UM2033
User manual

Discovery kit with STM32F769NI MCU

Introduction

The 32F769IDISCOVERY Discovery kit is a complete demonstration and development platform for STMicroelectronics Arm® Cortex®-M7 core-based STM32F769NIH6 microcontroller. It features four I^2Cs, six SPIs with three multiplexed simplex I^2S, 2xSDMMC, four USARTs, four UARTs, three CAN buses, three 12-bit ADCs, two 12-bit DACs, two SAIs, internal 512+4-Kbyte SRAM and 2-Mbyte flash memory, USB HS and FS OTGs, Ethernet MAC, FMC interface, Quad-SPI interface, and SWD debugging support.

The Discovery kit offers all required to get started quickly and develop applications easily. The full range of hardware features available on the 32F769IDISCOVERY Discovery kit for both STM32F769I-DISCO and STM32F769I-DISC1 variants (refer to *STM32F769I-DISCO (top view)* and *STM32F769I-DISC1 (top view)*), helps users to evaluate the following peripherals: USB OTG HS, 10/100-Mbit Ethernet, microSD™, USART, SAI audio DAC stereo with two audio jacks for input/output, ST MEMS digital microphones, SDRAM, Quad-SPI flash memory, SPDIF input/output, and DSI interface LCD with a capacitive multi-touch panel. The latter is only available on the STM32F769I-DISCO (refer to *Figure 1*).

ARDUINO® Uno V3 connectors allow easy connection of extension shields or daughterboards.

The integrated ST-LINK/V2-1 provides an embedded in-circuit debugger and programmer for the STM32. The 32F769IDISCOVERY Discovery kit comes with the STM32 comprehensive software HAL library together with various packaged software examples.

Figure 1. STM32F769I-DISCO (top view)

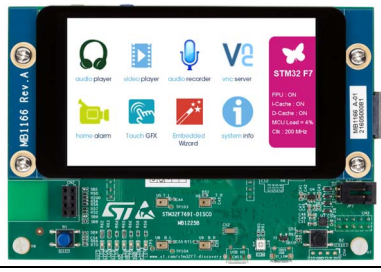


Figure 2. STM32F769I-DISC1 (top view)

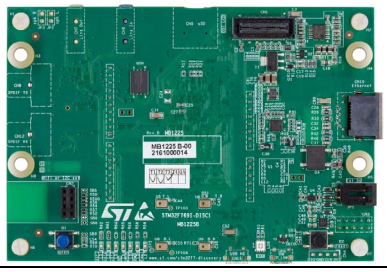
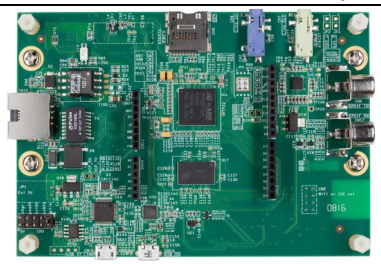


Figure 3. 32F769IDISCOVERY board (bottom view)



Bottom view of:
STM32F769I-DISCO and
STM32F769I-DISC1

Pictures are not contractual.

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1 Features

- STM32F769NIH6 Arm®(a)-based microcontroller with 2 Mbytes of flash memory and 532 Kbytes of RAM, in a TFBGA216 package
- 4-inch 800 x 472-pixel capacitive touch TFT color LCD with serial interface (on STM32F769I-DISCO only)
- Optional display accessories: HDMI and DSI adapters
- SAI audio codec
- Four digital ST MEMS microphones on DFSDM inputs
- 128-Mbit SDRAM
- 512-Mbit Quad-SPI flash memory
- Reset and user push-buttons
- Board connectors:
  - MIPI DSI®
  - SPDIF RCA input and output
  - Audio line input and output jacks
  - Stereo speaker output
  - microSD™ card holder with an included card
  - Wi-Fi® or Ext-EEP daughterboard
  - USB Micro-B
  - USB Micro-AB
  - IEEE-802.3-2002 compliant Ethernet
  - ARDUINO® Uno V3
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Flexible power supply options:
  - ST-LINK/V2-1 USB connector
  - USB OTG HS connector
  - 5 V delivered by RJ45 (Power over Ethernet)
  - 5 V delivered by ARDUINO® or external connector
  - USB charger
- Power over Ethernet based on IEEE 802.3af (powered device from 48 down to 5 V, 3 W)
- External application power supply: 3.3 V and 5 V
- Comprehensive free software libraries and examples available with the STM32Cube MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

arm

a. Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 Ordering information

To order the 32F769IDISCOVERY Discovery kit, refer to *Table 1*. Additional information is available from the datasheet and reference manual of the target microcontroller.

Table 1. List of the order codes

Order code	Board reference	Target STM32
STM32F769I-DISCO	– MB1225(1) – MB1166(2)	STM32F769NIH6

1. Main board
2. LCD daughterboard

To order the optional display accessories for the 32F769IDISCOVERY Discovery kit, refer to *Table 2*.

Table 2. List of the order codes for the display accessories

Order code	Product description
B-LCDAD-RPI1	15-pin single-row Flexible Printed Circuit DSI adapter board
B-LCDAD-HDMI1	DSI to HDMI adapter

3 Development environment

3.1 System requirements

- Multi.OS support: Windows®[a]10, Linux® [b] 64-bit, or macOS® [c]
- USB Type-A or USB Type-C® to Micro-B cable

3.2 Development toolchains

- IAR Systems - IAR Embedded Workbench® [d]
- Keil® - MDK-ARM[d]
- STMicroelectronics - STM32CubeIDE

4 Conventions

Table 3 defines some conventions used in the present document.

Table 3. ON/OFF conventions

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper fitted between pin 1 and pin 2
Solder bridge SBx ON	SBx connections closed by 0 Ω resistor
Solder bridge SBx OFF	SBx connections left open
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered
Capacitor Cx ON	Capacitor soldered
Capacitor Cx OFF	Capacitor not soldered

a. Windows is a trademark of the Microsoft group of companies.

b. Linux® is a registered trademark of Linus Torvalds.

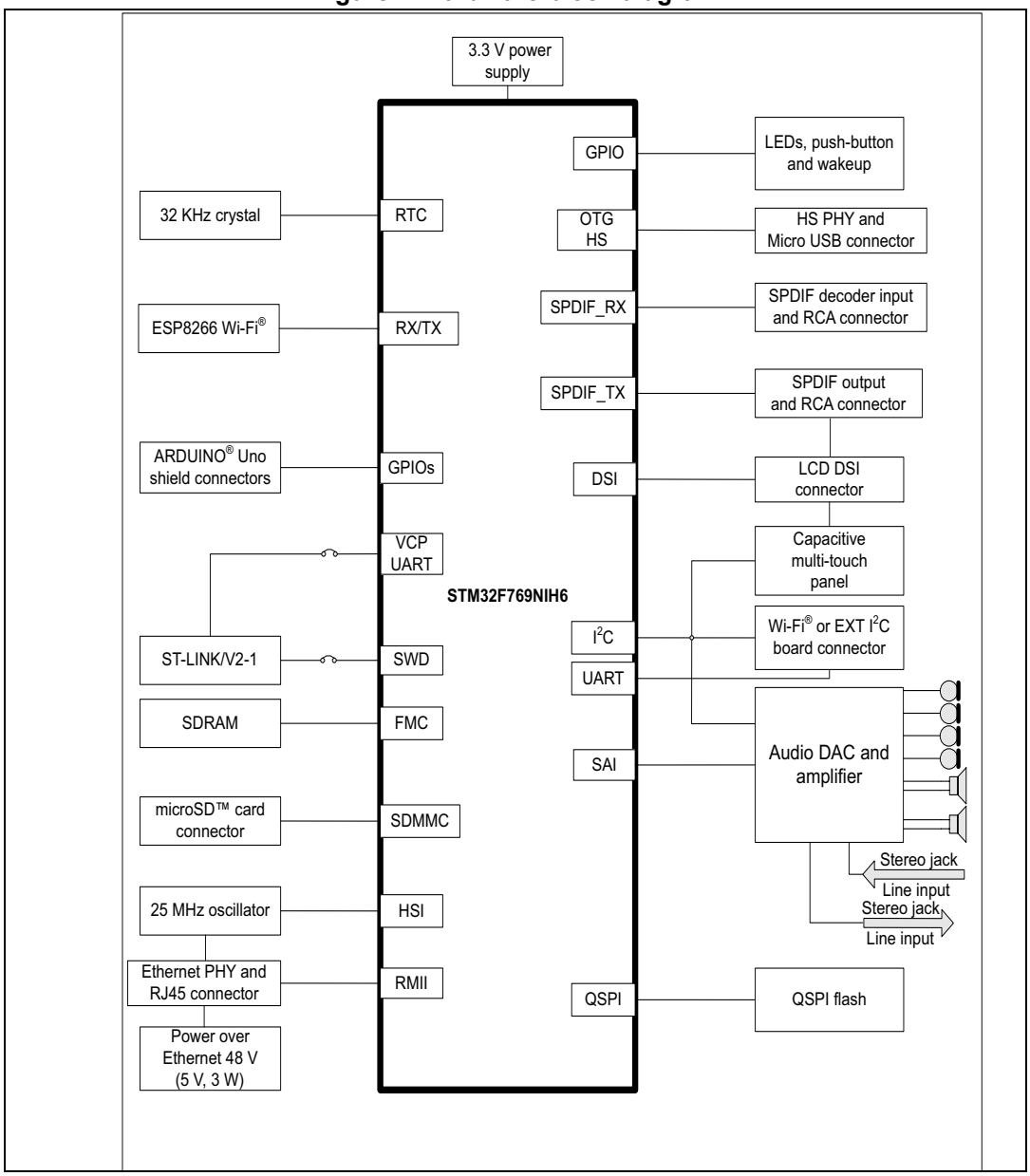
c. macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions. All other trademarks are the property of their respective owners.

d. On Windows® only.

