



5N60

Power MOSFET

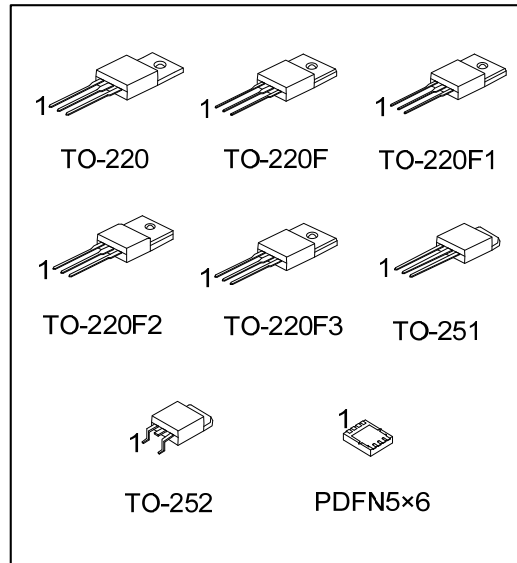
5.0A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

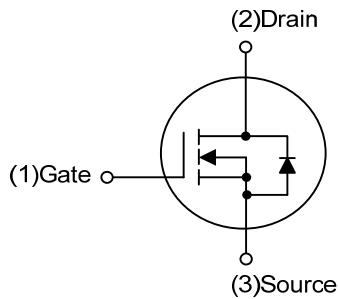
The UTC **5N60** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.

FEATURES

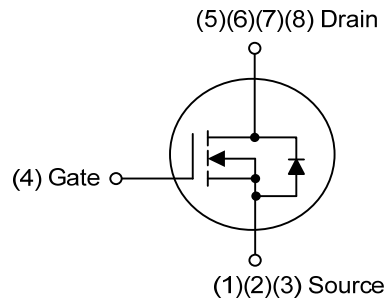
- * $R_{DS(ON)} \leq 2.2 \Omega @ V_{GS}=10V, I_D=2.5A$
- * Ultra Low Gate Charge (Typical 15 nC)
- * Low Reverse Transfer Capacitance ($C_{RSS} = \text{Typical } 6.5 \text{ pF}$)
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness



SYMBOL



TO-220/TO-220F/TO-220F1/TO-220F2
TO-220F3/TO-251/TO-252



PDFN5x6

ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
5N60L-TA3-T	5N60G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
5N60L-TF1-T	5N60G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
5N60L-TF2-T	5N60G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
5N60L-TF3-T	5N60G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
5N60L-TF3T-T	5N60G-TF3T-T	TO-220F3	G	D	S	-	-	-	-	-	Tube
5N60L-TM3-T	5N60G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
5N60L-TN3-R	5N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
5N60L-P5060-R	5N60G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

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

<p>5N60G-TA3-T</p> <ul style="list-style-type: none"> (1) Packing Type (2) Package Type (3) Green Package 	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252, P5060: PDFN5×6</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2 TO-220F3 / TO-251 / TO-252	PDFN5×6
<p>UTC 5N60 □</p> <p>L: Lead Free G: Halogen Free Date Code Lot Code</p> <p>1</p>	<p>UTC 5N60 • □</p> <p>Date Code Lot Code</p>

■ 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}	5	A
Continuous Drain Current		I_D	5	A
Pulsed Drain Current (Note 2)		I_{DM}	20	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	210	mJ
	Repetitive (Note 2)	E_{AR}	10	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P_D	100	W
	TO-220F/TO-220F1		36	
	TO-220F3		38	
	TO-220F2		54	
	TO-251/TO-252		28	
PDFN5x6				
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operation Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Note: 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. $L = 16.8\text{mH}$, $I_{AS} = 5\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, 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-220F	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/ TO-220F2			
	TO-220F3			
	TO-251/TO-252			
PDFN5x6			75	
Junction to Case	TO-220	θ_{JC}	1.25	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	
	TO-220F3		3.28	
	TO-220F2		2.3	
	TO-251/TO-252		4.46	
PDFN5x6				

