

NJ4N60 POWER MOSFET



4.0A 600V N-CHANNEL POWER MOSFET

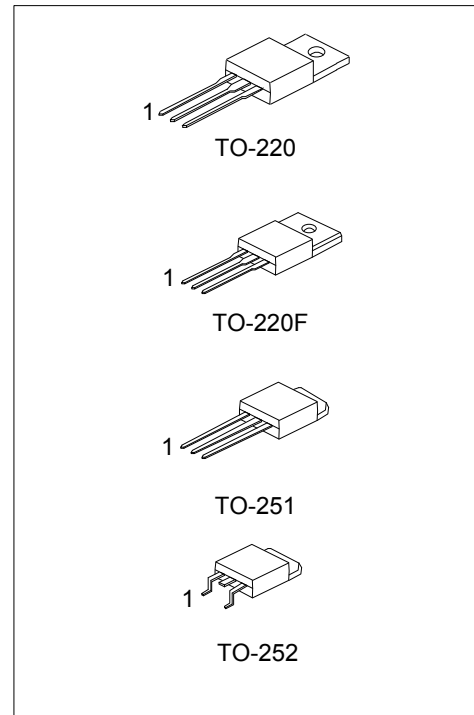
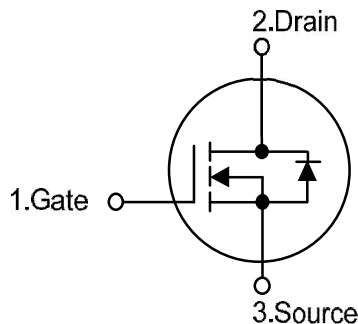
DESCRIPTION

The NJ4N60 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

- * $V_{DS} = 600V$
- * $I_D = 4.0A$
- * $R_{DS(ON)} = 2.5\Omega @ V_{GS} = 10V$.
- * Ultra Low gate charge (typical 15nC)
- * 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
		1	2	3	
NJ4N60-LI	TO-220	G	D	S	Tape Box
NJ4N60-BL	TO-220	G	D	S	Bulk
NJ4N60F-LI	TO-220F	G	D	S	Tube
NJ4N60A-LI	TO-251	G	D	S	Tube
NJ4N60D-TR	TO-252	G	D	S	Tape Ree
NJ4N60D-LI	TO-252	G	D	S	Tube

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

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■ 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 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}	200	mJ
	Repetitive (Note 2)			
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P _D	106	W
	TO-220F		36	
	TO-251		50	
	TO-252		50	
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 = 30mH, I_{AS} = 4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C

4. I_{SD} ≤ 4.4A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	θ _{JA}	62.5	°C/W
	TO-220F		62.5	
	TO-251		110	
	TO-252		110	
Junction to Case	TO-220	θ _{Jc}	1.18	°C/W
	TO-220F		3.47	
	TO-251		2.5	
	TO-252		2.5	

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

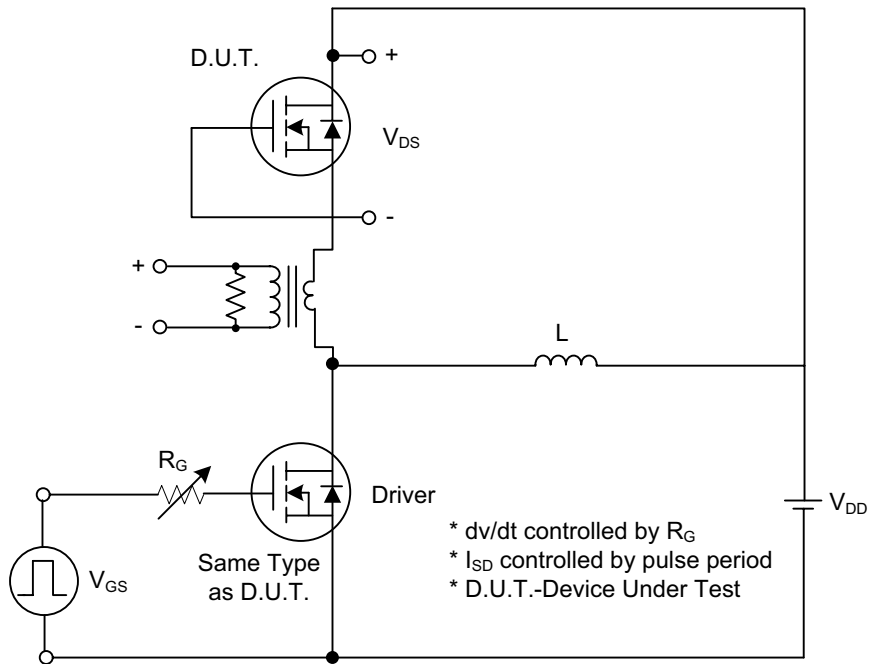
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			100	nA
	Reverse		V _{GS} = -30V, V _{DS} = 0V			-100	nA
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	4N60	R _{DS(ON)}	V _{GS} = 10 V, I _D = 2.2A		2.2	2.5	Ω
	4N60-E				2.2	2.5	Ω
	4N60-N				2.2	2.5	Ω
	4N60-Q				2.2	2.5	Ω
	4N60-S				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	4N60	t _R			70	100	ns
	4N60-E				60	100	ns
	4N60-N				100	130	ns
	4N60-Q				45	100	ns
	4N60-S				40	100	ns
Turn-Off Delay Time		t _{D(OFF)}			25	60	ns
Turn-Off Fall Time	4N60	t _F			100	120	ns
	4N60-E				70	120	ns
	4N60-N				180	220	ns
	4N60-Q				35	120	ns
	4N60-S			70	120	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}	dI _F /dt = 100 A/μs (Note 1)		1.5		μC

