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June 2014

FSA2270T Low-Voltage, Dual-SPDT (0.4 Ω) Analog Switch with Negative Swing Audio Capability

Features

- 0.4 Ω Typical On Resistance (R_{ON}) for +3.0 V Supply
- 0.25 Ω Maximum R_{ON} Flatness for +3.0 V Supply
- -3 db Bandwidth: > 50 MHz
- Low-I_{CCT} Current Over Expanded Control Input Range
- Packaged in 10-Lead UMLP
- Power-Off Protection on Common Ports
- Broad V_{CC} Operating Range: 1.65 to 4.3 V
- Noise Immunity Termination Resistors
- Low Electrostatic Discharge (ESD)
  - Human Body Model (JEDEC: JESD22-A114)
    - Power to GND 16 kV
    - I/O to GND 11 kV
    - All other pins 8 kV
  - Charged Device Model (JEDEC: JESD22-A101)

Applications

- Cell Phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

IMPORTANT NOTE:

For additional information, please contact analogswitch@fairchildsemi.com.

Description

The FSA2270T is a high-performance, dual Single-Pole Double-Throw (SPDT) analog switch with negative swing audio capability. The FSA2270T features ultra-low R_{ON} of 0.4 Ω (typical) at 3.0 V V_{CC}. The FSA2270T operates over a wide V_{CC} range of 1.65 V to 4.3 V, 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 FSA2270T features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature suits mobile handset applications by allowing direct interface with baseband processor general-purpose I/Os with minimal battery consumption.

The FSA2270T includes termination resistors that improve noise immunity during overshoot excursions, off-isolation coupling, or “pop-minimization.”

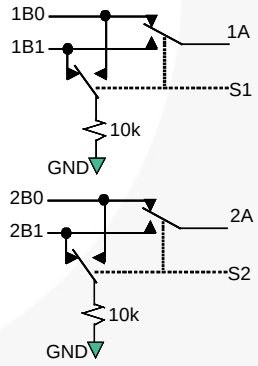


Figure 1. Analog Symbol

Ordering Information

Part Number	Top Mark	Package Description
FSA2270TUMX	HK	10-Lead, Quad Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8 mm, 0.4 mm Pitch

Pin Configuration

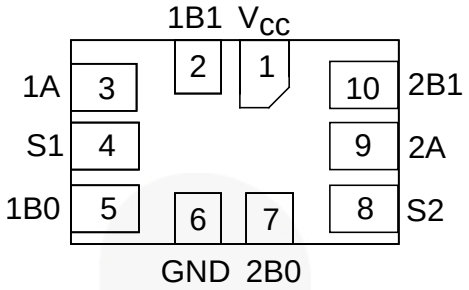


Figure 2. 10-Pin UMLP (Top Through View)

Pin Descriptions

Pin#	Name	Description
1	V_{CC}	Supply Voltage
3, 9	1A, 2A	Data Points
4, 8	S1, S2	Switch Select Pins
5, 7	1B0, 2B0	Data Ports
6	GND	Ground
2, 10	1B1, 2B1	Data Ports

Truth Table

Control Input, Sn	Function
LOW Logic Level	nB0 connected to nA; nB1 terminated to GND
HIGH Logic Level	nB1 connected to nA; nB0 terminated to GND

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. Functional operation above the recommended operating conditions is not implied. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. Absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Units
V_{CC}	Supply Voltage		-0.5	5.5	V
V_{SW}	Switch I/O Voltage[1]	1B0, 1B1, 2B0, 2B1, 1A, 2A Pins	V_{CC} - 4.3	V_{CC} + 0.3	V
V_{CNTRL}	Control Input Voltage[1]	S1, S2	-0.5	V_{CC} + 0.3	
I_{IK}	Input Clamp Diode Current			-50	mA
I_{SW}	Switch I/O Current (Continuous)			350	mA
I_{SWPEAK}	Peak Switch Current (Pulsed at 1 ms Duration, <10% Duty Cycle)			500	mA
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, JEDEC: JESD22-A114	Power to GND		16	kV
		I/O to GND		11	kV
		All Other Pins		8	kV
	Charged Device Model, JEDEC: JESD22-C101			2	kV

Note:

1. Input and output negative ratings may be exceeded if 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.	Units
V_{CC}	Supply Voltage	1.65	4.30	V
$V_{S1, S2}$	Control Input Voltage	0	V_{CC}	V
V_{SW}	Switch I/O Voltage	V_{CC} - 4.3	V_{CC}	V
T_A	Operating Temperature	-40	+85	°C

DC Electrical Characteristics

All typical values are for V_{CC}=3.3 V at T_A=25°C unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25ºC			T_A=-40 to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V_{IH}	Input Voltage High		3.60 to 4.30				1.7		V
			2.70 to 3.60				1.5		
			2.30 to 2.70				1.4		
			1.65 to 1.95				0.9		
V_{IL}	Input Voltage Low		3.60 to 4.30					0.7	V
			2.70 to 3.60					0.5	V
			2.30 to 2.70					0.4	
			1.65 to 1.95					0.4	
I_{IN}	Control Input Leakage (S1, S2)	V_{IN}=0 to V_{CC}	1.65 to 4.30				-0.5	0.5	µA
$I_{A(ON)}$	On Leakage Current of Port nA	nA=0.5 V, V_{CC}–0.5 V nB0 or nB1=V_{CC}-0.5 V, 0.5 V, or Floating Figure 5	1.95 to 4.30				-1	1	µA
I_{OFF}	Power-Off Leakage Current (Common Port Only 1A, 2A)	Common Port (1A, 2A), V_{IN}=0 V to 4.3 V, V_{CC}=0 V nB0, nB1=0 V or Floating	0				-45	45	µA
R_{ON}	Switch On Resistance[2,5]	I_{ON}=100 mA, nB0 or nB1=0.7 V, 3.6 V, 4.3 V Figure 3	4.30		0.30				Ω
		I_{ON}=100 mA, nB0 or nB1=0.7 V, 3.6 V, 4.3 V Figure 3	3.00		0.40			0.80	
		I_{ON}=100 mA, nB0 or nB1=0 V, 0.7 V, 1.6 V, 2.3 V Figure 3	2.30		0.52				
		I_{ON}=100 mA, nB0 or nB1=0 V, 0.7 V, 1.65 V Figure 3	1.65		1.00				
ΔR_{ON}	On Resistance Matching Between Channels[3]	I_{ON}=100 mA, nB0 or nB1=0.7 V	4.30		0.04			0.13	Ω
			3.00		0.06			0.13	
			2.30		0.12				
			1.65		1.00				
$R_{FLAT(ON)}$	On Resistance Flatness[4]	I_{OUT}=100 mA, nB0 or nB1=0 V to V_{CC}	4.30					0.25	Ω
			3.00					0.25	
			2.30		0.5				
			1.65		0.6				
R_{TERM}	Internal Termination Resistors[5]				10				kΩ
I_{CC}	Quiescent Supply Current	V_{IN}=0 V or V_{CC}, I_{OUT}=0 mA	4.30	-100		100	-500	500	nA
I_{CCT}	Increase in I_{CC} per Input	Input at 2.6 V	4.30		3.0			10.0	µA
		Input at 1.8 V			7.0			15.0	

Notes:

2. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
3. $\Delta R_{ON}=R_{ONmax}-R_{ONmin}$ measured at identical V_{CC}, temperature, and voltage.
4. Flatness is defined as the difference between the maximum and minimum value of on resistance (R_{ON}) over the specified range of conditions.
5. Guaranteed by characterization, not production tested.

AC Electrical Characteristics

All typical value are for V_{CC}=3.3 V at T_A=25ºC unless otherwise specified.

