

Product name	Description	Version
UC-1513	Datasheet of UC-1513 GPS module	1.0



1 Introduction

Locosys GPS UC-1513 module features high sensitivity, low power and ultra small form factor. This GPS module is powered by ATHEROS, it can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. The miniature size makes the module easy and the best choice to integrate into portable device like mobile phone, PDAs, camera and vehicle locators.

2 Features

- ATHEROS high sensitivity solution
- Support 20-channel GPS
- Fast TTFF at low signal level
- Capable of WAAS
- Built-in LNA and SAW filter
- Small form factor 15 x 13 x 2.2 mm
- SMD type with stamp holes; RoHS compliant

3 Application

- Personal positioning and navigation
- Automotive navigation
- Marine navigation

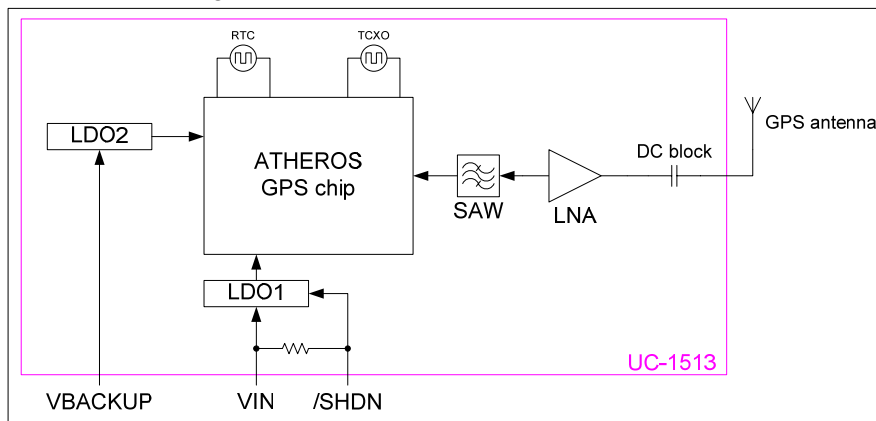


Fig 3-1 System block diagram.

