



## 7NM65

Power MOSFET

### 7.0A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

#### DESCRIPTION

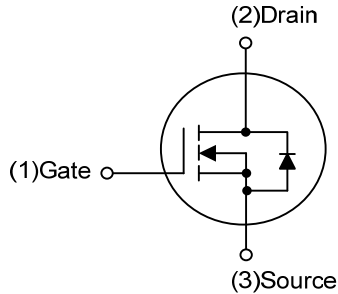
The UTC **7NM65** is a Super Junction MOSFET Structure. It uses UTC advanced planar stripe, DMOS technology to provide customers perfect switching performance, minimal on-state resistance.

The UTC **7NM65** is universally applied in electronic lamp ballasts based on half bridge topology, high efficiency switched mode power supplies, active power factor correction, etc.

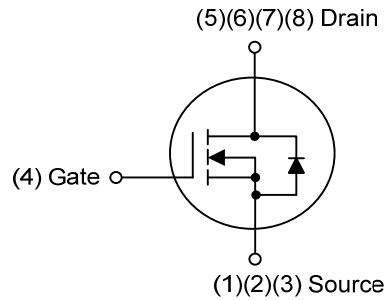
#### FEATURES

- \*  $R_{DS(ON)} \leq 0.9 \Omega @ V_{GS}=10V, I_D=3.5A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

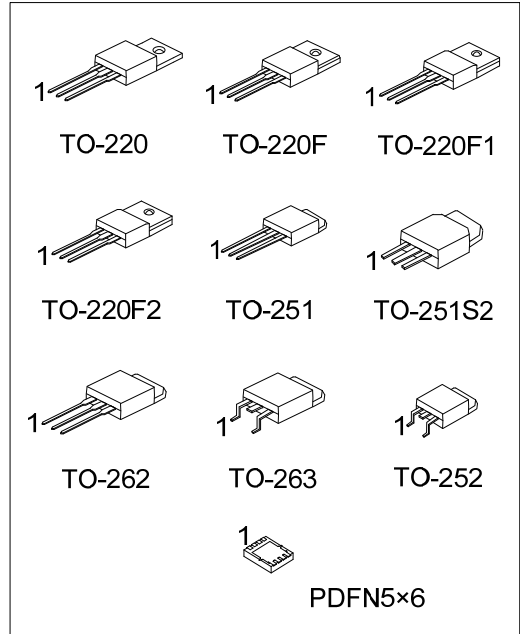
#### SYMBOL



TO-220/TO-220F/TO-220F1  
 TO-220F2/TO-251/TO-251S2  
 TO-252/TO-262/TO-263



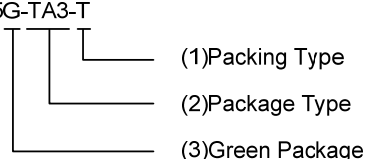
PDFN5x6



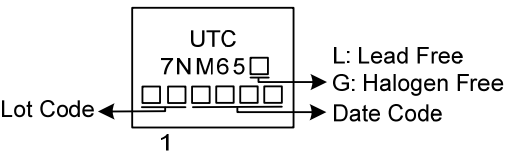
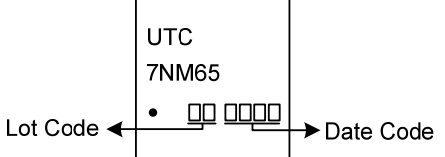
## ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
7NM65L-TA3-T	7NM65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
7NM65L-TF3-T	7NM65G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
7NM65L-TF1-T	7NM65G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
7NM65L-TF2-T	7NM65G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
7NM65L-TM3-T	7NM65G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
7NM65L-TMS2-T	7NM65G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
7NM65L-TN3-R	7NM65G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
7NM65L-T2Q-T	7NM65G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	Tube
7NM65L-TQ2-T	7NM65G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	Tube
7NM65L-TQ2-R	7NM65G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	Tape Reel
7NM65L-P5060-R	7NM65G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

