



# GPS Module DataSheet

Name: Ultra High Sensitivity and The Smart Antenna GPS Module

Model NO.: SKM53

Revision: 001

## Revision History:

Revision	Description	Approved	Date
001	Initial Release to 001	Neil	20100310

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# SkyNav SKM53 Series

## Ultra High Sensitivity and Low Power

### The Smart Antenna GPS Module



#### General Description

The SkyNav SKM53 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 3329 single-chip architecture, Its  $-165\text{dBm}$  tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The 6-pin UART connector design is the easiest and convenient solution to be embedded in a portable device and receiver like PND, GPS mouse, car holder, personal locator, speed camera detector and vehicle locator.

#### Applications

- LBS (Location Based Service)
- Vehicle navigation system
- PND (Portable Navigation Device)
- GPS mouse and Bluetooth GPS receiver
- Timing application

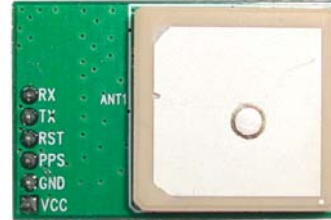


Figure 1: SKM53 Top View

#### Features

- Ultra high sensitivity:  $-165\text{dBm}$
- 22 tracking/66 acquisition-channel receiver
- WAAS/EGNOS/MSAS/GAGAN support
- NMEA protocols (default speed: 9600bps)
- Internal back-up battery
- One serial port
- Embedded patch antenna  $18.2 \times 18.2 \times 4.0 \text{ mm}$
- Operating temperature range:  $-40$  to  $85^\circ\text{C}$
- RoHS compliant (Lead-free)
- Tiny form factor :  $30\text{mm} \times 20\text{mm} \times 8.5\text{mm}$

#### Pin Assignment

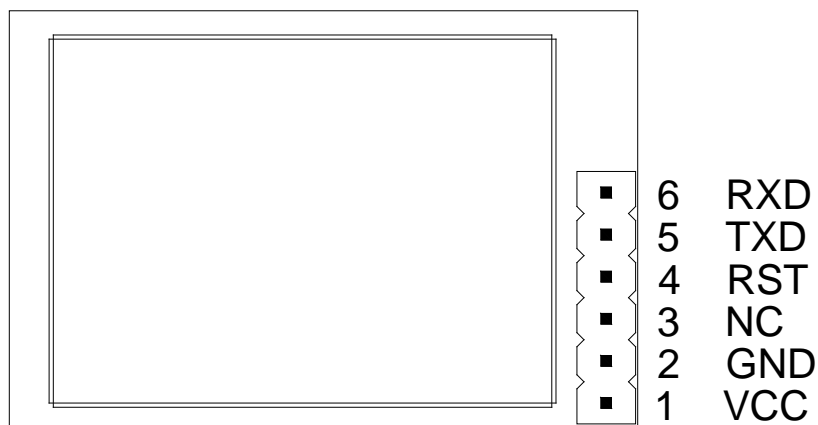


Figure 2: SKM53 Pin Package

## 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 Timing (PPS)	3.0m CEP without SA 0.1m/s without SA 60ns RMS
Acquisition Time	Cold Start Warm Start Hot Start Re-Acquisition	36s 33s 1s <1s
Power Consumption	Tracking Acquisition Sleep/Standby	<35mA @3.3V 45mA @3.3V TBD
Navigation Data Update Rate	1Hz	
Operational Limits	Altitude Velocity Acceleration	Max 18,000m Max 515m/s Less than 4g
Antenna Specifications		
Outline Dimension	18.2 x 18.2 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	30mm x20mm x 8.5mm	
Weight	15g	
Power consumption		
VCC	5V ±5%	
Current	50mA(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 SKM53 series is required. The input voltage Vcc should be 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 module supports one full duplex serial channels UART. The serial connections are at

2.85V LVTTTL 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. The RXD0 & TXD0 recommended to pull up (10KΩ). It can increase the stability of serial data.

Pin Description

Pin No.	Pin name	I/O	Description	Remark
UART Port				
1	VCC	P	Module Power Supply	VCC: 5V ±5%
2	GND	G	Module Power Ground	Reference Ground
3	NC	O	Not Open	Leave Open
4	RST	I	Module Reset (Active Low Status)	
5	TXD	I	TTL:VOH≥0.75 *VCC VOL≤0.25VCC	Leave Open in not used
6	RXD	O	TTL:VIH≥0.7 *VCC VIL≤0.3 *VCC	Leave Open in not used

