

SKG122C BDS-III L1 Positioning Module

Document Information

Title	SKG122C BDS-III L1 Positioning Module
--------------	---------------------------------------

Type	Datasheet
-------------	-----------

Code	SL-22030222
-------------	-------------

Version	V1.04 (1-July-2025)
----------------	---------------------

Confidentiality Level	Public
------------------------------	--------

Revision History

Version	Description	Writer	Date
V1.01	Original version	Eric	20220217
V1.02	Modify PPS description and Sensitivity	Wilson	20220420
V1.03	Update reference design diagram	George	20221010
V1.04	Update parameters	Dracy	20250701

SKYLAB reserves all rights to this document and its information. SKYLAB owns all intellectual properties concerning products, names, logos, and designs in the document. Copying, using, modification, or disclosure of all or part of the document to third parties without SKYLAB's permission is prohibited.

SKYLAB assumes no liability for the use of the information contained in this document. No explicit or implicit warranties are provided, including, but not limited to, the precision, correctness, reliability, and suitability of the information. SKYLAB reserves the right to revise this document at any time. The latest update can be obtained from www.skylab.com.cn.

Copyright © 2025, Skylab M&C Technology Co., Ltd

SKYLAB® is a registered trademark of Skylab M&C Technology Co., Ltd. in China.

Table of Contents

1 Product Overview	4
2 Typical Applications	4
3 Product Features	4
4 Performance Specifications	5
5 Pin Definition	6
6 Electrical Characteristics	7
6.1 Absolute Maximum Ratings	7
6.2 Operating Conditions	8
7 Interfaces and Peripherals	8
7.1 PPS	8
7.2 UART	8
7.3 GPIO (Reserved, Customizable)	9
7.4 EXTINT (Reserved, Customizable)	9
8 Default Configuration	9
9 Antenna Open/Short Detection	9
10 Software Protocol	10
10.1 NMEA 0183 Protocol	10
10.2 GGA – Global Positioning System Fix Data	11
10.3 GSA – GNSS DOP and Active Satellites	12
10.4 GSV – GNSS Satellites in View	13
10.5 RMC – Recommended Minimum GNSS Data	14
10.6 ZDA - Date and Time	14
10.7 TXT - Antenna Detection Data	15
11 Mechanical Dimensions	16
11.1 Layout Considerations	17
12 Packaging Specifications	19
13 SMT (Surface Mount Technology) Guidelines	20
14 Reference Circuit	20

15 Contact Information21

1 Product Overview

The **SKG122C** is a high-performance, multi-system navigation positioning module. It supports satellite reception for **GPS**, **BDS3**, **GLONASS**, **Galileo**, and **QZSS**, enabling faster positioning, higher accuracy, and more reliable performance.

Thanks to its outstanding performance, the SKG122C offers a highly sensitive, high-precision, and low-cost solution for positioning and navigation applications in automotive systems and portable handheld terminals. It meets the stringent requirements of professional positioning while also satisfying consumer-level demand.

Its compact form factor is compatible with mainstream international GNSS modules. The module uses SMD pads, allowing for standard pick-and-place and reflow soldering processes.



Figure 1: Front View of SKG122C

2 Typical Applications

- ◆ Automotive navigation
- ◆ Personal navigation devices
- ◆ Vehicle anti-theft systems
- ◆ Vehicle tracking and monitoring

3 Product Features

- ◆ Supports BDS3, GPS, GLONASS, Galileo, QZSS, and SBAS
- ◆ Ultra-fast TTFF: Cold start < 28s, Hot start < 1s
- ◆ Supports A-GPS
- ◆ Industrial-grade standards
- ◆ Ultra-compact size: 16.0 x 12.2 x 2.4 mm

- ◆ Complies with RoHS, FCC, and CE standards
- ◆ Fastest time to first fix (TTFF)
- ◆ High accuracy and valid positioning even under weak signal conditions
- ◆ Excellent quality and reliability

