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March 2015

FDD6688/FDU6688

FDD6688/FDU6688

30V N-Channel PowerTrench[®] MOSFET

General Description

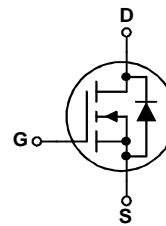
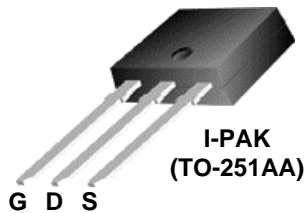
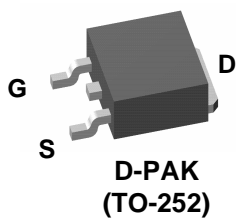
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Applications

- DC/DC converter
- Motor Drives

Features

- 84 A, 30 V. $R_{DS(ON)} = 5 \text{ m}\Omega$ @ $V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 6 \text{ m}\Omega$ @ $V_{GS} = 4.5 \text{ V}$
- Low gate charge
- Fast switching
- High performance trench technology for extremely low $R_{DS(ON)}$



Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|----------------|--|-----------------|------------------|
| V_{DSS} | Drain-Source Voltage | 30 | V |
| V_{GSS} | Gate-Source Voltage | ± 20 | |
| I_D | Drain Current – Continuous (Note 3) | 84 | A |
| | – Pulsed (Note 1a) | 100 | |
| P_D | Power Dissipation for Single Operation (Note 1) | 83 | W |
| | (Note 1a) | 3.8 | |
| | (Note 1b) | 1.6 | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to $+175$ | $^\circ\text{C}$ |

Thermal Characteristics

| | | | |
|-----------------|---|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1) | 1.8 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 40 | |
| | (Note 1b) | 96 | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|------------|
| FDD6688 | FDD6688 | D-PAK (TO-252) | 13" | 16mm | 2500 units |
| FDU6688 | FDU6688 | I-PAK (TO-251) | Tube | N/A | 75 |

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Drain-Source Avalanche Ratings (Note 2)

| | | | | | | |
|-----------|--------------------------------|--|--|--|-----|----|
| W_{DSS} | Drain-Source Avalanche Energy | Single Pulse, $V_{DD} = 15\text{ V}$, $I_D = 21\text{ A}$ | | | 370 | mJ |
| I_{AR} | Drain-Source Avalanche Current | | | | 21 | A |

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----|----|-----------|----------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C | | 24 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$ | | | 1 | μA |
| I_{GSS} | Gate-Body Leakage | $V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$ | | | ± 100 | nA |

On Characteristics (Note 2)

| | | | | | | |
|--|--|---|----|-------------|--------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 1 | 1.8 | 3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C | | -5 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}$, $I_D = 18\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 16.5\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 18\text{ A}$, $T_J = 125^\circ\text{C}$ | | 4 5 6 | 5 6 10 | m Ω |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = 10\text{ V}$, $V_{DS} = 5\text{ V}$ | 50 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{ V}$, $I_D = 18\text{ A}$ | | 88 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|--|------|--|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$ | | 3845 | | pF |
| C_{oss} | Output Capacitance | | | 930 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 368 | | pF |
| R_G | Gate Resistance | $V_{GS} = 15\text{ mV}$, $f = 1.0\text{ MHz}$ | | 1.2 | | Ω |

Switching Characteristics (Note 2)

| | | | | | | |
|--------------|---------------------|---|--|----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 15\text{ V}$, $I_D = 1\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 6\text{ }\Omega$ | | 15 | 27 | ns |
| t_r | Turn-On Rise Time | | | 13 | 23 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 62 | 99 | ns |
| t_f | Turn-Off Fall Time | | | 36 | 58 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 15\text{ V}$, $I_D = 18\text{ A}$, $V_{GS} = 5\text{ V}$ | | 37 | 56 | nC |
| Q_{gs} | Gate-Source Charge | | | 10 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 14 | | nC |

Electrical Characteristics (continued)

