



5N60K-MTQ

Preliminary

Power MOSFET

5A, 600V N-CHANNEL POWER MOSFET

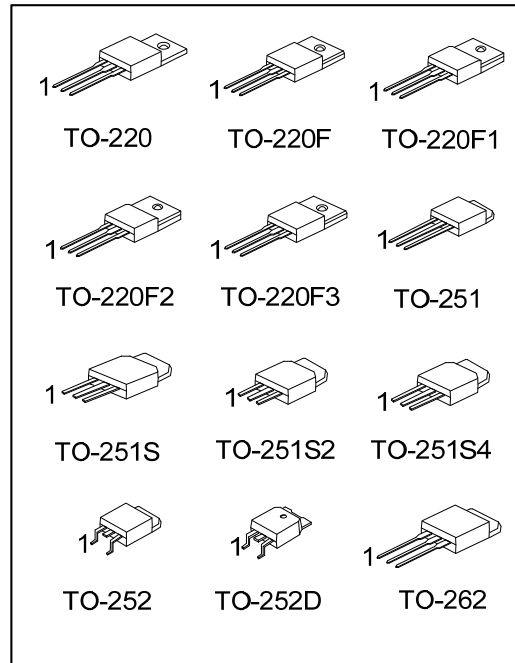
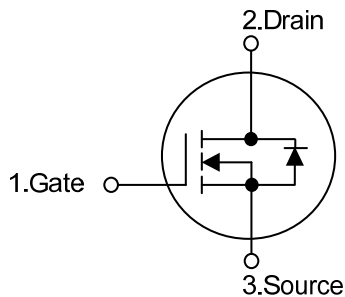
DESCRIPTION

The UTC **5N60K-MTQ** 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

- * $R_{DS(ON)} < 2.2\Omega$ @ $V_{GS} = 10V$, $I_D = 2.5A$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

SYMBOL



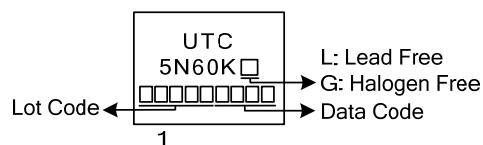
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N60KL-TA3-T	5N60KG-TA3-T	TO-220	G	D	S	Tube
5N60KL-TF1-T	5N60KG-TF1-T	TO-220F1	G	D	S	Tube
5N60KL-TF2-T	5N60KG-TF2-T	TO-220F2	G	D	S	Tube
5N60KL-TF3-T	5N60KG-TF3-T	TO-220F	G	D	S	Tube
5N60KL-TF3T-T	5N60KG-TF3T-T	TO-220F3	G	D	S	Tube
5N60KL-TM3-T	5N60KG-TM3-T	TO-251	G	D	S	Tube
5N60KL-TMS-T	5N60KG-TMS-T	TO-251S	G	D	S	Tube
5N60KL-TMS2-T	5N60KG-TMS2-T	TO-251S2	G	D	S	Tube
5N60KL-TMS4-T	5N60KG-TMS4-T	TO-251S4	G	D	S	Tube
5N60KL-TN3-R	5N60KG-TN3-R	TO-252	G	D	S	Tape Reel
5N60KL-TND-R	5N60KG-TND-R	TO-252D	G	D	S	Tape Reel
5N60KL-T2Q-T	5N60KG-T2Q-T	TO-262	G	D	S	Tube

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

<p>5N60KL-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, 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,</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}	600	V
Gate-Source Voltage		V_{GSS}	± 30	V
Continuous Drain Current		I_D	5	A
Pulsed Drain Current (Note 2)		I_{DM}	20	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	220	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262	P_D	100	W
	TO-220F/TO-220F1 TO-220F3		36	W
	TO-220F2		38	W
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		54	W
	Junction Temperature		T_J	+150
Operation 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. Pulse width limited by $T_{J(MAX)}$

3. $L = 17.6\text{mH}$, $I_{AS} = 5\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 5\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-262 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		160	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-262	θ_{JC}	1.25	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		3.47	$^\circ\text{C}/\text{W}$
	TO-220F2		3.28	$^\circ\text{C}/\text{W}$
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.30	$^\circ\text{C}/\text{W}$

