

2 Amps, 600 Volts

N-CHANNEL MOSFET

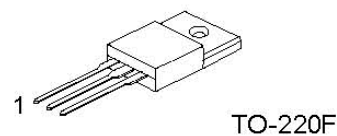
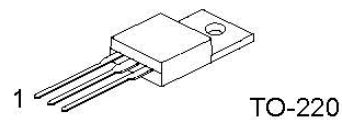
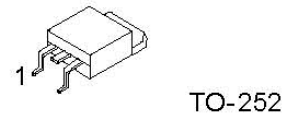
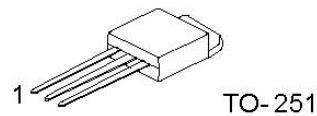
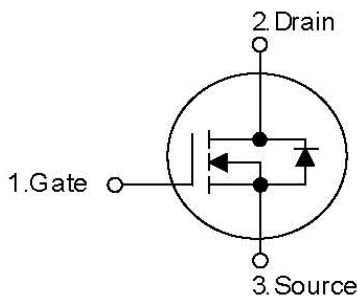
Description

The 2N60 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

- * $R_{DS(ON)} = 3.8\Omega @ V_{GS} = 10V$.
- * Ultra Low gate charge (typical 9.0nC)
- * Low reverse transfer capacitance (C_{rss} = typical 5.0 pF)
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL

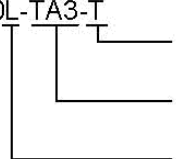


Pb-free plating product number: 2N60L

ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
2N60-TA3-T	2N60L-TA3-T	TO-220	G	D	S	Tube
2N60-TF3-T	2N60L-TF3-T	TO-220F	G	D	S	Tube
2N60-TM3-T	2N60L-TM3-T	TO-251	G	D	S	Tube
2N60-TN3-R	2N60L-TM3-T	TO-252	G	D	S	Tape Reel
2N60-TN3-T	2N60L-TN3-T	TO-252	G	D	S	Tube

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

2N60L-TA3-T  (1)Packing Type (2)Package Type (3)Lead Plating	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TM3: TO-251, TN 3: TO-252 (3) 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		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	2.0	A
Drain Current Continuous	$T_C = 25^\circ\text{C}$	I_D	2.0	A
	$T_C = 100^\circ\text{C}$		1.26	A
Drain Current Pulsed (Note 2)		I_{DP}	8.0	A
Avalanche Energy	Repetitive(Note 2)	E_{AR}	4.5	mJ
	Single Pulse(Note 3)	E_{AS}	140	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Total Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	45	W
	Derate above 25°C		0.36	W/ $^\circ\text{C}$
Junction Temperature		T_J	+150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Note: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. $L=64\text{mH}$, $I_{AS}=2.0\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $ISD \leq 2.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Thermal Resistance Junction-Ambient	TO-251	θ_{JA}	112	$^\circ\text{C} / \text{W}$
	TO-252		112	
	TO-220		54	
	TO-220F		54	
Thermal Resistance Junction-Case	TO-251	θ_{JC}	12	
	TO-252		12	
	TO-220		4	
	TO-220F		4	

ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless Otherwise specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Off Characteristics							
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS} = 0\text{V}$, $I_D = 250\mu\text{A}$	600			V
Zero Gate Voltage Drain 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-Body 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		BV_{DSS}/T_J	$I_D = 250\ \mu\text{A}$		0.4		V/
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-Resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{V}$, $I_D = 1\text{A}$		3.8	5	Ω
Forward Transconductance		g_{FS}	$V_{DS} = 50\text{V}$, $I_D = 1\text{A}$ (Note 1)		2.25		S
Dynamic Characteristics							
Input Capacitance		C_{ISS}	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$		270	350	pF
Output Capacitance		C_{OSS}			40	50	pF
Reverse Transfer Capacitance		C_{RSS}			5	7	pF

ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Switching Characteristics						
Turn-On Delay Time	t _{D (ON)}	V _{DD} =300V, I _D =2.4A, R _G =25Ω (Note 1,2)		10	30	ns
Rise Time	t _R			25	60	ns
Turn-Off Delay Time	t _{D(OFF)}			20	50	ns
Fall Time	t _F			25	60	ns
Total Gate Charge	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =2.4A (Note 1, 2)		9.0	11	nC
Gate-Source Charge	Q _{GS}			1.6		nC
Gate-Drain Charge	Q _{GD}			4.3		nC
Drain-Source Diode Characteristics						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0 V, I _{SD} = 2.0 A			1.4	V
Continuous Drain-Source Current	I _{SD}				2.0	A
Pulsed Drain-Source Current	I _{SM}				8.0	A
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, I _{SD} = 2.4A,		180		ns
Reverse Recovery Charge	Q _{RR}	di/dt = 100 A/μs (Note1)		0.72		μC

Note: 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycles $\leq 2\%$

2. Essentially Independent of Operating Temperature

TEST CIRCUITS AND WAVEFORMS

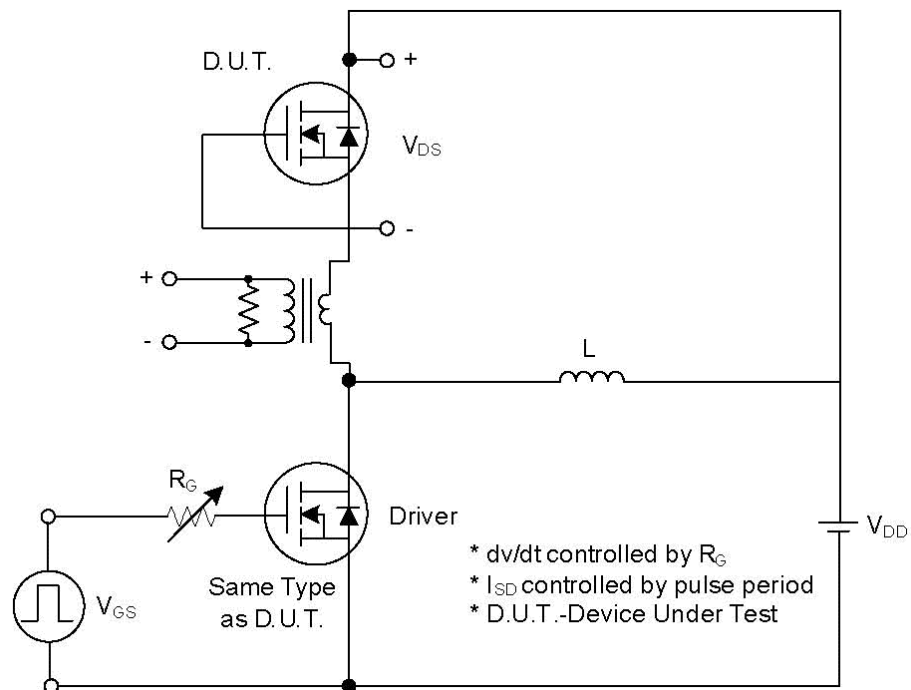


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

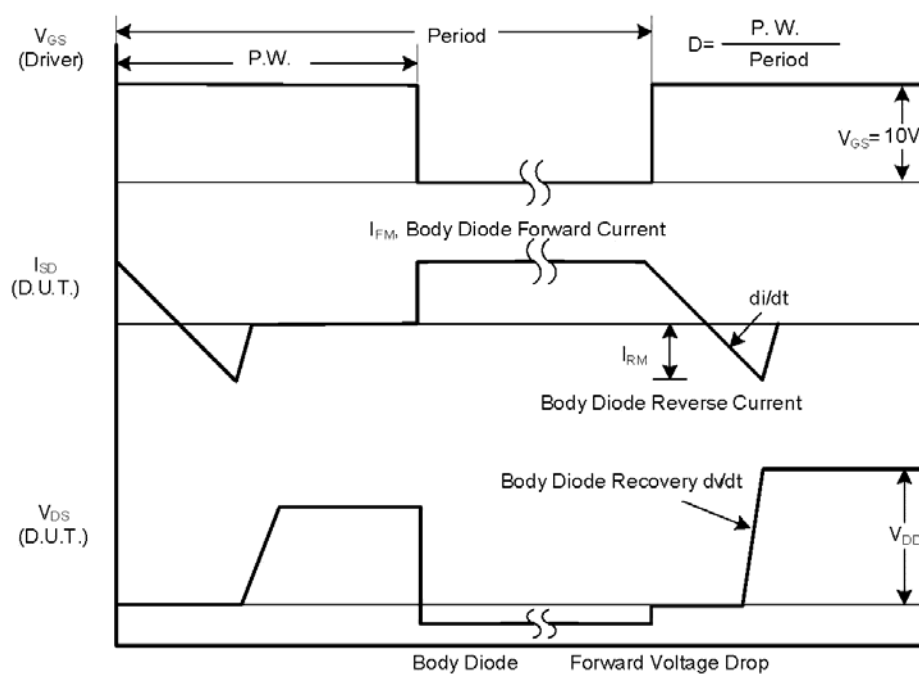


Fig. 1B Peak Diode Recovery dv/dt Waveforms

TEST CIRCUITS AND WAVEFORMS (Cont.)

