



5NM70-U2

Power MOSFET

5.4A, 700V N-CHANNEL SUPER-JUNCTION MOSFET

■ DESCRIPTION

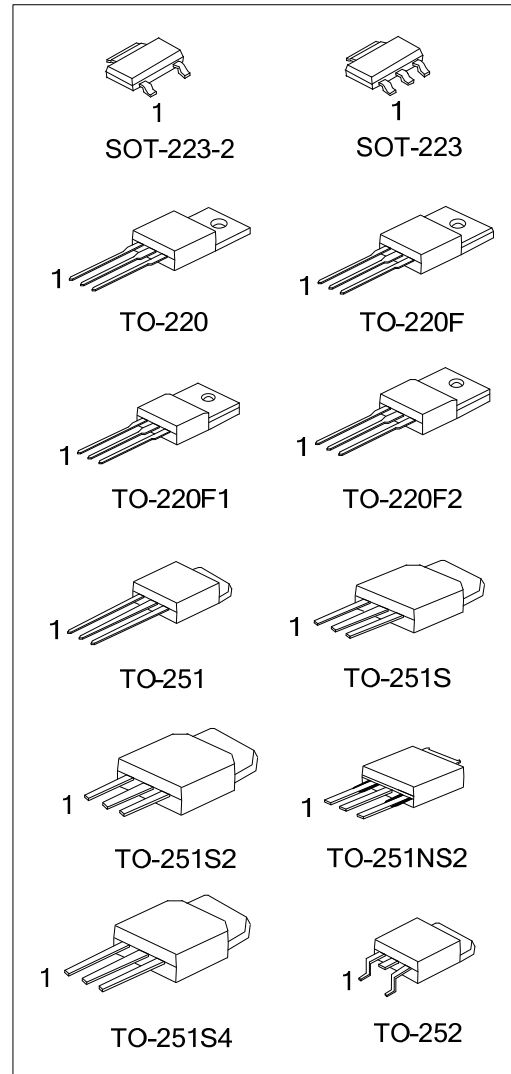
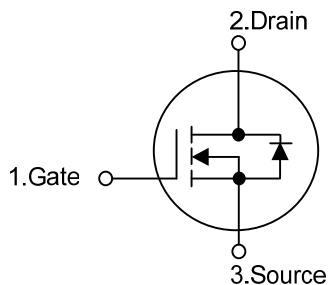
The UTC **5NM70-U2** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics.

This power MOSFET is usually used in high speed switching applications at power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.

■ FEATURES

- * $R_{DS(ON)} \leq 1.5 \Omega$ @ $V_{GS} = 10V$, $I_D = 1.25A$
- * Fast Switching Capability
- * Improved dv/dt Capability, High Ruggedness

■ SYMBOL



ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5NM70L-AA2-R	5NM70G-AA2-R	SOT-223-2	G	D	S	Tape Reel
5NM70L-AA3-R	5NM70G-AA3-R	SOT-223	G	D	S	Tape Reel
5NM70L-TA3-T	5NM70G-TA3-T	TO-220	G	D	S	Tube
5NM70L-TF1-T	5NM70G-TF1-T	TO-220F1	G	D	S	Tube
5NM70L-TF2-T	5NM70G-TF2-T	TO-220F2	G	D	S	Tube
5NM70L-TF3-T	5NM70G-TF3-T	TO-220F	G	D	S	Tube
5NM70L-TM3-T	5NM70G-TM3-T	TO-251	G	D	S	Tube
5NM70L-TMS-T	5NM70G-TMS-T	TO-251S	G	D	S	Tube
5NM70L-TMS2-T	5NM70G-TMS2-T	TO-251S2	G	D	S	Tube
5NM70L-TMS4-T	5NM70G-TMS4-T	TO-251S4	G	D	S	Tube
5NM70L-TMN2-T	5NM70G-TMN2-T	TO-251NS2	G	D	S	Tube
5NM70L-TN3-R	5NM70G-TN3-R	TO-252	G	D	S	Tape Reel

