VA416xx Schematic Symbol and PCB Footprint

July 2024, Version 0.1

VA416xx

Abstract

The VA416xx comes in four packages, 176 pin plastic PQFP, 176 pin ceramic CQFP, and 196 pin BGA. there is the reduced pin count VA41628 and VA41628 in ceramic CQFP128 and BGA.

This application note briefly describes how to use the associated vorago_lib.SchLib and vorago_lib.PcbLib and to create schematic symbols and PCB footprints in several PCB design tools such as Altium.

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Supplemental Files:

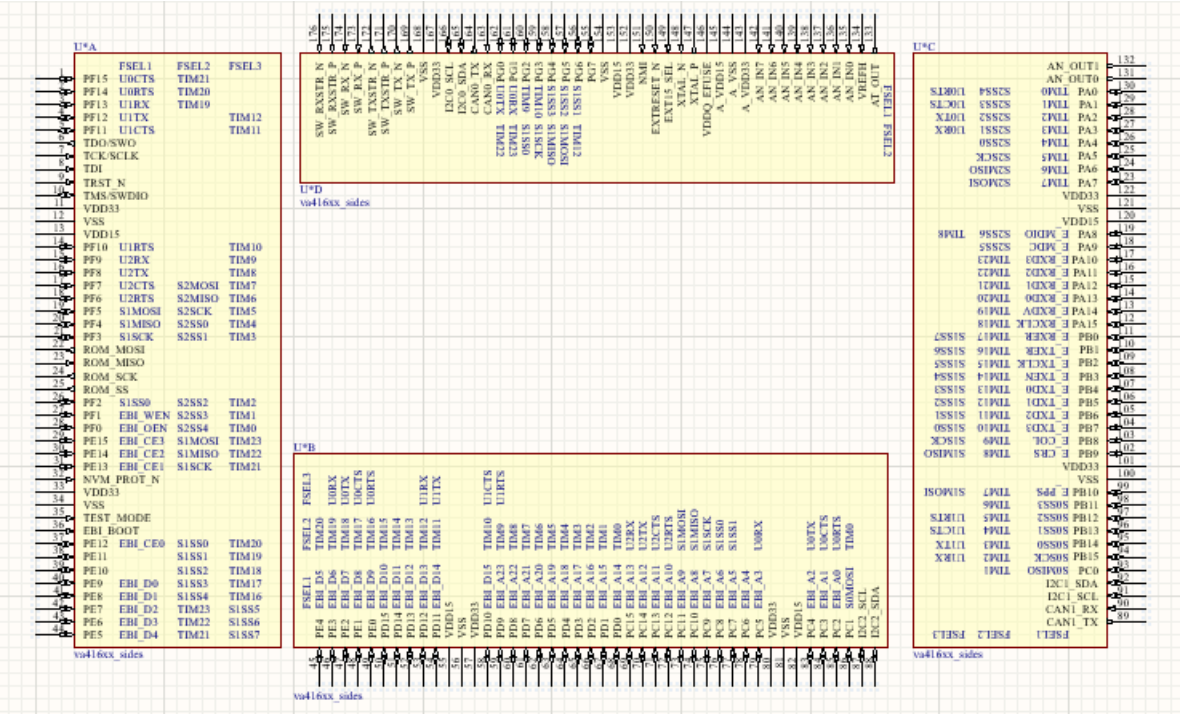
- Altium libraries
  - vorago_lib.SchLib
  - vorago_lib.PcbLib
- Graphical .STEP files of the physical part (also integrated into Altium files)
- For ceramic packages, the recommeded Fancort trim-form dimension chart

