



6N65K-MT

Power MOSFET

6A, 650V N-CHANNEL POWER MOSFET

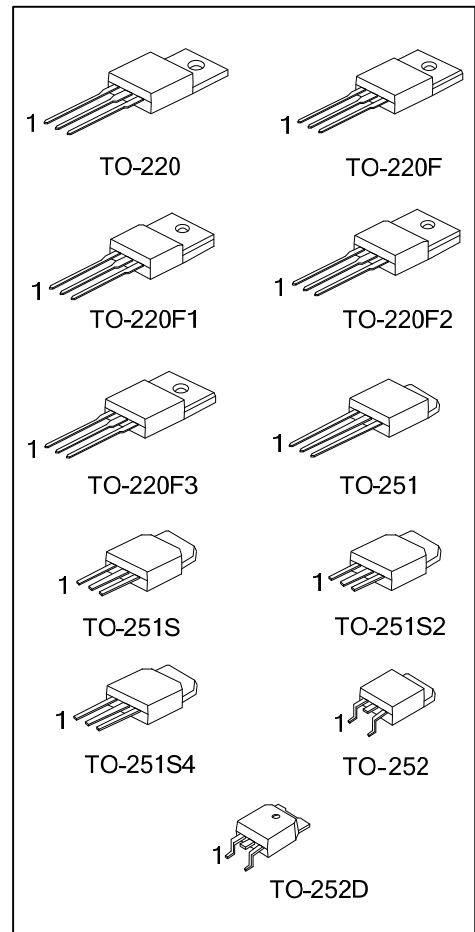
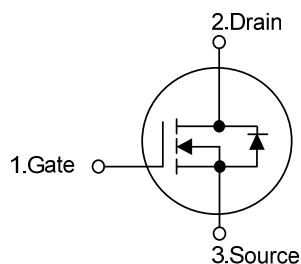
■ DESCRIPTION

The UTC 6N65K-MT 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 of switching power supplies and adaptors.

■ FEATURES

- * $R_{DS(ON)} < 1.5\Omega$ @ $V_{GS} = 10V$, $I_D = 3.0A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



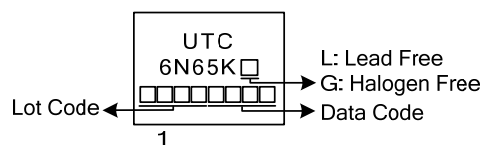
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6N65KL-TA3-T	6N65KG-TA3-T	TO-220	G	D	S	Tube
6N65KL-TF3-T	6N65KG-TF3-T	TO-220F	G	D	S	Tube
6N65KL-TF1-T	6N65KG-TF1-T	TO-220F1	G	D	S	Tube
6N65KL-TF2-T	6N65KG-TF2-T	TO-220F2	G	D	S	Tube
6N65KL-TF3-T	6N65KG-TF3-T	TO-220F3	G	D	S	Tube
6N65KL-TM3-T	6N65KG-TM3-T	TO-251	G	D	S	Tube
6N65KL-TMS-T	6N65KG-TMS-T	TO-251S	G	D	S	Tube
6N65KL-TMS2-T	6N65KG-TMS2-T	TO-251S2	G	D	S	Tube
6N65KL-TMS4-T	6N65KG-TMS4-T	TO-251S4	G	D	S	Tube
6N65KL-TN3-R	6N65KG-TN3-R	TO-252	G	D	S	Tape Reel
6N65KL-TND-R	6N65KG-TND-R	TO-252D	G	D	S	Tape Reel

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

6N65KL-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (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 (3) L: Lead Free, G: Halogen Free and Lead Free
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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_{DS}	650	V
Gate-Source Voltage		V_{GS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	6	A
Continuous Drain Current		I_D	6	A
Pulsed Drain Current (Note 2)		I_{DM}	24	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	300	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	ns
Power Dissipation	TO-220	P_D	125	W
	TO-220F/TO-220F1 TO-220F3		40	W
	TO-220F2		42	W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		55	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. $L = 16.6\text{mH}$, $I_{AS} = 6\text{A}$, $V_{DD} = 90\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 6\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/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	
Junction to Case	TO-220	θ_{JC}	1.0	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		3.2	
	TO-220F2		2.97	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.27	

