

## Low Phase Noise PECL VCXO (65MHz to 130MHz)

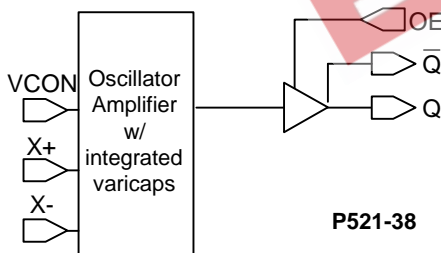
### FEATURES

- 65MHz to 130MHz Fundamental Mode Crystal.
- Output range: 65MHz – 130MHz.
- Complementary PECL outputs.
- Selectable OE Logic (enable high or enable low).
- Integrated variable capacitors.
- High pull linearity: < 5%.
- +/- 125 ppm pull range
- Supports 2.5V or 3.3V-Power Supply.
- Available in die form.
- Thickness 10 mil.

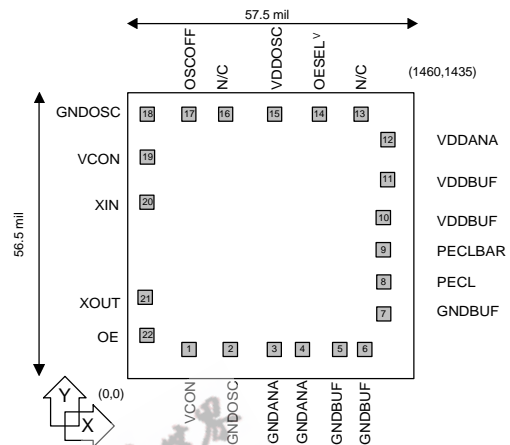
### DESCRIPTIONS

P521-38 is a VCXO IC specifically designed to pull high frequency fundamental crystals. Its internal varicaps allow an on chip frequency pulling, controlled by the VCON input. The chip provides a low phase noise, low jitter PECL differential clock output.

### BLOCK DIAGRAM



### DIE CONFIGURATION



### DIE SPECIFICATIONS

Name	Value
Size	56.5 x 57.5 mil
Reverse side	GND
Pad dimensions	80 micron x 80 micron
Thickness	10 mil

### OUTPUT ENABLE LOGIC SELECTION

OESEL (Pad #14)	OCTRL (Pad #22)	State
0 (Default)	0 (Default)	Output enabled
	1	Tri-state
1	0	Tri-state
	1 (Default)	Output enabled

Pad #14, 22: Bond to GND to set to "0", bond to VDD to set to "1"  
No connection results to "default" setting through internal pull-up/-down.  
Pad #22: Logical states defined by PECL V<sub>IH</sub> and V<sub>IL</sub> levels.

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### PAD ASSIGNMENT AND DESCRIPTION

Pad #	Name	X (μm)	Y (μm)	Description
1	VCON	329.6	110.1	Control Voltage input. Use this pin to change the output frequency by varying the applied Control Voltage.
2	GNDOSC	498.3	110.0	GND connection for oscillator circuitry.
3	GNDANA	696.2	110.0	GND connection for analog circuitry.
4	GNDANA	825.0	110.0	GND connection for analog circuitry.
5	GNDBUF	973.6	110.0	GND connection for output buffer circuitry.
6	GNDBUF	1150.0	109.1	GND connection for output buffer circuitry.
7	GNDBUF (optional)	1183.6	302.2	GND connection for output buffer circuitry.
8	PECL	1183.6	452.3	PECL output
9	PECLBAR	1183.6	613.5	PECL complementary output.
10	VDDBUF (optional)	1182.4	745.9	VDD connection for output buffer circuitry. VDDBUF should be separately decoupled from other VDDs whenever possible.
11	VDDBUF	1252.4	903.6	VDD connection for output buffer circuitry. VDDBUF should be separately decoupled from other VDDs whenever possible.
12	VDDANA	1252.4	1081.3	VDD connection for analog circuitry. VDDANA should be separately decoupled from other VDDs whenever possible.
13	Not used	1058.5	1221.6	
14	OESEL	864.5	1221.6	Selector input to choose the OE control logic. See table on page 1.
15	VDDOSC	624.0	1222.7	VDD connection for oscillator circuitry. VDDOSC should be separately decoupled from other VDDs whenever possible.
16	Not used	467.1	1222.6	
17	OSCOFF	271.1	1222.6	Oscillator Off Selection input pad. When low, turns off the oscillator when output is disabled. When high (default), oscillator running when output is disabled. Internal pull-up
18	GNDOSC (optional)	109.4	1222.9	GND connection for oscillator circuitry.
19	VCON	108.9	1062.1	Control Voltage input. Use this pin to change the output frequency by varying the applied Control Voltage (internally connected to pad 1).
20	XIN	109.0	865.8	Crystal oscillator input pad.
21	XOUT	108.6	358.4	Crystal oscillator output pad.
22	OCTRL	108.6	146.5	OE input pad. See table on page 1.

Note: for optimal Phase Noise performance, it is recommended to bond all optional VDD and GND pads.

