



13NM60

Power MOSFET

13A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

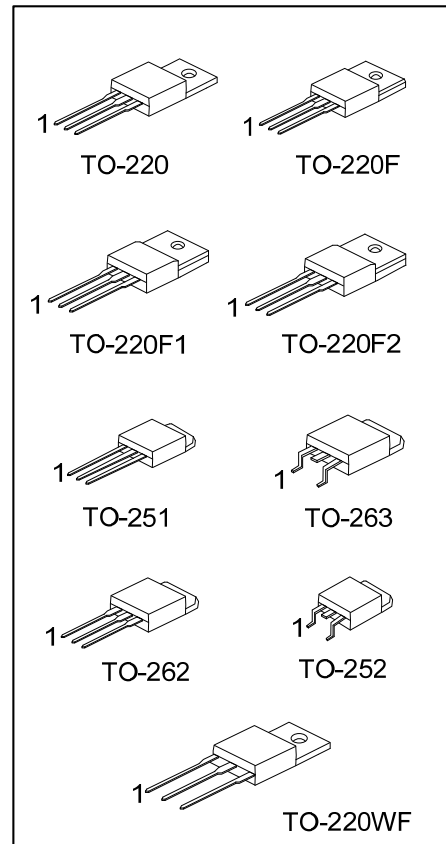
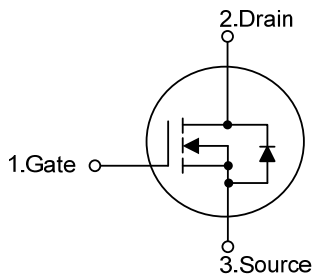
DESCRIPTION

The **UTC 13NM60** 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

- * $R_{DS(ON)} \leq 0.42 \Omega @ V_{GS}=10V, I_D=6.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

SYMBOL



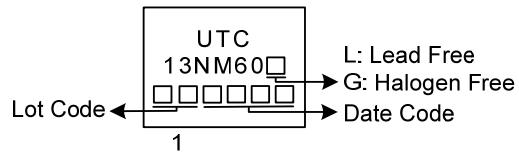
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13NM60L-TA3-T	13NM60G-TA3-T	TO-220	G	D	S	Tube
13NM60L-TF1-T	13NM60G-TF1-T	TO-220F1	G	D	S	Tube
13NM60L-TF2-T	13NM60G-TF2-T	TO-220F2	G	D	S	Tube
13NM60L-TF3-T	13NM60G-TF3-T	TO-220F	G	D	S	Tube
13NM60L-TW1-T	13NM60G-TW1-T	TO-220WF	G	D	S	Tube
13NM60L-TM3-T	13NM60G-TM3-T	TO-251	G	D	S	Tube
13NM60L-TN3-R	13NM60G-TN3-R	TO-252	G	D	S	Tape Reel
13NM60L-T2Q-T	13NM60G-T2Q-T	TO-262	G	D	S	Tube
13NM60L-TQ2-T	13NM60G-TQ2-T	TO-263	G	D	S	Tube
13NM60L-TQ2-R	13NM60G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>13NM60G-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TW1: TO-220WF, TM3: TO-251, TN3: TO-252, T2Q: TO-262, TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



■ ABSOLUTE MAXIMUM RATINGS (T_c=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		V _{DSS}	600	V	
Gate-Source Voltage		V _{GSS}	±30	V	
Drain Current	Continuous	I _D	T _C =25°C	13	A
			T _C =100°C	8.4	A
	Pulsed (Note 2)		I _{DM}	39	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-220F2/TO-220WF			60	W
	TO-251/TO-252				
Junction Temperature		T _J	+150	°C	
Storage Temperature Range		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=157mH, I_{AS}=2.4A, V_{DD}= 50V, R_G=25Ω, Starting T_J=25°C

