

MD-175

High Stability GNSS Disciplined Module



Summary

The MD-175 is a fully integrated GNSS disciplined oscillator module in a compact, surface-mount 40 × 50 mm footprint. The module can generate sine wave or 10 MHz CMOS, and 1 PPS HCMOS outputs and can be disciplined to an embedded 72-channel receiver that supports GPS, GLONASS and Galileo. An on-board precision OCXO provides high stability in unlocked mode and enables excellent holdover. The module can also operate over a temperature range of -40°C to +85°C

Features

- Embedded GNSS receiver—GPS, Galileo, GLONASS and BeiDou
- 1 PPS LVCMOS output signal
- 10 MHz sine wave RF output
- Other RF output frequencies available
- Serial communication interface
- NMEA 0183 V4.1
- Adaptive aging correction during holdover
- Barometric pressure correction
- Evaluation kit with software

Applications



Airborne



Vehicle Platforms



Radar Systems



LTE and LTE Advanced (LTE-A)



Laboratory Testing



Base Stations



MILSATCOM



Navigation and Position Systems



Radio Communications



UAV/UAS

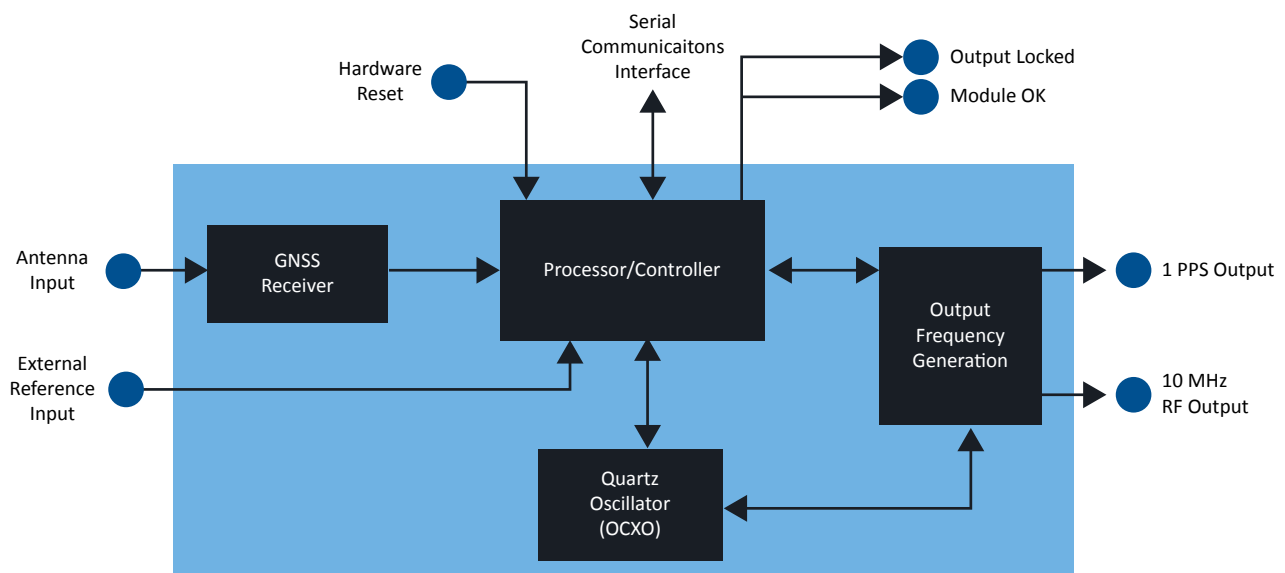


Manufacturing Testing



Time Synchronization

Functional Block Diagram



Summary Specifications

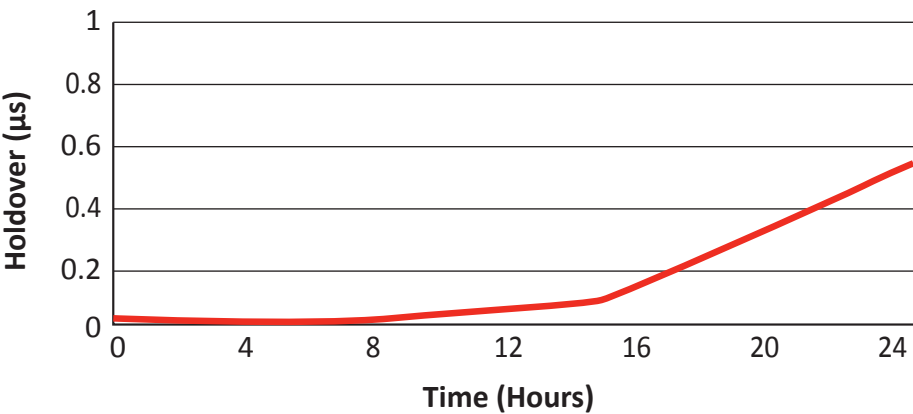
Holdover Performance 1

Holdover Time	10 Minutes	1 Hour	1 Hour	24 Hours
Holdover Temperature Change	$\Delta T = 2^{\circ}\text{C}$	$\Delta T = 2^{\circ}\text{C}$	$\Delta T = 10^{\circ}\text{C}$	$\Delta T = 2^{\circ}\text{C}$
Model	Maximum Accumulated Holdover (μs)			
MD-175	0.05	0.24	0.4	15 E7 option 1.5 40E7 option 4.0

