Discovery kit with 1 GHz STM32MP135FA MPU

Introduction

The STM32MP135 Discovery kit (STM32MP135F-DK) is designed as a complete demonstration and development platform for the STMicroelectronics Arm®-based single Cortex®-A7 32-bit STM32MP135 microcontrollers and their STPMIC1 companion chip. It leverages the capabilities of the 1 GHz STM32MP135 microprocessors to allow users to develop easily applications using STM32 MPU OpenSTLinux Distribution software (such as STM32MP1Starter).

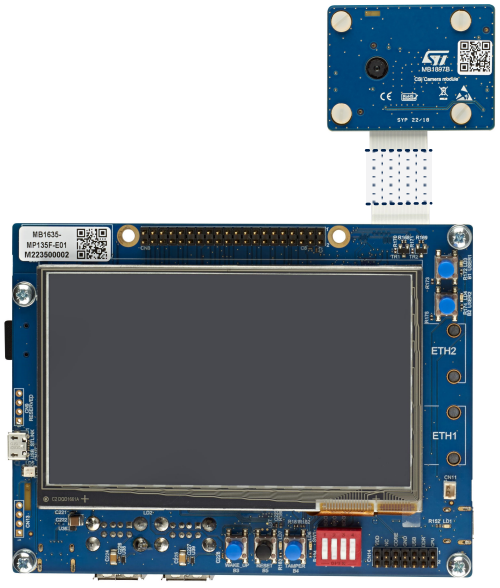
It features 16-bit DDR3L 4 Gbits at 533 MHz, MIPI CSI-2® bridge with dual lanes up to 1.6 Gbit/s, USB Type-C® DRP port, USB Type-A Host HS ports, microSD™ card high-speed mode up to 50 MHz, dual 10/100 Mbit/s Ethernet, 40-pin extended GPIOs, Wi-Fi® 802.11b/g/n, Bluetooth® Low Energy 4.1, and STLINK-V3E (UART console).

The STM32MP135F-DK, shown in Figure 1 and Figure 2, is used as a reference design for the user application development. It cannot be considered as the hardware design of a final application.

The hardware features of the Discovery kit are available for users to develop their applications: USB, dual Ethernet, LCD, microSD™ card, user buttons, Wi-Fi®, Bluetooth® Low Energy, and a 2-megapixel CMOS camera module. Extension headers allow the easy connection of a third-party board for a specific application.

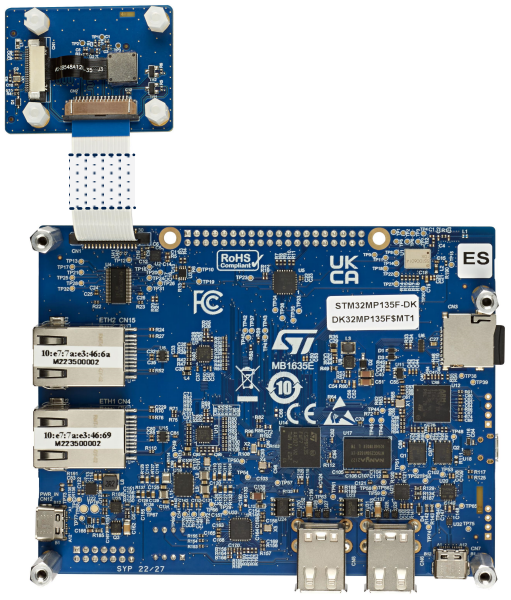
An STLINK-V3E is integrated on the board, as an embedded in-circuit debugger and programmer for the STM32 MPU and the USB Virtual COM port bridge.

Figure 1. STM32MP135F-DK top view



DT71719V1

Figure 2. STM32MP135F-DK bottom view



DT71720V1

Pictures are not contractual.

1 Features

- STM32MP135FAF7 MPU with an Arm® Cortex®-A7 32-bit processor at 1 GHz, in a TFBGA320 package
- ST PMIC STPMIC1
- 4-Gbit DDR3L, 16 bits, 533 MHz
- 4.3" 480×272 pixels LCD display module with capacitive touch panel and RGB interface
- UXGA 2-megapixel CMOS camera module (included) with MIPI CSI-2® / SMIA CCP2 deserializer
- Wi-Fi® 802.11b/g/n
- Bluetooth® Low Energy 4.1
- Dual 10/100 Mbit/s Ethernet (RMII) compliant with IEEE-802.3u, one with Wake on LAN (WoL) support
- USB Host 4-port hub
- USB Type-C® DRP based on an STM32G0 device
- 4 user LEDs
- 4 push-buttons (2× user, tamper, and reset)
- 1 wake-up button
- Board connectors:
  - Dual-lane MIPI CSI-2® camera module expansion
  - 2× Ethernet RJ45
  - 4× USB Type-A
  - USB Micro-B
  - USB Type-C®
  - microSD™ card holder
  - GPIO expansion
  - 5 V / 3 A USB Type-C® power supply input (charger not provided)
  - VBAT for power backup
- On-board current measurement
- On-board STLINK-V3E debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Full mainline open-source Linux® STM32 MPU OpenSTLinux Distribution (such as STM32MP1Starter) software and examples
- Support of several Integrated Development Environments (IDEs) including STM32CubeIDE
- Bare metal support for RTOS (Microsoft® Azure®)

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

2 Ordering information

To order the STM32MP135 Discovery kit, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. List of available products

Order code	Board reference	Target STM32
STM32MP135F-DK	• MB1635(1) • MB1897(2)	STM32MP135FAF7

1. *Main board.*
2. *Camera module board.*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

STM32TTTXXY-ZZ	Description	Example: STM32MP135F-DK
STM32TTT	MPU series in STM32 Arm Cortex MPUs	STM32MP1 series
XX	MPU product line in the series	STM32MP135
Y	Options: • F: Secure boot, cryptography hardware, 1 GHz frequency	Secure boot, cryptography hardware, 1 GHz frequency
ZZ	Toolkit configuration: • DK: Discovery kit with LCD, Wi-Fi®, and Bluetooth® Low Energy	LCD, Wi-Fi®, and Bluetooth® Low Energy

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®
- USB Type-C® to USB Type-C® charger 5 V / 3 A
- USB Type-A or USB Type-C® to USB Type-C® cable
- USB Type-A or USB Type-C® to Micro-B cable

Note: macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.
Linux® is a registered trademark of Linus Torvalds.
Windows is a trademark of the Microsoft group of companies.

