QinNav 钦天导航

PRODUCT SPECIFICATION

产品规范

适用于 For

QM602 GNSS 模块
QM602 GNSS Module

REVISION HISTORY / 修订历史

Revision/版本	Modification/更改	Date/日期
1.0	New Release / 新发	2023/2/14

DIRETORY / 目录

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1. INTRODUCTION / 简介

QM602 is high precision vehicle-regulation-level positioning multi-system OEM Modules based on a self-developed SoC by QinNav Technology Ltd, it has small size, multi-system and multi-frequency. It tracks constellations including BDS-2, BDS-3, GPS, GLONASS, Galileo, SBAS and QZSS. Also with onboard inertial navigation device, supporting integrated navigation algorithm. The QM602 GNSS module is mainly designed and used for intelligent driving, UAV, intelligent robot and other fields.

QM602模块是司南导航自主研发的全系统多频点的小尺寸高精度定位模块，支持BDS-2、BDS-3、GPS、GLONASS、Galileo、SBAS和QZSS等卫星导航系统的信号跟踪，板载惯导器件，支持组合导航算法，适用于智能驾驶、无人机、智能机器人等领域。

1.1. Product Characteristics / 产品特性

Table 1. Product Characteristics / 产品特性

Characteristics	QM602	
Signals **信号**	**Positioning** **定位**	GPS: L1C/A, L2P, L2C
		BDS-2: B1I, B2I BDS-3: B1C, B2b
		GLONASS: G1, G2
		Galileo: E1, E5b
		QZSS: L1C/A, L2C
		SBAS: L1C/A
Time to First Fix **首次定位时间**	**Cold Start** **冷启动**	< 20s（Adding Acceleration Capture Module,增加捕获加速模块）
	Hot Start (with RTC) **热启动（使用RTC）**	< 10s（Typical,典型）
Signal Capture **信号捕获**	**Reacquisition** **失锁重捕**	< 1s

	Signal Capture Sensitivity **信号捕获灵敏度**	-138dBm
Measurement Precision **测量准确度**	**Pseudo-range Precision** **伪距精度**	≤ 10cm
	Carrier Phase Precision **载波相位精度**	≤ 1mm
Accuracy **精度**	**Time Accuracy** **授时精度**	20ns
	SPP Accuracy **标准单点定位精度**	H ≤ 1.5m, V ≤ 3m (1σ, PDOP≤4)
	Static Differential Accuracy (Supported by Compass Solution) **静态差分精度（Compass Solution软件支持）**	H: ±(2.5+1×10^{-6}×D) mm V: ±(5.0+1×10^{-6}×D) mm D为基线长度(单位：mm) D - Baseline length (Unit: mm)
	Speed Accuracy **测速精度**	≤ 0.02 m/s (PDOP ≤4)
Anti-interference **抗干扰**	It can suppress the potential narrowband and single tone radio interference signals in the GNSS signal frequency band, and the interference to signal ratio can reach 50dB. 具备抑制GNSS信号频带内潜在的窄带和单音无线电干扰信号，干信比可达 50dB。	
RTK	**RTK Initialization Time** **RTK初始化时间**	< 5s（baseline < 10km，基线长小于 10km）
	Initialization Reliability **初始化置信度**	> 99.9 %
	RTK Accuracy **RTK精度**	H: ± (8 + 10^{-6} × D) mm V: ± (15 + 10^{-6} × D) mm

		D为基线长度(单位：mm) D - Baseline length (Unit: mm)
Data Rates **数据速率**	**Measurements & Position** **测量&定位**	Max 20Hz（Optional，选配项）
	RTK: Positioning **RTK：定位**	Max 20Hz（Optional，选配项）
Electrical **电气特性**	**Voltage** **供电电压**	+ 3.3 V ± 5 % DC
	Power Consumption **功耗**	0.8 W (Anti-interference off，未开启抗干扰) Set anti-interference on consumes more about 0.2W 抗干扰功能开启，功耗约增加 0.2W
Environmental **环境要求**	**Operating Temperature** **工作温度**	-40℃ ~ +85℃
	Storage Temperature **储存温度**	-55℃ ~ +95℃
Data Formats **输出数据格式**	**NMEA-0183**	GPGGA, GPGSV, GPGLL, GPGSA, GPGST, GPHDT, GPRMC, GPVTG, GPZDA etc.
	QinNav Binary（CNB) **钦天二进制格式**	QinNav Self-Defined Binary 钦天自定义二进制
	CMR(GPS)	CMROBS, CMRREF
	RTCM2.X	RTCM1, RTCM3, RTCM9, RTCM1819, RTCM31, RTCM41, RTCM42
	RTCM3.X	1004~1008,1012,1019,1020,1033,1042,1045/1046, 1230,4078 MSM3~MSM7:1073~1077,1083~1087,1123~1127,1093~1097
Antenna Interface	**Impedance Matching**	Wiring 50 Ohm impedance matching

