

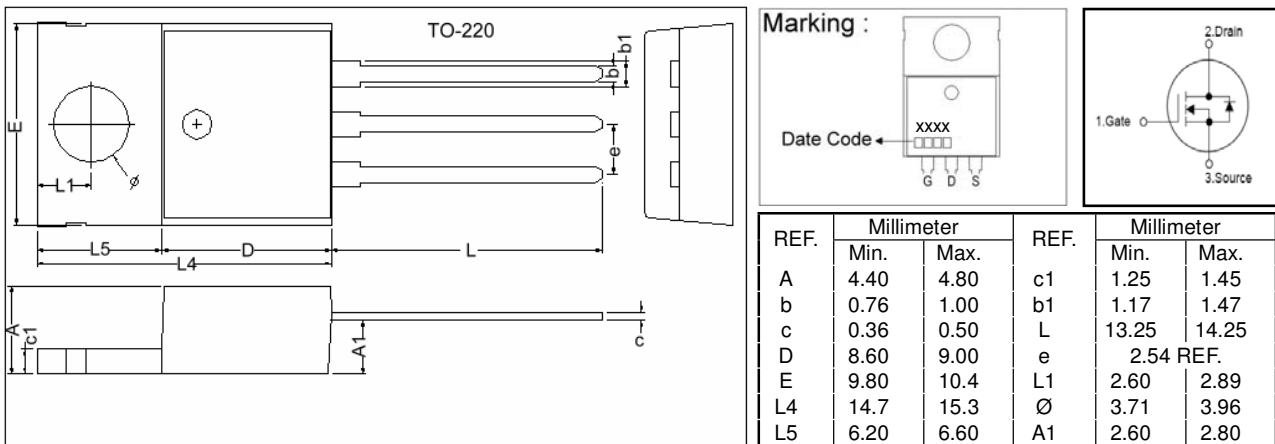
N-Channel MOSFET

V_{DS}	600/650V
$R_{DS(ON)}$	5Ω
I_D	2A

Features

- * $R_{DS(ON)} = 5\Omega @ V_{GS} = 10V$
- * Ultra Low gate charge (typical 9.0nC)
- * Low reverse transfer capacitance ($C_{RSS} =$ typical 5.0 pF)
- * Fast switching capability
- * Improved dv/dt capability, high ruggedness

Package Dimensions



ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	2N60-A	V_{DS}	600	V
	2N60-B		650	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 1)		I_{AR}	2.0	A
Drain Current Continuous		I_D	2.0	A
Drain Current Pulsed (Note 1)		I_{DP}	8.0	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	140	mJ
	Repetitive (Note 1)	E_{AR}	4.5	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Total Power Dissipation	TO-220	P_D	54	W
	TO-220F		23	W
	TO-251		44	W
	TO-252		44	W
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-55 ~ +150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

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	PACKAGE	SYMBOL	RATINGS	UNIT
Junction-to-Ambient	TO-220	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-220F		62.5	
	TO-251		50	
	TO-252		50	
Junction-to-Case	TO-220	θ_{Jc}	2.32	$^{\circ}\text{C}/\text{W}$
	TO-220F		5.5	
	TO-251		2.87	
	TO-252		2.87	

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	2N60-A	BV_{DSS}	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	600			V
	2N60-B			650			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$			10	μA	
Gate-Source Leakage Current	Forward	I_{GSS}	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$ $V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$			100	nA
	Reverse					-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.4		$\text{V}/^{\circ}\text{C}$	
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	$R_{DS(ON)}$	$V_{GS} = 10\text{V}, I_D = 1\text{A}$		3.8	5	Ω	
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	$t_{D(ON)}$	$V_{DD} = 300\text{V}, I_D = 2.4\text{A}, R_G = 25\Omega$ (Note 4, 5)		10	30	ns
Turn-On Rise Time	t_R			25	60	ns
Turn-Off Delay Time	$t_{D(OFF)}$			20	50	ns
Turn-Off Fall Time	t_F			25	60	ns
Total Gate Charge	Q_G	$V_{DS} = 480\text{V}, V_{GS} = 10\text{V}, I_D = 2.4\text{A}$ (Note 4, 5)		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}	$V_{GS} = 0\text{V}, I_{SD} = 2.0\text{A}$			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}	$V_{GS} = 0\text{V}, I_{SD} = 2.4\text{A}$		180		ns
Reverse Recovery Charge	Q_{RR}	$di/dt = 100\text{A}/\mu\text{s}$ (Note4)		0.72		μC

