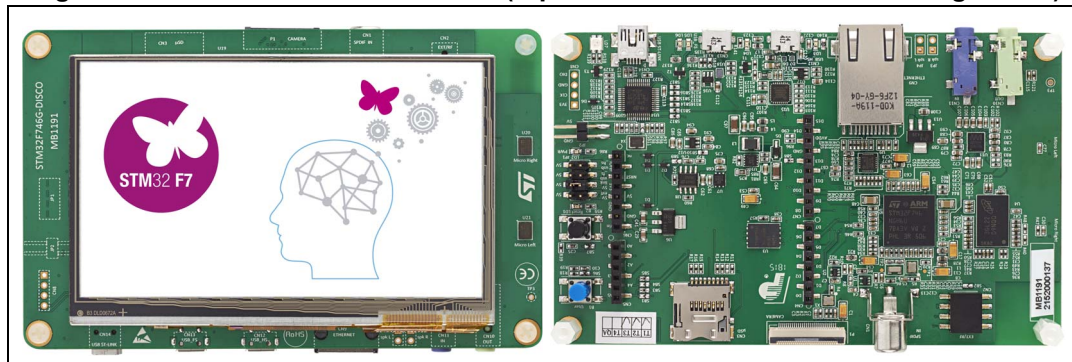# Discovery kit for STM32F7 series with STM32F746NG MCU

Introduction

The 32F746GDISCOVERY Discovery kit is a complete demonstration and development platform for the STMicroelectronics Arm® Cortex®-M7-core-based STM32F746NG microcontroller (STM32F746NGH6 order code). This microcontroller features four I²Cs, six SPIs with three multiplexed simplex I²S, SDMMC, four USARTs, four UARTs, two CANs, three 12-bit ADCs, two 12-bit DACs, two SAIs, 8- to 14-bit digital camera module interface, internal 320+16+4-Kbyte SRAM and 1-Mbyte flash memory, USB OTG_HS and FS, Ethernet MAC, FMC interface, quad-SPI interface, SWD debugging support. This Discovery kit offers everything required for users to get started quickly and develop applications easily.

The full range of hardware features on the board helps users to evaluate almost all peripherals (USB OTG_HS and FS, 10/100-Mbit Ethernet, microSD™ card, USART, SAI audio DAC stereo with audio jack input and output, ST-MEMS digital microphones, SDRAM, quad-SPI flash memory, 4.3" color LCD-TFT with a capacitive multitouch panel, SPDIF RCA input, and others) and to develop their applications. ARDUINO® Uno V3 connectors make it possible to easily connect extension shields or a daughterboard for users' specific applications. The integrated ST-LINK/V2-1 provides an embedded in-circuit debugger and programmer for the STM32.

The 32F746GDISCOVERY board is provided with the STM32CubeF7 MCU Package, which offers an STM32 comprehensive software HAL library as well as various software examples.

Figure 1. 32F746GDISCOVERY board (top view: left side - bottom view: right side)

1. Pictures are not contractual.

Contents

List of tables

List of figures

1   Features

- STM32F746NGH6 Arm® Cortex®[a] core-based microcontroller with 1 Mbyte of flash memory and 340 Kbytes of RAM, in a BGA216 package
- 4.3" RGB 480×272 color LCD-TFT with capacitive touchscreen
- Ethernet compliant with IEEE-802.3-2002
- USB OTG_HS
- USB OTG_FS
- SAI audio codec
- Two ST-MEMS digital microphones
- 128-Mbit quad-SPI flash memory
- 128-Mbit SDRAM (64 Mbits accessible)
- Two user and reset push buttons
- Board connectors:
  - Image sensor
  - microSD™ card
  - RF-EEPROM daughterboard connector
  - 2×USB with Micro-AB
  - Ethernet RJ45
  - SPDIF RCA input connector
  - Audio line-in and line-out jack
  - Stereo speaker outputs
  - ARDUINO® Uno V3 expansion connectors
- Flexible power-supply options: ST-LINK, USB $V_{BUS,}$ or external sources
- Power supply output for external applications: 3.3 V or 5 V
- Comprehensive free software libraries and examples available with the STM32Cube MCU Package
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Support of a wide choice of integrated development environments (IDEs) including IAR™, Keil®, and STM32CubeIDE

arm

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a. Arm and Cortex are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 Ordering information

To order the 32F746GDISCOVERY Discovery kit, refer to *Table 1*. Additional information is available from the datasheet and reference manual of the target microcontroller.

Table 1. List of available products

Order code	Board reference	Target STM32
STM32F746G-DISCO	MB1191	STM32F746NGH6

2.1 Codification

The meaning of the codification is explained in *Table 2*.

Table 2. Codification explanation

STM32F7XXY-DISCO	Description	Example: STM32F746G-DISCO
STM32F7	MCU series in STM32 32-bit Arm Cortex MCUs	STM32F7 series
XX	MCU product line in the series	STM32F746
Y	STM32 flash memory size: – E for 512 Kbytes – G for 1 Mbyte	1 Mbyte
DISCO	Discovery kit	Discovery kit

The order code is mentioned on a sticker placed on the top side of the board.

3   Development environment

3.1   System requirements

- Windows® OS (7, 8 and 10), Linux® 64-bit, or macOS®[a]
- USB Type-A to Mini-B cable

3.2   Development toolchains

- Keil® MDK-ARM[b]
- IAR™ EWARM[b]
- STMicroelectronics - STM32CubeIDE

3.3   Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the on-board microcontroller, is preloaded in the STM32 flash memory for easy demonstration of the device peripherals in standalone mode. The latest versions of the demonstration source code and associated documentation can be downloaded from *www.st.com*.

3.4   EDA resources

All board design resources, including schematics, EDA databases, manufacturing files, and the bill of materials are available from the 32F746GDISCOVERY product page at *www.st.com*.

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a. macOS® is a trademark of Apple Inc. registered in the U.S. and other countries.

b. On Windows® only.

4 Safety recommendations

4.1 Targeted audience

This product targets users with at least basic electronics or embedded software development knowledge such as engineers, technicians, or students. This board is not a toy and is not suited for use by children.

4.2 Handling the board

This product contains a bare printed circuit board and like all products of this type, the user must be careful about the following points:

- The connection pins on the board might be sharp. Be careful when handling the board to avoid hurting yourself.
- This board contains static-sensitive devices. To avoid damaging it, handle the board in an ESD.proof environment.
- While powered, do not touch the electric connections on the board with your fingers or anything conductive. The board operates at a voltage level that is not dangerous, but components might be damaged when shorted.
- Do not put any liquid on the board and avoid operating the board close to water or at a high humidity level.
- Do not operate the board if it is dirty or dusty.

5   Hardware layout and configuration

The 32F746GDISCOVERY Discovery board is designed around the STM32F746NGH6 microcontroller (216-pin in TFBGA package). The hardware block diagram (see *Figure 2*) illustrates the connections between STM32F746NGH6 and peripherals (SDRAM, quad-SPI flash memory, camera module, color LCD, USB OTG connectors, USART, Ethernet, audio, SPDIFRX, microSD™ card, ARDUINO® Uno shields, and embedded ST-LINK). *Figure 3* and *Figure 4* help users to locate these features on the Discovery board.

The mechanical dimensions of the Discovery board are shown in *Figure 5*.

