

Product name	Description	Version
LS26030-35AD	GNSS DR module of PCIe Full-Mini card	0.1
LS26031-35AD	GNSS DR module of PCIe Half-Mini card	


LS26030-35AD

LS26031-35AD

1 Introduction

LS26030-35AD and LS26031-35AD series integrate GNSS fusion modules into the PCIe Full-Mini card or PCIe Half-Mini card. These GNSS DR modules can provide superior sensitivity and performance even in urban canyon and dense foliage environment. Besides, the USB interface makes these modules easy to integrate into the laptop.

2 Features

- USB interface
- Support GPS/QZSS, GLONASS, GALILEO and BEIDOU
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN) and QZSS SLAS
- Fast TTFF at low signal level
- Up to 10 Hz update rate
- Built-in micro battery to reserve system data for rapid satellite acquisition

3 Application

- Laptop with GNSS function
- IPC with GNSS function

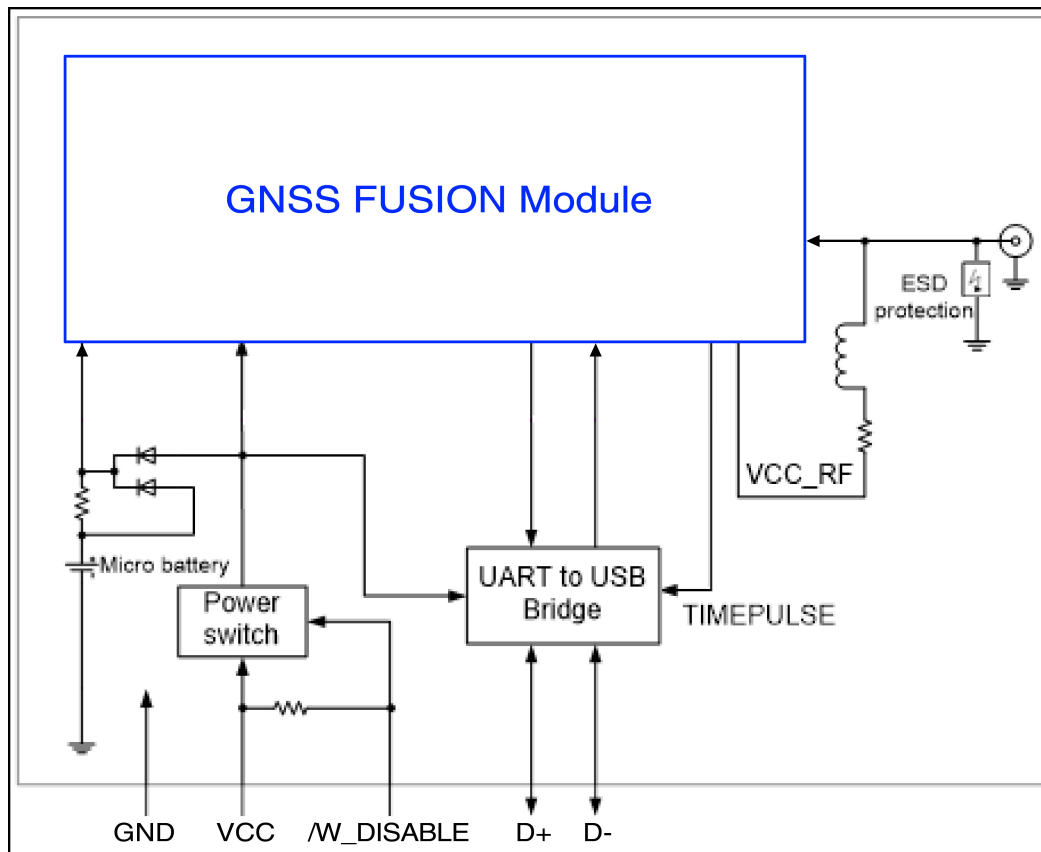


Fig 3-1 System block diagram.

