



3N60K-MK

Preliminary

Power MOSFET

3A, 600V N-CHANNEL
POWER MOSFET

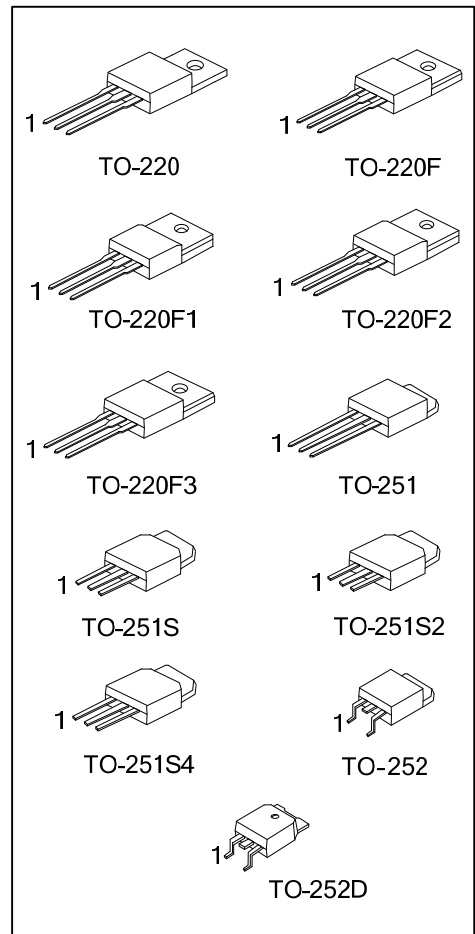
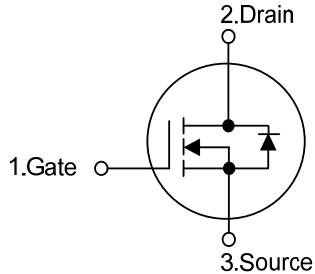
DESCRIPTION

The UTC **3N60K-MK** is a high voltage and high current 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 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

- * $R_{DS(ON)} < 3.6\Omega @ V_{GS} = 10V, I_D = 1.5A$
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL



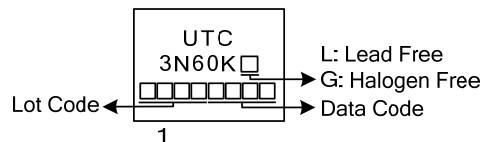
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
3N60KL-TA3-T	3N60KG-TA3-T	TO-220	G	D	S	Tube
3N60KL-TF3-T	3N60KG-TF3-T	TO-220F	G	D	S	Tube
3N60KL-TF1-T	3N60KG-TF1-T	TO-220F1	G	D	S	Tube
3N60KL-TF2-T	3N60KG-TF2-T	TO-220F2	G	D	S	Tube
3N60KL-TF3-T	3N60KG-TF3-T	TO-220F3	G	D	S	Tube
3N60KL-TM3-T	3N60KG-TM3-T	TO-251	G	D	S	Tube
3N60KL-TMS-T	3N60KG-TMS-T	TO-251S	G	D	S	Tube
3N60KL-TMS2-T	3N60KG-TMS2-T	TO-251S2	G	D	S	Tube
3N60KL-TMS4-T	3N60KG-TMS4-T	TO-251S4	G	D	S	Tube
3N60KL-TN3-R	3N60KG-TN3-R	TO-252	G	D	S	Tape Reel
3N60KL-TND-R	3N60KG-TND-R	TO-252D	G	D	S	Tape Reel

