

| Product name | Description  |       | Version |
|--------------|--|-------|---------|
| MC-1010-Vxx  | Dual-frequency multi-constellation GNSS positioning module |       | 1.0     |
|              |  |       |         |
|              |  |       |         |
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#### 1 Introduction

LOCOSYS MC-1010-Vxx series are high-performance dual-band GNSS positioning modules that are capable of tracking all global civil navigation systems. They adopt 12 nm process and integrate efficient power management architecture to perform low power and high sensitivity. Besides, concurrent reception of L1 and L5 band signals mitigates the multipath delay and achieves sub-meter position accuracy.

The modules support hybrid ephemeris prediction to achieve faster cold start. One is self-generated ephemeris prediction (called EASY) that is no need of both network assistance and host CPU's intervention. This is valid for up to 3 days and updates automatically from time to time when GNSS module is powered on and satellites are available. The other is server-generated ephemeris prediction (called EPO) that gets from an internet server. This is valid for up to 14 days. Both ephemeris predictions are stored in the on-board flash memory and perform a cold start time less than 15 seconds.

MC-1010-V3x with the active antenna can comply with the sensitivity specification contained in AIS 140 standard. It is the best solution to those customers that design tracking applications in compliance with AIS 140.

#### 2 Features

- Support GPS, GLONASS, GALILEO, BEIDOU, QZSS and NAVIC
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN) and QZSS SLAS
- Support 135-channel GNSS
- Ultra low power consumption (option)
- Fast TTFF at low signal level
- Free hybrid ephemeris prediction to achieve faster cold start
- Up to 10 Hz update rate
- $\pm 10$ ns high accuracy time pulse (PPS)
- Support Linux and Android OS driver
- Protocol support binary output
- IATF 16949 quality control
- Small form factor 10.1 x 9.7 x 2.2 mm
- SMD type with stamp holes; RoHS compliant





- 3 Application
  - Personal positioning and navigation
  - Automotive navigation
  - Autonomous Vehicle (ex: AVN/T-BOX/HUD)
  - Marine navigation
  - Fleet management
  - Unmanned Aerial Vehicles
  - Hand-Held Device
  - Tracker

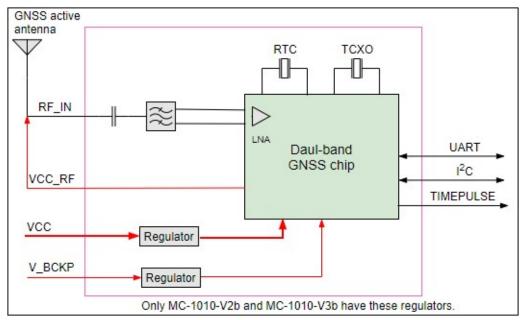


Fig 3-1 System block diagram

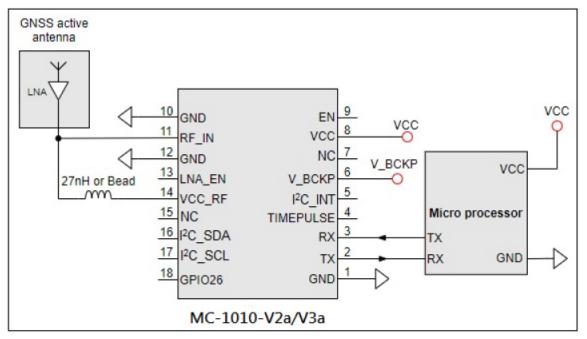


Fig 3-2 Typical application circuit that uses an active antenna for MC-1010-Vxa (1.8V) Series





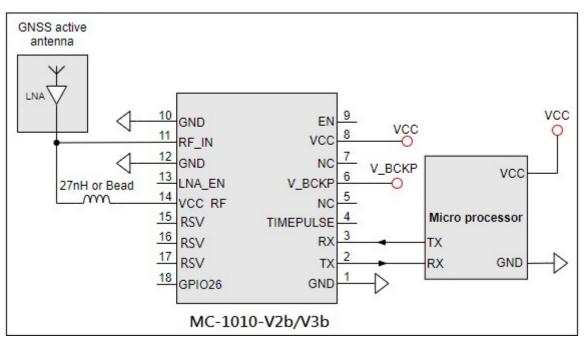


Fig 3-3 Typical application circuit that uses an active antenna for MC-1010-Vxb (3.3V) Series Note: MC-1010-V3x with the active antenna can comply with the sensitivity specification contained in AIS 140 standard.



