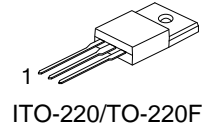
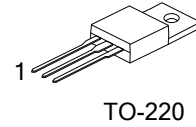
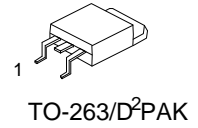
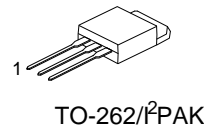


10 Amps, 600/650 Volts N-CHANNEL POWER MOSFET



DESCRIPTION

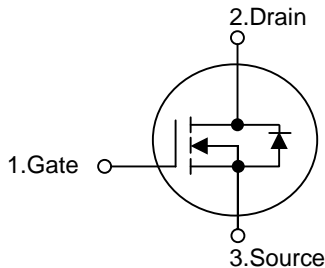
10N60 10N65 is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power 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



ORDERING INFORMATION

Ordering Number	Package	Pin Assignment		
		1	2	3
10N60	TO-220	G	D	S
	ITO-220/TO-220F	G	D	S
10N65	TO-262/I ² PAK	G	D	S
	TO-263/D ² PAK	G	D	S

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

Part No.	Package	Packing
10N6*-TU	TO-220	50pcs / Tube
10N6*-TU	ITO-220/TO-220F	50pcs / Tube
10N6*-TU	TO-262	50pcs / Tube
10N6*-TU	TO-263	50pcs / Tube
10N6*-TR	TO-263	800pcs / 13" Reel

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	10N60	V_{DSS}	600	V
	10N65		650	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}	38.0	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	P_D ($T_C = 25^\circ\text{C}$)	156	W
	TO-220F		50	W
	TO-263/D ² PAK		178	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Ambient 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 T_J

3. $L=7.3\text{mH}$, $I_S=10\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, 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	RATINGS	UNIT
Junction-to-Ambient	TO-262/I ² PAK	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-263/D ² PAK		62.5	
	TO-220		62.5	
	ITO-220/TO-220F		62.5	
Junction-to-Case	TO-262/I ² PAK	θ_{JC}	0.85	$^\circ\text{C}/\text{W}$
	TO-263/D ² PAK		0.85	
	TO-220		0.85	
	ITO-220/TO-220F		2.60	

■ 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	10N60	$V_{GS} = 0V, I_D = 250\mu A$	600			V
	10N65		650			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V$			1	μA
Gate-Source Leakage Current	Forward	$V_{GS} = 30V, V_{DS} = 0V$ $V_{GS} = -30V, V_{DS} = 0V$			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250 \mu A$, Referenced to 25°C		0.7		$^\circ\text{C}^{-1}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 4.75A$		0.6	0.73	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS} = 25V, V_{GS} = 0V, f = 1\text{MHz}$		1570	2040	pF
Output Capacitance	C_{OSS}		166	215	pF	
Reverse Transfer Capacitance	C_{RSS}		18	24	pF	
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 300V, I_D = 10A,$ $R_G = 25\Omega$ (Note 1, 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	$V_{DS} = 480V, V_{GS} = 10V,$ $I_D = 10A$ (Note 1, 2)		44	57	nC
Gate-Source Charge	Q_{GS}		6.7		nC	
Gate-Drain Charge	Q_{GD}		18.5		nC	
DRAIN-SOURCE DIODE CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_{SD} = 10A$			1.4	V
Continuous Drain-Source Current	I_{SD}				10	A
Pulsed Drain-Source Current	I_{SM}				38	A
Reverse Recovery Time	t_{RR}	$V_{GS} = 0V, I_{SD} = 10A,$		420		ns
Reverse Recovery Charge	Q_{RR}	$di/dt = 100 A/\mu s$ (Note1)		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

