

Maximite Hardware Manual

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For updates to this manual and more details on the Maximite
go to <http://geoffg.net/maximite.html>

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The Maximite

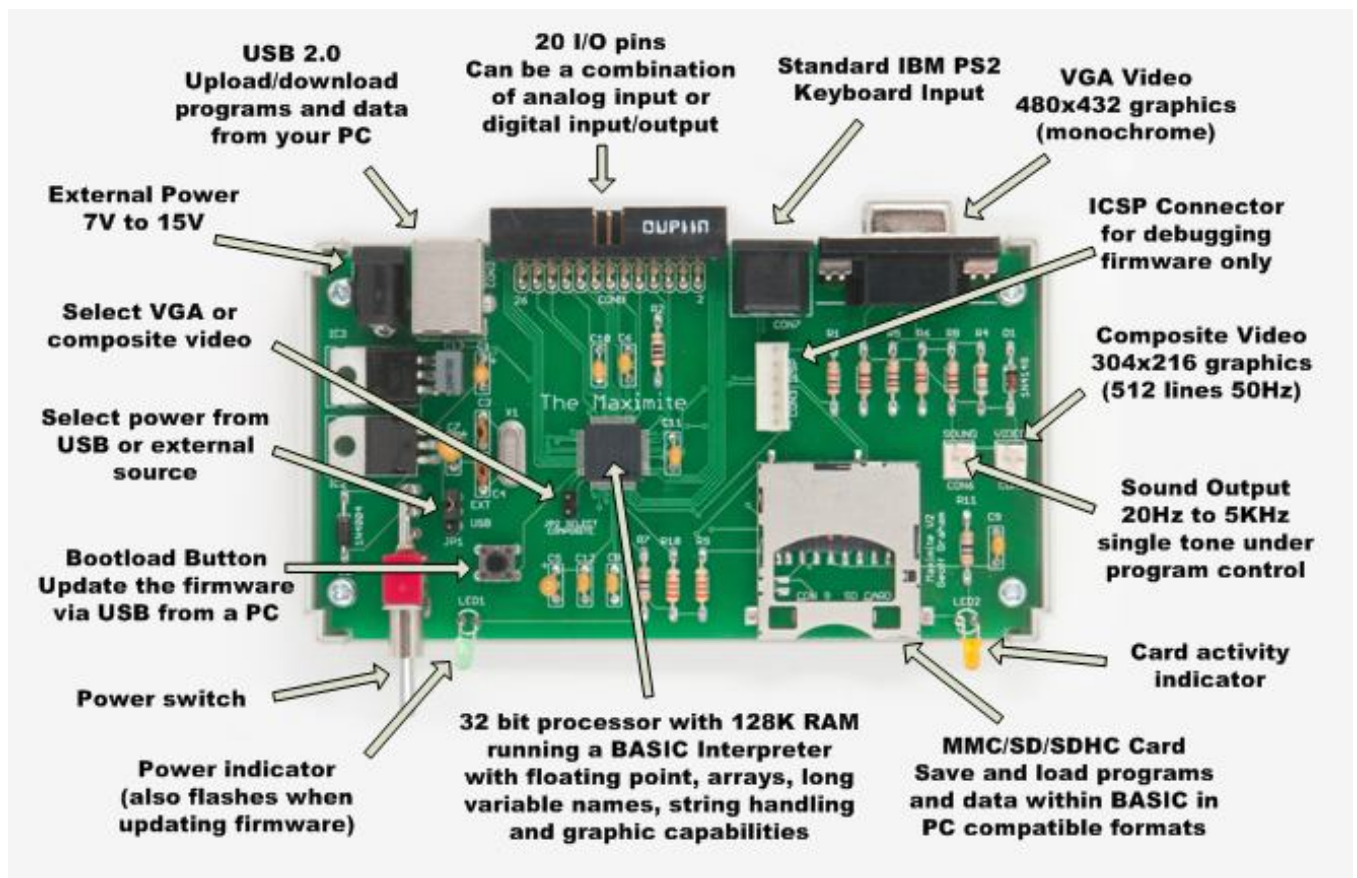


The Maximite is a small and versatile computer running a full featured BASIC interpreter with 128K of working memory. It will work with a standard VGA monitor and PC compatible keyboard and because the Maximite has its own built in SD memory card and BASIC language you need nothing more to start writing and running BASIC programs.

