

Smart Embedded[®]

User Guide

ESEMB043013XDHAL Interface Description

PCB 20-21054-4

V1.0

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Revision history:

Date	Page, change	Version
2020-03-13	First Release	1.0

Preliminary

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Introduction

Emerging Display Technologies has developed a new series of Display modules called



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The ETEMB043013XDHAL is a Display Module with Touchpanel and Integrated Driver board with MCU, Memory and a number of interfaces.

This Document describes the Interfaces used on the Board in detail.

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1. Module Description

1.1 General

This Smart Embedded module has everything needed to build a modern Graphic User Interface Module. The MCU used is STM32F750 Cortex-M7 series with integrated TFT controller. Resolution of this 4.3" module is 480x272. Power Supply input is 7 to 36V.

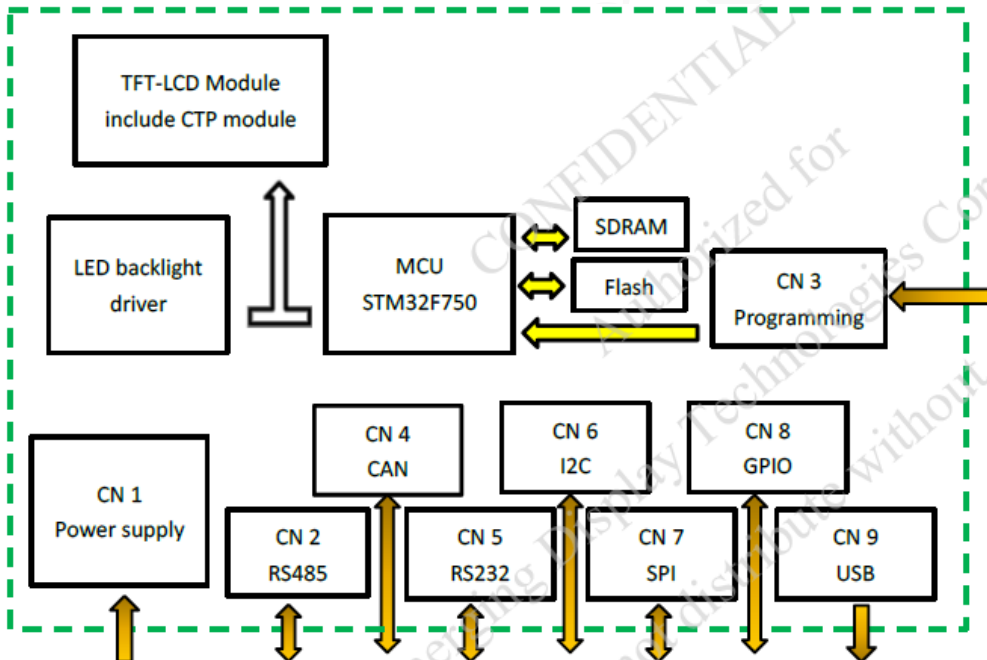
EDT Smart Embedded boards supports TouchGFX and FreeRTOS. We have implemented a number of generally used **Industrial** interfaces with **Driver** chips to connect to an external system.

The following interfaces are available as standard on the Evaluation Modules: I2C, SPI, CAN, RS485, RS232, 6-pin GPIO and USB OTG.

A programming interface for ST-LINK/V2/V3SET is also provided.

