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# FSA2257

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

### Features

- Maximum 1.15  $\Omega$  On Resistance ( $R_{ON}$ ) at 4.5 V  $V_{CC}$
- 0.3  $\Omega$  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

### Applications

- Cell Phone
- PDA
- Mobile Devices

### 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 de-multiplexer by select pins. The device features ultra-low  $R_{ON}$  of 1.3  $\Omega$  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.

### 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	FSA 2257	10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0 mm	4000 Units Tape and Reel

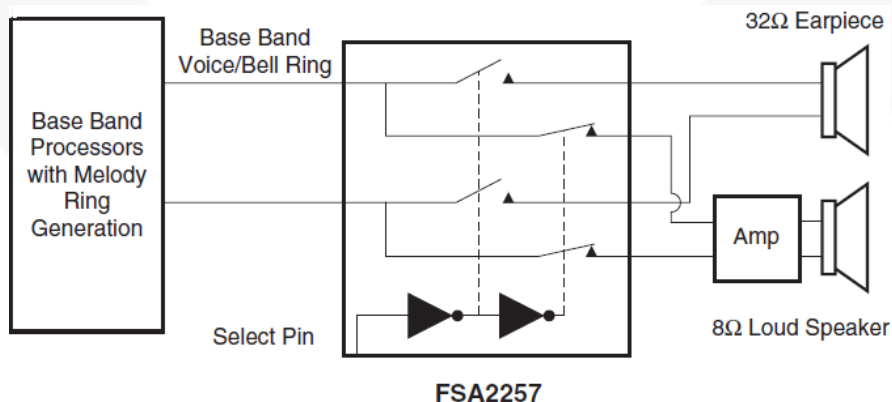


Figure 1. Block Diagram

## Pin Configurations

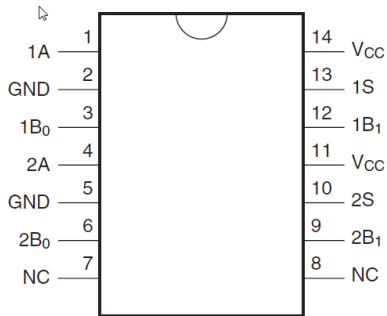


Figure 2. Pin Assignments for TSSOP (Top View)

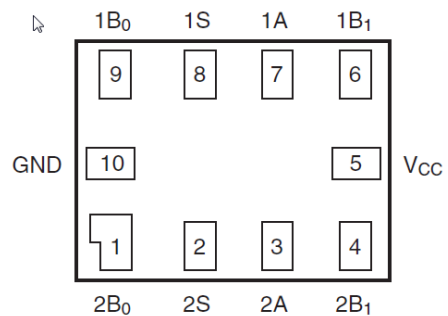


Figure 3. MicroPak™ Pad Assignments (Top View)

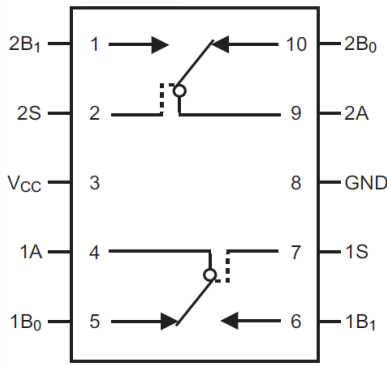


Figure 4. Pin Assignments for MSOP (Top View)

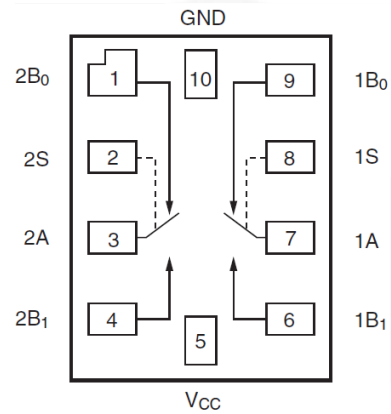


Figure 5. Analog Symbols (Top Through View)

## 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 <sub>0</sub>	Data Ports
4	3	9	2A	Data Ports
6	1	10	2B <sub>0</sub>	Data Ports
7,8			NC	No Connect
9	4	1	2B <sub>1</sub>	Data Ports
10	2	2	2S	Control Inputs
11,14	5	3	V <sub>CC</sub>	Power Supply
12	6	6	1B <sub>1</sub>	Data Ports
13	8	7	1S	Control Inputs

## Truth Table

Control Input (S)	Function
Low Logic Level	B <sub>0</sub> connected to A
High Logic Level	B <sub>1</sub> 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 <sub>CC</sub>	Supply Voltage		-0.5	6.0	V
V <sub>SW</sub>	DC Switch Voltage <sup>(1)</sup>		-0.5	V <sub>CC</sub> + 0.5	V
V <sub>IN</sub>	DC Input Voltage <sup>(1)</sup>		-0.5	6.0	V
I <sub>IK</sub>	Input Diode Current		-50		mA
	Switch Current			200	
	Peak Switch Current (Pulsed at 1 ms duration, <10% duty cycle)			400	
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
T <sub>J</sub>	Maximum Junction Temperature			+150	°C
T <sub>L</sub>	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 <sub>CC</sub>	Supply Voltage	1.65	5.50	V
V <sub>CNTRL</sub>	Control Input Voltage <sup>(2)</sup>	0	V <sub>CC</sub>	V
V <sub>SW</sub>	Switch Input Voltage	0	V <sub>CC</sub>	V
T <sub>A</sub>	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	$V_{CC}(V)$	$T_A=+25^{\circ}C$			$T_A=-40^{\circ}C$ to $+85^{\circ}C$		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	$V_{IN}=0\text{ V to }V_{CC}$	2.7 to 3.6				-1.0	1.0	$\mu A$
			4.5 to 5.5				-1.0	1.0	
$I_{NO(OFF)}, I_{NC(OFF)}$	Off Leakage Current of Port B <sub>0</sub> and B <sub>1</sub>	A=1 V, 4.5 V, B <sub>0</sub> or B <sub>1</sub> =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 <sub>0</sub> or B <sub>1</sub> =1 V, 4.5 V or Floating	5.5	-4		2	-40	40	nA
$R_{ON}$	Switch On Resistance MicroPak <sup>(3)</sup>	$I_{OUT}=100\text{ mA}$ , B <sub>0</sub> or B <sub>1</sub> =1.5 V	1.8		4.6				$\Omega$
			2.7		2.6	4.0		4.3	
	Switch On Resistance MSOP/TSSOP <sup>(3)</sup>	$I_{OUT}=100\text{ mA}$ , B <sub>0</sub> or B <sub>1</sub> =3.5 V	4.5		0.95	1.15		1.30	
$\Delta R_{ON}$	On Resistance Matching Between Channels MicroPak <sup>(4)</sup>	$I_{OUT}=100\text{ mA}$ , B <sub>0</sub> or B <sub>1</sub> =3.5 V	4.5		0.06	0.12		0.15	$\Omega$
	On Resistance Matching Between Channels MSOP / TSSOP <sup>(4)</sup>		4.5		0.7			0.3	
$R_{FLAT(ON)}$	On Resistance Flatness <sup>(5)</sup>	$I_{OUT}=100\text{ mA}$ , B <sub>0</sub> or B <sub>1</sub> =0 V, 0.75 V, 1.5 V	1.8		3.0				$\Omega$
			2.7		1.4				
		$I_{OUT}=100\text{ mA}$ , B <sub>0</sub> or B <sub>1</sub> =0 V, 1 V, 2 V	4.5		0.2	0.3		0.4	
$I_{CC}$	Quiescent Supply Current	$V_{IN}=0\text{ V or }V_{CC}$ , $I_{OUT}=0\text{ V}$	3.6		0.1	0.5		1.0	$\mu A$
			5.5		0.1	0.5		1.0	

### Notes:

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

## AC Electrical Characteristics

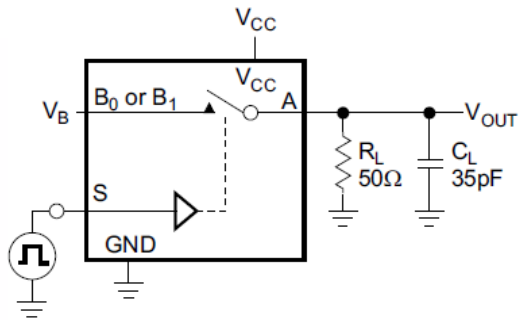
Typical values are at 25°C unless otherwise specified.

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

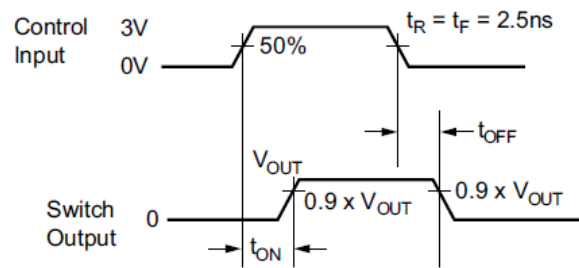
## Capacitance

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

## AC Loadings and Waveforms

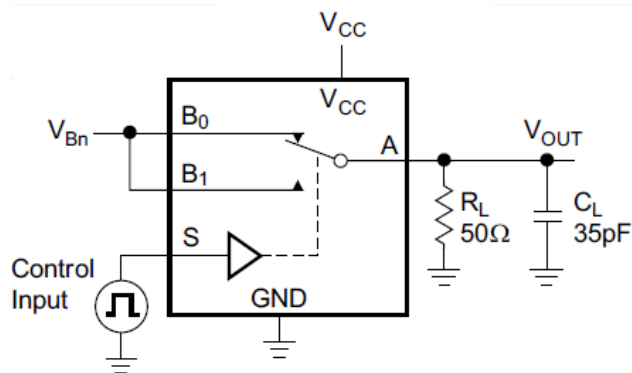


$C_L$  Includes Fixture and Stray Capacitance



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

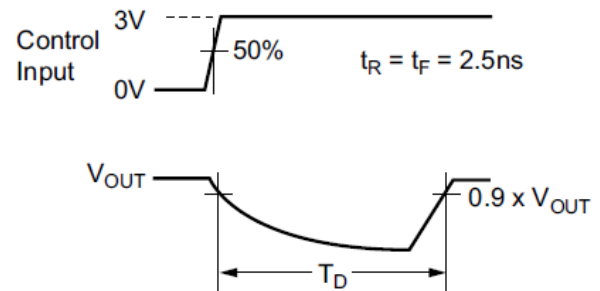


Figure 7. Break Before Make Timing

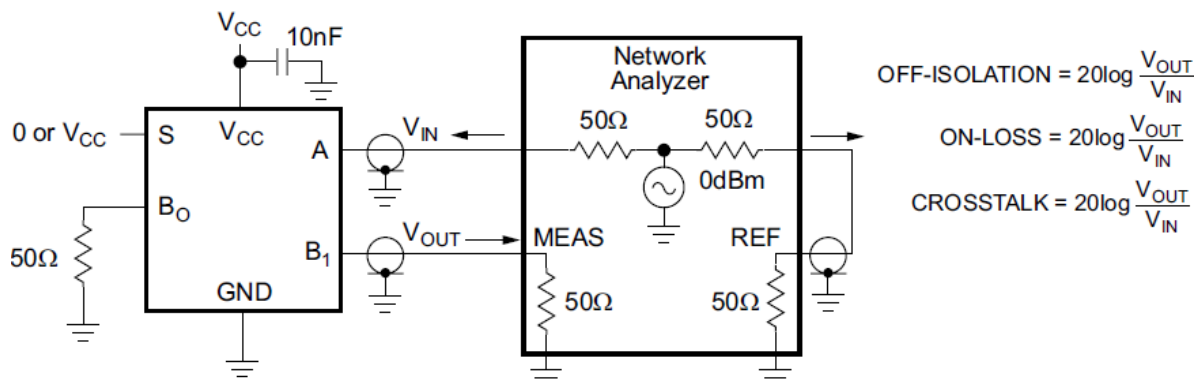


Figure 8. Off Isolation and Crosstalk

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

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

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

## AC Loadings and Waveforms (Continued)

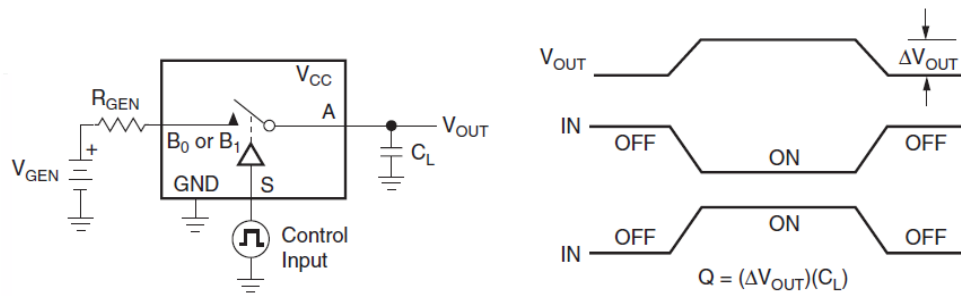


Figure 9. Charge Injection

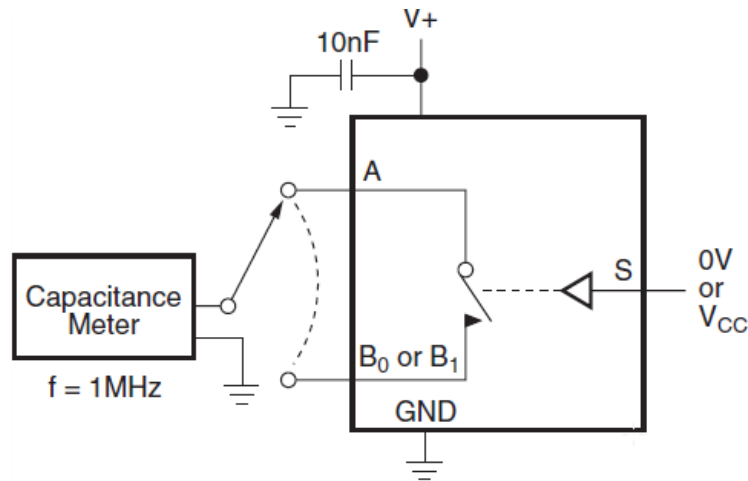


Figure 10. On / Off Capacitance Measurement Setup

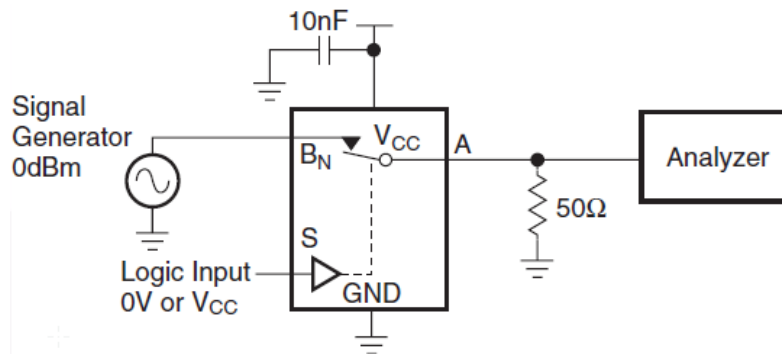


Figure 11. Bandwidth

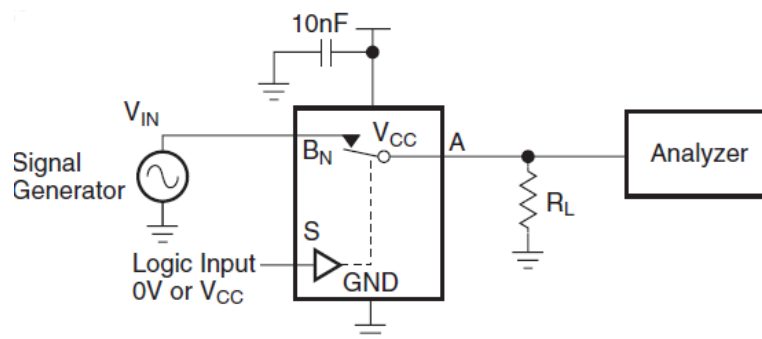
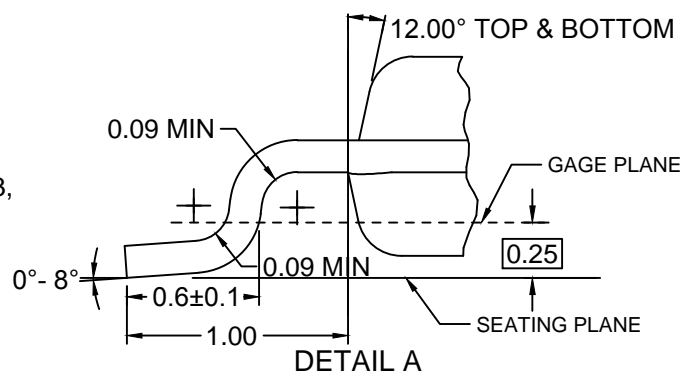
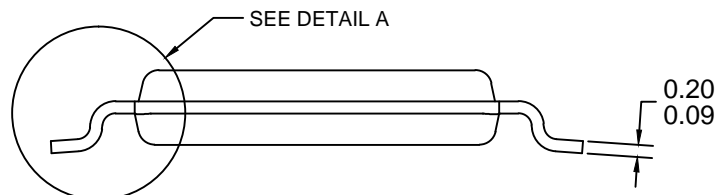
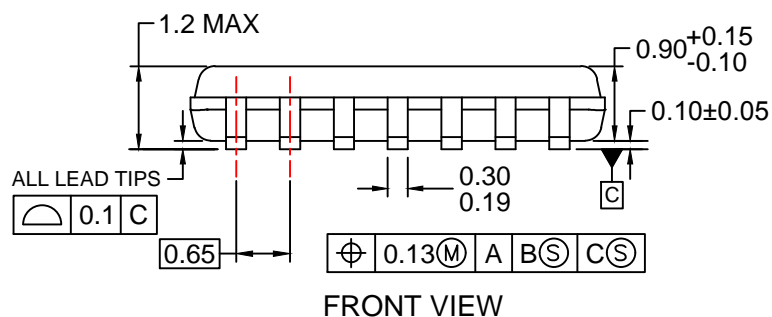
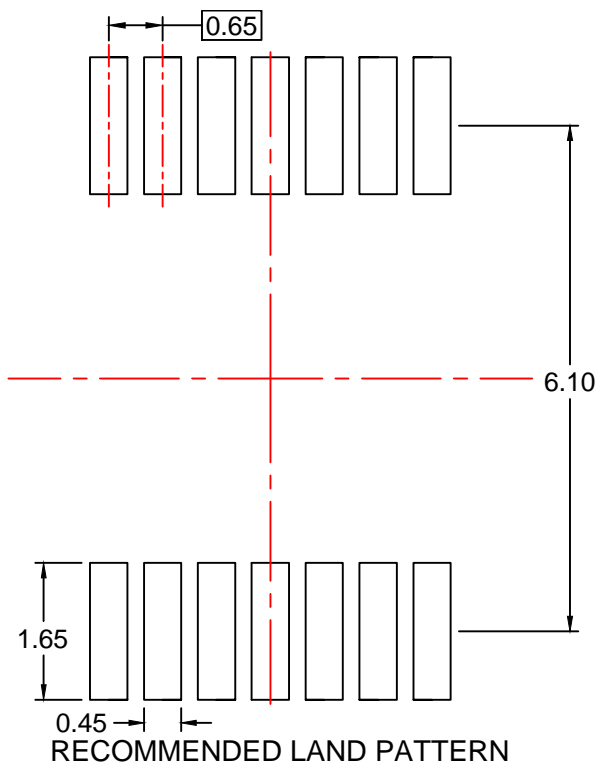
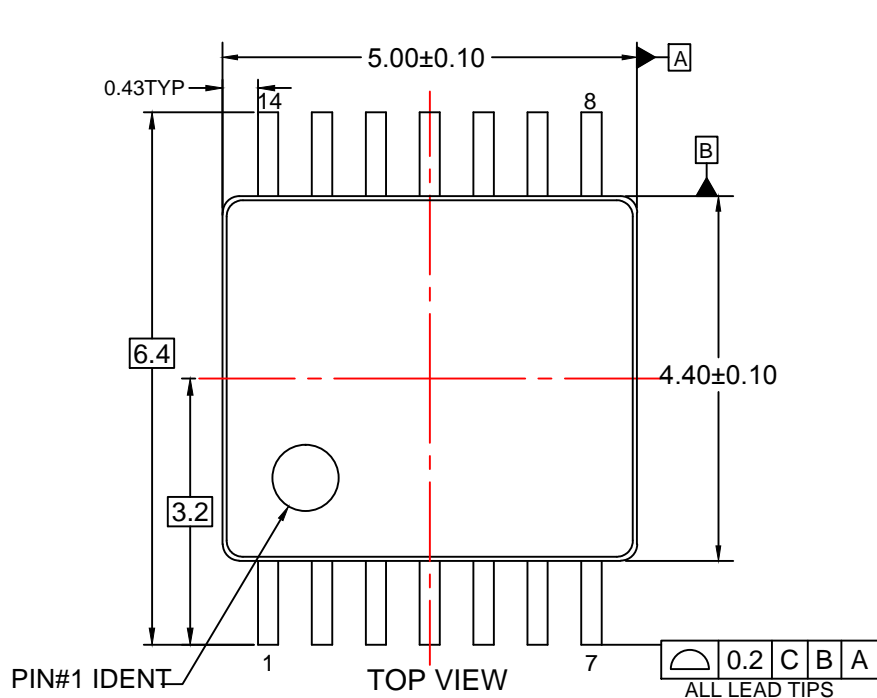


Figure 12. Harmonic Distortion





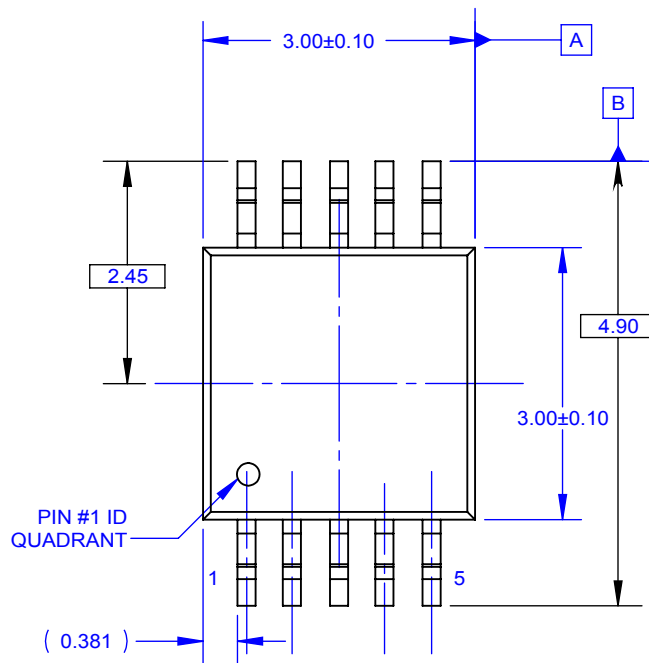
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- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
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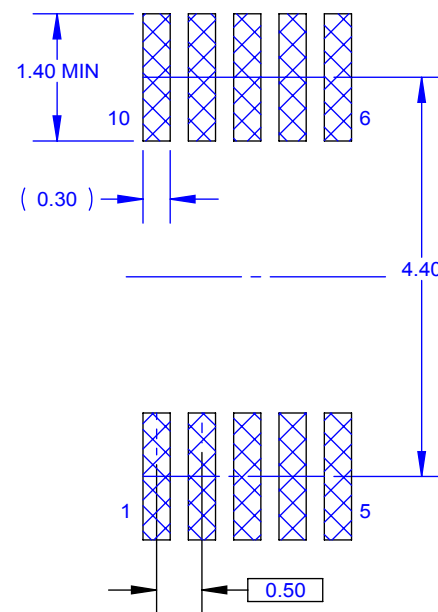


## REVISIONS

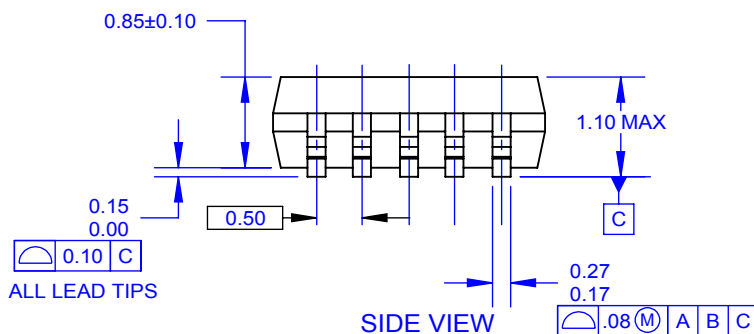
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3	* REVERT LEAD WIDTH TO 0.27MAX.	24SEP2009	KHLEE/FSSZ



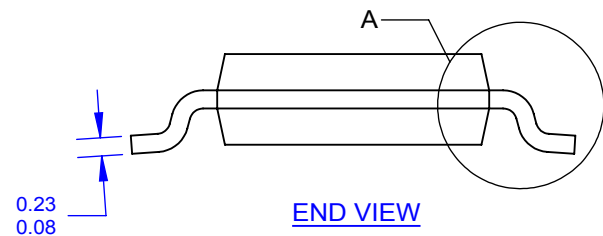
TOP VIEW



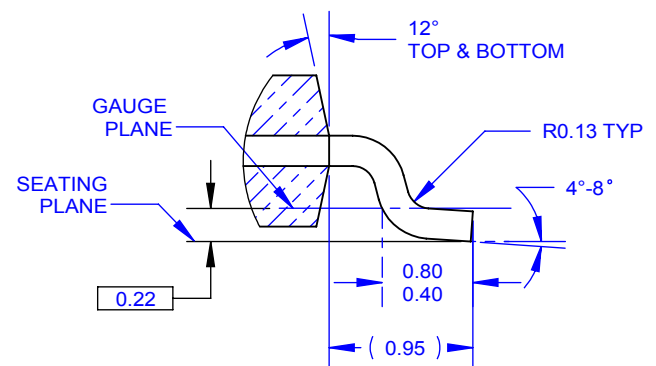
LAND PATTERN RECOMMENDATION



SIDE VIEW



END VIEW

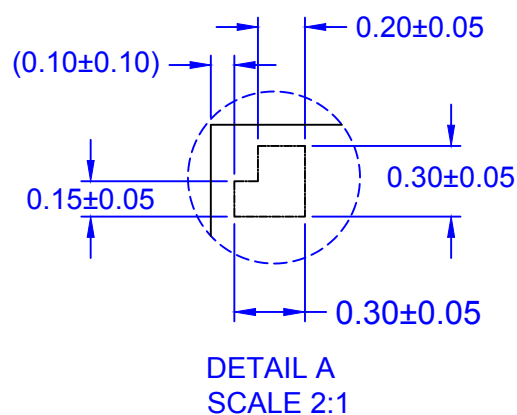
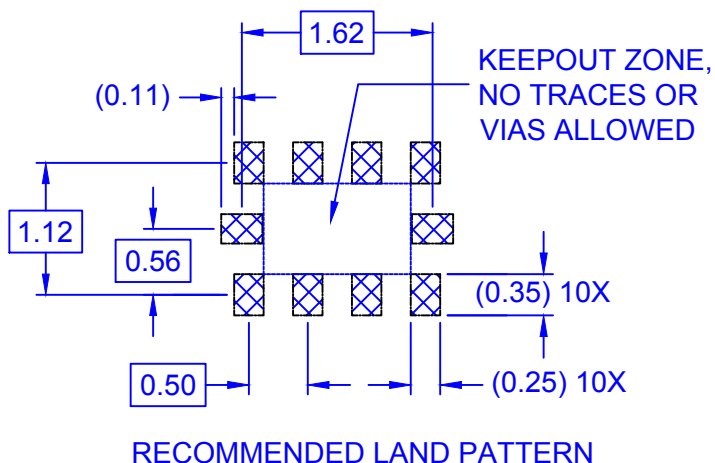
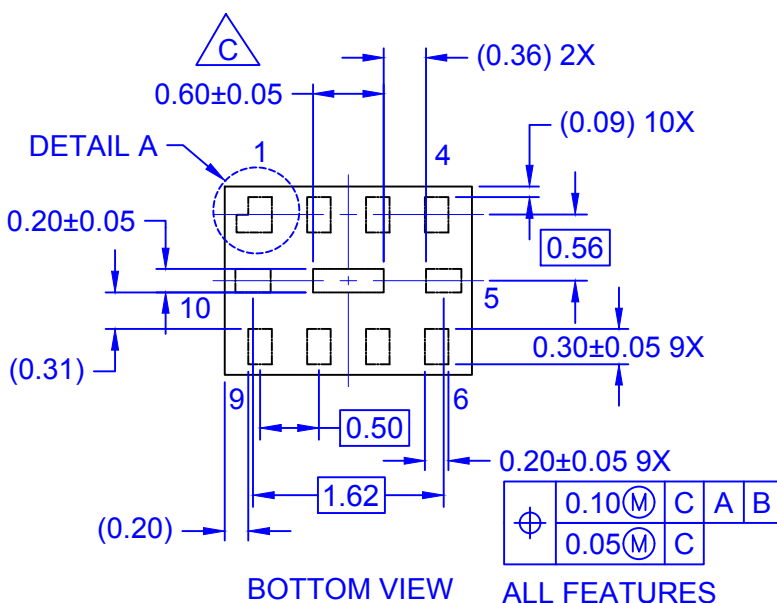
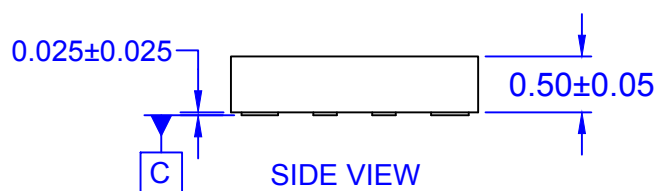
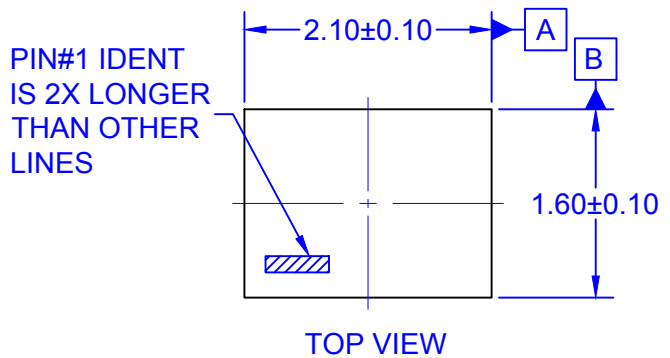


DETAIL A  
SCALE 20 : 1

### NOTES: UNLESS OTHERWISE SPECIFIED

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- DIMENSIONS AND TOLERANCES AS PER ASME Y14.5-1994.
- LAND PATTERN AS PER IPC7351#SOP50P490X110-10AN
- FILE NAME: MKT-MUA10AREV3

APPROVALS	DATE				
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CHECKED: KH LEE		10LD, MSOP, JEDEC MO-187, 3.0MM WIDE			
APPROVED: BY HUANG					
APPROVED: HOWARD ALLEN					
PROJECTION		SCALE 1:1	SIZE N/A	DRAWING NUMBER MKT-MUA10A	REV 3
				FORMERLY: N/A	SHEET: 1 OF 1



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