1 Altium Footprint and Symbol

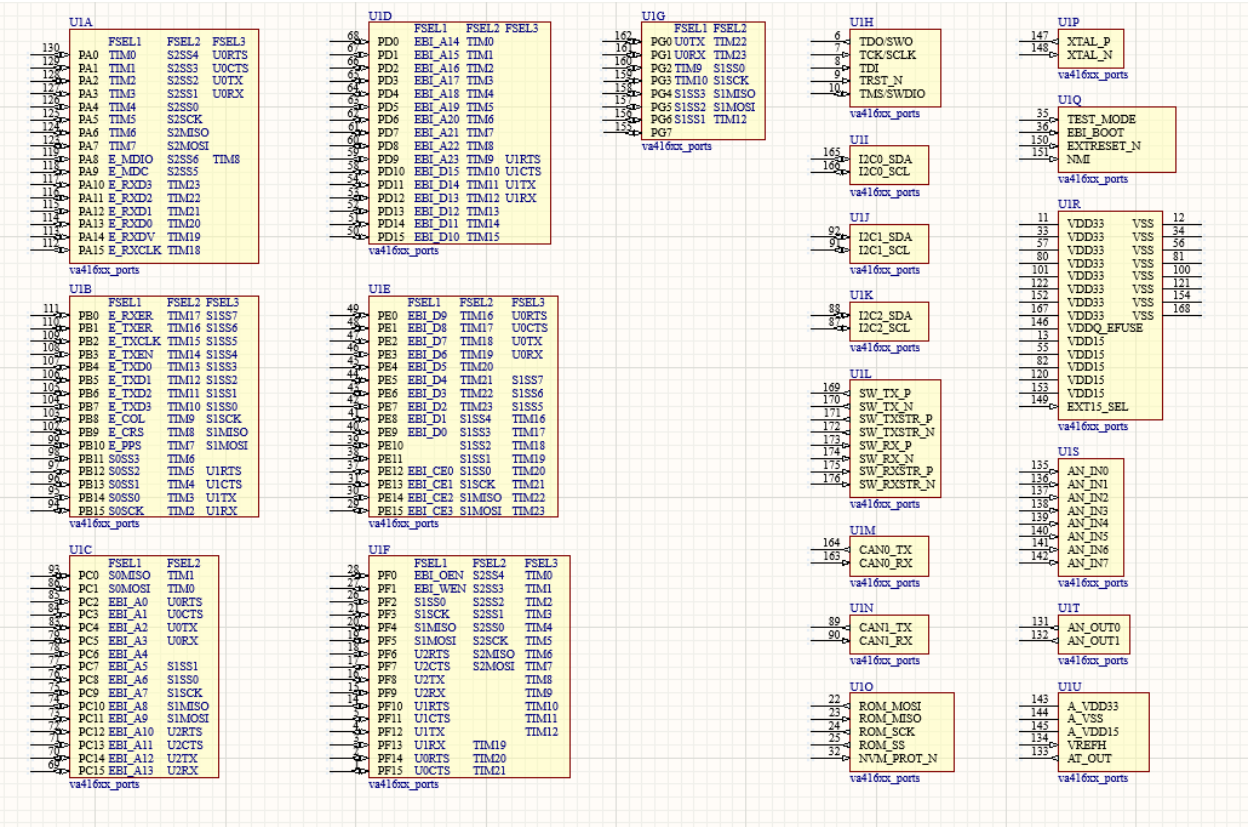
The Altium library (va416xx.lbr) consists of devices, symbols and footprints as shown in Figure 1. VA41620 and VA41630 are available in plastic QFP176 20mmx20mm 0.4mm pitch, ceramic CQFP176, and BGA 12mmx12mm 0.8mm pitch.
Each VORAGO part has two options for schematic representation of each part, the “sides” and, alternatively, a “ports” representation.

Due to the high pin count involved, it is generally impractical to represent the device as a single schematic symbol with the pins on all 4 sides as per the physical device. Here, we use an Altium-specific feature to divide and group the pins across multiple schematic objects representing a single device, which may be placed on the same schematic sheet or across multiple schematic sheets within the same project.

Altium footprints are provided here in a “sides” and “ports” representation.



