



60NM65

Power MOSFET

60A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

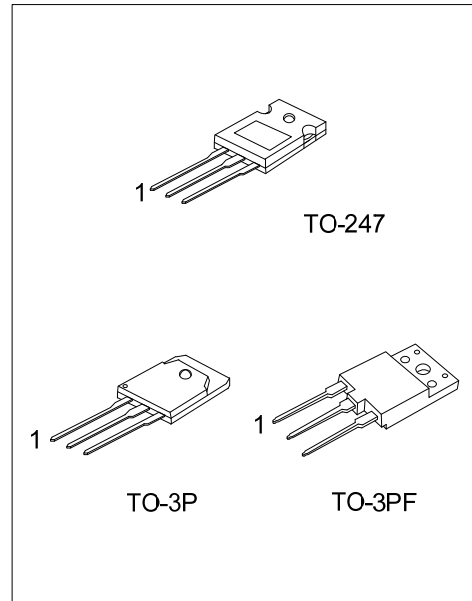
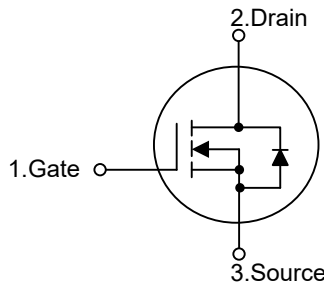
■ DESCRIPTION

The **UTC 60NM65** 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

- * $R_{DS(ON)} \leq 0.065 \Omega @ V_{GS}=10V, I_D=30A$
- * High Switching Speed
- * 100% Avalanche Tested

■ SYMBOL



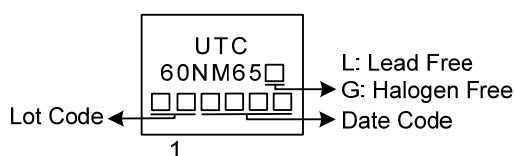
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
60NM65L-T3F-T	60NM65G-T3F-T	TO-3PF	G	D	S	Tube
60NM65L-T3P-T	60NM65G-T3P-T	TO-3P	G	D	S	Tube
60NM65L-T47-T	60NM65G-T47-T	TO-247	G	D	S	Tube

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

<p>60NM65G-T3F-T</p>	<p>(1) T: Tube (2) T3F: TO-3PF, T3P: TO-3P, T47: TO-247 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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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_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous	I_D	60	A
	Pulsed (Note 2)	I_{DM}	120	A
Avalanche Current (Note 2)		I_{AR}	10	A
Avalanche Energy		E_{AS}	2000	mJ
Peak Diode Recovery dv/dt		dv/dt	8	V/ns
Power Dissipation	TO-247	P_D	156	W
	TO-3P		250	W
	TO-3PF		80	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. $L = 36\text{mH}$, $I_{AS} = 10\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 30\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-247	θ_{JA}	40	$^\circ\text{C}/\text{W}$
	TO-3P/TO-3PF		30	$^\circ\text{C}/\text{W}$
Junction to Case	TO-247	θ_{JC}	0.8	$^\circ\text{C}/\text{W}$
	TO-3P		0.5	$^\circ\text{C}/\text{W}$
	TO-3PF		1.56	$^\circ\text{C}/\text{W}$

