



## 9NM90Z

Power MOSFET

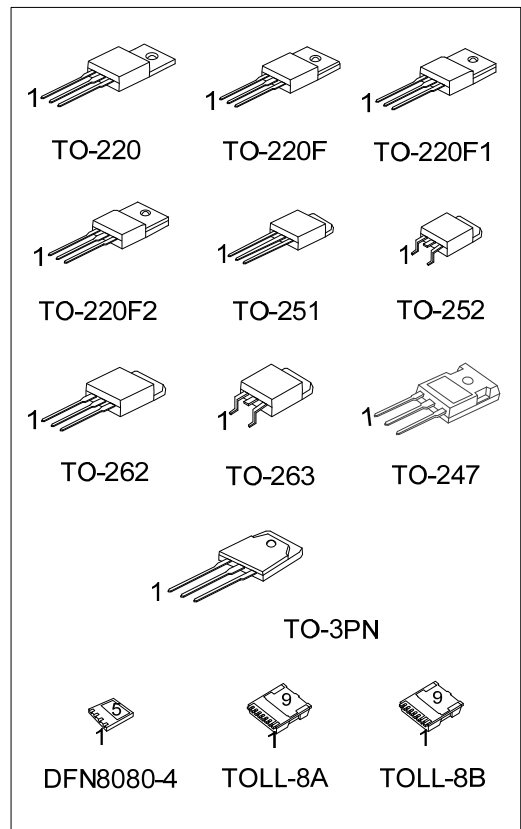
### 9.0A, 900V N-CHANNEL SUPER-JUNCTION MOSFET

#### DESCRIPTION

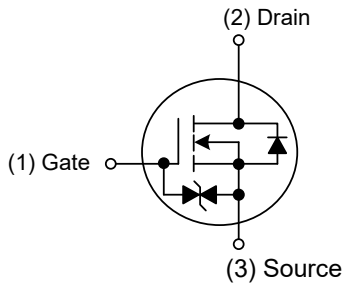
The UTC **9NM90Z** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

#### FEATURES

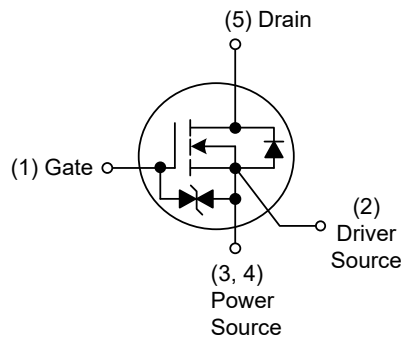
- \*  $R_{DS(ON)} \leq 1.4 \Omega @ V_{GS}=10V, I_D=4.5A$
- \* High Switching Speed



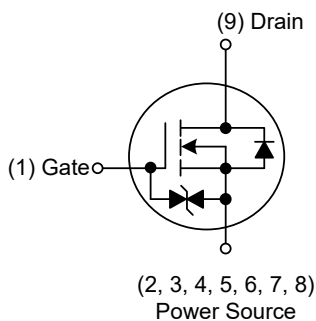
#### SYMBOL



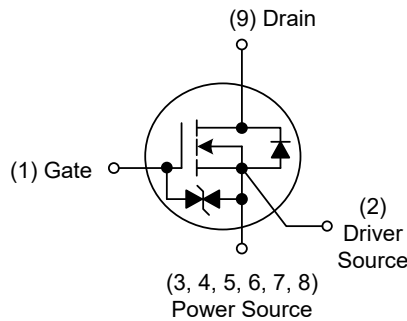
TO-220 / TO-220F / TO-220F1  
TO-220F2 / TO-251 / TO-252  
TO-247 / TO-262 / TO-263 / TO-3PN



