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FSA8049

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

Features

| Detection | Audio Plug GND & MIC Polarity |
|-------------------------------|--|
| V _{DD} | 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 |

Applications

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

Typical Application

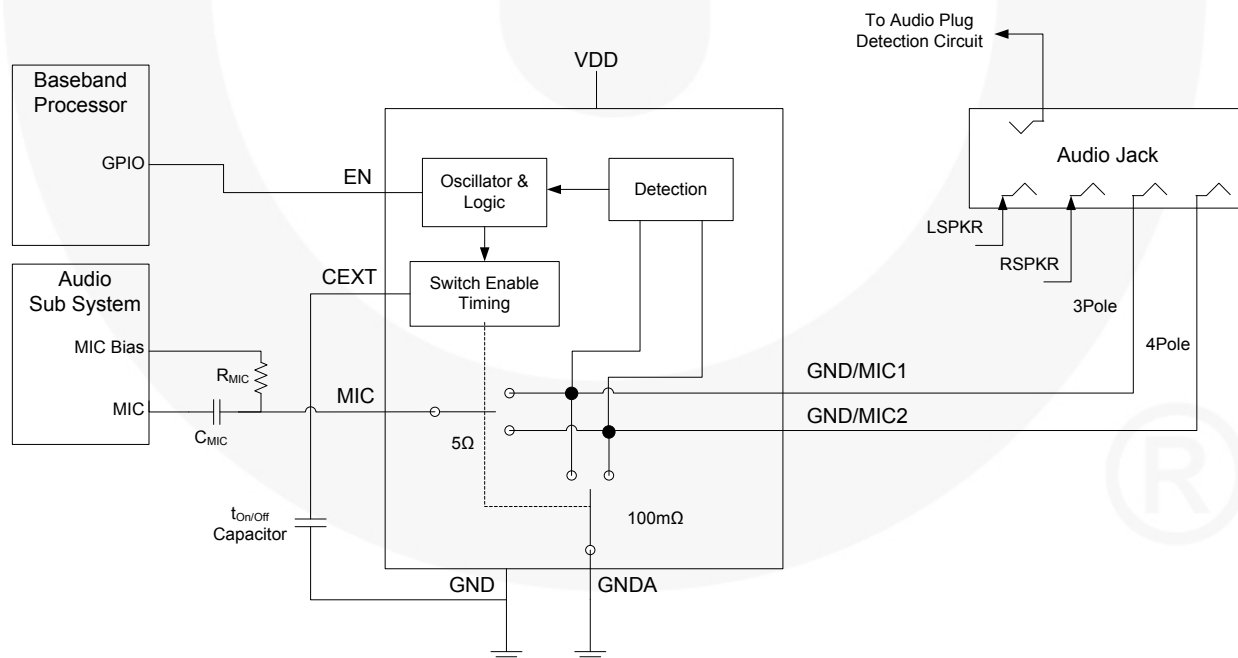


Figure 1. Mobile Phone Example

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.

Pin Configuration

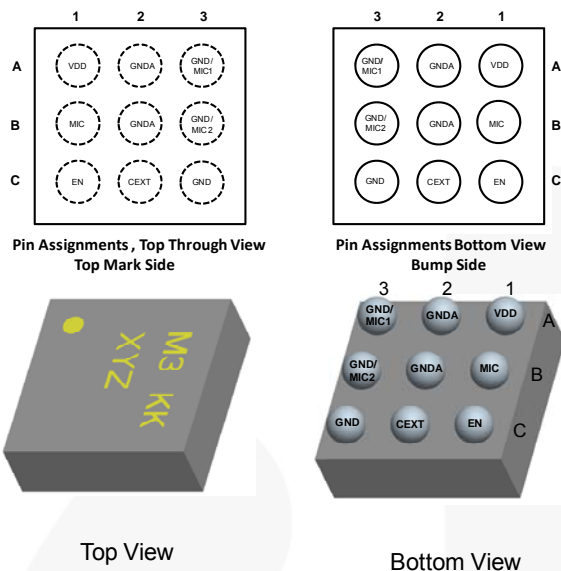
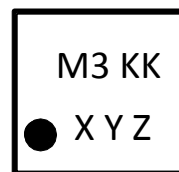


Figure 2. Pin Assignments



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 ⁽¹⁾ | | |
| 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 ⁽¹⁾ | | |
| GND/MIC2 | B3 | I/O | Switch connects to audio jack | | |
| EN | C1 | Input | Enable (0=V _{IL} , 1=V _{IH}) | 0 | Disabled |
| | | | | 1 | Enabled |
| CEXT | C2 | Input | External capacitor for switch slow t _{ON/OFF} timing | | |
| GND | C3 | GND | Device Ground ⁽¹⁾ | | |

