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January 2015

# FDMS0309AS

## N-Channel PowerTrench® SyncFET™

30 V, 49 A, 3.5 mΩ

### Features

- Max  $r_{DS(on)}$  = 3.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 21$  A
- Max  $r_{DS(on)}$  = 4.3 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 19$  A
- Advanced package and silicon combination for low  $r_{DS(on)}$  and high efficiency
- SyncFET™ Schottky Body Diode
- MSL1 Robust Package Design
- 100% UIL tested
- RoHS Compliant

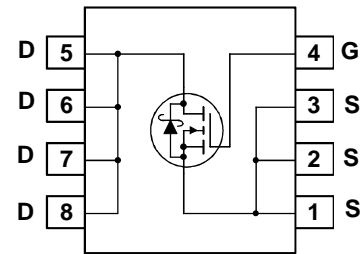
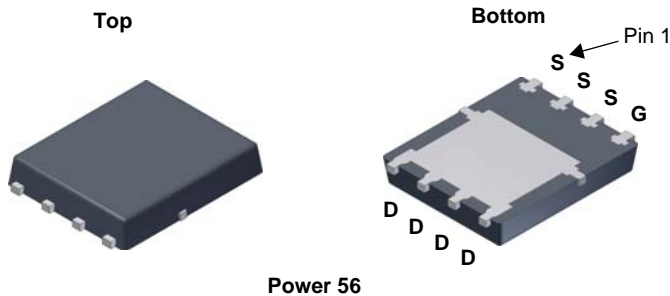


### General Description

The FDMS0309AS 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 Side Rectification



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{DSI}$	Drain to Source Transient Voltage ( $t_{\text{Transient}} < 100$ ns)	33	V
$V_{GS}$	Gate to Source Voltage (Note 4)	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	49	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	96	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	21	
	-Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	66	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	50	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	2.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS0309AS	FDMS0309AS	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 $25\text{ }^{\circ}\text{C}$		25		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$			500	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current, Forward	$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 1\text{ mA}$	1.2	1.6	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$ , referenced to $25\text{ }^{\circ}\text{C}$		-5		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 21\text{ A}$		2.7	3.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 19\text{ A}$		3.4	4.3	
		$V_{GS} = 10\text{ V}$ , $I_D = 21\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		3.7	4.8	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 21\text{ A}$		120		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		2255	3000	pF
$C_{oss}$	Output Capacitance			815	1085	pF
$C_{rss}$	Reverse Transfer Capacitance			85	125	pF
$R_g$	Gate Resistance			1.0	2.5	$\Omega$

**Switching Characteristics**

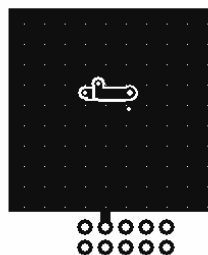
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$ , $I_D = 21\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		11	19	ns
$t_r$	Rise Time			4.5	10	ns
$t_{d(off)}$	Turn-Off Delay Time			29	46	ns
$t_f$	Fall Time			3.7	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}$	$V_{DD} = 15\text{ V}$ , $I_D = 21\text{ A}$	34	47	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }4.5\text{ V}$		16	23	nC
$Q_{gs}$	Gate to Source Charge			5.9		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			4.6		nC

**Drain-Source Diode Characteristics**

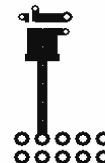
$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2\text{ A}$ (Note 2)		0.6	0.8	V
		$V_{GS} = 0\text{ V}$ , $I_S = 21\text{ A}$ (Note 2)		0.8	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 21\text{ A}$ , $di/dt = 300\text{ A}/\mu\text{s}$		26	42	ns
$Q_{rr}$	Reverse Recovery Charge			27	44	nC

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> 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 in<sup>2</sup> 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  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 66 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 21\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$

