

# CPU Board

The thing that runs the show

- Peripheral Allocation
- DMA Channel Allocations
- Clocking
- Hardware Errata

# Peripheral Allocation

- CAN0: Expansion
  - PA22 (TX), PA23 (RX)
- SERCOM0: I2C, front panel/rear IO (through mux)
  - IOSET1
  - PA8 (SDA, PAD0), PA9 (SCL, PAD1)
- SERCOM2: I<sup>2</sup>C, analog board
  - PA12 (SDA, PAD0), PA13 (SCL, PAD1)
- SERCOM3: SPI, analog board
  - IOSET1
  - PA16 (SCK, PAD1), PA17 (MOSI, PAD0), PA18 (MISO, PAD2)
  - Chip select: PA19 (/EN)
  - Chip index: PB16, PB17
- SERCOM4: SPI, front panel display
  - IOSET1
  - DIPO = 0x0
  - DOPO = 0x2
  - PB12 (MISO, PAD0), PB13 (SCK, PAD1), PB14 (/CS, PAD2), PB15 (MOSI, PAD3)
- SERCOM5: SPI, NOR flash (bonus data)
  - IOSET6
  - DIPO = 0x3
  - DOPO = 0x0
  - PB2 (MOSI, PAD0), PB3 (SCK, PAD1), PB0 (/CS, PAD2), PB1 (MISO, PAD3)
- TC3: Fan PWM
  - PA14: WO[0]
- TC5: Beeper
  - PB10: WO[0]
- EIC: External interrupt controller
  - PA15: /TRIGGER
    - EXTINT15
  - PA20: /ANALOG\_IRQ
    - EXTINT4
  - PB08: ENCODER\_B
    - EXTINT8
  - PB07: ENCODER\_A
    - EXTINT7
  - PA10: /IO\_I2C\_IRQ
    - EXTINT10
- XOSC1: 12MHz oscillator
  - XIN (PB22), XOUT (PB23)
- Debug

- SWCLK (PA30), SWDIO (PA31), SWO (PB30)

If desired, the driver communication interface can use CAN0 instead. It uses the same IO pins as the I<sup>2</sup>C bus, and requires a CAN transceiver on the board.

# DMA Channel Allocations

DMAC should operate with dynamic, round-robin priority arbitration within a DMA priority level. Priority levels listed are from 0 (highest) to 3 (lowest.)

- Ch0: NOR flash SPI Tx empty (SERCOM5)
  - Priority: 2
  - Operate in SPI 32 bit data mode
  - Burst transfers
- Ch1: NOR flash SPI Rx complete (SERCOM5)
  - Priority: 2
  - Operate in SPI 32 bit data mode
  - Burst transfers
- Ch2: Display SPI Tx empty (SERCOM4)
  - Priority: 1
  - Operate in SPI 32 bit data mode
  - Burst transfers

# Clocking

## Clock Inputs

All clocks on the system are derived from one of the following clock inputs (oscillators and internal generators:)

### Crystals

- XOSC1: External 12MHz oscillator
  - Provides primary system clock reference
- XOSC32K: External 32.768kHz oscillator
  - Runs in standby for RTC

### FLLs

- DFLL48M: 48MHz
  - Used for USB reference clk
  - Uses external 32kHz osc for reference

### PLLs

- DPLL0: 120MHz
  - CPU core clock

## Clock Sources

The above clock inputs are then synthesized into multiple clock sources, each used by a different set of peripherals:

- GCLK0: 120MHz
  - Sourced from DPLL0 / 1
  - General high speed clock
- GCLK1: 48MHz
  - Sourced from DFLL48M
  - Intended for USB use
- GCLK3: 32.768kHz
  - Sourced from XOSC32K
  - SERCOM slow clock
- GCLK4: 12MHz

- Sourced from XOSC1
- General low speed clock
- GCLK5: 32.768kHz
  - Sourced from ultra low power 32kHz osc

## Clock Consumers

- CPU core: GCLK0
  - Clock division factor: /1
  - Low power clock: /4
  - Backup domain: /8
  - High-speed: /1

# Hardware Errata

This page lists some issues with CPU board hardware, as they are discovered, and some workarounds.

## Rev 1

- /I2C\_IRQ's external IRQ line conflicts with ENCODER\_A
  - Move /I2C\_IRQ from PA7 to PA10
  - Rework required: solder line from pin 11 (/IRQ) of U101 to middle of J302 (TXD)
- Status LED (D302) footprint is wrong
  - The common (+) and red pins are swapped
- Footprint for MMBT3904 transistors (Q101, Q301) are slightly too small
  - The two pads side is slightly too much spacing between pads
  - They are still solderable, it just looks ugly
- NOR Flash (U303) is actually 4Mbit
  - This is the part I actually had lol
- Power LED driver doesn't work
  - The weird trick with the two resistors doesn't seem to work... like, at all
  - We'll have to revisit how this is controlled (external logic? sacrificing another pin?)
  - Footprint notes
    - Copper size on the pads could be increased
    - For mechanical retention of the switch, nudge the outer (switch) pads in by a small amount
- Switched front/rear I<sup>2</sup>C bus (from mux to MCU) is missing pull ups
  - Need to insert these between the mux (U101) and microcontroller

- Rework required: Bodge in a pair of 2k2 resistors to +3V3

