



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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Colour Maximite



The Colour Maximite is a small and versatile computer running a powerful BASIC interpreter with 128K of working memory.

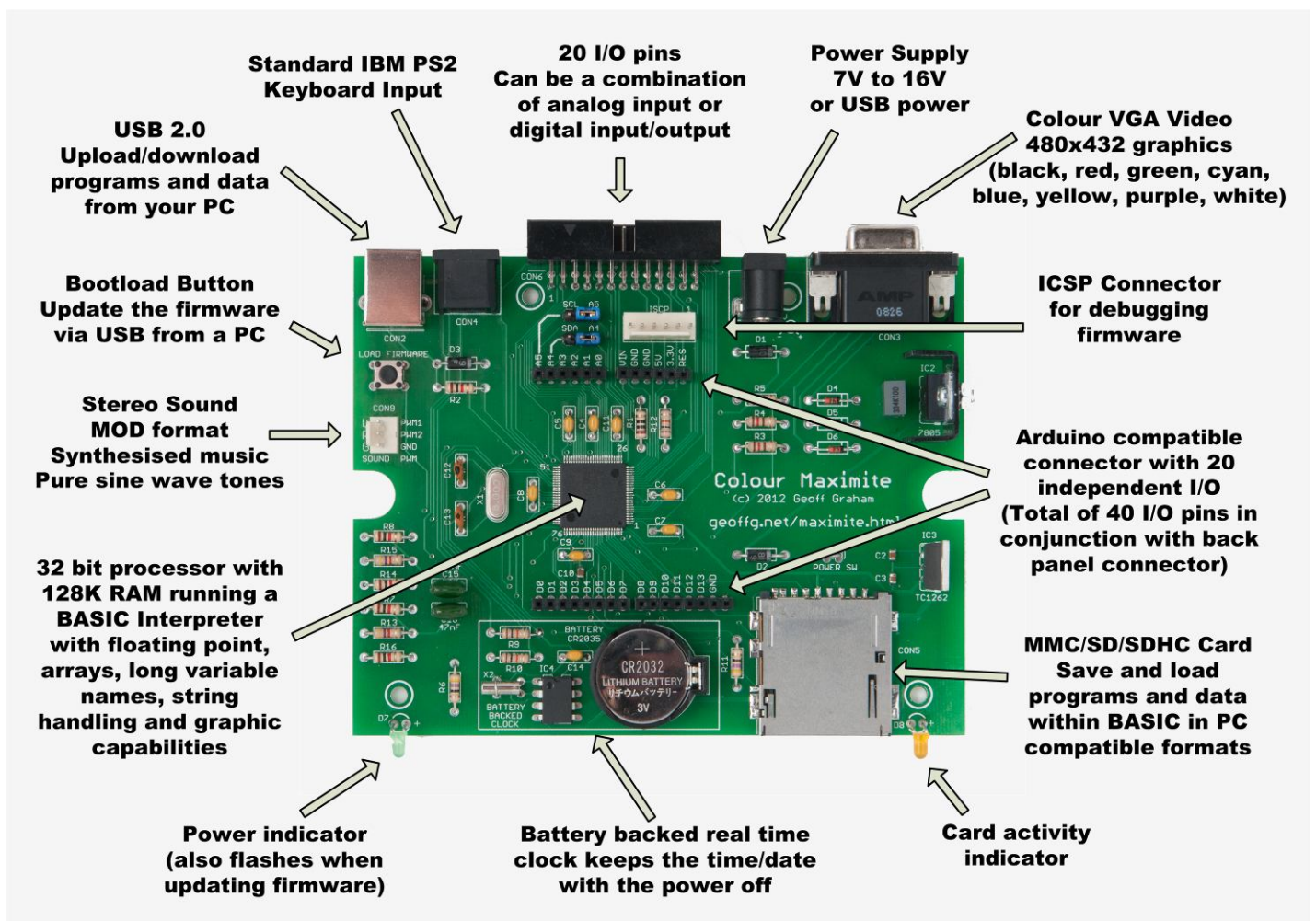
It will work with a standard VGA monitor and generate eight colours (**black**, **red**, **green**, **blue**, **cyan**, **yellow**, **purple** and white).

