

**Low Phase Noise VCXO (for 120-200MHz Fund Xtal)**

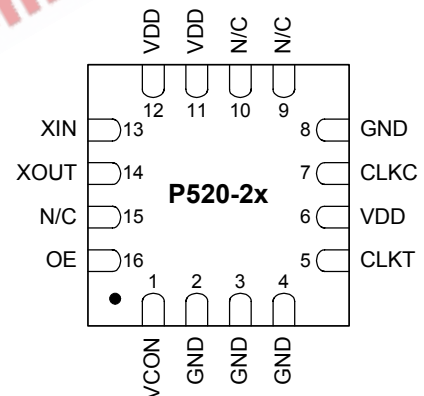
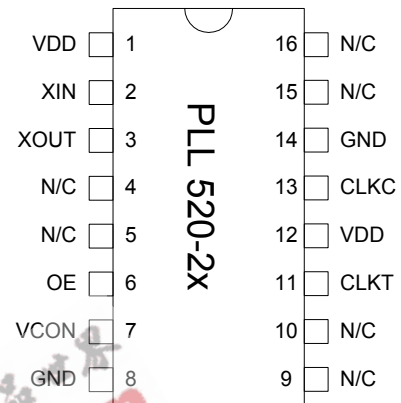
**FEATURES**

- 120MHz to 200MHz Fundamental Mode Crystal.
- Output range: 120 – 200MHz (no PLL).
- Low Injection Power for crystal 50uW.
- Sub 0.5pS RMS phase jitter ( 12kHz to 20MHz ).
- PECL (PLL520-28) or LVDS output (PLL520-29).
- Integrated variable capacitors.
- Supports 2.5V or 3.3V-Power Supply.
- Available in 16-Pin (TSSOP or 3x3mm QFN).

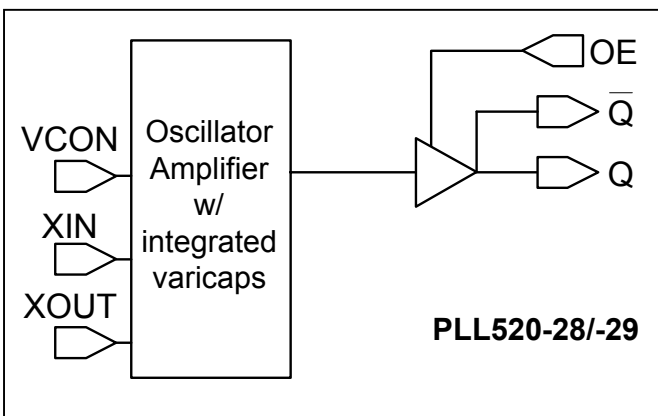
**DESCRIPTION**

The PLL520-28/-29 are a family of VCXO IC's specifically designed to pull high frequency fundamental crystals. They achieve very low current into the crystal resulting in better overall stability. Their internal varicaps allow an on chip frequency pulling, controlled by the VCON input. Their very low jitter makes them ideal for the most demanding timing requirements.

**PIN CONFIGURATION  
(Top View)**



**BLOCK DIAGRAM**



**OUTPUT ENABLE LOGICAL LEVELS**

Part #	OE	State
PLL520-28	0 (Default)	Output enabled
	1	Tri-state
PLL520-29	0	Tri-state
	1 (Default)	Output enabled

OE input: Logical states defined by PECL levels for PLL520-28  
Logical states defined by CMOS levels for PLL520-29

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### PIN DESCRIPTIONS

Name	TSSOP Pin number	3x3mm QFN Pin number	Type	Description
XIN	2	13	I	Crystal input. See Crystal Specifications on page 2.
XOUT	3	14	I	Crystal output. See Crystal Specifications on page 2.
OE	6	16	I	Output enable pin. See Output Enable Logic Levels on page 1.
VCON	7	1	I	Voltage control input.
GND	8, 14	2,3,4,8	P	Ground.
CLKT	11	5	O	True output PECL (PLL520-28) or LVDS (PLL520-29)
CLKC	13	7	O	Complementary output PECL (PLL520-28) or LVDS (PLL520-29).
N/C	4,5,9,10,15,16	9,10,15	-	Not connected.
VDD	1, 12	6,11,12	P	+3.3V power supply.