4 GNSS receiver

Frequency	GPS/QZSS: L1 C/A, L5C GLONASS: L1OF GALILEO: E1, E5a BEIDOU: B1I, B2a	
Channels	Support 135 channels	
Update rate	1Hz default, up to 5/10 Hz	
Sensitivity	Cold start	-148dBm
	Hot start	-155dBm
	Reacquisition	-158dBm
	Tracking	-165dBm
Acquisition Time	Hot start (Open Sky)	1s (typical)
	Cold Start (Open Sky)	24s (typical)
Position Accuracy	Autonomous:	1.5m CEP ⁽¹⁾
	UDR mode	CEP ≤ 3% of distance travelled without GNSS (< 60s signal lose)
Max. Altitude	< 18,000 m	
Max. Velocity	< 500 m/s	
Protocol Support	115200 bps ⁽²⁾ , 8 data bits, no parity, 1 stop bits (default)	
	NMEA 0183 ver. 4.1	1Hz: GGA, GLL, GSA, GSV, RMC, and VTG
	Proprietary message	1Hz: PLSATTIT

<Note>

1. 24hr, static, open sky, demonstrated with good dual-frequency active antennas.
2. Both baud rate and output message rate are configurable to be factory default.

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:

\$GNGGA,091250.000,2503.71250,N,12138.74514,E,1,32,0.55,119.0,M,17.2,M,,*7E

Table 5.1- 2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GNGGA		GGA protocol header
UTC Time	091250.000		hhmmss.sss
Latitude	2503.71250		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74514		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 5.1-3
Satellites Used	32		Number of satellite in use
HDOP	0.55		Horizontal Dilution of Precision (meters)
MSL Altitude	119.0	meters	Antenna Altitude above/below mean-sea-level (geoid) (in meters)
Units	M	meters	Units of antenna altitude, meters
Geoidal Separation	17.2	meters	
Units	M	meters	Units of geoidal separation, meters
Age of diff. GNSS data		second	Null fields when DGPS is not used
Diff. Ref. Station ID			Differential reference station ID, 0000-1023
Checksum	*7E		Checksum
<CR> <LF>			End of message termination

Table 5.1-3 Position Fix Indicators

Value	Description
0	No position fix
1	Autonomous GNSS fix
2	Differential GNSS fix
4	RTK fixed
5	RTK float

● GLL--- Geographic Position – Latitude/Longitude

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

\$GNGLL,2503.71193,N,12138.74582,E,094450.000,A,A*47

Table 5.1-4 GLL Data Format

Name	Example	Units	Description
Message ID	\$GNGLL		GLL protocol header
Latitude	2503.71193		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74582		dddmm.mmmmm
E/W indicator	E		E=east or W=west
UTC Time	094450.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Checksum	*47		
<CR> <LF>			End of message termination

● GSA---GNSS DOP and Active Satellites

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

\$GNGSA,A,3,11,195,194,199,08,07,01,27,16,09,23,,1.19,0.64,1.00,1*3F

\$GNGSA,A,3,87,81,76,,,,,,,,,1.19,0.64,1.00,2*0F

\$GNGSA,A,3,,,,,,,,,,1.19,0.64,1.00,3*09

\$GNGSA,A,3,34,24,12,07,11,10,08,38,25,09,13,16,1.19,0.64,1.00,4*02

Table 5.1-5 GSA Data Format

Name	Example	Units	Description
Message ID	\$GNGSA		GSA protocol header
Mode 1	A		See Table 5.1-6
Mode 2	3		See Table 5.1-7
ID of satellite used	11		SV on Channel 1
ID of satellite used	195		SV on Channel 2
....			
ID of satellite used			SV on Channel 12
PDOP	1.19		Position Dilution of Precision
HDOP	0.64		Horizontal Dilution of Precision
VDOP	1.00		Vertical Dilution of Precision
GNSS system ID	1		See Table 5.1-8
Checksum	*3F		
<CR> <LF>			End of message termination

Table 5.1-6 Mode 1

Value	Description
M	Manually set to operate in 2D or 3D mode
A	Automatically switching between 2D or 3D mode

