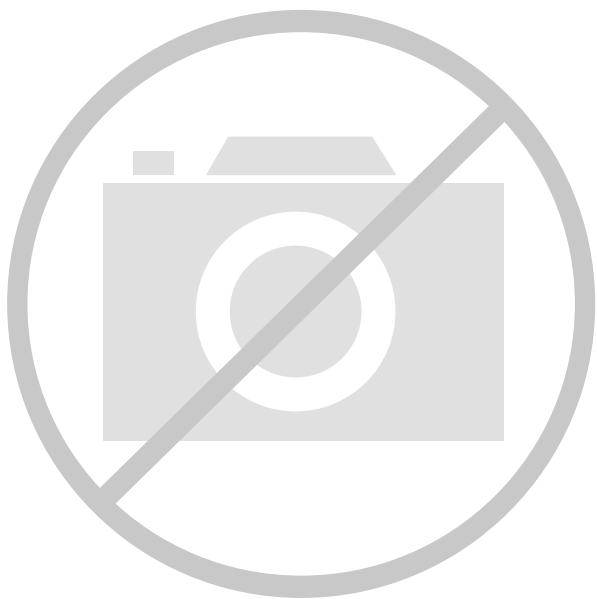




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Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details

Product Status	Obsolete
Number of LABs/CLBs	2688
Number of Logic Elements/Cells	-
Total RAM Bits	1032192
Number of I/O	624
Number of Gates	2000000
Voltage - Supply	1.425V ~ 1.575V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 100°C (TJ)
Package / Case	957-BBGA, FCBGA
Supplier Device Package	957-FCBGA (40x40)
Purchase URL	https://www.e-xfl.com/product-detail/xilinx/xc2v2000-5bf957i

Table 1: Virtex-II Field-Programmable Gate Array Family Members

Device	System Gates	CLB (1 CLB = 4 slices = Max 128 bits)			Multiplier Blocks	SelectRAM Blocks		DCMs	Max I/O Pads ⁽¹⁾
		Array Row x Col.	Slices	Maximum Distributed RAM Kbits		18 Kbit Blocks	Max RAM (Kbits)		
XC2V40	40K	8 x 8	256	8	4	4	72	4	88
XC2V80	80K	16 x 8	512	16	8	8	144	4	120
XC2V250	250K	24 x 16	1,536	48	24	24	432	8	200
XC2V500	500K	32 x 24	3,072	96	32	32	576	8	264
XC2V1000	1M	40 x 32	5,120	160	40	40	720	8	432
XC2V1500	1.5M	48 x 40	7,680	240	48	48	864	8	528
XC2V2000	2M	56 x 48	10,752	336	56	56	1,008	8	624
XC2V3000	3M	64 x 56	14,336	448	96	96	1,728	12	720
XC2V4000	4M	80 x 72	23,040	720	120	120	2,160	12	912
XC2V6000	6M	96 x 88	33,792	1,056	144	144	2,592	12	1,104
XC2V8000	8M	112 x 104	46,592	1,456	168	168	3,024	12	1,108

Notes:

1. See details in Table 2, "Maximum Number of User I/O Pads".

General Description

The Virtex-II family is a platform FPGA developed for high performance from low-density to high-density designs that are based on IP cores and customized modules. The family delivers complete solutions for telecommunication, wireless, networking, video, and DSP applications, including PCI, LVDS, and DDR interfaces.

The leading-edge 0.15 μm / 0.12 μm CMOS 8-layer metal process and the Virtex-II architecture are optimized for high speed with low power consumption. Combining a wide variety of flexible features and a large range of densities up to 10 million system gates, the Virtex-II family enhances programmable logic design capabilities and is a powerful alternative to mask-programmed gates arrays. As shown in Table 1, the Virtex-II family comprises 11 members, ranging from 40K to 8M system gates.

Packaging

Offerings include ball grid array (BGA) packages with 0.80 mm, 1.00 mm, and 1.27 mm pitches. In addition to traditional wire-bond interconnects, flip-chip interconnect is used in some of the BGA offerings. The use of flip-chip interconnect offers more I/Os than is possible in wire-bond versions of the similar packages. Flip-chip construction offers the combination of high pin count with high thermal capacity.

Wire-bond packages CS, FG, and BG are optionally available in Pb-free versions CSG, FGG, and BGG. See [Virtex-II Ordering Examples, page 6](#).

Table 2 shows the maximum number of user I/Os available. The Virtex-II device/package combination table (Table 6 at the end of this section) details the maximum number of I/Os for each device and package using wire-bond or flip-chip technology.

Table 2: Maximum Number of User I/O Pads

Device	Wire-Bond	Flip-Chip
XC2V40	88	-
XC2V80	120	-
XC2V250	200	-
XC2V500	264	-
XC2V1000	328	432
XC2V1500	392	528
XC2V2000	-	624
XC2V3000	516	720
XC2V4000	-	912
XC2V6000	-	1,104
XC2V8000	-	1,108

Revision History

This section records the change history for this module of the data sheet.

Date	Version	Revision
11/07/00	1.0	Early access draft.
12/06/00	1.1	Initial release.
01/15/01	1.2	Added values to the tables in the Virtex-II Performance Characteristics and Virtex-II Switching Characteristics sections.
01/25/01	1.3	The data sheet was divided into four modules (per the current style standard).
04/02/01	1.5	Skipped v1.4 to sync up modules. Reverted to traditional double-column format.
07/30/01	1.6	Made minor changes to items listed under Summary of Virtex-II™ Features .
10/02/01	1.7	Minor edits.
07/16/02	1.8	Updated Virtex-II Device/Package Combinations shown in Table 6 .
09/26/02	1.9	Updated Table 2 and Table 6 to reflect supported Virtex-II Device/Package Combinations.
08/01/03	2.0	All Virtex-II devices and speed grades now Production. See Table 13, Module 3.
03/29/04	2.0.1	Recompiled for backward compatibility with Acrobat 4 and above. No content changes.
06/24/04	3.3	Added references to available Pb-free wire-bond packages. (Revision number advanced to level of complete data sheet.)
03/01/05	3.4	<i>No changes in Module 1 for this revision.</i>
11/05/07	3.5	Updated copyright notice and legal disclaimer.

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Virtex-II Data Sheet

The Virtex-II Data Sheet contains the following modules:

- **Virtex-II Platform FPGAs: Introduction and Overview (Module 1)**
- **Virtex-II Platform FPGAs: Functional Description (Module 2)**
- **Virtex-II Platform FPGAs: DC and Switching Characteristics (Module 3)**
- **Virtex-II Platform FPGAs: Pinout Information (Module 4)**

Table 8: SelectI/O-Ultra Differential Buffers With On-Chip Termination

I/O Standard Description	IOSTANDARD Attribute	
	External Termination	On-Chip Termination
LVDS 2.5V	LVDS_25	LVDS_25_DCI
LVDS Extended 2.5V	LVDSEXT_25	LVDSEXT_25_DCI

Figure 11 provides examples illustrating the use of the HSTL_I_DCI, HSTL_II_DCI, HSTL_III_DCI, and HSTL_IV_DCI I/O standards. For a complete list, see the [Virtex-II Platform FPGA User Guide](#).

