



# 3N60-TA

**Power MOSFET**

## 3A, 600V N-CHANNEL POWER MOSFET

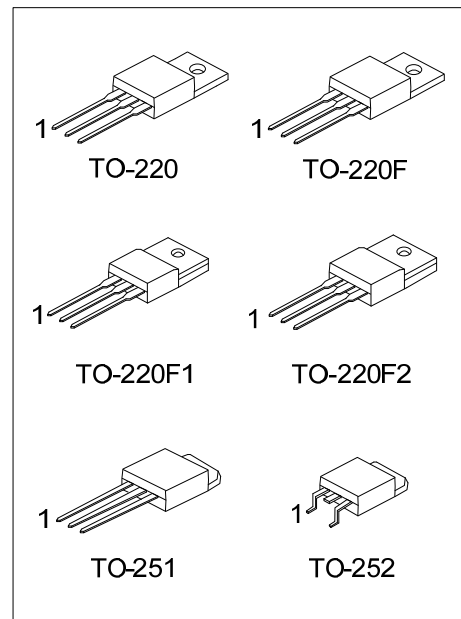
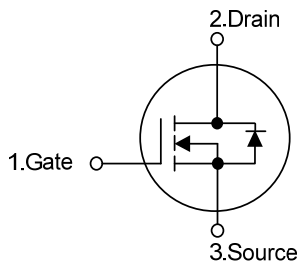
■ DESCRIPTION

The UTC **3N60-TA** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

■ FEATURES

- \*  $R_{DS(ON)} < 3.3\Omega @ V_{GS}=10V, I_D=1.5A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



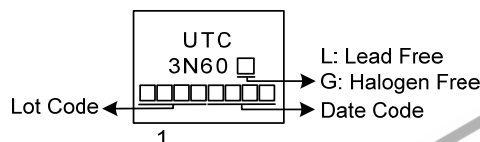
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
3N60L-TA3-T	3N60G-TA3-T	TO-220	G	D	S	Tube
3N60L-TF1-T	3N60G-TF1-T	TO-220F1	G	D	S	Tube
3N60L-TF2-T	3N60G-TF2-T	TO-220F2	G	D	S	Tube
3N60L-TF3-T	3N60G-TF3-T	TO-220F	G	D	S	Tube
3N60L-TM3-T	3N60G-TM3-T	TO-251	G	D	S	Tube
3N60L-TN3-R	3N60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>3N60G-TA3-T</p>	<p>(1) T: Tube, R: Tape Reel                  (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1                  TF2: TO-220F2, TM3: TO-251, TN3: TO-252                  (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		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Continuous Drain Current		$I_D$	3	A
Pulsed Drain Current (Note 2)		$I_{DM}$	6	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	101	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.3	V/ns
Power Dissipation	TO-220	$P_D$	75	W
	TO-220F/TO-220F1		34	W
	TO-220F2			
	TO-251/TO-252		45	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.  $L = 10\text{mH}$ ,  $I_{AS} = 4.5\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 3.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-251/TO-252			
Junction to Case	TO-220	$\theta_{JC}$	1.67	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.68	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		2.78 (Note)	$^\circ\text{C}/\text{W}$

Note: The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.