The Maximite also has also 20 input/output lines which can be used to control and monitor external electrical systems.

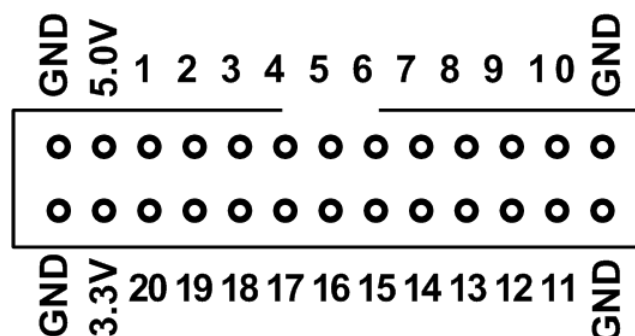
Refer to the [MMBasic Language Manual](http://geoffg.net/maximite.html) for details of the latest version of the Maximite BASIC language. This manual can be downloaded from <http://geoffg.net/maximite.html>.

Features and Connectors



External Input/Output Connector

Rear panel connector with the pin numbers as used in MMBasic (external view looking at the back panel):



The mini Maximite



The mini Maximite is a small low cost version of the full sized Maximite designed for use as an intelligent controller in a user designed system.

It is 100% software compatible with the larger Maximite so you can develop and test your program on the larger version and transfer it to the mini Maximite when you are ready to screw the covers down.

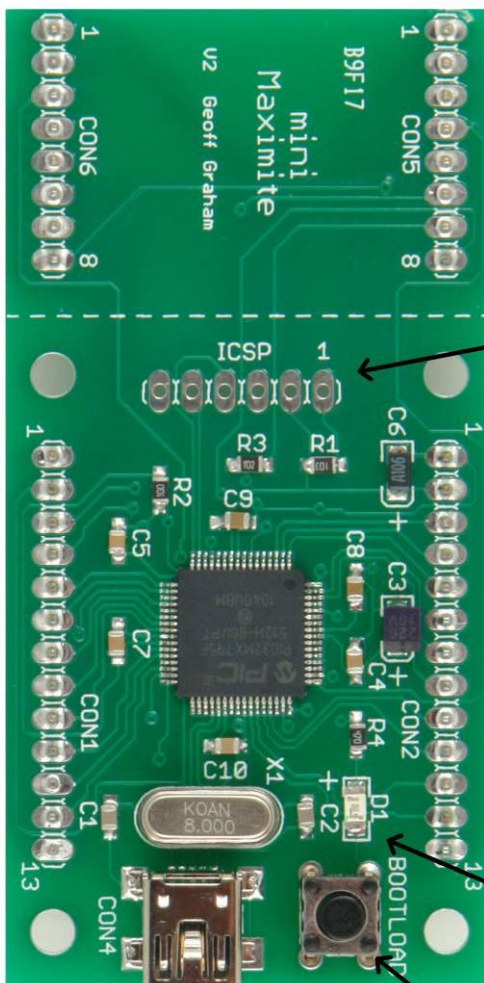
The only items that the mini Maximite is missing are the connectors for the VGA, keyboard, sound and SD card. You can add them to the mini Maximite if you wish; the signals are brought out onto header pins.

Refer to the MMBasic Users Manual for details of the latest version of the Maximite BASIC language. This manual can be downloaded from <http://geoffg.net/maximite.html>.

