



9NM70

Power MOSFET

9A, 700V N-CHANNEL SUPER-JUNCTION MOSFET

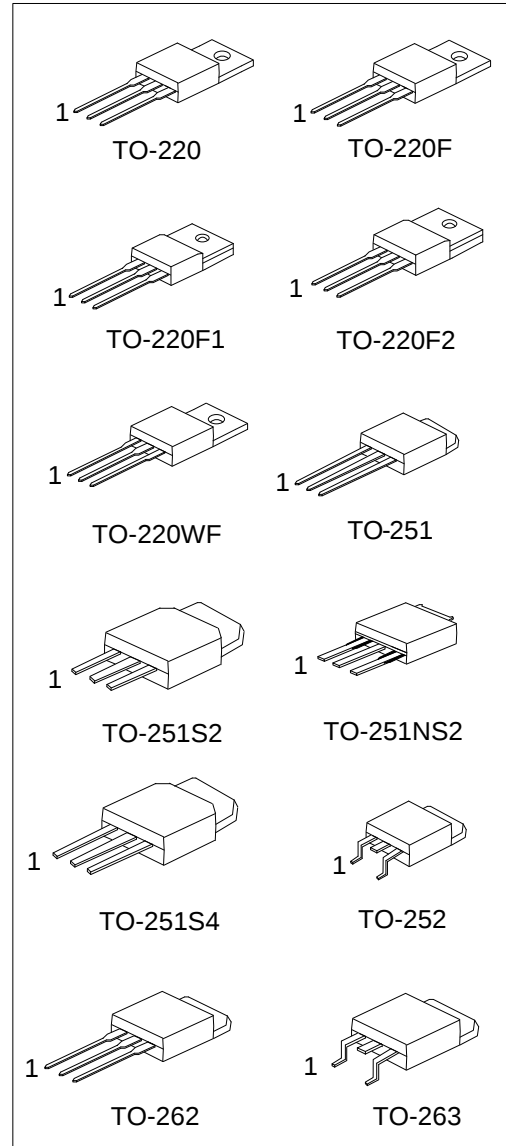
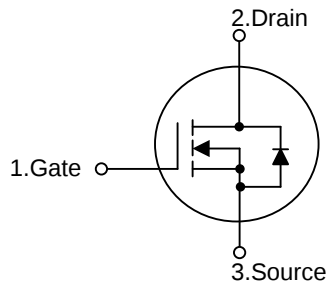
■ DESCRIPTION

The UTC 9NM70 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 a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

■ FEATURES

- * $R_{DS(ON)} \leq 0.7 \Omega$ @ $V_{GS}=10V$, $I_D=4.5A$
- * High switching Speed
- * 100% avalanche tested
- * Improved dv/dt capability

■ SYMBOL



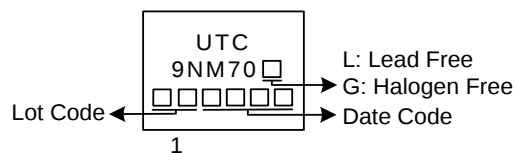
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
9NM70L-TA3-T	9NM70G-TA3-T	TO-220	G	D	S	Tube
9NM70L-TF1-T	9NM70G-TF1-T	TO-220F1	G	D	S	Tube
9NM70L-TF2-T	9NM70G-TF2-T	TO-220F2	G	D	S	Tube
9NM70L-TF3-T	9NM70G-TF3-T	TO-220F	G	D	S	Tube
9NM70L-TW1-T	9NM70G-TW1-T	TO-220WF	G	D	S	Tube
9NM70L-TM3-T	9NM70G-TM3-T	TO-251	G	D	S	Tube
9NM70L-TMS2-T	9NM70G-TMS2-T	TO-251S2	G	D	S	Tube
9NM70L-TMS4-T	9NM70G-TMS4-T	TO-251S4	G	D	S	Tube
9NM70L-TMN2-T	9NM70G-TMN2-T	TO-251NS2	G	D	S	Tube
9NM70L-TN3-R	9NM70G-TN3-R	TO-252	G	D	S	Tape Reel
9NM70L-T2Q-T	9NM70G-T2Q-T	TO-262	G	D	S	Tube
9NM70L-TQ2-T	9NM70G-TQ2-T	TO-263	G	D	S	Tube
9NM70L-TQ2-R	9NM70G-TQ2-R	TO-263	G	D	S	Tape Reel

