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# FSA8008/FSA8008A

## Audio Jack Detection and Configuration Switch

### Features

| Detection             | Accessory Plug-In<br>3- or 4-Pole Audio Jack<br>Send/End Key Pressed |                                                    |
|-----------------------|----------------------------------------------------------------------|----------------------------------------------------|
| Functionality         | FSA8008                                                              |                                                    |
|                       | FSA8008A                                                             | Decreased Timing<br>for Sensitive<br>Send/End Keys |
| Switch Type           | MIC                                                                  |                                                    |
| V <sub>DD</sub>       | 2.5 to 4.4 V                                                         |                                                    |
| V <sub>IO</sub>       | 1.6 to V <sub>DD</sub>                                               |                                                    |
| THD (MIC)             | 0.01% Typical                                                        |                                                    |
| ESD (Air Gap)         | 15 kV                                                                |                                                    |
| Operating Temperature | -40°C to 85°C                                                        |                                                    |
| Package               | 10-Lead UMLP<br>1.4 x 1.8 x 0.5 mm,<br>0.4 mm Pitch                  |                                                    |
| Top Mark              | FSA8008                                                              | KC                                                 |
|                       | FSA8008A                                                             | KD                                                 |
| Ordering Information  | FSA8008UMX                                                           |                                                    |
|                       | FSA8008AUMX                                                          |                                                    |

### Description

The FSA8008/FSA8008A is an audio jack detector and switch for 3- or 4-pole accessories. In addition to detection, the FSA8008/A features an integrated MIC switch that allows the processor to configure the audio jack. The architecture is designed to allow common third-party headphones to be used for listening to music from mobile handsets, personal media players, and portable peripheral devices.

- Determines 3- or 4-Pole Audio Jacks
- Removes Audio Jack Pop-n-Click Caused by MIC Bias
- Detects Audio Jack Accessories:
  - Standard Headphones
  - Headsets with MIC
  - Send / End Button Presses
- Integrates a MIC Switch for 4-Pole Configuration

