



4N65-N

Power MOSFET

4A, 650V N-CHANNEL POWER MOSFET

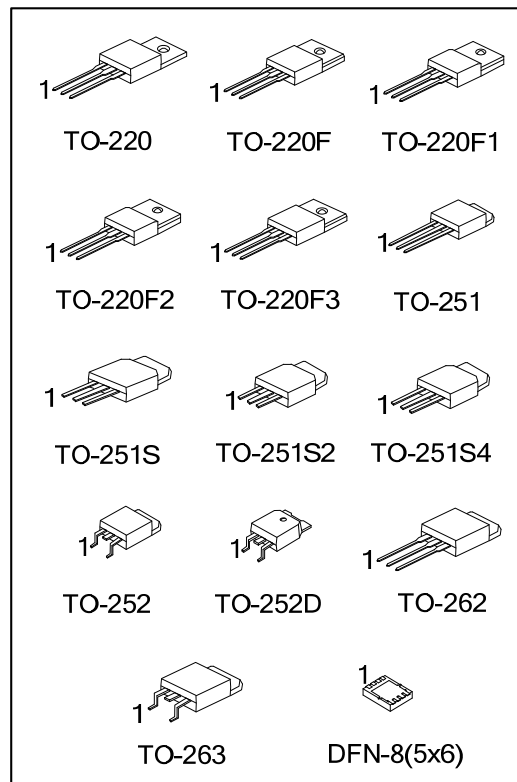
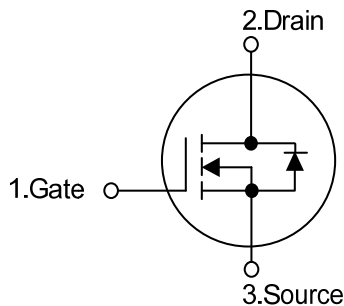
DESCRIPTION

The UTC **4N65-N** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} < 3.1\Omega$ @ $V_{GS} = 10V, I_D = 2.2A$
- * 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	
4N65L-TA3-T	4N65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
4N65L-TF1-T	4N65G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
4N65L-TF2-T	4N65G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
4N65L-TF3-T	4N65G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
4N65L-TF3T-T	4N65G-TF3T-T	TO-220F3	G	D	S	-	-	-	-	-	Tube
4N65L-TM3-T	4N65G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
4N65L-TMS-T	4N65G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	Tube
4N65L-TMS2-T	4N65G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
4N65L-TMS4-T	4N65G-TMS4-T	TO-251S4	G	D	S	-	-	-	-	-	Tube
4N65L-TN3-R	4N65G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
4N65L-TND-R	4N65G-TND-R	TO-252D	G	D	S	-	-	-	-	-	Tape Reel
4N65L-T2Q-T	4N65G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	Tube
4N65L-TQ2-R	4N65G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	Tape Reel
4N65L-TQ2-T	4N65G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	Tube
-	4N65G-E-K08-5060-R	DFN-8(5×6)	S	S	S	G	D	D	D	D	Tape Reel

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

4N65L-TA3-T

- (1) Packing Type
- (2) Package Type
- (3) Green Package

(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2
 TF3: TO-220F, TF3T: TO-220F3, TM3: TO-251,
 TMS: TO-251S, TMS2: TO-251S2, TN3: TO-252,
 TMS4: TO-251S4, TND: TO-252D, T2Q: TO-262,
 TQ2: TO-263, K08-5060: DFN-8(5×6)

