



5N60Z

Preliminary

Power MOSFET

**5A, 600V N-CHANNEL
POWER MOSFET**

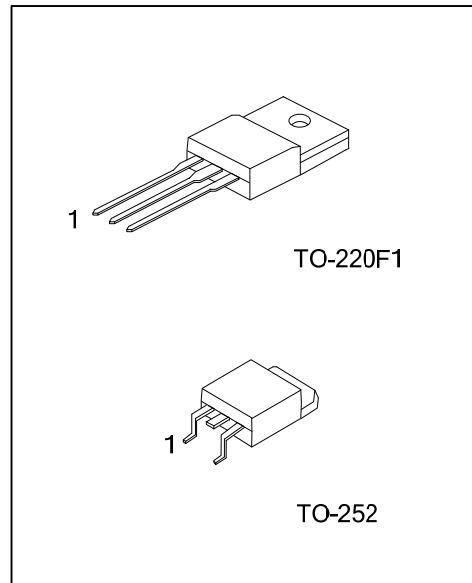
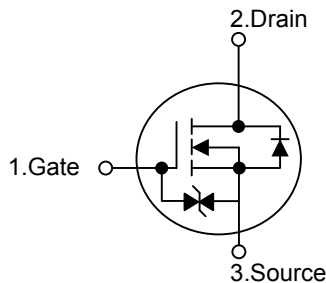
■ DESCRIPTION

The UTC **5N60Z** 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

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

■ SYMBOL



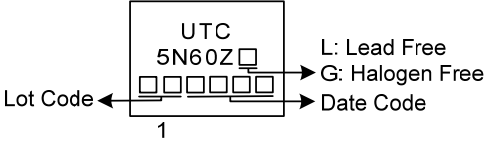
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N60ZL-TF1-T	5N60ZG-TF1-T	TO-220F1	G	D	S	Tube
5N60ZL-TN3-R	5N60ZG-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>5N60ZG-TF1-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TN3: TO-252 (3) G: Halogen Free and Lead Free, L: 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}	± 20	V
Avalanche Current (Note 2)		I_{AR}	5	A
Continuous Drain Current		I_D	5	A
Pulsed Drain Current (Note 2)		I_{DM}	10	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	90	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.4	V/ns
Power Dissipation	TO-220F1	P_D	36	W
	TO-252		50	W
Junction Temperature		T_J	+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 maximum junction temperature.

3. $L=10\text{mH}$, $I_{AS}=4.2\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, 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 CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1	θ_{JC}	3.47	$^\circ\text{C}/\text{W}$
	TO-252		2.5	$^\circ\text{C}/\text{W}$

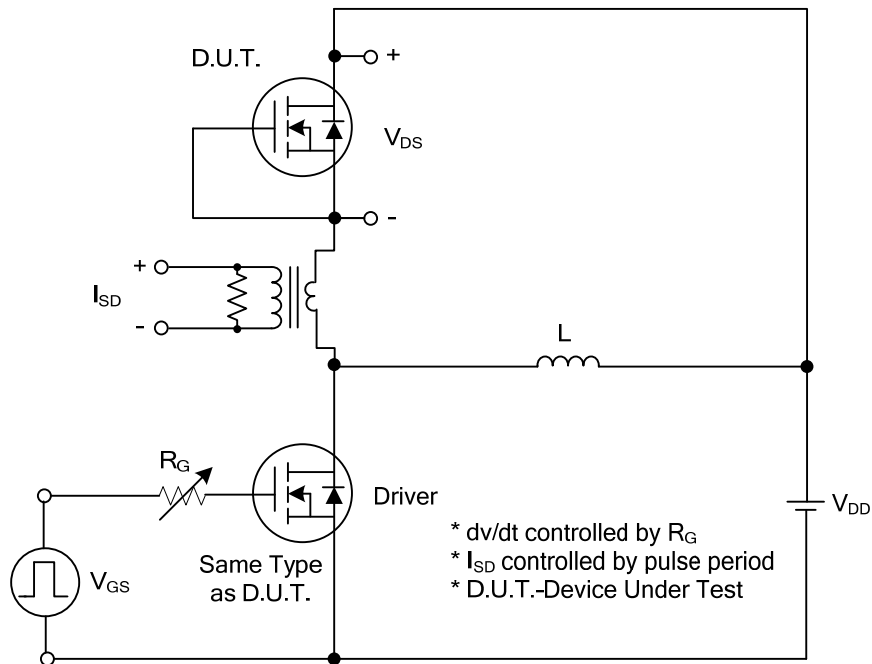
■ ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise specified)

