CY2XL13

Low-Noise LVDS Clock Generator

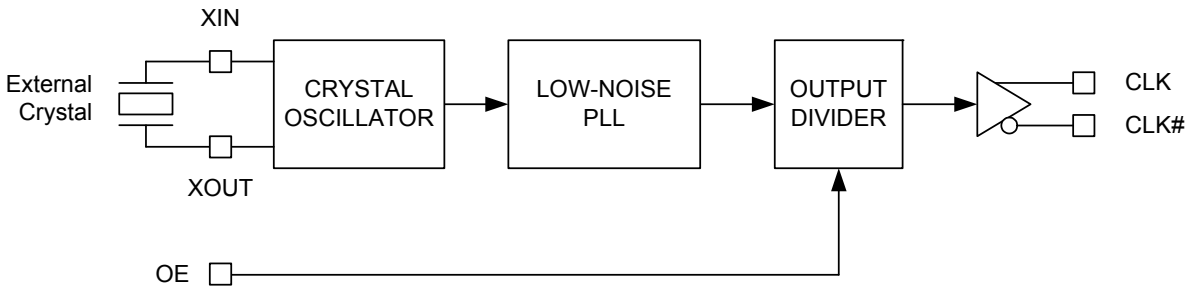
Features

- Output: One low-voltage differential signal (LVDS) output pair
- Output frequency: 125 MHz
- Input: 25-MHz external crystal
- RMS phase jitter:
  - At 125 MHz (12 kHz to 20 MHz offset): 0.65 ps typical
- Package: Pb-free 8-pin thin shrunk small outline package (TSSOP)
- Supply voltage: 3.3 V or 2.5 V
- Temperature range: Commercial or industrial

Functional Description

The CY2XL13 is a phase-locked loop (PLL)-based high-performance clock generator that uses Cypress's low-noise voltage control oscillator (VCO) technology to achieve less than 1-ps typical RMS phase jitter. The CY2XL13 uses an external crystal reference input to generate one LVDS output pair, which can be asynchronously enabled/disabled with an OE pin. The device operates at 3.3 V or 2.5 V.

Logic Block Diagram



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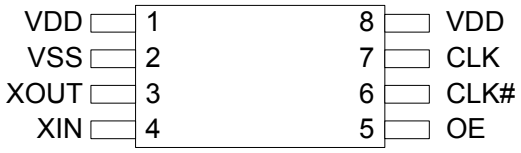
Pinout

Figure 1. 8-pin TSSOP pinout



Pin Definitions

8-pin TSSOP

Pin Number	Pin Name	I/O Type	Description
1, 8	VDD	Power	3.3-V or 2.5-V power supply. All supply current flows through pin 1
2	VSS	Power	Ground
3, 4	XOUT, XIN	XTAL output and input	Parallel resonant crystal interface
5	OE	CMOS input	Output enable: When high, the output is enabled. When low, the output is high impedance.
6, 7	CLK#, CLK	LVDS output	Differential clock output

Frequency Table

Part Number	Crystal Frequency	Output Frequency	Pin 5 Function	RMS Phase Jitter (Random)	
				Offset Range	Jitter (Typical)
CY2XL13ZXC01	25 MHz	125 MHz	OE	12 kHz to 20 MHz	0.65 ps
CY2XL13ZXI01					

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	–65	150	°C
T_J	Temperature, Junction		–	135	°C
ESD_{HBM}	Electrostatic discharge (ESD) protection (human body model)	JEDEC STD 22-A114-B	2000	–	V
UL–94	Flammability rating	At 1/8 in.	V–0		–
Θ_{JA}[2]	Thermal resistance, junction to ambient	0 m/s airflow	100		°C/W
		1 m/s airflow	91		
		2.5 m/s airflow	87		

Operating Conditions

Parameter	Description	Min	Max	Unit
V_{DD}	3.3-V supply voltage	3.135	3.465	V
	2.5-V supply voltage	2.375	2.625	V
T_A	Ambient temperature, commercial	0	70	°C
	Ambient temperature, industrial	–40	85	°C
T_{PU}	Power-up time for all V_{DD} to reach minimum specified voltage (ensure power ramp is monotonic)	0.05	500	ms

Notes
1. The voltage on any input or I/O pin cannot exceed the V_{DD} pins during power-up.
2. Simulated using Apache Sentinel TI software. 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% metallization. No vias are included in the model.

