USB-CAN Module

BM42D5601-1

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Features

- Operating voltage (V_{CC}): 4.5V~5.5V
- Operating current: 24mA @ 5V
- Standby current (Sleep current): 1000μA @ 5V
- Power down and wake-up functions to reduce power consumption
- Support bidirectional transparent conversion between USB and CAN
- USB interface
  - ♦ USB 2.0 Full Speed compatible
  - ♦ Implements USB protocol composite device
    - – Communication Device Class (CDC) for communications and configuration
- CAN Bus interface
  - ♦ Compatible ISO11898-1, su pport CAN 2.0A and CAN 2.0B
  - ♦ Support baud rates 5Kbps~1Mbps and up to 8-byte per CAN frame
  - ♦ Supported CAN modes: Normal, Loopback, Listen
- Support standard Windows® drivers for Virtual COM Port (VCP): Windows XP (SP2), Vista, Windows 7 & Windows 8 (only an INF file is required), Windows 10
- Support Android 4.0 or later version and Mac OS X
- Operating temperature range: -40℃ ~ 105℃

General Description

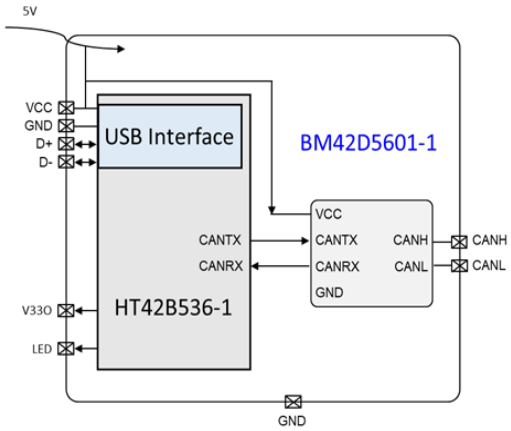
The BM42D5601-1 is a professional module for interconversion between USB and CAN Bus protocol, which can achieve communication and data conversion between USB and CAN Bus. This makes it easy for a personal computer (PC) to communicate with the CAN Bus via a USB interface. At the same time, it also provides a convenient and extensible CAN interface to meet a wider range of application requirements, which can be used in industrial control, building automation, telecommunications equipment, agricultural machinery and other fields.

Module Appearance Diagram

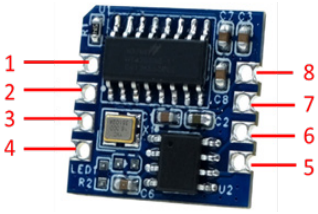
Applications

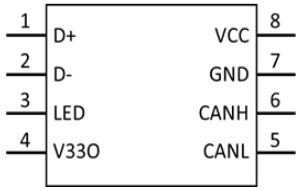
- Industrial automation control
- Building automation
- Telecommunications equipment
- Agricultural machinery

Block Diagram



Pin Assignment





Pin Description

Pin	Function	Type	Description
1	D+	I/O	USB D+ line
2	D-	I/O	USB D- line
3	LED	O	CAN Bus signal LED indication, active low
4	V33O	O	3.3V regulator output
5	CANL	I/O	CAN differential negative
6	CANH	I/O	CAN differential positive
7	GND	PWR	Negative power supply
8	VCC	PWR	Positive power supply

Note: PWR: Power; I/O: Input/output.

Technical Specifications

Absolute Maximum Ratings

Supply Voltage ..... V_{SS}-0.3V~V_{SS}+6.0V

Input Voltage ..... V_{SS}-0.3V~V_{CC}+0.3V

Storage Temperature..... -60℃~150℃

Storage Relative Humidity ..... 20%~60% RH

Operating (Ambient) Temperature ..... -40℃~105℃

Operating (Ambient) Humidity ..... 0%~75% RH

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of the device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Recommended Operating Conditions

To achieve optimal module performance, it is recommended to operate the module within the temperature range of -40℃ to 105℃ and the humidity range of 20% to 60%. If the module is exposed to an environment outside the recommended values for a long time, it can accelerate the aging of the module.