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_{DET}) 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_{SW} | Switch I/O Voltage | | -0.5 | $V_{CC}+0.5$ | V |
| I_{IK} | Input Clamp Diode Current | | -50 | | mA |
| I_{SW} | Switch I/O Current (Continuous) ⁽²⁾ | | | 50 | 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 | IEC 61000-4-2 System ESD | Air Gap | 15 | | kV |
| | | Contact | 8 | | |
| | Human Body Model, JEDEC JESD22-A114 | GND/MIC _n vs. GND | 11 | | |
| | | VDD vs. GND | 16 | | |
| | | All Pins | 7 | | |
| | Charged Device Model, JEDEC JESD22-C101 | All Pins | 1.5 | | |

Note:

2. 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_{DD} | Supply Voltage | 2.5 | 4.4 | V |
| V_{EN} | Enable Input Voltage | 0 | V_{DD} | V |
| T_A | 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°C | | | Unit |
|--|---|---------------------|--|------------------------------|------|-----------------|------|
| | | | | Min. | Typ. | Max. | |
| MIC Switch (MIC to (GND/MIC1 or GND/MIC2)) | | | | | | | |
| R _{ON(MIC)} | MIC Switch On Resistance | 2.8 | I _{OUT} =24 mA, V _{IN} =1.8 V | | 3.00 | 5.00 | Ω |
| | | 3.8 | | | 2.50 | 4.00 | |
| R _{FLAT(ON)} | On Resistance Flatness | 2.8 | I _{OUT} =24 mA, V _{IN} =1 V to V _{DD} | | 0.25 | 0.50 | Ω |
| | | 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 ⁽³⁾ | 3.8 | f=1 MHz | | 90 | | pF |
| C _{OFF(MIC)} | MIC Switch Off Capacitance ⁽³⁾ | 3.8 | f=1 MHz | | 21 | | pF |
| GND Switch (GND to (GND/MIC1 or GND/MIC2)) | | | | | | | |
| R _{ON(GNDA)} | GND Switch On Resistance | 2.8 | I _{OUT} =24 mA | | 90 | 170 | mΩ |
| | | 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 ⁽⁴⁾ | 3.8 | f=88 MHz to 108 MHz, V _{IN} =50 mV | | 100 | | mΩ |
| Parallel I/O | | | | | | | |
| 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 V | | | 3 | μA |
| Current | | | | | | | |
| I _{OZ} | Switch Leakage Current | 4.4 | GND/MIC _n =1 V, 4.3 V; MIC=4.3V, 1V; EN=LOW | −75 | | 75 | nA |
| I _{IN} | Input Leakage Current | 0 to 4.4 | EN Input 0 to 4.3 V | | | 0.1 | μA |
| 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→1, 3-Pole Mode, GND/MIC1=GND/MIC2 | | 0.5 | 2.0 | mA |

Notes:

3. Guaranteed by characterization.
4. 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°C | | | Unit |
|-----------------------|---|---------------------|---|-------------------------------|-------|------|------|
| | | | | Min. | Typ. | Max. | |
| MIC Switch | | | | | | | |
| THD | Total Harmonic Distortion ⁽⁵⁾ | 3.8 | R _T =600 Ω, V _{SW} =0.5 V _{PP} , f=20 Hz to 20 kHz, V _{IN} =1.8 V and 2.2 V (Figure 4) | | 0.002 | | % |
| O _{IRR} | Off Isolation ⁽⁵⁾ | 3.8 | f=20 kHz, R _S =32 Ω, C _L =0 pF, R _T =32 Ω (Figure 5) | | -108 | | dB |
| | | | f=20 KHz, R _S =600 Ω, C _L =0 pF, R _T =600 Ω (Figure 5) | | -85 | | |
| Parallel I/O | | | | | | | |
| t _{ON-GNDA} | Switch Turn-On Time (MIC & GND Switch), Measure 10/90 | 3.8 | CEXT=Float R _L =10 kΩ, C _L =10 pF | | 200 | | μs |
| | | | CEXT=0.1 μF R _L =10 kΩ, C _L =10 pF | | 140 | | ms |
| t _{OFF-GNDA} | Switch Turn-Off Time (MIC & GND Switch), Measure 10/90 | 3.8 | CEXT=Float R _L =10 kΩ, C _L =10 pF | | 20 | | μs |
| | | | CEXT=0.1 μF R _L =10 kΩ, C _L =1 0pF | | 6 | | ms |
| t _{OFF-MIC} | Switch Turn-Off Time (MIC Switch), Measure 10/90 | 3.8 | R _L =10 kΩ, C _L =10 pF | | 100 | | ns |
| t _{ON-DET} | Detection Circuit NMOS On time | 2.7 to 4.4 | | | 20 | | μs |
| t _{OFF-DET} | Detection Circuit NMOS OFF time | 2.7 to 4.4 | | | 20 | | μs |
| t _{DET} | Detection Time of Audio Jack GND and MIC Terminals ⁽⁶⁾ | 2.7 to 4.4 | EN=1 | | 50 | | ms |
| t _{EN} | Enable / Disable Time | 2.7 to 4.4 | EN=0→1, EN=1→0 | | 15 | | μs |
| Power | | | | | | | |
| PSRR | Power Supply Rejection Ratio ⁽⁵⁾ | 3.8 | Power Supply Noise 300mV _{PP} , Measured 10/90%, f=217 Hz Square Wave | | -89 | | dB |

