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June 2016



## FSA850

### Audio 3-Pole / 4-Pole MIC-GND Switch

#### Features

|                                 |                         |
|---------------------------------|-------------------------|
| Switch Type                     | 3-Pole/4-Pole MIC - GND |
| V <sub>CC</sub>                 | 2.3 to 4.5 V            |
| THD (MIC)                       | 0.001% Typical          |
| ESD                             |                         |
| IEC 61000-4-2 (Air Gap)         | 15 kV                   |
| IEC 61000-4-2 (Contact)         | 8 kV                    |
| HBM (All Pins)                  | 3 kV                    |
| GNDnA/GNDnB to GND              | 8 kV                    |
| Power to GND                    | 10 kV                   |
| CDM                             | 2 kV                    |
| Operating Temperature           | -40°C to 85°C           |
| R <sub>ON</sub> Maximum (GND1n) | 0.08 $\Omega$           |
| R <sub>ON</sub> Maximum (SENSE) | 1 $\Omega$              |

#### Applications

- 3.5 mm and 2.5 mm Audio Jacks
- Cellular Phones, Smart Phones
- MP3 and PMP (Portable Media Player)

#### Description

The FSA850 is a 3-pole or 4-pole audio jack microphone GND switch for accessories with General-Purpose Input / Output (GPIO) control signals. The FSA850 also has the ability to perform 4-pole cross-point switching to support Open Mobile Terminal Platform (OMTP) 4-pole headset plugs. The architecture is designed to replace discrete MOSFET solutions and allow common third-party headphones to be used for listening to music or playing video from mobile handsets, personal media players, and portable peripheral devices.

- Supports 4-Pole OMTP Cross Point Switching for GND Connection
- Integrates a MIC switch for 3- or 4-Pole Configuration Headset Plugs
- Reduces “Pop and Click” Caused by Microphone Bias

#### Ordering Information

| Part Number | Operating Temperature Range | Top Mark | Package                                                                                   | Packing Method            |
|-------------|-----------------------------|----------|-------------------------------------------------------------------------------------------|---------------------------|
| FSA850UCX   | -40 to +85°C                | M5       | 12-Ball, Wafer-Level Chip-Scale Package (WLCSP), 3x4 Array, 0.4mm Pitch, 250 $\mu$ m Ball | 3000 units on Tape & Reel |

