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# FSA8049

## Audio Jack Detection and Configuration, MIC / GND Cross Point Switch

### Features

Detection	Audio Plug GND & MIC Polarity
V <sub>DD</sub>	2.5 to 4.4 V
THD (MIC)	0.002% Typical
ESD (IEC 61000-4-2) (Air Gap)	15 kV
Operating Temperature	-40°C to 85°C
Package	9-Ball WLCSP 3x3 Array, 0.4 mm Terminal Pitch, 250 μm Ball
Top Mark	M3
Ordering Information	FSA8049UCX

### Description

The FSA8049 is an audio jack detection switch for 3- or 4-pole accessories. The FSA8049 detects the locations of ground (GND) and microphone (MIC) poles on the audio plug and automatically routes them to the appropriate connections. This allows the end user to plug accessories, such as headsets with different audio pole configurations, into the mobile device and have them operate correctly.

- Detects 3- or 4-pole audio accessories
- Detects polarity of GND and MIC on 4-pole plugs
- Automatically routes GND and MIC to audio jack terminals

### Related Resources

- For evaluation boards and questions, please contact: [Analog.Switch@fairchildsemi.com](mailto:Analog.Switch@fairchildsemi.com).

### Applications

- Cellular Phones, Smart Phones
- MP3 and Portable Multimedia Player

### Typical Application

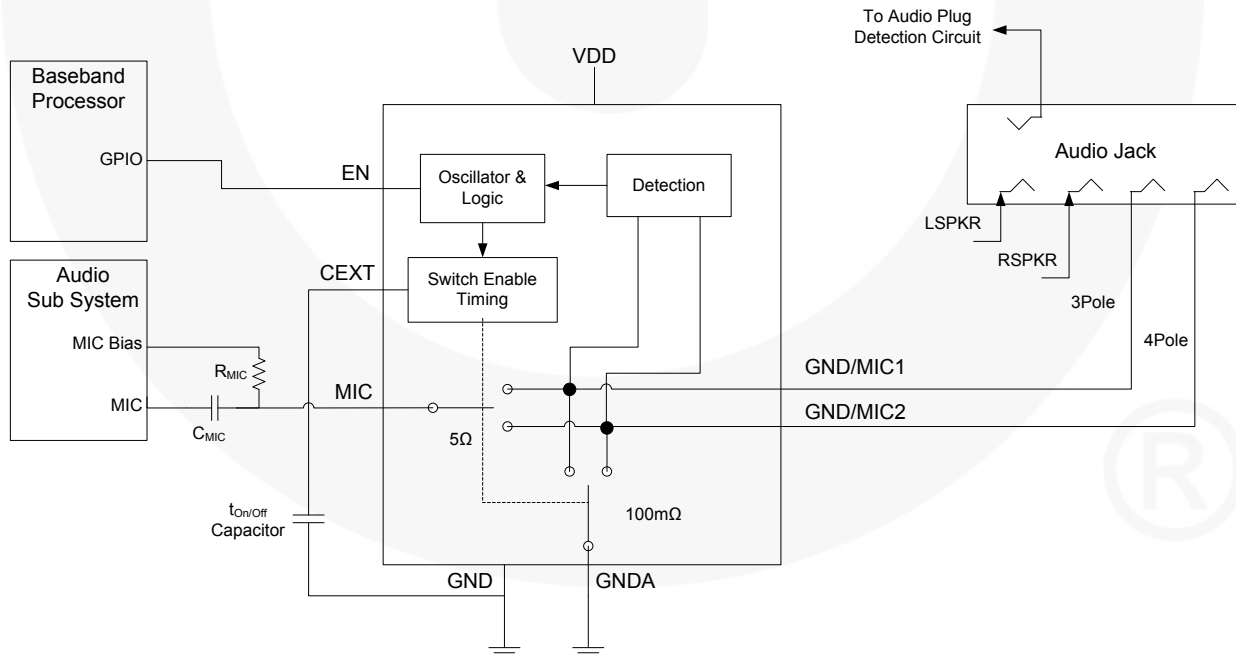


Figure 1. Mobile Phone Example

## Pin Configuration

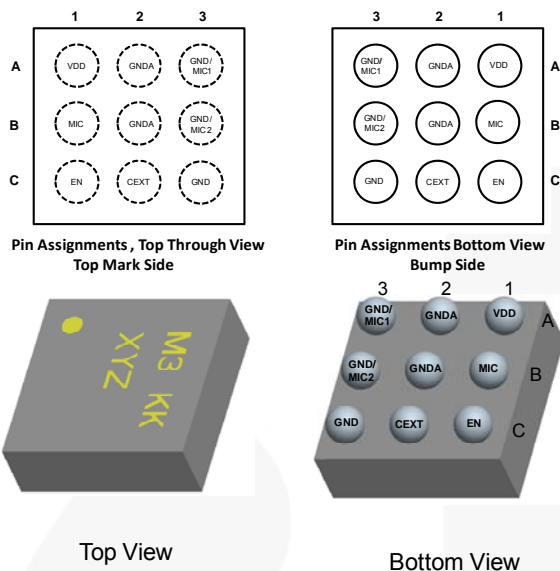
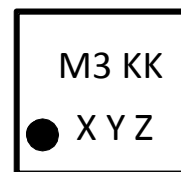


Figure 2. Pin Assignments



M3 = FSA8049UCX Product Identifier  
 KK = Lot Run Trace Code  
 X = Year  
 Y = Work Week  
 Z = Assembly Site (P= Penang, Malaysia)  
 ● = Pin 1 Indicator

Figure 3. Top Mark

## Pin Descriptions

Name	Ball	Type	Description		
VDD	A1	Power	Supply voltage		
GNDA	A2	GND	Switch Ground <sup>(1)</sup>		
GND/MIC1	A3	I/O	Switch connects to audio jack		
MIC	B1	I/O	Switch connects to audio subsystem microphone pre-amplifier		
GNDA	B2	GND	Switch Ground <sup>(1)</sup>		