(3) L: Lead Free, G: Halogen Free and Lead Free

MARKING

PACKAGE	MARKING
TO-220 TO-220F TO-220F1 TO-220F2 TO-220F3 TO-251 TO-251S TO-251S2 TO-251S4 TO-252 TO-252D TO-262 TO-263	<p>UTC 4N65</p> <p>Lot Code ← → Data Code</p> <p>1</p> <p>L: Lead Free G: Halogen Free</p>
DFN-8(5×6)	<p>UTC 4N65</p> <p>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}	± 30	V	
Avalanche Current (Note2)	I_{AR}	4.4	A	
Drain Current	Continuous	I_D	4.0	A
	Pulsed (Note2)	I_{DM}	16	A
Avalanche Energy	Single Pulsed (Note3)	E_{AS}	260	mJ
	Repetitive (Note2)	E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note4)	dv/dt	4.5	V/ns	
Power Dissipation	TO-220/TO-262/TO-263	P_D	106	W
	TO-220F/TO-220F1 TO-220F3		35	W
	TO-220F2		36	W
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		50	W
	DFN-8(5×6)		30	W
	Junction Temperature		T_J	+150
Operating Temperature	T_{OPR}	-55 ~ +150	$^\circ\text{C}$	
Storage Temperature	T_{STG}	-55 ~ +150	$^\circ\text{C}$	

Note: 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. $L = 30\text{mH}$, $I_{AS} = 4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-262/TO-263 TO-220F/TO-220F1 TO-220F2/TO-220F3	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	$^\circ\text{C}/\text{W}$
	DFN-8(5×6)		75	$^\circ\text{C}/\text{W}$
	Junction to Case		θ_{JC}	1.18
TO-220/TO-262/TO-263	3.5	$^\circ\text{C}/\text{W}$		
TO-220F/TO-220F1 TO-220F3	3.4	$^\circ\text{C}/\text{W}$		
TO-220F2	2.5	$^\circ\text{C}/\text{W}$		
TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D	4.17	$^\circ\text{C}/\text{W}$		
DFN-8(5×6)				

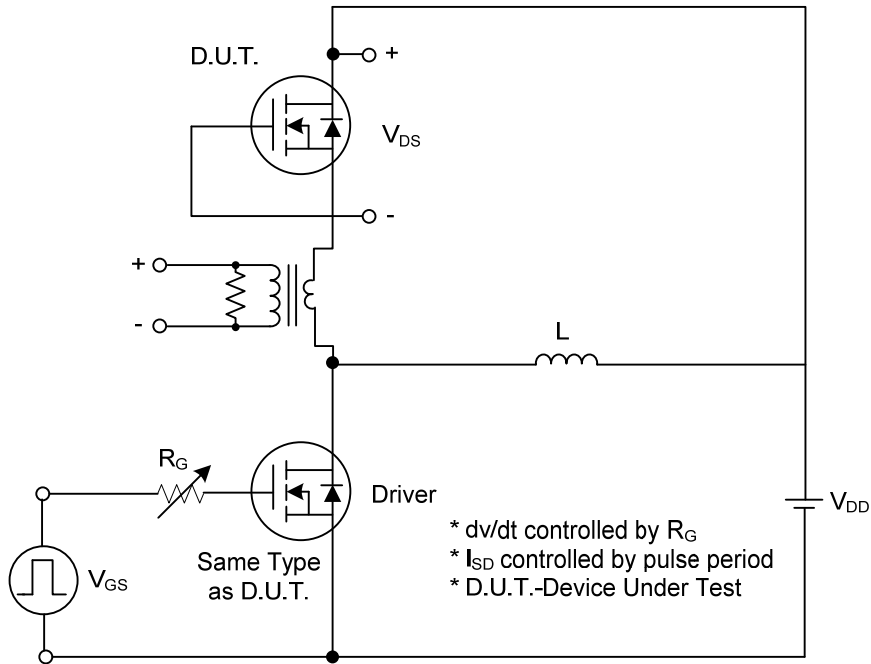
■ ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}$	650			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.6		$\text{V}/^\circ\text{C}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.2\text{A}$		2.6	3.1	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$		700	780	pF
Output Capacitance	C_{OSS}			100	120	pF
Reverse Transfer Capacitance	C_{RSS}			53	60	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DS} = 325\text{V}, I_D = 4.0\text{A},$ $R_G = 25\Omega$ (Note 1, 2)		30	70	ns
Turn-On Rise Time	t_R			100	140	ns
Turn-Off Delay Time	$t_{D(OFF)}$			150	190	ns
Turn-Off Fall Time	t_F			140	180	ns
Total Gate Charge	Q_G	$V_{DS} = 520\text{V}, I_D = 4.0\text{A},$ $V_{GS} = 10\text{V}$ (Note 1, 2)		110	130	nC
Gate-Source Charge	Q_{GS}			9	15	nC
Gate-Drain Charge	Q_{GD}			5	11	nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				17.6	A
Reverse Recovery Time	t_{rr}	$V_{GS} = 0\text{V}, I_S = 4.4\text{A},$		250		ns
Reverse Recovery Charge	Q_{RR}	$df/dt = 100\text{ A}/\mu\text{s}$ (Note 1)		1.5		μC