# Typical Application

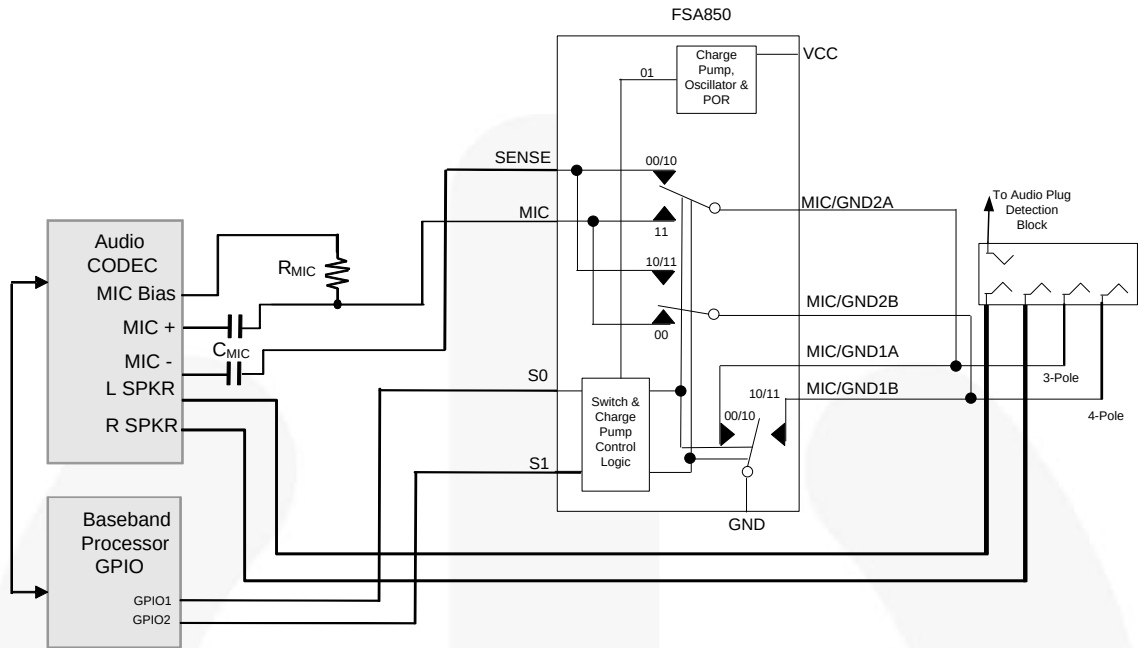


Figure 1. Typical Mobile Application

# Analog Symbol

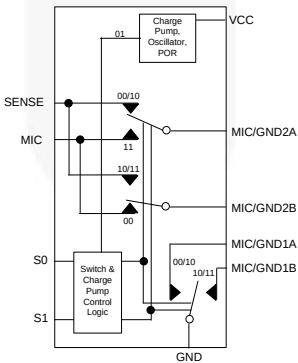


Figure 2. Analog Symbol

Table 1. Functional Truth Table

| S0 | S1 | GND                   | SENSE                 | MIC       |
|----|----|-----------------------|-----------------------|-----------|
| 0  | 0  | MIC/GND1A             | MIC/GND2A             | MIC/GND2B |
| 0  | 1  | HIGH-Z                | HIGH-Z                | HIGH-Z    |
| 1  | 0  | MIC/GND1A & MIC/GND1B | MIC/GND2A & MIC/GND2B | HIGH-Z    |
| 1  | 1  | MIC/GND1B             | MIC/GND2B             | MIC/GND2A |

## Pin Assignments

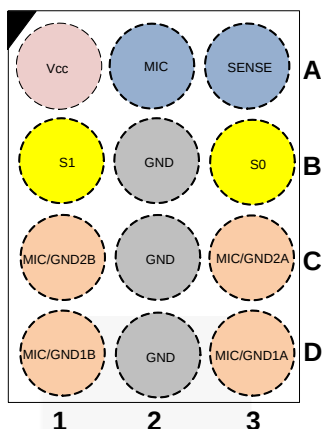


Figure 3. Pin Assignments (Top Through View, Top Mark Side)

## Pin Descriptions

| Name            | Ball #   | Type   | Description                                      |
|-----------------|----------|--------|--------------------------------------------------|
| MIC             | A2       | Switch | Microphone, connects to microphone pre-amplifier |
| SENSE           | A3       | Switch | Sense pin to detect GND offset                   |
| S0, S1          | B3, B1   | Input  | MIC, SENSE, and MIC/GNDn switch-select pin       |
| MIC/GND1A       | D3       | Switch | GND switch, connects to pole 3 of audio jack     |
| MIC/GND2A       | C3       | Switch | GND switch, connects to pole 3 of audio jack     |
| MIC/GND1B       | D1       | Switch | GND switch, connects to pole 4 of audio jack     |
| MIC/GND2B       | C1       | Switch | GND switch, connects to pole 4 of audio jack     |
| V <sub>CC</sub> | A1       | Power  | Supply voltage                                   |
| GND             | B2,C2,D2 | Ground | Ground for both the audio jack and PCB           |

