

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

---

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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 **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** 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 **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



ON Semiconductor®

# FDS4675-F085

## 40V P-Channel PowerTrench® MOSFET

### General Description

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

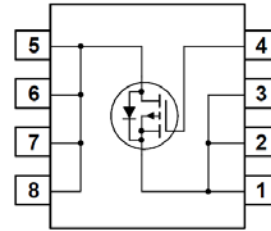
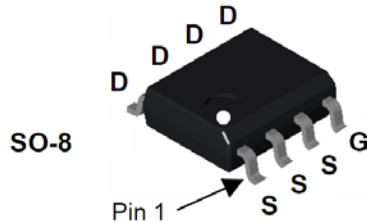
### Applications

- Power management
- Load switch
- Battery protection



### Features

- -11 A, -40 V  $R_{DS(ON)} = 0.013 \Omega @ V_{GS} = -10 \text{ V}$   
 $R_{DS(ON)} = 0.017 \Omega @ V_{GS} = -4.5 \text{ V}$
- 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 $T_A = 25^\circ\text{C}$ unless otherwise noted

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

### Thermal Characteristics

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

### Package Marking and Ordering Information

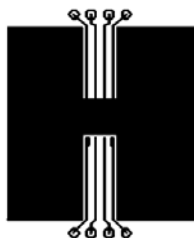
Device Marking	Device	Reel Size	Tape width	Quantity
FDS4675	FDS4675-F085	13"	12mm	2500 units

## Electrical Characteristics T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	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	$\mu\text{A}$
$I_{GSSF}$	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
<b>On Characteristics</b> <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 $\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -9.5\text{ A}$		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
<b>Dynamic Characteristics</b>						
$C_{ISS}$	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
<b>Switching Characteristics</b> <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
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	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 1in<sup>2</sup> pad of 2 oz copper



b) 105°C/W when mounted on a .04 in<sup>2</sup> 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  $\mu\text{s}$ , Duty Cycle < 2.0%