4. I_{SD} ≤ 13A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J=25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220WF/TO-262 TO-263	θ _{JA}	62.5	°C/W
	TO-251/TO-252		110	°C/W
Junction to Case	TO-220/TO-262/TO-263	θ _{JC}	1.35	°C/W
	TO-220F/TO-220F1 TO-220WF/TO-220F2		4.2	°C/W
	TO-251/TO-252 (Note)		2.08 (Note)	°C/W

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

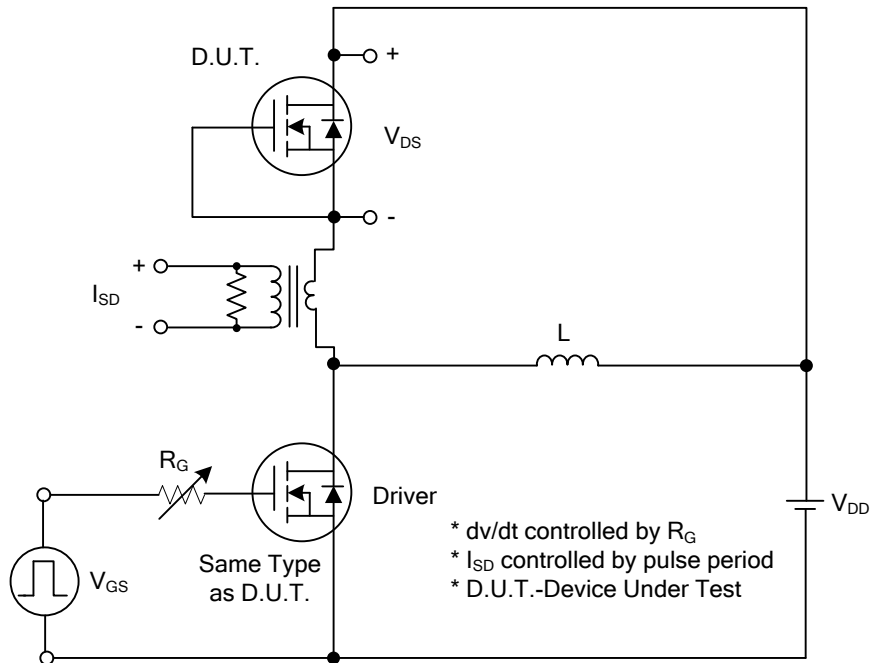
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}			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 = 6.5A			0.42	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1.0MHz		735		pF
Output Capacitance	C _{OSS}			96		pF
Reverse Transfer Capacitance	C _{RSS}			5		pF
Gate Resistance	R _G	V _{DS} =0V, V _{GS} =0V, f=1MHz		1.185		Ω
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =13A, I _G =1mA (Note 1,2)		28.5		nC
Gate to Source Charge	Q _{GS}			4.5		nC
Gate to Drain Charge	Q _{GD}			10		nC
Turn-ON Delay Time (Note 1)	t _{D(ON)}	V _{DD} =100V, I _D =13A, R _G =25Ω, V _{GS} =10V (Note 1,2)		10		nS
Rise Time	t _R			24		nS
Turn-OFF Delay Time	t _{D(OFF)}			80		nS
Fall-Time	t _F			47		nS
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I _S				13	A
Maximum Body-Diode Pulsed Current	I _{SM}				39	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =13A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t _{rr}	I _S =13A, V _{GS} =0V, dI _F /dt=100A/μs		370		nS
Body Diode Reverse Recovery Charge	Q _{rr}				5.4	

