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# 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 Ω
R <sub>ON</sub> Maximum (SENSE)	1 Ω

## 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

## Applications

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

## 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 μm Ball	3000 units on Tape & Reel

## Typical Application

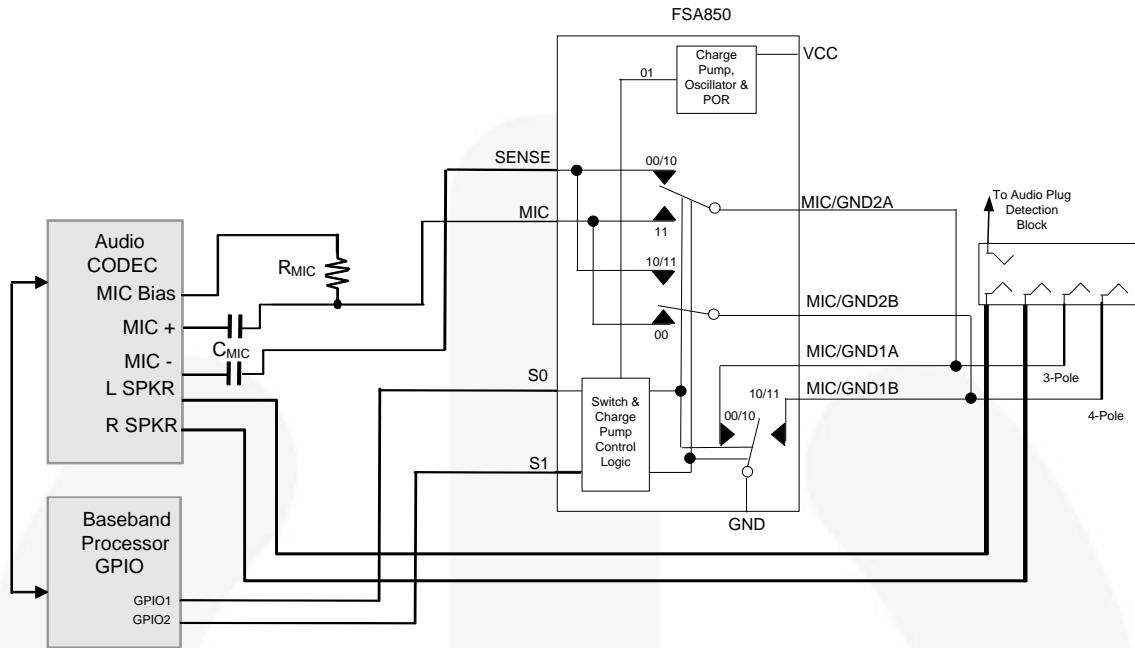


Figure 1. Typical Mobile Application

## Analog Symbol

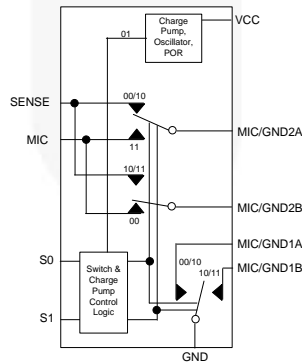


Figure 2. Analog Symbol

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

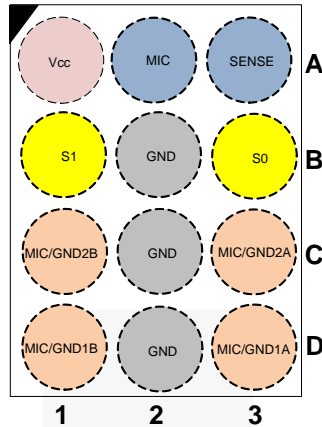


Figure 3. Pin Assignments (Top Through View, Top Mark Side)

## 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	
		All Pins		2	
Charged Device Model, JEDEC JESD22-C101	All Pins		2		

