FAIRCHILD SEMICONDUCTOR™

I-Cube®

OCX1601 Crosspoint Switch
Advanced Datasheet

Features

- 1.6 Gb/s port data bandwidth, >128Gb/s aggregate bandwidth
- Low power CMOS, 2.5V and 3.3V power supply
- SRAM-based, in-system programmable
- 160 configurable I/O ports
  - 80 dedicated differential input ports
  - 80 dedicated differential output ports
  - Supports LVPECL and LVDS I/O
  - LVTTL control interface
  - Output Enable control for all outputs
- Non-blocking switch matrix
  - Patented ActiveArray™ matrix for superior performance
  - Double-buffered configuration RAM cells for simultaneous global updates
  - ImpliedDisconnect™ function for single cycle disconnect/ connect
- Full Broadcast and multicast capability
  - One-to-One and One-to-Many connections
  - Special broadcast mode routes one input to all outputs at maximum data rate
- Low jitter and signal skew
- Low duty cycle distortion
- RapidConfigure™ parallel interface for configuration and readback
- Serial programming interface for configuration
- 420 BGA package with 1.27mm ball spacing
- Integrated Termination Resistors

Description

The OCX1601 SRAM-based device is a non-blocking *80 X 80* digital crosspoint switch capable of data rates of 1.6 Gigabits per second per port. The I/O ports are fixed as either input or output ports. The input ports support flow-through mode only. The output ports operate in flow-through (asynchronous) mode.

The patented ActiveArray provides greater density, superior performance, and greater flexibility compared to a traditional *n:1* multiplexer architecture. The OCX™ devices support various operating modes covering one input to one output at a time as well as one input to many outputs, plus a special broadcast mode to program one input to all outputs while maintaining maximum data rates. In all modes data integrity and connections are maintained on all unchanged data paths.

The RapidConfigure parallel interface allows fast configuration of the Output Buffers and the switch matrix. Readback is supported for device test and verification purposes. The OCX1601 also includes a JTAG-like serial interface for configuration of the device. A functional block diagram of the OCX1601 is shown in Figure 1.

Applications

- SONET/SDH and DWDM
- Digital Cross-Connects
- System Backplanes and Interconnects
- High Speed Test Equipment
- ATM Switch Cores
- Video Switching

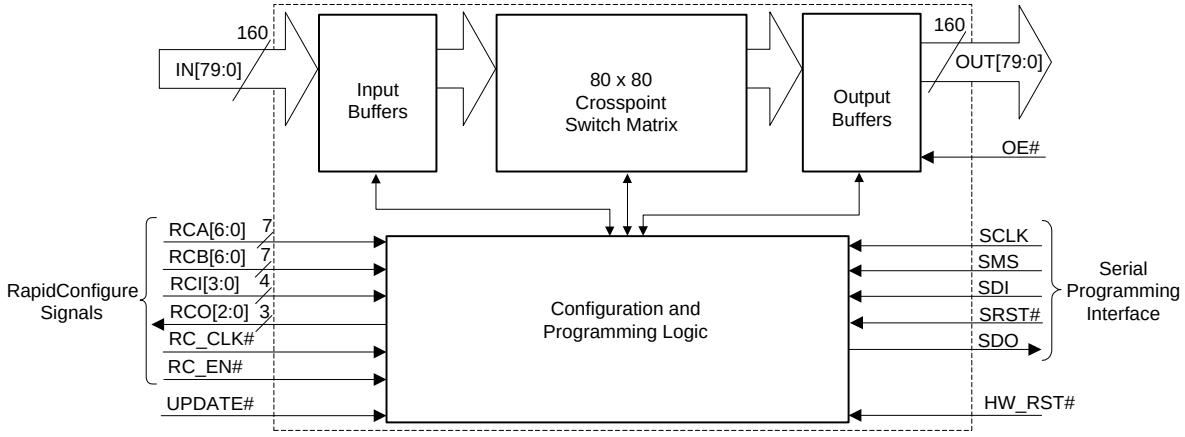

Figure 1 OCX1601 Functional Block Diagram

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Tables

1. Introduction

The OCX1601 is a differential crosspoint-switching device. The main functional block of the device is a Switch Matrix as shown in Figure 1. The Switch Matrix is a *x-y* structure supporting an input-to-output data flow. Figure 2 shows a conceptual view of the switch matrix with inputs connected to the horizontal trace and outputs to the vertical trace. Connections between vertical and horizontal lines are implemented with a proprietary high-performance buffering circuit. Signal path delays through the Switch Matrix are very well balanced, resulting in predictable and uniform pin-to-pin delays.

Note – For the purpose of clarity, the logic diagrams within this datasheet are conceptual representations only and do not show actual circuit implementation.

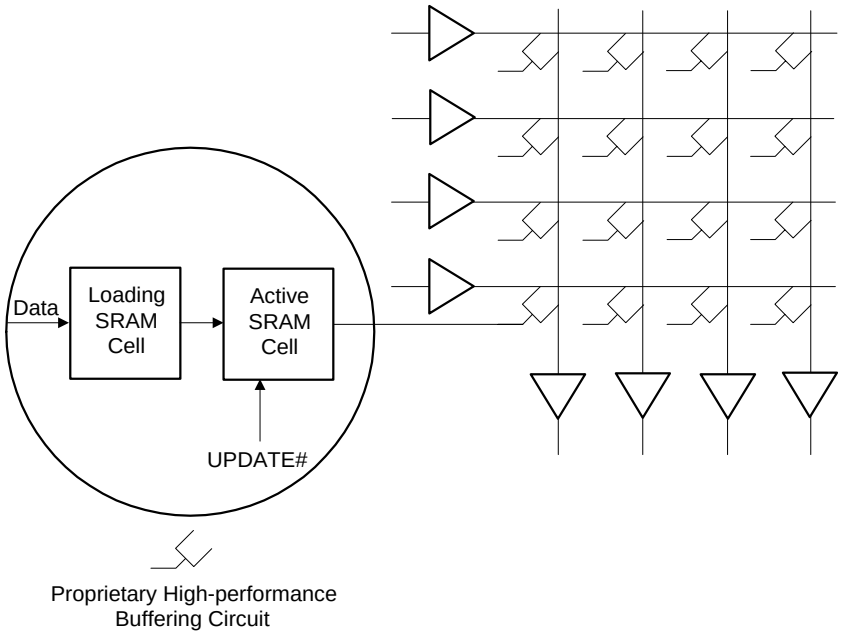


Figure 2 OCX1601 Switch Matrix

The Active SRAM cells are responsible for establishing connections in the switch matrix by turning on the interconnect circuit, while the Loading SRAM cell can be used to store a second configuration that can be transferred to the Active SRAM cell at a later time. The two SRAM cells are arranged so that a double buffered scheme can be employed. Through the use of an internal signal (generated automatically during a programming cycle) it is possible to store a second configuration map in the Loading SRAM while the Active SRAM maintains its present connection status. When the UPDATE# signal is asserted low, the contents of the Loading SRAM cell are transferred to the Active SRAM cell and the switch matrix connection is either made or broken.

The UPDATE# signal can be used to control when the switch matrix is reconfigured. For instance, as long as the UPDATE# signal is asserted high, the Loading SRAM cells for the entire switch matrix could be changed without affecting the current configuration of the switch. When the UPDATE# signal is asserted low, the entire switch matrix would be reconfigured simultaneously. If the UPDATE# signal is asserted continuously, all crosspoint programming commands (generated by RapidConfigure or Serial programming cycles) will take effect immediately, since the Loading SRAM cell's contents will be transferred directly to the Active SRAM cell.

1.1 Input and Output Buffers

All of the I/O buffers are differential with flow-through mode. Figure 3 shows the basic block diagram of the input and output blocks with the sources for the output control signals (OE#). The control signals are explained in more details in the following sections.

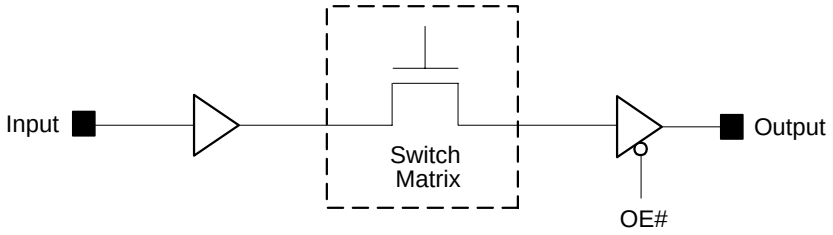


Figure 3 Input and Output Buffer Configuration

1.1.1 Input and Output Port Function Mode

The following legend describes the various modes of the Input and Output Ports and the specification used by the OCXPro™ Software.

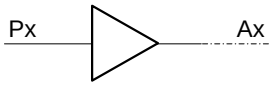
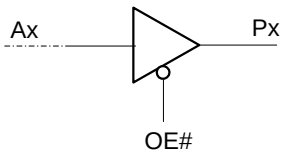
Legend:

Ax–Switch Matrix Signal

Px–Port Signal

OE#–Output Enable (# means “Active Low”)

Table 1 Summary for Programmable I/O Attributes for OCX1601

Symbol	I/O Port Function	Mnemonic
	**Input** – The external signal is buffered from the Input Port pin to the corresponding Switch Matrix line.	**IN**
	**Output** – The internal signal is buffered from the corresponding Switch Matrix line to the Output Port pin. In this mode an optional output enable (OE#) can be selected. The default state is logic high with enable set to ON.	**OP**
	**No Connect** – In this mode, the output Port pin is isolated from the Switch Matrix.	**NC**

1.1.2 Broadcast Mode

The OCX1601 has a special Broadcast Mode which connects any input to all outputs without performance degradation. The input is selected using RapidConfigure or Serial interface and disconnects all other inputs. The Global Update pin (UPDATE#) must be held high during Broadcast Mode. Asserting the UPDATE# pin returns the array to the previous program condition.

1.2 Output Control Signals

Every output port of the OCX1601 has a global Output Enable signal (OE#). All output buffers have output enables that have programmable polarity and are individually configurable.

Additionally each output can be permanently enabled (always ON) or disabled (always OFF) which is useful for applications which need to tri-state outputs (for example when using multiple chips in expansion mode) or for power saving in designs that do not need to use all the outputs available.

Two control bits are used to control the function of the output enable.

1.3 RapidConfigure Interface

RapidConfigure (RC) is a 23 signal parallel interface that is used to program the OCX1601 device. The 23 pins are allocated as follows:

RCA[6:0] = RapidConfigure Address A. RCA are input pins.

RCB[6:0] = RapidConfigure Address B. RCB are input pins.

RCI[3:0] = RapidConfigure Instruction Bits

RCO[2:0] = RapidConfigure Readback. RCO are output pins.

RC_CLK# = RapidConfigure Clock

RC_EN# = RapidConfigure Cycle Enable (state is sensed on the negative edge of clock)

1.3.1 RapidConfigure Programming Instructions

The RC interface supports both write and read types of operations:

1. Write Operations (reset crosspoint and Input or Output Buffer (IOB), configure an Output Buffer, connect/disconnect crosspoint)
2. Read Operations (Output Buffer and crosspoint configuration read).