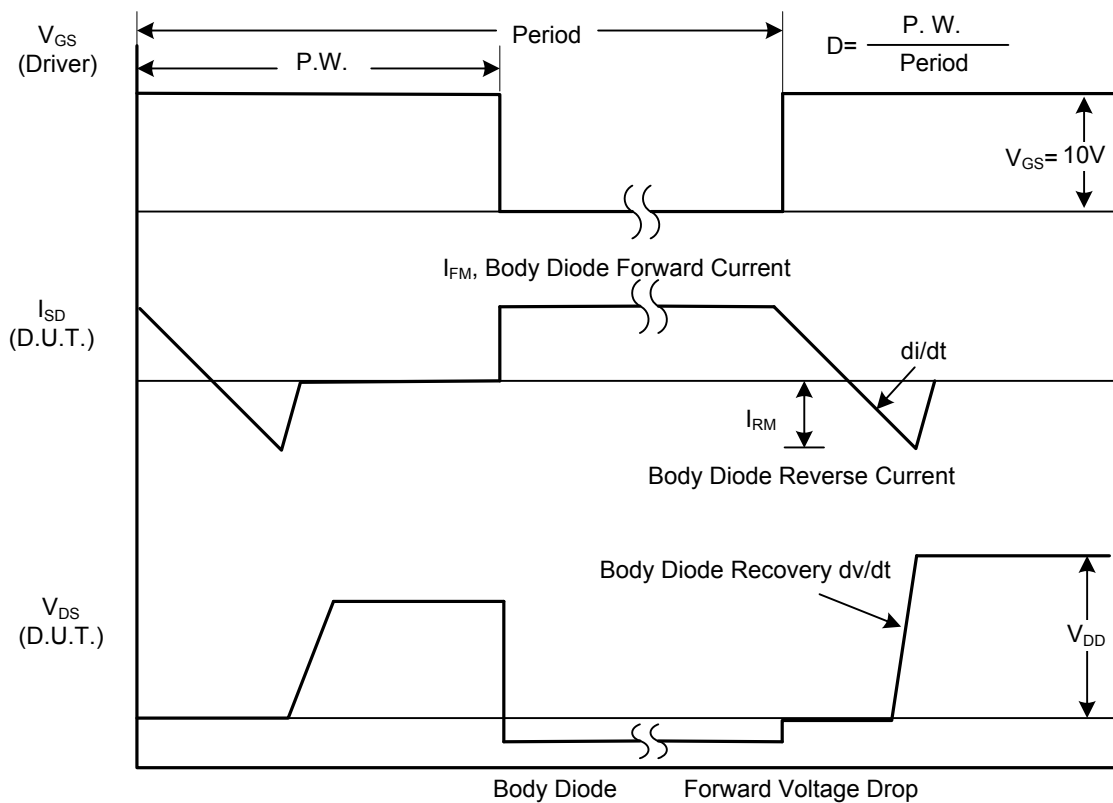
Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating ambient temperature.

