

## 38MHz-640MHz Low Phase Noise VCXO

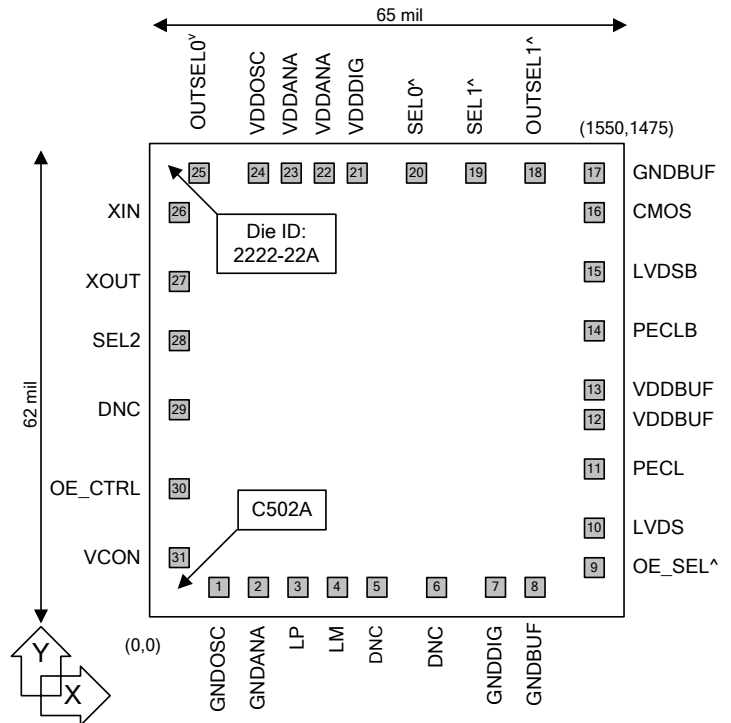
### FEATURES

- Less than 0.4ps RMS (12KHz-20MHz) phase jitter for all frequencies.
- Low phase noise output (@ 1MHz frequency offset)
  - \* -140dBc/Hz for 311.04MHz,
  - \* -131dBc/Hz for 622.08MHz
- 19MHz-40MHz crystal input.
- 38MHz-640MHz output.
- Selectable PECL, LVDS, or CMOS outputs.
- No external varicap required.
- Output Enable selector.
- Wide pull range (+/-200ppm).
- 3.3V operation.
- Available in 3x3 QFN or 16-pin TSSOP packages.

### DESCRIPTION

The PL580-30 is a monolithic low jitter and low phase noise VCXO, capable of 0.4ps RMS phase jitter and PECL, LVDS, or CMOS outputs, covering a wide frequency output range up to 640MHz. It allows the control of the output frequency with an input voltage (VCON), using a low cost crystal. The PL580-30 is designed to address the demanding requirements of high performance applications such as SONET, GPS, XDSL, etc.

