CY24292

Four Outputs PCI-Express Clock Generator

Features

- 25 MHz Crystal or Clock Input
- Four Differential 100 MHz PCI-Express Clocks
- Supports HCSL Compatible Output Levels
- One Single-ended 25 MHz Output
- Spread Spectrum Capability on all 100 MHz PCI-Express Clock Outputs
- SMBus Interface with Read Back Capability
- 32-pin QFN Package
- Operating Voltage 3.3 V
- Commercial and Industrial Operating Temperature Range

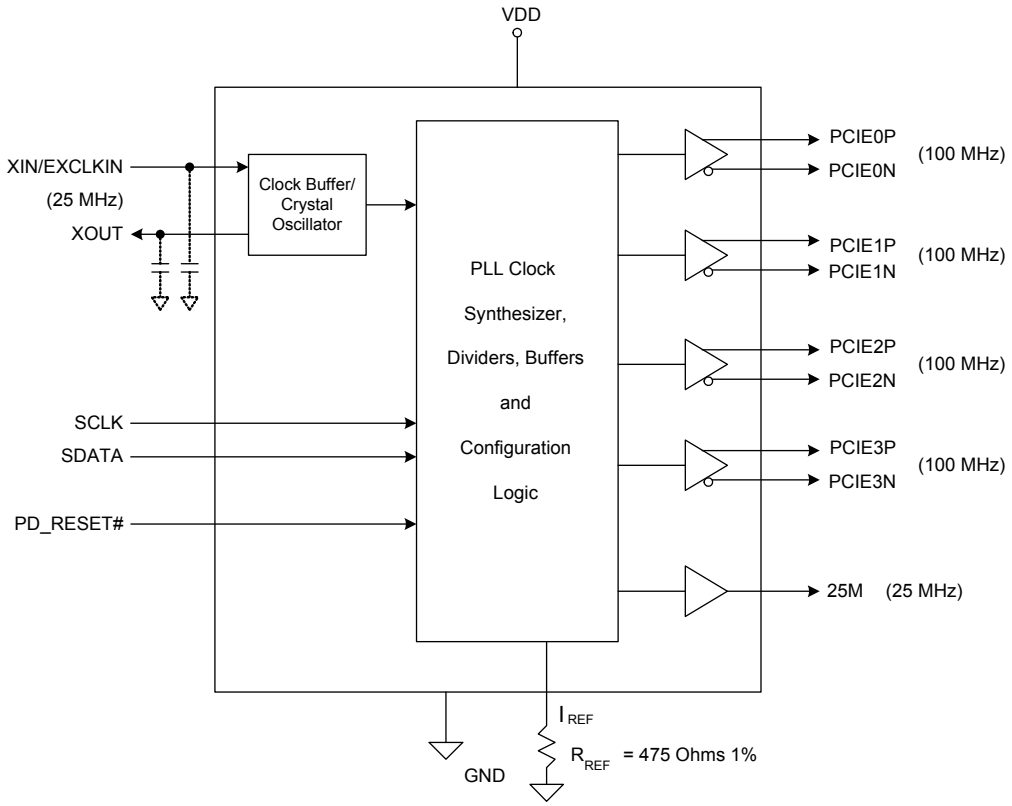
Functional Description

CY24292 is a clock generator device intended for PCI-Express applications. The device includes: four 100 MHz differential clocks with HCSL Compatible outputs for PCI-Express, and one single-ended 25 MHz output.

Using a serially programmable SMBus interface, the CY24292 incorporates spread spectrum modulation on all four 100 MHz outputs. The device incorporates a Lexmark Spread Spectrum profile for maximum electromagnetic interference (EMI) reduction. The spread feature or individual outputs can also be disabled using the SMBus interface.

For a complete list of related documentation, click here.

Logic Block Diagram



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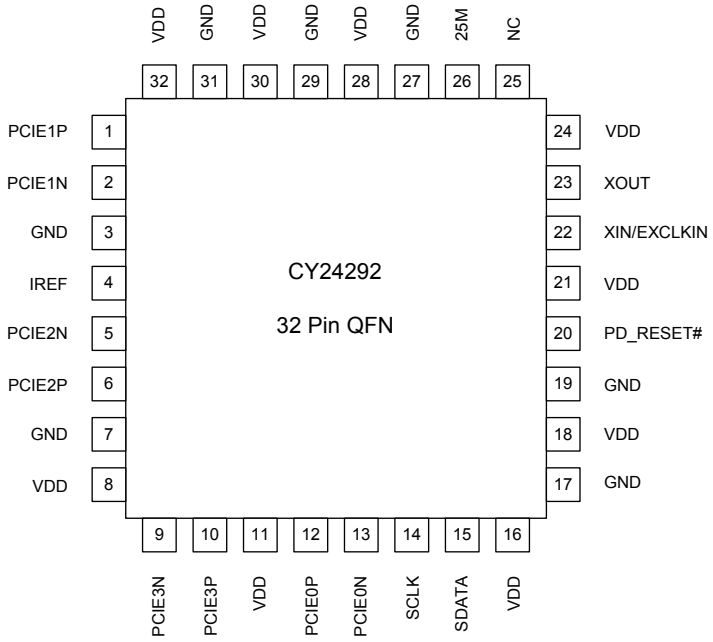
Pin Configuration