### ELECTRICAL SPECIFICATIONS

#### 1. Absolute Maximum Ratings

PARAMETERS	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage	V <sub>DD</sub>		4.6	V
Input Voltage, dc	V <sub>I</sub>	-0.5	V <sub>DD</sub> +0.5	V
Output Voltage, dc	V <sub>O</sub>	-0.5	V <sub>DD</sub> +0.5	V
Storage Temperature	T <sub>S</sub>	-65	150	°C
Ambient Operating Temperature*	T <sub>A</sub>	-40	85	°C
Junction Temperature	T <sub>J</sub>		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.	MAX.	UNITS
Built-in Capacitance	CX+	120MHz to 200MHz (VDD=3.3V)		2	pF
	CX-			2	
Inter-electrode capacitance	C <sub>0</sub>				
C0/C1 ratio (gamma)	γ			300	-
Oscillation Frequency	OF	Fund.	120	200	MHz

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### 3. Voltage Control Crystal Oscillator (3.3V)

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
VCXO Stabilization Time *	T <sub>VCXOSTB</sub>	From power valid			10	ms
VCXO Tuning Range		F <sub>XIN</sub> = 100 – 200MHz; XTAL C <sub>0</sub> /C <sub>1</sub> < 250 0V ≤ VCON ≤ 3.3V		200*		ppm
CLK output pullability		VCON=1.65V, ±1.65V	±100*			ppm
On-chip Varicaps control range		VCON = 0 to 3.3V		4 – 18*		pF
Linearity					10*	%
VCXO Tuning Characteristic				65		ppm/V
VCON input impedance				60		kΩ
VCON modulation BW		0V ≤ VCON ≤ 3.3V, -3dB	25			kHz

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

### 4. General Electrical Specifications

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Supply Current (Loaded Outputs)	I <sub>DD</sub>	PECL/LVDS			100/80	mA
Operating Voltage	V <sub>DD</sub>		2.97		3.63	V
Output Clock Duty Cycle		@ 1.25V (LVDS) @ V <sub>DD</sub> – 1.3V (PECL)	45	50	55	%
Short Circuit Current				±50		mA

### 5. Jitter Specifications

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Period jitter RMS	At 155.52MHz, with capacitive decoupling between VDD and GND.		2.5		ps
Period jitter peak-to-peak			18.5		
Accumulated jitter RMS	At 155.52MHz, with capacitive decoupling between VDD and GND. Over 10,000 cycles.		2.5		ps
Accumulated jitter peak-to-peak			24		
Integrated jitter RMS at 155MHz	Integrated 12 kHz to 20 MHz		0.3		ps

### 6. Phase Noise Specifications

PARAMETERS	FREQUENCY	@10Hz	@100Hz	@1kHz	@10kHz	@100kHz	UNITS
Phase Noise relative to carrier	155.52MHz	-75	-95	-125	-140	-145	dBc/Hz

Note: Phase Noise measured at VCON = 0V

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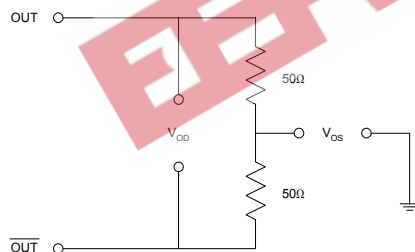
### 7. LVDS Electrical Characteristics

