



**2N65L**

Preliminary

**Power MOSFET**

**2A, 650V N-CHANNEL  
POWER MOSFET**

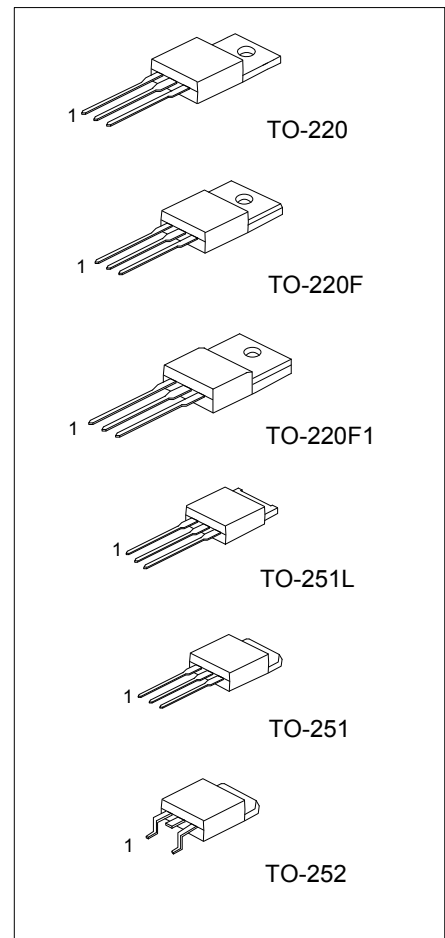
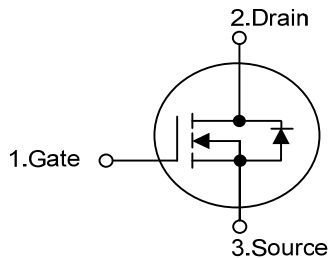
■ **DESCRIPTION**

The UTC **2N65L** 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 a 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**

- \*  $R_{DS(ON)} = 5.0\Omega @ V_{GS} = 10V$
- \* Ultra Low gate charge (typical 9.0nC)
- \* Low reverse transfer capacitance ( $C_{RSS} =$  typical 5.0 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	
2N65LL-TA3-T	2N65LG-TA3-T	TO-220	G	D	S	Tube
2N65LL-TF1-T	2N65LG-TF1-T	TO-220F1	G	D	S	Tube
2N65LL-TF3-T	2N65LG-TF3-T	TO-220F	G	D	S	Tube
2N65LL-TM3-T	2N65LG-TM3-T	TO-251	G	D	S	Tube
2N65LL-TMA-T	2N65LG-TMA-T	TO-251L	G	D	S	Tube
2N65LL-TN3-R	2N65LG-TN3-R	TO-252	G	D	S	Tape Reel
2N65LL-TN3-T	2N65LG-TN3-T	TO-252	G	D	S	Tube

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

<p>2N65LL-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F TM3: TO-251, TMA:TO-251L, TN3: TO-252, T2Q: TO-262 (3) G: Halogen Free, L: Lead Free</p>
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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
Avalanche Current (Note 2)		$I_{AR}$	2.0	A
Drain Current	Continuous	$I_D$	2.0	A
	Pulsed (Note 2)	$I_{DM}$	8.0	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	140	mJ
	Repetitive (Note 2)	$E_{AR}$	4.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	$P_D$	54	W
	TO-220F/TO-220F1		23	W
	TO-251/TO-251L/TO-252		44	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  $T_J$

3.  $L=64\text{mH}$ ,  $I_{AS}=2.0\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 2.4\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

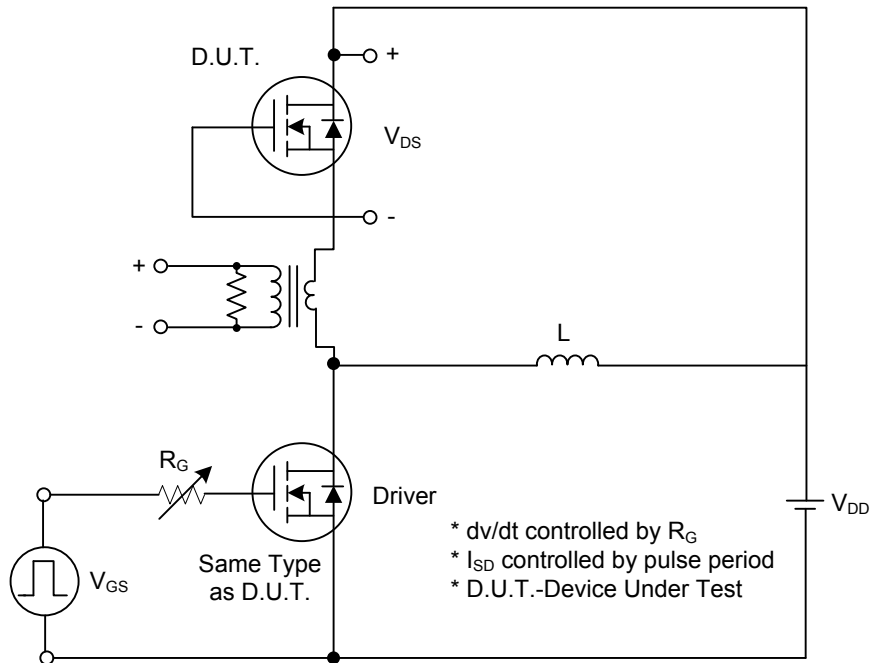
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F/TO-220F1	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251L/TO-252		100	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	2.32	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		5.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251L/TO-252		2.87	$^\circ\text{C}/\text{W}$