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

9NM70G-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TW1: TO-220WF, TM3: TO-251, TMS2: TO-251S2, TMS4: TO-251S4, TMN2: TO-251NS2, TN3: TO-252, T2Q: TO-262, TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free
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■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	700	V
Gate-Source Voltage		V_{GS}	± 30	V
Drain Current	Continuous	I_D	9	A
	Pulsed (Note 2)	I_{DM}	18	A
Avalanche Current		I_{AR}	3.0	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	270	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	5.2	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	80	W
	TO-220F/TO-220F1		28	W
	TO-220F2/TO-220WF			
	TO-251/TO-251S2		57	W
	TO-251S4/TO-251NS2 TO-252			
Junction Temperature		T_J	+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. $L=60\text{mH}$, $I_{AS}=3.0\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$.

4. $I_{SD} \leq 9.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$.

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220WF/TO-262 TO-263	θ_{JA}	62.5	$^{\circ}\text{C/W}$
	TO-251/TO-251S2 TO-251S4/TO-251NS2 TO-252		110	
Junction to Case	TO-220/TO-220WF TO-262/TO-263	θ_{JC}	1.56	$^{\circ}\text{C/W}$
	TO-220F/TO-220F1 TO-220F2		4.46	
	TO-251/TO-251S2 TO-251S4/TO-251NS2 TO-252		2.19 (Note)	

Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

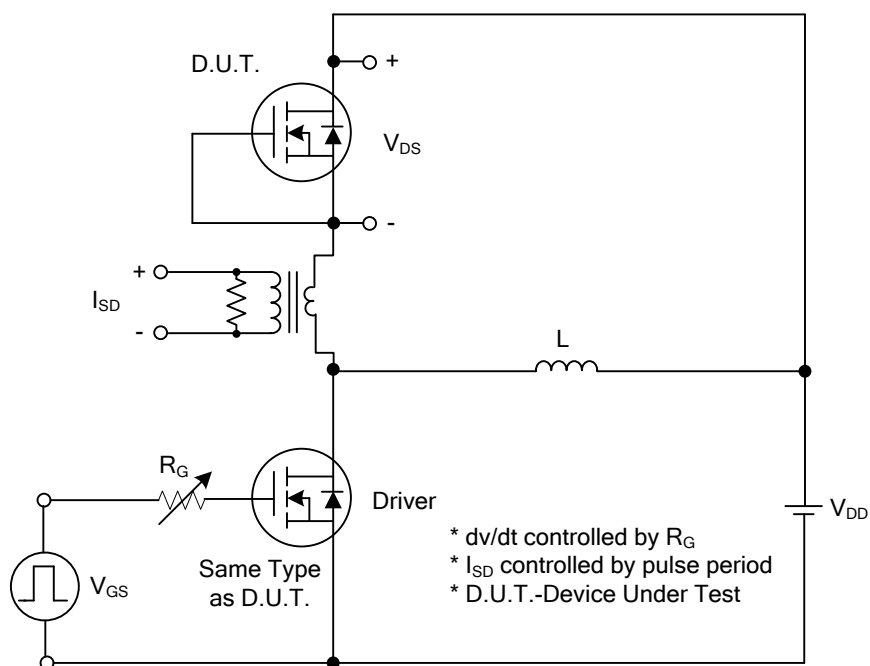
ELECTRICAL CHARACTERISTICS ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	I _D =1mA, V _{GS} =0V	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			+100	nA
	Reverse		V _{GS} =-30V			-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 =4.5A			0.7	Ω
			V _{GS} =10V, I _D =4.5A, T _J =100°C			1.3	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		620		pF
Output Capacitance		C _{OSS}			240		pF
Reverse Transfer Capacitance		C _{RSS}			19		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =560V, V _{GS} =10V, I _D =9A , I _G =100μA (Note 1, 2)		23		nC
Gate to Source Charge		Q _{GS}			8		nC
Gate to Drain Charge		Q _{GD}			6		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =9A, R _G =25Ω (Note 1, 2)		10		ns
Rise Time		t _R			19		ns
Turn-OFF Delay Time		t _{D(OFF)}			62		ns
Fall-Time		t _F			42		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				9	A
Maximum Body-Diode Pulsed Current		I _{SM}				18	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =9A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =9A, V _{GS} =0V,		350		ns
Body Diode Reverse Recovery Charge		Q _{rr}	dI _F /dt=100A/μs		4.1		μC

