

# FSA2257

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

### Features

- Maximum 1.15 $\Omega$  On Resistance ( $R_{ON}$ ) for 4.5V Supply
- 0.3 $\Omega$  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 de-multiplexer by select pins. The device features ultra-low  $R_{ON}$  of 1.3 $\Omega$  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

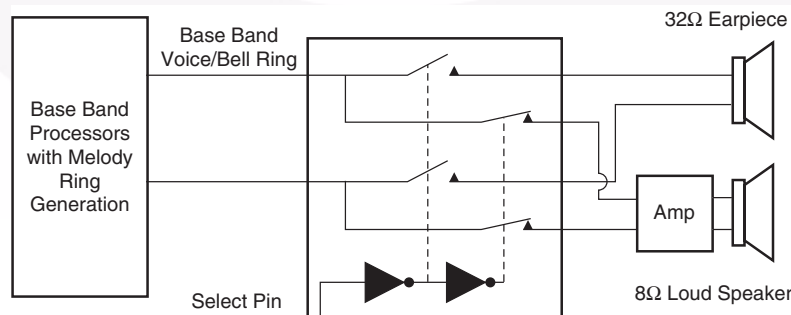
- Cell Phone
- PDA
- Mobile Devices

### 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	FSA2257	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](http://www.fairchildsemi.com/company/green/rohs_green.html).



FSA2257

Figure 1. Block Diagram

## Connection Diagrams

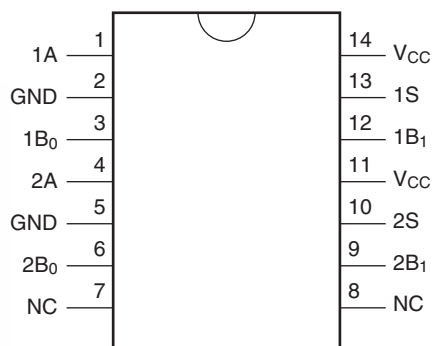


Figure 2. Pin Assignments for TSSOP (Top View)

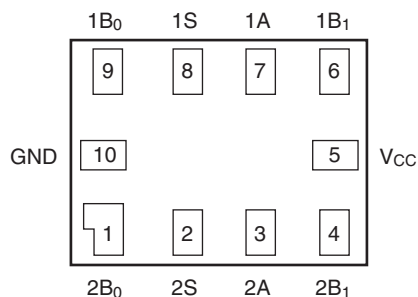


Figure 3. Pad Assignments for MicroPak (Top View)

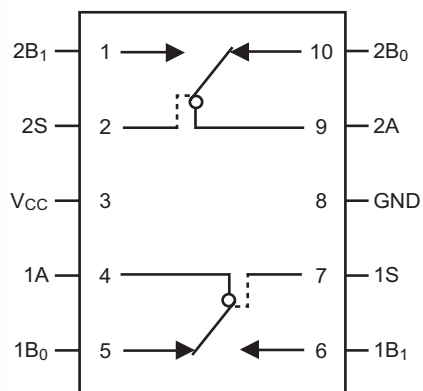


Figure 4. Pin Assignments for MSOP (Top View)

## Analog Symbols

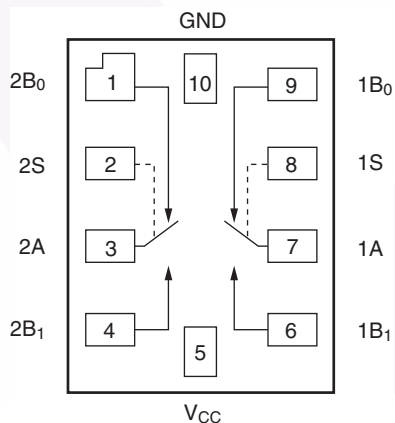


Figure 5. Analog Symbols (Top Through View)

## 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 <sup>(2)</sup>	-0.5	$V_{CC} + 0.5$	V
$V_{IN}$	DC Input Voltage <sup>(2)</sup>	-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 <sup>(3)</sup>	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	$\mu\text{A}$
			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 <sup>(4)</sup>	$I_{OUT} = 100\text{mA}, B_0 \text{ or } B_1 = 1.5\text{V}$	1.8		4.6				$\Omega$
			2.7		2.6	4.0		4.3	
	Switch On Resistance MSOP / TSSOP <sup>(4)</sup>	$I_{OUT} = 100\text{mA}, B_0 \text{ or } B_1 = 3.5\text{V}$	4.5		0.95	1.15		1.30	
		$I_{OUT} = 100\text{mA}, B_0 \text{ or } B_1 = 1.5\text{V}$	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	
$\Delta R_{ON}$	On Resistance Matching Between Channels <sup>(4)</sup> MicroPak	$I_{OUT} = 100\text{mA}, B_0 \text{ or } B_1 = 3.5\text{V}$	4.5		0.06	0.12		0.15	$\Omega$
	On Resistance Matching Between Channels <sup>(5)</sup> 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 <sup>(6)</sup>	$I_{OUT} = 100\text{mA}, B_0 \text{ or } B_1 = 0\text{V}, 0.75\text{V}, 1.5\text{V}$	1.8		3.0				$\Omega$
			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	$\mu\text{A}$
			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

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	$R_L = 600\Omega$ , $V_{IN} = 0.5V_{PP}$ $f = 20\text{Hz to } 20\text{kHz}$	2.7 to 3.6		0.002				%	Figure 12.
			4.5 to 5.5		0.002					

## Capacitance

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$			$T_A = 40 \text{ to } +85^\circ\text{C}$		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

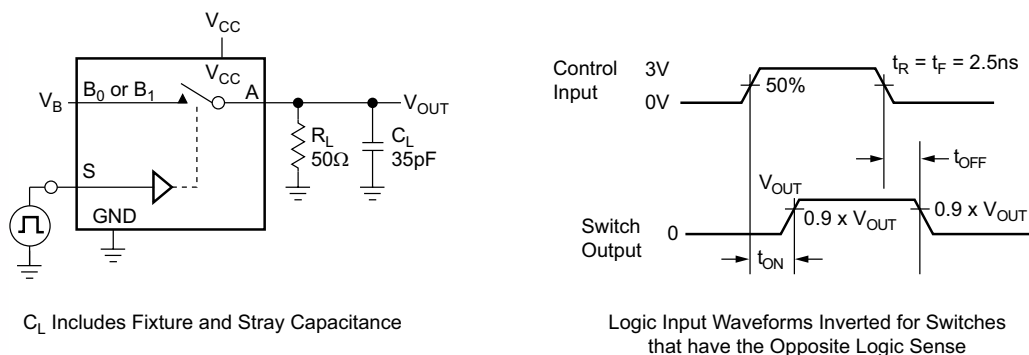


Figure 6. Turn-On / Turn-Off Timing

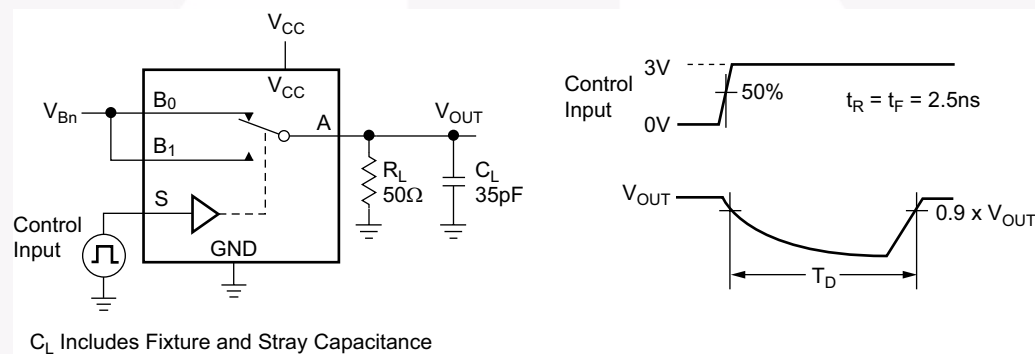


Figure 7. Break-Before-Make Timing

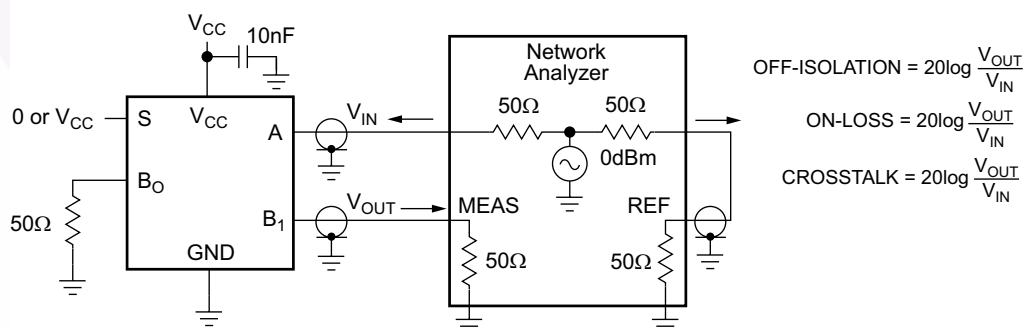


Figure 8. Off Isolation and Crosstalk

## AC Loading and Waveforms (Continued)

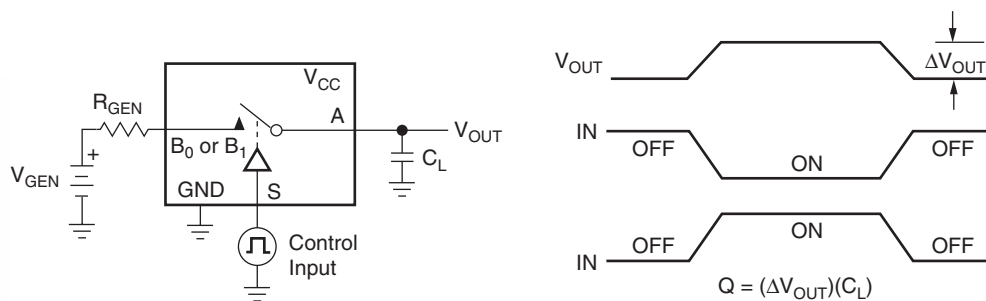


Figure 9. Charge Injection

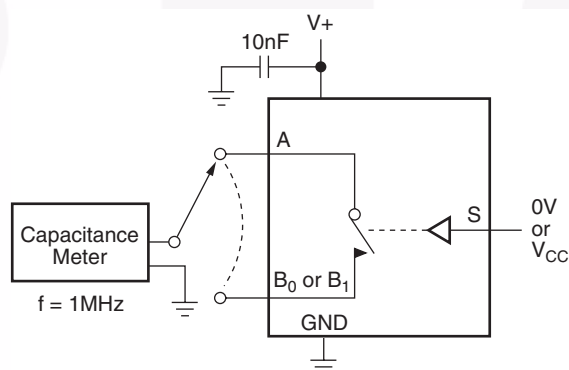


Figure 10. On / Off Capacitance Measurement Setup

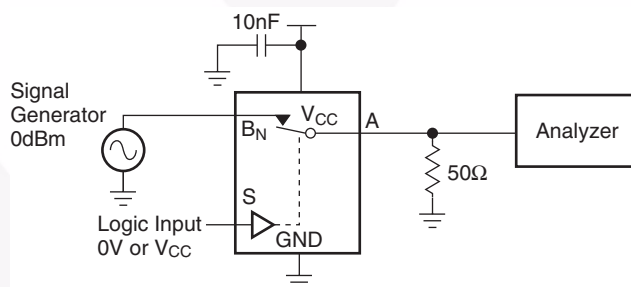


Figure 11. Bandwidth

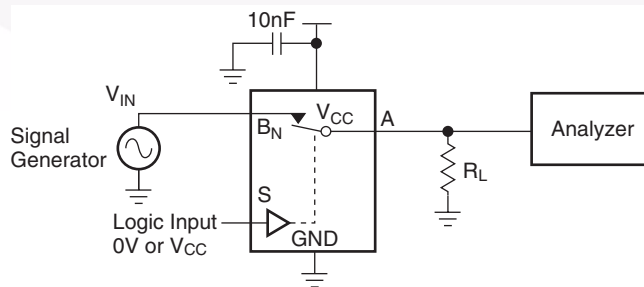
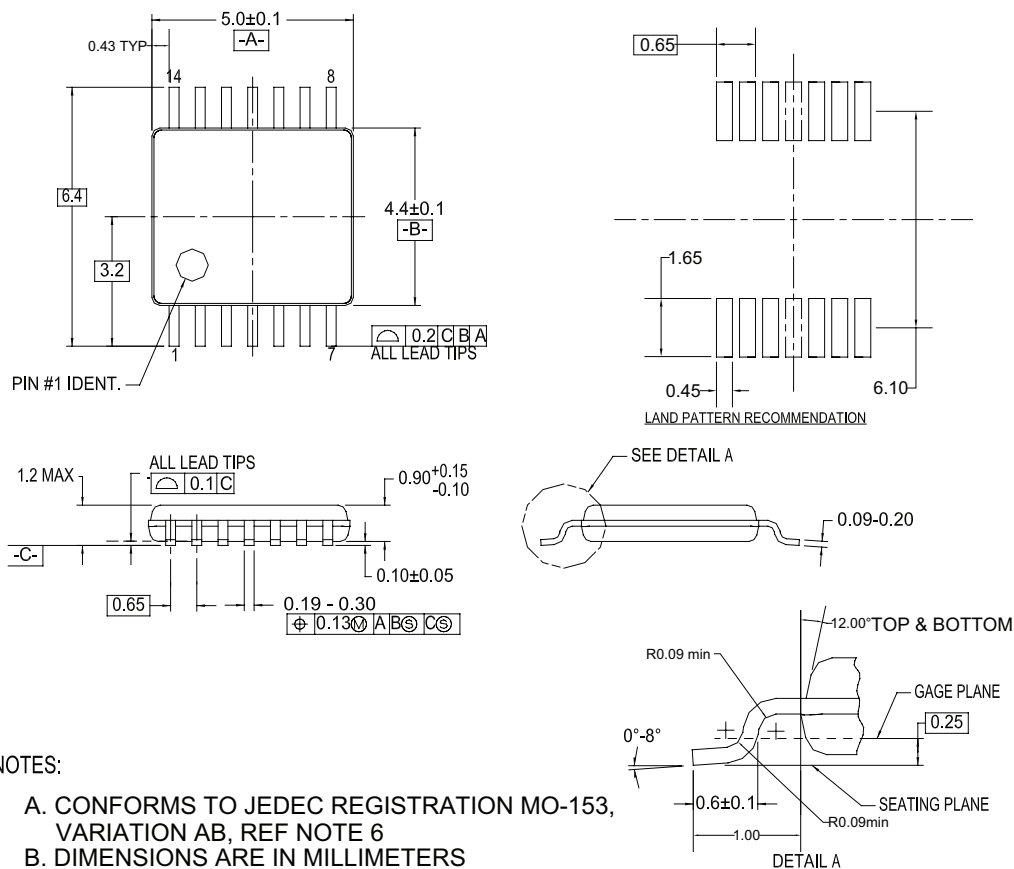


Figure 12. Harmonic Distortion





## Physical Dimensions (Continued)



## NOTES:

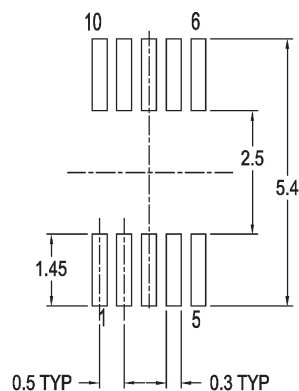
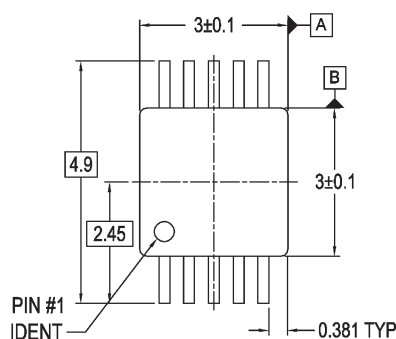
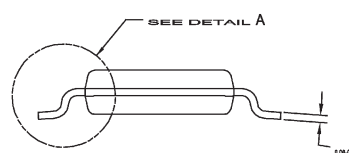
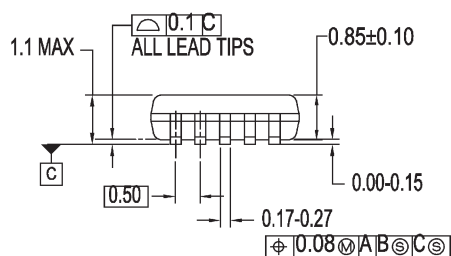
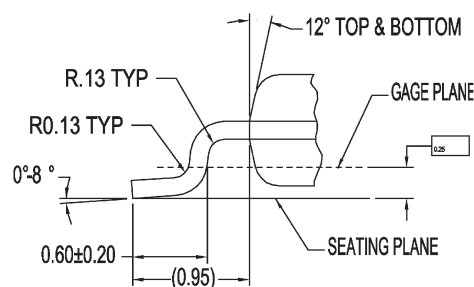
- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

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

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- A. CONFORMS TO JEDEC REGISTRATION MO-187, VARIATION BA, REF NOTE 6, DATE 11/00.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

MUA10AREVA

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

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### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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