



13NM65

Power MOSFET

13A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

DESCRIPTION

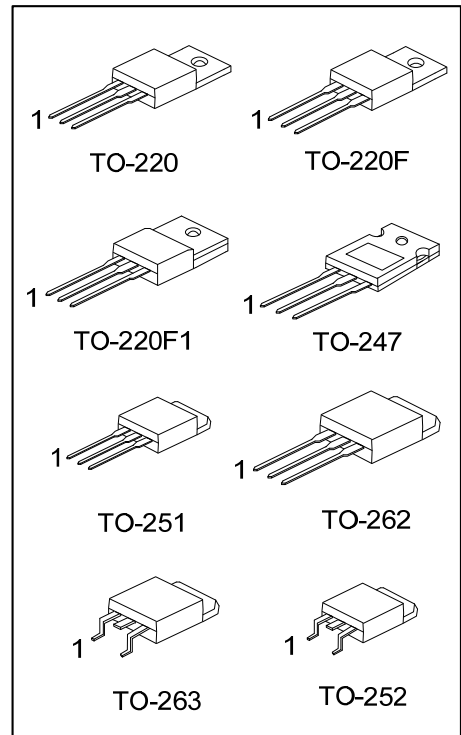
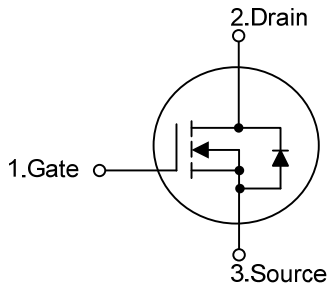
The UTC **13NM65** is a high voltage super junction MOSFET and is designed to have better characteristics.

The UTC **13NM65** Utilizing a advanced charge-balance technology, enhance system efficiency, improve EMI and reliability, such as low gate charge, low on-state resistance and have a high power density and high rugged avalanche characteristics. This super junction MOSFET usually used at AC/DC power conversion, and industrial power applications.

FEATURES

- * $R_{DS(ON)} \leq 0.43 \Omega @ V_{GS}=10V, I_D=6.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

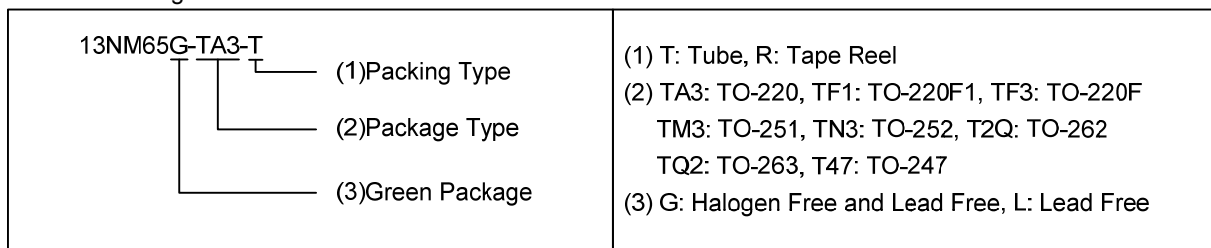
SYMBOL



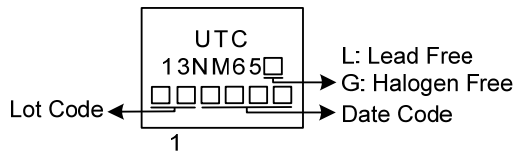
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13NM65L-TA3-T	13NM65G-TA3-T	TO-220	G	D	S	Tube
13NM65L-TF3-T	13NM65G-TF3-T	TO-220F	G	D	S	Tube
13NM65L-TF1-T	13NM65G-TF1-T	TO-220F1	G	D	S	Tube
13NM65L-TM3-T	13NM65G-TM3-T	TO-251	G	D	S	Tube
13NM65L-TN3-R	13NM65G-TN3-R	TO-252	G	D	S	Tape Reel
13NM65L-T2Q-T	13NM65G-T2Q-T	TO-262	G	D	S	Tube
13NM65L-TQ2-T	13NM65G-TQ2-T	TO-263	G	D	S	Tube
13NM65L-TQ2-R	13NM65G-TQ2-R	TO-263	G	D	S	Tape Reel
13NM65L-T47-T	13NM65G-T47-T	TO-247	G	D	S	Tube

