

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
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. **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®

FDD4141-F085

P-Channel PowerTrench® MOSFET -40V, -50A, 12.3mΩ

Features

- Max $r_{DS(on)}$ = 12.3mΩ at $V_{GS} = -10V$, $I_D = -12.7A$
- Max $r_{DS(on)}$ = 18.0mΩ at $V_{GS} = -4.5V$, $I_D = -10.4A$
- High performance trench technology for extremely low $r_{DS(on)}$
- Qualified to AEC Q101
- RoHS Compliant

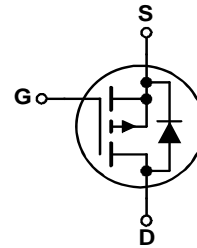
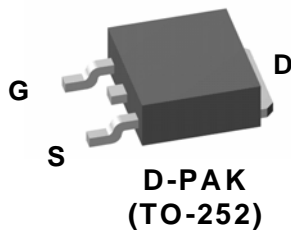


General Description

This P-Channel MOSFET has been produced using ON Semiconductor's proprietary PowerTrench® technology to deliver low $r_{DS(on)}$ and optimized Bvdss capability to offer superior performance benefit in the applications. and optimized switching performance capability reducing power dissipation losses in converter/inverter applications.

Applications

- Inverter
- Power Supplies



MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Conditions	Ratings	Units
V_{DS}	Drain to Source Voltage		-40	V
V_{GS}	Gate to Source Voltage		± 20	V
I_D	Drain Current -Continuous (Package limited)	$T_C = 25^\circ C$	-50	A
	-Continuous (Silicon limited)	$T_C = 25^\circ C$	-58	
	-Continuous	$T_A = 25^\circ C$ (Note 1a)	-10.8	
	-Pulsed		-100	
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	337	mJ
P_D	Power Dissipation	$T_C = 25^\circ C$	69	W
	Power Dissipation	$T_A = 25^\circ C$ (Note 1a)	2.4	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to +175	$^\circ C$

Thermal Characteristics

$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case		1.8	$^\circ C/W$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(Note 1a)	52	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD4141	FDD4141-F085	D-PAK (TO-252)	13"	16mm	2500 units

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

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

Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-40	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°C	-	-29	-	mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -32\text{V}, V_{GS} = 0\text{V}$	-	-	-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°C	-	5.8	-	mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{V}, I_D = -12.7\text{A}$	-	10.1	12.3	m Ω
		$V_{GS} = -4.5\text{V}, I_D = -10.4\text{A}$	-	14.5	18.0	
		$V_{GS} = -10\text{V}, I_D = -12.7\text{A}, T_J = 175^\circ\text{C}$	-	17.3	19.4	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -12.7\text{A}$	-	38	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -20\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	2085	2775	pF
C_{oss}	Output Capacitance		-	360	480	pF
C_{rss}	Reverse Transfer Capacitance		-	210	310	pF
R_g	Gate Resistance	$f = 1\text{MHz}$	-	4.6	-	Ω

Switching Characteristics

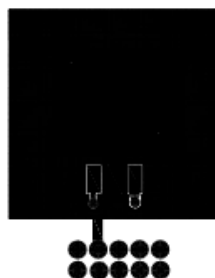
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -20\text{V}, I_D = -12.7\text{A}, V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$	-	10	19	ns
t_r	Rise Time		-	7	13	ns
$t_{d(off)}$	Turn-Off Delay Time		-	38	60	ns
t_f	Fall Time		-	15	27	ns
Q_g	Total Gate Charge		$V_{GS} = 0\text{V to } -10\text{V}$	-	36	50
Q_g	Total Gate Charge	$V_{GS} = 0\text{V to } -5\text{V}$	-	19	27	nC
Q_{gs}	Gate to Source Charge	$V_{DD} = -20\text{V}, I_D = -12.7\text{A}$	-	7	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	8	-	nC

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -12.7\text{A}$ (Note 2)	-	-0.8	-1.2	V
t_{rr}	Reverse Recovery Time	$I_F = -12.7\text{A}, di/dt = 100\text{A}/\mu\text{s}$	-	29	44	ns
Q_{rr}	Reverse Recovery Charge		-	26	40	nC

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 $R_{\theta JA}$ is determined by the user's board design.



a) $52^\circ\text{C}/\text{W}$ when mounted on a 1 in^2 pad of 2 oz copper



b) $100^\circ\text{C}/\text{W}$ when mounted on a minimum pad.

