



21NM65

Power MOSFET

21A, 650V N-CHANNEL POWER MOSFET

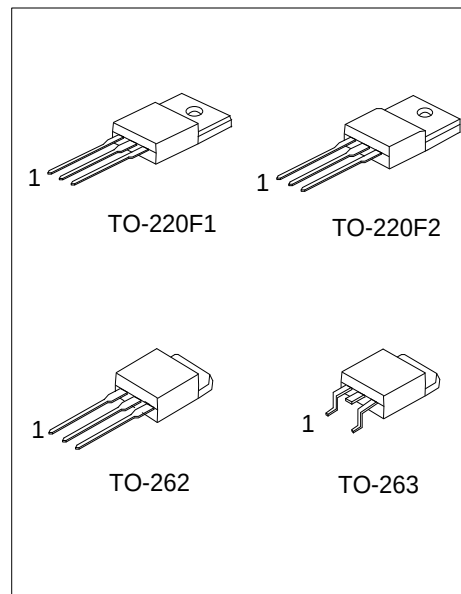
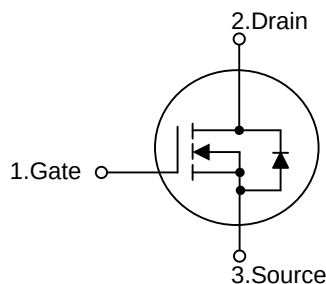
DESCRIPTION

The **UTC 21NM65** 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

- * $R_{DS(ON)} \leq 0.23 \Omega$ @ $V_{GS}=10V$, $I_D=10.5A$
- * High Switching Speed
- * 100% Avalanche Tested

SYMBOL



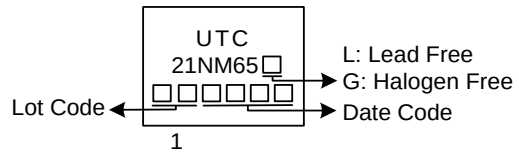
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
21NM65L-TF1-T	21NM65G-TF1-T	TO-220F1	G	D	S	Tube
21NM65L-TF2-T	21NM65G-TF2-T	TO-220F2	G	D	S	Tube
21NM65L-T2Q-T	21NM65G-T2Q-T	TO-262	G	D	S	Tube
21NM65L-TQ2-T	21NM65G-TQ2-T	TO-263	G	D	S	Tube
21NM65L-TQ2-R	21NM65G-TQ2-R	TO-263	G	D	S	Tape Reel

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

21NM65G-TF1-T (1) Packing Type (2) Package Type (3) Green Package		(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TF2: TO-220F2, 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°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V _{DSS}	650	V
Gate-Source Voltage		V _{GSS}	±30	V
Drain Current	Continuous	I _D	21	A
	Pulsed (Note 2)	I _{DM}	42	A
Avalanche Energy	Single Pulsed (Note 3)	E _{AS}	122	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	8.4	V/ns
Power Dissipation	TO-220F1/TO-220F2	P _D	34	W
	TO-262/TO-263		125	W
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 = 9.0mH, I_{AS} = 5.2A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

4. I_{SD} ≤ 21A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		θ _{JA}	62.5	°C/W
Junction to Case	TO-220F1/TO-220F2	θ _{JC}	3.67	°C/W
	TO-262/TO-263		1	°C/W

