

VCXO IC Die for 20 to 52MHz Parallel Resonant Crystals

FEATURES

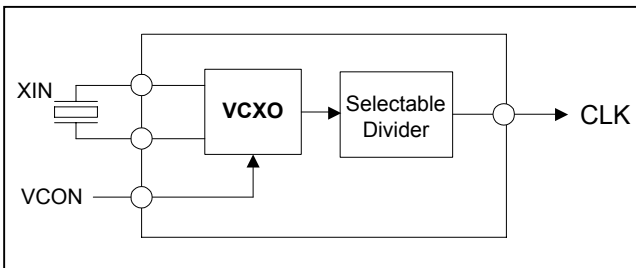
- Integrated voltage-controlled crystal oscillator circuitry (VCXO) (pull range 380ppm minimum).
- Selectable frequency dividers (x1, 1/2, 1/4, 1/8) available as bonding options.
- VCXO tuning range: 0.3V - 3.0V.
- Uses inexpensive fundamental-mode parallel resonant crystals (from 20 to 52MHz).
- 2.5V 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.).

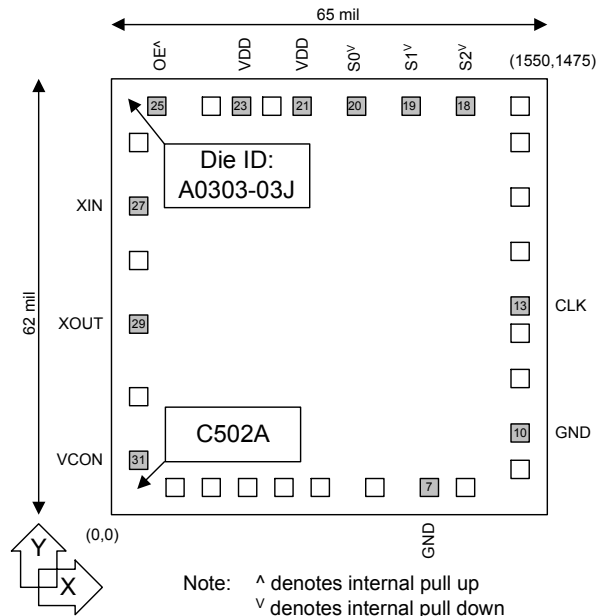
BLOCK DIAGRAM



DIE SPECIFICATIONS

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

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 VDD to set to '1'
(*) High-drive CMOS output

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 value when not connected) to enabled the output. |

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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. 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 - 52MHz; XTAL C ₀ /C ₁ < 250 0V ≤ VCON ≤ 3.3V | | 500 | | ppm |
| CLK output pullability | | VCON=1.65V ±1.65V | ±200 | | | ppm |
| VCXO Tuning Characteristic | | | | 150 | | ppm/V |
| Pull range linearity | | | | | 10 | % |
| VCON input impedance | | | | 80 | | 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.

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 | Ω |

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

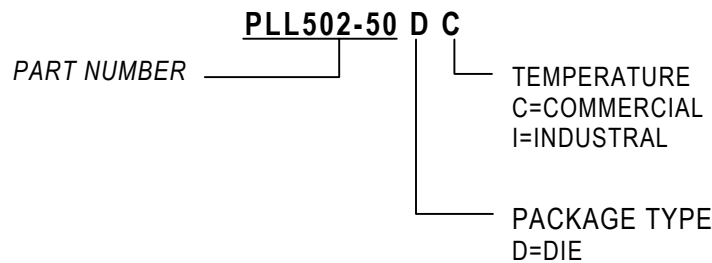
For part ordering, please contact our Sales Department:

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



| <u>Order Number</u> | <u>Marking</u> | <u>Package Option</u> |
|---------------------|----------------|-----------------------|
| PLL502-50DC | P502-50DC | Die (Waffle Pack) |

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