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## 4 Product marking and ordering information

## 4.1 Product marking

The marking of the module is engraved on the metal shielding that has product information, such as LOCOSYS logo, product name and manufacturing date.

# 4.2 Ordering information

| Product name   | Description   | Remark                |
|----------------|---|-----------------------|
|                |   | 1.8V                  |
|                | Dual-frequency multi-constellation<br>GNSS positioning module | GPS/QZSS: L1 C/A, L5C |
| MC-1010-V2a    |   | GLONASS: L10F         |
|                |   | GALILEO: E1, E5a      |
|                |   | BEIDOU: B1I, B2a      |
|                | Dual-frequency multi-constellation<br>GNSS positioning module | 3.3V                  |
|                |   | GPS/QZSS: L1 C/A, L5C |
| MC-1010-V2b    |   | GLONASS: L10F         |
|                |   | GALILEO: E1, E5a      |
|                |   | BEIDOU: B1I, B2a      |
|                |   | 1.8V                  |
|                |   | GPS/QZSS: L1 C/A      |
| MC-1010-V3a    | Dual-frequency multi-constellation                            | GLONASS: L1OF         |
| WIC-1010- v 5a | GNSS positioning module                                       | GALILEO: E1           |
|                |   | BEIDOU: B1I           |
|                |   | IRNSS (NAVIC): L5.    |
|                |   | 3.3V                  |
|                |   | GPS/QZSS: L1 C/A      |
| MC-1010-V3b    | Dual-frequency multi-constellation                            | GLONASS: L10F         |
| MC-1010-V30    | GNSS positioning module                                       | GALILEO: E1           |
|                |   | BEIDOU: B1I           |
|                |   | IRNSS (NAVIC): L5     |