### DIE CONFIGURATION

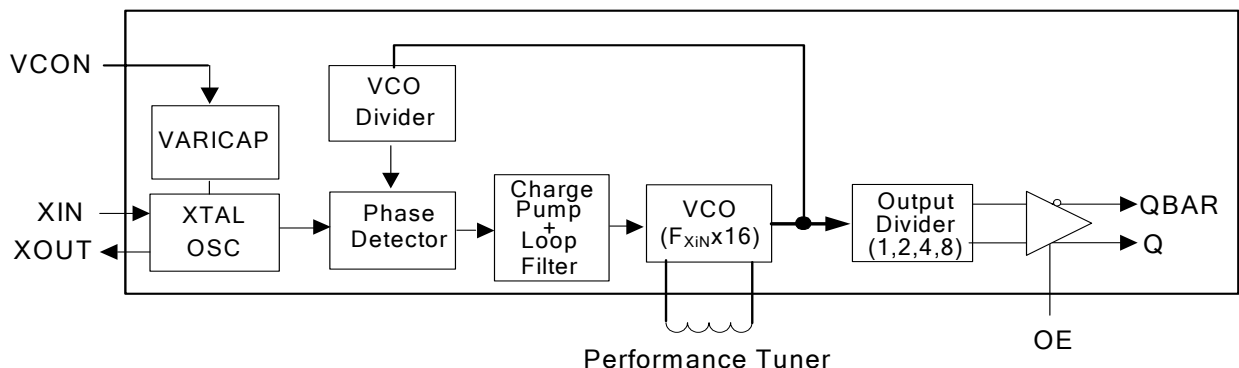


Note1: ^ Denotes internal pull up resistor.

### DIE SPECIFICATIONS

Name	Value
Size	62 x 65 mil
Reverse side	GND
Pad dimensions	80 micron x 80 micron
Thickness	10 mil

### BLOCK DIAGRAM



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### OUTPUT ENABLE LOGICAL LEVELS

OUTSEL0 <sup>V</sup> (Pad #25)	OUTSEL1 <sup>A</sup> (Pad #18)	Selected Output
0	0	LVDS
0	1	PECL (Default)
1	0	High Drive CMOS
1	1	Standard Drive CMOS

Note: For bonding convenience, 'OUTSEL0' incorporates an internal pull down resistor while 'OUTSEL1' incorporates an internal pull up resistor.

### OUTPUT SELECTION AND ENABLE

OE_SEL <sup>A</sup> (Pad #9)	OE_CTRL (Pad #30)	State
0	0 (Default)	Output enabled
	1	Tri-state
1 (Default)	0	Tri-state
	1 (Default)	Output enabled

Pad #9: Bond to GND to set to "0", bond to VDD to set to "1",

Pad #30: Logical states defined by PECL levels if OE\_SELECT is "0"

Logical states defined by CMOS levels if OE\_SELECT is "1"

### FREQUENCY SELECTION TABLE

SEL2	SEL1	SEL0	Selected Multiplier/Output Frequency
0	0	0	VCO Max*
0	0	1	VCO Min*
0	1	0	Reserved
0	1	1	Reserved
1	0	0	Fin x 2
1	0	1	Fin x 8
1	1	0	Fin x 16
1	1	1	Fin x 4

All SEL pads have internal pull-ups (default value is '1'). Bond to GND to set to 0.

\* Special Test Modes to help selecting the inductor value for the target output frequency.