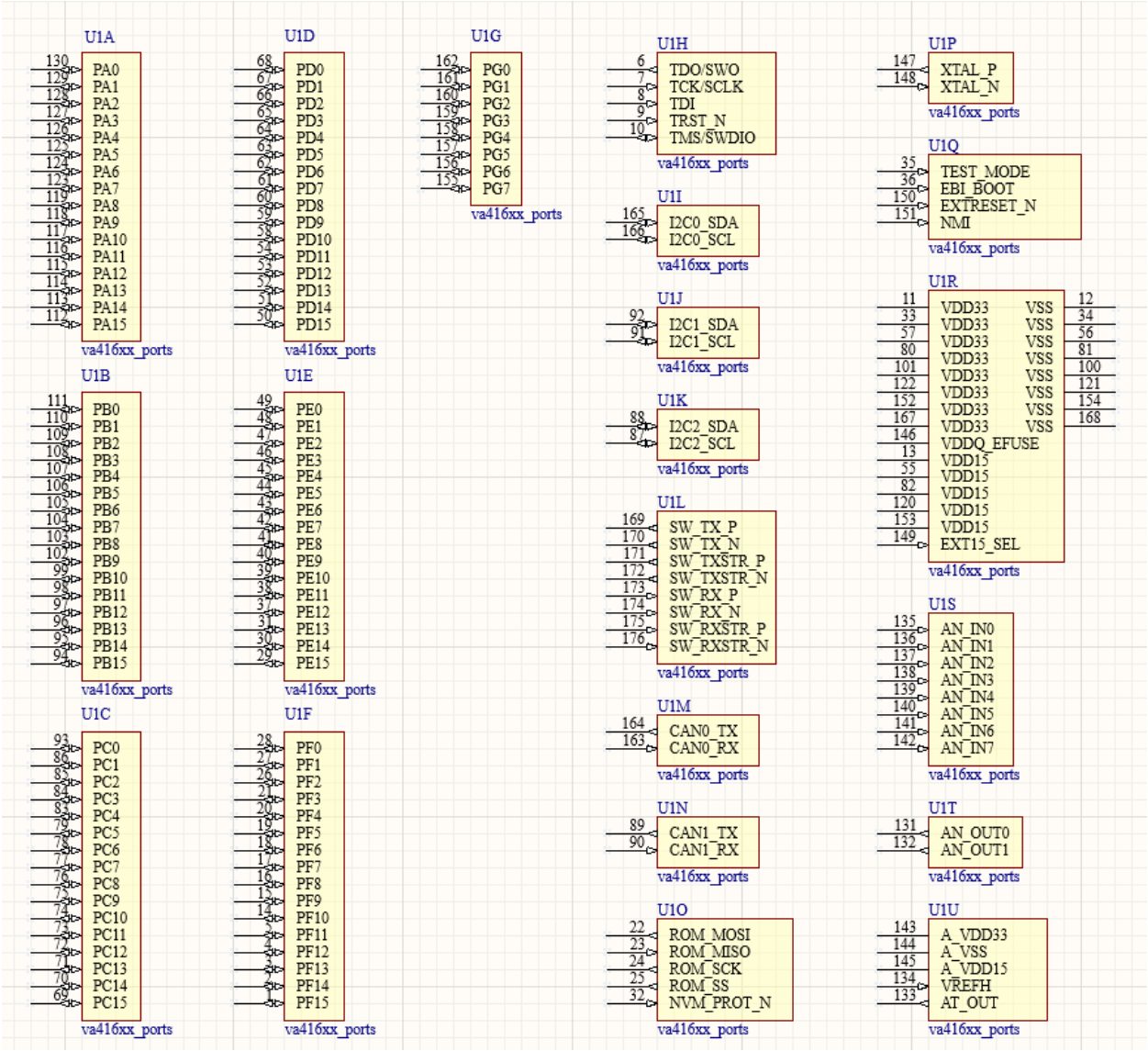
The “_sides” option represent the physical layout of the 4 sides, which helps the designer wire pins on the schematic in a way that achieves simpler, shorter routing on the PCB. A single part is graphically represented by 4 linked schematic parts representing the sides for a single device. This option is not provided for BGA packages as it has no equivalent grouping by side.



The "_ports" option groups the pins into objects based on similar functions, rather than physical side layout.

