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FAIRCHILD SEMICONDUCTOR®

March 2011

FSA2156
Low-Voltage SPST 0.4Ω Analog Switch

Features

- Maximum 0.7Ω On Resistance (R_{ON}) for +2.7V Supply
- 0.25Ω Maximum R_{ON} Flatness for +2.7V Supply
- Space-Saving MicroPak™ and SC70 Packaging
- Broad V_{CC} Operating Range: 1.65 to 4.3V
- Fast Turn-on and Turn-off Times
- Over-Voltage Tolerant TTL-Compatible Control Input
- Suitable for 2 UL USB2.0 Applications: 200mA
- Low I_{CCT} Current Over Expanded Control Input Range

Description

The FSA2156 is a high-performance Single-Pole Single-Throw (SPST) analog switch that features ultra low R_{ON} of 0.4Ω (typical) at 2.7V V_{CC}. The FSA2156 operates over the wide V_{CC} range of 1.65V to 4.3V and is fabricated with sub-micron CMOS technology to achieve fast switching speeds. The select input is TTL-level compatible.

FSA2156 features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature facilitates longer battery life in mobile handset applications and allows for the direct interface with baseband-processor, general-purpose I/Os.

Ordering Information

Part Number	Top Mark	Package Description	Packing Method
FSA2156P6X	256	6-lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units on Tape and Reel
FSA2156L6X	FY	6-lead MicroPak™, 1.0mm Wide	5000 Units on Tape and Reel
FSA2156FHX	FY	6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch	5000 Units on Tape and Reel

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Pin Configurations

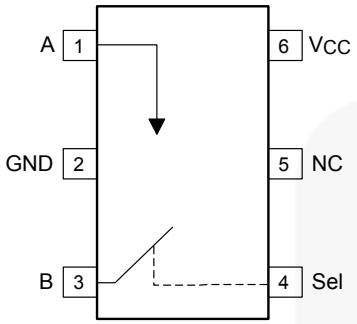


Figure 1. SC70 Pin Assignments (Top View)

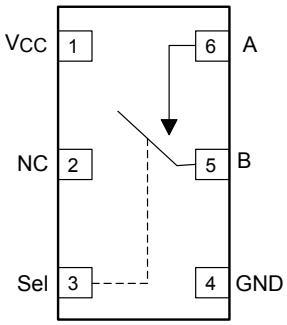


Figure 2. MicroPak™ Pin Assignments (Top View)

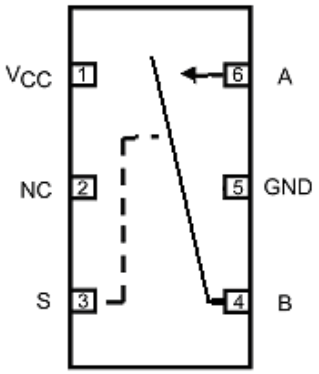


Figure 3. MicroPak2™ Pin Assignments (Top View)

Pin Definitions

Pin # SC70	Pin # MicroPak™	Pin # MicroPak2™	Name	Description
1	6	6	A	Switch I/O Data Ports
2	4	5	GND	Ground
3	5	4	B	Switch I/O Data Ports
4	3	3	Sel	Control Input
5	2	2	NC	No Connect
6	1	1	V_{CC}	Supply Voltage

Truth Table

Control Input (S)	Function
Logic Level LOW	Switch Open (OFF)
Logic Level HIGH	Switch Closed (ON)

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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	4.6	V
V_{SW}	Switch I/O Voltage(1)			-0.5	V_{CC} + 0.3	V
V_{CNTRL}	Control Input Voltage(1)			-0.5	4.6	V
I_{IK}	Input Clamp Diode Current			± 50	± 50	mA
I_{SW}	Switch I/O Current (Continuous)				500	mA
I_{SWPEAK}	Pulsed at 1ms Duration, <10% Duty Cycle				500	mA
P_D	Power Dissipation at 85°C	SC70 Package			180	mW
		MicroPak™ Package			180	mW
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	Electrostatic Discharge Capability	Human Body Model, JEDEC:JESD22-A114	All Pins		2	kV
			I/O to GND		8	kV
		Charge Discharge Model, JEDEC:JESD22-C101			2	kV

