March 2006

FAIRCHILD SEMICONDUCTOR®

FSA4157, FSA4157A
Low Voltage 1Ω SPDT Analog Switch

Features

- FSA4157A features lower I_{CC} when the S input is lower than V_{CC}
- Maximum 1.15Ω On Resistance (R_{ON}) at 4.5V V_{CC}
- 0.3Ω max R_{ON} flatness at 4.5V V_{CC}
- Space saving 6-lead Pb-Free MicroPak™ and SC70 6-lead surface mount packages
- Broad V_{CC} operating range:
  – FSA4157: 1.65V to 5.5V
  – FSA4157A: 2.7V to 5.5V
- Fast turn-on and turn-off time
- Break-before-make enable circuitry
- Over-voltage tolerant TTL compatible control circuitry

General Description

FSA4157 and FSA4157A are high performance Single Pole/Double Throw (SPDT) analog switches. Both devices feature ultra low R_{ON} of 1.15Ω maximum at 4.5V V_{CC} and will operate over the wide V_{CC} range of 1.65V to 5.5V for FSA4157, and 2.7V to 5.5V for FSA4157A. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL level compatible.

The FSA4157A features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature services the mobile handset applications very well allowing for the direct interface with baseband processor general purpose I/Os.

Technology Description

The Fairchild Switch family derives from and embodies Fairchild's proven switch technology used for several years in its 74LVXL384 (FST3384) bus switch product.

Ordering Information

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
FSA4157P6	MAA06A	A57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units on Tape and Reel
FSA4157P6X	MAA06A	A57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
FSA4157P6X_NL[1]	MAA06A	A57	Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
FSA4157L6X	MAC06A	EG	Pb-Free 6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel
FSA4157AP6	MAA06A	B57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units on Tape and Reel
FSA4157AP6X	MAA06A	B57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
FSA4157AP6X_NL[1]	MAA06A	B57	Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
FSA4157AL6X	MAC06A	EU	Pb-Free 6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

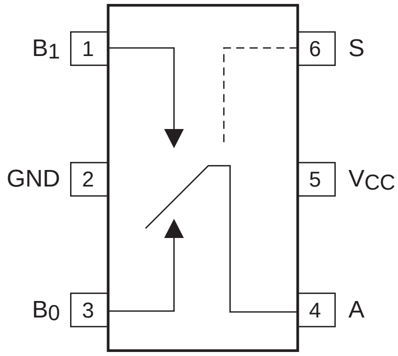
Pb-Free package per JEDEC J-STD-020B.

Note:
1. "_NL" indicates lead-free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

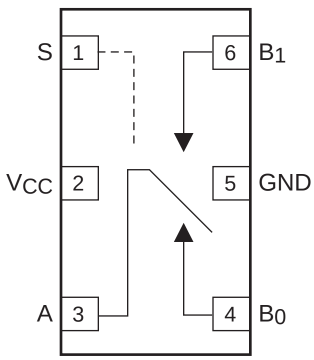
Analog Symbols

Pin Assignment for SC70



(Top View)

Pin Assignment for MicroPak



(Top Through View)

Truth Table

Control Input(s)	Function
L	B_0 Connected to A
H	B_1 Connected to A

H = HIGH Logic Level

L = LOW Logic Level

Pin Descriptions

Pin Names	Function
A, B_0, B_1	Data Ports
S	Control Input

Absolute Maximum Ratings

The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	–0.5V to +6.0V
	DC Switch Voltage[2]	–0.5V to V_{CC} +0.5V
V_{IN}	DC Input Voltage[2]	–0.5V to +6.0V
	DC Input Diode Current	–50mA
	Switch Current	200mA
	Peak Switch Current (Pulse at 1mS duration, <10% Duty Cycle)	400mA
P_D	Power Dissipation @ 85°C SC70 6L Package MicroPak 6L Package	 180mW 180mW
T_{STG}	Storage Temperature Range	–65°C to +150°C
T_J	Maximum Junction Temperature	+150°C
T_L	Lead Temperature (Soldering, 10 seconds)	+260°C
	ESD (Human Body Model) FSA4157A	 7500V

Recommended Operating Conditions[3]

Symbol	Parameter	Rating
V_{CC}	Supply Voltage FSA4157 FSA4157A	 1.65V to 5.5V 2.7V to 5.5V
	Control Input Voltage	0V to V_{CC}
	Switch Input Voltage	0V to V_{CC}
	Operating Temperature	–40°C to +85°C
	Thermal Resistance θ_{JA} in still air SC70 6L Package MicroPak 6L Package	 350°C/W 330°C/W (estimated)

Notes:

2. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.
3. Control input must be held HIGH or LOW and it must not float.