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25ºC			T_A=-40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{ON}	Turn-On Time	nB0 or nB1=1.5 V, R_L=50 Ω, C_L=35 pF	3.60 to 4.30			60	15	65	ns	Figure 6 Figure 7
			2.70 to 3.60			65	15	70		
			2.30 to 2.70			80	15	85		
			1.65 to 1.95		100					
t_{OFF}	Turn-Off Time	nB0 or nB1=1.5 V, R_L=50 Ω, C_L=35 pF	3.60 to 4.30			55	5	60	ns	Figure 6 Figure 7
			2.70 to 3.60			60	5	65		
			2.30 to 2.70			65	5	70		
			1.65 to 1.95		65					
t_{BBM}	Break-Before-Make Time	nB0 or nB1=1.5 V, R_L=50 Ω, C_L=35 pF	3.60 to 4.30		3		1		ns	Figure 8
			2.70 to 3.60		5		2			
			2.30 to 2.70		10		2			
			1.65 to 1.95		15		2			
Q	Charge Injection	C_L=1.0 nF, V_S=0 V, R_S=0 Ω	1.65 to 4.30		25				pC	Figure 12
OIRR	Off Isolation	f=100 kHz, R_L=50 Ω, C_L=0 pF	1.65 to 4.30		-70				dB	Figure 10
Xtalk	Crosstalk	f=100 kHz, R_L=50 Ω, C_L=0 pF	1.65 to 4.30		-70				dB	Figure 11
BW	-3 db Bandwidth	R_L=50 Ω, C_L=0 pF	1.65 to 4.30		>50				MHz	Figure 9
THD	Total Harmonic Distortion	f=20 Hz to 20 kHz, R_L=32 Ω, V_{IN}=2 V_{pp} V_{BIAS}=0 V	1.65 to 4.30		.06				%	Figure 15

Capacitance

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25ºC			Units	Figure
				Min.	Typ.	Max.		
C_{IN}	Control Pin Input Capacitance	f=1 MHz	0		2.5		pF	Figure 13
C_{OFF}	B Port Off Capacitance	f=1 MHz	3.3		30		pF	Figure 13
C_{ON}	A Port On Capacitance	f=1 MHz	3.3		120		pF	Figure 14

Test Diagrams

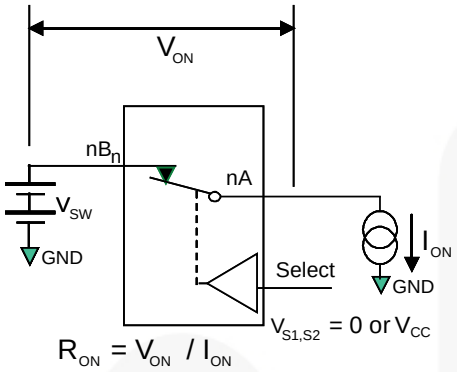
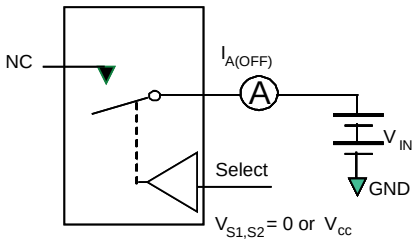


Figure 3. On Resistance



Each switch port is tested separately.

Figure 4. Off Leakage

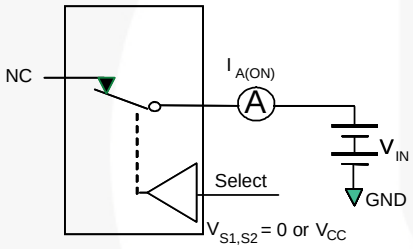
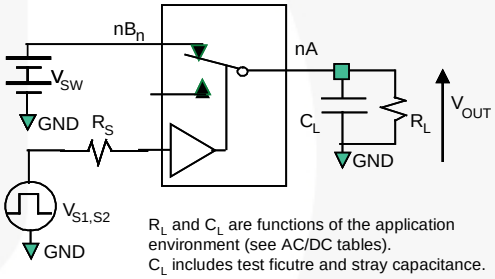


Figure 5. On Leakage



R_L and C_L are functions of the application environment (see AC/DC tables).
C_L includes test ficutre and stray capacitance.

Figure 6. Test Circuit Load

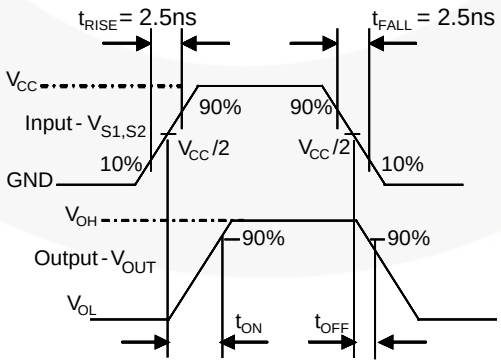
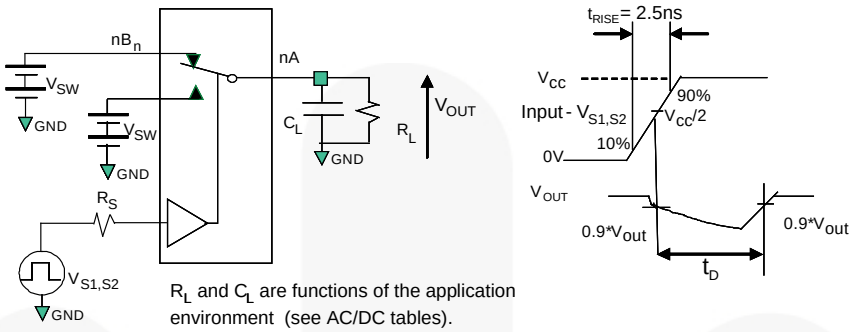


