Freescale Semiconductor
Reference Manual

VERTICALRM
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VertiCal System

1 VertiCal System Overview

The VertiCal system is designed to enable the use of new enhanced automotive calibration and debug tools on the MPC5500 family of automotive microcontrollers. VertiCal components are available to support a wide range of MPC5500 devices in various package types. All VertiCal hardware is designed to support a standardized tool connector, allowing a variety of calibration and debug hardware to be connected and reused.

Figure 1 shows the main components of a typical VertiCal hardware system. The VertiCal Base can be fitted onto the application printed circuit board (PCB) in place of the standard MPC5500 family microcontroller. A VertiCal compliant top board can then be attached to the VertiCal connector on the top of the VertiCal base. Top boards can range from simple memory expansion hardware to full-calibration and debug systems.

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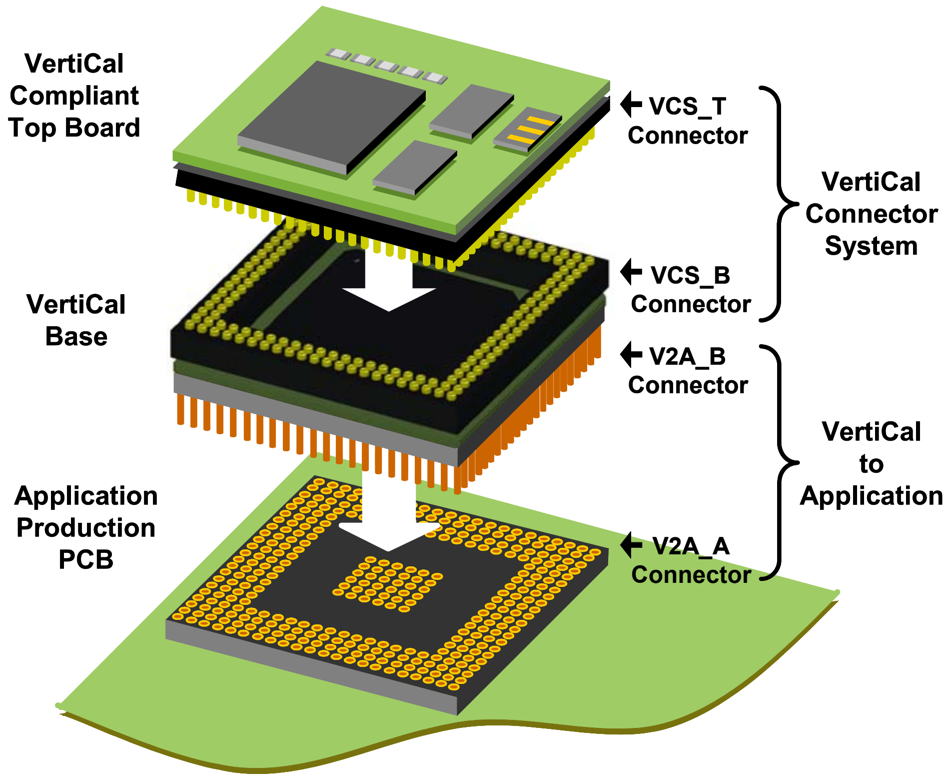


Figure 1. VertiCal System

1.1 VertiCal System Features

VertiCal calibration systems include these distinctive features:

- Use 100% production silicon, ensuring full hardware and software compatibility between production and calibration systems
- Support MCU-sized calibration tools allowing calibration systems to be built without requiring modifications to the standard production system housing
- Standardized hardware across the MPC5500 family, allowing reuse of VertiCal compatible tool hardware and software
- VertiCal interconnect standard supported by multiple calibration tool developers, ensuring maximum flexibility in tool choice
- Support for simplified implementation of overlay memory
- Support for Nexus-based debug tools even if application PCB does not include Nexus connector
- Support for full-feature calibration tools, via availability of comprehensive set of device signals available on VertiCal connector
- Flexibility to support new microcontroller features for prototyping use
- Flexibility to support new debug and calibration features, such as high-speed serial communications
- Allows system calibration without impacting standard MCU I/O resources
- Allows system calibration regardless of availability of standard MCU external bus
- Uses tried and tested technology

2 VertiCal Connector

The standardized 156-pin VertiCal connector system (Figure 1) allows any VertiCal compliant top board to be fitted to any VertiCal base, and provides connections for all signals required for debug and calibration. The female VCS_B connector is fitted on the top side of all VertiCal bases, and a male VCS_T connector is fitted to the underside of all VertiCal compliant top boards. The connectors use a 1 mm pitch grid with three grid positions used for mechanical locating pins. Figure 2 and Figure 3 show the arrangement of signals available on the VCS_B connector.

	1	2	3	4	5	6	7	8	9	10	11
A		●	VC_VSTBY	VC_RDY	VC_MSEO0	VC_MCKO	VC_EVTO	VC_EVTI	VC_MDO0	VC_MDO2	VC_MDO3
B	VC_VDDE12	VSS	VSS	VC_VDDE7	VSS	VC_MSEO1	VSS	VC_VDDE7	VSS	VC_MDO1	VSS
C	VC_CAL_ADDR13	VC_CAL_ADDR12									
D	VC_CAL_ADDR15	VC_CAL_ADDR14									
E	VC_CAL_ADDR17	VC_CAL_ADDR16									
F	VC_VDDE12	VC_VDDE12									
G	VSS	VSS									
H	VC_CAL_ADDR19	VC_CAL_ADDR18									
J	VC_CAL_ADDR21	VC_CAL_ADDR20									
K	VC_CAL_ADDR23	VC_CAL_ADDR22									
L	VC_VDDE12	VC_VDDE12									
M	VSS	VSS									
N	VC_CAL_ADDR25	VC_CAL_ADDR24									
P	VC_CAL_ADDR27	VC_CAL_ADDR26									
R	VC_CAL_ADDR29	VC_CAL_ADDR28									
T	VC_VDDE12	VC_VDDE12									
U	VSS	VSS									
V	Reserved	VC_CAL_ADDR30									
W	VC_CS1	VC_CS0									
Y	VC_CS3	VC_CS2									
AA	VC_VDDE12	VSS	VC_RD_WR	VC_TS	VC_OE	VSS	VC_VDDE12	VC_CAL_DATA1	VC_CAL_DATA3	VC_CAL_DATA5	VSS
AB	VSS	VC_VDDE12	VC_WE0	VC_WE1	VC_CAL_DATA0	VSS	VC_VDDE12	VC_CAL_DATA2	VC_CAL_DATA4	VC_CAL_DATA6	VSS