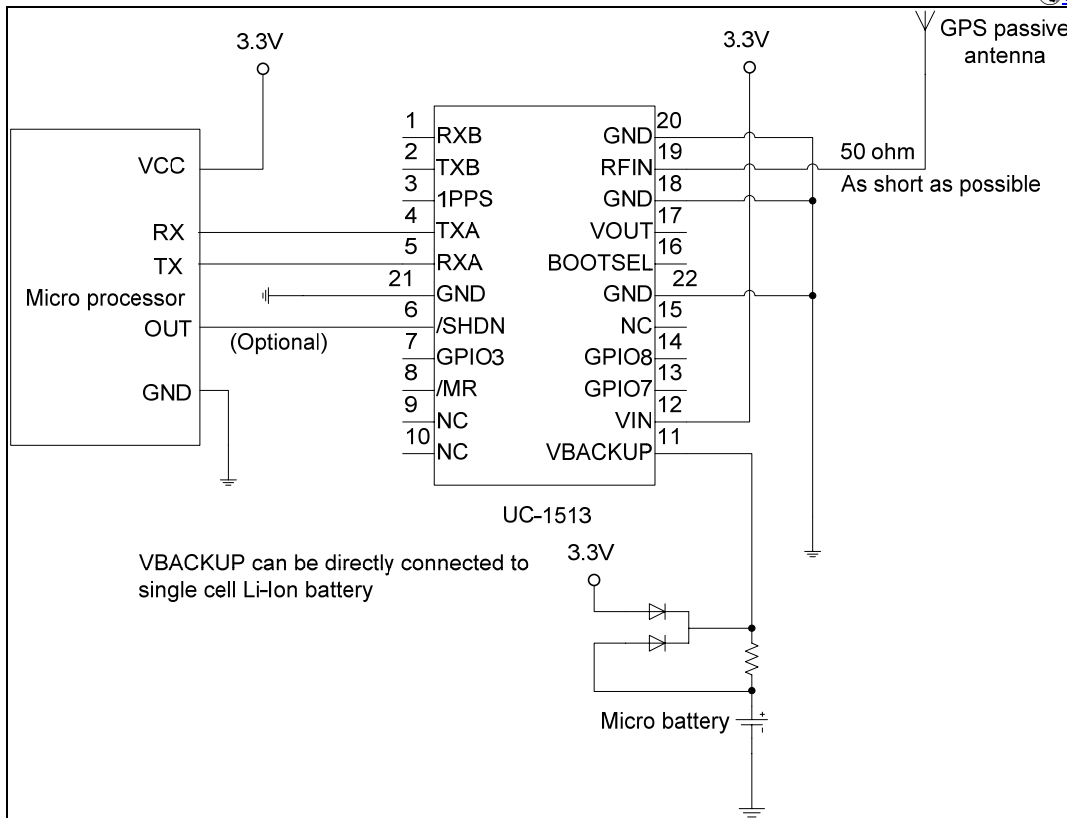


Fig 3-2 Typical application circuit that uses passive antenna.

