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USB to serial chip CH340

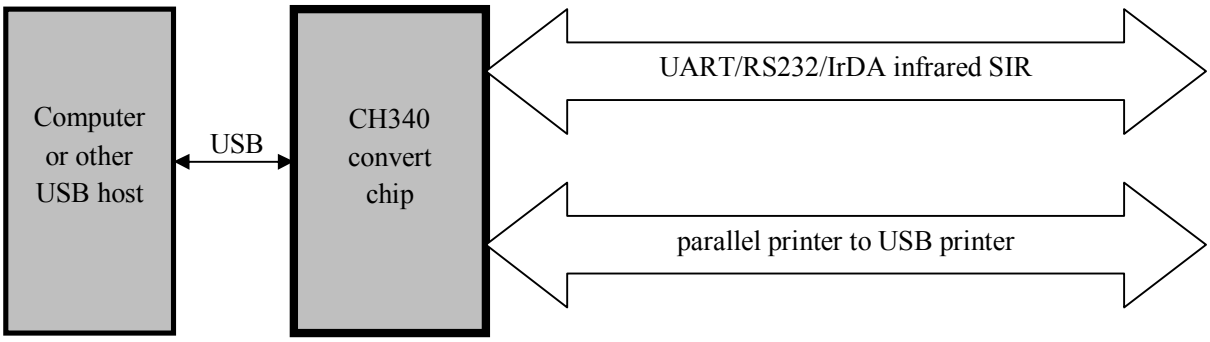
English DataSheet
Version: 1D
http://wch.cn

1. Introduction

CH340 is a USB bus convert chip and it can realize USB convert to serial interface, USB convert to IrDA infrared or USB convert to printer interface.

In serial interface mode, CH340 supplies common MODEM liaison signal, used to enlarge asynchronous serial interface of computer or upgrade the common serial device to USB bus directly. More detail about USB convert to printer interface please referring to the second manual CH340DS2.

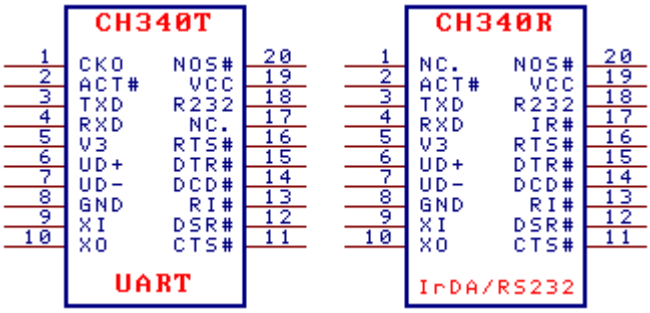
In infrared mode, add infrared transceiver to CH340 can compose USB infrared adapter, realize SIR infrared communication.



2. Features

- Full speed USB device interface, conforms to USB Specification Version 2.0, only needs crystal and capacitance external.
- Emulate standard serial interface, used to upgrade the former peripheral device, or add excess serial interface through USB.
- Totally compatible with serial application program in computer endpoint Windows operation system.
- Hardware full duplex serial interface, set transceiver buffer, supports communication baud rate varies from 50bps to 2Mbps.
- Supports common MODEM liaison signal RTS, DTR, DCD, RI, DSR and CTS.
- Through adding level converter equipment to supply RS232, RS485, RS422 and other interface.
- Supports IrDA criterion SIR infrared communication, supports baud rate varies from 2400bps to 115200bps.
- For it is through USB converts to serial interface, only compatible with application layer not totally.
- Software compatible with CH341, using drive of CH341 directly.
- Support 5V and 3.3V source voltage.
- Supply SSOP-20 package without lead, compatible with RoHS.