DC Electrical Characteristics

(All typical values are @ 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	(FSA4157A Only)	2.7 to 3.6	–	–	–	–	0.4	V
			2.7 to 3.6	–	–	–	–	0.6	
			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 = 4.5V, 1V	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(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	
ΔR_{ON}	On Resistance Matching Between Channels(5)	I_{OUT} = 100mA, B_0 or B_1 = 1.5V	4.5	–	0.06	0.12	–	0.15	Ω
$R_{FLAT(ON)}$	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	
ΔI_{CC}	Increase in I_{CC} per Input	One Input at 2.7V, others at V_{CC} or GND (FSA4157A only)	4.3	–	0.2	–	–	10.0	µA

Notes:

4. Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltage on the two (A or B Ports).
5. $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$ 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 @ 25°C unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = +25°C			T_A = –40°C to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{ON}	Turn ON Time	B_0 or B_1 = 1.5V, R_L = 50Ω, C_L = 35pF (FSA4157A only)	2.7 to 3.6	–	–	60.0	–	65.0	ns	Figure 6
		B_0 or B_1 = 1.5V, R_L = 50Ω, C_L = 35pF	2.7 to 3.6	–	–	50.0	–	60.0		
		B_0 or B_1 = 3V, 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 = 3V, R_L = 50Ω, C_L = 35pF	4.5 to 5.5	–	–	15.0	–	20.0		
$t_{B\text{-}M}$	Break Before Make Time		2.7 to 3.6	–	–	–	–	–	ns	Figure 10
			4.5 to 5.5	–	20.0	–	–	–		
		(FSA4157A only)	4.5 to 5.5	–	25.0	–	–	–		
Q	Charge Injection	C_L = 1.0nF, V_{GE} = 0V, R_{GEN} = 0Ω	2.7 to 3.6	–	10.0	–	–	–	pC	Figure 9
			4.5 to 5.5	–	20.0	–	–	–		
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	–	–70.0	–	–	–	dB	Figure 8
			4.5 to 5.5	–	–70.0	–	–	–		
BW	–3db Bandwidth	R_L = 50Ω	2.7 to 3.6	–	300	–	–	–	MHz	Figure 11
			4.5 to 5.5	–	300	–	–	–		
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°C 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}	ON Capacitance	f = 1MHz	4.5	–	40.0	–	–	–	pF	Figure 10