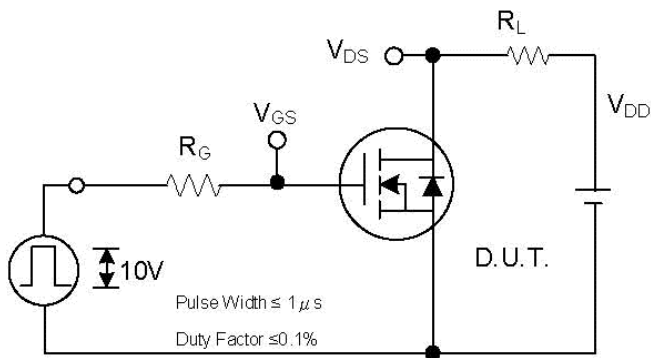


Fig. 2A Switching Test Circuit

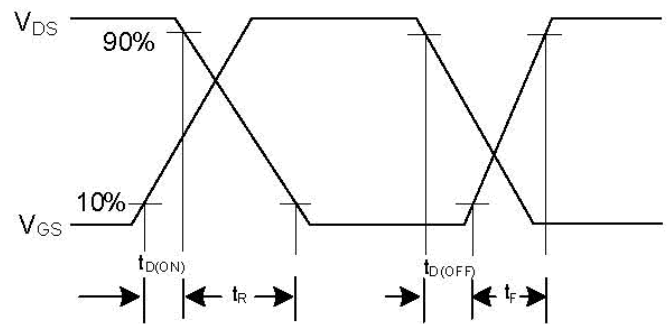


Fig. 2B Switching Waveforms

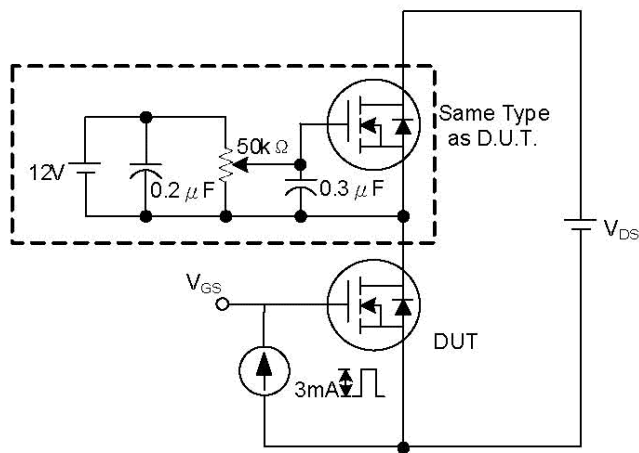


Fig. 3A Gate Charge Test Circuit

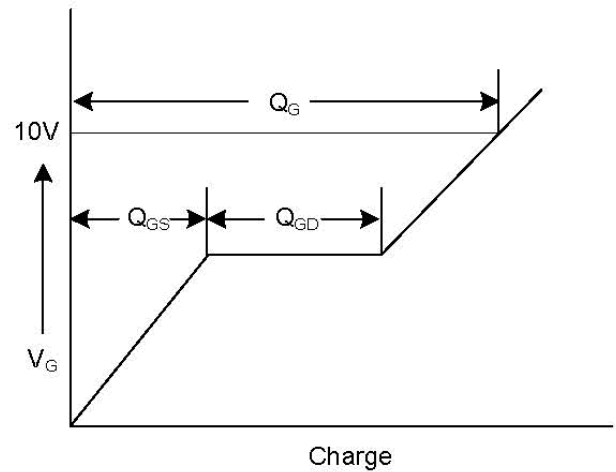


