

BREAKOUT BOARD DESCRIPTION

CME-WIDI-Core/CoreX is a smart (BLE) breakout board that implements MIDI over Bluetooth Low Energy functionality.

The breakout board can be used in any existing MIDI equipment that features MIDI I/O. The breakout board is low cost, ultra low in power consumption and works natively with Apple iOS, MacOS, Windows and Android, when used as a MIDI peripheral or central according to the MMA “MIDI over BLE” specification.

CME-WIDI-Core has an embedded antenna and does not require any external antenna. CME-WIDI-CoreX has an external antenna connector (IPEX) on board and requires an external antenna (note: external antenna is not included in the CME-WIDI-CoreX package and should be purchased separately.). Please refer to the section RECOMMENDED EXTERNAL ANTENNA for further information.

The breakout board is able to play a central or peripheral role to connect to any BLE MIDI third parties peripherals, such as Roland AX Edge, Korg MicroKey Air, Roli Seaboard, CME Xkey Air, Jamstik+ Guitar, and all other existing BLE MIDI peripherals.

CME-WIDI-Core/CoreX is a small size breakout board that implements all MIDI over BLE characteristics, services and IOs. Besides this, it has the ability to negotiate the smallest possible BLE connection interval to reduce MIDI latency depending on the connected BLE equipment.

Also, it works natively with all Apple devices (BLE functionality and iOS8+ installed), as well as with Mac OS computers (BLE functionality and Yosemite installed), Windows computers and Android devices.

The breakout board can be seen as a black box with MIDI In/Out on one side, and wireless BLE on the other side. Therewith it is able to send and receive pure MIDI data, and take care of encoding/decoding BLE packets.

The MIDI UART can be configured at a standard MIDI baud rate 31.25 kb/sec or in high speed mode at 100 kb/sec when connected to an external MCU.

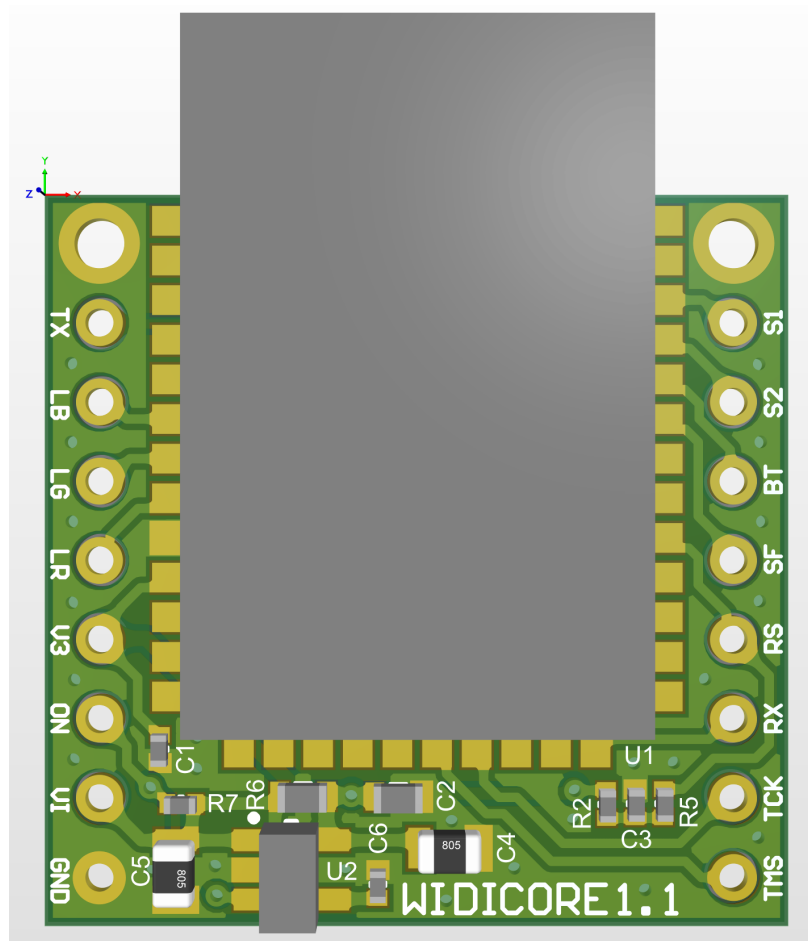
The breakout board features an onboard Low Drop Out regulator, able to accept input voltages from 2.0 to 16V