Typical Performance Characteristics

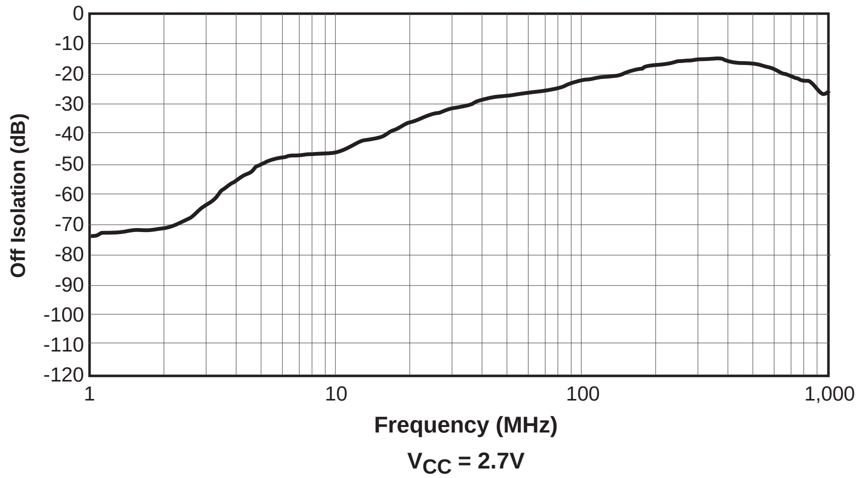


Figure 1. Off-Isolation, V_{CC} = 2.7V to 5.5V

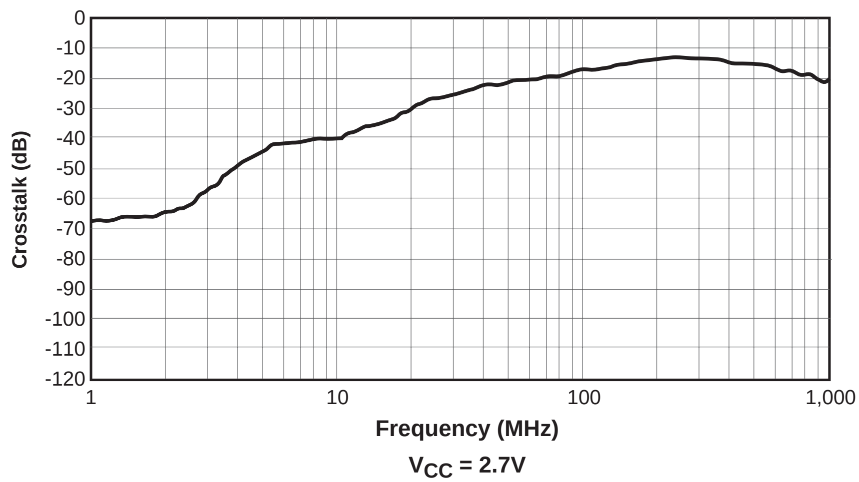


Figure 2. Crosstalk, V_{CC} = 2.7V to 5.5V

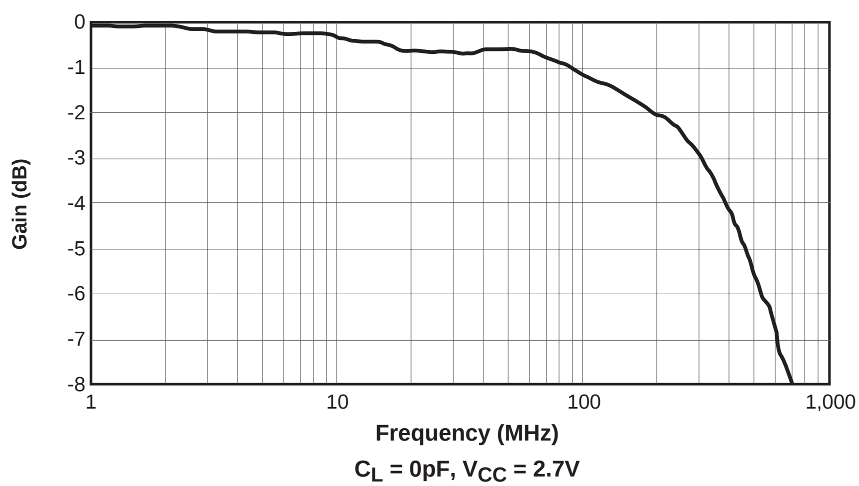


