Frequently Asked Questions

Rev A

For Series:	EMDS13	EMDS12

1. What are the Ecliptek EMDS13 and EMDS12 series of oscillators?

The EMDS13 and EMDS12 series of oscillators are devices where the output frequency is primarily controlled by an internal MEMS (micro-electro-mechanical system) resonator and an integrated low-voltage differential signal (LVDS) oscillator circuit. Utilizing a proprietary MEMS resonator design and exclusive processing methods, these series of oscillators are programmed to a specified frequency prior to shipment to the customer.

2. What are the typical circuit applications for these product series?

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

- Clock Recovery
- Phase-Locked Loop and Frequency Synthesis
- Digital Switching Networks
- Synthesizer or System Reference
- Clock Distribution
- Clock Translation and Multiplexing

3. What are the typical applications and end-item products for these series?

Here is a list of the most common applications and end-item products:

- PCI Express
- Gigabit Ethernet
- Fiber Channel
- SATA/SAS
- FBDIMM
- DDR
- Routers, Servers, Hubs
- Network Switches
- SONET/ATM/SDH System Equipment
- High Resolution Video

4. What commercial benefits do these product series offer?

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

5. What technical benefits do these product series offer?

These series of MEMS oscillators offer:

- Improved frequency stability through the use of a MEMS resonator
- Output frequencies up to 220.000MHz
- Supply voltages of $2.5V_{DC}$ or $3.3V_{DC}$
- ±20ppm, ±25ppm, ±50ppm, or ±100ppm maximum frequency stability options
- Commercial, extended commercial, and industrial temperature range options
- Tight duty cycle of 50% ±5%
- 30,000G Shock Resistance
- Superior period jitter performance
- Output Enable (OE: Tri-state, High Impedance) or Standby (ST: Tri-state, High Impedance) output options
- Industry Standard 5mm x 7mm six pad SMD package
- High speed LVDS output with fast rise and fall times
- Low profile plastic MSL1 rated package
- RoHS Compliant (Pb-free) with high temperature 260°C reflow capability

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

These series feature frequencies ranging from 1.000MHz to 220.000MHz. Any frequency in this range can be ordered, with up to five or six significant digits (i.e. XXX.XXXXX MHz or XX.XXXXXX MHz).

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

These series of oscillators are offered in an industry standard plastic six pad 5mm x 7mm x 0.9mm SMD package. The package dimensions for each product series can be found on the EMDS13 and EMDS12 datasheets.

8. What are the construction characteristics of 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 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.

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

These series offer operation at $3.3V_{DC}$ ±$0.3V_{DC}$ (EMDS13) and at $2.5V_{DC}$ ±$0.125V_{DC}$ (EMDS12).

10. What is the input current for these product series?

The input current specification is listed in milliamps as a maximum value on the EMDS13 and EMDS12 datasheets. These current ratings are for oscillators with the output load termination current excluded.

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

Ecliptek offers ±20ppm, ±25ppm, ±50ppm or ±100ppm frequency stability options for these product series. These four frequency stability options selectively apply to a 0°C to +70°C commercial temperature range, a -20°C to +70°C extended commercial temperature range, or a -40°C to +85°C industrial operating temperature range.

12. What are the differences between the Standby (ST) and Output Enable (OE) options?

These product series offer a tri-state output function to facilitate the customer's use of in-process assembly testing and a Standby (ST) or Output Enable (OE) option for power management.

If the Standby (ST) option is selected, all active circuitry within the oscillator is shut down when the voltage at the control pad (pad 1) is set to a logic low state. In this condition (Figure 1), 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 Standby (ST) 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 1). The series datasheet provides the V_{IH} and V_{IL} thresholds for the control pad.

If the Output Enable (OE) option is selected, only the output circuitry within the oscillator is shut down when the voltage at the control pad (pad 1) is set to a logic low state. In this condition (Figure 1), 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 (OE) current is specified 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 1). The series datasheet provides the V_{IH} and V_{IL} thresholds for the control pad.