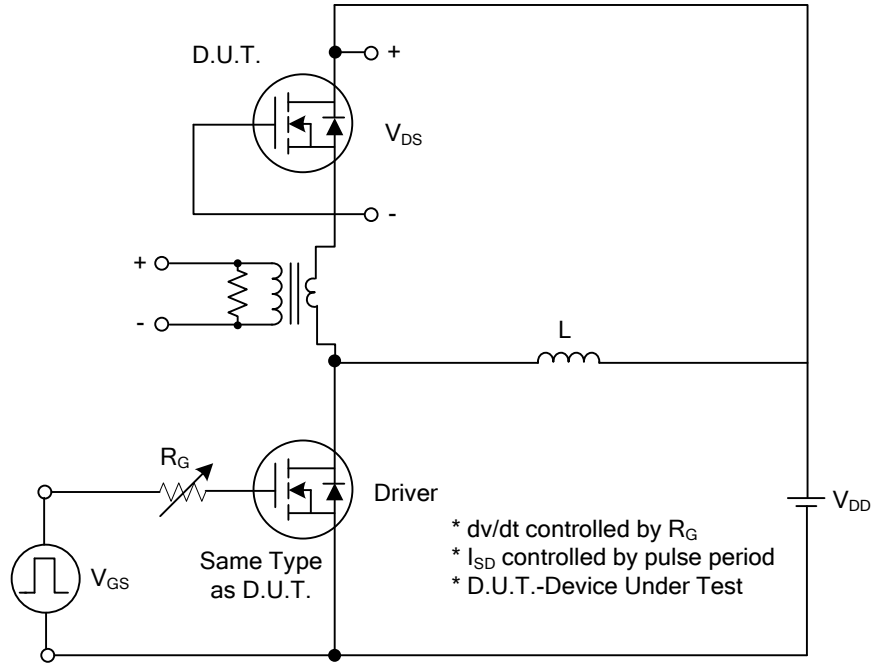
■ ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			1	μA
Gate-Source Leakage Current	Forward	I _{GSS}			100	nA
	Reverse				-100	
Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D = 250μA, Referenced to 25°C		0.6		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 = 2.5A		1.8	2.2	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz		520	620	pF
Output Capacitance	C _{OSS}			65	90	pF
Reverse Transfer Capacitance	C _{RSS}			8	12	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{D(ON)}	V _{DD} = 30V, I _D = 0.5A, R _G = 25Ω (Note 1, 2)		50		ns
Turn-On Rise Time	t _R			55		ns
Turn-Off Delay Time	t _{D(OFF)}			87		ns
Turn-Off Fall Time	t _F			40		ns
Total Gate Charge	Q _G	V _{DS} = 50V, I _D = 1.3A, V _{GS} = 10V (Note 1, 2)		25		nC
Gate-Source Charge	Q _{GS}			5.5		nC
Gate-Drain Charge	Q _{GD}			4.5		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0V, I _S = 5A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I _S				5	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				20	A

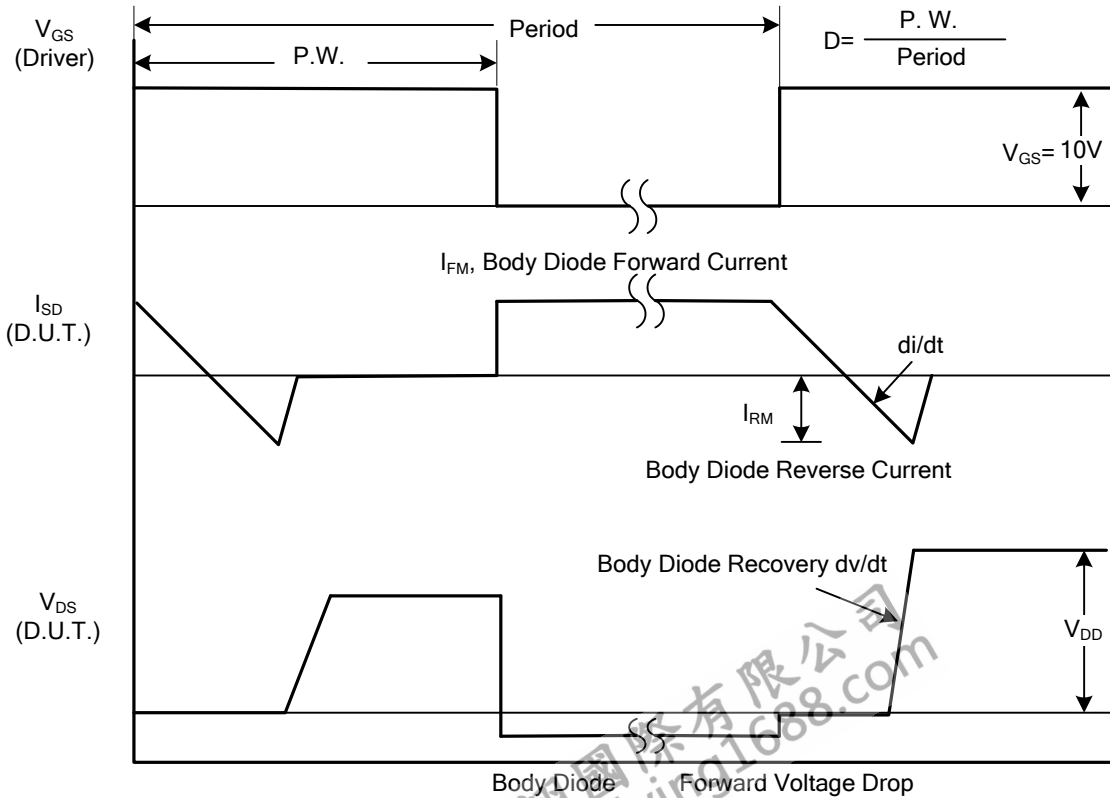
Note: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