3.2 Development toolchains

- STMicroelectronics - STM32CubeIDE
- GCC-based IDEs

3.3 Demonstration software

The STM32 MPU OpenSTLinux Distribution base demonstration software is preloaded in the microSD™ 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*.

4 Conventions

Table 3 provides the conventions used for the ON and OFF settings in the present document.

Table 3. ON/OFF convention

Convention	Definition
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered

5 Safety recommendations

5.1 Targeted audience

This product targets users with at least basic electronics or embedded software development knowledge like engineers, technicians, or students.

This board is not a toy and is not suited for use by children.

5.2 Handling the board

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

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

5.3 Battery

This product does not include a battery.

5.4 Laser

This product does not include a laser.

5.5 Power supply

This product is not delivered with a power supply.

The equipment must be powered by a power supply unit or an auxiliary equipment complying with the standard EN 60950-1 (2006+A11/2009+A1/2010+A12/2011+A2/2013) / EN 62368-1 (2014+A11/2017), which must be Safety Extra Low Voltage (SELV/ES1) with limited power capability (LPS/PS2).

6 Quick start

This chapter describes how to start a development quickly using the STM32MP135F-DK.

Before installing and using the product, accept the evaluation product license agreement from the www.st.com/epla webpage.

Before the first use, make sure that no damage occurred to the product during shipment and check that:

- All socketed components are firmly secured in their sockets
- Nothing is loose in the board plastic bag or in the box

The STM32MP135 Discovery kit is a low-cost and easy-to-use development kit to quickly evaluate and start a development with an STM32MP135 microprocessor in a TFBGA320 package.

To start using the STM32MP135F-DK, follow the steps below:

1. Check the boot mode switch positions on the board, as shown in Table 5.
2. For a correct identification among the host PC device interfaces, before connecting the board, install the USB driver available on the *www.st.com* website.
3. To power the board, connect its USB Type-C® connector CN12 to a 5 V / 3 A USB Type-C® charger with its cable. As a result, the green LED LD1 (5 V PWR LED) and the blue LED LD3 light up, and the LED LD5 (ST-LINK LED) blinks.
4. The software demonstration and the several software examples that allow the user to use the Discovery kit features are available at the www.st.com/stm32mp1 webpage.
5. Develop an application using the available examples.

7 Hardware layout and configuration

7.1 Hardware layout

The STM32MP135F-DK is designed around the STM32MP135FAF7 microprocessor (320 pins in a TFBGA package). The hardware block diagram (see Figure 3) illustrates the connection between the STM32MP135FAF7 microprocessor and the peripherals (such as dual Ethernet, MIPI CSI-2® camera module connector, USB Type-C® DRP and USB Type-A connectors, GPIO expansion, and embedded ST-LINK).

