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FSA2257

Low R_{ON}, Low-Voltage Dual SPDT Bi-Directional Analog Switch

Features

- Maximum 1.15 Ω On Resistance (R_{ON}) at 4.5 V V_{CC}
- 0.3 Ω Maximum R_{ON} Flatness at +5 V V_{CC}
- Space-Saving MicroPak™
- Broad V_{CC} Operating Range: 1.65 V to 5.50 V
- Fast Turn-On and Turn-Off Time
- Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Input

Description

The FSA2257 is a high-performance bi-directional dual Single-Pole/Double-Throw (SPDT) analog switch. This switch can be configured as either a multiplexer or a demultiplexer by select pins. The device features ultra-low R_{ON} of 1.3 Ω maximum at 4.5 V V_{CC} and operates over the wide V_{CC} range of 1.65 V to 5.50 V. The device is fabricated with submicron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL-level compatible.

Applications

- Cell Phone
- PDA
- Mobile Devices

Ordering Information

Part Number	Package Number	Top Mark	Package Description	Packing Method
FSA2257L10X	MAC10A	EP	10-Lead MicroPak™, 1.6 x 2.1 mm	5000 Units Tape and Reel
FSA2257MTCX	MCT14	FSA2257	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4 mm Wide	2500 Units Tape and Reel
FSA2257MUX	MUA10A	FSA2257	10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0 mm	4000 Units Tape and Reel

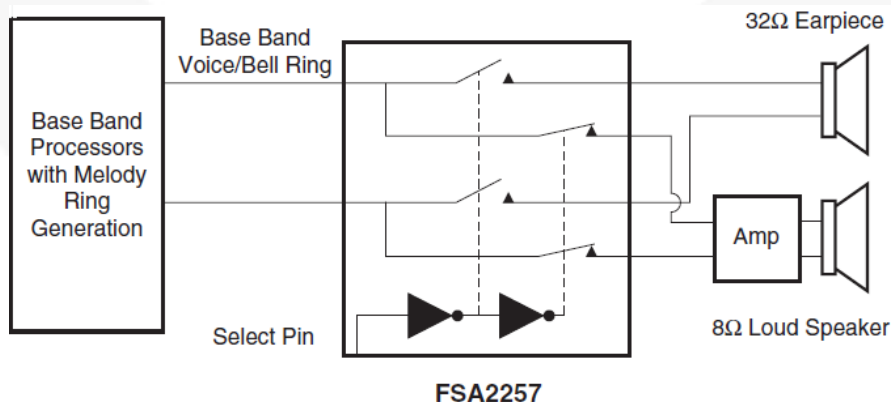


Figure 1. Block Diagram

Pin Configurations

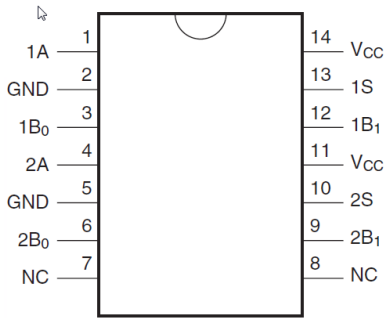


Figure 2. Pin Assignments for TSSOP (Top View)

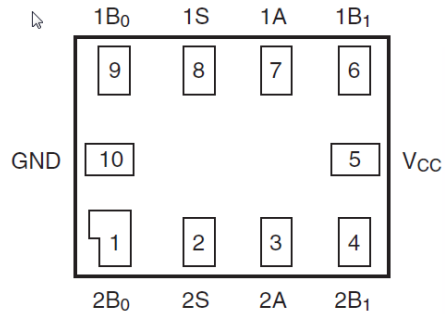


Figure 3. MicroPak™ Pad Assignments (Top View)

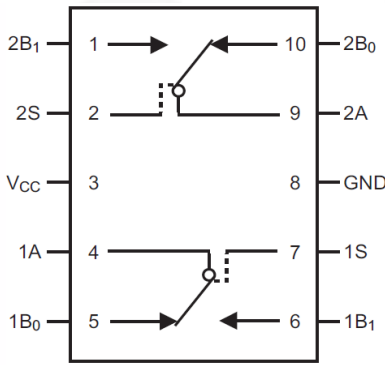


Figure 4. Pin Assignments for MSOP (Top View)

