

General Description

The Gotop GT-1513-MTBD is a complete GPS/BeiDou engine module that features super sensitivity, ultra low power and small form factor. The GPS/BeiDou signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

Its -165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS/BeiDou was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone



Figure 1: GT-1513-MTBD Top View

Features

- Build on high performance, low-power MT3333chipset
- Ultra high sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max $20\text{mA}@3.3\text{V}$
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.8V to 4.3V
- Operating temperature range: -40 to 85°C
- SMD type with stamp holes
- Small form factor: $15 \times 13 \times 2.4\text{mm}$
- RoHS compliant (Lead-free)

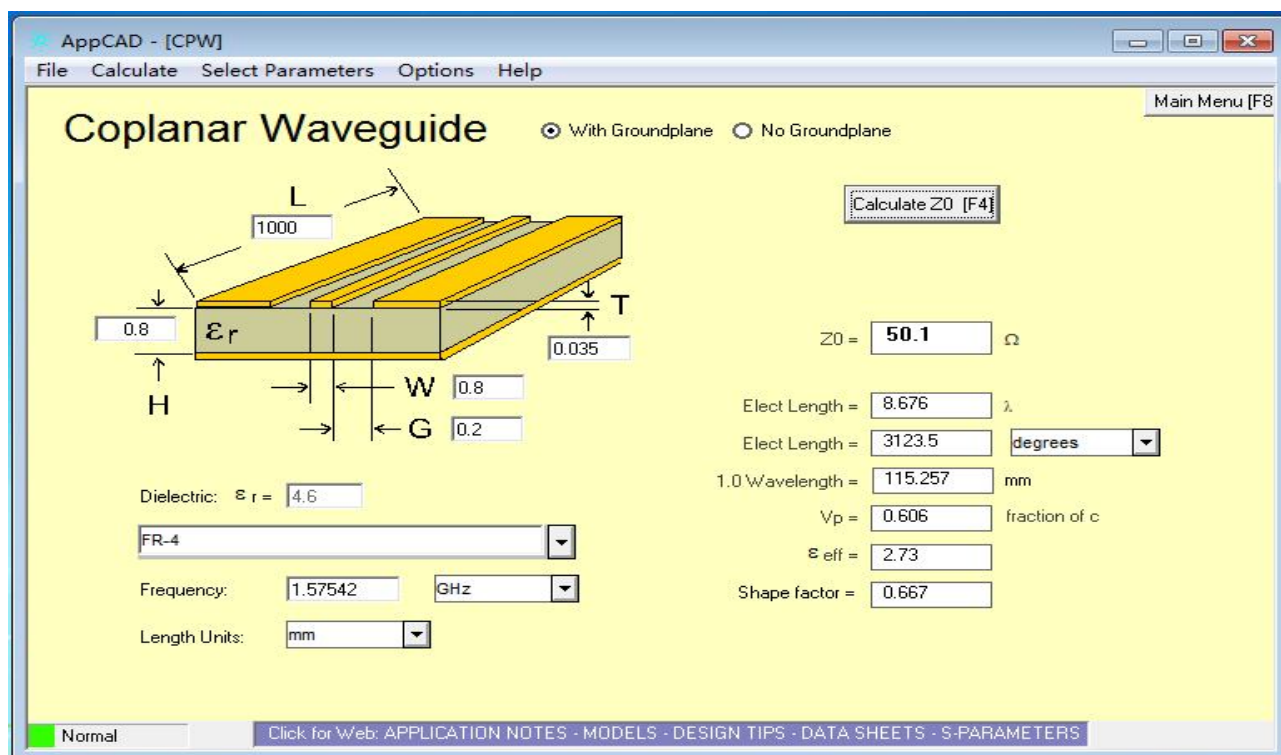
Performance Specification

| Parameter | Specification |
|---------------------------|--|
| Receiver Type | Gps/Glonass/Galileo/Beidou(afterICDreleased)receiver Supports multi-GNSS incl.QZSS,SBAS ranging Supports:WAAS/EGNOS/MSAS/GAGAN |
| Sensitivity | Tracking -165dBm Acquisition -163dBm(hot) -148dBm(cold) |
| Accuracy | Position 5m CEP without SA Velocity 0.1m/s without SA Timing (PPS) 10ns RMS |
| Acquisition Time | Cold Start 38s Warm Start 35s Hot Start 1s Re-Acquisition <1s |
| Power Consumption | Tracking 20mA @3.3V Vcc Acquisition 18mA Sleep/Standby TBD |
| NavigationDataUpdate Rate | 1Hz |
| Operational Limits | Altitude Max 18,000m Velocity Max 515m/s Acceleration Less than 4g |

Interfaces Configuration

Power Supply: Regulated power for the GT-1513-MTBD is required. The input voltage Vcc should be 3.3V \pm 10%, maximum, current is no less than 20mA. Suitable decoupling must be provided by external decoupling circuitry.

Antenna: The GT-1513-MTBD GPS/BeiDou receiver is designed for supporting the active antenna or passive antenna connected with pin RF_IN. The gain of active antenna should be no less than 15dB. The maximum noise figure should be no more than 2.5dB and output impedance is at 50 Ohm.



UART Ports: The module supports two full duplex serial channels UART . All serial connections are at 3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps, however, the user can change the default baud rate to any value from 4800 bps to 115kbps. UART is used e.g. for booting and NMEA interface.

