

# Phase-Aligned Clock Multiplier

## Features

- 3-multiplier configuration (1x, 2x, 4x Ref)
- 10 MHz to 166.67 MHz operating range (reference input from 10 MHz to 41.67 MHz)
- Phase Alignment
- 80 ps typical period jitter
- Output enable pin
- 3.3V operation
- 5V Tolerant input
- 8-pin 150-mil SOIC package
- Commercial and Industrial Temperature available

## Functional Description

The CY2303 is a 3 output 3.3V phase-aligned system clock designed to distribute high-speed clocks in PC, workstation, datacom, telecom, and other high-performance applications.

The part allows user to obtain 1x, 2x, and 4x Ref output frequencies on respective output pins.

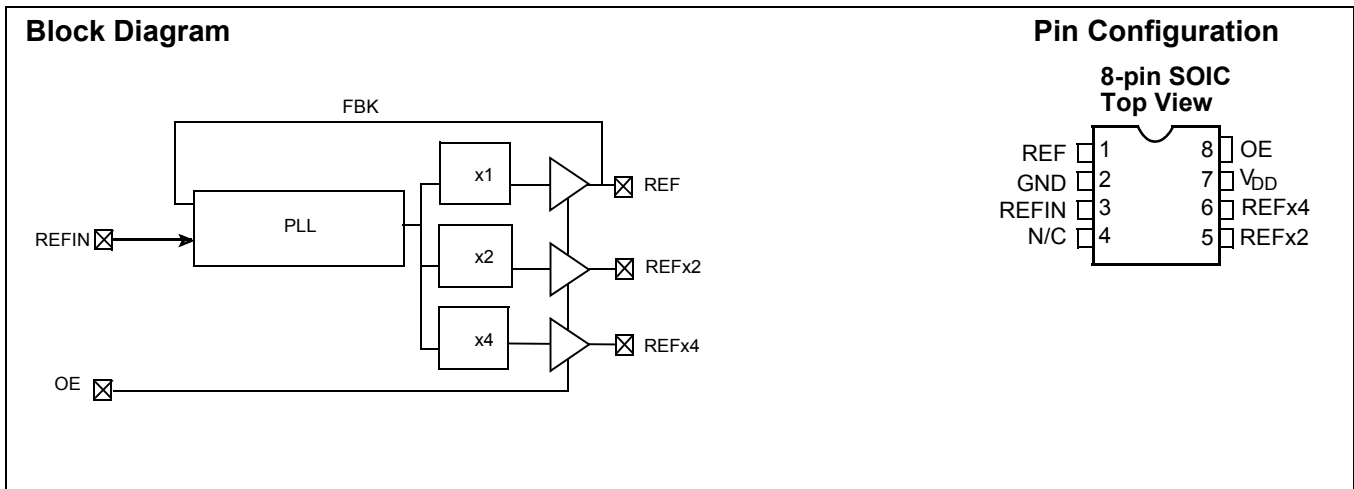
The CY2303 has an on-chip PLL, which locks to an input clock presented on the REFIN pin. The PLL feedback is internally connected to the REF output. The input-to-output skew is guaranteed to be less than  $\pm 200$  ps, and output-to-output skew is guaranteed to be less than 200 ps.

Multiple CY2303 devices can accept the same input clock and distribute it in a system. In this case, the skew between the outputs of two devices is guaranteed to be less than 400 ps.

The CY2303 is available in commercial and industrial temperature ranges.

## Selector Guide

Part Number	Outputs	Input Frequency Range	Output Frequency Range	Specifics
CY2303SC, CY2303SXC	3	10 MHz–41.67 MHz	10 MHz–166.67 MHz	Commercial Temperature
CY2303SI, CY2303SXI	3	10 MHz–41.67 MHz	10 MHz–166.67 MHz	Industrial Temperature



**Pin Description**

Pin	Signal <sup>[1]</sup>	Description
1	REF	REF output (1x Reference input)
2	GND	Ground
3	REFIN	Input reference frequency, 5V tolerant input
4	N/C	No Connect
5	REFx2	2x Reference input
6	REFx4	4x Reference input
7	VDD	3.3V Supply
8	OE	Output Enable (weak pull-up)

