USB to Serial Port Chip CH340

Datasheet

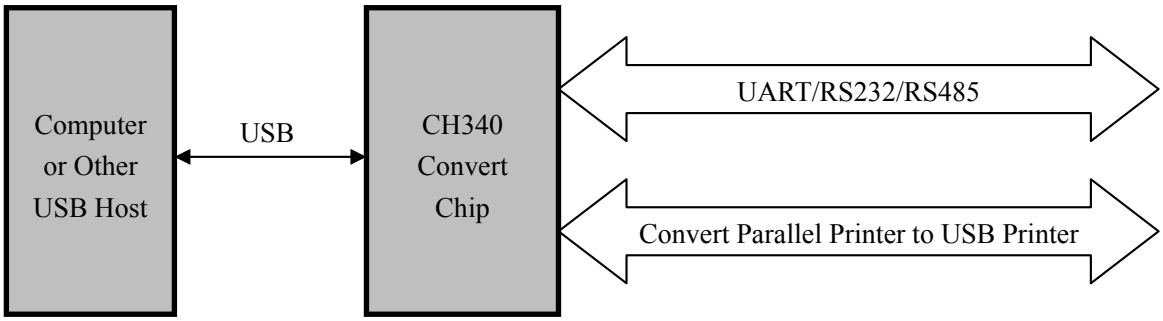
Version: 3A

http://wch.cn

1. Introduction

CH340 is a USB bus converter chip, converts USB to serial port or printer port.

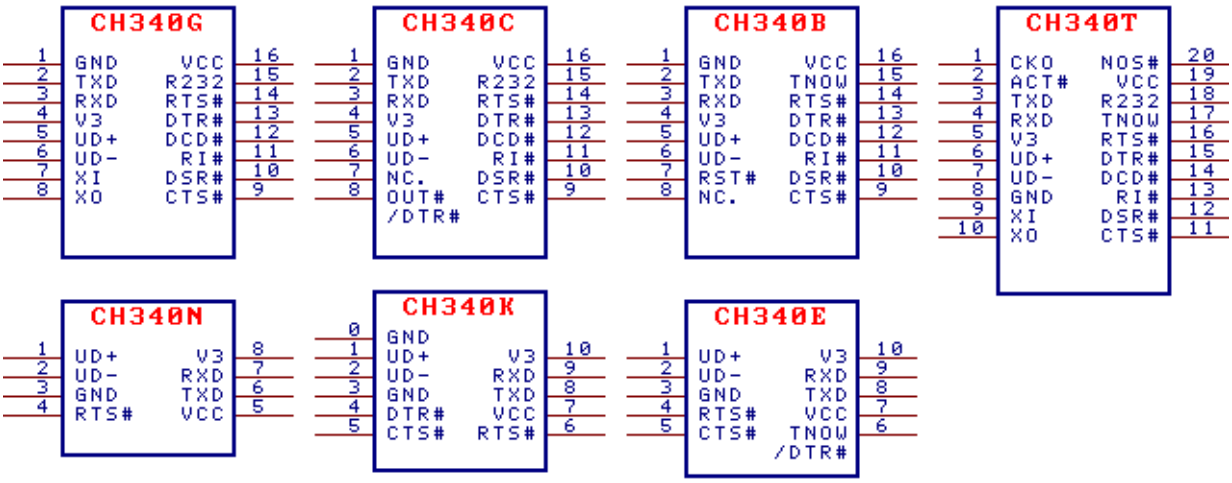
In serial port mode, CH340 provides common MODEM signal, to expand UART interface of computer or upgrade common serial devices to USB bus directly. For more information about converting USB to printer interface, please refer to the datasheet CH340DS2.



2. Features

- Full speed USB device interface, USB 2.0 compatible.
- Emulate standard UART interface, used to upgrade the original serial peripherals or expand additional serial UART via USB.
- Original serial applications of Windows are totally compatible without any modification.
- Hardware full duplex serial UART interface, integrated transmit-receive buffer, supports communication baud rate varies from 50bps to 2Mbps.
- Supports common MODEM interface signals RTS, DTR, DCD, RI, DSR and CTS.
- Provides further RS232, RS485, RS422 interface, etc. through external voltage conversion chip.
- CH340R supports IrDA criterion SIR infrared communication, supports baud rate varies from 2400bps to 115200bps.
- Built-in firmware, software compatible with CH341, use VCP driver of CH341 directly.
- Supports 5V and 3.3V power supply.
- CH340C/N/K/E and CH340B have integrated clock, no external crystal required, CH340B also integrates EEPROM used to configure the serial number, etc.
- RoHS compliant SOP-16, SOP-8, SSOP-20 and ESSOP-10, MSOP-10 lead-free package.

3. Packages



Package	Width of Plastic		Pitch of Pin		Instruction of Package	Ordering Information
SOP-16	3.9mm	150mil	1.27mm	50mil	Small outline 16-pin patch	CH340G
SOP-16	3.9mm	150mil	1.27mm	50mil	Small outline 16-pin patch	CH340C
SOP-16	3.9mm	150mil	1.27mm	50mil	Small outline 16-pin patch	CH340B
SOP-8	3.9mm	150mil	1.27mm	50mil	Small outline 8-pin patch	CH340N
ESSOP-10	3.9mm	150mil	1.00mm	39mil	Shrink Small outline 10-pin patch with backplane	CH340K
MSOP-10	3.0mm	118mil	0.50mm	19.7mil	Miniature Small outline 10-pin patch	CH340E
SSOP-20	5.3mm	209mil	0.65mm	25mil	Shrink Small outline 20-pin patch	CH340T
SSOP-20	5.3mm	209mil	0.65mm	25mil	Shrink Small outline 20-pin patch	CH340R

Note:

CH340C, CH340N, CH340K, CH340E and CH340B have integrated clock, no external crystal required.

CH340B has integrated EEPROM used to configure serial number, some functions can be customized, etc.