5 Hardware layout and configuration

The 32F769IDISCOVERY Discovery board is designed around the STM32F769NIH6 (TFBGA216 package). The hardware block diagram (refer to *Figure 4*) illustrates the connections between the STM32F769NIH6 and the peripherals (SDRAM, Quad-SPI flash memory, LCD DSI connector, USB OTG connectors, USART, Ethernet, audio, SPDIF RCA in, SPDIF RCA out, microSD™ card, ARDUINO® Uno shields, and embedded ST-LINK). *Figure 5* and *Figure 6* help users locate these features on the Discovery board. The mechanical dimensions of the Discovery board are shown in *Figure 7*.

Figure 4. Hardware block diagram



5.1 The 32F769IDISCOVERY Discovery board layout

Figure 5. 32F769IDISCOVERY top layout

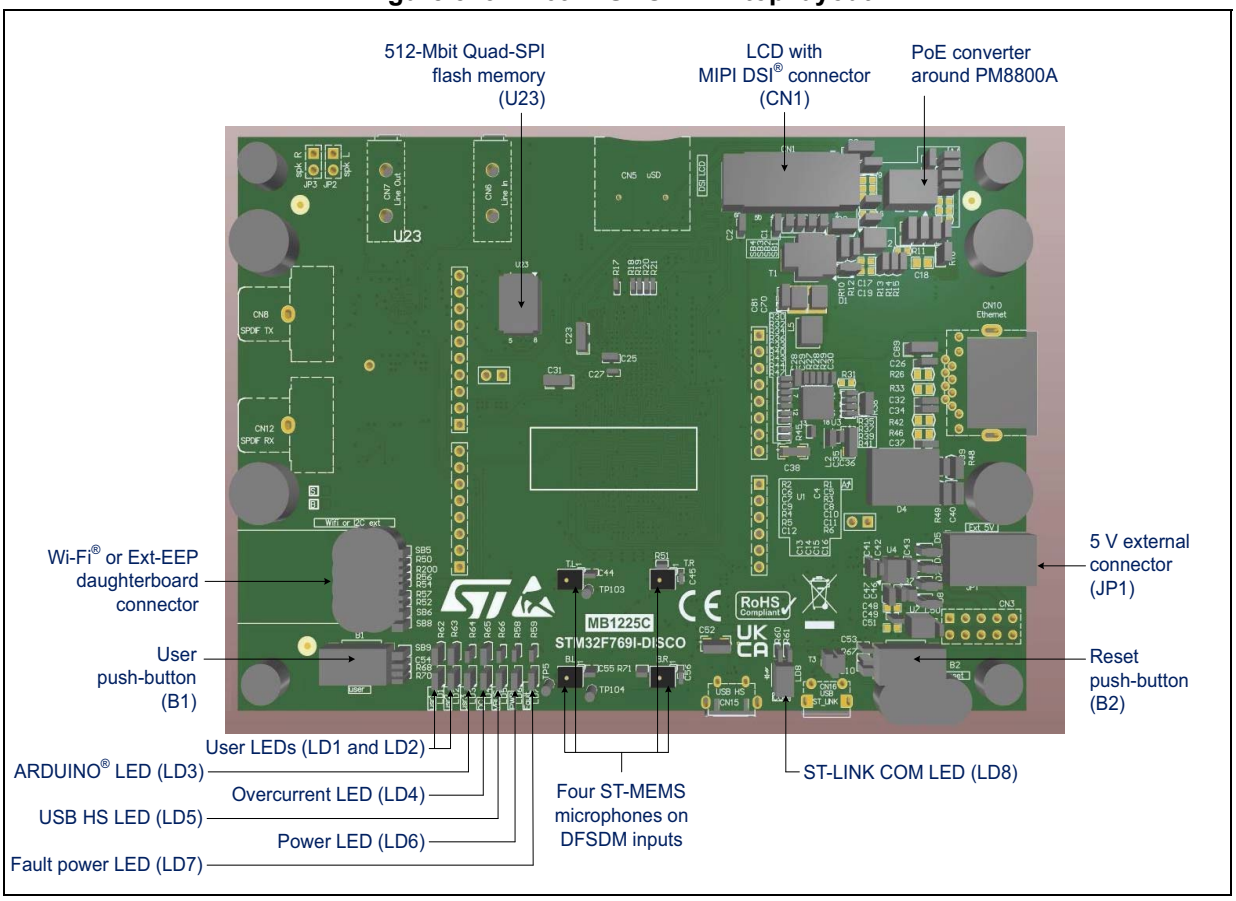
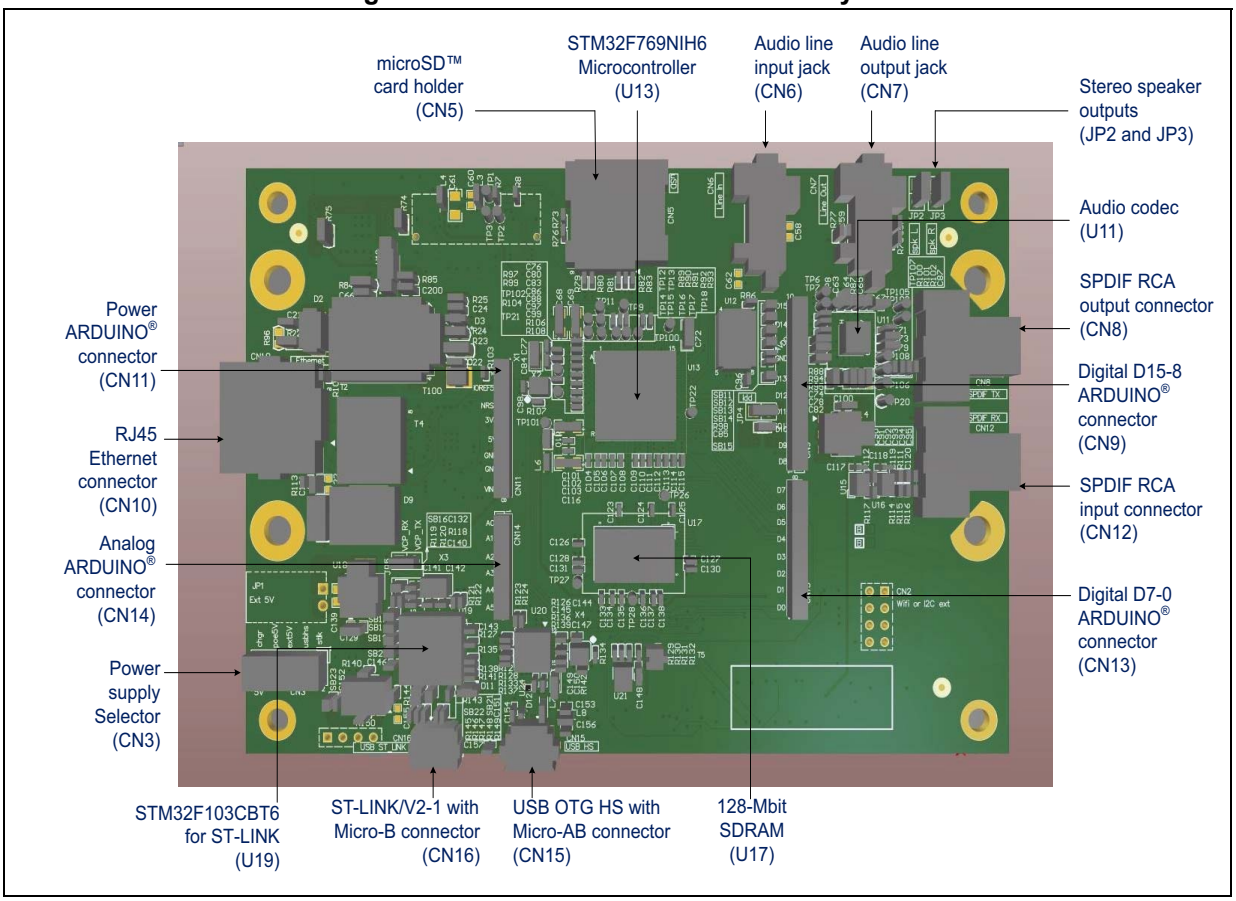
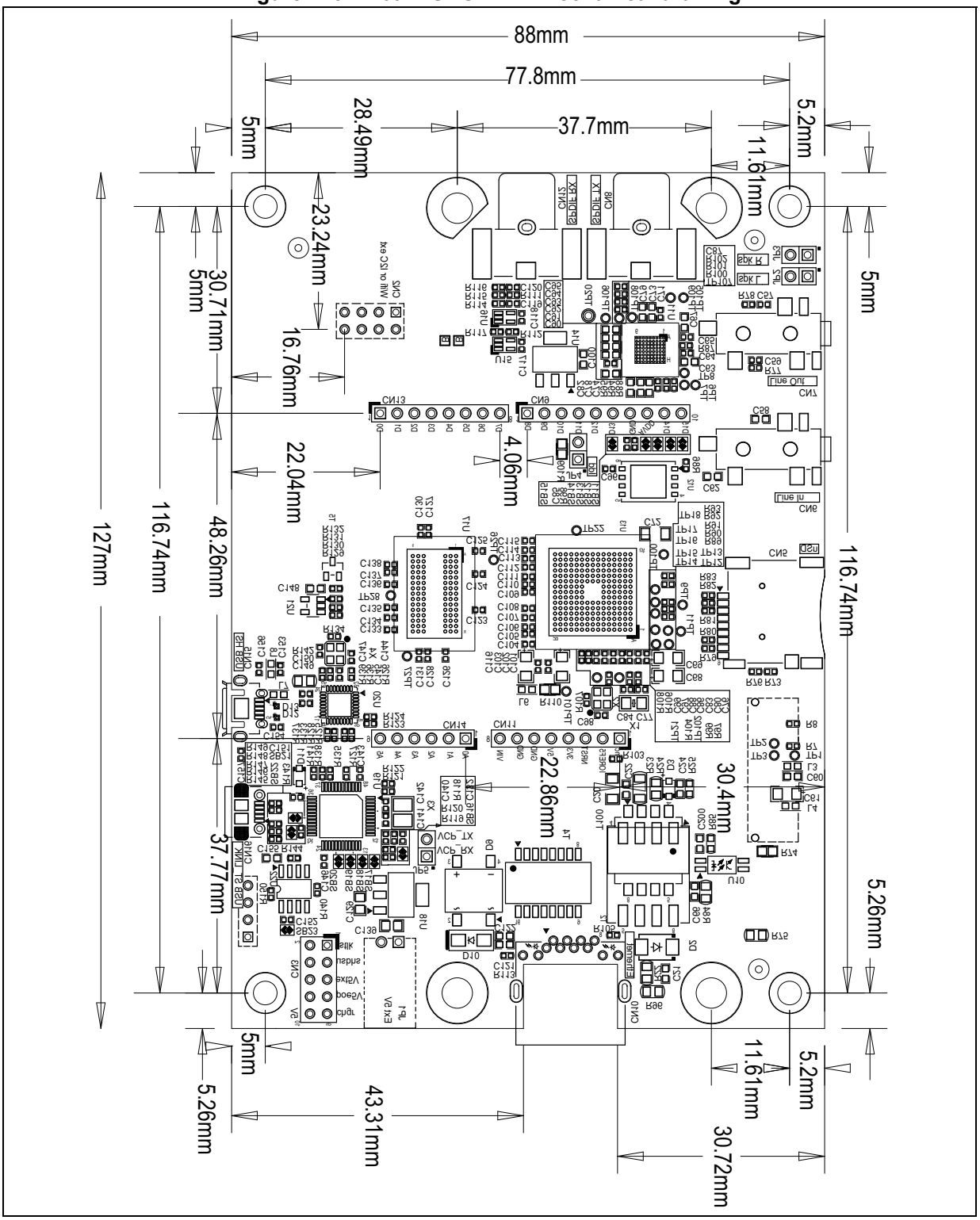


