ASCSM - Pure Silicon MEMS Oscillator Chip Scale Package Design and Manufacturing Guide

GENERAL DESCRIPTION

Abracon Corporation's ASCSM device is a wafer level chip scale packaged (CSP) version of Low Jitter CMOS MEMS Oscillator. This CSP device is constructed using proven ASIC and MEMS Resonator technologies. The CSP assembly is flipped and connected to the PCB via 450 µm solder balls. Final assembly is performed using standard Surface Mount equipment, with no under-fill requirements.

The benefits of migrating to a CSP include:

• Reduced PCB footprint as compared to the QFN device package sizes.

Percentage Reduction CSP Vs. QFN footprint	
Package	**4L 1.79 x1.25 mm**
A – 7.0 x 5.0 mm	6.4%
B – 5.0 x 3.2 mm	14.0%
C – 3.2 x 2.5 mm	28.0%
D – 2.5 x 2.0 mm	44.8%

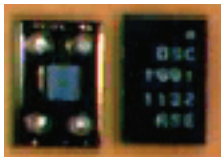

Figure 1 CSP – 4L 1.79 x 1.25 mm

• Electrical performance is improved by reducing package stress on the MEMS resonator allowing tighter frequency calibration and improved accuracy
• Reduced weight and lower height profile vs. the QFN package
• Assembly using standard SMT equipment, device under fill is not required
• Self-aligning characteristics of the low mass device resulting in high assembly yield

DEVICE CONSTRUCTION

CSP CONSTRUCTION

The CSP device starts with the Oscillator ASIC. An additional metal distribution layer is added to the ASIC to maintain the device pin out when the device is flipped, providing attach points for the MEMS resonator. The MEMS resonator is attached to the ASIC using 60 µm solder bumps. Larger 450 µm solder bumps are then used to attach the CSP device to the end-application PCB. The solder bumps are comprised of lead-free alloys.

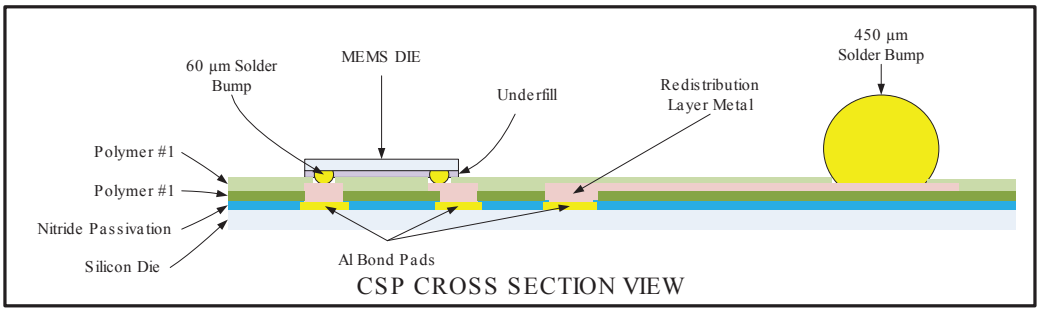

Figure 2 CSP Construction Diagram Cross Section

Figure 3 CSP – 4L 1.79 x 1.25 mm

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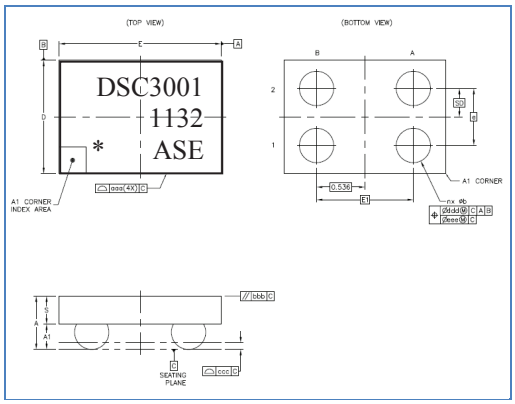
DEVICE CONFIGURATION

The ASCSM device is available in the 1.79 x 1.25 mm 4 Lead CSP package. The device has an on board height of 600 µm after reflow.



PCB DESIGN

STANDOFF

Do not route traces on the PCB top layer underneath the CSP de vice.