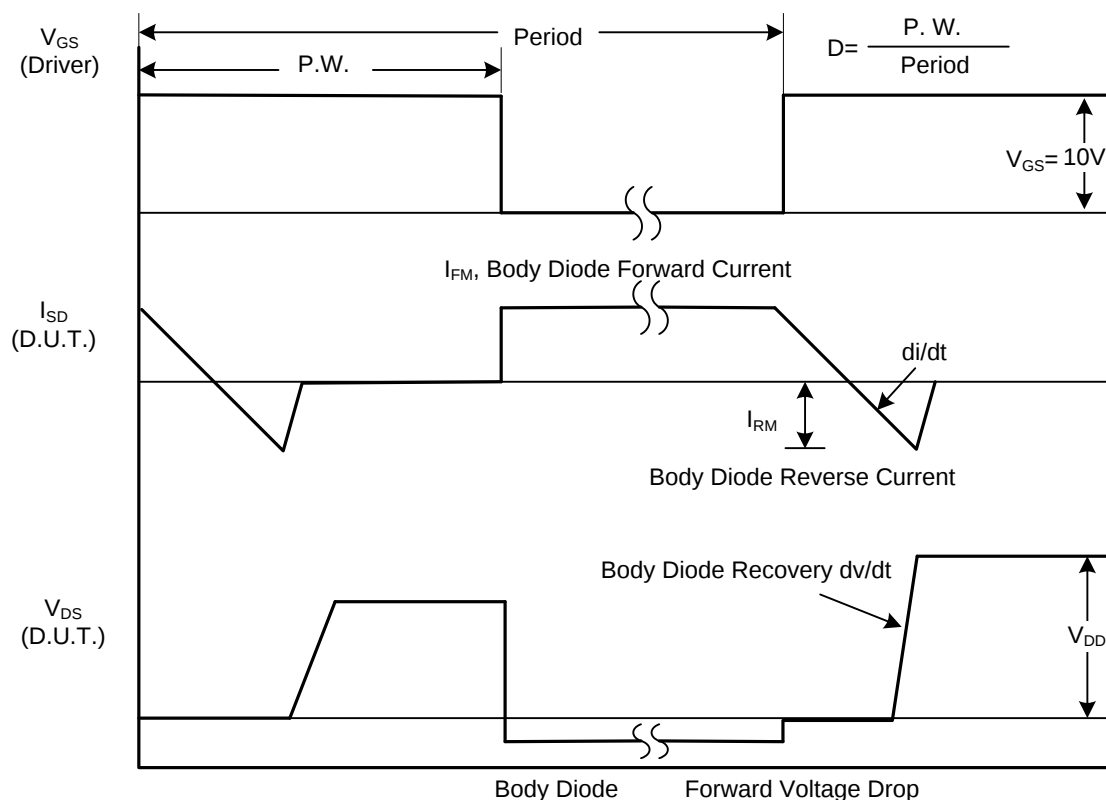
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