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

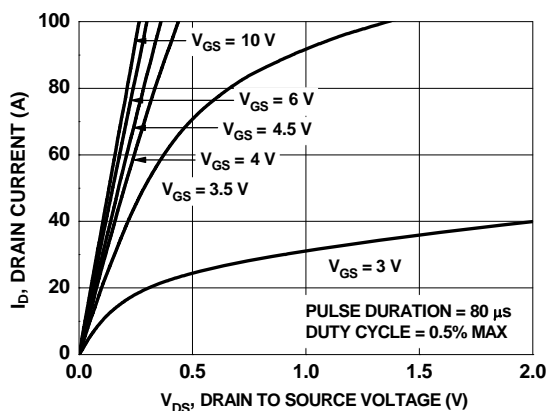


Figure 1. On Region Characteristics

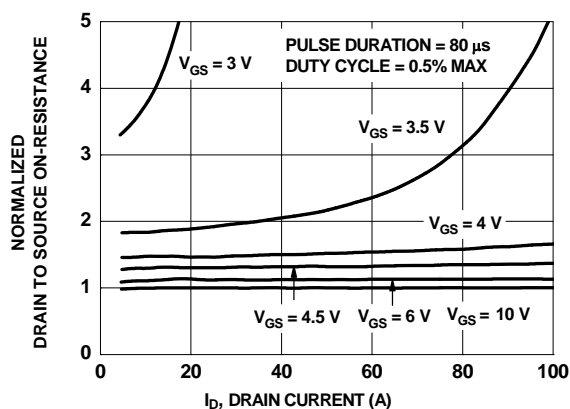


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

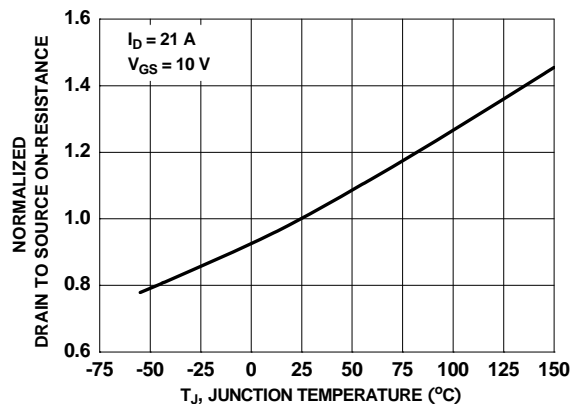


Figure 3. Normalized On Resistance vs Junction Temperature

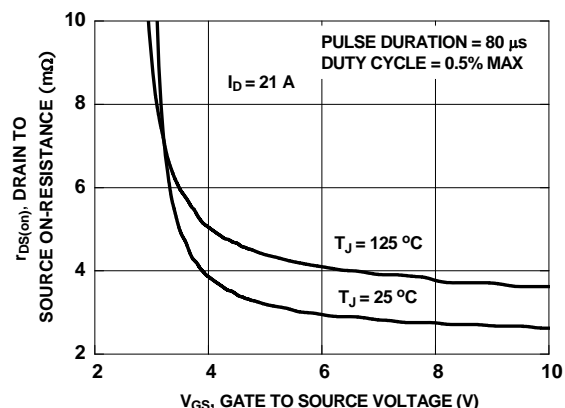


Figure 4. On-Resistance vs Gate to Source Voltage

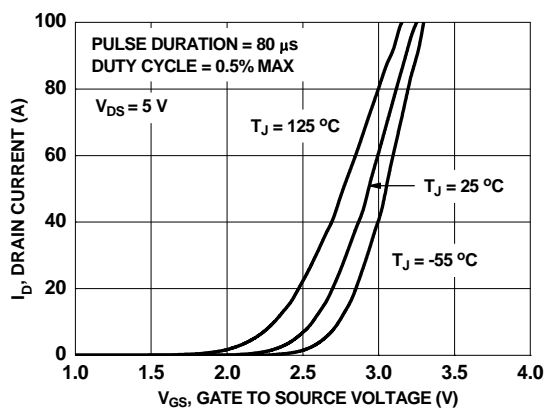


Figure 5. Transfer Characteristics

