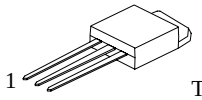
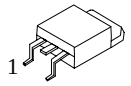
Power MOSFET

1.0 Amps, 600 Volts
N-CHANNEL MOSFET

I : 
TO - 251

D : 
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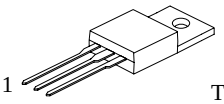
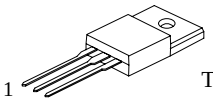
P : 
TO - 220

F : 
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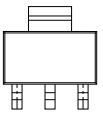
S : 
SOT-223

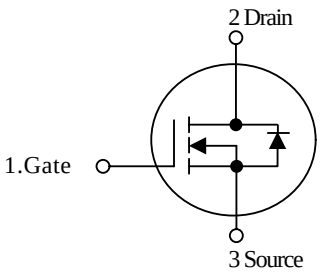
■ DESCRIPTION

The FTK 1N60 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

* $R_{DS(ON)}$ = 9.6Ω@V_{GS} = 10V
* Ultra Low gate charge (typical 5.0nC)
* Low reverse transfer capacitance (C_{RSS} = typical 3.5 pF)
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number	Package	Pin Assignment			Packing
		1	2	3	
FTK1N60P	TO-220	G	D	S	Tube
FTK1N60F	TO-220F	G	D	S	Tube
FTK1N60I	TO-251	G	D	S	Tube
FTK1N60D	TO-252	G	D	S	Tape Reel
FTK1N60S	SOT-223	G	D	S	Tape Reel

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

Power MOSFET

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25˚C, unless otherwise specified)

PARAMET		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 2)		I_{AR}	1.0	A
Continuous Drain Current	T_C = 25°C	I_D	1.0	A
	T_C = 100°C		0.6	
Pulsed Drain Current (Note 2)		I_{DM}	4	A
Avalanche Energy	Single Pulse (Note 3)	E_{AS}	65	mJ
	Repetitive Limited by $T_{J(MAX)}$	E_{AR}	2.7	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	T_C = 25°C	P_D	27	W
	Derate above 25°C		0.21	W / ˚C
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
Thermal Resistance Junction-Ambient	TO-251	θ_{JA}	112	˚C / W
	TO-252		112	
	TO-220		54	
Thermal Resistance Junction-Case	TO-251	θ_{Jc}	12	
	TO-252		12	
	TO-220		4	

■ ELECTRICAL CHARACTERISTICS (T_C = 25˚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			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -30V, V_{DS} = 0V			-100	nA
Breakdown Voltage Temperature Coefficient		ΔBV_{DSS} / ΔT_J	I_D = 250μA		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 = 0.6A		9.6	12.0	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS} =0V, f =1MHz		160		pF
Output Capacitance		C_{OSS}			25		pF
Reverse Transfer Capacitance		C_{RSS}			3.5		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} = 300V, I_D = 1.0A, R_G = 25Ω (Note 1,5)		20		ns
Turn-On Rise Time		t_R					
Turn-Off Delay Time		$t_{D(OFF)}$					
Turn-Off Fall Time		t_F					
Total Gate Charge		Q_G	V_{DS} =480V, V_{GS} =10V, I_D = 1.0A (Note 1,5)		5.0		nC
Gate-Source Charge		Q_{GS}			1.2		nC
Gate-Drain Charge		Q_{GD}			2.0		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 V, I_S = 1.0 A			1.5	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				1.0	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				4.8	A
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_S = 1.0A,		200		ns
Reverse Recovery Charge	Q_{RR}	dI_F/dt =100 A/μs (Note 4)		0.5		μC

Note:

1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%
2. Repetitive Rating : Pulse width limited by maximum junction temperature
3. L = 120mH, I_{AS} = 1.0A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD} ≤ 1.0A, di/dt ≤ 300A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

