



10N60

Power MOSFET

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

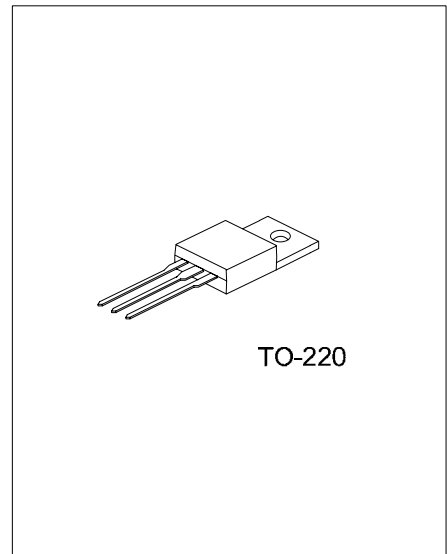
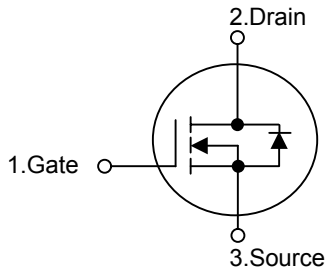
DESCRIPTION

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

- * 10A, 600V, $R_{DS(ON)} = 0.73\Omega @ V_{GS} = 10V$
- * Low gate charge (typical 44 nC)
- * Low C_{rss} (typical 18 pF)
- * Fast switching
- * 100% avalanche tested
- * Improved dv/dt capability

SYMBOL



*Pb-free plating product number: 10N60L

ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
10N60-x-TA3-T	10N60L-x-TA3-T	TO-220	G	D	S	Tube

<p>10N60L-x-TA3-T</p>	<p>(1)Packing Type (2)Package Type (3)Drain-Source Voltage (4)Lead Plating</p>	<p>(1) T: Tube (2) TA3: TO-220 (3) A: 600V, B: 650V (4) L: Lead Free Plating, Blank: Pb/Sn</p>
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■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	10N60-A	V_{DSS}	600	V
	10N60-B		650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 1)		I_{AR}	9.5	A
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	9.5	A
	$T_C = 100^\circ\text{C}$		3.3	
Pulsed Drain Current (Note 1)		I_{DM}	38	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	700	mJ
	Repetitive (Note 1)	E_{AR}	15.6	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation		P_D	156	W
Junction Temperature		T_J	+150	
Operating Temperature		T_{OPR}	-55 ~ +150	
Storage Temperature		T_{STG}	-55 ~ +150	

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction-to-Ambient	θ_{JA}	62.5	$^\circ\text{C/W}$
Junction-to-Case	θ_{JC}	0.8	$^\circ\text{C/W}$

■ 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	10N60-A	BV_{DSS}	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	600		V
	10N60-B	BV_{DSS}	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	650		V
Drain-Source Leakage Current		I_{DSS}	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$		1	μA
Gate-Source Leakage Current	Forward	I_{GSS}	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$		100	nA
	Reverse		$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$		-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.7		$\text{V}/^\circ\text{C}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{V}, I_D = 4.75\text{A}$		0.6	0.73	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25\text{V}, V_{GS}=0\text{V}, f=1.0\text{MHz}$		1570	2040	pF
Output Capacitance	C_{OSS}			166	215	pF
Reverse Transfer Capacitance	C_{RSS}			18	24	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300\text{V}, I_D = 10\text{A}, R_G = 25\Omega$ (Note 4, 5)		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	$V_{DS}=480\text{V}, I_D=10\text{A}, V_{GS}=10\text{V}$ (Note 4, 5)		44	57	nC
Gate-Source Charge	Q_{GS}			6.7		nC
Gate-Drain Charge	Q_{GD}			18.5		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 10\text{ A}$			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}	$V_{GS} = 0\text{ V}, I_S = 10\text{ A},$		420		ns
Reverse Recovery Charge	Q_{RR}	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)		4.2		μC

- Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. $L = 14.2\text{ mH}, I_{AS} = 10\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ Starting $T_J = 25^\circ\text{C}$
 3. $I_{SD} \leq 9.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
 4. Pulse Test : Pulse width $\leq 300\ \mu\text{s}$, Duty cycle $\leq 2\%$
 5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