2: Pulse Test: Pulse Width $< 300\mu\text{s}$, Duty cycle $< 2.0\%$.

3: Starting $T_J = 25^\circ\text{C}$, $L = 3\text{mH}$, $I_{AS} = 15\text{A}$, $V_{DD} = 40\text{V}$, $V_{GS} = 10\text{V}$.

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

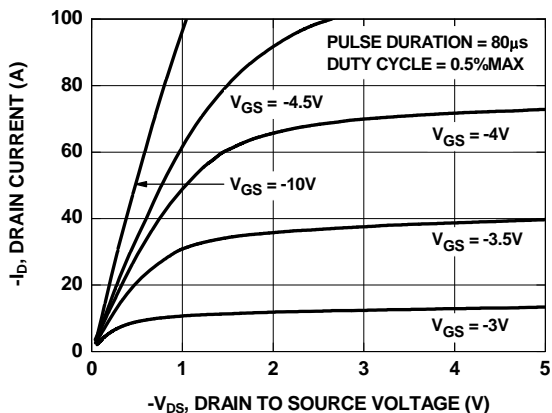


Figure 1. On-Region Characteristics

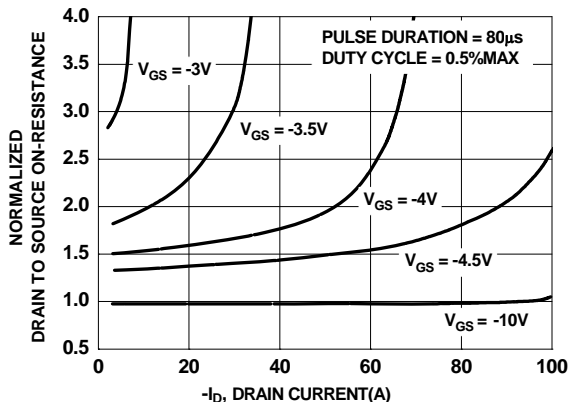


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

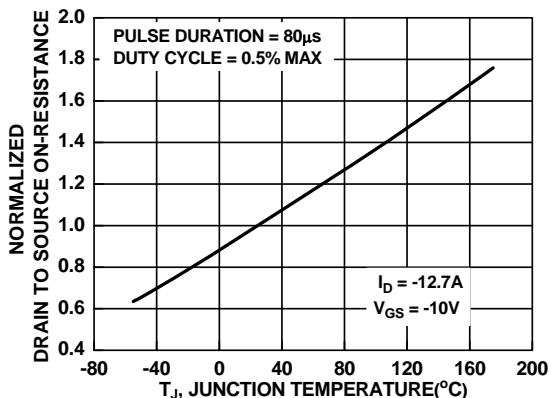


Figure 3. Normalized On-Resistance vs Junction Temperature

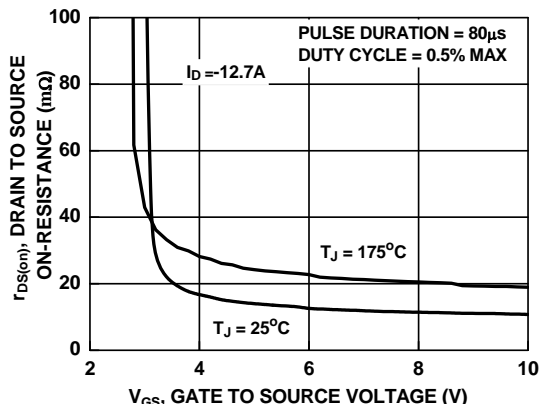