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			10	μA	
Gate-Source Leakage Current	Forward	I _{GSS}			+5	μA	
	Reverse						V _{GS} =20V, V _{DS} =0V
		V _{GS} =-20V, V _{DS} =0V			-5		
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	Ω	
DYNAMIC CHARACTERISTICS							
Input Capacitance	C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		760		pF	
Output Capacitance	C _{OSS}				80		pF
Reverse Transfer Capacitance	C _{RSS}				13		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge	Q _G	V _{DS} =100V, V _{GS} =10V, I _D =5.0A I _G =100μA (Note 1, 2)		22		nC	
Gate-Source Charge	Q _{GS}				5		nC
Gate-Drain Charge	Q _{GD}				7		nC
Turn-On Delay Time	t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =5.0A, R _G =25Ω (Note 1, 2)		7		ns	
Turn-On Rise Time	t _R				14		ns
Turn-Off Delay Time	t _{D(OFF)}				26		ns
Turn-Off Fall Time	t _F				18		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current	I _S				5	A	
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				10	A	
Drain-Source Diode Forward Voltage	V _{SD}	I _S =5.0A, V _{GS} =0V			1.4	V	
Reverse Recovery Time	t _{rr}	I _S =5.0A, V _{GS} =0V, dI _F /dt=100A/μs		300		ns	
Reverse Recovery Charge	Q _{rr}				2.9		μC

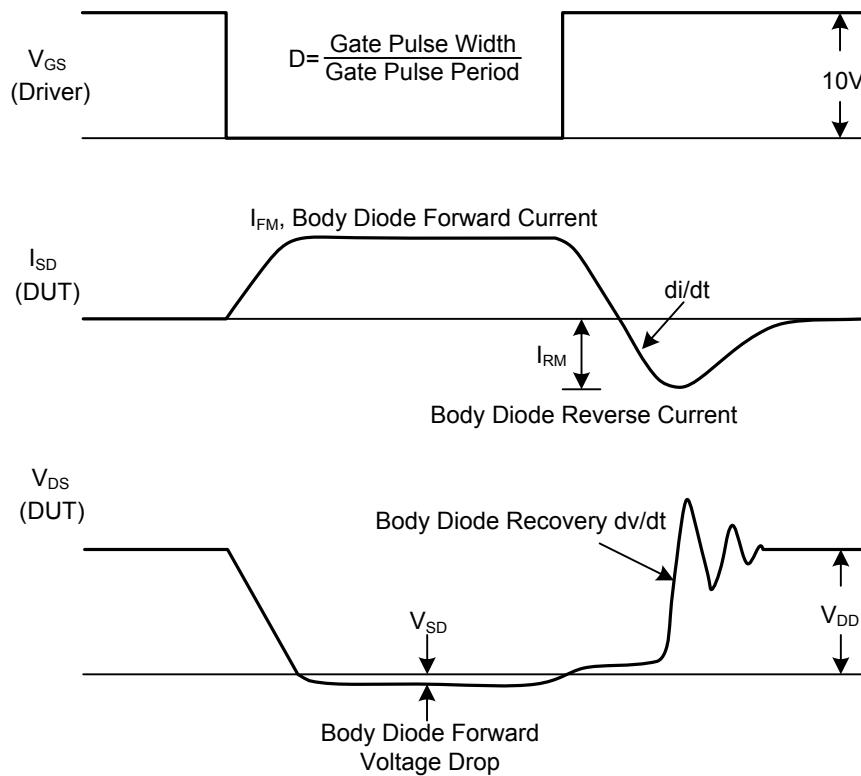
Note 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