Power MOSFET

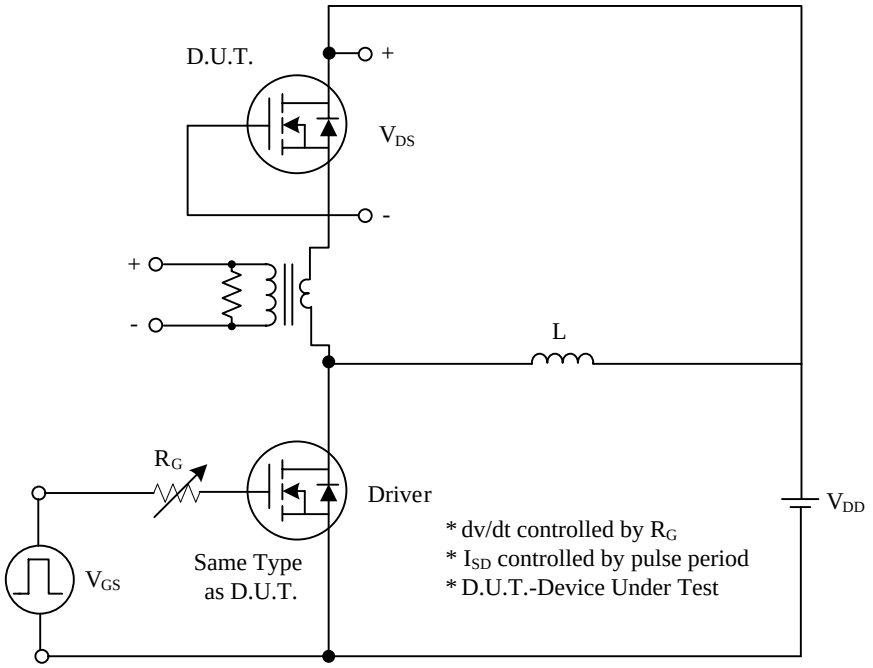


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

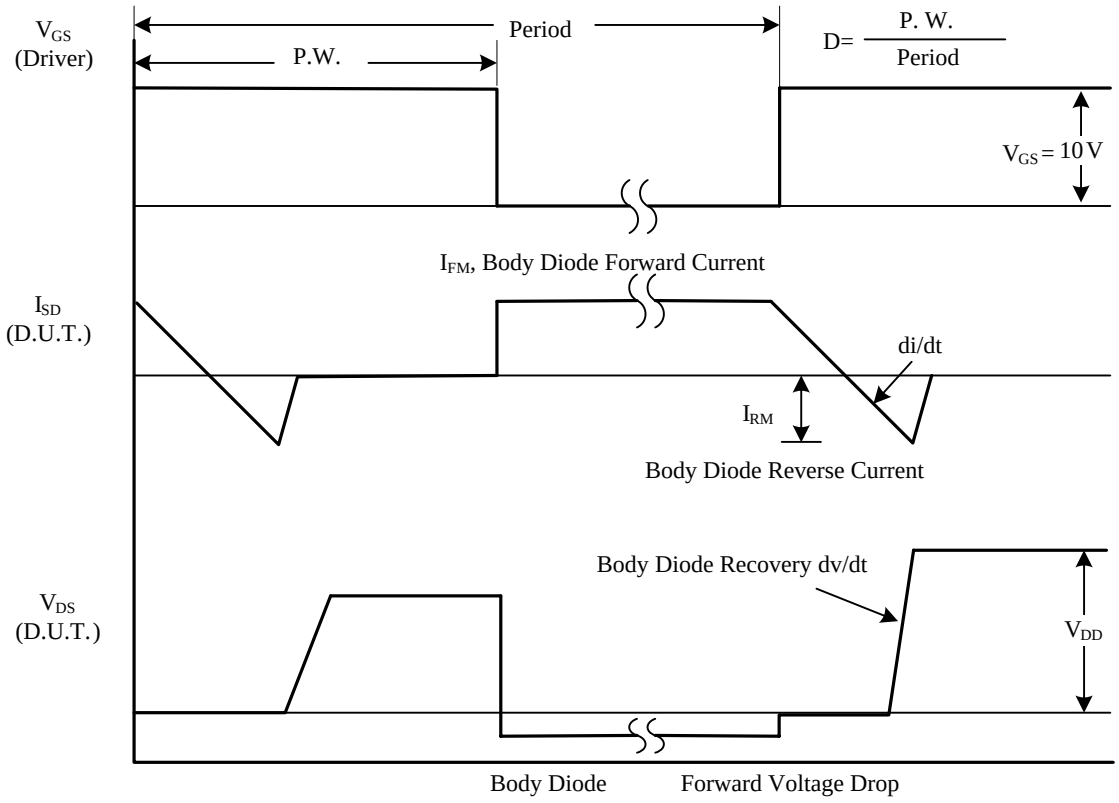


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ **TEST CIRCUITS AND WAVEFORMS (Cont.)**

