MD-261

GNSS (GPS and GLONASS) Disciplined Oscillator Module

The MD-261 is a fully integrated GNSS disciplined oscillator module in a compact surface mount 25 x 20 mm package. The module has an embedded 34 channel receiver that is both GPS and GLONASS compatible. and provides an HCMOS 10 MHz and and 1 pps output. An onboard OCXO or High Precision TCXO are available dependent on performance requirements. The module operates from -40 °C to +85 °C, and is capable of providing a holdover of 1.5 us over 4 hours over a +/-2°C temperature window. An evaluation kit with operating software is available for development purposes.

Features

- **Embedded GNSS Receiver - GPS and Glonass Compatible**
- **Field upgradeable for Galileo**
- **1pps HCMOS output signals standard**
- **10MHz HCMOS output standard**
- **1 pps auxiliary input**
- **Other output frequencies available**
- **Modified NMEA (VSIP)**
- **Holdover to 1.5 us over 4 hours, 8 us over 24 hours**
- **Evaluation kit with software available**

Applications

- **LTE**
- **Digital Video Broadcast**
- **E911 Location Systems**
- **General Timing and Synchronization**
- **Military Radio**

Block Diagram

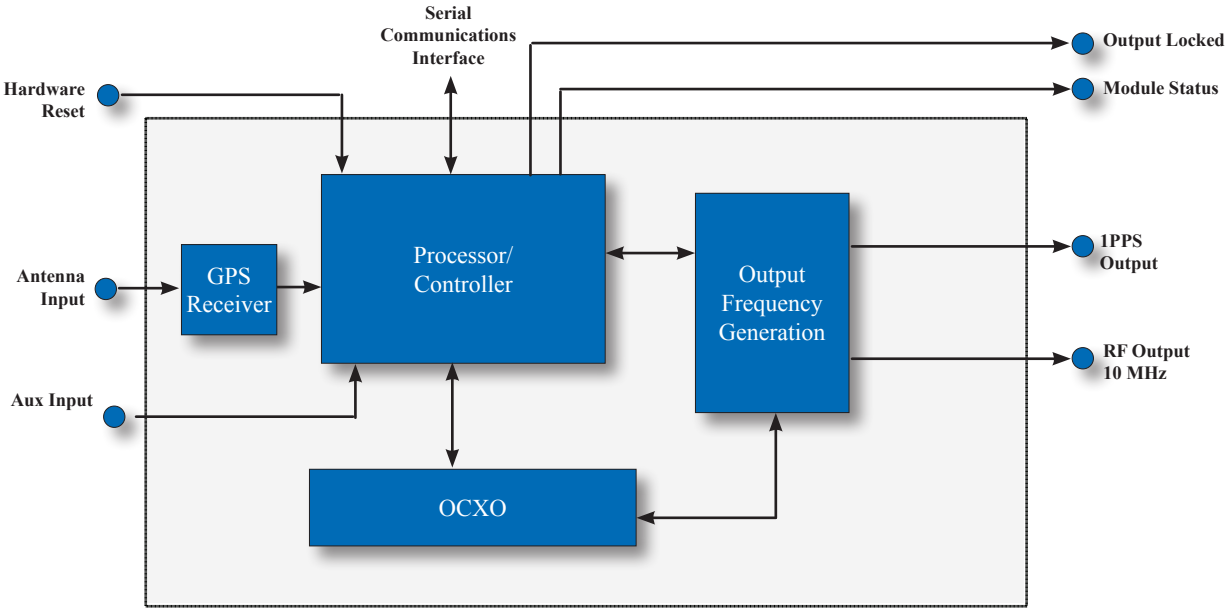


Figure 1. *Functional Block Diagram*

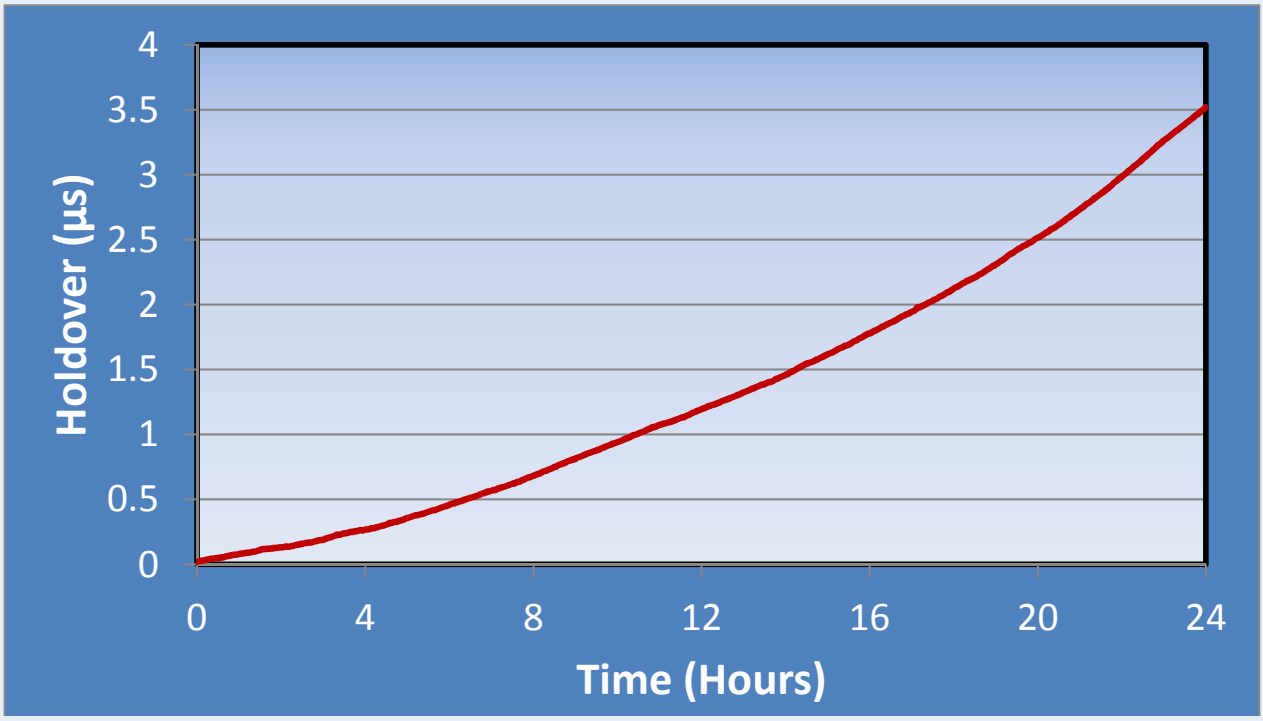
Summary Specifications

Comparitive Performance of Standard Modules		
