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ON Semiconductor®

February 2017

FDS4675_F085 40V P-Channel PowerTrench® MOSFET

General Description

This P-Channel MOSFET is a rugged gate version of On Semiconductor's advanced PowerTrench process. It has been optimized for power management applications requiring a wide range of gate drive voltage ratings (4.5 V – 20 V).

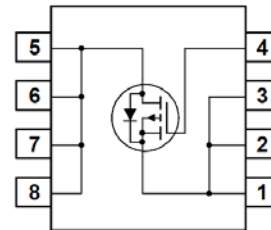
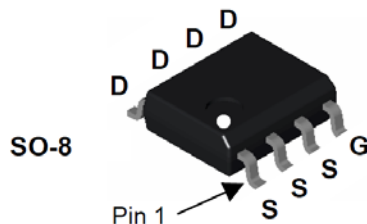
Applications

- Power management
- Load switch
- Battery protection



Features

- -11 A, -40 V $R_{DS(ON)} = 0.013 \Omega @ V_{GS} = -10 V$
 $R_{DS(ON)} = 0.017 \Omega @ V_{GS} = -4.5 V$
- Fast switching speed
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- Qualified to AEC Q101
- RoHS Compliant



Absolute Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

| Symbol | Parameter | Ratings | Units | |
|----------------|--|------------------------------|---------------|---|
| V_{DSS} | Drain-Source Voltage | -40 | V | |
| V_{GSS} | Gate-Source Voltage | ± 20 | V | |
| I_D | Drain Current | Continuous | -11 (Note 1a) | A |
| | | Pulsed | -50 | A |
| P_D | Power Dissipation for Single Operation | 2.4 (steady state) (Note 1a) | | W |
| | | 1.4 (Note 1b) | | W |
| | | 1.2 (Note 1c) | | W |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ C$ | |

Thermal Characteristics

| | | | |
|-----------------|---|--|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 62.5 (steady state), 50 (10 sec) (Note 1a) | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 125 (Note 1c) | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 25 (Note 1) | $^\circ C/W$ |

Package Marking and Ordering Information

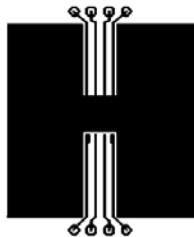
| Device Marking | Device | Reel Size | Tape width | Quantity |
|----------------|--------------|-----------|------------|------------|
| FDS4675 | FDS4675_F085 | 13" | 12mm | 2500 units |

Electrical Characteristics T_A = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|------|------|------|---------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$ | -40 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, Referenced to 25°C | | -34 | | mV/°C |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -32\text{ V}, V_{GS} = 0\text{ V}$ | | | -1 | μA |
| I_{GSSF} | Gate-Body Leakage, Forward | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$ | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage, Reverse | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$ | | | -100 | nA |
| On Characteristics <small>(Note 2)</small> | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$ | -1 | -1.4 | -3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, Referenced to 25°C | | 4.6 | | mV/°C |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = -10\text{ V}, I_D = -11\text{ A}$ | | 10 | 13 | m Ω |
| | | $V_{GS} = -4.5\text{ V}, I_D = -9.5\text{ A}$ | | 13 | 17 | |
| | | $V_{GS} = -10\text{ V}, I_D = -11\text{ A}, T_J = 125^\circ\text{C}$ | | 15 | 21 | |
| g_{FS} | Forward Transconductance | $V_{DS} = -5\text{ V}, I_D = -11\text{ A}$ | | 44 | | S |
| Dynamic Characteristics | | | | | | |
| C_{ISS} | Input Capacitance | $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 4350 | | pF |
| C_{OSS} | Output Capacitance | | | 622 | | pF |
| C_{RSS} | Reverse Transfer Capacitance | | | 290 | | pF |
| Switching Characteristics <small>(Note 2)</small> | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -20\text{ V}, I_D = -1\text{ A}$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$ | | 40 | 64 | ns |
| t_r | Turn-On Rise Time | | | 49 | 79 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 100 | 160 | ns |
| t_f | Turn-Off Fall Time | | | 60 | 96 | ns |
| Q_g | Total Gate Charge | | | 40 | 56 | nC |
| Q_{gs} | Gate-Source Charge | $V_{DS} = -20\text{ V}, I_D = -11\text{ A}, V_{GS} = -4.5\text{ V}$ | | 11 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 13 | | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | | | -2.1 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ A}, I_S = -2.1\text{ A}$ <small>(Note 2)</small> | | -0.7 | -1.2 | V |

Notes:

- $R_{\theta JA}$ 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.