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 650V, V _{GS} = 0V			10	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			100	nA
	Reverse		V _{GS} = -30V, V _{DS} = 0V			-100	nA
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA, Referenced to 25°C		0.53		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D = 3.0A			1.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0 MHz		875	1000	pF
Output Capacitance		C _{OSS}			88	120	pF
Reverse Transfer Capacitance		C _{RSS}			8	25	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} =30V, I _D =0.5A, R _G =25Ω (Note 1, 2)		40	48	ns
Turn-On Rise Time		t _R			44	53	ns
Turn-Off Delay Time		t _{D(OFF)}			190	230	ns
Turn-Off Fall Time		t _F			40	50	ns
Total Gate Charge		Q _G	V _{DS} =50V, I _D =1.3A, V _{GS} =10V (Note 1, 2)		67	80	nC
Gate-Source Charge		Q _{GS}			6.8		nC
Gate-Drain Charge		Q _{GD}			6.2		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0 V, I _S = 6 A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				6	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				24	A

Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature

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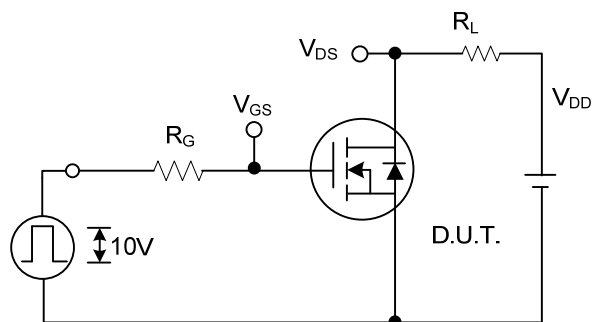
Timing diagram for a MOSFET switching a load inductor. The diagram shows three waveforms: V_{GS} (Driver), I_{SD} (D.U.T.), and V_{DS} (D.U.T.).

- V_{GS} (Driver): A square wave with pulse width (P.W.) and period (Period). The duty cycle is $D = \frac{P.W.}{Period}$. The gate voltage is $V_{GS} = 10V$.
- I_{SD} (D.U.T.): The source-drain current. It shows the MOSFET current during the pulse and the inductor current during the off-time. The body diode forward current is I_{FM} and the body diode reverse current is I_{RM} . The di/dt is indicated during the off-time.
- V_{DS} (D.U.T.): The drain-source voltage. It shows the MOSFET voltage during the pulse and the body diode recovery dv/dt during the off-time. The supply voltage is V_{DD} .

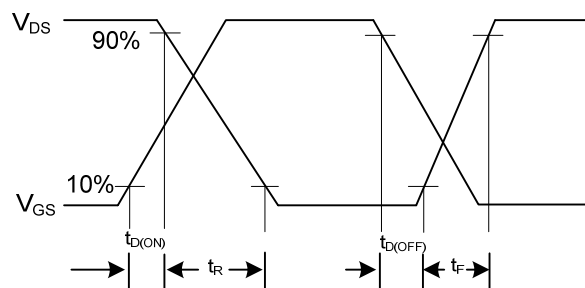
Labels at the bottom indicate the regions: Body Diode and Forward Voltage Drop.

Peak Diode Recovery dv/dt Waveforms

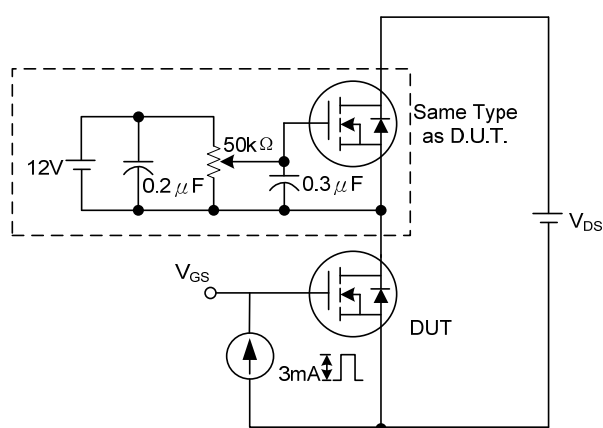
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