DC Electrical Characteristics

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
I_{DD}[3]	Power supply current with output terminated	V_{DD} = 3.465 V, OE = V_{DD}, output terminated	–	–	120	mA
		V_{DD} = 2.625 V, OE = V_{DD}, output terminated	–	–	115	mA
V_{OD}[4]	LVDS differential output voltage	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 100 Ω between CLK and CLK#	247	–	454	mV
ΔV_{OD}[4]	Change in V_{OD} between complementary output states	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 100 Ω between CLK and CLK#	–	–	50	mV
V_{OS}[5]	LVDS offset output voltage	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 100 Ω between CLK and CLK#	1.125	–	1.375	V
ΔV_{OS}	Change in V_{OS} between complementary output states	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 100 Ω between CLK and CLK#	–	–	50	mV
I_{OZ}	Output leakage current	Three-state output, unterminated, measured on one pin while floating the other pin, OE = V_{SS}	–35	–	35	µA
V_{IH}	Input high voltage, pin 5		0.7 × V_{DD}	–	–	V
V_{IL}	Input low voltage, pin 5		–	–	0.3 × V_{DD}	V
I_{IH}	Input high current, pin 5	Input = V_{DD}	–	–	115	µA
I_{IL}	Input low current, pin 5	Input = V_{SS}	–50	–	–	µA
C_{IN}	Input capacitance, pin 5		–	15	–	pF
C_{INX}	Pin capacitance, XIN and XOUT		–	4.5	–	pF

Notes
3. I_{DD} includes ~4 mA of current that is dissipated externally in the output termination resistor.
4. Refer to Figure 2 on page 7.
5. Refer to Figure 3 on page 7.

AC Electrical Characteristics

Parameter [6, 7]	Description	Test Conditions	Min	Typ	Max	Unit
F_{OUT}[8]	Output frequency			See note 8		MHz
T_R, T_F[9]	Output rise or fall time	20% to 80% of full output swing	–	0.5	1.0	ns
$T_{Jitter(\phi)}$[8, 10]	RMS phase jitter (random)	Offset = 12 kHz to 20 MHz	–	–	1.0	ps
T_{DC}[11]	Duty cycle	Measured at zero crossing point	45	–	55	%
T_{OHZ}[12]	Output disable time	Time from falling edge on OE to stopped outputs (asynchronous)	–	–	100	ns
T_{OE}[12]	Output enable time	Time from rising edge on OE to outputs at a valid frequency (asynchronous)	–	–	120	ns
T_{LOCK}	Startup time	Time for CLK to reach valid frequency measured from the time $V_{DD} = V_{DD(min)}$.	–	–	5	ms

Crystal Characteristics

Parameter	Description	Min	Max	Unit
MO	Mode of oscillation		Fundamental	
F[8]	Frequency		See note 8	MHz
ESR	Equivalent series resistance	–	50	Ω
C_S	Shunt capacitance	–	7	pF

Notes
6. Not 100% tested, guaranteed by design and characterization.
7. Outputs are terminated with 100 Ω between CLK and CLK#. Refer to Figure 8 on page 8.
8. Crystal frequency, output frequency, and typical phase jitter are listed in Frequency Table on page 3.
9. Refer to Figure 4 on page 7.
10. Refer to Figure 7 on page 8.
11. Refer to Figure 5 on page 7.
12. Refer to Figure 6 on page 7.