Figure 3. Bandwidth, V_{CC} = 2.7V to 5.5V

Typical Characteristics

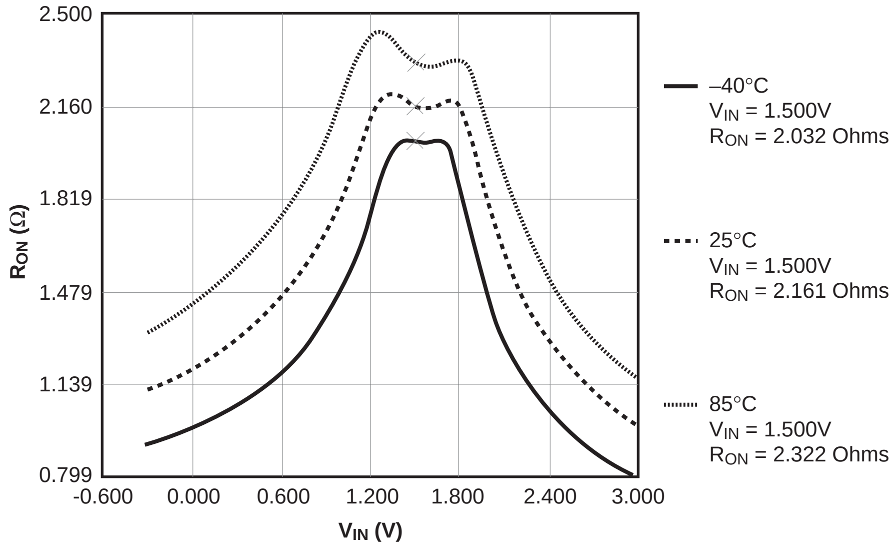


Figure 4. R_{ON} Switch On Resistance, I_{ON} = 100mA, V_{CC} = 2.7V

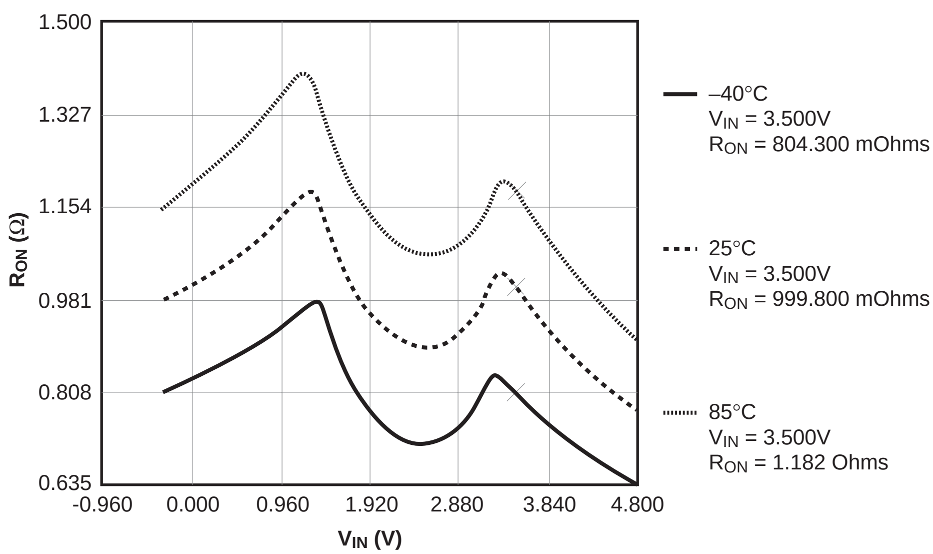
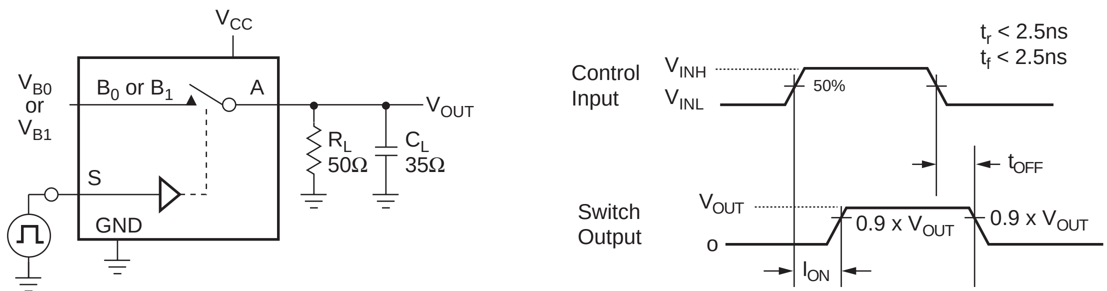


