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FDMS1D4N03S

N-Channel PowerTrench® SyncFET™

30 V, 211 A, 1.09 mΩ

Features

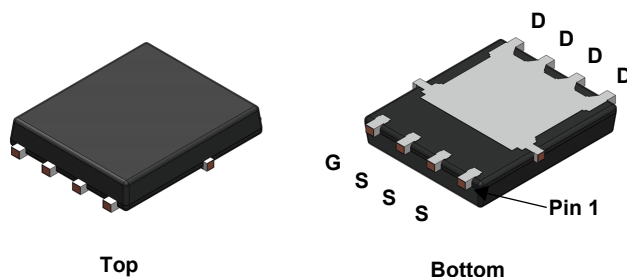
- Max $r_{DS(on)}$ = 1.09 mΩ at $V_{GS} = 10$ V, $I_D = 38$ A
- Max $r_{DS(on)}$ = 1.3 mΩ at $V_{GS} = 4.5$ V, $I_D = 35$ A
- High Performance Technology for Extremely Low $r_{DS(on)}$
- SyncFET™ Schottky Body Diode
- 100% UIL Tested
- RoHS Compliant

General Description

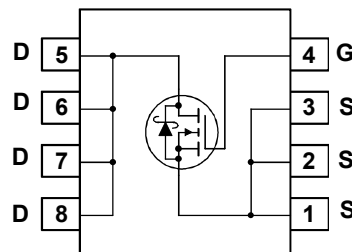
The FDMS1D4N03S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{DS(on)}$ while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic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



Power 56



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ 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 $T_C = 25^\circ\text{C}$ (Note 5)	211	A
	-Continuous $T_C = 100^\circ\text{C}$ (Note 5)	134	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	38	
	-Pulsed (Note 4)	1140	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	384	mJ
P_D	Power Dissipation $T_C = 25^\circ\text{C}$	74	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.7	$^\circ\text{C/W}$
$R_{\theta JA}$	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 $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^{\circ}\text{C}$		20		mV/ $^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$			500	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 16\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 1\text{ mA}$	1	1.6	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^{\circ}\text{C}$		-4		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$, $I_D = 38\text{ A}$		0.8	1.09	m Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 35\text{ A}$		1.0	1.3	
		$V_{GS} = 10\text{ V}$, $I_D = 38\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$		1.2	1.7	
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}$, $I_D = 38\text{ A}$		281		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		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

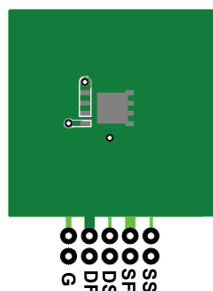
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$, $I_D = 38\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		21	33	ns
t_r	Rise Time			6	12	ns
$t_{d(off)}$	Turn-Off Delay Time			51	82	ns
t_f	Fall Time			5	10	ns
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$	$V_{DD} = 15\text{ V}$, $I_D = 38\text{ A}$	102	143	nC
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$		46	65	nC
Q_{gs}	Gate to Source Charge			18		nC
Q_{gd}	Gate to Drain "Miller" Charge			9		nC

Drain-Source Diode Characteristics

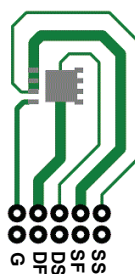
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = 2.1\text{ A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{ V}$, $I_S = 38\text{ A}$ (Note 2)		0.8	1.3	
t_{rr}	Reverse Recovery Time	$I_F = 38\text{ A}$, $di/dt = 246\text{ A}/\mu\text{s}$		44	70	ns
Q_{rr}	Reverse Recovery Charge			70	112	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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 $^{\circ}\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper



b) 125 $^{\circ}\text{C}/\text{W}$ 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 $T_J = 25\text{ }^{\circ}\text{C}$, $L = 3\text{ mH}$, $I_{AS} = 16\text{ A}$, $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 0.1\text{ mH}$, $I_{AS} = 52\text{ A}$.

