	GOTOP GT-1613-SKR
	Ultra High Sensitivity and Low Power
	GPS Receiver Module

General Description

The Gotop GT-1613-SKR 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: GT-1613-SKR Top View



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Features

- Build on high performance, low-power SKYTRAQ chipset
- Ultra high sensitivity: -159dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max 50mA@3.0V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.85V to 3.3V
- Operating temperature range: -40 to 85°C
- SMD type with stamp holes
- Small form factor: 15.9x13.1x3.0mm
- RoHS compliant (Lead-free)

Pin Assignment

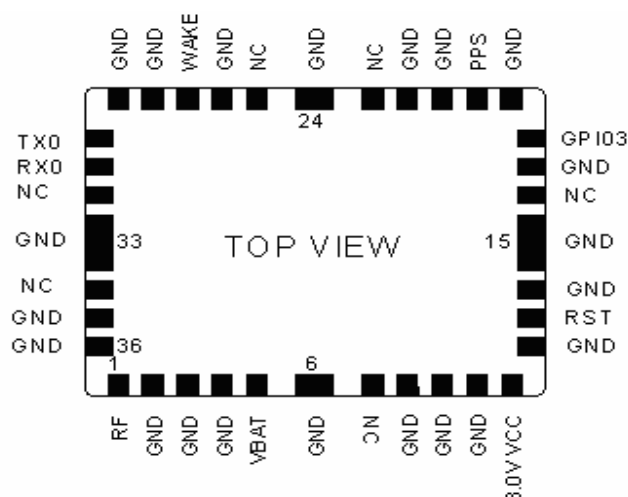
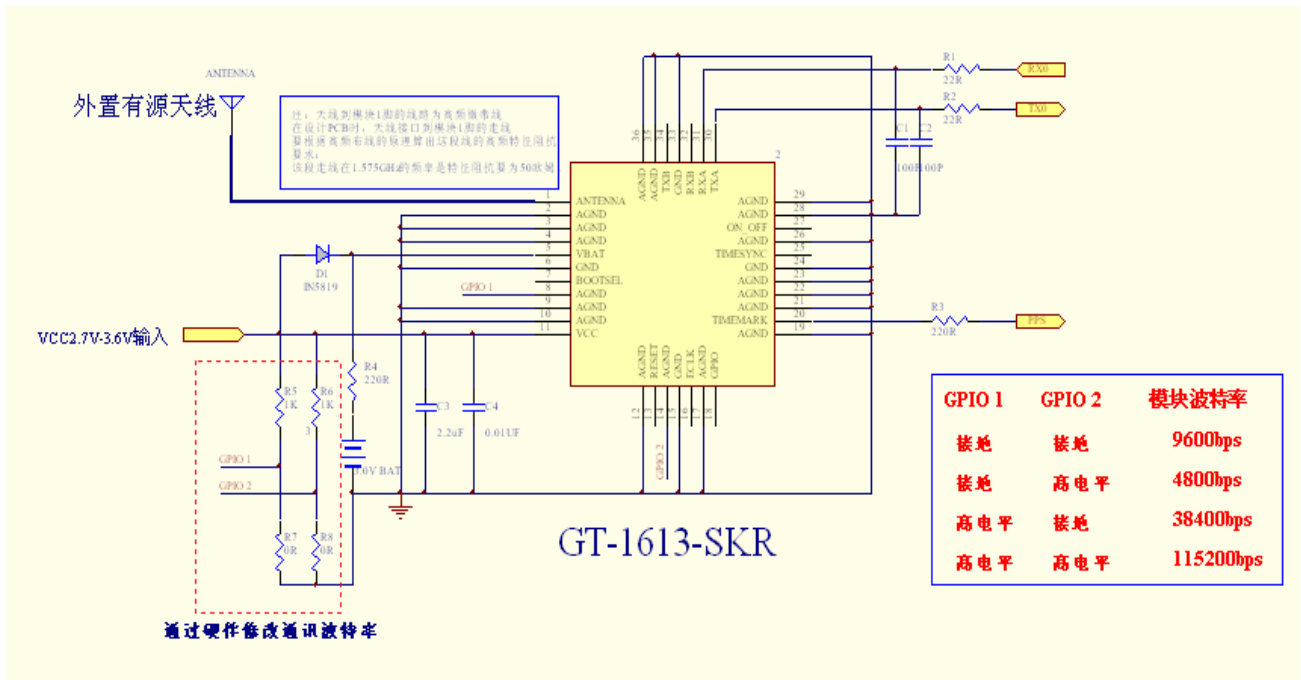


