

FDMC8200S

Dual N-Channel PowerTrench® MOSFET

30 V, 10 mΩ, 20 mΩ

Features

Q1: N-Channel

 ■ Max $r_{DS(on)}$ = 20 mΩ at $V_{GS} = 10$ V, $I_D = 6$ A

 ■ Max $r_{DS(on)}$ = 32 mΩ at $V_{GS} = 4.5$ V, $I_D = 5$ A

Q2: N-Channel

 ■ Max $r_{DS(on)}$ = 10 mΩ at $V_{GS} = 10$ V, $I_D = 8.5$ A

 ■ Max $r_{DS(on)}$ = 13.5 mΩ at $V_{GS} = 4.5$ V, $I_D = 7.2$ A

■ RoHS Compliant

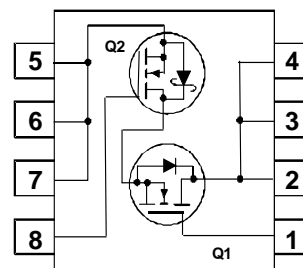
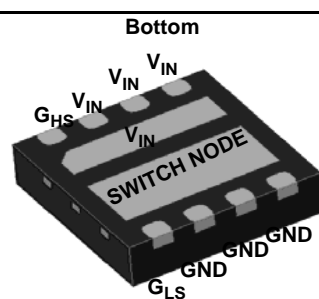
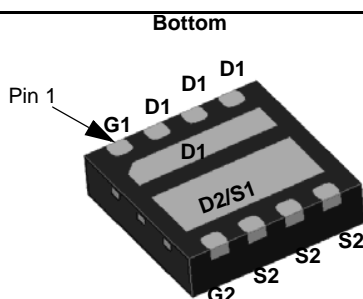


General Description

This device includes two specialized N-Channel MOSFETs in a dual power33(3mm X 3mm MLP) package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous MOSFET (Q2) have been designed to provide optimal power efficiency.

Applications

- Mobile Computing
- Mobile Internet Devices
- General Purpose Point of Load



Power33

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

Symbol	Parameter	Q1	Q2	Units
V_{DS}	Drain to Source Voltage	30	30	V
V_{GS}	Gate to Source Voltage (Note 4)	± 20	± 20	V
I_D	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	18	13	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	23	46	
	-Continuous $T_A = 25^\circ\text{C}$	6 ^{1a}	8.5 ^{1b}	
	-Pulsed	40	27	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	12	32	
P_D	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	1.9 ^{1a}	2.5 ^{1b}	W
	Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$	0.7 ^{1c}	1.0 ^{1d}	
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	65 ^{1a}	50 ^{1b}	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	180 ^{1c}	125 ^{1d}	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	7.5	4.2	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC8200S	FDMC8200S	Power 33	13"	12 mm	3000 units

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

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

Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$ $I_D = 1\ \text{mA}$, $V_{GS} = 0\ \text{V}$	Q1 Q2	30 30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C $I_D = 1\ \text{mA}$, referenced to 25°C	Q1 Q2		14 13		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\ \text{V}$, $V_{GS} = 0\ \text{V}$	Q1 Q2			1 500	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$	Q1 Q2			100 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$ $V_{GS} = V_{DS}$, $I_D = 1\ \text{mA}$	Q1 Q2	1.0 1.0	2.3 2.0	3.0 3.0	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 $I_D = 1\ \text{mA}$, referenced to 25°C	Q1 Q2		-5 -6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 6\ \text{A}$ $V_{GS} = 4.5\ \text{V}$, $I_D = 5\ \text{A}$ $V_{GS} = 10\ \text{V}$, $I_D = 6\ \text{A}$, $T_J = 125^\circ\text{C}$	Q1		16 24 22	20 32 28	m Ω
		$V_{GS} = 10\ \text{V}$, $I_D = 8.5\ \text{A}$ $V_{GS} = 4.5\ \text{V}$, $I_D = 7.2\ \text{A}$ $V_{GS} = 10\ \text{V}$, $I_D = 8.5\ \text{A}$, $T_J = 125^\circ\text{C}$	Q2		7.8 10.3 11.4	10.0 13.5 13.1	
g_{FS}	Forward Transconductance	$V_{DD} = 5\ \text{V}$, $I_D = 6\ \text{A}$ $V_{DD} = 5\ \text{V}$, $I_D = 8.5\ \text{A}$	Q1 Q2		29 43		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	Q1 Q2		495 1080	660 1436	pF
C_{oss}	Output Capacitance		Q1 Q2		145 373	195 495	pF
C_{rss}	Reverse Transfer Capacitance		Q1 Q2		20 35	30 52	pF
R_g	Gate Resistance		Q1 Q2	0.2 0.2	1.4 1.2	4.2 3.6	Ω