4. Pulse I_d 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 $T_J = 25^\circ\text{C}$ unless otherwise noted.

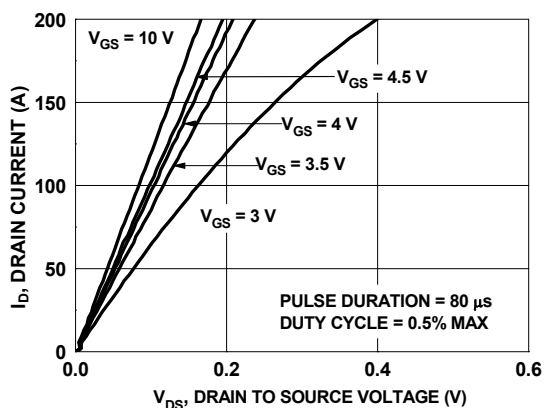


Figure 1. On Region Characteristics

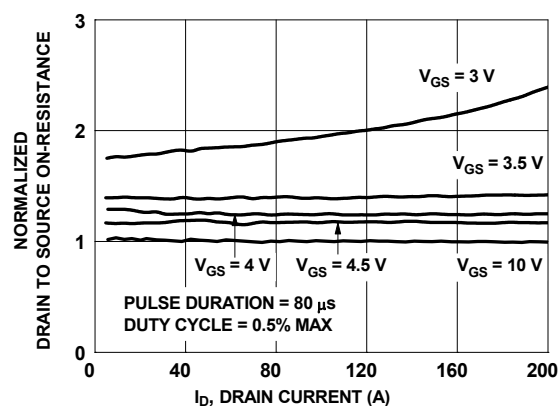


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

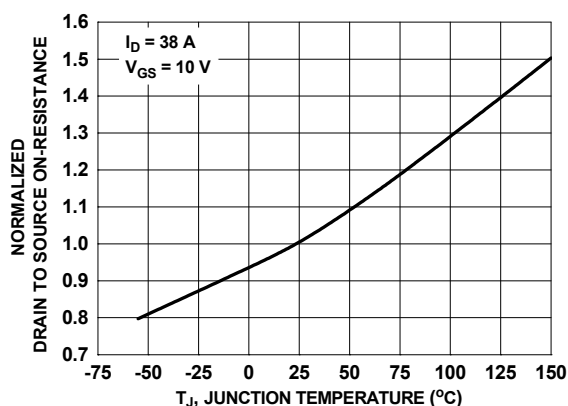


Figure 3. Normalized On Resistance vs. Junction Temperature

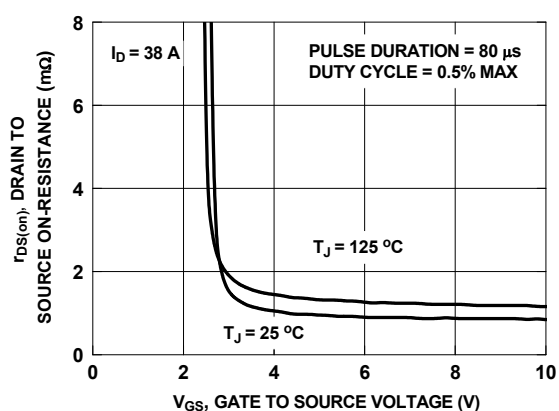


Figure 4. On-Resistance vs. Gate to Source Voltage

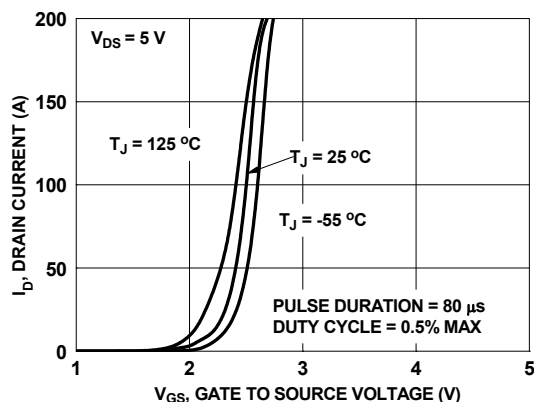


Figure 5. Transfer Characteristics