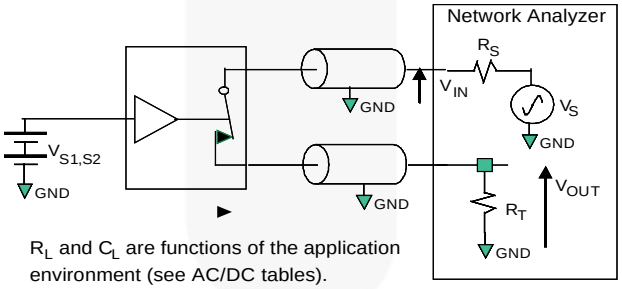
Figure 7. Turn-On / Turn-Off Waveforms

Test Diagrams (Continued)



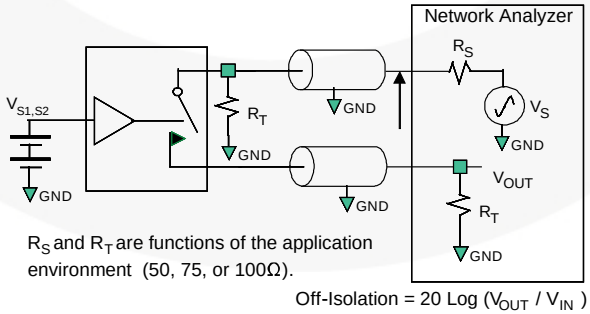
R_L and C_L are functions of the application environment (see AC/DC tables).
C_L includes test fixture and stray capacitance.

Figure 8. Break-Before-Make Interval Timing



R_L and C_L are functions of the application environment (see AC/DC tables).
C_L includes test fixture and stray capacitance.

Figure 9. Bandwidth

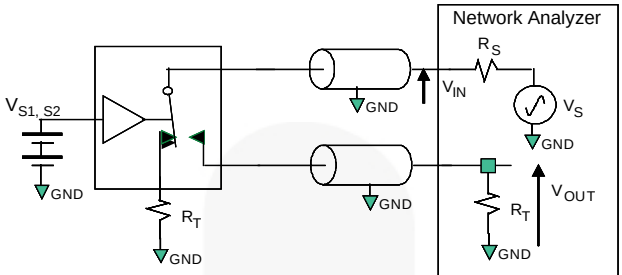


R_S and R_T are functions of the application environment (50, 75, or 100Ω).

Off-Isolation = 20 Log (V_{OUT} / V_{IN})

Figure 10. Channel Off Isolation

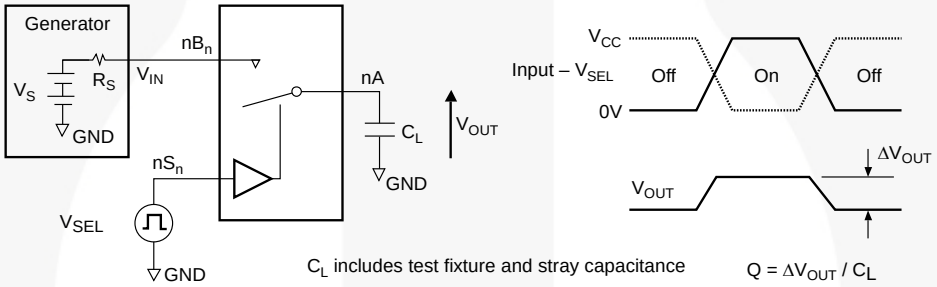
Test Diagrams (Continued)



R_S and R_T are functions of the application environment (see AD / DC tables).

