

Clocodile

An internet-connected digital clock in the shape of a crocodile with multiple fonts and multiple transition effects.

Construction

Solder the Raspberry Pi Pico 2 W (U1) to the circuit board orienting it so that the USB socket on the Pico is next to the cut-out in the board. Be careful to avoid bridges between pins.

Bend the legs of the regulator (REG1) at right angles and solder it such that the metal heatsink is flat on the board and the side with the writing is facing upwards.

Solder the Schottky diode (D1) matching the silver stripe on the body to the 'k' symbol on the board.

Solder the pushbuttons (SW1 to SW6) to the board.

Fit and solder the electrolytic capacitors (C1 and C2) paying attention to their polarity (negative is marked by the shorter leg and by a stripe on the side of the body).

Solder the dc barrel power socket (J1).

Optionally solder the two surface-mount resistors (R1 and R2) and the USB-C power socket (J2). These components are only needed if you wish to power *Clocodile* via USB-C and can be ignored if the board is powered by an external power supply through the barrel socket.

The USB-C socket is a power-only socket which excludes the USB data pins. This makes it a little easier to solder but to do so usually requires a needle-tipped soldering bit, flux, fine-gauge solder and probably solder wick as well. Be careful not to bridge pins on the socket if you do solder it.

The board can also be powered via the micro USB socket on the Pico itself. To do so bridge the two pads on the circuit board marked "Pico USB" with a small blob of solder. **If you bridge these pads then don't use the other two sources of power (barrel socket and USB-C) at all or you could get a voltage mismatch.** It would be safer to not solder J1 and J2 in this case. The cut-out in the board is to facilitate connection of a micro USB cable.

There are several options for mounting the LCD displays. The displays can either be parallel with the circuit board or at right angles to it.

For the former case the 7-way sockets need to be used. Solder them to the board using the sets of 7 holes (the ones nearer the board edge, the sets of 8 holes are for an alternative LCD display and are not used at the moment). The straight headers are then soldered to the LCD displays themselves and the displays fitted into the sockets. See left-hand pictures below.

For the latter case the use of the sockets is optional. If the sockets are used then the displays are a little higher above the board but they can be removed again which makes *Clocodile* more portable. In this case solder the right-angle headers to the LCD displays (soldering on the screen side of the display boards) and fit them into the sockets. See right-hand pictures below.

If you opt not to use the sockets and instead to solder the displays directly to the board then make sure they are all neatly aligned with each other at right angles to the board.

Finally stick the self-adhesive rubber feet to the underside of the board spaced around the perimeter (on the four feet and the head and tail). If mounting *Clocodile* vertically (displays parallel with the PCB) on a wall for example, the four 4mm holes in the feet can be used.

Power up *Clocodile* either from USB or a wall wart delivering 5 to 7.5V regulated dc with a centre-positive 2.1mm plug. (More than 7.5V could cause the regulator to heat up too much.)

On power-up the Pico on-board LED flashes twice and flashes twice again after Wi-Fi connection completes (which may take some time).

How to use

The < and > buttons in conjunction with the + and - buttons allow the current time to be set. The < and > buttons select the current digit to adjust (it is highlighted) and the + and - buttons increment and decrement that digit.

The **12/24** button toggles between a 12-hour and a 24-hour display.

The **MODE** button pressed and held down then at the same time the < or > button pressed cycles through the fonts (see below).

The **MODE** button pressed and held down then at the same time the + or - button pressed cycles through the transition effects (see below).

The **MODE** button pressed and held down then at the same time the **12/24** button pressed toggles between a bright and a dimmed display.

Settings are saved in non-volatile memory after an idle 10 seconds.

On power-up the current time is fetched from the internet. To enable this your Wi-Fi network name and password need to be entered via a serial terminal (see below).

Command line

A command line interpreter allows more settings to be adjusted and Wi-Fi credentials to be set.

Connect the micro USB socket on the Pico 2 W to a host computer and the Pico will enumerate as a virtual serial port (the board doesn't need to be powered via the power socket when doing this). Use a terminal program such as *PutTY* to connect to the virtual port.

Commands can be entered and terminated with CR, LF or CRLF.