Figure 3. STM32MP135F-DK hardware block diagram

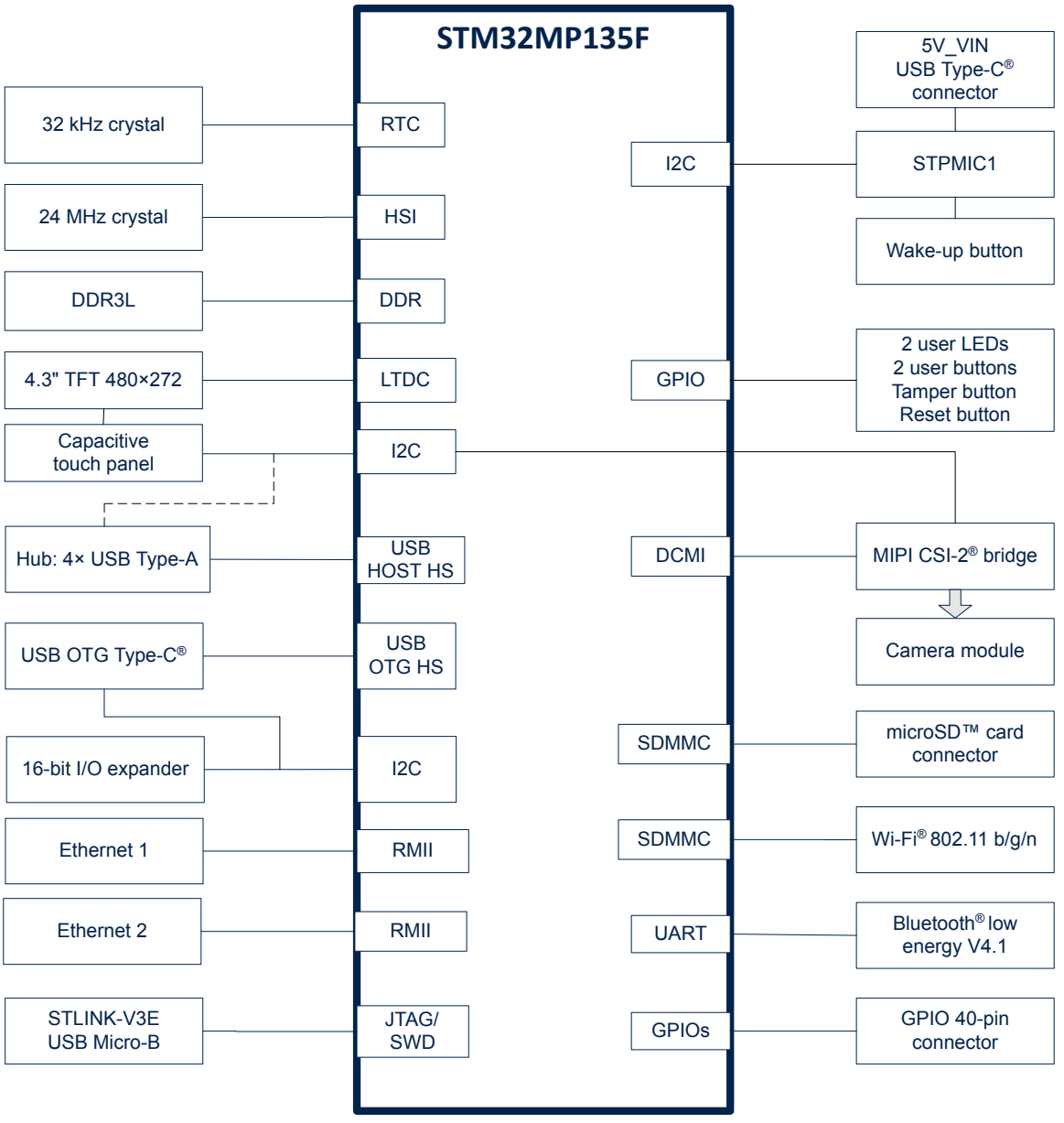


Figure 4 and Figure 5 show the locations of these features on the STM32MP135F-DK.

Figure 4. STM32MP135F-DK PCB layout: top side

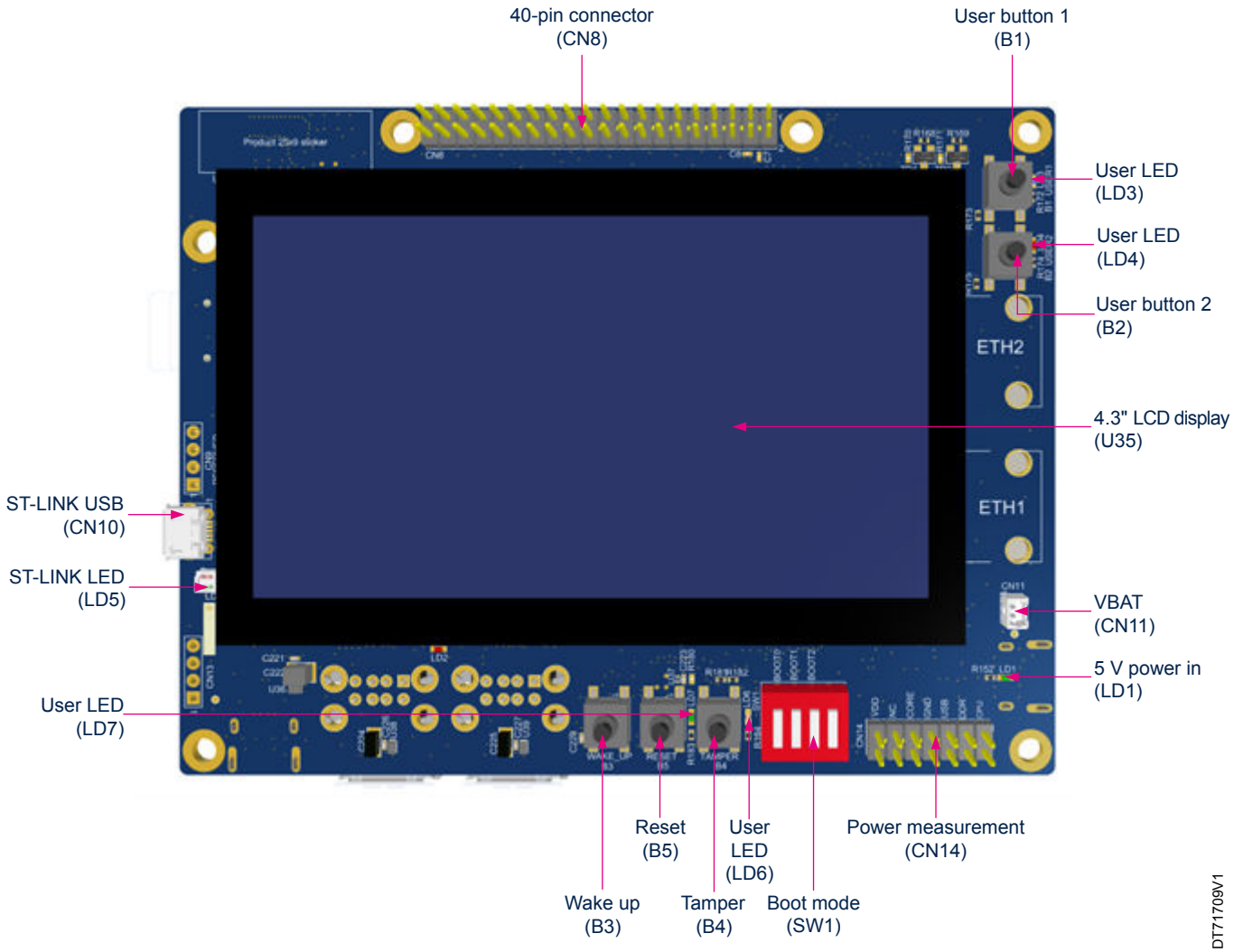
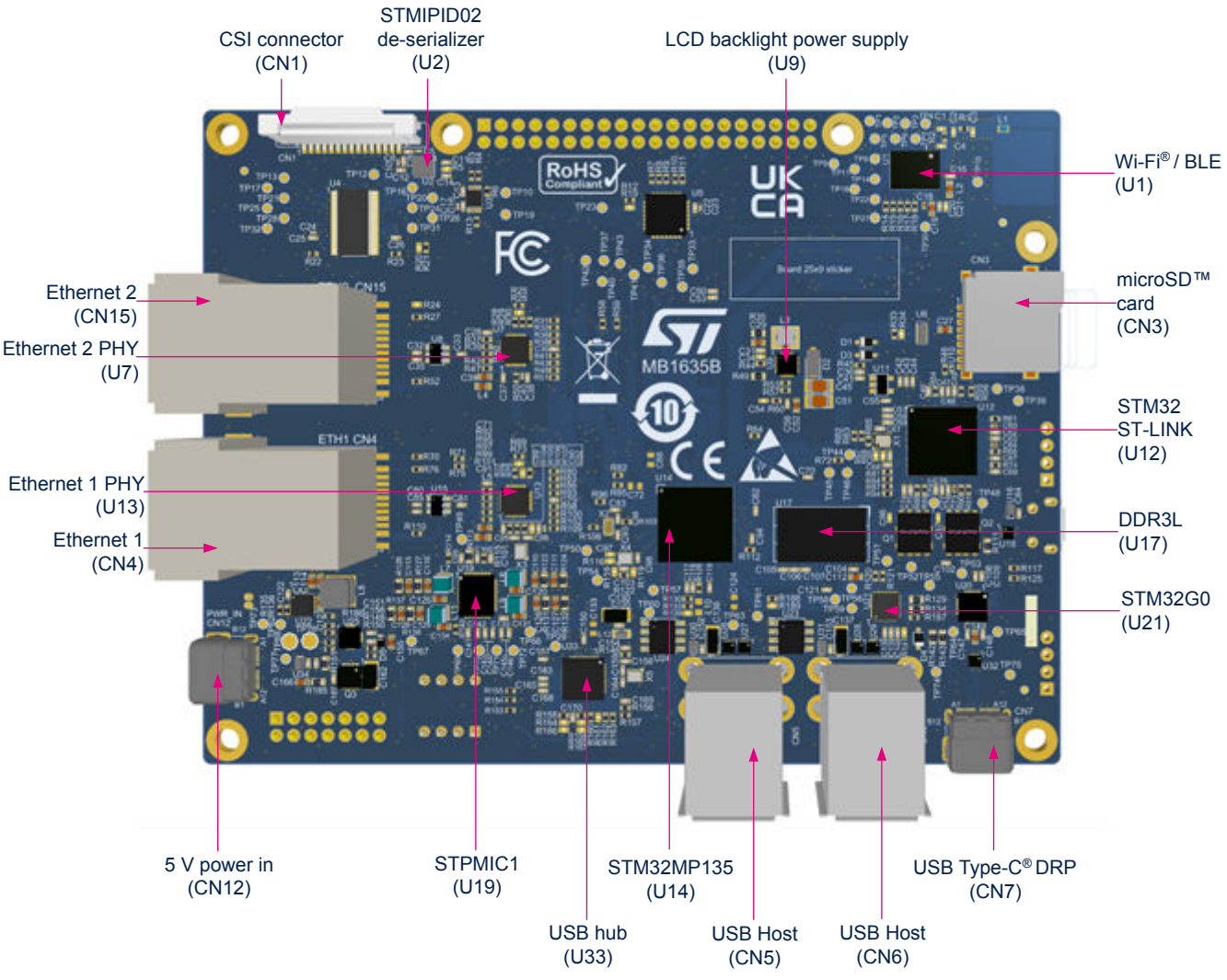


