



4N60

Power MOSFET

4 Amps, 600 Volts N-CHANNEL POWER MOSFET

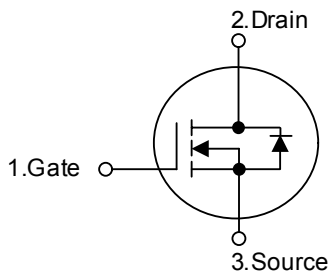
DESCRIPTION

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

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

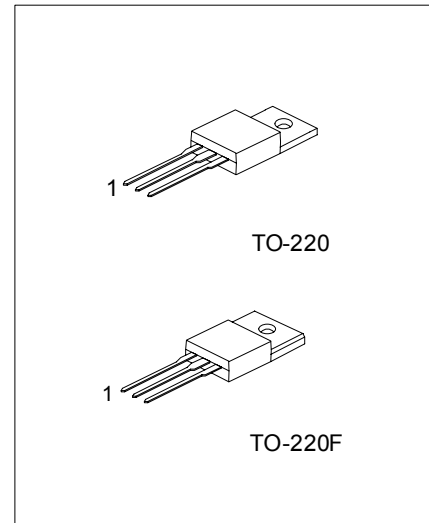
SYMBOL



ORDERING INFORMATION

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

<p>4N60L-TA3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Plating</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F</p> <p>(3) L: Lead Free Plating Blank: Pb/Sn</p>
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*Pb-free plating product number: 4N60L

■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25$, 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	I_D	$T_C = 25^\circ\text{C}$	4.0
		$T_C = 100^\circ\text{C}$	2.8
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 ($T_C = 25^\circ\text{C}$)	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	$^\circ\text{C/W}$
Junction-to-Case	θ_{JC}			3	$^\circ\text{C/W}$
Case-to-Sink	θ_{CS}		0.5		$^\circ\text{C/W}$

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	600			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$			10	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$			100	μA
Gate-Source Leakage Current	I_{GSS}	Forward $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$			100	nA
		Reverse $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
Breakdown Voltage Temperature Coefficient	BV_{DSS}/T_J	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		0.6		V/
On Characteristics						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0		4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.2\text{ A}$			2.5	Ω
Forward Transconductance	g_{FS}	$V_{DS} = 50\text{ V}, I_D = 2.2\text{ A}$ (Note 4)		4.0		S
Dynamic Characteristics						
Input Capacitance	C_{ISS}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		520	670	pF
Output Capacitance	C_{OSS}			70	90	pF
Reverse Transfer Capacitance	C_{RSS}			8	11	pF
Switching Characteristics						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 300\text{ V}, I_D = 4.0\text{ A}, R_G = 25\ \Omega$ (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	$V_{DS} = 480\text{ V}, I_D = 4.0\text{ A}, V_{GS} = 10\text{ V}$ (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}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{ A}$			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}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{ A},$		250		ns
Reverse Recovery Charge	Q_{RR}	$di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 4)		1.5		μC

- Notes: 1. Repetitive Rating : Pulse width limited by T_J
 2. $L = 25\text{mH}, I_{AS} = 4.4\text{A}, V_{DD} = 50\text{V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
 3. $I_{SD} \leq 4.4\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
 4. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
 5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

