

**VCXO IC Die for 20 to 52MHz Parallel Resonant Crystals**

**FEATURES**

- Integrated voltage-controlled crystal oscillator circuitry (VCXO) (pull range 380ppm minimum).
- Selectable frequency dividers (x1, 1/2, 1/4, 1/8) available as bonding options.
- VCXO tuning range: 0.3V - 3.0V.
- Uses inexpensive fundamental-mode parallel resonant crystals (from 20 to 52MHz).
- 2.5V or 3.3V supply voltage.
- Selectable High Drive (30mA) or Standard Drive (10mA) CMOS output.
- Available in DIE (65 mil x 62 mil).

**DESCRIPTION**

The PLL502-50 is a monolithic low jitter, high performance CMOS VCXO IC Die. It allows the control of the output frequency with an input voltage (VCON), using a low cost crystal.

The same die can be used as a VCXO with output frequencies ranging from  $F_{XIN} \times 1$  to  $F_{XIN} / 8$  thanks to selector pads allowing bonding options (see Divider Selection Table on this page). This makes the PLL502-50 ideal for a wide range of applications from 2.5MHz to 52MHz (including 27MHz, 35.328MHz, etc.).

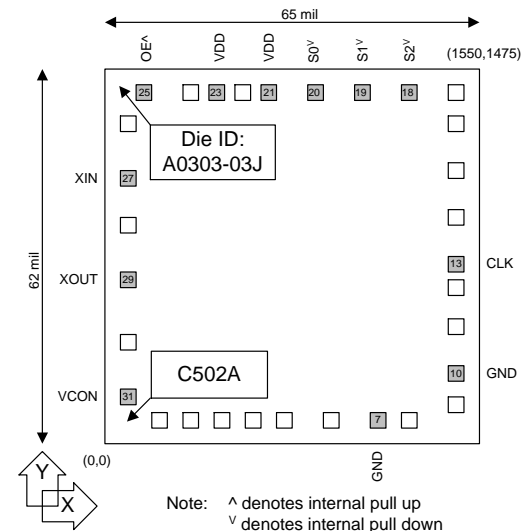
**DIE SPECIFICATIONS**

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

**PAD DESCRIPTIONS**

Name	Number	Description
XIN	27	Crystal input connection.
XOUT	29	Crystal output connection.
VCON	31	Voltage Control input.
GND	7,10	Ground.
CLK	13	Clock output.
S[0:2]	18,19,20	Frequency selection pad
VDD	21,22,23	Power supply.
OE	25	Output Enable: '0' to disable (tri-state output), 1' (default) to enabled the output.

**DIE CONFIGURATION**

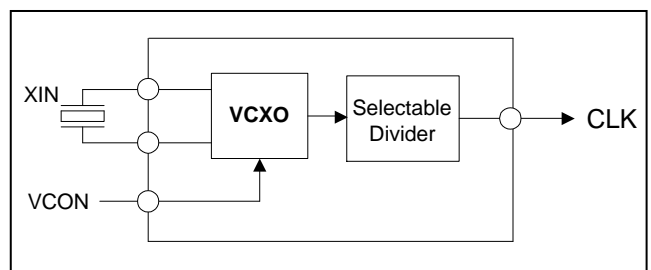


**DIVIDER SELECTION**

SELECTION			$F_{XIN}$	CLK (MHz)
S2	S1	S0		
0	0	0	20MHz – 52MHz	$F_{XIN} \times 1$
0	0	1		$F_{XIN} \div 2$
0	1	0		$F_{XIN} \div 4$
0	1	1		$F_{XIN} \times 1^*$
1	0	0		$F_{XIN} \div 8$
1	0	1		$F_{XIN} \div 4^*$
1	1	0		$F_{XIN} \div 2^*$
1	1	1		$F_{XIN} \div 8^*$

**Note:** Selector pads default to '0', wire bond to  $V_{DD}$  to set to '1'  
(\* ) High-drive CMOS output

**BLOCK DIAGRAM**



**VCXO IC Die for 20 to 52MHz Parallel Resonant Crystals**
**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. DC Electrical Specifications**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Supply Current, Dynamic, with Loaded Outputs	$I_{DD}$	$F_{XIN} = 20 - 52\text{MHz}$ Output load of 10pF		10		mA
Operating Voltage	$V_{DD}$		2.25		3.63	V
Output drive current (High Drive)	$I_{OH}$	$V_{OH} = V_{DD}-0.4\text{V}, V_{DD}=3.3\text{V}$	30			mA
	$I_{OL}$	$V_{OL} = 0.4\text{V}, V_{DD} = 3.3\text{V}$	30			mA
Output drive current (Standard Drive)	$I_{OH}$	$V_{OH} = V_{DD}-0.4\text{V}, V_{DD}=3.3\text{V}$	10			mA
	$I_{OL}$	$V_{OL} = 0.4\text{V}, V_{DD} = 3.3\text{V}$	10			mA
Short Circuit Current				±50		mA
VCXO Control Voltage	VCON		0		$V_{DD}$	V