Figure 4. On-Resistance vs Gate to Source Voltage

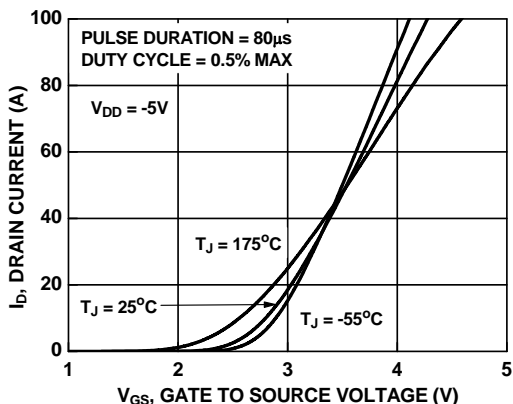


Figure 5. Transfer Characteristics

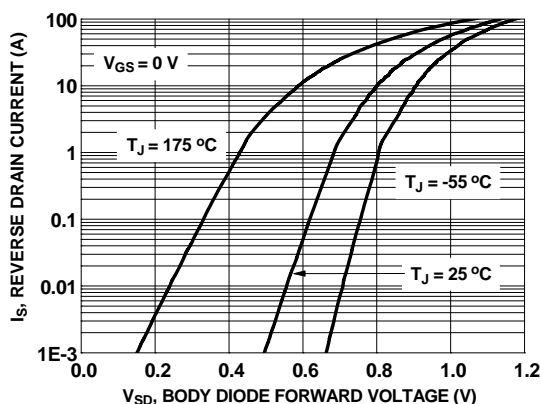


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

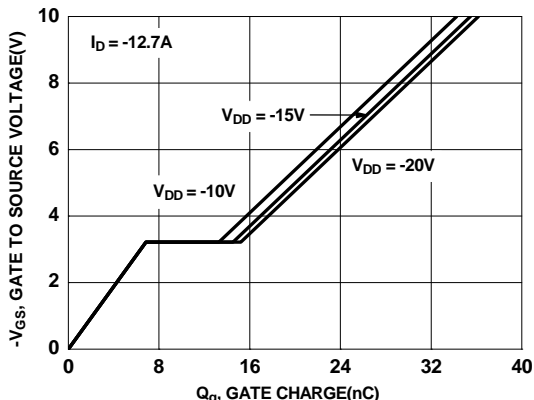


Figure 7. Gate Charge Characteristics

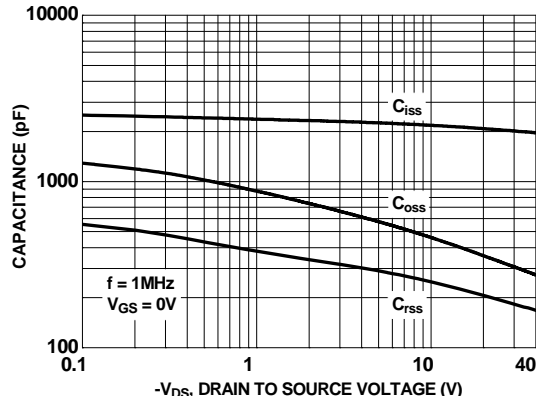


Figure 8. Capacitance vs Drain to Source Voltage

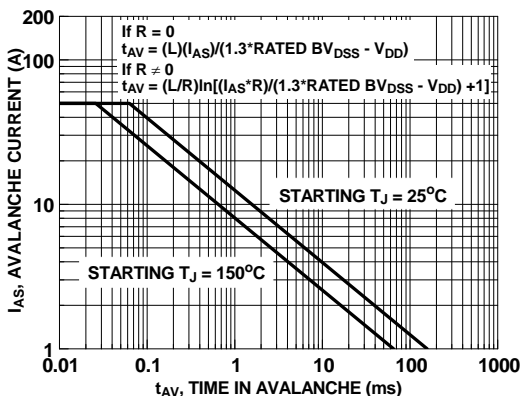


Figure 9. Unclamped Inductive Switching Capability

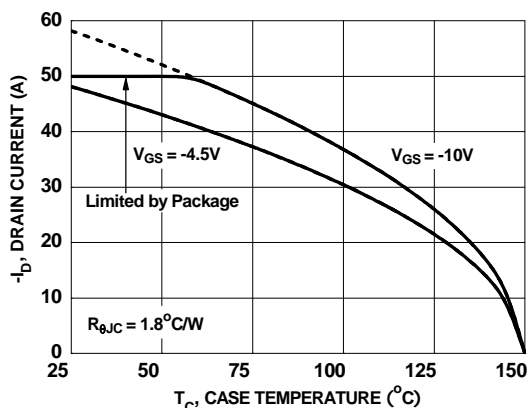