TEST CIRCUITS AND WAVEFORMS

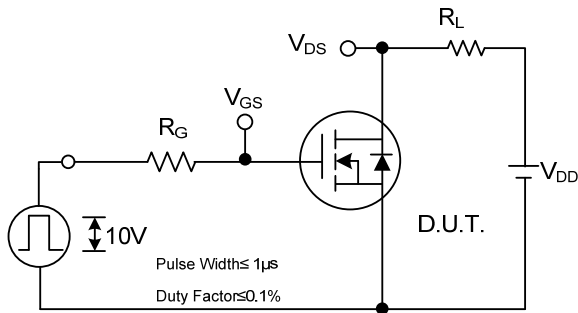


Peak Diode Recovery dv/dt Test Circuit

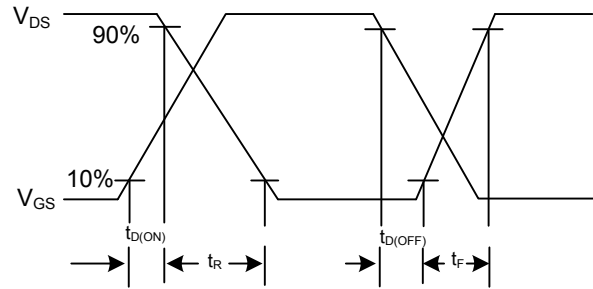


Peak Diode Recovery dv/dt Waveforms

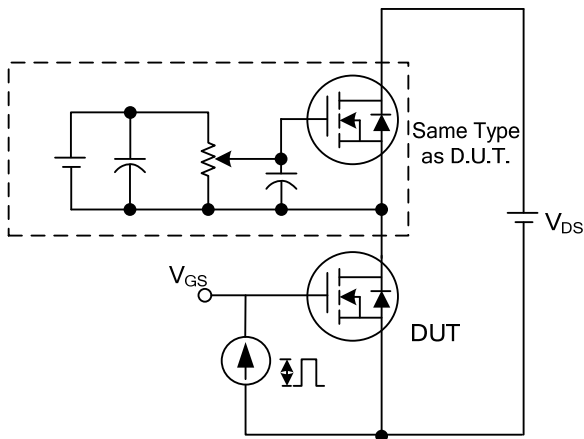
TEST CIRCUITS AND WAVEFORMS



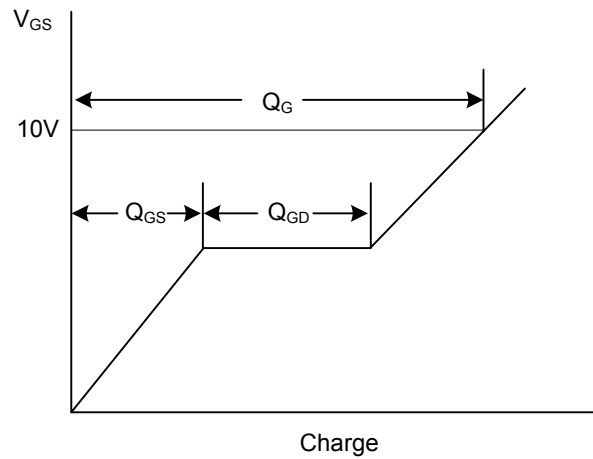
Switching Test Circuit