GND/MIC2	B3	I/O	Switch connects to audio jack		
EN	C1	Input	Enable (0=V <sub>IL</sub> , 1=V <sub>IH</sub> )	0	Disabled
				1	Enabled
CEXT	C2	Input	External capacitor for switch slow t <sub>ON/OFF</sub> timing		
GND	C3	GND	Device Ground <sup>(1)</sup>		

### Note:

- GND and GNDA can be shorted together if the system does not utilize an FM antenna on the handset ground. If the system utilizes an FM antenna on the handset ground; separate GND and GNDA, place the FM-decoupling inductor and capacitor on GNDA only, and connect GND to a low-impedance path to battery ground.

## States of Pins after Audio Jack Detection

State of pins GND/MIC1, GND/MIC2, and MIC after detection time (t<sub>DET</sub>) is complete.

GND/MIC1	GND/MIC2	Switch Configuration	Accessory Connected
0 (GND)	0 (GND)	GND/MIC1=GND, GND/MIC2=GND, MIC=GND	3-Pole Headphones
0 (GND)	1 (MIC Attached)	GND/MIC1=GND, GND/MIC2=MIC	4-Pole Headset with Microphone
1 (MIC Attached)	0 (GND)	GND/MIC1=MIC, GND/MIC2=GND	4-Pole Headset with Microphone

## 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	Supply Voltage from Battery	-0.5	6.0	V	
V <sub>SW</sub>	Switch I/O Voltage	-0.5	V <sub>CC</sub> +0.5	V	
I <sub>IK</sub>	Input Clamp Diode Current	-50		mA	
I <sub>SW</sub>	Switch I/O Current (Continuous) <sup>(2)</sup>		50	mA	
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C	
T <sub>J</sub>	Maximum Junction Temperature		+150	°C	
T <sub>L</sub>	Lead Temperature (Soldering, 10 Seconds)		+260	°C	
ESD	IEC 61000-4-2 System ESD	Air Gap	15		kV
		Contact	8		
	Human Body Model, JEDEC JESD22-A114	GND/MIC <sub>n</sub> vs. GND	11		
		VDD vs. GND	16		
		All Pins	7		
	Charged Device Model, JEDEC JESD22-C101	All Pins	1.5		

### Note:

- 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 <sub>DD</sub>	Supply Voltage	2.5	4.4	V
V <sub>EN</sub>	Enable Input Voltage	0	V <sub>DD</sub>	V
T <sub>A</sub>	Operating Temperature	-40	+85	°C