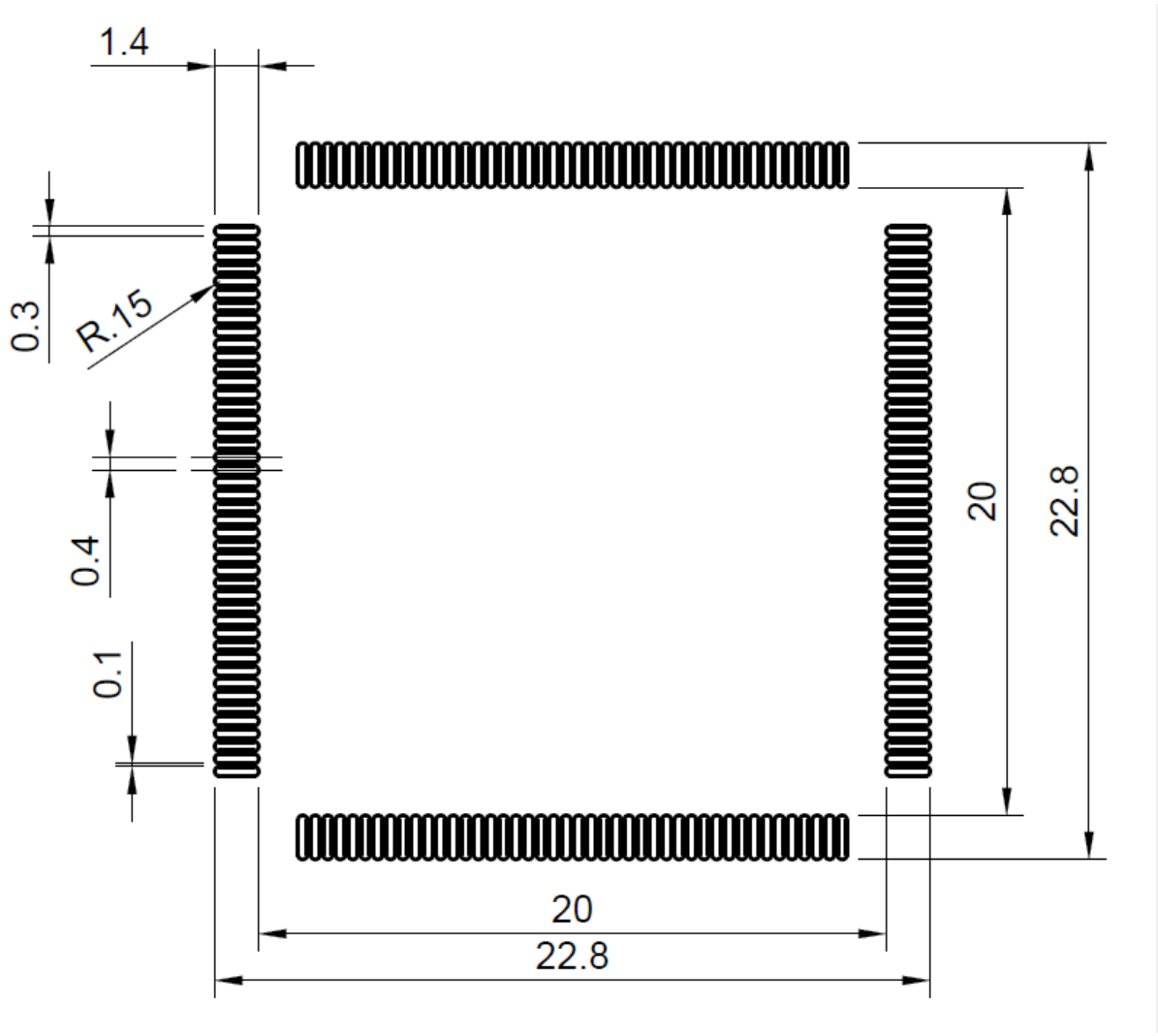
The divisions used are:

- Port A, B, C, D, E, F, and G
- Interfaces JTAG, I2C0, I2C1, SpaceWire, CAN0, CAN1, SPI boot NVM (in the case of VA41620), xtal, ADC inputs, DAC outputs
- Power: analog power, digital power, and grounds.