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



MARKING



■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, 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	13	A
	Pulsed (Note 2)	I_{DM}	26	A
Avalanche Current (Note 2)		I_{AR}	2.4	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	452	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262 TO-263	P_D	92	W
	TO-220F/TO-220F1		30	W
	TO-251/TO-252		60	W
	TO-247		120	W
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. $L = 157 \text{ mH}$, $I_{AS} = 2.4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 13\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-262 TO-263	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
	TO-247		40	$^\circ\text{C}/\text{W}$
	TO-220/TO-262 TO-263		θ_{JC}	1.35
Junction to Case	TO-220F/TO-220F1	4.17		$^\circ\text{C}/\text{W}$
TO-251/TO-252	2.08	$^\circ\text{C}/\text{W}$		
TO-247	1.04	$^\circ\text{C}/\text{W}$		

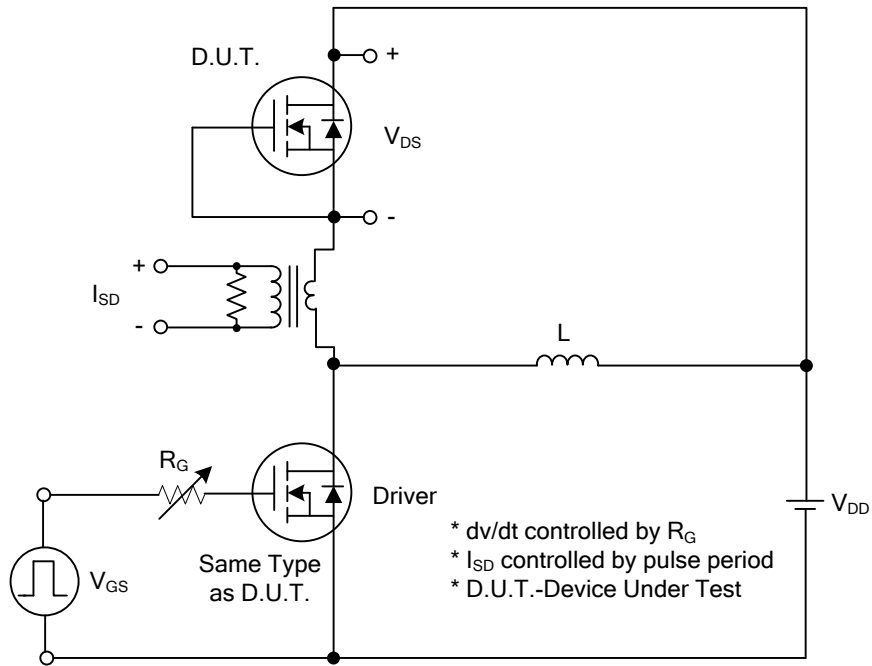
■ ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}			100	nA
	Reverse				-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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=6.5A$			0.43	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{GS}=0V, V_{DS}=25V, f=1.0\text{MHz}$		780		pF
Output Capacitance	C_{OSS}			590		pF
Reverse Transfer Capacitance	C_{RSS}			64		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q_G	$V_{DS}=520V, V_{GS}=10V$ $I_D=13A, I_G=1mA$ (Note 1,2)		28		nC
Gate-Source Charge	Q_{GS}			5		nC
Gate-Drain Charge	Q_{GD}			11		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=100V, V_{GS}=10V, I_D=13A,$ $R_G=25\Omega$ (Note 1,2)		12		nS
Turn-On Rise Time	t_R			26		nS
Turn-Off Delay Time	$t_{D(OFF)}$			82		nS
Turn-Off Fall Time	t_F			51		nS
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Maximum Continuous Drain-Source Diode Forward Current	I_S				13	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				26	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	$V_{GS}=0V, I_S=13A$			1.4	V
Reverse Recovery Time (Note 1)	t_{rr}	$V_{GS}=0V, I_S=13A,$ $di_F/dt=100A/\mu s$		376		nS
Reverse Recovery Charge	Q_{rr}			5.3		μC