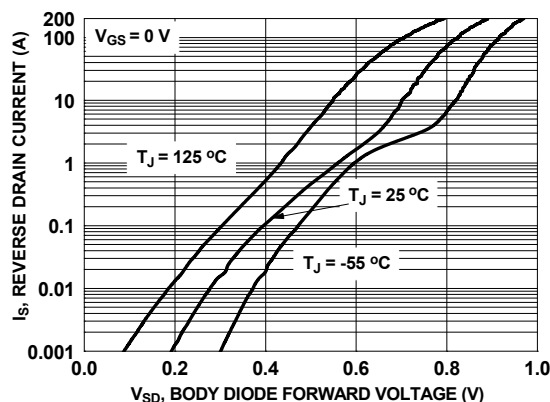


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

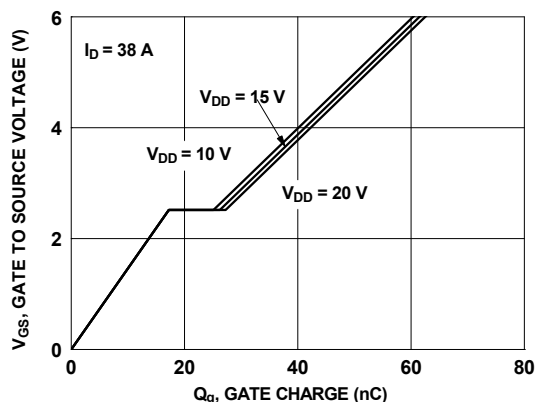


Figure 7. Gate Charge Characteristics

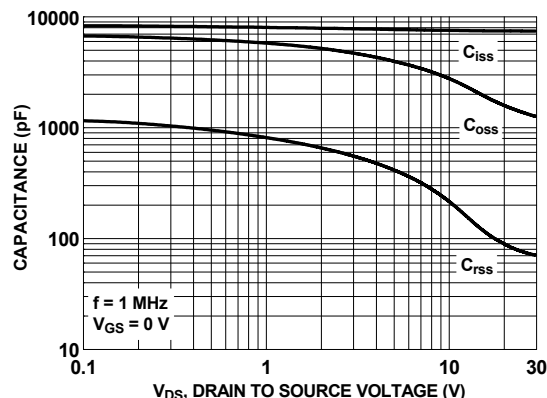


Figure 8. Capacitance vs. Drain to Source Voltage

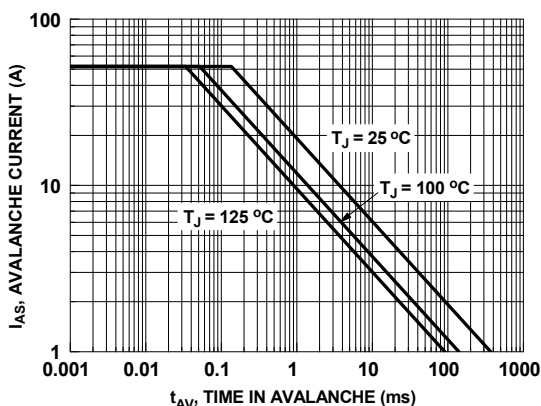


Figure 9. Unclamped Inductive Switching Capability

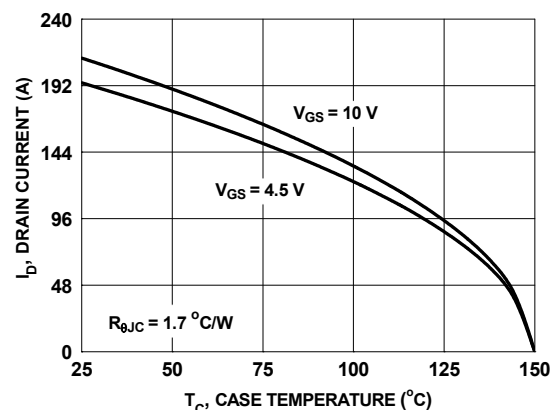


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

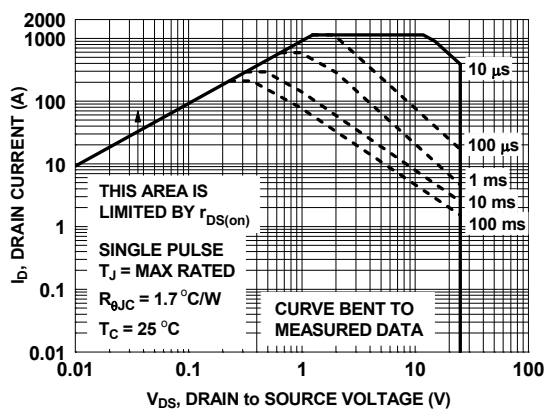


Figure 11. Forward Bias Safe Operating Area

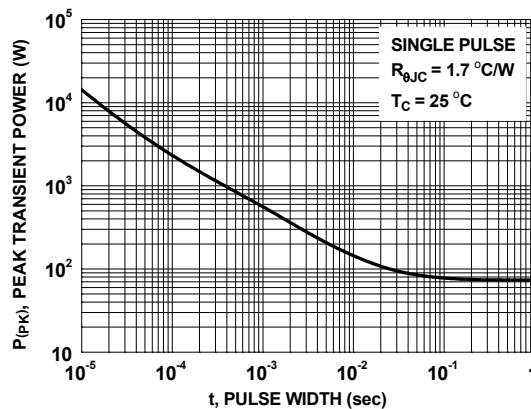


