



## 2N65K-MT

Power MOSFET

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

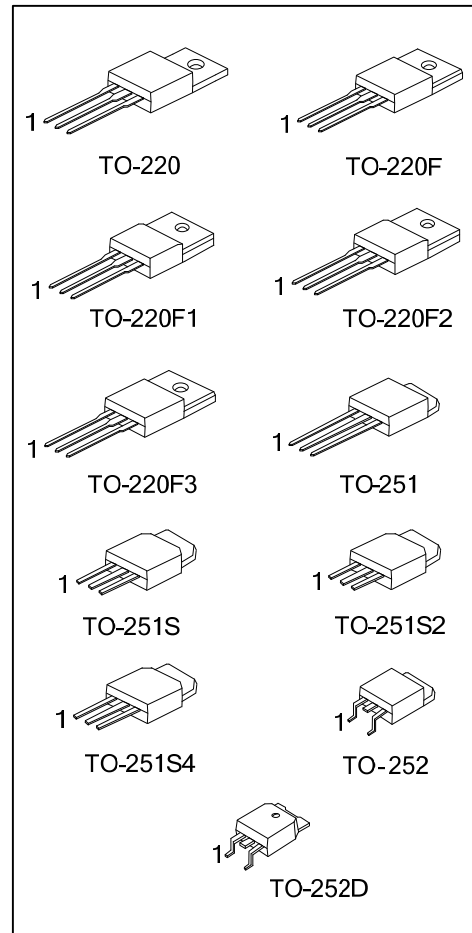
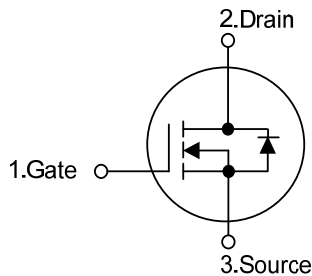
#### DESCRIPTION

The UTC **2N65K-MT** 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 have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} < 5.0\Omega$  @  $V_{GS} = 10V, I_D = 1A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



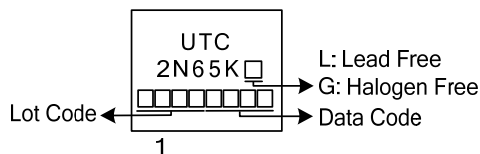
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N65KL-TA3-T	2N65KG-TA3-T	TO-220	G	D	S	Tube
2N65KL-TF3-T	2N65KG-TF3-T	TO-220F	G	D	S	Tube
2N65KL-TF1-T	2N65KG-TF1-T	TO-220F1	G	D	S	Tube
2N65KL-TF2-T	2N65KG-TF2-T	TO-220F2	G	D	S	Tube
2N65KL-TF3T-T	2N65KG-TF3T-T	TO-220F3	G	D	S	Tube
2N65KL-TM3-T	2N65KG-TM3-T	TO-251	G	D	S	Tube
2N65KL-TMS-T	2N65KG-TMS-T	TO-251S	G	D	S	Tube
2N65KL-TMS2-T	2N65KG-TMS2-T	TO-251S2	G	D	S	Tube
2N65KL-TMS4-T	2N65KG-TMS4-T	TO-251S4	G	D	S	Tube
2N65KL-TN3-R	2N65KG-TN3-R	TO-252	G	D	S	Tape Reel
2N65KL-TND-R	2N65KG-TND-R	TO-252D	G	D	S	Tape Reel

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

<p>2N65KL-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, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F3, TM3: TO-251 TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, TND: TO-252D</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p>
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■ MARKING



■ 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)	$E_{AS}$	110	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		21		
	TO-220F3				
	TO-220F2		23		
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		44		
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.  $L=55\text{mH}$ ,  $I_{AS}=2.0\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , 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