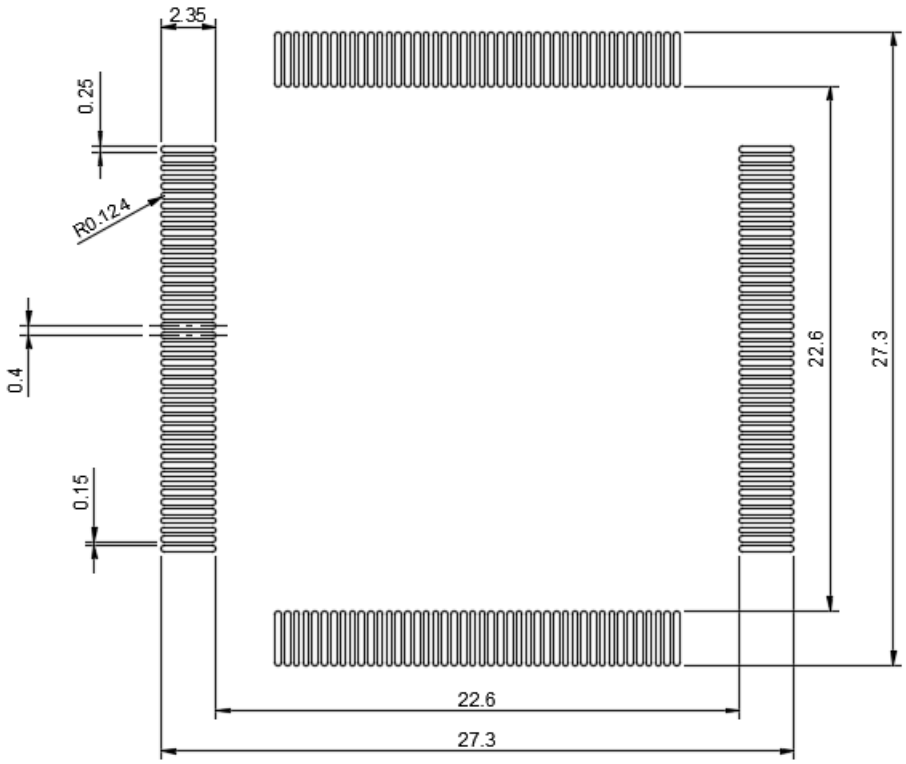


The inclusion of alt pin function selects (FSELx) does graphically increase the width of the schematic object on the screen. If a more compact pin-name-only representation is desired, this can be turned on or off at any time on a per-symbol basis without affecting the schematic connections under Properties tab->Graphical->Mode.

