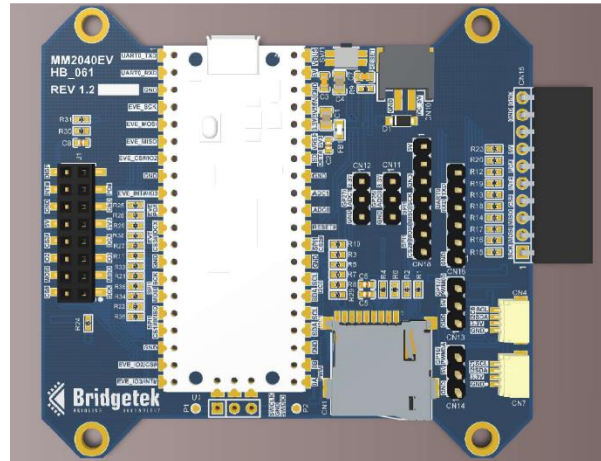


MM2040EV PICO Adapter Board Datasheet



1 Introduction

The MM2040EV PICO Adapter board consists of a PICO module which acts as the main MCU to control a supported BRT EVE Module (listed in Table 3) as well as the peripheral devices connected through the corresponding connectors.

1.1 Features

- Raspberry Pi PICO module mounted on board
- 1x Micro-B USB port on PICO module for power, communication & programming.
- 2x compatible BRT EVE module interfaces through 10 position right angle connector or 2x8-16 position back entry connector
- Several male pin header connectors exposed for
 - 2x ADC peripheral interfaces
 - 2x PWM peripheral interfaces
 - 1x SPI peripheral interface
 - 1x UART peripheral interface
- 1x Micro-SD card socket
- 2x Stemma QT (QWIIC) I2C peripheral interfaces
- 1x 2pin-JST connector for DC 5V power supply input or the module could also be powered up through Micro-B USB port on PICO module or by BRT EVE Module through the connector interfaces.
- 1x Hardware RESET button

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2 Ordering Information

Part No.	Description
MM2040EV	RP2040 EVE controller board

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3 Electrical Characteristics

3.1 Recommended Operating Conditions

Parameter	Description	Minimum	Typical	Maximum	Units
VDD_5V	Power Supply	4.5	5.0	5.5	V
T	Operating temperature range	-20	-	+85	°C

Table 1 - MM2040EV PICO Adapter Board Operating Parameters

3.2 Electrical Parameters

Parameter	Description	Minimum	Maximum	Units	Conditions
V _{OH}	Output Voltage High	2.62	VDD_3V3	V	I source = 2, 4, 8 or 12mA depending on setting
V _{OL}	Output Voltage Low	0	0.5	V	I sink = 2, 4, 8 or 12mA depending on setting
V _{TH}	Input Voltage High	2	VDD_3V3 + 0.3	V	
V _{IL}	Input Voltage Low	-0.3	0.8	V	
V _{HYS}	Input Hysteresis Voltage	0.2	-	V	Schmitt Trigger enabled
R _{PU}	Pull-Up Resistance	50	80	kΩ	
R _{PD}	Pull-Down Resistance	50	80	kΩ	
I _{IO_Source_MAX}	Maximum Total IO source current	-	50	mA	Sum of all current being sourced by GPIO and QSPI pins
I _{IO_Sink_MAX}	Maximum Total IO sink current	-	50	mA	Sum of all current being sunk into GPIO and QSPI pins

Table 2 - MM2040EV PICO Adapter Board I/O Pin Characteristic

4 Hardware Description

4.1 Board Layout

The MM2040EV PICO adapter board is a two-layer printed circuit board with key elements as shown in Figure 1.

