承 认 书

SPECIFICATION FOR APPROVAL

客户名称：

CUSTOMER`S NAME：

客户料号：

CUSTOMER`S P/N：

产品规格:

PRODUCT SPEC： GGPM01LK

制作日期：

ISSUE DATE: 2018/10/13

APPROVED		APPROVED SIGNATURES
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深圳市中易微电子科技有限公司

地址： 深圳市福田区第一世广场 8G

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Specification

Ⅰ. Application scope

① This delivery specification document is applied to the gyro module "GGPM01LK" used for the general consumer appliances such as home-use robot cleaner.

② This product corresponds to "RoHS Directive".

③ This Product supplied (and any technical information furnished, if any) by Shenzhen ZhongYiWei Corporation shall not be used for the development and manufacture of weapon of mass destruction or for other military purposes. Making available such products and technology to any third party who may use such products or technologies for the said purposes are also prohibited.

④ The products listed here are designed as components or parts for electronics equipment in general consumer use. We do not expect that any of these products would be incorporated or otherwise used as a component or part for the equipment which requires an extra high reliability, such as satellite, rocket and other space systems, and medical equipment, the functional purpose of which is to keep life.

Ⅱ. Model type

GGPM01LK

Ⅲ. Packaging method

Packaging method follows our packaging standard.

Ⅳ. Gratuitous warranty period

We'll replace the products for free if defective products due to our failure are found within a year from the purchase date.

Ⅴ. Revision and abolition of specification

Revision and abolition of this specification are supposed to be done based on the agreement between your company and Shenzhen ZhongYiWei Corporation.

Due to the product features upgrade, product specifications may be updated, without prior notice

Ⅵ. Table of contents

1. Introduction

The GGPM01LK(General Gyro Pilot Module) is a digital gyroscope module designed for Measuring angular rates and angle data, based on the high precision Gyro sensor, And the high performance MCU, with the advanced digital signal process technology And Kalman filter, this module can output the accuracy data of angular rate and angle data。

2. Features

- Heading reference for robot cleaner
- Angle & Angular rate output
- I2C digital output
- Uart digital output
- Low power consumption
- Compact package

3. Application

- Robot cleaner

4. Disclaimer and Limitation of Liability for Damages

SHENZHEN ZHONGYIWEI shall not be liable, under any circumstances, For any special, indirect, incidental, consequential, or contingent damages For any reason, whether or not the buyer has been advised of the Possibility of such damages.