DFN8080-4



TOLL-8A



TOLL-8B

## ORDERING INFORMATION

Ordering Number		Package	Pin Assignment									Packing	
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9		
9NM90ZL-TA3-T	9NM90ZG-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TF1-T	9NM90ZG-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TF2-T	9NM90ZG-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TF3-T	9NM90ZG-TF3-T	TO-220F	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TM3-T	9NM90ZG-TM3-T	TO-251	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TN3-R	9NM90ZG-TN3-R	TO-252	G	D	S	-	-	-	-	-	-	Tape Reel	
9NM90ZL-T2Q-T	9NM90ZG-T2Q-T	TO-262	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TQ2-T	9NM90ZG-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-TQ2-R	9NM90ZG-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel	
9NM90ZL-T47-T	9NM90ZG-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-T3N-T	9NM90ZG-T3N-T	TO-3PN	G	D	S	-	-	-	-	-	-	Tube	
9NM90ZL-K04-8080-R	9NM90ZG-K04-8080-R	DFN8080-4	G	S	S	S	S	D	-	-	-	Tape Reel	
9NM90ZL-T8A-R	9NM90ZG-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	S	D	Tape Reel
9NM90ZL-T8B-R	9NM90ZG-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	S	D	Tape Reel

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

<p>9NM90ZG-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TM3: TO-251, TN3: TO-252, T2Q: TO-262, TQ2: TO-263, T3N: TO-3PN, T47: TO-247, T8A: TOLL-8A, T8B: TOLL-8B, K04-8080: DFN8080-4</p> <p>(3) G: Halogen Free and Lead Free L: Lead Free</p>
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## MARKING

<p>TO-220 / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-252 TO-247 / TO-262 / TO-263 / TO-3PN</p>	<p>DFN8080-4</p>
<p>TOLL-8A / TOLL-8B</p>	<p>-</p>
	<p>-</p>

■ ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	900	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Drain Current	Continuous	$I_D$	9	A
	Pulsed (Note 2)	$I_{DM}$	27	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	225	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1	V/ns
Power Dissipation	TO-220/TO-262 TO-263	$P_D$	70	W
	TO-220F/TO-220F1 TO-220F2		27	W
	TO-3PN		130	W
	TO-247		120	W
	TO-251/TO-252		36	W
	DFN8080-4		50	W
	TOLL-8A/TOLL-8A		150	W
	Junction Temperature		$T_J$	+150
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.  $L = 100\text{mH}$ ,  $I_{AS} = 2.1\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$  Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 9.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	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-3PN		30	$^\circ\text{C}/\text{W}$
	TO-247		40	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
	DFN8080-4/TOLL-8A/TOLL-8A		35	$^\circ\text{C}/\text{W}$
	Junction to Case		TO-220/TO-262/TO-263	$\theta_{JC}$
	TO-220F/TO-220F1 TO-220F2	4.62	$^\circ\text{C}/\text{W}$	
	TO-3PN	0.96	$^\circ\text{C}/\text{W}$	
	TO-247	1.04	$^\circ\text{C}/\text{W}$	
	TO-251/TO-252	3.47 (Note)	$^\circ\text{C}/\text{W}$	
	DFN8080-4	2.5 (Note)	$^\circ\text{C}/\text{W}$	
	TOLL-8A/TOLL-8A	0.83 (Note)	$^\circ\text{C}/\text{W}$	

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

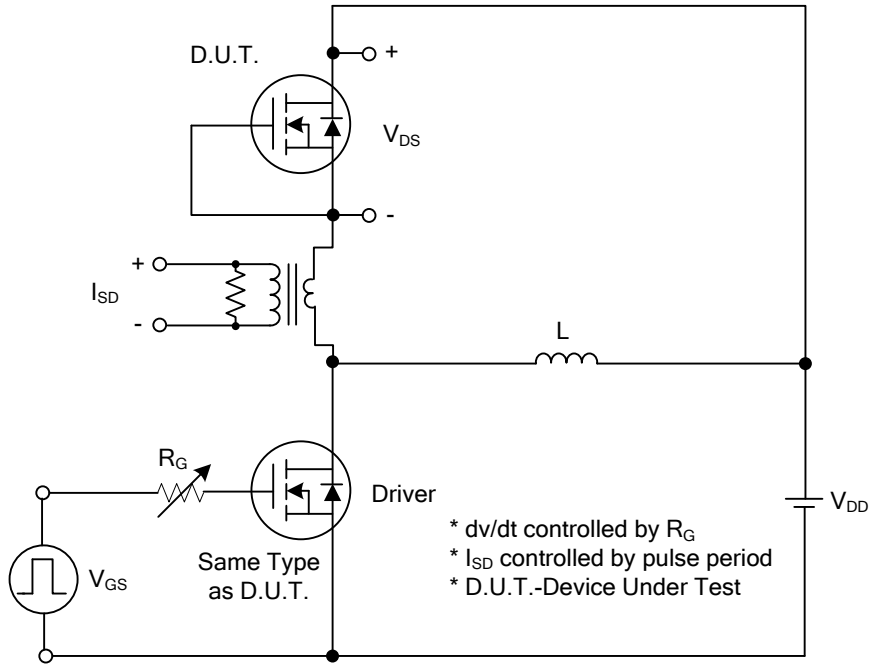
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