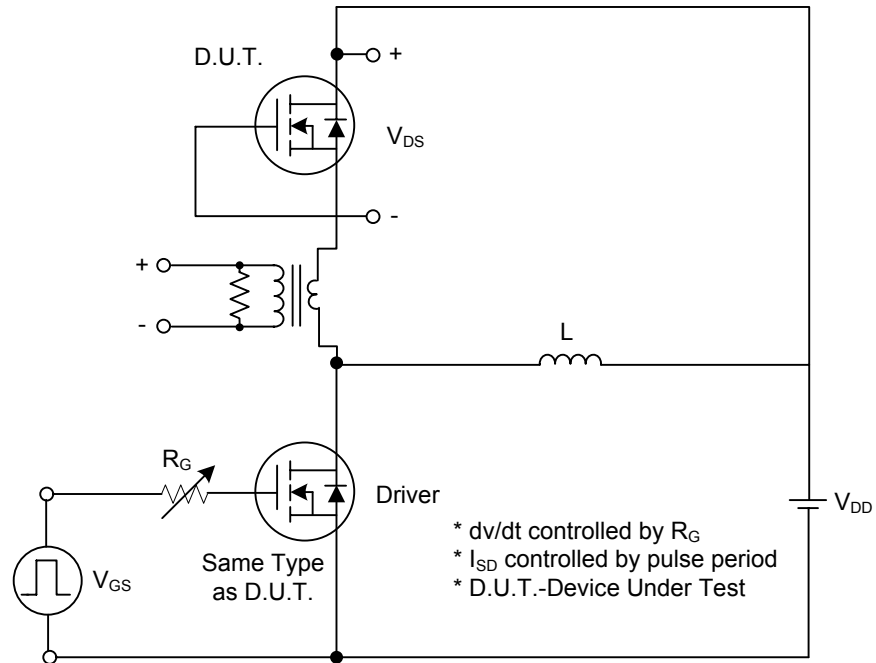


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

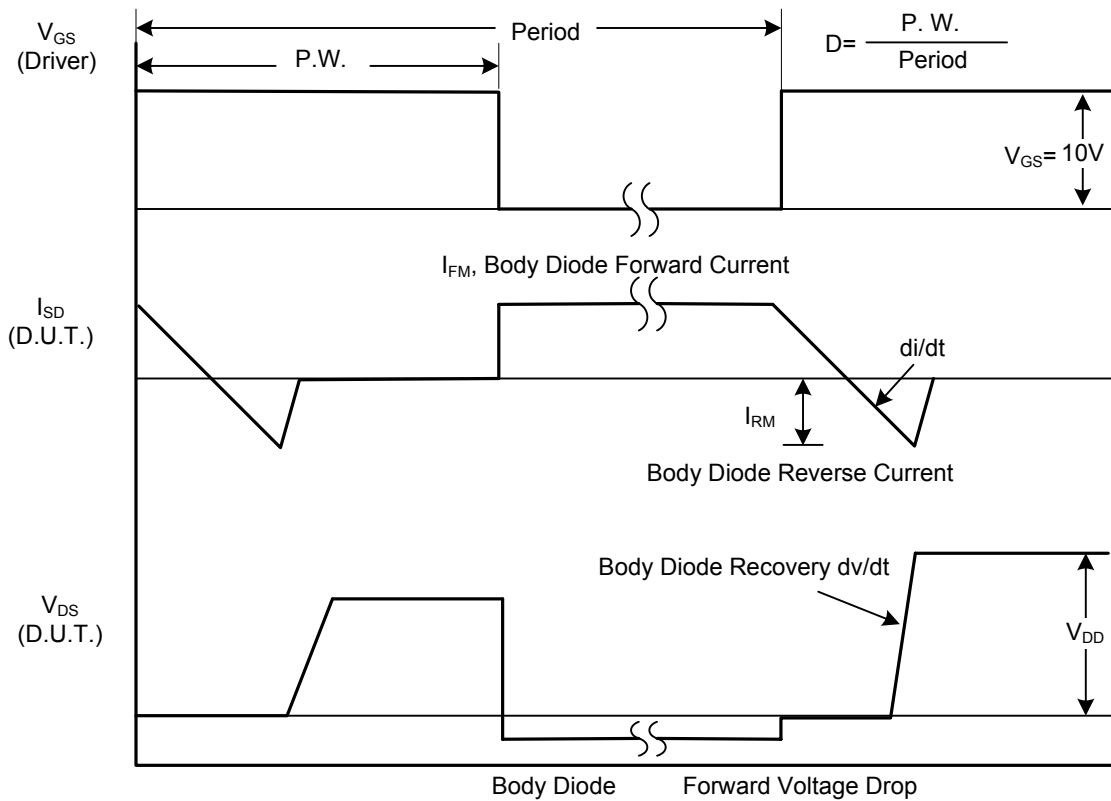


Fig. 1B Peak Diode Recovery dv/dt Waveforms

TEST CIRCUITS AND WAVEFORMS (Cont.)