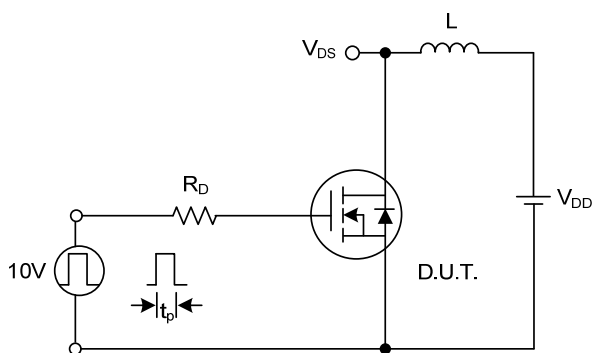
Switching Waveforms



Gate Charge Test Circuit



Gate Charge Waveform

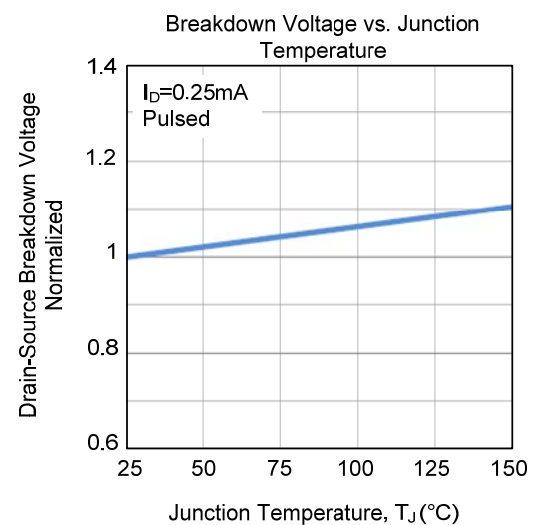
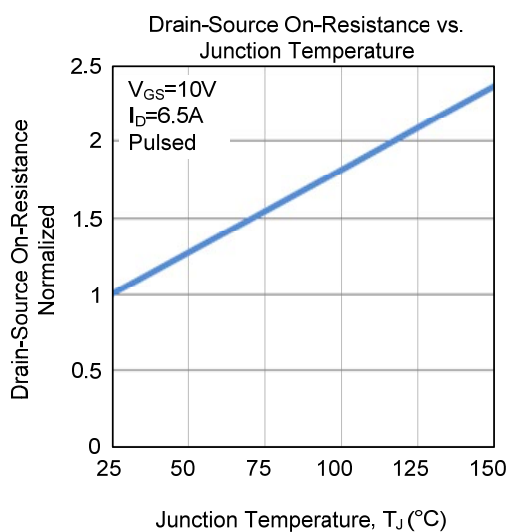
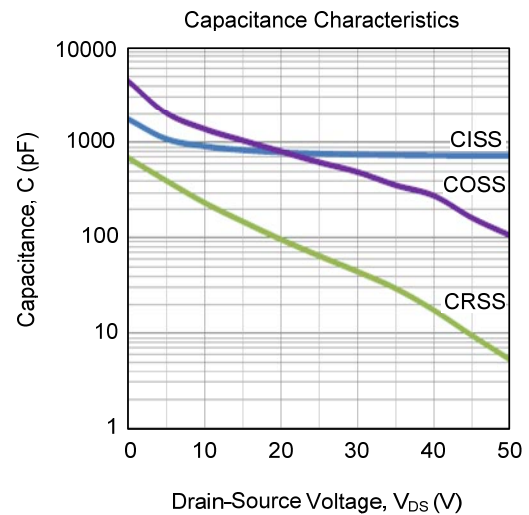
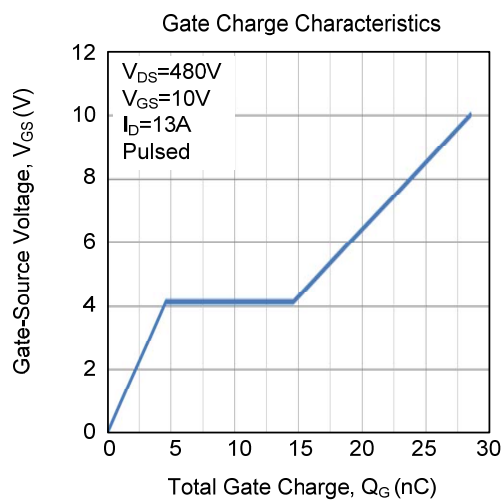
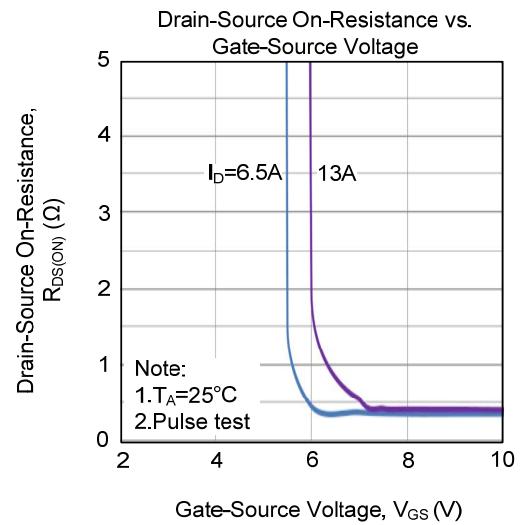
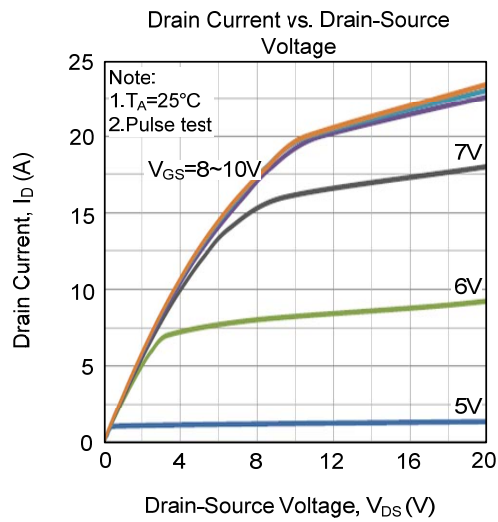


Unclamped Inductive Switching Test Circuit

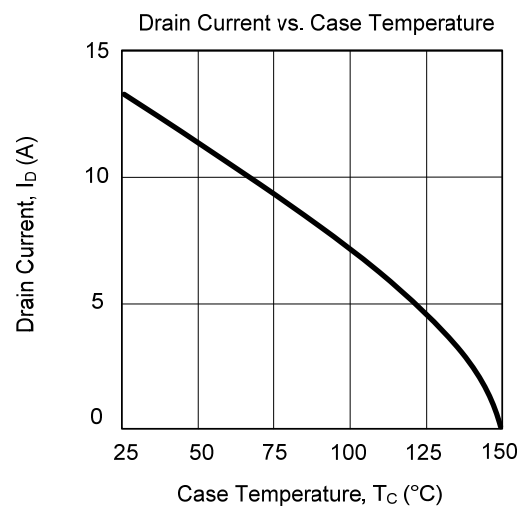
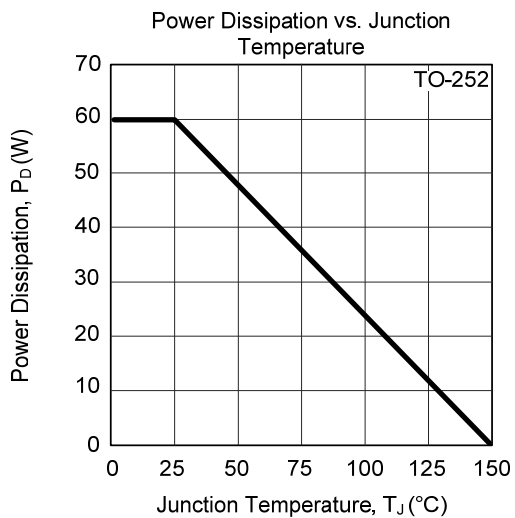
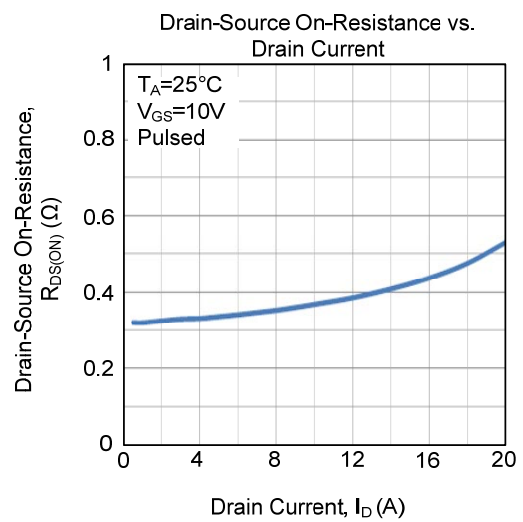
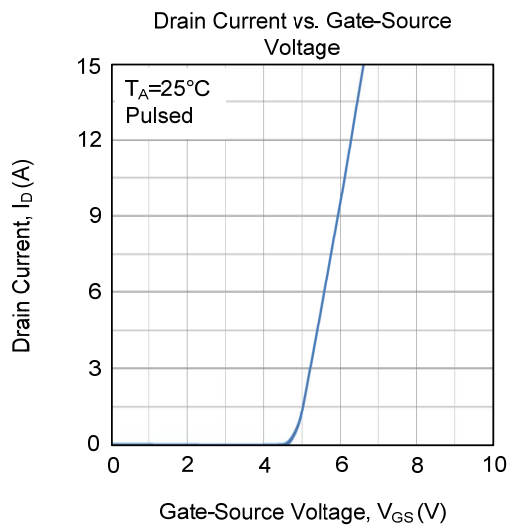
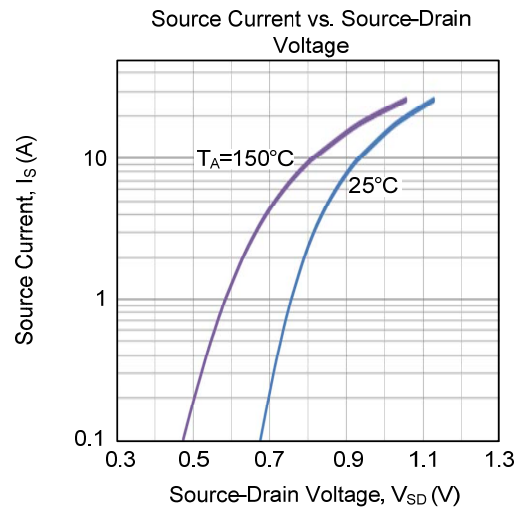
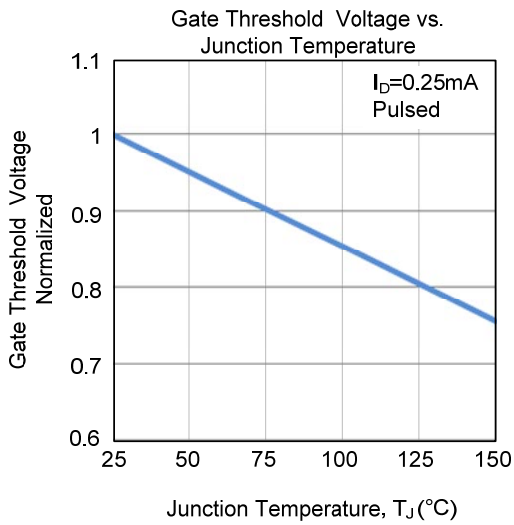