Crosstalk = 20 Log (V_{OUT} / V_{IN})

Figure 11. Adjacent Channel Crosstalk



C_L includes test fixture and stray capacitance

$Q = \Delta V_{OUT} / C_L$

Figure 12. Charge Injection Test

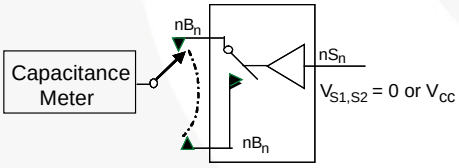


Figure 13. Channel Off Capacitance

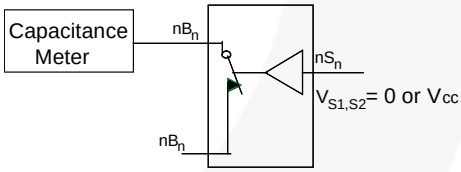
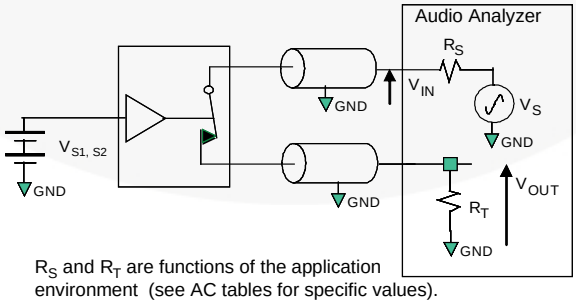


Figure 14. Channel On Capacitance



R_S and R_T are functions of the application environment (see AC tables for specific values).

Figure 15. Total Harmonic Distortion

Physical Dimensions

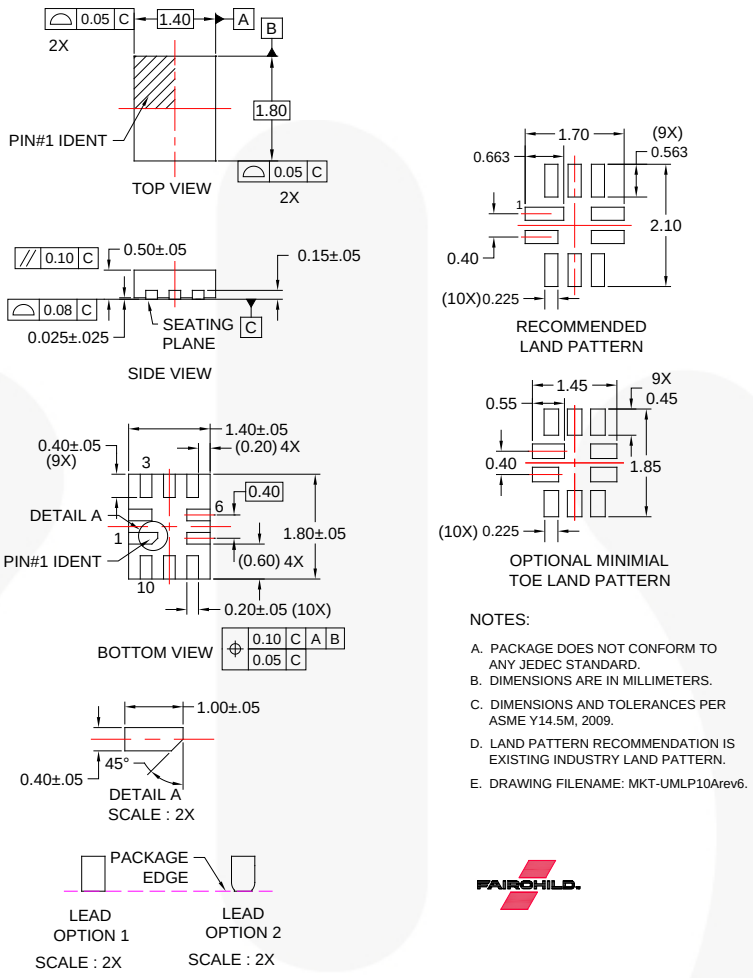


Figure 16. 10-Lead, Quad Ultrathin Molded Leadless Package (UMLP)

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Table 1. **Nominal Values**

JEDEC Symbol	Description	Nominal Values (mm)
A	Overall Height	0.5
A1	Package Standoff	0.026
A3	Lead Thickness	0.152
b	Lead Width	0.2
L	Lead Length	0.4
e	Lead Pitch	0.4
D	Body Length (Y)	1.8
E	Body Width (X)	1.4

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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.

Rev. I68

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