Frequently Asked Questions

Rev A

For Series: EL32D1

1. What is this oscillator series?

This oscillator series is a voltage controlled crystal oscillator (VCXO). It utilizes a quartz crystal oscillator where the output frequency is controlled by an external control voltage applied to the input of the oscillator and the output frequency varies as a function of the input voltage. Utilizing a proprietary crystal resonator design and exclusive oscillator design techniques, this series of oscillators is calibrated to a specified frequency prior to shipment to the customer.

2. How does this oscillator work?

A VCXO is a crystal controlled oscillator where the output frequency of the device is being controlled by the crystal and an external control voltage. VCXO's are designed with a varactor replacing a fixed capacitor internal to the oscillator. A varactor diode is a semiconductor device that behaves as a variable capacitor when a voltage is applied to it. Thus, when a change in the control voltage is applied to the control pad of the oscillator, it causes a change in the capacitance of the varactor diode. This results in a change in the overall load capacitance seen by the crystal internal to the oscillator. These changes in the circuit load capacitance cause changes in the oscillator output frequency due to crystal loading. As a result, variations in output frequency are achieved by variations in the external control voltage. This phenomenon is often called frequency modulation.

3. What are the typical customer circuit applications for this oscillator series?

This oscillator series can be used in any of the following applications:

- Clock Recovery
- Phase-Locked Loops (PLL's)
- Frequency Modulation/Demodulation
- Reference Signal Tracking
- Synthesizers clock
- Clock synchronization
- Digital Switching

4. What are the typical applications and end item products for this series?

Here is a list of the common applications and products:

- ADSL and HDSL Customer Premise Equipment (CPE)
- Hybrid Fiber Coax Equipment (HFC)
- Cable Modems
- SONET/ATM/SDH Equipment

- MPEG Audio/Video Equipment
- 1G, 2G, 4G, 10G Fiber Channel
- Hybrid Fiber Coax (HFC)
- Gigabit Ethernet
- PCI Express

5. What technical benefits does this product series offer?

This series of crystal oscillator offers:

- Improved frequency stability through the use of a bulk acoustic wave (BAW) quartz crystal resonator
- Use of a fundamental mode oscillator application specific integrated circuit (ASIC) design
- A voltage control function with linear frequency deviation
- High speed LVDS output with controlled rise and fall times
- Complementary output
- Tri-state function high impedance output
- Excellent rms phase jitter performance
- Superior phase noise performance
- Tight duty cycle option
- Commercial and industrial temperature ranges
- Industry standard moisture sensitivity level 1 (MSL1) rated six pad ceramic SMD package
- RoHS Compliant (Pb-free) with high temperature 260°C reflow capability

6. What are the construction characteristics of this product series?

This product series consists of a single ASIC and a fundamental mode BAW quartz crystal packaged inside a hermetically sealed ceramic leadless SMD package. The leadless SMD package has gold plated contact I/O pads. The package has a seam sealed metal cover that is case grounded for improved EMI performance.

7. What is the input supply voltage for this product series?

The nominal supply voltage and tolerance are provided on the datasheet.

8. What are the input current specifications for this product series?

The input current specification is listed in milliamps as a maximum value and is provided on the datasheet.

9. How do I specify a VCXO?

There are two common methods used for specifying VCXO's. The first method is to specify the performance of the device inclusive of all operating conditions. This is called the Absolute Pull Range (APR) Method. This is called the Absolute Pull Range (APR) Method. The second method is to specify device performance with individual operating conditions; such as frequency deviation, frequency tolerance, frequency stability over operating temperature range, supply voltage, output load, and aging. This is called the Separate Method. This oscillator series uses the Separate Method for specifying the VCXO. See the table below for an example comparison of the APR Method and the Separate Method.

VCXO Output Parameter	APR Method	Separate Method
Calibration Tolerance		±10ppm MAX
Stability over OTR		±40ppm MAX
Stability vs. Supply Voltage		±5ppm MAX
Stability vs. Output Load		±5ppm MAX
Aging over 10 years		±10ppm MAX
Pullability/Frequency Deviation		±150ppm MIN
Absolute Pull Range (APR)	±80ppm Minimum	
Operating Temperature Range (OTR)	-40°C to +85°C	-40°C to +85°C

Table: Example APR Method versus Separate Method

As shown in the above table, the APR Method of ±80ppm minimum in the second column is equivalent to the Separate Method of ±150ppm pullability minimum in the third column.

10. How do I specify the overall frequency stability for this product series?

Ecliptek defines the frequency stability performance of the device inclusive of specific oscillator operating conditions. This is often called the "Inclusive Method". Ecliptek specifies the following parameters for this series of product:

- Calibration Frequency Tolerance at 25°C
- Frequency Stability over Operating Temperature Range
- Supply Voltage
- Output Load
- First Year Aging at 25°C
- Shock and Vibration

The frequency stability specification can be found on the datasheet.