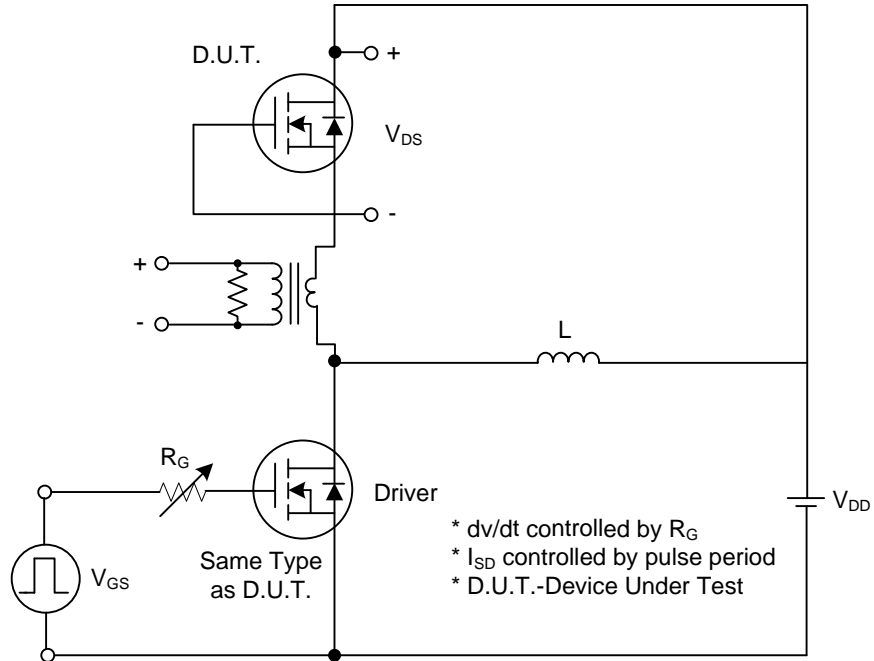


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

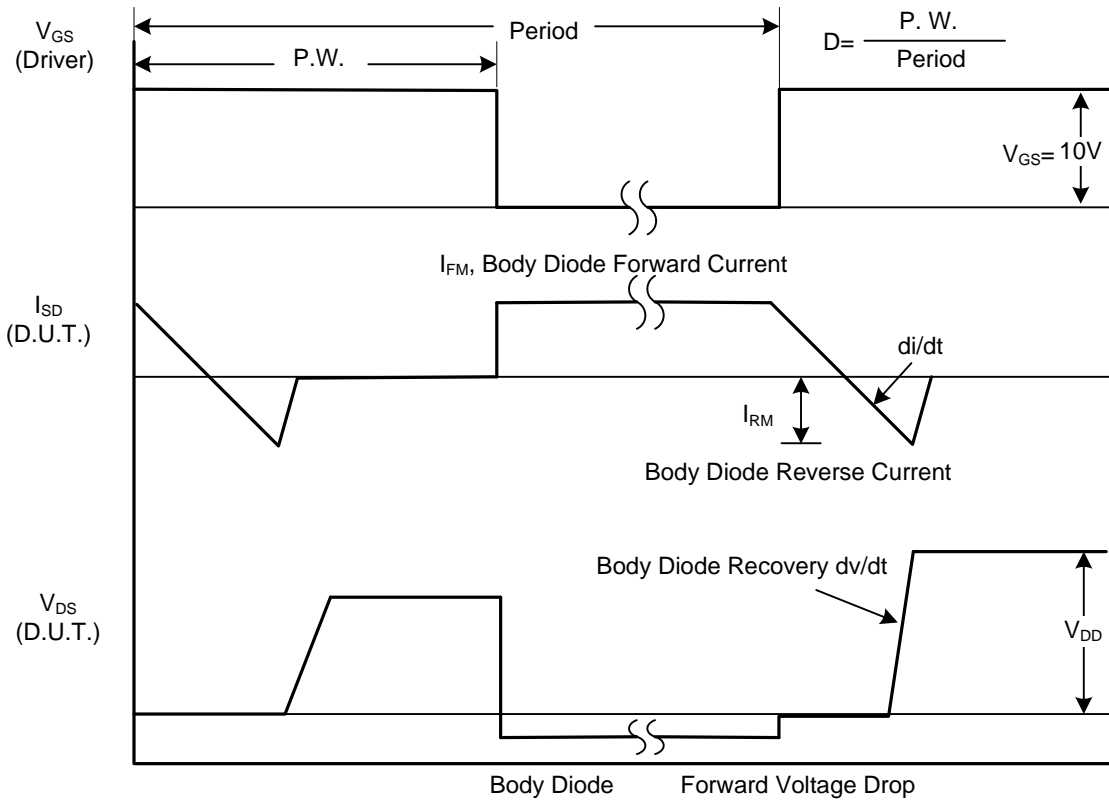


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

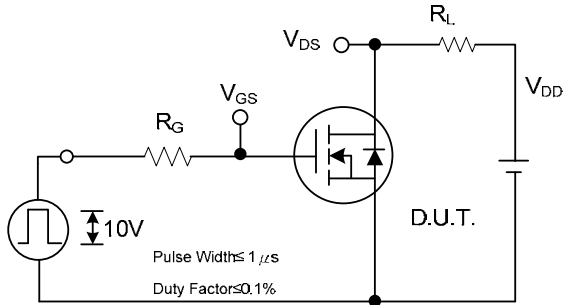


Fig. 2A Switching Test Circuit

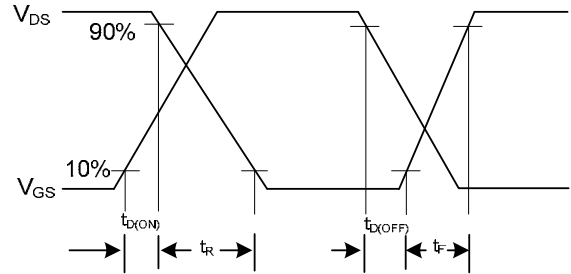


Fig. 2B Switching Waveforms