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### PAD ASSIGNMENT

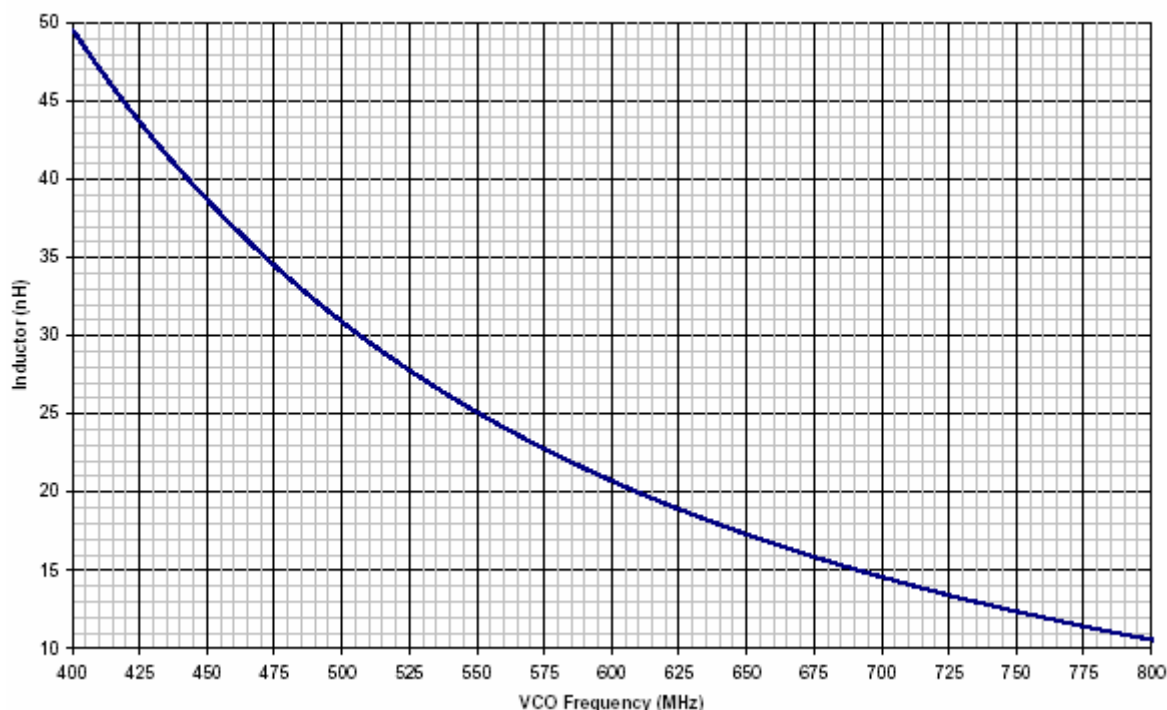
Pad #	Name	X (μm)	Y (μm)	Description
1	GNDOSC	248	109	Ground, Oscillator circuitry.
2	GNDANA	361	109	Ground, Analog circuitry.
3	LP	473	109	Performance/Frequency tuning Inductor.
4	LM	587	109	Performance/Frequency tuning Inductor.
5	DNC	702	109	Do No Connect.
6	DNC	874	109	Do No Connect.
7	GNDDIG	1042	109	Ground, Digital circuitry.
8	GNDBUF	1171	109	Ground, buffer circuitry.
9	OE_SELECT	1400	125	Used to select between PECL or CMOS logic states for OE. Incorporates internal pull up.
10	LVDS	1400	259	LVDS Output.
11	PECL	1400	476	PECL Output.
12	VDDBUF	1400	616	3.3V power supply, Buffer circuitry.
13	VDDBUF	1400	716	3.3V power supply, Buffer circuitry.
14	PECLB	1400	871	Complementary PECL Output.
15	LVDSB	1400	1089	Complementary LVDS Output.
16	CMOS	1400	1227	Single ended CMOS output.
17	GNDBUF	1389	1365	Ground, buffer circuitry.
18	OUTSEL1	1232	1365	Used to select CMOS, PECL or LVDS output type. Incorporates internal pull up.
19	SEL1	1042	1365	
20	SEL0	854	1365	Used to select multiplication factor. Incorporates internal pull up.
21	VDDDIG	659	1365	3.3V power supply, Digital circuitry.
22	VDDANA	559	1365	3.3V power supply, Analog circuitry.
23	VDDANA	459	1365	3.3V power supply, Analog circuitry.
24	VDDOSC	358	1365	3.3V power supply, Oscillator circuitry.
25	OUTSEL0B	194	1365	Used to select CMOS, PECL or LVDS output type. Incorporates internal pull down.
26	XIN	109	1223	Crystal input. See crystal specification for details.
27	XOUT	109	1017	Crystal output. See crystal specification for details.
28	SEL2	109	858	Used to select multiplication factor. Incorporates internal pull up.
29	DNC	109	646	Do Not Connect
30	OE_CTRL	109	397	Used to enable/disable the output(s). See Output Selection and Enable table.
31	VCON	109	181	Voltage Control Input. 0V to 3.3V.