CH340K has three built-in diodes to reduce current flow backwards between the I/O pins of the MCU.

The backplane of the CH340K is 0# pin GND, which is an optional connection; the 3# pin GND is the necessary connection.

CH340E which the last 3-digit batch number greater than B40, 6# pin can be changed to DTR# by adding a 4.7KΩ pull-down resistor.

CH340C which the batch number begin with 4 and last 3-digit greater than B40, 8# pin can be changed to DTR# by adding a 4.7KΩ pull-down resistor.

CH340R provides reverse polarity TXD and MODEM interface signals, discontinued.

The USB transceiver of CH340 is designed according to the built-in design of USB2.0, suggest that do not series additional resistors to UD+ and UD- pins.

4. Pin Out

SSOP20 Pin No.	SOP16 Pin No.	ESSOP10 Pin No.	SOP8 Pin No.	Pin Name	Pin Type	Pin Description (description in bracket is only about CH340R)
19	16	7	5	VCC	POWER	Power supply voltage input, requires an external 0.1uF decoupling capacitor
8	1	3, 0	3	GND	POWER	Ground, connected to ground wire of USB bus directly
5	4	10	8	V3	POWER	Connect to VCC when VCC is 3V3, connect to 0.1uF decoupling capacitor when VCC is 5V
9	7	NONE	NONE	XI	IN	CH340T/R/G: Input of crystal oscillator, connect to 12MHz crystal and capacitor
				NC.	NONE	CH340C: No Connection, must be suspended
				RST#	IN	CH340B: Input of external reset, active low, integrated pull-up resistor
10	8	NONE	NONE	XO	OUT	CH340T/R/G: Output of crystal oscillator, connect to 12MHz crystal and capacitor
				OUT#	OUT	CH340C: MODEM output IO, software controlled, active low. Part of batch number in CH340C switch to 2ed DTR# optionally
				NC.	NONE	CH340B: No Connection, must be suspended
6	5	1	1	UD+	USB signal	Connect to USB D+ Signal directly, do not series resistors
7	6	2	2	UD-	USB signal	Connect to USB D- Signal directly, do not series resistors
20	NONE	NONE	NONE	NOS#	IN	Forbid USB device suspending, active low, integrated pull-up resistor
3	2	8	6	TXD	OUT	Transmit asynchronous data output (reverse output for CH340R)
4	3	9	7	RXD	IN	Receive asynchronous data input, integrated configurable pull-up and pull-down resistor
11	9	5	NONE	CTS#	IN	MODEM input signal, clear to send, active low(high)
12	10	NONE	NONE	DSR#	IN	MODEM input signal, data set ready, active low(high)
13	11	NONE	NONE	RI#	IN	MODEM input signal, ring indicator , active low(high)

14	12	NONE	NONE	DCD#	IN	MODEM input signal, data carrier detect, active low(high)
15	13	4	NONE	DTR#	OUT	MODEM output signal, data terminal ready, active low(high)
16	14	6	4	RTS#	OUT	MODEM output signal, request to send, active low(high)
2	NONE	NONE	NONE	ACT#	OUT	USB configuration completed state output, active low
18	15	NONE	NONE	R232	IN	CH340T/R/G/C: Assistant RS232 enable, active high, integrated pull-down resistor
17	15	NONE	NONE	TNOW	OUT	CH340T/E/B: Ongoing data transmission status indicator, active high. Part of batch number in CH340E switch to DTR# optionally
				IR#	IN	CH340R:Serial mode input setting, integrated pull-up resistor, SIR infrared serial interface when low, common serial interface when high
1	NONE	NONE	NONE	CK0	OUT	CH340T: clock output
				NC.	NONE	CH340R:No Connection, must be suspended

Note: Unused I/O pins of CH340 should be suspended. The application diagram uses CH340T as an example and also applies to CH340G/C/N/K/E/B, etc.

5. Function Description

5.1. Clock, Reset, Power, Connect

CH340G/CH340T/CH340R need to work with 12MHz clock signal supplied to XI pin. Generally, clock signal is generated by the inverter in CH340 through crystal oscillation. The peripheral circuit needs to place a crystal of 12MHz between XI and XO, and connect to a capacitor to ground separately.

CH340C/N/K/E/B have integrated clock generator, no external crystal and oscillating capacitor required.

CH340 has integrated power-on reset circuit. CH340B also provides low active external reset pin.

CH340 supports 5V and 3.3V power voltage. When using 5V power supply, the VCC pin connects 5V power and the V3 pin should connect with decoupling 0.1uF capacitor. When using 3.3V power supply, connects V3 with VCC, both powered with 3.3V power supply, and the other circuit voltage which connected with CH340 cannot exceed 3.3V.

If the last 3-digit batch number of CH340C/N/E greater than B40, IO supports 5V, avoided inward current poured backwards.

CH340K not only avoided inward current poured backwards, but also reduce drive capacity to external, avoided current poured backwards from CH340 to external.

CH340 supports USB device suspending automatically to save power. USB device suspend is forbidden when NOS# is driven low.

DTR# pin of CH340G/C/T/K is used as a configuration input pin before the USB configuration completion. An external 4.7KΩ pull-down resistor can be connected with this pin to generate default low during USB enumeration, to apply larger supply current from USB bus via the configuration descriptor.

CH340 has integrated USB pull-up resistor, UD+ and UD- pins should be connected to USB bus directly.

In serial UART mode, CH340 contains these pins: data transfer pins, MODEM interface signals and assistant pins.

Data transfer pins contain: TXD and RXD. RXD keeps high when UART reception is idle. For CH340G/C/T/R, if pin R232 is driven high, assistant RS232 function will be enabled, an internal inverter will automatically insert to the RXD, and the pin becomes low by default. When UART transmission is idle, the TXD of CH340G/C/N/E/B/T keeps high, CH340K is weak high, while CH340R keeps low.