Table 2 RapidConfigure Programming Instructions

RCI[3:0]	RCA[6:0]	RCB[6:0]	RCO[2:0]	Instruction	Description
0000				Reserved	
0001				Reserved	
0010	X	X		Reset Crosspoint Array	Reset, along with an Update operation (UPDATE# pin or Update command) resets the entire crosspoint array to no connect. All Output Buffers remain unchanged by this operation.
0011	X	Input Port Address		Set Array to Broadcast mode	Connects the input selected by RCB[6:0] to all output ports and disconnects all other inputs. The Global Update (UPDATE#) pin must be held high during Broadcast mode. Activating the Global Update pin returns the array to the previous program condition.
0100	Output Port Address	Data		Configure an Output Buffer	Program an Output Buffer specified by RCA[6:0]. See Table 4 for RCB[6:0] bit assignment and buffer functionality.

Table 2 RapidConfigure Programming Instructions *(Continued)*

RCI[3:0]	RCA[6:0]	RCB[6:0]	RCO[2:0]	Instruction	Description
0101				Readback Crosspoint, Output Buffer status	This is a two-cycle instruction.
Cycle 1	Output Port Address	Input Port Address	X		Specify the crosspoint connect status at output location specified by RCA[6:0] to the input location specified by RCB[6:0].
Cycle 2	X	X	Output Data		Readback (using RCO[2:0]) the status of the input buffer specified in Cycle 1 by RCA[6:0], the output buffer specified in Cycle 1 by RCO[2:0] and the crosspoint connect status. See Table 3 for RCO[2:0] readback pin assignment.
0110	X	X		Update	Program the Global Update function without the use of the UPDATE# pin.
0111	X	Input Port Address		Disconnect Input	Disconnect the crosspoint cells of the input row location specified by RCA[6:0].
1000	Output Port Address	Input Port Address		Disconnect Input and Output	Disconnect the crosspoint cell at the output location specified by RCA[6:0] to the input location specified by RCB[6:0]. All other connections from the source input address or to the same output address remain the same as before.
1001	Output Port Address	Input Port Address		Connect, with ImpliedDisconnect	Connect the crosspoint cell at the output location specified by RCA[6:0] to the input location specified by RCB[6:0]. All other connections from the same input address or to the same output address are set to no connect (NC).
1010	Output Port Address	Input Port Address		Connect, without ImpliedDisconnect	Connect the crosspoint cell at the output location specified by RCA[6:0] to the input location specified by RCB[6:0]. All other connections to the same output address are set to “no connect” while all other connections from the same input address remain the same as before.
1011				Reserved	
1100				Reserved	
1101	X	X		Reset All	Reset the switch matrix to no connects (NC). Update is forced internally. Sets the Output buffer to Flow-through mode with Output Enabled.
1110				Reserved	
1111				Reserved	

Note – X = Don’t care.

Table 3 RCO[2:0] Readback Pin Assignment

RCO[2:0]	Readback Location	Signal/Function
O2	Crosspoint	**Connection Status:** 0 = No connection (NC) — (default state at reset) 1 = Connected
O1, O0 0,0 0,1 1,0 1,1	Output Buffer	**Output Enable:** Output enabled (ON) – this is the default state at reset Output disabled (OFF) Output controlled by OE (active high) Output controlled by OE# (active low)

Table 4 Programming an Output Buffer using RapidConfigure

RCB[6:0]	Signal/Function
B6, B5, B4, B3, B2	Don’t care
B1, B0 0,0 0,1 1,0 1,1	**Output Enable:** Output enabled (ON) – this is the default state at reset Output disabled (OFF) Output controlled by OE (active high) Output controlled by OE# (active low)

1.4 Serial Interface Configuration Controller

The Output port attributes and the Switch Matrix connections can be programmed using the serial bus. The RapidConfigure Interface can be enabled or disabled using the serial bus.

The serial interface mode is always available for configuration regardless of whether the RapidConfigure mode is enabled or disabled. However, proper care must be taken when switching between Serial Interface and RapidConfigure for configuring the devices. Before attempting to change Switch Matrix connections or output port configuration through the Serial Interface, the user must first ensure that the RapidConfigure mode is disabled by using the Serial Interface serial mode to set the RCE bit to zero in the Mode Control Register.

1.4.1 Serial Interface

The dedicated Serial interface has five pins: Serial Data Out (SDO), Serial Mode Select (SMS), Serial Data In (SDI), Serial Reset (SRST#), and Serial Clock (SCLK), for device configuration and verification. The Fairchild supplied software will automatically generate the necessary bitstream from a higher-level textual description of the required configuration. Data on the SDI and SMS pins are clocked into the device on the rising edge of the SCLK signal, while the valid data appears on the SDO pin after the falling edge of SCLK. For more detailed information on Serial programming, refer to the *OCX Family Register Programming Manual*.

1.4.2 Output Port Configuration

Output port configuration is accomplished by loading the appropriate bitstream into the programming registers present at each Output port. The serial bus is used to load configuration data into the Output port programming registers, one Output port at a time.

1.4.3 Switch Matrix Configuration

The contents of the SRAM cells controlling Switch Matrix connection can be modified using the Serial interface. This is accomplished by loading the configuration data, one word at a time, into the SRAM cells in the Switch Matrix.

1.4.4 Mode Control Register Configuration

The OCX1601 contains a single bit Mode Control Register used to store user flags for RapidConfigure Enable (RCE). These are required for proper functioning of the device. The contents of this register can be changed using the Serial interface and a special Serial instruction.

Table 5 Mode Control Register

RCE	Mode
0	RapidConfigure interface disabled (OFF)
1	RapidConfigure interface enabled (ON)