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

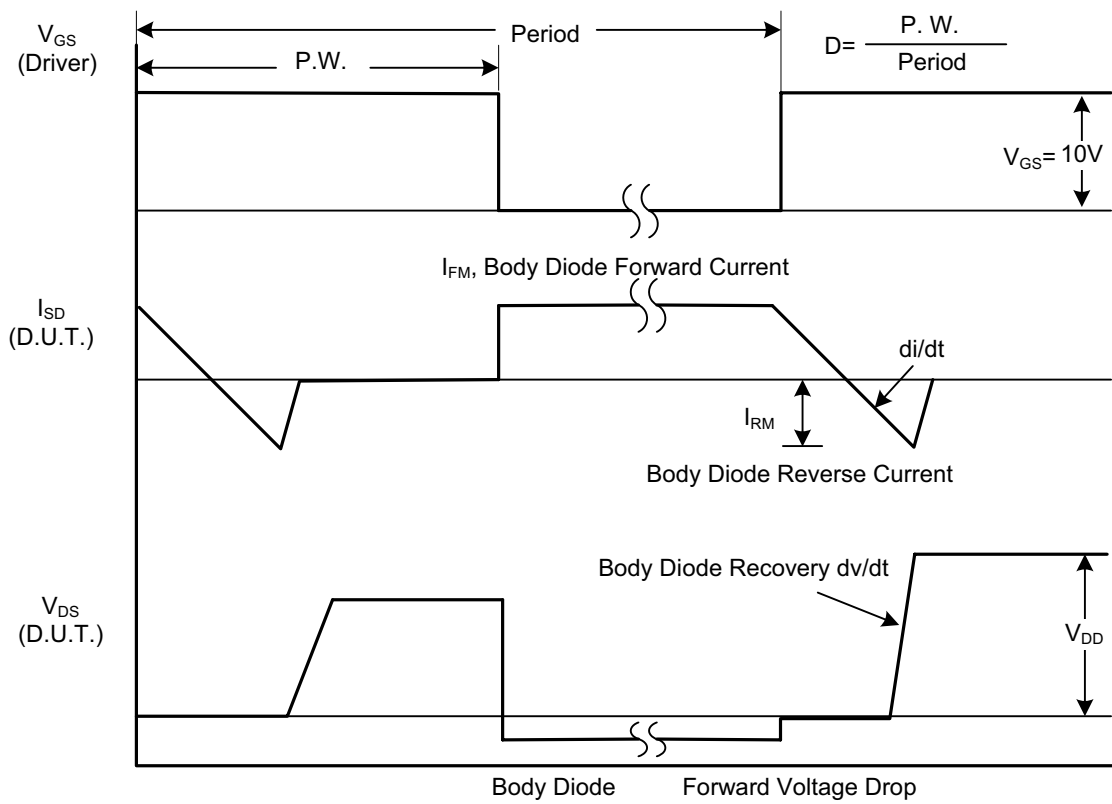
2. Essentially independent of operating temperature

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■ TEST CIRCUITS AND WAVEFORMS