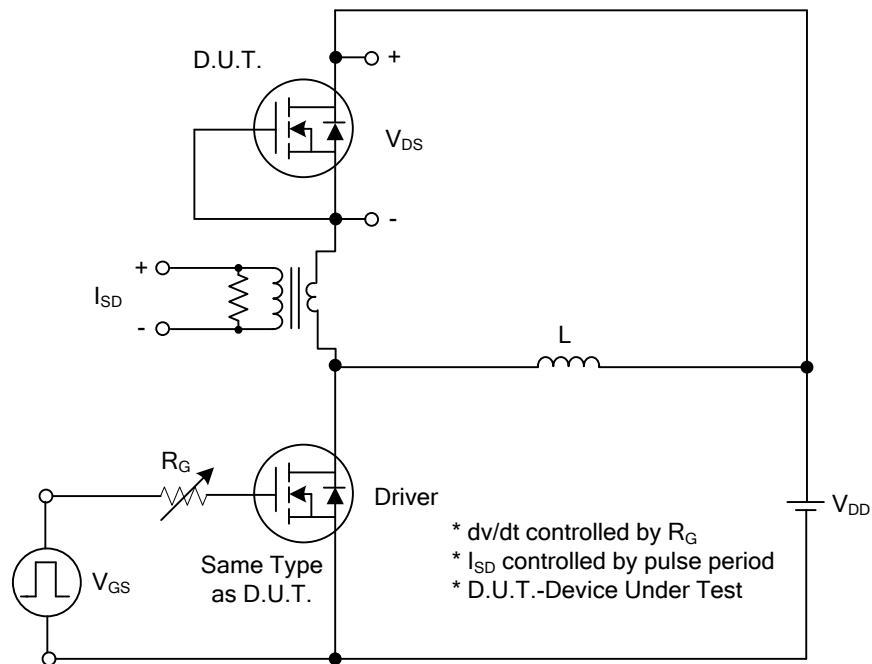
ELECTRICAL CHARACTERISTICS ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	$I_D=250\mu A, V_{GS}=0V$	650			V
Drain-Source Leakage Current		I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			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		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=10.5A$			0.23	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$		1500		pF
Output Capacitance		C_{OSS}			980		pF
Reverse Transfer Capacitance		C_{RSS}			51		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q_G	$V_{DS}=520V, V_{GS}=10V, I_D=21A$ $I_G=1mA$ (Note1, 2)		52		nC
Gate to Source Charge		Q_{GS}			8		nC
Gate to Drain Charge		Q_{GD}			18		nC
Turn-ON Delay Time		$t_{D(ON)}$	$V_{DS}=300V, V_{GS}=10V, I_D=15A,$ $R_G=25\Omega$ (Note1, 2)		26		ns
Rise Time		t_R			26		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			220		ns
Fall-Time		t_F			80		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				21	A
Maximum Body-Diode Pulsed Current		I_{SM}				42	A
Drain-Source Diode Forward Voltage		V_{SD}	$I_S=21A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time		t_{rr}	$I_S=21A, V_{GS}=0V,$		470		ns
Body Diode Reverse Recovery Charge		Q_{rr}	$dI_F/dt=100A/\mu s$ (Note 1)		8.6		μC

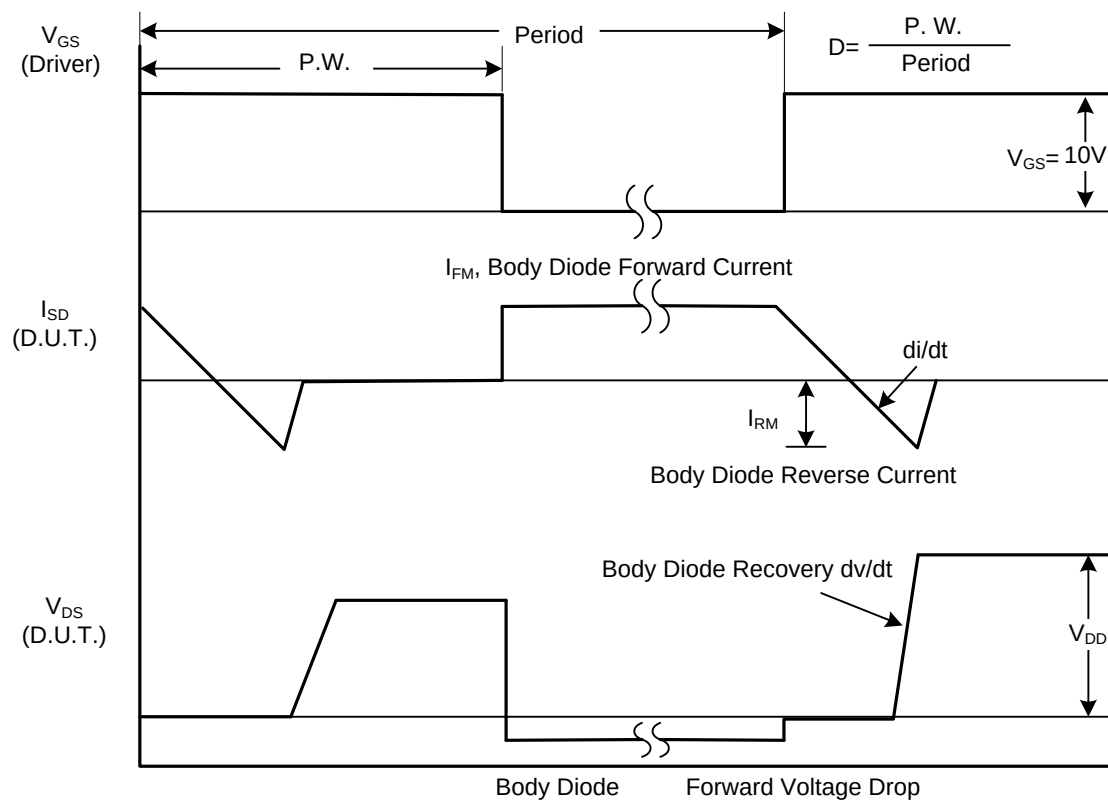
Notes: 1. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS



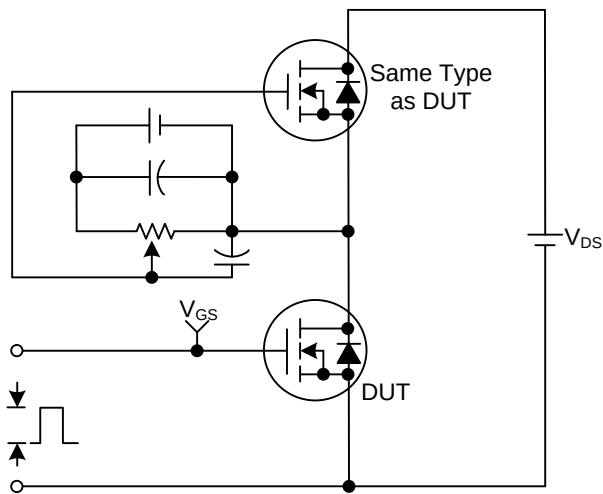
Peak Diode Recovery dv/dt Test Circuit



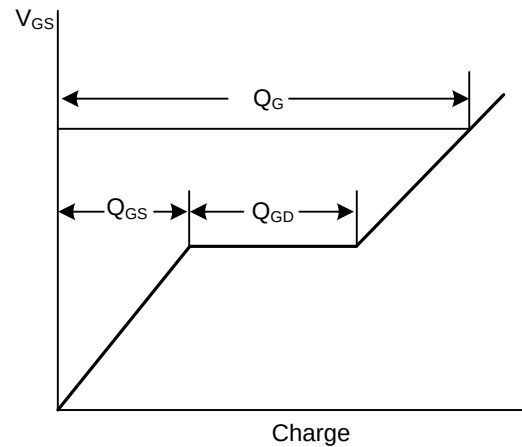
Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS

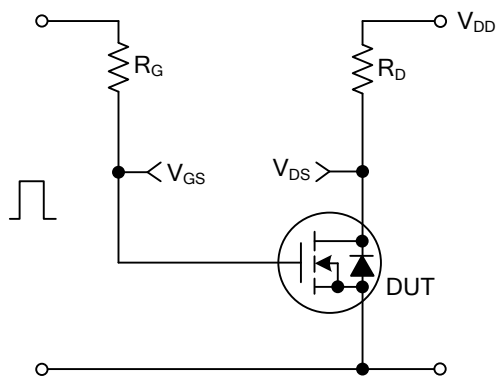
Gate Charge Test Circuit



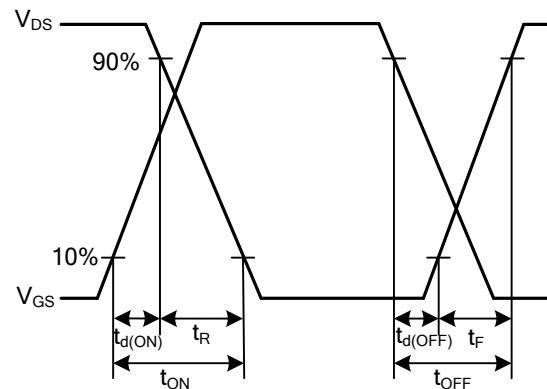
Gate Charge Waveforms



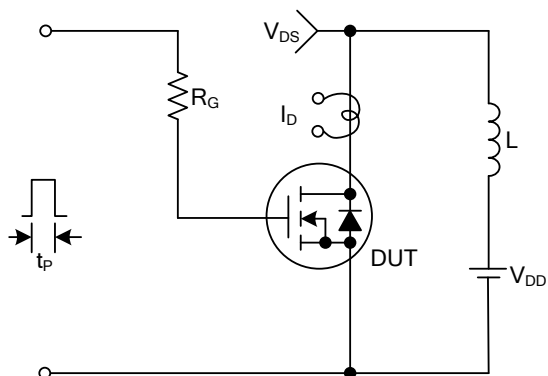
Resistive Switching Test Circuit



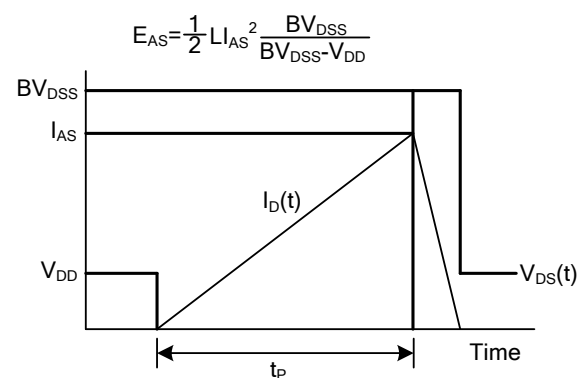
Resistive Switching Waveforms