Figure 1. 32-pin QFN Pinout CY24292



Pin Definitions

Pin Number	Pin Name	Pin Type	Description
1	PCIE1P	Output	Differential 100 MHz PCI-Express true clock output. High impedance when disabled.
2	PCIE1N	Output	Differential 100 MHz PCI-Express complementary clock output. High impedance when disabled.
3	GND	Power	Ground
4	IREF	Output	Current set for all differential clock drivers. Connect 475 Ω resistor to ground.
5	PCIE2N	Output	Differential 100 MHz PCI-Express complementary clock output. High impedance when disabled.
6	PCIE2P	Output	Differential 100 MHz PCI-Express true clock output. High impedance when disabled.
7	GND	Power	Ground
8	VDD	Power	3.3 V Power supply
9	PCIE3N	Output	Differential 100 MHz PCI-Express complementary clock output. High impedance when disabled.
10	PCIE3P	Output	Differential 100 MHz PCI-Express true clock output. High impedance when disabled.
11	VDD	Power	3.3 V Power supply
12	PCIE0P	Output	Differential 100 MHz PCI-Express true clock output. High impedance when disabled.
13	PCIE0N	Output	Differential 100 MHz PCI-Express complementary clock output. High impedance when disabled.
14	SCLK	Input	SMBus clock input
15	SDATA	Input	SMBus data input
16	VDD	Power	3.3 V Power supply
17	GND	Power	Ground

Pin Definitions (continued)

Pin Number	Pin Name	Pin Type	Description
18	VDD	Power	3.3 V Power supply
19	GND	Power	Ground
20	PD_RESET#	Input	Global reset pin. Powers down PLLs, disables outputs and sets the SMBus tables to their default state when pulled low. Has internal weak pull up.
21	VDD	Power	3.3 V Power supply
22	XIN/EXCLKIN	Input	Crystal or clock input. Connect to 25 MHz fundamental mode crystal or clock.
23	XOUT	Output	Crystal output. Connect to 25 MHz fundamental mode crystal. Float for clock input.
24	VDD	Power	3.3 V Power supply
25	NC	–	No connect. Pin has no internal connection.
26	25M	Output	25 MHz Single-ended LVCMOS output. Pull-down when disabled by PD_RESET#. Driven low when individually disabled (via SMBus byte 0, bit 0).
27	GND	Power	Ground
28	VDD	Power	3.3 V Power supply
29	GND	Power	Ground
30	VDD	Power	3.3 V Power supply
31	GND	Power	Ground
32	VDD	Power	3.3 V Power supply

Functional Overview

SMBus Serial Data Interface

A two-signal serial interface is provided to enhance the flexibility and function of the clock synthesizer. Through the serial data interface, various device functions such as clock output buffers can be individually enabled or disabled. The registers associated with the serial data interface initialize to their default setting upon power up, and therefore this interface is optional. Clock device register changes are normally made upon system initialization, if required. This is a RAM-based technology which does not keep its value when power is off or during a power transition.

Data Protocol

The clock driver serial protocol accepts byte write, byte read, block write, and block read operations from the controller. For block write and read operation, the bytes must be accessed in sequential order from lowest to highest byte (most significant bit first) with the ability to stop after any complete byte is transferred. For byte write and byte read operations, the system controller can access individually indexed bytes. The offset of the indexed byte is encoded in the command code, as described in Table 1.

The block write and block read protocol is outlined in Table 2 on page 5, while Table 3 on page 5 outlines the corresponding byte write and byte read protocol. The slave receiver address is 11010010 (D2h) for write and 11010011 (D3h) for read.

Table 1. Command Code Definition

Bit	Description
7	0 = block read or block write operation, 1 = byte read or byte write operation
(6:0)	Byte offset for byte read or byte write operation. For block read or block write operations, these bits must be '0000000'

Table 2. Block Read and Block Write Protocol

Block Write Protocol		Block Read Protocol	
Bit	**Description**	**Bit**	**Description**
1	Start	1	Start
2:8	Slave address – 7 bits	2:8	Slave address – 7 bits
9	Write	9	Write
10	Acknowledge from slave	10	Acknowledge from slave
11:18	Command code – 8-bit ‘00000000’ stands for block operation	11:18	Command code – 8-bit ‘00000000’ stands for block operation
19	Acknowledge from slave	19	Acknowledge from slave
20:27	Byte count – 8 bits	20	Repeat start
28	Acknowledge from slave	21:27	Slave address – 7 bits
29:36	Data byte 0 – 8 bits	28	Read
37	Acknowledge from slave	29	Acknowledge from slave
38:45	Data byte 1 – 8 bits	30:37	Byte count from slave – 8 bits
46	Acknowledge from slave	38	Acknowledge
	Data byte N/Slave acknowledge	39:46	Data byte from slave – 8 bits
	Data byte N – 8 bits	47	Acknowledge
	Acknowledge from slave	48:55	Data byte from slave – 8 bits
	Stop	56	Acknowledge
			Data bytes from slave/acknowledge
			Data byte N from slave – 8 bits
			Not acknowledge
			Stop

