



# 司南导航

Product Specification / 产品规范

## K705 OEM Board

## K705 OEM 板卡

2018-05-07

## REVISION HISTORY / 修订历史

REVISION / 版本	MODIFICATION / 更改	DATE / 日期
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## I. INTRODUCTION / 简介

ComNav K705 is a high precision positioning multi-system OEM board based on a self-developed ASIC baseband chip, it has small size, whole system and whole frequency. The K705 tracks OEM constellations including GPS, BDS-2, GLONASS, Galileo, SBAS, QZSS 和 L-band. It can track BDS-3 global signals including B1C and B2a, and support global precise point positioning (PPP). K705 is mainly designed and used for UAV and handheld devices with size, weight and power requirements.

K705 板卡是司南导航自主研发的全系统、全频点、小尺寸高精度定位 OEM 板卡，满足全系统全频点导航卫星系统板卡需求，支持 GPS、BDS-2、GLONASS、Galileo 以及 SBAS、QZSS 和 L-band；支持 BDS-3 北斗全球信号 B1C、B2a 信号的接收；支持全球精密单点定位（PPP）。适用于如无人机和手持设备等对板卡尺寸、重量和功耗要求严格的领域。

## II. SPECIFICATION OF K705 OEM BOARD / K705 OEM 板卡技术规范

Following table presents the detailed specification of ComNav K705 OEM board. Specific technical characteristics are listed with its physical interface and electrical parameters.

下表中为司南 K705 OEM 板卡的详细规范。同时，还列出了该板卡的各项技术性能，以及它的物理接口和电气接口参数。

Table 1. K705 Specification

K705 SPECIFICATION/ K705 规范		
GNSS Signals GNSS 信号	GPS L1, L2, L5	14 GPS satellite tracked at the same time 可同时跟踪 14 颗 GPS 卫星
	BDS-2 B1, B2, B3	14 BDS-2 satellite tracked at the same time 可同时跟踪 14 颗 BDS-2 卫星
	BDS-3 B1C, B2a	12 BDS-3 satellite tracked at the same time 可同时跟踪 14 颗 BDS-3 卫星
	GLONASS G1, G2	14 GLONASS satellites tracked at the same time 可同时跟踪 14 颗 GLONASS 卫星

K705 SPECIFICATION/ K705 规范		
	Galileo E1C, E5a, E5b	14 Galileo satellites tracked at the same time 可同时跟踪 14 颗 Galileo 卫星
	QZSS	4 QZSS satellites tracked at the same time 可同时跟踪 4 颗 QZSS 卫星
	SBAS	4 SBAS satellites tracked at the same time 可同时跟踪 4 颗 SBAS 卫星
<b>Time to First Fix</b> 首次定位时间	Cold Start 冷启动	< 60s (典型值) < 40s (增加捕获加速模块)
	Hot Start (with RTC) 热启动 (使用 RTC)	< 15s (典型值)
<b>Reacquisition</b> 信号重捕		< 1.5s
<b>Measurement Precision</b> 测量准确度	Pseudorange Precision 伪距精度	GPS: L1=10cm, L2=10cm, L5=5cm BDS-2: B1=10cm, B2=10cm, B3=5cm GLONASS: G1=10cm, G2=10cm Galileo: E1C=10cm, E5a=10cm, E5b=10cm
	Carrier Phase Precision 载波相位精度	GPS: L1=1.0mm, L2=1.0mm BDS-2: B1=1.0mm, B2=1.0mm GLONASS: G1=1.0mm, G2=1.0mm Galileo: E1C=1.0mm, E5a=1.0mm, E5b=1.0mm
<b>Accuracy</b> 精度	Time Accuracy 授时精度	20ns
	Output Delay 输出延迟	0~40ms
	SPP Accuracy 标准单点定位精度	single-frequency 单频: H≤3m, V≤5m (1σ, PDOP≤4) dual-frequency 双频: H≤1.5m, V≤3m (1σ, PDOP≤4)

