WCH CH340 Series USB Interface Integrated Circuit

CH340G USB to UART Interface Datasheet

WCH Version 1E

DreamCity Version 1.0

Disclaimer from DreamCity Innovations

This is a third-party translation of WCH's CH340 Series chipset's Chinese datasheet, with information regarding CH340G chip extracted. The two other chips sharing the same datasheet, CH340R and C340T, have official English version.

1. Overview

CH340 is a series of USB bus adapters, that provides serial, parallel or IrDA interfaces over the USB bus (*note: CH340G supports serial interface only*). The CH340G integrate circuit provides common MODEM signals to allow adding a UART to a computer, or converting existing UART devices to USB interface.

2. Features

- Full-speed USB interface, compatible with USB 2.0 interface.
- Operates with a minimum amount of external components: a crystal and a minimum of four capacitors.
- Provides a virtual serial port for upgrading existing serial port devices or adding serial ports to a PC.
- Supports all existing applications using serial ports without the need of changing existing code.
- Hardware full-duplex serial interface with internal FIFO. Baud rate range from 50bps to 2Mbps.
- Supports common flow control signals RTS, DTR, DCD, RI, DSR and CTS.
- Supports RS232, RS422 and RS485 with external level shifting components.
- Uses CH341 driver.
- Supports 5V and 3.3V operation.
- RoHS-compliant narrow body SO-16 package.

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3. Specifications

3.1. Absolute Maximum Ratings

Operating the chip at or beyond those ratings will cause the chip to malfunction, even irreversibly damage the chip.

Symbol	Name	Minimum	Maximum	Unit
T_A	Operating temperature	-40	85	ºC
T_S	Storage temperature	-40	125	ºC
V_{CC}	Supply rail voltage, reference to GND pin	-0.5	6.5	V
V_{IO}	IO pin voltage, reference to GND pin	-0.5	V_{CC}+0.5	V

3.2. DC characteristics

Symbol	Name		Minimum	Typical	Maximum	Unit
V_{CC}	Supply rail voltage	5V operation	4.5	5	5.5	V
		3.3V operation	3.3	3.3	3.8	
I_{CC}	Operating current			12	30	mA
I_{SLP}	Sleeping current	5V operation		150	200	µA
		3.3V operation		50	80	
V_{IL}	Low input voltage		-0.5		0.7	V
V_{IH}	High input voltage		2.0		V_{CC}+0.5	V
V_{OL}	Low output voltage				0.5	V
V_{OH}	High output voltage		V_{CC}-0.5			V
I_{UP}	Internal pull-up strength		3	150	300	µA
I_{DN}	Internal pull-down strength		-50	-150	-300	µA
V_R	Brown-out detector threshold voltage		2.3	2.6	2.9	V

3.3. AC characteristics

Symbol	Name	Minimum	Typical	Maximum	Unit
F_{CLK}	Clock frequency (at pin XI)	11.98	12.00	12.02	MHz
T_{PR}	Power-on reset time		20	50	ms

4. Pinout

Pin #	Name	Direction	Comment
1	GND	Power	Ground reference of the chip. Connect to the ground pin of USB bus.
2	TXD	Output	UART Data Transmit output.
3	RXD	Input	UART Data Receive input.
4	V3	Power	Internal 3.3V reference for USB physical layer. Decouple with a 4.7-20nF capacitor when in 5V operation, or tie to VCC when in 3.3V operation.
5	UD+	Analog	USB D+ signal.
6	UD-	Analog	USB D- signal.
7	XI	Input	Input of the crystal oscillator. Connect to the crystal resonator and load capacitors.
8	XO	Output	Output of the crystal oscillator. Connect to the crystal resonator and load capacitors.
9	CTS#	Input	UART flow control signal Clear to Send.
10	DSR#	Input	UART flow control signal Data Set Ready.
11	RI#	Input	UART flow control signal Ring In.
12	DCD#	Input	UART flow control signal Data Carrier Detect.
13	DTR#	Output	UART flow control signal Data Terminal Ready.
14	RTS#	Output	UART flow control signal Request to Send.
15	R232	Input	Auxiliary RS232 enable. Active high, internal pull down.
16	VCC	Power	Supply rail for the chip.