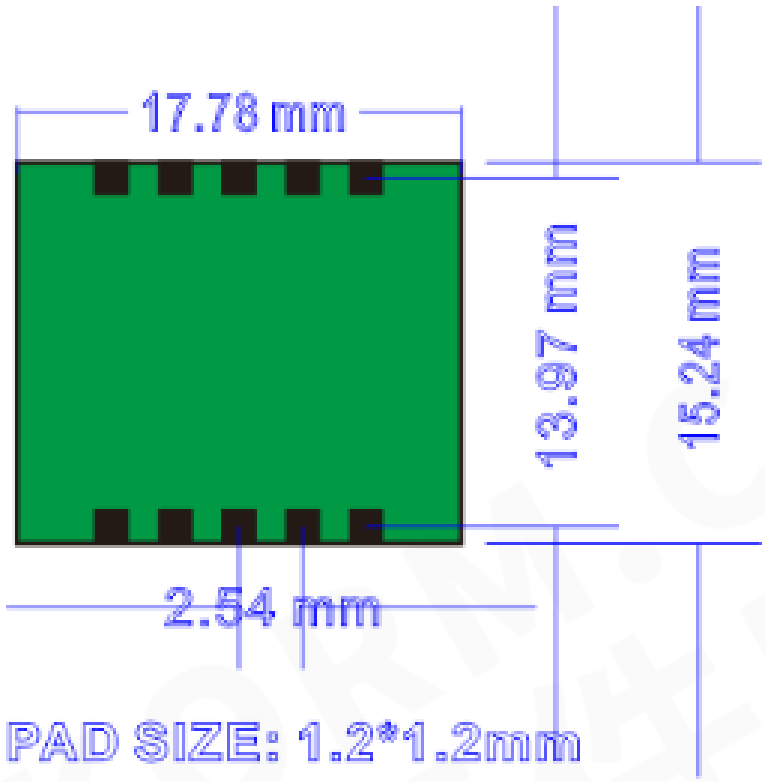
1. Outline

2. Functions of terminals

Pin No.	Name	Input /Output	Function
1	INT/ Mode	Output/Input	Data ready interrupt signal, high to low activity(Output) Interface mode select during the power on -Set to GND when using Uart I/F -Pull up to VCC or NC when using for IIC I/F
2	SCL/RX	Input	Serial clock for IIC/ Uart Rx
3	SDA/TX	Input /Output	Serial data for IIC/ Uart Tx
4	GND	-	GND
5	VCC	-	Power supply voltage, 3.3VDC +/-5%
6	GND	-	GND
7	GND	-	GND
8	GND	-	GND
9	GND	-	GND
10	RST	Input	Reset, Low activity

3. Soldering pattern

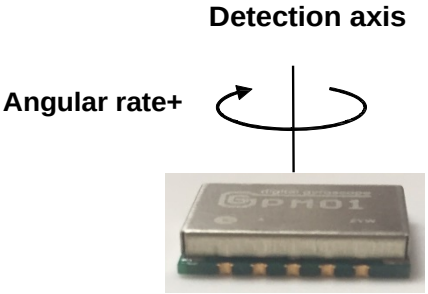
One of the design examples is shown as below. When in actual designing, please optimize the pattern in consideration of mounting density, soldering reliability and easiness of mounting etc. the PAD size we recommend for customer PCB design is 1.4*1.4mm.



4. Functions

4-1) Detecting direction

This product detects the angular rate of rotational movement. The correlation between the angular rate detection axis direction and the detection polarity are shown in the diagram below.



4-2) Serial interface

Communication by IIC, the address 0x6a.

Support standard mode (up to 100Kbit/s) and fast mode (up to 400Kbit/s).

The clock frequency is maximum 400kHz.

4-3) Uart interface

115200, 8bit data, no parity, 1bit stop

5. Electrical characteristics

5-1) Absolute maximum rating

Parameter	Symbol	Standard			Unit	Condition
		Min.	Typ.	Max.		
Supply voltage	VCC	-0.3		4.0	V	GND=0V
Storage temperature	T_{STG}	-40		85	°C	

5-2) Recommended operating conditions

Parameter	Symbol	Standard			Unit	Condition
		Min.	Typ.	Max.		
Supply voltage	VCC	2.7	3.3	3.6	V	GND=0V
Operating temperature	T_{OPR}	-20	25	+70	°C	
Supply voltage start up time	tPu	0.01		100	ms	VDDM 0%→90%
I2C clock frequency				400	kHz	

5-3) DC characteristics

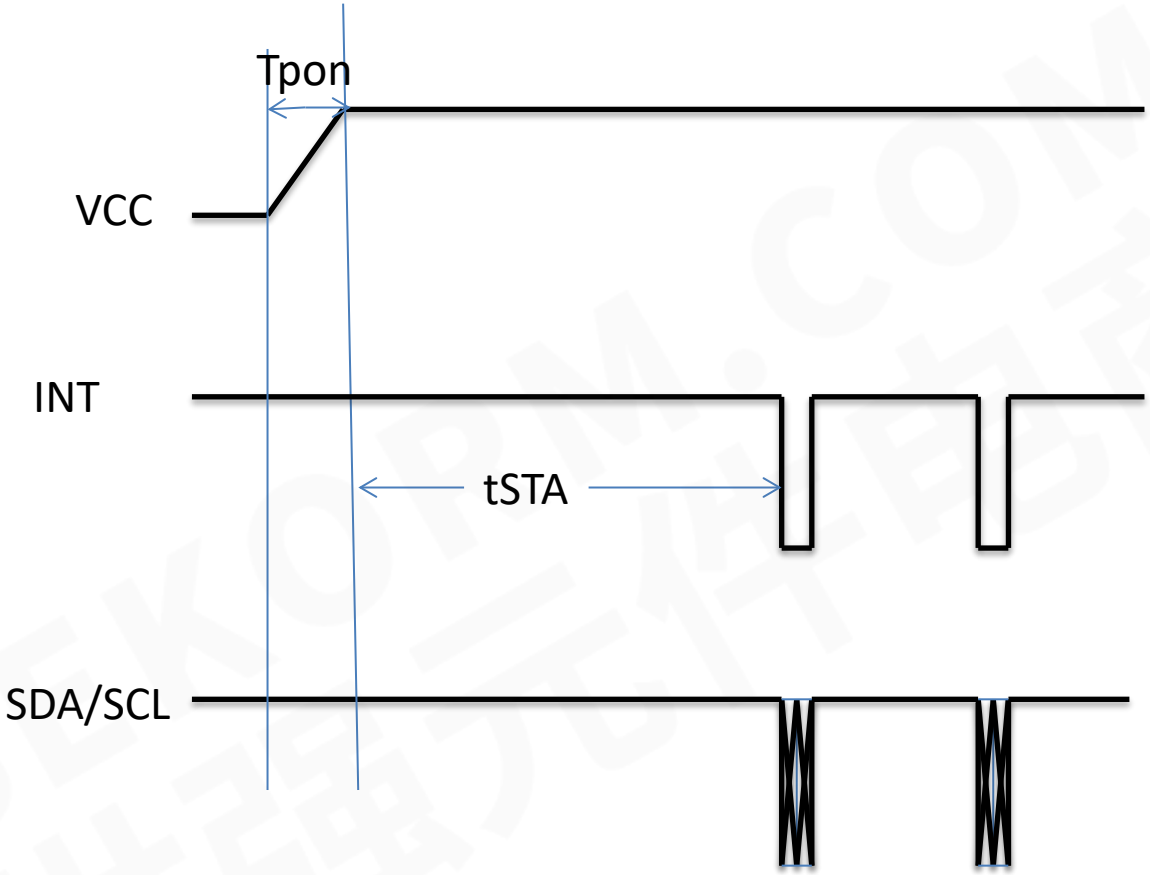
(VCC = 2.7 to 3.6V, GND=0V, Ta=-20 to +80°C)