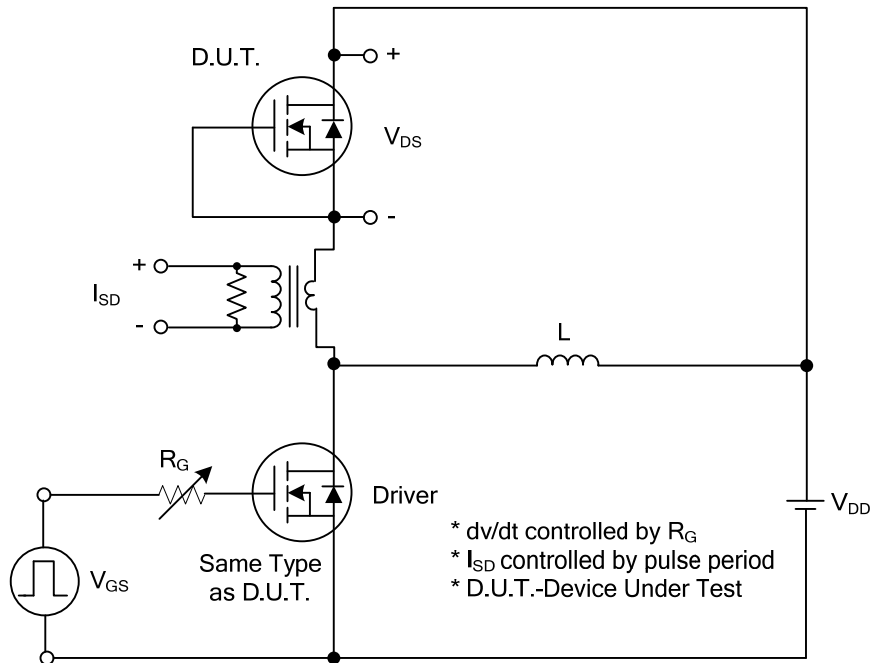
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			10	$\mu A$
Gate- Source Leakage Current	Forward	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$			-100
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 1.5A$			3.3	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1.0MHz$		392		pF
Output Capacitance	$C_{OSS}$			46		pF
Reverse Transfer Capacitance	$C_{RSS}$			3.4		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=100V, V_{GS}=10V, I_D=2A$ $I_G=1mA$ (Note 1, 2)		10		nC
Gate-Source Charge	$Q_{GS}$			3.4		nC
Gate-Drain Charge	$Q_{GD}$			1.8		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DS}=30V, V_{GS}=10V, I_D=0.5A,$ $R_G=25\Omega$ (Note 1, 2)		33		ns
Turn-On Rise Time	$t_R$			23		ns
Turn-Off Delay Time	$t_{D(OFF)}$			110		ns
Turn-Off Fall Time	$t_F$			52		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Maximum Body-Diode Continuous Current	$I_S$				3	A
Maximum Body-Diode Pulsed Current	$I_{SM}$				6	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_S=3.0A, V_{GS}=0V$			1.4	V
Reverse Recovery Time (Note 1)	$t_{rr}$	$I_S=3.0A, V_{GS}=0V$ $di/dt=100A/\mu s$		264		ns
Reverse Recovery Charge	$Q_{rr}$				1.6	

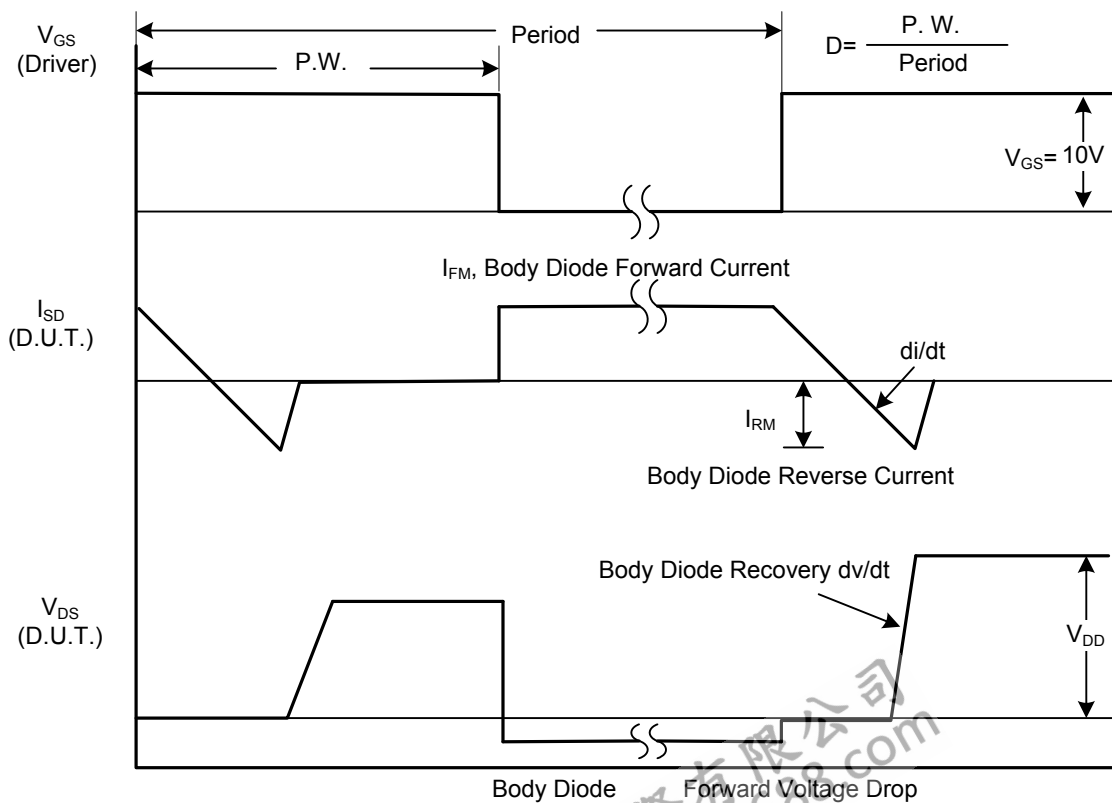
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS

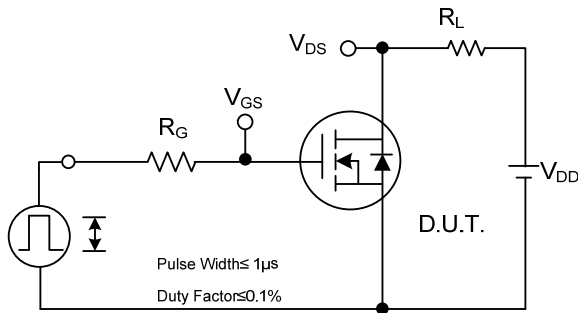


**Peak Diode Recovery  $dv/dt$  Test Circuit**

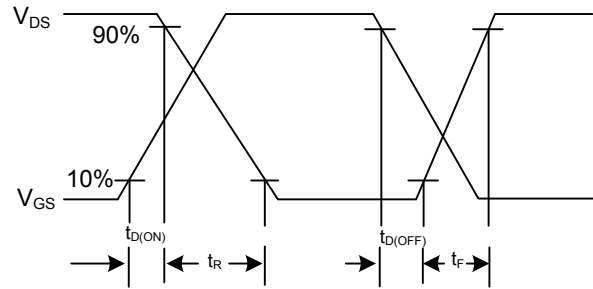


**Peak Diode Recovery  $dv/dt$  Waveforms**

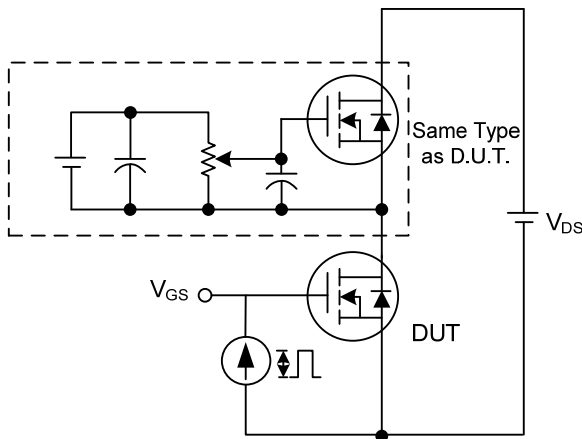
## TEST CIRCUITS AND WAVEFORMS



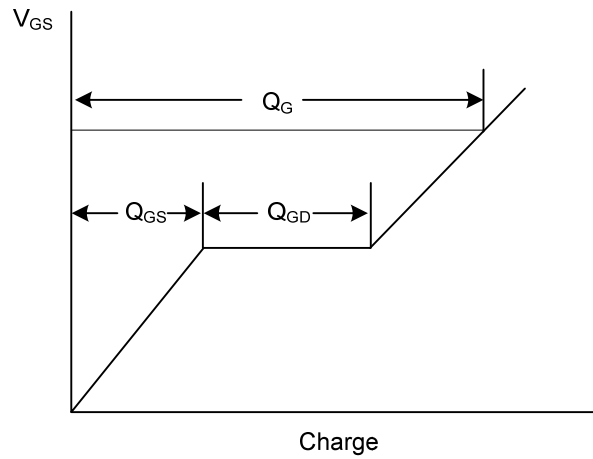
Switching Test Circuit



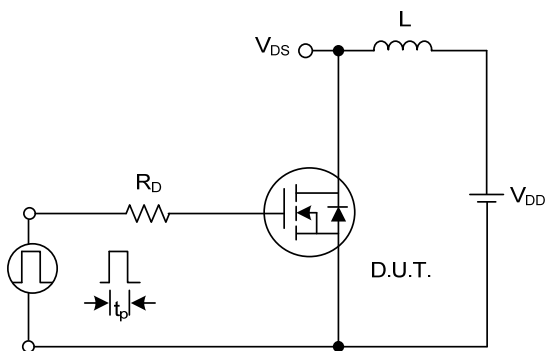
