



## 1N65A

Power MOSFET

### 0.5A, 650V N-CHANNEL POWER MOSFET

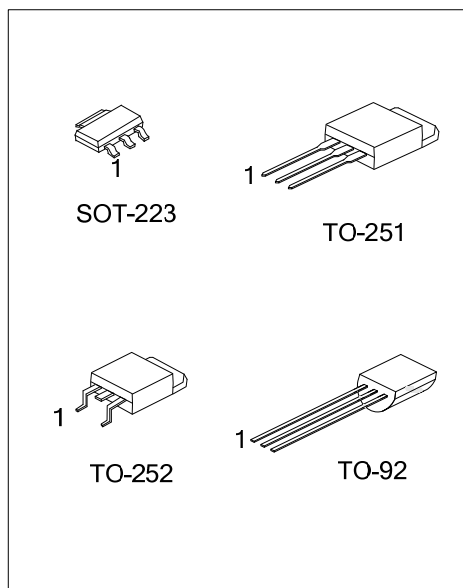
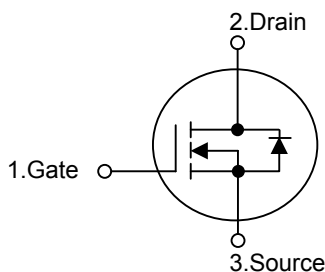
#### DESCRIPTION

The UTC **1N65A** 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 at power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} < 15.5\Omega @ V_{GS} = 10V, I_D = 0.5A$
- \* Ultra Low gate charge (typical 8.0nC)
- \* Low reverse transfer capacitance ( $C_{RSS} = 3.0\text{ pF(max)}$ )
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



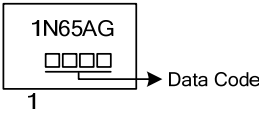
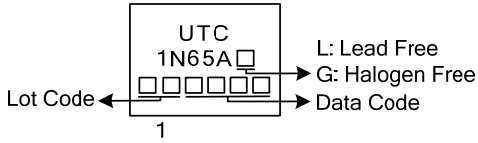
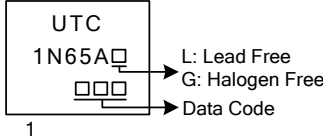
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	1N65AG-AA3-R	SOT-223	G	D	S	Tape Reel
1N65AL-TM3-T	1N65AG-TM3-T	TO-251	G	D	S	Tube
1N65AL-TN3-R	1N65AG-TN3-R	TO-252	G	D	S	Tape Reel
1N65AL-T92-B	1N65AG-T92-B	TO-92	G	D	S	Tape Box
1N65AL-T92-K	1N65AG-T92-K	TO-92	G	D	S	Bulk

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

<p>1N65AG-AA3-R</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) B: Tape Box, K: Bulk, T: Tube, R: Tape Reel (2) AA3: SOT-223, TM3: TO-251, TN3: TO-252 T92: TO-92 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING

PACKAGE	MARKING
SOT-223	
TO-251 / TO-252	
TO-92	

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■ 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
Continuous Drain Current		$I_D$	0.5	A
Pulsed Drain Current (Note 2)		$I_{DM}$	2	A
Avalanche Energy	Single Pulse(Note 3)	$E_{AS}$	50	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation ( $T_C=25^\circ\text{C}$ )	SOT-223	$P_D$	8.9	W
	TO-251/TO-252		27.6	W
	TO-92		1.42	W
Derate above $25^\circ\text{C}$	SOT-223		0.07	mW/ $^\circ\text{C}$
	TO-251/TO-252		0.22	mW/ $^\circ\text{C}$
	TO-92		0.011	mW/ $^\circ\text{C}$
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operating Temperature		$T_{OPR}$	-55 ~ +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.  $L=92\text{mH}$ ,  $I_{AS}=0.8\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=0\Omega$ , Starting  $T_J=25^\circ\text{C}$

4.  $I_{SD}\leq 1.0\text{A}$ ,  $di/dt\leq 100\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
	TO-92		180	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-223	$\theta_{JC}$	14	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		4.53	$^\circ\text{C}/\text{W}$
	TO-92		88	$^\circ\text{C}/\text{W}$