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### ELECTRICAL SPECIFICATIONS

#### 1. Absolute Maximum Ratings

PARAMETERS	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage	V <sub>DD</sub>		7	V
Input Voltage, dc	V <sub>I</sub>	V <sub>SS</sub> -0.5	V <sub>DD</sub> +0.5	V
Output Voltage, dc	V <sub>O</sub>	V <sub>SS</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>	0	70	°C
Junction Temperature	T <sub>J</sub>		125	°C
Lead Temperature (soldering, 10s)			260	°C
Input Static Discharge Voltage Protection			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.

#### 2. Crystal Specifications

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Crystal Resonator Frequency	F <sub>XIN</sub>	Parallel Fundamental Mode	65		130	MHz
Crystal Loading Rating	C <sub>L(xtal)</sub>	Die at VCON = 1.65V		7.5		pF
Interelectrode Capacitance	C <sub>0</sub>				3.5	pF
Crystal Pullability	C <sub>0</sub> /C <sub>1(xtal)</sub>	AT cut			250	-
Recommended ESR	R <sub>E</sub>	AT cut			30	Ω

#### 3. Voltage Control Crystal Oscillator

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
VCXO Stabilization Time *	T <sub>VCXOSTB</sub>	From power valid		10		ms
VCXO Tuning Range		XTAL C <sub>0</sub> /C <sub>1</sub> < 250	250*			ppm
CLK output pullability		0V ≤ VCON ≤ 3.3V at room temperature		±80*		ppm
On-chip Varicaps control range		VCON = 0 to 3.3V		4 – 18*		pF
Linearity				4*	5*	%
VCXO Tuning Characteristic				65		ppm/V
VCON input impedance			2000			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.

## Low Phase Noise PECL VCXO (65MHz to 130MHz)

### 4. General Electrical Specifications

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Supply Current (Loaded Outputs)	I <sub>DD</sub>	at 3.3V @ 77.76MHz			45	mA
Output valid after OE enabled		Oscillator off		10		ms
		Oscillator on			1	
Operating Voltage	V <sub>DD</sub>		2.25		3.63	V
Output Clock Duty Cycle		@ 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 77.76MHz	At 77.76MHz, with capacitive decoupling between VDD and GND. Over 10,000 cycles		2.5		ps
Period jitter peak-to-peak at 77.76MHz			18.5	20	
Accumulated jitter RMS at 77.76MHz	At 77.76MHz, with capacitive decoupling between VDD and GND. Over 1,000,000 cycles.		2.5		ps
Accumulated jitter peak-to-peak at 77.76MHz				24	
Random Jitter	"RJ" measured on Wavecrest SIA 3000		2.5		ps
Integrated jitter RMS at 77.76MHz	Integrated 12 kHz to 20 MHz		0.5	0.7	ps

Measured on Wavecrest SIA 3000

### 6. Phase noise specifications

PARAMETERS	FREQUENCY	10Hz	100Hz	1kHz	10kHz	100kHz	1MHz	UNITS
Phase Noise relative to carrier	77.76MHz	-75	-100	-125	-140	-145	-150	dBc/Hz

Note: Phase Noise measured at VCON = 0V

**Low Phase Noise PECL VCXO (65MHz to 130MHz)**

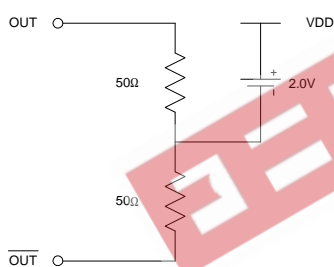
**7. PECL Electrical Characteristics**

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

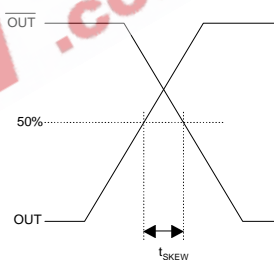
**8. PECL Switching Characteristics**

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

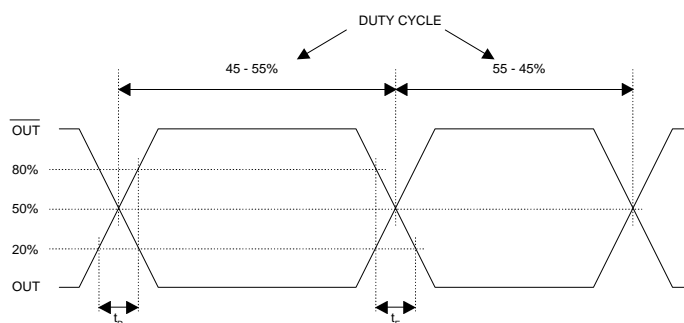
PECL Levels Test Circuit



PECL Output Skew



PECL Transition Time Waveform

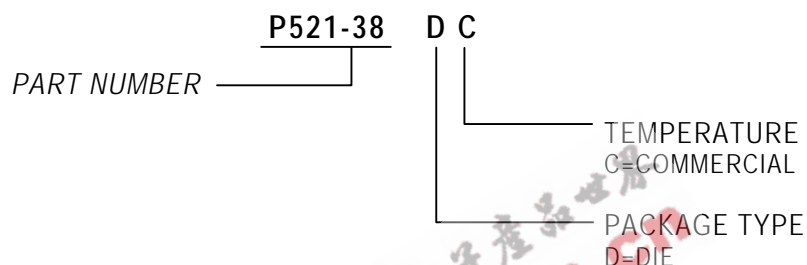


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**ORDERING INFORMATION**

**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>
P521-38DC	P521-38DC	Die – Waffle Pack

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