- Note:
1. Repetitive Rating : Pulse width limited by T_J
 2. $L = 64\text{mH}, I_{AS} = 2.0\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$
 3. $I_{SD} \leq 2.4\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$
 4. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
 5. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

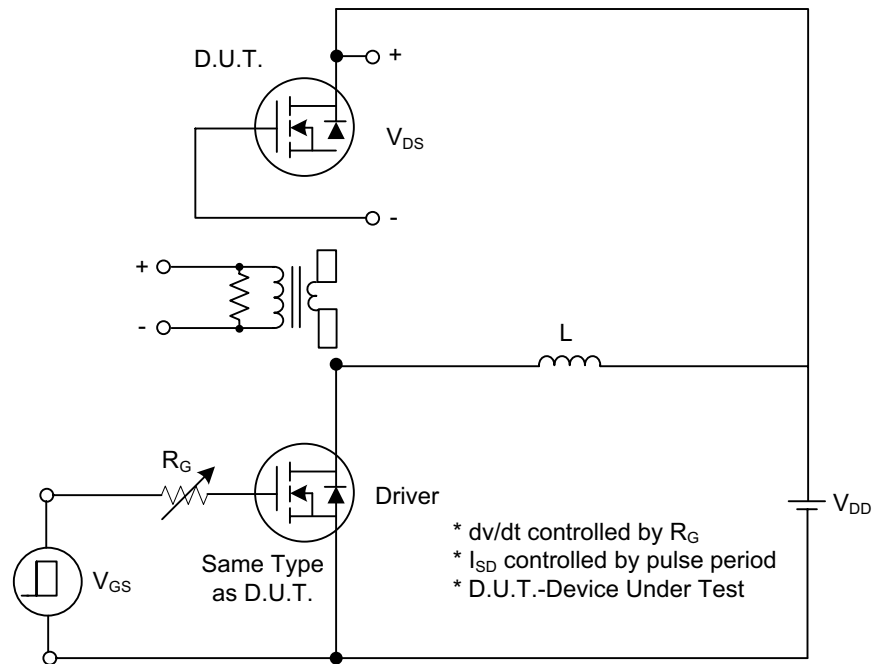


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

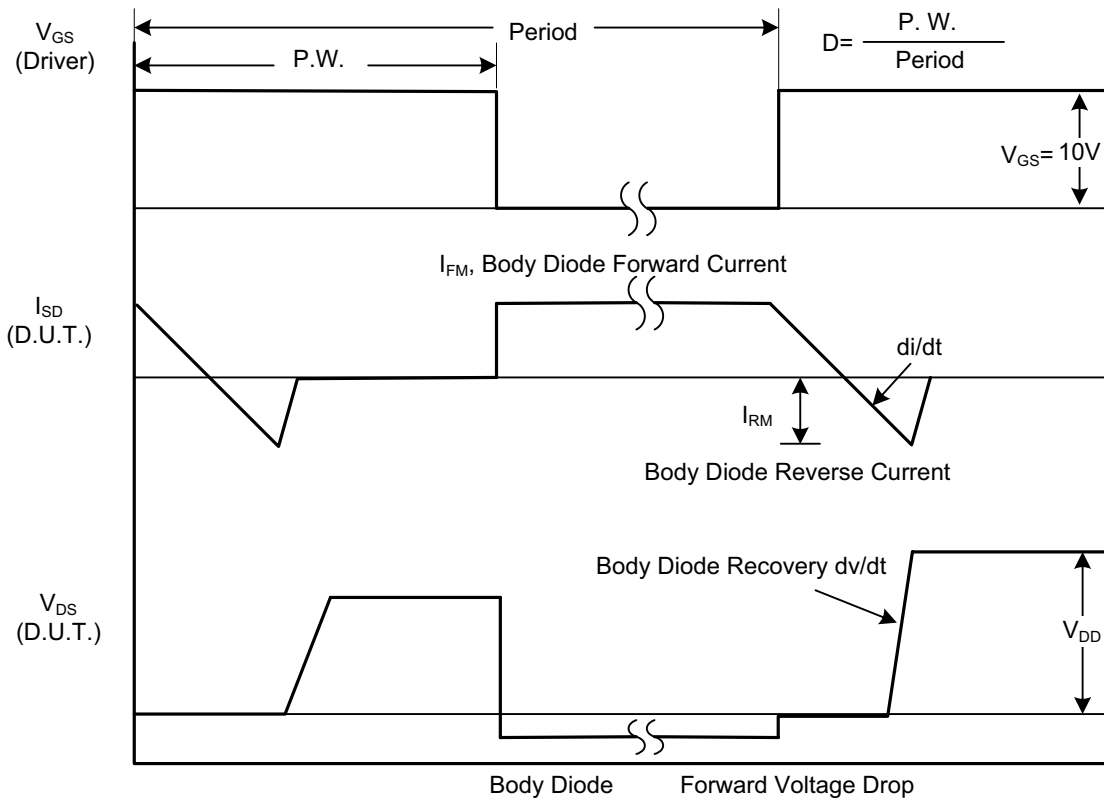


Fig. 1B Peak Diode Recovery dv/dt Waveforms

TEST CIRCUITS AND WAVEFORMS (Cont.)