### 5 GNSS receiver

| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   |                                 |                         |   |  |
|---|---------------------------------|-------------------------|---|--|
| $ \begin{array}{c c} \mbox{MC-1010-V2b} & GALILEO: E1, E5a \\ \mbox{BEIDOU: B1I, B2a} \\ \hline \mbox{GPS/QZSS: L1 C/A} \\ \mbox{GLONASS: L1OF} \\ \mbox{GALILEO: E1} \\ \mbox{BEIDOU: B11} \\ \mbox{IIEOU: B11} \\ \mbox{IRNSS (NAVIC): L5} \\ \hline \mbox{Channels} & Support 135 channels \\ \hline \mbox{Update rate} & 1Hz default, up to 10Hz \\ \hline \mbox{Cold start} & -165dBm (with external LNA) \\ \hline \mbox{Cold start} & -148dBm (with external LNA) \\ \hline \mbox{Cold start} & (Open Sky) & 1s (typical) \\ \hline \mbox{Cold Start (Open Sky)} & 1s (typical) \\ \hline \mbox{Cold Start (Open Sky)} & 1s (typical) with AGPS (ephemeris prediction) \\ \hline \mbox{MC-1010-V2a} & MC-1010-V2a \\ \hline \mbox{MC-1010-V2b} & Autonomous: 1.5m (CEP) ^{(1)} \\ \hline \mbox{Max. Altitude} & <18,000 m \\ \hline \mbox{Max. Velocity} & <500m/s \\ \hline \mbox{II 5200 bps}^{(3)}, 8 data bits, no parity, 1 stop bits \\ \hline \end{tabular}$  |                                 |                         | GPS/QZSS: L1 C/A, L5C   |  |
| FrequencyBEIDOU: B1I, B2aMC-1010-V3a<br>MC-1010-V3bGPS/QZSS: L1 C/A<br>GLONASS: L1OF<br>GALILEO: E1<br>BEIDOU: B11<br>IRNSS (NAVIC): L5ChannelsSupport 135 channelsUpdate rate1Hz default, up to 10HzSensitivityTrackingCold start-165dBm (with external LNA)Acquisition TimeKorlone Sky)MC-1010-V2a<br>MC-1010-V2b28s (typical)MC-1010-V2a<br>MC-1010-V2bAutonomous: 1.5m (CEP)Max. Altitude<18,000 m  |                                 | MC-1010-V2a             | GLONASS: L1OF   |  |
| Frequency $MC-1010-V3a$<br>MC-1010-V3b $GPS/QZSS: L1 C/A$<br>GLONASS: L1OF<br>GALILEO: E1<br>BEIDOU: B11<br>IRNSS (NAVIC): L5ChannelsSupport 135 channelsUpdate rate1Hz default, up to 10HzSensitivityTrackingCold start-165dBm (with external LNA)Acquisition TimeHot start (Open Sky)Requisition TimeCold Start (Open Sky)MC-1010-V2a<br>MC-1010-V2bAutonomous: 1.5m (CEP) (1)Max. Altitude<18,000 m  |                                 | MC-1010-V2b             | GALILEO: E1, E5a  |  |
| $\begin{array}{ c c c c c c } \label{eq:constraint} \begin{tabular}{ c c c c c c } & MC-1010-V3a & GLONASS: L1OF & GALILEO: E1 & BEIDOU: B11 & IRNSS (NAVIC): L5 & \\ \hline \\$  |                                 |                         | BEIDOU: B1I, B2a  |  |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | Frequency                       |                         | GPS/QZSS: L1 C/A  |  |
| $ \begin{array}{ c c c c c c } MC-1010-V3b & \begin{array}{c} GALILEO: E1 \\ BEIDOU: B1I \\ IRNSS (NAVIC): L5 \\ \hline \end{array} \\ \hline \rule{0ex}{channels} \\ \hline \rule{0ex}{channels} \\ \hline \cr Update rate & 1Hz default, up to 10Hz \\ \hline \rule{0ex}{channels} \\ \hline \cr Update rate & 1Hz default, up to 10Hz \\ \hline \rule{0ex}{channels} \\ \hline \cr \end{array} \\ \hline \rule{0ex}{channels} \\ $ |                                 |                         | GLONASS: L1OF   |  |
|   |                                 |                         | GALILEO: E1   |  |
| ChannelsSupport 135 channelsUpdate rate1Hz default, up to 10HzSensitivityTrackingCold start-165dBm (with external LNA)Cold start-148dBm (with external LNA)Acquisition TimeHot start (Open Sky)Cold Start (Open Sky)1s (typical)Acquisition TimeCold Start (Open Sky)MC-1010-V2a<br>MC-1010-V2b28s (typical) without AGPS<br>< 15s (typical) with AGPS (ephemeris prediction)   |                                 |                         | BEIDOU: B1I   |  |
| InterpretationUpdate rate1Hz default, up to 10HzSensitivityTracking-165dBm (with external LNA)Cold start-148dBm (with external LNA)Acquisition TimeHot start (Open Sky)1s (typical)Acquisition TimeMC-1010-V2a<br>MC-1010-V2a<br>MC-1010-V2bAutonomous: 1.5m (CEP) (1)Position AccuracyMC-1010-V3a<br>MC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude< 18,000 mAutonomous: 2.5m (CEP)Max. Velocity< 500m/s115200 bps (3), 8 data bits, no parity, 1 stop bits  |                                 |                         | IRNSS (NAVIC): L5   |  |