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

5NM70G-AA2-R (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) AA2: SOT-223-2, AA3: SOT-223, TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TM3: TO-251, TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, TMN2: TO-251NS2 (3) G: Halogen Free and Lead Free, L: Lead Free
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MARKING

SOT-223-2 / SOT-223	TO-220 / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-251S TO-251S2 / TO-251S4 / TO-252 / TO-251NS2
5NM70□ U2 □□□□ Version Code ← → L: Lead Free → G: Halogen Free → Date Code 1	UTC 5NM70□ U2 □□□□□ Version Code ← ← Lot Code → L: Lead Free → G: Halogen Free → Date Code 1

■ **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}	±30	V
Drain Current	Continuous	T _C =25°C	I _D	5.4	A
		T _C =100°C		3.4	A
	Pulsed (Note 2)		I _{DM}	20	A
Avalanche Current (Note 2)			I _{AR}	1.2	A
Avalanche Energy	Single Pulsed (Note 3)		E _{AS}	104	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	4.0	V/ns
Power Dissipation	SOT-223-2/SOT-223		P _D	5	W
	TO-220			108	W
	TO-220F/TO-220F1			36	W
	TO-220F2				
	TO-251/TO-251S			54	W
	TO-251S2/TO-251S4				
TO-251NS2/TO-252					
Junction Temperature			T _J	+150	°C
Storage Temperature			T _{STG}	-55 ~ +150	°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. $L = 144\text{mH}$, $I_{AS} = 1.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 5.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223-2/SOT-223	θ_{JA}	160	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F TO-220F1/TO-220F2		62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-251NS2/TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-223-2/SOT-223	θ_{JC}	25	$^\circ\text{C}/\text{W}$
	TO-220		1.16	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2		3.47	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-251NS2/TO-252		2.3	$^\circ\text{C}/\text{W}$

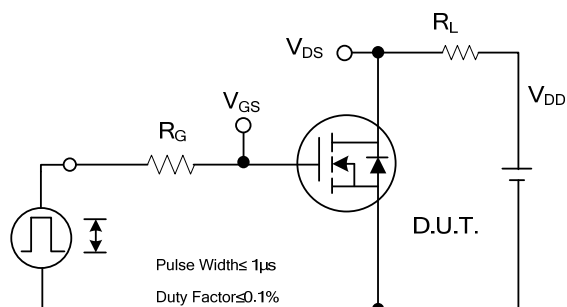
■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	700			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =700V, V _{GS} =0V			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
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	2.5		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =1.25A			1.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		280		pF
Output Capacitance		C _{OSS}			135		pF
Reverse Transfer Capacitance		C _{RSS}			18		pF
Gate Resistance		R _G	V _{GS} =0V, V _{DS} =0V, f=1.0MHz		2.3		Ω
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =50V, V _{GS} =10V, I _D =1.3A (Note 1, 2)		15		nC
Gate to Source Charge		Q _{GS}			5		nC
Gate to Drain Charge		Q _{GD}			4		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DD} =30V, V _{GS} =10V, I _D =0.5A, R _G =25Ω (Note 1, 2)		5		ns
Rise Time		t _R			10		ns
Turn-OFF Delay Time		t _{D(OFF)}			50		ns
Fall-Time		t _F			60		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				5	A
Maximum Body-Diode Pulsed Current		I _{SM}				20	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =5.0A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =5.0A, V _{GS} =0V,		290		ns
Body Diode Reverse Recovery Charge		Q _{rr}	dI _F /dt=100A/μs		2.5		μC

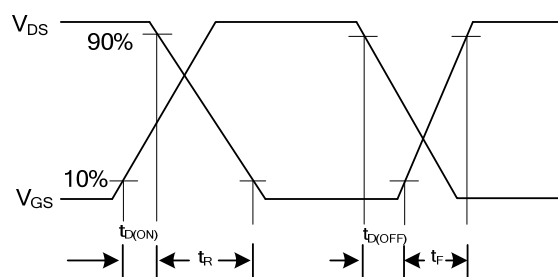
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