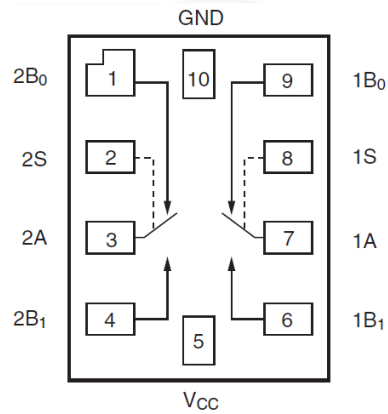


Figure 5. Analog Symbols (Top Through View)

Pin Definitions

Pin# TSSOP	Pin# MicroPak™	Pin # MSOP	Name	Description
1	7	4	1A	Data Ports
2,5	10	8	GND	Ground
3	9	5	1B ₀	Data Ports
4	3	9	2A	Data Ports
6	1	10	2B ₀	Data Ports
7,8			NC	No Connect
9	4	1	2B ₁	Data Ports
10	2	2	2S	Control Inputs
11,14	5	3	V _{CC}	Power Supply
12	6	6	1B ₁	Data Ports
13	8	7	1S	Control Inputs

Truth Table

Control Input (S)	Function
Low Logic Level	B ₀ connected to A
High Logic Level	B ₁ connected to A

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V _{CC}	Supply Voltage	-0.5	6.0	V
V _{SW}	DC Switch Voltage ⁽¹⁾	-0.5	V _{CC} + 0.5	V
V _{IN}	DC Input Voltage ⁽¹⁾	-0.5	6.0	V
I _{IK}	Input Diode Current	-50		mA
	Switch Current		200	
	Peak Switch Current (Pulsed at 1 ms duration, <10% duty cycle)		400	
T _{STG}	Storage Temperature Range	-65	+150	°C
T _J	Maximum Junction Temperature		+150	°C
T _L	Lead Temperature (Soldering, 10 seconds)		+260	°C
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	8000	V
		Charged Device Model, JESD22-C101	2000	

Note:

1. Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
V _{CC}	Supply Voltage	1.65	5.50	V
V _{CNTRL}	Control Input Voltage ⁽²⁾	0	V _{CC}	V
V _{SW}	Switch Input Voltage	0	V _{CC}	V
T _A	Operating Temperature	-40	+85	°C

Note:

2. Unused control input must be held HIGH or LOW and it must not float.

DC Electrical Characteristics

Typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V _{CC} (V)	T _A =+25°C			T _A =-40°C to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
V _{IH}	Input Voltage High		1.8 to 2.7				1.0		V
			2.7 to 3.6				2.0		
			4.5 to 5.5				2.4		
V _{IL}	Input Voltage Low		1.8 to 2.7					0.4	V
			2.7 to 3.6					0.6	
			4.5 to 5.5					0.8	
I _{IN}	Control Input Leakage	V _{IN} =0 V to V _{CC}	2.7 to 3.6				-1.0	1.0	μA
			4.5 to 5.5				-1.0	1.0	
I _{NO(OFF)} , I _{NC(OFF)}	Off Leakage Current of Port B ₀ and B ₁	A=1 V, 4.5 V, B ₀ or B ₁ =1 V, 4.5 V	5.5	-2		2	-20	20	nA
I _{A(ON)}	On Leakage Current of Port A	A=1 V, 4.5V, B ₀ or B ₁ =1 V, 4.5 V or Floating	5.5	-4		2	-40	40	nA
R _{ON}	Switch On Resistance MicroPak ⁽³⁾	I _{OUT} =100 mA, B ₀ or B ₁ =1.5 V	1.8		4.6				Ω
			2.7		2.6	4.0		4.3	
	Switch On Resistance MSOP/TSSOP ⁽³⁾	I _{OUT} =100 mA, B ₀ or B ₁ =3.5 V	4.5		0.95	1.15		1.30	
			2.7		2.8			4.5	
ΔR _{ON}	On Resistance Matching Between Channels MicroPak ⁽⁴⁾	I _{OUT} =100 mA, B ₀ or B ₁ =3.5 V	4.5		0.06	0.12		0.15	Ω
			4.5		0.7			0.3	
R _{FLAT(ON)}	On Resistance Flatness ⁽⁵⁾	I _{OUT} =100 mA, B ₀ or B ₁ =0 V, 0.75 V, 1.5 V	1.8		3.0				Ω
			2.7		1.4				
		I _{OUT} =100 mA, B ₀ or B ₁ =0 V, 1 V, 2 V	4.5		0.2	0.3		0.4	
I _{CC}	Quiescent Supply Current	V _{IN} =0 V or V _{CC} , I _{OUT} =0 V	3.6		0.1	0.5		1.0	μA
			5.5		0.1	0.5		1.0	