Figure 2. Hardware block diagram
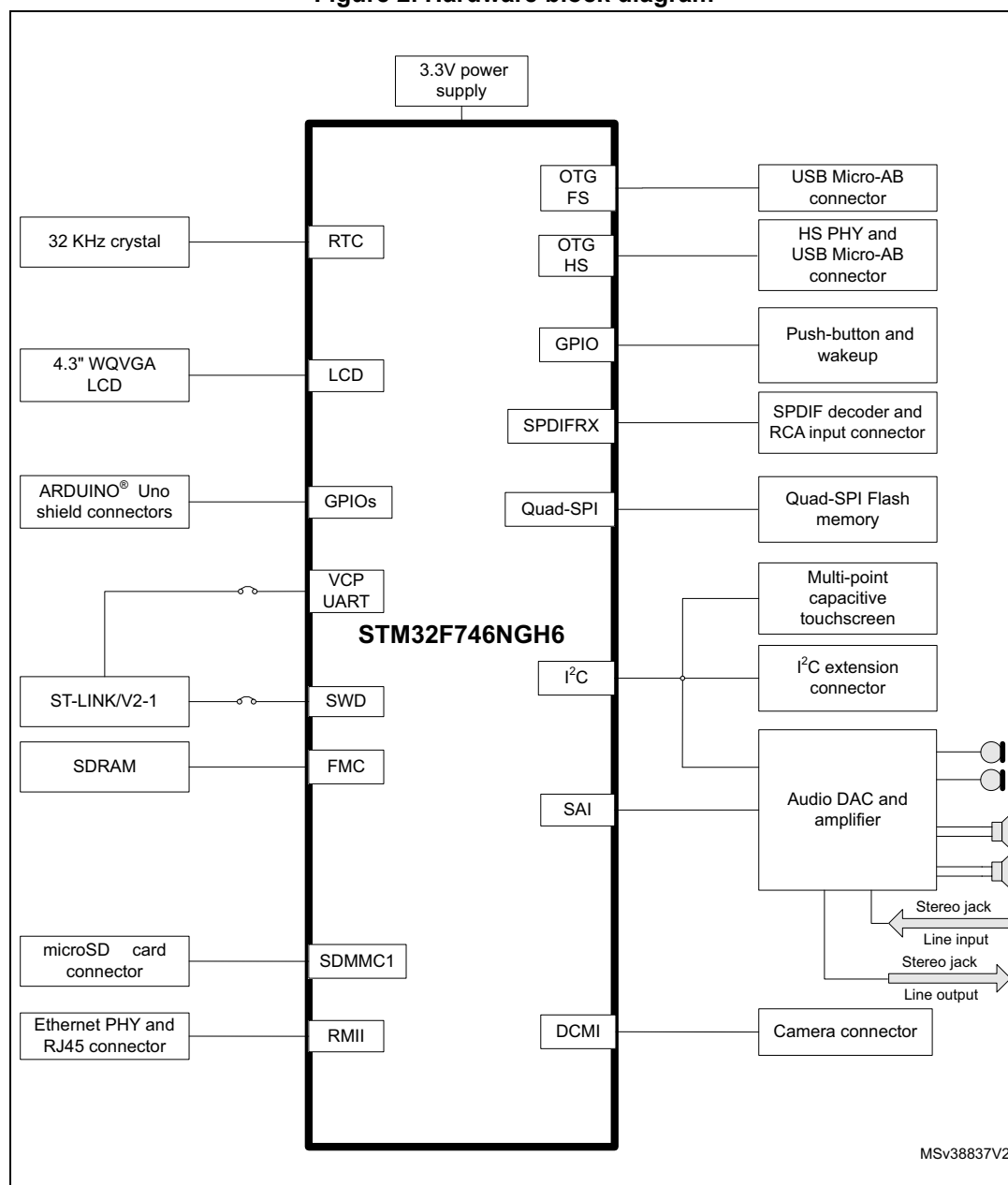
5.1 The 32F746GDISCOVERY Discovery board layout

Figure 3. 32F746GDISCOVERY Discovery board top layout

MSv38850V3

Figure 4. 32F746GDISCOVERY Discovery board bottom layout

4.3" RGB 480x272 color LCD-TFT
with capacitive touchscreen

Two ST MEMS microphones

MSv38851V2

5.2 32F746GDISCOVERY Discovery board mechanical drawing

Figure 5. Mechanical drawing

Plastic spacer height = 15 mm, Overall height = 23 mm +/- 1 mm.
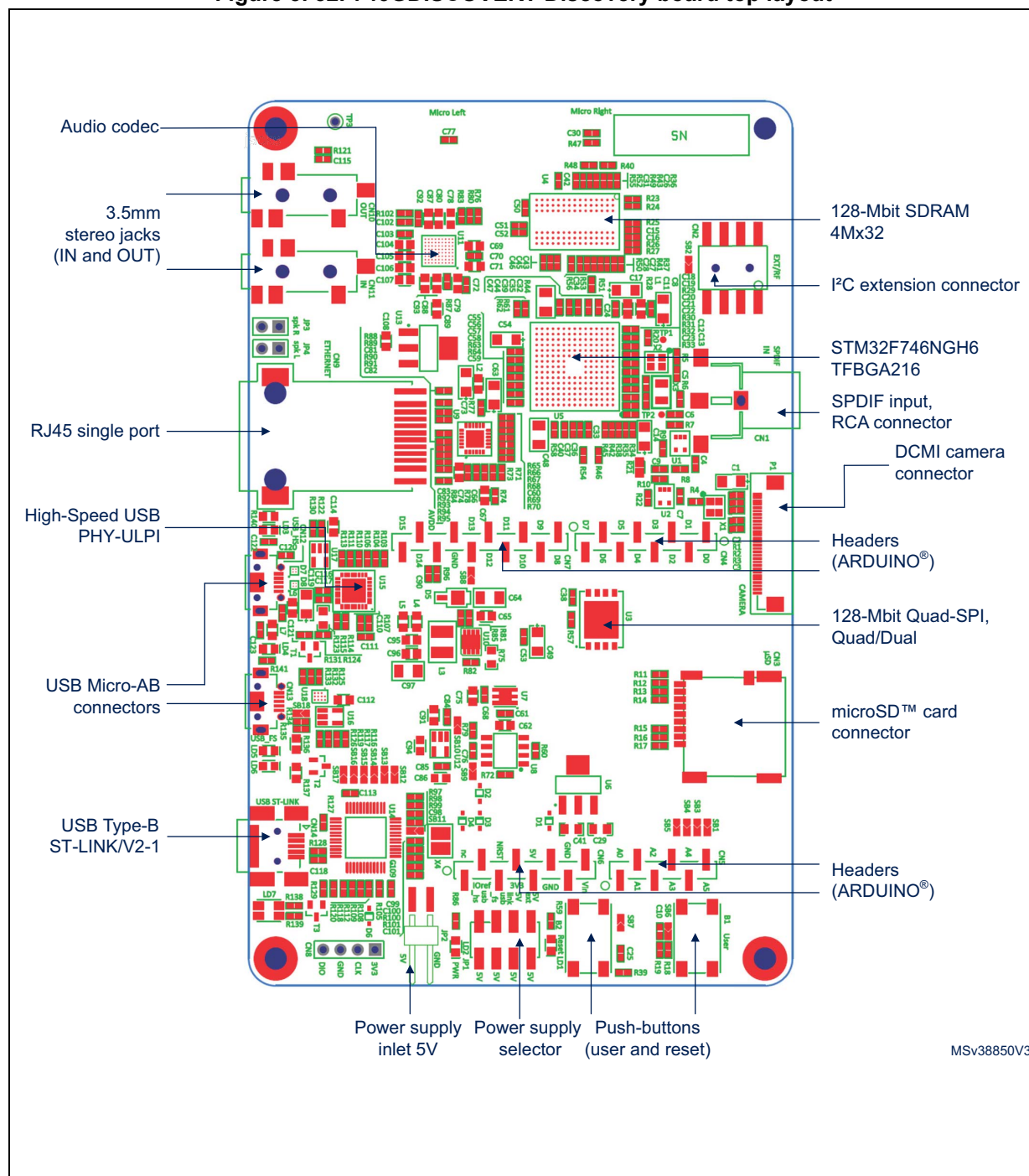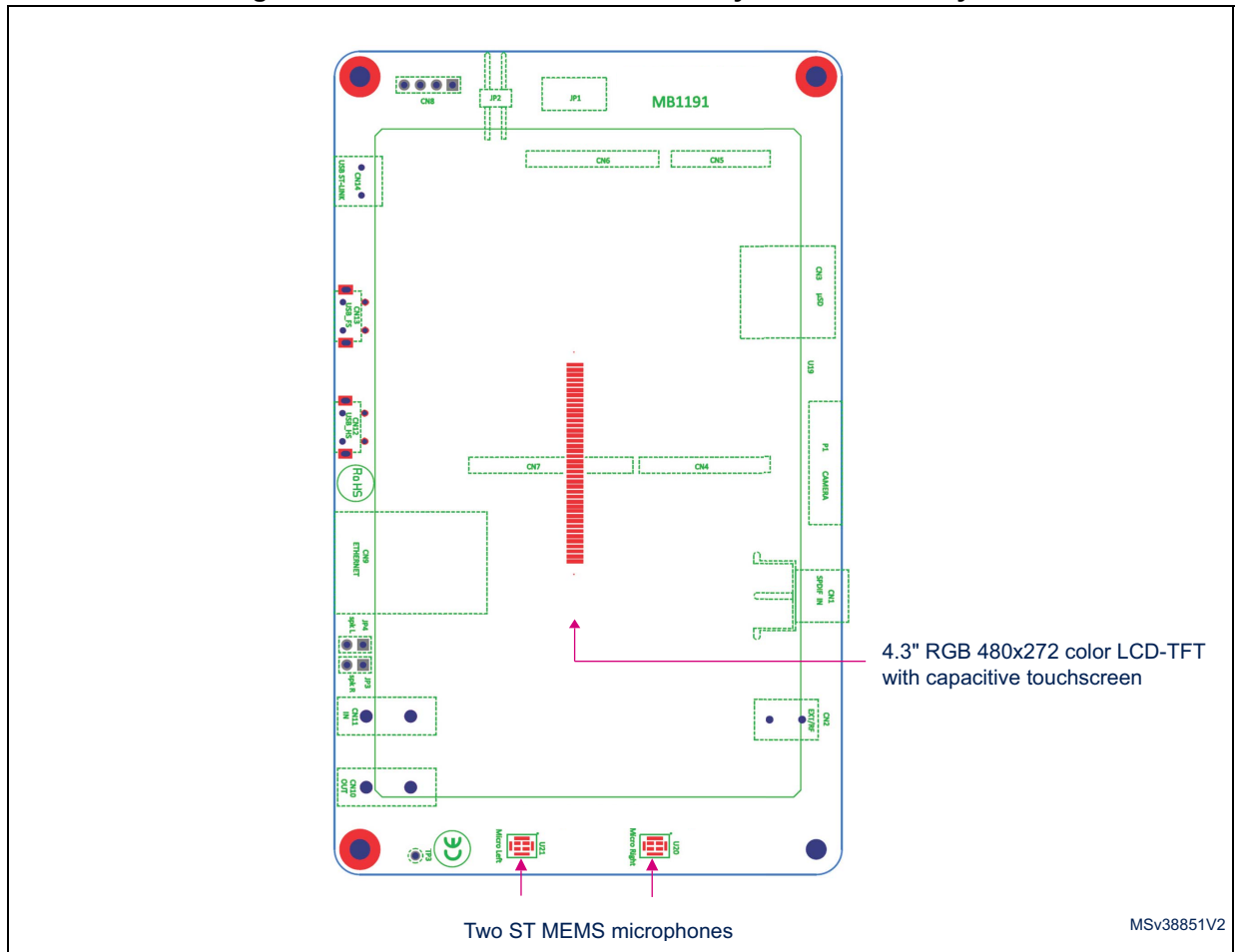
5.3 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the 32F746GDISCOVERY Discovery board. Compared to ST-LINK/V2 the changes are listed below.