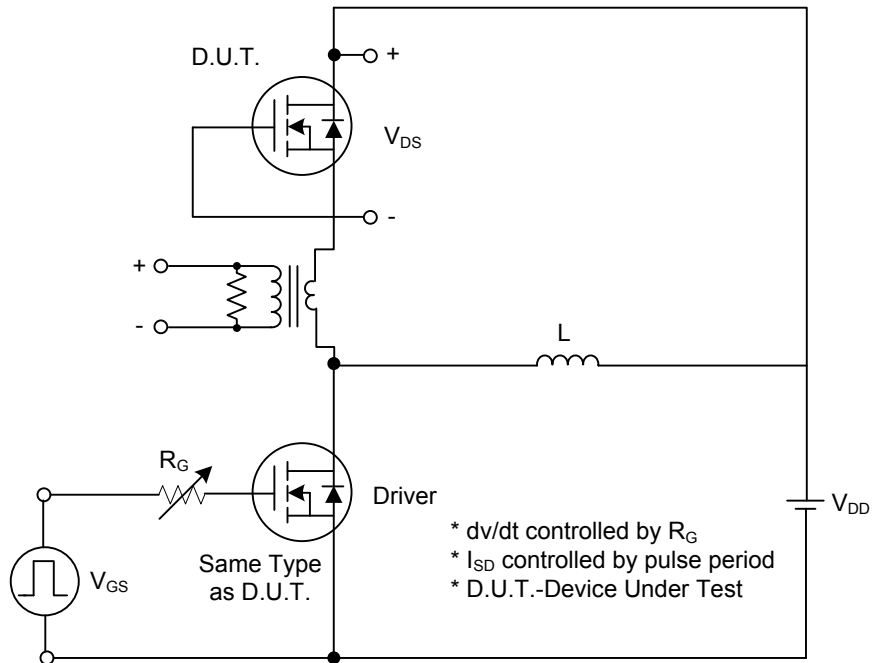
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220F3	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		100	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	2.32	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		5.95	$^\circ\text{C}/\text{W}$
	TO-220F2		5.43	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.87	$^\circ\text{C}/\text{W}$

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

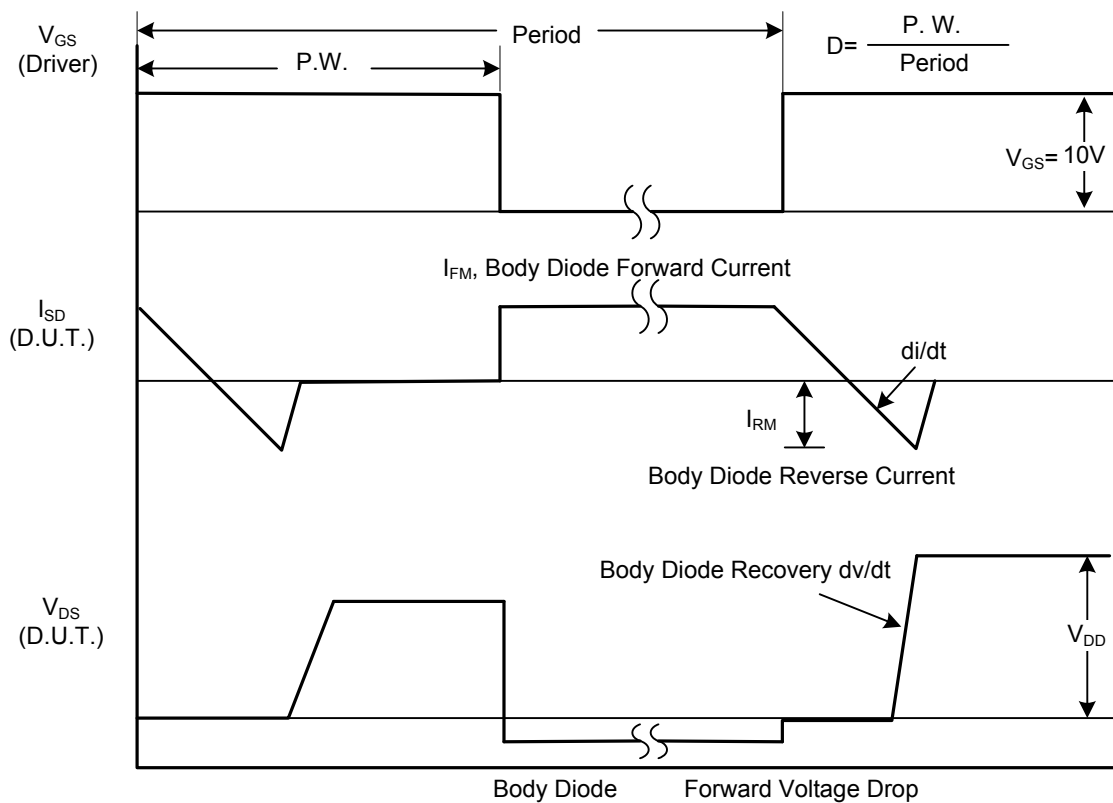
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	650			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V			10	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>			100	nA
	Reverse				V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	-100
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		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> = 1A		3.7	5.0	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		240	320	pF
Output Capacitance	C <sub>OSS</sub>			33	45	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			4.5	6	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.5A, R <sub>G</sub> = 25Ω (Note 1, 2)		40	60	ns
Turn-On Rise Time	t <sub>R</sub>			40	60	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			50	70	ns
Turn-Off Fall Time	t <sub>F</sub>			22	38	ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> = 50V, V <sub>GS</sub> = 1.0V, I <sub>D</sub> = 1.3A (Note 1, 2)		12	14	nC
Gate-Source Charge	Q <sub>GS</sub>			5.2		nC
Gate-Drain Charge	Q <sub>GD</sub>			2		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 2.0 A			1.4	V
Continuous Drain-Source Current	I <sub>SD</sub>				2.0	A
Pulsed Drain-Source Current	I <sub>SM</sub>				8.0	A

- Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%  
 2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

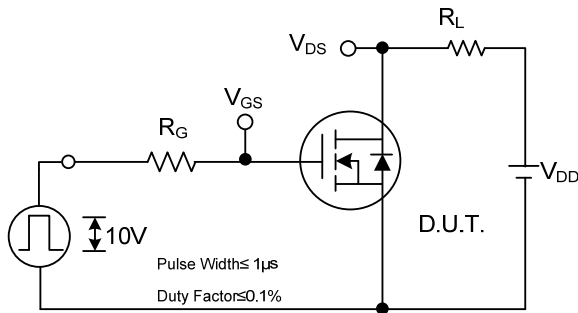


**Peak Diode Recovery  $dv/dt$  Test Circuit**

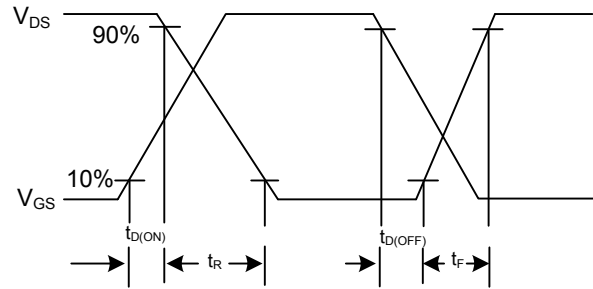


**Peak Diode Recovery  $dv/dt$  Waveforms**

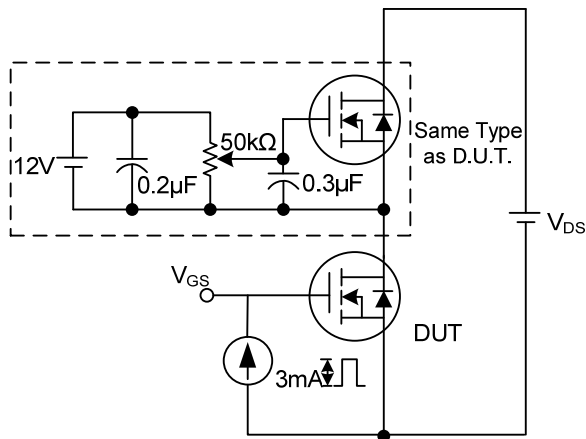
## TEST CIRCUITS AND WAVEFORMS (Cont.)



