

High-Performance LVDS Oscillator with Frequency Margining – Pin Control

Features

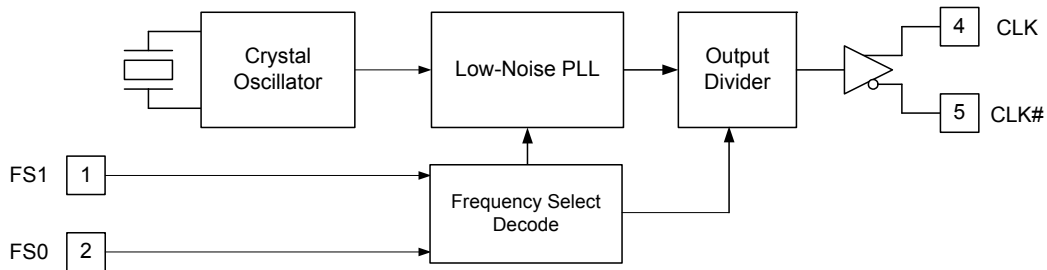
- Low jitter crystal oscillator (XO)
- Less than 1 ps typical RMS phase jitter
- Differential LVDS output
- Output frequency from 50 MHz to 690 MHz
- Two frequency margining control pins (FS0, FS1)
- Factory configured or field programmable
- Integrated phase-locked loop (PLL)
- Supply voltage: 3.3 V or 2.5 V
- Pb-free package: 5.0 × 3.2 mm LCC
- Industrial temperature range

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.

Logic Block Diagram

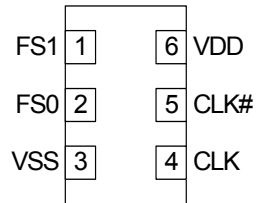


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Pinouts

Figure 1. 6-pin Ceramic LCC pinout



Pin Definitions

6-pin Ceramic LCC

| Pin | Name | I/O Type | Description |
|------|-----------|-------------|--------------------------------|
| 1, 2 | FS1, FS0 | CMOS input | Frequency select |
| 4, 5 | CLK, CLK# | LVDS output | Differential output clock |
| 6 | VDD | Power | Supply voltage: 2.5 V or 3.3 V |
| 3 | VSS | Power | Ground |

Functional Description

The FS0 and FS1 pins select between four different output frequencies, as shown in Table 1. 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 1. 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).

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 2. 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 (Industrial) |

Absolute Maximum Conditions

| Parameter | Description | Condition | Min | Max | Unit |
|---------------------|---|----------------------|------|----------------|------|
| V_{DD} | Supply voltage | – | –0.5 | 4.4 | V |
| $V_{IN}^{[1]}$ | Input voltage, DC | Relative to V_{SS} | –0.5 | $V_{DD} + 0.5$ | V |
| T_S | Temperature, storage | Non operating | –55 | 135 | °C |
| T_J | Temperature, junction | – | –40 | 135 | °C |
| ESD_{HBM} | ESD protection (human body model) | JEDEC STD 22-A114-B | 2000 | – | V |
| $\theta_{JA}^{[2]}$ | Thermal resistance, junction to ambient | 0 m/s airflow | 64 | | °C/W |

Operating Conditions

| Parameter | Description | Min | Typ | Max | Unit |
|-----------|---|-------|-----|-------|------|
| V_{DD} | 3.3 V supply voltage range | 3.135 | 3.3 | 3.465 | V |
| | 2.5 V supply voltage range | 2.375 | 2.5 | 2.625 | V |
| T_{PU} | Power up time for V_{DD} to reach minimum specified voltage (power ramp is monotonic) | 0.05 | – | 500 | ms |
| T_A | Ambient temperature (industrial) | –40 | – | 85 | °C |

Notes

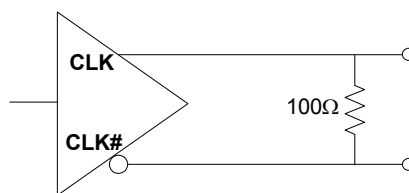
1. The voltage on any input or I/O pin cannot exceed the power pin during power up.
2. Simulated. The board is derived from the JEDEC multilayer standard. It measures 76 x 114 x 1.6 mm and has 4-layers of copper (2/1/1/2 oz.). The internal layers are 100% copper planes, while the top and bottom layers have 50% metalization. No vias are included in the model.

