CY2XP22

Crystal to LVPECL Clock Generator

Features

- One LVPECL output pair
- Selectable frequency multiplication: × 2.5 or × 5
- External crystal frequency: 25.0 MHz
- Output frequency: 62.5 MHz or 125 MHz
- Low RMS phase jitter at 125 MHz, using 25 MHz crystal (1.875 MHz to 20 MHz): 0.4 ps (typical)
- Phase noise at 125 MHz (typical):

Offset	Noise Power
1 kHz	–117 dBc/Hz
10 kHz	–126 dBc/Hz
100 kHz	–131 dBc/Hz
1 MHz	–131 dBc/Hz

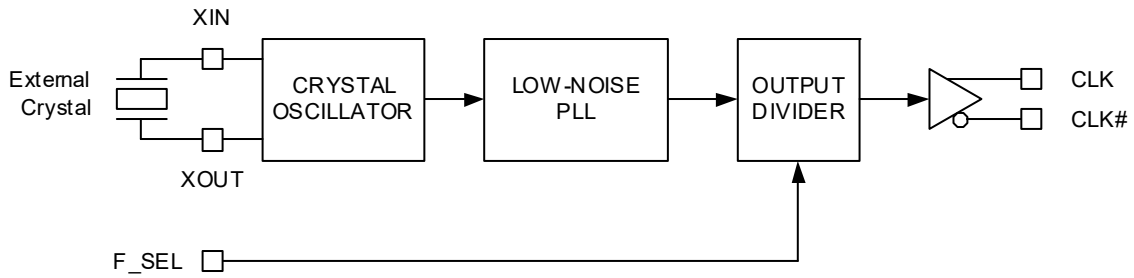
- Pb-free 8-pin TSSOP package
- Supply voltage: 3.3 V or 2.5 V
- Commercial and Industrial temperature range

Functional Description

The CY2XP22 is a PLL (Phase Locked Loop) based high performance clock generator that uses an external reference crystal. It is specifically targeted at FibreChannel and Gigabit Ethernet applications. It produces a selectable output frequency that is 2.5 or 5 times the crystal frequency. With a 25 MHz crystal, the user can select either a 62.5 MHz or 125 MHz output. It uses Cypress's low noise VCO technology to achieve less than 1 ps typical RMS phase jitter. The CY2XP22 has a crystal oscillator interface input and one LVPECL output pair.

For a complete list of related documentation, click here.

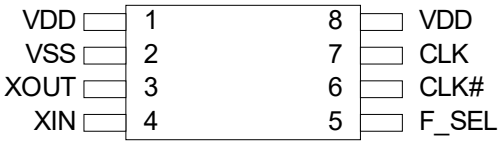
Logic Block Diagram



Contents

Pinouts

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
2	VSS	Power	Ground
3, 4	XOUT, XIN	XTAL output and input	Parallel resonant crystal interface
5	F_SEL	CMOS input	Frequency Select: see Frequency Table
6, 7	CLK#, CLK	LVPECL output	Differential clock output

Frequency Table

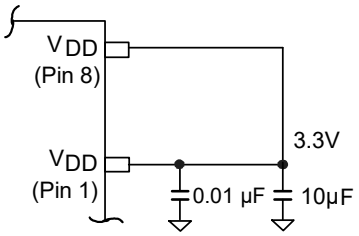
Inputs		PLL Multiplier Value	Output Frequency (MHz)
Crystal Frequency (MHz)	F_SEL		
25	0	5	125
	1	2.5	62.5

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 2 illustrates a typical filtering scheme. Since 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.

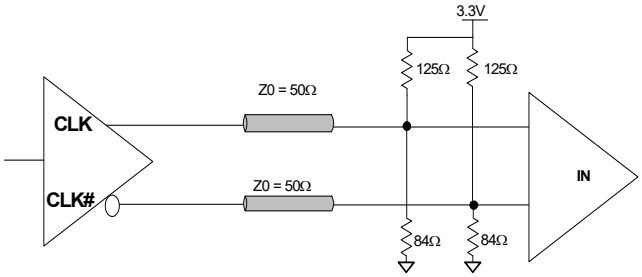
Figure 2. Power Supply Filtering



Termination for LVPECL Output

The CY2XP22 implements its LVPECL driver with a current steering design. For proper operation, it requires a 50 ohm dc termination on each of the two output signals. For 3.3 V operation, this data sheet specifies output levels for termination to V_{DD} – 2.0 V. This same termination voltage can also be used for V_{DD} = 2.5 V operation, or it can be terminated to V_{DD} – 1.5 V. Note that it is also possible to terminate with 50 ohms to ground (V_{SS}), but the high and low signal levels differ from the data sheet values. Termination resistors are best located close to the destination device. To avoid reflections, trace characteristic impedance (Z_0) should match the termination impedance. Figure 3 shows a standard termination scheme.