Viewed from the top

● Signifies mechanical locating pins with no electrical function

Figure 2. Left Side VCS_B Connector Signal Usage

	12	13	14	15	16	17	18	19	20	21	22
A	VC_MDO4	VC_MDO5	VC_MDO7	VC_MDO8	VC_MDO9	VC_MDO10	VC_MDO12	VC_MDO13	VC_MDO14	VC_MDO15	●
B	VC_VDDE7	VSS	VC_MDO6	VSS	VC_VDDE7	VSS	VC_MDO11	VSS	VC_VDDE7	VSS	VC_JCOMP
C										VC_TMS	VC_TDI
D										VSS	VC_TCK
E										VC_VDDE7	VC_TDO
F										VC_VDDEH6	VSS
G										VC_RESET	VC_VDDEH6
H										VC_RSTOUT	VC_BOOTCFG0
J										VC_CNTXA	VC_BOOTCFG1
K										VC_CNRXA	VC_RSTCFG
L										VC_TXDA	VC_TOOLIO_0
M										VC_RXDA	VC_TOOLIO_1
N										VC_GPIO206	VC_TOOLIO_2
P										VC_GPIO207	VC_TOOLIO_3
R										VC_VDDEH8	VC_ETRI0
T										VC_VDDEH8	VC_ETRIG1
U										VSS	VC_GPIO205
V										VC_TPWR	VSS
W										VC_TPWR	Reserved
Y										VC_VDDE2/3	VC_VDD
AA	VC_VDDE12	VC_CAL_DATA7	VC_CAL_DATA9	VC_CAL_DATA11	VSS	VC_VDDE12	VC_CAL_DATA13	VC_CAL_DATA15	VSS	VC_VDDE2/3	VC_VDD
AB	VC_VDDE12	VC_CAL_DATA8	VC_CAL_DATA10	VC_CAL_DATA12	VSS	VC_VDDE12	VC_CAL_DATA14	VSS	VC_CLKOUT	VSS	●

Figure 3. Right Side VCS_B Connector Signal Usage

2.1 VertiCal Connector Signal Properties Summary

The set of signals supported by the VertiCal connector includes serial debug signals, serial communication channels, power supplies, and reset configuration signals, as well as external bus interface signals. The next sections detail the various VertiCal connector signals with their typical calibration usage.

The majority of VertiCal connector signals (identified by the prefix "VC_") are connected to the corresponding MCU signals (without the "VC_" prefix) on VertiCal bases although this is not a fixed rule, and some base variants may use different MCU resources. For full details on which microcontroller resources are connected to which VertiCal connector signals on any particular VertiCal base variant, refer to the relevant VertiCal base data sheet.

2.2 Reset and Configuration Signals

VertiCal calibration and debug tools may use the reset and configuration signals included in the VertiCal connector to have visibility of when the MPC5500 device has been reset, and what configuration has been selected on exit from reset. Debug tools may also require the ability to force device reset. Top board hardware should be designed so that using these signals does not cause contention with expected application usage.

Table 1. Reset and Configuration Signals

Signal Name	Function	Notes
Reset / Configuration (5)		
VC_RESET	External reset input	May be monitored by the top board to detect reset events, or driven by top board to force reset event. If driven by Top Board, ensure that contention with any other drivers on application board is avoided.
VC_RSTOUT	External reset output	May be monitored by the top board to detect application reset events.
VC_RSTCFG	Reset configuration input	May be monitored by top board in conjunction with VC_BOOTCFG[0:1] to determine MCU reset configuration, or driven by top board to force a specific reset configuration. If driven by top board, ensure that contention with any other drivers on application board is avoided.
VC_BOOTCFG[0:1]	Boot configuration input	May be monitored by top board in conjunction with VC_RSTCFG to determine MCU reset configuration, or driven by top board to force a specific reset configuration. If driven by top board, ensure that contention with any other drivers on application board is avoided.

2.3 Calibration Bus

The calibration bus is made up of address bus, data bus, bus control, and clock signals, and is used by VertiCal base boards to access any memory-mapped devices on top boards. The VertiCal base board must be the initiating master of any calibration bus accesses, as bus arbitration and slave mode operation are not supported.

A 16-bit data bus and 19-bit address bus is included, giving a basic addressing range of 1 MB.

The VertiCal connector supports up to four chip selects signals, although the actual number of chip selects available depends on the specific VertiCal base variant used. The VC_CAL_CS[0] chip select is available on all VertiCal bases, and it is recommended that this should be used as the default chip select to ensure maximum portability of calibration tools across devices.

The additional VC_CAL_CS chip selects have alternate functions as additional address bits, allowing a flexible choice between increased addressing range or increased chip select availability. VertiCal bases that support less than four calibration chip selects maintain the capability to support increased contiguous calibration addressing range by omitting chip selects starting from VC_CAL_CS[1].

The microcontroller device resources used to drive the calibration bus signals depend on the particular microcontroller variant, with details shown in the table below. The MPC5554 device does not directly support a dedicated calibration bus; instead, the calibration bus signals are connected to the standard external bus interface. The MPC5553 also uses the standard external bus interface to source the calibration bus signals, although the signal mapping is different. The MPC5534 / 5565 / 5566 and 5567 devices all have dedicated calibration bus signals, so the VertiCal calibration bus signals are all connected to the corresponding microcontroller calibration bus signal.

Table 2. Calibration Bus Signals

VertiCal Signal Name	Function	MPC5554 Routing	MPC5553 Routing	MPC5534/65/66/67 Routing	Notes
Address/Data Bus (44)					
VC_CAL_ADDR[12:26]	Address bus	ADDR[12:26]	ADDR[12:26]	CAL_ADDR[12:26]	Calibration address bus. To be used as an output from the VertiCal base
VC_CAL_ADDR[27:30]	Address bus	ADDR[27:30]	ADDR[8:11]	CAL_ADDR[27:30]	
VC_CAL_CS[3]	Chip select	CS[3]	MDIO	CAL_CS[3]	Calibration chip select with alternate function as additional address line. CAL_CS[11]. To be used as an output from the VertiCal base
VC_CAL_CS[2]	Chip select	CS[2]	MDC	CAL_CS[2]	Calibration chip select with alternate function as additional address line. CAL_CS[10]. To be used as an output from the VertiCal base
VC_CAL_CS[1]	Chip select	CS[1]	No Connect	No Connect / CAL_CS1 on MPC5566	Calibration chip select with alternate function as additional address line. CAL_CS[9]. To be used as an output from the VertiCal base
VC_CAL_CS[0]	Chip select	CS[0]	TEA	CAL_CS[0]	Default usage calibration chip select. To be used as an output from VertiCal base
VC_CAL_DATA[0:15]	Data bus	DATA[0:15]	DATA[16:31]	CAL_DATA[0:15]	Calibration data bus
VC_CAL_OE	Output enable	OE	OE	CAL_OE	Calibration bus output enable. To be used as an output from VertiCal base
VC_CAL_RD_WR	Read/write	RD_WR	RD_WR	CAL_RD_WR	Calibration bus read/write. To be used as an output from VertiCal base
VC_CAL_TS	Transfer start	TS	TS	CAL_TS	Calibration bus transfer start. To be used as an output from VertiCal base
VC_CAL_WE[0:1]	Write enable	WE[0:1]	WE[2:3]	CAL_WE[0:1]	Calibration bus write enable signals have alternate usage as byte enable signals. To be used as an output from VertiCal base
VC_CAL_BE[0:1]	Byte enable	BE[0:1]	BE[2:3]	CAL_BE[0:1]	
Clock Synthesizer (1)					
VC_CLKOUT	System clock output	CLKOUT	CLKOUT	CLKOUT	Clock output signal from MCU. To be used as an output from VertiCal base

2.4 Nexus and JTAG

The full set of Nexus and JTAG signals are available on the VertiCal connector for use by VertiCal top boards, or for passing to additional tools connected to top boards. The VertiCal connector includes provision to support future MPC5500 devices with wider Nexus ports by reserving connections for MDO[12:15] signals.

