GPS Module DataSheet

Name: Ultra High Sensitivity and Low Power GPS Receiver Module

Model NO.: SKM51B

Revision: V1.02

Revision History:

Revision	Description	Approved	Date
V1.01	Initial Release to 001	Woody	20131121
V1.02	Update certification information	George	20170831

General Description

The SkyLab SKM51B Series with embedded GPS antenna enables high performance navigation in the most stringent applications and solid fix even in harsh GPS visibility environments.

It is based on the high performance features of the MediaTek single-chip architecture, Its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The connector design is the easiest and convenient solution to communication with other electronic equipment.

Applications

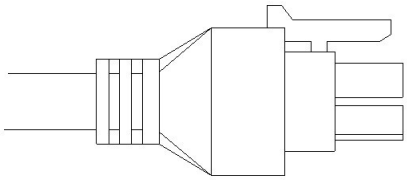
- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

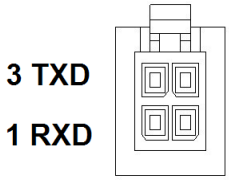
Features

- Ultra high sensitivity: -165dBm
- 22 tracking/66 acquisition-channel receiver
- QZSS support
- NMEA protocols (default: 9600bps)
- Internal back-up battery
- Embedded patch antenna 25 x 25 x 4.0 mm
- Operating temperature range: -40 to 85℃
- RoHS compliance (Lead-free)
- FCC,CE compliance
- Tiny form factor ： 50.5* 38.5 * 18mm

Figure 1: SKM51B Top View

Pin Assignment





RS232	TTL Level
1 RXD	1 RXD
2 GND	2 GND
3 TXD	3 TXD
4 VCC	4 VCC

Note：

RXD: Serial Data Input To SKM51
TXD: Serial Data Output From SKM51

Micro-Fit 3.0 Connector

RS232	TTL Level
1 VCC	1 VCC
2 RXD	2 RXD
3 TXD	3 TXD
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Note:

RXD: Serial Data Input To SKM51
TXD: Serial Data Ouput From SKM51

Audio Connector

Performance Specification

Parameter	Specification	
GPS receiver		
Receiver Type	L1 frequency band, C/A code, 22 Tracking / 66 Acquisition-Channel	
Sensitivity	Tracking Acquisition	-165dBm -148dBm
Accuracy	Position Velocity	3.0m CEP50 without SA(Typical Open Sky) 0.1m/s without SA
Acquisition Time	Cold Start Warm Start Hot Start Re-Acquisition	23s 2~3s 1s <1s
Power Consumption	Tracking Acquisition	25mA @5V Typical 30mA @5V
Navigation Data Update Rate	1Hz	
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g
Antenna Specifications		
Outline Dimension	25 x 25 x 4.0 mm	
Center Frequency	1575 ± 3 MHz	
Bandwidth	10 MHz min	
Impedance	50 Ω	
Axial Ratio	3 dB max	
Polarization	RHCP	
Mechanical requirements		
Dimension	50.5* 38.5 * 18mm	
Weight	80g	
Power consumption		
VCC	3.3V~5.5V	
Current	25mA(typical)	
Environment		
Operating temperature	-40 ~ +85 ℃ (w/o backup battery)	
Storage temperature	-40 ~ +125 ℃	
Humidity	≦95%	

Hardware Interfaces Configuration

Power Supply: Regulated power for the SKM51B series is required. The input voltage Vcc should be 3.3V~5V, current is no less than 150mA. Suitable decoupling must be provided by external decoupling circuitry(10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