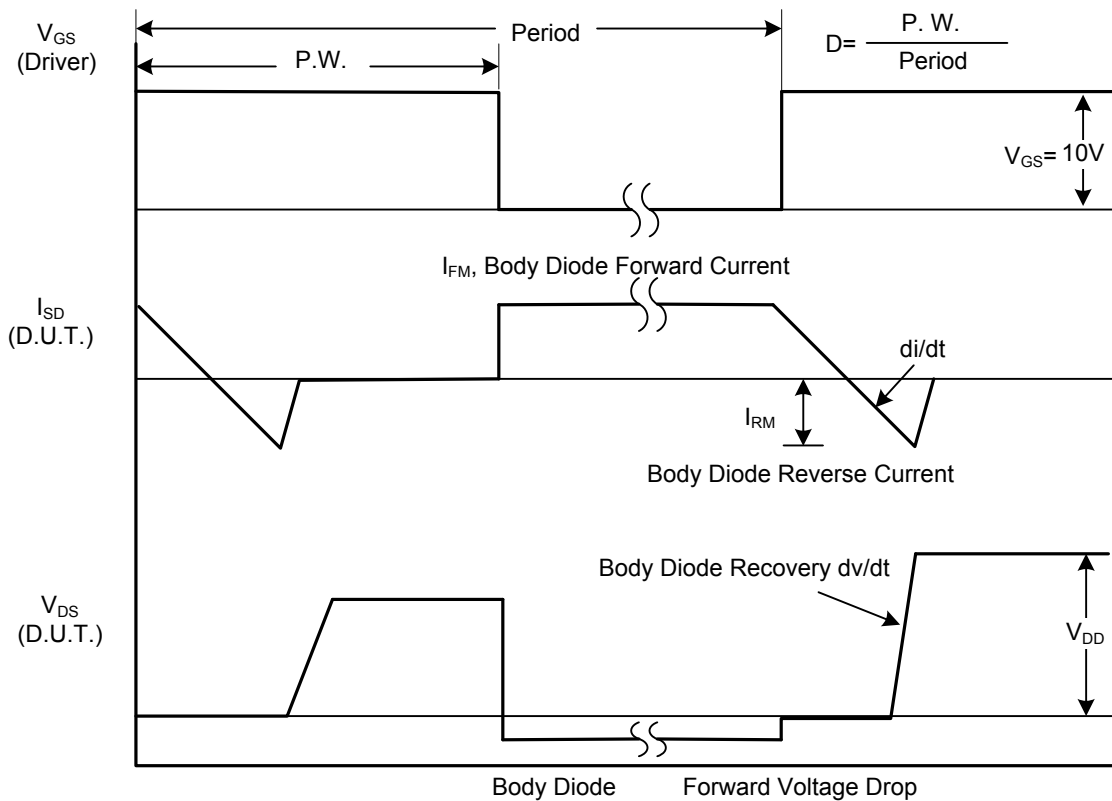
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS

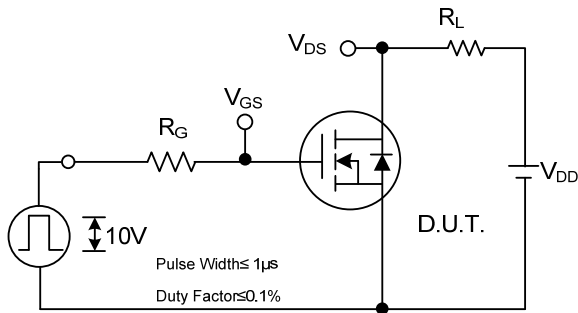


Peak Diode Recovery dv/dt Test Circuit



Peak Diode Recovery dv/dt Waveforms

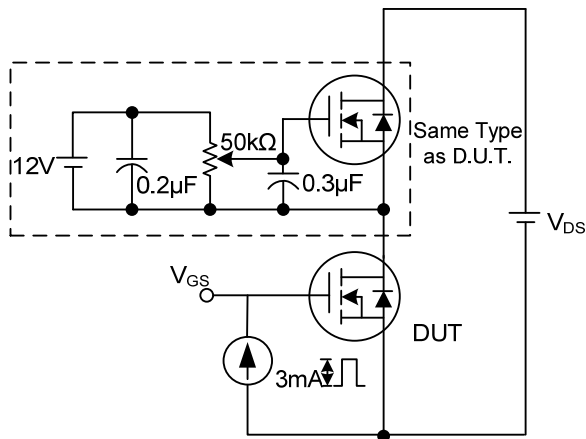
TEST CIRCUITS AND WAVEFORMS



Switching Test Circuit



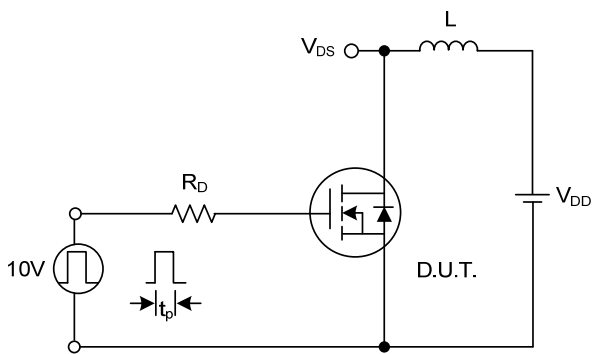
Switching Waveforms



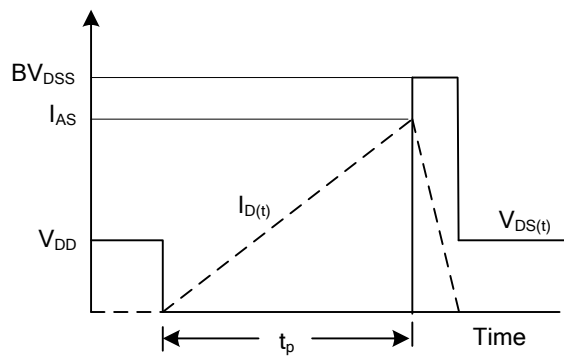
