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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor®

FDMS1D4N03S

N-Channel PowerTrench® SyncFET™

30 V, 211 A, 1.09 mΩ

Features

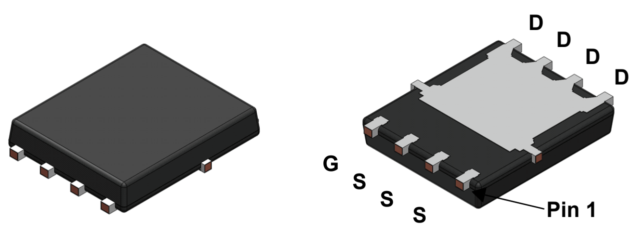
- Max $r_{DS(on)}$ = 1.09 mΩ at V_{GS} = 10 V, I_D = 38 A
- Max $r_{DS(on)}$ = 1.3 mΩ at V_{GS} = 4.5 V, I_D = 35 A
- High Performance Technology for Extremely Low $r_{DS(on)}$
- SyncFET™ Schottky Body Diode
- 100% UIL Tested
- RoHS Compliant

General Description

The FDMS1D4N03S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{DS(on)}$ while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic schottky body diode.

Applications

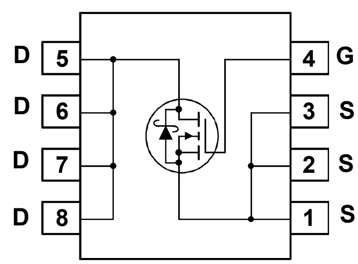
- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/ GPU Low Side Switch
- Networking Point of Load Low Side Switch
- Telecom Secondary Sde Rectification



Top

Bottom

Power 56



MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted.

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			30	V
V_{GS}	Gate to Source Voltage			±16	V
I_D	Drain Current -Continuous	T_C = 25 °C	(Note 5)	211	A
	-Continuous	T_C = 100 °C	(Note 5)	134	
	-Continuous	T_A = 25 °C	(Note 1a)	38	
	-Pulsed		(Note 4)	1140	
E_{AS}	Single Pulse Avalanche Energy		(Note 3)	384	mJ
P_D	Power Dissipation	T_C = 25 °C		74	W
	Power Dissipation	T_A = 25 °C	(Note 1a)	2.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case		1.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	50	

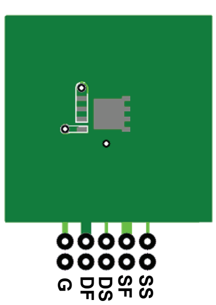
Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS1D4N03S	FDMS1D4N03S	Power 56	13 ”	12 mm	3000 units

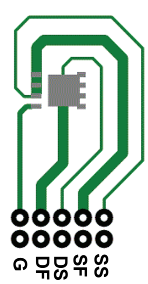
Electrical Characteristics T_J = 25 °C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0 V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, referenced to 25 °C		20		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			500	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±16 V, V_{DS} = 0 V			±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 1 mA	1	1.6	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 10 mA, referenced to 25 °C		-4		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 38 A		0.8	1.09	mΩ
		V_{GS} = 4.5 V, I_D = 35 A		1.0	1.3	
		V_{GS} = 10 V, I_D = 38 A, T_J = 125 °C		1.2	1.7	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 38 A		281		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHz		7320	10250	pF
C_{oss}	Output Capacitance			1950	2730	pF
C_{rss}	Reverse Transfer Capacitance			101	180	pF
R_g	Gate Resistance		0.1	0.5	1.5	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15 V, I_D = 38 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		21	33	ns
t_r	Rise Time			6	12	ns
$t_{d(off)}$	Turn-Off Delay Time			51	82	ns
t_f	Fall Time			5	10	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V; V_{DD} = 15 V, I_D = 38 A		102	143	nC
Q_g	Total Gate Charge	V_{GS} = 0 V to 4.5 V		46	65	nC
Q_{gs}	Gate to Source Charge			18		nC
Q_{gd}	Gate to Drain "Miller" Charge			9		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.7	1.2	V
		V_{GS} = 0 V, I_S = 38 A (Note 2)		0.8	1.3	
t_{rr}	Reverse Recovery Time	I_F = 38 A, di/dt = 246 A/μs		44	70	ns
Q_{rr}	Reverse Recovery Charge			70	112	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) 50 °C/W when mounted on a 1 in^2 pad of 2 oz copper