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

<p>7NM65G-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, TM3: TO-251, TN3: TO-252, TMS2: TO-251S2, T2Q: TO-262, TQ2: TO-263, P5060: PDFN5×6 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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## MARKING

PACKAGE		MARKING
TO-220 TO-220F TO-220F1 TO-220F2	TO-251 TO-251S2 TO-252 TO-262 TO-263	 <p>UTC 7NM65 Lot Code → Date Code</p> <p>L: Lead Free G: Halogen Free</p>
PDFN5×6		 <p>UTC 7NM65 Lot Code → Date Code</p>

■ 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		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	7	A
	Pulsed (Note 2)	$I_{DM}$	14	A
Avalanche Current (Note 2)		$I_{AR}$	1.7	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	208	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.0	V/ns
Power Dissipation	TO-220/TO-262/TO-263	$P_D$	74	W
	TO-220F/TO-220F1		26	W
	TO-220F2			
	TO-251/ TO-251S2			
	TO-252			
PDFN5×6		24	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.  $L = 144 \text{ mH}$ ,  $I_{AS} = 1.7\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 7.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT	
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-262/TO-263	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$	
	TO-251/ TO-251S2 TO-252		110	$^\circ\text{C}/\text{W}$	
	PDFN5×6		75	$^\circ\text{C}/\text{W}$	
	Junction to Case		$\theta_{JC}$	1.68	$^\circ\text{C}/\text{W}$
TO-220/TO-262/TO-263	4.8	$^\circ\text{C}/\text{W}$			
TO-220F/TO-220F1 TO-220F2					
TO-251/ TO-251S2 TO-252				2.6	$^\circ\text{C}/\text{W}$
PDFN5×6				5.2	$^\circ\text{C}/\text{W}$

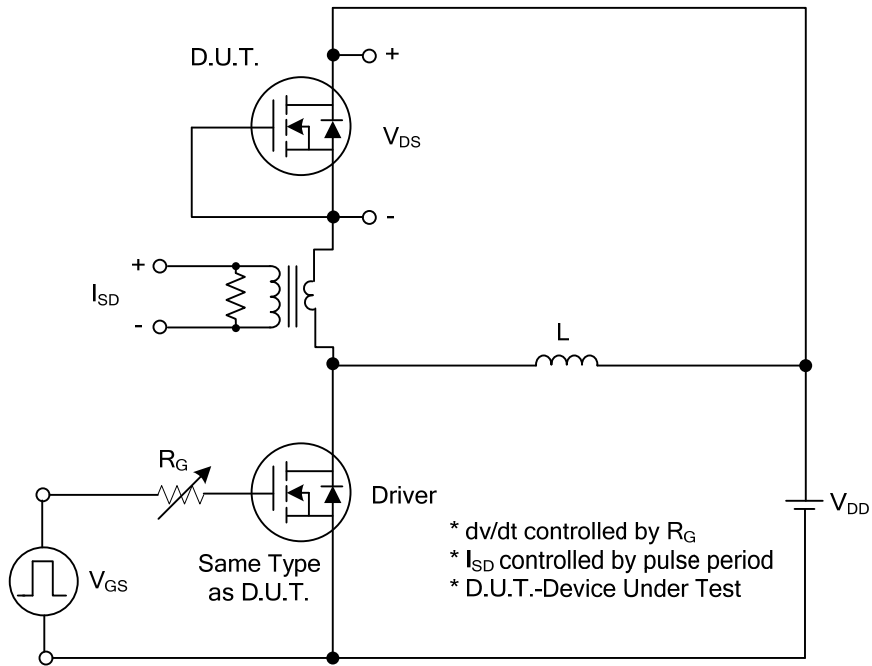
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	650			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V			10	μA
Gate- Source Leakage Current	Forward	I <sub>GSS</sub>			100	nA
	Reverse					
		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.5		4.5	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.5A			0.9	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0 MHz		430		pF
Output Capacitance	C <sub>OSS</sub>			250		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			22		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	Q <sub>G</sub>	V <sub>DS</sub> =520V, V <sub>GS</sub> =10V, I <sub>D</sub> =7A I <sub>G</sub> =1mA		22		nC
Gate-Source Charge	Q <sub>GS</sub>			3.6		nC
Gate-Drain Charge	Q <sub>GD</sub>			7.6		nC
Turn-On Delay Time (Note 1)	t <sub>D(ON)</sub>	V <sub>DD</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =7A, R <sub>G</sub> =10Ω (Note 1, 2)		5		ns
Turn-On Rise Time	t <sub>R</sub>			15		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			35		ns
Turn-Off Fall Time	t <sub>F</sub>			19		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				7	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				14	A
Drain-Source Diode Forward Voltage (Note 1)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =7.0A			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =7.0A, dI <sub>F</sub> /dt=100A/μs		300		nS
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>				3	