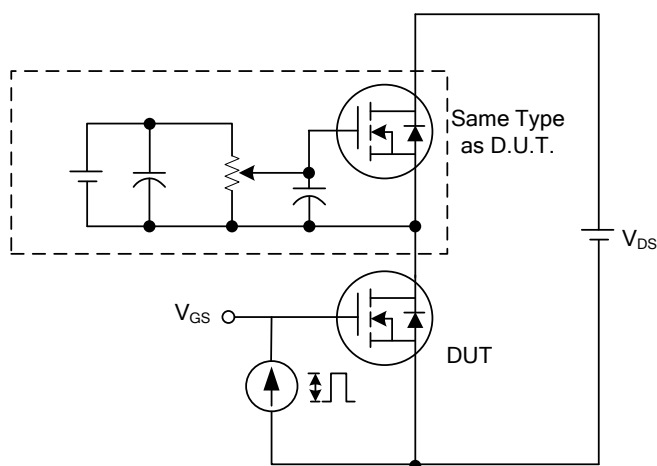
■ TEST CIRCUITS AND WAVEFORMS



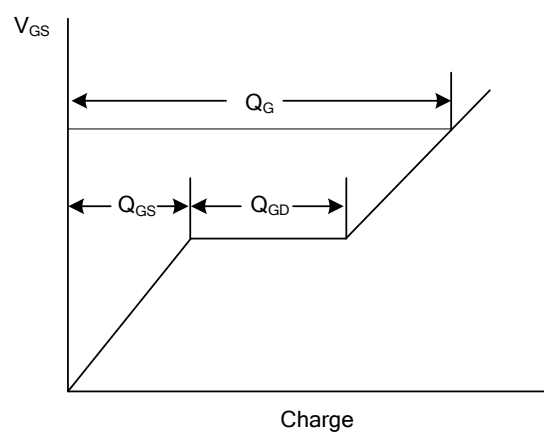
Switching Test Circuit



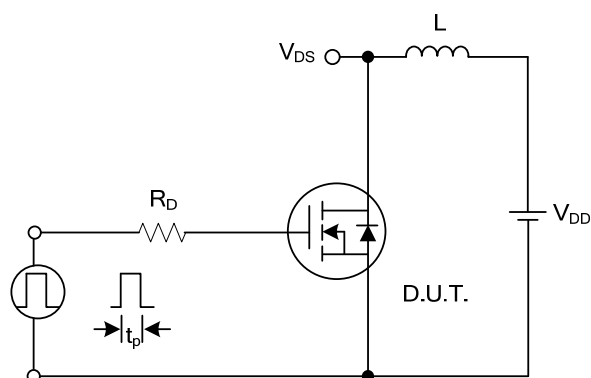
Switching Waveforms



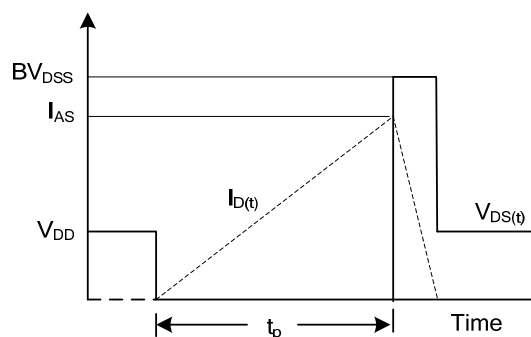
Gate Charge Test Circuit



