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# Phase-Aligned Clock Multiplier

## Features

- 10 MHz to 166.67 MHz output operating range
- Four-multiplier configuration
- Single PLL architecture
- Phase aligned outputs
- Low jitter, high accuracy outputs
- Output enable pin
- 3.3 V operation
- 5 V tolerant input
- Internal loop filter
- 8-pin 150-mil small-outline integrated circuit (SOIC) package
- Commercial temperature

## Functional Description

The CY2300 is a four output 3.3 V phase-aligned system clock designed to distribute high-speed clocks in PC, workstation, datacom, telecom, and other high-performance applications.

The part allows the user to obtain  $1/2x$ ,  $1x$ ,  $\overline{1x}$  and  $2x$  REF<sub>IN</sub> output frequencies on respective output pins.

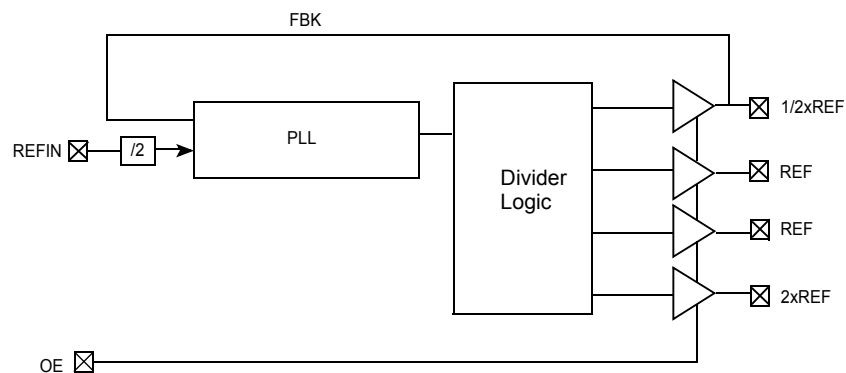
The part has an on-chip PLL which locks to an input clock presented on the REF<sub>IN</sub> pin. The input-to-output skew is guaranteed to be less than  $\pm 200$  ps, and output-to-output skew is guaranteed to be less than 200 ps.

Multiple CY2300 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 CY2300 is available in commercial temperature range.

For a complete list of related documentation, click [here](#).

## Logic Block Diagram

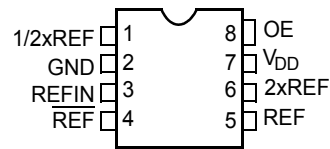


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## Pinouts

Figure 1. 8-pin SOIC pinout (Top View)



## Pin Definitions

Pin	Signal <sup>[1]</sup>	Description
1	1/2xREF	Clock output, 1/2x reference
2	GND	Ground
3	REFIN	Input reference frequency, 5 V tolerant input
4	$\overline{\text{REF}}$	Clock output reference
5	REF	Clock output reference
6	2xREF	Clock output, 2x reference
7	V <sub>DD</sub>	3.3 V Supply
8	OE	Output enable (weak pull-up)

**Note**

1. Weak pull-down on all outputs.

**Maximum Ratings**

Supply voltage to ground potential	.....-0.5 V to +7.0 V	Storage temperature	..... -65 °C to +150 °C
DC input voltage (except ref)	..... -0.5 V to V <sub>DD</sub> + 0.5 V	Junction temperature	..... 150 °C
DC input voltage REF	.....-0.5 V to 7 V	Static discharge voltage (per MIL-STD-883, method 3015)	..... > 2000 V

**Operating Conditions**

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, 10 MHz < 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 V <sub>DD</sub> 's to reach minimum specified voltage (power ramps must be monotonic)	0.05	50	ms

**Electrical Characteristics**

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> = 0 V	-	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 [2]	I <sub>OL</sub> = 8 mA	-	0.4	V
V <sub>OH</sub>	Output HIGH voltage [2]	I <sub>OH</sub> = -8 mA	2.4	-	V
I <sub>DD</sub>	Supply current	Unloaded outputs, REFIN = 66 MHz	-	45	mA
		Unloaded outputs, REFIN = 33 MHz	-	32	mA
		Unloaded outputs, REFIN = 20 MHz	-	18	mA

