



# 1N65

## Power MOSFET

### 1.2A, 650V N-CHANNEL POWER MOSFET

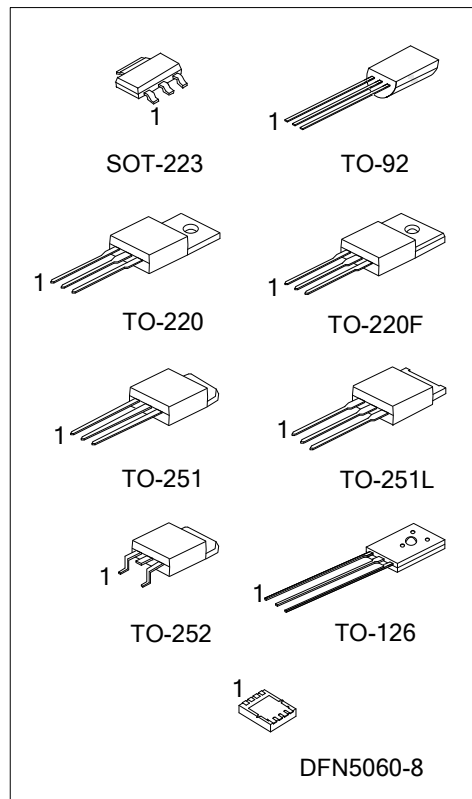
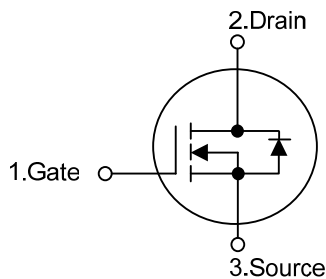
#### DESCRIPTION

The UTC **1N65** is a high voltage power MOSFET and is 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 the high speed switching applications of power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} < 12.5\Omega @ V_{GS}=10V, I_D=0.6A$
- \* Ultra Low gate charge (typical 5.0nC)
- \* Low reverse transfer capacitance ( $C_{RSS} = \text{typical } 3.0 \text{ pF}$ )
- \* 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	4	5	6	7	8	
1N65L-AA3-R	1N65G-AA3-R	SOT-223	G	D	S	-	-	-	-	-	Tape Reel
1N65L-TA3-T	1N65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
1N65L-TF3-T	1N65G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
1N65L-TM3-T	1N65G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
1N65L-TMA-T	1N65G-TMA-T	TO-251L	G	D	S	-	-	-	-	-	Tube
1N65L-TN3-R	1N65G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
1N65L-T60-K	1N65G-T60-K	TO-126	G	D	S	-	-	-	-	-	Bulk
1N65L-T92-B	1N65G-T92-B	TO-92	G	D	S	-	-	-	-	-	Tape Box
1N65L-T92-K	1N65G-T92-K	TO-92	G	D	S	-	-	-	-	-	Bulk
1N65L-K08-5060-R	1N65G-K08-5060-R	DFN5060-8	S	S	S	G	D	D	D	D	Tape Reel

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

<p>1N65G-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, T92: TO-92, TA3: TO-220, TF3: TO-220F, TM3: TO-251, TN3: TO-252, TMA: TO-251L, T60: TO-126, K08-5060: DFN5060-8 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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### MARKING