**Maximum Ratings**

Supply Voltage to Ground Potential .....	-0.5V to +7.0V	Storage Temperature .....	-65°C to +150°C
DC Input Voltage (Except Ref).....	-0.5V to V <sub>DD</sub> + 0.5V	Junction Temperature.....	150°C
DC Input Voltage REFIN .....	-0.5 to 7V	Static Discharge Voltage (per MIL-STD-883, Method 3015) .....	>2000V

**Operating Conditions for CY2303SC Commercial Temperature Devices**

Parameter	Description	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3.0	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	0	70	°C
C <sub>L</sub>	Load Capacitance, F <sub>out</sub> < 133.33 MHz	–	18	pF
	Load Capacitance, 133.33 MHz < F <sub>out</sub> < 166.67 MHz	–	12	pF
C <sub>IN</sub>	Input Capacitance	–	7	pF
t <sub>PU</sub>	Power-up time for all VDDs to reach minimum specified voltage (power ramps must be monotonic)	0.05	50	ms

**Electrical Characteristics for CY2303SC Commercial Temperature Devices**

Parameter	Description	Test Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage		–	0.8	V
V <sub>IH</sub>	Input HIGH Voltage		2.0	–	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	–	100	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	–	50	μA
V <sub>OL</sub>	Output LOW Voltage <sup>[2]</sup>	I <sub>OL</sub> = 8 mA	–	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>[2]</sup>	I <sub>OH</sub> = –8 mA	2.4	–	V
I <sub>DD</sub>	Supply Current	Unloaded outputs, REFIN = 41.67 MHz	–	45	mA
		Unloaded outputs, REFIN = 25 MHz	–	32	mA
		Unloaded outputs, REFIN = 10 MHz	–	18	mA

**Notes:**

- Weak pull-down on all outputs.
- Parameter is guaranteed by design and characterization. It is not 100% tested in production.

**Switching Characteristics for CY2303SC Commercial Temperature Devices**

Parameter	Name	Test Conditions	Min.	Typ.	Max.	Unit
1/t <sub>1</sub>	Output Frequency	18-pF load	10	–	133.33	MHz
		12-pF load	–	–	166.67	MHz
	Duty Cycle <sup>[3]</sup> = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at V <sub>DD</sub> /2	40	50	60	%
t <sub>3</sub>	Rise Time <sup>[3]</sup>	Measured between 0.8V and 2.0V	–	–	1.20	ns
t <sub>4</sub>	Fall Time <sup>[3]</sup>	Measured between 0.8V and 2.0V	–	–	1.20	ns
t <sub>5</sub>	Output to Output Skew on rising edges <sup>[3]</sup>	All outputs equally loaded Measured at V <sub>DD</sub> /2	–	–	200	ps
t <sub>6</sub>	Delay, REFIN Rising Edge to REF Rising Edge <sup>[3]</sup>	Measured at V <sub>DD</sub> /2 from REFIN to any output	–	–	±200	ps
t <sub>7</sub>	Device to Device Skew <sup>[3]</sup>	Measured at V <sub>DD</sub> /2 on the REF pin of the device (pin 1)	–	–	400	ps
t <sub>J</sub>	Period Jitter <sup>[3]</sup>	Measured at F <sub>out</sub> < 133.33 MHz, loaded outputs, 18-pF load	–	80	±175	ps
t <sub>LOCK</sub>	PLL Lock Time <sup>[3]</sup>	Stable power supply, valid clocks presented on REFIN	–	–	1.0	ms

**Operating Conditions for CY2303SI Industrial Temperature Devices**

Parameter	Description	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3.0	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	–40	85	°C
C <sub>L</sub>	Load Capacitance, F <sub>out</sub> < 133.33 MHz	–	15	pF
	Load Capacitance, 133.33 MHz < F <sub>out</sub> < 166.67 MHz,	–	10	pF
t <sub>PU</sub>	Power-up time for all VDDs to reach minimum specified voltage (power ramps must be monotonic)	0.05	50	ms