Note:

1. The input and output negative 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	4.30	V
V_{CNTRL}	Control Input Voltage(2)		0	V_{CC}	V
V_{SW}	Switch I/O Voltage		0	V_{CC}	V
I_{SW}	Switch I/O Load Current			350	mA
T_A	Operating Temperature		-40	+85	°C
θ_{JA}	Thermal Resistance (free air)	SC70 6L Package		350	°C/W
		MicroPak™ 6L Package		310	°C/W

Note:

2. Control input must be held HIGH or LOW; it must not float.

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DC Electrical Characteristics

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

Symbol	Parameter	Condition	V_{CC} (V)	T_A=+25°C			T_A=-40 to +85°C		Unit
				Min.	Typ.	Max.	Min.	Max.	
V_{IH}	Input Voltage High		3.6 to 4.3				1.4		V
			2.7 to 3.6				1.3		
			2.3 to 2.7				1.1		
			1.65 to 1.95				0.9		
V_{IL}	Input Voltage Low		3.6 to 4.3					0.7	V
			2.7 to 3.6					0.5	V
			2.3 to 2.7					0.4	
			1.65 to 1.95					0.4	
I_{IN}	Control Input Leakage	V_{CNTRL}=0 to V_{CC}	1.65 to 4.3				-0.5	0.5	µA
$I_{NO(0FF)}$	Off Leakage Current of Port B	V_A=0.3V, V_{CC} – 0.3V, V_B=0.3V, V_{CC} – 0.3V or Floating, Figure 5	1.95 to 4.3	-10		10	-50	50	nA
$I_{A(ON)}$	On Leakage Current of Port A	V_A=0.3V, V_{CC} – 0.3V, V_B=Floating, Figure 6	1.95 to 4.3	-20		20	-100	100	nA
I_{0FF}	Power Off Leakage Current	Port A V_A=0.3V, 4.3V, V_{CC}=0V, V_B=0V	0V					±25	µA
	Power Off Leakage Current[3]	Port A V_A=0.3V, 4.3V, V_{CC}=0V, V_B=Floating	0V	-4		+4	-35	35	nA
R_{ON}	Switch On Resistance[4] Figure 4	I_{ON}=100mA, V_B=0V, 0.7V, 3.6V and 4.3V	4.3		0.36			0.60	Ω
		I_{ON}=100mA, V_B=0V, 0.7V, 2.0V and 2.7V	2.7		0.40			0.70	
		I_{ON}=100mA, V_B=0V, 0.7V, 1.6V and 2.3V	2.3		0.55			0.80	
		I_{ON}=100mA, V_B=0.7V	1.65		1.50				
$R_{FLAT(ON)}$	On Resistance Flatness[5] Figure 4	I_{ON}=100mA, V_B=0V, 0.7V, 3.6V and 4.3V	4.3					0.25	Ω
		I_{ON}=100mA, V_B=0V, 0.7V, 2.0V and 2.7V	2.7					0.25	
		I_{ON}=100mA, B=0V, 0.7V, 1.6V and 2.3V	2.3					0.30	
		I_{ON}=100mA, V_B=0V, 0.7V, 0.9V and 1.65V	1.65		0.90				
I_{CC}	Quiescent Supply Current	V_{SW}=0 or V_{CC}, I_{OUT}=0	4.3	-100	30	100	-500	500	nA
I_{CCT}	Increase in I_{CC} per Input	V_{CNTRL}=2.6V	4.3		3			6	µA
		V_{CNTRL}=1.8V			7	12		15	

Notes:

3. Guaranteed by characterization; not production tested.
4. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
5. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

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AC Electrical Characteristics