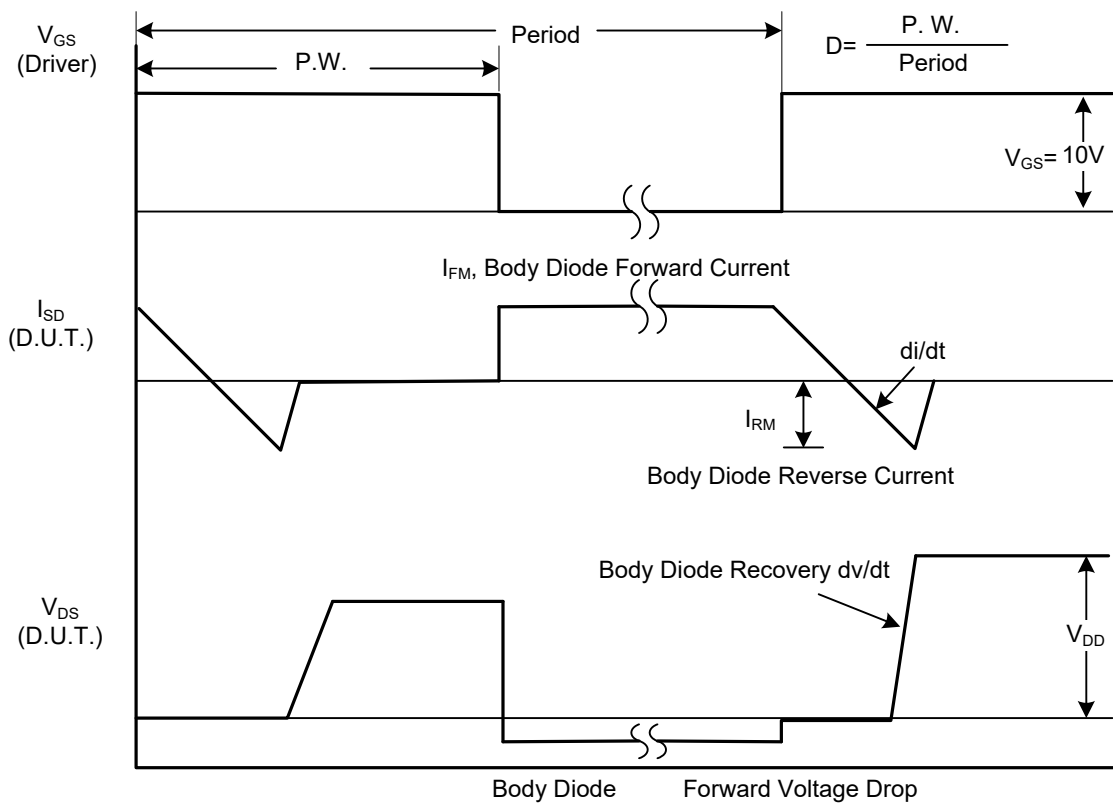
Notes: 1. Pulse Test: Pulse width≤300μs, Duty cycle≤2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