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

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. E_{AS} of 384 mJ is based on starting T_J = 25 °C, L = 3 mH, I_{AS} =16 A, V_{DD} =30 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} = 52 A.
4. Pulse Id please refer to Fig.11 SOA curve for detail.
5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design

Typical Characteristics T_J = 25 °C unless otherwise noted.

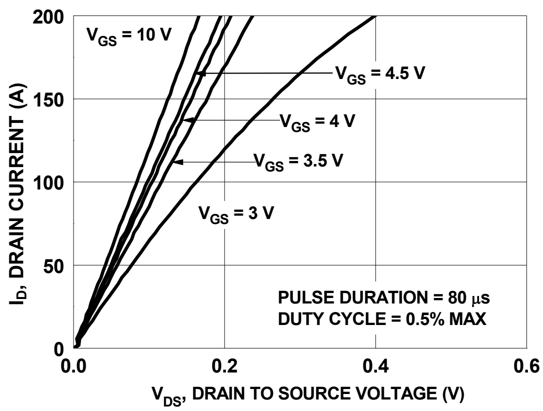


Figure 1. On Region Characteristics

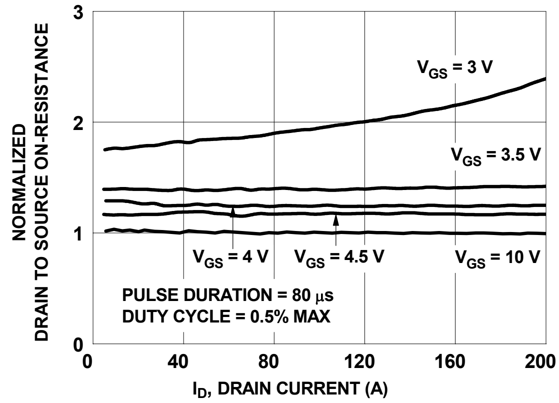


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

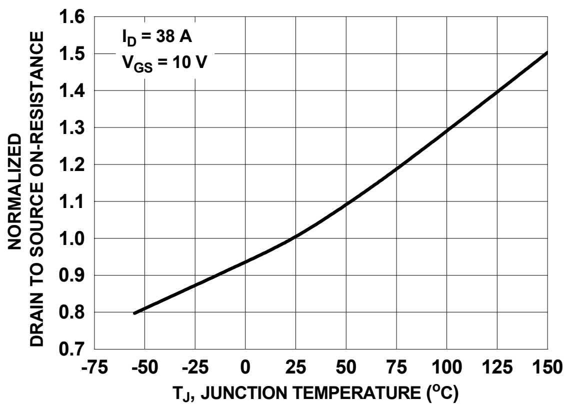


Figure 3. Normalized On Resistance vs. Junction Temperature

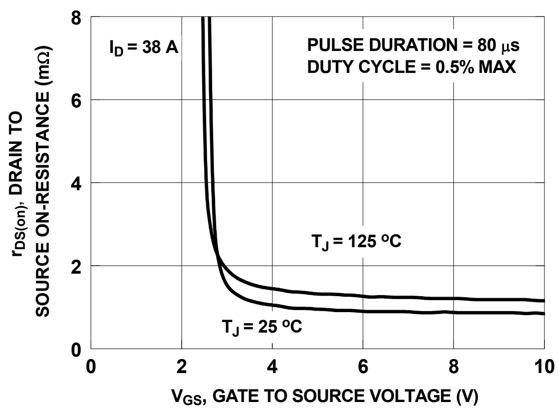


Figure 4. On-Resistance vs. Gate to Source Voltage

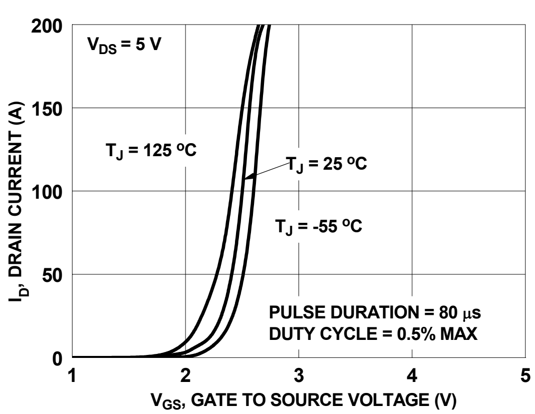


Figure 5. Transfer Characteristics

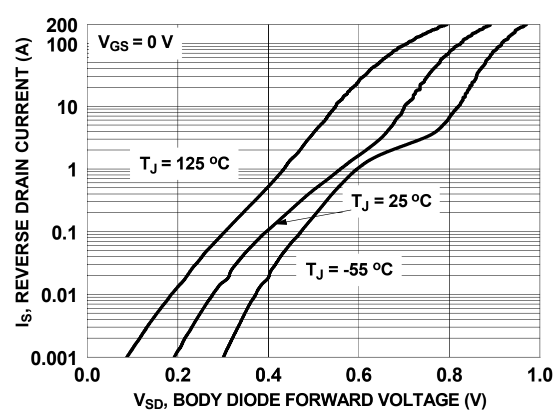


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted.