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### PERFORMANCE TUNING & INDUCTOR VALUE SELECTION

Please refer to PhaseLink's 'PhasorV Tuning Assistance' software to automatically calculate the optimum inductor values for your application. In addition, the chart below could be used as a reference for quick inductor value selection. Please note that the inductor values mentioned in the table below, or when using 'PhasorV Tuning Assistance' are derived based on the parasitic values of PhaseLink's evaluation board. For performance enhancement of your custom board design, please follow the following instruction:

Use the special test modes "VCO Max" and "VCO Min" to determine the optimum inductor value. "VCO Max" represents the high end of the VCO range and "VCO Min" represents the low end of the VCO range. The output frequency in the "VCO Max" and "VCO Min" test modes is VCO/16. This means that the output frequencies are around the crystal frequency that will be used. The optimum inductor value is where the target crystal frequency is closest to the middle between the "VCO Max" and "VCO Min" output frequencies. In this case the VCO will lock in the middle of its tuning range with maximum margin on either side.



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### ELECTRICAL SPECIFICATIONS

#### 1. Absolute Maximum Ratings

PARAMETERS	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage	$V_{DD}$		4.6	V
Input Voltage, dc	$V_I$	-0.5	$V_{DD}+0.5$	V
Output Voltage, dc	$V_O$	-0.5	$V_{DD}+0.5$	V
Storage Temperature	$T_S$	-65	150	°C
Ambient Operating Temperature*	$T_A$	-40	85	°C
Junction Temperature	$T_J$		125	°C
Lead Temperature (soldering, 10s)			260	°C
ESD Protection, Human Body Model			2	kV

Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied.

\* **Note:** Operating Temperature is guaranteed by design for all parts (COMMERCIAL and INDUSTRIAL), but tested for COMMERCIAL grade only.

#### 2. Crystal Specifications

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Crystal Resonator Frequency	$F_{XIN}$	Parallel Fundamental Mode	19		40	MHz
Crystal Loading Rating	$C_L (x_{tal})$	at $V_{CON} = 0V$		17.7		pF
		at $V_{CON} = 1.65V$		9.5		
		at $V_{CON} = 3.3V$		5.4		
Crystal Pullability	$C_0/C_1 (x_{tal})$	AT cut			250	-
Recommended ESR	$R_E$	AT cut			30	$\Omega$

**Note:** Crystal Loading rating: The listed numbers are for the IC only. Specify the crystal for the value at  $V_{CON} = 1.65V$  and add the PCB & package parasitic. A round number (i.e. 12pF) can be achieved by adding external capacitors. Try to add the same value to XIN and XOUT, and please note, that frequency pulling and oscillator gain may decrease.

#### 3. Voltage Control Crystal Oscillator

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
VCXO Stabilization Time *	$T_{VCXOSTB}$	From power valid			10	ms
VCXO Tuning Range		$F_{XIN} = 19 - 40MHz$ ; $XTAL C_0/C_1 < 250$ $0V \leq V_{CON} \leq 3.3V$		500		ppm
CLK output pullability		$V_{CON}=1.65V, \pm 1.65V$	$\pm 200$			ppm
VCXO Tuning Characteristic				150		ppm/V
Pull range linearity					10	%
$V_{CON}$ pin input impedance			60			k $\Omega$
$V_{CON}$ modulation BW		$0V \leq V_{CON} \leq 3.3V, -3dB$	25			kHz

**Note:** Parameters denoted with an asterisk (\*) represent nominal characterization data and are not production tested to any specific limits.

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### 4. General Electrical Specifications

PARAMETERS	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS
Supply Current, Dynamic (with Loaded Outputs)	I <sub>DD</sub>	PECL/LVDS/CMOS	38MHz<F <sub>out</sub> <100MHz			65/45/30	mA
			100MHz<F <sub>out</sub> <320MHz			80/60/40	
		PECL/LVDS	320MHz<F <sub>out</sub> <640MHz			90/70	
Operating Voltage	V <sub>DD</sub>			2.97		3.63	V
Output Clock Duty Cycle		@ 50% V <sub>DD</sub> (CMOS)		45	50	55	%
		@ 1.25V (LVDS)		45	50	55	
		@ V <sub>DD</sub> – 1.3V (PECL)		45	50	55	
Short Circuit Current					±50		mA