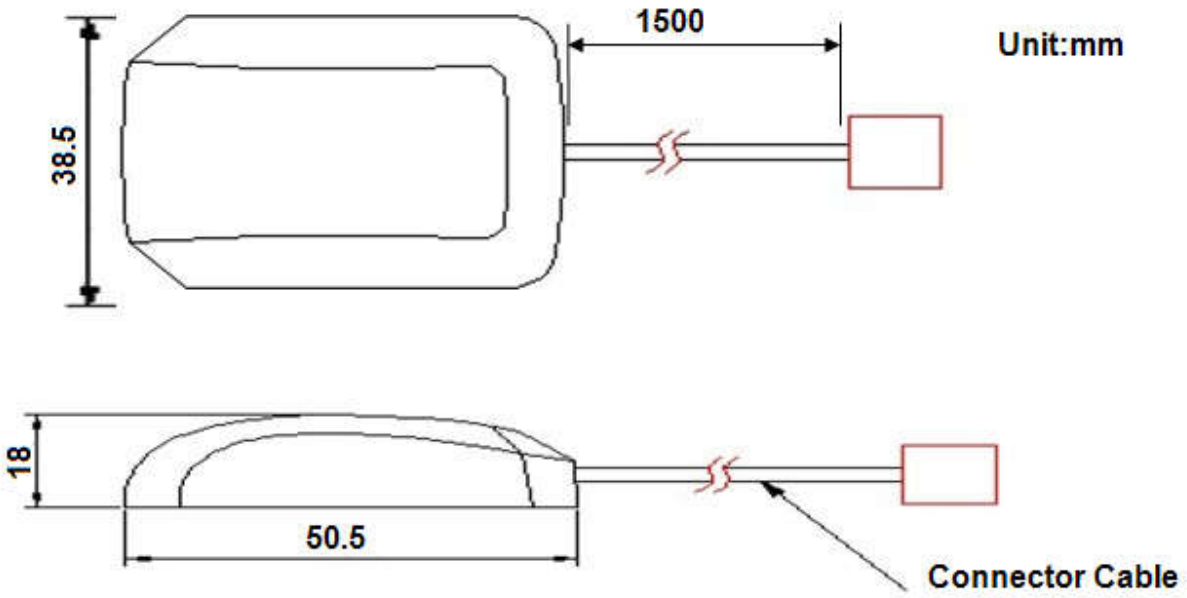
UART Ports: The SKM51B series supports one full duplex serial channels UART. The serial connections are at 2.85V LVTTL logic levels, if need different voltage levels, use appropriate level shifters. the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps.

RS232 Ports: The SKM51B series uses single-chip RS232 to UART bridge, It is 3V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements.

Pin Description

Pin No.	Pin name	I/O	Description	Remark
Micro-Fit 3.0 Connector				
1	RXD	I	UART Serial Data Input To SKM51B	TTL:3.6V≥VIH≥2.0V -0.3V≤VIL≤0.8V
2	GND	G	Power Ground	Reference Ground
3	TXD	O	UART Serial Data Output From SKM51B	TTL:3.1V≥VOH≥2.4V -0.3V≤VOL≤0.4V
4	VCC	P	Power Supply	VCC:3.3V~5.5V
Audio Connector				
1	VCC	P	Power Supply	VCC:3.3V~5.5V
2	RXD	I	UART Serial Data Input To SKM51B	TTL:3.6V≥VIH≥2.0V -0.3V≤VIL≤0.8V
3	TXD	O	UART Serial Data Output From SKM51B	TTL:3.1V≥VOH≥2.4V -0.3V≤VOL≤0.4V
4	GND	G	Power Ground	Reference Ground

Mechanical Specification



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 Skylab SKM81B supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC VTG. The module default NMEA-0183 output is set up GGA,GLL,GSA,GSV,RMC,VTG , and default baud rate is set up 9600bps.

Table 1: NMEA-0183 Output Messages

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

GGA-Global Positioning System Fixed Data

This sentence contains the position, time and quality of the navigation fix.
See RMC for Fix Status, Fix Mode, Fix Date, Speed, and True Course.
See GSA for Fix Type, PDOP, and VDOP.
$GPGGA,021514.000,2232.1799,N,11401.1823,E,1,6,1.25,84.0,M,-2.2,M,,*74
Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	021514.000		hhmmss.sss
Latitude	2232.1799		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	11401.1823		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	6		Range 0 to 12
HDOP	1.25		Horizontal Dilution of Precision
MSL Altitude	84.0	meters	Altitude (referenced to the Ellipsoid)
AltUnit	M	meters	Altitude Unit
GeoSep	-2.2	meters	Geoidal Separation
GeoSepUnit	M	meters	Geoidal Separation Unit
Age of Diff.Corr.	<Null>	second	Null fields when it is not Used
Diff.Ref.Station ID	<Null>		Null fields when it is not Used
Checksum	*74		
EOL	<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