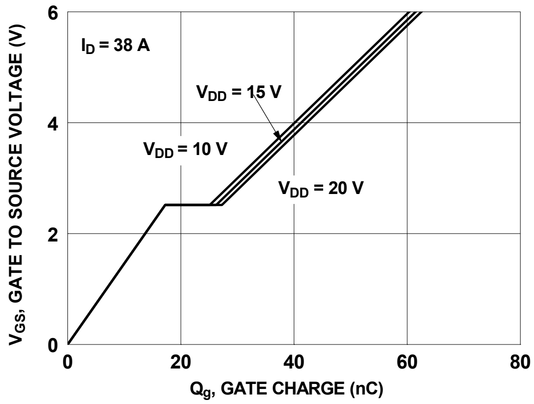


Figure 7. Gate Charge Characteristics

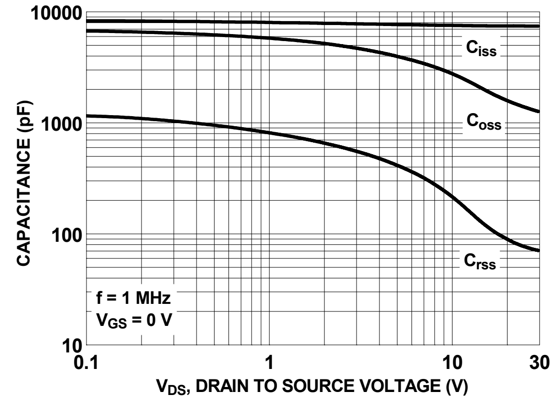


Figure 8. Capacitance vs. Drain to Source Voltage

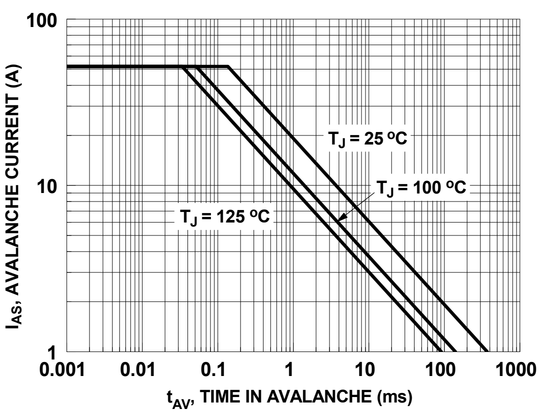


Figure 9. Unclamped Inductive Switching Capability

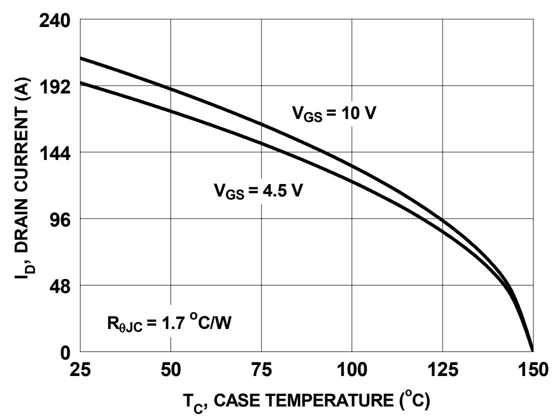


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

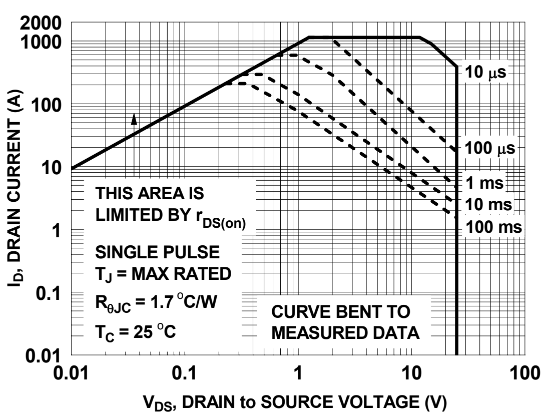


Figure 11. Forward Bias Safe Operating Area

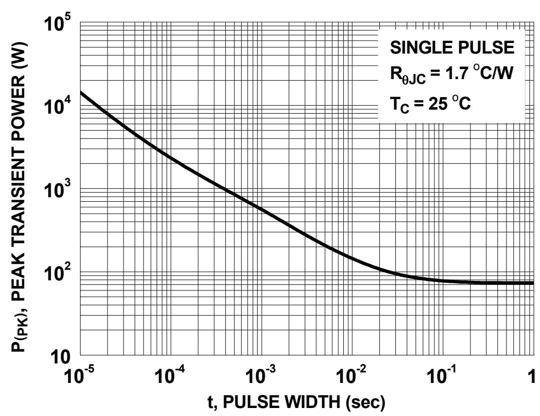


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted.