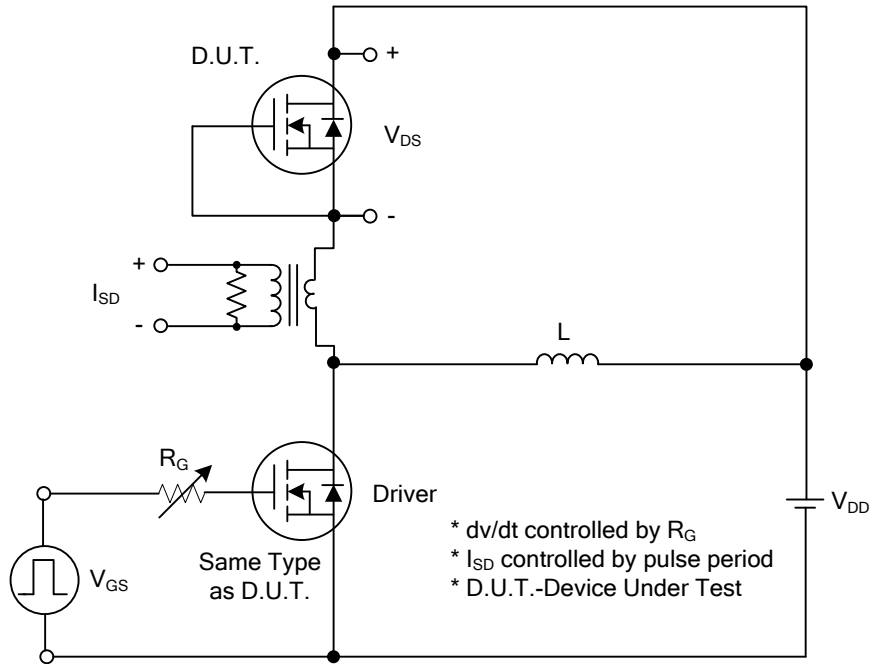
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	I _D =250μA, V _{GS} =0V	650			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V			50	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 =30A			0.065	Ω
DYNAMIC PARAMETERS						
Input Capacitance	C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		5000		pF
Output Capacitance	C _{OSS}			2700		pF
Reverse Transfer Capacitance	C _{RSS}			190		pF
SWITCHING PARAMETERS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =520V, V _{GS} =10V, I _D =60A (Note1, 2)		174		nC
Gate to Source Charge	Q _{GS}			42		nC
Gate to Drain Charge	Q _{GD}			75		nC
Turn-ON Delay Time (Note 1)	t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =60A, R _G =25Ω (Note1, 2)		60		ns
Rise Time	t _R			67		ns
Turn-OFF Delay Time	t _{D(OFF)}			468		ns
Fall-Time	t _F			126		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I _S				60	A
Maximum Body-Diode Pulsed Current	I _{SM}				120	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =60A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t _{rr}	I _S =30A, V _{GS} =0V, dI _F /dt=100A/μs (Note 1)		660		ns
Body Diode Reverse Recovery Charge	Q _{rr}				15	

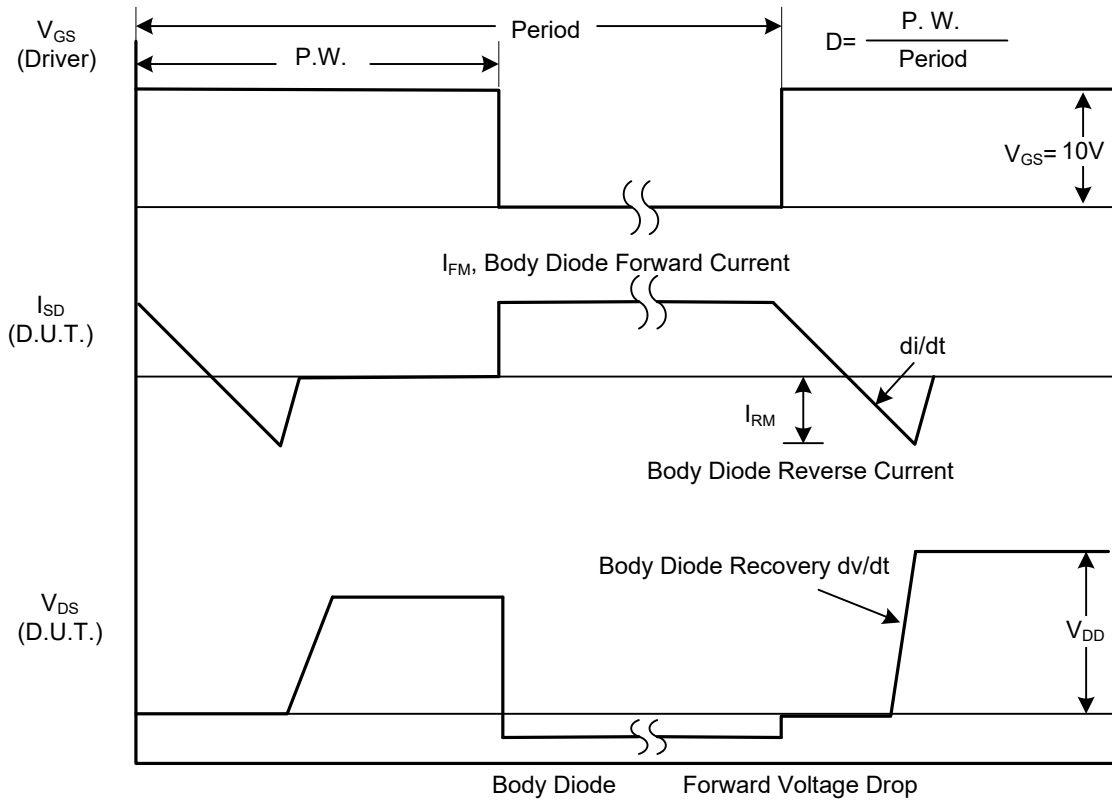
Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS



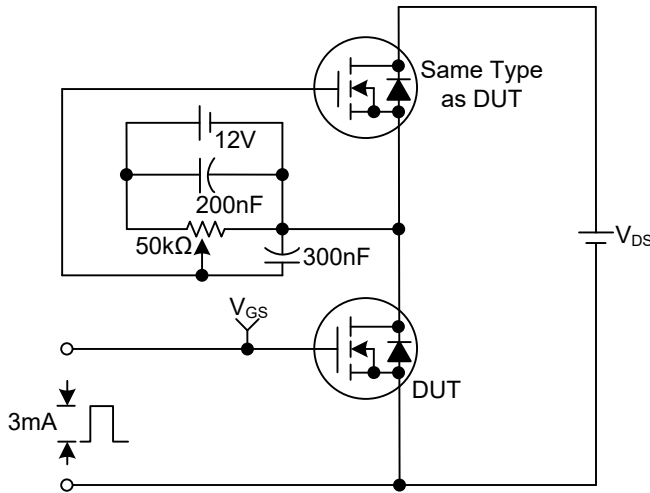
Peak Diode Recovery dv/dt Test Circuit



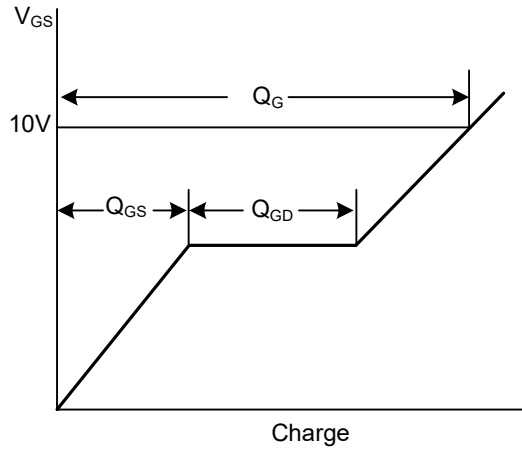
Peak Diode Recovery dv/dt Waveforms

TEST CIRCUITS AND WAVEFORMS

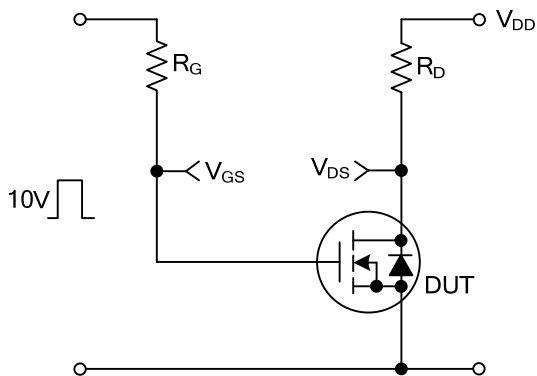
Gate Charge Test Circuit



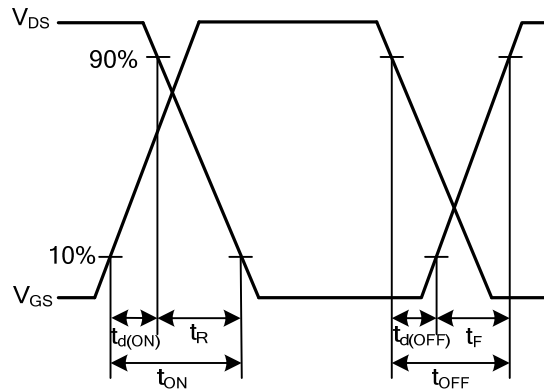
Gate Charge Waveforms



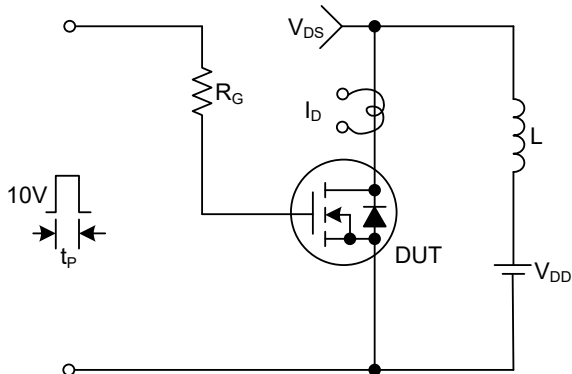
