

IMPORTANT - WAVESHARE-SPECIFIC WI-FI GPIO ASSIGNMENT

THIS VERSION USES GPIO 36, 37, 38 AND 39 FOR WI-FI.

IT DOES NOT USE THE CLASSIC ORIGINAL WI-FI GPIO ASSIGNMENT 23, 24, 25 AND 29.

GP36 -> WL_ON / WL_REG_ON

GP37 -> WL_D / DATA

GP38 -> WL_CS

GP39 -> WL_CLK

For Waveshare RP2350B-Plus-W only.

Patch Report

Waveshare RP2350B Plus W

WebMite MMBasic RP2350B Edition V6.04.00RC1

Final firmware: [Webmite 6.04.00RC1_WS_only.uf2](#)

1. Scope and Source Baseline

This report documents the software changes required to build WebMite MMBasic RP2350B Edition V6.04.00RC1 specifically for the Waveshare RP2350B-Plus-W. The changes are intentionally board-specific and must not alter the behaviour of other RP2350 WebMite targets.

Source tag: PicoMite-V6.04.00RC1
Commit: 083337152f09e84a0e538afb18986b530fe5804f
Pico SDK: 2.3.0
ARM GCC: 13.3.1
Build target: WEBRP2350

2. Summary of Software Changes

Area	Change	Result / Scope
CMakeLists.txt	WEBRP2350 selects a dedicated Waveshare board profile.	Other wireless RP2350 variants retain the previous Pimoroni profile.
Board header	New waveshare_rp2350b_plus_w.h with RP2350B, 16 MB flash and Wi-Fi GPIO definitions.	Provides the board data consumed by Pico SDK/CYW43.
PicoMite.c	GP23/24/25/29 returned to user GPIO status; GP36/37/38/39 reserved for Wi-Fi.	Prevents MMBasic from resetting or reconfiguring Wi-Fi lines.
core/MM_Misc.c	LIST PINS / MM.INFO(PIN) moved from pseudo pins 41-44 to 51-54 for Waveshare.	Diagnostic output now matches GP36-39.
net/WiFi.c	Limited retry after PICO_ERROR_CONNECT_FAILED.	Maximum 3 attempts; approx. 1 s poll settle between retries.
misc/External.c	No changes.	Original SoftReset path retained; no CYW43 deinit added.

3. CMake Build Selection - Detailed Change

Before the patch, the WEBRP2350 build path selected a board profile intended for another RP2350 wireless board. That profile does not describe the Waveshare RP2350B-Plus-W Wi-Fi GPIO routing.

The board selection logic was changed so that only WEBRP2350 in this dedicated Waveshare source tree selects the new board profile. HDMIWEB, BT and BTH paths continue to use the previous board profile.

```
if(IS_RP2350)
  set(PICO_PLATFORM rp2350)
  if(IS_WEBRP2350)
    # Waveshare RP2350B-Plus-W
    set(_PM_BOARD waveshare_rp2350b_plus_w)
  elseif(IS_HDMIWEB OR IS_BT OR IS_BTH)
    set(_PM_BOARD pimoroni_pico_plus2_w_rp2350)
  else()
    set(_PM_BOARD pimoroni_pga2350)
  endif()
```

A local Pico SDK board-header search path was also added before pico_sdk_import.cmake:

```
set(PICO_BOARD_HEADER_DIRS "${CMAKE_CURRENT_LIST_DIR}/board_headers" CACHE STRING "Local Pico SDK board headers"
FORCE)
include(pico_sdk_import.cmake)
```

Effect: CMake passes PICO_BOARD=waveshare_rp2350b_plus_w to the SDK, so the CYW43 driver compiles against the Waveshare-specific GPIO definitions.

4. New Board Header - Detailed Definition

A new file was added:

```
board_headers/waveshare_rp2350b_plus_w.h
```

The header describes the board as RP2350B rather than RP2350A and enables CYW43 support. It also defines 16 MB flash and the board-specific Wi-Fi interface pins.

```
pico_board_cmake_set(PICO_PLATFORM, rp2350)
pico_board_cmake_set(PICO_CYW43_SUPPORTED, 1)

#define WAVESHARE_RP2350B_PLUS_W
#define PICO_RP2350A 0

#define PICO_FLASH_SIZE_BYTES (16 * 1024 * 1024)
#define PICO_VSYS_PIN 46

#define CYW43_DEFAULT_PIN_WL_REG_ON 36u
#define CYW43_DEFAULT_PIN_WL_DATA_OUT 37u
#define CYW43_DEFAULT_PIN_WL_DATA_IN 37u
#define CYW43_DEFAULT_PIN_WL_HOST_WAKE 37u
#define CYW43_DEFAULT_PIN_WL_CS 38u
#define CYW43_DEFAULT_PIN_WL_CLOCK 39u

#define CYW43_WL_GPIO_COUNT 3
#define CYW43_WL_GPIO_LED_PIN 0
#define CYW43_WL_GPIO_VBUS_PIN 2
```

The key software consequence is that the Pico SDK CYW43 PIO/SPI driver is compiled for GP36-GP39 instead of the classic GP23/GP24/GP25/GP29 routing.