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

- USB software reenumeration
- Virtual COM port interface on USB
- Mass storage interface on USB
- USB power management requests for more than 100 mA power on USB

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

- SWIM interface
- Application voltage lower than 3 V

For all general information concerning debugging and programming features common between V2 and V2-1 refer to *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32* user manual (UM1075).

5.3.1 Drivers

Before connecting the 32F746GDISCOVERY board to a Windows® PC (7, 8, and 10) through the USB, a driver for the ST-LINK/V2-1 must be installed. It is available at the *www.st.com* website. In case the STM32 Discovery is connected to the PC before the driver is installed, some Discovery interfaces might be declared as *Unknown* in the PC device manager. To recover from this situation, after installing the dedicated driver, the association of "Unknown" USB devices found on the 32F746GDISCOVERY board to this dedicated driver, must be updated in the device manager manually.

Note: *It is recommended to proceed by using the USB Composite Device, as shown in Figure 6.*

Figure 6. USB composite device
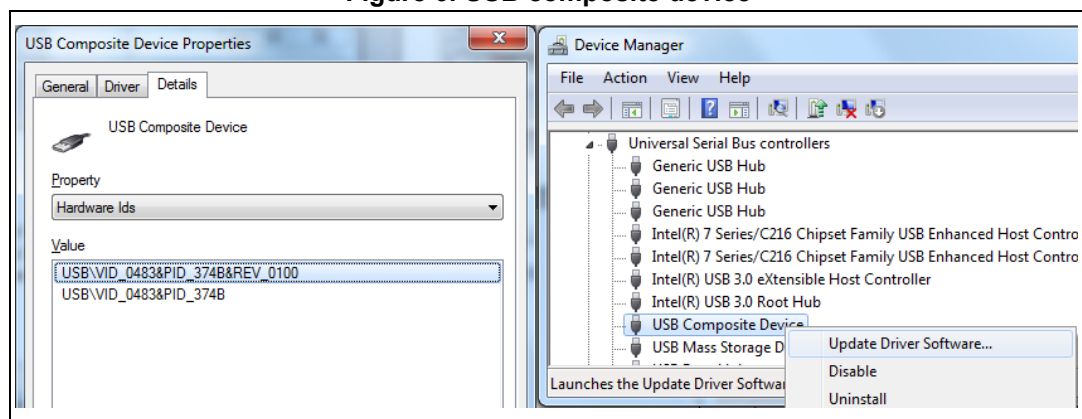
5.3.2 ST-LINK/V2-1 firmware upgrade

The ST-LINK/V2-1 embeds a firmware upgrade mechanism for in-place upgrade through the USB port. The firmware might evolve during the lifetime of the ST-LINK/V2-1 product (for example new functionality, bug fixes, and support for new microcontroller families). It is recommended to visit the *www.st.com* website before starting to use the 32F746GDISCOVERY board and periodically, to stay up to date with the latest firmware version.

5.4 Power supply

The 32F746GDISCOVERY Discovery board is designed to be powered by a 5V DC power supply. It is possible to configure the Discovery board to use any of the following five sources for the power supply:

• 5V DC power adapter connected to JP2 (external power supply on the silkscreen of JP1 (5 V ext)). In this case, the 32F746GDISCOVERY Discovery board must be powered by a power supply unit or by an auxiliary equipment complying with the EN 62368-1:2014+A11:2017 standard, and must be safety extralow voltage (SELV) with limited power capability (see *Figure 7*).

Figure 7. JP1 (5V ext) from JP2 (5V)
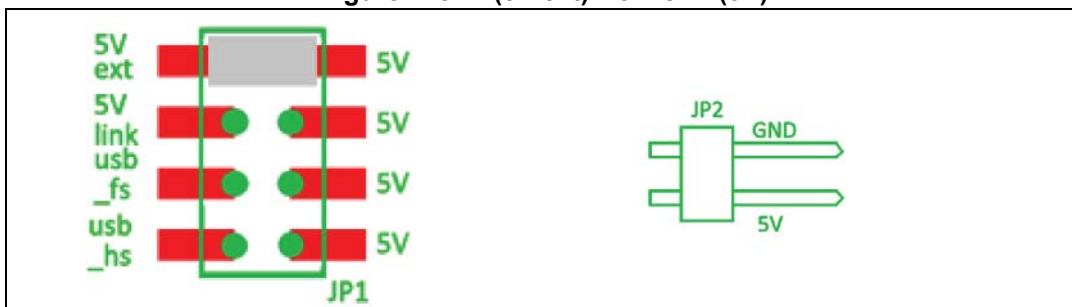
• 7-12 V DC power from CN6 pin named Vin on the silkscreen, the extension connectors for ARDUINO® Uno shields or daughterboard (external power source on the silkscreen of JP1 (5 V ext)), see *Figure 8*.

Figure 8. JP1 (5V ext) from CN6 (Vin)
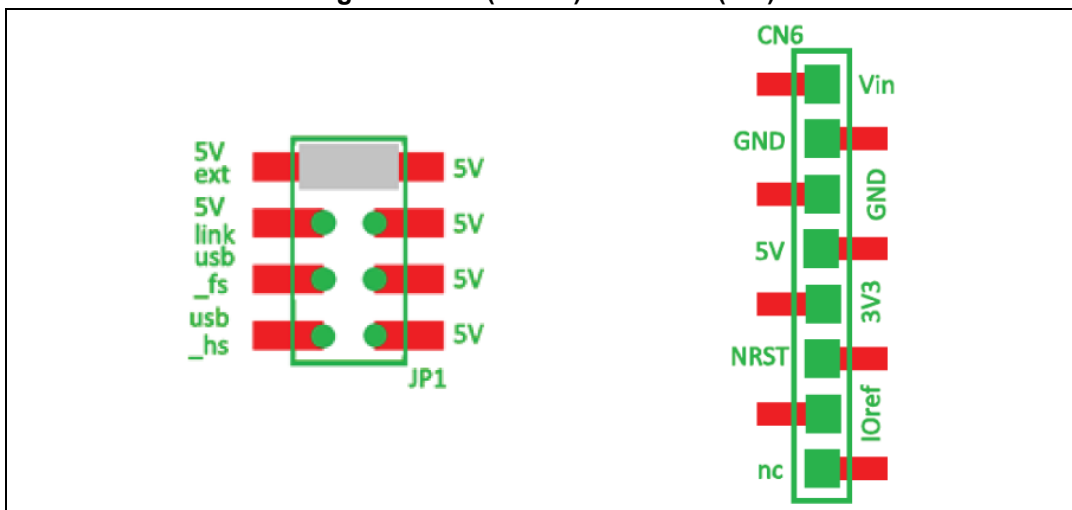
- 5V DC power with limitation from CN14, the USB Type-B connector of ST-LINK/V2-1 (USB 5V power source on the silkscreen of JP1 (5V link)). It is the default setting. If the USB enumeration succeeds (as explained below), the ST-LINK 5V link power is enabled, by asserting the PWR_ENn signal. This pin 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 600 mA).

The 32F746GDISCOVERY Discovery board can be powered from the ST-LINK USB connector CN14 (5V link), but only the ST-LINK circuit has the power before USB enumeration because the host PC only provides 100 mA to the board at that time. During the USB enumeration, the 32F746GDISCOVERY board asks for 500 mA power to the host PC. If the host can provide the required power, the enumeration ends with a *SetConfiguration* command and then, the power transistor U8 (ST890) is switched ON, the red LED LD2 is turned ON, thus the 32F746GDISCOVERY board can consume no more than 500 mA of current. If the host is not able to provide the requested current, the enumeration fails. Therefore, the ST890 (U8) remains OFF and the STM32 part including the extension board is not powered. As a consequence, the red LED LD2 remains turned OFF. In this case, it is mandatory to use an external power supply (see *Figure 9*).