Model	**Embedded Oscillator**	**Typical Uses**
MD-2610-EXE-OCXO-10M0000000	OCXO	Applications requiring a GPS disciplined clock with holdover below 1.5 us in 4 hours
MD-2610-EXJ-HPTC-10M0000000	Precision TCXO	Applications requiring 50 ppb stability when not disciplined to GPS

Hold Over Performance [1]							
Hold Over Time	**10 min**	**1 hr**	**1 hr**	**4 hr**	**4 hr**	**24hr**	**24 hr**
Hold Over Temperature Change	**ΔT= 2 °C**	**ΔT= 2 °C**	**ΔT= 10 °C**	**ΔT= 2 °C**	**ΔT= 10 °C**	**ΔT= 2 °C**	**ΔT= 10 °C**
Model		**Maximum Accumulated Hold Over in us**					
MD-2610-EXE-OCXO-10M0000000	.03	0.3	1	1.5	4	8	20
MD-2610-EXJ-HPTC-10M0000000	3	40	75	100	300	1000	2500

Summary Performance Characteristics									
Model	**Warm Up Time (min-utes)**	**Aging / day (ppb)[1]**	**Temperature Stability (ppb)[1]**	**Module Height (mm)**	**1 pps precision (rms)[2] (ns)**	**Accuracy at 24 hours[3]**	**Warm up Power @ 25 °C (W)**	**Steady State Power @ 25 °C (W)**	**Voltage (V)**
MD-2610-EXE-OCXO-10M0000000	5	0.2	1 ppb (-10 to 85°C) 4 ppb (-40 to -10°C)	14	20	1E-12	3.5	1.5	3.3
MD-2610-EXJ-HPTC-10M0000000	5	10	50	14	100	1E-10	0.33	0.33	3.3

Phase Noise/ AVAR							
	-10 Hz	-100 Hz	-1 kHz	-10 kHz	-100 kHz	AVAR (τ=1s)	AVAR (τ=10s)
MD-2610-EXE-OCXO-10M0000000	-120	-130	-145	-150	-150	3E-11	5E-11
MD-2610-EXJ-HPTC-10M0000000	-90	-115	-140	-155	-155	5E-10	5E-10