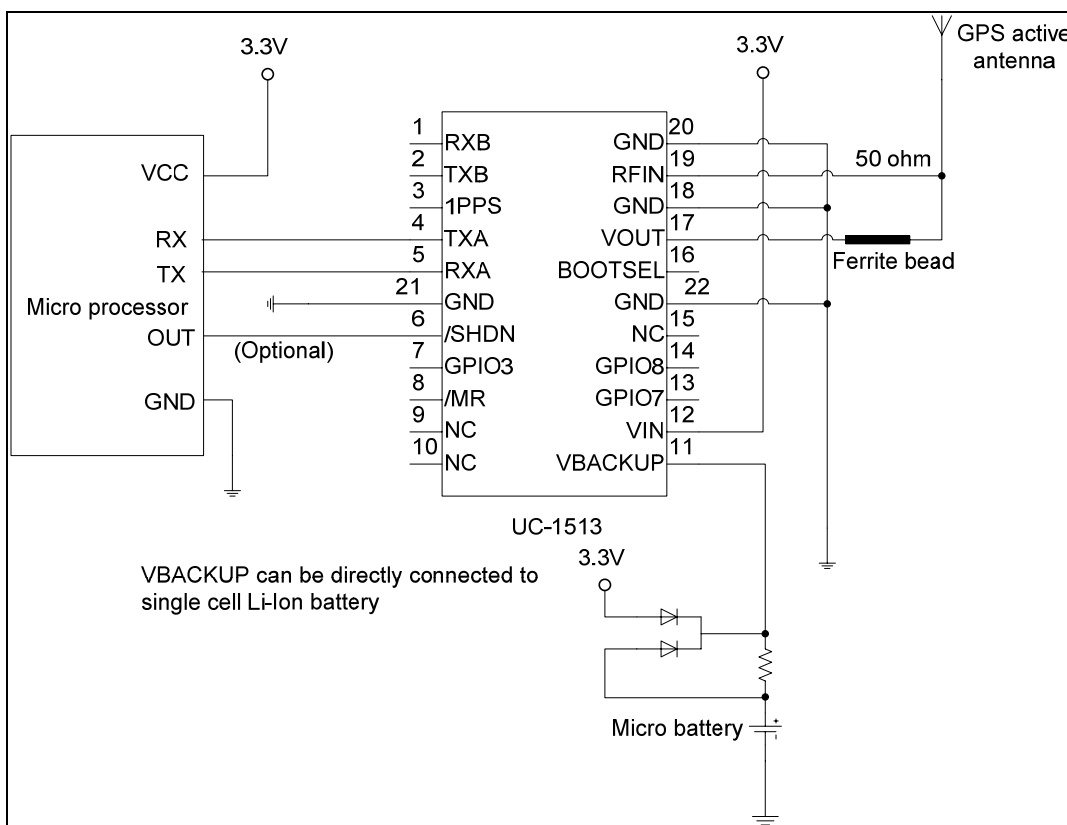


Fig 3-3 Typical application circuit that uses active antenna

4 GPS receiver

Chip	ATHEROS AR1511	
Frequency	L1 1575.42MHz, C/A code	
Channels	20	
Update rate	1Hz	
Sensitivity	Tracking	-154.5dBm, up to -157dBm (with external LNA)
	Cold start	-142.5dBm, up to -145dBm (with external LNA)
Acquisition Time	Hot start (Open Sky)	< 2s (typical)
	Hot start (Indoor)	< 30s
	Cold Start (Open Sky)	38s (typical)
Position Accuracy	Autonomous	3m (2D RMS)
	WAAS	2.5m (depends on accuracy of correction data).
Max. Altitude	< 18,000 m	
Max. Velocity	< 515 m/s	
Protocol Support	NMEA 0183 ver 3.0	9600 bps ⁽¹⁾ , 8 data bits, no parity, 1 stop bits (default)
		1Hz: GGA, GLL, GSA, GSV, RMC, VTG

Note 1: Both baud rate and output message rate are configurable.

5 Software interface

5.1 NMEA output message

Table 5.1-1 NMEA output message

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 5.1-2 contains the values for the following example:

\$GPGGA,053740.000,2503.6319,N,12136.0099,E,1,08,1.1,63.8,M,15.2,M,,0000*64

Table 5.1-2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	053740.000		hhmmss.sss

Latitude	2503.6319		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12136.0099		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 5.1-3
Satellites Used	08		Range 0 to 12
HDOP	1.1		Horizontal Dilution of Precision
MSL Altitude	63.8	meters	
Units	M	meters	
Geoid Separation	15.2	meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*64		
<CR> <LF>			End of message termination

Table 5.1-3 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

● GLL--- Geographic Position – Latitude/Longitude

Table 5.1-4 contains the values for the following example:

\$GPGLL,2503.6319,N,12136.0099,E,053740.000,A,A*52

Table 5.1-4 GLL Data Format

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	2503.6319		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12136.0099		dddmm.mmmm
E/W indicator	E		E=east or W=west
UTC Time	053740.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		A=autonomous, D=DGPS, E=DR

Checksum	*52		
<CR> <LF>			End of message termination

● GSA---GNSS DOP and Active Satellites

Table 5.1-5 contains the values for the following example:

\$GPGSA,A,3,24,07,17,11,28,08,20,04,.....,2.0,1.1,1.7*35

Table 5.1-5 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 5.1-6
Mode 2	3		See Table 5.1-7
ID of satellite used	24		Sv on Channel 1
ID of satellite used	07		Sv on Channel 2
....		
ID of satellite used			Sv on Channel 12
PDOP	2.0		Position Dilution of Precision
HDOP	1.1		Horizontal Dilution of Precision
VDOP	1.7		Vertical Dilution of Precision
Checksum	*35		
<CR> <LF>			End of message termination

Table 5.1-6 Mode 1

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

Table 5.1-7 Mode 2

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

● GSV---GNSS Satellites in View

Table 5.1-8 contains the values for the following example:

\$GPGSV,3,1,12,28,81,285,42,24,67,302,46,31,54,354,,20,51,077,46*73

\$GPGSV,3,2,12,17,41,328,45,07,32,315,45,04,31,250,40,11,25,046,41*75

\$GPGSV,3,3,12,08,22,214,38,27,08,190,16,19,05,092,33,23,04,127,*7B

Table 5.1-8 GSV Data Format

Name	Example	Units	Description
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Message ID	\$GPGSV		GSV protocol header
Total number of messages ¹	3		Range 1 to 3
Message number ¹	1		Range 1 to 3
Satellites in view	12		
Satellite ID	28		Channel 1 (Range 01 to 32)
Elevation	81	degrees	Channel 1 (Range 00 to 90)
Azimuth	285	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	42	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
Satellite ID	20		Channel 4 (Range 01 to 32)
Elevation	51	degrees	Channel 4 (Range 00 to 90)
Azimuth	077	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	46	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Checksum	*73		
<CR> <LF>			End of message termination

1. Depending on the number of satellites tracked multiple messages of GSV data may be required.

● RMC---Recommended Minimum Specific GNSS Data

Table 5.1-9 contains the values for the following example:

\$GPRMC,053740.000,A,2503.6319,N,12136.0099,E,2.69,79.65,100106,,A*53

Table 5.1-9 RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	053740.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.6319		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12136.0099		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed over ground	2.69	knots	True
Course over ground	79.65	degrees	
Date	100106		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west (Not shown)
Mode	A		A=autonomous, D=DGPS, E=DR
Checksum	*53		
<CR> <LF>			End of message termination

● **VTG---Course Over Ground and Ground Speed**

Table 5.1-10 contains the values for the following example:

\$GPVTG,79.65,T,,M,2.69,N,5.0,K,A*38

Table 5.1-10 VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Course over ground	79.65	degrees	Measured heading
Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic
Speed over ground	2.69	knots	Measured speed
Units	N		Knots
Speed over ground	5.0	km/hr	Measured speed
Units	K		Kilometer per hour
Mode	A		A=autonomous, D=DGPS, E=DR
Checksum	*38		
<CR> <LF>			End of message termination

5.2 Proprietary NMEA input message

Please refer to ATHEROS proprietary message.

6 Pin assignment and descriptions

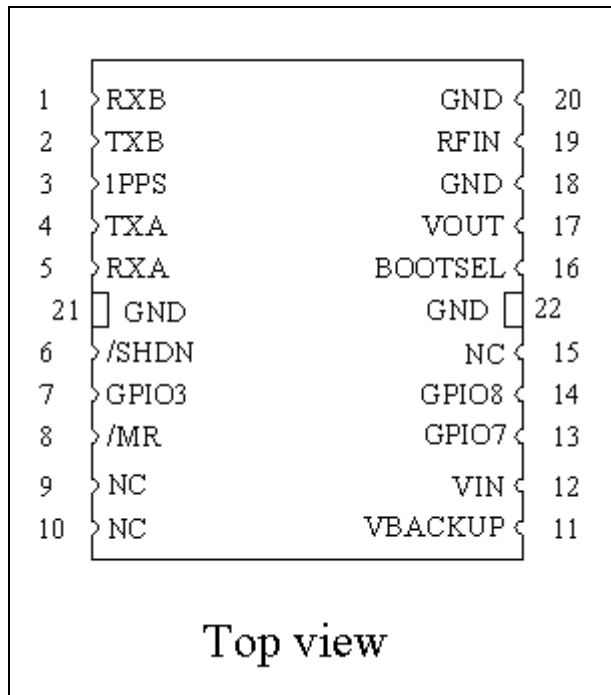


Table 6-1 Pin descriptions

Pin #	Name	Type	Description	Note
1	RXB	I	Serial input for channel B (Default null)	
2	TXB	O	Serial output for channel B (Default null)	
3	1PPS	O	Pulse per second (100ms pulse)	
4	TXA	O	Serial output for channel A (Default NMEA)	
5	RXA	I	Serial input for channel A (Default NMEA)	
6	/SHDN	I/O	Shutdown control input pin. Active at “L” input. Internal pulled up via a resistor. If /SHDN pin is not necessary, open this node.	
7	GPIO3	I/O	General purpose I/O (Default status indicator. When GPS position fix is available, it outputs 50ms high per second, otherwise it outputs low.)	1,2
8	/MR	I/O	Manual reset input pin. Active at “L” input. If /MR pin is not necessary, open this node.	
9	NC			
10	NC			
11	VBACKUP	P	Backup battery supply voltage. This pin must be powered to enable the module.	
12	VIN	P	DC supply voltage	

13	GPIO7	I/O	General purpose I/O	1,2
14	GPIO8	I/O	General purpose I/O	1,2
15	NC			
16	BOOTSEL	I	Boot mode selection. Internal pulled high (1.8V) during the boot sequence. Do not connect in normal operation.	
17	VOUT	P	Linear regulator power output, 2.85V (Do not use this as power source of backup battery)	
18	GND	P	Ground	
19	RFIN	I	GPS RF signal input	
20	GND	P	Ground	
21	GND	P	Ground	
22	GND	P	Ground	