Figure 12. Single Pulse Maximum Power Dissipation

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

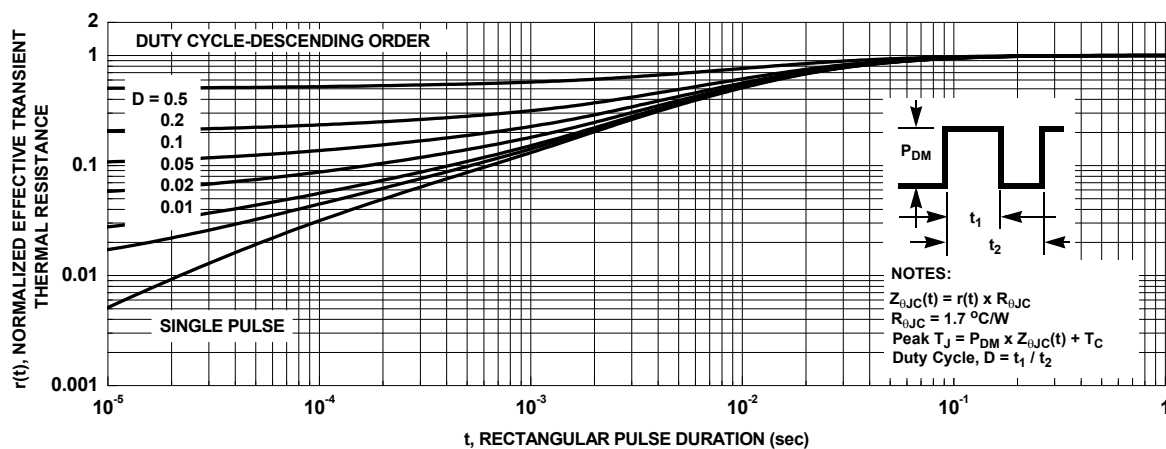


Figure 13. Junction-to-Case Transient Thermal Response Curve

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.

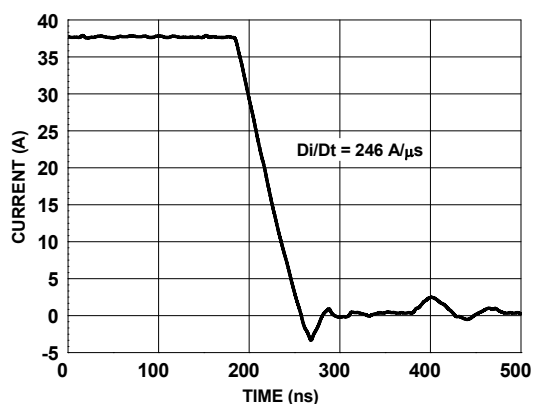


Figure 14. FDMS1D4N03S SyncFET[™] Body Diode Reverse Recovery Characteristic

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

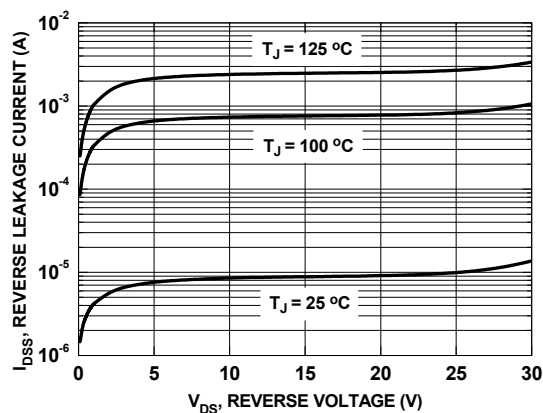
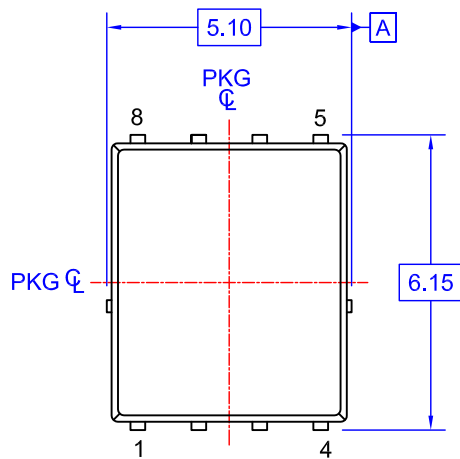
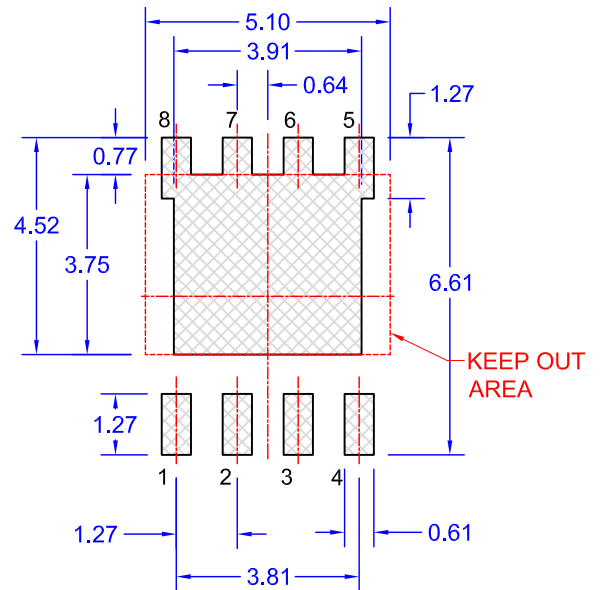
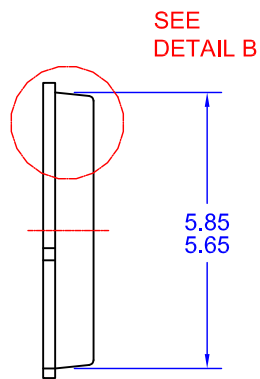