**3. AC Electrical Specifications**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input Crystal Frequency			20		52	MHz
Output Clock Rise/Fall Time (Standard Drive)		0.3V ~ 3.0V with 15 pF load		2.4		ns
Output Clock Rise/Fall Time (High Drive)		0.3V ~ 3.0V with 15 pF load		1.2		
Output Clock Duty Cycle		Measured @ 50% $V_{DD}$	45	50	55	%

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**4. Voltage Control Crystal Oscillator (3.3V)**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
VCXO Stabilization Time *	$T_{VCXOSTB}$	From power valid			10	ms
VCXO Tuning Range		$F_{XIN} = 20 - 52\text{MHz};$ $XTAL C_0/C_1 < 250$ $0V \leq VCON \leq 3.3V$		500		ppm
CLK output pullability		$VCON=1.65V \pm 1.65V$	$\pm 200$			ppm
VCXO Tuning Characteristic				150		ppm/V
Pull range linearity					10	%
VCON input impedance				80		k $\Omega$
VCON modulation BW		$0V \leq VCON \leq 3.3V, -3\text{dB}$	10			kHz

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

**5. Crystal Specifications**

PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Crystal Resonator Frequency	$F_{XIN}$	Parallel Fundamental Mode	20		52	MHz
Crystal Loading Rating	$C_L (xtal)$	At $Vcon = 1.65V$		9.5		pF
Crystal Pullability	$C_0/C_1 (xtal)$	AT cut			250	-
Recommended ESR	$R_E$	AT cut			30	$\Omega$

Note: Crystal Loading rating: 9.5pF is the loading the crystal sees from the VCXO chip at  $VCON = 1.65V$ . It is assumed that the crystal will be at nominal frequency at this load. If the crystal requires more load to be at nominal frequency, the additional load must be added externally. This however may reduce the pull range.

**6. Jitter specifications**

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Period jitter RMS	51.84MHz		2.3		ps
Period jitter peak-to-peak	51.84MHz		18		ps
Integrated jitter RMS	Integrated 12 kHz to 20 MHz at 51.84MHz		1		ps

**7. Phase noise specifications**

PARAMETERS	FREQUENCY	@10Hz	@100Hz	@1kHz	@10kHz	@100kHz	UNITS
Phase Noise relative to carrier	51.85MHz	-65	-90	-120	-140	-147	dBc/Hz

Note: Phase Noise at  $VCON = 0V$

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**PAD COORDINATES**

Pad #	Name	X (µm)	Y (µm)	Description
7	GND	1042	109	Ground.
10	GND	1400	259	Ground.
13	CLK	1400	716	Clock Output.
18	S2	1232	1365	Frequency Selector pad. Has internal pull down.
19	S1	1042	1365	Frequency Selector pad. Has internal pull down.
20	S0	854	1365	Frequency Selector pad. Has internal pull down.
21	VDD	659	1365	Power Supply.
23	VDD	459	1365	Power Supply.
25	OE	194	1365	Used to Enable/Disable the output. Has internal pull up.
27	XIN	109	1017	Crystal input pad. See Crystal Specifications on page 3.
29	XOUT	109	646	Crystal output pad. See Crystal Specifications on page 3.
31	VCON	109	181	Voltage control input.

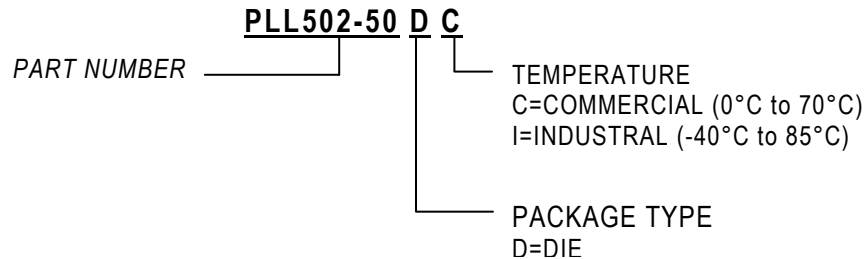
**ORDERING INFORMATION**

**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
PLL502-50DC	P502-50DC	Die (Waffle Pack)

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