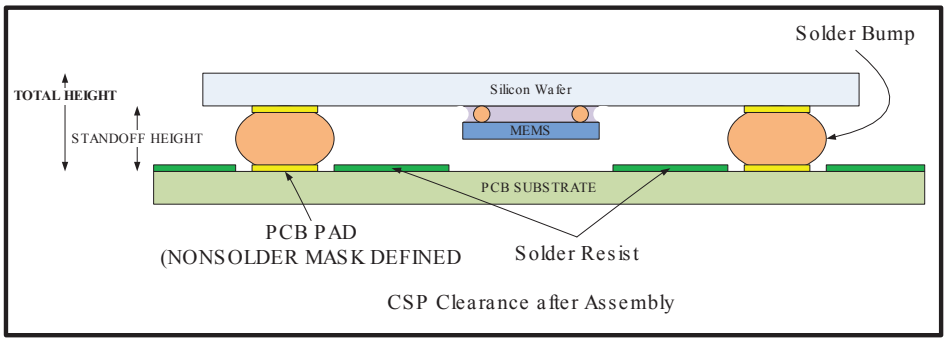


Figure 4 CSP Height Profile after assembly

DEVICE FOOT PRINTS

The footprints of the 4 Lead CSP package require a 300 µm diameter circular pad. Circuit traces from the pad should be symmetrical and exit from under the CSP in the most direct routing available. A trace width of 3 – 5 mils (76 - 127µm) is recommended to ensure that heat does not flow away from the pad during reflow. A solder resist with 25 µm clearance from the pad is recommended to maintain the proper ball shape and height.

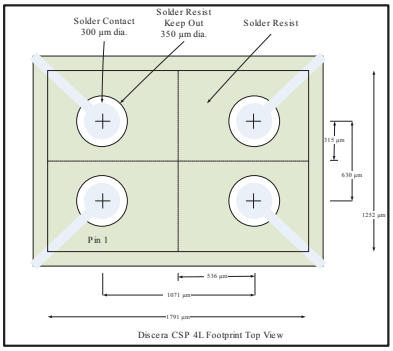


Figure 5 CSP – 4L Footprint

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SOLDER MASK DESIGN

Assembly with the Abracon Corporation CSP packages requires the use of a non-solder mask defined (NSMD) solder resist layer on the PCB. A NSMD layer provides a solder mask opening larger than the pad dimensions as shown in Figure 6 below. The solder mask should be pulled back 25 µm from the edge of the copper pad to allow proper formation of the solder balls; yielding a highly reliable solder joint. SMD solder mask is not recommended for assembly with Abracon Corporation CSP packages.

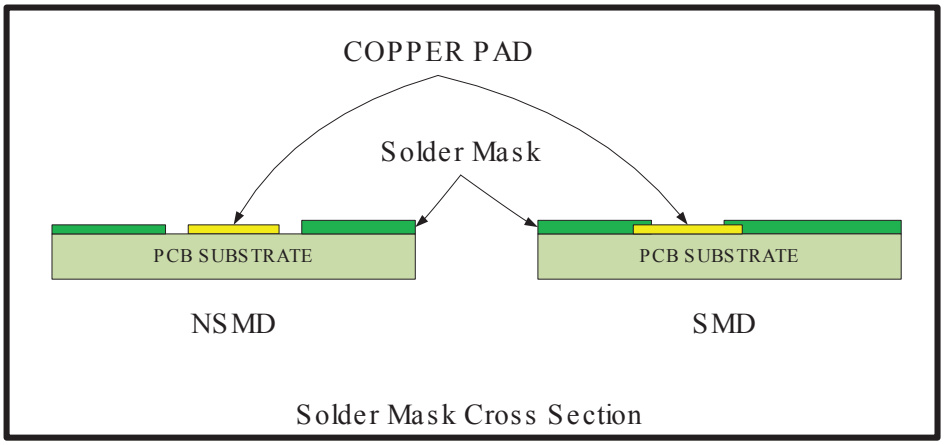

Figure 6 NSMD and SMD Pad Cross Sections

BOARD MATERIAL

The CSP package may be assembled to epoxy glass substrates such as FR-4. Reliability can be improved by using a PCB material with lower thermal expansion such as NELCO 4000-29. The glass transition temperature of the PCB material must be higher than the assembly temperature.

Metal pad finish will impact assembly yield and reliability. A silver immersion on the PCB or Organic surface preservative (OSP) is recommended. Gold is not recommended as it can cause embrittlement and reduce the reliability of the solder process.

ASSEMBLY

DEVICE INSPECTION

SOLDER PASTE

The ASCSM device may be assembled to the PCB using either a Water Soluble or a No-Clean Solder paste. A recommended RoHS Water Soluble Paste is Indium 800-413.

The recommended No-Clean solder paste is ALPHA OM-338-CSP. If an alternative paste is selected, the paste composition should be SAC305 (96.5%Sn/3.0%Ag/0.5%Cu) e1 alloys per JESD97 Classification with Type 4.5 Powder Size.

REFLOW PROFILE

http://www.lenz.com.pl/pasty_kleje/OM338CSPTB.pdf

This link contains technical information concerning the ALPHA OM-338-CSP processing guidelines and reflow profiles.

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2nd REFLOW

The ASCSM device may be reflowed a second time during the manufacturing process. If the second reflow is to be on the bottom side of the PCB, the second reflow should be at a lower temperature to ensure the device does not fall off the PCB during reflow.

REWORK

To rework the ASCSM device, bake the PCB assembly to prevent moisture damage during the rework process. During device removal, preheat the board to 190°C, and then remove the device with a vacuum wand.

The pads will need to be dressed and refluxed. The replacement device must be placed precisely at the site. A nozzle-directed hot air flow should be used to flow the solder and attach the device.

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