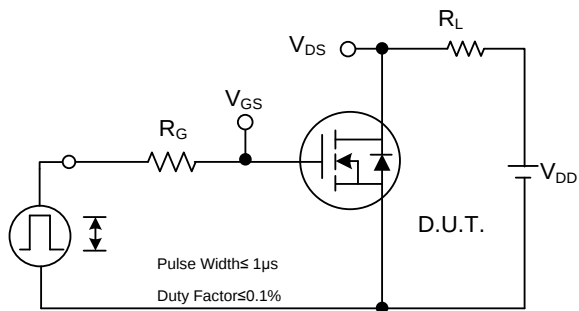


Peak Diode Recovery dv/dt Test Circuit

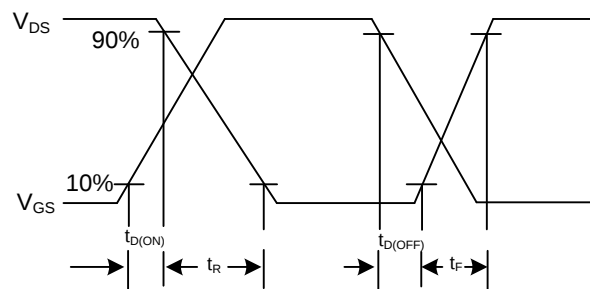


Peak Diode Recovery dv/dt Waveforms

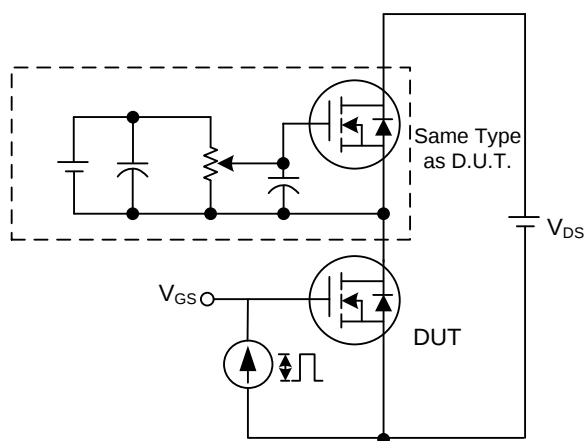
■ TEST CIRCUITS AND WAVEFORMS



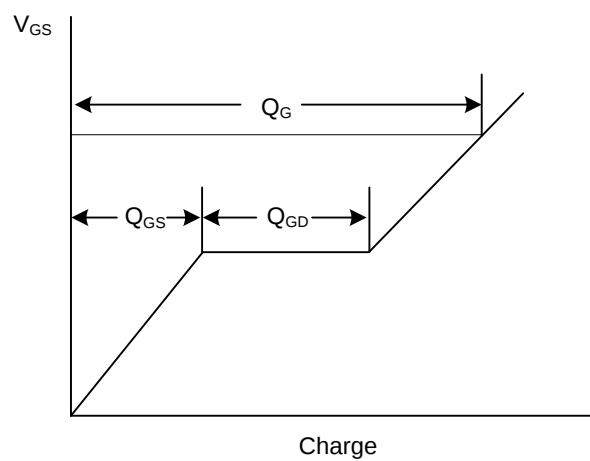
Switching Test Circuit



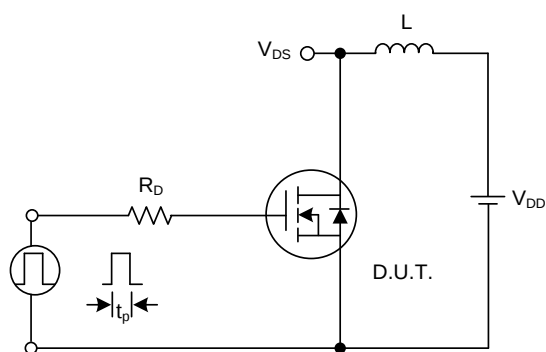