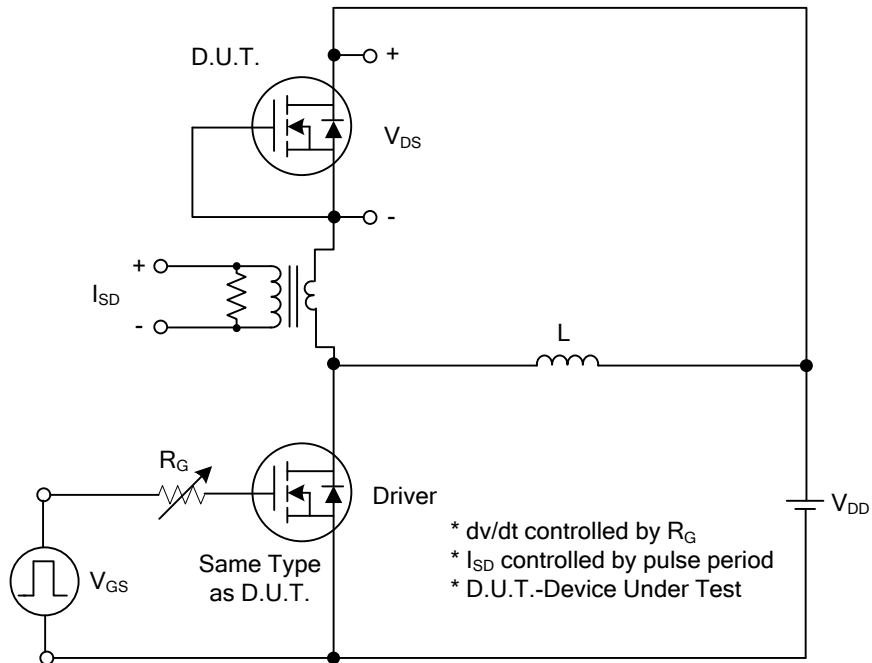
■ ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise specified)

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}			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		515	670	pF
Output Capacitance	C _{OSS}			55	72	pF
Reverse Transfer Capacitance	C _{RSS}			6.5	8.5	pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q _G	V _{DS} = 480 V, I _D = 5A, V _{GS} = 10 V (Note 1, 2)		15	19	nC
Gate-Source Charge	Q _{GS}			2.5		nC
Gate-Drain Charge	Q _{GD}			6.6		nC
Turn-On Delay Time	t _{D(ON)}	V _{DD} = 300V, I _D = 5A, R _G = 25Ω (Note 1, 2)		10	30	ns
Turn-On Rise Time	t _R			42	90	ns
Turn-Off Delay Time	t _{D(OFF)}			38	85	ns
Turn-Off Fall Time	t _F			46	100	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}				20	A
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0 V, I _S = 5A			1.4	V
Reverse Recovery Time	t _{rr}	V _{GS} = 0 V, I _S = 5A, dI _F / dt = 100 A/μs (Note 1)		300		ns
Reverse Recovery Charge	Q _{rr}				2.2	

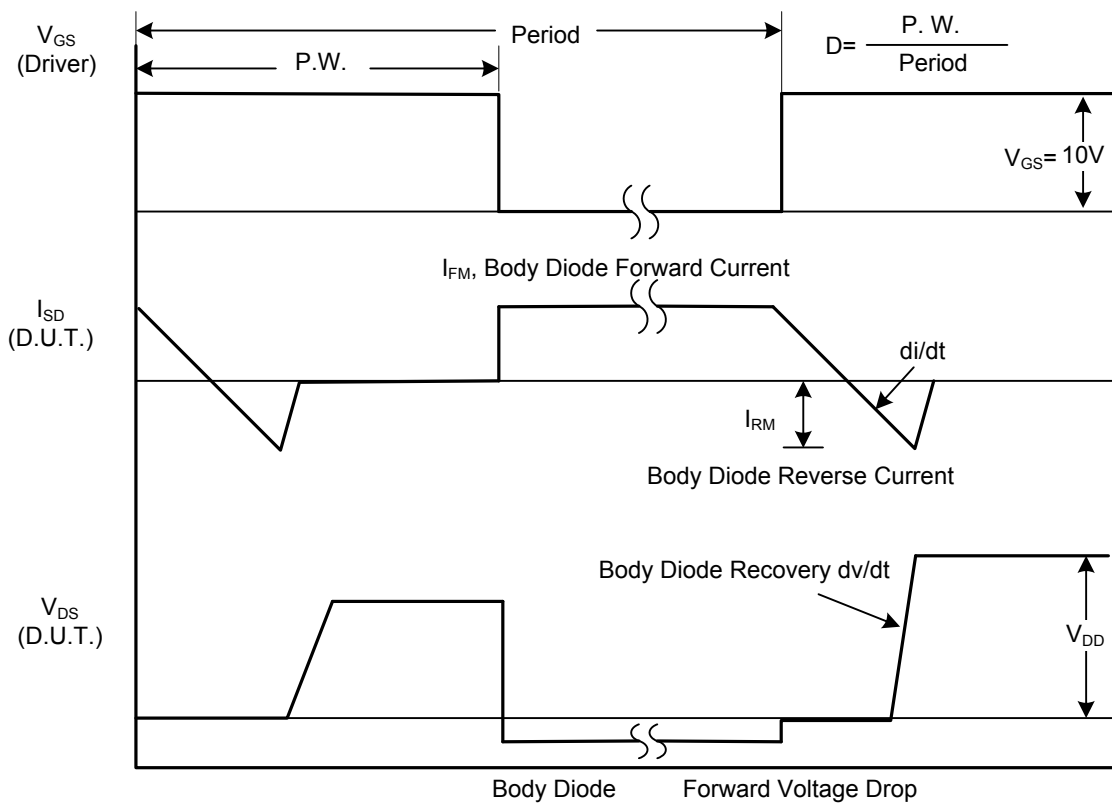
Note: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