MODEM interface signals contain: CTS#, DSR#, RI#, DCD#, DTR# and RTS#, CH340C also provides OUT# pin. All these MODEM interface signals are controlled and function defined by computer applications.

Assistant pins contain: IR#, R232, CK0, ACT# and TNOW. When IR# is low, infrared serial interface mode is enabled. R232 is used to control assistant RS232 function. If R232 is driven high, the RXD input will be reversed automatically. ACT# is USB device configuration complete status output (such as USB infrared adapter ready). TNOW indicates CH340 is transmitting data from UART when it is high and becomes low when transmits over. In RS485 and other half-duplex mode, TNOW could be used to indicate UART transmit-receive status. IR# and R232 are detected only once when chip powered on and reset.

5.2. Configuration Information of CH340B

CH340B also provides EEPROM for configuring data area, product serial number and other information could be customized for each chip by specific software tools, configurable data area is shown in the table below.

Byte Address	Abbreviation	Description Of Chip Configuration Data Area	Default
00H	SIG	For CH340B: internal configuration information valid reg, must be 58H. For CH340H/S: external configuration information valid reg, must be 53H. Invalid for other value	00H
01H	MODE	Serial mode, must be 23H	23H
02H	CFG	Specific configuration of chip, bit5 is used to configure product Serial Number: 0= valid; 1= invalid.	FEH
03H	WP	Internal configuration information write protect flag, 57H imply read only, otherwise can be rewrite	00H
05H~04H	VID	Vendor ID, high byte is behind, any value. Set to 0000H or 0FFFFH implies VID and PID using vendor default value	1A86H
07H~06H	PID	Product ID, high byte is behind, any value	7523H

0AH	PWR	Max Power, The maximum supply current in 2mA units	31H
17H~10H	SN	Serial Number, the length of ASCII string is 8, disable the Serial number when the first byte is not ASCII character (21H~7FH)	12345678
3FH~1AH	PROD	For CH340B: Product String, Unicode string for product description. The first byte is by total bytes (less than 26H), the next byte is 03H, Unicode string after that, using vendor default description when do not meet characteristics above.	Using product default description when the first byte is 00H
Others		(Reserved)	00H or FFH

5.3. DTR and Multi-mode MCU Download

For CH340E with the last 3-digit batch number greater than B40, 6# Pin defaults to TNOW, weak pull-up during power-on or reset, output TNOW during normal operation used for half-duplex transceiver switchover. If 6# pin is connected to a 4.7KΩ pull-down resistor, into DTR enhancement mode, 6# pin switches to open source driver DTR# automatically, connects BOOT mode of MCU, DTR# is default not output, kept low by external resistor, but DTR# pin can be set by the application to output high or no, for multi-mode MCU download.

For CH340C with batch number begin with 4 and last 3-digit greater than B40, 8# pin defaults to OUT#, weak pull-up during power-on or reset, output MODEM OUT# during normal operation. If 8# pin is connected to a 4.7KΩ pull-down resistor, into DTR enhancement mode, 8# pin switches to the open source driver's second DTR# automatically, connects BOOT mode of MCU, By default the second DTR# is not output, kept low by external resistor, but DTR# pin can be set by the application to output high or no, for multi-mode MCU download.

5.4. Serial Port Features

CH340 has integrated separate transmit-receive buffer and supports simplex, half-duplex and full duplex UART communication. Serial data contains one low-level start bit, 5, 6, 7 or 8 data bits and 1 or 2 high-level stop bits, supports odd/even/mark/space check. CH340 supports common baud rate: 50, 75, 100, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 9600, 14400, 19200, 28800, 33600, 38400, 56000, 57600, 76800, 115200, 128000, 153600, 230400, 460800, 921600, 1500000, 2000000, etc.

For one-directional 1Mbps and above, or bi-directional 500Kbps and above, recommended to use CH343, enable automatic hardware flow control.

The baud rate error of CH340 UART reception is about 2%, the baud rate error of CH340G/CH340T/CH340R UART transmission is less than 0.3%, less than 1.2% for CH340C/CH340N/CH340K/CH340E/CH340B.

In Windows OS of computer, CH340 driver can emulate standard serial port. So the mostly original serial applications are totally compatible, without any modification.

CH340 can be used to upgrade the serial interface peripherals, or expand extra serial port for computers via USB bus, through external level conversion chip provide further RS232, RS485, RS422 interface, etc.

Through extra infrared transceiver, CH340R can expand SIR infrared adapter for computer via USB bus, realize infrared communication between computers and peripheral equipment that comply with IrDA specifications.

6. Parameters

6.1. Absolute Maximum Ratings

(Critical state or exceeding maximum can cause chip to not work or even be damaged)

Name	Parameter Description		Min.	Max.	Unit
TA	Operating Ambient Temperature	CH340G/CH340T/CH340R	-40	85	℃
		CH340C/CH340N/CH340K/ CH340E/CH340B	-20	70	℃
		CH340C/N which batch number begin with 4, CH340E which last 3-digit batch number greater than B40	-40	85	℃
TS	Storage Temperature when Stored		-55	125	℃
VCC	Supply Voltage(VCC connects to power, GND to ground)		-0.5	6.0	V
VIO	The voltage of input or output pin		-0.5	VCC+0.5	V

6.2. 5V Electrical Parameters

(Test conditions: TA=25℃, VCC=5V, exclude pins connected to USB bus)

Name	Parameter Description			Min.	Typical	Max.	Unit
VCC	Supply Voltage	V3 external capacitance only, do not connect to VCC		4.0	5	5.3	V
ICC	Operating Total Supply Current		CH340G/C/N/K/E/ T/R		7	20	mA
			CH340B		6	15	mA
ISLP	USB Suspend Total Supply Current		CH340G/K/T/R/B		0.09	0.2	mA
			CH340C/N/E		0.05	0.15	mA
VIL	Input Low Voltage			0		0.9	V
VIH	Input High Voltage			2.3		VCC	V
VOL	Output Low Voltage(6mA draw current)					0.5	V
VOH	Output High Voltage(2mA output current) (Output 100uA current during chip reset)			VCC-0.6			V
IUP	Draw current of input with integrated pull-up resistor			3	150	300	uA
IDN	Draw current of input with integrated pull-down resistor			-40	-100	-300	uA
VR	Voltage threshold when power-up reset			2.4	2.6	2.8	V

