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# FSA806 — USB2.0 High-Speed (480Mbps), UART, and Audio Switch with Negative Signal Capability

#### **Features**

- 3:1 Switch Handles:
  - Audio Headsets
  - UART
  - Up to Two High- and Low-Speed USB Data
- Negative-Swing-Capable Audio Channel
- Built-in Termination Resistors for Audio Pop Reduction
- Simple Switch Control Using Two Select Pins

#### **Description**

The FSA806 is a 3:1 USB accessory switch that enables USB data, stereo and mono audio, and UART data to share a common connector port. Two ports are designed for high-speed USB 2.0 signaling, while also capable of full speed USB and UART communication. The architecture is designed to allow audio signals to swing below ground so a common USB and headphone jack can be used for personal media players and portable peripheral devices.

The FSA806 meets both USB Rev. 2.0 and micro-USB specifications.

## **Applications**

Cell Phones, MP3 Players, PDAs

## **Ordering Information**

Part Number	Operating Temperature Range	Top Mark	Package
FSA806UMX	-40 to +85°C	KN	12-Lead Quad, 1.8 x 1.8mm Ultrathin Molded Leadless Package (UMLP)

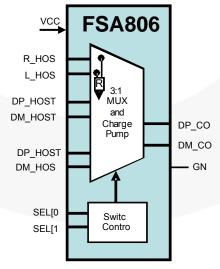


Figure 1. Functional Block Diagram

## **Application Diagram**

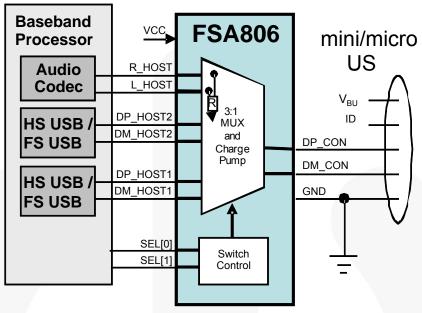


Figure 2. Typical Application

## **Functional Description**

The FSA806 USB2.0 accessory switch is designed to consolidate wired accessories for portable devices, such as cellular telephones and portable audio players. The benefits of consolidation include reduced space requirements from a reduction of connectors and their size. The micro-USB connector, for example, reduces connector height and depth, allowing for slimmer overall designs. Using the USB industry standard and a common connector type, for accessories such as chargers and headsets, greatly reduces the waste associated with new phone purchases by allowing re-use of the accessories.

Using just five wires for all connection types considerably reduces the cost of wired accessories and simplifies their construction. The FSA806 facilitates adopting this methodology because it is designed to redirect the DP/DM pins from the USB connector to one of three ports at the baseband's discretion.

## **Applications with Multiple USB Controllers**

When operating with two USB controllers, it is recommended to configure the switches to OPEN before switching to the other (second) USB interface. The OPEN setting duration should be long enough for the accessory to go to a SE0 state, when the switch is set to the other (second) USB port, the new controller reenumerates.

## **Mode Descriptions**

The FSA806 select pins control the switching operations, SEL[0] and SEL[1] described in Table 1

Table 1. Selection Truth Table

SEL[1]	SEL[0]	Switch Action	Description
0	0	OPEN	Open all switch paths (device in low-power mode)
0	1	USB1, UART	Closes USB1 path to D+/D-, default condition <sup>(1)</sup> - DP_CON connected to DP_HOST1 - DM_CON connected to DM_HOST1
1	0	USB2, UART	Closes USB2 path to D+/D DP_CON connected to DP_HOST2 - DM_CON connected to DM_HOST2
1	Closes audio path to D+/D- only  1 AUDIO - DP_CON connected to R_HOST  - DM_CON connected to L_HOST		- DP_CON connected to R_HOST

#### Notes:

- 1. The SELECT pins are CMOS inputs and should not be left in a floating condition. Some applications require a UART path be in the CLOSED position on power-up for initial programming of the device under test. If that condition is desired, the two SELECT pins should be pulled to the correct levels with external resistors that should exceed  $100 \mathrm{K}\Omega$  to reduce the static power consumption. In other applications, adding weak pull-down resistors to GND defaults the device to all paths open (low-power mode).
- 2. When the audio switch is in the OPEN position, the R and L are terminated to GND with internal termination resistors to discharge any stray capacitance that could cause audio pop.