Notes:

3. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
4. ΔR_{ON} = R_{ONmax} – R_{ONmin} measured at identical V_{CC}, temperature, and voltage.
5. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

AC Electrical Characteristics

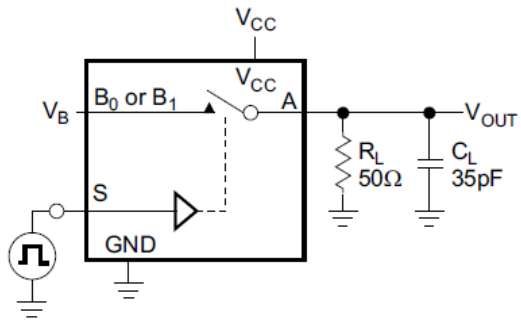
Typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V _{CC} (V)	T _A =+25°C			T _A =-40°C to +85°C		Unit	Figure
				Min.	Typ.	Max.	Min.	Max.		
t _{ON}	Turn-On Time	B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF	1.8 to 2.7		75				ns	Figure 6
			2.7 to 3.6			50		60		
		B ₀ or B ₁ =3.0 V, R _L =50 Ω, C _L =35 pF	4.5 to 5.5			35		40		
t _{OFF}	Turn-Off Time	B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF	1.8 to 2.7		20			ns	Figure 6	
			2.7 to 3.6			20				30
		B ₀ or B ₁ =3.0 V, R _L =50 Ω, C _L =35 pF	4.5 to 5.5			15				20
t _{BBM}	Break-Before-Make Time	B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF	2.7 to 3.6				1	ns	Figure 7	
			4.5 to 5.5		20		1			
Q	Charge Injection	C _L =1.0 nF, V _{GEN} =0 V, R _{GEN} =0 Ω	2.7 to 3.6		20			pC	Figure 9	
			4.5 to 5.5		10					
OIRR	Off Isolation	f=1 MHz, R _L =50 Ω	2.7 to 3.6		-70			dB	Figure 8	
			4.5 to 5.5		-70					
Xtalk	Crosstalk	f=1 MHz, R _L =50 Ω	2.7 to 3.6		-75			dB	Figure 8	
			4.5 to 5.5		-75					
BW	-3 db Bandwidth	R _L =50 Ω	2.7 to 3.6		200			MHz	Figure 11	
			4.5 to 5.5		200					
THD	Total Harmonic Distortion	R _L =600 Ω, V _{IN} =0.5 V _{PP} f=20 Hz to 20 kHz	2.7 to 3.6		0.002			%	Figure 12	
			4.5 to 5.5		0.002					

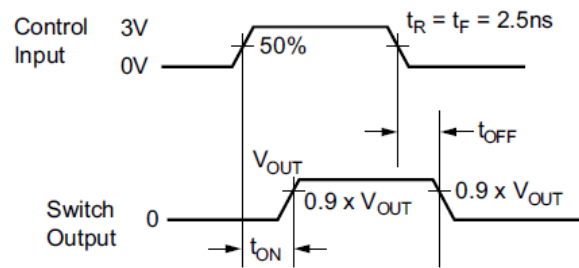
Capacitance

Symbol	Parameter	Conditions	V _{CC} (V)	T _A =+25°C			Unit	Figure
				Min.	Typ.	Max.		
C _{IN}	Control Pin Input Capacitance	f=1 MHz	0		3.5		pF	Figure 10
C _{OFF}	B Port Off Capacitance	f=1 MHz	4.5		12.0		pF	Figure 10
C _{ON}	A Port On Capacitance	f=1 MHz	4.5		40.0		pF	Figure 10