Table 5.1-7 Mode 2

Value	Description
1	No position fix
2	2D fix
3	3D fix

Table 5.1-8 GNSS system ID

Value	Description
1	GPS
2	GLONASS
3	GALILEO
4	BEIDOU
6	IRNSS

● GSV---GNSS Satellites in View

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

\$GPGSV,3,1,09,8,71,268,47,27,63,18,49,11,44,191,46,4,41,237,46,1*54

\$GPGSV,3,2,09,16,38,42,42,9,32,279,39,26,22,70,38,31,15,131,36,1*56

\$GPGSV,3,3,09,7,15,320,40,1*6B

\$GPGSV,1,1,04,8,71,268,50,27,63,18,49,9,32,279,43,26,22,70,42,8*6C
 \$GLGSV,2,1,05,82,63,47,47,83,56,182,36,80,47,9,42,79,33,85,45,1*71
 \$GLGSV,2,2,05,81,15,27,37,1*71
 \$GAGSV,1,1,04,08,48,300,43,03,47,025,45,13,36,309,42,05,06,061,34,7*79
 \$GAGSV,1,1,04,08,48,300,43,03,47,025,47,13,36,309,43,05,06,061,33,1*7B
 \$GBGSV,5,1,17,12,80,182,47,24,64,5,51,7,58,355,44,3,57,205,45,1*7C
 \$GBGSV,5,2,17,1,54,141,44,34,52,211,49,9,48,230,45,10,47,316,42,1*79
 \$GBGSV,5,3,17,26,44,100,47,16,39,207,43,4,38,117,41,2,37,240,41,1*77
 \$GBGSV,5,4,17,39,37,210,43,6,36,198,41,38,27,173,41,25,18,317,42,1*4E
 \$GBGSV,5,5,17,35,16,39,40,1*7F
 \$GBGSV,1,1,02,24,64,5,50,26,44,100,43,4*77

Table 5.1-9 GSV Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header GP=GPS/QZSS, GL=GLONSS, GA=GALILEO, GB=BEIDOU, GI=IRNSS.
Total number of messages	3		Range 1 to 9
Message number	1		Range 1 to 9
Satellites in view	09		
Satellite ID	8		Channel 1
Elevation	71	degrees	Channel 1 (Range 00 to 90)
Azimuth	268	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	47	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
....			
Satellite ID	4		Channel 4 (Range 01 to 196)
Elevation	41	degrees	Channel 4 (Range 00 to 90)
Azimuth	237	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	46	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Signal ID	1		GPS/QZSS: L1 C/A=1, L5Q=8 GLONASS: L1 C/A=1 GALILEO: E1=7, E5a=1 BEIDOU: B1=1, B2a=4 IRNSS: L6=1
Checksum	*54		
<CR> <LF>			End of message termination

● RMC---Recommended Minimum Specific GNSS Data

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

\$GNRMC,070143.000,A,2503.71317,N,12138.74533,E,0.002,70.50,130220,,,A,V*01

Table 5.1-10 RMC Data Format

Name	Example	Units	Description
Message ID	\$GNRMC		RMC protocol header
UTC Time	070143.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.71317		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.74533		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.002	knots	True
Course over ground	70.50	degrees	
Date	130220		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Navigational status indicator	V		S = Safe C = Caution U = Unsafe V = Void
Checksum	*01		
<CR> <LF>			End of message termination

● VTG---Course Over Ground and Ground Speed

Table 5.1-11 contains the values for the following example:

\$GNVTG,0.00,T,,M,0.003,N,0.006,K,A*26

Table 5.1-11 VTG Data Format

Name	Example	Units	Description
Message ID	GNVTG		VTG protocol header
Course over ground	0.00	degrees	Measured heading

Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic
Speed over ground	0.003	knots	Measured speed
Units	N		Knots
Speed over ground	0.006	km/hr	Measured speed
Units	K		Kilometer per hour
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Checksum	*26		
<CR> <LF>			End of message termination

5.2 Proprietary output message

● PLSATTIT

Table 5.2-1 contains the values for the following example:

\$PLSATTIT,061030.000,120723,3,2,0,155.54,0.70,-0.41,25.0619348,121.6561793,30.39,-27.99,11.84,0.06,37.00,
 21. 66,0.0,0.0*2D

Table 5.2- 1 PLSATTIT Data Format

Name	Example	Units	Description
Message ID	\$PLSATTIT		PLSATTIT protocol header
UTC Time	061030.000		hhmmss.sss
Date	120723		ddmmyy
DR_Stage	3		DR algorithm stage, 0: unknown, 1: initializing, 2: coarse, 3: stable.
Static_Status	2		User static status, 0: unknown, 1: static, 2: dynamic
Motion_Alarm	0		User motion detection alarm, 0: unknown 1: HARSH_ACCELERATION 2: HARSH_DECELERATION 4: HARSH_TURN 8: HARSH_LANE_CHANGE 16: HORIZONTAL_COLLISION