<Note>

1. Default input at reset
2. Internal pull up

7 DC & Temperature characteristics

7.1 Absolute maximum ratings

Parameter	Symbol	Ratings	Units
Input Voltage	VIN	6.5	V
Input Backup Battery Voltage	VBACKUP	7	V
2.85V Output Current	Iout	50	mA
Operating Temperature Range	TAopr	-40 ~ 85	°C
Storage Temperature Range	TAstg	-40 ~ 85	°C

7.2 DC Electrical characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	VIN	Iout = 0	3.0		4.2	V
Input Backup Battery Voltage	VBACKUP		2.1		6.0	V
2.85V Output Voltage	VOUT		2.79	2.85	2.91	V
Supply Current	Iss	VIN = 3.3V, Iout = 0, Peak			65	mA
		Acquisition		43.5		mA
		Tracking		46 ⁽¹⁾		mA
		Shutdown		10		uA

Backup Battery Current	I _{bat}	V _{IN} = 0V or /SUDN = Low		7		uA
2.85V Output Current	I _{out}	V _{IN} = 3.3V			30	mA
High Level Input Voltage	V _{IH}		2.1		3.6	V
		For /SHDN pin	1.3		V _{IN}	
Low Level Input Voltage	V _{IL}		-0.3		0.8	V
		For /SHDN pin			0.25	
High Level Input Current	I _{IH}	no pull-up or down	-1		1	uA
		For /SHDN pin	-15		15	
Low Level Input Current	I _{IL}	no pull-up or down	-1		1	uA
		For /SHDN pin	-15		15	
High Level Output Voltage	V _{OH}		2.2			V
Low Level Output Voltage	V _{OL}				0.6	V
High Level Output Current	I _{OH}			2		mA
Low Level Output Current	I _{OL}			2		mA
Minimum Pulse Width	T _{MPW}	For /MR pin	1			mS

Note 1: Measured when position fix is available and input voltage is 3.3V.

7.3 LNA characteristics

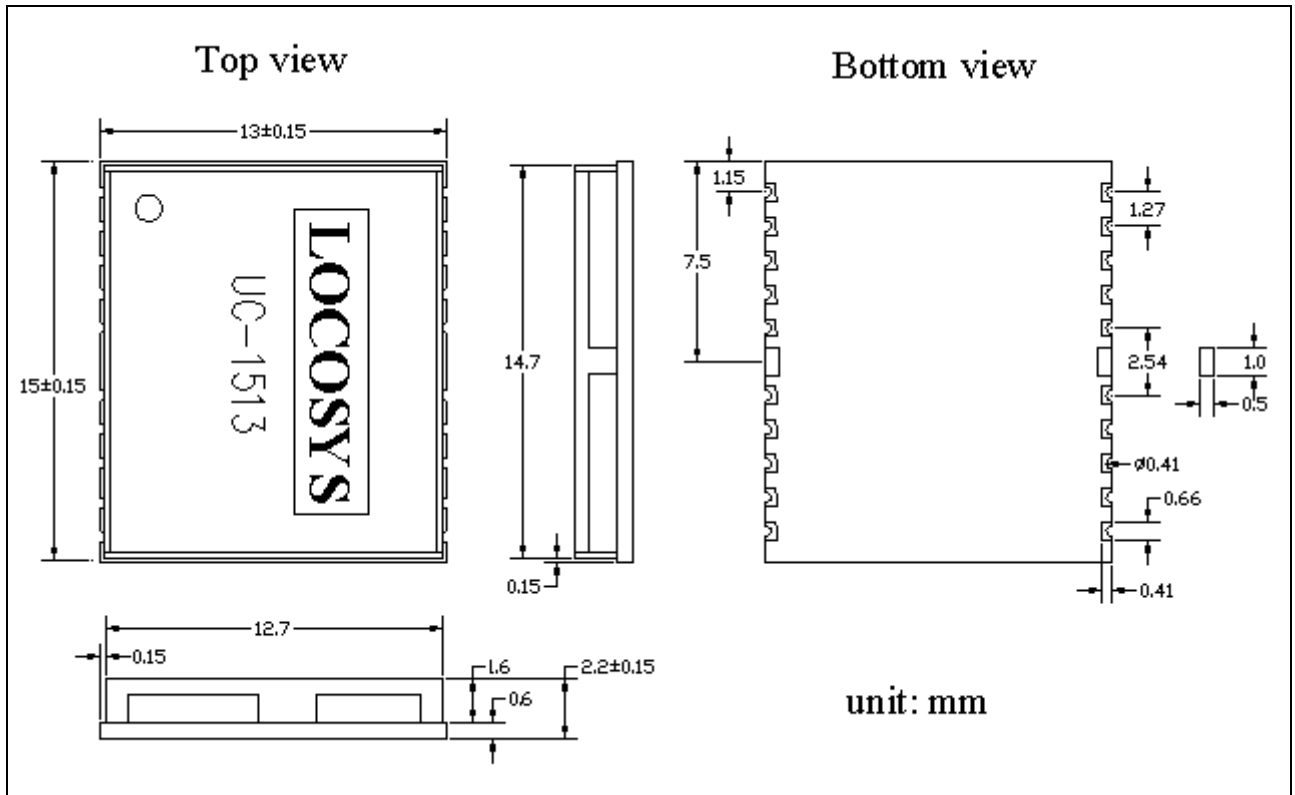
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Insertion power gain	S ₂₁ ²	T _A = 25°C		18		dB
Noise figure	NF	T _A = 25°C		1.1		dB

