# About

The mbhp Core Module is the heart and brain of every MIDIbox. It holds the PIC microcontroller which runs MIOS and your MIDIbox application. It handles MIDI communication, it drives an LCD (or two), and it connects all the other modules. Main part of this module is the PIC18F452, a microcontroller manufactured by Microchip. It is clocked at 40 MHz (externaly with a 10 MHz crystal) and offers enough performance to handle with all the analog and digital modules with latencies below 1ms. The PIC is a “system on chip” (SoC), this means, it contains not only a CPU, but also an integrated 32k flash program memory, 1536 bytes data memory, 256 bytes data EEPROM, and a lot of usefull peripherals like AD-converter and UART (for MIDI). I decided to use PIC controllers for my MIDI applications many years ago, and I stayed by this product family because of the low prices and worldwide availability for hobbyists. In distance to other (more modern) microcontrollers, the PIC is easy to program, requires no external memories, is almost non-destroyable and comes in a handy DIP package, so that also electronic beginners can work with this chip without the danger of damaging small SMD pins within some seconds with their soldering iron.

A nice outlook for the future is, that Microchip still considers pin compatible devices. The MBHP started with a PIC16F877, in the meantime PIC18F452 is used, and for memory intensive projects like MIDIbox SEQ V3 or MIDIbox SID V2 the PIC 18F4620/PIC 18F4685. So long this upgrade path is given, a switch to another microcontroller family (like Atmel devices) with all it's advantages, but also disadvantages, is not required, and hard/software compatible applications can still be expected in the next years.

### Specs

One core module, stuffed with a PIC18F452, can handle:

- up to 128 digital inputs
- up to 128 digital outputs
- up to 64 analog inputs
- character and graphical dotmatrix LCDs
- BankSticks (IIC EEPROMs)
- one MIDI In, one MIDI Out, optionally as to-COM interface

In addition, multiple cores can be linked together to extend these capabilities. Linking Multiple Cores

# Getting Started

- Preparation
- Soldering
- Where to buy Parts
- Etching PCBs
- Terminating Cables

**Special Instructions**

# Details

### Past Core Revision Documentation

(Check on PCB for revision number)

- Core V2 SmashTV
- Core R3 SmashTV
- Core R4c SmashTV

### Pin out list

| Pins | Description |
|---|---|
| **J1** | Connection to the power supply. Either the output of a 7V-10V transformer, or a wall adapter can be used. 500 mA is recommented, especially if a backlit display is used, but MIDIfilter and MIDImerger work also with ca. 100 mA. AC or DC doesn't matter, since the rectifier behind J1 converts to DC anyhow. Also the polarity has not to be taken into account. |
| **J2** | +5V output, can be used to supply other core modules in a multiprocessor environment, so that you only have to mount the parts for the power supply (BR1, IC3, C5, C6) on one core module. Restriction: the 7805 gets very hot when it delivers currents above 500 mA, so only core modules without backlit display like MIDIO128, MIDImerger, MIDIfilter should be supplied over this port. |
| **J4** | Interface to the BankStick, to MBHP_IIC_* modules like MBHP_IIC_MIDI, and to the second MIDI IN port for MIDImerger. |
| **J5, J5a, J5b** | This is an either-or setup. J5 matches the old (SIL) AIN connection. J5A and J5B match the with newer AIN boards (AIN_R3 up). Obviously with newer AIN boards leave out the SIL pinheader out and load J5A/B, if using older boards leave out J5A/B and load J5. Interface to the AIN module for MIDIbox64 and MIDIbox64E. There are also some application which use this as digital in- or output. |
| **J6** | J6-Interface to the AIN module for MIDIbox64 and MIDIbox64E. |
| **J7** | Interface to the MF module, sometimes also used for the MBHP_AOUT or MBHP_AOUT_LC module. |
| **J8** | Pay attention to this one, it has moved since last rev.... Interface to the DOUT module chain. |
| **J9** | Pay attention to this one, it has moved since last rev.... Interface to the DIN module chain. |
| **J10** | Pay attention to this one, it has moved since last rev.... Do not mistake it for J8 orJ9 since they were in this position on the last rev. Interface to application specific module extensions like the SID module. |

| | |
|---|---|
| **J11** | MIDI digital IO port, interface to the LED/Thru/COM module. Can also be used to cascade multiple core modules in a long MIDI chain. Note: Don't plug the optocoupler (IC2, 6N138) into the socket when using the J11:MI (MIDI-IN) pin as an input, otherwise the Rx input will get the data from two different sources, which is not provided by the MIDI protocol (point-to-point). A MIDImerger is necessary to combine multiple MIDI IN sources. In other words: when using the COM module or when connecting the J11:MO of one core module to J11:MI of another core module, or when connecting the core module directly with the Gameport, the optocoupler of the other module should not be plugged into the socket to avoid a corrupted MIDI data stream. |
| **J12** | MIDI OUT port. This is an either-or position, load SIL 3 pin header for wiring to panel mount MIDI jacks, otherwise install a PCB mount MIDI socket in/over the J12 pads. |
| **J13** | MIDI IN port. This is an either-or position, load SIL 3 pin header for wiring to panel mount MIDI jacks, otherwise install a PCB mount MIDI socket in/over the J12 pads. |
| **J14** | Used by MIOS as touch sensor strobe line. Sometimes also used for debugging purposes. |
| **J15** | Interface to LCD display module. |
| **GND LIFT** | Can be used to temorarily disconnect the CORE's ground from the ground on J12:Pin2. Leave this alone for normal operation! |

### PCB files

- Core V3 .brd -PCB data, can be viewed, modified and converted with Eagle Light
- Core V3 artwork Printible artwork for etching your own boards SmashTV

