

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®

FDD3690

100V N-Channel PowerTrench® MOSFET

General Description

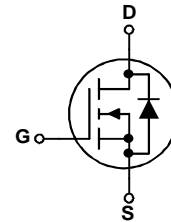
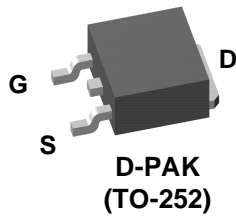
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications.

The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

Features

- 22 A, 100 V. $R_{DS(ON)} = 64 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 71 \text{ m}\Omega @ V_{GS} = 6 \text{ V}$
- Low gate charge (28nC typical)
- Fast Switching
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability



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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	100	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Continuous Drain Current @ $T_C=25^\circ\text{C}$ (Note 3)	22	A
	Pulsed (Note 1a)	75	
P_D	Power Dissipation @ $T_C=25^\circ\text{C}$ (Note 3)	60	W
	@ $T_A=25^\circ\text{C}$ (Note 1a)	3.8	
	@ $T_A=25^\circ\text{C}$ (Note 1b)	1.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	2.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	96	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD3690	FDD3690	13"	16mm	2500 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W _{DSS}	Single Pulse Drain-Source Avalanche Energy	V _{DD} = 50 V, I _D = 5.4 A			175	mJ
I _{AR}	Maximum Drain-Source Avalanche Current				5.4	A

Off Characteristics

BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		78		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 80 V, V _{GS} = 0 V			10	μA
I _{GSSF}	Gate-Body Leakage, Forward	V _{GS} = 20 V, V _{DS} = 0 V			100	nA
I _{GSSR}	Gate-Body Leakage, Reverse	V _{GS} = -20 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	2	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		-6.2		mV/°C
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 5.4 A V _{GS} = 6 V, I _D = 5.2 A V _{GS} = 10 V, I _D = 5.4 A, T _J = 125°C		44 47 88	64 71 135	mΩ
I _{D(on)}	On-State Drain Current	V _{GS} = 10 V, V _{DS} = 5 V	20			A
g _{FS}	Forward Transconductance	V _{DS} = 5 V, I _D = 5.4 A		20		S

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 50 V, V _{GS} = 0 V, f = 1.0 MHz		1514		pF
C _{oss}	Output Capacitance			82		pF
C _{riss}	Reverse Transfer Capacitance			44		pF

Switching Characteristics (Note 2)

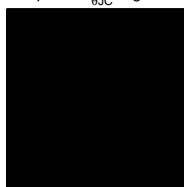
t _{d(on)}	Turn-On Delay Time	V _{DD} = 50 V, I _D = 1 A, V _{GS} = 10 V, R _{GEN} = 6 Ω		11	20	ns
t _r	Turn-On Rise Time			6.5	15	ns
t _{d(off)}	Turn-Off Delay Time			29	60	ns
t _f	Turn-Off Fall Time			10	20	ns
Q _g	Total Gate Charge	V _{DS} = 50 V, I _D = 5.4 A, V _{GS} = 10 V		28	39	nC
Q _{gs}	Gate-Source Charge			6.2		nC
Q _{gd}	Gate-Drain Charge			5.4		nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current			3.2		A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3.2 A (Note 2)		0.73	1.2	V

Notes:

1. R_{θJA} 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_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design.



a) R_{θJA} = 40°C/W when mounted on a 1in² pad of 2 oz copper



b) R_{θJA} = 96°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

3. Maximum current is calculated as:
- $$\sqrt{\frac{P_D}{R_{DS(on)}}}$$

where P_D is maximum power dissipation at T_C = 25°C and R_{DS(on)} is at T_{J(max)} and V_{GS} = 10V. Package current limitation is 21A

Typical Characteristics

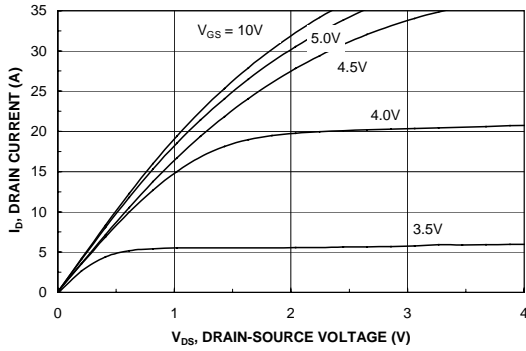


Figure 1. On-Region Characteristics.