Figure 6. 32F769IDISCOVERY bottom layout



5.2 The 32F769IDISCOVERY Discovery board mechanical drawing

Figure 7. 32F769IDISCOVERY mechanical drawing



5.3 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated into the 32F769IDISCOVERY Discovery board. Compared to ST-LINK/V2 the changes are listed below.

The new features supported on ST-LINK/V2-1 are:

- USB software re-enumeration
- Virtual COM port interface on USB
- Mass storage interface on USB
- USB power management request for more than 100 mA current on USB

These features are no more supported on ST-LINK/V2-1:

- SWIM interface
- Application voltage lower than 3 V

For general information concerning the debugging and programming features that are common to both versions V2 and V2-1, refer to the user manual *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32* (UM1075).

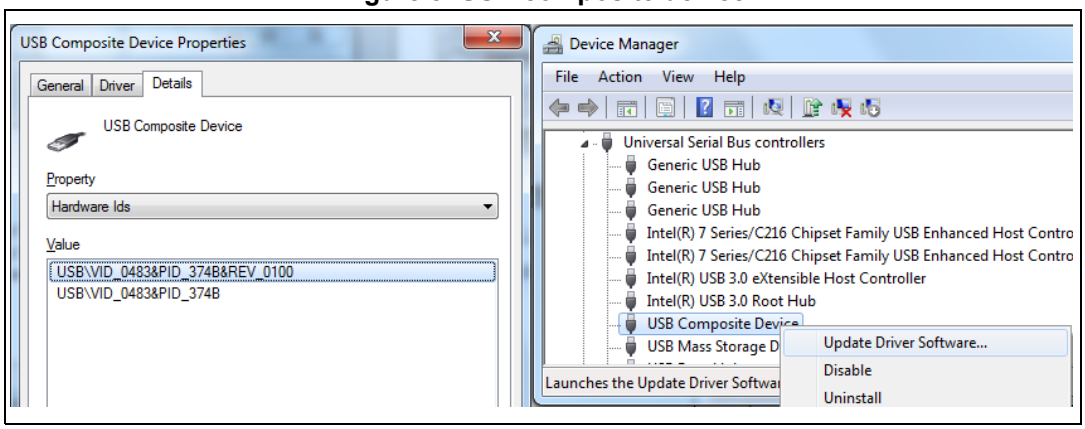
5.3.1 Drivers

The ST-LINK/V2-1 requires a dedicated USB driver for Windows® available at the *www.st.com* website.

In case the 32F769IDISCOVERY Discovery board is connected to the PC before the driver is installed, some 32F769IDISCOVERY interfaces might be declared as *unknown* in the PC device manager. In this case, the user must install the driver files and update the driver of the connected device from the device manager.

Note: Prefer using the 'USB Composite Device' handle for a full recovery.

Figure 8. USB composite device



5.3.2 ST-LINK/V2-1 firmware upgrade

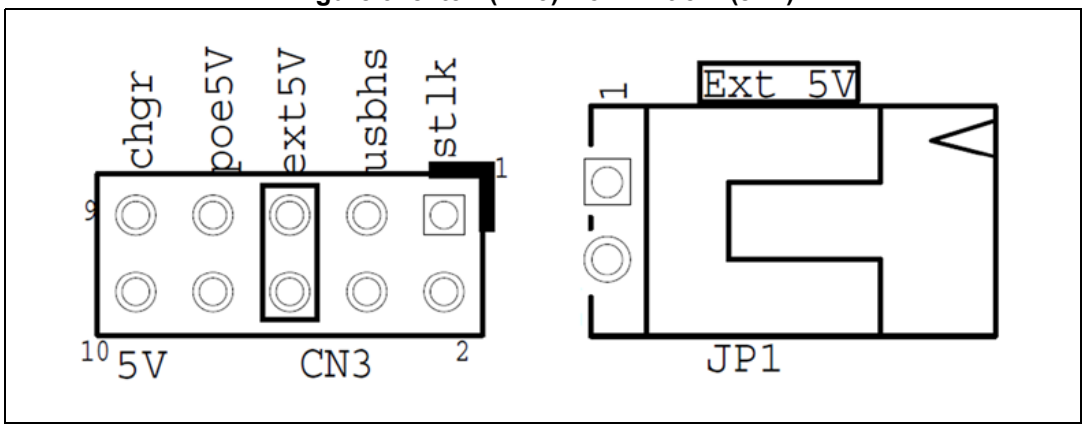
The ST-LINK/V2-1 embeds a firmware upgrade mechanism for the in-place upgrade through the USB port. As the firmware might evolve during the lifetime of the ST-LINK/V2-1 product (for example new functionalities, bug fixes, and support for new microcontroller families), it is recommended to visit the *www.st.com* website before starting to use the 32F769IDISCOVERY Discovery board and periodically, to stay up-to-date with the latest firmware version.

5.4 Power supply

The 32F769IDISCOVERY Discovery board is designed to be powered by the 5 V DC power supply. It is possible to configure the Discovery board to use any of the following five sources for the power supply:

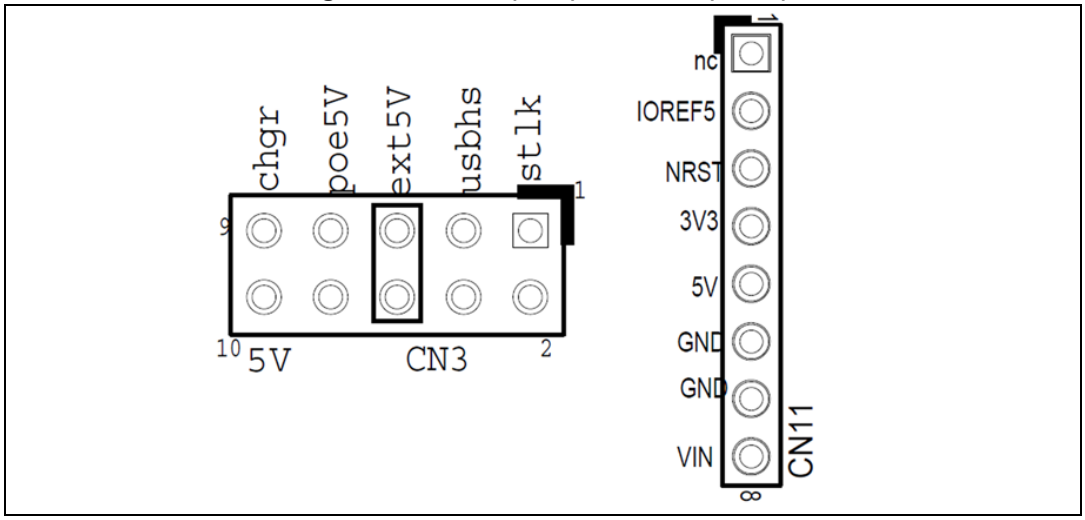
- 5 V DC power adapter connected to JP1 (Ext 5 V). In this case, the 32F769IDISCOVERY Discovery board must be powered by a power supply unit or by auxiliary equipment complying with the standard EN-60950-1: 2006+A11/2009, and must be a safety extra low voltage (SELV) with limited power capability (5 V power source on the JP1 Ext 5 V silkscreen). Refer to *Figure 9*:

Figure 9. ext5V (CN3) from Ext 5 V (JP1)



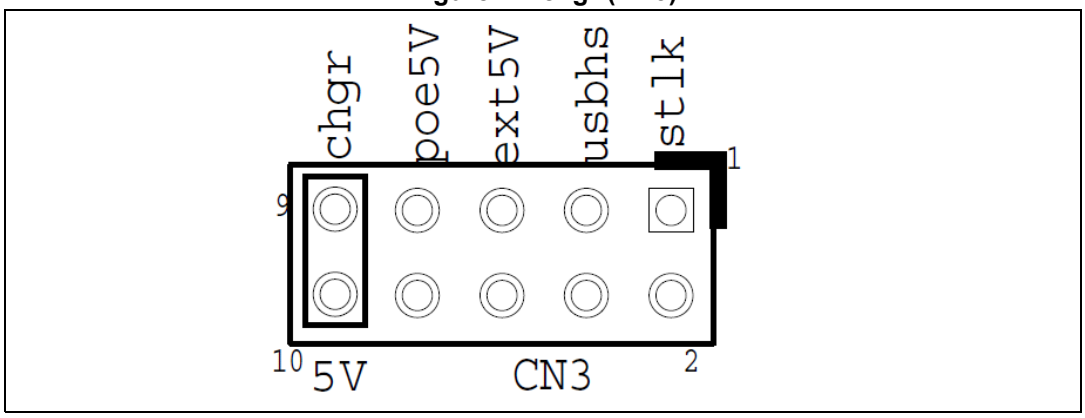
- 7-12 V DC power from the CN11 pin named VIN on the silkscreen, the extension connectors for ARDUINO® UNO shields or daughterboards (5 V power source on the JP1 Ext 5 V silkscreen). The input current capability is linked to the input voltage (refer to *Figure 10*):
  - 800 mA input current when Vin = 7 V
  - 450 mA input current when 7 V < Vin (< or =) 9 V
  - 250 mA input current when 9 V < Vin (< or =) 12 V