$T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|------------------------------------|--|-----|-----|-----|-------|
| Drain–Source Diode Characteristics and Maximum Ratings | | | | | | |
| V_{SD} | Drain–Source Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_S = 3.2\text{ A}$ (Note 2) | | 0.7 | 1.2 | V |
| t_{rr} | Diode Reverse Recovery Time | $I_F = 18\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$ | | 39 | | nS |
| Q_{rr} | Diode Reverse Recovery Charge | | | 31 | | nC |

Notes:8

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



Scale 1 : 1 on letter size paper

a) $R_{\theta JA} = 40^\circ\text{C}/\text{W}$ when mounted on a 1 in^2 pad of 2 oz copper



b) $R_{\theta JA} = 96^\circ\text{C}/\text{W}$ when mounted on a minimum pad.

2. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%

3. Maximum current is calculated as:
- $$\sqrt{\frac{P_D}{R_{DS(ON)}}}$$

where P_D is maximum power dissipation at $T_C = 25^\circ\text{C}$ and $R_{DS(on)}$ is at $T_{J(max)}$ and $V_{GS} = 10\text{ V}$. Package current limitation is 21A

Typical Characteristics

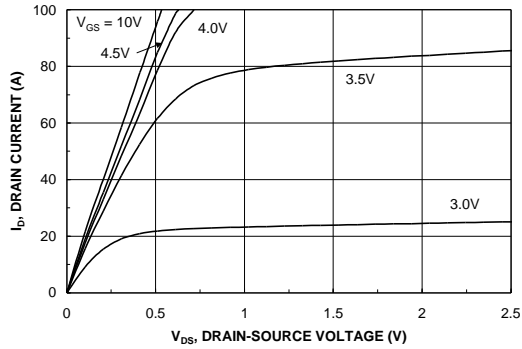


Figure 1. On-Region Characteristics.

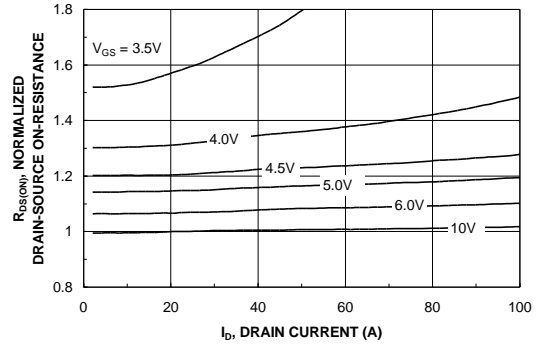


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

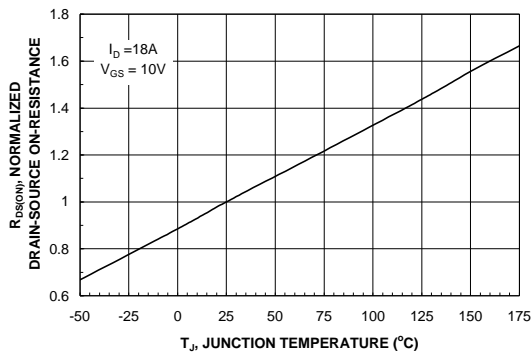


Figure 3. On-Resistance Variation with Temperature.

