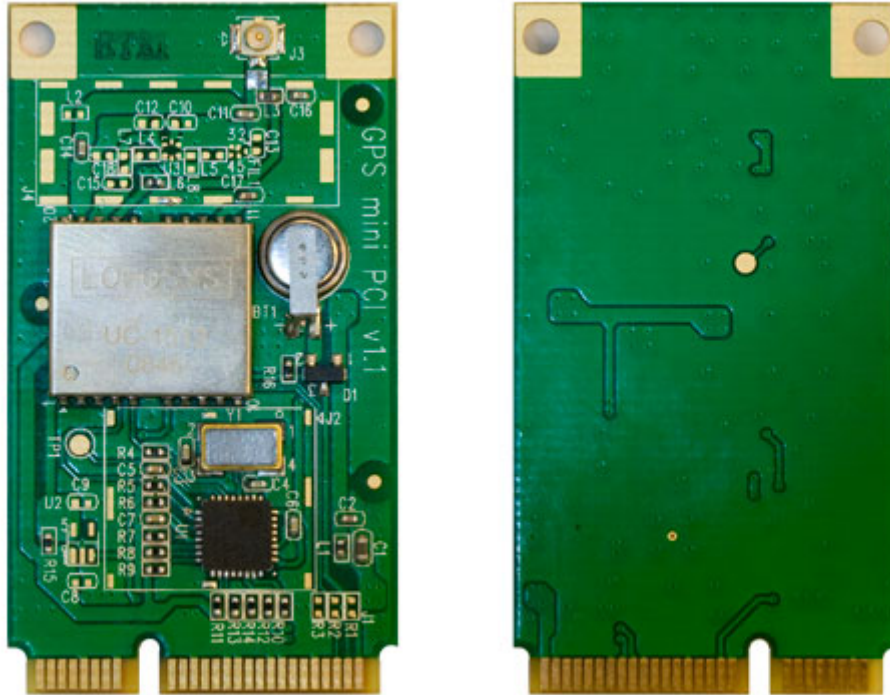


Product name	Description	Version
LS26050	Datasheet of LS26050 GPS mini PCIe card	0.9 preliminary



1 Introduction

LOCOSYS LS26050 is a GPS module with the form factor of mini PCIe card. This GPS module is powered by Atheros, it can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. Besides, the USB interface makes the module easy to integrate into the laptop.

2 Features

- USB interface
- Atheros high sensitivity solution
- Support 20-channel GPS
- Fast TTFF at low signal level
- Capable of WAAS
- Built-in LNA and SAW filter
- Built-in micro battery to reserve system data for rapid satellite acquisition