Table 3. Nexus and JTAG Signals

VertiCal Signal Name	Function	Notes
Nexus (22)		
VC_EVTI	Nexus event in	
VC_EVTO	Nexus event out	
VC_MCKO	Nexus message clock out	
VC_MDO[0]	Nexus message data out	
VC_MDO[1:3]	Nexus message data out	
VC_MDO[4:11]	Nexus message data out	
VC_MDO[12:15]	Nexus message data out	Not implemented on several VertiCal bases, reserved for future expansion.
MSEO[0:1]	Nexus message start/end out	
VC_RDY	Nexus ready output	
JTAG / Test (5)		
VC_TCK	JTAG test clock input	
VC_TDI	JTAG test data input	
VC_TDO	JTAG test data output	
VC_TMS	JTAG test mode select input	
VC_JCOMP	JTAG TAP controller enable	

2.5 CAN and SCI

The VertiCal connector includes connections to a CAN channel and an SCI channel on the MPC5500 device. These communications channels are not dedicated for calibration usage, and any use by a calibration tool must be compatible with any planned use by the end application.

Table 4. CAN and SCI Signals

VertiCal Signal Name	Function	Notes
CAN (2)		
VC_CNTX_A	CAN_A transmit	All calibration usage must be compatible with application usage.
VC_CNRX_A	CAN_A receive	All calibration usage must be compatible with application usage.
SCI (2)		
VC_TXD_A	SCI_A transmit	All calibration usage must be compatible with application usage.
VC_RXD_A	SCI_A receive	All calibration usage must be compatible with application usage.

2.6 eQADC and GPIO

A number of signals with GPIO capability are included in the VertiCal connector specification for optional use as hardware triggers to allow synchronization between the application software executing on the MPC5500 device and the VertiCal top board. Depending on the VertiCal base variant in use, some or all of these signals may be available for application use, and any usage for calibration purposes must be compatible with application usage.

Use of any of these signals also depends on the design VertiCal top board hardware, as alternative synchronization methods such as calibration bus monitoring may be used instead.

Table 5. eQADC and GPIO Signals

VertiCal Signal Name	Function	Notes
eQADC (2)		
VC_ETRIG[0]	eQADC trigger input and GPIO	
VC_ETRIG[1]	eQADC trigger input and GPIO	
GPIO (3)		
VC_GPIO[205]	GPIO	
VC_GPIO[206:207]	GPIO	

2.7 ToolIO

The VC_TOOLIO signals on the VertiCal connector are not connected to any signals on the MPC5500 device fitted to the VertiCal base, and are instead connected to additional footprint signals that are only available on some VertiCal base hardware versions. Additional footprint signals may be implemented as additional balls on BGA footprint VertiCal bases.

One possible use for the VC_TOOLIO signals is to allow VertiCal top board calibration tool to be controlled via a serial link (CAN, for example) that is routed through the base board and application PCB to a reserved signal path on a main application connector. As the VC_TOOLIO signals are totally separate from the standard MPC5500 device footprints and signals, they do not impact standard device resources.

Table 6. ToolIO Signals

VertiCal Signal Name	Function	Notes
Tool I/O (4)		
VC_ToolIO[0:3]	Tool I/O	Not connected to MPC5500 MCU. Signal connected to footprint on some VertiCal bases.

2.8 Power and Grounds

A number of different power signals are included in the VertiCal connector, which may be used for:

- Power and voltage monitoring
- Powering top board hardware from the base board or application
- Powering parts of the base board hardware from the top board

Power signals may be used by top board hardware to allow monitoring of the supply voltage levels being used by the application or for basic power status monitoring. One possible use of voltage monitoring is with VertiCal base boards (for example, base boards for MPC5554 and MPC5553 devices) where the MCU external bus interface is shared between calibration and application use. In this case, the voltage supplied by the application on the VC_VDDE2/3 lines must be compatible with any voltage requirements defined by the top board hardware. Top board hardware may monitor VC_VDDE2/3 on the VertiCal connector to ensure that a compatible voltage level is being used.

The VC_VDDE12 signal is used to power the dedicated calibration bus on VertiCal Bases fitted with MCUs (such as the MPC5534, MPC5565, MPC5566, and MPC5567), which include this bus rather than sharing an external bus interface with the application. Powering the calibration bus from the top board through the VC_VDDE12 signal ensures that no additional power loading is applied to the application system during calibration. On VertiCal bases that use devices without a dedicated calibration bus (such as the MPC5554 and MPC5553) the VC_VDDE12 is a no-connect.

The VC_VDDE7 signal on the VertiCal connector may be used to supplement the MCU VDDE7 supply on VertiCal bases with low signal count footprints (such as the 208 BGA) when top board hardware is connected that uses the full width Nexus port. The VC_VDDE7 signal on the VertiCal connector does not have to be used to supplement the VDDE7 supply on bases with 324 or 416 BGA footprints, or for low signal count footprint bases that include additional VDDE7 connections by means of optional balls.

Power signals on the VertiCal connector may also be used to power top board hardware, although this use is discouraged for most calibration hardware where a typical requirement is to present no additional power load to the application system.

Table 7. Power and Ground Signals

VertiCal Signal Name	Function	Notes
Power / Ground (63)		
VC_VDD (x2)	Internal logic sense supply	May be monitored by top board to detect MCU power status.
VC_VDDE2/3 (x2)	Standard bus voltage sense supply input	May be monitored by top board to detect calibration bus voltage levels for MCU devices without dedicated calibration bus.
VC_VDDEH6 (x2)	I/O voltage sense supply	May be monitored by top board to detect MCU power status.
VC_VDDE7 (x6)	External Nexus I/O supply input	May be used by top board to provide supplementary Nexus supply for VertiCal bases with low signal count footprints.
VC_VDDEH8 (x2)	I/O voltage sense supply	May be monitored by top board to detect MCU power status.
VC_VDDE12 (x15)	Calibration bus I/O supply input	Used by top board to power the calibration bus on MCU devices with dedicated calibration bus.
VC_VSTBY	Standby voltage sense	Used by top board to detect power status of MCU memory standby power supply.
VC_TPWR (x2)	Unswitched battery voltage	Optional line used to power top board from unswitched battery supply sourced from application board. VC_TPWR does not connect to or power any part of the MCU on VertiCal bases. VC_TPWR availability depends on availability and use of VertiCal base optional balls, and connection to suitable power supply on application board.
VSS (x32)	Ground	System ground shared between application, VertiCal base and top board.

3 VertiCal Base Footprints

VertiCal bases have footprints compatible with production packaged version of MPC5500 devices, ensuring that they can be fitted to an application PCB that has been designed to accept standard packaged MPC5500 devices.

Bases can be supplied with solder footprints, to allow direct and permanent soldered connection to an application PCB, or with pin adapter connectors fitted, allowing connection and removal from an application PCB that is fitted with a compatible receiver socket.

In addition to the standard production package ball maps, a small number of optional balls may be supported on BGA pattern solder ball footprint bases to allow additional functionality. VertiCal bases will be usable even if these balls are not present or not connected, although tool hardware may require a small number of supplementary connections by flying leads to support these added functions.

Refer to the appropriate VertiCal base data sheet for full information on the footprint layout of any VertiCal base.

3.1 Standard Signals

Standard signals are arranged in an identical manner to MPC5500 devices when packaged in a standard production package. Refer to the relevant MPC5500 variant documentation for specific details.

3.2 Optional Balls

Use of these balls is intended to be strictly optional, and if they are not present, their functionality may be recreated by flying lead connections directly to any tool hardware attached to the VertiCal base.