3. Package



Package shape	Width of plastic		Pitch of Pin		Instruction of package	Ordering type
SSOP-20	5.30mm	209mil	0.65mm	25mil	Shrink small outline package of 20-pin	CH340T
SSOP-20	5.30mm	209mil	0.65mm	25mil	Shrink small outline package of 20-pin	CH340R

4. Pins

Pin No.	Pin Name	Pin Type	Pin Description(description in bracket is only about CH340R)
19	VCC	POWER	Positive power input port, requires an external 0.1uF power decoupling capacitance
8	GND	POWER	Public ground, ground connection for USB
5	V3	POWER	connects of VCC to input outside power while 3.3V, connects of 0.01uF decoupling capacitance outside while 5V
9	XI	IN	Input of crystal oscillator, attachment of crystal and crystal oscillator capacitance outside
10	XO	OUT	Opposite output of crystal oscillator, attachment of crystal and crystal oscillator capacitance outside
6	UD+	USB signal	Directly connect to D+ data wire of USB bus, set up pull-up resistor internal
7	UD-	USB signal	Directly connect to D- data wire of USB bus
20	NOS#	IN	Forbid USB device suspending, active with low, set up pull-up resistor internal
3	TXD	OUT	Serial data output(opposite phasic output of CH340R)
4	RXD	IN	Serial data input, set up controlled pull-up and pull-down resistor
11	CTS#	IN	MODEM liaison input signal, clear sending, active with low(high)
12	DSR#	IN	MODEM liaison input signal, data equipment is ready, active with low(high)
13	RI#	IN	MODEM liaison input signal, oscillate ring to prompt, active with low(high)

14	DCD#	OUT	MODEM liaison input signal, carrier wave detection, active with low(high)
15	DTR#	OUT	MODEM liaison output signal, data endpoint is ready, active with low(high)
16	RTS#	OUT	MODEM liaison output signal, request to send, active with low(high)
2	ACT#	OUT	CH340T:negative phasic clock output (CH340R:USB configuration is finished state output, active with low)
18	R232	IN	Assistant RS232 enable, active with high, set up pull-down resistor internal
17	NC.	NC.	CH340T: unconnected, must be suspended
	IR#	IN	CH340R:Serial interface mode set input, set up pull-up resistor internal, low level is SIR infrared serial interface, high level is common serial interface
1	CKO.	OUT(NC.)	CH340T: clock output
	NC		CH340R:unconnected, must be suspend

5. Function description

CH340 chip set up USB pull-up resistor internal, UD+ and UD- pins must be connected to USB bus directly.

CH340 chip set up power up reset circuit internal.

When CH340 chip is working normally, the outside must supply 12MHz clock signal to XI pin. In generally, clock signal is generated by inverter in CH340 through oscillating of crystal keeping frequency. A crystal of 12MHz between XI and XO, XI and XO connect a high frequency oscillator capacitance to ground respectively can compose the peripheral circuit.

CH340 chip supports 5V and 3.3V power voltage. When using 5V source power, the VCC input 5V power and the pin of V3 must connect with 4700pF or 0.01uF decoupling capacitance. When using 3.3V power voltage, connects V3 with VCC, and input 3.3V power voltage. And the other circuit voltage which is connected with CH340 is no more than 3.3V.

CH340 automatically supports USB device suspending to save power consume. NOS# is low–level can forbid USB device suspending.

In asynchronous serial interface mode, CH340 chip contains these pins: data transfer pin, MODEM liaison signal pin and assistant pin.

Data transfer pin contains: TXD pin and RXD pin. When serial interface is idle, RXD must be high-level. If R232 is high-level, use assistant RS232 function, then RXD pin automatically inserts a inverter internal, and low-level is in default. When serial interface output is free, the TXD in CH340H and CH340T is high level, TXD in CH340R is low-level.

MODEM liaison signal pin contains: CTS#, DSR#, RI#, DCD# and RTS#. All these MODEM liaison signal are controlled by computer application program and application program defines function.

Assistant pin contains: IR#, R232, CKOH, CKOL and ACT#. When IR# is low-level, starts infrared serial interface mode. R232 is used to control assistant RS232 function. When R232 is high-level, RXD pin automatically insert a inverter internal, and output opposite phase clock from CKOH and CKOL. ACT# is USB device configuration finished state output (such as USB infrared adapter is ready) when R232 is low-level. IR# and R232 only be detected once a time after power reset.