**Thermal Resistance**

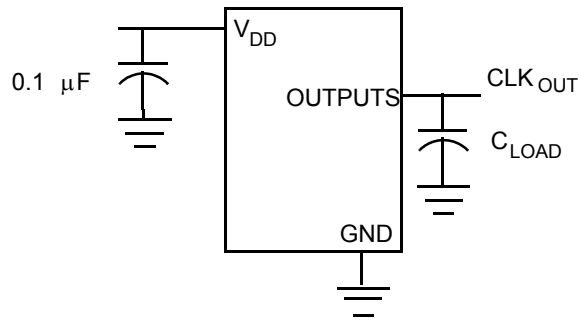
Parameter [3]	Description	Test Conditions	8-pin SOIC	Unit
θ <sub>JA</sub>	Thermal resistance (junction to ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, in accordance with EIA/JESD51.	140	°C/W
θ <sub>JC</sub>	Thermal resistance (junction to case)		54	°C/W

**Notes**

- 2. Parameter is guaranteed by design and characterization. It is not 100% tested in production.
- 3. These parameters are guaranteed by design and are not tested.

## Test Circuits

**Figure 2. Test Circuit #1**



## Switching Characteristics

Parameter	Description	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>[4]</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>[4]</sup>	Measured between 0.8 V and 2.0 V	–	–	1.20	ns
t <sub>4</sub>	Fall time <sup>[4]</sup>	Measured between 0.8 V and 2.0 V	–	–	1.20	ns
t <sub>5</sub>	Output to output skew on rising edges <sup>[4]</sup>	All outputs equally loaded Measured at V <sub>DD</sub> /2	–	–	200	ps
t <sub>6</sub>	Delay, REFIN rising edge to output rising edge <sup>[4]</sup>	Measured at V <sub>DD</sub> /2 from REFIN to any output	–	–	±200	ps
t <sub>7</sub>	Device to device skew <sup>[4]</sup>	Measured at V <sub>DD</sub> /2 on the 1/2xREF pin of devices (pin 1)	–	–	400	ps
t <sub>J</sub>	Period jitter <sup>[4]</sup>	Measured at F <sub>out</sub> = 133.33 MHz, loaded outputs, 18 pF load	–	–	±175	ps
t <sub>LOCK</sub>	PLL lock time <sup>[4]</sup>	Stable power supply, valid clocks presented on REFIN	–	–	1.0	ms