7.4 Temperature characteristics

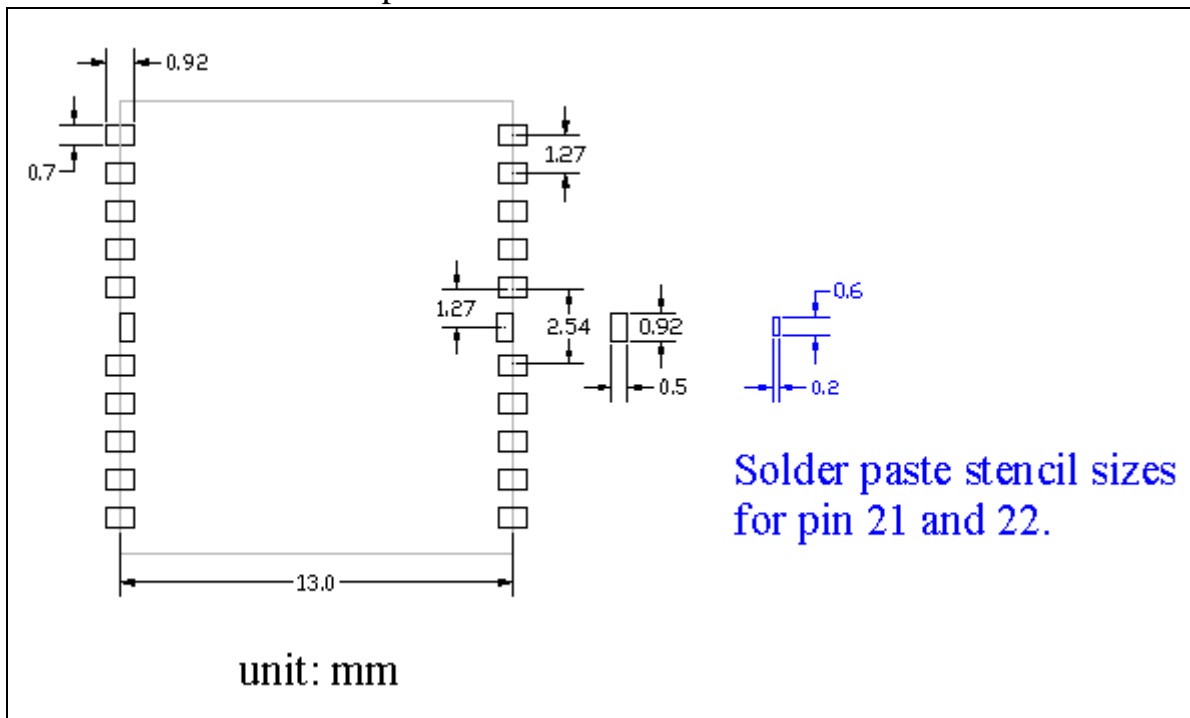
Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	T _{opr}	-30	-	85	°C
Storage Temperature	T _{stg}	-40	25	85	°C