CH340 set separate transceiver buffer internal and supports simplex, semiduplex and full duplex asynchronous serial communication. Serial data contains one low-level start bit , eight or nine data bit and

one high-level stop bit. Supporting odd check/even check/flag check/blank 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 and so on. The baud rate error of serial transfer signal is less than 0.3%, and permission baud rate error of serial receive signal is not less than 0.2%.

In the WINDOWS operation system of computer endpoint, drive program of CH340 can communicate standard serial interface. So the mostly original serial interface application program is totally compatible, and without any modify.

CH340 can be used to upgrade the former serial interface peripheral equipment, or add extra serial interface for computer via USB bus. Supply RS232, RS485, RS422 and other interface via adding level change device.

Only add infrared transceiver, CH340 can add SIR infrared adapter for computer via USB bus, realize infrared communication between computer and peripheral equipment which is according to IrDA criterion.

6. Parameter

6.1. Absolute maximum rating (Stresses above those listed can cause permanent damage to the device. Exposure to maximum rated conditions can affect device operation and reliability.)

Name	Parameter note	Min.	Max.	Units
TA	Ambient operating temperature	-40	85	℃
TS	Storage temperature	-55	125	℃
VCC	Voltage source (VCC connects to power, GND to ground)	-0.5	6.5	V
VIO	The voltage of input or output pin	-0.5	VCC+0.5	V

6.2. Electrical parameter (test conditions: TA=25℃, VCC=5V, exclude pin connection of USB bus)
(The every current parameter must multiply the coefficient of 40% when the power is 3.3V)

Name	Parameter note		Min.	Typical	Max.	Units
VCC	Source voltage	V3 doesn't connect to VCC	4.5	5	5.3	V
		V3 connect to VCC	3.3	3.3	3.8	
ICC	Total source current when working			12	30	mA
ISLP	Total source current when USB suspending	VCC=5V		0.15	0.2	mA
		VCC=3.3V		0.05	0.08	mA
VIL	Input Voltage LOW		-0.5		0.7	V
VIH	Input Voltage HIGH		2.0		VCC+0.5	V
VOL	Output Voltage LOW (draw 4mA current)				0.5	V
VOH	Output Voltage HIGH (output 3mA current) (Output 100uA current during chip reset)		VCC-0.5			V
IUP	Input current with pull-up resistor internal		3	150	300	uA
IDN	Input current with pull-down resistor internal		-50	-150	-300	uA
VR	Restrict voltage when power-up reset		2.3	2.6	2.9	V

6.3. sequence parameter (test conditions: TA=25℃,VCC=5V)

Name	Parameter note	Min.	Typical	Max.	Units
FCLK	Frequency of input clock in XI	11.98	12.00	12.02	MHz
TPR	Reset time of power-up		20	50	mS

7. Application

7.1. USB convert 9-wire serial interface (the following image)

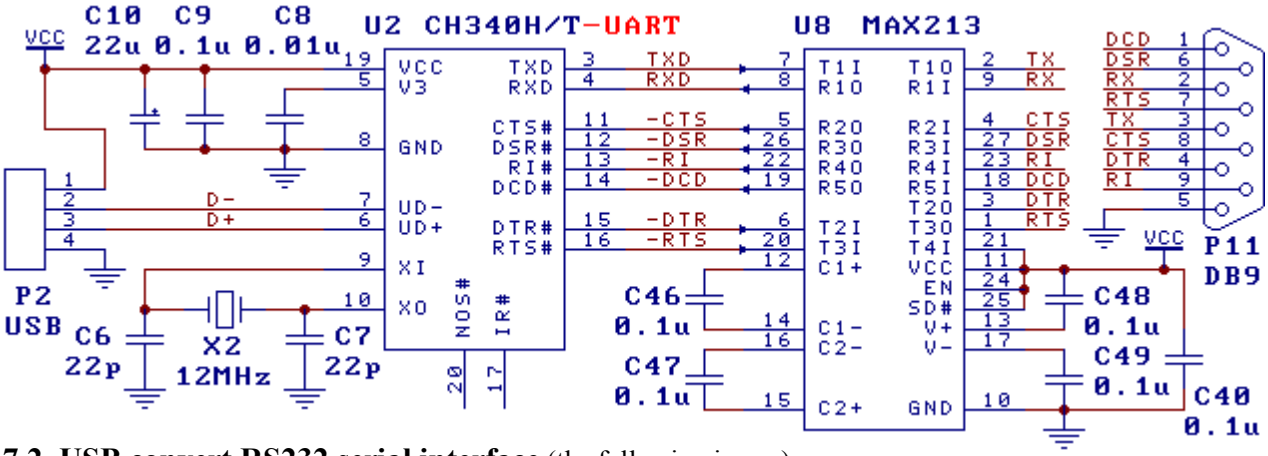
The following image is using CH340T to realize USB convert RS232 serial interface. CH340 supplies common serial interface signal and MODEM signal, changes TTL serial interface to RS232 serial interface through level convert circuit U8. Endpoint P11 is DB9 needle, the pin and its function is the same as common nine needles serial interface of computer. The similar with U8 is MAX213/ADM213/SP213 etc.