Switching Waveforms

Figure 2. Output Voltage Swing

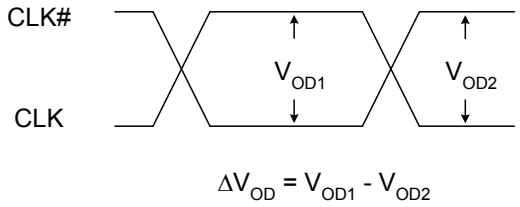


Figure 3. Output Offset Voltage

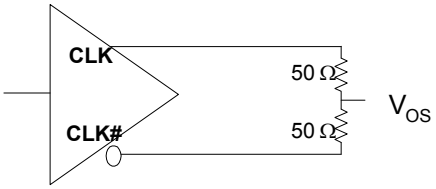


Figure 4. Output Rise or Fall Time

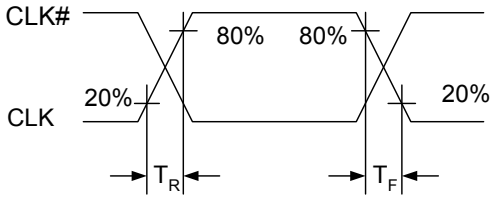


Figure 5. Duty Cycle Timing

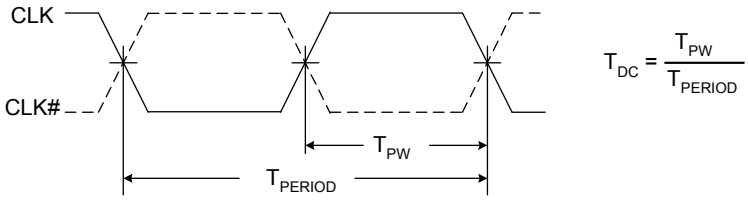
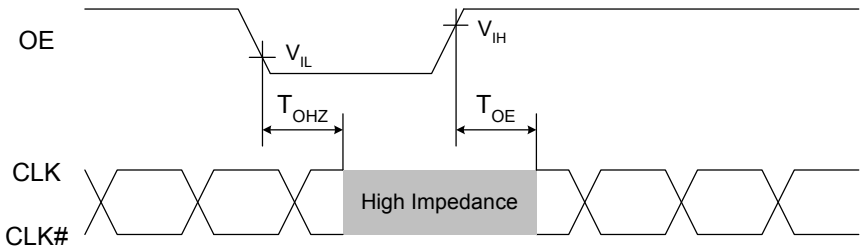
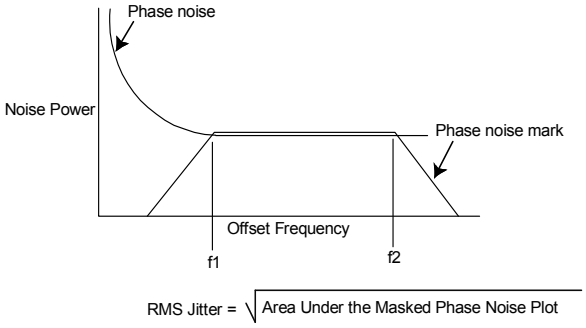


Figure 6. Output Enable and Disable Timing



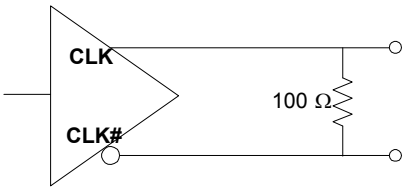
Switching Waveforms (continued)

Figure 7. RMS Phase Jitter



Termination Circuits

Figure 8. LVDS Termination

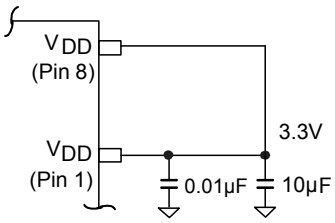


Application Information

Power Supply Filtering Techniques

As in any high-speed analog circuitry, noise at the power supply pins can degrade performance. To achieve optimum jitter performance, use good power-supply isolation practices. Figure 9 illustrates a typical filtering scheme. Because all the current flows through pin 1, the resistance and inductance between this pin and the supply is minimized. A 0.01 or 0.1 µF ceramic chip capacitor is also located close to this pin to provide a short and low-impedance AC path to ground. A 1 to 10 µF ceramic or tantalum capacitor is located in the general vicinity of this device and may be shared with other devices.

