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# FDMS1D5N03

## N-Channel PowerTrench® MOSFET

30 V, 218 A, 1.15 mΩ

### Features

- Max  $r_{DS(on)}$  = 1.15 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 40 A
- Max  $r_{DS(on)}$  = 1.3 mΩ at  $V_{GS}$  = 4.5 V,  $I_D$  = 37 A
- Advanced Package and Silicon Combination for Low  $r_{DS(on)}$  and High Efficiency
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

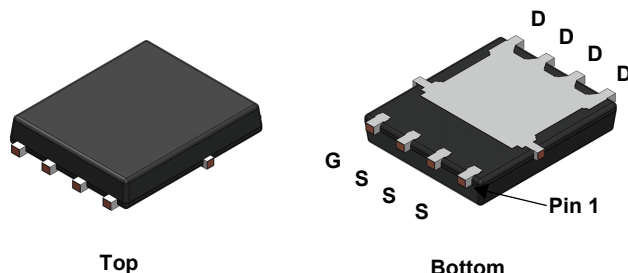


### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency and to minimize switch node ringing of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge and extremely low  $r_{DS(on)}$ .

### Applications

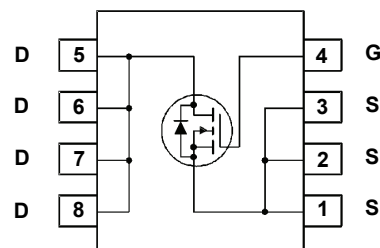
- OringFET
- Synchronous Rectifier



Top

Bottom

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	$\pm 16$	V
$I_D$	Drain Current -Continuous $T_C = 25^\circ\text{C}$ (Note 5)	218	A
	-Continuous $T_C = 100^\circ\text{C}$ (Note 5)	138	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	40	
	-Pulsed (Note 4)	1084	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	600	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	83	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	1.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS1D5N03	FDMS1D5N03	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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		14		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 16\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	0.8	1.1	2.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		-4		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$		0.9	1.15	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 37\text{ A}$		1.0	1.3	
		$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		1.3	1.6	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 40\text{ A}$		320		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		6920	9690	pF
$C_{oss}$	Output Capacitance			1700	2380	pF
$C_{rss}$	Reverse Transfer Capacitance			90	150	pF
$R_g$	Gate Resistance		0.1	0.5	1.5	$\Omega$

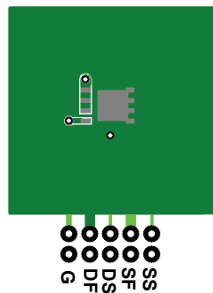
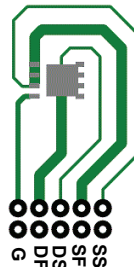
**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		16	29	ns
$t_r$	Rise Time			5	10	ns
$t_{d(off)}$	Turn-Off Delay Time			52	84	ns
$t_f$	Fall Time			4	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$	$V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$	99	139	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$		45	63	nC
$Q_{gs}$	Gate to Source Charge			13		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			7.8		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
		$V_{GS} = 0\text{ V}$ , $I_S = 40\text{ A}$ (Note 2)		0.8	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 40\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		51	82	ns
$Q_{rr}$	Reverse Recovery Charge			39	62	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.a) 50  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copperb) 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 600 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 20\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 63\text{ A}$ 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 &amp; electro-mechanical application board design.