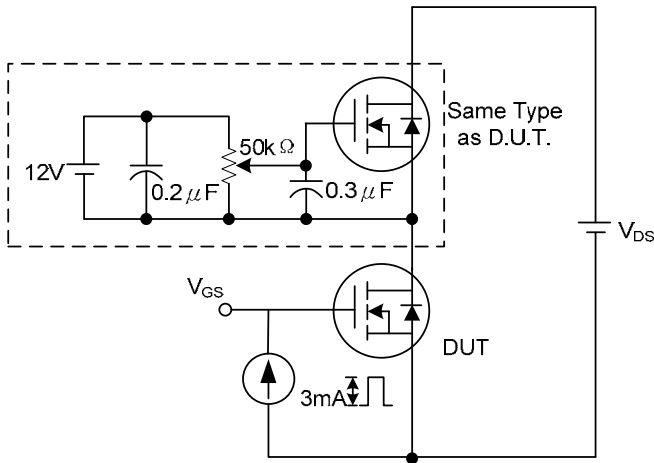


Fig. 3A Gate Charge Test Circuit

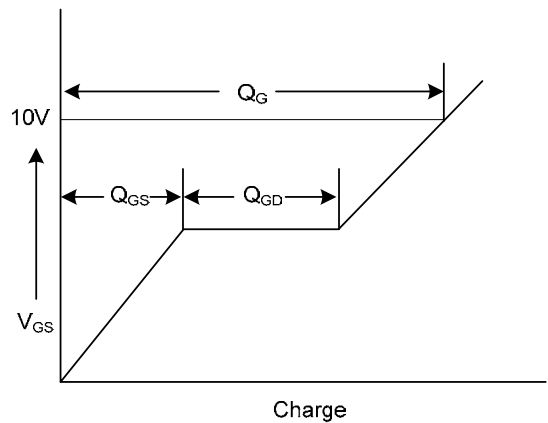


Fig. 3B Gate Charge Waveform

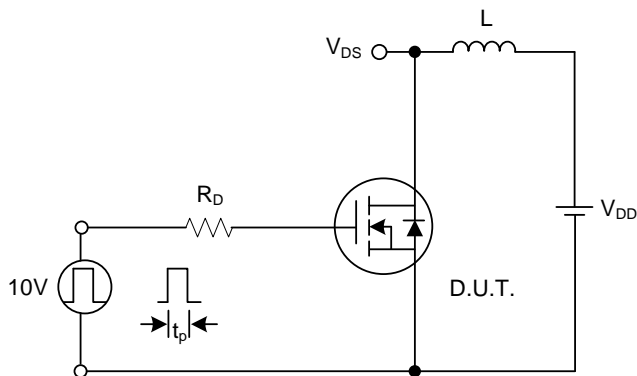


Fig. 4A Unclamped Inductive Switching Test Circuit

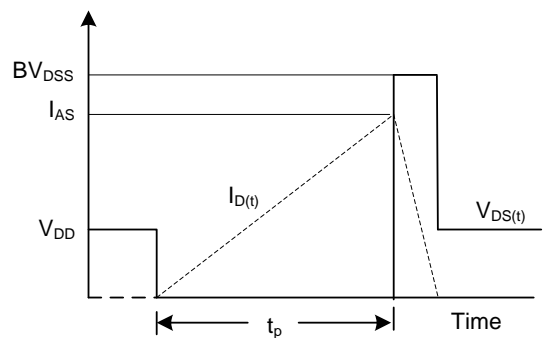
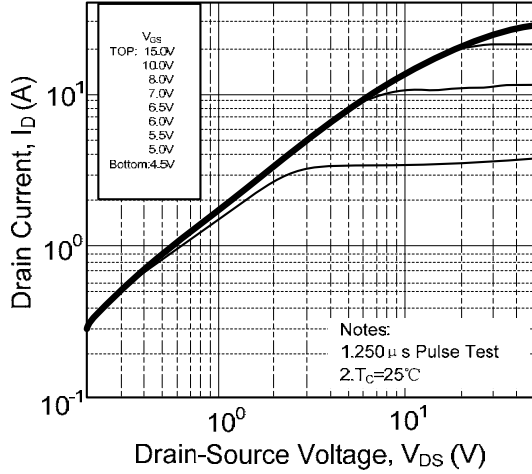