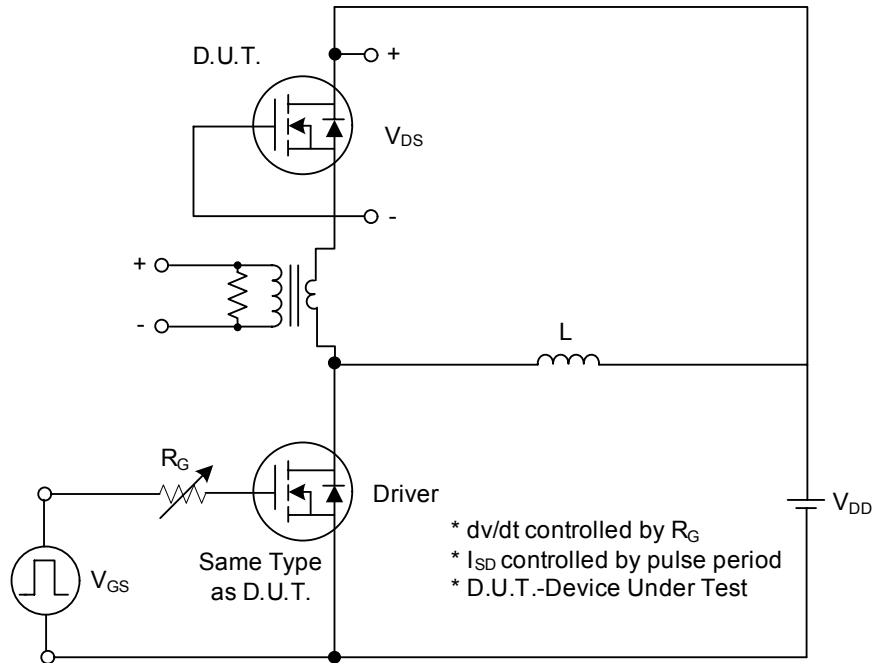


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

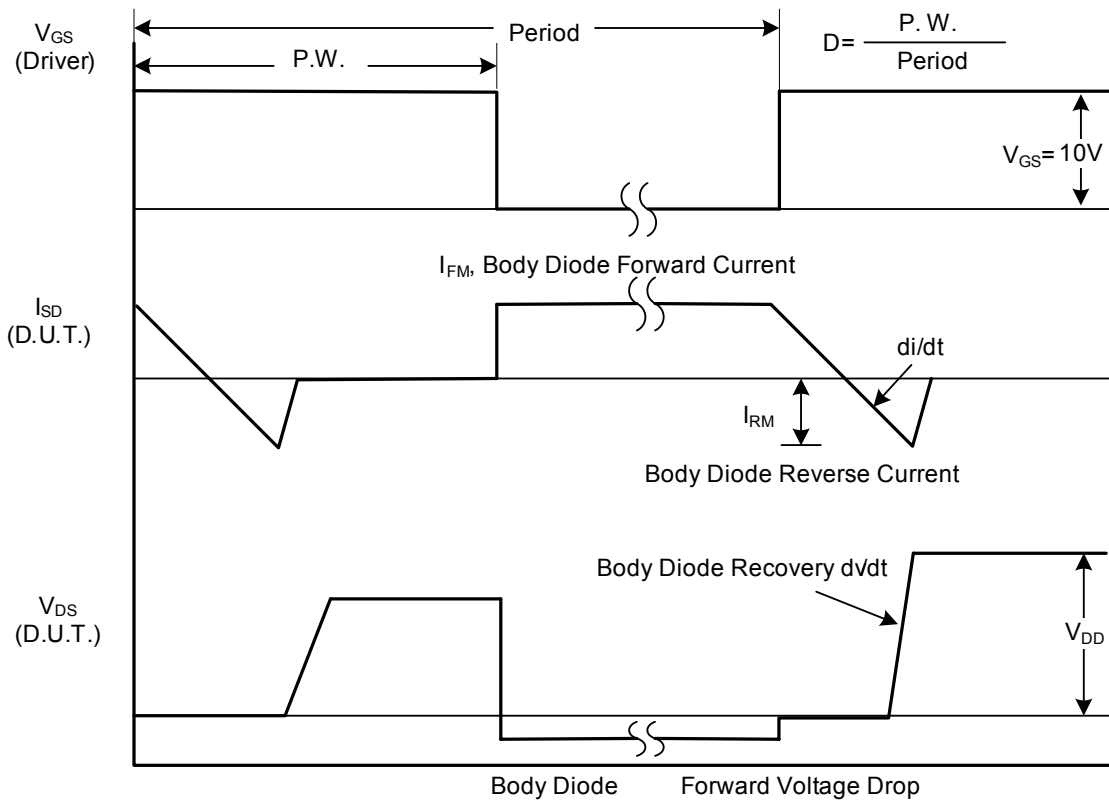


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

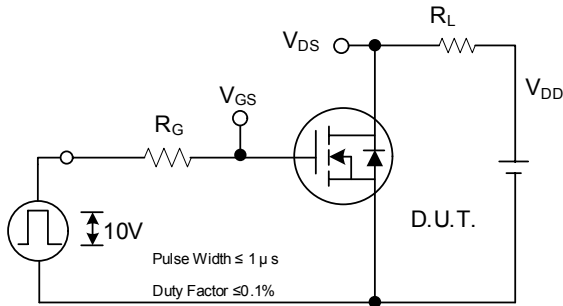


Fig. 2A Switching Test Circuit

