

FSA2257

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

Features

- Maximum 1.15Ω On Resistance (R_{ON}) for 4.5V Supply
- 0.3Ω Maximum R_{ON} Flatness for +5V Supply
- Space-Saving MicroPak™ Packaging
- Broad V_{CC} Operating Range: 1.65V to 5.5V
- Fast Turn-on / 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 1.3Ω maximum at 4.5V V_{CC} and operates over the wide V_{CC} range of 1.65V to 5.5V. 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	 Eco Status	Top Mark	Package Description	Packing Method
FSA2257L10X	MAC010A	RoHS	EP	10-Lead MicroPak™, 1.6 x 2.1mm	5000 Units on Tape and Reel
FSA2257MTCX	MTC14	RoHS	FSA2257	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide	2500 Units on Tape and Reel
FSA2257MUX	MUA101A	RoHS	FSA 2257	10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0mm	4000 Units on Tape and Reel

 For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

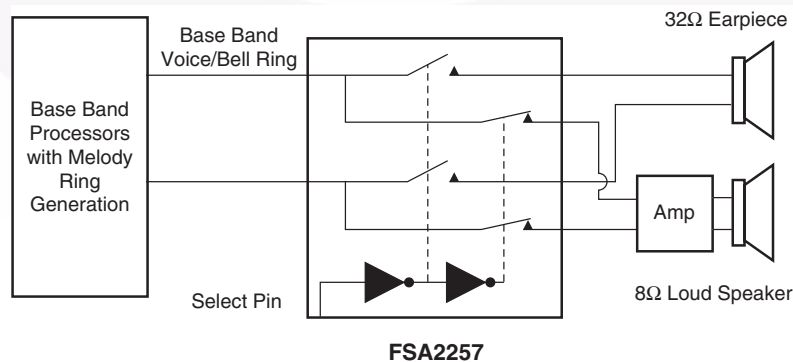


Figure 1. Block Diagram

Connection Diagrams

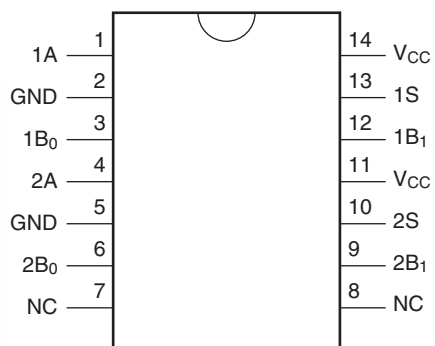


Figure 2. Pin Assignments for TSSOP (Top View)

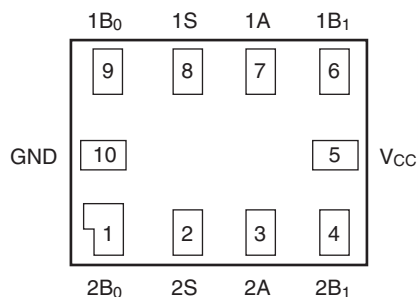


Figure 3. Pad Assignments for MicroPak (Top View)

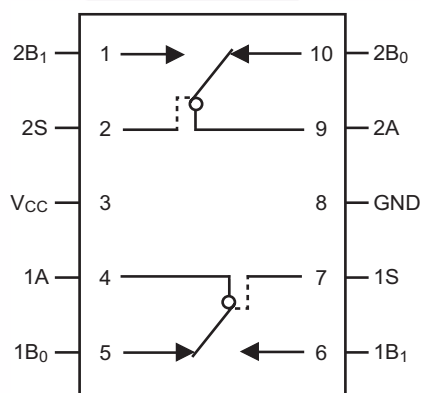


Figure 4. Pin Assignments for MSOP (Top View)

Analog Symbols

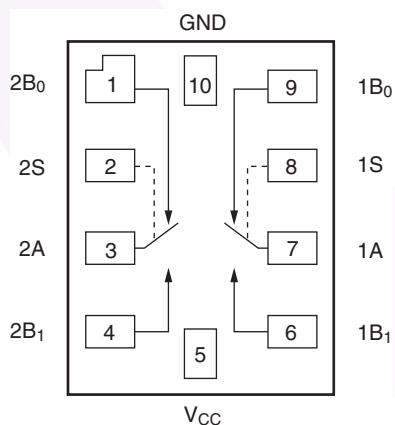


Figure 5. Analog Symbols (Top Through View)

Truth Table

Control Input(s)	Function
LOW Logic Level	B ₀ Connected to A
HIGH Logic Level	B ₁ Connected to A

Pin Descriptions

Pin Names	Function
A, B ₀ , B ₁	Data Ports
S	Control Input

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 ⁽²⁾	-0.5	V _{CC} +0.5	V
V _{IN}	DC Input Voltage ⁽²⁾	-0.5	+6.0	V
I _{IK}	Input Diode Current	-50		mA
	Switch Current		200	
	Peak Switch Current (Pulsed at 1ms 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	Human Body Model, JESD22-A114		8000	V
	Charged Device Model, JESD22-C101		2000	

Note:

2. The input and output negative voltage ratings may be exceeded if the 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 _{IN}	Control Input Voltage ⁽³⁾	0	V _{CC}	V
V _{SW}	Switch Input Voltage	0	V _{CC}	V
T _A	Operating Temperature	-40	+85	°C

Note:

3. Unused control inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units
				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	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	$A = 1\text{V, } 4.5\text{V, } B_0 \text{ or } B_1 = 1\text{V, } 4.5\text{V}$	5.5	-2.0		2.0	-20.0	20.0	nA
$I_{A(ON)}$	On Leakage Current of Port A	$A = 1\text{V, } 4.5\text{V, } B_0 \text{ or } B_1 = 1\text{V, } 4.5\text{V or Floating}$	5.5	-4.0		4.0	-40.0	40.0	nA
R_{ON}	Switch ON Resistance MicroPak ⁽⁴⁾	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 1.5\text{V}$	1.8		4.6				Ω
			2.7		2.6	4.0		4.3	
	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$	4.5		0.95	1.15		1.30		
	Switch On Resistance MSOP / TSSOP ⁽⁴⁾	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 1.5\text{V}$	2.7		2.8			4.5	
$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$		4.5		1.5			2.3		
ΔR_{ON}	On Resistance Matching Between Channels ⁽⁴⁾ MicroPak	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$	4.5		0.06	0.12		0.15	Ω
	On Resistance Matching Between Channels ⁽⁵⁾ MSOP / TSSOP	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$	4.5		0.7			0.3	
$R_{FLAT(ON)}$	On Resistance Flatness ⁽⁶⁾	$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 0\text{V, } 0.75\text{V, } 1.5\text{V}$	1.8		3.0				Ω
			2.7		1.4				
		$I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 0\text{V, } 1\text{V, } 2\text{V}$	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	μA
			5.5		0.1	0.5		1.0	

Notes:

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

AC Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Figure Number
				Min.	Typ.	Max.	Min.	Max.	Units	
t_{ON}	Turn-On Time	B_0 or $B_1 = 1.5\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	1.8 to 2.7		75				ns	Figure 6.
			2.7 to 3.6			50	60			
		B_0 or $B_1 = 3.0\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	4.5 to 5.5			35	40			
t_{OFF}	Turn-Off Time	B_0 or $B_1 = 1.5\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	1.8 to 2.7		20			ns	Figure 6.	
			2.7 to 3.6			20	30			
		B_0 or $B_1 = 3.0\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	4.5 to 5.5			15	20			
t_{BBM}	Break-Before-Make Time	B_0 or $B_1 = 1.5\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	2.7 to 3.6				1	ns	Figure 7.	
			B_0 or $B_1 = 3.0\text{V}$, $R_L = 50\Omega$, $C_L = 35\text{pF}$	4.5 to 5.5		20				1
Q	Charge Injection	$C_L = 1.0\text{nF}$, $V_{GEN} = 0\text{V}$, $R_{GEN} = 0\Omega$	2.7 to 3.6		20			pC	Figure 9.	
			4.5 to 5.5		10					
OIRR	Off Isolation	$f = 1\text{MHz}$, $R_L = 50\Omega$	2.7 to 3.6		-70			dB	Figure 8.	
			4.5 to 5.5		-70					
Xtalk	Crosstalk	$f = 1\text{MHz}$, $R_L = 50\Omega$	2.7 to 3.6		-75			dB	Figure 8.	
			4.5 to 5.5		-75					
BW	-3db Bandwidth	$R_L = 50\Omega$	2.7 to 3.6		200			MHz	Figure 11.	
			4.5 to 5.5		200					
THD	Total Harmonic Distortion	$R_L = 600\Omega$, $V_{IN} = 0.5\text{V}_{PP}$ $f = 20\text{Hz to } 20\text{kHz}$	2.7 to 3.6		0.002			%	Figure 12.	
			4.5 to 5.5		0.002					

Capacitance

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25^\circ\text{C}$			$T_A = 40$ to $+85^\circ\text{C}$		Units	Figure Number
				Min.	Typ.	Max.	Min.	Max.		
C_{IN}	Control Pin Input Capacitance	$f = 1\text{MHz}$	0.0		3.5				pF	Figure 10.
C_{OFF}	B Port Off Capacitance	$f = 1\text{MHz}$	4.5		12.0				pF	Figure 10.
C_{ON}	A Port On Capacitance	$f = 1\text{MHz}$	4.5		40.0				pF	Figure 10.

AC Loading and Waveforms

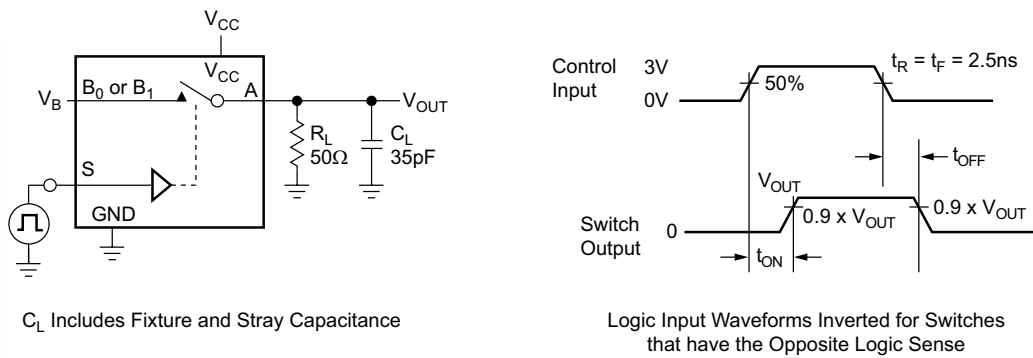


Figure 6. Turn-On / Turn-Off Timing

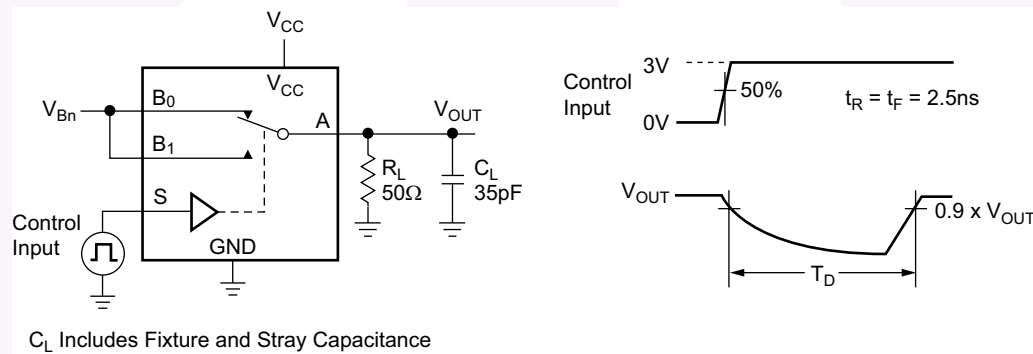


Figure 7. Break-Before-Make Timing

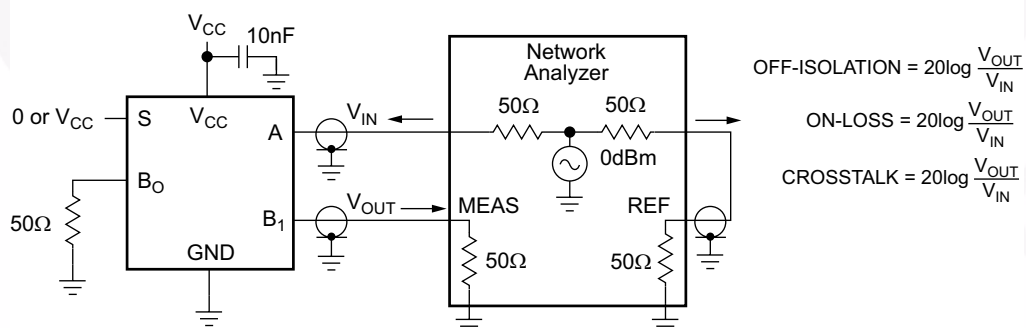


Figure 8. Off Isolation and Crosstalk

AC Loading and Waveforms (Continued)

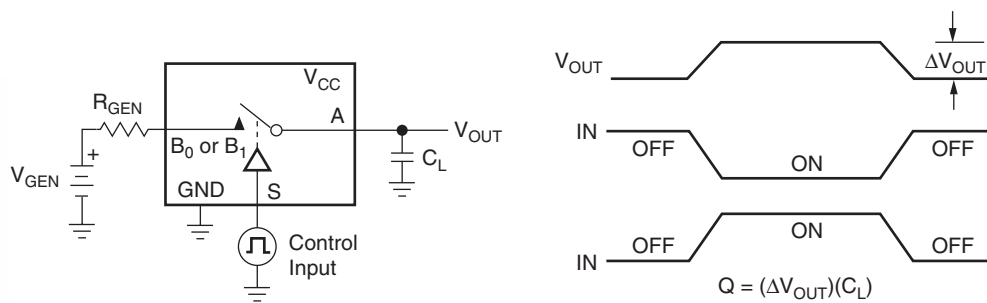


Figure 9. Charge Injection

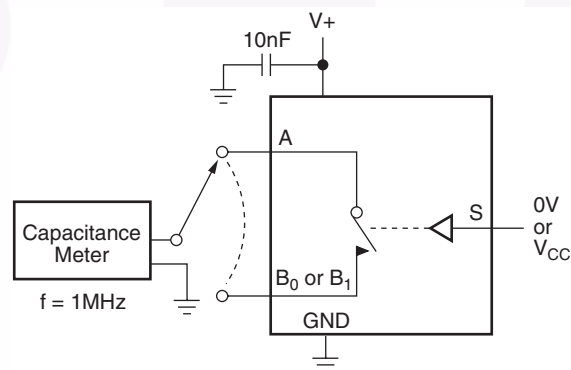


Figure 10. On / Off Capacitance Measurement Setup

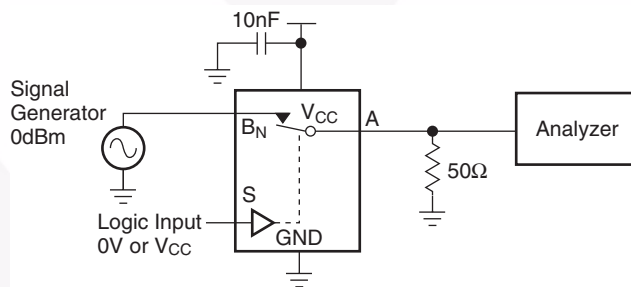


Figure 11. Bandwidth

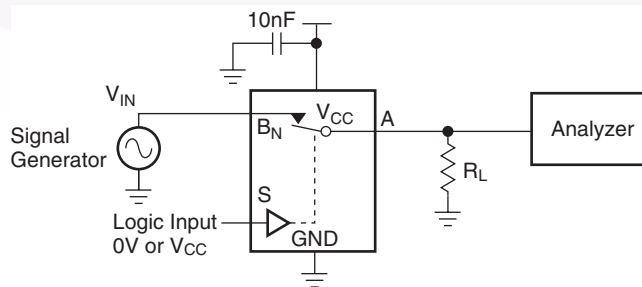
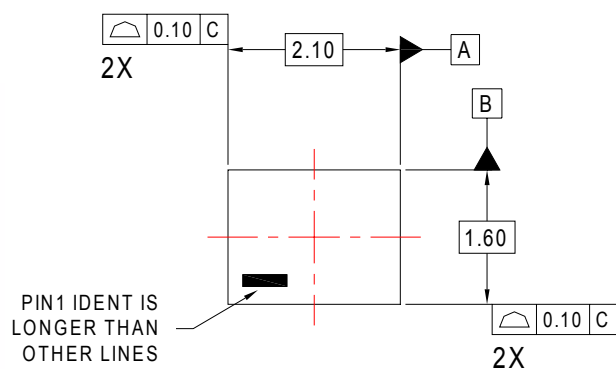
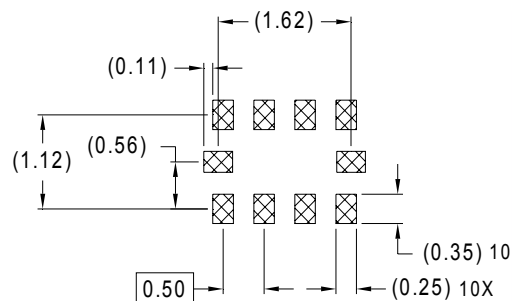


Figure 12. Harmonic Distortion

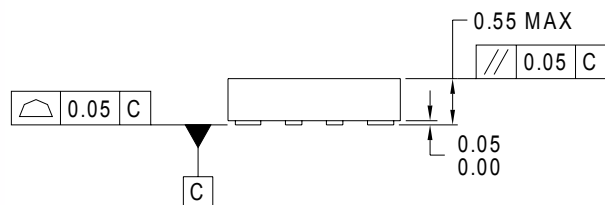
Physical Dimensions



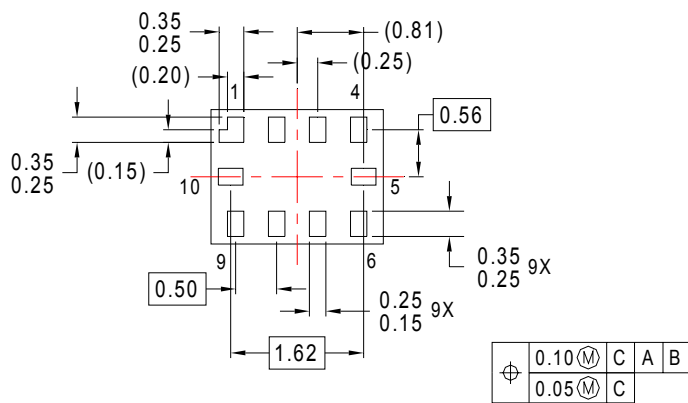
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW

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- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- D. DRAWING FILENAME: MKT-MAC10Arev4.

Figure 13. 10-Lead MicroPak, 1.6 x 2.1mm

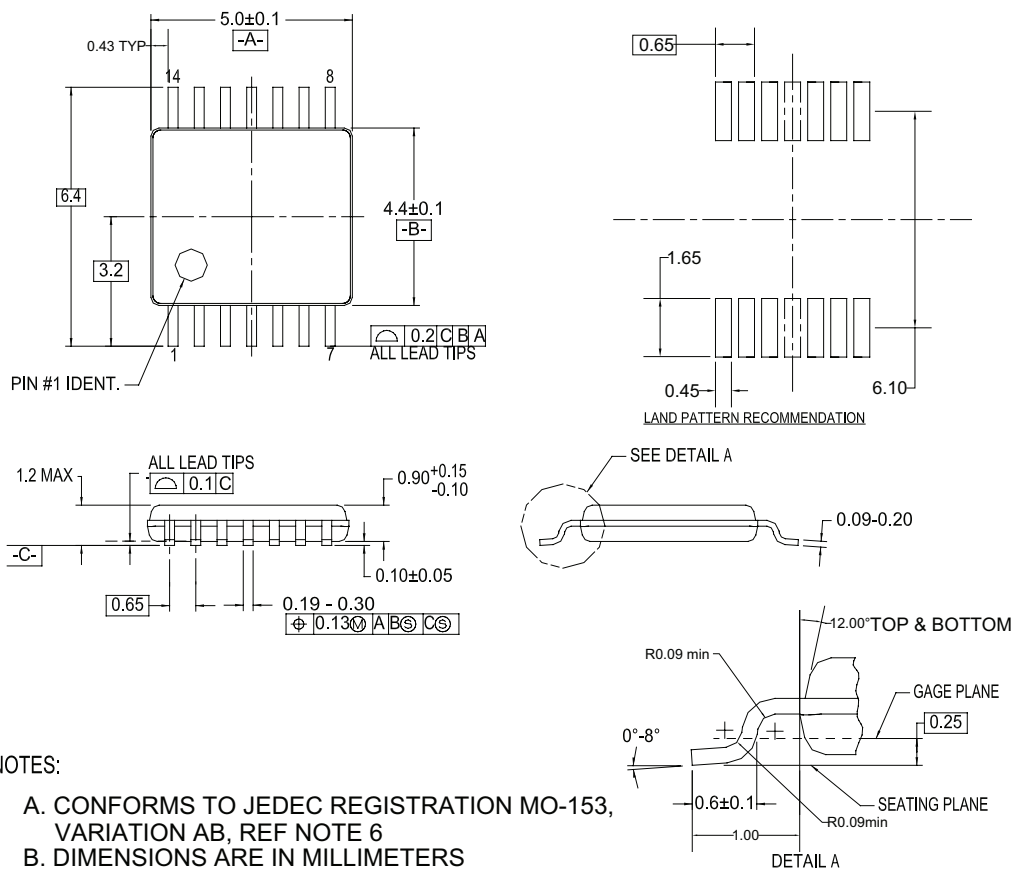
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Physical Dimensions (Continued)



NOTES:

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- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

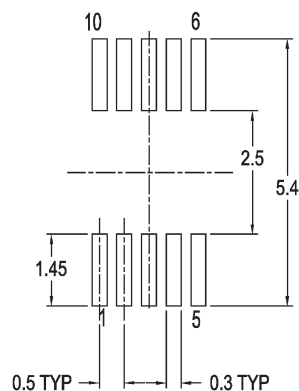
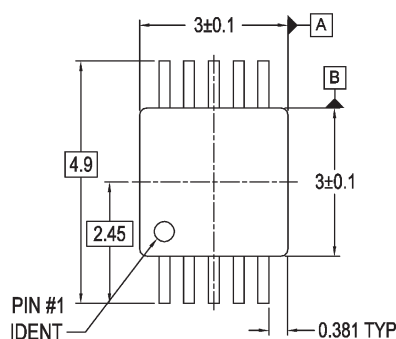
Figure 14. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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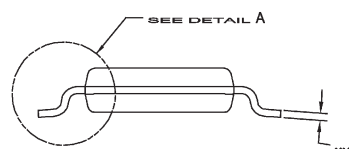
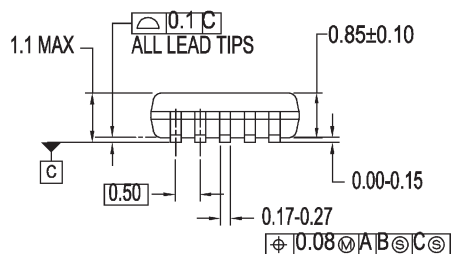
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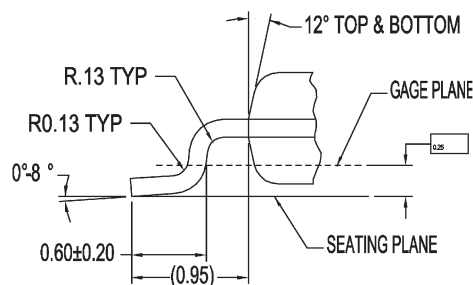
Physical Dimensions (Continued)



LAND PATTERN RECOMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

NOTES:

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- D. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

MUA10AREVA

Figure 15. 10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0m

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

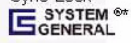
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