



10N60

Power MOSFET

10A, 600V N-CHANNEL POWER MOSFET

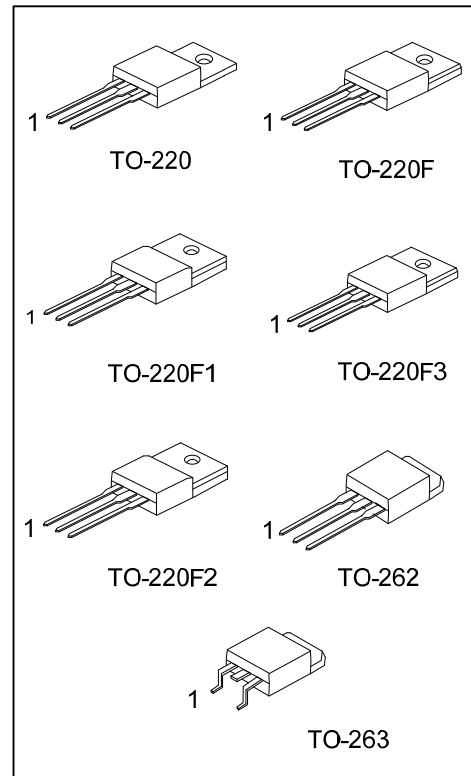
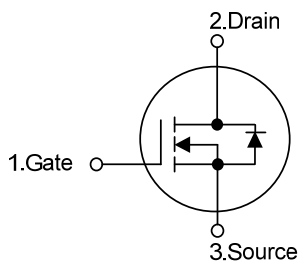
DESCRIPTION

The **UTC 10N60** 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

- * $R_{DS(ON)} < 0.75\Omega @ V_{GS} = 10V$
- * Fast switching
- * 100% avalanche tested
- * Improved dv/dt capability

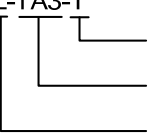
SYMBOL



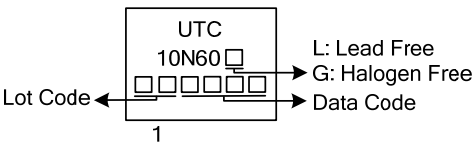
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N60L-TA3-T	10N60G-TA3-T	TO-220	G	D	S	Tube
10N60L-TF3-T	10N60G-TF3-T	TO-220F	G	D	S	Tube
10N60L-TF1-T	10N60G-TF1-T	TO-220F1	G	D	S	Tube
10N60L-TF2-T	10N60G-TF2-T	TO-220F2	G	D	S	Tube
10N60L-TF3T-T	10N60G-TF3T-T	TO-220F3	G	D	S	Tube
10N60L- T2Q-T	10N60G- T2Q-T	TO-262	G	D	S	Tube
10N60L-TQ2-T	10N60G-TQ2-T	TO-263	G	D	S	Tube
10N60L-TQ2-R	10N60G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>10N60L-TA3-T</p>  <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO220F, TF1: TO-220F1, (2) TF2: TO-220F2, TF3T: TO-220F3, (2) T2Q: TO-262, TQ2: TO-263 (3) L: Lead Free, G: Halogen Free</p>
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MARKING INFORMATION

PACKAGE	MARKING
TO-220 TO-220F TO-220F1 TO-220F2 TO-220F3 TO-262 TO-263	 <p>Lot Code → Data Code</p> <p>1</p> <p>L: Lead Free G: Halogen 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}	± 30	V
Avalanche Current (Note 2)		I_{AR}	10	A
Drain Current	Continuous	I_D	10	A
	Pulsed (Note 2)	I_{DM}	38	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	700	mJ
	Repetitive (Note 2)	E_{AR}	15.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	156	W
	TO-220F/TO-220F1		50	
	TO-220F3		52	
	TO-220F2		52	
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. $L=14.2\text{mH}$, $I_{AS}=10\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

4. $I_{SD} \leq 9.5\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220	θ_{JC}	0.8	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1		2.5	
	TO-220F3		2.4	
	TO-220F2		2.4	
	TO-262/TO-263		0.7	