4 Performance Specifications

Table 4-1: Basic Parameters

Parameter	Description	Specification
Voltage		3.0~3.6V
RF Input	Frequency Bands	GPS/QZSS :L1C/A GLONASS: L1 BeiDou: B1I,B1C GALILEO: E1 SBAS: L1C/A(WAAS, EGNOS, MSAS, GAGAN, SDCM)
	VSWR	≤1.5
	Input Impedance	50Ω±10%
	Antenna Gain	0~32dB
Physical Size		16.0 × 12.2 × 2.4 mm
Data Interface		1 UART, TTL level, baud rate: 1200 ~ 460800bps, default: 9600
Antenna Detection		Supports active antenna power supply (external detection circuit required)

Table 4-2: GNSS Performance Specifications

Parameter	Description	Specification
TTFF (First Fix Time)	Cold Start	≤28s
	Hot Start	≤1s
	Re-acquisition	≤1s
Sensitivity	Tracking Acquisition	-162dBm -148dBm
Accuracy	Position	GNSS Open-Sky CEP<2.5m SBAS Open-Sky CEP<2.0m D-GNSS Open-Sky CEP<1.0m
	Speed	GNSS 0.1m/s SBAS 0.05m/s D-GNSS 0.05m/s
Dynamics	Max Speed	515m/s

	Max Acceleration	4g
	Max Altitude	18000m
PPS		Supported, accuracy: 25 ns
Data Update Rate		1Hz ~ 10Hz, default: 1Hz
Navigation Format		NMEA 0183 Version 4.1

5 Pin Definition

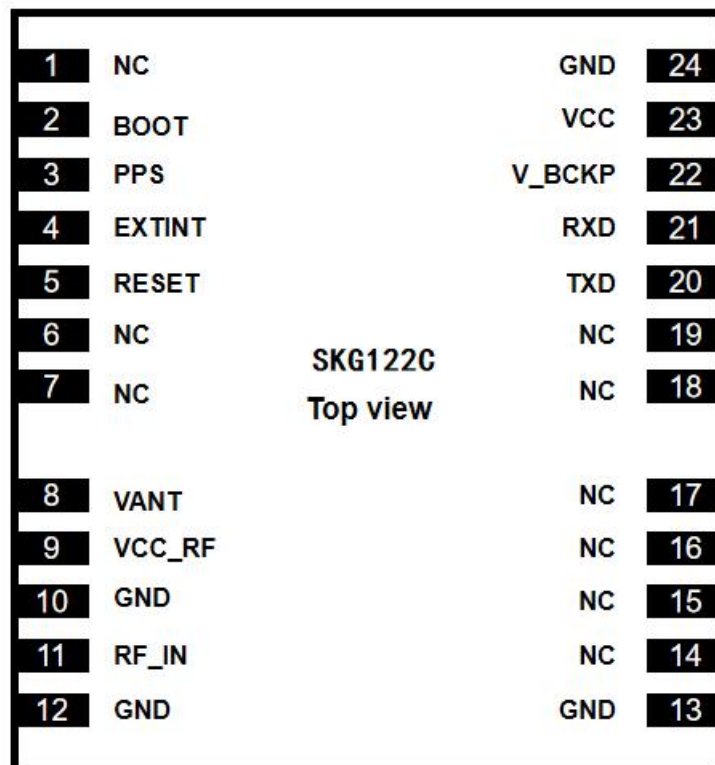


Figure 5-1: SKG122C Pin Layout

Table 5-1: Pin Descriptions

Pin No.	Name	I/O	Description	Notes
1	NC			Leave floating
2	BOOT	I	BOOT mode selection	Leave floating (reserved)
3	PPS	O	1PPS (Pulse Per Second) output	
4	EXTINT	I	External interrupt input	Leave floating (reserved)
5	RESET	I	External reset input	Leave floating (reserved)

6	NC			Leave floating
7	NC			Leave floating
8	VANT	P	Antenna power input	Internally connected to pin 9 via inductor. Connect external antenna power here if using external supply.
9	VCC_RF	O	RF power output	Can short with pin 8 to power antenna. Supports antenna open/short detection.
10	GND	G	Ground	
11	RF_IN	S	GNSS signal input	50Ω impedance
12	GND	G	Ground	
13	GND	G	Ground	
14	NC			Leave floating
15	NC			Leave floating
16	NC			Leave floating
17	NC			Leave floating
18	NC			Leave floating
19	NC			Leave floating
20	TXD	O	UART transmit	NMEA output
21	RXD	I	UART receive	
22	V_BCKP	P	Backup power input	1.6—3.6V
23	VCC	P	Main power input	2.8—3.6V
24	GND	G	Ground	