## 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 |
|--------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------|------|--------------|------|
| $V_{CC}$           | Supply Voltage from Battery                                                       |                                                         | -0.5 | +5.5         | V    |
| $V_{CNTRL}$        | Control Input Voltage (S0, S1)                                                    |                                                         | -0.5 | $V_{CC}$     | V    |
| $V_{SWM}, V_{SWG}$ | Switch I/O Voltage (SENSE, MIC, MIC/GND1A, MIC/GND2A, MIC/GND1B, MIC/GND2B)       |                                                         | -0.5 | $V_{CC}+0.5$ | V    |
| $I_{IK}$           | Input Clamp Diode Current <sup>(1)</sup>                                          |                                                         | -50  |              | mA   |
| $I_{SW}$           | Switch I/O Current (Continuous) <sup>(1)</sup> (SENSE, MIC, MIC/GND2A, MIC/GND2B) |                                                         |      | 50           | mA   |
| $I_D$              | GND Switch I/O Current (Continuous) <sup>(1)</sup> (MIC/GND1A, MIC/GND1B)         |                                                         |      | 300          | 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                                               | All Other Pins (S0,S1, SENSE, MIC)                      |      | 3            |      |
|                    |                                                                                   | I/O to GND (MIC/GND1A, MIC/GND2A, MIC/GND1B, MIC/GND2B) |      | 8            |      |
|                    |                                                                                   | Power to GND                                            |      | 10           |      |
|                    | Charged Device Model, JEDEC JESD22-C101                                           | All Pins                                                |      | 2            |      |

### Note:

1. 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 |
|-------------|------------------------------------------------------------------------|------|----------|------|
| $V_{CC}$    | Battery Supply Voltage                                                 | 2.3  | 4.5      | V    |
| $V_{CNTRL}$ | Control Input Voltage (S0, S1)                                         | 0    | $V_{CC}$ | V    |
| $V_{SWM}$   | Switch I/O Voltage (MIC)                                               | 0    | $V_{CC}$ | V    |
| $V_{SWG}$   | Switch I/O Voltage (SENSE, MIC/GND1A, MIC/GND2A, MIC/GND1B, MIC/GND2B) | 0    | 1.0      | V    |
| $T_A$       | Operating Temperature                                                  | -40  | +85      | °C   |

## DC Electrical Characteristics

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

| Symbol            | Parameter                                                           | Condition                                                                                              | $V_{CC}$ (V) | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ |      |          | Unit          |
|-------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------|------|----------|---------------|
|                   |                                                                     |                                                                                                        |              | Min.                                             | Typ. | Max.     |               |
| $V_{IK}$          | Clamp Diode Voltage                                                 | $I_{IN} = -18\text{ mA}$                                                                               | 2.8          |                                                  |      | -1.2     | V             |
| $V_{IH}$          | Input Voltage High                                                  | $V_{CNTRL} = 0$ to $V_{CC}$                                                                            | 2.3 to 4.5   | 1.0                                              |      |          | V             |
| $V_{IL}$          | Input Voltage Low                                                   | $V_{CNTRL} = 0$ to $V_{CC}$                                                                            | 2.3 to 4.5   |                                                  |      | 0.5      | V             |
| $I_{IN}$          | Control Input Leakage (S0,S1)                                       | $V_{CNTRL} = 0$ to $V_{CC}$                                                                            | 4.5          | -1                                               |      | 1        | $\mu\text{A}$ |
| $I_{OZ}$          | Off Leakage Current of Ports – Sense, MIC, MIC/GNDnA, and MIC/GNDnB | $S[0:1]=01$ ; SENSE=MIC=0.3 V; $V_{CC}=0.3\text{ V}$ ; MIC/GNDnA or MIC/GNDnB=1V0.3V or Floating       | 2.3 to 4.5   | -1.00                                            | 0.05 | 1.00     | $\mu\text{A}$ |
| $I_{AON}$         | On Leakage Current of Ports – Sense, MIC, MIC/GNDnA, and MIC/GNDnB  | $S[0:1]=00, 10, 11$ ; SENSE=MIC=0.3V; $V_{CC}=0.3\text{V}$ ; MIC/GNDnA or MIC/GNDnB=1V0.3V or Floating | 2.3 to 4.5   | -1.00                                            | 0.05 | 1.00     | $\mu\text{A}$ |
| $I_{CC}$          | Quiescent Supply Current                                            | $V_{SWG}=0$ or $1\text{V}$ ; $V_{SWM}=0$ or $V_{CC}$ ; $I_{OUT}=0$                                     | 4.5          |                                                  | 15   | 20       | $\mu\text{A}$ |
| $I_{CCZ}$         | Quiescent Supply Current – Hi-Z                                     | $S[0:1]=01$ ; $V_{SWG}=0$ or $1\text{ V}$ ; $V_{SWM}=0$ or $V_{CC}$ , $I_{OUT}=0$                      | 4.5          |                                                  | 0.2  | 1.0      | $\mu\text{A}$ |
| $I_{CCT}$         | Increase in $I_{CC}$ Current Per Control Voltage and $V_{CC}$       | S0, S1=1.65 V                                                                                          | 4.5          |                                                  |      | 3        | $\mu\text{A}$ |
| $R_{ON\_SEN}$     | Switch On Resistance for SENSE Switch Paths                         | $I_{ON} = -24\text{ mA}$ , $S[0:1]=00$ or $11$ MIC/GND2A or MIC/GND2B=1.0 V                            | 2.3          |                                                  | 0.6  | 1.0      | $\Omega$      |
| $R_{ONFLAT\_SEN}$ | On Resistance Flatness for SENSE Switch Paths                       | $I_{ON} = -24\text{ mA}$ , $S[0:1]=00$ or $11$ MIC/GND2A or MIC/GND2B=0 to 1.0 V                       | 2.3          |                                                  | 0.05 | 0.20     | $\Omega$      |
| $R_{ON\_MIC}$     | Switch On Resistance for MIC Switch Paths                           | $I_{ON} = -24\text{ mA}$ , $S[0:1]=00$ or $11$ MIC/GND2A or MIC/GND2B=1.0V                             | 2.3          |                                                  | 0.6  | 1.0      | $\Omega$      |
| $R_{ONFLAT\_MIC}$ | On Resistance Flatness for MIC Switch Path                          | $I_{ON} = -24\text{ mA}$ , $S[0:1]=00$ or $11$ MIC/GND2A or MIC/GND2B=0.5 to $V_{CC}$                  | 2.3          |                                                  | .08  | 0.5      | $\Omega$      |
| $V_{MIC}$         | MIC Input Signal Range                                              |                                                                                                        | 2.3 to 4.5   | 0                                                |      | $V_{CC}$ | V             |
| $R_{DSON(GND)}$   | GND Switch On Resistance                                            | $I_{ON} = -200\text{ mA}$ , $S[0:1]=00$ or $11$ MIC/GND1A or MIC/GND1B                                 | 2.3          |                                                  | 40   | 80       | m $\Omega$    |
| $V_{SENSE}$       | SENSE Input Signal Range                                            |                                                                                                        | 2.3 to 4.5   | 0                                                |      | 1        | V             |