8 Mechanical specification

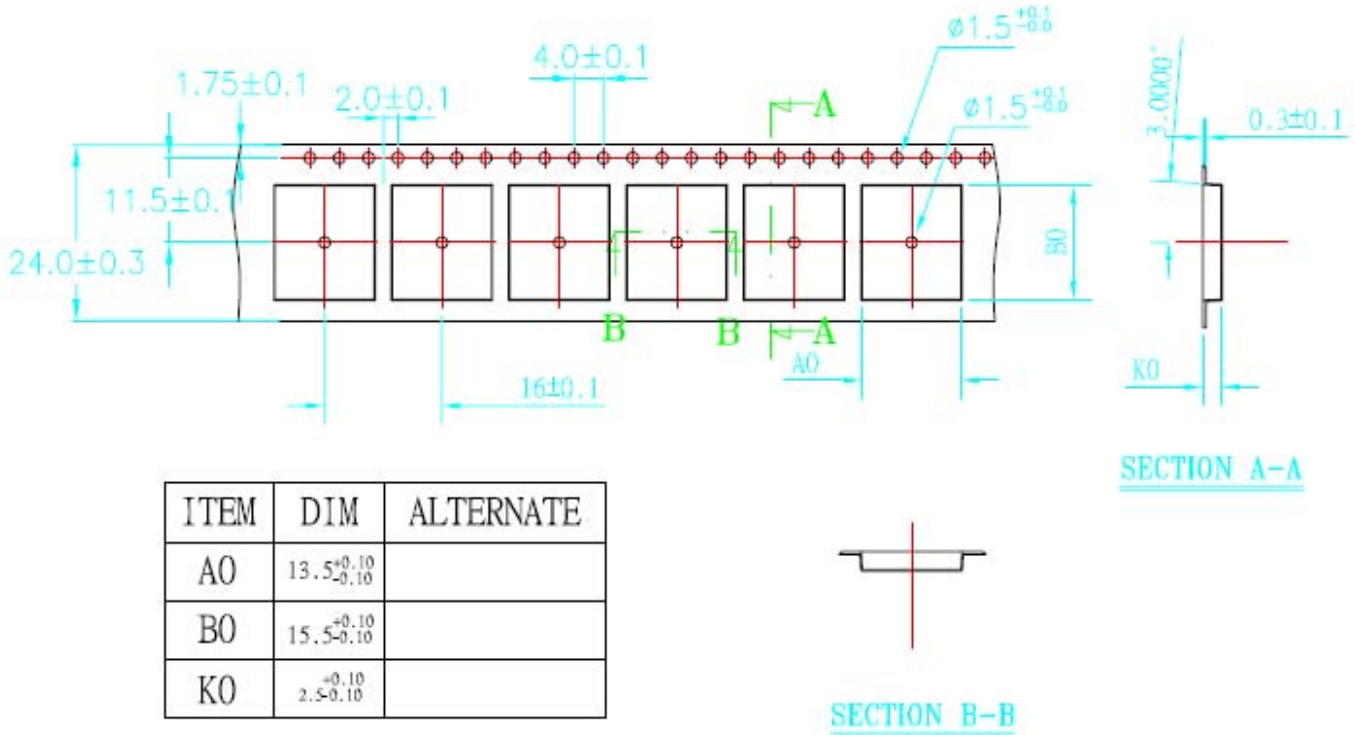
8.1 Outline dimensions



8.2 Recommended land pattern dimensions



9 Reel Packing information



1. 10 sprocket hole pitch cumulative tolerance $\pm 0.20\text{mm}$.
2. Carrier camber not to exceed 1mm in 100mm.
3. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket.
4. K0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. All dimensions meet EIA-481-2 requirements.
6. Material: Black Anti-Static Polystyrene.
7. Component load per 13" reel :1000 pcs.

Document change list

Revision 1.0

- First release on Nov. 27, 2008.