Connections and Features

The top part of the board holds the connectors CON5 and CON6 which carry the signals for the video, keyboard, sound and SD card. Most embedded systems will not use these peripherals so the board can be cut on the dotted line to make it smaller and more suited as an embedded controller:

3.3V (from CON5.2)	CON6.1
SD Card Activity LED	CON6.2
SD Card Write Protect	CON6.3
SD Card Present	CON6.4
Data from SD Card	CON6.5
Clock to SD Card	CON6.6
Data to SD Card	CON6.7
SD Card Enable	CON6.8



CON5.1	Ground
CON5.2	Keyboard Clock
CON5.3	Keyboard Data
CON5.4	Sound Output
CON5.5	Select Composite
CON5.6	Vertical Sync
CON5.7	Horizontal Sync
CON5.8	Video

ICSP Connector for programming via a PICKit 3 or similar

Ground	CON1.1
5V from USB	CON1.2
Pin 1	CON1.3
Pin 2	CON1.4
Pin 3	CON1.5
Pin 4	CON1.6
Pin 5	CON1.7
Pin 6	CON1.8
Pin 7	CON1.9
Pin 8	CON1.10
Pin 9	CON1.11
Pin 10	CON1.12
Ground	CON1.13

CON2.1	Ground
CON2.2	3.3V Power Supply
CON2.3	Pin 20
CON2.4	Pin 19
CON2.5	Pin 18
CON2.6	Pin 17
CON2.7	Pin 16
CON2.8	Pin 15
CON2.9	Pin 14
CON2.10	Pin 13
CON2.11	Pin 12
CON2.12	Pin 11
CON2.13	Ground

USB Connector
For upload and download of programs and data

Bootload Button
Update the firmware from a PC via USB

Power LED
Flashes when in bootload mode

Maximite Technical Details

Video Output

Placing a jumper on JP2 or grounding CON5.5 will select composite video timing (eg, for a TV set), removing it will select VGA video timing (only one type of video monitor can be connected at a time). By default the composite video output will be 50Hz PAL compatible but the firmware can be reconfigured for NTSC using the OPTION CONFIG NTSC command.

VGA

Standard monochrome VGA (31.5 kHz horizontal scanning with 60Hz vertical refresh).
480x432 pixel graphic screen. 80 characters per line and 36 lines per screen

Composite PAL Compatible

Standard monochrome PAL (15.625KHz horizontal scanning with 50Hz vertical refresh non interlaced).
304x216 pixel graphic screen. 50 characters per line and 18 lines per screen

Composite NTSC Compatible

Standard monochrome NTSC (15.73426KHz horizontal scanning with 60Hz vertical refresh non interlaced).
304x180 pixel graphic screen. 50 characters per line and 15 lines per screen

USB

Implements the CDC (Communication Device Class) protocol over USB 2.0. This is a serial interface to the BASIC interpreter so, by using a terminal emulator on the host, programs can be entered, edited and run. Using this interface you can upload programs by streaming the text with a suitable terminal editor.

The Windows driver is available from <http://geoffg.net/maximite.html>. There is native support for the CDC protocol in Linux (the cdc-acm driver) and Apple OS/X.

Keyboard

Standard IBM compatible PS2 keyboard with mini-DIN connector or a USB/mini-DIN adapter.
Non ASCII keys (such as the function keys) are mapped to special characters. See Appendix E for the details.

SD/MMC Card Interface

Will accept MMC, SD or SDHC memory cards formatted as FAT16 or FAT32. Note that there is no advantage in using a fast SD card as the card is clocked at a fixed 20MHz, regardless of its speed rating.

Electrical Characteristics

Power Supply - Maximite

- Via External Power: 7V to 12V (14V if no significant current is drawn from the I/O pins).
The connector is a standard 2.1 mm power connector with the centre pin positive.
- Via USB Connector: 4.5V to 5.5V (JP1 placed in the USB position)
- Current Draw: 140mA typical (plus current draw from the I/O pins)

Power Supply - mini Maximite

- 2.9 to 3.6V (3.3V nominal) 125mA typical (plus current draw from the I/O pins)

Digital Inputs

- Logic Low: 0 to 0.65V
- Logic High: 2.5V to 3.3V (I/O pins 1 to 10)
2.5V to 5.5V (I/O pins 11 to 20)
- Input Impedance: >1M Ω . All digital inputs are Schmitt Trigger buffered.
- Frequency Response: Up to 200KHz (pulse width 10nS or more) on the counting inputs (pins 11 to 14).

Analog Inputs (I/O pins 1 to 10)

Voltage Range: 0 to 3.3V

Accuracy: Typically better than $\pm 1\%$ although this can be considerably improved by using a correction factor in the BASIC program.