Resistive Switching Test Circuit



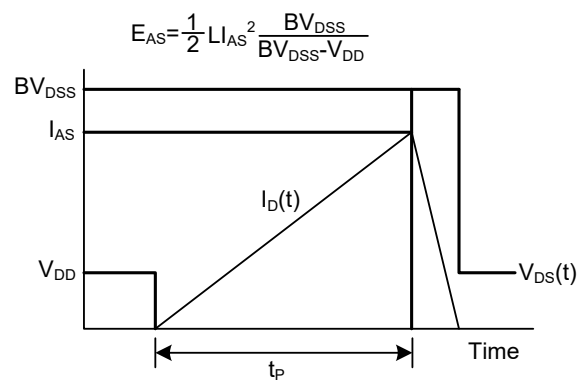
Resistive Switching Waveforms



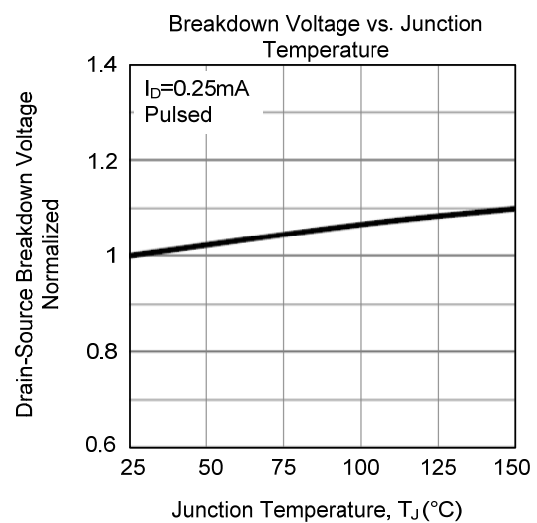
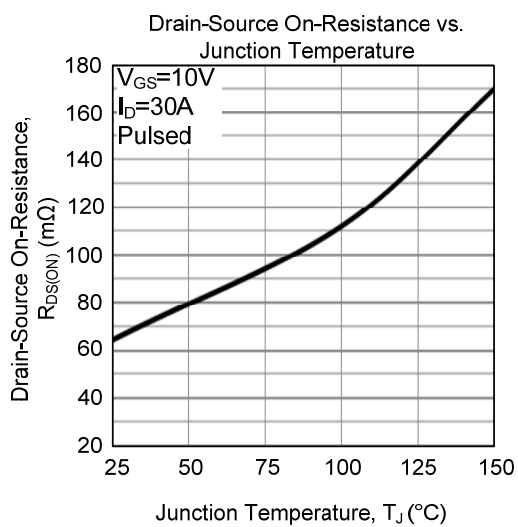
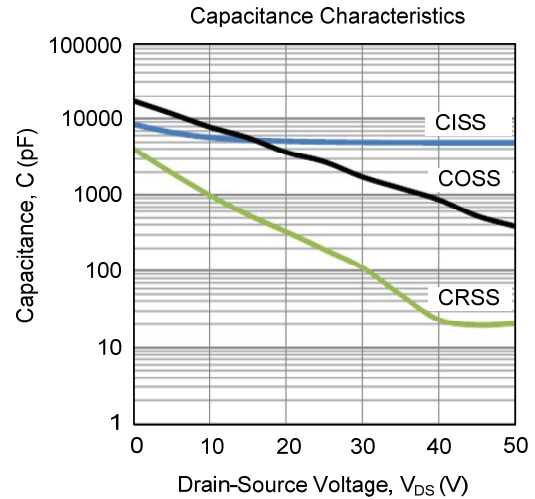
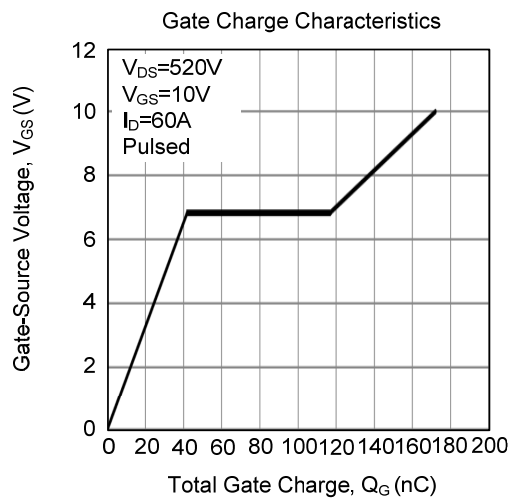
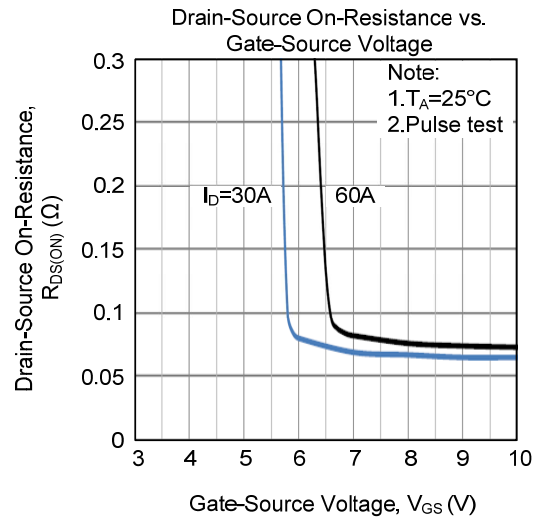
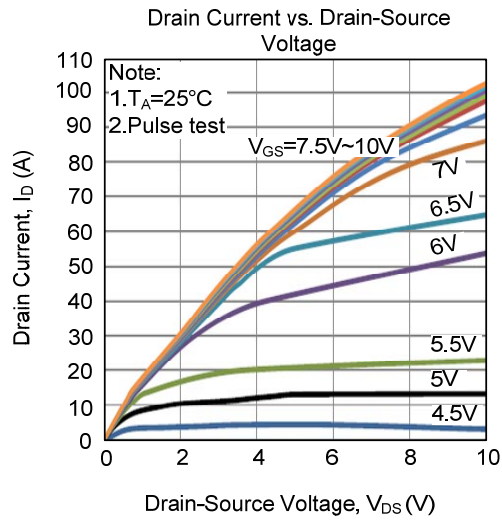
Unclamped Inductive Switching Test Circuit