Switching Characteristics

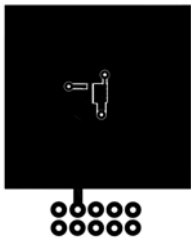
$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15\ \text{V}$, $I_D = 1\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$	Q1 Q2		11 7.6	20 15	ns
t_r	Rise Time		Q1 Q2		3.1 1.8	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = 15\ \text{V}$, $I_D = 1\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$	Q1 Q2		35 21	56 34	ns
t_f	Fall Time		Q1 Q2		1.3 8.5	10 17	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	Q1 Q2		7.3 15.7	10 22	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $4.5\ \text{V}$	Q1 Q2		3.1 7.2	4.3 10	nC
Q_{gs}	Gate to Source Charge	Q2 $V_{DD} = 15\ \text{V}$, $I_D = 8.5\ \text{A}$	Q1 Q2		1.8 3		nC
Q_{gd}	Gate to Drain "Miller" Charge		Q1 Q2		1 1.9		nC

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

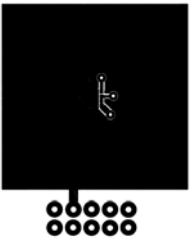
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
V_{SD}	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 6\text{ A}$ (Note 2)	Q1		0.8	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 8.5\text{ A}$ (Note 2)	Q2		0.8	1.2	
		$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)	Q2		0.6	0.8	
t_{rr}	Reverse Recovery Time	Q1 $I_F = 6\text{ A}, di/dt = 100\text{ A/s}$	Q1 Q2		13 20	24 32	ns
Q_{rr}	Reverse Recovery Charge	Q2 $I_F = 8.5\text{ A}, di/dt = 300\text{ A/s}$	Q1 Q2		2.3 15	10 24	nC

Notes:

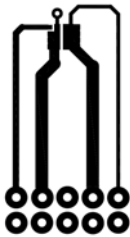
1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



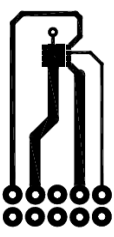
a. 65°C/W when mounted on a 1 in^2 pad of 2 oz copper



b. 50°C/W when mounted on a 1 in^2 pad of 2 oz copper



c. 180°C/W when mounted on a minimum pad of 2 oz copper



d. 125°C/W when mounted on a minimum pad of 2 oz copper

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

3. Starting Q1: $T = 25^{\circ}\text{C}$, $L = 1\text{ mH}$, $I = 5\text{ A}$, $V_{gs} = 10\text{ V}$, $V_{dd} = 27\text{ V}$, 100% test at $L = 3\text{ mH}$, $I = 4\text{ A}$; Q2: $T = 25^{\circ}\text{C}$, $L = 1\text{ mH}$, $I = 8\text{ A}$, $V_{gs} = 10\text{ V}$, $V_{dd} = 27\text{ V}$, 100% test at $L = 3\text{ mH}$, $I = 3.2\text{ A}$.