### Related Resources

- *FSA8008/FSA8008A Demonstration Board*

### Applications

- 3.5 mm and 2.5 mm Audio Jacks
- Cellular Phones, Smartphones
- MP3 and PMP

### Typical Application

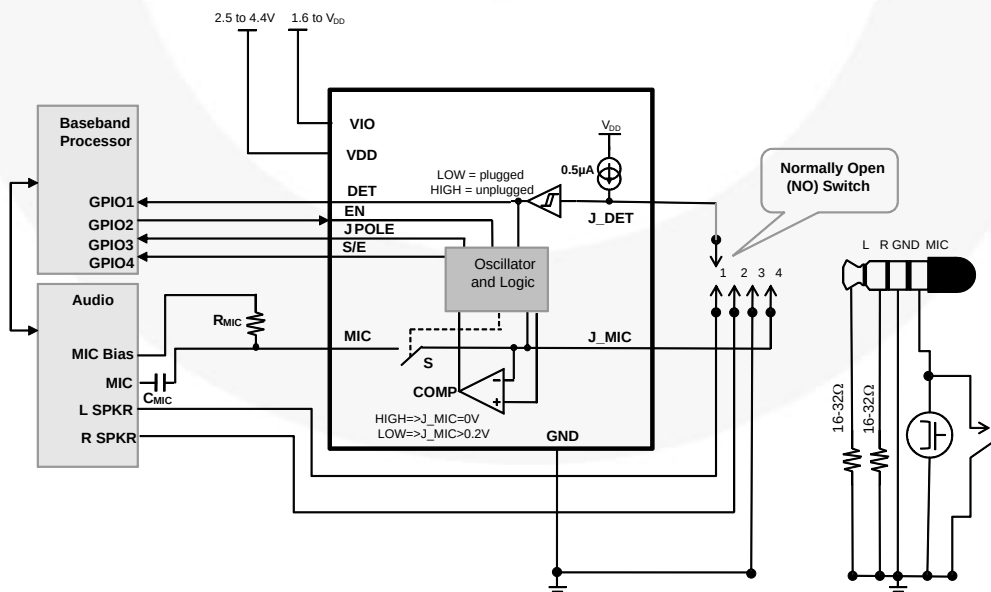


Figure 1. Mobile Phone Example

## Pin Configuration

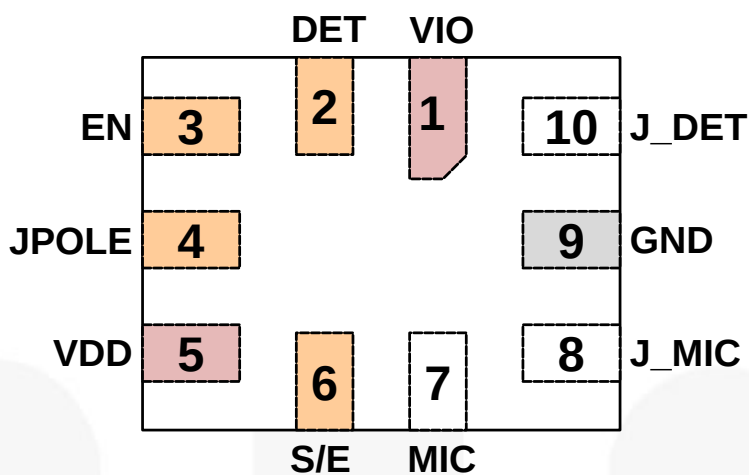


Figure 2. 10-Lead UMLP Pin Assignment (Through View)

## Pin Descriptions

| Name  | Pin # | Type   | Description                                                                                                                                     | Function   |                           |
|-------|-------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------|
| DET   | 2     | Output | Indicates if an accessory is plugged into the audio jack, as detected on the J_DET pin                                                          | 0          | Plugged                   |
|       |       |        |                                                                                                                                                 | 1          | Unplugged                 |
| JPOLE | 4     | Output | Indicates if an accessory plugged into the audio jack is 3 pole or 4 pole                                                                       | 0          | 4-pole jack               |
|       |       |        |                                                                                                                                                 | 1          | 3-pole jack               |
| S/E   | 6     | Output | Indicates state of SEND/END for a 4-pole accessory when a key has been pressed                                                                  | 0          | No key press              |
|       |       |        |                                                                                                                                                 | 1          | Key press                 |
| EN    | 3     | Input  | Controls internal microphone switch between the J_MIC and MIC pins                                                                              | 0          | MIC / J_MIC switch open   |
|       |       |        |                                                                                                                                                 | 1          | MIC / J_MIC switch closed |
| J_DET | 10    | Input  | Input from a pin of the audio jack socket tied to a mechanical switch that typically closes whenever an audio jack is inserted into that socket | 0          | Plugged                   |
|       |       |        |                                                                                                                                                 | 1          | Unplugged                 |
| MIC   | 7     | Switch | Microphone switch path that goes to the microphone preamplifier                                                                                 | See EN pin |                           |
| J_MIC | 8     | Switch | Microphone switch path that connects to the microphone and SEND/END key audio jack pole                                                         |            |                           |
| VDD   | 5     | Power  | Core supply voltage                                                                                                                             |            |                           |
| VIO   | 1     | Power  | Baseband I/O supply voltage                                                                                                                     |            |                           |
| GND   | 9     | Ground | Ground for both the audio jack and the PCB                                                                                                      |            |                           |