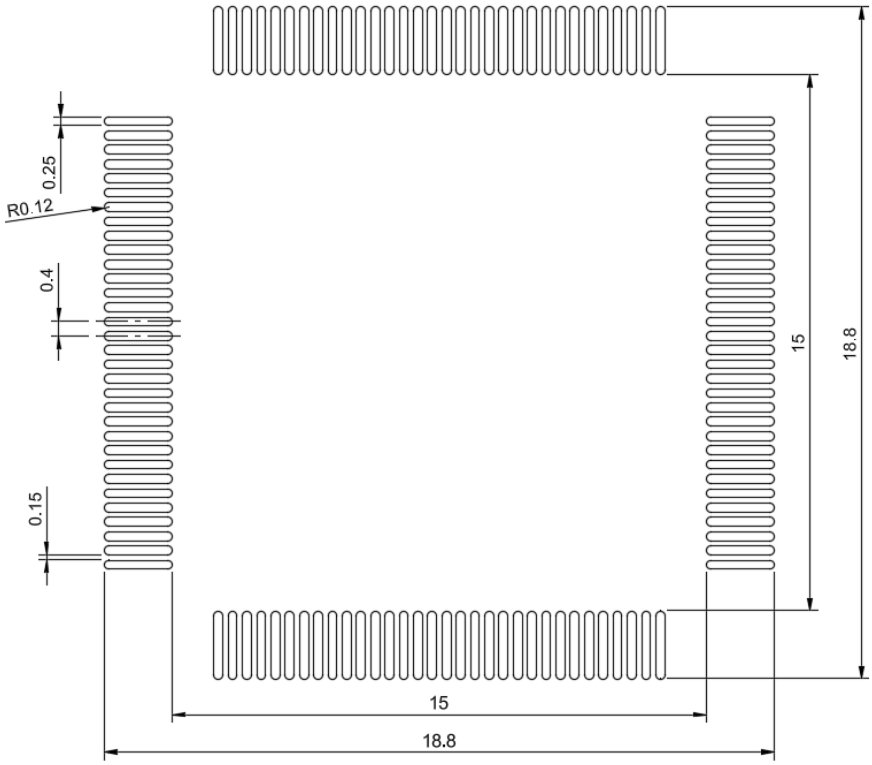
2 Recommended Pad Layout



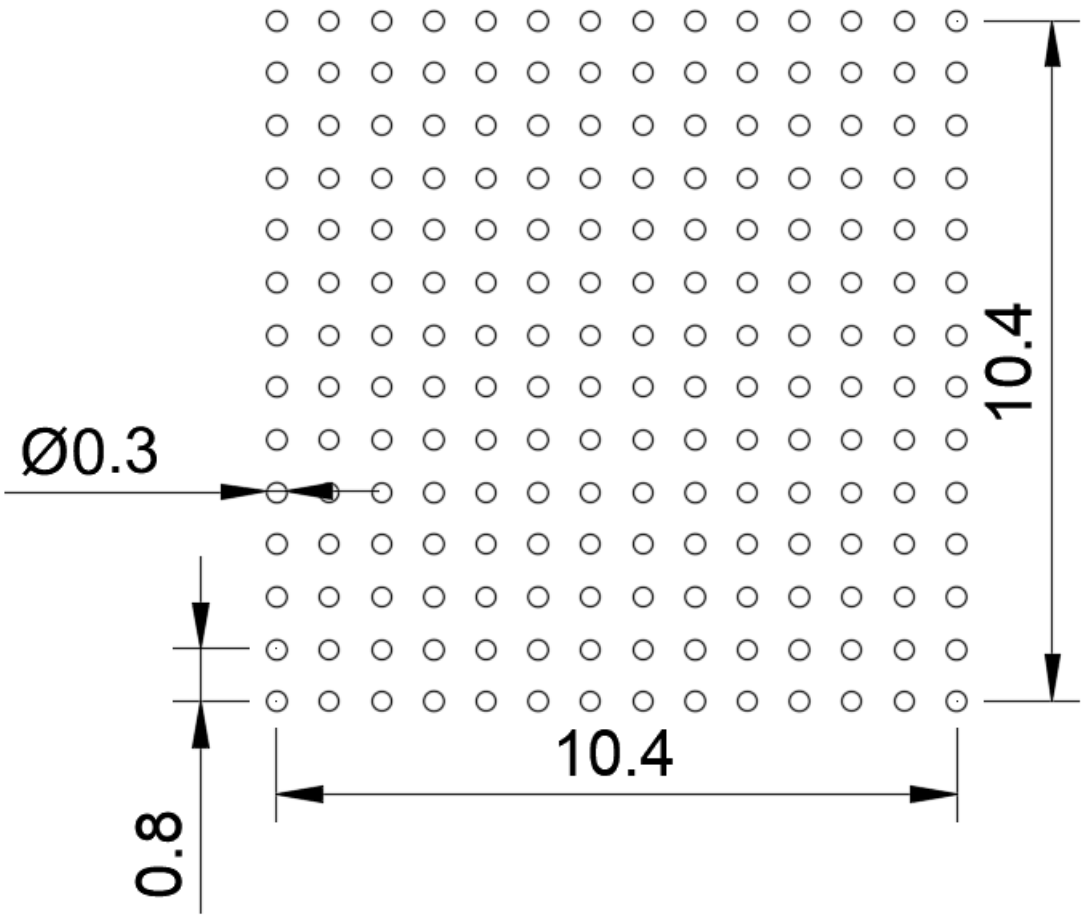
Pad measurements for PQFP176



Pad measurements for Ceramic CQFP176, when trim formed by the customer as per the enclosed Fancort dimensions- see Section 5 for trim-forming details.

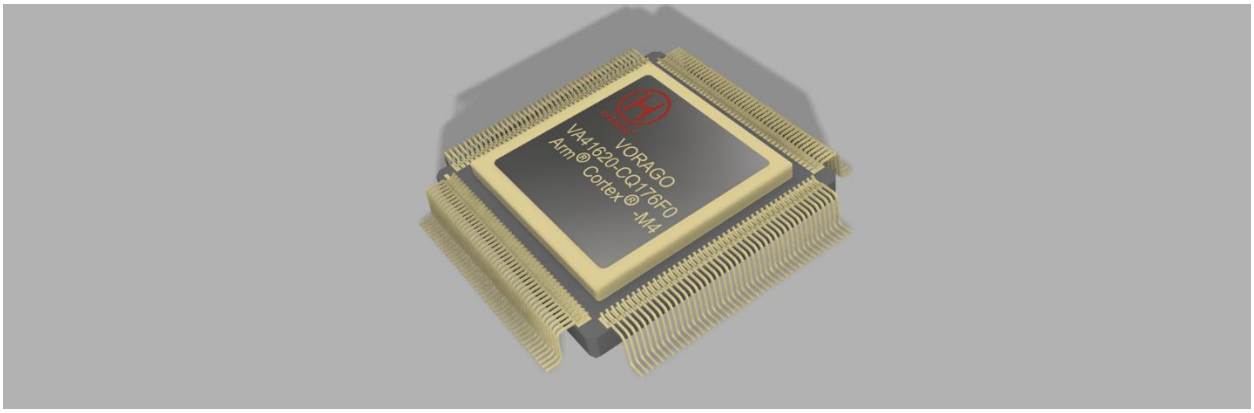


Pad layout for CQFP128 (VA41628/29 only). These are provided with leads trimmed and formed.