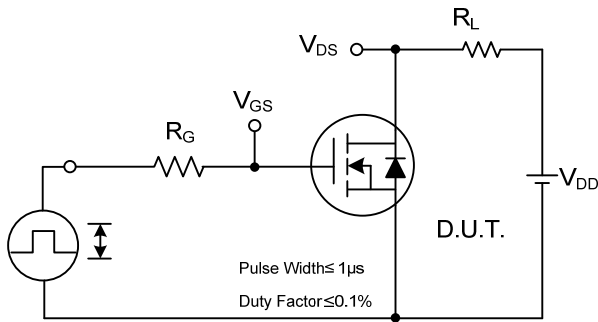


Peak Diode Recovery  $dv/dt$  Test Circuit

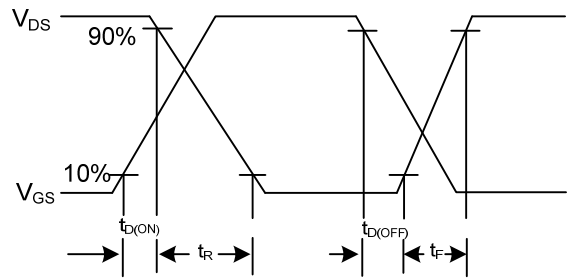


Peak Diode Recovery  $dv/dt$  Waveforms

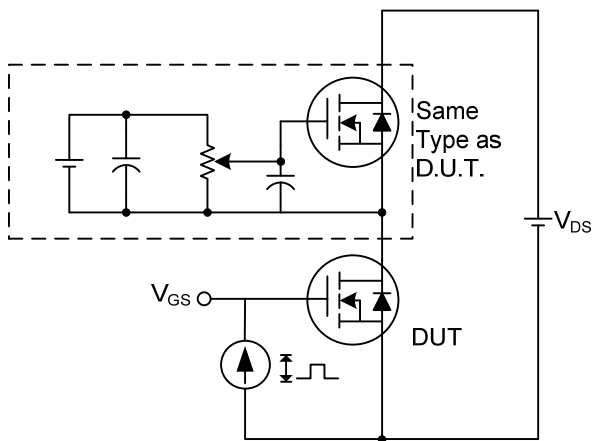
■ TEST CIRCUITS AND WAVEFORMS



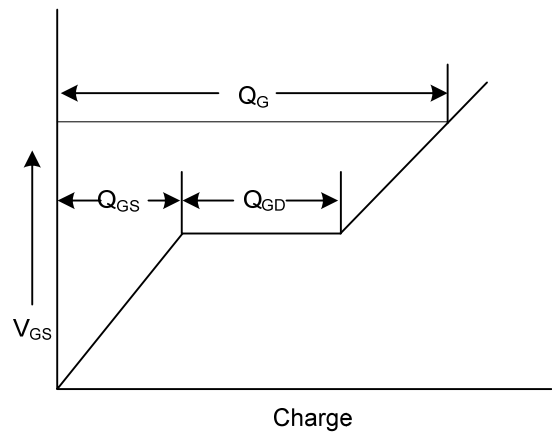
Switching Test Circuit



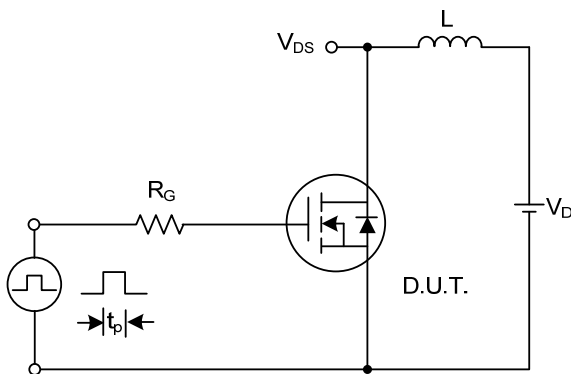