3 Application

- Laptop with GPS function
- Netbook with GPS function

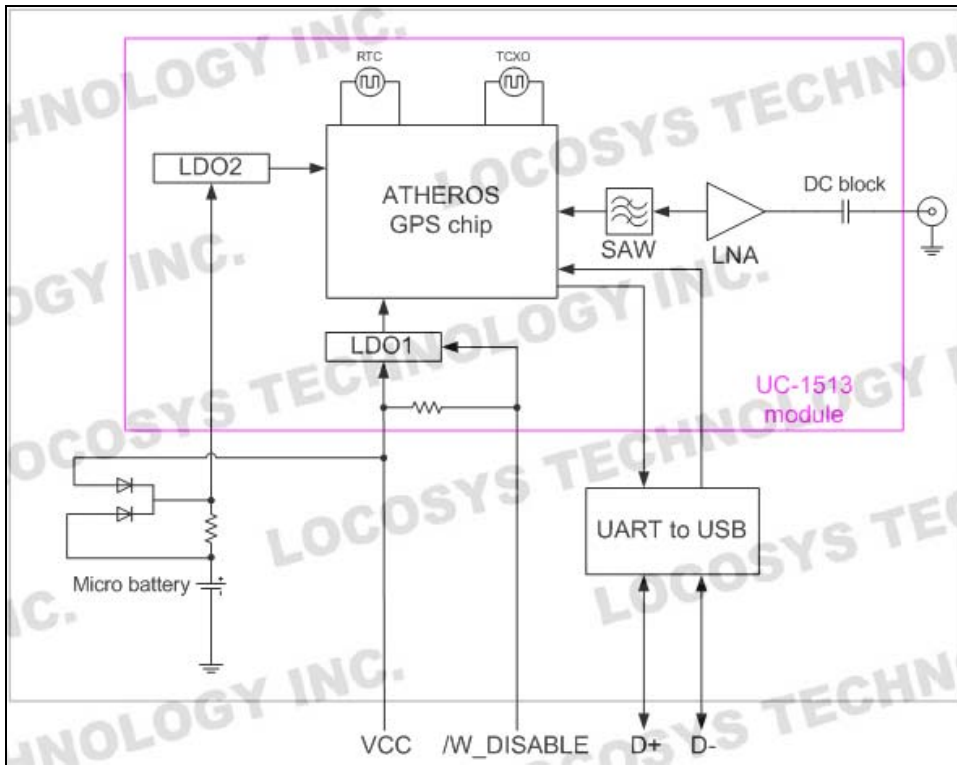


Fig 3-1 System block diagram.

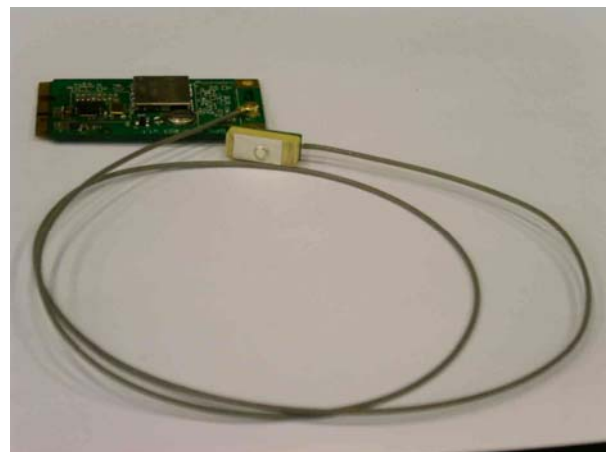


Fig 3-2. LS26050 with a GPS active antenna for a laptop.

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
------	---------	-------	-------------

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 of mini PCIe card

Pin #	Name	Type	Description	Note
1	NC			
2	NC			
3	NC			
4	GND	P	Ground	
5	NC			
6	NC			
7	NC			
8	NC			
9	GND	P	Ground	
10	NC			
11	NC			
12	NC			
13	NC			
14	NC			
15	GND	P	Ground	
16	NC			
17	NC			
18	GND	P	Ground	
19	NC			
20	/W_DISABLE	I	Disable GPS function. High: enable; Low: disable	
21	GND	P	Ground	
22	NC			
23	NC			
24	NC			
25	NC			
26	GND	P	Ground	
27	GND	P	Ground	
28	NC			
29	GND	P	Ground	
30	NC			
31	NC			
32	NC			

33	NC		
34	GND	P	Ground
35	GND	P	Ground
36	USB_D-		USB D- line
37	GND	P	Ground
38	USB_D+		USB D+ line
39	NC		
40	GND	P	Ground
41	NC		
42	NC		
43	GND	P	Ground
44	NC		
45	NC		
46	NC		
47	NC		
48	NC		
49	NC		
50	GND	P	Ground
51	NC		
52	VCC	P	Power input

7 DC & Temperature characteristics

7.1 DC Electrical characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	VCC		3.0		3.6	V
Supply Current	I _{SS}	VIN = 3.3V, Peak			70	mA
		Acquisition		50		mA
		Tracking		53 ⁽¹⁾		mA
		Disable		8.9 ⁽²⁾		mA
High Level Input Voltage	V _{IH}	For /SHDN pin	1.3		VCC	V
Low Level Input Voltage	V _{IL}	For /SHDN pin			0.25	V
High Level Input Current	I _{IH}	For /SHDN pin	-15		15	uA
Low Level Input Current	I _{IL}	For /SHDN pin	-15		15	uA

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

Note 2: Measured when /W_DISABLE pin is at low level and the corresponding COM port is not ever connected.