Figure 5. R_{ON} Switch On Resistance, I_{ON} = 100mA, V_{CC} = 4.5V

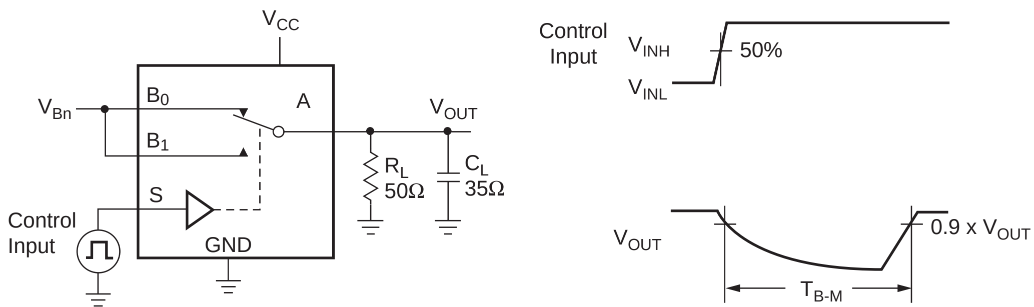
AC Loading and Waveforms



C_L Includes Fixture and Stray Capacitance

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

Figure 6. Turn-ON/OFF Timing



C_L includes fixture and stray capacitance

Figure 7. Break Before Make Timing

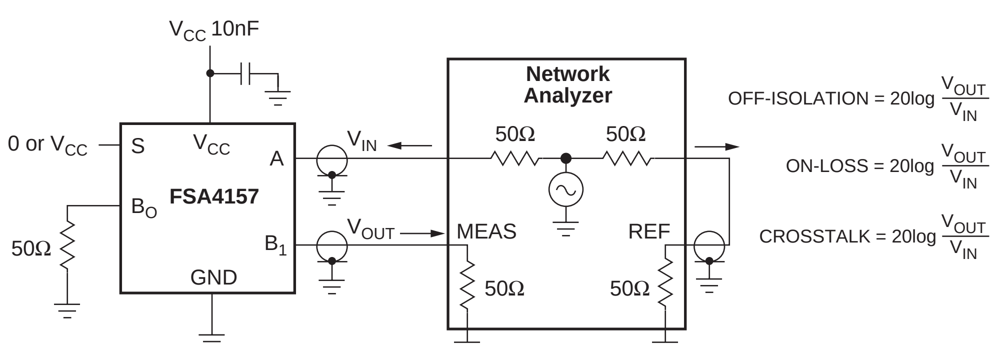


Figure 8. OFF Isolation and Crosstalk

AC Loading and Waveforms (Continued)