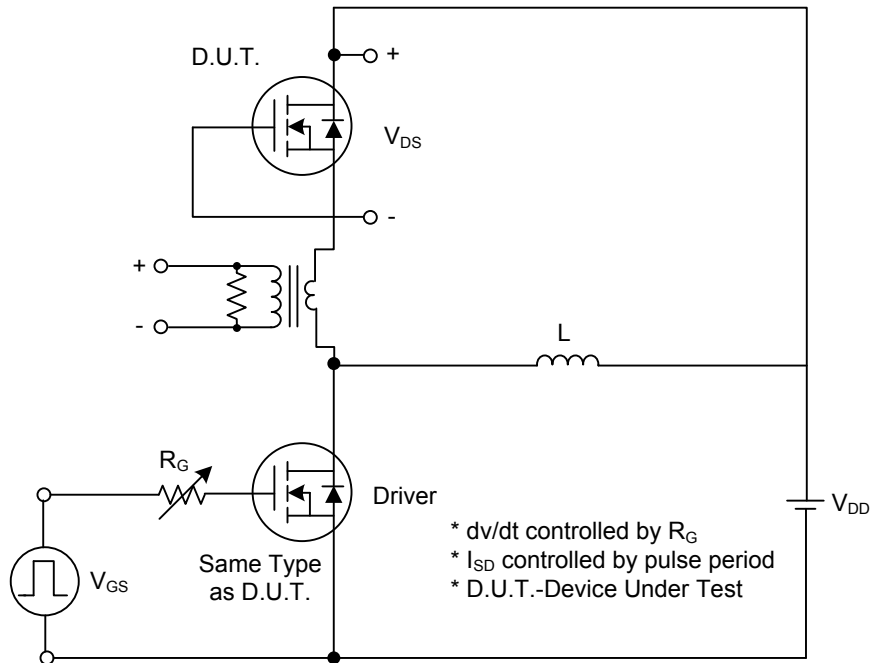
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^\circ\text{C}$ , unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse				$V_{GS} = -20V, V_{DS} = 0V$	-100
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250mA, \text{referenced to } 25^\circ\text{C}$		0.4		$V/^\circ\text{C}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 0.5A$		11.5	15.5	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V,$ $f=1MHz$			100	pF
Output Capacitance	$C_{OSS}$				20	pF
Reverse Transfer Capacitance	$C_{RSS}$				3	pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	$Q_G$	$V_{DS}=520V, V_{GS}=10V,$ $I_D=0.8A \text{ (Note 1,2)}$		8	10	nC
Gate-Source Charge	$Q_{GS}$			1.8		nC
Gate-Drain Charge	$Q_{GD}$			4.0		nC
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=325V, I_D=0.5A,$ $R_G=5\Omega \text{ (Note 1,2)}$		12	34	ns
Turn-On Rise Time	$t_R$			11	32	ns
Turn-Off Delay Time	$t_{D(OFF)}$			40	90	ns
Turn-Off Fall Time	$t_F$			18	46	ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				4.8	A
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_{SD} = 1.2A$			1.6	V
Reverse Recovery Time	$t_{rr}$	$V_{GS}=0V, I_{SD} = 1.2A$ $di/dt = 100A/\mu s$		136		ns
Reverse Recovery Charge	$Q_{RR}$			0.3		$\mu C$