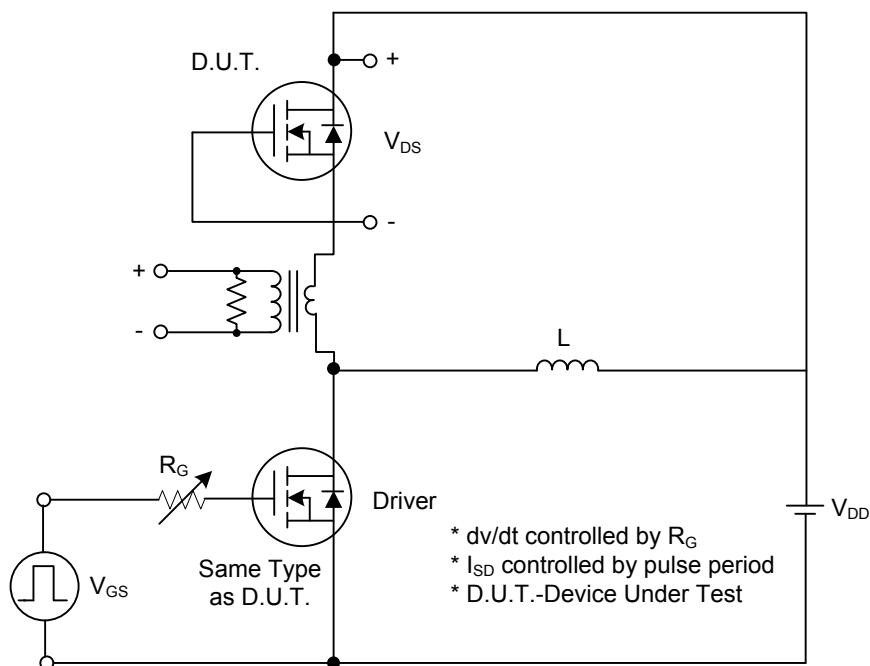
■ ELECTRICAL CHARACTERISTICS($T_C=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			1	μA
			V _{DS} =480V, T _C =125°C			100	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} =30 V, V _{DS} =0V			100	nA
	Reverse		V _{GS} =-30 V, V _{DS} =0V			-100	nA
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA, Referenced to 25°C		0.7		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} =10V, I _D =5A		0.68	0.75	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0 MHz		1570	2040	pF
Output Capacitance		C _{OSS}			166	215	pF
Reverse Transfer Capacitance		C _{RSS}			18	24	pF
Gate Resistance		R _G	V _{DS} =0V, V _{GS} =0V, f=1MHz	0.25		1.4	Ω
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} =300V, I _D =10A, R _G =25Ω (Note1, 2)		23	55	ns
Turn-On Rise Time		t _R			69	150	ns
Turn-Off Delay Time		t _{D(OFF)}			144	300	ns
Turn-Off Fall Time		t _F			77	165	ns
Total Gate Charge		Q _G	V _{DS} =480V, I _D =10A, V _{GS} =10 V (Note1, 2)		44	57	nC
Gate-Source Charge		Q _{GS}			6.7		nC
Gate-Drain Charge		Q _{GD}			18.5		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0 V, I _S =10A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				10	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				38	A
Reverse Recovery Time		t _{rr}	V _{GS} =0 V, I _S =10A,		420		ns
Reverse Recovery Charge		Q _{RR}	dI _F /dt=100A/μs (Note 1)		4.2		μC