## AC Electrical Characteristics

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

| Symbol         | Parameter                                  | Condition                                                                   | $V_{CC}$ (V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      |      | Unit          |
|----------------|--------------------------------------------|-----------------------------------------------------------------------------|--------------|-------------------------------------------------|------|------|---------------|
|                |                                            |                                                                             |              | Min.                                            | Typ. | Max. |               |
| $t_{ON\_MIC}$  | Turn-On Time (MIC, SENSE) S0, S1 to Output | $R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$                                | 2.3 to 4.5   |                                                 |      | 1    | $\mu\text{s}$ |
| $t_{OFF\_MIC}$ | Turn-Off Time (MIC, SENSE) S0,S1 to Output | $R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$                                | 2.3 to 4.5   |                                                 |      | 1    | $\mu\text{s}$ |
| $t_{ENABLE}$   | Enable Time (MIC, SENSE) S0,S1 to Output   | $S[0:1]=01$ to $00,10,11$ ,<br>$R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$ | 2.3 to 4.5   |                                                 | 1    |      | $\mu\text{s}$ |
| $t_{DISABLE}$  | Turn-Off Time (MIC, SENSE) S0,S1 to Output | $S[0:1]=00,10,11$ to $01$ ,<br>$R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$ | 2.3 to 4.5   |                                                 | 1    |      | $\mu\text{s}$ |