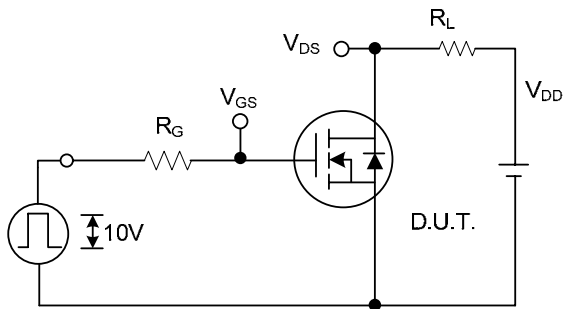


Fig. 2A Switching Test Circuit

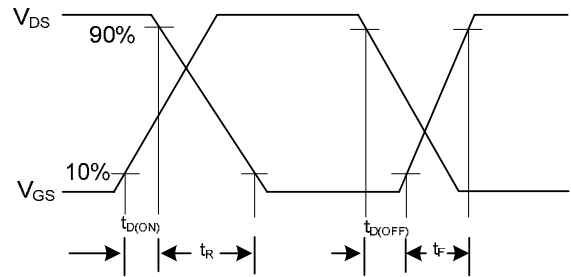


Fig. 2B Switching Waveforms

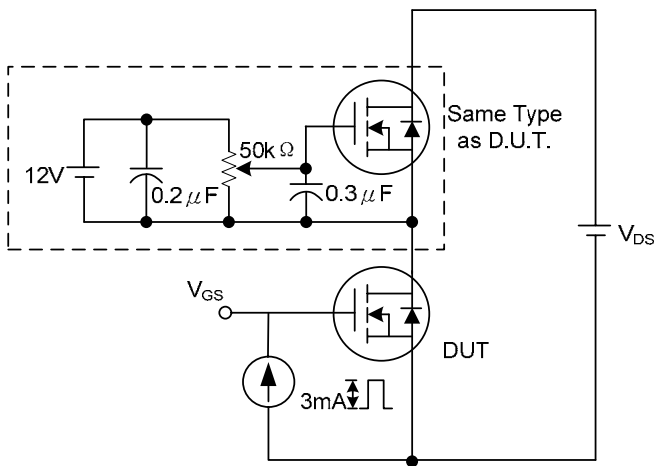


Fig. 3A Gate Charge Test Circuit

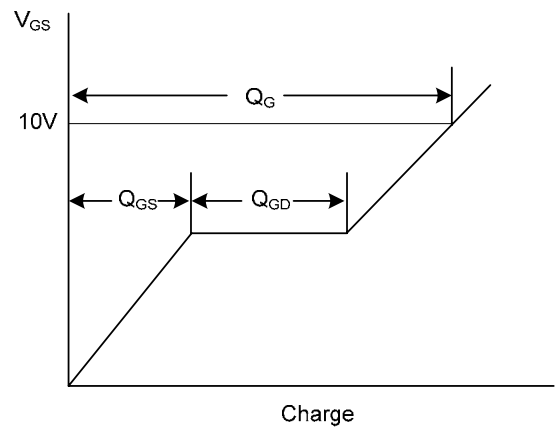


Fig. 3B Gate Charge Waveform