Backup Battery Power: In case of a power failure on pin Vcc, real-time clock and backup RAM are supplied through pin VBAT. This enables the GT-1513-MTBD GPS /BeiDou Receiver to recover from power failure with either a hot start or a warm start (depending on the duration of Vcc outage). If no Backup Battery is connected, the receiver performs a cold start upon powered up.

Pin Description

| Pin No. | Pin name | I/O | Description | Remark |
|---------|---------------|-----|---|--|
| 1 | RXB/SCK | I | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR,Serial input for UART2,Default:75Kpull-up | Default: 8mA driving |
| 2 | TXB/TXIND | O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR,Serial input for UART2,Default:75Kpull-up | Default:8mA driving |
| 3 | P1PPS | O | Time Pulse(1PPS) | Leave Open in not used |
| 4 | TXA/I2C_DA/SO | O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR,Serial input for UART1,Default:75Kpull-up | Default:8mA driving |
| 5 | RXA/I2C_CK/SI | I | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR,Serial input for UART1,Default:75Kpull-up | Default:8mA driving |
| 6 | GPIO11/SCS | I/O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR JTAG interface clock | Default:75Kpull-down Default:8mA driving |
| 7 | GPIO9 | I/O | Strap pin host_sel[0]Host_sel[1:0] | Interfac |
| 8 | GPIO10 | I/O | Strap pin host_sel[0]Host_sel[1:0] | Interfac |
| 9 | NC | | No connection | |
| 10 | NC | | No connection | |
| 11 | V_BAT | P | Backup battery supply voltage | |
| 12 | VCC | P | DC supply voltage | |
| 13 | GPIO8 | I/O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR JTAG interface clock | Default:75Kpull-down Default:8mA driving |
| 14 | GPIO1 | I/O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR JTAG interface clock | Default:75Kpull-down Default:8mA driving |
| 15 | GPIO2 | I/O | 2.8V,LVTTL I/O PPU,PPD,SMT2mA~16mA PDR JTAG interface clock | Default:75Kpull-down Default:8mA driving |
| 16 | NC | | No connection | |
| 17 | VCC_RF | P | Linear regulator power output, 3.0V (Do not use this as power source of backup battery) | |
| 18 | GND | G | Ground | |
| 19 | RF_IN | I | GPS&BeiDou Signal Input | |
| 20 | GND | G | Ground | |
| 21 | GND | G | Ground | |
| 22 | GND | G | Ground | |

