

Dash Concept - Design Summary

Scope: this document summarizes the current concept board based on the STM32H745 microcontroller.

Hardware status is Rev 0.1 (pre-prototype). It consolidates information from the CubeMX configuration and the schematics.

Inspiration



Dashboard visual inspiration: Chalmers Formula Student team. The image is used as a stylistic reference for UI layout and features, not as a functional specification.

Board Overview

Form factor: 137 mm x 94 mm, thickness 1.6 mm, 4 layers (FR4). Target controlled impedances: 50 ohm single ended and 90 ohm differential per stackup. Primary functions: LCD via FMC, RF via SPI1, CAN FD via FDCAN1, debug via SWD/JTAG.

MCU and Clocks

MCU: STM32H745ZITx (LQFP144), dual core Cortex-M7 and Cortex-M4. CubeMX configuration targets M7 at 480 MHz and M4 at 240 MHz using HSE bypass and PLLs.

Power System

Input: +12 V. Main regulator: TPS62130 buck converter to +3.3 V. Local decoupling: 100 nF at each VDD/VSSA pin plus bulk values (for example 4.7 uF, 10 uF, 22 uF) as shown in the schematic.

Key Interfaces

| Interface | Details |
|-----------|--|
| FMC (LCD) | Bank1 NE3 as chip select. A8 used as D/C (register select). 16-bit data bus D0..D15. Control NOE=RD, NWE=WR. |
| USART6 | Async 115200 baud (TX on PC6, RX on PC7). |
| SPI1 | Master interface to RF transceiver (NSS PA4, SCK PA5, MISO PA6, MOSI PA7). |
| FDCAN1 | FD mode (PB8 RX, PB9 TX). |
| SWD/JTAG | ST-LINK V3: SWDIO, SWCLK, JTDI, SWO and NRST. |

RF Subsystem

2.4 GHz transceiver: CC2500 on SPI1 with GDO0/GDO2 interrupts and a 26 MHz crystal. Includes a compact matching network and antenna port. Rev 0.1 keeps the RF minimal for bring-up (no external PA/LNA or SAW). Future expansion can add PA/LNA front-end, on-board antenna options, or alternative radios using spare MCU I/O and board area.

Initial FMC Timing (from CubeMX)

Address setup: 15 cycles; Data setup: 255 cycles; Bus turn around: 15 cycles. Adjust these values to meet the LCD controller timing.

LCD Connector (ER-TFTM050-5, JP2/CON1 highlights)

| Pin(s) | Signal | Notes |
|--------|----------|------------------------------------|
| 1,40 | VSS | Ground |
| 2 | VDD | 3.3 V or 5 V (per module) |
| 3 | /CS | Chip select (connect to FMC NE3) |
| 4 | D/C | Data or Command (connect to A8) |
| 5 | RD | 8080 read strobe (connect to NOE) |
| 6 | WR | 8080 write strobe (connect to NWE) |
| 7 | RESET | Active low, recommended |
| 8 | TE | Optional tearing effect |
| 9-32 | DB0-DB23 | Use DB0-DB15 for 16-bit mode |
| 39 | BL_ON | Backlight control (optional PWM) |

LCD Screen Details (ER-TFTM050-5)

| Parameter | Value |
|--------------------------|---|
| Diagonal size | 5.0 inch |
| Resolution | 800 x 480 (RGB) |
| Active area | 108.0 mm x 64.8 mm |
| Outline (PCB) | 132.7 mm x 75.95 mm |
| Interface | 8080/6800 parallel, selectable 8/9/16/18/24-bit; SSD1963 controller |
| Supply options | VDD 3.3 V (J8 short) or 5.0 V (J8 open); logic VDDIO 3.3 V |
| Module current (typ/max) | ~280 mA @5V, up to 450 mA @3.3V |
| Brightness (typ) | 300 cd/m ² |
| Contrast (typ) | 500:1 |
| Viewing angle (typ) | Left 75°, Right 75°, Up 75°, Down 60° |
| Operating temp | -20°C to +70°C |

Minimal Concept and Expansion Paths

Rev 0.1 focuses on the minimum viable hardware to validate power-up, clocks, debug, FMC LCD, SPI RF, CAN, and a UART console. The layout and spare pins leave room for future features such as external storage, audio codec, backlight driver with PWM dimming, additional sensors, and extended radio front-end.

Files Provided

| File | Description |
|----------------------|--|
| Design Breakdown.pdf | Manufacturing-oriented summary: board dimensions, 4-layer stackup with target impedances, layer previews (Top/Bottom/L1–L4), BOM snapshot, and drill table. |
| Schematics.pdf | Electrical design: Power (12 V to 3.3 V buck and decoupling), I/O (MCU pinout, FMC LCD connector, ST-LINK/JTAG, CAN, USART), and RF (CC2500 with 26 MHz crystal, matching network, and antenna). |
| DashCubeMX.pdf | STM32CubeMX configuration report: MCU selection and package, pin assignments (FMC NE3/A8, USART6, SPI1, FDCAN1), clock tree, and initial FMC timings. |

References

MCU Reference Manual RM0399 (STM32H745/755/747/757): [Open link \(URL: https://www.st.com/resource/en/reference_manual/rm0399-stm32h745755-and-stm32h747757-advanced-armbased-32bit-mcus-stmicroelectronics.pdf\)](https://www.st.com/resource/en/reference_manual/rm0399-stm32h745755-and-stm32h747757-advanced-armbased-32bit-mcus-stmicroelectronics.pdf)

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