Input Impedance: $>1\text{M}\Omega$ (for accurate readings the source impedance should be $<10\text{K}$)

Digital Outputs

Typical current draw or sink ability on any I/O pin: 10mA

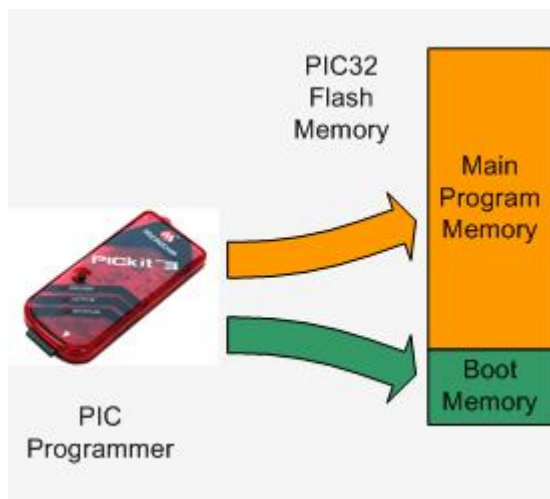
Maximum current draw or sink on any I/O pin: 25mA

Maximum current draw or sink for all I/O pins combined: 150mA

Maximum open collector voltage (I/O pins 11 to 20): 5.5V

Loading New Firmware

Loading new firmware into the Maximite is controlled by a boot loader. This is a small program which has the ability to reprogram the PIC32 program memory using data sent to it over the USB interface. It is located in a reserved section of the PIC32's program memory and is always there regardless of what program is loaded into the main memory.

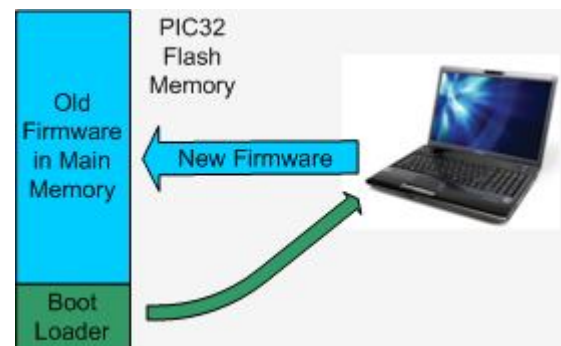


The boot loader was automatically installed when the PIC32 was programmed with the original firmware for the Maximite (version 2.1). This original firmware must be loaded by a PIC programmer such as the PICKit 3 and this will have been done by the kit supplier or yourself if you built the Maximite using a virgin PIC32 chip (this is illustrated in the diagram on the left).

Once the boot loader is installed all future upgrades are done over the USB interface under control of the boot loader (see the diagram below). No programmer is required.

Because the boot loader is located in a protected area of memory it is completely

unaffected by failures when programming the main memory. For example, if you loose power or accidentally unplug the USB cable while programming you can just go back to the beginning and restart the boot load process – the boot loader will never be corrupted or lost.



To avoid confusion all upgrades will be marked as an upgrade and you can load whatever version you want (ie, you can go back to an old version as well as load a recent version). There will also be special versions of the Maximite firmware and you can also try them out.

Windows 7

To load the new firmware you need to run the program BootLoader.exe on your Windows computer (this will be supplied with the upgrade). This program is used to send the new firmware over USB to the boot loader running on the Maximite.

On Windows 7 this program can be run directly (installation is not required). It will also run on earlier versions if you install Microsoft's .NET V2.0 or later runtime. However, in that case, it is probably easier to use MPHidFlash (described in the next section)

For Macintosh, Linux and Windows XP or Vista

You should download MPHidFlash from: <http://code.google.com/p/mphidflash/>

There are versions for Windows, Macintosh or Linux (called binaries) and the program is run from the command line (DOS Box in Windows).

The command that you should run is:

```
mphidflash -vendor 04D8 -product FA8D -noverify -write <filename>
```

Where <filename> is the name of the firmware upgrade file (it will have a .hex extension). Be careful to use the correct file as mpidflash will overwrite the boot loader if given the wrong file. The correct file should have a name like Maximite_MMBasic_Vx.xx.hex where x.xx represents the version number.