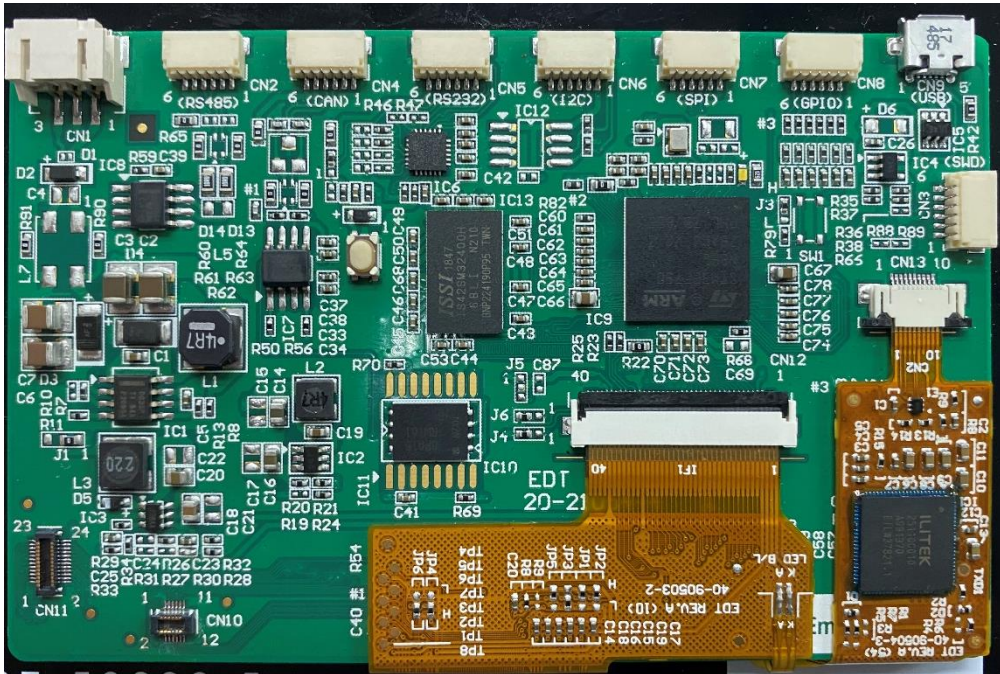
For **Electrical and Timing Specifications** please consult the **Datasheet** of STM32F750 and the appropriate CAS. For **Interface IC** specifications we have included links to datasheets.

1.2 Block Diagram



CN1: CHIN-TEK 2022-03/SMT
 CN2-CN8: JST SM06B-SRSS-TB(LF)(SN)
 CN9: MOLEX 47590-0001

1.3 Picture of PCB



1.4 TFT Backlight and Touch Interface

All circuits necessary to drive the TFT Display, Backlight and I2C channel for the **Touch System** are integrated on the Board. Backlight intensity is controlled by the application via a PWM signal.

Backlight ON/OFF Control is on **PB14** (Active High) and Backlight PWM Control is on **PB15**.

In the BSP there is a function to set the desired Backlight intensity. This is used in the StarterKit examples.

1.5 Memory

This module has 16MB **SDRAM** and 32MB **QSPI Flash**. Flash options: 16/32/64/128MB

The SDRAM is used for **Framebuffer(s)** .

QSPI **Flash** is used for storing **Application code**, **Fonts** and **Graphic** elements.

The MCU has 320KB Internal SRAM and 64KB Internal Flash which holds the Bootloader.

2. Hardware connections

In this section the HW interfaces and supply voltage requirements are described.

2.1 Power Input – CN1

The pin function, name and description can be seen in the following table:

Pin #	Name	I/O	Description
1	VP_IN	P	Positive Power Supply input (7-36V)
2	VP_EN*	I	POWER SUPPLY Enable (connect to VSS to Power down)
3	VSS	P	Ground

* **Note:** Pin 2 has a 10k Pull-up to VP_IN (after reverse voltage diode).

Pin types:

P – Power pins.

I – Input

O – Output

IO – Bi-directional pin.

The On-Board LED is controlled by P18.