AC Loadings and Waveforms

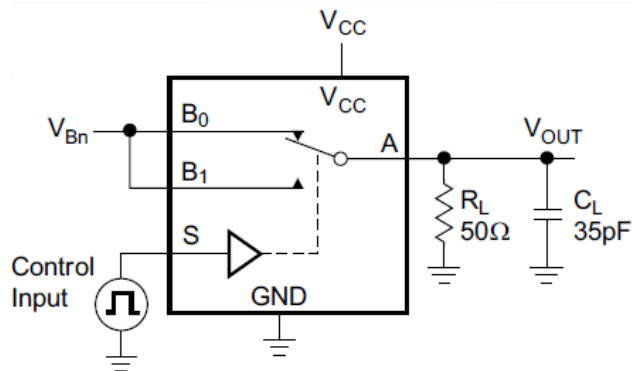


C_L Includes Fixture and Stray Capacitance



Logic Input Waveforms Inverted for Switches that have the Opposite Logic Sense

Figure 6. Turn On / Off Timing



C_L Includes Fixture and Stray Capacitance

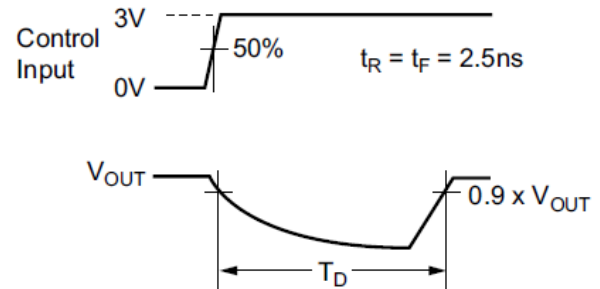
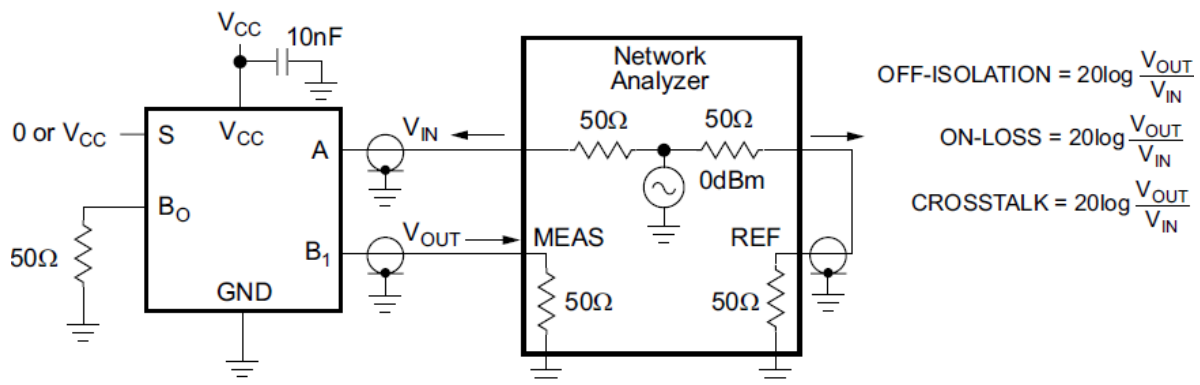