Table 3. Byte Read and Byte Write Protocol

Byte Write Protocol		Byte Read Protocol	
Bit	**Description**	**Bit**	**Description**
1	Start	1	Start
2:8	Slave address – 7 bits	2:8	Slave address – 7 bits
9	Write = 0	9	Write = 0
10	Acknowledge from slave	10	Acknowledge from slave
11:18	Command code – 8 bits ‘1xxxxxxx’ stands for byte operation, bits[6:0] of bits[6:0] the command code represents the offset of the byte to be accessed	11:18	Command code – 8 bits ‘1xxxxxxx’ stands for byte operation, of the command code represents the offset of the byte to be accessed
19	Acknowledge from slave	19	Acknowledge from slave
20:27	Data byte from master – 8 bits	20	Repeat start
28	Acknowledge from slave	21:27	Slave address – 7 bits
29	Stop	28	Read = 1
		29	Acknowledge from slave
		30:37	Data byte from slave – 8 bits
		38	Not acknowledge
		39	Stop

Control Registers

Table 4. Byte 0: Spread Spectrum Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
7	R/W	1	All 100 MHz PCI-Express outputs	Spread select for 100 MHz PCI-Express clocks	0 = spread off 1 = –0.5% down
6	R	Undefined	Not applicable	Not used	
5	R/W	1	All outputs	Global OE bit. Enables or disables all outputs.	0 = disabled 1 = enabled
4	R	Undefined	Not applicable	Not used	
3	R	Undefined	Not applicable	Not used	
2	R	Undefined	Not applicable	Not used	
1	R	Undefined	Not applicable	Not used	
0	R/W	1	Single-ended 25 MHz output, 25M	OE for single-ended 25 MHz output, 25M. Output driven low when disabled.	0 = disabled 1 = enabled

Table 5. Byte 1: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
0 to 7	R	Undefined	Not applicable	Not used	

Table 6. Byte 2: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
0 to 7	R	Undefined	Not applicable	Not used	

Table 7. Byte 3: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
6,7	R	0	Not applicable	Not used	
5	R/W	1	100 MHz PCI-Express output PCIE3	OE for 100 MHz PCI-Express output PCIE3	0 = disabled 1 = enabled
4	R/W	1	100 MHz PCI-Express output PCIE2	OE for 100 MHz PCI-Express output PCIE2	0 = disabled 1 = enabled
3	R	0	Not applicable	Not used	
2	R/W	1	100 MHz PCI-Express output PCIE1	OE for 100 MHz PCI-Express output PCIE1	0 = disabled 1 = enabled
1	R/W	1	100 MHz PCI-Express output PCIE0	OE for 100 MHz PCI-Express output PCIE0	0 = disabled 1 = enabled
0	R	Undefined	Not applicable	Not used	

Table 8. Byte 4: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
0 to 7	R	Undefined	Not applicable	Not used	

Table 9. Byte 5: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
7	R	0	Not applicable	Revision ID bit 3	
6	R	0	Not applicable	Revision ID bit 2	
5	R	0	Not applicable	Revision ID bit 1	
4	R	1	Not applicable	Revision ID bit 0	
3	R	1	Not applicable	Vendor ID bit 3	
2	R	0	Not applicable	Vendor ID bit 2	
1	R	0	Not applicable	Vendor ID bit 1	
0	R	0	Not applicable	Vendor ID bit 0	

Table 10. Byte 6: Control Register

Bit	Type	At Power up	Outputs Affected	Description	Notes
0 to 7	R	Undefined	Not applicable	Not used	

The state of the clock outputs upon assertion of the PD_RESET# signal from input pin or Global OE control bit from byte 0, bit 5 of the SMBus is shown in the following table.

Table 11. Power Down Reset Table

H/W PD_RESET# (pin 24)	S/W PD_RESET# (Byte 0 bit 5)	All Clock Outputs
0	0	Disabled, Hi-Z. 25M has weak pull-down.
0	1	Disabled, Hi-Z. 25M has weak pull-down.
1	0	Disabled, Hi-Z. 25M has weak pull-down.
1	1	Enabled

Application Information

Crystal Recommendations

The CY24292 requires a parallel resonance crystal. Substituting a series resonance crystal causes the CY24292 to operate at the wrong frequency and violate the ppm specification. For most applications there is a 300 ppm frequency shift between the series and parallel crystals due to incorrect loading.

Table 12. Crystal Recommendations

Frequency	Cut	Load Cap (max)	Eff Series Rest (max)	Drive (max)	Tolerance (max)	Stability (max)	Aging (max)
25.00 MHz	Parallel	16 pF	30 Ω	1.0 mW	30 ppm	10 ppm	5 ppm/yr

Crystal Loading

Crystal loading plays a critical role in achieving low ppm performance. To realize low ppm performance, consider the total capacitance the crystal sees to calculate the appropriate capacitive loading (CL).

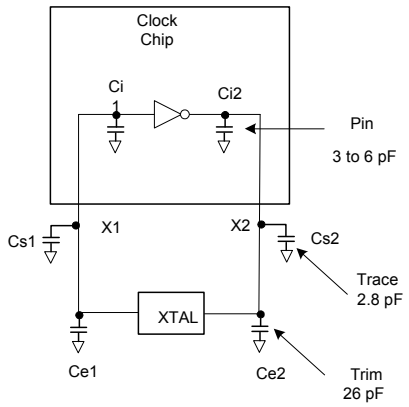
Figure 2 shows a typical crystal configuration using two trim capacitors. It is important to note that the trim capacitors in series with the crystal are not parallel. It is a common misconception that load capacitors are in parallel with the crystal and are approximately equal to the load capacitance of the crystal. This is not true.