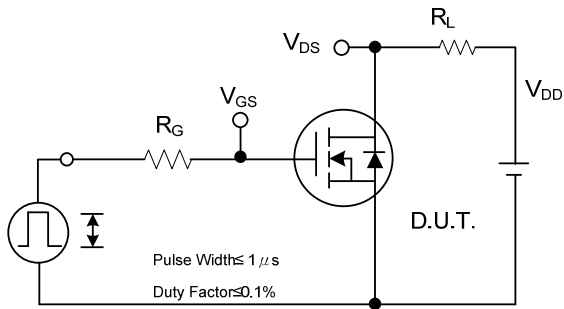


Peak Diode Recovery dv/dt Test Circuit

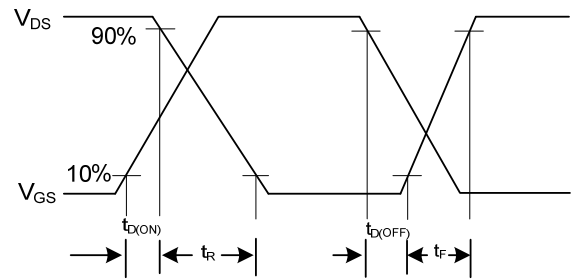


Peak Diode Recovery dv/dt Waveforms

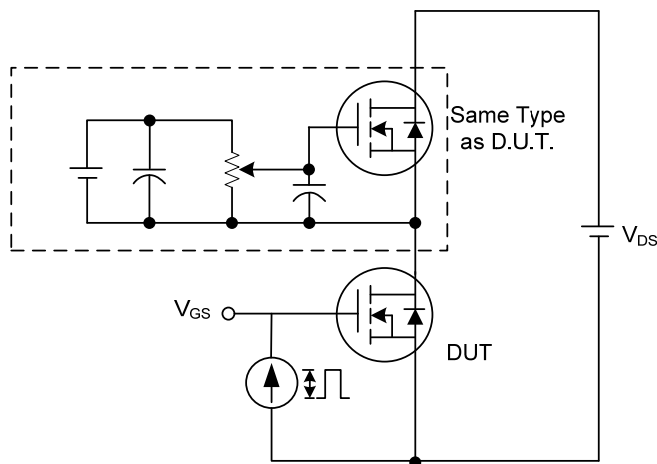
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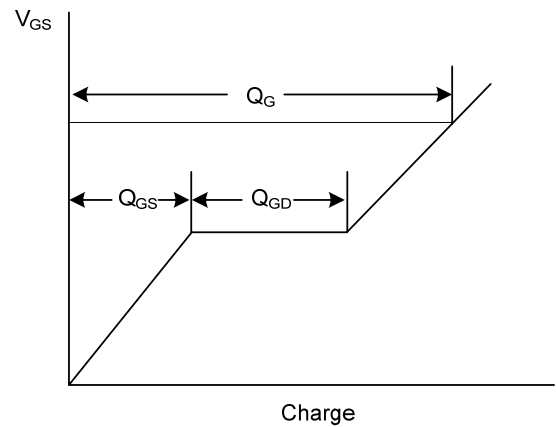
Switching Test Circuit



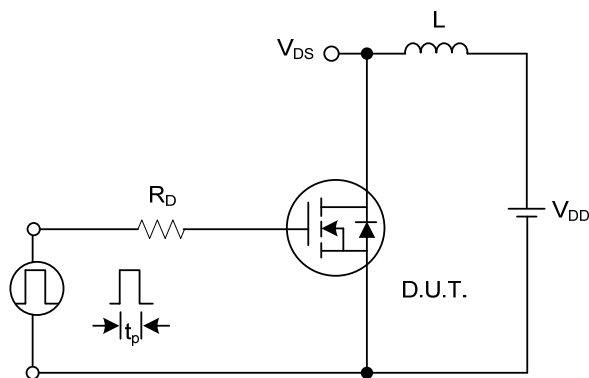
Switching Waveforms



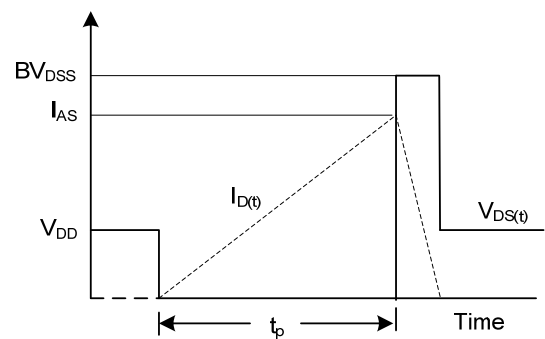
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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