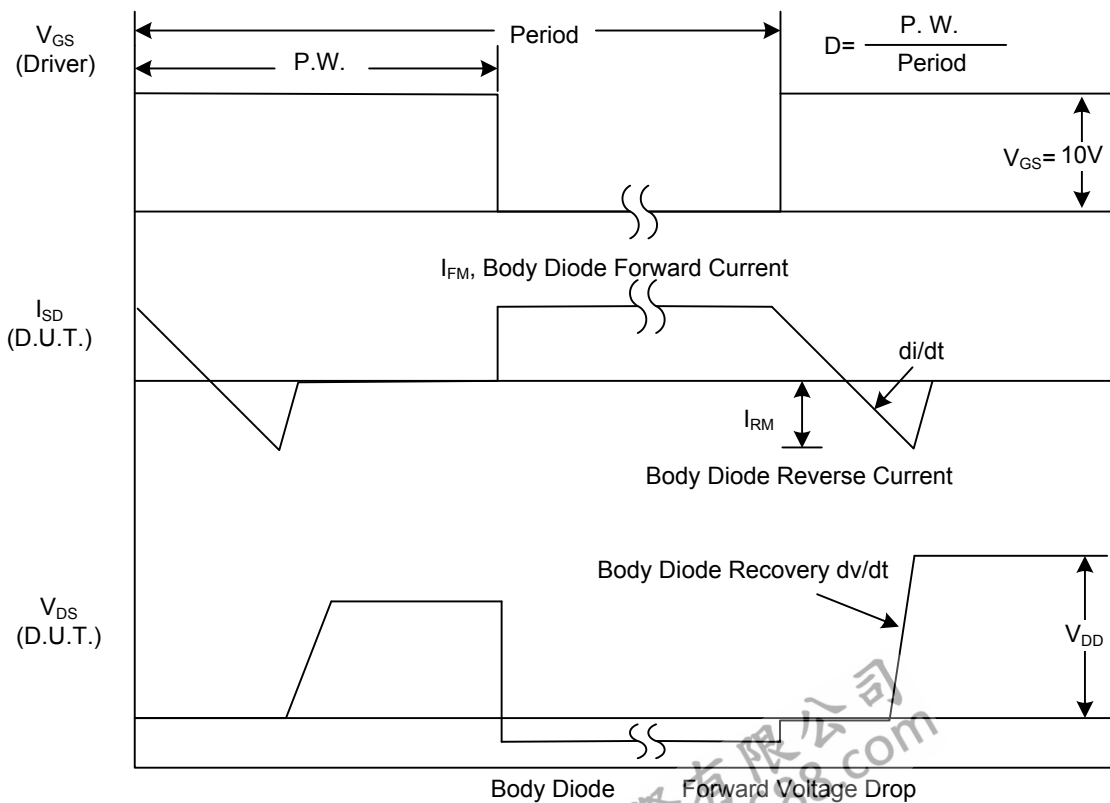
Note: 1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

2. Essentially independent of operating temperature

### TEST CIRCUITS AND WAVEFORMS

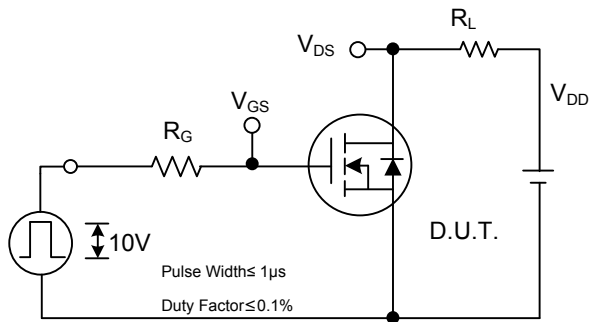


**Peak Diode Recovery dv/dt Test Circuit**

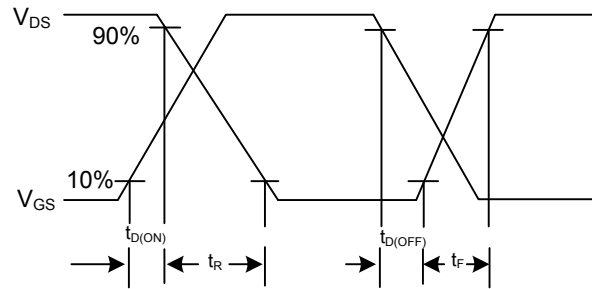


**Peak Diode Recovery dv/dt Waveforms**

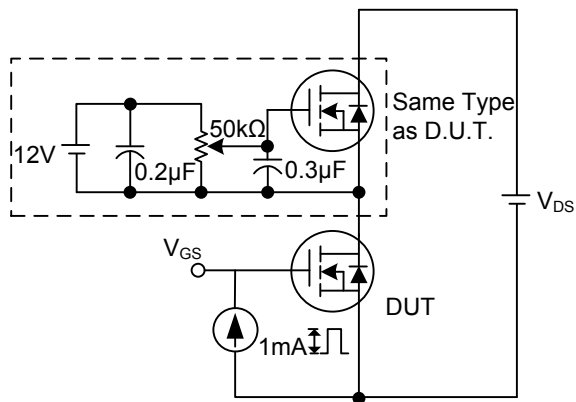
## TEST CIRCUITS AND WAVEFORMS (Cont.)