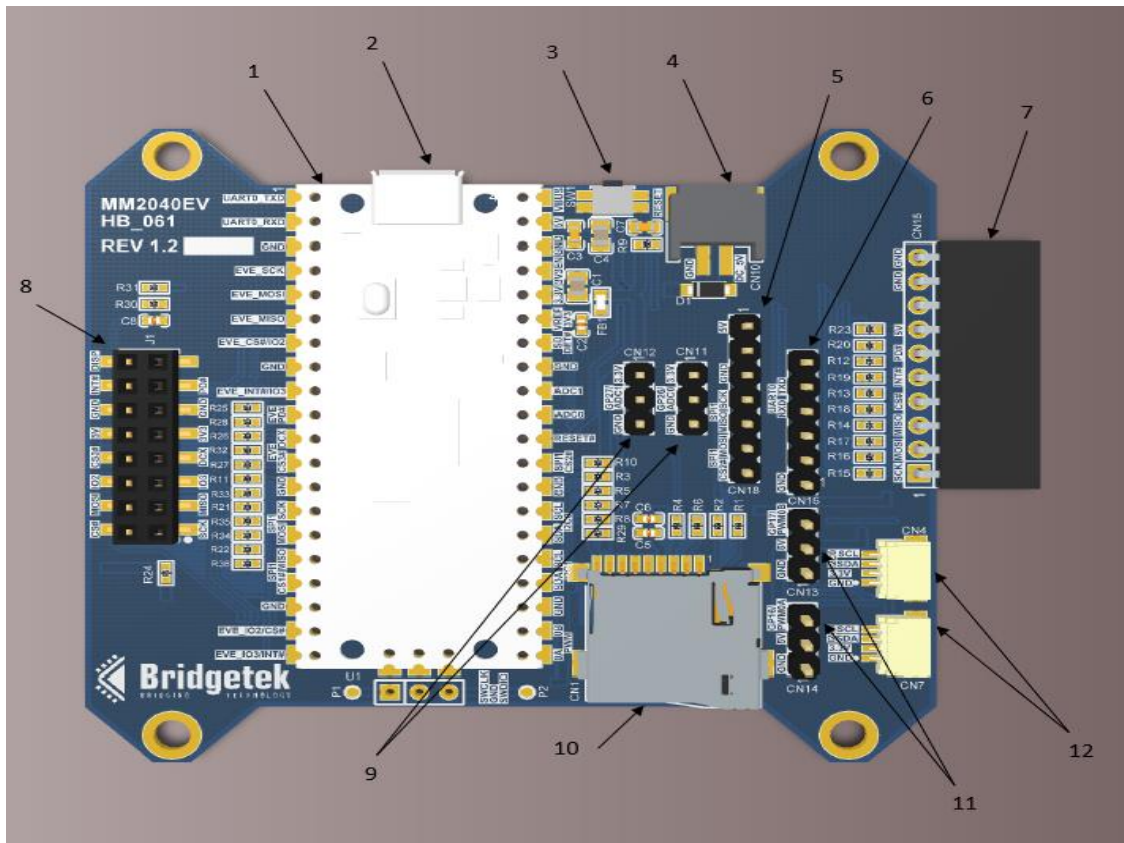


Figure 1 - MM2040EV PICO Adapter Board's Top View

Key Features:

1. Raspberry Pi PICO module
2. Micro-B USB connector
3. Hardware Reset Button
4. 2-position male JST DC connector for 5V DC input
5. 7-position vertical pin header connector (male) for SPI peripheral interface
6. 6-position vertical pin header connector (male) for UART peripheral interface
7. 10-position right angle header connector (female, CN15) for SPI peripheral interface to BRT EVE Module (Note 1)
8. 2x8-position back entry header connector (female, J1) for SPI peripheral interface to BRT EVE module (Note 1)
9. Two 3-position vertical pin header connectors (male) for ADC peripheral interface
10. Micro-SD card socket
11. Two 3-position vertical pin header connectors (male) for PWM peripheral interface
12. Two 4-position 1mm pitch JST connectors (Stemma QT/ QWIIC) for I2C peripheral interface

Note 1:- Table 3 contains the supported BRT EVE module list.

No.	Connected through	Targeted Eve Module
1	J1	ME810A-HV35R
2		ME812A-WH50R
3		ME813A-WH50C
4		ME817EV
1	CN15	VM800C50
2		VM800B35/43/50
3		VM801B43/50
4		VM810C50
5		VM816C50

Table 3 - BRT Eve Module Supported List

4.2 Power supply

There are various options for easily powering the MM2040EV PICO Adapter board from a 5V USB supply through a Micro-B USB connector or 5V DC supply input from 2-pin JST connector **CN10**, or the 5V supply from BRT EVE module through the respective connectors, **J1** or **CN15**.

Note: Users should check the maximum current provided by their chosen power source to ensure it can supply sufficient current for the overall consumption of their EVE module and peripherals.

This 5V supply is the main power supply for the system and will be fed to the RT6150 buck-boost Switched-Mode Power Supply (SMPS) IC which is on board of PICO module to generate a fixed 3.3V output for the RP2040 IC and those peripheral's 3.3V supply.