Fig. 3B Gate Charge Waveform

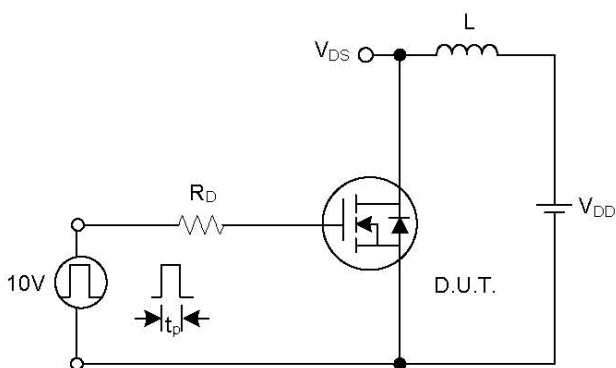


Fig. 4A Unclamped Inductive Switching Test Circuit

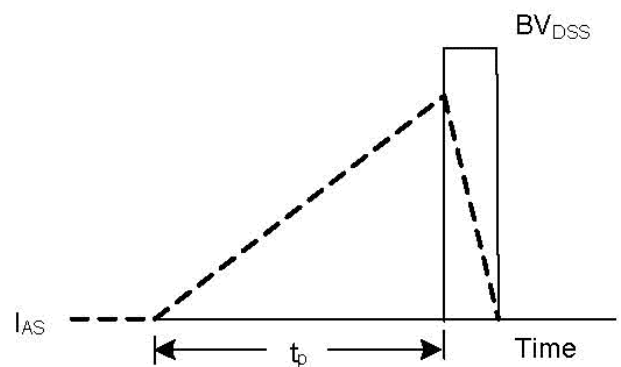
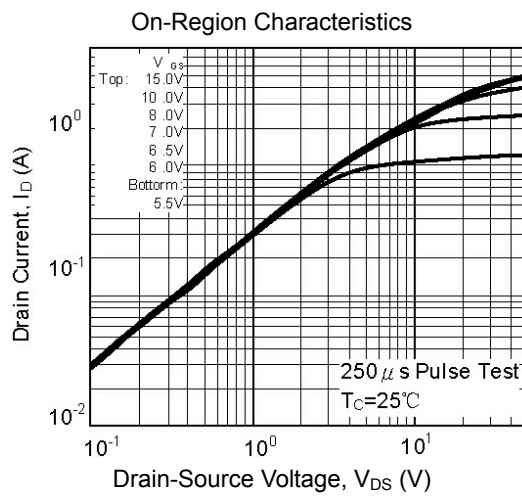
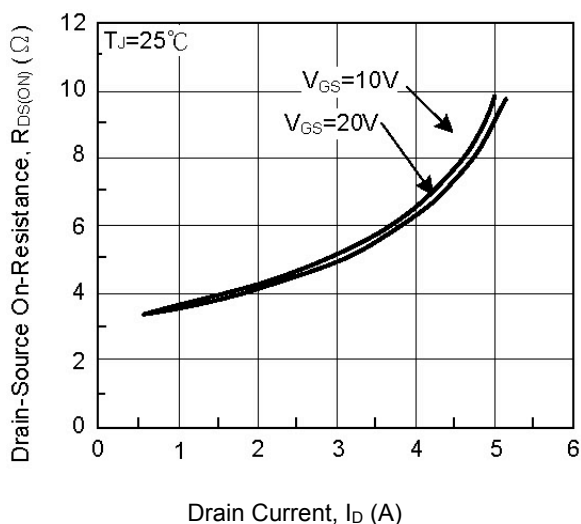