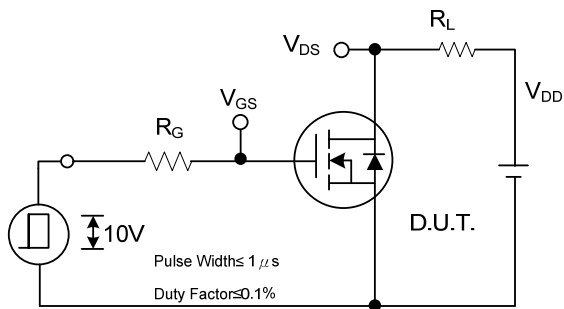


Fig. 2A Switching Test Circuit

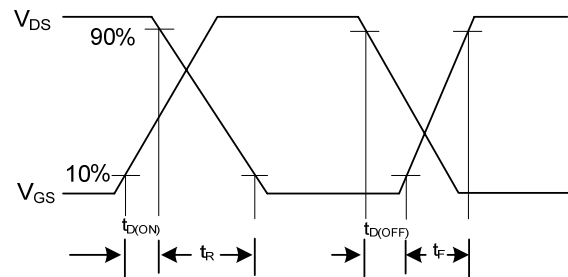


Fig. 2B Switching Waveforms

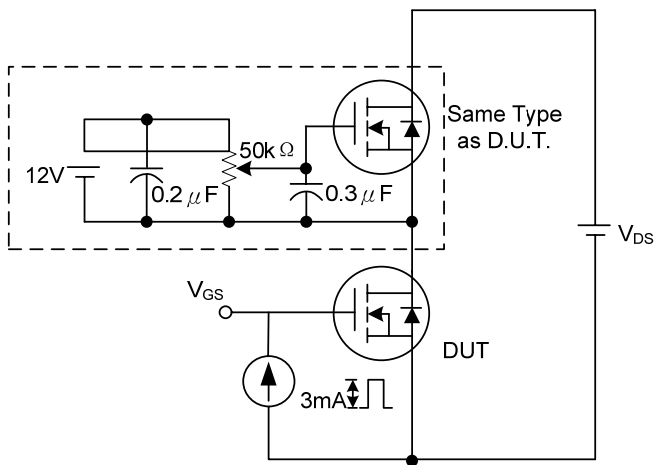


Fig. 3A Gate Charge Test Circuit