Switching Waveforms



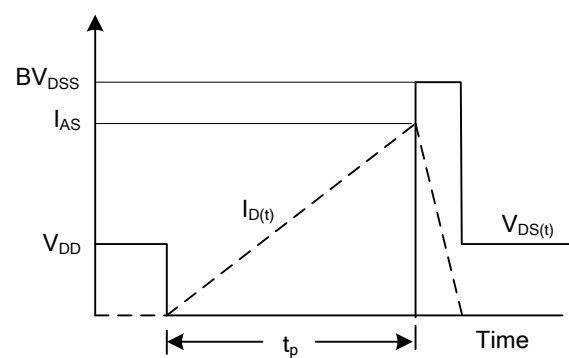
Gate Charge Test Circuit



Gate Charge Waveform

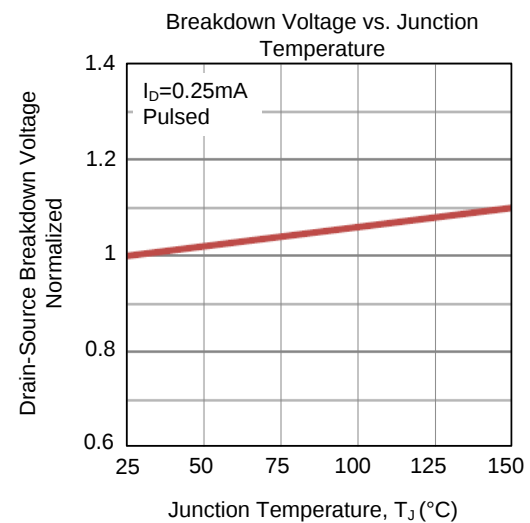
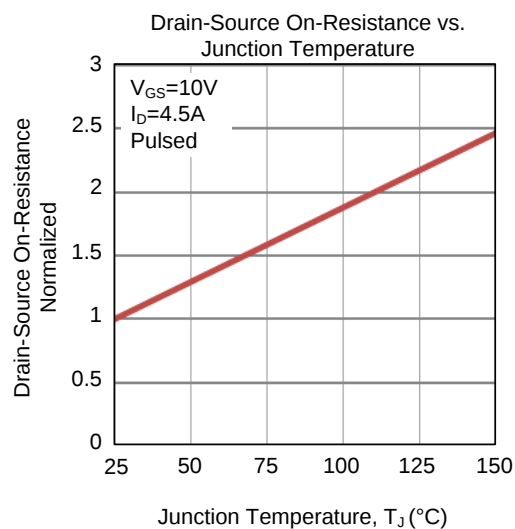
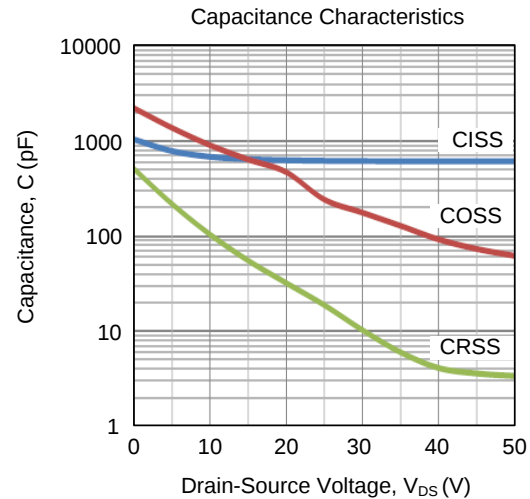
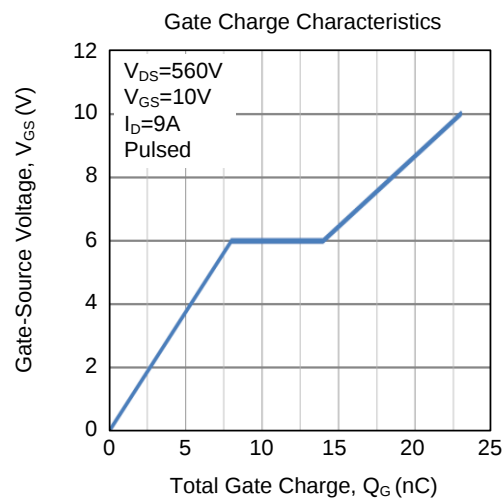
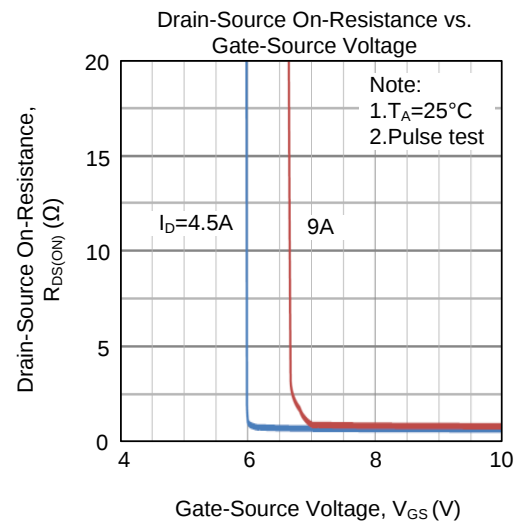
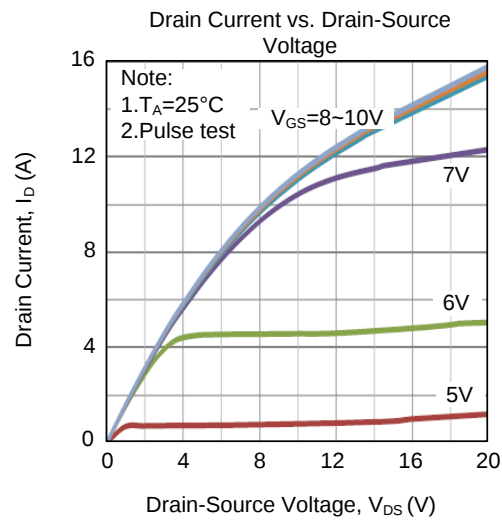