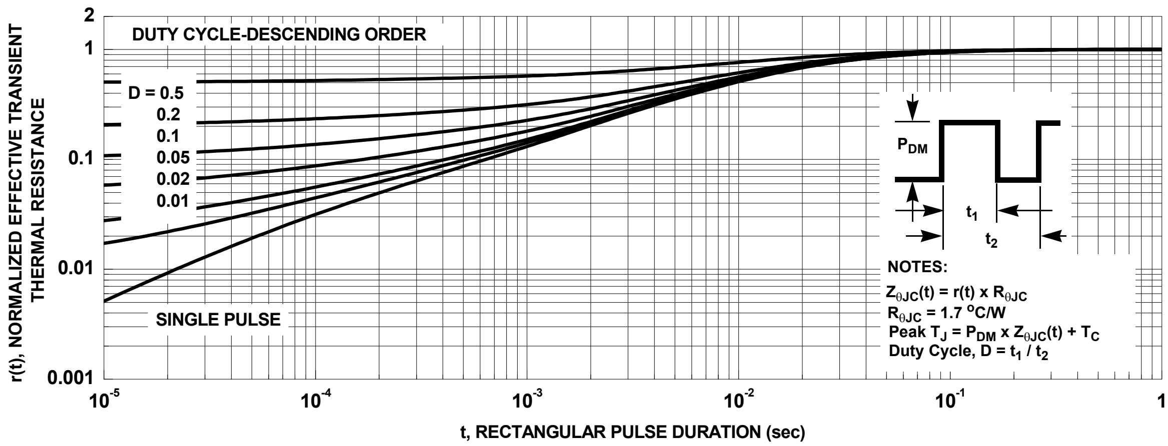


Figure 13. Junction-to-Case Transient Thermal Response Curve

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 FDMS1D4N03S.