Gate Charge Test Circuit



Gate Charge Waveform

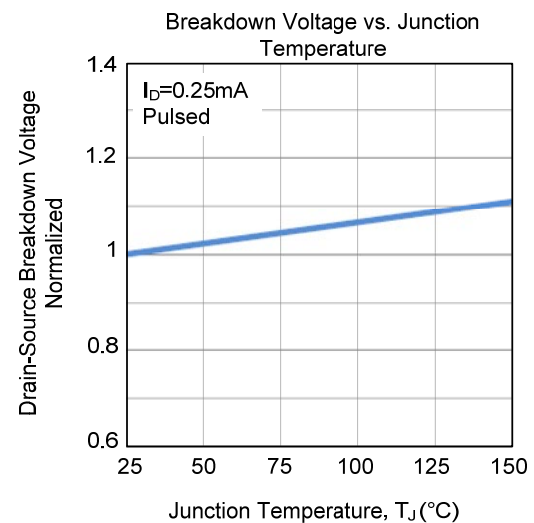
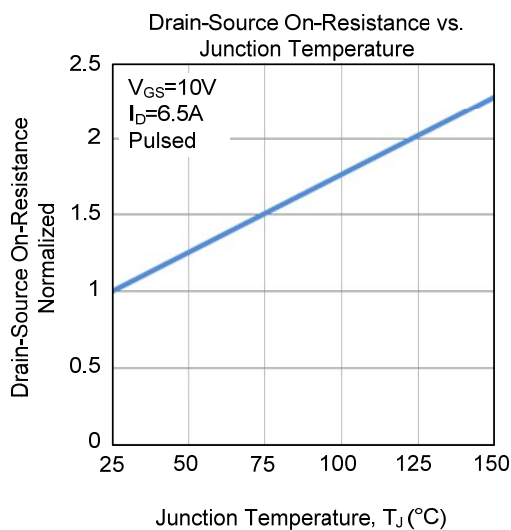
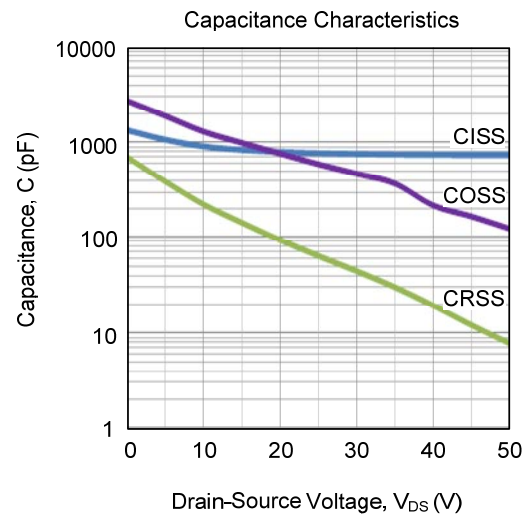
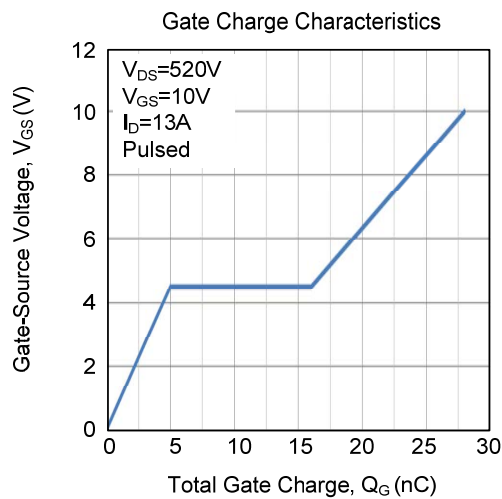
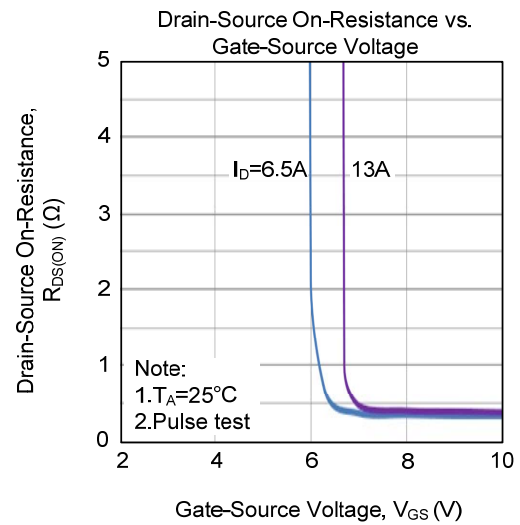
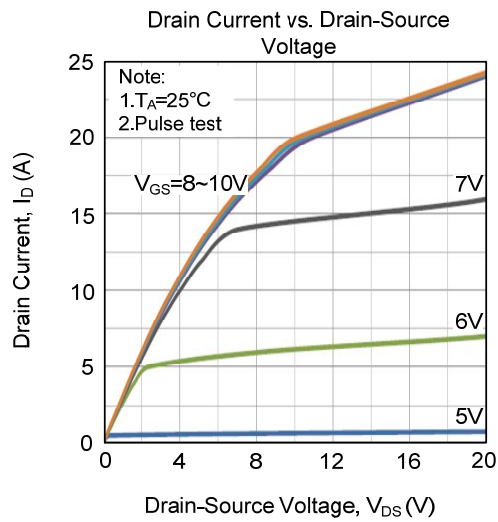