Unclamped Inductive Switching Test Circuit

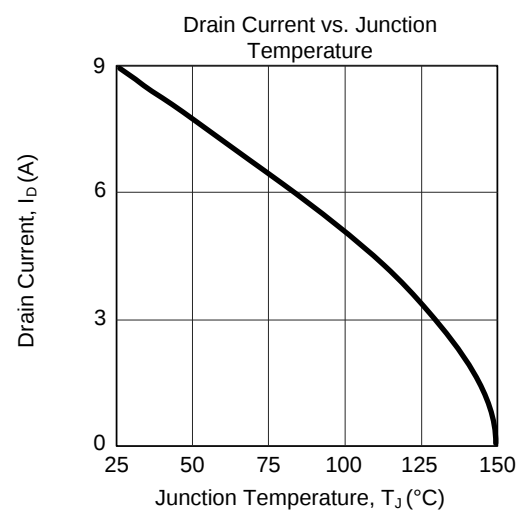
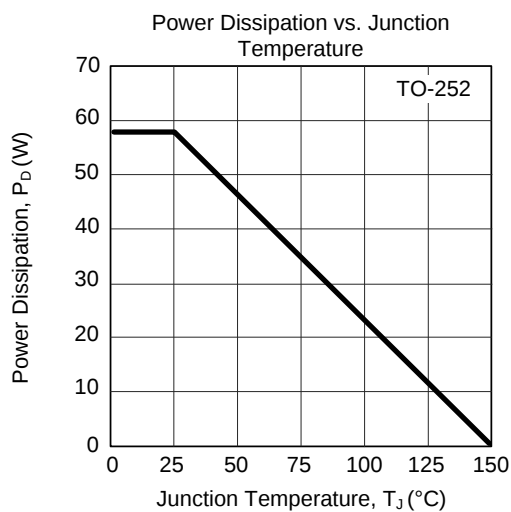
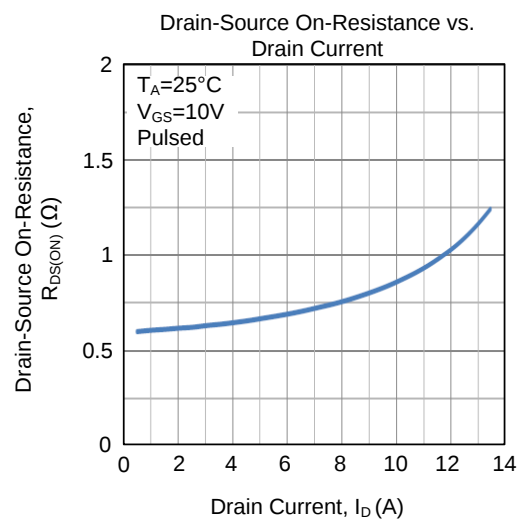
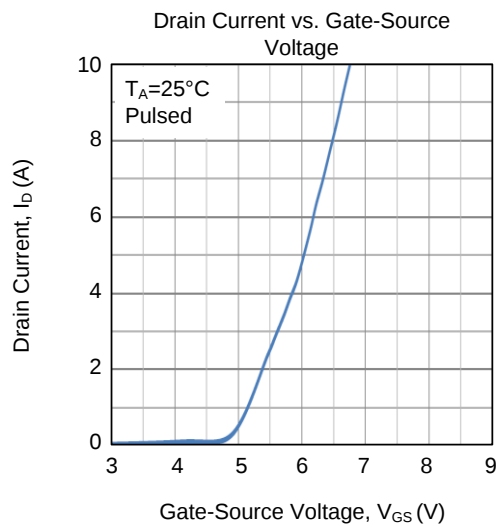
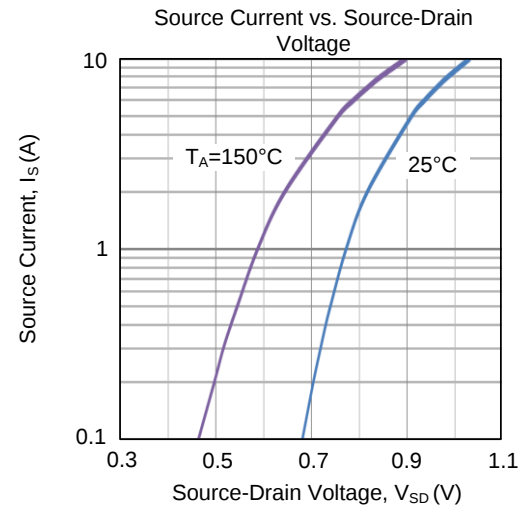