### Note:

- 0 =  $V_{OL}$  or  $V_{IL}$ ; 1 =  $V_{OH}$  or  $V_{IH}$

## Functional Diagram

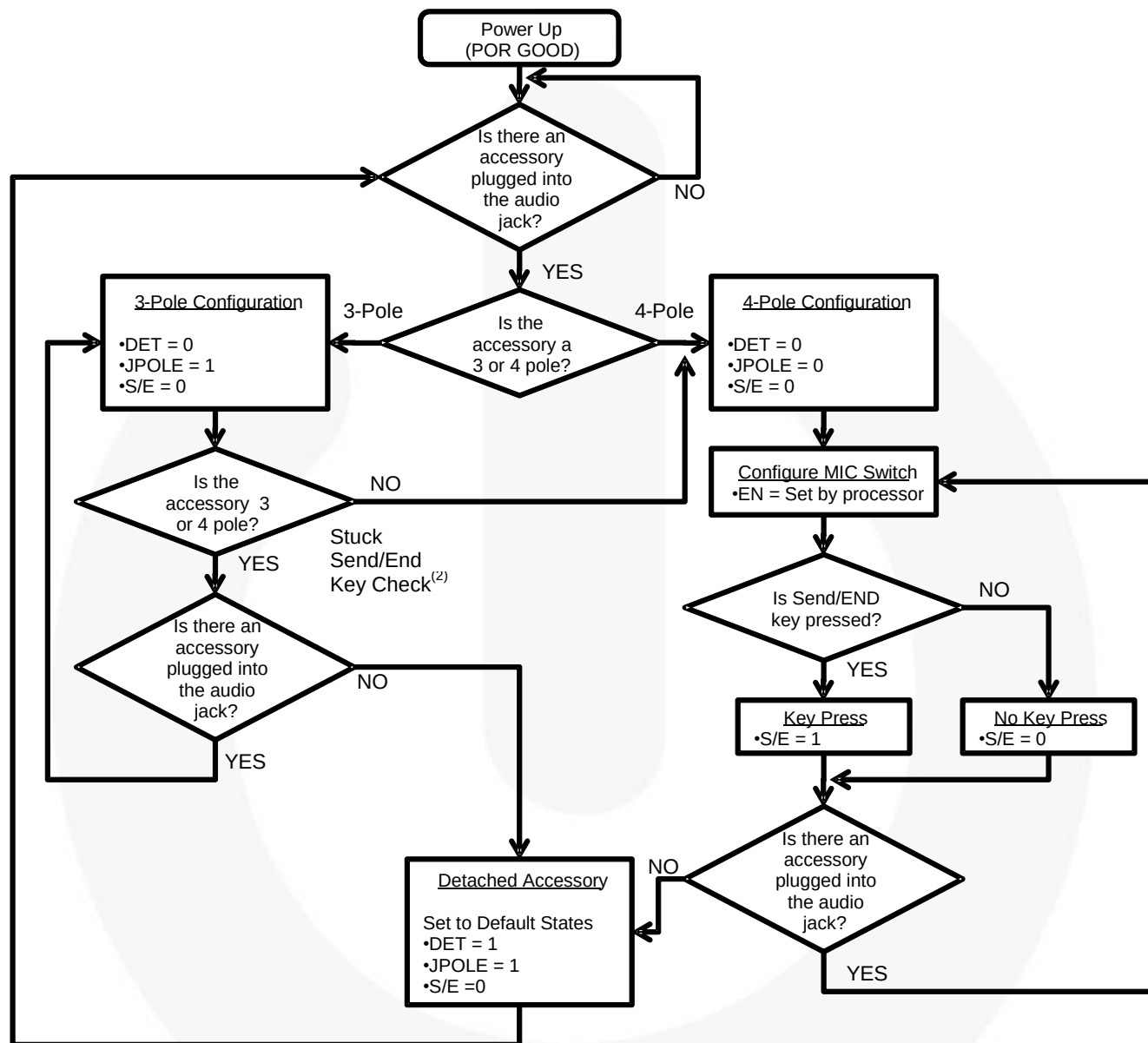


Figure 3. Functional Flow Diagram

**Note:**

2. FSA8008A stuck Send/End key function is only available if EN=H.

Table 1. FSA8008 vs. FSA8008A Stuck Send/End Key

| EN | FSA8008                     | FSA8008A                      |
|----|-----------------------------|-------------------------------|
| H  | Stuck Send / End Key Active | Stuck Send / End Key Active   |
| L  | Stuck Send / End Key Active | Stuck Send / End Key Disabled |