天线接口	**阻抗匹配**	布线 50 欧姆阻抗匹配
	LNA Power **天线供电电压**	External 外部供电: +3.3V ~ +5V ± 5%VDC @ 0-100mA
	LNA Gain **天线增益**	20 ~ 35dB Antenna gain is lower than 20dB or higher than 35dB, which may cause signal crosstalk and other problems. 增益低于 20dB或者高于 35dB,可能会造成信号串扰等问题
Hardware Interface **硬件接口**		表贴LGA（54PIN）
Physical **物理参数**	**Size 尺寸**	17mm×22mm×3.2mm
	Weight 重量	5.0 grams (克)
	Flatness 平整度	≤ 0.1mm

2. QM602 Product Size / QM602 尺寸

In this section, product photo, three-side views and the dimension of QM602 is provided for customers' further hardware design and installation.

本节提供了QM602的实物图，三视图和对应的物理尺寸，便于用户进一步系统硬件设计和安装。

Figure 1. QM602 Product Photo / QM602 实物图

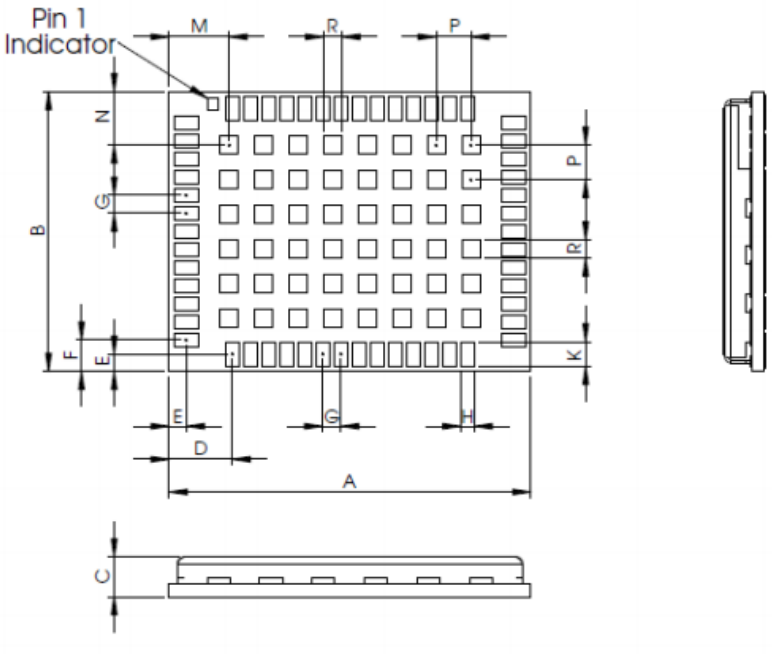

Figure 2. QM602 Dimension View / QM602 三视图

符号	最小值(mm)	标准值(mm)	最大值(mm)
A	21.80	22.00	22.20
B	16.80	17.00	17.20
C	2.70	2.80	2.90
D	3.65	3.85	4.05
E	0.85	1.05	1.25
F	1.70	1.90	2.10
G	1.05	1.10	1.15
H	0.70	0.80	0.90
K	1.20	1.50	1.80
M	3.45	3.65	3.85
N	3.05	3.25	3.45
P	2.05	2.10	2.15
R	0.88	1.10	1.32

Figure 3. QM602 Corresponding Hardware Specifications / QM602 对应的硬件规格参数

3. PIN Arrangement and Definition / 针脚标识和定义

QM602 is surface-mount OEM Module which integrates 54 pins.