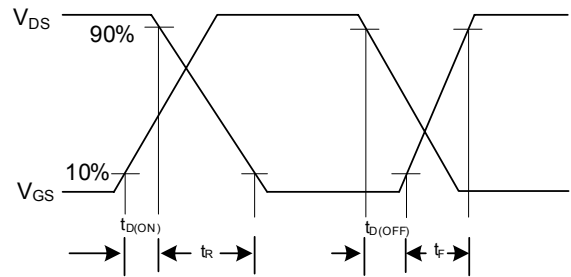


Fig. 2B Switching Waveforms

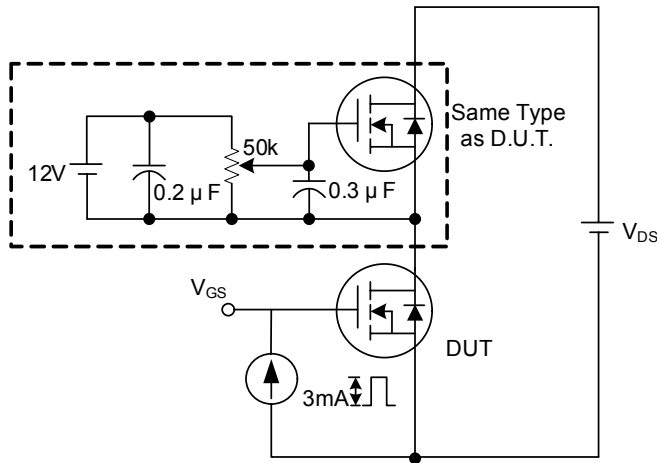


Fig. 3A Gate Charge Test Circuit

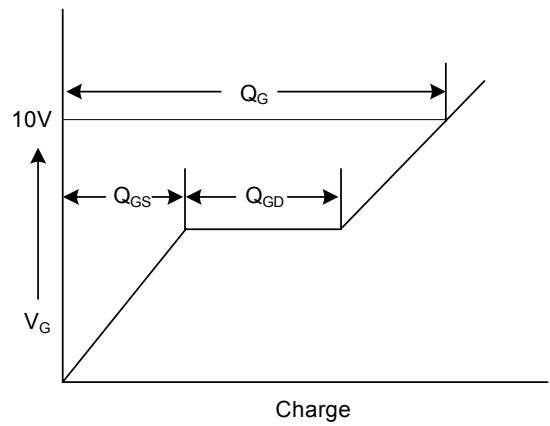


Fig. 3B Gate Charge Waveform

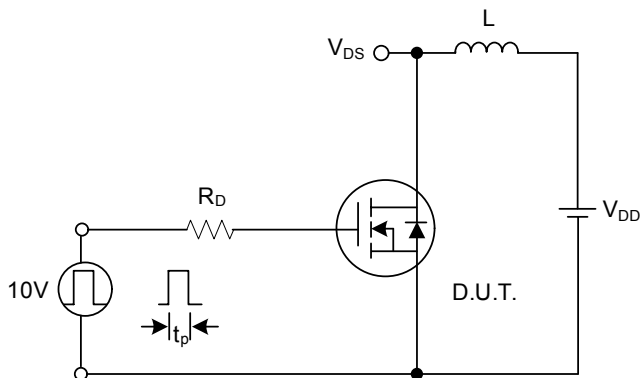


Fig. 4A Unclamped Inductive Switching Test Circuit