2.2 RS485 – CN2

Pin #	Name	I/O	Description
1	VSS	P	GND
2	VSS	P	GND
3	RS485_A	I/O	RS485A
4	RS485_B	I/O	RS485B
5	VSS	P	GND
6	VSS	P	GND

USART6_RX: PG9

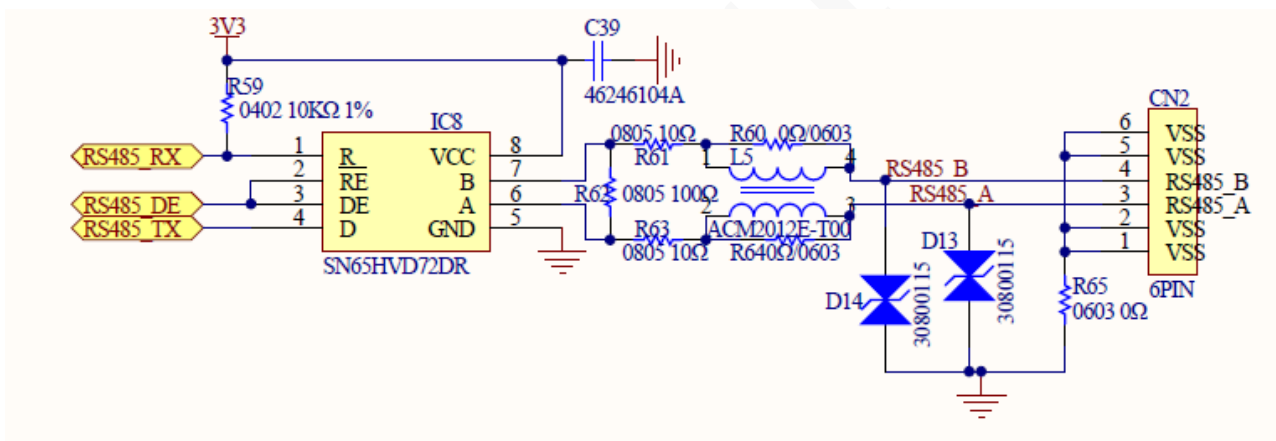
USART6_TX: PC6

USART6_DE: PG12 (Active High, Set LOW when Receiving).

The RS485 interface Chip used is **SN65HVD72DR** from Texas Instruments, datasheet can be downloaded from TI.com using following link:

<http://www.ti.com/lit/ds/symlink/sn65hvd78.pdf>

USART6 on STM32F750 is used.



*L5, Commonmode Filter, D13 and D14 are mounting options.

The RS485 lines are terminated with **R62** which can be removed if not needed.

- IC Bus I/O Protection;
 - >±15 kV HBM Protection
 - >±12 kV IEC 61000-4-2 Contact Discharge
 - >±4 kV IEC 61000-4-4 Fast Transient Burst

Initialization in BSP can be found here:

`\TouchGFXProjects\ProjectName\Drivers\vendor\Board\SE21054\Driver\edt_f750_usart.c`

2.3 ST_LINK/V2 – CN3

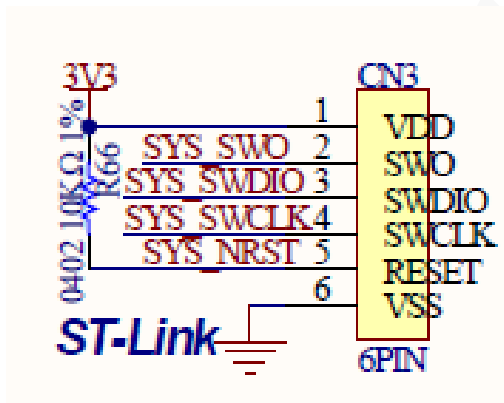
IF12 provides a programming interface for ST-LINK/V2

Pin #	Name	I/O	Description
1	VDD	P	Target VDD, connect to Pin 1 on ST-LINK/V2
2	SWO	O	Not used for programming
3	SWDIO	IO	Connect to Pin 7 on ST-LINK/V2
4	SWCLK	I	Connect to Pin 9 on ST-LINK/V2
5	NRST	I	RESET connect to Pin 15 on ST-LINK/V2
6	VSS	P	GND Connect to Pin 4 on ST-LINK/V2

Programming Software, ST-LINK/V2, can be downloaded from STMicroelectronics, registration required.