DC Electrical Characteristics

| Parameter | Description | Condition | Min | Typ | Max | Unit |
|-----------------|--|---|---------------------|-----|---------------------|---------------|
| $I_{DD}^{[3]}$ | Operating supply current | $V_{DD} = 3.465\text{ V}$, CLK = 150 MHz, output terminated | – | – | 120 | mA |
| | | $V_{DD} = 2.625\text{ V}$, CLK = 150 MHz, output terminated | – | – | 115 | mA |
| V_{OD} | LVDS differential output voltage | $V_{DD} = 3.3\text{ V}$ or 2.5 V , defined in Figure 3 as terminated in Figure 2 | 247 | – | 454 | mV |
| ΔV_{OD} | Change in V_{OD} between complementary output states | $V_{DD} = 3.3\text{ V}$ or 2.5 V , defined in Figure 3 as terminated in Figure 2 | – | – | 50 | mV |
| V_{OS} | LVDS offset output voltage | $V_{DD} = 3.3\text{ V}$ or 2.5 V , defined in Figure 4 as terminated in Figure 2 | 1.125 | – | 1.375 | V |
| ΔV_{OS} | Change in V_{OS} between complementary output states | $V_{DD} = 3.3\text{ V}$ or 2.5 V , $R_{TERM} = 100\ \Omega$ between CLK and CLK# | – | – | 50 | mV |
| V_{IH} | Input high voltage | – | $0.7 \times V_{DD}$ | – | – | V |
| V_{IL} | Input low voltage | – | – | – | $0.3 \times V_{DD}$ | V |
| I_{IH0} | Input high current, FS0 pin | Input = V_{DD} | – | – | 115 | μA |
| I_{IH1} | Input high current, FS1 pin | Input = V_{DD} | – | – | 10 | μA |
| I_{IL0} | Input low current, FS0 pin | Input = V_{SS} | –50 | – | – | μA |
| I_{IL1} | Input low current, FS1 pin | Input = V_{SS} | –20 | – | – | μA |
| $C_{IN0}^{[4]}$ | Input capacitance, FS0 pin | – | – | 15 | – | pF |
| $C_{IN1}^{[4]}$ | Input capacitance, FS1 pin | – | – | 4 | – | pF |

Termination Circuits

Figure 2. LVDS Termination



Notes

- I_{DD} includes ~4 mA of current that is dissipated externally in the output termination resistors.
- Not 100% tested, guaranteed by design and characterization.

AC Electrical Characteristics

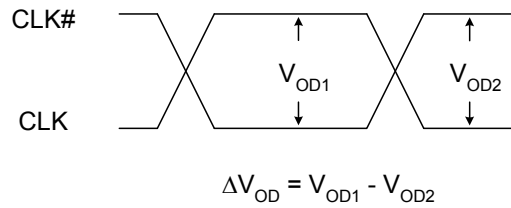
| Parameter ^[5] | Description | Condition | Min | Typ | Max | Unit |
|---------------------------------|--|---|-----|------|-----|------|
| F _{OUT} | Output frequency ^[6] | – | 50 | – | 690 | MHz |
| FSI | Frequency stability, industrial devices ^[7] | T _A = –40 °C to 85 °C | – | – | ±55 | ppm |
| AG | Aging, 10 years | – | – | – | ±15 | ppm |
| T _{DC} | Output duty cycle | F ≤ 450 MHz, measured at zero crossing | 45 | 50 | 55 | % |
| | | F > 450 MHz, measured at zero crossing | 40 | 50 | 60 | % |
| T _R , T _F | Output rise and fall time | 20% and 80% of full output swing | – | 0.35 | 1.0 | ns |
| T _{LOCK} | Startup time | Time for CLK to reach valid frequency measured from the time V _{DD} = V _{DD(min)} | – | – | 5 | ms |
| T _{LFS} | Re-lock time | Time for CLK to reach valid frequency from FS0 or FS1 pin change | – | – | 1 | ms |
| T _{Jitter(φ)} | RMS phase jitter (random) | f _{OUT} = 106.25 MHz (12 kHz–20 MHz) | – | 1 | – | ps |

Notes

5. Not 100% tested, guaranteed by design and characterization.
6. This parameter is specified in CyberClocks Online software.
7. Frequency stability is the maximum variation in frequency from F₀. It includes initial accuracy, plus variation from temperature and supply voltage.