11. What are the frequency stability and operating temperature range options for this product series?

The operating temperature range is defined as the minimum and maximum temperatures that the oscillator can be exposed to during oscillation. Over this temperature range, all of the specified operating parameters are guaranteed. Ecliptek offers commercial and industrial temperature ranges. The available operating temperature range and frequency stability options can be found on the datasheet.

12. What is the control voltage and control voltage range for this series?

The control voltage range (V_{CR}) is the minimum and maximum voltage that can be applied to the voltage control pad (pad one) of the oscillator. The control voltage (V_C) is the voltage applied to the voltage control pad (pad one)

of the oscillator for the measurement of the frequency deviation test conditions. The control voltage (V_C) and control voltage range (V_{CR}) can be found on the datasheet.

13. What is the pullability or frequency deviation for this series?

The frequency deviation, often called pullability, refers to the amount of frequency change (in ppm) with respect to a change in the control voltage (V_C). The frequency deviation specification can be found on the datasheet.

14. What is the transfer function for this product series?

Often called slope, the transfer function is the direction the frequency changes with respect to the control voltage. Positive slope means the output frequency increases with an increase in control voltage. Negative slope means that the output frequency is increasing with decreasing control voltage. The transfer function specification can be found on the datasheet.

15. What is linearity and what are the linearity specifications for this product series?

Often called monotonic linearity, this parameter is the calculation of the frequency error expressed in percentage with reference from the best straight line curve fit drawn on the output frequency versus control voltage graph. The linearity curve is the relationship between output frequency versus control voltage for a VCXO. In a phase locked loop application, the linearity requirements may be very loose, while in a frequency modulation application the linearity requirement may be very stringent. The linearity specification options can be found on the datasheet.

16. What is the input impedance for this product series?

Input impedance, measured in ohms, specifies the load of the control voltage input pad. The input impedance specification can be found on the datasheet.

17. What is the modulation bandwidth for this product series?

Often called tuning or video bandwidth, modulation bandwidth (MBW) is the modulation frequency at the input of the VCXO at which the output frequency deviation decreases to -3dB of its DC value. The MBW parameter can be found on the datasheet.

18. Does this series offer a tri-state output function?

This product series offers a tri-state output function to facilitate the customer's use of in-process assembly testing or for the use of multiple clocks on the same node. It features a tri-state output control where the output is three-stated (tri-state condition) when the voltage at the control pad is set to a logic low state. In this condition, the oscillator output buffer circuitry within the oscillator is shut down and the output pad is placed into a high impedance state. If the voltage at the control pad is set to a logic high or no connect state, the output is enabled (clocking).

19. What is oscillator aging and what are the aging specifications for this product series?

Aging is the systematic change in frequency with time due to internal changes in the crystal and/or oscillator. Aging is often expressed as a maximum value in parts per million per year [ppm/year]. The rate of aging is logarithmic in nature. The following factors effect oscillator aging: adsorption and desorption of contamination on

the surfaces of the quartz, stress relief of the mounting and bonding structures, material outgassing, and seal integrity. The oscillator aging specification can be found on the datasheet.

20. What are the period jitter, rms phase jitter, and phase noise characteristics for this product series?

Period Jitter is a time domain measurement and is specified in picoseconds (pS) as a maximum value. Phase noise is a measure in the frequency domain and is specified in decibels at various offset points from the carrier (-dBc/Hz). Phase jitter, often called offset jitter, is derived from the phase noise measurement of the spectral density over a given offset bandwidth. Ecliptek uses a proprietary design, exclusive processing methods, and a unique ASIC output driver circuit enabling this product series to have exceptionally low period jitter, phase jitter and phase noise. The period jitter, rms phase jitter, and phase noise specifications can be found on the datasheet.

21. Is tight duty cycle (symmetry) available for this product series?

The duty cycle specification options can be found on the datasheet.

22. What are the output and output load characteristics for this product series?

Ecliptek offers this product series with a low-voltage differential signal (LVDS) output. The oscillator output topology utilizes a constant current source that allows the end user to configure their output termination so as to optimize circuit load matching and signal performance. Signal integrity is optimized when the source-terminated outputs of the oscillator are driving fifty ohm transmission lines. Thus, Ecliptek specifies a load termination of 100 ohms between the output and the complementary output. This load configuration assures that any signal being reflected from the load will be absorbed by the source. The output load specification is listed on the datasheet.

