

# High Performance LVDS Oscillator with Frequency Margining - Pin Control

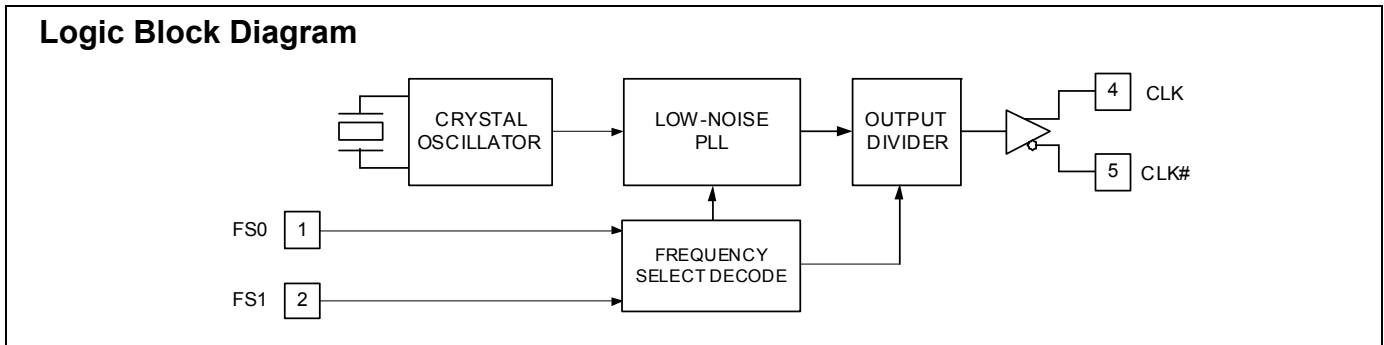
## Features

- Low Jitter Crystal Oscillator (XO)
- Less than 1 ps Typical RMS Phase Jitter
- Differential LVDS Output
- Output Frequency from 50 MHz to 690 MHz
- Two Frequency Margining Control Pins (FS0, FS1)
- Factory Configured or Field Programmable
- Integrated Phase-Locked Loop (PLL)
- Supply Voltage: 3.3V or 2.5V
- Pb-Free Package: 5.0 x 3.2 mm LCC
- Commercial and Industrial Temperature Ranges

## Functional Description

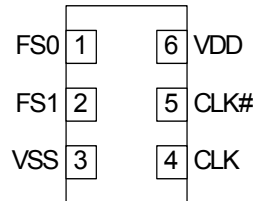
The CY2XF33 is a high performance and high frequency Crystal Oscillator (XO). It uses a Cypress proprietary low noise PLL to synthesize the frequency from an integrated crystal. The output frequency can be changed through two select pins, allowing easy frequency margin testing in applications.

The CY2XF33 is available as a factory configured device or as a field programmable device.



## Pinouts

**Figure 1. Pin Diagram - 6 Pin Ceramic LCC**



**Table 1. Pin Definitions - 6 Pin Ceramic LCC**

Pin	Name	I/O Type	Description
1, 2	FS0, FS1	CMOS Input	Frequency Select
4, 5	CLK, CLK#	LVDS Output	Differential Output Clock
6	VDD	Power	Supply Voltage: 2.5V or 3.3V
3	VSS	Power	Ground

## Functional Description

The FS0 and FS1 pins select between four different output frequencies, as shown in Table 2. Frequency margining is a common application for this feature. One frequency is used for the standard operating mode of the device, while the other frequencies are available for margin testing, either during product development or in system manufacturing test.

**Table 2. Frequency Select**

FS1	FS0	Output Frequency
0	0	Frequency 0
0	1	Frequency 1
1	0	Frequency 2
1	1	Frequency 3

When changing the output frequency, the frequency transition is not guaranteed to be smooth. There can be frequency excursions beyond the start frequency and the new frequency. Glitches and runt pulses are possible, and time must be allowed for the PLL to relock.