Figure 2: GT-1613-SKR Pin Package



Typical application circuit that uses active antenna

Performance Specification

Parameter	Specification
Receiver Type	L1 frequency band, C/A code, 65-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	50mA @3V Vcc
	Acquisition	55mA
	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 GT-1613-SKR is required. The input voltage Vcc should be 3.0V \pm 10%, maximum, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry.

Antenna: The GT-1613-SKRGPS 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 V_BAT. This enables the GT-1613-SKR 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.

Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	RF_IN	I	GPS Signal Input	
2	GND	G	Ground	
3	GND	G	Ground	
4	GND	G	Ground	
5	V_BAT	I	RTC Battery Input	Leave Open in not used
6	GND	G	Ground	
7	BOOT_INT	I	Boot Mode	Leave Open if not used
8	GPIO1	I	Typical application circuit that uses active antenna	

9	GND	G	Ground	
10	GND	G	Ground	
11	Vcc	I	Module Power Supply	
12	GND	G	Ground	
13	RESET	I	Module Reset (Active Low)	Leave Open in not used
14	GPIO2	I	Typical application circuit that uses active antenna	
15	GND	G	Ground	
16	NC		No connection	
17	GND	G	Ground	
18	GPIO3	I	General Purpose Input	
19	GND	G	Ground	
20	PPS	O	Time Pulse(1PPS)	Leave Open in not used
21	GND	G	Ground	
22	GND	G	Ground	
23	GND	G	Ground	
24	GND	G	Ground	
25	NC		No connection	
26	GND	G	Ground	
27	WAKE_UP	I	External wake-up input Pull low via 4.7k to 10kohm. (Only APM)	

28	GND	G	Ground	
29	GND	G	Ground	
30	TX0	O	UART Serial Data Output	Pull up (75K Ω) if not used
31	RX0	I	UART Serial Data Input	Pull up (75K Ω) if not used
32	NC			
33	GND	G	Ground	
34	NC			
35	GND	G	Ground	
36	GND	G	Ground	

Electrical Characteristics

Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	Vcc	-0.3	3.6	V
Input Pins				
Input Pin Voltage I/O	Reset	-0.3	3.6	V
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 Temperature <10s	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	V _{CC}		3.0	3.3	3.6	V
Power supply voltage ripple	V _{CC_PP}	V _{CC} =3.0V			30	mV
Consumption current	I _{CC}	V _{CC} =3.0V		40	45	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		$0.2 \times V_{CC}$	V
Operating temperature	T_{opr}		-40		85	°C

Mechanical Specification

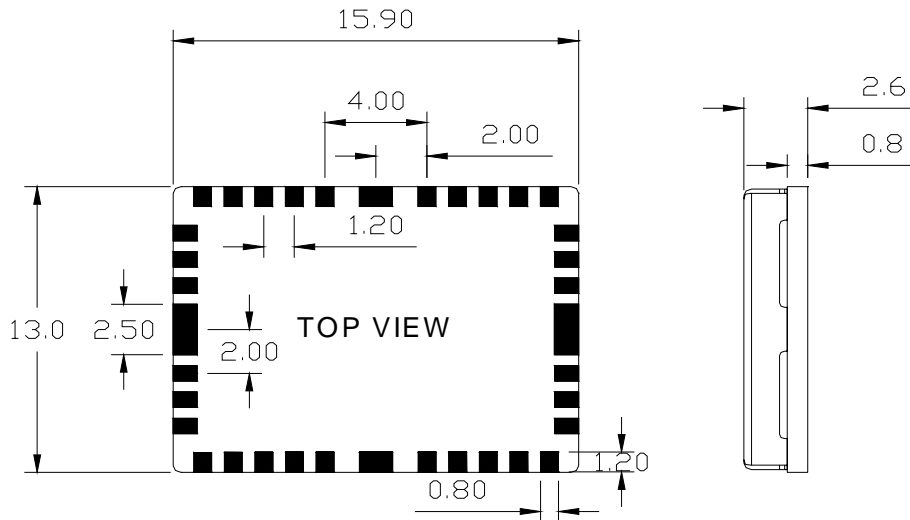


Figure 3: GT-1613-SKR Dimensions

Software Protocol

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 Gotop GT-1613-SK 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	1		See Table 2-1
Indicator			
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.mmmmm
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:

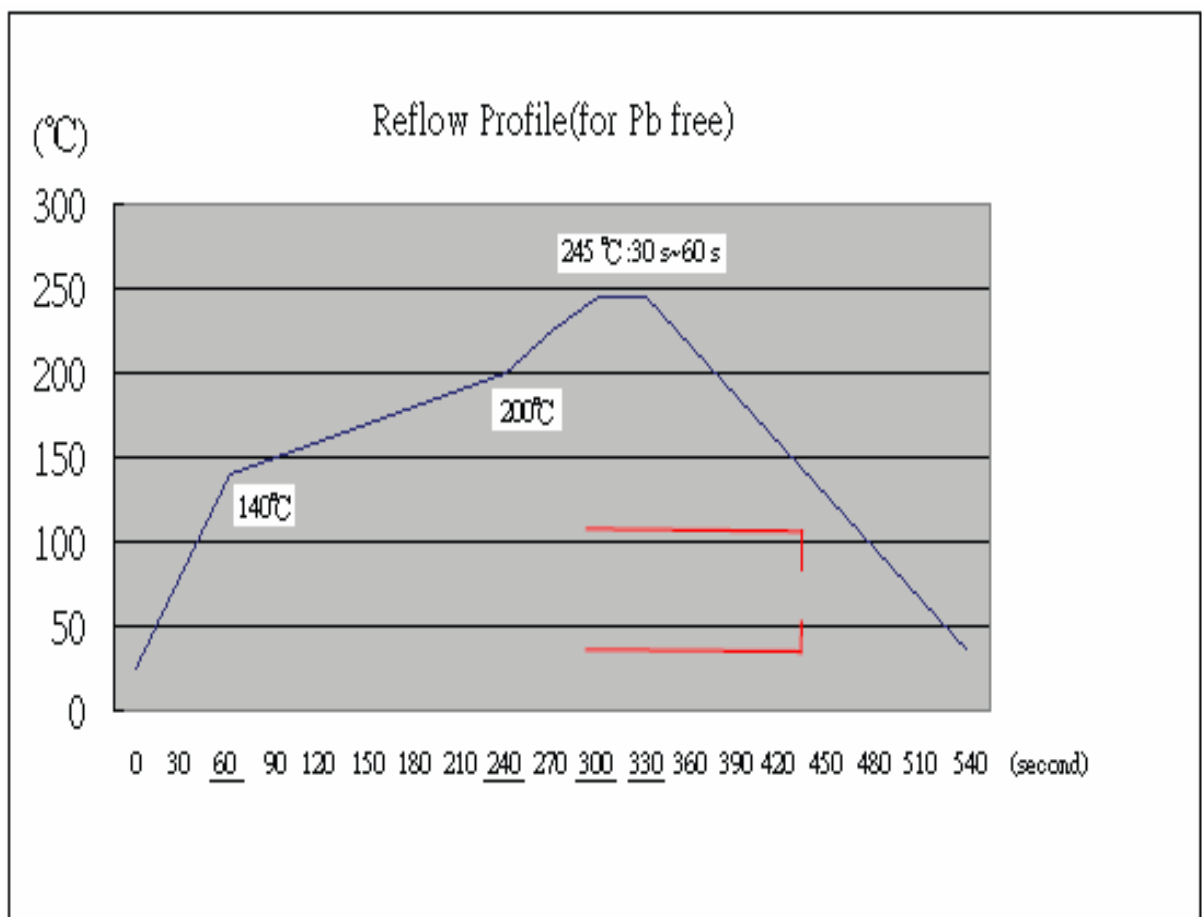
\$GPVTG, 309.62, T, M, 0.13, N, 0.2, K*6E