Unclamped Inductive Switching Waveforms

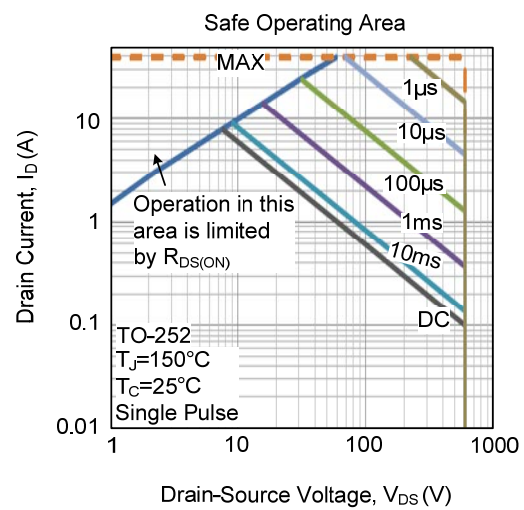
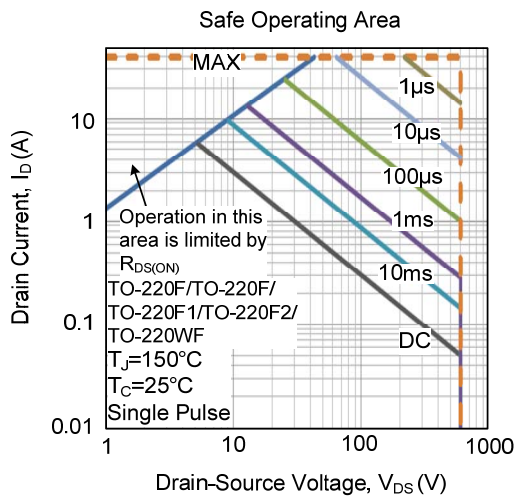
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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