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	900			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =900V, V <sub>GS</sub> =0V			10	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>			10	μA
	Reverse					
<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> =4.5A			1.4	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =50V, f=1.0 MHz		676		pF
Output Capacitance	C <sub>OSS</sub>			54		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			2		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	Q <sub>G</sub>	V <sub>DS</sub> =760V, V <sub>GS</sub> =10V, I <sub>D</sub> =9.0A (Note 1, 2)		33		nC
Gate-source Charge	Q <sub>GS</sub>			8		nC
Gate-drain Charge	Q <sub>GD</sub>			13		nC
Turn-on Delay Time (Note 1)	t <sub>D(ON)</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =9.0A, R <sub>G</sub> =25Ω (Note 1, 2)		11		ns
Rise Time	t <sub>R</sub>			22		ns
Turn-off Delay Time	t <sub>D(OFF)</sub>			79		ns
Fall-Time	t <sub>F</sub>			30		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				9	A
Drain-Source Diode Forward Voltage (Note 1)	V <sub>SD</sub>	I <sub>S</sub> =9.0A, V <sub>GS</sub> =0V			1.4	V
Reverse Recovery Time (Note 1)	t <sub>rr</sub>	I <sub>S</sub> =9.0A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/μs (Note1)		544		ns
Reverse Recovery Charge	Q <sub>rr</sub>				8.7	

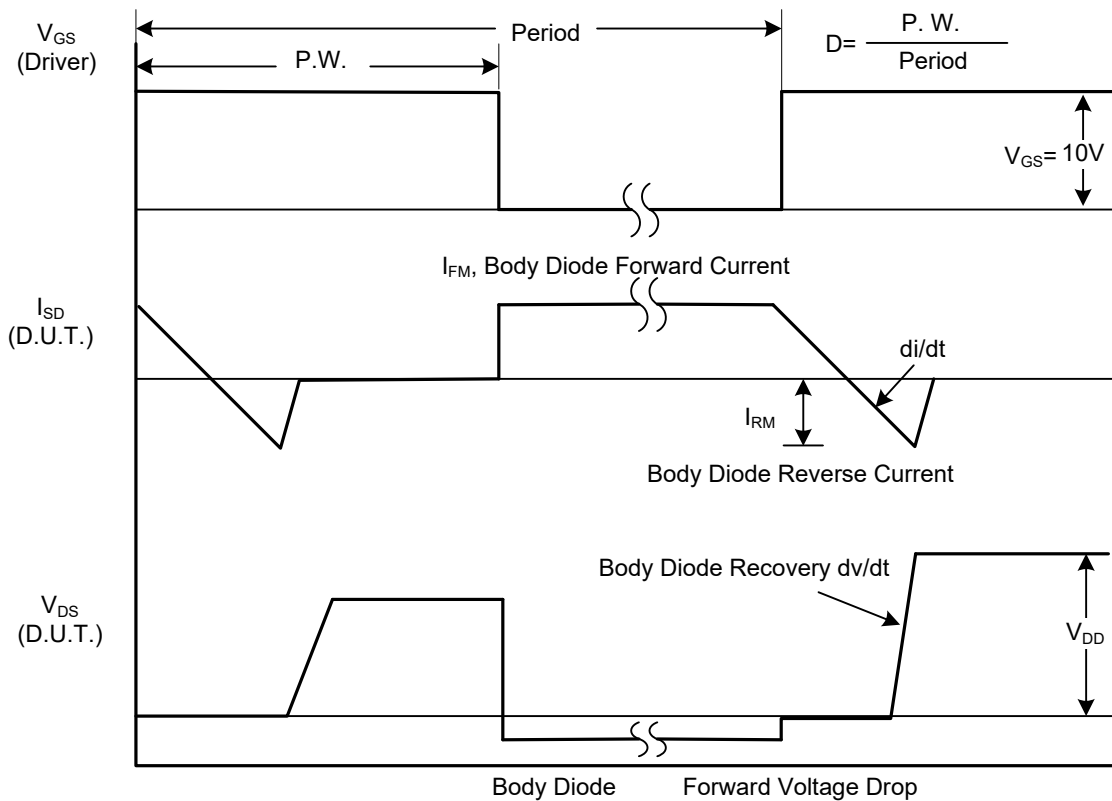
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