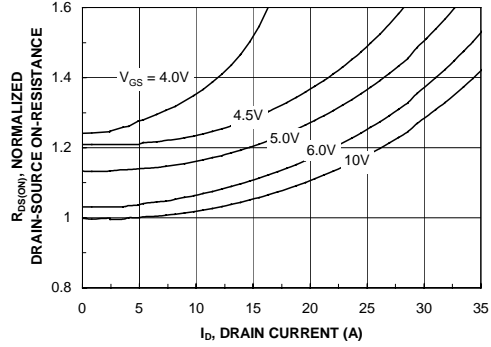


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

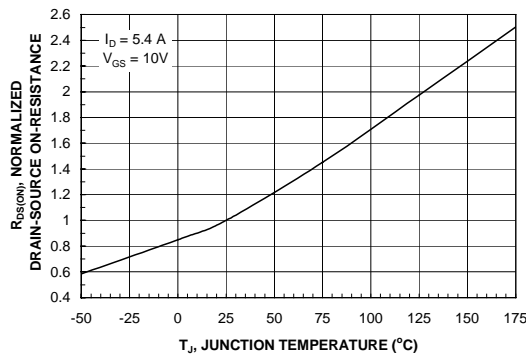


Figure 3. On-Resistance Variation with Temperature.

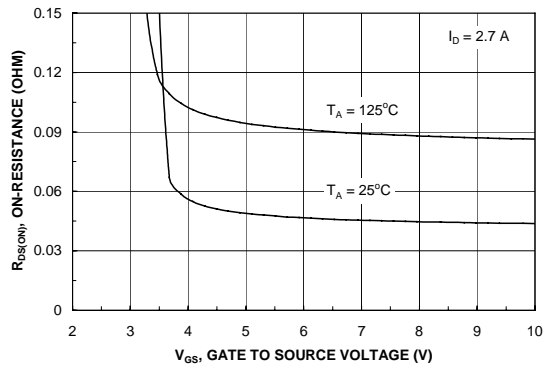


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

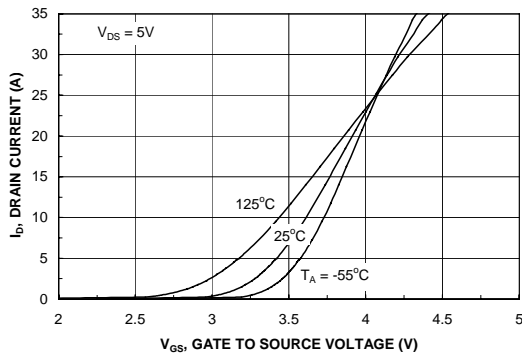


Figure 5. Transfer Characteristics.

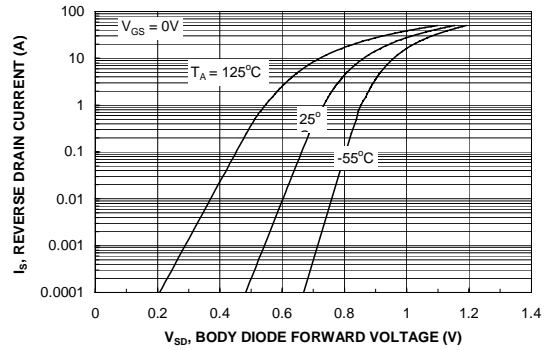


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

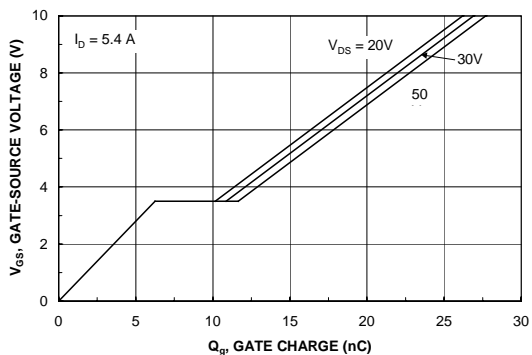


Figure 7. Gate Charge Characteristics.

