ON Semiconductor®

# FDC638P

## P-Channel 2.5V PowerTrench® Specified MOSFET

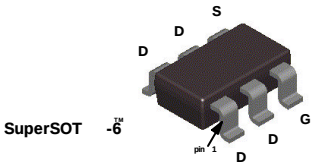
### General Description

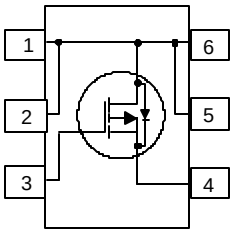
This PChannel 2.5V specified MOSFET is produced using ON Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance

These devices are well suited for battery power applications: load switching and power management, battery charging circuits, and DC/DC conversion.

### Features

- –4.5 A, –20 V. $R_{DS(ON)}$ = 48 mΩ @ $V_{GS}$ = –4.5 V
  $R_{DS(ON)}$ = 65 mΩ @ $V_{GS}$ = –2.5 V
- Low gate charge (10 nC typical)
- High performance trench technology for extremely low $R_{DS(ON)}$
- SuperSOT ™ –6 package: small footprint (72% smaller than standard SO-8; low profile (1mm thick)




## Absolute Maximum Ratings

$T_A$=25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | –20 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±8 | V |
| $I_D$ | Drain Current – Continuous | (Note 1a) | –4.5 | A |
| | – Pulsed | | –20 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 1.6 | W |
| | | (Note 1b) | 0.8 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 78 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | (Note 1) | 30 | °C/W |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| .638 | FDC638P | 7" | 8mm | 3000 units |

©2001 Semiconductor Components Industries, LLC.
October-2017, Rev. 6

Publication Order Number:
FDC638P /D

## 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 V, $I_D$ = –250 µA | –20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = –250 µA,Referenced to 25°C | | –14 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = –16 V, $V_{GS}$ = 0 V | | | –1 | µA |
| $I_{GSSF}$ | Gate–Body Leakage, Forward | $V_{GS}$ = 8 V, $V_{DS}$ = 0 V | | | 100 | nA |
| $I_{GSSR}$ | Gate–Body Leakage, Reverse | $V_{GS}$ = –8 V, $V_{DS}$ = 0 V | | | –100 | nA |
| **On Characteristics** (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = –250 µA | –0.4 | –0.8 | –1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = –250 µA,Referenced to 25°C | | 3 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = –4.5 V, $I_D$ = –4.5 A<br>$V_{GS}$ = –2.5 V, $I_D$ = –3.8 A<br>$V_{GS}$ = –4.5 V, $I_D$ = –4.5 $T_J$=125°C | | 39<br>52<br>54 | 48<br>65<br>72 | mΩ |
| $I_{D(on)}$ | On–State Drain Current | $V_{GS}$ = –4.5 V, $V_{DS}$ = –5 V | –20 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = –10 V, $I_D$ = –4.5 A | | 15 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = –10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 1160 | | pF |
| $C_{oss}$ | Output Capacitance | | | 195 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 105 | | pF |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = –5 V, $I_D$ = –1 A, $V_{GS}$ = –4.5 V, $R_{GEN}$ = 6 Ω | | 12 | 22 | ns |
| $t_r$ | Turn–On Rise Time | | | 9 | 18 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | | 33 | 53 | ns |
| $t_f$ | Turn–Off Fall Time | | | 12 | 22 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = –10 V, $I_D$ = –4.5 A, $V_{GS}$ = –4.5 V | | 10 | 14 | nC |
| $Q_{gs}$ | Gate–Source Charge | | | 2.2 | | nC |
| $Q_{gd}$ | Gate–Drain Charge | | | 1.5 | | nC |
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain–Source Diode Forward Current | | | | –1.3 | A |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = –1.3 A (Note 2) | | –0.73 | –1.2 | V |