5. Application Notes

CH340 chip have built in USB bus pull-up resistors and on-chip signal termination, UD+ and UD- pins should be connected to the USB bus lines directly.

CH340 have built in power on reset circuitry.

During operation CH340 requires a 12MHz clock signal present at XI pin. Generally this clock signal is provided by connecting a 12MHz crystal resonator and load capacitors between XI and XO pins, and the built-in crystal resonator will provide the required clock signal. When using an external oscillator feed the clock signal into XI pin, and leave XO pin unconnected.

CH340 supports 5V and 3.3V operation. When using 5V operation, supply 5V to VCC pin, and decouple the internal 3.3V reference with a capacitor of 4.7-20nF from V3 pin to ground. When using 3.3V operation, tie V3 pin to VCC pin and supply 3.3V power.

CH340 supports USB device suspension to reduce energy consumption. When NOS# signal is active this feature is disabled. (*Note: CH340G does not have this pin.*)

Supported hardware flow control signals: CTS#, DSR#, RI#, DCD#, DTR# and RTS#. All flow control pins are software controlled.

Auxiliary pins: IR#, R232, CKO and ACT#. (*Note: only R232 is present on CH340G*) When R232 signal is asserted the RXD signal is inverted. R232 is latched during Power-On Reset.

CH340 have built-in FIFO buffer, and supports simplex, half- and full-duplex asynchronous communication. The UART interface supports 1 start bit, 5-8 data bits, 1 or 2 stop bits, and odd, even, space or mark parity bits. CH340 supports common baud rates: 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 baud. Transmitter baud rate error is less than 0.3%, receiver baud rate error tolerance is at most 2%.

The emulated COM port is fully functional. Compatible with most applications using the serial port, without the need of changing existing code.

CH340 can be used to upgrade existing peripherals using serial ports into USB devices, or adding serial ports to a PC. With external level shifting hardware, interfaces including RS232, RS422 and RS485 can be provided.

By adding infrared adapters, CH340 can be used to implement USB to SIR adapter, allowing a PC to communicate with IrDA peripheral.

