helion microsystems

HU-320

Multi-Protocol USB Interface IC

SPI I2C UART GPIO LCD EEPROM PWM

Features

- Driverless USB2.0 Interface
- Serial Peripheral Interface (SPI)
- Inter-IC Interface (I2C/SMBUS)
- UART
- 20 General Purpose Digital IO Pins
- Event Counter
- Pulse Width Modulation Generator
- Buffered System Clock Output
- HD44780 LCD Interface
- 512 Bytes User EEPROM
- .NET API Software
- 3.0-5.5V Operation
- Internal 3.3V USB Pad Regulator

Applications

- Instrumentation
- Test Equipment
- ATE Systems
- Sensor Interface
- Process Control
- General USB Interface

Maximum Ratings

Parameter	Value	Unit
Operating temperature	-55 - 125	°C
Storage temperature	-65 - 150	°C
Voltage on UVCC	-0.5 - 6.0	V
Voltage on other pins	-0.5 - vcc + 0.5	V
Max operating voltage	6.0	V
IO pin current	30	mA
VCC / GND current	180	mA

Description

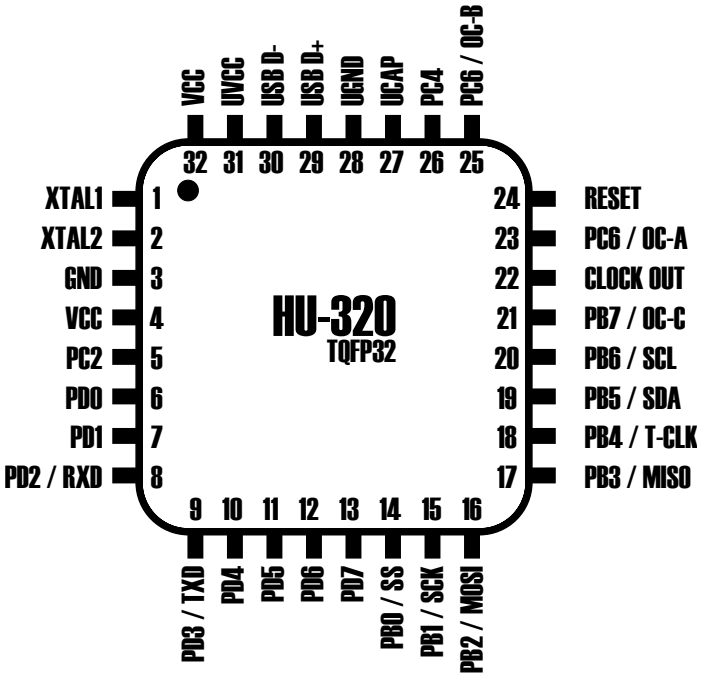
The helion micro HU-320 represents the simplest and quickest path to USB connectivity. This IC replaces a microcontroller and USB interface hardware to provide many industry standard interfaces, as well as various peripheral features such as PWM, LCD and EEPROM.

Communication with a USB host is acheived through a driverless HID (human interface device) class.

A fully documented API (application programming interface) is available to ensure full functionality is available in the minimum development time. Sample applications with source code are available to accelerate development.

Simply connect a clock source, power supply and USB connector for full functionality.

Pin Configuration



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Pin Description

#	Pin Name	General	Extended
1	XTAL1		Crystal Oscillator Input
2	XTAL2		Crystal Oscillator Input
3	GND		Digital Ground
4	VCC		3.0 - 5.5V Power Supply
5	PC2	GPIO	
6	PD0	GPIO	
7	PD1	GPIO	
8	PD2 / RXD	GPIO	UART Receive
9	PD3 / TXD	GPIO	UART Transmit
10	PD4	GPIO	
11	PD5	GPIO	
12	PD6	GPIO	
13	PD7	GPIO	
14	PB0 / SS	GPIO	Slave Select (Slave mode)
15	PB1 / SCK	GPIO	SPI Clock
16	PB2 / MOSI	GPIO	SPI Master Out Slave In
17	PB3 / MISO	GPIO	SPI Master In Slave Out
18	PB4 / T-CLK	GPIO	Clock source for internal timer register
19	PB5 / SDA	GPIO	I2C Bidirectional Data Line
20	PB6 / SCL	GPIO	I2C Clock Line
21	PB7 / OC-C	GPIO	Timer output compare C
22	CLOCK OUT		Buffered CPU clock output
23	PC6 / OC-A	GPIO	Timer output compare A
24	RESET		Reset (active low)
25	PC6 / OC-B	GPIO	Timer output compare B
26	PC4	GPIO	
27	UCAP		USB 3.0V PSU output
28	UGND		USB Ground
29	USB D+		USB Data +
30	USB D-		USB Data -
31	UVCC		USB Power supply
32	VCC		CPU Power supply