Parameter	Symbol	Standard			Unit	Condition
		Min.	Typ.	Max.		
Logic input voltage	VIH	VDDI x 0.7		-	V	
	VIL	-		VDDI x 0.3	V	
Logic output voltage	VOH	VDDI – 0.4		-	V	Load = 1 mA
	VOL	-		0.4	V	Load = 1 mA

5-4) Operating sequence at start-up

(VCC = 2.7 to 3.6V, GND=0V, Ta=-20 to +80°C)

Parameter	Symbol	Condition	Standard			Unit
			Min.	Typ.	Max.	
VCC power on time	Tpon	-	0.01		100	ms
Start-up time	tSTA	Output code ±1°/s	-	3	5	s



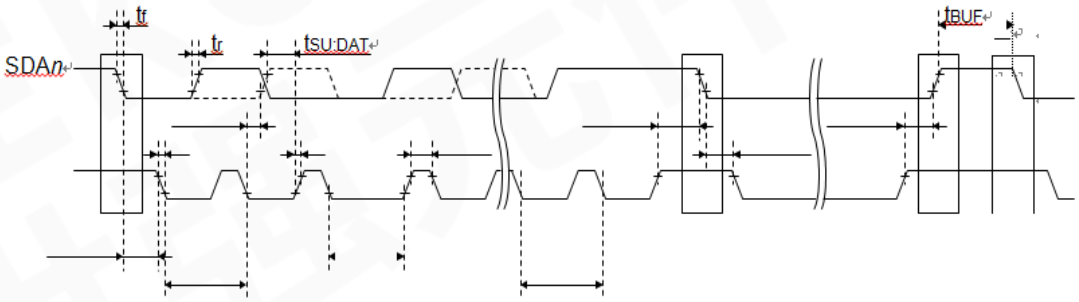
5-5) Characteristics (Unless otherwise specified, VCC = 2.7 to 3.6V, GND=0V, Ta=-20 to +80°C)

Parameter	Symbol	Condition	Standard			Unit
			Min.	Typ.	Max.	
Scale factor tolerance	Sp	Ta = +25°C	-1		+1	%
Bias drift	ZRL	Ta = +25°C	-1		1	°/s
Rate range	RR		-400		+400	°/s
Non linearity	NI	Ta = +25°C	-0.5		+0.5	%FS
Angle resolution	AR	Ta = +25°C		0.01		°
Angle drift error	ADE	Ta = +25°C		+/-20	+/-60	°/hr
Cross axis sensitivity	CS	Ta = +25°C	-5		+5	%
Current consumption	Iop				3	mA
Bandwidth	Bw				10	Hz
Data rate	Dr				100	Hz
Startup time	ST	Power on under still	-	3	5	s