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

Symbol	Parameter	Condition	V_{CC} (V)	T_A=+25°C			T_A=-40°C to +85°C		Unit	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{ON}	Turn-On Time	V_B=1.5V, R_L=50Ω, C_L=35pF	3.6 to 4.3			55		60	ns	Figure 7 Figure 8
			2.7 to 3.6			60		65		
			2.3 to 2.7			65		70		
			1.65 to 1.95		40					
t_{OFF}	Turn-Off Time	V_B=1.5V, R_L=50Ω, C_L=35pF	3.6 to 4.3			65		70	ns	Figure 7 Figure 8
			2.7 to 3.6			70		75		
			2.3 to 2.7			75		80		
			1.65 to 1.95		90					
Q	Charge Injection	C_L=1.0nF, V_S=0V, R_S=0Ω	2.3 to 4.3		6				pC	Figure 11
			1.65 to 1.95		1.3					
OIRR	Off Isolation	f=100kHz R_T=50Ω	1.65 to 4.3		-65				dB	Figure 10
BW	-3db Bandwidth	R_T=50Ω C_L=0pF	1.65 to 4.3		80				MHz	Figure 9
THD	Total Harmonic Distortion	R_T=600Ω, V_{SW}=0.5V_{PP}, f=20Hz to 20kHz	1.65 to 4.3		.02				%	

Capacitance

Symbol	Parameter	Condition	V_{CC} (V)	T_A=+25°C			Unit	Figures
				Min.	Typ.	Max.		
C_{IN}	Control Pin Input Capacitance	f=1MHz	0		1.5		pF	Figure 12
C_{OFF}	B-Port Off Capacitance	f=1MHz	4.3		38		pF	Figure 12
C_{ON}	A-Port On Capacitance	f=1MHz	4.3		115		pF	Figure 13

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Test Diagrams

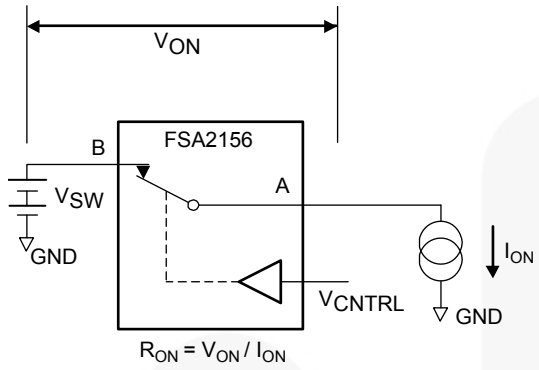


Figure 4. On Resistance

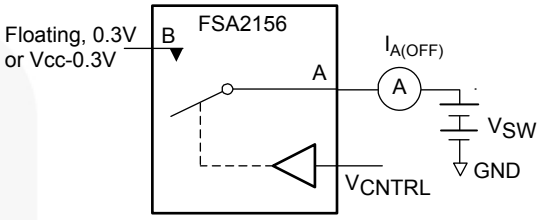


Figure 5. Off Leakage

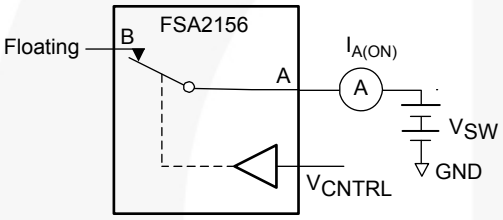
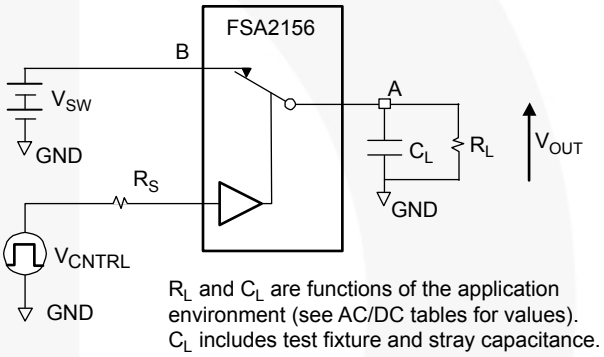


Figure 6. On Leakage



RL and CL are functions of the application environment (see AC/DC tables for values).
CL includes test fixture and stray capacitance.