1.4.5 Serial Interface Architecture

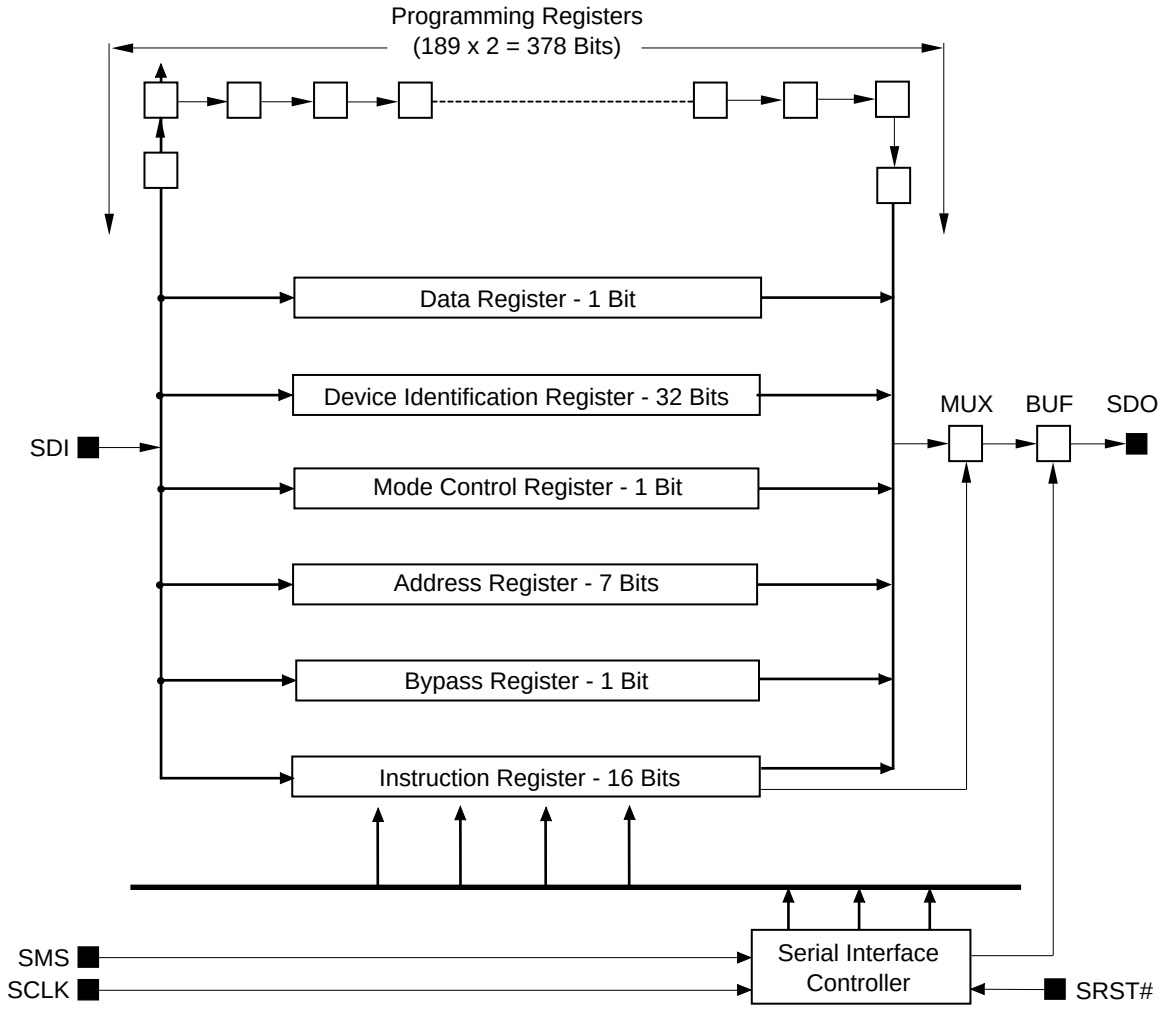


Figure 4 OCX1601 Serial Interface Architecture

1.4.6 Serial Interface State Machine

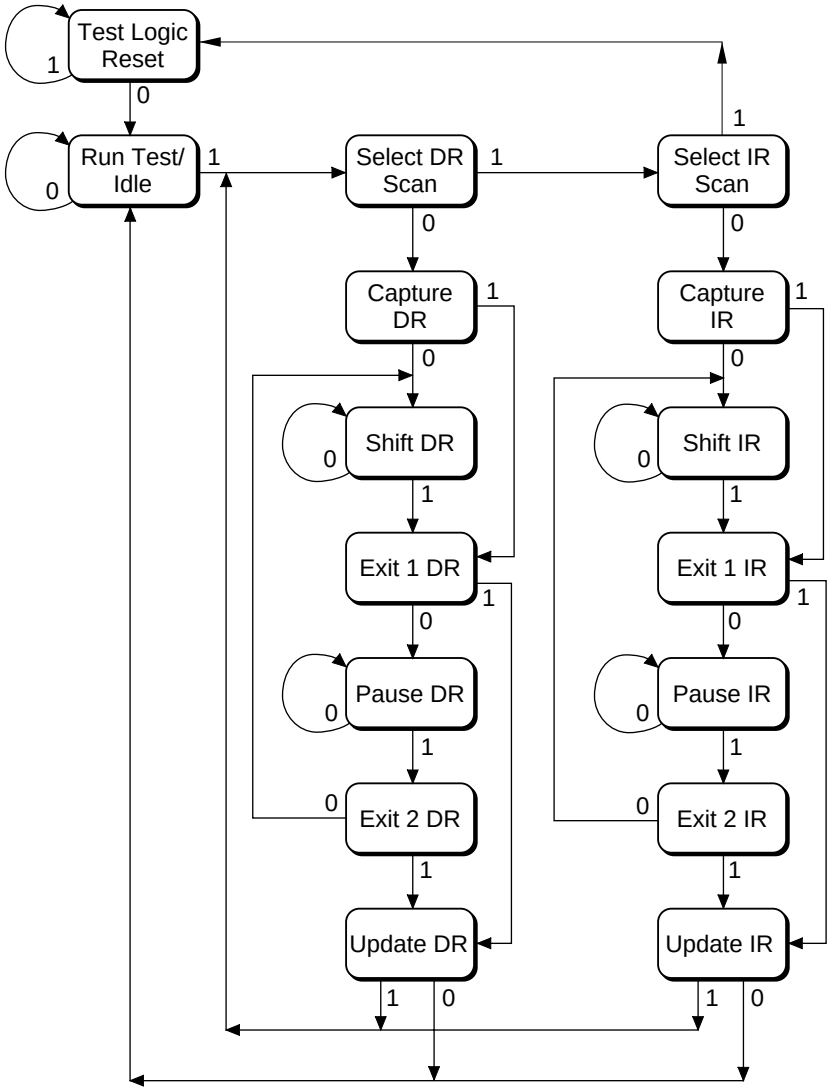


Figure 5 OCX1601 Serial Interface State Machine

1.4.7 Serial Input Format

Table 6 Serial Input Format

	Instruction				Data					Address A						
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit Name	I3	I2	I1	I0	BB	BA	B9	B8	B7	A6	A5	A4	A3	A2	A1	A0

1.4.8 Serial Interface Instructions

Table 7 Serial Interface Instructions

I [3:0]	BB	BA	B9	B8	B7	A6-A0	Instruction	Description
0 0 0 0	X	X	X	X	X	X	Sample/EXTEST	Places the device in scan mode.
0 0 0 1	X	X	X	X	X	X	Sample/EXTEST	Places the device in scan mode.
0 0 1 0	X	X	X	X	X	X	Reset the Crosspoint Array	Reset, along with an Update operation (UPDATE# pin or Update command) resets the entire Crosspoint Array to no-connect (B7 and B8 are not changed).
0 0 1 1	X	X	X	X	X	X	Set Array for Broadcast mode	Use the Address Register as the Input address to be the broadcast input. Connects the selected Input to all Output cells and disconnects all other Inputs. Activating the Global Update instruction returns the Crosspoint array from the Broadcast mode to the previous programed state.
0 1 0 0	X	X	X	OE	OE	Output Buffer Address	Program a Buffer	Programs the Output Buffer address specified in the Serial instruction (A6-A0). The configuration data is also specified in the Serial instruction bits BA-B7. See Table 8 for bit assignment of the Buffer functionality.
0 1 0 1	X	X	X	X	X	Output Address/ Buffer	Configuration readback	Readback the connectivity of the Crosspoint cell with the Input location specified in the Address Register and the Output location specified Serial instruction (A0-A6). It also returns the configuration of the Output Buffer addressed in the Serial instruction (A0-A6). The readback data is shifted out of SDO in the following sequence: 1. Crosspoint Connect (1=connected, 0=no connection) 2. Output Enable—B7 (see Table 8) 3. Output Enable—B8 (see Table 8) 4. Reserved (Don't Care) 5. Reserved (Don't Care) 6. State of Broadcast bit 7. State of the RCE bit NOTE: This instruction does not increment the Address Register. This instruction also requires two DR cycles
0 1 1 0	X	X	X	X	X	X	Update the Crosspoint Array	Update the programmed connection from the Loading SRAM to the Active SRAM.
0 1 1 1	X	X	X	X	X	X	Disconnect Input cell	Disconnect the Crosspoint connections from the Input address specified in the Address Register.
1 0 0 0	X	X	X	X	X	Output Address	Disconnect Input and Output	Disconnect the Crosspoint cell at the Input location specified at the Address Register and the Output location specified in the Disconnect instruction (A6-A0). All other connections from the same input address or to the same output address remain the same.

Table 7 Serial Interface Instructions *(Continued)*

I [3:0]	BB	BA	B9	B8	B7	A6-A0	Instruction	Description
1 0 0 1	X	X	X	X	X	Output Address	Connect with ImpliedDisconnect	Connects the Crosspoint cell at the Input location specified on the Address Register and the output location specified in the Connect Serial instruction (A6-A0). All other connections from the same Input address or the same Output address are set to no-connects. NOTE: This instruction increments the Address Register (Input address).
1 0 1 0	X	X	X	X	X	Output Address	Connect—no ImpliedDisconnect	Connects the Crosspoint cell at the Input address specified in the Address Register and the Output address specified in the Connect instruction (A6-A0). All connections to the same output address are set to “no connect” while all other connections from the same input remain the same as before.
1 0 1 1	X	X	X	X	X	Input Address	Set the Address Register	Sets the 7-bit Address Register with the 7-bit address (A6-A0) of the Instruction Register. The 7-bit address of the Address Register becomes the Input port address for Crosspoint Access.
1 1 0 0	X	X	X	X	X	X	Device ID out	Serialize the device ID and revision history out to SDO. ID for the OCX1601 is **0x0000D89F**
1 1 0 1	X	X	X	X	X	X	Reset Output Buffer and Crosspoint Array	Resets the Crosspoint Array to no-connects. Sets the Output buffer to Flow-through mode with Output Enabled. The device ID is serialized to SDO.
1 1 1 0	X	X	X	X	X	X	Set RCE Bit	Sets the RCE bit of the Mode Control Register with the Serial instruction bit A0. To turn ON the RCE bit, encode bit A0 to 1. To turn OFF the RCE bit, encode bit A0 to 0.
1 1 1 1	X	X	X	X	X	X	Bypass	Places device in a mode to pass SDI data to SDO with one clock delay. Used for programming and testing devices through serial connected controls.

Table 8 Programming an Output using the Serial Interface

BA, B9, B8, B7	Signal/Function
B8, B7	**Output Enable:**
0,0	Output enabled (ON) – this is the default state at reset
0,1	Output disabled (OFF)
1,0	Output controlled by OE (active high)
1,1	Output controlled by OE# (active low)

Table 9 Number of Cycles and Configuration Time

Operation	OCX1601 Serial Cycles
Reset Sequence (SMS = “11111”)	7
Enable or Disable RapidConfigure	28
Change attributes of ONE Output Port	28
Change attributes of ALL Output Ports	2,240
Reset Controller + Reset ALL Output Ports + Clear ALL SRAM cells	35
Connect or disconnect two Ports	56
Configure Entire Switch Matrix (All Switch Matrix Connections)	181,440
Completely Configure the Device (All Output Ports and All Switch Matrix Connections)	183,680

1.5 ImpliedDisconnect

ImpliedDisconnect is a feature that provides the ability to make fast switch connection changes. When using the normal “Connect” command, all other connection to the specified output are set to “no connect”. However, the specified input remains connected to any other outputs it was connected to before.

The “Connect with ImpliedDisconnect” command allows the user to disconnect the specified input from all other outputs as well. This enables the user to make a complete connection change in one RapidConfigure cycle.

1.6 Device Reset Options

The power-on reset, RapidConfigure reset, hardware reset, and Serial reset functions will program the output buffers to flow-through mode (with Global Clock selected), and Output Enabled (ON). The Serial interface can be reset via the SRST# pin or by clocking five consecutive one to the SMS pin. The hardware reset pin can be done accomplished through the HW_RST# pin (active low). RC reset can be accomplished by applying the RC instruction 1101 to the RCI[3:0] pins.

Table 10 Device Reset Options

Programming Interface	Reset Method	Output Ports	Switch Matrix	RCE Mode Control	Serial TAP
Hardware Reset	Power-on Reset	OP	NC	1 (RC Enabled)	TLR[1]
	HW_RST# (low pulse)	OP	NC	1 (RC Enabled)	TLR
Serial Reset	1. Low Pulse on SRST#	Unchanged	Unchanged	Unchanged	TLR
	2. SMS high for 5 SCLK cycles	Unchanged	Unchanged	Unchanged	TLR
	3. Device Reset (instruction 1101)	OP	NC	1 (RC Enabled)	TLR
	4. Reset Crosspoint Array (instruction 0010)	Unchanged	NC	Unchanged	Unchanged
RapidConfigure Reset	1. Device reset (instruction 1101)	OP	NC	1 (RC Enabled)	Unchanged
	2. Reset Crosspoint Array (instruction 0010)	Unchanged	NC	Unchanged	Unchanged

1. TLR = Test Logic Reset state.

2. Pin Description

Table 11 OCX1601 Pin Description

Pin Name	# of Pins	Type	Description
INP[79:0]	80	Input	Non-inverting differential input signals
INN[79:0]	80	Input	Inverting differential input signals
OUTP[79:0]	80	Output	Non-inverting differential input signals
OUTN[79:0]	80	Output	Inverting differential input signals
OE#	1	Input	Global Output Enable
HW_RST#	1	Input	Hardware Reset
UPDATE#	1	Input	Global Update
RC Pins			
RCA[6:0]	7	Input	RapidConfigure Address A
RCB[6:0]	7	Input	RapidConfigure Address B
RCO[2:0]	3	Output	RapidConfigure Readback
RCI[3:0]	4	Input	RapidConfigure Instruction Bits
RC_CLK#	1	Input	RapidConfigure Clock
RC_EN#	1	Input	RapidConfigure Cycle Enable
Serial Interface Pins			
SCLK	1	Input	Serial Clock
SMS	1	Input	Serial Mode Select
SDI	1	Input	Serial Data In
SRST#	1	Input	Serial Reset
SDO	1	Output	Serial Data Out
Power and Ground Pins			
V_{DD}.CORE	12	2.5V Power	Core Voltage
V_{DD}.PAD (2)	8	3.3V Power	Differential Output Buffer Voltage
V_{DD}.IN (1, 3)	8	3.3V Power	LVTTL Control pins Voltage and Differential Input Buffer Voltage
V_{SS}	36	Ground	Ground
NC	5	No Connect	No Connect

NOTES:

1. Dedicated differential input buffers can receive both LVPECL and LVDS voltage levels using 3.3V supply.
2. V_{DD}.PAD is 3.3V for LVPECL outputs.
3. The LVTTL control, Serial pins, and differential input ports are 3.3V—they are not 5V tolerant.

3. Differential I/O Standards

The OCX1601 support the two most popular differential signaling standards: Low Voltage Positive Emitter Coupled Logic (LVPECL) and Low Voltage Differential Signaling (LVDS).

LVPECL is commonly used in video switching applications or those designs requiring transmission of high-speed clock signals. This is the default I/O supported by the OCX1601 device.