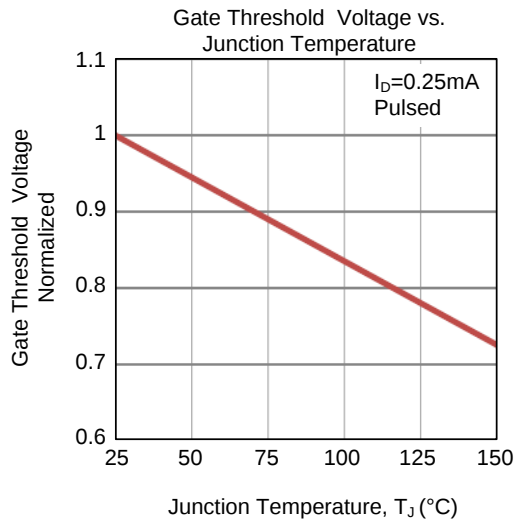


Unclamped Inductive Switching Waveforms

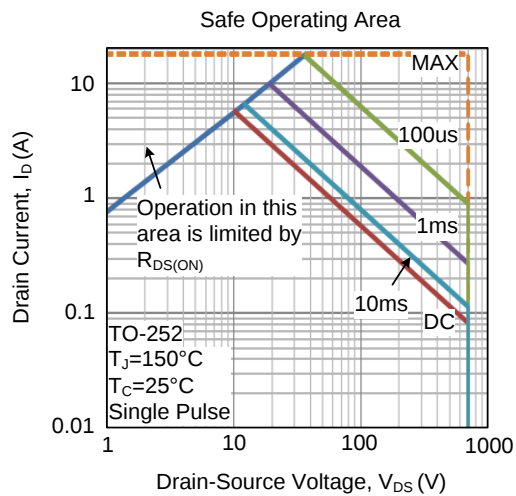
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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