

Helping Customers Innovate, Improve &amp; Grow


**MD-261**

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 26 channel receiver that is both GPS and GLONASS compatible, and provides an HCMOS 10 MHz 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
- 1pps HCMOS output signals standard
- 10MHz HCMOS output standard
- 1 pps external reference 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

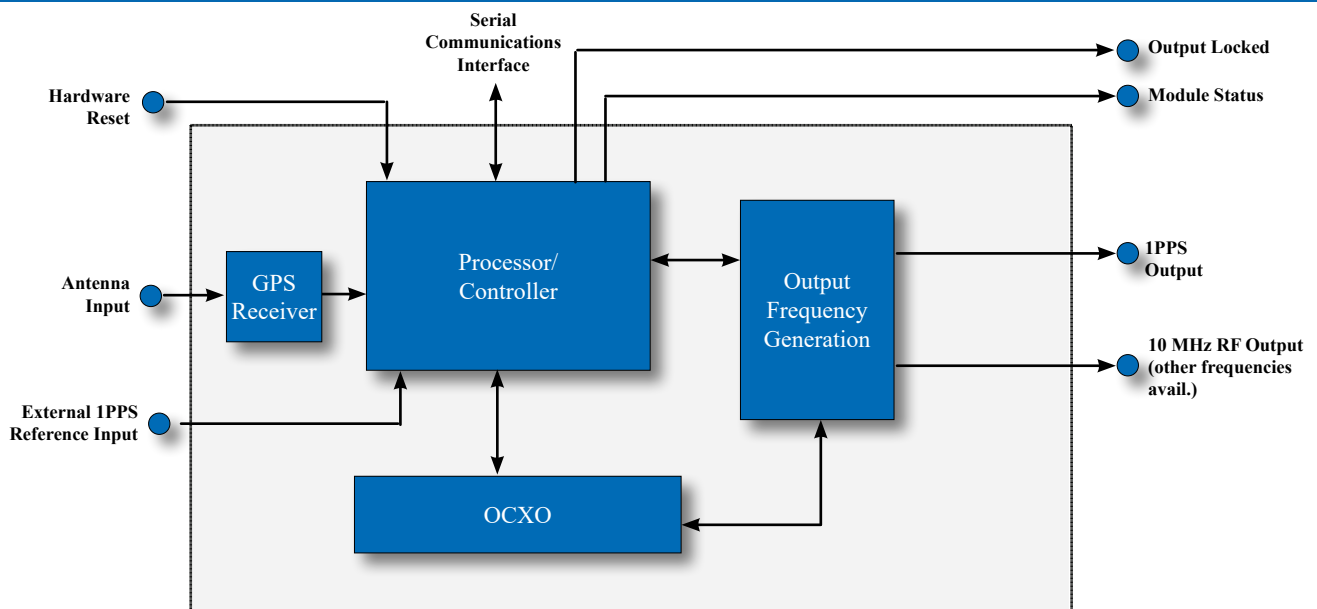
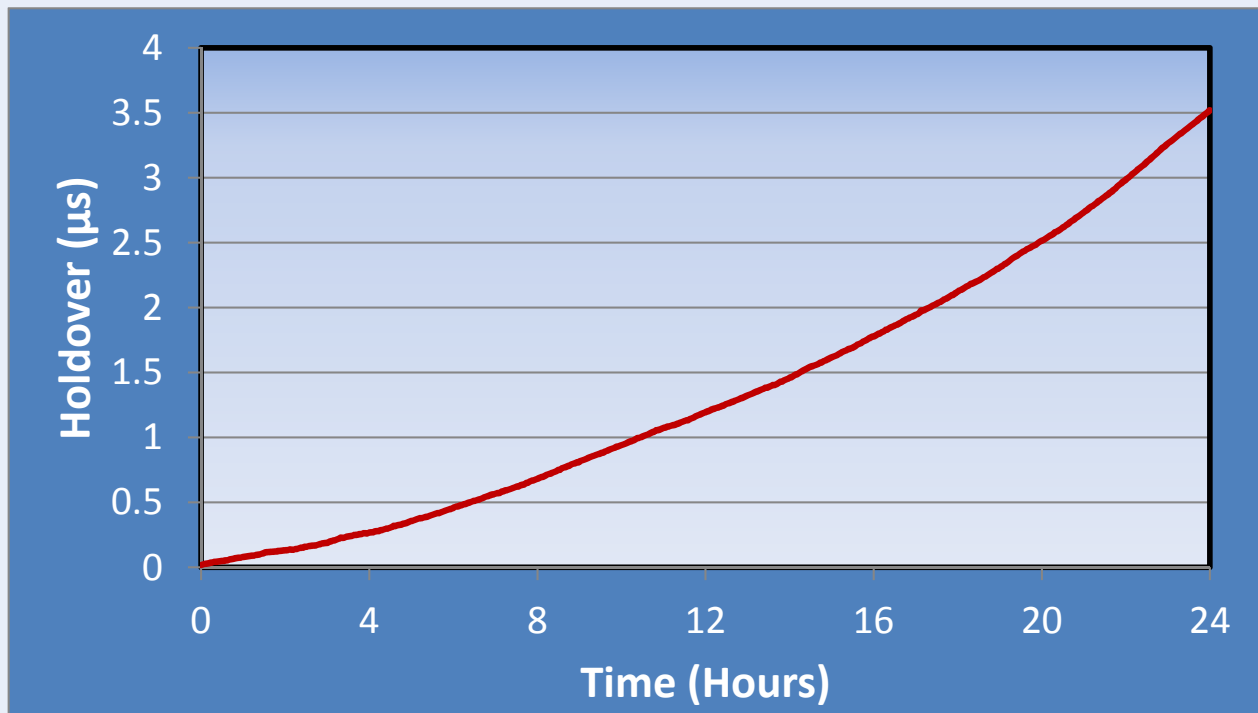