The Colour Maximite is the latest member of the Maximite family and brings new features including colour, stereo music synthesiser, Arduino compatible I/O connector and a battery backed clock.

It also has all the features of the original (monochrome) Maximite including input from a standard PC compatible keyboard or USB, built in SD memory card, BASIC language and rear panel I/O connector with an additional 20 I/O pins.

Refer to the [MMBasic Language Manual](http://geoffg.net/maximite.html) for details of how to use colour and the music synthesiser. This manual can be downloaded from <http://geoffg.net/maximite.html>.

Features and Connectors



Original (monochrome) Maximite



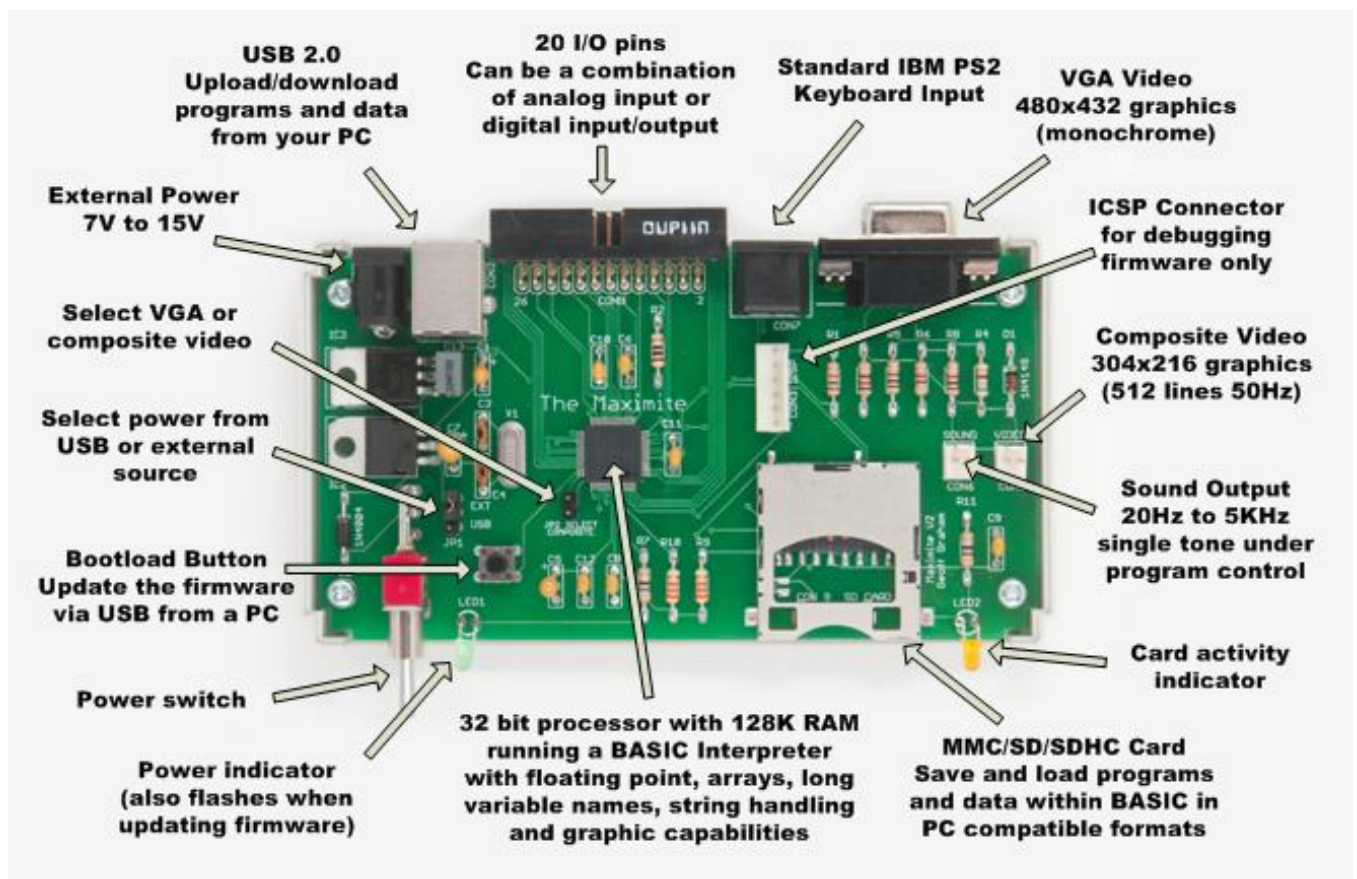
This is the original Maximite computer. It has a monochrome VGA/composite video output and mono sound output.