**Electrical Characteristics for CY2303SI Industrial Temperature Devices**

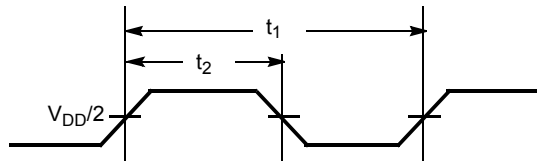
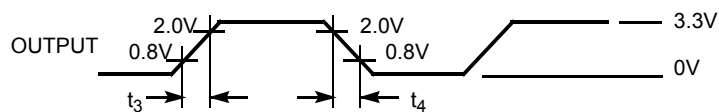
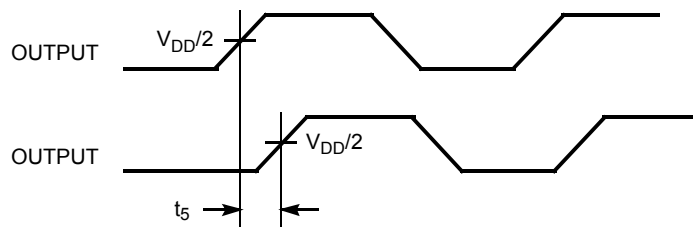
Parameter	Description	Test Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage		–	0.8	V
V <sub>IH</sub>	Input HIGH Voltage		2.0	–	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	–	100	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	–	50	μA
V <sub>OL</sub>	Output LOW Voltage <sup>[2]</sup>	I <sub>OL</sub> = 8 mA	–	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>[2]</sup>	I <sub>OH</sub> = –8 mA	2.4	–	V
I <sub>DD</sub>	Supply Current	Unloaded outputs, REFIN = 41.67 MHz	–	48	mA
		Unloaded outputs, REFIN = 25 MHz	–	35	mA
		Unloaded outputs, REFIN = 10 MHz	–	20	mA

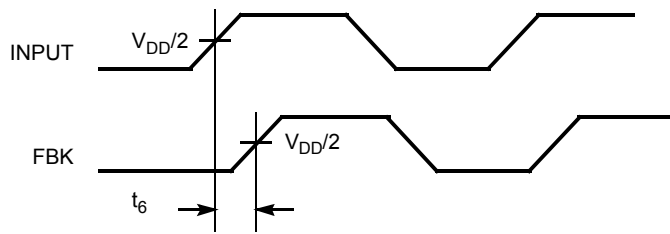
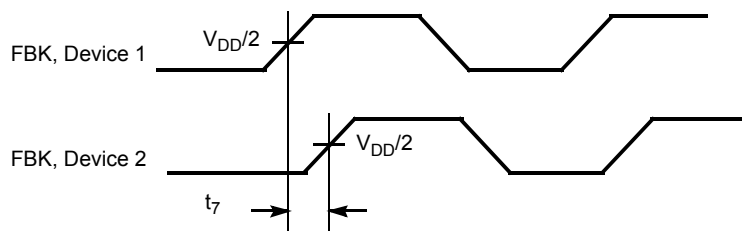
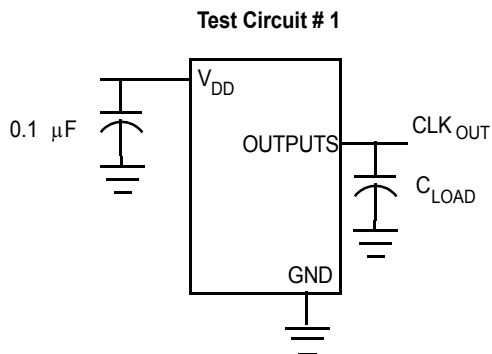
**Note:**

3. All parameters are specified with loaded outputs.

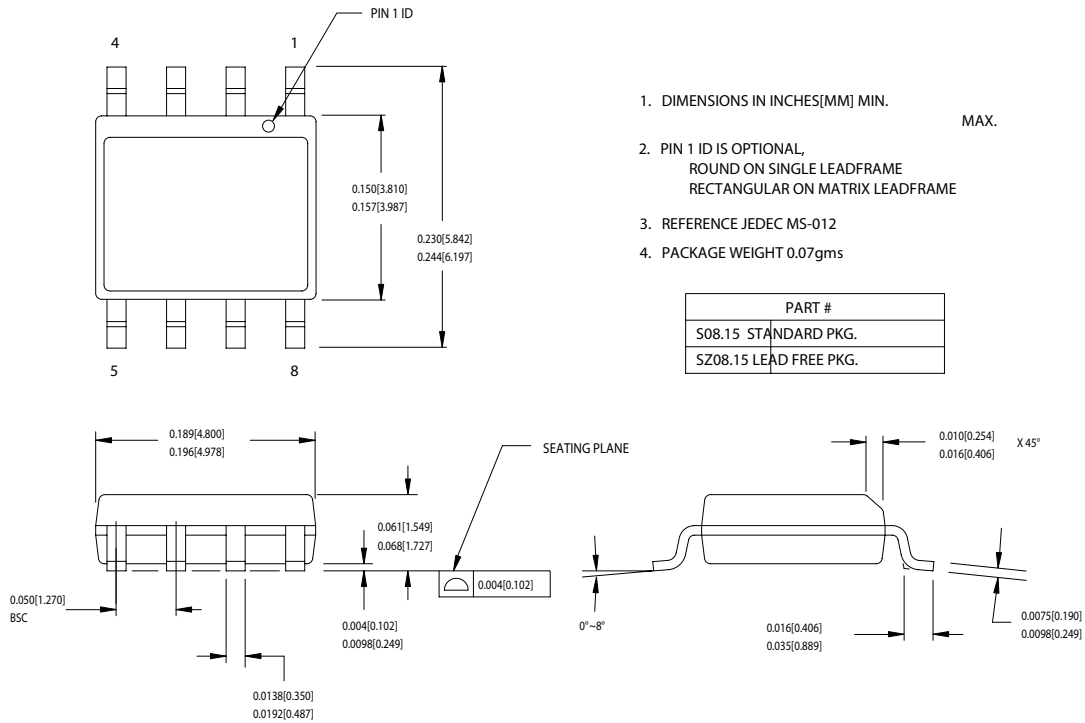
**Switching Characteristics for CY2303SI Industrial Temperature Devices**