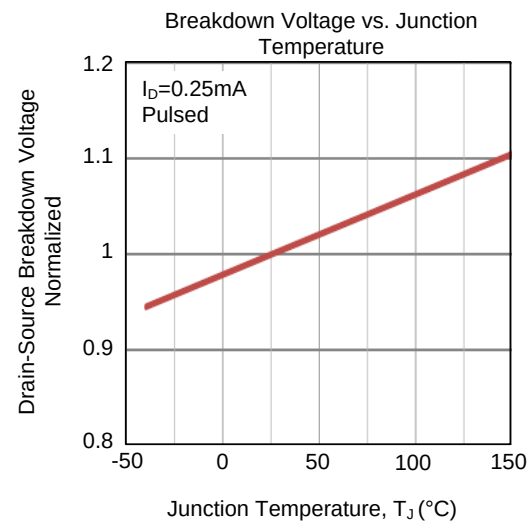
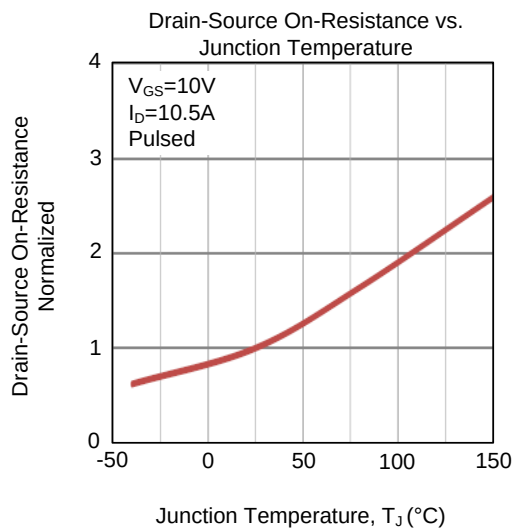
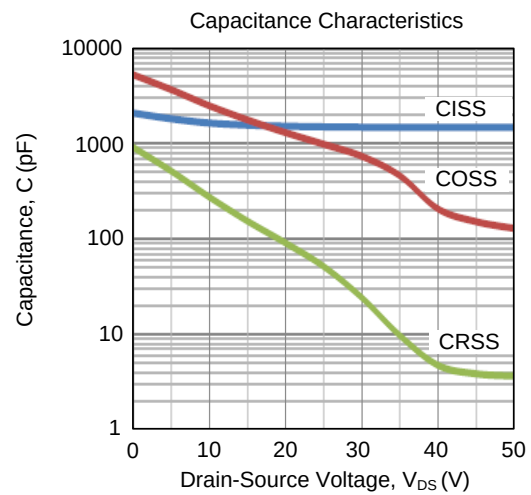
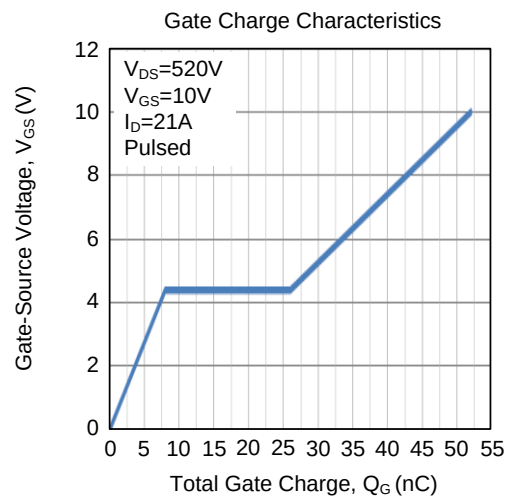
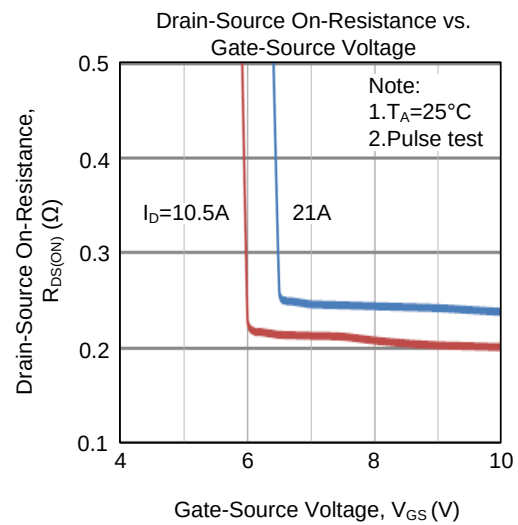
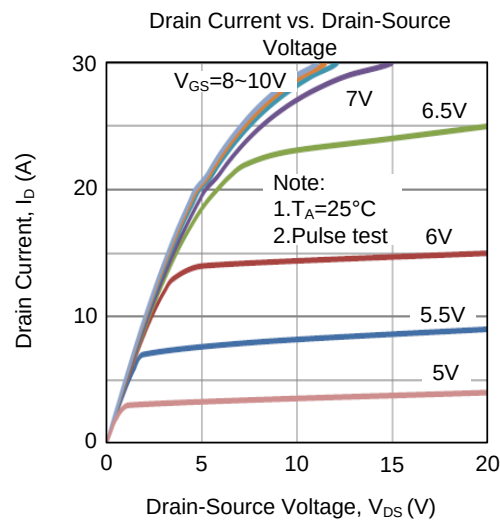
Unclamped Inductive Switching Test Circuit