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

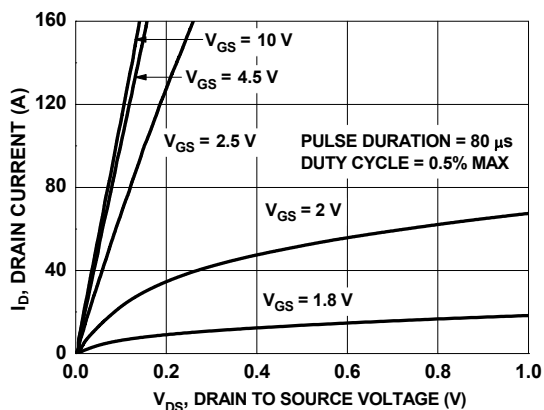


Figure 1. On Region Characteristics

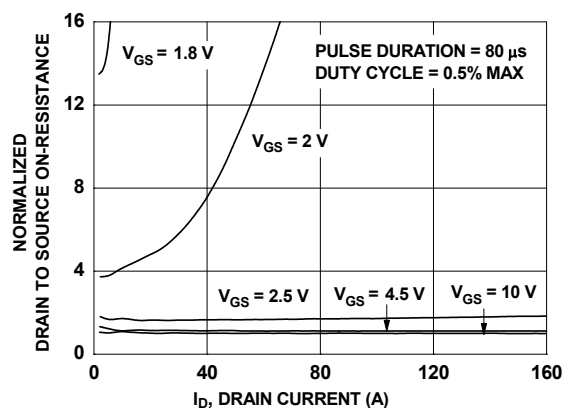


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

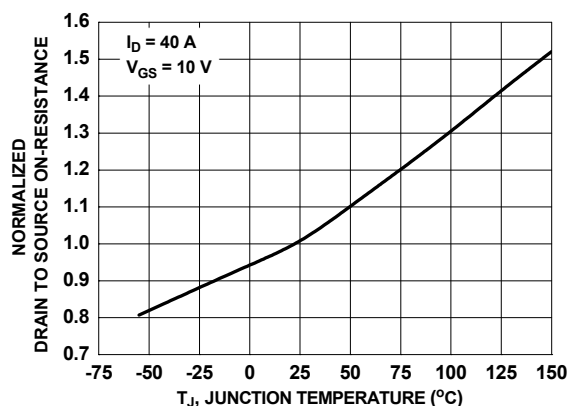


Figure 3. Normalized On Resistance vs. Junction Temperature

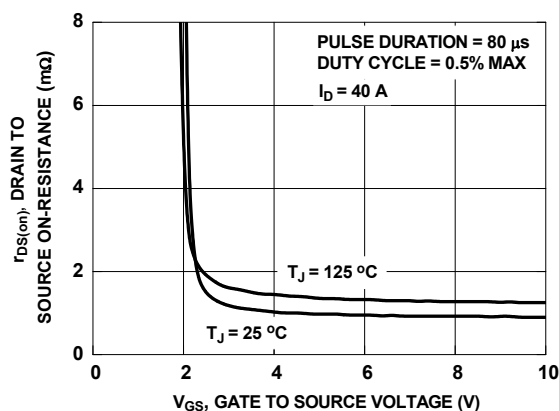


Figure 4. On-Resistance vs. Gate to Source Voltage

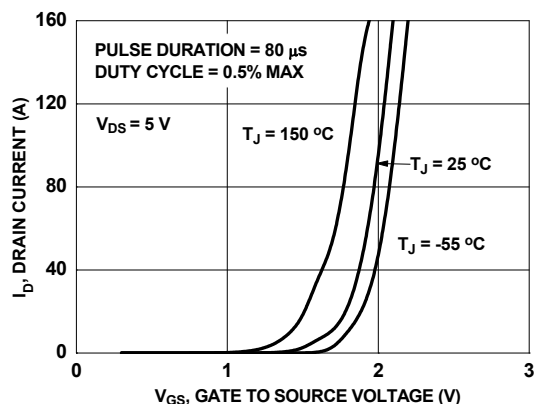