K705 SPECIFICATION/ K705 规范		
	Static Differential Accuracy (Supported by Compass Solution) 静态差分精度 (Compass Solution 软件支持)	H: $\pm(2.5+1\times 10^{-6}\times D)$ mm V: $\pm(5+1\times 10^{-6}\times D)$ mm
<b>Attitude Accuracy</b> 测姿精度	Azimuth Accuracy (dual-board) 方位角精度 (双板卡)	$(0.2/R)^\circ$ , R is baseline length in meter. R 为基线距离, 单位为米
	Roll or Pitch Accuracy (dual-board) 横滚或俯仰角 (双板卡)	$(0.4/R)^\circ$ , R is baseline length in meter. R 为基线距离, 单位为米
<b>RTD Performance</b> RTD 性能	Pseudorange Differential Accuracy ( $1\sigma$ ) 伪距差分精度( $1\sigma$ )	H: $\pm 0.3$ m V: $\pm 0.5$ m
<b>RTK</b>	RTK Initiation time RTK 初始化时间	< 10s (baseline<10km, 基线长小于 10km)
	Initiation Reliability 初始化置信度	> 99.9%
	RTK Accuracy RTK 精度	H: $\pm(10 + 10^{-6}\times D)$ mm V: $\pm(20 + 10^{-6}\times D)$ mm
<b>PPP</b> 精密单点定位	convergence time 收敛时间	20min
	Accuracy 精度	H: 10cm V: 20cm
<b>Data Rates</b> 数据速率	Measurements & Position 测量&定位	1Hz, 2Hz, 5Hz, 10Hz, 20Hz, 50Hz (可选项)
<b>Electrical</b> 电气特性	Voltage 供电电压	+3.3V ~ +5.5V $\pm 5\%$ DC
	Power Consumption 功耗	1.64W (抗干扰未开启)

K705 SPECIFICATION/ K705 规范		
<b>Environmental</b> 环境要求	Operating Temperature 工作温度	-40°C — +85°C
	Storage Temperature 储存温度	-55°C — +95°C
<b>Data Formats</b> 输出数据格式	NMEA-0183	GPGGA, GPGGARTK, GPGSV, GPGLL, GPGSA, GPGST, GPHDT, GPRMC, GPVTG, GPZDA etc.
	BINEX	0x00, 0x01-01, 0x01-02, 0x01-05, 0x7d-00, 0x7e-00, 0x7f-05
	ComNav Binary 司南二进制格式	ComNav Self-Defined 司南自定义
	RTCM2.X	RTCM1, RTCM3, RTCM9, RTCM1819, RTCM31, RTCM41, RTCM42, RTCM59
	RTCM3.X	1002, 1003, 1004, 1005, 1006, 1007, 1008, 1010, 1011, 1012, 1019, 1020, 1104, 1033, 1042, 1045, 1046, 1230 MSM3~7: 1073 ~ 1077, 1083 ~ 1087, 1093 ~ 1097, 1123 ~ 1127
	Other	PTNL,PJK, PTNL,GGK, PTNL,AVR, NAVPOS
<b>Antenna Interface</b> 天线接口	Antenna Connector 天线连接器	MMCX female (MMCX 母头弯头) 50Ω
	LNA Power 天线供电电压	External 外部供电: +5V ±2% DC @ 0-100mA
	LNA Gain 天线增益	20 ~ 45dB
<b>Hardware Interface</b> 硬件接口		2×22 pin male connector, pin pitch 1.27mm 44 针公头, 针脚间距 1.27mm

K705 SPECIFICATION/ K705 规范		
Physical 物理参数	Size 尺寸	50mm×40mm×8.2mm with connectors (含接头)
	Weight 重量	22 gram 克

### III. DIMENSION / 尺寸

In this section, three-side views and the dimension of K705 are provided for customers' further hardware design and installation.