Figure 7. Break Before Make Timing



$$\text{OFF-ISOLATION} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

$$\text{ON-LOSS} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

$$\text{CROSSTALK} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

Figure 8. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

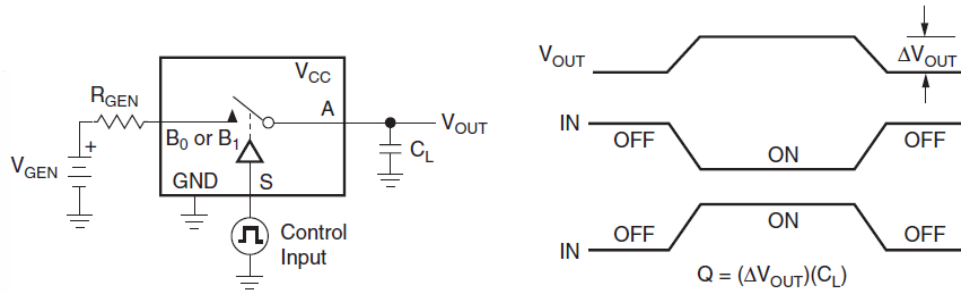


Figure 9. Charge Injection

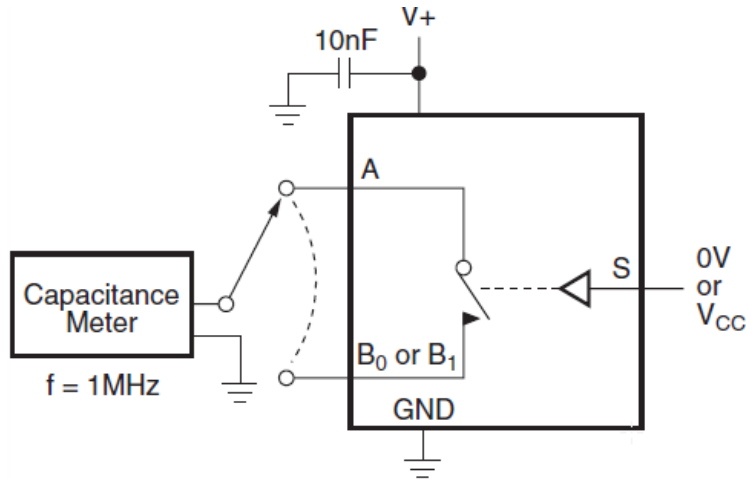


