

# SKG12C-05A Datasheet

## GNSS Module

Document Information		
<b>Title</b>	SKG12C-05A High-performance GPS/GLONASS/DBS Solution Module Datasheet	
<b>Document type</b>	Datasheet	
<b>Document Number</b>	SL-24080455	
<b>Revision and date</b>	V1.02	15-Aug-2024
<b>Disclosure restriction</b>	External public	

## Revision History

Revision	Description	Approved	Date
V1.01	初始版本/ Initial Release	Bennett	20240529
V1.02	更新了实物图和引脚说明/ Updated physical artwork and pin descriptions	Bennett	20240815

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## 1. 概述/ General Description

SKG12C-05A 是一款高性能的 GNSS 一体化解决方案模块，具有超灵敏度、超低功耗和较小的外形。将射频信号接入模块的天线输入端，在具有 NMEA 协议的串行接口上提供完整的位置、速度和时间信息的完整串行数据信息。其-162dBm 跟踪灵敏度扩展了定位覆盖到城市峡谷和茂密的树叶环境。

The SKG12C-05A is a high-performance GNSS all-in-one solution module with ultra-sensitivity, ultra-low power consumption, and standard size. The RF signal is connected to the antenna input of the module, and the complete serial data information of complete position, speed and time information is provided on the serial interface with the NMEA protocol. Its -162dBm tracking sensitivity extends localization coverage to urban canyons and dense foliage environments.



图 1: SKG12C-05A 产品图/ Figure 1: The SKG12C-05A product picture

## 2. 应用/ Applications

- ◆ LBS (Location Based Service)
- ◆ PND (Portable Navigation Device)
- ◆ 车辆导航系统/ Vehicle navigation system
- ◆ 个人导航设备/ Personal navigation equipment

## 3. 特性/ Features

- ◆ 支持 GPS/GLONASS/BDS/GALILEO/QZSS 系统/ GPS/GLONASS/BDS/GALILEO/QZSS receiver
- ◆ 超高灵敏度: -162dBm/ Ultra high sensitivity: -162dBm
- ◆ TTFF≤32s / TTFF≤32s
- ◆ 支持秒脉冲信号 (PPS) 输出/ Supports second pulse signal (PPS) output
- ◆ 支持 AGNSS/ Supports AGNSS

- ◆ 符合 RoHS 标准（无铅）/RoHS compliance (Lead-free)
- ◆ 符合 FCC,CE /FCC,CE compliance

## 4. 引脚分配/ Pin Assignment

1	DEBUG	GND	24
2	NC	VCC	22
3	PPS	NC	22
4	NC	RXD0	21
5	NC	TXD0	20
6	WK_OUT	GPIO2	19
7	WK_IN	GPIO3	18
SKG12C-05A Top view			
8	PWREN	RTS	17
9	VCC_ANT	CTS	16
10	GND	NC	15
11	RF_IN	V_TCXO	14
12	GND	GND	13

图 2: SKG12C-05A PIN 分配/ Figure 2: SKG12C-05A Pin Assignment

## 5. 引脚描述/ Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	DEBUG	I/O	通用 GPIO，默认为 debug UART，电平 3.3V/1.8V	Leave open if not used
2	NC			
3	PPS	O	时间脉冲信号/Time Pulse Signal	Leave open if not used
4	NC			
5	NC			
6	WK_OUT	O	默认为 GNSS 唤醒 HOST 信号,唤醒主机/	Leave open if not used

			The default is GNSS wake-up HOST signal	
7	WK_IN	I	默认为 HOST 唤醒 GNSS 信号, 唤醒 GNSS 模块/ GNSS wake-up signal	Leave open if not used
8	PWREN	I	芯片上电使能信号, 默认高电平, 低电平下电/ The chip power-on enables the signal, which defaults to a high level and a low level power-down	Leave open if not used
9	VCC_ANT	O	电源输出脚, 可用于外部天线供电/ Power output pins for external antenna power supply	VCC_ANT can be used to power an external active antenna.
10	GND	I	Ground	Assure a good GND connection to all GND pins of the module, preferably with a large ground plane
11	RF_IN	I	GNSS 射频信号输入/ GNSS signal input from antenna	The connection to the antenna has to be routed on the PCB. Use a controlled impedance of 50 Ω to connect RF_IN to the antenna or the antenna connector..
12	GND	I	Ground	
13	GND	I	Ground	
14	VCC_LNA	O	电源输出脚, 可用于外部 LNA 供电/ External LNA power supply	Leave open if not used.
15	NC			
16	CTS	I/O	UART CTS	Leave open if not used.
17	RTS	I/O	UART RTS	Leave open if not used.
18	GPIO3	I/O	GPIO,内部下拉/ GPIO, internal pulldown	DDC Data. Leave open, if not used.
19	GPIO2	I/O	GPIO, 内部下拉/	DDC Clock. Leave open, if not