**Note**

4. All parameters are specified with equally loaded outputs.

## Switching Waveforms

Figure 3. Duty Cycle Timing

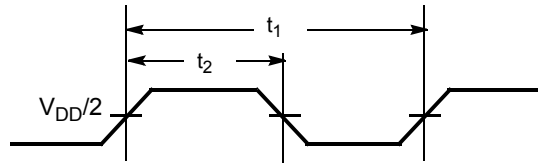


Figure 4. All Outputs Rise/Fall Time

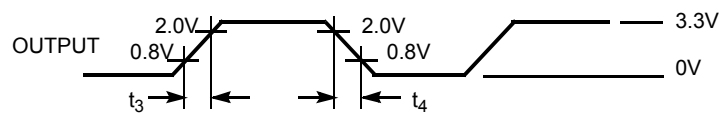


Figure 5. Output to Output Skew

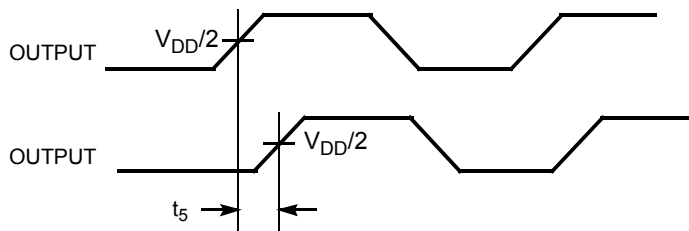


Figure 6. Input to Output Propagation Delay

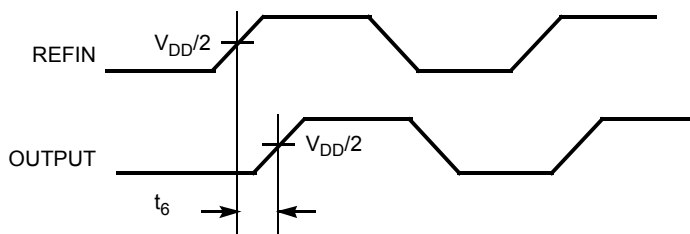
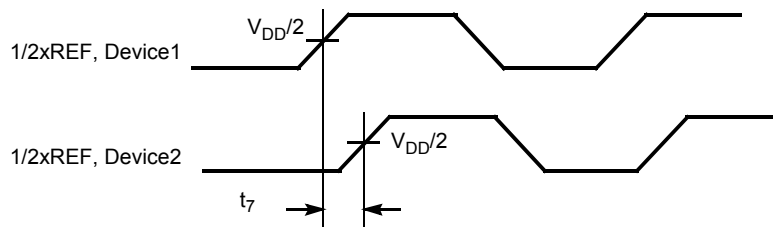


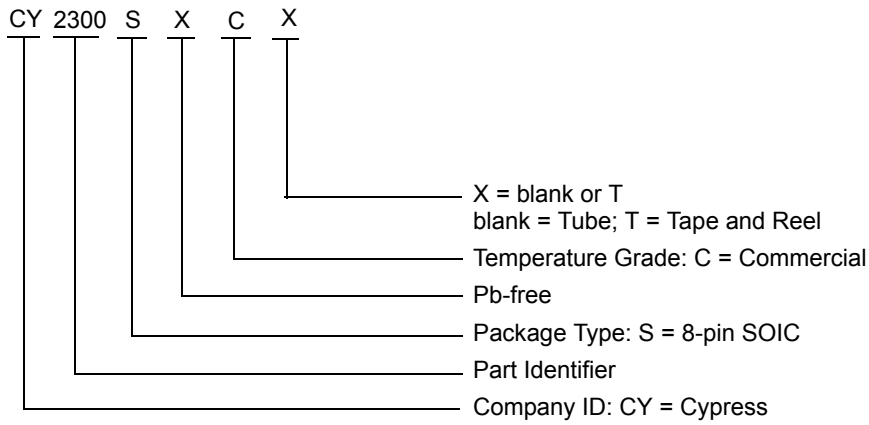
Figure 7. Device to Device Skew



**Ordering Information**

Ordering Code	Package Type	Operating Range
<b>Pb-free</b>		
CY2300SXC	8-pin SOIC	Commercial (0 °C to 70 °C)
CY2300SXCT	8-pin SOIC - Tape and Reel	Commercial (0 °C to 70 °C)