本节提供了 K705 的三视图和对应的物理尺寸，便于用户的进一步系统硬件设计和安装。

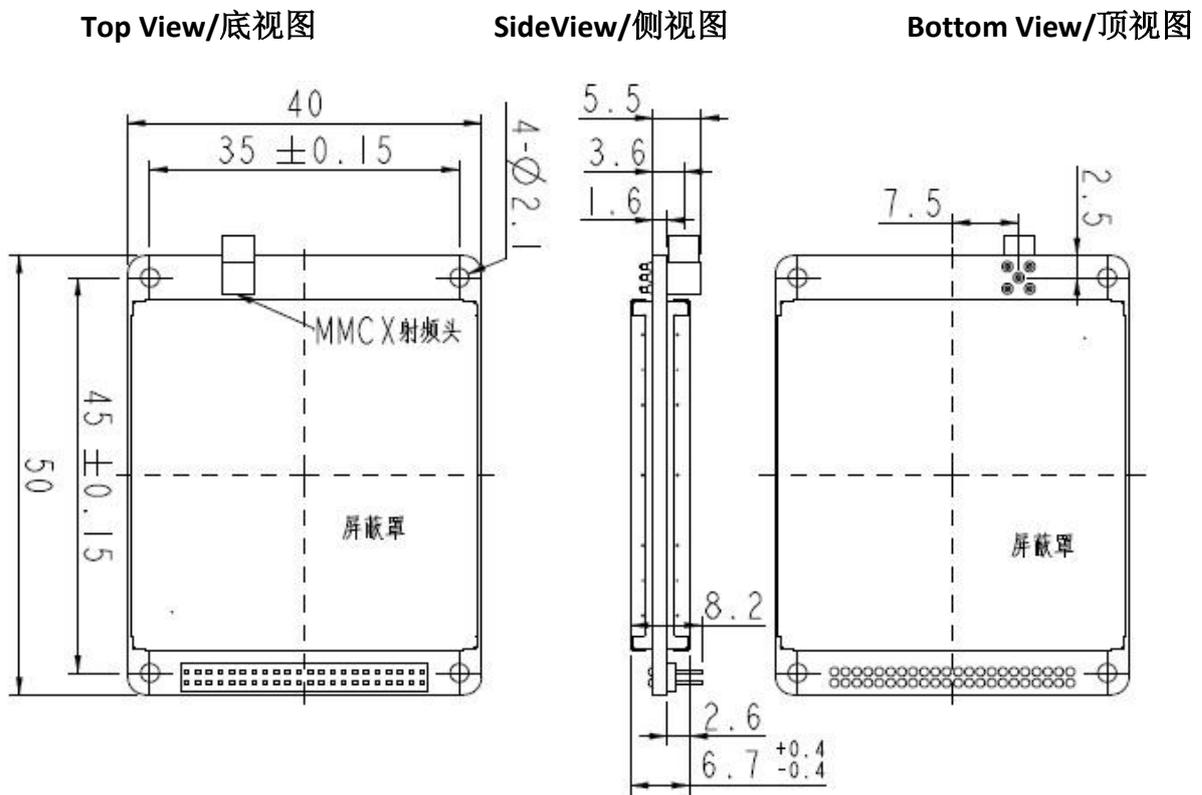


Figure 1. K705 Dimension View

图 1. K705 三视图

#### TIPS 提示:

The copy of AutoCAD dwg files as shown in figure 1 can be obtained from the attachment of this document, which can be imported into EDA tools directly facilitating your system hardware design.

该文档的附件包含上面的 AutoCAD dwg 文件，可直接导入 EDA 软件用于系统硬件设计。

## IV. PIN ARRANGEMENT AND DEFINITION / 引脚标识和定义

K705 has one 44-Pin connector (22 Pin, 1.27mm Dual Row vertical T/H HDR).

K705 板卡包括 44 针接头（针脚间距 1.27mm，双排）。

Table 2. Pin Definition of K705 44-Pin Connector

PIN	SIGNAL	TYPE	DESCRIPTION	
1	VIN	PWR	DC power supply for card (3.3V)	板卡供电电源(3.3V)
2	VIN	PWR	DC power supply for card (3.3V)	板卡供电电源(3.3V)
3	GND	PWR	Ground Reference	参考地
4	PWR_EN/ WAKEUP	I	CARD POWER ENABLE/ WAKE UP	板卡电源使能/唤醒
5	GND	PWR	Ground Reference	参考地
6	CARD_RST	I	Card Reset	系统复位信号
7	COM1_TXD	O	Transmitted Data for COM1 output	串口 1 输出信号
8	COM1_RXD	I	Received Data for COM1 input	串口 1 输入信号
9	COM2_TXD	O	Transmitted Data for COM2 output	串口 2 输出信号
10	COM2_RXD	I	Received Data for COM2 input	串口 2 输入信号
11	COM3_TXD	O	Transmitted Data for COM3 output	串口 3 输出信号
12	COM3_RXD	I	Received Data for COM3 input	串口 3 输入信号
13	GND	PWR	Ground Reference	参考地
14	VIN_LNA	PWR	Power supply for external antenna LNA	天线供电电源
15	PPS	O	Pulse output synchronized to GNSS Time	同步卫星时间脉冲
16	EVENT2/ GPIO	I/O	Event2 mark/ GPIO	外部事件输入 2/ GPIO