Figure 9. Power Supply Filtering



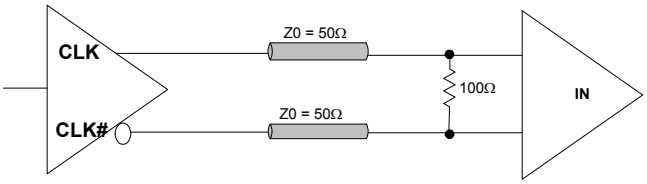
Board Layout and OE Pin

If the Output Enable (OE) function on pin 5 is not needed, it may be connected directly to the V_{DD} plane by a wide trace and multiple vias. This improves heat dissipation. A resistor between OE and V_{DD} is not necessary.

Termination for LVDS Output

The CY2XL13 is designed to drive a standard LVDS load with a 100-Ω termination resistor. Figure 10 shows the standard termination scheme. The termination resistor should always be located very close to the receiver. To minimize signal reflections from the receiver, the differential impedance (Z_0) of the trace pair should be 100 Ω to match the termination resistor.

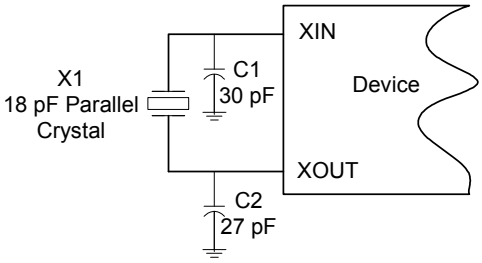
Figure 10. Output Termination



Crystal Interface

The CY2XL13 is characterized with 18 pF parallel resonant crystals. The capacitor values shown in Figure 11 are determined using an 18 pF parallel resonant crystal and are chosen to minimize the ppm error. Note that the optimal values for C1 and C2 depend on the parasitic trace capacitance and are, therefore, layout dependent.