Figure 5. STM32MP135F-DK PCB layout: bottom side



7.2 Hardware configuration

7.2.1 Ethernet configuration

The board embeds dual 10/100 MBit/s Ethernet ports, Ethernet 1 and Ethernet 2, with one featuring Wake on LAN (WoL).

The WoL feature is configured by default and is only available for the Ethernet 1 port. The Ethernet reference clock must be taken from the crystal X3 and the resistor R107 must be OFF.

If the WoL feature is not needed, the reference clock can be directly taken from the MPU pin PA11 by having resistor R107 ON, and resistors R105 and R106 OFF.

7.2.2 VBAT configuration

The VBAT feature is available to maintain critical operations when a power loss occurs on VDD. In the default configuration with the resistor R192 ON and the resistor R191 OFF, theVBAT feature is not available.

To enable the VBAT mode, swap the resistors R192 and R191, and connect a backup power source to the VBAT connector.

7.2.3 STLINK-V3E configuration

The embedded STLINK-V3, STLINK-V3E, proposes only the SWD interface.

Restriction: The STLINK_JTDI signal is shared with the µSD_DETECT signal. It is reserved for internal use only.

7.3 Embedded STLINK-V3E

7.3.1 Description

To debug the on-board STM32 MPU, the STLINK-V3E programming and debugging tool is integrated in the STM32MP135F-DK Discovery kit. The embedded STLINK-V3E supports only SWD and VCP for STM32 devices. For information about the debugging and programming features of STLINK-V3E, refer to the *ST-LINK in-circuit debugger/programmer for STM8 and STM32* user manual (UM1075) and *Overview of ST-LINK derivatives* technical note (TN1235).

It is recommended to power the board (CN12, 5 V power in connector, PWR_IN) before plugging the USB debug cable to the Micro-B connector.

7.3.2 Drivers

Before connecting STM32MP135F-DK to a Windows® (7, 8, or 10) PC via the USB, a driver for STLINK-V3 must be installed (not required for Windows® 10). It is available from the *www.st.com* website.