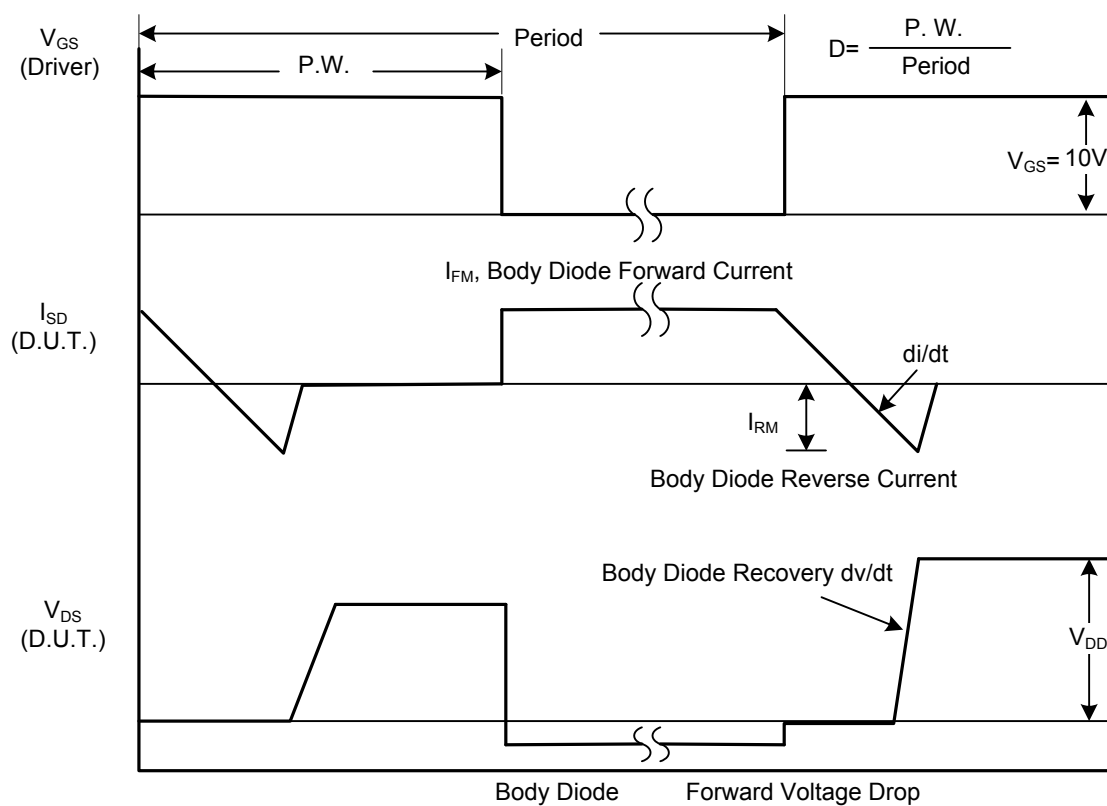
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

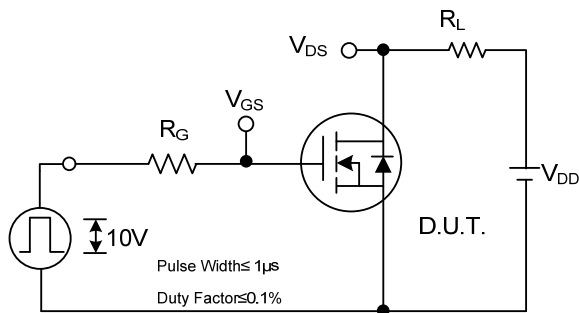


Peak Diode Recovery dv/dt Test Circuit

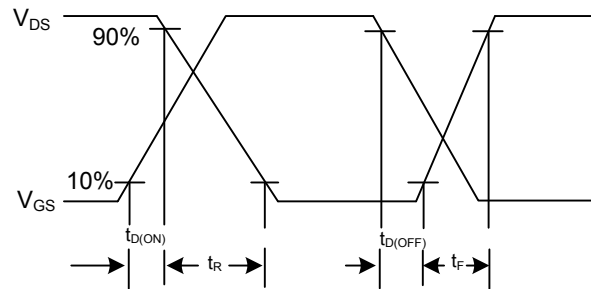


Peak Diode Recovery dv/dt Waveforms

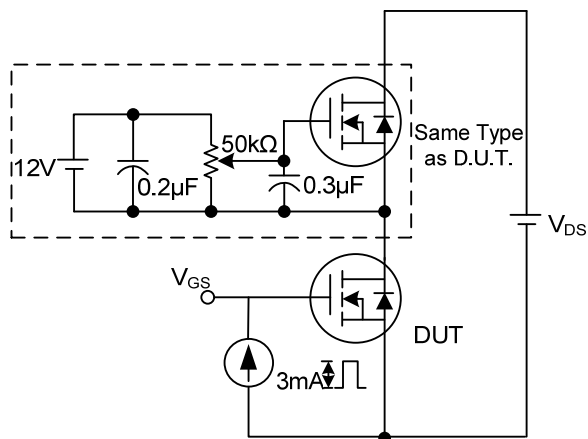
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