QM602包括54pin，表贴式模块。

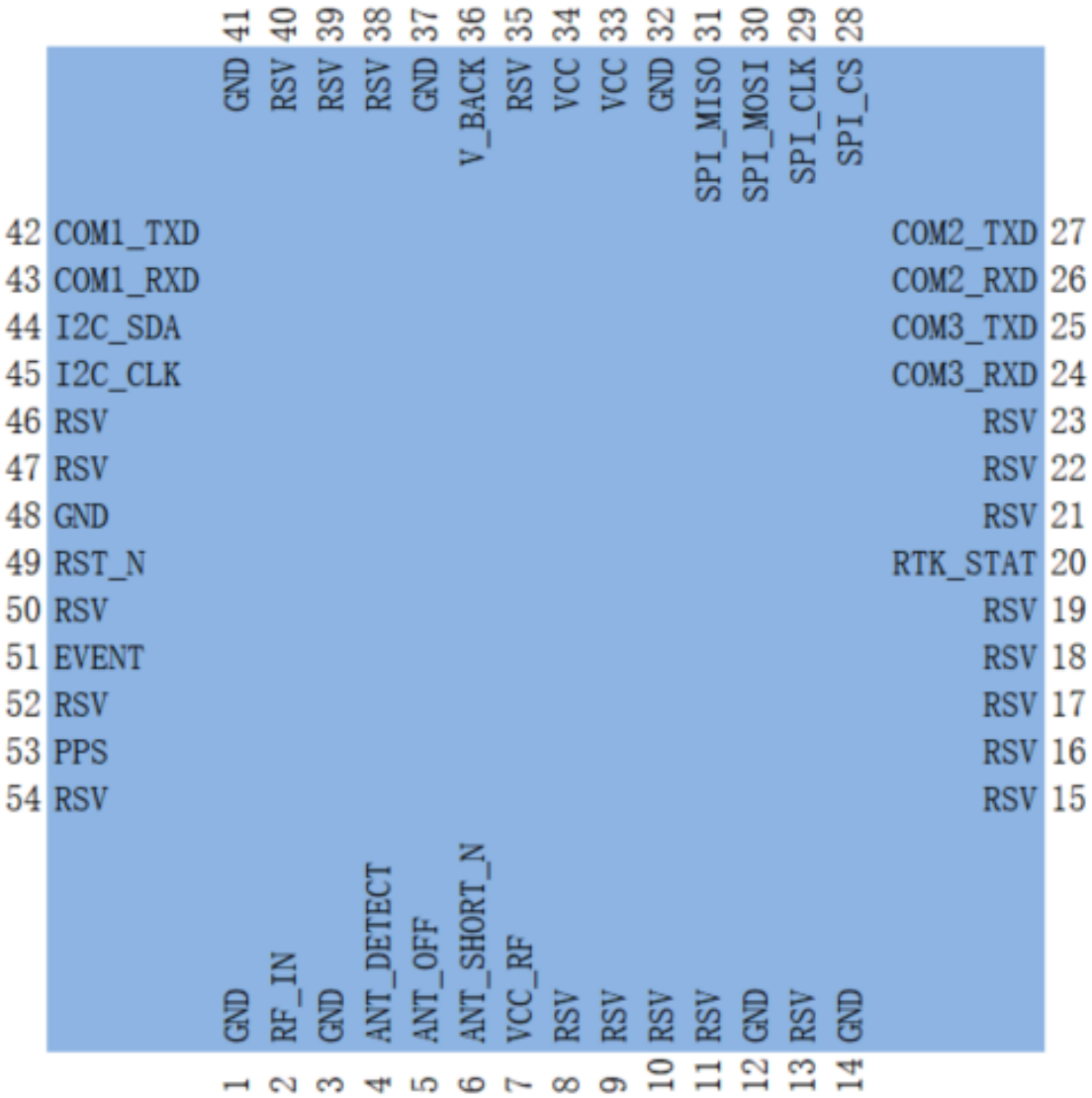

Figure 4. QM602 Includes 54-Pin Pad / QM602 包括54连接焊盘

Table 2. Pin Definition of QM602 54-Pin Pad / QM602 54针脚焊盘的针脚定义

PIN	SIGNAL	TYPE	DESCRIPTION	
1	GND	GND	Ground Reference	参考地
2	RF_IN	I	RF Input	天线射频输入
3	GND	GND	Ground Reference	参考地
4	ANT_DETECT	I	Active Antenna Detect - Default Active High	天线开路检测-默认高电平