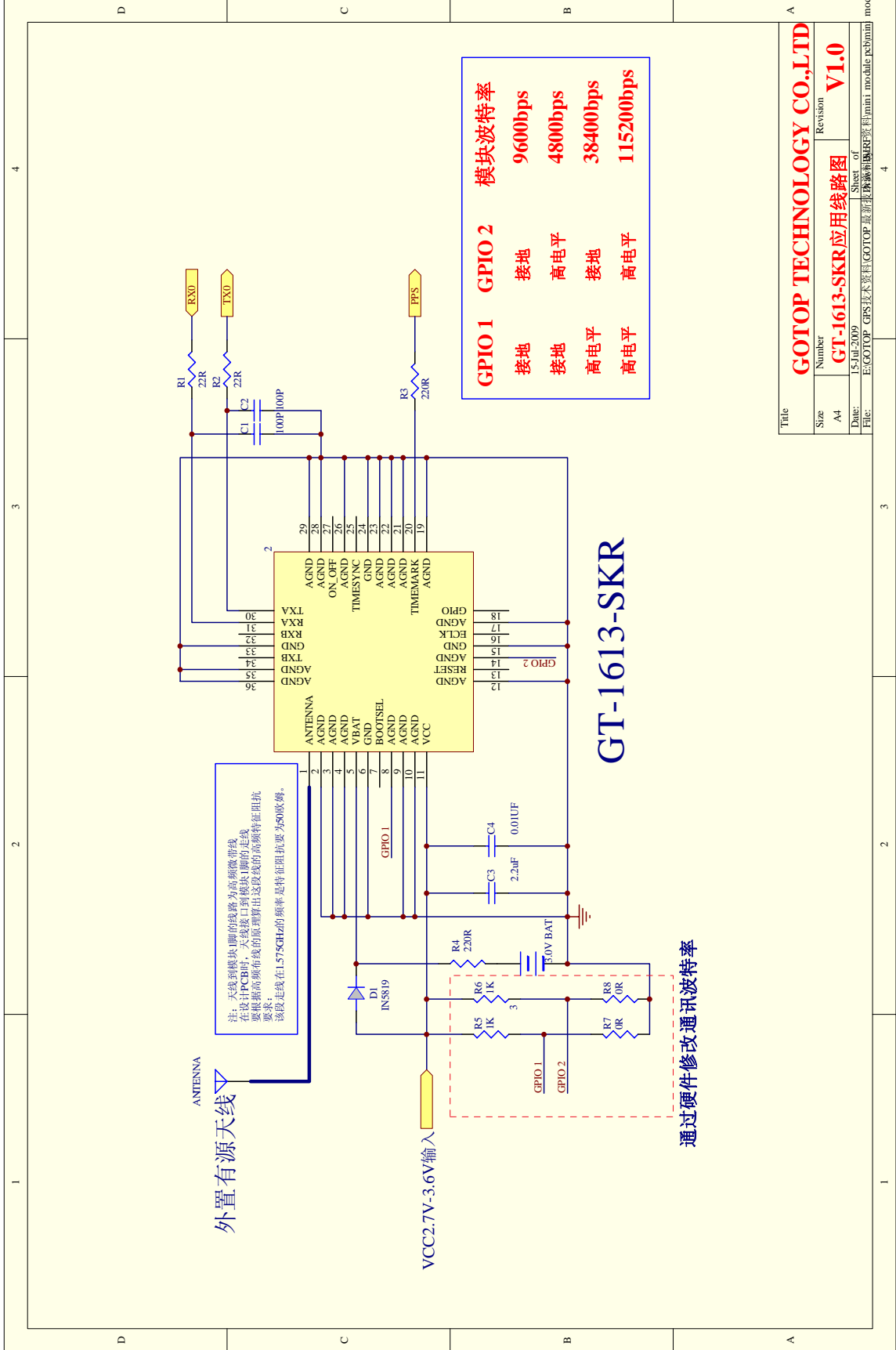
Table 7: VTG Data Format

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





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Gotop Technology Co. , LTD

Add:Room 603 Zhantao technology Building, Minzhi Road, Minzhi Street,Baoan District,
ShenZhen City, China