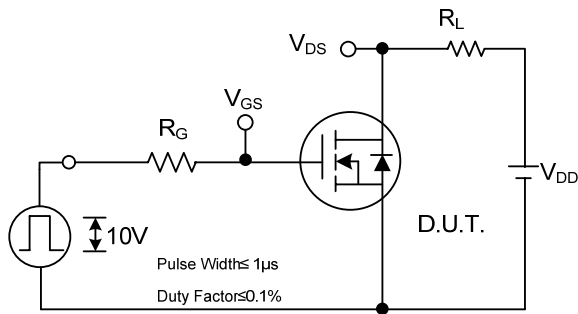
Peak Diode Recovery dv/dt Test Circuit



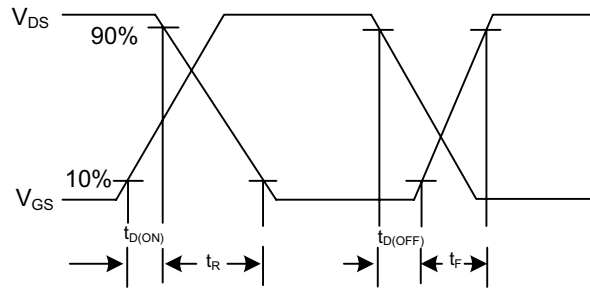
Peak Diode Recovery dv/dt Waveforms

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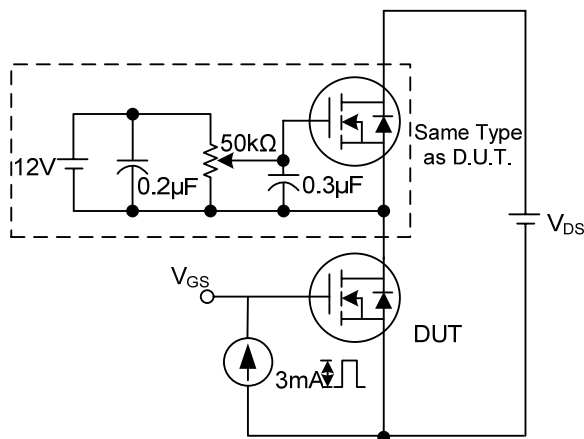
TEST CIRCUITS AND WAVEFORMS (Cont.)



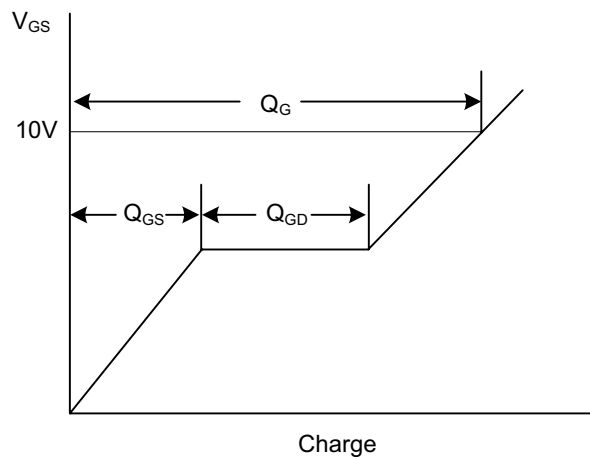
Switching Test Circuit



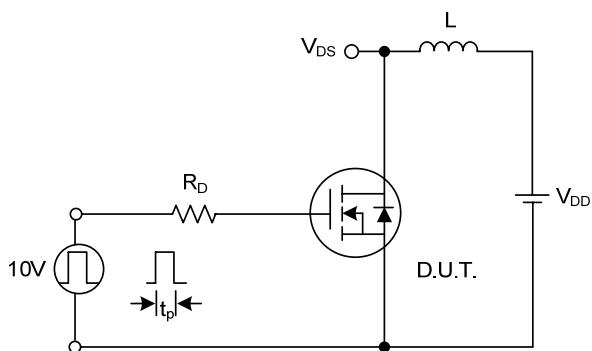
Switching Waveforms



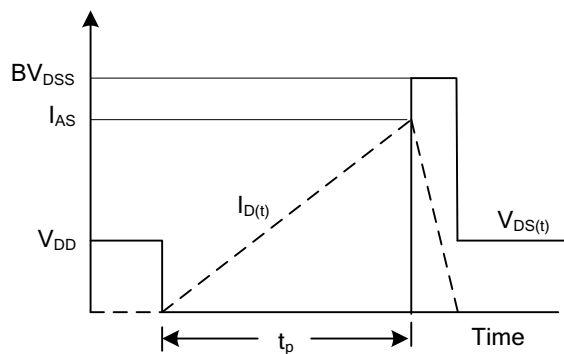
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit

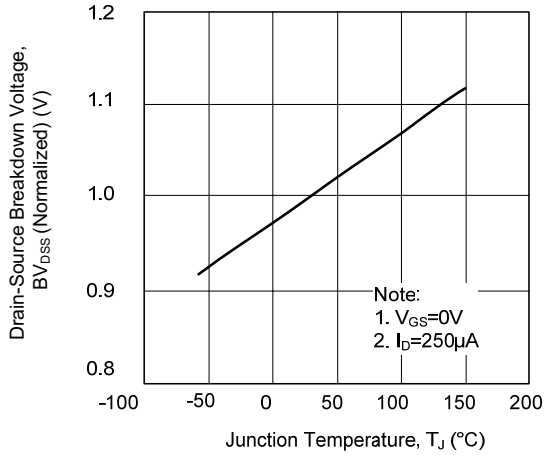


Unclamped Inductive Switching Waveforms

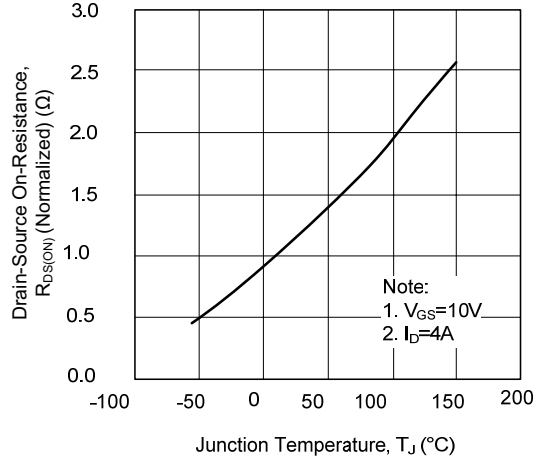
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TYPICAL CHARACTERISTICS

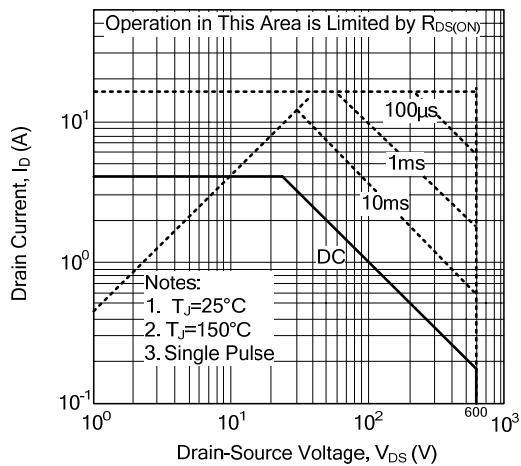
Breakdown Voltage Variation vs. Temperature



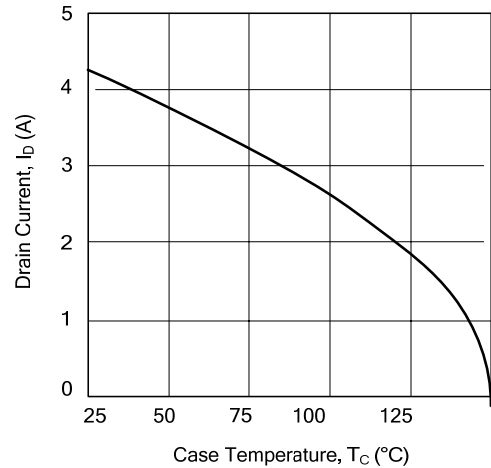
On-Resistance Junction Temperature



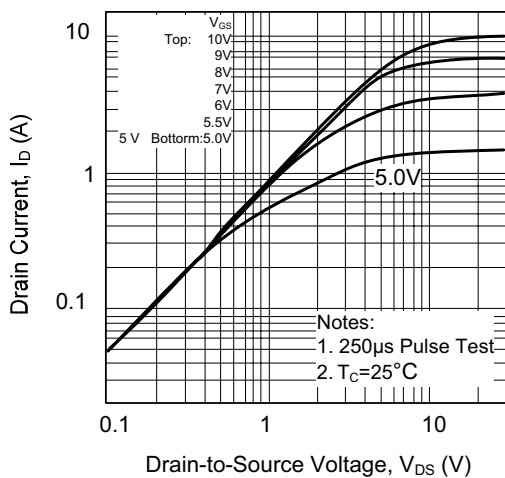
Safe Operating Area - 600V



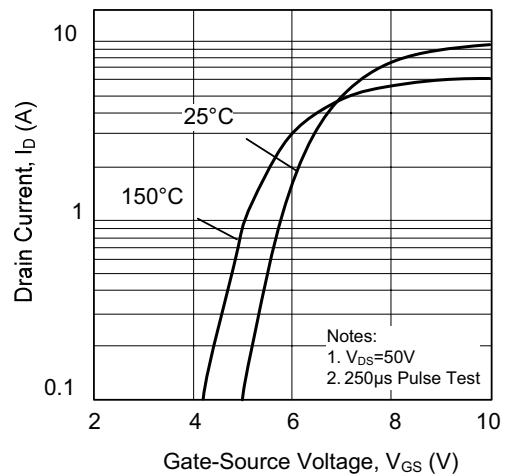
Maximum Drain Current vs. Case Temperature