Figure 5. Transfer Characteristics

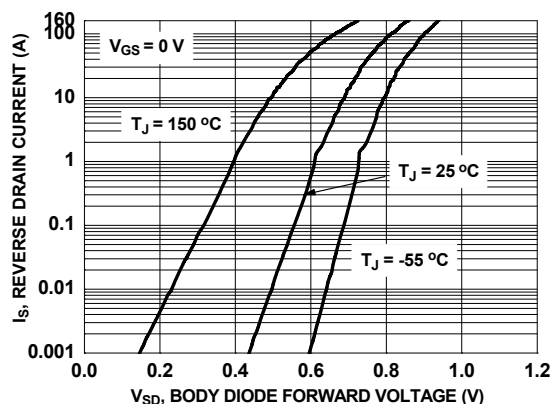


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

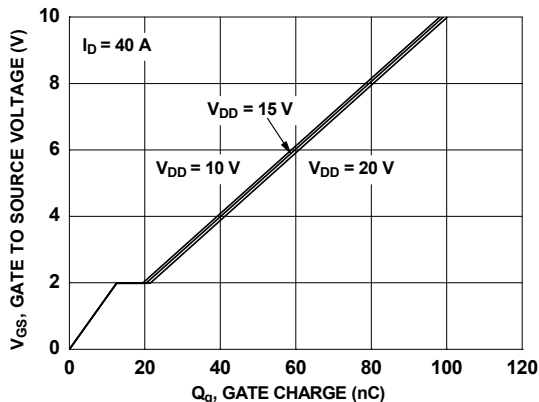


Figure 7. Gate Charge Characteristics

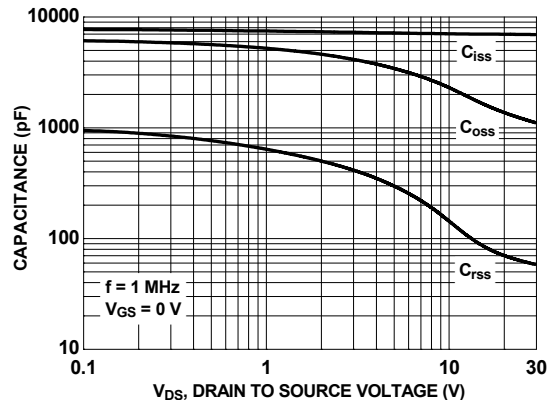


Figure 8. Capacitance vs. Drain to Source Voltage

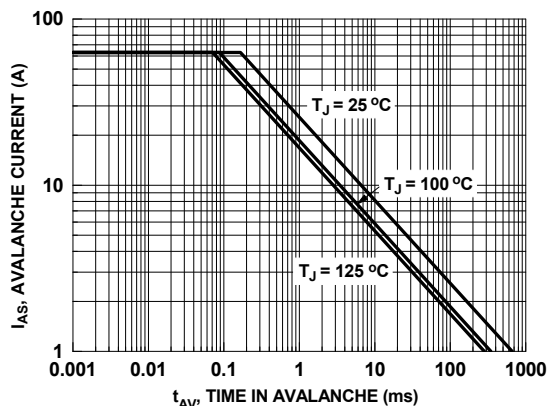


Figure 9. Unclamped Inductive Switching Capability

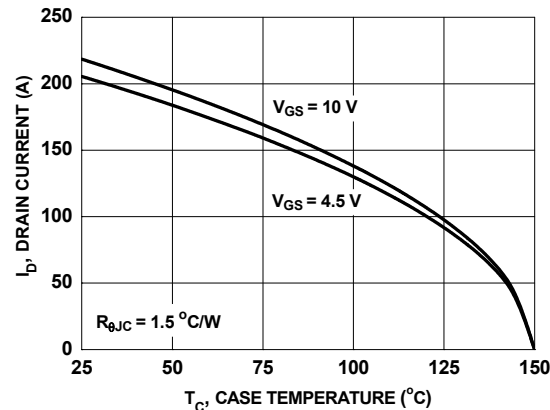