Figure 1. Functional Block Diagram

## Summary Specifications

Comparitive Performance of Standard Modules								
Model	Embedded Oscillator							
MD-2610-EXE-OCXO-10M0000000	OCXO							
MD-2610-EXJ-HPTC-10M0000000	Precision TCXO							
Hold Over Performance <sup>1</sup>								
Hold Over Time	10 min	1 hr	4 hr	4 hr	24hr	24 hr		
Hold Over Temperature Change	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$		
Model								
MD-2610-EXE-OCXO-10M0000000	.03	1	1.5	4	8	20		
MD-2610-EXJ-HPTC-10M0000000	3	75	100	300	1000	2500		
Summary Performance Characteristics								
Model	Warm Up Time (minutes)	Aging / day (ppb) <sup>1</sup>	Temperature Stability (ppb) <sup>1</sup>	1 pps precision (rms) <sup>2</sup> (ns)	Accuracy at 24 hours <sup>3</sup>	Warm up Power @ 25 °C (W)	Steady State Power @ 25 °C (W) Typical	Voltage (V)
MD-2610-EXE-OCXO-10M0000000	5	0.2	1 ppb (-10 to 85°C) 4 ppb (-40 to -10°C)	20	1E-12	3.5	1.5	3.3
MD-2610-EXJ-HPTC-10M0000000	5	10	50	100	1E-10	0.66	0.43	3.3
Phase Noise/ ADEV								
	-10 Hz	-1 kHz	-10 kHz	-100 kHz	ADEV ( $\tau=1s$ )	ADEV ( $\tau=10s$ )		
MD-2610-EXE-OCXO-10M0000000	-120	-145	-150	-150	3E-11	5E-11		
MD-2610-EXJ-HPTC-10M0000000	-90	-140	-155	-155	5E-10	5E-10		