## MIC and SENSE Switch

| Symbol                   | Parameter                              | Condition                                                                                                          | $V_{CC}$ (V) | $T_A = -40$ to $+85^\circ\text{C}$ |       |      | Unit |
|--------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------|-------|------|------|
|                          |                                        |                                                                                                                    |              | Min.                               | Typ.  | Max. |      |
| THD                      | Total Harmonic Distortion - MIC        | $R_T=600\ \Omega$ , $V_{SW}=0.5\text{ V}_{PP}$ ,<br>$f=20\text{ Hz}$ to $20\text{ kHz}$ ,<br>$V_{IN}=1.8\text{ V}$ | 2.8          |                                    | 0.001 |      | %    |
| $O_{IRRM}$               | Off Isolation – MIC/SENSE              | $f=20\text{ kHz}$ , $R_S=600\ \Omega$ ,<br>$C_L=0\text{ pF}$ , $R_T=600\ \Omega$ ,<br>$V_{SW}=0.2\text{ V}_{PP}$   | 2.8          |                                    | - 88  |      | dB   |
| $X_{TALKM}$              | Crosstalk from MIC to SENSE            | $f=1\text{ MHz}$ , $R_L=100\ \Omega$                                                                               | 2.8          |                                    | -80   |      | dB   |
| $X\text{-Talk}_{System}$ | X-Talk Between Left and Right Speakers | $f=2\text{ kHz}$ , $R_L=32\ \Omega$ ,<br>$C_L=0\text{ pF}$ , $V_{IN}=100\text{ mV}_{RMS}$                          | 2.8          |                                    | -54   |      | dB   |

## Capacitance

| Symbol     | Parameter                              |       | Condition                                                    | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      |      | Unit |
|------------|----------------------------------------|-------|--------------------------------------------------------------|-------------------------------------------------|------|------|------|
|            |                                        |       |                                                              | Min.                                            | Typ. | Max. |      |
| $C_{IN}$   | Control Pin Input Capacitance (S0, S1) |       | $V_{CC}=0\text{ V}$ , $f=1\text{ MHz}$                       |                                                 | 1.7  |      | pF   |
| $C_{ONM}$  | On Capacitance                         | SENSE | $V_{CC}=2.8\text{ V}$ , $EN=V_{CC}$ , $f=1\text{ MHz}$ ,     |                                                 | 65   |      |      |
|            |                                        | MIC   |                                                              |                                                 | 75   |      |      |
| $C_{OFFM}$ | Off Capacitance                        | SENSE | $V_{CC}=2.8\text{ V}$ , $EN=0\text{ V}$ , $f=1\text{ MHz}$ , |                                                 | 25   |      |      |
|            |                                        | MIC   |                                                              |                                                 | 30   |      |      |

## Power

| Symbol | Parameter                                             | Conditions                                                                                                        | $V_{CC}$ (V) | $T_A = -40$ to $+85^\circ\text{C}$ |      |      | Unit |
|--------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------|------|------|------|
|        |                                                       |                                                                                                                   |              | Min.                               | Typ. | Max. |      |
| PSRR   | Power Supply Rejection Ratio                          | Power Supply Noise at $300\text{ mV}_{PP}$ ,<br>Measured 10/90%,<br>$f=217\text{ Hz}$                             | 2.8          | -80                                |      |      | dB   |
| IL     | Insertion Loss through Switch<br>( $V_{OUT}/V_{IN}$ ) | SENSE/MIC: $V_{IN}=400\text{ mV}_{pk-pk}$ ,<br>$f=20\text{ kHz}$ , DC Bias= $0.3\text{ V}$ ,<br>$R_L=600\ \Omega$ | 2.8          |                                    | -0.4 |      | dB   |
|        |                                                       | SENSE/MIC: $V_{IN}=400\text{ mV}_{pk-pk}$ ,<br>$f=20\text{ kHz}$ , DC Bias= $2.5\text{ V}$ ,<br>$R_L=600\ \Omega$ | 2.8          |                                    | -0.4 |      |      |

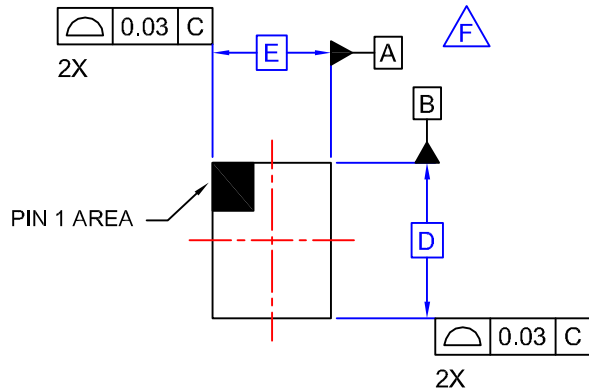
The following information applies to the WL-CSP package dimensions on the next page:

**Product Specific Dimensions**

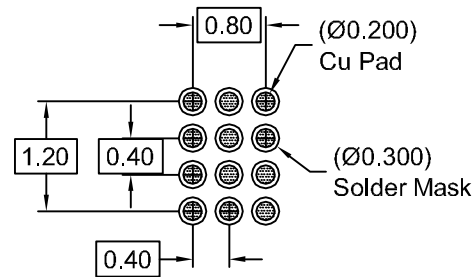
| D       | E       | X       | Y       |
|---------|---------|---------|---------|
| 1.56 mm | 1.16 mm | 0.18 mm | 0.18 mm |



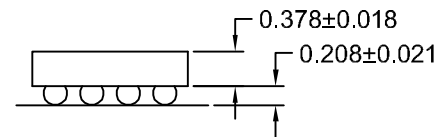
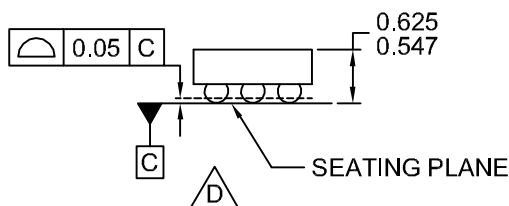
| REVISIONS |                          |         |                   |
|-----------|--------------------------|---------|-------------------|
| REV       | DESCRIPTION              | DATE    | APP'D / SITE      |
| 1         | Initial drawing release. | 8-19-09 | L. England / FSME |



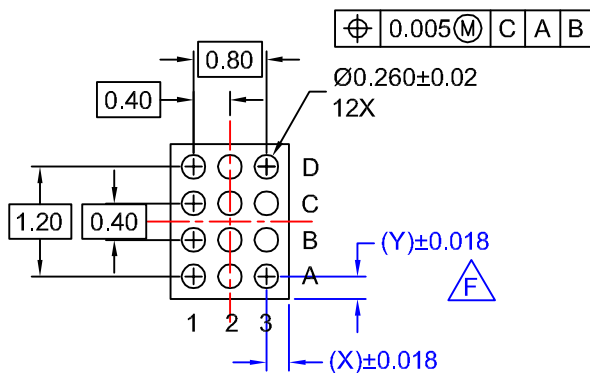
TOP VIEW



RECOMMENDED LAND PATTERN  
(NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

## NOTES:

A. NO JEDEC REGISTRATION APPLIES.

B. DIMENSIONS ARE IN MILLIMETERS.

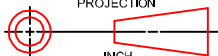
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

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 FILENAME: MKT-UC012ACrev1.

| APPROVALS                                                                                                               |            | DATE    | <div>FAIRCHILD</div> <div>SEMICONDUCTOR™</div>     |      |                |     |
|-------------------------------------------------------------------------------------------------------------------------|------------|---------|----------------------------------------------------|------|----------------|-----|
| DRAWN                                                                                                                   | L. England | 8-19-09 | 12BALL WLCSP, 3X4 ARRAY<br>0.4MM PITCH, 250UM BALL |      |                |     |
| DFTG. CHK.                                                                                                              | S. Martin  | 8-19-09 |                                                    |      |                |     |
| ENGR. CHK.                                                                                                              |            |         |                                                    |      |                |     |
|                                                                                                                         |            |         |                                                    |      |                |     |
| <div></div> <div>INCH<br/>[MM]</div> |            |         | SCALE                                              | SIZE | DRAWING NUMBER | REV |
|                                                                                                                         |            |         | N/A                                                | N/A  | MKT-UC012AC    | 1   |
| DO NOT SCALE DRAWING                                                                                                    |            |         |                                                    |      | SHEET 1 of 1   |     |

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