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

<p>3N60KL-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(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</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}	600	V	
Gate-Source Voltage		V_{GSS}	± 30	V	
Avalanche Current (Note 2)		I_{AR}	3.0	A	
Continuous Drain Current		I_D	3.0	A	
Pulsed Drain Current (Note 2)		I_{DM}	12	A	
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	150	mJ	
	Repetitive (Note 2)	E_{AR}	7.5	mJ	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns	
Power Dissipation	TO-220	P_D	75	W	
	TO-220F/TO-220F1 TO-220F3		34	W	
	TO-220F2		35	W	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		50	W	
	Derate above 25°C		0.6	$\text{W}/^\circ\text{C}$	
Derate above 25°C	TO-220F/TO-220F1 TO-220F3	P_D	0.27	$\text{W}/^\circ\text{C}$	
	TO-220F2		0.28	$\text{W}/^\circ\text{C}$	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		0.4	$\text{W}/^\circ\text{C}$	
	Power Dissipation		P_D	35	W
	Derate above 25°C		P_D	0.28	$\text{W}/^\circ\text{C}$
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. $L=33\text{mH}$, $I_{AS}=3\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD}\leq 3.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, 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}	1.67	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		3.68	
	TO-220F2		3.58	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.5	

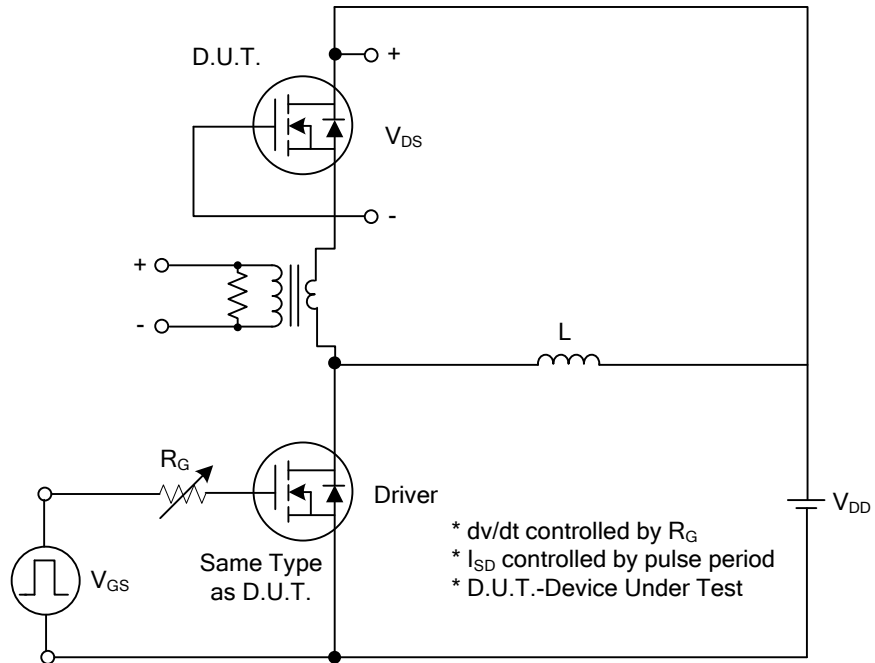
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0 V, I _D = 250 μA	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 600 V, V _{GS} = 0 V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}			100	nA
	Reverse					
		V _{GS} = -30 V, V _{DS} = 0 V			-100	nA
Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D = 250 μA, Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250 μA	2.5		4.5	V
Static Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} = 10 V, I _D = 1.5A			3.6	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1MHz		460	560	pF
Output Capacitance	C _{OSS}			41	60	pF
Reverse Transfer Capacitance	C _{RSS}			5.88	12	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{D(ON)}	V _{DD} = 30V, I _D = 0.5 A, R _G = 25Ω (Note 1, 2)		43		ns
Turn-On Rise Time	t _R			16		ns
Turn-Off Delay Time	t _{D(OFF)}			96		ns
Turn-Off Fall Time	t _F			17		ns
Total Gate Charge	Q _G	V _{DS} = 50V, I _D = 1.3A, V _{GS} = 10 V (Note 1, 2)		14	18	nC
Gate-Source Charge	Q _{GS}			4.4		nC
Gate-Drain Charge	Q _{GD}			1.4		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0 V, I _S = 3.0 A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I _S				3.0	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				12	A

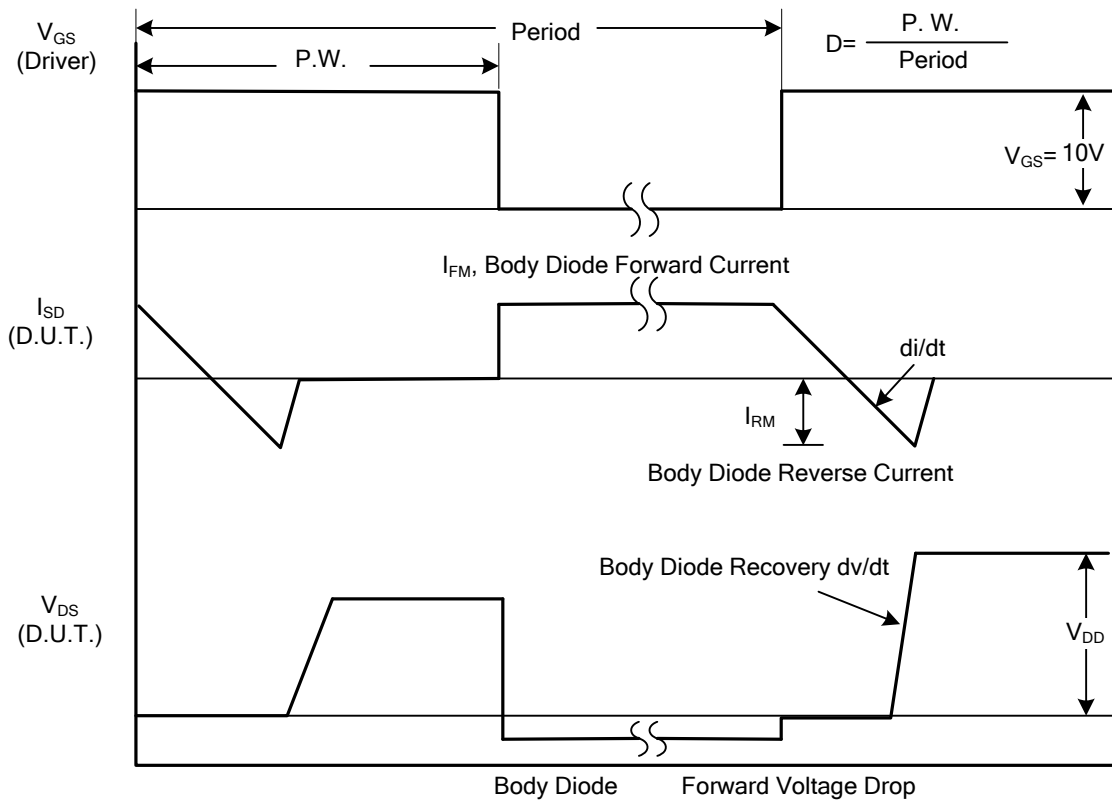
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

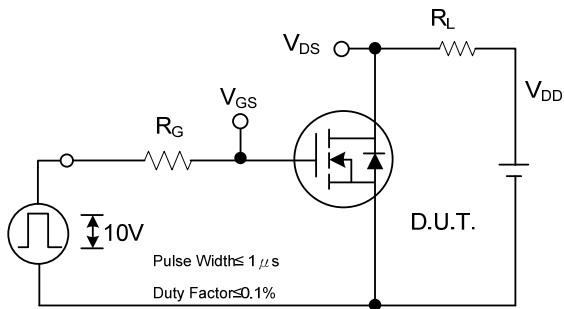


Peak Diode Recovery dv/dt Test Circuit

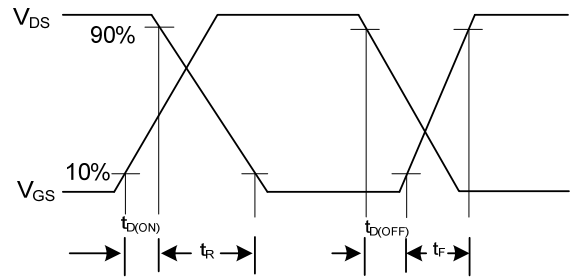


Peak Diode Recovery dv/dt Waveforms

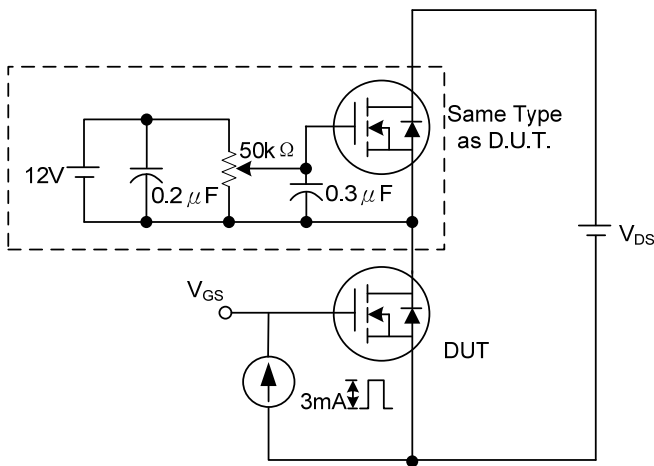
TEST CIRCUITS AND WAVEFORMS (Cont.)



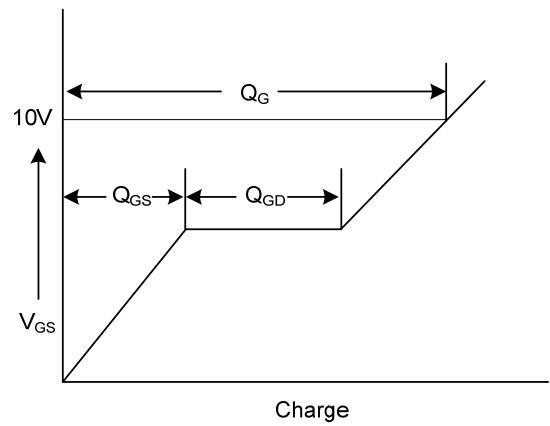
Switching Test Circuit



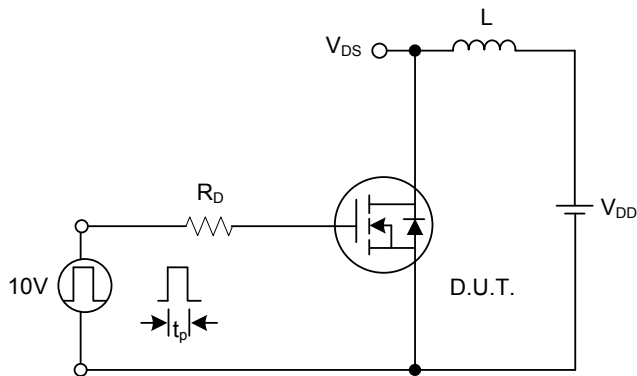
Switching Waveforms



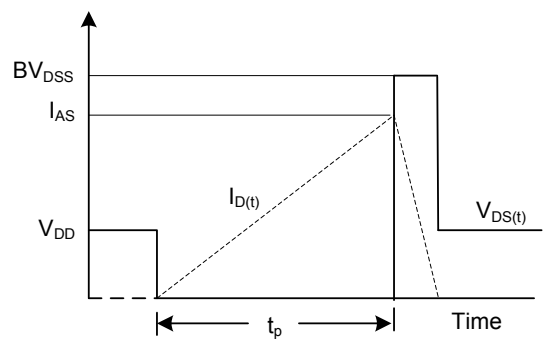
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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