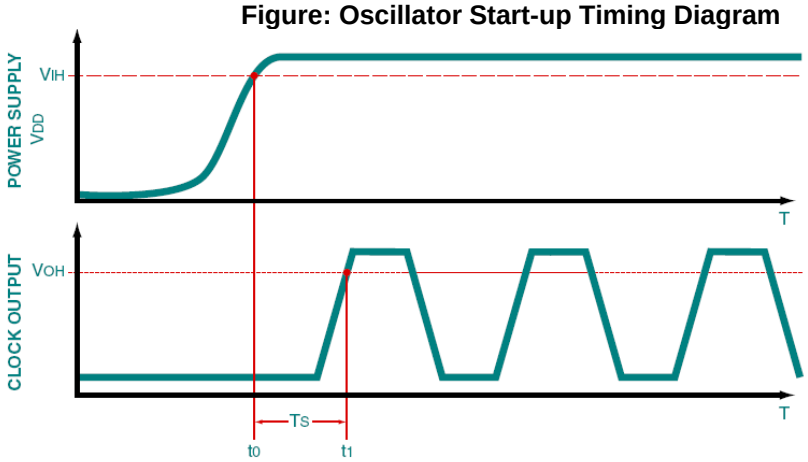
23. What is the function of the complementary output on pad five of the oscillator?

The term complementary output, often called a differential pair, is when one output signal is the logical opposite (complement) of the other output signal. Thus, when the output (pad four) of the oscillator is in a logic high state, the complementary output (pad five) of the oscillator is in a logic low state.

24. Is start-up time specified for this product series?

As shown in the figure below, start-up (T_S) time is defined as the time (t_0) from when the power supply reaches its specified V_{IH} value to the time (t_1) the oscillator output signal amplitude reaches its steady state V_{OH} output logic high level and the output is within the specified frequency tolerance.

Figure: Oscillator Start-up Timing Diagram



In order to ensure proper start-up, the power supply start-up should have an exponential curve typical of a capacitive charge of a linear voltage ramp. The maximum start-up time specification can be found on the datasheet.

25. How do I electrically test this product series at my facility?

The recommended electrical test fixture can be found on the datasheet.

26. Is this product series compatible with my existing assembly process equipment?

If the part number is specified with the TR packaging option, oscillator products are delivered to the customer in EIA481 compliant tape and reel packaging. Without the TR option, products are delivered to the customer in bulk packaging as specified on the datasheet.

27. Is this product series compatible with my existing reflow processes?

This product series is capable of withstanding industry standard high temperature (260°C, 10 seconds) convection reflow processes and is rated MSL1 per J-STD-020. The suggested solder reflow diagram is provided on the datasheet.

28. Is this product series RoHS compliant and Pb-free?

This product is RoHS compliant and Pb-free as defined in the Ecliptek RoHS Compliant (Pb-free) Roadmap.

29. How can I obtain a RoHS compliant (Pb-free) certification for this product series?

A RoHS and Pb-free product certification letter can be obtained directly from our website by using the Ecliptek RoHS/Pb-Free Certification Letter Generator.

30. Is an IPC-1752 material declaration available for customer review?

Ecliptek can provide a Material Declaration in compliance with IPC-1752 to assist customers with their material compliance requirements.

31. How do I layout my printed circuit board for this product series?

A suggested solder pad layout is provided on the datasheet. The customer should layout their PCB to include proper connections for the voltage control (pad one), tri-state output function (pad two), and the complementary output (pad five).

32. Who do I contact if I have additional technical questions about the use of this product series?

The Global Customer Support team at Ecliptek can provide applications engineering support or answer customer technical questions.

33. How do I order an oscillator that has custom requirements not specified on the standard oscillator series specification sheet?

Please contact the Ecliptek Global Customer Support team for additional support or questions regarding your oscillator requirements.

34. What are the environmental and mechanical specifications for this product series?

The environmental and mechanical specifications for this product series are listed on the datasheet.

35. What reliability information is available for this product series?

Failure in Time (FIT) and Mean Time to Failure (MTTF) reliability data is available for this product series within the product series qualification and reliability report found on the series home page.

36. Is thermal resistance information available for this product series?

θ_{JA} and θ_{JC} values are available for this product series and can be found on the Environmental / Mechanical section of the series homepage.

37. Is IBIS model information available for this product series?

Input/Output Buffer Information Specification (IBIS) modeling information can be found on the series home page.

38. What is the marking scheme for this product series?

As shown on the datasheet, this series of product has marking content on the top of the part. This marking consists of a pad one locator dot and additional lines of alpha numeric marking. The datasheet provides the marking content.

39. Can I identify the Ecliptek part number or specification based upon the markings on top of the part?

In order to protect our customer's intellectual property, the Ecliptek part marking does not identify the Ecliptek part number or specifications.

40. Where can I get the information regarding discontinued or End of Life (EOL) products?

Any Ecliptek part number currently under an End of Life statement will be identified as EOL on Ecliptek's Quotation, along with a link to the EOL statement. This information can also be found on the End of Life Statements for Discontinued and Obsolete Products section of our website.

41. Is Ecliptek ISO 9000 Certified?

Yes, Ecliptek is certified to ISO 9001.

42. How can I obtain a REACH compliance statement for this product series?

A Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) compliance statement can be obtained directly from our website by using the Ecliptek REACH Compliance Resources page of our website.