Summary Performance Characteristics

Model	Warmup Time (Min)	Aging/Day (ppb) ¹	Temperature Stability (ppb)	Accuracy to UTC (+/- 1 σ) (ns) ²	Frequency Accuracy (+/-) ³	Warmup Power @ 25°C (W)	Steady State Power @ 25°C (W)	Voltage (V)
MD-175	7	0.06	0.4	10	< 1E-12	4.5	2.0	5V analog 3.3V digital

Phase Noise and ADEV								
Model	-10 Hz	-100 Hz	-1 kHz	-10 kHz	-100 kHz	ADEV (t=1s)	ADEV (t=10s)	Condition
MD-175	-125	-140	-145	-145	-145	5E-12	1E-11	at 10 MHz



Internal Receiver Characteristics		
Parameter	Value	Condition
Type	Timing	Mobile, self-survey or fixed position
Number of Channels	72	
Frequency Bands	GPS L1C/A	
	GLONASS L1OF	
	Galileo E1B/C	
	QZSS L1C/A	
	SBAS L1C/A	Disabled by default
Tracking Capability	36 SVs	
Sensitivity	-167 dBm	Tracking (GPS and GLONASS)
	-148 dBm	Cold acquisition (GPS and GLONASS)
	-160 dBm	Reacquisition (GPS and GLONASS)
Position Accuracy	2.5m CEP	GPS and GLONASS, static, -130 dBm, > 6 SVs
TTF	25s	Cold start (GPS and GLONASS)

GPS Antenna Specifications					
Parameter	Min	Typical	Max	Units	Condition
Antenna Input Voltage ⁴	2.6	5.0	5.5	VDC	
Antenna Current		20	100	mA	

RF Output Waveform Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Waveform	Sinewave				
Load		50		Ohms	
Output Power	+3.0		+7	dBm	
Harmonics			-30	dBc	
Spurious			-80	dBc	
Waveform	LVCMOS				
Load		15		pF	
High-Level Output Voltage (VOH)	2.4		3.4	VDC	15 pFII, 10 kOhm
Low-Level Output Voltage (VOL)		0.0	0.4	VDC	15 pFII, 10 kOhm
Duty Cycle	45		55	%	15 pFII, 10 kOhm

1 PPS Output Characteristics					
Parameter	Min	Typical	Max	Units	
Waveform	LVCMOS				
High-Level Output Voltage (VOH)	3.0		3.4	VDC	> 100 Ohms
Low-Level Output Voltage (VOL)		0.0	0.4	VDC	> 100 Ohms
Pulse Width	10 ns to 99.999 ms				User programmable

External 1 PPS Reference Input Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Waveform	LVCMOS, TTL				
High-Level Output Voltage (VOH)	2.4		3.5	VDC	15 pFII, 10 kOhm
Low-Level Output Voltage (VOL)		0.0	0.4	VDC	
Pulse Width	10			μs	

Lock Status Indicator					
Parameter	Min	Typical	Max	Units	Condition
Module Locked	90		100	% VCC	
Module Not Locked	0		20	% VCC	

Module Hardware OK Indicator					
Parameter	Min	Type	Max	Units	Condition
Module Hardware OK	90		100	%VCC	
Module Hardware Failure	0		20	%VCC	

Module Hardware Reset					
Parameter	Min	Type	Max	Units	Condition
Reset Module	0		0.5	VDC	10 kOhm internal pullup

Serial Communications Interface					
Parameter	Min	Typical	Max	Units	Condition
Rx High-Level Input Voltage (VIH)	2.8			VDC	
Rx Low-Level Input Voltage (VIL)	0.5	0.0	0.5	VDC	
Tx High-Level Output Voltage (VOH)	3.15	3.3	3.4	VDC	
Tx Low-Level Output Voltage (VOL)	-0.2	0.0	0.2	VDC	
Update Rate		1		Hz	
Communications Protocol	VSIP2.1/NMEA 0183 V4.1				See VSIP2.1 for full details

Supply Voltage					
Parameter	Min	Typical	Max	Units	Condition
Supply Voltage (VCC)	+4.75	+5.0	+5.25	VDC	
Supply Voltage (Digital VCC)	+3.0	+3.3	+3.4	VDC	

Absolute Maximum Ratings					
Parameter	Min	Typical	Max	Units	Condition
Supply Voltage (VCC)			6	VDC	
Supply Voltage (Digital VCC)			3.5	VDC	
DC Voltage on Any I/O Pin			3.9	VDC	
Output Load	100			Ohms	
AC Ripple			50	mV pk-pk	10 Hz to 1 MHz

Environmental Conditions					
Parameter	Min	Typical	Max	Units	Condition
Operating Temperature	-40		+85	°C	
Humidity @ 40°C			90	%	
Storage Temperature	-55		+125	°C	