Figure 10. ext5V (CN3) from VIN (CN11)



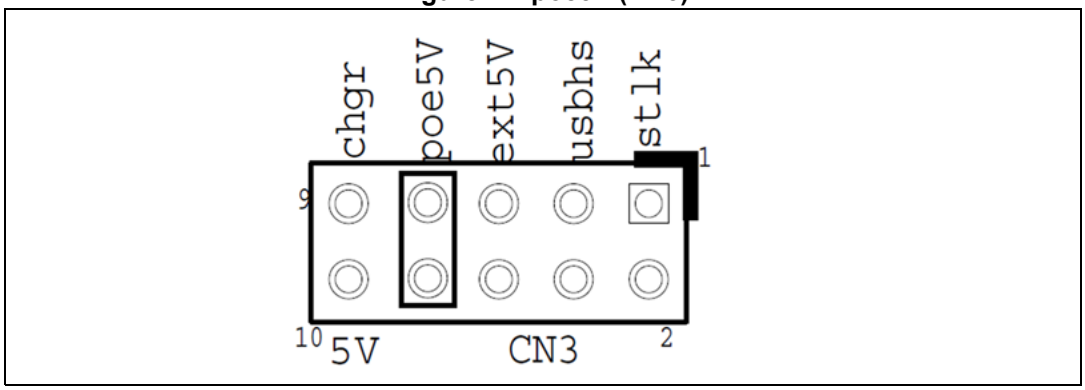
- 5 V DC power charger connected to USB ST-LINK (CN16). In this case, if the 32F769IDISCOVERY Discovery board is powered by an external USB charger then the debug features are not available. If the board is connected to the PC instead, the limitation is no more effective with a high risk of damaging the PC (5 V power source on the CN3 chgr silkscreen). Refer to *Figure 11*:

Figure 11. chgr (CN3)



- 48 V DC power from RJ45 Ethernet connector (CN10). In this case, the onboard module PoE (Power over Ethernet) generates 5 V and it can provide up to 600 mA. This module is a powered device complying with the standard IEEE802.3af, Class 1/2. The external power supply must be fully IEEE 802.3af compliant (5 V power source on the CN3 poe5V silkscreen). Refer to *Figure 12*:

Figure 12. poe5V (CN3)

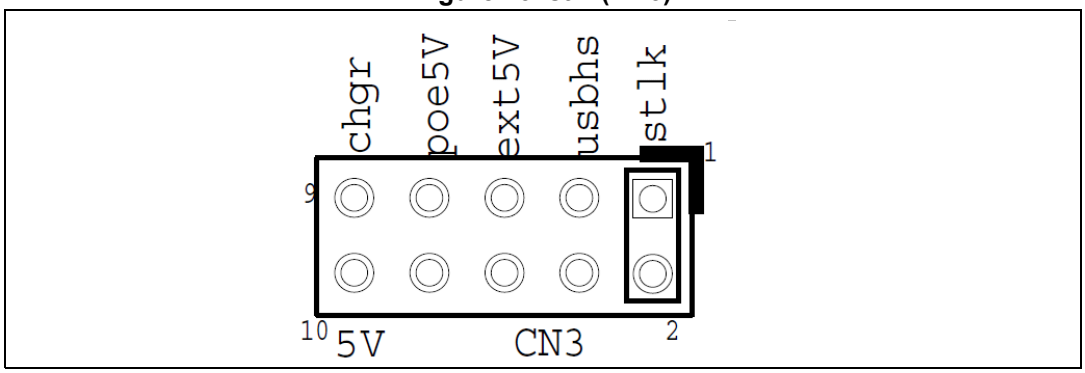


- 5 V DC power with limitation from CN16, the USB type Micro-B connector of ST-LINK/V2-1 (USB 5 V power source on the CN3 stlk silkscreen). It is the default setting. If the USB enumeration succeeds (as explained below), the ST-LINK 5 V link power is enabled, by asserting the PWR_ENn signal. This pin is connected to a power switch ST890, which powers the board. This power switch also features a current limitation to protect the PC in case of a short circuit on the board (more than 700 mA). Refer to *Figure 13*.

The 32F769IDISCOVERY Discovery board can be powered from the stlk ST-LINK USB connector (CN16), but only the ST-LINK circuit has the power before the USB enumeration because the host PC only provides 100 mA to the board at that time. During the USB enumeration, the 32F769IDISCOVERY Discovery board asks for 500 mA of current to the host PC. If the host can provide the required power, the enumeration finishes by a *SetConfiguration* command, and then, the power transistor ST890 is switched ON, and the

red LED LD6 is turned ON, thus the 32F769IDISCOVERY Discovery board can consume a maximum of 500 mA of current, but no more. If the host is not able to provide the requested current, the enumeration fails. Therefore, the ST890 remains OFF and the STM32 part including the extension board is not powered. As a consequence, the red LED LD6 remains turned OFF. In this case, it is mandatory to use an external power supply.

Figure 13. stlk (CN3)



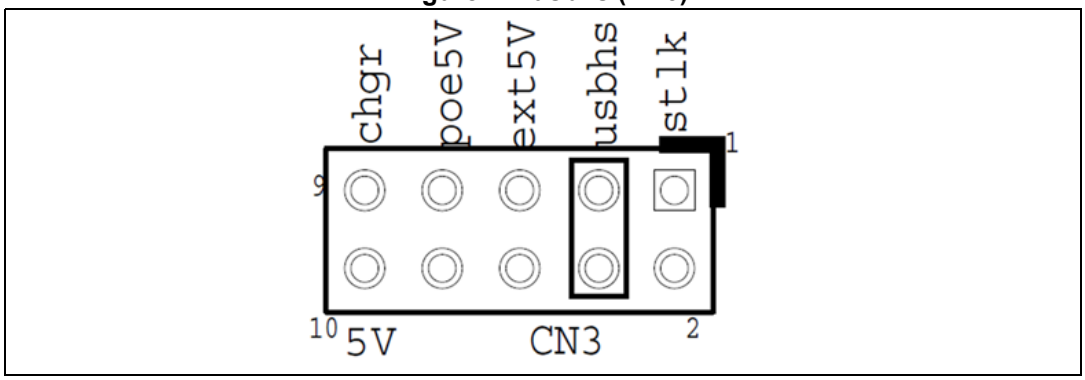
Note: In case the board is powered by a USB charger, there is no USB enumeration, so the LD2 LED remains set to OFF permanently and the board is not powered. Only in this specific case, the resistor (R138) needs to be soldered, to allow the board to be powered anyway.

The LD6 LED is lit when the 32F769IDISCOVERY Discovery board is powered by the 5 V correctly.

Caution: Do not connect the PC to the ST-LINK (CN16) when R138 is soldered. The PC might be damaged or the board not powered correctly.

- 5 V DC power with 500 mA limitation (CN15), the USB OTG HS Micro-AB connector (5 V power source on the CN3 usbhs silkscreen). Refer to *Figure 14*:

Figure 14. usbhs (CN3)



5.5 Programming/debugging when the power supply is not from ST-LINK (5 V link)

It is mandatory to power the board first using Ext 5 V on JP1, Vin on CN11, Ethernet (CN10), or usbhs (CN15), then connect the USB cable to the PC. Proceeding this way ensures that the enumeration succeeds thanks to the external power source.

The following power sequence procedure must be respected:

1. Connect the jumper CN3 on (ext5V) or (usbhs) or (poe5V).
2. Connect the external power source to JP1, CN11, CN10, or CN15.
3. Check that the red LD2 LED is turned ON.
4. Connect the PC to the USB connector (CN16).

If this order is not respected, the board might be powered first by VBUS from the ST-LINK, and the following risks might be encountered:

1. If the board needs a current higher than 500 mA, the PC might be damaged, or the PC can limit the current. As a consequence, the board is not powered correctly.
2. 500 mA is requested at the enumeration. In this case, there is a risk that the request is rejected and the enumeration does not succeed if the PC cannot provide such current.

5.6 Clock sources

Up to three clock sources are available, as described below:

- X1, 24MHz oscillator for USB OTG HS PHY
- X2, 25MHz oscillator for the STM32F769NIH6 microcontroller and Ethernet PHY
- X3, 32KHz crystal for the STM32F769NIH6 embedded RTC

5.7 Reset sources

The reset signal of the 32F769IDISCOVERY Discovery board is active low and the reset sources are:

- Reset button (B2)
- ARDUINO® Uno shield board (CN11)
- Embedded ST-LINK/V2-1

5.8 Audio

An audio codec with four DACs and two ADCs is connected to the SAI interface of the STM32F769NIH6. It communicates with the STM32F769NIH6 via an I^2C bus shared with the touch panel of the LCD DSI:

- The analog line input is connected to the ADC of the codec device via an audio jack (CN6).
- The analog line output is connected to the DAC of the codec device via an audio jack (CN7).
- Two external speakers can be connected to the codec device via the JP2 for the left speaker and JP3 for the right speaker.

- Four digital microphones (ST MEMS microphone) are available on the 32F769IDISCOVERY Discovery board. They are connected to the input digital microphones of the STM32F769NIH6 and the DFSDM functionality manages them.
- One coaxial connector (CN12) is implemented on the 32F769IDISCOVERY to receive external audio data compatible with SPDIF specifications.
- One coaxial connector (CN8) is implemented on the 32F769IDISCOVERY to output external audio data compatible with SPDIF specifications.

5.9 USB OTG HS

32F769IDISCOVERY Discovery board supports USB OTG high-speed communication via a USB Micro-AB connector and a USB high-speed PHY for high-speed function.

USB connectors at 5 V DC with a 500 mA current limitation can power the Discovery board.