5.1. Example: USB RS232 adapter
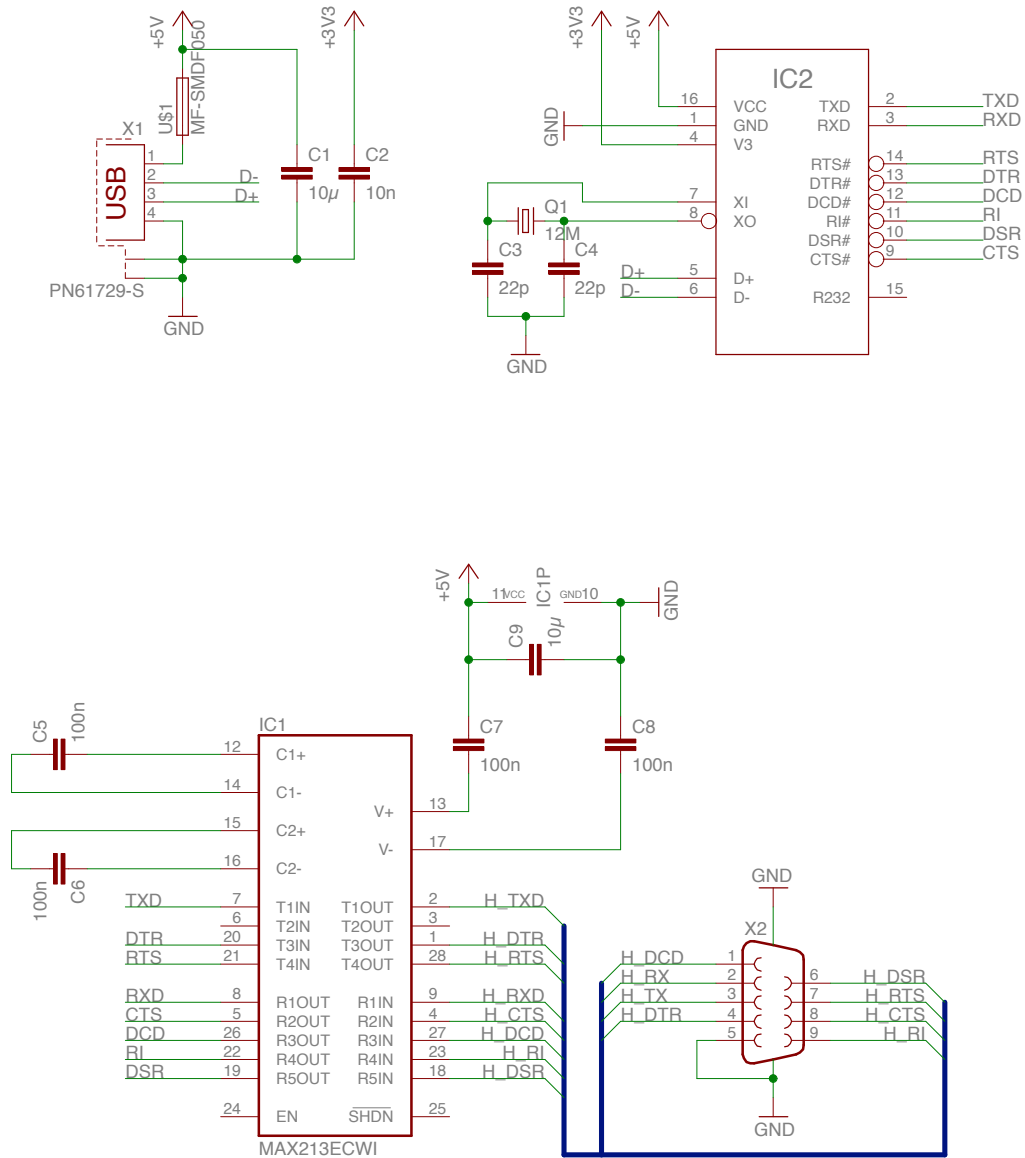
The schematic above implements a USB to RS232 adapter based on CH340G and external level adapter MAX213. When implementing this regulator-less 5V board, place capacitor C2 close to the V3 pin.