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PIN	SIGNAL	TYPE	DESCRIPTION	
17	GPIO/	I/O	GPIO	GPIO
	COM4_TXD/		Transmitted Data for COM4 output	串口 4 输出信号
	I <sup>2</sup> C1 DATA		I <sup>2</sup> C1 DATA	I <sup>2</sup> C1 数据线
18	PV/	I/O	Output indicates 'good solution' or	位置有效指示信号
	COM4_RXD/		valid GPS position when high	
	I <sup>2</sup> C1 CLK		Received Data for COM4 input	串口 4 输入信号
19	RTK_LED/	I/O	RTK data LED indicator	RTK 数据指示灯
	COM5_TXD/		Transmitted Data for COM5 output	串口 5 输出信号
	I <sup>2</sup> C2 DATA		I <sup>2</sup> C2 DATA	I <sup>2</sup> C2 数据线
20	SET_LED/	I/O	Tracked satellite number indicator	跟踪卫星数量指示灯
	COM5_RXD/		Received Data for COM5 input	串口 5 输入信号
	I <sup>2</sup> C2 CLK		I <sup>2</sup> C2 CLK	I <sup>2</sup> C2 时钟线
21	SPI1_CS0/	O	SPI1 CSO	SPI1 总线片选信号
	GPIO		GPIO	GPIO
22	SPI1_CLK/	O	SPI1 CLK	SPI1 总线时钟信号
	GPIO		GPIO	GPIO
23	SPI1_MOSI/	I/O	SPI1 MOSI	SPI1 主输出从输入信号
	COM6_TXD/		Transmitted Data for COM6 output	串口 6 输出信号
	I <sup>2</sup> C3 DATA		I <sup>2</sup> C3 DATA	I <sup>2</sup> C3 数据线
24	SPI1_MISO/	I/O	SPI1 MISO	SPI1 主输入从输出信号
	COM6_RXD/		Received Data for COM6 input	串口 6 输入信号
	I <sup>2</sup> C3 CLK		I <sup>2</sup> C3 CLK	I <sup>2</sup> C3 时钟线
25	GND	PWR	Ground Reference	参考地
26	SDMMC0_CK	O	SDIO CLK	SDIO 总线时钟信号
27	SDMMC0_CM D	O	SDIO COMMAND	SDIO 总线指令信号

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PIN	SIGNAL	TYPE	DESCRIPTION
28	SDMMC0_DAT 0	O	SDIO DATA SDIO 总线数据信号
29	SDMMC0_CD	I	SDIO DETECTION SDIO 总线检测信号
30	USB_N	I/O	USB interface data (-) USB 数据信号(-)
31	GND	PWR	Ground Reference 参考地
32	USB_P	I/O	USB interface data (+) USB 数据信号(+)
33	CAN_RX	I	CAN receive signal CAN 总线输入信号
34	ETH_TX-	O	Ethernet transmit signal (-) 以太网输出信号(-)
35	CAN_TX	O	CAN transmit signal CAN 总线输出信号
36	ETH_TX+	O	Ethernet transmit signal (+) 以太网输出信号(+)
37	EVENT1	I/O	Event1 mark 外部事件 1 输入
38	ETH_RX-	I/O	Ethernet receive signal (-) 以太网接收信号(-)
39	TDO	O	JTAG TDO JTAG TDO
40	ETH_RX+	O	Ethernet receive signal (+) 以太网接收信号(+)
41	TCK	I	JTAG TCK JTAG TCK
42	TMS	I/O	JTAG TMS JTAG TMS
43	NTRST	I	JTAG NTRST JTAG NTRST
44	TDI	I	JTAG TDI JTAG TDI

### REMARKS / 说明:

#### 1. Electronic characteristic/电气特性

COM1\_Tx, COM1\_Rx, COM2\_Tx, COM2\_Rx, COM3\_Tx, COM3\_Rx, COM4\_Tx, COM4\_Rx, COM5\_Tx, COM5\_Rx, COM6\_Tx, COM6\_Rx, CAN1\_RX, CAN1\_TX, SDMMC, I<sup>2</sup>C, RESETIN, SPI\_CLK, SPI\_CS, SPI\_MOSI and SPI\_MISO are LVCMOS 3.3V.