Fig. 4B Unclamped Inductive Switching Waveforms

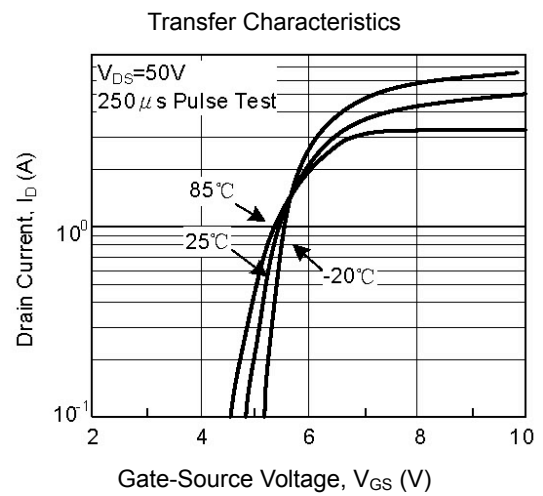
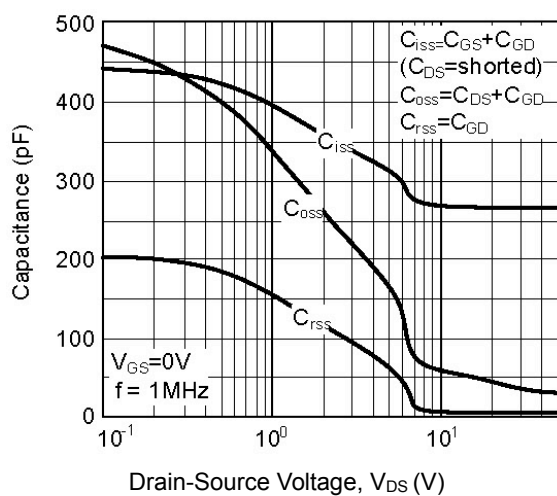
TYPICAL CHARACTERISTICS



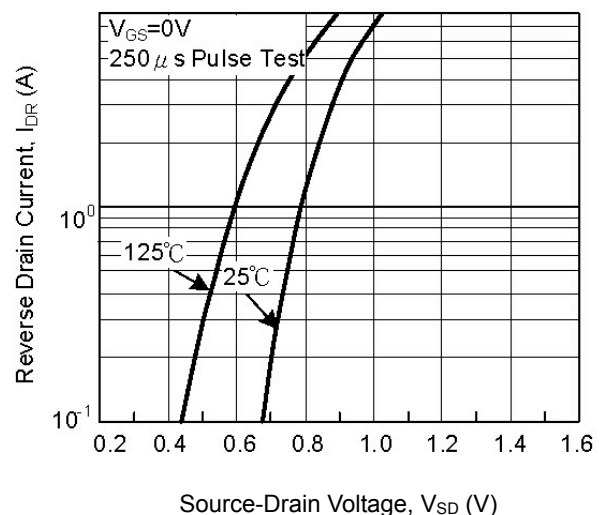
On-Resistance Variation vs. Drain Current and Gate Voltage