A USB power switch is also connected to V_{BUS} and provides power to CN15. The green LED LD5 is lit in one of these cases:

- Power switch is ON and 32F769IDISCOVERY works as a USB host
- VBUS is powered by another USB host when 32F769IDISCOVERY works as a USB device

The red LED LD4 is lit when an overcurrent occurs.

Note: 32F769IDISCOVERY Discovery board must be powered by an external power supply when using the OTG function.

5.10 microSD™ card

The board supports a 2-Gbyte (or more) microSD™ card connected to the SDMMC2 port of STM32F769NIH6.

5.11 Ethernet

The 32F769IDISCOVERY Discovery board supports 10/100-Mbit Ethernet communication by a PHY and integrates an RJ45 connector. Ethernet PHY is connected to the STM32F769NIH6 via an RMII interface.

The oscillator X2 generates a 25 MHz clock for the PHY. The PHY RMII_REF_CLK generates the 50 MHz clock for the STM32F769NIH6.

5.12 Power over Ethernet

The 32F769IDISCOVERY Discovery board integrates a power module that uses Ethernet. This module is an IEEE802.3af compliant, Class 1/2 PoE converter based on the simple diode rectified Flyback topology around the PM8800A component from ST. This ‘Powered Device' module accepts a 48 V input voltage and can provide 5 V with 600 mA.

5.13 SDRAM memory

A 128-Mbit SDRAM is connected to the FMC interface of the STM32F769NIH6. This memory is used as 4M x 32 bits.

5.14 Quad-SPI NOR flash memory

A 512-Mbit Quad-SPI NOR flash memory is connected to the Quad-SPI interface of the STM32F769NIH6.

5.15 Virtual COM port

The serial interface USART1 is directly available as a virtual COM port of the PC, connected to the ST-LINK/V2-1 USB connector (CN16). The Virtual COM port settings are configured with 115200 b/s, 8 bits data, no parity, one stop bit, and no flow control.

5.16 Buttons and LEDs

The black button (B2) located top side is the reset of the microcontroller STM32F769NIH6. The blue button (B1) located top side is available to be used as a digital input or as a wake-up alternate function. When the button is depressed the logic state is 1, otherwise, the logic state is 0. Four LEDs located on the top side are available for the user. From left to right the LEDs are LD1, LD2, LD3, and LD4 with respectively green, orange, red, and blue colors (refer to *Figure 5: 32F769IDISCOVERY top layout*). To light a LED, a zero low-logic state must be written in the corresponding GPIO register. *Table 4* shows the assignment of the control ports to the LED indicators.

Table 4. Control port assignment

Reference	Color	Name	Comment
B1	BLUE	USER	Alternate function Wake-up
B2	BLACK	RESET	-
LD1	RED	USER1	PJ13
LD2	GREEN	USER2	PJ5
LD3	GREEN	ARDUINO	PA12
LD4	RED	OTG overcurrent	PD4
LD5	GREEN	VBUS USB HS	-
LD6	RED	5 V Power	-
LD7	RED	Fault Power	Current upper than 625 mA
LD8	RED/GREEN	STLINK COM	Green when communication

5.17 LCD MIPI DSI® (with STM32F769I-DISCO only)

The color display on the board MB1166, 4-inch 800x472 LCD-TFT with capacitive touch panel is connected to the MIPI DSI® interface of the STM32F769NIH6 (for technical information on the board refer to the board schematics). The DSI (display serial interface) is a specification of the MIPI Alliance standard and defines the physical interface and the protocol used by the STM32F769NIH6 microcontroller to communicate with such an LCD module (refer to *Figure 15*). This module is an optional accessory for the STM32F769I-DISC1 board and must be ordered separately, while for the STM32F769I-DISCO board, it is provided in the board package.

Figure 15. 4-inch WVGA TFT DSI LCD daughterboard

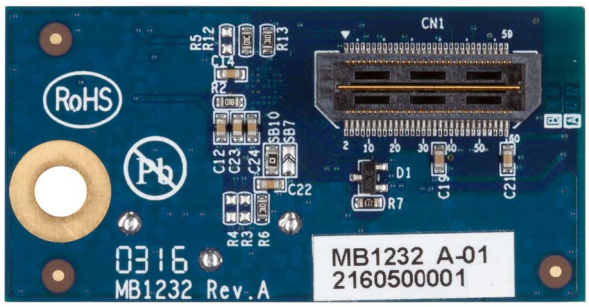
1. Picture is not contractual.

5.18 Adapter board from on-board DSI to HDMI (optional accessory display)

The DSI to HDMI adapter board provides a DSI input port and an HDMI output port. It is used on the 32F769IDISCOVERY Discovery board, to demonstrate video solutions based on STM32 (for technical information on this adapter board, refer to the board schematics).

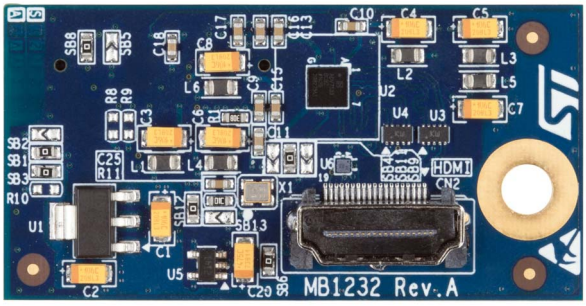
It supports 2-, 3-, or 4-lane DSI video as input data, S/PDIF, 2-channel I^2S audio as input data, and HDMI v1.3 output port (refer to *Figure 16* and *Figure 17*). For more information, refer to the user manual *DSI to HDMI adapter board for STM32 Development Tools* (UM2048).

Figure 16. DSI to HDMI adapter board



Bottom view

Figure 17. DSI to HDMI adapter board



Top view

1. Pictures are not contractual.

5.19 Adapter board from on-board DSI to external DSI (optional accessory display)

This adapter board allows the user to connect an external LCD in DSI format. This adapter board is connected to the high-speed connector from the 32F769IDISCOVERY Discovery board to the standard DSI display connector. For technical information on the board, refer to the board schematics.

This DSI adapter board features up to two lanes of MIPI/DSI data and I^2C interface support and enables the use of extended displays with the standard DSI interface on STM32 evaluation and Discovery board families (refer to *Figure 18* and *Figure 19*).

Figure 18. On-board DSI to external DSI

Bottom view

Figure 19. On-board DSI to external DSI

Top view

1. Pictures are not contractual.

5.20 Wi-Fi® and extension I²C connector

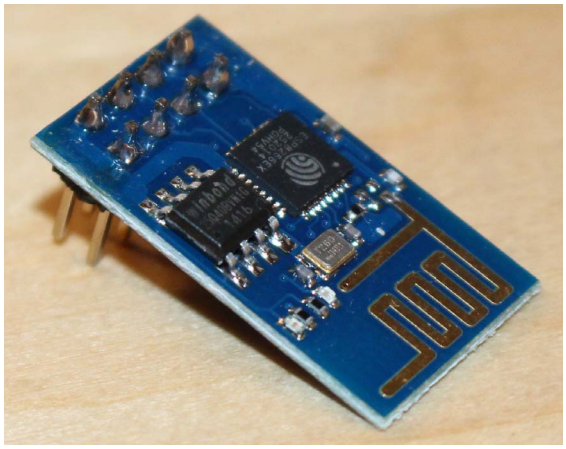
This connector (CN2) supports the Wi-Fi® module or extension I²C board.

5.20.1 Serial Wi-Fi® module

This module is 802.11 b/g/n compliant and is driven through serial communication using only the RX and TX signals of a UART interface (refer to *Figure 20*).

This low-cost module is not an STMicroelectronics accessory. Its order code is ESP8266-01.

Figure 20. Wi-Fi® module (ESP8266-01)



5.20.2 Extension I²C board

The user can design a board according to the pinout provided in *Connectors* and to the board schematics.

Each signal used for this I²C is a GPIO and software must manage the I²C protocol.

6 Connectors

6.1 Wi-Fi® and I²C extension connector (CN2)

Figure 21. Wi-Fi® and I²C extension connector (CN2) front view

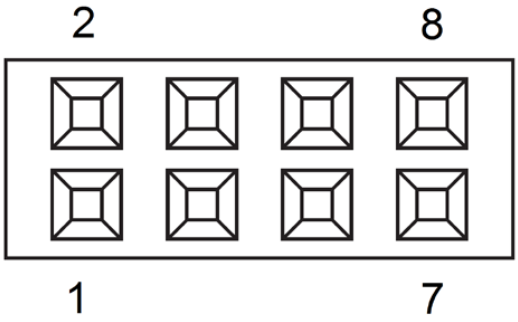
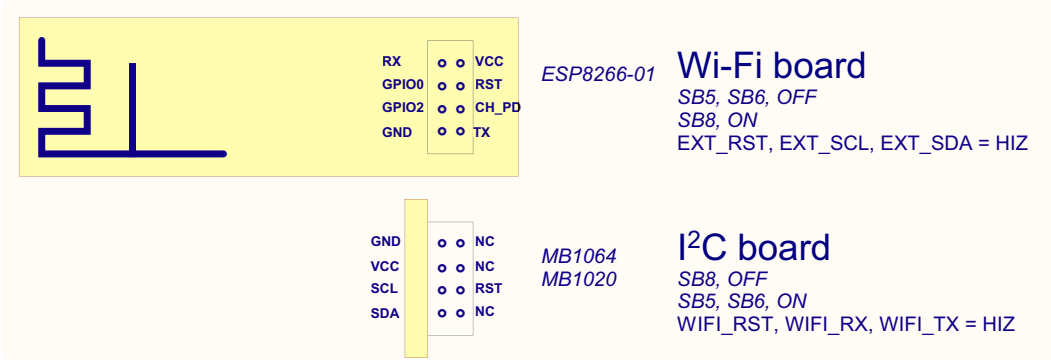


Table 5. Wi-Fi® and I²C extension connector (CN2)

Pin number	Wi-Fi® description	Pin number	I²C description
1	WIFI_RX	1	GND
2	3V3	2	NC
3	GPIO0	3	3V3
4	WIFI-RST	4	NC
5	GPIO2	5	EXT_SCL
6	CH_PD	6	EXT_RST
7	GND	7	EXT_SDA
8	WIFI_TX	8	NC