## Typical Characteristics

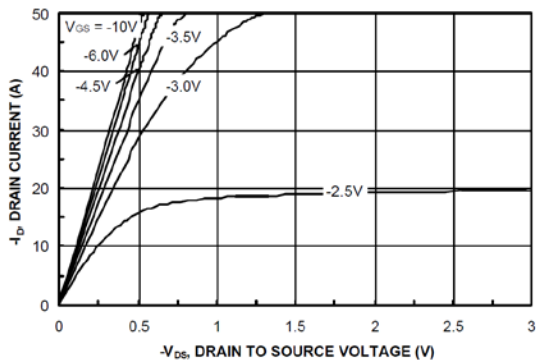


Figure 1. On-Region Characteristics

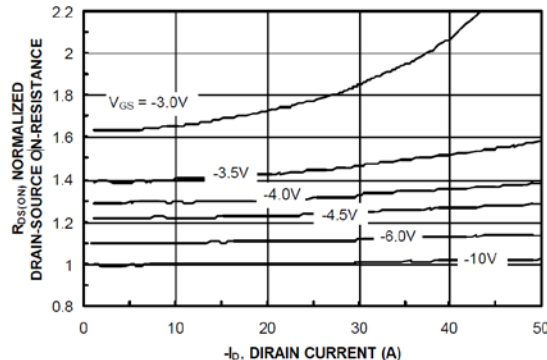


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

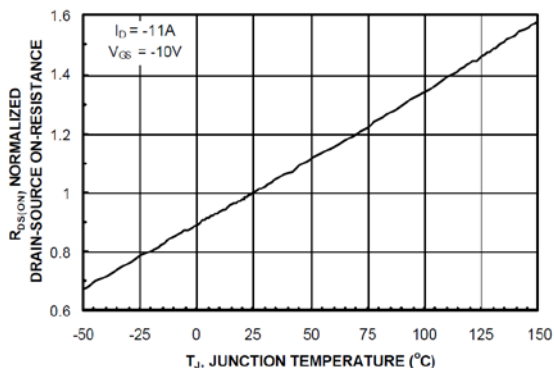


Figure 3. On-Resistance Variation with Temperature

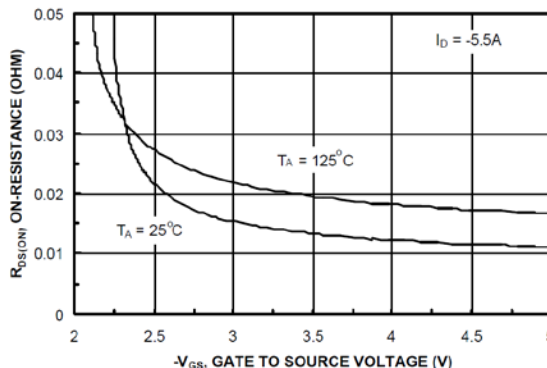


Figure 4. On-Resistance Variation with Gate to Source Voltage

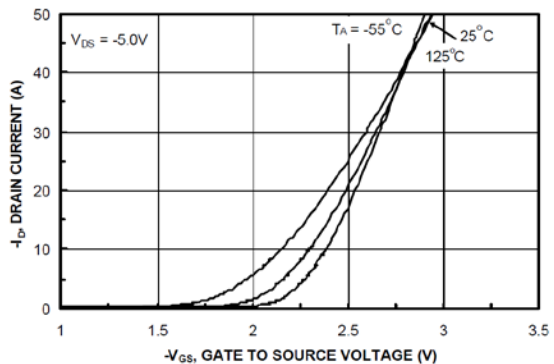


Figure 5. Transfer Characteristics

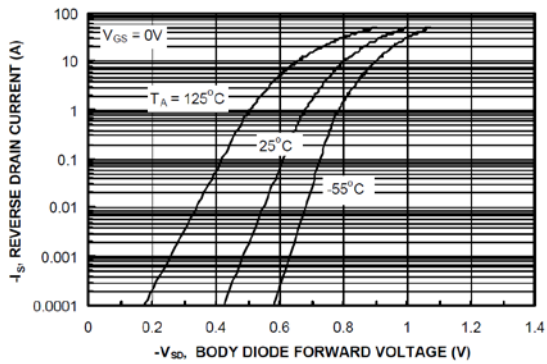


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

## Typical Characteristics

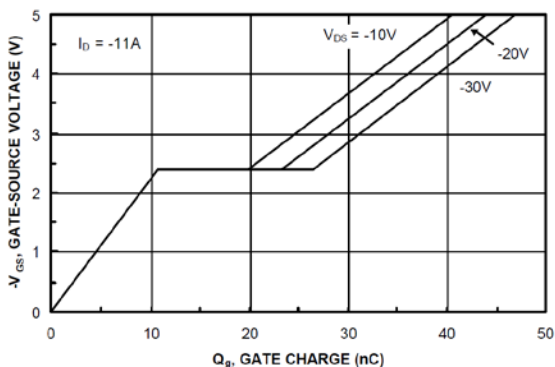


Figure 7. Gate Charge Characteristics

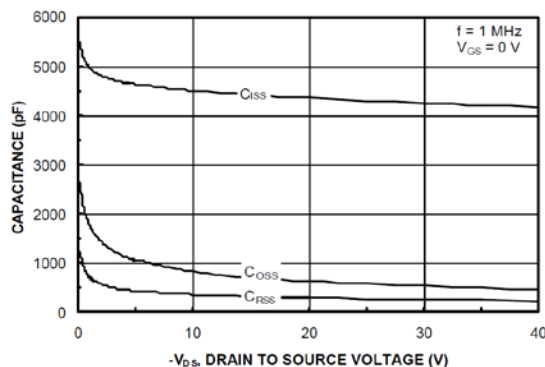


Figure 8. Capacitance Characteristics

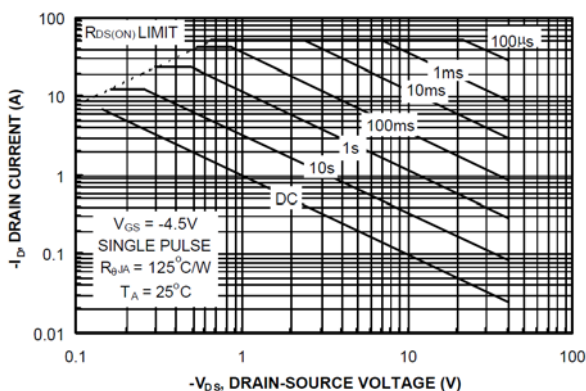


Figure 9. Maximum Safe Operating Area

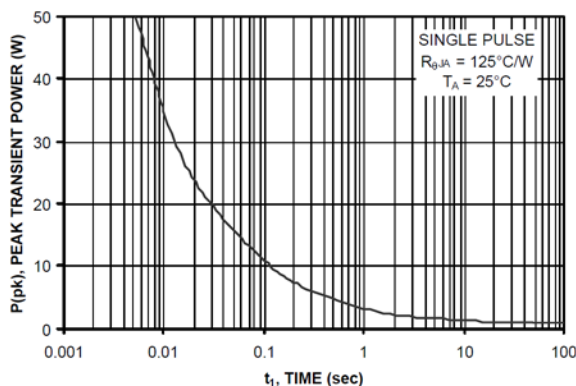


Figure 10. Single Pulse Maximum Power Dissipation

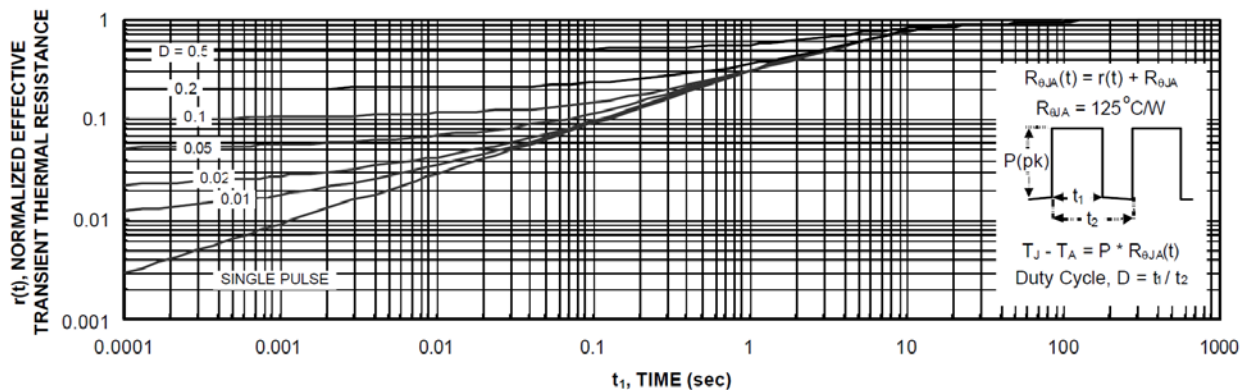


Figure 11. Transient Thermal Response Curve

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



ON Semiconductor and the ON Semiconductor logo 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](http://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](mailto: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](http://www.onsemi.com)

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative