

FSA2257 Low R_{ON} Low-Voltage Dual SPDT Bi-Directional Analog Switch

Features

- Maximum 1.15 Ω On Resistance (R_{ON}) for 4.5V Supply
- 0.3 Ω Maximum R_{ON} Flatness for +5V Supply
- Space-Saving Pb-Free 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 1.3 Ω 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
- Ultra-Portable

Ordering Information

Order Number	Package Number	Pb-Free	Product Code Top Mark	Package Description	Packing Method
FSA2257L10X ⁽¹⁾	MAC010A	Yes	EP	10-Lead MicroPak™, 1.6 x 2.1mm	5000 Units on Tape and Reel
FSA2257MTCX ⁽¹⁾	MTC14	Yes	FSA2257	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide	2500 Units on Tape and Reel
FSA2257MUX ⁽¹⁾	MUA101A	Yes	FSA 2257	10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0mm	4000 Units on Tape and Reel

Note:

1. Lead-free package per JEDEC J-STD-020B. Device available in tape and reel only.

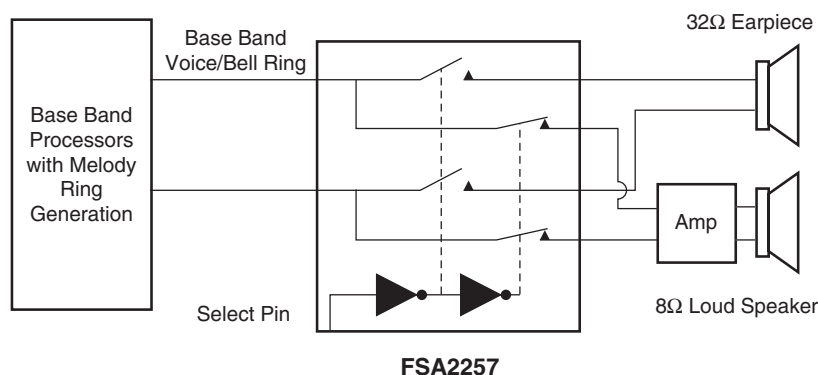


Figure 1. Block Diagram

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Connection Diagrams

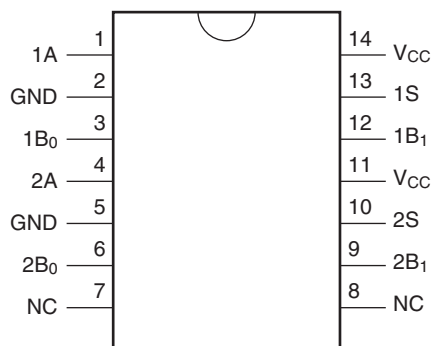


Figure 2. Pin Assignments for TSSOP (Top View)

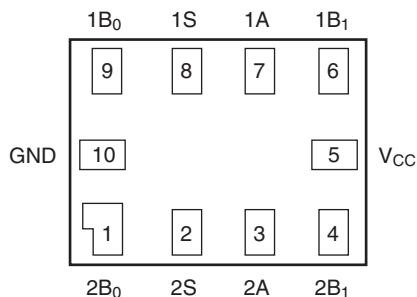


Figure 3. Pad Assignments for MicroPak (Top View)

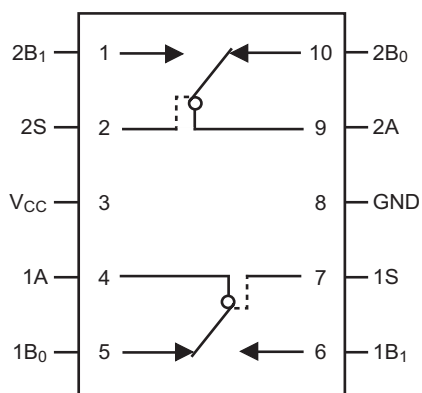


Figure 4. Pin Assignments for MSOP (Top View)

Analog Symbols

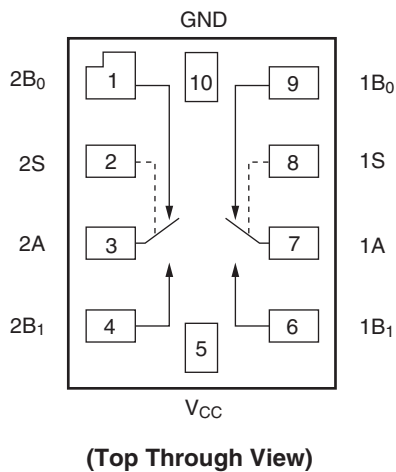


Figure 5. Analog Symbols (Top View)

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		8000	V

Note:

- 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	5.5	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:

- 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°C			T _A = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V _{IH}	Input Voltage High		2.7 to 3.6				2.0		V
			4.5 to 5.5				2.4		
V _{IL}	Input Voltage Low		2.7 to 3.6					0.6	V
			4.5 to 5.5					0.8	
I _{IN}	Control Input Leakage	V _{IN} = 0V 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 = 1V, 4.5V, B ₀ or B ₁ = 1V, 4.5V	5.5	-2.0		2.0	-20.0	20.0	nA
I _{A(ON)}	ON Leakage Current of Port A	A = 1V, 4.5V, B ₀ or B ₁ = 1V, 4.5V or Floating	5.5	-4.0		4.0	-40.0	40.0	nA
R _{ON}	Switch ON Resistance MicroPak ⁽⁴⁾	I _{OUT} = 100mA, B ₀ or B ₁ = 1.5V	2.7		2.6	4.0		4.3	Ω
		I _{OUT} = 100mA, B ₀ or B ₁ = 3.5V	4.5		0.95	1.15		1.3	
	Switch ON Resistance MSOP / TSSOP ⁽⁴⁾	I _{OUT} = 100mA, B ₀ or B ₁ = 1.5V	2.7		2.8			4.5	
		I _{OUT} = 100mA, B ₀ or B ₁ = 3.5V	4.5		1.5			2.3	
ΔR _{ON}	ON Resistance Matching Between Channels ⁽⁴⁾ MicroPak	I _{OUT} = 100mA, B ₀ or B ₁ = 3.5V	4.5		0.06	0.12		0.15	Ω
	ON Resistance Matching Between Channels ⁽⁵⁾ MSOP / TSSOP	I _{OUT} = 100mA, B ₀ or B ₁ = 3.5V	4.5		0.7			0.3	
R _{FLAT(ON)}	ON Resistance Flatness ⁽⁶⁾	I _{OUT} = 100mA, B ₀ or B ₁ = 0V, 0.75V, 1.5V	2.7		1.4				Ω
		I _{OUT} = 100mA, B ₀ or B ₁ = 0V, 1V, 2V	4.5		0.2	0.3		0.4	
I _{CC}	Quiescent Supply Current	V _{IN} = 0V or V _{CC} , I _{OUT} = 0V	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. ΔR_{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

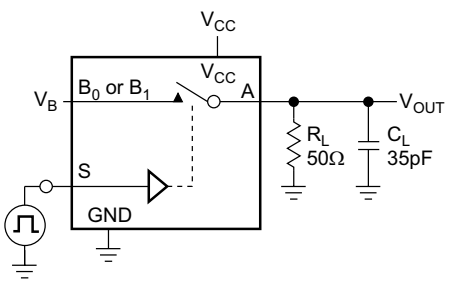
All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C			Figure Number
				Min.	Typ.	Max.	Min.	Max.	Units	
t _{ON}	Turn-On Time	B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35pF	2.7 to 3.6			50.0		60.0	ns	Figure 6.
		B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35pF	4.5 to 5.5			35.0		40.0		
t _{OFF}	Turn-Off Time	B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35pF	2.7 to 3.6			20.0		30.0	ns	Figure 6.
		B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35pF	4.5 to 5.5			15.0		20.0		
t _{B-M}	Break-Before-Make Time	B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35pF	2.7 to 3.6				1.0		ns	Figure 7.
		B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35pF	4.5 to 5.5		20.0		1.0			
Q	Charge Injection	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0Ω	2.7 to 3.6		20.0				pC	Figure 9.
			4.5 to 5.5		10.0					
OIRR	Off Isolation	f = 1MHz, R _L = 50Ω	2.7 to 3.6		-70.0				dB	Figure 8.
			4.5 to 5.5		-70.0					
Xtalk	Crosstalk	f = 1MHz, R _L = 50Ω	2.7 to 3.6		-75.0				dB	Figure 8.
			4.5 to 5.5		-75.0					
BW	-3db Bandwidth	R _L = 50Ω	2.7 to 3.6		350				MHz	Figure 11.
			4.5 to 5.5		350					
THD	Total Harmonic Distortion	R _L = 600Ω, V _{IN} = 0.5V P.P, f = 20Hz to 20kHz	2.7 to 3.6		0.002				%	Figure 12.
			4.5 to 5.5		0.002					

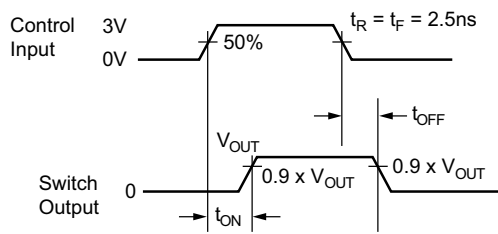
Capacitance

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = +25°C			T _A = 40 to +85°C		Units	Figure Number
				Min.	Typ.	Max.	Min.	Max.		
C _{IN}	Control Pin Input Capacitance	f = 1MHz	0.0		3.5				pF	Figure 10.
C _{OFF}	B Port Off Capacitance	f = 1MHz	4.5		12.0				pF	Figure 10.
C _{ON}	A Port On Capacitance	f = 1MHz	4.5		40.0				pF	Figure 10.

AC Loading and Waveforms

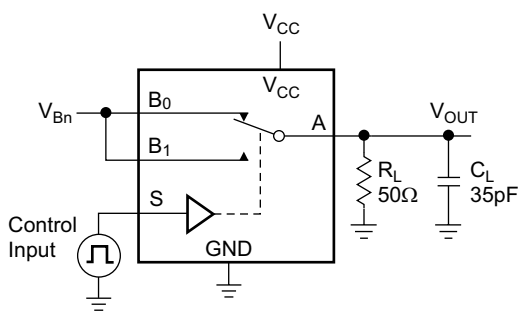


C_L Includes Fixture and Stray Capacitance



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

Figure 6. Turn-On / Turn-Off Timing



C_L Includes Fixture and Stray Capacitance

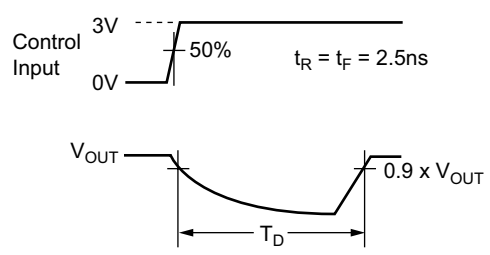
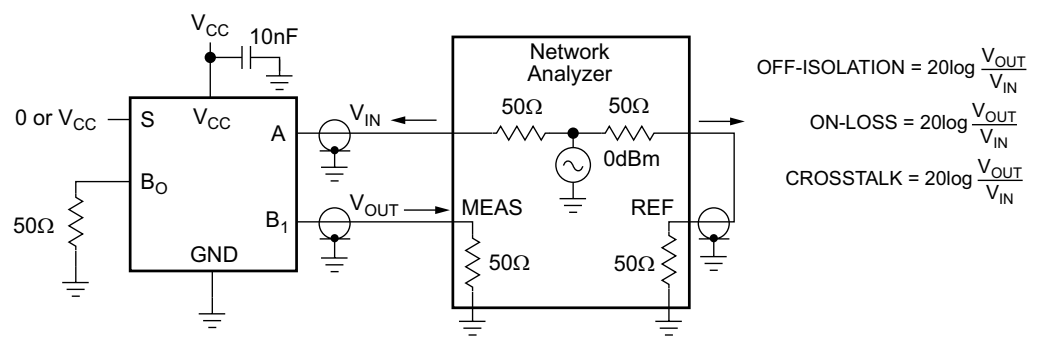


Figure 7. Break-Before-Make Timing



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

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

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

Figure 8. Off Isolation and Crosstalk

AC Loading and Waveform (continued)

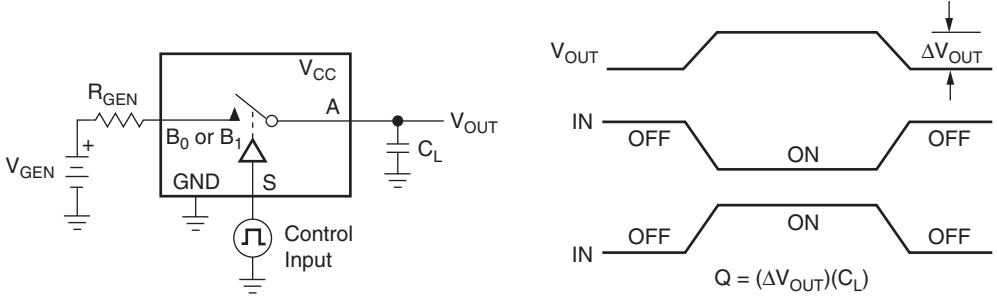


Figure 9. Charge Injection

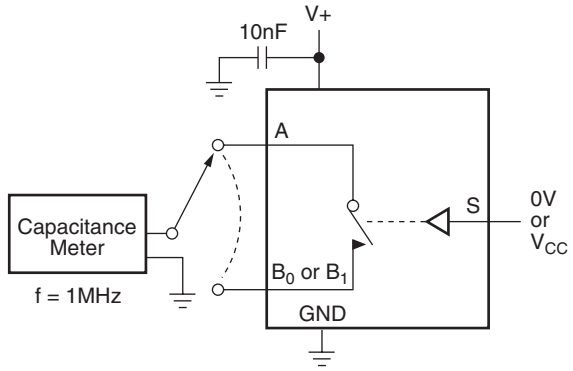


Figure 10. On / Off Capacitance Measurement Setup

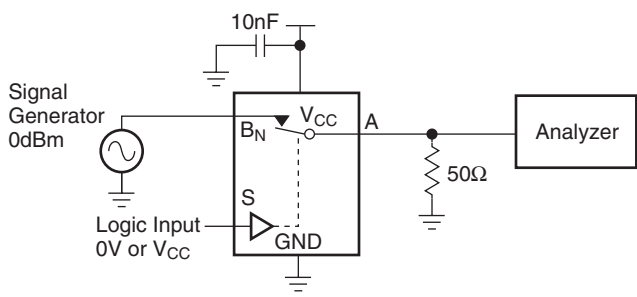


Figure 11. Bandwidth

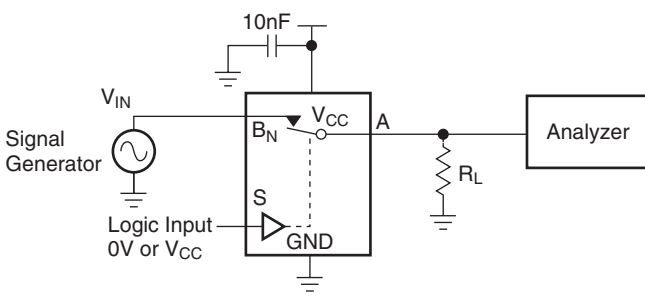


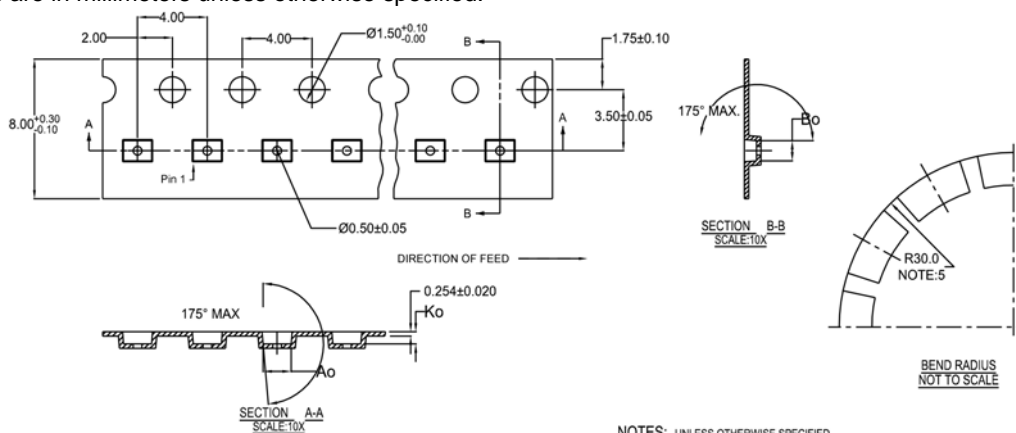
Figure 12. Harmonic Distortion

Package Specifications

Tape Dimensions for MicroPak 10

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L10X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

Dimensions are in millimeters unless otherwise specified.



10	300056	2.30 \pm 0.05	1.78 \pm 0.05	0.68 \pm 0.05
8	300038	1.78 \pm 0.05	1.78 \pm 0.05	0.68 \pm 0.05
6	300033	1.60 \pm 0.05	1.15 \pm 0.05	0.70 \pm 0.05

NOTES: UNLESS OTHERWISE SPECIFIED

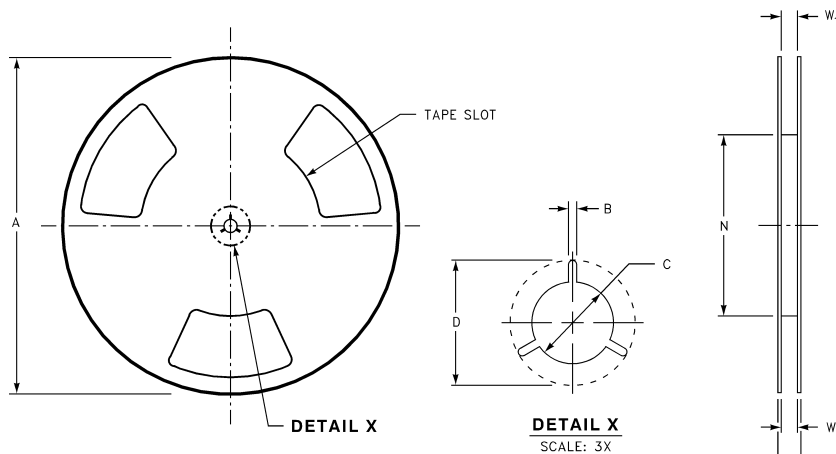
1. ACCUMULATED 50 SPROCKETS, SPROCKET HOLE PITCH IS 200.00 \pm 0.30MM
2. NO INDICATED CORNER RADIUS IS 0.127MM
3. CAMBER NOT TO EXCEED 1MM IN 100MM
4. SMALLEST ALLOWABLE BENDING RADIUS
5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE



SCALE: 6X

Reel Dimensions for MicroPak 10

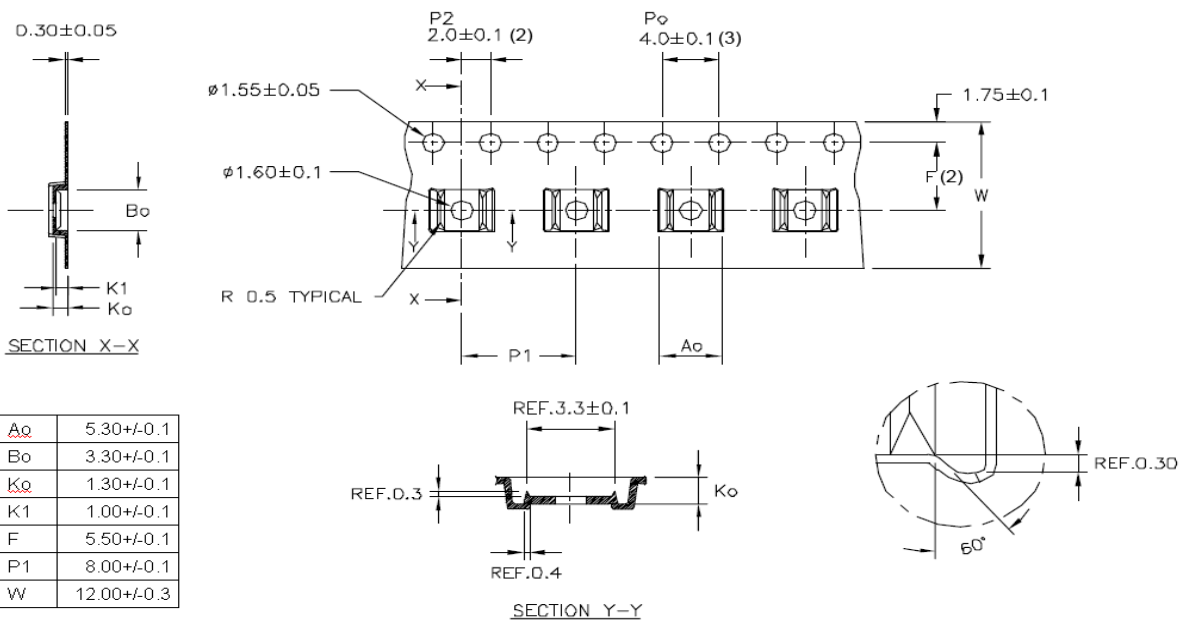
Dimensions are in inches (millimeters) unless otherwise noted.



Tape Size	A	B	C	D	N	W1	W2	W3
(8mm)	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059 / -0.000 (8.40 +1.50 / -0.00)	0.567 (14.40)	W1 +0.078 / -0.039 (W1 +2.00 / -1.00)

Tape Dimensions for MSOP

Dimensions are in inches (millimeters) unless otherwise specified.

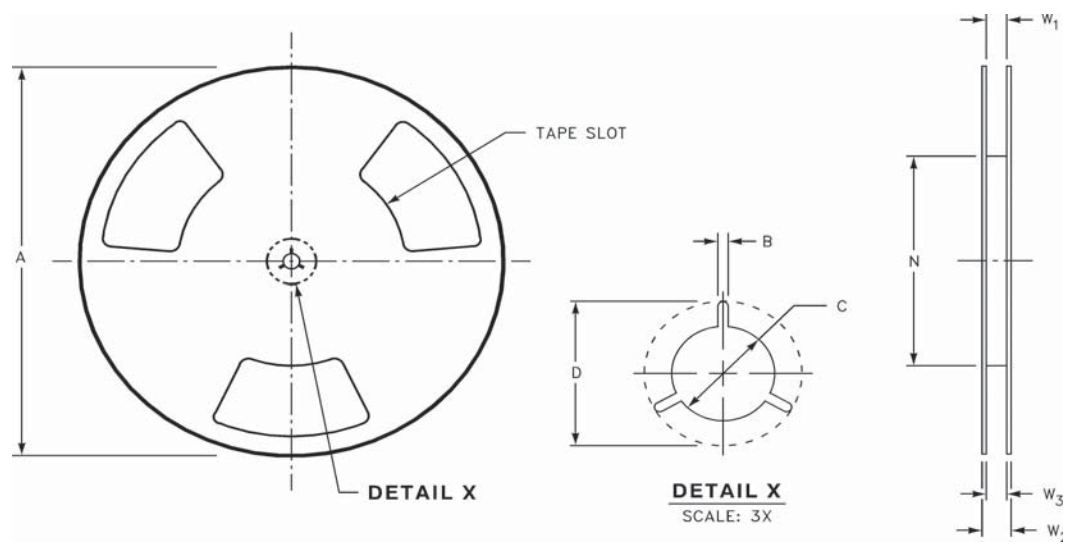


A ₀	5.30±0.1
B ₀	3.30±0.1
K ₀	1.30±0.1
K ₁	1.00±0.1
F	5.50±0.1
P ₁	8.00±0.1
W	12.00±0.3

- Notes:**
1. All dimensions are in millimeters.
 2. Measured from centerline of sprocket hole to centerline of pocket.
 3. Cumulative tolerance of ten sprocket holes is ±0.20mm.
 4. Other material available.

Reel Dimensions for MSOP

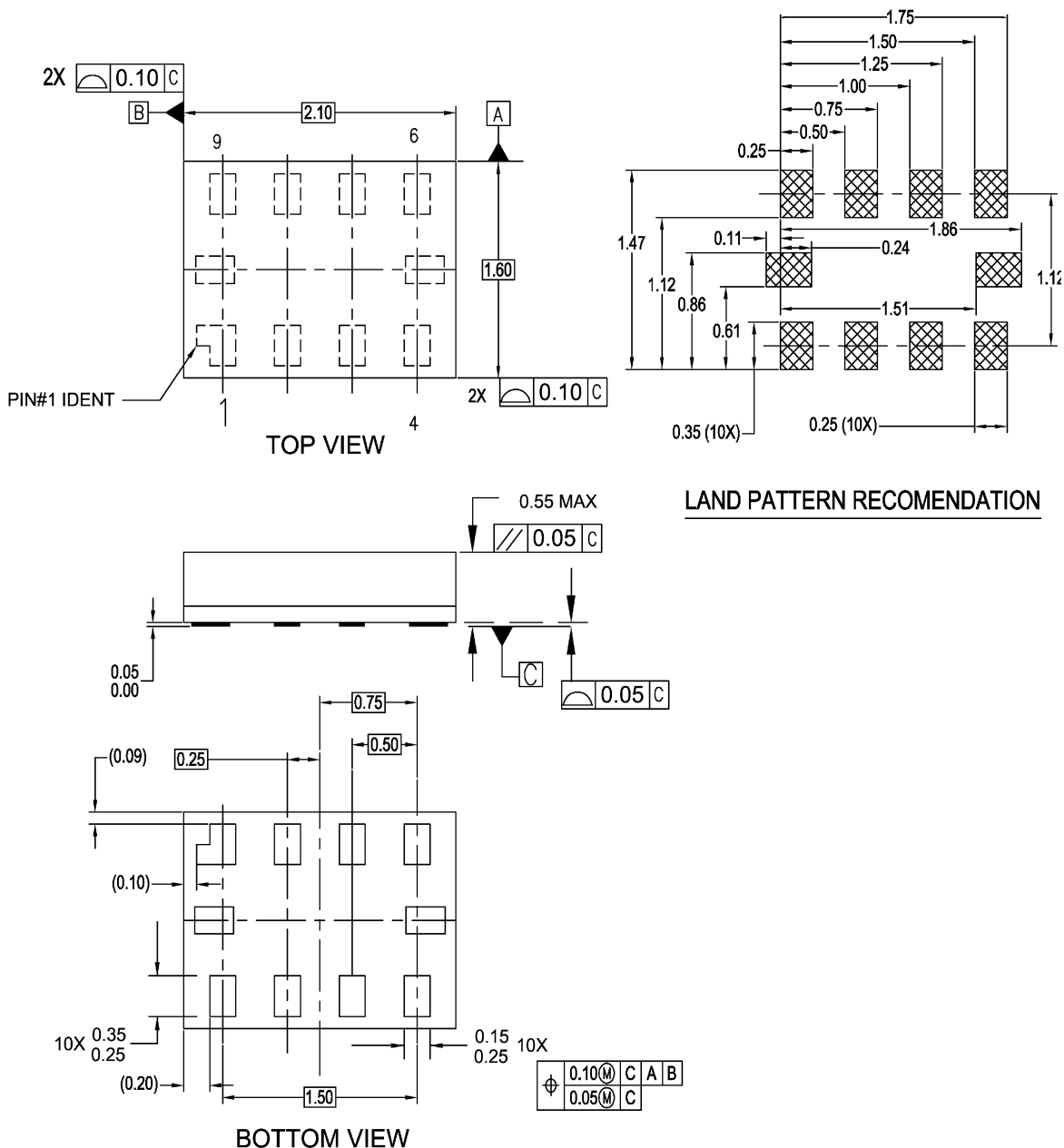
Dimensions are in inches (millimeters) unless otherwise specified.



Tape Size	A	B	C	D	N	W1	W2	W3
(12mm)	13 (330)	0.059 (1.5)	0.512 (13)	0.795 (20.2)	7.008 (178)	0.448 (12.4)	0.724 (18.4)	0.468-0.606 (11.9 -15.4)

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



NOTES:

A. PACKAGE CONFORMS TO JEDEC M0255, VARIATION UABD

B. DIMENSIONS ARE IN MILLIMETERS.

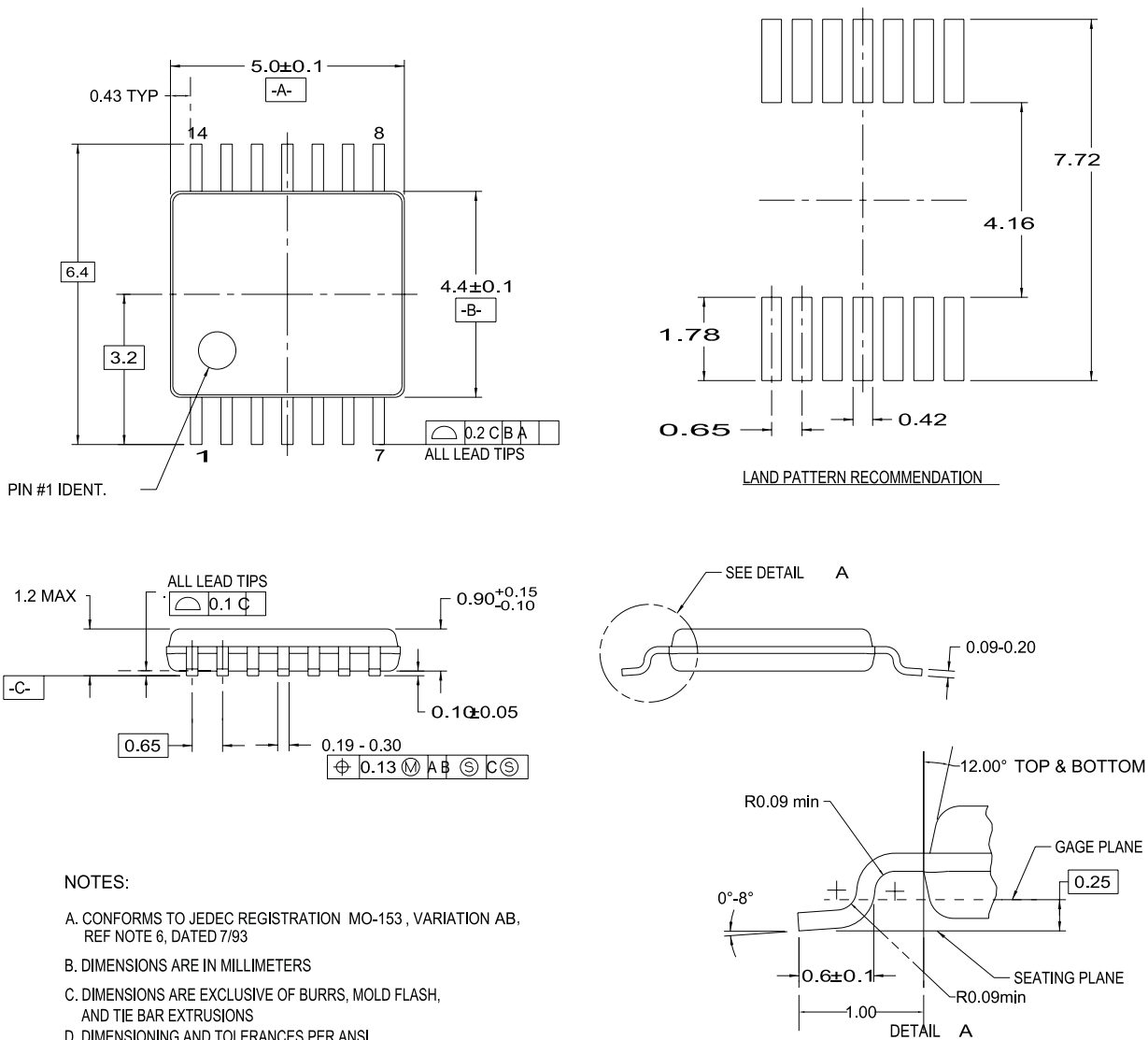
C. DIMENSIONS AND TOLERANCES CONFORMS TO ASME Y14.5M, 1994.