PIN	SIGNAL	TYPE	DESCRIPTION	
5	ANT_OFF	O	External LNA Disable - Default Active High	外部低噪放使能-默认高电平
6	ANT_SHORT_N	I	Active Antenna Short Detect - Default Active Low	天线短路检测-默认高电平
7	VCC_RF	O	Voltage for External LNA	外部低噪放供电
8~11	RSV	/	Reserve (Float)	保留管脚（悬空）
12	GND	GND	Ground Reference	参考地
13	RSV	/	Reserve (Float)	保留管脚（悬空）
14	GND	GND	Ground Reference	参考地
15~19	RSV	/	Reserve (Float)	保留管脚（悬空）
20	RTK_STAT	O	Blinking (Receiving RTCM Data and Processing RTK)	闪烁（接收RTCM数据并进行RTK解算时）
21~23	RSV	/	Reserve (Float)	保留管脚（悬空）
24	COM3_RXD	I	Transmitted Data for COM 3 Input	串口3输入信号
25	COM3_TXD	O	Received Data for COM 3 Output	串口3输出信号
26	COM2_RXD	I	Transmitted Data for COM 2 Input	串口2输入信号
27	COM2_TXD	O	Received Data for COM 2 Output	串口2输出信号
28	SPI_CS	O	SPI_CS	SPI总线片选信号
29	SPI_CLK	O	SPI_CLK	SPI总线时钟信号
30	SPI_MOSI	O	SPI_MOSI	SPI主输出从输入信号
31	SPI_MISO	I	SPI_MISO	SPI主输入从输出信号
32	GND	GND	Ground Reference	参考地
33~34	VCC	PWR	Voltage supply	电源输入
35	RSV	/	Reserve (Float)	保留管脚（悬空）
36	V_BCKP	PWR	Backup supply voltage	备用电源输入
37	GND	GND	Ground Reference	参考地
38~40	RSV	/	Reserve (Float)	保留管脚（悬空）
41	GND	GND	Ground Reference	参考地
42	COM1_TXD	O	Transmitted Data for COM 1 Output	串口1输出信号
43	COM1_RXD	I	Received Data for COM 1 Input	串口1输入信号
44	I2C_SDA	I/O	I2C Data	I2C数据
45	I2C_CLK	I/O	I2C Clock	I2C时钟
46~47	RSV	/	Reserve (Float)	保留管脚（悬空）
48	GND	GND	Ground Reference	参考地
49	RST_N	I	Quick Reset without Clearing User Configuration (Low Active)	快速复位，不清除用户配置（低电平有效）
50	RSV	/	Reserve (Float)	保留管脚（悬空）

PIN	SIGNAL	TYPE	DESCRIPTION	
51	EVENT	I	External Interrupt Pin	外部中断输入
52	RSV	/	Reserve (Float)	保留管脚（悬空）
53	PPS	O	Pulse Per Second	秒脉冲
54	RSV	/	Reserve (Float)	保留管脚（悬空）

3.1. Remarks / 说明

1. Electrical Characteristics / 电气特性

COM1/2/3(TX&RX), SPI, ANT(OPEN&SHORT), GPIO, RTK_STAT, RST_N, PPS and EVENT are LVCMOS 3.3V level, All these signals are LVCMOS/LVTTL 3.3V compatible.

COM1/2/3（TX&RX），SPI，ANT（OPEN&SHORT），GPIO，RTK_STAT，RST_N，PPS和EVENT为LVCMOS 3.3V 电平，所有这些信号均兼容LVCMOS / LVTTL 3.3V。

Table 3. LVCMOS 3.3V Electrical Standard / LVCMOS 3.3V电气标准

Symbols 符号	Description 描述	Min 最小	Max 最大
VIH	Input high voltage 输入高电压	2.0V	3.6V
V_{IL}	Input low voltage 输入低电压	-0.3V	0.8V
V_{OH}	High-level output voltage 高电平输出电压	2.9V	--
V_{OL}	Low-level output voltage 低电平输出电压	--	0.4V
I_{OH}	Sourcing current 拉电流	8mA	
I_{OL}	Sinking current 灌电流	8mA	