| SensitivityTracking-165dBm (with external LNA)SensitivityCold start-148dBm (with external LNA)Acquisition TimeHot start (Open Sky)1s (typical)Cold Start (Open Sky)28s (typical) without AGPSCold Start (Open Sky)28s (typical) with AGPS (ephemeris prediction)MC-1010-V2a<br>MC-1010-V2bAutonomous: 1.5m (CEP) (1)MC-1010-V3a<br>MC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude<18,000 m  | Channels                        | Support 135 channels    |   |  |
| Sensitivity   Cold start   -148dBm (with external LNA)     Acquisition Time   Hot start (Open Sky)   1s (typical)     Cold Start (Open Sky)   28s (typical) without AGPS     Cold Start (Open Sky)   28s (typical) without AGPS     Position Accuracy   MC-1010-V2a<br>MC-1010-V2b   Autonomous: 1.5m (CEP) <sup>(1)</sup> Max. Altitude   <18,000 m  | Update rate                     | 1Hz default, up to 10Hz |   |  |
| Cold start-148dBm (with external LNA)Acquisition TimeHot start (Open Sky)1s (typical)Cold Start (Open Sky)28s (typical) without AGPSCold Start (Open Sky)<15s (typical) with AGPS (ephemeris prediction)  | S iti it                        | Tracking                | -165dBm (with external LNA)                                     |  |
| Acquisition Time $Cold Start (Open Sky)$ $28s (typical) without AGPS$<br>< $< 15s (typical) with AGPS (ephemeris prediction)Position AccuracyMC-1010-V2aMC-1010-V2bAutonomous: 1.5m (CEP)^{(1)}Mc-1010-V3aMC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude< 18,000 mMax. Velocity< 500m/s115200 bps (3), 8 data bits, no parity, 1 stop bits$   | Sensitivity                     | Cold start              | -148dBm (with external LNA)                                     |  |
| Cold Start (Open Sky)Cold Start (Open Sky)< 15s (typical) with AGPS (ephemeris prediction)  |                                 | Hot start (Open Sky)    | 1s (typical)  |  |
| MC-1010-V2aAutonomous: 1.5m (CEP)Position AccuracyMC-1010-V2bMC-1010-V3aAutonomous: 2.5m (CEP)MC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude< 18,000 m  | Acquisition Time                | Cold Start (Open Sky)   | 28s (typical) without AGPS                                      |  |
| Position AccuracyMC-1010-V2bAutonomous: 1.5m (CEP) (1)MC-1010-V3a<br>MC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude< 18,000 m   |                                 |                         | < 15s (typical) with AGPS (ephemeris prediction)                |  |
| Position Accuracy $MC-1010-V2b$ MC-1010-V3a<br>MC-1010-V3bAutonomous: 2.5m (CEP)Max. Altitude< 18,000 m   |                                 | MC-1010-V2a             | Autonomous: 1.5m (CEP) <sup>(1)</sup>                           |  |
| MC-1010-V3a<br>MC-1010-V3b Autonomous: 2.5m (CEP)   Max. Altitude < 18,000 m  |                                 | MC-1010-V2b             |   |  |
| MC-1010-V3b   Max. Altitude   < 18,000 m   Max. Velocity < 500m/s   I15200 bps <sup>(3)</sup> , 8 data bits, no parity, 1 stop bits   | Position Accuracy               | MC-1010-V3a             | Autonomous: 2.5m (CEP)  |  |
| Max. Velocity < 500m/s<br>115200 bps <sup>(3)</sup> , 8 data bits, no parity, 1 stop bits   |                                 | MC-1010-V3b             |   |  |
| 115200 bps <sup>(3)</sup> , 8 data bits, no parity, 1 stop bits   | Max. Altitude                   | < 18,000 m              |   |  |
|   | Max. Velocity                   | < 500m/s                |   |  |
| $\mathbf{D}_{12} = \mathbf{D}_{12} = \mathbf{D}$  |                                 | NMEA 0183 ver. 4.1      | 115200 bps <sup>(3)</sup> , 8 data bits, no parity, 1 stop bits |  |
| Protocol Support - NMEA 0183 ver. 4.1 (default)   | Protocol Support <sup>(2)</sup> |                         | (default)   |  |
| 1Hz: GGA, GLL, GSA, GSV, RMC, VTG, GST  |                                 |                         | 1Hz: GGA, GLL, GSA, GSV, RMC, VTG, GST                          |  |

Note 1: Open sky, dual band, demonstrated with a good external LNA.

Note 2: The module protocol support binary output, if customers want to the product to support it, please contact us in advance.

Note 3: Both baud rate and output message rate are configurable to be factory default.