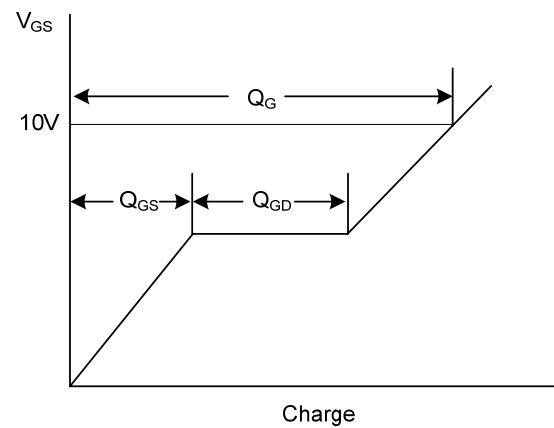


Fig. 3B Gate Charge Waveform

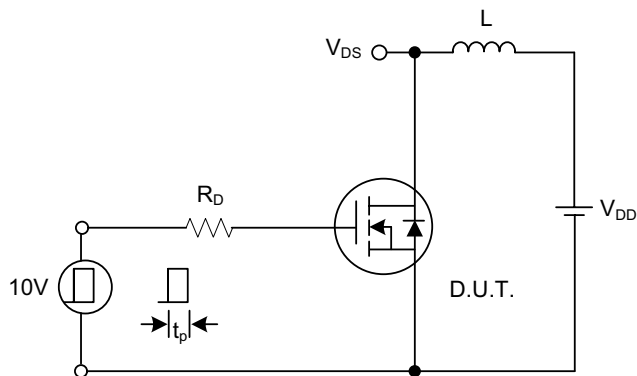


Fig. 4A Unclamped Inductive Switching Test Circuit

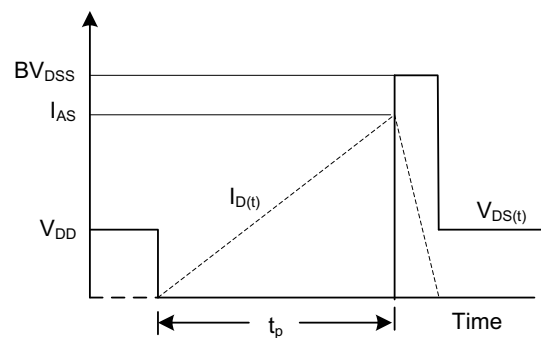
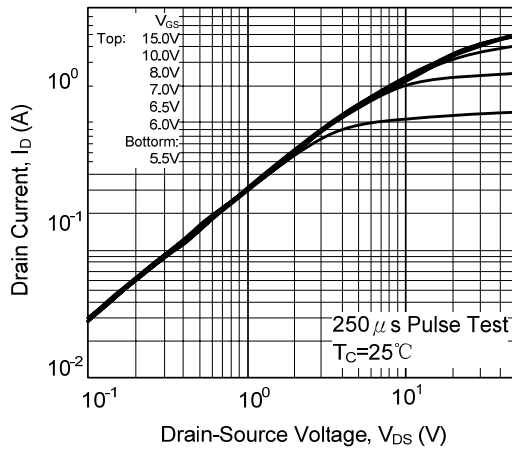