## **Pin Configuration**

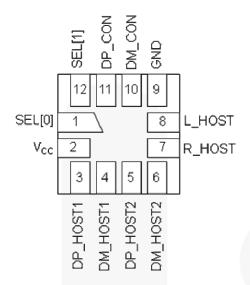


Figure 3. 12-Pin, UMLP Pin Assignments (Top-Through View)

## **Pin Descriptions**

Name	Pin#	Description				
USB, UART I	nterface					
DP_HOST1	3	D+ signal, dedicated USB port to be connected to the resident USB or UART transceiver on the phone.				
DM_HOST1	4	D- signal, dedicated USB port to be connected to the resident USB or UART transceiver on the phone.				
DP_HOST2	5	D+ signal, dedicated USB port to be connected to the resident USB or UART transceiver on the phone.				
DM_HOST2	6	D- signal, dedicated USB port to be connected to the resident USB or UART transceiver on the phone.				
Audio Interfa	ice					
R_HOST	7	ght audio channel from phone audio codec.				
L_HOST	8	eft audio channel from phone audio codec.				
Power Interfa	ace					
V <sub>CC</sub>	2	Input voltage supply pin to be connected to the phone battery output.				
Connector Ir	nterface					
GND	9	Ground				
DP_CON	11	Connected to the USB connector D+ pin; depending on the FSA806 signaling mode, this pin can share DP_HOST1, DP_HOST2 or R_HOST signals.				
DM_CON	10	Connected to the USB connector D- pin; depending on the FSA806 signaling mode, this pin can share DM_HOST1, DM_HOST2 or L_HOST signals.				
Switch Cont	rol					
SEL[1:0]	12, 1	Switch selection pins; refer to Table 1 for truth table.				

## **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	Param	Min.	Max.	Unit		
V <sub>CC</sub>	Supply Voltage from Battery / Baseba	ind		-0.5	6.0	V
		USB		-0.5	V <sub>BUS</sub> +0.5	
$V_{\text{SW}}$	Switch I/O Voltage	Stereo/Mono Audio Pa	ath Active	Vcc-8.5	V <sub>CC</sub> +0.5	V
		All Other Channels		-0.5	V <sub>CC</sub> +0.5	
I <sub>IK</sub>	Input Clamp Diode Current			-50		mA
		USB			50	
$I_{SW}$	Switch I/O Current (Continuous)	Audio		60	mA	
		All Other Channels		50		
		USB			150	mA
I <sub>SWPEAK</sub>	Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle)	Audio			150	mA
	Buration, 410% Buty Cycle)	All Other Channels		150	mA	
T <sub>STG</sub>	Storage Temperature Range					°C
$T_J$	Maximum Junction Temperature				+150	°C
$T_L$	Lead Temperature (Soldering, 10 Sec	conds)			+260	°C
	IFO 04000 4 0 0	USB Connector Pins	Air Gap		15	
FOD	IEC 61000-4-2 System	(D+, D-, V <sub>BUS</sub> )	Contact		8	147
ESD	Human Body Model, JEDEC JESD22-A114 All Pins				3	kV
	Charged Device Model, JEDEC JESE	022-C101	All Pins		2	

## **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	Parameter			Unit
V <sub>CC</sub>	Battery Supply Voltage		2.7	4.4	V
V	Switch I/O Voltage	USB/UART Path Active	0	4.4	V
$V_{SW}$	Switch I/O Voltage	Audio Path Active	V <sub>CC</sub> -7	2.0	V
T <sub>A</sub>	Operating Temperature		-40	+85	°C