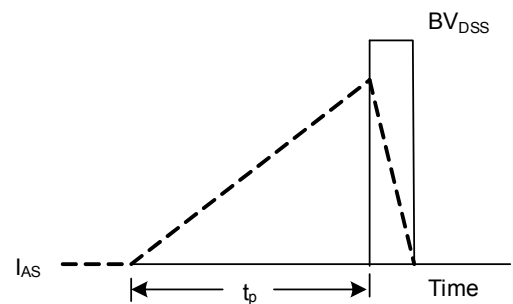
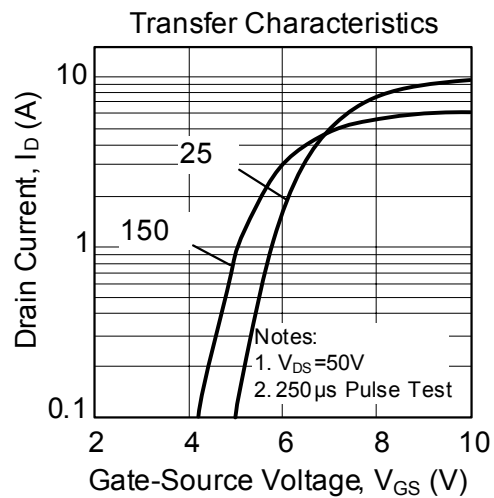
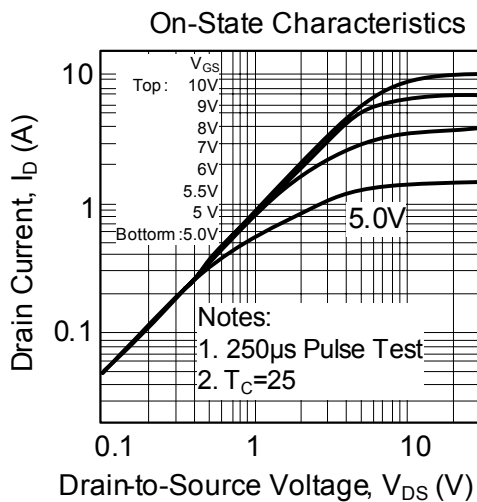
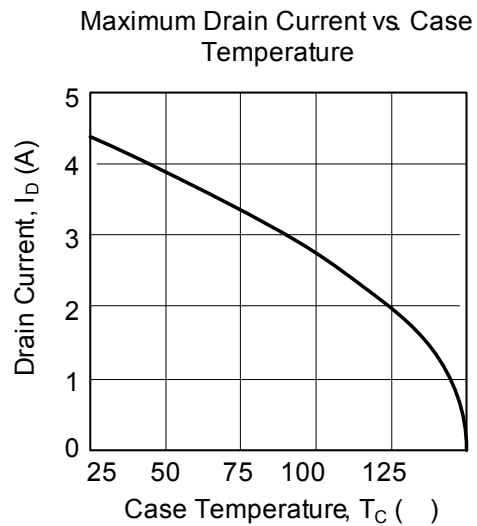
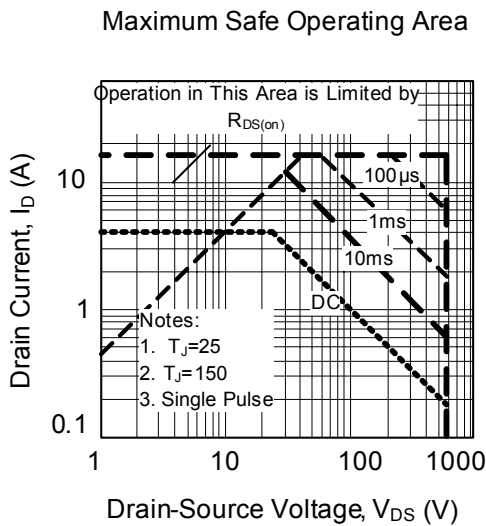
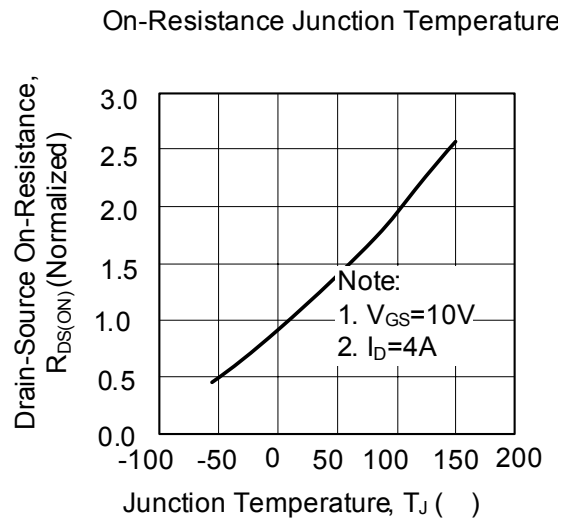
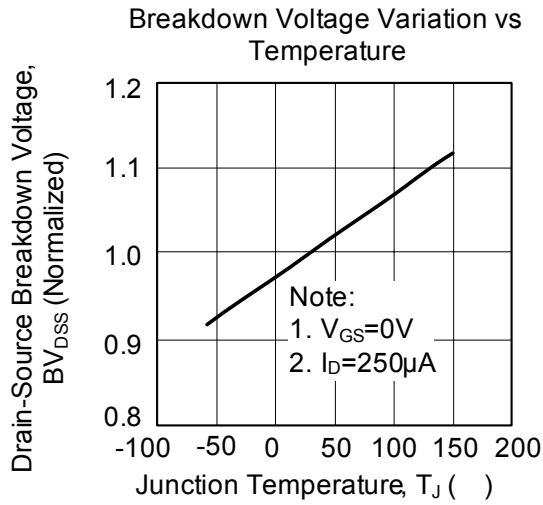