MAC010ARevC

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

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.

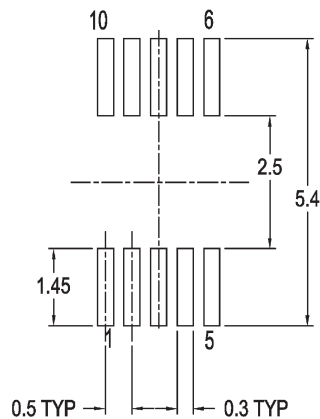
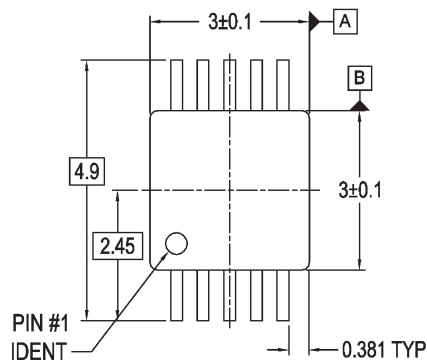


MTC14revD

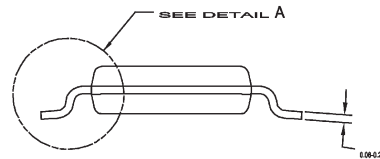
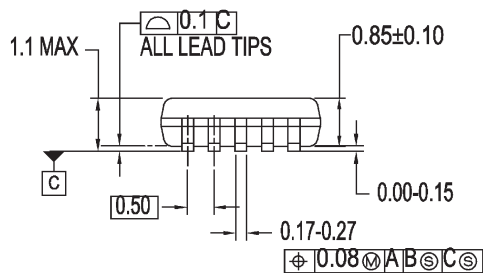
Figure 14. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Physical Dimensions

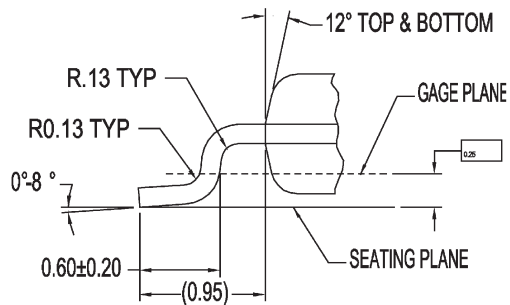
Dimensions are in millimeters unless otherwise noted.



LAND PATTERN RECOMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

NOTES:

- 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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Build it Now™	HiSeC™	OPTOPLANAR™	Stealth™	
CoolFET™	I ² C™	PACMAN™	SuperFET™	
CROSSVOLT™	i-Lo™	POP™	SuperSOT™-3	
DOME™	ImpliedDisconnect™	Power247™	SuperSOT™-6	
EcoSPARK™	IntelliMAX™	PowerEdge™	SuperSOT™-8	
E ² CMOS™	ISOPLANAR™	PowerSaver™	SyncFET™	
EnSigna™	LittleFET™	PowerTrench®	TCM™	
FACT®	MICROCOUPLER™	QFET®	TinyBoost™	
FAST®	MicroFET™	QS™	TinyBuck™	
FASTr™	MicroPak™	QT Optoelectronics™	TinyPWM™	
FPS™	MICROWIRE™	Quiet Series™	TinyPower™	
FRFET™	MSX™	RapidConfigure™	TinyLogic®	
	MSXPro™	RapidConnect™	TINYOPTO™	
Across the board. Around the world.™		μSerDes™	TruTranslation™	
The Power Franchise®		ScalarPump™	UHC®	
Programmable Active Droop™				

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- A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I22