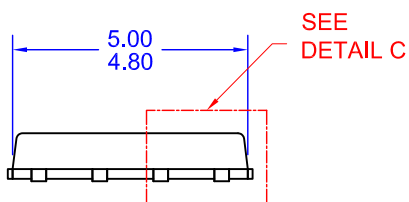
Figure 15. SyncFET[™] Body Diode Reverse Leakage vs. Drain-Source Voltage



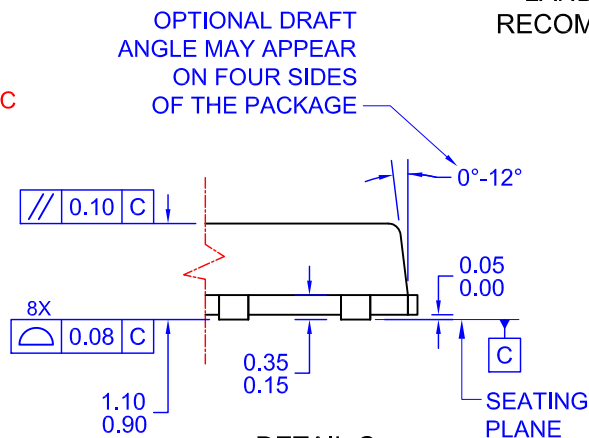
TOP VIEW



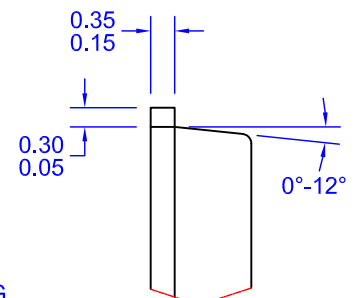
LAND PATTERN RECOMMENDATION



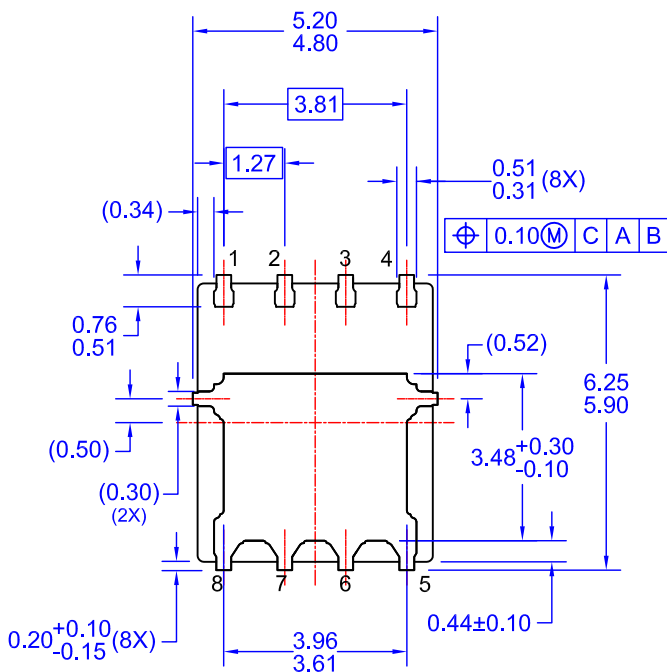
SIDE VIEW



DETAIL C
SCALE: 2:1



DETAIL B
SCALE: 2:1



BOTTOM VIEW

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