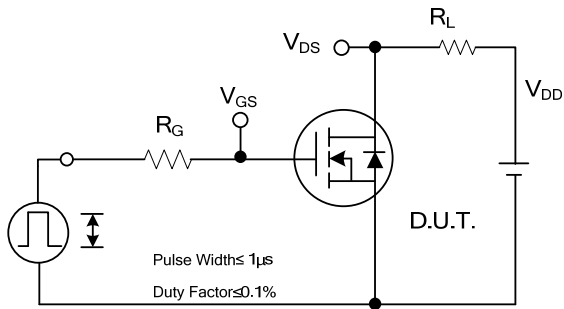


Peak Diode Recovery  $dv/dt$  Test Circuit

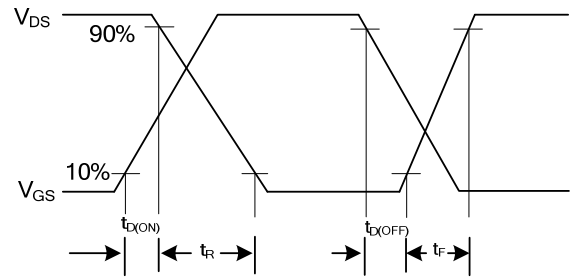


Peak Diode Recovery  $dv/dt$  Waveforms

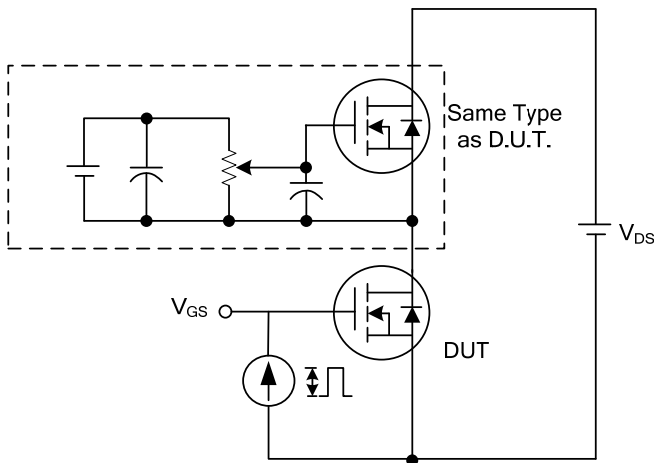
## TEST CIRCUITS AND WAVEFORMS



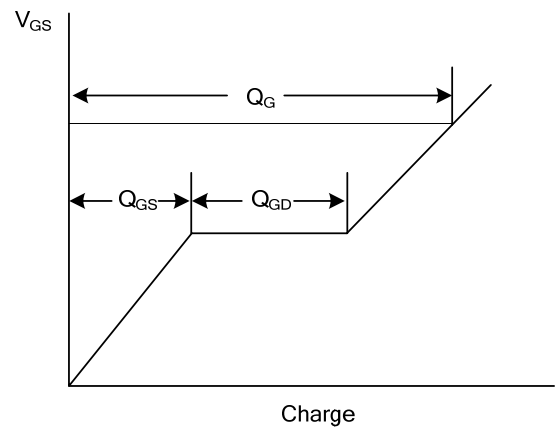
**Switching Test Circuit**



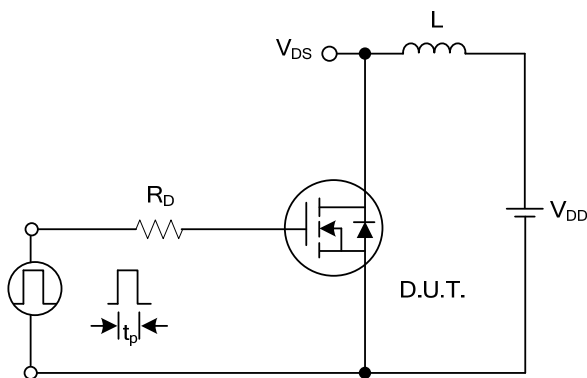
