

# Zynq UltraScale+ Device Packaging and Pinouts

## ***Product Specification User Guide***

**UG1075 (v1.11) January 18, 2022**

Xilinx is creating an environment where employees, customers, and partners feel welcome and included. To that end, we're removing non-inclusive language from our products and related collateral. We've launched an internal initiative to remove language that could exclude people or reinforce historical biases, including terms embedded in our software and IPs. You may still find examples of non-inclusive language in our older products as we work to make these changes and align with evolving industry standards. Follow this [link](#) for more information.



# Revision History

The following table shows the revision history for this document.

Date	Version	Revision
1/18/2022	1.11	<p>Added the XCZU1CG, XCZU1EG, XCZU42DR, XCZU65DR, and XCZU67DR devices throughout document. Added XQZU48DR and XQZU49DR. Added the UBVA494, FSRG1517, and FSRF1760 packages where applicable.</p> <p><a href="#">Chapter 1, Packaging Overview</a>: Added <a href="#">Note 1</a> to <a href="#">Table 1-5</a> and updated links to <a href="#">Note 2</a> in <a href="#">Table 1-6</a>. Updated and corrected bank diagrams <a href="#">Figure 1-36</a> and <a href="#">Figure 1-54</a>.</p> <p><a href="#">Chapter 2, PS Memory Interface Pin Guidelines</a>: Corrected the Important note on <a href="#">page 100</a>. Updated some of the descriptions in <a href="#">Table 2-1</a> and <a href="#">Table 2-2</a> to avoid confusion. In <a href="#">Table 2-4</a>, corrected the PS_DDR_ODT1 for LPDDR3 64-bit entry (can be left unconnected).</p> <p><a href="#">Chapter 5, Mechanical Drawings</a>: Added links to the MDDS file information. Updated <a href="#">Figure 5-21</a> with the correct diagram.</p> <p><a href="#">Chapter 8, Soldering Guidelines</a>: Updated the Important note on <a href="#">page 271</a>.</p> <p><a href="#">Chapter 10, Edge Bonding Guidelines</a>: Added the Important note on <a href="#">page 286</a>.</p> <p><a href="#">Chapter 12, Thermal Management Strategy</a>: Updated the <a href="#">Applied Pressure from Heat Sink to the Package via Thermal Interface Materials</a> and added <a href="#">Table 12-1</a>.</p>
7/01/2021	1.10	<p>Added InFO package (UBVA530) throughout.</p> <p><a href="#">Chapter 5, Mechanical Drawings</a>: Added <a href="#">Figure 5-21</a> and <a href="#">Figure 5-22</a>. Updated A<sub>3</sub> and A<sub>4</sub> dimensions in <a href="#">Figure 5-21</a>, <a href="#">Figure 5-29</a>, and <a href="#">Figure 5-34</a>.</p> <p><a href="#">Chapter 8, Soldering Guidelines</a>: Updated <a href="#">Pb-Free Reflow Soldering</a> to include <a href="#">Table 8-2</a>, <a href="#">Figure 8-3</a>, and <a href="#">Figure 8-4</a>. Added the <a href="#">Strain Gauge Measurement</a>, <a href="#">Solder Paste</a>, and <a href="#">Component Placement</a> sections.</p> <p><a href="#">Chapter 9, Recommended PCB Design Rules for BGA Packages</a>: Added <a href="#">Stencil</a> section.</p> <p><a href="#">Chapter 10, Edge Bonding Guidelines</a>: Added chapter.</p>
6/24/2020	1.9	<p>Added the XCZU43DR, XCZU47DR, XCZU46DR, XCZU48DR, and XCZU49DR devices throughout document. Added the FFVH1760 and FSVH1760 packages throughout document.</p> <p><a href="#">Chapter 2, PS Memory Interface Pin Guidelines</a>: Updated the <a href="#">DDR3/3L Pinout Example for Supported Configurations</a>, <a href="#">DDR4 Pin Rules</a>, <a href="#">DDR4 Pinout Example for Supported Configurations</a>, and <a href="#">LPDDR3 Pinout Example for Supported Configurations</a> sections. Clarified the headings in <a href="#">Table 2-4</a> and updated the LPDDR3 64-bit column for PS_DDR_CKE0, PS_DDR_CKE1, PS_DDR_CS_N0, and PS_DDR_ODT0.</p> <p><a href="#">Chapter 6, Package Marking</a>: Added a new top-mark diagram (<a href="#">Figure 6-1</a>).</p> <p><a href="#">Chapter 8, Soldering Guidelines</a>: Updated and removed notes linking to data sheets for reflow body temperatures.</p> <p><a href="#">Chapter 11, Thermal Specifications</a>: Added links to <a href="#">Package Thermal Data Query</a> for thermal simulation data.</p>

Date	Version	Revision
7/12/2019	1.8	<p>Added the XAZU7EV, XAZU11EG, XCZU39DR, XQZU3EG, XQZU9EG, XQZU11EG, XQZU19EG, XQZU21DR, XQZU28DR, and XQZU29DR devices throughout. Added the SFRA484, FFRD1156, FFRE1156, FFRB1517, FFRG1517, FFRC1760, and FFRF1760 packages where applicable.</p> <p>Updated the recommended applied pressure range on <a href="#">page 300</a>.</p>
1/31/2019	1.7	<p><b>Chapter 1:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 13</a>. Added the XQZU5EV (SFRC784, FFRB900), XQZU7EV (FFRB900, FFRC1156), and XQZU15EG (FFRC900, FFRB1156) device/package combinations to <a href="#">Table 1-1</a>, <a href="#">Table 1-2</a>, <a href="#">Table 1-3</a>, <a href="#">Table 1-6</a>, <a href="#">Table 1-7</a>, and the associated bank diagram figures in this section. In <a href="#">Table 1-4</a>, added the type and direction data for <a href="#">VCCO_PSO[0:3][500:503]</a> and <a href="#">VCCO_PSDDR</a>. Added a note for XQ ruggedized packages to <a href="#">VCCAUX_IO</a>. Revised the GTH Quad 229 coordinates in <a href="#">Figure 1-21</a>. Fixed GTH Quad location errors in <a href="#">Figure 1-27</a> through <a href="#">Figure 1-29</a>.</p> <p><b>Chapter 2:</b> Updated the <a href="#">DDR3/3L Pinout Example for Supported Configurations</a> description and added <a href="#">VCCO_PSDDR</a> and <a href="#">Note 1</a> to <a href="#">Table 2-1</a>. Updated the <a href="#">DDR4 Pinout Example for Supported Configurations</a> description and added <a href="#">VCCO_PSDDR</a> to <a href="#">Table 2-2</a> and <a href="#">Note 1</a>. Also in <a href="#">Table 2-2</a>, added to guidelines for PS_DDR_A17, and PS_DDR_DQ32 to PS_DDR_DQ63. Updated the <a href="#">LPDDR4 Pinout Example for Supported Configurations</a> description and added <a href="#">VCCO_PSDDR</a> to <a href="#">Table 2-3</a> and <a href="#">Note 1</a>. Updated the <a href="#">LPDDR3 Pinout Example for Supported Configurations</a> description and added <a href="#">VCCO_PSDDR</a> to <a href="#">Table 2-4</a> and <a href="#">Note 1</a>.</p> <p><b>Chapter 3:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 123</a>. Added the XQZU5EV (SFRC784, FFRB900), XQZU7EV (FFRB900, FFRC1156), and XQZU15EG (FFRC900, FFRB1156) device/package combinations to <a href="#">Table 3-1</a> labeled as production.</p> <p><b>Chapter 4:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 128</a>. In <a href="#">Table 4-1</a>, added the XQZU5EV (SFRC784, FFRB900), XQZU7EV (FFRB900, FFRC1156), and XQZU15EG (FFRC900, FFRB1156) device/package combinations.</p> <p><b>Chapter 5:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 224</a>. In <a href="#">Table 5-1</a>, added the XQZU5EV (SFRC784, FFRB900), XQZU7EV (FFRB900, FFRC1156), and XQZU15EG (FFRC900, FFRB1156) device/package combinations. Added <a href="#">Figure 5-8</a>, <a href="#">Figure 5-13</a>, <a href="#">Figure 5-16</a>, and <a href="#">Figure 5-17</a>.</p> <p><b>Chapter 6:</b> Updated <a href="#">Table 6-1</a> and added <a href="#">Figure 6-3</a>.</p> <p><b>Chapter 7:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 270</a>. In <a href="#">Table 7-1</a>, added the ruggedized packages (SFRC784, FFRB900, FFRC900, FFRB1156, and FFRC1156).</p> <p><b>Chapter 8:</b> Updated the chapter with more information on eutectic packages including adding the <a href="#">Sn/Pb Reflow Soldering</a> section. In <a href="#">Table 8-3</a>, added the ruggedized packages (SFRC784, FFRB900, FFRC900, FFRB1156, and FFRC1156).</p> <p><b>Chapter 11:</b> Added an Important Note about XQ devices with eutectic BGA balls on <a href="#">page 291</a>. In <a href="#">Table 11-1</a>, added the XQZU5EV (SFRC784, FFRB900), XQZU7EV (FFRB900, FFRC1156), and XQZU15EG (FFRC900, FFRB1156) device/package combinations.</p>

Date	Version	Revision
8/20/2018	1.6	<p><b>Chapter 1:</b> Added the XAZU4EV and XAZU5EV devices in the SFVC784 package. This includes updates to <a href="#">Table 1-2</a>, <a href="#">Table 1-3</a>, <a href="#">Table 1-5</a>, <a href="#">Table 1-6</a>, <a href="#">Table 1-7</a>, <a href="#">Figure 1-12</a>, and <a href="#">Figure 1-13</a>. Corrected the VCCO_PSDDR pin name (from VCCO_PSDDR_504) in <a href="#">Table 1-4</a>. Added a note to <a href="#">Figure 1-8 on page 51</a>.</p> <p><b>Chapter 2:</b> Clarified what a byte lane includes in the pin swapping restrictions discussions on <a href="#">page 100</a> and <a href="#">page 104</a>.</p> <p><b>Chapter 3:</b> Added the XAZU4EV and XAZU5EV devices to <a href="#">Table 3-1</a>. Labeled all of the devices in <a href="#">Table 3-2</a> as production.</p> <p><b>Chapter 4:</b> In <a href="#">Table 4-1</a>, added the XAZU4EV and XAZU5EV devices and changed the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR device labels to production. Added a note above <a href="#">Figure 4-3 on page 136</a>. Added the XAZU4EV and XAZU5EV devices in the SFVC784 package to <a href="#">Figure 4-19</a> and <a href="#">Figure 4-20</a>.</p> <p><b>Chapter 5:</b> Added the XAZU4EV and XAZU5EV devices to <a href="#">Table 5-1</a> and <a href="#">Figure 5-9</a>. Labeled all of the devices in <a href="#">Table 5-2</a> as production.</p> <p><b>Chapter 11:</b> Added the XAZU4EV and XAZU5EV devices to <a href="#">Table 11-1</a>.</p>
4/10/2018	1.5	<p><b>Chapter 1:</b> Added the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR devices. This includes updates to <a href="#">Table 1-1</a>, <a href="#">Table 1-2</a>, <a href="#">Table 1-3</a>, <a href="#">Table 1-4</a>, <a href="#">Table 1-5</a>, <a href="#">Table 1-6</a>, and <a href="#">Table 1-7</a>. Added <a href="#">Figure 1-36</a> through <a href="#">Figure 1-47</a>.</p> <p><b>Chapter 3:</b> Added the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR ASCII file links, see <a href="#">Table 3-2</a>.</p> <p><b>Chapter 4:</b> Added the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR devices to <a href="#">Table 4-1</a>.</p> <p><b>Chapter 5:</b> Added the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR mechanical drawings, see <a href="#">Table 5-2</a>.</p> <p><b>Chapter 7:</b> Added the FFVD1156, FFVE1156, FSVE1156, FFVG1517, FSVG1517, FFVF1760, and FSFV1760 packages to <a href="#">Table 7-1</a>.</p> <p><b>Chapter 8:</b> Revised the guidelines in <a href="#">Table 8-1</a> for <b>Ramp-up rate</b>, <b>Peak temperature (lead/ball)</b>, and <b>Peak temperature (body)</b>. Revised the same information in <a href="#">Figure 8-2</a>. Added the FFVD1156, FFVE1156, FSVE1156, FFVG1517, FSVG1517, FFVF1760, and FSFV1760 packages to <a href="#">Table 8-3</a>.</p> <p><b>Chapter 11:</b> Added the XCZU21DR, XCZU25DR, XCZU27DR, XCZU28DR, and XCZU29DR devices to <a href="#">Table 11-1</a> and added <a href="#">Note 1</a>.</p> <p><b>Chapter 12:</b> Updated the <b>System Level Heat Sink Solutions</b> section and added the <b>Heat Sink Removal</b> and <b>Measurement Debug</b> sections.</p>

Date	Version	Revision
12/21/2017	1.4	<p>Added the XAZU2EG and XAZU3EG devices throughout the document.</p> <p><b>Chapter 1:</b> Revise the <a href="#">VCCINT_VCU</a> description in <a href="#">Table 1-4</a>. Updated the ZU11EG (<a href="#">Figure 1-22</a> through <a href="#">Figure 1-26</a>) PCIE4 bank coordinates.</p> <p><b>Chapter 2:</b> Updated <a href="#">LPDDR4 Pin Swapping Restrictions</a> and <a href="#">DDR4 Pin Swapping Restrictions</a> and removed Figure 2-1: DDR Controller Implementation of DQ Mapping. In <a href="#">Table 2-2</a>, updated the <a href="#">PS_DDR_ZQ</a> connections.</p> <p><b>Chapter 5:</b> Revised <a href="#">Figure 5-10</a>: Symbol A from (2.57/2.77/2.97) to (2.48/2.68/2.88) and Symbol A2 from (1.27/1.42/1.62) to (1.18/1.33/1.48).</p> <p><b>Chapter 6:</b> Revised the top mark diagram to show both older device versions and newer ones with a 2D bar code.</p> <p><b>Chapter 8:</b> Added an Important note on <a href="#">page 271</a> about reflow rework.</p> <p><b>Chapter 11:</b> Updated the SFVC784, FFVC900, FFVB1156, FFVC1156, FFVB1517, FFVF1517 data to account for the stamped lid in <a href="#">Table 11-1</a>.</p>
8/29/2017	1.3	<p>In <a href="#">Chapter 1</a>, updated <a href="#">Figure 1-8</a>, <a href="#">Figure 1-19</a>, <a href="#">Figure 1-20</a>, <a href="#">Figure 1-21</a>, <a href="#">Figure 1-27</a>, <a href="#">Figure 1-28</a>, <a href="#">Figure 1-29</a>, <a href="#">Figure 1-30</a>, <a href="#">Figure 1-31</a>, <a href="#">Figure 1-32</a>, <a href="#">Figure 1-33</a>, and <a href="#">Figure 1-34</a>. Revise the <a href="#">VCCINT_VCU</a> description in <a href="#">Table 1-4</a>.</p> <p>In <a href="#">Chapter 2</a>, updated the <a href="#">DDR4 Pin Rules</a> and the <a href="#">DDR4 Pin Swapping Restrictions</a>.</p> <p>In <a href="#">Table 2-2</a>, updated the configurations for PS_DDR_CK_N1 (DDR4 1Rank).</p> <p>In <a href="#">Chapter 3</a>, updated the package specification designation of many of the packages listed in <a href="#">Table 3-1</a>.</p> <p>In <a href="#">Chapter 4</a>, updated <a href="#">Table 4-1</a> and added the following device diagrams: SFVC784 Package–XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG, SFVC784 Package–XCZU4EV, XCZU5EV, XAZU4EV, and XAZU5EV, FBVB900 Package–XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG, FBVB900 Package–XCZU4EV and XCZU5EV, FFVF1517 Package–XCZU7CG and XCZU7EG, FFVC1156 Package–XCZU7EV, FFVC1156 Package–XCZU11EG, FFVB1517 Package–XCZU11EG, FFVF1517 Package–XCZU11EG, and FFVC1760 Package–XCZU11EG.</p> <p>In <a href="#">Chapter 5</a>, replaced <a href="#">Figure 5-9</a>, added <a href="#">Figure 5-10</a>, <a href="#">Figure 5-11</a>, <a href="#">Figure 5-25</a>, and <a href="#">Figure 5-36</a>.</p> <p>In <a href="#">Table 8-3</a>, update the FFV packages to a mass reflow of 245°C.</p>
1/13/2017	1.2	<p>Added the following devices throughout: XCZU2CG, XCZU3CG, XCZU4CG, XCZU4EG, XCZU5CG, XCZU5EG, XCZU6CG, XCZU7CG, XCZU7EG, and XCZU9CG. In <a href="#">Table 1-3</a>, revised the available PS I/O pin values for the SBVA484 and SFVA625 packages. In <a href="#">Table 1-4</a>, updated the <a href="#">PS_MODE</a> directions and the pin descriptions in the <a href="#">Power/Ground Pins</a> section. In <a href="#">Table 1-6</a>, revised the XCZU4 bank numbers and updated the FBVB900 mapping. Revised the mapping for the FBVB900 package in <a href="#">Table 1-7</a>. Revised the <a href="#">Bank Locations of Dedicated and Multi-Function Pins</a> section. Updated the HD I/O bank numbers in <a href="#">Figure 1-26</a>.</p> <p>Added <a href="#">Chapter 2</a>, <a href="#">PS Memory Interface Pin Guidelines</a>. Added the <a href="#">Chapter 3</a>, <a href="#">Package Specifications Designations</a> section. In <a href="#">Table 3-1</a>, updated links. <a href="#">Chapter 4</a>, <a href="#">Device Diagrams</a> and <a href="#">Chapter 5</a>, <a href="#">Mechanical Drawings</a> have updated tables and new diagrams. Revised the <a href="#">Bar Code</a> section of <a href="#">Table 6-1</a> to include changes outlined in <a href="#">XCN16014: Top Marking change for 7 Series, UltraScale, and UltraScale+ Products</a>. Updated the <a href="#">AUTOMOTIVE APPLICATIONS DISCLAIMER</a>.</p>

Date	Version	Revision
6/14/2016	1.1	In <a href="#">Table 1-3</a> , updated <a href="#">Note 1</a> and the SBVA484 package total user HP I/Os. Clarified the I2C_SCLK and I2C_SDA descriptions and added SMBALERT and VCCINT_VCU to <a href="#">Table 1-4</a> . Also updated the <a href="#">Multi-gigabit Serial Transceiver Pins (GTHE4, GTYE4, and PS-GTR)</a> descriptions, Added further descriptions in the <a href="#">Die Level Bank Numbering Overview</a> including adding an example device diagram ( <a href="#">Figure 1-1</a> ). In <a href="#">Chapter 4</a> , added new figures and updated all of the graphics because the PERSTN pins and SMBALERT pins have moved. Updated <a href="#">Figure 5-16</a> and added <a href="#">Figure 5-18</a> . Added the bar code description in <a href="#">Chapter 6</a> .
1/20/2016	1.0.2	Replaced the missing graphics in <a href="#">Chapter 1</a> .
12/18/2015	1.0.1	Updated the package file links in <a href="#">Chapter 3</a> .
11/24/2015	1.0	Initial Xilinx release.

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# Packaging Overview

## Introduction to the UltraScale Architecture

The Xilinx® UltraScale™ architecture is the first ASIC-class architecture to enable multi-hundred gigabit-per-second levels of system performance with smart processing, while efficiently routing and processing data on-chip. UltraScale architecture-based devices address a vast spectrum of high-bandwidth, high-utilization system requirements by using industry-leading technical innovations, including next-generation routing, ASIC-like clocking, 3D-on-3D ICs, multiprocessor SoC (MPSoC) technologies, and new power reduction features. The devices share many building blocks, providing scalability across process nodes and product families to leverage system-level investment across platforms.

Virtex® UltraScale+™ devices provide the highest performance and integration capabilities in a FinFET node, including both the highest serial I/O and signal processing bandwidth, as well as the highest on-chip memory density. As the industry's most capable FPGA family, the Virtex UltraScale+ devices are ideal for applications including 1+Tb/s networking and data center and fully integrated radar/early-warning systems.

Kintex® UltraScale+ devices provide the best price/performance/watt balance in a FinFET node, delivering the most cost-effective solution for high-end capabilities, including transceiver and memory interface line rates as well as 100G connectivity cores. Our newest mid-range family is ideal for both packet processing and DSP-intensive functions and is well suited for applications including wireless MIMO technology, Nx100G networking, and data center.

Zynq® UltraScale+ MPSoC devices provide 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform, and packet processing. Integrating an Arm®-based system for advanced analytics and on-chip programmable logic for task acceleration creates unlimited possibilities for applications including 5G Wireless, next generation ADAS, and Industrial Internet-of-Things.

Zynq UltraScale+ RFSoC integrate the key subsystems required to implement a complete software-defined radio including direct RF sampling data converters, enabling CPRI and gigabit Ethernet-to-RF on a single, highly programmable SoC. Each device offers multiple RF-sampling analog-to-digital (RF-ADC) and RF-sampling digital-to-analog (RF-DAC) data converters. The data converters are high-precision, high-speed and power efficient.

For the latest Zynq UltraScale+ device descriptions, specifications, data sheets, and user guides are available at [www.xilinx.com/documentation](http://www.xilinx.com/documentation).

## Zynq UltraScale+ Device Packaging and Pinouts

This section describes the packages and pinouts for the in various organic flip-chip 0.5 mm, 0.8 mm, and 1.0 mm pitch BGA packages.



**IMPORTANT:** All standard packages are lead-free (signified by an additional V in the package name). All devices supported in a particular package are footprint compatible. Each device is split into I/O banks to allow for flexibility in the choice of I/O standards. See the UltraScale Architecture SelectIO Resources User Guide (UG571) [Ref 6].

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The flip-chip assembly materials for the Zynq UltraScale+ devices are manufactured using ultra-low alpha (ULA) materials defined as <0.002 cph/cm<sup>2</sup> or materials that emit less than 0.002 alpha-particles per square centimeter per hour.



**IMPORTANT:** All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q.

---

## Differences from Previous Generations

The packaging and pinout specifications for Zynq UltraScale+ devices differ from past generations, including the Zynq-7000 SoCs. These details are outlined in this section.

- All package and die components, including flip-chip solder bumps, are lead-free.
- Package names contain a single-character alphabetic designator followed by the exact number of pins found on the package.
- VCCAUX\_IO pins are not divided into bank groups. VCCAUX\_IO must be connected to VCCAUX at the board level.
- Internal logic is separated from I/O logic by the addition of the VCCINT\_IO power pins. VCCINT\_IO must be connected to VCCBRAM (depending on the device speed grade and voltage settings) at the board level.
- Groups of gigabit serial transceiver (GT) power pins are separated by column for each column of GT Quads.
- Standard HP I/O banks each have a total of 52 SelectIO™ pins, optionally configurable as (up to) 24 differential pairs.
- Standard HD I/O banks each have a total of 24 SelectIO pins, optionally configurable as (up to) 12 differential pairs.
- Each bank has one dedicated VREF pin. These pins cannot be used as user I/Os.

- Four differential clock pin pairs per bank consist of a single type of global clock (GC or HDGC) input.
- Four memory byte groups per HP I/O bank are each separated into an upper and a lower memory byte group.
- Multiple PL configuration pins are removed.
- A POR\_OVERRIDE pin is used to override the default power-on-reset delay. See [Table 1-4](#).

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## Device/Package Combinations

[Table 1-1](#) shows the size and BGA pitch of the Zynq UltraScale+ device packages. All packages are available with eutectic BGA balls. For these packages, the Pb-free signifier in the package name is a Q.

*Table 1-1: Package Specifications*

Packages	Description	Package Specifications		
		Package Type	Pitch (mm)	Size (mm)
UBVA494	Flip-chip, integrated fan out (InFO), bare-die	BGA	0.5	15 x 9.5
SBVA484	Flip-chip, bare-die			19 x 19
SFRA484	Ruggedized flip-chip, bare-die			19 x 19
SBVA625	Flip-chip, bare-die		0.8	21 x 21
SFVA625	Flip-chip			23 x 23
SFVC784	Flip-chip			
SFRC784	Ruggedized flip-chip			
FBVB900	Flip-chip, bare-die		1.0	31 x 31
FFRB900	Ruggedized flip-chip			
FFVC900	Flip-chip			
FFRC900	Ruggedized flip-chip			

**Table 1-1: Package Specifications (Cont'd)**

Packages	Description	Package Specifications		
		Package Type	Pitch (mm)	Size (mm)
FFVB1156	Flip-chip	BGA	1.0	35 x 35
FFRB1156	Ruggedized flip-chip			
FFVC1156	Flip-chip			
FFRC1156	Ruggedized flip-chip			
FFVD1156	Flip-chip			
FFRD1156	Ruggedized flip-chip			
FFVE1156	Flip-chip			
FFRE1156	Ruggedized flip-chip			
FFVB1517	Flip-chip			
FFRB1517	Ruggedized flip-chip			
FFVF1517	Flip-chip	BGA	1.0	40 x 40
FFVG1517	Flip-chip			
FFRG1517	Ruggedized flip-chip			
FFVC1760	Flip-chip			
FFRC1760	Ruggedized flip-chip			
FFVD1760	Flip-chip	BGA	1.0	42.5 x 42.5
FFVF1760	Flip-chip			
FFVH1760	Flip-chip			
FFRF1760	Ruggedized flip-chip			
FFVE1924	Flip-chip			
FSVE1156	Flip-chip, lidless with stiffener ring	BGA	1.0	45 x 45
FSVG1517				35 x 35
FSVF1760				40 x 40
FSVH1760				42.5 x 42.5
FSRG1517	Ruggedized flip-chip, lidless with stiffener ring	BGA	1.0	40 x 40
FSRF1760				42.5 x 42.5

## Gigabit Transceiver Channels by Device/Package

**Table 1-2** lists the quantity of gigabit transceiver channels for the Zynq UltraScale+ devices. In all devices, a PS-GTR, GTH, or GTY channel is one set of MGTRXP, MGTRXN, MGTTXP, and MGTTXN pins. All packages are available with eutectic BGA balls. For these packages, the device type is XQ and the Pb-free signifier in the package name is a Q.

**Table 1-2: Serial Transceiver Channels (PS-GTR, GTH, and GTY) by Device/Package**

Device	Package	PS-GTR Channels	GTH Channels	GTY Channels
XCZU1CG	SBVA484	4	0	0
XCZU1EG		4	0	0
XCZU2CG		4	0	0
XCZU2EG		4	0	0
XCZU3CG		4	0	0
XCZU3EG		4	0	0
XAZU2EG		4	0	0
XAZU3EG		4	0	0
XQZU3EG	SFRA484	4	0	0
XCZU1CG	UBVA494	4	0	0
XCZU1EG		4	0	0
XCZU2CG	UBVA530	4	0	0
XCZU2EG		4	0	0
XCZU3CG		4	0	0
XCZU3EG		4	0	0
XCZU1CG		4	0	0
XCZU1EG	SFVA625	4	0	0
XCZU2CG		4	0	0
XCZU2EG		4	0	0
XCZU3CG		4	0	0
XCZU3EG		4	0	0
XAZU2EG		4	0	0
XAZU3EG		4	0	0

**Table 1-2: Serial Transceiver Channels (PS-GTR, GTH, and GTY) by Device/Package (Cont'd)**

<b>Device</b>	<b>Package</b>	<b>PS-GTR Channels</b>	<b>GTH Channels</b>	<b>GTY Channels</b>
XCZU1CG	SFVC784	4	0	0
XCZU1EG		4	0	0
XCZU2CG		4	0	0
XCZU2EG		4	0	0
XCZU3CG		4	0	0
XCZU3EG		4	0	0
XCZU4CG		4	4	0
XCZU4EG		4	4	0
XCZU4EV		4	4	0
XCZU5CG		4	4	0
XCZU5EG		4	4	0
XCZU5EV		4	4	0
XAZU2EG		4	0	0
XAZU3EG		4	0	0
XAZU4EV		4	4	0
XAZU5EV		4	4	0
XQZU21DR	SFRC784	4	0	0
XQZU5EV		4	4	0
XCZU4CG		4	16	0
XCZU4EG		4	16	0
XCZU4EV	FBVB900	4	16	0
XCZU5CG		4	16	0
XCZU5EG		4	16	0
XCZU5EV		4	16	0
XCZU7CG		4	16	0
XCZU7EG		4	16	0
XCZU7EV		4	16	0
XAZU7EV		4	16	0
XQZU5EV		4	16	0
XQZU7EV		4	16	0
XCZU6CG	FFRB900	4	16	0
XCZU6EG		4	16	0
XCZU9CG		4	16	0
XCZU9EG		4	16	0
XCZU15EG		4	16	0

**Table 1-2: Serial Transceiver Channels (PS-GTR, GTH, and GTY) by Device/Package (Cont'd)**

<b>Device</b>	<b>Package</b>	<b>PS-GTR Channels</b>	<b>GTH Channels</b>	<b>GTY Channels</b>
XQZU9EG	FFRC900	4	16	0
XQZU15EG		4	16	0
XCZU6CG	FFVB1156	4	24	0
XCZU6EG		4	24	0
XCZU9CG	FFVB1156	4	24	0
XCZU9EG		4	24	0
XCZU15EG	FFRB1156	4	24	0
XQZU9EG		4	24	0
XCZU7CG	FFVC1156	4	20	0
XCZU7EG		4	20	0
XCZU7EV	FFVC1156	4	20	0
XCZU11EG		4	20	0
XQZU7EV	FFRC1156	4	20	0
XQZU11EG		4	20	0
XCZU21DR	FFVD1156	4	0	16
XQZU21DR	FFRD1156	4	0	16
XCZU25DR	FFVE1156	4	0	8
XCZU27DR		4	0	8
XCZU28DR	FFVE1156	4	0	8
XCZU42DR		4	0	8
XCZU43DR	FFVE1156	4	0	8
XCZU47DR		4	0	8
XCZU48DR	FFVE1156	4	0	8
XCZU65DR		4	0	8
XCZU67DR	FFRE1156	4	0	8
XQZU28DR		4	0	8

**Table 1-2: Serial Transceiver Channels (PS-GTR, GTH, and GTY) by Device/Package (Cont'd)**

<b>Device</b>	<b>Package</b>	<b>PS-GTR Channels</b>	<b>GTH Channels</b>	<b>GTY Channels</b>
XCZU25DR	FSVE1156	4	0	8
XCZU27DR		4	0	8
XCZU28DR		4	0	8
XCZU42DR		4	0	8
XCZU43DR		4	0	8
XCZU47DR		4	0	8
XCZU48DR		4	0	8
XCZU65DR		4	0	8
XCZU67DR		4	0	8
XCZU11EG	FFVB1517	4	16	0
XCZU17EG		4	16	0
XCZU19EG		4	16	0
XQZU19EG	FFRB1517	4	16	0
XCZU7CG	FFVF1517	4	24	0
XCZU7EG		4	24	0
XCZU7EV		4	24	0
XCZU11EG		4	32	0
XAZU11EG		4	32	0
XCZU25DR	FFVG1517	4	0	8
XCZU27DR		4	0	16
XCZU28DR		4	0	16
XCZU43DR		4	0	16
XCZU47DR		4	0	16
XCZU48DR		4	0	16
XQZU28DR	FFRG1517	4	0	16
XCZU25DR	FSVG1517	4	0	8
XCZU27DR		4	0	16
XCZU28DR		4	0	16
XCZU43DR		4	0	16
XCZU47DR		4	0	16
XCZU48DR		4	0	16
XQZU48DR	FSRG1517	4	0	16

**Table 1-2: Serial Transceiver Channels (PS-GTR, GTH, and GTY) by Device/Package (Cont'd)**

<b>Device</b>	<b>Package</b>	<b>PS-GTR Channels</b>	<b>GTH Channels</b>	<b>GTY Channels</b>
XCZU11EG	FFVC1760	4	32	16
XCZU17EG		4	32	16
XCZU19EG		4	32	16
XQZU11EG	FFRC1760	4	32	16
XQZU19EG		4	32	16
XCZU17EG	FFVD1760	4	44	28
XCZU19EG		4	44	28
XCZU29DR	FFVF1760	4	0	16
XCZU39DR		4	0	16
XCZU49DR		4	0	16
XCZU46DR	FFVH1760	4	0	16
XQZU29DR	FFRF1760	4	0	16
XCZU29DR	FSVF1760	4	0	16
XCZU39DR		4	0	16
XCZU49DR		4	0	16
XQZU49DR	FSRF1760	4	0	16
XCZU46DR	FSVH1760	4	0	16
XCZU17EG	FFVE1924	4	44	0
XCZU19EG		4	44	0

## User I/O Pins by Device/Package

**Table 1-3** lists the number of available PS I/Os, 3.3V-capable high-density (HD), and 1.8V-capable high-performance (HP) I/Os and the number of HD or HP differential I/O for each device/package combination. All packages are available with eutectic BGA balls. For these packages, the device type is XQ and the Pb-free signifier in the package name is a Q.

Table 1-3: Available I/O Pins by Device/Package

Device	Package	PS I/Os	Total User I/O		Differential I/O	
			HD <sup>(1)</sup>	HP <sup>(1)</sup>	HD	HP
XCZU1CG	SBVA484	170	24	58	24	52
XCZU1EG		170	24	58	24	52
XCZU2CG		170	24	58	24	52
XCZU2EG		170	24	58	24	52
XCZU3CG		170	24	58	24	52
XCZU3EG		170	24	58	24	52
XAZU2EG		170	24	58	24	52
XAZU3EG		170	24	58	24	52
XQZU3EG	SFRA484	170	24	58	24	52
XCZU1CG	UBVA494	170	24	58	24	52
XCZU1EG		170	24	58	24	52
XCZU2CG	UBVA530	170	24	58	24	52
XCZU2EG		170	24	58	24	52
XCZU3CG		170	24	58	24	52
XCZU3EG		170	24	58	24	52
XCZU1CG	SFVA625	170	24	156	24	144
XCZU1EG		170	24	156	24	144
XCZU2CG		170	24	156	24	144
XCZU2EG		170	24	156	24	144
XCZU3CG		170	24	156	24	144
XCZU3EG		170	24	156	24	144
XAZU2EG		170	24	156	24	144
XAZU3EG		170	24	156	24	144

**Table 1-3: Available I/O Pins by Device/Package (Cont'd)**

Device	Package	PS I/Os	Total User I/O		Differential I/O	
			HD <sup>(1)</sup>	HP <sup>(1)</sup>	HD	HP
XCZU1CG	SFVC784	170	24	156	24	144
XCZU1EG		170	24	156	24	144
XCZU2CG		214	96	156	96	144
XCZU2EG		214	96	156	96	144
XCZU3CG		214	96	156	96	144
XCZU3EG		214	96	156	96	144
XCZU4CG		214	96	156	96	144
XCZU4EG		214	96	156	96	144
XCZU4EV		214	96	156	96	144
XCZU5CG		214	96	156	96	144
XCZU5EG		214	96	156	96	144
XCZU5EV		214	96	156	96	144
XAZU2EG		214	96	156	96	144
XAZU3EG		214	96	156	96	144
XAZU4EV		214	96	156	96	144
XAZU5EV		214	96	156	96	144
XQZU3EG	SFRC784	214	96	156	96	144
XQZU5EV		214	96	156	96	114
XCZU4CG	FBVB900	214	48	156	48	144
XCZU4EG		214	48	156	48	144
XCZU4EV		214	48	156	48	144
XCZU5CG		214	48	156	48	144
XCZU5EG		214	48	156	48	144
XCZU5EV		214	48	156	48	144
XCZU7CG		214	48	156	48	144
XCZU7EG		214	48	156	48	144
XCZU7EV		214	48	156	48	144
XAZU7EV		214	48	156	48	144
XQZU5EV	FFRB900	214	48	156	48	144
XQZU7EV		214	48	156	48	144

**Table 1-3: Available I/O Pins by Device/Package (Cont'd)**

Device	Package	PS I/Os	Total User I/O		Differential I/O	
			HD <sup>(1)</sup>	HP <sup>(1)</sup>	HD	HP
XCZU6CG	FFVC900	214	48	156	48	144
XCZU6EG		214	48	156	48	144
XCZU9CG		214	48	156	48	144
XCZU9EG		214	48	156	48	144
XCZU15EG		214	48	156	48	144
XQZU9EG	FFRC900	214	48	156	48	144
XQZU15EG		214	48	156	48	144
XCZU6CG	FFVB1156	214	120	208	120	192
XCZU6EG		214	120	208	120	192
XCZU9CG		214	120	208	120	192
XCZU9EG		214	120	208	120	192
XCZU15EG		214	120	208	120	192
XQZU9EG	FFRB1156	214	120	208	120	192
XQZU15EG		214	120	208	120	192
XCZU7CG	FFVC1156	214	48	312	48	288
XCZU7EG		214	48	312	48	288
XCZU7EV		214	48	312	48	288
XCZU11EG		214	48	312	48	288
XQZU7EV	FFRC1156	214	48	312	48	288
XQZU11EG		214	48	312	48	288
XCZU21DR	FFVD1156	214	72	208	72	192
XQZU21DR	FFRD1156	214	72	208	72	192
XCZU25DR	FFVE1156	214	48	104	48	96
XCZU27DR		214	48	104	48	96
XCZU28DR		214	48	104	48	96
XCZU42DR		214	24	130	24	120
XCZU43DR		214	48	104	48	96
XCZU47DR		214	48	104	48	96
XCZU48DR		214	48	104	48	96
XCZU65DR		214	24	130	24	120
XCZU67DR		214	24	130	24	120
XQZU28DR	FFRE1156	214	48	104	48	96

**Table 1-3: Available I/O Pins by Device/Package (Cont'd)**

Device	Package	PS I/Os	Total User I/O		Differential I/O	
			HD <sup>(1)</sup>	HP <sup>(1)</sup>	HD	HP
XCZU25DR	FSVE1156	214	48	104	48	96
XCZU27DR		214	48	104	48	96
XCZU28DR		214	48	104	48	96
XCZU42DR		214	24	130	24	120
XCZU43DR		214	48	104	48	96
XCZU47DR		214	48	104	48	96
XCZU48DR		214	48	104	48	96
XCZU65DR		214	24	130	24	120
XCZU65DR		214	24	130	24	120
XCZU11EG	FFVB1517	214	72	416	72	384
XCZU17EG		214	72	572	72	528
XCZU19EG		214	72	572	72	528
XQZU19EG	FFRB1517	214	72	572	72	528
XCZU7CG	FFVF1517	214	48	416	48	384
XCZU7EG		214	48	416	48	384
XCZU7EV		214	48	416	48	384
XCZU11EG		214	48	416	48	384
XAZU11EG		214	48	416	48	384
XCZU25DR	FFVG1517	214	48	299	48	276
XCZU27DR		214	48	299	48	276
XCZU28DR		214	48	299	48	276
XCZU43DR		214	48	299	48	276
XCZU47DR		214	48	299	48	276
XCZU48DR		214	48	299	48	276
XQZU28DR	FFRG1517	214	48	299	48	276
XCZU25DR	FSVG1517	214	48	299	48	276
XCZU27DR		214	48	299	48	276
XCZU28DR		214	48	299	48	276
XCZU43DR		214	48	299	48	276
XCZU47DR		214	48	299	48	276
XCZU48DR		214	48	299	48	276
XQZU48DR	FSRG1517	214	48	299	48	276

**Table 1-3: Available I/O Pins by Device/Package (Cont'd)**

Device	Package	PS I/Os	Total User I/O		Differential I/O	
			HD <sup>(1)</sup>	HP <sup>(1)</sup>	HD	HP
XCZU11EG	FFVC1760	214	96	416	96	384
XCZU17EG		214	96	416	96	384
XCZU19EG		214	96	416	96	384
XQZU11EG	FFRC1760	214	96	416	96	384
XQZU19EG		214	96	416	96	384
XCZU17EG	FFVD1760	214	48	260	48	240
XCZU19EG		214	48	260	48	240
XCZU29DR	FFVF1760	214	96	312	96	288
XCZU39DR		214	96	312	96	288
XCZU49DR		214	96	312	96	288
XQZU49DR	FSRF1760	214	96	312	96	288
XCZU46DR	FFVH1760	214	48	312	48	288
XQZU29DR	FFRF1760	214	96	312	96	288
XCZU29DR	FSVF1760	214	96	312	96	288
XCZU39DR		214	96	312	96	288
XCZU46DR	FSVH1760	214	48	312	48	288
XCZU17EG	FFVE1924	214	96	572	96	528
XCZU19EG		214	96	572	96	528

**Notes:**

1. The maximum user I/O numbers do not include the GT serial transceiver pins or the PUDC\_B and POR\_OVERRIDE pins used for configuration.

# Pin Definitions

Table 1-4 lists the pin definitions.

Table 1-4: Pin Definitions

Pin Name	Type	Direction	Description
<b>User I/O Pins</b>			
IO_L[1 to 24][P or N]_T[0 to 3] [U or L]_N[0 to 12]_[multi-function]_[bank number] or IO_T[0 to 3][U or L]_N[0 to 12]_[multi-function]_[bank number]			
	Dedicated	Input/ Output	<p>Most user I/O pins are capable of differential signaling and can be implemented as pairs. Each user I/O pin name consists of several indicator labels, where:</p> <ul style="list-style-type: none"> <li>• IO indicates a user I/O pin.</li> <li>• L[1 to 24] indicates a unique differential pair with P (positive) and N (negative) sides. User I/O pins without the L indicator are single-ended.</li> <li>• T[0 to 3][U or L] indicates the assigned byte group and nibble location (upper or lower portion) within that group for the pin.</li> <li>• N[0 to 12] the number of the I/O within its byte group.</li> <li>• [multi-function] indicates any other functions that the pin can provide. If not used for this function, the pin can be a user I/O.</li> <li>• [bank number] indicates the assigned bank for the user I/O pin.</li> </ul>
<b>User I/O Multi-Function Pins</b>			
GC or HDGC	Multi- function	Input	<p>Four global clock (GC or HDGC) pin pairs are in each bank. HDGC pins have direct access to the global clock buffers. GC pins have direct access to the global clock buffers and the MMCMs and PLLs that are in the clock management tile (CMT) adjacent to the same I/O bank. GC and HDGC inputs provide dedicated, high-speed access to the internal global and regional clock resources. GC and HDGC inputs use dedicated routing and must be used for clock inputs where the timing of various clocking features is imperative.</p> <p>Up-to-date information about designing with the GC (or HDGC) pin is available in the <i>UltraScale Architecture Clocking Resources User Guide</i> (UG572) [Ref 7]</p>
VRP <sup>(1)</sup>	Multi- function	N/A	This pin is for the DCI voltage reference resistor of P transistor (per bank, to be pulled Low with a reference resistor).

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
DBC QBC	Multi-function	Input	Byte lane clock (DBC and QBC) input pin pairs are clock inputs directly driving source synchronous clocks to the bit slices in the I/O banks. In memory applications, these are also known as DQS. For more information, consult the <i>UltraScale Architecture SelectIO Resources User Guide</i> (UG571) [Ref 6].
PERSTN[0 to 1]	Multi-function	Input	Default reset pin locations for the integrated block for PCI Express.
<b>Configuration Pins</b>			
For more information on configuration and recommended external pull-up/pull-down resistors, see the <i>Zynq UltraScale+ Device Technical Reference Manual</i> (UG1085) [Ref 10] and the <i>UltraScale Architecture PCB and Pin Planning User Guide</i> (UG583) [Ref 14].			
PUDC_B	Dedicated	Input	Active-Low input enables internal pull-ups during configuration on all SelectIO pins: 0 = Weak preconfiguration I/O pull-up resistors enabled. 1 = Weak preconfiguration I/O pull-up resistors disabled. PUDC_B is powered by V <sub>CCAUX</sub> .
POR_OVERRIDE	Dedicated	Input	Power-on reset delay override. 0 = Standard PL power-on delay time (recommended default). 1 = Faster PL power-on delay time.  <b>CAUTION!</b> Do not allow this pin to float before and during configuration. This pin must be tied to V <sub>CCINT</sub> or GND.
PS_DONE	Dedicated	Output	PS DONE signal. Requires an external pull-up resistor.
PS_ERROR_OUT	Dedicated	Output	PS error indication.
PS_ERROR_STATUS	Dedicated	Output	PS error status.
PS_INIT_B	Dedicated	Input/Output	Initialization completion indicator after POR. High voltage indicates completion of initialization (PL). Requires an external pull-up resistor.
PS_JTAG_TCK	Dedicated	Input	JTAG data clock.
PS_JTAG_TDI	Dedicated	Input	JTAG data input.
PS_JTAG_TDO	Dedicated	Output	JTAG data output.
PS_JTAG_TMS	Dedicated	Input	JTAG mode select.
PS_MODE	Dedicated	Input/Output	PS MIO mode selection pins.
PS_PADI	Dedicated	Input	Crystal pad input. Real-time clock (RTC).
PS_PADO	Dedicated	Output	Crystal pad output. Real-time clock (RTC).

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
PS_POR_B	Dedicated	Input	Power on reset. PS_POR_B must be held at 0 until all PS power supplies meet voltage requirements and the PS_CLK reference is within specification. When deasserted the PS begins the boot process.
PS_PROG_B	Dedicated	Input	PROG_B signal to reset configuration block. Requires an external pull-up resistor.
PS_REF_CLK	Dedicated	Input	System reference clock. PS_CLK must be between 27 MHz and 60 MHz.
PS_SRST_B	Dedicated	Input	System reset. For use when debugging. When 0, forces the PS to enter the system reset sequence.
<b>Power/Ground Pins</b>			
For more information on voltage specifications see the <i>Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics</i> [Ref 8] or the <i>Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics</i> [Ref 9].			
GND	Dedicated	N/A	Ground.
RSVDGND	Dedicated	N/A	Reserved pins that must be tied to GND. <b>Note:</b> These pins are labeled differently depending upon the device. They can serve a different purpose between footprint compatible devices. To migrate to a footprint compatible device, account for any variation in pin functionality.
RSVD	Dedicated	N/A	Reserved pin. Leave floating.
VCCINT	Dedicated	N/A	Power-supply pins for the PL internal logic.
VCCINT_IO	Dedicated	N/A	Power-supply pins for the I/O banks. VCCINT_IO must be connected to VCCBRAM on the board.
VCCINT_VCU	Dedicated	N/A	Power-supply pins for the video codec unit (EV devices only). <b>Note:</b> If the video codec unit is not used, then connect the VCCINT_VCU pins to GND to reduce power. In the CG and EG devices, the EV device VCCINT_VCU pins appear as RSVDGND pins. <b>Note:</b> When migrating from an EV device to a CG or EG device in the same package, Xilinx recommends connecting the VCCINT_VCU pins to GND to reduce power. Further VCCINT_VCU migration guidelines are available in <i>UltraScale Architecture PCB and Pin Planning User Guide</i> (UG583) [Ref 14].  
VCCAUX	Dedicated	N/A	Power-supply pins for auxiliary circuits.

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
VCCAUX_IO	Dedicated	N/A	Auxiliary power-supply pins for the I/O banks. VCCAUX_IO must be connected to VCCAUX on the board.  <b>Note:</b> Package files for XQ ruggedized devices (for example: FFRC784) have unique pin names for VCCAUX_HPIO and VCCAUX_HDIO. These pins can be connected to a common VCCAUX_IO supply.
VCCBRAM	Dedicated	N/A	Power-supply pins for PL block RAM logic.
VCO_[bank number] <sup>(2)</sup>	Dedicated	N/A	Power-supply pins for the output drivers (per bank).
VREF_[bank number]	Dedicated	N/A	Voltage reference for input pins (per bank).
VCCADC	Dedicated	N/A	System Monitor analog supply voltage.
GNDADC	Dedicated	N/A	System Monitor analog ground.
VCC_PSADC	Dedicated	N/A	PS ADC supply voltage.
GND_PSADC	Dedicated	N/A	PS ADC analog ground.
VCC_PSAUX	Dedicated	N/A	PS auxiliary circuits supply voltage.
VCC_PSBATT	Dedicated	N/A	PS RTC battery supply voltage. When not used, tie to GND.
VCC_PSDDR_PLL	Dedicated	N/A	PS DDR PLL supply voltage.
VCC_PSPLL	Dedicated	N/A	PS PLL (DPLL, RPLL, APLL, VPLL, IOPLL) supply voltage.
VCC_PSINTFP	Dedicated	N/A	PS full-power domain supply voltage.
VCC_PSINTFP_DDR	Dedicated	N/A	PS DDR full-power domain supply voltage.
VCC_PSINTLP	Dedicated	N/A	PS low-power domain supply voltage.
VCO_PSIO[0:3]_[500:503]	Dedicated	N/A	PS I/O supply voltage.
VCO_PSDDR	Dedicated	N/A	PS DDR controller I/O supply voltage.
<b>PS MIO Pins</b>			
PS_MIO	Multi-function	Input/Output	Multiplexed I/O can be configured to support multiple I/O interfaces. These interfaces include SPI and Quad-SPI flash, NAND, USB, Ethernet, SDIO, UART, SPI, and GPIO interfaces.
<b>PS DDR Pins</b>			
PS_DDR_DQ	Dedicated	Input/Output	DRAM data.
PS_DDR_DQS_P	Dedicated	Input/Output	DRAM differential data strobe positive.
PS_DDR_DQS_N	Dedicated	Input/Output	DRAM differential data strobe negative.
PS_DDR_ALERT_N	Dedicated	Input	DRAM alert signal.
PS_DDR_ACT_N	Dedicated	Output	DRAM activation command.

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
PS_DDR_A	Dedicated	Output	DRAM row and column address.
PS_DDR_BA	Dedicated	Output	DRAM bank address.
PS_DDR_BG	Dedicated	Output	DRAM bank group.
PS_DDR_CK_N	Dedicated	Output	DRAM differential clock negative.
PS_DDR_CK	Dedicated	Output	DRAM differential clock positive.
PS_DDR_CKE	Dedicated	Output	DRAM clock enable.
PS_DDR_CS	Dedicated	Output	DRAM chip select.
PS_DDR_DM	Dedicated	Output	DRAM data mask.
PS_DDR_ODT	Dedicated	Output	DRAM termination control.
PS_DDR_PARITY	Dedicated	Output	DRAM parity signal
PS_DDR_RAM_RST_N	Dedicated	Output	DRAM reset signal, active low.
PS_DDR_ZQ	Dedicated	Input/Output	ZQ calibration signal.
<b>System Monitor Pins<sup>(3)</sup></b>			
AD[0 to 15][P or N]	Multi-function	Input	System Monitor differential auxiliary analog inputs 0–15.
VREFP	Dedicated	N/A	Voltage reference input.
VREFN	Dedicated	N/A	Voltage reference GND.
VP	Dedicated	Input	System Monitor dedicated differential analog input (positive side).
VN	Dedicated	Input	System Monitor dedicated differential analog input (negative side).
I2C_SCLK	Multi-function	Bidirectional	<p>I2C serial clock. Directly connected to the System Monitor DRP interface for I2C operation configuration.</p>  <p><b>IMPORTANT:</b> Because the SYSMON I2C interface is active after power-on, this pin should only be used for I2C access until after configuration.</p>
I2C_SDA	Multi-function	Bidirectional	<p>I2C serial data line. Directly connected to the System Monitor DRP interface for I2C operation configuration.</p>  <p><b>IMPORTANT:</b> Because the SYSMON I2C interface is active after power-on, this pin should only be used for I2C access until after configuration.</p>

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
SMBALERT	Multi-function	Bidirectional	<p>Optional PMBus alert, interrupt signal. When Low, indicates a system fault that must be cleared using PMBus commands. Connect to SMBALERT_TS.</p> <p>For more information, see the <i>UltraScale Architecture System Monitor User Guide</i> [Ref 13].</p>  <p><b>IMPORTANT:</b> By default, the PMBus is active prior to configuration. Only use as a multi-functional I/O pin in designs that can tolerate this pin being driven prior to configuration.</p> <p>This pin is present on Kintex UltraScale+ and Virtex UltraScale+ devices.</p>

#### Multi-gigabit Serial Transceiver Pins (GTHE4, GTYE4, and PS-GTR)

For more information on the GTH and GTY transceivers, see the *UltraScale Architecture GTH Transceivers User Guide* (UG576) [Ref 11] or *UltraScale Architecture GTY Transceivers User Guide* [Ref 12]. For more information on the PS-GTR transceivers, see the *Zynq UltraScale+ Device Technical Reference Manual* [Ref 10].

MGTHR[X][P or N][0 to 3]_[GT quad number]	Dedicated	Input	RXP and RXN are the differential input pairs for each of the receivers in the GTH Quad.
MGTHT[X][P or N][0 to 3]_[GT quad number]	Dedicated	Output	TXP and TXN are the differential output pairs for each of the transmitters in the GTH Quad.
MGTYRX[X][P or N][0 to 3]_[GT quad number]	Dedicated	Input	RXP and RXN are the differential input pairs for each of the receivers in the GTY Quad.
MGTYTX[X][P or N][0 to 3]_[GT quad number]	Dedicated	Output	TXP and TXN are the differential output pairs for each of the transmitters in the GTY Quad.
PS_MGTRRX[X][P or N][0 to 3]_[GT quad number]	Dedicated	Input	RXP and RXN are the differential input pairs for each of the receivers in the PS-GTR Quad.
PS_MGTRTX[X][P or N][0 to 3]_[GT quad number]	Dedicated	Output	TXP and TXN are the differential output pairs for each of the transmitters in the PS-GTR Quad.
MGTAVCC_[L or R]_[N or S] <sup>(4)</sup>	Dedicated	Input	Analog power-supply pin for the receiver and transmitter internal circuits for the GTH or GTY transceivers.
PS_MGTRAVCC	Dedicated	N/A	Analog power-supply pin for the receiver and transmitter internal circuits for the PS-GTR transceivers.
MGTAVTT_[L or R]_[N or S] <sup>(4)</sup>	Dedicated	Input	Analog power-supply pin for the transmitter and receiver termination circuits for the GTH or GTY transceivers.
MGTVCXAUX_[L or R]_[N or S] <sup>(4)</sup>	Dedicated	Input	Auxiliary analog Quad PLL (QPLL) voltage supply for the transceivers.

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
PS_MGTRAVTT	Dedicated	N/A	Analog power-supply pin for the transmitter and receiver termination circuits for the PS-GTR transceivers.
MGTREFCLK[0 or 1] [P or N]	Dedicated	Input/Output	Configured as either reference clock input pins or as RX recovered clock output pins for the GTH or GTY transceivers.
PS_MGTREFCLK[0 to 3] [P or N]	Dedicated	Input	Differential reference clock for the PS-GTR transceivers.
MGTAVTTRCAL_[L or R] [N or S] <sup>(4)</sup>	Dedicated	N/A	Bias current supply for the termination resistor calibration circuit.
MGTRREF_[L or R] [N or S] <sup>(4)</sup>	Dedicated	Input	Calibration resistor pin for the termination resistor calibration circuit for the GTH or GTY transceivers.
PS_MGTRREF	Dedicated	Input	Calibration resistor pin for the termination resistor calibration circuit for the PS-GTR transceivers.

**Zynq UltraScale+ RFSoC Dedicated Pins**

VCCSDFEC	Dedicated	N/A	Power supply for the FEC blocks.
VCCINT_AMS	Dedicated	N/A	Digital power supply for the DDC.
ADC_AVCC	Dedicated	N/A	Core ADC and PLL power supply.
ADC_AVCCAUX	Dedicated	N/A	Input buffer and PLL power supply.
ADC_GND	Dedicated	N/A	Analog ground for the ADC.
ADC_SUB_GND	Dedicated	N/A	Digital ground for the ADC.
ADC_CLK_[P or N]	Dedicated	Input	External reference clock for PLL or ADC direct sampling clock input.
VCM01/VCM23	Dedicated	N/A	ADC common mode voltage.
ADC_VIN_[0 to 3]_[P or N]	Dedicated	Input	Analog input signal to the ADC.
ADC_REXT	Dedicated	N/A	ADC external resistor.
DAC_AVCC	Dedicated	N/A	Core DAC and PLL power supply.
DAC_AVCCAUX	Dedicated	N/A	DAC and PLL power supply.
DAC_AVTT	Dedicated	N/A	Termination voltage for on-die 50Ω termination resistors.
DAC_GND	Dedicated	N/A	Analog ground for the DAC.
DAC_SUB_GND	Dedicated	N/A	Digital ground for the DAC.
DAC_CLK_[P or N]	Dedicated	Input	External reference clock for PLL or DAC direct sampling clock input.
SYSREF_[P or N]	Dedicated	Input	External reference clock/trigger for synchronizing timing of the data converters.
DAC_VOUT[0 to 3]_[P or N]	Dedicated	Output	Analog output signals from the DAC.
DAC_REXT	Dedicated	Input	DAC external resistor.

Table 1-4: Pin Definitions (Cont'd)

Pin Name	Type	Direction	Description
<b>Other Dedicated Pins</b>			
DXN	Dedicated	N/A	Temperature-sensing diode pins (Anode: DXP; Cathode: DXN). The thermal diode is accessed by using the DXP and DXN pins. When not used, tie to GND.
DXP			To use the thermal diode an appropriate external thermal monitoring IC must be added. Consult the external thermal monitoring IC data sheet for usage guidelines.

**Notes:**

1. See the DCI sections in *UltraScale Architecture SelectIO Resources User Guide* (UG571) [Ref 6] for more information on the VRP pins.
2. V<sub>CCO</sub> pins in unbonded banks must be connected to the V<sub>CCO</sub> for that bank (for package migration). Do NOT connect unbonded V<sub>CCO</sub> pins to different supplies. Without a package migration requirement, V<sub>CCO</sub> pins in unbonded banks can be tied to a common supply (V<sub>CCO</sub> or GND).
3. See the *UltraScale Architecture System Monitor User Guide* (UG580) [Ref 13] for the default connections required to support on-chip monitoring.
4. L (left), R (right), N (north), and S (south) signify the GT transceiver quad power supply groups.

## Footprint Compatibility between Packages

Zynq UltraScale+ devices are footprint compatible only with other Zynq UltraScale+ devices with the same number of package pins and the same preceding alphabetic designator. For example, XCZU9EG-FFVB1156 is compatible with the XCZU15EG-FFVB1156, but not with the XCZU9EG-FFVC900. Pins that are available in one device but are not available in another device are labeled as *No Connects* in the other device's package file.



**IMPORTANT:** *Footprint compatibility does not necessarily imply that all pins will function in the same manner for different devices in a package. For limitations and guidelines on designing for footprint compatible packages, refer to the Migration Between the Zynq UltraScale+ Devices and Packages section of UltraScale Architecture PCB and Pin Planning User Guide (UG583) [Ref 14].*

Table 1-5 shows the footprint compatible devices available for each package. See the *Zynq UltraScale+ MPSoC Overview (DS891)* [Ref 1] for specific package letter code options. All packages are available with eutectic BGA balls. For these packages, the device type is XQ and the Pb-free signifier in the package name is a Q.

Table 1-5: Footprint Compatibility

Packages	Footprint Compatible Devices			
SBVA484	XCZU1CG, XCZU1EG			
SBVA484 SFRA484	XCZU2CG, XCZU2EG, XAZU2EG	XCZU3CG, XCZU3EG, XAZU3EG, XQZU3EG		
UBVA494	XCZU1CG, XCZU1EG			
UBVA530	XCZU2CG, XCZU2EG,	XCZU3CG, XCZU3EG,		
SFVA625	XCZU1CG, XCZU1EG			
SFVA625	XCZU2CG, XCZU2EG, XAZU2EG	XCZU3CG, XCZU3EG, XAZU3EG		
SFVC784	XCZU1CG, XCZU1EG			
SFVC784 SFRC784	XCZU2CG, XCZU2EG, XAZU2EG	XCZU3CG, XCZU3EG, XAZU3EG, XQZU3EG	XCZU4CG, XCZU4EG, XCZU4EV, XAZU4EV	XCZU5CG, XCZU5EG, XCZU5EV, XAZU5EV, XQZU5EV
FBVB900 FFRB900	XCZU4CG, XCZU4EG, XCZU4EV	XCZU5CG, XCZU5EG, XCZU5EV, XQZU5EV	XCZU7CG, XCZU7EG, XCZU7EV, XAZU7EV, XQZU7EV	
FFVC900 FFRC900	XCZU6CG, XCZU6EG	XCZU9CG, XCZU9EG, XQZU9EG	XCZU15EG, XQZU15EG	
FFVB1156 FFRB1156	XCZU6CG, XCZU6EG	XCZU9CG, XCZU9EG, XQZU9EG	XCZU15EG, XQZU15EG	
FFVC1156 FFRC1156	XCZU7CG, XCZU7EG, XCZU7EV, XQZU7EV	XCZU11EG, XQZU11EG		

Table 1-5: Footprint Compatibility (Cont'd)

Packages	Footprint Compatible Devices			
FFVD1156	XCZU21DR, XQZU21DR			
FFVE1156 FSVE1156	XCZU25DR	XCZU27DR, XCZU43DR, XCZU47DR, XCZU49DR <sup>(1)</sup>	XCZU42DR, XCZU65DR, XCZU67DR <sup>(2)</sup>	XCZU28DR, XQZU28DR
FFVB1517	XCZU11EG	XCZU17EG	XCZU19EG, XQZU19EG	
FFVF1517	XCZU7CG, XCZU7EG, XCZU7EV	XCZU11EG, XAZU11EG		
FFVG1517 FSVG1517 FSRG1517	XCZU25DR	XCZU27DR, XCZU43DR, XCZU47DR, XCZU49DR <sup>(1)</sup>	XCZU28DR, XQZU28DR	XCZU48DR, XQZU48DR
FFVC1760	XCZU11EG, XQZU11EG	XCZU17EG	XCZU19EG, XQZU19EG	
FFVD1760	XCZU17EG	XCZU19EG		
FFVF1760 FSVF1760	XCZU29DR, XCZU39DR, XCZU49DR <sup>(1)</sup>			
FFRF1760 FSRF1760	XQZU29DR XQZU49DR			
FFVH1760	XCZU46DR			
FSVH1760	XCZU46DR			
FFVE1924	XCZU17EG	XCZU19EG		

**Notes:**

- These footprint compatible devices have a different set of ADC and DAC power sequencing requirements. Refer to *Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics* (DS926) for specific power sequencing differences.
- The XCZU42DR, XCZU65DR, and XCZU67DR are only partially compatible with other devices in the FFVE1156 and FSVE1156 packages due to key differences in the ADC and DAC architecture. When planning migration between devices, differences that must be addressed include ADC and DAC bank/pin locations and power rail voltage specifications.

Many Zynq UltraScale+ devices that are footprint compatible in a package have different I/O bank and transceiver quad numbers connected to the same package pins. Due to these differences, when migrating between devices in a specific package, the type of bank (HD vs. HP) or quad (PS-GTR, GTH, or GTY), whether a bank is connected or NC at the package pins, and where the bank or quad is located on the die must be taken into consideration.

[Table 1-6](#) and [Table 1-7](#) show how the banks and transceiver quads are numbered between devices in each package.

For all grouped-together footprint-compatible packages, the bank and quad numbers in the same column (indicated by the letters A through Z) for each device are connected to the same package pins. For example, in the FFVB1517 packages, bank 88 for the XCZU11 is connected to the same pins as bank 90 for the XCZU17 and XCZU19.

A limited number of HP I/O banks have fewer than 52 SelectIO pins. For a visual representation of all of this information, see the [Die Level Bank Numbering Overview](#) section.

Table 1-6: I/O Bank Migration (HD Banks are Shaded)

Package	Device	Package to Device I/O Mapping <sup>(1)</sup>																								Unbonded I/O Banks		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
SBVA484	XCZU1		44	65	66																						64	
	XCZU2 XAZU2		26	65	66 <sup>(2)</sup>																						25, 24, 44, 64	
	XCZU3 XAZU3		26	65	66 <sup>(2)</sup>																						25, 24, 44, 64	
	SFRA484	XQZU3		26	65	66 <sup>(2)</sup>																					25, 24, 44, 64	
UBVA494	XCZU1		44	65	66																						64	
UBVA530	XCZU2		26	65	66 <sup>(2)</sup>																						25, 24, 44, 64	
	XCZU3		26	65	66 <sup>(2)</sup>																						25, 24, 44, 64	
SBVA625	XCZU1		64	65	66	44																					25, 24, 44, 64	
SFVA625	XCZU2 XAZU2		64	65	66	26																					25, 24, 44	
	XCZU3 XAZU3		64	65	66	26																					25, 24, 44	
SFVC784	XCZU1		64	65	66											44												
	XCZU2 XAZU2		64	65	66	25	26								24	44												
	XCZU3 XAZU3		64	65	66	25	26								24	44												
	XCZU4 XAZU4		64	65	66	45	46								44	43												63
	XCZU5 XAZU5		64	65	66	45	46								44	43												63

Table 1-6: I/O Bank Migration (HD Banks are Shaded) (Cont'd)

Package	Device	Package to Device I/O Mapping <sup>(1)</sup>																						Unbonded I/O Banks			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
SFRC784	XQZU3	64	65	66	25	26								24	44												
	XQZU5	64	65	66	45	46								44	43												63
FBVB900	XCZU4	64	65	66										46	45												44, 43, 63
	XCZU5	64	65	66										46	45												44, 43, 63
	XCZU7	64	65	66										47	48												28, 27, 68, 67, 63, 88, 87
	XAZU7	64	65	66										47	48												28, 27, 68, 67, 63, 88, 87
FFRB900	XQZU5	64	65	66										46	45												44, 43, 63
	XQZU7	64	65	66										47	48												28, 27, 68, 67, 63, 88, 87
FFVC900	XCZU6	64	65	66										48	47												50, 49, 44, 67
	XCZU9	64	65	66										48	47												50, 49, 44, 67
	XCZU15	64	65	66										48	47												50, 49, 44, 67
FFRC900	XQZU9	64	65	66										48	47												50, 49, 44, 67
	XQZU15	64	65	66										48	47												50, 49, 44, 67
FFVB1156	XCZU6	44	64	65	66	67								47	48	49	50										
	XCZU9	44	64	65	66	67								47	48	49	50										
	XCZU15	44	64	65	66	67								47	48	49	50										
FFRB1156	XQZU9	44	64	65	66	67								47	48	49	50										
	XQZU15	44	64	65	66	67								47	48	49	50										
FFVC1156	XCZU7		64	65	66									87	88	68	67	28									27, 48, 47, 63
	XCZU11		64	65	66									88	89	69	68	67									71, 70, 91, 90
FFRC1156	XQZU7		64	65	66									87	88	68	67	28									27, 48, 47, 63
	XQZU11		64	65	66									88	89	69	68	67									71, 70, 91, 90

Table 1-6: I/O Bank Migration (HD Banks are Shaded) (Cont'd)

Package	Device	Package to Device I/O Mapping <sup>(1)</sup>																						Unbonded I/O Banks			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
FFVD1156	XCZU21		65	66	67	68								87	88	89											71, 70, 69, 64, 91, 90, 84
FFRD1156	XQZU21		65	66	67	68								87	88	89											71, 70, 69, 64, 91, 90, 84
FFVE1156 FSVE1156	XCZU25		65	66										88	89												69, 68, 67, 64, 87, 84
	XCZU27		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
	XCZU28		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
	XCZU42		65	66										67 <sup>(2)</sup>	88												68, 64
	XCZU43		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
	XCZU47		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
	XCZU48		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
	XCZU65		65	66										67 <sup>(2)</sup>	88												68, 64
	XCZU67		65	66										67 <sup>(2)</sup>	88												68, 64
FFRE1156	XQZU28		65	66										88	89												71, 70, 69, 68, 67, 64, 91, 90, 87, 84
FFVB1517	XCZU11		65	64	66									88	89	90				71	70	69	68	67			91
	XCZU17		65	64	66									90	91	93	74	73	72	71	70	69	68	67			94
	XCZU19		65	64	66									90	91	93	74	73	72	71	70	69	68	67			94
	FFRB1517	XQZU19		65	64	66								90	91	93	74	73	72	71	70	69	68	67			94
FFVF1517	XCZU7		65	66	64	63								87	88	67	68	28	27								48, 47
	XCZU11		65	66	67	64								88	89	70	71	69	68								91, 90
	XAZU11		65	66	67	64								88	89	70	71	69	68								91, 90

Table 1-6: I/O Bank Migration (HD Banks are Shaded) (Cont'd)

Package	Device	Package to Device I/O Mapping <sup>(1)</sup>																								Unbonded I/O Banks		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
FFVG1517	XCZU25	84	64	65	66									87		67	68	69										89, 88
	XCZU27	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
	XCZU28	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
	XCZU43	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
	XCZU47	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
	XCZU48	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
FFRG1517	XQZU28	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
FSRG1517	XQZU48	84	64	65	66									87		67	68	69										71, 70, 91, 90, 89, 88
FFVC1760	XCZU11			65	64	66	67							88	89	90	91	71	70	69	68							
	XCZU17			65	64	66	67							90	91	93	94	71	70	69	68							74, 73, 72
	XCZU19			65	64	66	67							90	91	93	94	71	70	69	68							74, 73, 72
FFRC1760	XQZU11			65	64	66	67							88	89	90	91	71	70	69	68							
	XQZU19			65	64	66	67							90	91	93	94	71	70	69	68							74, 73, 72
FFVD1760	XCZU17			65	66									90	91	71	70	69										74, 73, 72, 68, 67, 64, 94, 93
	XCZU19			65	66									90	91	71	70	69										74, 73, 72, 68, 67, 64, 94, 93
FFVF1760	XCZU29	84	64	65	66									87	88	89		67	68	69								71, 70, 91, 90
	XCZU39	84	64	65	66									87	88	89		67	68	69								71, 70, 91, 90
	XCZU49 <sup>(1)</sup>	84	64	65	66									87	88	89		67	68	69								71, 70, 91, 90
FFRF1760	XQZU29	84	64	65	66									87	88	89		67	68	69								71, 70, 91, 90
FSRF1760	XQZU49	84	64	65	66									87	88	89		67	68	69								71, 70, 91, 90
FFVH1760 FSVH1760	XCZU46		64	65	66									90	91		69	71	70									67, 68, 84, 87, 88, 89

Table 1-6: I/O Bank Migration (HD Banks are Shaded) (Cont'd)

Package	Device	Package to Device I/O Mapping <sup>(1)</sup>																						Unbonded I/O Banks			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
FFVE1924	XCZU17			65	64	66	67							90	91	93	94	74	73	72	71	70	69	68			
	XCZU19			65	64	66	67							90	91	93	94	74	73	72	71	70	69	68			

**Notes:**

1. An alphabetical designator, A through Z, is assigned to every bank in a package. I/Os from banks with the same designator are bonded out to the same pins in that package. For example, in the FFVF1517 package, the E designator is assigned to bank 67 for the XCZU11 and bank 64 for the XCZU7. These banks are bonded to the same pins, regardless of where they appear on the XCZU11 and XCZU7 device.
2. Bank 66 is partially bonded out in the SBVA484 package (see [Figure 1-8](#)). Bank 67 is partially bonded out in the FFVE1156 and FSVE1156 packages for the XCZU42DR, XCZU65DR, and XCZU67DR (see [Figure 1-49](#), [Figure 1-64](#), and [Figure 1-66](#)).

For each grouped set of footprint compatible packages listed in Table 1-7, there is a row detailing the power supply group for each Quad. These groups are labeled according to the regions for the transceiver power supply pins, as listed in the [ASCII Pinout Files](#) linked from [Chapter 3, Package Files](#). For a visual representation of all of this information, see the [Die Level Bank Numbering Overview](#) section.

**Table 1-7: Transceiver Quad Migration (GTY Quads are in Shaded)**

Package	Device	Package to Die Transceiver Mapping <sup>(1)</sup>																		Unbonded Quads	
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S-Z	AA-AF
SBVA484	XCZU1																				
	XCZU2																				
	XAZU2																				
	XCZU3																				
SFRA484	XQZU3																				
UBVA494	XCZU1																				
UBVA530	XCZU2																				
	XCZU3																				
SFVA625	XCZU1																				
	XCZU2																				
	XAZU2																				
	XCZU3																				
Power Supply Group	R																				
SFVC784	XCZU1																				
	XCZU2																				
	XAZU2																				
	XCZU3																				
	XAZU3																				
XCZU4	XAZU4																		226, 225, 223		
	XAZU4	224																			
XCZU5	XAZU5																		226, 225, 223		
	XAZU5	224																			

Table 1-7: Transceiver Quad Migration (GTY Quads are in Shaded) (Cont'd)

Package	Device	Package to Die Transceiver Mapping <sup>(1)</sup>																		Unbonded Quads																			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S-Z	AA-AF																		
SFRC784	XQZU3																																						
	XQZU5	224																			226, 225, 223																		
Power Supply Group		R																																					
FBVB900	XCZU4	223	224	225	226																																		
	XCZU5	223	224	225	226																																		
	XCZU7	224	225	226	227	228, 223																																	
	XAZU7	224	225	226	227	228, 223																																	
FFRB900	XQZU5	223	224	225	226																																		
	XQZU7	224	225	226	227	228, 223																																	
Power Supply Group		R			L																																		
FFVC900	XCZU6	228	229	230	128																		130, 129, 127																
	XCZU9	228	229	230	128																		130, 129, 127																
	XCZU15	228	229	230	128																		130, 129, 127																
FFRC900	XQZU9	228	229	230	128																		130, 129, 127																
	XQZU15	228	229	230	128																		130, 129, 127																
Power Supply Group		R			L																																		
FFVB1156	XCZU6	228	229	230	128	129	130																127																
	XCZU9	228	229	230	128	129	130																127																
	XCZU15	228	229	230	128	129	130																127																
FFRB1156	XQZU9	228	229	230	128	129	130																127																
	XQZU15	228	229	230	128	129	130																127																
Power Supply Group		R																																					
FFVC1156	XCZU7	223	224	225	226	227																		228															
	XCZU11	224	225	226	227	228																		131, 130, 129, 128, 127, 229, 231, 230															
FFRC1156	XQZU7	223	224	225	226	227																		228															
	XQZU11	224	225	226	227	228																		131, 130, 129, 128, 127, 229, 231, 230															

Table 1-7: Transceiver Quad Migration (GTY Quads are in Shaded) (Cont'd)

Package	Device	Package to Die Transceiver Mapping <sup>(1)</sup>																		Unbonded Quads						
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S-Z	AA-AF					
Power Supply Group		L																								
FFVD1156	XCZU21	128	129	130	131																			127		
FFRD1156	XQZU21	128	129	130	131																			127		
Power Supply Group		L																								
FFVE1156 FSVE1156	XCZU25	128	129																			127				
	XCZU27	128	129																			131, 130, 127				
	XCZU28	128	129																			131, 130, 127				
	XCZU42	127	128																							
	XCZU43	128	129																			131, 130, 127				
	XCZU47	128	129																			131, 130, 127				
	XCZU48	128	129																			131, 130, 127				
	XCZU65	127	128																							
	XCZU67	127	128																							
FFRE1156	XCZU28	128	129																			131, 130, 127				
Power Supply Group		R																								
FFVB1517	XCZU11	224	225	226	227																			131, 130, 129, 128, 127, 231, 230, 229, 228		
	XCZU17	224	225	226	227																			134, 133, 132, 131, 130, 129, 128, 127, 234, 233, 232, 231, 230, 229, 228		
	XCZU19	224	225	226	227																			134, 133, 132, 131, 130, 129, 128, 127, 234, 233, 232, 231, 230, 229, 228		
	XAZU11	224	225	226	227																			131, 130, 129, 128, 127, 231, 230, 229, 228		
FFRB1517	XQZU19	224	225	226	227																			134, 133, 132, 131, 130, 129, 128, 127, 234, 233, 232, 231, 230, 229, 228		
Power Supply Group		RS				RN																				
FFVF1517	XCZU7	223	224	225	226	227	228																			
	XCZU11	224	225	226	227	228	229	230	231																	

Table 1-7: Transceiver Quad Migration (GTY Quads are in Shaded) (Cont'd)

Package	Device	Package to Die Transceiver Mapping <sup>(1)</sup>																	Unbonded Quads						
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R						
Power Supply Group		L																							
FFVG1517 FSVG1517	XCZU25	128	129																				127		
	XCZU27	128	129	130	131																		127		
	XCZU28	128	129	130	131																		127		
	XCZU43	128	129	130	131																		127		
	XCZU47	128	129	130	131																		127		
	XCZU48	128	129	130	131																		127		
FFRG1517	XQZU28	128	129	130	131																		127		
FSRG1517	XQZU48	128	129	130	131																		127		
Power Supply Group		RS				RN				FFVC1760	L														
FFVC1760	XCZU11	224	225	226	227	228	229	230	231		128	129	130	131							127				
	XCZU17	224	225	226	227	228	229	230	231		128	129	130	131							127				
	XCZU19	224	225	226	227	228	229	230	231		128	129	130	131							134, 133, 132, 127, 234, 233, 232				
FFRC1760	XQZU11	224	225	226	227	228	229	230	231	FFVD1760	128	129	130	131							127				
	XQZU19	224	225	226	227	228	229	230	231		128	129	130	131							134, 133, 132, 127, 234, 233, 232				
Power Supply Group		RS				RN				L															
FFVD1760	XCZU17	224	225	226	227	228	229	230	231	232	233	234	128	129	130	131	132	133	134			127			
	XCZU19	224	225	226	227	228	229	230	231	232	233	234	128	129	130	131	132	133	134			127			
Power Supply Group		L																							
FFVF1760 FSVF1760	XCZU29	128	129	130	131																		127		
	XCZU39	128	129	130	131																		127		
	XCZU49	128	129	130	131																		127		
FFVH1760 FSVH1760	XCZU46	128	129	130	131																		127		
FFRF1760	XQZU29	128	129	130	131																		127		
FSRF1760	XQZU49	128	129	130	131																		127		

**Table 1-7: Transceiver Quad Migration (GTY Quads are in Shaded) (Cont'd)**

Package	Device	Package to Die Transceiver Mapping <sup>(1)</sup>																		Unbonded Quads			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S-Z	AA-AF		
Power Supply Group		RS										RN											
FFVE1924	XCZU17	224	225	226	227	228	229	230	231	232	233	234											134, 133, 132, 131, 130, 129, 128, 127
	XCZU19	224	225	226	227	228	229	230	231	232	233	234											134, 133, 132, 131, 130, 129, 128, 127

**Notes:**

1. An alphabetical designator, A through Z, is assigned to every Quad in a package. Transceivers from Quads with the same designator are bonded out to the same pins in that package. For example, in the FFVF1517 package, the E designator is assigned to Quad 228 for the XCZU11 and Quad 227 for the XCZU7. These Quads are bonded to the same pins, regardless of where they appear on the XCZU11 and XCZU7 device.

# Die Level Bank Numbering Overview

## ***Banking and Clocking Summary***

- For each device, not all banks are bonded out in every package.

## ***GTH/GTY Columns***

- One GT Quad = Four transceivers = Four GTHE4 or GTYE4 primitives.
- Not all GT Quads are bonded out in every package.
- Also shown are quads labeled with RCAL. This specifies the location of the RCAL masters for each device. With respect to the package, the RCAL masters are located on the same package pin for each package, regardless of the device.
- The XY coordinates shown in each quad correspond to the transceiver channel number found in the pin names for that quad, as shown in [Figure 1-7](#).
- An alphabetic designator is shown in each quad. Each letter corresponds to the columns in [Table 1-6](#) and [Table 1-7](#).
- The power supply group is shown in brackets [ ] for each quad.

## ***I/O Banks***

- Each user HP I/O bank has a total of 52 I/Os where 48 can be used as differential (24 differential pairs) or single-ended I/Os. The remaining four function only as single-ended I/Os. All 52 pads of a bank are not always bonded out to pins.
- A limited number of HP I/O banks have fewer than 52 SelectIO pins. These banks are labeled as partial.
- Each user HD I/O bank has a total of 24 I/Os that can be used as differential (12 differential pairs) or single-ended I/Os.
- Adjacent to each bank is a physical layer (PHY) containing a CMT and other clock resources.
- Adjacent to each bank and PHY is a tile of logic resources that makes up a clock region.
- Banks are arranged in columns and separated into rows which are pitch-matched with adjacent PHY, clock regions, and GT blocks.
- An alphabetic designator is shown in each bank. Each letter corresponds to the columns in [Table 1-6](#) and [Table 1-7](#).

## Clocking

- Each bank has four pairs of global clock (GC or HDGC) inputs for four differential or four single-ended clock inputs. Single-ended clock inputs should be connected to the P-side of the differential pair.
- Clock signals are distributed through global buffers driving routing and distribution networks to reach any clock region, I/O, or GT.
- Global clock inputs can connect to an MMCM and two PLLs within the horizontally adjacent CMT.

## Bank Locations of Dedicated and Multi-Function Pins

- All dedicated configuration I/Os and HD I/Os are 3.3V capable.

## Processor (PS) Blocks

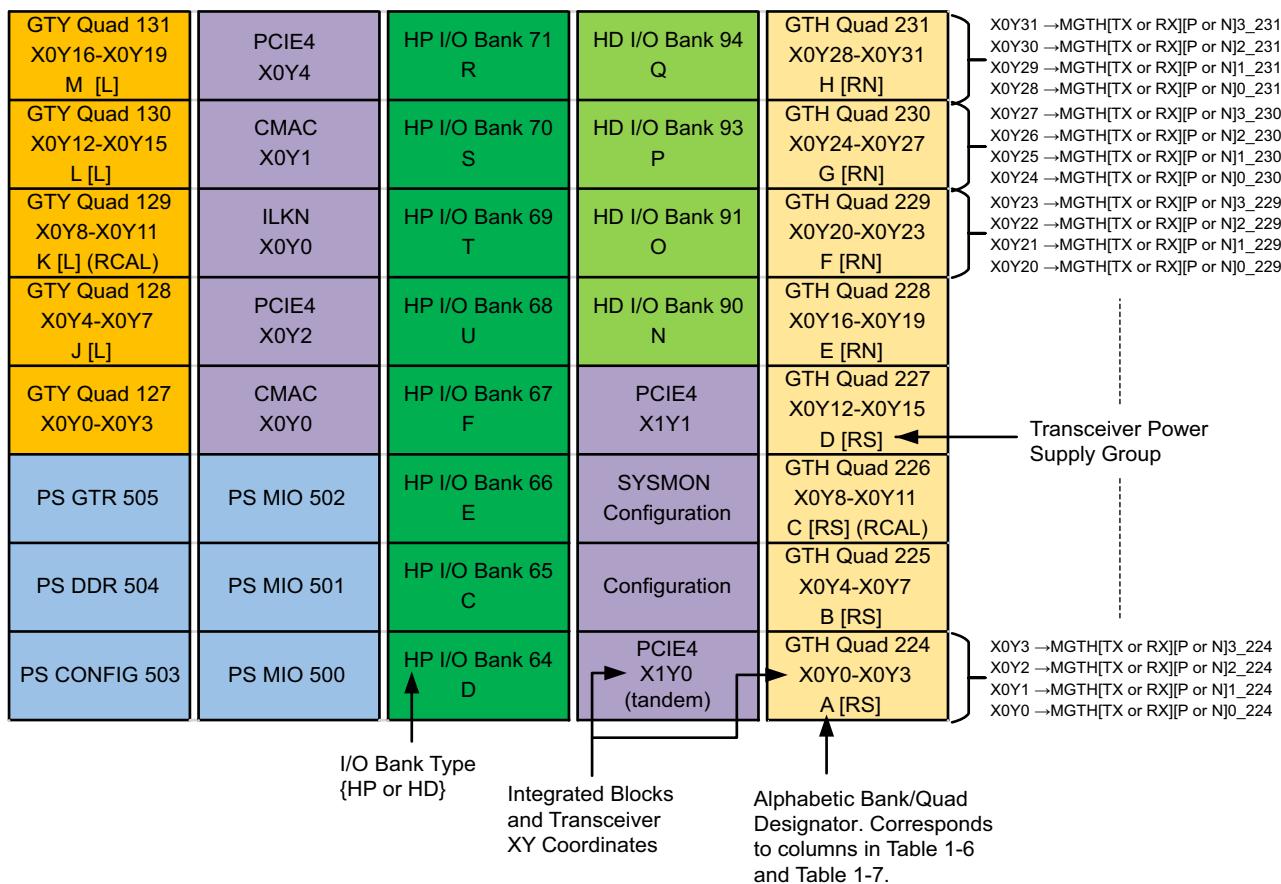
- MIO pins are shared between banks 500, 501, and 502.
- Configuration pins are in bank 503.
- DDR memory pins are in bank 504.
- Transceiver pins are in the PS-GTR quad 505.

## SYSMON, Configuration, PCIe, Interlaken, and 100GE Integrated Blocks

- Configuration: Configuration block.
- SYSMON/Configuration: Block shared between the SYSMONE4 and configuration.
- PCIe: Integrated block for PCIe.  
**Note:** PCIe blocks with an additional (Tandem) label support tandem configuration.
- ILKN: Interlaken block.
- CMAC: 100G Ethernet block.

## Device Diagrams

[Figure 1-1](#) shows an example diagram with a brief explanation for each component.

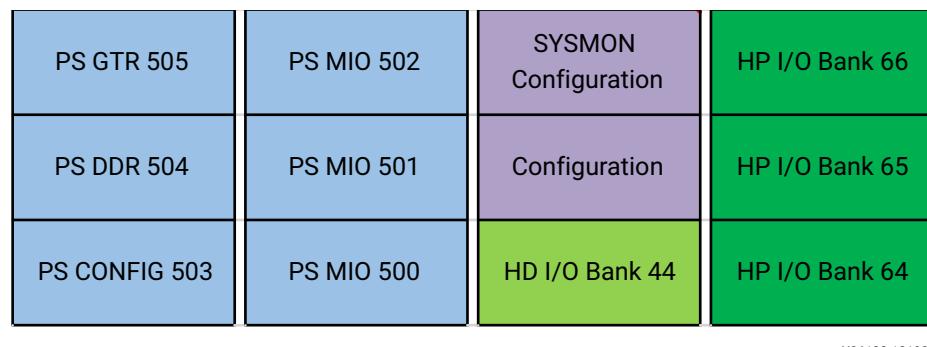


X17155-060219

[Figure 1-1: Example Device Diagram](#)

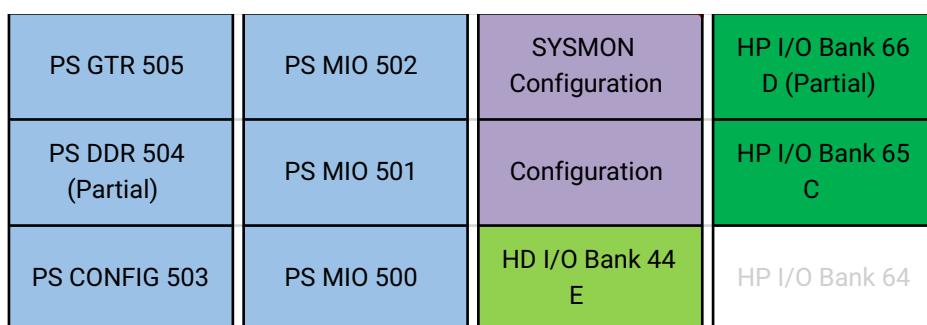
[Figure 1-7](#) through [Figure 1-47](#) show a die view of each device followed by a view with respect to each available package. The available resources by device and package are detailed in the *Zynq UltraScale+ MPSoC Overview* (DS891) [\[Ref 1\]](#) or *Zynq UltraScale+ RFSoC Overview* (DS889) [\[Ref 2\]](#).

## XCZU1CG Bank Diagram Overview

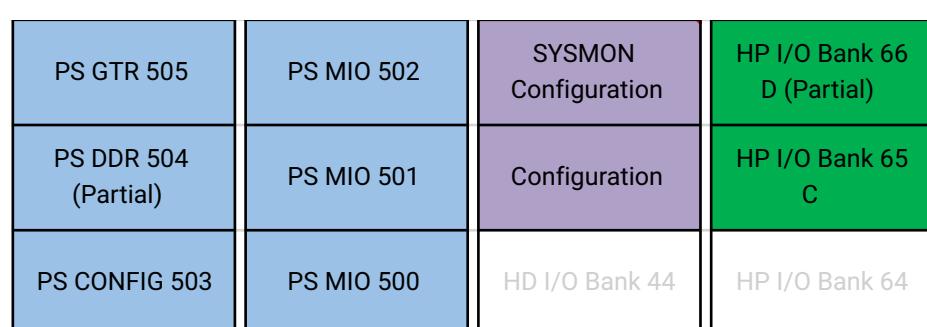


*Figure 1-2: XCZU1CG Banks*

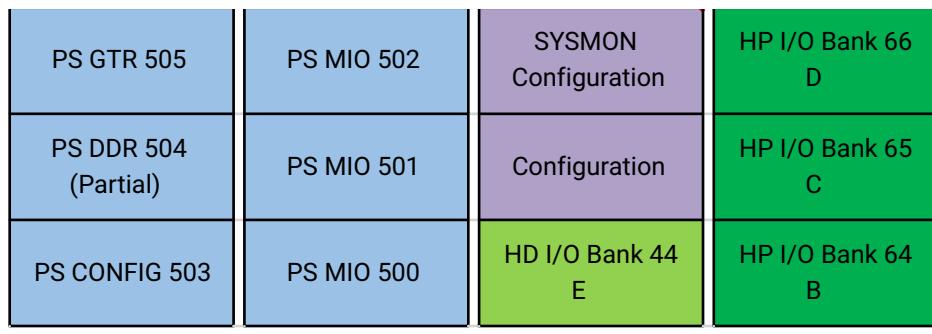
### *Bank Diagram by Package for XCZU1CG*



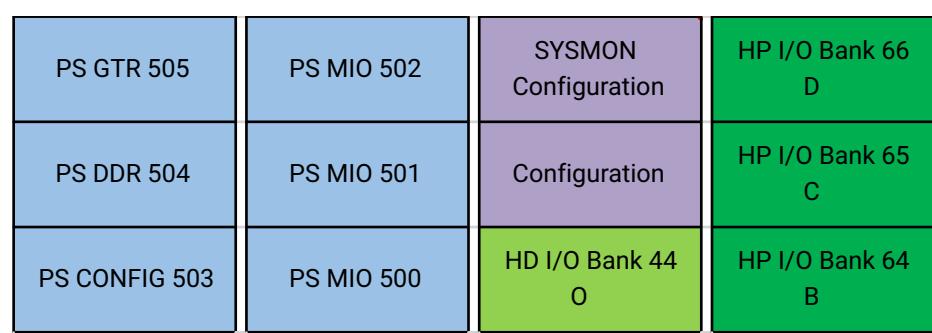
*Figure 1-3: XCZU1CG Banks in SBVA484 Package*



*Figure 1-4: XCZU1CG Banks in UBVA494 Package*



**Figure 1-5: XCZU1CG Banks in SBVA625 Package**



**Figure 1-6: XCZU1CG Banks in SFVC784 Package**

## XCZU2, XAZU2, XCZU3, XAZU3, and XQZU3 Bank Diagram Overview

PS GTR 505	PS MIO 502	HD I/O Bank 26	SYSMON Configuration	HP I/O Bank 66
PS DDR 504	PS MIO 501	HD I/O Bank 25	Configuration	HP I/O Bank 65
PS CONFIG 503	PS MIO 500	HD I/O Bank 24	HD I/O Bank 44	HP I/O Bank 64

X15118-060720

Figure 1-7: XCZU2, XAZU2, XCZU3, XAZU3, and XQZU3 Banks

### Bank Diagram by Package for XCZU2, XAZU2, XCZU3, XAZU3, and XQZU3

PS GTR 505	PS MIO 502	HD I/O Bank 26 B	SYSMON Configuration	HP I/O Bank 66 D (Partial)
PS DDR 504 (Partial)	PS MIO 501	HD I/O Bank 25	Configuration	HP I/O Bank 65 C
PS CONFIG 503	PS MIO 500	HD I/O Bank 24	HD I/O Bank 44	HP I/O Bank 64

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Figure 1-8: XCZU2, XAZU2, XCZU3, and XAZU3 Banks in SBVA484 Package

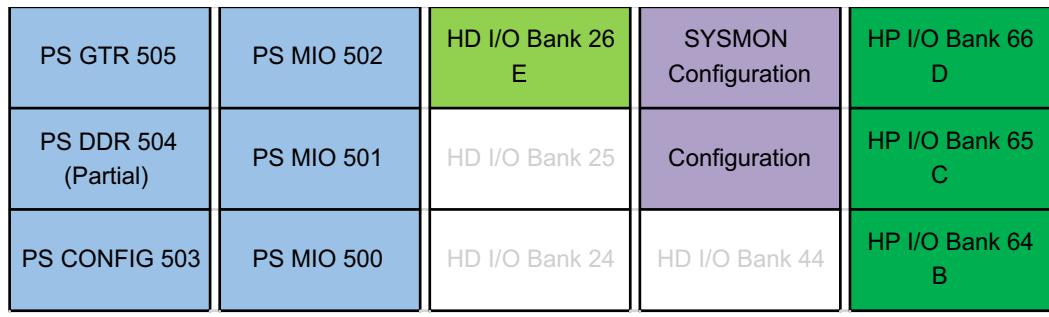


**IMPORTANT:** For the devices in the SBVA484 package shown in Figure 1-8, the HP I/Os in bank 66 are powered by VCCO\_65.