Calculating Load Capacitors

In addition to the standard external trim capacitors, the trace capacitance and pin capacitance must also be considered to correctly calculate crystal loading.

As mentioned in the previous section, the capacitance on each side of the crystal is in series with the crystal. This means the total capacitance on each side of the crystal must be twice the specified crystal load capacitance (CL). While the capacitance on each side of the crystal is in series with the crystal, the trim capacitors (Ce1, Ce2) must be calculated to provide equal capacitive loading on both sides.

Figure 2. Crystal Loading Example



Use the following formulas to calculate the trim capacitor values for Ce1 and Ce2.

Load capacitance (each side)

$$Ce = 2 * CL - (Cs + Ci)$$

Total capacitance (as seen by the crystal)

$$CLe = \frac{1}{\left(\frac{1}{Ce1 + Cs1 + Ci1} + \frac{1}{Ce2 + Cs2 + Ci2}\right)}$$

CL ..... Crystal load capacitance

CLe ..... Actual loading seen by crystal using standard value trim capacitors

Ce ..... External trim capacitors

Cs ..... Stray capacitance (terraced)

Ci ..... Internal capacitance

Current Source (Iref) Reference Resistor

If the board target trace impedance (Z) is 50 Ω, then for R_{REF} = 475 Ω (1%) provides IREF of 2.32 mA. The output current (I_{OH}) is equal to 6 × IREF.

Output Termination

The PCI-Express differential clock outputs of CY24292 are open source drivers and require an external series resistor and a resistor to ground. These resistor values and their allowable locations are explained in detail in the section PCI-Express Layout Guidelines on page 9.

PCB Layout Recommendations

For optimum device performance and lowest phase noise, the following guidelines must be observed.

1. Each 0.01 µF decoupling capacitor must be mounted on the component side of the board as close to the VDD pin as possible.
2. No vias must be used between the decoupling capacitor and the VDD pin.
3. The PCB trace to the VDD pin and the ground via must be kept as short as possible. The distance of the ferrite bead and bulk decoupling from the device is less critical.
4. An optimum layout is one with all components on the same side of the board, minimizing vias through other signal layers (any ferrite beads and bulk decoupling capacitors can be mounted on the back). Other signal traces must be routed away from the CY24292. This includes signal traces just underneath the device, or on layers adjacent to the ground plane layer used by the device.

Decoupling Capacitors

Decoupling capacitors of 0.01 µF must be connected between VDD and GND as close to the device as possible. Do not share ground vias between components. Route power from power source through the capacitor pad, and then into the CY24292 pin.

PCI-Express Layout Guidelines

HCSL Compatible Layout Guidelines

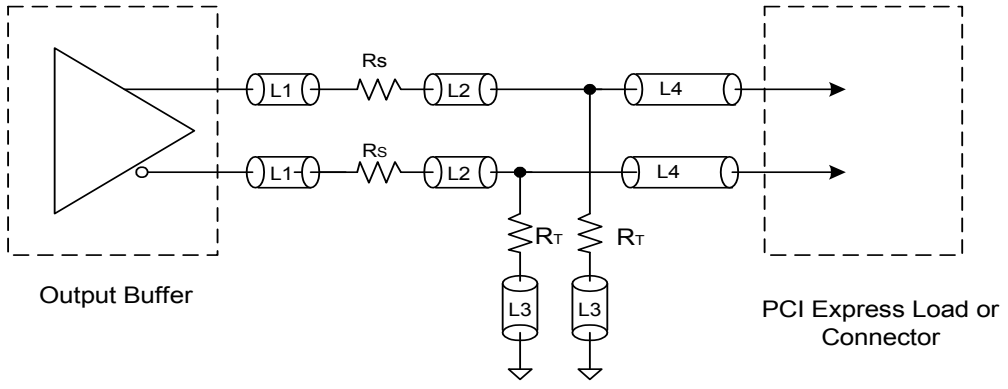
Table 13. Common Recommendations for Differential Routing

Differential Routing[1]	Dimension or Value	Unit
L1 length, route as non-coupled 50 Ω trace	0.5 max	inch
L2 length, route as non-coupled 50 Ω trace	0.2 max	inch
L3 length, route as non-coupled 50 Ω trace	0.2 max	inch
R_S	33	Ω
R_T	49.9	Ω

Table 14. Differential Routing for PCI-Express Load or Connector

Differential Routing [1]	Dimension or Value	Unit
L4 length, route as coupled microstrip 100 Ω differential trace	2 to 32	inch
L4 length, route as coupled stripline 100 Ω differential trace	1.8 to 30	inch

Figure 3. PCI-Express Device Routing



Note
1. Refer to Figure 3.