**Notes:**

**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.



a) 78°C/W when mounted on a 1in² pad of 2 oz copper



b) 156°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

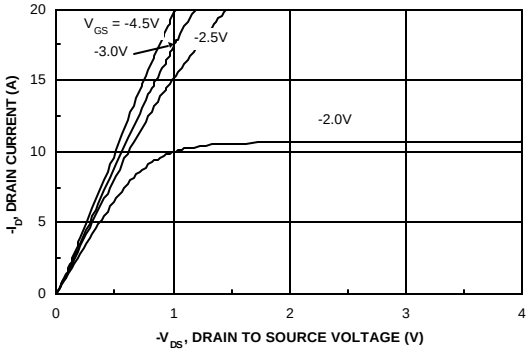



**Figure 1. On-Region Characteristics.**

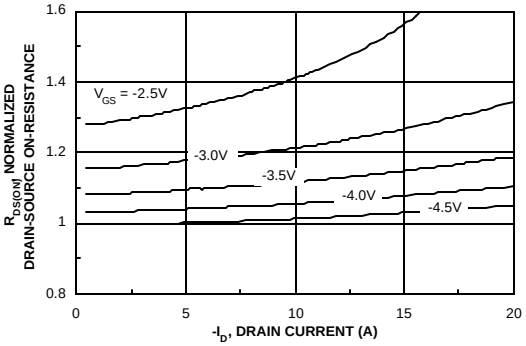



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

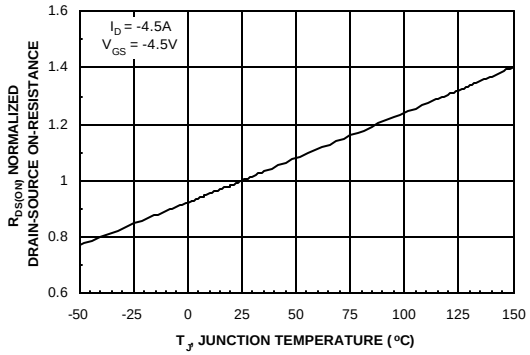



**Figure 3. On-Resistance Variation with Temperature.**

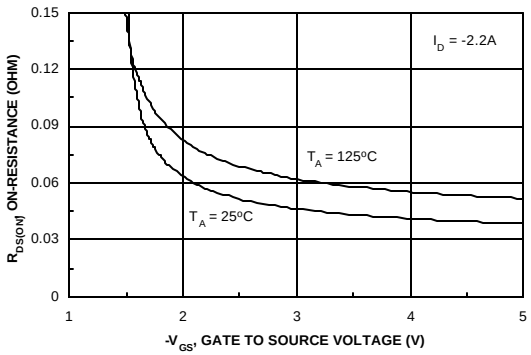



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

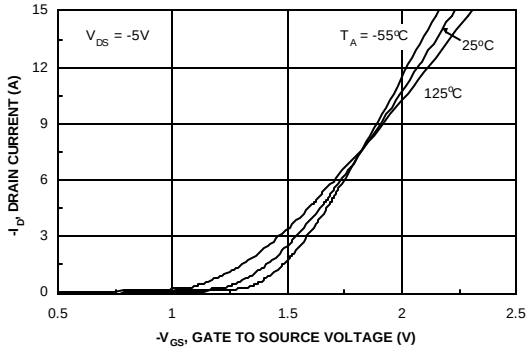



**Figure 5. Transfer Characteristics.**

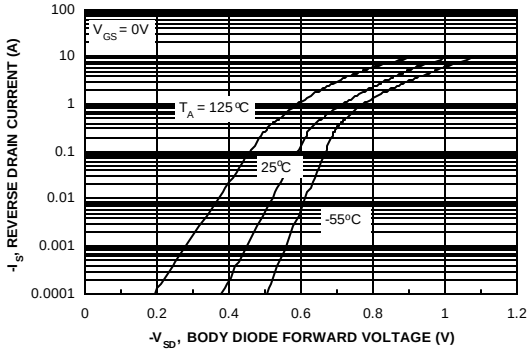



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics

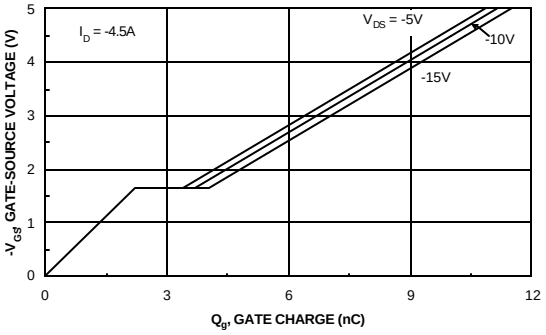



**Figure 7. Gate Charge Characteristics.**

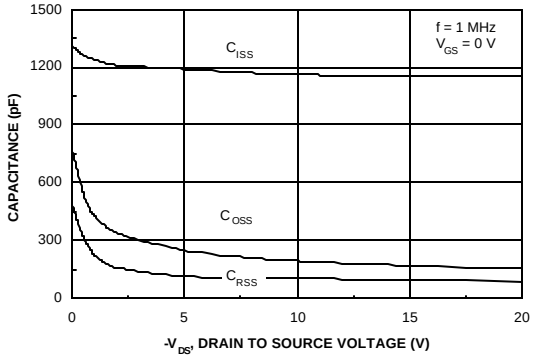