D.C. Electrical Characteristics

Ta=25°C, V_{CC}=5V

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating Voltage	—	4.5	5.0	5.5	V
I_{DD}	Operating Current	V_{CC}=5V, CAN=1Mbps	—	24	50	mA
I_{STB}	Sleep Current	V_{CC}=5V, sleep mode, no load, CAN BUS sleep	—	1000	—	μA
V_{IL}	Input Low Voltage	—	0	—	0.2V_{CC}	V
V_{IH}	Input High Voltage	—	0.8V_{CC}	—	V_{CC}	V
I_{OL}	Sink Current for I/O Ports	V_{CC}=5V, V_{OL}=0.1V_{CC}	10	20	—	mA
I_{OH}	Source Current for I/O Ports	V_{CC}=5V, V_{OH}=0.9V_{CC}	-5	-10	—	mA
V_{V33O}	3.3V Regulator Output Voltage	V_{CC}=5V, I_{V33O}=70mA	3.0	3.3	3.6	V

A.C. Characteristics

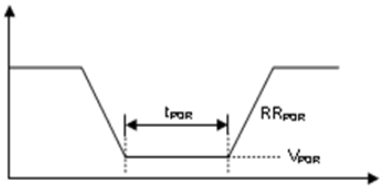
Ta=25°C, V_{CC}=5V

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{CC}	Conditions				
f_{CAN}	CAN Bus System Clock (OSC)	4.5V~5.5V	—	—	16	—	MHz
t_{RSTD}	System Reset Delay Time	—	Power-on reset	25	50	100	ms
f_{CLK_CAN}	CAN Baud Rate	5V	—	5K	—	1M	bps

Power-on Reset Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{CC}	Conditions				
V_{POR}	V_{CC} Start Voltage to Ensure Power-on Reset	—	—	—	—	100	mV
RR_{POR}	V_{CC} Rising Rate to Ensure Power-on Reset	—	—	0.035	—	—	V/ms
t_{POR}	Minimum Time for V_{CC} Stays at V_{POR} to Ensure Power-on Reset	—	—	1	—	—	ms



Functional Description

System Description

Operating Principle

The BM42D5601-1 is a professional module for interconversion between the USB and CAN Bus protocol. The CAN baud rate and other parameters of the module can be set through the PC host computer. When the module receives USB or CAN data, the data will be converted to CAN or USB data after internal processing and then sent out. The module supports 1 group of CAN receiving filters, which can be used with the PC host computer.

Sleep Mode

The BM42D5601-1 supports sleep mode. When the PC enters the sleep mode, the module will enter the sleep mode.

Interface

CAN Bus Interface

The BM42D5601-1 contains a CAN Bus control unit. The CAN Bus Controller supports the CAN 2.0 Part A and B protocol specifications and compatible with the ISO11898-1 standards. It is capable of transmitting and receiving standard and extended messages. It is also capable of both acceptance filtering and message handler.

USB Interface

To communicate with an external USB host, the internal USB module has the external pins known as D+ and D- along with the 3.3V regulator output pin V33O. A Serial Interface Engine (SIE) decodes the incoming USB data stream and transfers it to the correct endpoint buffer memory known as the FIFO. The USB module has 4 endpoints, EP0 ~ EP3. The endpoint 0 supports the Control transfer while the endpoint 1 ~ endpoint 3 support the Interrupt or Bulk transfer. The HT42B536-x Bridge IC supports the USB Communication Device Class (CDC) for communications and configuration.

Endpoint Transfer Type

Endpoint	Transfer Type
0	Control
1	Interrupt
2	Bulk Out
3	Bulk In

USB Endpoint Transfer Type

If there is no signal on the USB bus for over 3ms, the module will enter the suspend mode. The module enters the suspend state to meet the requirements of the USB suspend current specification. When the resume signal is asserted by the USB host, the module will be woken up and leave the suspend mode.

As the module has a remote wake-up function, the module can wake up the USB host by sending a remote wake-up pulse. Once the USB host receives a remote wake-up signal from the module, the host will send a resume signal to the module.

USB VID and PID Configure

The module has configured the default Vender ID (VID: 0x04D9), Product ID (PID: 0xB536) and product description strings of "USB to CAN Bridge".

This module has been configured to the default USB configuration data as shown in the following table.

