)}			20	50	ns
Turn-Off Fall Time		t _F			30	70	ns
Total Gate Charge		Q _G	V _{DS} = 480V,I _D = 3.0A, V _{GS} = 10 V (Note 4, 5)		10	13	nC
Gate-Source Charge		Q _{GS}			2.7		nC
Gate-Drain Charge		Q _{DD}			4.9		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}	$V_{GS} = 0\text{ V}, I_S = 3.0\text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				3.0	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				12	A
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, I_S = 3.0\text{ A},$		210		ns
Reverse Recovery Charge	Q_{RR}	$di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 4)		1.2		μC

- Notes: 1. Repetitive Rating : Pulse width limited by T_J
2. $L = 40\text{mH}$, $I_{AS} = 3.0\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 3.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

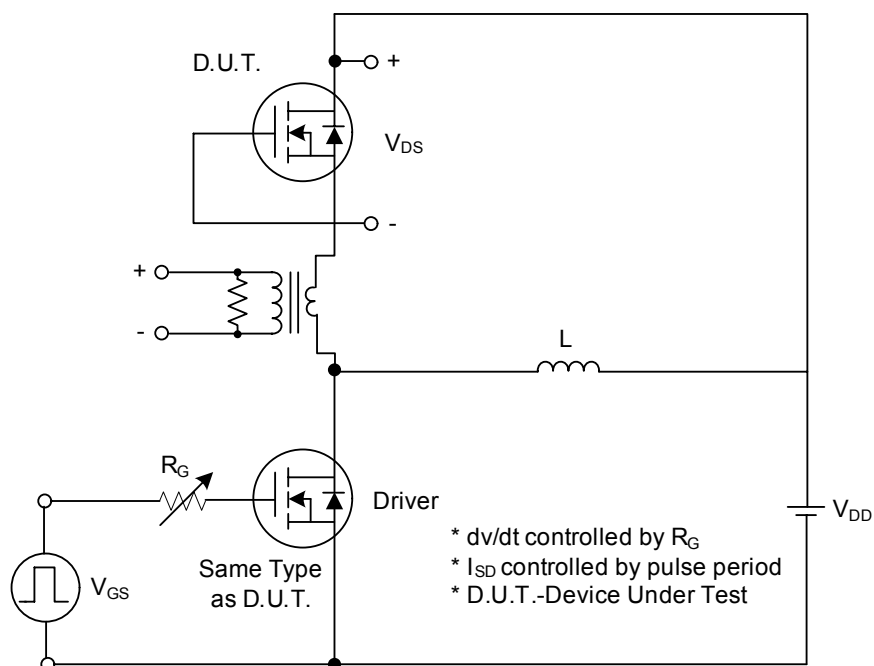


