



# 1N70

*Power MOSFET*

## 1.2A, 700V N-CHANNEL POWER MOSFET

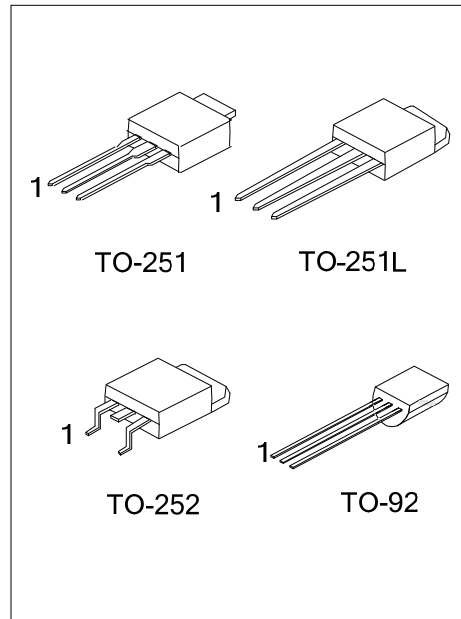
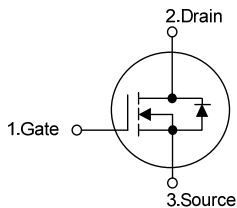
■ DESCRIPTION

The UTC **1N70** 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

- \*  $R_{DS(ON)} < 13.5\Omega @ V_{GS} = 10V, I_D = 0.6A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
1N70L-TM3-T	1N70G-TM3-T	TO-251	G	D	S	Tube
1N70L-TMA-T	1N70G-TMA-T	TO-251L	G	D	S	Tube
1N70L-TN3-R	1N70G-TN3-R	TO-252	G	D	S	Tape Reel
1N70L-T92-B	1N70G-T92-B	TO-92	G	D	S	Tape Box
1N70L-T92-K	1N70G-T92-K	TO-92	G	D	S	Bulk

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

	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube                  (2) TM3: TO-251, TMA: TO-251L, TN3: TO-252, T92: TO-92                  (3) L: Lead Free, G: Halogen Free and Lead Free</p>
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■ MARKING

TO-251 / TO-251L / TO-252	TO-92

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	700	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	1.2	A
Continuous Drain Current		$I_D$	1.2	A
Pulsed Drain Current (Note 2)		$I_{DM}$	4.8	A
Avalanche Energy (Note 2)	Single Pulsed	$E_{AS}$	50	mJ
	Repetitive	$E_{AR}$	4.0	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation	TO-251/TO-251L	$P_D$	28	W
	TO-252		1.6	W
	TO-92			
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
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 maximum junction temperature

3.  $L = 60\text{mH}$ ,  $I_{AS} = 1\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-251/TO-251L	$\theta_{JA}$	110	$^\circ\text{C/W}$
	TO-252		140	$^\circ\text{C/W}$
	TO-92			
Junction to Case	TO-251/TO-251L	$\theta_{JC}$	4.53	$^\circ\text{C/W}$
	TO-252		79	$^\circ\text{C/W}$
	TO-92			

■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified.)

