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|---|---|
|  | GOTOP GAM-1433-SF |
| | Ultra High Sensitivity and Low Power |
| | GPS Antenna Module |

General Description

The GOTOP GAM-1433-SF is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS 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 -159dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS 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: GAM-1433-SF Top View

Features

- Build on high performance, low-power SIRFIII chipset
- Ultra high sensitivity: -159dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max 45mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 3.3V to 5.0V
- Operating temperature range: -40 to 85°C
- Patch Antenna Size: 13(w)mmX13(d)mmX4(h)mm
- Small form factor: 33.4x14.0x7.0mm
- RoHS compliant (Lead-free)

Performance Specification

| Parameter | Specification | |
|------------------|--|-------------------|
| Receiver Type | L1 frequency band, C/A code, 20-channels | |
| Sensitivity | Tracking | -159dBm |
| | Acquisition | -155dBm |
| Accuracy | Position | 5m CEP without SA |
| | Velocity | 0.1m/s without SA |
| | Timing (PPS) | 60ns RMS |
| Acquisition Time | Cold Start | 38s |

| | | |
|-----------------------------|----------------|--------------|
| | Warm Start | 35s |
| | Hot Start | 1s |
| | Re-Acquisition | <1s |
| Power Consumption | Tracking | 40mA @3V Vcc |
| | Acquisition | 45mA |
| | Sleep/Standby | TBD |
| Navigation Data Update Rate | 1Hz | |
| Operational Limits | Altitude | Max 18,000m |
| | Velocity | Max 515m/s |
| | Acceleration | Less than 4g |

Interfaces Configuration

Power Supply: Regulated power for the GAM-1433-SF is required. The input voltage Vcc should be 3.3V \pm 10%, maximum, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry.

Antenna: The GAM-1433-SF GPS receiver is designed for supporting the active antenna or passive antenna connected. 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. UART0 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 V_BAT. This enables the GAM-1433-SF GPS 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.

CON1 Pin Description

| Pin No. | Pin name | I/O | Description | Remark |
|---------|----------|-----|---------------------------|------------------------|
| 1 | V_BAT | I | RTC Battery Input | Leave Open in not used |
| 2 | TX0 | O | UART Serial Data Output 0 | Leave Open in not used |
| 3 | RX0 | I | UART Serial Data Input 0 | Pull up if not used |
| 4 | Vcc | I | Module Power Supply | |
| 5 | GND | G | Ground | |

CON2 Pin Description

| Pin No. | Pin name | I/O | Description | Remark |
|---------|----------|-----|---------------------------|------------------------|
| 1 | Vcc | I | Module Power Supply | |
| 2 | GND | G | Ground | |
| 3 | TX0 | O | UART Serial Data Output 0 | Leave Open in not used |
| 4 | RX0 | I | UART Serial Data Input 0 | Pull up if not used |
| 5 | PPS | O | Time pulse Signal | Leave Open in not used |
| 6 | V_BAT | I | RTC Battery Input | Leave Open in not used |

Absolute Maximum Rating

| Parameter | Symbol | Min | Max | Units |
|-----------------------|--------|------|-----|-------|
| Power Supply | | | | |
| Power Supply Volt. | Vcc | -0.3 | 5.5 | V |
| Input Pins | | | | |
| Input Pin Voltage I/O | RX0 | -0.3 | 3.6 | V |
| Backup Battery | V_BAT | 2.0 | 3.6 | V |
| Environment | | | | |
| Storage Temperature | Tstg | -40 | 125 | °C |
| Peak Reflow Soldering | Tpeak | | 260 | °C |

| | | | | |
|------------------|--|--|----|---|
| Temperature <10s | | | | |
| 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 | V _{CC} | | 3.3 | | 5.0 | V |
| Power supply voltage ripple | V _{CC_PP} | V _{CC} =3.3V | | | 40 | mV |
| Consumption current | I _{CC} | V _{CC} =3.3V | | 40 | 50 | mA |
| Input high voltage | V _{IH} | | 0.7xV _{CC} | | V _{CC} +1.0 | V |
| Input low voltage | V _{IL} | | -0.3 | | 0.3xV _{CC} | V |
| Output high voltage | V _{OH} | | 0.8xV _{CC} | | V _{CC} | V |
| Output low voltage | V _{OL} | | 0 | | 0.2xV _{CC} | V |
| Operating temperature | T _{opr} | | -40 | | 85 | °C |

NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GPxxx 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 Label Jet GAM-1433-SF supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC and VTG.

