Elementino

Elementino is a small board, the same size as the Elemento with which it shares several attributes. It uses surface mount technology for most of the components. The resistors, capacitors etc. are all 1206 size so are not particularly difficult, but the HDMI and (in particular) the QWIIC connectors are more challenging.

I decided to drop the option of using optional VGA video because of the possibility of poor connections, especially whem using HDMI. This has meant dropping the option of using RP2040-based MCUs unless an adaptor is used.

Note that this is not compatible with the Pico Computer 3 system designed by Peter Mather. It uses a 40-pin MCU module which cannot produce or accept signals on the same GPIO pins. However, the HDMI output uses the same pin connections and resistor values so it should work with a VGA adapter intended for that system. There is also no need to use OPTION HDMI PINS as the defaults are used.

Elementino is intended to make use of Bluetooth for keyboard, mouse and controller connections. I2S audio is provided as a Line out signal and a front panel headphone socket. You can use Bluetooth audio for speakers or headphones instead if you wish. There is a single front panel USB socket (micro USB or USB-C depending on the MCU) but by default the 5V supply from it is disabled. It can be enabled to allow the use of a USB hub or similar. This socket is also used for firmware installation and updates.

The board was designed specifically for the PicoMiteHDMIBTH version of the firmware. You could also use the PicoMiteWEB version if the reduced HDMI capability is acceptable and you need Wi-Fi. It supports Bluetooth LE and standard keyboards, mice, game controllers and speakers. It also supports USB devices including USB touch screens.

When using Elementino please note that the power button operation depends on the state of charge in C1. It requires a second or two to recharge after being switched off so you can’t do a quick power off/power on to do a fast reset like you can with a mechanical switch. On the other hand, this circuit is bounce-free, can switch an appreciable current, has very low voltage drop and puts no load on the button contacts.

Note that, because Elementino uses custom pins for the CYW43, GP25 (driving the on-board LED) is still available to the user. It is bypassed by the red GP25 LED but you will probably stiil see a glimmer from the on-board LED. The Heartbeat function is taken over by the RF ON LED controlled by the CVW43 and not by the Heartbeat commands of MMBasic.

Bill of Materials

B1	CR2032	Battery & holder - see note
C1	100n	1206 ceramic capacitor
C2	100n	1206 ceramic capacitor
C3	1uF	1206 ceramic capacitor
C4	10uF	1206 MLCC capacitor
C5	10uF	1206 MLCC or tantalum capacitor
C6	100n	1206 ceramic capacitor
C7	100n	1206 ceramic capacitor
D1	RED LED	1206 LED
D2	BLUE LED	1206 LED
D3	diode	1206 Schottky low current type
H1	6-way	0.1in female socket header
H2	6-way	0.1in female socket header
	Strip of 5 0.1in male header pins for U3	
	Male and female headers for U2 if required	
LK1	OFF	PCB configuration link
LK2	closed	PCB configuration link
Q1	AO3400	N-channel mosfet
Q2	AO3401	P-channel mosfet
R1	100K	1206 resistor
R2	330K	1206 resistor
R3	220R	1206 resistor
R3	100K	1206 resistor
R4	220R	1206 resistor
R5	2R2	1206 resistor
R6	1K	1206 resistor
R7	6K8	1206 resistor
R8	6K8	1206 resistor
R9	10K	1206 resistor
R10	470R	1206 resistor
R11	10k	1206 resistor
R12	220R	1206 resistor
R13	220R	1206 resistor
R14	220R	1206 resistor
R15	220R	1206 resistor
R16	220R	1206 resistor
R17	220R	1206 resistor
R18	220R	1206 resistor
R19	220R	1206 resistor

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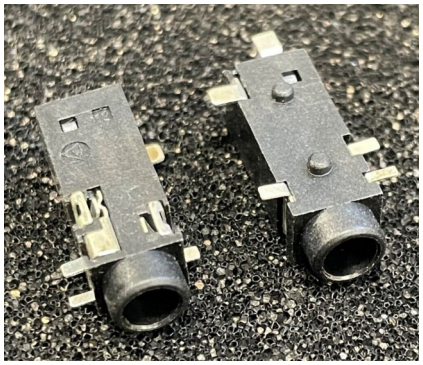
S1	B3F-315n	Horizontal 6x6 tactile switch c/w B32cap
S2	tactile switch	4.5x4.5mm side actuating