Figure 7. Test Circuit Load

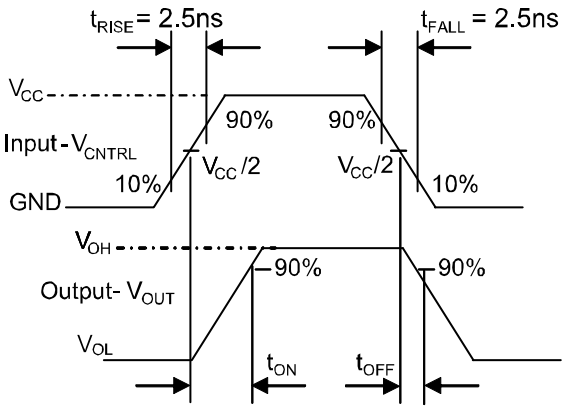
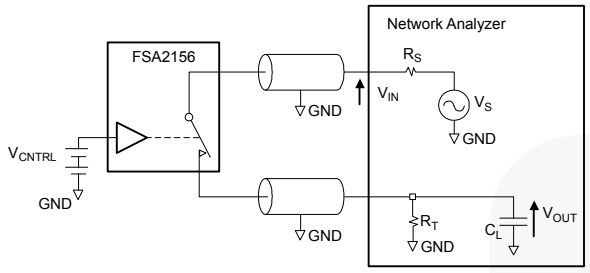


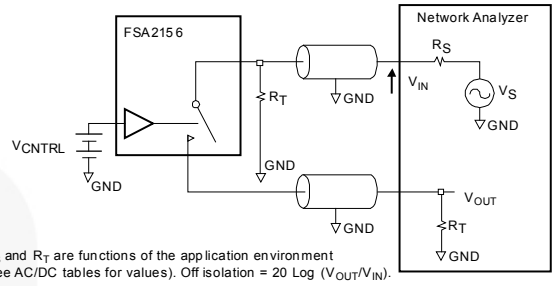
Figure 8. Turn-On / Turn-Off Waveforms

Test Diagrams (Continued)



R_T and C_L are functions of the application environment (see AC/DC tables for values). C_L includes test fixtures and stray capacitance.

Figure 9. Bandwidth



R_S and R_T are functions of the application environment (see AC/DC tables for values). Off isolation = 20 Log (V_{OUT}/V_{IN}).