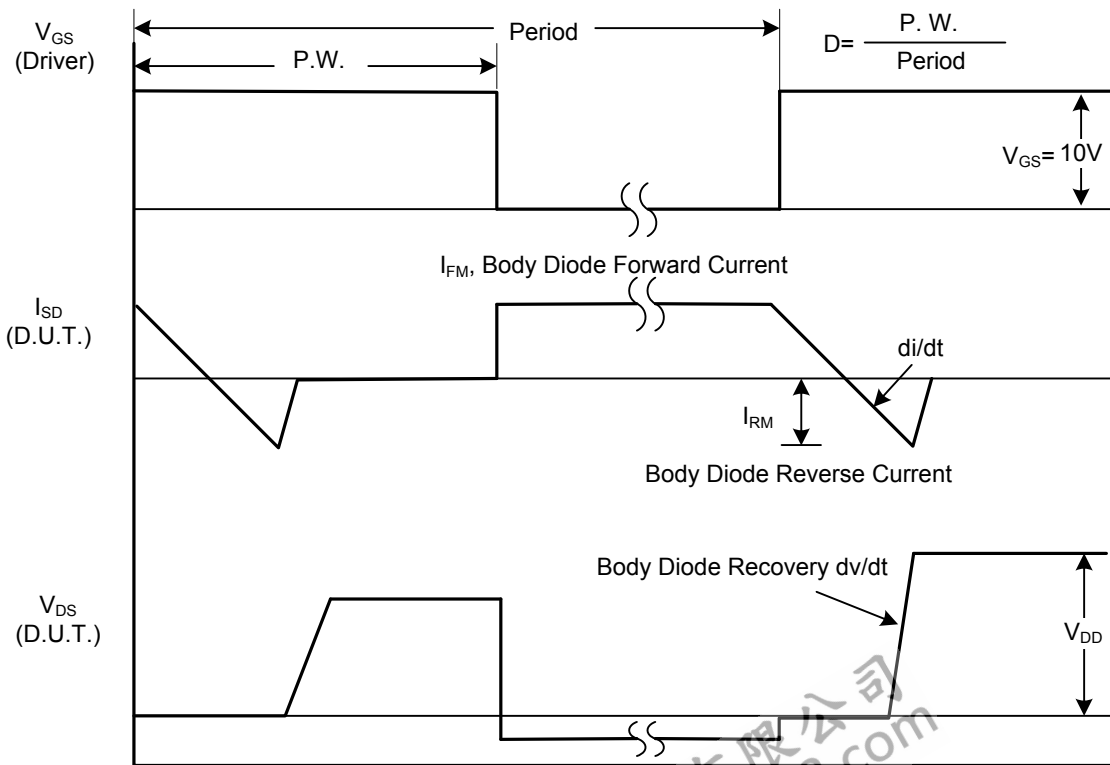
Note: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