In cases where the STM32MP135F-DK Discovery kit is connected to the PC before the driver is installed, some STM32MP135F-DK interfaces may be declared as “Unknown” in the PC device manager. In this case, the user must install the dedicated driver files, and update the driver of the connected device from the device manager.

7.3.3 STLINK-V3 firmware upgrade

The STLINK-V3 embeds a firmware upgrade mechanism for in place upgrade through the USB port. As firmware may evolve during the lifetime of the STLINK-V3 product (addition of new functionalities, bug fixes, or support of new microprocessor families), visiting the *www.st.com* website is recommended before starting to use the STM32MP135F-DK Discovery kit, then periodically to stay up-to-date with the latest firmware version.

7.3.4 Using the STLINK-V3 to program and debug the on-board STM32

To program the on-board STM32, no specific hardware configuration is required.

7.4 Power supply

7.4.1 5 V power supply

The STM32MP135F-DK Discovery kit is designed to be powered by a 5 V DC power source at 3 A maximum such as:

- 5V_VBUS connected to the CN12 connector through a USB Type-C® to USB Type-C® cable
  The two lines USB_PWR_CC1 and USB_PWR_CC2 are connected to PF12 and PA3 respectively to check what is connected to CN12 and control features enabling:
  - Legacy cable
  - Personal computer
  - 5 V DC power source at 3 A

Depending on the current needed on the devices connected to the USB port, and the board itself, power limitations can prevent the system from working as expected. The user must ensure that the STM32MP135F-DK Discovery kit is supplied with the correct power source depending on the current needed. It is recommended to use a USB Type-C® to USB Type-C® 5 V / 3 A charger.

7.4.2 STPMIC1 power supply

For general information concerning the STPMIC1, refer to the datasheet on the *www.st.com* website.

STPMIC1 supply

- VDD_CORE (BUCK1) used to supply the CPU of the STM32MP135F
  - Value: 1.35 V
- VDD_DDR (BUCK2) used to supply the DDR core and I/Os
  - Value: 1.35 V
- VDD (BUCK3) used to supply the VDD domain of the STM32MP135F
  - Value: 3.3 V
- VDD_CORE (BUCK4) used to supply the core of the STM32MP135F
  - Value: 1.2 V
- 3V3_SW (PWR_SW) used to supply some of the 3V3 domains of the STM32MP135F-DK peripherals
  - Value: 3.3 V
- VREF_DDR (LDO3) used to supply the DDR reference voltage
  - Value: 0.675 V
- VDD_ADC (LDO1) used to supply the VDDA domains of the STM32MP135F
  - Value: 3.3 V
- 1V8_PERIPH (LDO6) used to supply the digital core and I/Os of the CSI bridge
  - Value: 1.8 V
- VDD_SD (LDO5) used to supply the microSD™ card part
  - Value: 3.3 V
- VDD_USB (LDO4) used to supply the USB PHY of the STM32MP135F
  - Value: 3.3 V

7.5 Clock sources

7.5.1 LSE clock references

The LSE clock reference on the STM32MP135F microprocessor is provided by the external crystal X2:

- 32.768 kHz crystal

7.5.2 HSE clock references

The HSE clock reference on the STM32MP135F microprocessor is provided by the external crystal X4:

- 24 MHz crystal

7.6 Reset sources

The reset signal of STM32MP135F-DK is active low. The internal PU forces the RST signal to a high level.

The sources of reset are:

- Reset button B5 (black button)
- STPMIC1
- Embedded STLINK-V3
- STM32MP135F-DK

7.7 Boot mode

7.7.1 Description

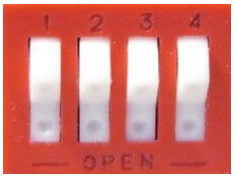
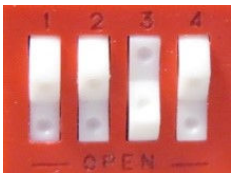
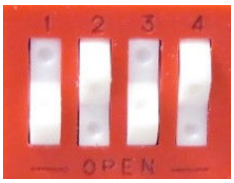
At startup, the boot pins select the boot source used by the internal boot ROM. Table 4 describes the configurations of the boot pins.

Table 4. Boot mode pins

Boot 0	Boot 1	Boot 2	Boot mode
0	0	0	Forced USB boot for programming.
0	0	1	Reserved.
1	0	1	SD™ card on SDMMC1.
Other combinations			Not supported.

Table 5 shows the configurations of the boot mode switch SW1.

Table 5. Boot mode switch SW1

Switch positions(1) (Boot0, Boot1, Boot2, NC)	Boot pin selection	Boot mode
	Boot0: 0 Boot1: 0 Boot2: 0 NC: X(2)	Forced USB boot for programming.
	Boot0: 0 Boot1: 0 Boot2: 1 NC: X(2)	Reserved.
	Boot0: 1 Boot1: 0 Boot2: 1 NC: X(2)	SD™ card on SDMMC1.

1. *Not connected.*
2. *X is either 1 or 0.*

7.8 USB Host

7.8.1 Description

The STM32MP135F-DK provides four USB Host ports (dual-USB Type-A sockets CN5 and CN6) through the use of the USB hub. The USB hub has a full power management for each USB port: no I/O is needed from the STM32MP135FAF7.

7.8.2 USB Host interface

Table 6 describes the I/O configuration for the USB Host interface.

Table 6. I/O configuration for the USB Host interface

I/O	Configuration
PD1	PD1 used as I2C5_SCL shared between LCD and MIPI CSI-2®(1)
PH6	PH6 used as I2C5_SDA shared between LCD and MIPI CSI-2®(1)
USB_PD1	USB1_P
USB_DM1	USB1_N

1. *I2C5 not connected by default (R166 and R167 OFF).*

Figure 6 shows the CN5 and CN6 USB Type-A connectors pinout.