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

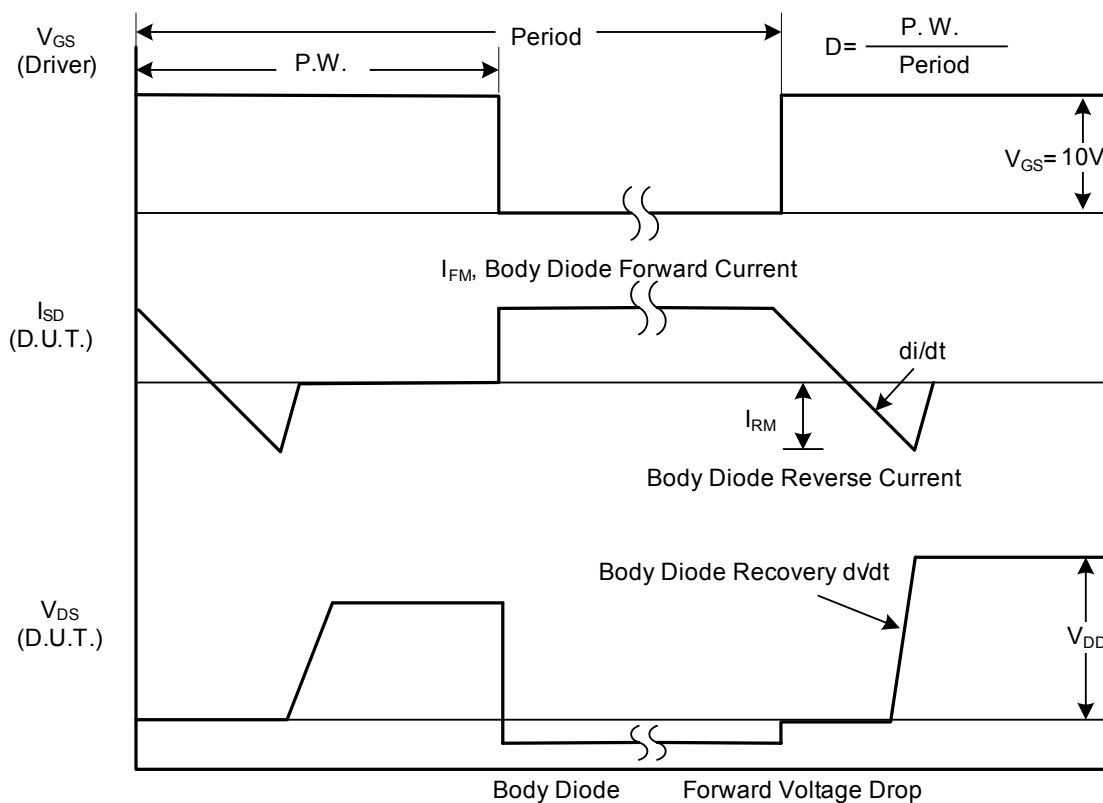


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

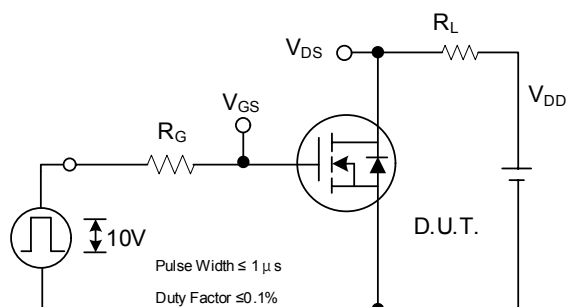


Fig. 2A Switching Test Circuit

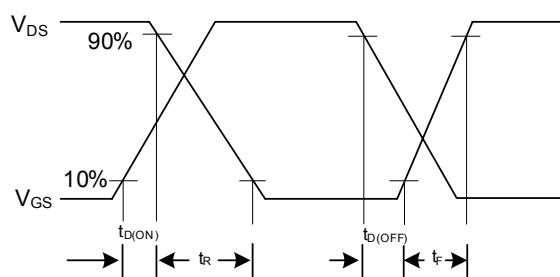


Fig. 2B Switching Waveforms

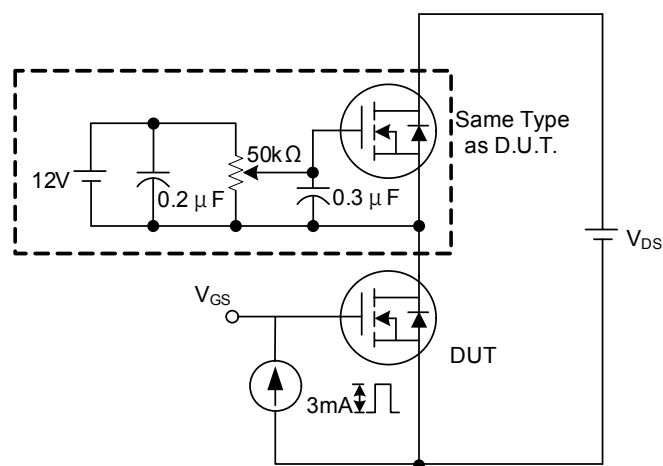


Fig. 3A Gate Charge Test Circuit

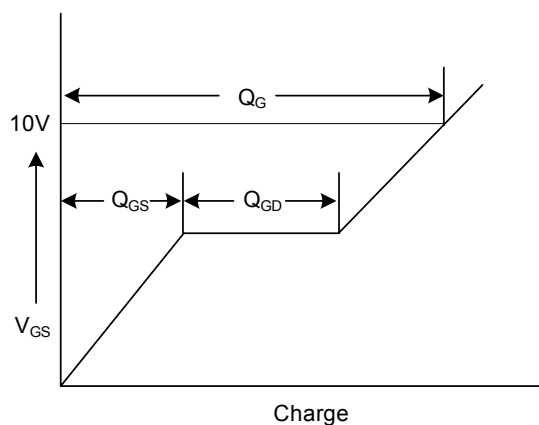