<http://www.st.com/en/development-tools/stsw-link004.html>

Picture of ST-LINK programmer. 20-pin connector is used.



2.4 CAN – CN4

Pin #	Name	I/O	Description
1	VSS	P	GND
2	VSS	P	GND
3	CAN_L	I/O	CANL
4	CAN_H	I/O	CANH
5	VSS	P	GND
6	VSS	P	GND

CAN2_STB: PD11, Set HIGH for Standby, LOW for Active

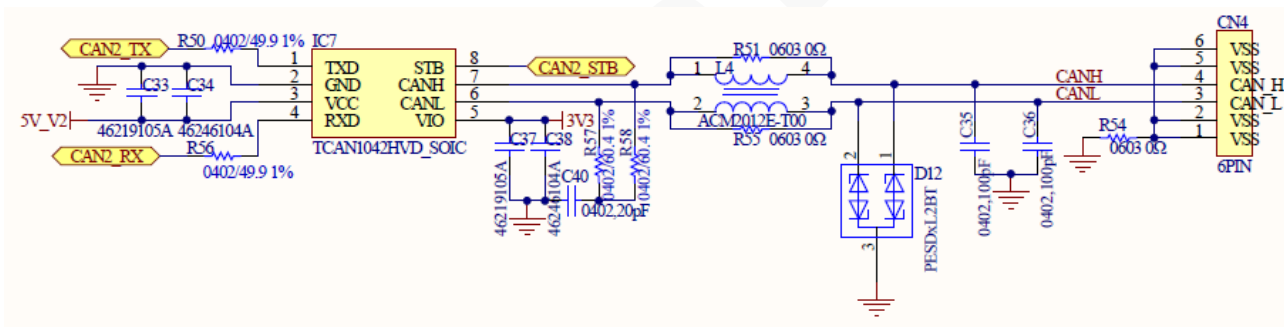
CAN2_TX: PB13

CAN2_RX: PB12

CAN2 is used for this Interface.

The CAN interface Chip used is **TCAN1042HVD** from Texas Instruments, datasheet can be downloaded from TI.com using following link:

<http://www.ti.com/lit/ds/symlink/tcan1042hv.pdf>



*L4, Commonmode Filter and D12 are mounting options.

The CAN signals are terminated on the PCB with R57-R58 which can be removed if not needed.

Initialization in BSP can be found here:

\\TouchGFXProjects\ProjectName\ Drivers \vendor\Board\SE21054\Driver\edt_f750_can.c

Mounting options: Remove Connector, IC and associated components if not used.