Switching Waveforms

Figure 3. Output Voltage Swing



$$\Delta V_{OD} = V_{OD1} - V_{OD2}$$

Figure 4. Output Offset Voltage

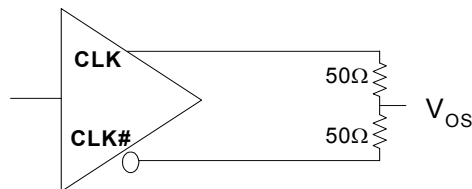


Figure 5. Output Duty Cycle Timing

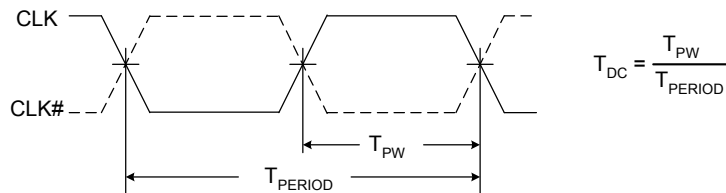


Figure 6. Output Rise and Fall Time

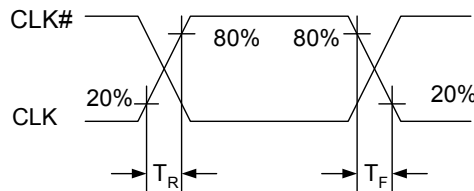
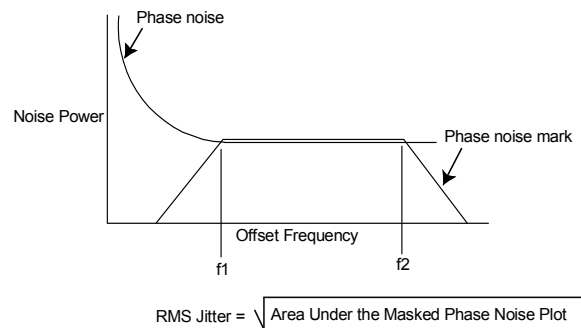


Figure 7. RMS Phase Jitter



Ordering Information

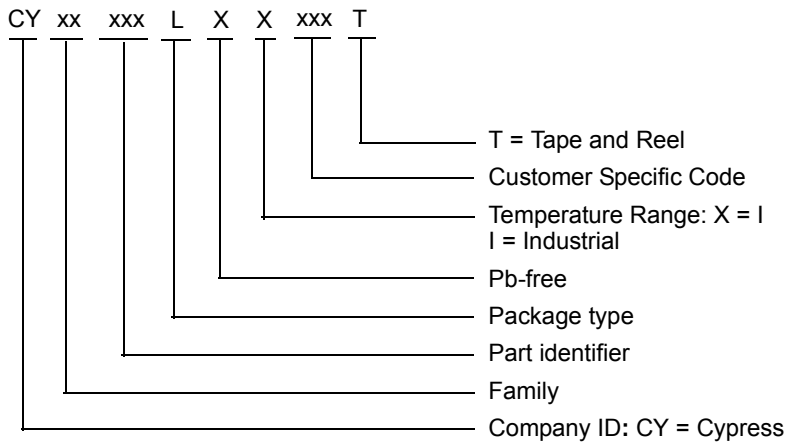
| Part Number | Configuration | Package Description | Product Flow |
|----------------|--------------------|---------------------------------------|-----------------------------|
| Pb-free | | | |
| CY2XF33FLXIT | Field programmable | 6-pin ceramic LCC SMD – Tape and Reel | Industrial, –40 °C to 85 °C |