4. As an N-ch device, the negative V_{gs} rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

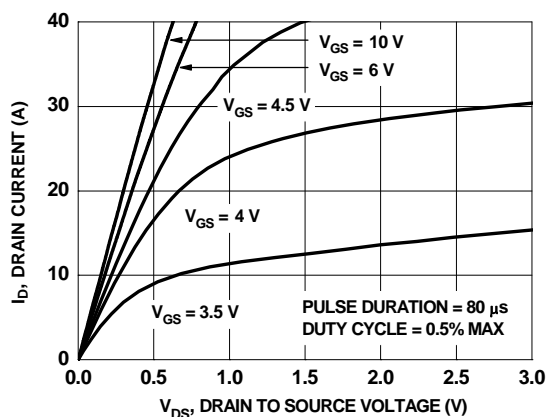


Figure 1. On Region Characteristics

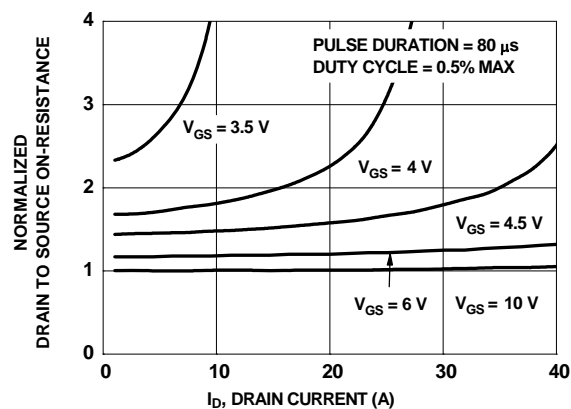


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

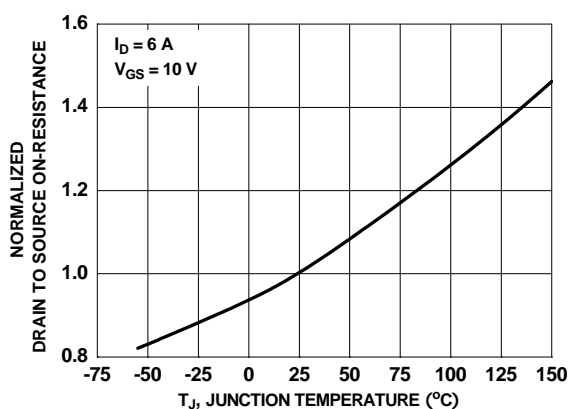


Figure 3. Normalized On Resistance vs Junction Temperature

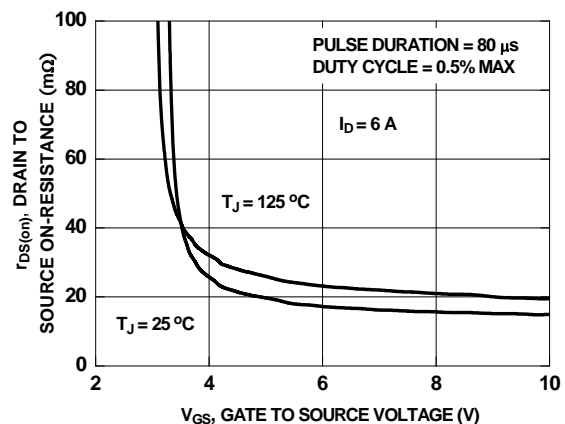


Figure 4. On-Resistance vs Gate to Source Voltage