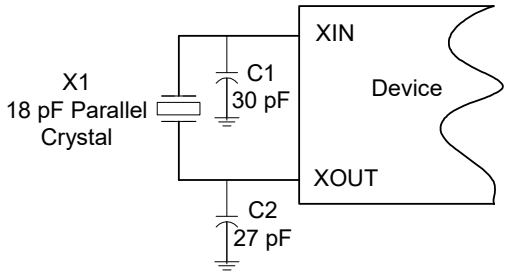
Figure 3. LVPECL Output Termination



Crystal Interface

The CY2XP22 is characterized with 18 pF parallel resonant crystals. The capacitor values shown in Figure 4 are determined using a 25 MHz 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 thus layout dependent.

Figure 4. Crystal Input Interface



Absolute Maximum Conditions

Parameter	Description	Conditions	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}	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 ramps is monotonic)	0.05	500	ms

Notes
1. The voltage on any input or IO pin cannot exceed the power pin 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% metalization. No vias are included in the model.

DC Electrical Characteristics

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
I_{DD}	Operating Supply Current with output unterminated	V_{DD} = 3.465 V, F_{OUT} = 125 MHz, output unterminated	–	–	125	mA
		V_{DD} = 2.625 V, F_{OUT} = 125 MHz, output unterminated	–	–	120	mA
I_{DDT}	Operating Supply Current with output terminated	V_{DD} = 3.465 V, F_{OUT} = 125 MHz, output terminated	–	–	150	mA
		V_{DD} = 2.625 V, F_{OUT} = 125 MHz, output terminated	–	–	145	mA
V_{OH}	LVPECL Output High Voltage	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 50 Ω to V_{DD} – 2.0 V	V_{DD} – 1.15	–	V_{DD} – 0.75	V
V_{OL}	LVPECL Output Low Voltage	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 50 Ω to V_{DD} – 2.0 V	V_{DD} – 2.0	–	V_{DD} – 1.625	V
V_{OD1}	LVPECL Peak-to-Peak Output Voltage Swing	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 50 Ω to V_{DD} – 2.0 V	600	–	1000	mV
V_{OD2}	LVPECL Output Voltage Swing (V_{OH} – V_{OL})	V_{DD} = 2.5 V, R_{TERM} = 50 Ω to V_{DD} – 1.5 V	500	–	1000	mV
V_{OCM}	LVPECL Output Common Mode Voltage (V_{OH} + V_{OL})/2	V_{DD} = 2.5 V, R_{TERM} = 50 Ω to V_{DD} – 1.5 V	1.2	–	–	V
V_{IH}	Input High Voltage, F_SEL		0.7 × V_{DD}	–	V_{DD} + 0.3	V
V_{IL}	Input Low Voltage, F_SEL		–0.3	–	0.3 × V_{DD}	V
I_{IH}	Input High Current, F_SEL	F_SEL = V_{DD}	–	–	115	µA
I_{IL}	Input Low Current, F_SEL	F_SEL = V_{SS}	–50	–	–	µA
C_{IN}[3]	Input Capacitance, F_SEL		–	15	–	pF
C_{INX}[3]	Pin Capacitance, XIN & XOUT		–	4.5	–	pF

Note
3. Not 100% tested, guaranteed by design and characterization.