Parameter	Value (Hex)
USB Vendor ID (VID)	0x04D9
USB Product ID (PID)	0xB536
Remote wake-up	Default disable
Manufacturer Name	Holtek
Product Description	USB to CAN Bridge

BM42D5601-1 Protocol Description

The BM42D5601-1 protocol, which combines the ASCII and hexadecimal codes, is used to configure CAN communication parameters and convert between USB data and CAN data.

Command Set

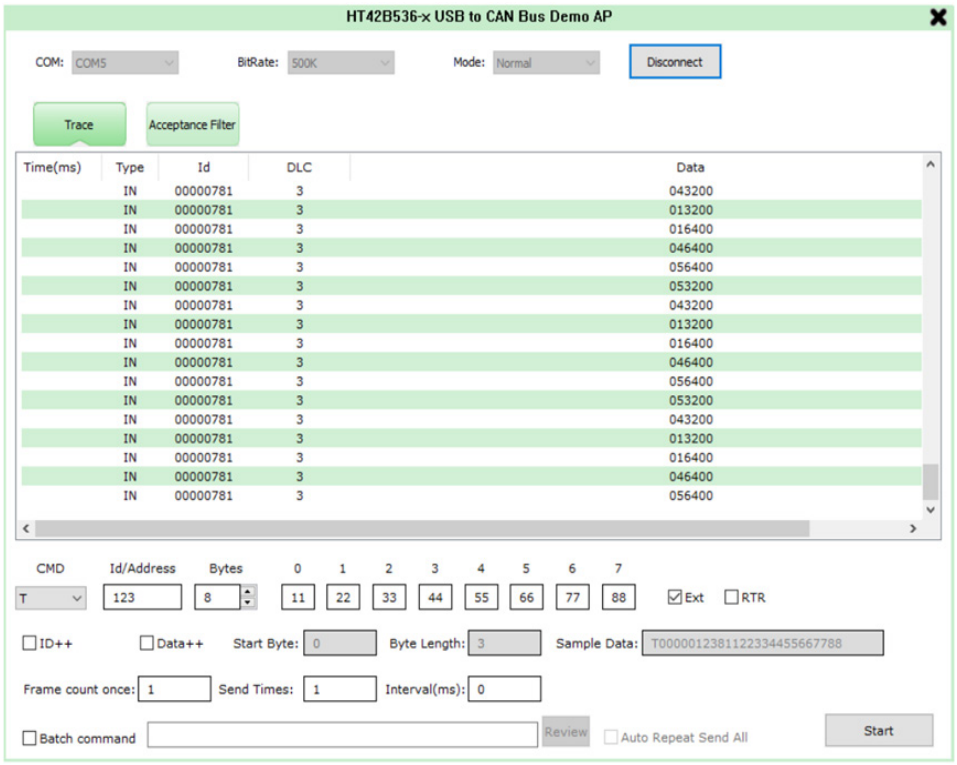
The data starts with ASCII and ends with the Carriage Return character, CR (0x0D). In the following, the hexadecimal code is represented by a backslash \.

Command	Response	Function
Open/Close the CAN bus device		
O[CR]	[CR]	Open the CAN bus device in Normal mode
I[CR]	[CR]	Open the CAN bus device in Loopback mode
L[CR]	[CR]	Open the CAN bus device in Listen mode
C[CR]	[CR]	Close the CAN bus device if it is opened
Setting CAN Bitrate (Standard)		
S\00[CR]	[CR]	Set the CAN bus bitrate to 5K
S\01[CR]	[CR]	Set the CAN bus bitrate to 10K
S\02[CR]	[CR]	Set the CAN bus bitrate to 20K
S\03[CR]	[CR]	Set the CAN bus bitrate to 50K
S\04[CR]	[CR]	Set the CAN bus bitrate to 100K
S\05[CR]	[CR]	Set the CAN bus bitrate to 125K
S\06[CR]	[CR]	Set the CAN bus bitrate to 250K