The information in this document is subject to change without notice

BREAKOUT BOARD OVERVIEW

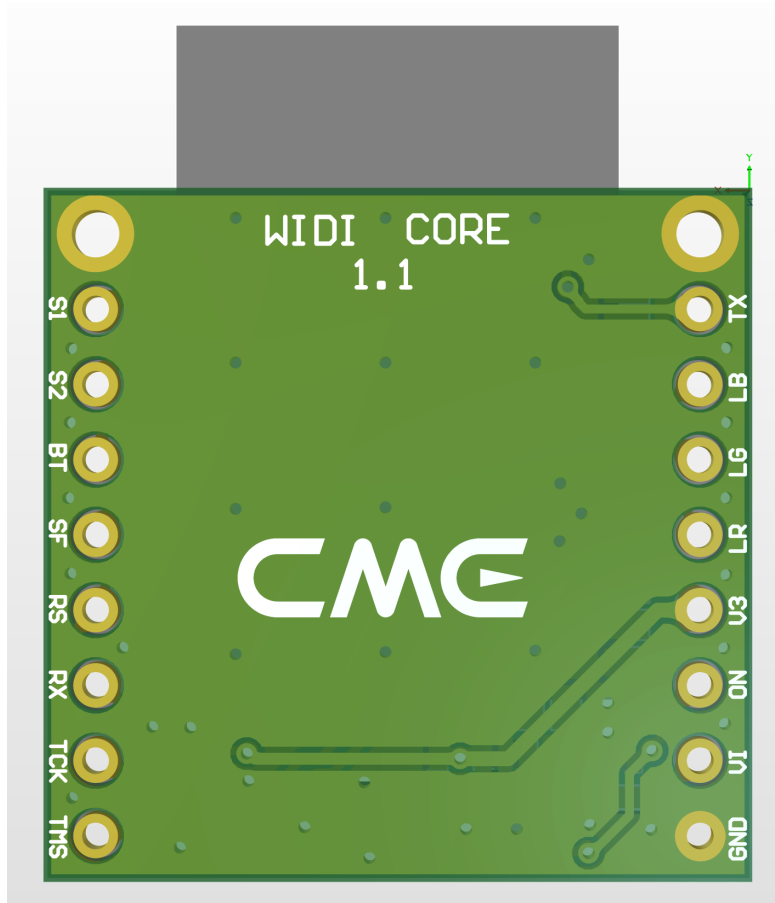
All pins are placed on a 2.54mm grid.
 Two M2 pins connected to ground can be used as fixing holes.
 All components are located on the top side for seamless integration.

Top view



The information in this document is subject to change without notice

Bottom view



The information in this document is subject to change without notice

PINS DESCRIPTION

PIN	TYPE (1)	DESCRIPTION
TX	O	3.3V MIDI Output, connect to external MCU serial port input
LB	O	3.3V Blue LED output, this pin can drive up to 8mA, active low. Connect to a LED cathode through a 470-820R resistor. LED anode connected to power supply. This Blue LED indicates Bluetooth states, roles etc. <i>This pin can be left unconnected if not used</i>
LG	O	3.3V Green LED output, this pin can drive up to 8mA, active low. Connect to a LED cathode through a 470-820R resistor. LED anode connected to power supply. This Green LED is On (in addition to the Blue LED) when the WIDI acts as a Bluetooth Central. This LED is also used in the bootloader mode <i>This pin can be left unconnected if not used</i>
LR	O	3.3V Red LED output, this pin can drive up to 8mA, active low. Connect to a LED cathode through a 470-820R resistor. LED anode connected to power supply. This Red LED indicates is only used in the bootloader mode <i>This pin can be left unconnected if not used</i>
ON	I	ON input, no pull up, no pull down. This pin allows to turn off the breakout board when tied to ground, and turn on the breakout board when tied to Vin. If this feature is not used, this pin can be connected to VI pin. If used, connect to external MCU output, through a pull down resistor to GND.
V3	PO	3.3V regulated output. This pin is the output of the on board 3.3V regulator. It can be used to power an external circuitry requiring 3.3V regulated output. Max current available through this output is about 100mA. <i>This pin can be left unconnected if not used</i> <i>This pin is an output, please do not provide power to this pin.</i>
VI	PI	Power input, connect a power supply (2.0V to 16V, see note 2 below), able to deliver at least 30mA.
GND	P	Ground power input.
TMS	IO	Programming data pin. This IO allows to externally program the breakout board, it should be connected to an external programmer during production. This pin can also be connected to an external MCU if the MCU is able to program the breakout board. <i>This pin can be left unconnected if not used</i>