Absolute Maximum Ratings

Parameter	Description	Condition	Min	Max	Unit
V_{DD}	Supply voltage		–0.5	4.6	V
V_{IN}	Input voltage	Relative to V_{SS}	–0.5	V_{DD} + 0.5	V
T_S	Temperature, Storage	Non Operating	–65	150	°C
T_J	Temperature, Junction		–	125	°C
ESD_{HBM}	ESD Protection (Human Body Model)	JEDEC EIA/JESD22-A114-E	2000	–	V
UL-94	Flammability rating		V-0 at 1/8 in.		
MSL	Moisture sensitivity level		3		

Recommended Operation Conditions

Parameter	Description	Min	Typ	Max	Unit
V_{DD}	Supply voltage	3.0	–	3.6	V
T_{AC}	Commercial ambient temperature	0	–	70	°C
T_{AI}	Industrial ambient temperature	–40	–	85	°C
t_{PU}	Power up time for all V_{DD} to reach minimum specified voltage (power ramps must be monotonic)	0.05	–	500	ms
t_{PD}	Minimum pulse width of PD_RESET# input	100	–	–	ns
V_{SMB}	SMBus Voltage	3.0	–	3.6	V
R_{REFTOL}	Tolerance on the 475Ω R_{REF} resistor that sets output currents on 100MHz ports	–	–	1	%

DC Electrical Characteristics

Unless otherwise stated, V_{DD} = 3.3 V ± 0.3 V, ambient temperature = –40 °C to 85 °C Industrial, 0 °C to 70 °C Commercial, R_{REF} = 475 Ω

Parameter[2]	Description	Condition	Min	Typ	Max	Unit
V_{OL1}	Low level output voltage of 25M clock	I_{OL} = 8 mA	–	–	0.4	V
V_{OH1}	High level output voltage of 25M clock	I_{OH} = –8 mA	V_{DD} – 0.4	–	–	V
V_{OL2}	Low level output voltage of 100M clocks	HCSL termination (R_S = 33 Ω, R_T = 49.9 Ω)	–0.2	0	0.05	V
V_{OH2}	High level output voltage of 100M clocks	HCSL termination (R_S = 33 Ω, R_T = 49.9 Ω)	0.65	0.71	0.95	V
V_{OL3}	Low level output voltage SDATA	I_{OL} = 4 mA	–	–	0.4	V
I_{OH}	Output high current for differential clocks	I_{OH} = 6 × I_{REF}	–13	–15.2	–17	mA
V_{IL1}	Low level input voltage of SCLK, SDATA		–0.3	–	0.8	V
V_{IH1}	High level input voltage of SCLK, SDATA		2.1	–	V_{DD} + 0.3	V
V_{IL2}	Low level input voltage of XIN/EXCLKIN, PD_RESET# pins		–0.3	–	0.8	V
V_{IH2}	High level input voltage of XIN/EXCLKIN, PD_RESET# pins		2.0	–	V_{DD} + 0.3	V
I_{DD}	Operating supply current	No load, PD_RESET# pin = 1	–	50	70	mA
		Full load, PD_RESET# pin = 1	–	135	170	mA
I_{DDPD}	Power down current	PD_RESET# pin = 0	–	250	350	µA
C_{IN}	Input capacitance	All input pins	–	5	–	pF
R_{PU}	Pull up resistor, PD_RESET#		–	90	–	kΩ
R_{PD}	Pull down resistor, 25M output	PD_RESET# = 0	50	–	150	kΩ

Thermal Resistance

Parameter[3]	Description	Test Conditions	32-pin QFN	Unit
θ_{JA}	Thermal resistance (junction to ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, in accordance with EIA/JESD51.	22	°C/W
θ_{JC}	Thermal resistance (junction to case)		19.5	°C/W

Notes
2. Parameters are guaranteed by design and characterization. Not 100% tested in production.
3. These parameters are guaranteed by design and are not tested.

AC Electrical Characteristics

Unless otherwise stated, V_{DD} = 3.3 V ± 0.3 V, ambient temperature = –40 °C to 85 °C Industrial, 0°C to 70°C Commercial, R_{REF} = 475 Ω.

Table 15. Single-Ended 25 MHz Output

Parameter[4]	Description	Condition	Min	Typ	Max	Unit
F_{IN}	Input clock frequency (crystal or external clock)	–	–	25	–	MHz
T_{INDC}	Input clock duty cycle	–	40	–	60	%
F_{OUT}	Output clock frequency, 25M	–	–	25	–	MHz
T_R	Output rise time[5]	20% to 80% of VDD	–	0.5	1	ns
T_F	Output fall time[5]	80% to 20% of VDD	–	0.5	1	ns
T_{DC}	Output clock duty cycle[5]	Measured at VDD/2	45	50	55	%
T_{CCJ}	Cycle-to-cycle jitter[5]	–	–	–	200	ps
T_{OEPD}	Output enable from power down reset	PD_RESET# going high to 99% of final frequency	–	–	2	ms
T_{LOCK}	Clock stabilization from power up	Measured from 90% of the applied power supply level	–	1	2	ms

Notes
4. Parameters are guaranteed by design and characterization. Not 100% tested in production.
5. Measured with Cload = 15 pF lumped load.