Switching Waveforms



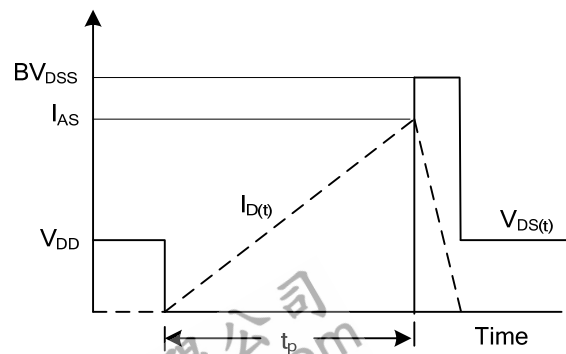
Gate Charge Test Circuit



Gate Charge Waveform

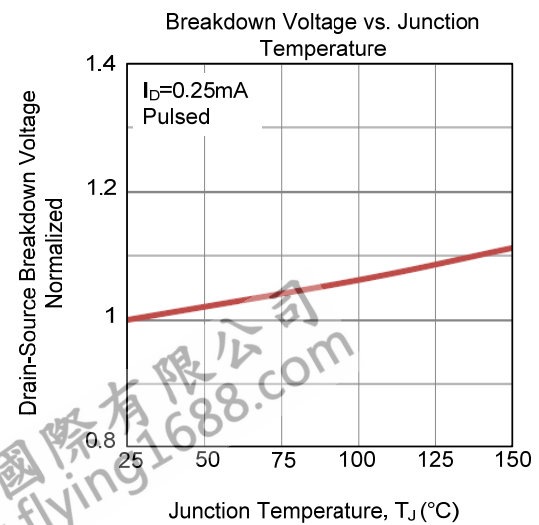
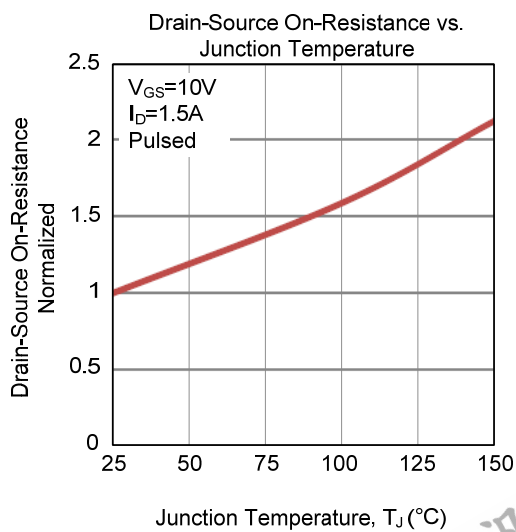
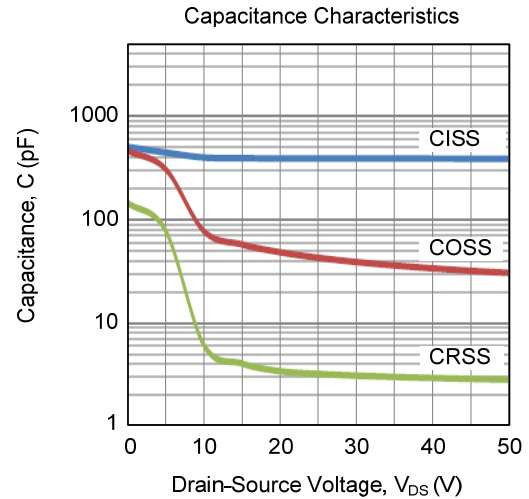
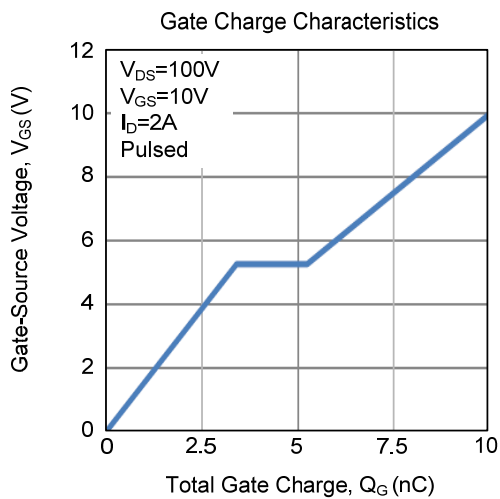
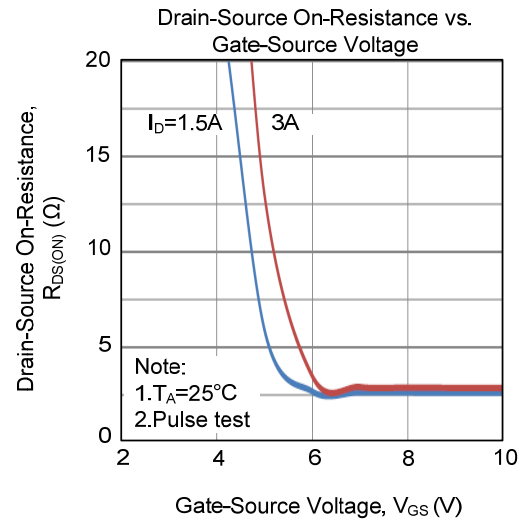
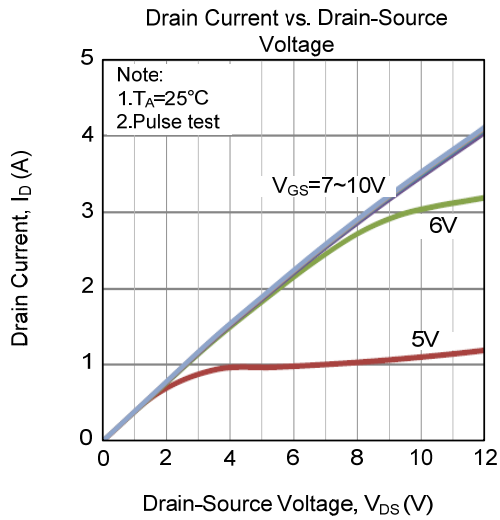