## Programming Description

The CY2XF33 is a programmable device. Before being used in an application, it must be programmed with the output frequencies and other variables described in a later section. Two different device types are available, each with its own programming flow. They are described in the following sections.

### Field Programmable CY2XF33F

Field programmable devices are shipped unprogrammed and must be programmed before being installed on a printed circuit board (PCB). Customers use CyberClocks™ Online Software to specify the device configuration and generate a JEDEC (extension .jed) programming file. Programming of samples and prototype quantities is available using a Cypress programmer. Third party vendors manufacture programmers for small to large volume applications. Cypress's value added distribution partners also provide programming services. Field programmable devices are designated with an "F" in the part number. They are intended for quick prototyping and inventory reduction. The CY2XF33 is one time programmable (OTP).

The software is located at [www.cyberclocksonline.com](http://www.cyberclocksonline.com).

### Factory Configured CY2XF33

For customers wanting ready-to-use devices, the CY2XF33 is available with no field programming required. All requests are submitted to the local Cypress Field Application Engineer (FAE) or sales representative. After the request is processed, the user receives a new part number, samples, and data sheet with the programmed values. This part number is used for additional sample requests and production orders.

## Programming Variables

### Output Frequencies

The CY2XF33 is programmed with up to four independent output frequencies, which are then selected using the FS0 and FS1 pins. The device can synthesize frequencies to a resolution of 1 part per million (ppm), but the actual accuracy of the output frequency is limited by the accuracy of the integrated reference crystal.

The CY2XF33 has an output frequency range of 50 MHz to 690 MHz, but the range is not continuous. The CY2XF33 cannot generate frequencies in the ranges of 521 MHz to 529 MHz and 596 MHz to 617 MHz.

### Industrial Versus Commercial Device Performance

Industrial and Commercial devices have different internal crystals. This has a potentially significant impact on performance levels for applications requiring the lowest possible phase noise. CyberClocks Online Software displays expected performance for both options.

### Phase Noise Versus Jitter Performance

In most cases, the device configuration for optimal phase noise performance is different from the device configuration for optimal cycle to cycle or period jitter. CyberClocks Online Software includes algorithms to optimize performance for either parameter.

**Table 3. Device Programming Variables**

Variable
Output Frequency 0 (Power on default)
Output Frequency 1
Output Frequency 2
Output Frequency 3
Optimization (phase noise or jitter)
Temperature range (Commercial or Industrial)

**Absolute Maximum Conditions**

Parameter	Description	Condition	Min	Max	Unit
V <sub>DD</sub>	Supply Voltage		-0.5	4.4	V
V <sub>IN</sub> <sup>[1]</sup>	Input Voltage, DC	Relative to V <sub>SS</sub>	-0.5	V <sub>DD</sub> +0.5	V
T <sub>S</sub>	Temperature, Storage	Non operating	-55	135	°C
T <sub>J</sub>	Temperature, Junction		-40	135	°C
ESD <sub>HBM</sub>	ESD Protection (Human Body Model)	JEDEC STD 22-A114-B	2000	-	V
Θ <sub>JA</sub> <sup>[2]</sup>	Thermal Resistance, Junction to Ambient	0 m/s airflow	64		°C/W

**Operating Conditions**

Parameter	Description	Min	Typ	Max	Unit
V <sub>DD</sub>	3.3V Supply Voltage Range	3.135	3.3	3.465	V
	2.5V Supply Voltage Range	2.375	2.5	2.625	V
T <sub>PU</sub>	Power Up Time for V <sub>DD</sub> to Reach Minimum Specified Voltage (Power Ramp is Monotonic)	0.05	-	500	ms
T <sub>A</sub>	Ambient Temperature (Commercial)	0	-	70	°C
	Ambient Temperature (Industrial)	-40	-	85	°C