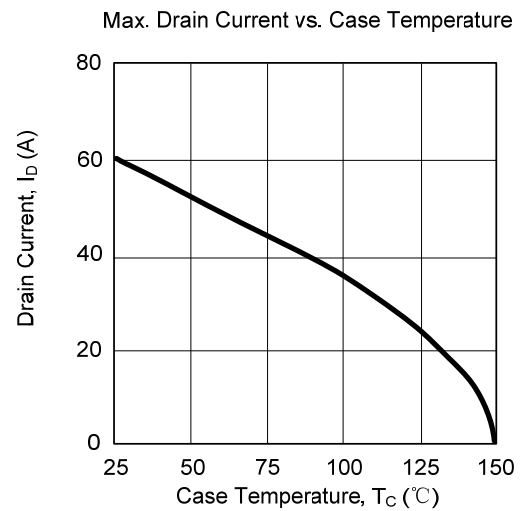
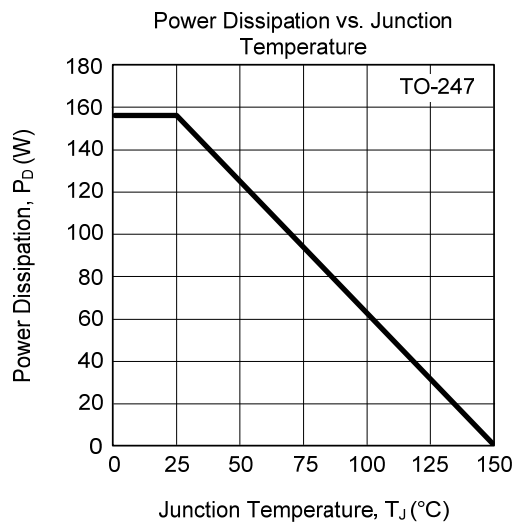
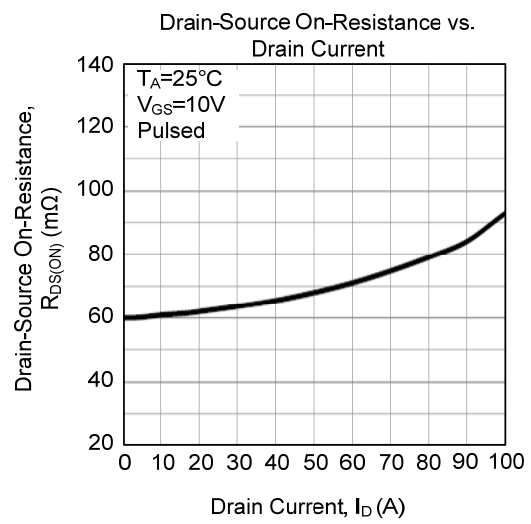
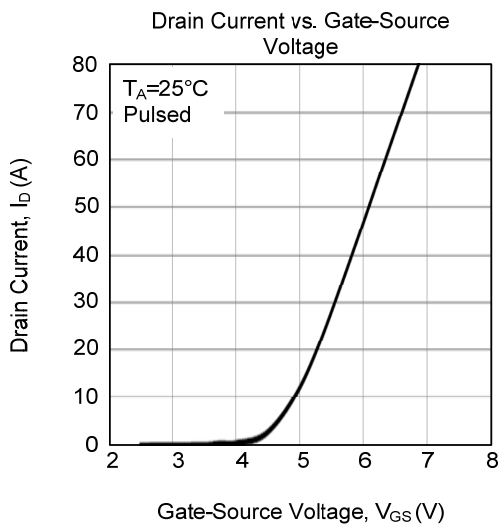
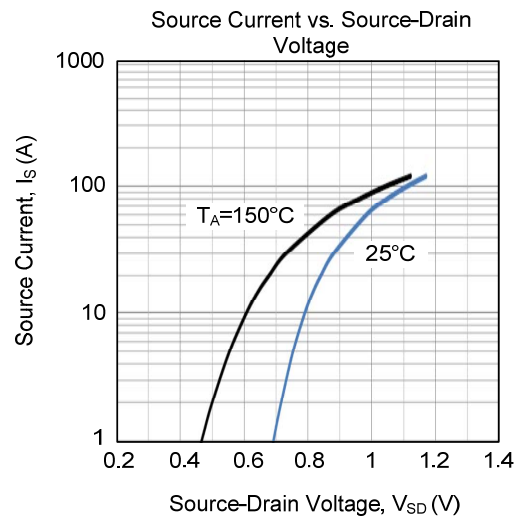