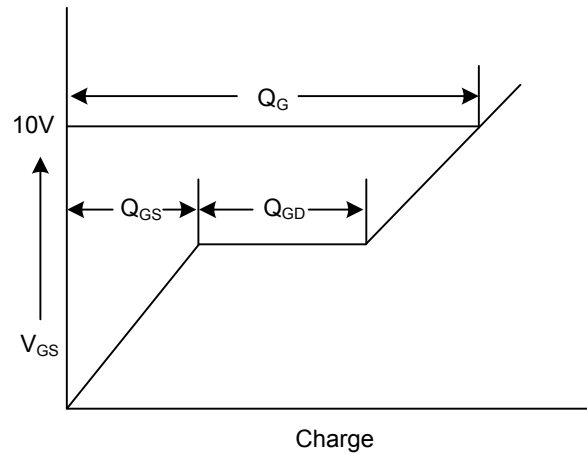
Switching Test Circuit



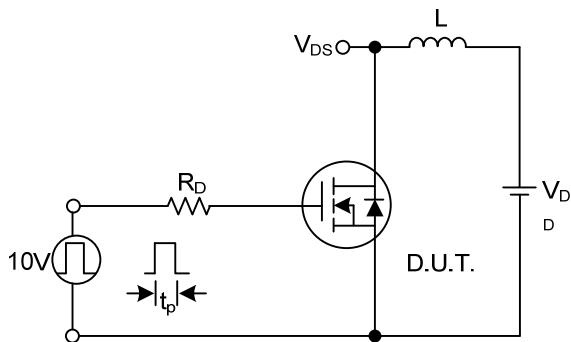
Switching Waveforms



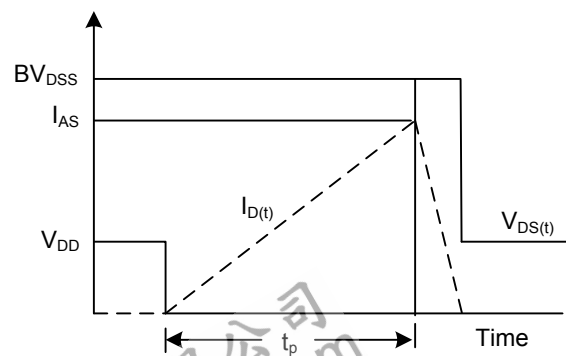
Gate Charge Test Circuit



Gate Charge Waveform