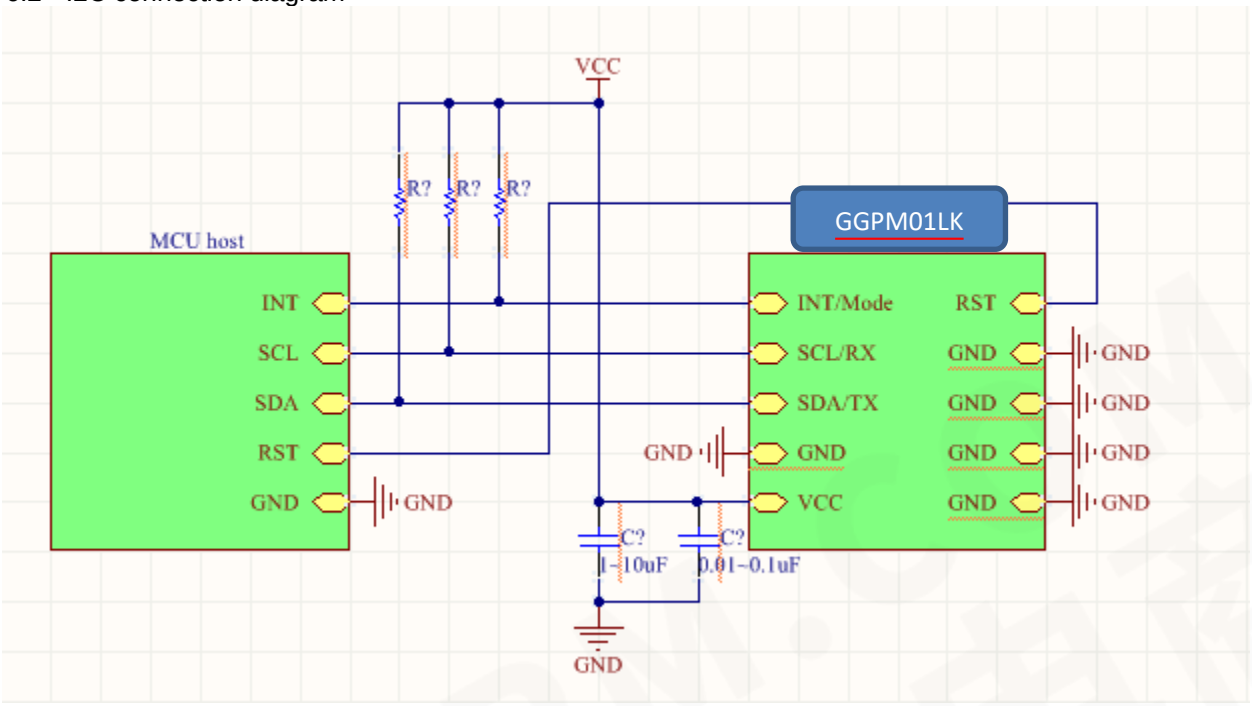
6.1 I²C (I2C) Characteristics

Unless otherwise specified: V_{CC} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = -20 to 80 °C

Item	Symbol	Condition	Standard mode V_{CC} = 2.7 to 3.6 V			Fast mode V_{CC} = 2.7 to 3.6 V			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
SCL*n* frequency	f_{SCL}		0	–	100	0	–	400	kHz
Hold time (repeated) START condition *	$t_{HD:STA}$		4.0	–	–	0.6	–	–	µs
SCL*n* Low pulse width	t_{LOW}		4.7	–	–	1.3	–	–	µs
SCL*n* High pulse width	t_{HIGH}		4.0	–	–	0.6	–	–	µs
Repeated START condition setup time	$t_{SU:STA}$		4.7	–	–	0.6	–	–	µs
Data hold time	$t_{HD:DAT}$		0	–	–	0	–	–	µs
Data setup time	$t_{SU:DAT}$		250	–	–	100	–	–	ns
SDA*n*, SCL*n* rise time	t_r		–	–	1,000	–	–	300	ns
SDA*n*, SCL*n* fall time	t_f		–	–	300	–	–	300	ns
STOP condition setup time	$t_{SU:STO}$		4.0	–	–	0.6	–	–	µs
Bus free time	t_{BUF}		4.7	–	–	1.3	–	–	µs



6.2 I2C connection diagram



Example of I²C connection

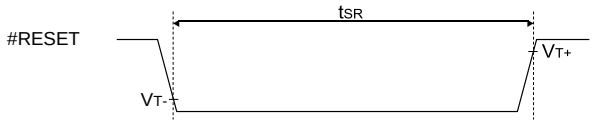
Connect bypass capacitors to VCC pin.
C1 : 0.01μF ~ 0.1μF
C2 : 1μF ~ 10μF
R1, R2, R3 : 4.7~10K(typ.)