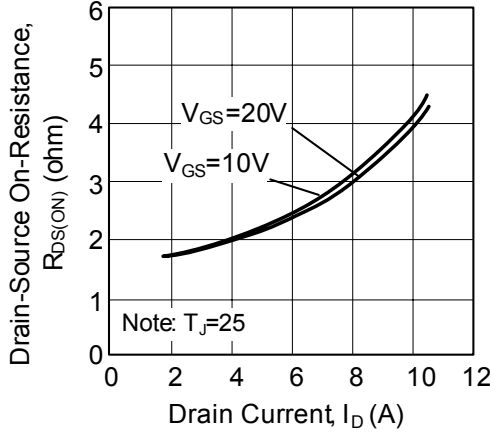
Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

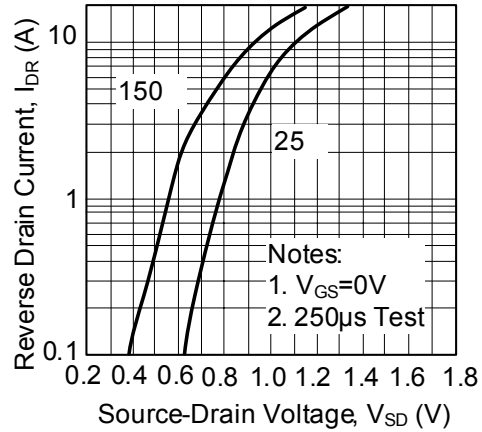


■ TYPICAL CHARACTERISTICS(Cont.)

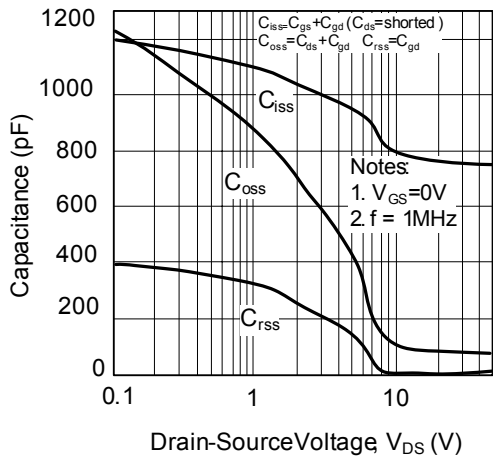
On-Resistance Variation vs Drain Current and Gate Voltage



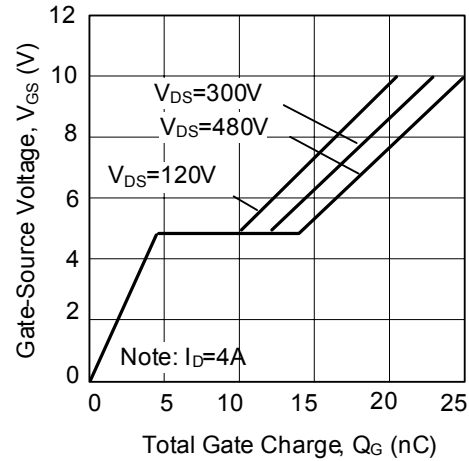
On State Current vs. Allowable Case Temperature



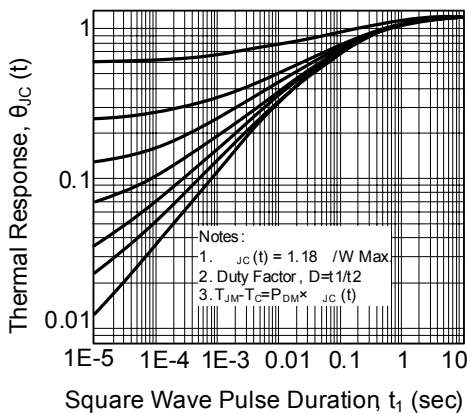
Capacitance Characteristics (Non-Repetitive)



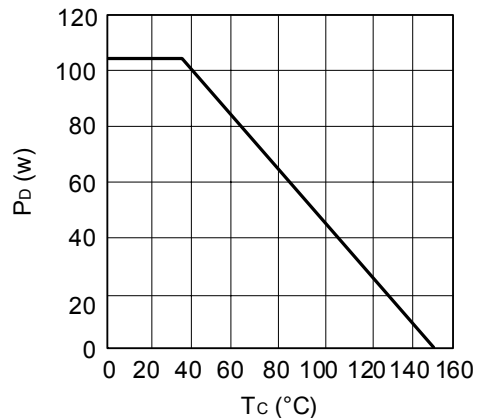
Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation



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