The information in this document is subject to change without notice

TCK	I	Programming clock pin. This input allows to externally program the breakout board, it should be connected to an external programmer during production. This pin can also be connected to an external MCU if the MCU is able to program the breakout board. <i>This pin can be left unconnected if not used</i>
RX	I	3.3V MIDI Input, connect to external MCU serial port output <i>Max input voltage is 4.1V</i>
RS	I (PU)	Reset input, internal pull up. The breakout board can be reset with this input. It is also used to program the breakout board. It should be connected to an external programmer during production. This pin can also be connected to an external MCU if the MCU is able to program the breakout board. <i>This pin can be left unconnected if not used</i> <i>Max input voltage is 4.1V</i>
SF	I (PD)	Slow / fast input, internal pull down. This input allows control the MIDI baud rate used on TX/RX pins. When connected to 3.3V, a high speed baud rate is used (100 kb/sec), when tied to ground or left unconnected (internal pull up), the baud rate is MIDI 31.25 Kb/sec. This input pin is sampled during boot, it cannot be changed dynamically. To change serial port speed setting, the SF pin should be asserted then a reset cycle should be done (RS pin 1->0->1). <i>This pin can be left unconnected if not used</i> <i>Max input voltage is 4.1V</i>
BT	I (PU)	Button input, internal pull up. This pin is used to connect a push button. When pressed, the button creates a short to Ground. Button behaviour controls different functions of the breakout board, described separately. <i>This pin can be left unconnected if not used</i> <i>Max input voltage is 4.1V</i>
S2	O	Status 2 : this output pin provides information about the bluetooth role used by the breakout board. (0 = peripheral, 1 = central). <i>This pin can be left unconnected if not used</i> <i>Max input voltage is 4.1V</i>
S1	O	Status 1 : this output pin provides information about the bluetooth connection status (0 = Not connected, 1 = Connected). <i>This pin can be left unconnected if not used</i> <i>Max input voltage is 4.1V</i>

*Note 1: Input, O: Output, IO: Input/Output, PI: Power input, PO: Power output
 PU: Pull up, PD: Pull down*

Note 2: Input voltage should be typically 5V. If VI is lower than 3.3V, all IOs will be limited to VI input voltage. An internal LDO converts VI to 3.3V, this 3.3V LDO output is available on V3 output pin.

The information in this document is subject to change without notice

The voltage input range on VI should not exceed 16V, this is true if there is no additional power consumption on V3 output.

In the case of V3 output pin is used to power external parts, the voltage input on VI has to be decreased, according to the following formulas.

$$Pd = (VI - 3.3) * (0.02 + I3)$$

$$(Pd * 180) + Ta < 150$$

with I3 = Current drawn from V3 output pin
Ta = Ambient temperature

Example 1 : If 25mA is requested from the V3 output pin, with an ambient temperature of 30 degrees celsius, the equation results in :

$$Pd = (VI - 3.3) * (0.02 + 0.025) = (0.045 * VI) - 0.1485$$

$$(Pd * 180) + 30 < 150$$

$$Pd < 0.6667$$

$$VI < (0.815 / 0.045)$$

$$VImax = 18.1V$$

VImax must be lower than 16V in all situations

Example 2 : If 55mA is requested from the V3 output pin, with an ambient temperature of 35 degrees celsius, the equation results in :