Figure 22. Wi-Fi® and I²C extension connector (CN2) front view



1. For more details, refer to the board schematics.

6.2 ARDUINO® Uno V3 connectors (CN11, CN14, CN13, and CN9)

Table 6. ARDUINO® connectors (CN11, CN14, CN13, and CN9)

Left connectors					-	Right connectors				
CN No.	Pin No.	Pin name	STM32 pin	Function	-	Function	STM32 pin	Pin name	Pin No.	CN No.
-					-	I2C1_SCL	PB8	D15	10	CN9 digital
						I2C1_SDA	PB9	D14	9	
						AVDD	-	AREF	8	
						Ground	-	GND	7	
CN11 power	1	NC	-	-		SPI2_SCK	PA12	D13	6	
	2	IOREF	-	3.3 V Ref		SPI2_MISO	PB14	D12	5	
	3	RESET	NRST	RESET		TIM12_CH2, SPI2_MOSI	PB15	D11	4	
	4	+3V3	-	3.3 V input/output		TIM1_CH4, SPI2_NSS	PA11	D10	3	
	5	+5 V	-	5 V output		TIM12_CH1	PH6	D9	2	
	6	GND	-	Ground		-	PJ4	D8	1	
	7	GND	-	Ground		-				
	8	VIN	-	Power input		-	PJ3	D7	8	CN13 digital
-						TIM11_CH1	PF7	D6	7	
CN14 analog	1	A0	PA6	ADC1_IN6		TIM3_CH3	PC8	D5	6	
	2	A1	PA4	ADC1_IN4		-	PJ0	D4	5	
	3	A2	PC2	ADC1_IN12		TIM10_CH1	PF6	D3	4	
	4	A3	PF10	ADC3_IN8		-	PJ1	D2	3	
	5	A4	PF8 or PB(1)	ADC3_IN6 (PF8) or I2C1_SDA (PB9)		USART6_TX	PC6	D1	2	
	6	A5	PF9 or PB8(1)	ADC3_IN7 (PF9) or I2C1_SCL (PB8)		USART6_RX	PC7	D0	1	

1. For details refer to *Table 14: 32F769IDISCOVERY I/O assignment*.

6.3 USB OTG HS Micro-AB connector (CN15)

Figure 23. USB OTG Micro-AB connector (CN15) front view

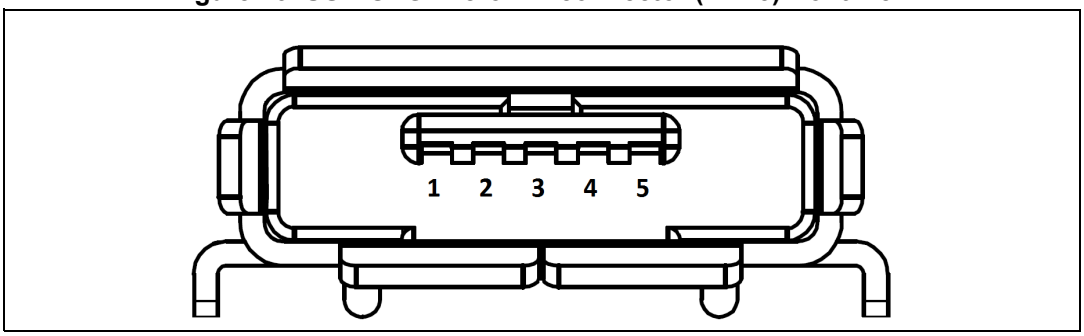


Table 7. USB OTG HS Micro-AB (CN15)

Pin number	Description	Pin number	Description
1	VBUS	4	ID
2	D-	5	GND
3	D+	-	-

6.4 Ethernet RJ45 connector (CN10)

Figure 24. Ethernet RJ45 connector (CN10) front view

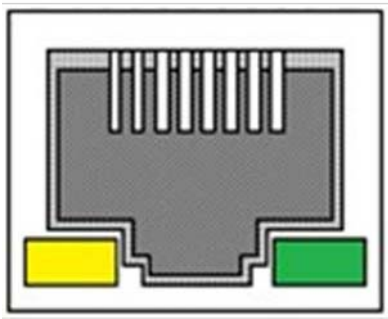


Table 8. Ethernet RJ45 connector (CN10)

Pin number	Description	Pin number	Description
1	TX+	7	-
2	TX-	8	-
3	RX+	9	K, yellow LED
4	-	10	A, yellow LED
5	-	11	K, green LED
6	RX-	12	A, green LED

6.5 LCD MIPI DSI® connector (CN1)

Figure 25. LCD MIPI DSI® connector (CN1) front view

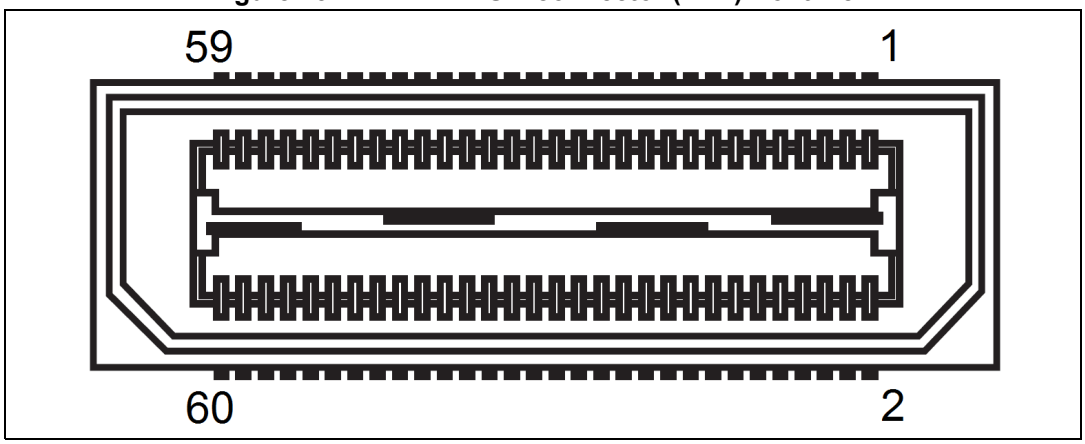


Table 9. LCD MIPI DSI® connector (CN1)

Pin No.	Description	Pin connection	Pin No.	Description	Pin connection
1	GND	-	2	-	-
3	DSI_CK_P	H12	4	LCD_INT	PI13
5	DSI_CK_N	H13	6	GND	-
7	GND	-	8	DSI_D2_P/GND	-
9	DSI_D0_P	J12	10	DSI_D2_N/GND	-
11	DSI_D0_N	J13	12	GND	-
13	GND	-	14	DSI_D3_P/GND	-
15	DSI_D1_P	F12	16	DSI_D3_N/GND	-
17	DSI_D1_N	F13	18	GND	-
19	GND	-	20	-	-
21	BLVDD(5 V)	-	22	-	-
23	BLVDD(5 V)	-	24	-	-
25	-	-	26	-	-
27	BLGND	-	28	-	-
29	BLGND	-	30	-	-
31	-	-	32	-	-
33	-	-	34	-	-
35	SCLK/MCLK	NC	36	3.3V	-
37	LRCLK	NC	38	-	-
39	SPDIF_I2S	PD11	40	I2C1_SDA	PB7
41	-	-	42	-	-
43	-	-	44	I2C1_SCL	PD12

Table 9. LCD MIPI DSI® connector (CN1) (continued)

Pin No.	Description	Pin connection	Pin No.	Description	Pin connection
45	CEC_CLK	-	46	-	-
47	CEC	-	48	-	-
49	DSI_TE	PJ2	50	-	-
51	-	-	52	-	-
53	BL_CTRL	PI14	54	-	-
55	-	-	56	-	-
57	DSI_RESET	PJ15	58	-	-
59	-	-	60	1V8	-

6.6 microSD™ connector (CN5)

Figure 26. microSD™ connector (CN5) front view

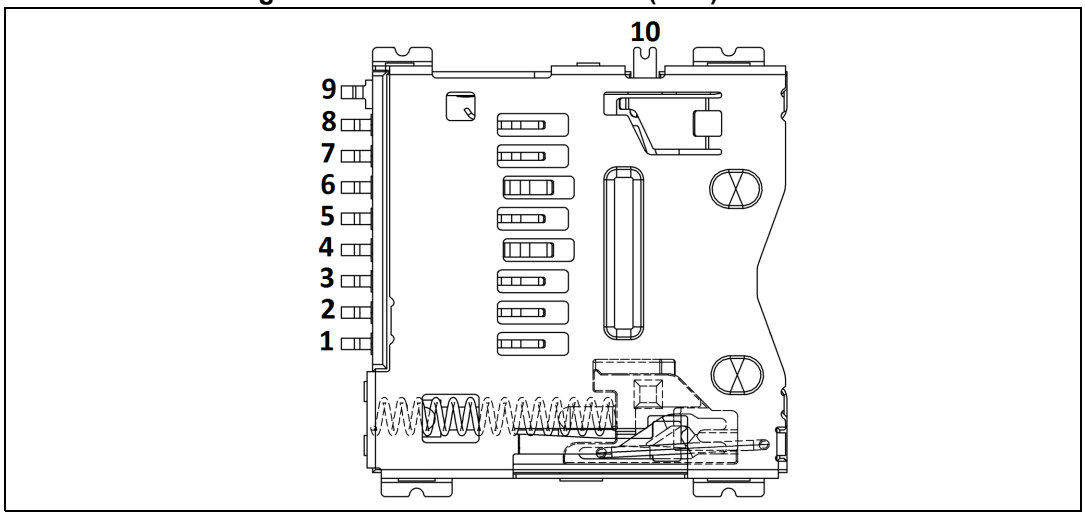


Table 10. microSD™ connector (CN5)

Pin number	Description	Pin number	Description
1	SDMMC2_D2	6	VSS/GND
2	SDMMC2_D3	7	SDMMC2_D0
3	SDMMC2_CMD (PD2)	8	SDMMC2_D1
4	+3.3V	9	GND
5	SDMMC2_CK (PC12)	10	microSD™ card_detect

6.7 ST-LINK/V2-1 USB Micro-B connector (CN16)

CN16 is used to connect the embedded ST-LINK/V2-1 to a PC for programming and debugging purposes.