**Table 2. States During Power Good and OFF**

| State Description | VDD | VIO | DET              | EN      | JPOLE         | S/E             | J-DET            | MIC Switch |
|-------------------|-----|-----|------------------|---------|---------------|-----------------|------------------|------------|
| Active            | 1   | 1   | Active           |         |               |                 |                  |            |
| OFF               | 0   | 0   | 1<br>(unplugged) | 3-State | 1<br>(3 Pole) | 0<br>(No Press) | H<br>(unplugged) | Open       |
|                   | 1   | 0   |                  |         |               |                 |                  |            |
|                   | 0   | 1   |                  |         |               |                 |                  |            |

**Table 3. FSA8008 I/O States During Detection<sup>(3)</sup>**

| J_DET | J_MIC | EN | S/E          |              | JPOLE                     |            | DET |
|-------|-------|----|--------------|--------------|---------------------------|------------|-----|
|       |       |    | 3 Pole       | 4 Pole       | 3 Pole                    | 4 Pole     |     |
| 0     | 1     | 1  | 0 (no press) | 0 (no press) | 0 (4 Pole)                | 0 (4 Pole) | 0   |
| 0     | 0     | 0  | 0 (no press) | 1 (press)    | 1 (3 Pole)                | 0 (4 Pole) | 0   |
| 0     | 1     | 0  | 0 (no press) | 0 (no press) | 0 (4 Pole) <sup>(4)</sup> | 0 (4 Pole) | 0   |
| 0     | 0     | 1  | 0 (no press) | 1 (press)    | 1 (3 Pole)                | 0 (4 Pole) | 0   |
| 1     | X     | X  | 0 (no press) | 0 (no press) | 1 (3 Pole)                | 1 (3 Pole) | 1   |

**Notes:**

3. State detected after initial plug-in.  
 4. Difference between the FSA8008 and the FSA8008A products.

**Table 4. FSA8008A I/O States During Detection<sup>(5)</sup>**

| J_DET | J_MIC | EN | S/E          |              | JPOLE                     |            | DET |
|-------|-------|----|--------------|--------------|---------------------------|------------|-----|
|       |       |    | 3 Pole       | 4 Pole       | 3 Pole                    | 4 Pole     |     |
| 0     | 1     | 1  | 0 (no press) | 0 (no press) | 0 (4 Pole)                | 0 (4 Pole) | 0   |
| 0     | 0     | 0  | 0 (no press) | 1 (press)    | 1 (3 Pole)                | 0 (4 Pole) | 0   |
| 0     | 1     | 0  | 0 (no press) | 0 (no press) | 1 (3 Pole) <sup>(6)</sup> | 0 (4 Pole) | 0   |
| 0     | 0     | 1  | 0 (no press) | 1 (press)    | 1 (3 Pole)                | 0 (4 Pole) | 0   |
| 1     | X     | X  | 0 (no press) | 0 (no press) | 1 (3 Pole)                | 1 (3 Pole) | 1   |

**Notes:**

5. State detected after initial plug-in.  
 6. Difference between the FSA8008 and the FSA8008A products.

## 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.         | Units |
|---------------------|-----------------------------------------------------------------------|-----------------------------------|------|--------------|-------|
| $V_{DD}$ & $V_{IO}$ | Supply Voltage from Battery                                           |                                   | -0.5 | 6.0          | V     |
| $V_{SW}$            | Switch I/O Voltage for “S” Switch and All Input Voltages Except J_DET |                                   | -0.5 | $V_{DD}+0.5$ | V     |
| $V_{JD}$            | Input Voltage for J_DET Input                                         |                                   | -1.5 | $V_{DD}+0.5$ | V     |
| $I_{IK}$            | Input Clamp Diode Current                                             |                                   | -50  |              | mA    |
| $I_{SW}$            | Switch I/O Current (Continuous)                                       |                                   |      | 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                           | 15.0 |              | kV    |
|                     |                                                                       | Contact                           | 8.0  |              |       |
|                     | JEDEC JESD22-A114, Human Body Model                                   | All Pins                          | 7.5  |              |       |
|                     |                                                                       | J_DET, J_MIC, $V_{DD}$ , $V_{IO}$ | 12.0 |              |       |
|                     | JEDEC JESD22-C101, Charged Device Model                               | All Pins                          | 2.0  |              |       |