Mechanical Specification

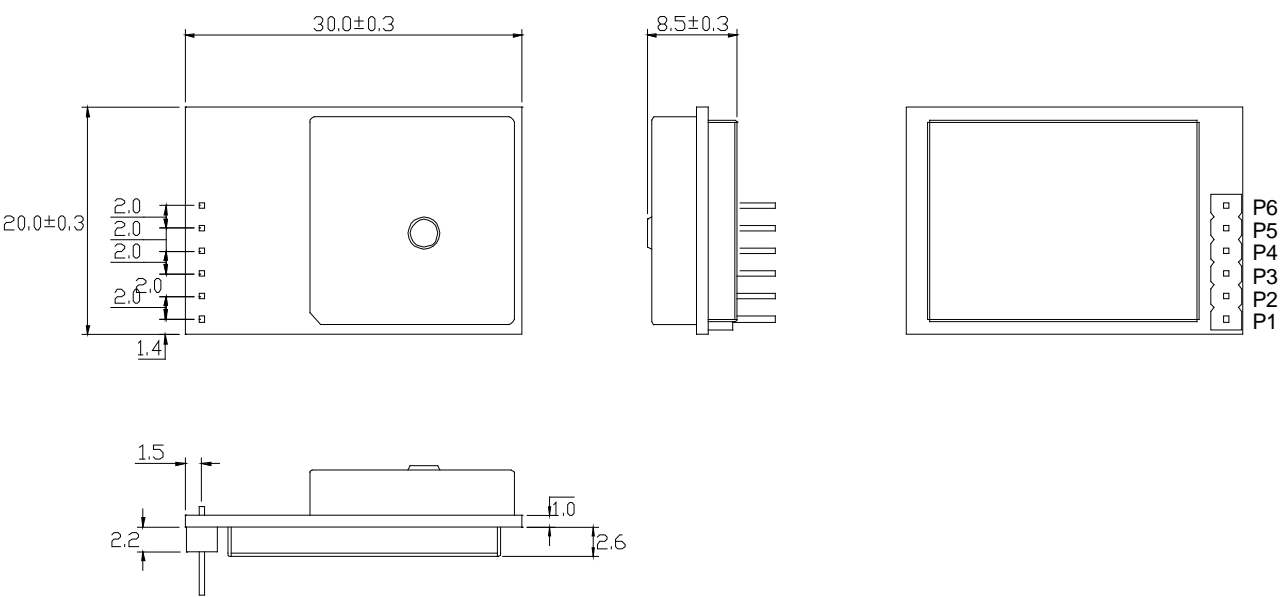


Figure 3: SKM53 Series Dimensions

## Packaging Specification

SKM53 modules are shipped in tray and with 24 units per tray. Each tray is 'dry' package.