COM1\_Tx, COM1\_Rx, COM2\_Tx, COM2\_Rx, COM3\_Tx, COM3\_Rx, COM4\_Tx, COM4\_Rx, COM5\_Tx, COM5\_Rx, COM6\_Tx, COM6\_Rx, CAN1\_RX, CAN1\_TX, SDMMC, I<sup>2</sup>C, RESETIN, SPI\_CLK, SPI\_CS, SPI\_MOSI以及SPI\_MISO为LVCMOS 3.3V电气标准。

## LVCMOS 3.3V电气标准

Symbols 符号	Description 描述	Min 最小	Max 最大
V <sub>IH</sub>	Input high voltage 输入高电压	2V	3.6V
V <sub>IL</sub>	Input low voltage 输入低电压	-0.3V	0.8V
V <sub>OH</sub>	High-level output voltage 高电平输出电压	2.9V	--
V <sub>OL</sub>	Low-level output voltage 低电平输出电压	--	0.4V
I <sub>OH</sub>	Sourcing current 拉电流	8mA	
I <sub>OL</sub>	Sinking current 灌电流	8mA	

2. RTK\_LED, SAT\_LED, PPS, EVENT, EVENT2 are LVTTTL 3.3V. All these signals are compatible with LVCMOS/LVTTTL 3.3V.

RTK\_LED, SAT\_LED, PPS, EVENT, EVENT2 为 LVTTTL 3.3V 电平，所有这些信号均兼容 LVCMOS/LVTTTL 3.3V。

Symbols/符号	Description/描述	Min/最小	Max/最大
V <sub>IH</sub>	Input high voltage 输入高电压	2.0V	---
V <sub>IL</sub>	Input low voltage 输入低电压	-0.3V	0.8V
V <sub>OH</sub>	High-level output voltage 高电平输出电压	2.4V	----
V <sub>OL</sub>	Low-level output voltage 低电平输出电压	---	0.4V
I <sub>OH</sub>	Sourcing current 拉电流	8mA	
I <sub>OL</sub>	Sinking current 灌电流	8mA	

3. Signals which absolute maximum rating is -0.3V ~ 3.6V are as follows:

所能承受电压的最大值范围是-0.3V ~ 3.6V的信号如下：COM1\_Tx, COM1\_Rx, COM2\_Tx, COM2\_Rx, COM3\_Tx, COM3\_Rx, COM4\_Tx, COM4\_Rx, COM5\_Tx, COM5\_Rx, COM6\_Tx, COM6\_Rx, CAN1\_RX, CAN1\_TX, SDMMC, I<sup>2</sup>C, RESETIN, SPI\_CLK, SPI\_CS, SPI\_MOSI and SPI\_MISO.

4. PWR\_ON / OFF and CARD\_RST

Their voltage range is 3.3VDC ~ (VIN+ 0.3V).

这两者的电压范围为3.3VDC ~ (VIN+ 0.3V)。

5. CAN is LVCMOS 3.3V, so a transceiver is needed for normal use.

CAN是LVCMOS 3.3V，所以需要有一个收发器才能正常使用。

6. USB

K705 USB has a built-in controller. The unit supports USB device configuration at low/full/high speed. The port has ESD protection, but a USB compliant common mode choke should be added near the USB connector if better EMI performance is needed.

K705使用内建控制器，可配置为低速/全速/高速USB设备。接口有做ESD防护，如果需要获得较好的EMC表现，可以在接插件处增加安装共模电感。

7. ETHERNET

LAN8720 is used by K705 as a network transceiver, with 10M/100M Ethernet communication function and the default setting is 100M full-duplex communications. It also has auto-negotiation function. OEM board does not have any internal magnetics and ESD protection. Additional magnetics and TVS diode are required to ensure a stable and secure Ethernet network communication. The Ethernet is closed by default.