**Figure 8. Capacitance Characteristics.**

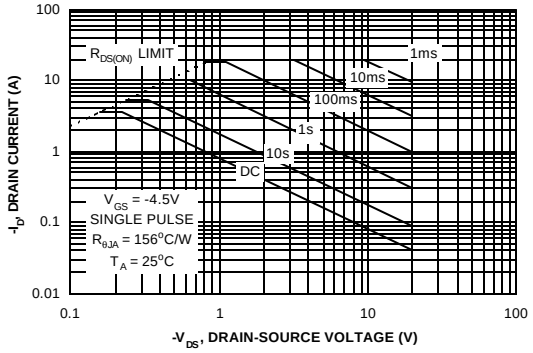



**Figure 9. Maximum Safe Operating Area.**

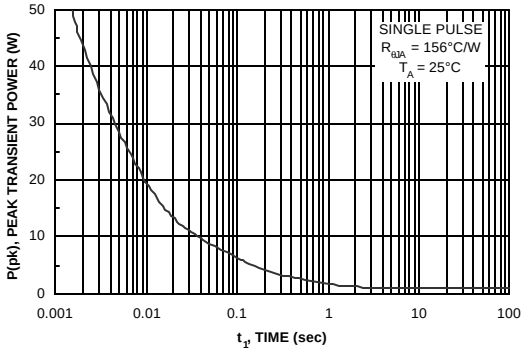



**Figure 10. Single Pulse Maximum Power Dissipation.**

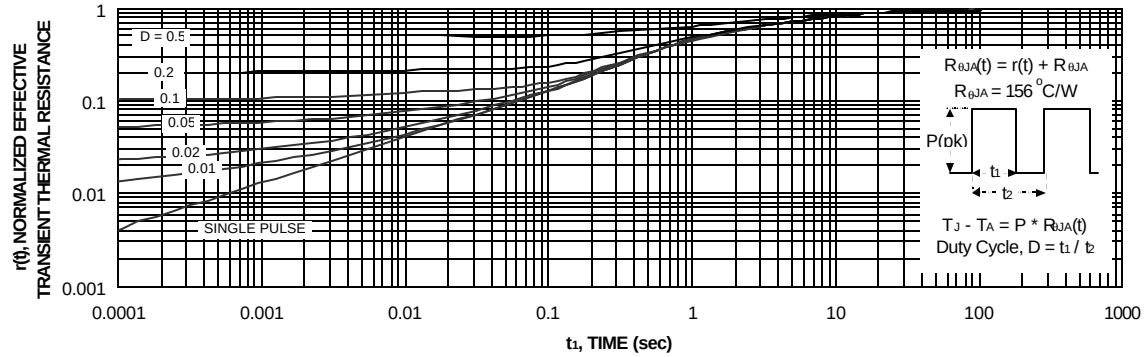



**Figure 11. Transient Thermal Response Curve.**

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

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
**Phone**: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
**Fax**: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

**N. American Technical Support**: 800−282−9855 Toll Free USA/Canada
**Europe, Middle East and Africa Technical Support:**
Phone: 421 33 790 2910
**Japan Customer Focus Center**
Phone: 81−3−5817−1050

**ON Semiconductor Website**: **www.onsemi.com**

**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

ON Semiconductor:

FDC638P