Figure 10. On / Off Capacitance Measurement Setup

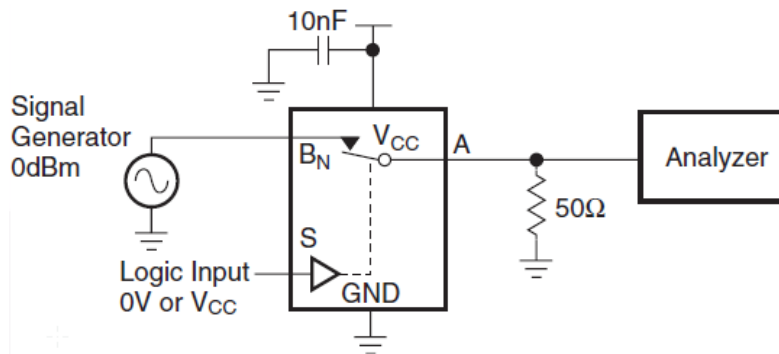


Figure 11. Bandwidth

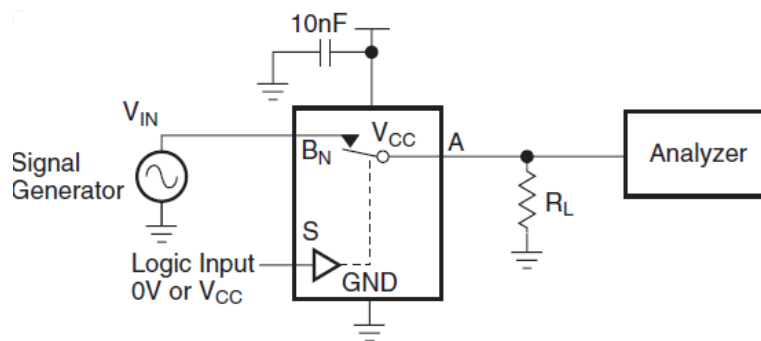
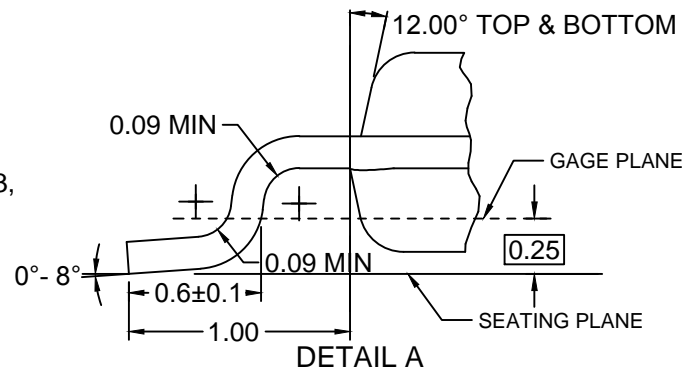
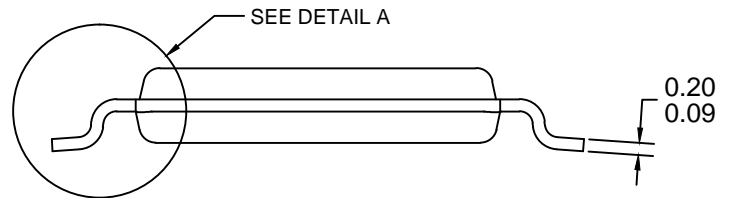
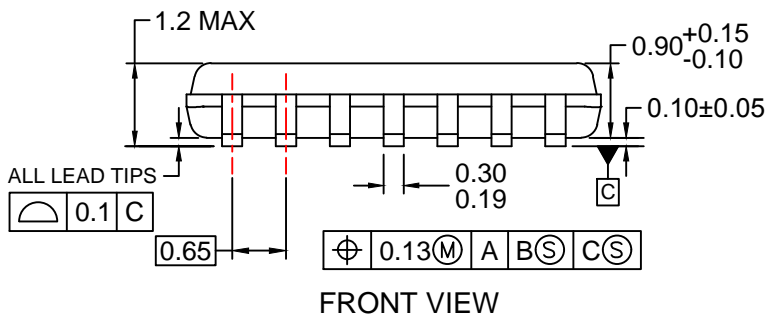
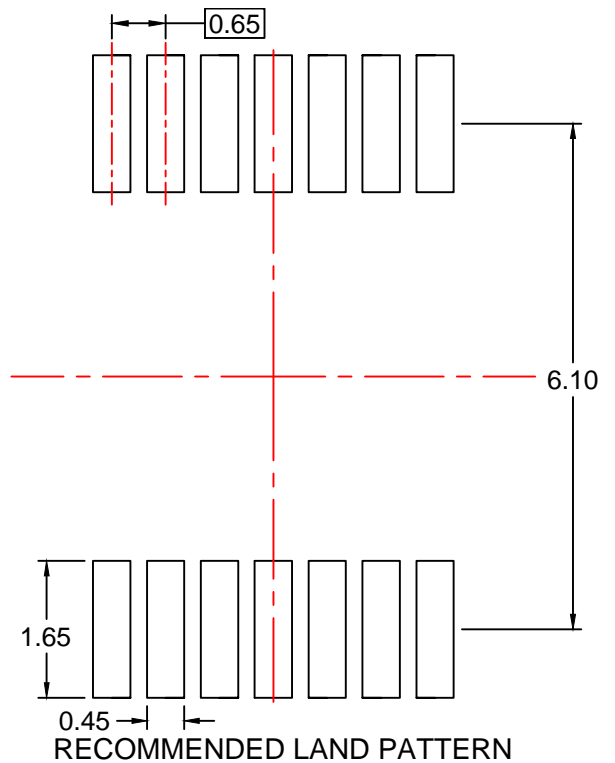
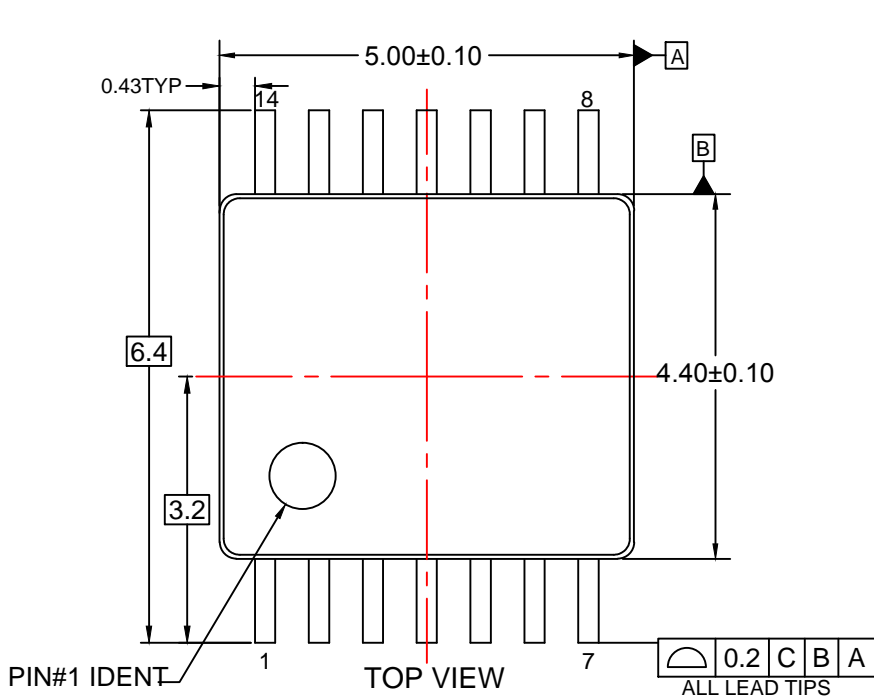


Figure 12. Harmonic Distortion



NOTES:

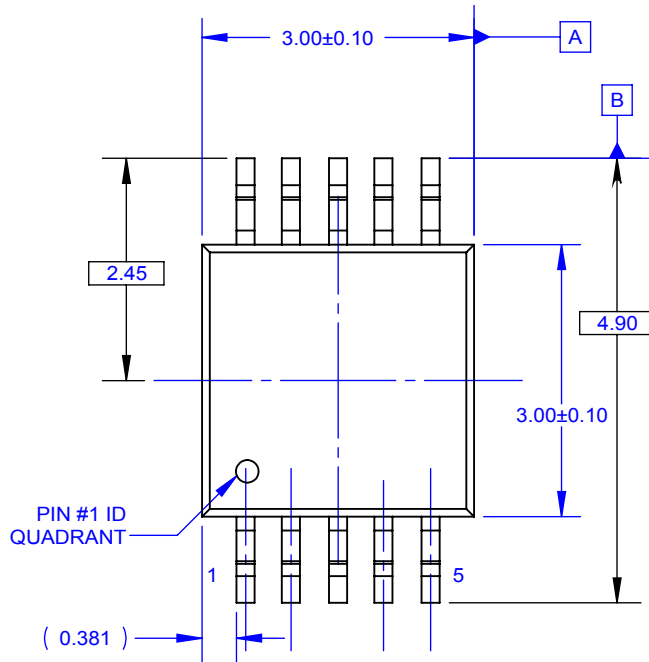
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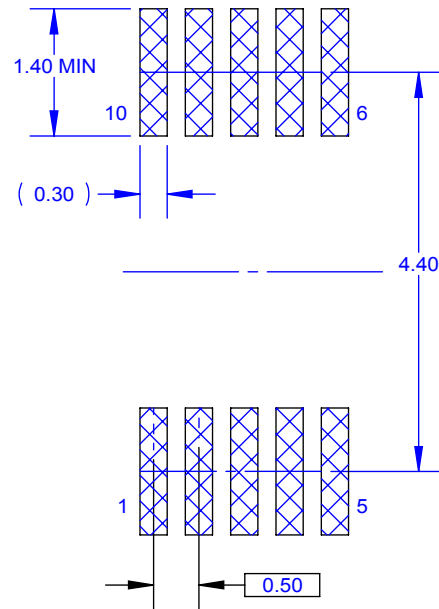
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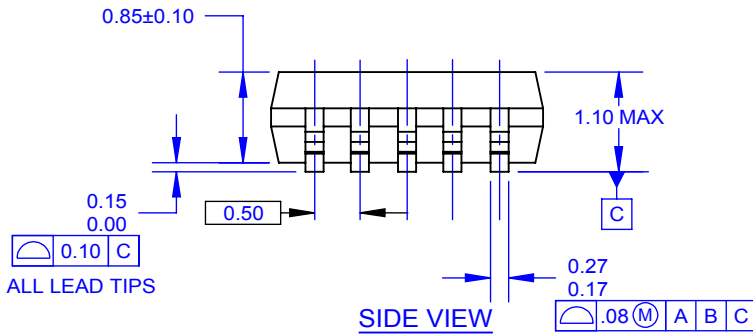
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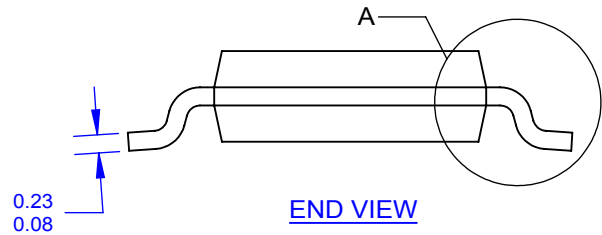
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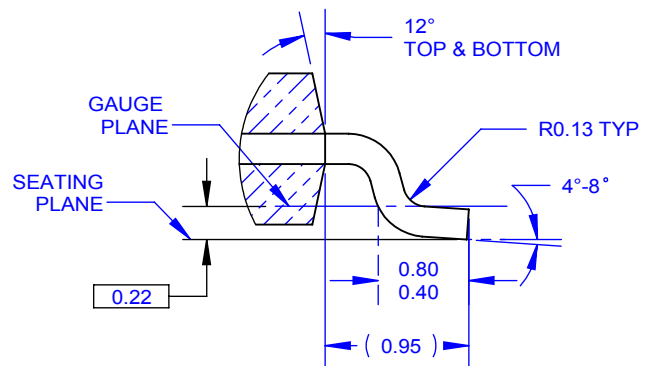
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SIDE VIEW