Figure 6. CN5 and CN6 USB Type-A connector pinout

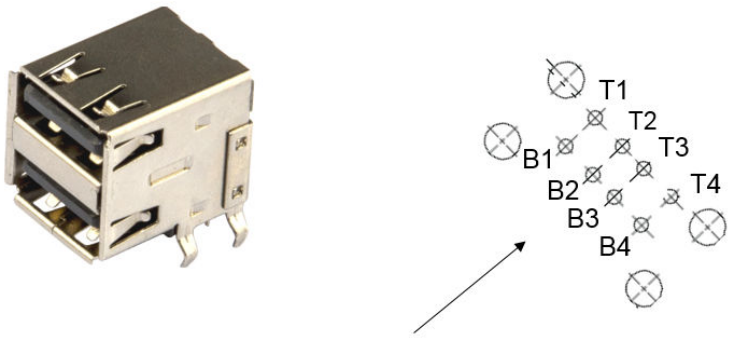


Table 7 describes the CN5 and CN6 USB Host connectors pinout.

Table 7. CN5 and CN6 USB Host connectors pinout

Pin	Pin name	Signal name	Function
CN5			
T1	T1	VBUS	VBUS
T2	T2	USB1CN26_N	DM
T3	T3	USB1CN26_P	DP
T4	T4	GND	GND
B1	B1	VBUS	VBUS
B2	B2	USB1CN26_N	DM

Pin	Pin name	Signal name	Function
B3	B3	USB1CN26_P	DP
B4	B4	GND	GND
CN6			
T1	T1	VBUS	VBUS
T2	T2	USB1CN25_N	DM
T3	T3	USB1CN25_P	DP
T4	T4	GND	GND
B1	B1	VBUS	VBUS
B2	B2	USB1CN25_N	DM
B3	B3	USB1CN25_P	DP
B4	B4	GND	GND

7.9 USB Type-C® HS

7.9.1 Description

The STM32MP135F-DK Discovery kit supports USB high speed (HS) communication. USB connector CN7 is a USB Type-C® connector.

The STM32MP135F-DK Discovery kit supports the USB Type-C® Source mode.

7.9.2 Operating voltage

The STM32MP135F-DK Discovery kit supports 5 V USB voltage from 4.75 V to 5.25 V.

7.9.3 USB HS Source

When a USB Device connection to the CN7 USB Type-C® connector of STM32MP135F-DK is detected, the Discovery kit starts behaving as a USB Host.

7.9.4 USB Type-C® connector

Figure 7 shows the pinout of USB Type-C® connector CN7.

Figure 7. CN7 USB Type-C® connector pinout

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1-	VBUS	CC1	D+	D-	SBU1	VBUS	RX2-	RX2+	GND
GND	RX1+	RX1-	VBUS	SBU2	D-	D+	CC2	VBUS	TX2-	TX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

Table 8 describes the pinout of USB Type-C® connector CN7.

Table 8. CN7 USB Type-C® connector pinout

Function	STM32 pin	Signal name	Pin name	Pin	Pin	Pin name	Signal name	STM32 pin	Function
GND	-	GND	GND	A1	B12	GND	GND	-	GND
TX1+	-	-	TX1+	A2	B11	RX1+	-	-	RX1+
TX1-	-	-	TX1-	A3	B10	RX1-	-	-	RX1-
VBUS	-	-	VBUS	A4	B9	VBUS	-	-	VBUS
CC1	-	-	CC1	A5	B8	SBU2	-	-	SBU2
D+	USB_DP2	USB_DP2	D+	A6	B7	D-	USB_DM2	USB_DM2	D-
D-	USB_DM2	USB_DM2	D-	A7	B6	D+	USB_DP2	USB_DP2	D+
SBU1	-	-	SBU1	A8	B5	CC2	-	-	CC2
VBUS	-	-	VBUS	A9	B4	VBUS	-	-	VBUS
RX2-	-	-	RX2-	A10	B3	TX2-	-	-	TX2-
RX2+	-	-	RX2+	A11	B2	TX2+	-	-	TX2+
GND	-	GND	GND	A12	B1	GND	GND	-	GND

7.10 microSD™ card

7.10.1 Description

The CN3 slot for the microSD™ card is routed to the STM32MP135F SDIO port (SDMMC1). This interface is compliant with *SD Memory Card Specification Version 3.01: High Speed*.

7.10.2 Operating voltage

The microSD™ card interface is only compatible with the 3.3 V voltage range: from 2.7 V to 3.6 V. All microSD™ card types are supported (including SDHC and SDXC), but only Default and High-Speed modes (3V3) are supported on STM32MP135F-DK. UHS-I modes (1.8 V) are not supported on this Discovery kit.

7.10.3 microSD™ card interface

The microSD™ card interface is used in the four data lines D[0:3] with one clock (CLK), one command line (CMD), and one card detection signal (CARD_DETECT).

The SDMMC1 is a bootable interface.

Table 9 describes the I/O configuration for the SDIO interface.

Table 9. I/O configuration for the SDIO interface

I/O	Configuration
PH4	PH4 is connected to µSD_DETECT
PC8	PC8 is connected to SDMMC1_D0
PC9	PC9 is connected to SDMMC1_D1
PC10	PC10 is connected to SDMMC1_D2
PC11	PC11 is connected to SDMMC1_D3
PC12	PC12 is connected to SDMMC1_CLK
PD2	PD2 is connected to SDMMC1_CMD

Figure 8 shows the pinout of the microSD™ card connector CN3.

Figure 8. microSD™ card connector CN3

Table 10 describes the pinout of the microSD™ card connector CN3.

