ON Semiconductor

Is Now

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®

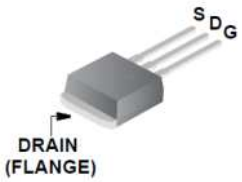
FDI9406-F085

N-Channel PowerTrench® MOSFET

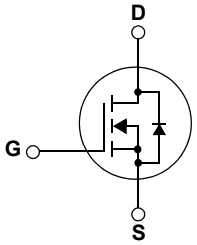
40 V, 110 A, 2.2 mΩ

Features

- Typ $R_{DS(on)}$ = 1.73mΩ at V_{GS} = 10V, I_D = 80A
- Typ $Q_{g(tot)}$ = 107nC at V_{GS} = 10V, I_D = 80A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101



TO-262AB



FDI SERIES

Applications

- Automotive Engine Control
- Powertrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter/Alternator
- Distributed Power Architectures and VRM
- Primary Switch for 12V Systems

MOSFET Maximum Ratings T_J = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-to-Source Voltage		40	V
V_{GS}	Gate-to-Source Voltage		±20	V
I_D	Drain Current - Continuous (V_{GS}=10) (Note 1)	T_C = 25°C	110	A
	Pulsed Drain Current	T_C = 25°C	See Figure 4	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	174	mJ
P_D	Power Dissipation		176	W
	Derate above 25°C		1.18	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 175	°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case		0.85	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	(Note 3)	43	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDI9406	FDI9406-F085	TO-262AB	Tube	N/A	50 units

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 0.045mH, I_{AS} = 88A, V_{DD} = 40V during inductor charging and V_{DD} = 0V during time in avalanche.
3: $R_{\theta JA}$ 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. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

2013 ON Semiconductor Components Industries, LLC

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
Off Characteristics							
B_{VDSS}	Drain-to-Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V		40	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=40V,	T_J = 25°C	-	-	1	μA
		V_{GS} = 0V	T_J = 175°C(Note 4)	-	-	1	mA
I_{GSS}	Gate-to-Source Leakage Current	V_{GS} = ±20V		-	-	±100	nA
On Characteristics							
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA		2.0	2.83	4.0	V
$R_{DS(on)}$	Drain-to-Source On Resistance	I_D = 80A, V_{GS}= 10V	T_J = 25°C	-	1.73	2.2	mΩ
			T_J = 175°C(Note 4)	-	2.86	3.2	mΩ
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	7710	-	pF
C_{oss}	Output Capacitance			-	2015	-	pF
C_{rss}	Reverse Transfer Capacitance			-	140	-	pF
R_g	Gate Resistance	f = 1MHz		-	2.7	-	Ω
$Q_{g(ToT)}$	Total Gate Charge at 10V	V_{GS} = 0 to 10V	V_{DD} = 32V, I_D = 80A	-	107	138	nC
$Q_{g(th)}$	Threshold Gate Charge	V_{GS} = 0 to 2V		-	14	19	nC
Q_{gs}	Gate-to-Source Gate Charge			-	33	-	nC
Q_{gd}	Gate-to-Drain “Miller“ Charge			-	18	-	nC

Switching Characteristics

t_{on}	Turn-On Time	V_{DD} = 20V, I_D = 80A, V_{GS} = 10V, R_{GEN} = 6Ω	-	-	160	ns
$t_{d(on)}$	Turn-On Delay		-	32	-	ns
t_r	Rise Time		-	81	-	ns
$t_{d(off)}$	Turn-Off Delay		-	50	-	ns
t_f	Fall Time		-	23	-	ns
t_{off}	Turn-Off Time		-	-	93	ns

Drain-Source Diode Characteristics

V_{SD}	Source-to-Drain Diode Voltage	I_{SD} = 80A, V_{GS} = 0V	-	-	1.25	V
t_{rr}	Reverse-Recovery Time	I_F = 80A, dI_{SD}/dt = 100A/μs, V_{DD}=32V	-	85	110	ns
Q_{rr}	Reverse-Recovery Charge		-	122	160	nC

Note:

4: The maximum value is specified by design at T_J = 175°C. Product is not tested to this condition in production.