Parameter	Name	Test Conditions	Min.	Typ.	Max.	Unit
1/t <sub>1</sub>	Output Frequency	15-pF load	10	–	133.33	MHz
		10-pF load	–	–	166.67	MHz
	Duty Cycle <sup>[3]</sup> = $t_2 \div t_1$	Measured at $V_{DD}/2$	40	50	60	%
t <sub>3</sub>	Rise Time <sup>[3]</sup>	Measured between 0.8V and 2.0V	–	–	1.20	ns
t <sub>4</sub>	Fall Time <sup>[3]</sup>	Measured between 0.8V and 2.0V	–	–	1.20	ns
t <sub>5</sub>	Output to Output Skew on rising edges <sup>[3]</sup>	All outputs equally loaded Measured at $V_{DD}/2$	–	–	200	ps
t <sub>6</sub>	Delay, REFIN Rising Edge to REF Rising Edge <sup>[3]</sup>	Measured at $V_{DD}/2$ from REFIN to any output	–	–	±200	ps
t <sub>7</sub>	Device to Device Skew <sup>[3]</sup>	Measured at $V_{DD}/2$ on the REF pin of the device (pin 1)	–	–	400	ps
t <sub>J</sub>	Period Jitter <sup>[3]</sup>	Measured at $f_{out} < 133.33$ MHz, loaded outputs, 15-pF load	–	80	±175	ps
t <sub>LOCK</sub>	PLL Lock Time <sup>[3]</sup>	Stable power supply, valid clocks presented on REFIN	–	–	1.0	ms

**Switching Waveforms**
**Duty Cycle Timing**

**All Outputs Rise/Fall Time**

**Output-Output Skew**


**Switching Waveforms (continued)**
**Input-Output Propagation Delay**

**Device-Device Skew**

**Test Circuits**

**Ordering Information**

Ordering Code	Package Type	Operating Range
CY2303SC	8-Pin 150-mil SOIC	Commercial
CY2303SCT	8-Pin 150-mil SOIC - Tape and Reel	Commercial
CY2303SI	8-Pin 150-mil SOIC	Industrial
CY2303SIT	8-Pin 150-mil SOIC - Tape and Reel	Industrial
<b>Lead-free</b>		
CY2303SXC	8-Pin 150-mil SOIC	Commercial
CY2303SXCT	8-Pin 150-mil SOIC - Tape and Reel	Commercial
CY2303SXI	8-Pin 150-mil SOIC	Industrial
CY2303SXIT	8-Pin 150-mil SOIC - Tape and Reel	Industrial

**Package Diagram**
**8-lead (150-Mil) SOIC S8**


51-85066-C

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<b>Document Number: 38-07249</b>				
<b>REV.</b>	<b>ECN NO.</b>	<b>Issue Date</b>	<b>Orig. of Change</b>	<b>Description of Change</b>
**	110514	01/07/02	SZV	Change from Spec number: 38-01036 to 38-07249
*A	121852	12/14/02	RBI	Power up requirements added to Operating Conditions Information
*B	390413	See ECN	RGL	Added Lead-free devices Added typical values for jitter