PS GTR 505	PS MIO 502	HD I/O Bank 26 B	SYSMON Configuration	HP I/O Bank 66 D (Partial)
PS DDR 504 (Partial)	PS MIO 501	HD I/O Bank 25	Configuration	HP I/O Bank 65 C
PS CONFIG 503	PS MIO 500	HD I/O Bank 24	HD I/O Bank 44	HP I/O Bank 64

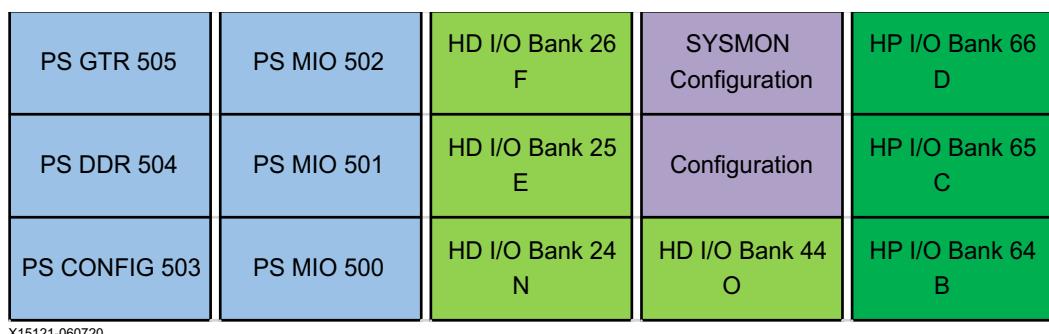
X25451-061521

Figure 1-9: XCZU2 and XCZU3 Banks in UBVA494 Package



X15120-060720

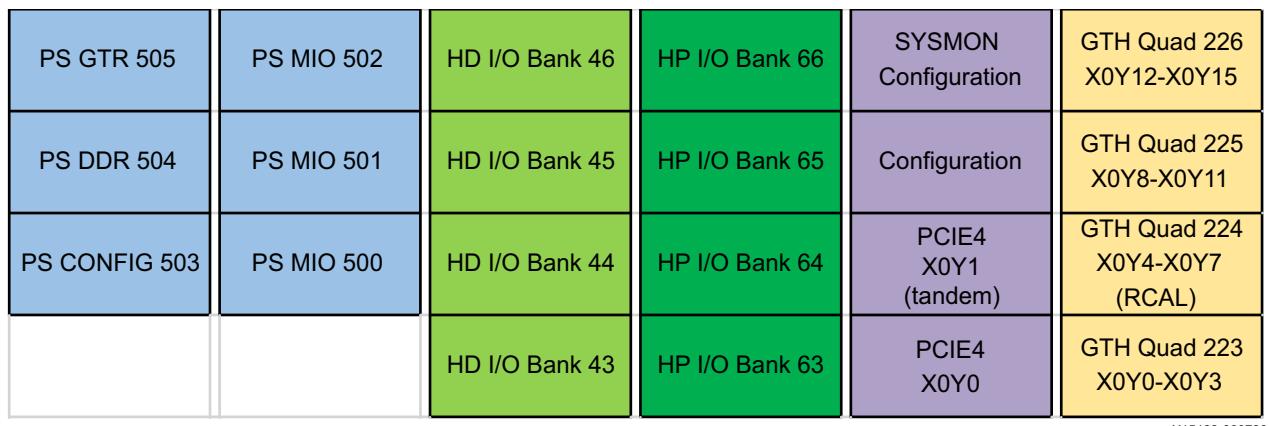
**Figure 1-10: XCZU2, XAZU2, XCZU3, and XAZU3 Banks in SFVA625 Package**



X15121-060720

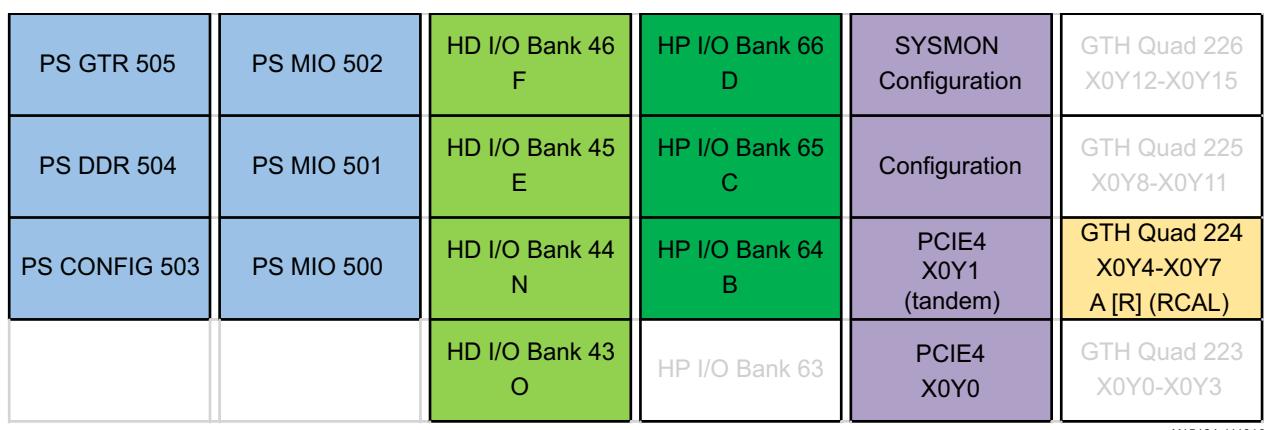
**Figure 1-11: XCZU2, XAZU2, XCZU3, XAZU3, and XQZU3 Banks in SFVC784 Package**

## XCZU4, XAZU4, XCZU5, XAZU5, and XQZU5 Bank Diagram Overview



*Figure 1-12: XCZU4, XAZU4, XCZU5, XAZU5, and XQZU5 Banks*

### ***Bank Diagram by Package for XCZU4, XAZU4, XCZU5, XAZU5, and XQZU5***



*Figure 1-13: XCZU4, XAZU4, XCZU5, and XAZU5 Banks in SFVC784 Package and XQZU5 Banks in SFRC784 Package*

PS GTR 505	PS MIO 502	HD I/O Bank 46 N	HP I/O Bank 66 D	SYSMON Configuration	GTH Quad 226 X0Y12-X0Y15 D [R]
PS DDR 504	PS MIO 501	HD I/O Bank 45 O	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y8-X0Y11 C [R]
PS CONFIG 503	PS MIO 500	HD I/O Bank 44	HP I/O Bank 64 B	PCIE4 X0Y1	GTH Quad 224 X0Y4-X0Y7 B [R] (RCAL)
		HD I/O Bank 43	HP I/O Bank 63	PCIE4 X0Y0	GTH Quad 223 X0Y0-X0Y3 A [R]

X15123-112916

**Figure 1-14: XCZU4 and XCZU5 Banks in FBVB900 Package and XQZU5 Banks in FFRB900 Package**

## XCZU7, XAZU7, and XQZU7 Bank Diagram Overview

HP I/O Bank 28	HD I/O Bank 48	HP I/O Bank 68	HD I/O Bank 88	GTH Quad 228 X0Y20-X0Y23
HP I/O Bank 27	HD I/O Bank 47	HP I/O Bank 67	HD I/O Bank 87	GTH Quad 227 X0Y16-X0Y19
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	GTH Quad 226 X0Y12-X0Y15
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	GTH Quad 225 X0Y8-X0Y11
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	PCIE4 X0Y1 (tandem)	GTH Quad 224 X0Y4-X0Y7 (RCAL)
		HP I/O Bank 63	PCIE4 X0Y0	GTH Quad 223 X0Y0-X0Y3

X15125-111316

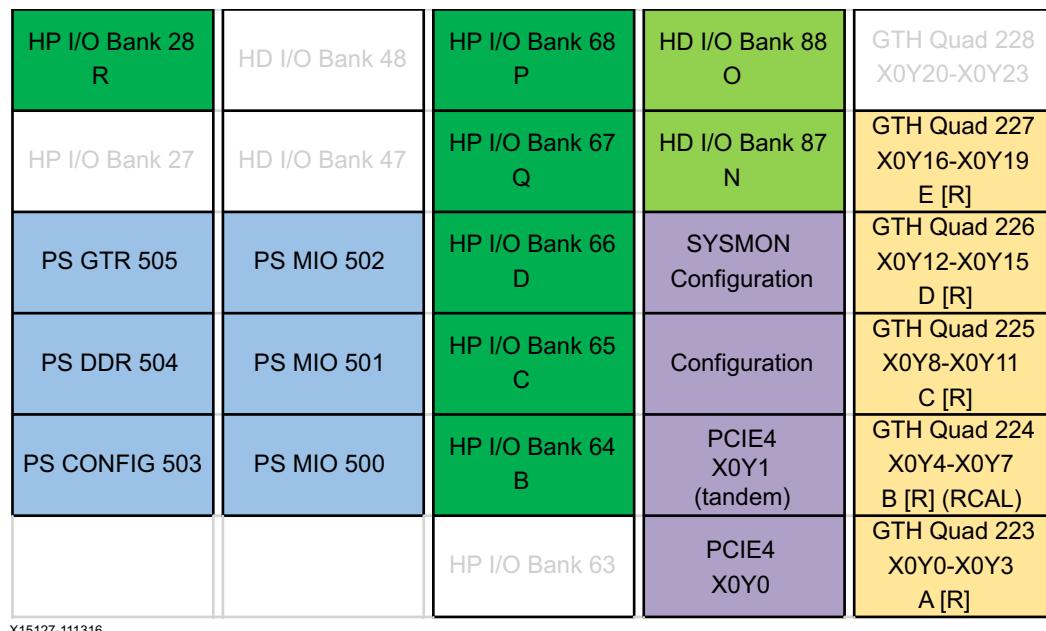
Figure 1-15: XCZU7, XAZU7, and XQZU7 Banks

## Bank Diagram by Package for XCZU7, XAZU7, and XQZU7

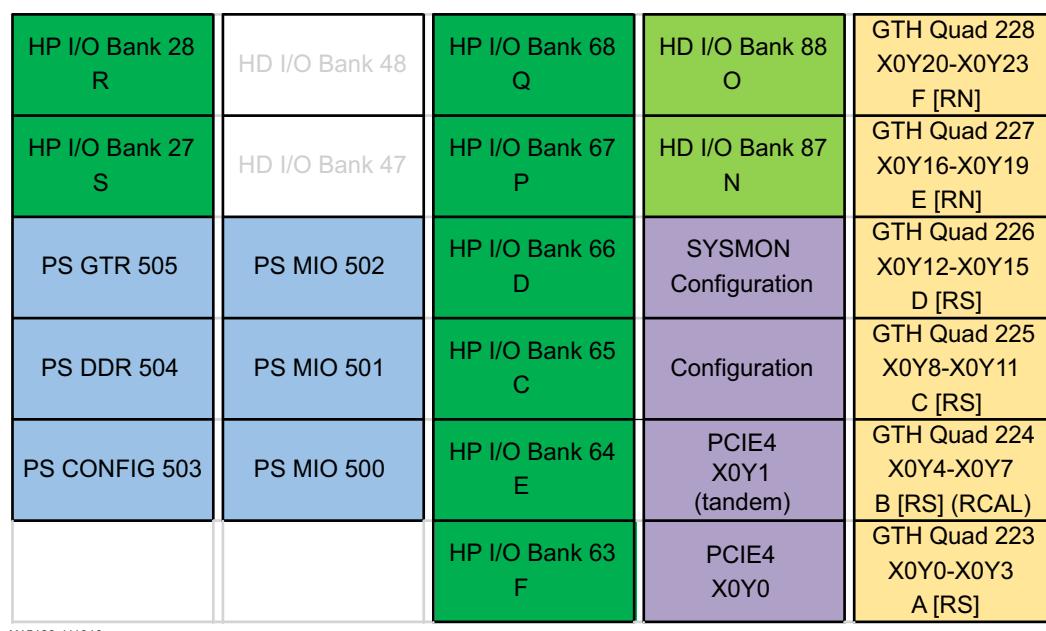
HP I/O Bank 28	HD I/O Bank 48 O	HP I/O Bank 68	HD I/O Bank 88	GTH Quad 228 X0Y20-X0Y23
HP I/O Bank 27	HD I/O Bank 47 N	HP I/O Bank 67	HD I/O Bank 87	GTH Quad 227 X0Y16-X0Y19 D [R]
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	GTH Quad 226 X0Y12-X0Y15 C [R]
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y8-X0Y11 B [R]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B	PCIE4 X0Y1	GTH Quad 224 X0Y4-X0Y7 A [R] (RCAL)
		HP I/O Bank 63	PCIE4 X0Y0	GTH Quad 223 X0Y0-X0Y3

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Figure 1-16: XCZU7 and XAZU7 Banks in FBVB900 Package and XQZU7 Banks in FFRB900 Package

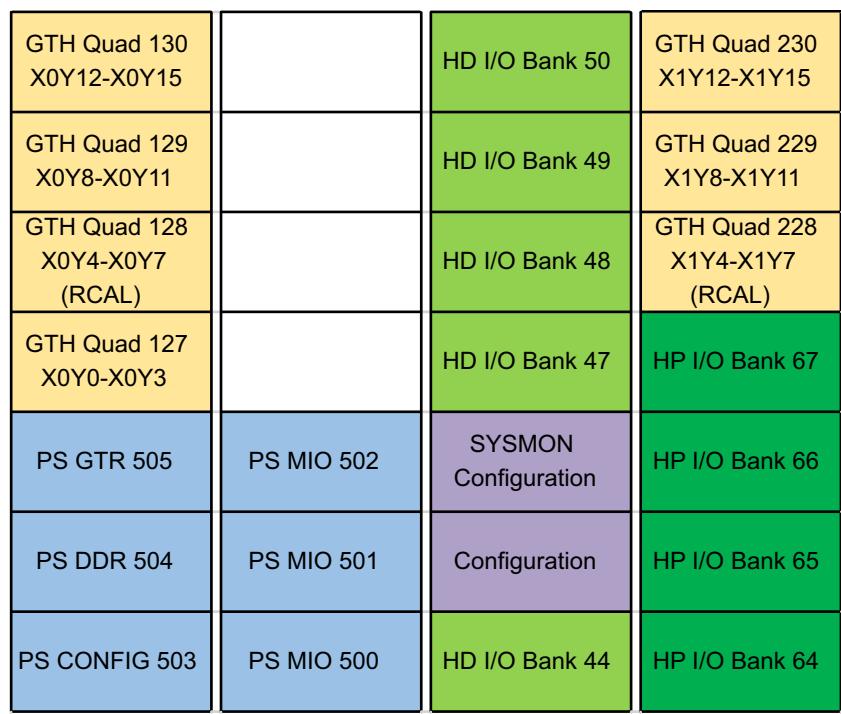


**Figure 1-17: XCZU7 Banks in FFVC1156 Package and XQZU7 Banks in FFRC1156 Package**

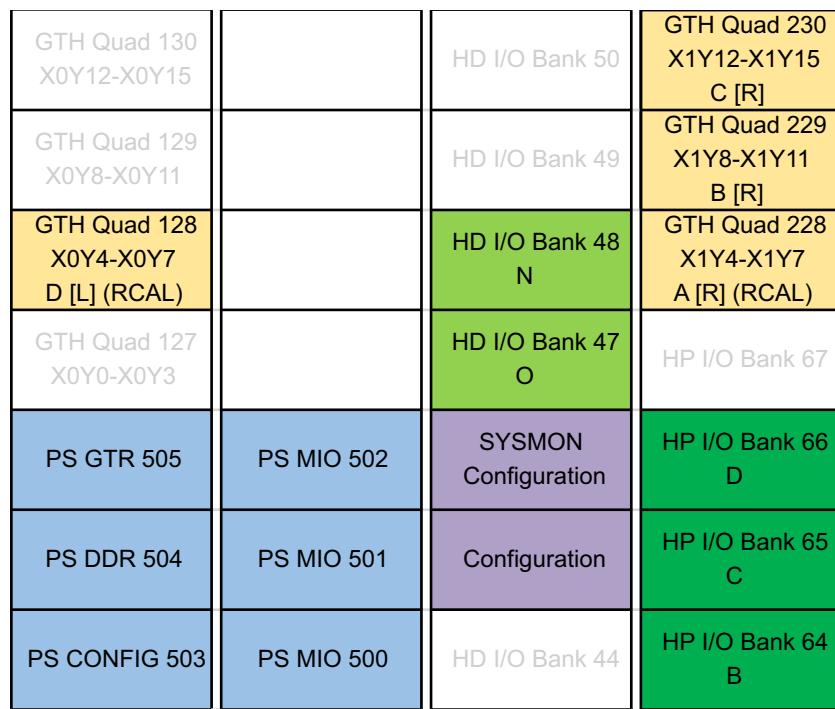


**Figure 1-18: XCZU7 Banks in FFVF1517 Package**

## XCZU6, XCZU9, and XQZU9 Bank Diagram Overview



*Figure 1-19: XCZU6, XCZU9, and XQZU9 Banks*

***Bank Diagram by Package for XCZU6, XCZU9, and XQZU9***


X15130-061420

*Figure 1-20: XCZU6 and XCZU9 Banks in FFVC900 Package and XQZU9 in FFRC900 Package*

GTH Quad 130 X0Y12-X0Y15 F [L]		HD I/O Bank 50 Q	GTH Quad 230 X1Y12-X1Y15 C [R]
GTH Quad 129 X0Y8-X0Y11 E [L]		HD I/O Bank 49 P	GTH Quad 229 X1Y8-X1Y11 B [R]
GTH Quad 128 X0Y4-X0Y7 D [L] (RCAL)		HD I/O Bank 48 O	GTH Quad 228 X1Y4-X1Y7 A [R] (RCAL)
GTH Quad 127 X0Y0-X0Y3		HD I/O Bank 47 N	HP I/O Bank 67 E
PS GTR 505	PS MIO 502	SYSMON Configuration	HP I/O Bank 66 D
PS DDR 504	PS MIO 501	Configuration	HP I/O Bank 65 C
PS CONFIG 503	PS MIO 500	HD I/O Bank 44 A	HP I/O Bank 64 B

X15131-061420

Figure 1-21: XCZU6 and XCZU9 Banks in FFVB1156 Package and XQZU9 in FFRB1156 Package

## XCZU11, XAZU11, and XQZU11 Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71	HD I/O Bank 91	GTH Quad 231 X0Y28-X0Y31
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	GTH Quad 230 X0Y24-X0Y27
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	GTH Quad 229 X0Y20-X0Y23
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68	HD I/O Bank 88	GTH Quad 228 X0Y16-X0Y19
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	GTH Quad 225 X0Y4-X0Y7
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3

X15132-121517

Figure 1-22: XCZU11, XAZU11, and XQZU11 Banks

***Bank Diagram by Package for XCZU11, XAZU11, and XQZU11***

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71	HD I/O Bank 91	GTH Quad 231 X0Y28-X0Y31
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	GTH Quad 230 X0Y24-X0Y27
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69 P	HD I/O Bank 89 O	GTH Quad 229 X0Y20-X0Y23
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68 Q	HD I/O Bank 88 N	GTH Quad 228 X0Y16-X0Y19 E [R]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 R	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [R]
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [R] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [R]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [R]

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*Figure 1-23: XCZU11 Banks in FFVC1156 Package and XQZU11 Banks in FFRC1156 Package*

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71 T	HD I/O Bank 91	GTH Quad 231 X0Y28-X0Y31
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70 U	HD I/O Bank 90 P	GTH Quad 230 X0Y24-X0Y27
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69 V	HD I/O Bank 89 O	GTH Quad 229 X0Y20-X0Y23
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68 W	HD I/O Bank 88 N	GTH Quad 228 X0Y16-X0Y19
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 X	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [R]
PS GTR 505	PS MIO 502	HP I/O Bank 66 E	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [R] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [R]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 D	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [R]

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*Figure 1-24: XCZU11 Banks in FFVB1517 Package*

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71 Q	HD I/O Bank 91	GTH Quad 231 X0Y28-X0Y31 H [RN]
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70 P	HD I/O Bank 90	GTH Quad 230 X0Y24-X0Y27 G [RN]
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69 R	HD I/O Bank 89 O	GTH Quad 229 X0Y20-X0Y23 F [RN]
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68 S	HD I/O Bank 88 N	GTH Quad 228 X0Y16-X0Y19 E [RN]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 E	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [RS]
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [RS] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [RS]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 F	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [RS]

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*Figure 1-25: XCZU11 and XAZU11 Banks in FFVF1517 Package*

GTY Quad 131 X0Y16-X0Y19 M [L]	PCIE4 X0Y3	HP I/O Bank 71 R	HD I/O Bank 91 Q	GTH Quad 231 X0Y28-X0Y31 H [RN]
GTY Quad 130 X0Y12-X0Y15 L [L]	CMAC X0Y1	HP I/O Bank 70 S	HD I/O Bank 90 P	GTH Quad 230 X0Y24-X0Y27 G [RN]
GTY Quad 129 X0Y8-X0Y11 K [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 T	HD I/O Bank 89 O	GTH Quad 229 X0Y20-X0Y23 F [RN]
GTY Quad 128 X0Y4-X0Y7 J [L]	PCIE4 X0Y2	HP I/O Bank 68 U	HD I/O Bank 88 N	GTH Quad 228 X0Y16-X0Y19 E [RN]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 F	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [RS]
PS GTR 505	PS MIO 502	HP I/O Bank 66 E	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [RS] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [RS]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 D	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [RS]

X15136-121517

**Figure 1-26: XCZU11 Banks in FFVC1760 Package and XQZU11 Banks in FFRC1760 Package**

## XCZU15 and XQZU15 Bank Diagrams

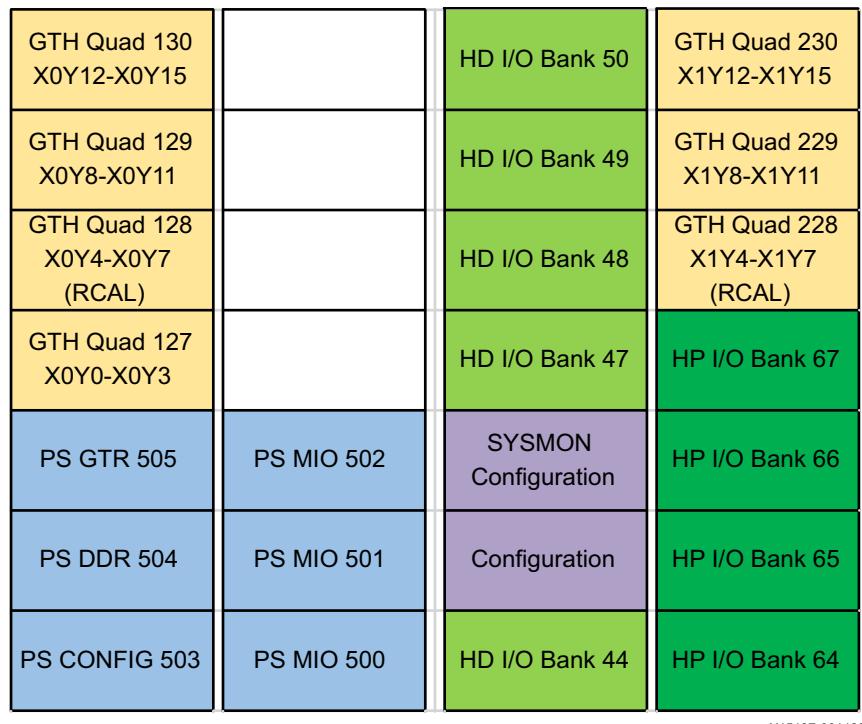
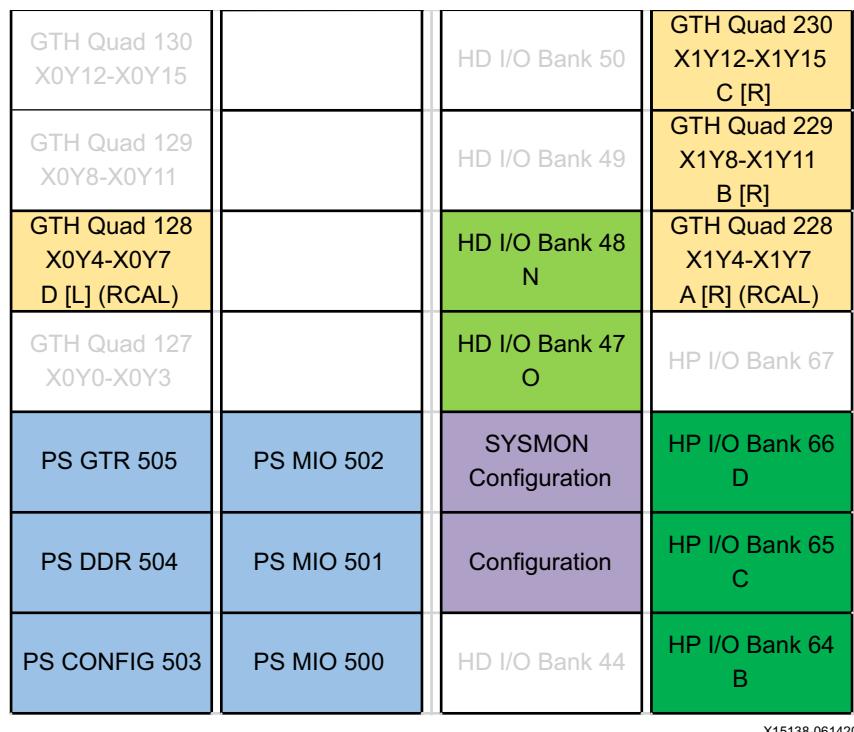
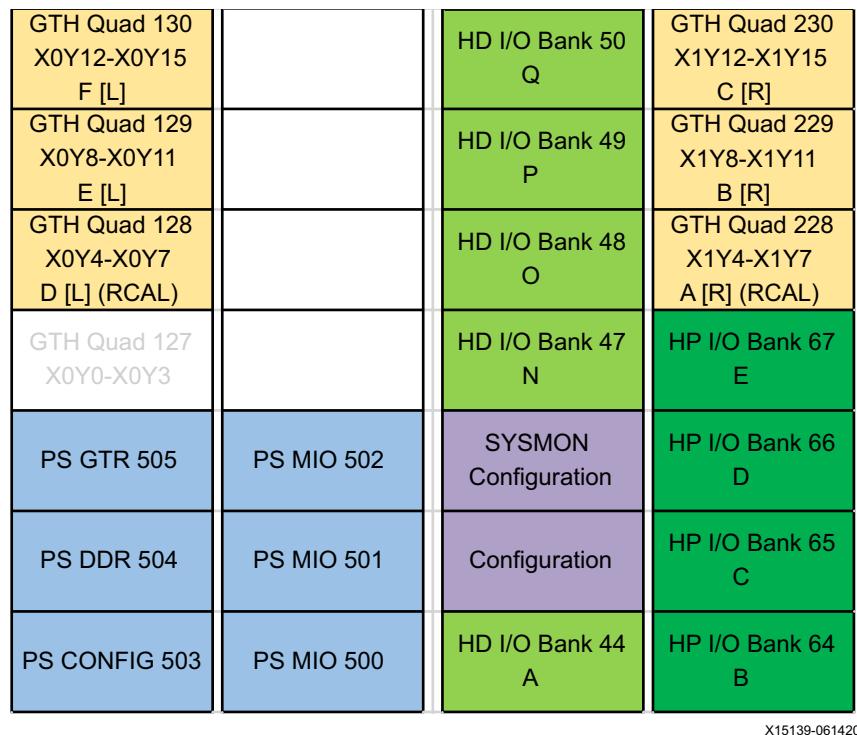


Figure 1-27: XCZU15 and XQZU15 Banks

***Bank Diagram by Package for XCZU15 and XQZU15***


**Figure 1-28: XCZU15 Banks in FFVC900 Package and XQZU15 Banks in FFRC900 Package**



*Figure 1-29: XCZU15 Banks in FFVB1156 Package and XQZU15 Banks in FFRB1156 Package*

## XCZU17, XCZU19, and XQZU19 Bank Diagram Overview

GTY Quad 134 X0Y28-X0Y31	CMAC X0Y3	HP I/O Bank 74	HD I/O Bank 94	GTH Quad 234 X0Y40-X0Y43
GTY Quad 133 X0Y24-X0Y27	ILKN X0Y2	HP I/O Bank 73	HD I/O Bank 93	GTH Quad 233 X0Y36-X0Y39
GTY Quad 132 X0Y20-X0Y23	CMAC X0Y2	HP I/O Bank 72	ILKN X1Y1	GTH Quad 232 X0Y32-X0Y35
GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71	HD I/O Bank 91	GTH Quad 231 X0Y28-X0Y31
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	GTH Quad 230 X0Y24-X0Y27
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	ILKN X1Y0	GTH Quad 229 X0Y20-X0Y23
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68	PCIE4 X1Y2	GTH Quad 228 X0Y16-X0Y19
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	GTH Quad 225 X0Y4-X0Y7
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3

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Figure 1-30: XCZU17, XCZU19, and XQZU19 Banks

***Bank Diagram by Package for XCZU17, XCZU19, and XQZU19***

GTY Quad 134 X0Y28-X0Y31	CMAC X0Y3	HP I/O Bank 74 Q	HD I/O Bank 94	GTH Quad 234 X0Y40-X0Y43
GTY Quad 133 X0Y24-X0Y27	ILKN X0Y2	HP I/O Bank 73 R	HD I/O Bank 93 P	GTH Quad 233 X0Y36-X0Y39
GTY Quad 132 X0Y20-X0Y23	CMAC X0Y2	HP I/O Bank 72 S	ILKN X1Y1	GTH Quad 232 X0Y32-X0Y35
GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71 T	HD I/O Bank 91 O	GTH Quad 231 X0Y28-X0Y31
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70 U	HD I/O Bank 90 N	GTH Quad 230 X0Y24-X0Y27
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69 V	ILKN X1Y0	GTH Quad 229 X0Y20-X0Y23
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68 W	PCIE4 X1Y2	GTH Quad 228 X0Y16-X0Y19
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 X	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [R]
PS GTR 505	PS MIO 502	HP I/O Bank 66 E	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [R] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [R]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 D	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [R]

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*Figure 1-31: XCZU17 and XCZU19 Banks in FFVB1517 Package and XQZU19 Banks in FFRB1517 Package*

GTY Quad 134 X0Y28-X0Y31	CMAC X0Y3	HP I/O Bank 74	HD I/O Bank 94 Q	GTH Quad 234 X0Y40-X0Y43
GTY Quad 133 X0Y24-X0Y27	ILKN X0Y2	HP I/O Bank 73	HD I/O Bank 93 P	GTH Quad 233 X0Y36-X0Y39
GTY Quad 132 X0Y20-X0Y23	CMAC X0Y2	HP I/O Bank 72	ILKN X1Y1	GTH Quad 232 X0Y32-X0Y35
GTY Quad 131 X0Y16-X0Y19 M [L]	PCIE4 X0Y3	HP I/O Bank 71 R	HD I/O Bank 91 O	GTH Quad 231 X0Y28-X0Y31 H [RN]
GTY Quad 130 X0Y12-X0Y15 L [L]	CMAC X0Y1	HP I/O Bank 70 S	HD I/O Bank 90 N	GTH Quad 230 X0Y24-X0Y27 G [RN]
GTY Quad 129 X0Y8-X0Y11 K [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 T	ILKN X1Y0	GTH Quad 229 X0Y20-X0Y23 F [RN]
GTY Quad 128 X0Y4-X0Y7 J [L]	PCIE4 X0Y2	HP I/O Bank 68 U	PCIE4 X1Y2	GTH Quad 228 X0Y16-X0Y19 E [RN]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 F	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [RS]
PS GTR 505	PS MIO 502	HP I/O Bank 66 E	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [RS] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [RS]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 D	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [RS]

X15142-071417

*Figure 1-32: XCZU17 and XCZU19 Banks in FFVC1760 Package and XQZU19 Banks in FFRC1760 Package*

GTY Quad 134 X0Y28-X0Y31 R [L]	CMAC X0Y3	HP I/O Bank 74	HD I/O Bank 94	GTH Quad 234 X0Y40-X0Y43 K [RN]
GTY Quad 133 X0Y24-X0Y27 Q [L]	ILKN X0Y2	HP I/O Bank 73	HD I/O Bank 93	GTH Quad 233 X0Y36-X0Y39 J [RN]
GTY Quad 132 X0Y20-X0Y23 P [L]	CMAC X0Y2	HP I/O Bank 72	ILKN X1Y1	GTH Quad 232 X0Y32-X0Y35 I [RN]
GTY Quad 131 X0Y16-X0Y19 O [L]	PCIE4 X0Y3	HP I/O Bank 71 P	HD I/O Bank 91 O	GTH Quad 231 X0Y28-X0Y31 H [RN]
GTY Quad 130 X0Y12-X0Y15 N [L]	CMAC X0Y1	HP I/O Bank 70 Q	HD I/O Bank 90 N	GTH Quad 230 X0Y24-X0Y27 G [RN]
GTY Quad 129 X0Y8-X0Y11 M [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 R	ILKN X1Y0	GTH Quad 229 X0Y20-X0Y23 F [RS]
GTY Quad 128 X0Y4-X0Y7 L [L]	PCIE4 X0Y2	HP I/O Bank 68	PCIE4 X1Y2	GTH Quad 228 X0Y16-X0Y19 E [RS]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [RS]
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [RS] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [RS]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [RS]

X15143-071417

Figure 1-33: XCZU17 and XCZU19 Banks in FFVD1760 Package

GTY Quad 134 X0Y28-X0Y31	CMAC X0Y3	HP I/O Bank 74 R	HD I/O Bank 94 Q	GTH Quad 234 X0Y40-X0Y43 K [RN]
GTY Quad 133 X0Y24-X0Y27	ILKN X0Y2	HP I/O Bank 73 S	HD I/O Bank 93 P	GTH Quad 233 X0Y36-X0Y39 J [RN]
GTY Quad 132 X0Y20-X0Y23	CMAC X0Y2	HP I/O Bank 72 T	ILKN X1Y1	GTH Quad 232 X0Y32-X0Y35 I [RN]
GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y3	HP I/O Bank 71 U	HD I/O Bank 91 O	GTH Quad 231 X0Y28-X0Y31 H [RN]
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70 V	HD I/O Bank 90 N	GTH Quad 230 X0Y24-X0Y27 G [RN]
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69 W	ILKN X1Y0	GTH Quad 229 X0Y20-X0Y23 F [RS]
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y2	HP I/O Bank 68 X	PCIE4 X1Y2	GTH Quad 228 X0Y16-X0Y19 E [RS]
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 F	PCIE4 X1Y1	GTH Quad 227 X0Y12-X0Y15 D [RS]
PS GTR 505	PS MIO 502	HP I/O Bank 66 E	SYSMON Configuration	GTH Quad 226 X0Y8-X0Y11 C [RS] (RCAL)
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	GTH Quad 225 X0Y4-X0Y7 B [RS]
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 D	PCIE4 X1Y0 (tandem)	GTH Quad 224 X0Y0-X0Y3 A [RS]

X15144-071417

Figure 1-34: XCZU17 and XCZU19 Banks in FFVE1924 Package

## XCZU21DR and XQZU21DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66	SYSMON Configuration
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65	Configuration
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84

X19543-101518

Figure 1-35: XCZU21DR and XQZU21DR Banks

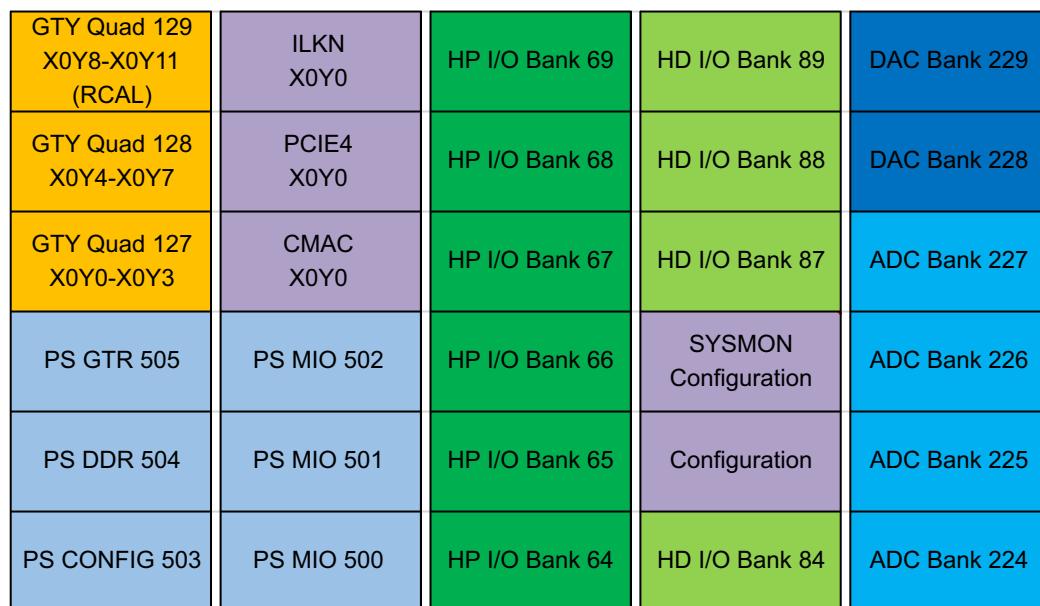
***Bank Diagram by Package for XCZU21DR and XQZU21DR***

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90
GTY Quad 129 X0Y8-X0Y11 B [L1] (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89 P
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68 F	HD I/O Bank 88 O
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67 E	HD I/O Bank 87 N
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66 D	SYSMON Configuration
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65 C	Configuration
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84

X19535-081621

**Figure 1-36: XCZU21DR Banks in FFVD1156 Package and XQZU21DR Banks in FFRD1156 Package**

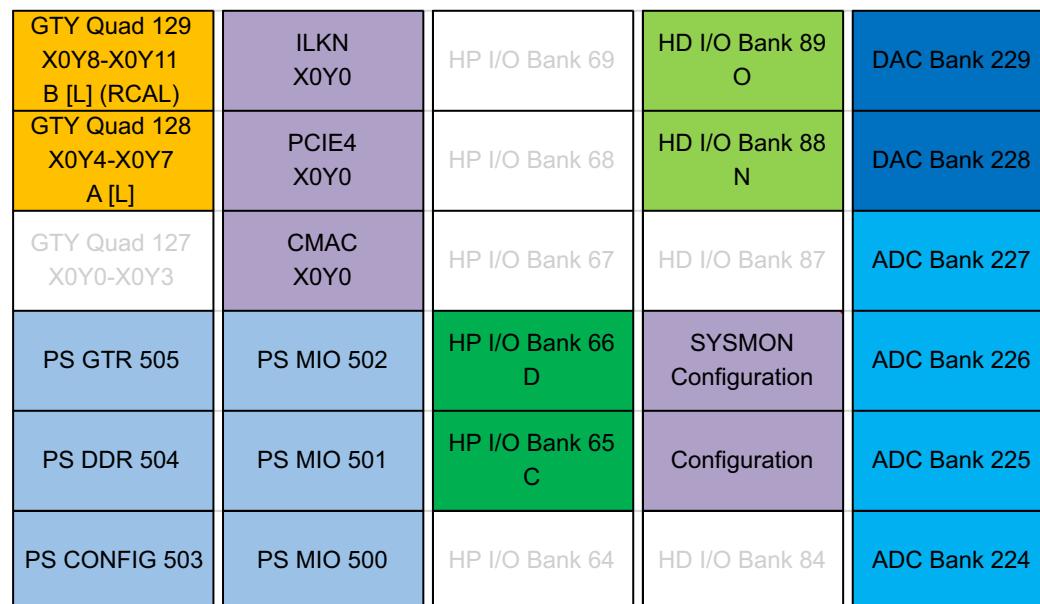
## XCZU25DR Bank Diagram Overview



X19546-042720

Figure 1-37: XCZU25DR Banks

### Bank Diagram by Package for XCZU25DR



X19547-042720

Figure 1-38: XCZU25DR Banks in FFVE1156 and FSVE1156 Packages

GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X19548-040720

*Figure 1-39: XCZU25DR Banks in FFVG1517 and FSVG1517 Packages*

## XCZU27DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X19549-040320

*Figure 1-40: XCZU27DR Banks*

***Bank Diagram by Package for XCZU27DR***

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89 O	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88 N	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X19550-040320

*Figure 1-41: XCZU27DR Banks in FFVE1156 and FSVE1156 Packages*

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X19551-040320

*Figure 1-42: XCZU27DR Banks in FFVG1517 and FSVG1517 Packages*

## XCZU28DR and XQZU28DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X19552-040320

Figure 1-43: XCZU28DR and XQZU28DR Banks

***Bank Diagram by Package for XCZU28DR and XQZU28DR***

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89 O	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88 N	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X19553-042720

***Figure 1-44: XCZU28DR Banks in FFVE1156 and FSVE1156 Packages and XQZU28DR in FFRE1156 Package***

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X19554-042720

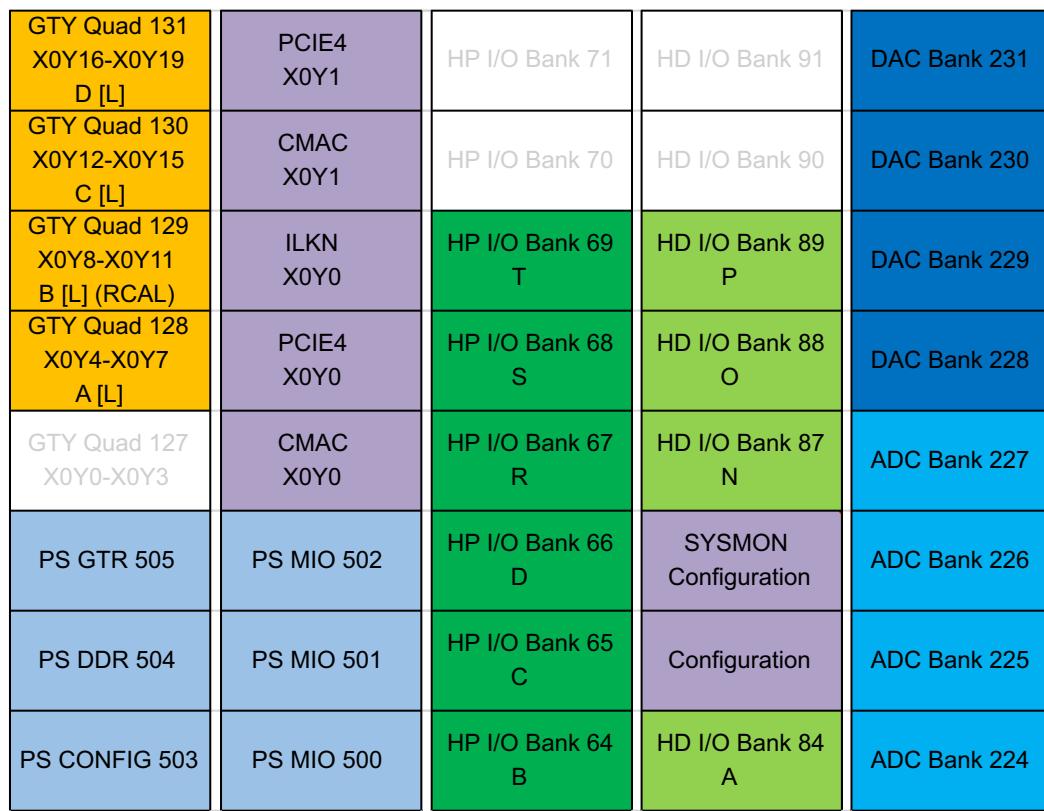
**Figure 1-45: XCZU28DR Banks in FFVG1517 and FSVG1517 Packages and XQZU28DR in FFRG1517 Package**

## XCZU29DR, XQZU29DR, and XCZU39DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X19555-040620

Figure 1-46: XCZU29DR, XQZU29DR, and XCZU39DR Banks

***Bank Diagram by Package for XCZU29DR, XQZU29DR, and XCZU39DR***


X19556-042620

**Figure 1-47: XCZU29DR and XCZU39DR Banks in FFVF1760 and FSVF1760 Packages and XQZU29DR Banks in FFRF1760 Package**

## XCZU42DR Bank Diagram Overview

GTY Quad 128 X0Y4-X0Y7 (RCAL)		HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25704-090221

Figure 1-48: XCZU42DR Banks

### Bank Diagram by Package for XCZU42DR

GTY Quad 128 X0Y4-X0Y7 B [L] (RCAL)		HP I/O Bank 68	HD I/O Bank 88 O	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3 A [L]	CMAC X0Y0	HP I/O Bank 67 N (Partial)		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25705-011422

Figure 1-49: XCZU42DR Banks in FFVE1156 and FSVE1156 Packages

## XCZU43DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23814-042620

Figure 1-50: XCZU43DR Banks

***Bank Diagram by Package for XCZU43DR***

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89 O	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88 N	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23816-122021

*Figure 1-51: XCZU43DR Banks in FFVE1156 and FSVE1156 Packages*

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X23817-042720

*Figure 1-52: XCZU43DR Banks in FFVG1517 and FSVG1517 Packages*

## XCZU46DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23818-042720

*Figure 1-53: XCZU46DR Banks*

***Bank Diagram by Package for XCZU46DR***

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71 S	HD I/O Bank 91 P	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	SD-FEC	HP I/O Bank 70 T	HD I/O Bank 90 O	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69 R	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64 B	HD I/O Bank 84	ADC Bank 224

X23819-081621

*Figure 1-54: XCZU46DR Banks in FFVH1760 and FSVH1760 Packages*

## XCZU47DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23820-04272C

Figure 1-55: XCZU47DR Banks

***Bank Diagram by Package for XCZU47DR***

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89 O	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88 N	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23821-04272C

**Figure 1-56: XCZU47DR Banks in FFVE1156 and FSVE1156 Packages**

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X23822-042720

**Figure 1-57: XCZU47DR Banks in FFVG1517 and FSVG1517 Packages**

## XCZU48DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23823-042720

Figure 1-58: XCZU48DR Banks

### **Bank Diagram by Package for XCZU48DR**

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	FEC	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	FEC	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	FEC	HP I/O Bank 69	HD I/O Bank 89 O	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	FEC	HP I/O Bank 68	HD I/O Bank 88 N	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	FEC	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	FEC	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	FEC	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	FEC	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23824-042720

**Figure 1-59: XCZU48DR Banks in FFVE1156 and FSVE1156 Packages**

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	SD-FEC	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	SD-FEC	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	SD-FEC	HP I/O Bank 69 S	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	SD-FEC	HP I/O Bank 68 R	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	SD-FEC	HP I/O Bank 67 Q	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	SD-FEC	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	SD-FEC	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	SD-FEC	HP I/O Bank 64 B (Partial)	HD I/O Bank 84 A	ADC Bank 224

X23825-042720

**Figure 1-60: XCZU48DR Banks in FFVG1517 and FSVG1517, and XQZU48DR Banks in FSRG1517 Packages**

## XCZU49DR Bank Diagram Overview

GTY Quad 131 X0Y16-X0Y19	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 (RCAL)	ILKN X0Y0	HP I/O Bank 69	HD I/O Bank 89	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7	PCIE4 X0Y0	HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67	HD I/O Bank 87	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64	HD I/O Bank 84	ADC Bank 224

X23826-042720

Figure 1-61: XCZU49DR Banks

***Bank Diagram by Package for XCZU49DR***

GTY Quad 131 X0Y16-X0Y19 D [L]	PCIE4 X0Y1	HP I/O Bank 71	HD I/O Bank 91	DAC Bank 231
GTY Quad 130 X0Y12-X0Y15 C [L]	CMAC X0Y1	HP I/O Bank 70	HD I/O Bank 90	DAC Bank 230
GTY Quad 129 X0Y8-X0Y11 B [L] (RCAL)	ILKN X0Y0	HP I/O Bank 69 T	HD I/O Bank 89 P	DAC Bank 229
GTY Quad 128 X0Y4-X0Y7 A [L]	PCIE4 X0Y0	HP I/O Bank 68 S	HD I/O Bank 88 O	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67 R	HD I/O Bank 87 N	ADC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64 B	HD I/O Bank 84 A	ADC Bank 224

X23815-042720

**Figure 1-62: XCZU49DR Banks in FFVF1760 and FSVF1760, and XQZU49DR Banks in FSRF1760 Packages**

## XCZU65DR Bank Diagram Overview

GTY Quad 128 X0Y4-X0Y7 (RCAL)		HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25706-090221

Figure 1-63: XCZU65DR Banks

### Bank Diagram by Package for XCZU65DR

GTY Quad 128 X0Y4-X0Y7 B [L] (RCAL)		HP I/O Bank 68	HD I/O Bank 88 O	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3 A [L]	CMAC X0Y0	HP I/O Bank 67 N (Partial)		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25707-011322

Figure 1-64: XCZU65DR Banks in FFVE1156 and FSVE1156 Packages

## XCZU67DR Bank Diagram Overview

GTY Quad 128 X0Y4-X0Y7 (RCAL)		HP I/O Bank 68	HD I/O Bank 88	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3	CMAC X0Y0	HP I/O Bank 67		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25708-090221

Figure 1-65: XCZU67DR Banks

### Bank Diagram by Package for XCZU67DR

GTY Quad 128 X0Y4-X0Y7 B [L] (RCAL)		HP I/O Bank 68	HD I/O Bank 88 O	DAC Bank 228
GTY Quad 127 X0Y0-X0Y3 A [L]	CMAC X0Y0	HP I/O Bank 67 N (Partial)		DAC Bank 227
PS GTR 505	PS MIO 502	HP I/O Bank 66 D	SYSMON Configuration	ADC Bank 226
PS DDR 504	PS MIO 501	HP I/O Bank 65 C	Configuration	ADC Bank 225
PS CONFIG 503	PS MIO 500	HP I/O Bank 64		ADC Bank 224

X25709-011322

Figure 1-66: XCZU67DR Banks in FFVE1156 and FSVE1156 Packages

# PS Memory Interface Pin Guidelines

## Introduction to PS Memory Interface Pins

This chapter shows what is needed to support the broad requirements of various memory interfaces using the Zynq® UltraScale+™ device DDR subsystem. It covers DDR3/3L, DDR4, LPDDR4, and LPDDR3.



**IMPORTANT:** SBVA484 and SFVA625 packages only support 32-bit data buses for the PS DDR controller. The Zynq UltraScale+ device DDR subsystem can only be configured for 32-bit or 32-bit plus ECC DDR3/DDR4/LPDDR3 designs when using these packages.

## DDR3/3L Guidelines

### DDR3/3L Pin Rules

The DDR3/3L pin rules are for single and dual-rank memory interfaces.

- All unused DDR pins can be left unconnected. For example, in a 64-bit interface without ECC, the PS\_DDR\_DQ64 to PS\_DDR\_DQ71, PS\_DDR\_DQS\_P8/N8, and PS\_DDR\_DM8 pins can be left unconnected.
- Connect the PS\_DDR\_ZQ pin to GND using a  $240\Omega$  resistor. There should be separate  $240\Omega$  resistors at the MPSoC or RFSoC and at the DRAM.

### DDR3/3L Pin Swapping Restrictions

- Address/command/control bits cannot be swapped.
- DQ byte lane swapping is allowed. A byte lane includes any signals associated with the aligned 8-bits of DQ, such as DM, DQS, DQS\_N, and DQ signals.
- DQ bits swapping within a byte lane is allowed.

## DDR3/3L Pinout Example for Supported Configurations

**Table 2-1** shows a pinout example for the DDR3/3L supported configurations. For termination details, see the *UltraScale Architecture PCB Design Guide* [Ref 14]. When not being used for a memory interface, all pins should be left unconnected with the exception of VCCO\_PSDDR and VCC\_PSDDR\_PLL, which should be tied to GND.



**IMPORTANT:** *VCC\_PSINTFP must be tied to VCC\_PSINTFP\_DDR. This requirement is in Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics [Ref 8] and Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics [Ref 9], where both VCC\_PSINTFP and VCC\_PSINTFP\_DDR must be connected to the same supply and thus both must be powered to avoid MBIST failure.*

Table 2-1: DDR3/3L Supported Pinout Configurations

Pin Name	DDR3/3L 64-bit 1Rank	DDR3/3L 64-bit 2Rank	DDR3/3L 32-bit 1Rank	DDR3/3L 32-bit 2Rank
VCCO_PSDDR <sup>(1)</sup>	Set to 1.5V (1.35V for DDR3L)			
PS_DDR_A0 to PS_DDR_A15	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on.
PS_DDR_A16	WE#	WE#	WE#	WE#
PS_DDR_A17	CAS#	CAS#	CAS#	CAS#
PS_DDR_ACT_N	RAS#	RAS#	RAS#	RAS#
PS_DDR_ALERT_N	Can be left unconnected.			
PS_DDR_BA0	BA[0]	BA[0]	BA[0]	BA[0]
PS_DDR_BA1	BA[1]	BA[1]	BA[1]	BA[1]
PS_DDR_BG0	BA[2]	BA[2]	BA[2]	BA[2]
PS_DDR_BG1	Can be left unconnected.			
PS_DDR_CK_N0	CK#	CK#[0]	CK#	CK#[0]
PS_DDR_CK_N1	Can be left unconnected.	CK#[1]	Can be left unconnected.	CK#[1]
PS_DDR_CK0	CK.	CK[0]	CK.	CK[0]
PS_DDR_CK1	Can be left unconnected.	CK[1]	Can be left unconnected.	CK[1]
PS_DDR_CKE0	CKE	CKE[0]	CKE	CKE[0]
PS_DDR_CKE1	Can be left unconnected.	CKE[1]	Can be left unconnected.	CKE[1]
PS_DDR_CS_N0	CS#	CS#[0]	CS#	CS#[0]

Table 2-1: DDR3/3L Supported Pinout Configurations (Cont'd)

Pin Name	DDR3/3L 64-bit 1Rank	DDR3/3L 64-bit 2Rank	DDR3/3L 32-bit 1Rank	DDR3/3L 32-bit 2Rank
PS_DDR_CS_N1	Can be left unconnected.	CS#[1]	Can be left unconnected.	CS#[1]
PS_DDR_DM0 to PS_DDR_DM3	Connect DM0 to PS_DDR_DM0, DM1 to PS_DDR_DM1, and so on.	Connect DM0 to PS_DDR_DM0, DM1 to PS_DDR_DM1, and so on.	Connect DM0 to PS_DDR_DM0, DM1 to PS_DDR_DM1, and so on.	Connect DM0 to PS_DDR_DM0, DM1 to PS_DDR_DM1, and so on.
PS_DDR_DM4 to PS_DDR_DM7	Connect DM4 to PS_DDR_DM4, DM5 to PS_DDR_DM5, and so on.	Connect DM4 to PS_DDR_DM4, DM5 to PS_DDR_DM5, and so on.	Can be left unconnected.	Can be left unconnected.
PS_DDR_DM8	DM8, can be left unconnected without ECC.	DM8, can be left unconnected without ECC.	DM4, can be left unconnected without ECC.	DM4, can be left unconnected without ECC.
PS_DDR_DQ0 to PS_DDR_DQ31	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.
PS_DDR_DQ32 to PS_DDR_DQ63	Connect DQ32 to PS_DDR_DQ32, DQ33 to PS_DDR_DQ33, and so on.	Connect DQ32 to PS_DDR_DQ32, DQ33 to PS_DDR_DQ33, and so on.	Can be left unconnected.	Can be left unconnected.
PS_DDR_DQ64	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.
PS_DDR_DQ65	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.
PS_DDR_DQ66	ECC_bit[2], can be left unconnected without ECC.	ECC_bit[2], can be left unconnected without ECC.	ECC_bit[2], can be left unconnected without ECC.	ECC_bit[2], can be left unconnected without ECC.
PS_DDR_DQ67	ECC_bit[3], can be left unconnected without ECC.	ECC_bit[3], can be left unconnected without ECC.	ECC_bit[3], can be left unconnected without ECC.	ECC_bit[3], can be left unconnected without ECC.
PS_DDR_DQ68	ECC_bit[4], can be left unconnected without ECC.	ECC_bit[4], can be left unconnected without ECC.	ECC_bit[4], can be left unconnected without ECC.	ECC_bit[4], can be left unconnected without ECC.
PS_DDR_DQ69	ECC_bit[5], can be left unconnected without ECC.	ECC_bit[5], can be left unconnected without ECC.	ECC_bit[5], can be left unconnected without ECC.	ECC_bit[5], can be left unconnected without ECC.
PS_DDR_DQ70	ECC_bit[6], can be left unconnected without ECC.	ECC_bit[6], can be left unconnected without ECC.	ECC_bit[6], can be left unconnected without ECC.	ECC_bit[6], can be left unconnected without ECC.

Table 2-1: DDR3/3L Supported Pinout Configurations (Cont'd)

Pin Name	DDR3/3L 64-bit 1Rank	DDR3/3L 64-bit 2Rank	DDR3/3L 32-bit 1Rank	DDR3/3L 32-bit 2Rank
PS_DDR_DQ71	ECC_bit[7], can be left unconnected without ECC.			
PS_DDR_DQS_N0 to PS_DDR_DQS_N3	Connect DQS#0 to PS_DDR_DQS_N0, DQS#1 to PS_DDR_DQS_N1, and so on.	Connect DQS#0 to PS_DDR_DQS_N0, DQS#1 to PS_DDR_DQS_N1, and so on.	Connect DQS#0 to PS_DDR_DQS_N0, DQS#1 to PS_DDR_DQS_N1, and so on.	Connect DQS#0 to PS_DDR_DQS_N0, DQS#1 to PS_DDR_DQS_N1, and so on.
PS_DDR_DQS_N4 to PS_DDR_DQS_N7	Connect DQS#4 to PS_DDR_DQS_N4, DQS#5 to PS_DDR_DQS_N5, and so on.	Connect DQS#4 to PS_DDR_DQS_N4, DQS#5 to PS_DDR_DQS_N5, and so on.	Can be left unconnected.	Can be left unconnected.
PS_DDR_DQS_N8	DQS#8, can be left unconnected without ECC.	DQS#8, can be left unconnected without ECC.	DQS#4, can be left unconnected without ECC.	DQS#4, can be left unconnected without ECC.
PS_DDR_DQS_P0 to PS_DDR_DQS_P3	Connect DQS0 to PS_DDR_DQS_P0, DQS1 to PS_DDR_DQS_P1, and so on.	Connect DQS0 to PS_DDR_DQS_P0, DQS1 to PS_DDR_DQS_P1, and so on.	Connect DQS0 to PS_DDR_DQS_P0, DQS1 to PS_DDR_DQS_P1, and so on.	Connect DQS0 to PS_DDR_DQS_P0, DQS1 to PS_DDR_DQS_P1, and so on.
PS_DDR_DQS_P4 to PS_DDR_DQS_P7	Connect DQS4 to PS_DDR_DQS_P4, DQS5 to PS_DDR_DQS_P5, and so on.	Connect DQS4 to PS_DDR_DQS_P4, DQS5 to PS_DDR_DQS_P5, and so on.	Can be left unconnected.	Can be left unconnected.
PS_DDR_DQS_P8	DQS8, can be left unconnected without ECC.	DQS8, can be left unconnected without ECC.	DQS4, can be left unconnected without ECC.	DQS4, can be left unconnected without ECC.
PS_DDR_ODT0	ODT	ODT[0]	ODT	ODT[0]
PS_DDR_ODT1	Can be left unconnected.	ODT[1]	Can be left unconnected.	ODT[1]
PS_DDR_PARITY	Par_In for RDIMMs. Can be left unconnected for components and UDIMMs.	Par_In for RDIMMs. Can be left unconnected for components and UDIMMs.	Par_In for RDIMMs. Can be left unconnected for components and UDIMMs.	Par_In for RDIMMs. Can be left unconnected for components and UDIMMs.
PS_DDR_RAM_RST_N	RESET#	RESET#	RESET#	RESET#
PS_DDR_ZQ	Connect a 240Ω resistor to GND. <sup>(2)</sup>			

**Notes:**

1. For VCCO\_PSDDR decoupling guidelines, see the *UltraScale Architecture PCB Design Guide* [Ref 14].
2. There should be separate 240Ω resistors at the FPGA and at the DRAM.

# DDR4 Guidelines

## ***DDR4 Pin Rules***

The DDR4 pin rules are for single and dual-rank memory interfaces.

- All unused DDR pins can be left unconnected. For example, in a 64-bit interface without ECC, the PS\_DDR\_DQ64 to PS\_DDR\_DQ71, PS\_DDR\_DQS\_P8/N8, and PS\_DDR\_DM8 pins can be left unconnected.
- The PS\_DDR\_ALERT\_N can be left floating at the DRAM. For component interfaces, connect the PS\_DDR\_ALERT\_N pin to the ALERT\_N pins of the DDR4 devices in fly-by routing, and terminate to V<sub>DD</sub> with a 50Ω pull-up resistor. For DIMM designs, connect the PS\_DDR\_ALERT\_N pin to the ALERT\_N pin of the connector.
- Connect the PS\_DDR\_ZQ pin to GND using a 240Ω resistor. There should be separate 240Ω resistors at the FPGA and at the DRAM.
- Component interfaces with the same component for all components in the interface. The x16 components have a different number of bank groups than the x8 components. For example, create a 72-bit wide component interface by using nine x8 components or five x16 components, where half of one component is not used. Creating four x16 components and one x8 component is not permissible.

## ***DDR4 Pin Swapping Restrictions***

- Address/command/control bits cannot be swapped.
- DQ byte lane swapping is allowed. A byte lane includes any signals associated with the aligned 8-bits of DQ, such as DM, DQS, DQS\_N, and DQ signals.
- DQ bits swapping within a byte lane is allowed.

## DDR4 Pinout Example for Supported Configurations

Table 2-2 shows a pinout example for the DDR4 supported configurations. For termination details, see the *UltraScale Architecture PCB Design Guide* [Ref 14]. When not being used for a memory interface, all pins should be left unconnected with the exception of VCCO\_PSDDR and VCC\_PSDDR\_PLL, which should be tied to GND.



**IMPORTANT:** VCC\_PSINTFP must be tied to VCC\_PSINTFP\_DDR. This requirement is in Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics [Ref 8] and Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics [Ref 9], where both VCC\_PSINTFP and VCC\_PSINTFP\_DDR must be connected to the same supply and thus both must be powered to avoid MBIST failure.

Table 2-2: DDR4 Supported Pinout Configurations

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
VCCO_PSDDR <sup>(1)</sup>	Set to 1.2V.					
PS_DDR_A0 to PS_DDR_A16	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.	Connect A0 to PS_DDR_A0, A1 to PS_DDR_A1, and so on. WE_N can be shared with PS_DDR_A14, CAS_N can be shared with PS_DDR_A15, and RAS_N can be shared with PS_DDR_A16.
PS_DDR_A17	Can be left unconnected					
PS_DDR_ACT_N	ACT_n	ACT_n	ACT_n	ACT_n	ACT_n	ACT_n
PS_DDR_ALERT_N	ALERT_n	ALERT_n	ALERT_n	ALERT_n	ALERT_n	ALERT_n
PS_DDR_BA0	BA[0]	BA[0]	BA[0]	BA[0]	BA[0]	BA[0]
PS_DDR_BA1	BA[1]	BA[1]	BA[1]	BA[1]	BA[1]	BA[1]
PS_DDR_BG0	BG[0]	BG[0]	BG[0]	BG[0]	BG[0]	BG[0]

Table 2-2: DDR4 Supported Pinout Configurations (Cont'd)

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
PS_DDR_BG1 <sup>(2)</sup>	BG[1]	BG[1]	BG[1]	BG[1]	BG[1]	BG[1]
PS_DDR_CK_N0	CK_c[0]	CK_c[0]	CK_c[0]	CK_c[0]	CK_c[0]	CK_c[0]
PS_DDR_CK_N1	Can be left unconnected.	CK_c[1]	Can be left unconnected.	CK_c[1]	Can be left unconnected.	CK_c[1]
PS_DDR_CK0	CK_t[0]	CK_t[0]	CK_t[0]	CK_t[0]	CK_t[0]	CK_t[0]
PS_DDR_CK1	Can be left unconnected.	CK_t[1]	Can be left unconnected.	CK_t[1]	Can be left unconnected.	CK_t[1]
PS_DDR_CKE0	CKE	CKE[0]	CKE	CKE[0]	CKE	CKE[0]
PS_DDR_CKE1	Can be left unconnected.	CKE[1]	Can be left unconnected.	CKE[1]	Can be left unconnected.	CKE[1]
PS_DDR_CS_N0	CS_n	CS_n[0]	CS_n	CS_n[0]	CS_n	CS_n[0]
PS_DDR_CS_N1	Can be left unconnected.	CS_n[1]	Can be left unconnected.	CS_n[1]	Can be left unconnected.	CS_n[1]
PS_DDR_DM0 to PS_DDR_DM1	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.	Connect DM_n[0]/DBI_n[0] to PS_DDR_DM0, DM_n[1]/DBI_n[1] to PS_DDR_DM1, and so on.
PS_DDR_DM2 to PS_DDR_DM3	Connect DM_n[2]/DBI_n[2] to PS_DDR_DM2, DM_n[3]/DBI_n[3] to PS_DDR_DM3, and so on.	Connect DM_n[2]/DBI_n[2] to PS_DDR_DM2, DM_n[3]/DBI_n[3] to PS_DDR_DM3, and so on.	Connect DM_n[2]/DBI_n[2] to PS_DDR_DM2, DM_n[3]/DBI_n[3] to PS_DDR_DM3, and so on.	Connect DM_n[2]/DBI_n[2] to PS_DDR_DM2, DM_n[3]/DBI_n[3] to PS_DDR_DM3, and so on.	Can be left unconnected.	Can be left unconnected.

Table 2-2: DDR4 Supported Pinout Configurations (Cont'd)

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
PS_DDR_DM4 to PS_DDR_DM7	Connect DM_n[4]/DBI_n[4] to PS_DDR_DM4, DM_n[5]/DBI_n[5] to PS_DDR_DM5, and so on.	Connect DM_n[4]/DBI_n[4] to PS_DDR_DM4, DM_n[5]/DBI_n[5] to PS_DDR_DM5, and so on.	Can be left unconnected.			
PS_DDR_DM8	DM_n[8]/DBI_n[8], can be left unconnected without ECC.	DM_n[8]/DBI_n[8], can be left unconnected without ECC.	DM_n[4]/DBI_n[4], can be left unconnected without ECC.	DM_n[4]/DBI_n[4], can be left unconnected without ECC.	DM_n[2]/DBI_n[2], can be left unconnected without ECC.	DM_n[2]/DBI_n[2], can be left unconnected without ECC.
PS_DDR_DQ0 to PS_DDR_DQ15	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.	Connect DQ0 to PS_DDR_DQ0, DQ1 to PS_DDR_DQ1, and so on.
PS_DDR_DQ16 to PS_DDR_DQ31	Connect DQ16 to PS_DDR_DQ16, DQ17 to PS_DDR_DQ17, and so on.	Connect DQ16 to PS_DDR_DQ16, DQ17 to PS_DDR_DQ17, and so on.	Connect DQ16 to PS_DDR_DQ16, DQ17 to PS_DDR_DQ17, and so on.	Connect DQ16 to PS_DDR_DQ16, DQ17 to PS_DDR_DQ17, and so on.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ15.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ15.
PS_DDR_DQ32 to PS_DDR_DQ63	Connect DQ32 to PS_DDR_DQ32, DQ33 to PS_DDR_DQ33, and so on.	Connect DQ32 to PS_DDR_DQ32, DQ33 to PS_DDR_DQ33, and so on.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ31.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ31.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ31.	Can be left unconnected. Do not swap with PS_DDR_DQ0 to PS_DDR_DQ31.
PS_DDR_DQ64	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.	ECC_bit[0], can be left unconnected without ECC.
PS_DDR_DQ65	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.	ECC_bit[1], can be left unconnected without ECC.

Table 2-2: DDR4 Supported Pinout Configurations (Cont'd)

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
PS_DDR_DQ66	ECC_bit[2], can be left unconnected without ECC.					
PS_DDR_DQ67	ECC_bit[3], can be left unconnected without ECC.					
PS_DDR_DQ68	ECC_bit[4], can be left unconnected without ECC.					
PS_DDR_DQ69	ECC_bit[5], can be left unconnected without ECC.					
PS_DDR_DQ70	ECC_bit[6], can be left unconnected without ECC.					
PS_DDR_DQ71	ECC_bit[7], can be left unconnected without ECC.					
PS_DDR_DQS_N0 to PS_DDR_DQS_N1	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.	Connect DQS_c0 to PS_DDR_DQS_N0, DQS_c1 to PS_DDR_DQS_N1, and so on.
PS_DDR_DQS_N2 to PS_DDR_DQS_N3	Connect DQS_c2 to PS_DDR_DQS_N2, DQS_c3 to PS_DDR_DQS_N3, and so on.	Connect DQS_c2 to PS_DDR_DQS_N2, DQS_c3 to PS_DDR_DQS_N3, and so on.	Connect DQS_c2 to PS_DDR_DQS_N2, DQS_c3 to PS_DDR_DQS_N3, and so on.	Connect DQS_c2 to PS_DDR_DQS_N2, DQS_c3 to PS_DDR_DQS_N3, and so on.	Can be left unconnected.	Can be left unconnected.

Table 2-2: DDR4 Supported Pinout Configurations (Cont'd)

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
PS_DDR_DQS_N4 to PS_DDR_DQS_N7	Connect DQS_c4 to PS_DDR_DQS_N4, DQS_c5 to PS_DDR_DQS_N5, and so on.	Connect DQS_c4 to PS_DDR_DQS_N4, DQS_c5 to PS_DDR_DQS_N5, and so on.	Can be left unconnected.			
PS_DDR_DQS_N8	DQS_c8, can be left unconnected without ECC.	DQS_c8, can be left unconnected without ECC.	DQS_c4, can be left unconnected without ECC.	DQS_c4, can be left unconnected without ECC.	DQS_c2, can be left unconnected without ECC.	DQS_c2, can be left unconnected without ECC.
PS_DDR_DQS_P0 to PS_DDR_DQS_P1	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.	Connect DQS_t0 to PS_DDR_DQS_P0, DQS_t1 to PS_DDR_DQS_P1, and so on.
PS_DDR_DQS_P2 to PS_DDR_DQS_P3	Connect DQS_t2 to PS_DDR_DQS_P2, DQS_t3 to PS_DDR_DQS_P3, and so on.	Connect DQS_t2 to PS_DDR_DQS_P2, DQS_t3 to PS_DDR_DQS_P3, and so on.	Connect DQS_t2 to PS_DDR_DQS_P2, DQS_t3 to PS_DDR_DQS_P3, and so on.	Connect DQS_t2 to PS_DDR_DQS_P2, DQS_t3 to PS_DDR_DQS_P3, and so on.	Can be left unconnected.	Can be left unconnected.
PS_DDR_DQS_P4 to PS_DDR_DQS_P7	Connect DQS_t4 to PS_DDR_DQS_P4, DQS_t5 to PS_DDR_DQS_P5, and so on.	Connect DQS_t4 to PS_DDR_DQS_P4, DQS_t5 to PS_DDR_DQS_P5, and so on.	Can be left unconnected.			
PS_DDR_DQS_P8	DQS_t8, can be left unconnected without ECC.	DQS_t8, can be left unconnected without ECC.	DQS_t4, can be left unconnected without ECC.	DQS_t4, can be left unconnected without ECC.	DQS_t2, can be left unconnected without ECC.	DQS_t2, can be left unconnected without ECC.
PS_DDR_ODT0	ODT	ODT[0]	ODT	ODT[0]	ODT	ODT[0]
PS_DDR_ODT1	Can be left unconnected.	ODT[1]	Can be left unconnected.	ODT[1]	Can be left unconnected.	ODT[1]
PS_DDR_PARITY	PAR	PAR	PAR	PAR	PAR	PAR
PS_DDR_RAM_RST_N	RESET_n	RESET_n	RESET_n	RESET_n	RESET_n	RESET_n

Table 2-2: DDR4 Supported Pinout Configurations (Cont'd)

Pin Name	DDR4 64-bit 1Rank	DDR4 64-bit 2Rank	DDR4 32-bit 1Rank	DDR4 32-bit 2Rank	DDR4 16-bit 1Rank	DDR4 16-bit 2Rank
PS_DDR_ZQ	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VSSQ through a 240Ω resistor.

**Notes:**

1. For VCCO\_PSDDR decoupling guidelines, see the *UltraScale Architecture PCB Design Guide* [Ref 14].
2. The PS\_DDR\_BG1 pin can be left unconnected when targeting x16 component interfaces without a BG1 pin, but it should always be connected for DIMM applications.

# LPDDR4 Guidelines

## ***LPDDR4 Pin Rules***

The LPDDR4 pin rules are for single and dual-rank memory interfaces.

- All unused DDR pins can be left unconnected. For example, in an 64-bit interface without ECC, the PS\_DDR\_DQ64 to PS\_DDR\_DQ71, PS\_DDR\_DQS\_P8/N8, and PS\_DDR\_DM8 pins can be left unconnected.
- Connect the PS\_DDR\_ZQ pin to GND using a  $240\Omega$  resistor. There should be separate  $240\Omega$  resistors at the FPGA and at the DRAM.
- To achieve maximum performance, address copy mode is suggested.

## ***LPDDR4 Pin Swapping Restrictions***

- Command/address bits cannot be swapped.
- To support write DQS to DQ training, DQ byte lane swapping is not allowed.
- To support write DQS to DQ training, DQ bits with bytes 0, 2, and 8 are not allowed to be swapped.
- Bits within bytes 1 and 3 can be swapped.

## ***LPDDR4 Pinout Example for Supported Configurations***

Table 2-3 shows a pinout example for the LPDDR4 supported configurations. For termination details, see the *UltraScale Architecture PCB Design Guide* [Ref 14]. When not being used for a memory interface, all pins should be left unconnected with the exception of VCCO\_PSDDR and VCC\_PSDDR\_PLL, which should be tied to GND.



**IMPORTANT:** *VCC\_PSINTFP must be tied to VCC\_PSINTFP\_DDR. This requirement is in Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics [Ref 8] and Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics [Ref 9], where both VCC\_PSINTFP and VCC\_PSINTFP\_DDR must be connected to the same supply and thus both must be powered to avoid MBIST failure.*

Table 2-3: LPDDR4 Supported Pinout Configurations

Pin Name	LPDDR4 32-bit 1Rank	LPDDR4 32-bit 1Rank ECC	LPDDR4 32-bit 2Rank	LPDDR4 32-bit 2Rank ECC
VCCO_PSDDR <sup>(1)</sup>	Set to 1.1V	Set to 1.1V	Set to 1.1V	Set to 1.1V
PS_DDR_A0	CA0_A	CA0_A	CA0_A	CA0_A
PS_DDR_A1	CA1_A	CA1_A	CA1_A	CA1_A
PS_DDR_A2	CA2_A	CA2_A	CA2_A	CA2_A

Table 2-3: LPDDR4 Supported Pinout Configurations (Cont'd)

Pin Name	LPDDR4 32-bit 1Rank	LPDDR4 32-bit 1Rank ECC	LPDDR4 32-bit 2Rank	LPDDR4 32-bit 2Rank ECC
PS_DDR_A3	CA3_A	CA3_A	CA3_A	CA3_A
PS_DDR_A4	CA4_A	CA4_A	CA4_A	CA4_A
PS_DDR_A5	CA5_A	CA5_A	CA5_A	CA5_A
PS_DDR_A6 to PS_DDR_A9	Can be left unconnected.			
PS_DDR_A10	CA0_B	CA0_B	CA0_B	CA0_B
PS_DDR_A11	CA1_B	CA1_B	CA1_B	CA1_B
PS_DDR_A12	CA2_B	CA2_B	CA2_B	CA2_B
PS_DDR_A13	CA3_B	CA3_B	CA3_B	CA3_B
PS_DDR_A14	CA4_B	CA4_B	CA4_B	CA4_B
PS_DDR_A15	CA5_B	CA5_B	CA5_B	CA5_B
PS_DDR_A16	Can be left unconnected.			
PS_DDR_A17	Can be left unconnected.			
PS_DDR_ACT_N	Can be left unconnected.			
PS_DDR_ALERT_N	Can be left unconnected.			
PS_DDR_BA0	Can be left unconnected.			
PS_DDR_BA1	Can be left unconnected.			
PS_DDR_BG0	Can be left unconnected.			
PS_DDR_BG1	Can be left unconnected.			
PS_DDR_CK_N0	CK_c_A	CK_c_A	CK_c_A	CK_c_A
PS_DDR_CK_N1	CK_c_B	CK_c_B	CK_c_B	CK_c_B
PS_DDR_CK0	CK_t_A	CK_t_A	CK_t_A	CK_t_A
PS_DDR_CK1	CK_t_B	CK_t_B	CK_t_B	CK_t_B
PS_DDR_CKE0	CKE_A and CKE_B	CKE_A	CKE0_A and CKE0_B	CKE0_A
PS_DDR_CKE1	Can be left unconnected.	Can be left unconnected.	CKE1_A and CKE1_B	CKE1_A
PS_DDR_CS_N0	CS_A and CS_B	CS_A	CS0_A and CS0_B	CS0_A
PS_DDR_CS_N1	Can be left unconnected.	Can be left unconnected.	CS1_A and CS1_B	CS1_A
PS_DDR_DM0	DMI0_A	DMI0_A	DMI0_A	DMI0_A

Table 2-3: LPDDR4 Supported Pinout Configurations (Cont'd)

Pin Name	LPDDR4 32-bit 1Rank	LPDDR4 32-bit 1Rank ECC	LPDDR4 32-bit 2Rank	LPDDR4 32-bit 2Rank ECC
PS_DDR_DM1	DMI1_A	DMI1_A	DMI1_A	DMI1_A
PS_DDR_DM2	DMI0_B	DMI0_B	DMI0_B	DMI0_B
PS_DDR_DM3	DMI1_B	DMI1_B	DMI1_B	DMI1_B
PS_DDR_DM4 to PS_DDR_DM7	Can be left unconnected.			
PS_DDR_DM8	Can be left unconnected.	DMI_ECC	Can be left unconnected.	DMI_ECC
PS_DDR_DQ0 to PS_DDR_DQ15	Connect DQ0_A to PS_DDR_DQ0, DQ1_A to PS_DDR_DQ1, and so on.	Connect DQ0_A to PS_DDR_DQ0, DQ1_A to PS_DDR_DQ1, and so on.	Connect DQ0_A to PS_DDR_DQ0, DQ1_A to PS_DDR_DQ1, and so on.	Connect DQ0_A to PS_DDR_DQ0, DQ1_A to PS_DDR_DQ1, and so on.
PS_DDR_DQ16 to PS_DDR_DQ31	Connect DQ0_B to PS_DDR_DQ16, DQ1_B to PS_DDR_DQ17, and so on.	Connect DQ0_B to PS_DDR_DQ16, DQ1_B to PS_DDR_DQ17, and so on.	Connect DQ0_B to PS_DDR_DQ16, DQ1_B to PS_DDR_DQ17, and so on.	Connect DQ0_B to PS_DDR_DQ16, DQ1_B to PS_DDR_DQ17, and so on.
PS_DDR_DQ32 to PS_DDR_DQ63	Can be left unconnected.			
PS_DDR_DQ64	Can be left unconnected.	DQ_ECC0 (ECC_bit[0])	Can be left unconnected.	DQ_ECC0 (ECC_bit[0])
PS_DDR_DQ65	Can be left unconnected.	DQ_ECC1 (ECC_bit[1])	Can be left unconnected.	DQ_ECC1 (ECC_bit[1])
PS_DDR_DQ66	Can be left unconnected.	DQ_ECC2 (ECC_bit[2])	Can be left unconnected.	DQ_ECC2 (ECC_bit[2])
PS_DDR_DQ67	Can be left unconnected.	DQ_ECC3 (ECC_bit[3])	Can be left unconnected.	DQ_ECC3 (ECC_bit[3])
PS_DDR_DQ68	Can be left unconnected.	DQ_ECC4 (ECC_bit[4])	Can be left unconnected.	DQ_ECC4 (ECC_bit[4])
PS_DDR_DQ69	Can be left unconnected.	DQ_ECC5 (ECC_bit[5])	Can be left unconnected.	DQ_ECC5 (ECC_bit[5])
PS_DDR_DQ70	Can be left unconnected.	DQ_ECC6 (ECC_bit[6])	Can be left unconnected.	DQ_ECC6 (ECC_bit[6])
PS_DDR_DQ71	Can be left unconnected.	DQ_ECC7 (ECC_bit[7])	Can be left unconnected.	DQ_ECC7 (ECC_bit[7])
PS_DDR_DQS_N0	DQS0_c_A	DQS0_c_A	DQS0_c_A	DQS0_c_A
PS_DDR_DQS_N1	DQS1_c_A	DQS1_c_A	DQS1_c_A	DQS1_c_A
PS_DDR_DQS_N2	DQS0_c_B	DQS0_c_B	DQS0_c_B	DQS0_c_B
PS_DDR_DQS_N3	DQS1_c_B	DQS1_c_B	DQS1_c_B	DQS1_c_B
PS_DDR_DQS_N4 to PS_DDR_DQS_N7	Can be left unconnected.			

Table 2-3: LPDDR4 Supported Pinout Configurations (Cont'd)

Pin Name	LPDDR4 32-bit 1Rank	LPDDR4 32-bit 1Rank ECC	LPDDR4 32-bit 2Rank	LPDDR4 32-bit 2Rank ECC
PS_DDR_DQS_N8	Can be left unconnected.	DQS_c_ECC	Can be left unconnected.	DQS_c_ECC
PS_DDR_DQS_P0	DQS0_t_A	DQS0_t_A	DQS0_t_A	DQS0_t_A
PS_DDR_DQS_P1	DQS1_t_A	DQS1_t_A	DQS1_t_A	DQS1_t_A
PS_DDR_DQS_P2	DQS0_t_B	DQS0_t_B	DQS0_t_B	DQS0_t_B
PS_DDR_DQS_P3	DQS1_t_B	DQS1_t_B	DQS1_t_B	DQS1_t_B
PS_DDR_DQS_P4 to PS_DDR_DQS_P7	Can be left unconnected.			
PS_DDR_DQS_P8	Can be left unconnected.	DQS_t_ECC	Can be left unconnected.	DQS_t_ECC
PS_DDR_ODT0	Unconnected at FPGA.	Unconnected at FPGA.	Unconnected at FPGA.	Unconnected at FPGA.
PS_DDR_ODT1	Can be left unconnected.			
PS_DDR_PARITY	Can be left unconnected.			
PS_DDR_RAM_RST_N	RESET_n	RESET_n	RESET_n	RESET_n
PS_DDR_ZQ	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VDDQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VDDQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VDDQ through a 240Ω resistor.	Connect to GND through a 240Ω resistor. Connect DRAM ZQ pins to VDDQ through a 240Ω resistor.

**Notes:**

- For VCCO\_PSDDR decoupling guidelines, see the *UltraScale Architecture PCB Design Guide* [Ref 14].

# LPDDR3 Guidelines

## ***LPDDR3 Pin Rules***

The LPDDR3 pin rules are for single and dual-rank memory interfaces.

- All unused DDR pins can be left unconnected. For example, in an 64-bit interface without ECC, the PS\_DDR\_DQ64 to PS\_DDR\_DQ71, PS\_DDR\_DQS\_P8/N8, and PS\_DDR\_DM8 pins can be left unconnected.
- Connect the PS\_DDR\_ZQ pin to GND using a  $240\Omega$  resistor. There should be separate  $240\Omega$  resistors at the FPGA and at the DRAM.
- To achieve maximum performance, address copy mode is suggested.

## ***LPDDR3 Pin Swapping Restrictions***

- Command/address bits cannot be swapped.
- To support command/address training, DQ byte lane swapping is not allowed.
- To support command/address training, DQ bits swapping within a byte lane is not allowed.

## ***LPDDR3 Pinout Example for Supported Configurations***

Table 2-4 shows a pinout example for the LPDDR3 supported configurations. For termination details, see the *UltraScale Architecture PCB Design Guide* [Ref 14]. When not being used for a memory interface, all pins should be left unconnected with the exception of VCCO\_PSDDR and VCC\_PSDDR\_PLL, which should be tied to GND.



**IMPORTANT:** *VCC\_PSINTFP must be tied to VCC\_PSINTFP\_DDR. This requirement is in Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics [Ref 8] and Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics [Ref 9], where both VCC\_PSINTFP and VCC\_PSINTFP\_DDR must be connected to the same supply and thus both must be powered to avoid MBIST failure.*

Table 2-4: LPDDR3 Supported Pinout Configurations)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
VCCO_PSDDR <sup>(1)</sup>	Set to 1.2V	Set to 1.2V	Set to 1.2V
PS_DDR_A0	CA0_A	CA0_A	CA0
PS_DDR_A1	CA1_A	CA1_A	CA1
PS_DDR_A2	CA2_A	CA2_A	CA2
PS_DDR_A3	CA3_A	CA3_A	CA3

Table 2-4: LPDDR3 Supported Pinout Configurations) (Cont'd)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
PS_DDR_A4	CA4_A	CA4_A	CA4
PS_DDR_A5	CA5_A	CA5_A	CA5
PS_DDR_A6	CA6_A	CA6_A	CA6
PS_DDR_A7	CA7_A	CA7_A	CA7
PS_DDR_A8	CA8_A	CA8_A	CA8
PS_DDR_A9	CA9_A	CA9_A	CA9
PS_DDR_A10	CA0_B	CA0_B	Can be left unconnected.
PS_DDR_A11	CA1_B	CA1_B	Can be left unconnected.
PS_DDR_A12	CA2_B	CA2_B	Can be left unconnected.
PS_DDR_A13	CA3_B	CA3_B	Can be left unconnected.
PS_DDR_A14	CA4_B	CA4_B	Can be left unconnected.
PS_DDR_A15	CA5_B	CA5_B	Can be left unconnected.
PS_DDR_A16	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_A17	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_ACT_N	CA9_B	CA9_B	Can be left unconnected.
PS_DDR_ALERT_N	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_BA0	CA6_B	CA6_B	Can be left unconnected.
PS_DDR_BA1	CA7_B	CA7_B	Can be left unconnected.
PS_DDR_BG0	CA8_B	CA8_B	Can be left unconnected.
PS_DDR_BG1	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_CK_N0	CK_c_A	CK_c_A	CK_c
PS_DDR_CK_N1	CK_c_B	CK_c_B	Can be left unconnected.
PS_DDR_CK0	CK_t_A	CK_t_A	CK_t
PS_DDR_CK1	CK_t_B	CK_t_B	Can be left unconnected.
PS_DDR_CKE0	CKE_A and CKE_B	CKE0_A and CKE0_B	CKE0
PS_DDR_CKE1	Can be left unconnected.	CKE1_A and CKE1_B	CKE1
PS_DDR_CS_N0	CS_n_A and CS_n_B	CS0_n_A and CS0_n_B	CS0_n
PS_DDR_CS_N1	Can be left unconnected.	CS1_n_A and CS1_n_B	CS1_n
PS_DDR_DM0	DM0_A	DM0_A	DM0
PS_DDR_DM1	DM1_A	DM1_A	DM1
PS_DDR_DM2	DM2_A	DM2_A	DM2
PS_DDR_DM3	DM3_A	DM3_A	DM3
PS_DDR_DM4	DM0_B	DM0_B	Can be left unconnected.
PS_DDR_DM5	DM1_B	DM1_B	Can be left unconnected.

Table 2-4: LPDDR3 Supported Pinout Configurations) (Cont'd)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
PS_DDR_DM6	DM2_B	DM2_B	Can be left unconnected.
PS_DDR_DM7	DM3_B	DM3_B	Can be left unconnected.
PS_DDR_DM8	DM_ECC, can be left unconnected without ECC.	DM_ECC, can be left unconnected without ECC.	DM_ECC, can be left unconnected without ECC.
PS_DDR_DQ0	DQ0_A	DQ0_A	DQ0
PS_DDR_DQ1	DQ1_A	DQ1_A	DQ1
PS_DDR_DQ2	DQ2_A	DQ2_A	DQ2
PS_DDR_DQ3	DQ3_A	DQ3_A	DQ3
PS_DDR_DQ4	DQ4_A	DQ4_A	DQ4
PS_DDR_DQ5	DQ5_A	DQ5_A	DQ5
PS_DDR_DQ6	DQ6_A	DQ6_A	DQ6
PS_DDR_DQ7	DQ7_A	DQ7_A	DQ7
PS_DDR_DQ8	DQ8_A	DQ8_A	DQ8
PS_DDR_DQ9	DQ9_A	DQ9_A	DQ9
PS_DDR_DQ10	DQ10_A	DQ10_A	DQ10
PS_DDR_DQ11	DQ11_A	DQ11_A	DQ11
PS_DDR_DQ12	DQ12_A	DQ12_A	DQ12
PS_DDR_DQ13	DQ13_A	DQ13_A	DQ13
PS_DDR_DQ14	DQ14_A	DQ14_A	DQ14
PS_DDR_DQ15	DQ15_A	DQ15_A	DQ15
PS_DDR_DQ16	DQ16_A	DQ16_A	DQ16
PS_DDR_DQ17	DQ17_A	DQ17_A	DQ17
PS_DDR_DQ18	DQ18_A	DQ18_A	DQ18
PS_DDR_DQ19	DQ19_A	DQ19_A	DQ19
PS_DDR_DQ20	DQ20_A	DQ20_A	DQ20
PS_DDR_DQ21	DQ21_A	DQ21_A	DQ21
PS_DDR_DQ22	DQ22_A	DQ22_A	DQ22
PS_DDR_DQ23	DQ23_A	DQ23_A	DQ23
PS_DDR_DQ24	DQ24_A	DQ24_A	DQ24
PS_DDR_DQ25	DQ25_A	DQ25_A	DQ25
PS_DDR_DQ26	DQ26_A	DQ26_A	DQ26
PS_DDR_DQ27	DQ27_A	DQ27_A	DQ27
PS_DDR_DQ28	DQ28_A	DQ28_A	DQ28
PS_DDR_DQ29	DQ29_A	DQ29_A	DQ29

Table 2-4: LPDDR3 Supported Pinout Configurations) (Cont'd)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
PS_DDR_DQ30	DQ30_A	DQ30_A	DQ30
PS_DDR_DQ31	DQ31_A	DQ31_A	DQ31
PS_DDR_DQ32	DQ0_B	DQ0_B	Can be left unconnected.
PS_DDR_DQ33	DQ1_B	DQ1_B	Can be left unconnected.
PS_DDR_DQ34	DQ2_B	DQ2_B	Can be left unconnected.
PS_DDR_DQ35	DQ3_B	DQ3_B	Can be left unconnected.
PS_DDR_DQ36	DQ4_B	DQ4_B	Can be left unconnected.
PS_DDR_DQ37	DQ5_B	DQ5_B	Can be left unconnected.
PS_DDR_DQ38	DQ6_B	DQ6_B	Can be left unconnected.
PS_DDR_DQ39	DQ7_B	DQ7_B	Can be left unconnected.
PS_DDR_DQ40	DQ8_B	DQ8_B	Can be left unconnected.
PS_DDR_DQ41	DQ9_B	DQ9_B	Can be left unconnected.
PS_DDR_DQ42	DQ10_B	DQ10_B	Can be left unconnected.
PS_DDR_DQ43	DQ11_B	DQ11_B	Can be left unconnected.
PS_DDR_DQ44	DQ12_B	DQ12_B	Can be left unconnected.
PS_DDR_DQ45	DQ13_B	DQ13_B	Can be left unconnected.
PS_DDR_DQ46	DQ14_B	DQ14_B	Can be left unconnected.
PS_DDR_DQ47	DQ15_B	DQ15_B	Can be left unconnected.
PS_DDR_DQ48	DQ16_B	DQ16_B	Can be left unconnected.
PS_DDR_DQ49	DQ17_B	DQ17_B	Can be left unconnected.
PS_DDR_DQ50	DQ18_B	DQ18_B	Can be left unconnected.
PS_DDR_DQ51	DQ19_B	DQ19_B	Can be left unconnected.
PS_DDR_DQ52	DQ20_B	DQ20_B	Can be left unconnected.
PS_DDR_DQ53	DQ21_B	DQ21_B	Can be left unconnected.
PS_DDR_DQ54	DQ22_B	DQ22_B	Can be left unconnected.
PS_DDR_DQ55	DQ23_B	DQ23_B	Can be left unconnected.
PS_DDR_DQ56	DQ24_B	DQ24_B	Can be left unconnected.
PS_DDR_DQ57	DQ25_B	DQ25_B	Can be left unconnected.
PS_DDR_DQ58	DQ26_B	DQ26_B	Can be left unconnected.
PS_DDR_DQ59	DQ27_B	DQ27_B	Can be left unconnected.
PS_DDR_DQ60	DQ28_B	DQ28_B	Can be left unconnected.
PS_DDR_DQ61	DQ29_B	DQ29_B	Can be left unconnected.
PS_DDR_DQ62	DQ30_B	DQ30_B	Can be left unconnected.
PS_DDR_DQ63	DQ31_B	DQ31_B	Can be left unconnected.

Table 2-4: LPDDR3 Supported Pinout Configurations) (Cont'd)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
PS_DDR_DQ64	DQ_ECC0 (ECC_bit[0]), can be left unconnected without ECC.	DQ_ECC0 (ECC_bit[0]), can be left unconnected without ECC.	DQ_ECC0 (ECC_bit[0]), can be left unconnected without ECC.
PS_DDR_DQ65	DQ_ECC1 (ECC_bit[1]), can be left unconnected without ECC.	DQ_ECC1 (ECC_bit[1]), can be left unconnected without ECC.	DQ_ECC1 (ECC_bit[1]), can be left unconnected without ECC.
PS_DDR_DQ66	DQ_ECC2 (ECC_bit[2]), can be left unconnected without ECC.	DQ_ECC2 (ECC_bit[2]), can be left unconnected without ECC.	DQ_ECC2 (ECC_bit[2]), can be left unconnected without ECC.
PS_DDR_DQ67	DQ_ECC3 (ECC_bit[3]), can be left unconnected without ECC.	DQ_ECC3 (ECC_bit[3]), can be left unconnected without ECC.	DQ_ECC3 (ECC_bit[3]), can be left unconnected without ECC.
PS_DDR_DQ68	DQ_ECC4 (ECC_bit[4]), can be left unconnected without ECC.	DQ_ECC4 (ECC_bit[4]), can be left unconnected without ECC.	DQ_ECC4 (ECC_bit[4]), can be left unconnected without ECC.
PS_DDR_DQ69	DQ_ECC5 (ECC_bit[5]), can be left unconnected without ECC.	DQ_ECC5 (ECC_bit[5]), can be left unconnected without ECC.	DQ_ECC5 (ECC_bit[5]), can be left unconnected without ECC.
PS_DDR_DQ70	DQ_ECC6 (ECC_bit[6]), can be left unconnected without ECC.	DQ_ECC6 (ECC_bit[6]), can be left unconnected without ECC.	DQ_ECC6 (ECC_bit[6]), can be left unconnected without ECC.
PS_DDR_DQ71	DQ_ECC7 (ECC_bit[7]), can be left unconnected without ECC.	DQ_ECC7 (ECC_bit[7]), can be left unconnected without ECC.	DQ_ECC7 (ECC_bit[7]), can be left unconnected without ECC.
PS_DDR_DQS_N0	DQS0_c_A	DQS0_c_A	DQS0_c
PS_DDR_DQS_N1	DQS1_c_A	DQS1_c_A	DQS1_c
PS_DDR_DQS_N2	DQS2_c_A	DQS2_c_A	DQS2_c
PS_DDR_DQS_N3	DQS3_c_A	DQS3_c_A	DQS3_c
PS_DDR_DQS_N4	DQS0_c_B	DQS0_c_B	Can be left unconnected.
PS_DDR_DQS_N5	DQS1_c_B	DQS1_c_B	Can be left unconnected.
PS_DDR_DQS_N6	DQS2_c_B	DQS2_c_B	Can be left unconnected.
PS_DDR_DQS_N7	DQS3_c_B	DQS3_c_B	Can be left unconnected.
PS_DDR_DQS_N8	DQS_c_ECC, can be left unconnected without ECC.	DQS_c_ECC, can be left unconnected without ECC.	DQS_c_ECC, can be left unconnected without ECC.
PS_DDR_DQS_P0	DQS0_t_A	DQS0_t_A	DQS0_t
PS_DDR_DQS_P1	DQS1_t_A	DQS1_t_A	DQS1_t
PS_DDR_DQS_P2	DQS2_t_A	DQS2_t_A	DQS2_t
PS_DDR_DQS_P3	DQS3_t_A	DQS3_t_A	DQS3_t
PS_DDR_DQS_P4	DQS0_t_B	DQS0_t_B	Can be left unconnected.
PS_DDR_DQS_P5	DQS1_t_B	DQS1_t_B	Can be left unconnected.

Table 2-4: LPDDR3 Supported Pinout Configurations) (Cont'd)

Pin Name	LPDDR3 64-bit	LPDDR3 64-bit (Dual Rank)	LPDDR3 32-bit (Dual Rank)
PS_DDR_DQS_P6	DQS2_t_B	DQS2_t_B	Can be left unconnected.
PS_DDR_DQS_P7	DQS3_t_B	DQS3_t_B	Can be left unconnected.
PS_DDR_DQS_P8	DQS_t_ECC, can be left unconnected without ECC.	DQS_t_ECC, can be left unconnected without ECC.	DQS_t_ECC, can be left unconnected without ECC.
PS_DDR_ODT0	ODT_A and ODT_B	ODT_A and ODT_B	ODT
PS_DDR_ODT1	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_PARITY	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_RAM_RST_N	Can be left unconnected.	Can be left unconnected.	Can be left unconnected.
PS_DDR_ZQ	Connect a 240Ω resistor to GND. <sup>(2)</sup>	Connect a 240Ω resistor to GND. <sup>(2)</sup>	Connect a 240Ω resistor to GND. <sup>(2)</sup>

**Notes:**

1. For VCCO\_PSDDR decoupling guidelines, see the *UltraScale Architecture PCB Design Guide* [Ref 14].
2. There should be separate 240Ω resistors at the FPGA and at the DRAM.

# Package Files

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## About ASCII Package Files

The ASCII package files for each Zynq® UltraScale+™ device include a comma-separated-values (CSV) version and a text version optimized for a browser or text editor in fixed-width fonts. The information in each of the files includes:

- Device/Package name (*family-device-package*), with date and time of creation
- Six columns containing data for each pin:
  - Pin—Pin location on the package.
  - Pin Name—The name of the assigned pin.
  - Memory Byte Group—Memory byte group between 0 and 3 split into upper (U) and lower (L) halves. For more information on the memory byte group, see the *UltraScale Architecture-Based Memory Interface Solutions Product Guide* (PG150) [Ref 15].
  - Bank—Bank number.
  - I/O Type—CONFIG, HD, HP, GTH, GTY, PS-GTR, PSMIO, PSDDR, or PSCONFIG depends on the I/O type. For more information on the I/O type, see the *UltraScale Architecture SelectIO Resources User Guide* (UG571) [Ref 6].
  - Super Logic Region—Number corresponding to the super logic region (SLR) in the devices implemented with stacked silicon interconnect (SSI) technology.
- Total number of pins in the package.

# Package Specifications Designations

Package specifications are designated as evaluation only, engineering sample, or production. Each designation is defined as follows.

## Evaluation Only

These package specifications are based on initial device specifications, package routability analysis and mechanical package construction. Package specifications with this designation are not stable and package pinouts are likely to change and these specifications should only be used for initial system level design feasibility.

## Engineering Sample

These package specifications are based on a released package design and validated with ES engineering sample (ES) devices. Package specifications with this designation are considered stable, however some pinout and mechanical specifications might change prior to the production release of the particular device. Package pinouts with this designation are to be used for PCB and Vivado® designs using ES devices.

## Production

These package specifications are released coincident with production release of a particular device. Customers receive formal notification of any subsequent changes.

## ASCII Pinout Files

Links to the ASCII pinout information device/package combinations are listed in Table 3-1.

Download all available package/device/pinout files at:

[www.xilinx.com/support/package-pinout-files/zynq-ultrascale-plus-pkgs.html](http://www.xilinx.com/support/package-pinout-files/zynq-ultrascale-plus-pkgs.html)

**Note:** All package files are ASCII files in TXT and CSV file format. Only the available files listed in Table 3-1 are linked and consolidated in this ZIP file:

[www.xilinx.com/support/packagefiles/zupackages/zupall.zip](http://www.xilinx.com/support/packagefiles/zupackages/zupall.zip)



**IMPORTANT:** All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q.

Table 3-1: Package/Device Pinout Files for CG, EG, and EV devices

Packages	Footprint Compatible Devices		
SBVA484	XCZU1CG XCZU1EG Production		
SBVA484	XCZU2CG XCZU2EG XAZU2EG Production	XCZU3CG XCZU3EG XAZU3EG Production	
SFRA484	XQZU3EG Production		
UBVA494	XCZU1CG XCZU1EG Engineering Sample		
UBVA530	XCZU2CG XCZU2EG Production	XCZU3CG XCZU3EG Production	
SFVA625	XCZU1CG XCZU1EG Production		
SFVA625	XCZU2CG XCZU2EG XAZU2EG Production	XCZU3CG XCZU3EG XAZU3EG Production	

**Table 3-1: Package/Device Pinout Files for CG, EG, and EV devices (Cont'd)**

Packages	Footprint Compatible Devices						
SFVC784	XCZU1CG XCZU1EG Production						
SFVC784	XCZU2CG XCZU2EG XAZU2EG Production	XCZU3CG XCZU3EG XAZU3EG Production	XCZU4CG XCZU4EG XCZU4EV XAZU4EV Production	XCZU5CG XCZU5EG XCZU5EV XAZU5EV Production			
SFRC784	XQZU3EG Production	XQZU5EV Production					
FBVB900	XCZU4CG XCZU4EG XCZU4EV Production	XCZU5CG XCZU5EG XCZU5EV Production	XCZU7CG XCZU7EG XCZU7EV Production	XAZU7EV Production			
FFRB900	XQZU5EV Production	XQZU7EV Production					
FFVC900	XCZU6CG XCZU6EG Production	XCZU9CG XCZU9EG Production	XCZU15EG Production				
FFRC900	XQZU9EG Production	XQZU15EG Production					
FFVB1156	XCZU6CG XCZU6EG Production	XCZU9CG XCZU9EG Production	XCZU15EG Production				
FFRB1156	XQZU9EG Production	XQZU15EG Production					
FFVC1156	XCZU7CG XCZU7EG XCZU7EV Production	XCZU11EG Production					
FFRC1156	XQZU7EV Production	XQZU11EG Production					
FFVB1517	XCZU11EG Production	XCZU17EG Production	XCZU19EG Production				
FFRB1517	XCZU19EG Production						

*Table 3-1: Package/Device Pinout Files for CG, EG, and EV devices (Cont'd)*

Packages	Footprint Compatible Devices		
FFVF1517	XCZU7CG XCZU7EG XCZU7EV Production	XCZU11EG Production	XAZU11EG Production
FFVC1760	XCZU11EG Production	XCZU17EG Production	XCZU19EG Production
FFRC1760	XQZU11EG Production	XQZU19EG Production	
FFVD1760	XCZU17EG Production	XCZU19EG Production	
FFVE1924	XCZU17EG Production	XCZU19EG Production	

Table 3-2: Package/Device Pinout Files for Zynq UltraScale+ RFSoCs

Package	Footprint Compatible Devices																				
FFVD1156	XCZU21DR Production																				
FFRD1156	XQZU21DR Production																				
FFVE1156	XCZU25DR Production	XCZU27DR Production	XCZU28DR Production	XCZU42DR <sup>(2)</sup> Production	XCZU43DR Production	XCZU47DR Production	XCZU48DR Production	XCZU65DR <sup>(2)</sup> Production	XCZU67DR <sup>(2)</sup> Production												
FFRE1156	XQZU28DR Production																				
FSVE1156	XCZU25DR Production	XCZU27DR Production	XCZU28DR Production	XCZU42DR Production	XCZU43DR Production	XCZU47DR Production	XCZU48DR Production	XCZU65DR <sup>(2)</sup> Production	XCZU67DR <sup>(2)</sup> Production												
FFVG1517	XCZU25DR Production	XCZU27DR Production	XCZU28DR Production		XCZU43DR Production	XCZU47DR Production	XCZU48DR Production														
FFRG1517	XQZU28DR Production																				
FSRG1517	XQZU48DR Production																				
FSVG1517	XCZU25DR Production	XCZU27DR Production	XCZU28DR Production		XCZU43DR Production	XCZU47DR Production	XCZU48DR Production														
FFVF1760	XCZU29DR Production	XCZU39DR Production	XCZU49DR <sup>(1)</sup> Production																		
FFVH1760	XCZU46DR Production																				
FFRF1760	XQZU29DR Production																				
FSRF1760	XQZU49DR <sup>(1)</sup> Production																				

Table 3-2: Package/Device Pinout Files for Zynq UltraScale+ RFSoCs

Package	Footprint Compatible Devices			
FSVF1760	XCZU29DR Production	XCZU39DR Production	XCZU49DR <sup>(1)</sup> Production	
FSVH1760	XCZU46DR Production			

**Notes:**

1. These footprint compatible devices have a different set of ADC and DAC power sequencing requirements. Refer to *Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics* ([DS926](#)) for specific power sequencing differences.
2. The XCZU42DR, XCZU65DR, and XCZU67DR are only partially compatible with other devices in the FFVE1156 and FSVE1156 packages due to key differences in the ADC and DAC architecture. When planning migration between devices, differences that must be addressed include ADC and DAC bank/pin locations and power rail voltage specifications.

# Device Diagrams

## Summary

The diagrams in this chapter show top-view perspective of the package pinout of each Zynq® UltraScale+™ device/package combination. [Table 4-1](#) is a cross reference to the device/package diagrams. The I/O-bank diagram shows the location of each user I/O, PSMIO, PSDDR, PS CONFIG, and PS-GTR, GTH, and GTY transceiver and the respective bank or GT quad. The configuration-power diagram shows the location of every power pin and dedicated as well as multi-function configuration pin in the package. See [Package Specifications Designations in Chapter 3](#) for definitions of [Evaluation Only](#), [Engineering Sample](#), and [Production](#) device diagrams.

 **IMPORTANT:** All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q.

*Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package*

Packages	Footprint Compatible Devices	
SBVA484	XCZU1CG XCZU1EG Production <a href="#">page 134</a>	

Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package (*Cont'd*)

Packages	Footprint Compatible Devices	
SBVA484	XCZU2CG, XCZU2EG, XAZU2EG  Production <a href="#">page 136</a>	XCZU3CG, XCZU3EG, XAZU3EG  Production <a href="#">page 136</a>
SFRA484		XQZU3EG  Production <a href="#">page 136</a>
UBVA494	XCZU1CG XCZU1EG  Production <a href="#">page 138</a>	
UBVA530	XCZU2CG, XCZU2EG  Production <a href="#">page 140</a>	XCZU3CG, XCZU3EG  Production <a href="#">page 140</a>
SFVA625	XCZU1CG XCZU1EG  Production <a href="#">page 142</a>	
SFVA625	XCZU2CG, XCZU2EG, XAZU2EG  Production <a href="#">page 144</a>	XCZU3CG, XCZU3EG, XAZU3EG  Production <a href="#">page 144</a>
SFVC784	XCZU1CG XCZU1EG  Production <a href="#">page 146</a>	

Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package (*Cont'd*)

Packages	Footprint Compatible Devices				
SFVC784	XCZU2CG, XCZU2EG, XAZU2EG <a href="#">Production page 148</a>	XCZU3CG, XCZU3EG, XAZU3EG <a href="#">Production page 148</a>	XCZU4CG, XCZU4EG, XCZU5CG, XCZU5EG <a href="#">Production page 150</a>	XCZU4EV, XCZU5EV, XAZU4EV, XAZU5EV <a href="#">Production page 152</a>	
SFRC784		XQZU3EG <a href="#">Production page 148</a>		XQZU5EV <a href="#">Production page 152</a>	
FBVB900	XCZU4CG, XCZU4EG, XCZU5CG, XCZU5EG <a href="#">Production page 154</a>	XCZU4EV, XCZU5EV <a href="#">Production page 156</a>	XCZU7CG, XCZU7EG <a href="#">Production page 158</a>	XCZU7EV XAZU7EV <a href="#">Production page 160</a>	
FFRB900		XQZU5EV <a href="#">Production page 156</a>		XQZU7EV <a href="#">Production page 160</a>	
FFVC900	XCZU6CG, XCZU6EG <a href="#">Production page 162</a>	XCZU9CG, XCZU9EG <a href="#">Production page 162</a>	XCZU15EG <a href="#">Production page 162</a>		
FFRC900		XQZU9EG <a href="#">Production page 162</a>	XQZU15EG <a href="#">Production page 162</a>		

Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package (Cont'd)

Packages	Footprint Compatible Devices							
FFVB1156	XCZU6CG, XCZU6EG <a href="#">Production page 164</a>	XCZU9CG, XCZU9EG <a href="#">Production page 164</a>	XCZU15EG <a href="#">Production page 164</a>					
FFRB1156		XQZU9EG <a href="#">Production page 164</a>	XQZU15EG <a href="#">Production page 164</a>					
FFVC1156	XCZU7CG, XCZU7EG <a href="#">Production page 166</a>	XCZU7EV <a href="#">Production page 168</a>	XCZU11EG <a href="#">Production page 170</a>					
FFRC1156		XQZU7EV <a href="#">Production page 168</a>	XQZU11EG <a href="#">Production page 170</a>					
FFVD1156	XCZU21DR <a href="#">Production page 172</a>							
FFRD1156	XQZU21DR <a href="#">Production page 172</a>							
FFVE1156 FSVE1156	XCZU25DR <a href="#">Production page 174</a>	XCZU27DR XCZU28DR <a href="#">Production page 176</a>	XCZU42DR <a href="#">Production page 178</a>	XCZU43DR <a href="#">Production page 180</a>	XCZU47DR <a href="#">Production page 182</a>	XCZU48DR <a href="#">Production page 184</a>	XCZU65DR <a href="#">Production page 186</a>	XCZU67DR <a href="#">Production page 188</a>
FFRE1156			XQZU28DR <a href="#">Production page 176</a>					

Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package (*Cont'd*)

Packages	Footprint Compatible Devices							
FFVB1517	XCZU11EG Production <a href="#">page 190</a>	XCZU17EG Production <a href="#">page 192</a>	XCZU19EG Production <a href="#">page 192</a>					
FFRB1517			XQZU19EG Production <a href="#">page 192</a>					
FFVF1517	XCZU7CG, XCZU7EG Production <a href="#">page 194</a>	XCZU7EV Production <a href="#">page 196</a>	XCZU11EG Production <a href="#">page 198</a>	XAZU11EG Production <a href="#">page 198</a>				
FFVG1517 FSVG1517 FSRG1517	XCZU25DR Production <a href="#">page 200</a>	XCZU27DR Production <a href="#">page 202</a>	XCZU28DR Production <a href="#">page 202</a>	XCZU43DR Production <a href="#">page 204</a>	XCZU47DR Production <a href="#">page 206</a>	XCZU48DR Production <a href="#">page 208</a>	XQZU48DR Production <a href="#">page 208</a>	
FFRG1517			XQZU28DR Production <a href="#">page 202</a>					
FFVC1760	XCZU11EG Production <a href="#">page 210</a>	XCZU17EG Production <a href="#">page 212</a>	XCZU19EG Production <a href="#">page 212</a>					
FFRC1760	XQZU11EG Production <a href="#">page 210</a>		XQZU19EG Production <a href="#">page 212</a>					
FFVD1760	XCZU17EG Production <a href="#">page 214</a>	XCZU19EG Production <a href="#">page 214</a>						

**Table 4-1: Cross-Reference to Zynq UltraScale+ Device Diagrams by Package (*Cont'd*)**

Packages	Footprint Compatible Devices					
FFVF1760 FSVF1760	XCZU29DR <a href="#">Production page 216</a>	XCZU39DR <a href="#">Production page 216</a>	XCZU49DR <a href="#">Production page 218</a>	XCZU49DR <a href="#">Production page 218</a>	XQZU49DR <a href="#">Production page 218</a>	
FFVH1760 FSVH1760	XCZU46DR <a href="#">Production page 220</a>					
FFRF1760	XQZU29DR <a href="#">Production page 216</a>					
FSRF1760	XQZU49DR <a href="#">Production page 218</a>					
FFVE1924	XCZU17EG <a href="#">Production page 222</a>	XCZU19EG <a href="#">Production page 222</a>				

## SBVA484 Package—XCZU1CG, XCZU1EG

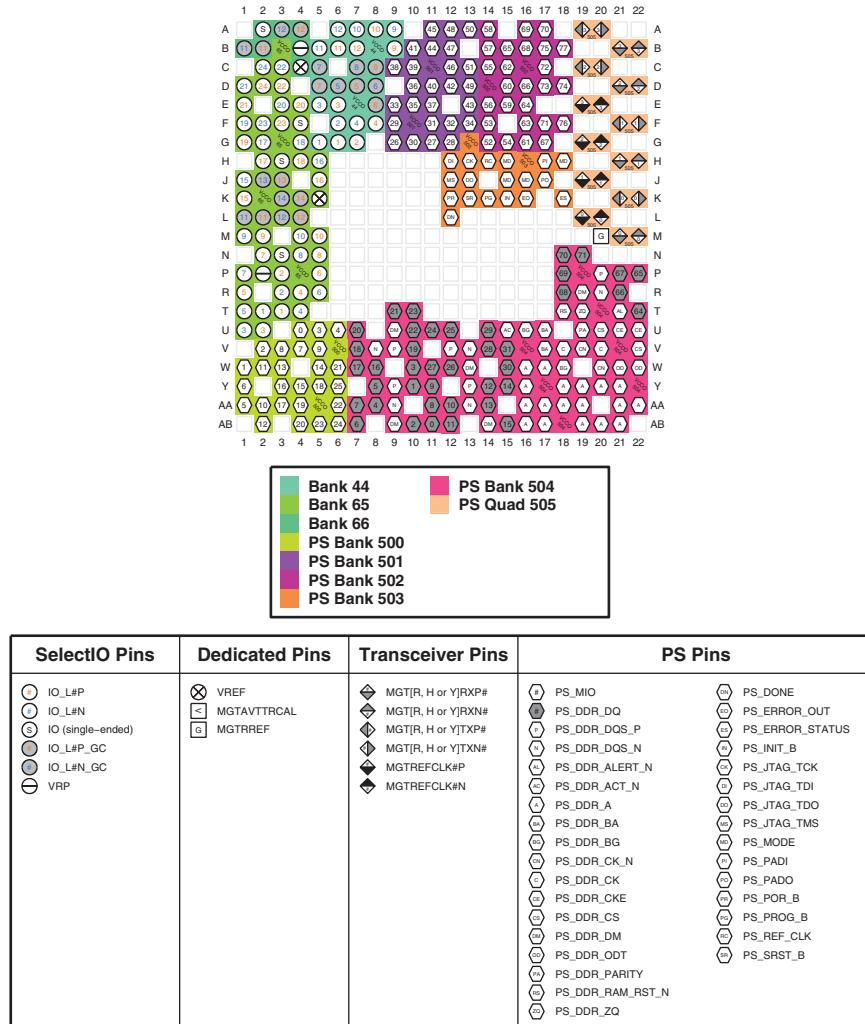
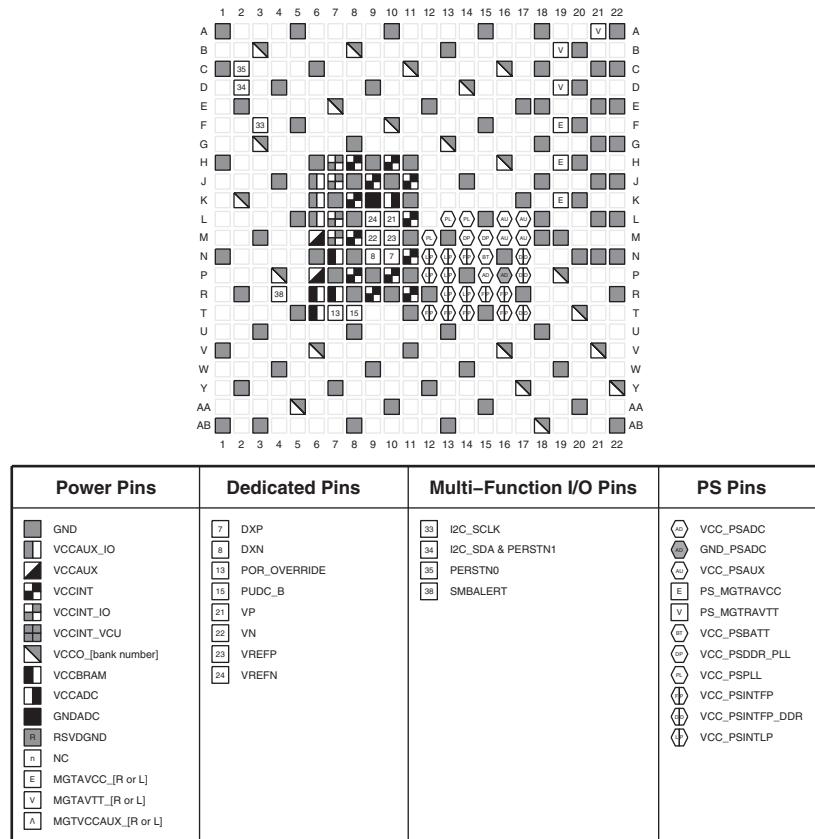


Figure 4-1: SBVA484 Package—XCZU1CG and XCZU1EG I/O Bank Diagram



**Figure 4-2: SBVA484 Package—XCZU1CG and XCZU1EG Power, Dedicated, and Multi-function Pin Diagram**

## SBVA484 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG



**IMPORTANT:** For the devices in the SBVA484 package, the HP I/Os in bank 66 are powered by VCCO\_65.

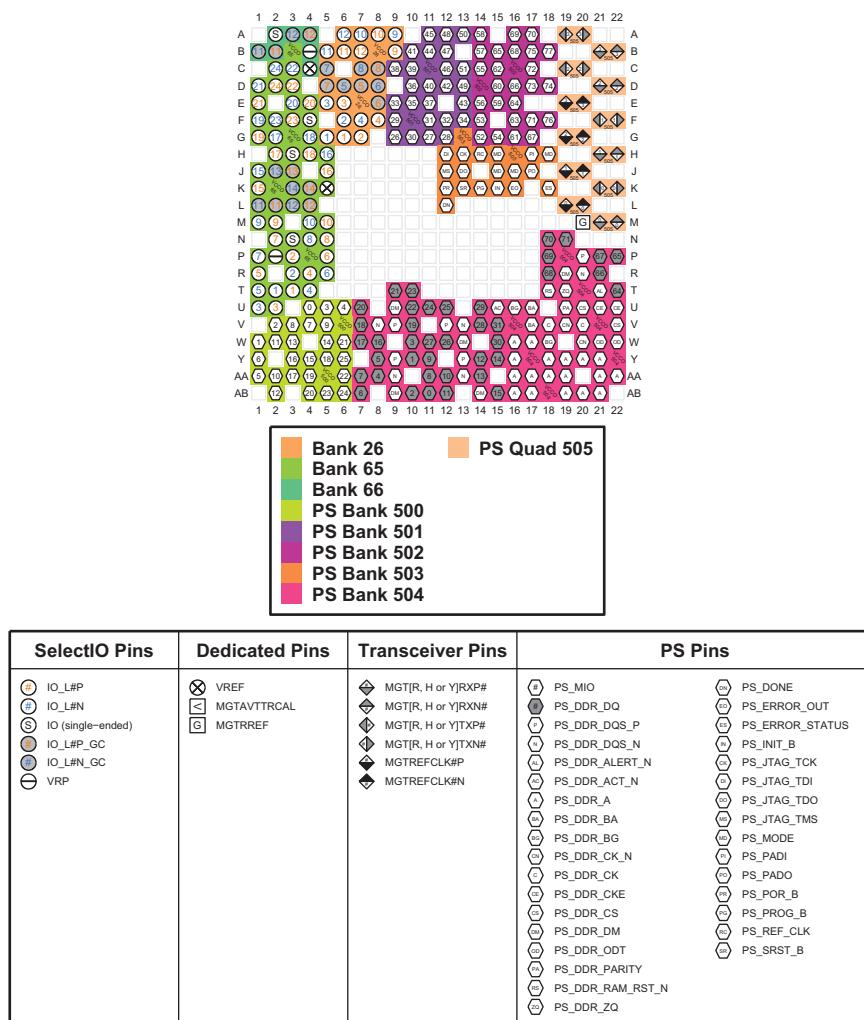
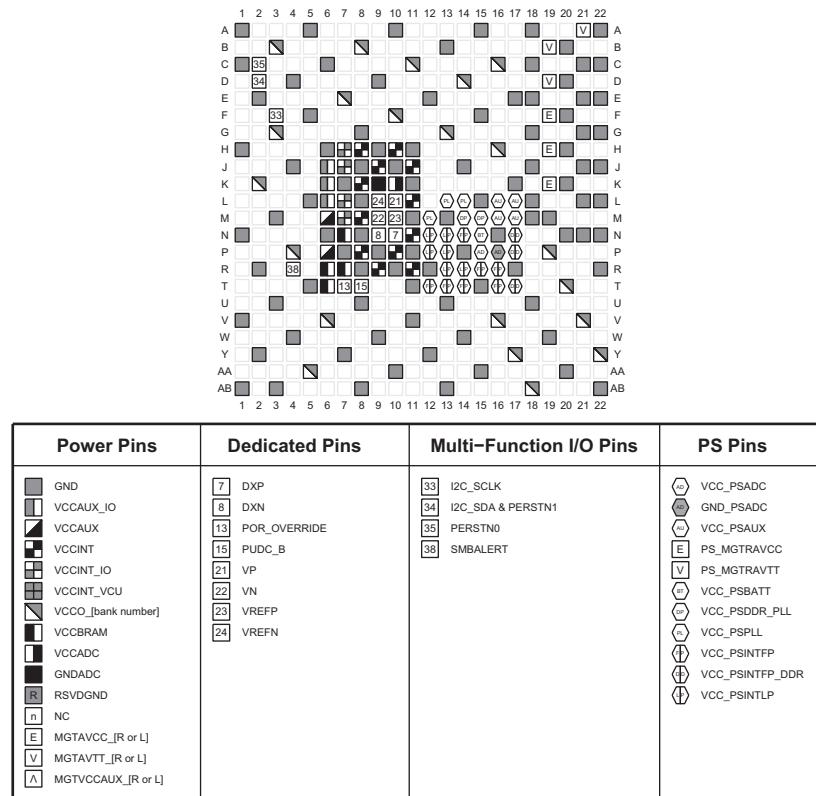


Figure 4-3: SBVA484 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG I/O Bank Diagram



**Figure 4-4: SBVA484 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG Power, Dedicated, and Multi-function Pin Diagram**

## UBVA494 Package—XCZU1CG, XCZU1EG

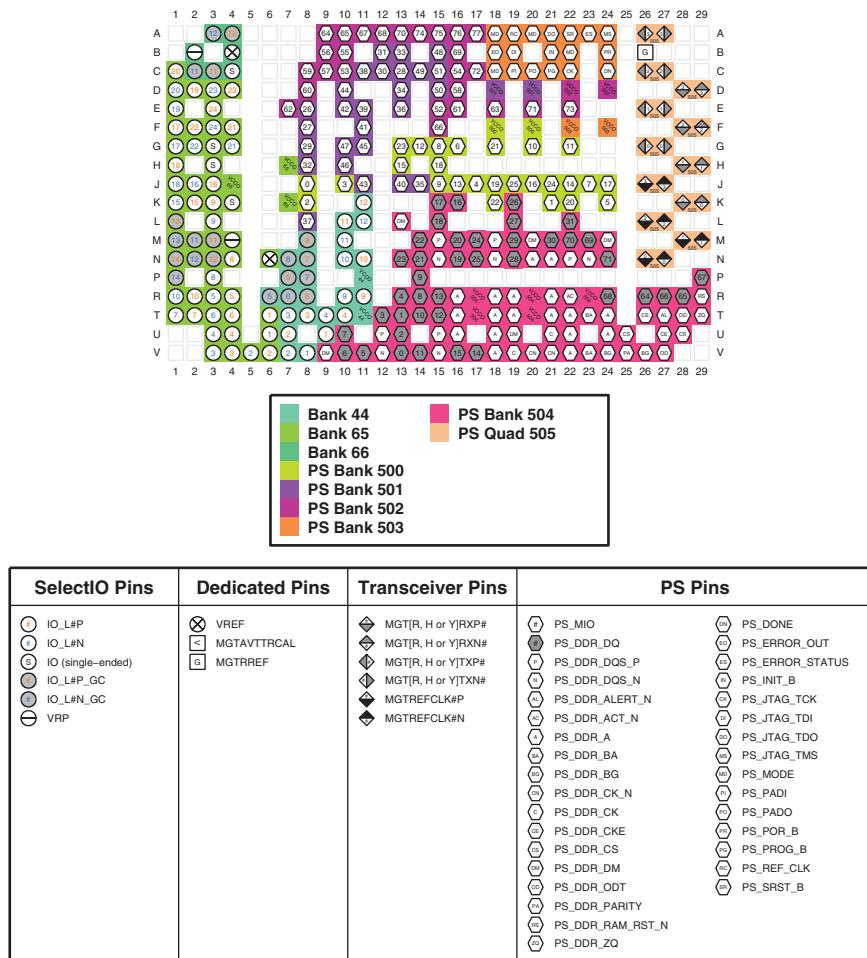


Figure 4-5: UBVA494 Package—XCZU1CG and XCZU1EG I/O Bank Diagram

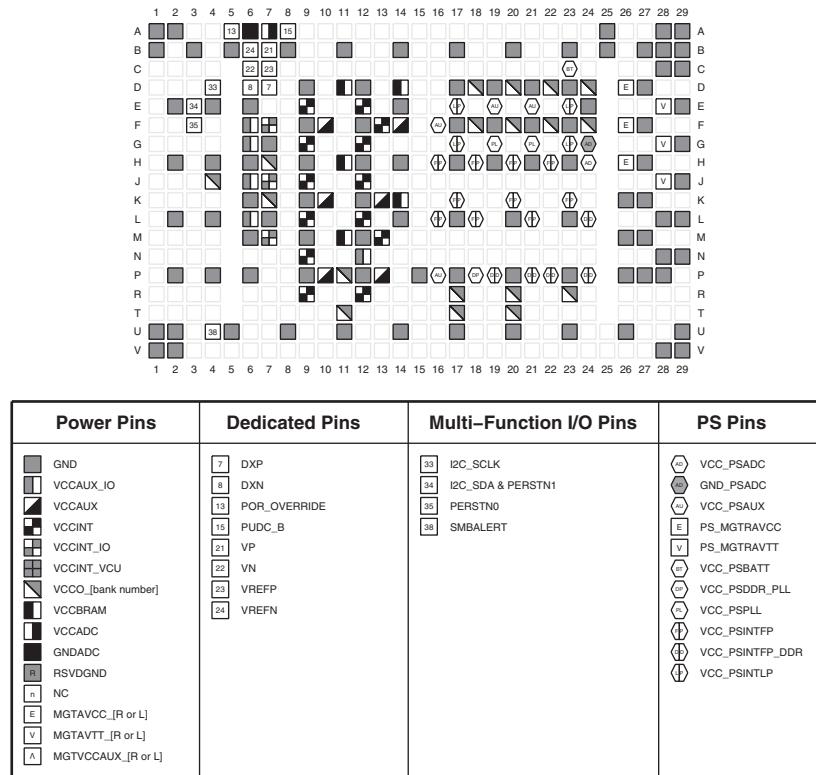


Figure 4-6: UBVA494 Package—XCZU1CG and XCZU1EG Power, Dedicated, and Multi-function Pin Diagram

# UBVA530 Package—XCZU2CG, XCZU2EG, XCZU3CG, and XCZU3EG

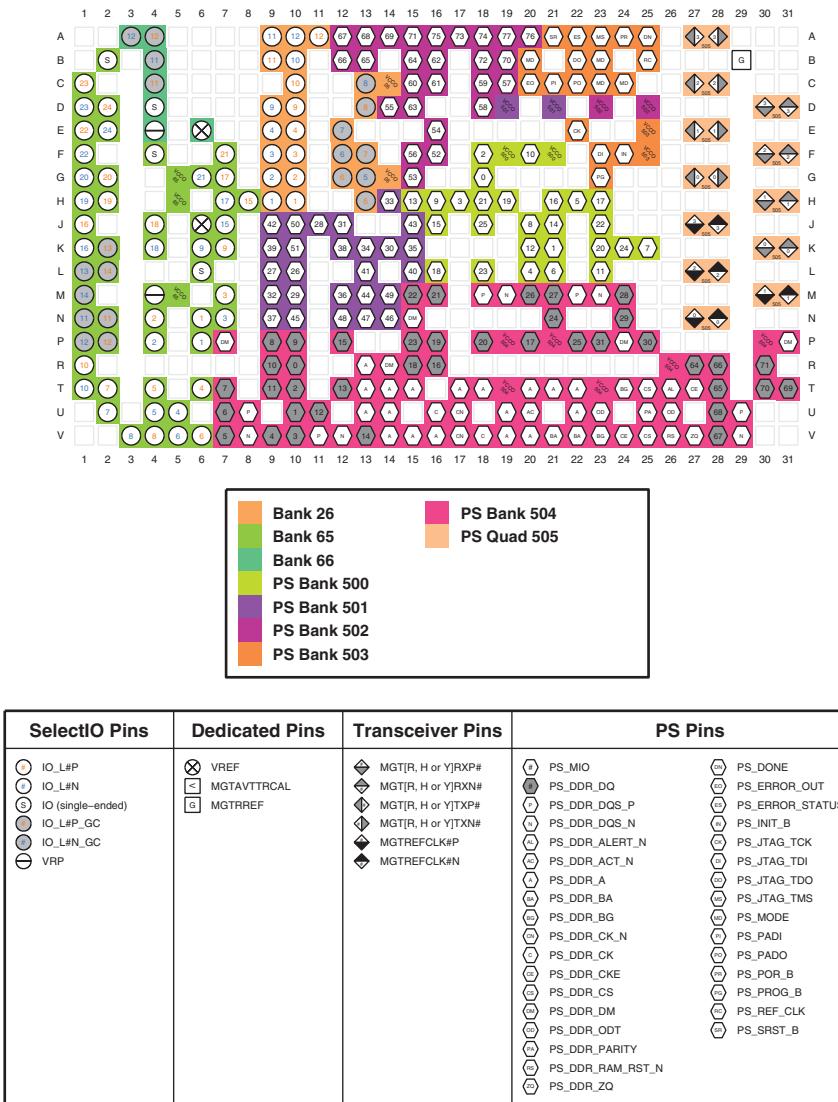
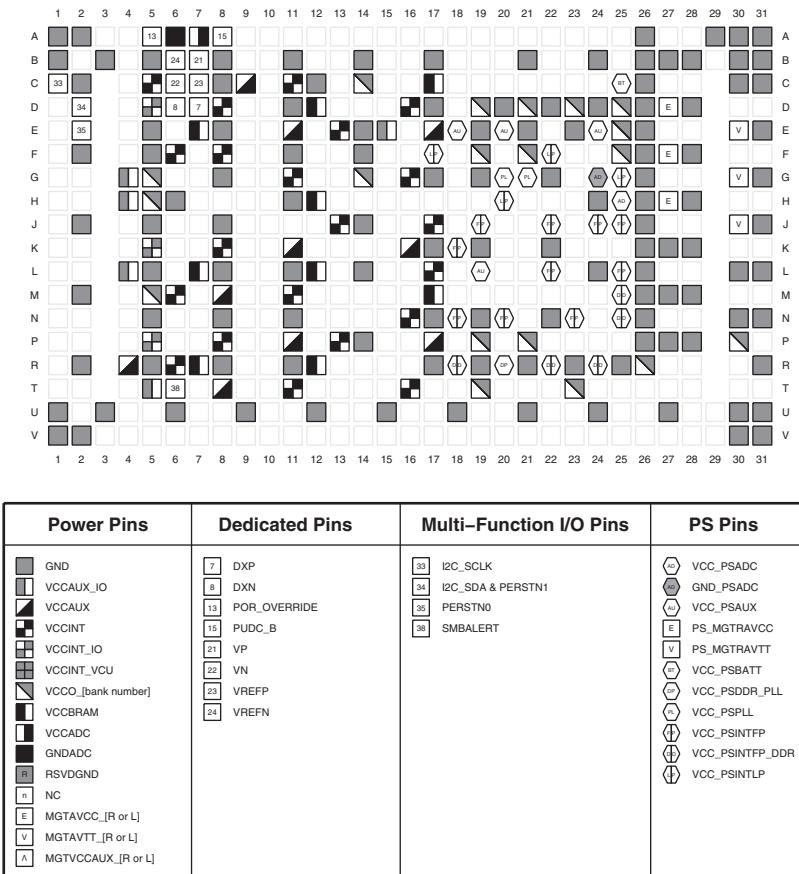


Figure 4-7: UBVA530 Package—XCZU2CG, XCZU2EG, XCZU3CG, and XCZU3EG I/O Bank Diagram



**Figure 4-8: UBVA530 Package—XCZU2CG, XCZU2EG, XCZU3CG, and XCZU3EG Power, Dedicated, and Multi-function Pin Diagram**

## SFVA625 Package—XCZU1CG, XCZU1EG

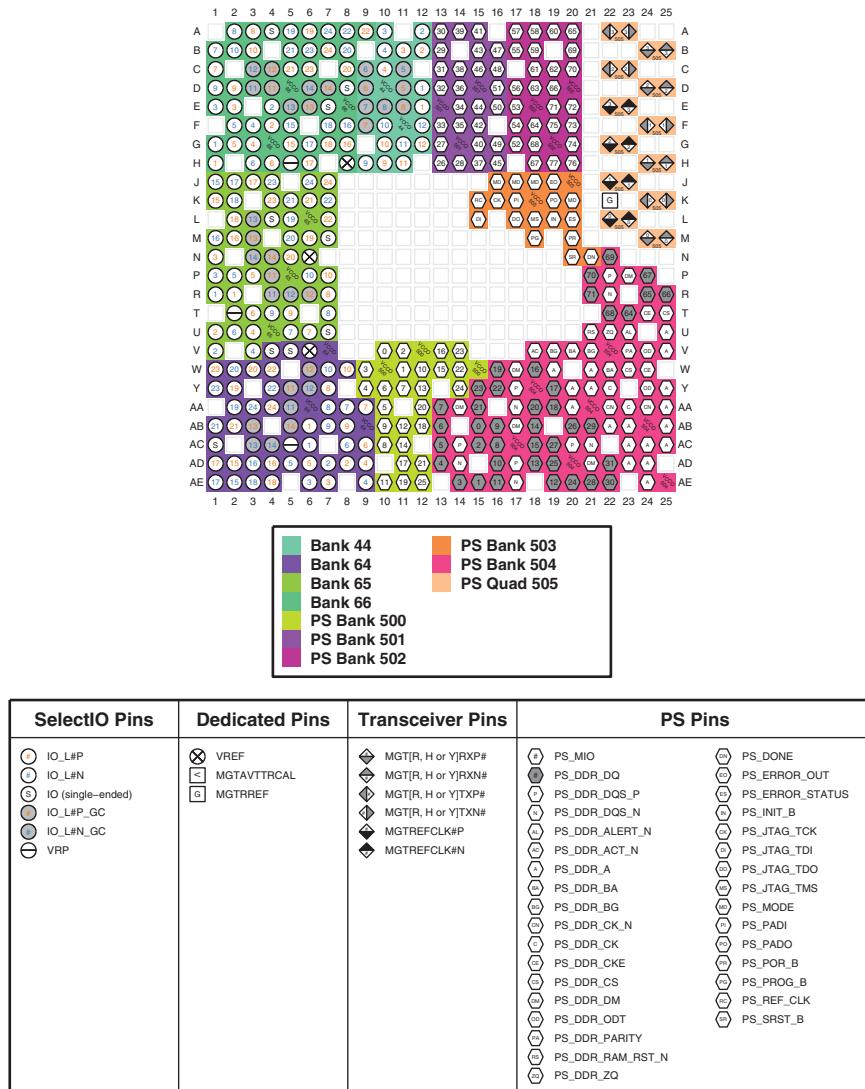


Figure 4-9: SFVA625 Package—XCZU1CG and XCZU1EG I/O Bank Diagram

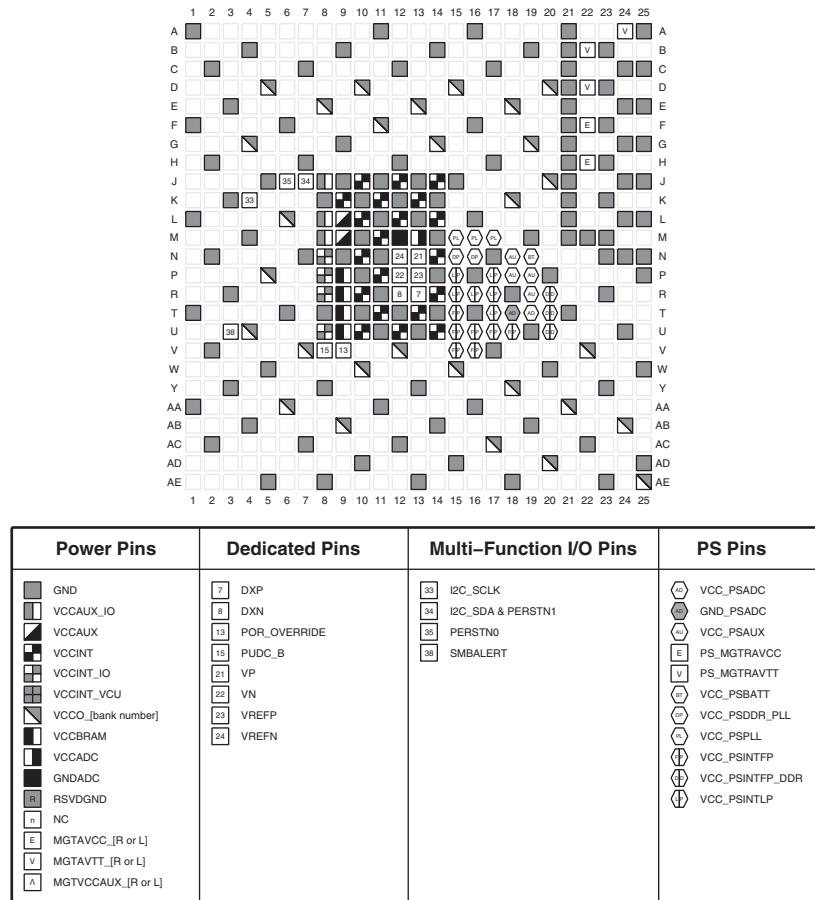


Figure 4-10: SFVA625 Package—XCZU1CG and XCZU1EG Power, Dedicated, and Multi-function Pin Diagram

## SFVA625 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG

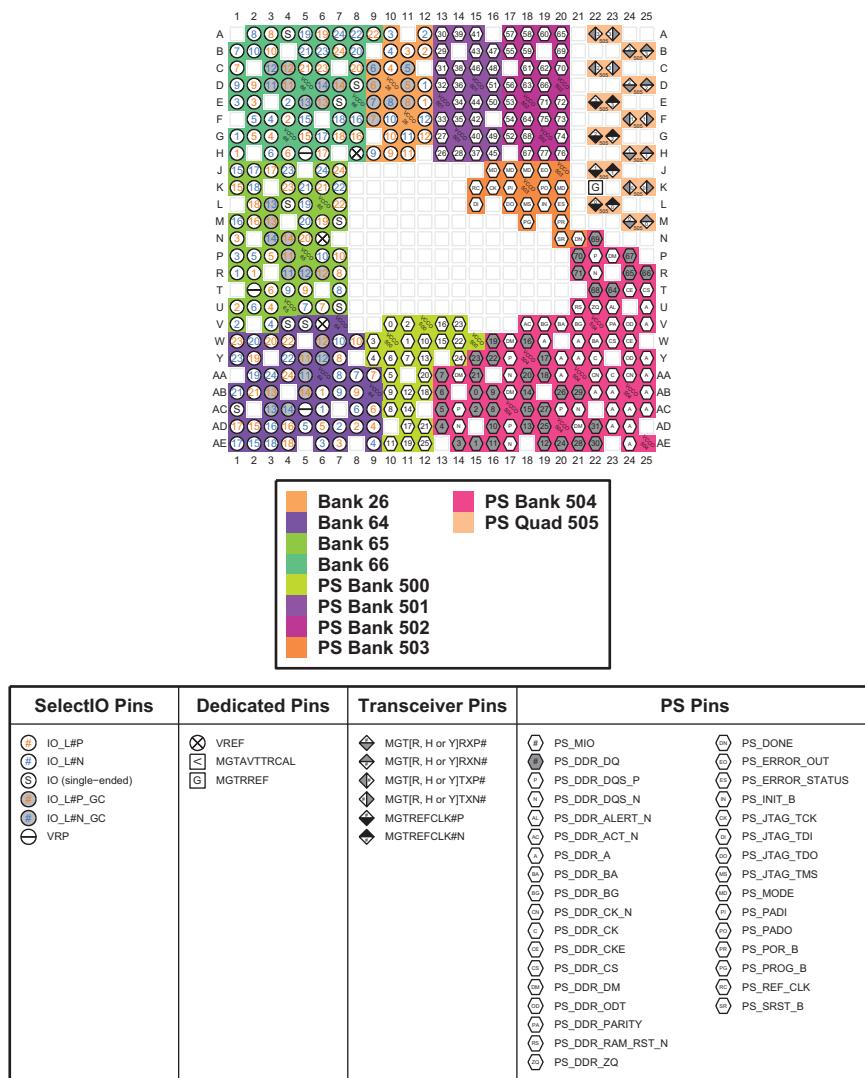


Figure 4-11: SFVA625 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG I/O Bank Diagram

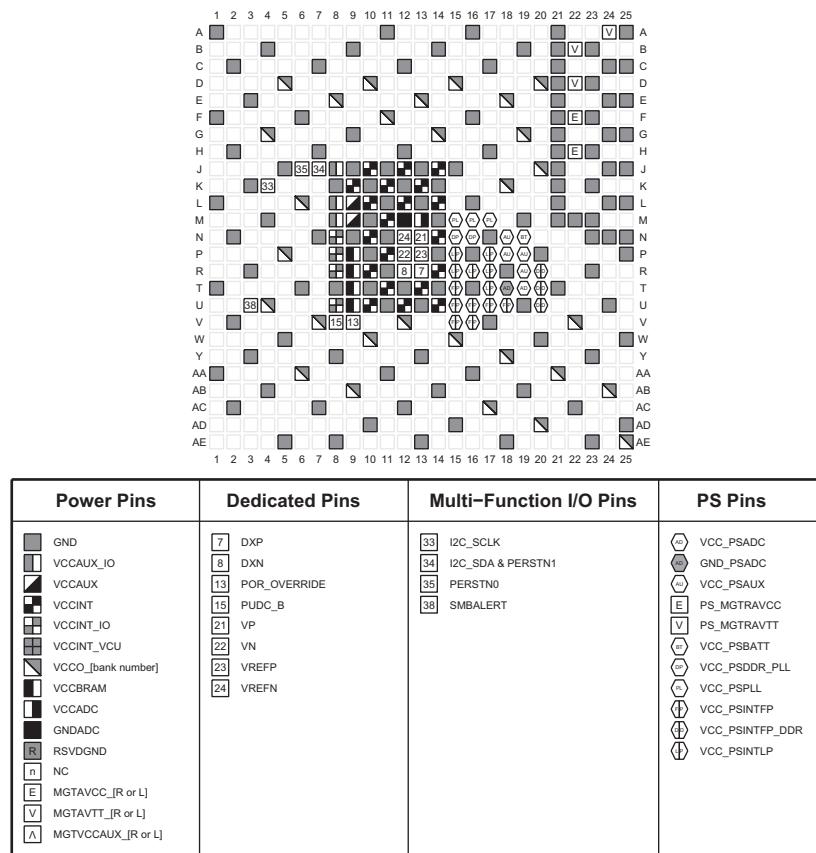


Figure 4-12: SFVA625 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG Power, Dedicated, and Multi-function Pin Diagram

## SFVC784 Package—XCZU1CG, XCZU1EG

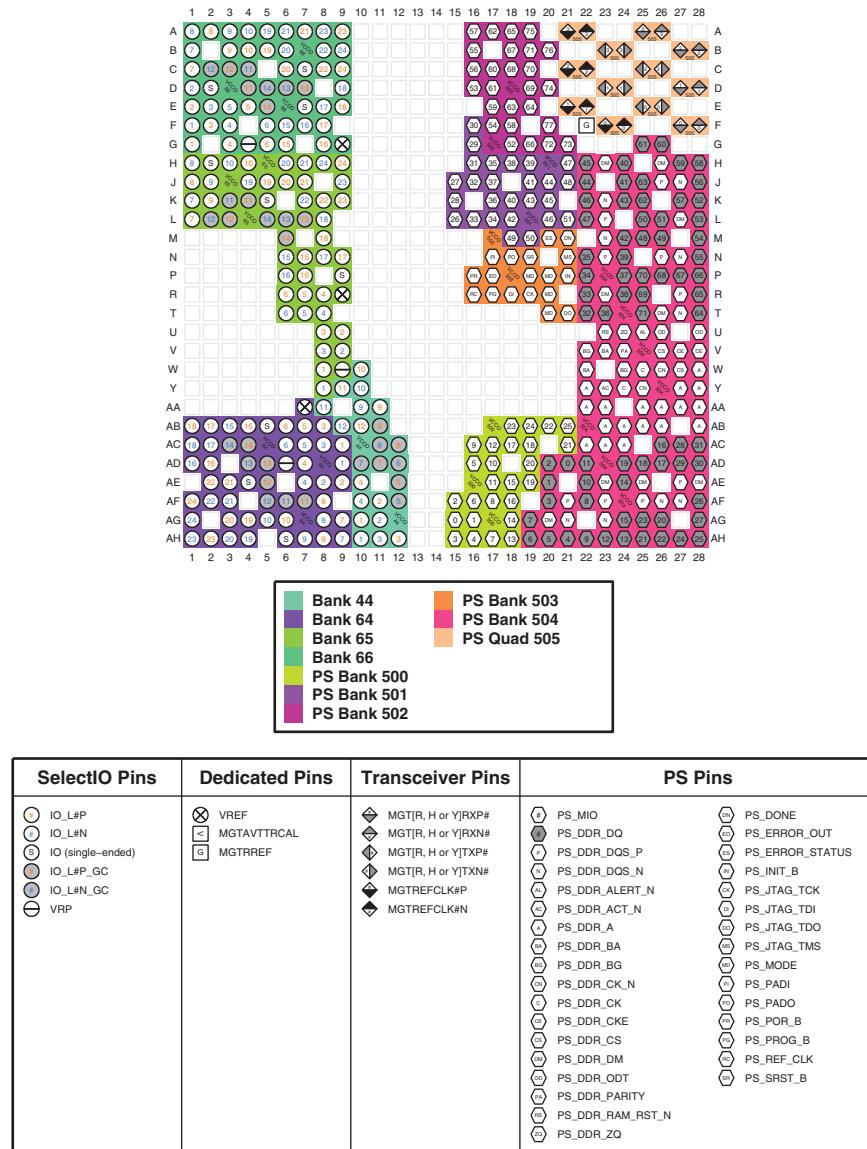


Figure 4-13: SFVC784 Package—XCZU1CG and XCZU1EG I/O Bank Diagram

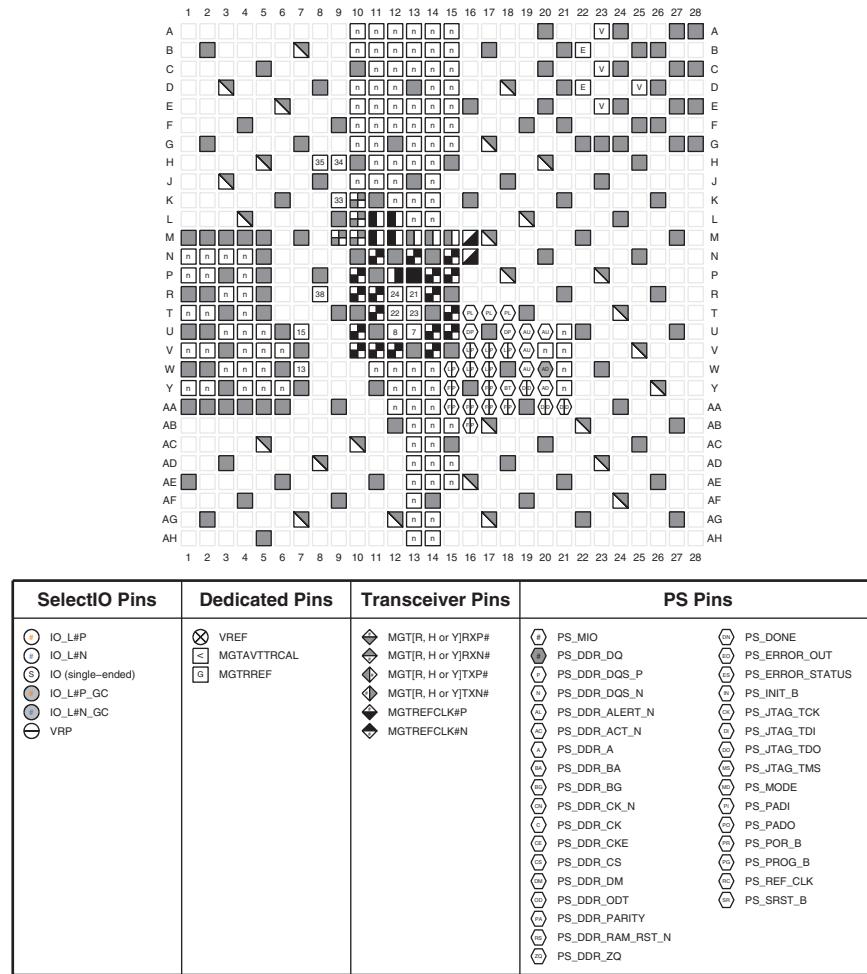


Figure 4-14: SFVC784 Package—XCZU1CG and XCZU1EG Power, Dedicated, and Multi-function Pin Diagram

## SFVC784 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG

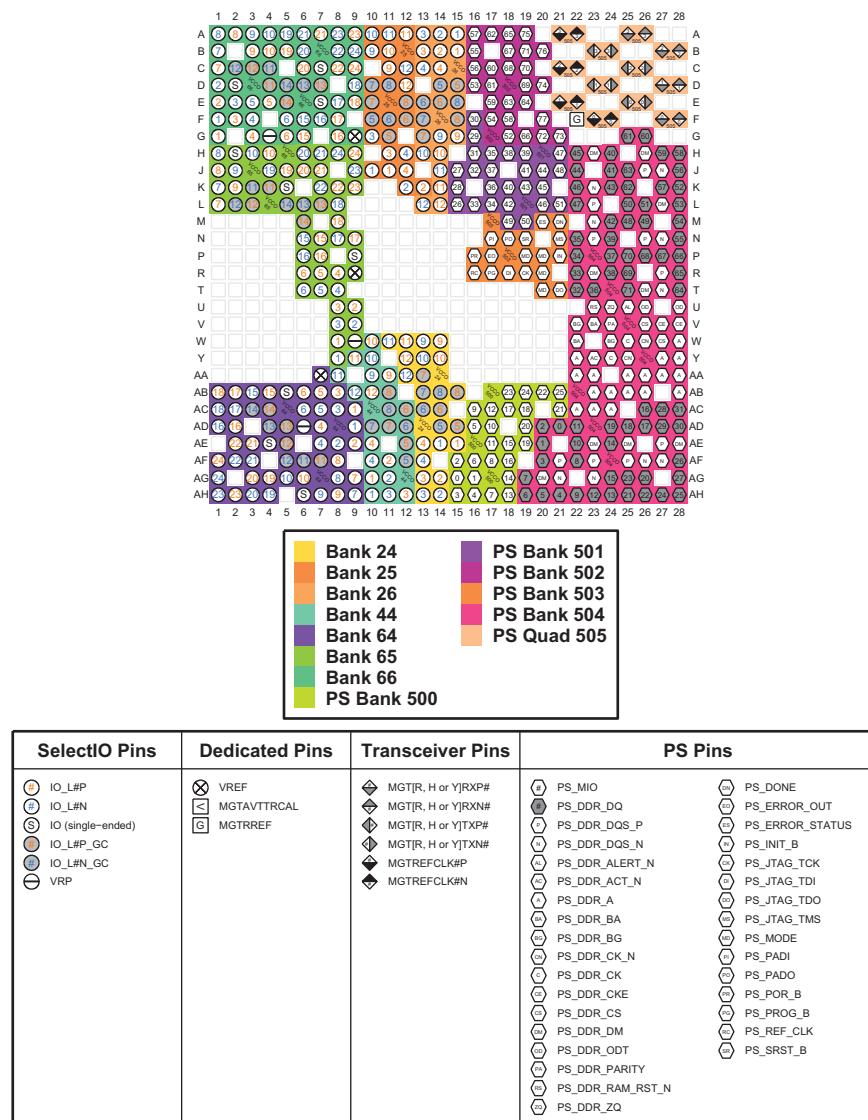


Figure 4-15: SFVC784 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG I/O Bank Diagram

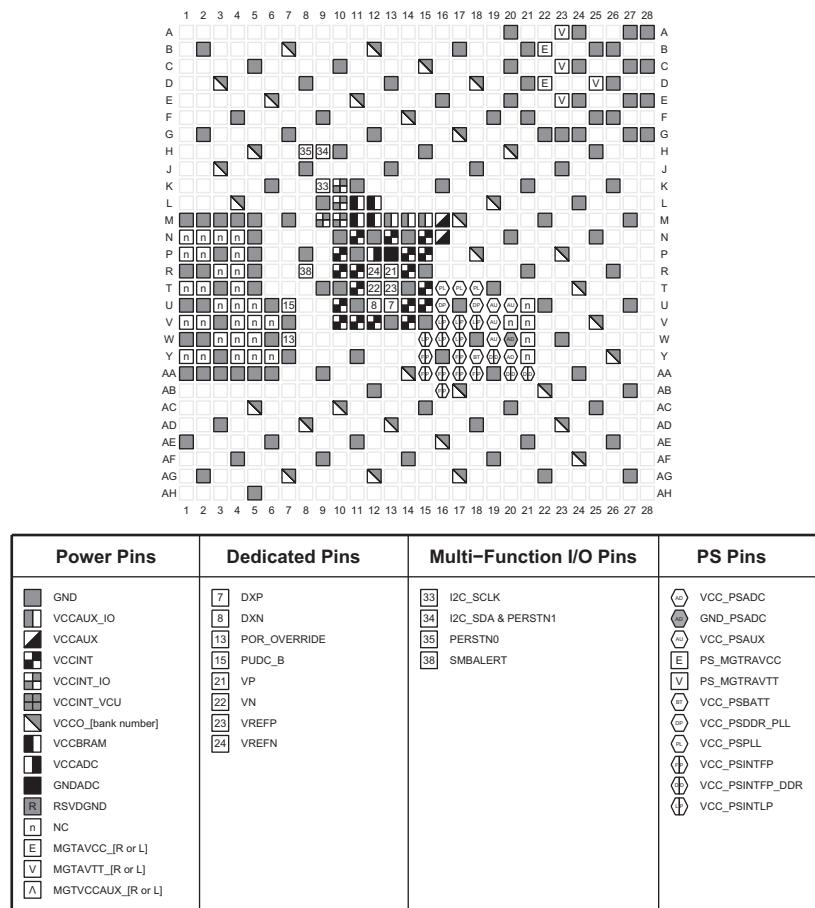


Figure 4-16: SFVC784 Package—XCZU2CG, XCZU2EG, XCZU3CG, XCZU3EG, XAZU2EG, and XAZU3EG Power, Dedicated, and Multi-function Pin Diagram

## SFVC784 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG

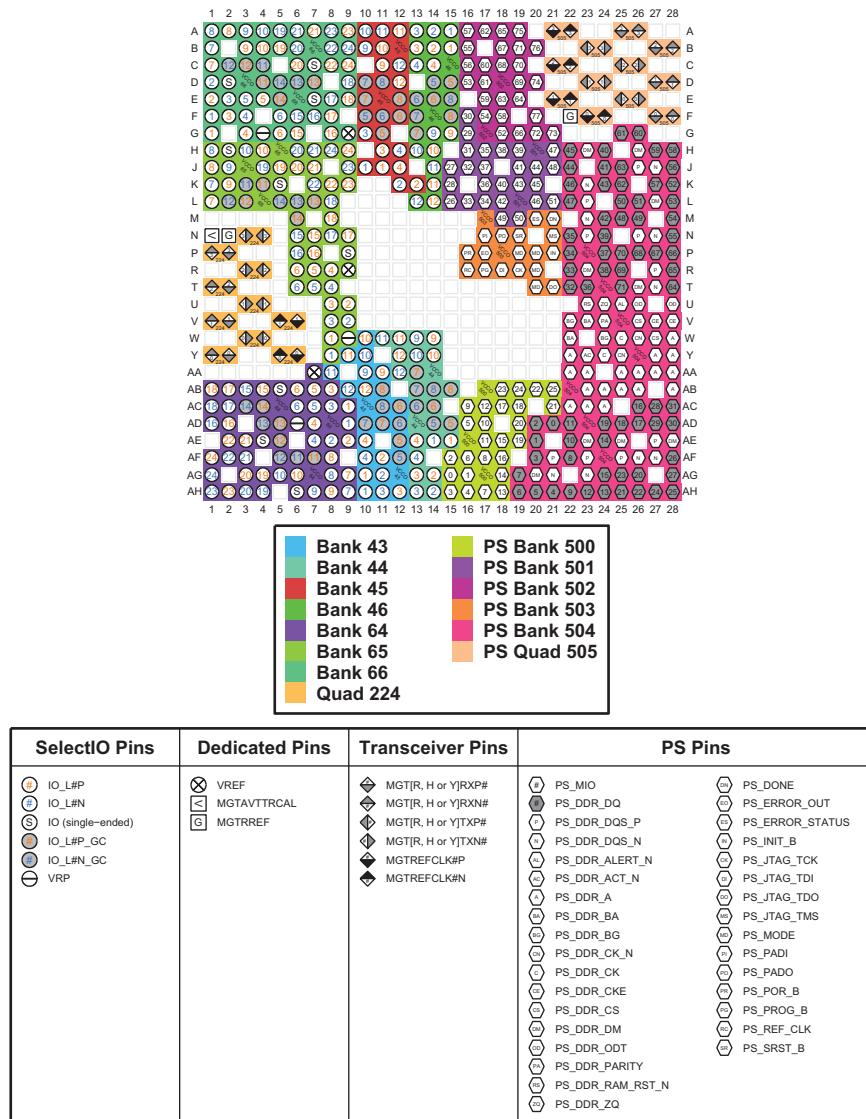
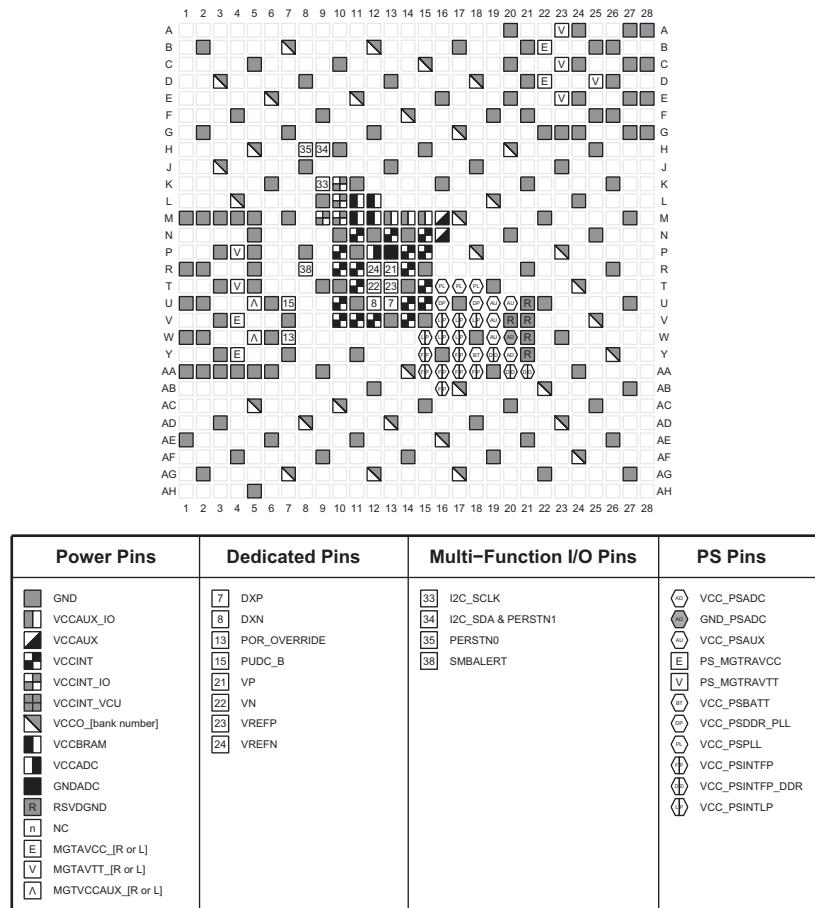


Figure 4-17: SFVC784 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG I/O Bank Diagram



*Figure 4-18: SFVC784 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG Power, Dedicated, and Multi-function Pin Diagram*

## SFVC784 Package—XCZU4EV, XCZU5EV, XAZU4EV, and XAZU5EV

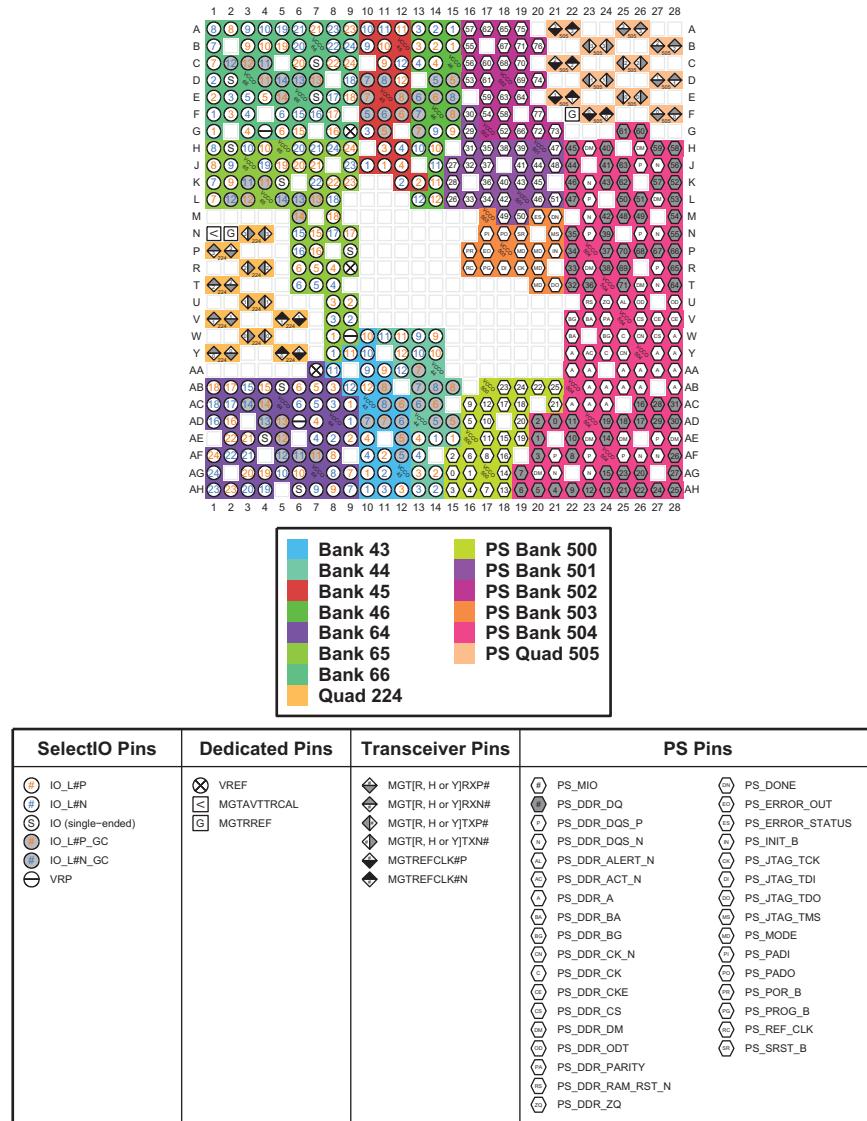


Figure 4-19: SFVC784 Package—XCZU4EV, XCZU5EV, XAZU4EV, and XAZU5EV I/O Bank Diagram

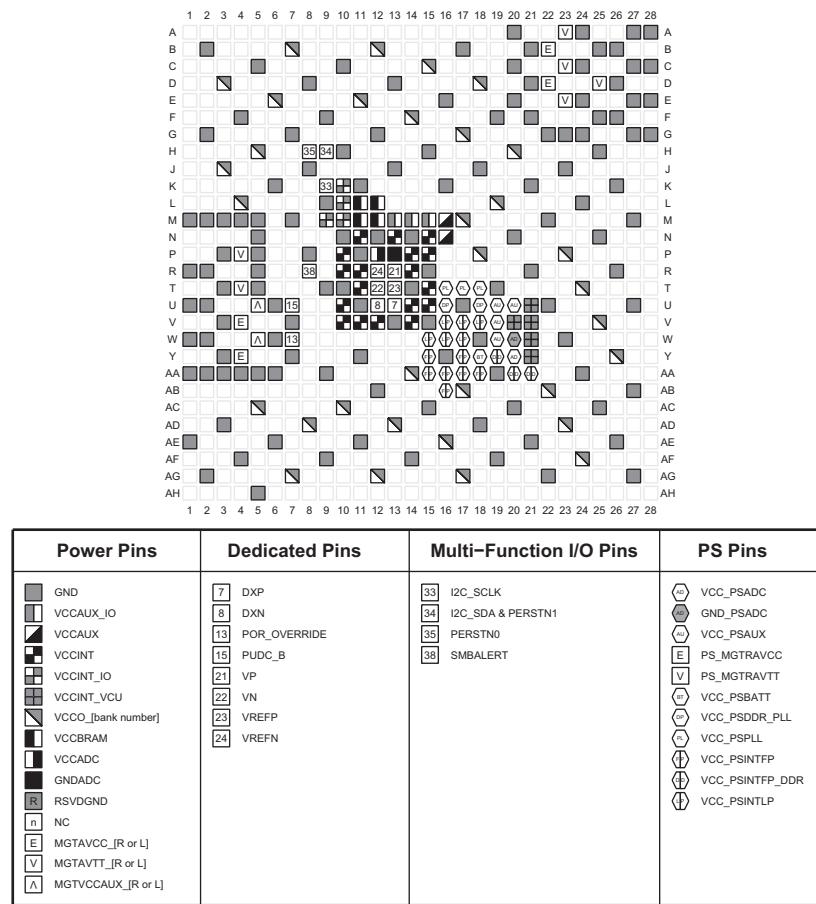


Figure 4-20: SFVC784 Package—XCZU4EV, XCZU5EV, XAZU4EV, and XAZU5EV Power, Dedicated, and Multi-function Pin Diagram

## FBVB900 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG

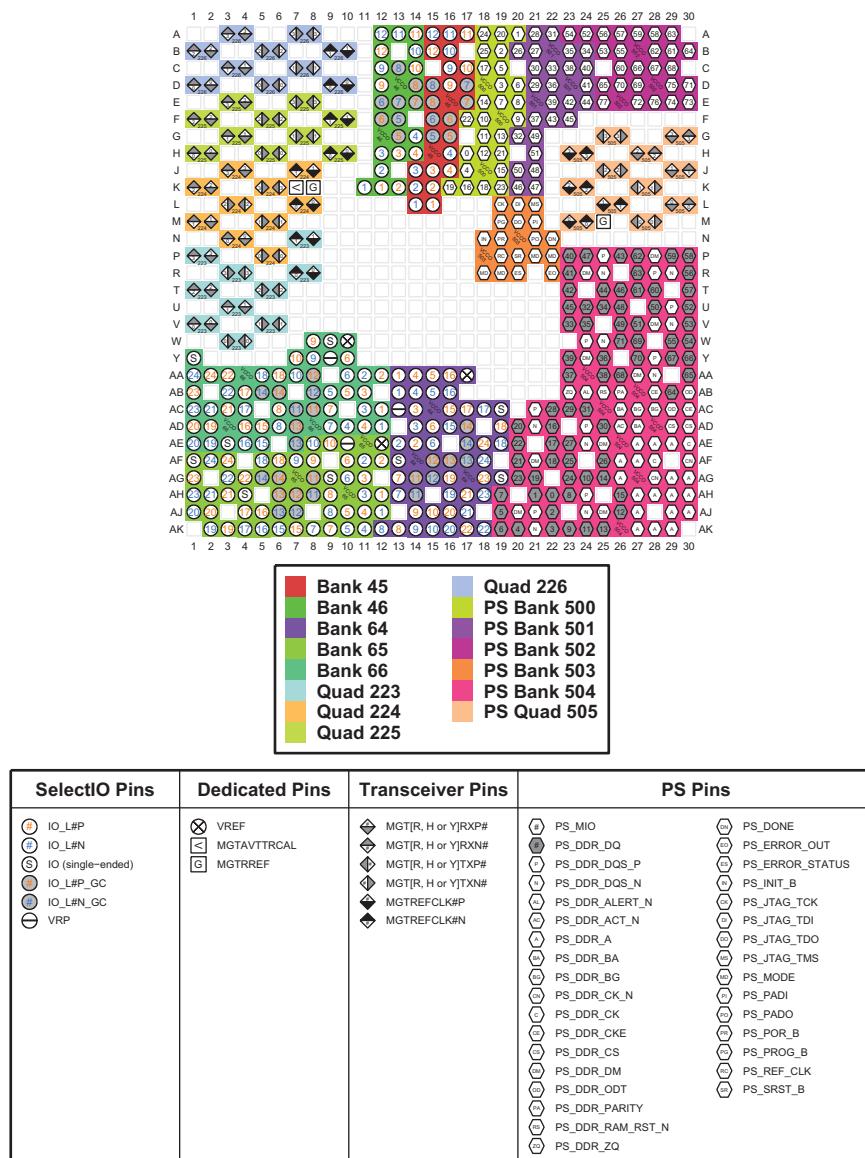


Figure 4-21: FBVB900 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG I/O Bank Diagram

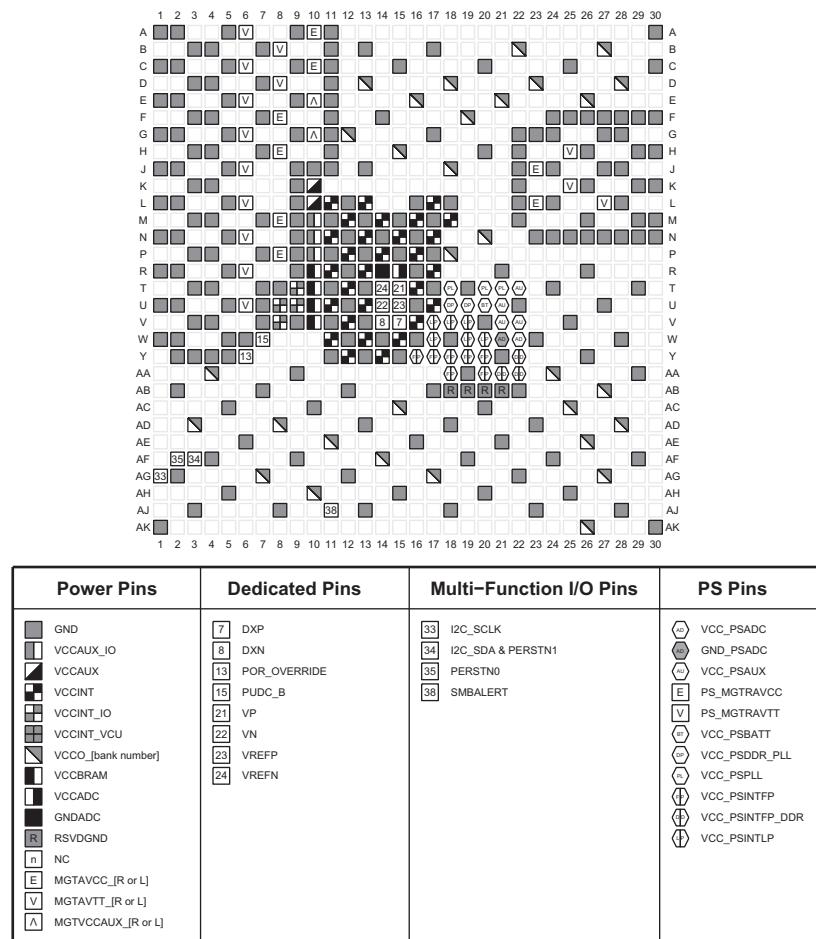


Figure 4-22: FBVB900 Package—XCZU4CG, XCZU4EG, XCZU5CG, and XCZU5EG Power, Dedicated, and Multi-function Pin Diagram

## FBVB900 Package—XCZU4EV and XCZU5EV

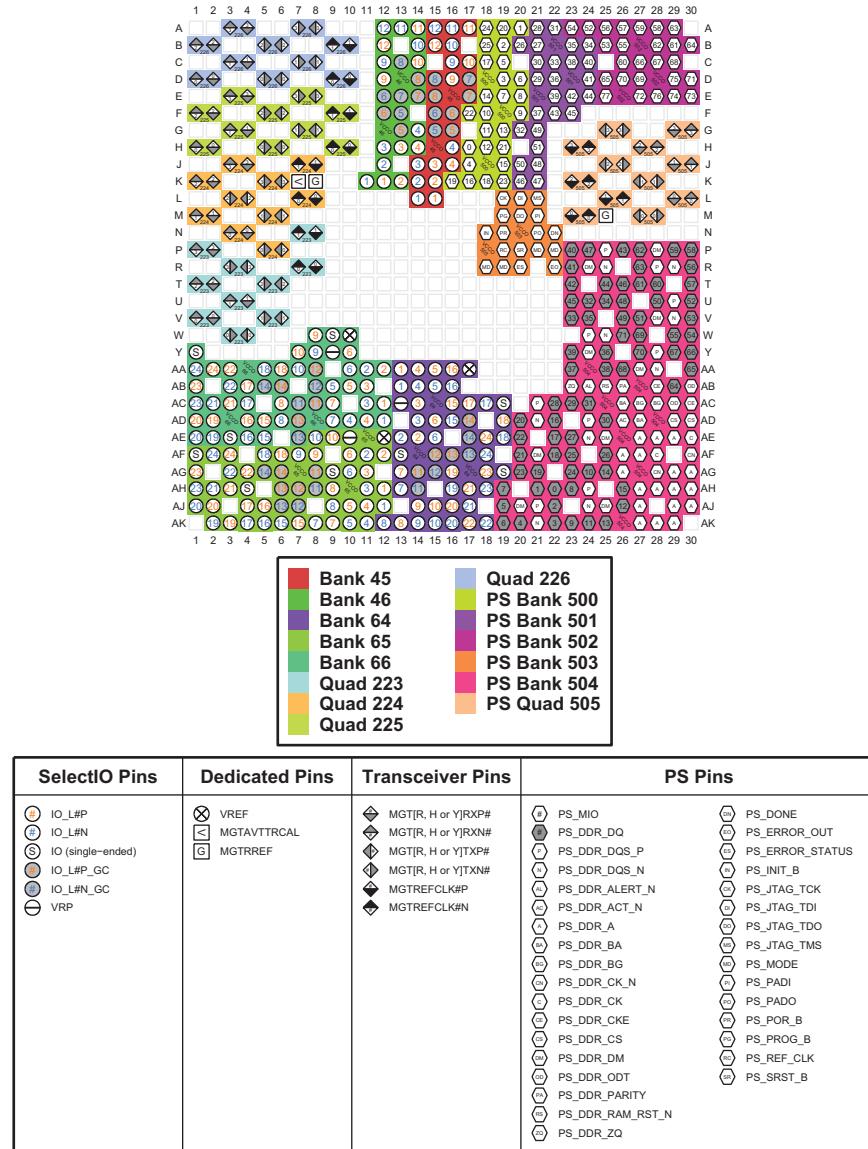


Figure 4-23: FBVB900 Package—XCZU4EV and XCZU5EV I/O Bank Diagram

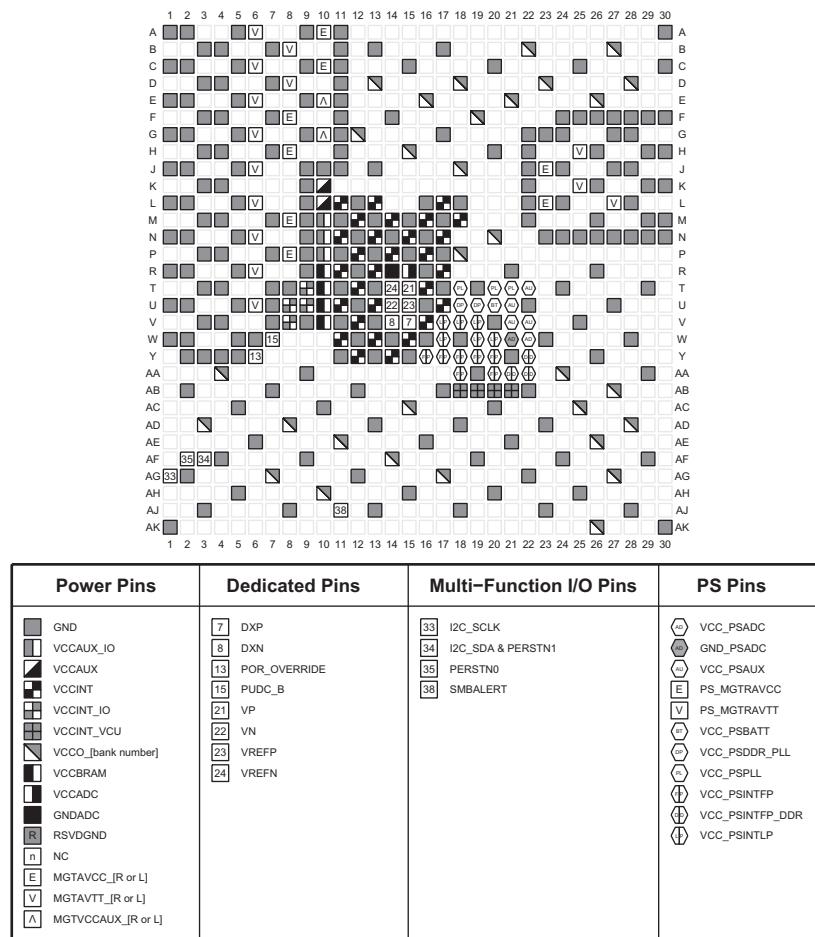


Figure 4-24: FBVB900 Package—XCZU4EV and XCZU5EV Power, Dedicated, and Multi-function Pin Diagram

## FBVB900 Package—XCZU7CG and XCZU7EG

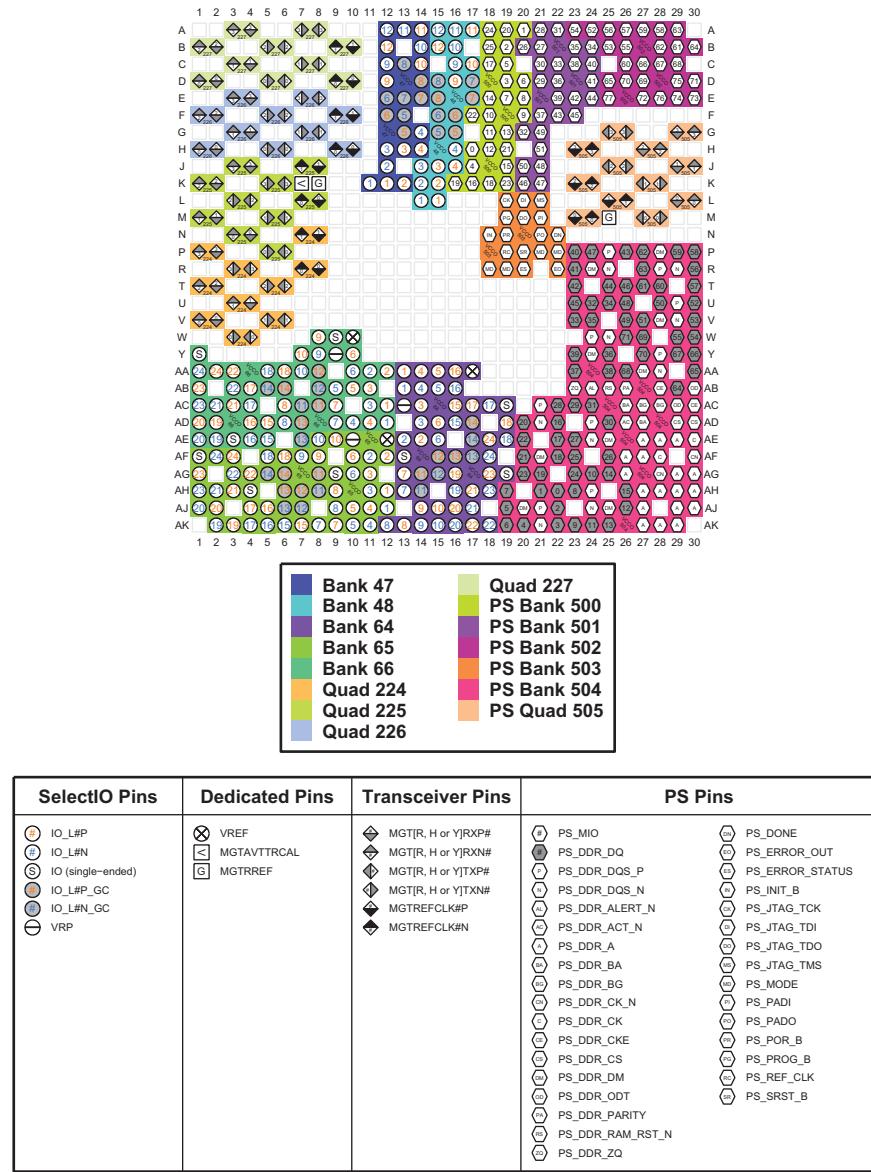


Figure 4-25: FBVB900 Package—XCZU7CG and XCZU7EG I/O Bank Diagram

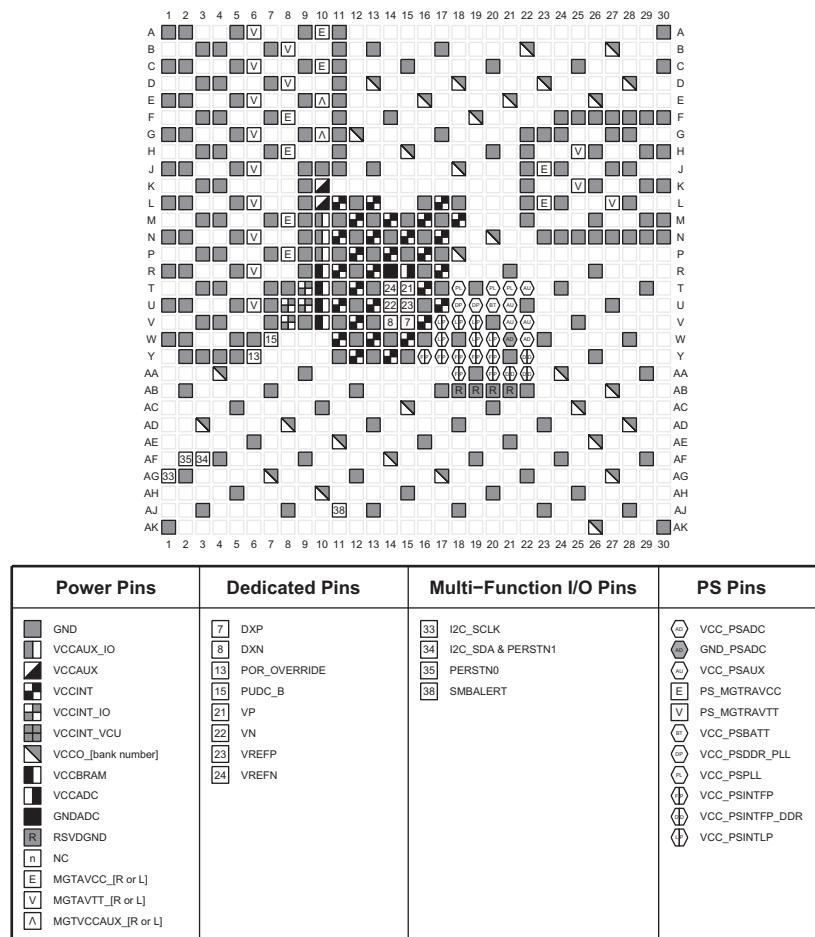


Figure 4-26: FBVB900 Package—XCZU7CG and XCZU7EG Power, Dedicated, and Multi-function Pin Diagram

## FBVB900 Package—XCZU7EV

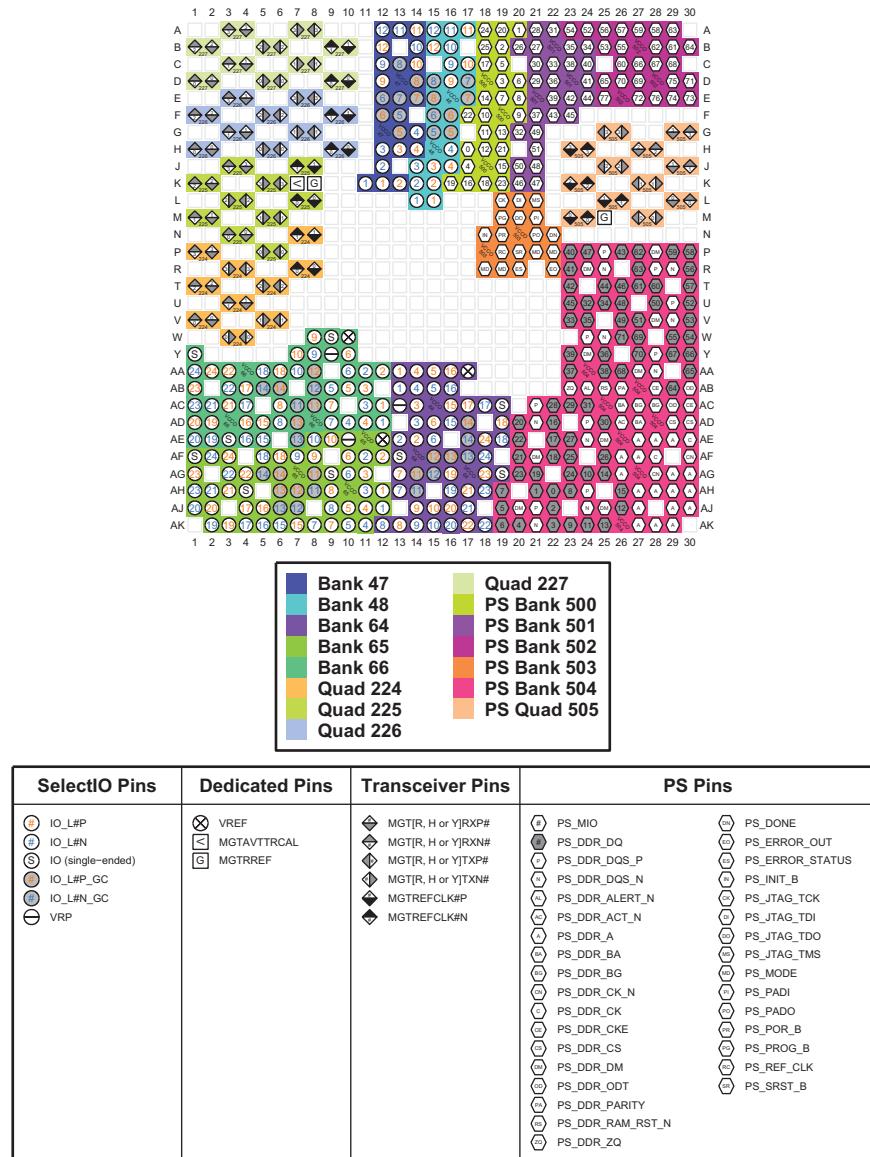


Figure 4-27: FBVB900 Package—XCZU7EV I/O Bank Diagram

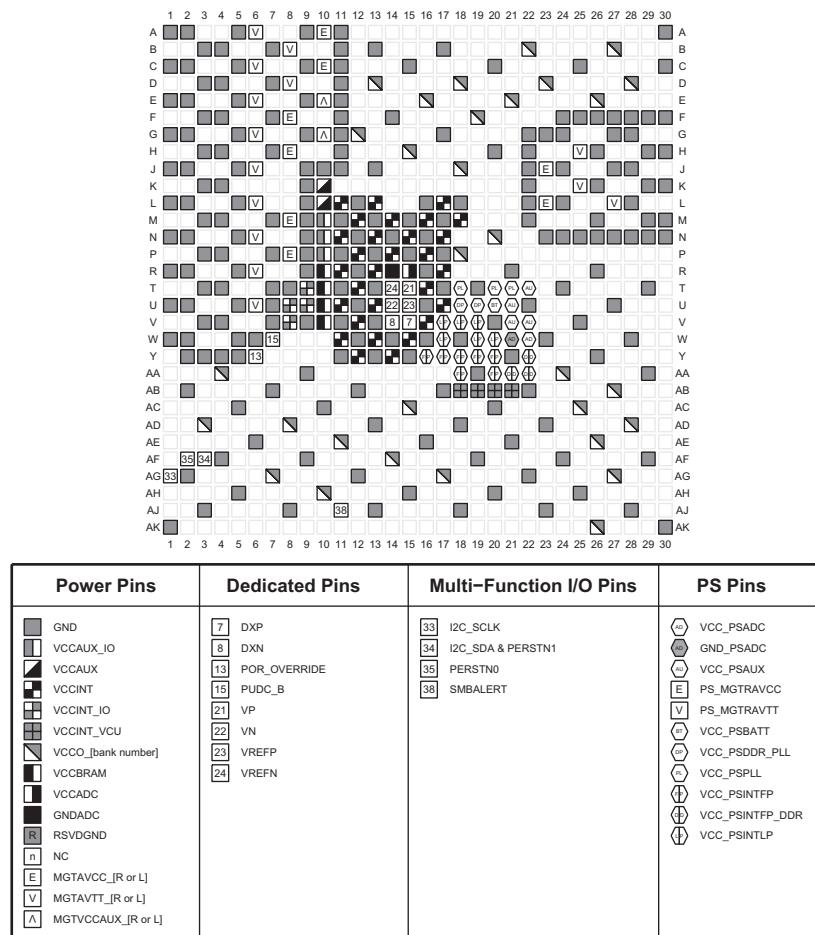


Figure 4-28: FBVB900 Package—XCZU7EV  
Power, Dedicated, and Multi-function Pin Diagram

## FFVC900 Package—XCZU6EG, XCZU9EG, and XCZU15EG

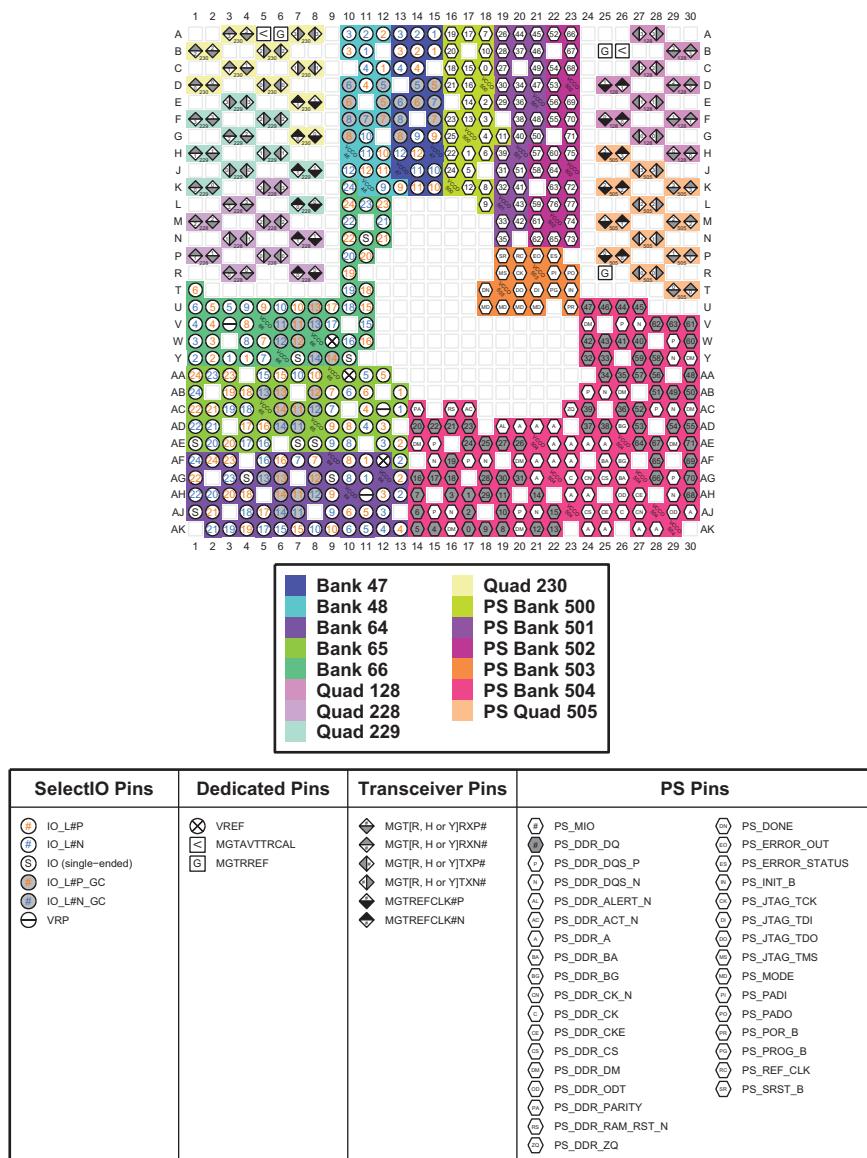


Figure 4-29: FFVC900 Package—XCZU6EG, XCZU9EG, and XCZU15EG I/O Bank Diagram

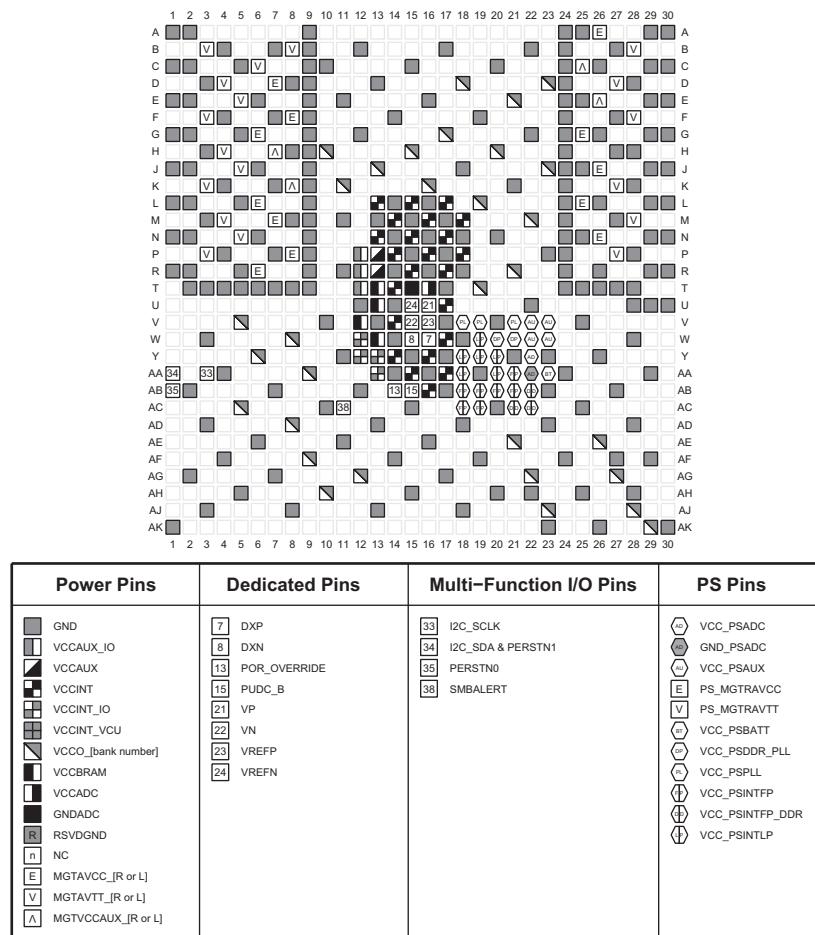
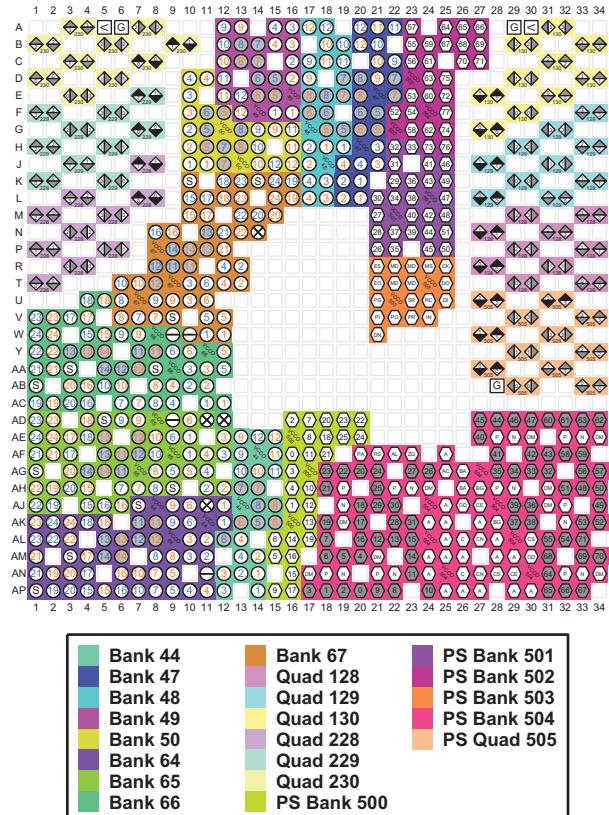


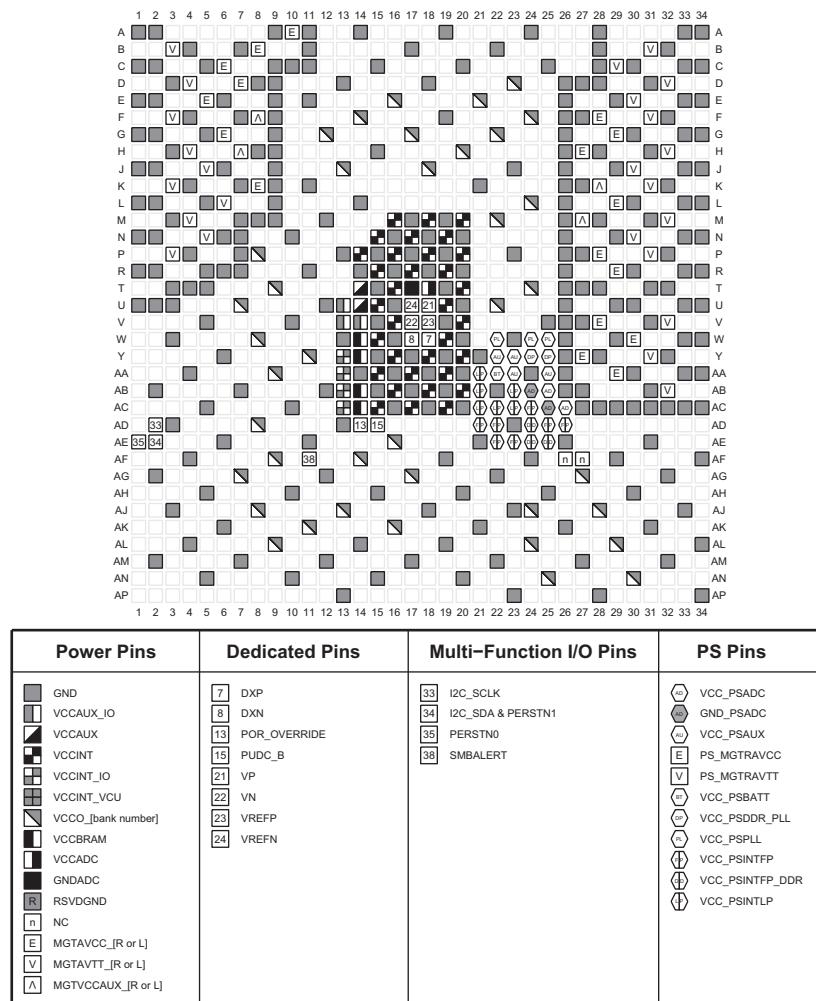
Figure 4-30: FFVC900 Package—XCZU6EG, XCZU9EG, and XCZU15EG Power, Dedicated, and Multi-function Pin Diagram

## FFVB1156 Package—XCZU6EG, XCZU9EG, and XCZU15EG



SelectIO Pins	Dedicated Pins	Transceiver Pins	PS Pins
<ul style="list-style-type: none"> <li>○ IO_L#P</li> <li>○ IO_L#N</li> <li>○ IO (single-ended)</li> <li>○ IO_L#P_GC</li> <li>○ IO_L#N_GC</li> <li>○ VRP</li> </ul>	<ul style="list-style-type: none"> <li>⊗ VREF</li> <li>⊜ MGTAVTRCAL</li> <li>⊜ MGTREF</li> </ul>	<ul style="list-style-type: none"> <li>◇ MGT[R, H or Y]RXP#</li> <li>◇ MGT[R, H or Y]RXN#</li> <li>◇ MGT[R, H or Y]TXP#</li> <li>◇ MGT[R, H or Y]TXN#</li> <li>◇ MGTREFCLK#P</li> <li>◇ MGTREFCLK#N</li> </ul>	<ul style="list-style-type: none"> <li>⊕ PS_MIO</li> <li>⊕ PS_DDR_DQ</li> <li>⊕ PS_DDR_DQS_P</li> <li>⊕ PS_DDR_DQS_N</li> <li>⊕ PS_DDR_ALERT_N</li> <li>⊕ PS_DDR_ACT_N</li> <li>⊕ PS_DDR_A</li> <li>⊕ PS_DDR_BA</li> <li>⊕ PS_DDR_BG</li> <li>⊕ PS_DDR_CK_N</li> <li>⊕ PS_DDR_CK</li> <li>⊕ PS_DDR_CKE</li> <li>⊕ PS_DDR_CS</li> <li>⊕ PS_DDR_DM</li> <li>⊕ PS_DDR_ODT</li> <li>⊕ PS_DDR_PARITY</li> <li>⊕ PS_DDR_RAM_RST_N</li> <li>⊕ PS_DDR_ZQ</li> <li>⊕ PS_DONE</li> <li>⊕ PS_ERROR_OUT</li> <li>⊕ PS_ERROR_STATUS</li> <li>⊕ PS_INIT_B</li> <li>⊕ PS_JTAG_TCK</li> <li>⊕ PS_JTAG_TDI</li> <li>⊕ PS_JTAG_TDO</li> <li>⊕ PS_JTAG_TMS</li> <li>⊕ PS_MODE</li> <li>⊕ PS_PADI</li> <li>⊕ PS_PAD0</li> <li>⊕ PS POR_B</li> <li>⊕ PS_PROG_B</li> <li>⊕ PS_REF_CLK</li> <li>⊕ PS_SRST_B</li> </ul>

Figure 4-31: FFVB1156 Package—XCZU6EG, XCZU9EG, and XCZU15EG I/O Bank Diagram



**Figure 4-32: FFVB1156 Package—XCZU6EG, XCZU9EG, and XCZU15EG Power, Dedicated, and Multi-function Pin Diagram**

## FFVC1156 Package—XCZU7CG and XCZU7EG

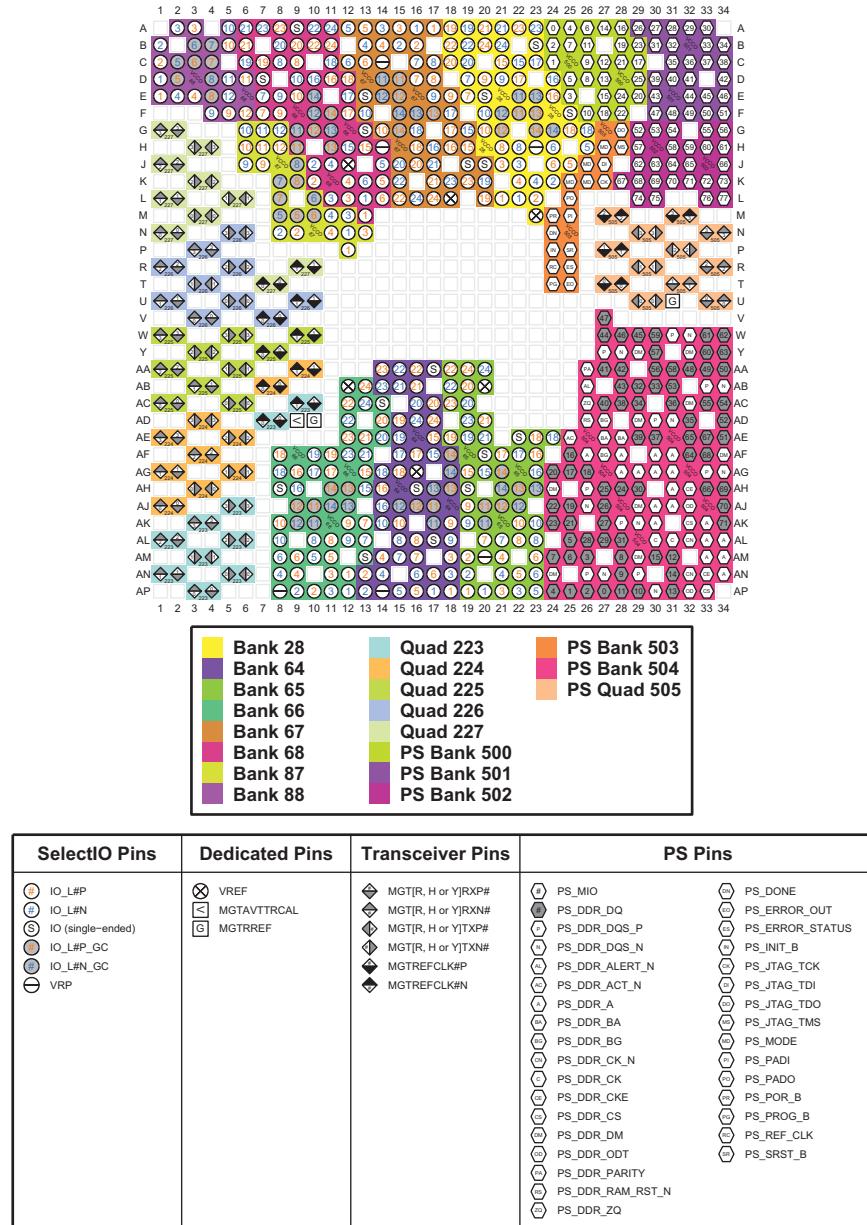


Figure 4-33: FFVC1156 Package—XCZU7CG and XCZU7EG I/O Bank Diagram

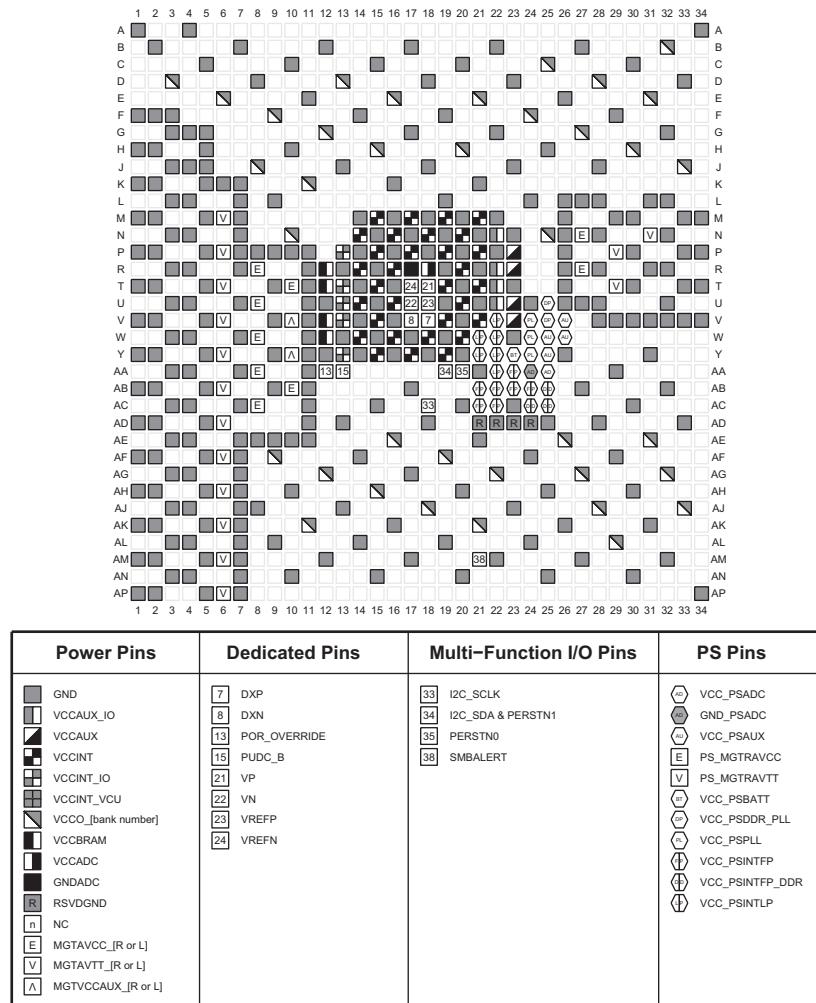


Figure 4-34: FFVC1156 Package—XCZU7CG and XCZU7EG Power, Dedicated, and Multi-function Pin Diagram

## FFVC1156 Package—XCZU7EV

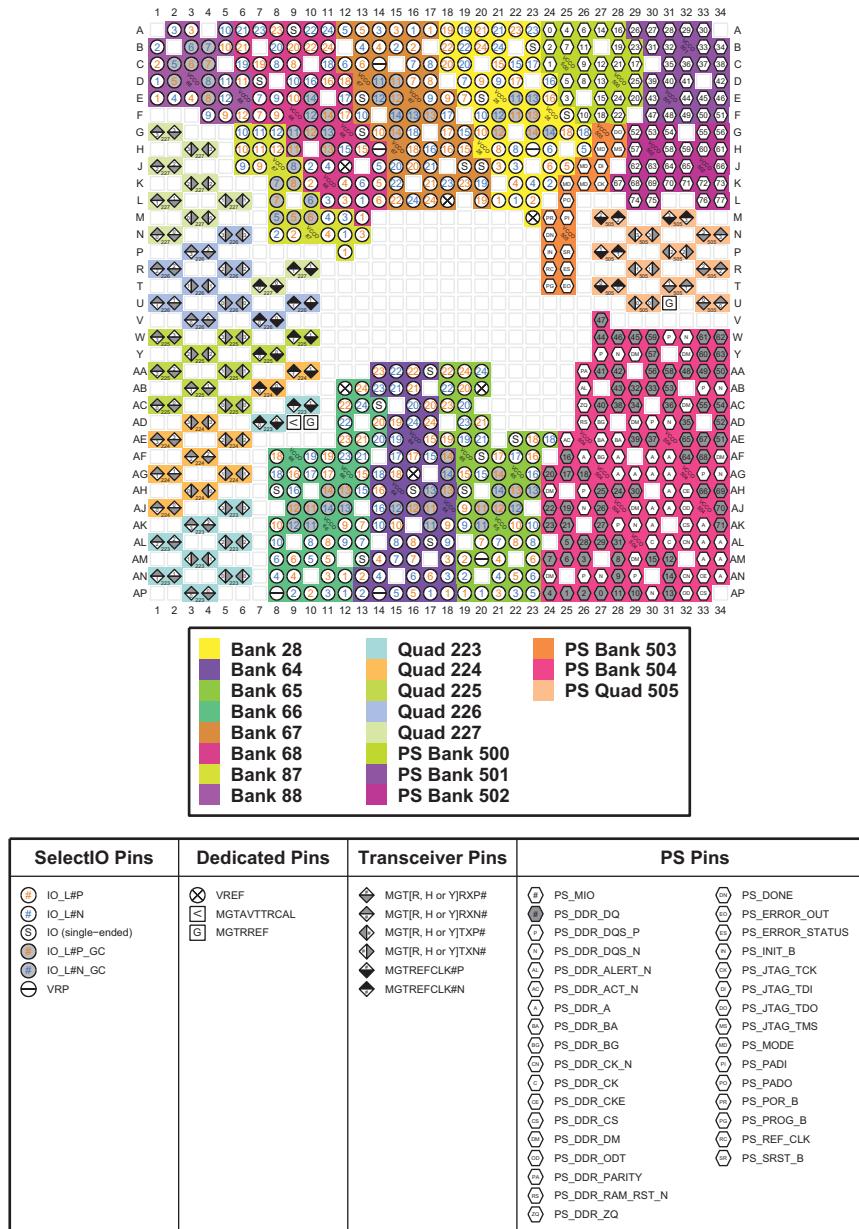


Figure 4-35: FFVC1156 Package—XCZU7EV I/O Bank Diagram

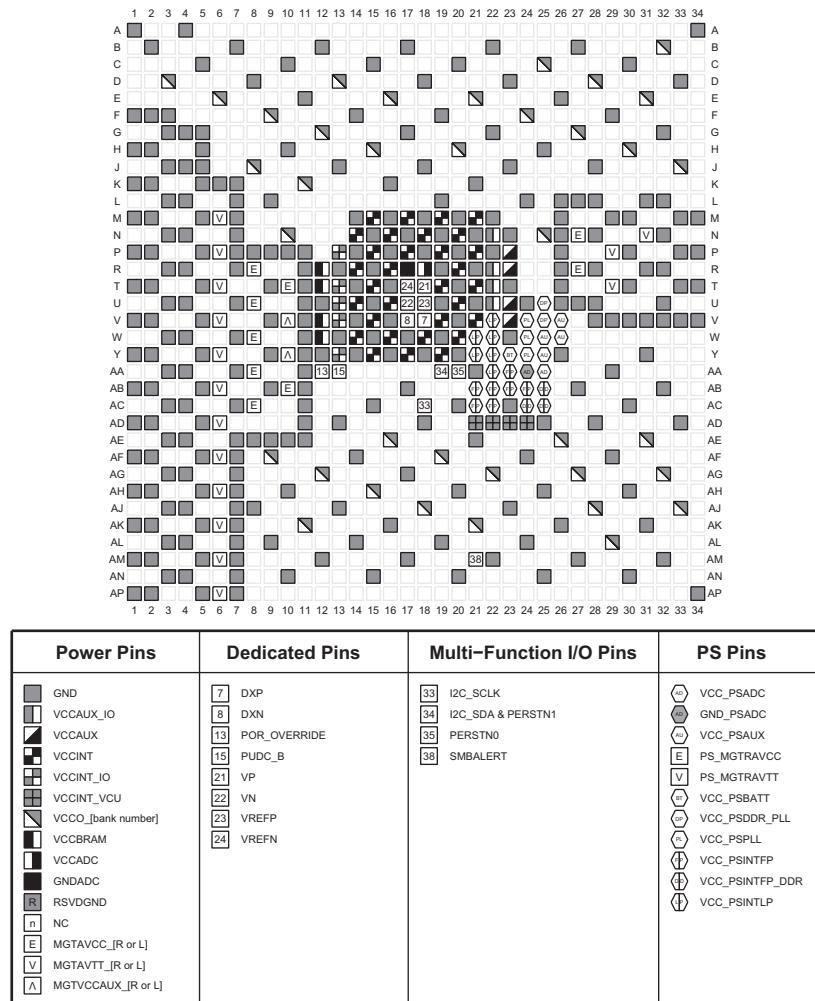


Figure 4-36: FFVC1156 Package—XCZU7EV Power, Dedicated, and Multi-function Pin Diagram

## FFVC1156 Package—XCZU11EG

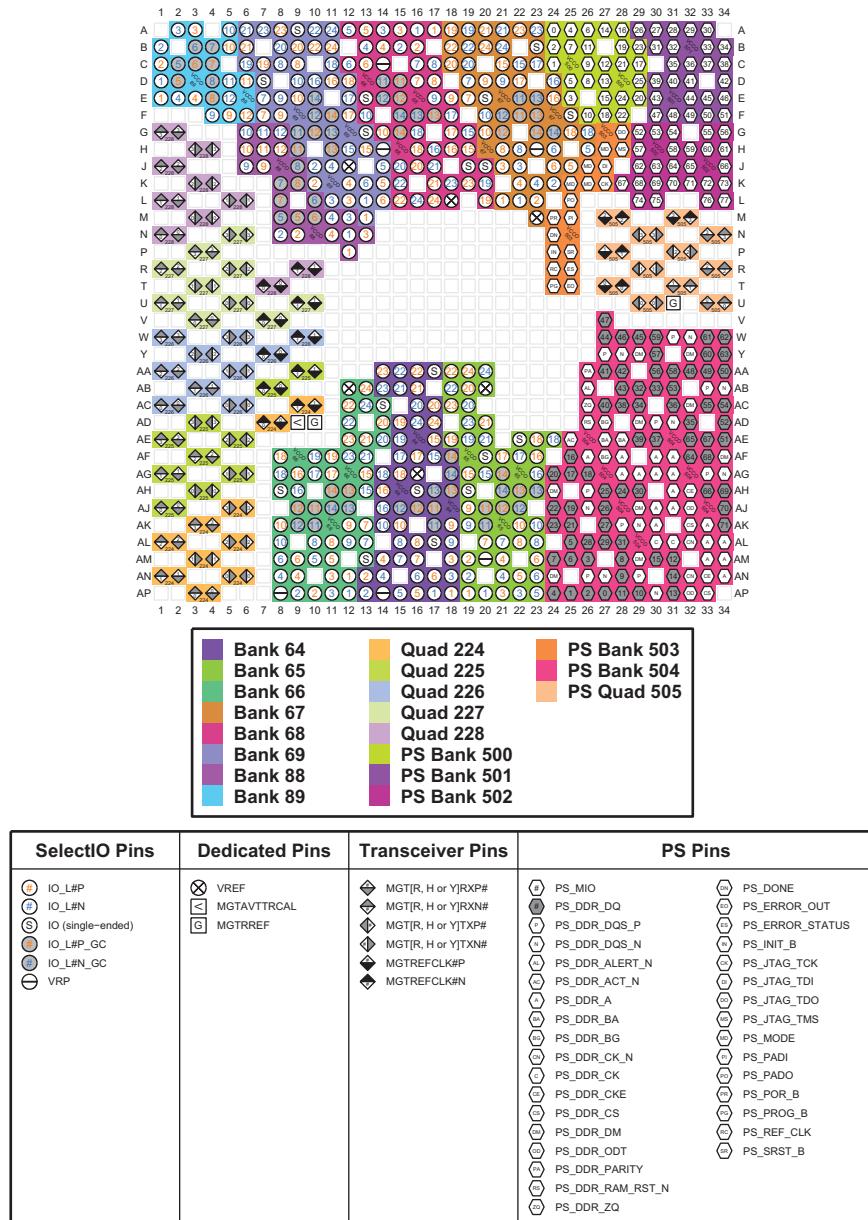


Figure 4-37: FFVC1156 Package—XCZU11EG I/O Bank Diagram

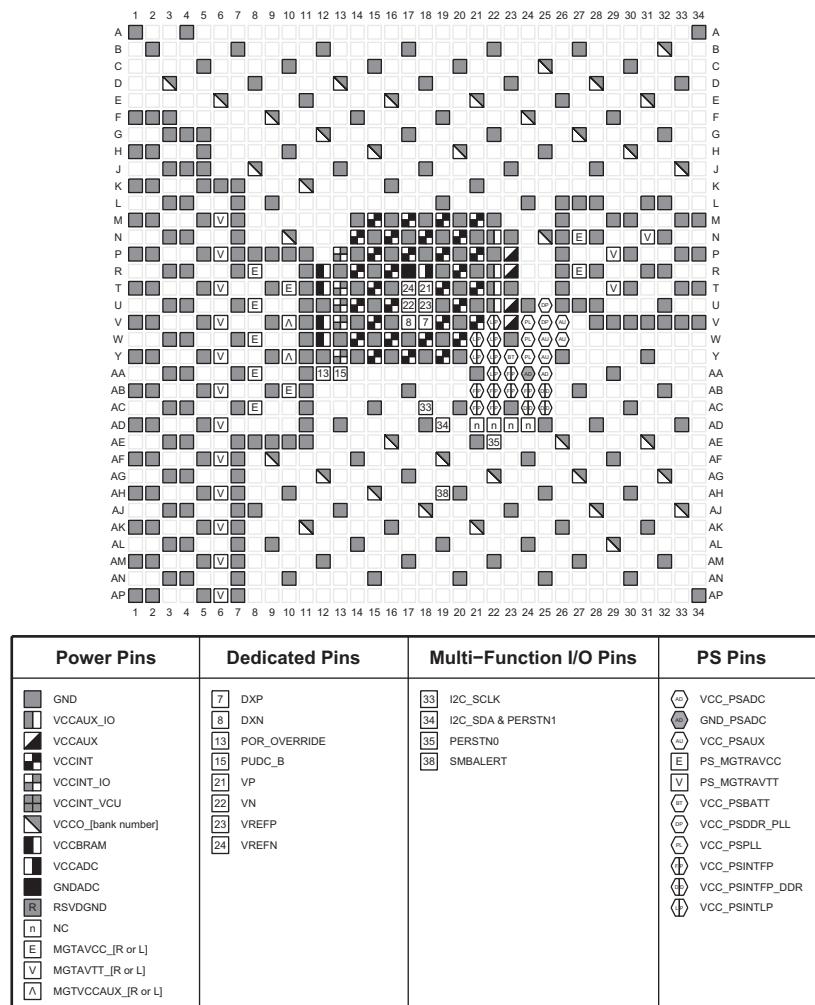


Figure 4-38: FFVC1156 Package—XCZU11EG Power, Dedicated, and Multi-function Pin Diagram

## FFVD1156 Package—XCZU21DR

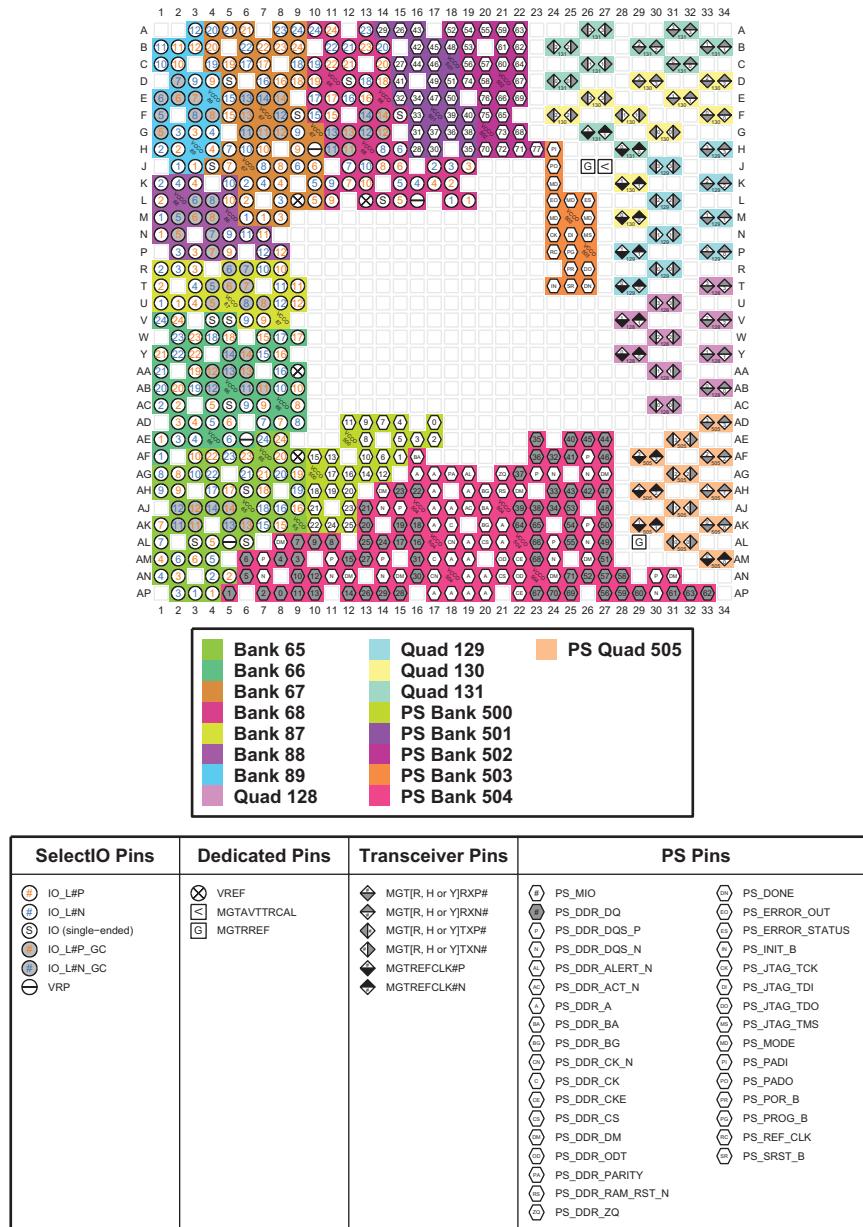


Figure 4-39: FFVD1156 Package—XCZU21DR I/O Bank Diagram

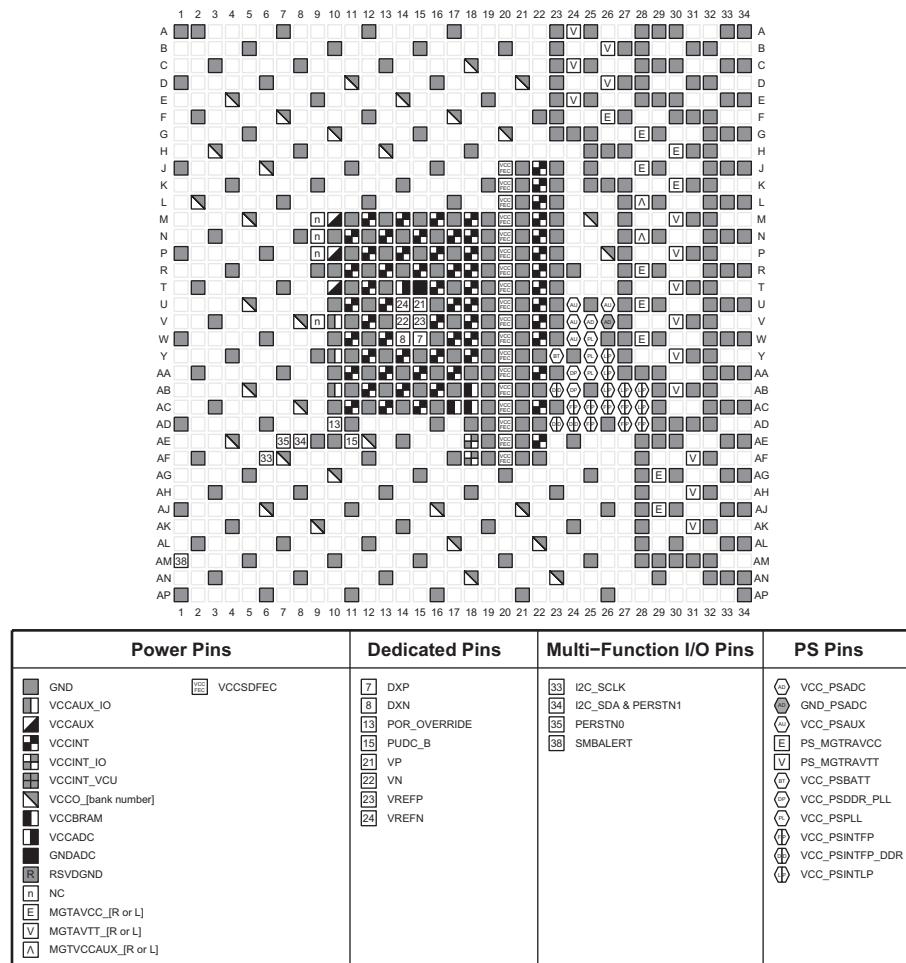


Figure 4-40: FFVD1156 Package—XCZU21DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU25DR

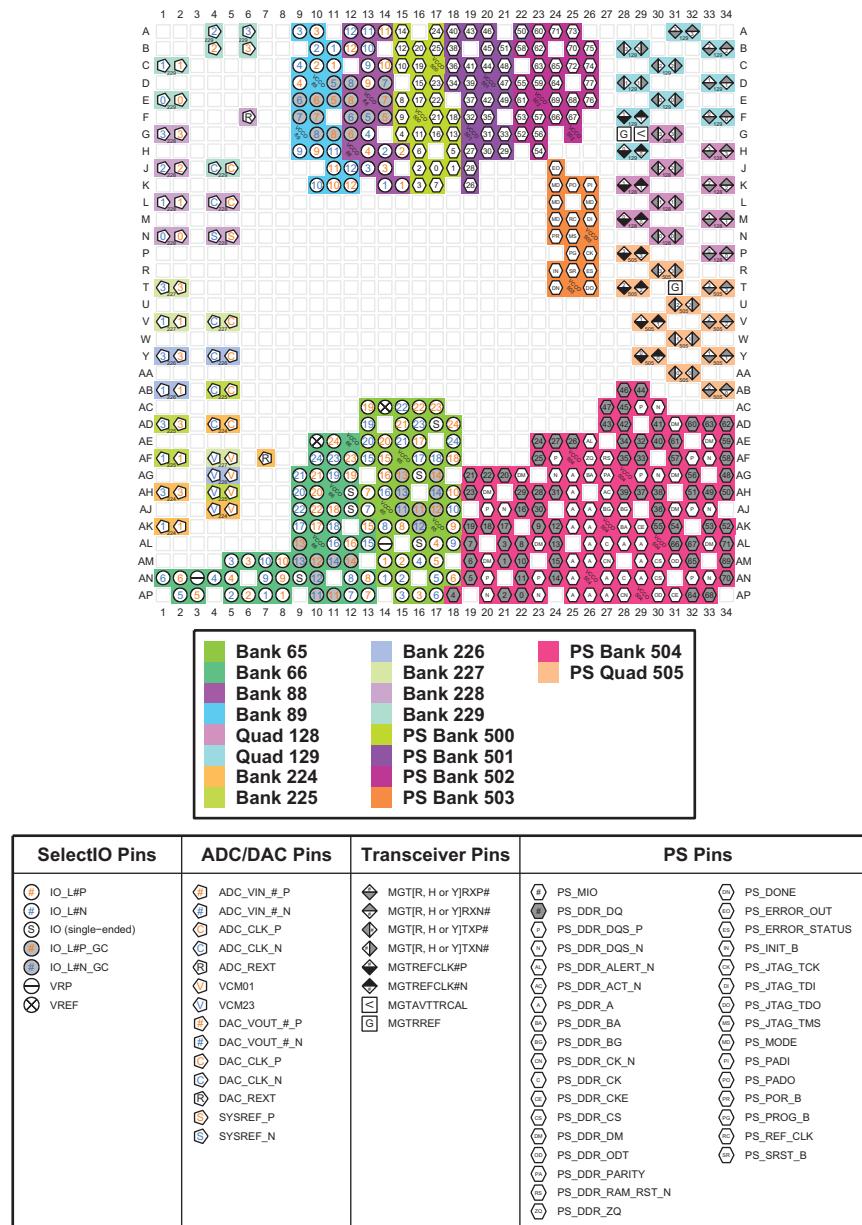


Figure 4-41: FFVE1156 and FSVE1156 Packages—XCZU25DR I/O Bank Diagram

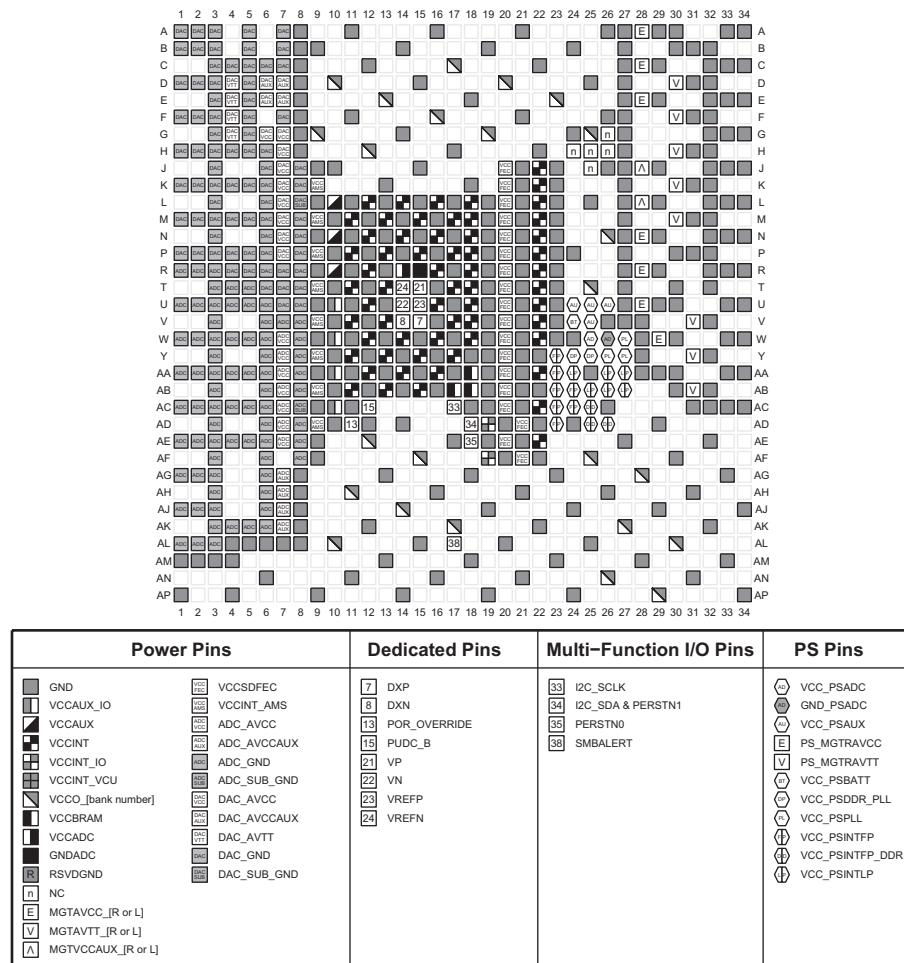


Figure 4-42: FFVE1156 and FSVE1156 Packages—XCZU25DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU27DR and XCZU28DR

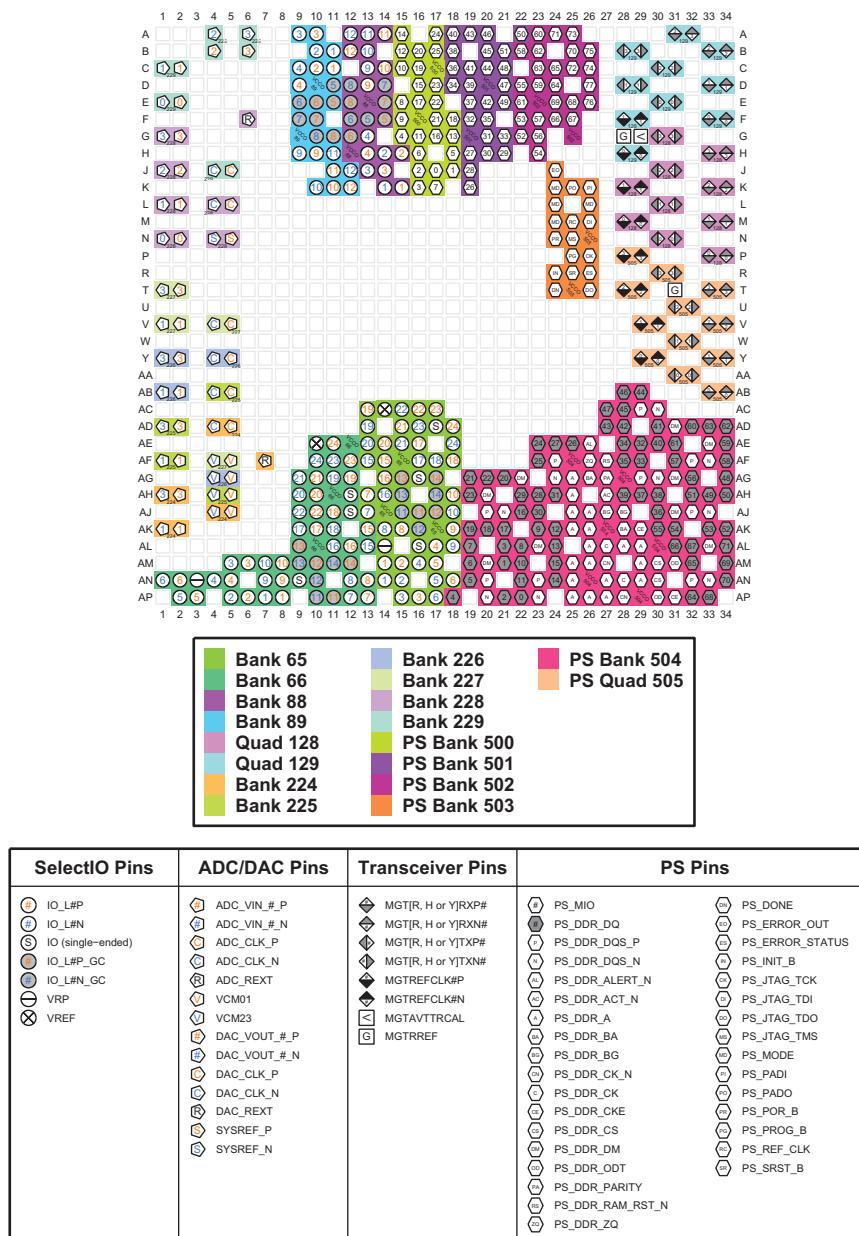


Figure 4-43: FFVE1156 and FSVE1156 Packages—XCZU27DR and XCZU28DR I/O Bank Diagram

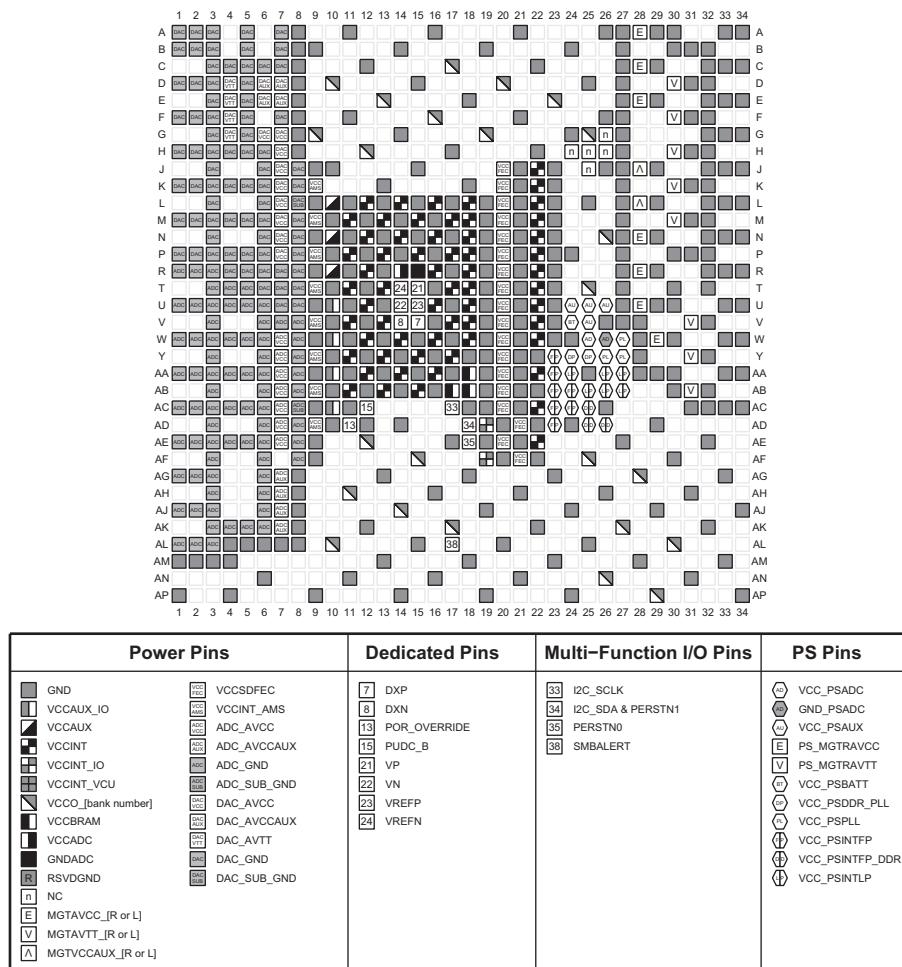


Figure 4-44: FFVE1156 and FSVE1156 Packages—XCZU27DR and XCZU28DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU42DR

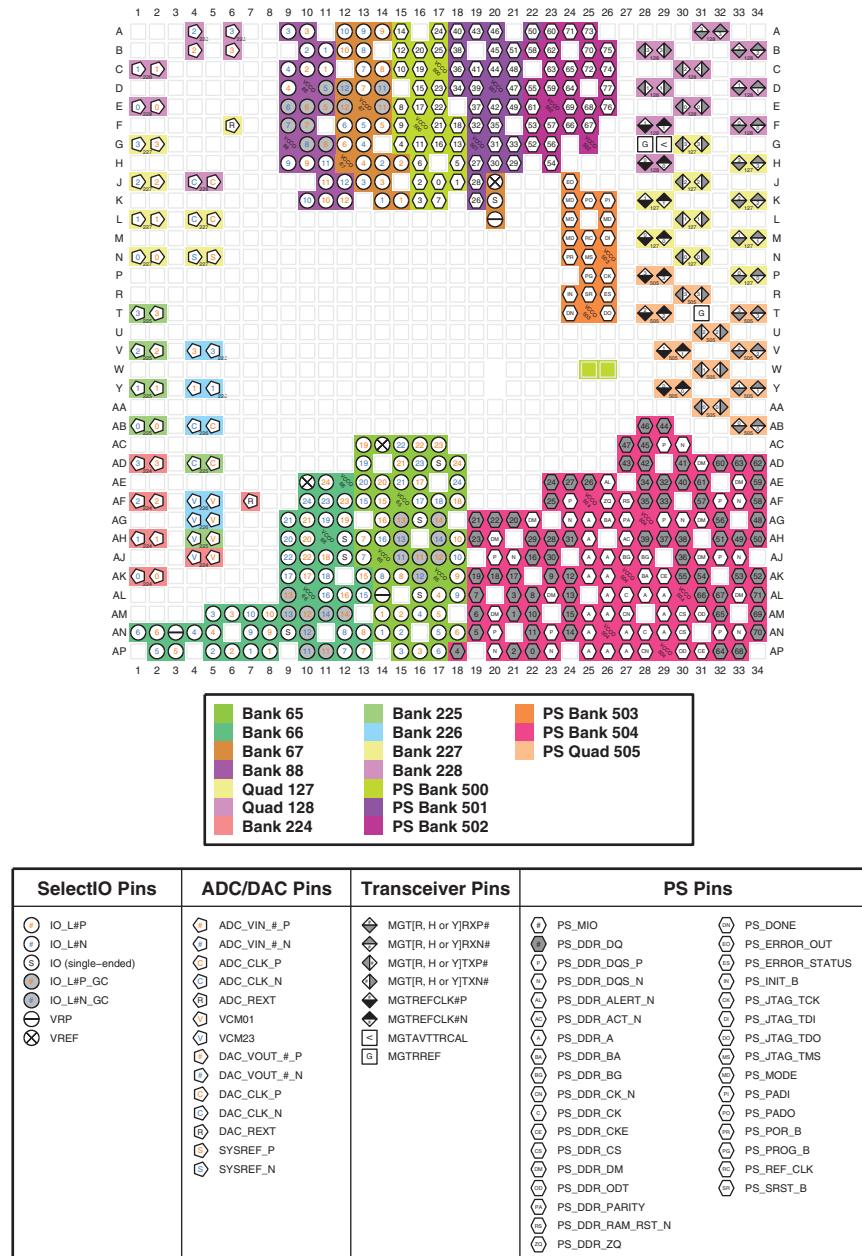


Figure 4-45: FFVE1156 and FSVE1156 Packages—XCZU42DR I/O Bank Diagram

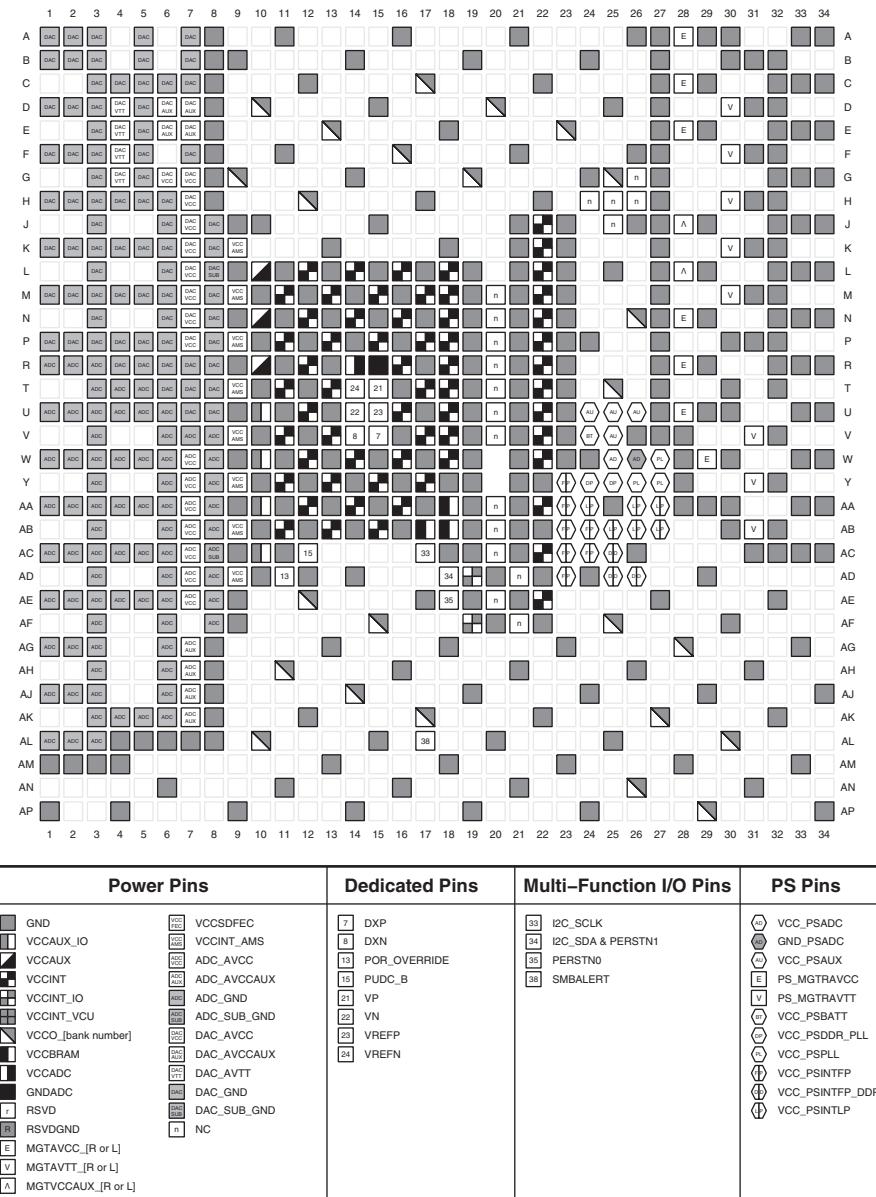


Figure 4-46: FFVE1156 and FSVE1156 Packages—XCZU42DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU43DR

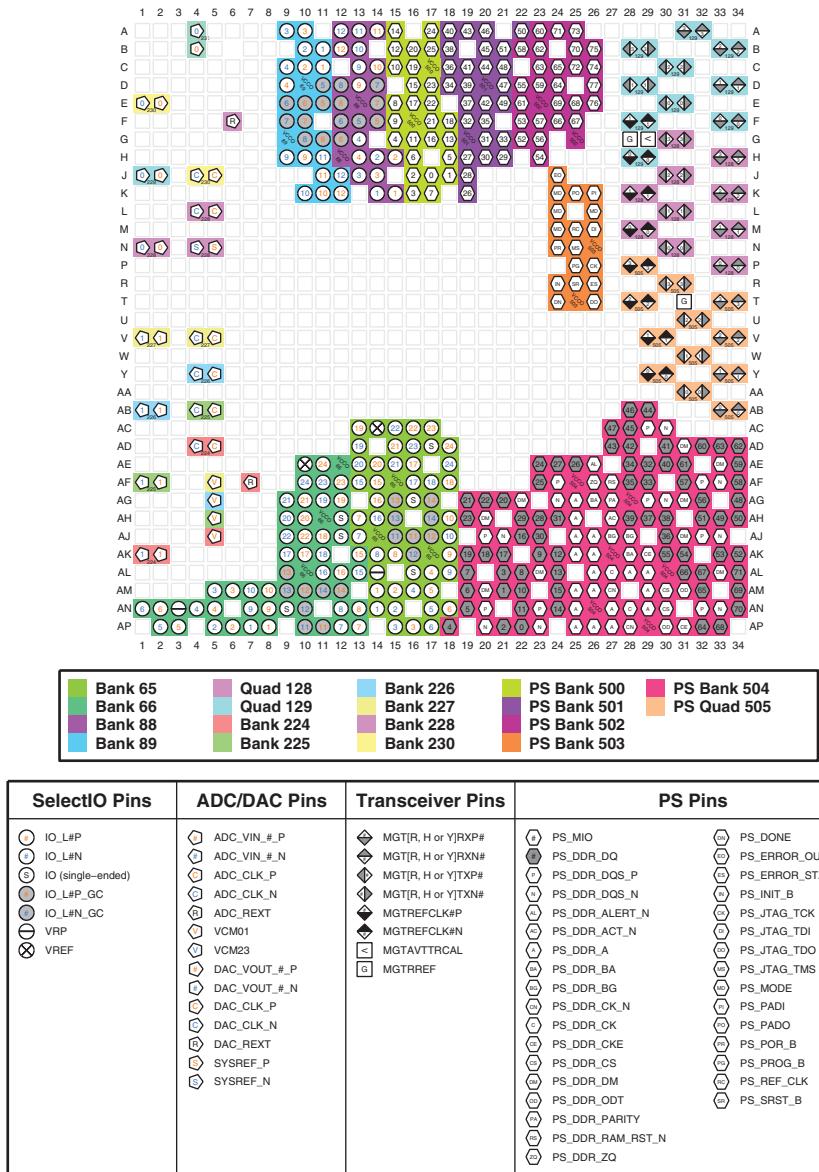


Figure 4-47: FFVE1156 and FSVE1156 Packages—XCZU43DR I/O Bank Diagram

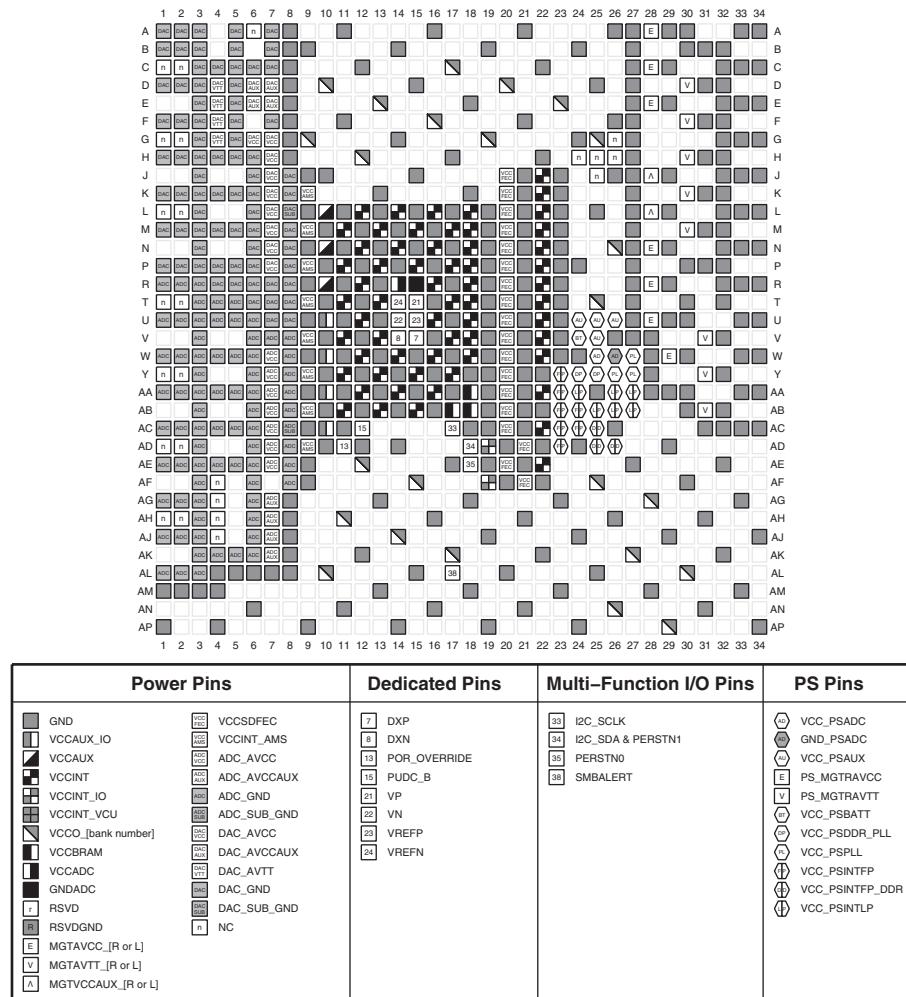


Figure 4-48: FFVE1156 and FSVE1156 Packages—XCZU43DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU47DR

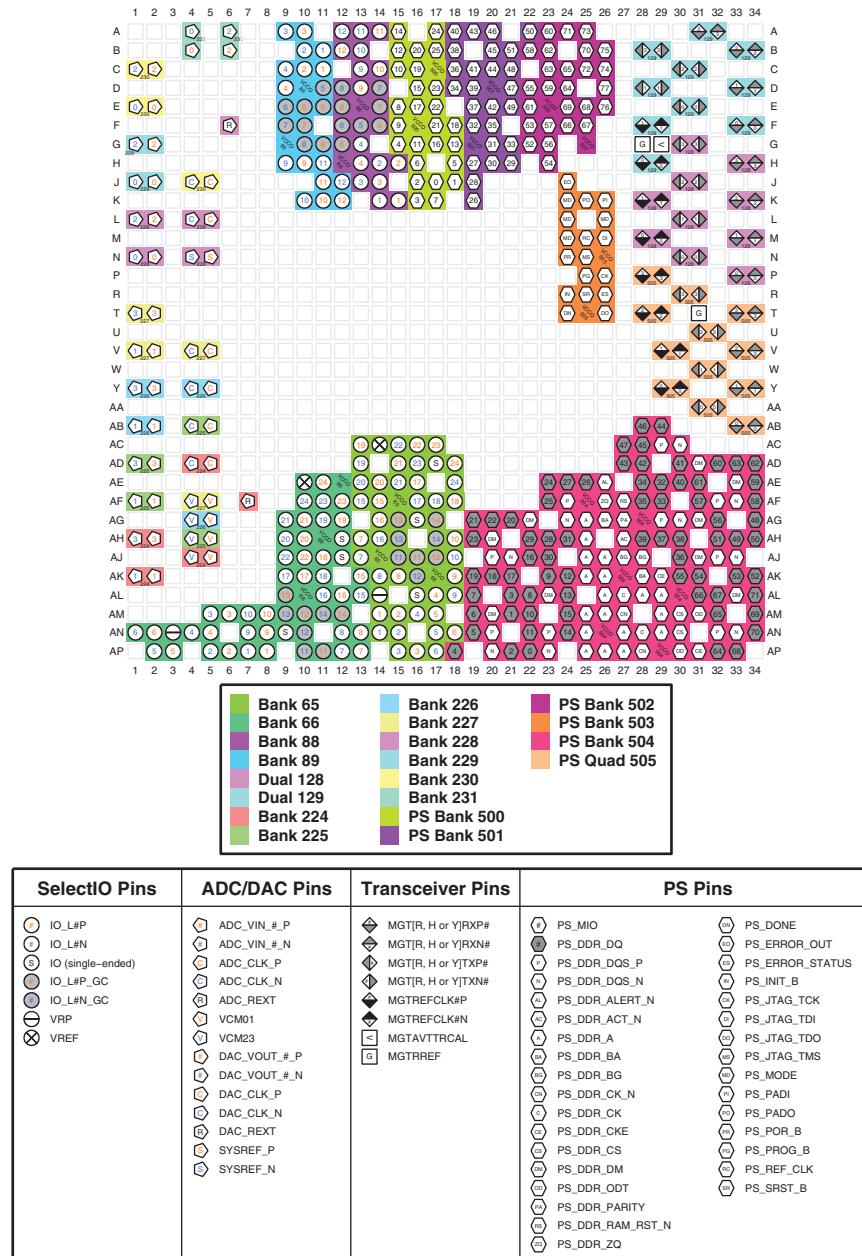


Figure 4-49: FFVE1156 and FSVE1156 Packages—XCZU47DR I/O Bank Diagram

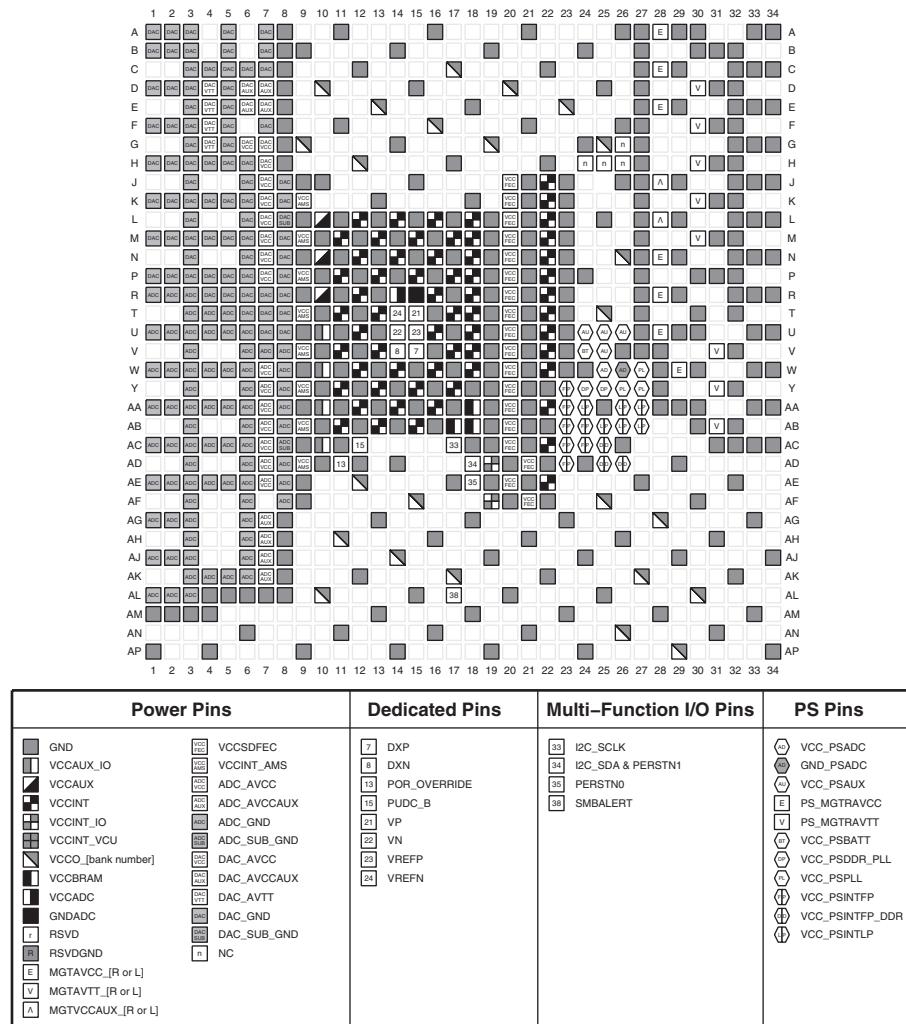


Figure 4-50: FFVE1156 and FSVE1156 Packages—XCZU47DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU48DR

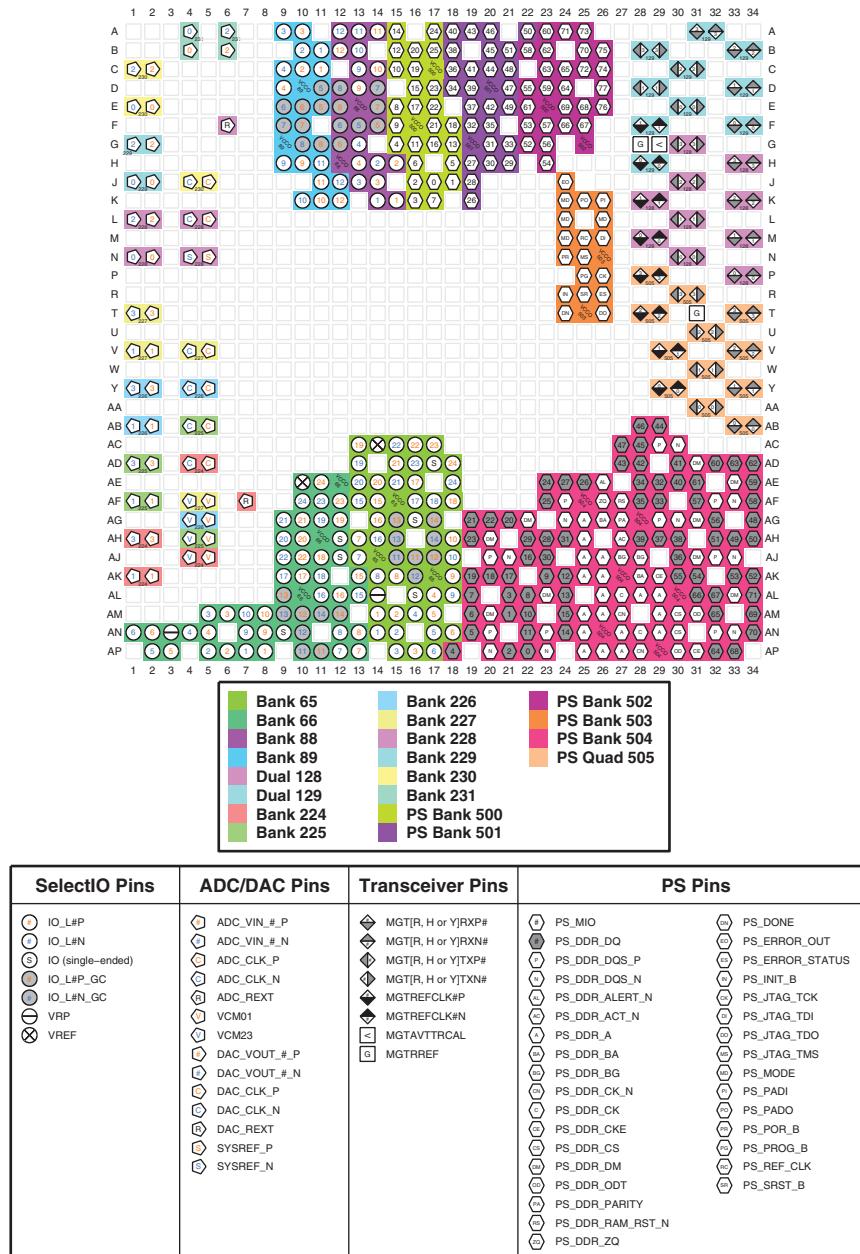


Figure 4-51: FFVE1156 and FSVE1156 Packages—XCZU48DR I/O Bank Diagram

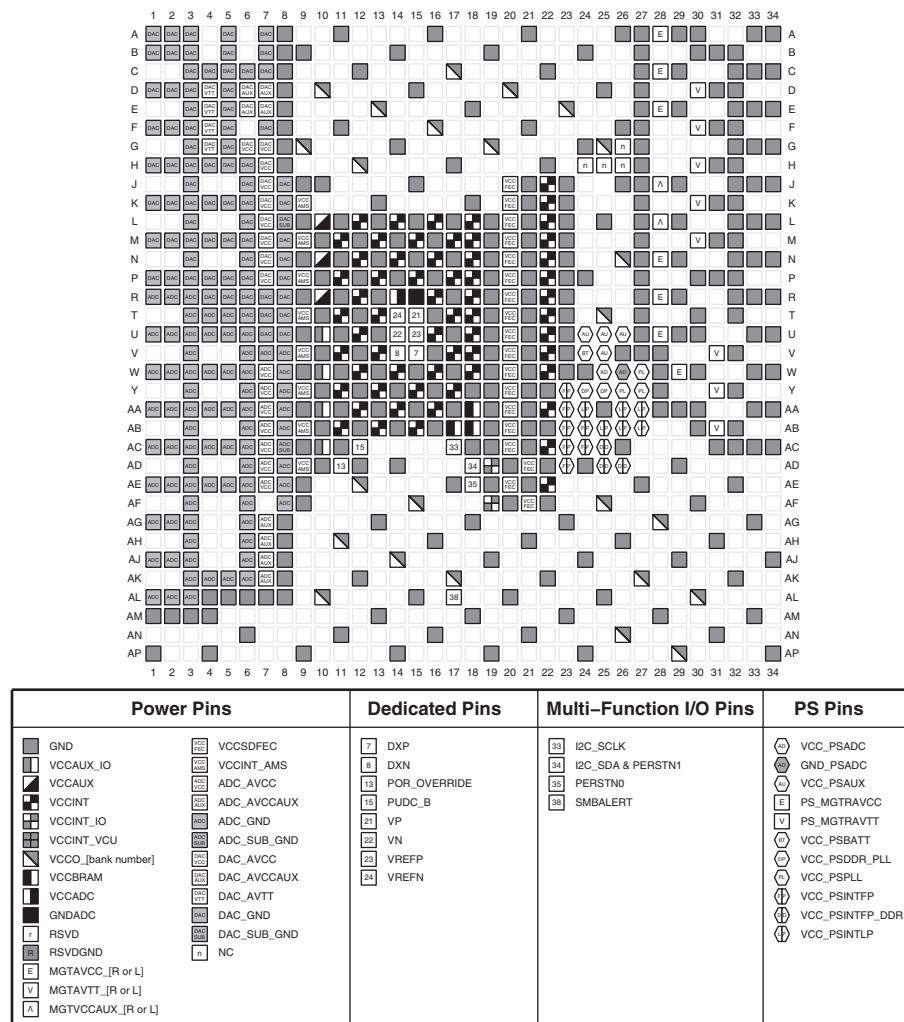
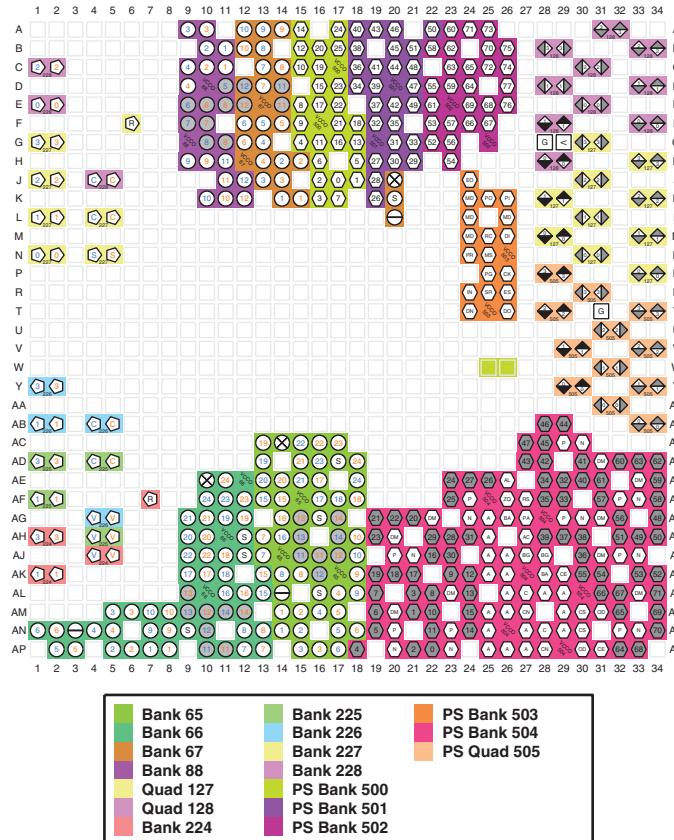


Figure 4-52: FFVE1156 and FSVE1156 Packages—XCZU48DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU65DR



SelectIO Pins	ADC/DAC Pins	Transceiver Pins	PS Pins
IO_L#P IO_L#N IO (single-ended) IO_L#P_GC IO_L#N_GC VRP VREF	ADC_VIN_#_P ADC_VIN_#_N ADC_CLK_P ADC_CLK_N ADC_REXT VCM01 VCM23 DAC_VOUT_#_P DAC_VOUT_#_N DAC_CLK_P DAC_CLK_N DAC_REXT SYSREF_P SYSREF_N	MGT[R, H or Y]RXP# MGT[R, H or Y]RXN# MGT[R, H or Y]TXP# MGT[R, H or Y]TXN# MGTRREFCLK#P MGTRREFCLK#N MGTAVTRCAL MGTRREF	PS_MIO PS_DDR_DQ PS_DDR_DQS_P PS_DDR_DQS_N PS_DDR_ALERT_N PS_DDR_ACT_N PS_DDR_A PS_DDR_BA PS_DDR_BG PS_DDR_CK_N PS_DDR_CK PS_DDR_CKE PS_DDR_CS PS_DDR_DM PS_DDR_ODT PS_DDR_PARITY PS_DDR_RAM_RST_N PS_DDR_ZQ

Figure 4-53: FFVE1156 and FSVE1156 Packages—XCZU65DR I/O Bank Diagram

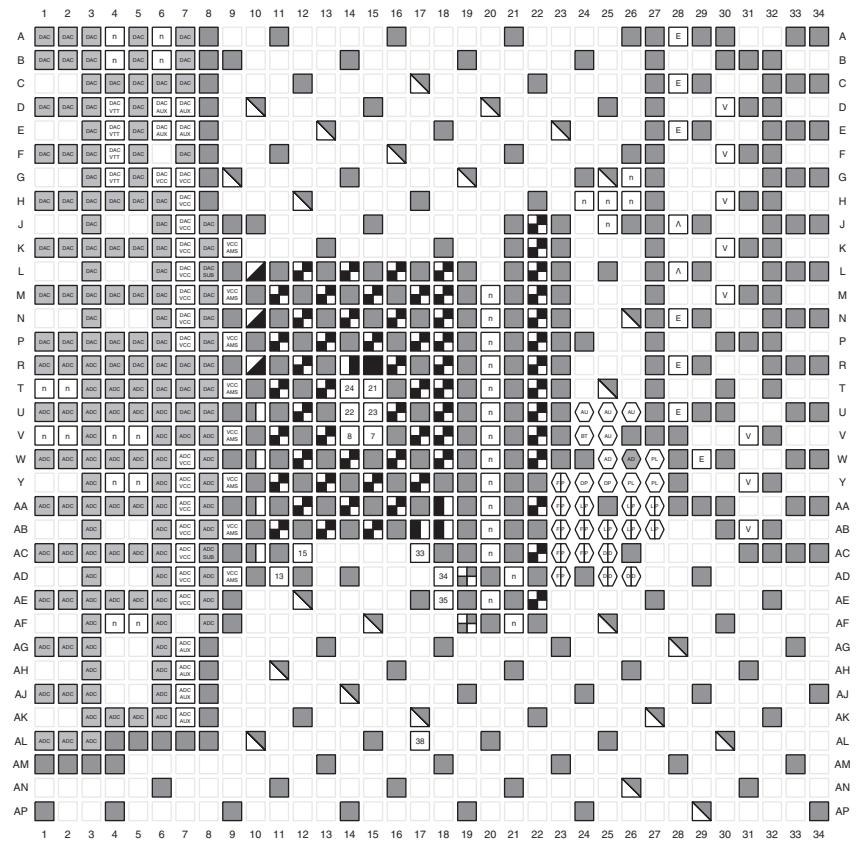
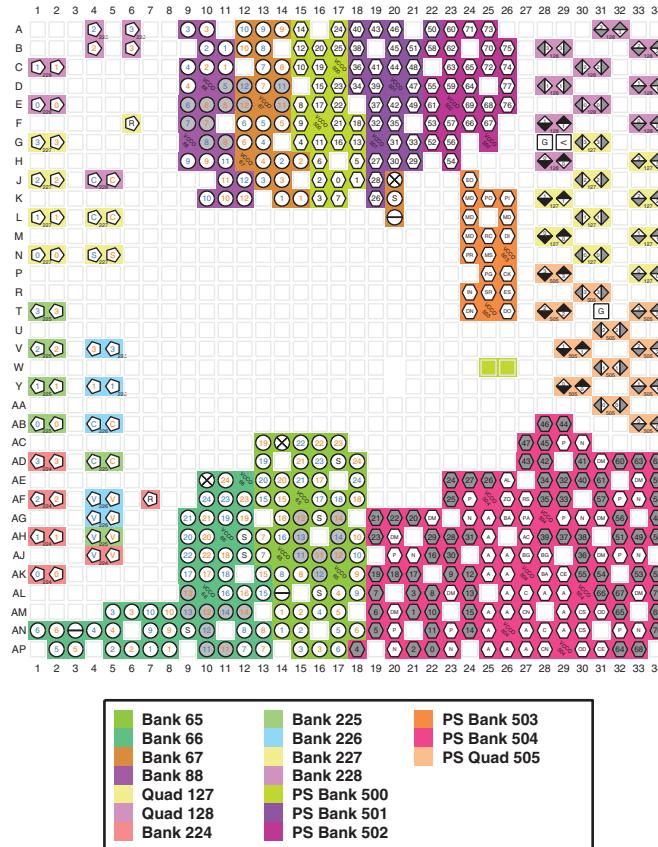


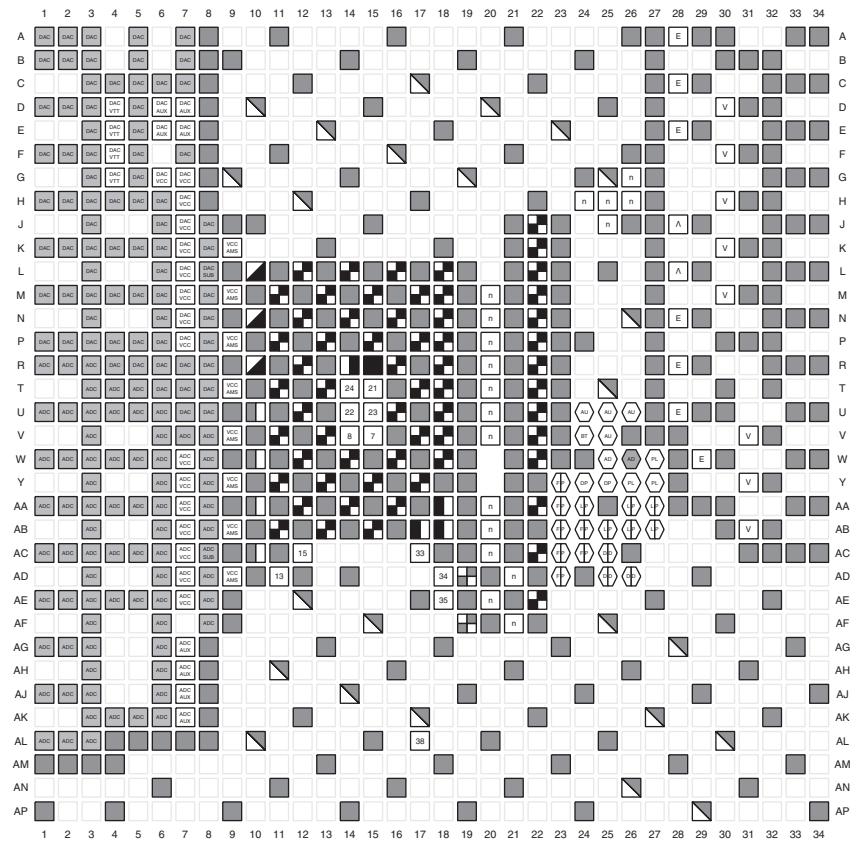
Figure 4-54: FFVE1156 and FSVE1156 Packages—XCZU65DR Power, Dedicated, and Multi-function Pin Diagram

## FFVE1156 and FSVE1156 Packages—XCZU67DR



SelectIO Pins	ADC/DAC Pins	Transceiver Pins	PS Pins
<ul style="list-style-type: none"> <li>○ IO_L#P</li> <li>○ IO_L#N</li> <li>○ S IO (single-ended)</li> <li>○ IO_L#P_GC</li> <li>○ IO_L#N_GC</li> <li>○ VRP</li> <li>⊗ VREF</li> </ul>	<ul style="list-style-type: none"> <li>○ ADC_VIN_#.P</li> <li>○ ADC_VIN_#.N</li> <li>○ ADC_CLK_P</li> <li>○ ADC_CLK_N</li> <li>○ ADC_REXT</li> <li>○ VCM01</li> <li>○ VCM23</li> <li>○ DAC_VOUT_#.P</li> <li>○ DAC_VOUT_#.N</li> <li>○ DAC_CLK_P</li> <li>○ DAC_CLK_N</li> <li>○ DAC_REXT</li> <li>○ SYSREF_P</li> <li>○ SYSREF_N</li> </ul>	<ul style="list-style-type: none"> <li>◆ MGT[R, H or Y]RXP#</li> <li>◆ MGT[R, H or Y]RXN#</li> <li>◆ MGT[R, H or Y]TXP#</li> <li>◆ MGT[R, H or Y]TXN#</li> <li>◆ MGTREFCLK#P</li> <li>◆ MGTREFCLK#N</li> <li>◆ MGTAVTTRCAL</li> <li>◆ MGTRREF</li> </ul>	<ul style="list-style-type: none"> <li>○ PS_MIO</li> <li>○ PS_DDR_DQ</li> <li>○ PS_DDR_DQS_P</li> <li>○ PS_DDR_DQS_N</li> <li>○ PS_DDR_ALERT_N</li> <li>○ PS_DDR_ACT_N</li> <li>○ PS_DDR_A</li> <li>○ PS_DDR_BA</li> <li>○ PS_DDR_BG</li> <li>○ PS_DDR_CK_N</li> <li>○ PS_DDR_CK</li> <li>○ PS_DDR_CKE</li> <li>○ PS_DDR_CS</li> <li>○ PS_DDR_DM</li> <li>○ PS_DDR_ODT</li> <li>○ PS_DDR_PARITY</li> <li>○ PS_DDR_RAM_RST_N</li> <li>○ PS_DDR_ZQ</li> <li>○ PS_DONE</li> <li>○ PS_ERROR_OUT</li> <li>○ PS_ERROR_STATUS</li> <li>○ PS_INIT_B</li> <li>○ PS_JTAG_TCK</li> <li>○ PS_JTAG_TDI</li> <li>○ PS_JTAG_TDO</li> <li>○ PS_JTAG_TMS</li> <li>○ PS_MODE</li> <li>○ PS_PADI</li> <li>○ PS_PAD0</li> <li>○ PS_POR_B</li> <li>○ PS_PROG_B</li> <li>○ PS_REF_CLK</li> <li>○ PS_SRST_B</li> </ul>

Figure 4-55: FFVE1156 and FSVE1156 Packages—XCZU67DR I/O Bank Diagram



Power Pins	Dedicated Pins	Multi-Function I/O Pins	PS Pins
<ul style="list-style-type: none"> <li>GND</li> <li>VCCAUX_IO</li> <li>VCCAUX</li> <li>VCCINT</li> <li>VCCINT_VCU</li> <li>VCCO_[bank number]</li> <li>VCCBRAM</li> <li>VCCADC</li> <li>GNDADC</li> <li>RSVD</li> <li>RSVGDND</li> <li>MGTAVCC_[R or L]</li> <li>MGTAVTT_[R or L]</li> <li>MGTVAUXAUX_[R or L]</li> </ul>	<ul style="list-style-type: none"> <li>VCCSDIFEC</li> <li>VCCINT_AMS</li> <li>ADC_AVCC</li> <li>ADC_AVCCAUX</li> <li>ADC_GND</li> <li>ADC_SUB_GND</li> <li>DAC_AVCC</li> <li>DAC_AVCCAUX</li> <li>DAC_AVTT</li> <li>DAC_GND</li> <li>DAC_SUB_GND</li> <li>NC</li> </ul>	<ul style="list-style-type: none"> <li>DXP</li> <li>DXN</li> <li>POR_OVERRIDE</li> <li>PUDC_B</li> <li>VP</li> <li>VN</li> <li>VREFP</li> <li>VREFN</li> </ul>	<ul style="list-style-type: none"> <li>I2C_SCLK</li> <li>I2C_SDA &amp; PERSTN1</li> <li>PERSTN0</li> <li>SMBALERT</li> <li>VCC_PSADC</li> <li>GND_PSADC</li> <li>VCC_PSAUX</li> <li>PS_MGTRAVCC</li> <li>PS_MGTRAVTT</li> <li>VCC_PSBATT</li> <li>VCC_PSDDR_PLL</li> <li>VCC_PSPLL</li> <li>VCC_PSINTFP</li> <li>VCC_PSINTFP_DDR</li> <li>VCC_PSINTLP</li> </ul>

Figure 4-56: FFVE1156 and FSVE1156 Packages—XCZU67DR Power, Dedicated, and Multi-function Pin Diagram

## FFVB1517 Package—XCZU11EG

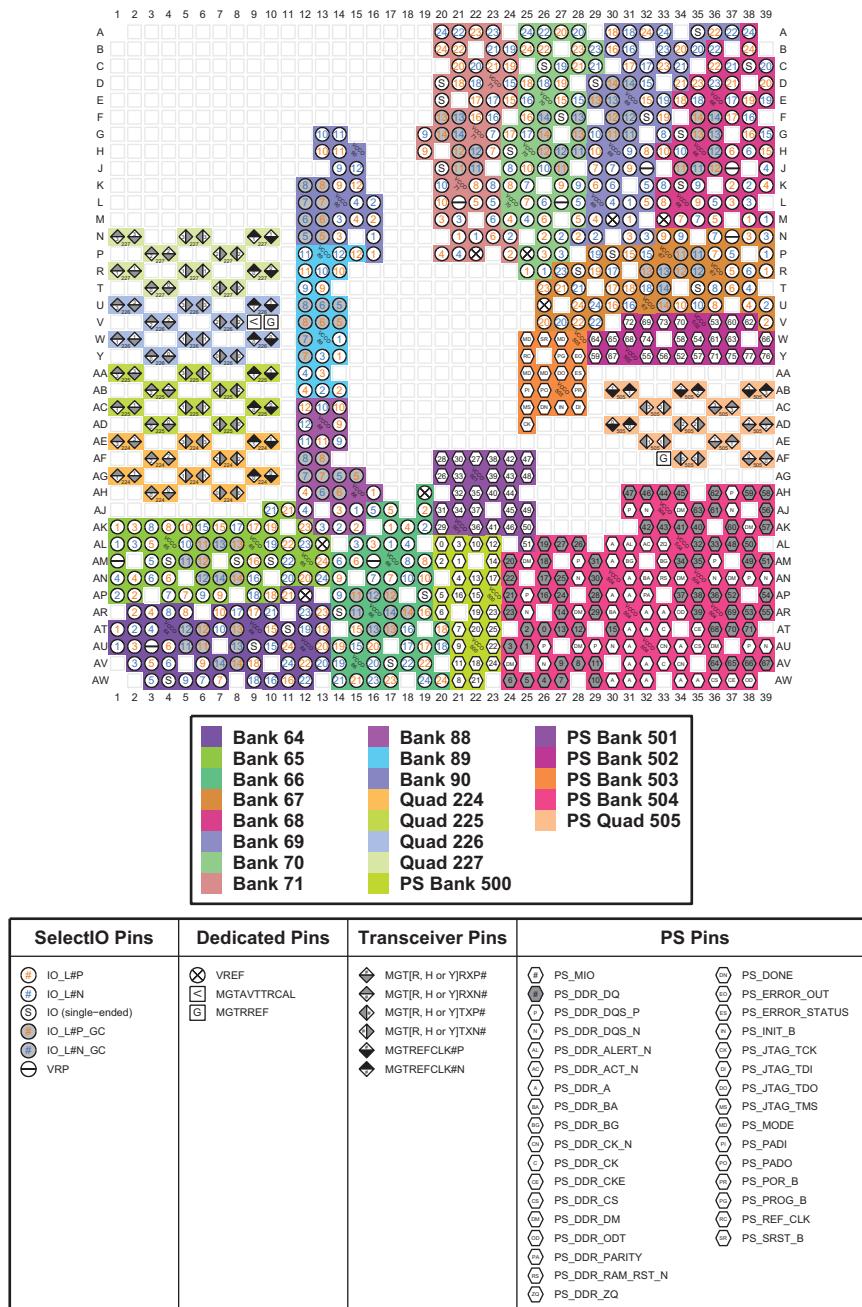
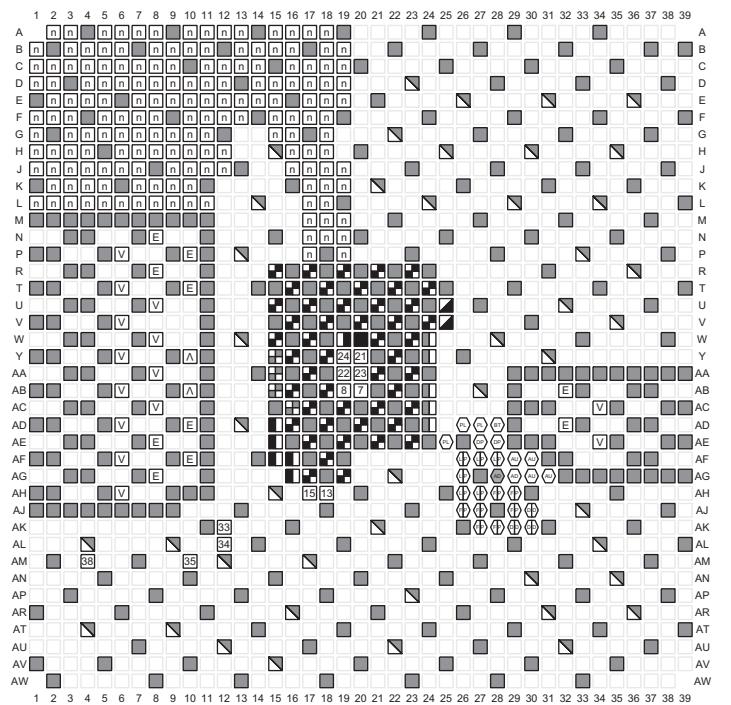


Figure 4-57: FFVB1517 Package—XCZU11EG I/O Bank Diagram



Power Pins	Dedicated Pins	Multi-Function I/O Pins	PS Pins
<ul style="list-style-type: none"> <li>[Symbol] GND</li> <li>[Symbol] VCCAUX_IO</li> <li>[Symbol] VCCAUX</li> <li>[Symbol] VCCINT</li> <li>[Symbol] VCCINT_IO</li> <li>[Symbol] VCCINT_VCU</li> <li>[Symbol] VCCO_[bank number]</li> <li>[Symbol] VCCBRAM</li> <li>[Symbol] VCCADC</li> <li>[Symbol] GNDADC</li> <li>[R] RSVDDND</li> <li>[n] NC</li> <li>[E] MGTAVCC_[R or L]</li> <li>[V] MGTAVTT_[R or L]</li> <li>[A] MGTVCXAUX_[R or L]</li> </ul>	<ul style="list-style-type: none"> <li>[Symbol] 7 DXP</li> <li>[Symbol] 8 DXN</li> <li>[Symbol] 13 POR_OVERRIDE</li> <li>[Symbol] 15 PUDC_B</li> <li>[Symbol] 21 VP</li> <li>[Symbol] 22 VN</li> <li>[Symbol] 23 VREFP</li> <li>[Symbol] 24 VREFN</li> </ul>	<ul style="list-style-type: none"> <li>[Symbol] 33 I2C_SCLK</li> <li>[Symbol] 34 I2C_SDA &amp; PERSTN1</li> <li>[Symbol] 35 PERSTN0</li> <li>[Symbol] 38 SMBALERT</li> </ul>	<ul style="list-style-type: none"> <li>[Symbol] VCC_PSADC</li> <li>[Symbol] GND_PSADC</li> <li>[Symbol] VCC_PSAUX</li> <li>[Symbol] PS_MGTRAVCC</li> <li>[Symbol] PS_MGTRAVTT</li> <li>[Symbol] VCC_PSBATT</li> <li>[Symbol] VCC_PSDDR_PLL</li> <li>[Symbol] VCC_PSPLL</li> <li>[Symbol] VCC_PSINTFP</li> <li>[Symbol] VCC_PSINTFP_DDR</li> <li>[Symbol] VCC_PSINTLP</li> </ul>

Figure 4-58: FFVB1517 Package—XCZU11EG  
Power, Dedicated, and Multi-function Pin Diagram

## FFVB1517 Package—XCZU17EG and XCZU19EG

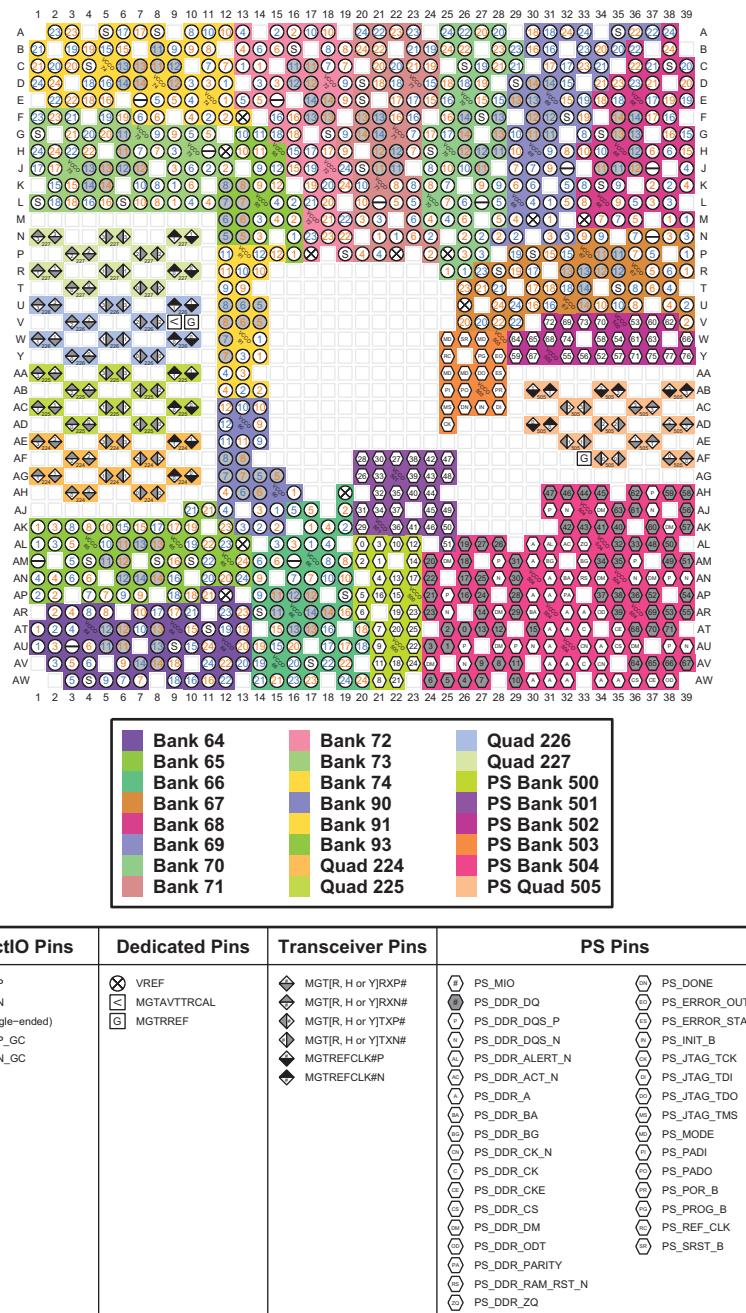
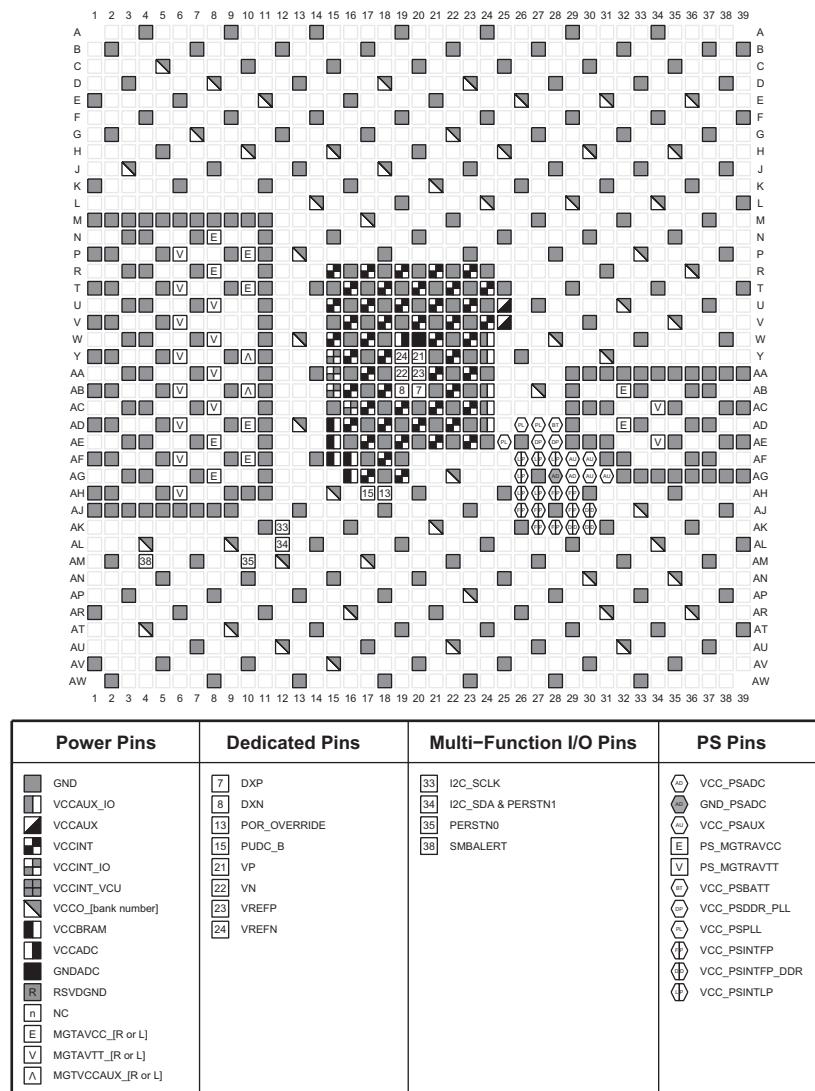
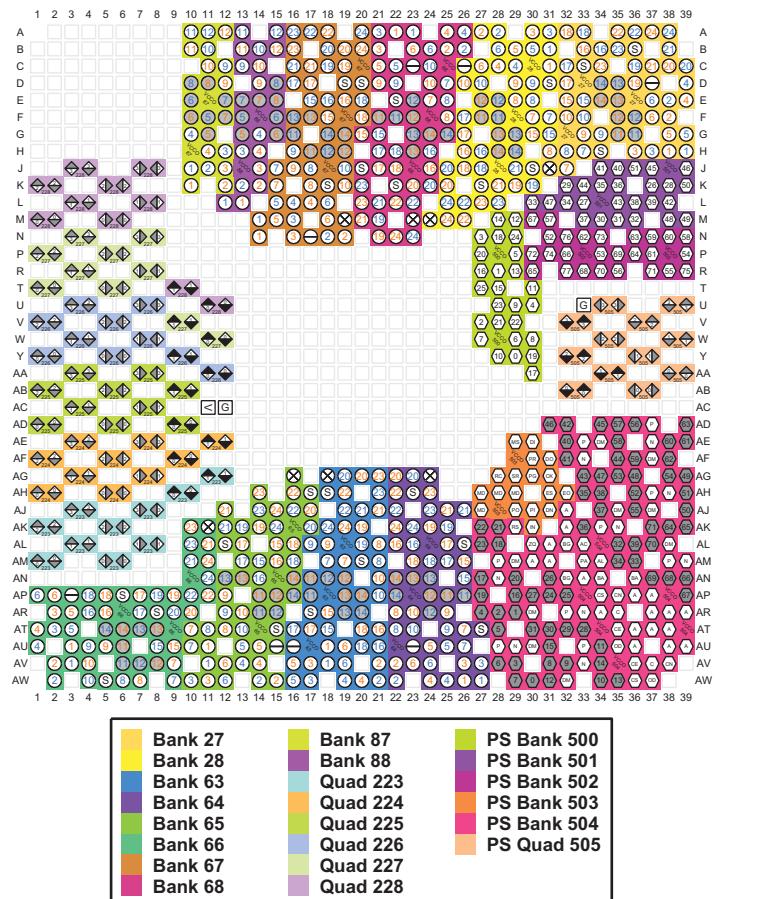


Figure 4-59: FFVB1517 Package—XCZU17EG and XCZU19EG I/O Bank Diagram



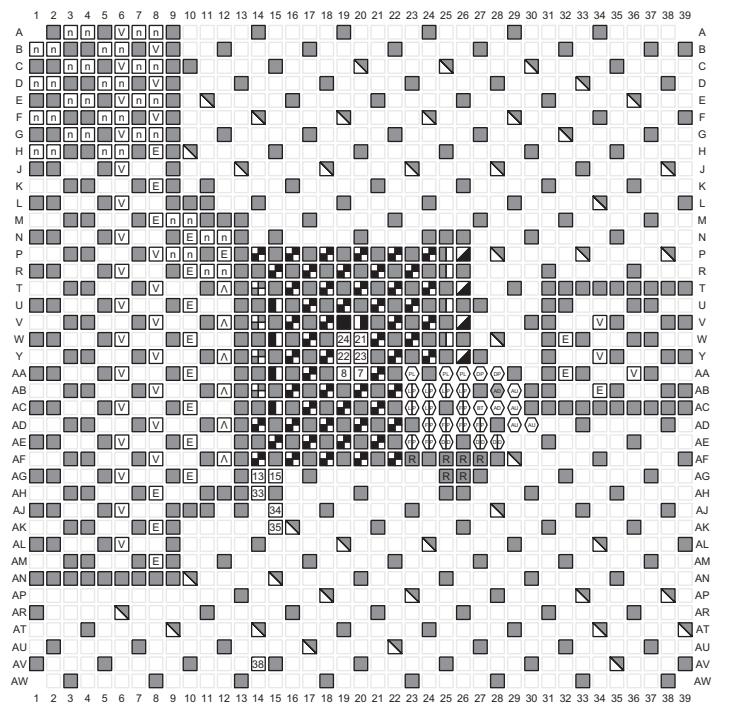
**Figure 4-60: FFVB1517 Package—XCZU17EG and XCZU19EG Power, Dedicated, and Multi-function Pin Diagram**

## FFVF1517 Package—XCZU7CG and XCZU7EG



SelectIO Pins	Dedicated Pins	Transceiver Pins	PS Pins
<ul style="list-style-type: none"> <li>○ IO_L#P</li> <li>○ IO_L#N</li> <li>○ IO (single-ended)</li> <li>○ IO_L#P_GC</li> <li>○ IO_L#N_GC</li> <li>○ VRP</li> </ul>	<ul style="list-style-type: none"> <li>○ VREF</li> <li>◀ MGTAVTRCAL</li> <li>○ MGTRREF</li> </ul>	<ul style="list-style-type: none"> <li>◆ MGT[R, H or Y]RXP#</li> <li>◆ MGT[R, H or Y]RXN#</li> <li>◆ MGT[R, H or Y]TXP#</li> <li>◆ MGT[R, H or Y]TXN#</li> <li>◆ MGTRREFCLK#P</li> <li>◆ MGTRREFCLK#N</li> </ul>	<ul style="list-style-type: none"> <li>○ PS_MIO</li> <li>○ PS_DDR_DQ</li> <li>○ PS_DDR_DQS_P</li> <li>○ PS_DDR_DQS_N</li> <li>○ PS_DDR_ALERT_N</li> <li>○ PS_DDR_ACT_N</li> <li>○ PS_DDR_A</li> <li>○ PS_DDR_BA</li> <li>○ PS_DDR_BG</li> <li>○ PS_DDR_CK_N</li> <li>○ PS_DDR_CK</li> <li>○ PS_DDR_CKE</li> <li>○ PS_DDR_CS</li> <li>○ PS_DDR_DM</li> <li>○ PS_DDR_ODT</li> <li>○ PS_DDR_PARITY</li> <li>○ PS_DDR_RAM_RST_N</li> <li>○ PS_DDR_ZQ</li> <li>○ PS_DONE</li> <li>○ PS_ERROR_OUT</li> <li>○ PS_ERROR_STATUS</li> <li>○ PS_INIT_B</li> <li>○ PS_JTAG_TCK</li> <li>○ PS_JTAG_TDI</li> <li>○ PS_JTAG_TDO</li> <li>○ PS_JTAG_TMS</li> <li>○ PS_MODE</li> <li>○ PS_PADI</li> <li>○ PS_PAD0</li> <li>○ PS POR_B</li> <li>○ PS_PROG_B</li> <li>○ PS_REF_CLK</li> <li>○ PS_SRST_B</li> </ul>

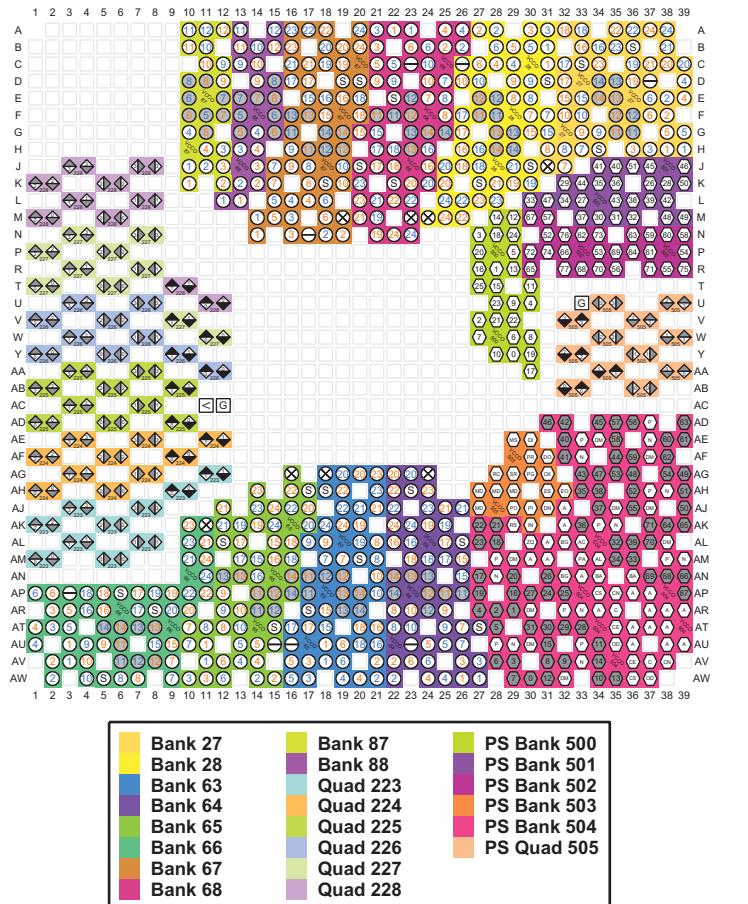
Figure 4-61: FFVF1517 Package—XCZU7CG and XCZU7EG I/O Bank Diagram



Power Pins	Dedicated Pins	Multi-Function I/O Pins	PS Pins
GND	[7] DXP	[33] I2C_SCLK	[V] VCC_PSADC
VCCAUXX_IO	[8] DXN	[34] I2C_SDA & PERSTN1	[GND] GND_PSADC
VCCAUXX	[13] POR_OVERRIDE	[35] PERSTN0	[VCC] VCC_PSAUX
VCCINT	[15] PUDC_B	[38] SMBALERT	[PS] PS_MGTRAVCC
VCCINT_IO	[21] VP		[V] PS_MGTRAVTT
VCCINT_VCU	[22] VN		[VCC] VCC_PSBBATT
VCCO_[bank number]	[23] VREFP		[VCC] VCC_PSDDR_PLL
VCCBRAM	[24] VREFN		[VCC] VCC_PSPLL
VCCADC			[VCC] VCC_PSINTFP
GNDADC			[VCC] VCC_PSINTFP_DDR
RSVDGND			[VCC] VCC_PSINTLP
NC			
MGTAVCC_[R or L]			
MGTAVTT_[R or L]			
MGTVCVAUX_[R or L]			

Figure 4-62: FFVF1517 Package—XCZU7CG and XCZU7EG Power, Dedicated, and Multi-function Pin Diagram

## FFVF1517 Package—XCZU7EV



SelectIO Pins	Dedicated Pins	Transceiver Pins	PS Pins
<input type="radio"/> IO_L#P <input type="radio"/> IO_L#N <input checked="" type="radio"/> IO (single-ended) <input type="radio"/> IO_L#P_GC <input type="radio"/> IO_L#N_GC <input type="radio"/> VRP	<input checked="" type="checkbox"/> VREF <input checked="" type="checkbox"/> MGTAVTRCAL <input checked="" type="checkbox"/> MGTRREF	<input checked="" type="checkbox"/> MGTI[R, H or Y]RXP# <input checked="" type="checkbox"/> MGTI[R, H or Y]RXN# <input checked="" type="checkbox"/> MGTI[R, H or Y]TXP# <input checked="" type="checkbox"/> MGTI[R, H or Y]TXN# <input checked="" type="checkbox"/> MGTRREFCLK#P <input checked="" type="checkbox"/> MGTRREFCLK#N	<input checked="" type="checkbox"/> PS_MIO <input checked="" type="checkbox"/> PS_DDR_DQ <input checked="" type="checkbox"/> PS_DDR_DQS_P <input checked="" type="checkbox"/> PS_DDR_DQS_N <input checked="" type="checkbox"/> PS_DDR_ALERT_N <input checked="" type="checkbox"/> PS_DDR_ACT_N <input checked="" type="checkbox"/> PS_DDR_A <input checked="" type="checkbox"/> PS_DDR_BA <input checked="" type="checkbox"/> PS_DDR_BG <input checked="" type="checkbox"/> PS_DDR_CK_N <input checked="" type="checkbox"/> PS_DDR_CK <input checked="" type="checkbox"/> PS_DDR_CKE <input checked="" type="checkbox"/> PS_DDR_CS <input checked="" type="checkbox"/> PS_DDR_DM <input checked="" type="checkbox"/> PS_DDR_ODT <input checked="" type="checkbox"/> PS_DDR_PARITY <input checked="" type="checkbox"/> PS_DDR_RAM_RST_N <input checked="" type="checkbox"/> PS_DDR_ZQ

Figure 4-63: FFVF1517 Package—XCZU7EV I/O Bank Diagram

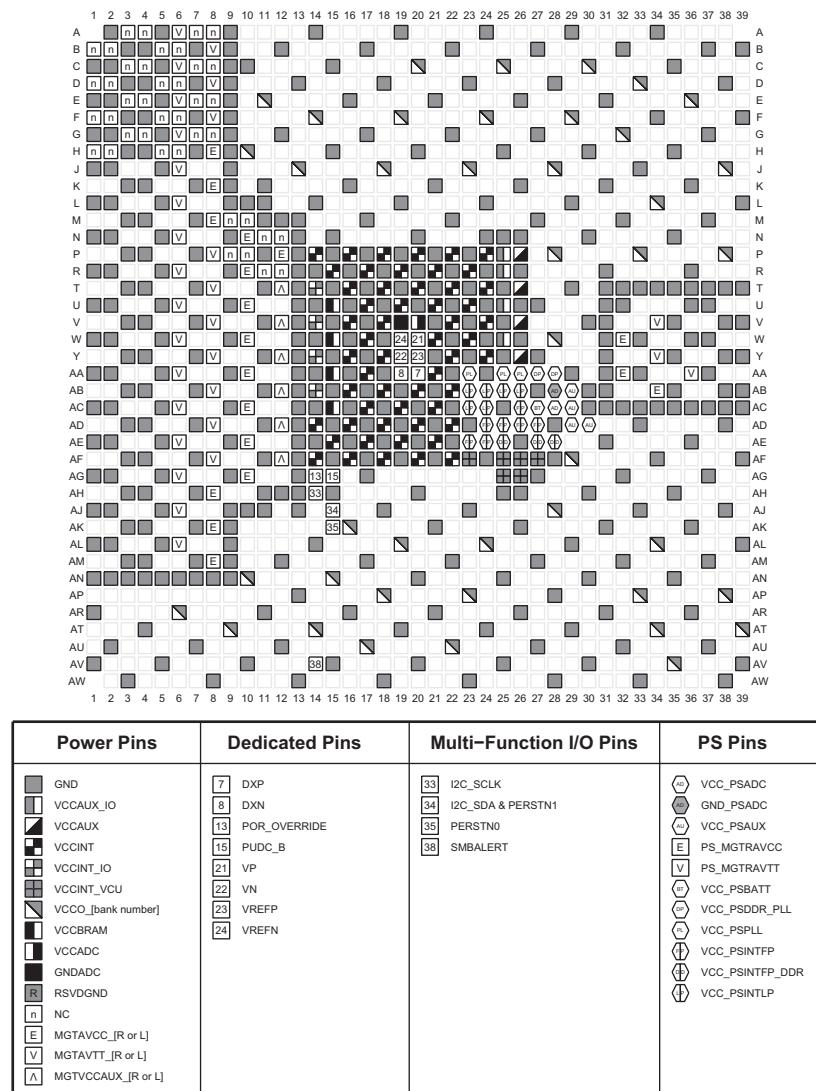


Figure 4-64: FFVF1517 Package—XCZU7EV Power, Dedicated, and Multi-function Pin Diagram

## FFVF1517 Package—XCZU11EG

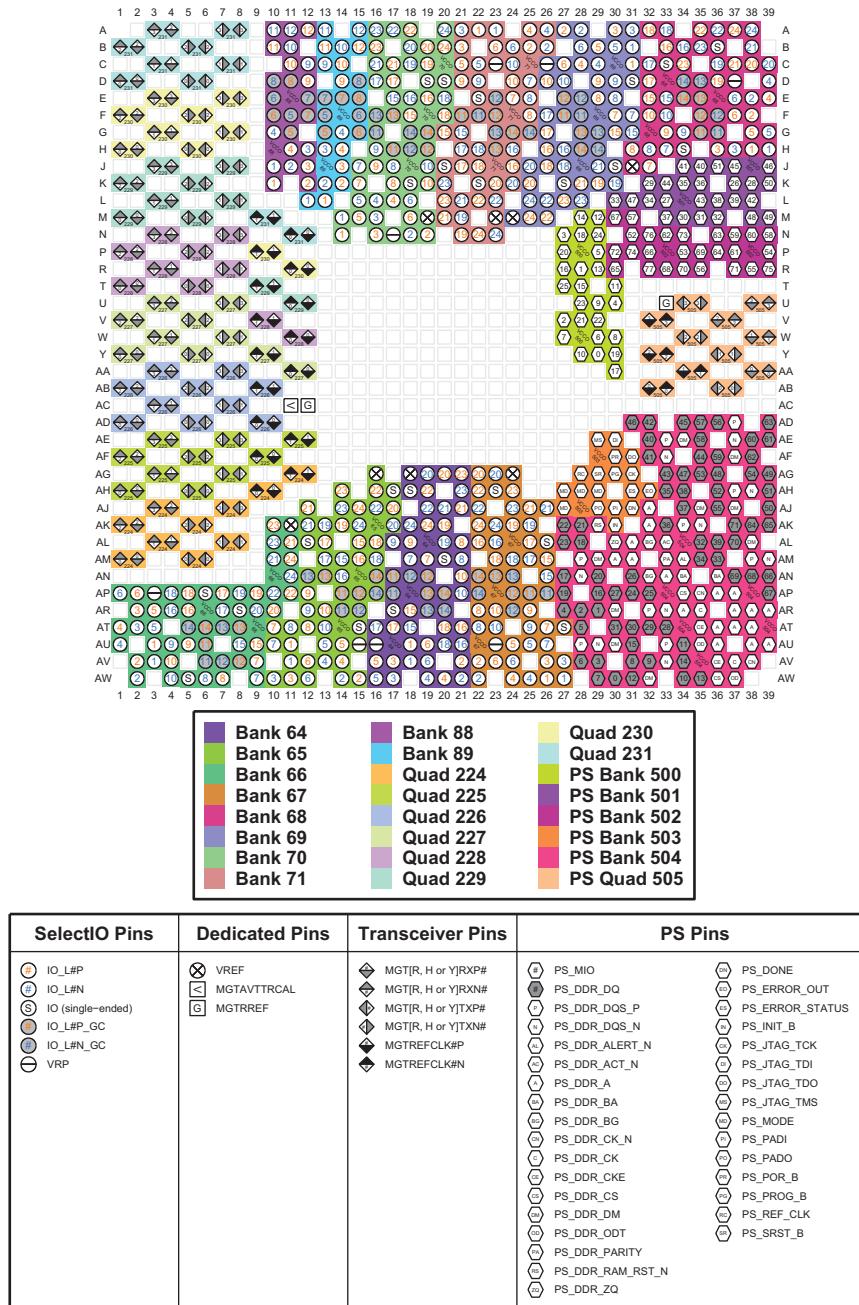


Figure 4-65: FFVF1517 Package—XCZU11EG I/O Bank Diagram

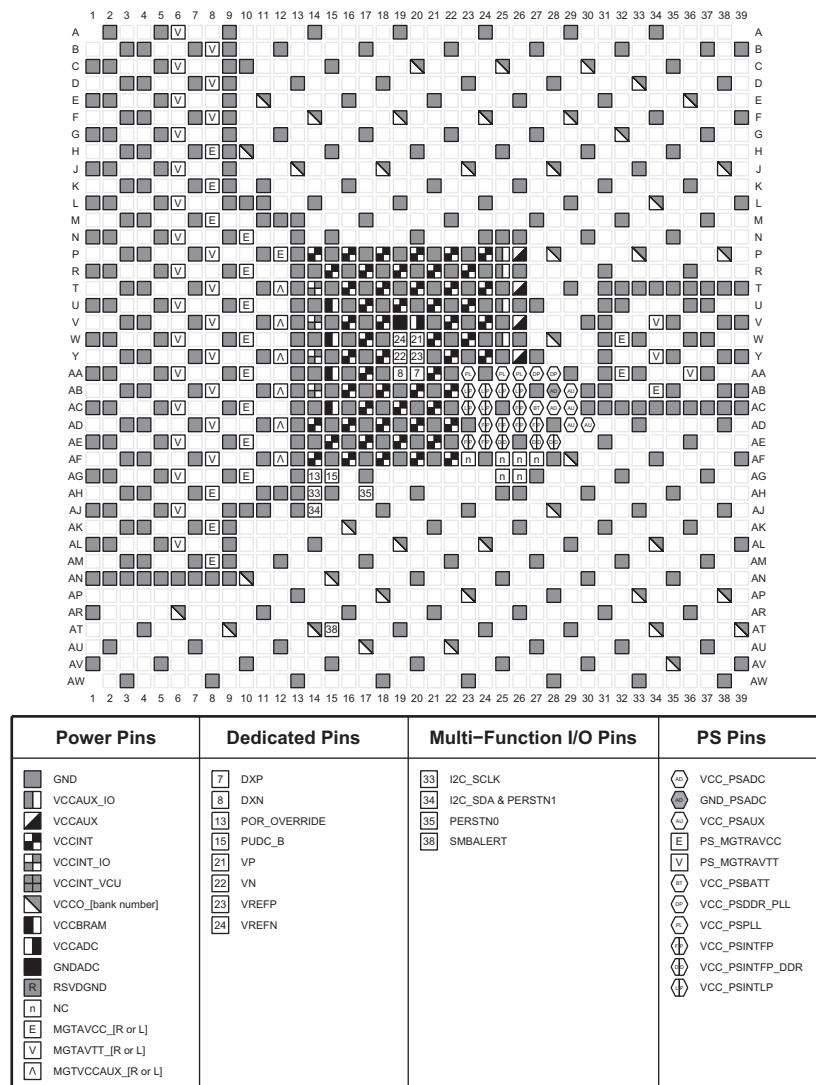


Figure 4-66: FFVF1517 Package—XCZU11EG Power, Dedicated, and Multi-function Pin Diagram

## FFVG1517 and FSVG1517 Packages—XCZU25DR

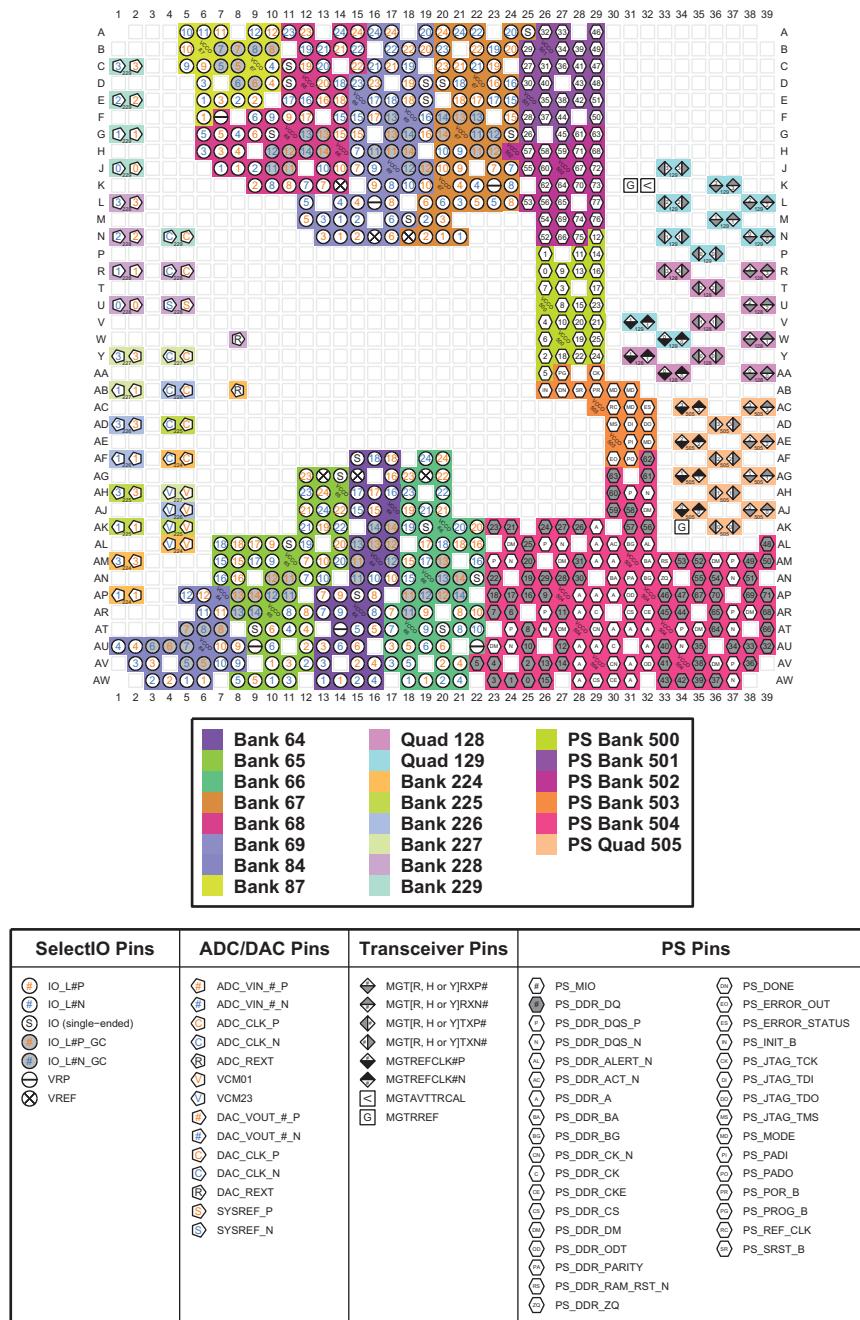


Figure 4-67: FFVG1517 and FSVG1517 Packages—XCZU25DR I/O Bank Diagram

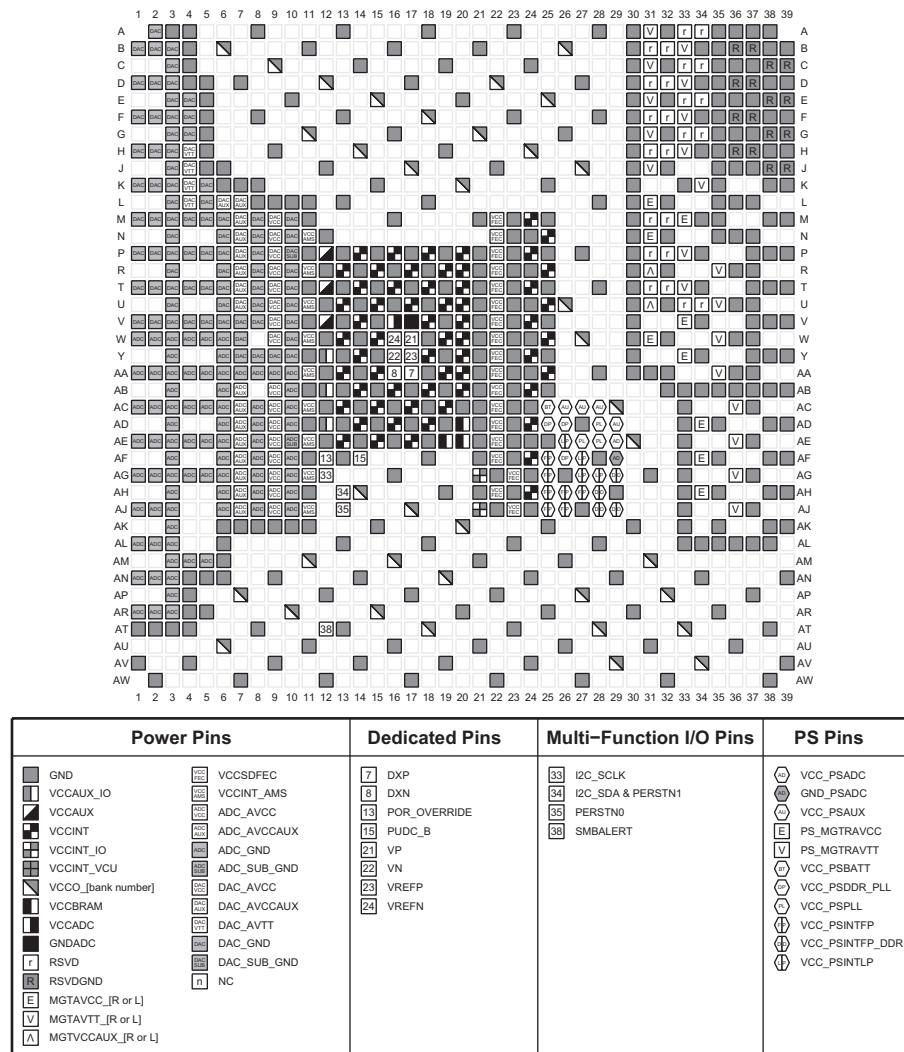


Figure 4-68: FFV1517 and FSVG1517 Packages—XCZU25DR Power, Dedicated, and Multi-function Pin Diagram

## FFVG1517 and FSVG1517 Packages—XCZU27DR and XCZU28DR

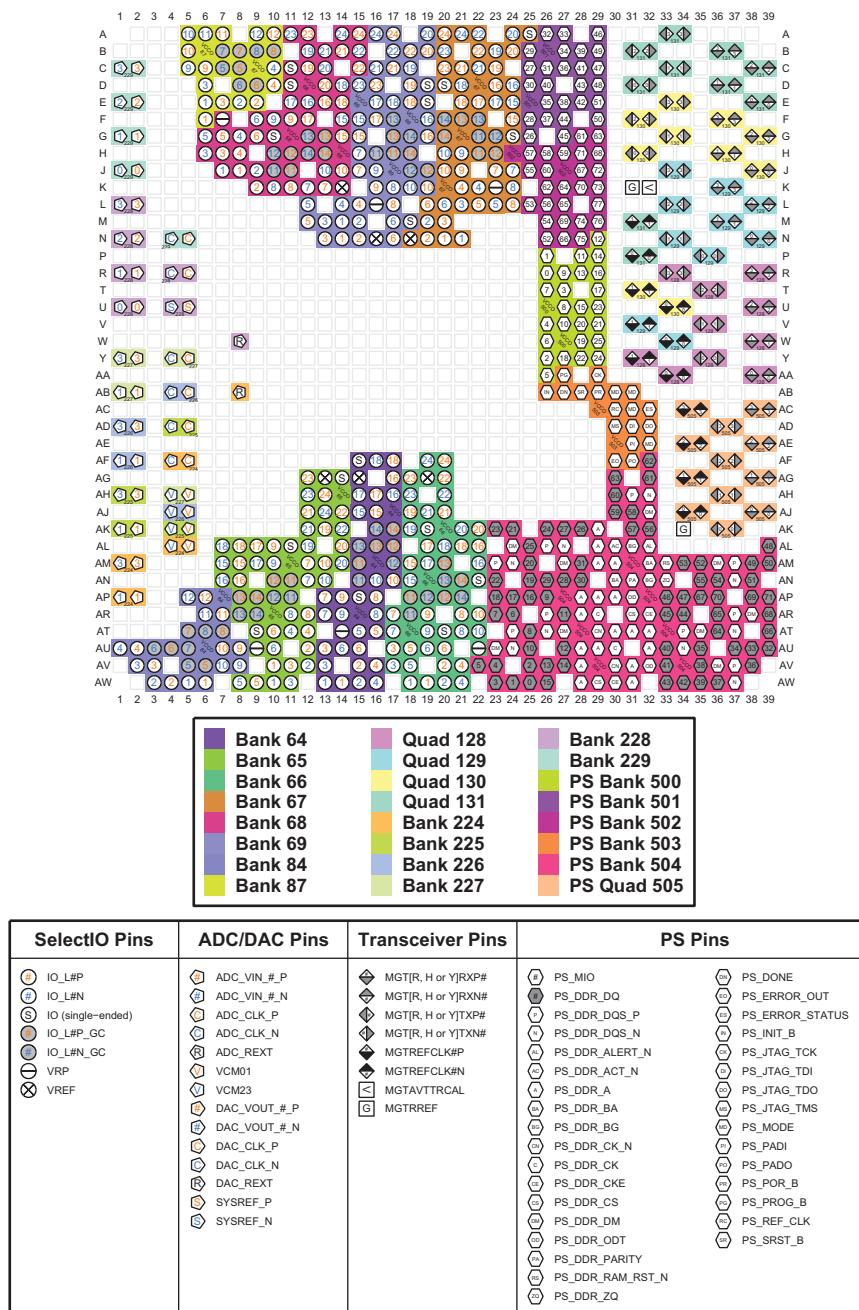


Figure 4-69: FFVG1517 and FSVG1517 Packages—XCZU27DR and XCZU28DR I/O Bank Diagram

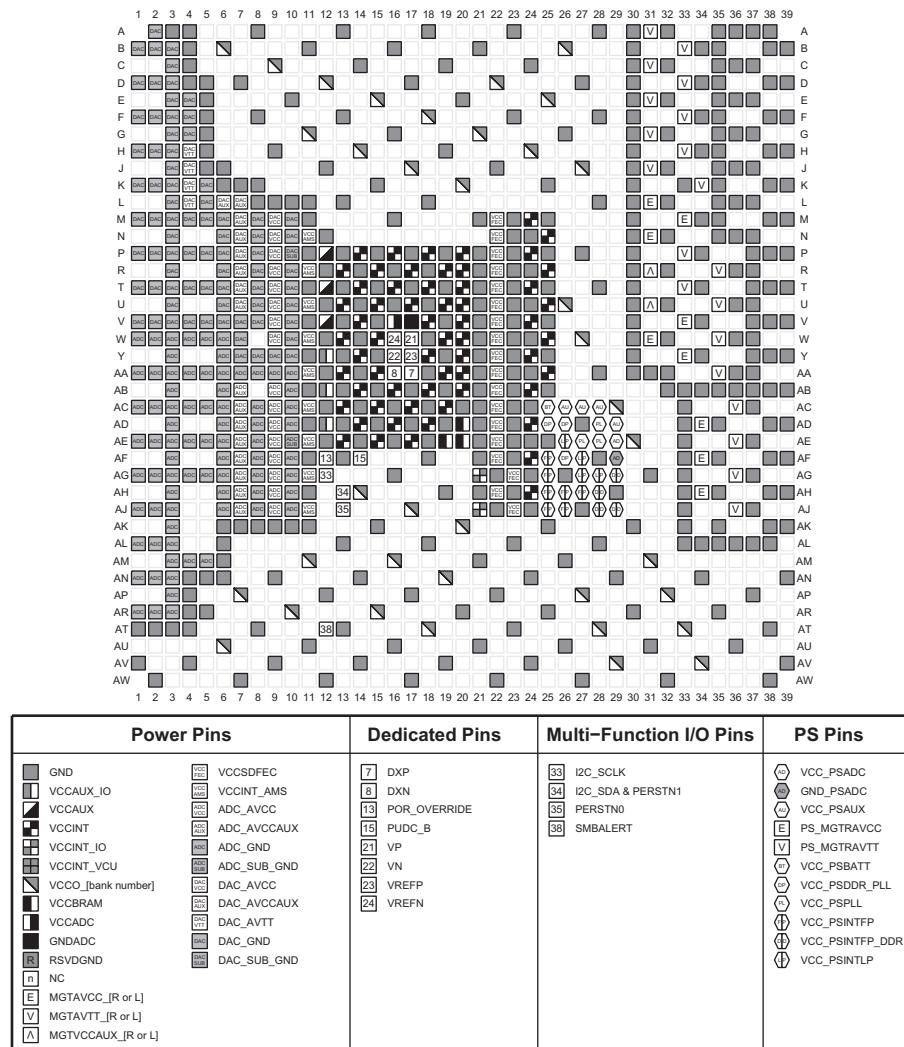


Figure 4-70: FFVG1517 and FSVG1517 Packages—XCZU27DR and XCZU28DR Power, Dedicated, and Multi-function Pin Diagram

## FFVG1517 and FSVG1517 Packages—XCZU43DR

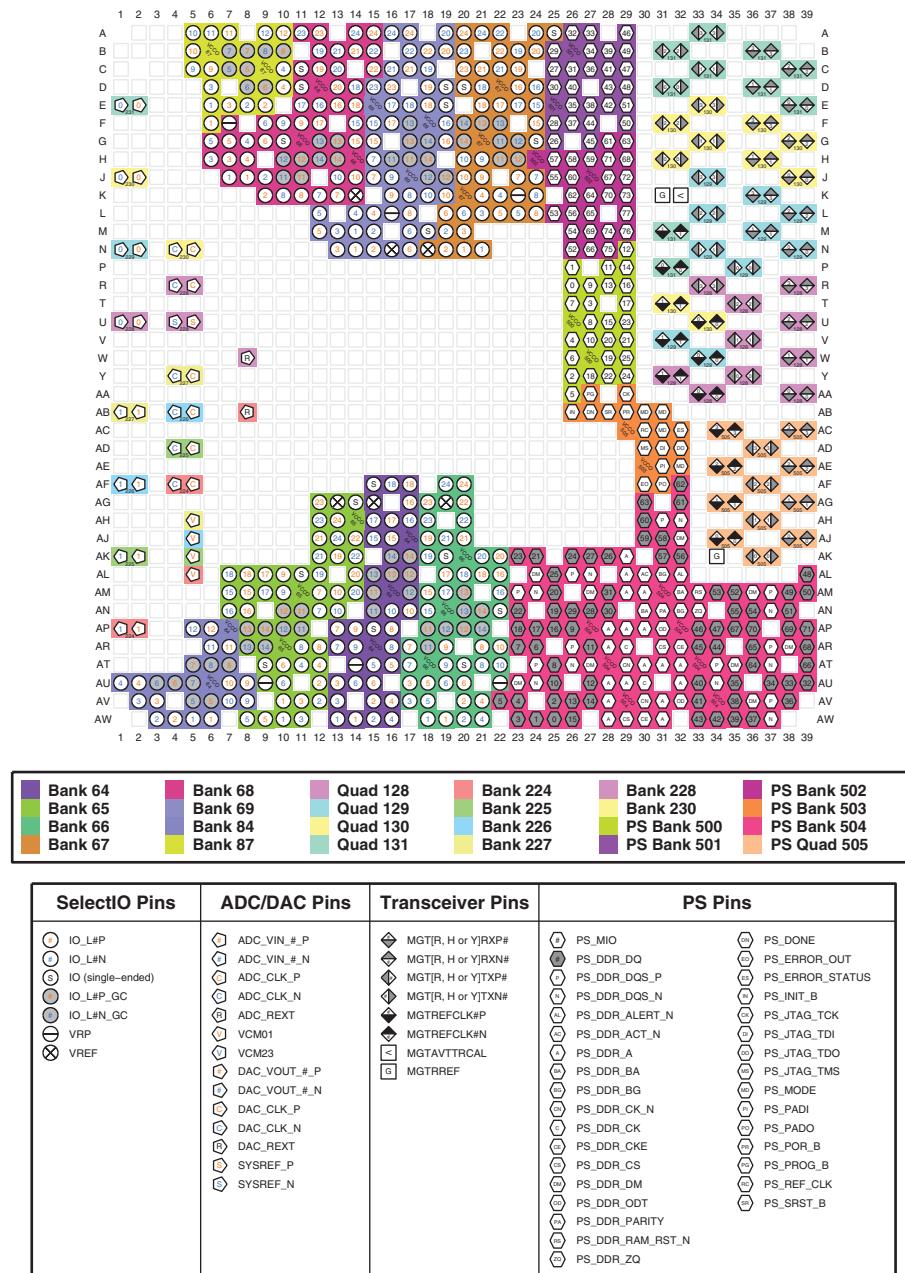


Figure 4-71: FFVG1517 and FSVG1517 Packages—XCZU43DR I/O Bank Diagram

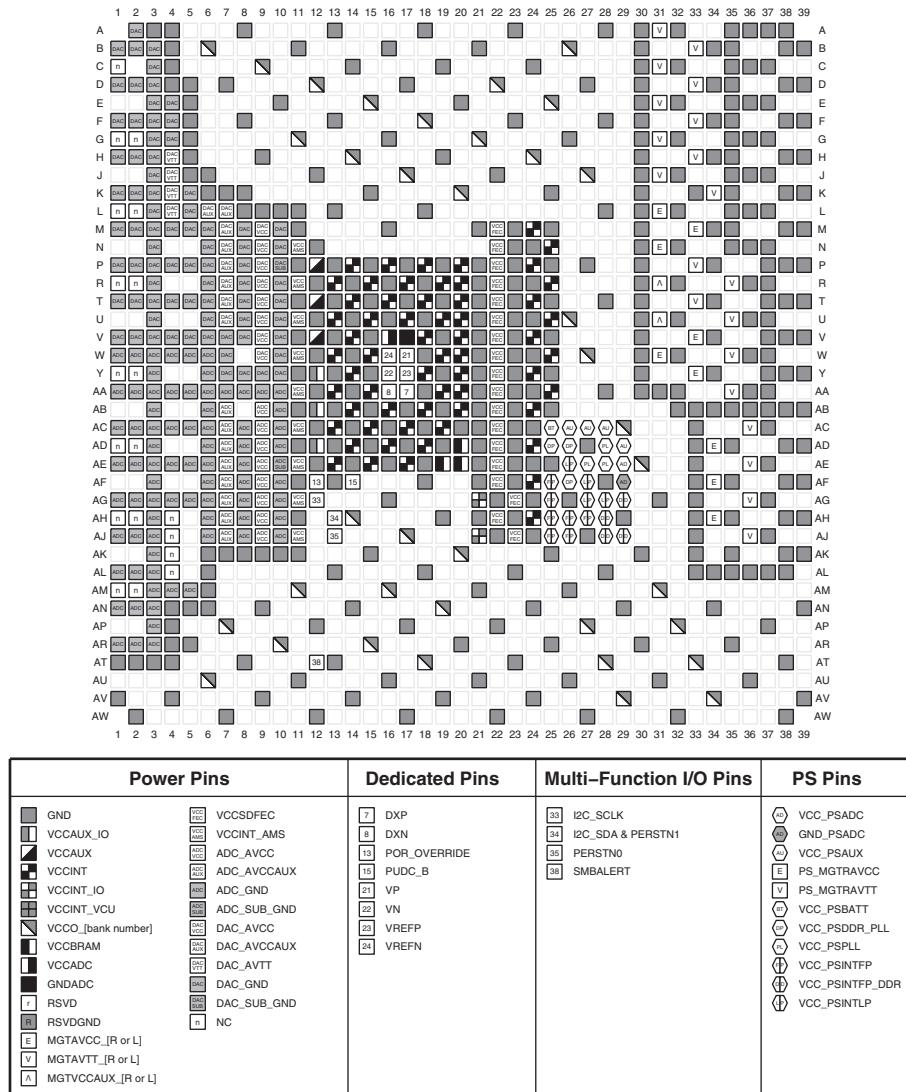


Figure 4-72: FFVG1517 and FSVG1517 Packages—XCZU43DR Power, Dedicated, and Multi-function Pin Diagram

## FFVG1517 and FSVG1517 Packages—XCZU47DR

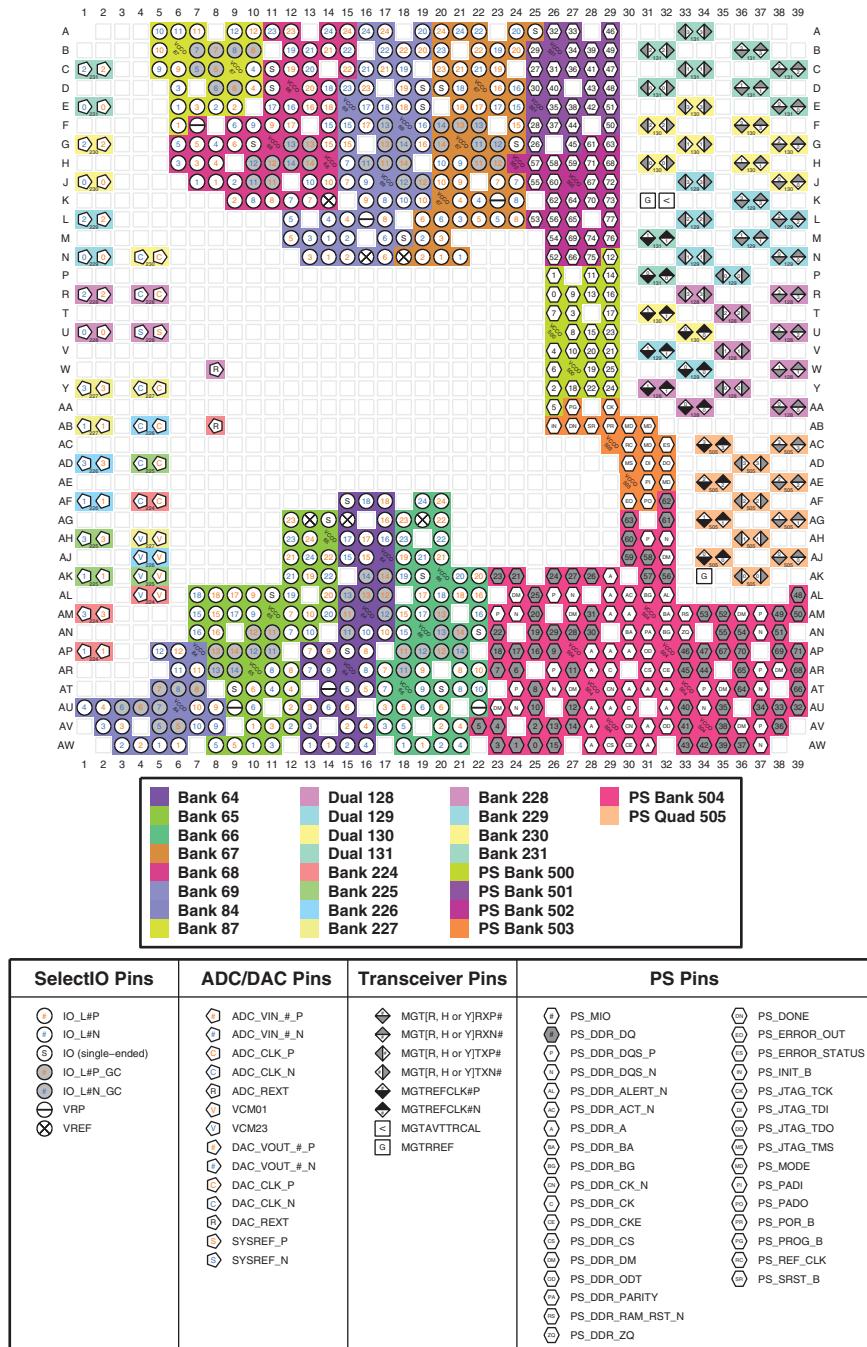


Figure 4-73: FFVG1517 and FSVG1517 Packages—XCZU47DR I/O Bank Diagram

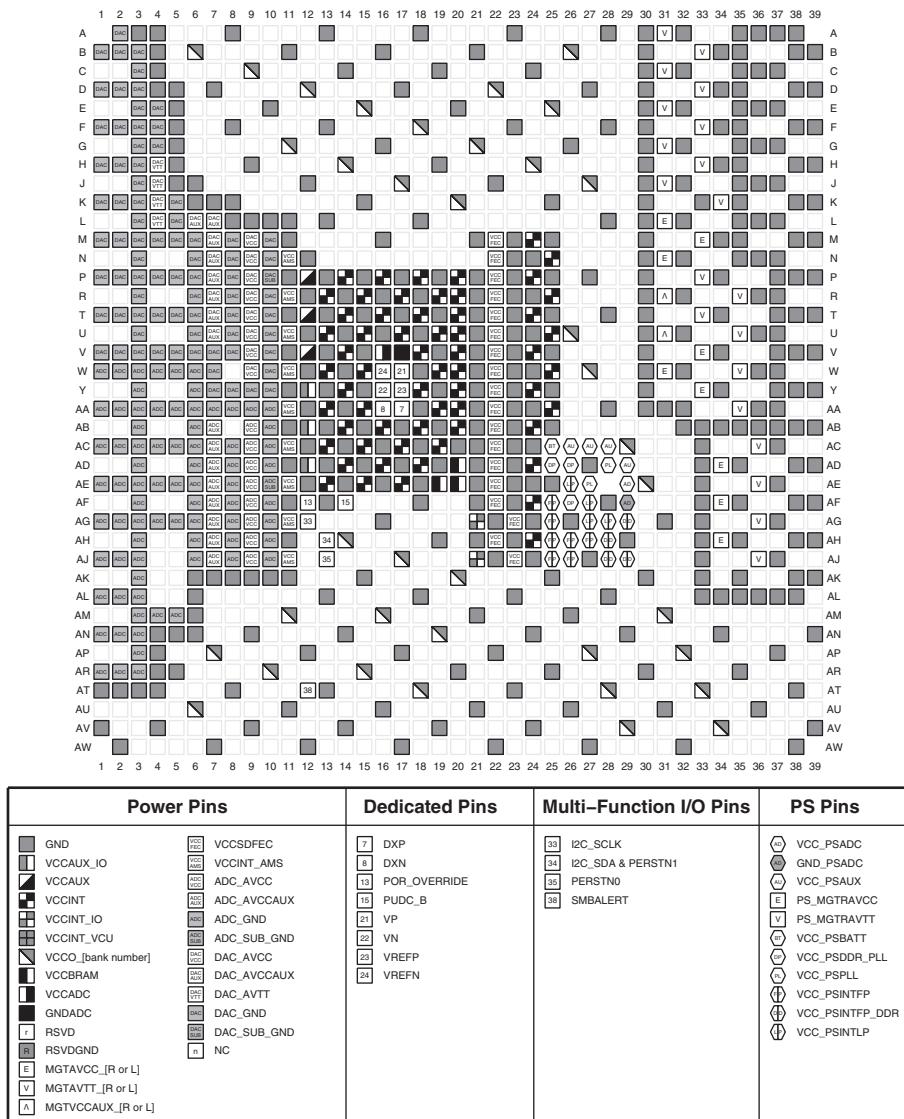


Figure 4-74: FFVG1517 and FSVG1517 Packages—XCZU47DR Power, Dedicated, and Multi-function Pin Diagram

## FFVG1517, FSVG1517 Packages—XCZU48DR FSRG1517 Package—XQZU48DR

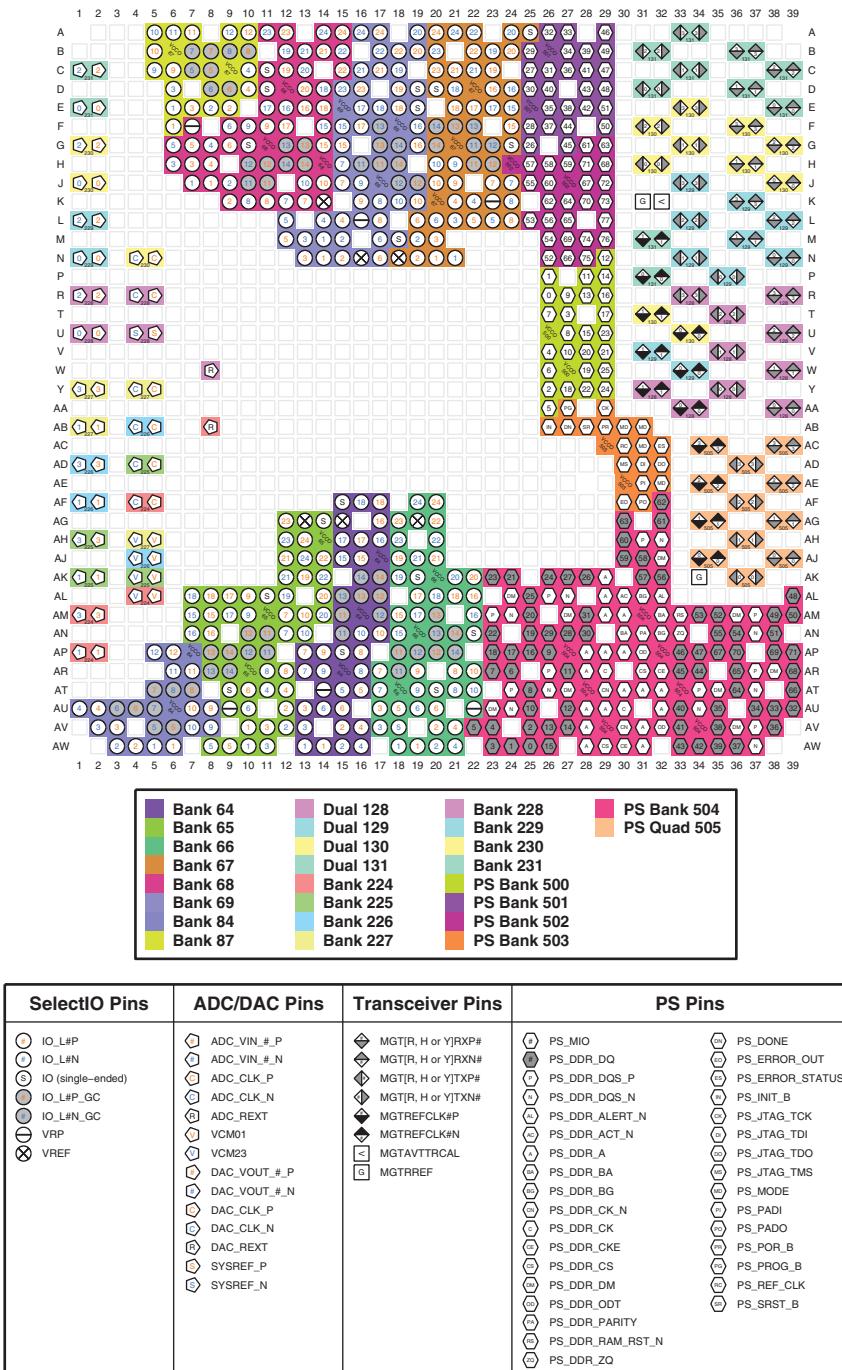


Figure 4-75: FFVG1517, FSVG1517, FSRG1517 Packages—XCZU48DR, XQZU48DR I/O Bank Diagram

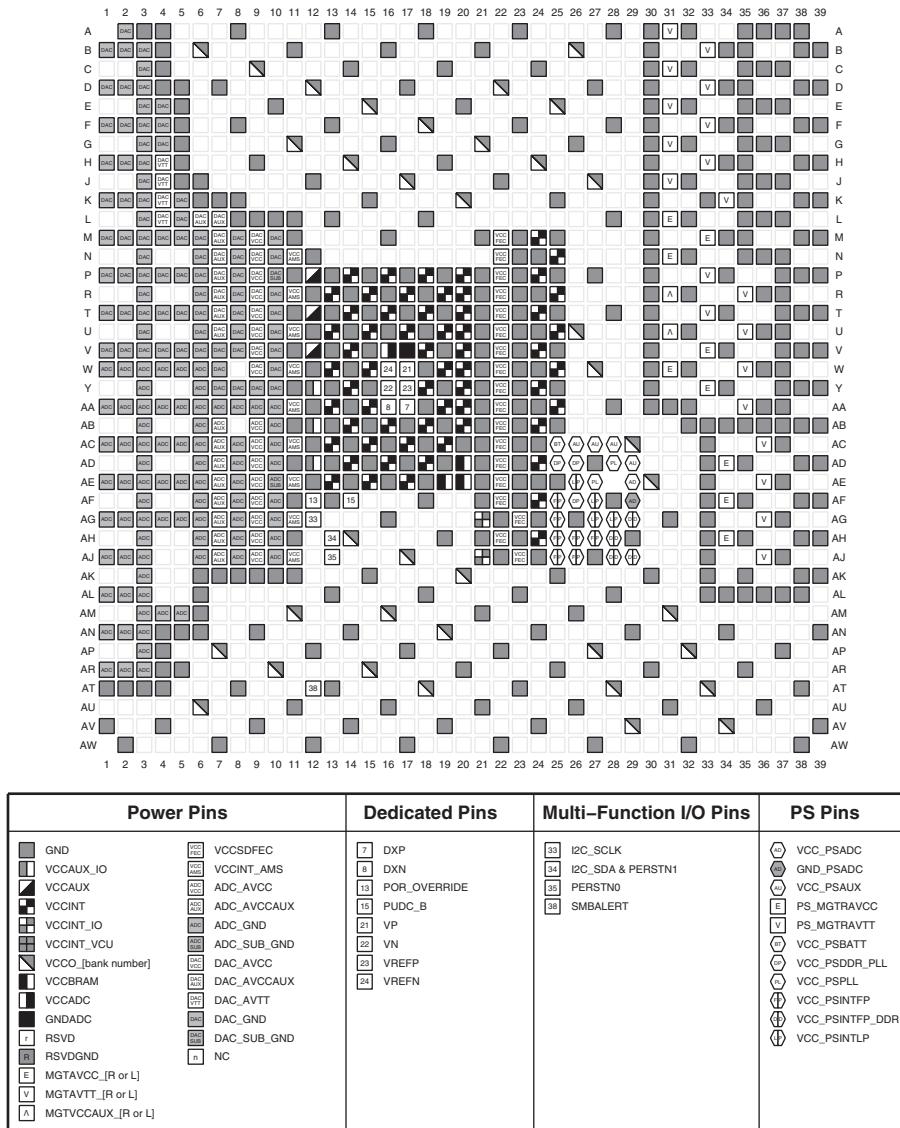


Figure 4-76: FFVG1517, FSVG1517, FSRG1517 Packages—XCZU48DR, XQZU48DR Power, Dedicated, and Multi-function Pin Diagram

## FFVC1760 Package—XCZU11EG

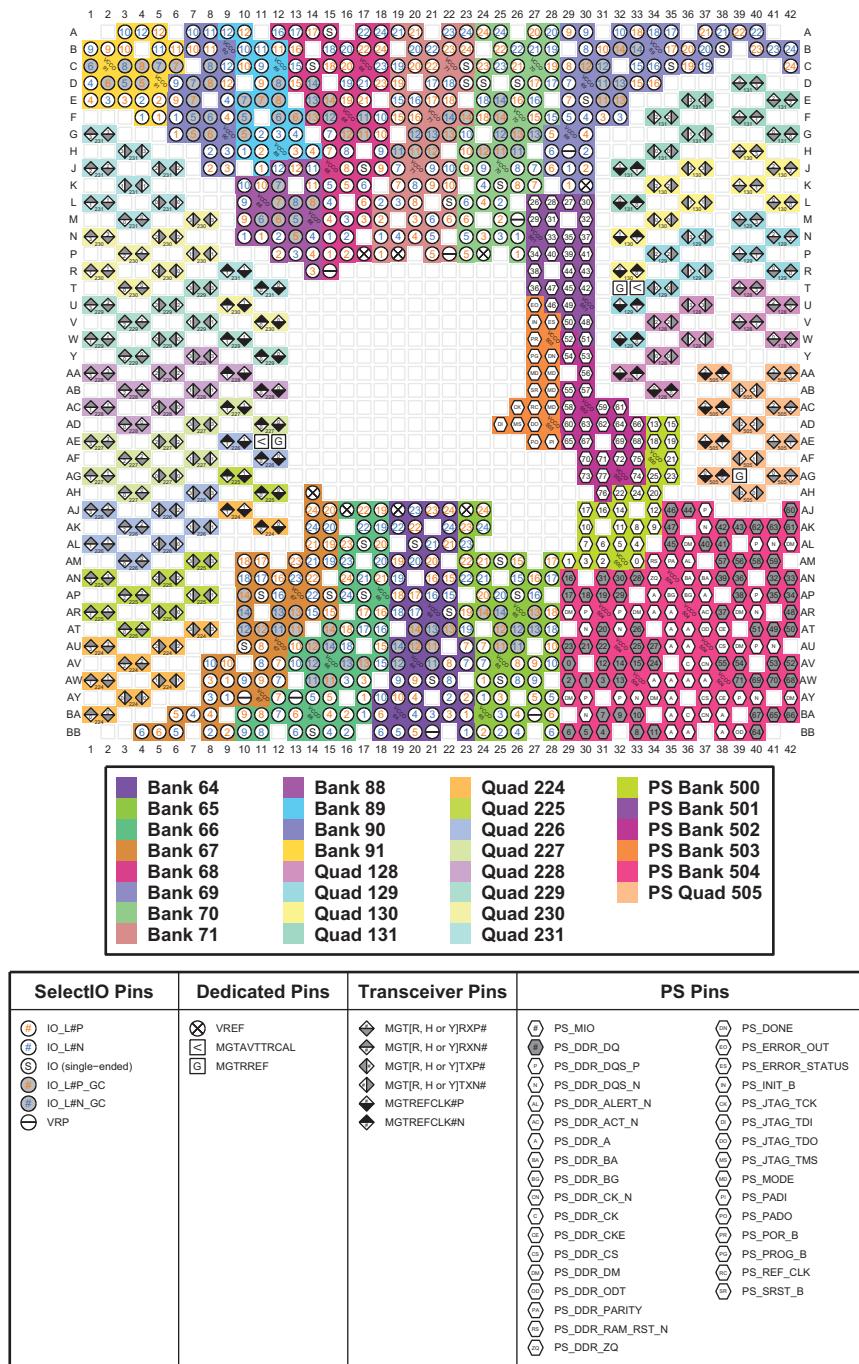


Figure 4-77: FFVC1760 Package—XCZU11EG I/O Bank Diagram

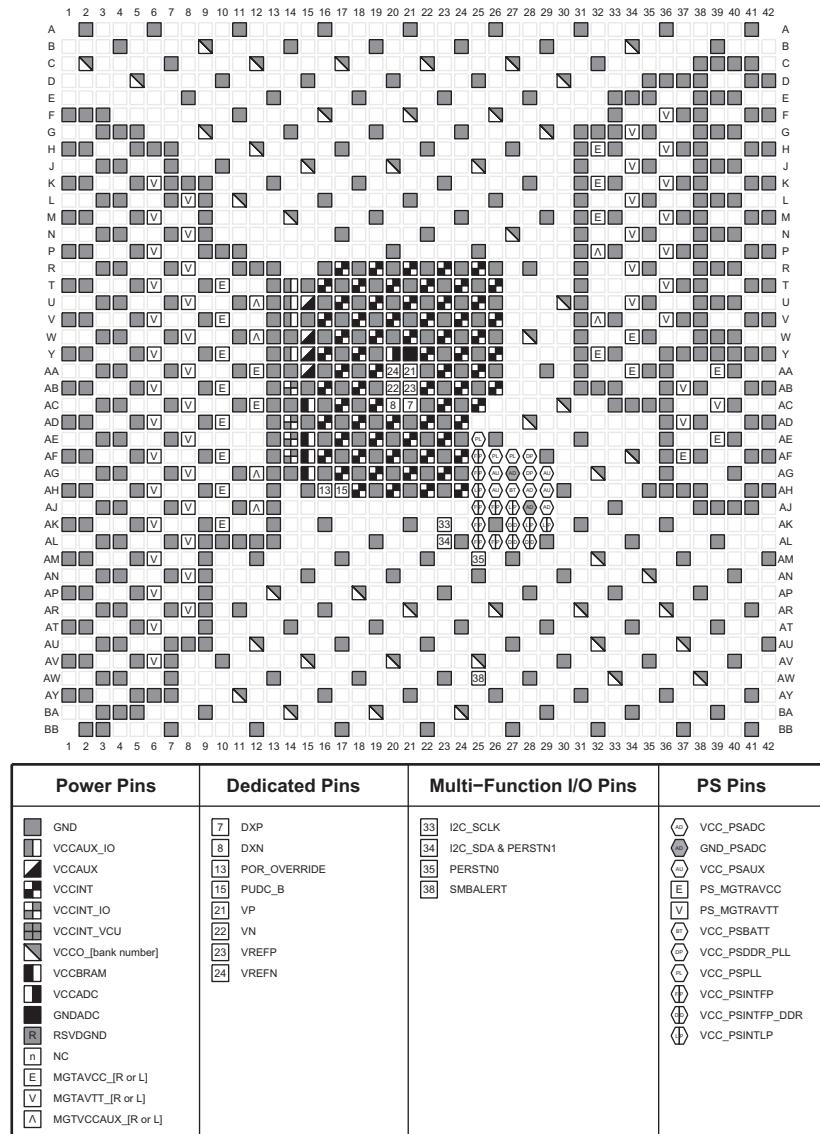


Figure 4-78: FFVC1760 Package—XCZU11EG Power, Dedicated, and Multi-function Pin Diagram

## FFVC1760 Package—XCZU17EG and XCZU19EG

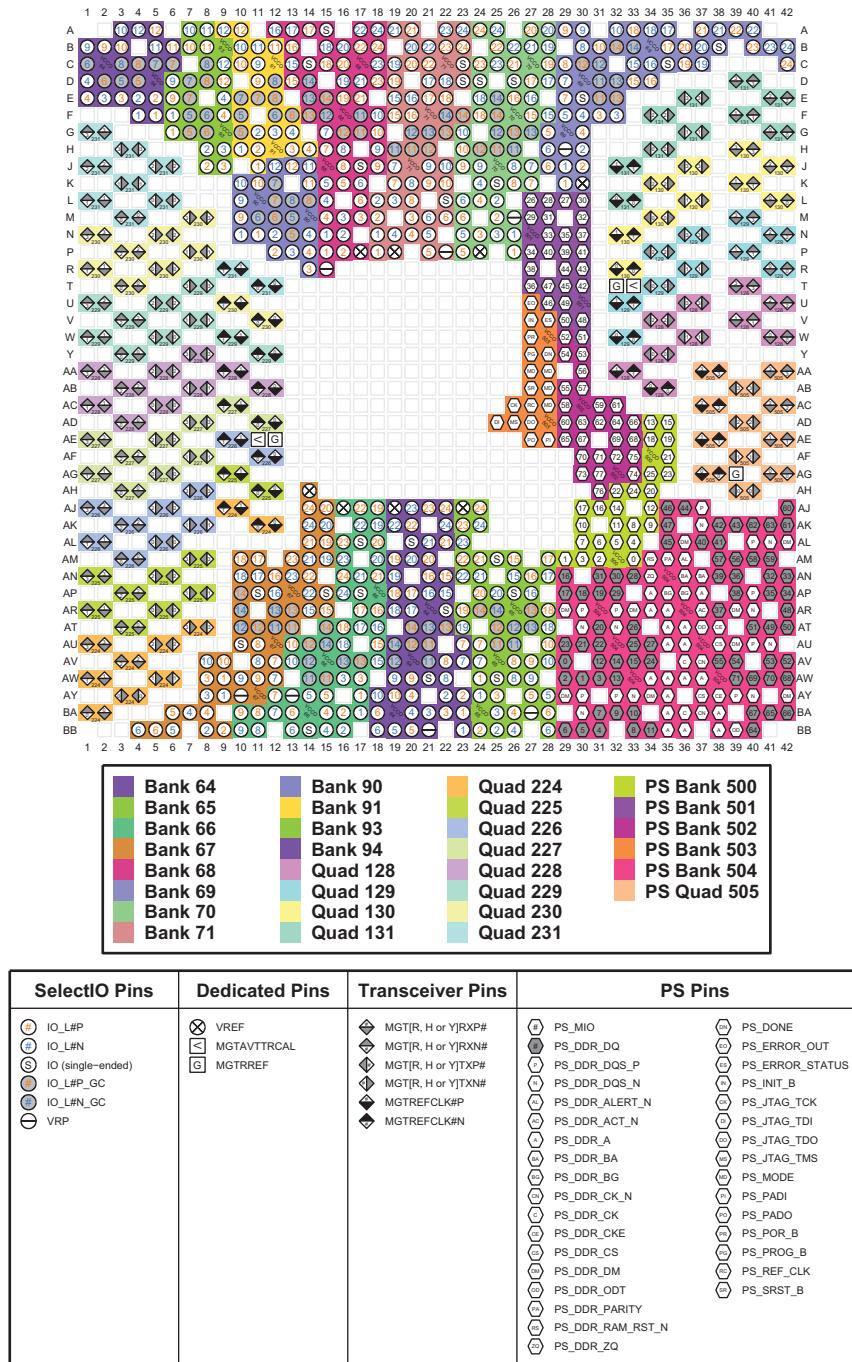


Figure 4-79: FFVC1760 Package—XCZU17EG and XCZU19EG I/O Bank Diagram

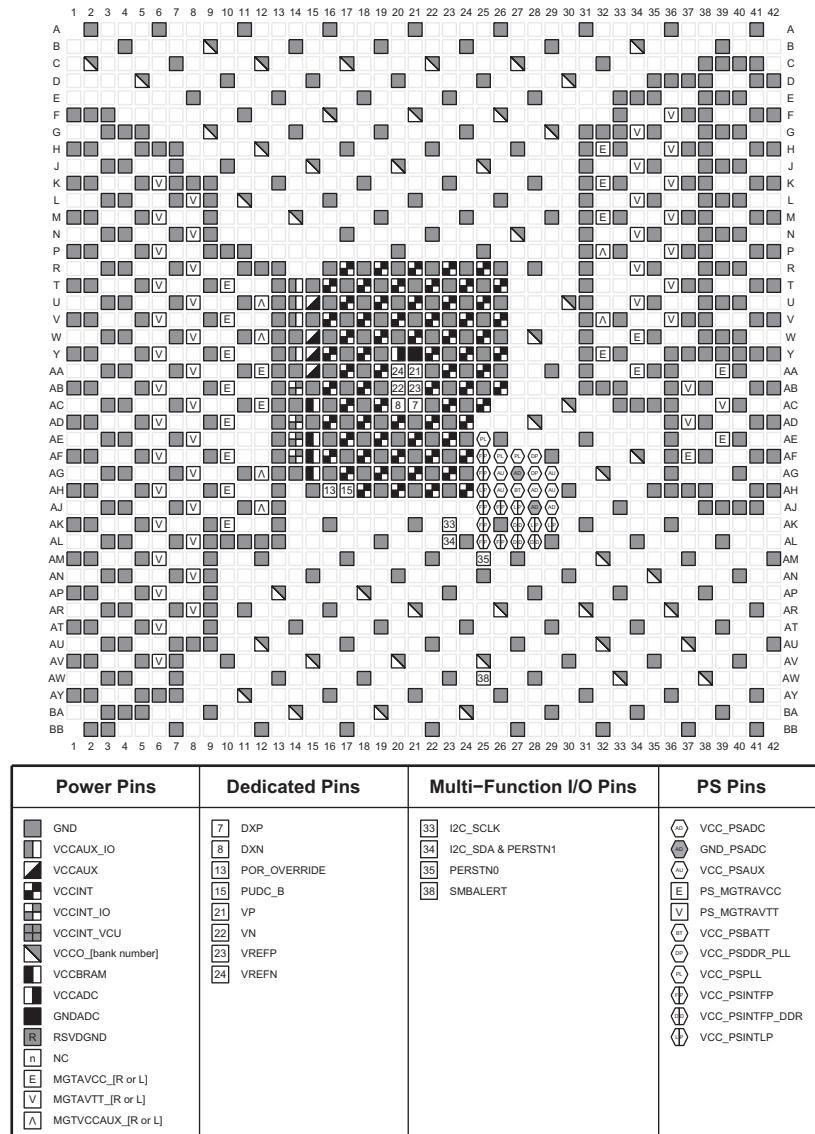


Figure 4-80: FFVC1760 Package—XCZU17EG and XCZU19EG Power, Dedicated, and Multi-function Pin Diagram

## FFVD1760 Package—XCZU17EG and XCZU19EG

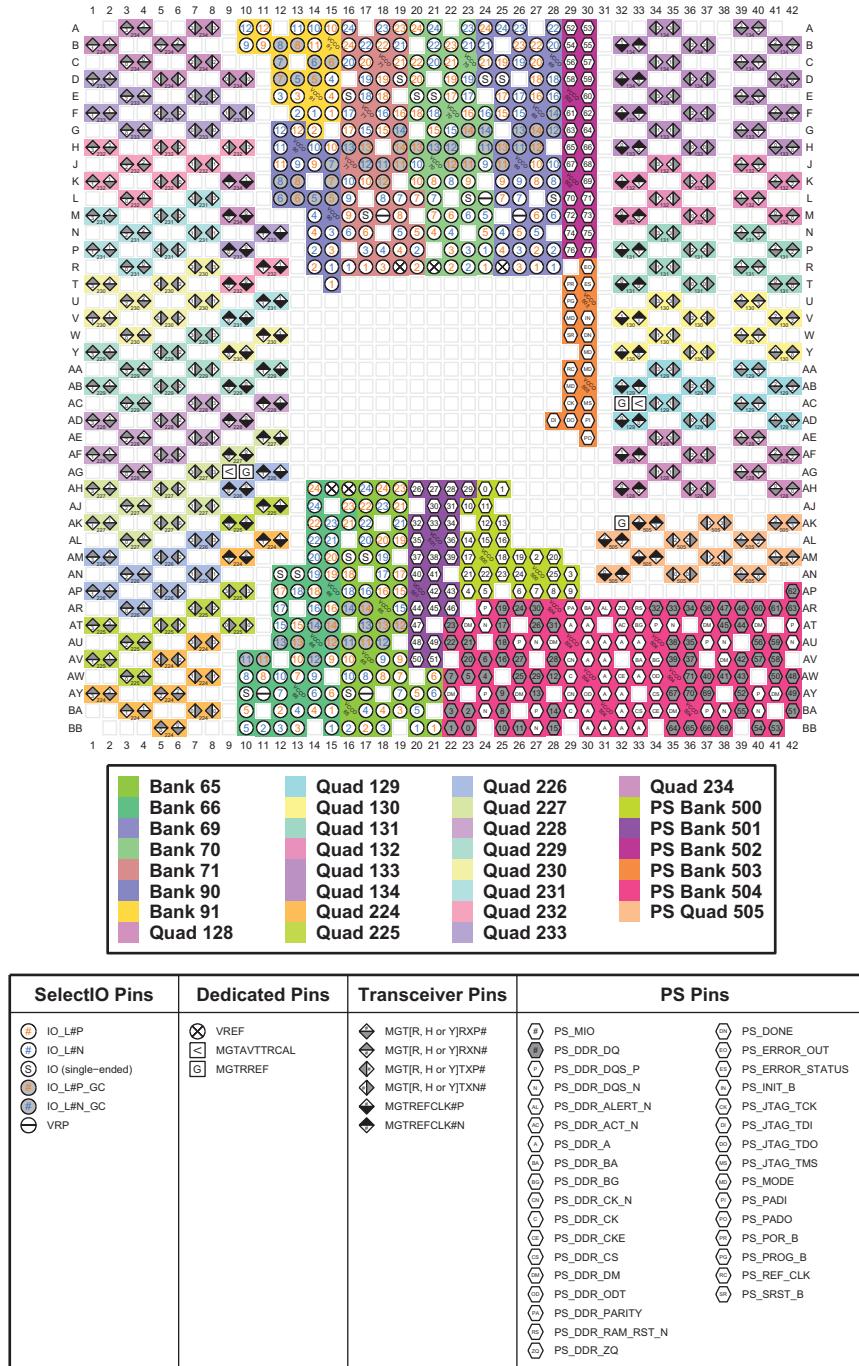


Figure 4-81: FFVD1760 Package—XCZU17EG and XCZU19EG I/O Bank Diagram

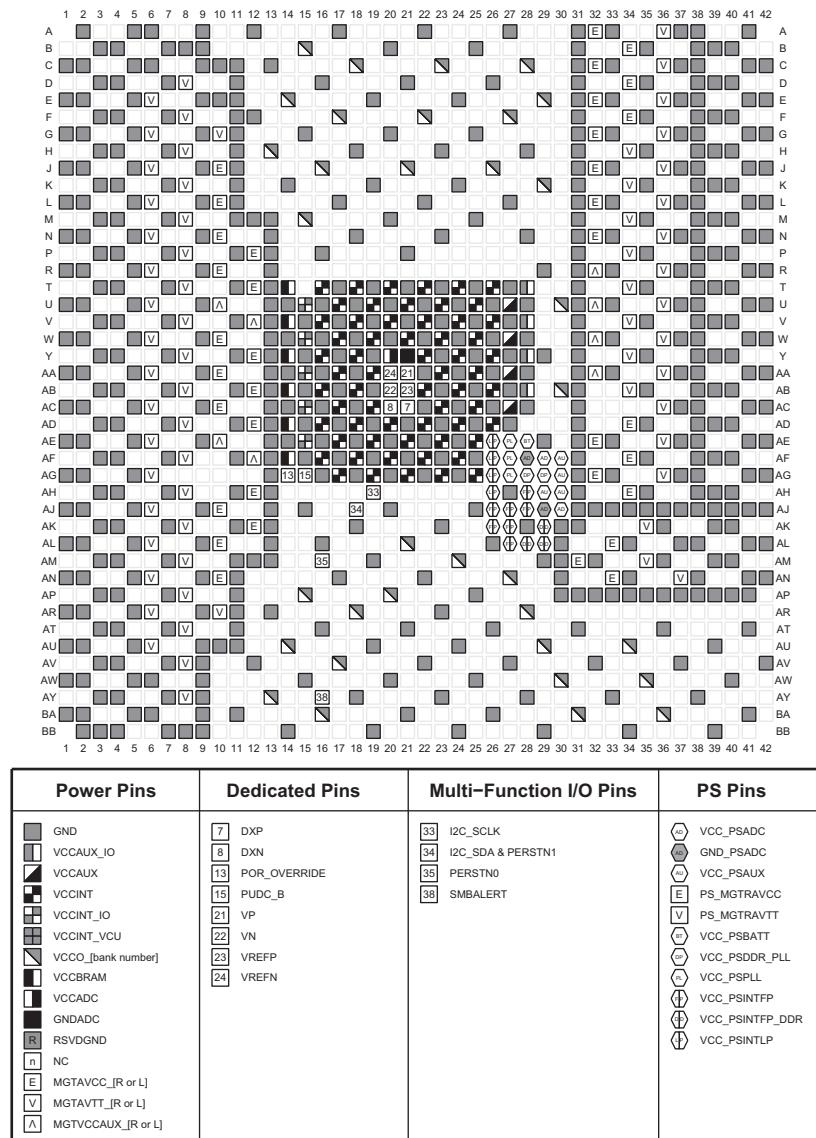


Figure 4-82: FFVD1760 Package—XCZU17EG and XCZU19EG Power, Dedicated, and Multi-function Pin Diagram

## FFVF1760 and FSVF1760 Packages—XCZU29DR and XCZU39DR

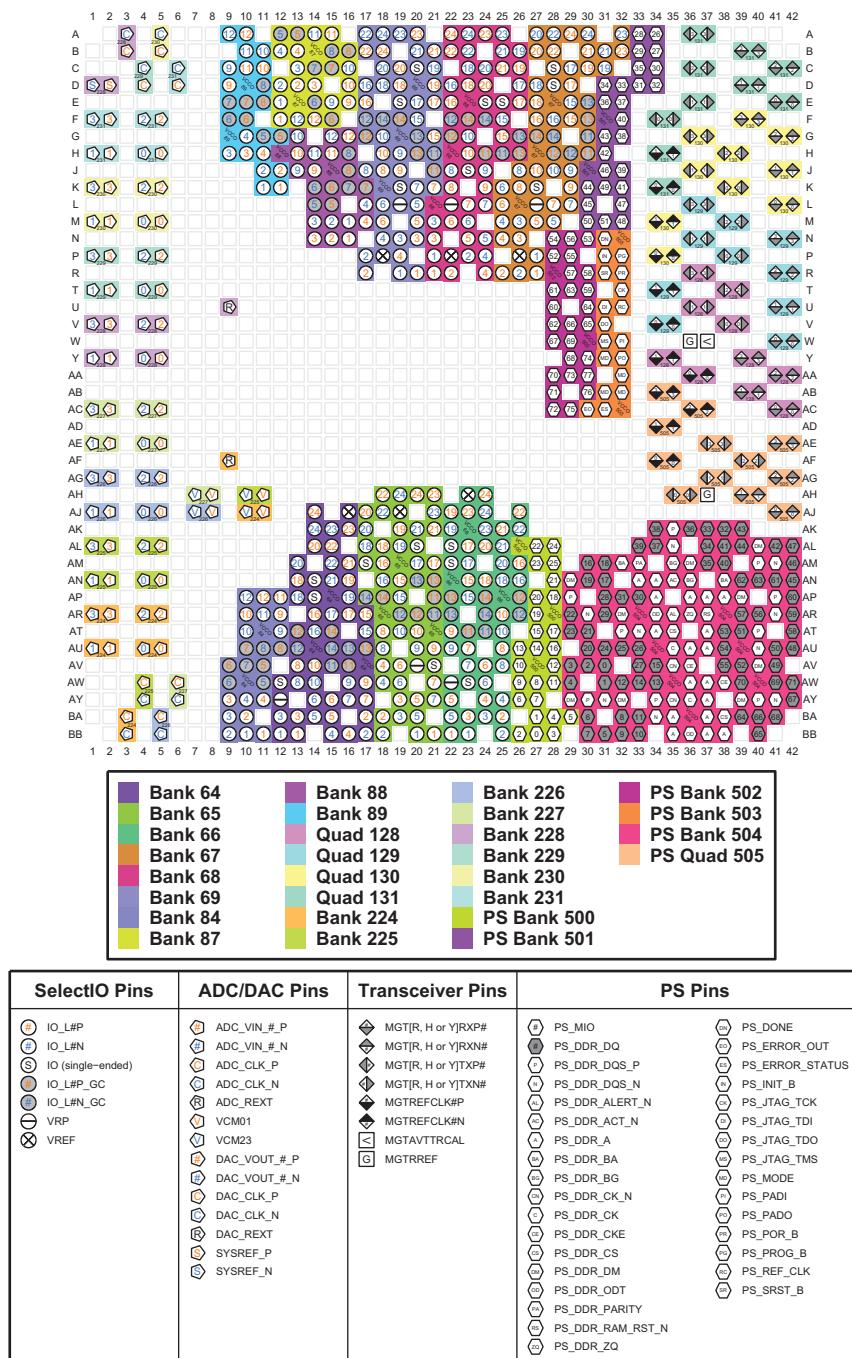
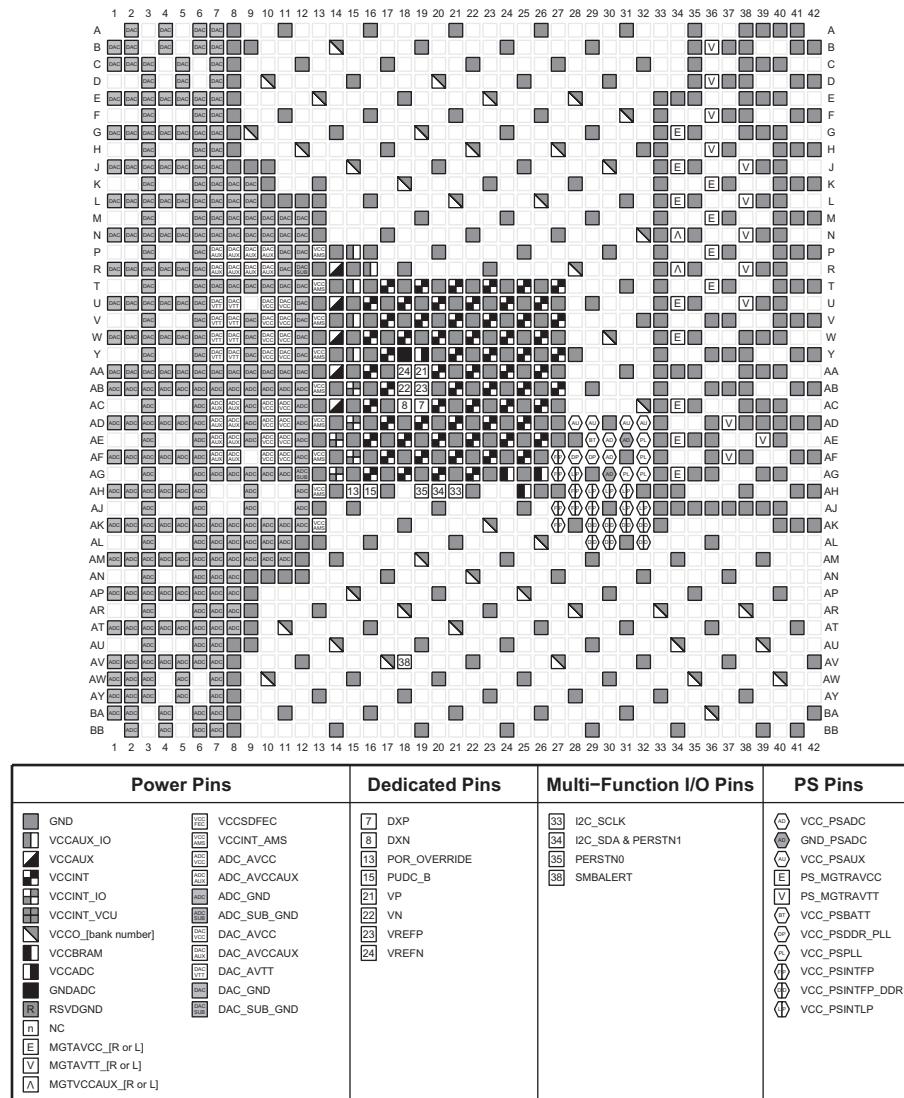
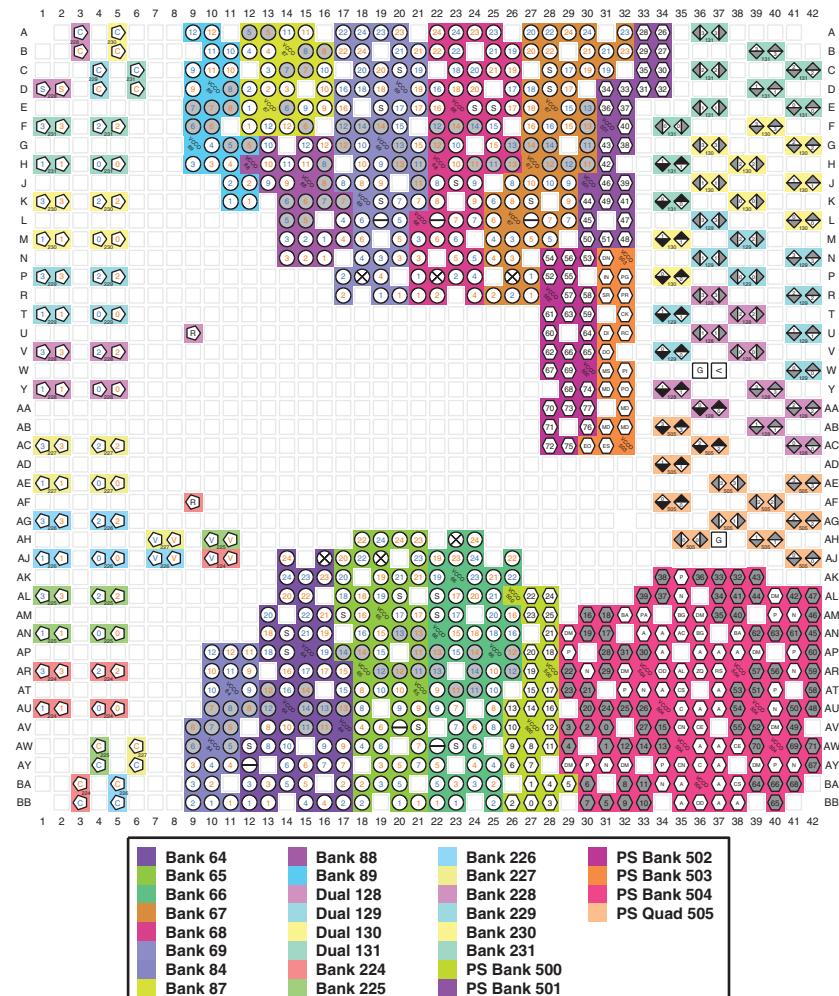


Figure 4-83: FFVF1760 and FSVF1760 Packages—XCZU29DR and XCZU39DR I/O Bank Diagram



**Figure 4-84: FFVF1760 and FSVF1760 Packages—XCZU29DR and XCZU39DR Power, Dedicated, and Multi-function Pin Diagram**

## FFVF1760 and FSVF1760 Packages—XCZU49DR FSRF1760 Package—XQZU49DR



SelectIO Pins	ADC/DAC Pins	Transceiver Pins	PS Pins
IO_L#P IO_L#N IO (single-ended) IO_L#P_GC IO_L#N_GC VRP VREF	ADC_VIN_#_P ADC_VIN_#_N ADC_CLK_P ADC_CLK_N ADC_REXT VCM01 VCM23 DAC_VOUT_#_P DAC_VOUT_#_N DAC_CLK_P DAC_CLK_N DAC_REXT SYSREF_P SYSREF_N	MGT[R, H or Y]RXP# MGT[R, H or Y]RXN# MGT[R, H or Y]TXP# MGT[R, H or Y]TXN# MGTRCLK#P MGTRCLK#N MGTAVTTRCAL MGTRREF	PS_MIO PS_DDR_DQ PS_DDR_DQS_P PS_DDR_DQS_N PS_DDR_ALERT_N PS_DDR_ACT_N PS_DDR_A PS_DDR_BA PS_DDR_BG PS_DDR_CK_N PS_DDR_CK PS_DDR_CKE PS_DDR_CS PS_DDR_DM PS_DDR_ODT PS_DDR_PARITY PS_DDR_RAM_RST_N PS_DDR_ZQ

Figure 4-85: FFVF1760, FSVF1760, FSRF1760 Packages—XCZU49DR, XQZU49DR I/O Bank Diagram

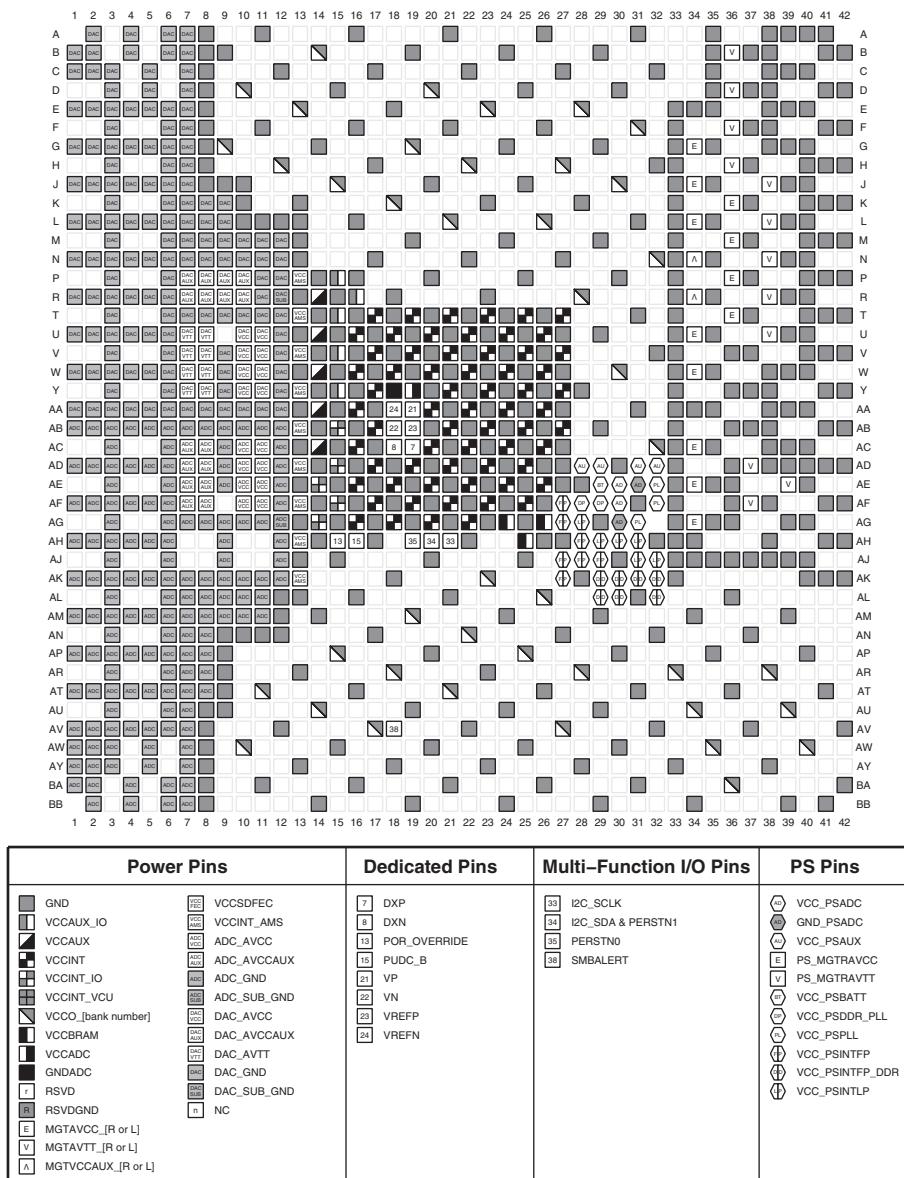


Figure 4-86: FFVF1760, FSVF1760, FSRF1760 Packages—XCZU49DR, XQZU49DR Power, Dedicated, and Multi-function Pin Diagram

## FFVH1760 and FSVH1760 Packages—XCZU46DR

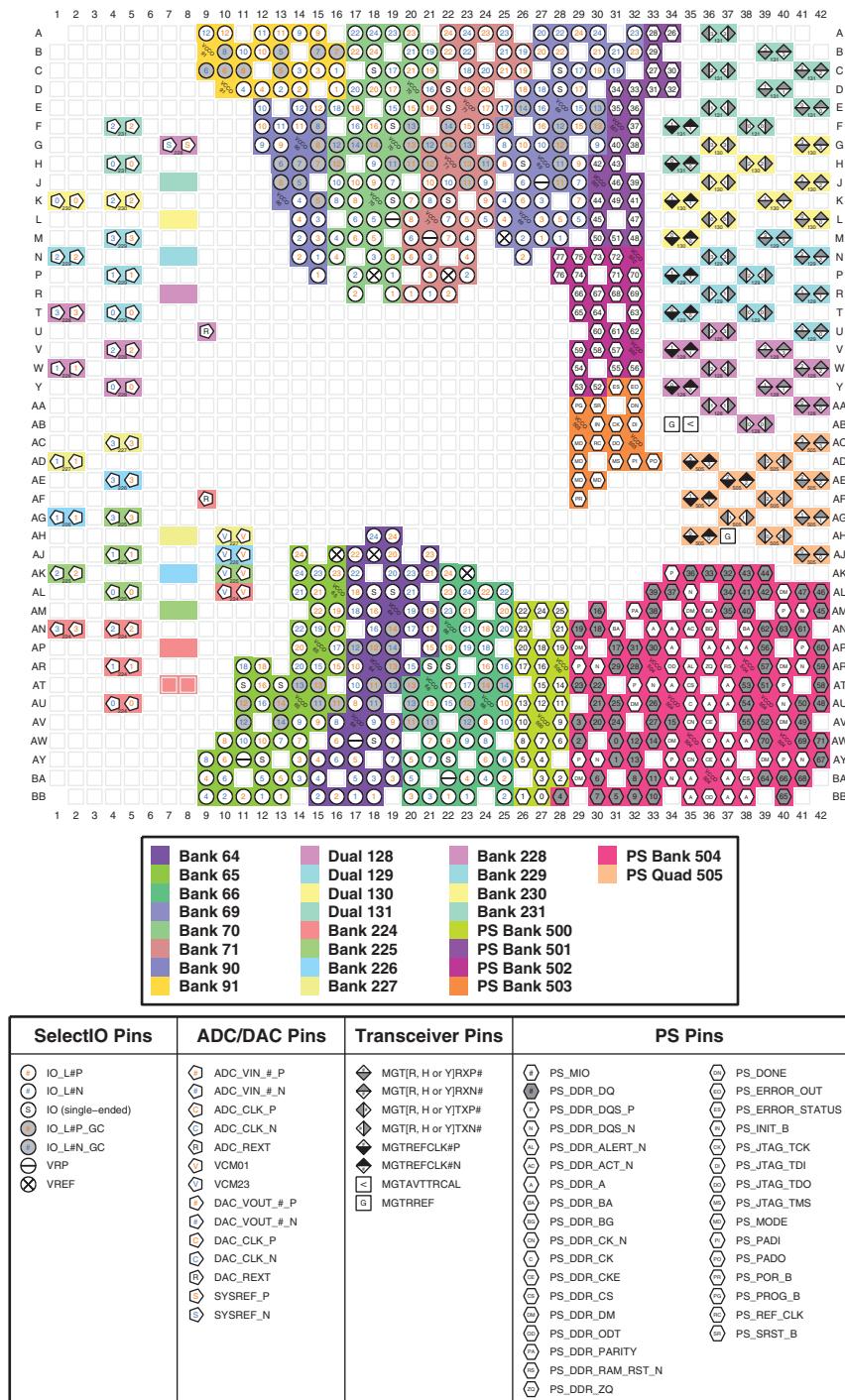


Figure 4-87: FFVH1760 and FSVH1760 Packages—XCZU49DR I/O Bank Diagram

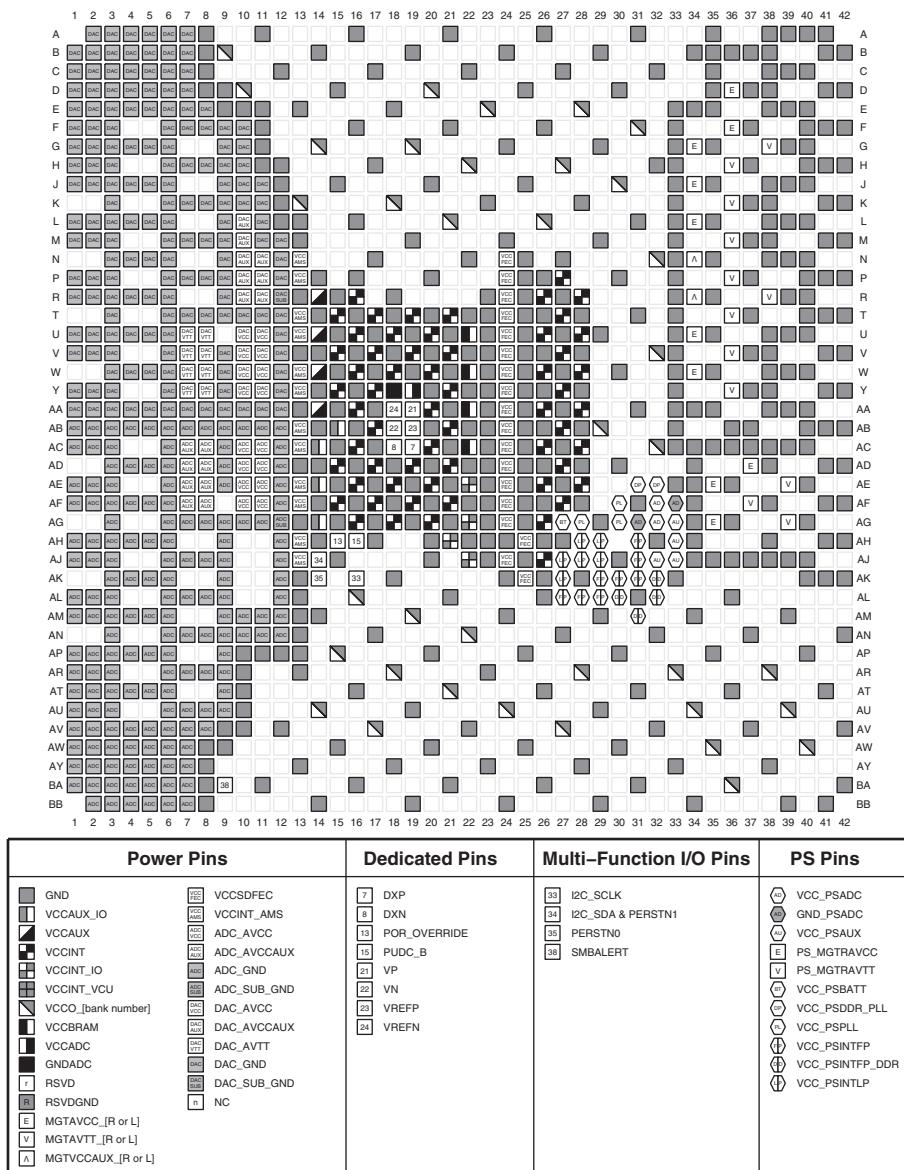


Figure 4-88: FFVH1760 and FSVH1760 Packages—XCZU49DR  
Power, Dedicated, and Multi-function Pin Diagram

## FFVE1924 Package—XCZU17EG and XCZU19EG

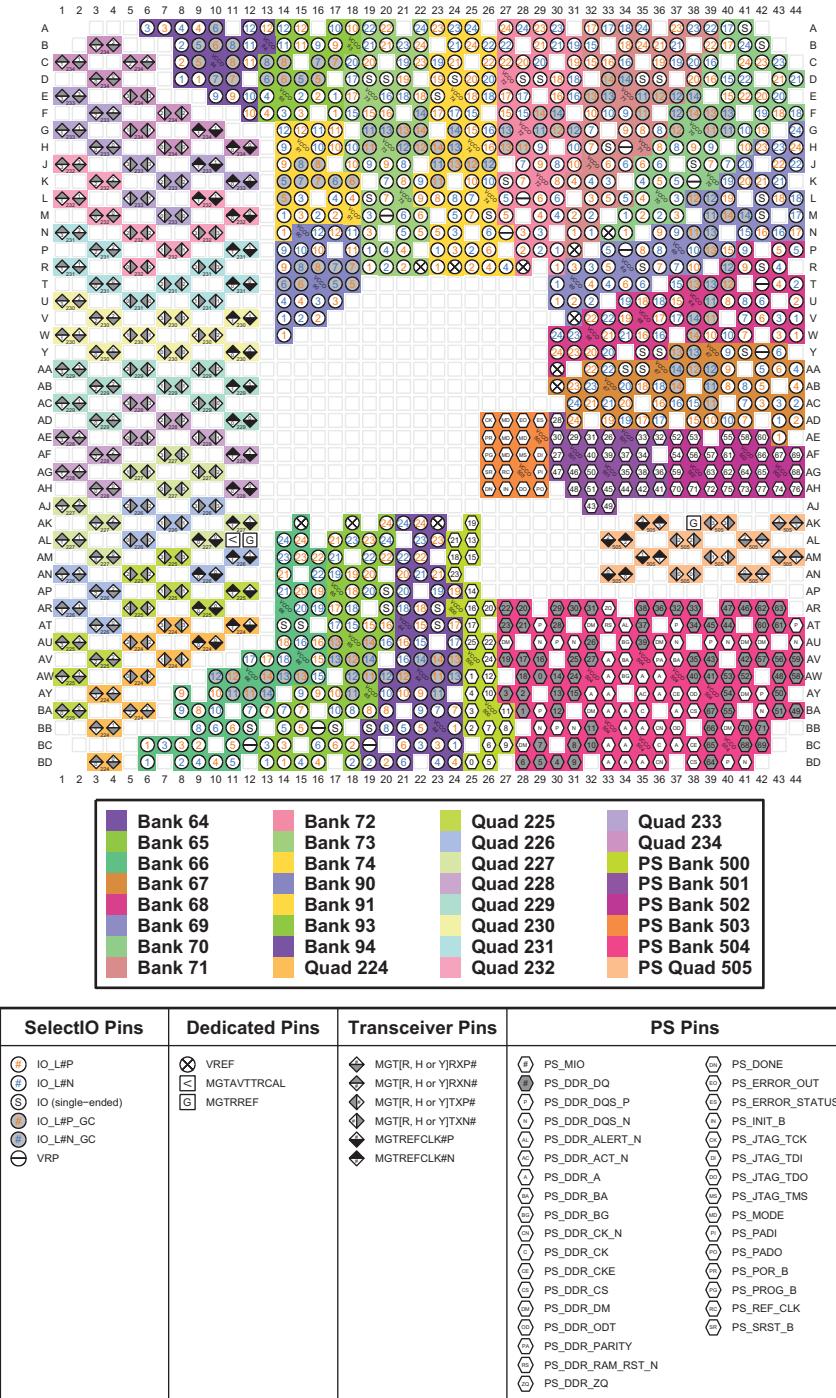


Figure 4-89: FFVE1924 Package—XCZU17EG and XCZU19EG I/O Bank Diagram

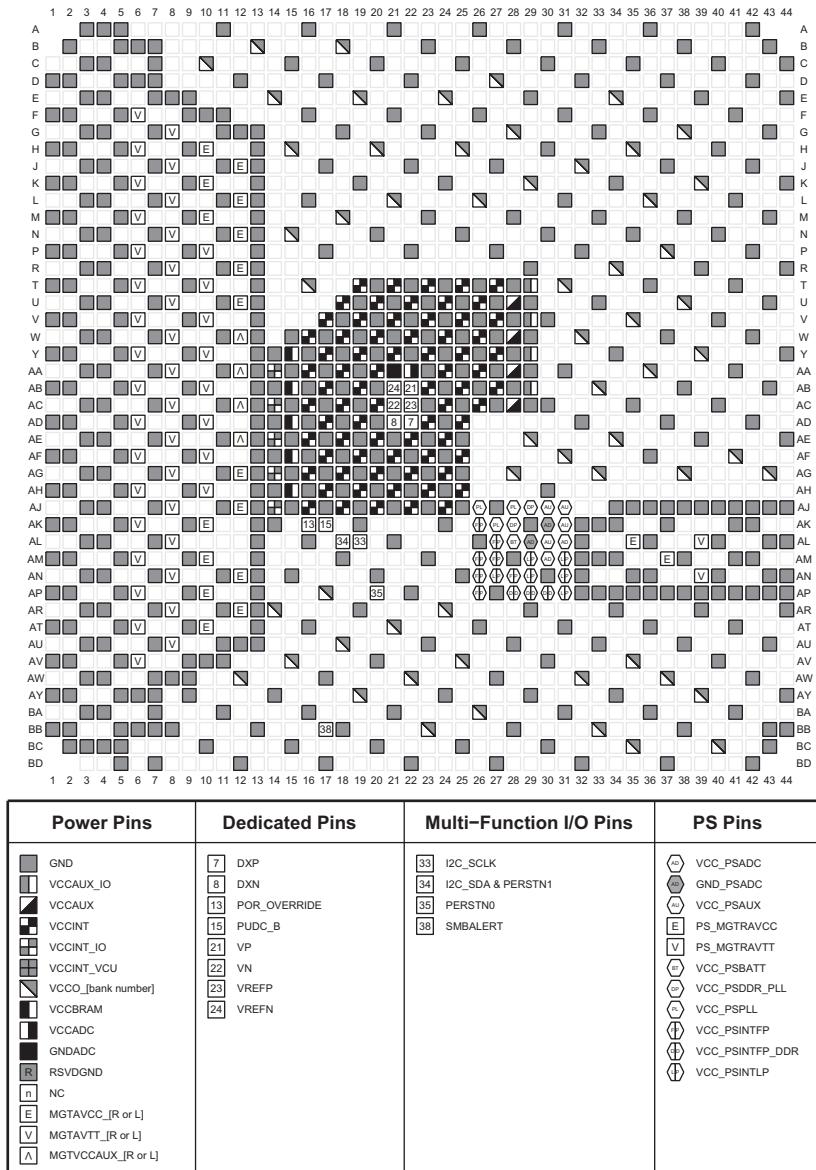


Figure 4-90: FFVE1924 Package—XCZU17EG and XCZU19EG Power, Dedicated, and Multi-function Pin Diagram

# Mechanical Drawings

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## Summary

This chapter provides mechanical drawings (package specifications) of the Zynq® UltraScale+™ devices. [Table 5-1](#) and [Table 5-2](#) cross-reference to the mechanical drawings by device and package combination. See [Package Specifications Designations in Chapter 3](#) for definitions of [Evaluation Only](#), [Engineering Sample](#), and [Production](#) mechanical drawings.



**IMPORTANT:** All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q. For the mechanical drawings, refer to the Pb-free version of these packages.



**TIP:** For information on materials composition and weight of a device, refer to the material declaration data sheet (MDDS). MDDS files: Click on this link to find the Zynq UltraScale+ devices [Packaging Specifications](#). In step 2 select the product category: SoCs, MPSoCs & RFSoCs. In step 3, select the product type. In step 4, click on the package specifications selection to find the available MDDS files. All published MDDS files are also available on the [See All Package Specifications](#) page.

Table 5-1: Cross-Reference to Zynq UltraScale+ MPSoC Mechanical Drawings by Package

Package	Device																		
	XCZU1CG XCZU1EG	XCZU2CG XCZU2EG XAZU2EG	XCZU3CG XCZU3EG XAZU3EG XQZU3EG	XCZU4CG XCZU4EG XCZU4EV XAZU4EV	XCZU5CG XCZU5EG XCZU5EV XAZU5EV XQZU5EV	XCZU6CG XCZU6EG	XCZU7CG XCZU7EG XCZU7EV XAZU7EV XQZU7EV	XCZU9CG XCZU9EG XQZU9EG	XCZU11EG XAZU11EG XQZU11EG	XCZU15EG XQZU15EG XQZU15EG	XCZU17EG	XCZU19EG XQZU19EG							
SBVA484	Figure 5-2 Production	Figure 5-2 Production																	
SFRA484			Figure 5-3 Production																
UBVA494	Figure 5-4 Engineering Sample																		
UBVA530		Figure 5-5 Production	Figure 5-5 Production																
SFVA625	Figure 5-6 Production	Figure 5-7 Production																	
SFRC784			Figure 5-8 Production		Figure 5-8 Production														
SFVC784	Figure 5-9 Production																		
FBVB900				Figure 5-10 Production			Figure 5-11 Production												
FFRB900					Figure 5-13 Production		Figure 5-12 Production												
FFRC900								Figure 5-13 Production			Figure 5-13 Production								
FFVC900						Figure 5-14 Production		Figure 5-14 Production		Figure 5-14 Production									
FFRB1156								Figure 5-15 Production		Figure 5-15 Production									

Table 5-1: Cross-Reference to Zynq UltraScale+ MPSoC Mechanical Drawings by Package (*Cont'd*)

Package	Device											
	XCZU1CG XCZU1EG	XCZU2CG XCZU2EG XAZU2EG	XCZU3CG XCZU3EG XAZU3EG XQZU3EG	XCZU4CG XCZU4EG XCZU4EV XAZU4EV	XCZU5CG XCZU5EG XCZU5EV XAZU5EV XQZU5EV	XCZU6CG XCZU6EG	XCZU7CG XCZU7EG XCZU7EV XAZU7EV XQZU7EV	XCZU9CG XCZU9EG XAZU9EG	XCZU11EG XAZU11EG XQZU11EG	XCZU15EG XQZU15EG XQZU15EG	XCZU17EG	XCZU19EG XQZU19EG
FFVB1156					Figure 5-16 Production		Figure 5-16 Production		Figure 5-16 Production			
FFRC1156					Figure 5-17 Production		Figure 5-17 Production					
FFVC1156					Figure 5-18 Production		Figure 5-18 Production					
FFRB1517												Figure 5-24 Production
FFVB1517								Figure 5-25 Production		Figure 5-25 Production		
FFVF1517					Figure 5-25 Production		Figure 5-25 Production					
FFRC1760								Figure 5-31 Production			Figure 5-31 Production	
FFVC1760								Figure 5-30 Production		Figure 5-30 Production		
FFVD1760										Figure 5-30 Production		
FFVE1924										Figure 5-36 Production		

Table 5-2: Cross-Reference to Zynq UltraScale+ RFSoC Mechanical Drawings by Package

Package	Device											
	XCZU21DR XQZU21DR	XCZU25DR XCZU27DR	XCZU28DR XQZU28DR	XCZU29DR XQZU29DR	XCZU39DR	XCZU42DR	XCZU43DR	XCZU46DR	XCZU47DR XCZU48DR XQZU48DR	XCZU49DR XQZU49DR	XCZU65DR	XCZU67DR
FFRD1156	<a href="#">Figure 5-19</a> Production											
FFVD1156	<a href="#">Figure 5-21</a> Production											
FFRE1156			<a href="#">Figure 5-20</a> Production									
FFVE1156		<a href="#">Figure 5-21</a> Production	<a href="#">Figure 5-21</a> Production			<a href="#">Figure 5-21</a> Production	<a href="#">Figure 5-21</a> Production		<a href="#">Figure 5-21</a> Production		<a href="#">Figure 5-21</a> Production	<a href="#">Figure 5-21</a> Production
FSVE1156		<a href="#">Figure 5-22</a> Production	<a href="#">Figure 5-22</a> Production			<a href="#">Figure 5-22</a> Production	<a href="#">Figure 5-22</a> Production		<a href="#">Figure 5-22</a> Production		<a href="#">Figure 5-22</a> Production	<a href="#">Figure 5-22</a> Production
FFRG1517			<a href="#">Figure 5-26</a> Production									
FFVG1517		<a href="#">Figure 5-27</a> Production	<a href="#">Figure 5-27</a> Production				<a href="#">Figure 5-27</a> Production		<a href="#">Figure 5-27</a> Production			
FSRG1517									<a href="#">Figure 5-28</a> Production			
FSVG1517		<a href="#">Figure 5-29</a> Production	<a href="#">Figure 5-29</a> Production				<a href="#">Figure 5-29</a> Production		<a href="#">Figure 5-29</a> Production			
FFRF1760				<a href="#">Figure 5-33</a> Production								
FFVF1760				<a href="#">Figure 5-32</a> Production	<a href="#">Figure 5-32</a> Production						<a href="#">Figure 5-32</a> Production	
FSRF1760									<a href="#">Figure 5-35</a> Production			

Table 5-2: Cross-Reference to Zynq UltraScale+ RFSoC Mechanical Drawings by Package (*Cont'd*)

Package	Device												
	XCZU21DR XQZU21DR	XCZU25DR XCZU27DR	XCZU28DR XQZU28DR	XCZU29DR XQZU29DR	XCZU39DR	XCZU42DR	XCZU43DR	XCZU46DR	XCZU47DR XCZU48DR XQZU48DR	XCZU49DR XQZU49DR	XCZU65DR	XCZU67DR	
FSVF1760	<a href="#">Figure 5-34</a> Production				<a href="#">Figure 5-34</a> Production				<a href="#">Figure 5-34</a> Production				
FFVH1760									<a href="#">Figure 5-32</a> Production				
FSVH1760									<a href="#">Figure 5-34</a> Production				

Table 5-3: Mechanical Drawing Dimension Definitions

Dimension	Definition
$\Delta$	Bilateral tolerance of package sides with respect to datums A and B
$\square$	Flatness tolerance of silicon die or package lid top surface
$/\!/$	Bilateral tolerance for parallelism of silicon die or package lid top surface with respect to the seating plane datum C
A	Thickness of package with respect to the seating plane datum C
A <sub>1</sub>	Thickness of BGA balls with respect to the seating plane datum C
A <sub>2</sub>	Thickness of package body, including stiffener ring or lid and excluding BGA balls, with respect to the seating plane datum C
A <sub>3</sub>	Distance from top of silicon die to top of stiffener ring or lid with respect to the seating plane datum C
D/E	Length/width of package with respect to datums A and B
D <sub>1</sub> /E <sub>1</sub>	Length/width of BGA matrix with respect to datums A and B
e	BGA ball pitch measured at the center of each ball
$\varnothing b$	BGA ball diameter
$\Delta_{aaa}$	Unidirectional upward tolerance with respect to the seating plane datum C
$/\!/ bbb$	Bilateral tolerance for parallelism of package surface with respect to the seating plane datum C
$\varnothing ddd$	BGA ball position tolerance of diameter ddd with respect to datums A and B perpendicular to the seating plane datum C in which the center of each ball must lie
$\varnothing eee$	BGA ball position tolerance of diameter eee measured with respect to other balls within the BGA matrix in which the center of each ball must lie
M	BGA ball matrix size

## SBVA484 Flip-Chip, Fine-Pitch BGA (XCZU1CG and XCZU1EG)

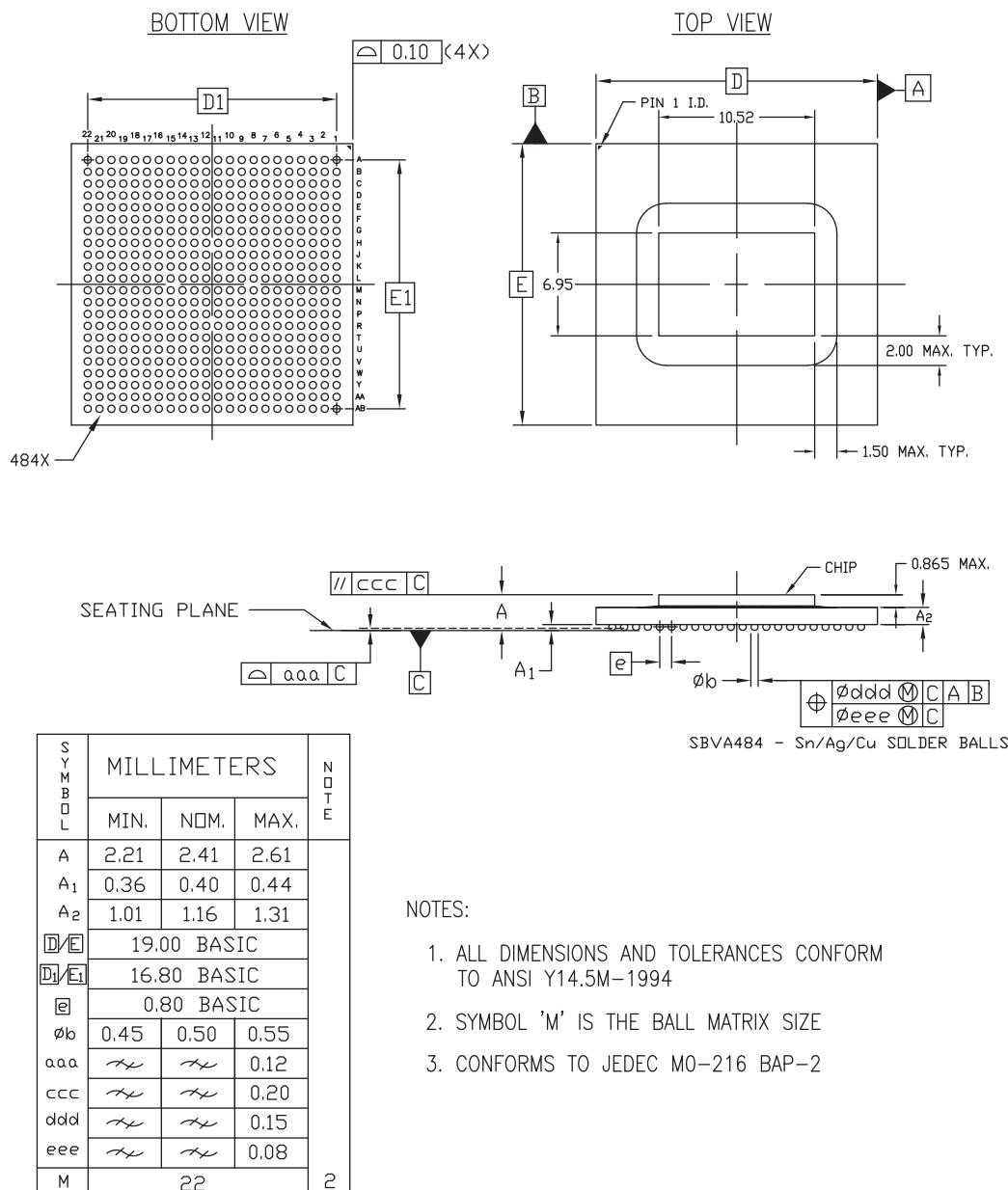


Figure 5-1: Package Dimensions for SBVA484 (XCZU1CG and XCZU1EG)

### NOTES:

1. ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1994
2. SYMBOL 'M' IS THE BALL MATRIX SIZE
3. CONFORMS TO JEDEC M0-216 BAP-2

## SBVA484 Flip-Chip, Fine-Pitch BGA (XCZU2, XCZU3, XAZU2EG, and XAZU3EG)

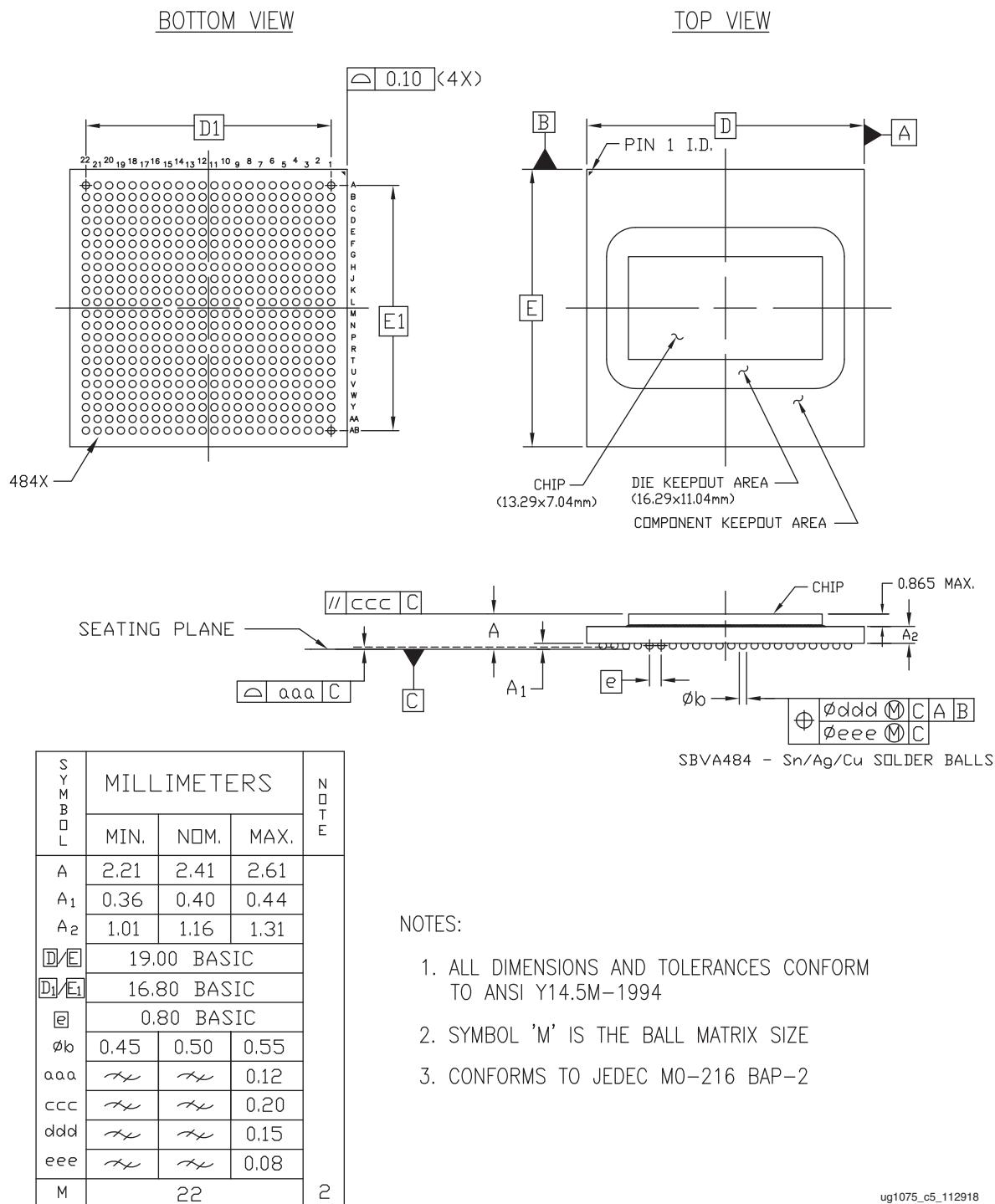
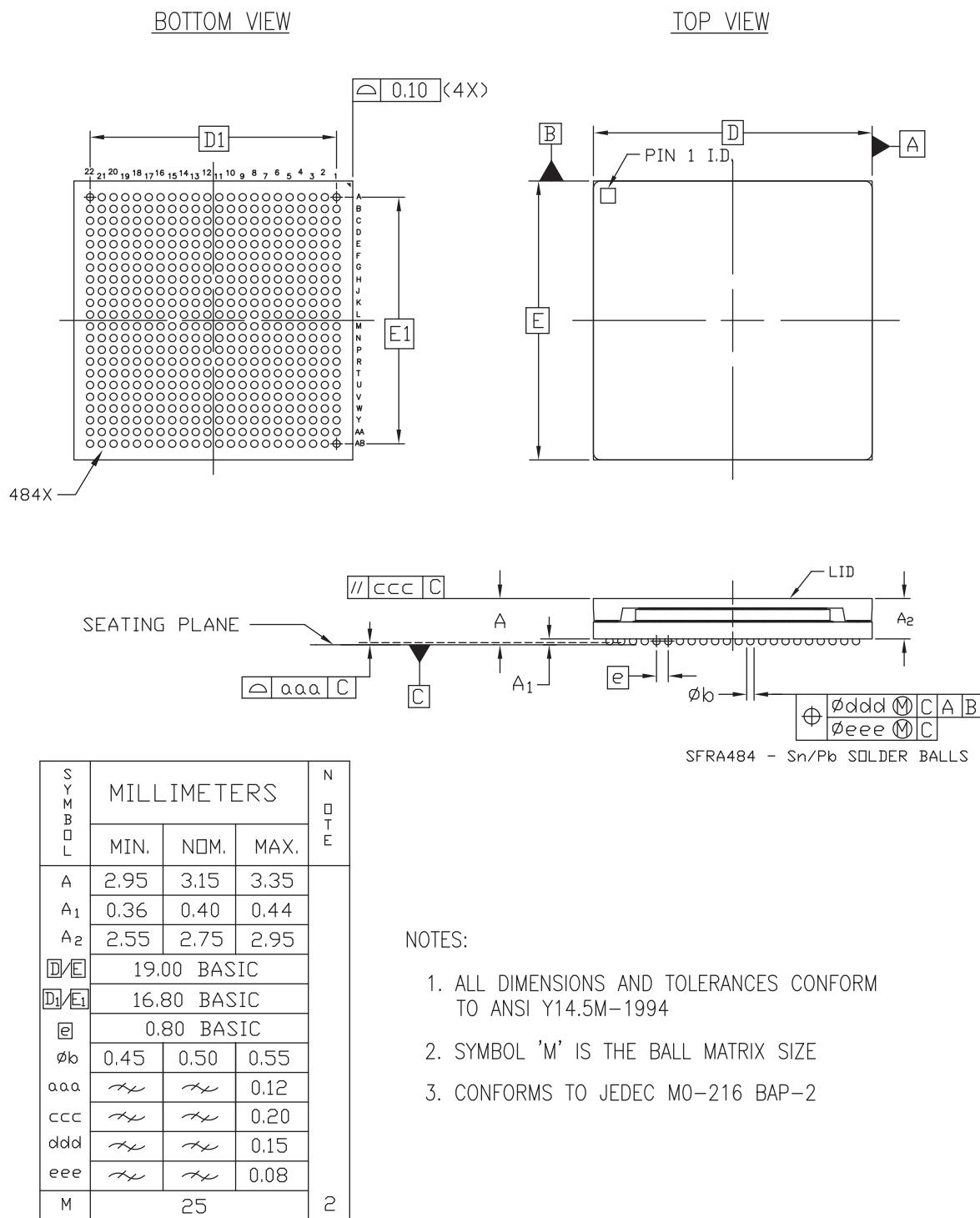


Figure 5-2: Package Dimensions for SBVA484 (XCZU2, XCZU3, XAZU2EG, and XAZU3EG)

## SFRA484 Flip-Chip, Fine-Pitch BGA (XQZU3EG)



ug1085\_c5\_061419

Figure 5-3: Package Dimensions for SFRA484 (XQZU3EG)

## UBVA494 Flip-Chip, Fine-Pitch BGA (XCZU1)

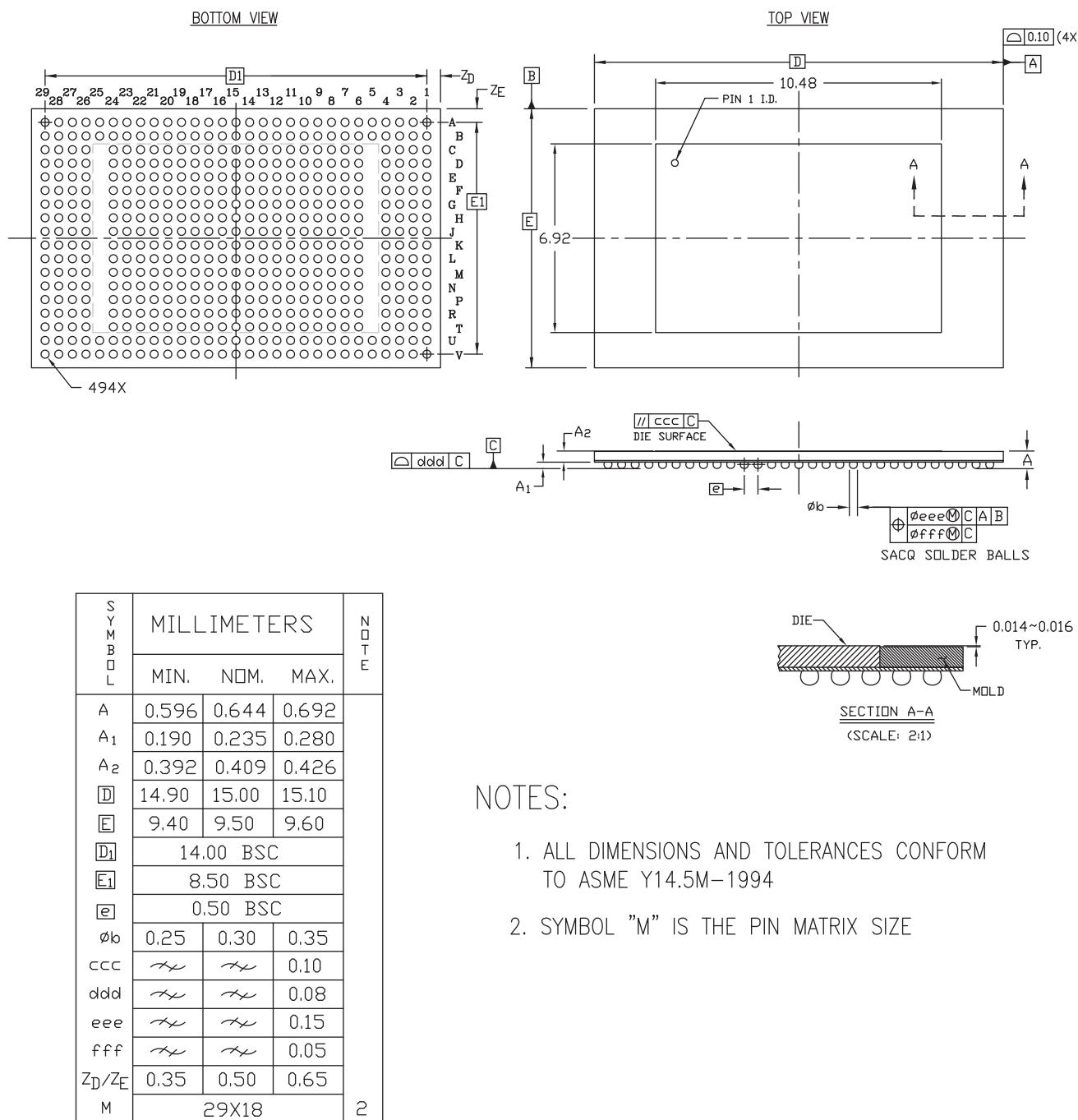


Figure 5-4: Package Dimensions for UBVA494 (XCZU1)

## UBVA530 Flip-Chip, Fine-Pitch BGA (XCZU2, XCZU3)

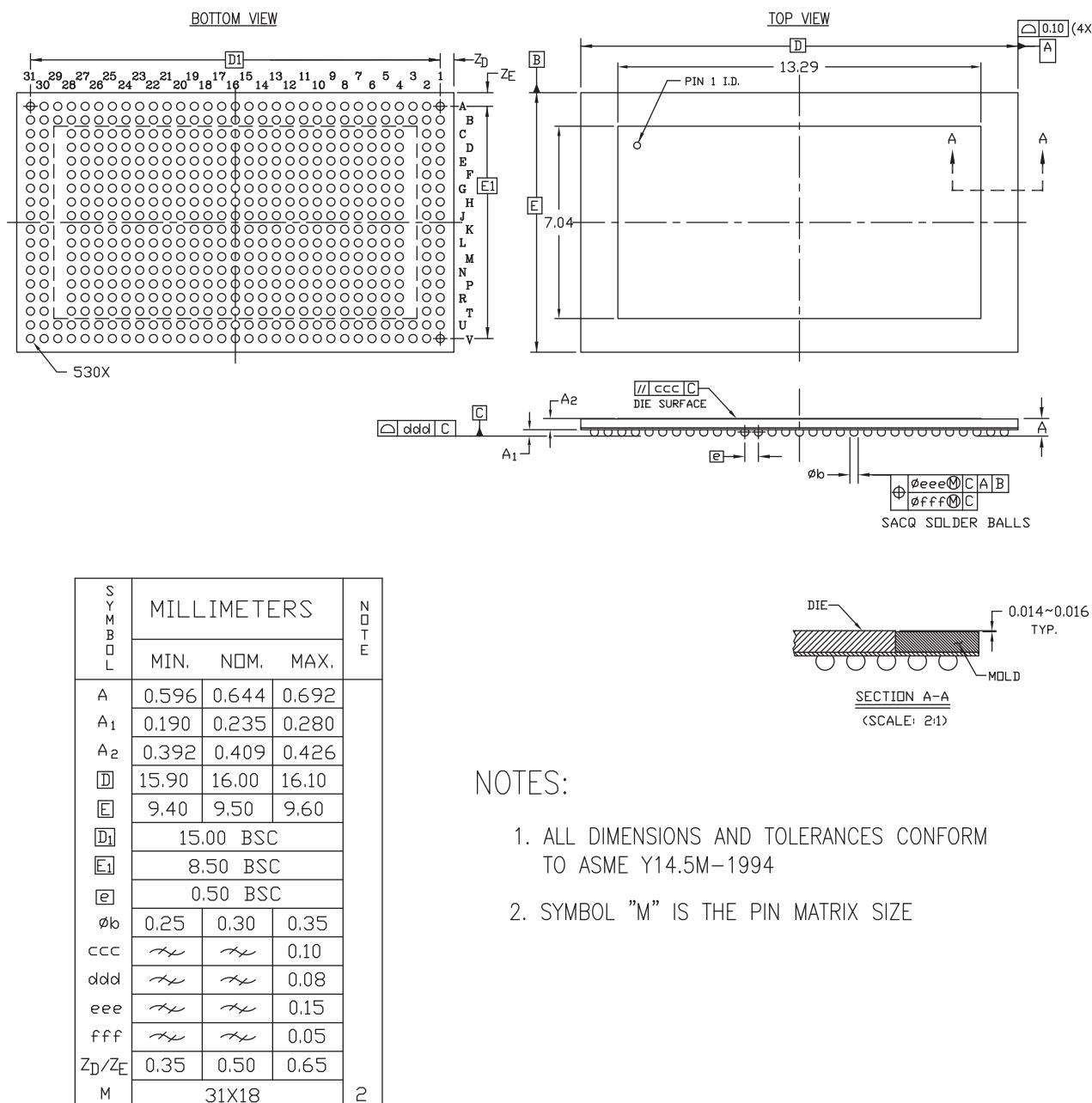


Figure 5-5: Package Dimensions for UBVA530 (XCZU2, XCZU3)

**IMPORTANT:** The weight for the UBVA530 is 0.2 grams.



## SFVA625 Flip-Chip, Fine-Pitch BGA (XCZU1CG and XCZU1EG)

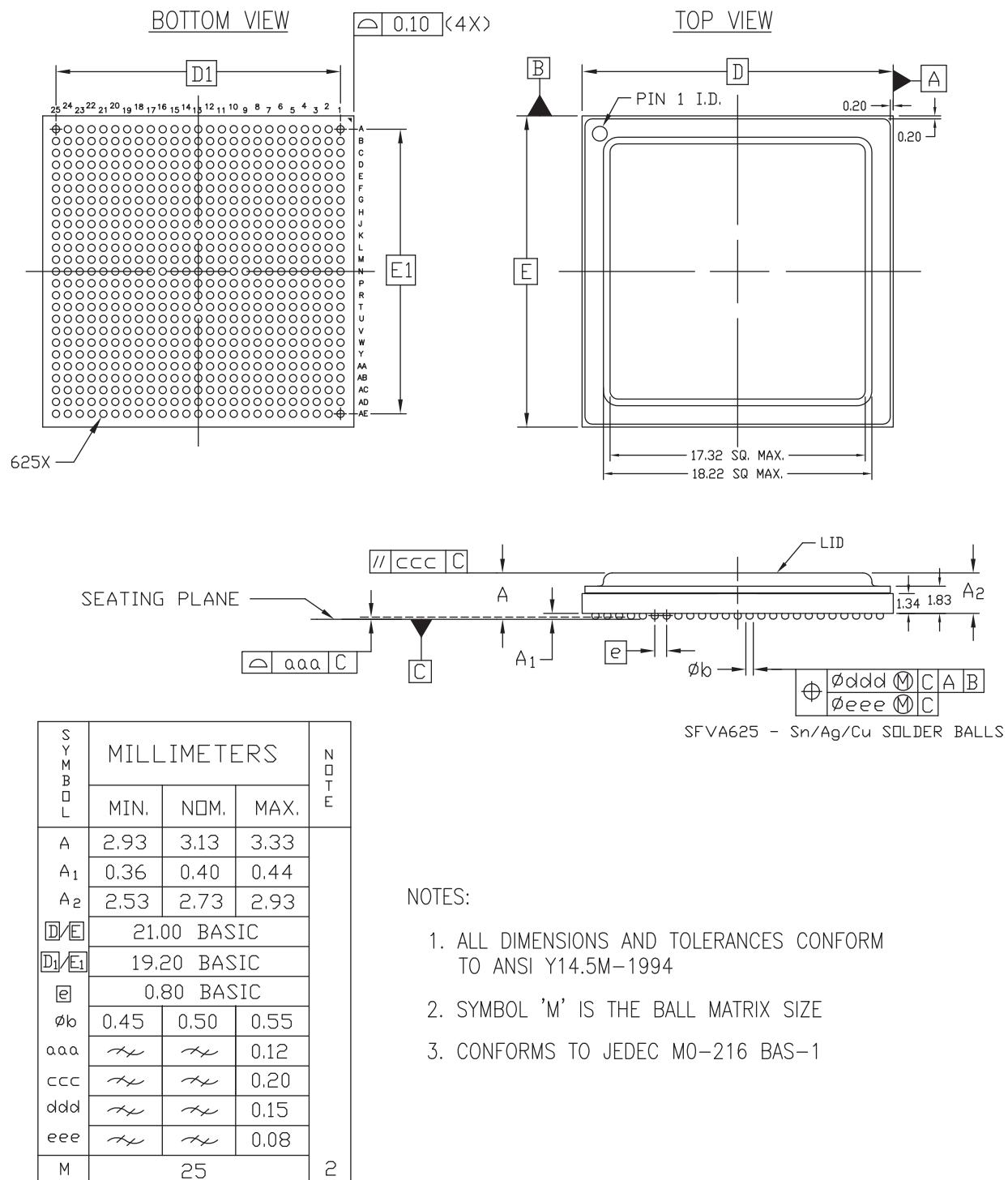


Figure 5-6: Package Dimensions for SFVA625 (XCZU1CG, and XCZU1EG)

## SFVA625 Flip-Chip, Fine-Pitch BGA (XCZU2, XCZU3, XAZU2EG, and XAZU3EG)

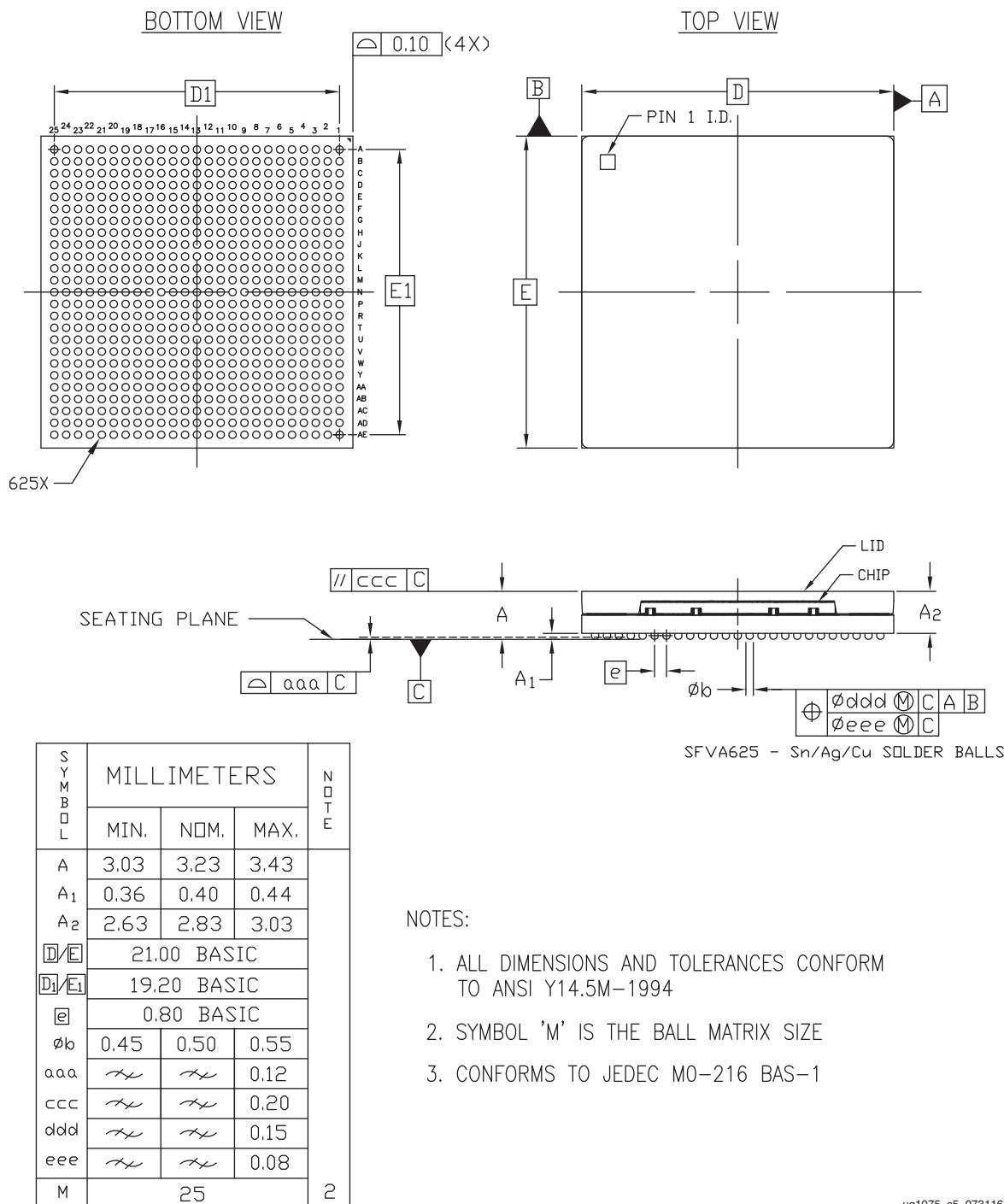


Figure 5-7: Package Dimensions for SFVA625 (XCZU2, XCZU3, XAZU2EG, and XAZU3EG)

## SFRC784 Ruggedized Flip-Chip BGA (XQZU3EG and XQZU5EV)

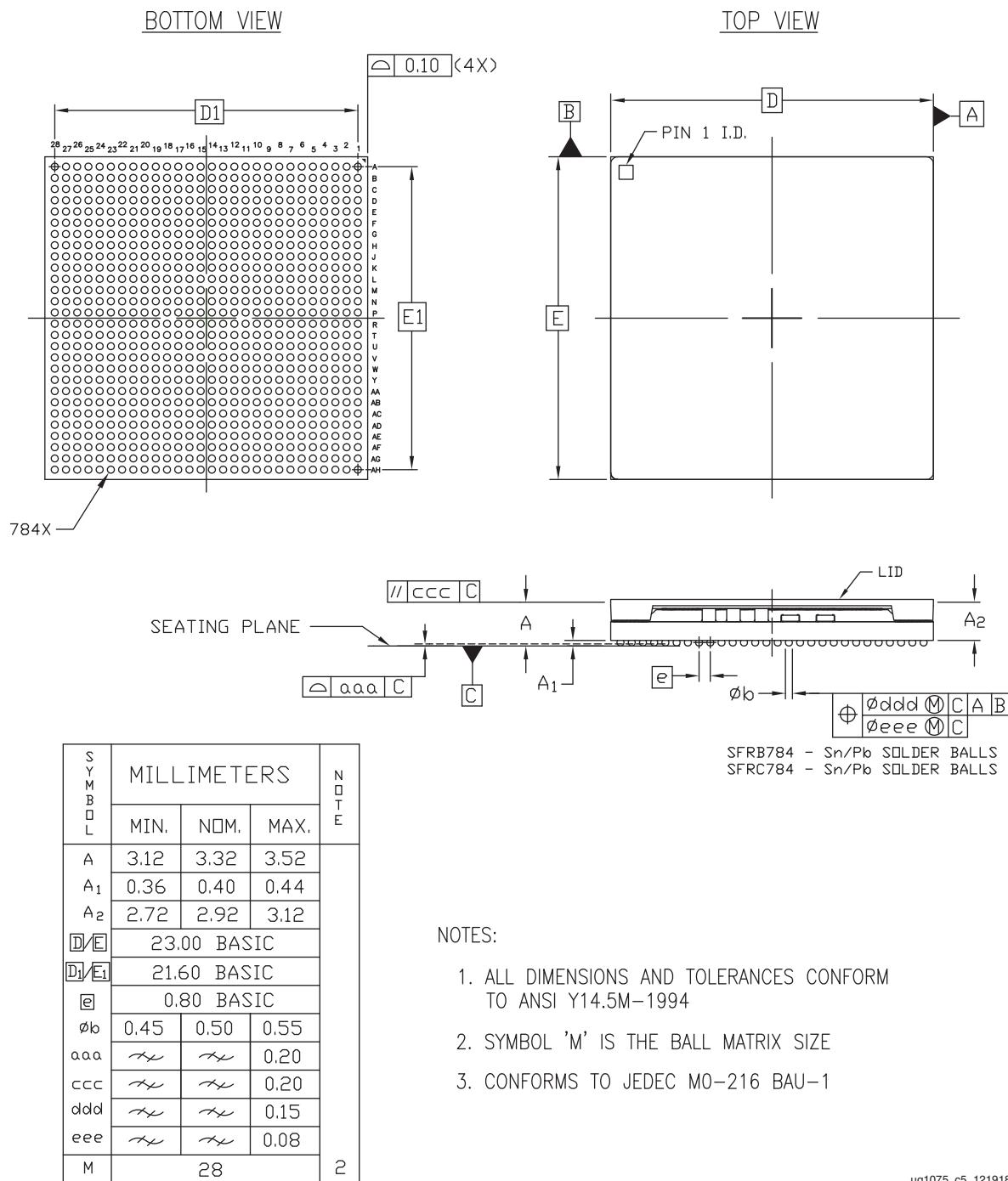
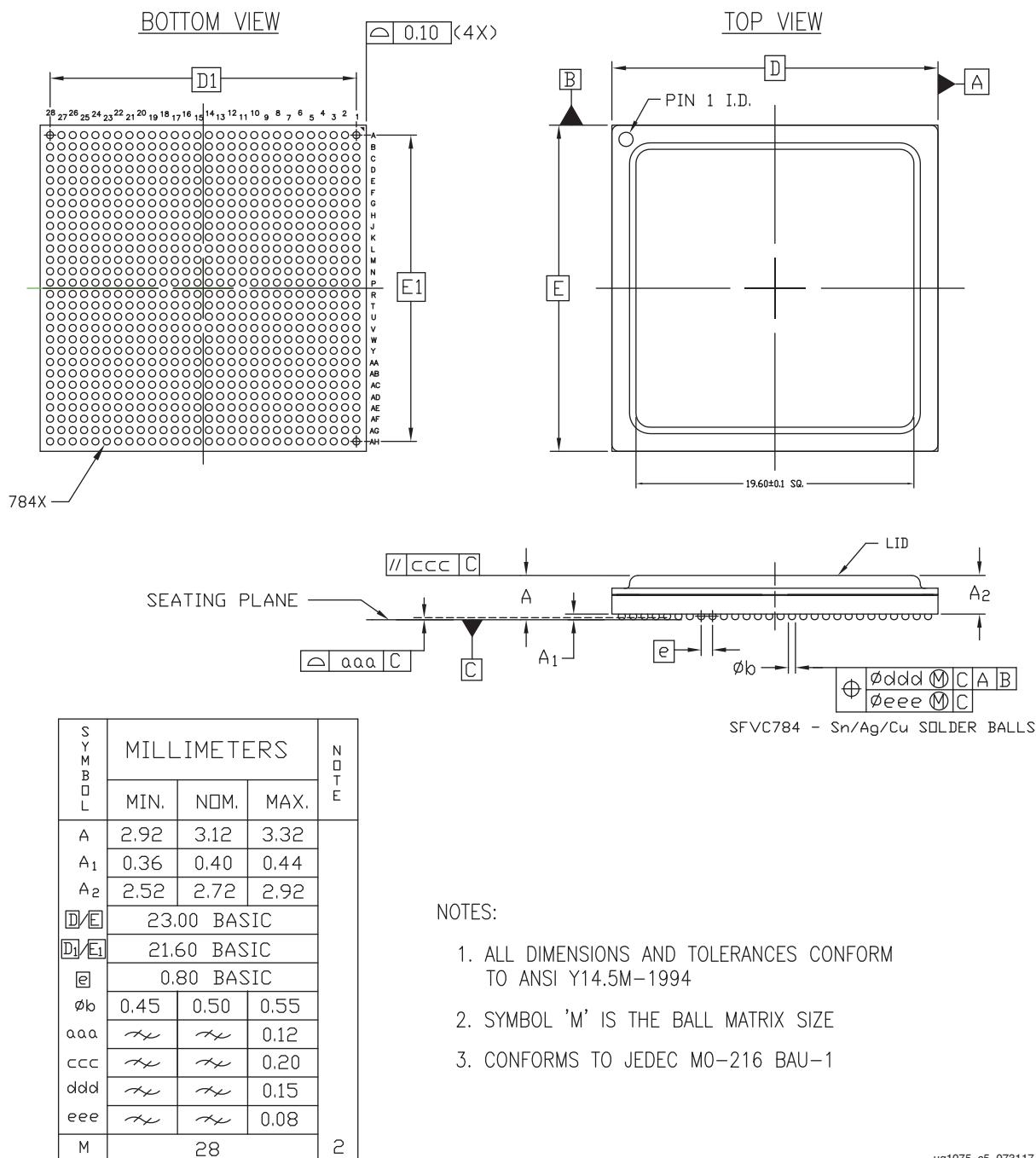


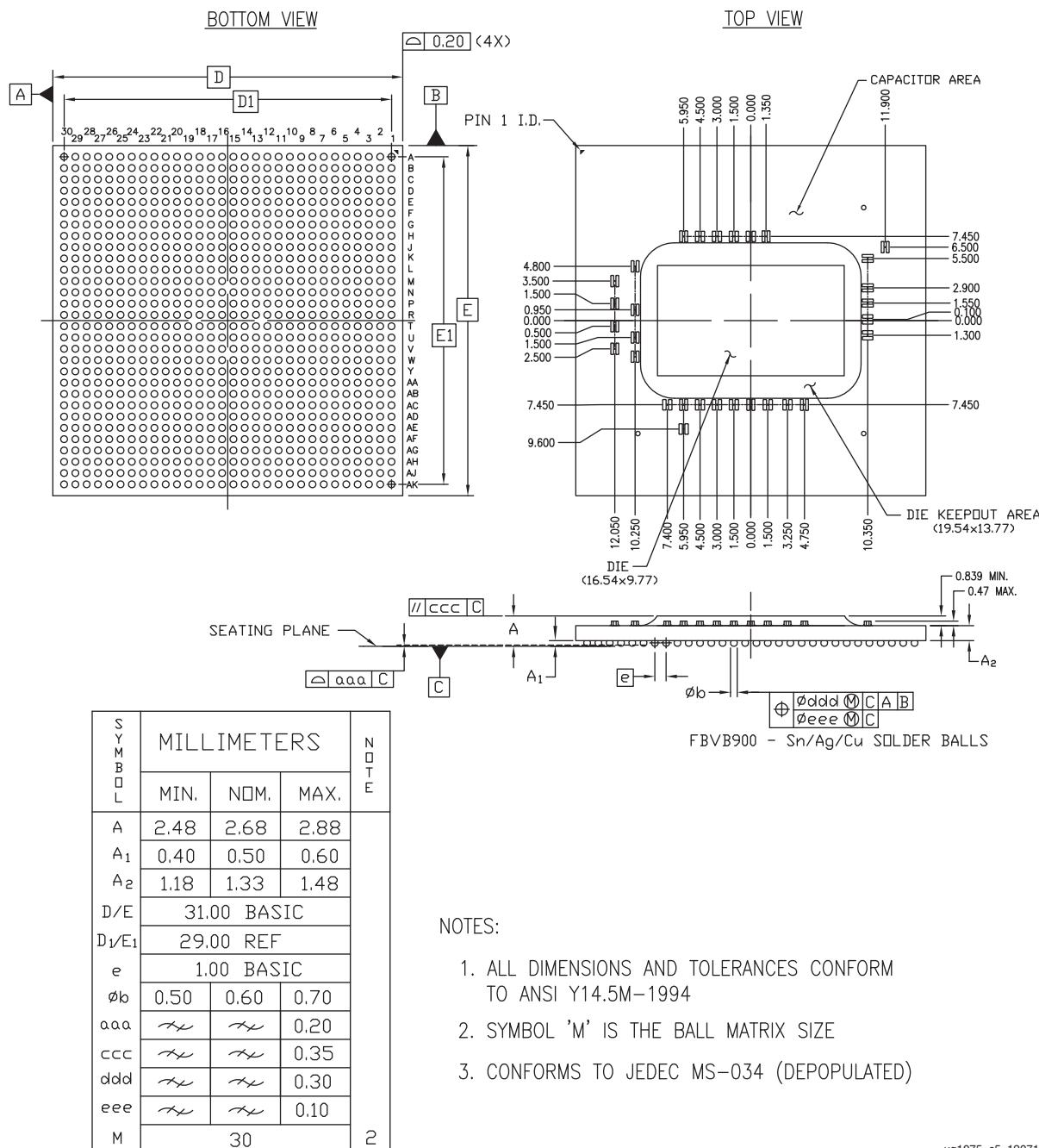
Figure 5-8: Package Dimensions for SFRC784 (XQZU3EG and XQZU5EV)

# SFVC784 Flip-Chip, Fine-Pitch BGA (XCZU1, XCZU2, XAZU2EG, XCZU3, XAZU3EG, XCZU4, XAZU4EV, XCZU5, and XAZU5EV)



**Figure 5-9: Package Dimensions for SFVC784 (XCZU1, XCZU2, XAZU2EG, XCZU3, XAZU3EG, XCZU4, XAZU4EV, XCZU5, and XAZU5EV)**

# **FBVB900 Flip-Chip, Fine-Pitch BGA (XCZU4CG, XCZU4EG, XCZU4EV, XCZU5CG, XCZU5EG, and XCZU5EV)**



*Figure 5-10: Package Dimensions for FBVB900 (XCZU4CG, XCZU4EG, XCZU4EV, XCZU5CG, XCZU5EG, and XCZU5EV)*

ug1075\_c5\_120717

## FBVB900 Flip-Chip, Fine-Pitch BGA (XCZU7CG, XCZU7EG, XCZU7EV, and XAZU7EV)

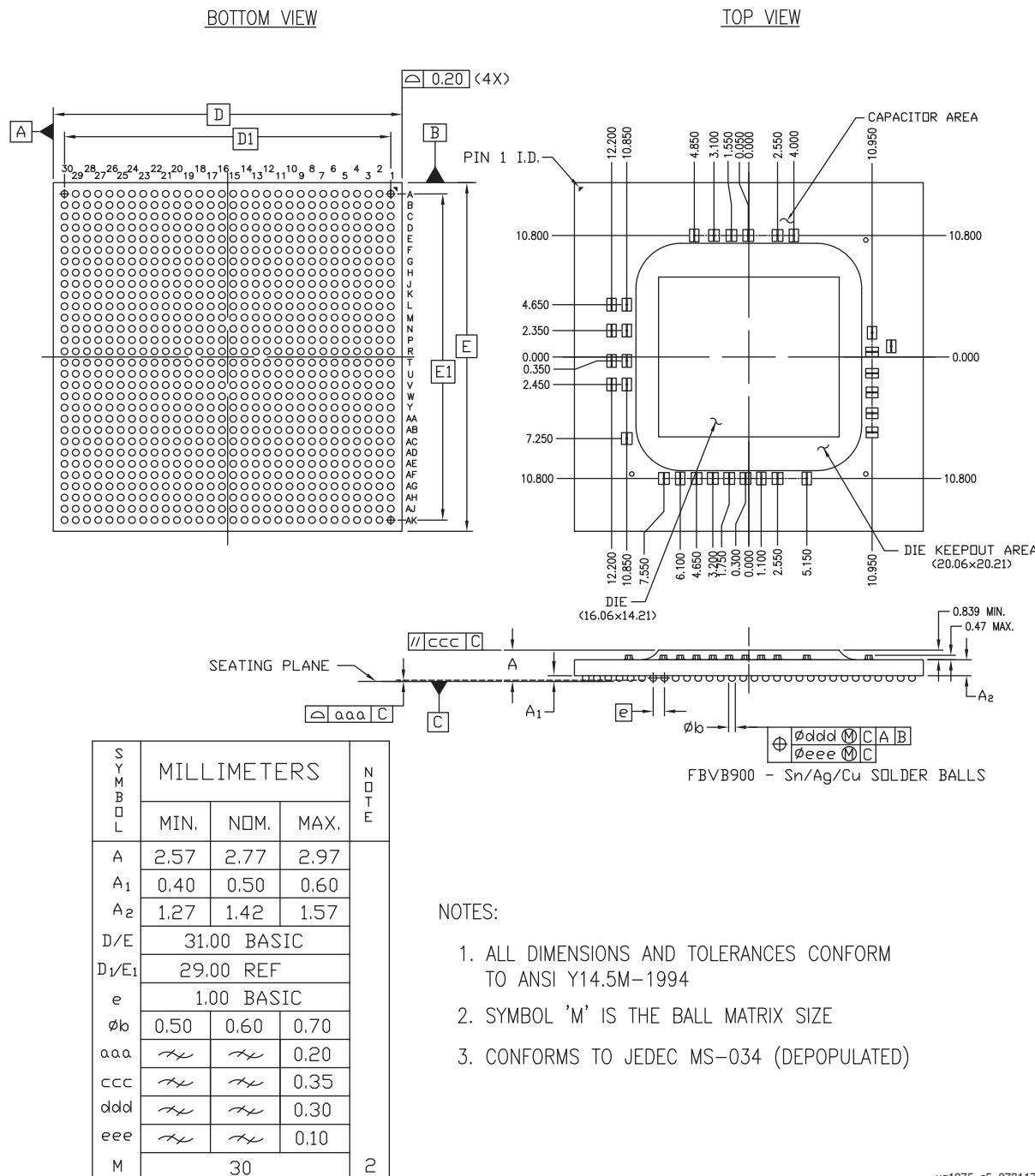


Figure 5-11: Package Dimensions for FBVB900 (XCZU7CG, XCZU7EG, XCZU7EV, and XAZU7EV)

## FFRB900 (XQZU7EV) Ruggedized Flip-Chip BGA

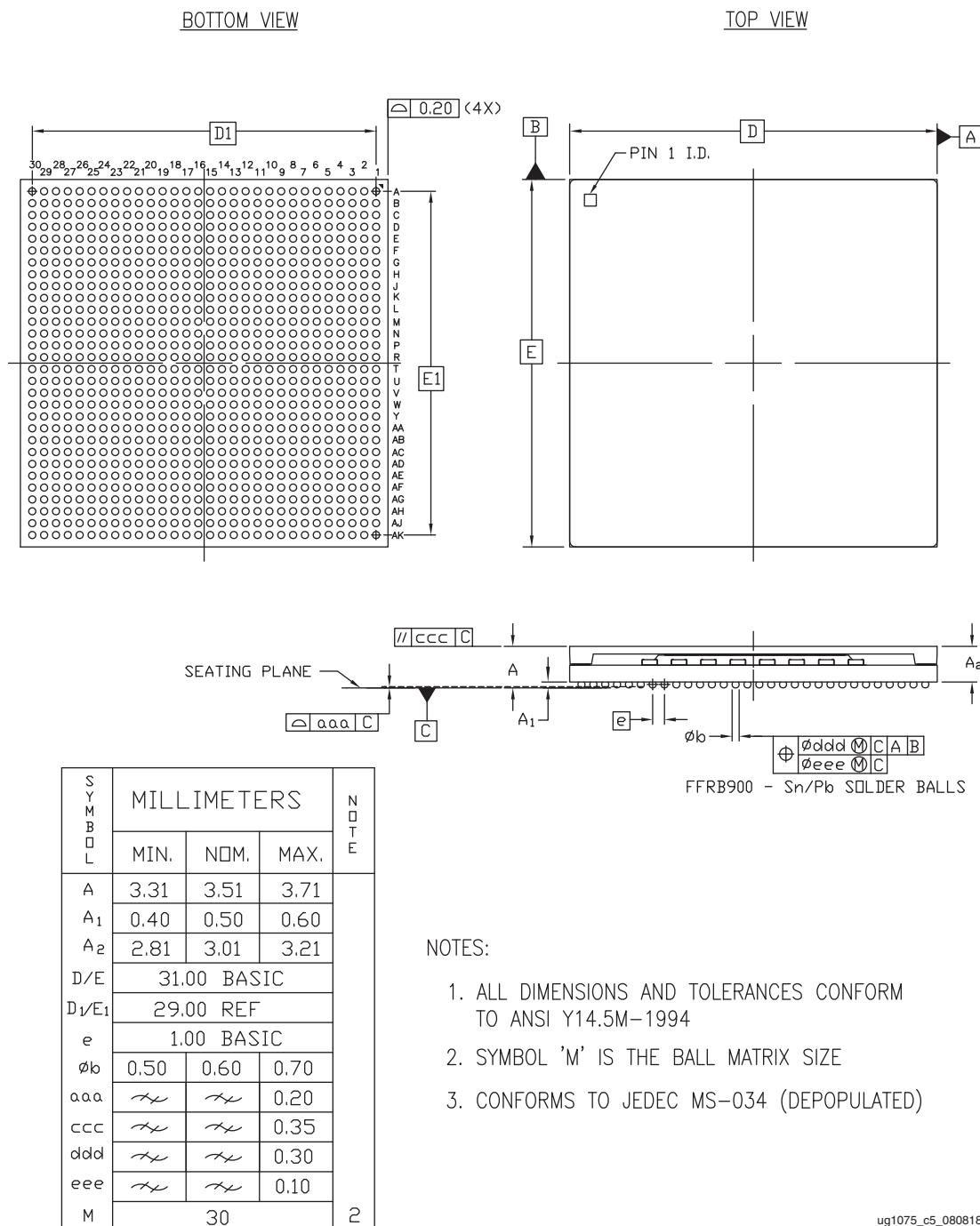


Figure 5-12: Package Dimensions for FFRB900 (XQZU7EV)

## FFRB900 (XQZU5EV) and FFRC900 (XQZU9EG and XQZU15EG) Ruggedized Flip-Chip BGA

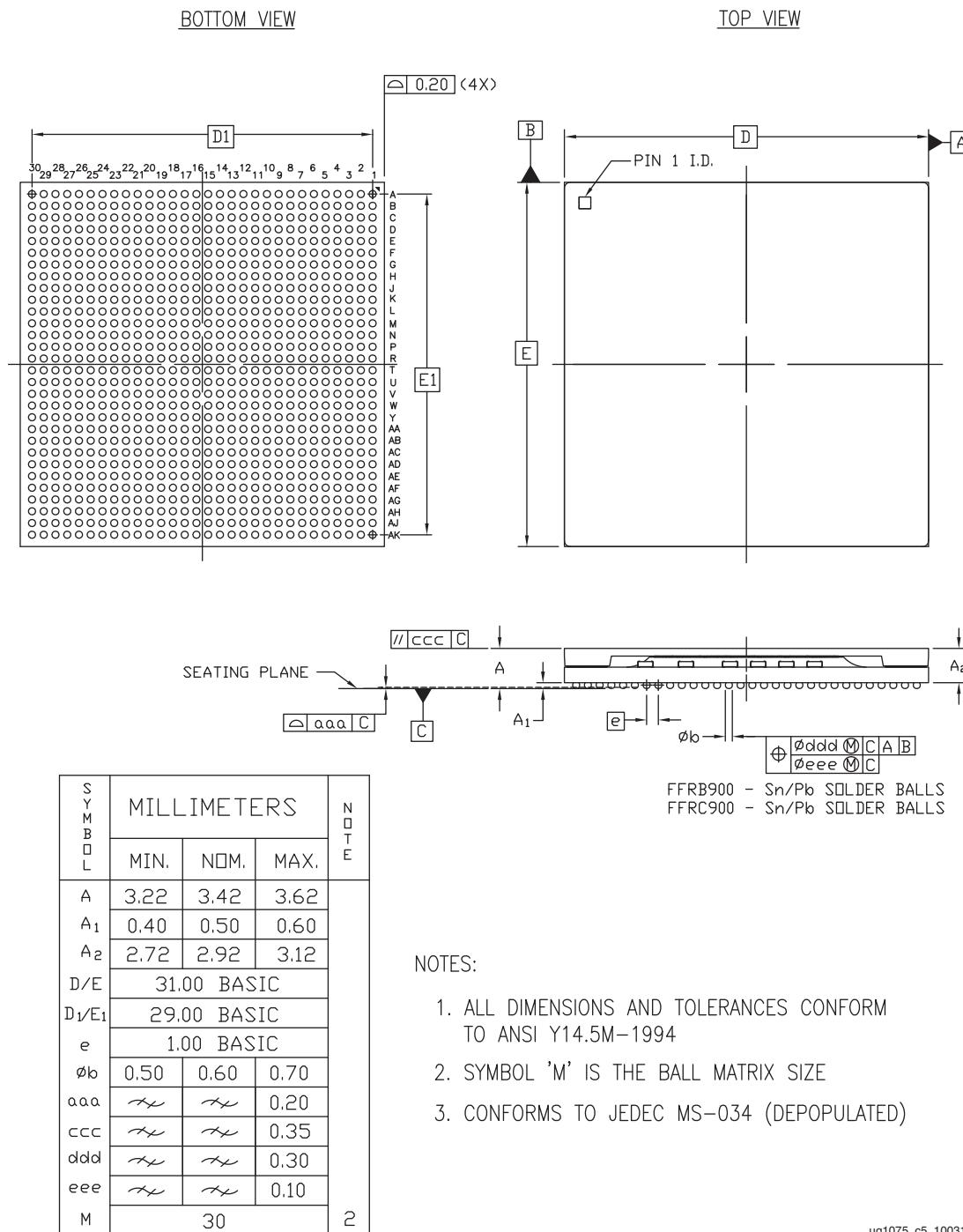
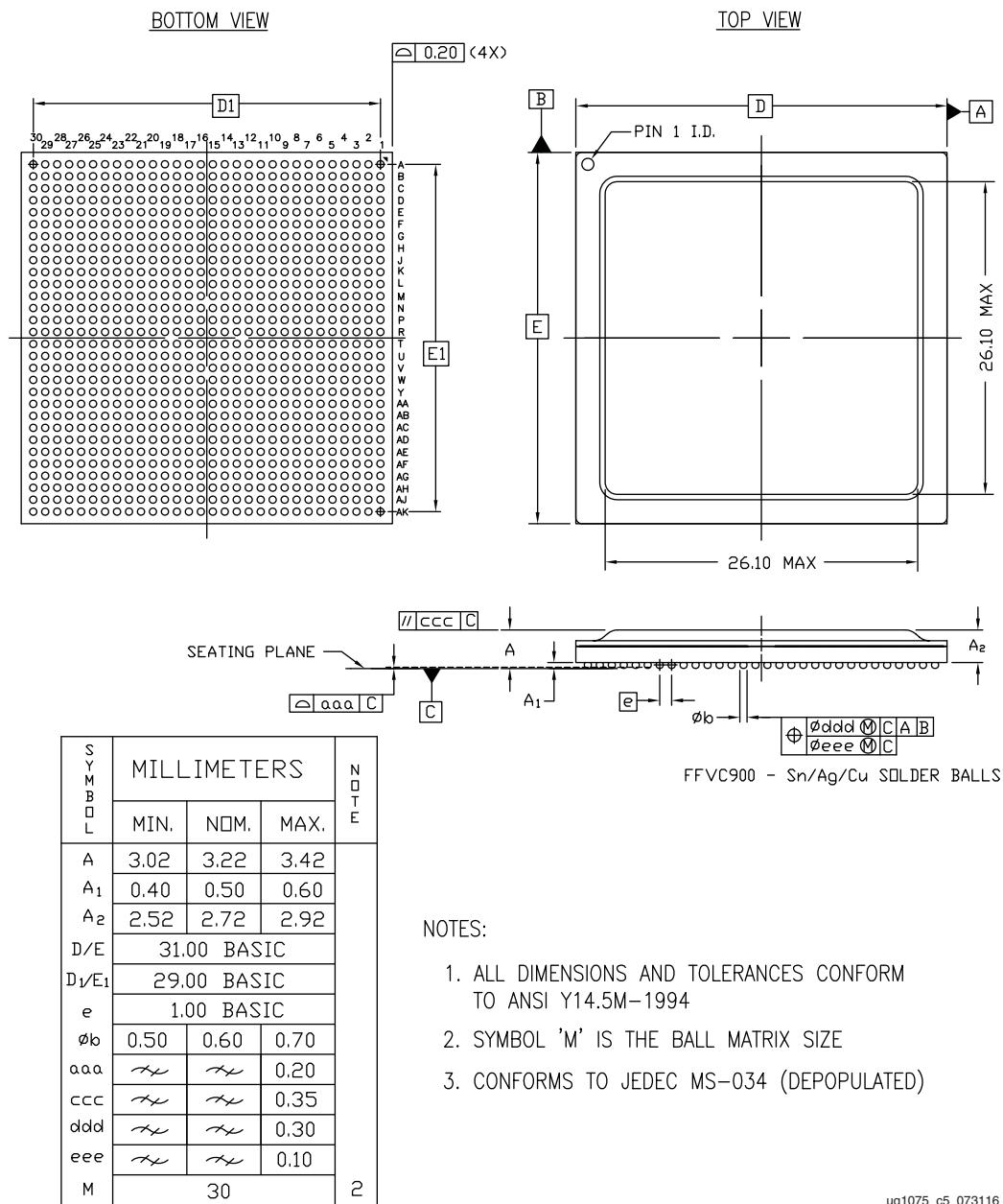