Figure 10. Maximum Continuous Drain Current vs Case Temperature

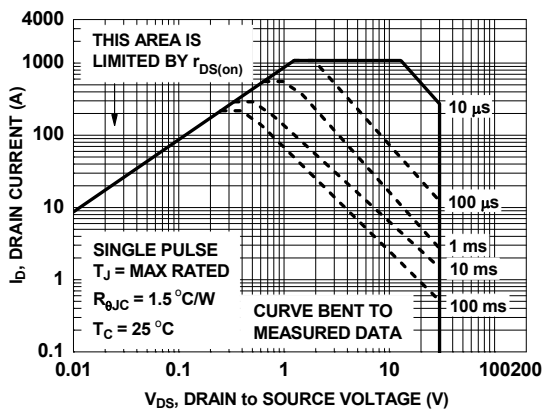


Figure 11. Forward Bias Safe Operating Area

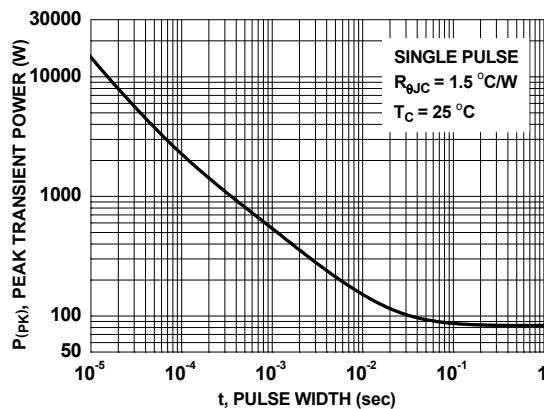


Figure 12. Single Pulse Maximum Power Dissipation

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

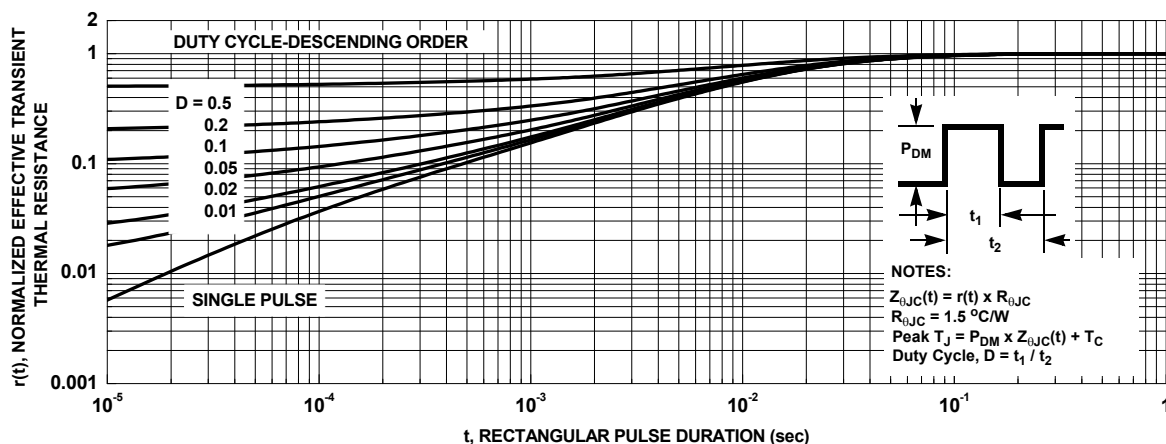
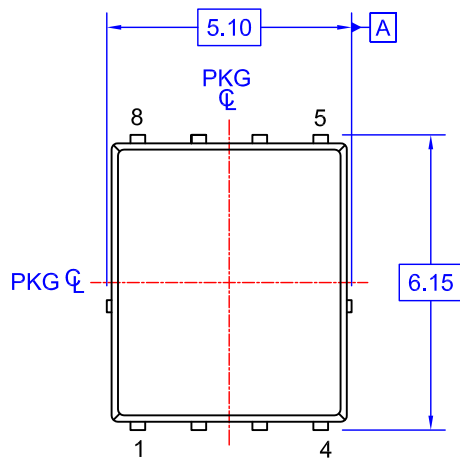
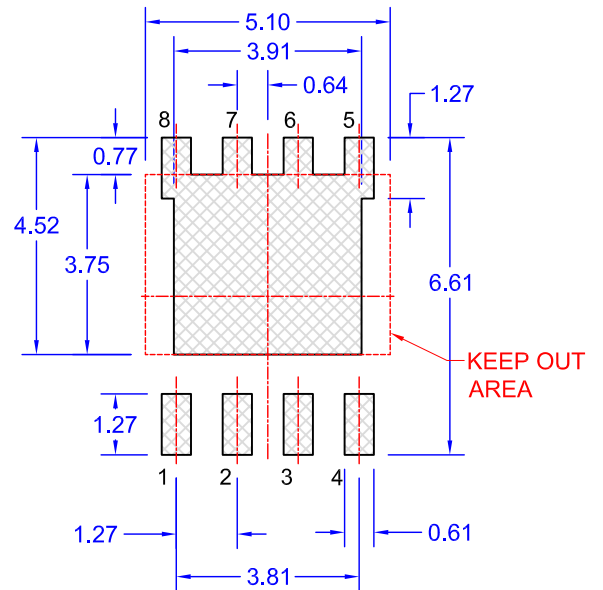
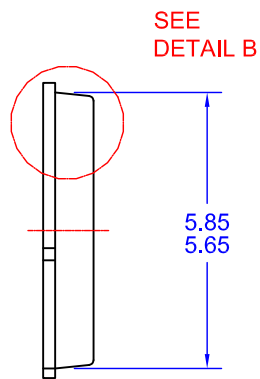