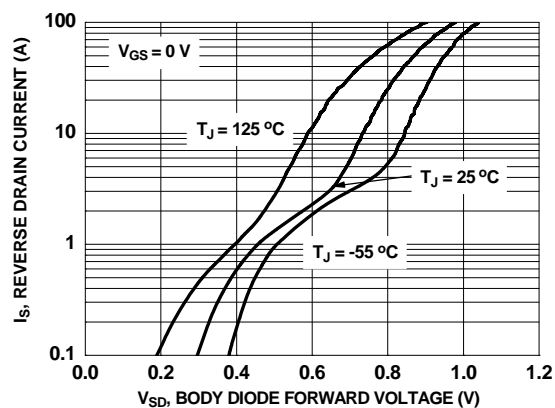


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

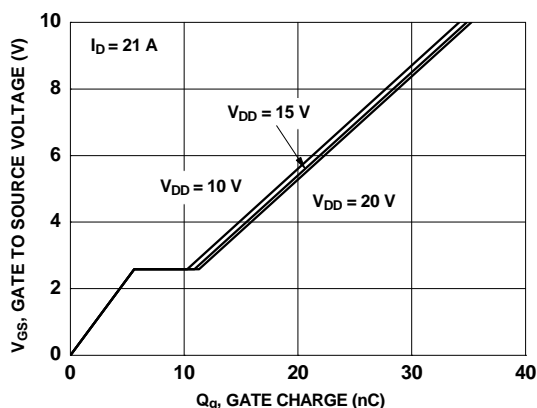


Figure 7. Gate Charge Characteristics

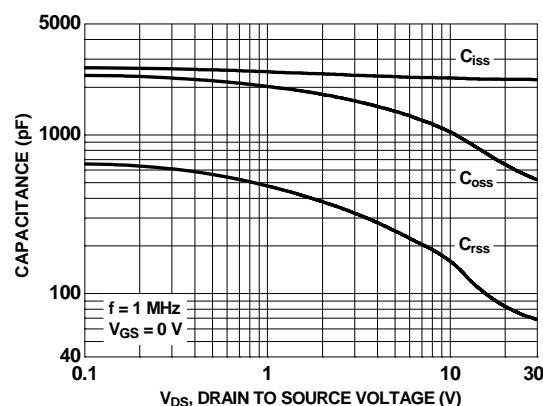


Figure 8. Capacitance vs Drain to Source Voltage

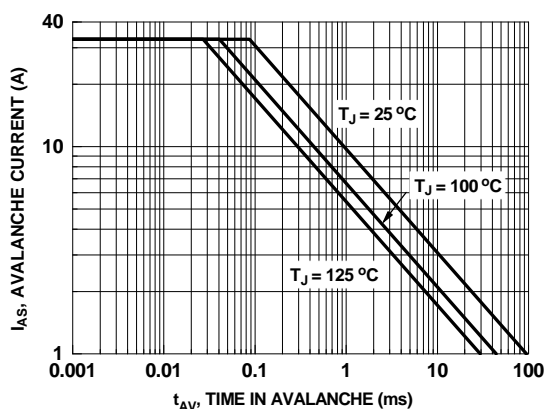


Figure 9. Unclamped Inductive Switching Capability

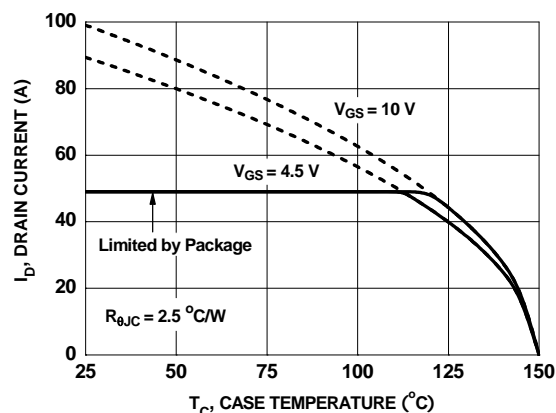


Figure 10. Maximum Continuous Drain Current vs Case Temperature

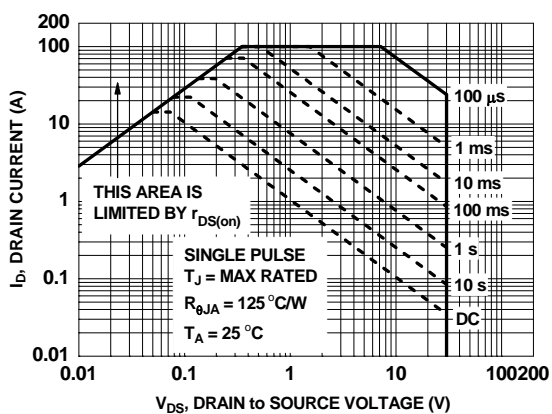