2.5 RS232 -CN5

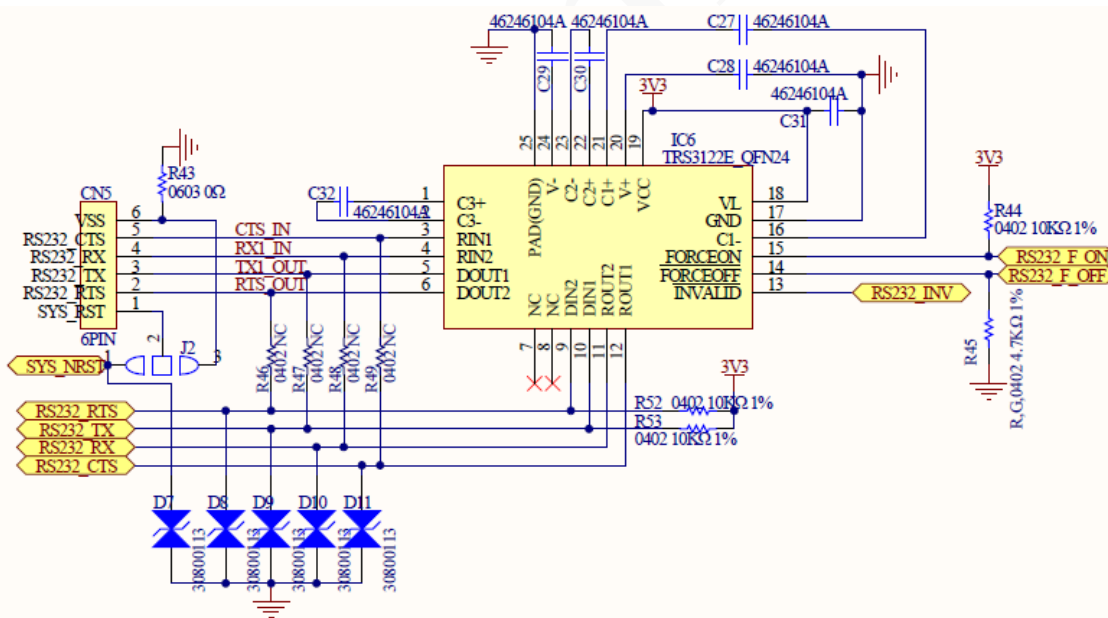
Pin #	Name	I/O	Description
1	VSS	P	GND
2	RTS	O	RS232 Request To Send
3	TX	O	RS232 TXD
4	RX	I	RS2132 RXD
5	CTS	O	RS232 Clear To Send
6	VSS	P	GND

RTS: PD4
 TX: PD5
 RX: PD6
 CTS: PD3
 FORCE_ON: PJ12, OUTPUT normally HIGH
 /FORCE_OFF: PF10, OUTPUT normally HIGH
 /INVALID: PB9, INPUT

USART2 is used for this Interface.

The RS232 Interface Chip used is **TRS3122E**, datasheet can be downloaded from TI.com using following link:

<http://www.ti.com/lit/ds/symlink/trs3122e.pdf>



Initialization in BSP can be found here:

\\TouchGFXProjects\ProjectName\ Drivers\vendor\Board\SE21054\Driver\edt_f750_usart.c

*Pin 1 and 6 are connected to VSS as standard, D7-11 normally not mounted.

2.6 I2C – CN6

Pin #	Name	I/O	Description
1	VDD	P	3.3Volt Power Supply
2	I2C_SCL	IO	SCL
3	I2C_SDA	IO	SDA
4	I2C_INT	I	Interrupt
5	I2C_RST	O	Reset
6	VSS	P	GND

SCL: PH4, 1KΩ Pull Up to VDD
 SDA: PB11, 1KΩ Pull Up to VDD
 I2C_INT: PE2
 I2C_RST: PG2

I2C2 is used for this Interface.

Initialization in BSP can be found here:

`\TouchGFXProjects\ProjectName\ Drivers\vendor\Board\SE21054\Driver\edt_f750_i2c.c`

SPI – CN7

Pin #	Name	I/O	Description
1	VDD	P	3.3Volt
2	SPI1_NSS	O	Negative Slave Select
3	SPI1_SCK	O	SPI Clock
4	SPI1_MISO	I	SPI Data Input
5	SPI1_MOSI	O	SPI Data Output
6	VSS	P	GND