Table 10. CN3 microSD™ card connector pinout

Pin	Pin name	Signal name	STM32 pin	Function
1	DAT2	SDMMC1_D2	PC10	SDIO.D2
2	DAT3_CD	SDMMC1_D3	PC11	SDIO.D3
3	CMD	SDMMC1_CMD	PD2	SDIO.CMD
4	VDD	VDD_SD	-	VDD_SDCARD
5	CLK	SDMMC1_CLK	PC12	SDIO.CLK
6	VSS	GND	-	GND
7	DAT0	SDMMC1_D0	PC8	SDIO.D0
8	DAT1	SDMMC_D1	PC9	SDIO.D1
9	CARD_DETECT	µSD_DETECT	PH4	µSD_DETECT active low
10	GND	GND	-	GND
11	GND	GND	-	GND
12	GND	GND	-	GND
13	NC	NC	NC	NC

7.11 LEDs

7.11.1 Description

The LD1 LED turns green when the power cable is inserted in connector CN12.

Two general-purpose LED color LEDs (LD3 and LD6) are available as light indicators:

- The LD3 blue LED is used as Linux® Heartbeat LED, which is blinking as long as Linux® is alive on the Cortex®-A.
- The LD6 orange LED is used as STM32Cube examples verdict LED.

The two indicator LEDs, the red LD4 and green LD7 LEDs, are respectively connected to the STM32MP135 MPU and to the MCP series I/O expander.

7.11.2 Operating voltage

All LEDs are driven by the I/O level; they are operating in the 3.3 V voltage range.

7.11.3 LED interface

Table 11 describes the I/O configuration of the LED interface.

Table 11. I/O configuration of the LED interfaces

I/O	Configuration
PA14	PA14 is connected to the blue LED LD3. Active Low.
PA13	PA13 is connected to the red LED LD4. Active Low.
MCP IO14	MCP IO14 is connected to the green LED LD7. Active High.
MCP IO15	MCP IO15 is connected to the orange LED LD6. Active High.

7.12 Buttons

7.12.1 Description

The STM32MP135F-DK Discovery kit provides five buttons:

- USER1 button (B1)
  - Used at boot time by U-Boot to enter the USB programming mode
- USER2 button (B2)
  - Used at boot time by U-Boot to enter the Android™ Fastboot mode
- Wake-up button (B3)
  - Allows the platform to be woken up from any low-power mode
  - Connected to STPMIC1 PONKEY, which generates a wake-up signal on STM32MP135FAF7 pin PF8
- Tamper button (B4)
  - Allows the detection of case opening as a security event
- Reset button (B5)
  - Used to reset the Discovery kit

7.12.2 I/O interface

Table 12 describes the I/O configuration for the physical user interface.

Table 12. I/O configuration for the physical user interface

I/O	Configuration
PA14	USER1 button (B1)
PA13	USER2 button (B2)
-	Wake-up button (B3). Connected to the PONKEY pin of the STPMIC1
PA6	Tamper button (B4)
NRST	Reset button (B5). Active Low.

7.13 CSI-DCMI

7.13.1 Description

The STM32MP135F-DK Discovery kit provides an external camera module with a 1/4" color CMOS UXGA 2-megapixel image sensor. A CSI-DCMI bridge deserializes data from the camera module, which are then transmitted to the MPU.

The resolution is up to 1600 x 1200 with 20 frames per second.

Output signals are 8-bit RGB RAW.

The control signals are I2C5.

7.13.2 DCMI I/O interface

Table 13 describes the I/O configuration for the DCMI interface.

Table 13. I/O configuration for the DCMI interface

I/O	Configuration
PA9	PA9 is connected to DCMI_D0
PD0	PD0 is connected to DCMI_D1
PG10	PG10 is connected to DCMI_D2
PE4	PE4 is connected to DCMI_D3
PD11	PD11 is connected to DCMI_D4
PD3	PD3 is connected to DCMI_D5
PB8	PB8 is connected to DCMI_D6
PE14	PE14 is connected to DCMI_D7
PB7	PB7 is connected to DCMI_PIXCLK
PG9	PG9 is connected to DCMI_VSYNC
PH8	PH8 is connected to DCMI_HSYNC
MCP_IO1	MCP_IO1 is connected to STMIPI_ERROR
MCP_IO0	MCP_IO0 is connected to STMIPI_INT
PD7	PD7 is connected to STMIPI_EXTCLK
MCP_IO2	MCP_IO2 is connected to STMIPI_XSDN
PD1	PD1 is used as I2C5_SCL shared between USB and touch panel
PH6	PH6 is used as I2C5_SDA shared between USB and touch panel

Figure 9 shows the pinout of CSI connector CN1.

Figure 9. CN1 CSI connector pinout

Table 14 describes the CSI interface and pinout of CSI connector CN1.

Table 14. CSI interface and CN1 connector pinout

Pin	STM32 pin	Signal name	Function
1	-	GND	GND
2	-	DATA1_N	Negative data lane 1 from MIPI-CSI receiver 1
3	-	DATA1_P	Positive data lane 1 from MIPI-CSI receiver 1
4	-	GND	GND
5	-	DATA2_N	Negative data lane 2 from MIPI-CSI receiver 1
6	-	DATA2_P	Positive data lane 2 from MIPI-CSI receiver 1
7	-	GND	GND
8	-	CKL_N	Negative clock lane
9	-	CKL_P	Positive clock lane
10	-	GND	GND
11	MCP_IO3	CAM_ENABLE	Camera shutdown
12	MCP_IO4	CAM_RESET	Camera reset
13	PD1	I2C5_SCL	I2C5_SCL shared between USB and touch panel
14	PH6	I2C5_SDA	I2C5_SDA shared between USB and touch panel
15	-	3V3_SW	3V3

7.14 Wi-Fi® and Bluetooth® Low Energy

7.14.1 Description

The STM32MP135F-DK Discovery kit supports Wi-Fi® 802.11b/g/n and Bluetooth® Low Energy (BLE) V4.1. This module is driven by an SDIO for the Wi-Fi® interface, and a USART for the Bluetooth®. The PCM format is used for audio data.