**DC Electrical Characteristics**

Parameter	Description	Condition	Min	Typ	Max	Unit
I <sub>DD</sub> <sup>[3]</sup>	Operating Supply Current	V <sub>DD</sub> = 3.465V, CLK = 150 MHz, output terminated	-	-	120	mA
		V <sub>DD</sub> = 2.625V, CLK = 150 MHz, output terminated	-	-	115	mA
V <sub>OD</sub>	LVDS Differential Output Voltage	V <sub>DD</sub> = 3.3V or 2.5V, defined in Figure 3 as terminated in Figure 2	247	-	454	mV
ΔV <sub>OD</sub>	Change in V <sub>OD</sub> between Complementary Output States	V <sub>DD</sub> = 3.3V or 2.5V, defined in Figure 3 as terminated in Figure 2	-	-	50	mV
V <sub>OS</sub>	LVDS Offset Output Voltage	V <sub>DD</sub> = 3.3V or 2.5V, defined in Figure 4 as terminated in Figure 2	1.125	-	1.375	V
ΔV <sub>OS</sub>	Change in V <sub>OS</sub> between Complementary Output States	V <sub>DD</sub> = 3.3V or 2.5V, R <sub>TERM</sub> = 100Ω between CLK and CLK#	-	-	50	mV
V <sub>IH</sub>	Input High Voltage		0.7*V <sub>DD</sub>	-	-	V
V <sub>IL</sub>	Input Low Voltage		-	-	0.3*V <sub>DD</sub>	V
I <sub>IH0</sub>	Input High Current, FS0 pin	Input = V <sub>DD</sub>	-	-	115	μA
I <sub>IH1</sub>	Input High Current, FS1 pin	Input = V <sub>DD</sub>	-	-	10	μA
I <sub>IL0</sub>	Input Low Current, FS0 pin	Input = V <sub>SS</sub>	-50	-	-	μA
I <sub>IL1</sub>	Input Low Current, FS1 pin	Input = V <sub>SS</sub>	-20	-	-	μA
C <sub>IN0</sub> <sup>[4]</sup>	Input Capacitance, FS0 pin		-	15	-	pF
C <sub>IN1</sub> <sup>[4]</sup>	Input Capacitance, FS1 pin		-	4	-	pF

**Notes**

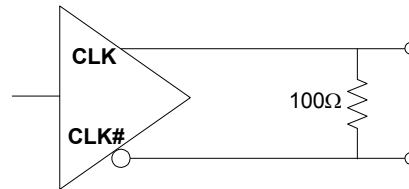
1. The voltage on any input or IO pin cannot exceed the power pin during power up.
2. Simulated. The board is derived from the JEDEC multilayer standard. It measures 76 x 114 x 1.6 mm and has 4-layers of copper (2/1/1/2 oz.). The internal layers are 100% copper planes, while the top and bottom layers have 50% metalization. No vias are included in the model.
3. I<sub>DD</sub> includes ~4 mA of current that is dissipated externally in the output termination resistors.
4. Not 100% tested, guaranteed by design and characterization.

**AC Electrical Characteristics<sup>[4]</sup>**

Parameter	Description	Condition	Min	Typ	Max	Unit
F <sub>OUT</sub>	Output Frequency <sup>[6]</sup>		50	–	690	MHz
FSC	Frequency Stability, commercial devices <sup>[5]</sup>	T <sub>A</sub> = 0°C to 70°C	–	–	±35	ppm
FSI	Frequency Stability, industrial devices <sup>[5]</sup>	T <sub>A</sub> = –40° to 85°C	–	–	±55	ppm
AG	Aging, 10 years		–	–	±15	ppm
T <sub>DC</sub>	Output Duty Cycle	F ≤ 450 MHz, measured at zero crossing	45	50	55	%
		F > 450 MHz, measured at zero crossing	40	50	60	%
T <sub>R</sub> , T <sub>F</sub>	Output Rise and Fall Time	20% and 80% of full output swing	–	0.35	1.0	ns
T <sub>LOCK</sub>	Startup Time	Time for CLK to reach valid frequency measured from the time V <sub>DD</sub> = V <sub>DD(min)</sub>	–	–	5	ms
T <sub>LFS</sub>	Re-lock Time	Time for CLK to reach valid frequency from FS0 or FS1 pin change	–	–	1	ms
T <sub>Jitter(φ)</sub>	RMS Phase Jitter (Random)	f <sub>OUT</sub> = 106.25 MHz (12 kHz–20 MHz)	–	1	–	ps