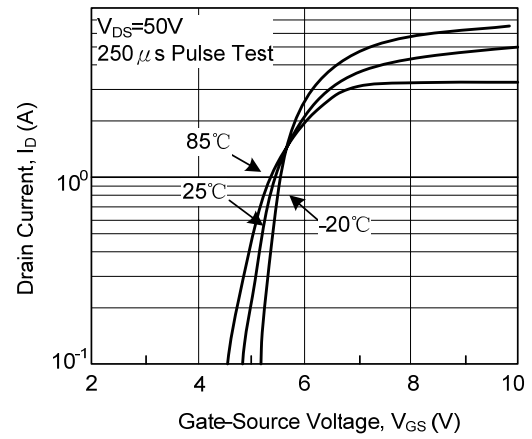
Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

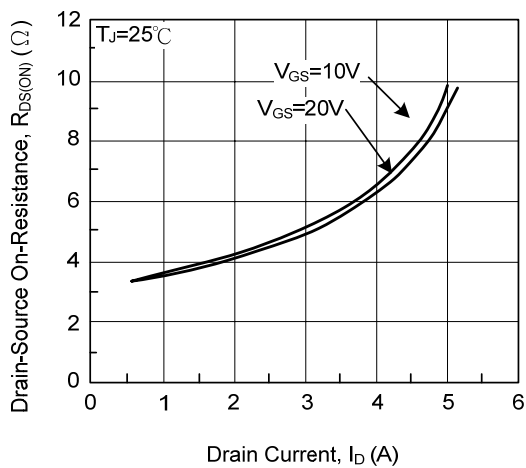
On-Region Characteristics



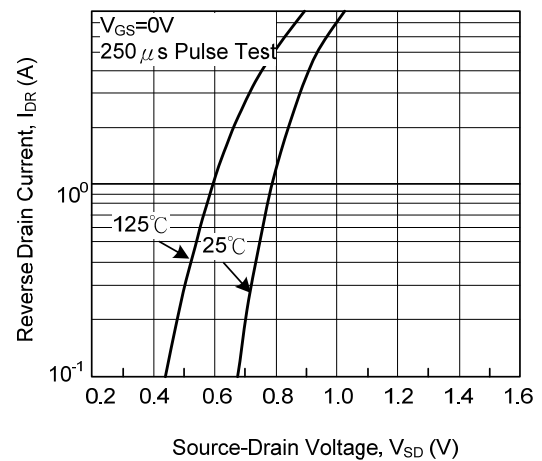
Transfer Characteristics



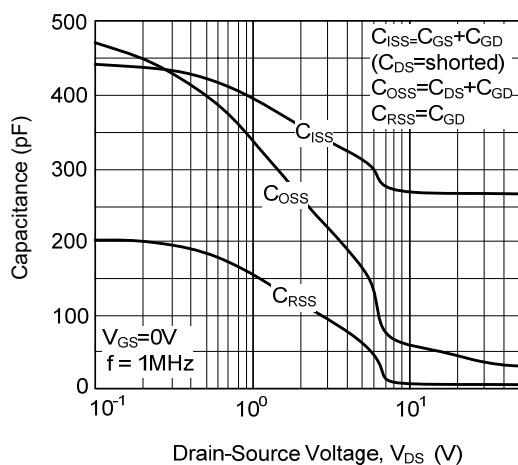
On-Resistance Variation vs. Drain Current and Gate Voltage



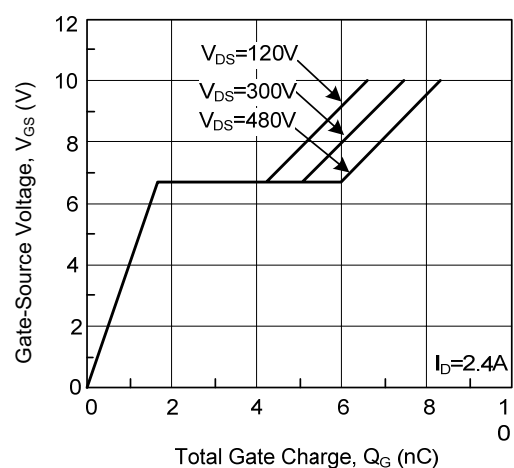
Body Diode Forward Voltage Variation vs. Source Current and Temperature