Figure 9. JP1 (5V link)
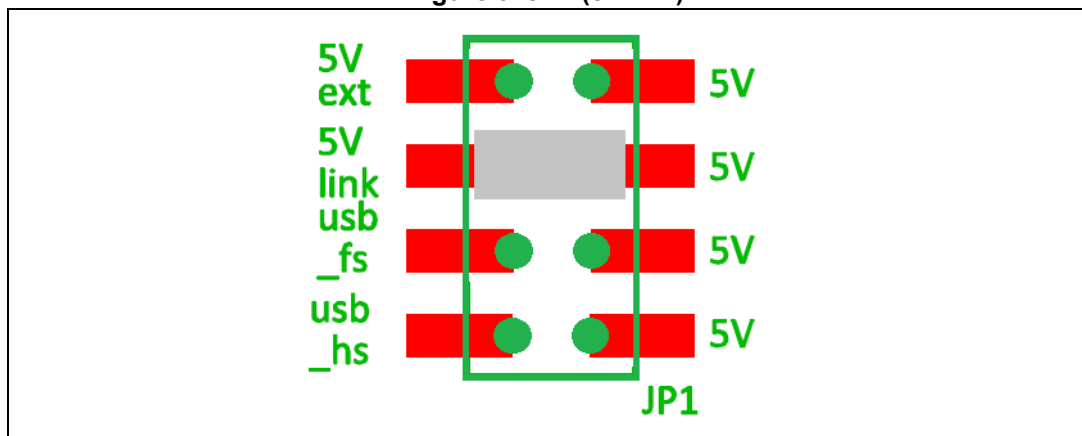
Note: *In case the board is powered by a USB charger, there is no USB enumeration, so the led LD2 remains set to OFF permanently and the board is not powered. Only in this specific case, the resistor R109 needs to be soldered, to allow the board to be powered anyway.*

The LED LD2 is lit when the 32F746GDISCOVERY Discovery board is powered by the 5V correctly.

Caution: Do not connect the PC to the ST-LINK (CN14) when R109 is soldered. The PC might be damaged or the board not powered correctly.

- 5V DC power with 500 mA limitation from CN13, the USB OTG_FS Micro-AB connector (USB 5V power source on the silkscreen of JP1 (usb_fs)), see *Figure 10*.

Figure 10. JP1 (usb_fs)
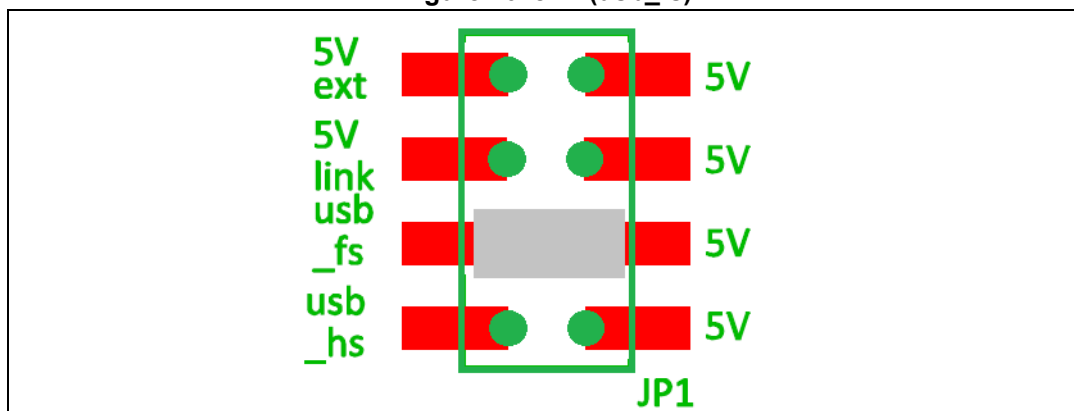
- 5V DC power with 500 mA limitation from CN12, the USB OTG_HS Micro-AB connector (USB 5V power source on the silkscreen of JP1 (usb_hs)), see *Figure 11*.

Figure 11. JP1 (usb_hs)
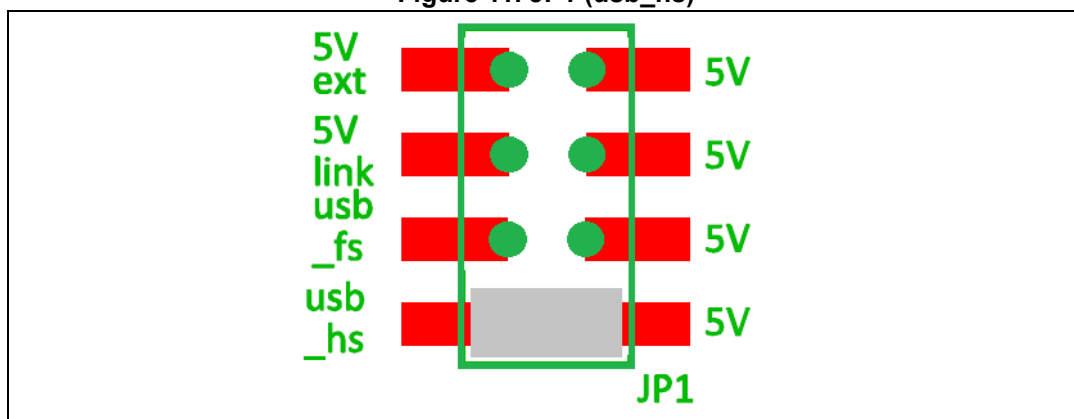
5.5 Programming/debugging when the power supply is not from ST-LINK (5V link)

It is mandatory to power the board first using JP1 (5V ext) or (usb_hs) or (usb_fs), then connect the USB cable to the PC. Proceeding this way the enumeration succeeds thanks to the external power source.

The following power sequence procedure must be respected:

1. Connect the jumper JP1 on (5V ext) or (usb_hs) or (usb_fs)
2. Connect the external power source to JP2 or CN6 or CN12 or CN13
3. Check that the red LED LD2 is turned ON
4. Connect the PC to USB connector CN14

If this order is not respected, V_{BUS} might power the Discovery board first from ST-LINK, and the following risks might be encountered:

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

5.6 Clock sources

Up to three clock sources as described below:

- X1, 24 MHz oscillator for the USB OTG_HS PHY and camera module (daughterboard)
- X2, 25 MHz oscillator for the STM32F746NGH6 microcontroller and Ethernet PHY
- X3, 32 kHz crystal for the STM32F746NGH6 embedded RTC

5.7 Reset sources

The reset signal of the 32F746GDISCOVERY Discovery board is active at a low level and the reset sources include:

- Reset button B2
- ARDUINO® Uno shield board from CN6
- Embedded ST-LINK/V2-1

5.8 Audio

An audio codec WM8994ECS/R from CIRRUS with four DACs and two ADCs is connected to the SAI interface of the STM32F746NGH6 microcontroller. It communicates with STM32F746NGH6 via I^{2}C bus shared with the camera module and I^{2}C extension connector.

- The analog line input is connected to the ADC of WM8994ECS/R through the blue audio jack CN11.
- The analog line output is connected to the DAC of WM8994ECS/R via the green audio jack CN10.
- Two external speakers can be connected to WM8994ECS/R via JP3 for the right speaker and JP4 for the left speaker.
- Two digital microphones (ST-MEMS microphone) are on the 32F746GDISCOVERY Discovery board. They are connected to the input digital microphones of WM8994ECS/R.
- One coaxial connector CN1 is implemented on 32F746GDISCOVERY to receive external audio data compatible with the SPDIF specification.

5.9 USB OTG_FS

The 32F746GDISCOVERY Discovery board supports USB OTG full-speed communication via a USB Micro-AB connector (CN13) and a USB power switch (U6) connected to V_{BUS}. This USB connection can power the Discovery board at 5 V DC with a 500 mA current limitation.

A green LED LD5 lights up in one of these cases:

- The power switch (U6) is ON and 32F746GDISCOVERY works as a USB Host
- V_{BUS} is powered by another USB host when 32F746GDISCOVERY works as a USB device.

The red LED LD6 lights up when an overcurrent occurs.

Note: *The 32F746GDISCOVERY must be powered by an external power supply when using the OTG function.*

5.10 USB OTG_HS

The 32F746GDISCOVERY Discovery board supports the USB OTG high-speed communication via a USB Micro-AB connector (CN12), USB high-speed PHY (U15) USB3320C-EZK from MICROCHIP for high-speed function.

The Discovery board can be powered by the USB connectors (CN12) at 5V DC with a 500 mA current limitation.

A USB power switch (U7) is also connected to V_{BUS} and provides power to CN12.

The green LED LD4 is lit in one of these cases:

- The power switch (U17) is ON and 32F746GDISCOVERY works as a USB host
- V_{BUS} is powered by another USB host when 32F746GDISCOVERY works as a USB device.

The red LED LD3 is lit when an overcurrent occurs.

Note: The 32F746GDISCOVERY *board must be powered by an external power supply when using the OTG function.*

5.11 microSD™ card

The 32F746GDISCOVERY board supports the 2-Gbyte (or more) microSD™ card connected to the SDMMC1 port of STM32F746NGH6.

5.12 Ethernet

The 32F746GDISCOVERY Discovery board supports 10/100-Mbit Ethernet communication by a PHY LAN8742A-CZ-TR (U9) from MICROCHIP and RJ45 jack (CN9). Ethernet PHY is connected to STM32F746NGH6 via the RMII interface.

The X2 oscillator generates the 25-MHz clock for the PHY, while the PHY RMII_REF_CLK generates the 50-MHz clock for STM32F746NGH6.