LVDS is typically used in communication systems as high speed, low noise point-to-point links. The OCX1601 conforms to the ANSI/TIA/EIA-644 standard covering electrical specifications for output drivers and receiver inputs.

3.1 LVPECL

LVPECL is a differential signaling standard that specifies two pins per input or output. The voltage swing between these two signal lines is approximately 850 mV. The use of a reference voltage or a board termination voltage is not required.

Transmitting and receiving circuits for LVPECL are shown in Figure 6 with termination resistors integrated on-chip, thus, removing the need for any external resistors. Integrated Output Attenuation resistors produce the required LVPECL output swing while providing a 100 ohm output impedance to minimize return reflections.

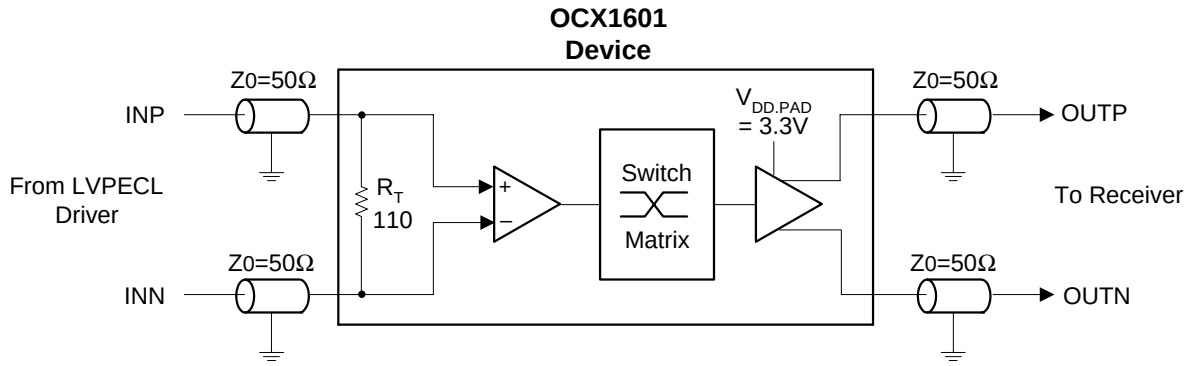


Figure 6 OCX1601 Operating in LVPECL Mode

3.2 LVDS

LVDS is a differential signaling standard that requires the use of two pins per input or output. It requires that one data bit is carried through two signal lines. As with all differential signaling standards, LVDS has an inherent noise immunity over single-ended standards. The voltage swing between two signal lines is approximately 350mV. The use of a reference voltage or a board termination voltage is not required.

Note – It is possible to operate the OCX1601 device with $V_{DD.}$PAD = 2.5V that will allow the outputs to closely approximate “true LVDS” levels. Refer to the application note “Operating the OCX1601 in LVDS Applications” for further details.

4. Electrical Specifications

4.1 Absolute Maximum Ratings

Table 12 Absolute Maximum Ratings[1]

Symbol	Parameter	Limits	Units
V_{DD}.CORE	Supply Voltage (core)	-0.3 to +3.0	V
V_{DD}.IN	Supply Voltage (inputs)	-0.3 to +3.6	V
V_{DD}.PAD	Supply Voltage (differential outputs)	-0.3 to +3.6	V
V_{IN}[2]	Input Voltage	-0.3 to +3.6[3]	V
T_J	Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{MAX}	Maximum Power Dissipation	6	W
ESD[6]	Electrostatic Discharge	2000	V

4.2 Recommended Operating Conditions

Table 13 Recommended Operating Conditions

Symbol	Parameter	Limits	Units
V_{DD}.CORE	Supply Voltage (core)	+2.375 to +2.625	V
V_{DD}.PAD[4]	Supply Voltage (differential output buffers)	3.3V ±10%	V
V_{DD}.IN	Supply Voltage (inputs)	+3.0 to +3.6	V
T_A	Operating Temperature: Commercial Operating Temperature: Industrial	0 to +70 -40 to +85	°C

4.3 Pin Capacitance

Table 14 Pin Capacitance[5]

Symbol	Parameter	Max	Units
C_{PIN}	Signal Pin Capacitance	10	pF

1. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.
2. A maximum undershoot of 2V for a maximum duration of 20 ns is acceptable. Overshoot to 3.6V is acceptable.
3. All inputs are 3.3V tolerant with the V_{DD} pin at 2.5V or 3.3V.
4. Note that min and max values for V_{DD} for differential outputs are I/O Standard dependent.
5. Capacitance measured at 25°C. Sample tested only.
6. Measured using Human Body Model.

4.4 DC Electrical Specifications

(T_A = -40°C to 85°C, V_{DD}.IN = 3.3V ±10%, V_{DD}.CORE = 2.5V ±5%)

Table 15 LVTTL DC Electrical Specifications

Symbol	Parameter	Conditions	Min	Max	Units
V_{IH}	High-level Input	Ports are 3.3V tolerant	2.0	3.6	V
V_{IL}	Low-level Input	Ports are 3.3V tolerant	-0.3	0.8	V
V_{OH}	High-level Output	V_{DD}.PAD = Min I_{OH} = -4mA	2.4	V_{DD}.PAD+ 0.3	V
V_{OL}	Low-level Output	V_{DD}.PAD = Min I_{OL} = 8mA		0.4	V
IL_{IH}, IL_{IL} (1)	Input Pin Leakage Current (2)	V_{DD}.IN= Max 0.0 < In < $V_{DD.PAD}$		+5 -50	µA
IL_{OZ}	Tristate Leakage Output OFF State (2)	V_{DD}.PAD = Max 0.0 < In < $V_{DD.PAD}$		+5 -5	µA
Power					
P_{DDQ} (3)	Quiescent Power	All V_{DD} = Max		0.5	W

Table 16 LVPECL DC Electrical Specifications

Symbol	DC Parameters	Min	Max	Units
V_{IN_DIFF}	Input Differential Voltage	±100		mV
V_{IN_COM}	Input Common Mode Voltage	0.25	2.25	V
V_{OUT_DIFF}	Output Differential Voltage	±650	±900	mV
V_{OUT_COM}	Output Common Mode Voltage	$\frac{V_{DD}.PAD}{2}$	$\frac{V_{DD}.PAD}{2}$	V
Z_{IN}	Termination Impedance	80	120	Ω

1. All LVTTL input pins have pull-up resistors.
2. Input leakage only valid when both positive and negative inputs/outputs are equal (i.e. both high or both low).
3. See section 7 for dynamic power consumption calculation.
4. Maximum capacitive load is 12 pF.

The V_{OH} levels are 200mV below standard single-grounded LVPECL levels and are compatible with devices tolerant of lower common-mode ranges. The above table summarizes the DC output specifications of LVPECL.

4.5 LVPECL AC Electrical Specifications

(V_{DD}.IN = 3.3V ±10%, V_{DD}.CORE = 2.5V ±5%, , V_{DD}.PAD = 3.3V ±10%)

Table 17 LVPECL AC Electrical Specifications

Symbol	Parameter	0°C to 70°C		-40°C to +85°C		Units
		Min	Max	Min	Max	
R_{DATA}	NRZ Data Rate (1)		1.6		1.6	Gb/s
t_{PHL}, t_{PLH}	One Way Signal Propagation Delay, Fanout = 1		3.0		3.5	ns
t_{W+}	Input Flow-through Positive Pulse Width	0.6		0.6		ns
t_{W-}	Input Flow-through Negative Pulse Width	0.6		0.6		ns
t_{DCD+}, t_{DCD-}	Duty Cycle Distortion		50		60	ps
t_{JITTER}	Output Jitter		50		60	ps
t_{SK}	Skew between Output Ports (1)		0.2		0.25	ns
t_{PHZ_OT}, t_{PLZ_OT}	Output Enable to Valid Data		5		5	ns
t_{PZH_OT}, t_{PZL_OT}	Output Enable to High Z State		5		5	ns
t_{RC}	RapidConfigure Clock Period	12		12		ns
t_{W+_RC} t_{W-_RC}	RapidConfigure Clock Pulse Width	5		5		ns
t_{S_RC}	RapidConfigure Address Setup to RC_CLK#	3		4		ns
t_{H_RC}	RapidConfigure Address and Enable Hold Time to RC_CLK#	3		4		ns
t_{P_UD}	Update of Crosspoint to Data Out		10		10	ns
f_{SI}	Serial Clock Frequency (SCLK)		20		20	MHz
t_{W_SI}	Serial Clock Pulse Width (SCLK) @ 20MHz cycle	20	30	20	30	ns
t_{S_SI}	Serial Setup Time	4		4		ns
t_{H_SI}	Serial Hold Time	0		0		ns
t_{P_SI}	Serial Clock to Output Data Valid (SDO)		20		20	ns

NOTES:

1. These parameters are guaranteed but not tested in production.

4.6 Timing Diagrams

Note – For the purpose of clarity, the timing diagrams within this datasheet are conceptual representations only and do not show actual circuit implementation.