The signals supported by these optional balls are:

- TPWR
- Tool IO [0:3]
- VDDE7 (208 BGA footprint only)

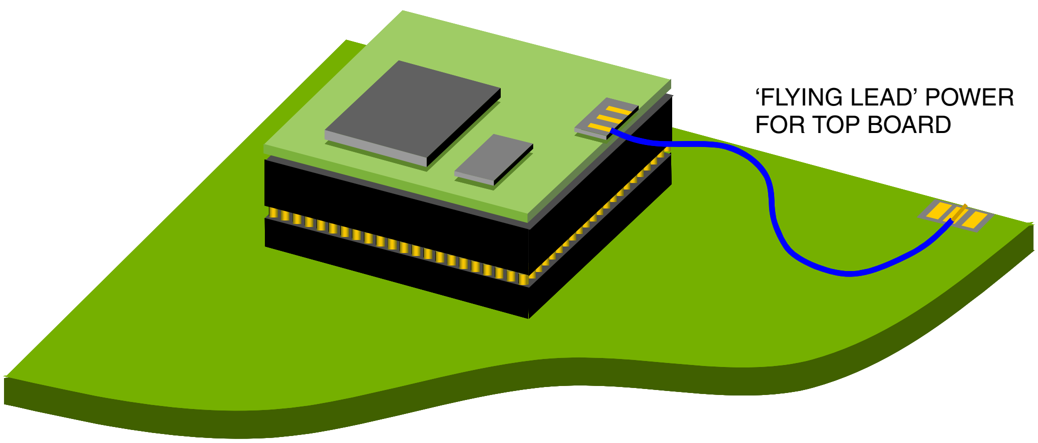


Figure 4. Top Board Power Without Use of Optional TPWR Balls

TPWR can be used to power tool hardware connected to the VertiCal base, removing the need for any separate flying lead power connection to the tool. Ideally the TPWR balls should be connected to an unswitched battery connection on the application PCB, allowing power to VertiCal top board hardware to be maintained when main application power is removed. This power scheme allows VertiCal top board operations (such as overlay memory initialization) to be performed while the main application is powered down. The VertiCal base itself does not require TPWR. If the optional TPWR balls are not supported by the application PCB, a separate flying lead connection can be used to supply the top board as shown in Figure 4.

ToolIO [0:3] are intended to allow direct connection of IO signals between any tool hardware connected to the VertiCal base and the application PCB. The VertiCal base itself does not require these signals. Possible uses for ToolIO [0:3] include:

- Connection of serial communications from tool hardware to the application PCB, allowing connection through a production connector
- Direct control of application hardware by rapid prototyping hardware connected to the VertiCal base
- Communication between tool hardware for multi-processor systems

The optional VDDE7 balls are fitted to 208 footprint bases only, and are intended to supplement the single standard VDDE7 ball on the standard 208 BGA footprint. If the optional VDDE7 balls are not fitted or used on a 208 footprint base and a debug tool is used that connects to the wide Nexus port available on the VertiCal connector, it may be necessary to supplement the VDDE7 power supply with a flying lead connection.

4 VertiCal Software Compatibility

The VertiCal bases use standard production silicon MPC5500 family devices that have been packaged in the required chip scale package. Therefore, all production silicon features exist and are identical on the VertiCal base.

Depending on the top board hardware and tool software used with the base, some added initialization software might be required to configure special calibration resources such as overlay memory. The required initialization code may be as simple as the configuration of a calibration memory chip select and pin control registers, and could be integrated into standard application software.

Top board hardware that can access microcontroller resources via the Nexus debug port may also be able to directly configure calibration resources, removing the need for added configuration software.

5 VertiCal Power Supply Schemes

VertiCal bases contain no active components other than the MCU device. When no VertiCal compliant top boards are fitted, the power required by a VertiCal base is identical to that required by a standard MPC5500 device. The amount of any additional power loading with a VertiCal compliant top board fitted is dependent on the specific MPC5500 device type being used, as well as the hardware design of the top board.

MPC5500 devices fall into two categories for power supply estimation purposes: devices with independent calibration bus power supplies, and those without. Appendix A, “Power Supply Architecture,” details the power supply schemes for both categories of devices when fitted to all footprint varieties of VertiCal bases.

5.1 Devices With Independent Calibration Bus Power Supplies

Devices with an independently powered calibration bus include the MPC5534, MPC5565, MPC5566, and MPC5567 microcontrollers. On VertiCal bases fitted with these devices, no additional power is drawn from any standard balls on the VertiCal base footprint to power accesses to external calibration memory. Power for calibration bus accesses and any VertiCal top board hardware is supplied either from a flying lead connection directly to the top board, or via the TPWR optional balls on the base footprint as described in section Section 3.2, "Optional Balls," and Figure 4. VertiCal compliant top board hardware must be designed so that TPWR is not connected to the VertiCal connector when TPWR is supplied from a flying lead to the top board.

The supply Vdde12 powers the calibration bus, and is powered from the VertiCal top board via the VertiCal connector. The top board generates Vdde12 power by regulating a battery voltage supply, from the TPWR supply via the VertiCal base optional balls, or via a flying lead connected to an off-board battery voltage supply.

5.2 Devices Without Independent Calibration Bus Power Supplies

Devices without independently powered calibration buses include the MPC5554 and MPC5553. On VertiCal bases fitted with these devices, an increased current is drawn from the Vdde2 and Vdde3 balls to power any accesses to external calibration memory. The exact increase in Vdde2 current depends on how often accesses are made to calibration memory. Appendix A, "Power Supply Architecture," details estimated additional Vdde2/Vdde3 loading for typical use. Power for VertiCal top board hardware is supplied from a flying lead connection directly to the top board, or via the TPWR optional balls on the base footprint as described in section Section 3.2, "Optional Balls," and Figure 4. VertiCal compliant top board hardware must be designed so that TPWR is not connected to the VertiCal connector when TPWR is supplied from a flying lead to the top board.

For these devices, the Vdde12 supply is not used by the MCU, and the Vdde2/3 supplies are instead used to power calibration accesses.

Appendix A
Power Supply Architecture

There are some differences in the routing of the various VertiCal power signals depending on which VertiCal base board is being used. These differences are due to the footprint type of the VertiCal base, and whether the MCU has an independently powered dedicated calibration bus, or shares the standard external bus for calibration and application use. The following sections detail power supply routing for the three main BGA footprint types for devices with and without an independently powered calibration bus. Some power supply signals that have consistent routing for all systems are omitted from the diagrams.