K705使用LAN8720作为网络收发器，具备10M/100M以太网通讯功能，默认设置为100M全双工通讯，具备自动诊断及自适应线缆功能。OEM板卡内部不包含网络变压器以及ESD保护措施，需要额外的网络变压器以及TVS二极管确保稳定安全的以太网网络通讯。网络功能系统默认关闭。

8. VCC

Main power supply, voltage range is 3.3VDC ~ 5.5VDC.

The requirement for voltage ripple and spike is less than 100mV.

主供电电源，电压范围：3.3V ~ 5.5V（直流）。电压纹波和尖峰脉冲要求小于100mV。

9. RTK\_LED / SAT\_LED

SAT\_LED is used to indicate the satellite number. RTK\_LED indicates that RTK is undergoing. Both RTK\_LED and SAT\_LED are all high active. External LED driver is needed for normal use.

RTK\_LED闪烁指示接收到基准站的数据，SAT\_LED指示卫星数量，一次连续闪烁的次数表示当前搜到卫星的数量。RTK\_LED与SAT\_LED均为高电平驱动LED，需要外加LED驱动。

## V. APPLICATION CONNECTION EXAMPLE / 应用连接示例

In this section, an application connection example of K705 OEM board is presented via specific schematic diagrams. Per the instruction of these diagrams, you could easily build the communication circuits between K705 OEM board 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 K705 板卡应用连接示例。参照下面的图示，您可以很方便建立 K705 板卡和其他终端（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。