### 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
$V_{CC}$	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, $R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$	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, $R_L=10\text{ k}\Omega$ , $C_L=10\text{ pF}$	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	$R_T=600\ \Omega$ , $V_{SW}=0.5\ V_{PP}$ , $f=20\text{ Hz}$ to $20\text{ kHz}$ , $V_{IN}=1.8\text{ V}$	2.8		0.001		%
$O_{IRRM}$	Off Isolation – MIC/SENSE	$f=20\text{ kHz}$ , $R_S=600\ \Omega$ , $C_L=0\text{ pF}$ , $R_T=600\ \Omega$ $V_{SW}=0.2\ V_{PP}$	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	$f=2\text{ kHz}$ , $R_L=32\ \Omega$ , $C_L=0\text{ pF}$ , $V_{IN}=100\text{ mV}_{RMS}$	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	$V_{CC}=2.8\text{ V}$ , $EN=V_{CC}$ , $f=1\text{ MHz}$ ,		65		
				75		
$C_{OFFM}$	Off Capacitance	$V_{CC}=2.8\text{ V}$ , $EN=0\text{ V}$ , $f=1\text{ MHz}$ ,		25		
				30		

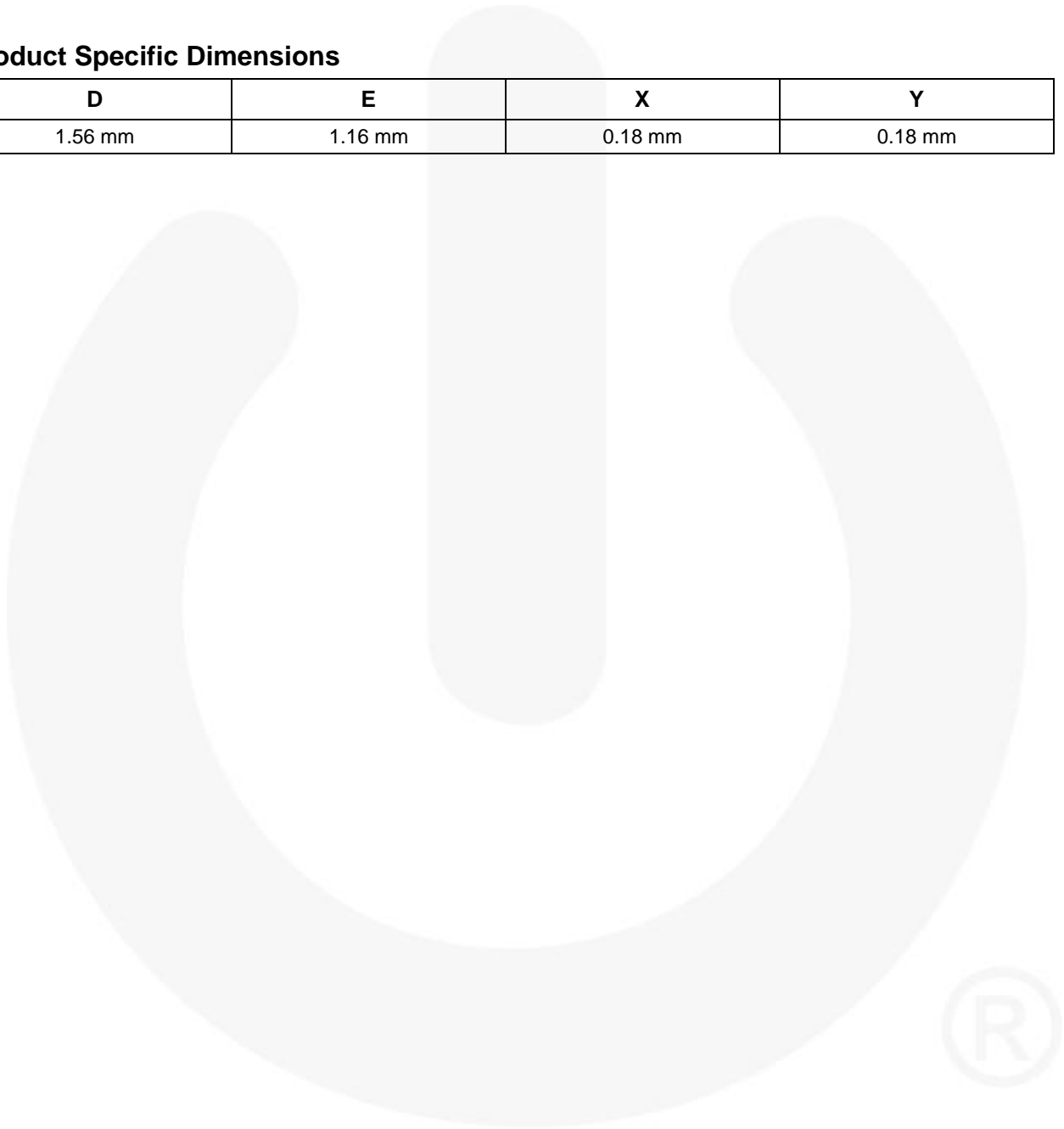
## Power

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 $300\text{ mV}_{PP}$ , Measured 10/90%, $f=217\text{ Hz}$	2.8	-80			dB