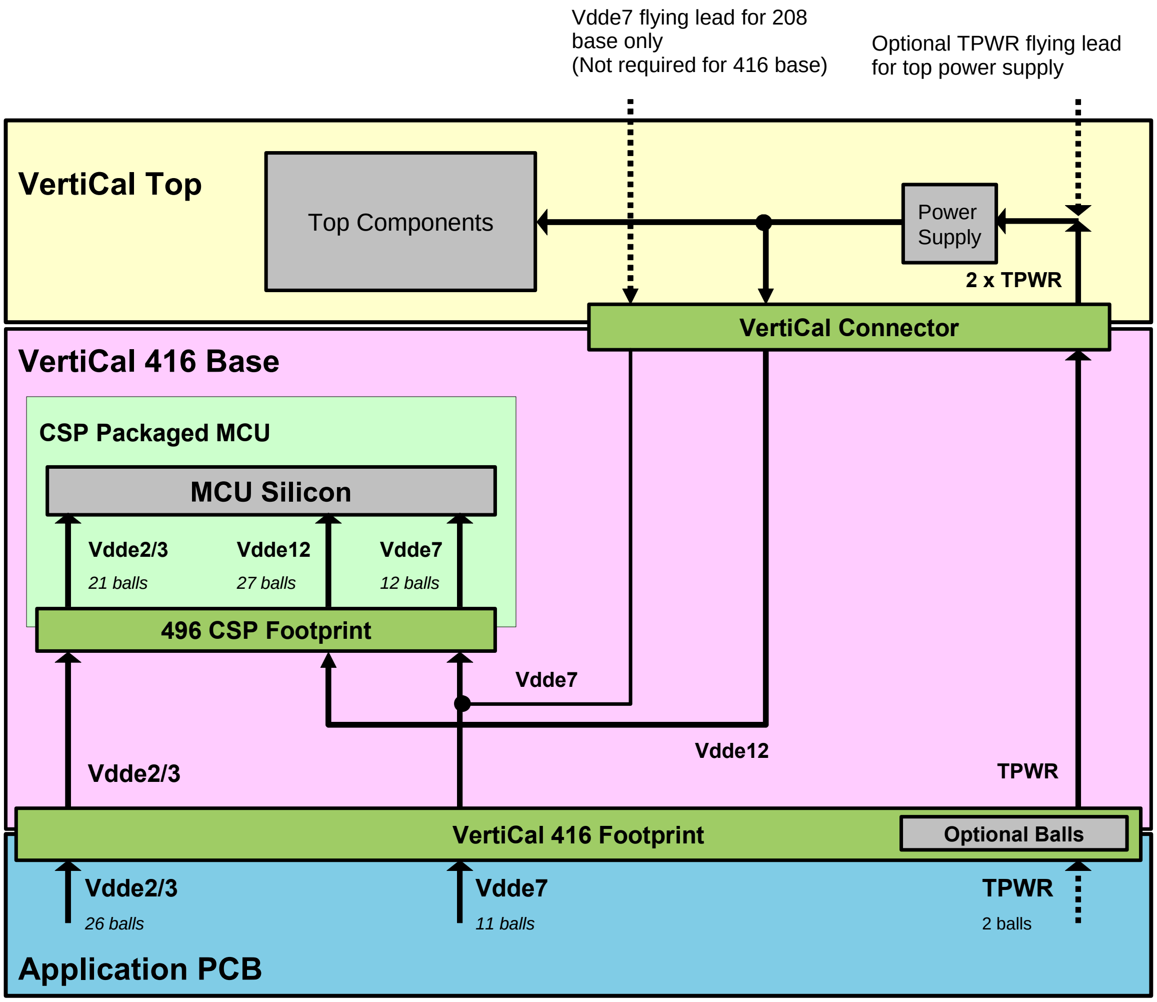
A.1 VertiCal 416 Base

A.1.1 Devices With Independent Calibration Bus Power Supplies

For this hardware configuration, the VertiCal top board must power the calibration bus using the VC_Vdde12 line. VC_Vdde12 may remain unpowered when the calibration bus is not in use.

NOTE

Devices with an independently powered calibration bus include the MPC5534, MPC5565, MPC5566, and MPC5567 microcontrollers.

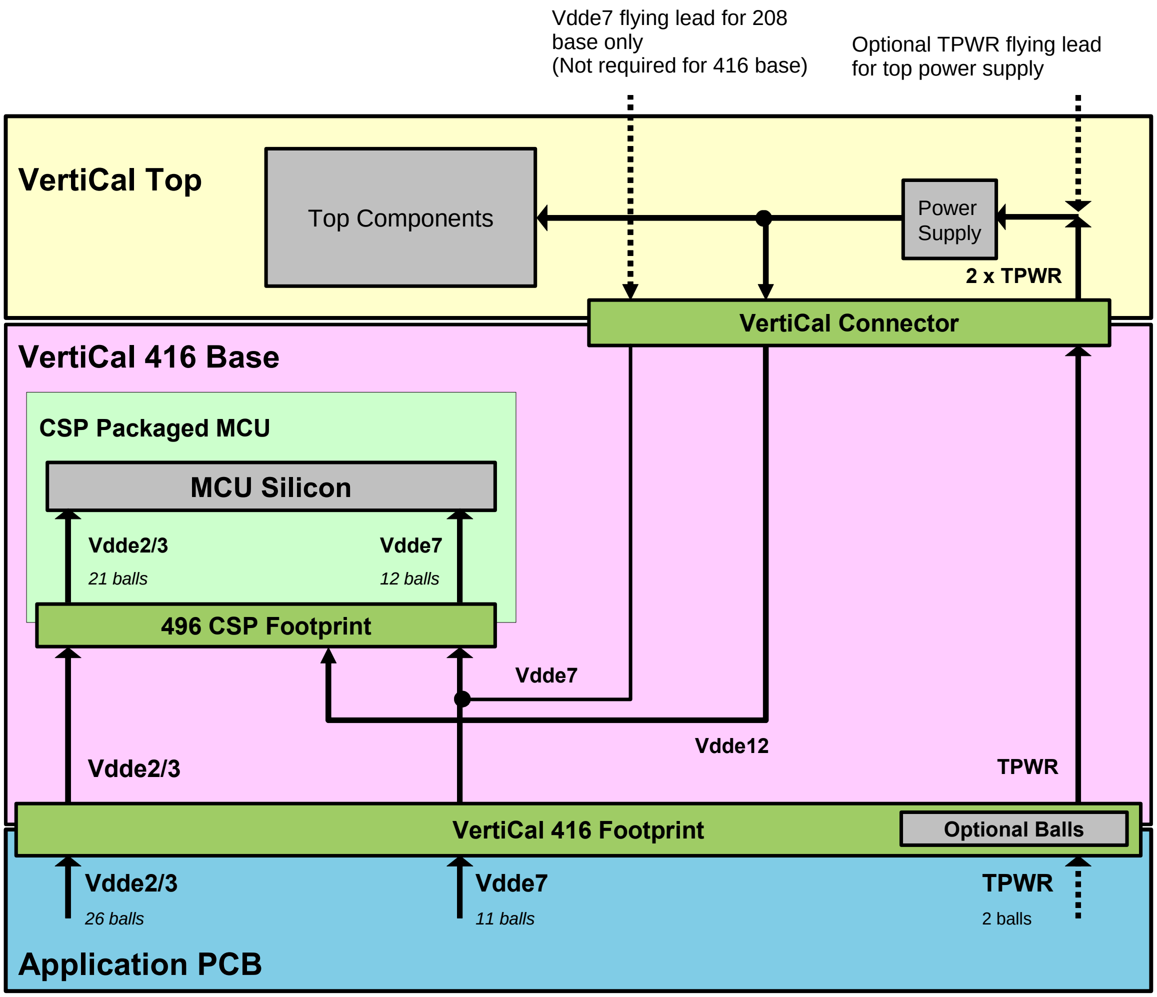


A.1.2 Devices Without Independent Calibration Bus Power Supplies

For this hardware configuration, the shared calibration/application bus is powered from the application through the Vdde2/3 lines. The VC_Vdde12 line from the top board is not used to power any hardware on the VertiCal base.

NOTE

Devices without independently powered calibration buses include the MPC5554 and MPC5553.