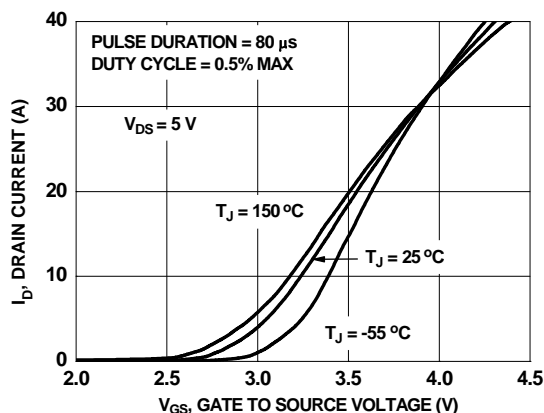


Figure 5. Transfer Characteristics

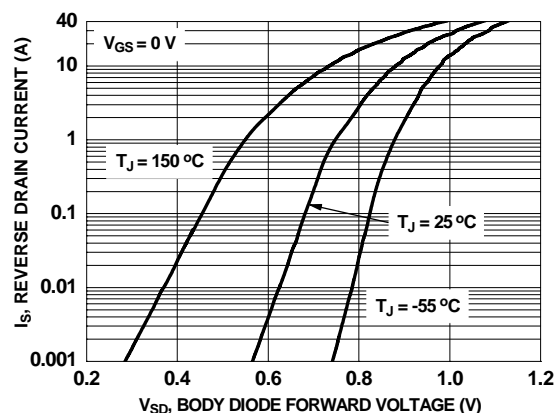


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

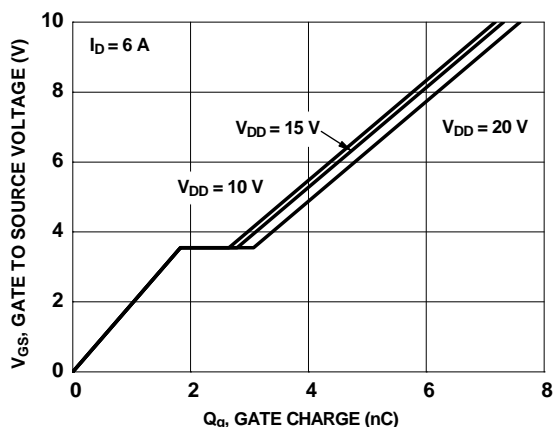


Figure 7. Gate Charge Characteristics

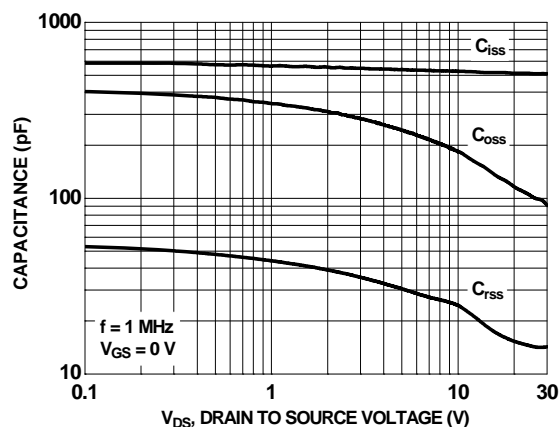


Figure 8. Capacitance vs Drain to Source Voltage

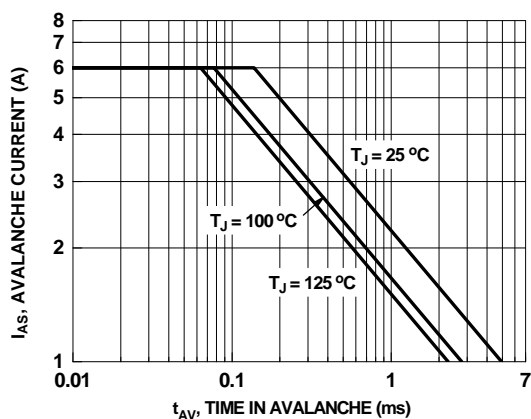


Figure 9. Unclamped Inductive Switching Capability