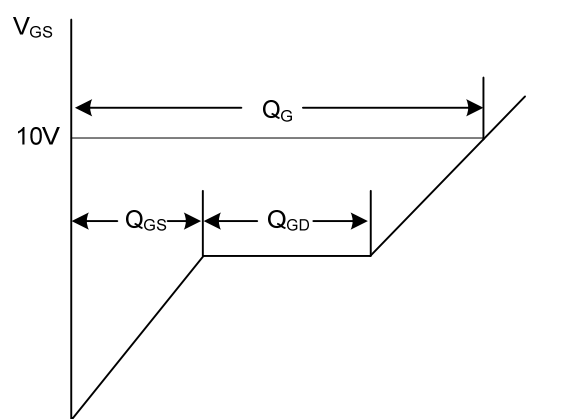
Switching Test Circuit



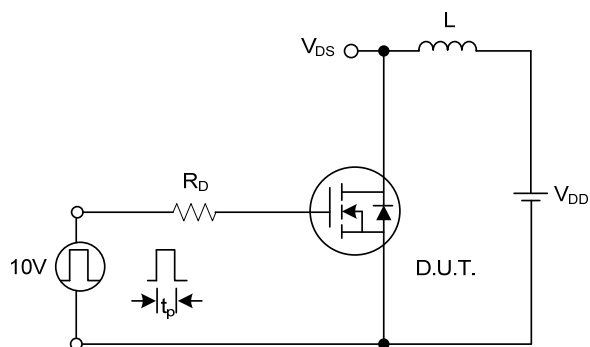
Switching Waveforms



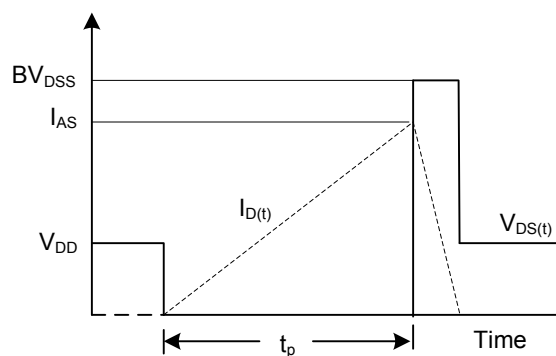
Gate Charge Test Circuit



Charge
Gate Charge Waveform

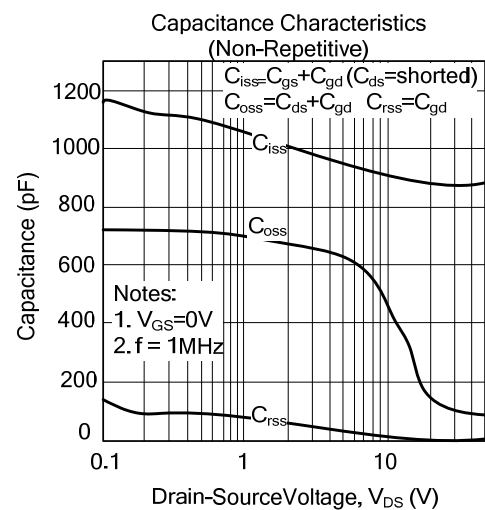
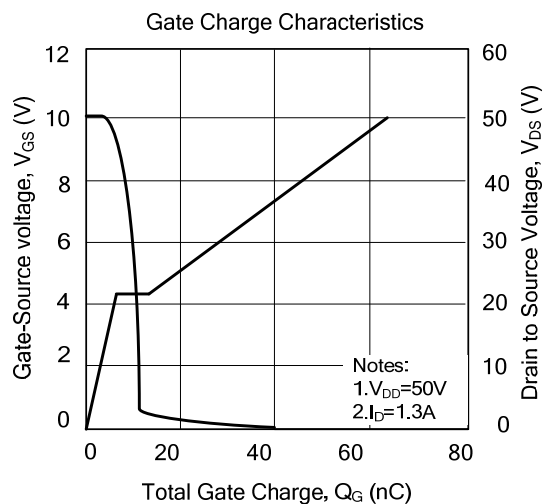
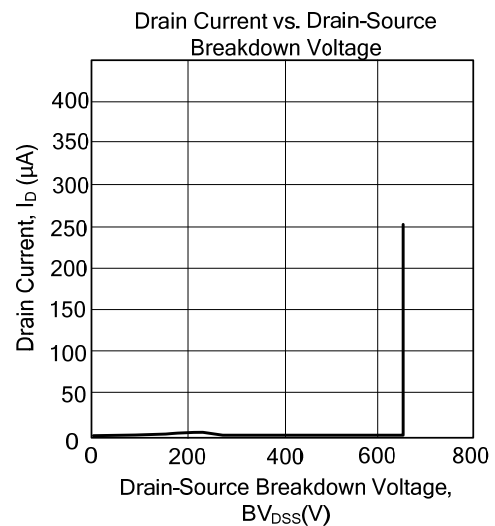
