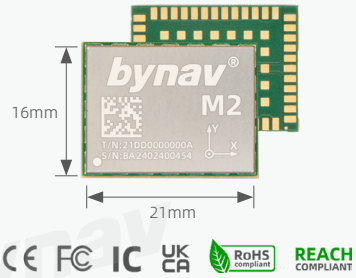
M21D High-precision Combined Navigation Module

Deeply-coupled GNSS/IMU Dual-antenna Anti-jamming

Brief Introduction

M21D is a high-precision combined navigation and dual-antenna heading module, it has 48 pins with package of LGA. The MEMS IMU and functional safety processor are integrated in the module. It supports anti-jamming of 65dBc narrowband to deal with harsh environments such as satellite signal interference and outage, and can provide continuous, real-time and reliable high-precision position. It can be applied to L4 automated driving, drones, intelligent robots, precision agriculture, surveying, mapping, etc.



Technological Advantage

Full-constellation Multi-frequency Positioning & Heading

It supports BDS/GPS/GLONASS/Galileo/QZSS full-constellation multi-frequency high-precision RTK positioning and dual-antenna heading solution. Bynav REAL (Ransac Enhanced Advanced Location) GNSS positioning engine and dual-antenna heading engine have integrity monitoring algorithm which improves the fault tolerance and fixed solution rate under multipath and interference conditions in urban environments.

Deeply-coupled Combined Navigation Algorithm

Built-in with a MEMS IMU, it enables DR calculation, allowing continuous output of high-precision position and velocity information even in brief occlusion scenarios. It supports the deeply coupled combined navigation algorithm based on the Bynav Alice SoC, which improves the quality of GNSS observation. In environments like urban canyons, its positioning accuracy is 2 to 5 times better than loosely coupled algorithms.

High-performance Multiple Interference Suppression*

SAIF (Smart Advanced Interference Defense), the high-performance multiple interference suppression technoloy with high AD quantization bits, is built in and capable of handling different interferences such as single-frequency, multitone, sweeping, pulse, narrowband with interference-signal ratio of 65 dBc. It can address common interference signals in complex electromagnetic environments, and greatly improve the availability and integrity of high-precision positioning in vehicle scenarios.

Feature

- 22nm Process GNSS SoC, Alice
- On-chip RTK Solution and Dual-antenna Heading
- Deeply-coupled Combined Navigation
- DR Accuracy 0.8% (1km/2min)
- Support BDS-3, B2b (PPP)*
- High-performance Anti-jamming*
- Support Ethernet Port, Embedded SDK Differential Account, Support gPTP Time Synchronization
- AP Partition Design Ensures Stable and Reliable OTA Upgrades
- Support System Self-check and Fault Diagnosis*

Application

Intelligent Driving

UGV

Intelligent Robot

Performance

Constellation: GPS, BDS, GLO, GAL, QZSS

Number of Channel: 1500

Tracking

BDS	B1I, B2I, B1C*, B2b (PPP)*
GPS	L1 C/A, L1C*, L2
GLO	G1, G2
GAL	E1, E5b
QZSS	L1 C/A, L1C*, L2

Anti-jamming*

Single-frequency, Multitone, Sweeping, Pulse, Narrowband;
Interference-Signal Ratio: 65 dBc

Interfaces

UART	×3
SPI*	×1
CAN FD	×1
RMII	×1

Horizontal Positioning Accuracy (RMS)[1,2]	
Single Point	1.5 m
RTK	1.0 cm + 1 ppm
Vertical Positioning Accuracy (RMS)[1,2]	
Single Point	2.5 m
RTK	1.5 cm + 1 ppm
Heading Accuracy (RMS)[1,2]	0.2° /1m baseline
DR Accuracy (2σ)[11]	0.8%
Max. Output Rate	
Dual-antenna GNSS Observation	10 Hz
Dual-antenna GNSS Position & Heading[9]	5 Hz
INS Positioning Result	100 Hz
IMU Raw Data	100 Hz
Time To First Fix	
Cold Start[3,5]	30 s
Hot Start[4,5]	5 s
RTK Initialization[1]	5 s
Re-acquisition Time	≤ 1 s
Timing Accuracy (RMS) [7]	≤ 20 ns
Velocity Accuracy [6]	0.03 m/s
RTK Solution Delay	50 ms

IMU

	Gyroscope	Accelerometer
Measure Range	±300 ° /s	±16 g
Random Walk	0.5 ° / √ h	0.3 m/s/ √ h
Bias instability	5 ° /h	50 μg
Bias	0.3 ° /s	5 mg
Scale Error	4 ‰	2 ‰
Cross Coupling Error	1.7 ‰ (0.1°)	0.9 ‰ (0.05°)

Mechanical and Electrical

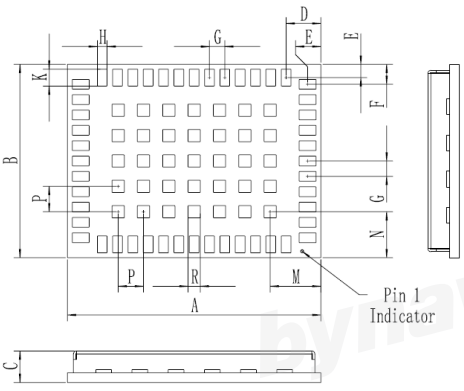
Size	16.0 x 21.0 x 2.6 mm
Package	48 pin LGA
Power Consumption[8]	540 mW
Power Supply Range	3.15~3.45 V
Weight	1.90 g

Environment and Certification

Operation Temperature[10]	-40 ℃ ~ +85 ℃
Storage Temperature	-40 ℃ ~ +105 ℃
Humidity	95% Non-condensing
Vibration	JESD22-B103
Shock	JESD22-B110

IATF 16949*
ISO 26262 ASIL B*
AEC-Q104*

Mechanical Specification



Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	20.90	21.00	21.10
B	15.90	16.00	16.10
C	2.50	2.60	2.70
D	2.78	2.88	2.98
E	1.00	1.10	1.20
F	1.55	1.65	1.75
G	1.22	1.27	1.32
H	0.71	0.81	0.96
K	1.30	1.40	1.50
M	4.10	4.20	4.30
N	3.70	3.80	3.90
P	2.05	2.10	2.15
R	0.92	1.02	1.12

Note:

1. Typical value.Performance will be affected by GNSS status, satellites' location, baseline length, multipath and other interference;
2. Using 1 km baseline and the receiver with good antenna performance, without considering possible errors due to antenna phase center offset;
3. Typical value. The time taken from power-on to the first output of a valid single-point position after clearing ephemeris/almanac/coarse position and time information.
4. Typical value. The time taken from power-on to the first output of a valid single-point position when the receiver has stored valid ephemeris/almanac/coarse position and relatively accurate time information (with an error of less than 5 minutes). The special firmware supports a 3-second hot start, but the firmware not support the network port;
5. -130dBm and more than 12 satellites are available;
6. Open sky without any obstruction, 99%@ static;
7. Optional. Bias caused by RF and antenna is not included;
8. Typical value. Power of antenna and peripherals is not included;
9. 10Hz is supported in special firmware;
10. There is optional temperature range of -40℃ ~105℃ ;
11. When odometer is connected and vehicle model is used.

* Optional, supported in special firmware.

More information, please refer to

www.bynav.com

Wechat Official Account

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Make Mobility More Intelligent