6.3. 3.3V Electrical Parameters

(Test conditions: TA=25℃, VCC=V3=3.3V, exclude pins connected to USB bus)

Name	Parameter Description			Min.	Typical	Max.	Unit
VCC	Supply Voltage	V3 connects to VCC	CH340G/T/R	2.9	3.3	3.6	V
			CH340C/N/K/E/B	3.1	3.3	3.6	
ICC	Operating Total Supply Current		CH340G/C/N/K/E/T/R		4	12	mA
			CH340B		3	9	mA
ISLP	USB Suspend Total Supply Current		CH340G/K/T/R/B		0.08	0.2	mA
			CH340C/N/E		0.04	0.15	mA
VIL	Input Low Voltage			0		0.8	V
VIH	Input High Voltage			1.9		VCC	V
VOL	Output Low Voltage(6mA draw current)					0.5	V
VOH	Output High Voltage(2mA output current) (Output 100uA current during chip reset)			VCC-0.6			V
IUP	Draw current of input with integrated pull-up resistor			3	70	200	uA
IDN	Draw current of input with integrated pull-down resistor			-30	-70	-200	uA
VR	Voltage threshold when power-up reset			2.4	2.6	2.8	V

6.4. Timing Parameters

(Test conditions: TA=25℃, VCC=5V or 3.3V)

Name	Parameter Description	Min.	Typ.	Max.	Unit
FCLK	Frequency of input clock in XI	11.98	12.00	12.02	MHz
TPR	Reset time of power-up	20	35	50	mS

7. Applications

7.1. USB to 9-Line RS232 Serial Port

The image below convert USB to RS232 by CH340T (or CH340C/B). CH340 provides common UART and MODEM signals, converts TTL to RS232 through level conversion chip U8. Port P11 is DB9 connector, the pins and their functions are the same as common PC DB9 connector, the chips similar with U8 is MAX213/ADM213/SP213/MAX211 etc.

U8 and C46/C47/C48/C49/C40 could be removed when realize USB to TTL converter only. The signal lines in the image only RXD, TXD and public ground need connected, the other signal lines should suspend when not use.

P2 is USB port, USB bus contains a pair of 5V power lines and a pair of data signal lines. Usually, the color

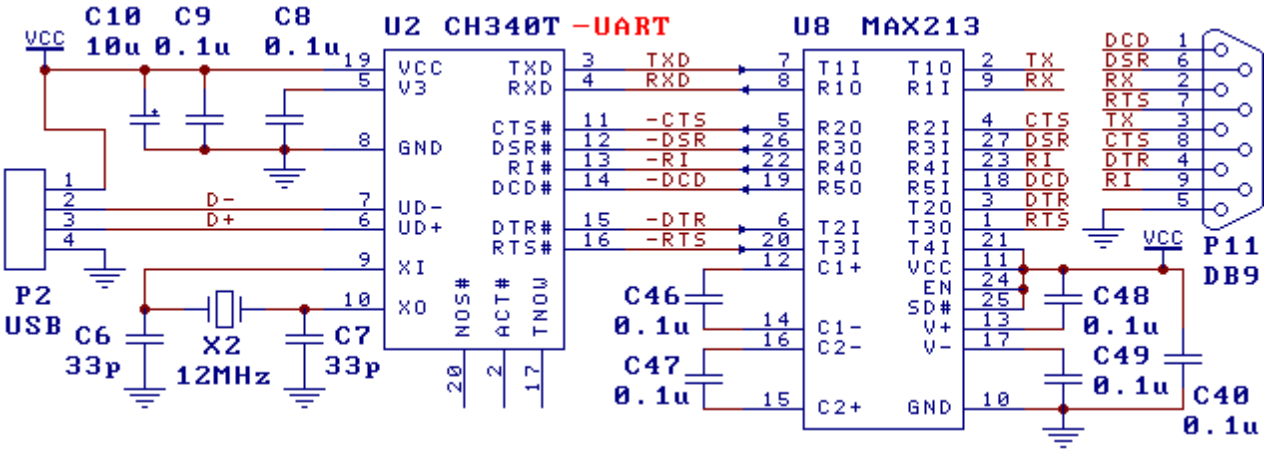
of +5V power line is red, the black one is ground. D+ signal line is green and the D- signal line is white. The max supply current of USB bus is up to 500mA. Generally, CH340 and low power consumption USB products can use the 5V power supplied by USB bus directly. **If the USB products supply standing power by other manner, CH340 should use this power too, this can be avoided I/O current poured backwards between USB power supplies.** If the USB bus power and standing power are necessary at the same time, connect a 1Ω resistor between USB bus 5V power line and USB products 5V standing power line, and connect the ground lines of these two power directly.