Power MOSFET

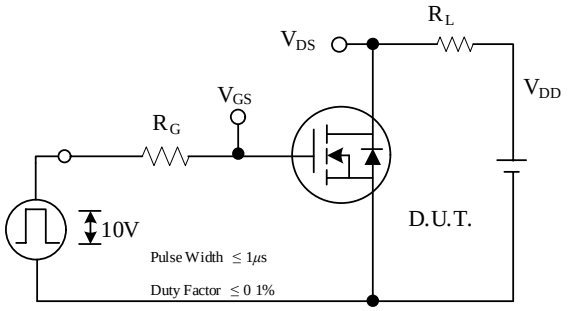


Fig. 2A Switching Test Circuit

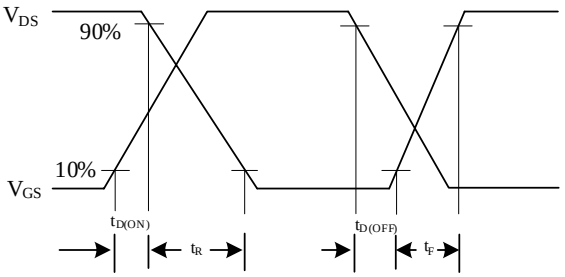


Fig. 2B Switching Waveforms

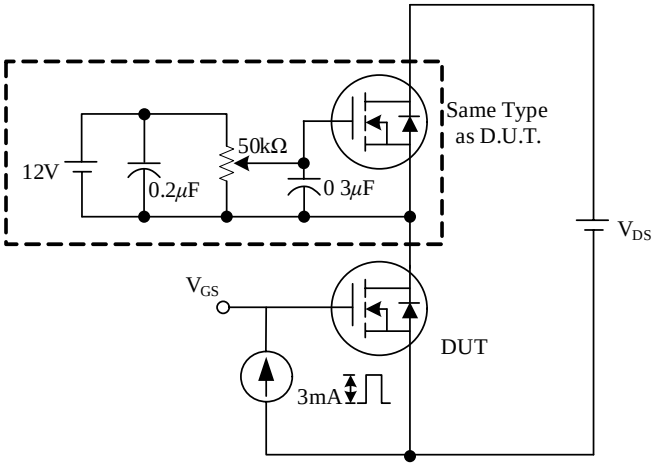


Fig. 3A Gate Charge Test Circuit