Figure 10. Channel Off Isolation

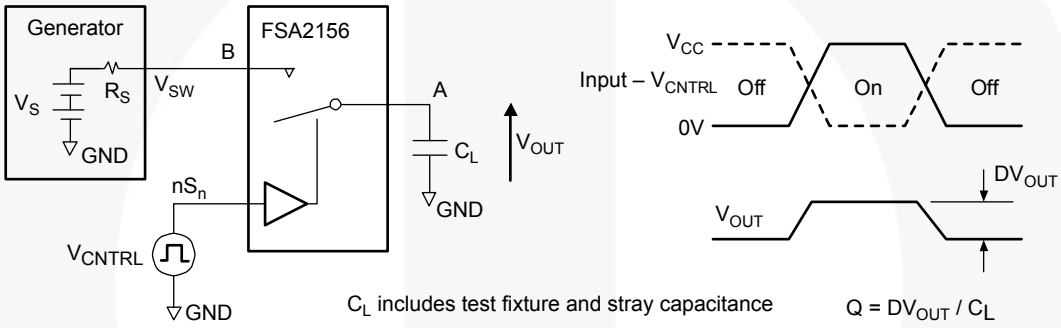


Figure 11. Charge Injection Test

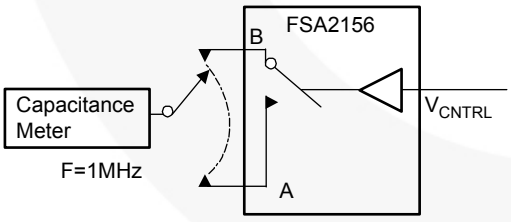


Figure 12. Channel Off Capacitance

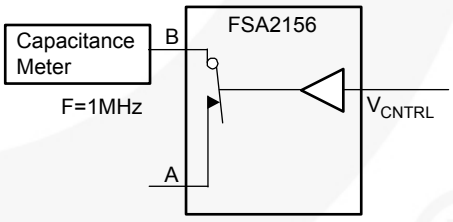


Figure 13. Channel On Capacitance

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Physical Dimensions