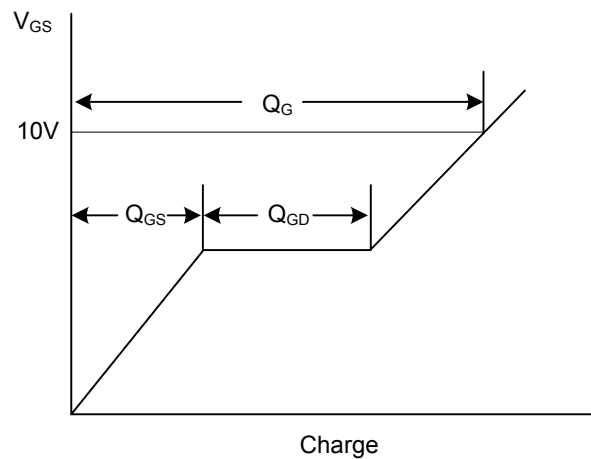
Switching Test Circuit



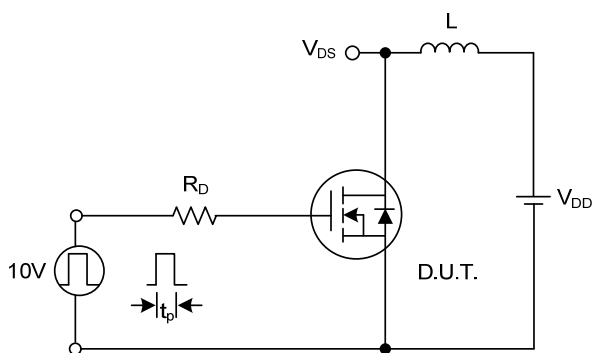
Switching Waveforms



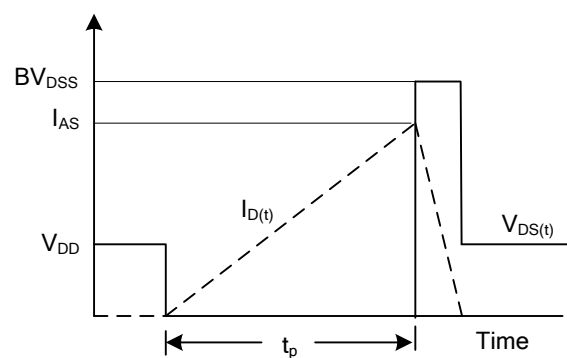
Gate Charge Test Circuit



Gate Charge Waveform



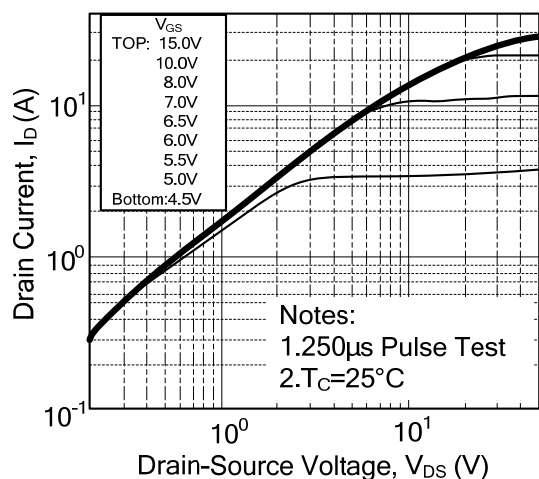
Unclamped Inductive Switching Test Circuit



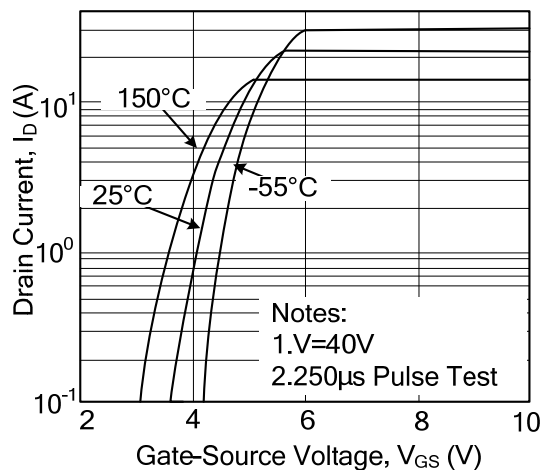
Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