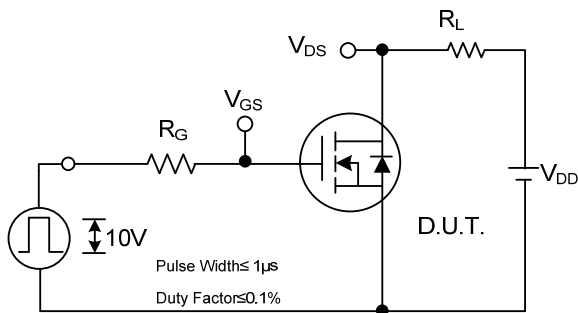


Peak Diode Recovery dv/dt Test Circuit

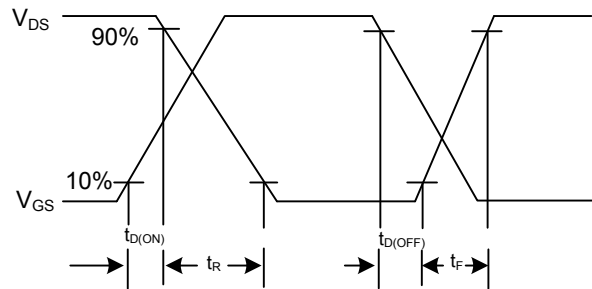


Peak Diode Recovery dv/dt Waveforms

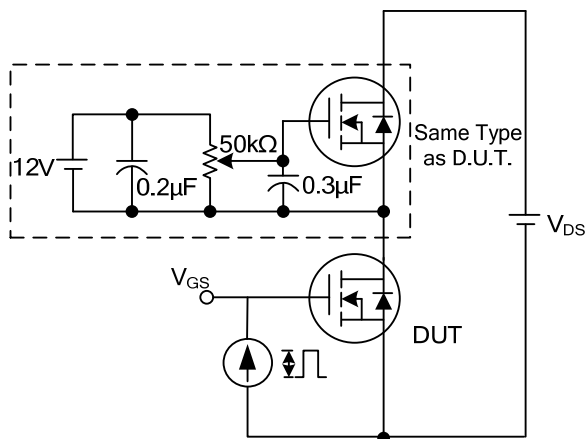
TEST CIRCUITS AND WAVEFORMS (Cont.)