Gate Charge Waveform

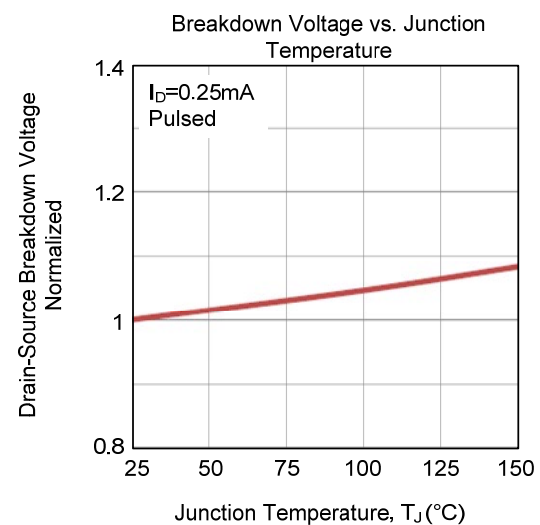
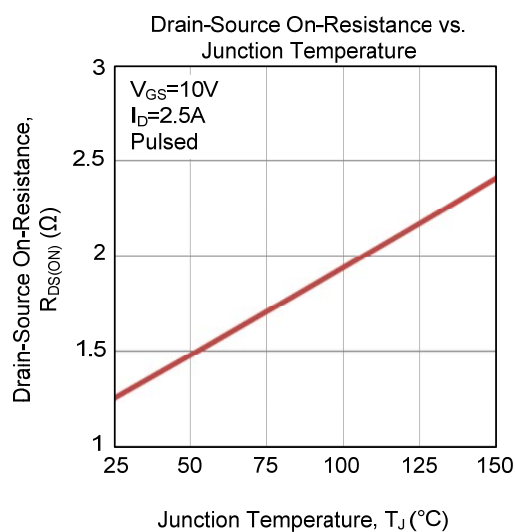
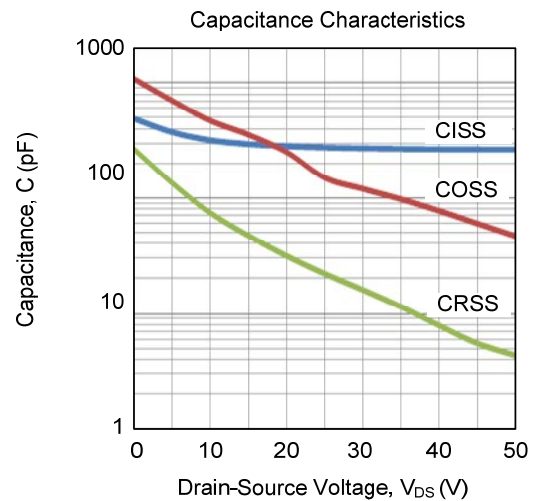
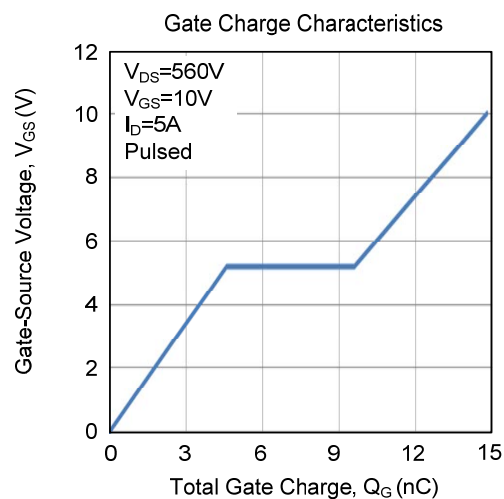
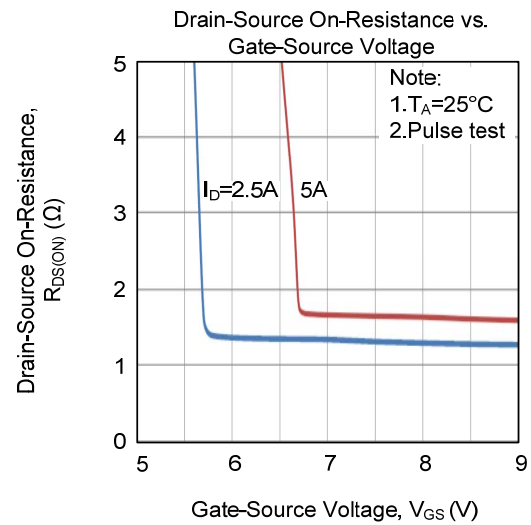
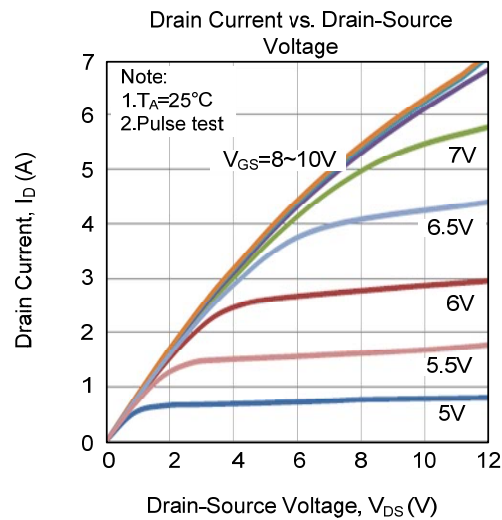