Typical Characteristics

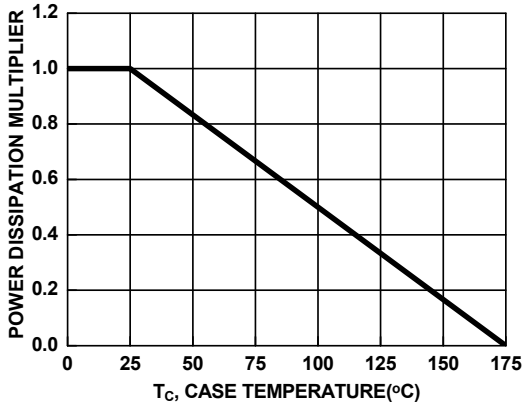


Figure 1. Normalized Power Dissipation vs. Case Temperature

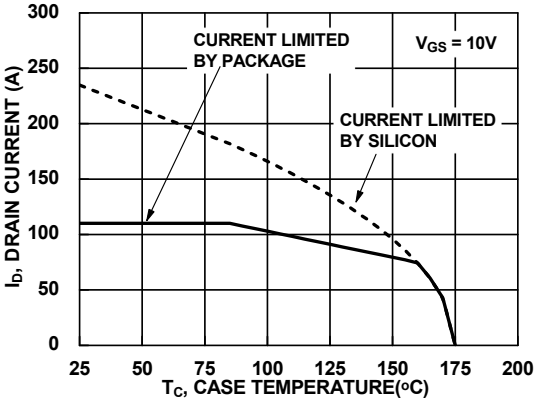


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

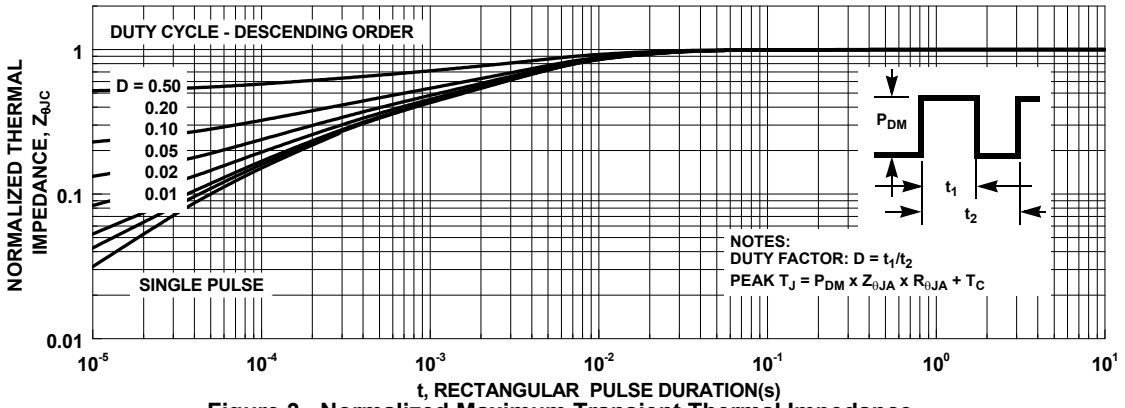


Figure 3. Normalized Maximum Transient Thermal Impedance

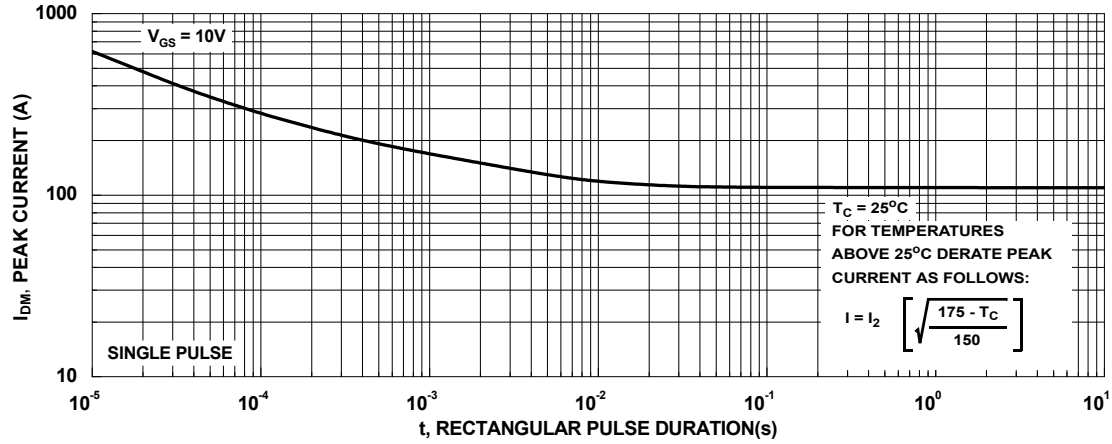


Figure 4. Peak Current Capability

Typical Characteristics

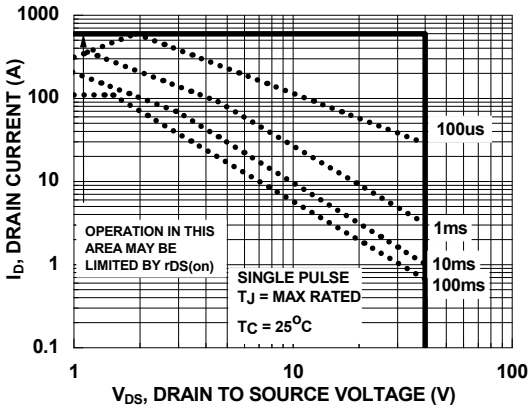
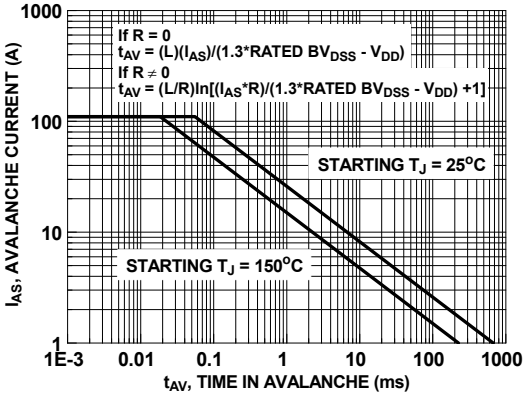