Measured accumulated phase error at 25 °C

# Specifications

Internal Receiver Characteristics					
Parameter					Condition
Type	Timing w/ Auto Position Lock				
Number of channels	26				
Frequency band	GPS L1 C/A				
	SBAS L1 C/A				WAAS, MSAS, EGNOS, GAGAN
	GLONASS L1 OF				
	Galileo				Firmware update will be required
Tracking capability	12 satellites - GPS 26 satellites all GNSS source				
Position Accuracy	< 2.5 m CEP				Open sky. 24 hours
TTFF (receiver - position only)	<5 seconds				HOT (current 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 <sup>4</sup>	0	5.0	5.5	V <sub>DC</sub>	3.3 or 5V antenna operation supported - pin 21
Antenna Current		20	100	mA	
RF Output Waveform Characteristics					
Waveform	LVCMOS				
High Level Output Voltage (V <sub>OH</sub> )	90		100	%V <sub>CC</sub>	
Low Level Output Voltage (V <sub>OL</sub> )		0.0	20	%V <sub>CC</sub>	
Rise/Fall Time		3	5	nSec	15 pF  10kOhm
Duty Cycle	40	50	60	%	15 pF  10kOhm
1pps Output Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Waveform	LVCMOS				
High-level output voltage (V <sub>OH</sub> )	90		100	%V <sub>CC</sub>	15 pF  10kOhm
Low-level output voltage (V <sub>OL</sub> )		0.0	20	%V <sub>CC</sub>	15 pF  10kOhm
Pulse Width		10		us	
External 1pps Reference input Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Waveform	LVCMOS, TTL				
High-level input voltage (V <sub>IH</sub> )	2.4		3.6	VDC	15 pF  10kOhm
Low-level input voltage (V <sub>IL</sub> )		0.0	0.3	VDC	15 pF  10kOhm
Pulse Width	5			us	

## Specifications

Lock Status Indicator					
Parameter	Min	Typical	Max	Units	Condition
Module Locked	90		100	%V <sub>CC</sub>	15 pFII10kOhm
Module Not Locked	0		20	%V <sub>CC</sub>	15 pFII10kOhm
Module Hardware OK Indicator					
Module Hardware OK	90		100	%V <sub>CC</sub>	15 pFII10kOhm
Module Hardware Failure	0		20	%V <sub>CC</sub>	15 pFII10kOhm
Module Hardware Reset					
Reset Module	0		0.5	V <sub>DC</sub>	10 kOhm internal pullup
Serial Communications Interface					
Rx high-level input voltage (V <sub>IH</sub> )	90		100	%V <sub>CC</sub>	
Rx low-level input voltage (V <sub>IL</sub> )	0		20	%V <sub>CC</sub>	
Tx high-level output voltage (V <sub>OH</sub> )	90		100	%V <sub>CC</sub>	
Tx low-level output voltage (V <sub>OL</sub> )	0		20	%V <sub>CC</sub>	
Baud rate		115.2		kBaud	8N1
Communications Protocol	VSIP/NMEA 0183			See VSIP Command List for Full Details	
Supply Voltage					
Supply voltage (V <sub>CC</sub> )	+3.15	+3.3	+3.4	V <sub>DC</sub>	
Absolute Maximum Ratings					
Supply voltage (V <sub>CC</sub> )			3.5	V <sub>DC</sub>	
Dc voltage on any I/O pin			4.0	V <sub>DC</sub>	
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 available ranges				
Humidity @ 40°C			90	%	
Storage Temperature	-55		+125	°C	
Physical Characteristics					
Weight			15	g	

## Environmental

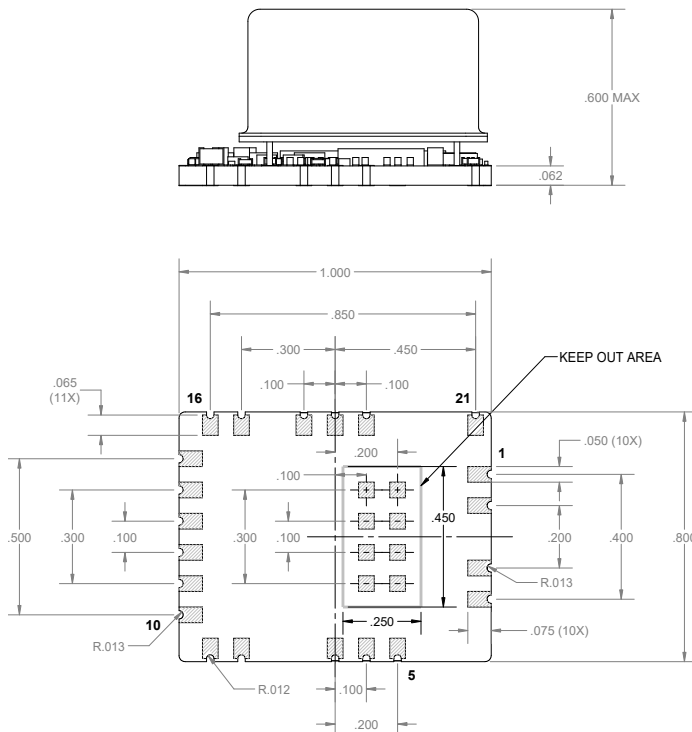
Environmental Compliance	
Parameter	Conditions
Mechanical shock	MIL-STD-202, Method 213 condition B
Mechanical vibration	MIL-STD-202, Method 204 condition A
Resistance to solvents	MIL-STD-202, Method 215