Pin Assignment

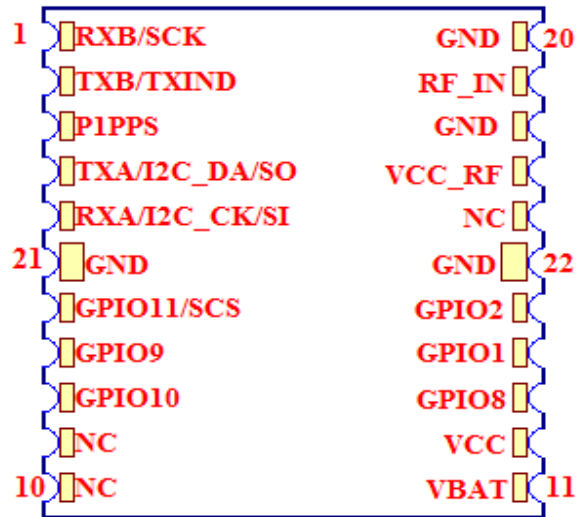


Figure 2: GT-1513-MTBD Pin Package

Mechanical Specification

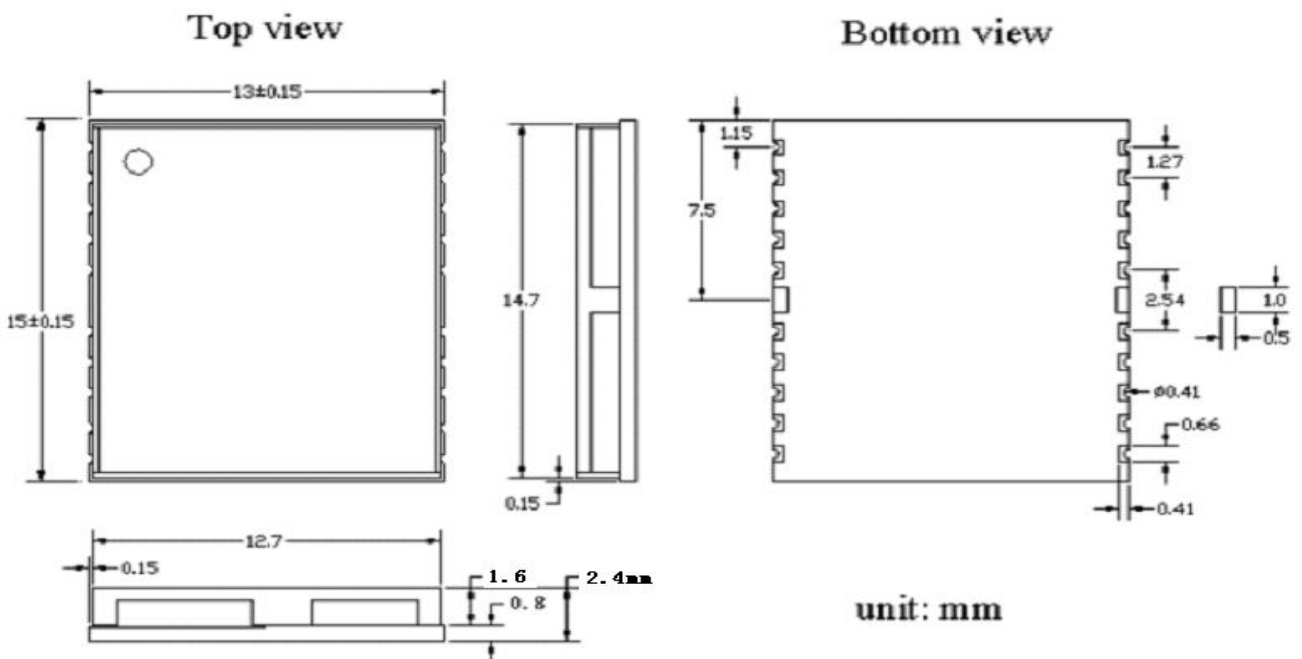


Figure 3: GT-1513-MTBD Dimensions

Electrical Characteristics

Absolute Maximum Rating

| Parameter | Symbol | Min | Max | Units |
|----------------------------------|---------|------|-----|-------|
| Power Supply | | | | |
| Power Supply Volt. | Vcc | 2.8 | 4.3 | V |
| Input Pins | | | | |
| Input Pin Voltage I/O | RXD/TXD | -0.3 | 3.6 | V |
| Backup Battery | VBAT | 2.0 | 3.6 | V |
| Environment | | | | |
| Storage Temperature | Tstg | -40 | 125 | °C |
| PeakReflow Soldering Temperature | Tpeak | | 260 | °C |
| Humidity | | | 95 | % |

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

Operating Conditions

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|----------------------------|-----------------|-----------|---------|-----|---------|-------|
| Power supply voltage | Vcc | | 2.8 | 3.3 | 4.3 | V |
| Powersupplyvoltagegeripple | Vcc_PP | Vcc=3.0V | | | 30 | mV |
| Consumption current | Icc | Vcc=3.0V | | 20 | 18 | mA |
| Input high voltage | V _{IH} | | 0.7xVcc | | Vcc+1.0 | V |

| | | | | | | |
|-----------------------|-----------|--|---------------------|--|---------------------|----|
| Input low voltage | V_{IL} | | -0.3 | | $0.3 \times V_{CC}$ | V |
| Output high voltage | V_{OH} | | $0.8 \times V_{CC}$ | | V_{CC} | V |
| Output low voltage | V_{OL} | | 0 | | $0.2 \times V_{CC}$ | V |
| Operating temperature | T_{opr} | | -40 | | 85 | °C |

Software Protocol

NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS&BeiDou specific messages all start with \$GPxxx/GNxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers.