Physical Characteristics					
Parameter	Min	Typical	Max	Units	Condition
Weight			43	g	
g-Sensitivity		1		ppb/g	10 to 1,000 Hz

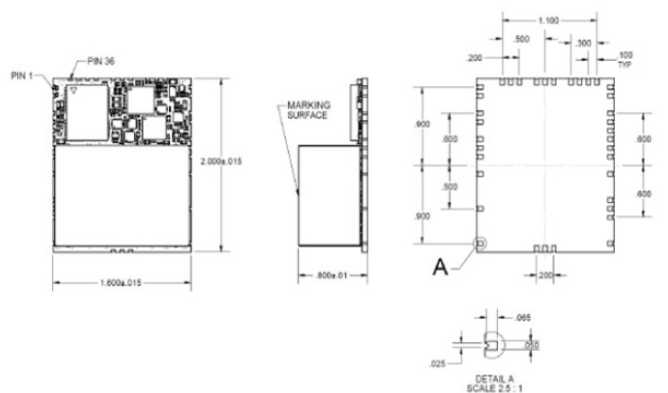
Environmental Compliance	
Parameter	Conditions
Mechanical Shock	MIL-STD-202, Method 213 Condition B
Mechanical Vibration	MIL-STD-202, Method 204 Condition A
Resistance to Solvents	MIL-STD-202, Method 215

Although ESD protection circuitry has been designed into the MD-175, proper precautions should be taken when handling and mounting. Microchip employs a Human Body Model (HBM) and a Charged-Device Model (CDM) for ESD susceptibility testing and design protection evaluation.

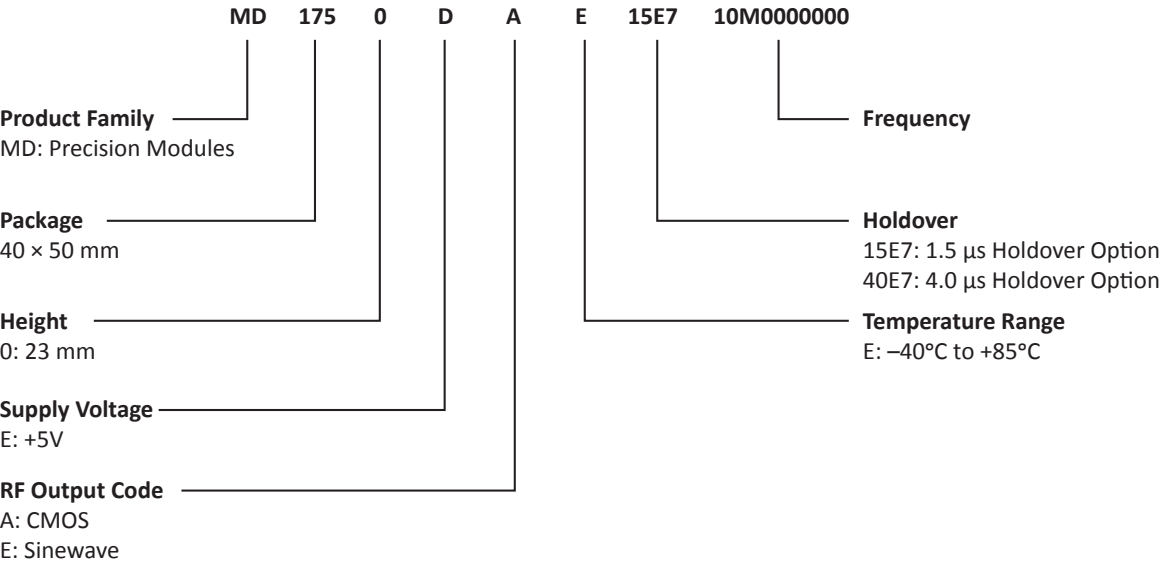
ESD Ratings		
Model	Minimum	Conditions
Human Body Model	1,500V	MIL-STD-883, Method 3015
Charged Device Model	1,000V	JEDEC, JESD22-C101

Package Outline

36-Pin I/O Connections		
Number	Name	Description
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	Sine wave 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		Reserved, leave floating
28	MOD_RST	Pull up, active low
30	STATUS	Pull down
31	LOCK	Pull down



Ordering Information



Available Models	
MD-1750DAE-15E7-10M0000000	MD-1750DAE-40E7-10M0000000
MD-1750DEE-15E7-10M0000000	MD-1750DEE-40E7-10M0000000

Notes

- 1. Holdover and aging performance are after seven days of power-on time; temperature and aging rates are when device is not locked; and performance is measured in still air
- 2. Assuming that the user has applied a cable delay correction and allowed the module to lock to GPS for 24 hours
- 3. ADEV at t=86400s while locked, after 24 hours of locked operation
- 4. Antenna supply pin at pin 21 is an input voltage from the user. The DC input voltage is coupled to the RF signal of the GPS signal on the module. The user does not need to provide any additional blocking or coupling circuitry.

Technical Support

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