It is not likely to be able to communicate by the influence of the noise of signal line, overshoot / undershoot by the design of the wiring pattern. In this case, the dumping resistance is recommended to be inserted properly.

#RESET pin characteristics

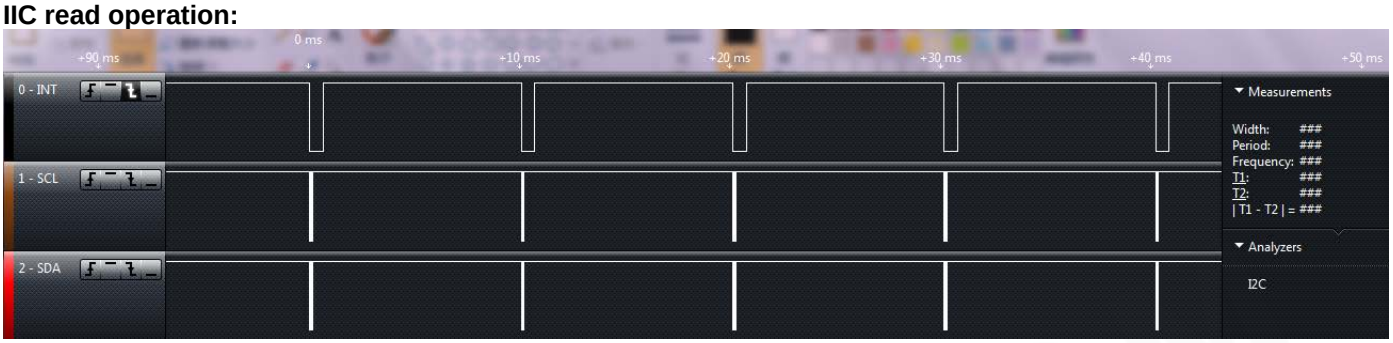
Unless otherwise specified: V_{DD} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = -20 to 80°C

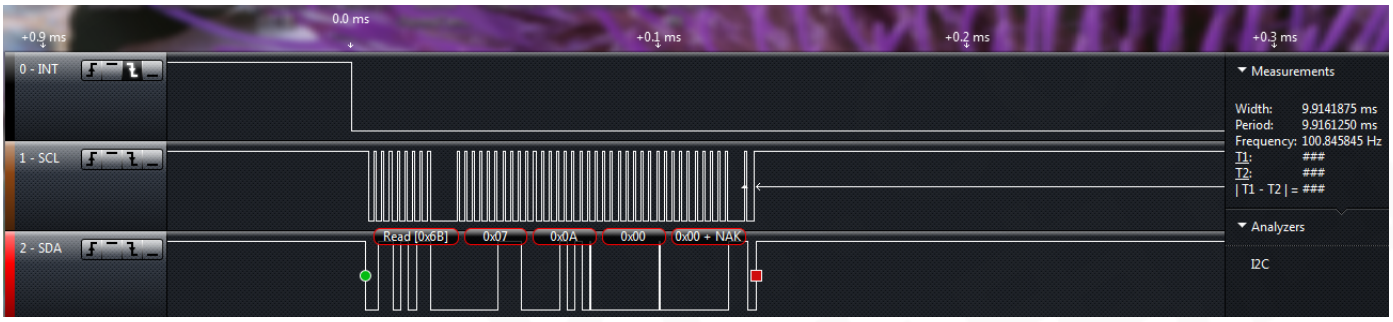
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
High level Schmitt input threshold voltage	V_{T+}		0.5 × V_{DD}	–	0.8 × V_{DD}	V
Low level Schmitt input threshold voltage	V_{T-}		0.2 × V_{DD}	–	0.5 × V_{DD}	V
Schmitt input hysteresis voltage	ΔV_T		20	–	–	mV
Input pull-up resistance	R_{IN}		100	270	500	kΩ
Pin capacitance	C_{IN}		–	–	15	pF
Reset Low pulse width	t_{SR}		5	–	–	μs