Measured accumulated phase error at 25 °C

Specifications

Internal Receiver Characteristics					
Parameter					**Condition**
Type	Timimg w/ Auto Position Lock				
Number of channels	34				
Frequency band	GPS L1 C/A				
	SBAS L1 C/A				WAAS, MSAS, EGNOS, GAGAN
	GLONASS L1 OF				
	Galilieo				Firmware update will be required
Tracking capability	12 satellites - GPS 34 satellites all GNSS source				
Position Accuracy	< 2.5 m CEP				Open sky. 24 hours
TTFF (receiver - position only)	<5 seconds				HOT (currrent almanac, position, time and ephemeris)
	<35 seconds				Warm (current almanac, position, time)
	< 35 seconds				Cold (no data)
GPS Antenna					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Antenna Voltage[4]	0	3.3	5.5	V_{DC}	3.3 or 5V antenna operation supported - pin 21
Antenna Current		20	100	mA	see protocol for short circuit protection
RF Output Waveform Characteristics					
Waveform	LVCMOS				
High Level Output Voltage (V_{OH})	90		100	$\%V_{cc}$	
Low Level Output Voltage (V_{OL})		0.0	20	$\%V_{cc}$	
Rise/Fall Time		3	5	nSec	15 pFll10kOhm
Duty Cycle	40	50	60	%	15 pFll10kOhm
1pps Output Characteristics					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Waveform	LVCMOS				
High-level output voltage (V_{OH})	90		100	$\%V_{CC}$	15 pFll10kOhm
Low-level output voltage (V_{OL})		0.0	20	$\%V_{CC}$	15 pFll10kOhm
Pulse Width		10		us	
Aux 1pps input Characteristics					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Waveform	LVCMOS, TTL				
High-level input voltage (V_{iH})	2.4		5	VDC	15 pFll10kOhm
Low-level input voltage (V_{IL})		0.0	0.3	VDC	15 pFll10kOhm

Specifications

Lock Status Indicator					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Module Locked	90		100	$\%V_{cc}$	15 pFll10kOhm
Module Not Locked	0		20	$\%V_{cc}$	15 pFll10kOhm
Module Hardware OK Indicator					
Module Hardware OK	90		100	%Vcc	15 pFll10kOhm
Module Hardware Failure	0		20	%Vcc	15 pFll10kOhm
Module Hardware Reset					
Reset Module	0		0.5	V_{DC}	10 kOhm internal pullup
Serial Communications Interface					
Rx high-level input voltage (V_{IH})	90		100	%Vcc	
Rx low-level input voltage (V_{IL})	0		20	%Vcc	
Tx high-level output voltage (V_{OH})	90		100	%Vcc	
Tx low-level output voltage (V_{OL})	0		20	%Vcc	
Baud rate		115.2		kBaud	8N1
Communications Protocol		Vectron Binary/NMEA 0183			See VSIP Command List for Full Details
Pulse width	10			usec	
Supply Voltage					
Supply voltage (Vcc)	+3.15	+3.3	+3.4	V_{DC}	
Absolute Maximum Ratings					
Supply voltage (Vcc)			3.5	V_{DC}	
Dc voltage on any I/O pin			4.0	V_{DC}	
Output load	1			kOhms	
AC ripple			50	mVpk-pk	10Hz to 1MHz

Environmental Conditions					
Parameter	**Min**	**Typical**	**Max**	**Units**	**Condition**
Operating temperature	see ordering information for avaialble ranges				
Humidity @ 40˚C			90	%	
Storage Temperature	-55		+125	˚C	
Physical Characteristics					
			120	g	

Reliability

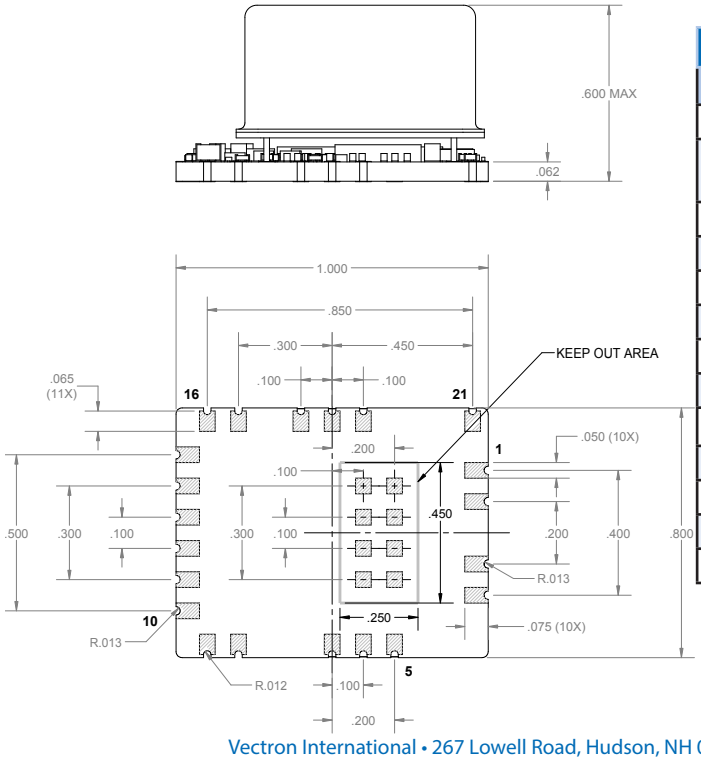
VI qualification includes aging various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The MD-261 family is capable of meeting the following qualification tests:

Environmental Compliance	
Parameter	**Conditions**
Mechanical shock	MIL-STD-202, Method 213 condition B
Mechanical vibration	MIL-STD-202, Method 204 condition A
Resistance to solvents	MIL-STD-202, Method 215

Although ESD protection circuitry has been designed into the MD-261 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged-device model (CDM) for ESD susceptibility testing and design protection evaluation.

ESD Ratings		
Model	**Minimum**	**Conditions**
Human body model	1500 V	MIL-STD-833, Method 3015
Charged device model	1000 V	JEDEC, JESD22-C101

Package Outline



21 Pin I/O Connections		
Number	**Name**	**Description**
1,2	Vcc	Power Supply
3,4,5,7,10,15,18,20	GND	Module Ground
6	RFOUT	HCMOSRF Output
8	Rx	Serial Communications Receive
9	Tx	Serial Communications Transmit
11	Reserved	Do not connect - Float
12	Reset	Hardware reset
13	Status	Logic low = Failure with module operation
14	Locked	Logic-high = Output locked to GPS
16	PPS Out	Pulse Per Second Out
17	PPS in	LVCMOS, LVTTL
19	ANT	GPS antenna input
21	VCC ANT	Active Antenna Supply

Accessories

Vectron Partnumber	Description
MD-261-EK	MD-261X-XXX-XXXX Module with Evaluation Kit

Ordering Information Instructions

The MD-261 series of GNSS disciplined oscillators has multiple options with embedded OCXOs and TCXOs. Options are created to optimize customer hold over requirements while meeting pricing needs. Customization to unique customer requirements is available and is common for this level of integration. Common customizations include alternate output frequencies, temperature ranges, differing values and methods of hold over specification. Not all combinations of codes are available.

Ordering Information

MD - 261 0 - E X E - OCXO - 10M0000000

Product Family
MD: Precision Modules

Package
20x25.4 mm

Height
0: 14 mm

Supply Voltage
E: +3.3 V

RF Output Code
X: standard outputs per specification

Temperature Range
D: -40°C to +70°C
E: -40°C to +85°C
J: -20°C to +70°C
T: 0°C to +70°C

Embedded Oscillator
HPTC (High Precision TCXO)
OCXO (Oven Controlled XO)

Frequency

Notes

1) Holdover and aging performance is after 7 days of power-on time. Temperature and aging rates are when device is not locked. Performance measured in still air. 1 ppb temperature stability is measured in factory, however due to internal heating and variations in airflow, -40 to -10 °C values vary in the differing environments . The MD-2610-EXE-OCXO-10M0000 may vary by as much as 4ppb, unlocked, ove
2) After customer applies offset corrected using cable delay command while locked, after 24 hours of locked operation
3) Allan Variance at τ=86400s while locked, after 24 hours of locked operation
4) Antenna supply pin at pin 21 is an input voltage from customer. Vectron couples the DC input voltage to the rf signal of the GPS signal. The customer does not need to provide any additional blocking or coupling circuitry.

For Additional Information, Please Contact

USA:
Vectron International
267 Lowell Road
Hudson, NH 03051
Tel: 1.888.328.7661
Fax: 1.888.329.8328

Europe:
Vectron International
Landstrasse, D-74924
Neckarbischofsheim, Germany
Tel: +49 (0) 7268.801.100
Fax: +49 (0) 7268.801.282

Asia:
Vectron International
1F-2F, No 8 Workshop, No 308 Fenju Road
WaiGaoQiao Free Trade Zone
Pudong, Shanghai, China 200131
Tel: 86.21.5048.0777
Fax: 86.21.5048.1881

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