**Switching Waveforms**



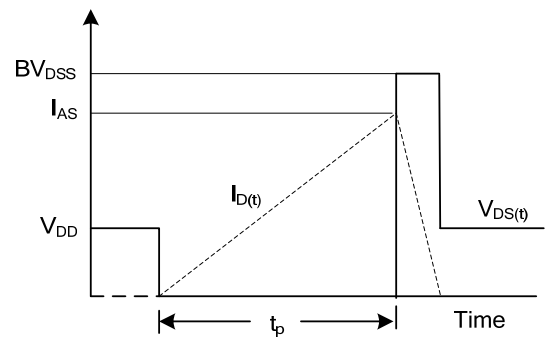
**Gate Charge Test Circuit**



**Gate Charge Waveform**

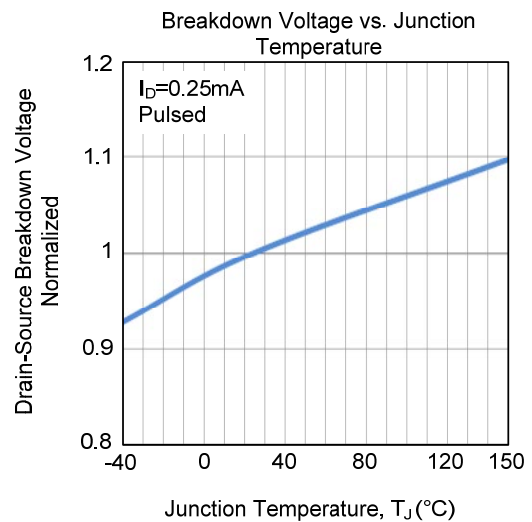
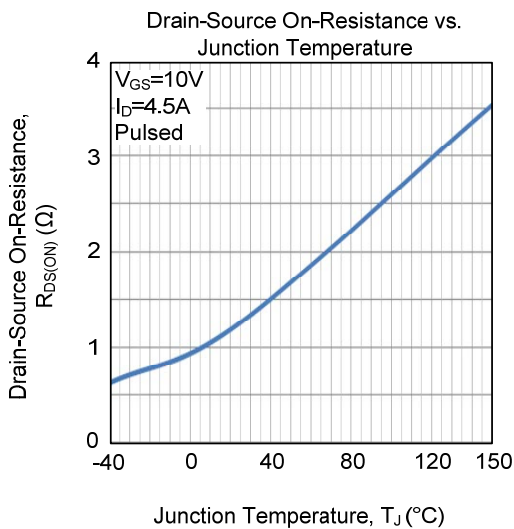
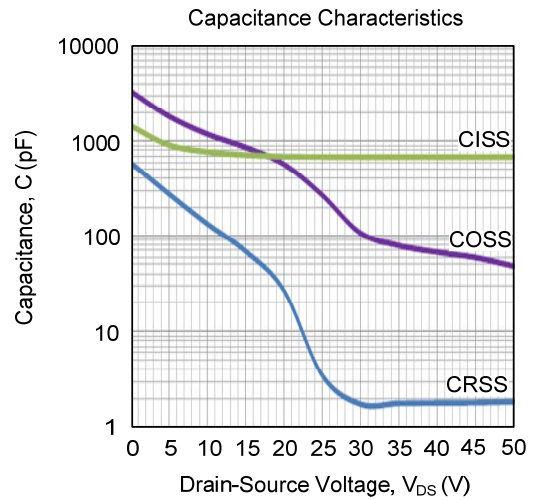
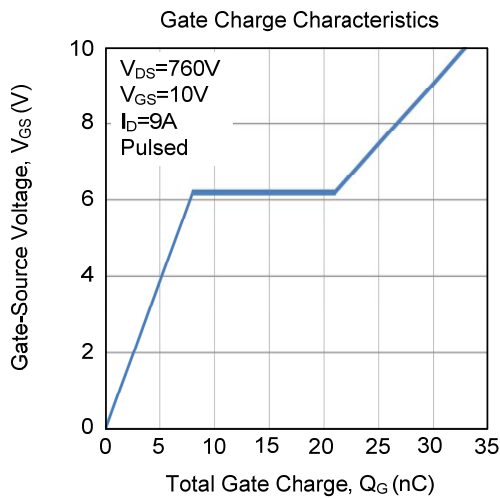
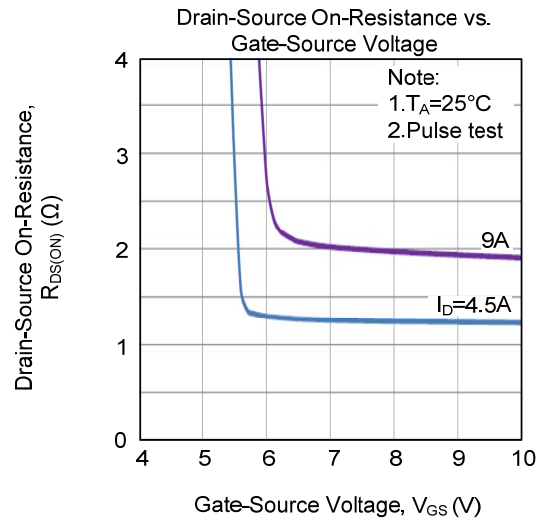
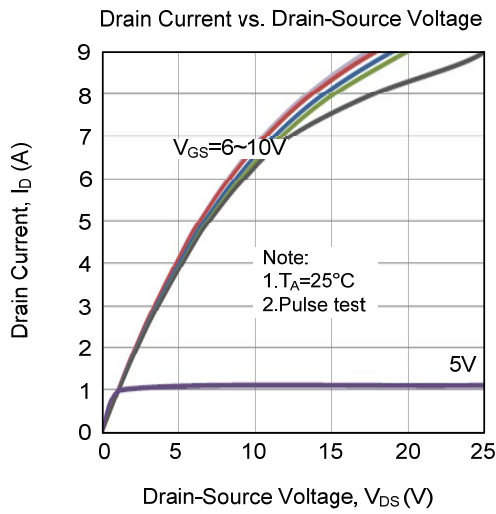