Table 1: NMEA-0183 Output Messages

| NMEA Record | DESCRIPTION |
|-------------|--|
| GGA | Global positioning system fixed data |
| GLL | Geographic position—latitude/longitude |
| GSA | GNSS DOP and active satellites |
| GSV | GNSS satellites in view |
| RMC | Recommended minimum specific GNSS data |
| VTG | Course over ground and ground speed |

GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

\$GPGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000*18

Table 2: GGA Data Format

| Name | Example | Units | Description |
|------------------------|------------|--------|-----------------------------------|
| Message ID | \$GPGGA | | GGA protocol header |
| UTC Position | 161229.487 | | hhmmss.sss |
| Latitude | 3723.2457 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | ddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Position Fix Indicator | 1 | | See Table 2-1 |
| Satellites Used | 07 | | Range 0 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | 9.0 | meters | |
| Units | M | meters | |
| Geoids Separation | | meters | |
| Units | M | meters | |
| Age of Diff.Corr. | | second | Null fields when DGPS is not Used |
| Diff.Ref.Station ID | 0000 | | |
| Checksum | *18 | | |
| <CR> <LF> | | | End of message termination |

Table 2-1: Position Fix Indicators

| Value | Description |
|-------|---------------------------------------|
| 0 | Fix not available or invalid |
| 1 | GPS SPS Mode, fix valid |
| 2 | Differential GPS, SPS Mode, fix valid |
| 3 | GPS PPS Mode, fix valid |

GLL-Geographic Position – Latitude/Longitude

Table 3 contains the values of the following example:

\$GPGLL , 3723.2475, N,12158.3416, W,161229.487, A*2C.

Table 3: GLL Data Format

| Name | Example | Units | Description |
|---------------|------------|-------|----------------------------------|
| Message ID | \$GPGLL | | GLL protocol header |
| Latitude | 3723.2475 | | Ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | Ddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| UTC Position | 161229.487 | | Hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Checksum | *2C | | |
| <CR> <LF> | | | End of message termination |

GSA-GNSS 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 |

GSV-GNSS Satellites in View

Table 5 contains the values of the following example:

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

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

Table 5: GGA Data Format

| Name | Example | Units | Description |
|--------------------|---------|-------|---------------------|
| Message ID | \$GPGSV | | 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 32) |
| 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 32) |
| 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 GSV data may be required.

RMC-Recommended Minimum Specific GNSS 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 | | Ddmm.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 |

VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:

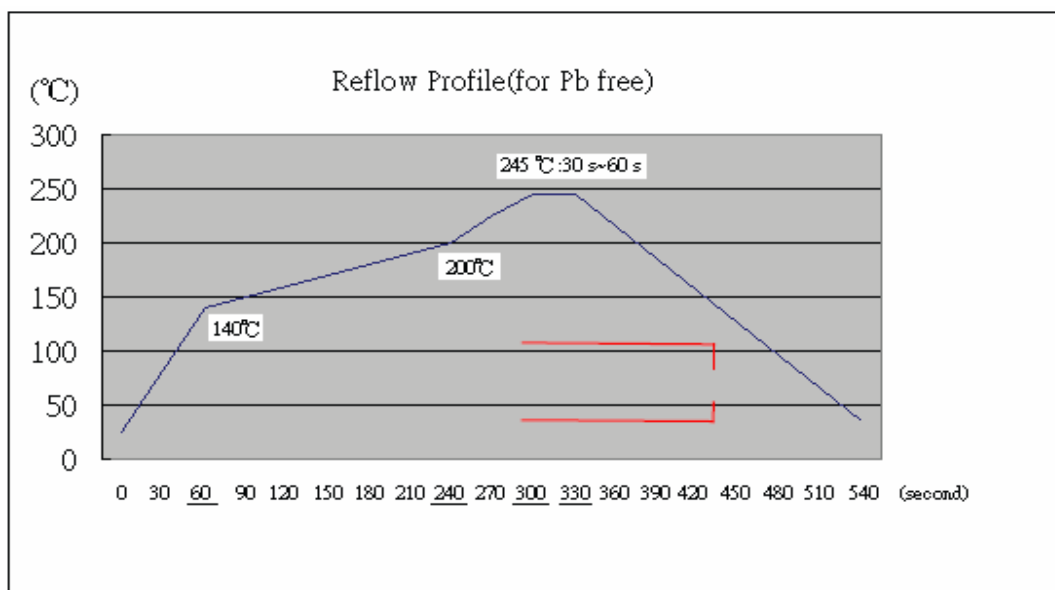
\$GPVTG, 309.62, T, M, 0.13, N, 0.2, K*6E