Figure 12. Inside RJ45 jack
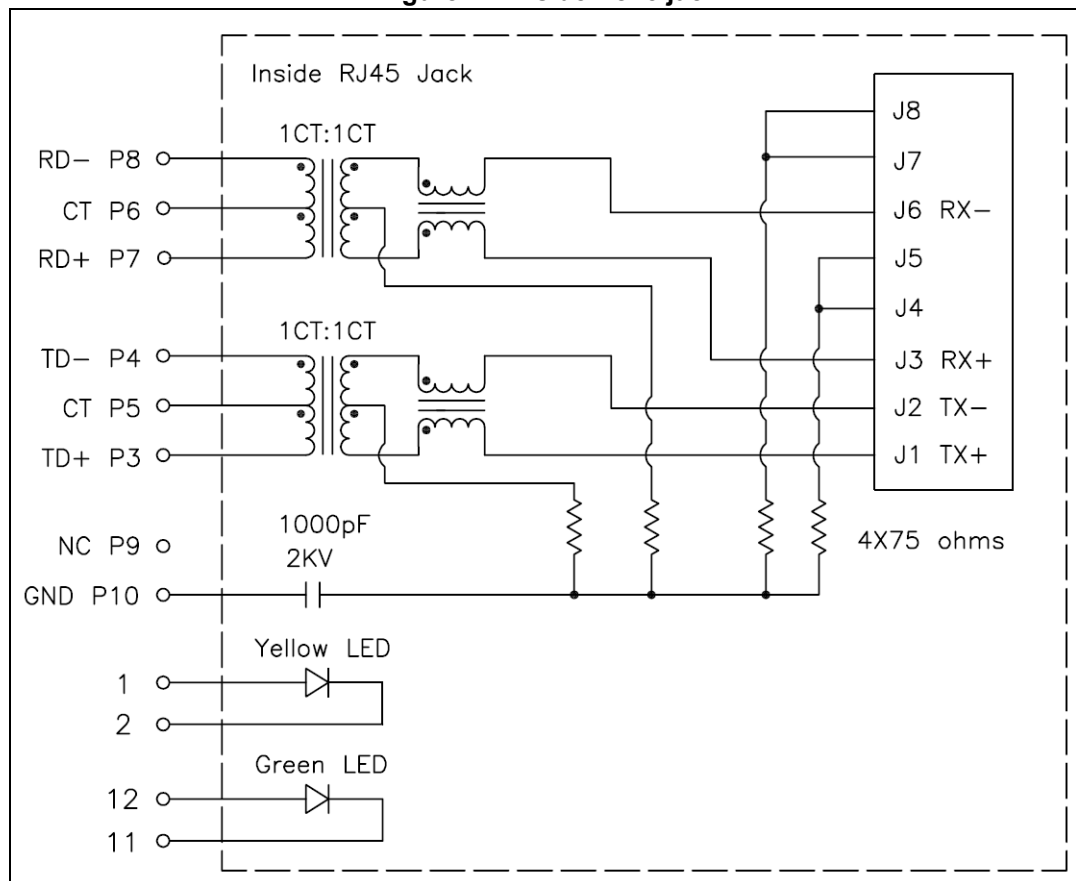
5.13 SDRAM memory

The 128-Mbit SDRAM is connected to the FMC interface of the STM32F746NGH6 microcontroller. Only the lowest 16-bit data is used (64-Mbit accessible). DQ16 to DQ31 are unused and connected to a 10K ohm pull-down resistor.

5.14 Quad-SPI NOR flash memory

The 128-Mbit quad-SPI NOR flash memory is connected to the quad-SPI interface of the STM32F746NGH6 microcontroller.

5.15 Camera module

A connector P1 with the DCMI signals is available to connect a camera module such as STM32F4DIS-CAM (ST order code).

5.16 Display LCD-TFT

The 4.3" 480x272 LCD-TFT with a capacitive touch panel is connected to the RGB LCD interface of the STM32F746NGH6 microcontroller.

6 Connectors

6.1 I²C extension connector CN2

Figure 13. I²C extension connector CN2 (front view)

MS30715V2
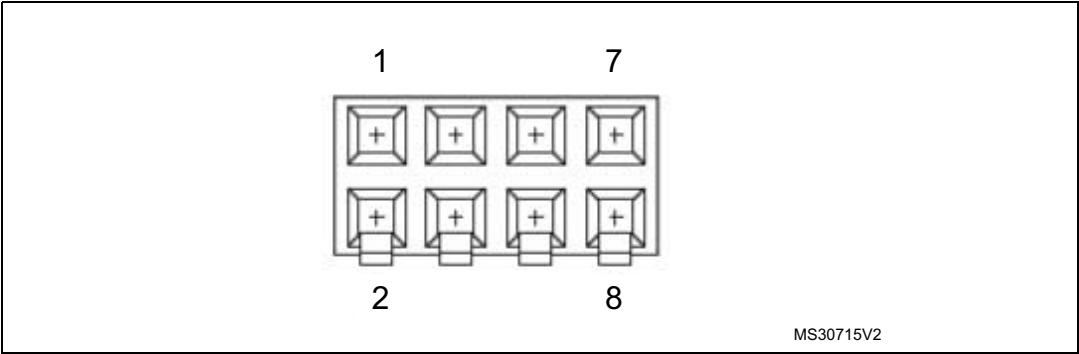
Table 3. I²C extension connector CN2

Pin number	Description	Pin number	Description
1	I2C_SDA (PB9)	5	+3V3
2	NC	6	NC
3	I2C_SCL (PB8)	7	GND
4	RESET(PC10)	8	NC or 5V

6.2 Camera module connector P1

Figure 14. Camera module connector P1 (front view)
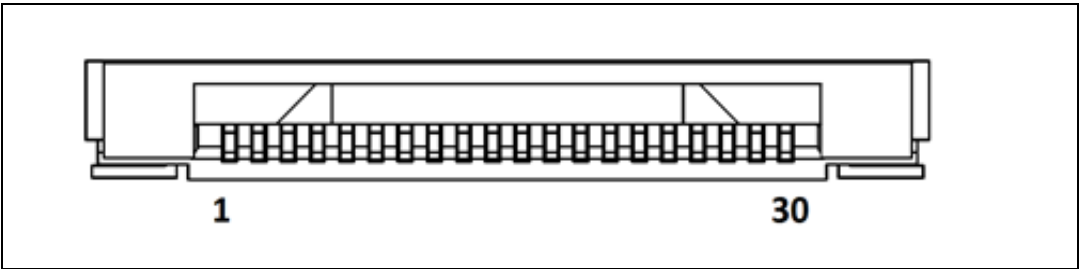
Table 4. Camera module connector P1

Pin number	Description	Pin number	Description
1	GND	16	GND
2	NC	17	DCMI_HSYNC
3	NC	18	NC
4	DCMI_D0	19	DCMI_VSYNC
5	DCMI_D1	20	3V3

Table 4. Camera module connector P1 (continued)

Pin number	Description	Pin number	Description
6	DCMI_D2	21	Camera_CLK (OSC_24M)
7	DCMI_D3	22	NC
8	DCMI_D4	23	GND
9	DCMI_D5	24	NC
10	DCMI_D6	25	DCMI_PWR_EN
11	DCMI_D7	26	DCMI_NRST
12	NC	27	DCMI_SDA
13	NC	28	DCMI_SCL
14	GND	29	GND
15	DCMI_PIXCK	30	3V3

6.3 ARDUINO® Uno V3 connectors

CN4, CN5, CN6, and CN7 are female connectors compatible with ARDUINO® standard. Most shields designed for ARDUINO® can fit to the 32F746GDISCOVERY Discovery board.

The ARDUINO® connectors on the 32F746GDISCOVERY Discovery board support the ARDUINO® Uno V3 (see *Table 5*).

Caution: The I/Os of the STM32 microcontroller are 3.3 V compatible instead of 5 V for ARDUINO® Uno.