### Schematic

- MBHP Core V3 uCapps.de

### List of parts

Here are suggested part numbers for various distributors for parts for the core V3 board. If you find another site or dealer with a different parts list feel free add it into the list. Also if you've successfully used a different part from what was listed here please add the number and/or link to the list.

| Description | **polarity** | **Soldering Instructions** | **QTY** | **Reichelt Part#** [1)] | **Mouser Part#** |
|---|---|---|---|---|---|
| **PIC18F452-I/P** | Yes | Don't (use socket) | 1 | PIC 18F452-I/P | 579-PIC18F452-I/P |
| **Crystal 10 MHz** | No | | 1 | 10-HC18 | 73-XT49S1000-20 |
| **Voltage Regulator 7805** | Yes | | 1 | uA 7805 | 512-LM7805CT |
| **IC-Socket for PIC** | Yes | | 1 | GS 40P | 571-3902625 |
| **Optocoupler 6N138** | Yes | Don't (use socket) | 1 | 6N 138 | 782-6N138 |
| **IC-Socket for Optocoupler** | Yes | | 1 | GS 8P | 571-3902612 |
| **Transistor BC337** | Yes | quick | 1 | BC 337-16 | 512-BC337TF |
| **Resistor 10 kOhm** | No | | 3 | 1/4W 10k | 291-10K-RC |
| **Resistor 5.6 kOhm** | No | | 1 | 1/4W 5.6k | 291-5.6K-RC |

| Description | polarity | Soldering Instructions | QTY | Reichelt Part# [1)] | Mouser Part# |
|---|---|---|---|---|---|
| **Resistor 1.2 kOhm** | No | | 1 | 1/4W 1.2k | 291-1.2K-RC |
| **Resistor 1 kOhm** | No | | 3 | 1/4W 1k | 291-1K-RC |
| **Resistor 220 Ohm** | No | | 3 | 1/4W 220 | 291-220-RC |
| **Resistor 100 Ohm** | No | | 1 | 1/4W 100 | 291-100-RC |
| **Ceramic Cap 100 nF** | No | | 3 | Z5U-2,5 100n | 80-C412C104K5R |
| **Ceramic Cap 330 nF** | No | | 1 | MKS-2 330n | 80-C320C334M5U |
| **Ceramic Cap 33 pF** | No | | 2 | Kerko 33p | 140-50N2-330J |
| **Polarised Capacitor 10 uF** | Yes | | 1 | rad 10/35 | 140-HTRL25V10-RC |
| **Polarised Capacitor 2200 uF** | Yes | | 1 | rad 2200/16 | 140-HTRL16V2200-RC |
| **Diode 1N4148** | Yes | quick | 1 | 1N 4148 | 78-1N4148 |
| **Rectifier** | Yes | | 1 | B80C800RUND | 625-W08G |
| **TrimmPot 10 k** | Yes | | 2 | PIHER 10-S 10K | 531-PT6KV-10K |
| **MIDI Sockets** | Yes | | 2 | MAB 5S | 161-0505 |
| **1-row SIL Headers (about 30 pins)** | No | | 1 | STIFTL. 40G | 517-6111TG |
| **1-row sil female 36 con** | No | | 1 | - | 517-850-01-36 |
| **2-row SIL Headers (about 2*22 pins)** | No | | 1 | STIFTL. 2X40G | 517-6221TG |
| **2-row sil female 25 rows** | No | | 1 | - | 517-852-01-25 |
| **Ribbon cable 3 meters** | No | | 3 | AWG 28-16G | - |
| **Wall adapter (Power supply) 500 mA** | - | | 1 | MW 17-GS/6 | - |
| **Socket for Power Supply** | - | | 1 | HEBLM 21 | - |

Reichelt Shopping Cart Links

# Multiple Cores

There are different possibilities to have multiple Cores.

- MIDIbox Link [uCApps] *Linking multiple Cores via MIDI (a special configured MIDI forwarding pipe)*
- MBNet [uCApps] *The new MIDIbox Network utilizing the CAN (Controller Area Network) Interface on the brandnew PIC18F4685 microcontrollers ===== Building it ===== ==== Building instructions ==== * How to assemble a SmashTV Core module kit - Link to PDF document [VirtualOrgan] ==== Loading MIOS and Applications ==== ==English Version== This page has been split into two pieces: Newbie Section everything you need to know if you want to upload MIOS and an application to the Core Experts Section this is the old page which discusses some details about the MIOS Bootstrap Loader. ==French Version== Cette page est maintenant structurée de la manière suivante: Section "Newbie" (débutants) Tout ce que vou s avez besoin de savoir pour uploader le MIOS et une application vers un module Core Section "Experts" C'est l'ancienne page, plus d&eac ute;taillée quant au*

*MIOS Bootstrap Loader. ==Spanish Version== Esta página ha sido dividida en dos secciones: Sección "Novatos" (newbie) Todo lo que debes saber si quieres cargar MIOS y una aplicación en el módulo Core Sección Expertos Esta es la antigua página en la que se discuten algunos detalles del cargador bootstrap MIOS. ==== Testing ==== **How do I test my circuit?** Before you plug the ICs into the sockets, you should measure the voltage levels at the power pins (Vss and Vdd - Vss means: ground (0V), Vdd means: +5V, you will find the corresponding pins in the schematics). Disconnect the power, plug the ICs into the sockets, turn on the power. Now quickly measure the voltage between any ground and 5V pin again. If you don't see any change (already +5V) you've made the most critical step. Otherwise you have a shorted in your circuit and should disconnect the power as fast as possible to avoid damages. Continue with the MIDI Out port tests like described at the Troubleshooting uCapps.de page. === Troubleshooting === Troubleshooting ==== Reference ==== * Core Module uCApps * Core Module R4D from SmashTV smashTV*

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