AC Electrical Characteristics

Parameter [4]	Description	Conditions	Min	Typ	Max	Unit
F_{OUT}	Output Frequency		62.5	–	125	MHz
T_R, T_F	Output Rise or Fall Time	20% to 80% of full output swing	–	0.5	1.0	ns
$T_{Jitter(\phi)}$	RMS Phase Jitter (Random)	125 MHz, (1.875–20 MHz)	–	0.4	–	ps
T_{DC}	Output Duty Cycle	Measured at zero crossing point	48	50	52	%
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 F_SEL pin change	–	–	1	ms

Recommended Crystal Specifications

Parameter [5]	Description	Min	Max	Unit
Mode	Mode of Oscillation	Fundamental		
F	Frequency	25	25	MHz
ESR	Equivalent Series Resistance	–	50	Ω
C_0	Shunt Capacitance	–	7	pF

Notes
4. Not 100% tested, guaranteed by design and characterization.
5. Characterized using an 18 pF parallel resonant crystal.

Parameter Measurements

Figure 5. 3.3 V Output Load AC Test Circuit

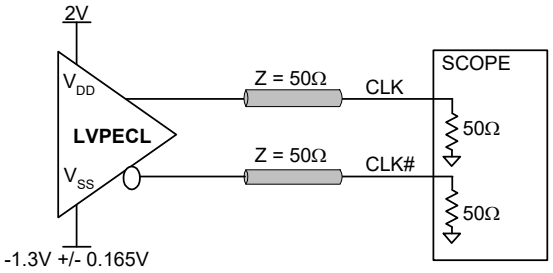


Figure 6. 2.5 V Output Load AC Test Circuit

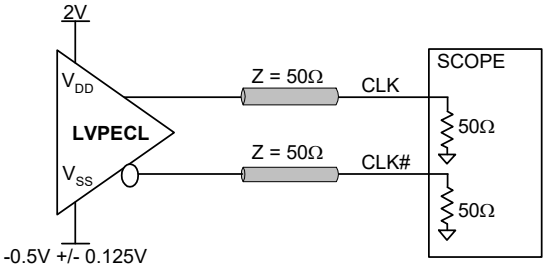


Figure 7. Output DC Parameters

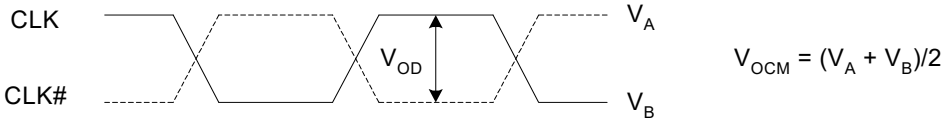
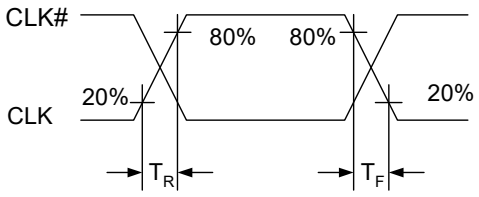


Figure 8. Output Rise and Fall Time



Parameter Measurements (continued)

Figure 9. RMS Phase Jitter

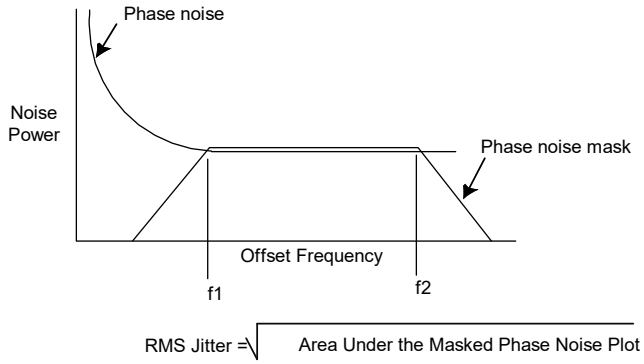
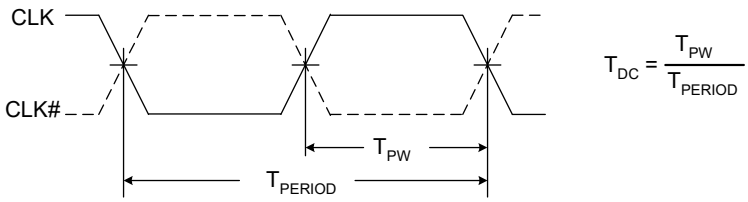