Figure 27. USB Micro-B connector (CN16) front view

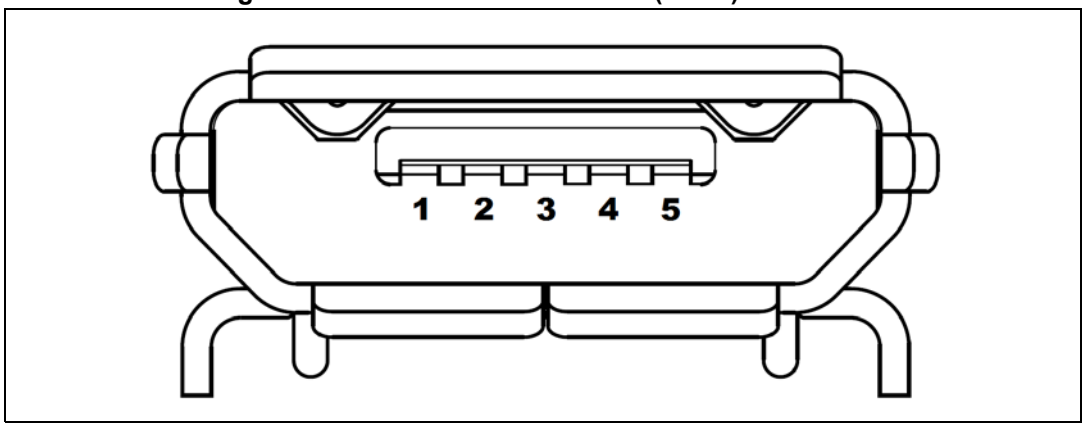


Table 11. USB Micro-B connector (CN16)

Pin number	Description	Pin number	Description
1	VBUS (power)	4	GND
2	DM	5, 6	Shield
3	DP	-	-

6.8 Audio stereo speaker (JP2 and JP3)

The stereo audio outputs (JP2 and JP3) are available to support the stereo speakers (left and right respectively).

6.9 Audio line output jack (CN7)

A 3.5-mm stereo audio jack output (CN7) is available to support the headphone.

6.10 Audio line input jack (CN6)

A 3.5-mm stereo audio jack input (CN6) is available to support the audio line input.

6.11 SPDIF input RCA connector (CN12)

Table 12. SPDIF input RCA connector (CN12)

Pin number	Description	Pin number	Description
1	SPDIF_RX	2	GND
2	GND	-	-

6.12 SPDIF output RCA connector (CN8)

Table 13. SPDIF output RCA connector (CN8)

Pin number	Description	Pin number	Description
1	SPDIF_TX	2	GND
2	GND	-	-

7 32F769IDISCOVERY I/O assignment

Table 14. 32F769IDISCOVERY I/O assignment

Pin No.	Pin name	Signal or label	Comment
A1	PE4	SAI1_FS_A	-
A2	PE3	SAI1_SD_B	-
A3	PE2	QUADSPI_BK1_IO2	-
A4	PG14	ETH_TXD1	-
A5	PE1	FMC_NBL1	-
A6	PE0	FMC_NBL0	-
A7	PB8	I2C1_SCL	ARD_D15/SCL
A8	PB5	USB_OTG_HS_ULPI_D7	-
A9	PB4	SDMMC2_D3	-
A10	PB3	SDMMC2_D2	-
A11	PD7	SDMMC2_CMD	-
A12	PC12	UART5_TX	WIFI_RX
A13	PA15	CEC	CEC
A14	PA14	SYS_JTCK-SWCLK	SWCLK
A15	PA13	SYS_JTMS-SWDIO	SWDIO
B1	PE5	SAI1_SCK_A	-
B2	PE6	SAI1_SD_A	-
B3	PG13	ETH_TXD0	-
B4	PB9	I2C1_SDA	ARD_D14/SDA
B5	PB7	I2C4_SDA	-
B6	PB6	QUADSPI_BK1_NCS	-
B7	PG15	FMC_SDNCAS	-
B8	PG11	ETH_TX_EN	-
B9	PJ13	GPIO_Input	LD_USER1
B10	PJ12	GPIO_Input	Audio_INT
B11	PD6	SDMMC2_CK	-
B12	PD0	FMC_D2	-
B13	PC11	DFSDM_DATIN5	-
B14	PC10	QUADSPI_BK1_IO1	-
B15	PA12	SPI2_SCK	ARD_D13/SCK
C1	VBAT	-	-
C2	PI8	GPIO_Input	NC4

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
C3	PI4	FMC_NBL2	-
C4	PK7	GPIO_Input	NC3
C5	PK6	GPIO_Input	NC2
C6	PK5	GPIO_Input	NC1
C7	PG12	SPDIFRX_IN1	-
C8	PG10	SDMMC2_D1	-
C9	PJ14	GPIO_Input	WIFI_RST
C10	PD5	GPIO_Input	RMII_RXER
C11	PD3	DFSDM_CKOUT	-
C12	PD1	FMC_D3	-
C13	PI3	FMC_D27	-
C14	PI2	FMC_D26	-
C15	PA11	SPI2_NSS	ARD_D10/PWM/CS
D1	PC13	RTC_OUT_ALARM	NC6
D2	PF0	FMC_A0	-
D3	PI5	FMC_NBL3	-
D4	PI7	FMC_D29	-
D5	PI10	FMC_D31	-
D6	PI6	FMC_D28	-
D7	PK4	GPIO_Input	NC8
D8	PK3	GPIO_Input	NC7
D9	PG9	SDMMC2_D0	-
D10	PJ15	GPIO_Input	DSI_RESET
D11	PD4	GPIO_Input	OTG_HS_OverCurrent
D12	PD2	UART5_RX	WIFI_TX
D13	PH15	FMC_D23	-
D14	PI1	FMC_D25	-
D15	PA10	USART1_RX	VCP_RX
E1	PC14/OSC32_IN	RCC_OSC32_IN	-
E2	PF1	FMC_A1	-
E3	PI12	GPIO_Input	NC5
E4	PI9	FMC_D30	-
E5	PDR_ON	-	-
E6	BOOT0	-	-
E7	VDD	-	-

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
E8	VDD	-	-
E9	VDD	-	-
E10	VDD	-	-
E11	VCAP_2	-	-
E12	PH13	FMC_D21	-
E13	PH14	FMC_D22	-
E14	PI0	FMC_D24	-
E15	PA9	USART1_TX	VCP_TX
F1	PC15/OSC32_OUT	RCC_OSC32_OUT	-
F2	VSS	-	-
F3	PI11	USB_OTG_HS_ULPI_DIR	-
F4	VDD	-	-
F5	VDD	-	-
F6	VSS	-	-
F7	VSS	-	-
F8	VSS	-	-
F9	VSS	-	-
F10	VSS	-	-
F11	VDD	-	-
F12	DSIHOST_D1P	DSIHOST_D1P	-
F13	DSIHOST_D1N	DSIHOST_D1N	-
F14	PC9	QUADSPI_BK1_IO0	-
F15	PA8	RCC_MCO_1	CEC_CLK
G1	PH0/OSC_IN	RCC_OSC_IN	-
G2	PF2	FMC_A2	-
G3	PI13	GPIO_Input	LCD_INT
G4	PI15	GPIO_Input	uSD_Detect
G5	VDD	-	-
G6	VSS	-	-
G10	VSS	-	-
G11	VDDUSB	-	-
G12	VSSDSI	-	-
G13	VDD	-	-
G14	PC8	TIM3_CH3	ARD_D5/PWM
G15	PC7	USART6_RX	ARD_D0/RX

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
H1	PH1/OSC_OUT	RCC_OSC_OUT	-
H2	PF3	FMC_A3	-
H3	PI14	GPIO_Input	LCD_BL_CTRL
H4	PH4	USB_OTG_HS_ULPI_NXT	-
H5	VDD	-	-
H6	VSS	-	-
H10	VSS	-	-
H11	VDDDSI	-	-
H12	DSIHOST_CKP	DSIHOST_CKP	-
H13	DSIHOST_CKN	DSIHOST_CKN	-
H14	PG8	FMC_SDCLK	-
H15	PC6	USART6_TX	ARD_D1/TX
J1	NRST	-	-
J2	PF4	FMC_A4	-
J3	PH5	FMC_SDNWE	-
J4	PH3	FMC_SDNE0	-
J5	VDD	-	-
J6	VSS	-	-
J10	VSS	-	-
J11	VDD	-	-
J12	DSIHOST_D0P	DSIHOST_D0P	-
J13	DSIHOST_D0N	DSIHOST_D0N	-
J14	PG7	SAI1_MCLK_A	-
J15	PG6	GPIO_Input	EXT_SDA
K1	PF7	TIM11_CH1	ARD_D6/PWM
K2	PF6	TIM10_CH1	ARD_D3/PWM
K3	PF5	FMC_A5	-
K4	PH2	FMC_SDCKE0	-
K5	VDD	-	-
K6	VSS	-	-
K7	VSS	-	-
K8	VSS	-	-
K9	VSS	-	-
K10	VSS	-	-
K11	VDD	-	-

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
K12	VCAPDSI	-	-
K13	PD15	FMC_D1	-
K14	PB13	USB_OTG_HS_ULPI_D6	-
K15	PD10	FMC_D15	-
L1	PF10	ADC3_IN8	ARD_A3
L2	PF9	ADC3_IN7	ARD_A5
L3	PF8	ADC3_IN6	ARD_A4
L4	PC3	DFSDM_DATIN1	-
L5	BYPASS_REG	-	-
L6	VSS	-	-
L7	VDD	-	-
L8	VDD	-	-
L9	VDD	-	-
L10	VDD	-	-
L11	VCAP_1	-	-
L12	PD14	FMC_D0	-
L13	PB12	USB_OTG_HS_ULPI_D5	-
L14	PD9	FMC_D14	-
L15	PD8	FMC_D13	-
M1	VSSA	-	-
M2	PC0	USB_OTG_HS_ULPI_STP	-
M3	PC1	ETH_MDC	-
M4	PC2	ADC1_IN12	ARD_A2
M5	PB2	QUADSPI_CLK	-
M6	PF12	FMC_A6	-
M7	PG1	FMC_A11	-
M8	PF15	FMC_A9	-
M9	PJ4	GPIO_Input	ARD_D8
M10	PD12	I2C4_SCL	-
M11	PD13	QUADSPI_BK1_IO3	-
M12	PG3	GPIO_Input	EXT_SCL
M13	PG2	FMC_A12	-
M14	PJ5	GPIO_Input	LD_USER2
M15	PH12	FMC_D20	-
N1	VREF-	-	-