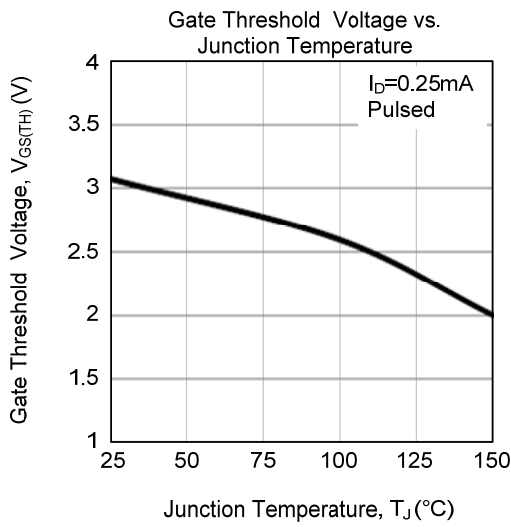
Unclamped Inductive Switching Waveforms



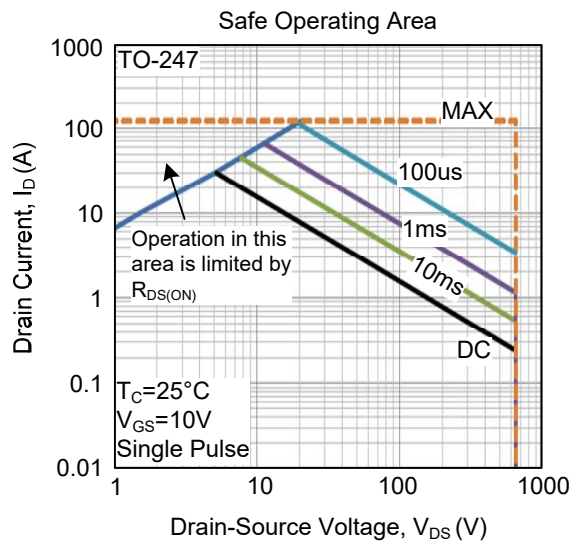
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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