### Note:

8. 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.     | Units |
|----------|-----------------------------|------|----------|-------|
| $V_{DD}$ | Battery Supply Voltage      | 2.5  | 4.4      | V     |
| $V_{IO}$ | Parallel I/O Supply Voltage | 1.6  | $V_{DD}$ | 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.

### MIC Switch

| Symbol         | Parameter                            | $V_{DD}$ (V) | Conditions                                             | $T_A = -40$ to $+85^{\circ}\text{C}$ |      |          | Units    |
|----------------|--------------------------------------|--------------|--------------------------------------------------------|--------------------------------------|------|----------|----------|
|                |                                      |              |                                                        | Min.                                 | Typ. | Max.     |          |
| $R_{ON}$       | MIC Switch On Resistance             | 2.5          | $I_{OUT} = 30\text{ mA}$ ,<br>$V_{IN} = 2.0\text{ V}$  |                                      | 0.9  | 2.9      | $\Omega$ |
|                |                                      | 2.8          |                                                        |                                      | 0.8  | 2.5      |          |
|                |                                      | 3.8          |                                                        |                                      | 0.6  | 2.0      |          |
| $R_{FLAT(ON)}$ | On Resistance Flatness               | 2.5          | $I_{OUT} = 30\text{ mA}$ ,<br>$V_{IN} = 1.6, 2.0, 2.5$ |                                      | 1.50 |          |          |
|                |                                      | 2.8          | $I_{OUT} = 30\text{ mA}$ ,<br>$V_{IN} = 1.6, 2.0, 2.8$ |                                      | 0.70 |          |          |
|                |                                      | 3.8          |                                                        |                                      | 0.25 |          |          |
| $V_{IN}$       | Switch Input Voltage Range           | 2.5 to 4.4   |                                                        | 0                                    |      | $V_{DD}$ | V        |
| $C_{ON}$       | MIC and J_MIC Switch ON Capacitance  | 3.8          | $f = 1\text{ MHz}$                                     |                                      | 76   |          | pF       |
| $C_{OFF}$      | MIC and J_MIC Switch OFF Capacitance | 3.8          | $f = 1\text{ MHz}$                                     |                                      | 24   |          | pF       |

### J\_DET

| Symbol            | Parameter                        | $V_{DD}$ (V) | Conditions          | $T_A = -40$ to $+85^{\circ}\text{C}$ |      |       | Units      |
|-------------------|----------------------------------|--------------|---------------------|--------------------------------------|------|-------|------------|
|                   |                                  |              |                     | Min.                                 | Typ. | Max.  |            |
| $J\_DET_{AudioV}$ | Audio Voltage Range on J_DET Pin | 2.5 to 4.4   | DET = L             | -1                                   |      | 1     | V          |
| $J\_DET_{Audiof}$ | Audio Frequency on J_DET Pin     | 2.5 to 4.4   | DET = L             | 20                                   |      | 20000 | Hz         |
| $J\_DET_{RGND}$   | Detection Resistance to Ground   | 2.5 to 4.4   | Audio Jack Inserted | 0                                    |      | 500   | K $\Omega$ |
| $J\_DET_{HYS}$    | Hysteresis of J_DET              |              |                     |                                      | 100  |       | mV         |