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



The mini Maximite



The mini Maximite is a small low cost version of the original (monochrome) 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

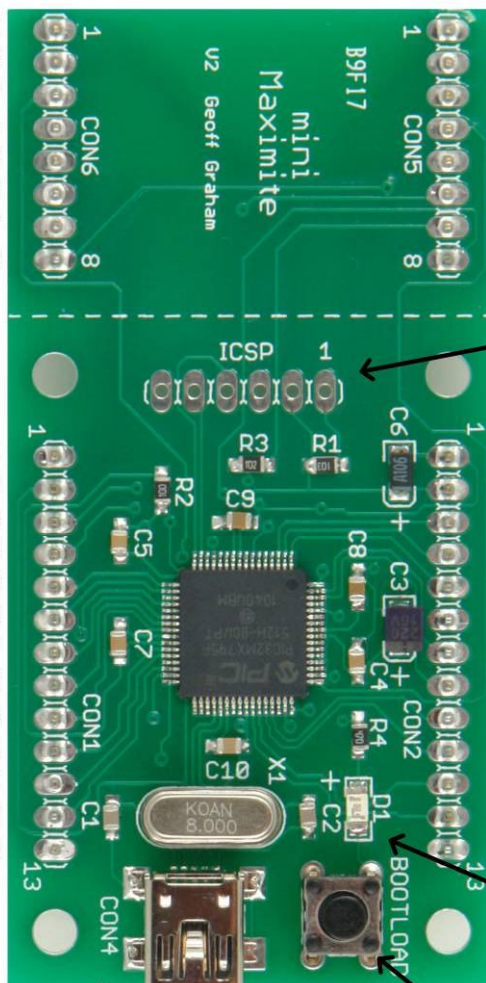
Ground	CON1.1
5V from USB	CON1.2
Pin 1	CON1.3
Pin 2	CON1.4
Pin 3	CON1.5
Pin 4	CON1.6
Pin 5	CON1.7
Pin 6	CON1.8
Pin 7	CON1.9
Pin 8	CON1.10
Pin 9	CON1.11
Pin 10	CON1.12
Ground	CON1.13

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

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



ICSP Connector for
programming via a
PICKit 3 or similar

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

Maximite Technical Details

Video Output

VGA

Standard VGA (31.5 kHz horizontal scanning with 60Hz vertical refresh).

Colour Maximite: Eight colours 480x432 pixels. 80 characters per line and 36 lines per screen or 240x216 pixels high speed games mode

Original Maximite: Monochrome 480x432 pixels. 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).

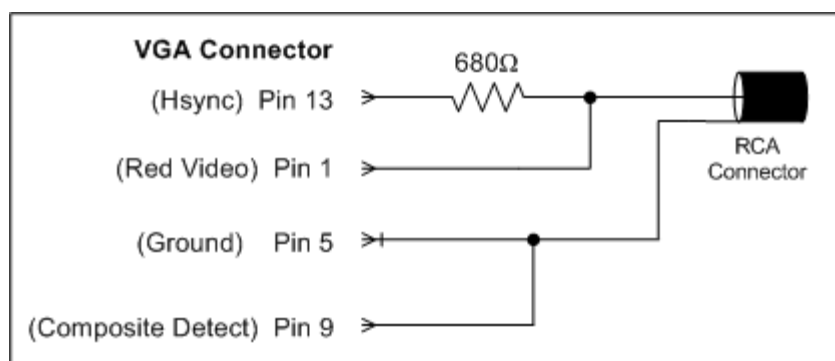
304x180 pixel graphic screen. 50 characters per line and 15 lines per screen

The default composite video output is 50Hz PAL compatible but the firmware can be reconfigured for NTSC using the OPTION CONFIG NTSC command.