5. PicoMite.c Pin Table - Detailed Change

This is the most important PicoMite-side change. The original wireless pin table reserved pseudo pins 41-44, which map to GP23, GP24, GP25 and GP29. That is correct for the classic layout but not for Waveshare RP2350B-Plus-W.

5.1 Original behaviour

```
#if (defined(PICOMITEWEB) && defined(rp2350)) || defined(PICOMITEBT) || defined(PICOMITEBTH) || defined(PICOMITEHDMIBTH)
    {41, 23, "GP23", UNUSED, 99, 99},
    {42, 24, "GP24", UNUSED, 99, 99},
    {43, 25, "GP25", UNUSED, 99, 99},
    {44, 29, "GP29", UNUSED, 99, 99},
```

With this definition, CheckPin() treats GP23/24/25/29 as unavailable and ClearExternalIO() does not reset them. However, GP36/37/38/39 remained ordinary GPIO entries.

5.2 Patched Waveshare behaviour

```
#if defined(WAVESHARE_RP2350B_PLUS_W) && defined(PICOMITEWEB)
    {41, 23, "GP23", DIGITAL_IN | DIGITAL_OUT | SPI0TX | I2C1SCL | PWM3B, 99, 131},
    {42, 24, "GP24", DIGITAL_IN | DIGITAL_OUT | SPI1RX | UART1TX | I2C0SDA | PWM4A, 99, 4},
    {43, 25, "GP25", DIGITAL_IN | DIGITAL_OUT | UART1RX | I2C0SCL | PWM4B, 99, 132},
    {44, 29, "GP29", DIGITAL_IN | DIGITAL_OUT | ANALOG_IN | UART0RX | I2C0SCL | PWM6B, 3, 134},
#elseif ...
```

GP23/24/25/29 are therefore restored as normal user-accessible GPIOs only for this Waveshare WebMite build.

The actual Waveshare Wi-Fi pins are separately converted to reserved entries:

```
#if defined(WAVESHARE_RP2350B_PLUS_W) && defined(PICOMITEWEB)
    {51, 36, "GP36", UNUSED, 99, 99}, // WL_ON
    {52, 37, "GP37", UNUSED, 99, 99}, // WL_D
    {53, 38, "GP38", UNUSED, 99, 99}, // WL_CS
    {54, 39, "GP39", UNUSED, 99, 99}, // WL_CLK
#else
    // Original normal GPIO definitions for GP36-GP39
#endif
```

Why this matters: the UNUSED mode prevents the generic MMBasic I/O cleanup/reset paths from treating the Wi-Fi transport pins as user I/O. This protects the CYW43 connection after initialization and during later I/O housekeeping.

6. core/MM_Misc.c - LIST PINS / MM.INFO(PIN)

PicoMite uses internal pseudo-pin indexes when reporting pin state. Two separate code paths had hard-coded CYW43 detection for pseudo pins 41-44. Both paths were made Waveshare-aware.

6.1 Integer pin recognition

```
#if defined(PICOMITEWEB) || defined(PICOMITEBT) || defined(PICOMITEBTH) || defined(PICOMITEHDMIBTH)
#if defined(WAVESHARE_RP2350B_PLUS_W) && defined(PICOMITEWEB)
    if (pin >= 51 && pin <= 54)
#else
    if (pin >= 41 && pin <= 44)
#endif
{
    iret = pin;
    targ = T_INT;
    return;
}
```

```
#endif
```

6.2 Text status reporting

```
#if defined(PICOMITEWEB) || defined(PICOMITEBT) || defined(PICOMITEBTH) || defined(PICOMITEHDMIBTH)
#if defined(WAVESHARE_RP2350B_PLUS_W) && defined(PICOMITEWEB)
    if (pin >= 51 && pin <= 54)
#else
    if (pin >= 41 && pin <= 44)
#endif
    {
        strcpy((char *)sret, "Boot Reserved : CYW43");
        CtoM(sret);
        targ = T_STR;
        return;
    }
#endif
```

Expected diagnostic result after flashing:

```
GP36  Boot Reserved : CYW43
GP37  Boot Reserved : CYW43
GP38  Boot Reserved : CYW43
GP39  Boot Reserved : CYW43
```

At the same time, GP23/24/25/29 must no longer appear as CYW43-reserved pins in this Waveshare-only build.

7. net/WiFi.c - Warm-Restart Retry Logic

The original connection path performed a single blocking Wi-Fi join. During warm-reset testing, the CYW43 stack could return PICO_ERROR_CONNECT_FAILED on the first join attempt even though a later attempt could succeed.