6 Electrical Characteristics

6.1 Absolute Maximum Ratings

Table 6-1 Power Supply Characteristics

Parameter	Symbol	Min	Max	Unit	Condition
Supply Voltage (VCC)	VCC	1.7	3.63	V	--
VCC Max Ripple	Vrpp	0	50	mV	--

Voltage					
Input Pin Voltage	Vin	1.7	3.63	V	--
Storage Temperature	Tstg	-40	125	°C	--
ESD	VESD(HBM)	--	2000	V	All pins

6.2 Operating Conditions

Table 6-2 Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (VCC)	Vcc	3.0	3.3	3.6	V
RTC Supply Voltage (VRTC)	Vrtc	2.0	3.0	3.6	V
Peak Current	Iccp			53	mA
Input Low Voltage	Vin_low	0		0.2*Vcc	V
Input High Voltage	Vin_high	0.67*Vcc		VCC	V
Output Low Voltage	Vout_low			0.4	V
Output High Voltage	Vout_high	2.64			V
Operating Temperature		-40		85	°C
Storage Temperature		-40		125	°C

7 Interfaces and Peripherals

7.1 PPS

The SKG122C provides a highly precise PPS (Pulse Per Second) signal for external time synchronization.

- ◆ The pulse width is configurable
- ◆ Accuracy: 20 ns
- ◆ Default: outputs one pulse per second

7.2 UART

Supports data transmission and firmware upgrades.

- ◆ Signal level: LVTTTL
- ◆ Default baud rate: 9600 bps

- ◆ Configurable up to 460800 bps
- ◆ Fully user-configurable

7.3 GPIO (Reserved, Customizable)

Provides one general-purpose GPIO interface reserved for user-defined configuration.

7.4 EXTINT (Reserved, Customizable)

Provides one external interrupt input pin.

8 Default Configuration

Message Type	Parameter	Default Setting	Description
NMEA	RMC	1	Output at 1Hz
	GGA	1	Output at 1Hz
	GSA	1	Output at 1Hz
	GSV	1	Output at 1Hz
	ZDA	1	Output at 1Hz
	TXT	1	Output at 1Hz

Default supported satellite systems:

GPS/QZSS :L1C/A

GLONASS: L1

BeiDou: B1I,B1C

GALILEO: E1

9 Antenna Open/Short Detection

The SKG122C supports antenna open/short circuit detection. The antenna bias current range is **0–20 mA**.

- ◆ When current is 0–2 mA, status is open circuit
- ◆ When current is 2–20 mA, status is normal
- ◆ When current exceeds 45 mA, status is short circuit, and antenna usage is temporarily disabled

10 Software Protocol

10.1 NMEA 0183 Protocol

Table 10.1-1 NMEA-0183 Output Messages

NMEA Sentence	Description	Default
GGA	Position fix data	Enabled
GSA	Current satellite data	Enabled
GSV	Satellites in view	Enabled
RMC	Recommended minimum GNSS data	Enabled
ZDA	Time and date	Enabled
TXT	Antenna detection data	Enabled

Table 10.1-2 Identifier Mnemonics

Identifier	Data Type
BD	BeiDou mode
GP	GPS mode
GL	GLONASS mode
GA	GALILEO mode
GN	Multi-mode (hybrid)

10.2 GGA – Global Positioning System Fix Data

This sentence includes position, time, and fix quality.

Example:

\$GNGGA,074614.000,2232.71326,N,11406.11642,E,1,23,0.70,27.9,M,-1.9,M,,*5F

Table 10.2-1 GGA Sentence Format

Name	Example	Unit	Description
Message ID	\$GNGGA		GGA message header
UTC Time	074614.000		Time (HHMMSS.sss)
Latitude	2232.71326		ddmm.mmmm
N/S Indicator	N		N = North, S = South
Longitude	11406.11642		dddmm.mmmm
E/W Indicator	E		E = East, W = West
Fix Status	1		See Table 10.2-2
Satellites Used	23		0 to 24
HDOP	0.70		
Altitude	27.9	M	
Geoid Separation	-1.9	M	
Checksum	*5F		
EOL	<CR> <LF>		Message terminator

Table 10.2-2 Fix Status

Value	Description
0	No fix or invalid data
1	SPS mode fix
2	GNSS SPS mode fix
3	PPS mode fix

10.3 GSA – GNSS DOP and Active Satellites

Contains fix mode, satellite IDs used in fix, and PDOP, HDOP, VDOP values.

Example:

```
$GPGSA,A,3,27,199,194,04,08,26,16,31,,,,,1.47,0.70,1.29,1*15
```

```
$BDGSA,A,3,222,206,239,216,207,203,230,229,210,259,260,240,1.47,0.70,1.29,4*0C
```

Table 10.3-1 GSA Sentence Format

Name	Example	Unit	Description
Message ID	\$GPGSA		GSA message header
Mode 1	A		See Table 10.3-3
Mode 2	3		See Table 10.3-2
Satellite ID	27		Sv on Channel 1 (up to 12)
Satellite ID	199		Sv on Channel 2
...	...		...
Satellite ID	<Null>		Sv on Channel 12 (empty if not used)
PDOP	1.47		Position Dilution of Precision
HDOP	0.70		Horizontal DOP
VDOP	1.29		Vertical DOP
Checksum	1*15		
EOL	<CR> <LF>		Message terminator

Table 10.3-2 Mode 2 (Fix Type)

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

Table 10.3-3 Mode 1 (Fix Selection)

Value	Description
M	Manual 2D/3D selection
A	Automatic selection

10.4 GSV – GNSS Satellites in View

Contains PRN, elevation, azimuth, and signal-to-noise ratio for satellites in view.

Example (GPS):

\$GPGSV,2,1,08,27,59,171,39,199,59,149,37,194,56,42,37,4,43,315,35*7C

Example (Beidou):

\$BDGSV,4,1,16,222,36,272,42,206,81,34,40,239,75,119,40,216,79,85,39*69

Table 10.4-1 GSV Sentence Format

Name	Example	Unit	Description
Message ID	\$GPGSV		GSV message header
Total Sentences	2		Total number of GSV sentences (Range 1 to 3)
Sentence Number	1		Sentence number of the total (Range 1 to 3)
Satellites in View	08		Number of satellites in view
Satellite ID	27		
Elevation	59	degrees	Range 00 to 90
Azinmuth	171	degrees	Range 000 to 359
SNR(C/NO)	39	dB-Hz	Range 00 to 90
...			...
Satellite ID	4		
Elevation	43	degrees	Range 00 to 90
Azimuth	315	degrees	Range 000 to 359

SNR(C/NO)	35	dB-Hz	Range 00 to 90
Checksum	*7C		
EOL	<CR> <LF>		Message terminator

10.5 RMC – Recommended Minimum GNSS Data

Provides minimum recommended positioning information.

Example:

\$GNRMC,074614.000,A,2232.71326,N,11406.11642,E,6.082,173.29,311221,,,A*42

Table 10.5-1: RMC Sentence Format

Name	Example	Unit	Description
Message ID	\$GNRMC		RMC message header
UTC Time	074614.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2232.71326		ddmm.mmmm
N/S Indicator	N		N = North or S = South
Longitude	11406.11642		dddmm.mmmm
E/W Indicator	E		E = East or W = West
Speed Over Ground	6.082	Knots	
Course Over Ground	173.29	Degrees	True Course
Date(UTC)	311221		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	*42		
EOL	<CR> <LF>		Message terminator

10.6 ZDA - Date and Time

Provides UTC time and date.