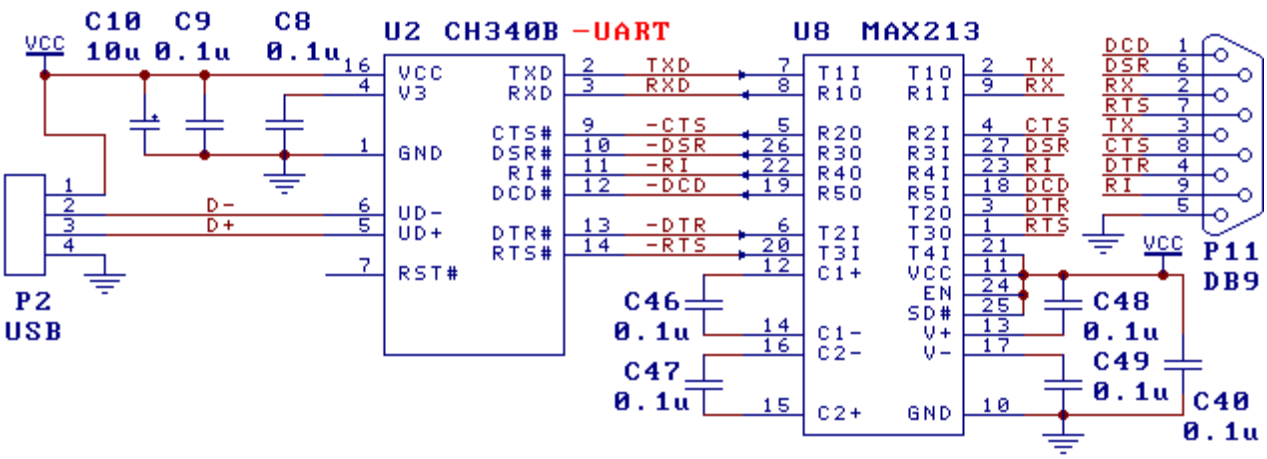
The capacitor C8 on V3 is 0.1uF, used to CH340 internal power node decoupling. The capacitor C9 is 0.1uF, used to external power decoupling.

For CH340G/T/R, Crystal X2, capacitor C6 and C7 are used for clock oscillation circuit. The X2 is 12MHz quartz crystal, C6 and C7 are monolithic or high frequency ceramic capacitors with 33pF. If X2 is ceramic with low cost, C6 and C7 must use the recommended value of crystal manufacturer and generally is 47pF. For the crystal which is difficult to oscillate, halved value is suggested for C6.

For CH340C/N/K/E/B, crystal X2 and capacitor C6, C7 are not required.

When designing the PCB, pay attention to: decoupling capacitor C8 and C9 must keep near to connection pin of CH340; make sure D+ and D- signal lines are parallel and provide ground or pour copper on both sides to reduce outside interference; the signal lines relevant to XI and XO should be kept as short as possible. In order to reduce the high frequency interference, around the ground or pour copper around the relevant components.

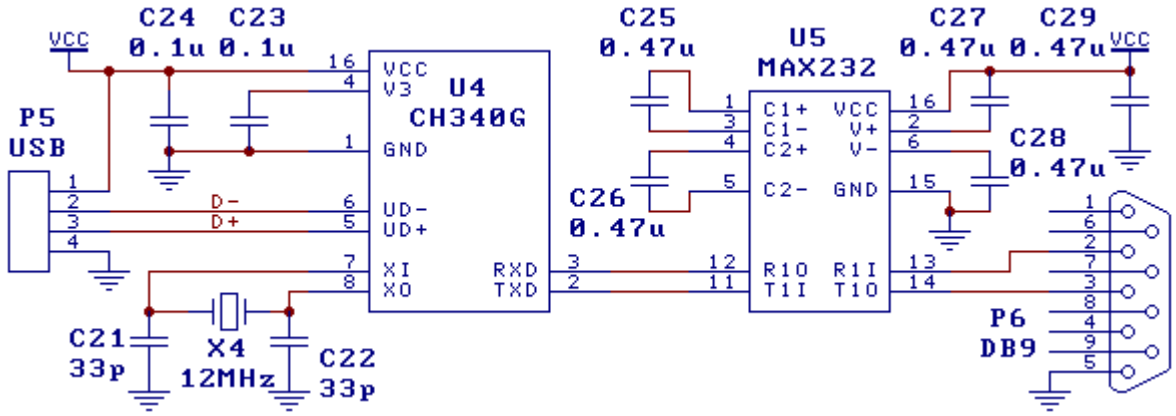




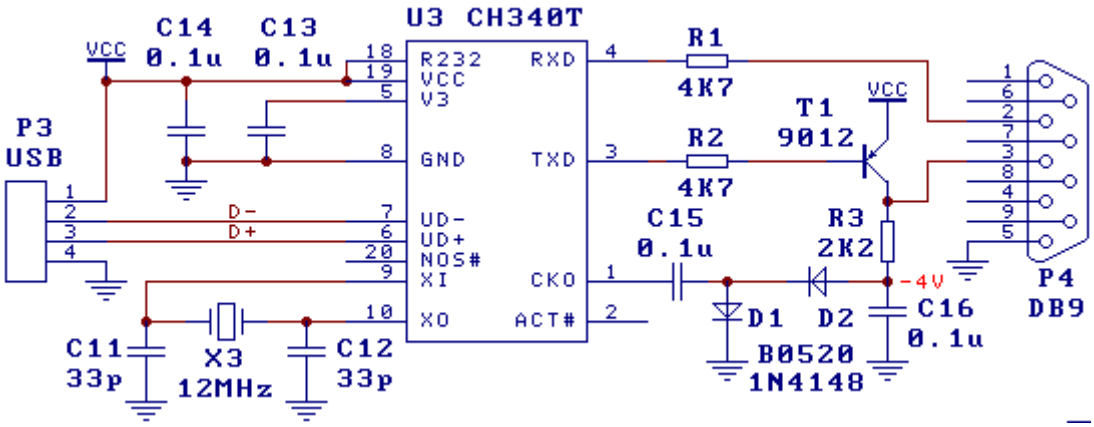
7.2. USB to 3-Line RS232 Serial Port

The image below is USB to 3-wire RS232 converter design which is the most basic and most commonly used, U5 uses MAX232/ICL232/SP232 etc.

Unused CH340 pins can be suspended. For CH340C/N/K/E/B, X4, C21 and C22 are not required.