Possible Configuration

Some product offerings are factory programmed customer specific devices with customized part numbers. The Possible Configurations table shows the available device types, but not complete part numbers. Contact your local Cypress FAE or Sales Representative for more information.

| Part Number ^[8] | Configuration | Package Description | Product Flow |
|----------------------------|--------------------|---------------------------------------|-----------------------------|
| Pb-free | | | |
| CY2XF33LXIxxxT | Factory configured | 6-pin ceramic LCC SMD – Tape and Reel | Industrial, –40 °C to 85 °C |

Ordering Code Definitions

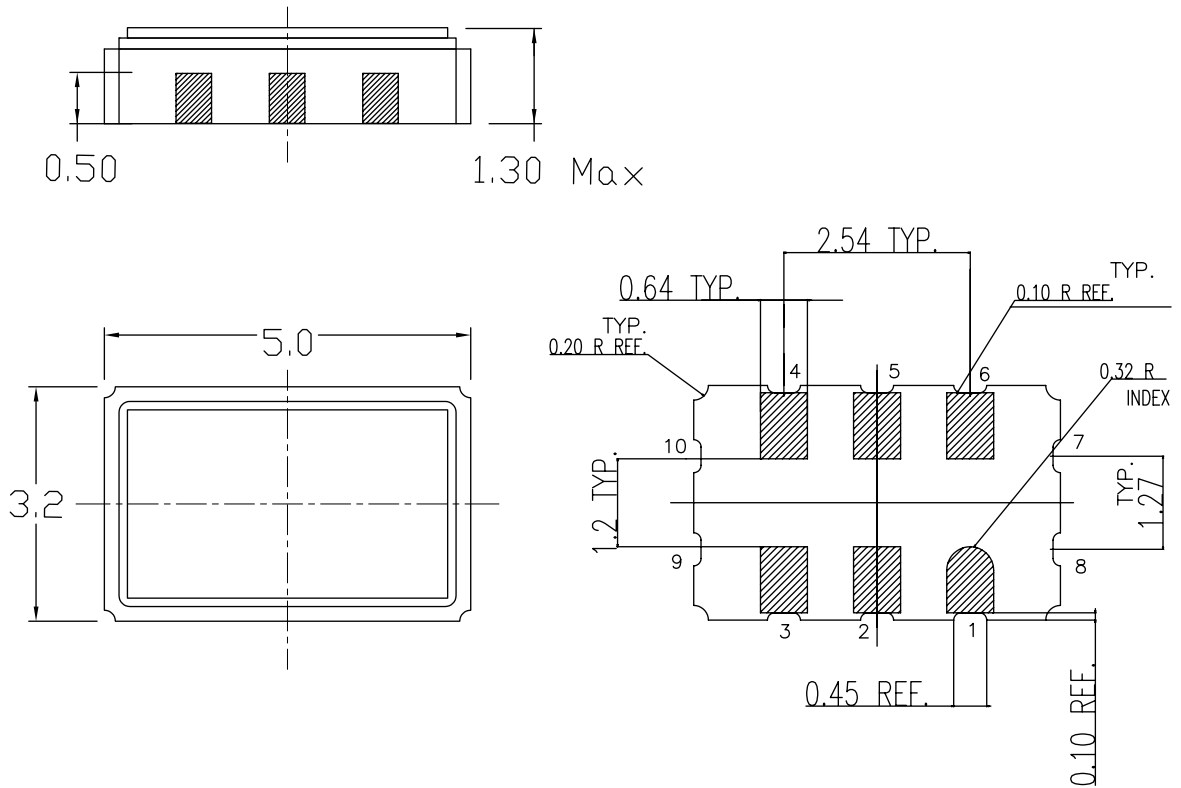


Note

8. "xxx" is a factory assigned code that identifies the programming option. For more details, contact your local Cypress FAE or Sales Representative.