**Ordering Code Definitions**



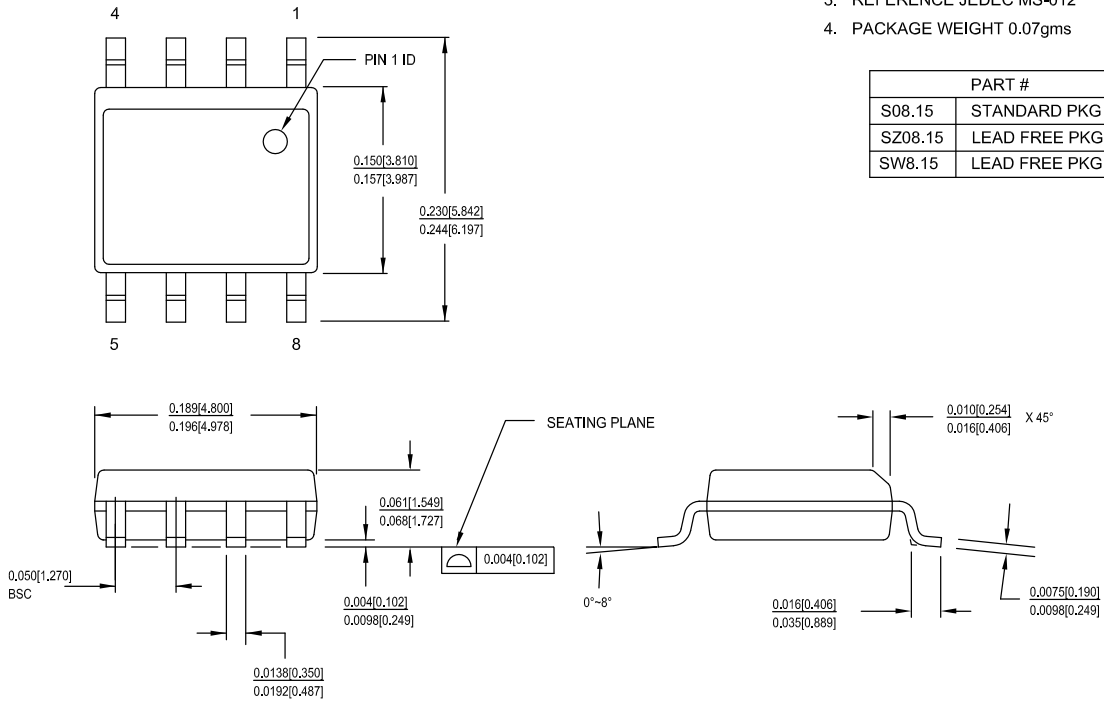


### Package Drawing and Dimensions

Figure 8. 8-pin SOIC (150 Mils) Package Outline, 51-85066

1. DIMENSIONS IN INCHES[MM] MIN. MAX.
2. PIN 1 ID IS OPTIONAL.  
ROUND ON SINGLE LEADFRAME  
RECTANGULAR ON MATRIX LEADFRAME
3. REFERENCE JEDEC MS-012
4. PACKAGE WEIGHT 0.07gms

PART #	
S08.15	STANDARD PKG
SZ08.15	LEAD FREE PKG
SW8.15	LEAD FREE PKG



51-85066 \*H

## Reference Documents

Reference documents are available through your local Cypress sales representative. You can also direct your requests to [tsbusdev@cypress.com](mailto:tsbusdev@cypress.com).

Document Number	Document Title	Description
NA	NA	NA

## Acronyms

Acronym	Description
FBK	Feedback
OE	Output Enable
PLL	Phase Locked Loop
REFIN	Reference Input

## Document Conventions

### Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
Hz	hertz
kHz	kilohertz
MHz	megahertz
μA	microampere
μF	microfarad
μs	microsecond
μV	microvolt
mA	milliampere
mm	millimeter
ms	millisecond
mV	millivolt
ns	nanosecond
pA	picoampere
pF	picofarad
ps	picosecond
V	volt

## Errata

This section describes the errors, workaround solution and silicon design fixes for Cypress zero delay clock buffers belonging to the families CY2300. Details include errata trigger conditions, scope of impact, available workaround and silicon revision applicability. Contact your local Cypress Sales Representative if you have questions.

### Part Numbers Affected

Part Number	Device Characteristics
CY2300SXC	All Variants
CY2300SXCT	All Variants

### CY2300 Errata Summary

Items	Part Number	Fix Status
Start up lock time issue [CY2300]	All	Silicon fixed. New silicon available from WW 10 of 2013

### CY2300 Qualification Status of fixed silicon

Product Status: In production

Qualification report last updated on 11/27/2012

<http://www.cypress.com/?rID=72595>

#### 1. Start up lock time issue

##### ■ Problem Definition

Output of CY2300 fails to locks within 1 ms upon power up (as per datasheet spec).

##### ■ Parameters Affected

PLL lock time ( $t_{LOCK}$ )

##### ■ Trigger Condition(S)

Start up

##### ■ Scope of Impact

It can impact the performance of system and its throughput.

