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The AVED store MB2K2 Microbox 2K2 (MB2K2) Instruction Manual

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The AVED store

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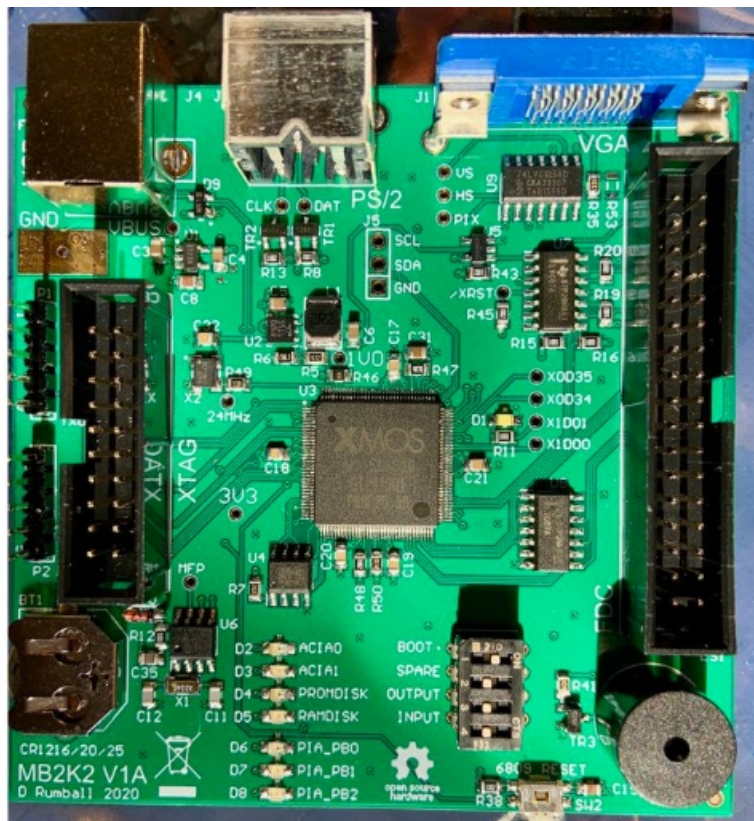
Specifications

- Version: 0.95
- Date: 10th May 2023
- Assembly: MB2K2 PCB
- Cost: <$50 for total BOM

Product Usage Instructions

Construction Guidelines

The PCB has been designed for manual assembly with features to simplify the process. Follow good safety procedures for soldering, ensuring protection from fumes and hot solder splashes.

BOM (Bill of Materials)

Refer to the component BOM in the hardware folder of the release package or access the non-generic parts BOM on Octopart for convenience. Ensure all components are readily available.

Interactive BOM

Use the html-based interactive BOM for a visual placement guide on both sides of the PCB.

Component Assembly

Follow guidelines for soldering fine pitch SMD components. Ensure proper alignment, use flux, and make good connections. Check pin 1 orientation and follow markings on the PCB.

Firmware Flashing

To flash the firmware, install the Xmos xTIMEcomposer toolchain (version 14.4.1) and obtain an 'XTAG' USB debug interface. Download the toolchain from Xmos and purchase the XTAG interface from suppliers worldwide for about $20.

FAQ

Q: What tools are required for assembly?

A: You will need a temperature-controlled soldering iron, flux, and basic soldering tools.

Q: Can the PCB be assembled without a hot air gun or reflow plate?

A: Yes, the PCB can be assembled using just a temperature-controlled soldering iron.

Version 0.95 10th May 2023

Introduction

- This document contains some brief notes to assist during the assembly of the MB2K2 PCB. It assumes that the reader has some experience with fine pitch SMD soldering, if not don't panic as there are any number of online resources and YouTube videos that go over the basics.
- As with all SMD assembly it's important to follow good safety procedures particularly to ensure that you have good protection from the fumes generated from soldering and from any hot solder splashes, again there is a wealth of online information concerning protection from these and other hazards, follow it!
- The tips and suggestions below are intended to be guidelines and don't need to be followed slavishly, if you have a better way of doing things then by all means use it.
- The PCB has been designed with an eye towards manual assembly and has a number of features to simplify the process. It's entirely possible to assemble the board using just a temperature controlled soldering iron and without needing to use a hot air gun or reflow plate.