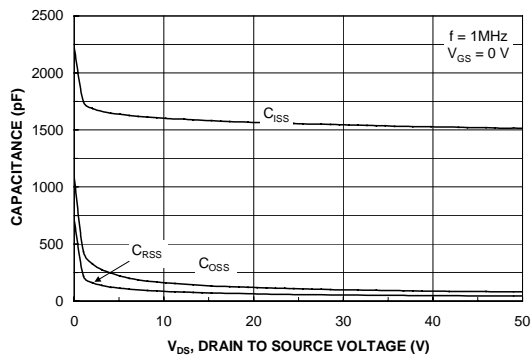


Figure 8. Capacitance Characteristics.

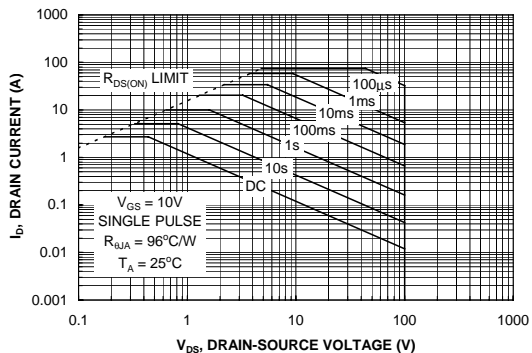


Figure 9. Maximum Safe Operating Area.

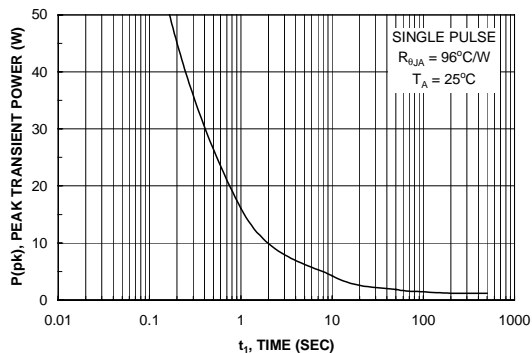


Figure 10. Single Pulse Maximum Power Dissipation.

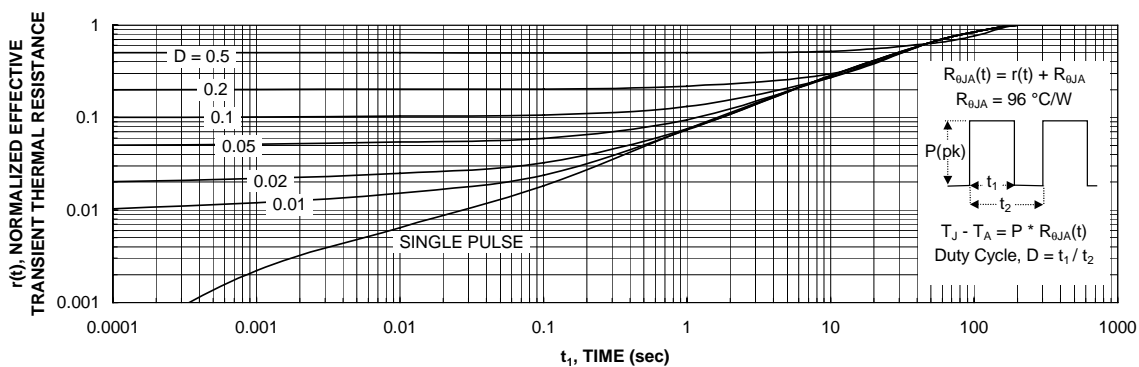



Figure 11. Transient Thermal Response Curve.

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

ON Semiconductor and  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