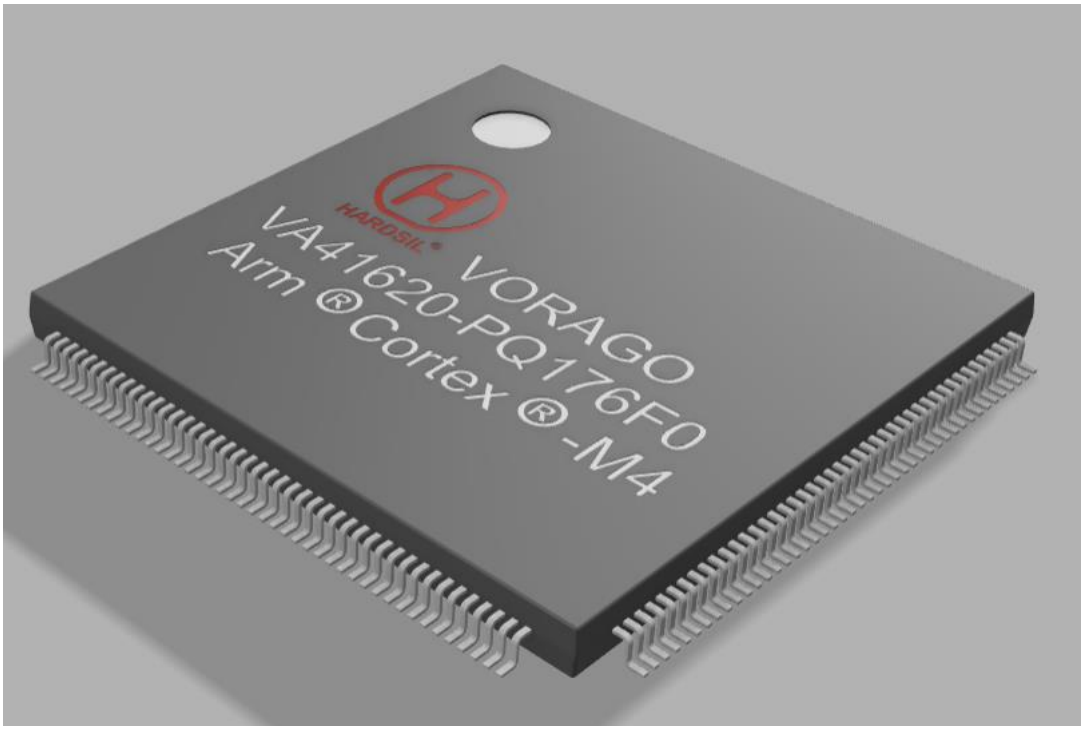
Pad measurements for BGA196

3 Physical Models



Screenshot of Ceramic CQFP176 3D STEP model

Screenshot of Ceramic CQFP128 STEP model



Screenshot of PQFP176 3D STEP model

The Altium pcb library already integrates physical 3D models of the VORAGO parts. These are also provided as standalone .STEP files, a standard exchange format any PCB tool can utilize as well as most all 3D modeling software.

The VA41620/VA41630 are available in plastic QFP176, ceramic CQFP176 (requires trim forming by the customer), and BGA 196. The VA41628/VA4129 is provided in ceramic CQFP128 with leads already trimmed and formed, as well as BGA196.

Since the pinouts are almost identical, there is one common schematic object VA416x0 is shared by the VA41620 and VA41630. The VA41630 has internal NVM ROM thus the ROM SPI interface (MOSI, SCK, SS) are unused and must be NC (No Connect), but MISO must be held low on the board, tied to ground directly or through a <10K pulldown resistor.

The BGA has its own pin numbering system and is provided as a separate schematic object and PCB footprint.

4 Trim Form of Ceramic CQFP176 Devices

The ceramic CQFP176 is unique among the VORAGO product line in that it is provided on a tiebar and must have its leads trimed and formed by the customer. This is typically done with a special machine made by Fancort:
https://fancort.com/pages/lead-forming-services
The exact dimensions of the leads are configurable on the fixture during this process. The Fancort dimension chart below has parameters that are most typical and match the PCB footprint shown here and also in the Altium library.

The dimensions for standoff height “A” and foot length “E”/”x” leads can be varied during the trim-form process. A change in the foot length will affect the length of the pads needed on the PCB footprint.