			GPIO, internal pulldown	used.
20	TXD	O	模块 UART 数据输出/ UART data output from module	3.6 V tolerant serial output. Internal pull-up resistor to VCC.
21	RXD	I	模块 UART 数据输入/ UART data input to module	3.6 V tolerant serial input. Internal pull-up resistor to VCC.
22	NC			
23	VCC	P	模块电源输入/ Module Power Supply	3.0-3.6V
24	GND	G	Ground	

## 6. 接口/ Interfaces

### 电源/ Power Supply

输入电压VCC应为3.0V~3.6V范围内，电流不小于100mA。外部解耦电路（10uF和1uF）必须提供合适的解耦。这样可降低电源噪声，提高功率稳定性。

The input voltage VCC should be 3.0V to 3.6V range, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry (10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

主电源VCC电流随处理器负载和卫星采集而变化。采集期间的平均供应电流约为40mA。

Main power supply VCC current varies according to the processor load and satellite acquisition. Average supply current is about 40mA during acquisition.

### UART

该模块支持一个全双工串行通道UART。串行连接在3.3V LVTTTL逻辑电平，如果需要不同的电压电平，使用适当的电平移位器。但是数据格式是固定的： X, N, 8,1，即X波特率，没有奇偶校验，8个数据位和1个停止位，不支持其他数据格式，请先发送LSB。

The module supports one full duplex serial channels UART. The serial connections are at 3.3V 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.

UART接口时序如下。

The timing of the UART interface is as follows.

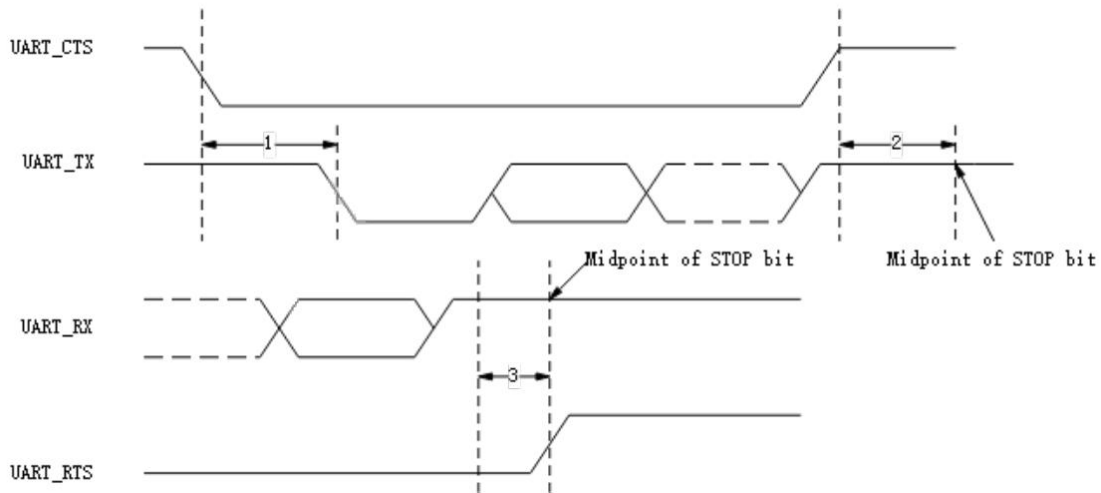


图 3 UART 时序图/ Figure 3: UART timing diagram

其中标注1为CTS信号拉低到TXD信号有效的最大延时；标注2为结束位的中点到CTS信号拉高需要保持的最大时间；标注3为结束位的中点到RTS信号拉高的最大延时。

where annotation 1 is the maximum delay when the CTS signal is pulled down to the TXD signal. Label 2 is the maximum time from the midpoint of the end bit to the CTS signal pull-up. Label 3 indicates the maximum delay from the midpoint of the end bit to the RTS signal pull-up.