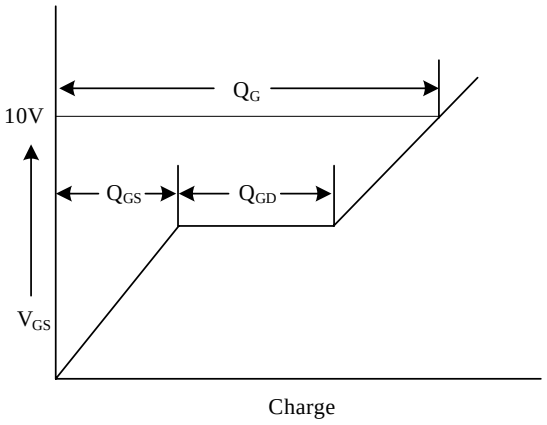


Fig. 3B Gate Charge Waveform

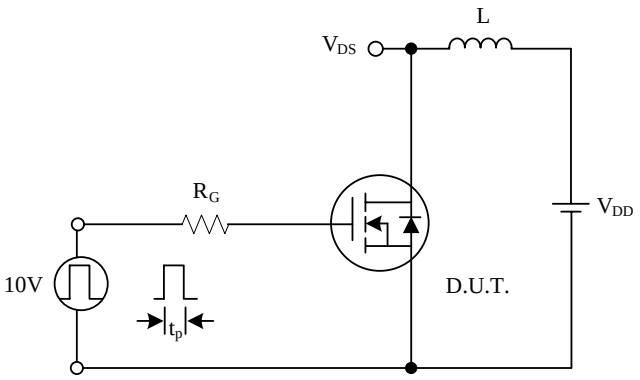


Fig. 4A Unclamped Inductive Switching Test Circuit

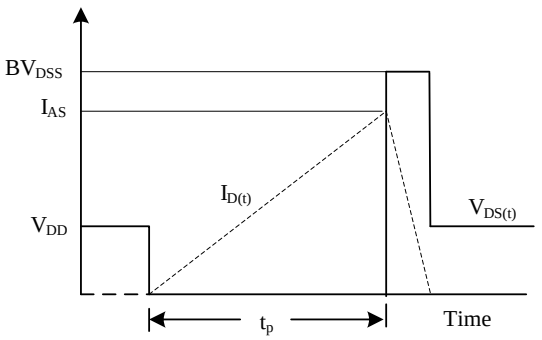
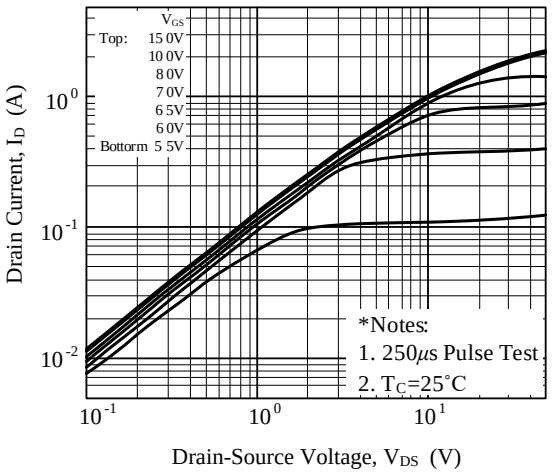