### Parallel I/O

| Symbol   | Parameter           | Conditions                         | $T_A = -40$ to $+85^{\circ}\text{C}$ |      |                     | Units |
|----------|---------------------|------------------------------------|--------------------------------------|------|---------------------|-------|
|          |                     |                                    | Min.                                 | Typ. | Max.                |       |
| $V_{IH}$ | Input High Voltage  |                                    | $0.7 \times V_{IO}$                  |      | $V_{IO}$            | V     |
| $V_{IL}$ | Input Low Voltage   |                                    |                                      |      | $0.3 \times V_{IO}$ | V     |
| $V_{OH}$ | Output High Voltage | $I_{OH} = -100\text{ }\mu\text{A}$ | $0.8 \times V_{IO}$                  |      |                     | V     |
| $V_{OL}$ | Output Low Voltage  | $I_{OL} = +100\text{ }\mu\text{A}$ |                                      |      | $0.2 \times V_{IO}$ | V     |

**DC Electrical Characteristics** (Continued)

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

**Comparator**

| Symbol     | Parameter                                 | $V_{DD}$ (V) | Conditions    | $T_A = -40$ to $+85^{\circ}\text{C}$ |      |      | Units |
|------------|-------------------------------------------|--------------|---------------|--------------------------------------|------|------|-------|
|            |                                           |              |               | Min.                                 | Typ. | Max. |       |
| $V_{COMP}$ | Comparator Threshold for SEND/END Sensing | 2.5-3.8      | J_DET, EN = L |                                      | 200  |      | mV    |

**Current**

| Symbol        | Parameter                                                 | $V_{DD}$ (V) | Conditions                                | $T_A = -40$ to $+85^{\circ}\text{C}$ |      |      | Units         |
|---------------|-----------------------------------------------------------|--------------|-------------------------------------------|--------------------------------------|------|------|---------------|
|               |                                                           |              |                                           | Min.                                 | Typ. | Max. |               |
| $I_{OFF}$     | Power Off Leakage Current Through Switch                  | 0            | MIC and J_MIC Ports $V_{IN} = 4.4$ V      |                                      |      | 1.5  | $\mu\text{A}$ |
| $I_{IN}$      | Input Leakage Current                                     | 0 to 4.4     | Inputs 0 = 4.4 V                          |                                      |      | 1    | $\mu\text{A}$ |
| $I_{CC-SLNA}$ | Battery Supply Sleep Mode Current No Accessory Attached   | 2.5 to 4.4   | Static Current During Sleep Mode (EN = L) |                                      | 1    | 3    | $\mu\text{A}$ |
| $I_{CC-SLWA}$ | Battery Supply Sleep Mode Current with Accessory Attached | 2.5 to 4.4   | Active Current (EN = L and/or DET = H)    |                                      | 15   | 25   | $\mu\text{A}$ |



## AC Electrical Characteristics

All typical values are for  $V_{CC}=3.3\text{ V}$  at  $T_A=25^\circ\text{C}$  unless otherwise specified.

### MIC Switch

| Symbol    | Parameter                 | $V_{DD}\text{ (V)}$ | Conditions                                                                                                            | $T_A = -40\text{ to }+85^\circ\text{C}$ |      |      | Unit |
|-----------|---------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|------|
|           |                           |                     |                                                                                                                       | Min.                                    | Typ. | Max. |      |
| THD       | Total Harmonic Distortion | 3.8                 | $R_T = 600\ \Omega$ , $V_{SW} = 0.5\text{ V}_{PP}$ ,<br>$f = 20\text{ Hz to }20\text{ kHz}$ , $V_{IN} = 2.0\text{ V}$ |                                         | 0.01 |      | %    |
| $O_{IRR}$ | Off Isolation             | 3.8                 | $f = 20\text{ kHz}$ , $R_S = 32\ \Omega$ ,<br>$C_L = 0\text{ pF}$ , $R_T = 32\ \Omega$                                |                                         | -90  |      | dB   |