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Feature Description

USB 2.0 HID interface
The HU-320 provides a driverless HID interface to the PC. This type of interface has benefits over a virtual comport device class, as the specific port number does not need to be found by the user, nor does a driver need to be installed. The device can be uniquely identified using a USB PID/VID as well as a five digit serial number, this allows many devices to be attached to the same PC. All devices are shipped with unique serial numbers. Devices can be ordered with any combination of USB PID/VID, serial number, manufacturer and product strings etc.

Software library
A .NET software component is available to download from www.helionmicro.com. Using this library, the user requires no knowledge of USB interface software or firmware in order to develop a USB interface for an electronic product.

The library exposes all functions of the HU-320 through a very simple structure. Simply create an instance of the object and all hardware functions can be accessed though the available methods. All methods are documented with Intellisense, so referring to the software manual is very rare. Visual C# or VB .NET express editions are free from Microsoft and the ideal development platform.

SPI
The HU-320 includes a Serial Peripheral Interface (SPI) port capable of transfers at up to 4Mbps. All four SPI operation modes are configurable as well as byte order (MSB/LSB first). Any of the IO pins may be used as chip-select signals for the SPI slaves, and are toggled automatically by the SPI function.

The SPI port is also able to act as an SPI slave for transfers at low speed. See the communication interrupt section in the software manual for more information.

I2C master
The HU-320 provides an I2C master interface operating at the standard rate of 100kHz. This interface is compatible with SMBUS and allows communication with many industry standard ICs.

UART
The HU-320 is able to provide communication through a logic-level UART interface. With the addition of an IC such as a MAX232 or MAX485, the IC is able to communicate with other hardware via RS232 or RS422/485. The UART block features separate 64 byte receive and transmit buffers. Available baud rates range from 2400bps to 1Mbps, covering all standard rates between. (1Mbps, 500kbps, 250kbps, 125kbps, 115.2kbps, 76.8kbps, 57.6kbps, 38.4kbps, 19.2kbps, 14.4kbps, 9600bps, 4800bps, 2400bps). One or two stop bits may be selected.

GPIO
20 general purpose digital IO pins are available. Each pin may be individually configured. When set as input, the pin may be at high impedance (Z-state) or may be configured with a internal pull-up resistor. When set as output, each pin may sink or source 20mA, allowing LEDs, transistors etc to be driven directly. (Note: The total IO pin current should not exceed 150mA in either direction) Many of the GPIO pins are shared with other functions, however when these functions are not enabled, the pins default to GPIO operation.

Timers & PWM
A 16bit timer is implemented on the HU-320. This timer can be configured to give a high speed PWM signal for motor control or digital-analog conversion, or it can be used to count edges from an external source.

When configured as a PWM source, two outputs are available. Each output is constrained to the same period, however the duty-cycle and polarity for each is adjustable individually. This allows for driving of bridge type motor controllers etc, or just two separate loads.

When configured for event counting, a digital signal can be applied to pin 18 (T-CLK). Upon each transition in the configured direction, the internal timer register is updated. The value of this register may be requested by software.

LCD
A HD44780 LCD interface is built into the HU-320, character LCDs up to 40x4 are able to be driven with a simple interface. ASCII and non-standard character sets are supported.

EEPROM
512 bytes of user configurable EEPROM is available for storage of hardware specific information, calibration curves etc. This memory is non-volatile, and has a minimum endurance of 100,000 write cycles.

Application Hints

USB
The USB D+ and D- lines require 22Ω resistors in series with the pins on the IC. The USB signal traces should be kept as short as possible

Power supply
All power supply pins should be bypassed with 0.1uF capacitors as close as possible to the pin. The capacitors should have a good low-impedance path to ground. Pin 27 (UCAP) is wired to the internal 3.3V regulator required for USB operation, this pin must be bypassed to with a 1uF capacitor in order to ensure quality of this power supply.