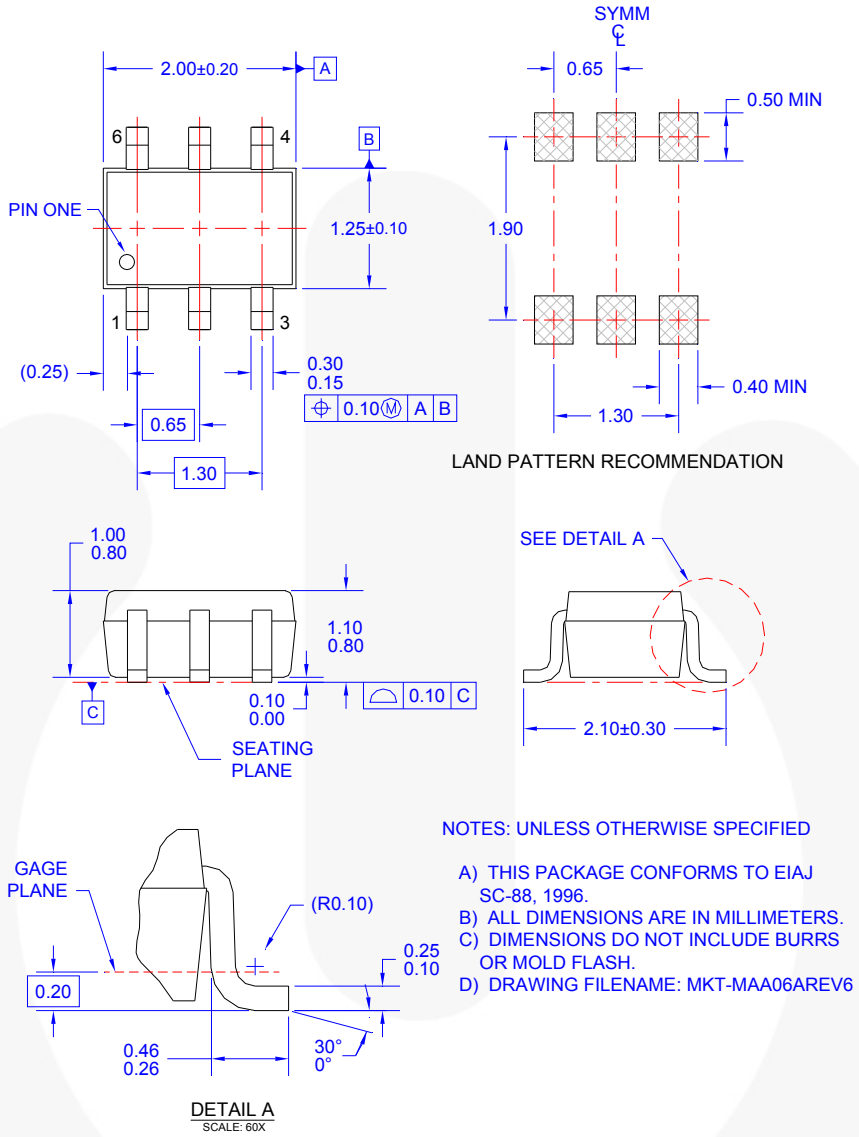


Figure 14. 6-Lead, SC70, EIAJ SC-88a, 1.25mm Wide

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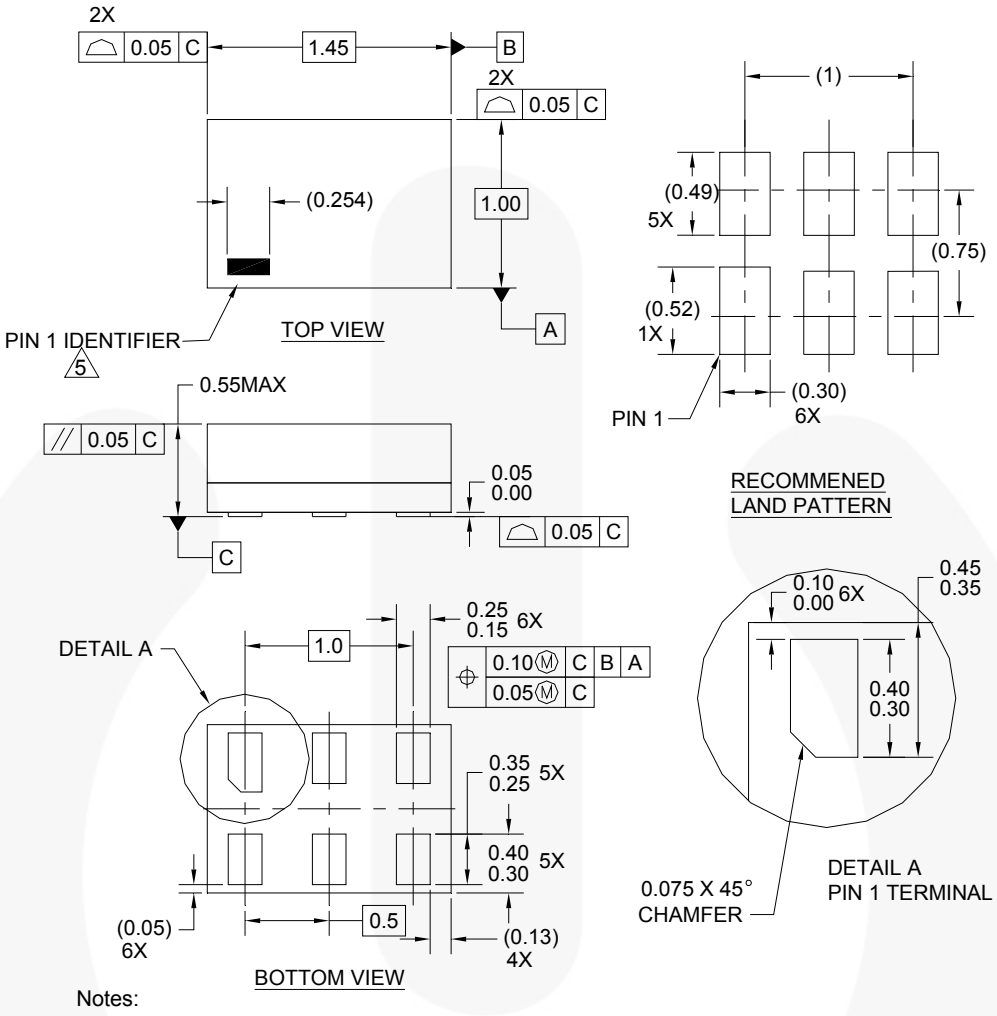
Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:
http://www.fairchildsemi.com/products/analog/pdf/sc70-6_tr.pdf.