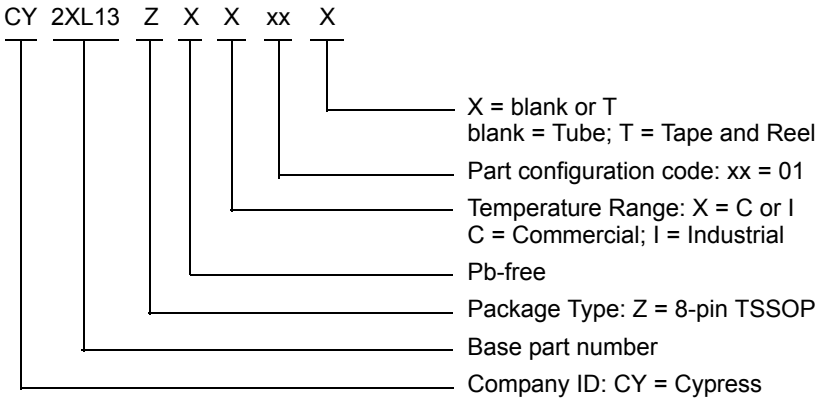
Figure 11. Crystal Input Interface



Ordering Information

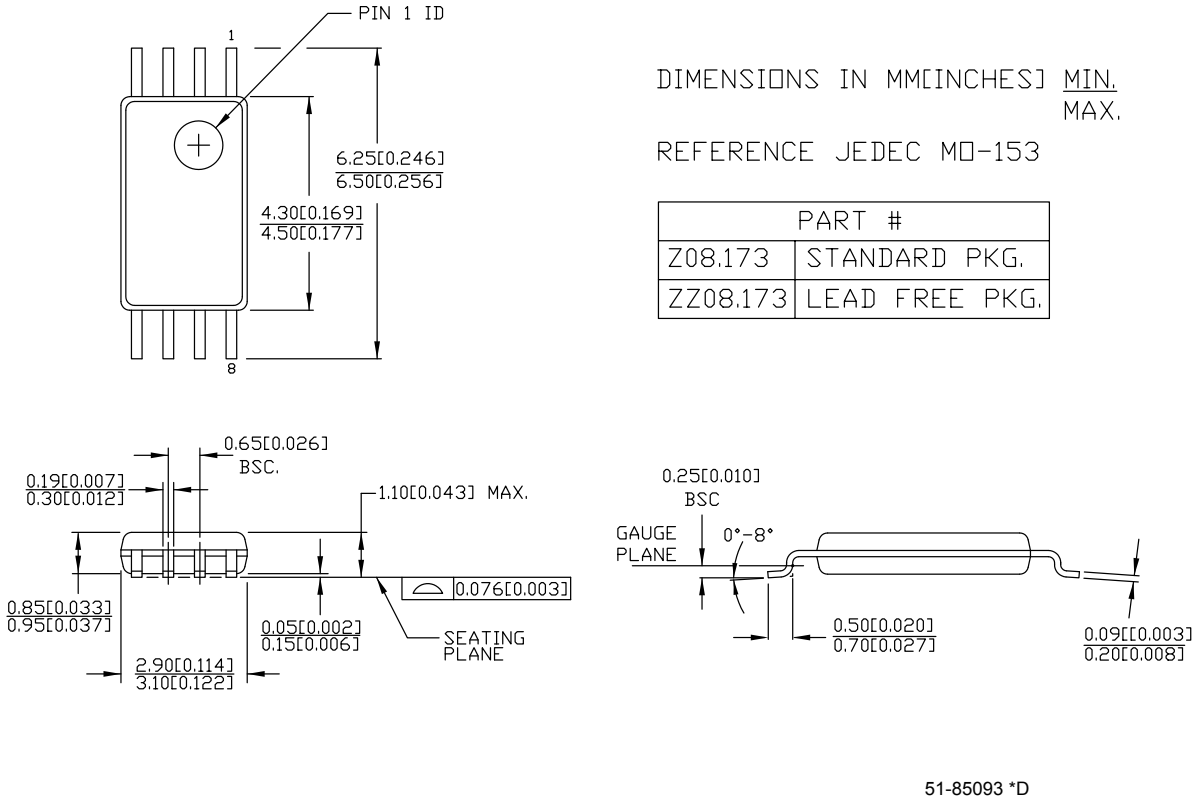
Part Number	Package Description	Product Flow
CY2XL13ZXC01	8-pin TSSOP	Commercial, 0 °C to 70 °C
CY2XL13ZXC01T	8-pin TSSOP – Tape and Reel	Commercial, 0 °C to 70 °C
CY2XL13ZXI01	8-pin TSSOP	Industrial, –40 °C to 85 °C
CY2XL13ZXI01T	8-pin TSSOP – Tape and Reel	Industrial, –40 °C to 85 °C

Ordering Code Definitions



Package Drawing and Dimensions

Figure 12. 8-pin TSSOP (4.40 mm Body) Z08.173/ZZ08.173 Package Outline, 51-85093



Acronyms

Acronym	Description
ESD	Electrostatic Discharge
FAE	Field Application Engineer
HBM	Human Body Model
JEDEC	Joint Electron Devices Engineering Council
LCC	Leadless Chip Carrier
LVDS	Low-Voltage Differential Signaling
OE	Output Enable
PCB	Printed Circuit Board
PLL	Phase-Locked Loop
RMS	Root Mean Square
TSSOP	Thin Shrunk Small Outline Package
VCO	Voltage Controlled Oscillator
XO	Crystal Oscillator

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
MHz	megahertz
µA	microampere
µs	microsecond
mA	milliampere
mm	millimeter
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
V	volt
W	watt

Document History Page

Document Title: CY2XL13, Low-Noise LVDS Clock Generator Document Number: 001-63177				
Rev.	**ECN No.**	**Submission Date**	**Orig. of Change**	**Description of Change**
**	2991849	07/23/2010	KVM	New data sheet.
*A	4118896	09/10/2013	CINM	Updated Package Drawing and Dimensions: spec 51-85093 – Changed revision from *C to *D. Updated in new template. Completing Sunset Review.

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