**Note:** CMOS operation is not advised above 200MHz with 15pF load; and 320MHz with 10pF load.

### 5. Jitter Specifications

PARAMETERS	CONDITIONS	FREQUENCY	MIN.	TYP.	MAX.	UNITS
Integrated jitter RMS	Integrated 12 kHz to 20 MHz	155.52MHz		0.4	0.5	ps ps
		311.04MHz		0.4	0.5	
		622.08MHz		0.4	0.5	
Period jitter RMS	With capacitive decoupling between VDD and GND. Over 10,000 cycles.	77.76MHz		2.5	4	
		155.52MHz		3	5	
		311.04MHz		3	5	
		622.08MHz		6	8	
Period jitter Peak-to-Peak	With capacitive decoupling between VDD and GND. Over 10,000 cycles.	77.76MHz		18	30	ps
		155.52MHz		20	30	
		311.04MHz		25	30	
		622.08MHz		40	50	

### 6. Phase Noise Specifications

PARAMETERS	FREQ.	@10Hz	@100Hz	@1kHz	@10kHz	@100kHz	@1M	@10M	UNITS
Phase Noise relative to carrier (typical)	77.76MHz	-66	-96	-124	-136	-132	-145	-149	dBc/Hz
	155.52MHz	-62	-92	-120	-132	-128	-144	-150	
	311.04MHz	-59	-86	-116	-129	-124	-140	-148	
	622.08MHz	-48	-80	-108	-118	-114	-131	-138	

**Note:** Phase Noise measured at VCON = 0V.

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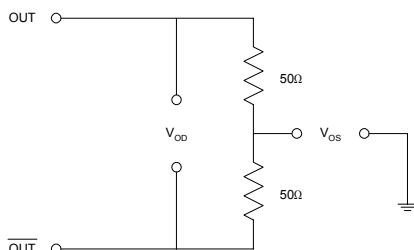
### 7. LVDS Electrical Characteristics

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Differential Voltage	$V_{OD}$	$R_L = 100\ \Omega$ (see figure)	247	355	454	mV
$V_{DD}$ Magnitude Change	$\Delta V_{OD}$		-50		50	mV
Output High Voltage	$V_{OH}$			1.4	1.6	V
Output Low Voltage	$V_{OL}$		0.9	1.1		V
Offset Voltage	$V_{OS}$		1.125	1.2	1.375	V
Offset Magnitude Change	$\Delta V_{OS}$		0	3	25	mV
Power-off Leakage	$I_{OXD}$	$V_{out} = V_{DD}$ or GND $V_{DD} = 0V$		$\pm 1$	$\pm 10$	$\mu A$
Output Short Circuit Current	$I_{OSD}$			-5.7	-8	mA

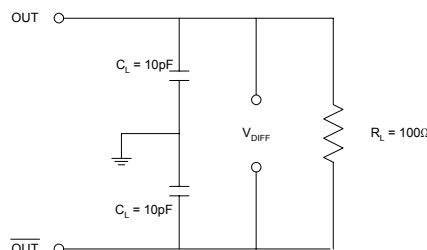
### 8. LVDS Switching Characteristics

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Differential Clock Rise Time	$t_r$	$R_L = 100\ \Omega$ $C_L = 10\ pF$ (see figure)	0.2	0.7	1.0	ns
Differential Clock Fall Time	$t_f$		0.2	0.7	1.0	ns

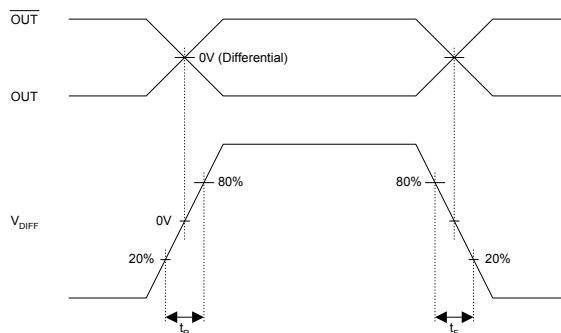
LVDS Levels Test Circuit



LVDS Switching Test Circuit



LVDS Transition Time Waveform



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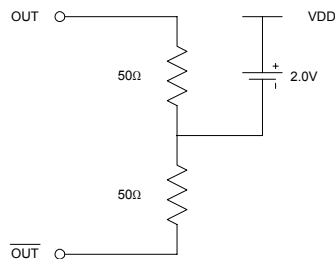
### 9. PECL Electrical Characteristics