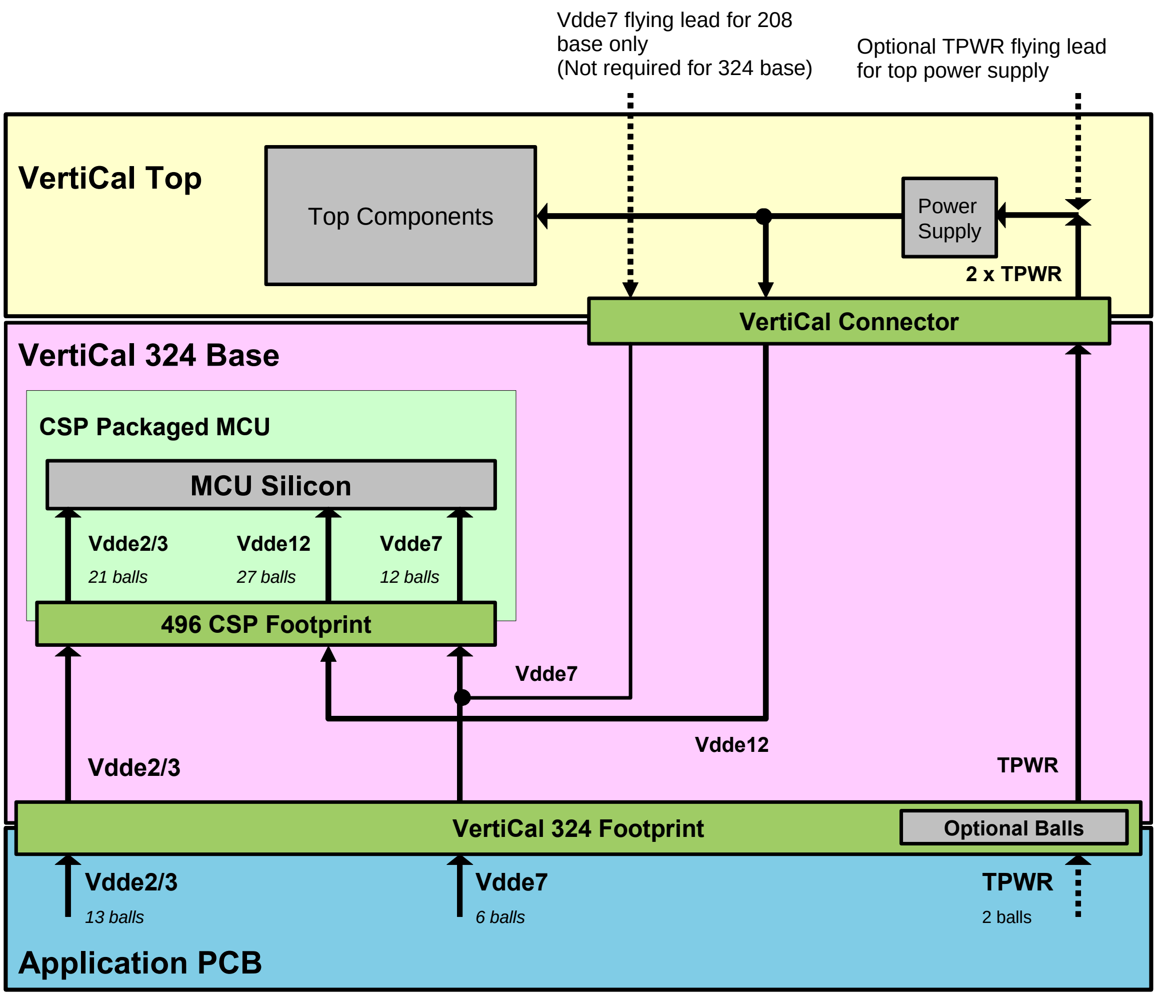
A.2 VertiCal 324 Base

A.2.1 Devices With Independent Calibration Bus Power Supplies

For this hardware configuration, the VertiCal top board must power the calibration bus using the VC_Vdde12 line. VC_Vdde12 may remain unpowered when the calibration bus is not in use.

NOTE

Devices with an independently powered calibration bus include the MPC5534, MPC5565, MPC5566, and MPC5567 microcontrollers.

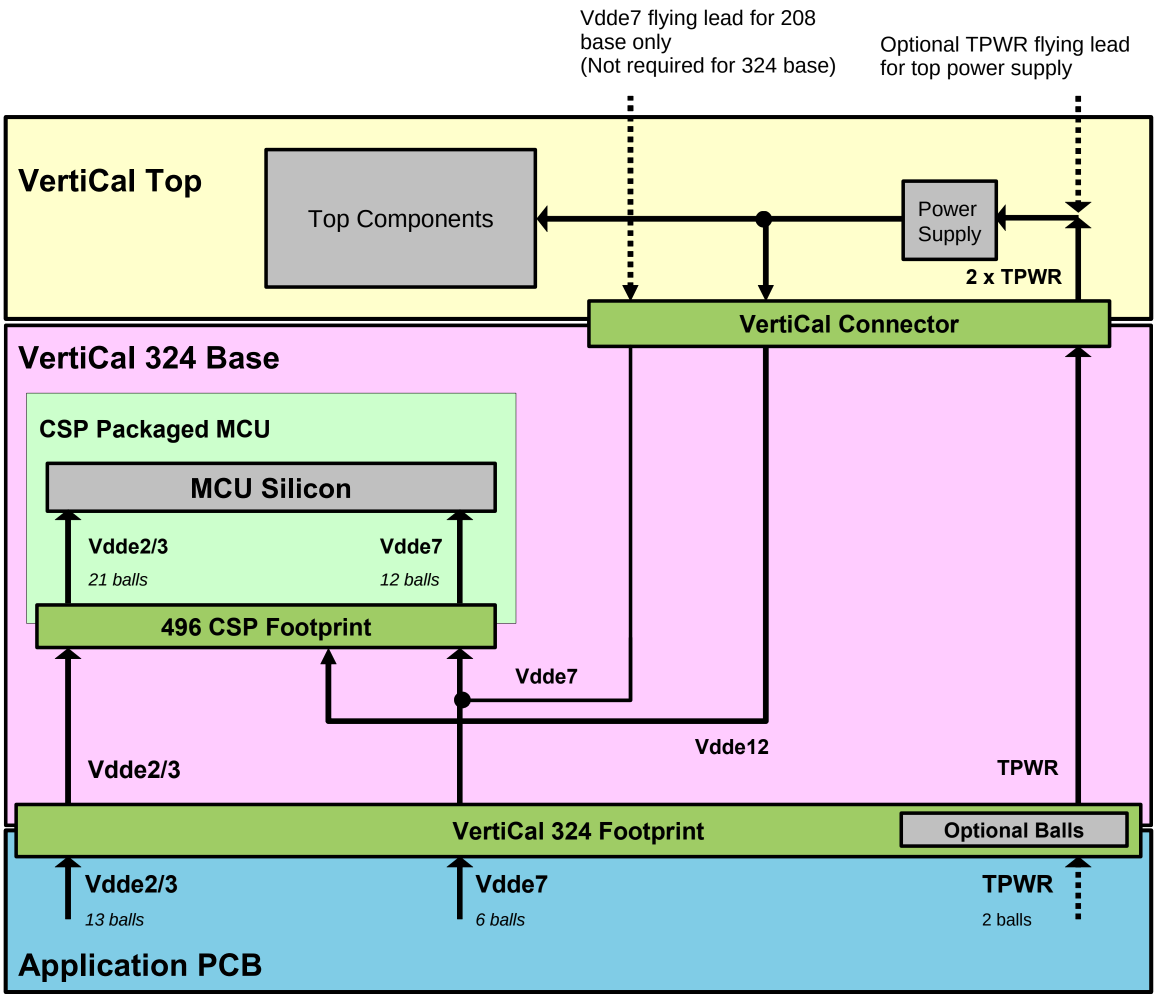


A.2.2 Devices Without Independent Calibration Bus Power Supplies

For this hardware configuration, the shared calibration/application bus is powered from the application through the Vdde2/3 lines. The VC_Vdde12 line from the top board is not used to power any hardware on the VertiCal base.