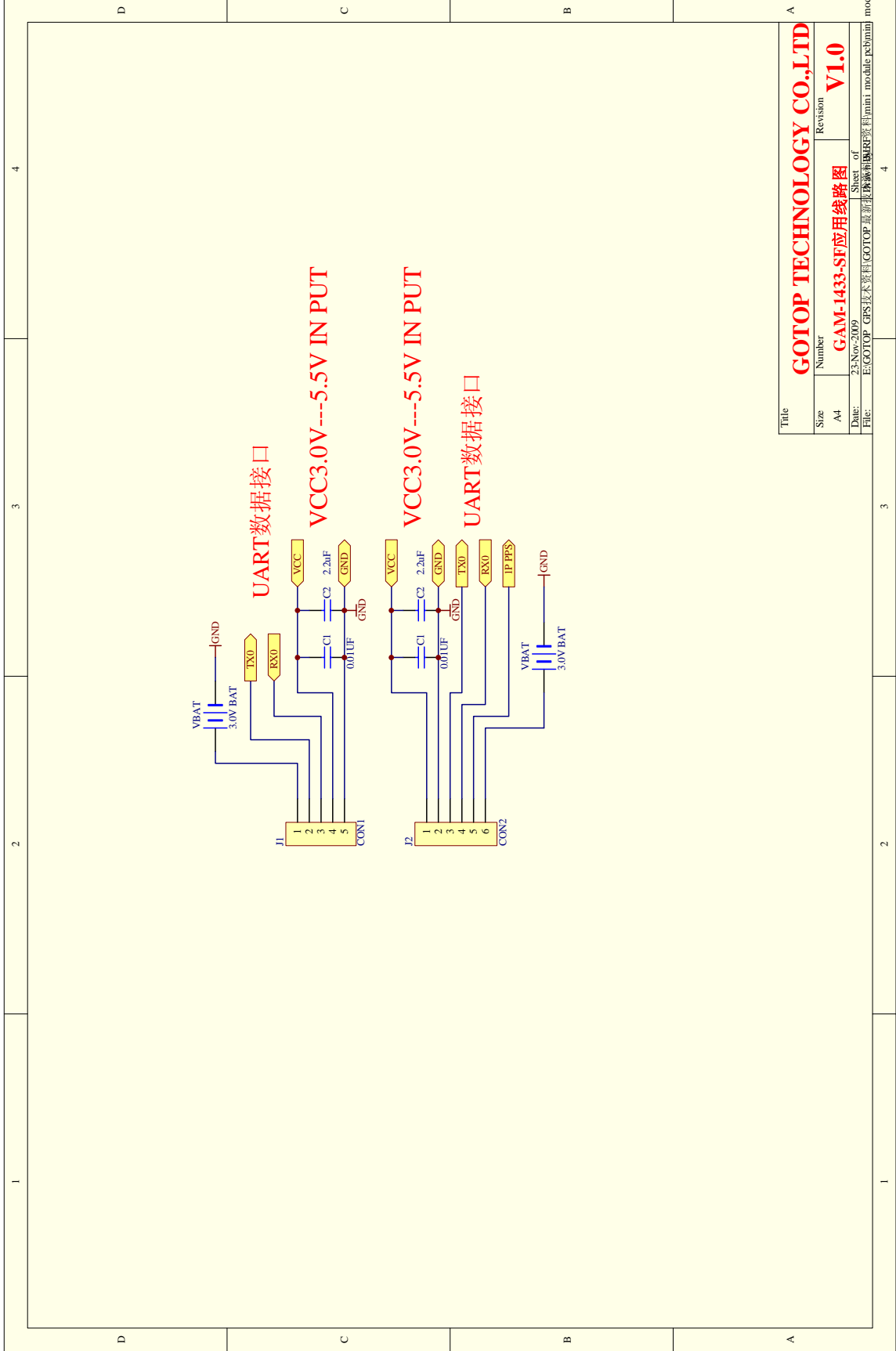
Table 7: VTG Data Format

| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

| | | | |
|------------|---------|---------|----------------------------|
| Message ID | \$GPVTG | | VTG protocol header |
| Course | 309.62 | Degrees | Measured heading |
| Reference | T | | True |
| Course | | Degrees | Measured heading |
| Reference | M | | Magnetic |
| Speed | 0.13 | Knots | Measured horizontal speed |
| Units | N | | Knots |
| Speed | 0.2 | Km/hr | Measured horizontal speed |
| Units | K | | Kilometer per hour |
| Checksum | *6E | | |
| <CR> <LF> | | | End of message termination |

RECOMMENDED REFLOW PROFILE





| | | | |
|-------|--|---------------------------------|--|
| Title | | GOTOP TECHNOLOGY CO.,LTD | |
| Size | Number | Revision | |
| A4 | GAM-1433-SF应用线路图 | V1.0 | |
| Date: | 23-Nov-2009 Sheet of | | |
| File: | E:\GOTOP_GPS技术资料\GOTOP_最新北漂资料\GOTOP应用线路图 | | |

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