The -noverify option is required because, for some reason, the verify function in MPHidFlash does not work with MMBasic upgrades. The file will still be written correctly and you can test it by cycling the power and checking that MMBasic runs OK.

Firmware Upgrade

To upgrade the firmware you should hold down the boot load button on the Maximite while you apply power. The power LED will rapidly flash to indicate that the boot loader is in control.

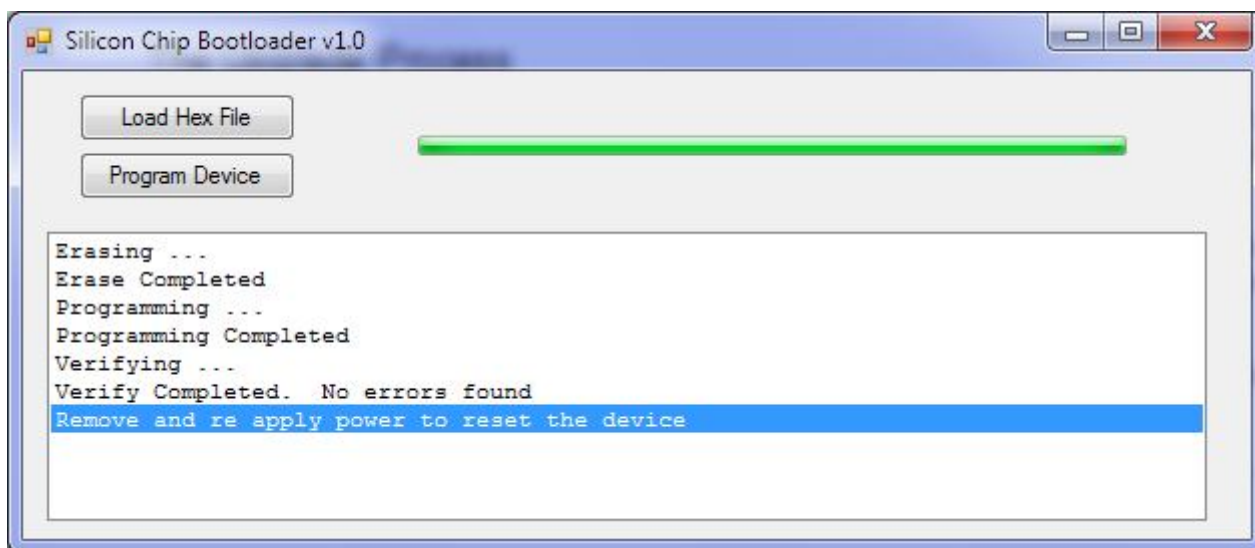
Plug the USB cable from the Maximite into your computer and it should automatically recognise the Maximite and load the appropriate driver (called a HID driver). In Windows the Maximite (in boot load mode) will show up in Device Manager as a "Human Interface Device", "USB Input Device".

If you are using BootLoader.exe it will automatically detect the Maximite and show the message "Device attached". Click on the "Load Hex File" button and load the firmware upgrade file (it will have a .hex extension). Click on the "Program Device" button and the program will show the status as it progresses. It should finish with the screen shot shown below.

If you are using MPHidFlash enter the command line as shown in the previous section. As it runs it will first show "Erasing" then many dots as it writes each block of data to the PIC32.

At the completion of the process the power LED on the Maximite will flash slowly to indicate that the new firmware is programmed and ready to run. The complete cycle (erase, program and verify) should take less than 60 seconds.

Remove and re apply power (without holding down the boot load button) and the Maximite will start up running the new firmware.



Possible Problems

If the "Load Hex File" button in BootLoader.exe is greyed out it means that the Maximite is not connected or not in boot load mode. Check the USB cable and that the power light on the Maximite is flashing.

In some cases BootLoader.exe will not show "Verify Completed" after verifying the programming, instead it will simply print a second "Verifying ..." message and appear to hang. Despite this the programming has verified correctly and you can then recycle the power on the Maximite to start running the new firmware.

For new firmware and other updates go to <http://geoffg.net/maximite.html>