	HSTL_I	HSTL_II	HSTL_III	HSTL_IV
Conventional				
DCI Transmit Conventional Receive				
Conventional Transmit DCI Receive				
DCI Transmit DCI Receive				
Bidirectional	N/A		N/A	
Reference Resistor	$VRN = VRP = R = Z_0$	$VRN = VRP = R = Z_0$	$VRN = VRP = R = Z_0$	$VRN = VRP = R = Z_0$
Recommended $Z_0^{(1)}$	50 Ω	50 Ω	50 Ω	50 Ω

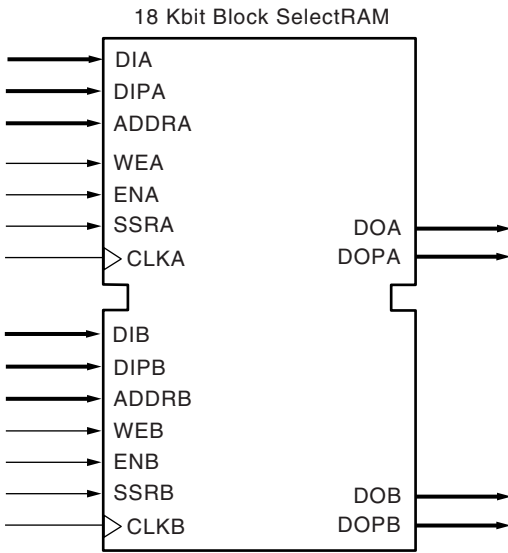
Note:

1. Z_0 is the recommended PCB trace impedance.

DS031_65a_100201

Figure 11: HSTL DCI Usage Examples

Each block SelectRAM cell is a fully synchronous memory, as illustrated in Figure 30. The two ports have independent inputs and outputs and are independently clocked.



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Figure 30: 18 Kbit Block SelectRAM in Dual-Port Mode

Port Aspect Ratios

Table 16 shows the depth and the width aspect ratios for the 18 Kbit block SelectRAM. Virtex-II block SelectRAM also includes dedicated routing resources to provide an efficient interface with CLBs, block SelectRAM, and multipliers.

Table 16: 18 Kbit Block SelectRAM Port Aspect Ratio

Width	Depth	Address Bus	Data Bus	Parity Bus
1	16,384	ADDR[13:0]	DATA[0]	N/A
2	8,192	ADDR[12:0]	DATA[1:0]	N/A
4	4,096	ADDR[11:0]	DATA[3:0]	N/A
9	2,048	ADDR[10:0]	DATA[7:0]	Parity[0]
18	1,024	ADDR[9:0]	DATA[15:0]	Parity[1:0]
36	512	ADDR[8:0]	DATA[31:0]	Parity[3:0]

Read/Write Operations

The Virtex-II block SelectRAM read operation is fully synchronous. An address is presented, and the read operation is enabled by control signals WEA and WEB in addition to ENA or ENB. Then, depending on clock polarity, a rising or falling clock edge causes the stored data to be loaded into output registers.

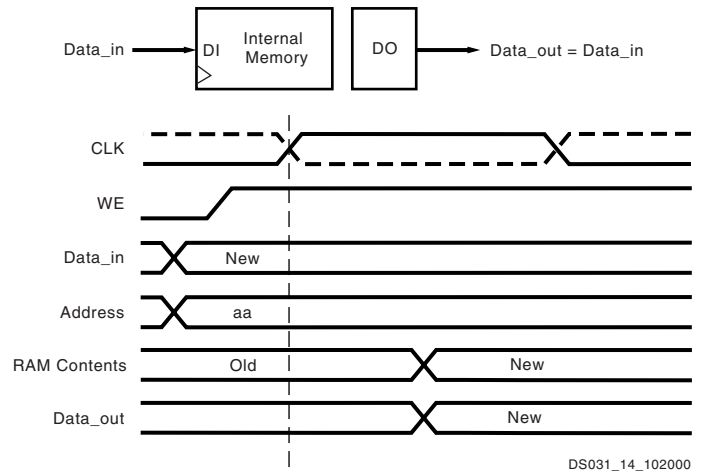
The write operation is also fully synchronous. Data and address are presented, and the write operation is enabled by control signals WEA or WEB in addition to ENA or ENB. Then, again depending on the clock input mode, a rising or

falling clock edge causes the data to be loaded into the memory cell addressed.

A write operation performs a simultaneous read operation. Three different options are available, selected by configuration:

1. "WRITE_FIRST"

The "WRITE_FIRST" option is a transparent mode. The same clock edge that writes the data input (DI) into the memory also transfers DI into the output registers DO as shown in Figure 31.



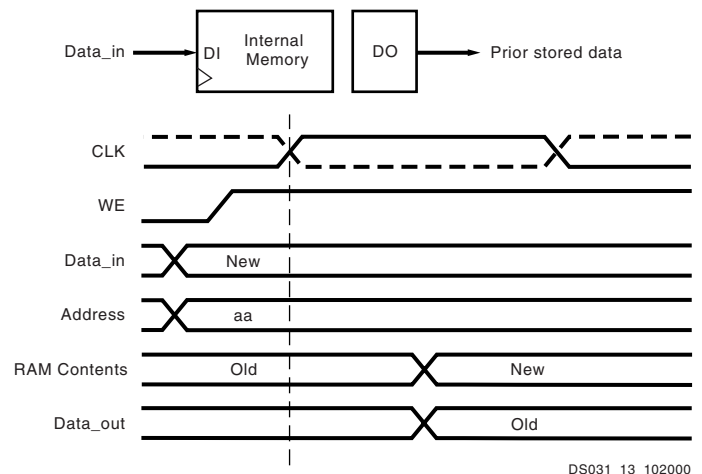
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Figure 31: WRITE_FIRST Mode

2. "READ_FIRST"

The "READ_FIRST" option is a read-before-write mode.

The same clock edge that writes data input (DI) into the memory also transfers the prior content of the memory cell addressed into the data output registers DO, as shown in Figure 32.