Table 16. Differential 100 MHz, HCSL Terminated Outputs

Parameter [6]	Description	Test Condition	Min	Typ	Max	Unit
F_{OUT}	Output frequency		–	–	100	MHz
$SP_{PROFILE}$	Spread modulation profile		–	–	Lexmark	type
SP_{MOD}	Spread modulation frequency		30	32	33	kHz
T_{CCJ}	Cycle-to-cycle jitter[7]		–	–	90	ps
T_{PHJ}	Peak-to-peak phase jitter[7, 8]		–	–	86	ps
T_{DC}	Output clock duty cycle[7]		45	50	55	%
ER_R	Rising edge rate[7, 9]	See notes 7 and 9	0.6	–	4.0	V/ns
ER_F	Falling edge rate[7, 9]	See notes 7 and 9	0.6	–	4.0	V/ns
V_{CROSS}	Absolute crossing point voltage [10, 11, 12]	See notes 10, 11, and 12	0.25	0.35	0.55	V
V_{Xdelta}	Variation of V_{CROSS} over all rising clock edges[10, 11, 13]	See notes 10, 11, and 13	–	–	140	mV
$T_{PERIOD\ AVG}$	Average clock period accuracy[7, 14]	See notes 7 and 14	–300	–	2800	ppm
$T_{PERIOD\ ABS}$	Absolute clock period[7, 15]	See notes 7 and 15	9.847	–	10.203	ns
$T_{OSKEW\ ALL}$	Output skew, all pairs[16]	Measured at V_{CROSS} point See note 16	–	–	100	ps
$T_{OSKEW\ P-P}$	PCIE0P/N to PCIE3P/N skew and PCIE1P/N to PCIE2P/N skew[16]	Measured at V_{CROSS} point See note 16	–	–	50	ps
T_{OEPD}	Output enable from power down reset	PD_RESET# going high to 99% of final frequency	–	–	2	ms
T_{LOCK}	Clock stabilization from power up	Measured from 90% of the applied power supply level	–	1	2	ms

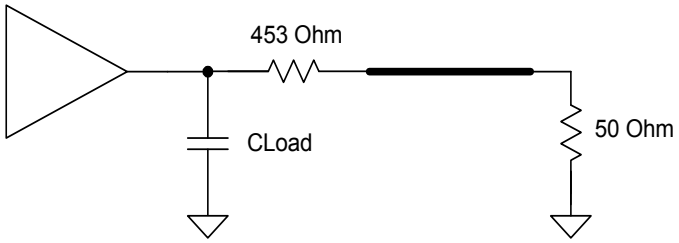
Notes

6. Parameters are guaranteed by design and characterization. Not 100% tested in production.
7. Measurement taken from differential waveform (PCIEP minus PCIEN). Either single ended probes with math or a differential probe can be used.
8. Phase jitter is determined using data captured on an oscilloscope at a sample rate of 20 GS/sec, for a minimum 100,000 continuous clock periods. This data is then processed using the ClockJitter 1.3.0 software from PCISIG, using the PCI_E_1_1 template.
9. Measured from -150 mV to +150 mV on the differential waveform (derived from PCIEP minus PCIEN). The signal must be monotonic through the measurement region for rise and fall time. The 300 mV measurement window is centered on the differential zero crossing.
10. Measurement taken from a single-ended waveform.
11. Measured at crossing point where the instantaneous voltage value of the rising edge of PCIEP equals the falling edge of PCIEN.
12. Refers to the total variation from the lowest crossing point to the highest, regardless of which edge is crossing. Refers to all crossing points for this measurement.
13. Defined as the total variation of all crossing voltages of Rising PCIEP and Falling PCIEN. This is the maximum allowed variance in V_{CROSS} for any particular system.
14. PPM refers to parts per million and is a DC absolute period accuracy specification. 1 PPM is 1/1,000,000th of 100.000000 MHz exactly, or 100 Hz. For 300 PPM then we have an error budget of 30 kHz. The period is to be measured with a frequency counter with measurement window set to 100 ms or greater. The ±300 PPM applies to systems that do not employ Spread Spectrum or that use common clock source. For systems employing Spread Spectrum, there is an additional 2500 PPM nominal shift in maximum period resulting from the 0.5% down spread, resulting in a maximum average period specification of +2800 PPM.
15. Defined as the absolute minimum or maximum instantaneous period. This includes cycle-to-cycle jitter, relative PPM tolerance, and spread spectrum modulation.
16. Measured at the rising 0 V point of the differential signal. Skew is the time difference of the rising 0 V point between any two differential signal pairs. The measurement is taken over 1000 samples, and the average value is used.