SPI1_NSS: PA15
 SPI1_SCK: PA5
 SPI1_MISO: PA6
 SPI1_MOSI: PB5

SPI1 is used for this Interface

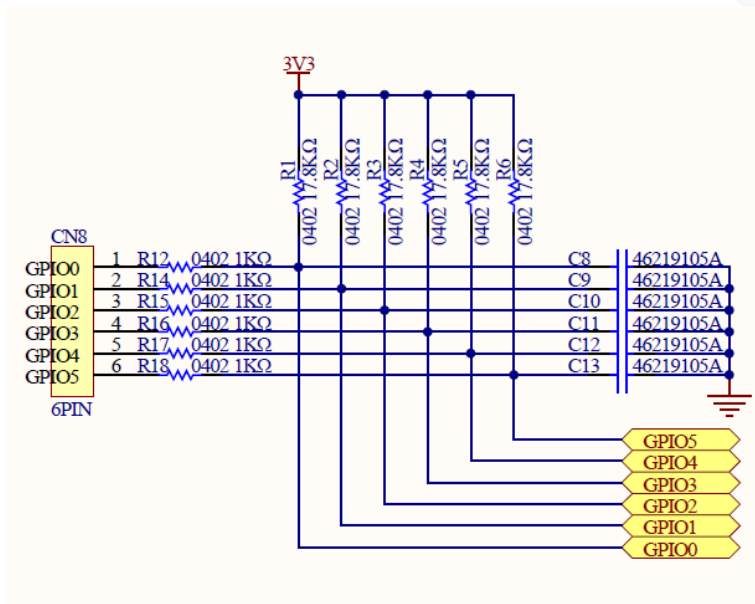
`\TouchGFXProjects\ProjectName\ Drivers\vendor\Board\SE21054\Driver\edt_f750_spi.c`

GPIO – CN8

Pin #	Name	I/O	Description
1	GPIO1	IO	Configured as Input with filter
2	GPIO2	IO	Configured as Input with filter
3	GPIO3	IO	Configured as Input with filter
4	GPIO4	IO	Configured as Input with filter
5	GPIO5	IO	Configured as Input with filter
6	GPIO6	IO	Configured as Input with filter

GPIO1: PG3
 GPIO2: PF6
 GPIO3: PD7
 GPIO4: PI11
 GPIO5: PC7
 GPIO6: PC0

All GPIO's are equipped with series resistor, filter capacitor and Pull-Up to 3.3V. Series resistor is 1KΩ, capacitor is 1nF and Pull-Up resistor is 17.8KΩ as shown below.



The Port Pins are configured as Inputs in the BSP. They can be changed here:

`\TouchGFXProjects\ProjectName\ Drivers\vendor\Board\SE21054\Driver\edt_f750_gpio.c`

2.7 USB OTG – CN9

USB OTG Port is equipped with a **MICRO USB AB** connector

Pin #	Name	I/O	Description
1	VBUS	P	VBUS
2	DM	P	USB D-
3	DP	I/O	USB D+
4	ID	I/O	ID
5	VSS	P	GND