Fig. 3B Gate Charge Waveform

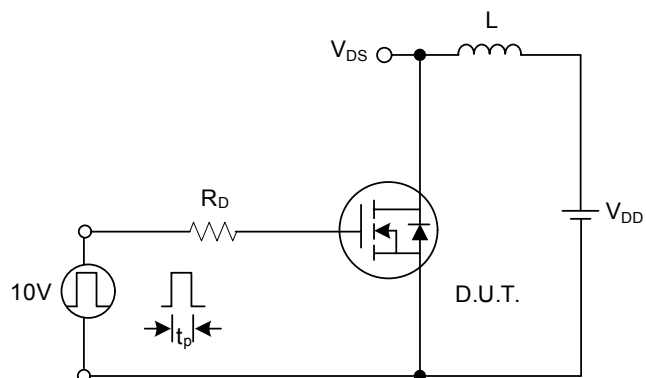


Fig. 4A Unclamped Inductive Switching Test Circuit

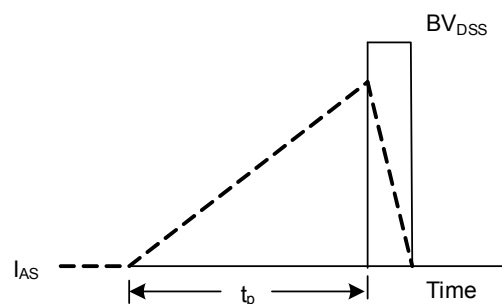
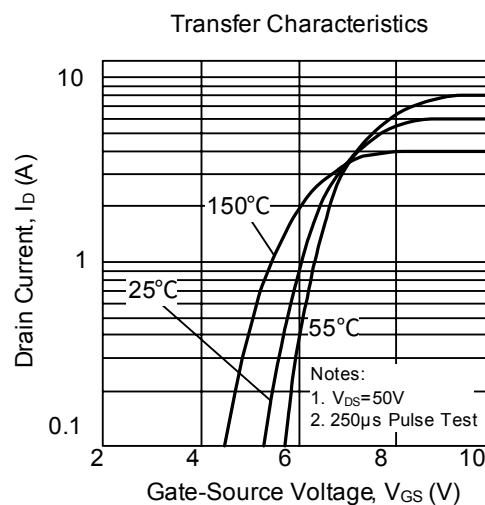
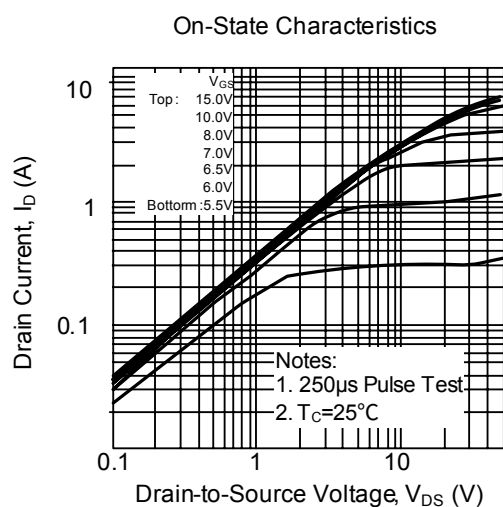
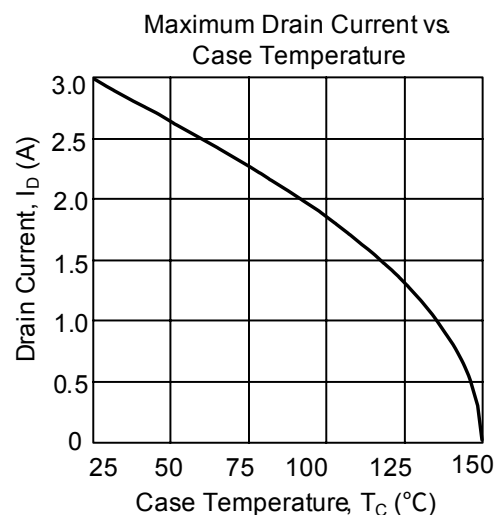
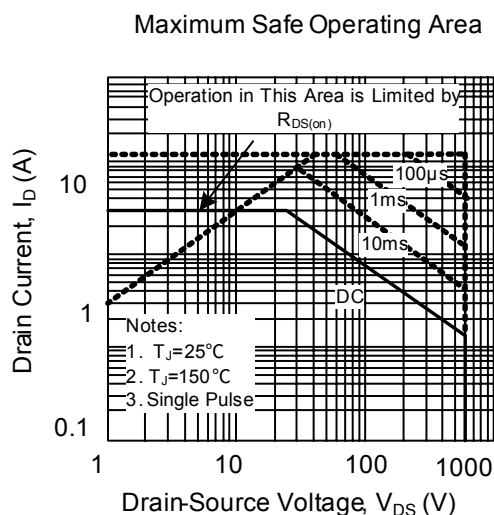
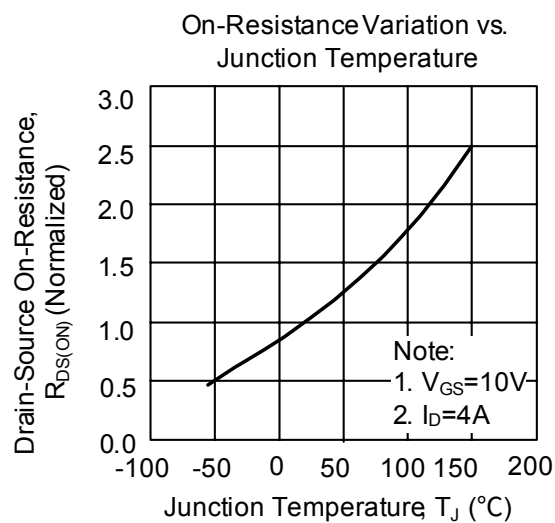
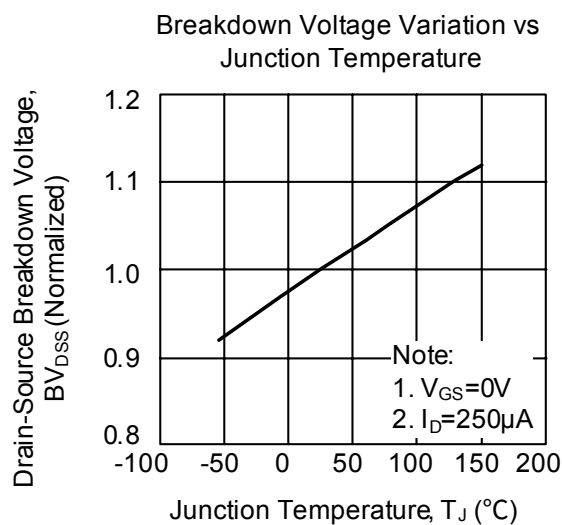


