ROD2522S2H [Preliminary]

The ROD2522S2H is a 0.5 ppb FvT stable ageing learning[1] OCXO in an industry-standard SMD package. It is the world's first 25 x 22 mm oscillator that can provide 24-hour (≤1.5 µs) holdover across a 4°C external temperature variation. The device accepts 1PPS input signal from a synchronisation servo or GNSS module and delivers a ultra-stable free-running frequency at 10 MHz, 12.8 MHz or 20 MHz.

In standard mode, the device learns its own ageing behaviour by using the primary reference traceable clock input. The device's holdover mode is supported by frequency ageing compensation (0.004 ppb/day).

Taking advantage of Rakon's proprietary smart compensation techniques, advanced themo mechanical design and unique control circuitry, the OCXO module delivers 24 hour holdover (1.5 µs). Status and commands are available through the I²C bus interface. When the 1PPS reference is lost or when the device is forced into holdover, the advanced compensation algorithms dynamically compensate for ageing-related frequency variations. These features make the ROD2522S2H an ideal solution where 24-hour holdover, highly accurate and precise frequency stability requirements are critical.

Features

- Holdover 1.5 µs over 24 hours with 4°C external temperature variation
- Frequency stability (FvT. Gradient of 0.5°C/minute): ≤0.5 ppb over -40 to 85°C
- 3.3V signal power supply
- Free-running output (squarewave) with ageing compensation in holdover mode
- I²C bus device status and commands

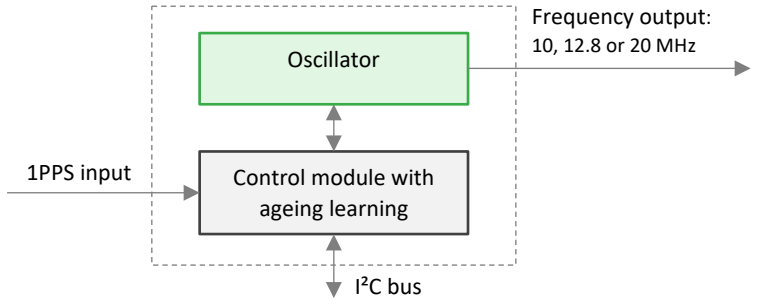
Applications

- Edge grandmasters
- DU/CU/servers
- Cell-site routers
- Front-haul switches
- NIC time cards
- Test equipment
- GNSS modules

25.4 x 22.0 x 12.1 mm

Block Diagram

1PPS Input and free-running frequency 10, 12.8 or 20 MHz



[1] Ageing learning (AL) refers to frequency stability learning over a lifetime. It is an intelligent model with a short-term frequency stability self-learning algorithm. The AI's primary focus is achieving superior ageing compensation.

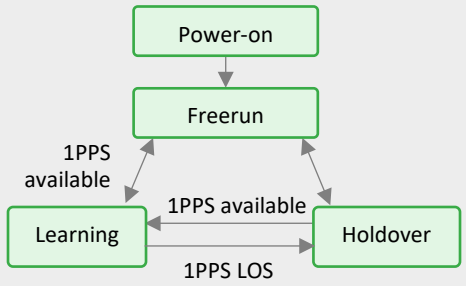
Issue: A, 13 June 2023

Standard Specifications

Parameter	Min.	Typ.	Max.	Unit	Test Condition / Description
Nominal frequency		10 - 20		MHz	Standard frequencies: 10, 12.8 and 20 MHz
Operating temperature range	-40		85	°C	-40 to 95°C temperature range available on request
Frequency stability over temperature		0.5		ppb	Peak to peak
Free-run accuracy (20 years)		±1		ppm	
Supply voltage stability		±0.5		ppb	±5% at 25°C
24-hour holdover performance			±1.5	µs	After 3 days of continuous power on, constant temperature and calm air
Hysteresis		0.3		ppb	Over -40 to +85°C, gradient 10°C / hour
Long term stability (Ageing)		±0.2 ±10 ±50		ppb/day ppb/month ppb/year	After 1 week of operation
Compensated ageing		±0.004		ppb/day	
Short term 1s to 10s integration time		±0.005		ppb	
Retrace at 25°C		±1		ppb	After 24 hours off and 1 hour on
Supply voltage (V_{CC})		3.3		V	±5%. Standard options 5.0 V
Power consumption			3.5 1.5	W W	During warm-up Steady state at 25°C calm air
Warm-up time			±5	mn	Within 10 ppb of prior steady state output frequency at the time of power-off. 24 hours on min. + 24 hours off max.
Oscillator output – Compatible CMOS Output voltage level high (V_{OH}) Output voltage level low (V_{OL}) Rise & fall time	2.4		 0.4 5	 V V ns	