Unclamped Inductive Switching Test Circuit

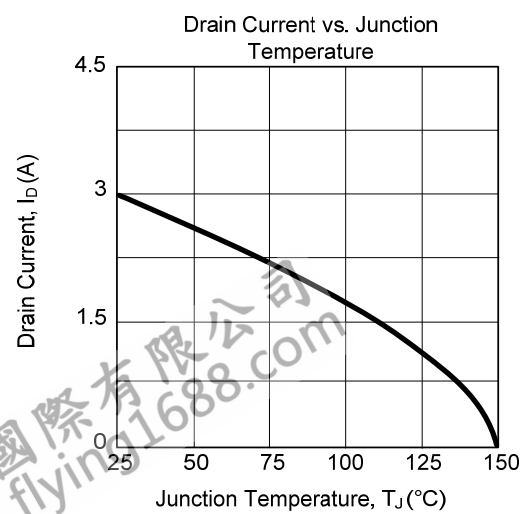
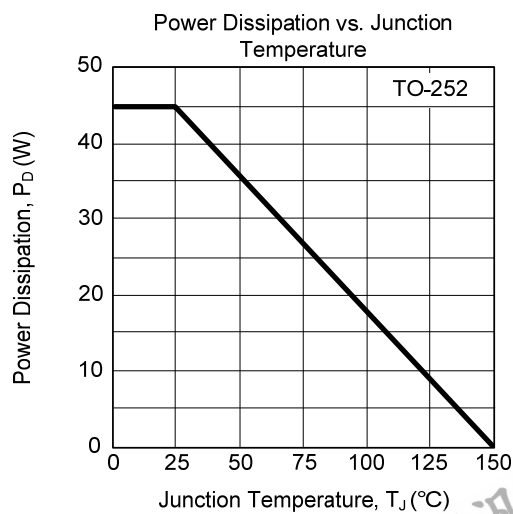
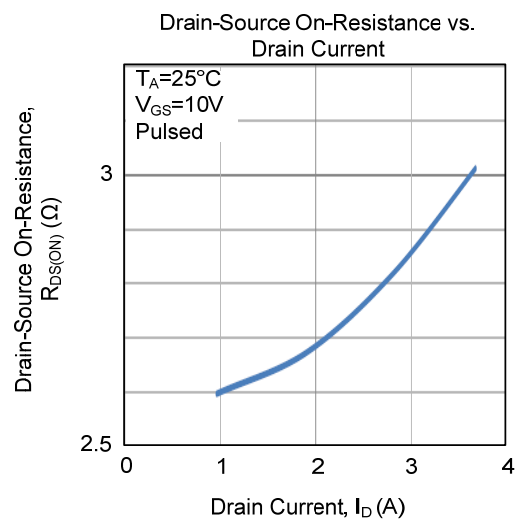
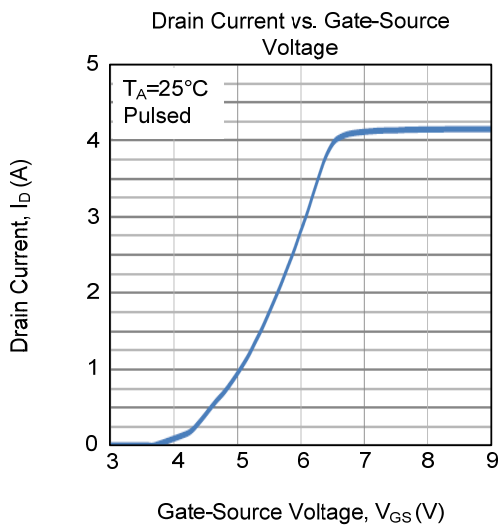
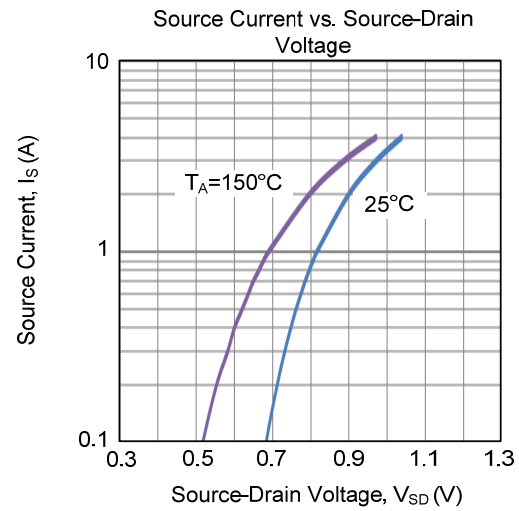