On the Original Maximite composite mode is selected by placing a jumper on JP2 or grounding CON5.5.

On the Colour Maximite composite video (in monochrome not colour) can be accessed via the VGA connector using the connections depicted on the right.

Because some VGA monitors ground pin 9 (which causes the Colour Maximite to enter composite video mode even when it should not) the composite mode is disabled by default in versions 4.0A and later of MMBasic for the Colour Maximite.



To enable composite video you must issue one of the following two commands and reboot the Maximite:

CONFIG COMPOSITE PAL

- or -

CONFIG COMPOSITE NTSC

Either of these two commands will enable the composite detect (pin 9 on the VGA connector) and select the correct video timing.

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.

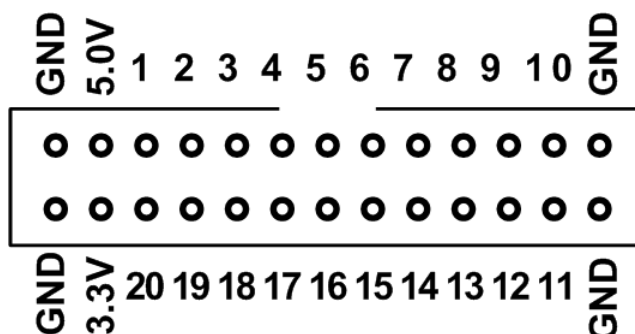
Non ASCII keys (such as the function keys) are mapped to special characters. See Appendix E of the MMBasic Language Manual for the details.

SD/MMC Card Interface

Will accept MMC, SD or SDHC memory cards formatted as FAT16 or FAT32 up to 32GB in capacity. 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.

Rear Panel I/O Connector

The Colour and the original (monochrome) Maximite have the same 20 pin I/O connector on the back panel. These I/O pins are addressed in MMBasic as a number. This diagram lists the connections to this connector along with the I/O pin numbers used in MMBasic.



The mini-Maximite also has 20 I/O pins – refer to the board diagram for details.

Arduino Compatible I/O Connector

The Colour Maximite has an additional 20 I/O pins (40 in total) on the Arduino compatible connector. These are independent of the I/O pins on the back panel.

The designation of the Arduino pins are printed on the PCB and follow the standard layout numbering D0 to D13 and A0 to A5. You can use the labels D0, D1, etc in the PIN, PORT and SETPIN statements or you can use their corresponding numbers (D0 = 21, D1 = 22, etc and A0 = 35, A1 = 36, etc).

The digital pins (D0 to D13) have the same characteristics (5V, open collector, etc) as the digital pins 11 to 20 and the analog capable pins (A0 to A5) have the same capabilities as pins 1 to 10.

Many Arduino systems make the I²C available on connector pins A4 and A5. Using the jumpers (J2 and J3) you can select between the normal I/O function for these pins (A4 and A5) or the I²C signals (SCL and SCA). Note that these I²C signals are also available on the external I/O pins 12 and 13 on the back panel so effectively these jumpers join these I/O pins together when in the I²C position.

Serial I/O Ports

Serial port COM1: uses pin 15 for receive data (data in) and pin 16 for transmit data (data out). If flow control is specified pin 17 will be used for RTS (receive flow control – it is an output) and pin 18 will be CTS (transmit flow control – it is an input).

Original and mini-Maximite: Serial port COM2: uses pin 19 for receive data (data in) and pin 20 for transmit data (data out).

Colour Maximite: Serial port COM2: is on the Arduino connector at D0 for receive data and pin D1 for transmit data (this is common with Arduino boards).

Battery Backed Clock (Colour Maximite only)

If you have installed the battery backed clock the firmware will recognise that the clock is present and will display a message under the Maximite logo saying that the clock is not set. To set it you use the standard commands in MMBasic for setting the time (TIME\$ and DATE\$).

From then on MMBasic will automatically retrieve the current time and date on power up and display it under the Maximite logo– just to let you know that your battery backed clock is working correctly.

