WM7331E

Bottom Port Analog Silicon Microphone

DESCRIPTION

The WM7331 is a low-profile silicon analog microphone. It offers high Signal to Noise Ratio (SNR) and low power consumption and is suited to a wide variety of consumer applications.

The WM7331 incorporates Cirrus Logic® proprietary CMOS/MEMS membrane technology, offering high reliability and high performance in a miniature, low-profile package. The compact integration of transducer and internal circuitry on a single die enables implementation within an extremely small package size.

The WM7331 is designed to withstand the high temperatures associated with automated flow solder assembly processes. (Note that conventional microphones can be damaged by this process.)

The WM7331 offers tight tolerance on the microphone sensitivity, giving reduced variation between parts. This removes the need for in-line production calibration of part-to-part microphone variations.

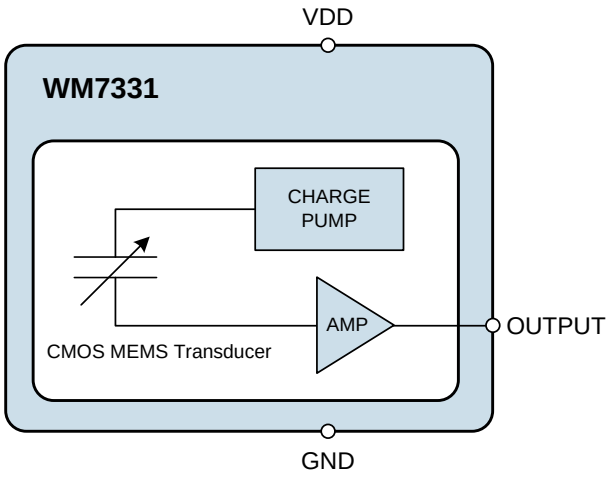
FEATURES

- High SNR (63dB)
- Low variation in sensitivity (±1dB tolerance)
- Low current consumption (55µA)
- Analog output
- Bottom Port LGA Package
- 2.5mm x 1.6mm x 0.9mm package
- 1.6V to 3.6V supply

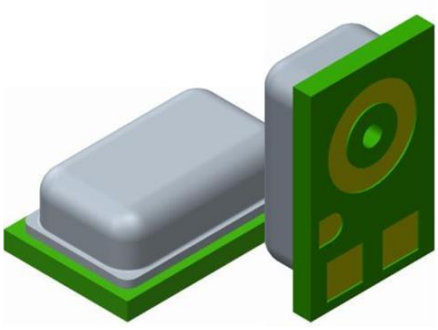
APPLICATIONS

- Mobile phone handsets
- Wearable devices
- Portable media players
- Digital cameras

BLOCK DIAGRAM



3D VIEW

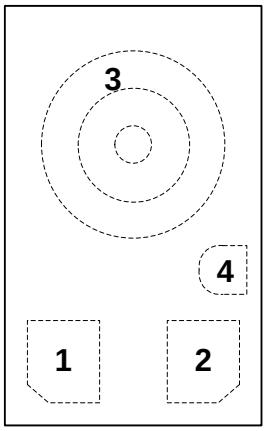


2.50mm x 1.60mm x 0.90mm LGA package

Pre-Production	This document contains information for a product under development. Cirrus Logic reserves the right to modify this product.

TABLE OF CONTENTS

PIN CONFIGURATION



Top View

PIN DESCRIPTION

PIN	NAME	TYPE	DESCRIPTION
1	VDD	Supply	Analog supply
2	OUTPUT	Analog Output	Microphone analog output signal
3	GND	Supply	Analog ground
4	GND		Can be left floating (recommended), or connected to GND

ORDERING INFORMATION

ORDER CODE	TEMPERATURE RANGE	PACKAGE	MOISTURE SENSITIVITY LEVEL	PEAK SOLDERING TEMPERATURE
WM7331IMSE/RV	-40 to +100°C	LGA (tape and reel)	MSL2A	+260°C

Note:
Reel quantity = 6000
All devices are Pb-free and Halogen free.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

ESD Sensitive Device. This device is manufactured on a CMOS process. It is therefore generically susceptible to damage from excessive static voltages. Proper ESD precautions must be taken during handling and storage of this device.

