```
// -------------------------------------------------- //
// This file is autogenerated by pioasm; do not edit! //
// -------------------------------------------------- //

#pragma once

#if !PICO_NO_HARDWARE
#include "hardware/pio.h"
#endif

// ------ //
// ws2812 //
// ------ //

#define ws2812_wrap_target 0
#define ws2812_wrap 3

#define ws2812_T1 2
#define ws2812_T2 5
#define ws2812_T3 3

static const uint16_t ws2812_program_instructions[] = {
```

array list with Instructions

```
            //     .wrap_target
    0x6221, //  0: out    x, 1            side 0 [2]
    0x1123, //  1: jmp    !x, 3           side 1 [1]
    0x1400, //  2: jmp    0               side 1 [4]
```

Shift 1 bit datum to register
Jump to 3 when x=0
Jum to 0

```
    0xa442, //  3: nop                    side 0 [4]
            //     .wrap
};

#if !PICO_NO_HARDWARE
static const struct pio_program ws2812_program = {
    .instructions = ws2812_program_instructions,
    .length = 4,
    .origin = -1,
};
```

define the Instructor with length and origin

```
static inline pio_sm_config ws2812_program_get_default_config(uint offset) {
    pio_sm_config c = pio_get_default_sm_config();
    sm_config_set_wrap(&c, offset + ws2812_wrap_target, offset + ws2812_wrap);
    sm_config_set_sideset(&c, 1, false, false);
    return c;
}
```

set up the state machine wrap and side set

```
#include "hardware/clocks.h"
static inline void ws2812_program_init(PIO pio, uint sm, uint offset, uint pin, float freq, bool rgbw) {
    pio_gpio_init(pio, pin);
```

Initialize GPIO for PIO usage

```
    pio_sm_set_consecutive_pindirs(pio, sm, pin, 1, true);
    pio_sm_config c = ws2812_program_get_default_config(offset);
    sm_config_set_sideset_pins(&c, pin);
```

set up sm pin

```
    sm_config_set_out_shift(&c, false, true, rgbw ? 32 : 24);
    sm_config_set_fifo_join(&c, PIO_FIFO_JOIN_TX);
```

set the fifo pin

```
    int cycles_per_bit = ws2812_T1 + ws2812_T2 + ws2812_T3;
```

calculate divider at clock

```
    float div = clock_get_hz(clk_sys) / (freq * cycles_per_bit);
```

Calculate clkdiv

```
    sm_config_set_clkdiv(&c, div);
    pio_sm_init(pio, sm, offset, &c);
    pio_sm_set_enabled(pio, sm, true);
}
```

Initializ the state machin

```
#endif
```

The rest is repeated from above

```
// -------------- //
// ws2812_parallel //
// -------------- //

#define ws2812_parallel_wrap_target 0
#define ws2812_parallel_wrap 3

#define ws2812_parallel_T1 2
#define ws2812_parallel_T2 5
#define ws2812_parallel_T3 3

static const uint16_t ws2812_parallel_program_instructions[] = {
            //     .wrap_target
    0x6020, //  0: out    x, 32
    0xa10b, //  1: mov    pins, !null           [1]
    0xa401, //  2: mov    pins, x               [4]
    0xa103, //  3: mov    pins, null            [1]
            //     .wrap
};

#if !PICO_NO_HARDWARE
static const struct pio_program ws2812_parallel_program = {
    .instructions = ws2812_parallel_program_instructions,
    .length = 4,
    .origin = -1,
};

static inline pio_sm_config ws2812_parallel_program_get_default_config(uint offset) {
    pio_sm_config c = pio_get_default_sm_config();
    sm_config_set_wrap(&c, offset + ws2812_parallel_wrap_target, offset + ws2812_parallel_wrap);
    return c;
}

#include "hardware/clocks.h"
static inline void ws2812_parallel_program_init(PIO pio, uint sm, uint offset, uint pin_base, uint pin_count, float freq) {
    for(uint i=pin_base; i<pin_base+pin_count; i++) {
        pio_gpio_init(pio, i);
    }
    pio_sm_set_consecutive_pindirs(pio, sm, pin_base, pin_count, true);
    pio_sm_config c = ws2812_parallel_program_get_default_config(offset);
    sm_config_set_out_shift(&c, true, true, 32);
    sm_config_set_out_pins(&c, pin_base, pin_count);
    sm_config_set_set_pins(&c, pin_base, pin_count);
    sm_config_set_fifo_join(&c, PIO_FIFO_JOIN_TX);
    int cycles_per_bit = ws2812_parallel_T1 + ws2812_parallel_T2 + ws2812_parallel_T3;
    float div = clock_get_hz(clk_sys) / (freq * cycles_per_bit);
    sm_config_set_clkdiv(&c, div);
    pio_sm_init(pio, sm, offset, &c);
    pio_sm_set_enabled(pio, sm, true);
}

#endif
```