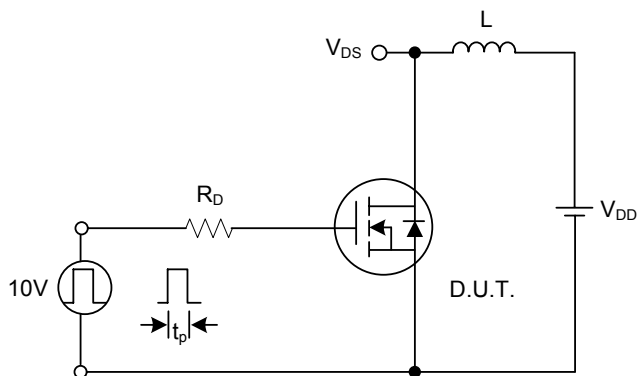


Fig. 4A Unclamped Inductive Switching Test Circuit

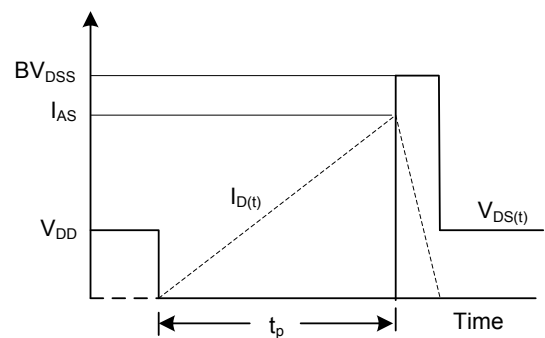
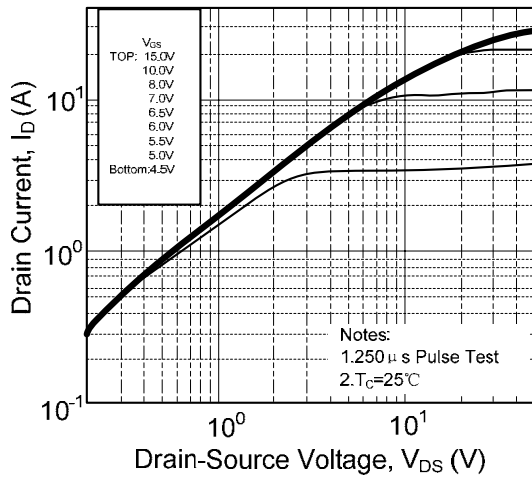


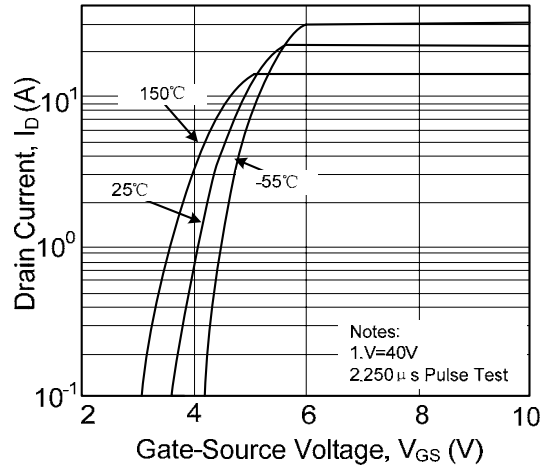
Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