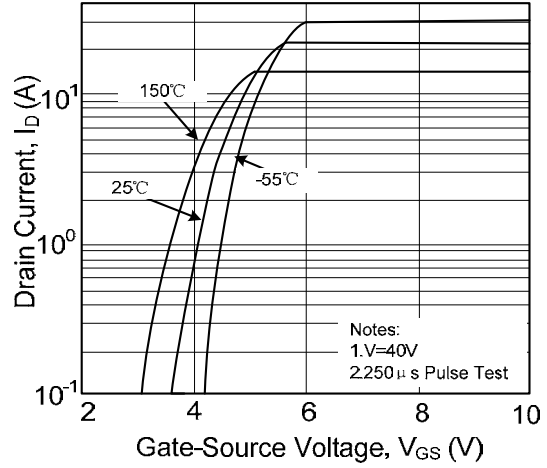
Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

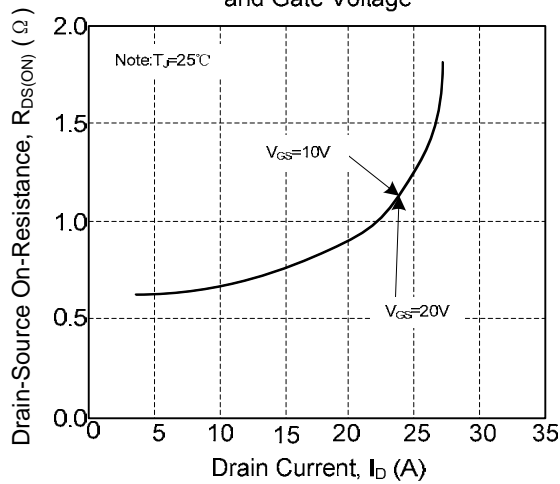
On-Region Characteristics



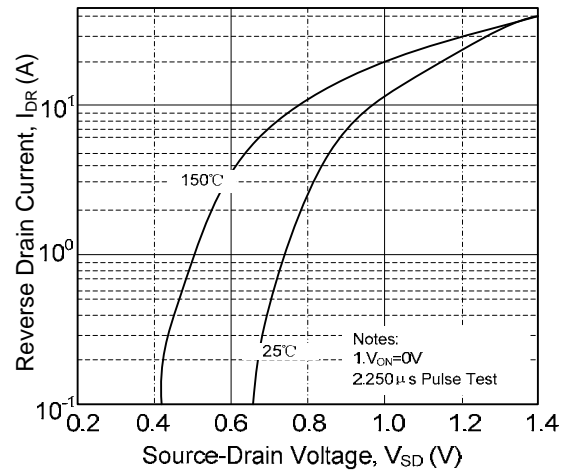
Transfer Characteristics



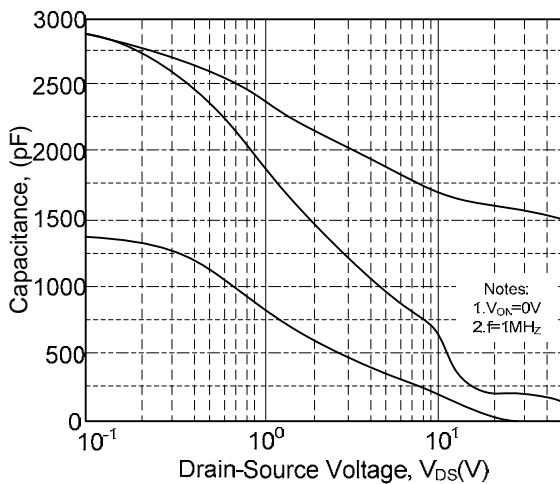
On-Resistance Variation vs. Drain Current and Gate Voltage



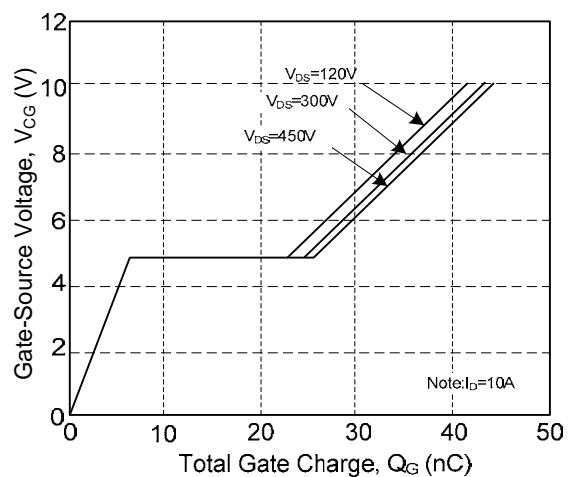
Body Diode Forward Voltage Variation with Source Current and Temperature