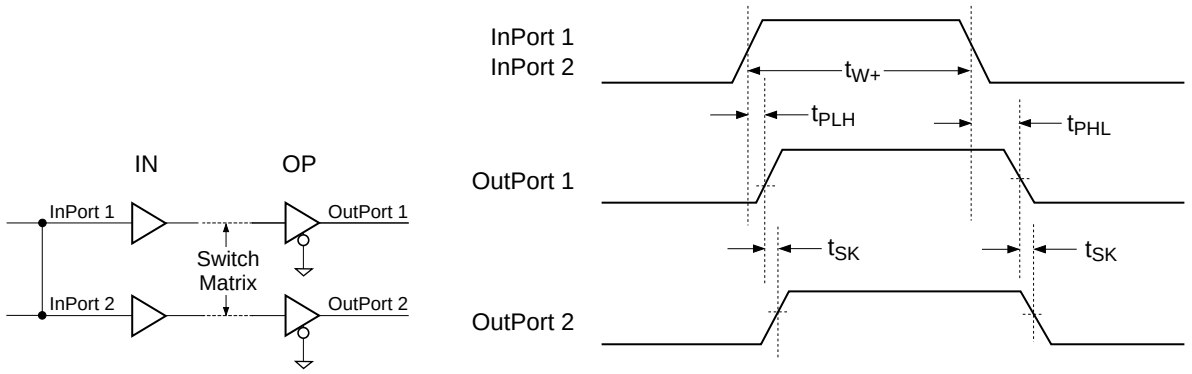


Figure 7 Flow-Through Mode Timing

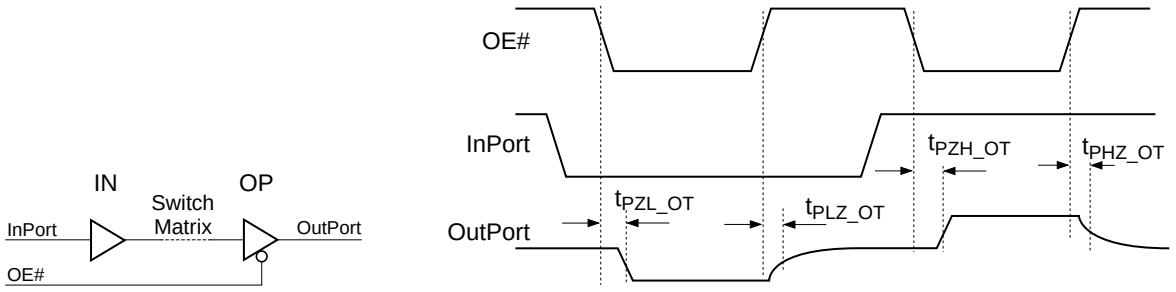


Figure 8 Output Enable Timing

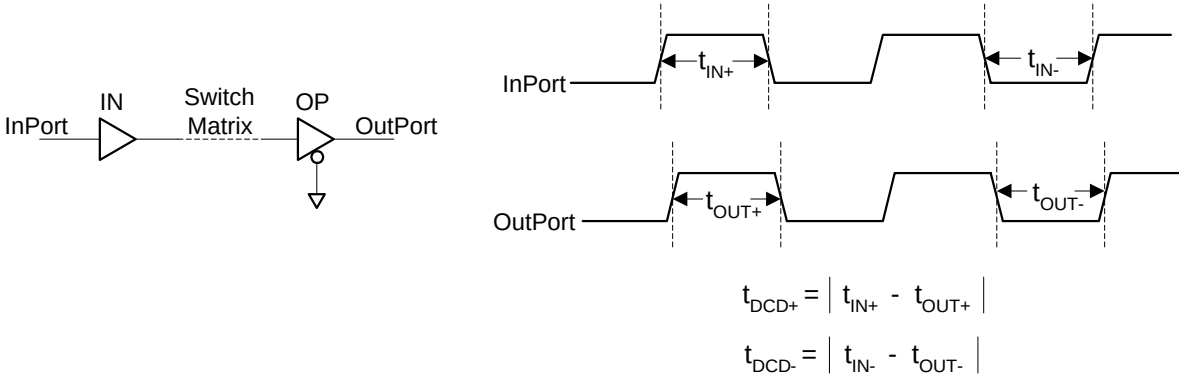


Figure 9 Duty Cycle Distortion

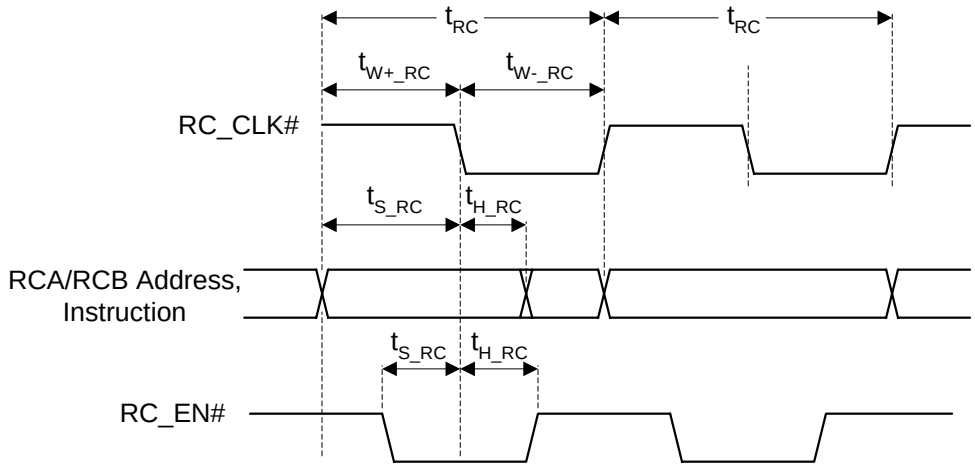


Figure 10 RapidConfigure Write Cycle

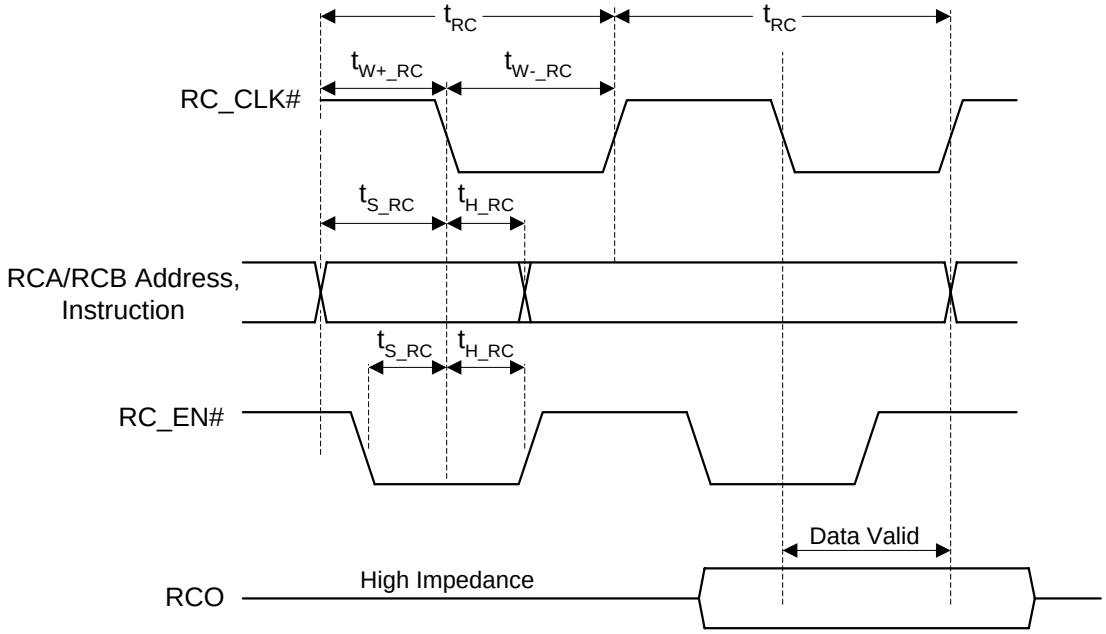


Figure 11 RapidConfigure Read Cycle

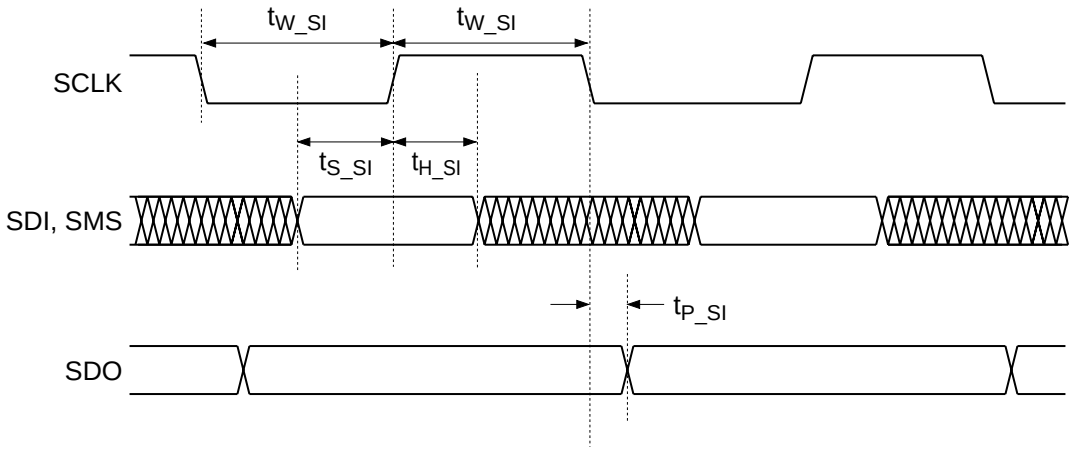


Figure 12 Serial Timing

Typical Performance at 1.6 Gb/s with PRBS Data

(Currently not available for this document)