Take the U8 and C46/C47/C48.C49/C40 out when only realize USB convert to TTL serial interface. The signal wire in the image can only connect RXD、TXD and public ground, the other signal wire can suspend when not use.

P2 is USB endpoint. USB bus contains a pair of 5V power wire and a pair of data signal wire. Usually, the +5V power wire is red, the black is ground. D+ signal wire is green and the D- signal wire is white. The max source current of USB bus is up to 500mA. In generally, CH340 and low power exhaust USB product can directly use the 5V power supplied by USB bus. If the USB product supplies stock power by other manner, CH340 must use this stock power. If the USB bus power and stock power are necessary at the same time, connect a 1Ω resistor between USB bus 5V power wire and USB product 5V stock power, and connect the two power wires' ground wire directly.

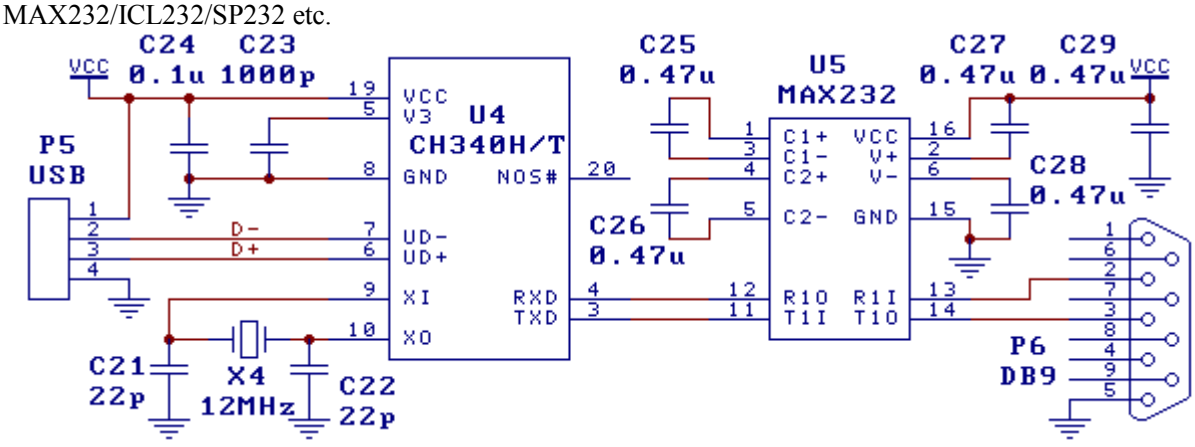
The capacitance of C8 varies from 4700pF to 0.02uF, used to internal power node decoupling of CH340. The C9 is 0.1uF, used to external power decoupling. Crystal X2、capacitance C6 and C7 are used to clock surge circuit. The X2 is 12MHz quartz crystal, C6 and C7 are monolithic or high frequency stoneware capacitance with 22pF. If X2 is ceramic with low cost, C6 and C7 must use the recommend value of crystal manufacturer and generally is 47pF.