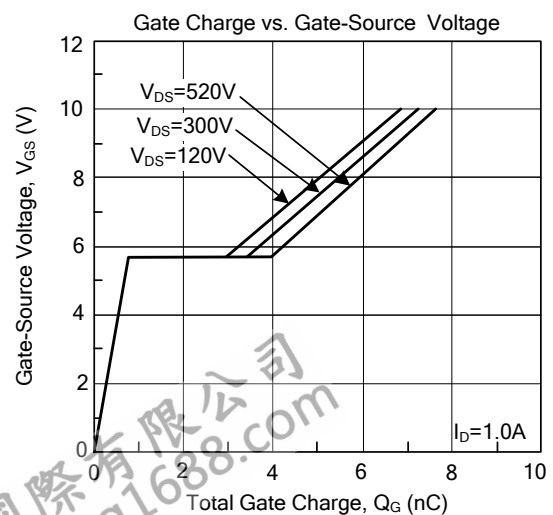
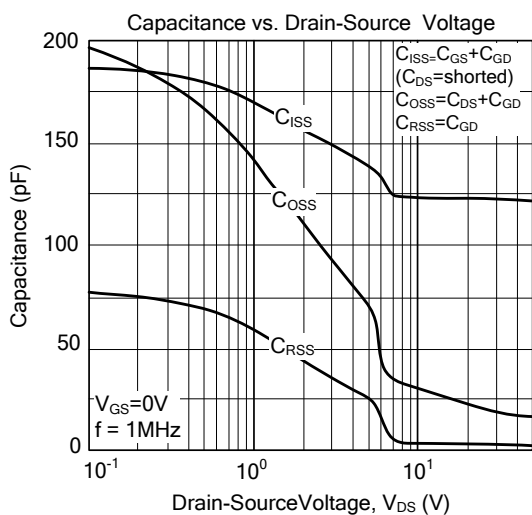
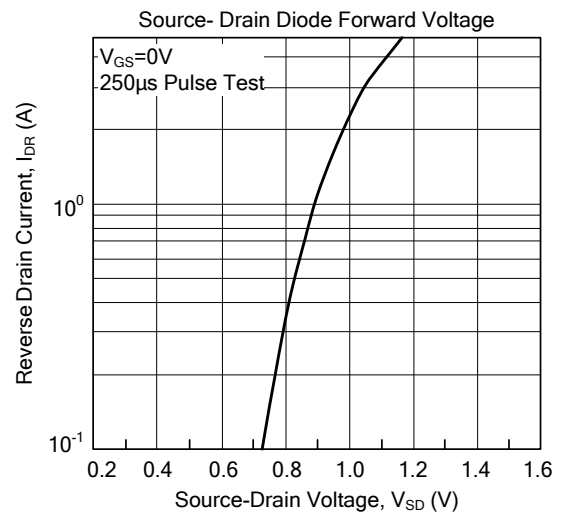
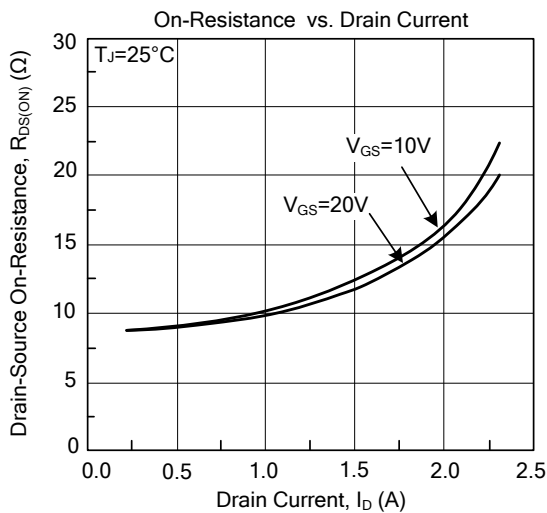
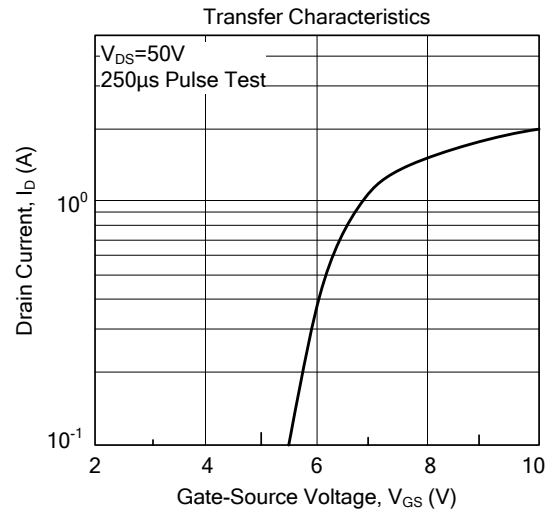
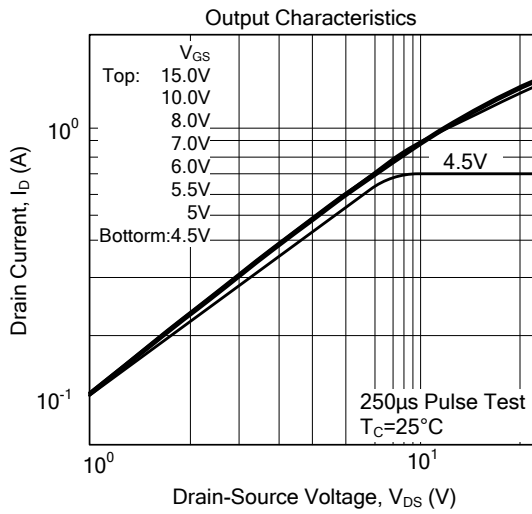