Unclamped Inductive Switching Test Circuit

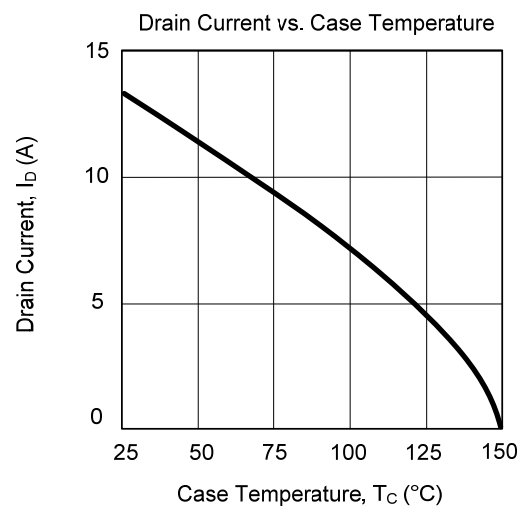
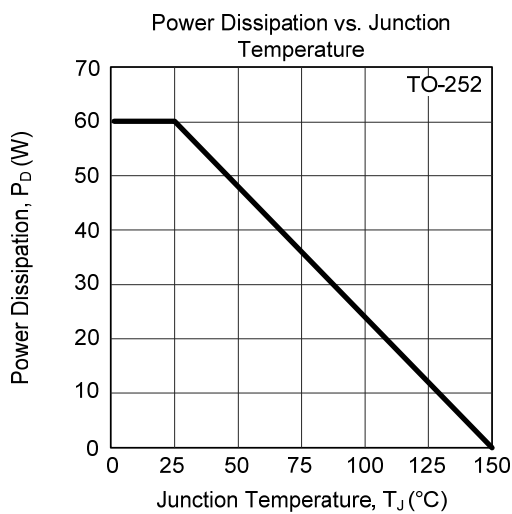
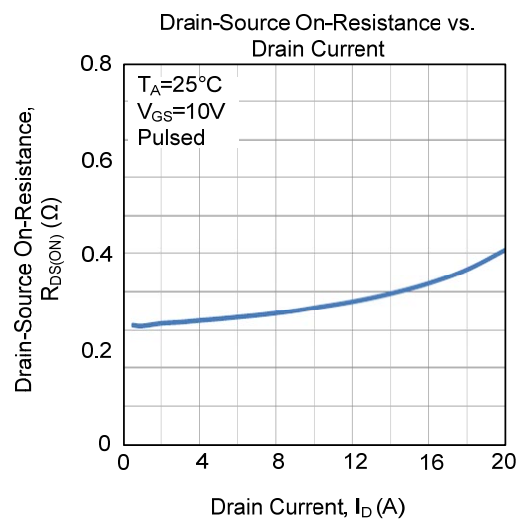
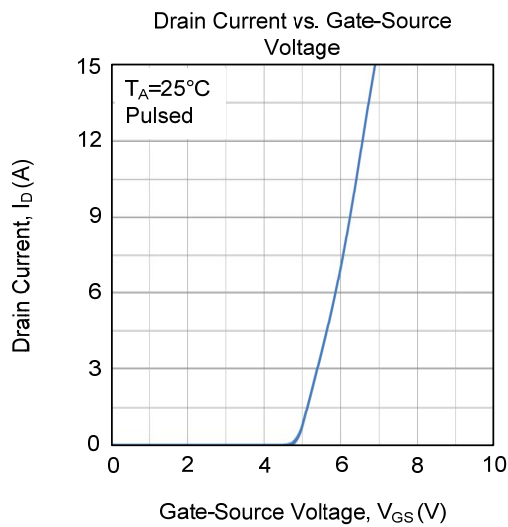
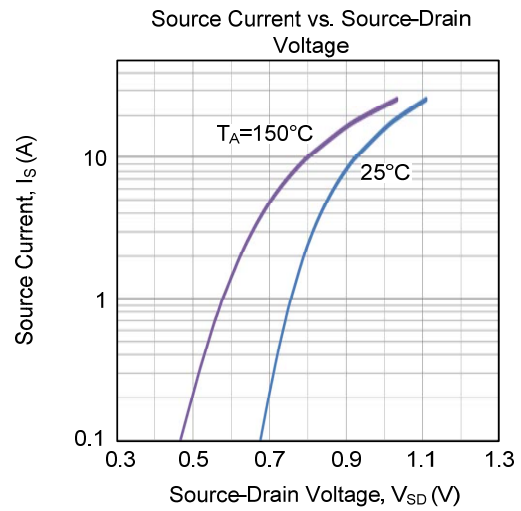
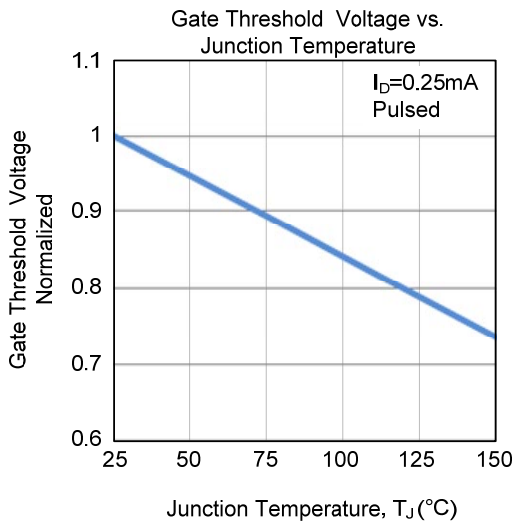


Unclamped Inductive Switching Waveforms

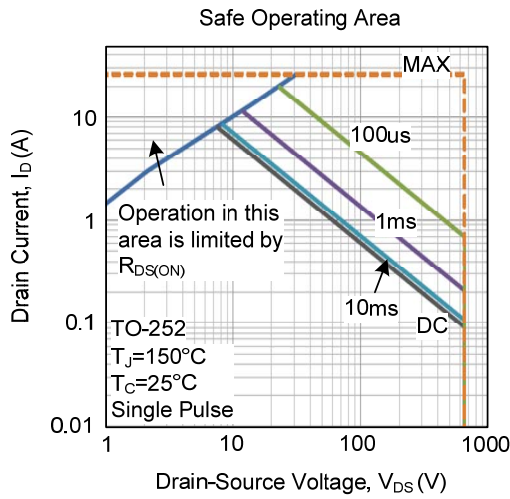
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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