PACKAGE	MARKING
SOT-223	
TO-220 TO-220F TO-251 TO-251L TO-252	
TO-126	
TO-92	
DFN5060-8	

■ 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
Avalanche Current (Note 2)		$I_{AR}$	1.2	A
Continuous Drain Current		$I_D$	1.2	A
Pulsed Drain Current (Note 2)		$I_{DM}$	4.8	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	50	mJ
	Repetitive (Note 2)	$E_{AR}$	4.0	mJ
Peak Diode Recovery $dv/dt$ (Note 4)		$dv/dt$	4.5	V/ns
Power Dissipation	SOT-223	$P_D$	8	W
	TO-251/TO-251L		28	W
	TO-252			
	TO-220		40	W
	TO-220F		21	W
	TO-92 ( $T_A=25^\circ\text{C}$ )		1	W
	TO-126		12.5	W
DFN5060-8	14	W		
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.  $L = 60\text{mH}$ ,  $I_{AS} = 1\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 1.2\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^\circ\text{C}/\text{W}$
	TO-220/TO-220F		62.5	
	TO-251/TO-251L		4.53	
	TO-252			
	TO-92		140	
	TO-126		132	
	DFN5060-8		75	
Junction to Case	SOT-223	$\theta_{JC}$	14	$^\circ\text{C}/\text{W}$
	TO-220		3.13	
	TO-220F		5.95	
	TO-251/TO-251L		4.53	
	TO-252			
	TO-92		80	
	TO-126		10	
DFN5060-8	8.9			

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

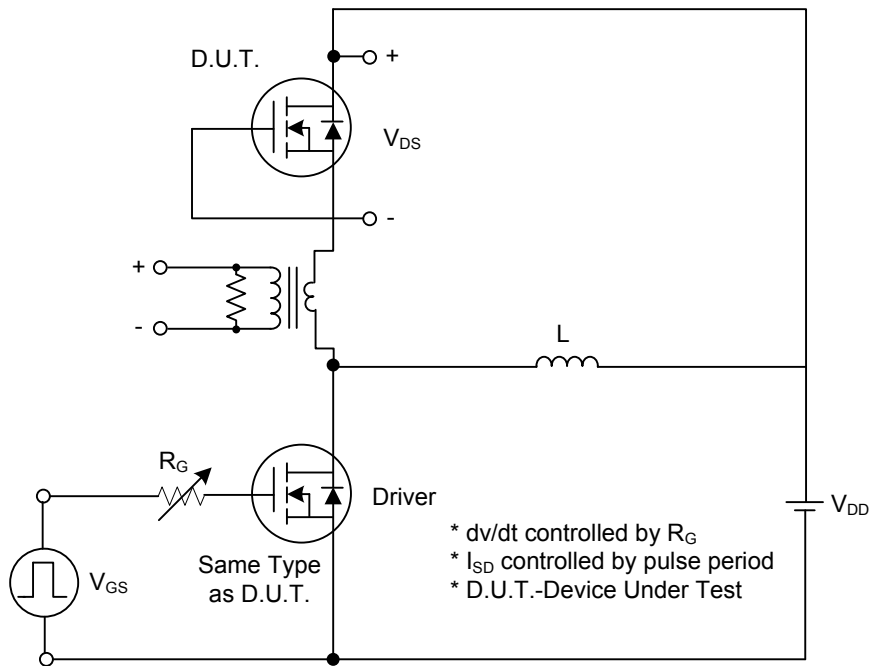
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V			10	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA		0.4		V/°C
<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	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =0.6A		9.5	12.5	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz		120	150	pF
Output Capacitance	C <sub>OSS</sub>			20	25	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			3.0	4.0	pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =520V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.2A (Note 2,3)		5.0	6.0	nC
Gate-Source Charge	Q <sub>GS</sub>			1.0		nC
Gate-Drain Charge	Q <sub>GD</sub>			2.6		nC
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =325V, I <sub>D</sub> =1.2A, R <sub>G</sub> =50Ω (Note 2,3)		5	20	ns
Turn-On Rise Time	t <sub>R</sub>			25	60	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			7	25	ns
Turn-Off Fall Time	t <sub>F</sub>			25	60	ns
<b>SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				4.8	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =1.2A			1.4	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =1.2A dI <sub>F</sub> /dt=100A/μs (Note 1)		160		ns
Reverse Recovery Charge	Q <sub>rr</sub>			0.3		μC

Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

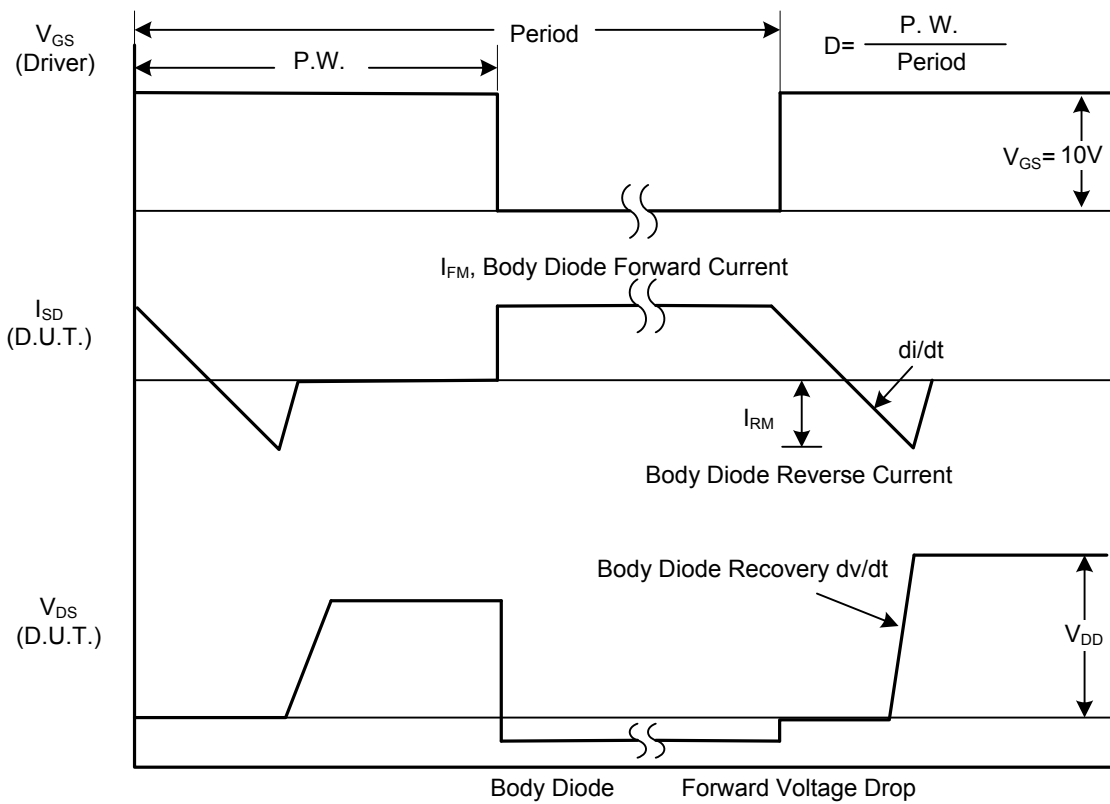
2. Pulse Test: Pulse Width ≤300μs, Duty Cycle≤2%