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

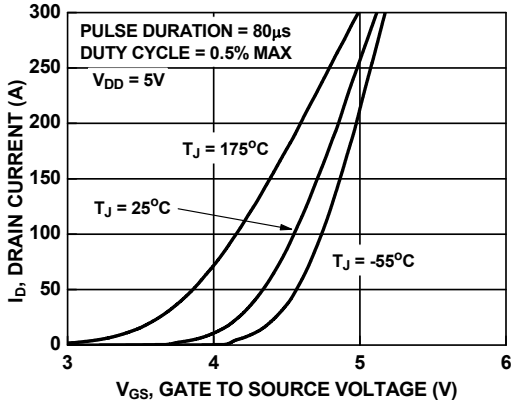


Figure 7. Transfer Characteristics

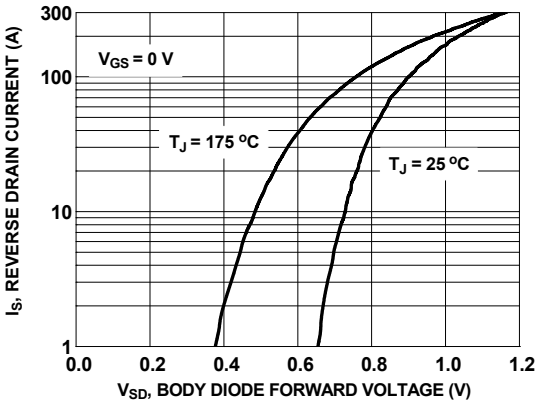


Figure 8. Forward Diode Characteristics

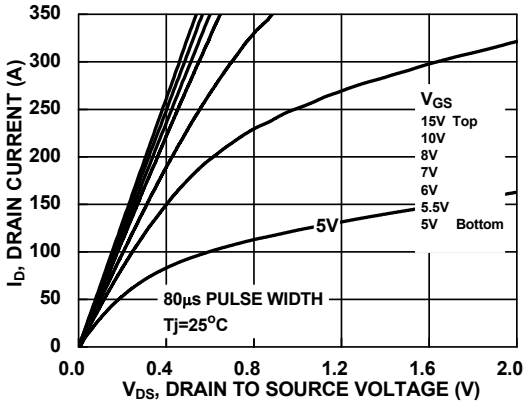


Figure 9. Saturation Characteristics

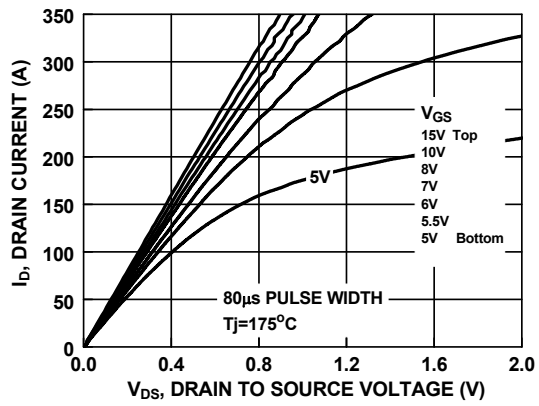


Figure 10. Saturation Characteristics

Typical Characteristics

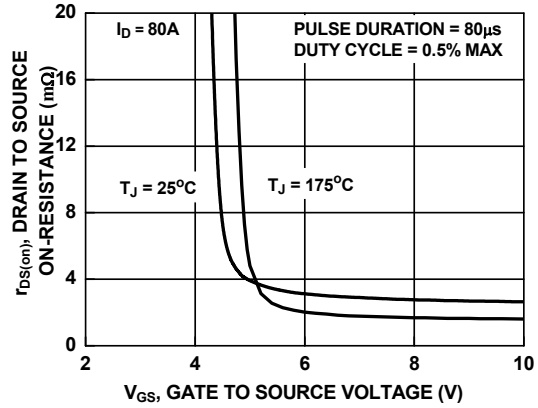


Figure 11. R_{DSON} vs. Gate Voltage

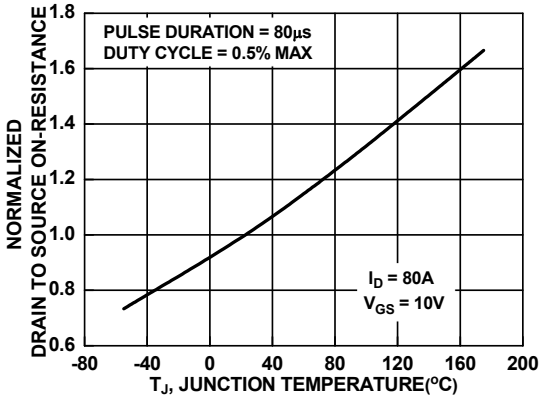


