

Through-hole version of the Reference Design by Peter Mather

PCB design by MIXTEL90

MMBasic by Geoff Graham & Peter Mather

Reference system design for SMD assembly by Peter Mather

PicoMite 2350 - "The Silver Pineapple"

With the exception of the micro SD card socket (which I couldn't avoid due to space reasons) there are no essential surface mount components.

The Reset button and the Audio socket have been reversed, front to back. Only my preference!

Some changes have been made to Peter's design:

Important differences:

- The connections to the DVI/HDMI are different. This means that a different OPTION HDMI has to be used. Due to the necessary positioning of components on the PCB it proved to be very difficult to keep compatibility here while keeping trace lengths approximately the same.
- There is no power switch (see later note).
- There is no externally accessible programming socket The case has to be opened and, depending on the connector, the front panel may have to be removed. However, this is only necessary when installing or upgrading MMBasic. Peter's design also necessitates opening the case to remove the USB hub isolating links.
- Audio noise reduction uses VHF ferrite beads rather than inductors (because I already have them!).

The following are optional changes and can be omitted:

- A bi-colour LED is included, The Red side is controlled by the GP25 output from the Pico, the other side is fed from 3V3 via a resistor. (I had to do something to make up for the lack of pretty lights!). The red LED replaces the on-board green one on the Pico so it is using no additional IO.
- An optional LM4040 can be fitted to provide a 3V ADC reference, together with a jumper to disconnect it.
- An optional JDY-41 serial & remote control module can be fitted. This uses GP0, GP1 (COM1) and GP23 if it is fitted. Set mode can be entered from software. When used as a remote control receiver it can detect up to 8 switches feeding a similar device elsewhere. Both key down and key up are detected. It can also be used as a transparent RF serial port at up to 38400 baud.
- The 5V output to the DVI socket and the 3V3 supply to the GPIO port are protected by solid state fuses. These will carry their rated current value and trip at twice that current. If these are not required they can be linked out.
- The audio output is DC isolated by C14 and C15 and then reduced in level by R7/R9 and R8/R10. These can all be changed to suit your requirements.

With the above exceptions this version is as compatible as possible with the Reference Design. If the optional JDY-41 is omitted all GPIO pins are used in the same way and the GPIO port is pin compatible. It uses the same size PCB and fits the same case, but the front and rear panels are obviously different.

ASSEMBLY NOTES

As usual, start by mounting the lowest components first and working your way up to the highest ones. If you don't follow this sequence assembly can get very difficult in the later stages.

Ideally the ferrite beads should be threaded onto insulated wire as they are uninsulated, but they are not very conductive anyway. Some insulation will reduce any mechanical rattling. FB1 and FB2 are threaded onto the resistor leads.

When connecting to TP4 and TP5 on the Pico, to get access to GP23 and GP25 respectively, there are several options available.

1. The wires can be soldered to the pads and dropped through the hole in the pcb then, with a little slack, soldered to the PCB pads.
2. Single core wire can be soldered to the pads and dropped through the PCB pads before soldering there.
3. The wires from the pads can be twisted together and terminated in a 2-way female Dupont socket and plugged onto a male header (position marked on the PCB),
4. The male header pins on the Pico and the sockets can be extended to 21 on each side, making it a 42-pin assembly. The TP pads on the Pico are then wired to the additional male header pins. This has the advantage that the Pico can still be unplugged easily and the board is left compatible with any other Pico except that GP23 and GP25 are missing. Also, the removed assembly can still be plugged into a breadboard.

The PCB modules are mounted by "staking" them with short pieces of bare wire. It's a good idea to raise them up from the PCB slightly as it makes it a little easier to remove them if necessary. Note, though, that the USB-C to TTL converter and the Adafruit DVI/HDMI module have to be mounted flat to the PCB for strength..

H4 is soldered to the USB hub prior to mounting it. The PCB holes beneath it are only to clear the bottom side of the connection.

The USB hub and the Pico are linked by a short single pair wire connecting the two. This is terminated in a "mini" micro USB plug at one end and a Dupont connector at the other. Only the two data wires are needed. When programming you simply remove the link and plug the PC lead directly into the Pico. This will then power the board and make the necessary data connections while isolating the hub connections.