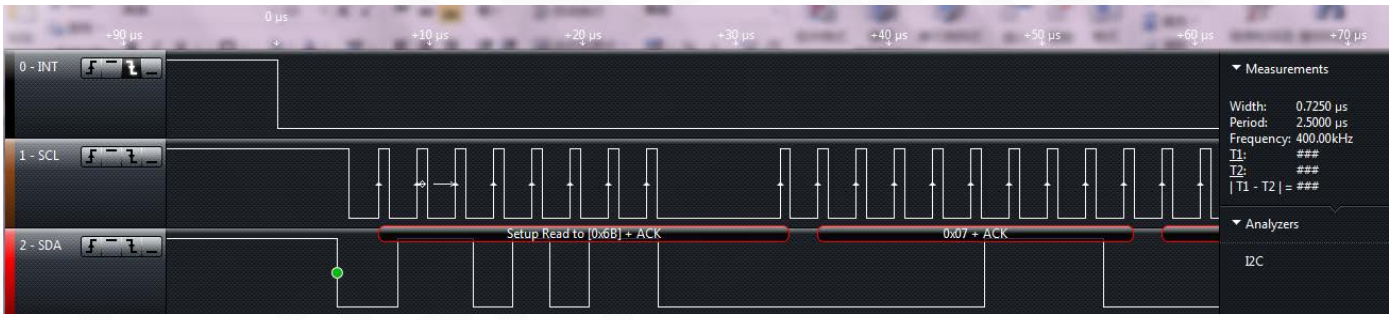


IIC communication timing examples:

IIC read operation:







Notice:

This communication chart is just for your reference,
it not stands for a full frame of the communication,
In generally, the checksum bytes also need to be read out for reference

7. IIC Data format:

Table 1: reading data format.

ANGLE		ANGULAR RATE		CHECKSUM	
High byte	Low byte	High byte	Low byte	High byte	Low byte
0xXX	0xXX	0xXX	0xXX	0xXX	0xXX
2bytes		2bytes			

* First byte is the most significant

Table 2: data fields description.

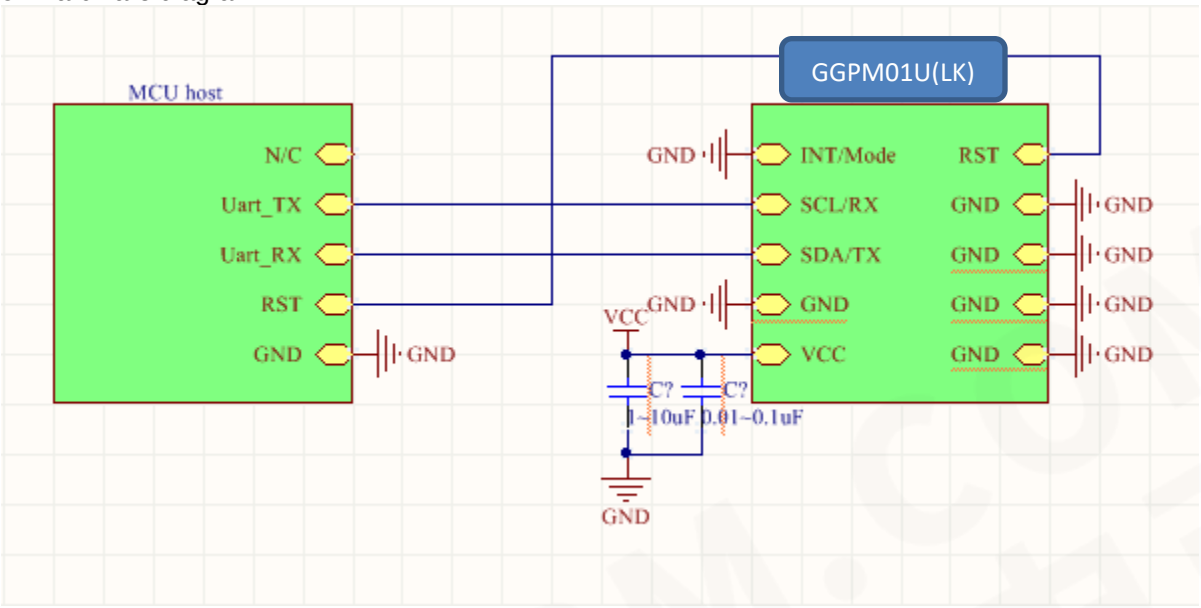
OUTPUT DATA	BYTE	COMMENTS
ANGLE	1-2	Provided in hundredths of deg. and normalized to ±180 deg.
ANGULAR RATE	3-4	Provided in hundredths of deg/sec
CHECKSUM	5-6	CHECKSUM = ANGLE + ANGLERATE

Table 3: Data packet parsing example.