Figure 12. Normalized R_{DSON} vs. Junction Temperature

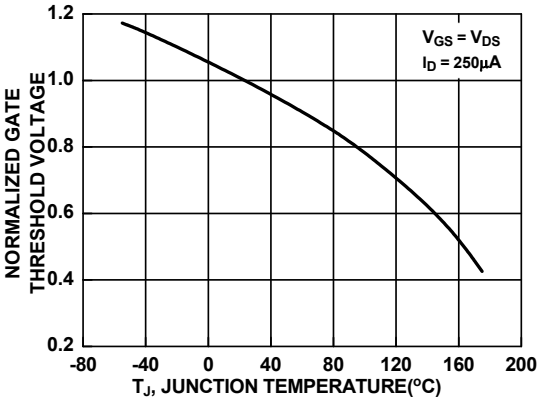


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

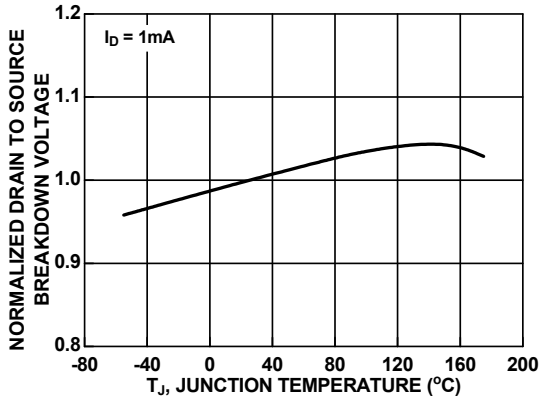


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

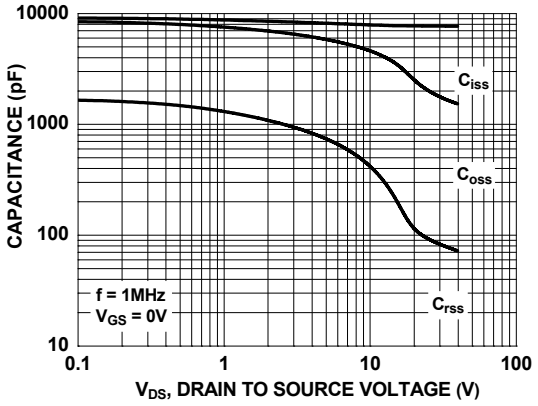


Figure 15. Capacitance vs. Drain to Source Voltage

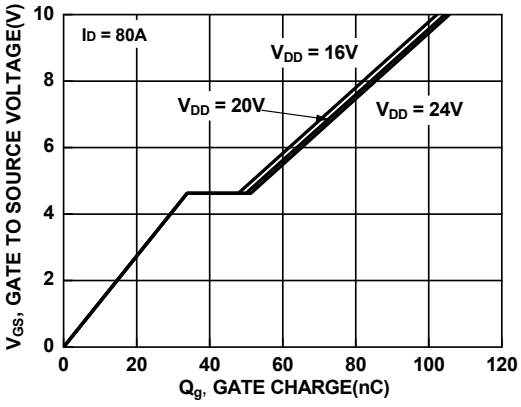


Figure 16. Gate Charge vs. Gate to Source Voltage

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