Figure 10. Maximum Continuous Drain Current vs Case Temperature

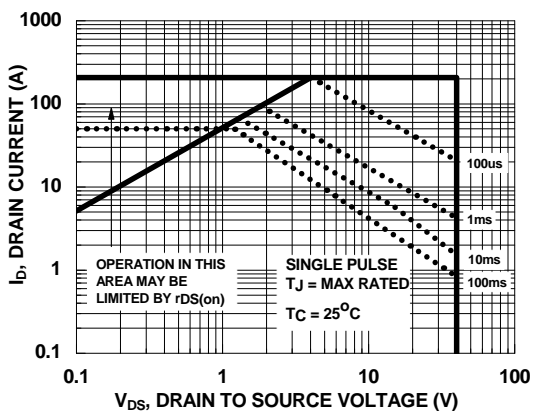


Figure 11. Forward Bias Safe Operating Area

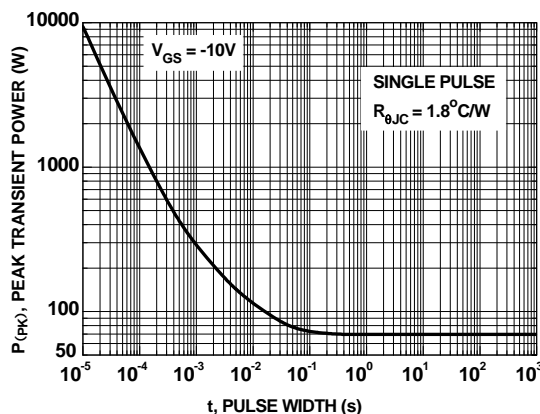


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

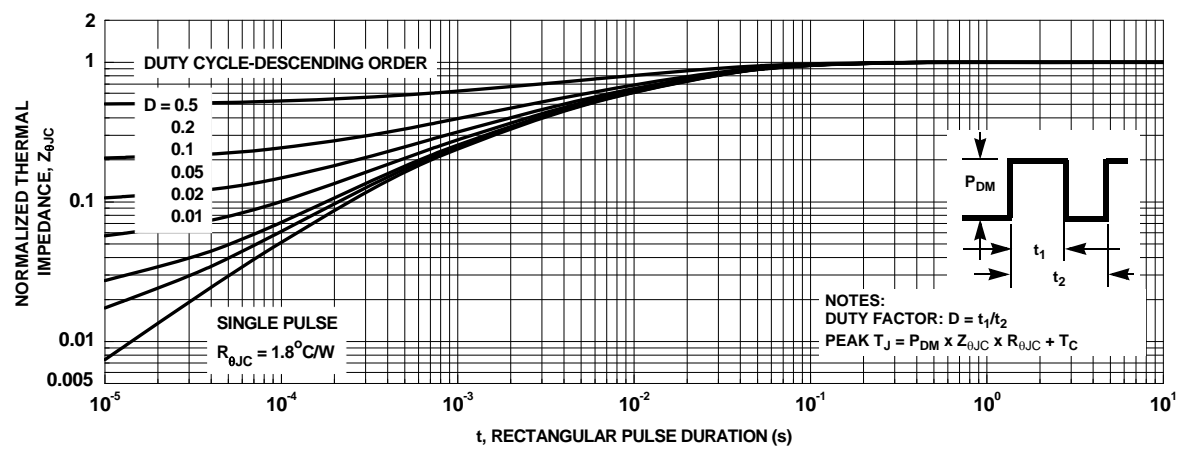


Figure 13. Transient Thermal Response Curve

ON Semiconductor and  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

ON Semiconductor Website: www.onsemi.com

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

For additional information, please contact your local
Sales Representative