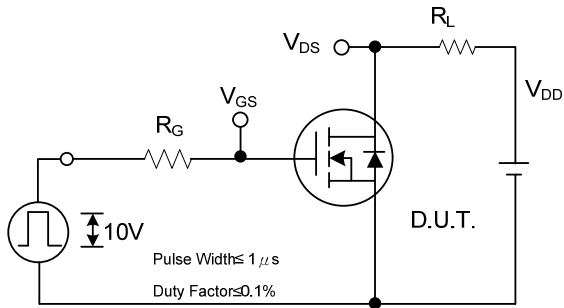


Peak Diode Recovery dv/dt Test Circuit

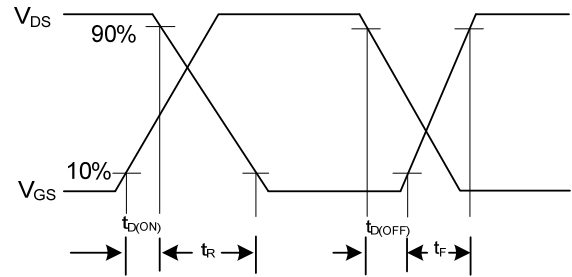


Peak Diode Recovery dv/dt Waveforms

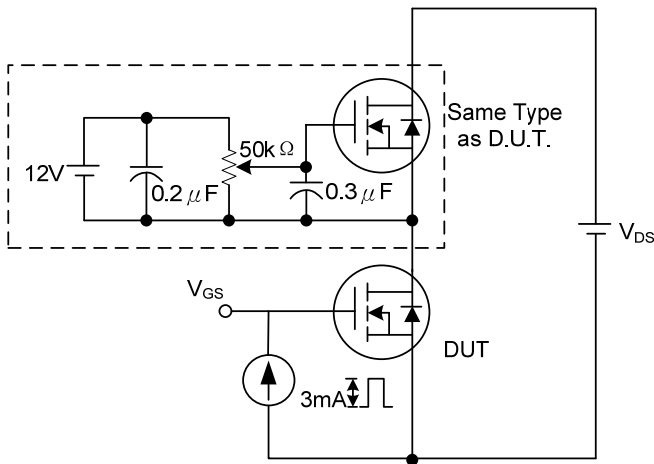
TEST CIRCUITS AND WAVEFORMS (Cont.)



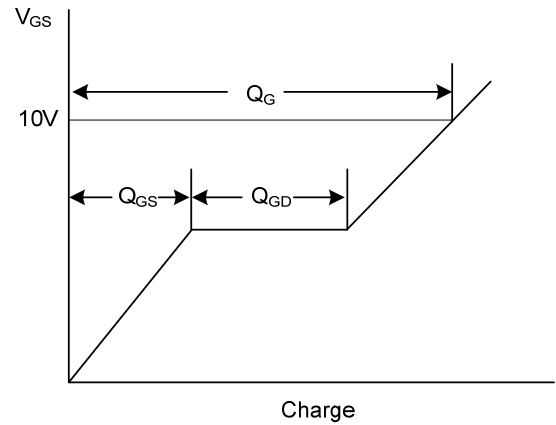
Switching Test Circuit



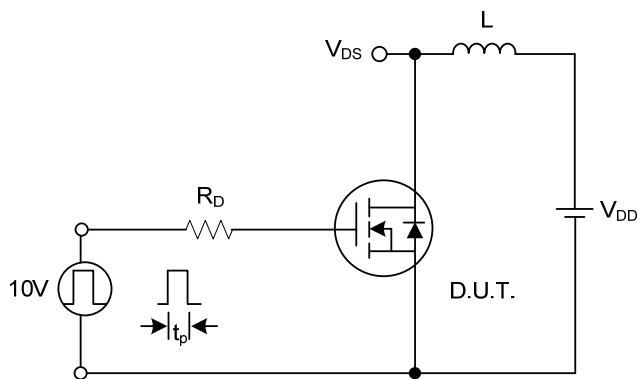
Switching Waveforms



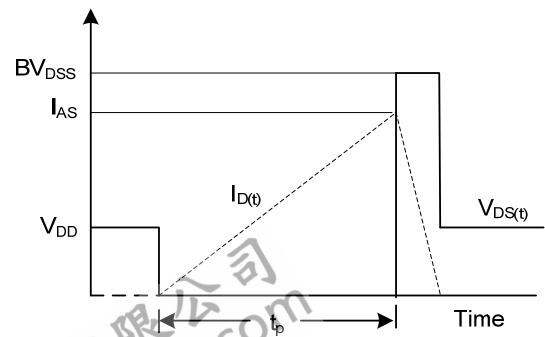
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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