The Gotop GT-1513-MTBD supports the following NMEA-0183 messages: GPGSA, GPRMC, GNGSA, GNRMC, GLGSV

Table 1: NMEA-0183 Output Messages

| NMEA Record | DESCRIPTION |
|-------------|--|
| GPGSA | GPS DOP and active satellites |
| GPRMC | Recommended minimum specific GPS data |
| GNGSA | BeiDou DOP and active satellites |
| GNRMC | Recommended minimum specific BeiDou data |
| GLGSV | GPS/BeiDou satellites in view |

GPGSA-GPS DOP and Active Satellites

Table 4 contains the values of the following example:

\$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,,,,1.8,1.0,1.5*33.

Table 4: GSA Data Format

| Name | Example | Units | Description |
|---------|---------|-------|---------------------|
| Message | \$GPGSA | | GSA protocol header |
| Mode 1 | A | | See Table 4-2 |

| | | | |
|----------------|-----|--|----------------------------------|
| Mode 2 | 3 | | See Table 4-1 |
| Satellite Used | 07 | | Sv on Channel 1 |
| Satellite Used | 02 | | Sv on Channel 2 |
| ... | ... | | ... |
| Satellite Used | | | Sv on Channel 12 |
| PDOP | 1.8 | | Position Dilution of Precision |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| VDOP | 1.5 | | Vertical Dilution of Precision |
| Checksum | *33 | | |
| <CR> <LF> | | | End of message termination |

Table 4-1: Mode 1

| Value | Description |
|-------|-------------------|
| 1 | Fix not available |
| 2 | 2D |
| 3 | 3D |

Table 4-2: Mode 2

| Value | Description |
|-------|---|
| M | Manual-forced to operate in 2D or 3D mode |
| A | Automatic-allowed to automatically switch 2D/3D |

GPRMC-Recommended Minimum Specific GPS Data

Table 6 contains the values of the following example:

\$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13,309.62, 120598,, *10

Table 6: RMC Data Format

| Name | Example | Units | Description |
|--------------|------------|-------|---------------------|
| Message ID | \$GPRMC | | RMC protocol header |
| UTS Position | 161229.487 | | hhmmss.sss |

| | | | |
|--------------------|------------|---------|----------------------------------|
| Status | A | | A=data valid or V=data not valid |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Speed Over Ground | 0.13 | Knots | |
| Course Over | 309.62 | Degrees | True |
| Ground | | | |
| Date | 120598 | | Dummy |
| Magnetic variation | | Degrees | E=east or W=west |
| Checksum | *10 | | |
| <CR> <LF> | | | End of message termination |

GNSSA-BeiDou DOP and Active Satellites

Table 4 contains the values of the following example:

\$GNSSA , A, 3, 07, 02, 26,27, 09, 04,15, , , , , , 1.8,1.0,1.5*33.

Table 4: GSA Data Format

| Name | Example | Units | Description |
|----------------|---------|-------|---------------------|
| Message | \$GNSSA | | GSA protocol header |
| Mode 1 | A | | See Table 4-2 |
| Mode 2 | 3 | | See Table 4-1 |
| Satellite Used | 07 | | Sv on Channel 1 |
| Satellite Used | 02 | | Sv on Channel 2 |

| | | | |
|----------------|-----|--|----------------------------------|
| ... | ... | | ... |
| Satellite Used | | | Sv on Channel 12 |
| PDOP | 1.8 | | Position Dilution of Precision |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| VDOP | 1.5 | | Vertical Dilution of Precision |
| Checksum | *33 | | |
| <CR> <LF> | | | End of message termination |

Table 4-1: Mode 1

| Value | Description |
|-------|-------------------|
| 1 | Fix not available |
| 2 | 2D |
| 3 | 3D |

Table 4-2: Mode 2

| Value | Description |
|-------|---|
| M | Manual-forced to operate in 2D or 3D mode |
| A | Automatic-allowed to automatically switch 2D/3D |

GPRMC-Recommended Minimum Specific BeiDou Data

Table 6 contains the values of the following example:

\$GNRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13,309.62, 120598,, *10

Table 6: RMC Data Format

| Name | Example | Units | Description |
|--------------|------------|-------|----------------------------------|
| Message ID | \$GNRMC | | RMC protocol header |
| UTS Position | 161229.487 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |

| | | | |
|--------------------|------------|---------|----------------------------|
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Speed Over Ground | 0.13 | Knots | |
| Course Over | 309.62 | Degrees | True |
| Ground | | | |
| Date | 120598 | | Dummy |
| Magnetic variation | | Degrees | E=east or W=west |
| Checksum | *10 | | |
| <CR> <LF> | | | End of message termination |

GLGSV-GPS/GNSS Satellites in View

Table 5 contains the values of the following example:

\$GLGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71

\$GLGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

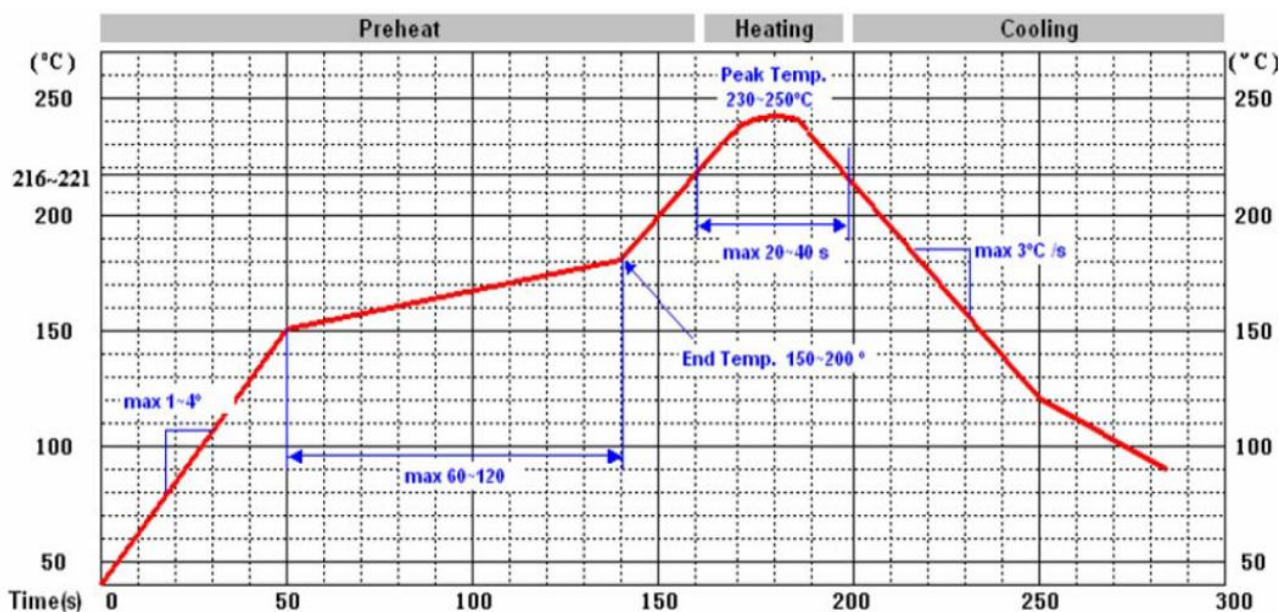
Table 5: GLGGA Data Format

| Name | Example | Units | Description |
|--------------------|---------|---------|---------------------------------|
| Message ID | \$GLGSV | | GSV protocol header |
| Number of Message | 2 | | Range 1 to 3 |
| Message Number | 1 | | Range 1 to 3 |
| Satellites in View | 07 | | |
| Satellite ID | 07 | | Channel 1(Range 1 to 214) |
| Elevation | 79 | degrees | Channel 1(Maximum 90) |
| Azinmuth | 048 | degrees | Channel 1(True, Range 0 to 359) |

| | | | |
|--------------|-----|---------|---------------------------------------|
| SNR(C/NO) | 42 | dBHz | Range 0 to 99,null when not tracking |
| ... | | | ... |
| Satellite ID | 27 | | Channel 4(Range 1 to 214) |
| Elevation | 27 | degrees | Channel 4(Maximum 90) |
| Azimuth | 138 | degrees | Channel 4(True, Range 0 to 359) |
| SNR(C/NO) | 42 | dBHz | Range 0 to 99, null when not tracking |
| Checksum | *71 | | |
| <CR> <LF> | | | End of message termination |

Depending on the number of satellites tracked multiple messages of GLGSV data may be required. The range of GPS SVID is 1~32, BeiDou SVID is 201~214.

Manufacturing Process Recommendations



Note: The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste, size, thickness and properties of the baseboard, etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

©Copyright 2013 Gotop Technology Co., Ltd. All Right Reserved

The information contained herein is subject to change without notice.

Gotop Technology Co. , LTD

Add:Room 603 Zhantao Technology Building,Minzhi Road,Xinniu Communnity,Minzhi Street,Baoan District,ShenZhen City China.

Not to be reproduced in whole or part for any purpose without written permission of Gotop Technology Inc ('Gotop'). Information provided by Gotop is believed to be accurate and reliable. These materials are provided by Gotop as a service to its customers and may be used for informational purposes only. Gotop assumes no responsibility for errors or omissions in these materials, nor for its use. Gotop reserves the right to change specification at any time without notice.

These materials are provides 'as is' without warranty of any kind, either expressed or implied, relating to sale and/or use of Gotop products including liability or warranties relating to fitness for a particular purpose, consequential or incidental damages, merchantability, or infringement of any patent, copyright or other intellectual property right. Gotop further does not warrant the accuracy or completeness of the information, text, graphics or other items contained within these materials. Gotop shall not be liable for any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits, which may result from the use of these materials.

Gotop products are not intended for use in medical, life-support devices, or applications involving potential risk of death, personal injury, or severe property damage in case of failure of the product.