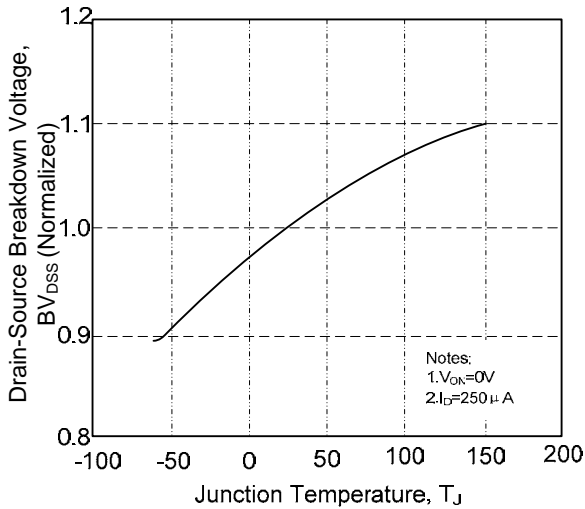
Capacitance Characteristics



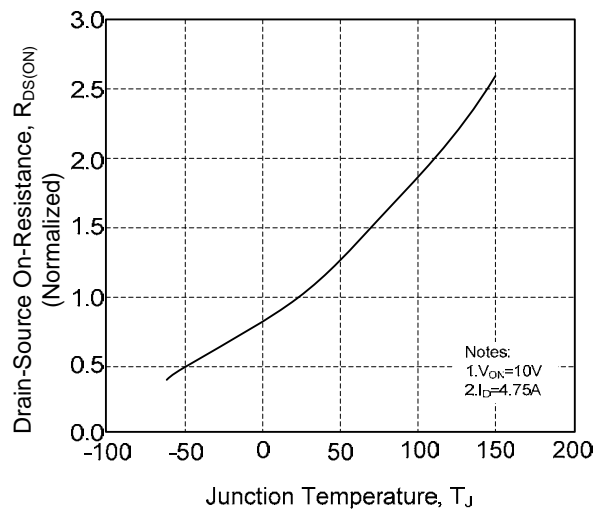
Gate Charge Characteristics



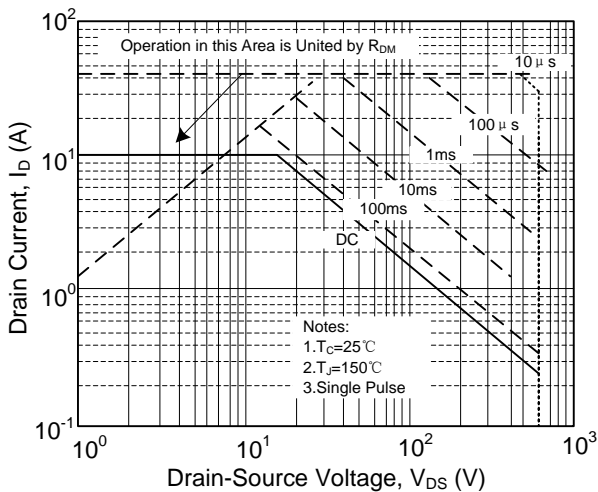
Breakdown Voltage Variation vs. Temperature



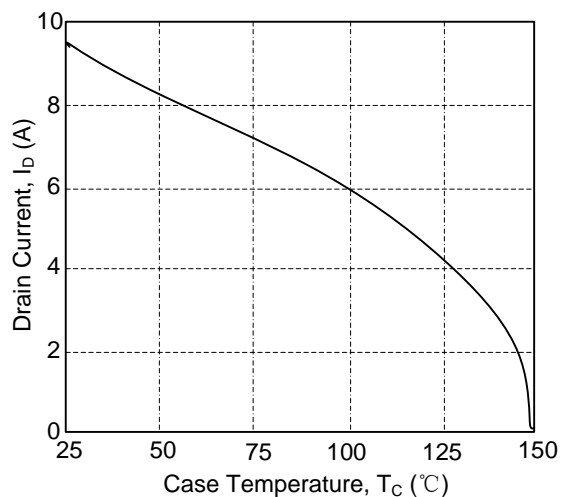
On-Resistance Variation vs. Temperature



Maximum Safe Operating Area



Maximum Drain Current vs. Case Temperature



Transient Thermal Response Curve