This sentence contains the fix latitude and longitude.
$GPGLL,2232.1799,N,11401.1824,E,021513.000,A,A*50
Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	2232.1799		ddmm.mmmm

N/S Indicator	N		N=north or S=south
Longitude	11401.1824		dddmm.mmmm
E/W Indicator	E		E=east or W=west
UTC Position	021513.000		hhmmss.sss
Fix Status	A		A=data valid or V=data not valid
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*50		
EOL	<CR> <LF>		End of message temination

GSA-GNSS DOP and Active Satellites

This sentence contains the mode of operation, type of fix, PRNs of the satellites used in the solution as well as PDOP, HDOP and VDOP.

$GPGSA,A,3,26,05,18,15,27,29,,,,,,,1.52,1.25,0.87*0F

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
ID of satellite used	26		Sv on Channel 1
ID of satellite used	05		Sv on Channel 2
…	…		…
ID of satellite used	<Null>		Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.52		Position Dilution of Precision
HDOP	1.25		Horizontal Dilution of Precision
VDOP	0.87		Vertical Dilution of Precision
Checksum	*0F		
EOL	<CR> <LF>		End of message termination

Table 4-1: Mode 1

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

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

This sentence contains the PRNs, azimuth, elevation, and signal strength of all satellites in view.
$GPGSV,3,1,12,15,79,333,42,42,50,127,,29,45,263,44,02,36,124,30*7E
$GPGSV,3,2,12,26,36,226,34,05,35,046,22,27,33,161,29,21,16,319,*7D
$GPGSV,3,3,12,10,15,066,31,18,14,285,45,24,12,319,15,08,09,047,18*7E
Table 5: GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Message	3		Total number of GSV sentences (Range 1 to 3)
Message Number	1		Sentence number of the total (Range 1 to 3)
Satellites in View	12		Number of satellites in view
Satellite ID	15		Channel 1(Range 01 to 32)
Elevation	79	degrees	Channel 1(Range 00 to 90)
Azinmuth	333	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	02		Channel 4(Range 01 to 32)
Elevation	36	degrees	Channel 4(Range 00 to 90)
Azimuth	124	degrees	Channel 4(Range 000 to 359)
SNR(C/NO)	30	dB-Hz	Channel 4(Range 00 to 99, null when not tracking)
Checksum	*7E		
EOL	<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

This sentence contains the recommended minimum fix information.
See GGA for Fix Quality, Sats Used, HDOP, Altitude, Geoidal Separation, and DGPS data.
See GSA for Fix Type, PDOP and VDOP.
$GPRMC,023345.000,A,2232.1767,N,11401.1953,E,0.18,151.55,100410,,,A*6B
Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTS Position	023345.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2232.1767		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11401.1953		dddmm.mmmm
E/W Indicator	E		E=east or W=west

Speed Over Ground	0.18	Knots	
Course Over Ground	151.55	Degrees	True Course
Date(UTC)	100410		ddmmyy
Magnetic variation	<Null>	Degrees	Null fields when it is not Used
Magnetic Variation Direction	<Null>		E=east or W=west (Null fields when it is not Used)
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*6B		
EOL	<CR> <LF>		End of message termination

VTG-Course Over Ground and Ground Speed

This sentence contains the course and speed of the navigation solution.

$GPVTG,148.81,T,,M,0.13,N,0.24,K,A*3D

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Tcourse	148.81	Degrees	True Course
Reference	T		T = True
Mcourse	<Null>	Degrees	Magnetic Course (Null fields when it is not Used)
Reference	M		M = Magnetic (Null fields when it is not Used)
Speed over ground	0.13	Knots	Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.24	Km/hr	in Kilometers per Hour
Units	K		Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
Checksum	*3D		
EOL	<CR> <LF>		End of message termination

CMD List

CMD TYPE	**CMD Example:**
Hot Restart	$PMTK101*32<CR><LF>
Warm Restart	$PMTK102*31<CR><LF>
Cold Restart	$PMTK103*30<CR><LF>
Full Cold Restart	$PMTK104*37<CR><LF>
Set baud rate	$PMTK251,baudrate*CRC<CR><LF>

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