Table 1 shows the required connections to be made when selecting a power supply paradigm. USB bus power or self powered options are available for a range of voltages.

Topology	VCC	UVCC
USB Power 5V IO	USB VBUS	USB VBUS
USB Power 3V IO	UCAP	USB VBUS
Self Power 3.6-5.5V IO	3.6-5.5V PSU	3.6-5.5V PSU
Self Power 3.0-3.6V IO	3.0-3.6V PSU	NC

Table 1: Power supply connection options

Reset Pin
The reset pin should not be required in normal operation. If used, the USB interface will be disrupted, causing the device to be disconnected. This should only be used in special circumstances. The reset pin should be tied to VCC through 50-100kΩ, with a 10nF capacitor to ground.

I2C pull-ups
The I2C bus operates as a wired-OR type of arrangement. Thus, each node can either set or release the bus state. At the hardware level, this means an open-collector pin can pull the line low, or can release it to high impedance. As each node only drives low, pull-up resistors are required to set a high state. 1.5 kΩ resistors to VCC are suggested for both SCL and SDA pins. As the bus idles at high impedance, very little power is consumed by these pull-up resistors.

GPIO pin circuit
Each IO pin is represented by the circuit shown below. Each output pin can be configured as an input or an output. When configured as an input, the pin may be set by software as high impedance, or with a weak pull-up to VCC. When configured as an output, the pin will switch to either ground or VCC, and is capable of sinking or sourcing 20mA.

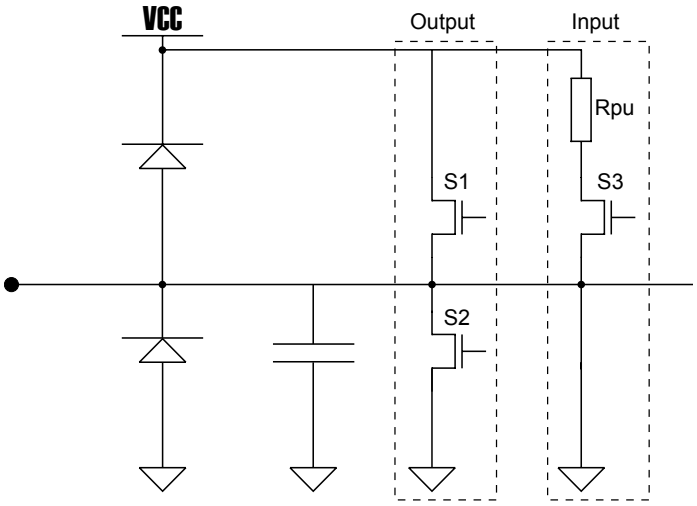

Figure 3: GPIO pin circuit

Clock Source
For USB compliance, this IC requires an 8MHz +/- 0.25% clock. To achieve this, a high quality crystal oscillator is recommended. Ceramic resonators may not achieve this accuracy under all conditions. 12-22pF capacitors are recommended for C1 and C2.

A buffered clock output (8MHz) is provided on pin 22 for supplying a clock to any other components.

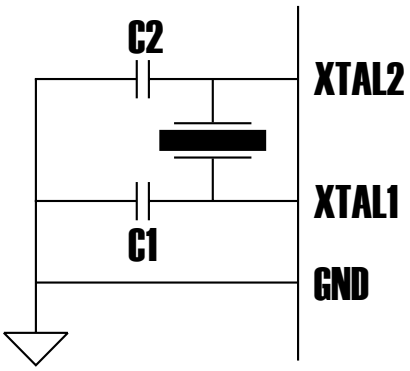

Figure 4: Crystal oscillator circuit

Electrical Characteristics

Parameter	Min	Typ	Max	Unit
Input low voltage	0.5	-	(0.2)Vcc	V
Input high voltage	0.6	-	Vcc+0.5	V
Output low voltage (@ 10mA pin current)	-	-	0.7	V
Output high voltage (@ 20mA pin current)	-	-	Vcc-0.7	V
Active current draw	-	7	8.5	mA
USB series resistors		22		Ohms
USB D+ internal pullup	900	-	1500	Ohms

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