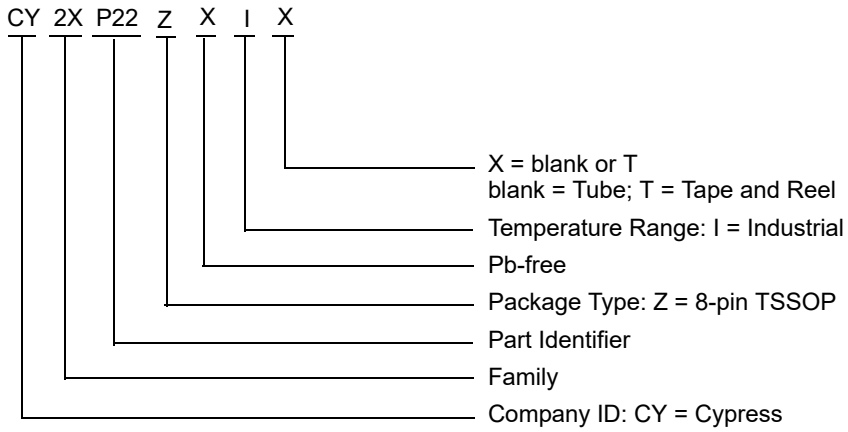
Figure 10. Output Duty Cycle



Ordering Information

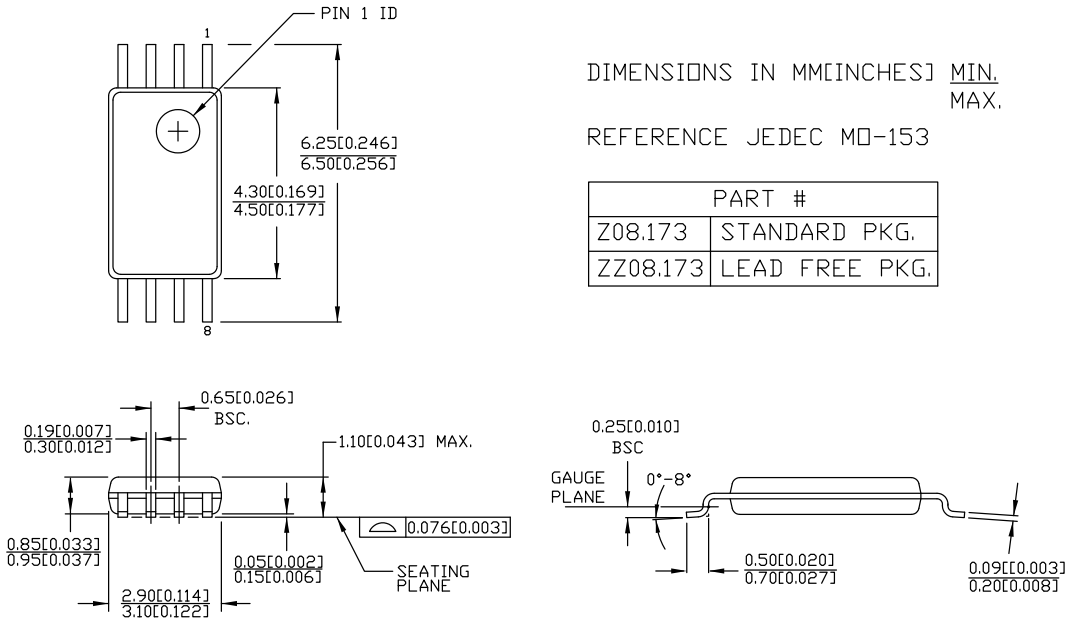
Part Number	Package Type	Product Flow
CY2XP22ZXI	8-pin TSSOP	Industrial, –40 °C to 85 °C
CY2XP22ZXIT	8-pin TSSOP – Tape and Reel	Industrial, –40 °C to 85 °C

Ordering Code Definitions



Package Diagram

Figure 11. 8-pin TSSOP (4.40 mm Body) Package Outline, 51-85093



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
LVPECL	Low-Voltage Positive Emitter Coupled Logic
NTSC	National Television System Committee
OE	Output Enable
PAL	Phase Alternate Line
PD	Power-Down
PLL	Phase Locked Loop
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
ppm	parts per million
V	volt