On-State Characteristics



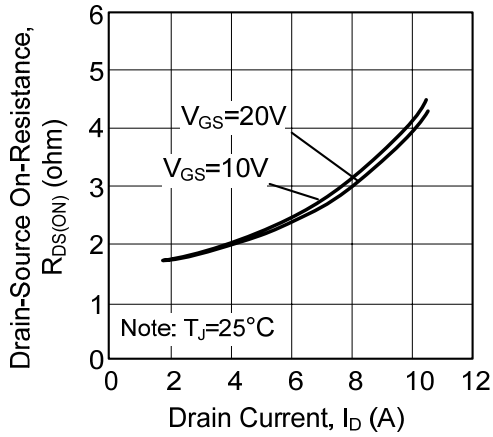
Transfer Characteristics



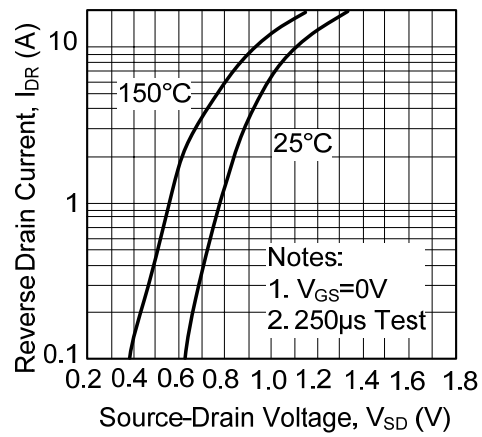
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TYPICAL CHARACTERISTICS(Cont.)

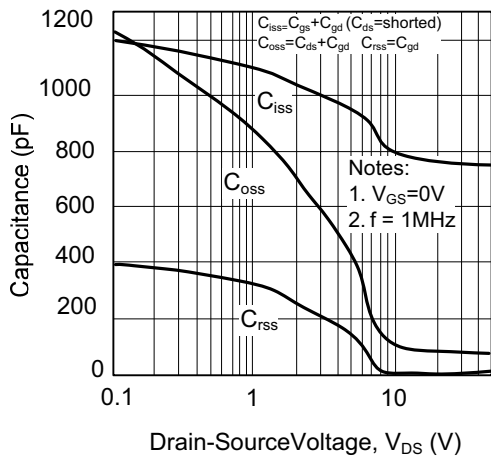
On-Resistance Variation vs. Drain Current and Gate Voltage



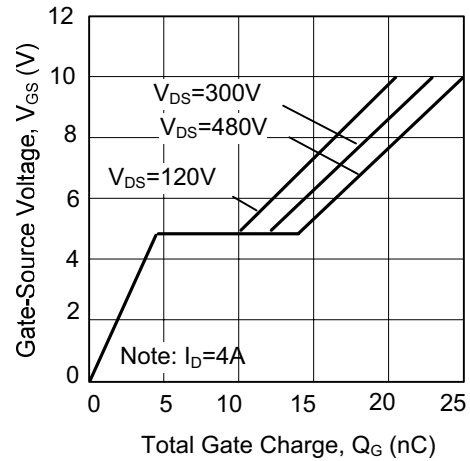
On State Current vs. Allowable Case Temperature



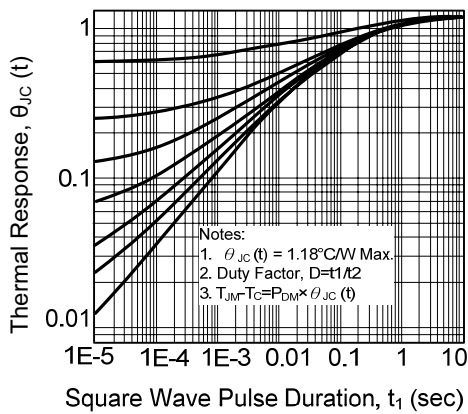
Capacitance Characteristics (Non-Repetitive)



Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation