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Figure 32: READ_FIRST Mode

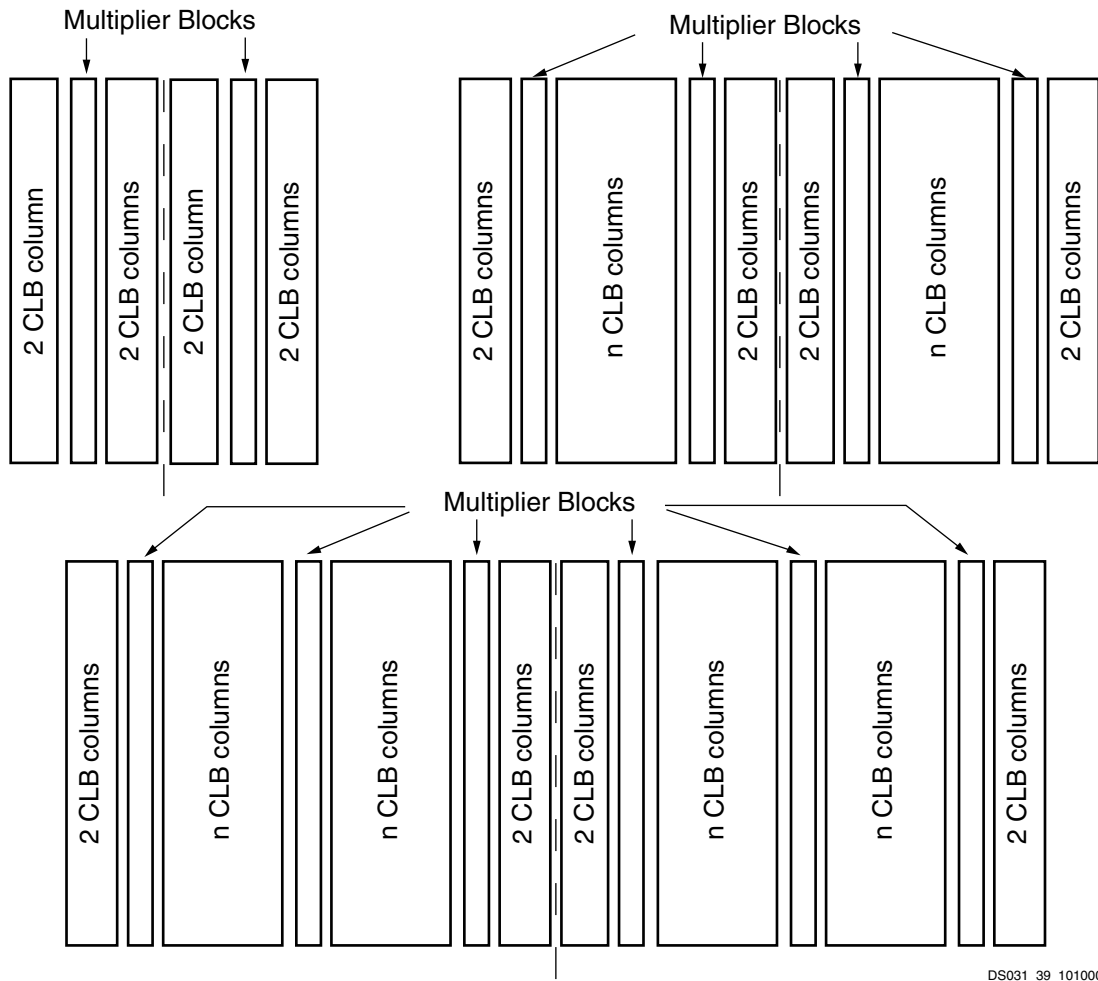


Figure 37: Multipliers (2-column, 4-column, and 6-column)

Global Clock Multiplexer Buffers

Virtex-II devices have 16 clock input pins that can also be used as regular user I/Os. Eight clock pads are on the top edge of the device, in the middle of the array, and eight are on the bottom edge, as illustrated in Figure 38.

The global clock multiplexer buffer represents the input to dedicated low-skew clock tree distribution in Virtex-II devices. Like the clock pads, eight global clock multiplexer buffers are on the top edge of the device and eight are on the bottom edge.

Each global clock buffer can either be driven by the clock pad to distribute a clock directly to the device, or driven by the Digital Clock Manager (DCM), discussed in [Digital Clock Manager \(DCM\)](#), page 29. Each global clock buffer can also be driven by local interconnects. The DCM has clock output(s) that can be connected to global clock buffer inputs, as shown in Figure 39.

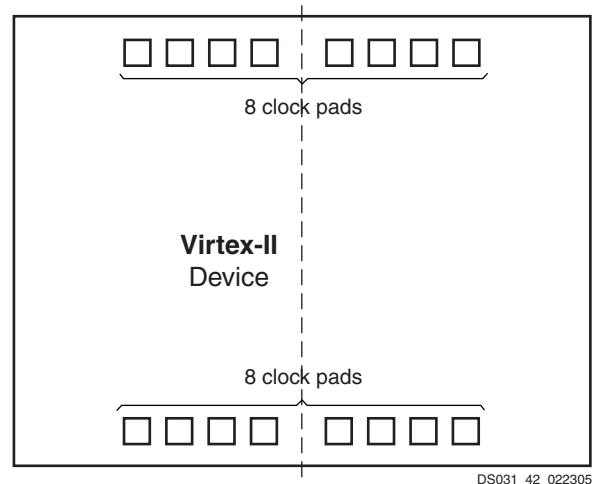


Figure 38: Virtex-II Clock Pads

Configuration

Virtex-II devices are configured by loading application specific configuration data into the internal configuration memory. Configuration is carried out using a subset of the device pins, some of which are dedicated, while others can be re-used as general purpose inputs and outputs once configuration is complete.

Depending on the system design, several configuration modes are supported, selectable via mode pins. The mode pins M2, M1 and M0 are dedicated pins. The M2, M1, and M0 mode pins should be set at a constant DC voltage level, either through pull-up or pull-down resistors, or tied directly to ground or V_{CCAUX} . The mode pins should not be toggled during and after configuration.

An additional pin, HSWAP_EN is used in conjunction with the mode pins to select whether user I/O pins have pull-ups during configuration. By default, HSWAP_EN is tied High (internal pull-up) which shuts off the pull-ups on the user I/O pins during configuration. When HSWAP_EN is tied Low, user I/Os have pull-ups during configuration. Other dedicated pins are CCLK (the configuration clock pin), DONE, PROG_B, and the Boundary-Scan pins: TDI, TDO, TMS, and TCK. Depending on the configuration mode chosen, CCLK can be an output generated by the FPGA, or an input accepting an externally generated clock. The configuration pins and Boundary-Scan pins are independent of the V_{CCO} . The auxiliary power supply (V_{CCAUX}) of 3.3V is used for these pins. All configuration pins are LVTTTL 12 mA. (See **Virtex-II DC Characteristics** in Module 3.)

A persist option is available which can be used to force the configuration pins to retain their configuration function even after device configuration is complete. If the persist option is not selected then the configuration pins with the exception of CCLK, PROG_B, and DONE can be used as user I/O in normal operation. The persist option does not apply to the Boundary-Scan related pins. The persist feature is valuable in applications which employ partial reconfiguration or reconfiguration on the fly.

Configuration Modes

Virtex-II supports the following five configuration modes:

- **Slave-Serial Mode**
- **Master-Serial Mode**
- **Slave SelectMAP Mode**
- **Master SelectMAP Mode**
- **Boundary-Scan (JTAG, IEEE 1532) Mode**

A detailed description of configuration modes is provided in the *Virtex-II User Guide*.

Slave-Serial Mode

In slave-serial mode, the FPGA receives configuration data in bit-serial form from a serial PROM or other serial source of configuration data. The CCLK pin on the FPGA is an input in this mode. The serial bitstream must be setup at the

DIN input pin a short time before each rising edge of the externally generated CCLK.

Multiple FPGAs can be daisy-chained for configuration from a single source. After a particular FPGA has been configured, the data for the next device is routed internally to the DOUT pin. The data on the DOUT pin changes on the falling edge of CCLK.

Slave-serial mode is selected by applying <111> to the mode pins (M2, M1, M0). A weak pull-up on the mode pins makes slave serial the default mode if the pins are left unconnected.

Master-Serial Mode

In master-serial mode, the CCLK pin is an output pin. It is the Virtex-II FPGA device that drives the configuration clock on the CCLK pin to a Xilinx Serial PROM which in turn feeds bit-serial data to the DIN input. The FPGA accepts this data on each rising CCLK edge. After the FPGA has been loaded, the data for the next device in a daisy-chain is presented on the DOUT pin after the falling CCLK edge.

The interface is identical to slave serial except that an internal oscillator is used to generate the configuration clock (CCLK). A wide range of frequencies can be selected for CCLK which always starts at a slow default frequency. Configuration bits then switch CCLK to a higher frequency for the remainder of the configuration.

Slave SelectMAP Mode

The SelectMAP mode is the fastest configuration option. Byte-wide data is written into the Virtex-II FPGA device with a BUSY flag controlling the flow of data. An external data source provides a byte stream, CCLK, an active Low Chip Select (CS_B) signal and a Write signal (RDWR_B). If BUSY is asserted (High) by the FPGA, the data must be held until BUSY goes Low. Data can also be read using the SelectMAP mode. If RDWR_B is asserted, configuration data is read out of the FPGA as part of a readback operation.

After configuration, the pins of the SelectMAP port can be used as additional user I/O. Alternatively, the port can be retained to permit high-speed 8-bit readback using the persist option.

Multiple Virtex-II FPGAs can be configured using the SelectMAP mode, and be made to start-up simultaneously. To configure multiple devices in this way, wire the individual CCLK, Data, RDWR_B, and BUSY pins of all the devices in parallel. The individual devices are loaded separately by deasserting the CS_B pin of each device in turn and writing the appropriate data.

Master SelectMAP Mode

This mode is a master version of the SelectMAP mode. The device is configured byte-wide on a CCLK supplied by the

Table 15: IOB Input Switching Characteristics Standard Adjustments (Continued)

Description	IOSTANDARD Attribute	Timing Parameter	Speed Grade			Units
			-6	-5	-4	
LVDCI, 3.3V, Half-Impedance	LVDCI_DV2_33	T _{ILVDCI_DV2_33}	0.00	0.00	0.00	ns
LVDCI, 2.5V, Half-Impedance	LVDCI_DV2_25	T _{ILVDCI_DV2_25}	0.11	0.11	0.12	ns
LVDCI, 1.8V, Half-Impedance	LVDCI_DV2_18	T _{ILVDCI_DV2_18}	0.42	0.43	0.49	ns
LVDCI, 1.5V, Half-Impedance	LVDCI_DV2_15	T _{ILVDCI_DV2_15}	0.98	1.00	1.14	ns
HSLVDCI (High-Speed Low-Voltage DCI), 1.5V	HSLVDCI_15	T _{IHSLVDCI_15}	0.42	0.42	0.48	ns
HSLVDCI, 1.8V	HSLVDCI_18	T _{IHSLVDCI_18}	0.52	0.53	0.60	ns
HSLVDCI, 2.5V	HSLVDCI_25	T _{IHSLVDCI_25}	0.42	0.42	0.48	ns
HSLVDCI, 3.3V	HSLVDCI_33	T _{IHSLVDCI_33}	0.42	0.42	0.48	ns
GTL (Gunning Transceiver Logic) with DCI	GTL_DCI	T _{IGTL_DCI}	0.42	0.42	0.48	ns
GTL Plus with DCI	GTLP_DCI	T _{IGTLP_DCI}	0.42	0.42	0.48	ns
HSTL (High-Speed Transceiver Logic), Class I, with DCI	HSTL_I_DCI	T _{IHSTL_I_DCI}	0.42	0.42	0.48	ns
HSTL, Class II, with DCI	HSTL_II_DCI	T _{IHSTL_II_DCI}	0.42	0.42	0.48	ns
HSTL, Class III, with DCI	HSTL_III_DCI	T _{IHSTL_III_DCI}	0.42	0.42	0.48	ns
HSTL, Class IV, with DCI	HSTL_IV_DCI	T _{IHSTL_IV_DCI}	0.42	0.42	0.48	ns
HSTL, Class I, 1.8V, with DCI	HSTL_I_DCI_18	T _{IHSTL_I_DCI_18}	0.42	0.42	0.48	ns
HSTL, Class II, 1.8V, with DCI	HSTL_II_DCI_18	T _{IHSTL_II_DCI_18}	0.42	0.42	0.48	ns
HSTL, Class III, 1.8V, with DCI	HSTL_III_DCI_18	T _{IHSTL_III_DCI_18}	0.42	0.42	0.48	ns
HSTL, Class IV, 1.8V, with DCI	HSTL_IV_DCI_18	T _{IHSTL_IV_DCI_18}	0.42	0.42	0.48	ns
SSTL (Stub Series Terminated Logic), Class I, 1.8V, with DCI	SSTL18_I_DCI	T _{ISSTL18_I_DCI}	0.42	0.42	0.48	ns
SSTL, Class II, 1.8V, with DCI	SSTL18_II_DCI	T _{ISSTL18_II_DCI}	0.42	0.42	0.48	ns
SSTL, Class I, 2.5V, with DCI	SSTL2_I_DCI	T _{ISSTL2_I_DCI}	0.42	0.42	0.48	ns
SSTL, Class II, 2.5V, with DCI	SSTL2_II_DCI	T _{ISSTL2_II_DCI}	0.42	0.42	0.48	ns
SSTL, Class I, 3.3V, with DCI	SSTL3_I_DCI	T _{ISSTL3_I_DCI}	0.35	0.35	0.40	ns
SSTL, Class II, 3.3V, with DCI	SSTL3_II_DCI	T _{ISSTL3_II_DCI}	0.35	0.35	0.40	ns
LVDS (Low-Voltage Differential Signaling), 2.5V, with DCI	LVDS_25_DCI	T _{ILVDS_25_DCI}	0.60	0.60	0.69	ns
LVDS, 3.3V, with DCI	LVDS_33_DCI	T _{ILVDS_33_DCI}	0.60	0.60	0.69	ns
LVDSEXT (LVDS Extended Mode), 2.5V, with DCI	LVDSEXT_25_DCI	T _{ILVDSEXT_25_DCI}	0.58	0.59	0.79	ns
LVDSEXT, 3.3V, with DCI	LVDSEXT_33_DCI	T _{ILVDSEXT_33_DCI}	0.56	0.56	0.65	ns

Notes:

1. Input timing for LVTTTL is measured at 1.4V. For other I/O standards, see [Table 18](#).

Table 17: IOB Output Switching Characteristics Standard Adjustments (Continued)

Description	IOSTANDARD Attribute	Timing Parameter	Speed Grade			Units
			-6	-5	-4	
HSTL, Class II, 1.8V	HSTL_II_18	T _{OHSTL_II_18}	-0.17	-0.18	-0.20	ns
HSTL, Class III, 1.8V	HSTL_III_18	T _{OHSTL_III_18}	-0.16	-0.16	-0.18	ns
HSTL, Class IV, 1.8V	HSTL_IV_18	T _{OHSTL_IV_18}	-0.39	-0.40	-0.44	ns
SSTL (Stub Series Terminated Logic), Class I, 1.8V	SSTL18_I	T _{OSSTL18_I}	0.20	0.20	0.22	ns
SSTL, Class II, 1.8V	SSTL18_II	T _{OSSTL18_II}	-0.05	-0.05	-0.06	ns
SSTL, Class I, 2.5V	SSTL2_I	T _{OSSTL2_I}	0.21	0.22	0.24	ns
SSTL, Class II, 2.5V	SSTL2_II	T _{OSSTL2_II}	-0.15	-0.16	-0.18	ns
SSTL, Class I, 3.3V	SSTL3_I	T _{OSSTL3_I}	0.29	0.30	0.33	ns
SSTL, Class II, 3.3V	SSTL3_II	T _{OSSTL3_II}	-0.05	-0.05	-0.05	ns
AGP-2X/AGP (Accelerated Graphics Port)	AGP	T _{OAGP}	-0.27	-0.28	-0.31	ns
LVDCI (Low-Voltage Digitally Controlled Impedance), 3.3V	LVDCI_33	T _{OLVDCI_33}	0.74	0.77	0.84	ns
LVDCI, 2.5V	LVDCI_25	T _{OLVDCI_25}	0.78	0.80	0.88	ns
LVDCI, 1.8V	LVDCI_18	T _{OLVDCI_18}	0.84	0.87	0.95	ns
LVDCI, 1.5V	LVDCI_15	T _{OLVDCI_15}	1.82	1.88	2.06	ns
LVDCI, 3.3V, Half-Impedance	LVDCI_DV2_33	T _{OLVDCI_DV2_33}	0.12	0.12	0.13	ns
LVDCI, 2.5V, Half-Impedance	LVDCI_DV2_25	T _{OLVDCI_DV2_25}	0.03	0.03	0.03	ns
LVDCI, 1.8V, Half-Impedance	LVDCI_DV2_18	T _{OLVDCI_DV2_18}	0.42	0.43	0.48	ns
LVDCI, 1.5V, Half-Impedance	LVDCI_DV2_15	T _{OLVDCI_DV2_15}	1.20	1.23	1.36	ns
HSLVDCI (High-Speed Low-Voltage DCI), 1.5V	HSLVDCI_15	T _{OHSLVDCI_15}	1.82	1.88	2.06	ns
HSLVDCI, 1.8V	HSLVDCI_18	T _{OHSLVDCI_18}	1.05	1.08	1.24	ns
HSLVDCI, 2.5V	HSLVDCI_25	T _{OHSLVDCI_25}	0.78	0.80	0.88	ns
HSLVDCI, 3.3V	HSLVDCI_33	T _{OHSLVDCI_33}	0.74	0.77	0.84	ns
GTL (Gunning Transceiver Logic) with DCI	GTL_DCI	T _{OGTL_DCI}	-0.31	-0.32	-0.35	ns
GTL Plus with DCI	GTL_P_DCI	T _{OGTL_P_DCI}	-0.15	-0.16	-0.17	ns
HSTL (High-Speed Transceiver Logic), Class I, with DCI	HSTL_I_DCI	T _{OHSTL_I_DCI}	0.23	0.23	0.26	ns
HSTL, Class II, with DCI	HSTL_II_DCI	T _{OHSTL_II_DCI}	0.06	0.06	0.07	ns
HSTL, Class III, with DCI	HSTL_III_DCI	T _{OHSTL_III_DCI}	-0.17	-0.18	-0.20	ns
HSTL, Class IV, with DCI	HSTL_IV_DCI	T _{OHSTL_IV_DCI}	-0.46	-0.47	-0.52	ns
HSTL, Class I, 1.8V, with DCI	HSTL_I_DCI_18	T _{OHSTL_I_DCI_18}	0.05	0.05	0.06	ns
HSTL, Class II, 1.8V, with DCI	HSTL_II_DCI_18	T _{OHSTL_II_DCI_18}	-0.03	-0.03	-0.03	ns
HSTL, Class III, 1.8V, with DCI	HSTL_III_DCI_18	T _{OHSTL_III_DCI_18}	-0.14	-0.14	-0.16	ns
HSTL, Class IV, 1.8V, with DCI	HSTL_IV_DCI_18	T _{OHSTL_IV_DCI_18}	-0.41	-0.42	-0.47	ns
SSTL (Stub Series Terminated Logic), Class I, 1.8V, with DCI	SSTL18_I_DCI	T _{OSSTL18_I_DCI}	0.36	0.37	0.40	ns
SSTL, Class II, 1.8V, with DCI	SSTL18_II_DCI	T _{OSSTL18_II_DCI}	0.06	0.06	0.07	ns
SSTL, Class I, 2.5V, with DCI	SSTL2_I_DCI	T _{OSSTL2_I_DCI}	0.12	0.13	0.14	ns
SSTL, Class II, 2.5V, with DCI	SSTL2_II_DCI	T _{OSSTL2_II_DCI}	-0.10	-0.10	-0.11	ns
SSTL, Class I, 3.3V, with DCI	SSTL3_I_DCI	T _{OSSTL3_I_DCI}	0.15	0.16	0.17	ns
SSTL, Class II, 3.3V, with DCI	SSTL3_II_DCI	T _{OSSTL3_II_DCI}	0.08	0.08	0.09	ns

CS144/CSG144 Chip-Scale BGA Package

As shown in [Table 5](#), XC2V40, XC2V80, and XC2V250 Virtex-II devices are available in the CS144/CSG144 package. Pins in the XC2V40, XC2V80, and XC2V250 devices are the same except for pin differences in the XC2V40 device, shown in the No Connect column. Following this table are the [CS144/CSG144 Chip-Scale BGA Package Specifications \(0.80mm pitch\)](#).

Table 5: CS144/CSG144 — XC2V40, XC2V80, and XC2V250

Bank	Pin Description	Pin Number	No Connect in the XC2V40
0	IO_L01N_0	B3	
0	IO_L01P_0	A3	
0	IO_L02N_0	C4	
0	IO_L02P_0	B4	
0	IO_L03N_0/VRP_0	A4	
0	IO_L03P_0/VRN_0	D5	
0	IO_L94N_0/VREF_0	A5	
0	IO_L94P_0	D6	
0	IO_L95N_0/GCLK7P	C6	
0	IO_L95P_0/GCLK6S	B6	
0	IO_L96N_0/GCLK5P	A6	
0	IO_L96P_0/GCLK4S	D7	
1	IO_L96N_1/GCLK3P	A7	
1	IO_L96P_1/GCLK2S	B7	
1	IO_L95N_1/GCLK1P	A8	
1	IO_L95P_1/GCLK0S	B8	
1	IO_L94N_1	C8	
1	IO_L94P_1/VREF_1	D8	
1	IO_L03N_1/VRP_1	C9	
1	IO_L03P_1/VRN_1	D9	
1	IO_L02N_1	A10	
1	IO_L02P_1	B10	
1	IO_L01N_1	C10	
1	IO_L01P_1	D10	
2	IO_L01N_2	C13	
2	IO_L01P_2	D11	
2	IO_L02N_2/VRP_2	D12	
2	IO_L02P_2/VRN_2	D13	
2	IO_L03N_2	E10	
2	IO_L03P_2/VREF_2	E11	
2	IO_L93N_2	E13	NC
2	IO_L93P_2/VREF_2	F11	NC
2	IO_L94N_2	F12	
2	IO_L94P_2	G10	

Table 6: FG256/FGG256 BGA — XC2V40, XC2V80, XC2V250, XC2V500, and XC2V1000

Bank	Pin Description	Pin Number	No Connect in XC2V40	No Connect in XC2V80
NA	GND	T16		
NA	GND	T1		
NA	GND	R15		
NA	GND	R2		
NA	GND	P14		
NA	GND	P3		
NA	GND	L11		
NA	GND	L6		
NA	GND	K10		
NA	GND	K9		
NA	GND	K8		
NA	GND	K7		
NA	GND	J10		
NA	GND	J9		
NA	GND	J8		
NA	GND	J7		
NA	GND	H10		
NA	GND	H9		
NA	GND	H8		
NA	GND	H7		
NA	GND	G10		
NA	GND	G9		
NA	GND	G8		
NA	GND	G7		
NA	GND	F11		
NA	GND	F6		
NA	GND	C14		
NA	GND	C3		
NA	GND	B15		
NA	GND	B2		
NA	GND	A16		
NA	GND	A1		

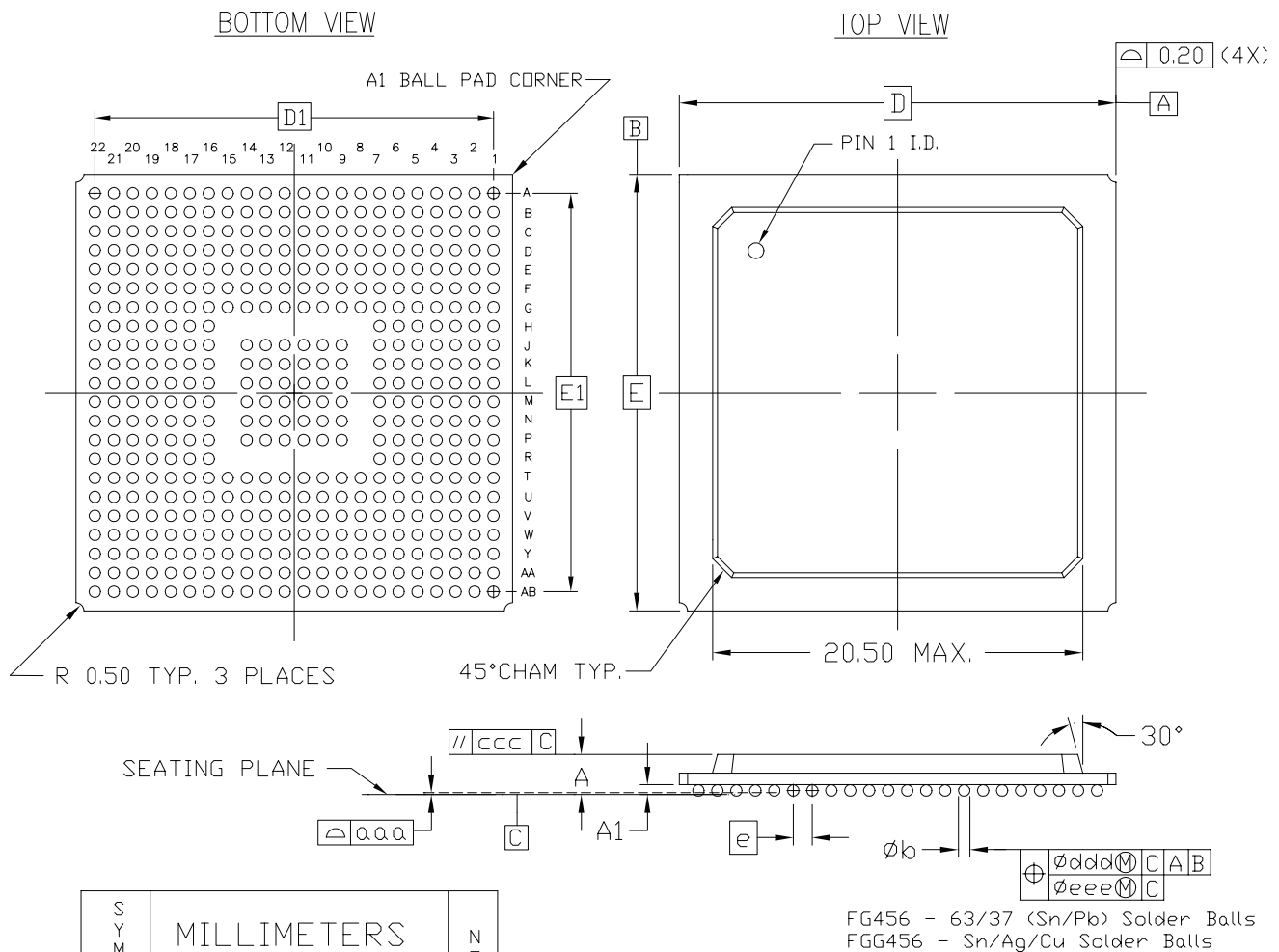
Notes:

1. See Table 4 for an explanation of the signals available on this pin.

Table 7: FG456/FGG456 BGA — XC2V250, XC2V500, and XC2V1000

Bank	Pin Description	Pin Number	No Connect in XC2V250	No Connect in XC2V500
7	IO_L51N_7	J2	NC	
7	IO_L49P_7	J3	NC	
7	IO_L49N_7	J4	NC	
7	IO_L48P_7	H1		
7	IO_L48N_7	H2		
7	IO_L46P_7	H3		
7	IO_L46N_7	H4		
7	IO_L45P_7/VREF_7	J6		
7	IO_L45N_7	H5		
7	IO_L43P_7	G1		
7	IO_L43N_7	G2		
7	IO_L24P_7	G3	NC	NC
7	IO_L24N_7	G4	NC	NC
7	IO_L22P_7	F1	NC	NC
7	IO_L22N_7	F2	NC	NC
7	IO_L21P_7/VREF_7	F3	NC	NC
7	IO_L21N_7	F4	NC	NC
7	IO_L19P_7	G5	NC	NC
7	IO_L19N_7	F5	NC	NC
7	IO_L06P_7	E1		
7	IO_L06N_7	E2		
7	IO_L04P_7	E3		
7	IO_L04N_7	E4		
7	IO_L03P_7/VREF_7	D1		
7	IO_L03N_7	D2		
7	IO_L02P_7/VRN_7	C1		
7	IO_L02N_7/VRP_7	C2		
7	IO_L01P_7	E5		
7	IO_L01N_7	E6		
0	VCCO_0	G11		
0	VCCO_0	G10		
0	VCCO_0	G9		
0	VCCO_0	F8		

FG456/FGG456 Fine-Pitch BGA Package Specifications (1.00mm pitch)



NOTES:

1. ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1994
2. SYMBOL 'M' IS THE BALL MATRIX SIZE.
3. NOMINAL 'A' DIMENSION FOR 2-LAYER IS 2.03mm AND FOR 4-LAYER IS 2.20mm.
4. CONFORMS TO JEDEC MS-034-AAJ-1 (DEPOPULATED)

456-BALL FINE PITCH BGA (FG456/FGG456)

Figure 3: FG456/FGG456 Fine-Pitch BGA Package Specifications

Table 8: FG676/FGG676 BGA — XC2V1500, XC2V2000, and XC2V3000

Bank	Pin Description	Pin Number	No Connect in XC2V1500	No Connect in XC2V2000
2	IO_L45N_2	H23		
2	IO_L45P_2/VREF_2	H24		
2	IO_L46N_2	J21		
2	IO_L46P_2	J20		
2	IO_L48N_2	H25		
2	IO_L48P_2	H26		
2	IO_L49N_2	J22		
2	IO_L49P_2	J23		
2	IO_L51N_2	K21		
2	IO_L51P_2/VREF_2	K22		
2	IO_L52N_2	K20		
2	IO_L52P_2	L20		
2	IO_L54N_2	J24		
2	IO_L54P_2	J25		
2	IO_L67N_2	K23		
2	IO_L67P_2	K24		
2	IO_L69N_2	J26		
2	IO_L69P_2/VREF_2	K26		
2	IO_L70N_2	L22		
2	IO_L70P_2	L21		
2	IO_L72N_2	L25		
2	IO_L72P_2	L26		
2	IO_L73N_2	L19	NC	
2	IO_L73P_2	M19	NC	
2	IO_L75N_2	L23	NC	
2	IO_L75P_2/VREF_2	L24	NC	
2	IO_L76N_2	M22	NC	
2	IO_L76P_2	M21	NC	
2	IO_L78N_2	M23	NC	
2	IO_L78P_2	M24	NC	
2	IO_L91N_2	M25		
2	IO_L91P_2	M26		
2	IO_L93N_2	M20		
2	IO_L93P_2/VREF_2	N20		
2	IO_L94N_2	N22		
2	IO_L94P_2	N21		
2	IO_L96N_2	N24		

Table 10: BG728 BGA — XC2V3000

Bank	Pin Description	Pin Number
4	IO_L27P_4/VREF_4	AG19
4	IO_L28N_4	AB19
4	IO_L28P_4	AA19
4	IO_L30N_4	AC19
4	IO_L30P_4	AD19
4	IO_L49N_4	AE19
4	IO_L49P_4	AF19
4	IO_L51N_4	AA18
4	IO_L51P_4/VREF_4	Y18
4	IO_L52N_4	AB18
4	IO_L52P_4	AC18
4	IO_L54N_4	AD18
4	IO_L54P_4	AE18
4	IO_L67N_4	AF18
4	IO_L67P_4	AG18
4	IO_L69N_4	AA17
4	IO_L69P_4/VREF_4	Y17
4	IO_L70N_4	AB17
4	IO_L70P_4	AB16
4	IO_L72N_4	AD17
4	IO_L72P_4	AE17
4	IO_L73N_4	AF17
4	IO_L73P_4	AG17
4	IO_L75N_4	Y16
4	IO_L75P_4/VREF_4	W16
4	IO_L76N_4	AC16
4	IO_L76P_4	AD16
4	IO_L78N_4	AF16
4	IO_L78P_4	AG16
4	IO_L91N_4/VREF_4	W15
4	IO_L91P_4	Y15
4	IO_L92N_4	AB15
4	IO_L92P_4	AA15
4	IO_L93N_4	AC15
4	IO_L93P_4	AD15
4	IO_L94N_4/VREF_4	AE15

Table 11: FF896 BGA — XC2V1000, XC2V1500, and XC2V2000

Bank	Pin Description	Pin Number	No Connect in the XC2V1000	No Connect in the XC2V1500
2	IO_L78P_2	P5	NC	NC
2	IO_L91N_2	R2		
2	IO_L91P_2	P2		
2	IO_L92N_2	P8		
2	IO_L92P_2	R8		
2	IO_L93N_2	P4		
2	IO_L93P_2/VREF_2	R4		
2	IO_L94N_2	R1		
2	IO_L94P_2	T2		
2	IO_L95N_2	R7		
2	IO_L95P_2	R6		
2	IO_L96N_2	R3		
2	IO_L96P_2	P3		
3	IO_L96N_3	T7		
3	IO_L96P_3	T6		
3	IO_L95N_3	U1		
3	IO_L95P_3	V1		
3	IO_L94N_3	T3		
3	IO_L94P_3	U3		
3	IO_L93N_3/VREF_3	T8		
3	IO_L93P_3	U8		
3	IO_L92N_3	U2		
3	IO_L92P_3	V2		
3	IO_L91N_3	T4		
3	IO_L91P_3	U4		
3	IO_L78N_3	U9	NC	NC
3	IO_L78P_3	T9	NC	NC
3	IO_L77N_3	W1	NC	NC
3	IO_L77P_3	Y1	NC	NC
3	IO_L76N_3	T5	NC	NC
3	IO_L76P_3	U5	NC	NC
3	IO_L75N_3/VREF_3	U6	NC	NC
3	IO_L75P_3	V6	NC	NC
3	IO_L74N_3	W2	NC	NC
3	IO_L74P_3	Y2	NC	NC
3	IO_L73N_3	V4	NC	NC