Phone: 13926505646 86-755-23804156

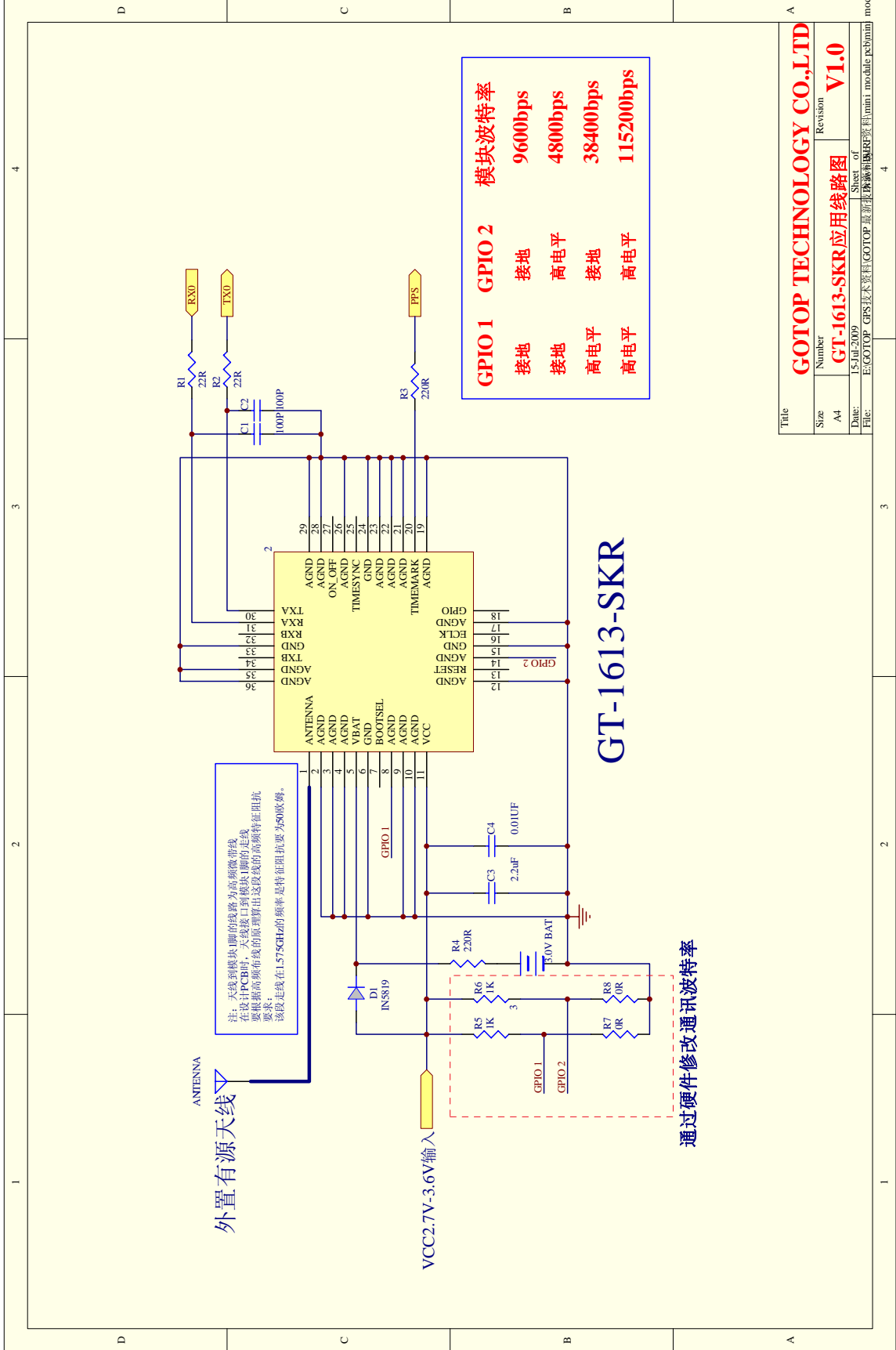
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Date:	15-Jul-2019		
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