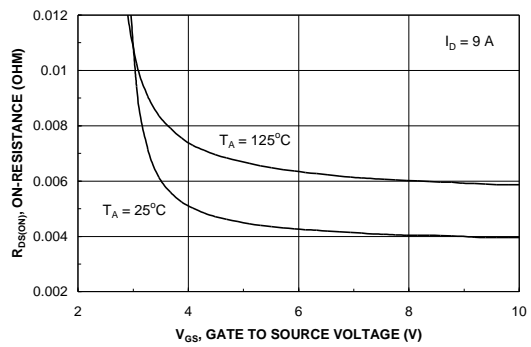


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

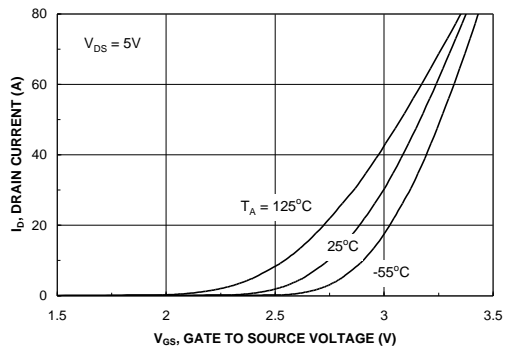


Figure 5. Transfer Characteristics

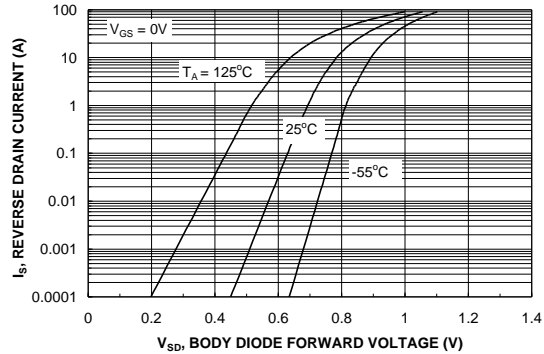


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

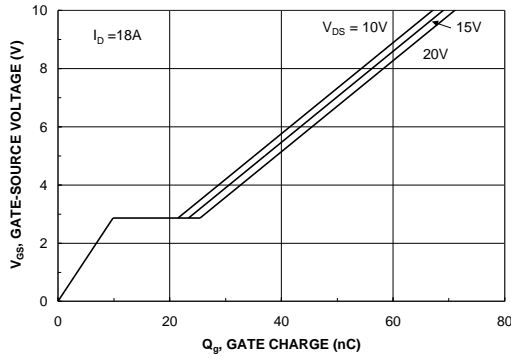


Figure 7. Gate Charge Characteristics

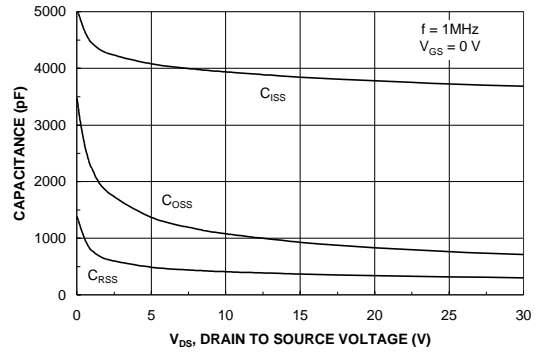


Figure 8. Capacitance Characteristics

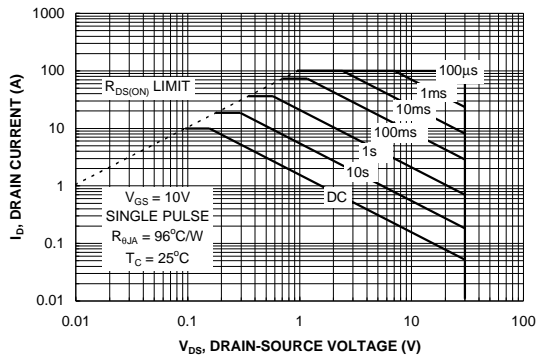


Figure 9. Maximum Safe Operating Area

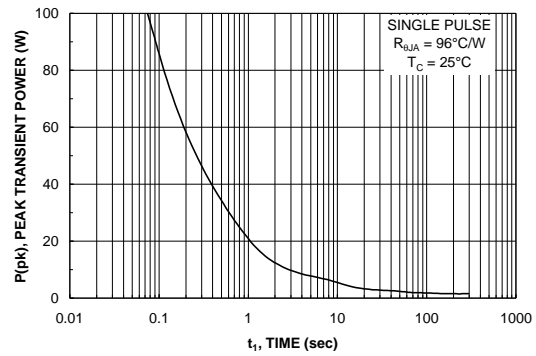