OTG_FS_OverCurrent: PG10

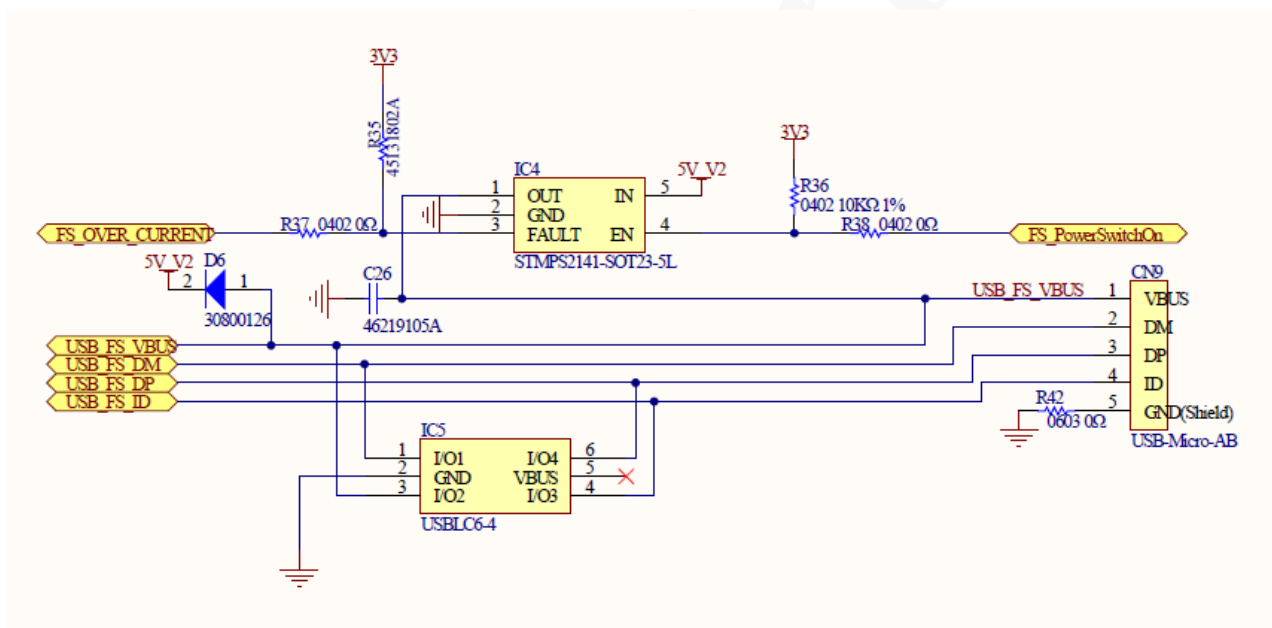
OTG_FS_PowerSwitchOn: PI13

OTG_FS_VBUS: PA9

OTG_FS_DM: PA11

OTG_FS_DP: PA12

OTG_FS_ID: PA10



A USB CDC Class is implemented as part of the Starter Kit example.

3. Alternate Port functions

I2C, SPI and GPIO Port pins can be used for alternate functions according to following table:

3.1 CN6-I2C

Pin	Name	PORT	Alternate Functions					
1	VDD							
2	I2C2_SCL	PH4	Analog	GPIO	EVENTOUT	EXTI4		
3	I2C2_SDA	PB11	Analog	GPIO	EVENTOUT	ADC1/2/3_EXTI11	USART3_RX	
4	I2C2_INT	PE2	Analog	GPIO	EVENTOUT	EXTI2		
5	I2C2_RST	PG2	Analog	GPIO	EVENTOUT	EXTI2		
6	VSS							

3.2 CN7-SPI

Pin	Name	Port	Alternate Functions					
1	VDD							
2	SPI_NSS	PA15	Analog	GPIO	EVENTOUT	EXTI5		
3	SPI_CK	PA5	Analog	GPIO	EVENTOUT	TIM2_CH1	TIM2_ETR	
4	SPI_MOSI	PB5	Analog	GPIO	EVENTOUT	EXTI5	TIM3_CH2	TIM8_CH1N
5	SPI_MISO	PA6	Analog	GPIO	EVENTOUT	EXTI6	TIM1_BKIN	TIM3_CH1
6	VSS							

3.3 CN8-GPIO

Pin	Name	PORT	Alternate Functions						
1	GPIO0	PG3	Analog	GPIO	EVENTOUT	EXTI3			
2	GPIO1	PF6	Analog	GPIO	EVENTOUT	EXTI6	UART7_RX	TIM10_CH1	ADC3_IN4
3	GPIO2	PD7	Analog	GPIO	EVENTOUT	EXTI7	USART2_RX		
4	GPIO3	PI11	Analog	GPIO	EVENTOUT	EXTI11	ADC1_EXT11	ADC2_EXT11	ADC3_EXT11
5	GPIO4	PC7	Analog	GPIO	EVENTOUT	EXTI7	USART6_RX	TIM3_CH2	TIM8_CH2
6	GPIO5	PC0	Analog	GPIO	EVENTOUT	EXTI0	ADC1_IN10	ADC3_IN10	ADC3_IN10

4. Expansion Connectors

We have provided PCB Pads for two expansion connectors, CN10 and CN11. The idea is to make it possible to add functionality in a quick way and eventually add this to a redesigned PCB Board.

We have added the most obvious Alternate functions in the Tables. You can consult the STM32F750 datasheet for more details.