UART 时序约束表/ UART Timing Constraint Table

编号	特性	最大值	单位
1	CTS low to TXD valid	1.5	Bit Periods
2	CTS high before mid of stop bit	0.5	Bit Periods
3	Mid of stop bit to RTS high	0.5	Bit Periods

## 7. 高级软件功能/ Advanced Software Features

### Assisted GNSS

辅助信息的提供，如星历、年历、粗略的最后位置和时间，将显著减少首次修复的时间，提高采集灵敏度。

Supply of aiding information, such as ephemeris, almanac, rough last position and time, will reduce the time to first fix significantly and improve the acquisition sensitivity.



## GNSS

SKG12C-05A GNSS 模块可以接收和跟踪多个 GNSS 系统（如 GPS、信号、伽利略和 BDS 信号）。SKG12C-05A 可以配置为开始搜索哪个卫星系统。默认情况下，接收器被配置为并发的 GPS 和 BDS 接收。

The SKG12C-05A GNSS modules can receive and track multiple GNSS systems (e.g. GPS, GLONASS, GALILEO and BDS signals). The SKG12C-05A can be configure to start searching of which satellite system. By default the receivers are configured for concurrent GPS and BDS reception.

## 8. 性能说明/ Performance Specification

参数/ Parameter	说明/ Specification	
接收机类型/ Receiver Type	GPS/QZSS :L1C/A GLONASS: L1 BeiDou: B1I GALILEO: E1	
灵敏度/ Sensitivity	Tracking	-162dBm Typical
	Acquisition	-148dBm Typical
精度/ Accuracy	Position	2.5m CEP50 without SA
	Velocity	0.1m/s
Time To First Fix	Cold Start	32s(Typical Open Sky)
	Hot Start	1s
功耗/ Power Consumption	Tracking	20mA @3.3V Typical
	Acquisition	22mA @3.3V
Navigation Data Update Rate	Max 10Hz	Default 1Hz
操作限制/ Operational Limits	Altitude	Max 18,000m
	Velocity	Max 500m/s
	Acceleration	Less than 4g

## 9. 电气特性/ Electrical Characteristics

### 最大绝对额定值/ Absolute Maximum Rating

参数/ Parameter	符号/ Symbol	Min	Max	Units
---------------	---------------	-----	-----	-------

电源/ Power Supply				
电源电压/ Power Supply Volt.	VCC	-0.3	3.6	V
输入引脚/ Input Pins				
输入电压/ Input voltage on any input connection	VIO	-0.3	VCC+0.2	V
射频输入功率/ RF input power	RF_IN		0	dBm
人体模型 ESD 能力/ Human Body Model ESD capability	RF_IN		2000	V
机器模型 ESD 能力/Machine Model ESD capability	RF_IN		100	V
环境/ Environment				
储存温度/ Storage Temperature	Tstg	-40	105	°C
峰值回流焊温度<10s/ Peak Reflow Soldering Temperature <10s	Tpeak		260	°C
湿度/ Humidity			95	%

注：绝对最大等级仅为应力等级，且不能保证准则下的功能运行。超过本表中规定的范围的压力可能会影响设备的可靠性或对设备造成永久性损坏。有关功能操作条件，请参见以下操作条件表。

SKG12C-05A 模块为静电敏感器件,可能因 ESD 或峰值电压而损坏。请小心处理，以避免永久故障或性能下降。

**Note:** Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

The SKG12C-05A module is Electrostatic Sensitive Device (ESD) and may be damaged with ESD or spike voltage. Please handle with care to avoid permanent malfunction or performance degradation.

## 操作条件/ Operating Conditions

参数/ Parameter	符号/ Symbol	条件/ Condition	Min	Typ	Max	Units
Power supply voltage	Vcc		3	3.3	3.6	V
Backup Battery	V_BCKP		1.5	3.0	3.6	V
Power supply voltage ripple	Vcc_PP	Vcc=3.3V			30	mV
Supply current, Acquisition	Icc	Vcc=3.3V		20		mA

Supply current, Tracking	I <sub>cc</sub>	V <sub>cc</sub> =3.3V		22		mA
VCC peak current	I <sub>peak</sub>				100	mA
V_ANT_OUT supply voltage	VANT			3.3		V
V_ANT_OUT current	IANT				50	mA
Operating temperature	T <sub>opr</sub>		-40		85	°C