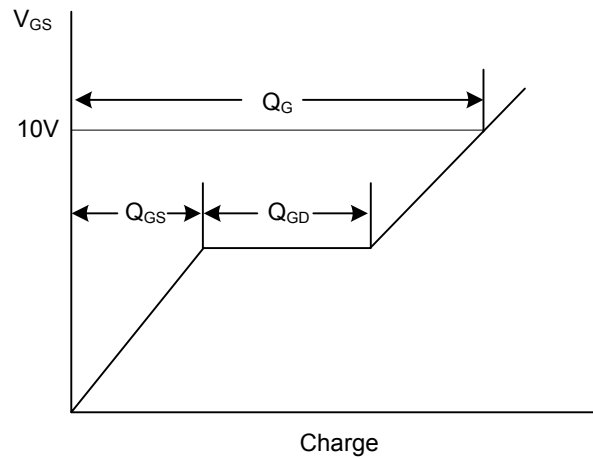
**Switching Test Circuit**



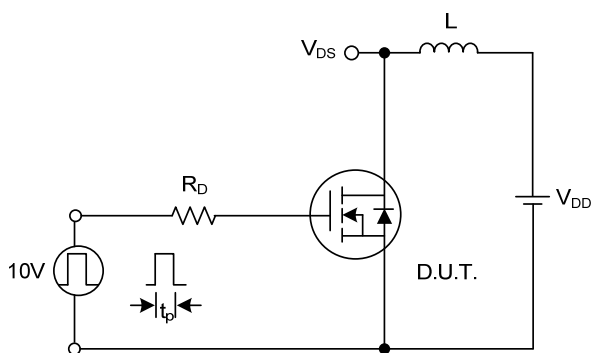
**Switching Waveforms**



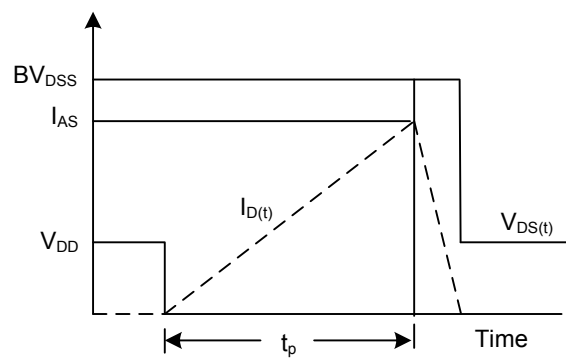
**Gate Charge Test Circuit**



**Gate Charge Waveform**

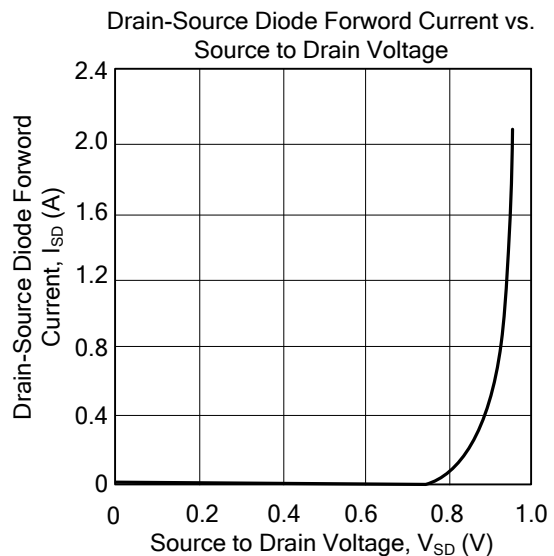
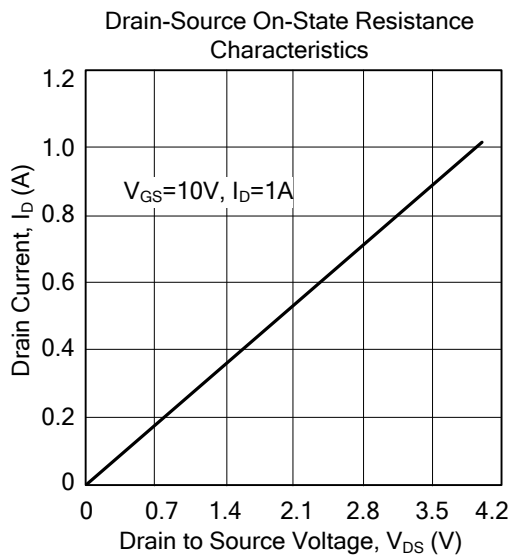
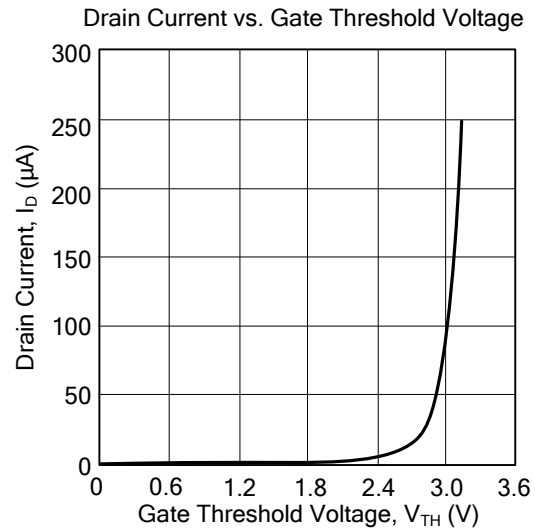
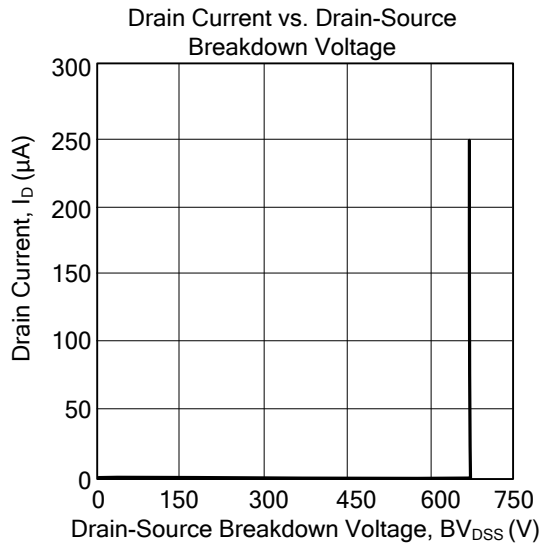


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

### TYPICAL CHARACTERISTICS



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