4.1 CN10 SD Card

Pin	Name	PORT	Alternate Functions					
1	+3V3							
2	SPI5_CK	PH6	Analog	GPIO	EVENTOUT	EXTI6		
3	SPI5_MOSI	PF9	Analog	GPIO	EVENTOUT	EXTI9	TIM14_CH1	
4	SD_D0	PC8	Analog	GPIO	EVENTOUT	EXTI8	TIM3_CH3	TIM8_CH3
5	SD_D1	PC9	Analog	GPIO	EVENTOUT	EXTI9	TIM3_CH4	TIM8_CH4
6	SD_D2	PC10	Analog	GPIO	EVENTOUT	EXTI10	UART4_TX	USART3_TX
7	SD_D3	PC11	Analog	GPIO	EVENTOUT	EXTI11	UART4_RX	USART3_RX
8	SD_CK	PC12	Analog	GPIO	EVENTOUT	EXTI12	UART5_TX	
9	SD_CMD	PD2	Analog	GPIO	EVENTOUT	EXTI2	UART5_RX	
10	SD_DETECT	PH7	Analog	GPIO	EVENTOUT	EXTI7		
11	VSS							
12	+5V							

Please check STM32F750 Datasheet for additional functions if needed

Connector type: MOLEX 55909-9974

The primary intention is to provide the possibility to implement a SD Card interface, but alternate functions exist. Specially the UART / USART can be useful.

4.2 CN11 Ethernet

Pin	Name	Port	Alternate Functions						
1	+3V3								
2	VSS								
3	ETH_TX_EN	PG11	Analog	GPIO	EVENTOUT				
4	ETH_TX_CLK	PC3	Analog	GPIO	EVENTOUT				
5	ETH_TX_D1	PG14	Analog	GPIO	EVENTOUT				
6	ETH_TX_D0	PG13	Analog	GPIO	EVENTOUT				
7	I2C2_INT	PE2	Analog	GPIO	EVENTOUT				
8	ETH_TX_D2	PC2	Analog	GPIO	EVENTOUT				
9	ETH_RX_D1	PC5	Analog	GPIO	EVENTOUT				
10	ETH_RX_D0	PC4	Analog	GPIO	EVENTOUT				
11	ETH_RX_D3	PB1	Analog	GPIO	EVENTOUT	TIM2_CH3			USART3_TX
12	ETH_RX_D2	PB0	Analog	GPIO	EVENTOUT	TIM1_CH2N	TIM3_CH3		
13	ETH_RX_DV	PA7	Analog	GPIO	EVENTOUT	TIM1_CH1N	TIM3_CH2		
14	ETH_RX_ER	PB10	Analog	GPIO	EVENTOUT				
15	ETH_COL	PA3	Analog	GPIO	EVENTOUT	TIM2_CH4	TIM5_CH4		
16	ETH_RX_CLK	PA1	Analog	GPIO	EVENTOUT	TIM2CH2	TIM5_CH2		
17	ETH_MDC	PC1	Analog	GPIO	EVENTOUT				
18	ETH_CRD	PA0	Analog	GPIO	EVENTOUT	TIM2_CH1	TIM5_CH1		
19	ETH_INT	PE6	Analog	GPIO	EVENTOUT	TIM1_BKIN2	TIM9_CH2		
20	ETH_MDIO	PA2	Analog	GPIO	EVENTOUT	TIM2_CH3	TIM5_CH3		
21	ETH_MCO	PA8	Analog	GPIO	EVENTOUT	TIM1_CH1	TIM1_CH1		
22	LCD_CSB	PE3	Analog	GPIO	EVENTOUT				
23	VSS								
24	+5V								

Please check STM32F750 Datasheet for additional functions if needed

Connector type: MOLEX 55909-2474

The primary intention is to provide an Ethernet Interface, but alternate functions are available.

5. Additional resources

We have provided unpopulated PCB Pads for the following functions:

- SW1, Button to BOOT0 pin
- X2, 32.768KHz Xtal for RTC
- SO-8 Footprint for I2C EEPROM (shared with I2C2 on CN6)