Notes:

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

Typical Performance Characteristics

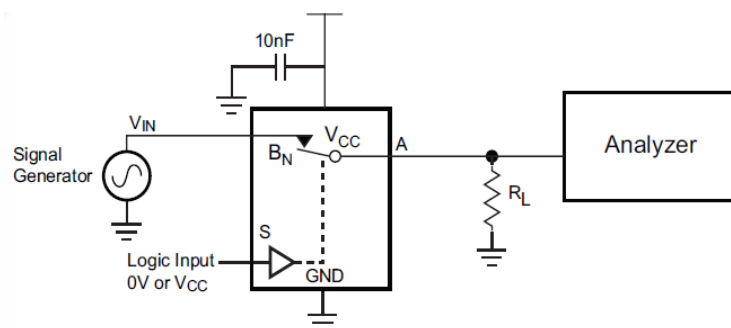


Figure 4. THD Test Setup

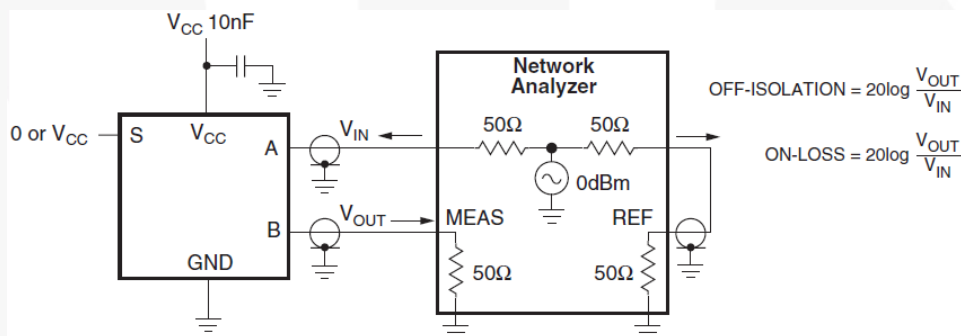
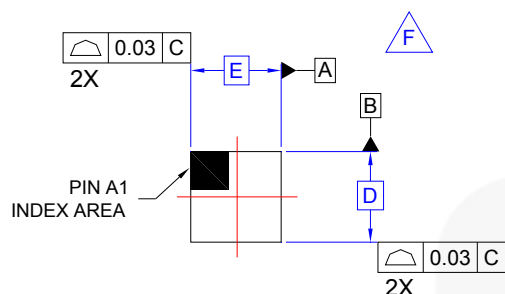
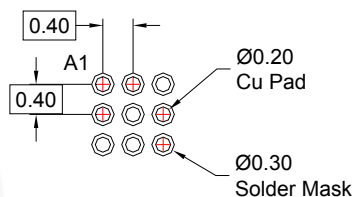


Figure 5. Off Isolation

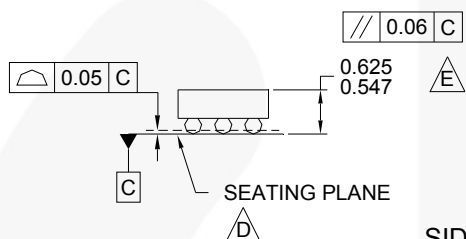
Physical Dimensions



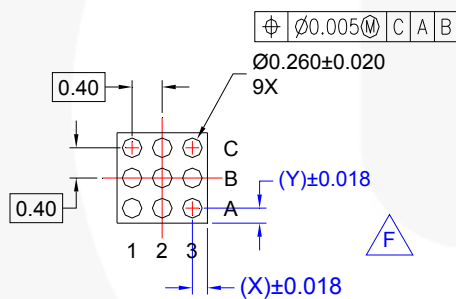
TOP VIEW



LAND PATTERN RECOMMENDATION (NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

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- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASMEY14.5M, 1994.
- D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E. PACKAGE NOMINAL HEIGHT IS 586 MICRONS ±39 MICRONS (547-625 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
- G. DRAWING FILNAME: MKT-UC009ABrev2

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