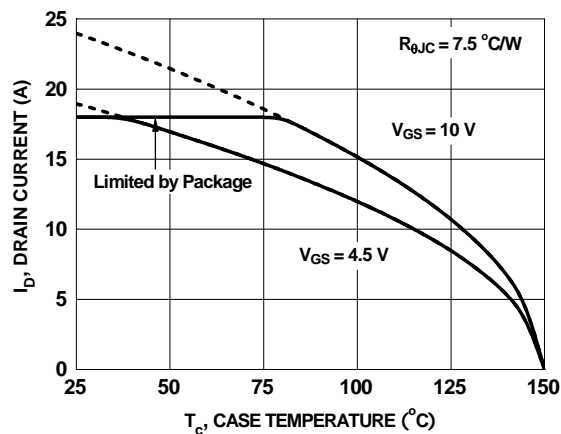


Figure 10. Maximum Continuous Drain Current vs Case Temperature

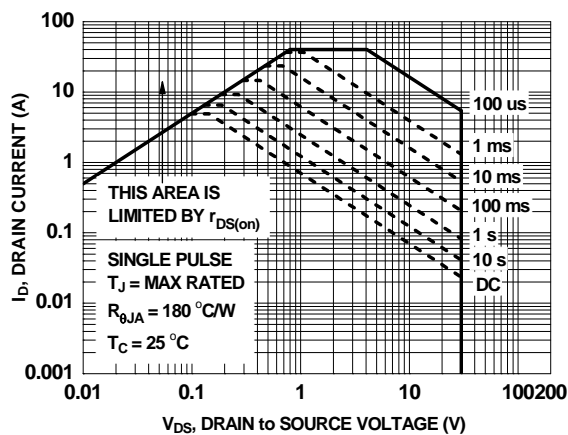


Figure 11. Forward Bias Safe Operating Area

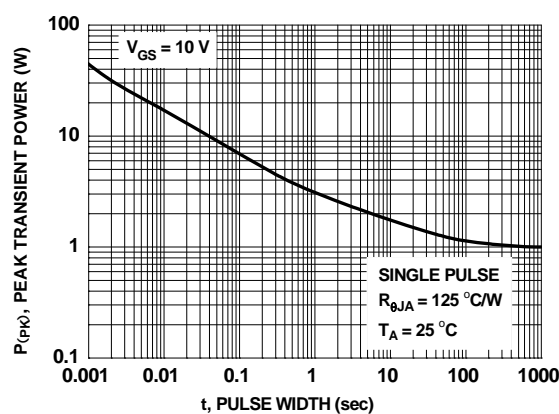


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

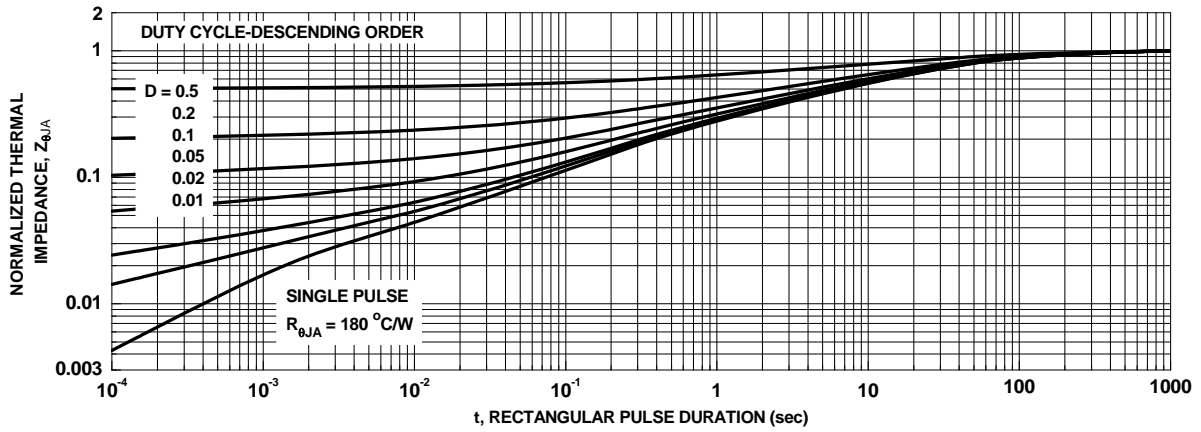


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (Q2 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