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
N2	PA1	ETH_REF_CLK	-
N3	PA0/WKUP	SYS_WKUP0	B_USER
N4	PA4	ADC1_IN4	ARD_A1
N5	PC4	ETH_RXD0	-
N6	PF13	FMC_A7	-
N7	PG0	FMC_A10	-
N8	PJ3	GPIO_Input	ARD_D7
N9	PE8	FMC_D5	-
N10	PD11	SAI2_SD_A	-
N11	PG5	FMC_BA1	-
N12	PG4	FMC_BA0	-
N13	PH7	GPIO_Input	EXT_RST
N14	PH9	FMC_D17	-
N15	PH11	FMC_D19	-
P1	VREF+	-	-
P2	PA2	ETH_MDIO	-
P3	PA6	ADC1_IN6	ARD_A0
P4	PA5	USB_OTG_HS_ULPI_CK	-
P5	PC5	ETH_RXD1	-
P6	PF14	FMC_A8	-
P7	PJ2	DSIHOST_TE	DSIHOST_TE
P8	PF11	FMC_SDNRAS	-
P9	PE9	FMC_D6	-
P10	PE11	FMC_D8	-
P11	PE14	FMC_D11	-
P12	PB10	USB_OTG_HS_ULPI_D3	-
P13	PH6	TIM12_CH1	ARD_D9/PWM
P14	PH8	FMC_D16	-
P15	PH10	FMC_D18	-
R1	VDDA	-	-
R2	PA3	USB_OTG_HS_ULPI_D0	-
R3	PA7	ETH_CRS_DV	-
R4	PB1	USB_OTG_HS_ULPI_D2	-
R5	PB0	USB_OTG_HS_ULPI_D1	-
R6	PJ0	GPIO_Input	ARD_D4

Table 14. 32F769IDISCOVERY I/O assignment (continued)

Pin No.	Pin name	Signal or label	Comment
R7	PJ1	GPIO_Input	ARD_D2
R8	PE7	FMC_D4	-
R9	PE10	FMC_D7	-
R10	PE12	FMC_D9	-
R11	PE15	FMC_D12	-
R12	PE13	FMC_D10	-
R13	PB11	USB_OTG_HS_ULPI_D4	-
R14	PB14	SPI2_MISO	ARD_D12/MISO
R15	PB15	SPI2_MOSI	ARD_D11/PWM/MOSI

8 32F769IDISCOVERY board information

8.1 Product marking

The stickers located on the top or bottom side of all PCBs provide product information:

- First sticker: product order code and product identification, generally placed on the main board featuring the target device.
  Example:

  Product order code
  Product identification

- Second sticker: board reference with revision and serial number, available on each PCB.
  Example:

  MBxxxx-Variant-yzz
  syywwxxxxx

On the first sticker, the first line provides the product order code, and the second line the product identification.

On the second sticker, the first line has the following format: *"MBxxxx-Variant-yzz"*, where *"MBxxxx"* is the board reference, *"Variant"* (optional) identifies the mounting variant when several exist, *"y"* is the PCB revision and *"zz"* is the assembly revision, for example B01. The second line shows the board serial number used for traceability.

Parts marked as *"ES"* or *"E"* are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST's Quality department must be contacted prior to any decision to use these engineering samples to run a qualification activity.

"E" or *"ES"* marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet *Package information* paragraph at the *www.st.com* website).
- Next to the evaluation tool ordering part number that is stuck or silk-screen printed on the board.

Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a *"U"* marking option at the end of the standard part number and is not available for sales.

To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

8.2 32F769IDISCOVERY product history

Table 15. Product history

Order code	Product identification	Product details	Product change description	Product limitations
STM32F769I-DISCO	32F769I-DISCO/	MCU: – STM32F769NIH6 revision A	Initial revision	No limitation
		MCU errata sheet: – *STM32F76xxx and STM32F77xxx device limitations (ES0334)*		
		Boards: – MB1225-F769I-A01 or MB1225-F769I-B01 (main board) – MB1166-DEFAULT-A03 (LCD daughterboard)		
	DK32F769I$AU1	MCU: – STM32F769NIH6 revision Z or 1	LCD board revision change	No demonstration software preloaded in this product
		MCU errata sheet: – *STM32F76xxx and STM32F77xxx device limitations (ES0334)*		
		Boards: – MB1225-F769I-B03 (main board) – MB1166-DEFAULT-A09 (LCD daughterboard)		
	DK32F769I$AU2	MCU: – STM32F769NIH6 revision Z or 1	– Plastic blister packaging replaced by a carton box one – Main board revision change	No demonstration software preloaded in this product
		MCU errata sheet: – *STM32F76xxx and STM32F77xxx device limitations (ES0334)*		
		Boards: – MB1225-F769I-C01 (main board) – MB1166-DEFAULT-A09 (LCD daughterboard)		

Table 15. Product history (continued)

Order code	Product identification	Product details	Product change description	Product limitations
STM32F769I-DISCO	DK32F769I$AU3	MCU: – STM32F769NIH6 revision Z or 1	LCD board revision change	No demonstration software preloaded in this product
		MCU errata sheet: – *STM32F76xxx and STM32F77xxx device limitations (ES0334)*		
		Boards: – MB1225-F769I-C01 (main board) – MB1166-DEFAULT-A10 (LCD daughterboard)		

8.3 Board revision history

Table 16. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1225 (main board)	F769I-A01	Initial revision	No limitation
	F769I-B01	– VDD_VREGDSI of U13 is connected to VDD instead of DSI_VDD12, EXT I^2C for CN2 is built by GPIOs. – Added DFSDM_CKOUT/DATAIN1/DATAIN5 – L1 OFF	No limitation
	F769I-B02	– C77 and C84 changed to 3 pF – R38 OFF – T100 not fitted	No limitation
	F769I-B03	– Several part references updated due to obsolescence. Refer to the bill of materials for details. – Memory MICRON MT48LC4M32B2B5-6A IT:L TR is replaced by ISSI IS42S32400F-6BL.	No limitation
	F769I-C01	– A new PCB is introduced for different footprints required for obsolete parts. – Several part references updated due to obsolescence. Refer to the bill of materials for details. – Memory MICRON MT48LC4M32B2B5-6A IT:L TR is replaced by ISSI IS42S32400F-6BL.	No limitation

Table 16. Board revision history (continued)

Board reference	Board variant and revision	Board change description	Board limitations
MB1166 (LCD daughterboard)	DEFAULT-A03	Initial revision	No limitation
	DEFAULT-A09	LCD FRIDA FRD397B25009-D-CTK is replaced by FRIDA FRD400B25025-A-CTK	No limitation
	DEFAULT-A10	LCD FRIDA FRD400B25025-A-CTK is replaced by FRIDA FRD400B25021-B-CTQ	No limitation

9 Federal Communications Commission (FCC) and ISED Canada Compliance Statements

9.1 FCC Compliance Statement

9.1.1 Part 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

9.1.2 Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

9.1.3 Part 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Responsible party (in the USA)

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9.2 ISED Compliance Statement

9.2.1 Compliance Statement

ISED Canada ICES-003 Compliance Label: *CAN ICES-3 (A)/NMB-3(A)*

9.2.2 Déclaration de conformité

Étiquette de conformité à la NMB-003 d'ISDE Canada: *CAN ICES-3 (A)/NMB-3(A)*

10 CE conformity

10.1 Warning

EN 55032 / CISPR32 (2012) Class A product

Warning: this device is compliant with Class A of EN55032 / CISPR32. In a residential environment, this equipment may cause radio interference.

Avertissement : cet équipement est conforme à la Classe A de la EN55032 / CISPR 32. Dans un environnement résidentiel, cet équipement peut créer des interférences radio.

Revision history

Table 17. Document revision history

Date	Revision	Changes
20-May-2016	1	Initial release.
03-Oct-2016	2	Updates to introduce optional display accessories: *Section 1: Features* and *Section 4: Ordering information* *Section 6.4: Power supply* New sections added: *Section 6.18: Adapter board from on-board DSI to HDMI (optional accessory display)* *Section 6.19: Adapter board from on-board DSI to external DSI (optional accessory display)* New figures added: *Figure 3: 32F769IDISCOVERY board (Bottom view)*, *Figure 15: 4-inch WVGA TFT DSI LCD daughterboard*, *Figure 16: DSI to HDMI adapter board*, *Figure 17: DSI to HDMI adapter board*, *Figure 18: On-board DSI to external DSI*, *Figure 19: On-board DSI to external DSI*, *Figure 20: Wi-Fi® module (ESP8266-01)*, *Figure 39: 4-inch DSI LCD board*, *Figure 40: DSI to HDMI adapter*, *Figure 41: DSI connector adapter*.
13-Apr-2018	3	Updated the former order code STM32F769I-DISCO1 to STM32F769I-DISC1 across the whole document. Added note about U device suffix in *Chapter 3: Product marking*. Corrected PI3 to PJ3 in *Table 5: ARDUINO® connectors (CN11, CN14, CN13, and CN9)*. Corrected USART3 to USART1 in *Section 6.15: Virtual COM port*. Added missing SDRAM schematic as *Figure 32: SDRAM*. Attributed Quad-SPI flash memory.
14-Apr-2022	4	Reshuffled document from *Introduction* to *Conventions* to align with the latest standards. Added: – *32F769IDISCOVERY board information* – *Federal Communications Commission (FCC) and Innovation, Science and Economic Development Canada (ISED) Compliance Statements* Removed *Demonstration software*, *Technology partners*, and *Schematic diagrams*.
2-Jun-2023	5	Updated: – *Introduction* and *Features* with digital camera connector removed – *Figure 5* Added: – *Table 15* and *Table 16* with updated *Product marking* to *32F769IDISCOVERY board information* – *CE conformity*.