Cirrus Logic tests its package types according to IPC/JEDEC J-STD-020 for Moisture Sensitivity to determine acceptable storage conditions prior to surface mount assembly. These levels are:

MSL1 = unlimited floor life at <30°C / 85% Relative Humidity. Not normally stored in moisture barrier bag.
MSL2 = out of bag storage for 1 year at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
MSL2A = out of bag storage for 4 weeks at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
MSL3 = out of bag storage for 168 hours at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.

The Moisture Sensitivity Level for each package type is specified in Ordering Information.

CONDITION	MIN	MAX
Supply Voltage (VDD)	-0.3V	+4.2V
Operating temperature range, T_A	-40°C	+100°C
Storage temperature prior to soldering	30°C max / 60% RH max	
Storage temperature after soldering	-40°C	+100°C

IMPORTANT ASSEMBLY GUIDELINES

Do not put a vacuum over the port hole of the microphone. Placing a vacuum over the port hole can damage the device.

Do not board wash the microphone after a re-flow process. Board washing and the associated cleaning agents can damage the device. Do not expose to ultrasonic cleaning methods.

Do not use a vapour phase re-flow process. The vapour can damage the device.

Please refer to application note WAN0273 (MEMS MIC Assembly and Handling Guidelines) for further assembly and handling guidelines.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog Supply Range	VDD	1.6	1.8	3.6	V
Ground	GND		0		V

ACOUSTIC AND ELECTRICAL CHARACTERISTICS

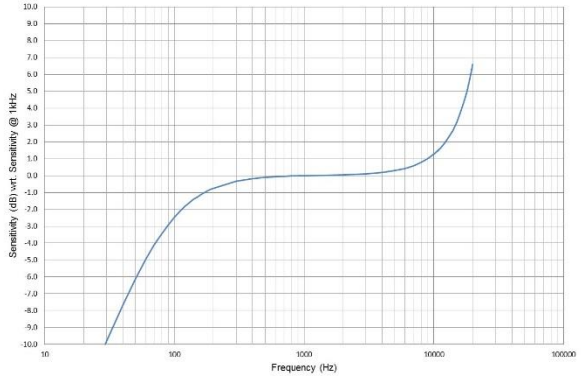
Test Conditions: VDD=1.8V, 1kHz test signal, T_A = 25°C, unless otherwise stated.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Directivity			Omni-directional			
Polarity		Positive sound pressure	Positive output voltage			
Sensitivity	S	94dB SPL	-39	-38	-37	dBV
Acoustic Overload		No Load, THD < 10%		124		dB SPL
Total Harmonic Distortion	THD	94dB SPL		0.04		%
		114dB SPL		0.3		
		120dB SPL		1		
Signal to Noise Ratio	SNR	A-weighted		63		dB
Dynamic Range	DR	A-weighted		89		dB
Frequency Response		-3dB low frequency	70		100	Hz
		+3dB high frequency		15000		
Frequency Response Flatness		200Hz to 8kHz	-1		+1	dB
Part-to-Part Phase Matching		80Hz to 100Hz			±10	°
		200Hz			±5	
Acoustic Noise Floor		A-weighted		31		dB SPL
Electrical Noise Floor		A-weighted		-101		dBV
Power Supply Rejection Ratio	PSRR	217Hz sine wave, 100mV (peak-peak)		62		dB
Power Supply Rejection	PSR	217Hz square wave, 100mV (peak-peak)		-88		dBV
Current Consumption	I_{VDD}			55	60	µA
Output DC Impedance	Z_{OUT}			200	400	Ω

