

**General Description**

The UT4N60F is the highest performance trench P-ch MOSFETs with extreme high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The UT4N60F meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

**Features**

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

**Absolute Maximum Ratings**

Symbol	Parameter	TO220F	Unites
V <sub>DSS</sub>	Drain-source Voltage	600	V
I <sub>D</sub>	Drain current -Continuous (T <sub>c</sub> =25°C)	4	A
	-Continuous (T <sub>c</sub> =100°C)	2.8	A
I <sub>DM</sub>	Drain current - pulsed (Note1)	16	A
V <sub>GSS</sub>	Gate-Source Voltage	±30	V
EAS	Single Pulsed Avalanche Energy (Note2)	8.8	mJ
Dv/Dt	Peak Diode Recovery Dv/Dt (Note3)	4.5	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>c</sub> =25°C)	33	W
	- Derate above 25°C	0.26	W/°C
T <sub>J</sub> T <sub>STG</sub>	Operating and Storage Temperature Range	-55-150	°C
T <sub>L</sub>	Maximum Lead temperature for soldering purposes, 1/8" from case for seconds	300	°C

**Thermal Data**

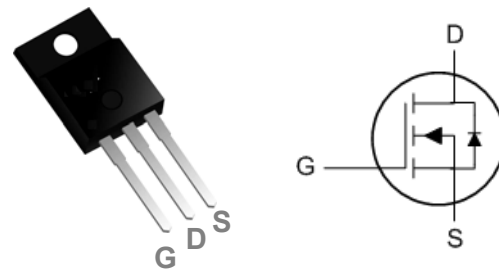
Symbol	Parameter	Type	Max	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to-case	--	3.8	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	--	6.5	°C/W

**Product Summary**

BV <sub>DSS</sub>	RD <sub>S(ON)</sub>	I <sub>D</sub>
600V	2.2Ω	4A

**Applications**

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

**TO220F Pin Configuration**


**Electrical Characteristics ( $T_J=25\text{ }^\circ\text{C}$ , unless otherwise noted)**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}$	600	644	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.6	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ ( $T_C = 25^\circ\text{C}$ )	--	--	10	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$ ( $T_C = 125^\circ\text{C}$ )	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.5	3.5	4.5	V
$R_{DS(on)}$	Static Drain-Source On-resistance	$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	--	2.2	2.5	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 2\text{ A}$ (Note 4)	--	3.0	--	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	484	629	pF
$C_{oss}$	Output Capacitance		--	51.7	67	pF
$C_{rss}$	Reverse Transfer Capacitance		--	8.7	11	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 4\text{ A},$ $R_G = 25\Omega$ (Note 4, 5)	--	11	27	ns
$t_r$	Turn-On Rise Time		--	20	48	ns
$t_{d(off)}$	Turn-Off Delay Time		--	30	72	ns
$t_f$	Turn-Off Fall Time		--	19	46	ns
$Q_g$	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 4\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4, 5)	--	14.5	20	nC
$Q_{gs}$	Gate-Source Charge		--	3.4	--	nC
$Q_{gd}$	Gate-Drain Charge		--	7.0	--	nC

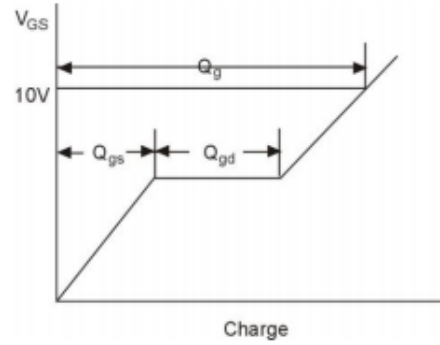
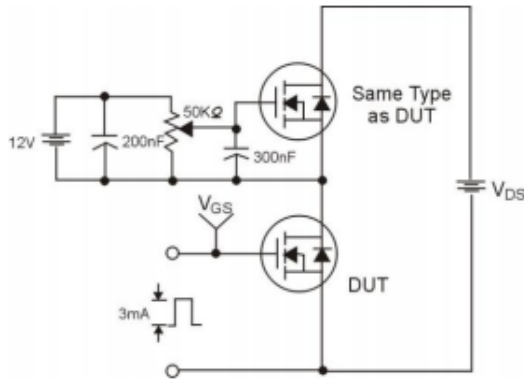
**Drain-Source Diode Characteristics and Maximum Ratings**

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	4	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	16	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 4\text{ A}$	--	0.97	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 4\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	557	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	1.6	--	$\mu\text{C}$

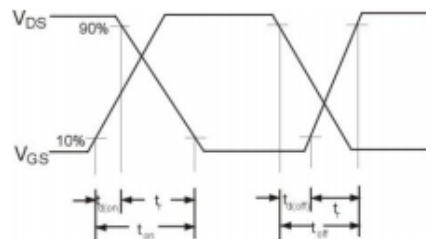
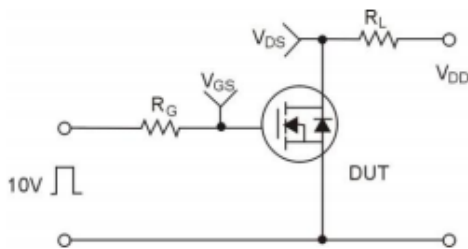
Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 1\text{ mH}, I_{AS} = 4\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 4\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