Test and Measurement Setup

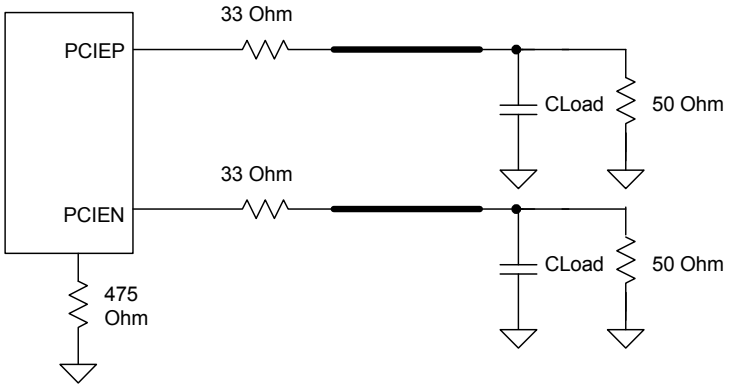
Single-ended Signals

Figure 4. Test Load Configuration for Single-ended Output Signal



Differential Signals

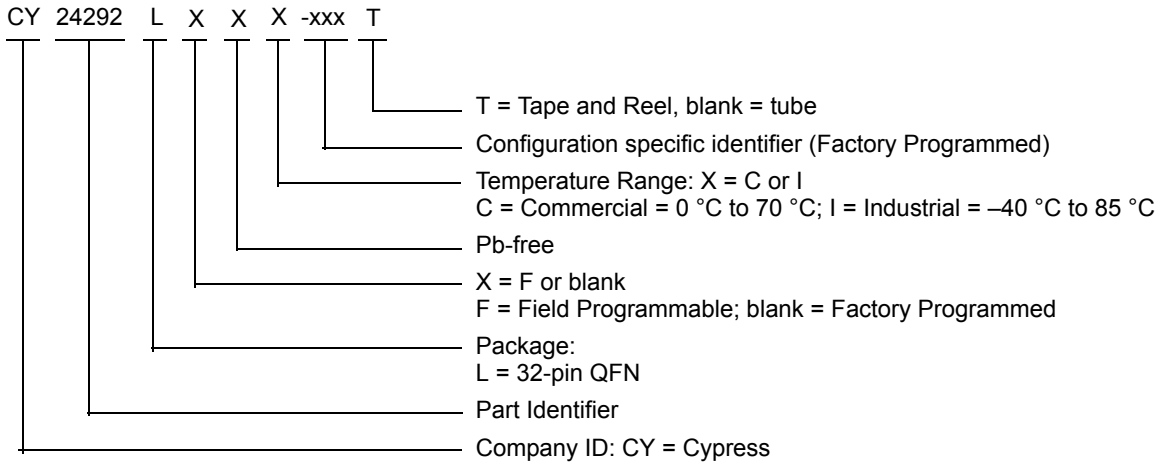
Figure 5. Test Load Configuration for Differential Output Signal



Ordering Information

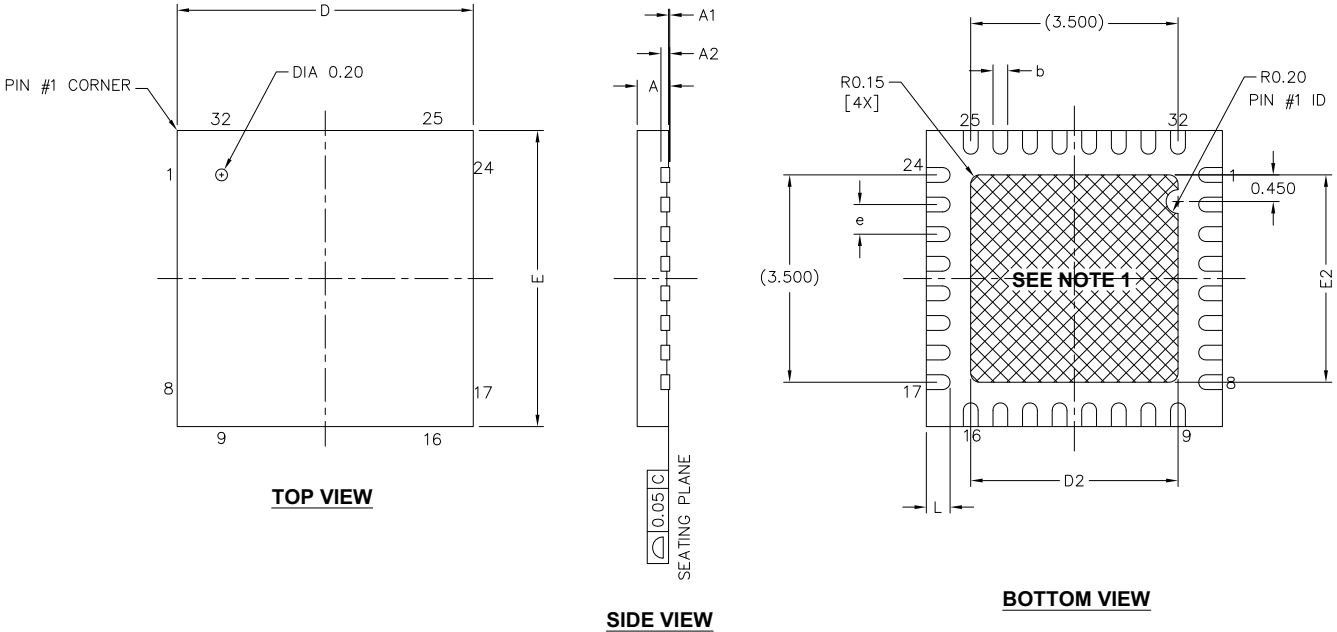
Ordering Code	Package Type	Production Flow
Pb-free		
CY24292LFXC	32-pin QFN	Commercial, 0 °C to 70 °C
CY24292LFXCT	32-pin QFN – Tape and Reel	Commercial, 0 °C to 70 °C
CY24292LFXI	32-pin QFN	Industrial, –40 °C to 85 °C
CY24292LFXIT	32-pin QFN – Tape and Reel	Industrial, –40 °C to 85 °C

Ordering Code Definitions



Package Diagram

Figure 6. 32-pin QFN (5 × 5 × 0.55 mm) LQ32 3.5 × 3.5 E-Pad (Sawn) Package Outline, 001-42168



NOTES:

1. HATCH AREA IS SOLDERABLE EXPOSED PAD
2. BASED ON REF JEDEC # MO-248
3. PACKAGE WEIGHT: 0.0388g
4. DIMENSIONS ARE IN MILLIMETERS