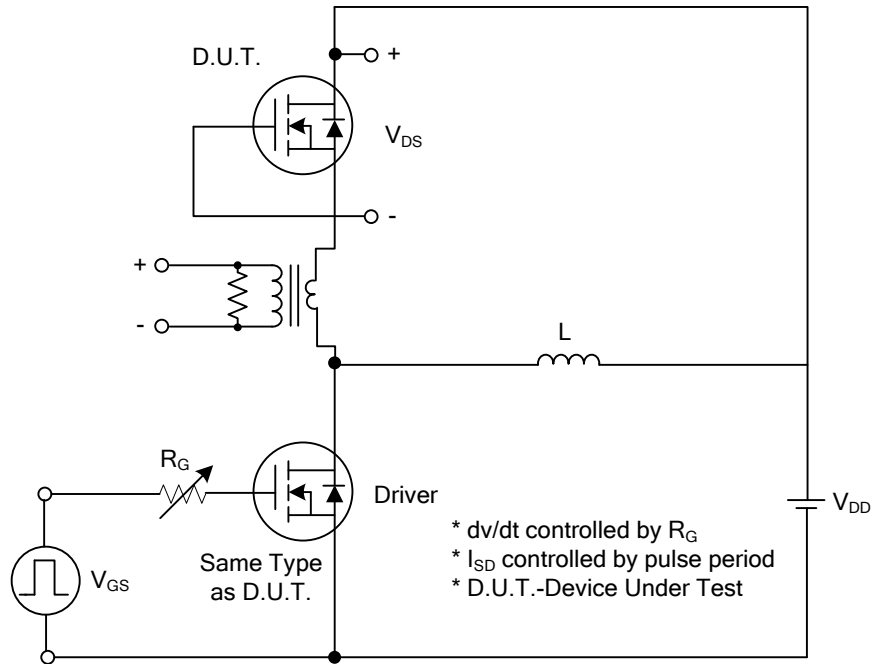
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	700			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 700V, V <sub>GS</sub> = 0V			10	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>			100	nA
	Reverse					
		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> = 250μA		0.4		V/°C
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.6A		9.3	13.5	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz		190	220	pF
Output Capacitance	C <sub>OSS</sub>			25	35	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			20	25	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω (Note 2,3)		33	45	ns
Turn-On Rise Time	t <sub>R</sub>			45	60	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			62	80	ns
Turn-Off Fall Time	t <sub>F</sub>			31	45	ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A (Note 2,3)		12	18	nC
Gate-Source Charge	Q <sub>GS</sub>			3.5		nC
Gate-Drain Charge	Q <sub>GD</sub>			2.2		nC
<b>SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> = 1.2A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				4.8	A

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

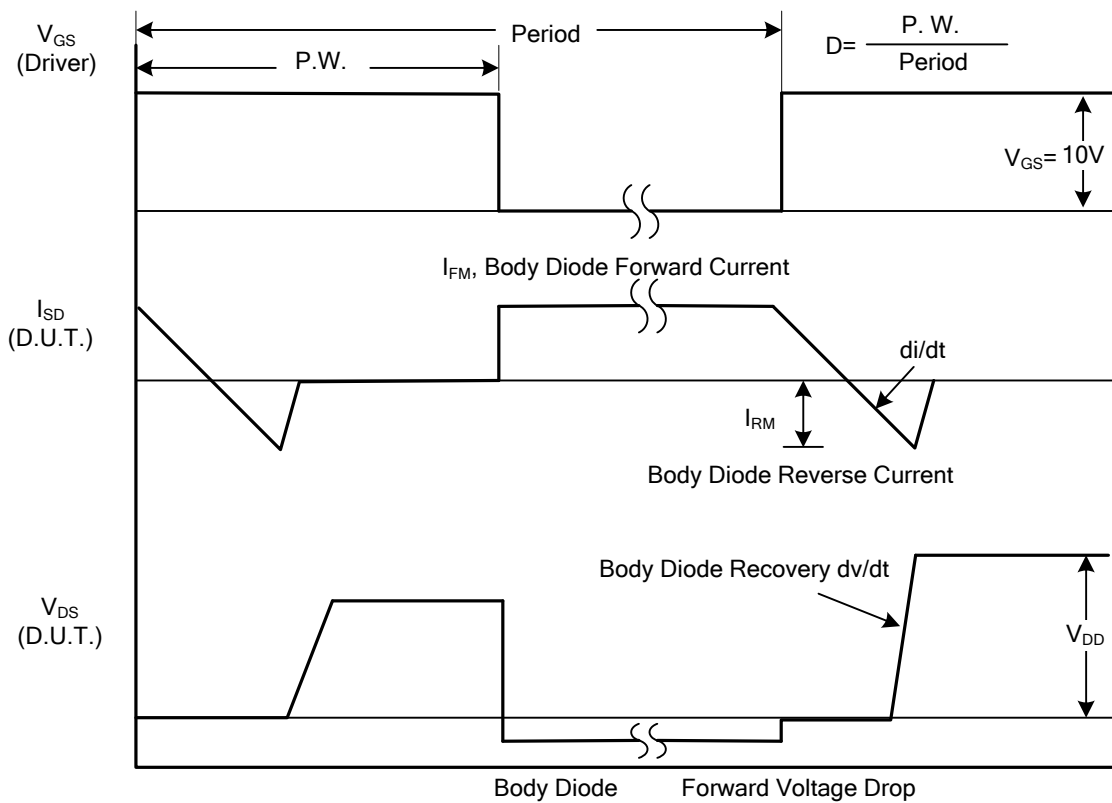
2. Pulse Test: Pulse Width ≤300μs, Duty Cycle≤2%