3. Essentially Independent of Operating Temperature

■ TEST CIRCUITS AND WAVEFORMS

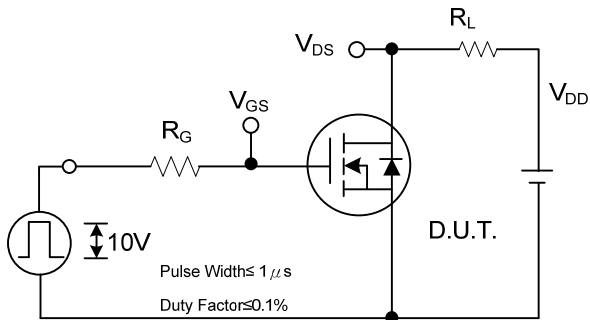


Peak Diode Recovery dv/dt Test Circuit

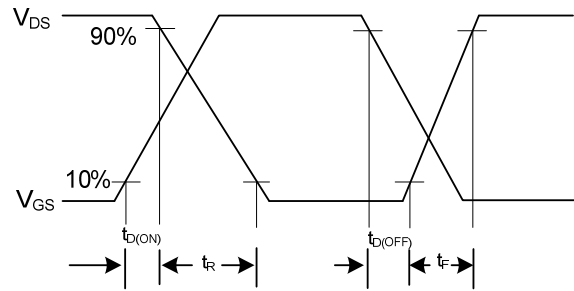


Peak Diode Recovery dv/dt Waveforms

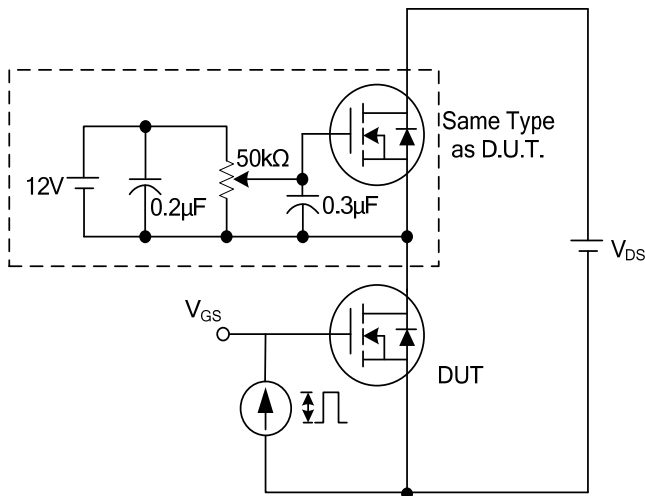
### TEST CIRCUITS AND WAVEFORMS (Cont.)