001-42168 *F

Acronyms

Table 17. Acronyms Used in this Document

Acronym	Description
EIA	electronic industries alliance
EMI	electromagnetic interference
ESD	electrostatic discharge
HCSL	host clock signal level
JEDEC	joint electron devices engineering council
LVCMOS	low voltage complementary metal oxide semiconductor
OE	output enable
PCI	peripheral component interconnect
PLL	phase-locked loop
QFN	quad-flat no-leads
RAM	random access memory

Document Conventions

Units of Measure

Table 18. Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
kHz	kilohertz
kΩ	kilohm
MHz	megahertz
µF	microfarad
mA	milliampere
ms	millisecond
mV	millivolt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
ppm	parts per million
ps	picosecond
V	volt

Document History Page

Document Title: CY24292, Four Outputs PCI-Express Clock Generator Document Number: 001-46142				
Rev.	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	2490167	PYG / DPF / AESA	See ECN	New data sheet.
*A	2507681	DPF / AESA	05/23/2008	Updated Pin Configuration (Changed pinout based on PCIE_Bonding_Rev G). Updated DC Electrical Characteristics (Added Note 2 and referred the same note in parameter column, added HCSL termination in Condition column for V_{OL2}, V_{OH2}). Updated AC Electrical Characteristics (updated Note 5, added Note 11 and referred the same note in T_{DC} parameter in Table 16, changed Cload from 2 pF to 4 pF in a Note below, added maximum value of V_{Xdelta} (140 mV) in the Table 16). Updated to new template.
*B	2811340	CXQ	12/03/2009	Changed status from Preliminary to Final. Updated Pin Definitions (Added explanation of 25M output disable feature). Updated Control Registers (Changed default setting (At Power up column) for bit 7 in Table 4 to '1', changed description of bit 5 in Table 4 to 'Global OE bit', added explanation of 25M output disable feature in Table 4, changed unused bits (Type Column) from R/W to R in Table 7, changed default setting (At Power up column) for bit 4 in Table 9 to '1', added explanation of 25M output disable feature in Table 11). Updated the sub-section Crystal Recommendations under the main section Application Information (Added "max" to Load Cap and Eff Series Rest columns in Table 12). Updated sub-section "LVDS Compatible Layout Guidelines" under the main section PCI-Express Layout Guidelines (changed "LVDS Down Device" to "LVDS Device" in all instances). Updated Absolute Maximum Ratings (Changed maximum value of T_J parameter to 125 °C). Updated Recommended Operation Conditions (Added V_{SMB} and R_{REFTOL} parameters and its details). Updated DC Electrical Characteristics (added R_{REF} value to conditions at top, removed V_{OHSD} and V_{OLSD} parameters and their details, changed maximum value of V_{OH2} parameter from 0.85 V to 0.95 V, added V_{OL3} parameter and its details, changed typical value of I_{OH} parameter from –14.2 mA to –15.2 mA, added minimum value of V_{IL1} parameter, changed maximum value of V_{IL1} parameter from 1 V to 0.8 V, changed minimum value of V_{IH1} parameter from 2.2 V to 2.1 V, added typical and maximum values for I_{DD} no load and full load parameters, changed typical value of I_{DDPD} parameter from TBD to 250 µA, changed maximum value of I_{DDPD} parameter from TBD to 350 µA, added R_{PU} parameter and its details, changed R_{PD} parameter to apply to 25M output only). Updated AC Electrical Characteristics (added R_{REF} value to conditions at top, removed F_{ERR} parameter and its details in Table 15, added $SP_{PROFILE}$ parameter and its details in Table 16, added minimum and maximum values for SP_{MOD} parameter, changed maximum value of T_{CCJ} parameter from 100 ps to 90 ps in Table 16, added T_{PHJ} parameter and its details in Table 16, changed T_R and T_F parameters and its details into ER_R and ER_F parameters in Table 16, removed $T_{RFMATCH}$ parameter and its details in Table 16, splitted T_{OSKEW} parameter into two parameters namely $T_{OSKEW\ ALL}$ and $T_{OSKEW\ P-P}$ parameter and also changed their details in Table 16, added minimum value of V_{CROSS} parameter and also changed the description of the same parameter in Table 16, changed description of V_{Xdelta} parameter in Table 16). Updated Package Diagram (to spec 001-42168 Rev *C). Fixed various typos.
*C	2901711	KVM	05/14/10	Updated Package Diagram.

Document History Page (continued)

Document Title: CY24292, Four Outputs PCI-Express Clock Generator Document Number: 001-46142				
Rev.	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
*D	3448896	PURU	11/28/2011	Updated Features (Removed LVDS related information). Updated Functional Description (Removed LVDS related information). Updated Output Termination under Application Information (Removed LVDS related information). Removed the sub-section “LVDS Compatible Layout Guidelines” under the main section PCI-Express Layout Guidelines. Added Ordering Code Definitions. Added Acronyms and Units of Measure. Updated to new template.
*E	4580588	TAVA	12/05/2014	Updated Functional Description: Added “For a complete list of related documentation, click here.” at the end. Updated Package Diagram.
*F	5281281	PSR	04/26/2017	Added Thermal Resistance. Updated to new template.
*G	5784045	PSR	06/27/2017	Updated AC Electrical Characteristics: Added F_{IN} and T_{INDC} parameters. Updated Figure 6 in Package Diagram (spec 001-42168 *E to *F).

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