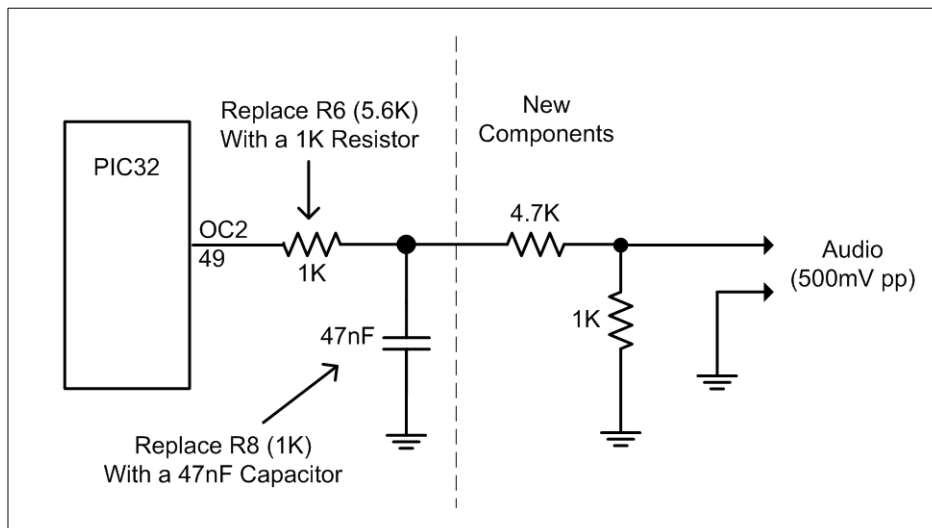
If you do not install the components Colour MMBasic will use its internal clock (which is reset to zero on power up).

Sound or PWM Output on the Monochrome Maximite

In MMBasic version 4.0 (and later) the sound output can be used to play stereo music, sound effects or sine wave tones using MMBasic's stereo music synthesiser.

The output is a pulse width modulated (PWM) signal with a carrier of about 100KHz. This needs to be passed through a low-pass filter to remove the carrier frequency as this can cause trouble with some amplifiers. The Colour Maximite has this filter built in but if you want to use the PLAYMOD and TONE commands on the monochrome Maximite you need to modify the sound output circuit to add the low-pass filter.

These are the required modifications for the Monochrome Maximite:



For more details refer to the section "Sound or PWM Output" at <http://geoffg.net/MaximiteDesign.html>.

Controller Area Network (CAN) support (Colour Maximite only)

A special version of MMBasic which supports CAN is available from <http://geoffg.net/maximite.html>. Except for the support of CAN this version runs the same as the standard version of MMBasic.

The CAN signals are available on D4 (Rx) and D5 (Tx) of the Arduino connector. The Colour Maximite does not have a driver chip so that will need to be added, probably on a daughter board which could plug into the Arduino connector. For an example of the required circuit see:

http://www.thebackshed.com/forum/forum_posts.asp?TID=5249&PN=1

Electrical Characteristics

Power Supply – Colour Maximite

- Via External Power: 7V to 16V. The connector is a standard 2.1 mm power connector with the centre pin positive.
- Via USB Connector: 4.5V to 5.5V (automatic switchover from external to USB power)
- Current Draw: 160mA typical (plus current draw from the I/O pins)

Power Supply – Original 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: 150mA 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 and A0 to A5)
2.5V to 5.5V (I/O pins 11 to 20 and D0 to D13)
- 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 and A0 to A5)

- Voltage Range: 0 to 3.3V
- Accuracy: Typically $\pm 1\%$. This accuracy is dependent of the accuracy of the 3.3V supply voltage. The Colour Maximite uses a precision regulator so the accuracy is typically much better than this.
- Input Impedance: >1M Ω (for accurate readings the source impedance should be <10K)

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 and D0 to D13): 5.5V

Audio Output

- Audio Frequency Response: <20Hz to 4KHz
- Output Level: 0.5V pp (with components as specified)
0 to 3.3V when operated as a PWM output.

Battery Backed Clock (Colour Maximite)

- Time keeping accuracy: ± 50 ppm (typical at room temperatures)
- Battery Life: 10 to 15 years (limited by the battery shelf life)

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