

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_{DSS} | Drain-source Voltage | 600 | V |
| I_D | Drain current -Continuous ($T_c=25^\circ\text{C}$) -Continuous ($T_c=100^\circ\text{C}$) | 4 | A |
| | | 2.8 | A |
| I_{DM} | Drain current - pulsed (Note1) | 16 | A |
| V_{GSS} | 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_D | Power Dissipation ($T_c=25^\circ\text{C}$) - Derate above 25°C | 33 | W |
| | | 0.26 | W/ $^\circ\text{C}$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55-150 | $^\circ\text{C}$ |
| T_L | Maximum Lead temperature for soldering purposes, 1/8" from case for seconds | 300 | $^\circ\text{C}$ |

Thermal Data

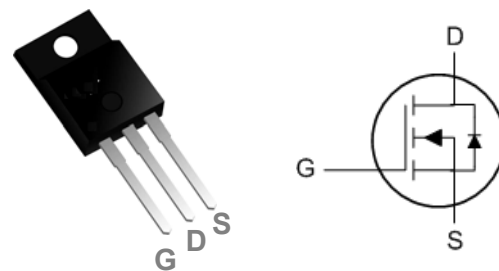
| Symbol | Parameter | Type | Max | Units |
|-----------------|---|------|-----|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-case | -- | 3.8 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 6.5 | $^\circ\text{C}/\text{W}$ |

Product Summary

| BV_{DSS} | $R_{DS(ON)}$ | I_D |
|------------|---------------|-------|
| 600V | $2.2\ \Omega$ | 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 |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

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°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 | μA |
| | | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$ ($T_C = 125^\circ\text{C}$) | -- | -- | 100 | μA |
| 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 | Ω |
| 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 |

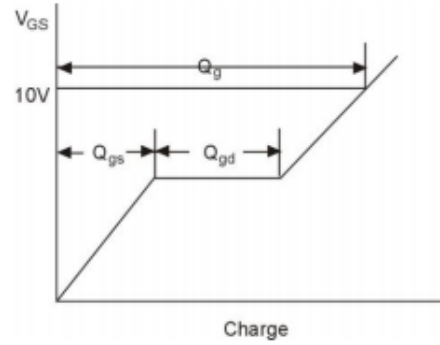
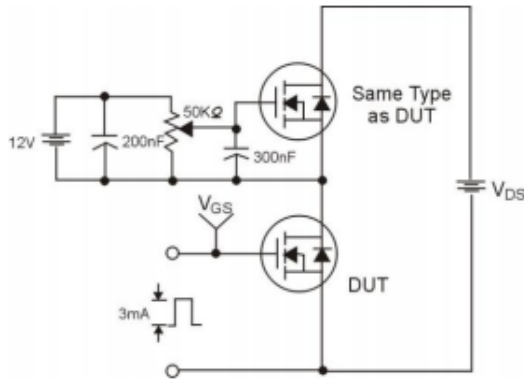
Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | | |
|----------|---|---|----|------|-----|---------------|
| 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 | $V_{GS} = 0\text{ V}, I_S = 4\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 4) | -- | 557 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | | -- | 1.6 | -- | μC |

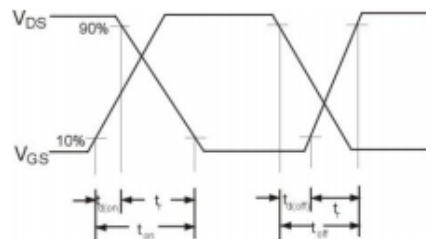
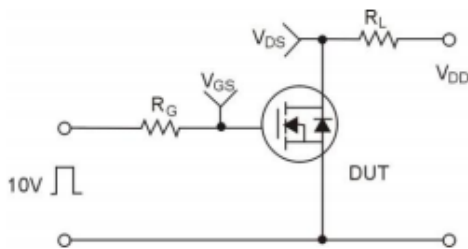
Notes:

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

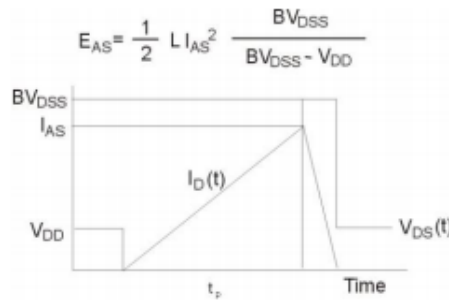
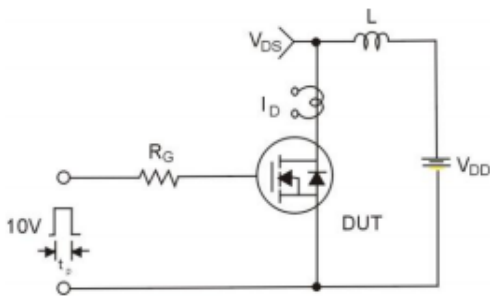
Gate Charge Test Circuit Waveform

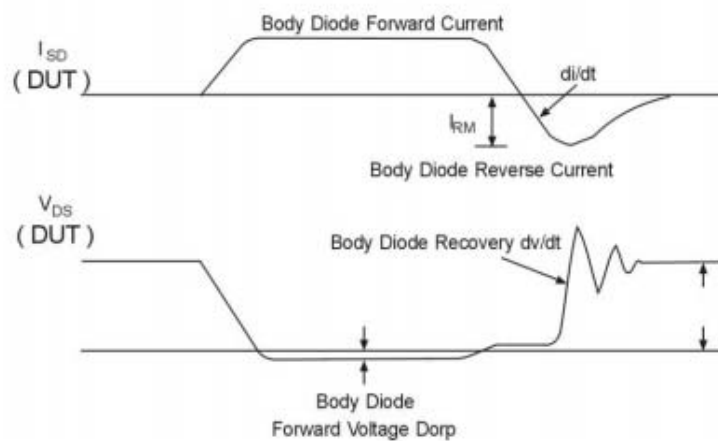
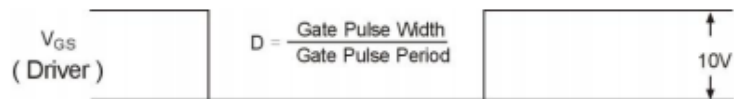
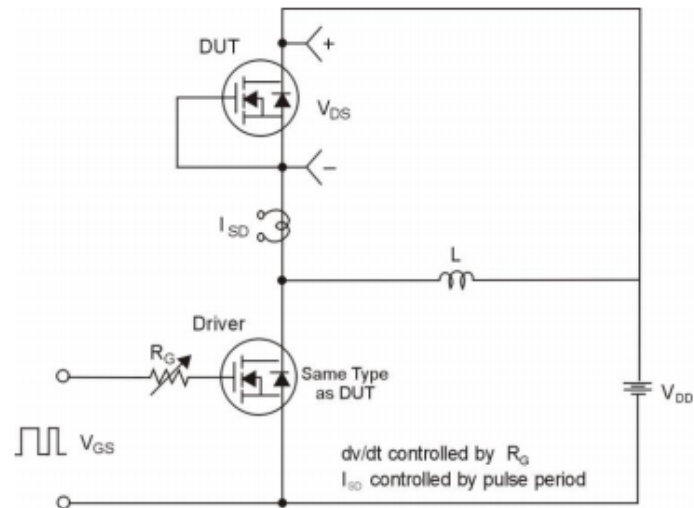


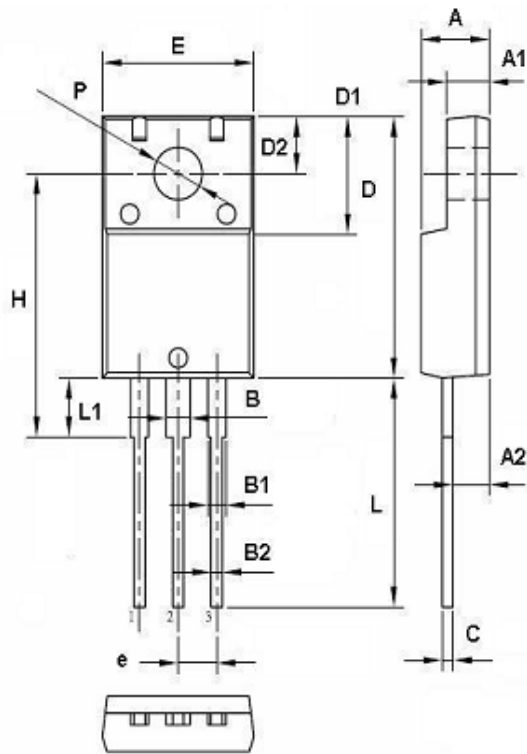
Resistive Switching Test Circuit Waveforms



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 |