Frequently Asked Questions

Rev B

For Series:	EMVA12	EMVA13

1. What are the Ecliptek EMVA series of oscillators?

The EMVA12 and EMVA13 series of oscillators are voltage controlled MEMS oscillator (VCMO) devices where the output frequency is primarily controlled by an internal MEMS (micro-electro-mechanical system) resonator and an integrated programmable CMOS oscillator circuit. 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 do the EMVA series of oscillators work?

A VCMO is a voltage controlled oscillator where the output frequency of the device is being controlled by a MEMS resonator, the internal Fractional-N PLL 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 these EMVA oscillator series?

These product series can be used in the following circuit 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 customer products are these series of oscillators typically used in?

These series of oscillators are commonly found in the following customer 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 commercial benefits do these product series offer?

These series of oscillators have very short lead times with cost effective pricing. These EMVA series are Ecliptek Quick Turn oscillator products.

6. What technical benefits do these product series offer?

These oscillator series offer:

- Improved frequency stability through the use of a MEMS resonator
- Output frequencies up to 106.250MHz
- Supply voltages of $2.5V_{DC}$, and $3.3V_{DC}$.
- ±50ppm maximum frequency stability options
- ±30ppm, ±50ppm, ±80ppm, and ±100ppm minimum Absolute Pull Ranges (APR)
- High speed CMOS output with controlled rise and fall times
- 30,000G Shock Resistance
- Tight Duty Cycle (45% / 55%)
- 0.4% typical and 1% maximum linearity
- Excellent rms phase jitter performance
- Commercial and industrial temperature ranges
- Industry standard low profile 5mm x 7mm four pad plastic SMD package
- Low profile plastic MSL1 rated package
- RoHS Compliant (Pb-free) with high temperature 260°C reflow capability

7. What are the package types for these product series?

The EMVA12 and EMVA13 series oscillators are offered in the industry standard 5mm x 7mm four-pad leadless plastic SMD package. The table below outlines the series product offerings.

8. What are the input voltage (power supply) options for these product series?

The EMVA13 series is a 3.3Vdc ±10% version and the EMVA12 series is offered at 2.5Vdc ±5%. Please contact the Ecliptek Global Customer Support Team if you have a custom supply voltage requirement.

9. What are the input current specifications for these product series?

The input current specification is listed as a maximum on the respective datasheet. These current ratings are for oscillators with the specified output load connected.

10. What output frequencies can I obtain for these product series?

These series feature standard frequencies ranging from 1.000MHz to 106.250MHz. Any frequency in this range can be ordered.

11. What are the construction characteristics for these product series?

These product series consist of a single ASIC and a MEMS resonator die stacked inside an industry standard QFN-type plastic injection molded packaging. 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.

12. What are the operating temperature range (OTR) options for these product series?

Ecliptek offers a commercial temperature range of 0°C to +70°C and an industrial temperature range of -40°C to +85°C.

13. What are the frequency tolerance/stability options for these product series?

The frequency tolerance/stability for these series is ±50ppm maximum over an operating temperature range of -40°C to +85°C or 0°C to +70°C.

14. How do I specify the overall frequency stability for these product series?

The frequency stability of the device is specified as an inclusive parameter with the following oscillator operating conditions:

- 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
- Vibration

15. How do I specify a VCMO?

There are two common methods customers and suppliers use 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 under specific operating conditions and to specify separate operating parameters such as frequency deviation, frequency tolerance, frequency stability over operating temperature range, supply voltage, output load, and aging. This is called the Separate Method.

These oscillator series use the APR Method for specifying the VCMO. This method utilizes the absolute pull range (APR) definition. 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 a comparison of the APR Method and the Separate Method.

VCMO Output Parameter	APR Method	Separate Method
Calibration Tolerance		±10ppm MAX
Stability over OTR		±35ppm MAX
Stability vs. Supply Voltage		±2ppm MAX
Stability vs. Output Load		±2ppm MAX
Aging (over first year)		±1ppm MAX
Pullability or Frequency Deviation		±100ppm MIN
Absolute Pull Range (APR)	±50ppm Minimum	
Operating Temperature Range (OTR)	-40°C to +85°C	-40°C to +85°C

Table: APR Method versus Separate Method

As shown in the above table, the APR Method of ±50ppm minimum in the second column is equivalent to the Separate Method of ±120ppm pullability minimum and ±50ppm Calibration Tolerance/Stability/Voltage/Load/Aging maximum in the third column.

16. What is APR?

APR stands for 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.

17. What APR options do these product series offer?

Ecliptek offers the ±30ppm, ±50ppm, ±80ppm, and the ±100ppm APR options.

18. What are the control voltage range and control voltage specifications for these product series?

The control voltage range (V_{CR}) is the minimum and maximum voltage that can be applied to the voltage control pad (pad 1) of the oscillator.