#### **Switch Path DC Electrical Characteristics**

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

Comple al	Danamatan	V 00	O	$T_A = -40 \text{ to } +85^\circ$			; ]
Symbol	ymbol Parameter V <sub>cc</sub> (V) Con		Conditions	Min.	Тур.	Max.	Unit
Host Inter	face Pins (SEL[2:0])					•	
V <sub>IH</sub>	Input High Voltage	3.2 to 4.4		1.3			V
$V_{IL}$	Input Low Voltage	3.2 to 4.4				0.7	V
I <sub>IN</sub>	Control Input Leakage	0 to 4.4	V <sub>SW</sub> =0 to V <sub>CC</sub>	-1		1	μΑ
I <sub>OZ</sub>	Off-State Leakage	4.4	0 ≤ DP_CON, DM_CON, DP_HOSTn, DM_HOSTn, R_HOST, L_HOST ≤ 3.6V	-2		2	μA
Switch Of	f Characteristics						
I <sub>OFF</sub>	Power-Off Leakage Current	0	All Ports Except MIC & Audio path V <sub>SW</sub> =0V to 4.4V, Figure 8			10	μA
USB Swite	ch On Paths	•			•		
R <sub>ONUSB</sub>	HS USB Range Switch On Resistance	3.2 to 4.4	V <sub>DP_CON/DM_CON</sub> =0V, 0.4V, I <sub>ON</sub> =8mA, Figure 7		6	9	Ω
R <sub>ONUART</sub>	UART Range Switch On Resistance	3.2 to 4.4	V <sub>DP_CON/DM_CON</sub> =0V, 3.2V, I <sub>ON</sub> =8mA, Figure 7		8		Ω
Audio R/L	Switch On Paths	•			III		
R <sub>ONAUD</sub>	Audio Switch On Resistance	3.2 to 4.4	V <sub>L/R</sub> =-0.8V, 0.8V, I <sub>ON</sub> =30mA,			3	Ω
R <sub>FLAT</sub>	Audio R <sub>ON</sub> Flatness <sup>(1)</sup>	3.8	Figure 7		0.16		Ω
R <sub>TERM</sub>	Internal Termination Resistors				1		kΩ
Total Swit	ch Current Consumption						
I <sub>CCSL</sub>	Battery Supply Sleep Mode Average Current	3.2 to 4.4	Static Current During Sleep Mode (SEL[2:0]=0)			1	μA
	Battery Supply Active Mode	0.04- 4.4	USB/UART Mode		20	35	μA
I <sub>CCWK</sub>	Average Current	3.2 to 4.4	Audio Mode			1	μΑ
	Increase in I <sub>CCSL</sub> /I <sub>CCWK</sub> Current	3.2 to 4.4	V <sub>SEL</sub> =2.8V and V <sub>CC</sub> =4.4V			8	μΑ
ICCSELT	per Control Voltage and V <sub>CC</sub>	3.2 10 4.4	V <sub>SEL</sub> =1.8V and V <sub>CC</sub> =4.4V			10	μΑ

#### Note:

3. Flatness is defined as the difference between the maximum and minimum values of on resistance over the specified range of conditions.

## Switch Path AC Electrical Characteristics<sup>(4)</sup>

All typical value are for  $V_{\text{CC}}$  =3.8V at 25°C unless otherwise specified.

Cy made al		Davamatar	V <sub>CC</sub> (V) Conditions		TA =	-40 to	+85°C	11:4:4	F:	
Symbol		Parameter	V <sub>cc</sub> (V)	Conditions	Min.	Min. Typ. Max.		Unit	Figure	
	Active	Audio Mode	3.8	f=20kHz, $R_T$ =32 $\Omega$ , $C_L$ =0pF		-95				
Xtalk	Channel Crosstalk DP_CON	LISP Mode	3.8	f=1MHz, $R_T$ =50 $\Omega$ , $C_L$ =0pF		-75		dB	Figure 10	
	to DM_CON	USB Mode	3.0	f=240MHz, $R_T$ =50 $\Omega$ , $C_L$ =0pF		-36				
	Off	Audio Rejection L_HOST to DM_CON, R_HOST to DP_CON	3.8	f=20kHz, $R_T$ =32 $\Omega$ , $C_L$ =0pF		-100				
O <sub>IRR</sub>	Isolation Rejection Ratio	USB Rejection DM HOST to	3.8	f=1 MHz, $R_T$ =50 $\Omega$ , $C_L$ =0pF		-85		dB	Figure 9	
		DM_CON, DP_HOST to DP_CON	DM_CON, DP_HOST	OST	f=240MHz, $R_T$ =50 $\Omega$ , $C_L$ =0pF		-35			
TUDAN Total Harmonic		monic Distortion + Noise		20Hz to 20kHz, R <sub>L</sub> =16Ω, Input Signal Range $1.6V_{PP}$		0.10		%	Figure 14	
I HU+N	THD+N (Audio Path)		3.8	20Hz to 20kHz, R <sub>L</sub> =32Ω, Input Signal Range $1.6V_{PP}$		0.07		%	Figure 14	

#### Note:

## Capacitance

Cymah al	Combal Baranatar		Conditions	$T_A = -40 \text{ to } +85^{\circ}\text{C}$			Unit	<b></b>
Symbol	Parameter	V <sub>cc</sub> (V)	Conditions	Min.	Тур.	Max.	Unit	Figure
C <sub>IN</sub>	Select Pins Capacitance <sup>(5)</sup>	0	V <sub>BIAS</sub> =0.2V		2.5		pF	Figure 12
C <sub>OFF(D+, D-)</sub>	D+, D- On Capacitance (HS USB Mode) <sup>(5)</sup>	3.8	V <sub>BIAS</sub> =0.2V, f=1MHz		4.0		pF	Figure 12
C <sub>ON(D+, D-)</sub>	D+, D- On Capacitance (HS USB Mode) <sup>(5)</sup>	3.8	V <sub>BIAS</sub> =0.2V, f=1MHz		6.8		pF	Figure 13

#### Note:

5. Guaranteed by characterization; not production tested.

<sup>4.</sup> Guaranteed by characterization; not production tested.