Unclamped Inductive Switching Test Circuit

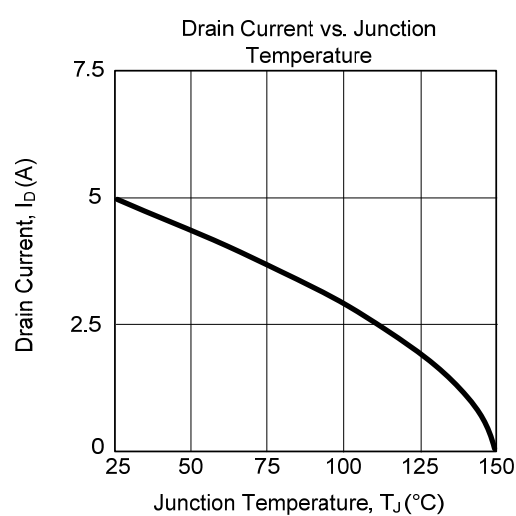
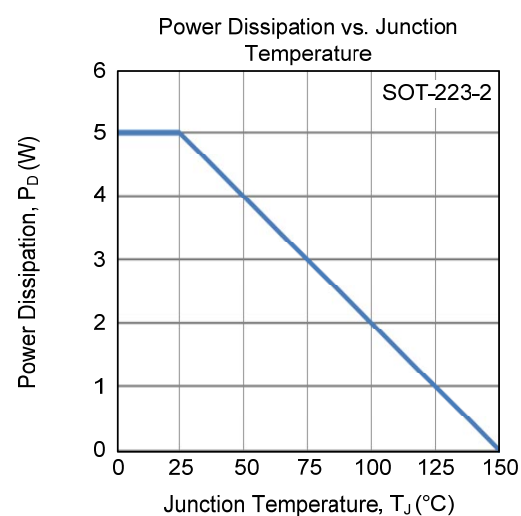
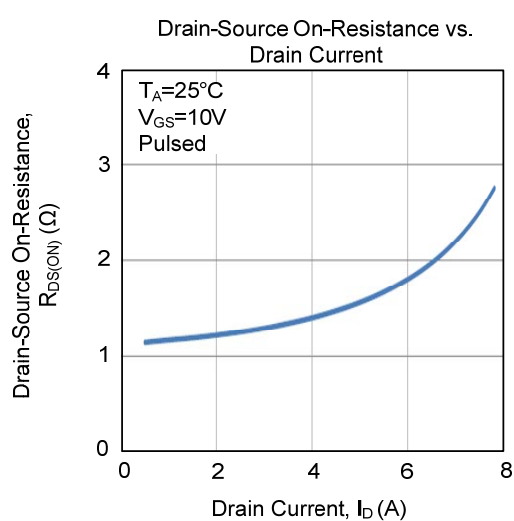
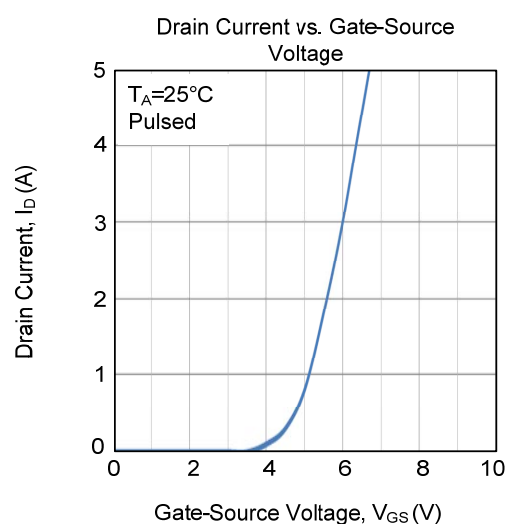
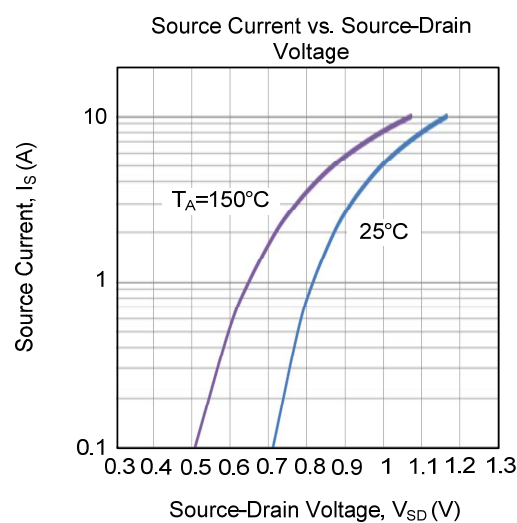