7.1 Original connection call

```
connect_result = cyw43_arch_wifi_connect_timeout_ms(
    (char *)Option.SSID,
    (char *)(*Option.PASSWORD ? Option.PASSWORD : NULL),
    (*Option.PASSWORD ? CYW43_AUTH_WPA2_MIXED_PSK : CYW43_AUTH_OPEN),
    30000);
```

7.2 Patched retry logic

```
int connect_result = PICO_ERROR_CONNECT_FAILED;

for (int rm2_attempt = 1; rm2_attempt <= 3; rm2_attempt++)
{
    connect_result = cyw43_arch_wifi_connect_timeout_ms(
        (char *)Option.SSID,
        (char *)(*Option.PASSWORD ? Option.PASSWORD : NULL),
        (*Option.PASSWORD ? CYW43_AUTH_WPA2_MIXED_PSK : CYW43_AUTH_OPEN),
        30000);

    if (connect_result == 0)
        break;

    if (connect_result != PICO_ERROR_CONNECT_FAILED || rm2_attempt == 3)
        break;
```

```

for (int rm2_wait = 0; rm2_wait < 100; rm2_wait++)
{
    cyw43_arch_poll();
    uSec(10000);
}
}

```

Behavioural rules:

- Maximum of three total connection attempts.
- A second or third attempt is made only for PICO_ERROR_CONNECT_FAILED.
- Any other error exits immediately and preserves the original error handling.
- Between retry attempts the poll backend runs for approximately one second (100 x 10 ms).
- There is no infinite retry loop and no automatic CYW43 deinitialization.

8. SoftReset and misc/External.c - Explicitly Not Modified

Earlier experimental approaches that attempted to deinitialize or manually toggle the wireless hardware during SoftReset were rejected. The final Waveshare patch does not contain those changes.

```

void SoftReset(int code)
{
    _excep_code = code;
#ifdef USBKEYBOARD
    USBenabled = false;
    uSec(50000);
#endif
    watchdog_enable(1, 1);
    while (1)
    {
    }
}

```

Verified conditions:

- misc/External.c is unchanged from commit 083337152f09e84a0e538afb18986b530fe5804f.
- No cyw43_arch_deinit() call exists in the SoftReset path.
- No manual GPIO operation on GP36-GP39 is added to SoftReset.
- The watchdog-based original restart behaviour is retained.

9. Source Integrity and Line Ending Verification

During development, accidental CRLF conversion of two LF source files was detected and corrected before the final build.

```

CMakeLists.txt i/crlf w/crlf
PicoMite.c i/lf w/lf
core/MM_Misc.c i/lf w/lf
net/WiFi.c i/lf w/lf

```

The final source audit also confirmed:

- git diff --check: PASS
- Only CMakeLists.txt, PicoMite.c, core/MM_Misc.c and net/WiFi.c are modified tracked files.
- board_headers/waveshare_rp2350b_plus_w.h is the only new source component required for the board profile.
- No temporary Wi-Fi debug strings remain.

10. Verified Source Diff Size

```
CMakeLists.txt    +6 -1
PicoMite.c        +14 -1
core/MM_Misc.c    +8 -0
net/WiFi.c        +21 -1
```

These counts are included to make later source-tree comparison easier and to detect accidental extra edits.

11. Final Build Verification

```
COMPILE = WEBRP2350

FLASH: used 0x16B6B4 / limit 0x16C000
      margin: +2380 bytes (+2.3 KB) [PASS]

RAM:  0x2007FAE0 / STACK_TOP 0x20082000
      margin: +9504 bytes (+9.3 KB) [PASS]

HEAP: alignment PASS
LFS:  alignment PASS

Build time: 00:00:54.27
```

Verified SHA256 of the newly built firmware image before final naming:

```
2C22D3527A24F27BC67E56EB2147642CEF4A54521F14C8964CB8B72E47F8171A
```

Final firmware name:

```
Webmite 6.04.00RC1_WS_only.uf2
```

12. Expected Runtime Verification

After flashing, the following checks should be used to verify that the software changes are active:

- Cold start: firmware boots and the heartbeat is present.
- Wi-Fi connects using GP36-GP39.
- LIST PINS reports GP36-GP39 as 'Boot Reserved : CYW43'.
- GP23/GP24/GP25/GP29 are not reported as CYW43-reserved.
- Normal Wi-Fi traffic does not stop the heartbeat.
- CPU RESTART is followed by a successful reconnect, using the limited retry logic when required.

FOR WAVESHARE RP2350B-PLUS-W ONLY

Wi-Fi GPIOs: GP36, GP37, GP38, GP39

Do not use the classic GP23/GP24/GP25/GP29 Wi-Fi assignment with this firmware.