4.3 Raspberry Pi PICO module and its MCU

Raspberry Pi PICO module is designed based on Raspberry Pi RP2040 micro-controller unit (MCU) with the following key features:

- RP2040 microcontroller with 16M-bit (2M-byte) Flash
- Micro-B USB port for power, data and for reprogramming the Flash; reprogramming the Flash can be done by simply dragging and dropping a file onto the Pico which appears as a mass storage device.
- 26 multi-function 3.3V General Purpose I/O (GPIO) with 23 GPIOs being digital-only and 3 ADC capable GPIOs.
- 3-pin ARM Serial Wire Debug (SWD) port; the standard Serial Wire Debug (SWD) port can reset the system and load and run code without any button presses as well as for debugging purpose.

For full details of the Raspberry Pi PICO module, please see the [Raspberry Pi Pico datasheet](#) while for full details of RP2040 microcontroller, please see the [RP2040 Datasheet](#).

4.4 The Connectors & Hardware Reset Button

The connectors and the hardware reset button are described in the following sections.

Note: All GP(IO)s stated as below can also be configured as PIO or PWM.

- **CN1** is the Micro SD card socket which is supporting SPI-single mode. The physical interface supports the card detection.
- **CN4 & CN7** are the Stemma QT/ QWIIC connectors for power (3.3V) and I2C interface.

Pin No.	Name	Type	Description	Pin Configurable Function
1	GND	P	Ground	-
2	VDD_3V3	P	DC power supply (3.3V)	-
3	CN4: I2C0_SDA CN7: I2C1_SDA	I/O	I2C Serial Bus, Data Line	CN4: GP20/I2C0_SDA CN7: GP18/SPI0_SCK/I2C1_SDA
4	CN4: I2C0_SCL CN7: I2C1_SCL	O	I2C Serial Bus, Clock Line	CN4: GP21/I2C0_SCL CN7: GP19/SPI0_TX/I2C1_SCL

Table 4 - CN4 & CN7 Pinout

- **CN10** is the 2-position male JST DC connector for 5V power input to the board. Alternative to Micro-B USB connector or BRT EVE module through the respectively connectors, **J1** or **CN15**.

Pin No.	Name	Type	Description
1	DC_5V	P	DC power supply (5V)
2	GND	P	Ground

Table 5 - CN10 Pinout

- **CN11 & CN12** are the 3-position vertical pin header connectors for power (3.3V) and ADC input or it could also be configured as GPIO port.

Pin No.	Name	Type	Description	Pin Configurable Function
1	VDD_3V3	P	DC power supply (3.3V)	-
2	GND	P	Ground	-
3	CN11: GP26/ADC0 CN12: GP27/ADC1	I	CN11: by default, it is ADC0 input; CN12: by default, it is ADC1 input.	CN11: GP26/ADC0/I2C1_SDA CN12: GP27/ADC1/I2C1_SCL

Table 6 - CN11 & CN12 Pinout

- **CN13 & CN14** are the 3-position vertical pin header connectors for power (5V) and PWM output or it could also be configured as GPIO port.

Pin No.	Name	Type	Description	Pin Configurable Function
1	GND	P	Ground	-
2	VDD_5V	P	DC power supply (5V)	-
3	CN13: GP17/PWM0B CN14: GP16/PWM0A	O	CN13: by default, it is PWM0B output CN14: by default, it is PWM0A output	CN13: GP17/SPI0_CS#/I2C0_SCL/UART0_RX CN14: GP16/SPI0_RX/I2C0_SDA/UART0_TX

Table 7 - CN13 & CN14 Pinout

- **CN16** is the 6-position vertical pin header connector for UART interface which is compatible with USB to TTL serial UART converter cable, TTL-232R-3V3 cable.

Pin No.	Name	Type	Description	Pin Configurable Function
1	GND	P	Ground	-
2	-	-	NC	-
3	-	-	NC	-
4	UART0_RXD	I	Receive Asynchronous Data input	GP1/SPI0_CS#/I2C0_SCL/UART0_RX
5	UART0_TXD	O	Transmit Asynchronous Data output	GP0/SPI0_RX/I2C0_SDA/UART0_TX
6	-	-	NC	-

Table 8 - CN16 Pinout

- **CN18** is the 7-position vertical pin header connector for power (5V) and SPI interface & this SPI bus signals are shared with Micro-SD card.

