

Helping Customers Innovate, Improve & Grow



The MD-174 is a Vectron GNSS disciplined module. It is a fully integrated GNSS disciplined oscillator module in a compact surface mount 40 x 50 mm footprint. The module has an embedded 34 channel receiver that is both GPS and GLONASS compatible and provides a sinewave 10 MHz and HCMOS 1 pps output. An onboard OCXO provides stability in the unlocked mode. The module operates from -40 °C to +85 °C.

Features

- Embedded GNSS Receiver - GPS and Glonass Compatible
- Field upgradeable for Galileo in 2017
- 1pps HCMOS output signal standard
- 10MHz sinewave output standard
- Modified NMEA (VSIP)
- Evaluation kit with software available
- -135 dBc/Hz phase noise at 10 Hz offset
- -170 dBc/Hz phase noise floor

Applications

- Radar systems
- Digital Video Broadcast
- E911 Location Systems
- General Timing and Synchronization
- Military Radio

Block Diagram

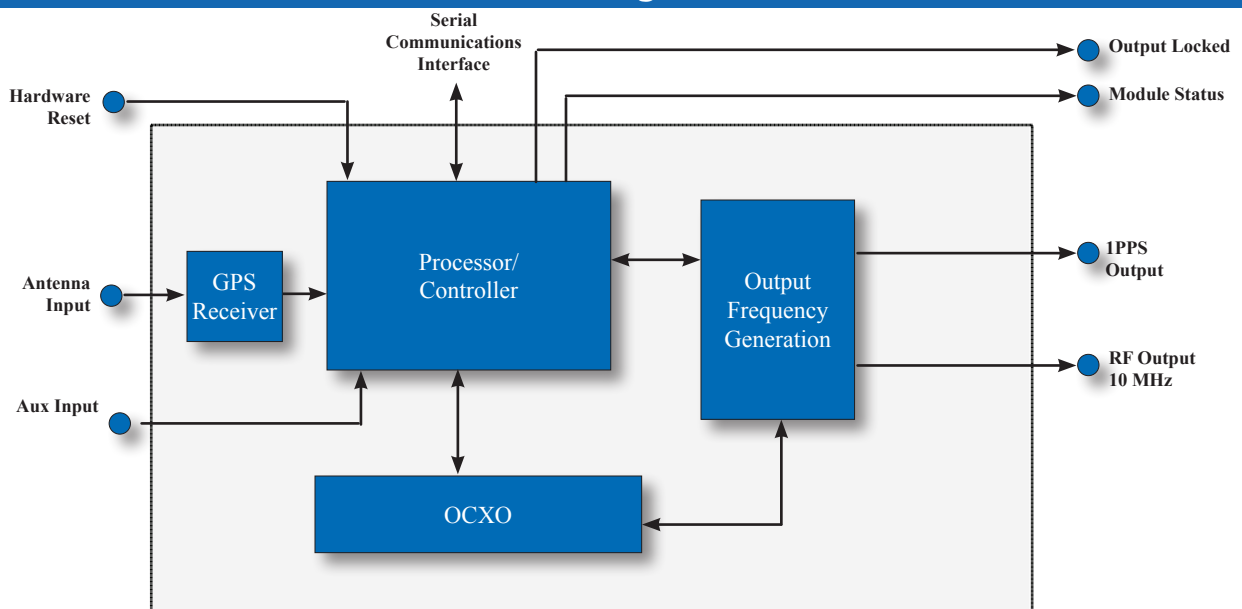


Figure 1. Functional Block Diagram

Summary Specifications

Hold Over Performance ¹

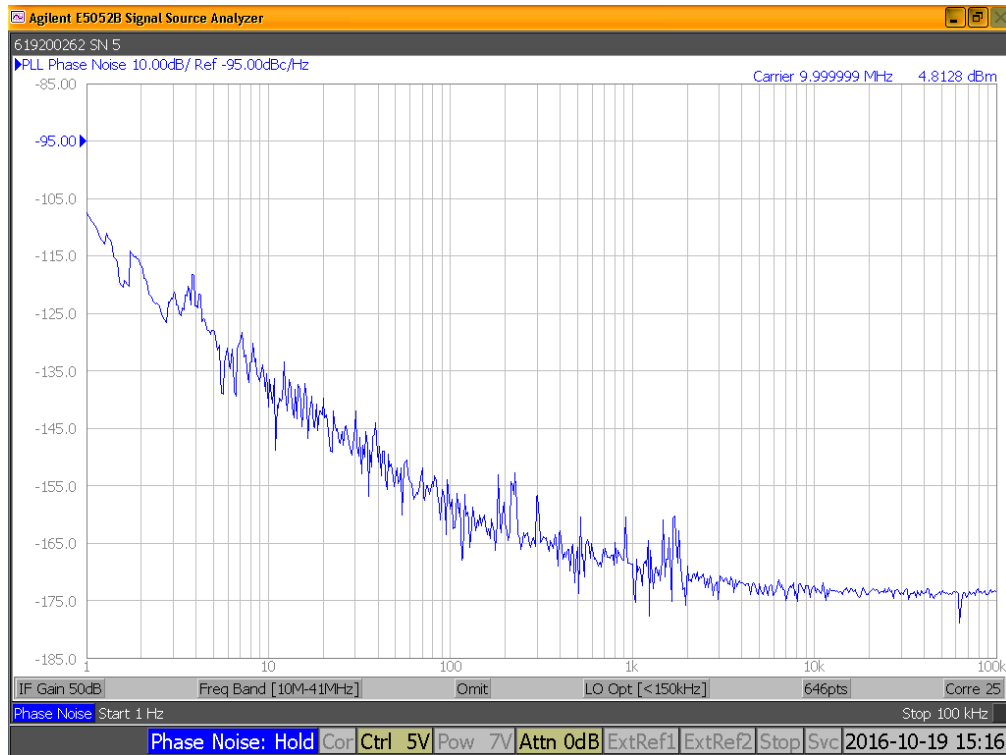
Hold Over Time	10 min	1 hr	1 hr	4 hr	4 hr	24hr	24 hr
Hold Over Temperature Change	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$	$\Delta T = 2\text{ }^{\circ}\text{C}$	$\Delta T = 10\text{ }^{\circ}\text{C}$
Model	Maximum Accumulated Hold Over in us						
MD-1740-DXE-DAOC-10M0000000	0.3	1.8	7.2	8.0	20	15	30

Summary Performance Characteristics

