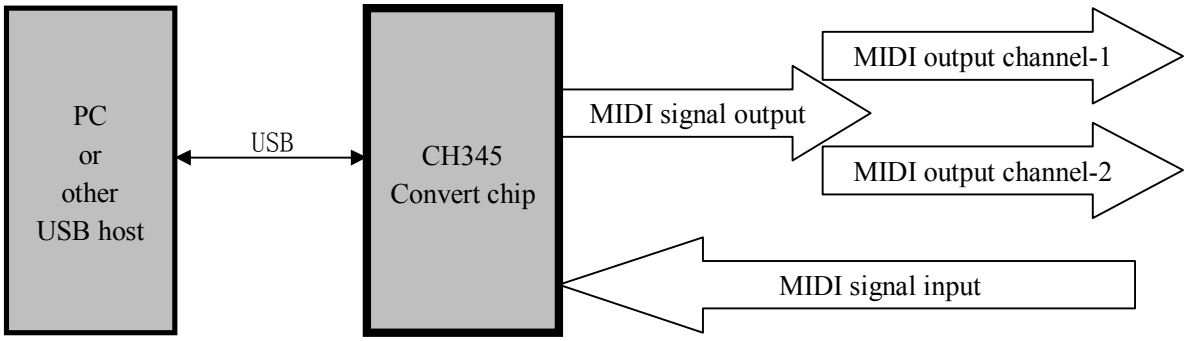
USB to MIDI CH345

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

1. Introduction

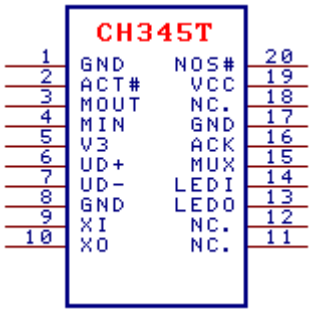
CH345 is one USB to MIDI chip. CH345 supports one MIDI signal input channel and two MIDI signal output channels, used to make MIDI keyboard, MIDI music replay based on USB bus, and change MIDI electron musical instrument to USB interface.



2. Features

● Full speed USB device interface, compatible with USB V2.0, peripheral device only need crystal and capacitance.
● Supplies one MIDI signal input channel and two MIDI signal output channel.
● According with correlation criterion, in Windows 2000/XP/Vista no need to install driver program.
● Input and output are TTL level, direct connect with MCU, supports adding photic coupler isolate transfer external.
● SSOP-20 package lead-free, 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	CH345T

4. Pins

PIN No.	PIN Name	Pin Type	Pin Description
19	VCC	POWER	Positive power input, requires an 0.1uF power decoupling capacitance

1,8,17	GND	POWER	Public ground, ground connection for USB bus
5	V3	POWER	Connect with VCC to input outside power when 3.3V, Connect with 0.01uF power decoupling capacitance when 5V
9	XI	IN	Input of crystal oscillator, attachment of crystal and crystal oscillator capacitance external
10	XO	OUT	Opposite output of crystal oscillator, attachment of crystal and crystal oscillator capacitance outside
6	UD+	USB signal	Directly connects to D+ data wire of USB bus
7	UD-	USB signal	Directly connects to D- data wire of USB bus
20	NOS#	IN	Forbid USB device to suspend, active with low, with pull-up resistor
3	MOUT	OUT	MIDI signal output, active with high-level
4	MIN	IN	MIDI signal input, active with low, with pull-up resistor
2	ACT#	OUT	USB configuration finish state output, active with low
13	LEDO	OUT	MIDI output state indicator light control, active with high
14	LEDI	OUT	MIDI input state indicator light control, active with high
15	MUX	OUT	MIDI output channel state, low is channel-1, high is channel-2
16	ACK	OUT	MIDI input receive acknowledges, active with high pulse rising edge
11,12,18	NC.	NC.	Forbid to connect, must be suspended

5. Function description

CH345 sets USB pull-up resistor internal, the UD+ and UD- must directly connect to USB bus.

CH345 sets power-up reset circuit internal.

When CH345 chip is working normally, the outside must supply 12MHz clock signal to XI pin. In generally, clock signal is generated by inverter in CH345 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.

When CH345 uses 5V power, the V3 pin must connect with 0.01uF power decoupling capacitance.

CH345 auto supports USB device suspend to save power, NOS# low will forbid USB device suspend.

ACT# is USB device configuration finish state output in CH345, it is used to indicate USB device has successfully connect to computer.