Figure 13 Typical Performance

5. Pinout

5.1 Package Pinout

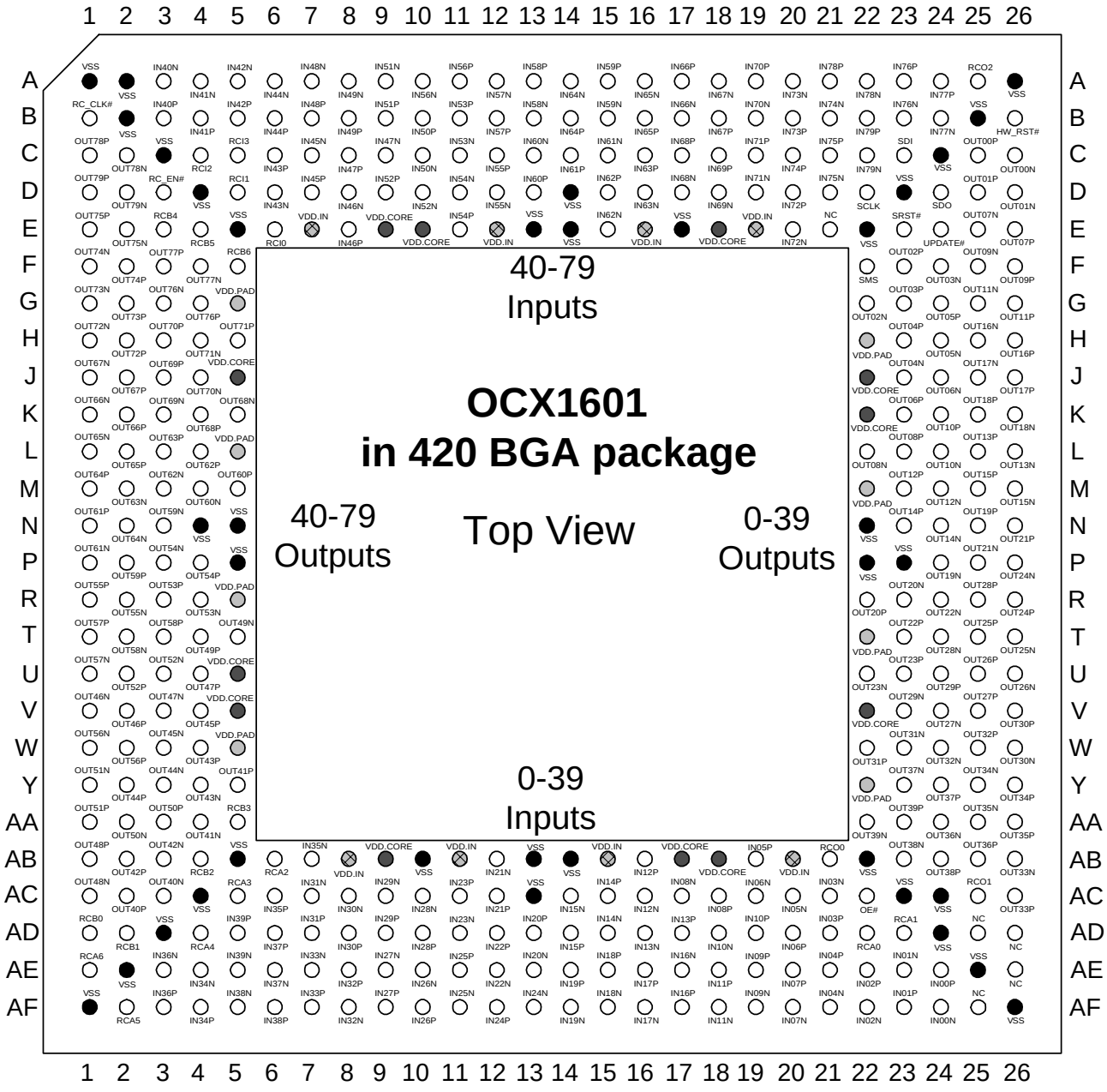


Figure 14 OCX1601 Package Pinout

5.2 Pinout by Ball Sequence

Table 18 OCX1601 Pinout By Ball Sequence

Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name
A1	V_{SS}	B1	RC_CLK#	C1	OUT78P	D1	OUT79P	E1	OUT75P
A2	V_{SS}	B2	V_{SS}	C2	OUT78N	D2	OUT79N	E2	OUT75N
A3	IN40N	B3	IN40P	C3	V_{SS}	D3	RC_EN#	E3	RCB4
A4	IN41N	B4	IN41P	C4	RCI2	D4	V_{SS}	E4	RCB5
A5	IN42N	B5	IN42P	C5	RCI3	D5	RCI1	E5	V_{SS}
A6	IN44N	B6	IN44P	C6	IN43P	D6	IN43N	E6	RCI0
A7	IN48N	B7	IN48P	C7	IN45N	D7	IN45P	E7	V_{DD}.IN
A8	IN49N	B8	IN49P	C8	IN47P	D8	IN46N	E8	IN46P
A9	IN51N	B9	IN51P	C9	IN47N	D9	IN52P	E9	V_{DD}.CORE
A10	IN56N	B10	IN50P	C10	IN50N	D10	IN52N	E10	V_{DD}.CORE
A11	IN56P	B11	IN53P	C11	IN53N	D11	IN54N	E11	IN54P
A12	IN57N	B12	IN57P	C12	IN55P	D12	IN55N	E12	V_{DD}.IN
A13	IN58P	B13	IN58N	C13	IN60N	D13	IN60P	E13	V_{SS}
A14	IN64N	B14	IN64P	C14	IN61P	D14	V_{SS}	E14	V_{SS}
A15	IN59P	B15	IN59N	C15	IN61N	D15	IN62P	E15	IN62N
A16	IN65N	B16	IN65P	C16	IN63P	D16	IN63N	E16	V_{DD}.IN
A17	IN66P	B17	IN66N	C17	IN68P	D17	IN68N	E17	V_{SS}
A18	IN67N	B18	IN67P	C18	IN69P	D18	IN69N	E18	V_{DD}.CORE
A19	IN70P	B19	IN70N	C19	IN71P	D19	IN71N	E19	V_{DD}.IN
A20	IN73N	B20	IN73P	C20	IN74P	D20	IN72P	E20	IN72N
A21	IN78P	B21	IN74N	C21	IN75P	D21	IN75N	E21	NC
A22	IN78N	B22	IN79P	C22	IN79N	D22	SCLK	E22	V_{SS}
A23	IN76P	B23	IN76N	C23	SDI	D23	V_{SS}	E23	SRST#
A24	IN77P	B24	IN77N	C24	V_{SS}	D24	SDO	E24	UPDATE#
A25	RCO2	B25	VSS	C25	OUT00P	D25	OUT01P	E25	OUT07N
A26	V_{SS}	B26	HW_RST#	C26	OUT00N	D26	OUT01N	E26	OUT07P

Table 18 OCX1601 Pinout By Ball Sequence *(Continued)*

Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name
F1	OUT74N	G1	OUT73N	H1	OUT72N	J1	OUT67N	K1	OUT66N
F2	OUT74P	G2	OUT73P	H2	OUT72P	J2	OUT67P	K2	OUT66P
F3	OUT77P	G3	OUT76N	H3	OUT70P	J3	OUT69P	K3	OUT69N
F4	OUT77N	G4	OUT76P	H4	OUT71N	J4	OUT70N	K4	OUT68P
F5	RCB6	G5	V_{DD}.PAD	H5	OUT71P	J5	V_{DD}.CORE	K5	OUT68N
F22	SMS	G22	OUT02N	H22	V_{DD}.PAD	J22	V_{DD}.CORE	K22	V_{DD}.CORE
F23	OUT02P	G23	OUT03P	H23	OUT04P	J23	OUT04N	K23	OUT06P
F24	OUT03N	G24	OUT05P	H24	OUT05N	J24	OUT06N	K24	OUT10P
F25	OUT09N	G25	OUT11N	H25	OUT16N	J25	OUT17N	K25	OUT18P
F26	OUT09P	G26	OUT11P	H26	OUT16P	J26	OUT17P	K26	OUT18N
L1	OUT65N	M1	OUT64P	N1	OUT61P	P1	OUT61N	R1	OUT55P
L2	OUT65P	M2	OUT63N	N2	OUT64N	P2	OUT59P	R2	OUT55N
L3	OUT63P	M3	OUT62N	N3	OUT59N	P3	OUT54N	R3	OUT53P
L4	OUT62P	M4	OUT60N	N4	V_{SS}	P4	OUT54P	R4	OUT53N
L5	V_{DD}.PAD	M5	OUT60P	N5	V_{SS}	P5	V_{SS}	R5	V_{DD}.PAD
L22	OUT08N	M22	V_{DD}.PAD	N22	V_{SS}	P22	V_{SS}	R22	OUT20P
L23	OUT08P	M23	OUT12P	N23	OUT14P	P23	V_{SS}	R23	OUT20N
L24	OUT10N	M24	OUT12N	N24	OUT14N	P24	OUT19N	R24	OUT22N
L25	OUT13P	M25	OUT15P	N25	OUT19P	P25	OUT21N	R25	OUT28P
L26	OUT13N	M26	OUT15N	N26	OUT21P	P26	OUT24N	R26	OUT24P
T1	OUT57P	U1	OUT57N	V1	OUT46N	W1	OUT56N	Y1	OUT51N
T2	OUT58N	U2	OUT52P	V2	OUT46P	W2	OUT56P	Y2	OUT44P
T3	OUT58P	U3	OUT52N	V3	OUT47N	W3	OUT45N	Y3	OUT44N
T4	OUT49P	U4	OUT47P	V4	OUT45P	W4	OUT43P	Y4	OUT43N
T5	OUT49N	U5	V_{DD}.CORE	V5	V_{DD}.CORE	W5	V_{DD}.PAD	Y5	OUT41P
T22	V_{DD}.PAD	U22	OUT23N	V22	V_{DD}.CORE	W22	OUT31P	Y22	V_{DD}.PAD
T23	OUT22P	U23	OUT23P	V23	OUT29N	W23	OUT31N	Y23	OUT37N
T24	OUT28N	U24	OUT29P	V24	OUT27N	W24	OUT32N	Y24	OUT37P
T25	OUT25P	U25	OUT26P	V25	OUT27P	W25	OUT32P	Y25	OUT34N
T26	OUT25N	U26	OUT26N	V26	OUT30P	W26	OUT30N	Y26	OUT34P
AA1	OUT51P								
AA2	OUT50N								
AA3	OUT50P								
AA4	OUT41N								
AA5	RCB3								
AA22	OUT39N								
AA23	OUT39P								
AA24	OUT36N								
AA25	OUT35N								
AA26	OUT35P								

Table 18 OCX1601 Pinout By Ball Sequence *(Continued)*

Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name
AB1	OUT48P	AC1	OUT48N	AD1	RCB0	AE1	RCA6	AF1	V_{SS}
AB2	OUT42P	AC2	OUT40P	AD2	RCB1	AE2	V_{SS}	AF2	RCA5
AB3	OUT42N	AC3	OUT40N	AD3	V_{SS}	AE3	IN36N	AF3	IN36P
AB4	RCB2	AC4	V_{SS}	AD4	RCA4	AE4	IN34N	AF4	IN34P
AB5	V_{SS}	AC5	RCA3	AD5	IN39P	AE5	IN39N	AF5	IN38N
AB6	RCA2	AC6	IN35P	AD6	IN37P	AE6	IN37N	AF6	IN38P
AB7	IN35N	AC7	IN31N	AD7	IN31P	AE7	IN33N	AF7	IN33P
AB8	V_{DD}.IN	AC8	IN30N	AD8	IN30P	AE8	IN32P	AF8	IN32N
AB9	V_{DD}.CORE	AC9	IN29N	AD9	IN29P	AE9	IN27N	AF9	IN27P
AB10	V_{SS}	AC10	IN28N	AD10	IN28P	AE10	IN26N	AF10	IN26P
AB11	V_{DD}.IN	AC11	IN23P	AD11	IN23N	AE11	IN25P	AF11	IN25N
AB12	IN21N	AC12	IN21P	AD12	IN22P	AE12	IN22N	AF12	IN24P
AB13	V_{SS}	AC13	V_{SS}	AD13	IN20P	AE13	IN20N	AF13	IN24N
AB14	V_{SS}	AC14	IN15N	AD14	IN15P	AE14	IN19P	AF14	IN19N
AB15	V_{DD}.IN	AC15	IN14P	AD15	IN14N	AE15	IN18P	AF15	IN18N
AB16	IN12P	AC16	IN12N	AD16	IN13N	AE16	IN17P	AF16	IN17N
AB17	V_{DD}.CORE	AC17	IN08N	AD17	IN13P	AE17	IN16N	AF17	IN16P
AB18	V_{DD}.CORE	AC18	IN08P	AD18	IN10N	AE18	IN11P	AF18	IN11N
AB19	IN05P	AC19	IN06N	AD19	IN10P	AE19	IN09P	AF19	IN09N
AB20	V_{DD}.IN	AC20	IN05N	AD20	IN06P	AD20	IN07P	AF20	IN07N
AB21	RCO0	AC21	IN03N	AD21	IN03P	AE21	IN04P	AF21	IN04N
AB22	V_{SS}	AC22	OE#	AD22	RCA0	AE22	IN02P	AF22	IN02N
AB23	OUT38N	AC23	V_{SS}	AD23	RCA1	AE23	IN01N	AF23	IN01P
AB24	OUT38P	AC24	V_{SS}	AD24	V_{SS}	AE24	IN00P	AF24	IN00N
AB25	OUT36P	AC25	RCO1	AD25	NC	AE25	V_{SS}	AF25	NC
AB26	OUT33N	AC26	OUT33P	AD26	NC	AE26	NC	AF26	V_{SS}