3. Essentially Independent of Operating Temperature

■ TEST CIRCUITS AND WAVEFORMS

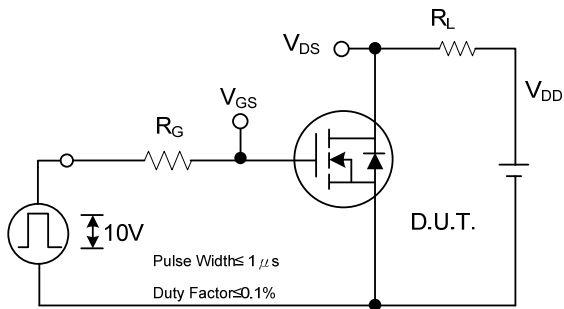


Peak Diode Recovery  $dv/dt$  Test Circuit

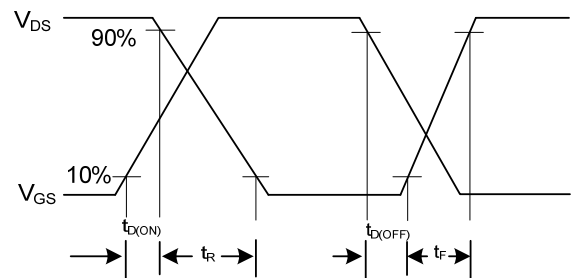


Peak Diode Recovery  $dv/dt$  Waveforms

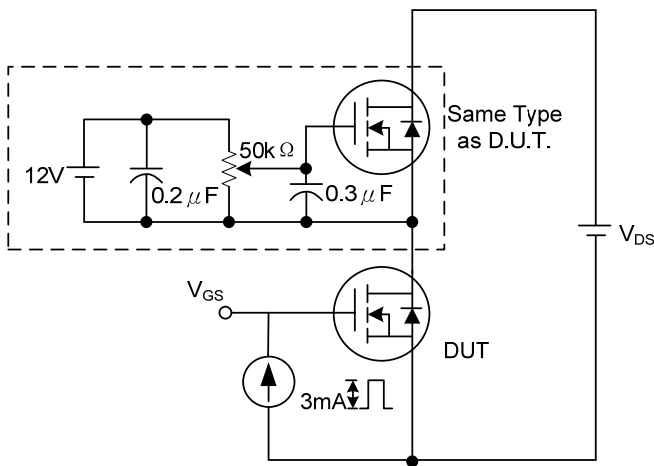
## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