Command	Response	Function
S\07[CR]	[CR]	Set the CAN bus bitrate to 500K
S\08[CR]	[CR]	Set the CAN bus bitrate to 800K
S\09[CR]	[CR]	Set the CAN bus bitrate to 1M
Transmitting a CAN Frame		
t\0i\ii\l\dd\dd\...\dd[CR]	z[CR]	Transmits a standard CAN frame (11-bit identifier) over the CAN bus
T\ii\ii\ii\ii\l\dd\dd\...\dd[CR]	Z[CR]	Transmits an extended CAN frame (29-bit identifier) over the CAN bus
Transmitting a Remote Request CAN Frame		
r\0i\ii\l[CR]	z[CR]	Transmits a standard remote request (11-bit identifier) over the CAN bus
R\ii\ii\\ii\ii\l[CR]	Z[CR]	Transmits an extended remote request (29-bit identifier) over the CAN bus
Setting Acceptance Mask Code		
m\ii\ii[CR]	[CR]	Set acceptance filter mask code for standard CAN frame (11-bit identifier)
m\ii\ii\ii\ii[CR]	[CR]	Set acceptance filter mask code for extended CAN frame (29-bit identifier)
Setting Acceptance Code		
M\ii\ii[CR]	[CR]	Set acceptance filter code for standard CAN frame (11-bit identifier)
M\ii\ii\ii\ii[CR]	[CR]	Set acceptance filter code for extended CAN frame (29-bit identifier)
Getting Status Flags		
F[CR]	F\xx[CR]	Get CAN bus status
Getting Version Information		
v[CR]	vXXXX[CR]	Get the current firmware version

USB to CAN Bus Bridge DLL User Guide

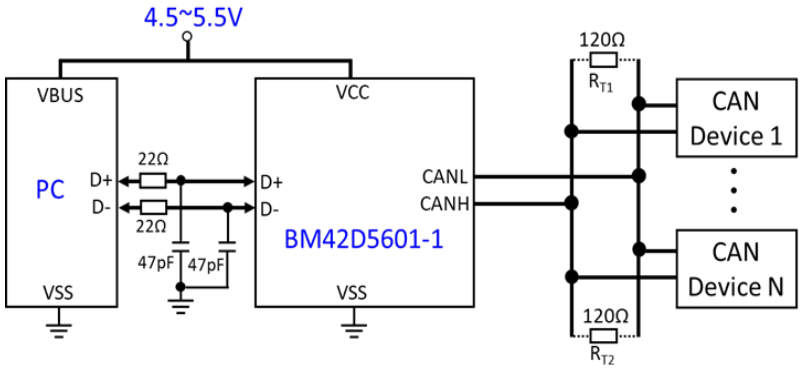
Holtek provides UsbCANBusTool and DLL for customer development. The UsbCANBusTool is a test tool. It is a Windows application software that can view, send and record CAN messages.



The UsbCANBusTool & DLL instructions can be found by searching the keyword “UsbCANBus” on the Holtek website.

Application Circuit

Hardware Circuit



Layout Description

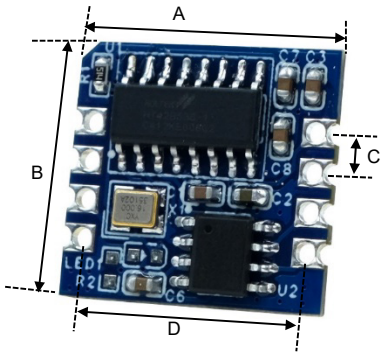
(1) The track length should be as short as possible to avoid the high-speed USB differential lines (D+/ D-) being close to the connectors and the digital signal line with steep edges (such as the clock signal lines).

(2) The vias and corners on the USB signal line should be reduced as possible to achieve a better impedance control and avoid the signal reflection.

(3) Do not use tracks with right angles, users can use two 45 degrees or an arc to achieve turning, which can reduce the signal reflection and impedance discontinuity.

(4) For the differential signals D+ and D-, CANH and CANL, it should be ensured that the line distandce between two tracks is consistent everywhere, and the length is matched, and the maximum length difference is controlled within 50mils.

Dimensions



Symbol \ Unit	mm	inch
A (Product length)	18	0.71
B (Product width)	17	0.67
C (Pin pitch)	2.54	0.1
D (Pin pitch)	15.24	0.6

Reference Information

Modification History

Date	Author	Issue	Modification Information
2024.09.13	吴海富	V1.0	First Version

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