**Termination Circuits**

**Figure 2. LVDS Termination**

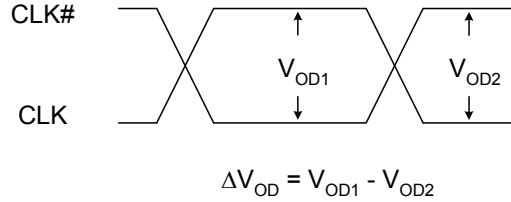


**Notes**

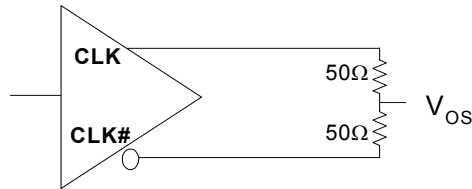
- 5. Frequency stability is the maximum variation in frequency from F<sub>0</sub>. It includes initial accuracy, plus variation from temperature and supply voltage.
- 6. This parameter is specified in CyberClocks Online software.

**Switching Waveforms**

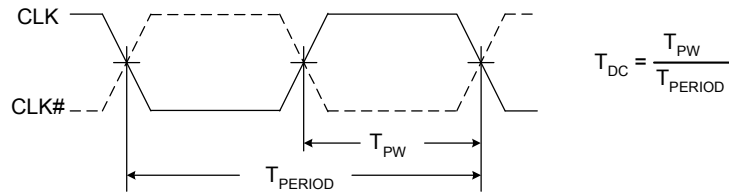
**Figure 3. Output Voltage Swing**



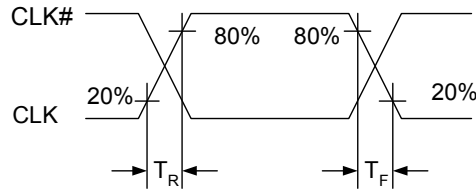
**Figure 4. Output Offset Voltage**



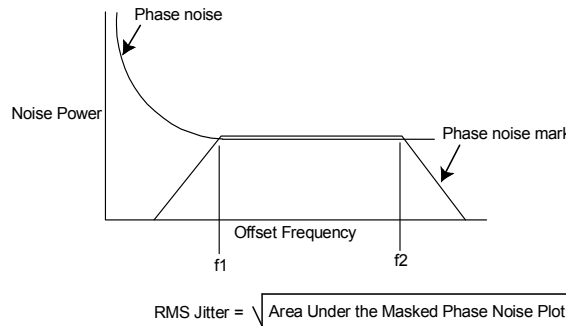
**Figure 5. Output Duty Cycle Timing**



**Figure 6. Output Rise and Fall Time**



**Figure 7. RMS Phase Jitter**

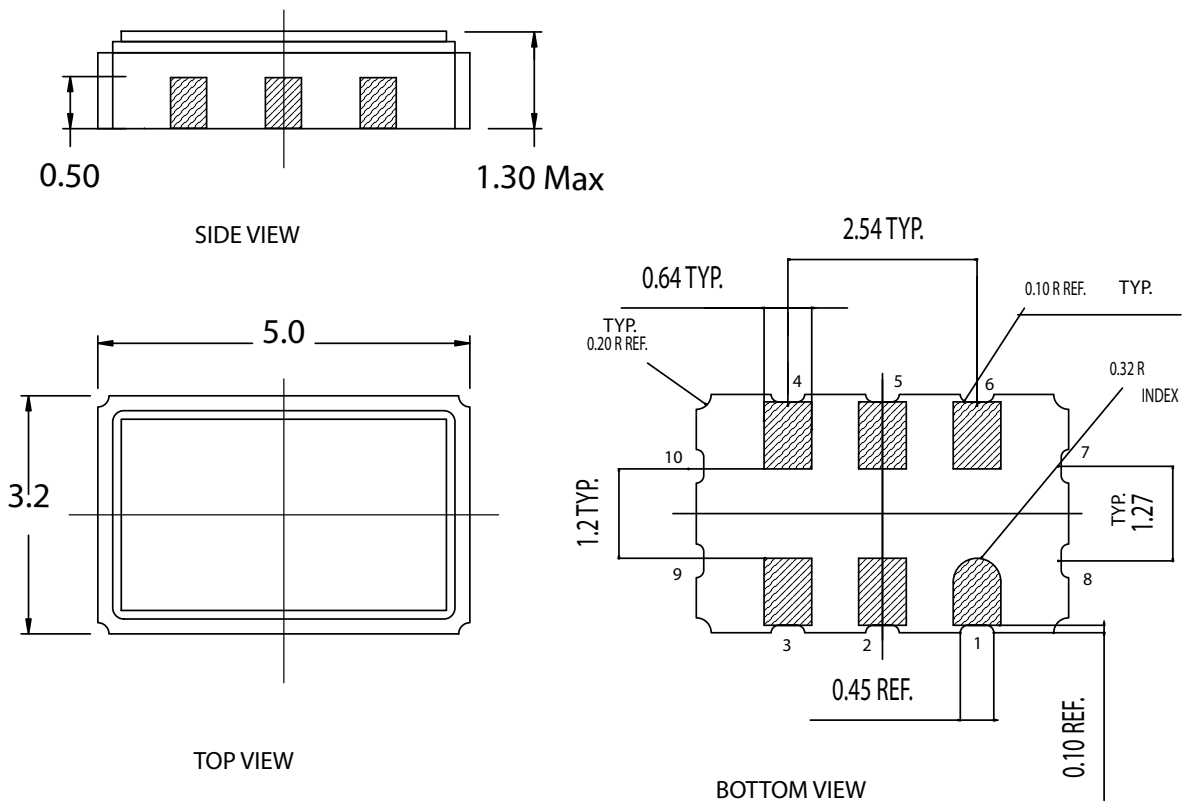


**Ordering Information**

Part Number <sup>[7]</sup>	Configuration	Package Description	Product Flow
<b>Pb-Free</b>			
CY2XF33FLXCT	Field Programmable	6-Pin Ceramic LCC SMD - Tape and Reel	Commercial, 0° to 70°C
CY2XF33FLXIT	Field Programmable	6-Pin Ceramic LCC SMD - Tape and Reel	Industrial, -40° to 85°C