$$Pd = (VI - 3.3) * (0.02 + 0.055) = (0.075 * VI) - 0.2475$$

$$(Pd * 180) + 35 < 150$$

$$Pd < 0.638$$

$$VI < (0.8863 / 0.075)$$

$$VImax = 11.8V$$

The information in this document is subject to change without notice

FEATURES

- Built in CC2642R single-chip Bluetooth Smart (BLE 4 / 5) System-On-Chip (SOC).
- TX power: -21dBm to 5dBm
- RX sensitivity: up to -105dBm (LE coded PHY)
- Breakout board size: 23.82mm (W) x 29.03mm (L) x 4.3 mm (H) (With Shielding)
- Operating Voltage: 2.0V to 16V
- Maximum input voltage on ON input pin : VI input voltage
- Maximum input voltage on other input pins : 4.1V (3.3V recommended)
- RX current: 6.9mA
- TX current @ 0dBm: 7.4mA
- TX current @ 5dBm: 9.7mA
- Auto-negotiation of the lowest possible connection interval
- Auto-negotiation of the faster PHY 1Mb / 2Mb depending on RSSI
- Auto-negotiation of the largest supported MTU
- Over The Air firmware update
- Support BLE central and peripheral roles
- Support automatic connection with other BLE devices
- Full MIDI implementation available on request
- Support MIDI SYSEXs up to 5K bytes @ lowest BLE connection interval
- Support Unlimited MIDI SYSEX size @ higher BLE connection interval
- Support all MIDI events (SYSEX, Real-time, controllers, ...)
- Support MIDI Running status

ELECTRICAL SPECIFICATION

Max input voltage on VI pin : 16VDC (See note 2 above)

Max input voltage on other pins : 4.1VDC

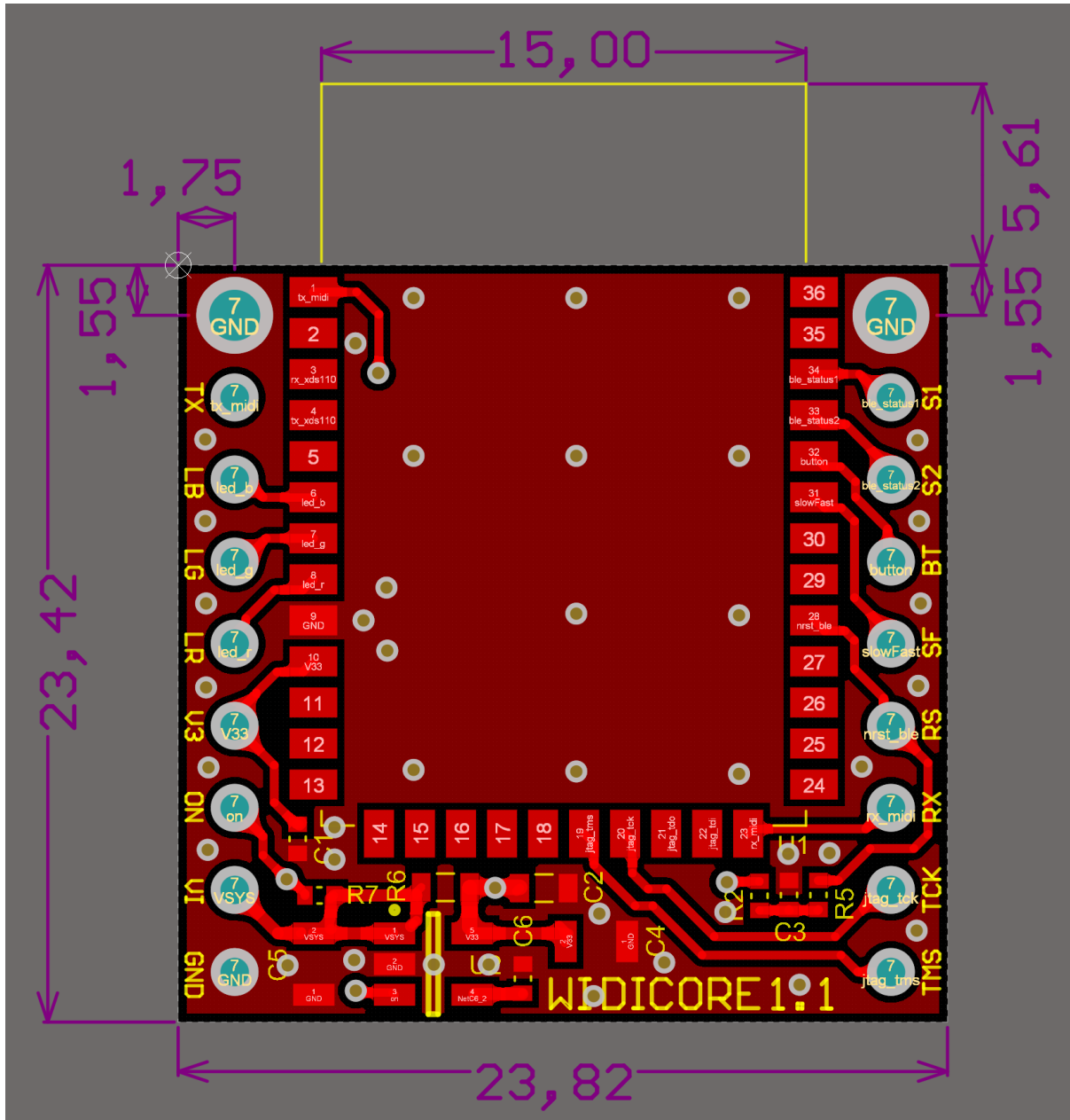
Quiescent input current (ON = GND) : TBD