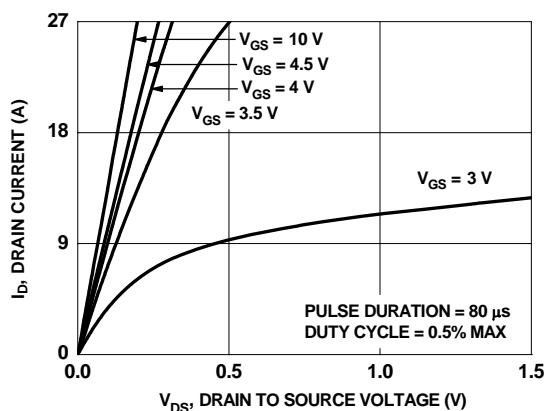


Figure 14. On-Region Characteristics

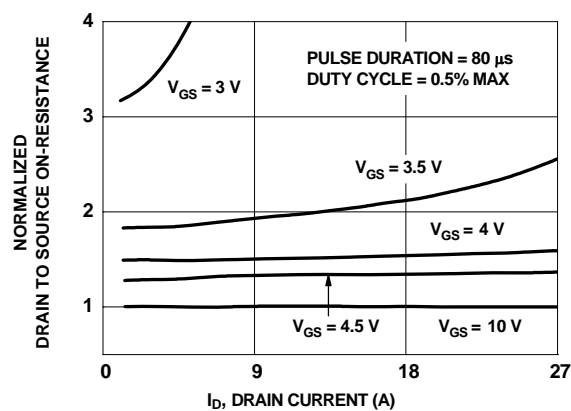


Figure 15. Normalized on-Resistance vs Drain Current and Gate Voltage

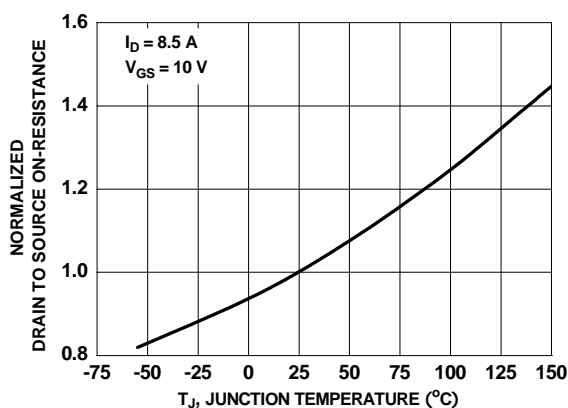


Figure 16. Normalized On-Resistance vs Junction Temperature

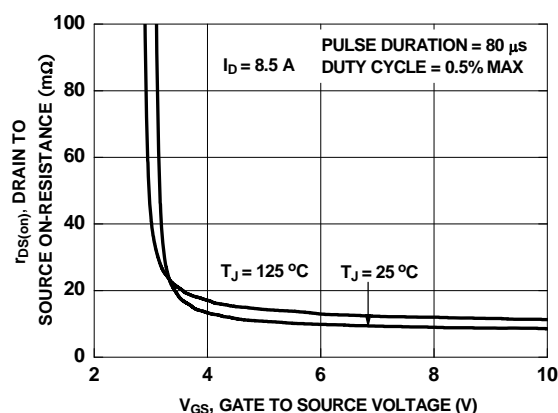


Figure 17. On-Resistance vs Gate to Source Voltage

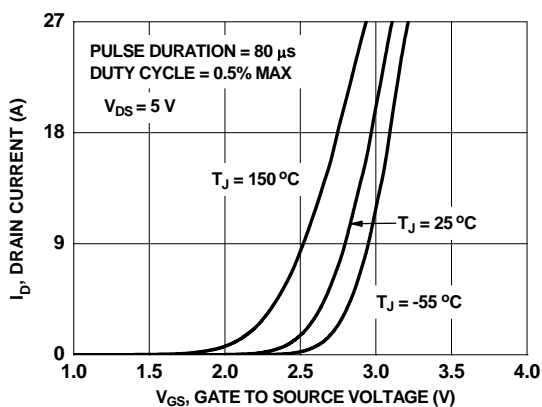


Figure 18. Transfer Characteristics

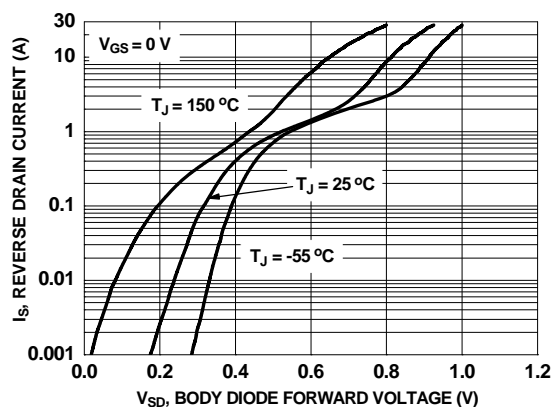


Figure 19. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q2 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