5.3 Pinout by Ball Name

Table 19 OCX1601 Pinout By Ball Name

Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #
HW_RST#	B26	IN21P	AC12	IN43P	C6	IN65P	B16	OUT04P	H23
IN00N	AF24	IN22N	AE12	IN44N	A6	IN66N	B17	OUT05N	H24
IN00P	AE24	IN22P	AD12	IN44P	B6	IN66P	A17	OUT05P	G24
IN01N	AE23	IN23N	AD11	IN45N	C7	IN67N	A18	OUT06N	J24
IN01P	AF23	IN23P	AC11	IN45P	D7	IN67P	B18	OUT06P	K23
IN02N	AF22	IN24N	AF13	IN46N	D8	IN68N	D17	OUT07N	E25
IN02P	AE22	IN24P	AF12	IN46P	E8	IN68P	C17	OUT07P	E26
IN03N	AC21	IN25N	AF11	IN47N	C9	IN69N	D18	OUT08N	L22
IN03P	AD21	IN25P	AE11	IN47P	C8	IN69P	C18	OUT08P	L23
IN04N	AF21	IN26N	AE10	IN48N	A7	IN70N	B19	OUT09N	F25
IN04P	AE21	IN26P	AF10	IN48P	B7	IN70P	A19	OUT09P	F26
IN05N	AC20	IN27N	AE9	IN49N	A8	IN71N	D19	OUT10N	L24
IN05P	AB19	IN27P	AF9	IN49P	B8	IN71P	C19	OUT10P	K24
IN06N	AC19	IN28N	AC10	IN50N	C10	IN72N	E20	OUT11N	G25
IN06P	AD20	IN28P	AD10	IN50P	B10	IN72P	D20	OUT11P	G26
IN07N	AF20	IN29N	AC9	IN51N	A9	IN73N	A20	OUT12N	M24
IN07P	AE20	IN29P	AD9	IN51P	B9	IN73P	B20	OUT12P	M23
IN08N	AC17	IN30N	AC8	IN52N	D10	IN74N	B21	OUT13N	L26
IN08P	AC18	IN30P	AD8	IN52P	D9	IN74P	C20	OUT13P	L25
IN09N	AF19	IN31N	AC7	IN53N	C11	IN75N	D21	OUT14N	N24
IN09P	AE19	IN31P	AD7	IN53P	B11	IN75P	C21	OUT14P	N23
IN10N	AD18	IN32N	AF8	IN54N	D11	IN76N	B23	OUT15N	M26
IN10P	AD19	IN32P	AE8	IN54P	E11	IN76P	A23	OUT15P	M25
IN11N	AF18	IN33N	AE7	IN55N	D12	IN77N	B24	OUT16N	H25
IN11P	AE18	IN33P	AF7	IN55P	C12	IN77P	A24	OUT16P	H26
IN12N	AC16	IN34N	AE4	IN56N	A10	IN78N	A22	OUT17N	J25
IN12P	AB16	IN34P	AF4	IN56P	A11	IN78P	A21	OUT17P	J26
IN13N	AD16	IN35N	AB7	IN57N	A12	IN79N	C22	OUT18N	K26
IN13P	AD17	IN35P	AC6	IN57P	B12	IN79P	B22	OUT18P	K25
IN14N	AD15	IN36N	AE3	IN58N	B13	NC	E21	OUT19N	P24
IN14P	AC15	IN36P	AF3	IN58P	A13	NC	AD25	OUT19P	N25
IN15N	AC14	IN37N	AE6	IN59N	B15	NC	AD26	OUT20N	R23
IN15P	AD14	IN37P	AD6	IN59P	A15	NC	AE26	OUT20P	R22
IN16N	AE17	IN38N	AF5	IN60N	C13	NC	AF25	OUT21N	P25
IN16P	AF17	IN38P	AF6	IN60P	D13	OE#	AC22	OUT21P	N26
IN17N	AF16	IN39N	AE5	IN61N	C15	OUT00N	C26	OUT22N	R24
IN17P	AE16	IN39P	AD5	IN61P	C14	OUT00P	C25	OUT22P	T23
IN18N	AF15	IN40N	A3	IN62N	E15	OUT01N	D26	OUT23N	U22
IN18P	AE15	IN40P	B3	IN62P	D15	OUT01P	D25	OUT23P	U23
IN19N	AF14	IN41N	A4	IN63N	D16	OUT02N	G22	OUT24N	P26
IN19P	AE14	IN41P	B4	IN63P	C16	OUT02P	F23	OUT24P	R26
IN20N	AE13	IN42N	A5	IN64N	A14	OUT03N	F24	OUT25N	T26
IN20P	AD13	IN42P	B5	IN64P	B14	OUT03P	G23	OUT25P	T25
IN21N	AB12	IN43N	D6	IN65N	A16	OUT04N	J23	OUT26N	U26

Table 19 OCX1601 Pinout By Ball Name *(Continued)*

Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #	Ball Name	Ball #
OUT26P	U25	OUT50N	AA2	OUT73P	G2	V_{DD}.CORE	K22	V_{SS}	AB14
OUT27N	V24	OUT50P	AA3	OUT74N	F1	V_{DD}.CORE	U5	V_{SS}	AB22
OUT27P	V25	OUT51N	Y1	OUT74P	F2	V_{DD}.CORE	V5	V_{SS}	AC4
OUT28N	T24	OUT51P	AA1	OUT75N	E2	V_{DD}.CORE	V22	V_{SS}	AC13
OUT28P	R25	OUT52N	U3	OUT75P	E1	V_{DD}.CORE	AB9	V_{SS}	AC23
OUT29N	V23	OUT52P	U2	OUT76N	G3	V_{DD}.CORE	AB17	V_{SS}	AC24
OUT29P	U24	OUT53N	R4	OUT76P	G4	V_{DD}.CORE	AB18	V_{SS}	AD3
OUT30N	W26	OUT53P	R3	OUT77N	F4	V_{DD}.IN	E7	V_{SS}	AD24
OUT30P	V26	OUT54N	P3	OUT77P	F3	V_{DD}.IN	E12	V_{SS}	AE2
OUT31N	W23	OUT54P	P4	OUT78N	C2	V_{DD}.IN	E16	V_{SS}	AE25
OUT31P	W22	OUT55N	R2	OUT78P	C1	V_{DD}.IN	E19	V_{SS}	AF1
OUT32N	W24	OUT55P	R1	OUT79N	D2	V_{DD}.IN	AB8	V_{SS}	AF26
OUT32P	W25	OUT56N	W1	OUT79P	D1	V_{DD}.IN	AB11		
OUT33N	AB26	OUT56P	W2	RCA0	AD22	V_{DD}.IN	AB15		
OUT33P	AC26	OUT57N	U1	RCA1	AD23	V_{DD}.IN	AB20		
OUT34N	Y25	OUT57P	T1	RCA2	AB6	V_{DD}.PAD	G5		
OUT34P	Y26	OUT58N	T2	RCA3	AC5	V_{DD}.PAD	H22		
OUT35N	AA25	OUT58P	T3	RCA4	AD4	V_{DD}.PAD	L5		
OUT35P	AA26	OUT59N	N3	RCA5	AF2	V_{DD}.PAD	M22		
OUT36N	AA24	OUT59P	P2	RCA6	AE1	V_{DD}.PAD	R5		
OUT36P	AB25	OUT60N	M4	RCB0	AD1	V_{DD}.PAD	T22		
OUT37N	Y23	OUT60P	M5	RCB1	AD2	V_{DD}.PAD	W5		
OUT37P	Y24	OUT61N	P1	RCB2	AB4	V_{DD}.PAD	Y22		
OUT38N	AB23	OUT61P	N1	RCB3	AA5	V_{SS}	A1		
OUT38P	AB24	OUT62N	M3	RCB4	E3	V_{SS}	A2		
OUT39N	AA22	OUT62P	L4	RCB5	E4	V_{SS}	A26		
OUT39P	AA23	OUT63N	M2	RCB6	F5	V_{SS}	B2		
OUT40N	AC3	OUT63P	L3	RC_CLK#	B1	V_{SS}	B25		
OUT40P	AC2	OUT64N	N2	RC_EN#	D3	V_{SS}	C3		
OUT41N	AA4	OUT64P	M1	RCI0	E6	V_{SS}	C24		
OUT41P	Y5	OUT65N	L1	RCI1	D5	V_{SS}	D4		
OUT42N	AB3	OUT65P	L2	RCI2	C4	V_{SS}	D14		
OUT42P	AB2	OUT66N	K1	RCI3	C5	V_{SS}	D23		
OUT43N	Y4	OUT66P	K2	RCO0	AB21	V_{SS}	E5		
OUT43P	W4	OUT67N	J1	RCO1	AC25	V_{SS}	E13		
OUT44N	Y3	OUT67P	J2	RCO2	A25	V_{SS}	E14		
OUT44P	Y2	OUT68N	K5	SCLK	D22	V_{SS}	E17		
OUT45N	W3	OUT68P	K4	SDI	C23	V_{SS}	E22		
OUT45P	V4	OUT69N	K3	SDO	D24	V_{SS}	N4		
OUT46N	V1	OUT69P	J3	SMS	F22	V_{SS}	N5		
OUT46P	V2	OUT70N	J4	SRST#	E23	V_{SS}	N22		
OUT47N	V3	OUT70P	H3	UPDATE#	E24	V_{SS}	P5		
OUT47P	U4	OUT71N	H4	V_{DD}.CORE	E9	V_{SS}	P22		
OUT48N	AC1	OUT71P	H5	V_{DD}.CORE	E10	V_{SS}	P23		
OUT48P	AB1	OUT72N	H1	V_{DD}.CORE	E18	V_{SS}	AB5		
OUT49N	T5	OUT72P	H2	V_{DD}.CORE	J5	V_{SS}	AB10		
OUT49P	T4	OUT73N	G1	V_{DD}.CORE	J22	V_{SS}	AB13		