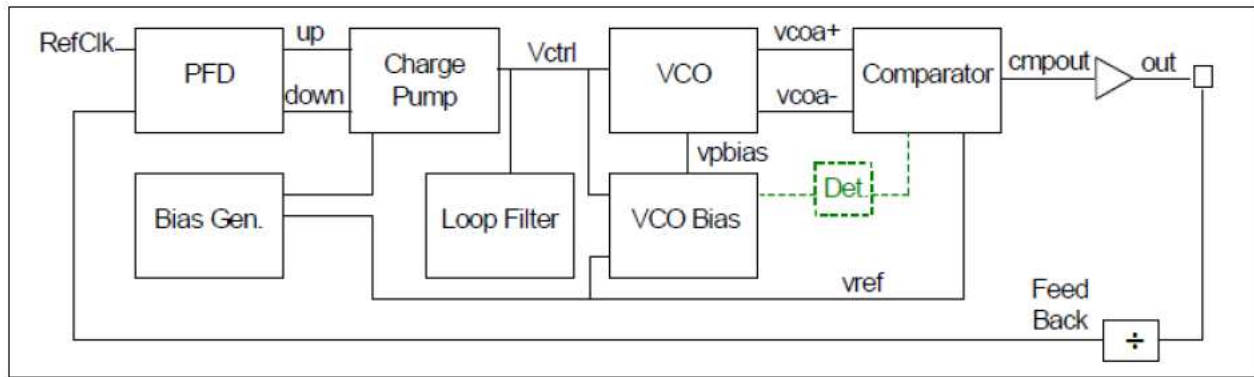
##### ■ Workaround

Apply reference input (RefClk) before power up (VDD). If RefClk is applied after power up, noise gets coupled on the output and propagates back to the PLL causing it to take higher time to acquire lock. If reference input is present during power up, noise will not propagate to the PLL and device will start up normally without problems.

##### ■ Fix Status

This issue is due to design marginality. Two minor design modifications have been made to address this problem.

- Addition of VCO bias detector block as shown in the following figure keeps comparator power down till VCO bias is present and thereby eliminating the propagation of noise to feedback.
- Bias generator enhancement for successful initialization.



## Document History Page

Document Title: CY2300, Phase-Aligned Clock Multiplier Document Number: 38-07252				
Rev.	ECN	Orig. of Change	Submission Date	Description of Change
**	110517	SZV	01/07/02	Changed from spec number 38-01039 to spec number 38-07252.
*A	121854	RBI	12/14/02	Updated <a href="#">Operating Conditions</a> : Added t <sub>PU</sub> parameter and its details.
*B	246829	RGL	08/02/04	Updated <a href="#">Ordering Information</a> : Added Lead Free Devices.
*C	2568533	AESA	09/23/08	Removed Selector Guide. Removed Operating Conditions (for CY2300SI Industrial Temperature Devices). Removed Electrical Characteristics (for CY2300SI Industrial Temperature Devices). Removed Switching Characteristics (for CY2300SI Industrial Temperature Devices). Updated <a href="#">Ordering Information</a> : Removed part numbers CY2300SC, CY2300SC, CY2300SI, CY2300SI, CY2300SXI and CY2300SXIT. Updated to new template.
*D	3026183	BASH	09/01/2010	Removed Benefits. Updated <a href="#">Operating Conditions</a> : Updated details in "Description" column corresponding to C <sub>L</sub> parameter (Added lower limit of 10 MHz for 18pF load capacitance). Added <a href="#">Ordering Code Definitions</a> . Added <a href="#">Reference Documents, Acronyms and Units of Measure</a> .
*E	4126294	CINM	11/25/2013	Updated <a href="#">Package Drawing and Dimensions</a> : spec 51-85066 – Changed revision from *D to *F. Added <a href="#">Errata</a> . Updated to new template. Completing Sunset Review.
*F	4325140	CINM	03/28/2014	Updated <a href="#">Errata</a> .
*G	4578443	TAVA	11/25/2014	Updated <a href="#">Functional Description</a> : Added "For a complete list of related documentation, click <a href="#">here</a> ." at the end.
*H	5240894	PSR	04/25/2016	Updated <a href="#">Features</a> : Added "10 MHz to 166.67 MHz output operating range". Added <a href="#">Thermal Resistance</a> . Updated <a href="#">Package Drawing and Dimensions</a> : spec 51-85066 – Changed revision from *F to *H. Updated to new template.
*I	5542709	TAVA	12/05/2016	Updated to new template. Completing Sunset Review.

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