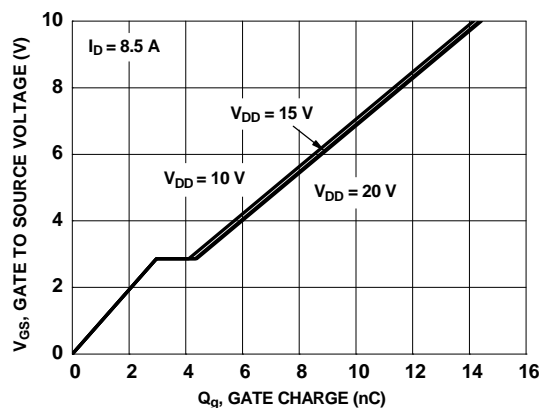


Figure 20. Gate Charge Characteristics

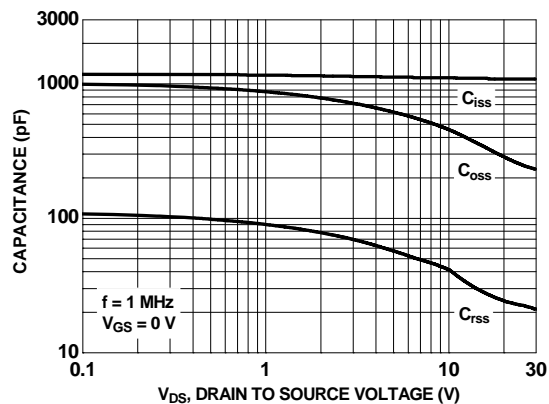


Figure 21. Capacitance vs Drain to Source Voltage

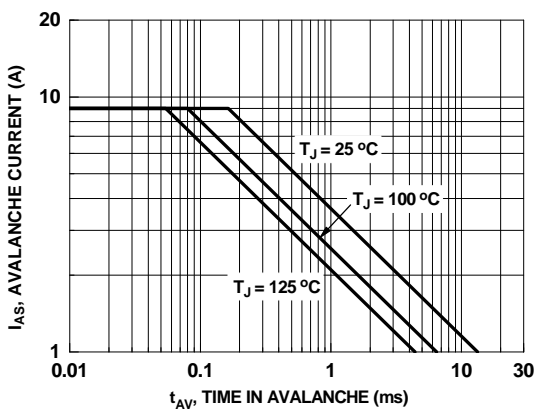


Figure 22. Unclamped Inductive Switching Capability

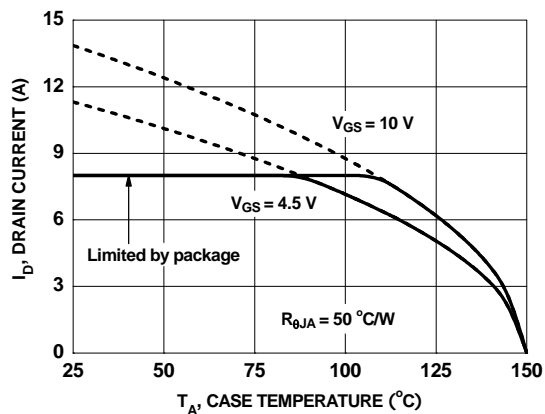


Figure 23. Maximum Continuous Drain Current vs Case Temperature

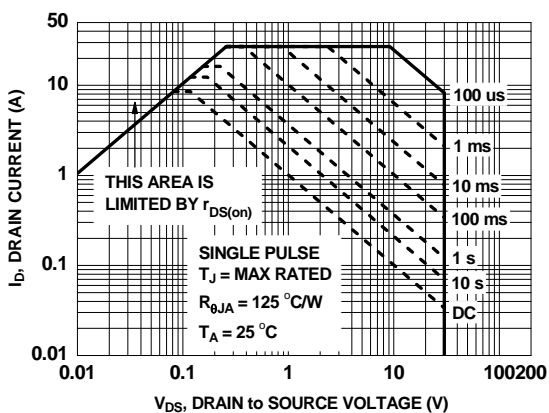


Figure 24. Forward Bias Safe Operating Area

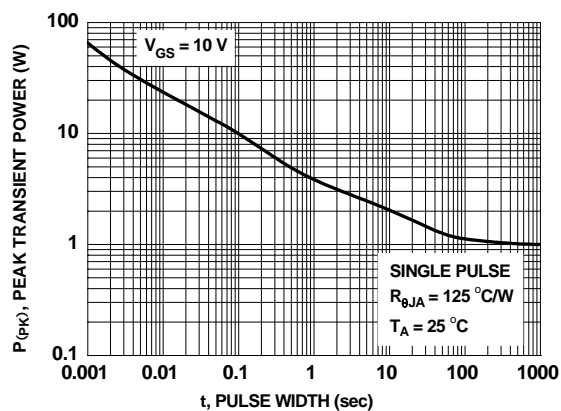


Figure 25. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q2 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

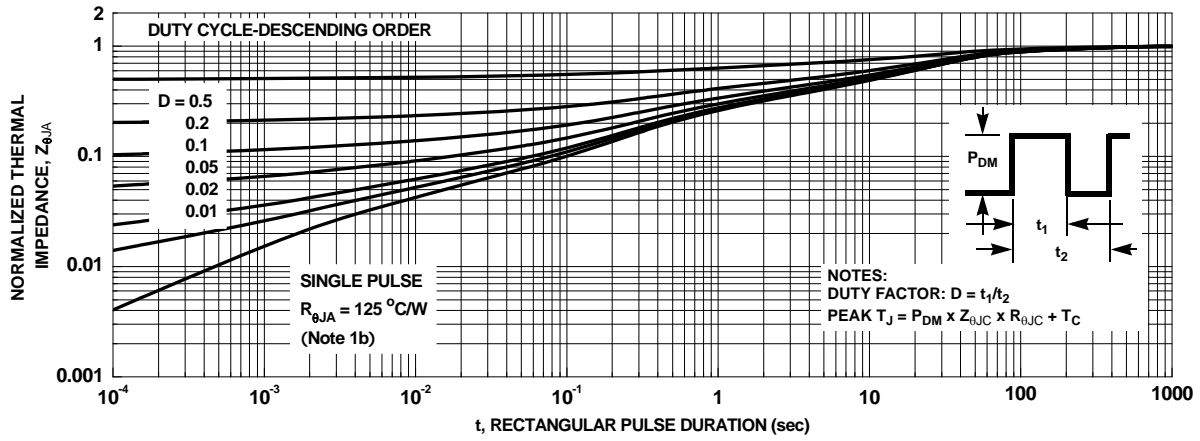


Figure 26. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET Schottky body diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 14 shows the reverse recovery characteristic of the FDMC8200S.