Model	Warm Up Time (minutes)	Aging / day (ppb) ¹	Temperature Stability (ppb)	Module Height (mm)	Accuracy to UTC (+/-1 σ) (ns) ²	Accuracy (+/-) ³	Warm up Power @ 25 $^{\circ}\text{C}$ (W)	Steady State Power @ 25 $^{\circ}\text{C}$ (W)	Voltage (V)
MD-1740-DXE-DAOC-10M0000000	5	0.5	5	25	20	1E-12	4.5	2.8	5.0 V analog/ 3.3V digital

Phase Noise/ ADEV

	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	ADEV $\tau=1\text{s}$	ADEV $\tau=10\text{s}$		
at 10 MHz	-135	-155	-165	-170	-170	1E-11	5E-11		



Specifications

Internal Receiver Characteristics					
Parameter					Condition
Type	Timing 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				
	Galileo				Firmware update will be required
Tracking capability	12 satellites				
sensitivity tracking	-161 dBm				
sensitivity acquisition	-147 dBm				
Position Accuracy	< 2.5 m CEP				Open sky. 24 hours
TTFF	<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 Input Voltage ⁴	2.6	3.1	5.5	V _{DC}	3.3 or 5V antenna operation supported - pin 6
Antenna Current		20	100	mA	see protocol for under current flag and short circuit protection
RF Output Waveform Characteristics					
Waveform	Sinewave				
Load		50		Ω	
Output Power	+3	+5	+7	dBm	
Harmonics			-30	dBc	
Spurious			-80	dBc	
1pps Output Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Waveform	LVCMOS				
High-level output voltage (V _{OH})	3.0		3.4	V _{DC}	> 100 Ohms
Low-level output voltage (V _{OL})		0.0	0.4	V _{DC}	> 100 Ohms
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 pF 10kOhm
Low-level input voltage (V _{IL})		0.0	0.3	VDC	15 pF 10kOhm