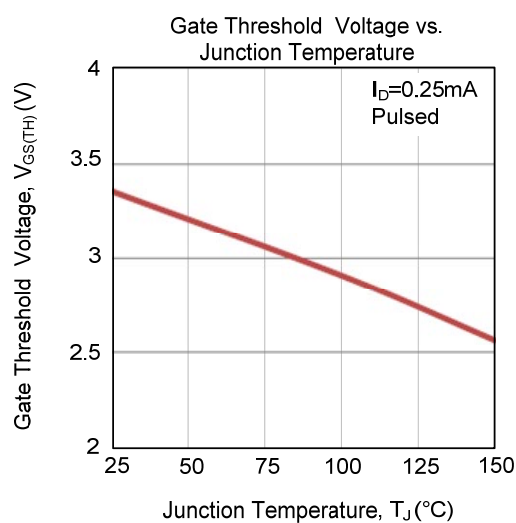


Unclamped Inductive Switching Waveforms

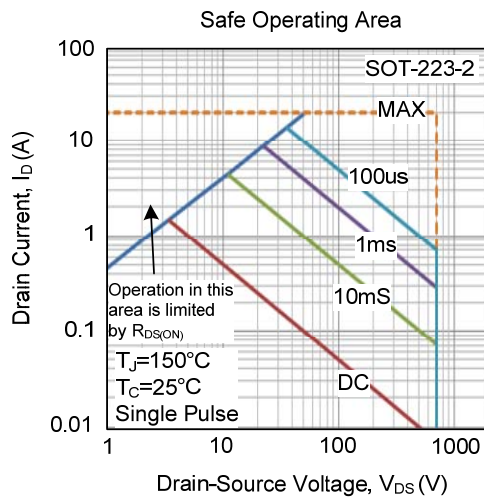
■ TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (Cont.)



TYPICAL CHARACTERISTICS (Cont.)



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