Average input current (ON = Unconnected) : TBD

LEDs outputs (LR, LG, LB) maximum current : 8mA

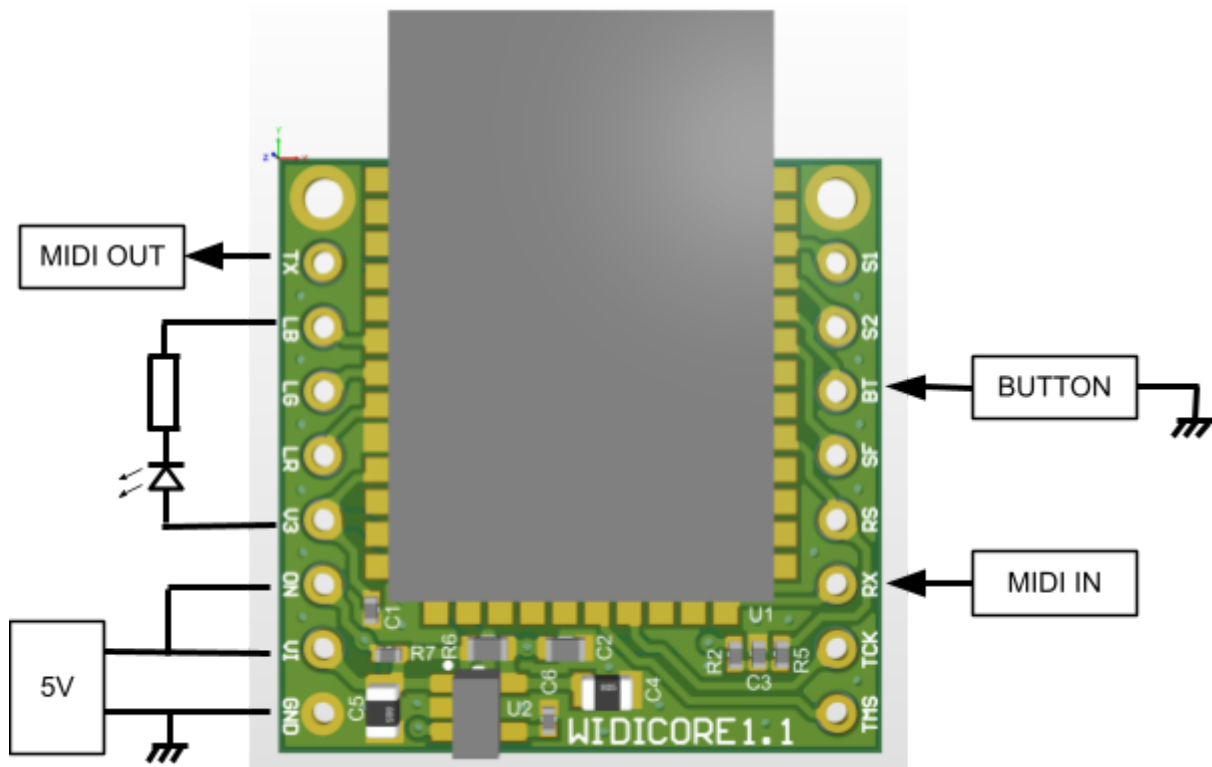
The information in this document is subject to change without notice