Table 4. LVTTL 3.3V Electrical Standard / LVTTL 3.3V电气标准

Symbols 符号	Description 描述	Min 最小	Max 最大
VIH	Input high voltage 输入高电压	2.0V	--
V_{IL}	Input low voltage 输入低电压	-0.3V	0.8V
V_{OH}	High-level output voltage	2.4V	--

Symbols 符号	Description 描述	Min 最小	Max 最大
	高电平输出电压		
V_{OL}	Low-level output voltage 低电平输出电压	--	0.4V
I_{OH}	Sourcing current 拉电流	8mA	
I_{OL}	Sinking current 灌电流	8mA	

2. Can withstand Voltage Range / 能承受的电压范围

The maximum voltage range is -0.3V ~ 3.6V. The signals are as follows: COM1/2/3(TX&RX), SPI, ANT(OPEN&SHORT), RTK_STAT, RST_N, PPS and EVENT.

所能承受电压的最大值范围是-0.3V~3.6V的信号如下：COM1/2/3（TX&RX），SPI，ANT（OPEN&SHORT），RTK_STAT，RST_N，PPS和EVENT。

3. Supply Voltage / 供电电压

VCC main power supply, voltage range: 3.3V (DC). Voltage ripple and spikes require less than 50mV. QM602: VCC_RF, voltage range: 3.3V ~ 5.5V (DC). Voltage ripple and spikes require less than 50mV. V_BACK, the voltage is 1.8V~3.6V, and the voltage ripple and spikes are required to be less than 30mV.

VCC主供电电源，电压范围：3.3V（直流）。电压纹波和尖峰脉冲要求小于50mV。QM602：VCC_RF，电压范围：3.3V~5.5V（直流）。电压纹波和尖峰脉冲要求小于 50mV。V_BACK，电压1.8V~3.6V，电压纹波和尖峰脉冲要求小于30mV。

4. RTK_STAT

RTK_STAT positioning indicator, high level is valid, output high level when RTK is fixed, output low level in other positioning states or no positioning, need to add LED indicator.

RTK_STAT定位指示灯，高电平有效，RTK固定解时输出高电平，其他定位状态或者不定位输出低电平，需要外加LED指示灯。

5. Add Surge Protection / 增加浪涌保护

The QM602 module has the function of feeding the antenna from the inside, but in order to effectively prevent lightning strikes, anti-surge, and prevent the damage of the feeding current limiting chip inside the module, it is recommended that users supply power to the antenna from the outside of the module.

If you need to feed the antenna from the outside, it is recommended to use a high-voltage, high-power feeder chip; or add high-power protection devices such as gas discharge tubes, varistors, and TVS tubes to the feeder circuit.

QM602模块拥有从内部为天线馈电的功能，但为了有效防雷击、防浪涌，防止模块内部的馈电限流芯片损坏,建议用户从模块外部给天线供电。

如需从外部为天线馈电，建议选用高耐压、大功率的馈电芯片；或在馈电电路上增设气体放电管、压敏电阻、TVS管等大功率的防护器件。

4. Assembling & Repairing Note / 装配及维修说明

4.1. Module Assembling Note / 模块装配说明

QM602 is surface mounted, SMT welding is recommended for assembly.