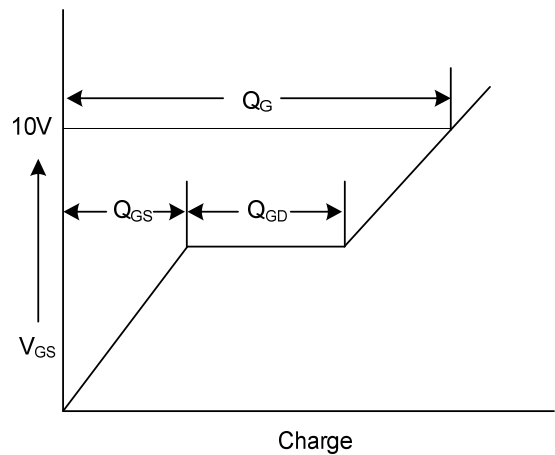
**Switching Test Circuit**



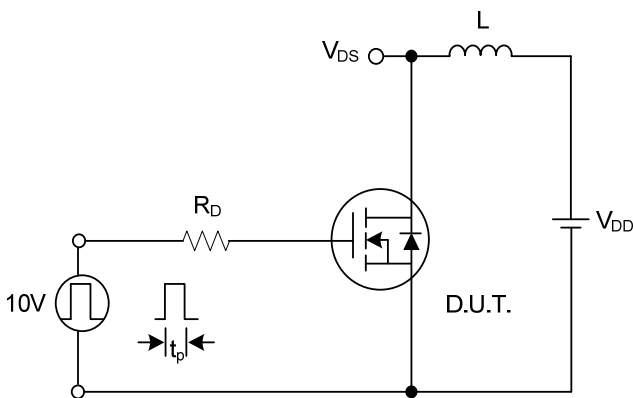
**Switching Waveforms**



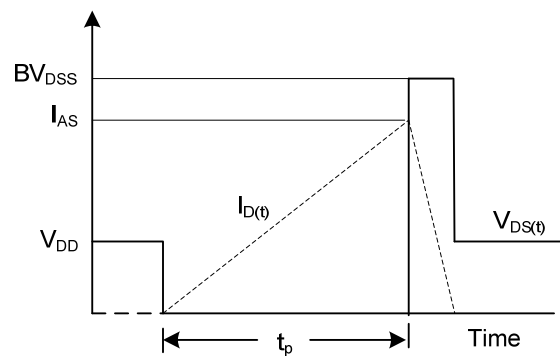
**Gate Charge Test Circuit**



**Gate Charge Waveform**

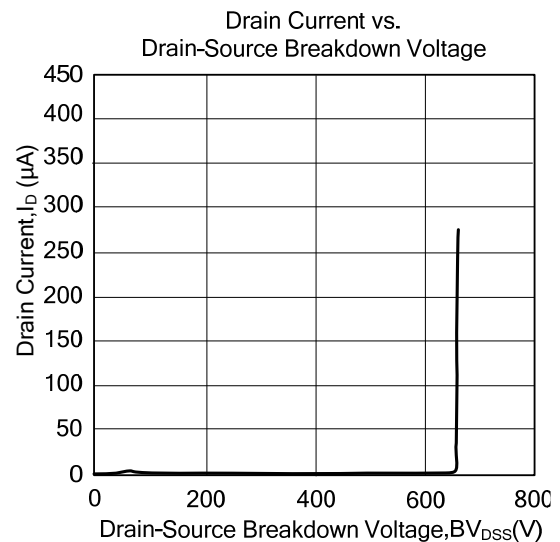
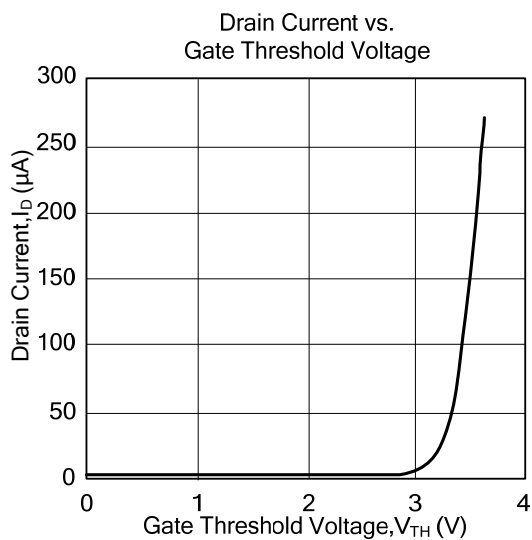
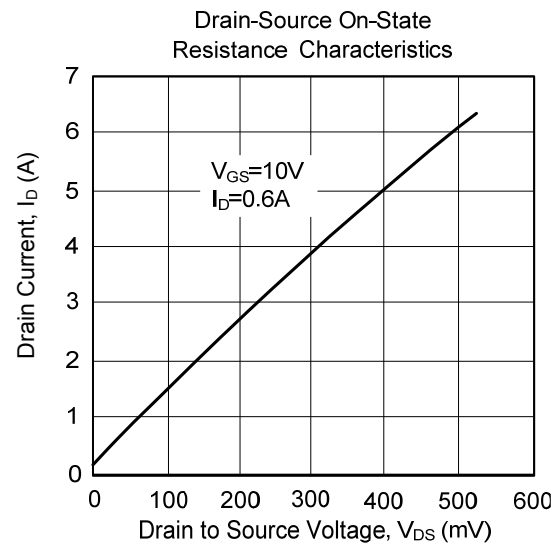
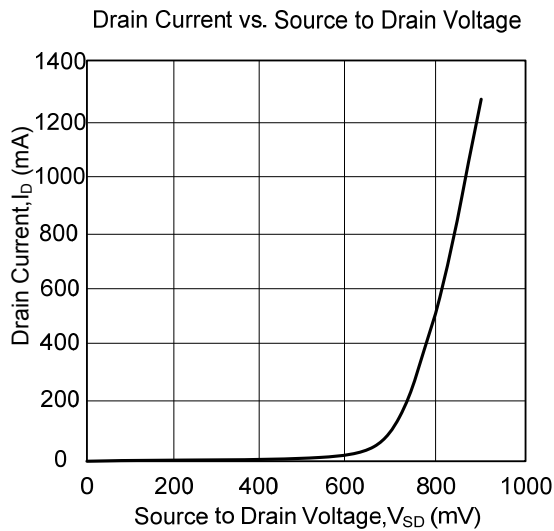


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveformst**

### ■ TYPICAL CHARACTERISTICS



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