DIMENSIONS



The information in this document is subject to change without notice

TYPICAL APPLICATION



The information in this document is subject to change without notice

LEDs BEHAVIOUR

Red (LR)	Green (LG)	Blue (LB)	Description
Blink	Blink	Off	Booting to bootloader mode
Off	Blink	Off	Upgrading firmware
Off	Off	Blink	Bluetooth is advertising or scanning
Off	On	On	Bluetooth is connected, WIDICore is central
Off	Off	On	Bluetooth is connected, WIDICore is peripheral

BUTTON BEHAVIOUR

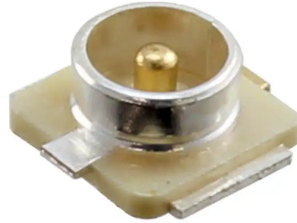
Press & hold during boot	Press & hold during normal operation	Description
< 7sec		Reset settings to factory defaults and erase all existing bonds
> 7sec		Reboot the WIDICore in bootloader mode
	> 3sec	Force WIDI to BLE peripheral mode and disconnect any existing connection.

RECOMMENDED EXTERNAL ANTENNA (for CME-WIDI-CoreX only)

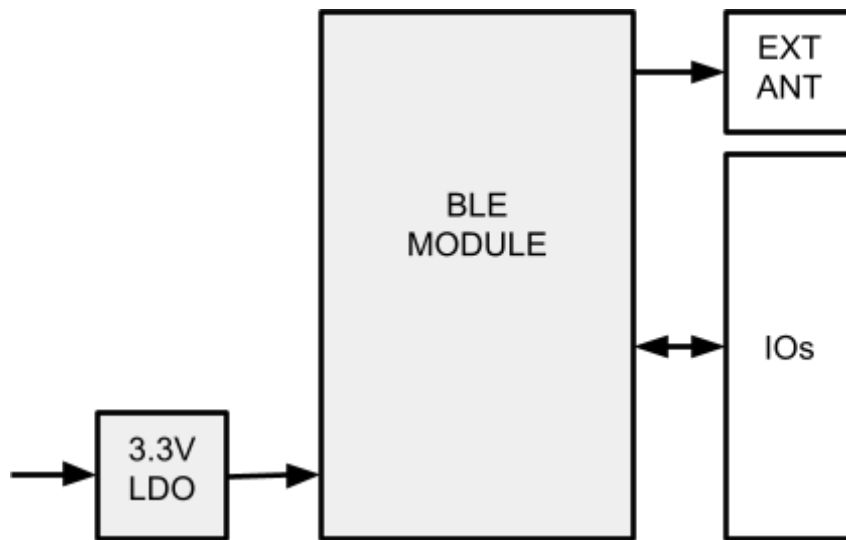
Rod Antenna	Flex Antenna
<ul style="list-style-type: none"> - Frequency range: 2400~2500MHz - Peak gain: 2.8dBi - Radiation type: Omni-directional - Polarization: Linear, vertical - Nominal impedance: 50 ohm - Require SMA to IPEX connection cable 	<ul style="list-style-type: none"> - Frequency range: 2400~2500MHz - Peak gain: 3.7dBi - Radiation type: Omni-directional - Polarization: Linear, vertical - Nominal impedance: 50 ohm
Datasheet can be downloaded at https://www.dropbox.com/s/e2tnto7pzbf9sdk/Rod_Antenna.pdf?dl=0	Datasheet can be downloaded at https://www.dropbox.com/s/w3ro4wa7ndevmv7/Flex_Antenna.pdf?dl=0

The information in this document is subject to change without notice

Note: Antenna connector (2mm diameter) used on WIDI Core X is U.FL-R-SMT-1 from Hirose



