Frequently Asked Questions

Rev A

For Series:	EQVC13

1. What is this oscillator series?

This series of devices are voltage controlled crystal oscillators (VCXO) where the output frequency is primarily controlled by an internal quartz bulk acoustic wave (BAW) crystal resonator and an integrated low-voltage positive emitter-coupled logic (LVPECL) oscillator circuit. 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 also 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
- 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
- Output Enable (Tri-state, High Impedance) or Standby (Tri-state, High Impedance) output options
- High speed LVPECL output with fast rise and fall times
- A voltage control function with linear frequency deviation
- Complementary output
- Superior rms phase jitter and phase noise performance
- Tight duty cycle
- Commercial, extended commercial, and industrial temperature range options
- Industry standard moisture sensitivity level one (MSL1) rated ceramic six pad SMD packages
- 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 six 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. 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		±15ppm MAX
Stability over OTR		±20ppm MAX
Stability vs. Supply Voltage		±5ppm MAX
Stability vs. Output Load		±5ppm MAX
Aging		±5ppm MAX
Pullability/Frequency Deviation		±125ppm MIN
Absolute Pull Range (APR)	±75ppm 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 ±75ppm minimum in the second column is equivalent to the Separate Method of ±125ppm 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. Ecliptek specifies the following inclusive 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 tolerance/stability specification options can be found on the datasheet.

11. 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 without causing damage to 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}) specifications can be found on the datasheet.

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

The frequency deviation, also 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.

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

Also 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.

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

Also 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 can be found on the datasheet.

15. 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.

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

Also 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 modulation bandwidth specification can be found on the datasheet.

17. What are the differences between the output enable and standby function options?

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. This series offers output enable and stand-by options for power management.

If the output enable function is selected, the output circuitry within the oscillator is shut down when the voltage at the control pad (pad two) is set to a logic low state. In this condition, the output signal is three-stated (tri-state). The oscillator output gate becomes high impedance and the oscillator input current on the power supply line is only slightly decreased from normal operating current. The maximum output enable current is specified on the applicable Ecliptek datasheet.

If the stand-by function is selected, then all active circuitry within the oscillator is shut down when the voltage at the control pad (pad two) is set to a logic low state. In this condition, the output signal is three-stated (tri-state). The oscillator output gate becomes high impedance and the oscillator input current on the power supply line is negligible. The maximum stand-by current is listed on the applicable Ecliptek datasheet.

If the voltage at the control pad is set to no connect or a logic high state, the output is enabled (clocking). Note: The oscillator has an internal pull up resistor on the control pad (pad two). The datasheet provides the VIH and VIL thresholds for the control pad.

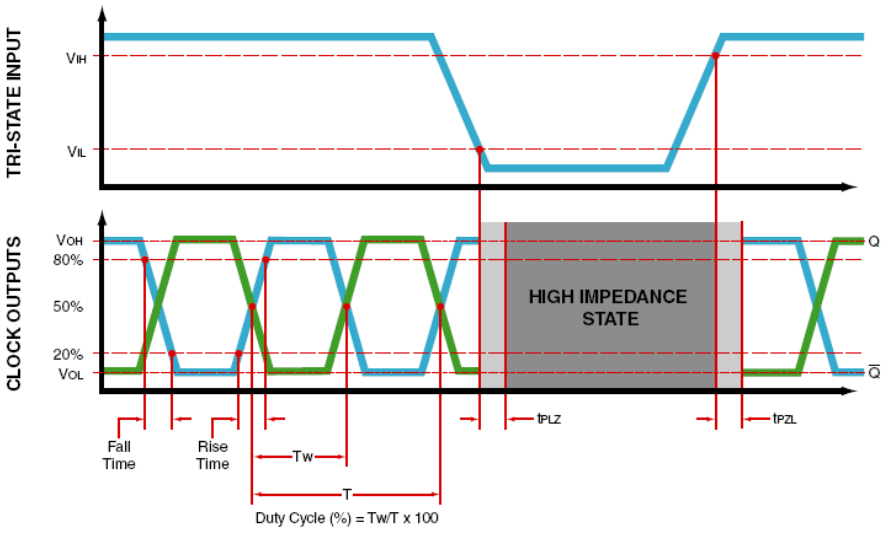


Figure: Tri-State Timing Diagram

When entering the tri-state mode, the time from when the oscillator pad one input control reaches V_{IL} and the oscillator output pad becomes high impedance is shown as t_{PLZ}. When exiting the tri-state mode, the time from when the oscillator pad two input control reaches V_{OH} and the oscillator output begins clocking is shown as t_{PZL}.

18. Can I obtain a non-tri-state function for this product series?

This product series only offers an output enable or standby control function on pad two of the oscillator. The customer can use this oscillator series as a non-tri-state oscillator by setting the voltage on output enable control (pad two) to either no connect or logic high. The oscillator has an internal pull up resistor on output enable control (pad two). The datasheet provides the V_{IH} and V_{IL} thresholds for control of the tri-state function. The datasheet provides the V_{IH} and V_{IL} thresholds for control of the tri-state function.

19. 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). 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, also 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.

20. What is duty cycle and what is the duty cycle specification for this product series?

Duty cycle is the measure of output waveform uniformity. This term, also referred to as symmetry, is a measurement of the time that the output waveform is in a logic high state, expressed as a percentage (%) of the clock period. This parameter is measured at a specified percentage of the output waveform amplitude. The duty cycle specification, which provides measurement thresholds and load conditions, can be found on the datasheet.

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

Ecliptek offers this product series with a low-voltage positive emitter-coupled logic (LVPECL) output. The oscillator output topology utilizes an open collector transistor 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 low impedance output of the oscillator is driving a fifty ohm transmission line. Thus, Ecliptek specifies a load termination of fifty ohms into V_{DD} minus $2.0V_{DC}$. 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.

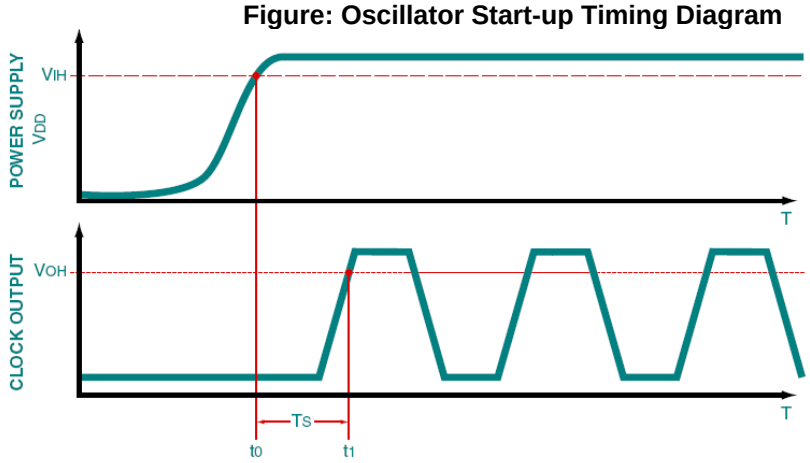
22. What is the function of the complementary output on pad five of the oscillator?

The term complementary output, also 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.

23. 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.

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

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

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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 control function (pad two), and the complementary output (pad five).

31. 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.

32. 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.

33. 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.

34. 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.

35. 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.

36. 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.

37. 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.

38. 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.

39. 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.

40. Is Ecliptek ISO 9000 Certified?

Yes, Ecliptek is certified to ISO 9001.

41. 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.