			32: ROLLOVER 64: STABILITY_WARNING 128: EULER_ANOMALY
Vehicle_Heading	155.54	degree	0~360
Vehicle_Pitch	0.70	degree	-180~180
Vehicle_Roll	-0.41	degree	~180~180
Latitude	25.0619348	degree	dd.ddddddd, latitude in WGS84
Longitude	121.6561793	degree	dd.ddddddd, longitude in WGS84
Ground_Speed	30.39	km/hr	Speed over ground (2D)
Velocity_North	-27.99	km/hr	Velocity in north direction
Velocity_East	11.84	km/hr	Velocity in east direction
Velocity_Down	0.06	km/hr	Velocity in down direction
Height_WGS84_Ellipsoid	37.00	meter	Altitude above WGS84 ellipsoid
Height_Mean_Sea_Level	21.66	meter	Altitude above mean sea level
Reserved1	0.0		
Reserved2	0.0		
Checksum	*2D		
<CR><LF>			

5.3 Proprietary input command

Table 5.3-1 Proprietary input message

NMEA like record	Description
\$PAIR004	Perform GNSS hot start
\$PAIR005	Perform GNSS warm start
\$PAIR006	Perform GNSS cold start

- **\$PAIR004 --- Perform GNSS hot start**

Table 5.3-2 contains the values for the following example:

\$PAIR004*3E

Table 5.3-2 PAIR004 Data Format

Name	Example	Units	Description
Message ID	\$PAIR004		\$PAIR004 protocol header
Checksum	*3E		
<CR> <LF>			End of message termination

Response:

\$PAIR001,004,0*3F\r\n ==> Success

- **\$PAIR005 --- Perform GNSS warm start**

Table 5.3-3 contains the values for the following example:

\$PAIR005*3F

Table 5.3-3 PAIR005 Data Format

Name	Example	Units	Description
Message ID	\$PAIR005		\$PAIR005 protocol header
Checksum	*3F		
<CR> <LF>			End of message termination

Response:

\$PAIR001,005,0*3E\r\n ==> Success

- **\$PAIR006 --- Perform GNSS cold start**

Table 5.3-4 contains the values for the following example:

\$PAIR006*3C

Table 5.3-4 PAIR006 Data Format

Name	Example	Units	Description
Message ID	\$PAIR006		\$PAIR006 protocol header
Checksum	*3C		
<CR> <LF>			End of message termination

Response:

\$PAIR001,006,0*3D\r\n ==> Success

※ *If you need more detail commands for Fusion (DR/VMDS), please refer to the document "LOCOSYS GNSS Fusion Series Product command list".*

6 Pin assignment and descriptions

Table 6-1 Pin descriptions of PCIe Mini 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	Power control input pin. Internal pull-up resistor. High: power on; Low: power off	
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	DC supply input. Must be clean and stable.	

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}	VCC = 3.3V, Peak Tracking Power off		78 ⁽²⁾ < 1 ⁽³⁾	150 ⁽¹⁾	mA mA uA
High Level Input Voltage	V _{IH}	/W_DISABLE pin	1.3		VCC	V
Low Level Input Voltage	V _{IL}	/W_DISABLE pin			0.25	V

<Note>

1. Measured with 1MHz sampling rate.
2. Measured when position fix (1Hz) is available and input voltage is 3.3V.
3. Measured when /W_DISABLE pin is at low level.