### Parallel I/O

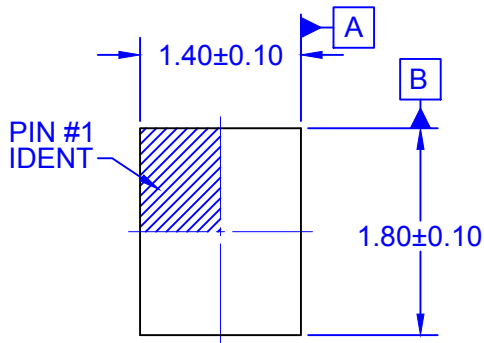
| Symbol        | Parameter                                                                            | $V_{DD}\text{ (V)}$ | Conditions                       | $T_A = -40\text{ to }+85^\circ\text{C}$ |      |      | Unit          |
|---------------|--------------------------------------------------------------------------------------|---------------------|----------------------------------|-----------------------------------------|------|------|---------------|
|               |                                                                                      |                     |                                  | Min.                                    | Typ. | Max. |               |
| $t_R, t_F$    | Output Edge Rates<br>(DET, S/E, JPOLE)                                               | 2.5                 | $C_L = 5\text{ pF}$ , 20% to 80% |                                         | 19   |      | ns            |
|               |                                                                                      | 3.8                 |                                  |                                         | 15   |      |               |
| $t_{POLL}$    | On Time of MIC Switch for<br>Sensing SEND/END Button Press<br>Oscillator Stable Time | 2.5 to 4.4          | FSA8008                          |                                         | 15   |      | ms            |
|               |                                                                                      |                     | FSA8008A                         |                                         | 1    |      |               |
| $t_{PER}$     | Period of MIC Switching Time for<br>Sensing SEND/END Button Press                    | 2.5 to 4.4          | FSA8008                          |                                         | 140  |      | ms            |
|               |                                                                                      |                     | FSA8008A                         |                                         | 10   |      |               |
| $t_{DET-IN}$  | Debounce Time after J-DET<br>Changes State from High to Low                          | 2.5 to 4.4          |                                  |                                         | 422  |      | ms            |
| $t_{DET-REM}$ | Debounce Time after J_DET<br>Changes State from Low to High                          | 2.5 to 4.4          |                                  |                                         | 30   |      | $\mu\text{s}$ |
| $t_{DET}$     | Detection Timeout for Sensing<br>3-Pole or 4-Pole Audio Jack<br>Plugged In           | 2.5 to 4.4          | FSA8008                          |                                         | 70   |      | ms            |
|               |                                                                                      |                     | FSA8008A                         |                                         | 4.5  |      |               |
| $t_{KBK}$     | Debounce Time for Sensing<br>SEND/END Key Press / Release                            | 2.5 to 4.4          |                                  |                                         | 27   |      | ms            |

### Power

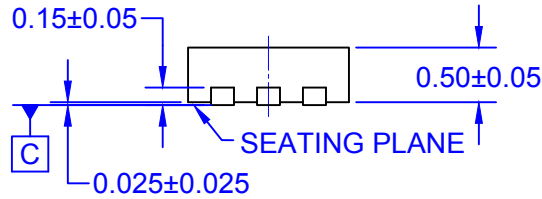
| Symbol | Parameter                    | $V_{DD}\text{ (V)}$ | Conditions                                                                        | $T_A = -40\text{ to }+85^\circ\text{C}$ |      |      | Unit |
|--------|------------------------------|---------------------|-----------------------------------------------------------------------------------|-----------------------------------------|------|------|------|
|        |                              |                     |                                                                                   | Min.                                    | Typ. | Max. |      |
| PSRR   | Power Supply Rejection Ratio | 3.8                 | Power Supply Noise 300 mV <sub>PP</sub> ,<br>Measured 10/90%, $f = 217\text{ Hz}$ |                                         | -90  |      | dB   |