## DC Electrical Characteristics

All typical values are at  $T_A=25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	$V_{DD}$ (V)	Condition	$T_A=-40$ to $+85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
<b>MIC Switch (MIC to (GND/MIC1 or GND/MIC2))</b>							
$R_{ON(MIC)}$	MIC Switch On Resistance	2.8	$I_{OUT}=24\text{ mA}$ , $V_{IN}=1.8\text{ V}$		3.00	5.00	$\Omega$
		3.8			2.50	4.00	
$R_{FLAT(ON)}$	On Resistance Flatness	2.8	$I_{OUT}=24\text{ mA}$ , $V_{IN}=1\text{ V to }V_{DD}$		0.25	0.50	$\Omega$
		3.8			0.20	0.40	
$V_{IN(MIC)}$	Switch Input Voltage Range	2.7 to 4.4		0		$V_{DD}$	V
$C_{ON(MIC)}$	MIC Switch On Capacitance <sup>(3)</sup>	3.8	$f=1\text{ MHz}$		90		pF
$C_{OFF(MIC)}$	MIC Switch Off Capacitance <sup>(3)</sup>	3.8	$f=1\text{ MHz}$		21		pF
<b>GND Switch (GND to (GND/MIC1 or GND/MIC2))</b>							
$R_{ON(GNDA)}$	GND Switch On Resistance	2.8	$I_{OUT}=24\text{ mA}$		90	170	m $\Omega$
		3.8			80	100	
$V_{IN(GNDA)}$	Switch Input Voltage Range	2.7 to 4.4		0		1	V
$X_C(GNDA)$	GND Switch On Reactance <sup>(4)</sup>	3.8	$f=88\text{ MHz to }108\text{ MHz}$ , $V_{IN}=50\text{ mV}$		100		m $\Omega$
<b>Parallel I/O</b>							
$V_{IH}$	Input High Voltage	2.7 to 4.4		1.1		$V_{DD}$	V
$V_{IL}$	Input Low Voltage	2.7 to 4.4		0		0.55	V
$I_{CCT}$	Increase in Quiescent Supply Current	4.4	$EN=1.3\text{ V}$			3	$\mu\text{A}$
<b>Current</b>							
$I_{OZ}$	Switch Leakage Current	4.4	$GND/MIC_n=1\text{ V, }4.3\text{ V}$ ; $MIC=4.3\text{ V, }1\text{ V}$ ; $EN=LOW$	-75		75	nA
$I_{IN}$	Input Leakage Current	0 to 4.4	$EN\text{ Input }0\text{ to }4.3\text{ V}$			0.1	$\mu\text{A}$
$I_{CC-DIS}$	Disabled Current	2.7 to 4.4	$EN=0$		100		nA
$I_{CC-EN}$	Enabled Current After Detection	2.7 to 4.4	$EN=1$		100		nA
$I_{CC-DET}$	Current During Detection Mode	2.7 to 4.4	$EN=0 \rightarrow 1$ , 3-Pole Mode, $GND/MIC1=GND/MIC2$		0.5	2.0	mA

### Notes:

- Guaranteed by characterization.
- Guaranteed by design.