Figure 10. Single Pulse Maximum Power Dissipation

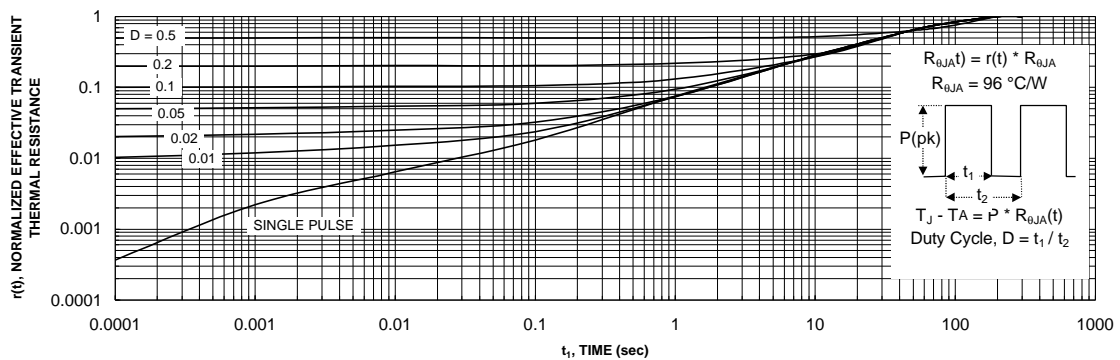
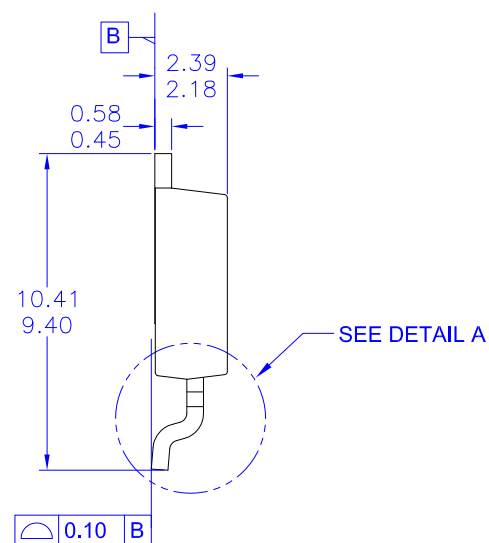
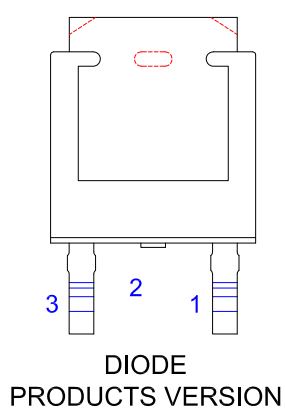
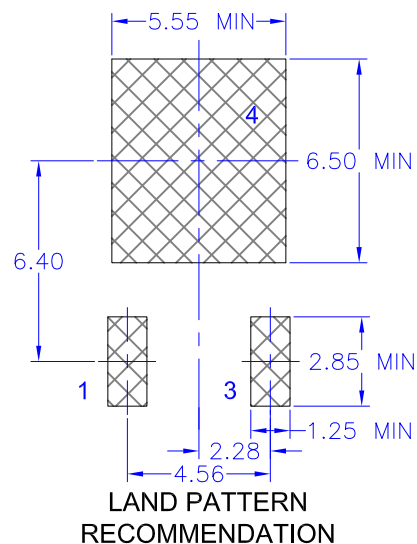
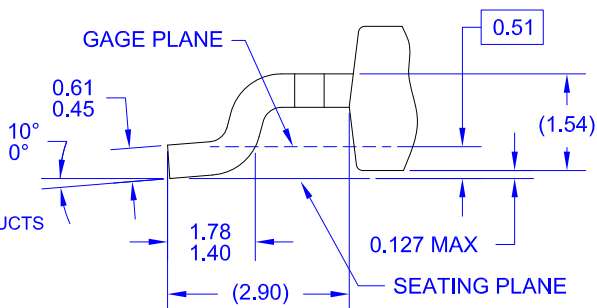


Figure 11. Transient Thermal Response Curve

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.



H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11



DETAIL A
(ROTATED -90°)
SCALE: 12X



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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А