BOM

The component BOM is given in the hardware folder of the release package. For convenience the non generic parts BOM is also accessible as a shared 'live' BOM on Octopart. At the time of writing all the components are readily available and the total BOM cost is < $50.

Construction notes

As an aid to construction there is an html based 'interactive' BOM, this can be opened in a browser and provides a BOM and visual placement guide for both sides of the PCB.

- R51 is no fit
- R55-57 are optional components
- The surface finish of the PCB is ENIG as this eases the soldering of the fine pitch components. With this finish it's important to clean the PCB thoroughly before assembly and to use a good quality flux. I've found that one of

- the no clean 'gel' fluxes gives the best results.
- Assemble the 3.3V and 1.0V power power supply components first and test that these are working correctly before proceeding with the rest of the assembly. This can save some expensive problems later on. The switch mode regulator chip U2 has a 'hidden' ground pad underneath its package. So that this device can be attached without reflow there is a large via in the PCB underneath the parts and this allows the hidden pad to be soldered from the bottom of the PCB. This feature also has the side effect of forming a good heat sink to the inner layers of the PCB although in practice this isn't needed as the design runs very cool in use as this thermograph shows:-
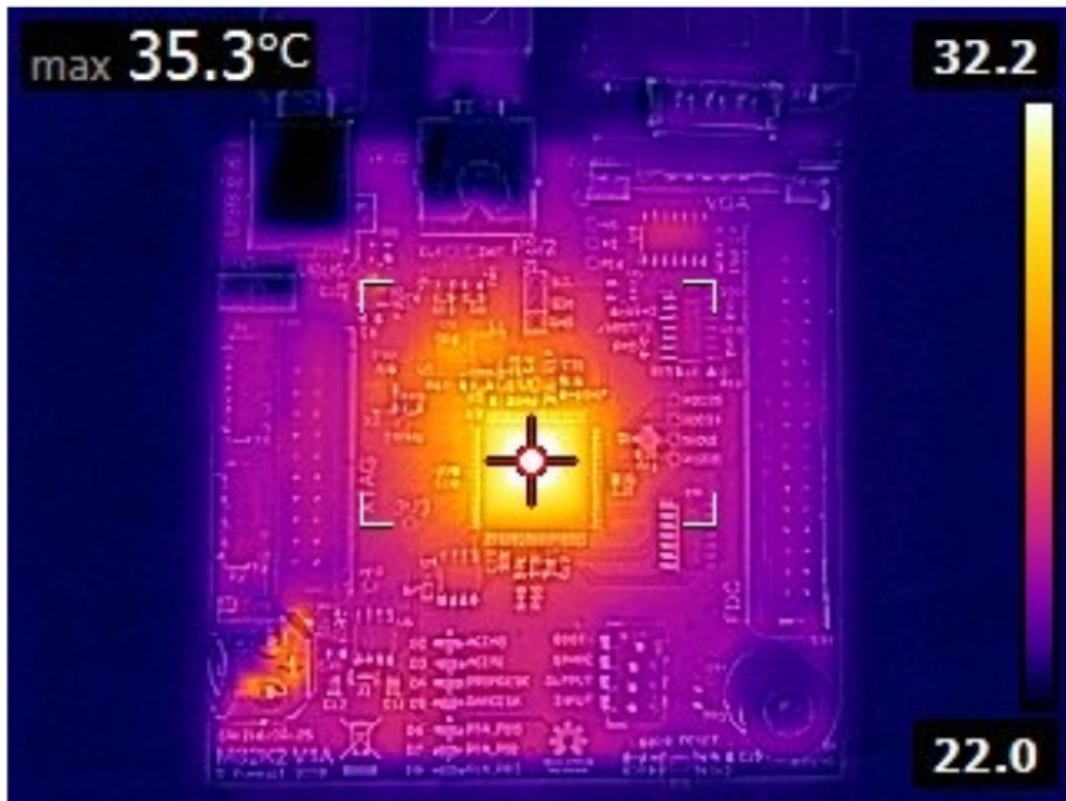
- The XU216 should be added next, this is probably the most difficult part. Be sure to leave the XU216 in its moisture sealed packaging until just before assembly as the part is prone to 'popcorning' if left in a humid atmosphere too long. The leads of this part are quite fragile, if possible handle just with a vacuum pencil to avoid touching the leads.
- Use plenty of flux; this is where the gel flux is handy because it holds the part in place but still allows fine adjustments of position.
  (Don't forget to put some flux on the ground pad in and around the via). Check that pin 1 is in the correct place! (there is a flat corner and depression marking on the part and a dot on the PCB to show the location of pin one). When the part is correctly positioned, tack down one lead near a corner and check the alignment again, if ok tack a pin on the opposite corner.
- Because of the fine pitch of the leads on the part, the best way to solder the leads isn't to use the traditional technique of applying the solder to the joint, instead it's better to apply a small amount of solder to the iron tip and apply this to the very end of the pin allowing the solder to wick along the pad to form the joint. The PCB features solder mask slivers between the pads (this would not normally be a good idea in a mass production PCB) which helps discourages the solder from bridging between pins and if any solder bridges do form the solder mask assists clearing these with solder wick.
- In the same manner as the switch mode regulator the XU216 has a hidden pad underneath the device which is its only connection to ground. This pad carries all of the logic and I/O current so it's important to ensure that a