WIDI CORE BLOCK DIAGRAM



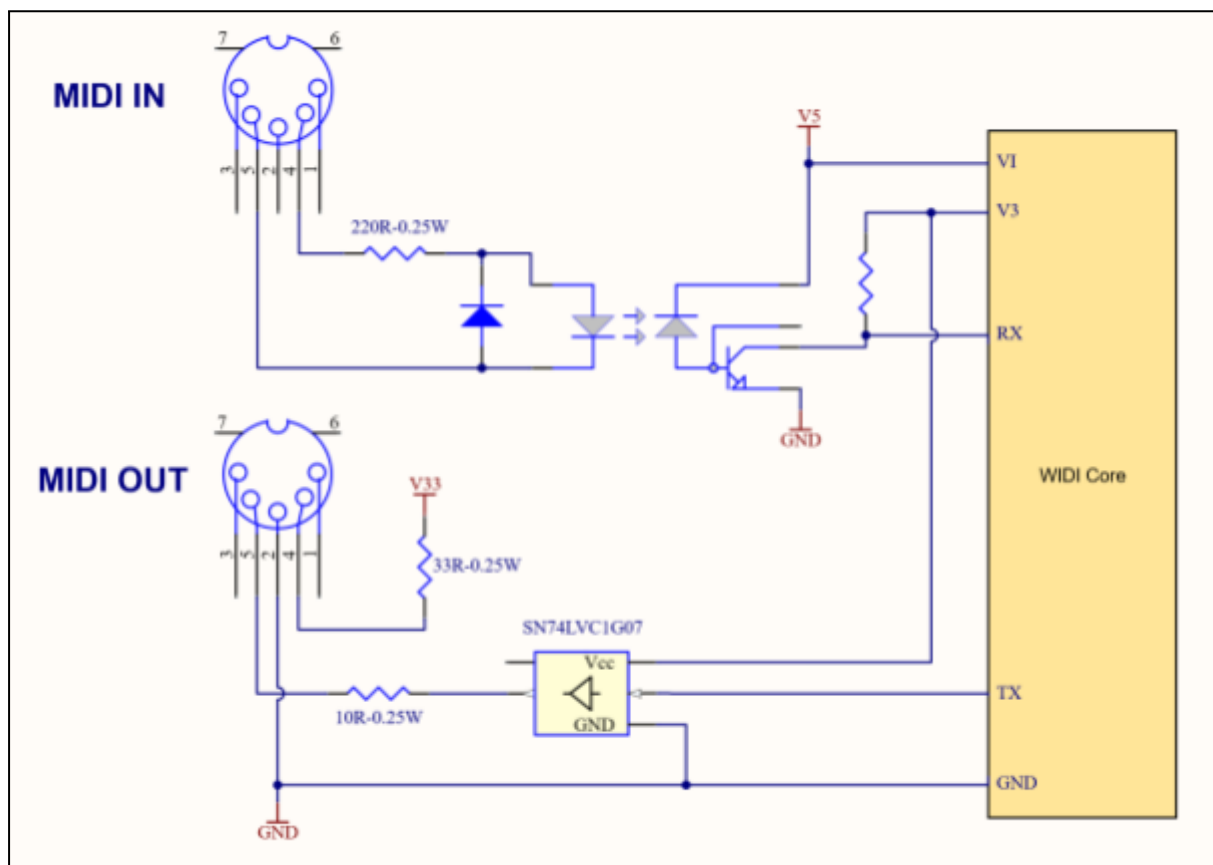
The information in this document is subject to change without notice

CONNECTING WIDI CORE TO MIDI DIN CONNECTORS

The WIDI Core was designed to be connected to a MCU UART with 3.3V IOs, MIDI connectors should not be connected directly to the WIDI Core, especially when MIDI is specified for 5V operations.

Open-drain buffer is recommended to connect WIDI Core to MIDI Out connector.

Below a suggested circuit to interface the WIDI Core to standard MIDI connectors. Opto-isolator is powered from a 5V power supply (Same as WIDI Core), its output is pulled up to 3.3V (From WIDI Core 3V output), so the RX input is driven with GND / 3.3V only, as maximum input voltage on inputs is limited to 4.1V



The information in this document is subject to change without notice

DOCUMENT HISTORY

V1.1

- Updated WIDI Core photos with latest HW version
- Updated LEDs output active states from high to low (LB, LG, LR)
- Updated product dimensions

V1.2

- Added external antenna information
- Updated drawing in page 8

V1.3

- Added block diagram
- Updated UART to 100Kb/sec when configured in high speed mode
- SF is now with pull down instead of pull up. Reverted SF setting
- Added schematics to interface with MIDI connectors
- Added reference of WIDI Core X antenna connector

V1.4

- Added maximum input voltage on input pins

V1.5

- Added guidelines about input voltage range on VI

V1.6

- Added maximum input voltage for ON pin

The information in this document is subject to change without notice