Specifications

Lock Status Indicator					
Parameter	Min	Typical	Max	Units	Condition
Module Locked	90		100	%V _{CC}	
Module Not Locked	0		20	%V _{CC}	
Module Hardware OK Indicator					
Module Hardware OK	90		100	%V _{CC}	
Module Hardware Failure	0		20	%V _{CC}	
Module Hardware Reset					
Reset Module	0		0.5	V _{DC}	2 kOhm internal pullup
Serial Communications Interface					
Rx high-level input voltage (V _{IH})	2.8			V _{DC}	
Rx low-level input voltage (V _{IL})	-0.5	0.0	0.5	V _{DC}	
Tx high-level output voltage (V _{OH})	3.15	3.3		V _{DC}	
Tx low-level output voltage (V _{OL})	-0.2	0.0	0.2	V _{DC}	
Update rate		1		Hz	
Communications Protocol	Vectron Binary/NMEA 0183				See VSIP Command List for Full Details
Pulse width ⁷	10			uSec	
Supply Voltage					
Supply voltage (V _{CC})	+4.75	+5.0	+5.25	V _{DC}	
Supply voltage (Dig V _{CC})	+3.0	+3.3	+3.4	V _{DC}	
Absolute Maximum Ratings					
Supply voltage (V _{CC})			6	V _{DC}	
Dc voltage on any I/O pin			3.9	V _{DC}	
Output load	100			Ohms	
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			120	g	
g-sensitivity		1		ppb/g	10 to 1000 Hz

Reliability

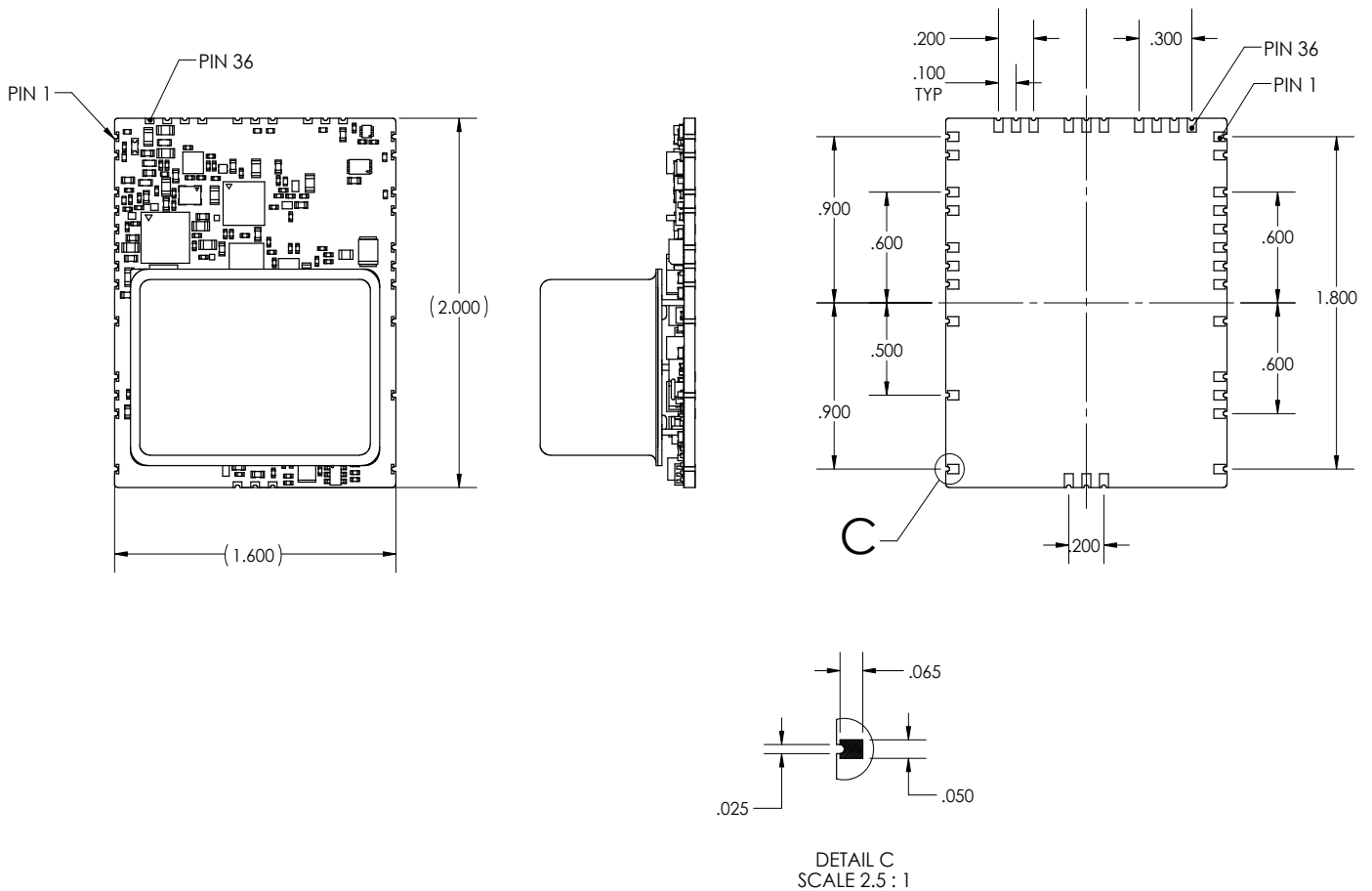
VI qualification includes aging various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The MD-171 family is capable of meeting the following qualification tests:

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-171 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-883, Method 3015
Charged device model	1000 V	JEDEC, JESD22-C101

Package Outline

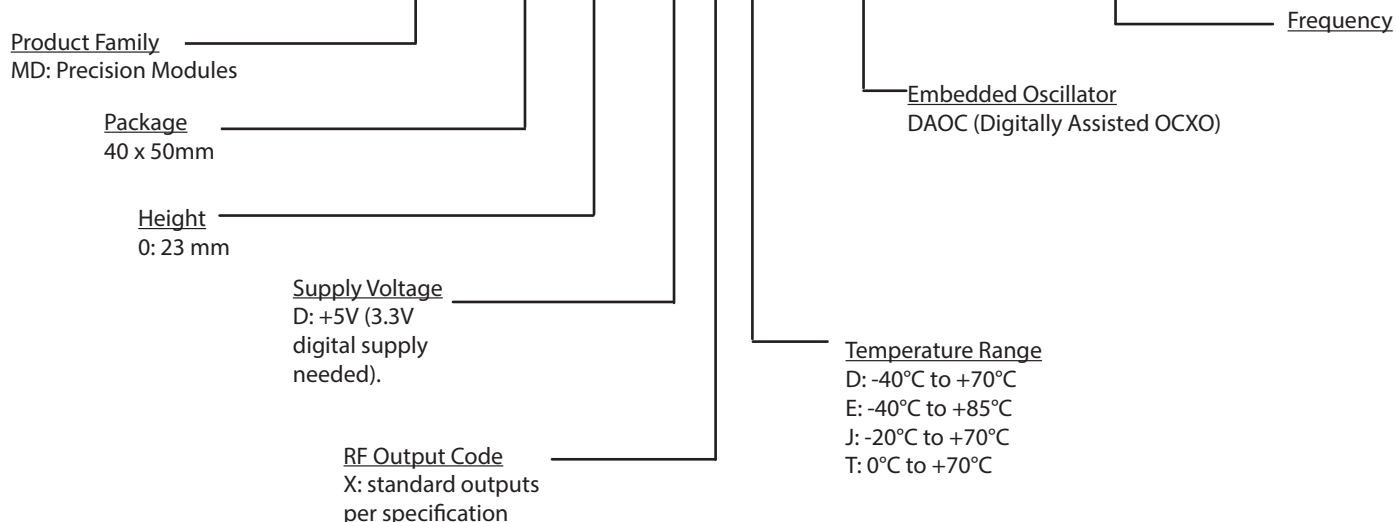


Pin Configuration

36 Pin I/O Connections		
Number	Name	Description/comment
1	PPS_OUT	1 pps output
2	REF_IN	Reference input
3,5,7,20,26,36	D_GND	Digital Ground
4	ANT_IN	Antenna
6	VCC_ANT	Antenna Supply
8,27	D_VCC	Digital 3.3V supply
9,12,13,14,16,17,18,19	A_GND	Analog Ground
10,11	A_VCC	Analog 5.0V supply
15	RF_OUT	Sinewave or CMOS (see ordering code)
21,22,29,32,33,34,35	N/C	Do not connect - leave floating
23	RX_IN	Data in - internal pull up
24	TX_OUT	data out
25	AUXIO	
28	MOD_RST	Pull up - active low
30	STATUS	pull down
31	LOCK	pull down

Ordering Information

MD - 174 0 - DX E - DAOC - 10M0000000



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
- 2) After customer applies offset corrected using cable delay command while locked, after 24 hours of locked operation
- 3) Allan Variance at $\tau=86400s$ 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.

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