good connection is made. As before there is a large via which is used to allow access to the ground pad from the rear of the PCB so when the signal leads are soldered then the ground connection can be made. Use plenty of
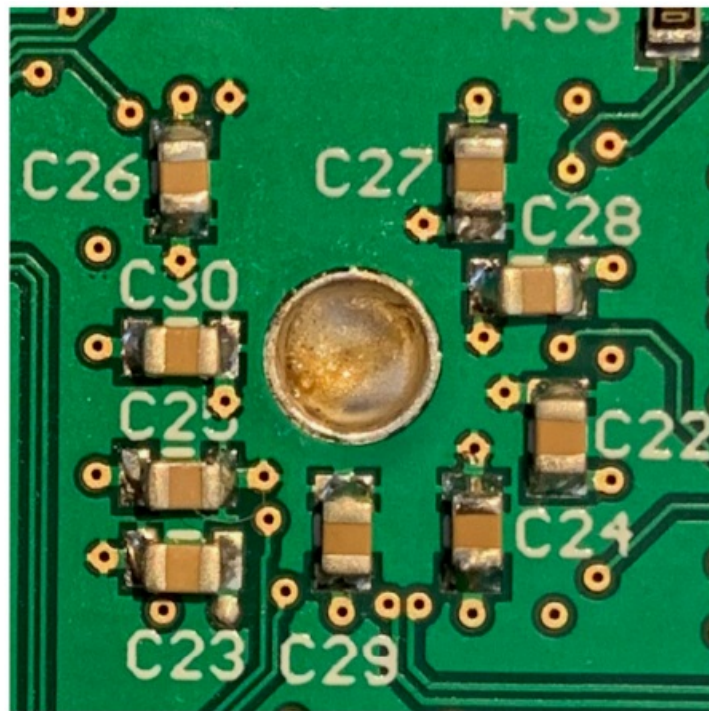
flux here and flood solder into the via. Heat will tend to flow into the internal planes of the PCB so use a hot iron and beware of forming a 'cold' solder joint. When complete it should look something like this :-

- After the XU216 is in place, place the other SMD components. For the discrete parts flux both pads then tin one of the pads. Then slide the part into place with fine point tweezers whilst melting the solder to make the first joint and then solder the other end. In practice this takes less time to do than to describe. I find that it's easiest to work down the BOM placing all the instances of a particular component value in one pass. The 'interactive' BOM works well for this approach.
- After placing the SMD parts place the through hole parts last of all and give the PCB a good clean with IPA and an old toothbrush.