PARAMETERS	SYMBOL	CONDITIONS	MIN.	MAX.	UNITS
Output High Voltage	$V_{OH}$	$R_L = 50 \Omega$ to $(V_{DD} - 2V)$ (see figure)	$V_{DD} - 1.025$		V
Output Low Voltage	$V_{OL}$			$V_{DD} - 1.620$	V

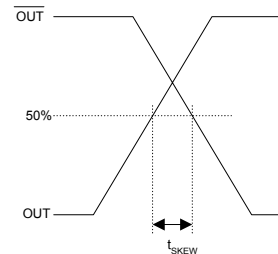
### 11. PECL Switching Characteristics

PARAMETERS	SYMBOL	FREQ.	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Clock Rise & Fall Times	$t_r$ & $t_f$	<150MHz	@20/80% - PECL @80/20% - PECL	0.2	0.5	0.7	ns
Clock Rise & Fall Times		>150MHz <320MHz		0.2	0.4	0.55	
Clock Rise & Fall Times		>320MHz		0.2	0.3	0.45	

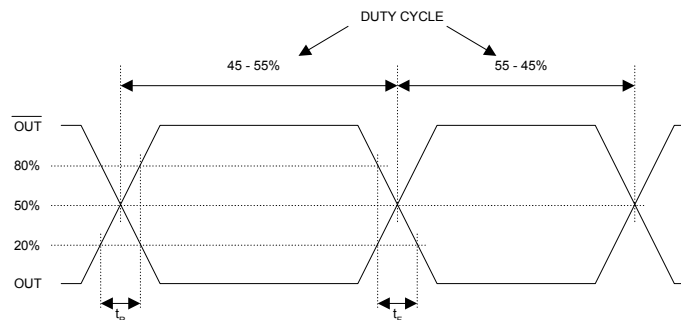
PECL Levels Test Circuit



PECL Output Skew



PECL Transition Time Waveform



### 11. CMOS Electrical Characteristics

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output drive current	$I_{OH}$	$V_{OH} = V_{DD} - 0.4V$ , $V_{DD} = 3.3V$	30			mA
	$I_{OL}$	$V_{OL} = 0.4V$ , $V_{DD} = 3.3V$	30			mA
Output Clock Rise/Fall Time		0.3V ~ 3.0V with 15 pF load		0.7		ns
Output Clock Rise/Fall Time		20%-80% with 50Ω Load		0.3		ns



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### ORDERING INFORMATION

**For part ordering, please contact our Sales Department:**

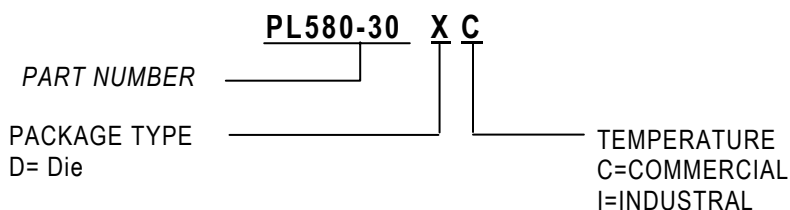
47745 Fremont Blvd., Fremont, CA 94538, USA

Tel: (510) 492-0990 Fax: (510) 492-0991

#### **PART NUMBER**

The order number for this device is a combination of the following:

Device number, Package type and Operating temperature range



Order Number	Marking	Package Option
PL580-30DC	P580-30DC	Die (Waffle Pack)

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