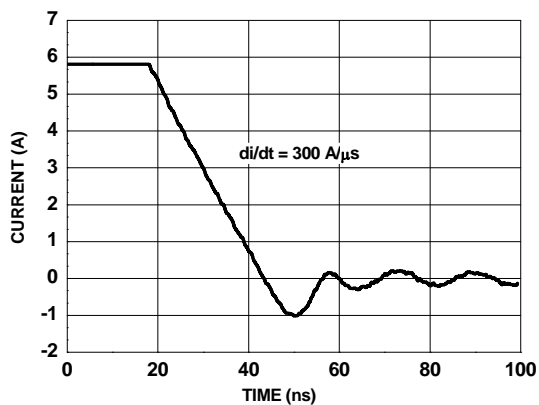


Figure 27. FDMC8200S SyncFET body diode reverse recovery characteristic

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

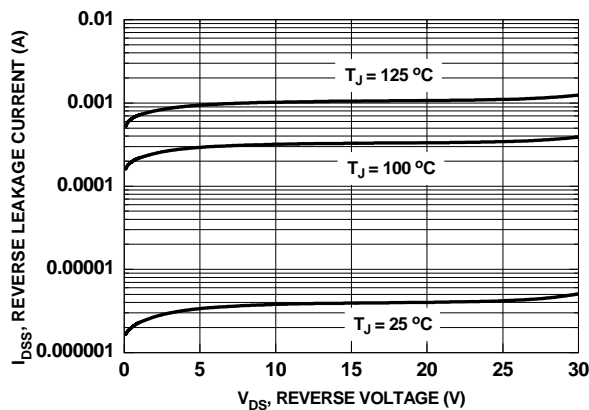
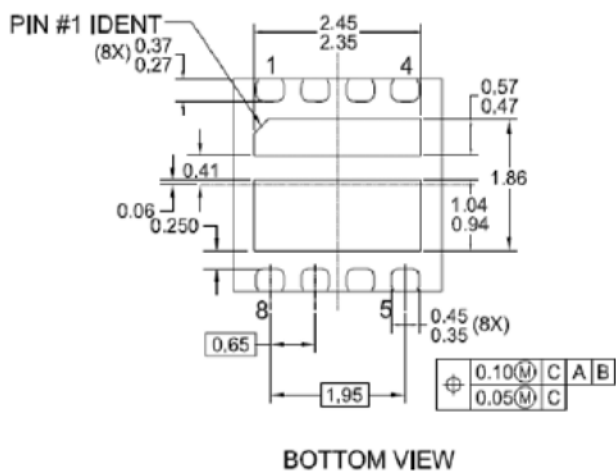
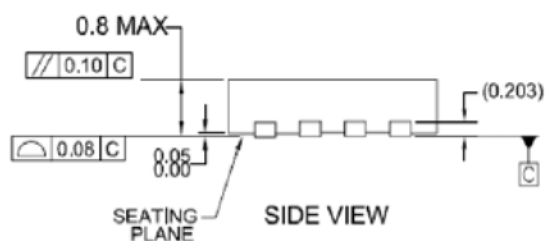
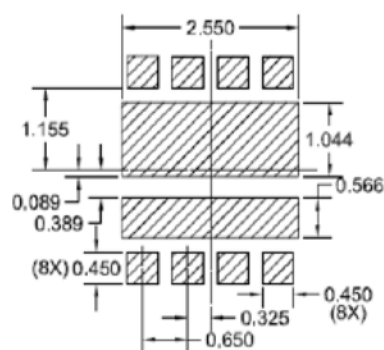
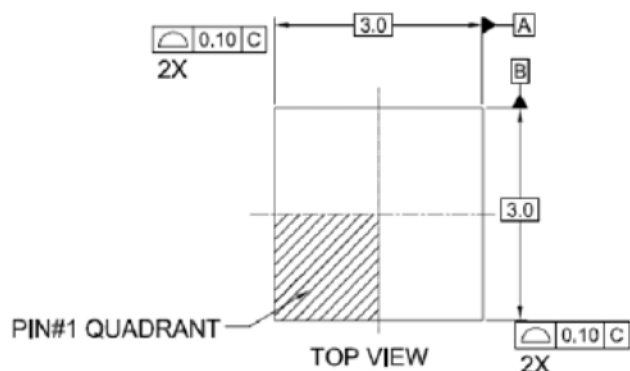


Figure 28. SyncFET body diode reverse leakage versus drain-source voltage

Dimensional Outline and Pad Layout



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