Frequently Asked Questions

Rev A

For Series:	EMVA13

1. What is this oscillator series?

This oscillator series is a voltage controlled MEMS oscillator (VCMO). 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 MEMS resonator design and exclusive processing methods, these series of oscillators are set to a specified frequency prior to shipment to the customer.

2. How does this oscillator work?

A VCMO is a voltage controlled oscillator where the output frequency of the device is being controlled by a MEMS resonator, internal oscillator circuitry, and an external control voltage. When an external control voltage is applied to the input control pad of the oscillator, the output frequency varies as a function of the input voltage. The variation in the internal PLL results in frequency modulation of the output signal.

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) and Frequency Synthesis
- Frequency Modulation/Demodulation
- Reference Signal Tracking
- Synthesizers Clock
- Clock Synchronization and Translation

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 do these product series offer?

These oscillator series offer:

- Improved frequency stability through the use of a MEMS resonator
- Use of an application specific integrated circuit (ASIC) oscillator design
- A voltage control function with linear frequency deviation
- High speed CMOS output with controlled rise and fall times
- Absolute Pull Range (APR) options
- High Shock Resistance
- Superior linearity
- Excellent rms phase jitter and phase noise performance
- Extended commercial and industrial temperature ranges
- Industry standard low profile four pad plastic SMD package
- Low profile plastic MSL1 rated package

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

This product series consists of a single LVCMOS application specific integrated circuit (ASIC) and a MEMS resonator die stacked inside an industry standard QFN-type plastic injection molded package. This assembly configuration results in superior thermal performance, high reliability, and low lead inductance. The termination I/O pads consist of Ni/Pd/Au metallization.

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 VCMO?

There are two common methods used for specifying VCMO's. The first method is to specify the performance of the device inclusive of all operating conditions. This is called the 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 Absolute Pull Range (APR) Method for specifying the VCMO. The advantage of the APR Method is that a customer can simply specify one parameter, APR, rather than specifying many individual parameters such as frequency deviation, temperature stability over operating temperature range, output load, supply voltage, and aging.

See the table below for an example comparison of the APR Method and the Separate Method.

VCMO 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. What is APR?

Absolute Pull Range (APR) is defined as the minimum guaranteed frequency deviation (specified in ±ppm) from the nominal frequency (F_0) over all operating parameters. These operating parameters include: frequency tolerance, frequency stability over operating temperature range, supply voltage, output load, and aging. For example, a 35.328MHz VCMO used in a PLL clock recovery circuit that has a ±50ppm minimum APR specification will track or capture a ±50ppm maximum 35.328MHz source oscillator under all operating conditions. The available APR options can be found on the datasheet.

11. 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
- 260°C Reflow
- Shock and Vibration

The frequency stability specification can be found on the datasheet.

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

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

13. 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 APR test conditions. The control voltage (V_C) and control voltage range (V_{CR}) can be found on the datasheet.

14. 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). This parameter is specified when using the Separate Method. This series does not specify VCMO frequency deviation as this series specifies the APR Method. The available APR options can be found on the datasheet.

15. 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.

16. 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 VCMO. 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.

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

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

18. 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 VCMO at which the output frequency deviation decreases to -3dB of its DC value. The MBW parameter can be found on the datasheet.

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

This product series does not offer a tri-state output function.

20. 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 MEMS and/or oscillator. Aging is often expressed as a maximum value in parts per million per year [ppm/year]. The following factors effect oscillator aging: adsorption and desorption of contamination on the surfaces of the MEMS resonator, stress relief of the mounting and bonding structures, material outgassing, and seal integrity. The oscillator aging specification is listed on the datasheet.

21. 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.

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

The duty cycle specification can be found on the datasheet.

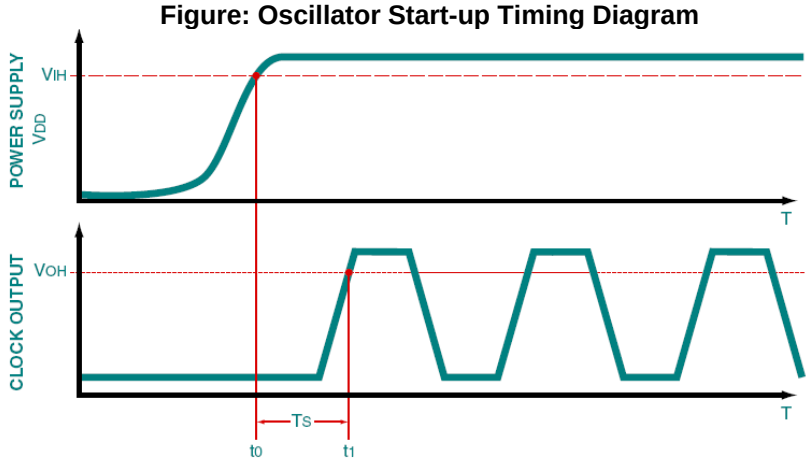
23. What are the output and output load characteristics for this product series?

Ecliptek offers this product series with a low voltage high speed CMOS driver that enables the output signal to swing from ground to V_{DD}. The oscillator output topology is designed 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 high impedance-low capacitance input. The output load specification is listed on the datasheet.

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

As shown in the figure below, start-up 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 is listed 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 listed 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 function.

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. Are IBIS models 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 one additional line of alpha numeric marking. The marking represents an Ecliptek manufacturing identifier. This identifier is used internally at Ecliptek for manufacturing lot traceability. This manufacturing identifier provides no indication of part number or date code or output frequency. 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 an Ecliptek 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.