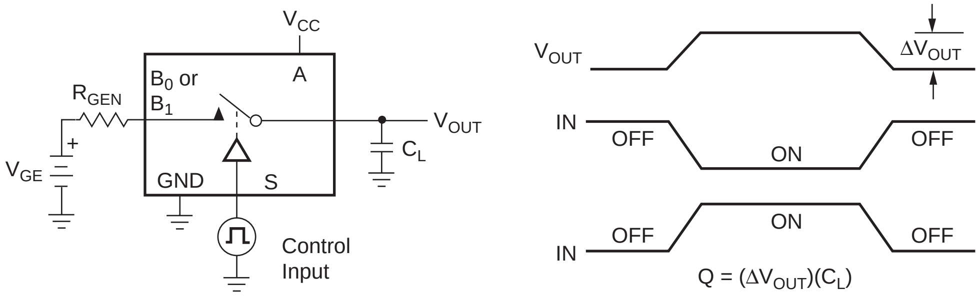


Figure 9. Charge Injection

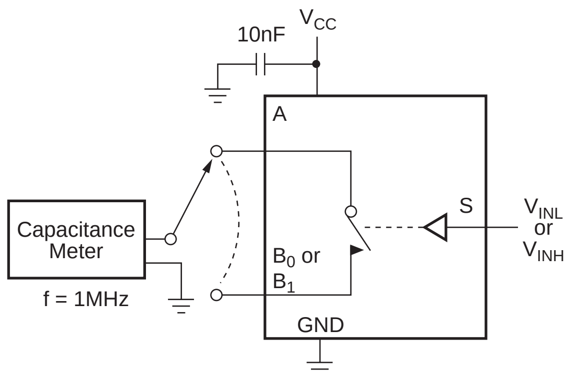


Figure 10. ON/OFF Capacitance Measurement Setup

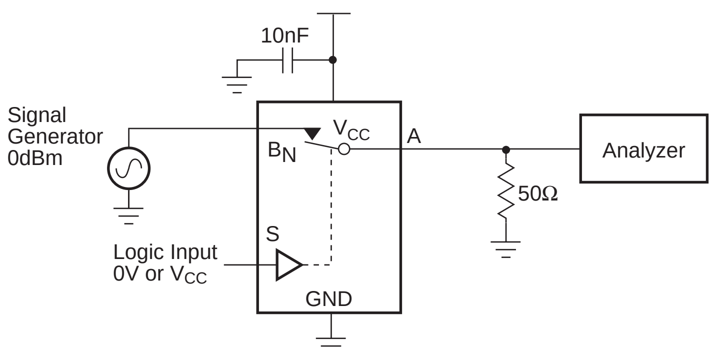


Figure 11. Bandwidth

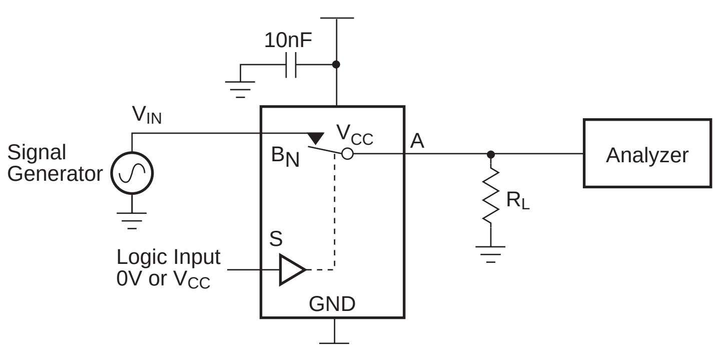
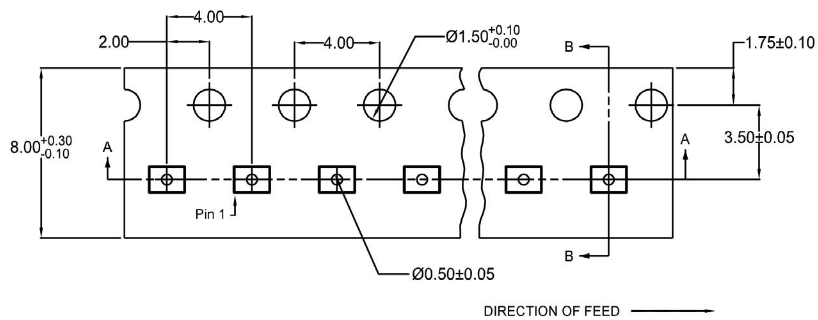


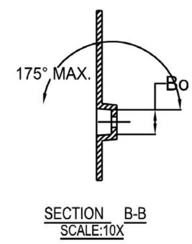
Figure 12. Harmonic Distortion

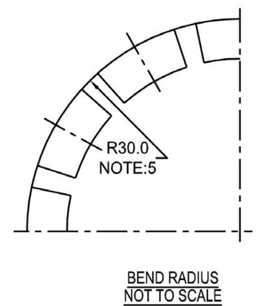
Tape Specification

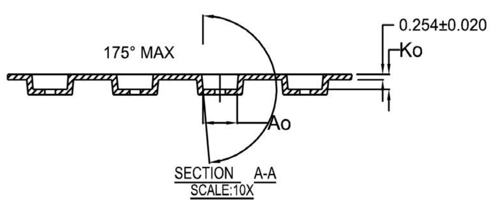