a) 50°C/W when mounted on a 1in² pad of 2 oz copper



b) 105°C/W when mounted on a .04 in² pad of 2 oz copper



c) 125°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

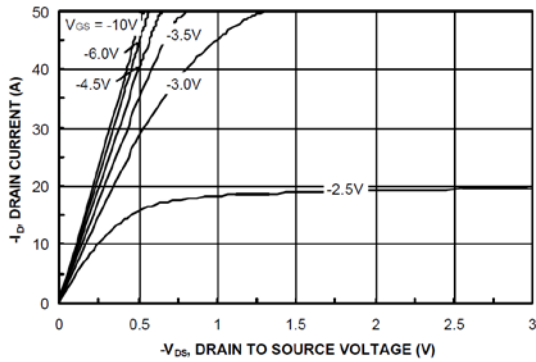


Figure 1. On-Region Characteristics

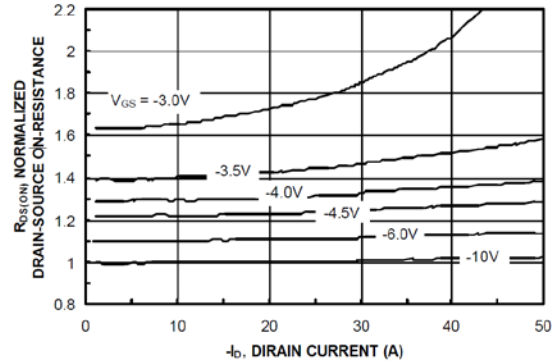


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

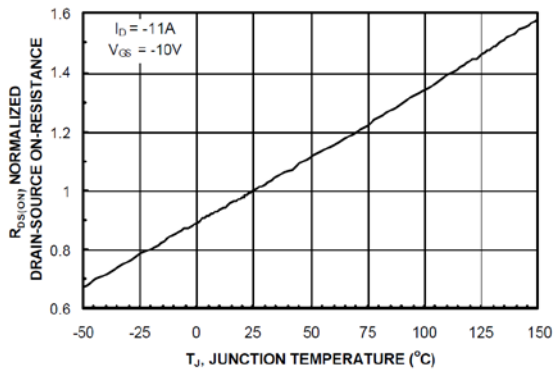


Figure 3. On-Resistance Variation with Temperature

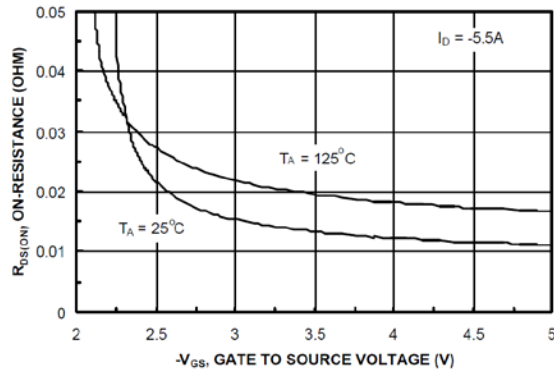


Figure 4. On-Resistance Variation with Gate to Source Voltage

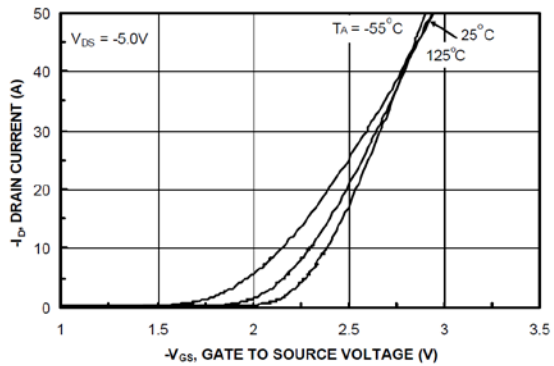


Figure 5. Transfer Characteristics

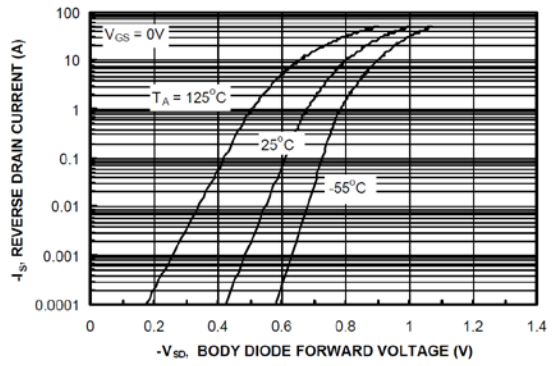