IL	Insertion Loss through Switch ( $V_{OUT}/V_{IN}$ )	SENSE/MIC: $V_{IN}=400\text{ mV}_{pk-pk}$ , $f=20\text{ kHz}$ , DC Bias= $0.3\text{ V}$ , $R_L=600\ \Omega$	2.8		-0.4		dB
		SENSE/MIC: $V_{IN}=400\text{ mV}_{pk-pk}$ , $f=20\text{ kHz}$ , DC Bias= $2.5\text{ V}$ , $R_L=600\ \Omega$	2.8		-0.4		

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

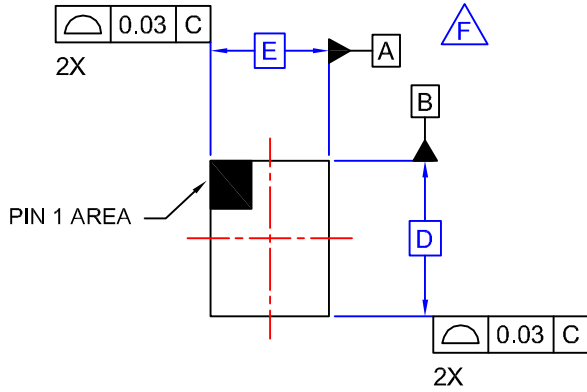
**Product Specific Dimensions**

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

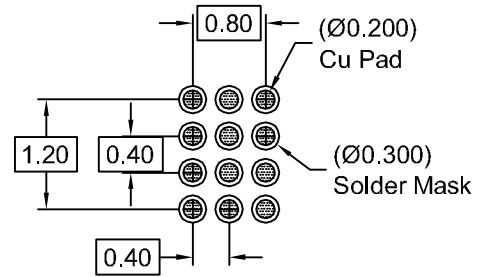




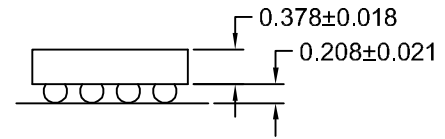
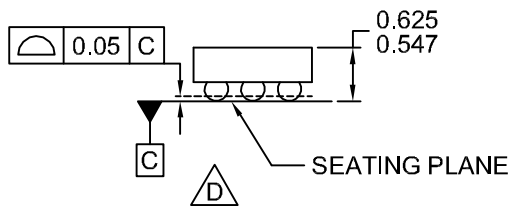
REVISIONS			
REV	DESCRIPTION	DATE	APP'D / SITE
1	Initial drawing release.	8-19-09	L. England / FSME



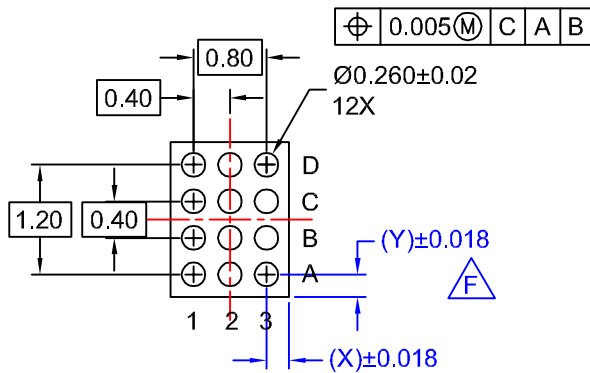
TOP VIEW



RECOMMENDED LAND PATTERN  
(NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

NOTES:

- A. NO JEDEC REGISTRATION APPLIES.
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- 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.

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

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