Table 5. ARDUINO® connectors (CN4, CN5, CN6, and CN7)

			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	
						I2C1_SDA	PB9	D14	9	
						AVDD	-	AREF	8	
						Ground	-	GND	7	
	1	NC	-	-		SPI2_SCK	PI1	D13	6	CN7 digital
	2	IOREF	-	3.3V Ref		SPI2_MISO	PB14	D12	5	
	3	RESET	NRST	RESET		TIM12_CH2, SPI2_MOSI	PB15	D11	4	
CN6 power	4	+3V3	-	3.3V input/output		TIM1_CH1	PA8	D10	3	
	5	+5V	-	5V output		TIM2_CH1	PA15	D9	2	
	6	GND	-	Ground		-	PI2	D8	1	
	7	GND	-	Ground		-				
	8	VIN	-	Power input		-	PI3	D7	8	
			-			TIM12_CH1	PH6	D6	7	
	1	A0	PA0	ADC3_IN0		TIM5_CH4,SPI2_NSS	PI0	D5	6	
	2	A1	PF10	ADC3_IN8		-	PG7	D4	5	
	3	A2	PF9	ADC3_IN7		TIM3_CH1	PB4	D3	4	CN4 digital
	4	A3	PF8	ADC3_IN6		-	PG6	D2	3	
CN5 analog	5	A4	PF7 or PB[1]	ADC3_IN5 (PF7) or I2C1_SDA (PB9)		USART6_TX	PC6	D1	2	
	6	A5	PF6 or PB8[1]	ADC3_IN4 (PC0) or I2C1_SCL (PB8)		USART6_RX	PC7	D0	1	

1. Refer to *Table 12* for details.

6.4 USB OTG_HS Micro-AB connector CN12

Figure 15. USB OTG Micro-AB connector CN12 (front view)
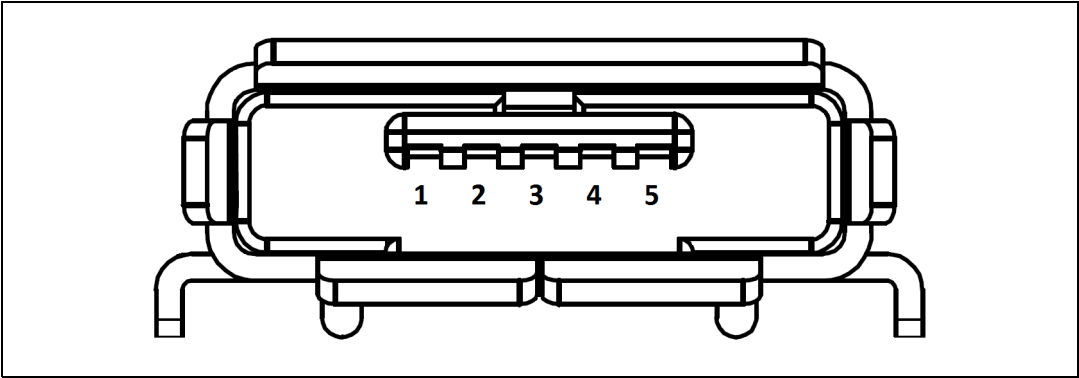
Table 6. USB OTG HS Micro-AB CN12

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

6.5 Ethernet RJ45 connector CN9

Figure 16. Ethernet RJ45 connector CN9 (front view)
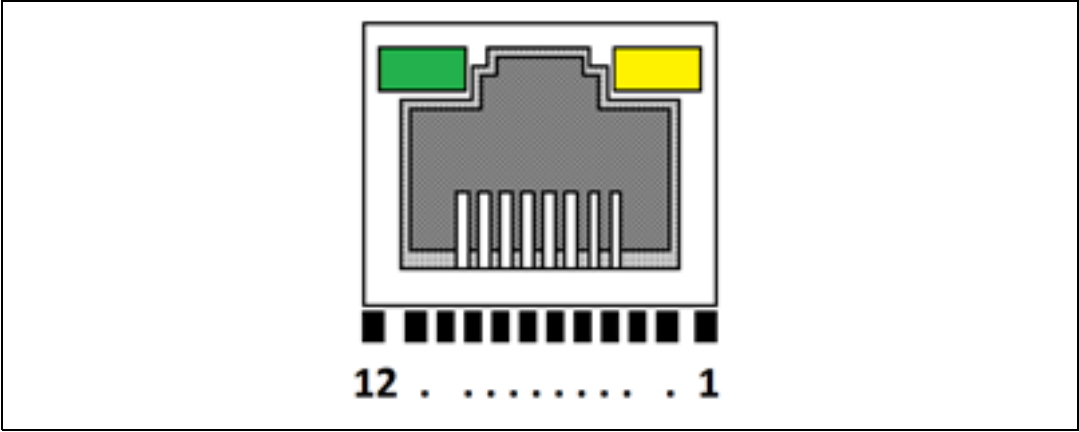
Table 7. RJ45 connector CN9

Pin number	Description	Pin number	Description
1	A, yellow LED	7	RD+
2	K, yellow LED	8	RD-
3	TD+	9	NC
4	TD-	10	GND
5	CT, 3V3	11	K, green LED
6	CT, 3V3	12	A, green LED

6.6 USB OTG_FS Micro-AB connector CN13

Figure 17. USB OTG Micro-AB connector CN13 (front view)
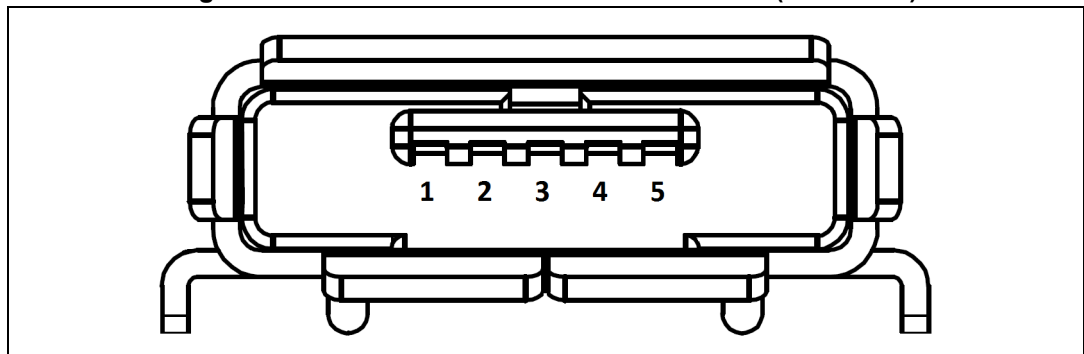
Table 8. USB OTG FS Micro-AB connector CN13

Pin number	Description	Pin number	Description
1	VBUS (PA9)	4	ID (PA10)
2	D- (PA11)	5	GND
3	D+ (PA12)	-	-

6.7 microSD™ connector CN3

Figure 18. microSD connector CN3 (front view)
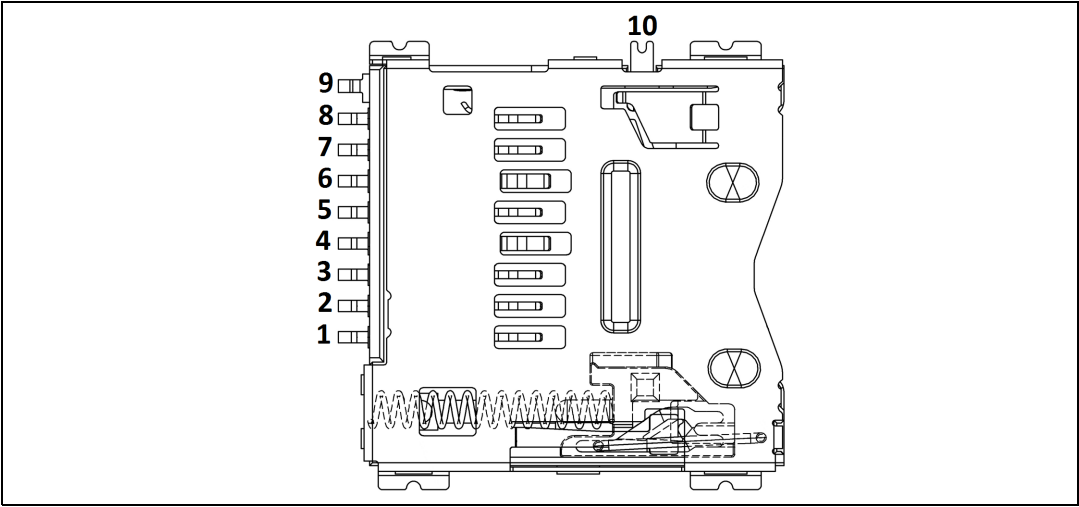
Table 9. microSD connector CN3

Pin number	Description	Pin number	Description
1	SDMMC_D2 (PC10)	6	VSS/GND
2	SDMMC_D3 (PC11)	7	SDMMC_D0 (PC8)
3	SDMMC_CMD (PD2)	8	SDMMC_D1 (PC9)
4	+3.3V	9	GND
5	SDMMC_CK (PC12)	10	MicroSDcard_detect (PC13)

6.8 ST-LINK/V2-1 USB Type-B connector CN14

The USB connector CN14 is used to connect the embedded ST-LINK/V2-1 to the PC for programming and debugging the STM32F746NGH6 microcontroller.

Figure 19. USB Type-B connector CN14 (front view)
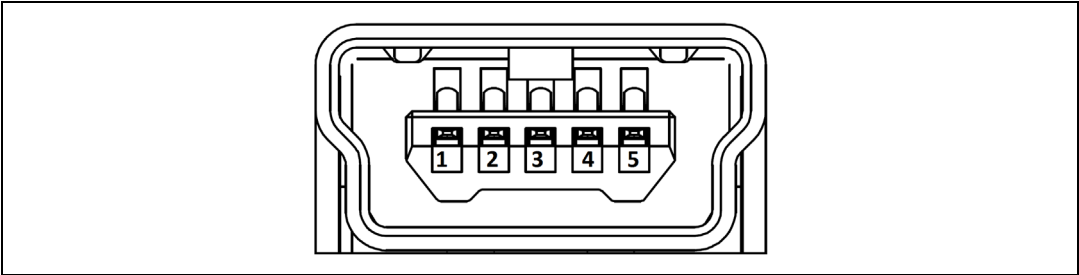
Table 10. USB Type-B connector CN14

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

6.9 Audio stereo speakers JP3 and JP4

The stereo audio output JP3 and JP4 are available to support the stereo speakers (left and right).