Figure 5-13: Package Dimensions for FFRB900 (XQZU5EV) and FFRC900 (XQZU9EG and XQZU15EG)

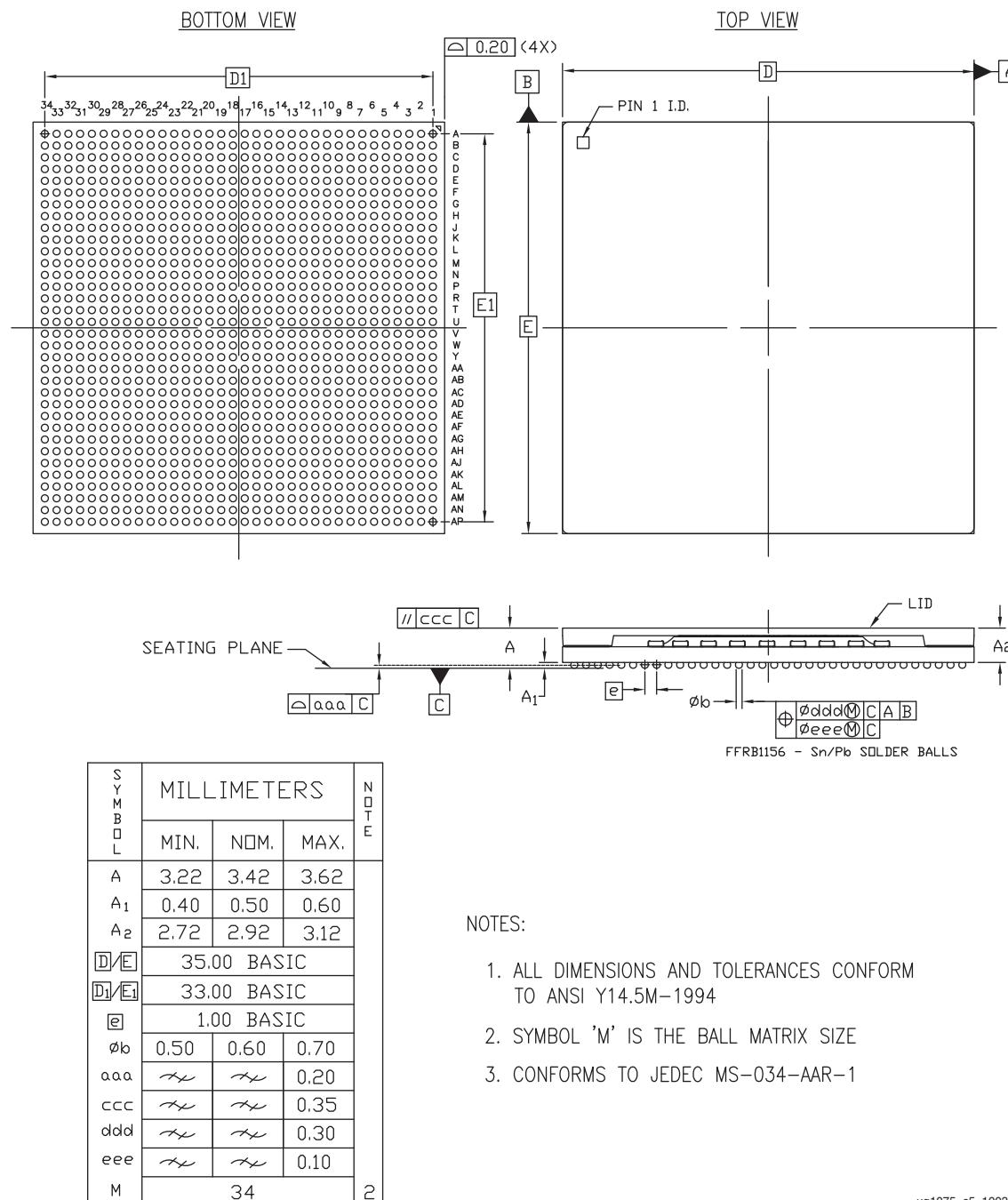
## FFVC900 Flip-Chip, Fine-Pitch BGA (XCZU6CG, XCZU6EG, XCZU9CG, XCZU9EG, and XCZU15EG)



ug1075\_c5\_073116

Figure 5-14: Package Dimensions for FFVC900 (XCZU6CG, XCZU6EG, XCZU9CG, XCZU9EG, and XCZU15EG)

## FFRB1156 Ruggedized Flip-Chip BGA (XQZU9EG and XQZU15EG)



ug1075\_c5\_100318

Figure 5-15: Package Dimensions for FFRB1156 (XQZU9EG and XQZU15EG)

## FFVB1156 Flip-Chip, Fine-Pitch BGA (XCZU6CG, XCZU6EG, XCZU9CG, XCZU9EG, and XCZU15EG)

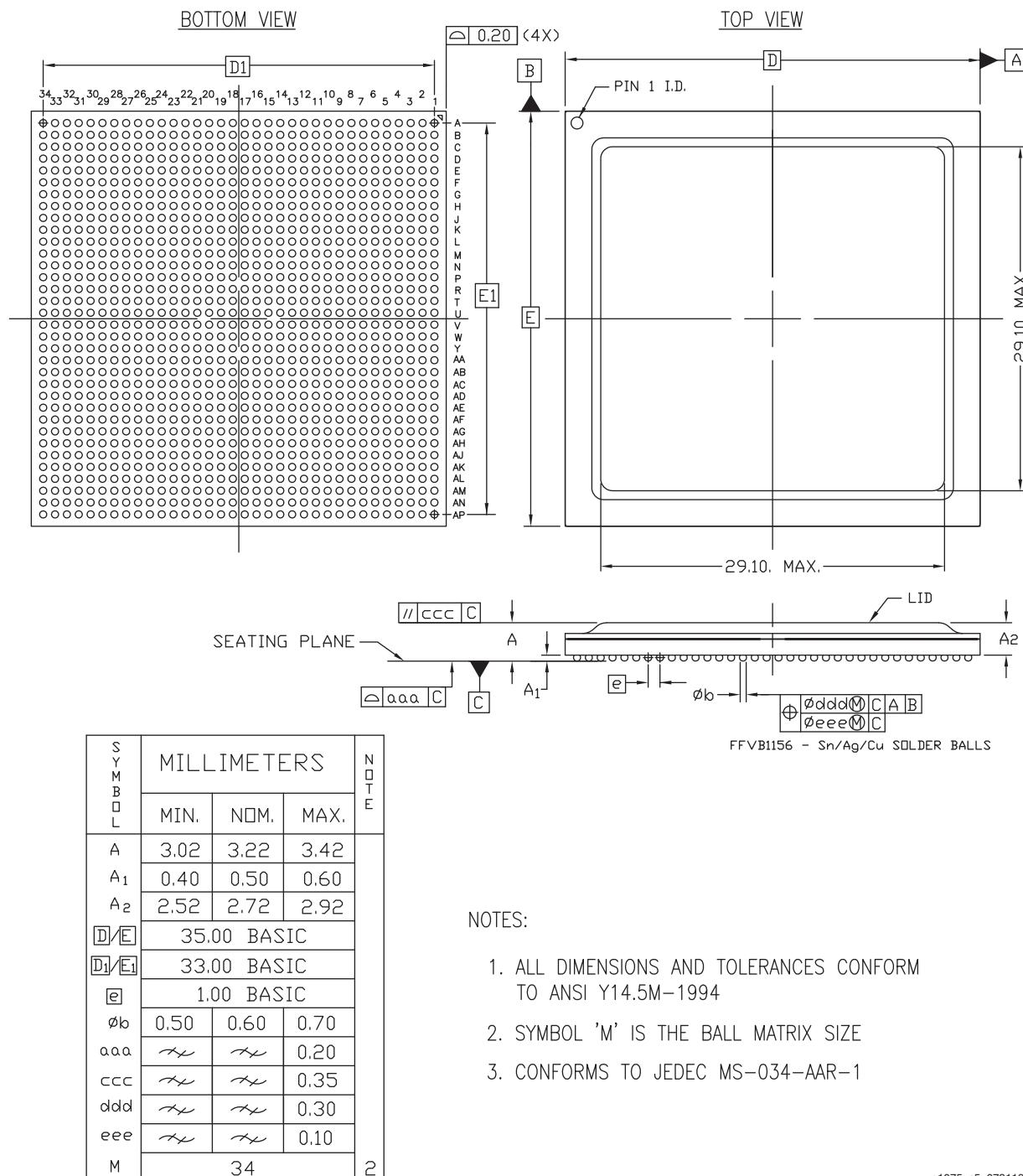


Figure 5-16: Package Dimensions for FFVB1156 (XCZU6CG, XCZU6EG, XCZU9CG, XCZU9EG, and XCZU15EG)

## FFRC1156 Ruggedized Flip-Chip BGA (XQZU7EV and XQZU11EG)

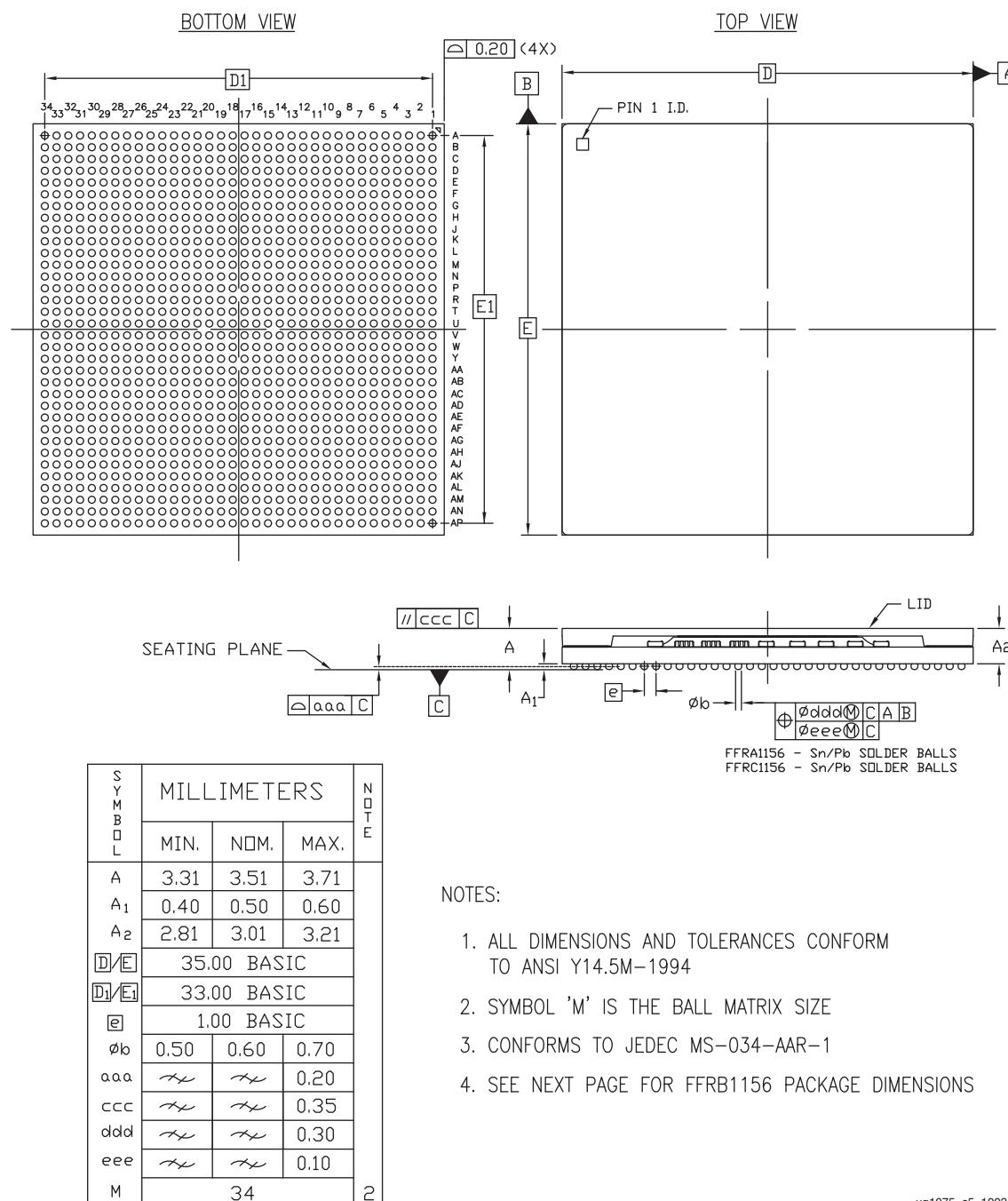


Figure 5-17: Package Dimensions for FFRC1156 (XQZU7EV and XQZU11EG)

## FFVC1156 Flip-Chip, Fine-Pitch BGA (XCZU7CG, XCZU7EG, XCZU7EV, and XCZU11EG)

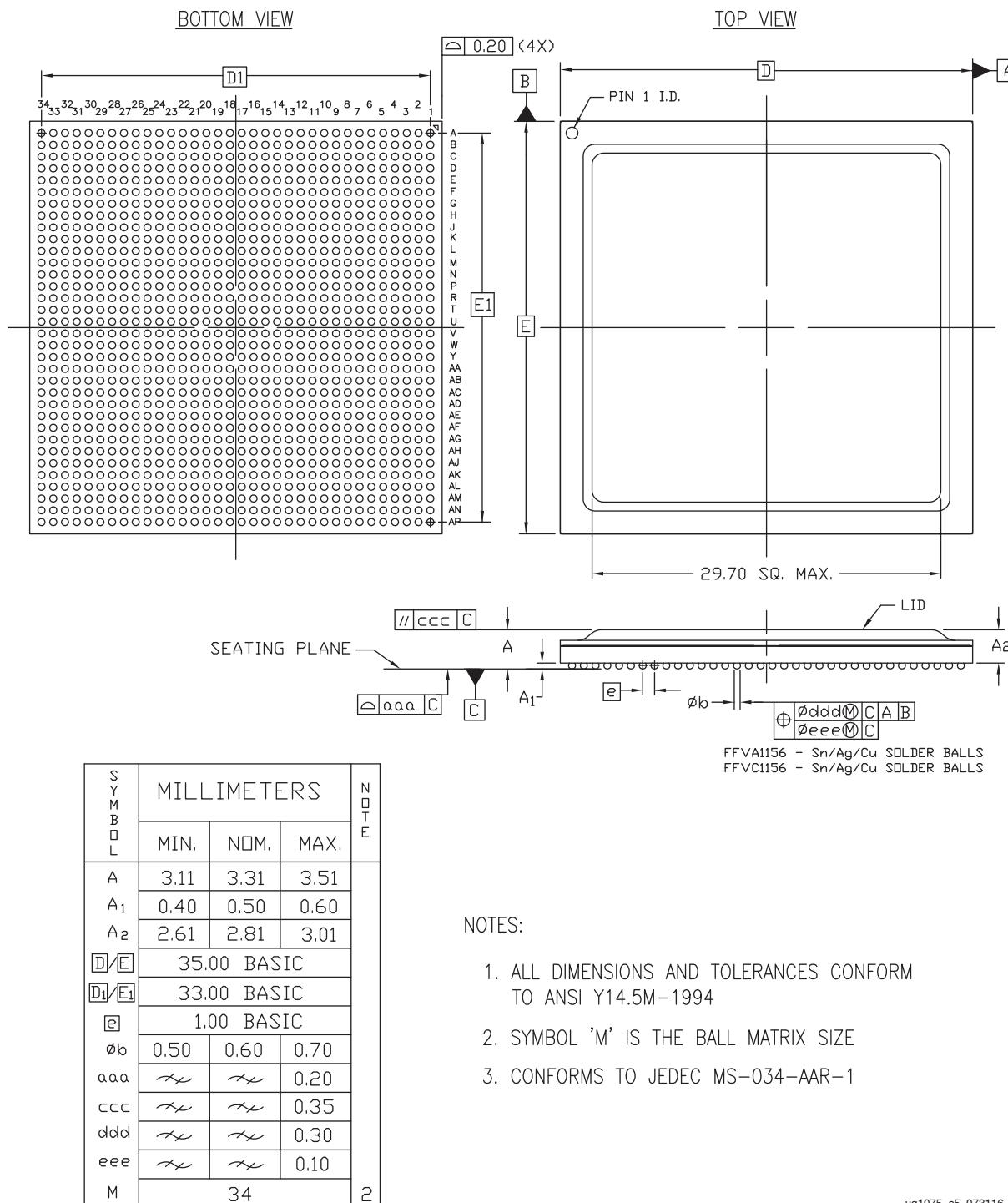
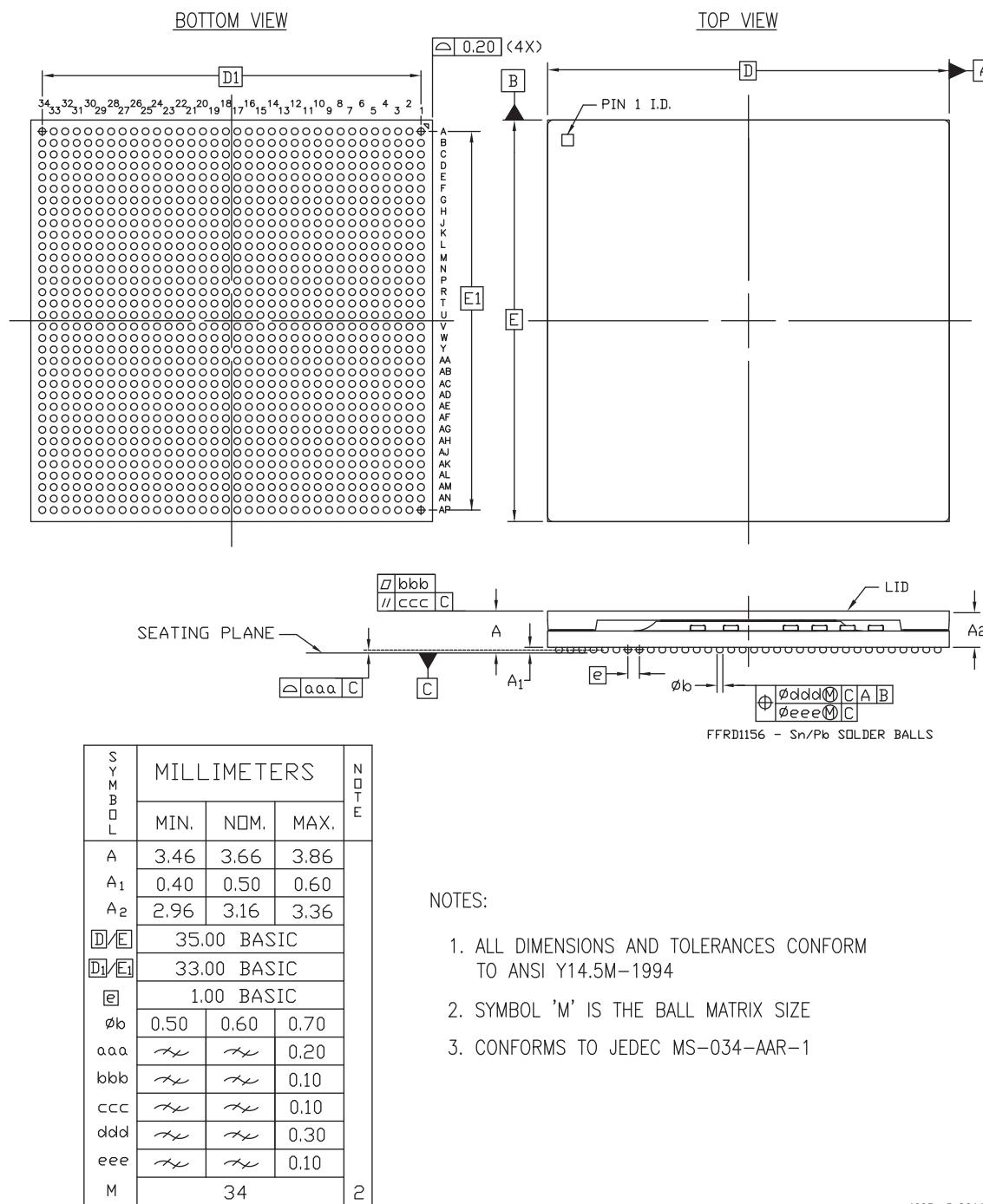


Figure 5-18: Package Dimensions for FFVC1156 (XCZU7CG, XCZU7EG, XCZU7EV, and XCZU11EG)

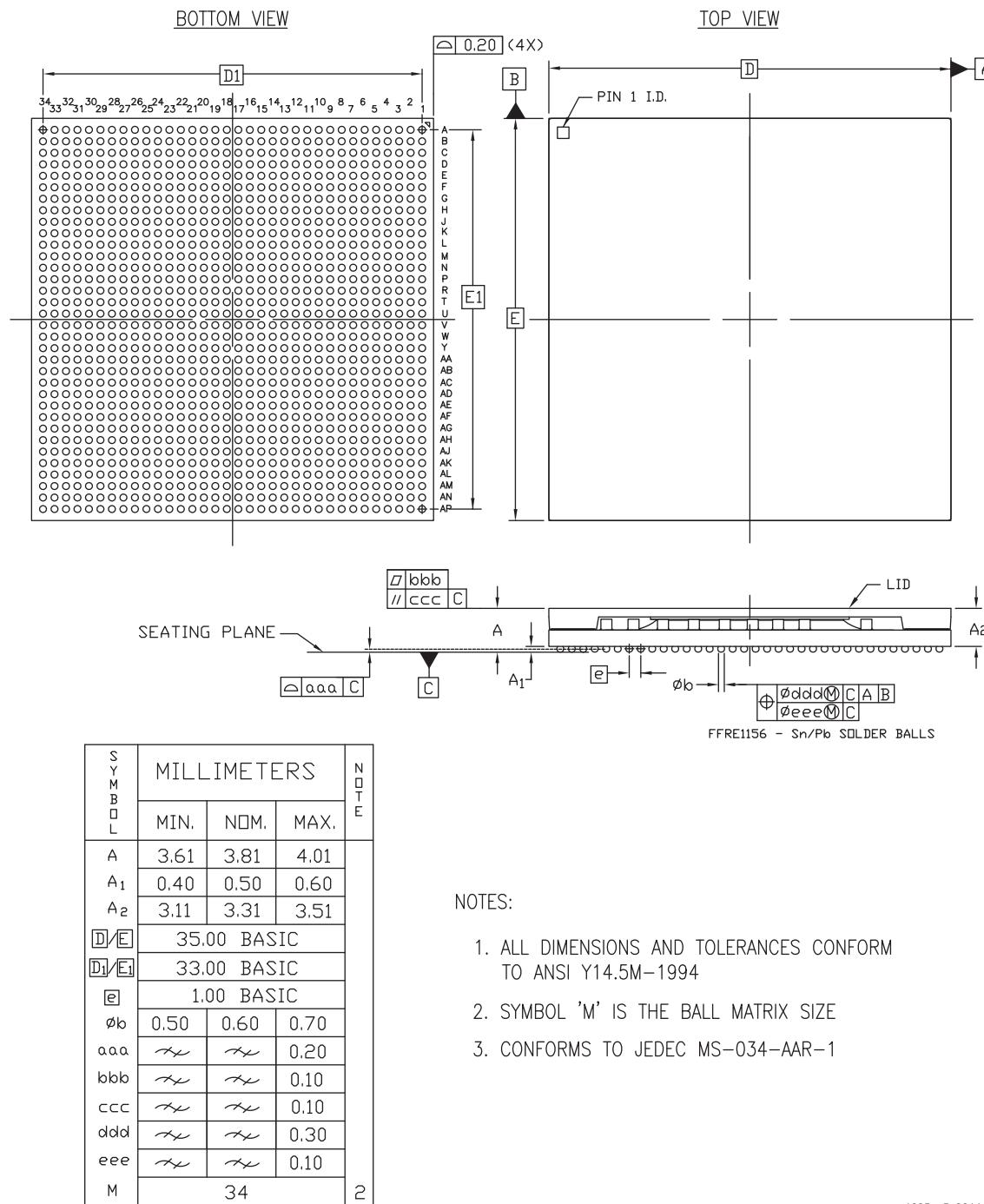
## FFRD1156 (XQZU21DR) Ruggedized Flip-Chip BGA



ug1085\_c5\_061419

Figure 5-19: Package Dimensions for FFRD1156 (XQZU21DR)

## FFRE1156 (XQZU28DR) Ruggedized Flip-Chip BGA



ug1085\_c5\_061419

Figure 5-20: Package Dimensions for FFRE1156 (XQZU28DR)

## FFVD1156 (XCZU21DR) and FFVE1156 (XCZU25DR–XCZU27DR, XCZU42DR–XCZU48DR, XCZU65DR–XCZU67DR) Flip-Chip, Fine-Pitch BGA

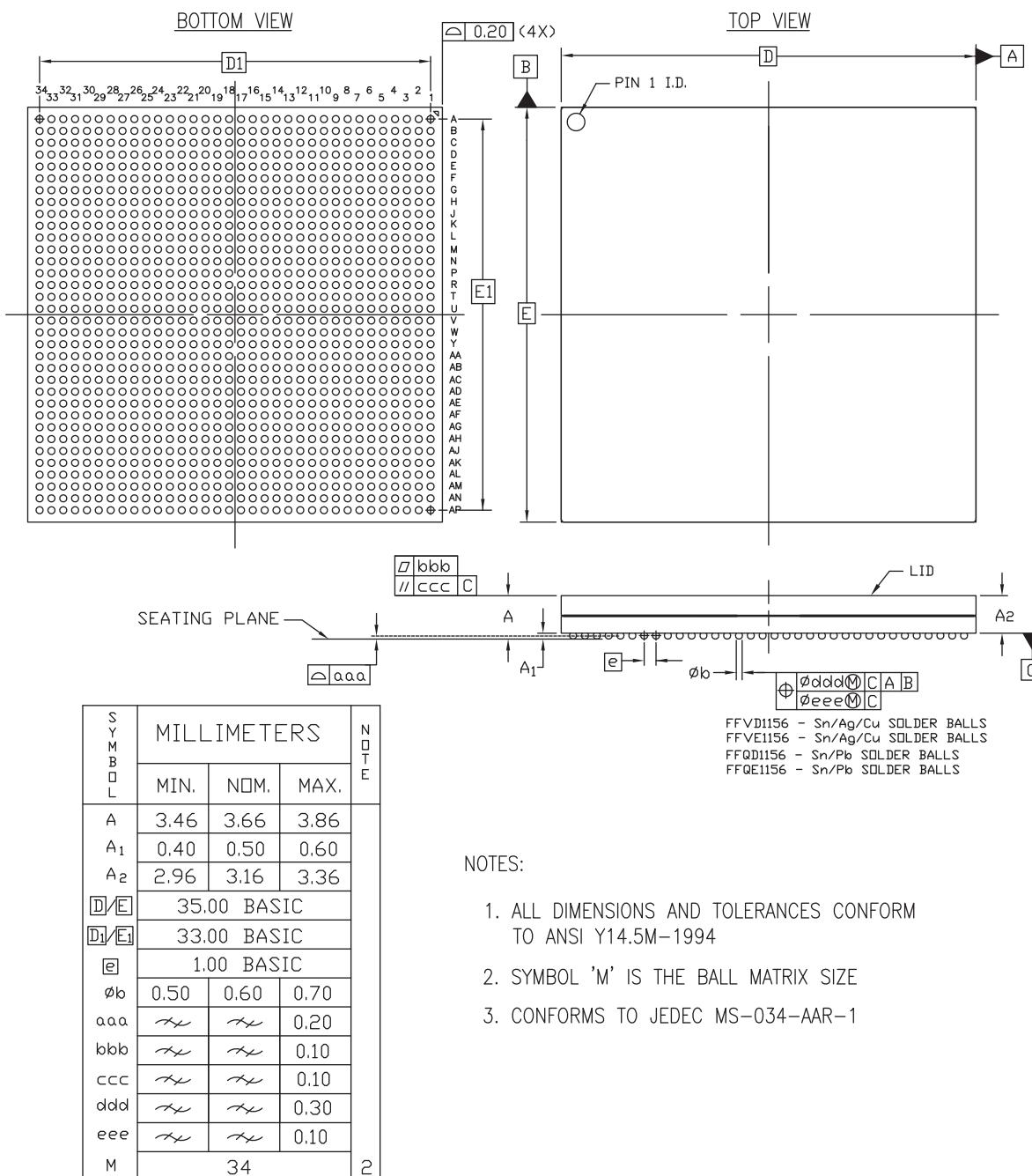


Figure 5-21: Package Dimensions for FFVE1156 (XCZU21DR) and FFVE1156 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU42DR, XCZU43DR, XCZU47DR, XCZU48DR, XCZU65DR, XCZU67DR)

## FSVE1156 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR) Flip-Chip, Fine-Pitch, Lidless w/Stiffener Ring BGA

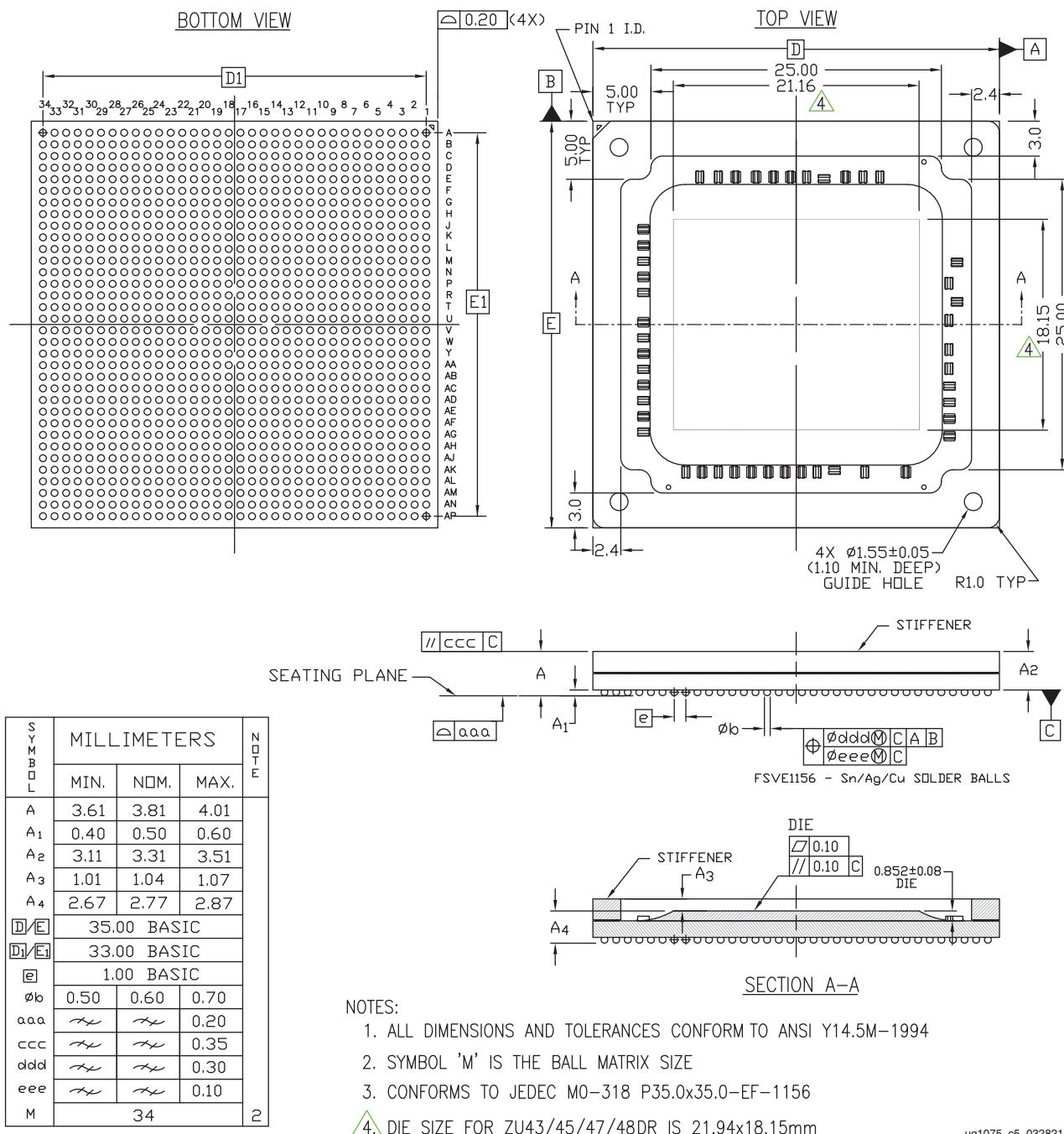
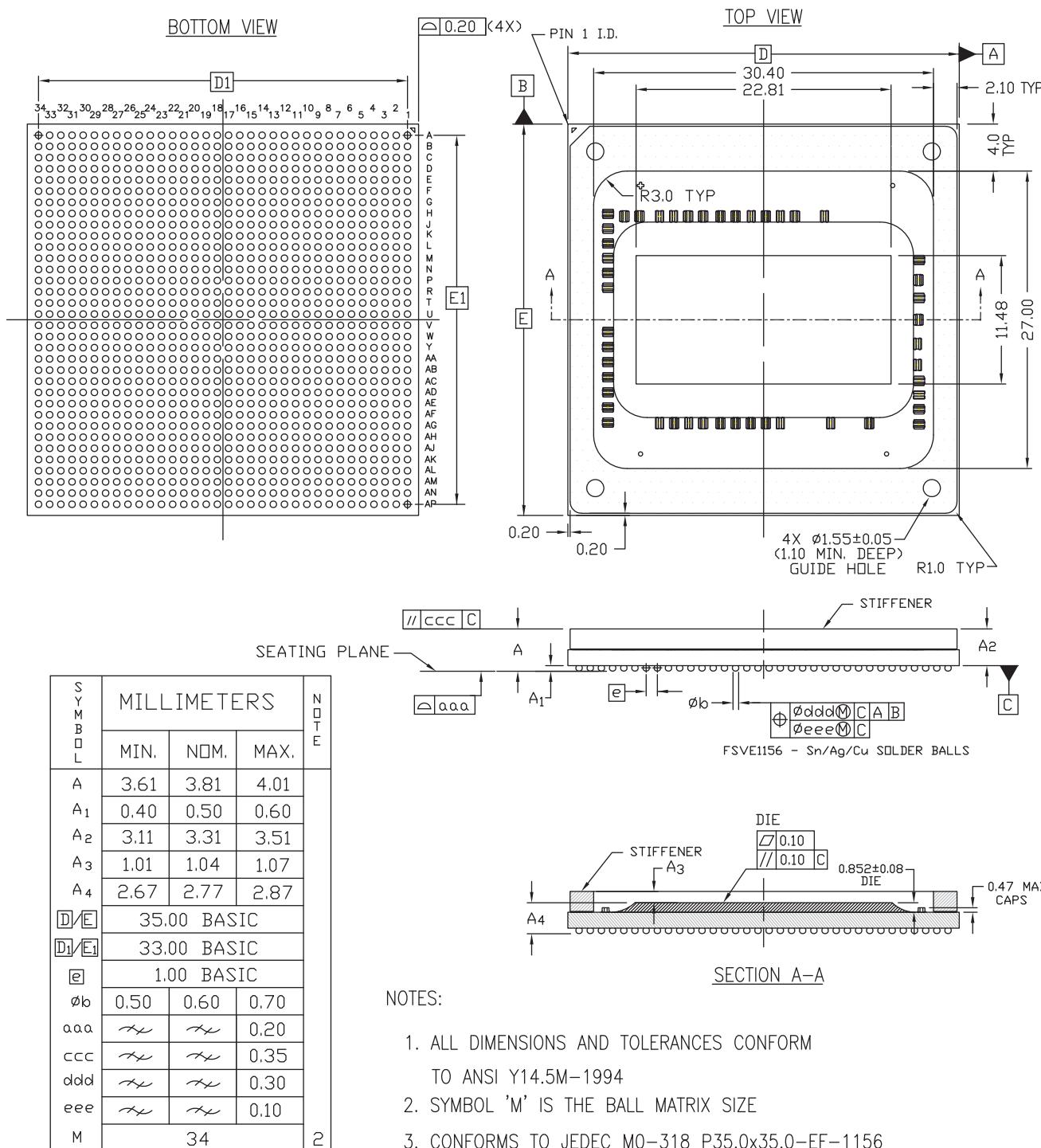


Figure 5-22: Package Dimensions for FSVE1156 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR)

# **FSVE1156 (XCZU42DR, XCZU65DR, XCZU67DR) Flip-Chip, Fine-Pitch, Lidless w/Stiffener Ring BGA**



**Figure 5-23:** Package Dimensions for FSVE1156 (XCZU42DR, XCZU65DR, XCZU67DR)

## FFRB1517 (XQZU19EG) Ruggedized Flip-Chip BGA

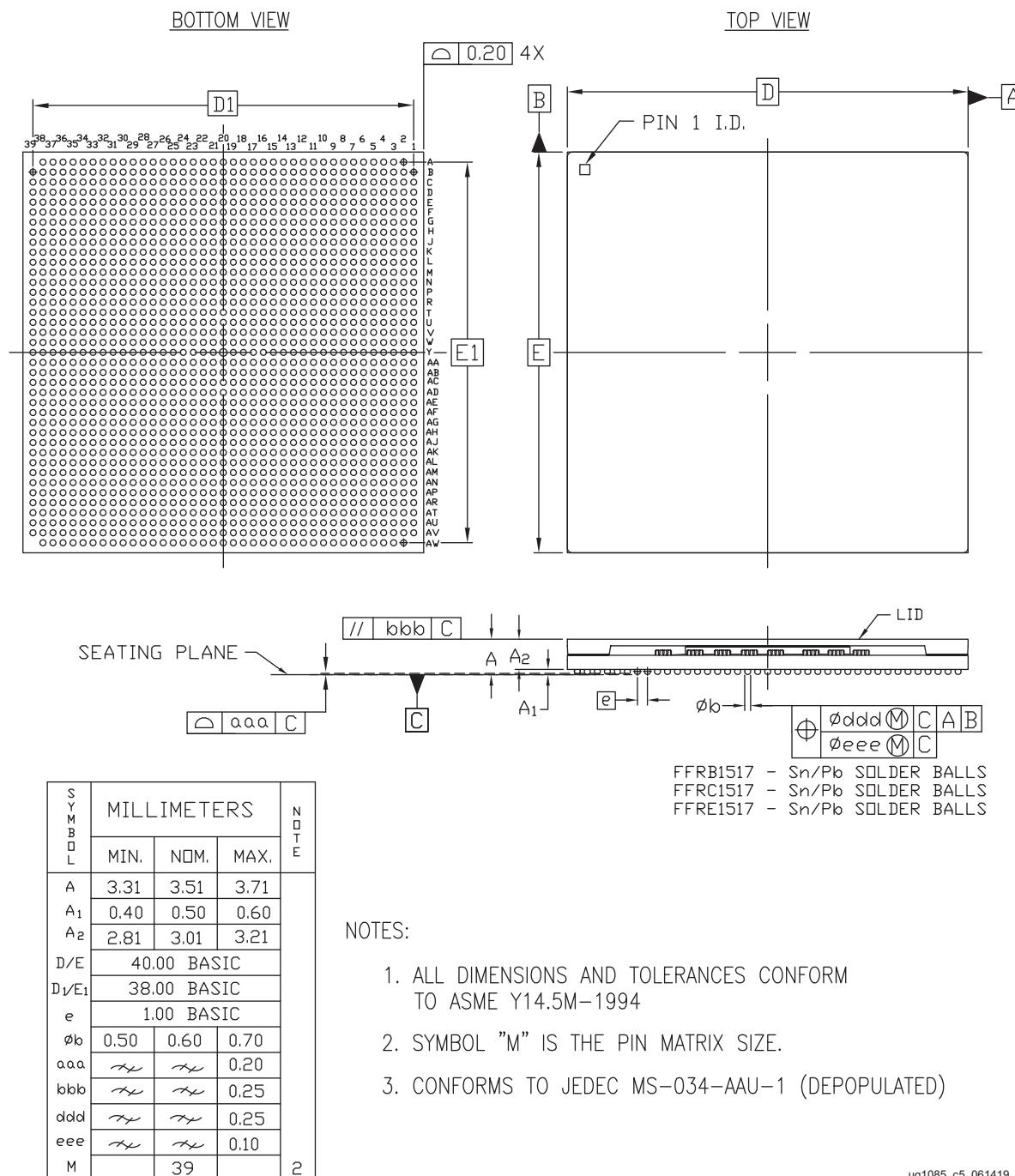


Figure 5-24: Package Dimensions for FFRB1517 (XQZU19EG)

## FFVB1517 (XCZU11EG, XCZU17EG, and XCZU19EG) and FFVF1517 (XCZU7CG, XCZU7EG, XCZU7EV, XCZU11EG, and XAZU11EG) Flip-Chip, Fine-Pitch BGA

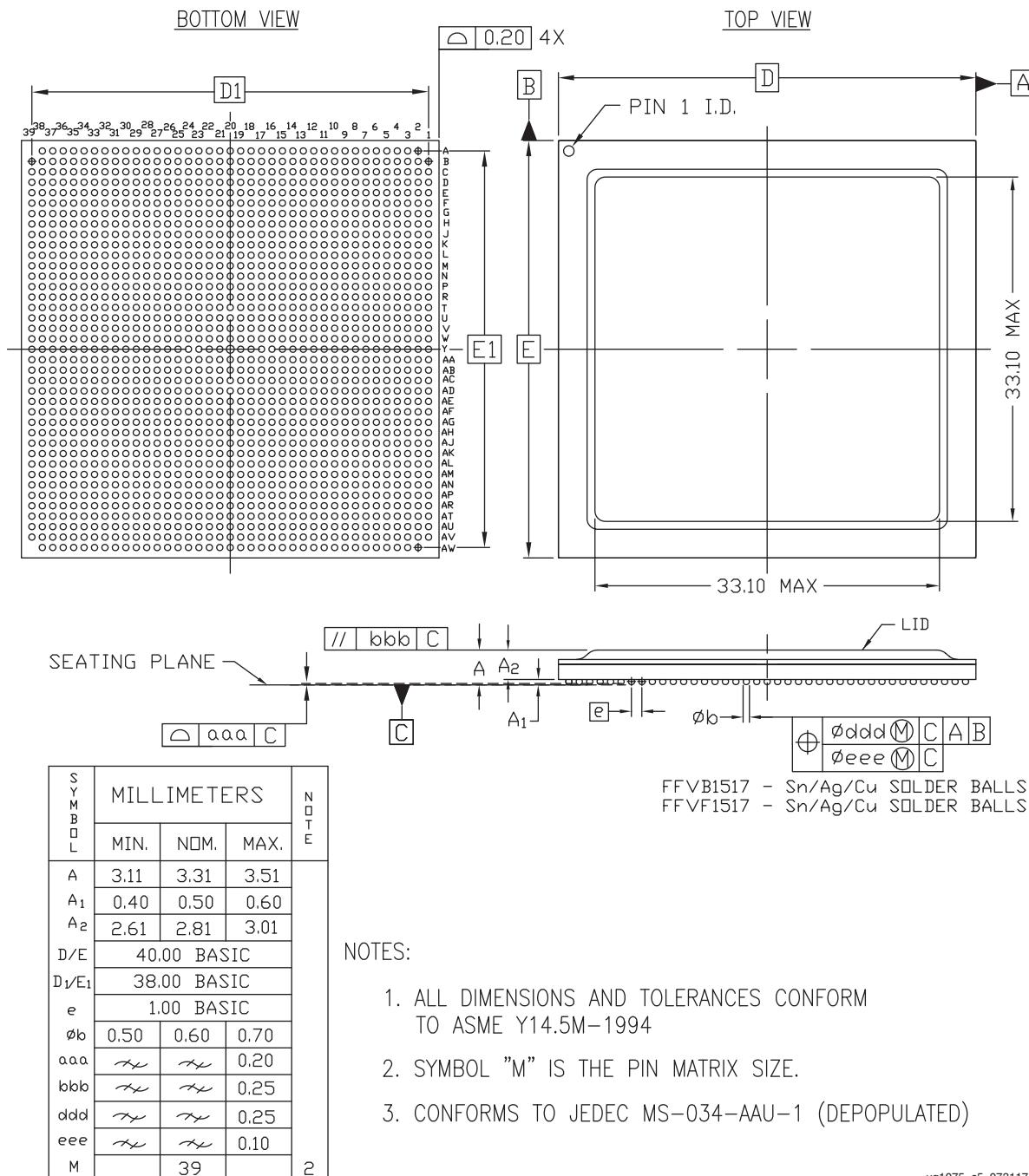


Figure 5-25: Package Dimensions for FFVB1517 (XCZU11EG, XCZU17EG, and XCZU19EG) and FFVF1517 (XCZU7CG, XCZU7EG, XCZU7EV, XCZU11EG, and XAZU11EG)

## FFRG1517 (XQZU28DR) Ruggedized Flip-Chip BGA

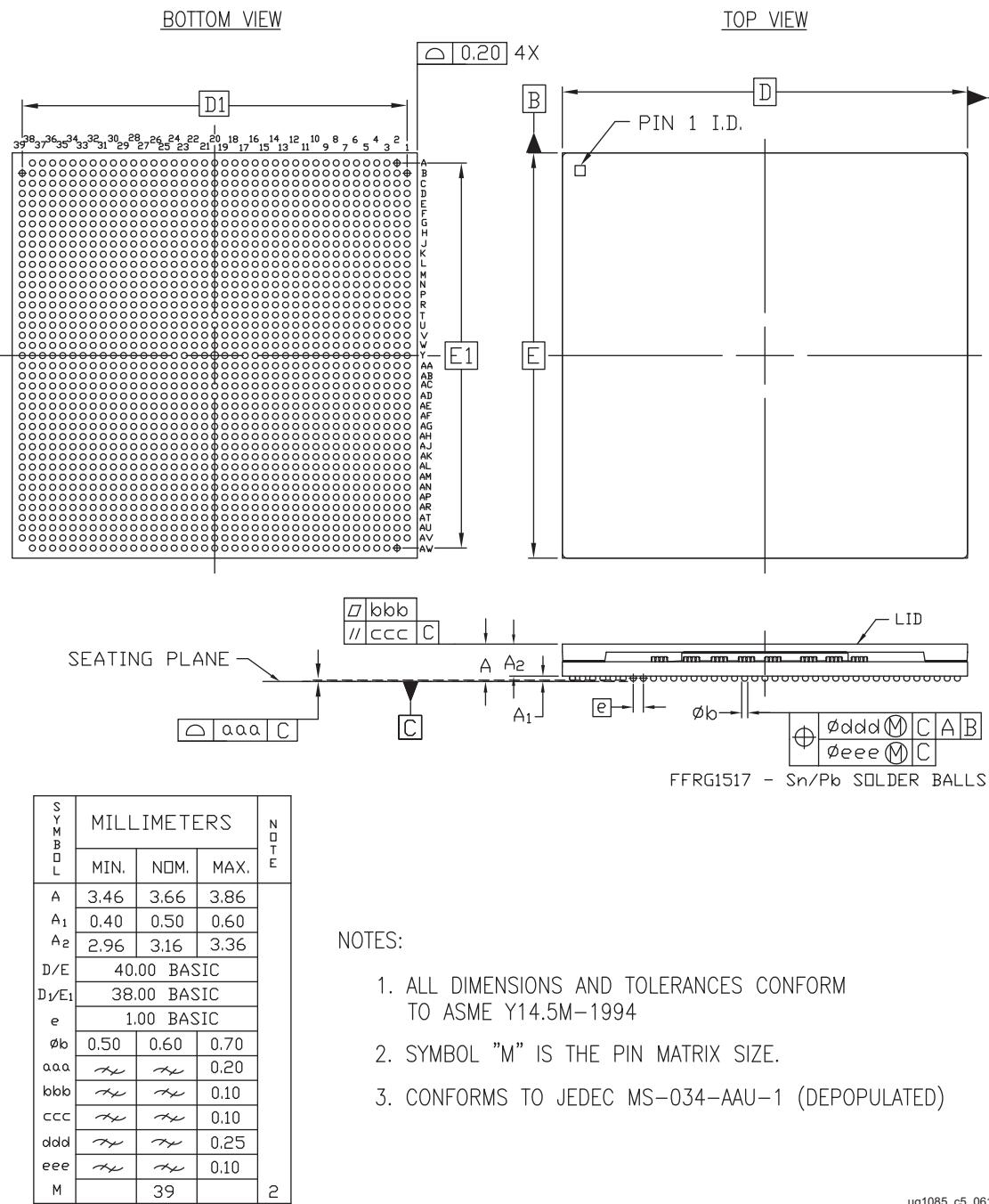


Figure 5-26: Package Dimensions for FFRG1517 (XQZU28DR)

# FFVG1517 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR) Flip-Chip, Fine-Pitch BGA

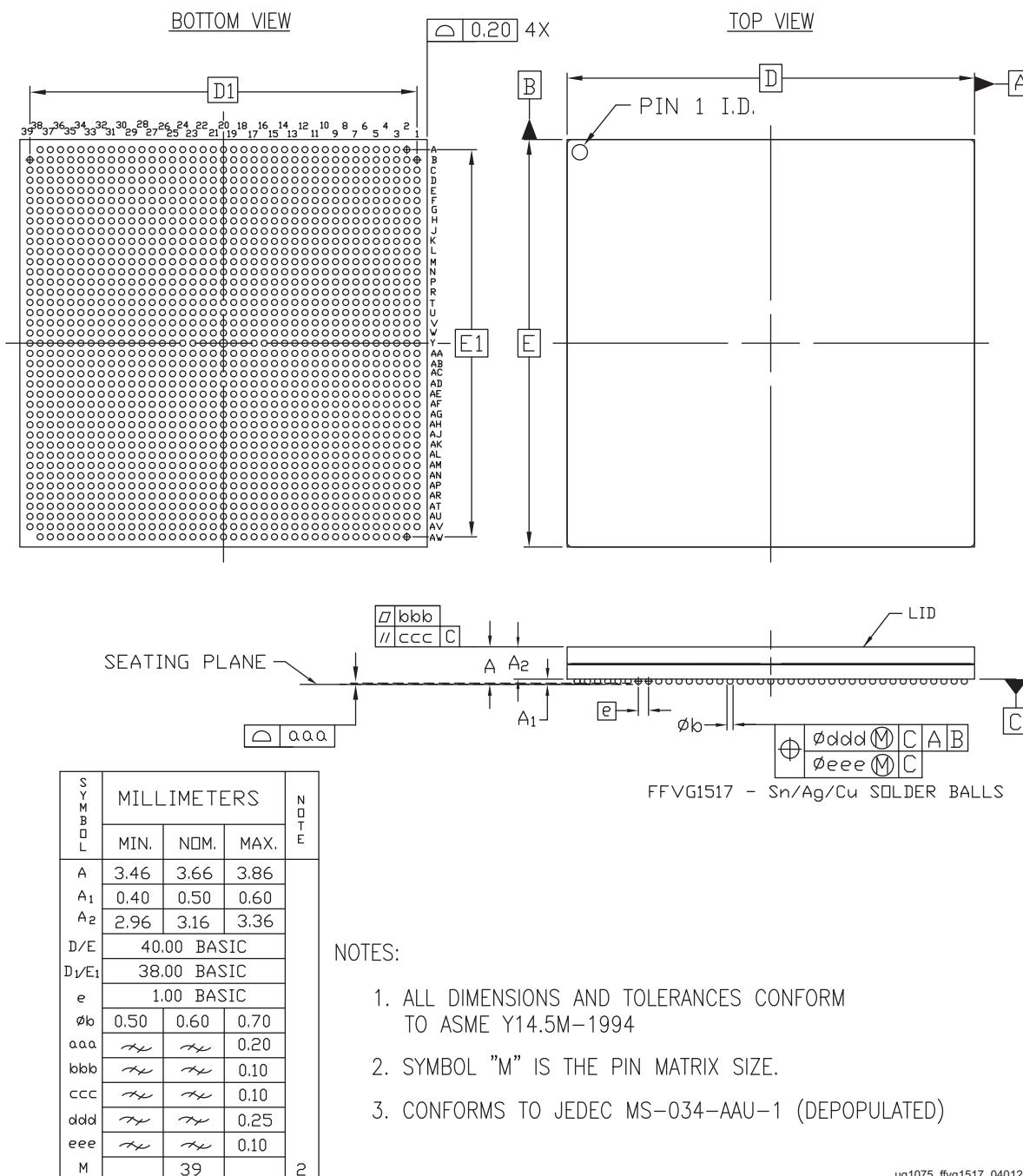


Figure 5-27: Package Dimensions for FFVG1517 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR)

## FSRG1517 (XQZU48DR) Ruggedized Flip Chip, Lidless with Stiffener Ring BGA

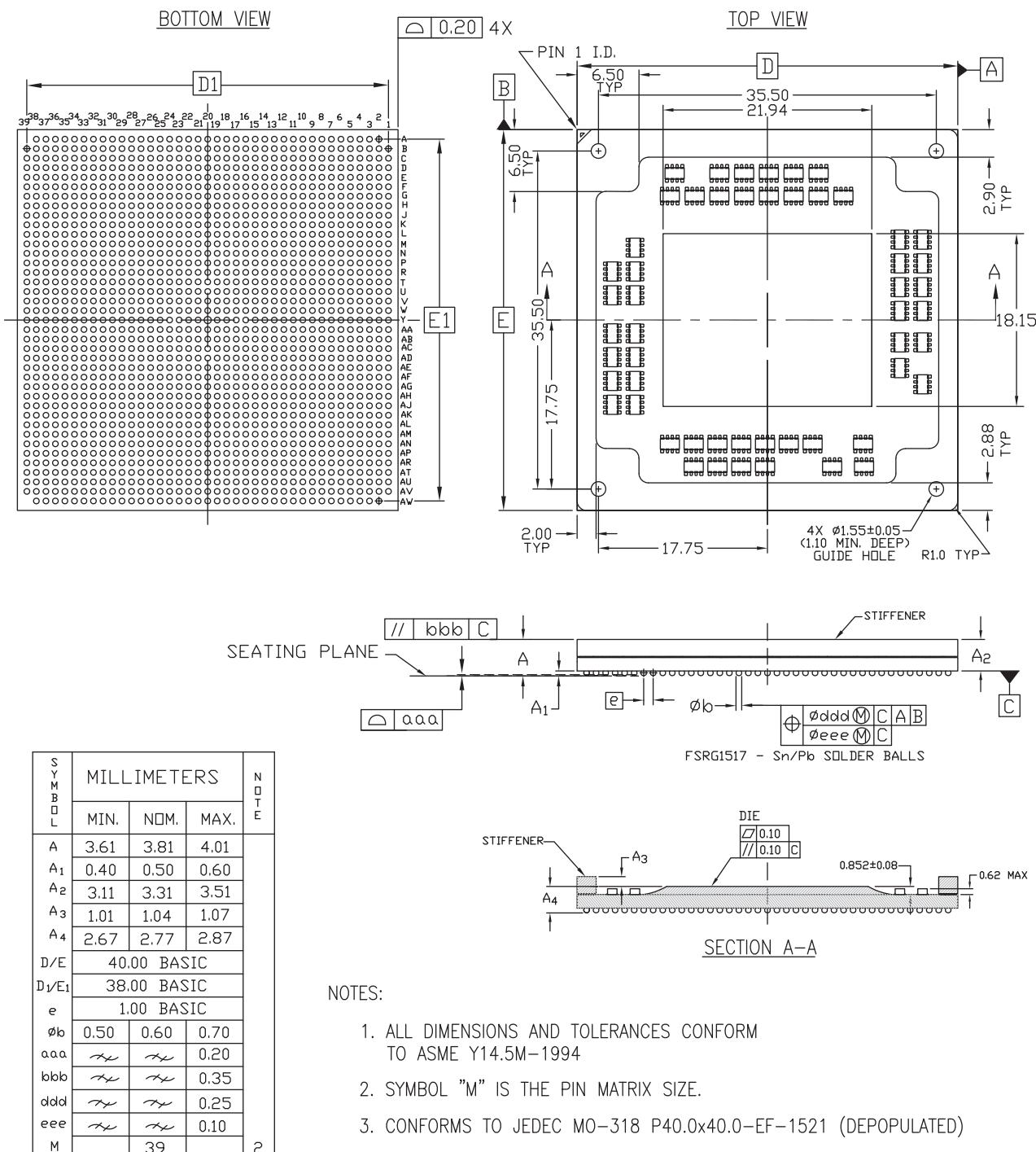


Figure 5-28: Package Dimensions for FSRG1517 (XQZU48DR)

# FSVG1517 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR) Flip-Chip, Fine-Pitch, Lidless with Stiffener Ring BGA

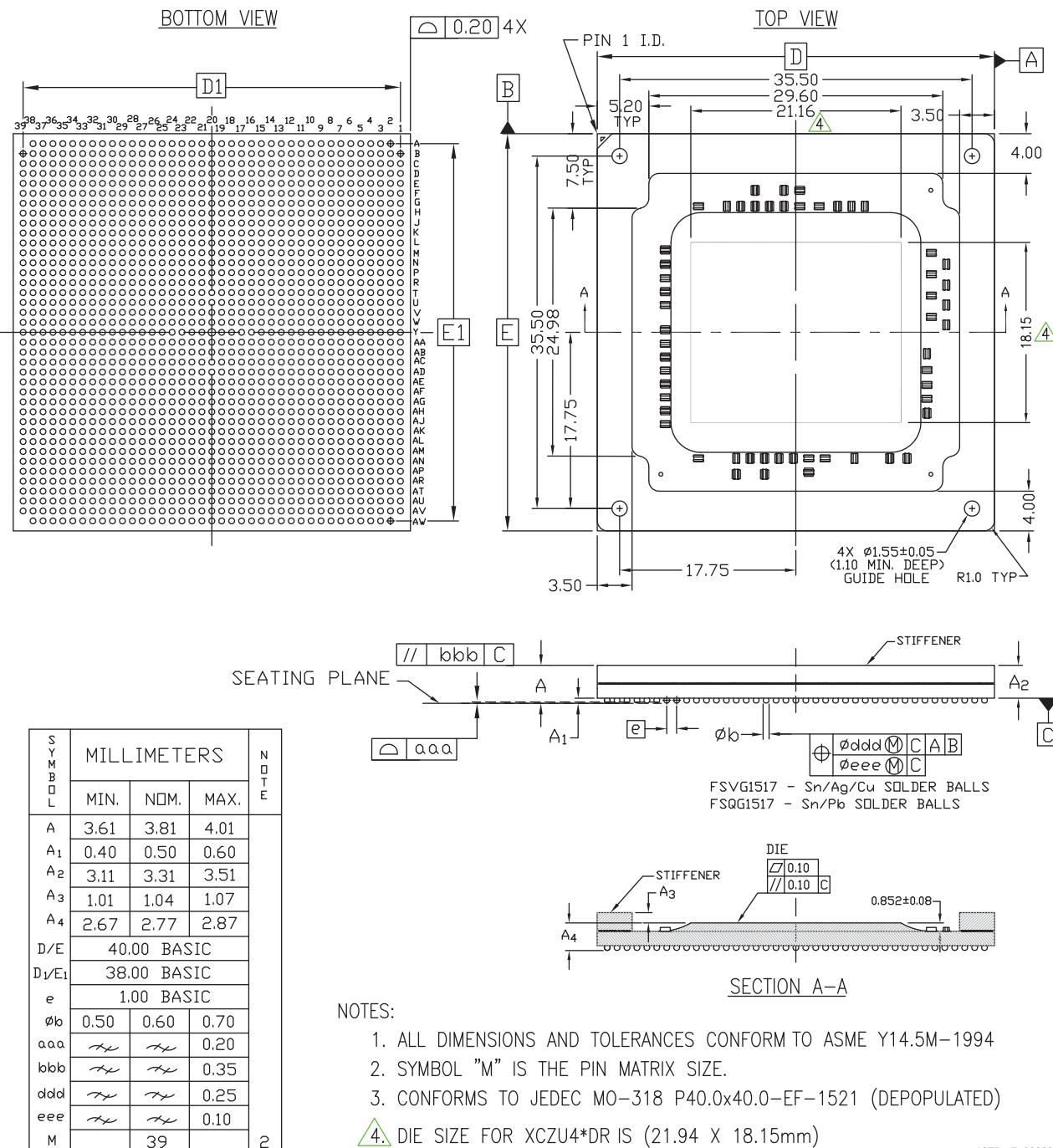


Figure 5-29: Package Dimensions for FSVG1517 (XCZU25DR, XCZU27DR, XCZU28DR, XCZU43DR, XCZU47DR, XCZU48DR)

## FFVC1760 and FFVD1760 Flip-Chip, Fine-Pitch BGA (XCZU11EG, XCZU17EG, and XCZU19EG)

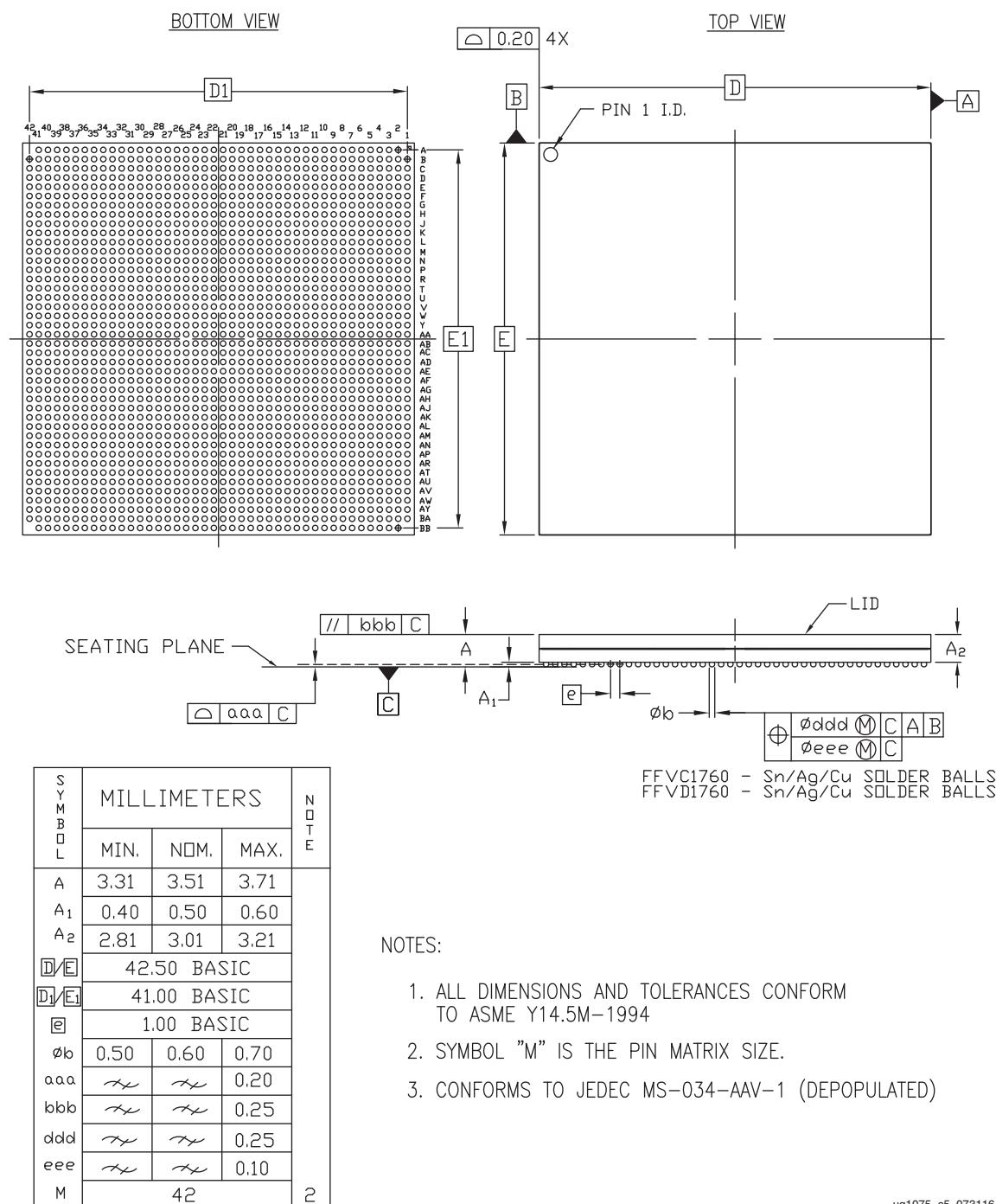


Figure 5-30: Package Dimensions for FFVC1760 and FFVD1760 (XCZU11EG, XCZU17EG, and XCZU19EG)

## FFRC1760 Ruggedized Flip-Chip BGA (XQZU11EG and XQZU19EG)

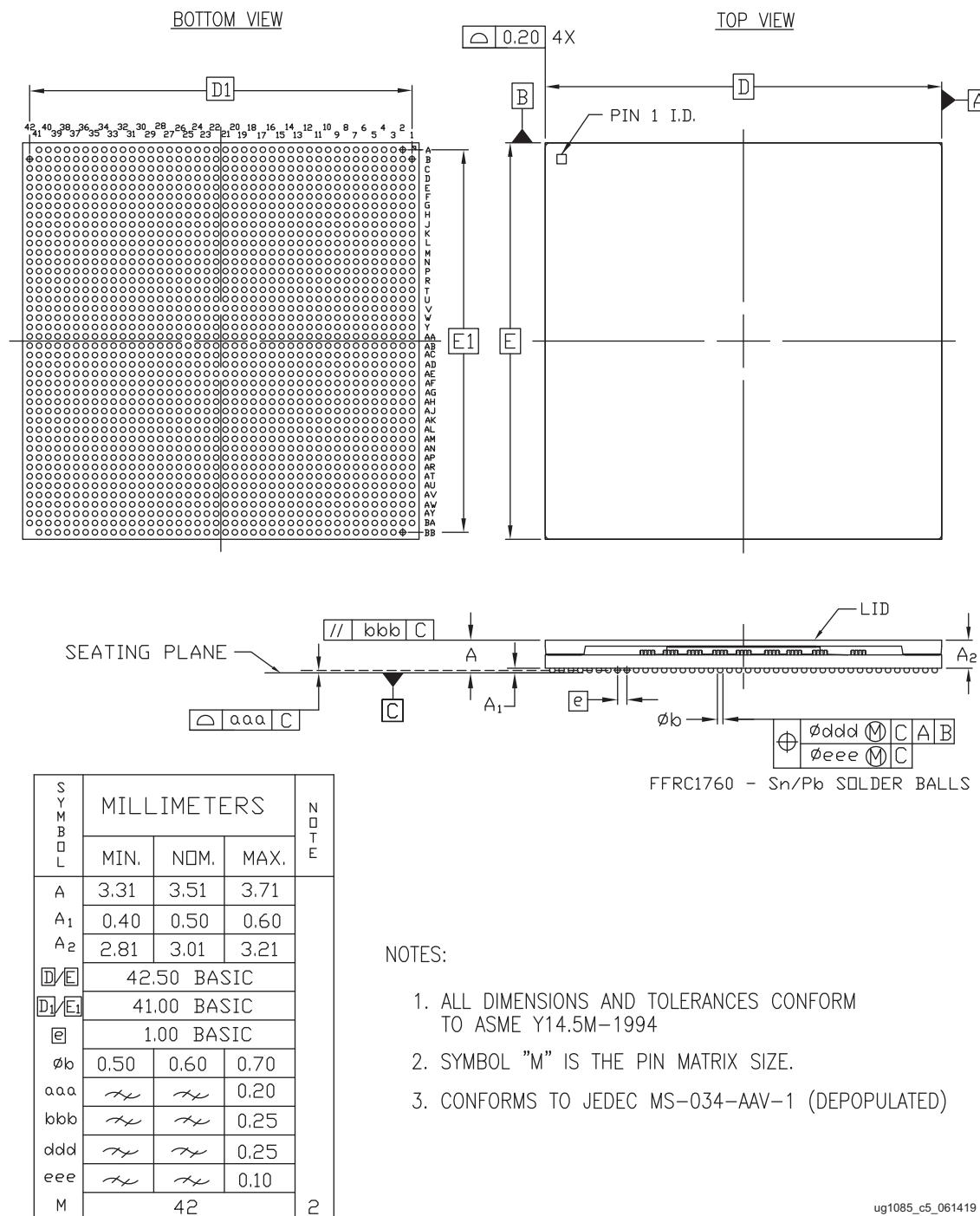


Figure 5-31: Package Dimensions for FFRC1760 (XQZU11EG and XQZU19EG)

## FFVF1760 (XCZU29DR, XCZU39DR, XCZU49DR) and FFVH1760 (XCZU46DR) Flip-Chip, Fine-Pitch BGA

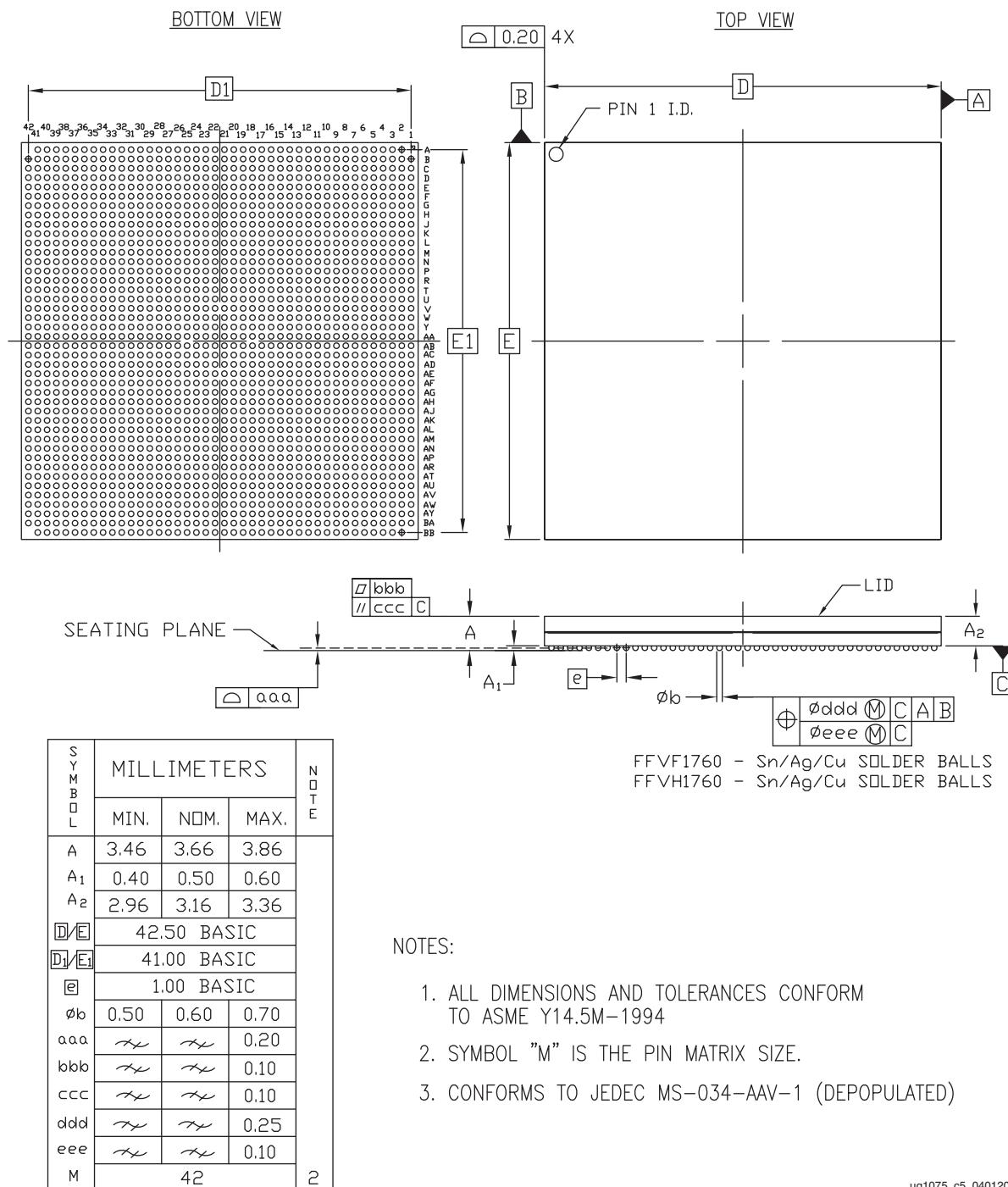


Figure 5-32: Package Dimensions for FFVF1760 (XCZU29DR, XCZU39DR, XCZU49DR) and FFVH1760 (XCZU46DR)

## FFRF1760 (XQZU29DR) Ruggedized Flip-Chip BGA

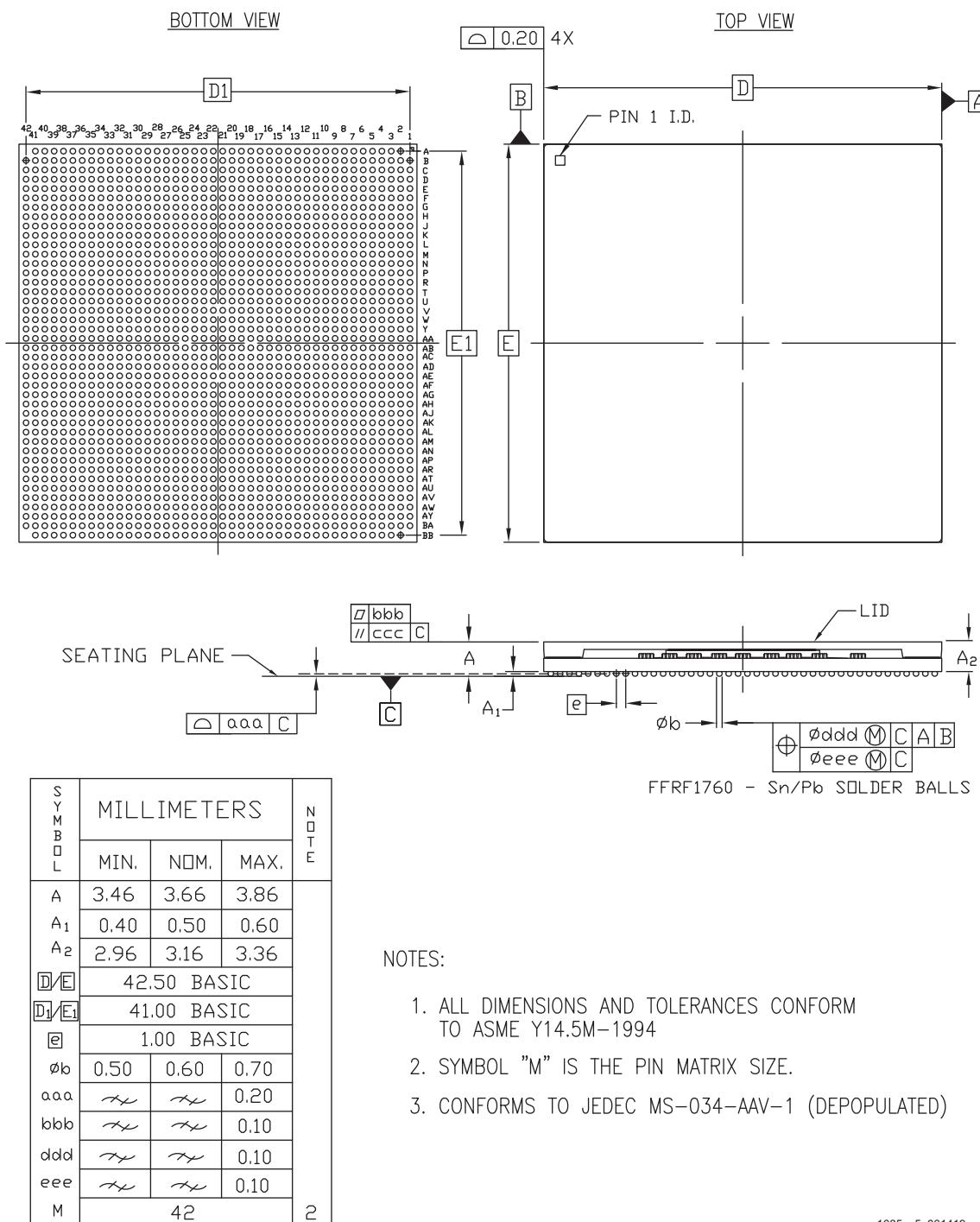


Figure 5-33: Package Dimensions for FFRF1760 (XQZU29DR)

## FSVF1760 (XCZU29DR, XCZU39DR, XCZU49DR) and FSVH1760 (XCZU46DR) Flip-Chip, Fine-Pitch, Lidless with Stiffener Ring BGA

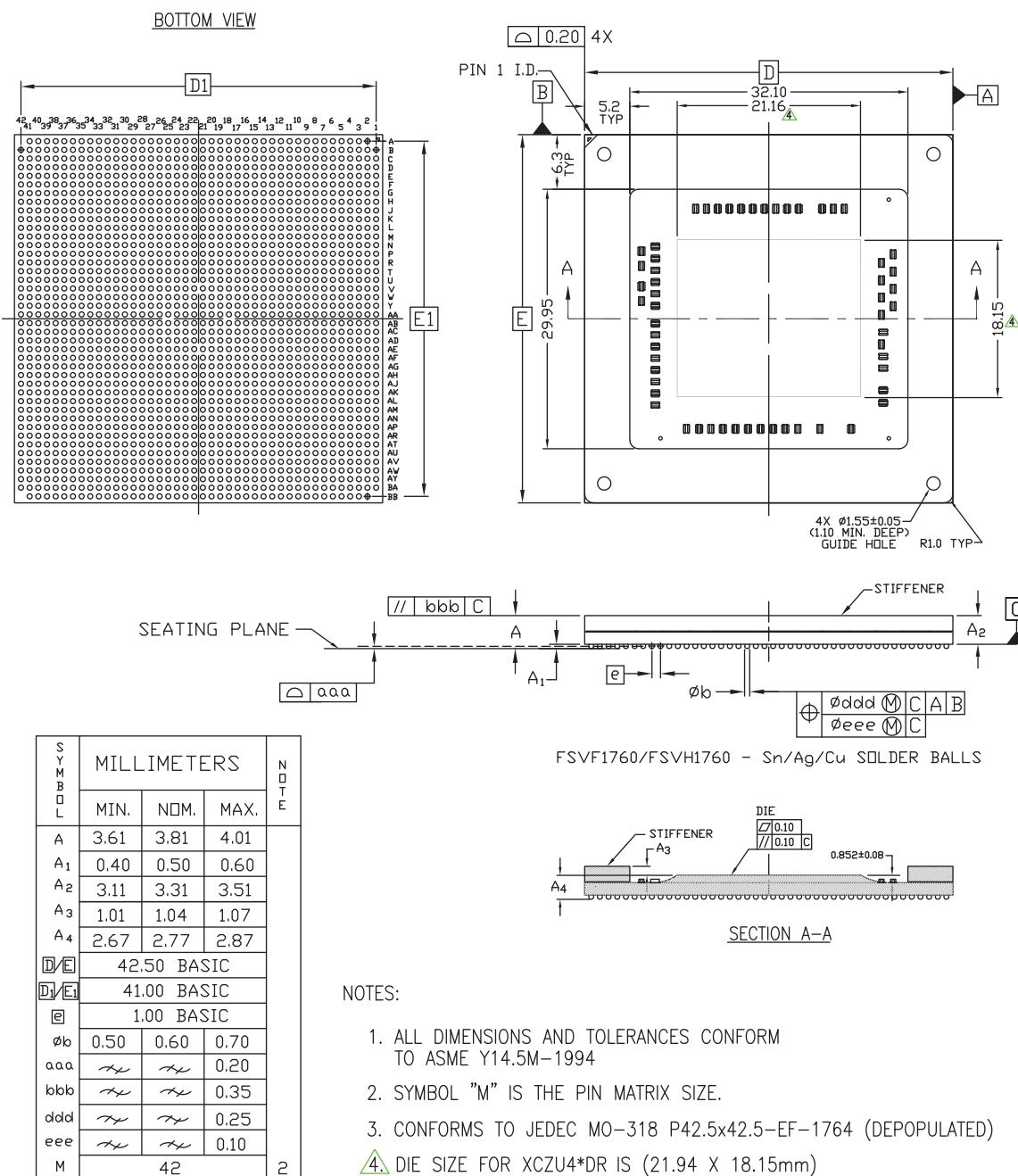


Figure 5-34: Package Dimensions for FSVF1760 (XCZU29DR, XCZU39DR, XCZU49DR) and FSVH1760 (XCZU46DR)

## FSRF1760 (XQZU49DR) Ruggedized Flip Chip, Lidless with Stiffener Ring BGA

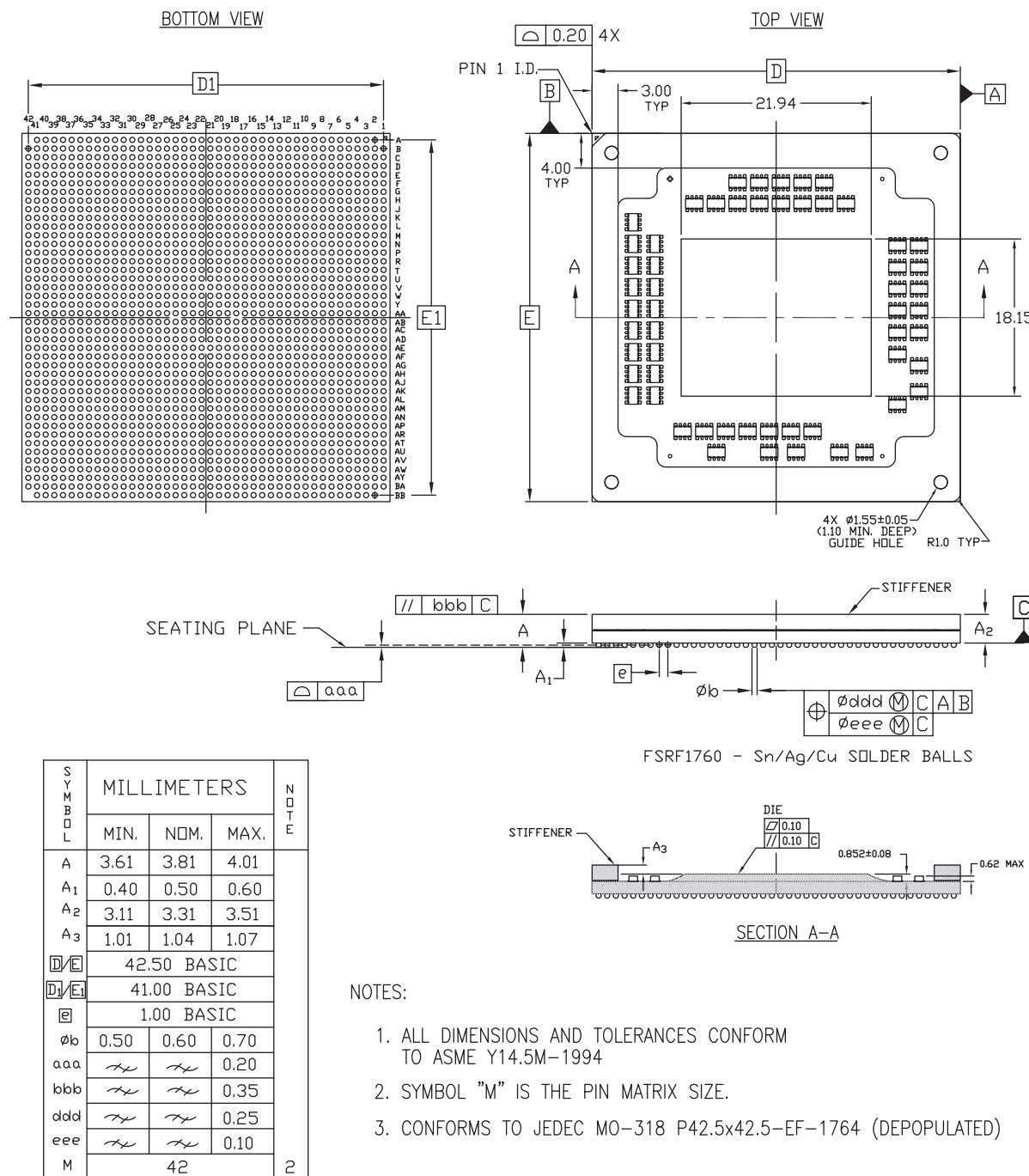


Figure 5-35: Package Dimensions for FSRF1760 (XQZU49DR)

## FFVE1924 Flip-Chip, Fine-Pitch BGA (XCZU17EG, and XCZU19EG)

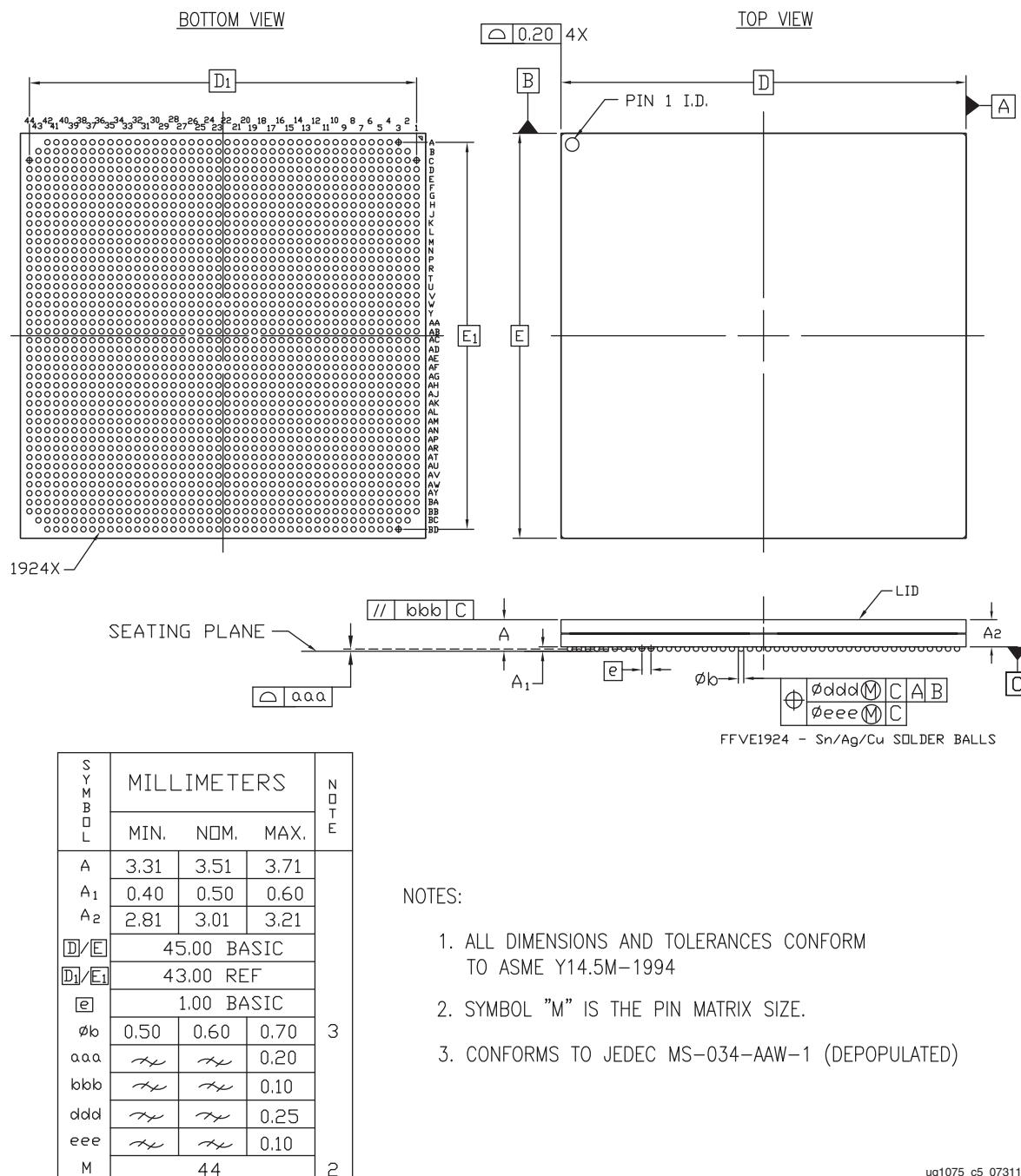


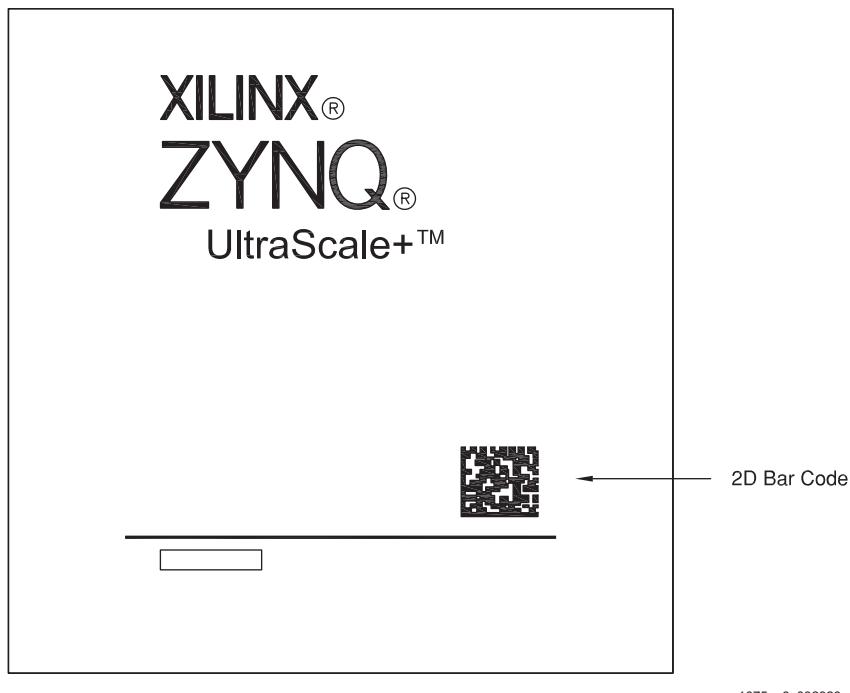
Figure 5-36: Package Dimensions for FFVE1924 (XCZU17EG and XCZU19EG)

# Package Marking

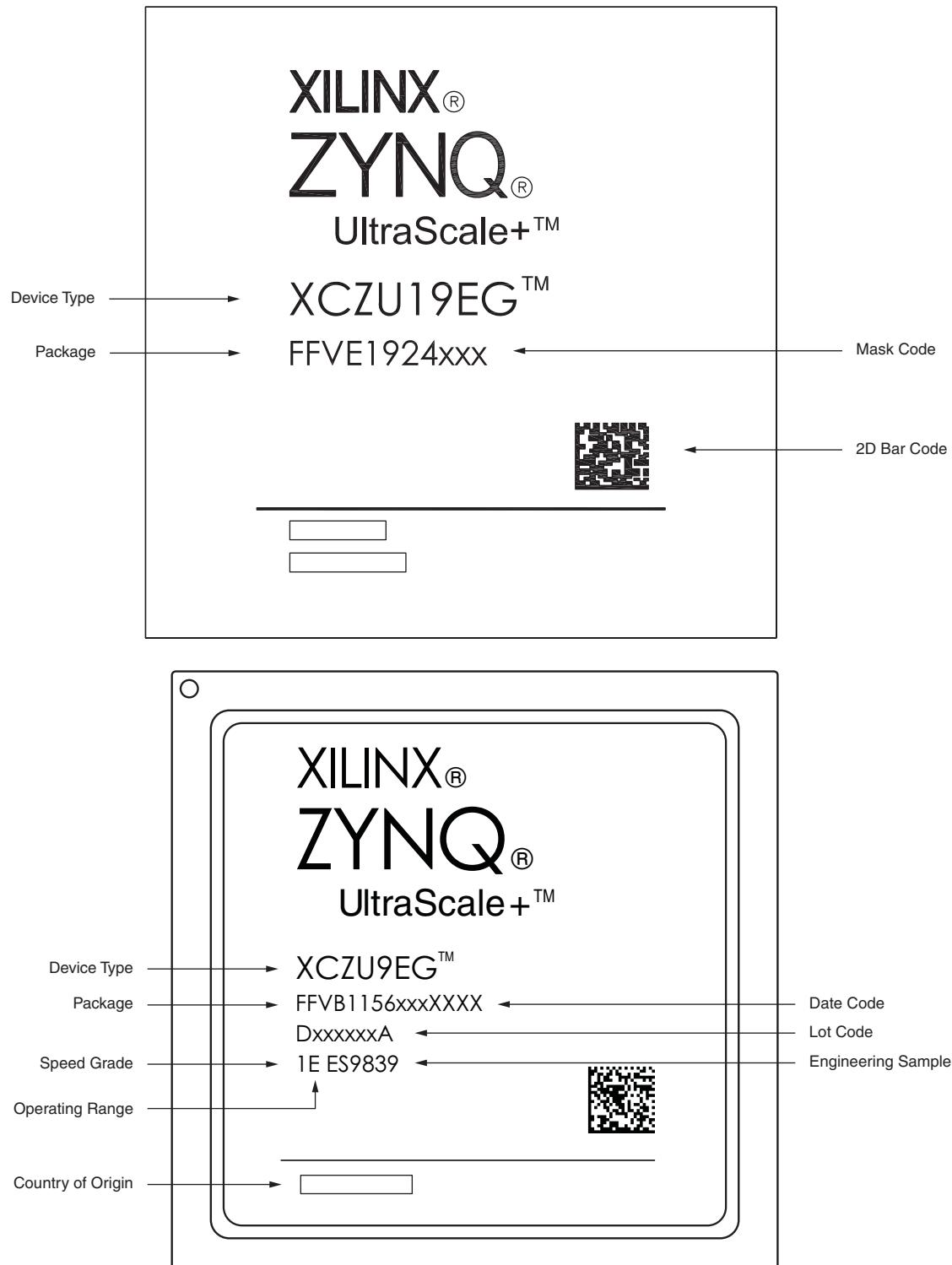
## Introduction

The package top-markings for the XC and XA Zynq® UltraScale+™ devices are similar to the examples shown in [Figure 6-1](#) and [Figure 6-2](#). In addition to the markings explained in [Table 6-1](#), refer to the *FAQ: Top Marking Change for 7 Series, UltraScale, and UltraScale+ Products* (XTP424) [\[Ref 17\]](#) and (XTP544) [\[Ref 18\]](#).