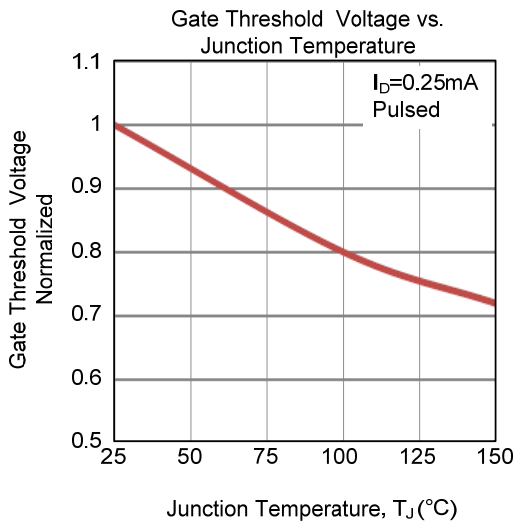


Unclamped Inductive Switching Waveforms

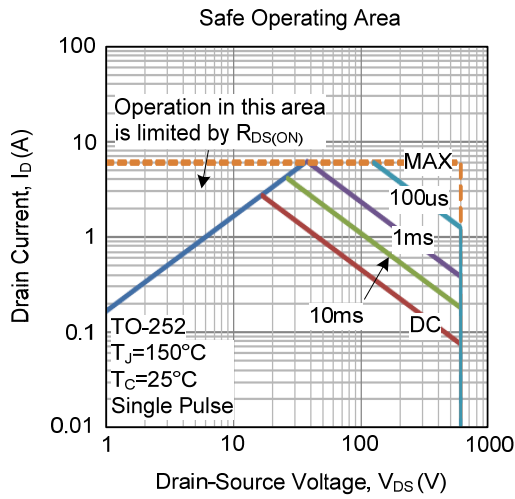
## TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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