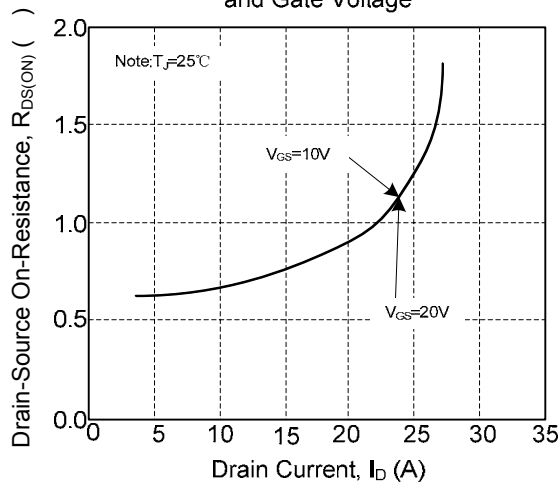
On-Region Characteristics



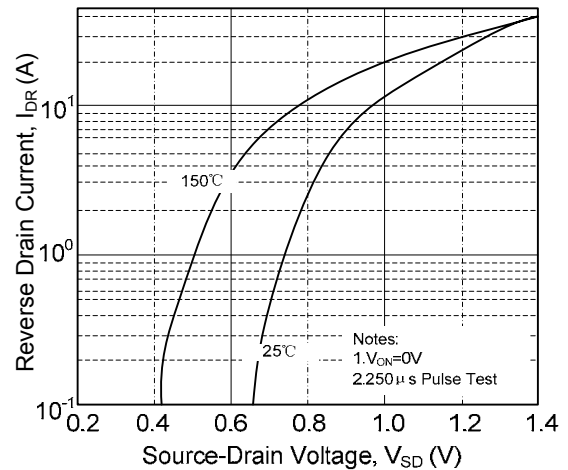
Transfer Characteristics



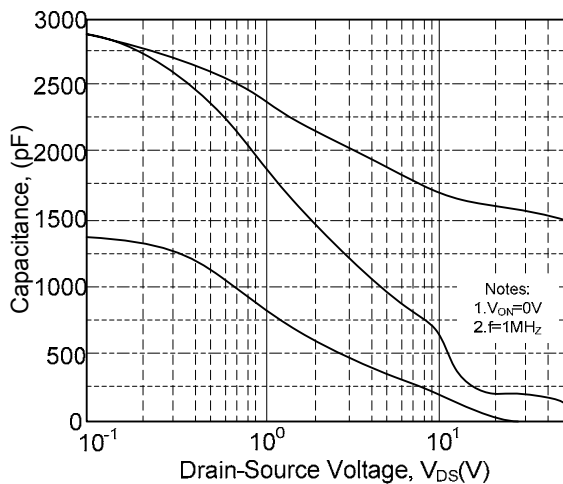
On-Resistance Variation vs. Drain Current and Gate Voltage



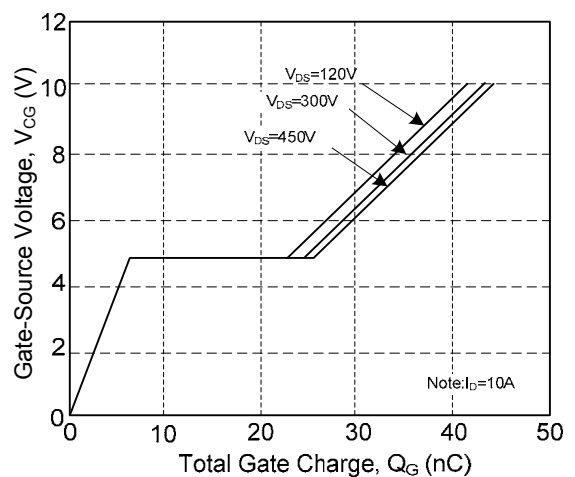
Body Diode Forward Voltage Variation with Source Current and Temperature