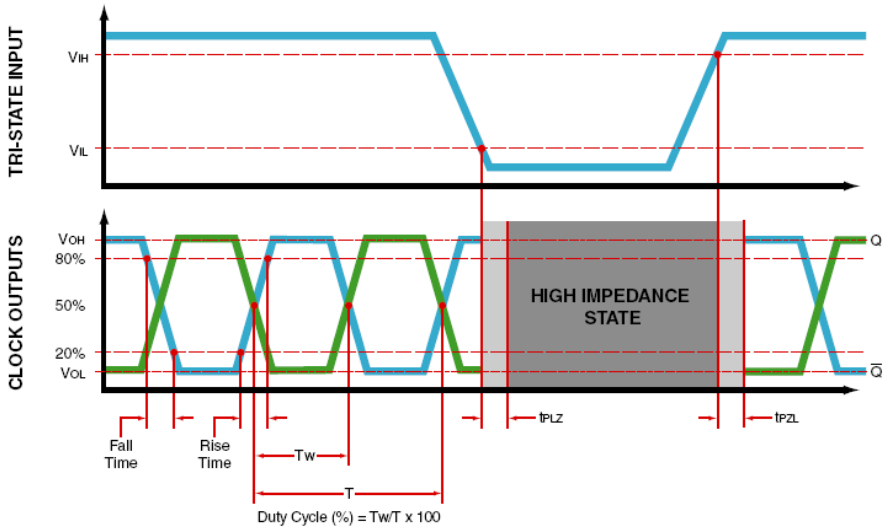


Figure 1: Tri-State Output Timing Diagram

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 one input control reaches V_{OH} and the oscillator output begins clocking is shown as t_{PZL}. For these series, characterization test data indicates that t_{PLZ} is approximately 50nS and t_{PZL} is approximately 3 to 7mS.

13. Can I obtain a non-tri-state function for these product series?

Ecliptek does not offer a no connect (NC) option for pad 1. Only the Standby (ST) and Output Enable (OE) options are available as standard offerings. However, the customer can use the EMDS13 or EMDS12 series oscillator as a non-tri-state oscillator by setting the voltage on pad 1 to either no connect or logic high. The oscillator has an internal pull up resistor on pad 1. The series datasheet provides the V_{IH} and V_{IL} thresholds for the control pad.

14. What is the function of the complementary output (pad 5)?

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 4) of the oscillator is in a logic high state, the complementary output (pad 5) of the oscillator is in a logic low state.

15. How do I specify the overall frequency stability for these 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 these 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
- Vibration

16. 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.

17. 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 various period jitter parameters for these series can be found on the series datasheets.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

Table: Click on the series to see the series datasheet

18. Are the period jitter characteristics of these series different than standard fixed frequency quartz crystal oscillator products?

In certain cases, jitter may be different than the Ecliptek standard fixed frequency quartz crystal oscillator products. It is recommended that customers review the applicable specifications from our web site (EMDS13 and EMDS12) and compare the jitter specification at the specific frequency of operation and input voltage condition. In conjunction with using a proprietary oscillator design and exclusive processing methods, Ecliptek has implemented controlled rise and fall times, unique output driver circuitry, and innovative circuit layout techniques enabling the EMDS13 and EMDS12 oscillator series to have low period jitter.

19. 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 (pSec) 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 low jitter and phase noise. The rms phase jitter performance specifications can be found on the series datasheets. Please contact Ecliptek to obtain phase noise performance information.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

Table: Click on the series to see the series datasheet

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

Tight duty cycle (45% minimum, 55% maximum) is standard for these product series and is measured at the threshold level specified on the datasheet.

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

Ecliptek offers these 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 configure circuit load matching and signal performance. Signal integrity is optimized when the source-terminated

outputs of the oscillator are driving a 50 ohm transmission line. Thus, Ecliptek specifies a load termination of 100 ohms between the output and the complementary output.

This configuration assures that any signal being reflected from the load will be absorbed by the source. The table below outlines the output load for these series. If a customer requires a different load from that specified on the datasheet, please contact Ecliptek with your custom requirements.

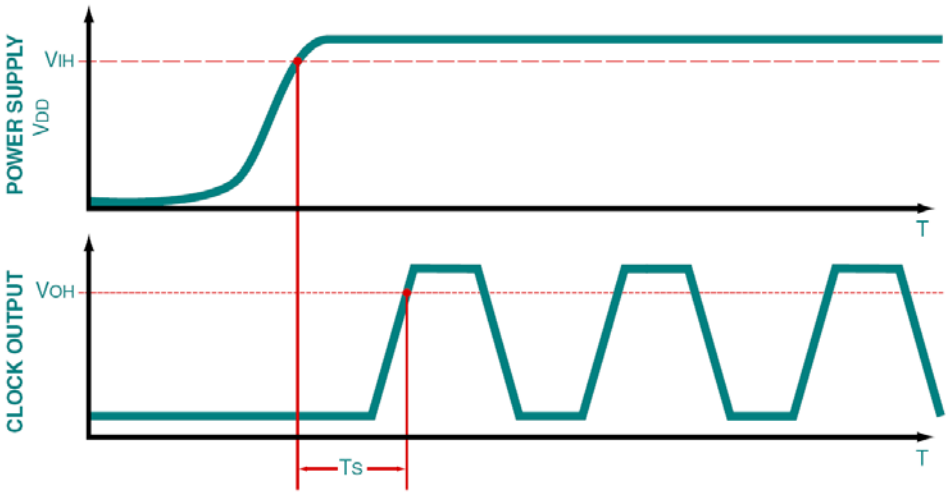
Series	Supply Voltage	Between Output Pad 4 and Pad 5
EMDS13	$3.3V_{DC}$	100 ohms
EMDS12	$2.5V_{DC}$	100 ohms