7.2 Temperature characteristics

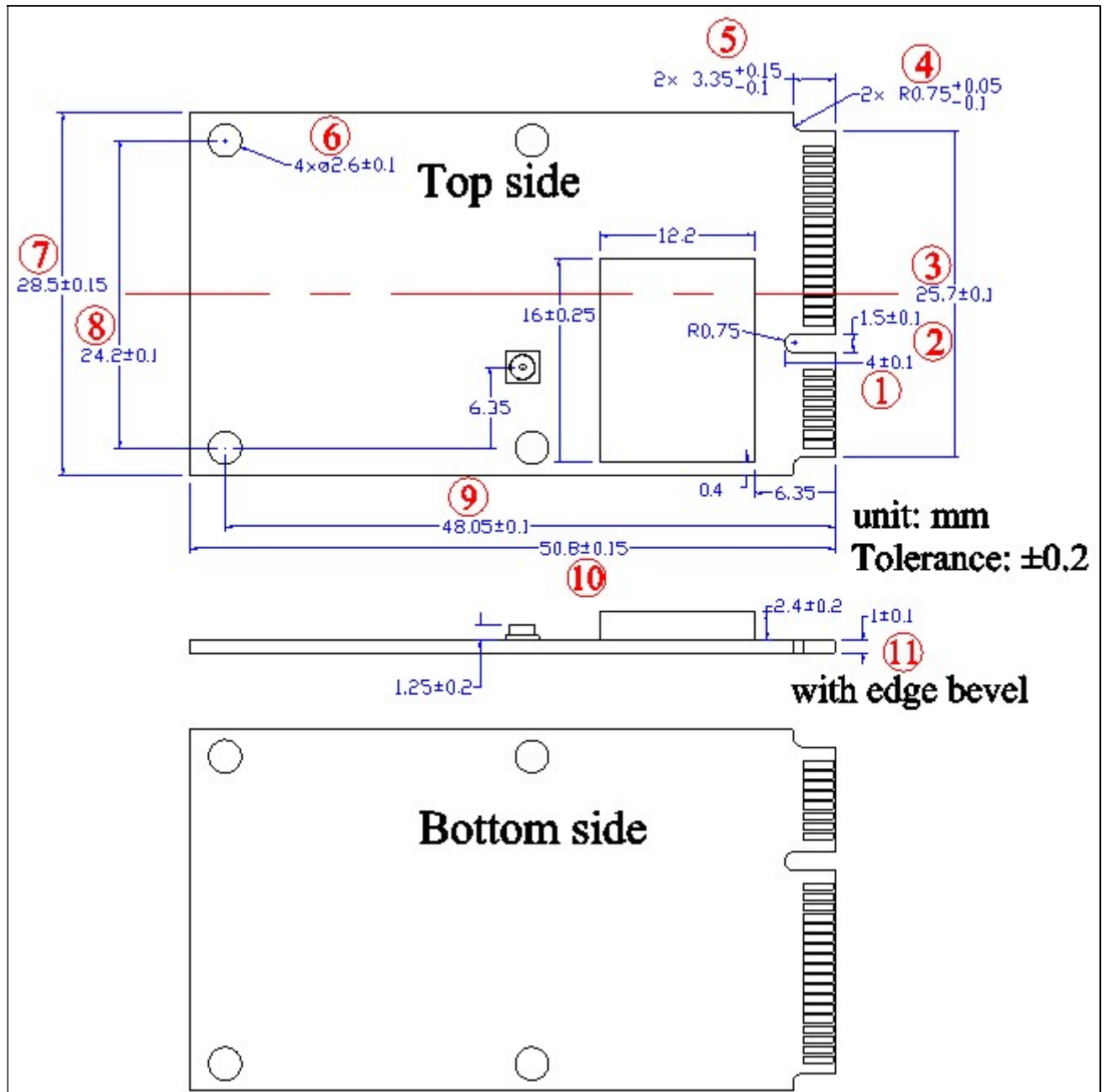
Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	T _{opr}	-40	-	85	°C
Storage Temperature	T _{stg}	-40	25	85	°C

Note the operating and storage temperature of the built-in micro battery are -20 ~ +60 °C and -40 ~ +60 °C respectively.
 The module will still work even the battery is broken or short due to temperature or other issues.