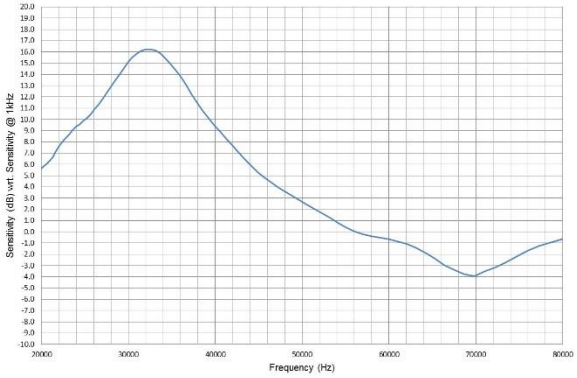
TERMINOLOGY

1. Sensitivity (dBV) - Sensitivity is a measure of the microphone output response to the acoustic pressure of a 1kHz 94dB SPL (1Pa RMS) sine wave.
2. Total Harmonic Distortion (%) – THD is the ratio of the RMS sum of the harmonic distortion products in the specified bandwidth (see note below) relative to the amplitude of the fundamental (ie. test frequency) output.
3. Signal-to-Noise Ratio (dB) – SNR is a measure of the difference in level between the output response of a 1kHz 94dB SPL sine wave and the idle noise output.
4. Dynamic Range (dB) – DR is the ratio of the 1% THD microphone output level (in response to a sine wave input) and the idle noise output level.
5. All performance measurements are carried out within a 20Hz to 20kHz bandwidth and, where noted, an A-weighted filter. Failure to use these filters will result in higher THD and lower SNR values than are found in the Acoustic and Electrical Characteristics. The low pass filter removes out of band noise.

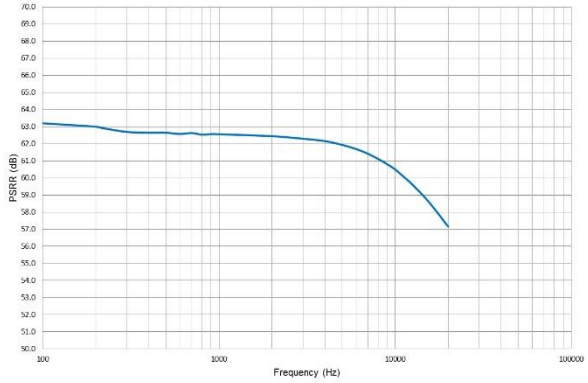
TYPICAL PERFORMANCE



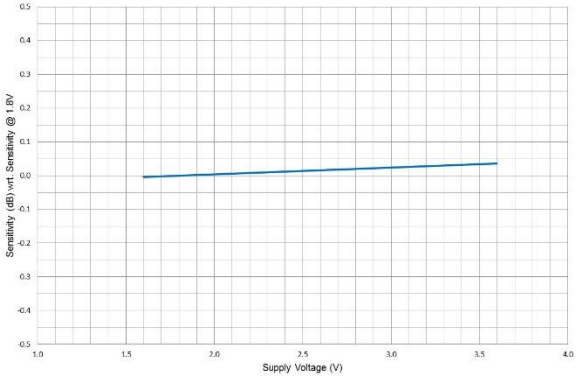
Sensitivity vs. Frequency (20Hz–20kHz)



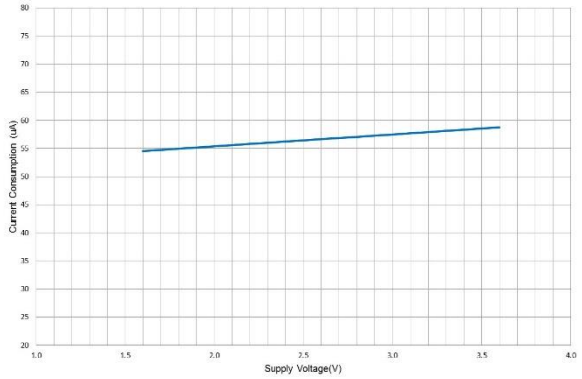
Sensitivity vs. Frequency (20kHz–80kHz)



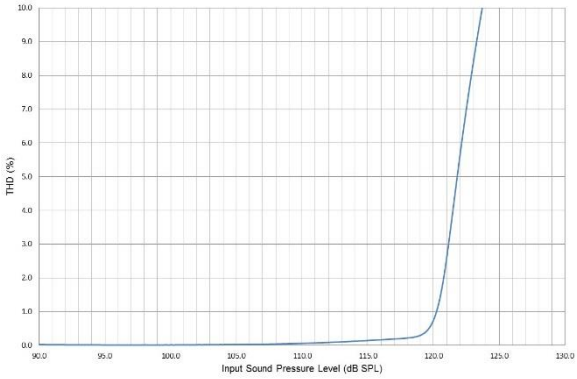
PSRR vs. Frequency



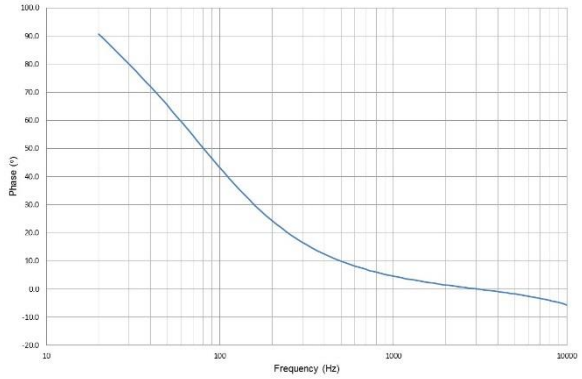
Sensitivity vs. Supply Voltage



Current Consumption vs. Supply Voltage



THD vs. Sound Pressure Level



Phase Response vs. Frequency (20Hz–10kHz)

APPLICATIONS INFORMATION

RECOMMENDED EXTERNAL COMPONENTS

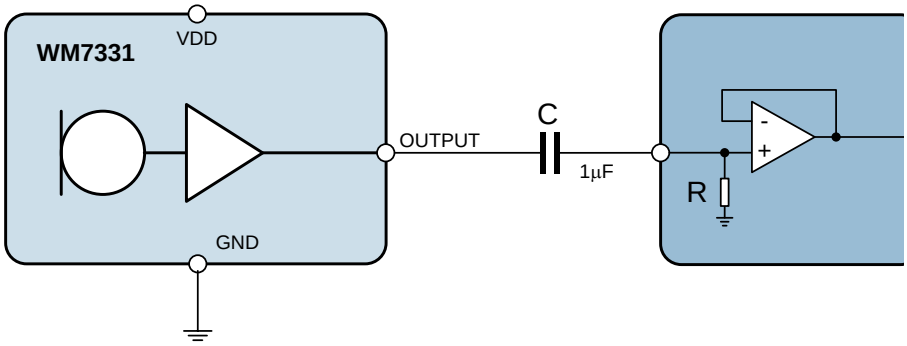


Figure 1 WM7331 Recommended External Components

A DC-blocking output capacitor is required on the OUTPUT pin, as illustrated in Figure 1. A single capacitor is required for a single-ended connection. The capacitor must be correctly selected as it affects the cut-off frequency of the output path. A low cut-off frequency is desirable as it means there is no significant filtering of the audio bandwidth.

The 3dB cut-off frequency of the output path is given by the equation below, where C is the output capacitance and R is the input resistance of the other circuit.

$$\text{3dB filter roll-off frequency} = \frac{1}{2\pi RC}$$

A typical recommended configuration, with 1uF DC-blocking capacitor and 20kΩ minimum input circuit impedance, gives a 3dB cut-off frequency of 10Hz or less. Tantalum electrolytic capacitors are particularly suitable for the DC-blocking components as they offer high stability in a small package size.

CONNECTION TO A CIRRUS LOGIC CODEC

Cirrus Logic provides a range of audio CODECs incorporating an analog microphone input interface; these support connection to silicon microphones such as the WM7331.

The recommended connection of a WM7331 silicon microphone is illustrated in Figure 2 (for single-ended mode) and Figure 3 (for pseudo-differential mode).

A DC blocking capacitor is required, as described in the previous section. A 2.2µF decoupling capacitor is also recommended; this should be positioned close to the VDD pin of the WM7331.

Further information on Cirrus Logic audio CODECs is provided in the respective product datasheet, which is available from the Cirrus Logic website.