**Unclamped Inductive Switching Test Circuit**

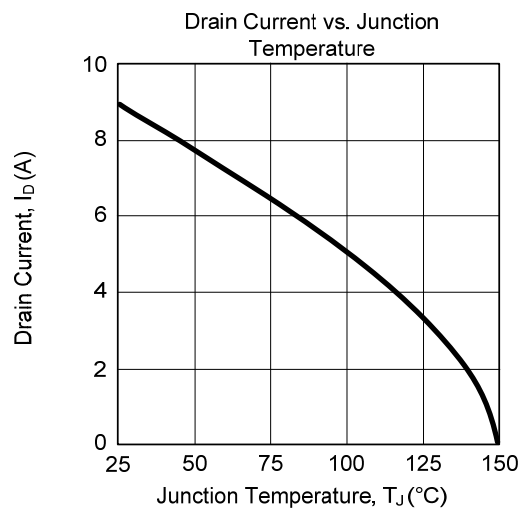
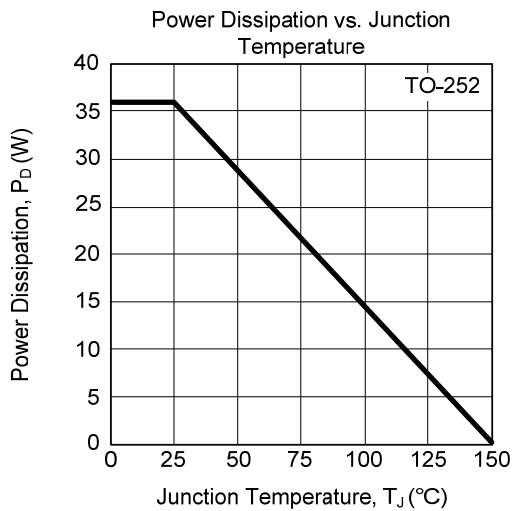
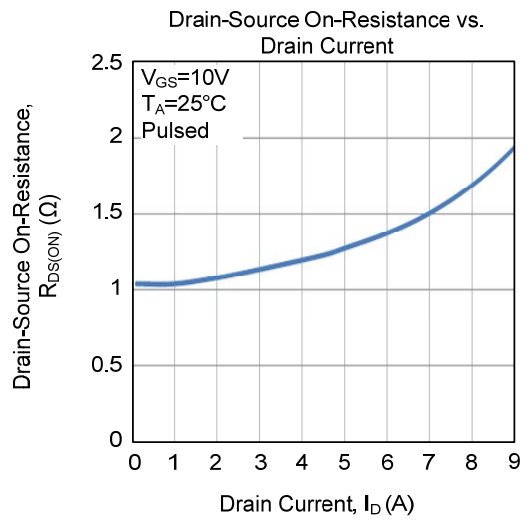
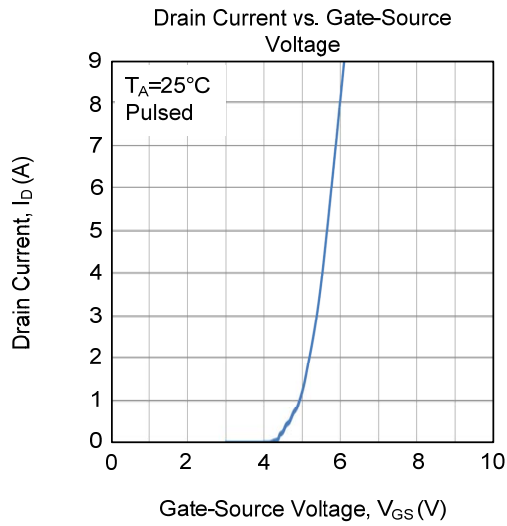
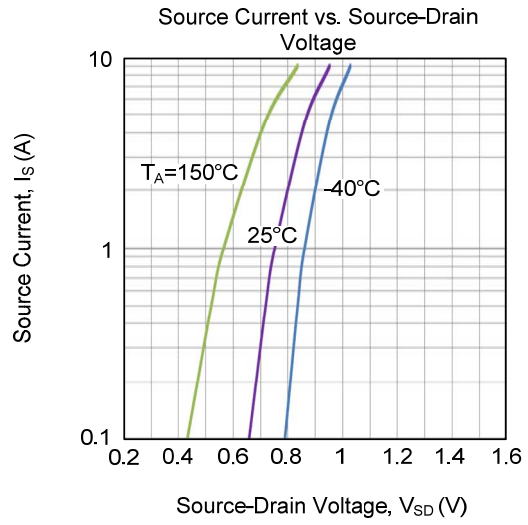