The control voltage (V_C) is the specific voltage applied to the voltage control pad (pad 1) of the oscillator for the measurement of the APR test conditions. The table below outlines the control voltage and control voltage range for each series.

EMVA Series	Supply Voltage	Control Voltage	Control Voltage Range
EMVA12	$2.5V_{DC}$	$0.050V_{DC}$ to $1.7V_{DC}$	$0V_{DC}$ to $1.8V_{DC}$
EMVA13	$3.3V_{DC}$	$0.050V_{DC}$ to $1.7V_{DC}$	$0V_{DC}$ to $1.8V_{DC}$

Table: Control Voltage per series

19. What are the pullability or frequency deviation specifications for these product series?

The pullability or frequency deviation of a VCMO refers to the amount of frequency change (in ppm) with respect to a change in the control voltage (V_C). These parameters are specified when using the Separate Method mentioned above. The Ecliptek EMVA product series do not specify VCMO pullability or frequency deviation; these series specify the APR Method. If a customer would like to specify a VCMO using the Separate Method, please contact the Ecliptek Global Customer Support Team.

20. What is oscillator aging and what are the aging specifications for these product series?

Aging is the systematic change in frequency over time due to internal changes in the MEMS resonator 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. At a rated operating temperature of 25°C, these series of products typically age at a rate of less than ±1ppm over the first year. The aging parameter can be found on the applicable series datasheet. It should be noted that oscillator aging is inclusive of the APR.

21. What is the transfer function and what is the transfer function for these product series?

Often called slope, the transfer function of a VCMO 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 for these oscillator series is positive.

22. What is linearity and what are the linearity specifications for these 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. 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. These Ecliptek VCMO series generate a varying output frequency by modulating the internal Fractional-N PLL, resulting in extremely low percentage values of linear pull range. The linearity specifications can be found on the applicable Ecliptek datasheet.

23. What are the modulation bandwidth and input impedance specifications for these 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. Input impedance specifies the load of the VCMO control input pad (pad 1). The MBW and input impedance parameters can be found on the applicable Ecliptek datasheet.

24. What are the period jitter characteristics for these product series?

Jitter is a time domain measurement and is typically specified in picoseconds (pSec). Ecliptek uses a proprietary oscillator design, exclusive processing methods, and a unique output driver circuit enabling these oscillator series to have exceptionally low period jitter. The rms and peak to peak period jitter parameters for these series can be found on the EMVA12 and EMVA13 datasheets.

25. What are the rms phase jitter and phase noise characteristics for these product series?

RMS 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 these product series to have exceptionally low jitter and phase noise. The rms phase jitter and phase noise parameters can be found on the applicable series datasheets.

26. Do these product series offer tri-state output capability?

These product series do not offer a tri-state output control.

27. Is tight duty cycle (symmetry) available for these product series?

The duty cycle specifications can be found on the applicable Ecliptek datasheet.

28. What are the output signal characteristics for these product series?

Ecliptek offers these product series with a LVCMOS output. The oscillator output topology is designed so as to optimize circuit loading matching and signal performance. Signal integrity is optimized when the low impedance output of the oscillator is driving a high impedance-low capacitance input. If you require a different output signal characteristic from that specified on the datasheet, please consult the factory with your custom requirements.

29. What are the output load options for these product series?

These oscillators have a high speed CMOS output driver that enables the output signal to swing from ground to V_{DD}. The output load specifications for each product series can be found on the applicable Ecliptek datasheet. If you require a different load from that specified on the datasheet, please consult the factory with your custom requirements.

30. Is start-up time specified for these product series?

Start-up time for these series can be found on the applicable datasheet and is defined as the time from when the power supply reaches its specified value to the time the oscillator output signal amplitude reaches its minimum voltage output logic high threshold (V_{OH}) and the output is within the specified frequency tolerance. For these series, characterization test data indicates that the start-up time is typically around 3 to 5mS.

Note: In order to ensure proper start-up, the power supply start-up should have an exponential curve typical of a capacitive charge or a linear voltage ramp and not exceed 300mS. If you have a special voltage start-up profile (i.e. odd ramp steps or shapes), please contact Ecliptek to discuss possible oscillator performance issues.

31. How do I electrically test these product series at my facility?

See the below table for the recommended electrical test fixture.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to see recommended electrical test fixture

32. Are these product series compatible with my existing assembly process equipment?

If the part number is specified with the TR option (tape and reel packaging), oscillator products are delivered to the customer in EIA-481A compliant tape and reel packaging. Without the TR option, products are delivered to the customer in bulk packaging (ESD protective bag). See the table below for the carrier tape and reel dimensions.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to see tape and reel dimensions

33. Are these product series compatible with my existing reflow processes?

These product series are RoHS compliant and Pb-free as defined in the Ecliptek Pb-free Roadmap and are capable of withstanding industry standard high temperature (260°C, 10 seconds) convection reflow processes and are rated MSL1 per J-STD-020. See the below table for the recommended solder reflow diagram.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	$2.5V_{DC}$
EMVA13	5mm x 7mm	$3.3V_{DC}$

Table: Click on a series to see recommended solder reflow methods

34. Are these oscillator series RoHS compliant and Pb-free?

These product series are RoHS compliant and Pb-free as defined in the Ecliptek RoHS Compliant (Pb-free) Roadmap.