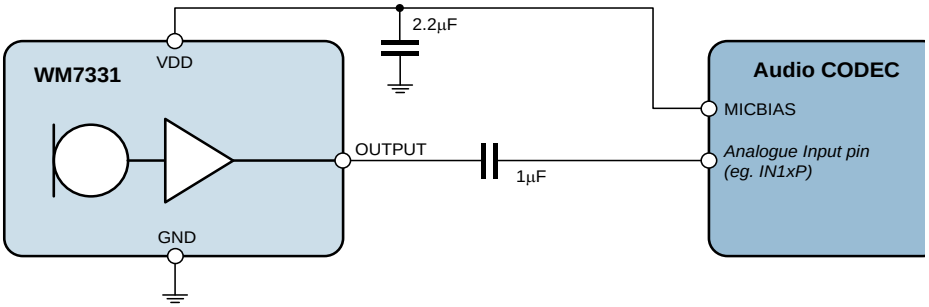


Figure 2 WM7331 Silicon Microphone Single-ended Connection

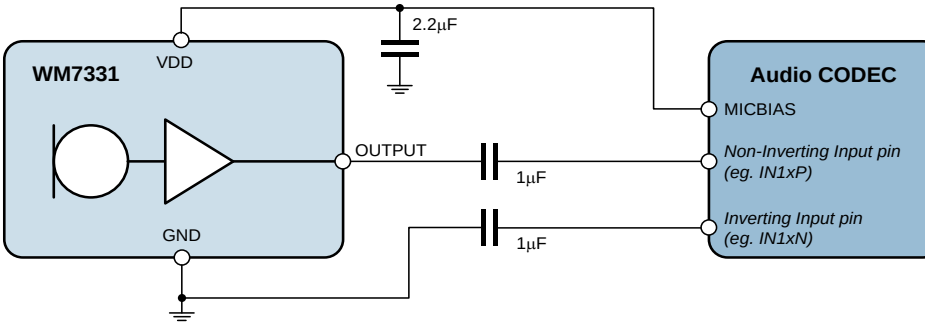


Figure 3 WM7331 Silicon Microphone Pseudo-differential Connection

PCB LAND PATTERN AND PASTE STENCIL

The recommended PCB Land Pattern and Paste Stencil Pattern for the WM7331 microphone are shown in Figure 4 and Figure 5.

See also Application Note WAN0284 (General Design Considerations for MEMS Microphones) for further details of PCB footprint design.

Full definition of the package dimensions is provided in the "Package Dimensions" section.