Example:

\$GNZDA,074614.000,31,12,2021,00,00*48

Table 10.6-1: ZDA Sentence Format

Name	Example	Unit	Description
Sentence ID	\$GNZDA		ZDA message header
UTC Time	074614.000		hhmmss
Day	31		
Month	12		
Year	2021		
Time Zone	00		
Checksum	*48		Message terminator

10.7 TXT - Antenna Detection Data

Example:

\$GNTXT,01,01,02,ANT_OPEN,B1,*30

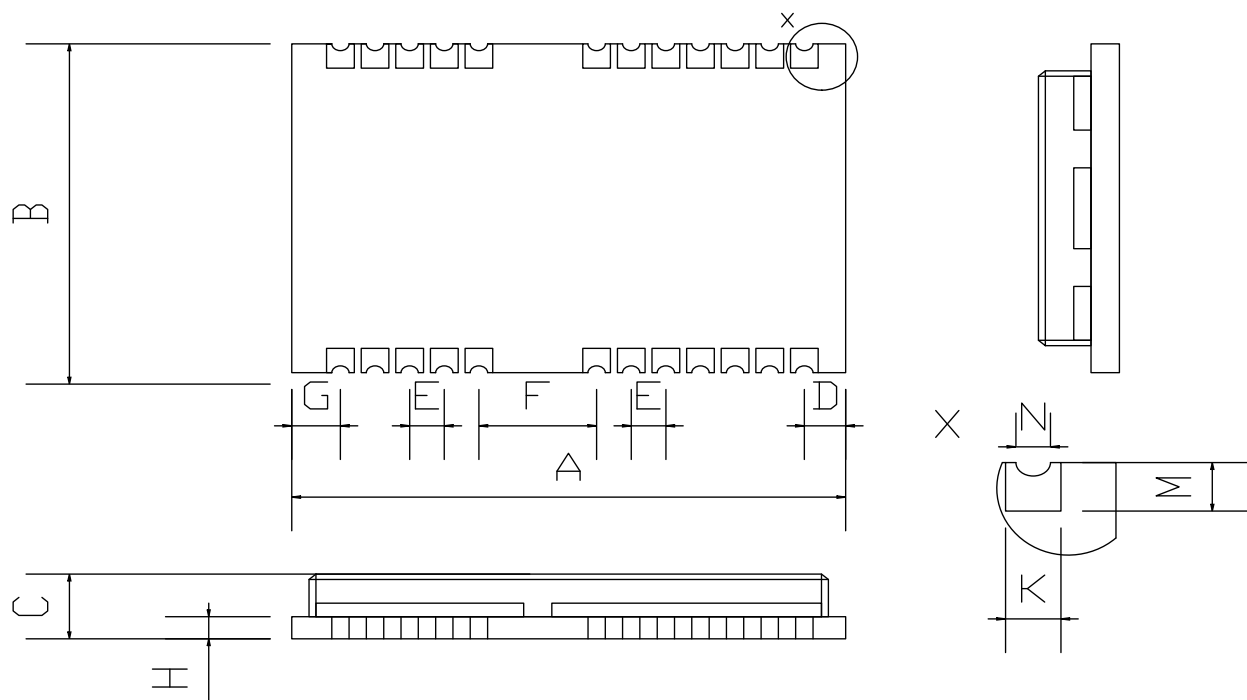
Table 10.7-1: TXT Sentence Format

Name	Example	Unit	Description
Message ID	\$GNTXT		TXT message header
NumField1	01		
NumField2	01		
NumField3	02		
ANTCode	ANT_OPEN		See Table 10.7-2
Checksum	*30		
EOL	<CR> <LF>		Message terminator

Table 10.7-2 Antenna Status

Value	Description
ANT_OPEN	Antenna open circuit
ANT_OK	Antenna operating
ANT_Short	Antenna short circuit

11 Mechanical Dimensions



Parameter	specification	Units
Coplanarity	≤0.1	mm

Symbol	Min.(mm)	Typ.(mm)	Max.(mm)
A	16.0	16.3	16.6
B	12.0	12.2	12.4
C	2.2	2.4	2.6
D	0.9	1.0	1.3
E	1.0	1.1	1.2
F	2.9	3.0	3.1
G	0.9	1.0	1.3
H		0.8	
M	0.8	0.9	1.0
N	0.4	0.5	0.6
K	0.7	0.8	0.9
Weight	1.6g		