The package top-markings for the XQ Zynq UltraScale+ devices are as shown in [Figure 6-3](#). On XQ products only the Xilinx logo and the 2D bar code are marked.

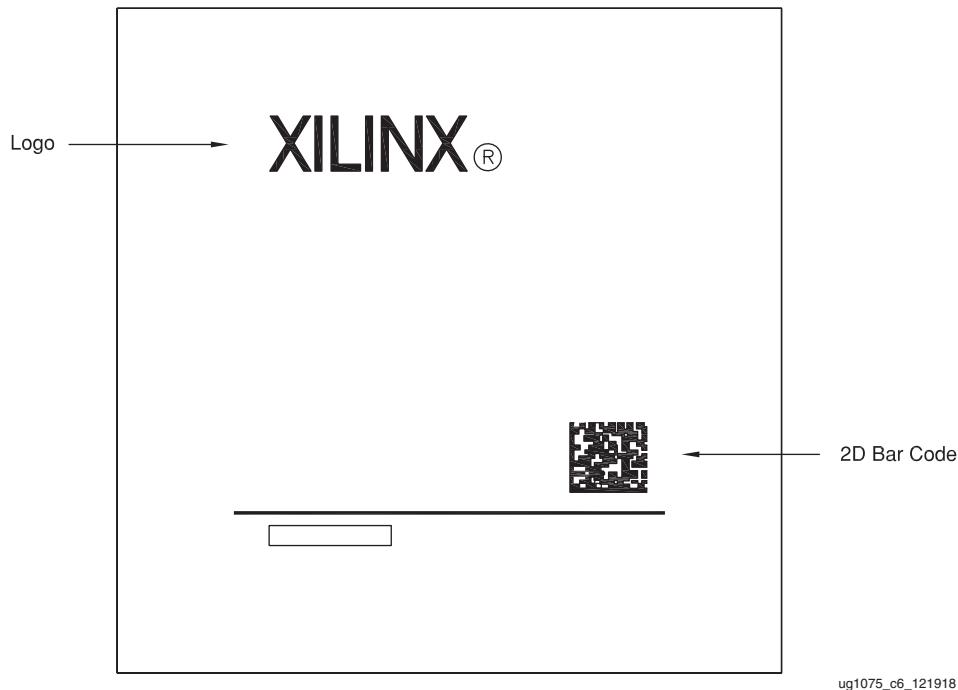


*Figure 6-1: XC and XA Zynq UltraScale+ Devices Package Marking*



ug1075\_ch6\_01\_121517

Figure 6-2: XC and XA Zynq UltraScale+ Devices Package Marking



**Figure 6-3: XQ Zynq UltraScale+ Devices Package Marking**

**Table 6-1: XC and XA Device Marking Definition—Example**

Item	Definition
Xilinx Logo	Xilinx logo, Xilinx name with trademark, and trademark-registered status.
Family Brand Logo	Device family name with trademark and trademark-registered status. This line is optional and could appear blank.
1st Line	Device name. This line is not marked on some devices. Refer to the bar code for more information.
2nd Line	<p>This line is not marked on some devices. Refer to the bar code for more information.</p> <ul style="list-style-type: none"> <li>• Package code: <b>FF</b> <ul style="list-style-type: none"> <li>1st digit: F for flip-chip BGA, S for flip-chip BGA with 0.8 mm ball pitch.</li> <li>2nd digit: F for lidded, B for bare-die.</li> </ul> </li> <li>• 3rd digit: Pb-free code: <b>V</b> for RoHS 6/6, <b>R</b> or <b>Q</b> for packages with eutectic BGA balls.</li> <li>All Zynq UltraScale+ devices are available with Pb-free RoHS compliant packaging. For more details on Xilinx Pb-free and RoHS compliant products, see: <a href="http://www.xilinx.com/pbfree">www.xilinx.com/pbfree</a>.</li> <li>• 4th digit: This is the pin out (net list) identifier.</li> <li>• 5th–8th digits: These are the physical pin count identifiers: <b>B1156</b> is shown in the <a href="#">Figure 6-2</a> example marking drawing. Example: A package code of FFVB1517 and FFVF1517 means they have a different pinout (net list) but the same physical ball count and physical dimensions.</li> <li>• Three letter circuit design revision, the location code for the wafer fab, and the geometry code (<b>xxx</b>).</li> <li>• When marked, the date code: <b>YYWW</b>. This code is not marked on some devices. Refer to the bar code for more information.</li> </ul>

Table 6-1: XC and XA Device Marking Definition—Example (Cont'd)

Item	Definition	
3rd Line	<p>When marked, this line describes ten alphanumeric characters for assembly location, 7-digit lot number, and step information. The last digit is usually an A or an M if a stepping version does not exist.</p> <p>This line is not marked on some devices. Refer to the bar code for more information.</p>	
4th Line	<p>When marked, this line describes the device speed grade (<b>1</b>) and temperature operating range (<b>E</b>). When not marked on the package, the product is considered to operate at the extended (E) temperature range. If a bar code is present on the device, the 4th line might be blank or unmarked. In this case, refer to the bar code for speed grade and temperature range information. For more information on the ordering codes, see the <i>Zynq UltraScale+ MPSoC Overview</i> (DS891) [Ref 1].</p> <p>Other variations for the 4th line:</p>	
	L1I	The L1I indicates a -1LI device. The -1LI speed grade offers reduced maximum power consumption. For more information, see the <i>Zynq UltraScale+ MPSoC data sheet</i> [Ref 8].
	1E xxxx	The xxxx indicates a 4-digit SCD device option. An SCD is a special ordering code that is not always marked in the device top mark.
	1E ES 2I ES L1I ES	The addition of an ES after the operating temperature range code indicates an engineering sample.
Bar Code	A device-specific bar code is marked on each device. Refer to the <i>FAQ: Top Marking Change for 7 Series, UltraScale, and UltraScale+ Products</i> (XTP424) [Ref 17].	

# Packing and Shipping

## Introduction

Zynq® UltraScale+™ devices are packed in trays. Trays are used to pack most of Xilinx surface-mount devices since they provide excellent protection from mechanical damage. In addition, they are manufactured using antistatic material to provide limited protection against ESD damage and can withstand a bake temperature of 125°C.

Table 7-1: Standard Device Counts per Tray and Box

Package	Maximum Number of Devices Per Tray	Maximum Number of Units In One Internal Box
SBVA484, SFRA484	84	420
UBVA494		
UBVA530	126	630
SFVA625	60	300
SFVC784, SFRC784	60	300
FBVB900, FFVC900, FFRB900, FFRC900	27	135
FFVB1156, FFRB1156, FFVC1156, FFRC1156 FFVD1156, FFRD1156, FFVE1156, FFRE1156	24	120
FSVE1156	24	72
FFVB1517, FFRB1517, FFVF1517	21	105
FFVG1517, FFRG1517	21	63
FSVG1517, FSRG1517	21	63
FFVC1760, FFRC1760 FFVD1760, FFVF1760, FFVH1760, FFRF1760	12	60
FSVF1760, FSVH1760, FSRF1760	12	36
FFVE1924	12	36



**IMPORTANT:** All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q (for example: FFQE1156).

# Soldering Guidelines

## Soldering Guidelines

To implement and control the production of surface-mount assemblies, the dynamics of the solder reflow process and how each element of the process is related to the end result must be thoroughly understood.



**RECOMMENDED:** *Xilinx recommends that customers qualify their custom PCB assembly processes using package samples.*

The primary phases of the reflow process are:

- Melting the particles in the solder paste
- Wetting the surfaces to be joined
- Solidifying the solder into a strong metallurgical bond

The peak reflow temperature of a surface-mount component body should not be more than 250°C maximum (260°C for dry rework only) for Pb-free packages and 220°C for eutectic packages, and is package size dependent. For multiple BGAs in a single board and because of surrounding component differences, Xilinx recommends checking all BGA sites for varying temperatures.

The infrared reflow (IR) process is strongly dependent on equipment and loading. Components might overheat due to lack of thermal constraints. Unbalanced loading can lead to significant temperature variation on the board. These guidelines are intended to assist users in avoiding damage to the components; the actual profile should be determined by those using these guidelines. For complete information on package moisture / reflow classification and package reflow conditions, refer to the Joint IPC/JEDEC Standard J-STD-020C.



**IMPORTANT:** *Following the initial placement and reflow process, devices should not be reflowed more than two additional times and should not be removed from the board. Any additional rework beyond that is likely to cause irreparable damage to the device.*

## Sn/Pb Reflow Soldering

Figure 8-1 shows typical conditions for solder reflow processing of Sn/Pb soldering using IR/convection. Both IR and convection furnaces are used for BGA assembly. The moisture sensitivity of surface-mount components must be verified prior to surface-mount flow.

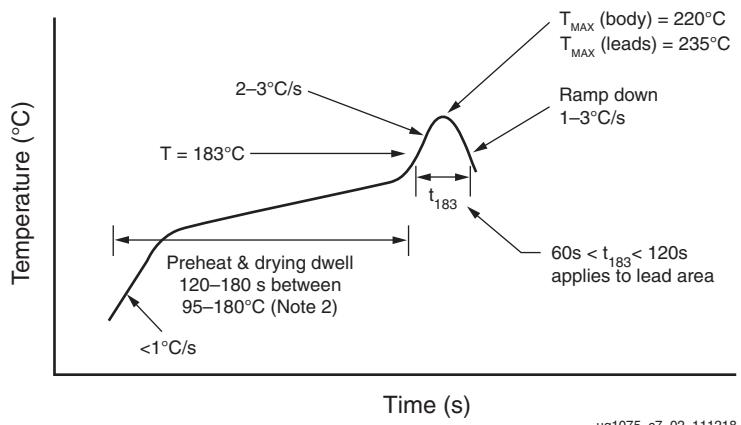


Figure 8-1: Typical Conditions for IR Reflow Soldering of Sn/Pb Solder

Notes for Figure 8-1:

1. Maximum temperature range = 220°C (body). Minimum temperature range before 205°C (leads/balls).
2. Preheat dwell 95–180°C for 120–180 seconds.
3. IR reflow must be performed on dry packages.

## Pb-Free Reflow Soldering

Xilinx uses SnAgCu solder balls for commercial-grade (XC) and automotive-grade (XA) BGA packages. In addition, suitable package materials are qualified for the higher reflow temperatures (250°C maximum, 260°C for dry rework only) required by Pb-free soldering processes.

Xilinx does not support soldering SnAgCu BGA packages with SnPb solder paste using a Sn/Pb soldering process. Traditional Sn/Pb soldering processes have a peak reflow temperature of 220°C. At this temperature range, the SnAgCu BGA solder balls do not properly melt and wet to the soldering surfaces. As a result, reliability and assembly yields can be compromised.

The optimal profile must take into account the solder paste/flux used, the size of the board, the density of the components on the board, and the mix between large components and smaller, lighter components. Profiles should be established for all new board designs using thermocouples at multiple locations on the component. In addition, if there is a mixture of devices on the board, then the profile should be checked at various locations on the board. Ensure that the minimum reflow temperature is reached to reflow the larger components and at the same time, the temperature does not exceed the threshold temperature that might damage the smaller, heat sensitive components.

[Table 8-1](#) and [Figure 8-2](#) provide guidelines for profiling Pb-free solder reflow of 0.8 mm and 1.0 mm pitch packages. InFo package guidelines are listed in a separate [Table 8-2](#). In general, a gradual, linear ramp into a spike has been shown by various sources to be the optimal reflow profile for Pb-free solders ([Figure 8-2](#)). This profile has been shown to yield better wetting and less thermal shock than conventional ramp-soak-spike profile for the Sn/Pb system. SnAgCu alloy reaches full liquidus temperature at 235°C. When profiling, identify the possible locations of the coldest solder joints and ensure that those solder joints reach a minimum peak temperature of 235°C for at least 10 seconds. Reflowing at high peak temperatures of 260°C and above can damage the heat sensitive components and cause the board to warp. Users should reference the latest IPC/JEDEC J-STD-020 standard for the allowable peak temperature on the component body. The allowable peak temperature on the component body is dependent on the size of the component. Refer to [Table 8-3](#) for peak package reflow body temperature information. In any case, use a reflow profile with the lowest peak temperature possible.

**Table 8-1: Pb-Free Reflow Soldering Guidelines**

Profile Feature	Convection, IR/Convection
Ramp-up rate	2°C/s maximum. 1°C/s maximum for lidless packages with stiffener ring.
Preheat temperature 150°–200°C	60–120 seconds.
Temperature maintained above 217°C	60–150 seconds (60–90 seconds typical).
Time within 5°C of actual peak temperature	30 seconds maximum.

Table 8-1: Pb-Free Reflow Soldering Guidelines (Cont'd)

Profile Feature	Convection, IR/Convection
Peak temperature (lead/ball)	230°C—245°C typical (depends on solder paste, board size, component mixture).
Peak temperature (body)	240°C—250°C, package body size dependent.
Ramp-down rate	2°C/s maximum.
Time 25°C to peak temperature	3.5 minutes minimum, 5.0 minutes typical, 8 minutes maximum.

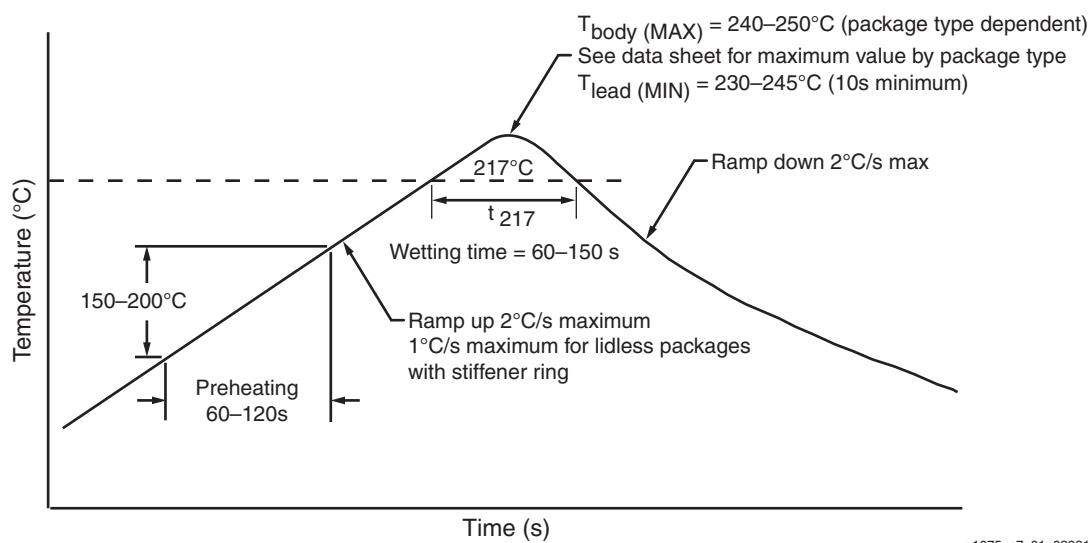


Figure 8-2: Typical Conditions for Pb-Free Reflow Soldering

Table 8-2: InFO Package Reflow Soldering Guidelines

Profile Feature	Convection, IR/Convection
Ramp-up rate	4°C/s maximum
Preheat temperature 150°–190°C	60–100 seconds
Temperature maintained above 217°C	45–75 seconds
Time within 5°C of actual peak temperature	30 seconds maximum
Peak temperature (lead/ball)	230°C—235°C typical (depends on solder paste, board size, component mixture)
Peak temperature (body)	240°C—245°C
Ramp-down rate	2°C/s maximum.
Time 25°C to peak temperature	3.5 minutes minimum, 5.0 minutes typical, 8 minutes maximum.

## Peak Package Reflow Temperatures

Table 8-3: Peak Package Reflow Body Temperature (Based on J-STD-020 Standard)

Package	Product Category	Peak Package Reflow Body Temperature	JEDEC Moisture Sensitivity Level (MSL)
SBVA484 SFVA625 SFVC784	XC XA	Mass reflow: 250°C	4
		Dry rework: 260°C	3
UBVA494 UBVA530 FBVB900, FFVC900 FFVB1156, FFVC1156 FFVD1156, FFVE1156 FFVB1517, FFVF1517, FFVG1517 FFVC1760, FFVD1760, FFVF1760, FFVH1760 FFVE1924	All	Mass reflow: 245°C Dry rework: 260°C	4
FSVE1156 FSVG1517 FSVF1760, FSVH1760	All	Mass reflow: 240°C Dry rework: 260°C	4
SFRA484, SFRC784 FFRB900, FFRC900 FFRB1156, FFRC1156 FFRD1156, FFRE1156 FFRB1517, FFRG1517, FSRG1517 FFRC1760, FFRF1760, FSF1760	XQ <sup>(1)</sup>	Mass reflow: 220°C Dry rework: 235°C	4

**Notes:**

- For devices with the Pb-free signifier in the package name (labeled as Q vs. V) use the temperatures and MSL listed for the XQ product category.

For sophisticated boards with a substantial mix of large and small components, it is critical to minimize the  $\Delta T$  across the board ( $<10^\circ\text{C}$ ) to minimize board warpage and thus, attain higher assembly yields. Minimizing the  $\Delta T$  is accomplished by using a slower rate in the warm-up and preheating stages. Xilinx recommends a heating rate of less than  $1^\circ\text{C}/\text{s}$  during the preheating and soaking stages, in combination with a heating rate of not more than  $3^\circ\text{C}/\text{s}$  throughout the rest of the profile.

It is also important to minimize the temperature gradient on the component, between top surface and bottom side, especially during the cooling down phase. The key is to optimize cooling while maintaining a minimal temperature differential between the top surface of the package and the solder joint area. The temperature differential between the top surface of the component and the solder balls should be maintained at less than  $7^\circ\text{C}$  during the critical region of the cooling phase of the reflow process. This critical region is in the part of the cooling phase where the balls are not completely solidified to the board yet, usually

between the 200°C–217°C range. To efficiently cool the parts, divide the cooling section into multiple zones, with each zone operating at different temperatures.

The optimal profile must take into account the solder paste/flux used, the size of the board, the density of the components on the board, and the mix between large components and smaller, lighter components. Profiles should be established for all new board designs using thermocouples at multiple locations on the component. In addition, if there is a mixture of devices on the board, then the profile should be checked at various locations on the board, as shown in [Figure 8-3](#) and [Figure 8-4](#). Ensure that the minimum reflow temperature is reached to reflow the larger components and at the same time, the temperature does not exceed the threshold temperature that might damage the smaller, heat sensitive components.

**TOP Profile,**  
TC 1 : U17 Edge 1  
TC 2 : U17 Edge 2  
TC 3 : U17 Edge 3  
TC 4 : U17 Edge 4  
TC 5 : U17 Middle 1  
TC 6 : U17 Middle 2  
TC 7 : U17 Body  
TC 8 : Q25  
TC 9 : U25



Figure 8-3: Thermocouple Top

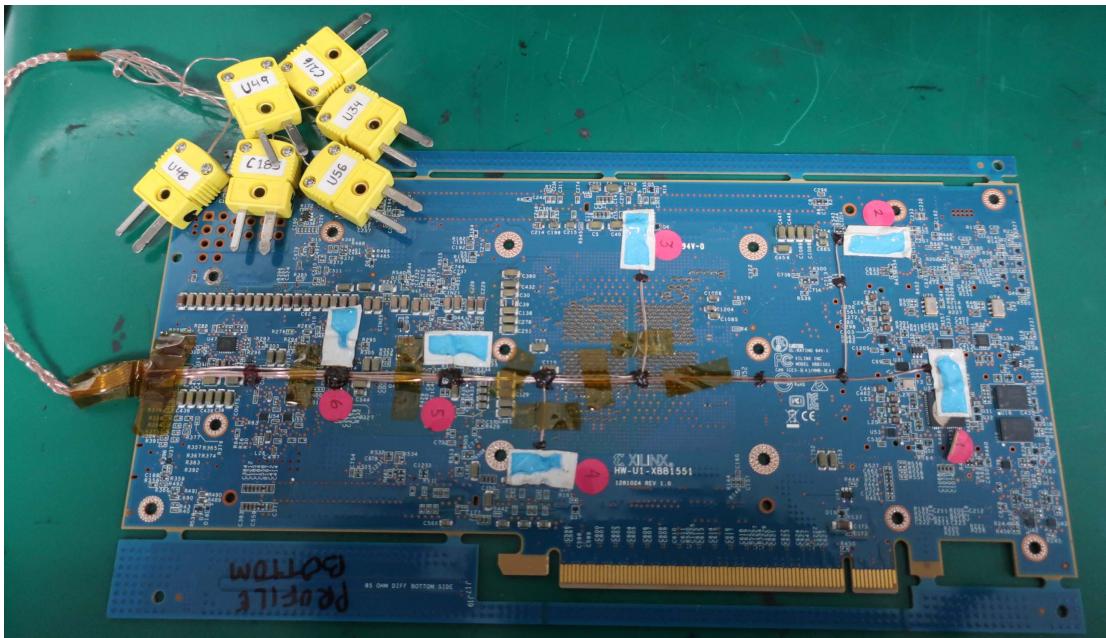


Figure 8-4: Thermocouple Bottom

## Post Reflow/Cleaning/Washing

Many PCB assembly subcontractors use a no-clean process in which no post-assembly washing is required. Although a no-clean process is recommended, if cleaning is required, Xilinx recommends a water-soluble paste and a washer using a deionized-water. Baking after the water wash is recommended to prevent fluid accumulation.

Cleaning solutions or solvents are not recommended because some solutions contain chemicals that can compromise the lid adhesive, thermal compound, or components inside the package.

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## Conformal Coating

Xilinx does not have information regarding the reliability of flip-chip BGA packages on a board after exposure to any specific conformal coating process. Therefore, any process using conformal coating should be qualified for the specific use case to cover the materials and process steps.

Ruggedized XQ packages are designed to support conformal coating, with vented lids that ensure proper cleaning can occur after the etching process and prior to conformal coating.



**RECOMMENDED:** When a conformal coating is required, Parylene-based material should be used to avoid potential risk of weakening the lid or stiffener ring adhesive used in Xilinx packages.

## Strain Gauge Measurement

Strain gauge measurements are recommended to be done at each process step that has the potential to cause excessive board flexing leading to solder joint cracking. Assembly processes where strain gauge measurements are recommended include:

- PCB Router (during PCB loading/unloading into fixture and during the routing process)
- PTH solder assembly during top-catch loading/unloading
- Press fit assembly during press base and tooling loading/unloading and during machine pressing process
- DIMM memory (during PCB loading/unloading and during insertion/removal of DIMM)
- Heat-sink assembly process (during PCB loading/unloading and during entire screw assembly process)
- X-ray fixture (during PCBA loading/unloading)

Strain gauge measurements should be in the range of  $\pm 500 \mu\text{strain}$ . Dye and pry analysis is required to confirm if the measured strain causes solder joint cracking. It is recommended to conduct dye and pry analysis for any strain reading greater than  $500 \mu\text{strain}$ .

To reduce the affects of strain on a device, edge bonding can be used and is recommended for larger packages. See [Edge Bonding Guidelines](#) for implementation details.

## Solder Paste

Solder paste consists of solder alloy and a flux system. A typical solder paste composition by volume is split between about 50% alloy and 50% flux. The metal load mass (solder alloy powder) is around 90%, with the remaining 10% mass a flux system. The primary purpose of the flux system is to remove the contaminations from the solder joints during the soldering process. The capability of removing contaminations is determined by the activation level of the type of solder paste. The preferred solder paste metal alloy has a lead-free composition (SnAgCu where Ag is 3–4% and Cu is 0.5–1%). A *no-clean* solder paste is preferred to eliminate any risk of improper cleaning that could leave active residue beneath the device and other BTC components. The paste must be suitable for printing the solder stencil aperture dimensions. Type 4 paste is recommended for better paste release performance. When using a solder paste, you must adhere to the handling recommendations of the paste manufacturer.

## Component Placement



**IMPORTANT:** *The following component placement guidelines apply to all package types included in this guide (lidded, lidless, bare-die, etc.).*

Xilinx device packages must be placed accurately according to their geometry outline. Positioning packages manually via hand mounting is not recommended.

Typical component placement accuracies of  $\pm 50 \mu\text{m}$  can be achieved using standard pick and placement machine equipment with vision system. The PCB and the components are optically checked and measured and the components are placed on the PCB in specific programmed positions based on the PCB CAD information. The pick and placement machine vision system detects the fiducials on the PCB immediately prior to mounting the FPGA. Recognition of the packages is performed by the vision system, to ensure correct centering of the FPGA placement on the PCB pad array.

BGA packages with solder balls can self-align during the reflow process because of the solder high surface tension that enables the pulling and centering of the device, and where a slight offset of the placement is still allowed. For guidance, the maximum tolerable offset of device placement is around 30% of the pad diameter on the PCB for typical non-solder mask defined pads. This means that for device packages the solder ball to PCB pad misalignment must be better than  $150 \mu\text{m}$  to assure a robust mounting process. Generally, this is achievable using a wide range of modern pick and placement systems. The following setup conditions are important for the pick and placement systems:

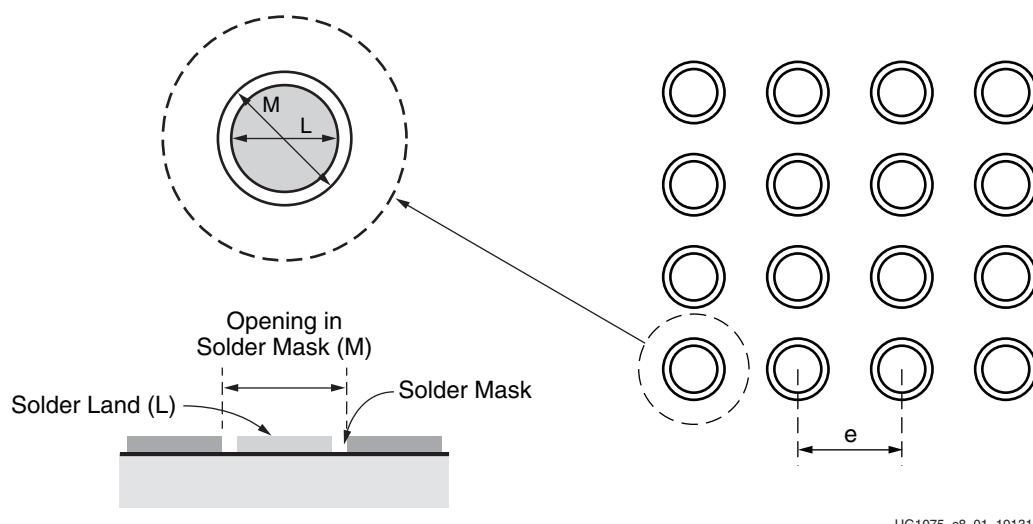
- The pick and placement nozzle type should be sized to the dimensions of the Xilinx device. The nozzle needs to firmly hold the device package during the pick and placement stage. The appropriate nozzle type for the device package can be chosen from the manual provided by the pick and placement equipment company.
- The ball recognition capabilities of the placement system should be used and package outline centering should be avoided. This eliminates the solder ball to package edge tolerances of the package. Refer to the specific package outline drawing for details.
- To ensure the proper identification of the device package by the vision system, a suitable lighting system and the correct choice of the features of the measuring method are essential. The most suitable settings can be chosen from the manual provided by the pick and placement equipments company.
- To avoid solder bridging or solder smear, ensure the proper placement force of the device package during placement on the PCB. Excessive placement force can lead to excess solder paste and cause solder bridging. However, a slight placement force can lead to insufficient solder paste contact between the device package solder balls and the solder paste, causing solder defects including open solder joints, badly centered packages, or even head-in-pillow (HIP) defects.

# Recommended PCB Design Rules for BGA Packages

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## BGA Packages

Xilinx provides the diameter of a land pad on the package side. This information is required prior to the start of the board layout so the board pads can be designed to match the component-side land geometry. The typical values of these land pads are described in [Figure 9-1](#) and summarized in [Table 9-1](#) for 1.0 mm pitch packages. For Xilinx BGA packages, non-solder mask defined (NSMD) pads on the board are suggested to allow a clearance between the land metal (diameter L) and the solder mask opening (diameter M) as shown in [Figure 9-1](#). An example of an NSMD PCB pad solder joint is shown in [Figure 9-2](#). It is recommended to have the board land pad diameter with a 1:1 ratio to the package solder mask defined (SMD) pad for improved board level reliability. The space between the NSMD pad and the solder mask as well as the actual signal trace widths depend on the capability of the PCB vendor. The cost of the PCB is higher when the line width and spaces are smaller.


UG1075\_c8\_01\_101315

*Figure 9-1: Suggested Board Layout of Soldered Pads for BGA Packages*

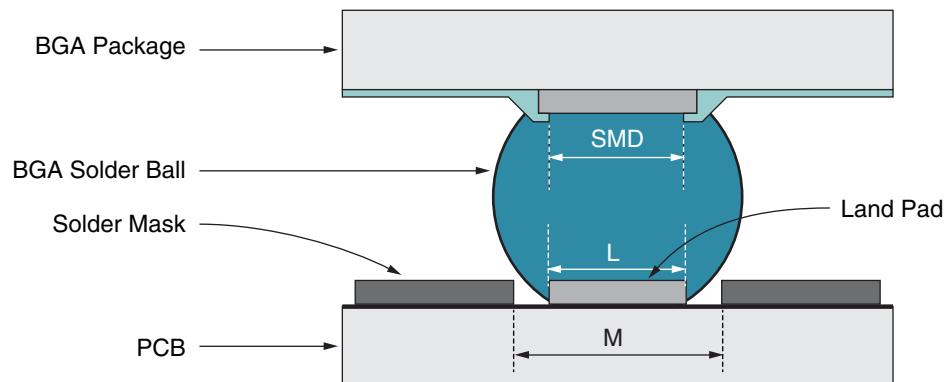


Figure 9-2: Example of an NSMD PCB Pad Solder Joint

Table 9-1: BGA Package Design Rules

Flip-Chip BGA Packages	1.0 mm Pitch	0.8 mm Pitch	0.5 mm Pitch
Design Rule	Dimensions in mm (mils)		
Package land pad opening (SMD)	0.53 mm (20.9 mils)	0.40 mm (15.7 mils)	0.28 mm (11.0 mils)
Maximum PCB solder land (L) diameter	0.53 mm (20.9 mils)	0.40 mm (15.7 mils)	0.26 mm (10.2 mils)
Opening in PCB solder mask (M) diameter	0.63 mm (24.8 mils)	0.50 mm (19.7 mils)	0.36 mm (14.2 mils)
Solder ball land pitch (e)	1.00 mm (39.4 mils)	0.80 mm (31.5 mils)	0.50 mm (19.7 mils)

**Notes:**

1. Controlling dimension in mm.

## Stencil

Solder paste is applied to PCB metal pads by screen printing. The volume of the printed solder paste is determined by the stencil aperture and the stencil thickness. In most cases, the thickness of a stencil must be matched to the needs of all components on the PCB. Stencil apertures should be a circular shape. To ensure a uniform and high-solder paste transfer to the PCB, laser-cut stencil, made from mostly stainless steel, is typically used. Nickel blank stencils, referring to stencils where the entire foil is laser-cut from a sheet of pure nickel material, can also be used. However, high-quality nano-coated stencils (laser cut from stainless steel) can perform as well as or better than nickel blanks.

### Uniform Stencil Aperture Design

- For packages with 1 mm or 0.8 mm ball pitch, a uniform stencil aperture opening of 19.7 mils to 20.0 mils round is recommended.
- For InFO packages with 0.5 mm ball pitch, a uniform stencil with squared aperture openings (rounded corners) of 12 mils and pitch of 19.8 mils, as show in [Figure 9-3](#) is recommended. A stencil thickness of 4 mils is also recommended.

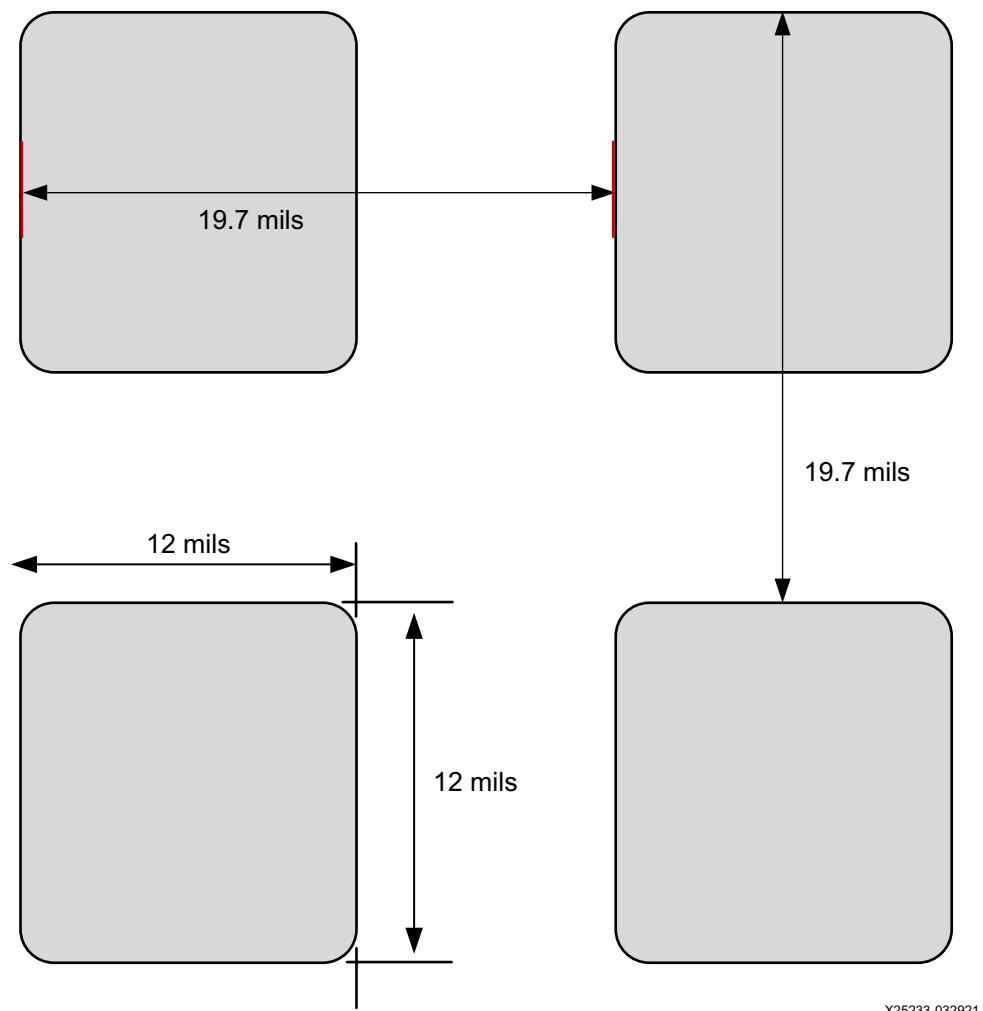
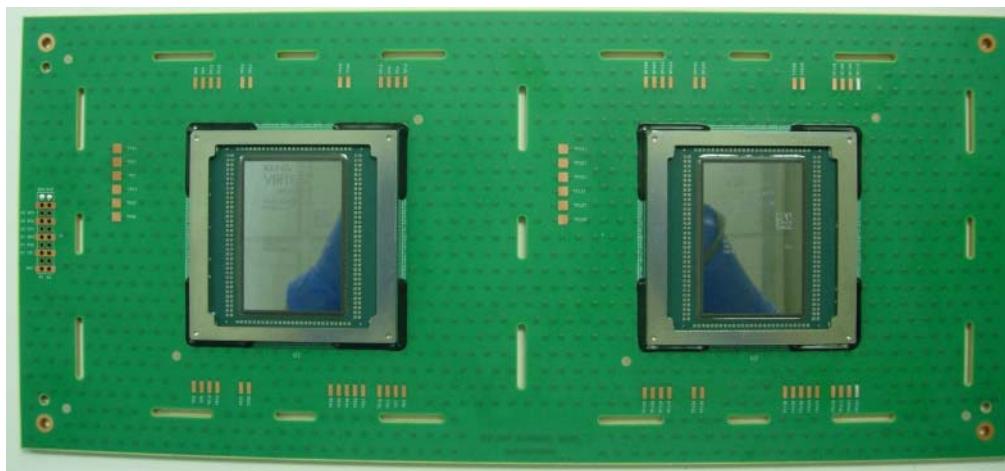


Figure 9-3: Recommended Stencil Design for InFO Packages

# Edge Bonding Guidelines

## Summary

The edge bonding technique uses high-adhesion adhesives dispensed along the periphery of a component, as shown in [Figure 10-1](#). Xilinx recommends edge bonding for increased mechanical reliability in cases where the device is exposed to extensive temperature cycling or extreme shock and vibration, such as space, defense, and telecommunications applications. Designers are expected to evaluate the need for edge bonding based on the requirements of the specific application implementation.



*Figure 10-1: Edge Bonded BGA Packages*

Various edge-bonding adhesive patterns were evaluated using an in-line dispensing machine. Based on the evaluation, the dispensing pattern shown in [Table 10-1](#) is recommended. A dot pattern, shown in Figure 10-2, was also successfully evaluated following the same parameters (dot locations at L1 and L2) as the recommended dispensing pattern.

*Table 10-1: Edge Bonding Pattern and Parameters*

Dimension	UBVA494	UBVA530
Length (L1)	5.3 mm	5.6 mm
Length (L2)	3.2 mm	3.2 mm

Table 10-1: Edge Bonding Pattern and Parameters (Cont'd)

Dimension	UBVA494	UBVA530
Width (W)/Dot (Size)	1 mm	1 mm
Height (% of body height)	50–90%	50–90%



Figure 10-2: Dot Pattern

## Edge Bonding Implementation

Edge bonding is the dispensing of an epoxy material around the periphery of the package after board mount. Xilinx requires the use of the [Zymet UA-2605-B](#) edge-bonding material.

Edge bonding is not intended to under fill the package. This technique allows for component rework and improves the robustness of the mounted component by controlling the expansion and warpage of the board during normal operating conditions.



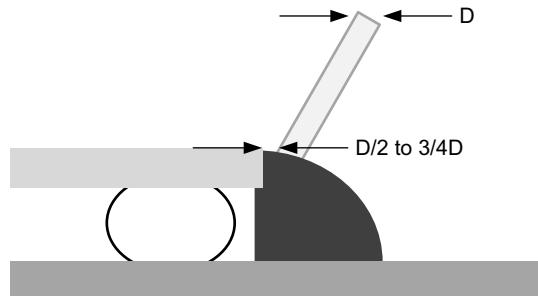
**IMPORTANT:** Following the initial placement and reflow process, devices should not be reflowed more than two additional times and should not be removed from the board. Any additional rework beyond that is likely to cause irreparable damage to the device.

To place the adhesive while using an in-line soldering robot, Xilinx recommends the parameters shown in [Table 10-2](#).

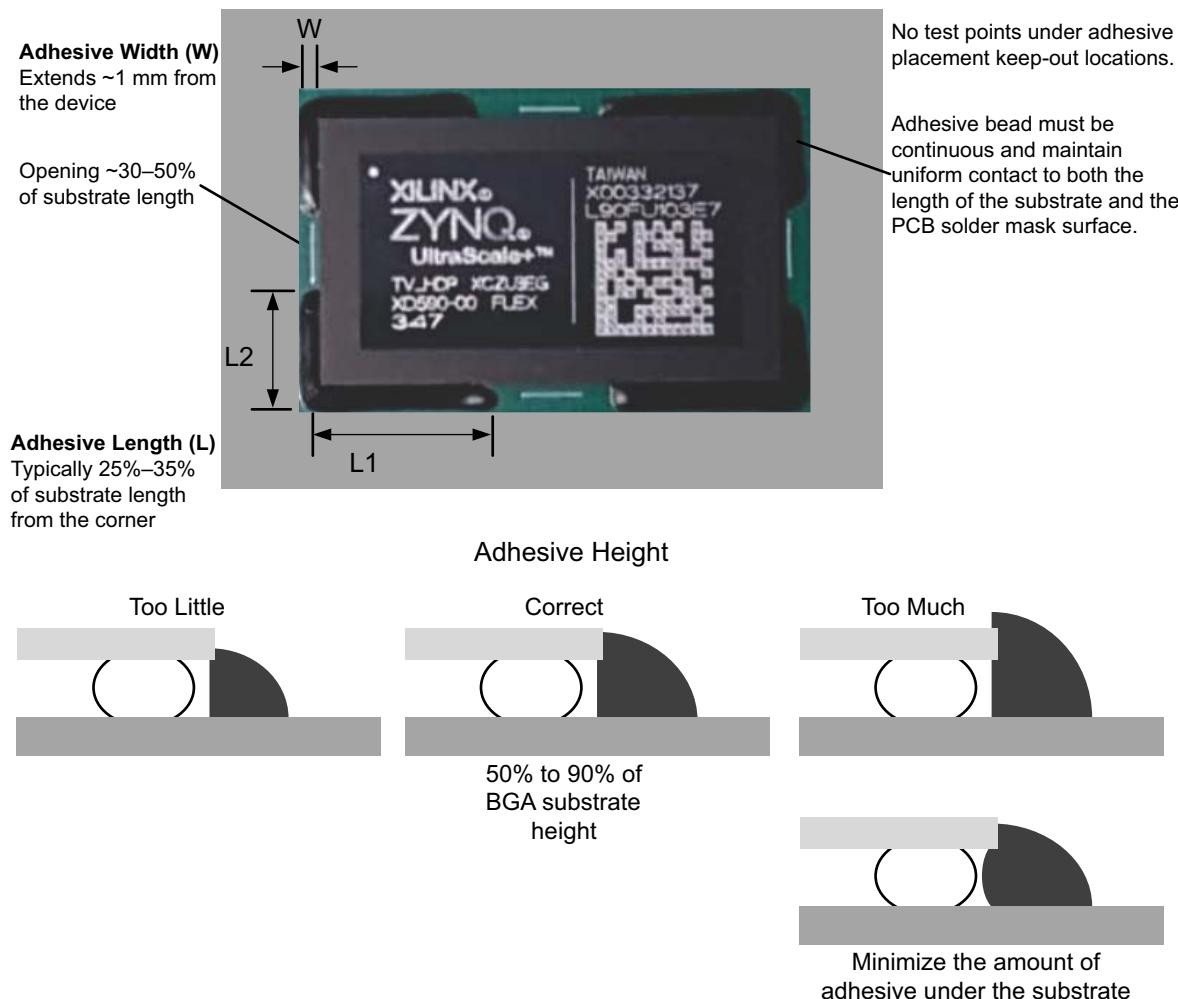
Table 10-2: Process Parameters for Edge Bonding

Process Parameter	Range Specification
Needle size	25–20 gauge
Needle height	Above the device edge midpoint, or 0 to 1.5 mm below the device top surface

Table 10-2: Process Parameters for Edge Bonding (Cont'd)

Process Parameter	Range Specification
Needle edge spacing	Half to three quarters of the needle outer diameter (D)  X23147-090519
Dispense needle speed	0.1 to 200 mm/second (typical 15 mm/sec)
Valve pressure	20 to 60 psi (typical 25 psi)

The adhesive is dispensed along the perimeter of the assembled component at a width of 3 mm and a height of 50% to 90% the substrate height, leaving a small section at the center of each edge unbonded, as illustrated in [Figure 10-3](#). This is to ensure that there is an outlet for any expansion of the air during processing. Xilinx recommends centering the opening on each side with a width of 25–30% the length of the package substrate. The exact locations and size of the openings can be varied depending on the design and rework.



X25244-040821

Figure 10-3: Edge Bonding Adhesive Placement Parameters

**RECOMMENDED:** Curing conditions are 155°C for 10 minutes.

## Component Clearance Surrounding Edge Bond

An adjacent component clearance surrounding the Xilinx device is necessary to have the 30° to 45° angle required by the edge bond dispenser to dispense the edge bond adhesive material. The surrounding component height and distance from the device is validated based on each unique product design layout.

## Edge Bond Removal

Edge bond material can be removed by heating to 170–180°C, and scraping using a stiff probe made of stable organic material such as a non-resinous wood or Teflon. Use a hot air blower on the edge bond area and slowly remove the edge bond adhesive from side to side. Do not use force to remove the edge bond adhesive. Excess adhesive on the PCB can be removed using a chisel-tip soldering iron, with sufficient precautions to limit damage to the PCB surface.

# Thermal Specifications

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## Introduction

Zynq® UltraScale+™ devices are offered exclusively in thermally efficient flip-chip BGA packages. These flip-chip packages range in pin-count from the smaller 19 x 19 mm SBVA484 to the 45 x 45 mm FFVE1924. This suite of packages is used to address the various power requirements of the Zynq UltraScale+ devices. Zynq UltraScale+ devices are implemented in the 16 nm process technology.

Unlike features in an ASIC, the combination of Zynq UltraScale+ device features used in a user application is not known to the component supplier. Therefore, it remains a challenge for Xilinx to predict the power requirements of a given Zynq UltraScale+ device when it leaves the factory. Accurate estimates are obtained when the board design takes shape. For this purpose, Xilinx offers and supports a suite of integrated device power analysis tools to help users quickly and accurately estimate their design power requirements. Zynq UltraScale+ devices are supported similarly to previous products. The uncertainty of design power requirements makes it difficult to apply canned thermal solutions to fit all users. Therefore, Xilinx devices do not come with preset thermal solutions. Your design's operating conditions dictate the appropriate solution.

## Thermal Resistance Data

**Table 11-1** shows the thermal resistance data for Zynq UltraScale+ devices (grouped in the packages offered). The data includes junction-to-ambient in still air, junction-to-case, and junction-to-board data based on standard JEDEC four-layer measurements.

**IMPORTANT:** *The data in Table 11-1 is for device/package comparison purposes only. Attempts to recreate this data are only valid using the transient 2-phase measurement techniques outlined in JESD51-14. Do not use these values for thermal simulations. Use the [Package Thermal Models \[Ref 23\]](#).*

**TIP:** *The thermal data query for all available devices by package is available on the Xilinx website: [www.xilinx.com/cgi-bin/thermal/thermal.pl](http://www.xilinx.com/cgi-bin/thermal/thermal.pl).*

**IMPORTANT:** *All packages are available with eutectic BGA balls. To order these packages, the device type starts with an XQ vs. XC or XA, and the Pb-free signifier in the package name is Q (for example: FFQE1156). Refer to the Pb-free version of these packages for their thermal resistance data and thermal models.*

**Table 11-1: Thermal Resistance Data**

Package	Package Body Size	Devices	$\theta_{JB}$ (1) (°C/W)	$\theta_{JC}$ (1) (°C/W)	$\theta_{JA}$ (1) (°C/W)	$\theta_{JA-Effective}$ (°C/W) (2)		
			@250 LFM	@500 LFM	@750 LFM			
SBVA484	19 x 19	XCZU1	3.35	0.09	16.9	12.5	10.5	9.7
		XCZU2	2.46	0.06	14.9	11.5	9.6	8.9
		XCZU3	2.46	0.06	14.9	11.5	9.6	8.9
		XAZU2EG	2.46	0.06	14.9	11.5	9.6	8.9
		XAZU3EG	2.46	0.06	14.9	11.5	9.6	8.9
SFRA484	19 x 19	XQZU3EG	2.70	0.43	15.3	11.7	9.8	9.1
UBVA494	15 x 9.5	XCZU1	2.28	0.03	22.4	19.7	16.5	15.0
UBVA530	16 x 9.5	XCZU2	2.28	0.03	22.4	19.7	16.5	15.0
		XCZU3	2.28	0.03	22.4	19.7	16.5	15.0
SFVA625	21 x 21	XCZU1	2.58	0.52	13.8	10.2	8.6	8.0
		XCZU2	2.22	0.38	13.2	9.9	8.3	7.8
		XCZU3	2.22	0.38	13.2	9.9	8.3	7.8
		XAZU2EG	2.22	0.38	13.2	9.9	8.3	7.8
		XAZU3EG	2.22	0.38	13.2	9.9	8.3	7.8

Table 11-1: Thermal Resistance Data (Cont'd)

Package	Package Body Size	Devices	$\theta_{JB}$ (1) (°C/W)	$\theta_{JC}$ (1) (°C/W)	$\theta_{JA}$ (1) (°C/W)	$\theta_{JA-Effective}$ (°C/W) (2)		
			@250 LFM	@500 LFM	@750 LFM			
SFVC784	23 x 23	XCZU1	2.50	0.49	12.5	9.1	7.6	7.1
		XCZU2	2.67	0.50	12.8	9.2	7.8	7.2
		XCZU3	2.67	0.50	12.8	9.2	7.8	7.2
		XCZU4	2.28	0.27	12.2	8.9	7.4	7.0
		XCZU5	2.28	0.27	12.2	8.9	7.4	7.0
		XAZU2EG	2.67	0.50	12.8	9.2	7.8	7.2
		XAZU3EG	2.67	0.50	12.8	9.2	7.8	7.2
		XAZU4EV	2.28	0.27	12.2	8.9	7.4	7.0
		XAZU5EV	2.28	0.27	12.2	8.9	7.4	7.0
SFRC784	23 x 23	XQZU3EG	2.44	0.42	12.4	9.0	7.6	7.1
		XQZU5EV	2.26	0.27	12.1	8.9	7.4	7.0
FBVB900	31 x 31	XCZU4	2.62	0.04	9.6	6.3	5.3	5.0
		XCZU5	2.62	0.04	9.6	6.3	5.3	5.0
		XCZU7	2.32	0.03	9.2	6.1	5.1	4.8
		XAZU7	2.32	0.03	9.2	6.1	5.1	4.8
FFRB900	31 x 31	XQZU5EV	2.26	0.27	9.1	6.1	5.1	4.8
		XQZU7EV	2.14	0.19	8.9	6.0	5.0	4.8
FFVC900	31 x 31	XCZU6	2.33	0.25	9.2	6.1	5.1	4.9
		XCZU9	2.33	0.25	9.2	6.1	5.1	4.9
		XCZU15	2.25	0.18	9.1	6.1	5.1	4.8
FFRC900	31 x 31	XQZU9EG	2.10	0.18	8.9	6.0	5.0	4.7
		XQZU15EG	2.07	0.17	8.9	6.0	5.0	4.7
FFVB1156	35 x 35	XCZU6	2.40	0.20	8.3	5.3	4.5	4.2
		XCZU9	2.40	0.20	8.3	5.3	4.5	4.2
		XCZU15	2.09	0.23	7.9	5.1	4.3	4.1
FFRB1156	35 x 35	XQZU9EG	2.09	0.18	7.9	5.1	4.3	4.1
		XQZU15EG	2.06	0.17	7.9	5.1	4.3	4.1
FFVC1156	35 x 35	XCZU7	2.39	0.21	8.3	5.3	4.5	4.2
		XCZU11	2.20	0.16	8.0	5.2	4.3	4.1
FFRC1156	35 x 35	XQZU7EV	2.12	0.19	7.9	5.2	4.3	4.1
		XQZU11EG	2.01	0.15	7.8	5.1	4.3	4.1
FFVD1156	35 x 35	XCZU21DR	1.94	0.16	7.8	5.1	4.2	4.0
FFRD1156	35 x 35	XQZU21DR	1.94	0.16	7.8	5.1	4.2	4.0

Table 11-1: Thermal Resistance Data (Cont'd)

Package	Package Body Size	Devices	$\theta_{JB}$ <sup>(1)</sup> ( $^{\circ}\text{C}/\text{W}$ )	$\theta_{JC}$ <sup>(1)</sup> ( $^{\circ}\text{C}/\text{W}$ )	$\theta_{JA}$ <sup>(1)</sup> ( $^{\circ}\text{C}/\text{W}$ )	$\theta_{JA\text{-Effective}}$ ( $^{\circ}\text{C}/\text{W}$ ) <sup>(2)</sup>		
			@250 LFM	@500 LFM	@750 LFM			
FFVE1156	35 x 35	XCZU25DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU27DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU28DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU42DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU43DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU47DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU48DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU65DR	1.94	0.16	7.8	5.1	4.2	4.0
		XCZU67DR	1.94	0.16	7.8	5.1	4.2	4.0
FFRE1156	35 x 35	XQZU28DR	1.93	0.11	7.7	5.1	4.2	4.0
FSVE1156	35 x 35	XCZU25DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU27DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU28DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU42DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU43DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU47DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU48DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU65DR	2.40	0.02	8.3	5.3	4.4	4.2
		XCZU67DR	2.40	0.02	8.3	5.3	4.4	4.2
FFVB1517	40 x 40	XCZU11	2.22	0.16	7.1	4.4	3.7	3.5
		XCZU17	2.17	0.11	7.0	4.4	3.7	3.5
		XCZU19	2.17	0.11	7.0	4.4	3.7	3.5
FFRB1517	40 x 40	XQZU19EG	1.90	0.11	6.8	4.3	3.5	3.4
FFVF1517	40 x 40	XCZU7	2.38	0.21	7.3	4.5	3.8	3.6
		XCZU11	2.22	0.16	7.1	4.4	3.7	3.5
		XAZU11	2.22	0.16	7.1	4.4	3.7	3.5
FFVG1517	40 x 40	XCZU25DR	1.93	0.16	6.8	4.3	3.6	3.4
		XCZU27DR	1.93	0.16	6.8	4.3	3.6	3.4
		XCZU28DR	1.93	0.16	6.8	4.3	3.6	3.4
		XCZU43DR	1.93	0.16	6.8	4.3	3.6	3.4
		XCZU47DR	1.93	0.16	6.8	4.3	3.6	3.4
		XCZU48DR	1.93	0.16	6.8	4.3	3.6	3.4
FFRG1517	40 x 40	XQZU28DR	1.93	0.16	6.8	4.3	3.6	3.4
FSRG1517	40 x 40	XQZU48DR	2.43	0.02	7.3	4.5	3.8	3.6

Table 11-1: Thermal Resistance Data (Cont'd)

Package	Package Body Size	Devices	$\theta_{JB}$ (1) (°C/W)	$\theta_{JC}$ (1) (°C/W)	$\theta_{JA}$ (1) (°C/W)	$\theta_{JA\text{-Effective}}$ (°C/W) (2)		
			@250 LFM	@500 LFM	@750 LFM			
FSVG1517	40 x 40	XCZU25DR	2.43	0.02	7.3	4.5	3.8	3.6
		XCZU27DR	2.43	0.02	7.3	4.5	3.8	3.6
		XCZU28DR	2.43	0.02	7.3	4.5	3.8	3.6
		XCZU43DR	2.43	0.02	7.3	4.5	3.8	3.6
		XCZU47DR	2.43	0.02	7.3	4.5	3.8	3.6
		XCZU48DR	2.43	0.02	7.3	4.5	3.8	3.6
FFVC1760	42.5 x 42.5	XCZU11	1.96	0.14	6.4	4.0	3.3	3.2
		XCZU17	1.77	0.10	6.3	3.9	3.2	3.1
		XCZU19	1.77	0.10	6.3	3.9	3.2	3.1
FFRC1760	42.5 x 42.5	XQZU11EG	1.96	0.14	6.4	4.0	3.3	3.2
		XQZU19EG	1.77	0.10	6.3	3.9	3.2	3.1
FFVD1760	42.5 x 42.5	XCZU17	1.77	0.10	6.3	3.9	3.2	3.1
		XCZU19	1.77	0.10	6.3	3.9	3.2	3.1
FFVF1760	42.5 x 42.5	XCZU29DR	2.04	0.17	6.5	4.0	3.3	3.2
		XCZU39DR	2.04	0.17	6.5	4.0	3.3	3.2
		XCZU49DR	2.04	0.17	6.5	4.0	3.3	3.2
FFVH1760	42.5 x 42.5	XCZU46DR	2.04	0.17	6.5	4.0	3.3	3.2
FFRF1760	42.5 x 42.5	XQZU29DR	2.04	0.17	6.5	4.0	3.3	3.2
FSRF1760	42.5 x 42.5	XQZU49DR	2.47	0.02	7.0	4.3	3.5	3.6
FSVF1760	42.5 x 42.5	XCZU29DR	2.47	0.02	7.0	4.3	3.5	3.6
		XCZU39DR	2.47	0.02	7.0	4.3	3.5	3.6
		XCZU49DR	2.47	0.02	7.0	4.3	3.5	3.6
FSVH1760	42.5 x 42.5	XCZU46DR	2.47	0.02	7.0	4.3	3.5	3.6
FFVE1924	45 x 45	XCZU17	1.77	0.10	5.9	3.6	3.0	2.9
		XCZU19	1.77	0.10	5.9	3.6	3.0	2.9

**Notes:**

- This data is for device/package comparison purposes only. Attempts to recreate this data are only valid using the transient 2-phase measurement techniques outlined in JESD51-14. Do not use these values for thermal simulations. Use the [Package Thermal Models \[Ref 23\]](#).
- All  $\theta_{JA\text{-Effective}}$  values assume no heat sink and include thermal dissipation through a standard JEDEC four-layer board. The Xilinx power estimation tools (Vivado® Power Analysis, and Xilinx Power Estimator), which require detailed board dimensions and layer counts, are useful for deriving more precise  $\theta_{JA\text{-Effective}}$  values.

## Support for Thermal Models

Table 11-1 provides the traditional thermal resistance data for Zynq UltraScale+ devices. These resistances are measured using a prescribed JEDEC standard that might not necessarily reflect your actual board conditions and environment. The quoted  $\theta_{JA}$  and  $\theta_{JC}$  numbers are environmentally dependent, and JEDEC has traditionally recommended that these be used with that awareness. For more accurate junction temperature prediction, these might not be enough, and a system-level thermal simulation might be required.

Though Xilinx continues to support these figures of merit data, for Zynq UltraScale+ devices, boundary conditions independent thermal resistor network (Delphi) models are offered for all Zynq UltraScale+ devices. These compact models seek to capture the thermal behavior of the packages more accurately at predetermined critical points (junction, case, top, leads, and so on) with the reduced set of nodes as illustrated in Figure 11-1.

Unlike a full 3D model, these are computationally efficient and work well in an integrated system simulation environment. Delphi models are available for download on the Xilinx website (under the [Device Model tab](#)).

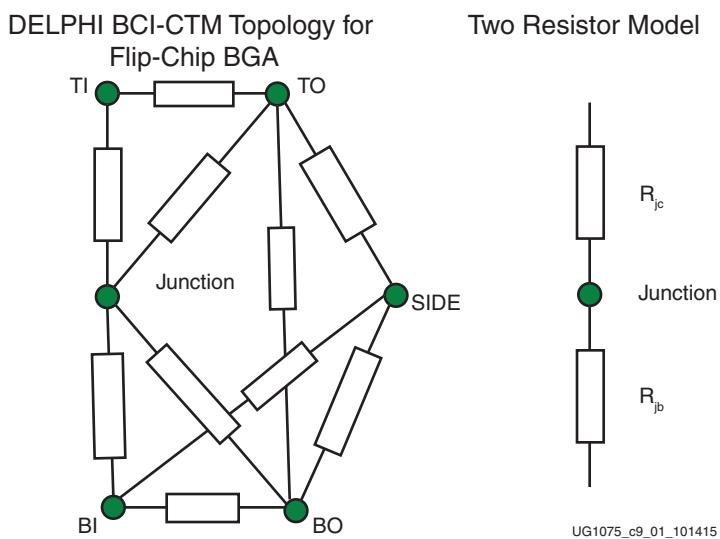


Figure 11-1: Thermal Model Topologies



**RECOMMENDED:** Xilinx recommends the use of the Delphi thermal model. Xilinx also recommends a best practice review of manufacturing variations on the thermal performance of the device from both the thermal interface material parameters and thermal solution variations. Examples of manufacture variations include the tolerance in airflow from a fan, the tolerance on performance of the heat pipe and vapor chamber, and manufacturing variations of the attachment of fins to the heat-sink base and the flatness of the surface.

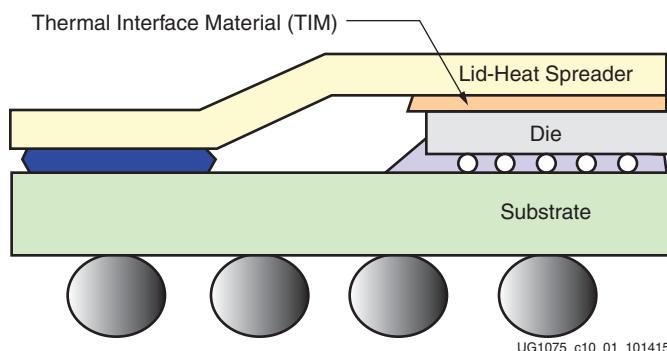
# Thermal Management Strategy

## Introduction

As described in this section, Xilinx relies on a multi-pronged approach to consuming less power and dissipating heat for systems using Zynq® UltraScale+™ devices.

## Flip-Chip Packages

Zynq UltraScale+ devices are offered in flip-chip BGA packages, which present a low thermal path. With the exception of the bare-die packages, the flip-chip BGA packages incorporate a heat spreader with an additional thermal interface material (TIM), as shown in [Figure 12-1](#).



*Figure 12-1: Heat Spreader with Thermal Interface Material*

Materials with better thermal conductivity and consistent process deliver low thermal resistance to the heat spreader.

A parallel effort to ensure optimized package electrical return paths produces the added benefit of enhanced power and ground plane arrangement in the packages. A boost in copper density on the planes improves the overall thermal conductivity through the laminate. In addition, the extra dense and distributed via fields in the package increase the vertical thermal conductivity.

## System Level Heat Sink Solutions

To complete a comprehensive thermal management strategy, an overall thermal budget that includes custom or OEM heat sink solutions depends on the physical and mechanical constraints of the system. A heat-sink solution, managed by the system-level designer, should be tailored to the design and specific system constraints. This includes understanding the inherent device capabilities for delivering heat to the surface.

By considering the system's physical, mechanical, and environmental constraints, the overall thermal budget is maintained and does not exceed the device's maximum operating temperature. The heat sink is an integral part of the thermal management solution to maintain a safe operating temperature. As a result, the system-level designer must be aware of the following:

- For lidless packages, the nominal stiffener height can be different from the height of the die. Therefore, the heat sink must have an island to contact the die.
- Especially for lidless packages, Xilinx advises against direct use of the  $\theta_{JC}$  parameters (see [Table 11-1](#)) to determine the thermal performance of the device in your application. The calculation of these parameters are done in accordance with the JEDEC standard JESD51 where system parameters differ greatly from most applications. Instead, run thermal simulations of the system in worst-case environmental conditions using Delphi thermal models, which more accurately represent the device thermal performance under all boundary conditions.
- Consider the mechanical specifications of the package as well as the selection of the thermal interface between the die and the thermal management solution to ensure the lowest thermal contact resistance.
- The total thermal contact of the thermal interface material is determined based on parameters from the thermal interface supplier's data sheet.
- See the applied pressure recommendation on [page 300](#). Lower pressure runs the risk of poor thermal contact and higher pressure runs the risk of damaging the device; therefore, strict control of pressure is required.
- Consider all uncertainties in thermal modeling, including manufacturing variations from the thermal solutions (for example, fan airflow tolerance, heat pipe or vapor chamber performance tolerance, variation of the attachment of fins to heat sink base, and surface flatness).

## Thermal Interface Material

When installing heat sinks for Zynq UltraScale+ devices, a suitable thermal interface material (TIM) must be used. This thermal material significantly aids the transfer of heat from the component to the heat sink.

For bare-die flip-chip BGAs, the surface of the silicon contacts the heat sink. For lidded flip-chip BGAs, the lid contacts the heat sink. The surface size of the bare-die flip-chip BGA and lidded flip-chip BGAs are different. Xilinx recommends a different type of thermal material for long-term use with each type of flip-chip BGAs package.

Thermal interface material is needed because even the largest heat sink and fan cannot effectively cool an Zynq UltraScale+ device unless there is good physical contact between the base of the heat sink and the top of the Zynq UltraScale+ device. The surfaces of both the heat sink and the Zynq UltraScale+ device silicon are not absolutely smooth. This surface roughness is observed when examined at a microscopic level. Because surface roughness reduces the effective contact area, attaching a heat sink without a thermal interface material is not sufficient due to inadequate surface contact.

A thermal interface material such as phase-change material, thermal grease, or thermal pads fills these gaps and allows effective transference of heat between the Zynq UltraScale+ device die and the heat sink.

The selection of the thermal interface (TIM) between the package and the thermal management solution is critical to ensure the lowest thermal contact resistance. Therefore, the following parameters must be considered.

1. The flatness of the lid and the flatness of the contact surface of the thermal solution.
2. The applied pressure of the thermal solution on the package, which must be within the allowable maximum pressure that can be applied on the package.
3. The total thermal contact of the thermal interface material. This value is determined based on the parameters in [step 1](#) and [step 2](#), which are published in the data sheet of the thermal interface supplier.

## Types of TIM

There are many type of TIM available for sale. The most commonly used thermal interface materials are listed.

- Thermal grease
- Thermal pads
- Phase change material
- Thermal paste
- Thermal adhesives
- Thermal tape

## Guidelines for Thermal Interface Materials

Five factors affect the choice, use, and performance of the interface material used between the processor and the heat sink:

- Thermal Conductivity of the Material
- Electrical Conductivity of the Material
- Spreading Characteristics of the Material
- Long-Term Stability and Reliability of the Material
- Ease of Application
- Applied Pressure from Heat Sink to the Package via Thermal Interface Materials

### ***Thermal Conductivity of the Material***

Thermal conductivity is the quantified ability of any material to transfer heat. The thermal conductivity of the interface material has a significant impact on its thermal performance. The higher the thermal conductivity, the more efficient the material is at transferring heat. Materials that have a lower thermal conductivity are less efficient at transferring heat, causing a higher temperature differential to exist across the interface. To overcome this less efficient heat transfer, a better cooling solution (typically, a more costly solution) must be used to achieve the desired heat dissipation.

### ***Electrical Conductivity of the Material***

Some metal-based TIM compounds are electrically conductive. Ceramic-based compounds are typically not electrically conductive. Manufacturers produce metal-based compounds with low-electrical conductivity, but some of these materials are not completely electrically inert. Metal-based thermal compounds are not hazardous to the Zynq UltraScale+ device die itself, but other elements on the Zynq UltraScale+ device or motherboard can be at risk

if they become contaminated by the compound. For this reason, Xilinx does not recommend the use of electrically conductive thermal interface material.

### ***Spreading Characteristics of the Material***

The spreading characteristics of the thermal interface material determines its ability, under the pressure of the mounted heat sink, to spread and fill in or eliminate the air gaps between the Zynq UltraScale+ device and the heat sink. Because air is a very poor thermal conductor, the more completely the interface material fills the gaps, the greater the heat transference.

### ***Long-Term Stability and Reliability of the Material***

The long-term stability and reliability of the thermal interface material is described as the ability to provide a sufficient thermal conductance even after an extended time or extensive. Low-quality compounds can harden or leak out over time (the pump-out effect), leading to overheating or premature failure of the Zynq UltraScale+ device. High-quality compounds provide a stable and reliable thermal interface material throughout the lifetime of the device. Thermal greases with higher viscosities are typically more resistant to pump out effects on bare-die devices.

### ***Ease of Application***

A spreadable thermal grease requires the surface mount supplier to carefully use the appropriate amount of material. Too much or too little material can cause problems. The thermal pad is a fixed size and is therefore easier to apply in a consistent manner.

### ***Applied Pressure from Heat Sink to the Package via Thermal Interface Materials***



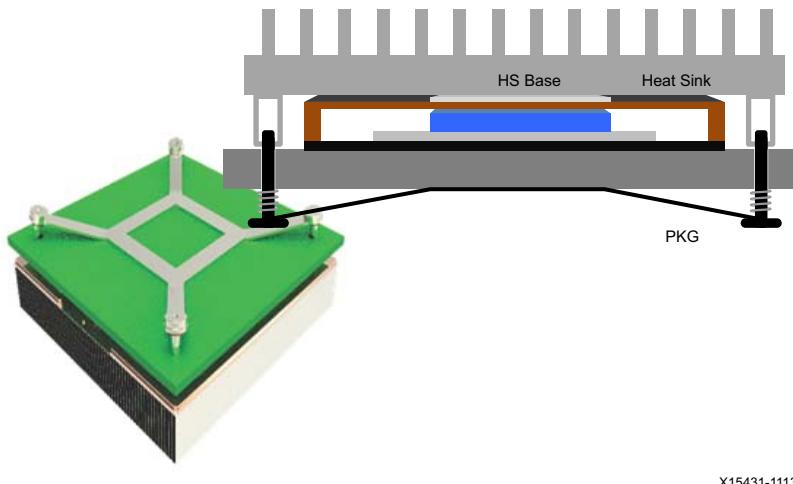
**IMPORTANT:** The following table shows the required applied pressure on the thermal interface material (TIM) between the package and the heat sink. Thermocouples should not be present between the package and the heat sink, as their presence will degrade the thermal contact and result in incorrect thermal measurements. The best practice is to select the appropriate pressure for the optimum thermal contact performance between the package and the thermal system solution, and the mechanical integrity of the package (with the thermal solution to pass all mechanical stress and vibration qualification tests).

Table 12-1: Required Applied Pressure by Package Type

Package Type	Supported Pressure Range (PSI)
0.8 mm and 1.0 mm pitch	20 to 50 PSI
InFO packages (e.g., UBVA530)	3 to 5 PSI



**RECOMMENDED:** Xilinx recommends using dynamic mounting around the four corners of the device package. On the PCB, use a bracket clip as part of the heat sink attachment to provide mechanical package support. See [Figure 12-2](#).



X15431-111316

**Figure 12-2: Dynamic Mounting and Bracket Clips on Heat Sink Attachment**

## Heat Sink Removal

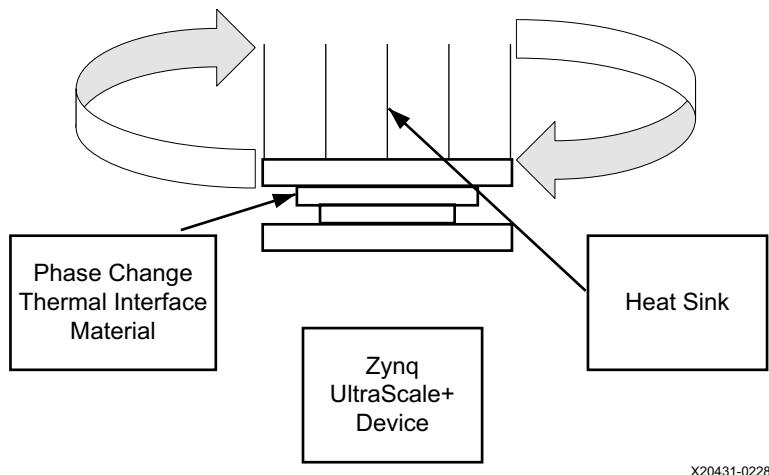
When removing or reworking heat sinks, the phase-change material residue must be removed from the surface of the die. Laird Technologies, Inc. provides the following guidance for complete removal of the phase-change material from the component.

### Instructions for Removal of Phase-change Material

1. [Separate the Components](#)
2. [Scrape Away Thick Residue](#)
3. [Clean Remaining Residue with Solvent](#)
4. [Working with Laird Material](#)

#### ***Separate the Components***

At room temperature, if possible, use a back and forth twisting motion to break the bond between the phase-change thermal interface material and mated components (i.e., heat sink and Zynq UltraScale+ device). See [Figure 12-3](#).



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**Figure 12-3: Breaking the Bond between Thermal Interface Material and Mated Components**

For smaller components (typically 15 mm x 15 mm or less), the bond usually breaks free easily at room temperature. For larger components, in situations where minimal movement is available, or if using fragile components, heat the component (preferred) or heat sink to about 40°C–60°C before removal.

The guideline is 40°C–60°C, however, you might find that for your application, heating to 35°C is adequate. You might prefer to heat to 70°C which makes the phase-change thermal interface material very soft and the components can be easily separated.

### **Scrape Away Thick Residue**

For a faster clean-up once components are separated, scrape away any large residual material amounts with a plastic spatula or a wooden tongue depressor. A clean dry rag can be used to wipe away excess material.

### **Clean Remaining Residue with Solvent**

Using a clean cloth/wipe, wet it with your choice of solvent (see the following list) and wipe away any remaining residue.

- Toluene (easiest)
- Acetone (very good)
- Isoparaffinic hydrocarbon: Isopar, Soltrol (trade names) (very good)
- Isopropyl alcohol (OK)

### ***Working with Laird Material***

Safe handling, disposal, and first-aid measures for working with phase-change material are included in the Laird Technologies material safety data sheet (MSDS). Read the MSDS before using or handling. See the Laird Technologies, Inc. website, [www.lairdtech.com](http://www.lairdtech.com).

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## **Measurement Debug**

When performing in-system thermal testing, to ensure accurate data and not incur damage to the device, do not place a thermocouple in between the device and the heat sink. On the extreme side, it might cause additional mechanical and/or thermal stress to the device, leading to damage. Even if damage does not occur, it often leads to a thicker and or uneven thermal interface material thickness, leading to a thermal performance difference from a system without a thermocouple. To obtain the device temperature, use the System Monitor as a non-invasive means to get accurate device measurements while debugging the system.

# Heat Sink Guidelines for Bare-die Flip-Chip Packages

## Heat Sink Attachments for Bare-die FB Packages

Heat sinks can be attached to the package in multiple ways. For heat to dissipate effectively, the advantages and disadvantages of each heat sink attachment method must be considered. Factors influencing the selection of the heat sink attachment method include the package type, contact area of the heat source, and the heat sink type.

## Silicon and Decoupling Capacitors Height Consideration

When designing heat sink attachments for bare-die flip-chip BGA packages, the height of the die above the substrate and also the height of decoupling capacitors must be considered (Figure 13-1). This is to prevent electrical shorting between the heat sink (metal) and the decoupling capacitors.

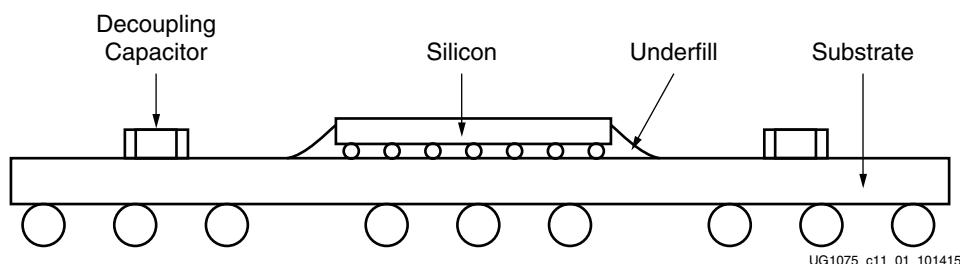


Figure 13-1: Cross Section of Bare-die Flip-chip BGA

## Types of Heat Sink Attachments

There are six main methods for heat sink attachment. [Table 13-1](#) lists their advantages and disadvantages.

- Thermal tape
- Thermally conductive adhesive or glue
- Wire form Z-clips
- Plastic clip-ons
- Threaded stand-offs (PEMs) and compression springs
- Push-pins and compression springs

*Table 13-1: Heat Sink Attachment Methods*

Attachment Method	Advantages	Disadvantages
Thermal tape	<ul style="list-style-type: none"> <li>• Generally easy to attach and is inexpensive.</li> <li>• Lowest cost approach for aluminum heat sink attachment.</li> <li>• No additional space required on the PCB.</li> </ul>	<ul style="list-style-type: none"> <li>• The surfaces of the heat sink and the chip must be very clean to allow the tape to bond correctly.</li> <li>• Because of the small contact area, the tape might not provide sufficient bond strength.</li> <li>• Tape is a moderate to low thermal conductor that could affect the thermal performance.</li> </ul>
Thermally conductive adhesive or glue	<ul style="list-style-type: none"> <li>• Outstanding mechanical adhesion.</li> <li>• Fairly inexpensive, costs a little more than tape.</li> <li>• No additional space required on the PCB.</li> </ul>	<ul style="list-style-type: none"> <li>• Adhesive application process is challenging and it is difficult to control the amount of adhesive to use.</li> <li>• Difficult to rework.</li> <li>• Because of the small contact area, the adhesive might not provide sufficient bond strength.</li> </ul>
Wire form Z-clips	<ul style="list-style-type: none"> <li>• It provides a strong and secure mechanical attachment. In environments that require shock and vibration testing, this type of strong mechanical attachment is necessary.</li> <li>• Easy to apply and remove. Does not cause the semiconductors to be destroyed (epoxy and occasionally tape can destroy the device).</li> <li>• It applies a preload onto the thermal interface material (TIM). Pre-loads actually improve thermal performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires additional space on the PCB for anchor locations.</li> </ul>

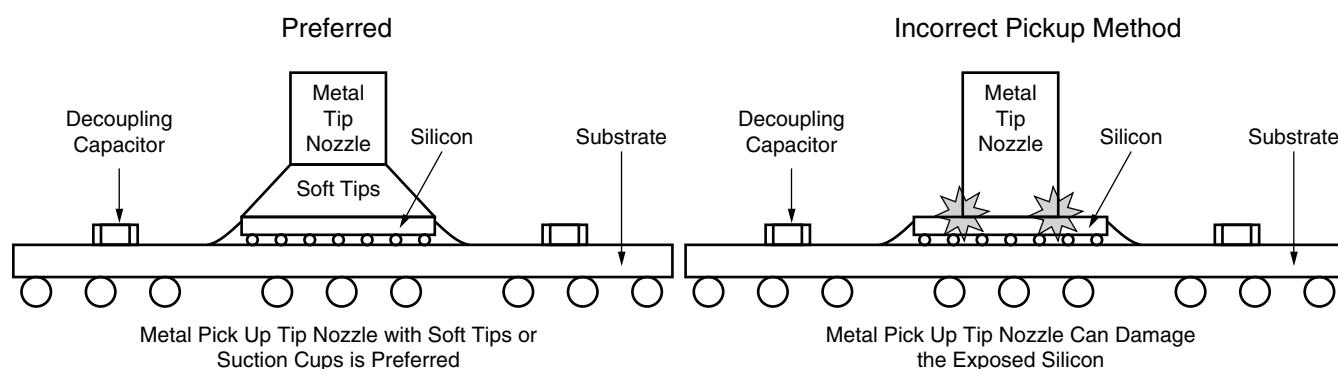
Table 13-1: Heat Sink Attachment Methods (Cont'd)

Attachment Method	Advantages	Disadvantages
Plastic clip-ons	<ul style="list-style-type: none"> <li>Suitable for designs where space on the PCB is limited.</li> <li>Easy to rework by allowing heat sinks to be easily removed and reapplied without damaging the PCB board.</li> <li>Can provide a strong enough mechanical attachment to pass shock and vibration test.</li> </ul>	<ul style="list-style-type: none"> <li>Needs a keep out area around the silicon devices to use the clip.</li> <li>Caution is required when installing or removing clip-ons because localized stress can damage the solder balls or chip substrate.</li> </ul>
Threaded stand-offs (PEMs) and compression springs	<ul style="list-style-type: none"> <li>Provides stable attachments to heat source and transfers load to the PCB, backing plate, or chassis.</li> <li>Suitable for high mass heat sinks.</li> <li>Allows for tight control over mounting force and load placed on chip and solder balls.</li> </ul>	<ul style="list-style-type: none"> <li>Holes are required in the PCB taking valuable space that can be used for trace lines.</li> <li>Tends to be expensive, especially since holes need to be drilled or predrilled onto the PCB board to use stand-offs.</li> </ul>
Push-pins and compression springs	<ul style="list-style-type: none"> <li>Provides a stable attachment to a heat source and transfers load to the PCB.</li> <li>Allows for tight control over mounting force and load placed on chip and solder balls.</li> </ul>	<ul style="list-style-type: none"> <li>Requires additional space on the PCB for push-pin locations.</li> </ul>

## Heat Sink Attachment

### Component Pick-up Tool Consideration

For pick-and-place machines to place bare-die flip-chip BGAs onto PCBs, Xilinx recommends using soft tips or suction cups for the nozzles. This prevents chipping, scratching, or even cracking of the bare die (Figure 13-2).



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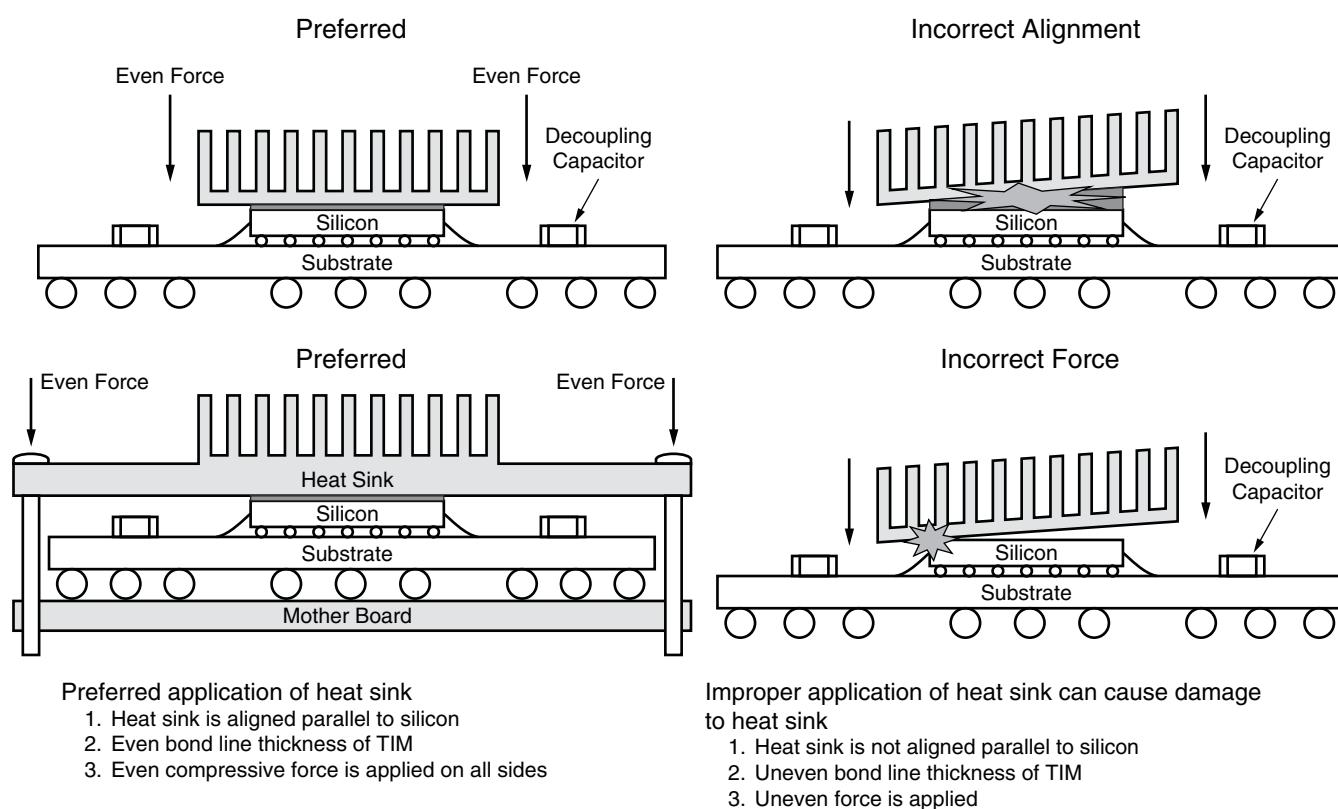
Figure 13-2: Recommended Method For Using Pick-up Tools

## Heat Sink Attachment Process Considerations

After the component is placed onto the PCBs, when attaching a heat sink to the bare-die package, the factors in Table 13-2 must be carefully considered (see Figure 13-3).

Table 13-2: Heat Sink Attachment Considerations

Consideration(s)	Effect(s)	Recommendation(s)
In heat sink attach process, what factors can cause damage to the exposed die and passive capacitors?	<ul style="list-style-type: none"> <li>Uneven heat sink placement</li> <li>Uneven TIM thickness</li> <li>Uneven force applied when placing heat sink placement</li> </ul>	<ul style="list-style-type: none"> <li>Even heat sink placement</li> <li>Even TIM thickness</li> <li>Even force applied when placing heat sink placement</li> </ul>
Does the heat sink tilt or tip the post attachment?	Uneven heat sink placement will damage the silicon and can cause field failures.	<ul style="list-style-type: none"> <li>Careful handling not to contact the heat sink with the post attachment.</li> <li>Use a fixture to hold the heat sink in place with post attachment until it is glued to the silicon.</li> </ul>



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Figure 13-3: Recommended Application of Heat Sink

### Standard Heat Sink Attach Process with Thermal Conductive Adhesive

Prior to attaching the heat sink, the Zynq UltraScale+ device needs be surface mounted on the motherboard.

1. Place the motherboard into a jig or a fixture to hold the motherboard steady to prevent any movement during the heat sink attachment process.
2. Thermoset material (electrically non-conductive) is applied over the backside surface of silicon in a pattern using automated dispensing equipment. Automated dispensers are often used to provide a stable process speed at a relatively low cost. The optimum dispensing pattern needs to be determined by the SMT supplier.

**Note:** Minimal volume coverage of the backside of the silicon can result in non-optimum heat transfer.

3. The heat sink is placed on the backside of the silicon with a pick and place machine. A uniform pressure is applied over the heat sink to the backside of the silicon. As the heat sink is placed, the adhesive spreads to cover the backside silicon. A force transducer is normally used to measure and limit the placement force.
4. The epoxy is cured with heat at a defined time.

**Note:** The epoxy curing temperature and time is based on manufacturer's specifications.

### Standard Heat Sink Attach Process with Thermal Adhesive Tape

Prior to attaching the heat sink, the Zynq UltraScale+ device needs be surface mounted on the motherboard.

1. Place the motherboard into a jig or a fixture to hold the motherboard steady to prevent any movement during the heat sink attachment process.
2. Thermal adhesive tape cut to the size of the heat sink is applied on the underside of the heat sink at a modest angle with the use of a squeegee rubber roller. Apply pressure to help reduce the possibility of air entrapment under the tape during application.
3. The heat sink is placed on the backside of the silicon with a pick and place machine. A uniform pressure is applied over the heat sink to the backside of the silicon. As the heat sink is placed, the thermal adhesive tape is glued to the backside of the silicon. A force transducer is normally used to measure and limit the placement force.
4. A uniform and constant pressure is applied uniformly over the heat sink and held for a defined time.

**Note:** The thermal adhesive tape hold time is based on manufacturer's specifications.

### **Push-Pin and Shoulder Screw Heat Sink Attachment Process with Phase Change Material (PCM) Application**

Prior to attaching the heat sink, the Zynq UltraScale+ device needs be surface mounted on the motherboard.

1. Place the motherboard into a jig or a fixture to hold the motherboard steady to prevent any movement during the heat sink attachment process.

**Note:** The jig or fixture needs to account for the push pin depth of the heat sink.

2. PCM tape, cut to the size of the heat sink, is applied on the underside of the heat sink at a modest angle with the use of a squeegee rubber roller. Apply pressure to help reduce the possibility of air entrapment under the tape during application.
3. Using the push-pin tool, heat sinks are applied over the packages ensuring a pin locking action with the PCB holes. The compression load from springs applies the appropriate mounting pressure required for proper thermal interface material performance.

**Note:** Heat sinks must not tilt during installation. This process cannot be automated due to the mechanical locking action which requires manual handling. The PCB drill hole tolerances need to be close enough to eliminate any issues concerning the heat sink attachment.

# Additional Resources and Legal Notices

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## Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see [Xilinx Support](#).

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## Solution Centers

See the [Xilinx Solution Centers](#) for support on devices, software tools, and intellectual property at all stages of the design cycle. Topics include design assistance, advisories, and troubleshooting tips.

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## Documentation Navigator and Design Hubs

Xilinx® Documentation Navigator provides access to Xilinx documents, videos, and support resources, which you can filter and search to find information. To open the Xilinx Documentation Navigator (DocNav):

- From the Vivado® IDE, select **Help > Documentation and Tutorials**.
- On Windows, select **Start > All Programs > Xilinx Design Tools > DocNav**.
- At the Linux command prompt, enter docnav.

Xilinx Design Hubs provide links to documentation organized by design tasks and other topics, which you can use to learn key concepts and address frequently asked questions. To access the Design Hubs:

- In the Xilinx Documentation Navigator, click the **Design Hubs View** tab.
- On the Xilinx website, see the [Design Hubs](#) page.

**Note:** For more information on Documentation Navigator, see the [Documentation Navigator](#) page on the Xilinx website.

## References

1. Zynq UltraScale+ MPSoC Overview ([DS891](#))
2. Zynq UltraScale+ RFSoC Overview ([DS889](#))
3. XQ UltraScale Architecture Data Sheet: Overview ([DS895](#))
4. XA Zynq UltraScale+ MPSoC Data Sheet: Overview ([DS894](#))
5. Zynq UltraScale+ device [Packaging Specifications](#)
6. UltraScale Architecture SelectIO Resources User Guide ([UG571](#))
7. UltraScale Architecture Clocking Resources User Guide ([UG572](#))
8. Zynq UltraScale+ MPSoC Data Sheet: DC and AC Switching Characteristics ([DS925](#))
9. Zynq UltraScale+ RFSoC Data Sheet: DC and AC Switching Characteristics ([DS926](#))
10. Zynq UltraScale+ Device Technical Reference Manual ([UG1085](#))
11. UltraScale Architecture GTH Transceiver User Guide ([UG576](#))
12. UltraScale Architecture GTY Transceiver User Guide ([UG578](#))
13. UltraScale Architecture System Monitor User Guide ([UG580](#))
14. UltraScale Architecture PCB Design Guide ([UG583](#))
15. UltraScale Architecture-Based Memory Interface Solutions Product Guide ([PG150](#))
16. UltraScale Architecture Configuration User Guide ([UG570](#))
17. FAQ: Top Marking Change for 7 Series, UltraScale, and UltraScale+ Products ([XTP424](#))
18. FAQ: Top Marking Change for 7 Series, UltraScale, and UltraScale+ Products ([XTP544](#))
19. MDD files: Click on this link to find the Zynq UltraScale+ devices [Packaging Specifications](#). In step 2 select the product category: SoCs, MPSoCs & RFSoCs. In step 3, select the product type. In step 4, click on the package specifications selection to find the available MDD files. All published MDD files are also available on the [See All Package Specifications](#) page.
20. The following websites contain additional information on heat management and contact information.
  - Wakefield: [www.wakefield-vette.com](http://www.wakefield-vette.com)
  - Aavid: [www.aavid.com](http://www.aavid.com)
  - Advanced Thermal Solutions: [www.qats.com](http://www.qats.com)
  - Radian Thermal Products: [www.radianheatsinks.com](http://www.radianheatsinks.com)
  - Thermo Cool: [www.thermocoolcorp.com](http://www.thermocoolcorp.com)
  - CTS: [www.ctscorp.com](http://www.ctscorp.com)

21. Refer to the following websites for interface material sources:

- Henkel: [www.henkel.com](http://www.henkel.com)
- Bergquist Company: [www.bergquistcompany.com](http://www.bergquistcompany.com)
- AOS Thermal Compound: [www.aosco.com](http://www.aosco.com)
- Chomerics: [www.chomerics.com](http://www.chomerics.com)
- Kester: [www.kester.com](http://www.kester.com)

22. Refer to the following websites for CFD tools Xilinx supports with thermal models.

- Mentor Flotherm: [www.mentor.com/products/mechanical/flotherm/flotherm/](http://www.mentor.com/products/mechanical/flotherm/flotherm/)
- ANSYS Icepak: [www.ansys.com](http://www.ansys.com)

23. Refer to the [Package Thermal Models](#) on [xilinx.com](http://xilinx.com).

24. The following papers are referenced for more information on thermal modeling.

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