In both CQFP176 and CQFP128, the die is physically mounted on the bottom of the package. If heat dissipation is a concern, trim-form ceramic packages can potentially have a thermal interface pad fitted between the package and PCB. In this case the standoff height “A” may need to be adjusted for precise contact. However, the heat produced by the VA4xxx line generally does not require any extra thermal connection.

It is also possible to trim and form in the inverted “Bottom Exit” configuration, which results in the footprint’s pin assignments being mirrored and increment clockwise from pin 1 instead of counterclockwise. This might be done if the heat dissipation would be better for a particular use case. This configuration is not included in this version of the Altium library.

Once trimmed and formed, the leads of the CQFP176 are very susceptible to bending. Care should be taken during transport, handling, and special considerations may be needed for PCB insertion of a ceramic trim-form package.
Note: this section does not apply to the ceramic CQFP128 used in the VA41628, which is provided already trimmed and formed.

fancort industries, inc.

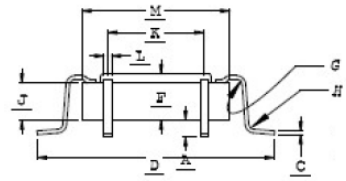
Fancort Industries

31 Fairfield Place, West Caldwell, New Jersey 07006
Phone 973-575-0610 www.fancort.com Fax 973-575-9234

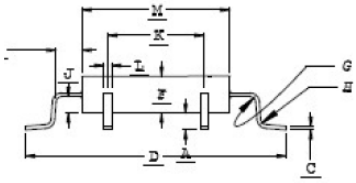
Quad Pack Specification Sheet

PACKAGE TYPE:

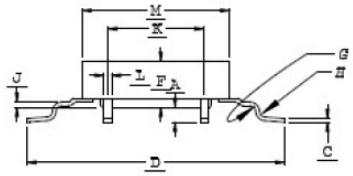
TOP BRAZE [X]



SIDE EXIT [ ]

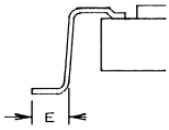


BOTTOM EXIT [ ]

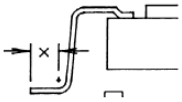


FOOT CONFIGURATION:

OPTION 1 [ ]



OPTION 2 (JEDEC) [X]



FA / FS NUMBER
CUSTOMER Cybel
PART NUMBER VA41630-CQ176FOEBA
DATE 9/28/23
DRAWN BY Chris Childs

	DIM X	DIM Y	TOLERANCE
A	recommend	same	±0.002
C	0.1	same.	±0.
D	<24.8	same	±0.
E	NA	same	±0.
X	recommend	same	±0.
F	3.03	same	±0.
G	recommend	same	±0.
H	recommend	same	±0.
J	2.03	same	±0.
K	17.2	same	±0.
L	0.2	same	±0.
M	20.5	same	±0.
PITCH	0.4	same	±0.
# OF LEADS PER SIDE	44		
TOTAL # OF LEADS	176		

LEADS TINNED: YES [X] NO [ ]

CONTROLLING UNITS: METRIC [X] INCHES [ ]

PACKAGE TYPE: METAL [ ] CERAMIC [X] PLASTIC [ ] GLASS SEAL [ ]

LEAD TYPE: FLAT [ ] ROUND [ ] UP 0-4° [ ] DOWN 0-4° [ ]

Template Version 3/6/14

5 Pre-tinning of gold leads on CQFP176 and CQFP128 packages

CQFP176 is provided with gold-plated leads. The VA41628/VA41629 using the CQFP128 are available in a Rev A with gold finish and Rev B with tin finish.
While gold provides excellent resistance to oxidation, gold can diffuse into the solder joint resulting a phenomenon called gold embrittlement, in which an intermediate alloy may form which reduces joint reliability.

Dipping these leads in a solder pot is a typical practice in the Mil/Aero industries to wash the gold off the tips of the leads and pre-tin them.

6 Other Resources

VORAGO datasheets:http://www.voragotech.com/
VORAGO MCU products: http://www.voragotech.com/VORAGO-products
VORAGO Application notes: http://www.voragotech.com/resources
Altium website - http://www.altium.com

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VORAGO Technologies
1501 S. MOPAC Expressway, Suite #350
Austin, TX 78746
www.voragotech.com
Email: info@voragotech.com
Phone: (512) 347-1800