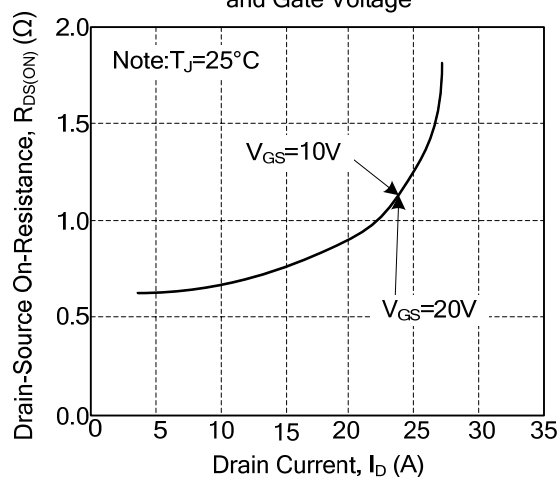
On-Region Characteristics



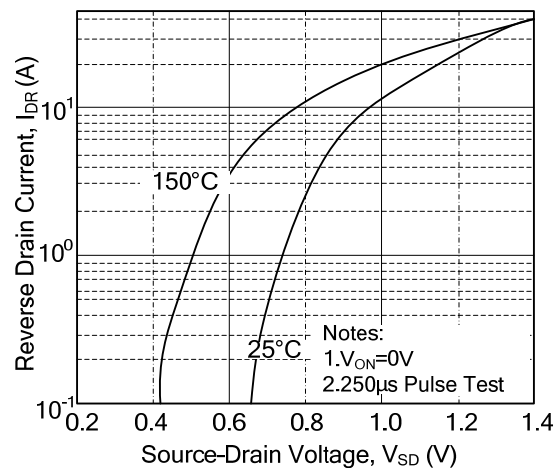
Transfer Characteristics



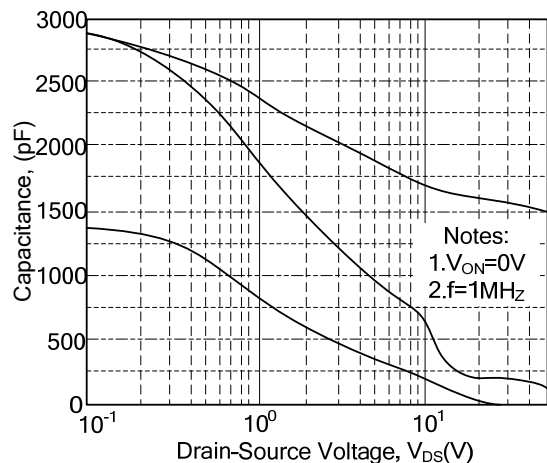
On-Resistance Variation vs. Drain Current and Gate Voltage



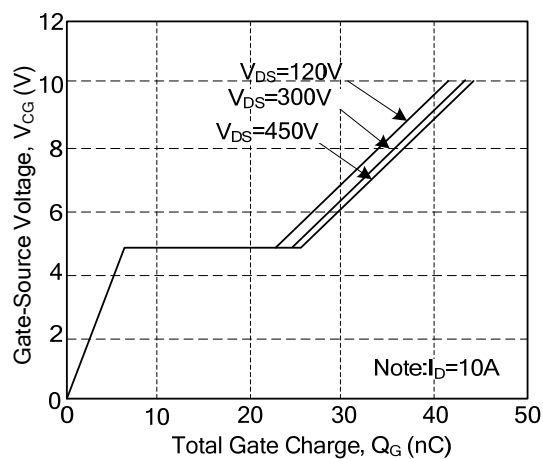
Body Diode Forward Voltage Variation with Source Current and Temperature