## AC Electrical Characteristics

All typical values are at  $T_A=25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	$V_{DD}$ (V)	Condition	$T_A = -40$ to $+85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	
<b>MIC Switch</b>							
THD	Total Harmonic Distortion <sup>(5)</sup>	3.8	$R_T=600\ \Omega$ , $V_{SW}=0.5\ V_{PP}$ , $f=20\ \text{Hz}$ to $20\ \text{kHz}$ , $V_{IN}=1.8\ \text{V}$ and $2.2\ \text{V}$ (Figure 4)		0.002		%
$O_{IRR}$	Off Isolation <sup>(5)</sup>	3.8	$f=20\ \text{kHz}$ , $R_S=32\ \Omega$ , $C_L=0\ \text{pF}$ , $R_T=32\ \Omega$ (Figure 5)		-108		dB
			$f=20\ \text{kHz}$ , $R_S=600\ \Omega$ , $C_L=0\ \text{pF}$ , $R_T=600\ \Omega$ (Figure 5)		-85		
<b>Parallel I/O</b>							
$t_{ON-GNDA}$	Switch Turn-On Time (MIC & GND Switch), Measure 10/90	3.8	CEXT=Float $R_L=10\ \text{k}\Omega$ , $C_L=10\ \text{pF}$		200		$\mu\text{s}$
			CEXT=0.1 $\mu\text{F}$ $R_L=10\ \text{k}\Omega$ , $C_L=10\ \text{pF}$		140		ms
$t_{OFF-GNDA}$	Switch Turn-Off Time (MIC & GND Switch), Measure 10/90	3.8	CEXT=Float $R_L=10\ \text{k}\Omega$ , $C_L=10\ \text{pF}$		20		$\mu\text{s}$
			CEXT=0.1 $\mu\text{F}$ $R_L=10\ \text{k}\Omega$ , $C_L=10\ \text{pF}$		6		ms
$t_{OFF-MIC}$	Switch Turn-Off Time (MIC Switch), Measure 10/90	3.8	$R_L=10\ \text{k}\Omega$ , $C_L=10\ \text{pF}$		100		ns
$t_{ON-DET}$	Detection Circuit NMOS On time	2.7 to 4.4			20		$\mu\text{s}$
$t_{OFF-DET}$	Detection Circuit NMOS OFF time	2.7 to 4.4			20		$\mu\text{s}$
$t_{DET}$	Detection Time of Audio Jack GND and MIC Terminals <sup>(6)</sup>	2.7 to 4.4	EN=1		50		ms
$t_{EN}$	Enable / Disable Time	2.7 to 4.4	EN=0 $\rightarrow$ 1, EN=1 $\rightarrow$ 0		15		$\mu\text{s}$
<b>Power</b>							
PSRR	Power Supply Rejection Ratio <sup>(5)</sup>	3.8	Power Supply Noise 300mV <sub>PP</sub> , Measured 10/90%, $f=217\ \text{Hz}$ Square Wave		-89		dB

### Notes:

- Guaranteed by characterization.
- Detection time may be longer if there is noise in the system or a poor audio jack connection.