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

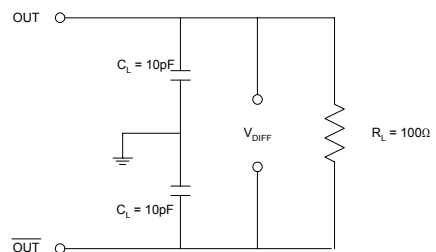
### 8. LVDS Switching Characteristics

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

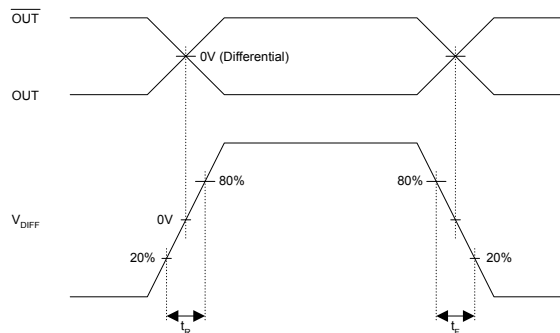
LVDS Levels Test Circuit



LVDS Switching Test Circuit



LVDS Transition Time Waveform



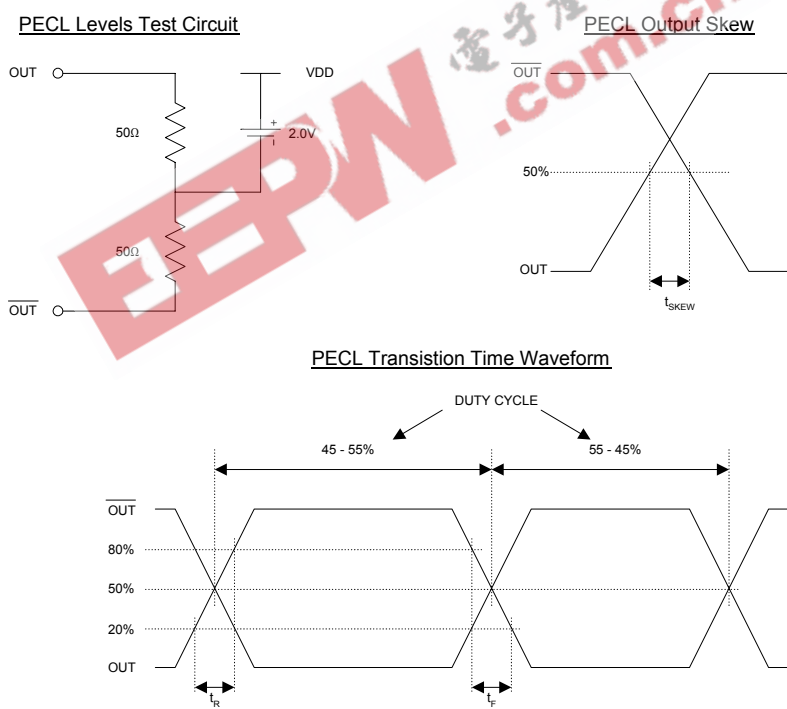
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**9. PECL Electrical Characteristics**

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

**10. PECL Switching Characteristics**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Clock Rise Time	$t_r$	@20/80% - PECL		0.6	1.5	ns
Clock Fall Time	$t_f$	@80/20% - PECL		0.5	1.5	ns



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**PACKAGE INFORMATION**

16 PIN TSSOP ( mm )		
Symbol	Min.	Max.
A	-	1.20
A1	0.05	0.15
B	0.19	0.30
C	0.09	0.20
D	4.90	5.10
E	4.30	4.50
H	6.40 BSC	
L	0.45	0.75
e	0.65 BSC	

**3x3mm QFN**

VARIATIONS:

SYMBOL	16 LD		
	MIN	NOM	MAX
e	0.50 BSC		
k	0.18	0.23	0.30
L	0.30	0.40	0.50
ND	4		
NE	4		

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**ORDERING INFORMATION**

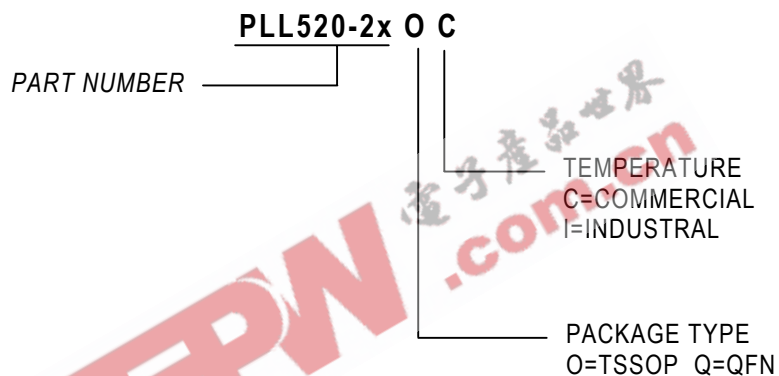
**For part ordering, please contact our Sales Department:**

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



<u>Order Number</u>	<u>Marking</u>	<u>Package Option</u>
PLL520-28OC	P520-28OC	TSSOP - Tube
PLL520-28OC-R	P520-28OC	TSSOP - Tape & Reel
PLL520-28QC	P520-28QC	QFN - Tube
PLL520-28QC-R	P520-28QC	QFN - Tape & Reel
PLL520-29OC	P520-29OC	TSSOP - Tube
PLL520-29OC-R	P520-29OC	TSSOP - Tape & Reel
PLL520-29QC	P520-29QC	QFN - Tube
PLL520-29QC-R	P520-29QC	QFN - Tape & Reel

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