CY2XP22

Crystal to LVPECL Clock Generator

Features

- One LVPECL output pair
- Selectable frequency multiplication: x2.5 or x5
- 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):

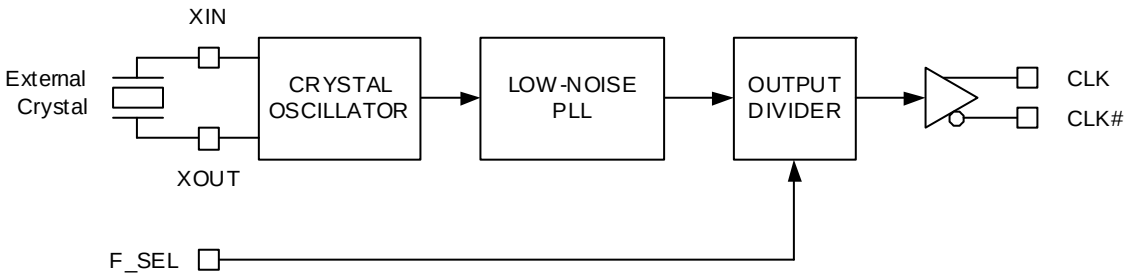
Offset	Noise Power
1 kHz	–117 dBc/Hz
10 kHz	–126 dBc/Hz
100 kHz	–131 dBc/Hz
1 MHz	–131 dBc/Hz

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

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.

Logic Block Diagram



Pinouts

Figure 1. Pin Diagram – 8-Pin TSSOP

Table 1. 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

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

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} = 50Ω 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} = 50Ω to V_{DD} – 2.0 V	V_{DD} –2.0	–	V_{DD} –1.625	V

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 (continued)

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
V_{OD1}	LVPECL Peak-to-Peak Output Voltage Swing	V_{DD} = 3.3 V or 2.5 V, R_{TERM} = 50Ω 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} = 50Ω 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} = 50Ω 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

AC Electrical Characteristics[3]

Parameter	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[4]

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

Parameter Measurements

Figure 2. 3.3 V Output Load AC Test Circuit

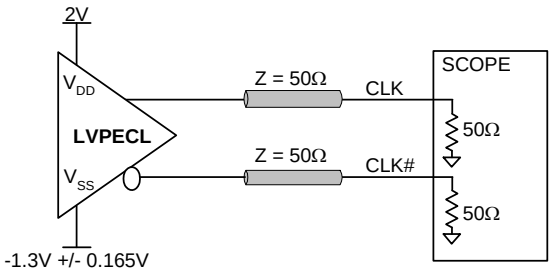


Figure 3. 2.5 V Output Load AC Test Circuit

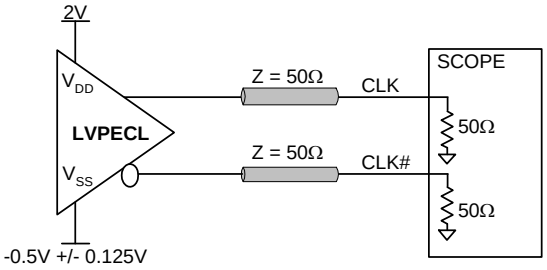


Figure 4. Output DC Parameters

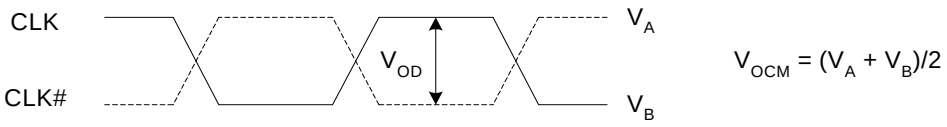


Figure 5. Output Rise and Fall Time

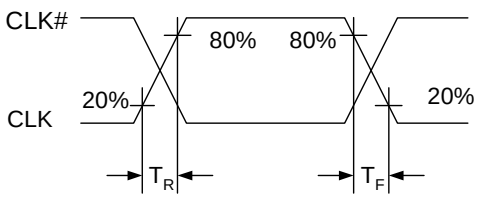


Figure 6. RMS Phase Jitter

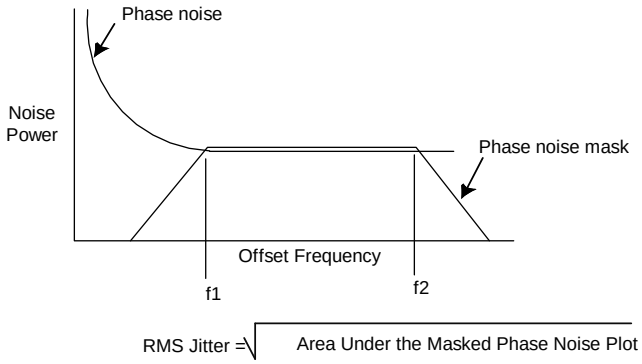
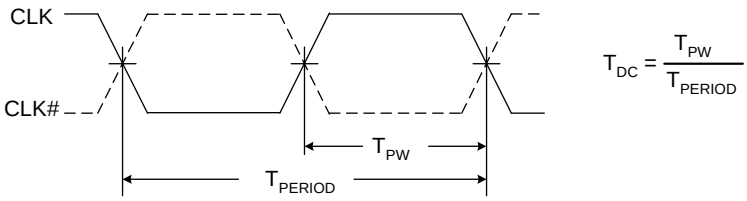