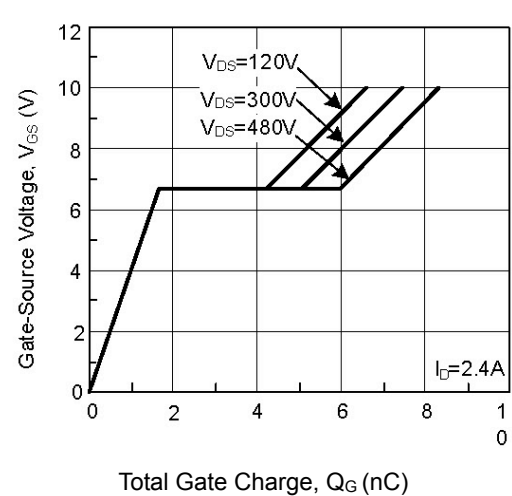
Capacitance vs. Drain-Source Voltage



Body Diode Forward Voltage Variation vs. Source Current and Temperature

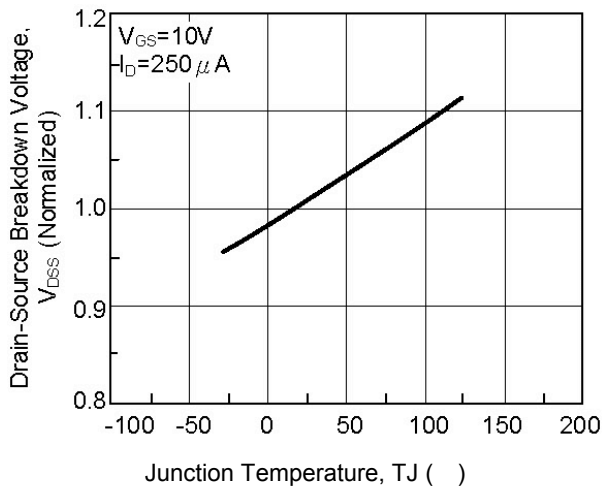


Gate Charge vs. Gate Charge Voltage

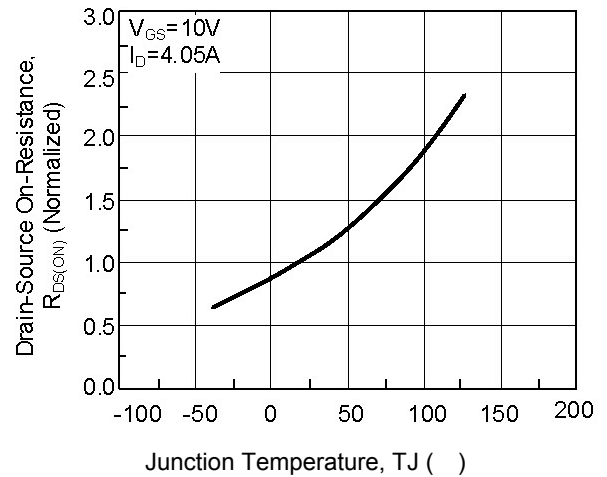


TYPICAL CHARACTERISTICS(Cont.)

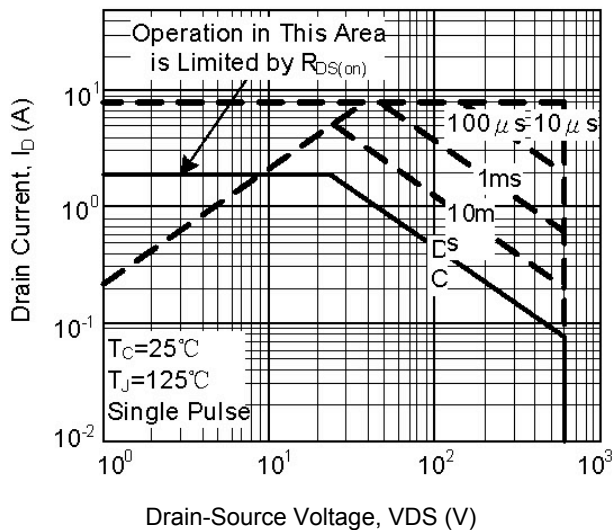
Breakdown Voltage vs. Temperature



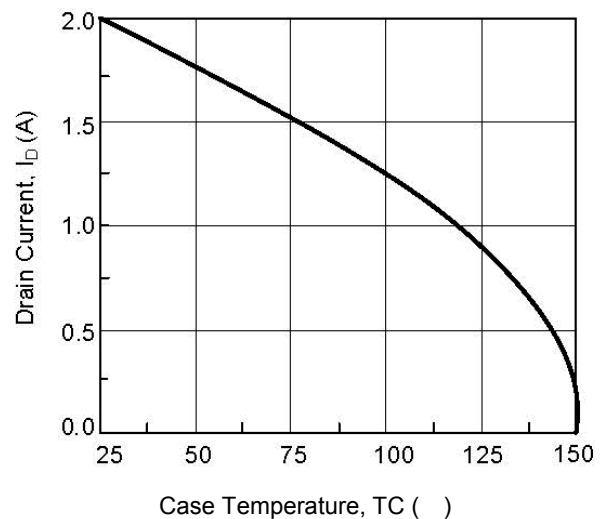
On-Resistance vs. Temperature



Max. Safe Operating Area



Max. Drain Current vs. Case Temperature



Thermal Response