### Ordering Information

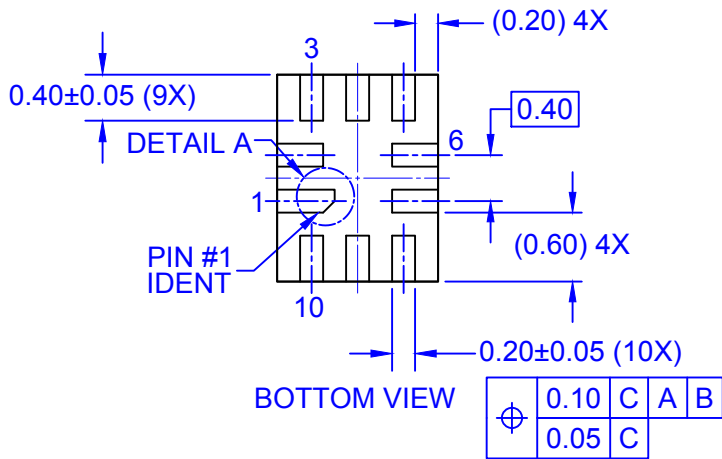
| Part Number | Operating Temperature Range | Top Mark | Package                                                                                 |
|-------------|-----------------------------|----------|-----------------------------------------------------------------------------------------|
| FSA8008UMX  | -40 to +85°C                | KC       | 10-Lead, 1.4 x 1.8 x 0.55 mm, 0.4 mm Pitch,<br>Ultrathin Molded Leadless Package (UMLP) |
| FSA8008AUMX |                             | KD       |                                                                                         |



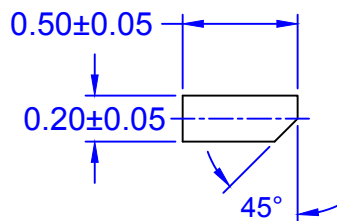
TOP VIEW



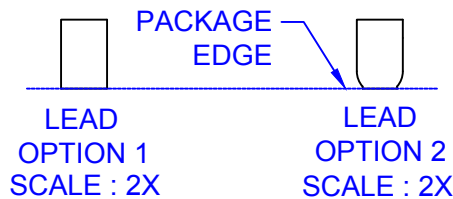
SIDE VIEW



BOTTOM VIEW

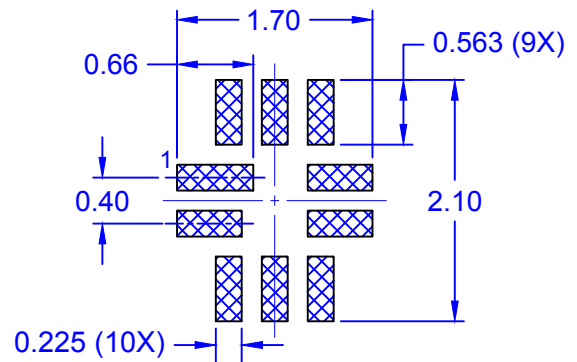


DETAIL A  
SCALE : 2X

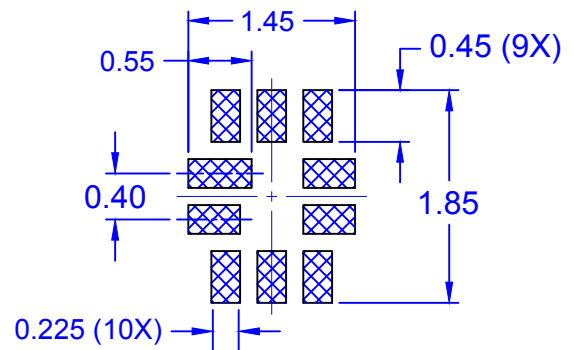


LEAD  
OPTION 1  
SCALE : 2X

LEAD  
OPTION 2  
SCALE : 2X



RECOMMENDED LAND PATTERN



OPTIONAL MINIMAL  
TOE LAND PATTERN

#### NOTES:

- PACKAGE DOES NOT CONFORM TO ANY JEDEC STANDARD.
- DIMENSIONS ARE IN MILLIMETERS.
- LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
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