Pin No.	Name	Type	Description	Pin Configurable Function
1	VDD_5V	P	DC power supply (5V)	-
2	-	-	NC	-
3	GND	P	Ground	-
4	SPI1_SCK	O	SPI1 clock output	GP10/SPI1_SCK/I2C1_SDA
5	SPI1_MISO	I	SPI master input, slave output.	GP12/SPI1_RX/I2C0_SDA/UART0_TX
6	SPI1_MOSI	O	SPI master output, slave input.	GP11/SPI1_TX/I2C1_SCL
7	SPI1_CS2#	O	SPI Chip Select output for external SPI peripheral device, active low. On board 10kΩ pull-up to 3.3V.	GP22

Table 9 - CN18 Pinout

- **J1** & **CN15** are the 2.54mm pitch female header connectors special dedicated for the connection to BRT EVE modules which listed in Table 2 and Table 3 respectively.

The entire pin mapping on **J1** is listed in Table 8.

Pin No.	Name	Type	Description	Pin Configurable Function
1	MA_SCK	O	SPI clock output	GP2/SPI0_SCK/I2C1_SDA
2	MA_CS#	O	SPI Chip Select output for EVE Controller IC, active low. On board 10kΩ pull-up to 3.3V.	GP5/SPI0_CS#/I2C0_SCL/UART1_RX
3	MA_MISO	I/O	SPI master input, slave output or QSPI IO1	GP4/SPI0_RX/I2C0_SDA/UART1_TX
4	MA_MOSI	I/O	SPI master output, slave input or QSPI IO0	GP3/SPI0_TX/I2C1_SCL
5	MA_IO3	I/O	QSPI IO3	GP15/SPI1_TX/I2C1_SCL
6	MA_IO2	I/O	QSPI IO2	GP14/SPI1_SCK/I2C1_SDA
7	MA_DCX	O	LCD panel data / command selection pin Low: Command High: Parameter On board 10kΩ pull-up to 3.3V.	GP8/SPI1_RX/I2C0_SDA/UART1_TX
8	MA_CS3#	O	LCD panel SPI chip select, active low. On board 10kΩ pull-up to 3.3V.	GP9/SPI1_CS#/I2C0_SCL/UART1_RX
9	VDD_3V3	P	3.3V power supply	-
10	VDD_5V	P	5V power supply	-
11	GND	P	Ground	-
12	GND	P	Ground	-
13	MA_PD#	O	EVE controller IC's powers down output, active low. On board 10kΩ pull-up to 3.3V.	GP7/SPI0_TX/I2C1_SCL
14	MA_INT#	I	Host interrupts input, active low. On board 10kΩ pull-up to 3.3V.	GP6/SPI0_SCK/I2C1_SDA
15	-	-	NC	-
16	MA_DISP	-	LCD display reset. On board 10kΩ pull-low to GND.	-

Table 10 - J1 Pinout

The entire pin mapping on **CN15** is listed in Table 9.

Pin No.	Name	Type	Description	Pin Configurable Function
1	MA_SCK	O	<i>SPI Clock output</i>	GP2/SPI0_SCK/I2C1_SDA
2	MA_MOSI	I/O	SPI-Single mode: SPI master output, slave input SPI-Dual mode: SPI data line 0	GP3/SPI0_TX/I2C1_SCL
3	MA_MISO	I/O	SPI Single mode: SPI master input, slave output SPI Dual mode: SPI data line 1	GP4/SPI0_RX/I2C0_SDA/UART1_TX
4	MA_CS#	O	SPI Chip Select Output, active low. On board 10kΩ pull-up to 3.3V.	GP5/SPI0_CS#/I2C0_SCL/UART1_RX
5	MA_INT#	I	Host interrupt input, active low. On board 10kΩ pull-up to 3.3V.	GP6/SPI0_SCK/I2C1_SDA
6	MA_PD#	O	EVE controller IC's powers down output, active low. On board 10kΩ pull-up to 3.3V.	GP7/SPI0_TX/I2C1_SCL
7	VDD_5V	P	5V power supply	-
8	-	-	NC	-
9	GND	P	Ground	-
10	GND	P	Ground	-

Table 11 - CN15 Pinout

- **SW1** is the hardware reset button & could be used to reset MCU RP2040 on Raspberry Pi PICO module.