7.3. USB to RS232 Serial Port, Simplified Version



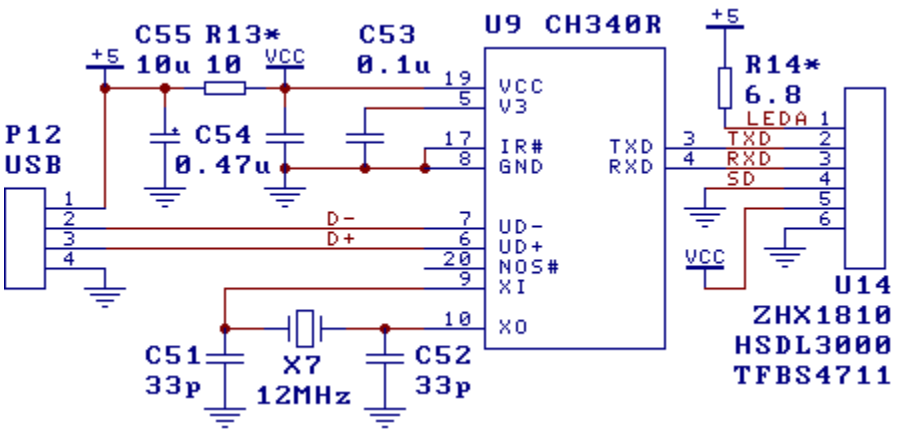
The image above is USB to RS232 converter design too, the function of this circuit is the same with 7.2 section except the range of output RS232 is narrower. When R232 pin is driven high, the assistant RS232 function will be enabled, just need to add some diodes, transistors, resistors and capacitors, the special level conversion chip U5 in section 7.2 could be replaced and the hardware cost is lower.

7.4. USB to RS485 Serial Port

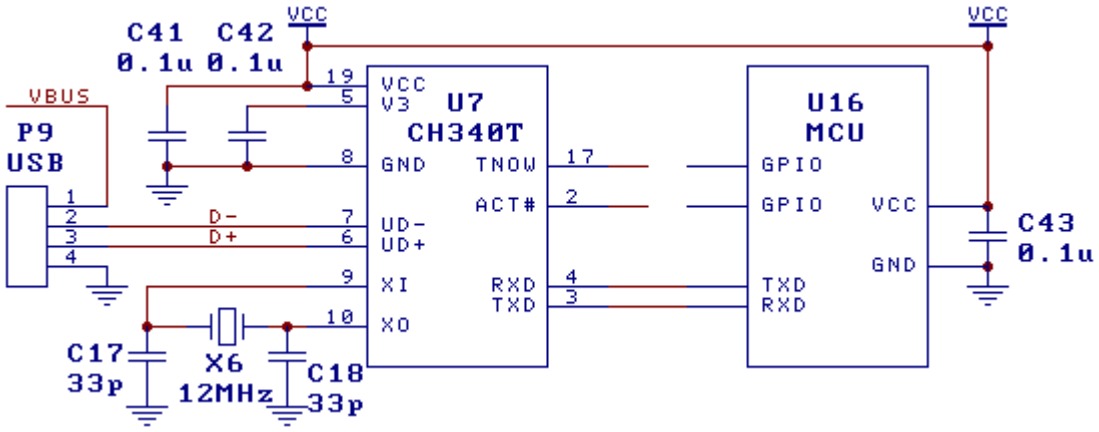
TNOW pin can be used to control DE (high active send enable) and RE# (low active receive enable) pin of RS485 transceiver.

7.5. USB to Infrared Adapter

The image below is a USB to infrared adapter design which is composed with USB convert IrDA infrared chip CH340R and infrared transceiver U14 (ZHX1810/HSDL3000 etc). The resistor R13 is used to weaken influence of large current in infrared transmitting. The current limiting resistor R14 should be adjusted according to the manufacturer's recommended value of the infrared transceiver U14.



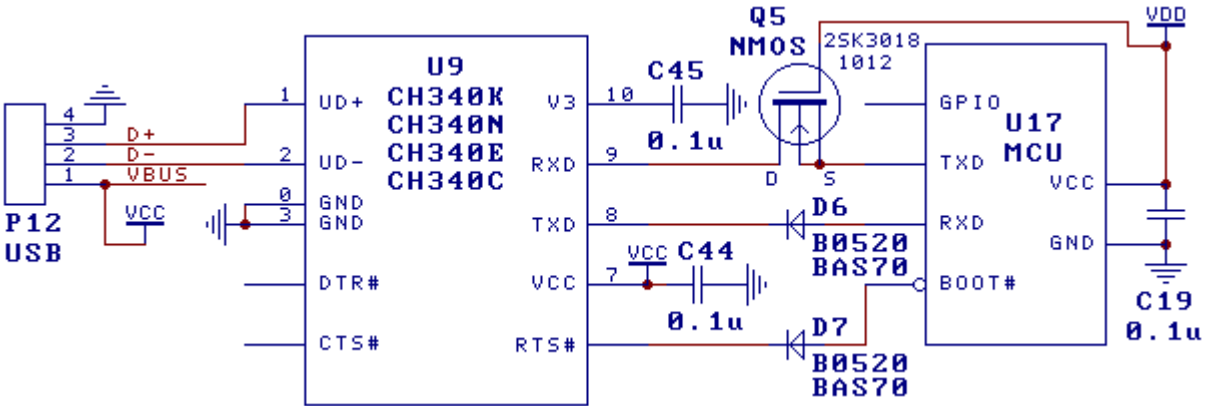
7.6. Connect to MCU and Supply Power Together



The image above is a sample design to achieve USB connection on an MCU by connecting it to a CH340 via TTL serial port. Here we use self-power mode, VCC supports 5V or 3.3V (V3 shorted to VCC if VCC is 3.3V), and don't use USB bus power VBUS at all (Can be tested by connecting series resistor to I/O of MCU if needed). CH340 shares the same power source with MCU, hence there would be no current inrush through I/O between CH340 and MCU.

Unused CH340 pins can be suspended. For CH340C/N/K/E/B, X6, C17 and C18 are not required.