Tape Format For Micropak 6

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L6X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed





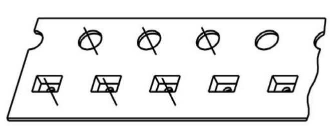




NOTES: UNLESS OTHERWISE SPECIFIED

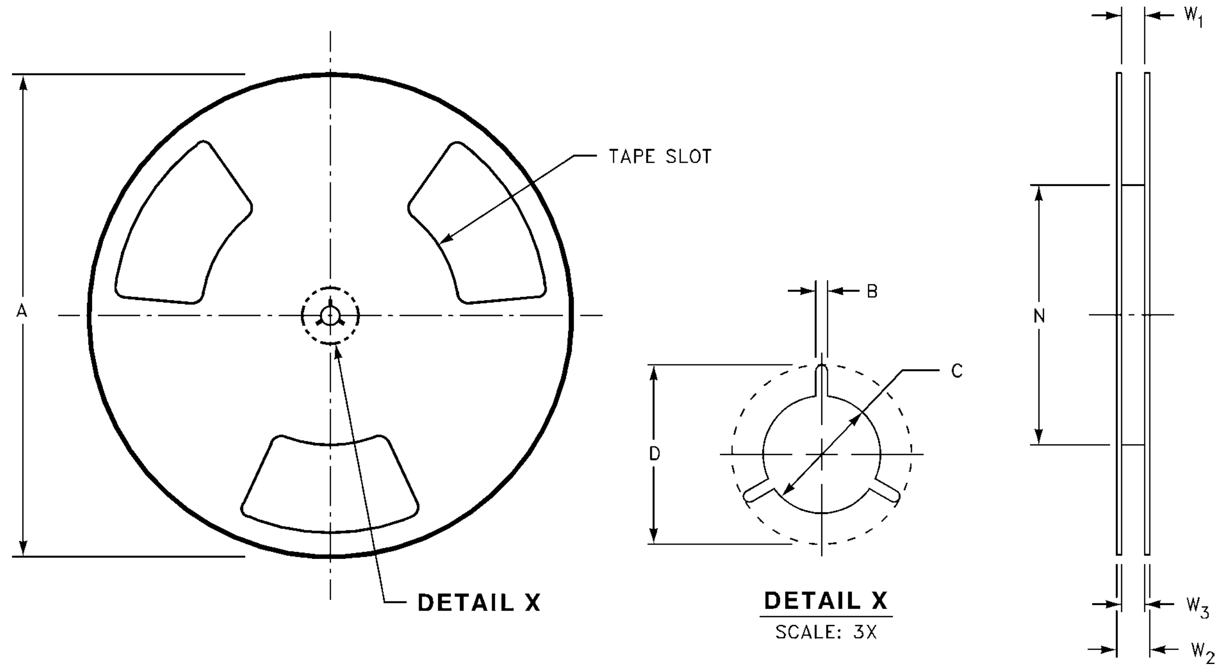
1. ACCUMULATED 50 SPROCKETS, SPROCKET HOLE PITCH IS 200.00 ±0.30MM
2. NO INDICATED CORNER RADIUS IS 0.127MM
3. CAMBER NOT TO EXCEED 1MM IN 100MM
4. SMALLEST ALLOWABLE BENDING RADIUS
5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