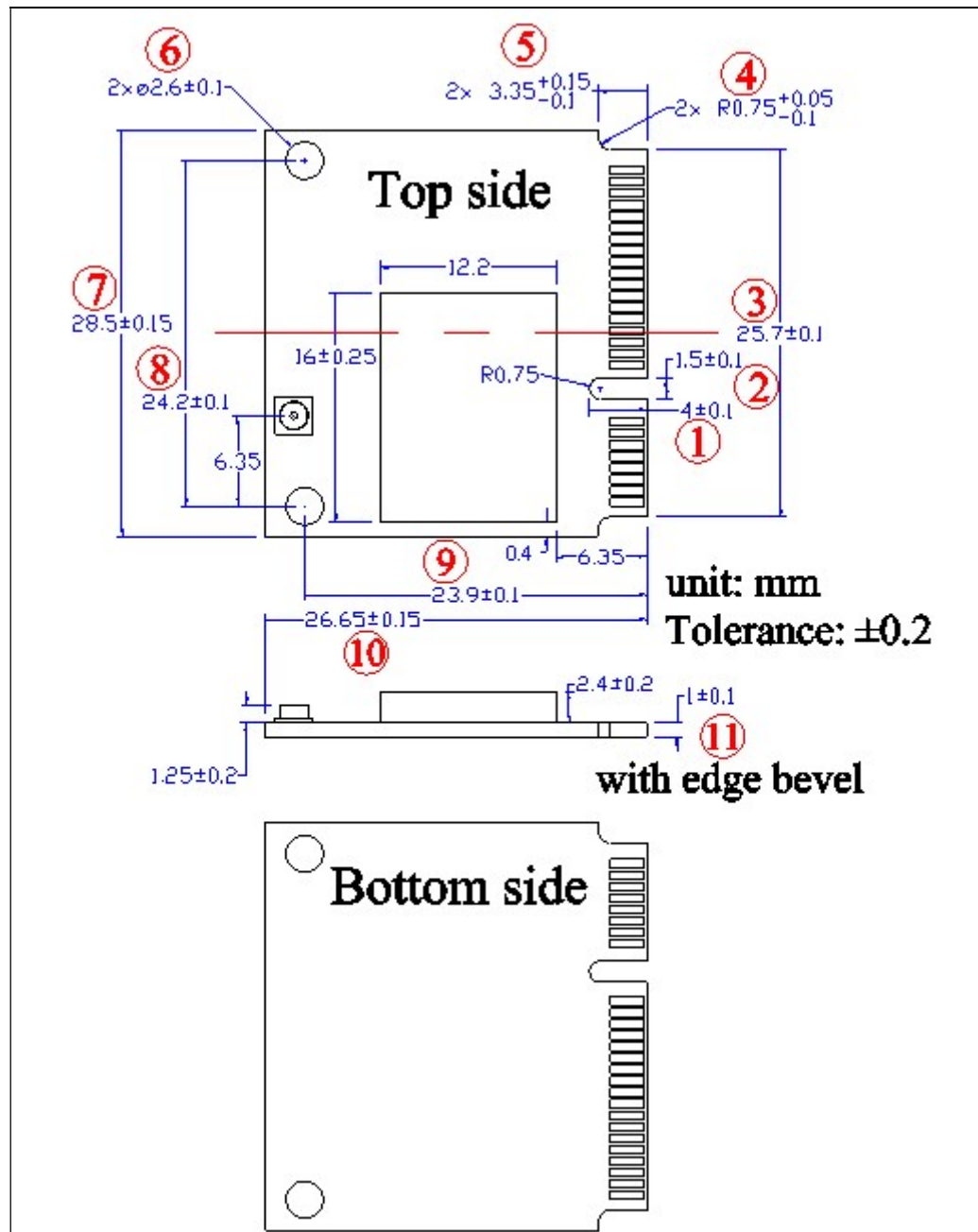
8 Mechanical specification

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

8.1 Outline dimensions of LS26030-35AD



8.2 Outline dimensions of LS26031-35AD

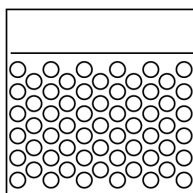


9 Packing information

Both LS26030-35AD and LS26031-35AD use the same package.

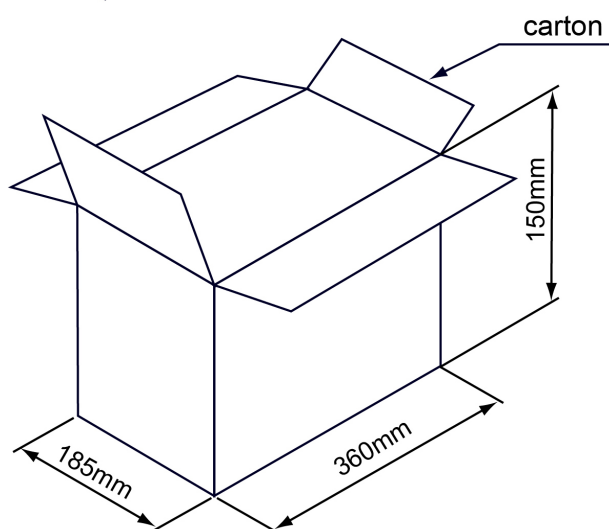


1pcs in an antistatic bag



6pcs in a bubble bag

30 bubble bags in a carton
(180pcs)



Tolerance: ± 10 mm

Document change list

Revision 0.1

- Draft release on October 09, 2024.