Fig. 4B Unclamped Inductive Switching Waveforms

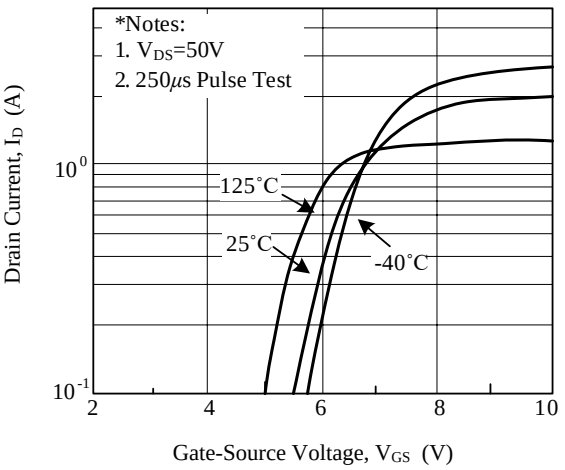
■ TYPICAL CHARACTERISTICS

Power MOSFET

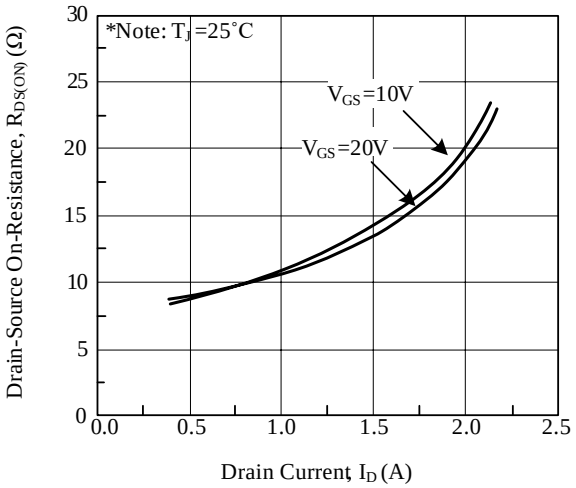
Output Characteristics



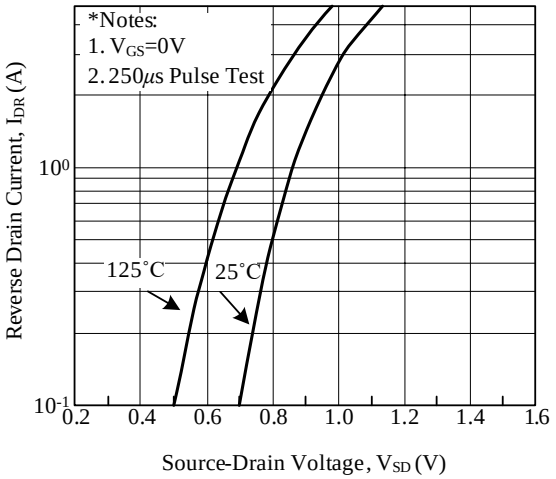
Transfer Characteristics



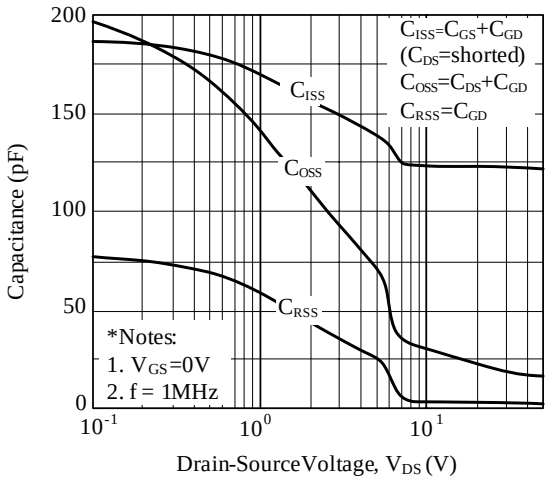
On-Resistance vs. Drain Current



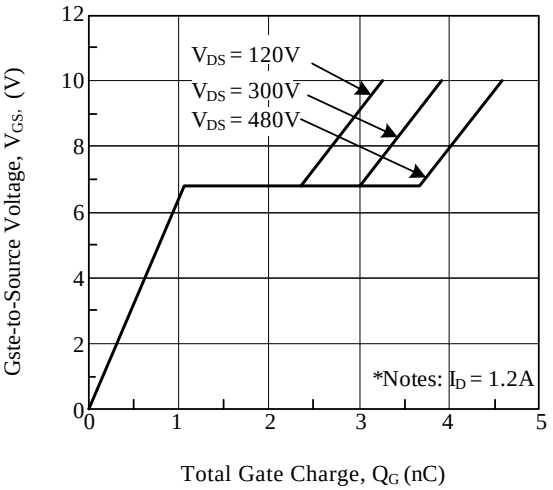
Source-Drain Diode Forward Voltage