NOTE

Devices without independently powered calibration buses include the MPC5554 and MPC5553.



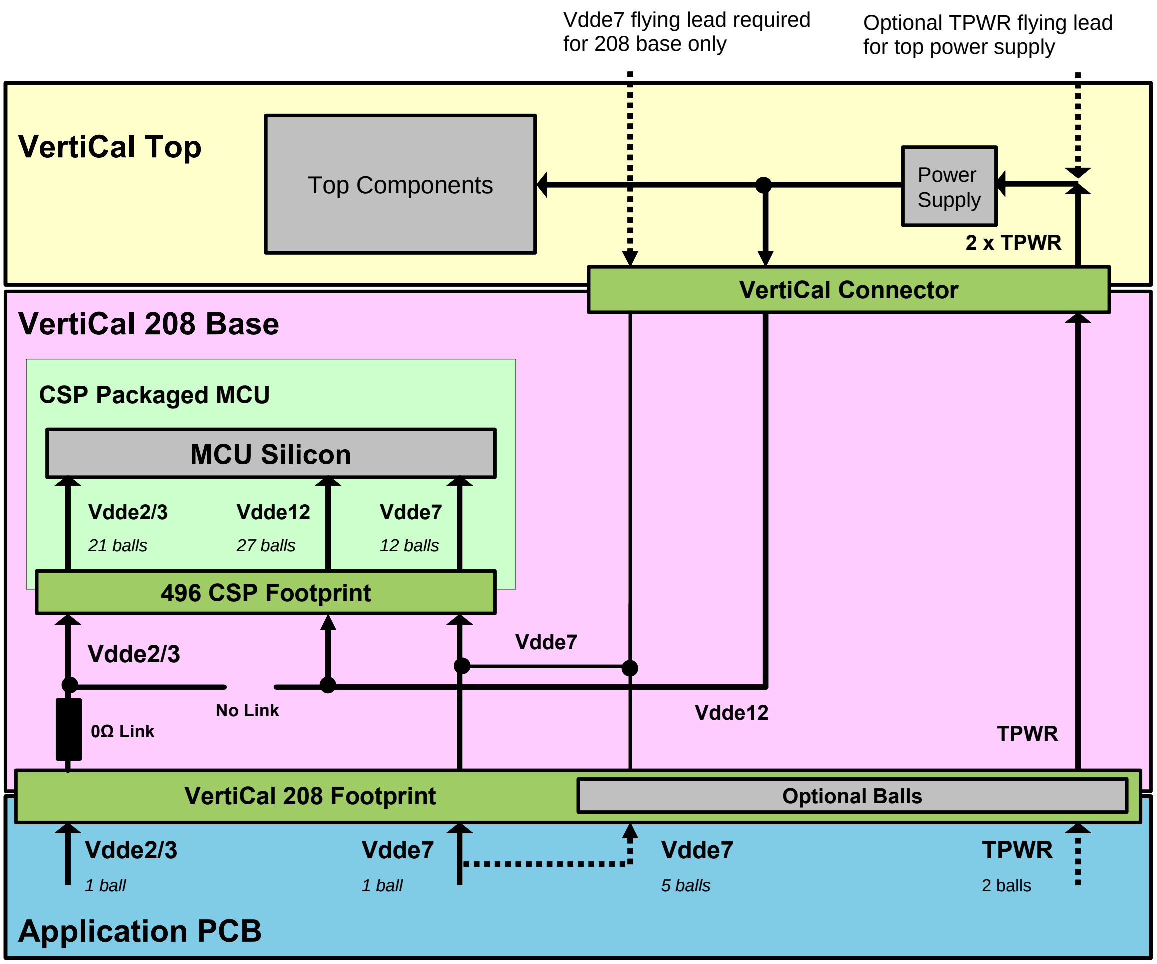
A.3 VertiCal 208 Base

A.3.1 Devices With Independent Calibration Bus Power Supplies

For this hardware configuration, the VertiCal top board must power the calibration bus using the VC_Vdde12 line. VC_Vdde12 may remain unpowered when the calibration bus is not in use.

NOTE

Devices with an independently powered calibration bus include the MPC5534, MPC5565, MPC5566, and MPC5567 microcontrollers.