Commands

SSID <string> - specifies the Wi-Fi network name

Password <string> - specifies the Wi-Fi password

Time <hours>:<mins>:<secs> | <hours>:<mins> - sets the current time (disables network time updates and resets the time zone)

Display - toggles 12-hour or 24-hour mode

Zone <hours>:<mins> | <hours> - specifies the time zone, hours = -12 to +14

Font <n> - specifies the current font, n = 1 to 14

Fx <n> - specifies the current transition effect, n = 1 to 14

Synch <hours>:<mins>:<secs> | <hours>:<mins> | <hours> - network time update period, 0 to disable

Help - displays this list of commands

Help font - displays a list of available fonts

Help fx - displays a list of available transition effects

The firmware will try multiple times on power-up to connect to the internet and fetch the current time from the network. (Ctrl+C from the terminal will abort the internet connection process after an up-to-30s delay.) The time that is fetched is UTC time (GMT) and typically will need offsetting to your local time zone.

This can be done from the command line using the **Zone** command which specifies the offset from UTC in hours or hours and minutes. This setting is stored in non-volatile memory and only needs to be done once. No further adjustment is needed except when daylight saving time changes.

The current time offset can also be set with the pushbuttons to add or subtract the appropriate number of hours from the displayed time. Doing so disables further fetches of UTC time from the network until the board is next powered up.

The current time can also be fetched periodically from the internet to avoid drift from the Pico's internal clock and keep *Clocodile* accurate. Use the **Synch** command for this. A few hours or up to a day perhaps would be reasonable update periods.

If the current time is set via the pushbuttons or the command line then the network time update is suspended until the next reboot. If the **Synch** update period is set to zero then the current time is only fetched from the internet when *Clocodile* is first powered up.

Setting the Wi-Fi network name to an empty string disables fetching of network time.