Package Drawings and Dimensions

Figure 8. 6-pin Ceramic LCC (5.0 × 3.2 × 1.3 mm) LZ06A Package Outline, 001-10044



Dimensions in mm
Kyocera dwg ref KD-VA6432-A
Package Weight ~ 0.12 grams

001-10044 *C

Acronyms

| Acronym | Description |
|---------|---|
| CLKOUT | clock output |
| CMOS | complementary metal oxide semiconductor |
| DPM | die pick map |
| EPROM | erasable programmable read only memory |
| LVDS | low-voltage differential signaling |
| NTSC | national television system committee |
| OE | output enable |
| PAL | phase alternate line |
| PD | power-down |
| PLL | phase-locked loop |
| PPM | parts per million |
| TTL | transistor-transistor logic |

Document Conventions

Units of Measure

| Symbol | Unit of Measure |
|--------|-----------------------------|
| °C | degree Celsius |
| kHz | kilohertz |
| kΩ | kilohm |
| MHz | megahertz |
| MΩ | megaohm |
| μA | microampere |
| μs | microsecond |
| μV | microvolt |
| μVrms | microvolts root-mean-square |
| mA | milliampere |
| mm | millimeter |
| ms | millisecond |
| mV | millivolt |
| nA | nanoampere |
| ns | nanosecond |
| nV | nanovolt |
| Ω | ohm |

Document History Page

| Document Title: CY2XF33, High-Performance LVDS Oscillator with Frequency Margining – Pin Control | | | | |
|--|---------|-----------------|-----------------|--|
| Document Number: 001-53148 | | | | |
| Revision | ECN | 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 | Updated DC Electrical Characteristics : Changed minimum value of V_{OD} parameter from 250 mV to 247 mV. Changed maximum value of V_{OD} parameter from 450 mV to 454 mV. Updated AC Electrical Characteristics : Added maximum value for T_R , T_F parameter as 1.0 ns. Changed maximum value of T_{LOCK} parameter from 10 ms to 5 ms. Changed maximum value of T_{LFS} parameter from 10 ms to 1 ms. |
| *C | 2898472 | KVM | 03/24/2010 | Updated Ordering Information : No change in part numbers. Added Possible Configuration . Moved 'xxx' parts to Possible Configurations table. Updated Package Drawings and Dimensions . |
| *D | 3165931 | BASH | 02/10/2011 | Changed status from Preliminary to Final. Added "Application Specific Factory Configurations". Updated Ordering Information : Updated part numbers (Added application specific part numbers). Added note "Device configuration details are described in the "Application-Specific Factory Configurations" on page 4." and referred the same note in newly added MPNs. |
| *E | 3279652 | BASH | 06/13/2011 | Updated Logic Block Diagram : Swapped FS0 and FS1. Updated Pinouts : Updated Figure 1 : Swapped FS0 and FS1. Updated Pin Definitions : Swapped FS0 and FS1 in "Name" column. Updated Application Specific Factory Configurations: Removed CY2XF33LXC533T related information Updated Ordering Information : Updated part numbers (Removed CY2XF33LXC533T). |
| *F | 3847770 | AJU | 01/23/2013 | Removed "Application-Specific Factory Configurations". Updated Ordering Information : Removed pruned part CY2XF33LXC700T. Removed the Note "Device configuration details are described in the "Application-Specific Factory Configurations" on page 4." and its references. Updated Package Drawings and Dimensions : spec 001-10044 – Changed revision from *A to *B. |
| *G | 4292282 | XHT | See ECN | Obsolete document. Completing Sunset Review. |

Document History Page (continued)

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|--|---------|-----------------|-----------------|---|
| Document Number: 001-53148 | | | | |
| Revision | ECN | Orig. of Change | Submission Date | Description of Change |
| *H | 5364178 | PSR | 07/21/2016 | Reactivated document. Removed Commercial Temperature Range related information in all instances across the document. Updated Programming Description : Updated Field Programmable CY2XF33F : Updated description. Updated Ordering Information : Updated part numbers. Updated Possible Configuration : Updated part numbers. Updated Package Drawings and Dimensions : spec 001-10044 – Changed revision from *B to *C. Updated to new template. Completing Sunset Review. |
| *I | 5992952 | AESATMP9 | 12/14/2017 | Updated logo and copyright. |

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