FRONTGRADE

APPLICATION NOTE

UT32M0R500

Recommended Footprint for the CCGA Package

8/27/2019
Version #: 1.0.0

Product Name	Manufacturer Part Number	SMD #	Device Type	Internal Pic Number
Arm Cortex M0+	UT32M0R500	5962-17212	CCGA Footprint	QS30

Table 1: Cross Reference of Applicable Products

1.0 Overview

The growth of the "New Space" and "Small Satellite" markets is introducing more companies to the radiation-hardened space market, some of which are either not familiar with designing PCBs for spaceflight, or are used to the manufacturer providing a recommended footprint for their many parts. This document provides guidance necessary for creating a PCB footprint for the UT32M0R500's Ceramic Column Grid Array (CCGA) package, in addition to a couple of recommendations for attachment of the CCGA package.

The information in this document is intended **ONLY** to help customers begin PCB design, and Frontgrade insists that customers should work with a PCB manufacturing expert to ensure that they are following PCB design rules with respect to their part's operating environment. The use of this document without a consulting with a PCB manufacturer is **NOT** recommended.

2.0 Technical Background

The Ceramic Column Grid Array (CCGA) package of the UT32M0R500 starts as a Ceramic Land Grid Array package (a package with nothing attached to its pads). Metal columns are attached to the pads to become a CCGA package. Compared to Ball Grid Array packages, which have solder balls attached to the package's pads, CCGAs typically have increased durability due to the height of the columns and the column's material composition. Correctly sizing the pad of a PCB footprint to match with the size of the column is important, as a mismatch could cause a weak or even faulty connection between the package and the part.

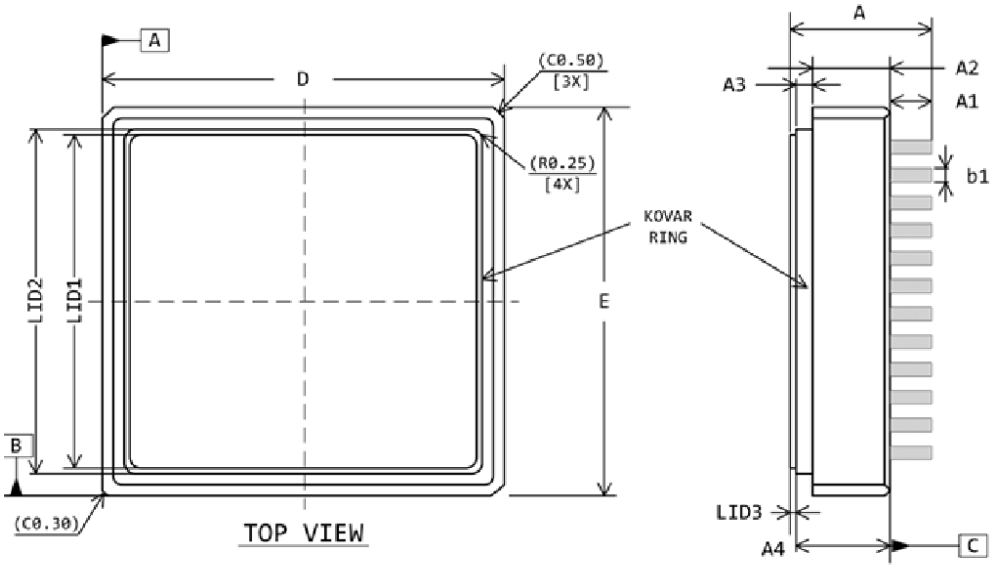
Note: Section 4.0 is specific to the CCGA package. However, the recommendations in that section can also be used as to create an *initial* CBGA footprint.