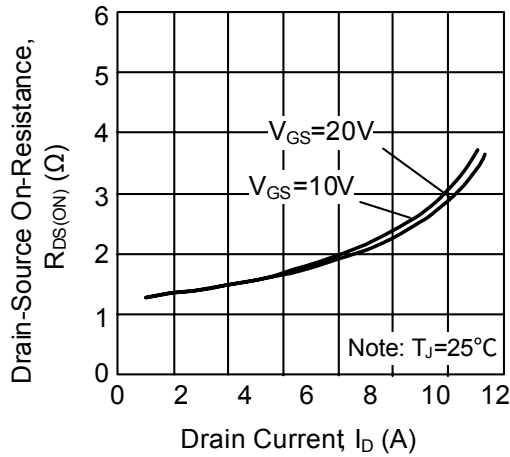
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

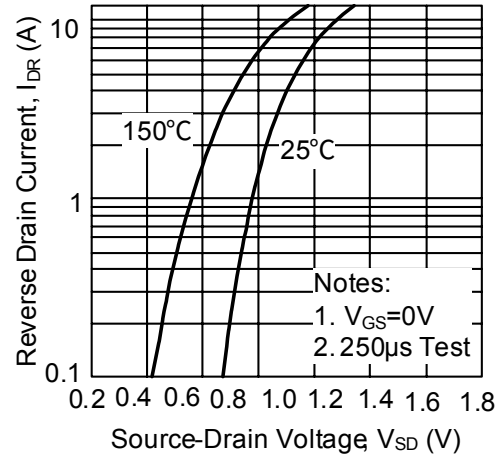


■ TYPICAL CHARACTERISTICS(Cont.)

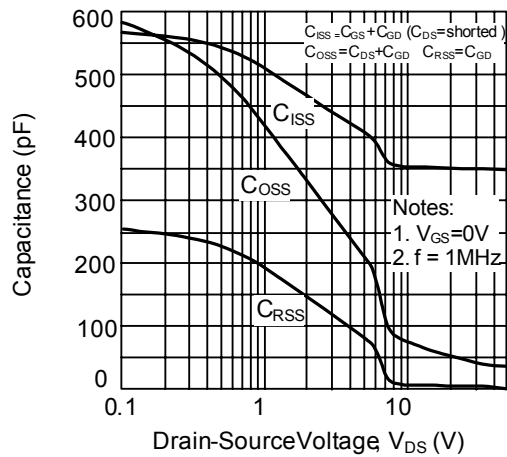
On-Resistance Variation vs
Drain Current and Gate Voltage



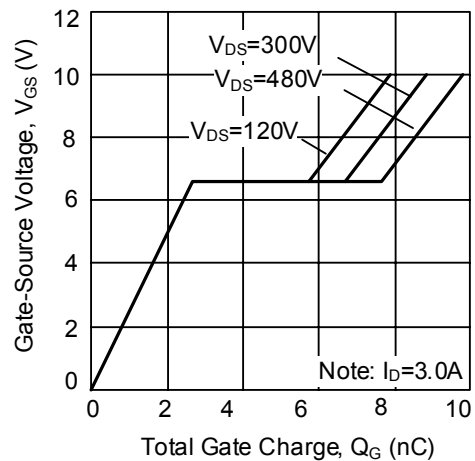
On State Current vs.
Allowable Case Temperature



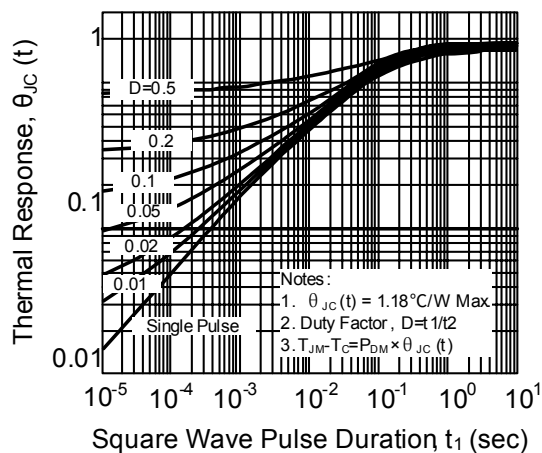
Capacitance Characteristics
(Non-Repetitive)



Gate Charge Characteristics



Transient Thermal Response Curve



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