

UNISONIC TECHNOLOGIES CO., LTD

4N60-S Power MOSFET

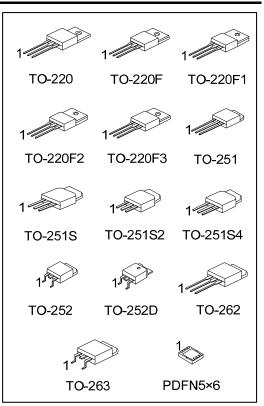
4.0A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

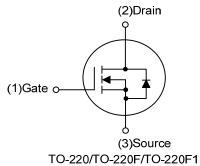
The UTC **4N60-S** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.

■ FEATURES

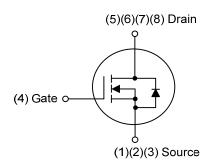
- * $R_{DS(ON)} \le 2.5 \Omega$ @ V_{GS} =10V, I_D =2.2A
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, high RuggednessA



■ SYMBOL



TO-220/TO-220F/TO-220F1 TO-220F2/TO-220F3/TO-251 TO-251S/TO-251S2/TO-251S4 TO-252/TO-252D/TO-262/TO-263

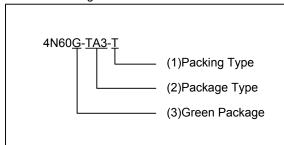


PDFN5×6

■ ORDERING INFORMATION

Ordering Number		Dookogo	Pin Assignment							Dealing		
Lead Free	Halogen Free	Package	1	2	3	4	5	6	7	8	Packing	
4N60L-TA3-T	4N60G-TA3-T	TO-220	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TF1-T	4N60G-TF1-T	TO-220F1	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TF2-T	4N60G-TF2-T	TO-220F2	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TF3-T	4N60G-TF3-T	TO-220F	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TF3T-T	4N60G-TF3T-T	TO-220F3	G	D	S	-	-	-	-	-	Tube	
4N60L-TM3-T	4N60G-TM3-T	TO-251	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TMS-T	4N60G-TMS-T	TO-251S	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TMS2-T	4N60G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube	
4N60L-TMS4-T	4N60G-TMS4-T	TO-251S4	G	D	S	-	ı	-	-	ı	Tube	
4N60L-TN3-R	4N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel	
4N60L-TND-R	4N60G-TND-R	TO-252D	G	D	S	-	ı	-	-	ı	Tape Reel	
4N60L-T2Q-T	4N60G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	Tube	
4N60L-TQ2-R	4N60G-TQ2-R	TO-263	G	D	S	-	ı	-	-	ı	Tape Reel	
4N60L-TQ2-T	4N60G-TQ2-T	TO-263	G	D	S	-	ı	-	-	•	Tube	
4N60L-P5060-R	4N60G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel	

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



- (1) T: Tube, R: Tape Reel
- (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,
 TQ2: TO-263, P5060: PDFN5×6
- (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

PACKAGE		MARKING				
TO-220 TO-220F TO-220F1 TO-220F2 TO-220F3 TO-251	TO-251S2 TO-251S4 TO-252 TO-252D TO-262 TO-263	UTC 4N60 ☐ L: Lead Free G: Halogen Free Date Code 1				
PDFN5×6		UTC 4N60 Lot Code				

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{ extsf{DSS}}$	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 2)		I _{AR}	4.4	А
Desir Ownerd	Continuous	I_{D}	4.0	Α
Drain-Source Voltage	А			
A	Single Pulsed (Note 3)	E _{AS}	100	mJ
Avaianche Energy	Repetitive (Note 2)	E _{AR}	10.6	mJ
Peak Diode Recovery	• • • • • • • • • • • • • • • • • • • •		4.5	V/ns
Power Dissipation	TO-220F/TO-220F1		106	
	TO-251S2/TO-251S4 TO-252/TO-252D	P_D		W
Junction Temperature		TJ	+150	°C
Operating Temperature		T _{OPR}	-55 ~ +150	°C
Storage Temperature		T _{STG}	-55 ~ +150	°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 = 30mH, I_{AS} = 2.6A, V_{DD} = 50V, R_G = 25 Ω , Starting T_J = 25°C
- 4. $I_{SD} \le 4.4A$, di/dt $\le 200A/\mu s$, $V_{DD} \le BV_{DSS}$, Starting $T_J = 25^{\circ}C$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT		
	TO-220/TO-262/TO-263					
	TO-220F/TO-220F1		62.5			
	TO-220F2/TO-220F3					
Junction to Ambient	TO-251/TO-251S	θ_{JA}		°C/W		
	TO-251S2/TO-251S4		110			
	TO-252/TO-252D					
	PDFN5×6		75 (Note)			
Junction to Case	TO-220/TO-262/TO-263		1.18			
	TO-220F/TO-220F1 TO-220F3		3.47			
	TO-220F2	0	3.28	°0.044		
	TO-251/TO-251S	θ_{JC}		°C/W		
	TO-251S2/TO-251S4		2.5			
	TO-252/TO-252D					
	PDFN5×6		4.17 (Note)			

Note: Note: The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

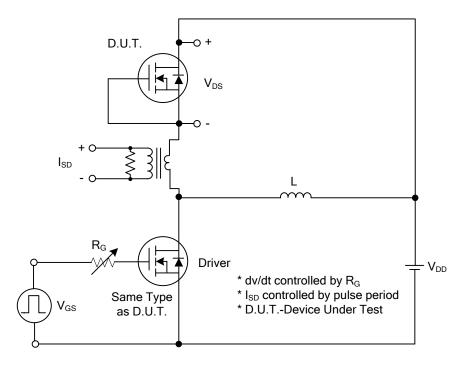
■ ELECTRICAL CHARACTERISTICS (T_C =25°C, unless otherwise specified)