Table 11: FF896 BGA — XC2V1000, XC2V1500, and XC2V2000

Bank	Pin Description	Pin Number	No Connect in the XC2V1000	No Connect in the XC2V1500
3	IO_L73P_3	W4	NC	NC
3	IO_L72N_3	W7	NC	
3	IO_L72P_3	V7	NC	
3	IO_L71N_3	V5	NC	
3	IO_L71P_3	W6	NC	
3	IO_L70N_3	W3	NC	
3	IO_L70P_3	Y3	NC	
3	IO_L69N_3/VREF_3	V8	NC	
3	IO_L69P_3	W8	NC	
3	IO_L68N_3	AA1	NC	
3	IO_L68P_3	AB1	NC	
3	IO_L67N_3	Y4	NC	
3	IO_L67P_3	AA4	NC	
3	IO_L54N_3	AA6		
3	IO_L54P_3	Y6		
3	IO_L53N_3	AA2		
3	IO_L53P_3	AB2		
3	IO_L52N_3	Y5		
3	IO_L52P_3	AA5		
3	IO_L51N_3/VREF_3	Y8		
3	IO_L51P_3	AA8		
3	IO_L50N_3	AC2		
3	IO_L50P_3	AD2		
3	IO_L49N_3	Y7		
3	IO_L49P_3	AA7		
3	IO_L48N_3	AC6		
3	IO_L48P_3	AB6		
3	IO_L47N_3	AD1		
3	IO_L47P_3	AE1		
3	IO_L46N_3	AB3		
3	IO_L46P_3	AC3		
3	IO_L45N_3/VREF_3	AB7		
3	IO_L45P_3	AC7		
3	IO_L44N_3	AB4		
3	IO_L44P_3	AC4		
3	IO_L43N_3	AB5		
3	IO_L43P_3	AC5		

Table 13: FF1517 BGA — XC2V4000, XC2V6000, and XC2V8000

Bank	Pin Description	Pin Number	No Connect in the XC2V4000	No Connect in the XC2V6000
6	IO_L47N_6	AJ39		
6	IO_L48P_6	AG35		
6	IO_L48N_6	AH35		
6	IO_L49P_6	AG32		
6	IO_L49N_6	AF32		
6	IO_L50P_6	AH37		
6	IO_L50N_6	AG37		
6	IO_L51P_6	AD29		
6	IO_L51N_6/VREF_6	AE29		
6	IO_L52P_6	AD28		
6	IO_L52N_6	AC28		
6	IO_L53P_6	AH38		
6	IO_L53N_6	AG38		
6	IO_L54P_6	AF34		
6	IO_L54N_6	AG34		
6	IO_L55P_6	AE32		
6	IO_L55N_6	AD32		
6	IO_L56P_6	AH39		
6	IO_L56N_6	AG39		
6	IO_L57P_6	AE33		
6	IO_L57N_6/VREF_6	AF33		
6	IO_L58P_6	AD30		
6	IO_L58N_6	AC30		
6	IO_L59P_6	AF37		
6	IO_L59N_6	AE37		
6	IO_L60P_6	AF36		
6	IO_L60N_6	AG36		
6	IO_L67P_6	AD31		
6	IO_L67N_6	AC31		
6	IO_L68P_6	AE34		
6	IO_L68N_6	AD34		
6	IO_L69P_6	AD35		
6	IO_L69N_6/VREF_6	AE35		
6	IO_L70P_6	AB28		
6	IO_L70N_6	AA28		
6	IO_L71P_6	AF39		

Table 13: FF1517 BGA — XC2V4000, XC2V6000, and XC2V8000

Bank	Pin Description	Pin Number	No Connect in the XC2V4000	No Connect in the XC2V6000
NA	GND	D4		
NA	GND	C39		
NA	GND	C38		
NA	GND	C37		
NA	GND	C3		
NA	GND	C2		
NA	GND	C1		
NA	GND	B39		
NA	GND	B38		
NA	GND	B37		
NA	GND	B29		
NA	GND	B11		
NA	GND	B3		
NA	GND	B2		
NA	GND	B1		
NA	GND	A38		
NA	GND	A37		
NA	GND	A20		
NA	GND	A3		
NA	GND	A2		

Notes:

- See Table 4 for an explanation of the signals available on this pin.

Table 14: BF957 — XC2V2000, XC2V3000, XC2V4000, and XC2V6000

Bank	Pin Description	Pin Number	No Connect in XC2V2000
2	IO_L70N_2	K1	
2	IO_L70P_2	L1	
2	IO_L71N_2	N9	
2	IO_L71P_2	P9	
2	IO_L72N_2	N5	
2	IO_L72P_2	P5	
2	IO_L73N_2	M3	
2	IO_L73P_2	N3	
2	IO_L74N_2	R8	
2	IO_L74P_2	R9	
2	IO_L75N_2	M2	
2	IO_L75P_2/VREF_2	N2	
2	IO_L76N_2	M1	
2	IO_L76P_2	N1	
2	IO_L77N_2	P7	
2	IO_L77P_2	R7	
2	IO_L78N_2	N4	
2	IO_L78P_2	P4	
2	IO_L91N_2	T8	
2	IO_L91P_2	T9	
2	IO_L92N_2	P6	
2	IO_L92P_2	R6	
2	IO_L93N_2	P2	
2	IO_L93P_2/VREF_2	R2	
2	IO_L94N_2	R5	
2	IO_L94P_2	T5	
2	IO_L95N_2	P1	
2	IO_L95P_2	R1	
2	IO_L96N_2	R4	
2	IO_L96P_2	R3	
3	IO_L96N_3	T6	
3	IO_L96P_3	U5	
3	IO_L95N_3	U6	
3	IO_L95P_3	V6	
3	IO_L94N_3	T3	
3	IO_L94P_3	U3	
3	IO_L93N_3/VREF_3	U1	

Table 14: BF957 — XC2V2000, XC2V3000, XC2V4000, and XC2V6000

Bank	Pin Description	Pin Number	No Connect in XC2V2000
NA	GND	D10	
NA	GND	D16	
NA	GND	D22	
NA	GND	D28	
NA	GND	E5	
NA	GND	E27	
NA	GND	F6	
NA	GND	F26	
NA	GND	G7	
NA	GND	G13	
NA	GND	G16	
NA	GND	G19	
NA	GND	G25	
NA	GND	H2	
NA	GND	H8	
NA	GND	H24	
NA	GND	H30	
NA	GND	J9	
NA	GND	J23	
NA	GND	K4	
NA	GND	K16	
NA	GND	K28	
NA	GND	N7	
NA	GND	N25	
NA	GND	P14	
NA	GND	P15	
NA	GND	P16	
NA	GND	P17	
NA	GND	P18	
NA	GND	R14	
NA	GND	R15	
NA	GND	R16	
NA	GND	R17	
NA	GND	R18	
NA	GND	T1	
NA	GND	T4	
NA	GND	T7	
NA	GND	T10	