6.10 Audio green jack (line out) CN10

A 3.5 mm stereo audio green jack output CN10 is available to support headphones.

6.11 Audio blue jack (line in) CN11

A 3.5 mm stereo audio blue jack input CN11 is available to support the audio-line input.

6.12 SPDIF input RCA connector CN1

Table 11. SPDIF input RCA connector CN1

Pin number	Description	Pin number	Description
1	SPDIF_RX0 (PD7)	2	GND
2	GND	-	-

7 32F746GDISCOVERY I/O assignment

Table 12. 32F746GDISCOVERY I/O assignment

Pin No.	Pin Name	Signal or Label	Comment
A1	PE4	LTDC_B0	-
A2	PE3	OTG_HS_OverCurrent	-
A3	PE2	QUADSPI_BK1_IO2	-
A4	PG14	ETH_TXD1	-
A5	PE1	FMC_NBL1	-
A6	PE0	FMC_NBL0	-
A7	PB8	ARDUINO SCL/D15	-
A8	PB5	USB_OTG_HS_ULPI_D7	-
A9	PB4	ARDUINO PWM/D3	-
A10	PB3	SYS_JTDO-SWO	-
A11	PD7	SPDIF_RX0	-
A12	PC12	SDMMC_CK	-
A13	PA15	ARDUINO PWM/D9	-
A14	PA14	SYS_JTCK-SWCLK	-
A15	PA13	SYS_JTMS-SWDIO	-
B1	PE5	DCMI_D6	-
B2	PE6	DCMI_D7	-
B3	PG13	ETH_TXD0	-
B4	PB9	ARDUINO SDA/D14	-
B5	PB7	VCP_RX	-
B6	PB6	QUADSPI_BK1_NCS	-
B7	PG15	FMC_SDNCAS	-
B8	PG11	ETH_TX_EN	-
B9	PJ13	LTDC_B1	-
B10	PJ12	OTG_FS_VBUS	[1]
B11	PD6	Audio_INT	-
B12	PD0	FMC_D2_DA2	-
B13	PC11	SDMMC_D3	-
B14	PC10	SDMMC_D2	-
B15	PA12	USB_OTG_FS_DP	-
C1	VBAT	-	Connected to VDD
C2	PI8	NC1	-

Table 12. 32F746GDISCOVERY I/O assignment (continued)

Pin No.	Pin Name	Signal or Label	Comment
C3	PI4	SAI2_MCLK_A	-
C4	PK7	LTDC_DE	-
C5	PK6	LTDC_B7	-
C6	PK5	LTDC_B6	-
C7	PG12	LTDC_B4	-
C8	PG10	SAI2_SD_B	-
C9	PJ14	LTDC_B2	-
C10	PD5	OTG_FS_PowerSwitchOn	-
C11	PD3	DCMI_D5	-
C12	PD1	FMC_D3_DA3	-
C13	PI3	ARDUINO D7	-
C14	PI2	ARDUINO D8	-
C15	PA11	USB_OTG_FS_DM	-
D1	PC13	uSD_Detect	-
D2	PF0	FMC_A0	-
D3	PI5	SAI2_SCK_A	-
D4	PI7	SAI2_FS_A	-
D5	PI10	LTDC_HSYNC	-
D6	PI6	SAI2_SD_A	-
D7	PK4	LTDC_B5	-
D8	PK3	LCD_BL_CTRL	-
D9	PG9	DCMI_VSYNC	-
D10	PJ15	LTDC_B3	-
D11	PD4	OTG_FS_OverCurrent	-
D12	PD2	SDMMC_CMD	-
D13	PH15	TP3	-
D14	PI1	ARDUINO SCK/D13	-
D15	PA10	USB_OTG_FS_ID	-
E1	PC14/OSC32_IN	RCC_OSC32_IN	-
E2	PF1	FMC_A1	-
E3	PI12	LCD_DISP	-
E4	PI9	LTDC_VSYNC	-
E5	PDR_ON	-	Connected to PU R38
E6	BOOT0	-	Connected to PD R45
E7	VDD	-	-

Table 12. 32F746GDISCOVERY I/O assignment (continued)

Pin No.	Pin Name	Signal or Label	Comment
E8	VDD	-	-
E9	VDD	-	-
E10	VDD	-	-
E11	VCAP_2	-	Connected to C48
E12	PH13	DCMI_PWR_EN	-
E13	PH14	DCMI_D4	-
E14	PI0	ARDUINO PWM/CS/D5	-
E15	PA9	VCP_TX	(1)
F1	PC15/OSC32_OUT	RCC_OSC32_OUT	-
F2	VSS	-	-
F3	PI11	B_USER	-
F4	VDD	-	-
F5	VDD	-	-
F6	VSS	-	-
F7	VSS	-	-
F8	VSS	-	-
F9	VSS	-	-
F10	VSS	-	-
F11	VDD	-	-
F12	PK1	LTDC_G6	-
F13	PK2	LTDC_G7	-
F14	PC9	SDMMC_D1	-
F15	PA8	ARDUINO PWM/D10	-
G1	PH0/OSC_IN	RCC_OSC_IN	-
G2	PF2	FMC_A2	-
G3	PI13	LCD_INT	-
G4	PI15	LTDC_R0	-
G5	VDD	-	-
G6	VSS	-	-
G10	VSS	-	-
G11	VDDUSB	-	Connected to VDD
G12	PJ11	LTDC_G4	-
G13	PK0	LTDC_G5	-
G14	PC8	SDMMC_D0	-
G15	PC7	ARDUINO RX/D0	-

Table 12. 32F746GDISCOVERY 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	LTDC_CLK	-
H4	PH4	USB_OTG_HS_ULPI_NXT	-
H5	VDD	-	-
H6	VSS	-	-
H10	VSS	-	-
H11	VDD	-	-
H12	PJ8	LTDC_G1	-
H13	PJ10	LTDC_G3	-
H14	PG8	FMC_SDCLK	-
H15	PC6	ARDUINO TX/D1	-
J1	NRST	-	Hardware RESET
J2	PF4	FMC_A4	-
J3	PH5	FMC_SDNWE	-
J4	PH3	FMC_SDNE0	-
J5	VDD	-	-
J6	VSS	-	-
J10	VSS	-	-
J11	VDD	-	-
J12	PJ7	LTDC_G0	-
J13	PJ9	LTDC_G2	-
J14	PG7	ARDUINO D4	-
J15	PG6	ARDUINO D2	-
K1	PF7	ARDUINO A4	-
K2	PF6	ARDUINO A5	-
K3	PF5	FMC_A5	-
K4	PH2	NC2	-
K5	VDD	-	-
K6	VSS	-	-
K7	VSS	-	-
K8	VSS	-	-
K9	VSS	-	-
K10	VSS	-	-
K11	VDD	-	-

Table 12. 32F746GDISCOVERY I/O assignment (continued)

Pin No.	Pin Name	Signal or Label	Comment
K12	PJ6	LTDC_R7	-
K13	PD15	FMC_D1_DA1	-
K14	PB13	USB_OTG_HS_ULPI_D6	-
K15	PD10	FMC_D15_DA15	-
L1	PF10	ARDUINO A1	-
L2	PF9	ARDUINO A2	-
L3	PF8	ARDUINO A3	-
L4	PC3	FMC_SDCKE0	-
L5	BYPASS_REG	-	Connected to PD R20
L6	VSS	-	-
L7	VDD	-	-
L8	VDD	-	-
L9	VDD	-	-
L10	VDD	-	-
L11	VCAP_1	-	Connected to C47
L12	PD14	FMC_D0_DA0	-
L13	PB12	USB_OTG_HS_ULPI_D5	-
L14	PD9	FMC_D14_DA14	-
L15	PD8	FMC_D13_DA13	-
M1	VSSA	-	Connected to GND
M2	PC0	USB_OTG_HS_ULPI_STP	-
M3	PC1	ETH_MDC	-
M4	PC2	USB_OTG_HS_ULPI_DIR	-
M5	PB2/BOOT1	QUADSPI_CLK	-
M6	PF12	FMC_A6	-
M7	PG1	FMC_A11	-
M8	PF15	FMC_A9	-
M9	PJ4	LTDC_R5	-
M10	PD12	QUADSPI_BK1_IO1	-
M11	PD13	QUADSPI_BK1_IO3	-
M12	PG3	EXT_RST	-
M13	PG2	RMII_RXER	-
M14	PJ5	LTDC_R6	-
M15	PH12	DCMI_D3	-
N1	VREF-	-	Connected to GND

Table 12. 32F746GDISCOVERY I/O assignment (continued)