When designing the PCB, pay much attention to some notes: decoupling capacitance C8 and C9 must keep near to connection pin of CH340; makes sure D+ and D- are parallel and supply ground net or pour copper beside them to decrease the disturbance from outside signal; the relevant signal between XI and XO must be kept as short as possible. In order to lessen the high frequency disturbance, play ground net or pour copper to the relative equipment.



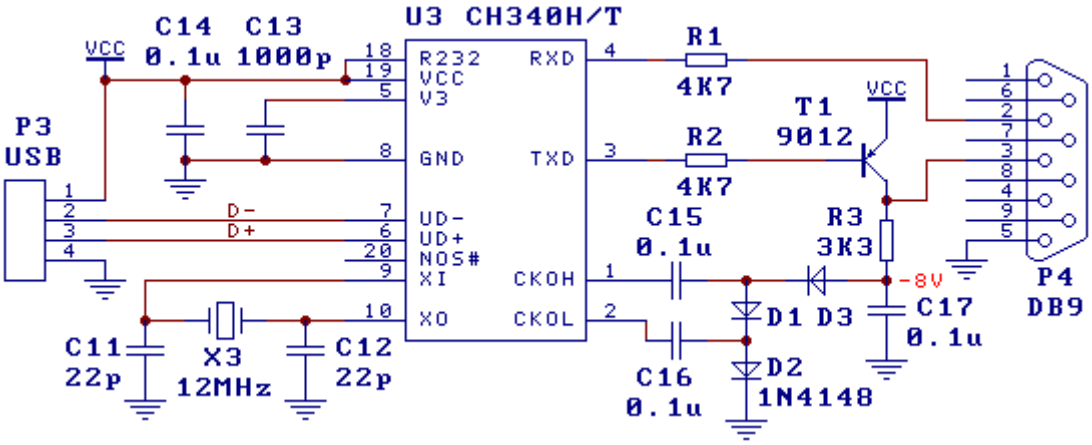
7.2. USB convert RS232 serial interface (the following image)

The image is USB converts to basic and common three wires RS232 serial interface, and U5 is MAX232/ICL232/SP232 etc.



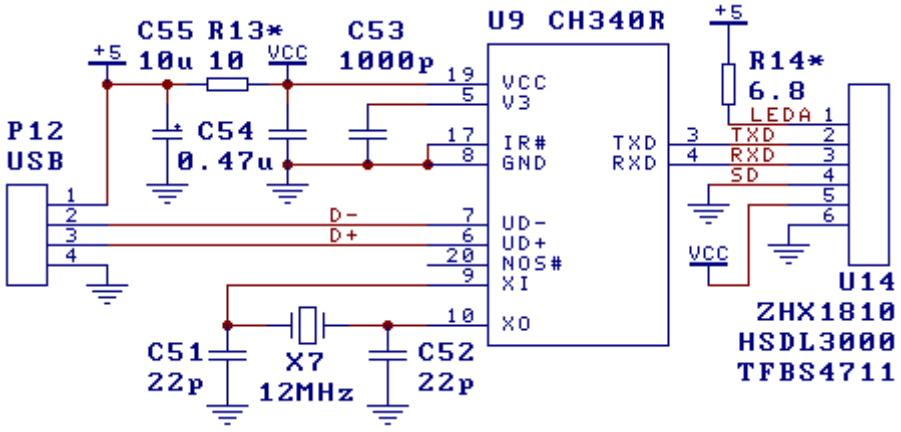
7.3. USB convert RS232 serial interface, handing edition (the following image)

The following image also is USB convert three RS232 serial interface, the function of this circuit is the same with 7.2. except the range of output RS232 is low. R232 in CH340 is high-level starts assistant RS232 function, only add diode、audion、resistor and capacitance can replace the special level convert circuit U5 in 7.2.. So the hardware cost is lower.



7.4. USB infrared adapter (the following image)

The following USB infrared adapter image 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 when infrared transferring. R13 can be ignored when the request is low. The limited current resistor R14 can be adjusted according recommended value supplied by the infrared transceiver U14's manufacture.



Consulting the following image, if selecting CH340H or CH340T chip, only to insert a inverter in TXD signal wire can realize the similar infrared function of the upper image.(the converter circuit in the following is composed of audion T12 and two resistors R10 and R11).