Switching Waveforms



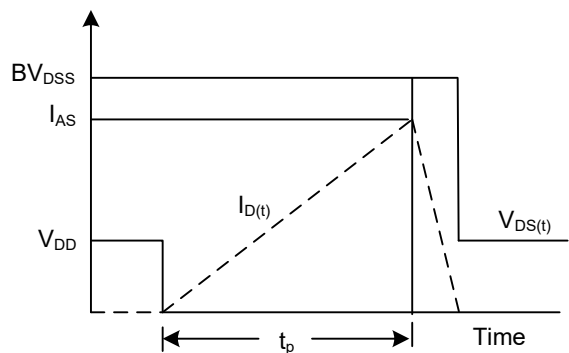
Gate Charge Test Circuit



Gate Charge Waveform

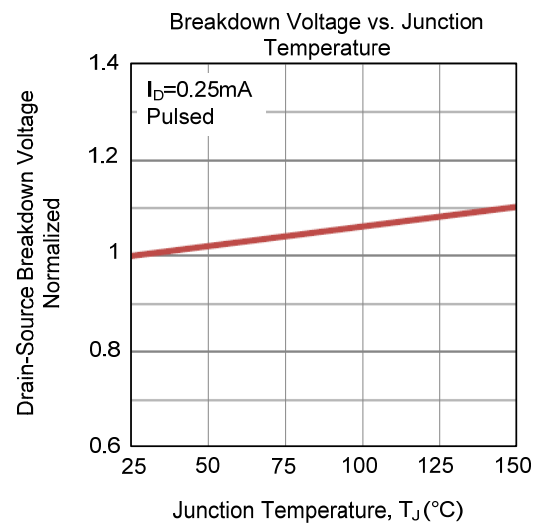
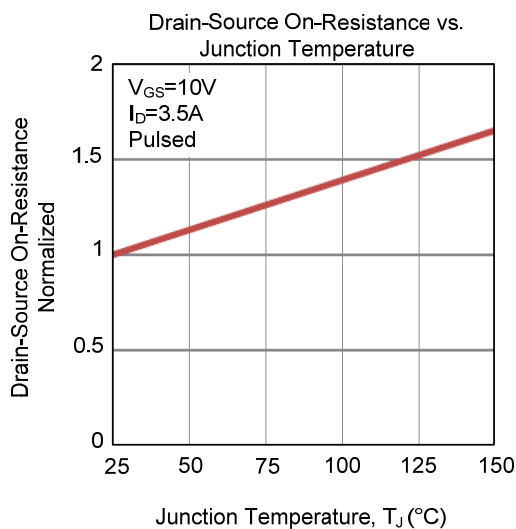
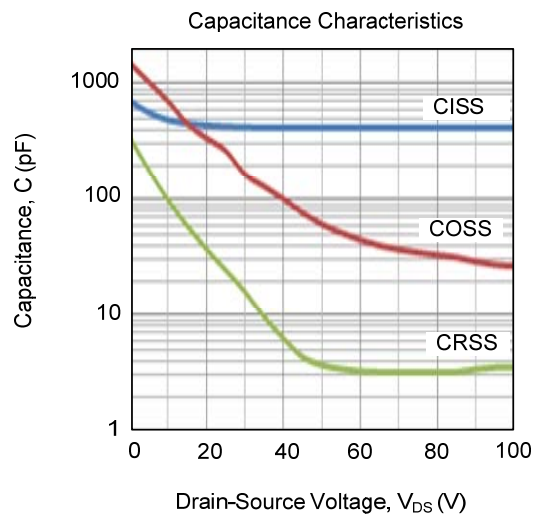
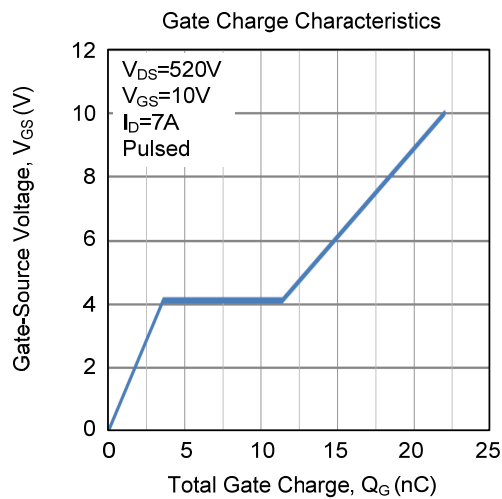
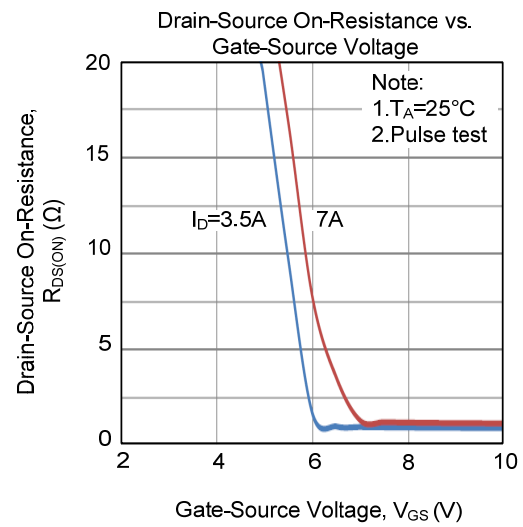
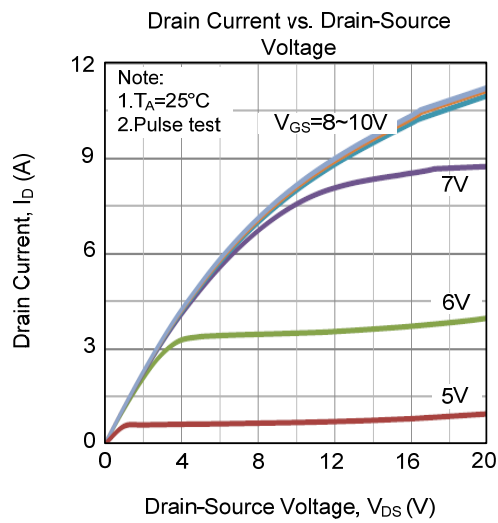