Pin No.	Pin Name	Signal or Label	Comment
N2	PA1	ETH_REF_CLK	-
N3	PA0/WKUP	ARDUINO A0	-
N4	PA4	DCMI_HSYNC	-
N5	PC4	ETH_RXD0	-
N6	PF13	FMC_A7	-
N7	PG0	FMC_A10	-
N8	PJ3	LTDC_R4	-
N9	PE8	FMC_D5_DA5	-
N10	PD11	QUADSPI_BK1_IO0	-
N11	PG5	FMC_A15_BA1	-
N12	PG4	FMC_A14_BA0	-
N13	PH7	I2C3_SCL	-
N14	PH9	DCMI_D0	-
N15	PH11	DCMI_D2	-
P1	VREF+	-	Connected to VDDA
P2	PA2	ETH_MDIO	-
P3	PA6	DCMI_PIXCK	-
P4	PA5	USB_OTG_HS_ULPI_CK	-
P5	PC5	ETH_RXD1	-
P6	PF14	FMC_A8	-
P7	PJ2	LTDC_R3	-
P8	PF11	FMC_SDNRAS	-
P9	PE9	FMC_D6_DA6	-
P10	PE11	FMC_D8_DA8	-
P11	PE14	FMC_D11_DA11	-
P12	PB10	USB_OTG_HS_ULPI_D3	-
P13	PH6	ARDUINO PWM/D6	-
P14	PH8	I2C3_SDA	-
P15	PH10	DCMI_D1	-
R1	VDDA	-	Connected to VREF+
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	LTDC_R1	-

Table 12. 32F746GDISCOVERY I/O assignment (continued)

Pin No.	Pin Name	Signal or Label	Comment
R7	PJ1	LTDC_R2	-
R8	PE7	FMC_D4_DA4	-
R9	PE10	FMC_D7_DA7	-
R10	PE12	FMC_D9_DA9	-
R12	PE13	FMC_D10_DA10	-
R11	PE15	FMC_D12_DA12	-

1. By default OTG_FS_VBUS is driven by the software and not by the alternate function of the STM32F746NGH6 (R64 = ON, R63 = OFF, R58 = ON and PA9 = VCP_TX (Virtual Com Port) and PJ12 = OTG_FS_VBUS).

   To use the alternate function OTG_FS_VBUS of the STM32F746NGH6, it is needed to have: R64 = OFF, R63 = ON, R58 = OFF. In this configuration, VCP_TX is no longer available and PA9 = OTG_FS_VBUS, PJ12 = not connected.

8 32F746GDISCOVERY information

8.1 Product marking

The product and each board composing the product are identified with one or several stickers. The stickers, located on the top or bottom side of each PCB, provide product information:

- Main board featuring the target device: product order code, product identification, serial number, and board reference with revision.
  Single-sticker example:
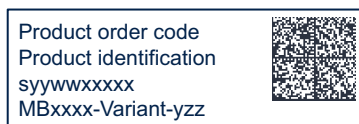
  Dual-sticker example:

- Other boards if any: board reference with revision and serial number.
  Examples:

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

On all board stickers, the line formatted as *"MBxxxx-Variant-yzz"* shows the board reference *"MBxxxx"*, the mounting variant *"Variant"* when several exist (optional), the PCB revision *"y"*, and the assembly revision *"zz"*, for example B01. The other line shows the board serial number used for traceability.

Products and parts labeled as *"ES"* or *"E"* are not yet qualified or feature devices that are not yet qualified. STMicroelectronics disclaims any responsibility for consequences arising from their use. Under no circumstances will STMicroelectronics be liable for the customer's use of these engineering samples. Before deciding to use these engineering samples for qualification activities, contact STMicroelectronics' quality department.

"ES" or *"E"* 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 32F746GDISCOVERY product history

Table 13. Product history

Order code	Product identification	Product details		Product change description	Product limitations
STM32F746G-DISCO	32F746GDISCO/	MCU: – STM32F746NGH6 revision "Z"	Initial revision	No limitation	
		MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290)			
		Board: – MB1191-F746NGH6-B02 or MB1191-F746NGH6-B03 or MB1191-F746NGH6-B04			
	32F746GDISEM/	MCU: – STM32F746NGH6 revision "Z"	Main board revision changed	No limitation	
		MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290)			
		Board: – MB1191-F746NGH6-B05			
	DK32F746G$CU1	MCU: – STM32F746NGH6 revision "Z"	Main board revision changed	No limitation	
		MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290)			
		Board: – MB1191-F746NGH6-C01			

Table 13. Product history (continued)

Order code	Product identification	Product details	Product change description	Product limitations
STM32F746G-DISCO	DK32F746G$CU2	MCU: – STM32F746NGH6 revision "Z" MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290) Board: – MB1191-F746NGH6-C02	Main board revision changed	No limitation
	DK32F746G$CU3	MCU: – STM32F746NGH6 revision "Z" MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290) Board: – MB1191-F746NGH6-C02	Packaging: plastic blister replaced by a carton box	No limitation
	DK32F746G$CU4	MCU: STM32F746NGH6 revision "Z" MCU errata sheet: – *STM32F74xxx and STM32F75xxx device limitations* (ES0290) Board: – MB1191-F746NGH6-C03	Main board revision changed	No limitation

8.3 Board revision history

Table 14. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1191 (main board)	F746NGH6-B02	Initial revision	No limitation
	F746NGH6-B03	Changing the footprint of RCA connector CN1	No limitation
	F746NGH6-B04	Changing the footprint of the header JP2 Changing the footprint of MicroSD connector CN3	No limitation
	F746NGH6-B05	Memory Micron N25Q128A13EF840F is replaced by MT25QL128ABA1EW9-0SIT without impact on firmware	No limitation
	F746NGH6-C01	– LCD Rocktech RK043FN48H-CT672B replaced by Kunjian HT043C without impact on firmware – Memory MICRON MT48LC4M32B2B5 replaced by ISSI IS42S32400F-6BL without impact on firmware – Several part references updated due to obsolescence (such as microphones or others, refer to the bill of materials for details)	No limitation
	F746NGH6-C02	LCD Kunjian HT043C replaced by GJX GJX043A6-40DY without impact on firmware	No limitation
	F746NGH6-C03	Memory MICRON MT25QL128ABA1EW9-0SIT replaced by WINBOND ELECTRONICS W25Q128JVEIQ with impact on firmware	No limitation

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

9.1 FCC Compliance Statement

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.

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.

Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: *Use only shielded cables.*

Responsible party - U.S. contact information

Francesco Doddo
STMicroelectronics, Inc.
200 Summit Drive | Suite 405 | Burlington, MA 01803
USA
Telephone: +1 781-472-9634

9.2   ISED Compliance Statement

Compliance Statement

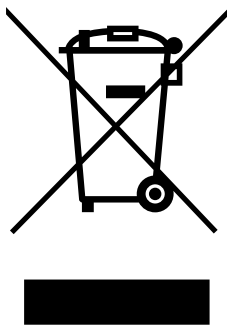ISED Canada ICES-003 Compliance Label: *CAN ICES-3 (B) / NMB-3 (B)*.

Déclaration de conformité

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

10   Product disposal

Disposal of this product: WEEE (Waste Electrical and Electronic Equipment)

(Applicable in Europe)

This symbol on the product, accessories, or accompanying documents indicates that the product and its electronic accessories must not be disposed of with household waste at the end of their working life.

To prevent possible harm to the environment and human health from uncontrolled waste disposal, separate these items from other types of waste and recycle them responsibly at a designated collection point to promote the sustainable reuse of material resources.

Household users:

Contact the retailer that you purchased the product from or your local authority for details of your nearest designated collection point.

Business users:

Contact your dealer or supplier for further information.

Revision history

Table 15. Document revision history

Date	Revision	Changes
12-Jun-2015	1	Initial release.
02-Nov-2015	2	Updated cover page adding mbed-enabled logo. Added: – *Section 1: Features* – *Section 5: Demonstration software* – *Section 2: Product marking* – *Section 6: Ordering information* – *Section 7: Technology partners* – *Section Appendix B: Compliance Statements* Updated *Section 10: Electrical schematics* figure 19 until the figure 31. Updated *Section 7.4: Power supply*. Updated *Section 7.3.1: Drivers*.
22-Mar-2016	3	Updated *Section Appendix B: Compliance Statements*.
02-Jun-2017	4	Updated: – *Section 7.2: 32F746GDISCOVERY Discovery board mechanical drawing* – *Table 4: ARDUINO® connectors (CN4, CN5, CN6, and CN7)* – *Table 11: 32F746GDISCOVERY I/O assignment*

Table 15. Document revision history (continued)

Date	Revision	Changes
13-Jan-2020	5	Revised and reorganized Sections *Introduction*, *Features*, *Ordering information*, *Product marking*, *System requirements*, *Development toolchains* and *Demonstration software*. Updated *Figure 1: 32F746GDISCOVERY board (top view: left side - bottom view: right side)*. Added *Section 2.2: Codification*. Added *Section 3: Development environment* Updated *Figure 2: Hardware block diagram*, *Figure 3: 32F746GDISCOVERY Discovery board top layout* and *Figure 4: 32F746GDISCOVERY Discovery board bottom layout*. Removed product references in *Section 4.8: Audio*, *Section 4.13: SDRAM memory*, *Section 4.14: Quad-SPI NOR flash memory* and *Section 4.16: Display LCD-TFT*. Removed Section 7: Technology partners and Section 10 Electrical schematics.
08-Sep-2025	6	Updated: – *Section 1: Features* – *Section 3.4: EDA resources* – *Section 9.1: FCC Compliance Statement* Added: – *Safety recommendations* – *32F746GDISCOVERY information* with updated *Product marking*, and new *Product history* and *Board revision history* tables – *Product disposal* Removed all references to Arm Mbed™.

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