6. Package Information

6.1 PB420 Package Information

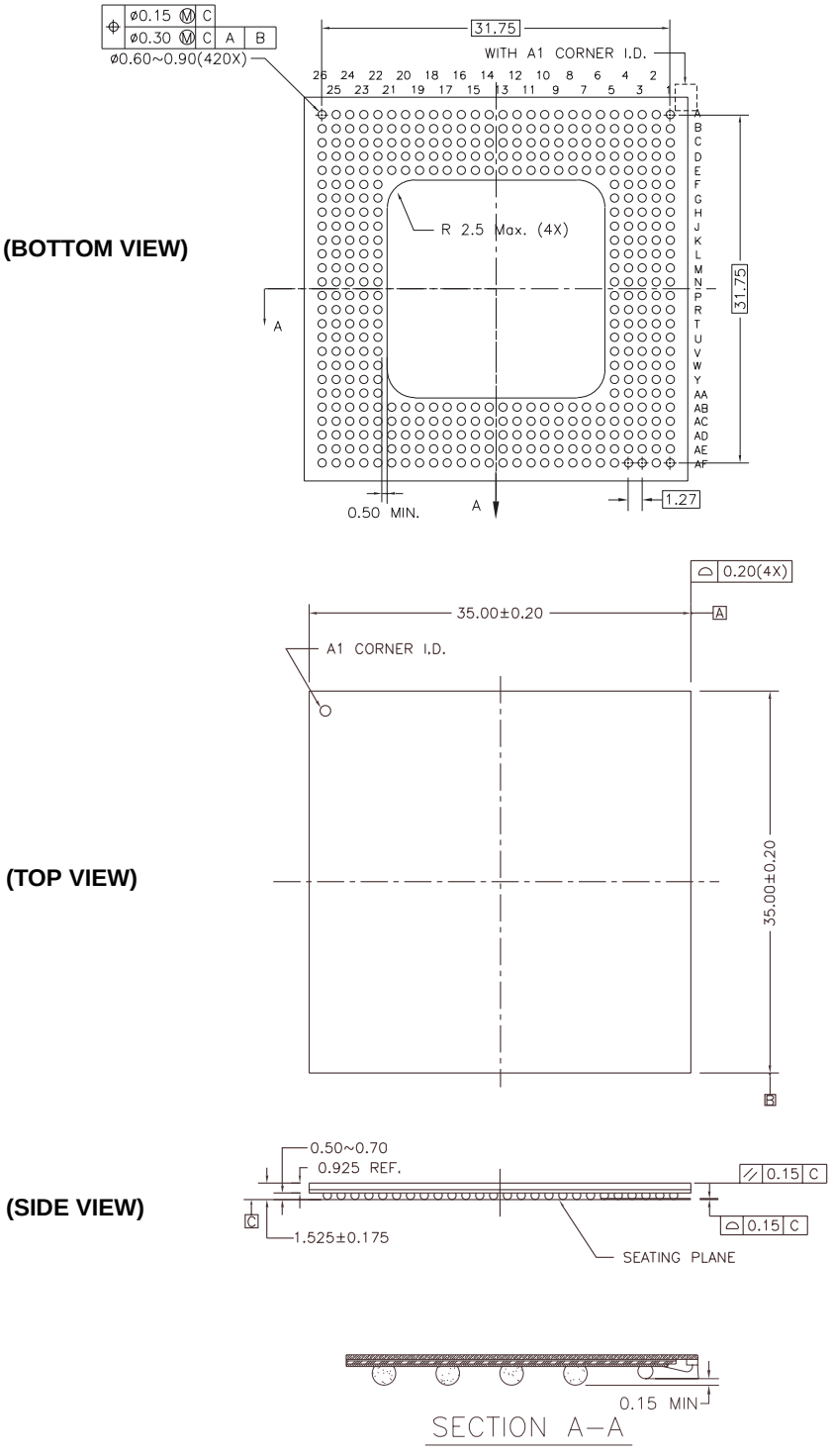


Figure 15 OCX1601 Package—Bottom, Top and Side Views

6.2 Package Thermal Characteristics

Table 20 Package Thermal Coefficients

Package	Pin Count	Θ_{JC}(C/W)	Θ_{JA}(°C/W) Still Air
PBGA	420	1.7°C/W	12°C/W

NOTE:

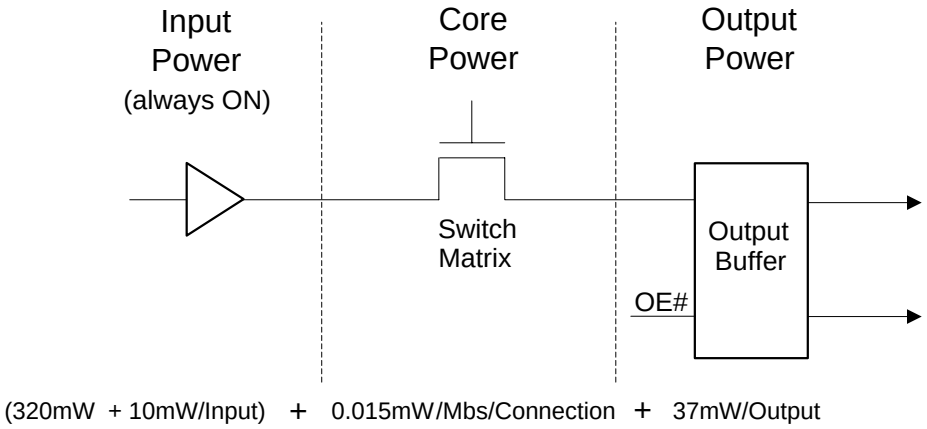
1. Thermal performance values are based on simulation data.

7. Power Consumption

Chip power, consists of three integral elements (refer to Figure 16):

1. **Input Power**—This element has two components:
   - a steady state component that is always ON, and
   - a component that is based on the number of inputs being used.
2. **Core Power**—This element is the same for LVPECL or LVDS outputs. Core power is a function of data rate (Mb/s) and the number of connection paths through the switch matrix.
3. **Output Power**—This element is a fixed amount for each differential output. The value is zero if the Output Enable (OE#) is disabled or set to OFF.

7.1 Power for LVPECL I/O



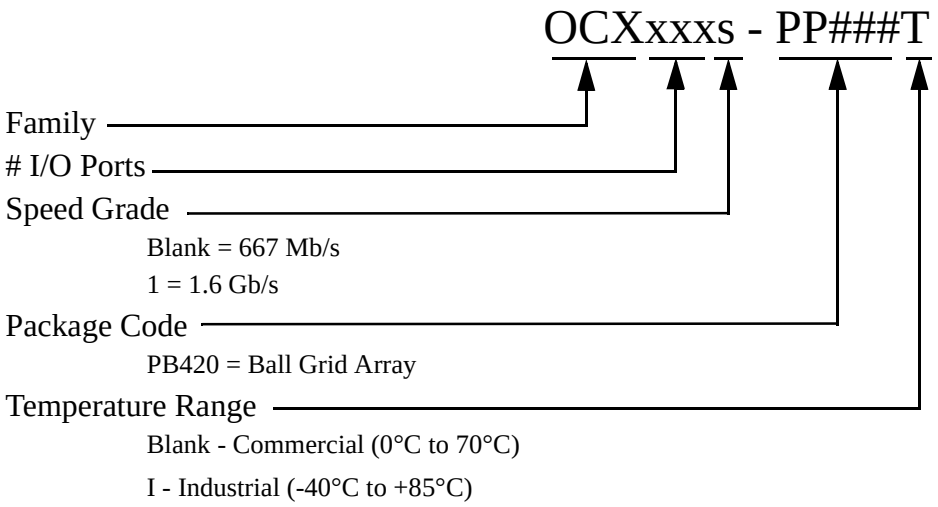
Example: Worst Case = (320mW + 800mW) + (0.015 mW x 1600 x 80) + (37mW x 80)

1120mW + 1920mW + 2960mW

= 6.00 watts

Figure 16 Power Consumption Diagram for the OCX1601 using LVPECL

8. Component Availability and Ordering Information



9. Glossary

CROSSPOINT: A single cell controlled by two RAM bits. The RAM bits are connected in a master-slave configuration to provide an update for programming and changing program information all at once.

CROSSPOINT ARRAY: An array of Crosspoint cells used to connect any input port to any output port.

INPUT OR OUTPUT PATH: The signal flow from pin to array and array to pin. Each path has a register with selectable clocks, drivers for the loaded outputs with selectable enables, and sense circuits to detect changes on either side of the IO Buffer.

PORT: A name followed by a number to identify a pin on the device.

RAPIDCONFIGURE: A parallel programming method for the OCX devices. The RC mode uses 23 dedicated pins to program the Crosspoint Array and the IO Buffers. The 23 pins consist of an enable, a clock, four instruction bits, two seven-bit address fields, and a three-bit data field.

Revision History

Date/	Version No.	Description
11/14/2000	Revision 1.0	Preliminary release of “Advanced” mini datasheet.
12/1/00	Revision 2.0	Changed device name from 160-1G to 1601; changes to Functional Block Diagram - RCO changed from [4:0] to [2:0] and added SRST# to Serial Programming Interface; changes to Component Ordering number. Expanded mini datasheet to full datasheet; added new power consumption diagrams; replaced RCO4 with RCO2; changed RCO3, RCO2, CLKP, and CLKN to NC (no connects) on pinout drawing and tables; split the AC Electrical table into one for LVPECL and one for LVDS.
12/28/00	Revision 2.1	Corrected Pinout tables to match Pinout drawing. Table 22: AC25 was NC; now RCO1 AD25 was RCO3; now NC IN22N was AE13; now AE12 T4 was OUT49N; now OUT49P T5 was OUT49P; now OUT49N Table 23: IN07P was AD20; now AE20 IN22N was AE13; now AE12 OUT49P is now OUT49N for T5 OUT49N is now OUT49P for T4 OUT50P is now OUT50N for AA2 OUT50N is now OUT50P for AA3 Removed CLKP and CLKN from pin description table (Table 11)
2/14/2001	Revision 2.2	Removed statement “The output buffers are programmable...” in section 1.1, “Input and Output Buffers”, and removed CLK reference; changed Min and Max specs in Table 19, “LVPECL DC Electrical Specifications”; changed description for RapidConfigure Programming Instruction 1101 in Table 2; changed “Pass Transistor” verbiage in Introduction to “Proprietary High-performance Buffering Circuit”; description updates to RC Programming Instructions 0010 and 1101; corrected “Receiving LVPECL...” and “Receiving LVDS...” diagrams to include the resistor; updates to LVPECL and LVDS “Output Enable...” AC electrical specs; changed pin signals for AF25 and AE26 on pinout drawing and tables from NC to Vss; replaced “CLK” with “OE#” on LVPECL and LVDS power consumption drawings.
4/52001	Revision 2.3	Made LVPECL standard for OCX1601; updated definitions for ImpliedDisconnect; integrated on-chip termination resistors; replaced LVPECL Signal circuit drawings and Power Consumption drawings with updated versions; changes/corrections to LVPECL DC Electrical Specs table.
5/21/01	Revision 2.4	Corrections to LVPECL power consumption calculations; changed 667 Mb/s to 1600; changed 128 outputs to 80; added new information regarding input power.
7/27/01	Revision 2.5	Changed LVPECL Dc Electrical specs table; added termination impedance values
8/7/01	Revision 2.6	Changed pin names of AE26 and AF25 on Figure 14 (package pinout) from Vss to NC; Table 2—Corrected input/output descriptions for RCA and RCB pins in instructions 0101, 1000, 1001, and 1010; Table 11—changed count on # of pins for Vss (from 38 to 36) and NC (from 3 to 5); Tables 18 & 19—changed pin name of AE26 from Vss to NC and AF25 from Vss to NC.
9/17/01	Revision 2.7	Added Output Jitter and Duty Cycle Distortion specs to AC Electrical table

10. Product Status Definition

Datasheet Identification	Product Status	Definition
Advanced	Formative or In Design	This datasheet contains the design specifications for product development. Specification may change in any manner without notice.
Preliminary	Preproduction Product	This datasheet contains the preliminary data, and supplementary data will be published at a later date. Fairchild reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
No Identification	Full Production	This datasheet contains final specifications. Fairchild reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Obsolete	No longer in Production	This datasheet contains specifications for a product that has been discontinued by Fairchild. The datasheet is provided for reference information only.