A piece of good quality double-sided tape under the USB-C to TTL converter will help take the strain from the connections. They aren't too bad as they are in shear, but every little helps!

I suggest that, when mounting the USB hub, you mount it a few mm above the board. These are very difficult to remove later otherwise, should you need to do so.

There is no power switch, and this is deliberate. When you disconnect the 5V output from the USB-C to TTL converter it does not remove the 5V pull-up resistors from GP8 and GP9 - the supply remains on them. These inputs are only 5V tolerant while the Pico has a 3V3 supply so the 5V feed into the regulator cannot be disconnected..

When mounting the audio jack socket you need to trim off the "front" end locating pins as they are right on the edge of the PCB and it wasn't sensible to drill for them.

B1 and it's holder are optional. The RTC module has a self-contained battery. When this eventually dies you can remove it and connect a wire between the closest pad to the connector and the B+ pad on the PCB. Fitting B1 will then give you a replaceable RTC battery and there is no need to dispose of the module.. It's probably sensible to fit the holder anyway.

Bear in mind that H2 has a 2mm pitch, not 0.1in. You will also need some male pin strip for the JDY-41.

If you wish to drive headphones from the audio output I recommend increasing the output drive by reducing R6 and R7 to 1K. You can get better bass by increasing C14 and C15 to 100uF. You get better audio quality if you don't need to reduce the level by using PLAY VOLUME.

BILL OF MATERIALS

Name	Value	Comment
B1	CR2032	battery & holder (optional)
C1	100uF	electrolytic capacitor
C1	22uF	electrolytic capacitor
C2	100uF	electrolytic capacitor
C3	100n	Ceramic cap
C5	100n	Ceramic cap
C6	100n	Ceramic cap
C7	100n	Ceramic cap
C8	33nF	capacitor
C9	33nF	capacitor
C10	2n7	capacitor
C11	2n7	capacitor
C12	68nF	capacitor
C13	68nF	capacitor
C14	1uF	electrolytic capacitor
C15	1uF	electrolytic capacitor
C16	100n	Ceramic cap
C17	10uF	electrolytic capacitor
D1	1N5158	or similar Schottky diode
D2	LED	red/green or red/blue common cathode 3mm
FB1	B-20L-48B	KEMET ferrite bead
FB2	B-20L-48B	KEMET ferrite bead
FB3	B-20L-48B	KEMET2 ferrite bead
H1	2x12	0.1in 90 deg.male pin header
H2	6-way	2mm female SIP socket (optional)
H3	5-way	0.1in male pin header
H4	4-way	o.1in male pin header
J1	3-way	0.1in male pin header with jumper
J2	3-way	0.1in male pin header with jumper
J3	3-way	0.1in male pin header with jumper
J4	2-waw	0.1in male oin header with jumper (optional)
L1	4.7mH	Epcos B78108S +value
L2	4.7mH	Epcos B78108S +value
PF1	0.1A	RXE010 (optional but recommended)
PF2	0.2A	RXE020 (optional but recommended)
PL1	mini USB plug	4-way short "pad" type

R1	10K	resistor
R2	10K	resistor
R3	2R2	resistor
R4	1K	resistor
R5	220R	resistor
R6	220R	resistor
R7	47K	resistor
R8	47K	resistor
R9	47K	resistor
R10	47K	resistor
S1	Reset sw	Horizontal 6x6 tactile switch. Omron B3F-315n, with B32 round cap
SK1	3.5mm	jack socket. "Square" design
SK2		Dual horizontal USB-A socket
SK3		Dual horizontal USB-A socket
SK4	TFP09-2-12B	push-push micro SD card socket
SK5	DVI module	Adafruit
U1		USB-C Converter BTE17-06B
U2	LM1117T	3V3 LDO regulator
U3		PicoMite 2 with mounting accessories
U4	mini RTC	Raspberry Pi compatible RTC module
U4	LM4040-3	voltage reference (optional)

Also required will be mounting sockets & male header pins for the Pico.

Why the pineapple? I like pineapple, so why not? :)