Unclamped Inductive Switching Test Circuit

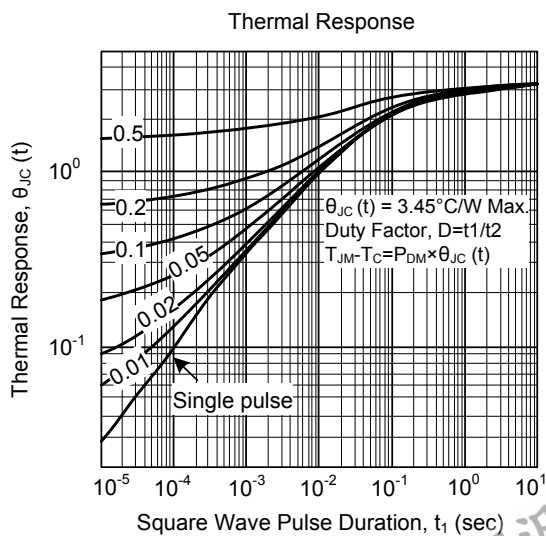
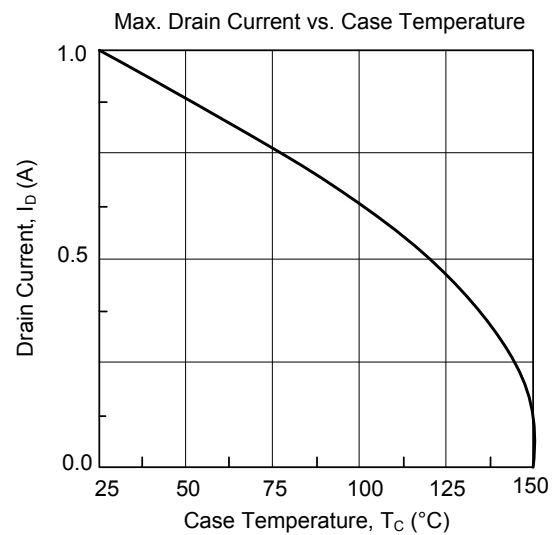
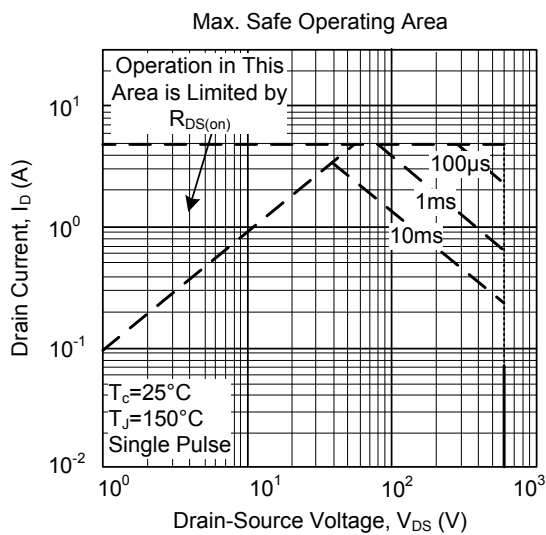
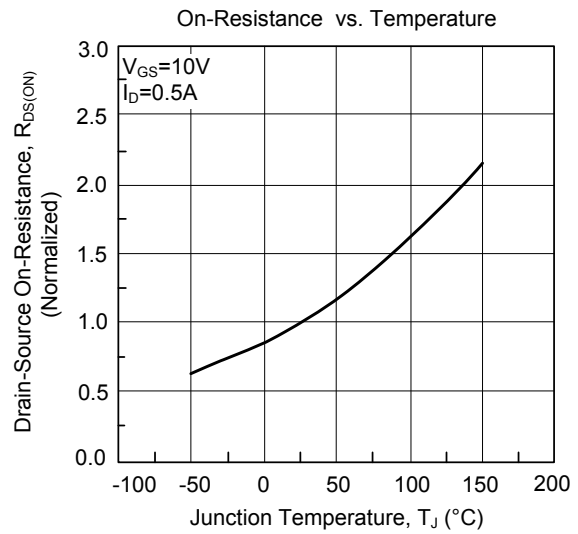
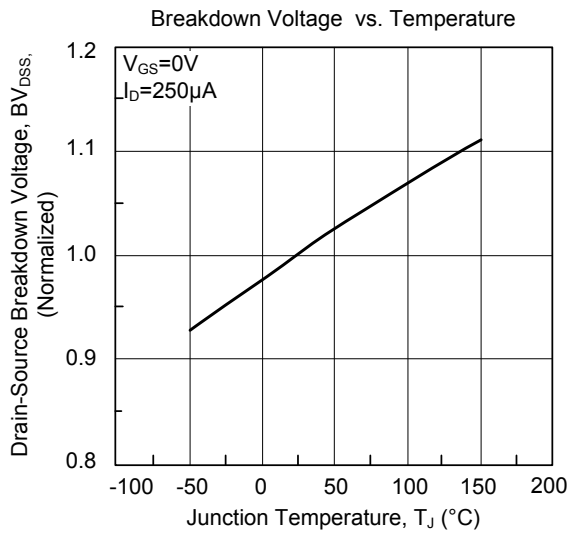


Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS



### TYPICAL CHARACTERISTICS (Cont.)





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