Figure 7. Output Duty Cycle

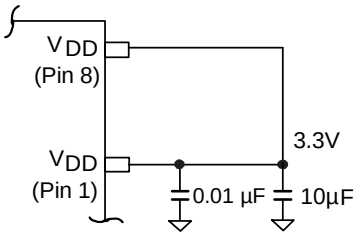


Application Information

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 8 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.

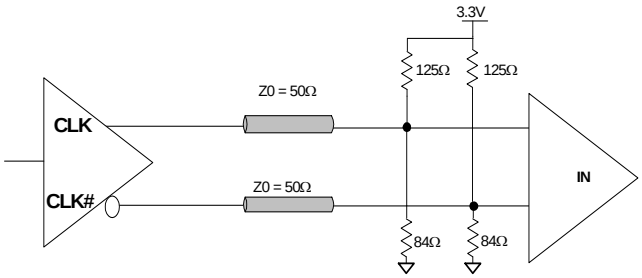
Figure 8. Power Supply Filtering



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 9 shows a standard termination scheme.

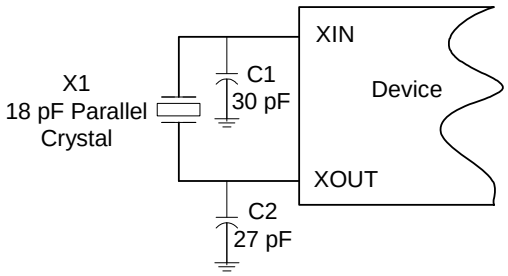
Figure 9. LVPECL Output Termination



Crystal Interface

The CY2XP22 is characterized with 18 pF parallel resonant crystals. The capacitor values shown in Figure 10 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.