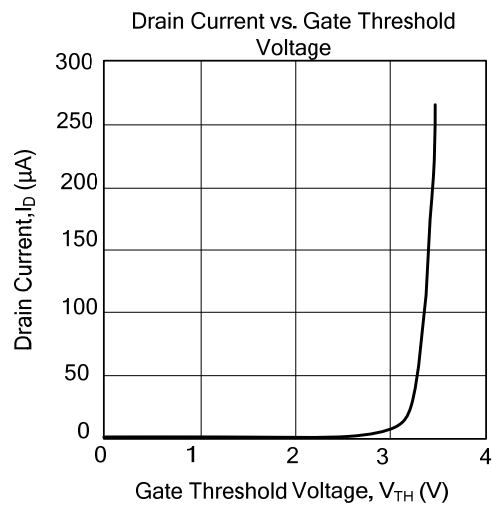
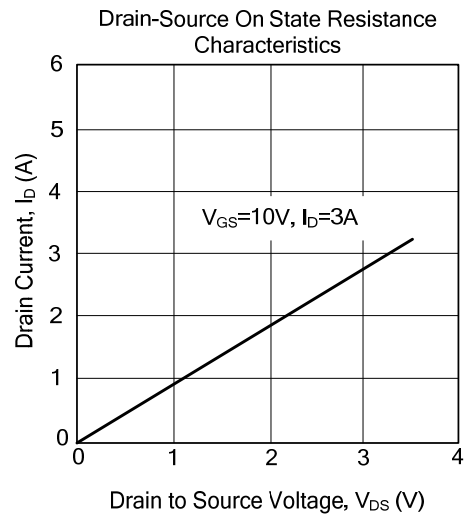
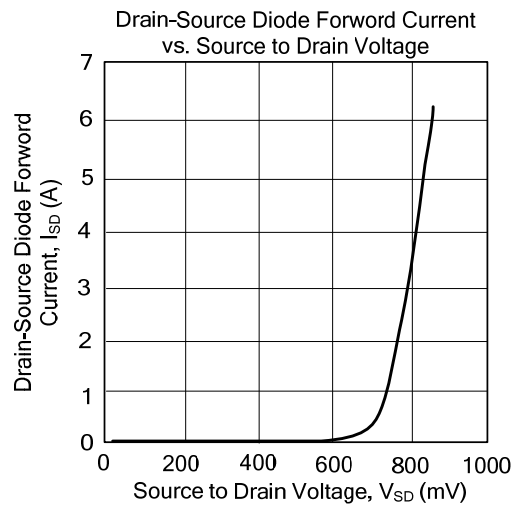


Unclamped Inductive Switching Test Circuit

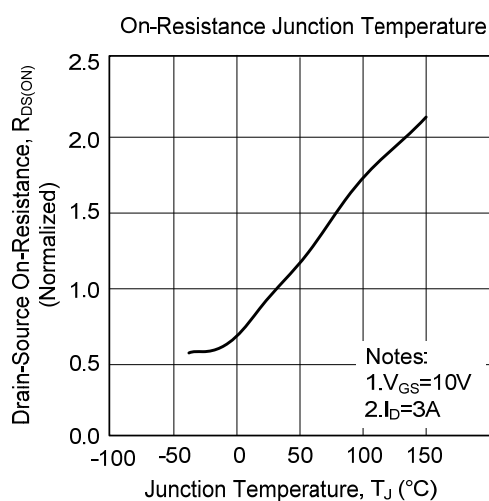


Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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