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			
Coto Course Looke to Current For	Forward	l Cee	$V_{GS} = 30V, V_{DS} = 0V$			100	nA		
Gate-Source Leakage Current Rev	erse		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA		
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I _D =250μA,Referenced to 25°C		0.6		V/°C		
ON CHARACTERISTICS									
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	3.0		5.0	V		
Static Drain-Source On-State Resistan	nce	R _{DS(ON)}	$V_{GS} = 10 \text{ V}, I_D = 2.2 \text{A}$		2.2	2.5	Ω		
DYNAMIC CHARACTERISTICS									
Input Capacitance		C_{ISS}	V 05V V 0V		440	520	pF		
Output Capacitance		Coss	$V_{DS} = 25V, V_{GS} = 0V,$ of = 1MHz		45	60	pF		
Reverse Transfer Capacitance		C_{RSS}			8	11	pF		
SWITCHING CHARACTERISTICS									
Turn-On Delay Time		$t_{D(ON)}$			40	60	ns		
Turn-On Rise Time		t _R	$V_{DD} = 300V, I_D = 4.0A,$		40	60	ns		
Turn-Off Delay Time		t _{D(OFF)}	$R_G = 25\Omega$ (Note 1, 2)		35	55	ns		
Turn-Off Fall Time		t _F			80	100	ns		
Total Gate Charge		Q_G	1001/1 4 0 4		35		nC		
Gate-Source Charge		Q_GS	V_{DS} = 480V, I_{D} = 4.0A,		5		nC		
Gate-Drain Charge		Q_GD	V _{GS} = 10V (Note 1, 2)		3		nC		
SOURCE- DRAIN DIODE RATINGS A	AND CH	HARACTERIST	rics						
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0V, I _S = 4.4A			1.4	V		
Maximum Continuous Drain-Source Di					4.4	۸			
Forward Current	Is				4.4	Α			
Maximum Pulsed Drain-Source Diode		la				17.6	^		
Forward Current	I _{SM}				17.0	Α			
Reverse Recovery Time		t _{rr}	$V_{GS} = 0 \text{ V}, I_{S} = 4.4\text{A},$		250		ns		
Reverse Recovery Charge		Q_{rr}	dI _F /dt = 100 A/μs (Note 1)		1.5		μC		

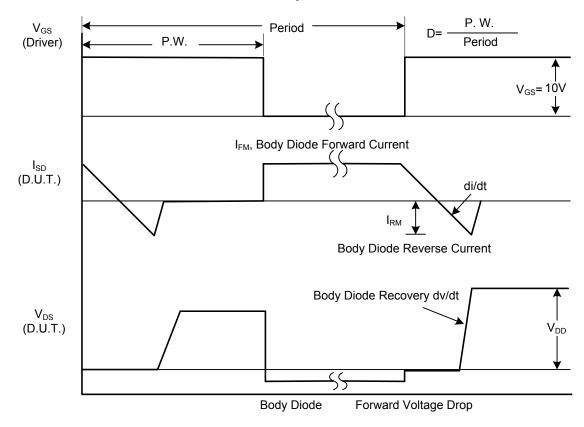
Notes: 1. Pulse Test: Pulse width≤300µs, Duty cycle≤2%

^{2.} Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS



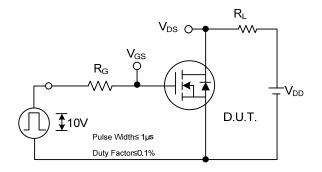
Peak Diode Recovery dv/dt Test Circuit

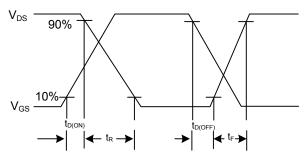


Peak Diode Recovery dv/dt Waveforms

4N60-S

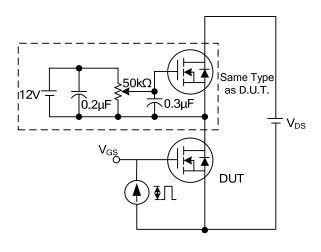
■ TEST CIRCUITS AND WAVEFORMS (Cont.)

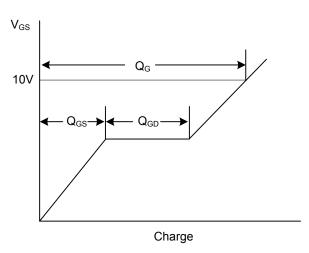




Switching Test Circuit

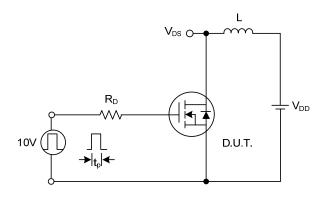
Switching Waveforms

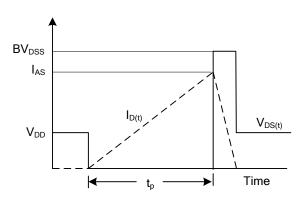




Gate Charge Test Circuit

Gate Charge Waveform





Unclamped Inductive Switching Test Circuit

Unclamped Inductive Switching Waveforms

4N60-S

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Power MOSFET