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

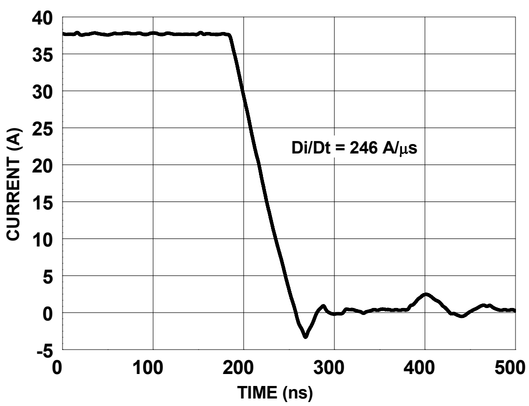


Figure 14. FDMS1D4N03S SyncFET™ Body Diode Reverse Recovery Characteristic

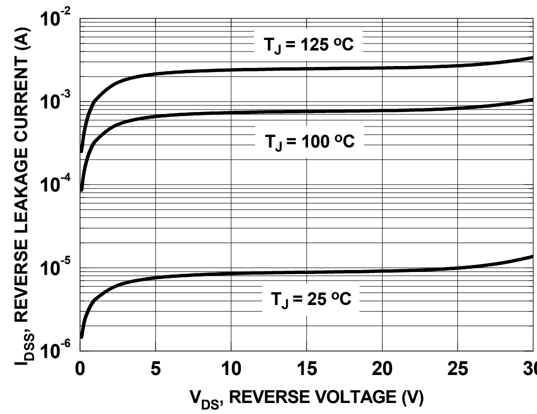
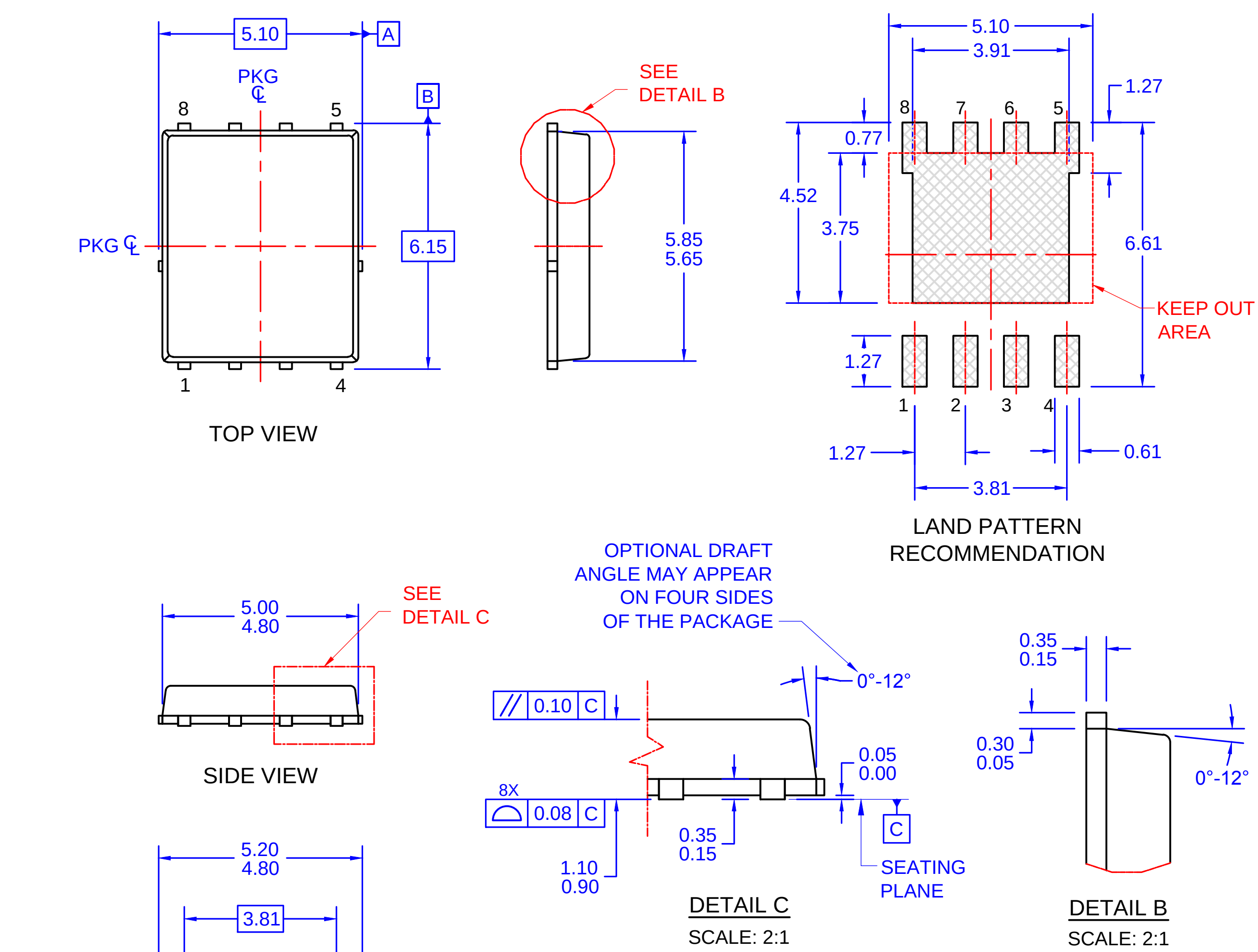
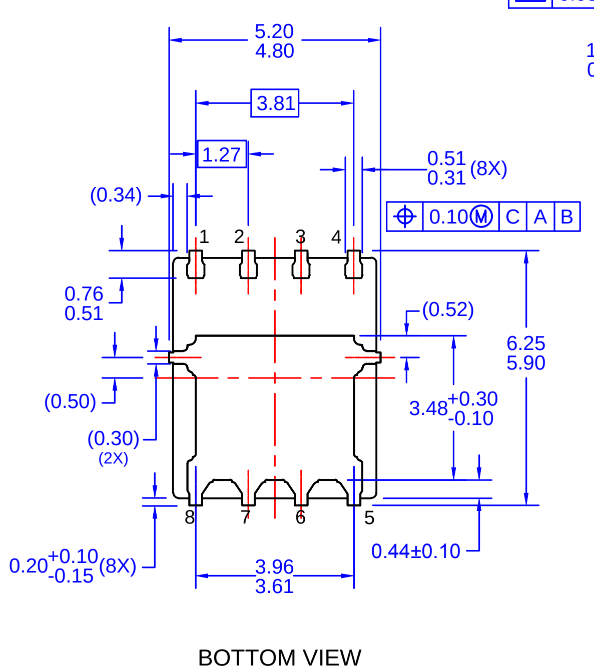


Figure 15. SyncFET™ Body Diode Reverse Leakage vs. Drain-Source Voltage

PQFN8 5X6, 1.27P
CASE 483AE
ISSUE A





NOTES: UNLESS OTHERWISE SPECIFIED

A. PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA,.
B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
E. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

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