Figure 11-1 External Dimensions

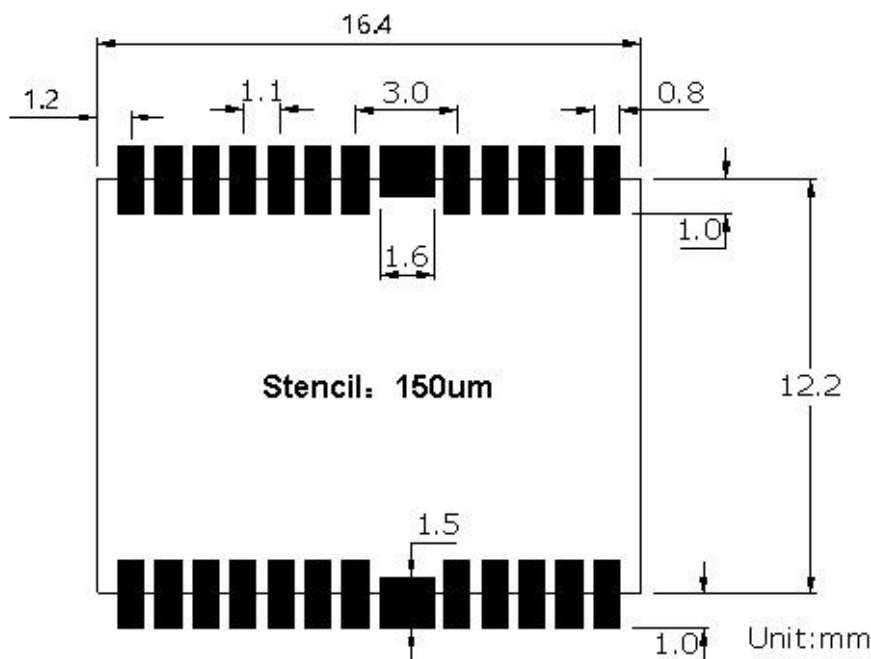


Figure 11-2 Reference Package Dimensions

11.1 Layout Considerations

1) Component Placement

The layout of the GNSS module on the PCB is critical for optimal GNSS performance.

- ◆ The connection to the antenna should be as short as possible to minimize signal loss.
- ◆ In system board design, the RF circuit must be strictly isolated from other digital circuits.
- ◆ Place the module away from high-temperature components on the PCB.

2) Passive Antenna Design

- ◆ Keep the antenna feed line as short as possible.
- ◆ A complete ground plane should be placed directly below the passive antenna.
- ◆ It is recommended to place the passive antenna on the opposite side of the PCB from the GNSS module.

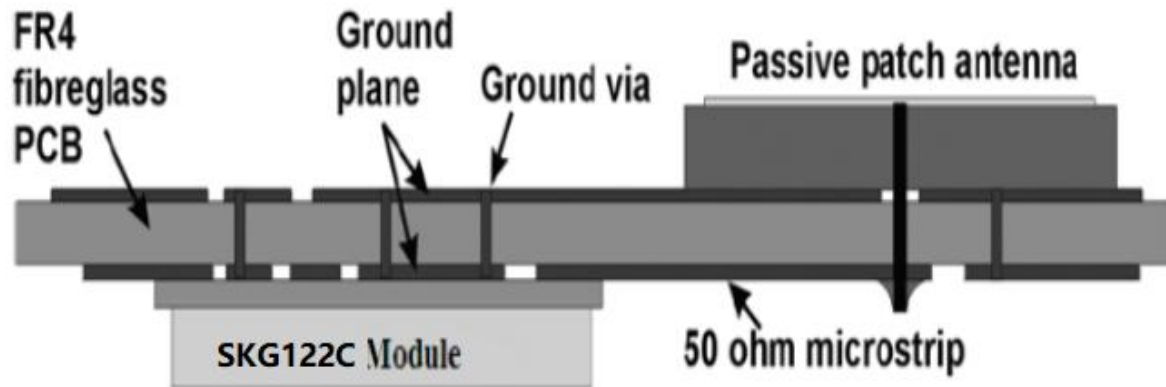


Figure 11.1-1 SKG122C Reference Design

3) Impedance Matching

- ◆ The impedance of the antenna feed line must be 50 Ohm.
- ◆ To achieve 50 Ohm impedance, the width (W) of the microstrip line should be calculated based on:
 - ◆ the height (H) between the trace and the reference ground,
 - ◆ the dielectric constant (ϵ_r) of the PCB material,
 - ◆ and the overall PCB stack-up structure.