7.7. Connect to MCU and Supply Power Separately, Avoided Bi-directional Current Poured Backwards



The image above is a sample design to achieve USB connection on an MCU by connecting it to a CH340 via TTL serial port. CH340 is powered by USB bus VBUS. MCU is powered by another power source VDD, VDD supports 5V, 3.3V and even 2.5V, 1.8V.

The RXD pin of MCU in the figure should enable the internal pull-up resistor. If not, it is recommended to add 2KΩ ~ 22KΩ pull-up resistor to the RXD pin and connect it to the power supply VDD of MCU.

Prevent current backward when CH340 is powered on but MCU is not powered on. Diodes D6 and D7 and NMOS tube Q5 in the figure are used to prevent CH340 from flowing back current to the power-off MCU through the RXD or TXD internal diode of MCU under dual power supply mode. The connection between D7 and RTS/BOOT0# is optional. Diode D6 reverses current to MCU through RXD internal diode of MCU for TXD high level of CH340; D the current to MCU through the boot internal diode of MCU for RTS high level of CH340; The NMOS tube Q5 reverses the current to the MCU through the TXD internal diode of the MCU for the RXD internal pull-up current of the CH340.

Prevent internal current backward when CH340 is not powered but MCU is powered on. The IO of CH340K and CH340C, CH340N and CH340E with the last 3-digit of batch number greater than B40 will automatically prevent internal backflow, that is, when CH340 is not powered on, but MCU is powered on, there will be no backflow current. In addition, D6, D7 and Q5 can prevent CH340 from injecting current to the power-off MCU, so the above figure can realize complete two-way anti backflow.

For CH340 of other batch numbers or models, additional anti filling circuit shall be added. Usually an NMOS tube is connected in series with a Schottky diode to prevent bidirectional backflow. For example, a Schottky diode is connected in series at the drain D end of Q5, and its anode terminal is connected to the RXD of CH340. An NMOS tube is connected in series between D6 and CH340, and its drain is connected to D6 and its gate is connected to the power supply VCC of CH340.

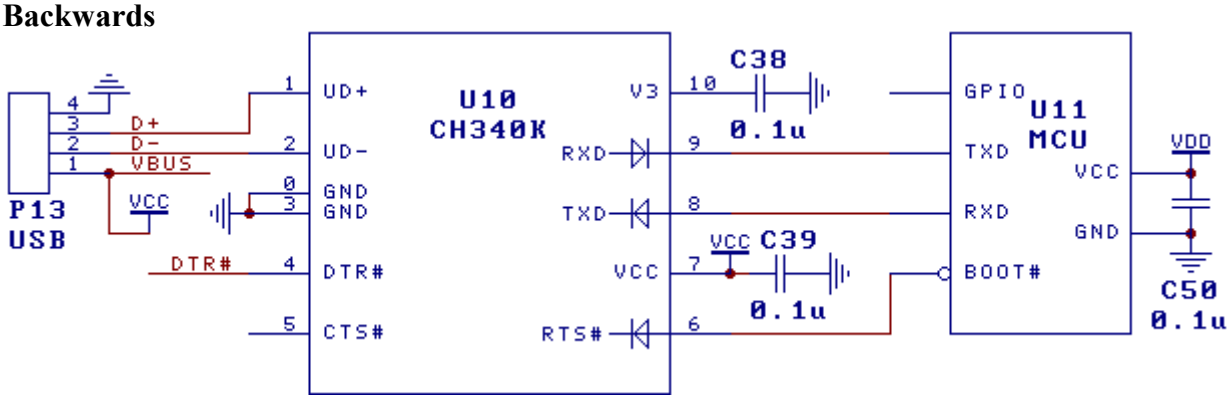
If it is determined that a certain situation will not occur, the corresponding NMOS tube or diode can be removed. For example, the IO of some MCU models supports anti backflow or 5VT, or the MCU has a permanent self-contained power supply. There is no need to worry about CH340 injecting current to the MCU, then D6, D7 and Q5 can be removed and short circuited.

Prioritized choice for diode is low power Schottky diode, like BAS70, BAT54, B0520, etc.

NMOS tubes with low power and capacitance are preferred, like 2SK3018, 1012, etc.

Generally, it is not recommended that CH340 and MCU be powered separately. If it is really necessary, it is recommended to use CH340K or CH343 which I/O independent power supply with VIO power pins supports.

7.8. Connect to MCU and Supply Power Separately, Avoided Inward Current Poured Backwards



The figure above shows the reference circuit of MCU connecting CH340K chip through TTL serial port to realize USB communication under dual power supply mode. The CH340K is powered by the USB bus, VBUS (VCC), and the MCU uses another power supply VDD, which supports 5V, 3.3V or even 2.5V and 1.8V. The backplane of CH340K package is an optional GND pin, which can be easily connected to GND or suspended according to PCB routing.

The TXD, RTS# pins and RXD pins of CH340K chip have built-in diodes (as shown in the figure) to prevent current backward, and a weak pull-up resistor of about 75KΩ is built to maintain the high level of default or idle state (not shown in the figure), which can not only realize low-level drive and weak high-level drive, but also reduce the current backflow when CH340K and MCU supply power independently. CH340K can completely prevent the internal current of MCU power supply to power-off CH340K, but also reduce the external current of CH340K power supply to power-off MCU (no more than 150μA）.