35. How can I obtain a RoHS compliant (Pb-free) certification for these 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.

36. Are RoHS and RoHS (Pb-free) material declaration data available for customer review?

Ecliptek can provide Material Declaration data in compliance with IPC-1752 to assist customers with their RoHS Compliance (Pb-free) concerns.

37. How do I layout my printed circuit board for these product series?

The customer should layout their PCB to include proper connections for the voltage control input function (pad 1). See the below table for the recommended solder pad layout.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	$2.5V_{DC}$
EMVA13	5mm x 7mm	$3.3V_{DC}$

Table: Click on a series to see recommended solder pad layout diagram

38. What is the function of the paddle on the bottom center of the part?

The bottom center pad, often called a paddle, is labeled 'A' and is defined as 'Ground'. This pad is internally connected to the oscillator circuit ground (pad 2). This pad has no electrical function and has been added for mechanical manufacturing reasons.

39. Should I include a land pattern on my PCB layout for the paddle?

It is not recommended that the customer include a land pattern on the PCB for the center paddle (pad A). If a customer adds a PCB land pattern for this paddle, it is not recommended that the customer apply solder paste to this PCB land pattern. Ecliptek does not guarantee the solderability of this oscillator paddle (pad A).

40. What will happen if the paddle is connected to V_{DD}?

Connecting the center paddle to V_{DD} is not recommended and may affect operation of the device. Ecliptek Engineering recommends leaving the paddle (pad A) as a no connect.

41. How do I cross these product series with a competitor part number?

Please see the Ecliptek Cross Reference by Competitor Part Number.

42. What information is needed to obtain a quote for these product series?

Obtaining a quote on-line is simple. Fill in the required information in the part number constructor for the specific series that you would like to order. This part number will define the specifications you desire. After you construct a part number, you can request a quote or check stock by following the prompts on our website. You can go to a part number constructor now by selecting a link below:

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to go to part number constructor

43. How do I obtain a PDF copy of the product series data sheet?

You can go to the specific series you desire now by selecting a link from the table below.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to open the PDF data sheet

44. How do I obtain a PDF copy of the data sheet for a specific part number?

Simply complete the required information in the part number constructor for the specific series that you would like to order. After you construct the part number, you will be prompted with an icon labeled “View Datasheet”. Click on this icon and you can download and save a PDF copy of the specific Ecliptek part number you created.

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

The Engineering staff at Ecliptek can provide applications engineering support or answer customer technical questions.

46. How do I order an oscillator that has custom requirements not specified on the standard oscillator series datasheet?

Complete the Ecliptek Custom Oscillator Request Form from our website. From this page you will be able to enter custom specifications that are unavailable from the standard part number constructor forms. These parameters will be sent to our Engineering team where they will be evaluated. Upon review, you will be contacted by our Ecliptek Global Customer Support team or Engineering team.

47. What are the environmental and mechanical specifications for these product series?

The environmental and mechanical specifications for each product series are listed on the applicable specifications and are outlined in the table below.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to see the mechanical and environmental specifications

48. What reliability information is available for these product series?

Failure in Time (FIT) and Mean Time To Failure (MTTF) reliability data is available for these product series as provided in the below table.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	2.5V_{DC}
EMVA13	5mm x 7mm	3.3V_{DC}

Table: Click on a series to open the Qualification and Reliability Report in PDF

49. Is thermal resistance information available for these product series?

θ_{JA} and θ_{JC} values are available for these product series. Please see the Oscillator Thermal Resistance information provided.

50. Is IBIS model information available for these product series?

IBIS modeling information is available for these product series as provided in the below table.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	$2.5V_{DC}$
EMVA13	5mm x 7mm	$3.3V_{DC}$

Table: Click on a series to open the IBIS Model document

51. What are the marking specifications for these product series?

As shown on the applicable datasheet, these series of products have marking content on the top of the part. This marking consists of a pad one (1) locator dot and a four digit alpha numeric. These digits represent an Ecliptek manufacturing designator. This designator is used internally at Ecliptek for manufacturing lot traceability. This manufacturing designator provides no indication of part number or date code or output frequency.

EMVA Series	Package Type	Supply Voltage
EMVA12	5mm x 7mm	$2.5V_{DC}$
EMVA13	5mm x 7mm	$3.3V_{DC}$

Table: Click on a series to go to the marking content

52. Where can I get the information regarding discontinued or End of Life 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.

53. Is Ecliptek ISO 9000 Certified?

Yes, Ecliptek is certified to ISO 9001.