CY2XF33LXCxxxT	Factory Configured	6-Pin Ceramic LCC SMD - Tape and Reel	Commercial, 0° to 70°C
CY2XF33LXIxxxT	Factory Configured	6-Pin Ceramic LCC SMD - Tape and Reel	Industrial, -40° to 85°C

**Package Drawings and Dimensions**

Figure 8. 6-Pin 3.2x5.0 mm Ceramic LCC LZ06A



Dimensions in mm  
 General Tolerance: ± 0.15MM  
 Kyocera dwg ref KD-VA6432-A  
 Package Weight ~ 0.12 grams

001-10044-\*\*

**Note**

7. "xxx" is a factory assigned code that identifies the programming option.

**Document History Page**

Document Title: CY2XF33 High Performance LVDS Oscillator with Frequency Margining - Pin Control				
Document Number: 001-53148				
REV.	ECN NO.	Orig. of Change	Submission Date	Description of Change
**	2704379	KVM/PYRS	05/11/2009	New data sheet
*A	2734005	WWZ	07/09/2009	Post to external web
*B	2764787	KVM	09/18/2009	Change V <sub>OD</sub> limits from 250/450 mV to 247/454 mV Add max limit for T <sub>R</sub> , T <sub>F</sub> : 1.0 ns Change T <sub>LOCK</sub> max from 10 ms to 5 ms Change T <sub>LFS</sub> max from 10 ms to 1 ms

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