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

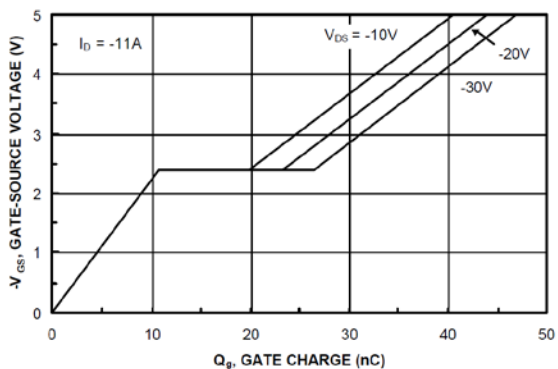


Figure 7. Gate Charge Characteristics

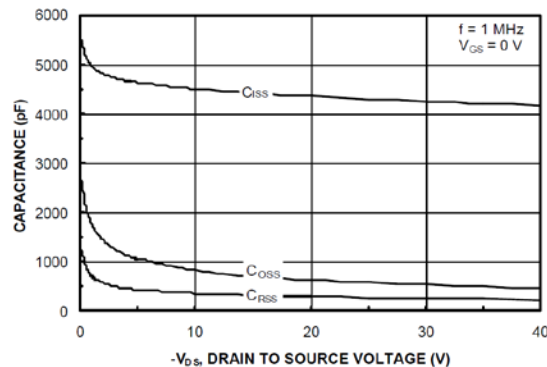


Figure 8. Capacitance Characteristics

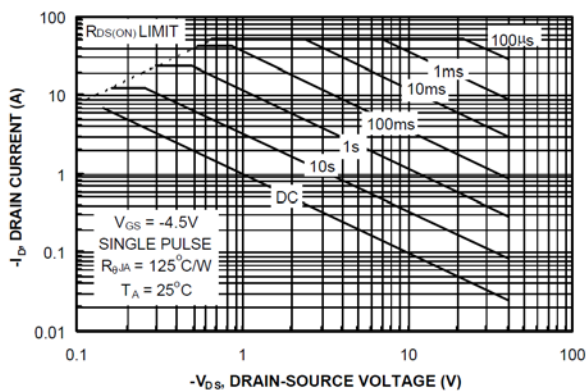


Figure 9. Maximum Safe Operating Area

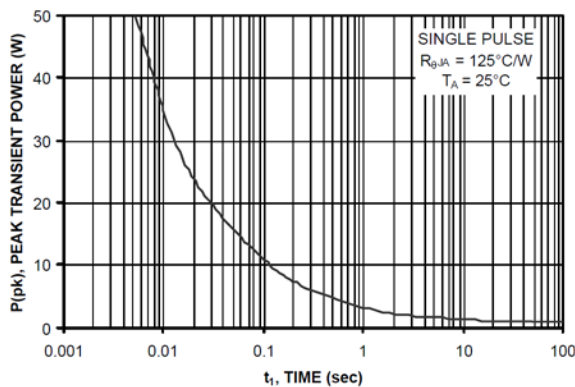


Figure 10. Single Pulse Maximum Power Dissipation

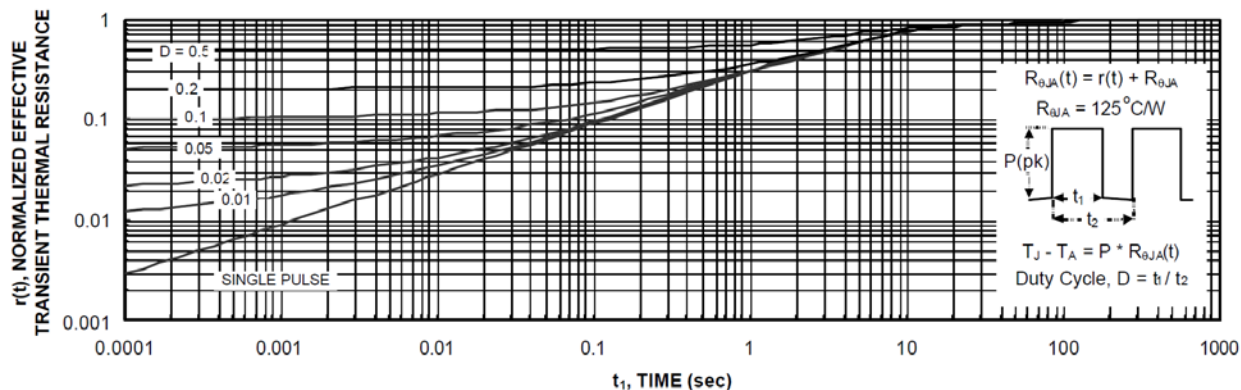


Figure 11. Transient Thermal Response Curve

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



NOTES:

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M
- E) DRAWING FILENAME: M08Arev16



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