Unclamped Inductive Switching Test Circuit

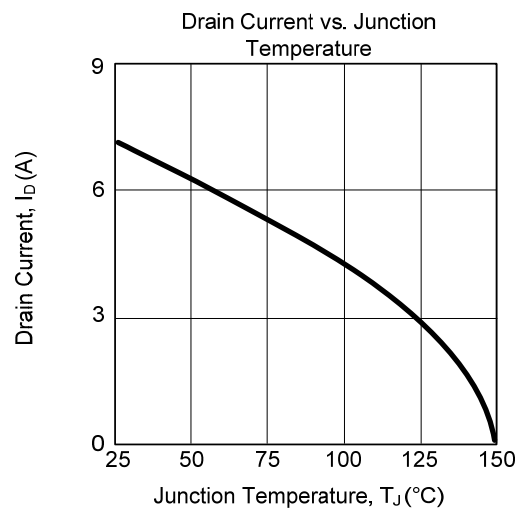
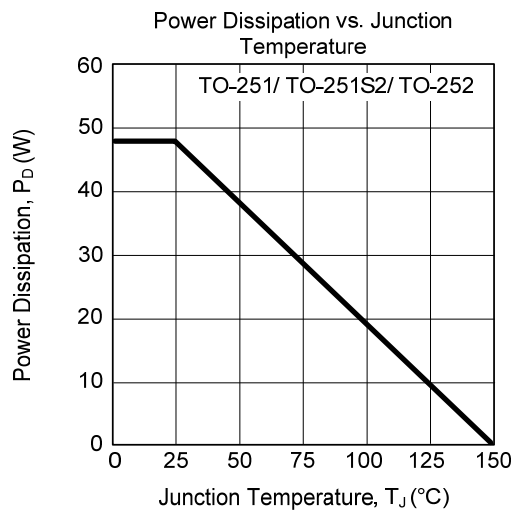
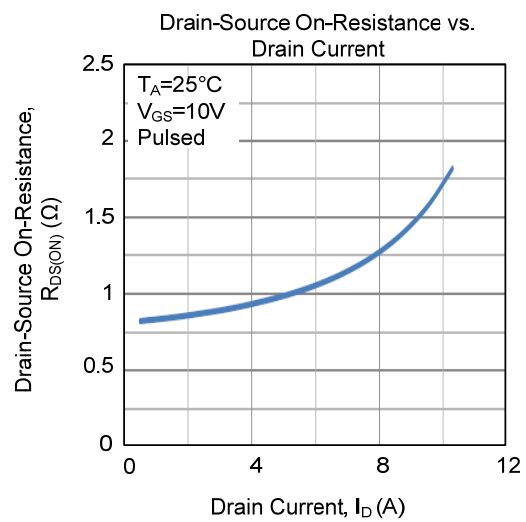
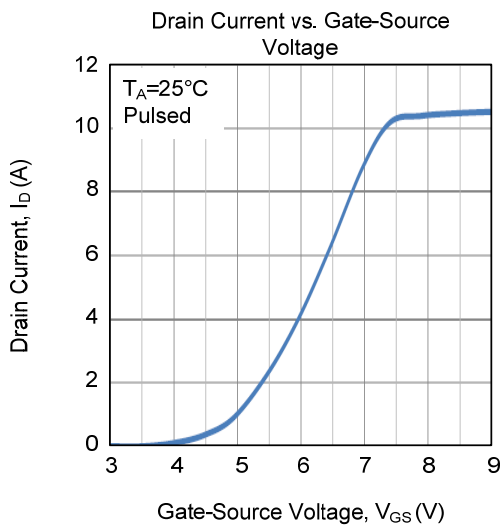
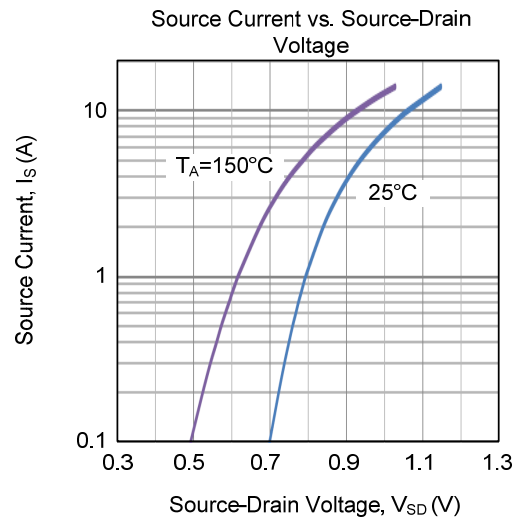