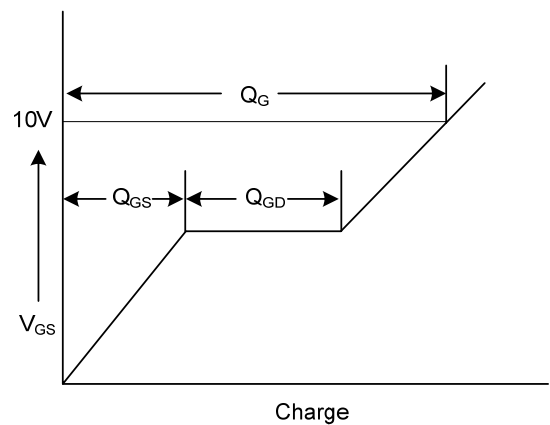
**Switching Test Circuit**



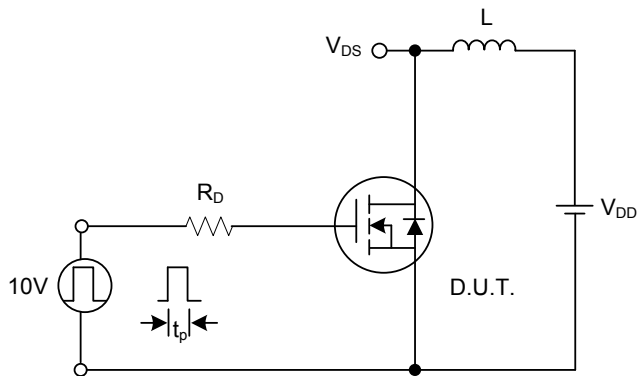
**Switching Waveforms**



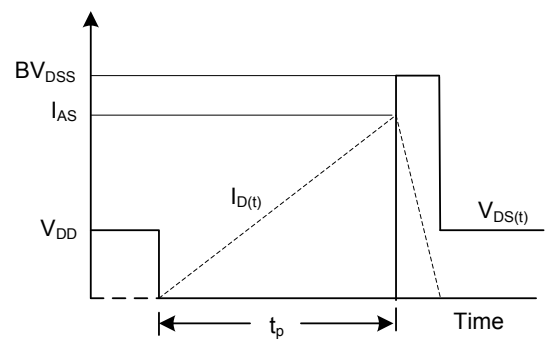
**Gate Charge Test Circuit**



**Gate Charge Waveform**



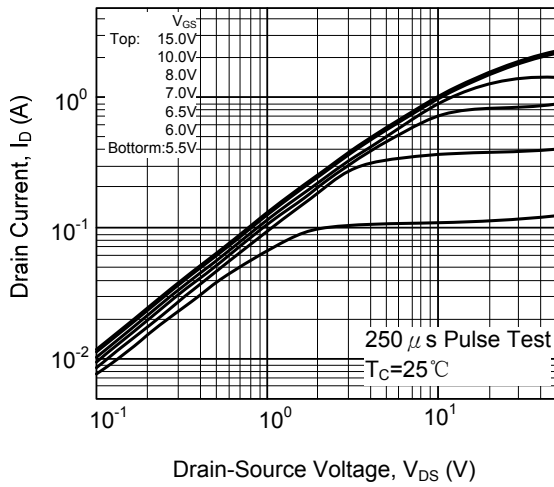
**Unclamped Inductive Switching Test Circuit**



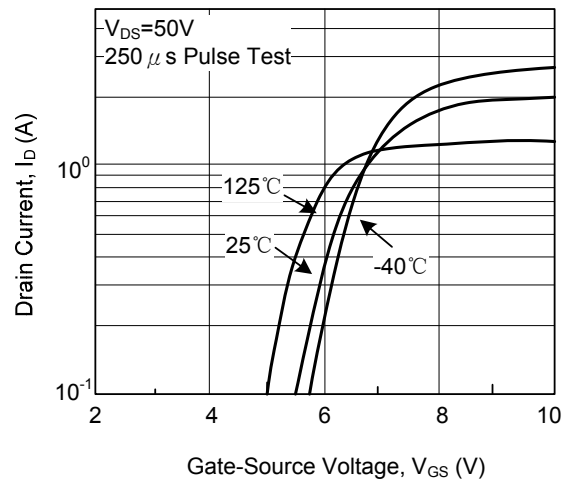
**Unclamped Inductive Switching Waveforms**