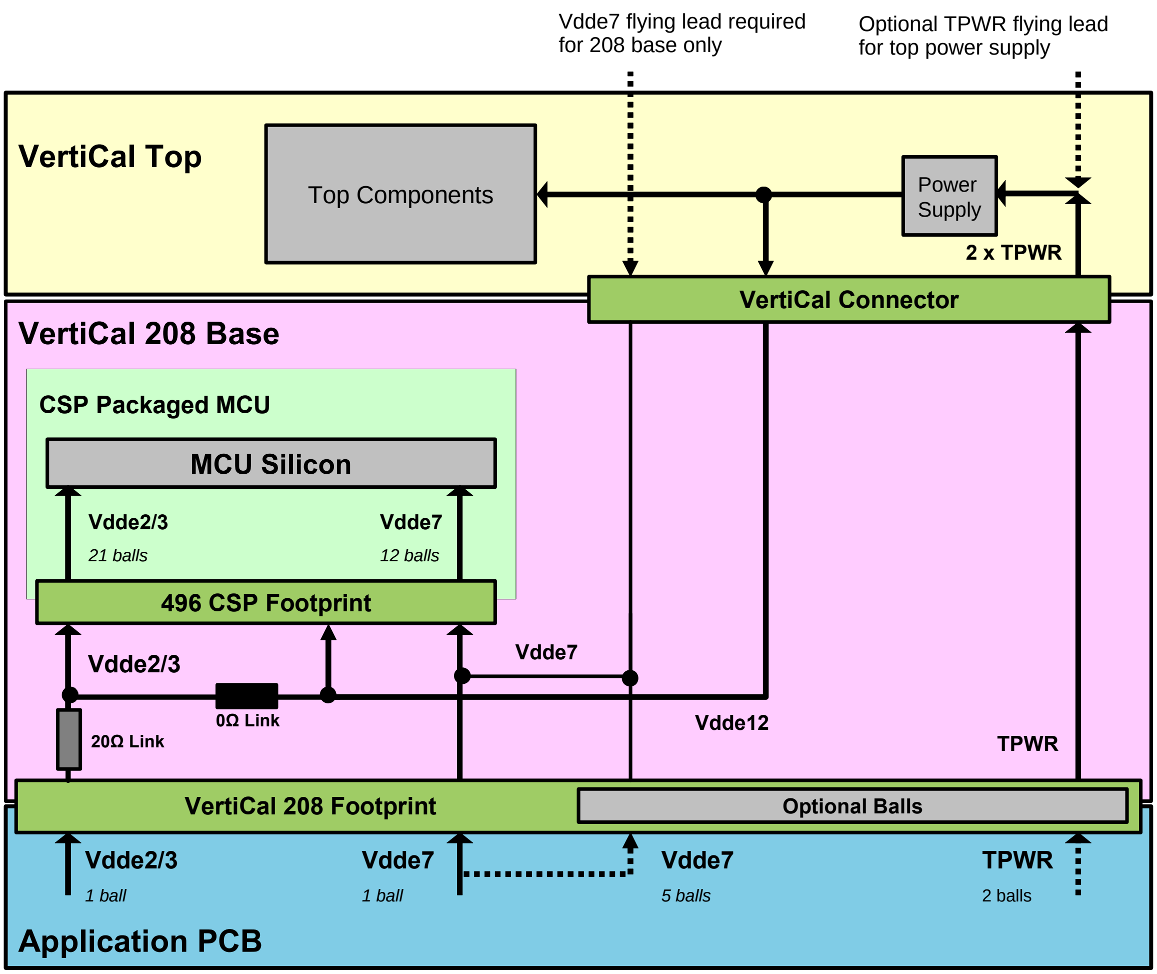


A.3.2 Devices Without Independent Calibration Bus Power Supplies

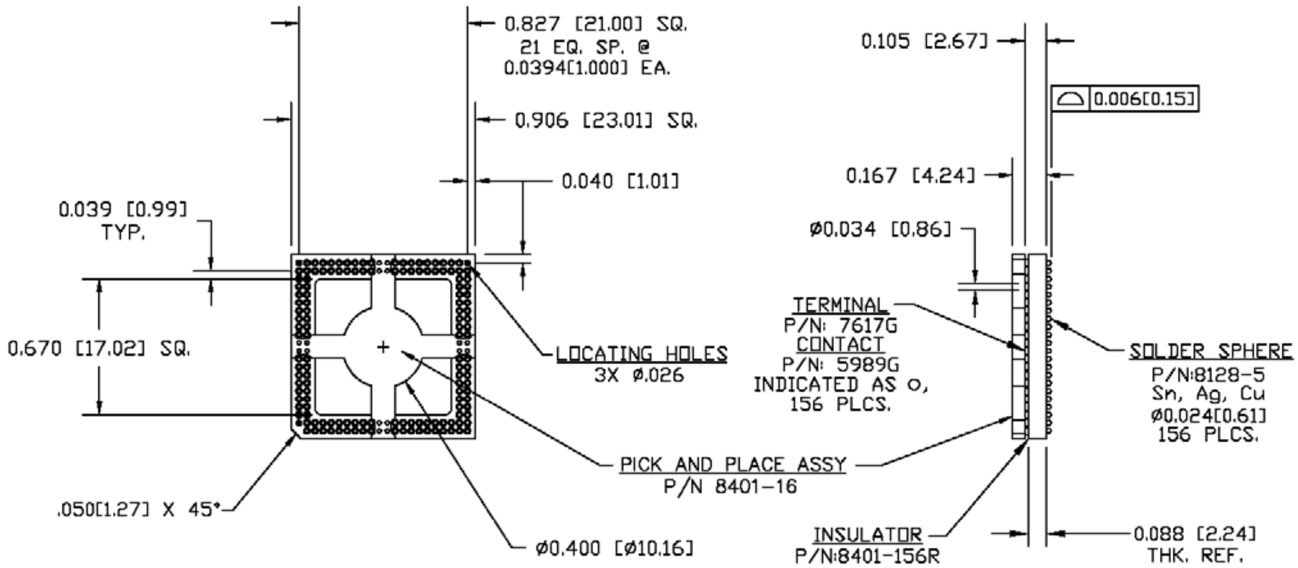
For this hardware configuration, the VertiCal top board must power the bus using the VC_Vdde12 line, as there are insufficient Vdde2/3 balls available in the 208 BGA base footprint. Any top board hardware designed to support this configuration must ensure that the VC_Vdde12 voltage applied matches the Vdde2/3 voltage applied by the application, or remains floating when the bus is not in use.

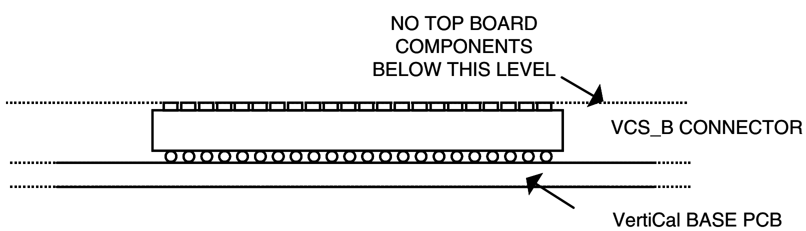
NOTE

Devices without independently powered calibration buses include the MPC5554 and MPC5553.


Vdde7 flying lead required for 208 base only
Optional TPWR flying lead for top power supply
VertiCal Top
Top Components
Power Supply
2 x TPWR
VertiCal Connector
VertiCal 208 Base
CSP Packaged MCU
MCU Silicon
Vdde2/3
21 balls
Vdde7
12 balls
496 CSP Footprint
Vdde2/3
Vdde7
0Ω Link
20Ω Link
Vdde12
TPWR
VertiCal 208 Footprint
Optional Balls
Vdde2/3
1 ball
Vdde7
1 ball
Vdde7
5 balls
TPWR
2 balls
Application PCB

Appendix B
VCS_B Connector Mechanical Drawings



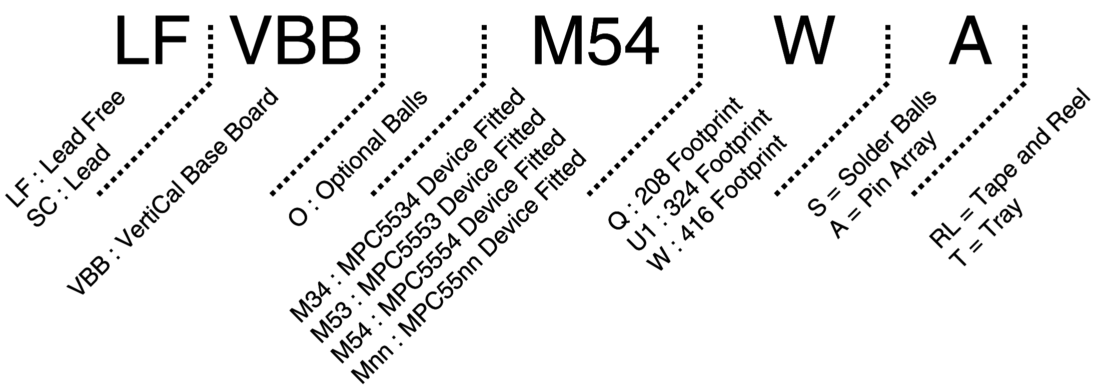


SIDE VIEW SHOWING KEEP OUT AREA FOR TOP BOARD COMPONENTS

NOTE

The pick and place assembly shown above is removed during VertiCal Base assembly.

Appendix C
VertiCal Base Options



NOTE

Example shown identifies Lead-Free VertiCal base with 416-pin array footprint fitted with MPC5554 silicon.

Not all option variants may be available.

Additional packaging option identifiers will be added when required.

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