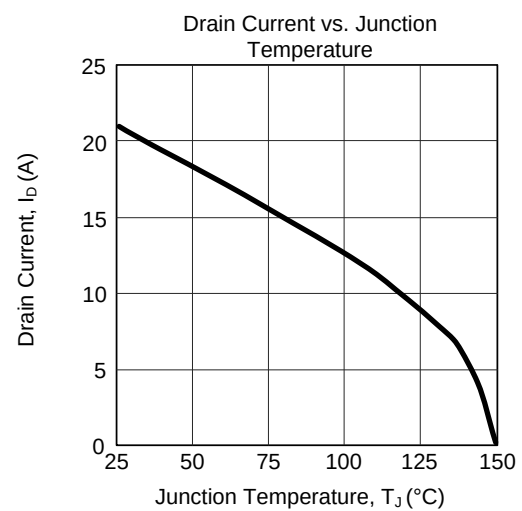
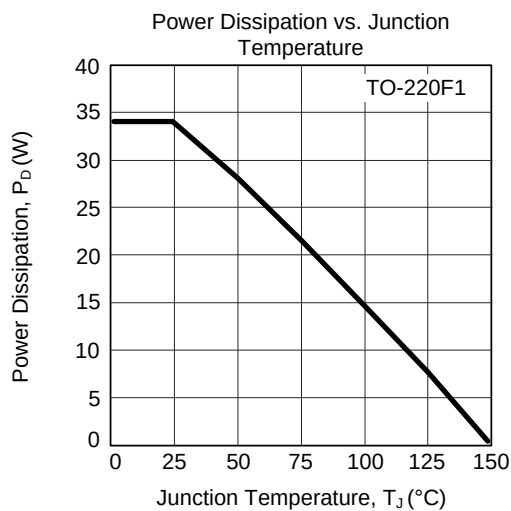
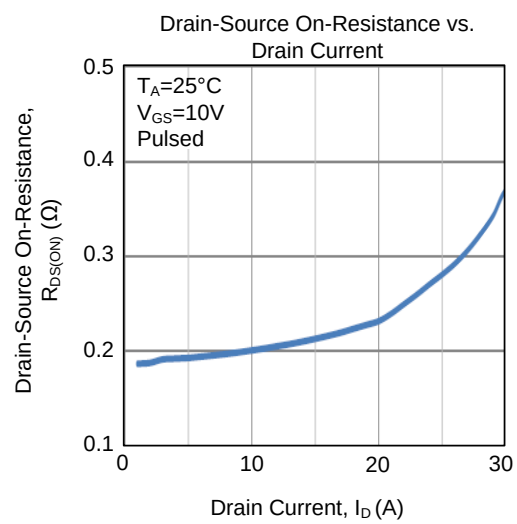
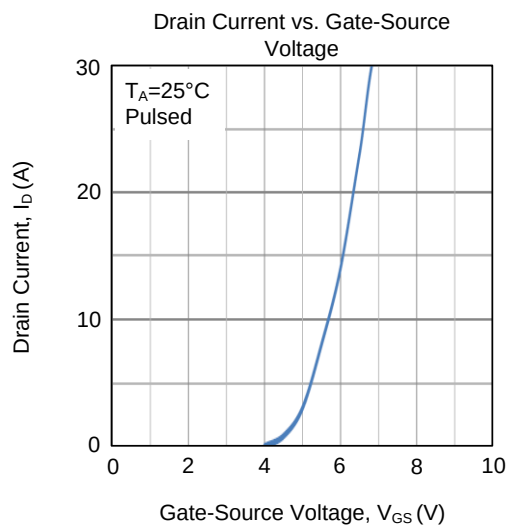
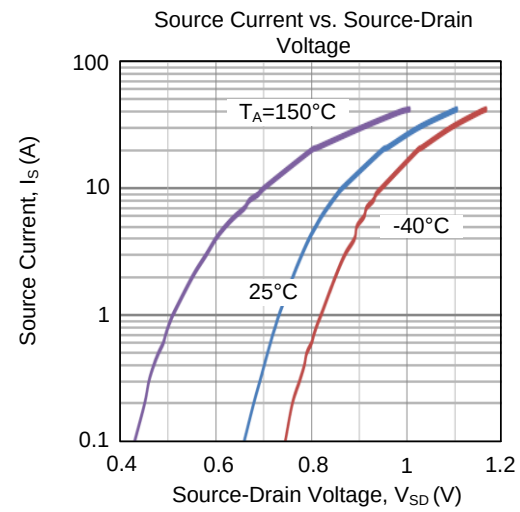
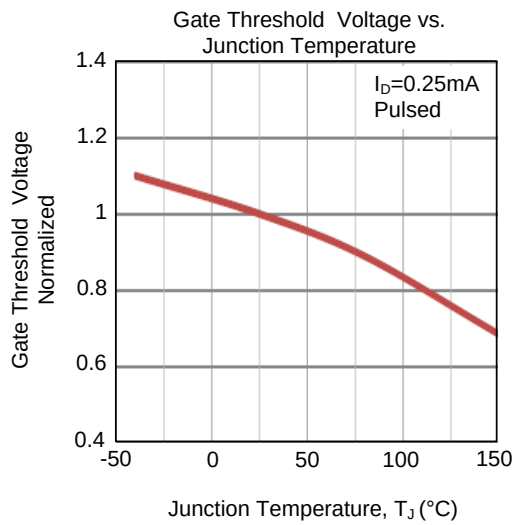
Unclamped Inductive Switching Waveforms



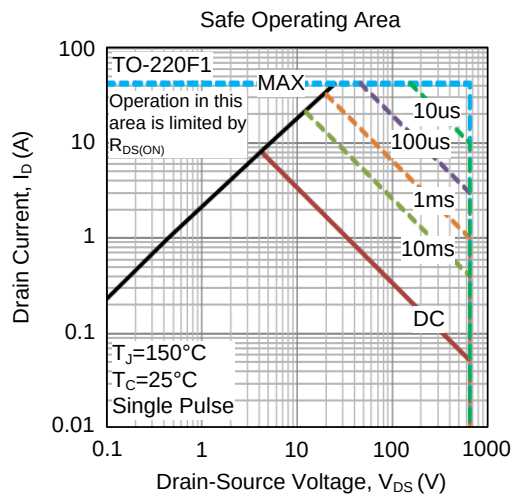
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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