## TYPICAL CHARACTERISTICS

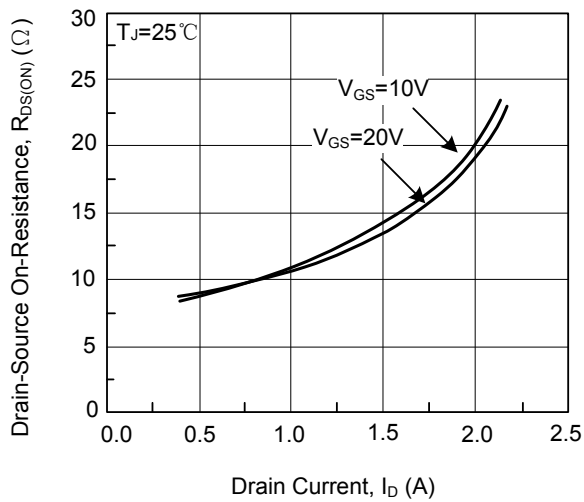
Output Characteristics



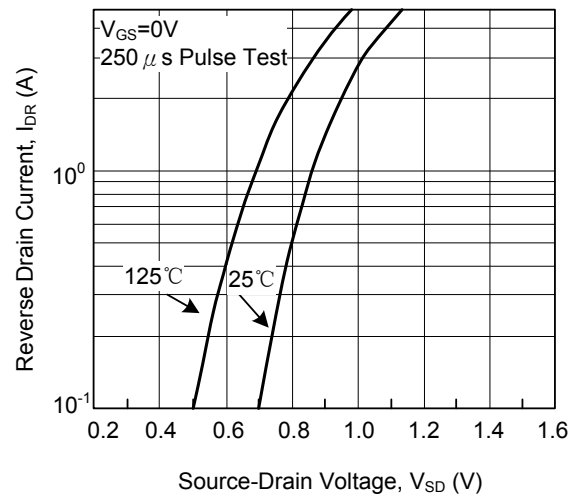
Transfer Characteristics



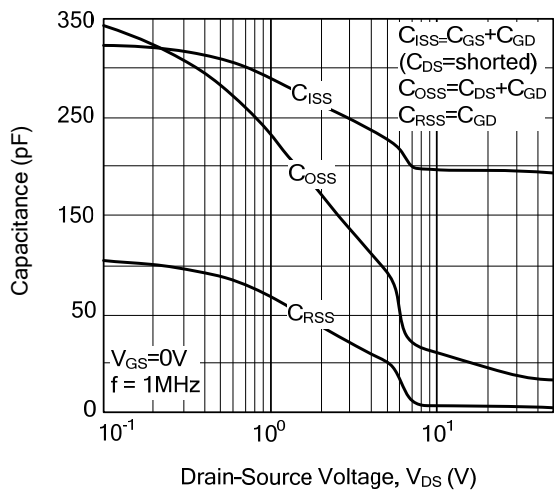
On-Resistance vs. Drain Current



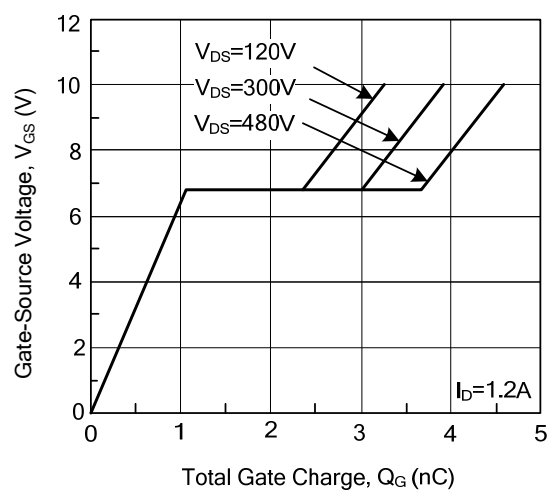
Source- Drain Diode Forward Voltage



Capacitance vs. Drain-Source Voltage

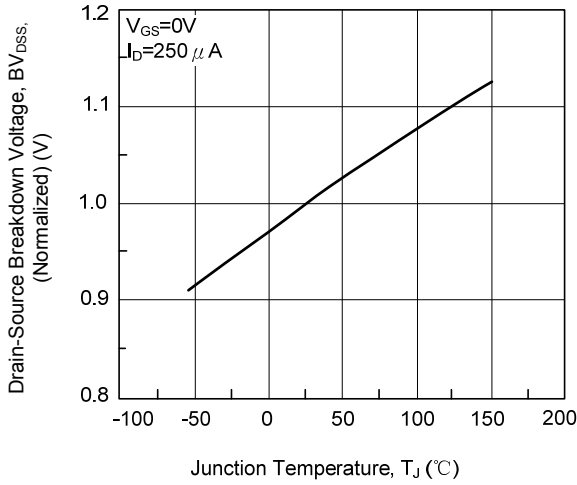


Gate Charge vs. Gate-Source Voltage