Figure 11. Forward Bias Safe Operating Area

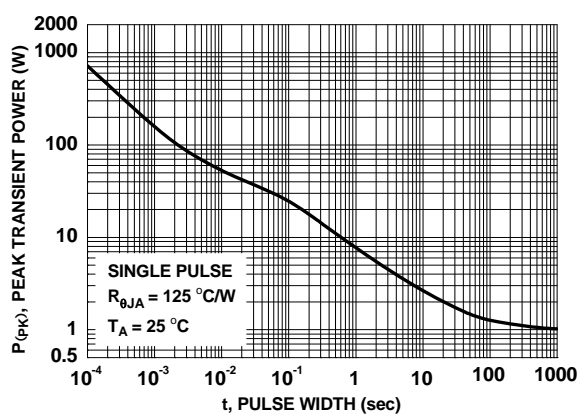


Figure 12. Single Pulse Maximum Power Dissipation

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

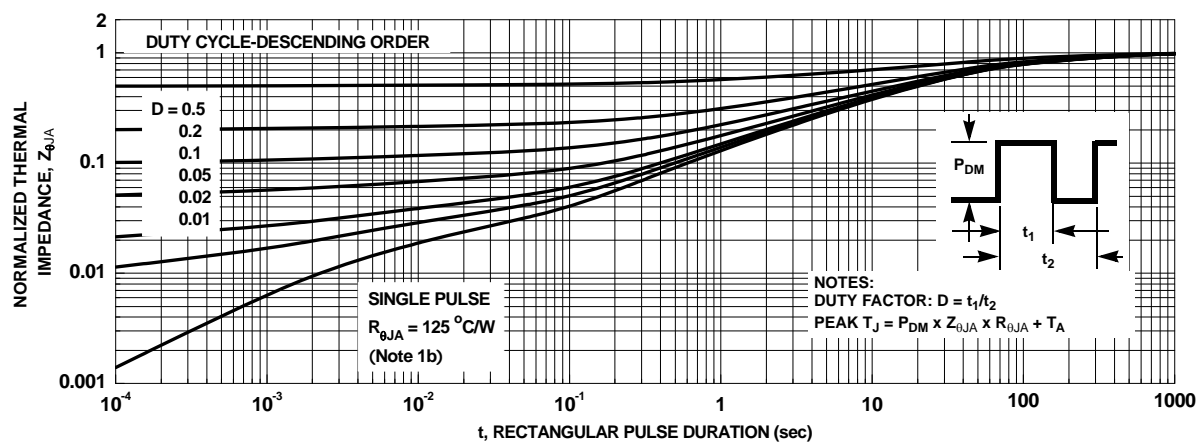


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

## Typical Characteristics (continued)

### SyncFET<sup>™</sup> Schottky body diode Characteristics

Fairchild's SyncFET<sup>™</sup> 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 FDMS0309AS.