5 Board Schematic

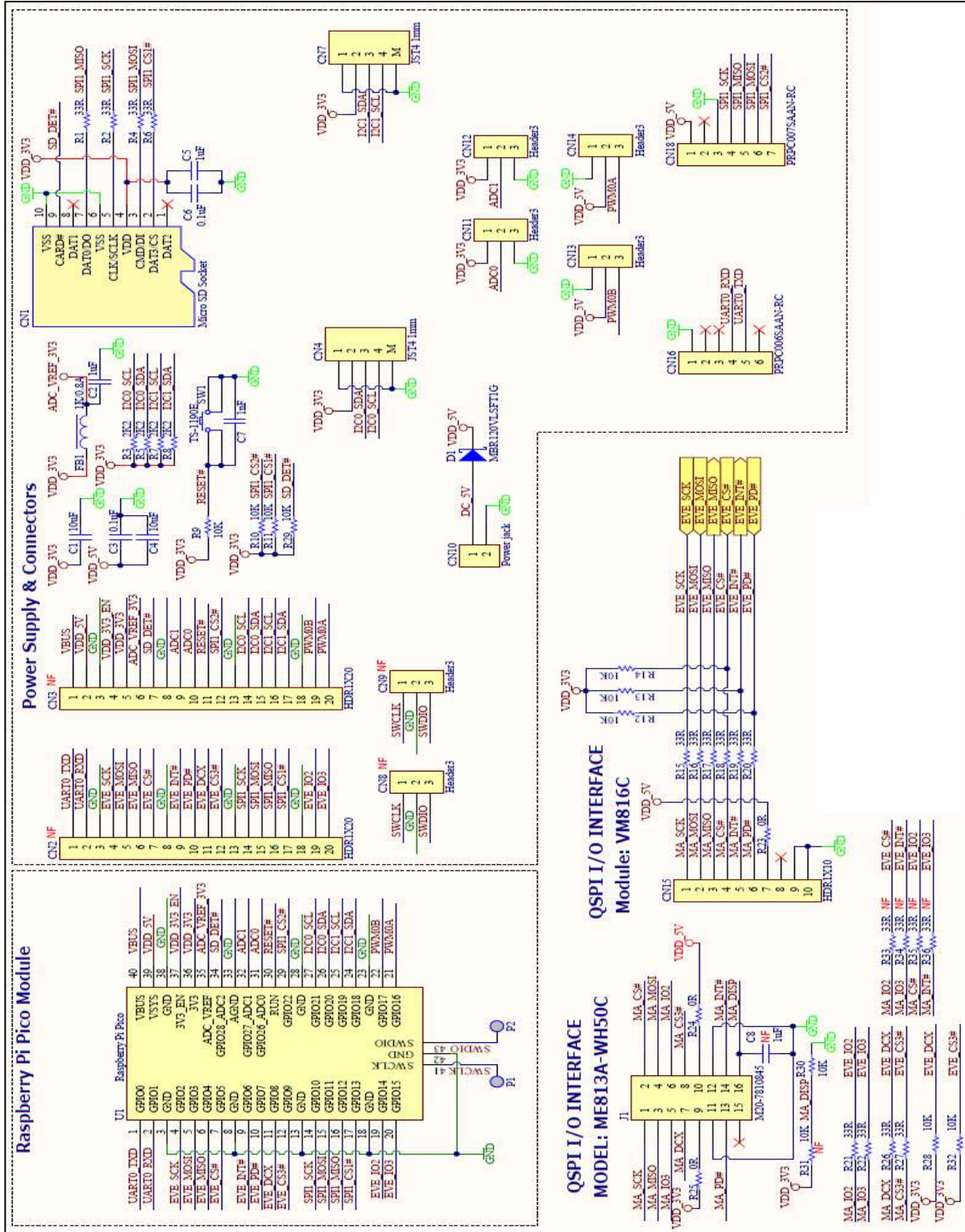


Figure 2 - MM2040EV PICO Adapter Board's Schematic

6 Mechanical Dimensions

6.1 MM2040EV PICO Adapter Board PCB Dimensions

All units are in millimeters (mm).