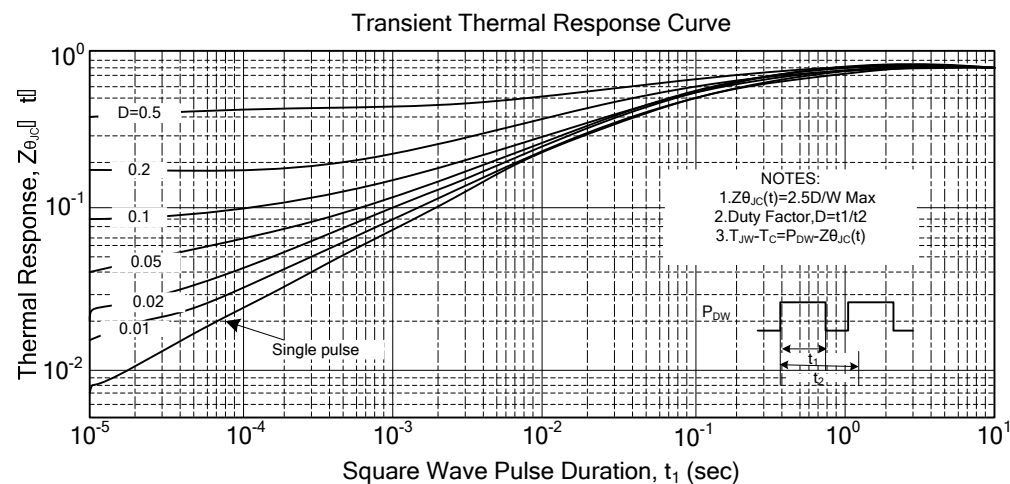
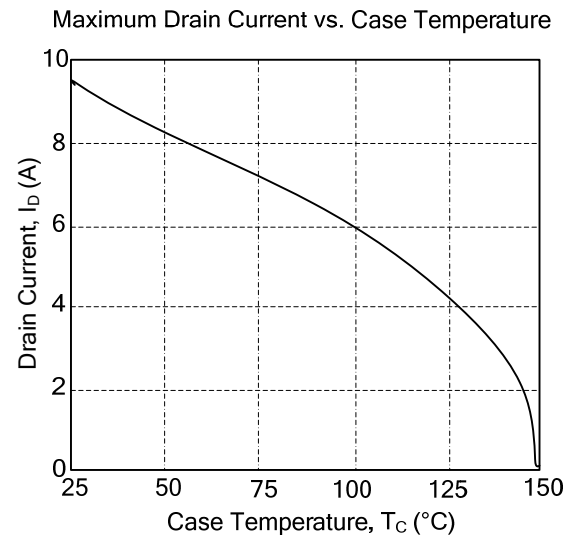
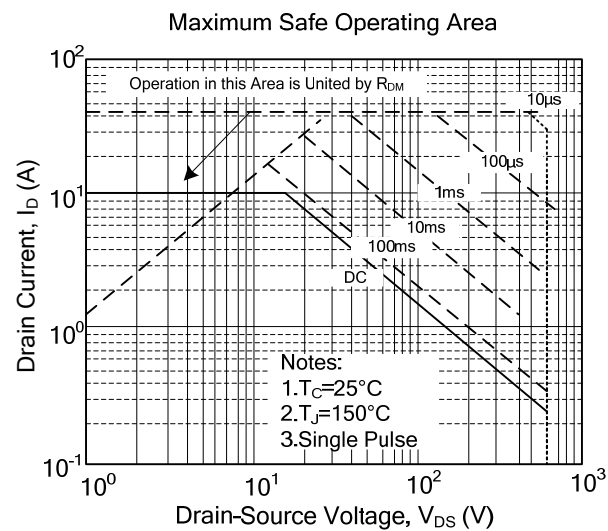
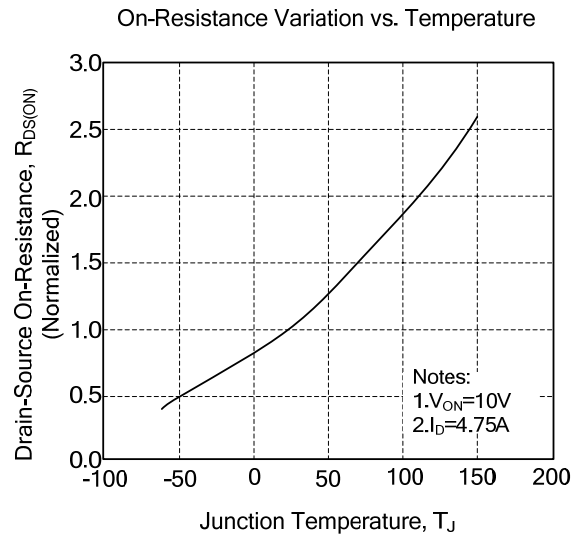
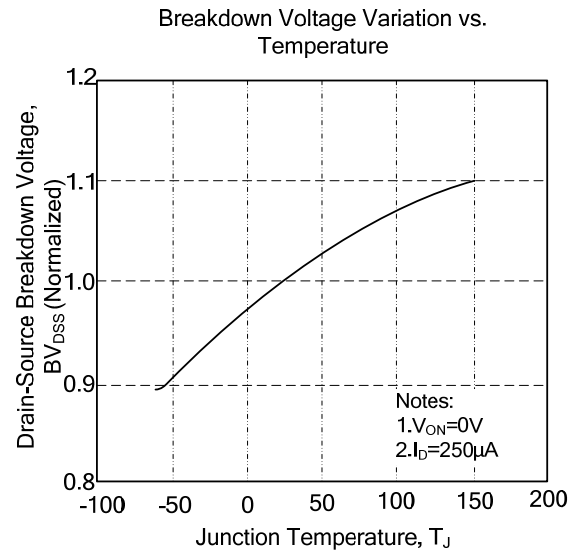
Capacitance Characteristics



Gate Charge Characteristics



■ TYPICAL CHARACTERISTICS(Cont.)



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