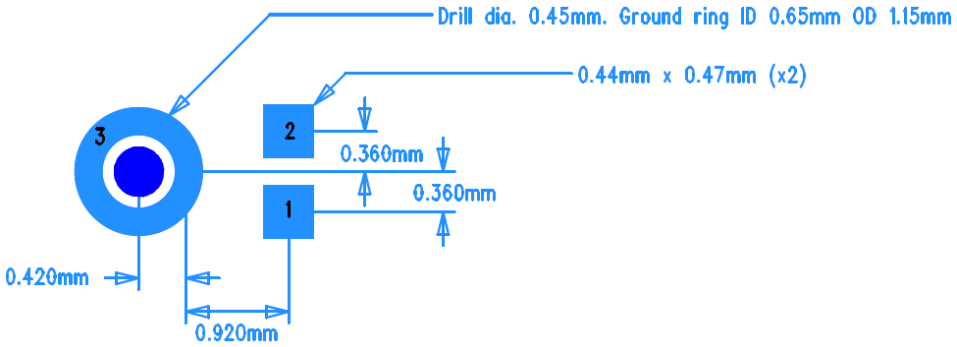


Figure 4 DM131 – PCB Land Pattern, Top View

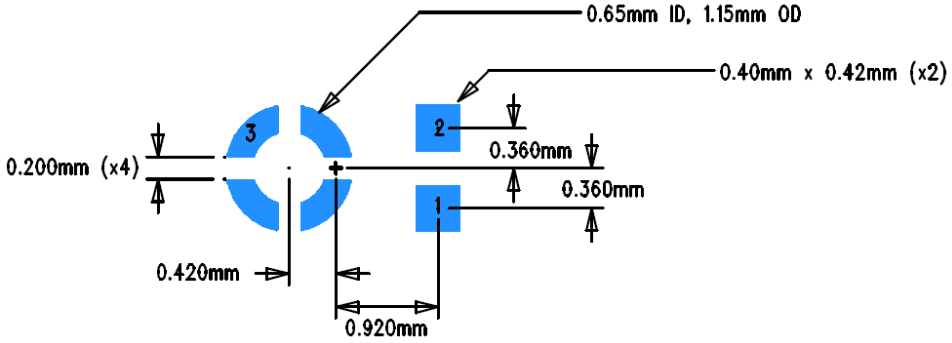
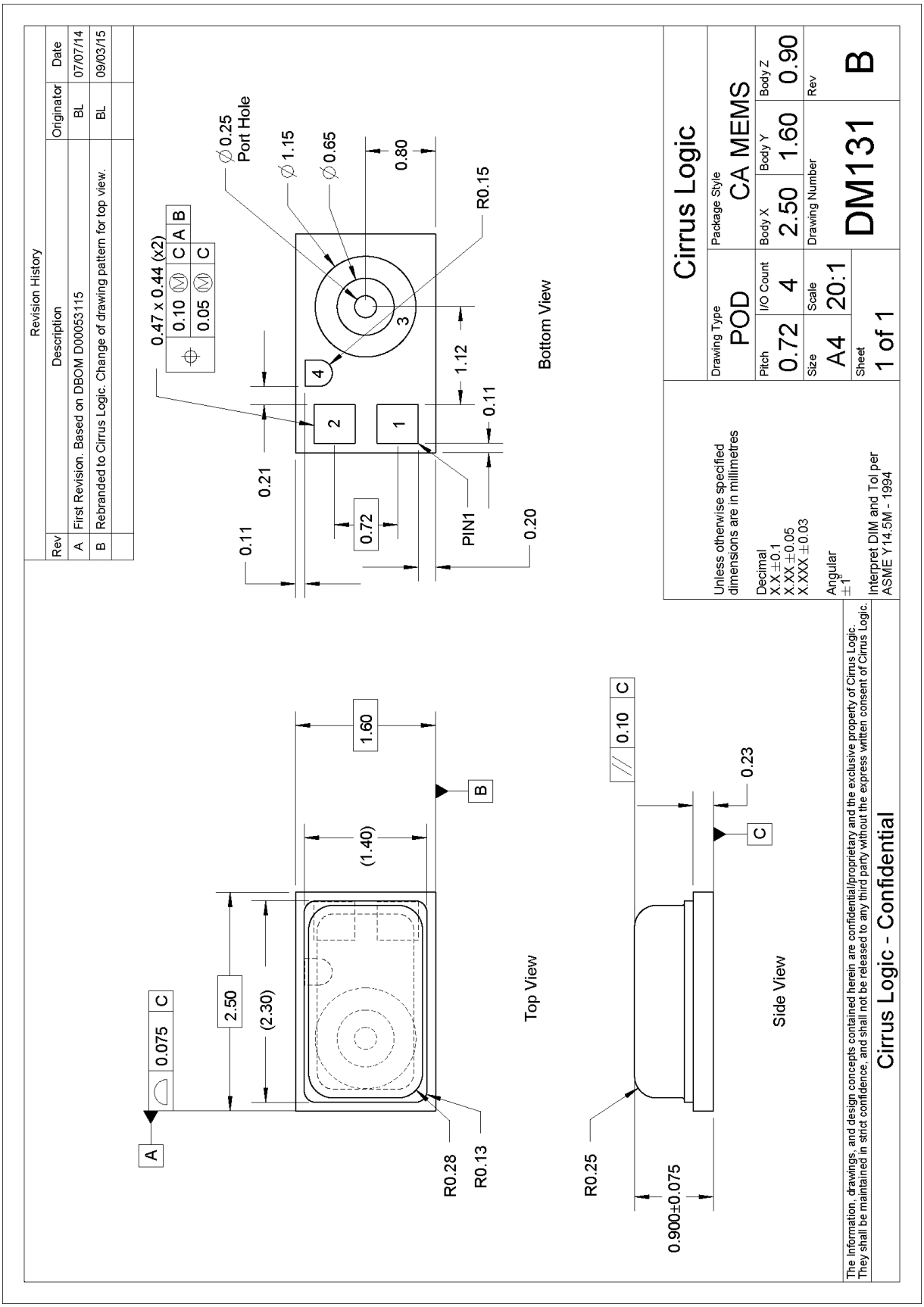


Figure 5 DM131 – Paste Stencil, Top View

PACKAGE DIMENSIONS



IMPORTANT NOTICE

Contacting Cirrus Logic Support

For all product questions and inquiries, contact a Cirrus Logic Sales Representative.
To find one nearest you, go to www.cirrus.com.

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REVISION HISTORY

DATE	REV	DESCRIPTION OF CHANGES	PAGE	CHANGED BY
01/04/14	1.0	Initial version		CT
29/09/14	2.0	3D image added Electrical Characteristics updated Package Outline Drawing added	1 5 8	PH
08/10/14	2.0	Test Pin (pin 4) added to Pin Configuration & Pin Description	4	PH
24/03/15	2.1	Frequency response updated PCB Land Pattern and Paste Stencil added Package Drawing updated	5 8 9	PH
27/05/15	2.2	Released for general distribution		PH
06/11/15	3.0	Frequency response updated Typical performance graphs added	5 6	PH
01/03/16	3.1	Frequency response performance graphs updated	6	PH
26/04/16	3.2	Phase variation specification and performance plot added	5, 6	PH