## 10.机械规范/ Mechanical Specification

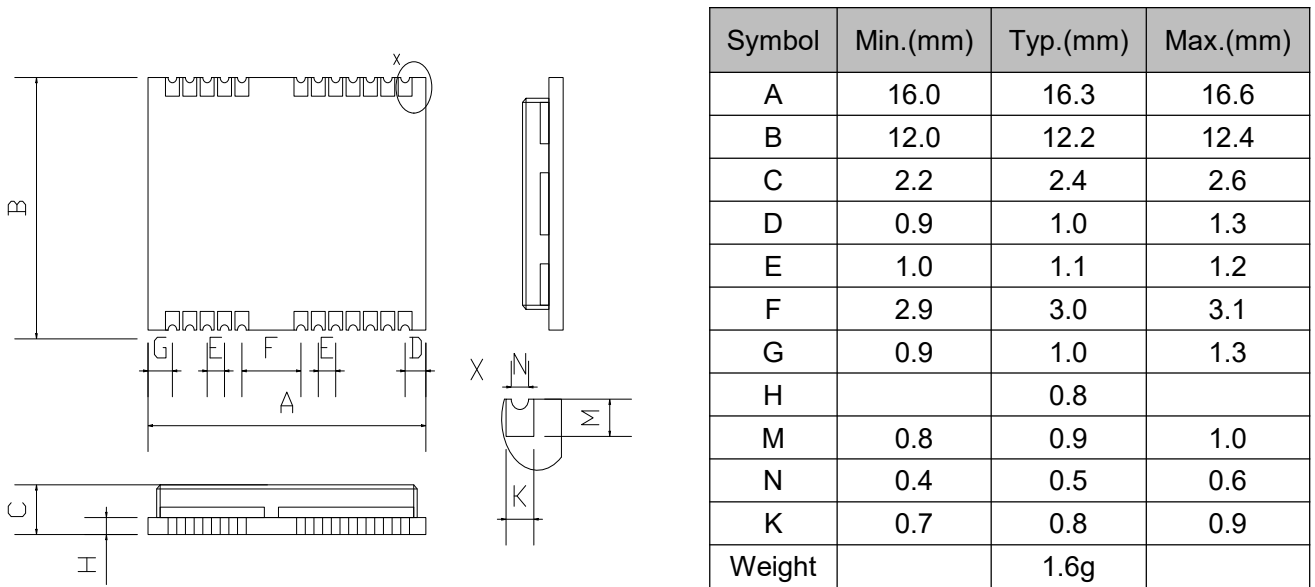


图 4: SKG12C-05A 尺寸/ Figure 4: SKG12C-05A Dimensions

Parameter	specification	Units
Coplanarity	≤0.1	mm

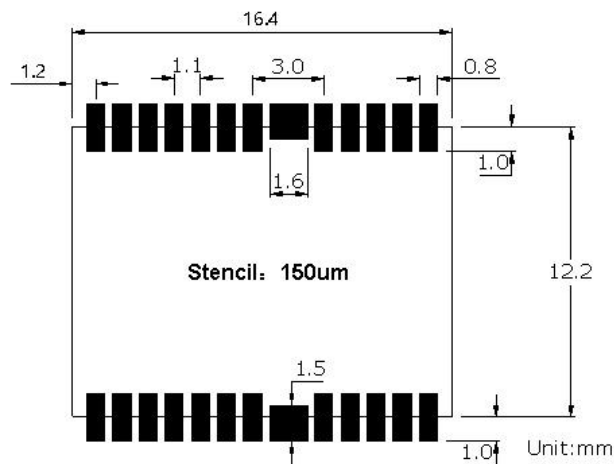


图 5: SKG12C-05A 推荐封装/ Figure 5: SKG12C-05A Recommend Layout

## 11. 包装说明/ Packing Instructions

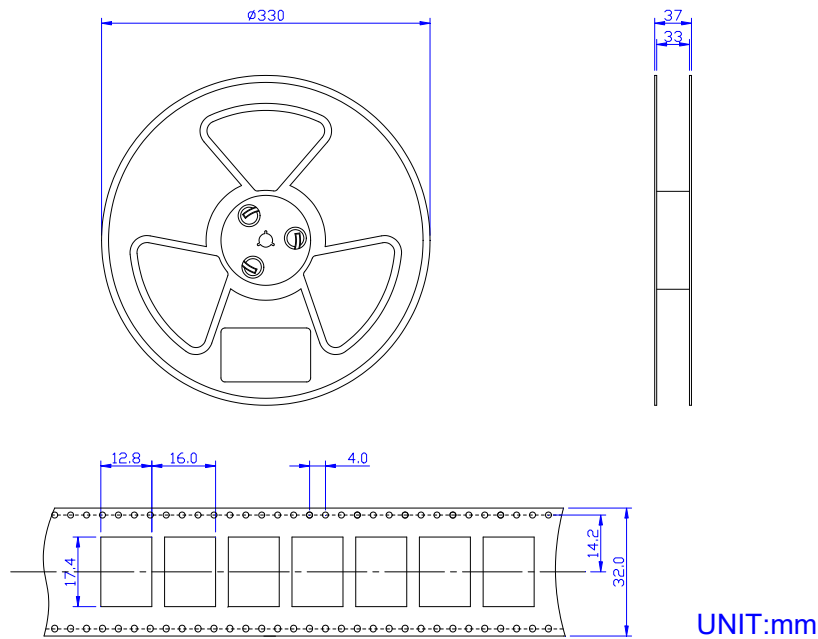


图 6: SKG12C-05A 包装/ Figure 6: SKG12C-05A Packaging

## 12. 制造工艺的建议/ Manufacturing Process Recommendations

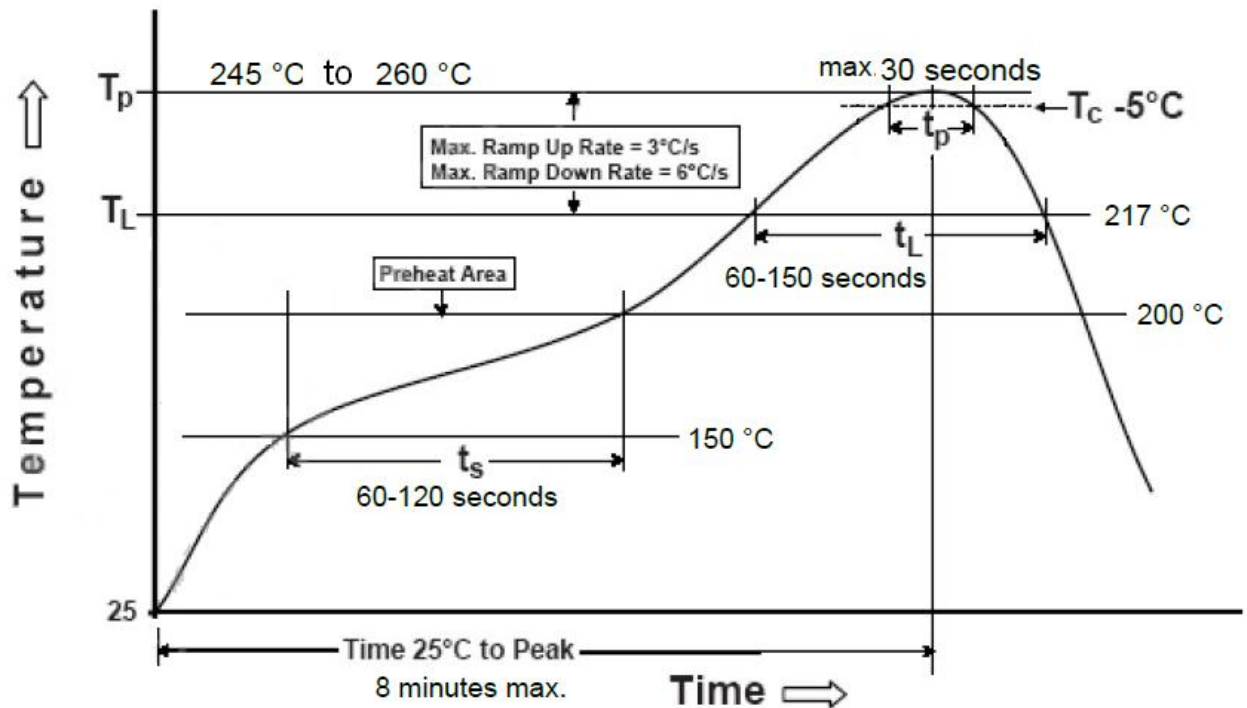


图 7: SKG12C-05A 典型无铅焊接外形图/ Figure 7: SKG12C-05A Typical Leadfree Soldering Profile

**注：**在工厂选择的最终焊接温度取决于其他外部因素，如焊膏的选择、尺寸、厚度和底板的性能等。超过推荐焊接轮廓线中的最大焊接温度可能会永久损坏模块。

**Note:** The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste, size, thickness and properties of the baseboard, etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

### 13. 联系方式/Contact Information

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