Initial testing

- Don't install the battery until after the firmware is flashed.
- Briefly apply power to the board and check current draw, it should be in the region of 100mA – 150mA, much greater than this indicates a short somewhere or a reversed IC. If the initial 'smoke test' is OK check that the 3.3V and 1V power rails are correct.
- If a scope is available check that the 24MHz clock is present and that reset is asserted following power up.

Flashing the firmware

- Flashing the MB2K2's firmware requires the installation of the free Xmos xTIMEcomposer toolchain (version 14.4.1) and obtaining an 'XTAG' USB debug interface. The toolchain may be downloaded directly from Xmos at the tools download page and the XTAG interface is readily available from several suppliers world wide for about $20, see Octopart for details.

- Documentation for the xTIMEcomposer tools is in the 'data sheets & app notes etc' folder in the firmware folder and covers importing project, the IDE, building the project and flashing. It may be also necessary to install the Java runtime
- Download the latest MB2K2 release package from GitHub, unzip the project folder located in MB2K2_V0.95-release-master\firmware and locate the binary images in MB2K2\bin within the project.
- Power on the MB2K2 and connect the XTAG to the board. (the XTAG may be safely connected or disconnected to a powered MB2K2) then open up the Xmos command line interface installed as part of xTIMEcomposer in the earlier step and use the following command:-

xrun -l
This command looks for the XTAG connector then reports on the connected device. The command should report something like :-
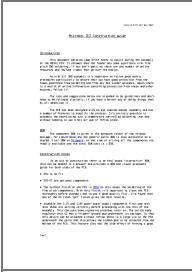
Available XMOS Devices

```
ID    Name                      Adapter ID      Devices
--    ----                      ----------      -------
0     XMOS XTAG-3               ZByhc2hJ        0[0]
```

if the command reports 'none' for the devices then there is a hardware fault with the board. If the power supplies and 24MHz clock are OK then this will most likely be an issue with a bad solder joint on the XU216 so check the pin connections and the ground connection under the PCB.
If all is well then the firmware may be flashed with the 'xflash' command thus:-

- xflash -—verbose -—no-compression -—factory <image.xe> –boot-partition-size 0x100000 –data <promdisk.dsk>
- <image.xe> is the path to the image file use MB2K2\bin\mb2k2_release_usb.xe as the default
- <promdisk.dsk> is the path to the promdisk image use MB2K2/promdisk/MB2K2PD.dsk as the default
- After about 30 seconds or so the flashing will begin with a series of messages of the form 'site 0 write' followed by an incrementing address as each flash block is written. With the current build and promdisk the block address will run up to about 0x003CFF00, (the actual number may be different to this as the build is updated).
- After the flashing process is complete the MB2K2 will restart and you should see the debug LED (to the right hand side of the XU216) flashing on and off in a 'breathing' pattern. This is the sign that the firmware is working correctly. Power down and insert the battery (noting polarity).
- **Congratulations on a successful build!**

Connect a VGA compatible monitor and PS/2 keyboard and boot into FLEX with the 'BF' command in MON09 then set the current date and time with the SETTIME command.
This completes the initial testing of your MB2K2, so make yourself a nice cup of tea (or whatever you prefer), sit down with your feet up, type DEMO and watch the pretty graphics!

Documents / Resources

The AVED store MB2K2 Microbox 2K2 (MB2K2) [pdf] Instruction Manual
MB2K2 Microbox 2K2 MB2K2, MB2K2, Microbox 2K2 MB2K2, 2K2 MB2K2, MB2K2

References

- **Apple (United Kingdom)**
- **User Manual**