Document History Page

Document Title: CY2XP22, Crystal to LVPECL Clock Generator Document Number: 001-10229				
Revision	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	506262	RGL	09/27/2006	New data sheet
*A	838060	RGL	03/12/2007	Changed status from Advance to Preliminary
*B	2700242	KVM / PYRS	04/30/2009	Updated Features: Updated details under “Phase Noise at 125 MHz”. Updated Pinouts: Replaced VCCA with VDD. Replaced VEE with VSS. Replaced VCC with VDD. Updated Pin Definitions: Replaced VCCA with VDD. Replaced VCC with VDD. Replaced VEE with VSS. Updated details in “I/O Type” and “Description” columns for all pins. Updated Frequency Table: Added a column “PLL Multiplier Value” and added details in that column. Updated Application Information: Updated Power Supply Filtering Techniques: Updated Figure 2. Updated description. Removed “Termination for 3.3V LVPECL Output”. Added “Termination for LVPECL Output”. Updated Crystal Interface: Updated description. Updated Absolute Maximum Conditions: Replaced V_{CC} with V_{DD}. Changed maximum value of T_J parameter from 125 °C to 135 °C. Added Θ_{JA} parameter and its details. Updated Operating Conditions: Replaced V_{CC}, V_{CCA} with V_{DD}. Added Industrial Temperature Range corresponding to T_A parameter. Removed I_{EE}, C_{IN}, R_{UP} parameters and their details. Removed “Electrical Characteristics for F_SEL”. Removed “DC Electrical Characteristics for LVPECL”. Added DC Electrical Characteristics. Updated AC Electrical Characteristics: Removed Note “Refer to Figure 4 on page 4” and its reference. Removed Note “Refer to Figure 2 on page 4” and its reference. Removed Note “Refer to Figure 3 on page 4” and its reference. Updated details in “Min”, “Typ” and “Max” columns corresponding to F_{OUT} parameter. Changed typical value of T_R, T_F parameter from 550 ps to 500 ps. Added details in “Test Conditions” column corresponding to t_{DC} parameter. Added T_{LOCK} parameter and its details. Updated Recommended Crystal Specifications: Removed “Resonance Type” parameter and its details.

Document History Page (continued)

Document Title: CY2XP22, Crystal to LVPECL Clock Generator Document Number: 001-10229				
Revision	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
*B (cont.)	2700242	KVM / PYRS	04/30/2009	Updated Parameter Measurements: Removed figure “Output Load Test Circuit”. Removed figure “Output Duty Cycle/Pulse Width/Period”. Removed figure “Output Rise/Fall Time and Peak-PeakVoltage Swing”. Added Figure 5. Added Figure 6. Added Figure 7. Added Figure 8. Added Figure 10. Updated Ordering Information: Updated part numbers. Updated to new template.
*C	2718898	WWZ	06/15/2009	Minor Change: Post to external web.
*D	2767298	KVM	09/22/2009	Updated DC Electrical Characteristics: Replaced I_{DD} with I_{DDT} in “Parameter” column (for terminated outputs). Add I_{DD} parameter and its details (for unterminated outputs). Removed Note “I_{DD} includes approximately 24 mA of current that is dissipated externally in the output termination resistors.” and its reference. Added Note 3 and referred the same note in C_{IN} and C_{INX} parameters. Updated AC Electrical Characteristics: Added 1.0 ns under “Max” column corresponding to T_R, T_F parameter. Updated details in “Test Conditions” column corresponding to T_{LOCK} parameter. Changed maximum value of T_{LOCK} parameter from 10 ms to 5 ms. Added T_{LFS} parameter and its details.
*E	2896121	KVM	03/19/2010	Updated Package Diagram: spec 51-85093 – Changed revision from *A to *B.
*F	3219081	BASH	04/07/2011	Changed status from Preliminary to Final. Updated Ordering Information: No change in part numbers. Added Ordering Code Definitions. Updated Package Diagram: spec 51-85093 – Changed revision from *B to *C. Added Acronyms and Units of Measure. Updated to new template. Completing Sunset Review.
*G	4336622	XHT	05/02/2014	Updated Package Diagram: spec 51-85093 – Changed revision from *C to *D. Updated to new template. Completing Sunset Review.
*H	4570097	XHT	11/14/2014	Updated Functional Description: Added “For a complete list of related documentation, click here.” at the end. Updated Ordering Information: Updated part numbers. Updated Package Diagram: spec 51-85093 – Changed revision from *D to *E.
*I	6135134	XHT	04/12/2018	Updated to new template. Completing Sunset Review.

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