Capacitance Characteristics



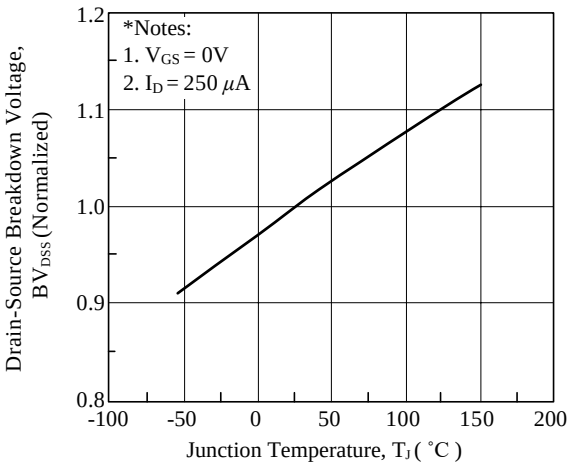
Gate Charge vs. Gate-Source Voltage



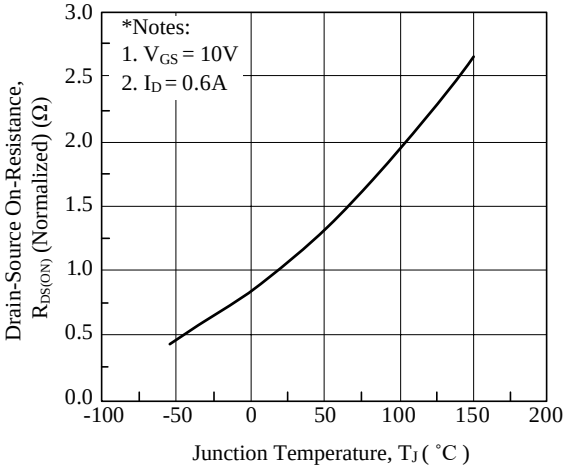
■ TYPICAL PERFORMANCE CHARACTERISTICS(cont.)

Power MOSFET

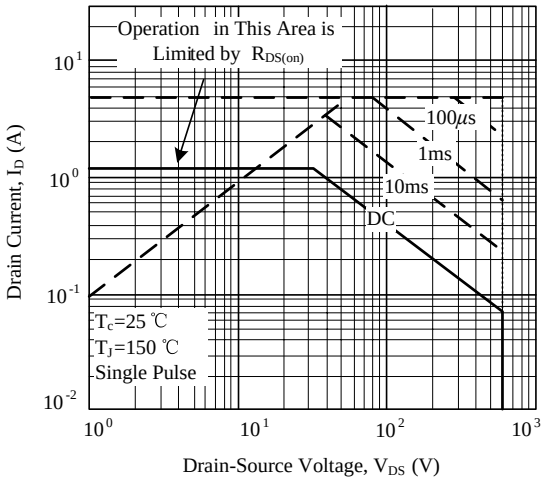
Breakdown Voltage vs Temperature



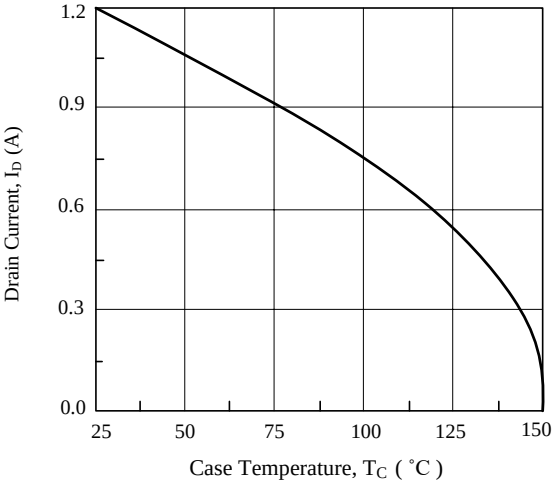
On-Resistance vs Temperature



Max. Safe Operating Area



Max. Drain Current vs. Case Temperature



Thermal Response