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

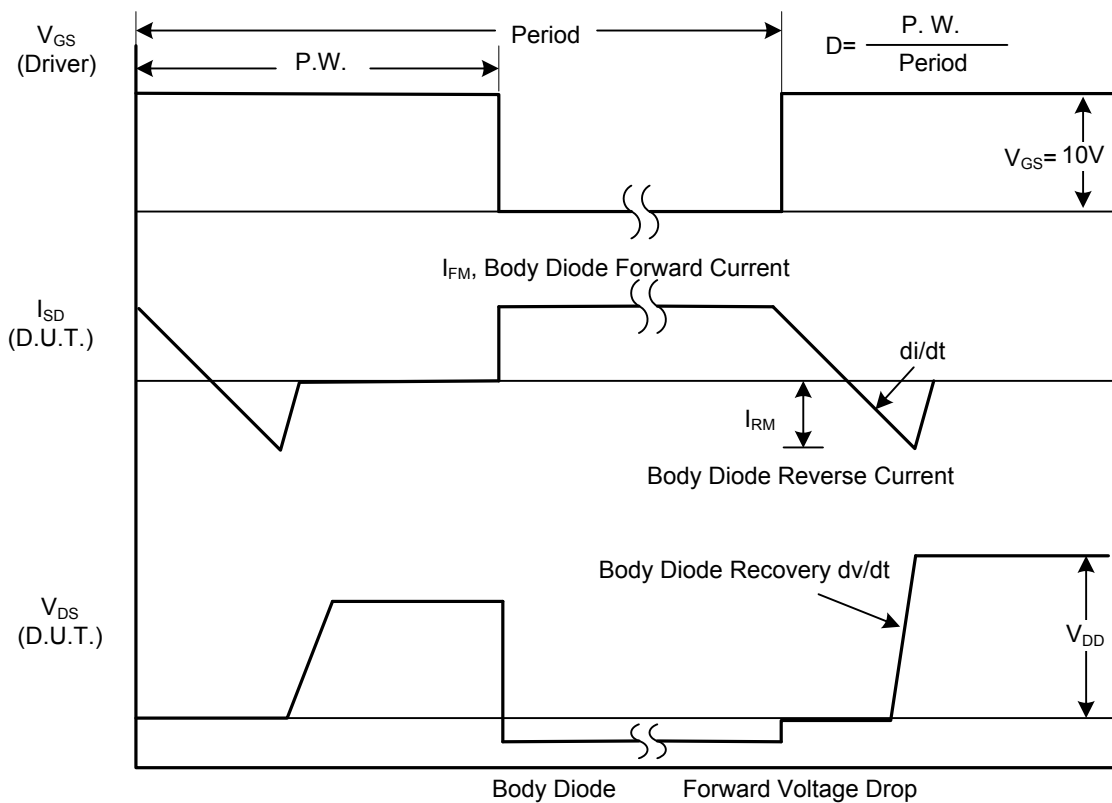
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$ , 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		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 1A$		3.9	5.0	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1\text{MHz}$		270	350	pF
Output Capacitance	$C_{OSS}$		40	50	pF	
Reverse Transfer Capacitance	$C_{RSS}$		5	7	pF	
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 325V, I_D = 2.4A,$ $R_G = 25\Omega$ (Note 1, 2)		10	30	ns
Turn-On Rise Time	$t_R$		25	60	ns	
Turn-Off Delay Time	$t_{D(OFF)}$		20	50	ns	
Turn-Off Fall Time	$t_F$		25	60	ns	
Total Gate Charge	$Q_G$	$V_{DS} = 520V, V_{GS} = 10V,$ $I_D = 2.4A$ (Note 1, 2)		9.0	11	nC
Gate-Source Charge	$Q_{GS}$		1.6		nC	
Gate-Drain Charge	$Q_{GD}$		4.3		nC	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_{SD} = 2.0A$			1.4	V
Continuous Drain-Source Current	$I_{SD}$				2.0	A
Pulsed Drain-Source Current	$I_{SM}$				8.0	A
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_{SD} = 2.4A,$ $di/dt = 100 A/\mu s$ (Note1)		180		ns
Reverse Recovery Charge	$Q_{RR}$		0.72		$\mu C$	

- Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$   
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

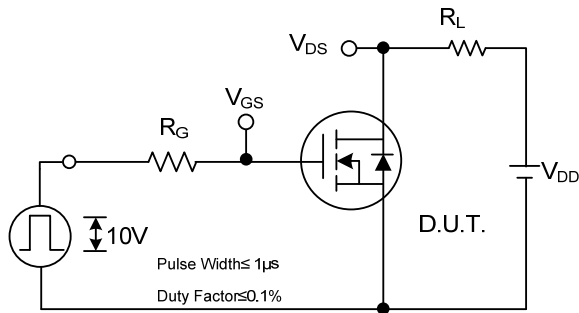


Peak Diode Recovery  $dv/dt$  Test Circuit

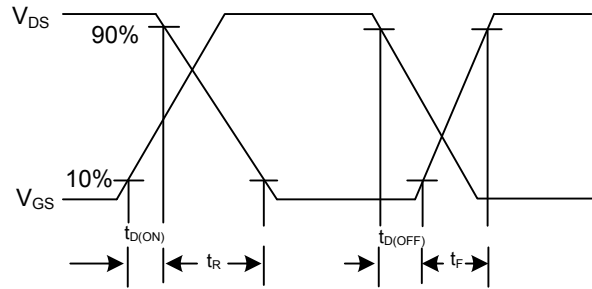


Peak Diode Recovery  $dv/dt$  Waveforms

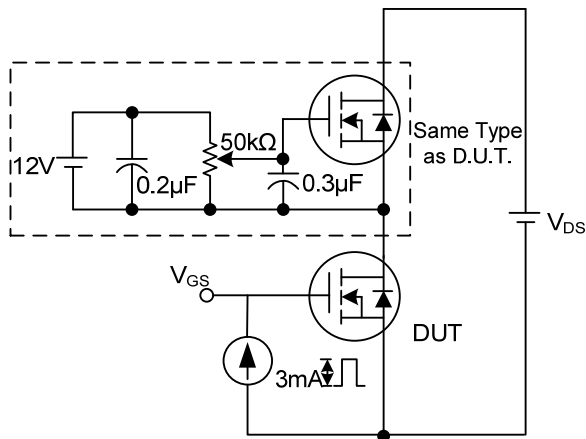
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



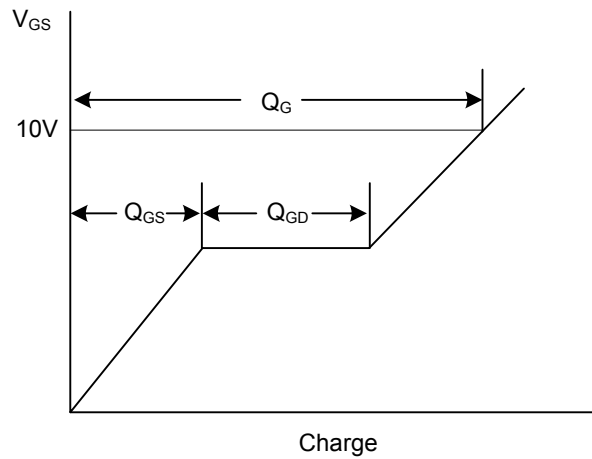
Switching Test Circuit



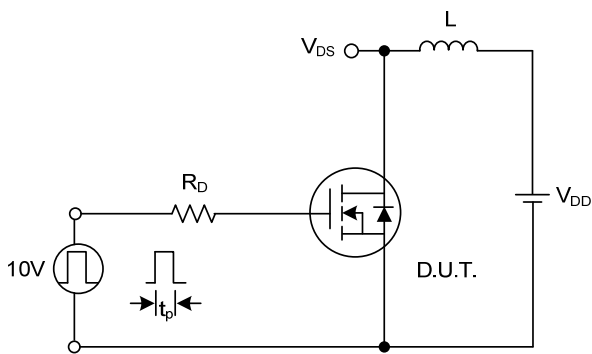
Switching Waveforms



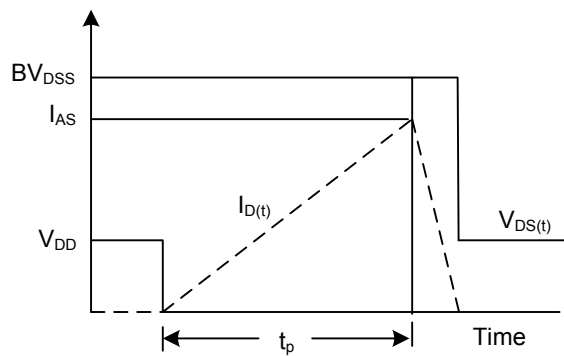
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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