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



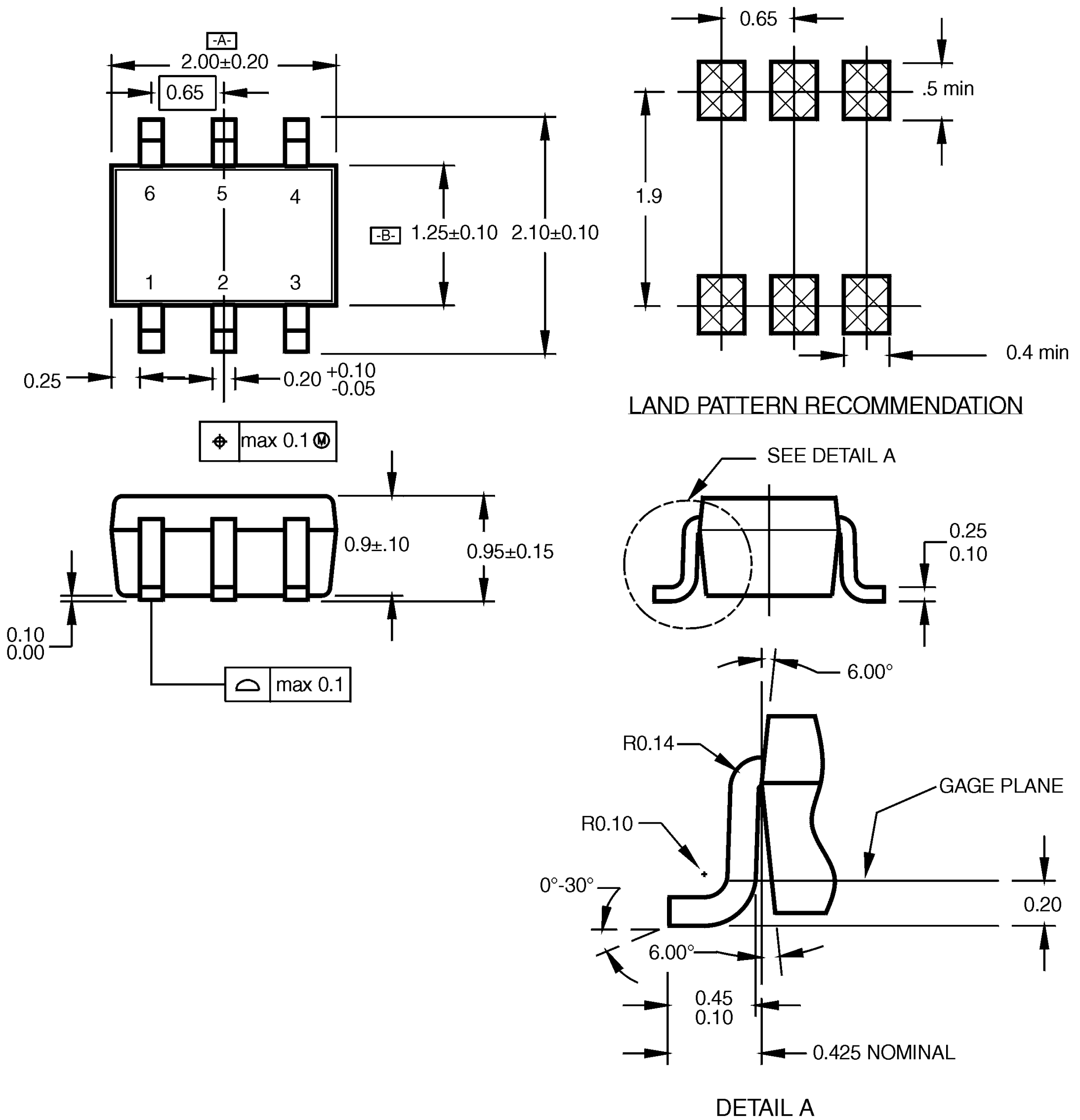
SCALE: 6X

Reel Dimensions for Micropack 6 inches (millimeters)



Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	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)

Physical Dimensions millimeters unless otherwise noted



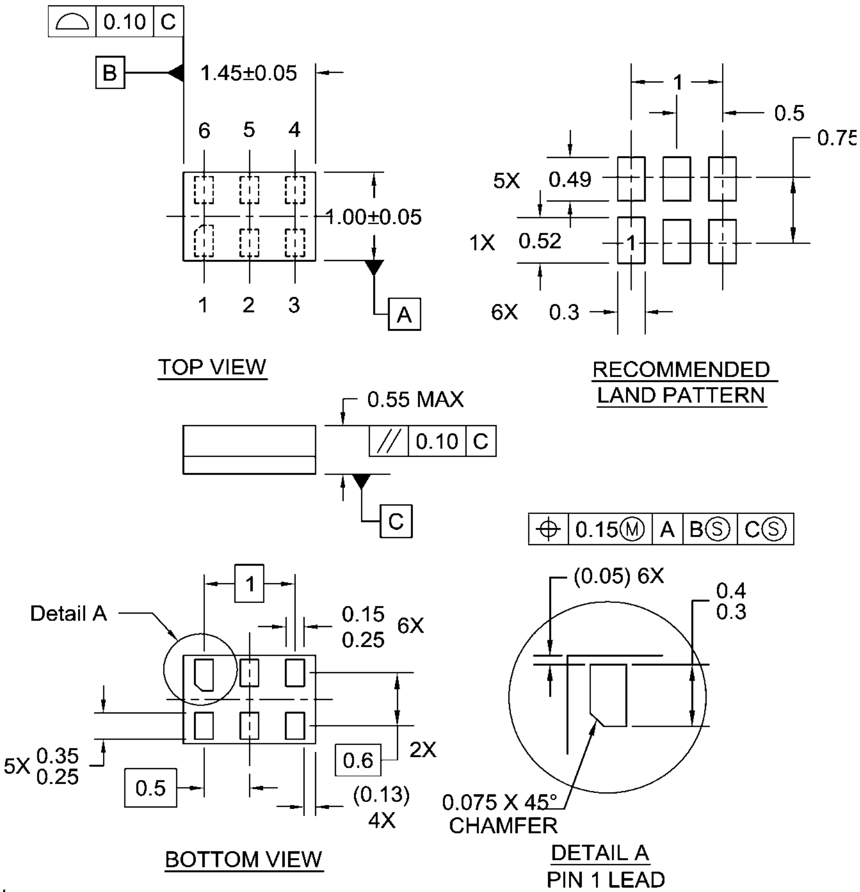
NOTES:

A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide
Package Number MAA06A

Physical Dimensions millimeters unless otherwise noted



Notes:

1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

Pb-Free 6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A

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FAST®
FASTr™
FPS™
FRFET™
GlobalOptoisolator™
GTO™
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I^2C™
i-Lo™
ImpliedDisconnect™
IntelliMAX™
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The Power Franchise®
Programmable Active Droop™
ISOPLANAR™
LittleFET™
MICROCOUPLER™
MicroFET™
MicroPak™
MICROWIRE™
MSX™
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OPTOPLANAR™
PACMAN™
POP™
Power247™
PowerEdge™
PowerSaver™
PowerTrench®
QFET®
QS™
QT Optoelectronics™
Quiet Series™
RapidConfigure™
RapidConnect™
µSerDes™
ScalarPump™
SILENT SWITCHER®
SMART START™
SPM™
Stealth™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
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TINYOPTO™
TruTranslation™
UHC™
UltraFET®
UniFET™
VCX™
Wire™

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2. 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 in order 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 in order 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. I18