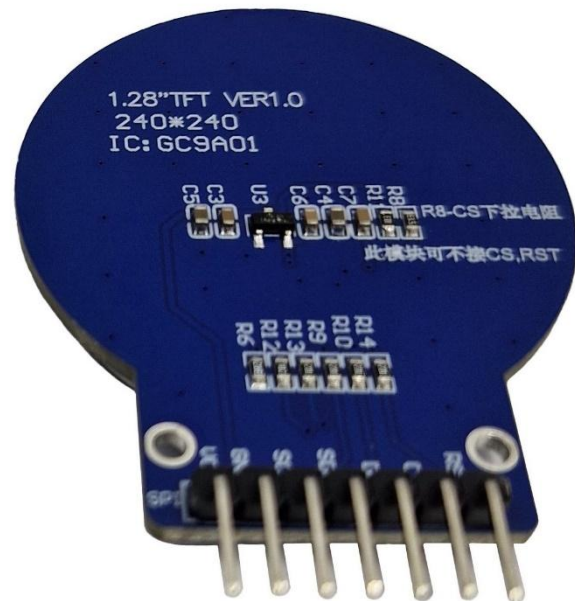
Fonts

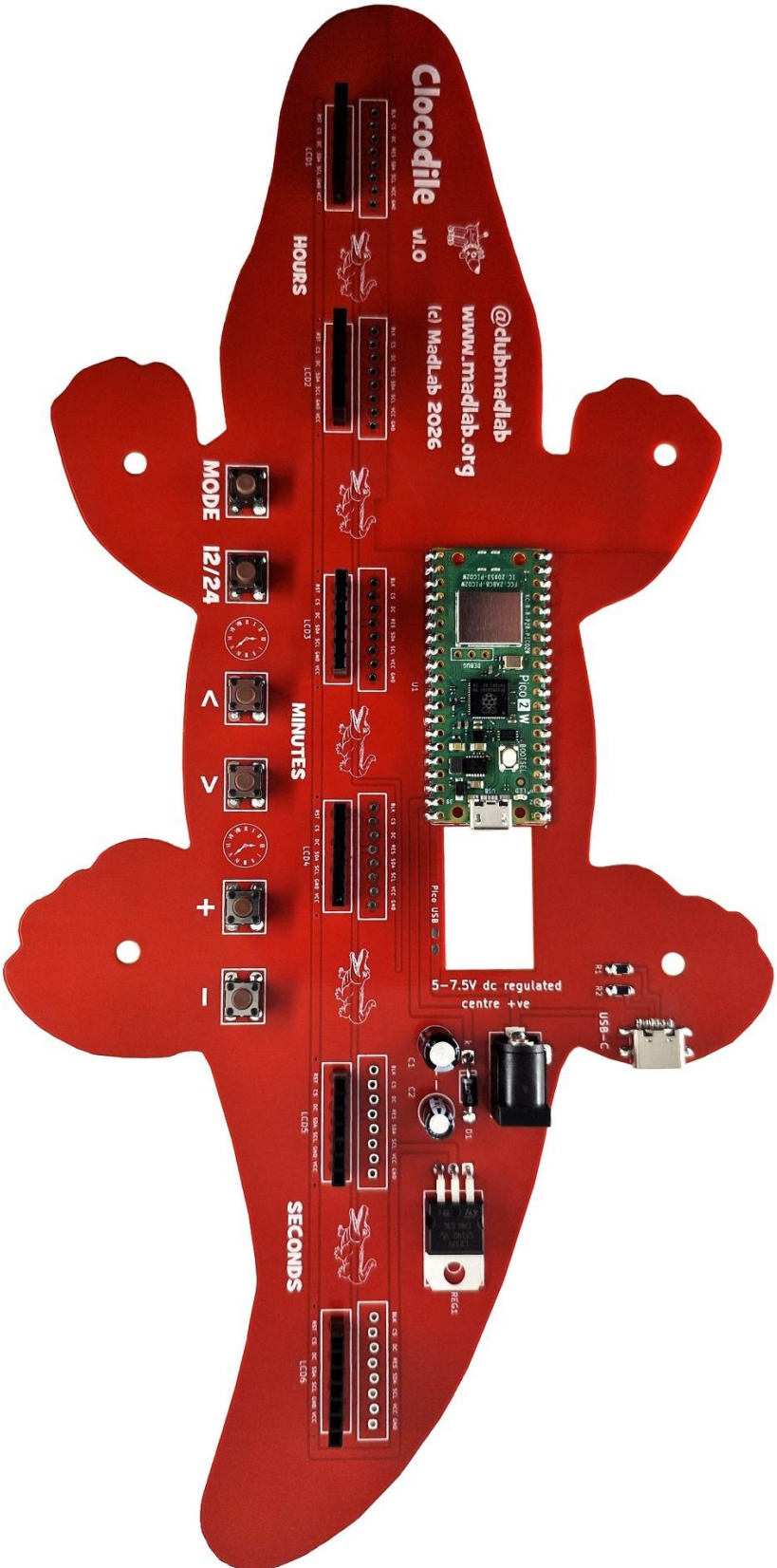
- blue 7-segment LED
- red 7-segment LED
- amber backlight 7-segment LCD
- 'scope
- flip digits
- flowers
- Nixie tubes
- retro
- golden
- animals
- cartoons
- balloons
- coloured bold
- Matrix digital rain

Transition effects

- simple replacement
- scroll down both
- scroll down over
- overwrite
- slide in from the left
- overwrite from the left
- blinds

- expand outwards from centre
- expand outwards from four corners in turn
- slide outwards from four corners in turn
- expand outwards from centre in a spiral
- erase outwards from centre then expand outwards
- dissolve
- flip digits





Component list

Resistors

R1, R2 5k1 1% 1206 SMD

Capacitors

C1 100uF electrolytic (blue or black)

C2 10uF electrolytic (blue or black)

Semiconductors

REG1 LD1117V33 LDO 3.3V 0.8A regulator (black/silver)

D1 Schottky diode (black)

LCD1 – LCD6 1.28" 240 x 240 circular TFT LCD display

U1 Raspberry Pi Pico 2 W single-board computer

Miscellaneous

SW1 – SW6 miniature tactile pushbutton

J1 2.1mm dc power barrel socket

J2 USB-C power socket

PCB

7-way socket x 6

7-way SIL straight header x 6

7-way SIL right-angle header x 6

Self-adhesive rubber feet x 6

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Email: info@madlab.org

Web: www.madlab.org

Social: @clubmadlab

GitHub: <https://github.com/clubmadlab/Clocodile>

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