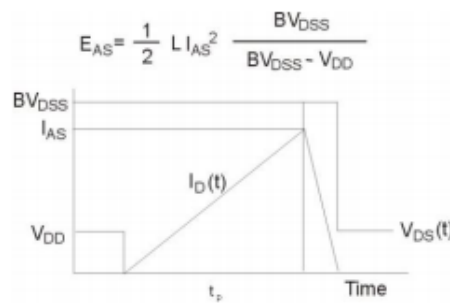
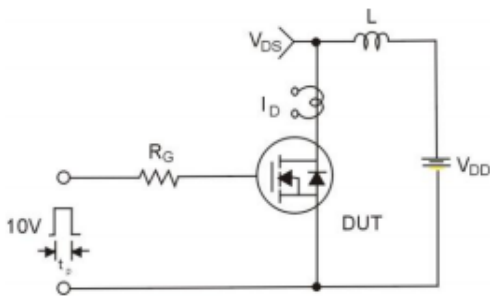
**Gate Charge Test Circuit Waveform**



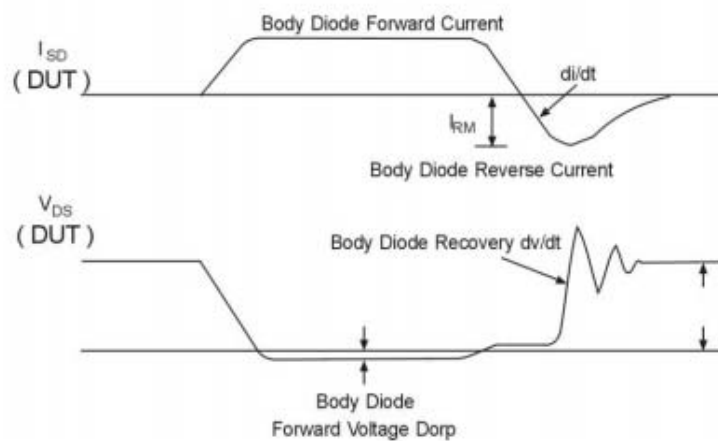
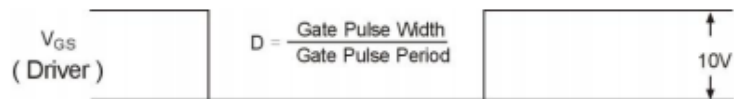
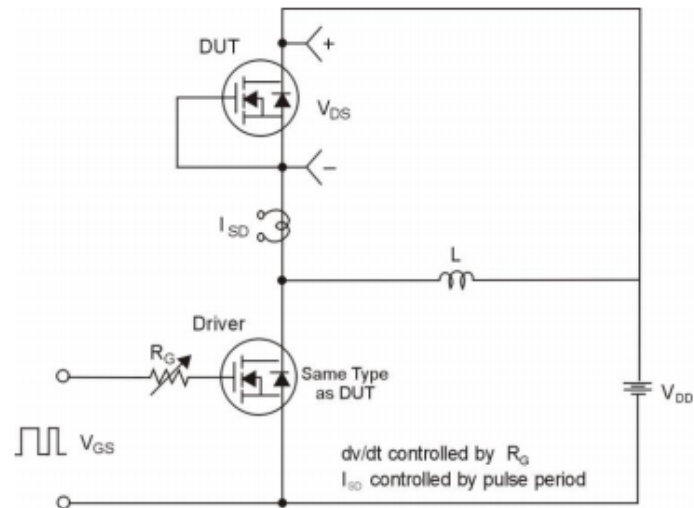
**Resistive Switching Test Circuit Waveforms**

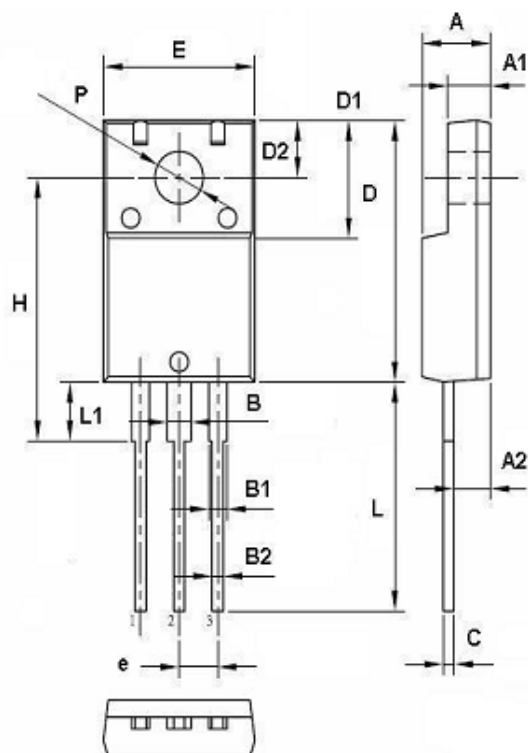


**Unclamped Inductive Switching Test Circuit Waveforms**



### Gate Charge Test Circuit Waveform



**TO-220F Mechanical Drawing**


TO-220F DIMENSION				
Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.200	4.800	0.165	0.189
A1	2.500	3.100	0.098	0.122
A2	2.100	2.700	0.083	0.106
B	1.300	1.900	0.051	0.075
B1	0.900	1.500	0.035	0.059
B2	0.650	1.050	0.026	0.041
C	0.400	1.000	0.016	0.039
D	15.700	16.300	0.618	0.642
D1	6.900	7.500	0.272	0.295
D2	3.200	3.800	0.126	0.150
E	9.700	10.300	0.382	0.406
e	2.350	2.750	0.093	0.108
H	15.800	16.400	0.622	0.646
L	13.500	14.500	0.531	0.571
L1	3.400	3.800	0.134	0.150