5.2. Example: Optically isolated USB to UART adapter
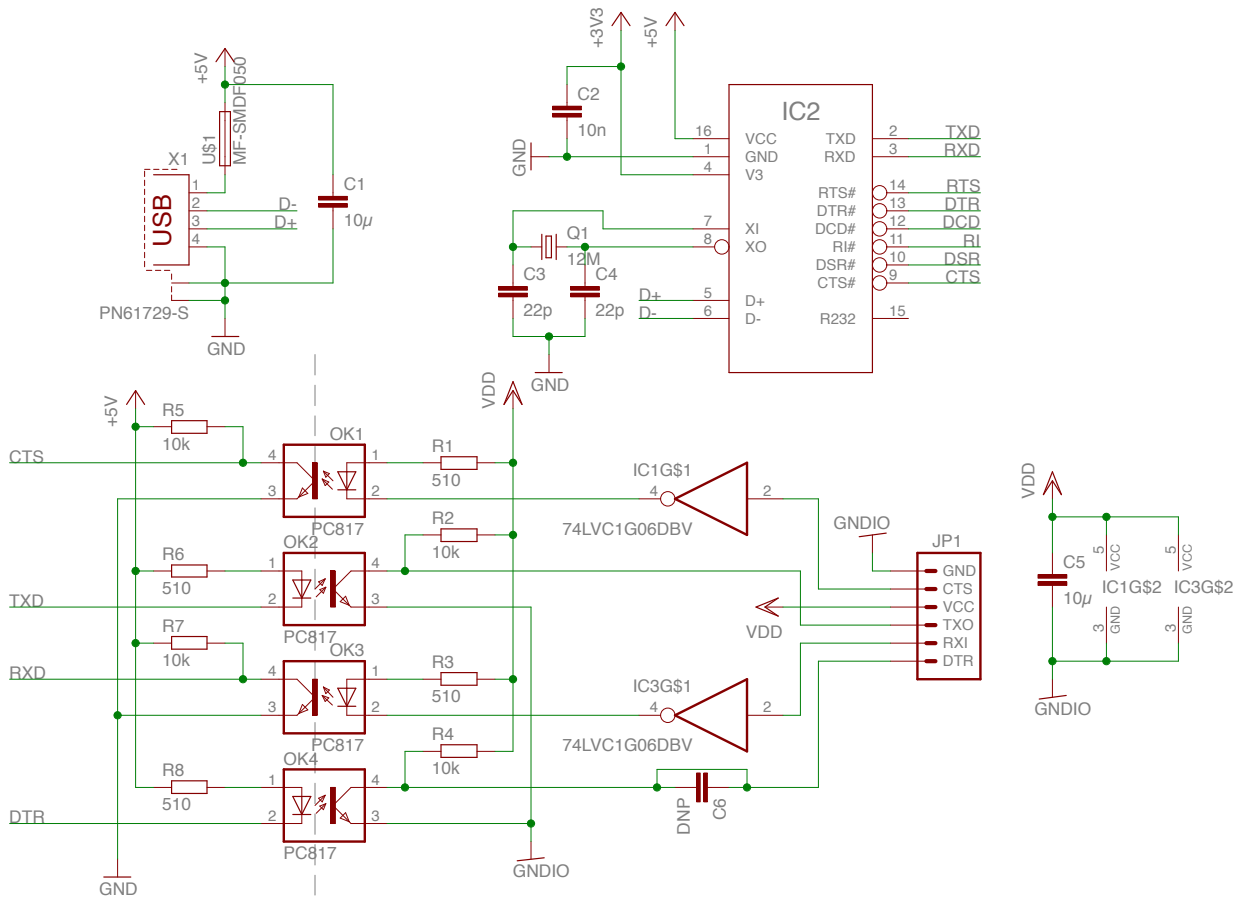
This adapter provides optically isolated inputs and outputs with 4 PC817 optoisolators. Respect the isolation border when laying out the board, and if possible, cut slots under the optoisolators. The two 74LVC1G06 is optional, but helpful when the input pins cannot source too many current.

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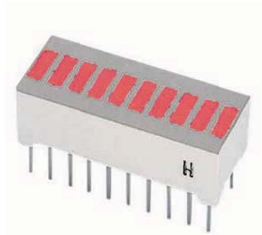
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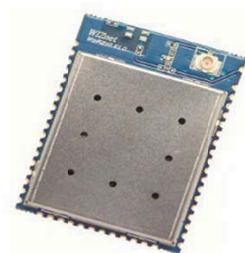
LCD+Keyboard Shield

10-Segments LED Bar Display
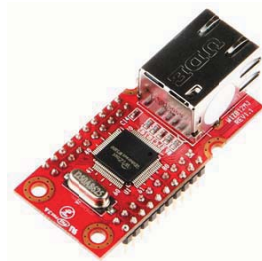
Ethernet Module

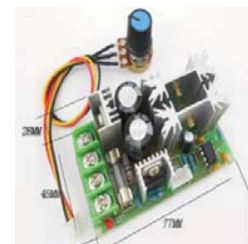Arduino Uno

MicroSD Breakout Board

WiFi Module

20x4 LCD Display Module

Stepper Motor Driver

PWM Motor Speed Controller

Breakout Board & Modules

Integrated Circuits

Discrete Parts

Assembled Kits

Connectors