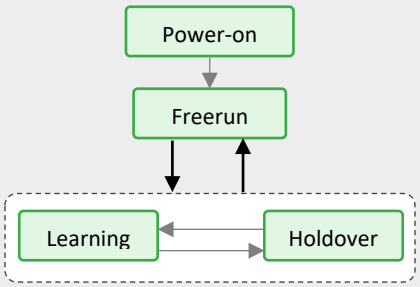
Device Operating Modes

Generic State Diagram



Default behaviour

Register Driven State Diagram



Some stages can be forced through the I²C interface

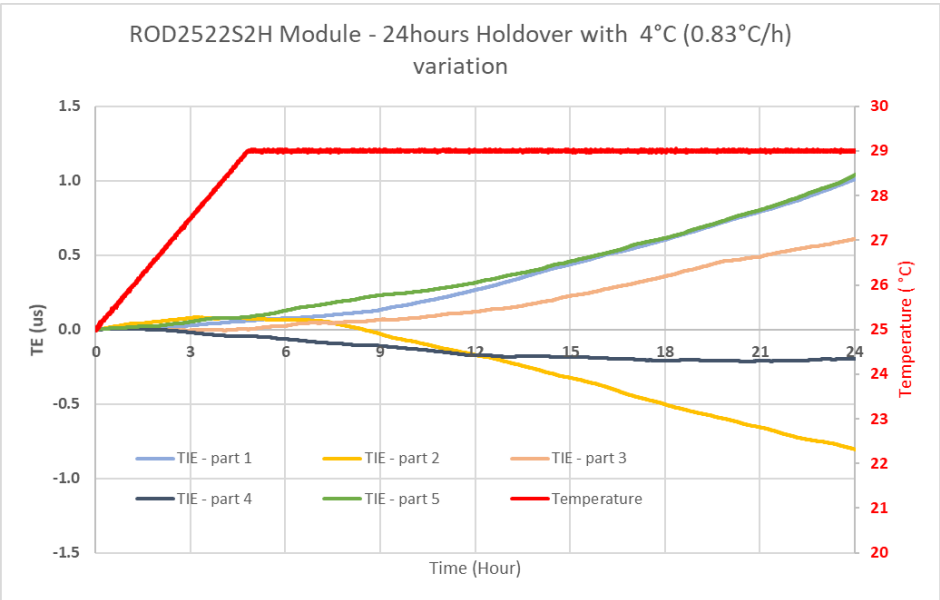
Other Features

Frequency stability over operating temperature is guaranteed in all operating modes. After initial warm-up, the system requires 2 days of continuous locked mode operation in ambient temperature conditions to meet specified holdover stability.

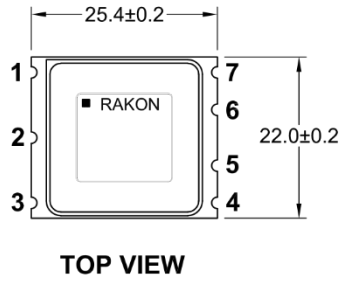
The DO NOT LEARN feature of the OCXO disables the learning process even when the 1PPS signal is available. This feature can be enabled thorugh the I²C bus interface (Address details). In system conditions when the learning feature is to be disabled or if the incoming 1PPS signal is assumed to be not fit for synchronisation, this feature is to be used. This “Learning Pause” feature enables to retain the coefficients that are already learnt, and prohibits the coefficients to be frozen in desired conditions.

The “clear learnt parameters” accessed through register (0x98) can be used to reset the learning coefficents. If the system has learned wrong parameters through non valid PPS inputs, this feature can be used to reset the system parameters.

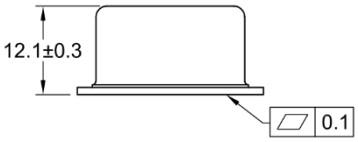
Sample holdover performance graph across 4°C (0.83°C/hour) temperature variation at the start of holdover illustrating worst case holdover performance over 24 hours



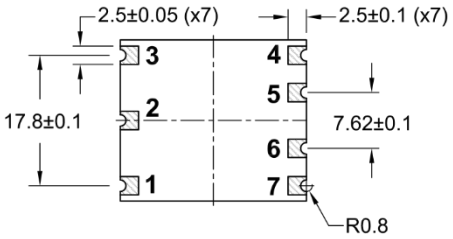
Model Outline, Pin Connections and Recommended Pad Layout



TOP VIEW



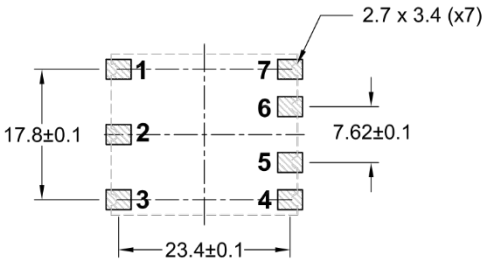
FRONT VIEW



BOTTOM VIEW

RECOMMENDED PAD LAYOUT

- TOP VIEW



NOTE

- Planarity of the bottom PCB ≤0.15mm typicao ≤0.1mm / PCB interfacing with customer's board
- No via, no trace on bottom side
- Unit: mm. Tolerance is ±0.2 mm if it has not been indicated.

Pin	Connections
1	1PPS input
2	Do not connect
3	Supply Voltage (Vcc)
4	RF Output (HCMOS)
5	I^2C bus – SCL
6	I^2C bus – SDA
7	GND (mechanical & electrical)