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
P6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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Physical Dimensions (Continued)



Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994
4. FILENAME AND REVISION: MAC06AREV4
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

Figure 15. 6-Lead, MicroPak™, 1.0mm Wide

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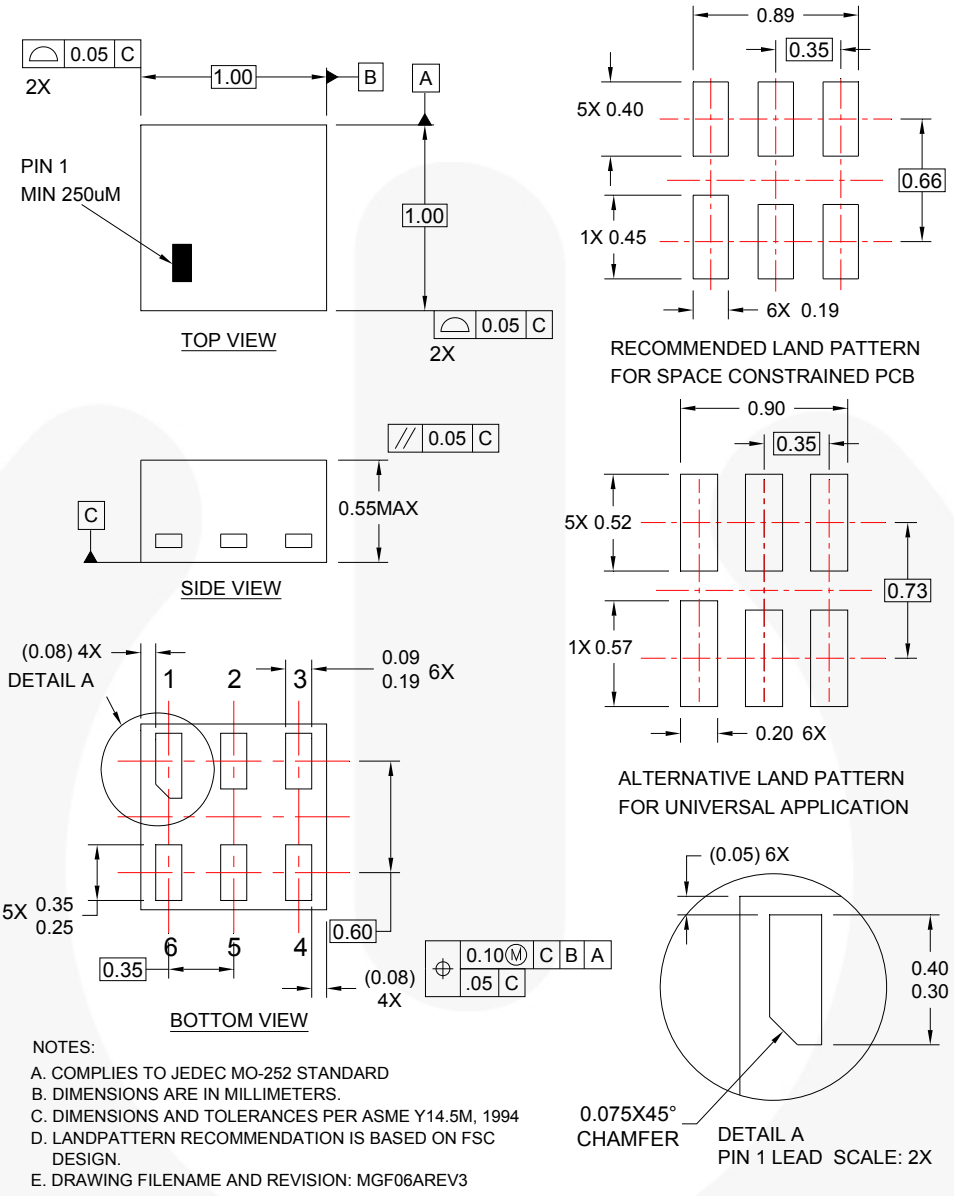
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Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:
http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf.

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

Physical Dimensions (Continued)



NOTES:

A. COMPLIES TO JEDEC MO-252 STANDARD
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
D. LANDPATTERN RECOMMENDATION IS BASED ON FSC DESIGN.
E. DRAWING FILENAME AND REVISION: MGF06AREV3

Figure 16. 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch

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Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:
http://www.fairchildsemi.com/packaging/MicroPAK2_6L_tr.pdf.

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
FHX	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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SuperSOT™-6
SuperSOT™-8
SupreMOS®
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the power franchise
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Definition of Terms

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