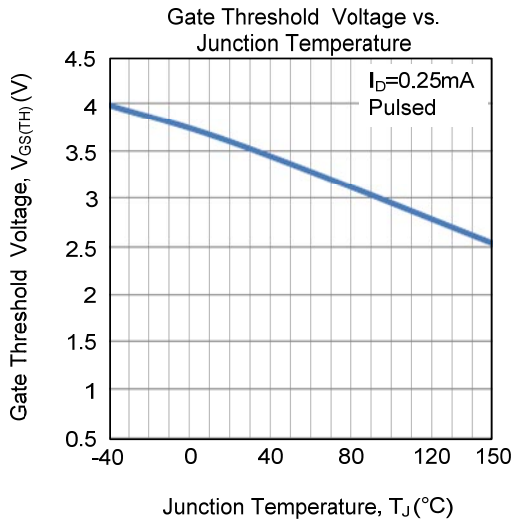


**Unclamped Inductive Switching Waveforms**

## TYPICAL CHARACTERISTICS

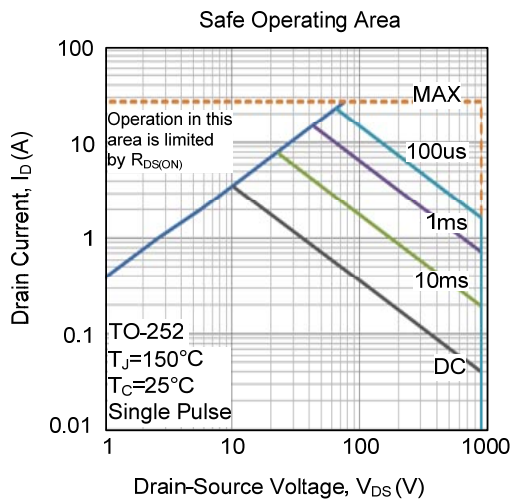


■ TYPICAL CHARACTERISTICS (Cont.)





■ TYPICAL CHARACTERISTICS (Cont.)



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