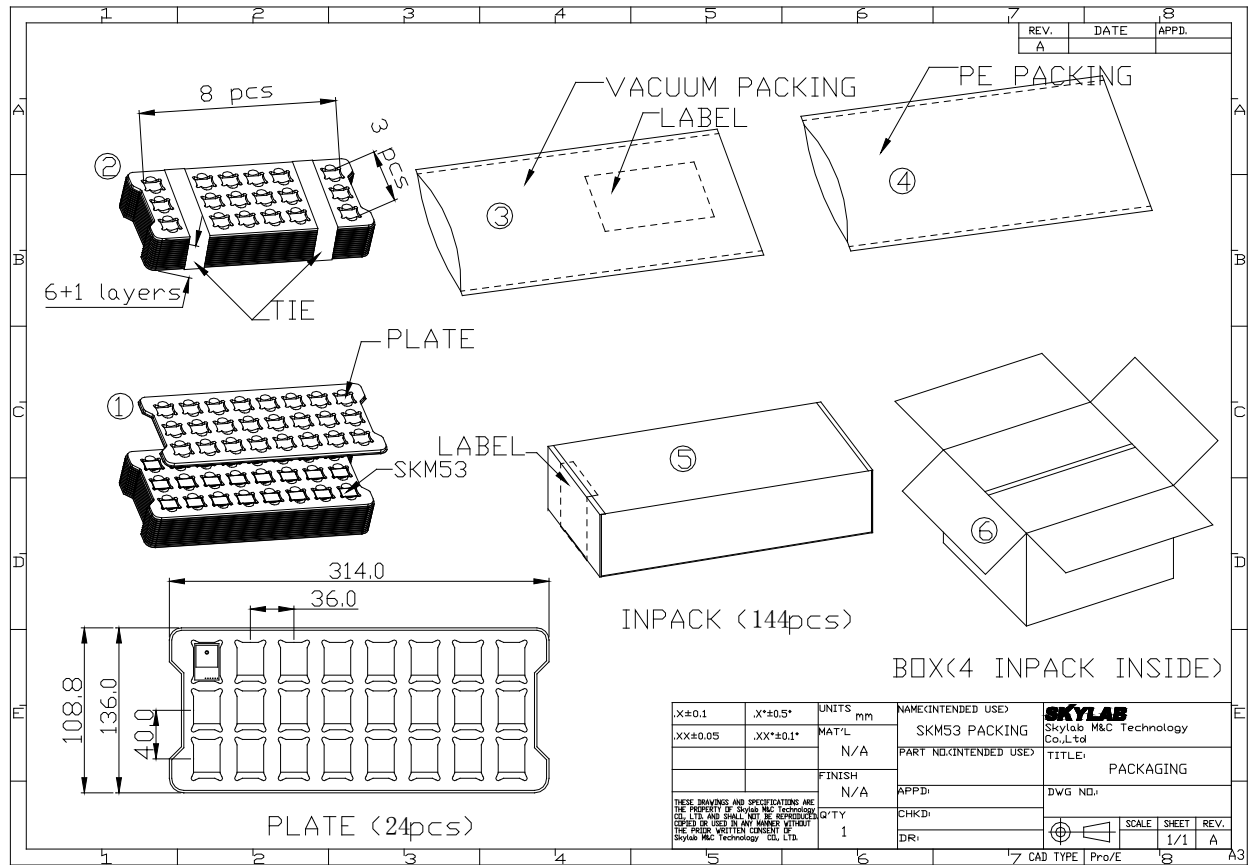


Figure 2: SKM56 Dimensions

## 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 SkyNav SKM53 module supports the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC, VTG, ZDA and DTM. The module default NMEA-0183 output is set up GGA, GSA, GSV, RMC 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	N
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	N
ZDA	Date and Time	N
DTM	Datum reference	N

### 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,033410.000,2232.1745,N,11401.1920,E,1,07,1.1,107.14,M,0.00,M,,\*64

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	033410.000		hhmmss.sss
Latitude	2232.1745		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	11401.1920		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.1		Horizontal Dilution of Precision
MSL Altitude	107.14	meters	Altitude (referenced to the Ellipsoid)
AltUnit	M	meters	Altitude Unit
GeoSep	0.00	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	*64		
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,2232.1843,N,11401.1905,E,035059.000,A,A\*54

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	2232.1843		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11401.1905		dddmm.mmmm
E/W Indicator	E		E=east or W=west
UTC Position	035059.000		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	*54		
EOL	<CR> <LF>		End of message termination

### 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,3,02,09,10,15,18,24,27,29,,,,,1.8,0.9,1.5\*39

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	02		Sv on Channel 1
ID of satellite used	09		Sv on Channel 2
...	...		...
ID of satellite used	<Null>		Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.8		Position Dilution of Precision
HDOP	0.9		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*39		
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,3,1,12,02,35,123,25,24,22,321,48,15,78,335,53,29,45,261,45\*77

\$GPGSV,3,2,12,26,22,223,28,05,34,046,30,10,16,064,39,18,14,284,48\*75

\$GPGSV,3,3,12,27,32,161,31,33,,,30,09,25,170,34,21,15,318,\*4B

Table 5: GGA 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	02		Channel 1(Range 01 to 32)
Elevation	35	degrees	Channel 1(Range 00 to 90)
Azinmuth	123	degrees	Channel 1(Range 000 to 359)
SNR(C/NO)	25	dB-Hz	Channel 1(Range 00 to 99, null when not tracking)
...			...
Satellite ID	29		Channel 4(Range 01 to 32)
Elevation	45	degrees	Channel 4(Range 00 to 90)
Azimuth	261	degrees	Channel 4(Range 000 to 359)
SNR(C/NO)	45	dB-Hz	Channel 4(Range 00 to 99, null when not tracking)
Checksum	*77		
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,075747.000,A,2232.8990,N,11405.3368,E,3.9,357.8,260210,,,A\*6A

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTS Position	075747.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2232.8990		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11405.3368		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	3.9	Knots	
Course Over Ground	357.8	Degrees	True Course



Date(UTC)	260210		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	*6A		
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,303.8,T,,0.0,N,0.0,K,A\*48

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Tcourse	303.8	Degrees	True Course
Reference	T		T = True
Mcourse	<Null>	Degrees	Magnetic Course (Null fields when it is not Used)
Reference	<Null>		M = Magnetic (Null fields when it is not Used)
Speed over ground	0.0	Knots	Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.0	Km/hr	in Kilometers per Hour
Units	K		Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
Checksum	*48		
EOL	<CR> <LF>		End of message termination

### ZDA-Date and Time

This sentence contains UTC date & time, and local time zone offset information.

\$GPZDA,060819.000,22,03,2010,,\*50

Table 8: ZDA Data Format

Name	Example	Units	Description
Message ID	\$GPZDA		ZDA protocol header
UTC Time	060819.000		hhmmss.sss
Day	22		UTC time: day (01 ... 31) dd
Month	03		UTC time: month (01 ... 12) mm
Year	2010		UTC time: year (4 digit year) yyyy
local zone hours	<null>		Local Time Zone Offset Hours (Null fields when it is not Used)
local zone minutes	<null>		Local Time Zone Offset Minutes (Null fields when it is not Used)
Checksum	*50		

EOL	<CR> <LF>		End of message termination
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**DTM - Datum reference**

This sentence contains the ID of the datum selected, along with configured offsets.

\$GPDTM,W84,,0.000000,S,0.000000,W,0.00,W84\*50

Table 9: DTM Data Format

Name	Example	Units	Description
Message ID	\$GPDTM		DTM protocol header
DatumID	W84		Local Datum ID
DatumSubD	<null>		Datum Subdivision Code (Null fields when it is not Used)
LatOfs	0.000000		Latitude Offset (in minutes)
LatDirection	S		N = North S = South
LonOfs	0.000000		Longitude Offset (in minutes)
LonDirection	W		E = East W = West
AltOfs	0.00		Altitude Offset (in meters)
RefDatum	W84		Reference Datum ID
Checksum	*50		
EOL	<CR> <LF>		End of message termination