Capacitance Characteristics

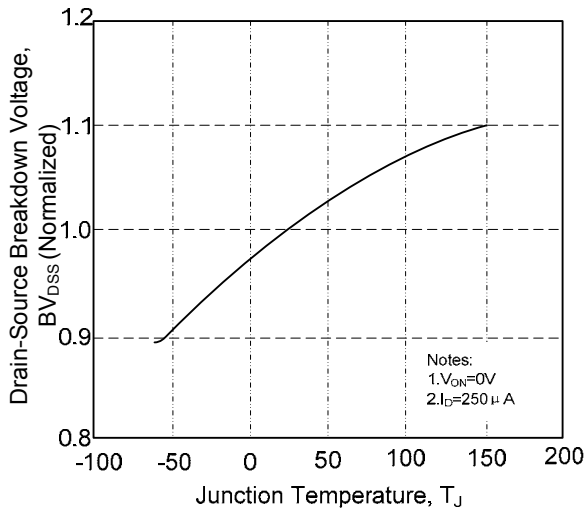


Gate Charge Characteristics

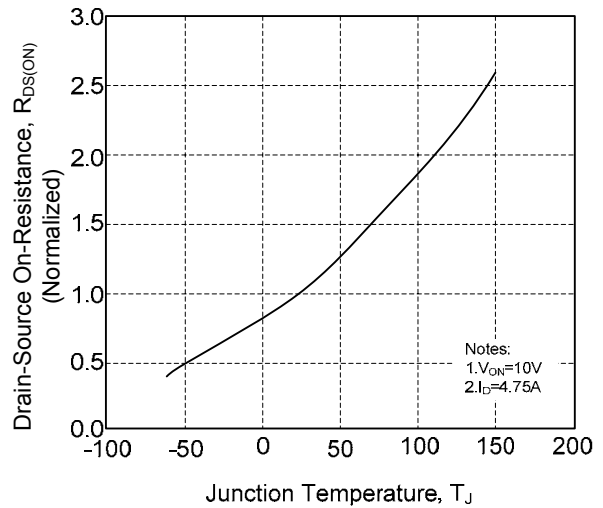


■ TYPICAL CHARACTERISTICS(Cont.)

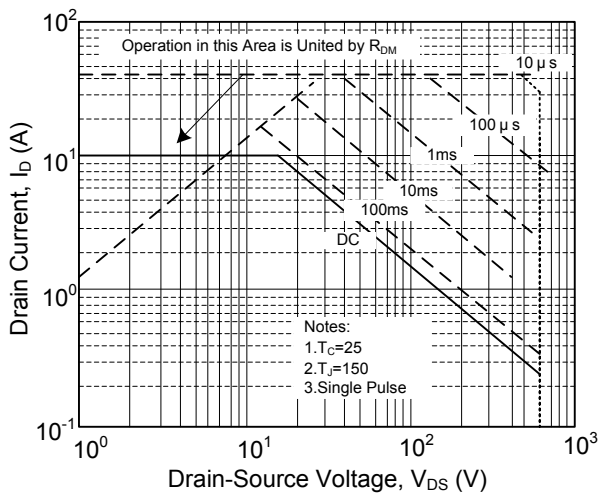
Breakdown Voltage Variation vs. Temperature



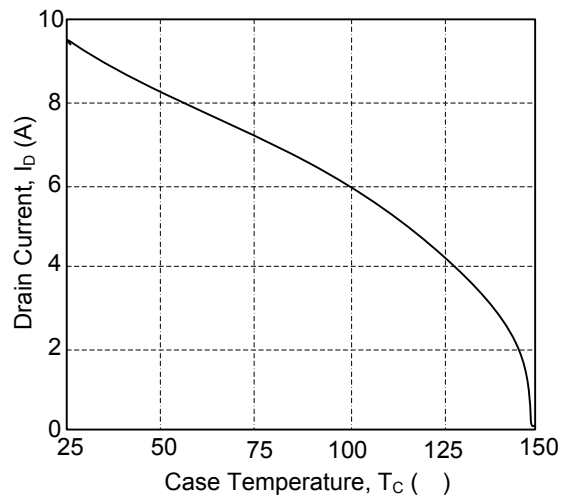
On-Resistance Variation vs. Temperature

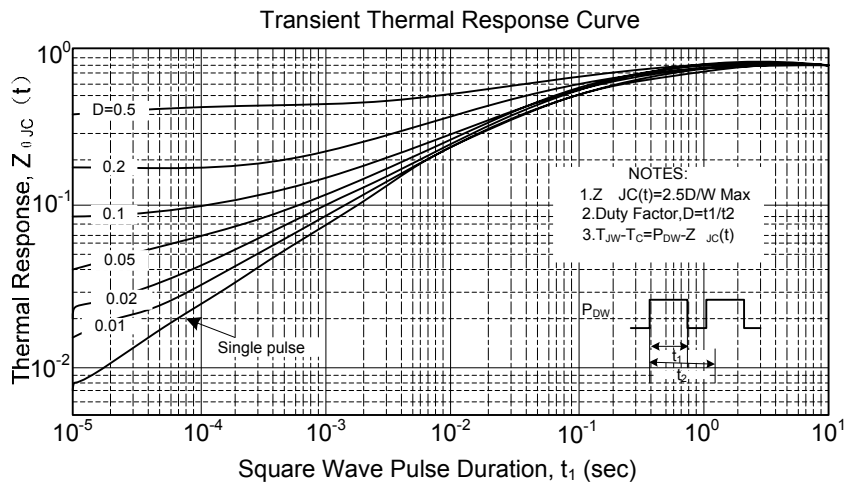


Maximum Safe Operating Area



Maximum Drain Current vs. Case Temperature





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