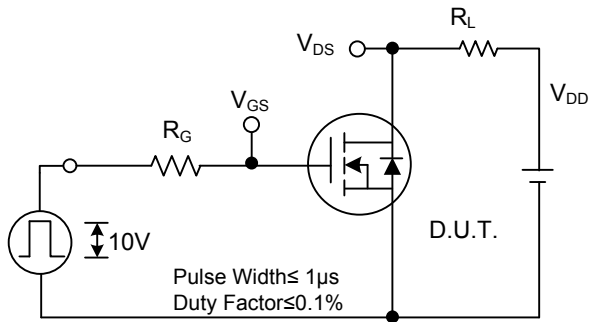


Peak Diode Recovery dv/dt Test Circuit

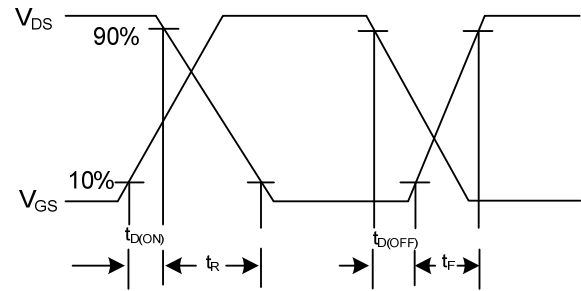


Peak Diode Recovery dv/dt Waveforms

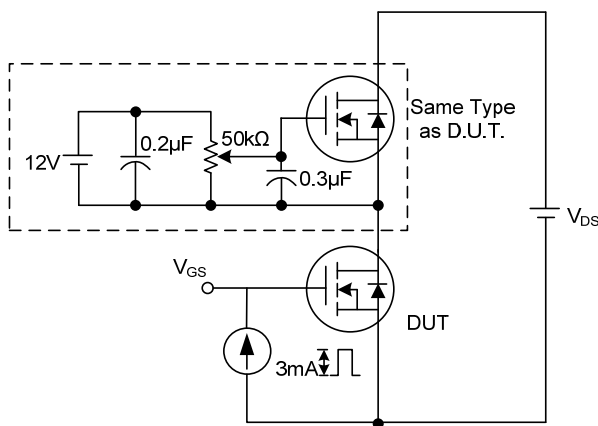
TEST CIRCUITS AND WAVEFORMS (Cont.)



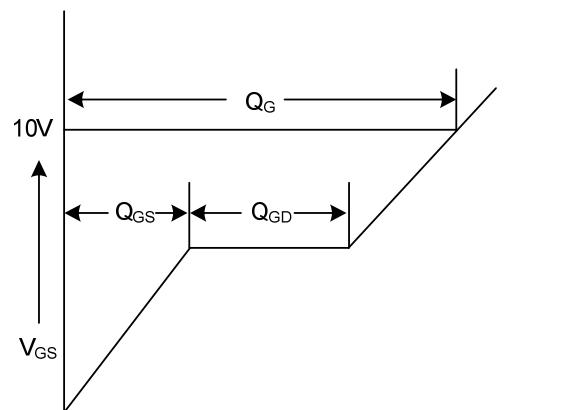
Switching Test Circuit



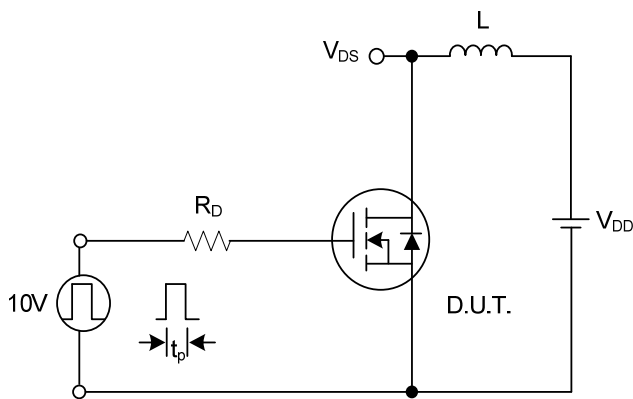
Switching Waveforms



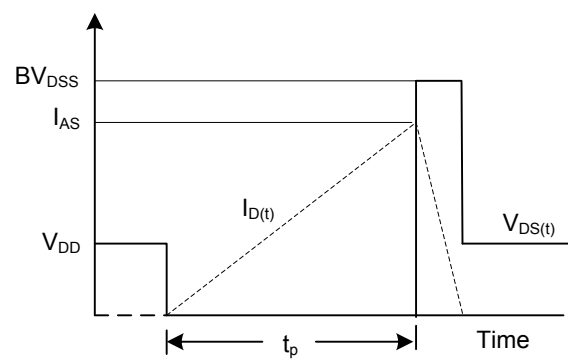
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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