QM602为表贴式模块，推荐使用SMT的焊接方式进行装配。

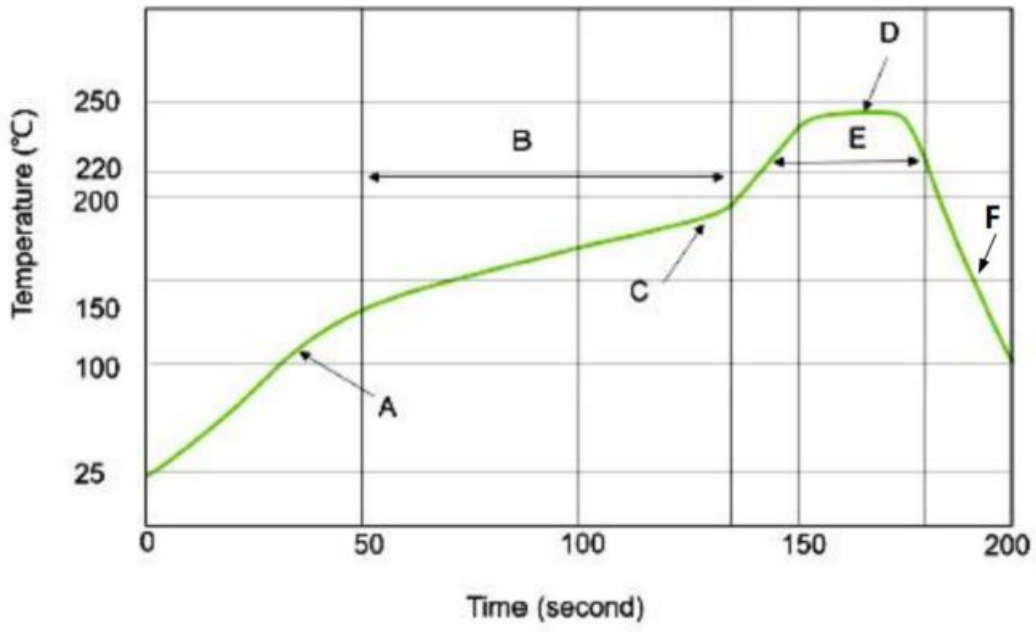

Figure 5. Furnace Temperature Curve / 炉温曲线

The process temperature limits are as follows:

A: Heating Zone: Rising Slope: 1 ~ 3℃ / sec

B: Constant Temperature Zone: Range: 150 ~ 190 ℃ Time: 80 ~ 110 S

C: Constant Temperature→Reflow Zone: Rising Slope: 1 ~ 3℃ / sec

D: Peak Temperature: 235 ~ 245℃

E: Reflow Zone: Range: Over 220℃ Time: 50 ~ 80 S

F: Descent Slope: -5℃ ~ -1℃ / sec

制程温度界限如下:

A：升温区： 斜率：1 ~ 3℃ / sec

B：恒温区： 150 ~ 190℃ 时间：80 ~ 110S

C：恒温→回流区： 斜率：1 ~ 3℃ / sec

D：峰值温度： 235 ~ 245℃

E：回流区： 大于220℃ 时间：50 ~ 80S

F：下降斜率： -5 ~ -1℃ / sec

In order to prevent the module from being damaged by repeated heating, it is recommended to place the module after finishing the first side of PCB board.

为避免模块因反复受热而损坏，建议在完成PCB板第一面的回流焊之后再贴模块。

4.2. Repairing Note / 维修说明

When disassembling the module, it is suggested using a BGA welding bench. Please use correct air tuyere and choose certain temperature curve. Keep peak temperature under 245℃, rising slope under 3℃/s.

拆卸模块时，请使用BGA返修台，选择适合尺寸的风嘴并使用合适的温度曲线，最高温度不超过245℃，升温斜率不超过3℃/s。

5. Application Connection Example / 应用连接示例

In this section, an application connection example of QM602 OEM Module is presented via specific schematic diagrams. Per the instruction of these diagrams, you could easily build the communication circuits between QM602 OEM Module and other terminals such as PC, GPRS or Bluetooth module, and some other devices with an UART.

本部分以具体电路的形式提供一个QM602模块应用连接示例。参照下面的图示，您可以很方便建立QM602模块和其他终端（如PC，GPRS模块，蓝牙模块或其他带有UART的设备）之间的通讯电路。

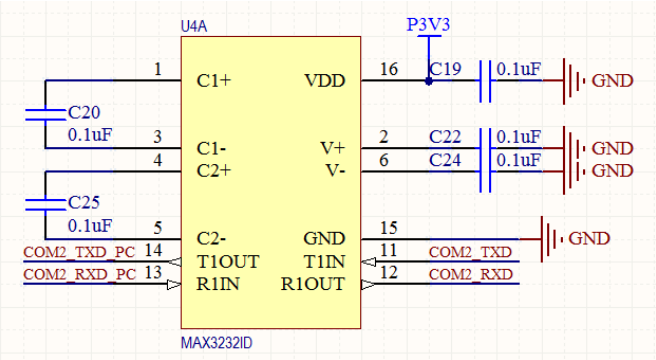

Figure 6. Connections between RS232 COM1, 2 of QM602 and Some Other Devices with an UART / QM602 RS232 COM1、2与其他使用UART接口的设备之间的连接示意