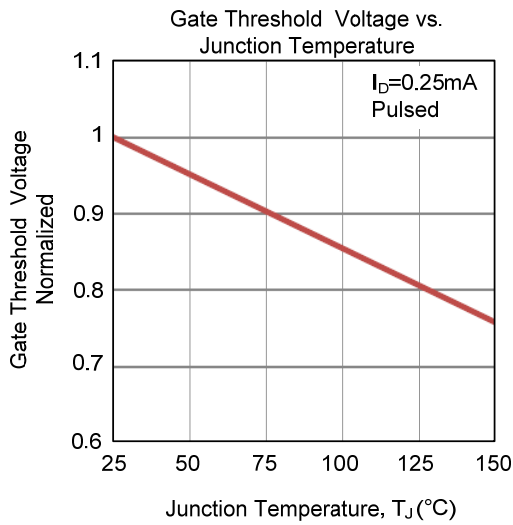


Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS

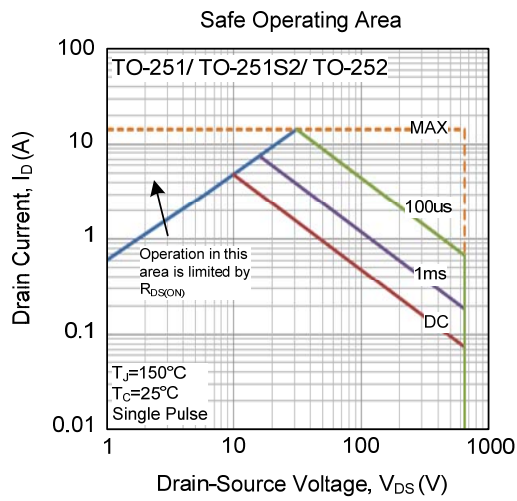


## ■ TYPICAL CHARACTERISTICS (Cont.)





■ TYPICAL CHARACTERISTICS (Cont.)



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