Typical Performance Characteristics

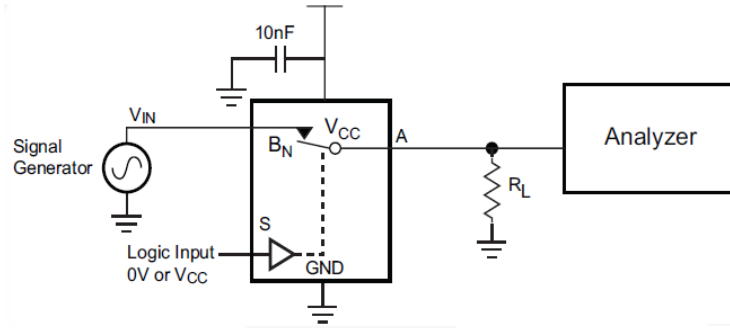


Figure 4. THD Test Setup

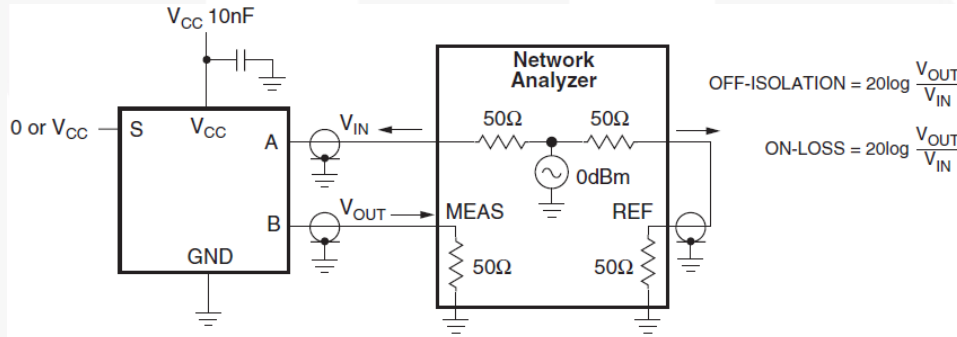


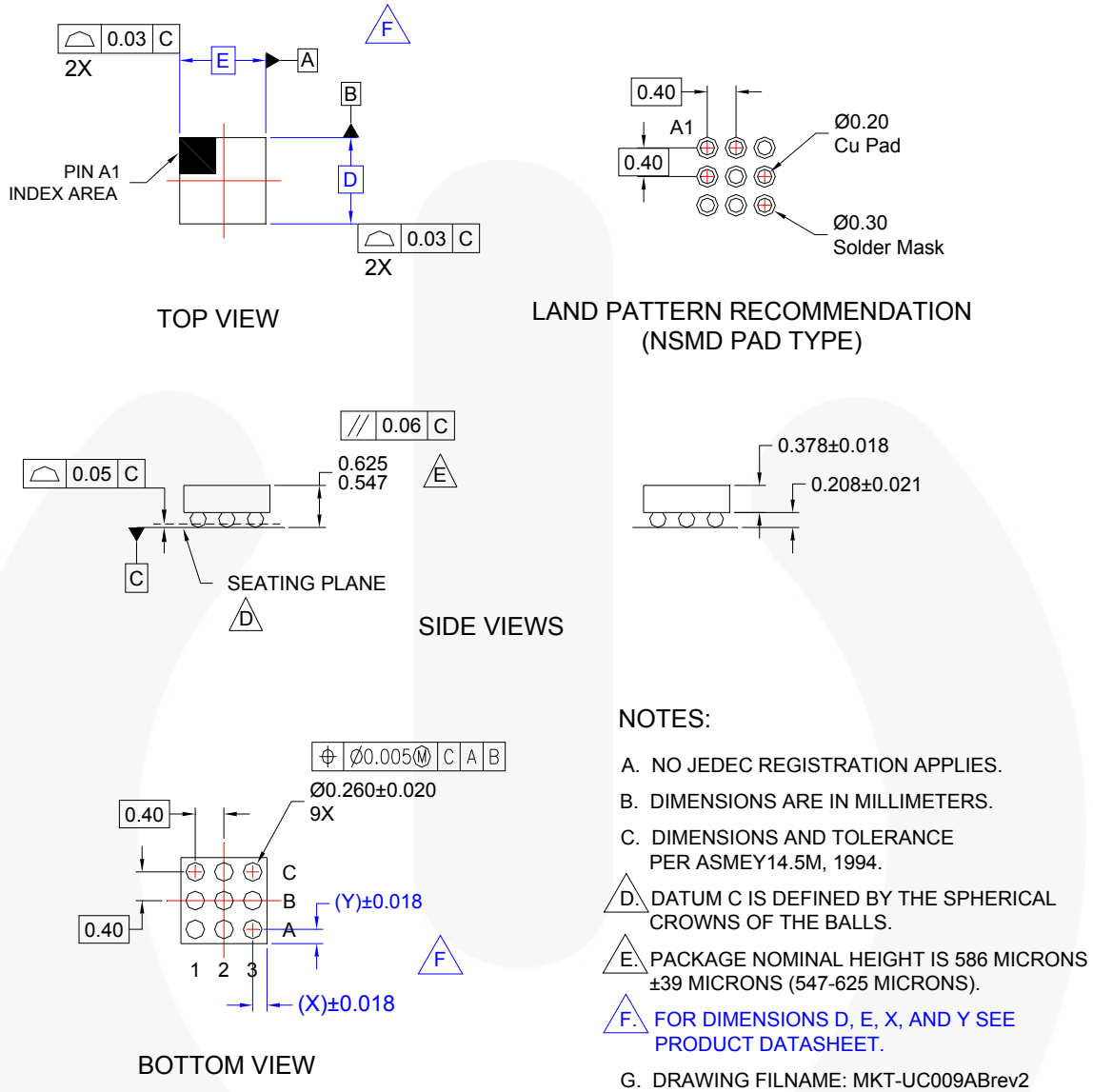
Figure 5. Off Isolation

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

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



## Physical Dimensions



**Figure 6. 9-Ball, Wafer-Level Chip-Scale Package (WLCSP), 3x3 Array, 0.4 mm Pitch, 250 µm Ball**

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## Ordering Information

Part Number	Operating Temperature Range	Top Mark	Package	D	E	X	Y
FSA8049UCX	-40 to +85°C	M3	9-Ball, Wafer-Level Chip-Scale Package (WLCSP), 3x3 Array, 0.4 mm Pitch, 250 µm Ball	1.16 mm	1.16 mm	0.018 mm	0.018 mm





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