END VIEW

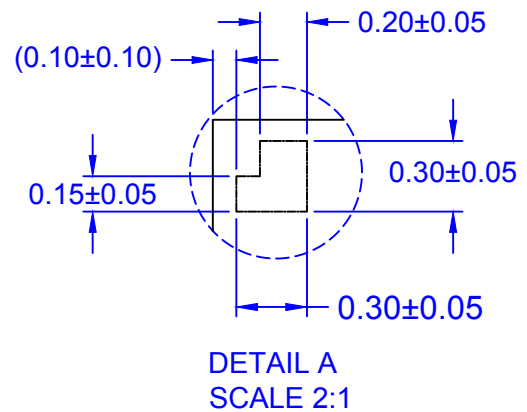
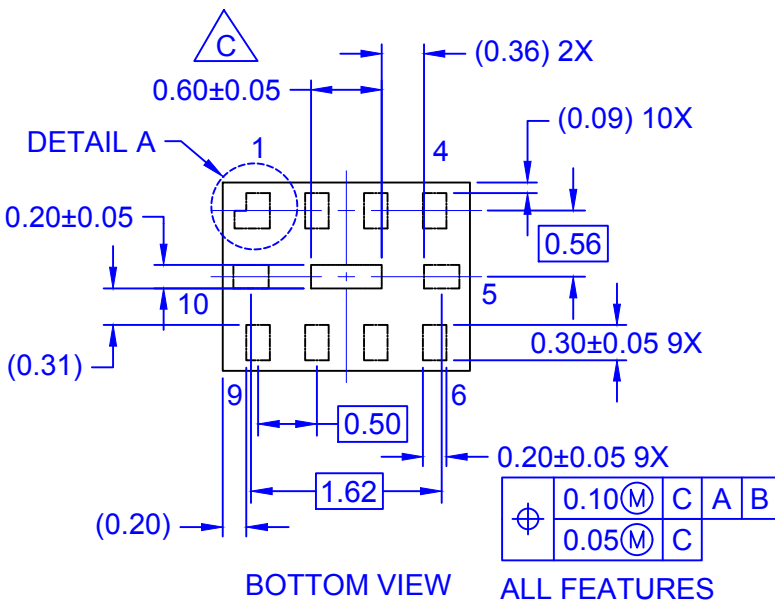
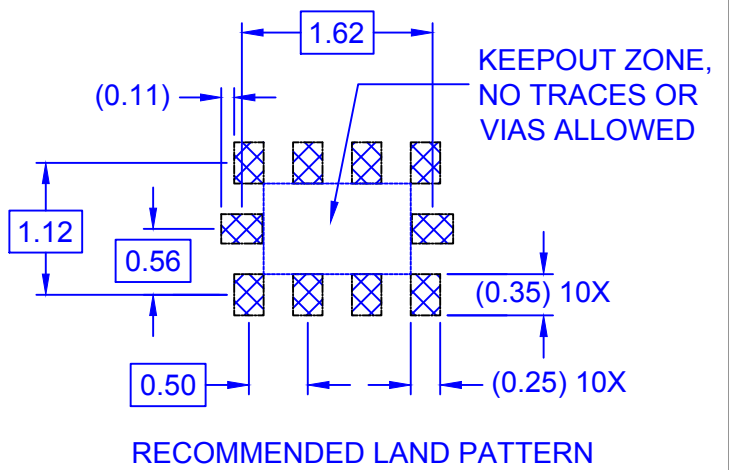
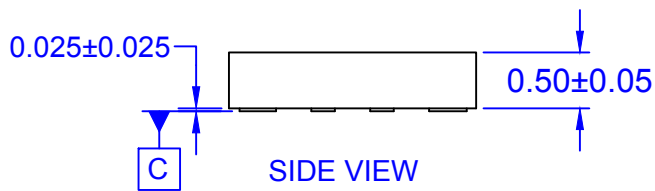
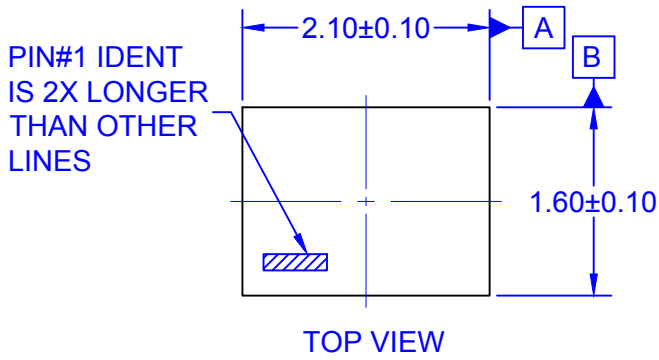


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