4) Microstrip Line Design Guidelines

- ◆ The microstrip line should be **as short as possible**.
- ◆ On a standard PCB, **avoid unshielded microstrip lines longer than 2.5 cm (1 inch)**.
- ◆ RF traces should not run close to digital signal lines.
- ◆ Use as **many vias as possible** to connect to the ground plane.
- ◆ Routing should stay **away from noise sources** such as switching power supplies, digital signals, crystal oscillators, processors, etc.
- ◆ The ground plane corresponding to the microstrip line should be **continuous**.
- ◆ Characteristic impedance of the microstrip line must be **50 ohms**.
- ◆ To reduce signal attenuation, **avoid sharp corners** in the RF trace.

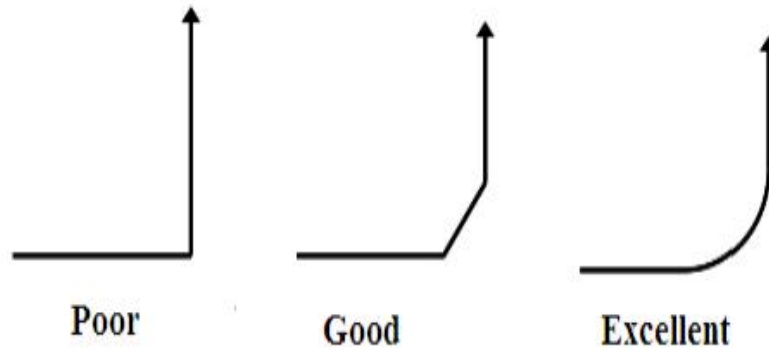


Figure 11.1-2 SKG122C Recommended Microstrip Line Design

12 Packaging Specifications

- ◆ Modules are packaged in tape and reel format.
- ◆ Each reel contains 1200 pieces.

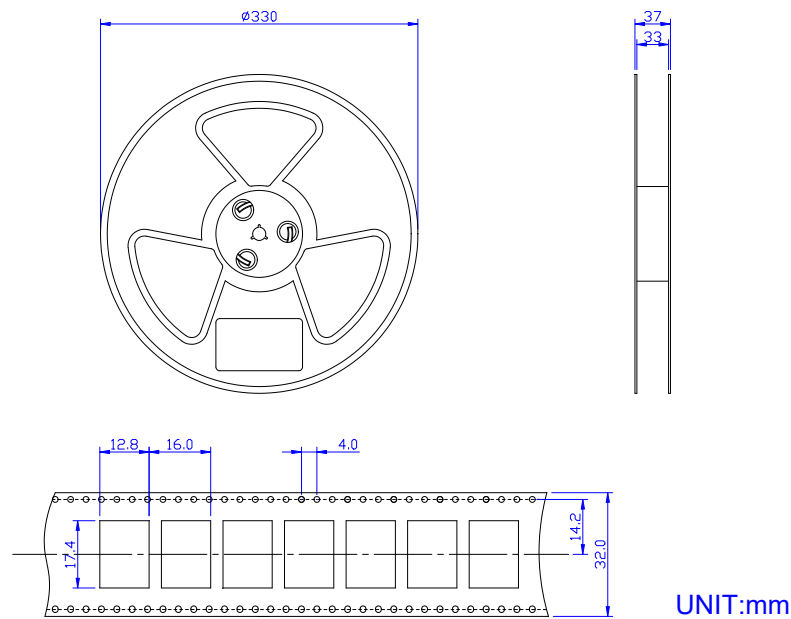


Figure 12-1: SKG122C Packaging Diagram

15 Contact Information

Skylab M&C Technology Co., Ltd

Address: 11th Floor, Building 6, Hongchuang Science and Technology Center, Fucheng Street, Longhua District, Shenzhen, Guangdong, China.

Phone: 86-0755 8340 8210 (Sales Support)

E-Mail: sales1@skylab.com.cn

Website: www.skylab.com.cn www.skylabmodule.com