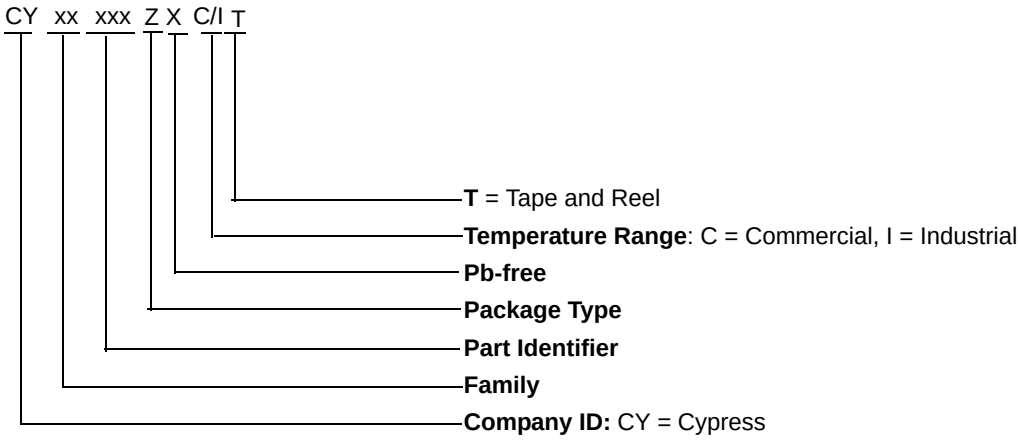
Figure 10. Crystal Input Interface



Ordering Information

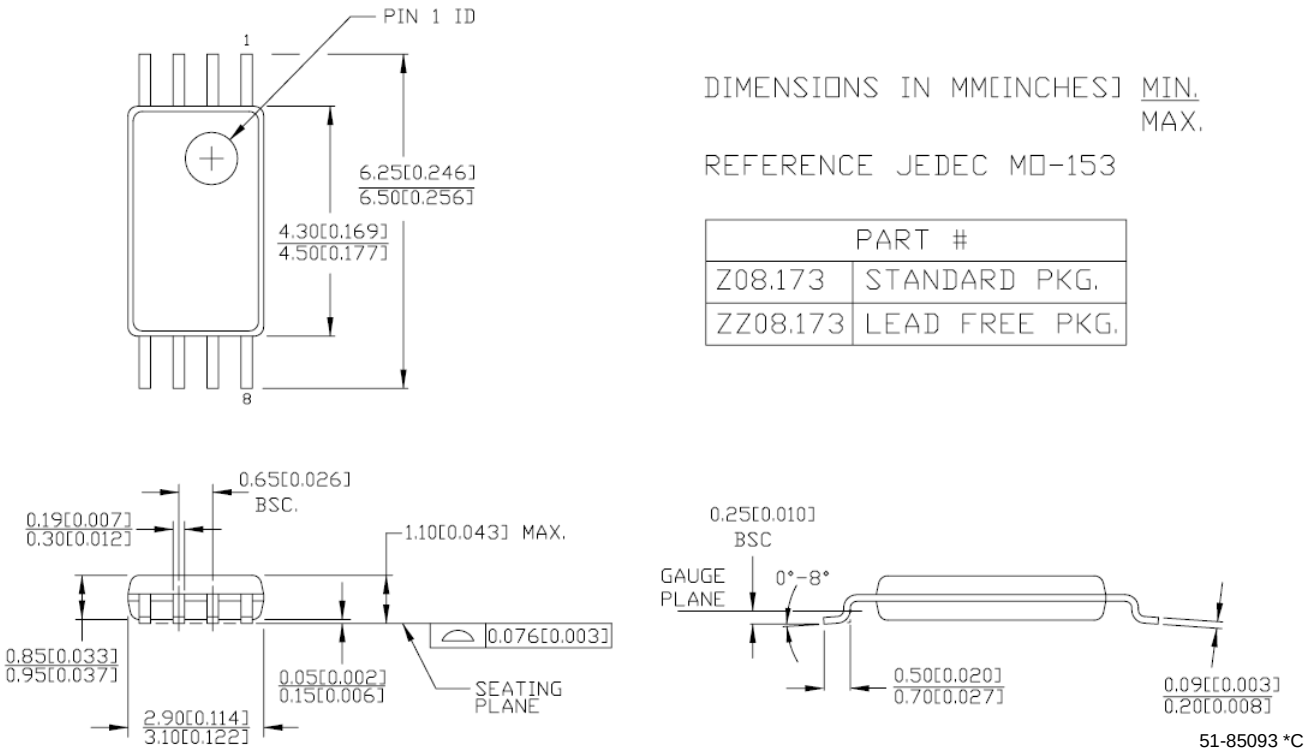
Part Number	Package Type	Product Flow
CY2XP22ZXC	8-pin TSSOP	Commercial, 0°C to 70°C
CY2XP22ZXCT	8-pin TSSOP - Tape and Reel	Commercial, 0°C to 70°C
CY2XP22ZXI	8-pin TSSOP	Industrial, -40°C to 85°C
CY2XP22ZXIT	8-pin TSSOP - Tape and Reel	Industrial, -40°C to 85°C

Ordering Code Definitions



Package Drawing and Dimensions

Figure 11. 8-Pin Thin Shrunk Small Outline Package (4.40 MM Body) Z8



Acronyms

Table 2. Acronyms Used

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
PPM	Parts per million
TTL	Transistor transistor logic

Document Conventions

Table 3. Units of Measure

Symbol	Unit of Measure
°C	degrees Celsius
kHz	kilohertz
kΩ	kilohms
MHz	megahertz
MΩ	megaohms
µA	microamperes
µs	microseconds
µV	microvolts
µVrms	microvolts root-mean-square
mA	milliamperes
mm	millimeters
ms	milliseconds
mV	millivolts
nA	nanoamperes
ns	nanoseconds
nV	nanovolts
Ω	ohms

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	See ECN	New Data Sheet
*A	838060	RGL	See ECN	Changed status from Advance to Preliminary
*B	2700242	KVM/PYRS	04/30/2009	Reformatted Revised phase noise values Replaced VCC with VDD; VEE with VSS; updated pin names Removed pull-up resistor on F_SEL Corrected temperature range, added industrial temperature range Increased IDD from 120 / 100 mA to 150 / 140 mA Added CINX parameter, revised CIN parameter Revised LVPECL output specs Added thermal resistance information Changed VIL, VIH, IIL & IIH specs Revised suggested crystal load capacitor values
*C	2718898	WWZ	06/15/09	Minor ECN to post data sheet to external web
*D	2767298	KVM	09/22/09	Add I_{DD} spec for unterminated outputs Change parameter name for I_{DD} (terminated outputs) from I_{DD} to I_{DDT} Remove I_{DD} footnote about externally dissipated current Add footnote reference to C_{IN} and C_{INX}:not 100% tested Add max limit for T_R, T_F: 1.0 ns Change T_{LOCK} max from 10 ms to 5 ms Split out parameter T_{LFS} from T_{LOCK}
*E	2896121	KVM	03/19/2010	Updated Package Diagram (Figure 11)
*F	3219081	04/07/2011	BASH	Changed status from preliminary to final. Template and style updates as per current Cypress standards. Added ordering code definitions, acronyms, and units of measure. Updated package diagram to *C.

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