Parameter	Comments/Calculations
Angular Rate output	Angle Rate (hundredths deg/sec) = 0x0070 (hex) = 112 Angle Rate (deg/sec) = 112/100 = 1.12
Angle output	Angle (hundredths deg) = 0x00C8 (hex) = 200 Angle (deg) = 200/100 = 2.00

8 UART communications

8.1 hardware diagram:



8.2 communication protocol:

Band rate: **115200, 8bit data, no parity, 1bit stop**

8.3 data format:

	HEAD		RATE		ANGLE		CHECKSUM		STATUS		CK2	END	
offset	0	1	2	3	4	5	6	7	8	9	10	11	12
bytes	-	-	Low byte	High byte	Low byte	High byte	Low byte	High byte	Low byte	High byte	-	-	-
code	**0xFF**	**0xFF**	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX	**0x0D**	**0x0A**

a. First byte is the least significant/低位字节在前
b. HEAD is fixed code 0xFF 0xFF
c. END is fixed code 0x0D 0x0A
d. CHECKSUM = HEAD + RATE +ANGLE
e. STATUS, reserve bytes
f. CK2, byte(10) = bytes(0) + byte(1) + byte(2) + … + byte(9)
g. Final Rate = Rate/100,
h. Final Angle = Angle/100;

9. Handling precaution

★★ This device are high precision products. Use the following precautions during handling ★★

a) This product design incorporates shock resistance but there is the risk of product damage due to drops and shock. Do not use this product if it has been dropped as we cannot guarantee product performance.

b) When the products are automatically mounted (vacuum-chucking, mechanical chucking, mounting on the circuit board), the excessive shock may make the characteristics of quartz products change or deteriorate. So please set up the condition so that the shock becomes as small as possible. Please be sure to test in your site before use and confirm that there is no influence on the characteristics. And confirm similarly when the condition is changed. And be careful not to collide the products with the machinery or with other circuit board when/after mounting.

c) The sensor includes a static electricity protection circuit but application of significant static electricity can result in damage to the sensor's internal IC. Make sure to use conductive materials for packaging and transport containers as well. For the soldering iron, measurement circuit, etc., use products with no high-voltage leaks and during mounting make sure to employ static electricity measures such as the use of a ground wire.

d) Applying ultrasonic oscillation (ex. Ultrasonic washing、Printed circuit board cutting) to our product, the crystal unit may be cause resonant destruction under some use conditions. Since we can not specify your use conditions, we cannot guarantee the operation of our product after you apply ultrasonic oscillation. If you have no choice but to apply it, please be sure to examine and set up the conditions beforehand.

e) Keep reflow to no more than 1 time. Use a soldering iron to correct any soldering mistakes. Here, the temperature of the iron type should be below +350°C and less than 3 seconds.

f) We recommend using board production based on our Soldering pattern dimensions.

g) Do not use in high condensation or other environments prone to short circuits between terminals.

h) To detect angular rate, this product uses a drive frequency to drive the sensor element. External application of a signal with frequency components in the vicinity of the drive frequency or high-order harmonics can result in fluctuations in angular rate output by the sensor. Be sure to confirm internally in advance concerning power supply decoupling measures and serial interface communications frequency settings.

i) The detuning frequency for this product is 900Hz±200Hz. During board design, the customer must ensure that the board resonance frequency is not within the vicinity of this detuning frequency. When mounting on a board, align the sensor near a board loading component with low resonance variation.

j) To prevent malfunctions caused by electromagnetic and static induction from other signal lines, during pattern design do not pass other signal lines near the sensor or along the back of the package. Also use a pattern design that does not cross with other signal lines.

k) Confirm internally in advance concerning measures for vibration, shock, and noise. We will provide design support if you provide us with board design information.