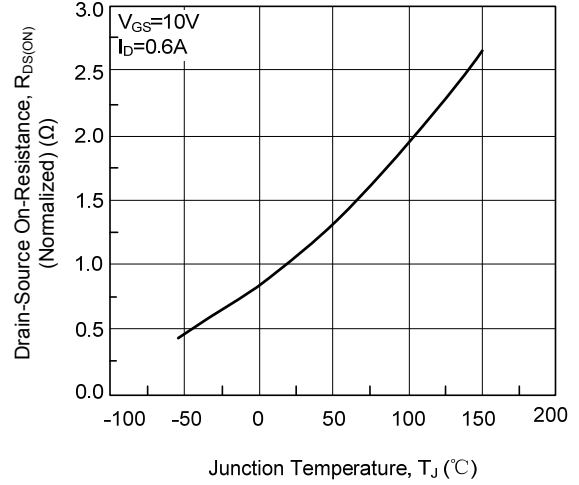


## TYPICAL CHARACTERISTICS(Cont.)

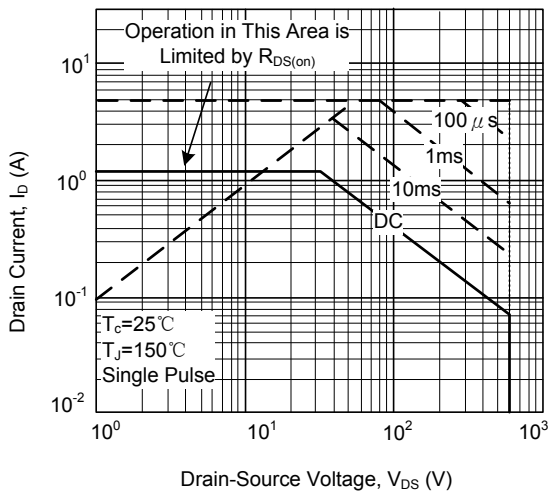
Breakdown Voltage vs. Temperature



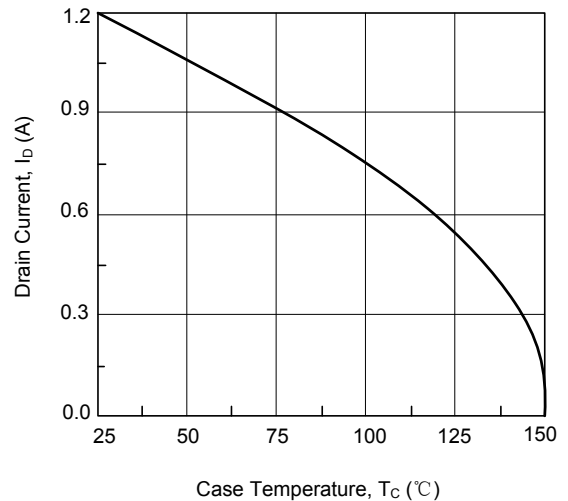
On-Resistance vs. Temperature



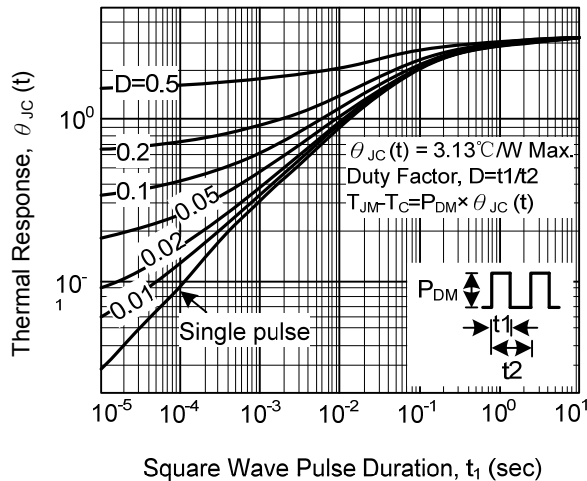
Max. Safe Operating Area



Max. Drain Current vs. Case Temperature



Thermal Response



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