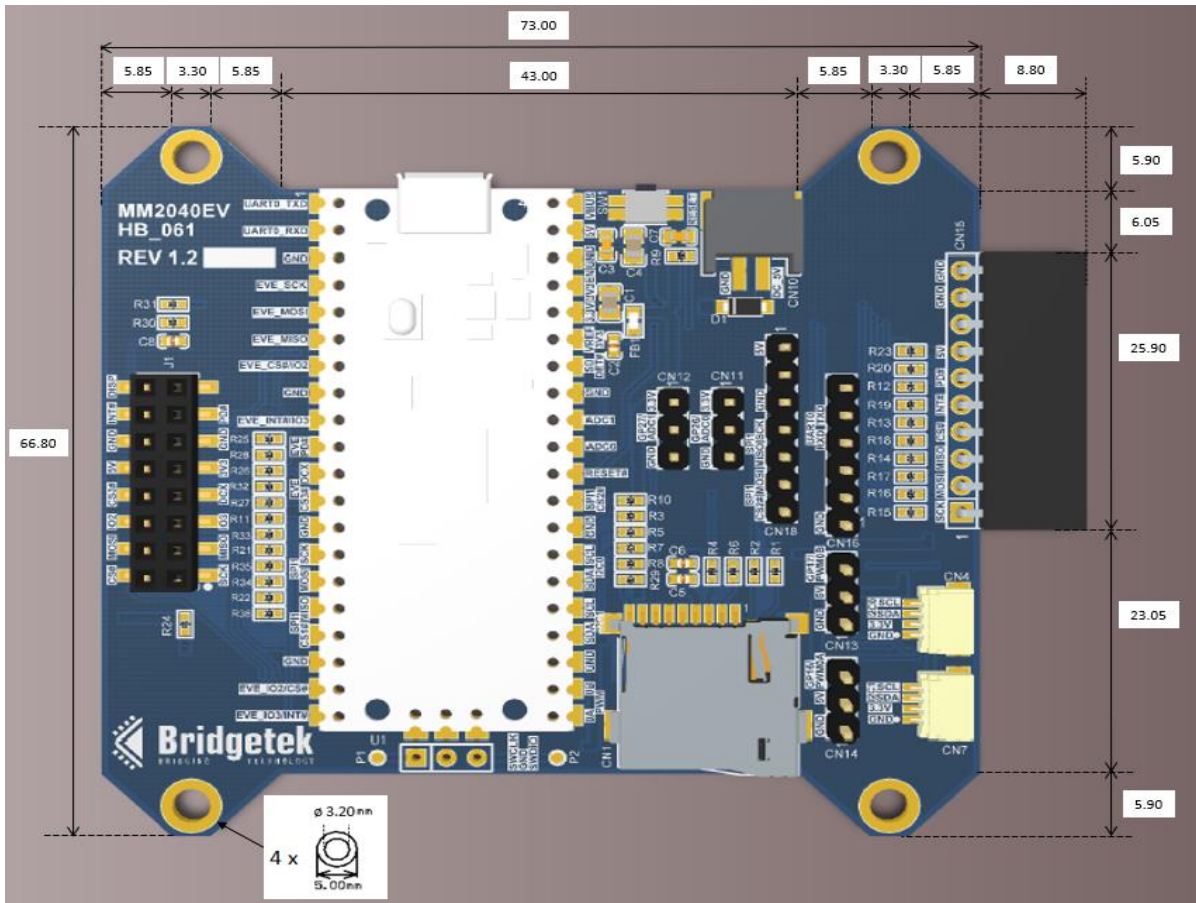


Figure 3 – MM2040EV PICO Adapter Board PCB Dimensions (Top view)

7 Software Setup Information

- Raspberry Pi PICO module is fully supported not only with C/C++ SDK & an official MicroPython port but also with a CircuitPython port. For this evaluation board, CircuitPython is recommended as it is an easier way to get started.
- Below is the link which provides the sample code & libraries to run the EVE module with MM2040EV PICO Adapter Board in CircuitPython.
 - [pico-bteve github link](#)
- Visit BRT's website at <https://brtchip.com/eve/> for more information regarding the EVE module & its toolchain.

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Appendix A – References

Document References

[Raspberry Pi Pico datasheet](#)

[RP2040 Datasheet](#)

Acronyms and Abbreviations

Terms	Description
ARM	Acorn RISC Machine
DC	Direct Current
EVE	Embedded Video Engine
IC	Integrated Circuit
I2C	Inter-Integrated Circuit
MCU	Micro Controller Unit
PWM	Pulse Width Modulation
SPI	Serial Peripheral Interface
SWD	Serial Wire Debug
SMPS	Switched Mode Power Supply
TTL	Transistor-transistor Logic
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver-Transmitter

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Appendix C – Revision History

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Version 1.0	Initial Release	29-06-2021