7.2 LNA characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Insertion power gain	$ S_{21} ^2$	$T_A = 25^\circ\text{C}$		18		dB
Noise figure	NF	$T_A = 25^\circ\text{C}$		1.1		dB

7.3 Temperature characteristics

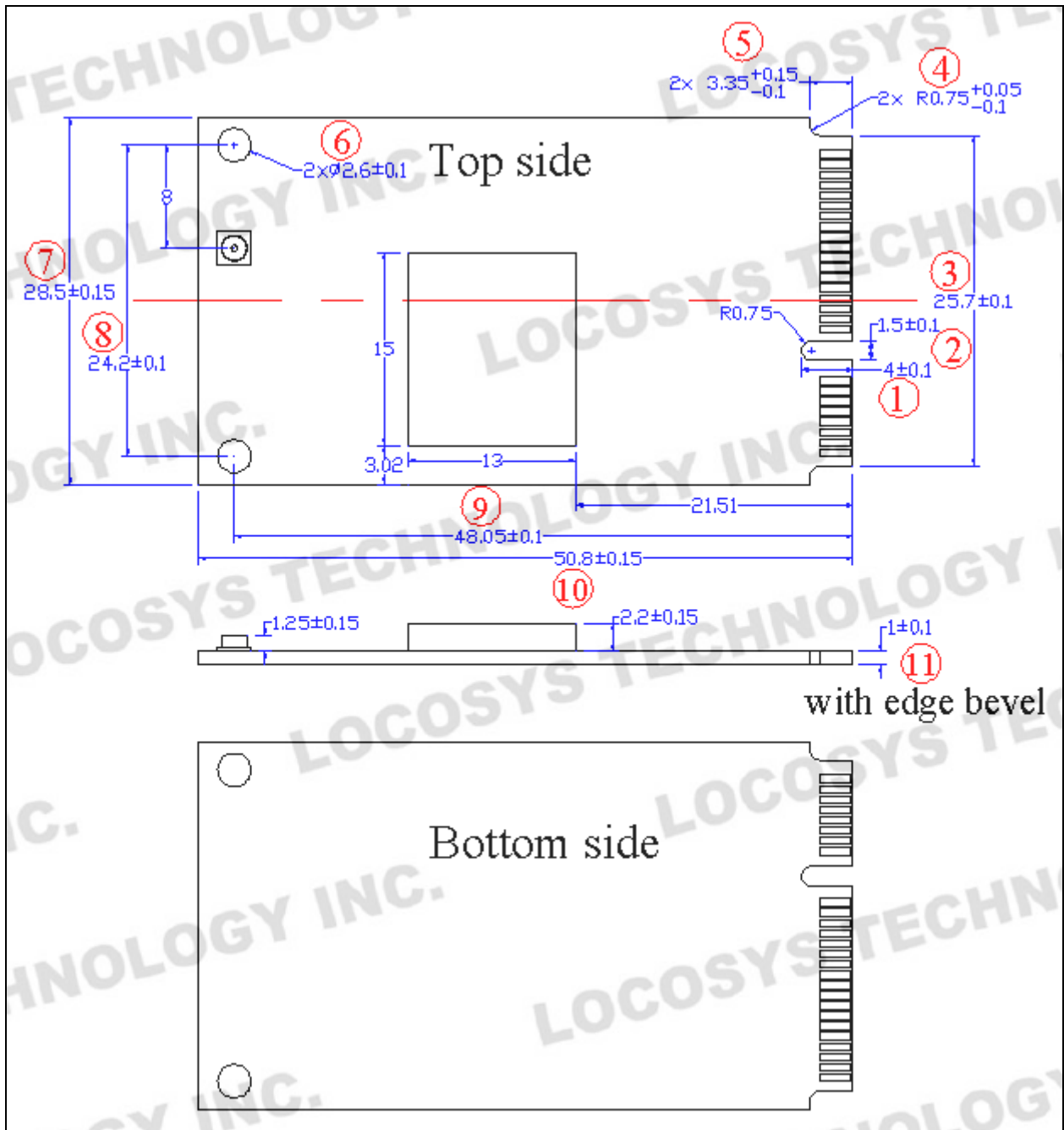
Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	T_{opr}	-30	-	85	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40	25	85	$^\circ\text{C}$

Note: The operating and storage temperature of the built-in micro battery are $-20 \sim +60$ and $-40 \sim +60$ $^\circ\text{C}$ respectively.

LS26050 will still work even the battery is broken or short due to temperature or other issue.

8 Mechanical specification

8.1 Outline dimensions



The dimension and pin definition is compliant with PCI Express Mini Card Revision 1.2.

9 Packing information

Document change list

Revision 0.9

- Preliminary