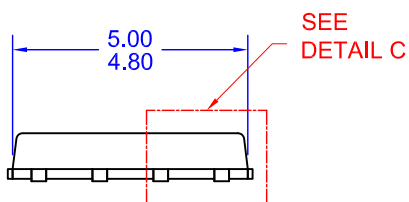
Figure 13. Junction-to-Case Transient Thermal Response Curve



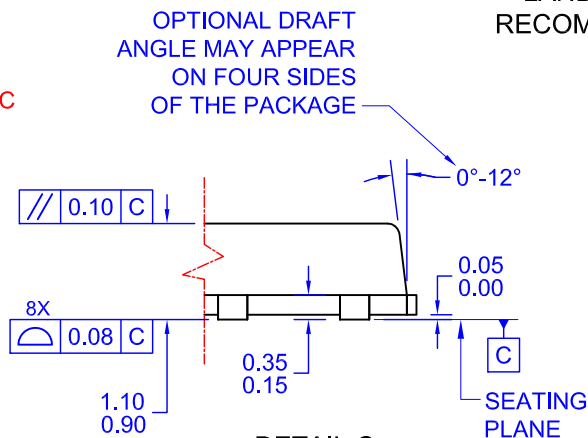
TOP VIEW



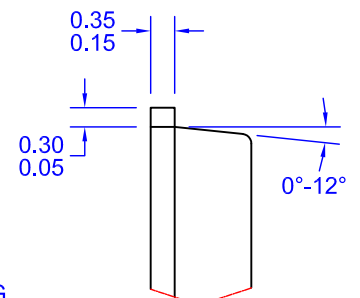
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RECOMMENDATION



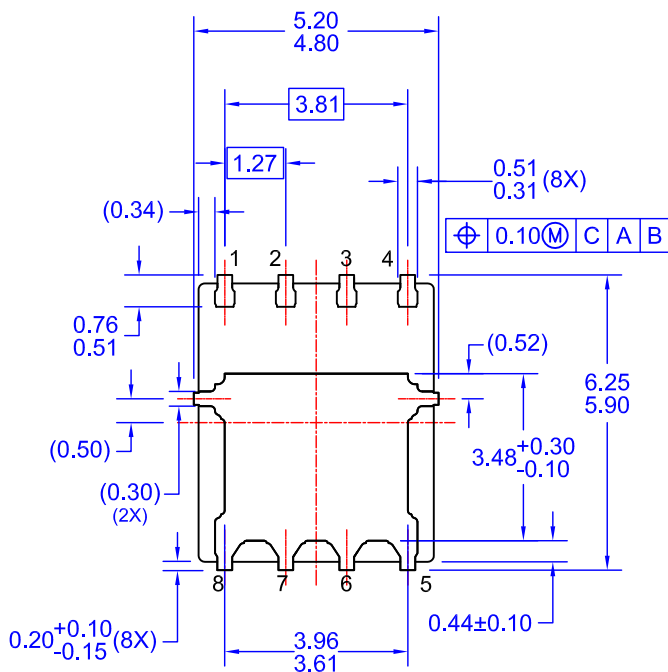
SIDE VIEW



DETAIL C  
SCALE: 2:1



DETAIL B  
SCALE: 2:1



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

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