## Handling Precautions

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

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
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, LVTTTL
19	ANT	GPS antenna input
21	VCC ANT	Active Antenna Supply

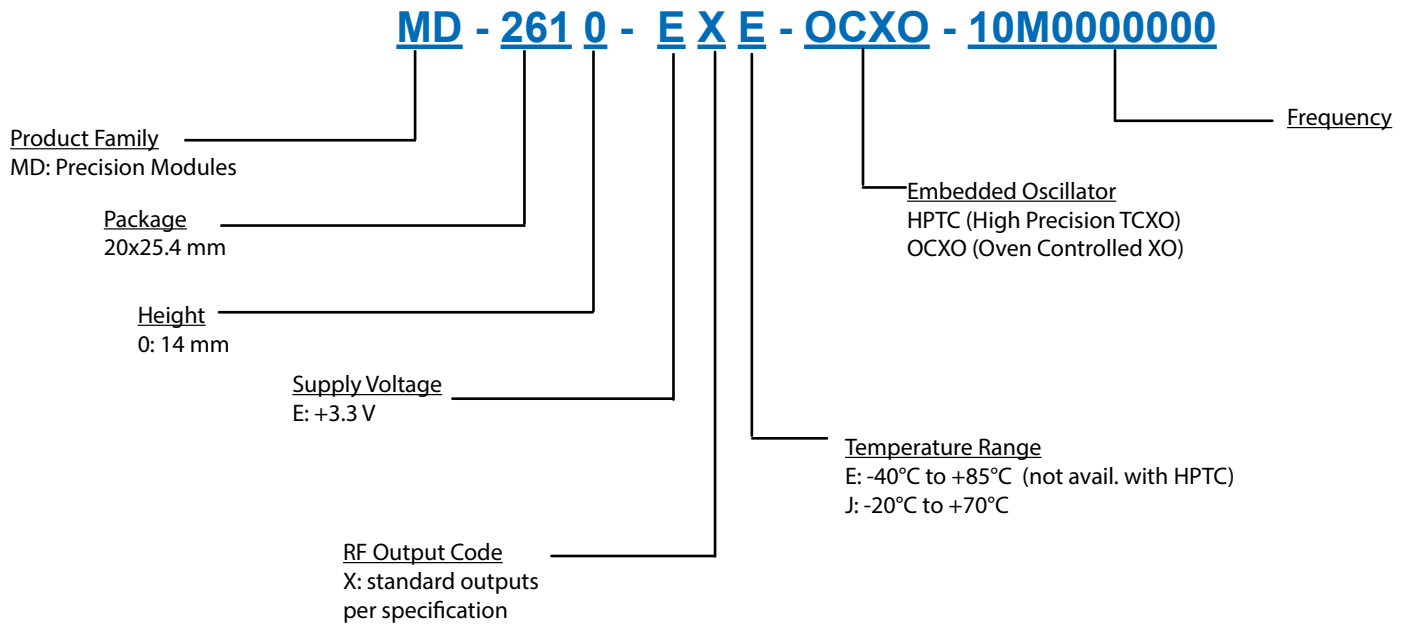
## Accessories

Microsemi 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



## 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, over temperature.
- 2) After customer applies correct offset using cable delay command while locked, after 24 hours of locked operation.
- 3) ADEV at  $\tau=86400s$  while locked, after 24 hours of locked operation.
- 4) Antenna supply pin at pin 21 is an input voltage from customer. The DC input voltage is coupled to the RF signal of the GPS signal. The customer does not need to provide any additional blocking or coupling circuitry.



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