MOUT used to time-division multiplex output two channels MIDI signal, MUX used to indicate current output channel state, separate use MOUT pin, it is two channel mix output; use with MUX can separate two isolated output channel.

MIN pin is used to output MIDI signal, high-level in default, directly connect to MIDI output pin in musical instrument MCU, or add photic coupler isolate transfer to transfer. ACK is receive acknowledge, after receiving each MIDI data byte, ACK will output one high-level pulse, the width is between 1.1uS to 10uS.

CH345 according with relative criterion, support plug-and-play, Windows 2000/XP/Vista in computer has set driver program, directly use after connection.

CH345 can used to make MIDI keyboard, MIDI music replay device based on USB bus, or connect MIDI electron musical instrument to USB interface on computer to record or edit.

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)

Name	Parameter note	Min.	Typical	Max.	Units
VCC	Source voltage (V3 doesn't connect to VCC)	4.5	5	5.3	V
ICC	Total source current when working		12	30	mA
ISLP	Total source current when USB suspending			0.2	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	5	150	300	uA
IDN	Input current with pull-down resistor internal	-40	-80	-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 to single channel MIDI (the following image)

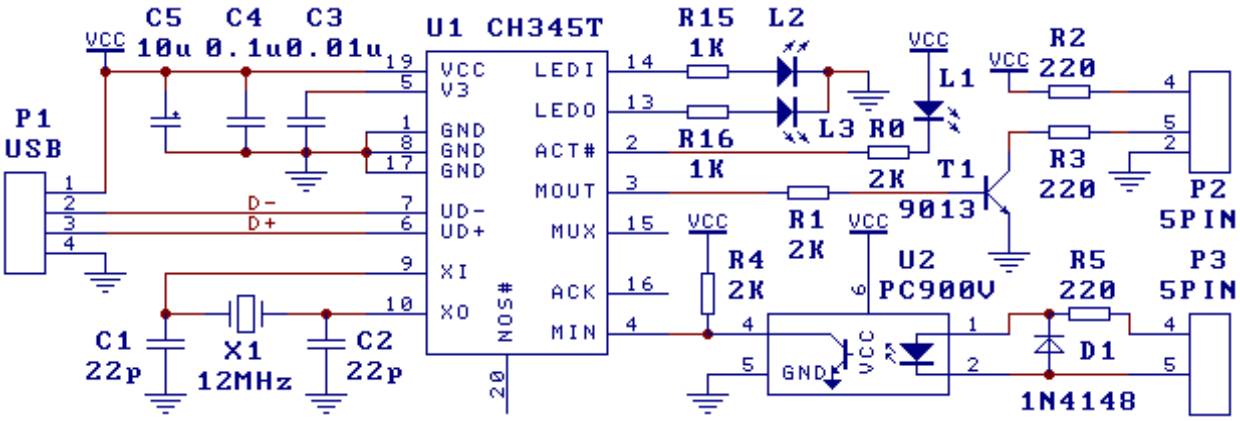
The following image is USB to single input single output MIDI by CH345. P2 is five pins MIDI output endpoint, P3 is five pins MIDI input endpoint. Audion T1 used to reverse output drive current, photic coupler isolate U2 used to realize current isolate input, D1 used to protect U2 when the polarity is in reverse, L1 used to indicate the USB device is ready, L2 and L3 separate indicate MIDI IN and OUT state.

P1 is USB interface, USB bus contains one pair 5V power wire and one pair 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, CH345 and low power exhaust USB product can directly use the 5V power supplied by USB bus. If USB productions supply common power by other mode, CH345 need to use the common power. If these productions use other common power and USB bus power at the same time, connects 5V power wire of USB bus to 5V common power of USB productions via 1Ω resistance. And join ground wire of the two power devices.

The capacity of C3 varies from 4700pF to 0.02uF, eliminates the coupling of inner power of CH345. The capacity of C4 is 0.1uF, eliminates the coupling of external power. The crystal X1, capacitance C1 and C2 are composed of clock oscillating circuit of CH345.if selects ceramic crystal as X1, C1 and C2 are using the recommend value by manufacture, 47pF in generally.

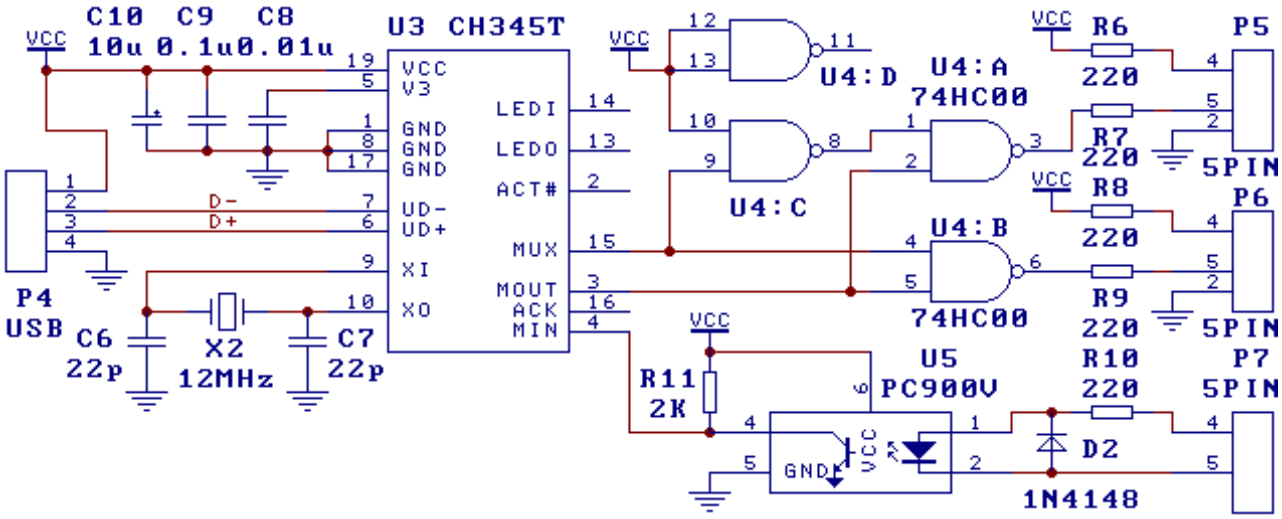
When designing the PCB, pay much attention to some notes: decoupling capacitance C3 and C4 must

keep near to connection pin of CH345; makes sure D+ and D- are parallel and supply ground or covering copper besides to decrease the disturb from outside signal; the relevant signal leads between XI and XO must be kept as short as possible. In order to lessen the high frequency clock disturb outside, setting ground wire on the circle or covering copper to the relative equipments.



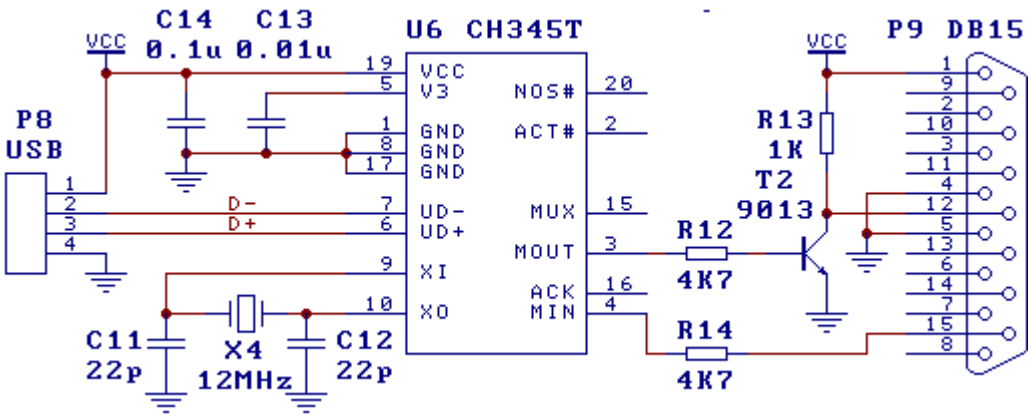
7.2. USB to dual channels MIDI (the following image)

The following image is USB to single input double outputs MIDI by CH345. U4 is used to divided two channels in duplex MIDI output signal, output to MIDI output endpoint in P5 and P6.



7.3. USB to unseparated MIDI (the following image)

The following image is USB to unseparated MIDI with TTL level, P9 is similar with computer 15 needs GAME/MIDI endport.



7.4. MIDI kyeboard (the following image)

The following image is MIDI keyboard based on USB bus composed of CH345 and MCS51, TXD in U8 output data to MIN pin in CH345, if necessary, MCU can get sample ACK in CH345 to certify whether CH345 has received data.