Capacitance vs. Drain-Source Voltage

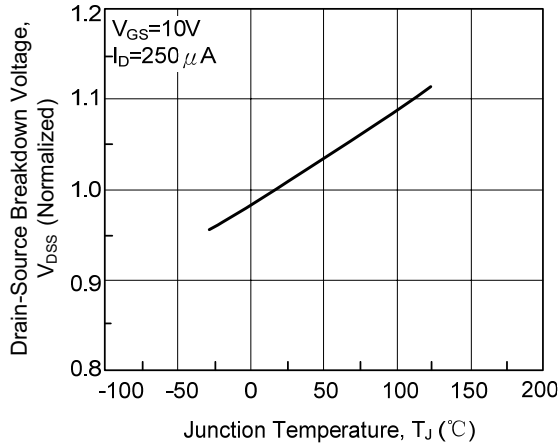


Gate Charge vs. Gate Charge Voltage

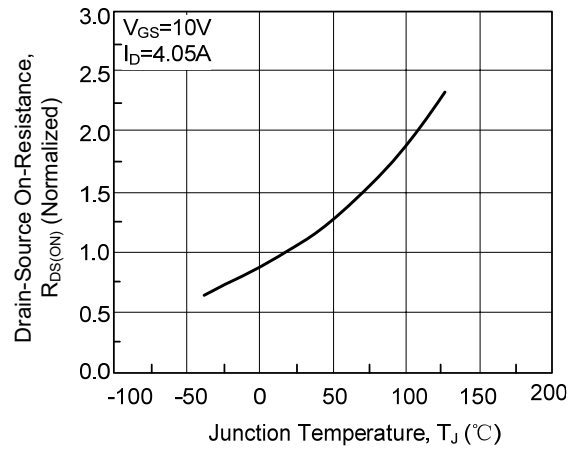


TYPICAL CHARACTERISTICS(Cont.)

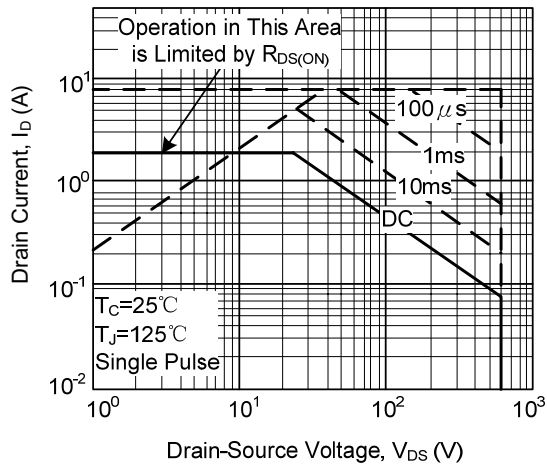
Breakdown Voltage vs. Temperature



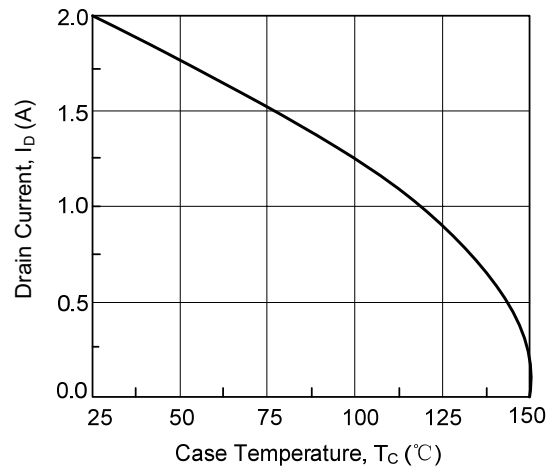
On-Resistance vs. Temperature



Max. Safe Operating Area



Max. Drain Current vs. Case Temperature



Thermal Response