## **High-Speed USB Eye Compliance Results**

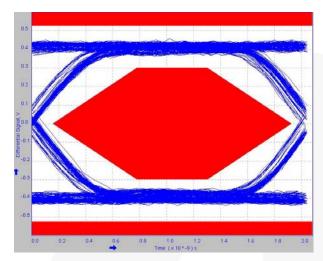


Figure 4. High-Speed Test Results (DP\_CON/DM\_CON - DP\_HOST1/DM\_HOST1)

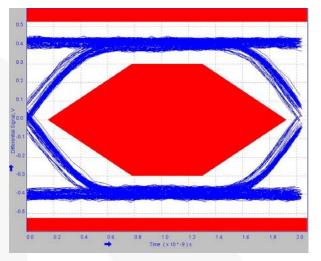


Figure 5. High-Speed Test Results (DP\_CON/DM\_CON - DP\_HOST2/DM\_HOST2)

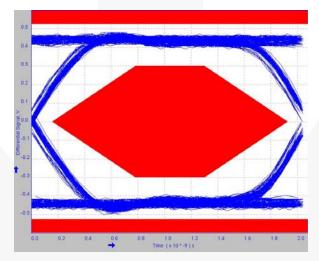


Figure 6. High-Speed Eye Compliance Input Signal

## **Test Diagrams**

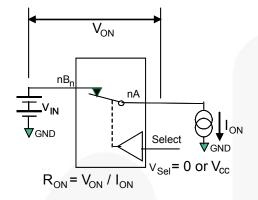
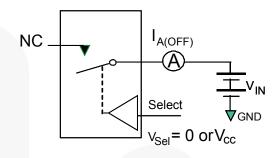


Figure 7. On Resistance



\*\*Each switch port is tested separately.

Figure 8. Off Leakage

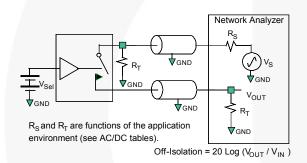


Figure 9. Channel Off Isolation

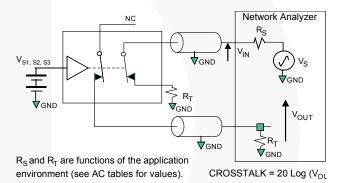


Figure 10. Active Channel Crosstalk

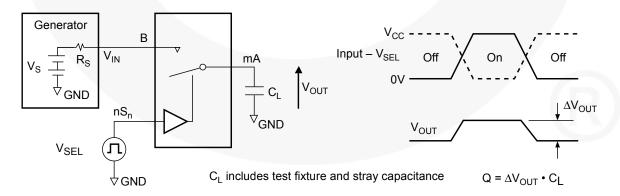


Figure 11. Charge Injection Test

## Test Diagrams (Continued)

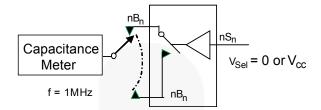


Figure 12. Channel Off Capacitance

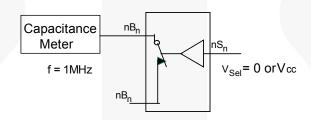


Figure 13. Channel On Capacitance

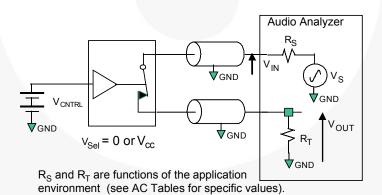
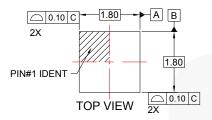
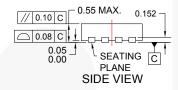
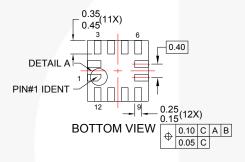


Figure 14. Total Harmonic Distortion + Noise

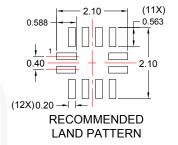
## **Physical Dimensions**

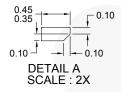






LEAD LEAD
OPTION 1 OPTION 2
SCALE: 2X SCALE: 2X





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- E. DRAWING FILENAME: MKT-UMLP12Arev4.

Figure 15. 12-Lead, Ultrathin Molded Leadless Package (UMLP)

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