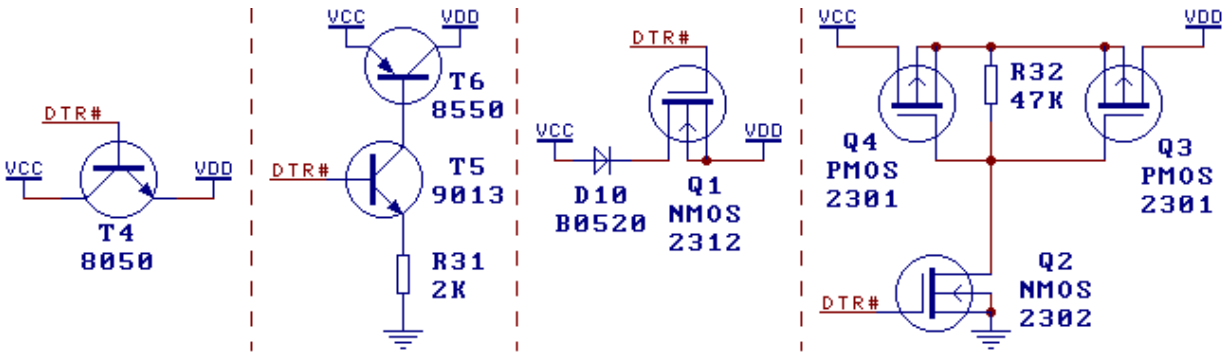
In addition, CH340C, CH340N and CH340E with the last 3-digit of the batch number greater than B40 can also completely prevent the MCU power supply from injecting the current of the power-off CH340, so as to avoid the CH340 wasting the current of the MCU power supply after the USB power is off.

If it is necessary to completely prevent the CH340K power supply from injecting the current to the power-off MCU, refer to the figure in section 7.7 and add NMOS and diode.

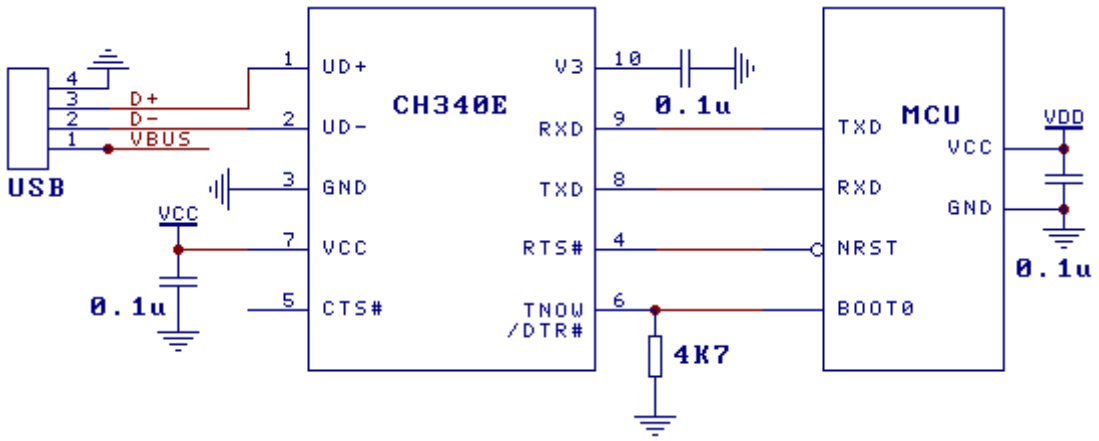
When it is used for communication baud rate above 120Kbps, it is recommended to enable the built-in or external 2K Ω ~ 22K Ω pull-up resistor for the RX pin of MCU, or select other models of USB to serial port chip with VIO power supply pin to support I/O independent power supply.

The DTR# pin of CH340K chip is an ordinary push-pull output, and the CTS# pin is an ordinary input with built-in pull-up resistor. Neither of these two pins has built-in diodes and does not have the function of preventing current backflow. Generally, they are not used to connect MCU.

DTR # can be used to control the power switch of VCC supplying power to VDD. As shown in the figure below, four power control schemes can be selected. T4 scheme and Q1 scheme (Q1 should choose N-MOSFET with lower Vth) are simplified schemes. The VDD output voltage is about VCC-0.8V and the current does not exceed 200mA; T6 scheme and Q3 scheme are complete schemes. D10 in the figure is used to prevent VDD from supplying power to VCC, which is optional.



7.9. One-click download of single-chip microcomputer USB



The image above is a reference circuit for one-key download of a multi-mode MCU based on USB to serial port, without manual setting or manual reset.

For this type of MCU: the MCU itself needs to support one-key download of the serial port, NRST is a low-level reset input terminal, BOOT0 low-level selection application, high-level selection Boot-Loader download.

The last 3-digit of the CH340E batch number must be greater than B40. In the figure, the 4.7KΩ pull-down resistor can be selected from 3 to 5.6KΩ. This resistor also serves as the BOOT0 pull-down resistor of the MCU. For CH340C with the last 3-digit of the batch number greater than B40, OUT# can be used as the second DTR# to connect to BOOT0.

Note: For other MCUs with opposite BOOT mode levels, you can directly use CH340C/G DTR# to control.

MCU normal working status: The pull-down resistor makes CH340E enter DTR enhanced mode, pin 6# is switched to DTR#, DTR# is not output by default, BOOT0 remains low, RTS# defaults to high, and MCU runs applications normally.

One-click download: The computer download tool program opens the serial port, sets DTR# to high level, sets RTS# to low level, and then high level, and the MCU enters the BOOT download program. After the download is complete, set DTR# to low level, set RTS# to low level, then high level, the MCU runs the application normally, and keep DTR# unchanged before closing the serial port. Note that the MODEM data and the pin level are inverted.

Unified power supply mode: CH340E uses the same 5V or 3.3V power supply of MCU. The disadvantage is that CH340E will consume tens of uA sleep current.

Independent power supply mode: the CH340E uses the USB VBUS power supply, which does not consume the MCU power supply current at all. After the power failure of the CH340E itself, it basically does not affect the IO of the MCU, but it is necessary to avoid the situation that some MCU pour power back to the MCU because the USB is powered but the MCU is not powered. If it is necessary to completely prevent the CH340 power supply from injecting the current to the power-off MCU, refer to the figure in section 7.7 and add NMOS and diode.

If NRST pin needs to support additional manual reset, a 1~2KΩ resistor or a diode with anode connected to NRST can be connected in series between RTS# and NRST.