Table: Click on the series to see the electrical specifications

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

As shown in the figure below, start-up time is defined as the time from when the power supply reaches its specified V_{IH} value to the time the oscillator output signal amplitude reaches its steady state V_{OH} output logic high level and the output is within the specified frequency tolerance. Note: The complementary output waveform is not shown in the below figure.

Figure: Oscillator Start-up Timing Diagram



Note: 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 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. The start-up time specification for these series can be found on the series datasheet.

23. What are the differences between these Ecliptek product series and other PLL (Phase Locked Loop) based products offered in the marketplace?

In conjunction with using exclusive MEMS processing methods and proprietary design techniques, Ecliptek has implemented custom LVDS output driver circuitry and innovative circuit layout techniques enabling these oscillator series to have low jitter and phase noise using an internal PLL. It is recommended that the customer obtain the applicable electrical specifications from the Ecliptek web site and compare the electrical parameter(s) of interest.

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

See the table below for the recommended electrical test fixture.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

25. Are these oscillator series compatible with my existing assembly processes and equipment?

If the part number is specified with the TR option (tape and reel packaging), oscillator products are delivered to the customer in EIA481A 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.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

26. Are these series compatible with my existing assembly reflow processes?

These product series 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 table below for the recommended solder reflow diagram.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

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

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

28. How can I obtain a RoHS compliant certification for these product series?

A RoHS product certification letter can be obtained directly from our website by using our Ecliptek RoHS Certification Generator.

29. How can I obtain material declaration data for these product series?

Material declaration data in compliance with IPC-1752 is available to assist customers with their RoHS and REACH compliance concerns.

30. How can I obtain a REACH certification for these product series?

Please contact Ecliptek to request a REACH certification letter. Please include the Ecliptek part number(s) with your request.

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

The customer should layout their PCB to include proper connections for the tri-state input control (pad 1), the center paddle (pad A), and the complementary output (pad 5). See the table below for the recommended solder pad layout.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

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

This bottom center pad, often called a paddle, is labeled 'A' on the EMDS13 and EMDS12 datasheets. This pad is internally connected to the oscillator circuit ground (pad 3). Its main function is for thermal heat dissipation.

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

It is recommended, but not required, that the customer include a land pattern on the PCB for the paddle (pad A). The addition of the land pattern will improve the dissipation of thermal heat from the bottom of the oscillator.

34. What will happen if the paddle is connected to Ground or V_{DD}?

Connecting the paddle to V_{DD} is not recommended and may affect operation of the device. Ecliptek recommends connecting the paddle (pad A) to ground. If this is not possible, an acceptable alternate configuration is leaving it as a no connect.

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

Please see the Ecliptek Competitor Cross Reference.

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

Obtaining a quote on-line is simple. Simply 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 require. 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:

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

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

You can go to the specific series now by selecting a link below.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

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

Simply 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 require. After you construct a part number, you will be prompted with the following: Get a data sheet for this part number (PDF).

39. 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.

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

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 acceptance, a custom part number will be assigned and an engineering document created to represent your product.

41. 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.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

42. 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 table below.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

43. 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 FAQ for complete details.

44. Are IBIS models available for these product series?

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

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	$3.3V_{DC}$
EMDS12	5mm x 7mm	$2.5V_{DC}$

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

45. What is the marking scheme for these product series?

As shown on the applicable datasheet, these series of product have marking content on the top of the part. This marking consists of a pad one (1) locator dot and a four or five 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.

Series	Package Type	Supply Voltage
EMDS13	5mm x 7mm	3.3V_{DC}
EMDS12	5mm x 7mm	2.5V_{DC}

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

46. 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.

47. Is Ecliptek ISO 9000 Certified?

Yes, Ecliptek is certified to ISO 9001.