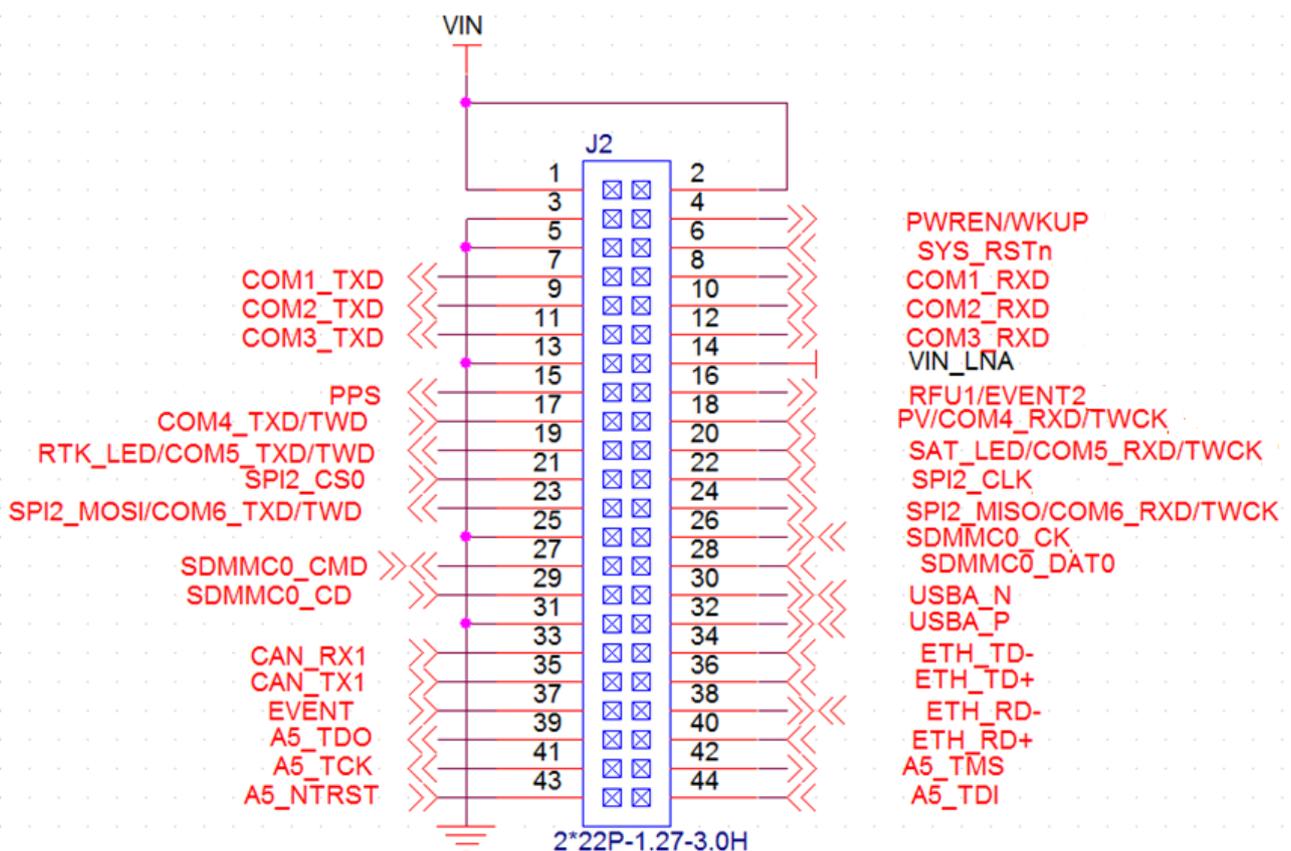


Figure 2. K705 Pin Assignment Schematic

图 2. K705 引脚分配及外接电路示意

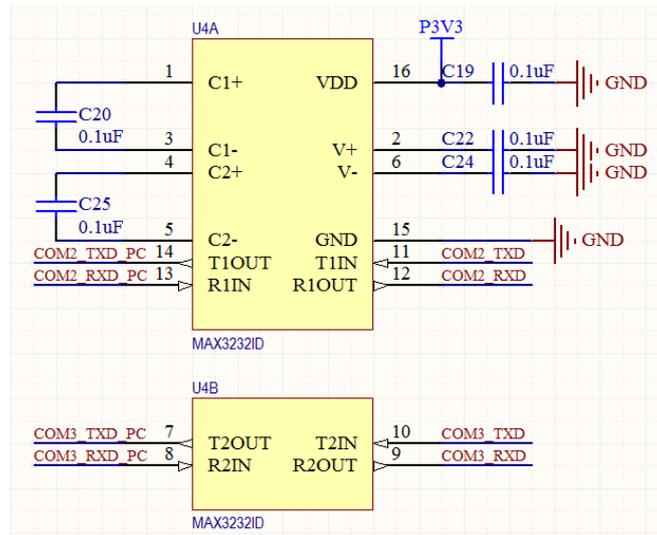


Figure 3. Connections between RS232 COM1, 2, 3 of K705 and Some Other Devices with an UART

图 3. K705 RS232 COM1/2/3 与其他使用 UART 接口的设备之间的连接示意

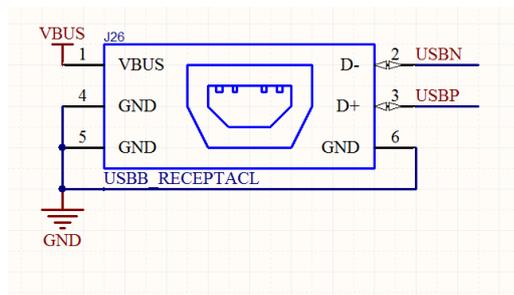


Figure 4. USB Connection

图 4. USB 连接

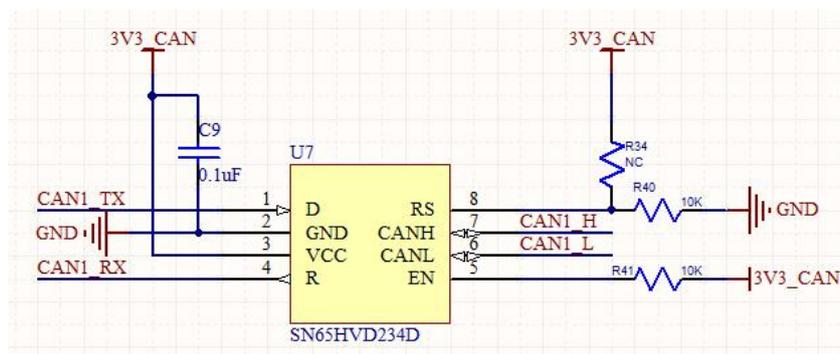


Figure 5. CAN Connection

图 5. CAN 连接