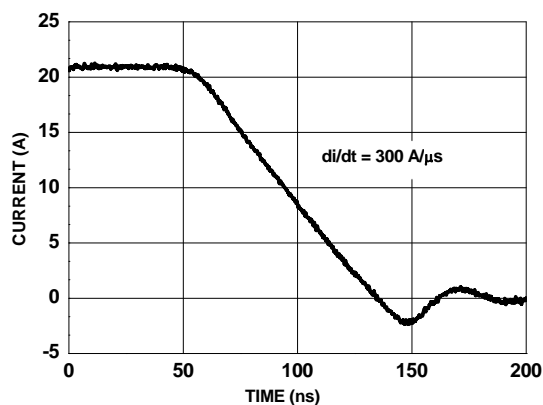


Figure 14. FDMS0309AS SyncFET<sup>™</sup> body diode reverse recovery characteristic

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

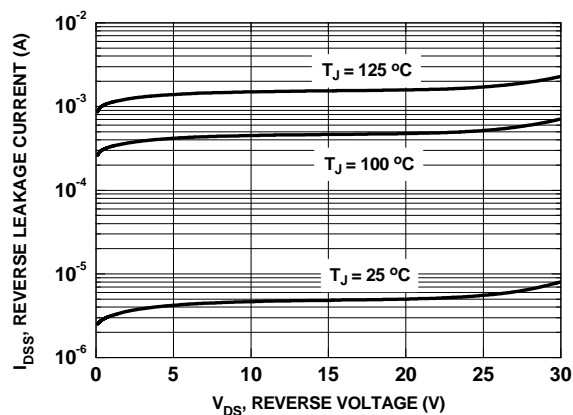
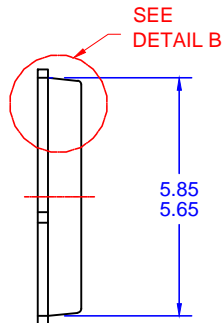


Figure 15. SyncFET<sup>™</sup> body diode reverse leakage versus drain-source voltage

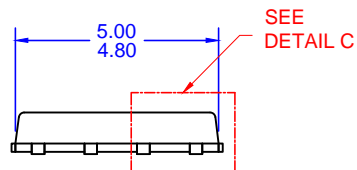
PQFN8 5X6, 1.27P  
CASE 483AE  
ISSUE A



TOP VIEW

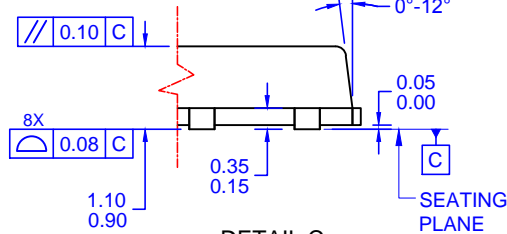


LAND PATTERN  
RECOMMENDATION



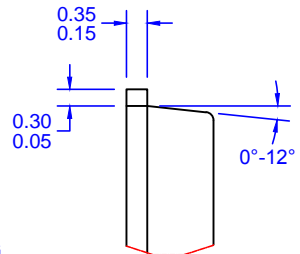
SIDE VIEW

OPTIONAL DRAFT  
ANGLE MAY APPEAR  
ON FOUR SIDES  
OF THE PACKAGE



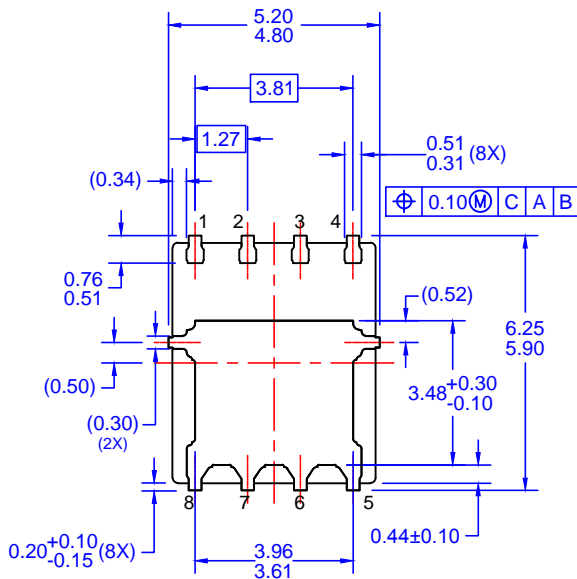
DETAIL C

SCALE: 2:1



DETAIL B

SCALE: 2:1



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

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

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