SK1	HDMI PCB socket	
SK2	TFP09-2-12B	push-push micro SD card socket
SK3	3.5mm jack	RS 705-1490
SK4	JST RM2.0	4-pin vertical QWIIC socket
SK5	JST RM2.0	4-pin vertical QWIIC socket

U1	CP2102	USB-C to UART converter module
U2	Pico 2	see notes
U3	mini RTC	Mini RTC for Raspberry Pi
U4	PCM5102	I2S audio module
U5	RM2	Raspberry Pi Radio Module

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U1</td>
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U3</td>
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U4</td>
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SK1</td>
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SK2</td>
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Notes

The MCU can be any of several types with varying facilities available.

	Socket or headers needed	**PSRAM available**	**RM2 needed**
Pico 2	optional	No	If BT or Wi-Fi needed
Pico 2W	Yes	No	no
Pico 2 + RM2	optional	No	--
Pimoroni Pico Plus 2 W	Yes	Yes	no
Waveshare RP2350B-Plus-W	Yes	DIY	no

The most reliable and consistent results will usually be obtained using the Pico 2 and Pico 2W but, as shown above, these do not provide PSRAM.

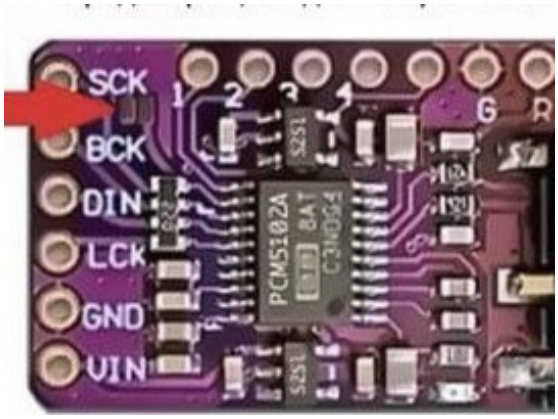
The RTC used is intended for plugging into the GPIO of a Raspberry Pi. It's a very good little module with an on-board battery. Unfortunately you don't know the state of the battery when buying these modules and it is soldered in. Spare batteries do not appear to be available. I strongly recommend unsoldering the battery and running a piece of wire from the closest battery pad to the header round and up to the spare pin of the module (next to the – pin). This allows the CR2032 external battery to be used, which has a longer life and is easily replaceable.

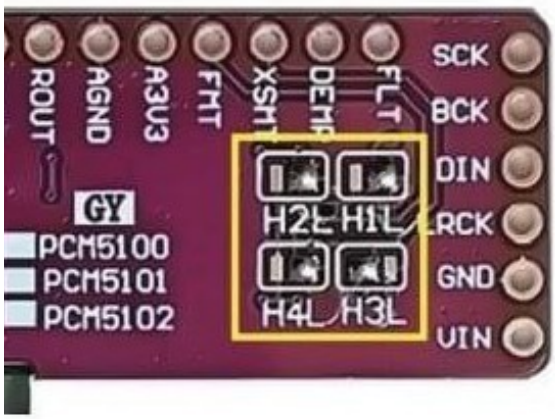
I found the QWIIC connectors to be particularly fiddly to mount. It might be an idea to solder these at an early stage, before too many other components make things even more difficult.

To work correctly D1 must have a forward voltage drop of 1V8 or less, hence red.
If surface mounting the Pico put some Kapton tape in the areas marked on the PCB. In all probability you won't need it, but it's safer to use it than discover that you have a mysterious short circuit later. To solder the GP25 connection clean the PCB and Pico pad with isopropyl alcohol, tin both surfaces then remove the solder with solder wick to leave a clean, shiny, flat surface. Apply some flux then put the Pico in position and solder some of the pins. Make sure the Pico is flat againt the PCB. Apply some solder to the GP25 pad under the board, heat it for a few seconds and some solder will be sucked into the hole to make the connection.

The I2S module is mounted "upside down" with the components on the bottom. The four solder blob links are on top. Don't have the iron too hot when blobbing these, it is a bit too easy to lift the pads!

The pads on the I2S module have to have solder blob links in these positions





Immediately behind the I2S module there is a space for a M2.5 x 15mm hex spacer. This is to take some of the force off the connections when a jack plug is plugged in. It’s purely optional.