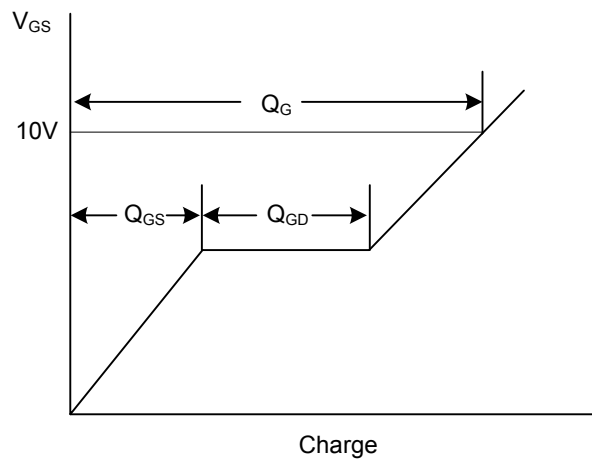
Switching Test Circuit



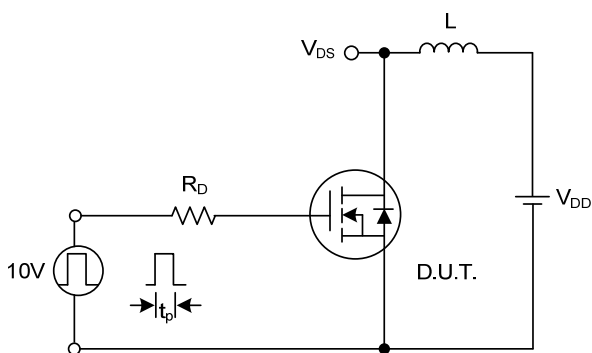
Switching Waveforms



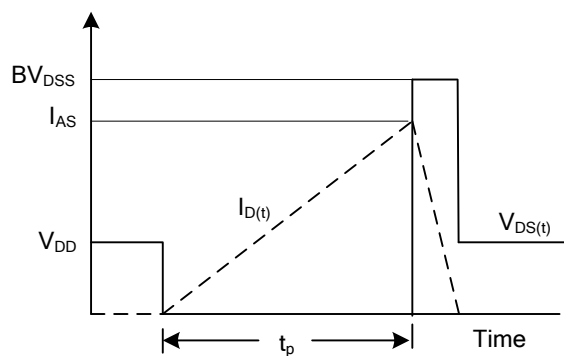
Gate Charge Test Circuit



Gate Charge Waveform

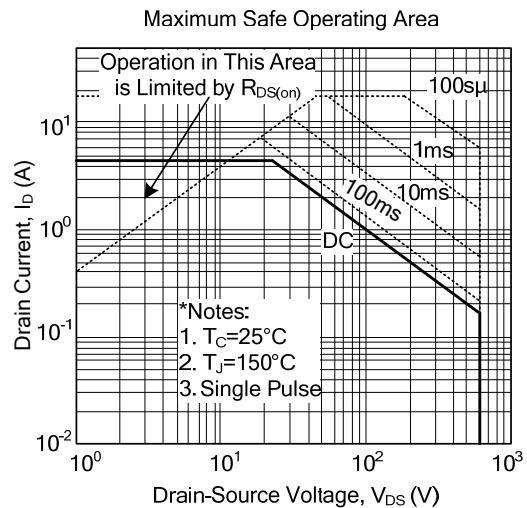
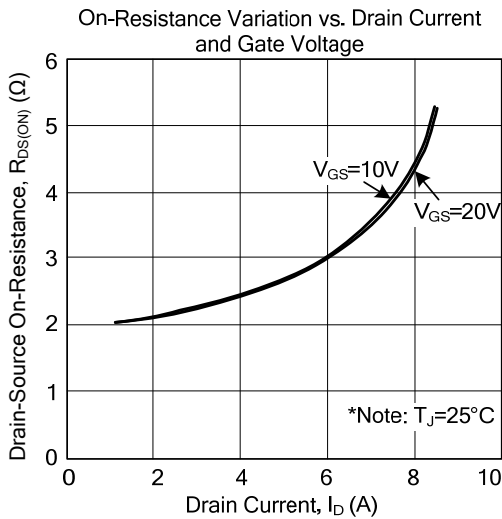
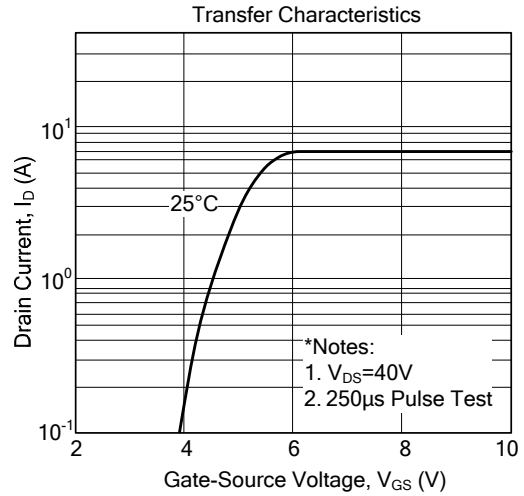
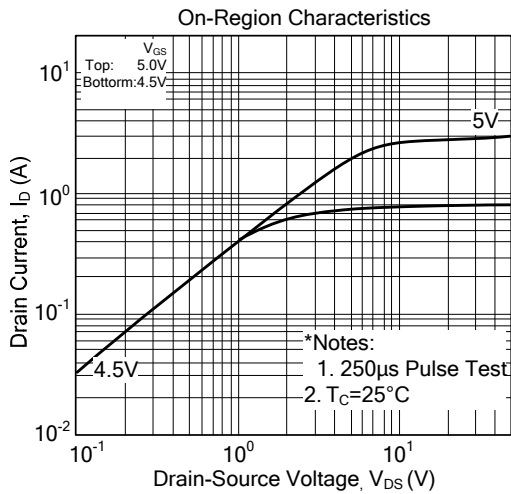


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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