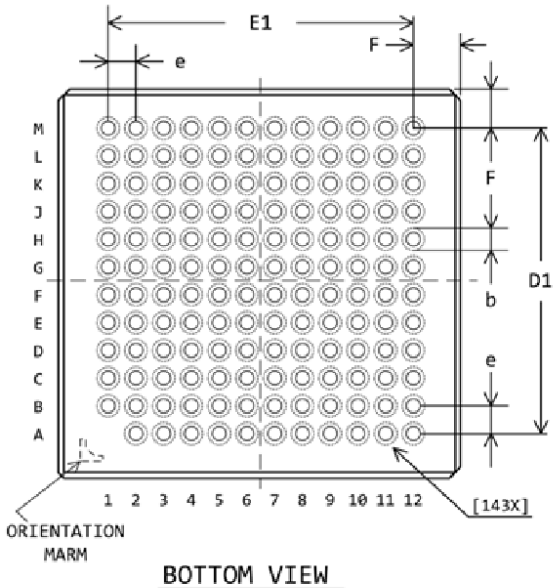
Additionally, based upon the size of the columns, a specific solder paste volume (solids content) should be met to ensure the ideal ratio of solder to flux in the solder paste used to attach the CCGA part to the PCB during reflow (the process of using solder paste and controlled high temperatures to solder one or more parts to a PCB).

3.0 Ceramic Column Grid Array Dimensions

The dimensions of the CCGA package directly affect both the recommended footprint and assembly recommendations. Below is the Package Outline Drawing for the UT32M0R500's CCGA package, which can also be found in the UT32M0R500's datasheet.

3.1 143-Pin CCGA Package Outline Drawing





SYMBOL	Millimeters		
	Min	Typ	Max
A			7.69
A1	2.01	2.21	2.41
A2	3.6	4.0	4.4
A3	0.60	0.65	0.70
A4	4.20	4.65	5.10
b	0.75	0.80	0.85
b1	0.51	0.51	0.61
D/E	14.35	14.5	14.65
D1/E1	10.87	11.0	11.13
e	0.95	1.0	1.05
F		1.75	
LID1	12.38	12.43	12.47
LID2	12.81	12.94	13.07
LID3	0.124	0.127	0.130

NOTES
1. MATERIAL IS 90%-MINIMUM ALUMINA (er = 9.8)
2. UNITS ARE MILLIMETERS
3. LID IS CONNECTED TO VSS
4. EXPOSED-METAL PLATING PER MIL-PRF-38535
   i. NICKEL BASE: ELECTRO-PLATED 2.54 - 8.89um
   ii. GOLD: ELECTRO-PLATED 2.54 - 5.72um

4.0 Creating a PCB Footprint

The columns of the CCGA parts are attached by Six Sigma. Six Sigma has provided guidelines for designing a PCB footprint for parts that use their columns. In regards to the CCGA package, the solder column diameter is typically 0.51mm. To determine PCB pad diameter, Six Sigma says "the optimum [PCB] pad diameter is 0.30mm larger than the column diameter." – SM-4077: User's Guide - Six Sigma Solder Columns *(Information reprinted with permission from Six Sigma)*

Based on this information, because the column diameter is 0.51mm, the PCB pad diameter should be 0.76mm. All other relevant dimensions of the PCB footprint should be made to match that of the CCGA Package Outline Drawing.

5.0 Assembly Recommendations

Six Sigma provides two recommendations on how to perform assembly upon CCGA parts using their columns. In regards to solder paste volume:

> *"For board assembly, Six Sigma recommends that the "solids content" of the solder paste be […] ~0.10 mm^3 for the 0.51 mm and 0.55 mm diameter columns. This does not include the flux, which can be as much as 50% of the solder paste volume. If the pad size is outside of the recommended range, then the solder paste volume may need to be adjusted."*
>
> SM-4077: User's Guide - Six Sigma Solder Columns
> (Information reprinted with permission from Six Sigma)

In regards to the reflow process:

> *"During reflow, it is important to ensure that the component body temperature be less than or equal to the board temperature. This will avoid issues such as "column kick-out" or "columns that do not attach to the board". This issue can occur when the existing fillet (between the column and the component) reflows before the solder paste."*
>
> SM-4077: User's Guide - Six Sigma Solder Columns
> (Information reprinted with permission from Six Sigma)

6.0 Summary and Conclusion

This document contains advice on how to create a PCB footprint for the UT32M0R500's CCGA package, including the CCGA package outline drawing, proper PCB footprint pad size based upon the column size, the recommended solder paste volume, and reflow recommendations for attaching the CCGA part to a PCB. As stated previously, this information is provided as a recommendation to put our customers upon the correct path, and the above information should still be discussed with a PCB manufacturing expert before being implemented into a final design.

7.0 Disclaimer

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Revision History

Date	Revision #	Author	Change Description	Page #
08/27/2019	1.0.0	OW	Initial Release	