7.14.2 Operating voltage

The Wi-Fi®/BLE module supports the 3.3 V voltage range.

7.14.3 Wi-Fi® I/O interface

Table 15 describes the I/O configuration for the Wi-Fi® interface.

Table 15. I/O configuration for the Wi-Fi® interface

I/O	Configuration
PB4	PB4 is connected to SDMMC2_D3
PB3	PB3 is connected to SDMMC2_D2
PB15	PB15 is connected to SDMMC2_D1
PB14	PB14 is connected to SDMMC2_D0
PG6	PG6 is connected to SDMMC2_CMD
PE3	PE3 is connected to SDMMC2_CK
MCP_IO11	MCP_IO11 is connected to WL_REG_ON
PF0	PF0 is connected to WL_HOST_WAKE

7.14.4 Bluetooth® Low Energy I/O interface

Table 16 describes the I/O configuration for the Bluetooth® Low Energy interface.

Table 16. I/O configuration for the Bluetooth® Low Energy interface

I/O	Configuration
PH12	PD5 is connected to USART2_TX
PD15	PD6 is connected to USART2_RX
PD4	PD4 is connected to USART2_RTS
PE11	PD3 is connected to USART2_CTS
PB13	PZ3 is connected to BT_PCM_WS
PH10	PZ2 is connected to BT_PCM_SDO
PB5	PZ1 is connected to BT_PCM_SDI
PB10	PZ0 is connected to BT_PCM_CK
MCP_IO13	PZ6 is connected to BT_REG_ON
PE10	PH5 is connected to BT_HOST_WAKE
MCP_IO12	PZ7 is connected to BT_DEV_WAKE
PI1	LP0_32

7.15 LCD

The LCD is provided and mounted with the STM32MP135F-DK Discovery kit.

7.15.1 Description

The TFT LCD module is connected to the board through the 40-pin connector CN16. The touch panel is embedded in the LCD module.

The LCD module is composed of a TFT LCD module with an LCD driver. The 4.3" LCD supports a resolution of 480 × 272 dots in 262K colors (RGB). The touch panel drive works with a self-capacitive controller.

7.15.2 Operating voltage

The LCD module with its touch panel power supply is connected to 3V3_SW.

The backlight of the LCD is driven by a dedicated circuit connected to 5V_VIN.

7.15.3 LCD interface

Table 17 describes the I/O configuration of the LCD and CTP interfaces.

Table 17. I/O configuration of the LCD and CTP interfaces

I/O	Configuration
PD10	PD10 is connected to LTDC_B2
PF2	PF2 is connected to LTDC_B3
PH14	PH14 is connected to LTDC_B4
PE0	PE0 is connected to LTDC_B5
PB6	PB6 is connected to LTDC_B6
PF1	PF1 is connected to LTDC_B7
PH13	PH13 is connected to LTDC_G2
PF3	PF3 is connected to LTDC_G3
PD5	PD5 is connected to LTDC_G4
PG0	PG0 is connected to LTDC_G5
PC7	PC7 is connected to LTDC_G6
PA15	PA15 is connected to LTDC_G7
PG7	PG7 is connected to LTDC_R2
PB12	PB12 is connected to LTDC_R3
PD14	PD14 is connected to LTDC_R4
PE7	PE7 is connected to LTDC_R5
PE13	PE13 is connected to LTDC_R6
PE9	PE9 is connected to LTDC_R7
PD9	PD9 is connected to LTDC_CLK
PH9	PH9 is connected to LTDC_DE
PC6	PC6 is connected to LTDC_HSYNC
PG4	PG4 is connected to LTDC_VSYNC
PF5	PF5 is connected to LCD_INT
PD1	PD1 is used as I2C5_SCL shared between USB and CSI
PH6	PH6 is used as I2C5_SDA shared between USB and CSI
PH2	PH2 is connected to LCD_NRST

7.16 Dual 10/100Mbit/s Ethernet

7.16.1 Description

The STM32MP135F-DK Discovery kit provides a reduced media-independent interface (RMII).

The STM32MP135FAF7 requires an external physical interface device (PHY) for each RMII. The Ethernet PHY on the Discovery kit is connected to the physical LAN bus using 10 or 11 signals for RMII on Wake on LAN (WoL) support.

The main Ethernet port, Ethernet 1, can be clocked using the 25 MHz from the STM32MP135FAF7 or from a crystal (X3) as it supports Wake on LAN (WoL) operation. The default configuration is 25 MHz from the X3 crystal.

The second Ethernet port, Ethernet 2, can only be clocked using the 25 MHz from the STM32MP135FAF7 as it does not support Wake on LAN (WoL) operation.

The Ethernet connector embedded LED blink to indicate data transmission.

For more details about the Ethernet PHY (such as clocking or configuration), refer to the bill of material and to the corresponding datasheet from the PHY provider.

7.16.2 Operating voltage

The Ethernet PHYs are supplied with 3V3_AO for Ethernet 1 and with 3V3_SW for Ethernet 2.

7.17 GPIO expansion connector

7.17.1 Description

- The GPIO pins can be used as GPIOs or alternate functions. The available alternate functions are listed in Table 23. STM32MP135 Discovery kit I/O assignment.
- Other functions such as I^2C, UART, or CAN FD can be mapped on the GPIO connector, for instance using the STM32CubeMX tool.
- The GPIO expansion connector CN8 offers Raspberry Pi® shields capability.

7.17.2 GPIO expansion connector interface

Figure 10 shows the pinout of the CN8 GPIO connector.

Figure 10. CN8 GPIO connector

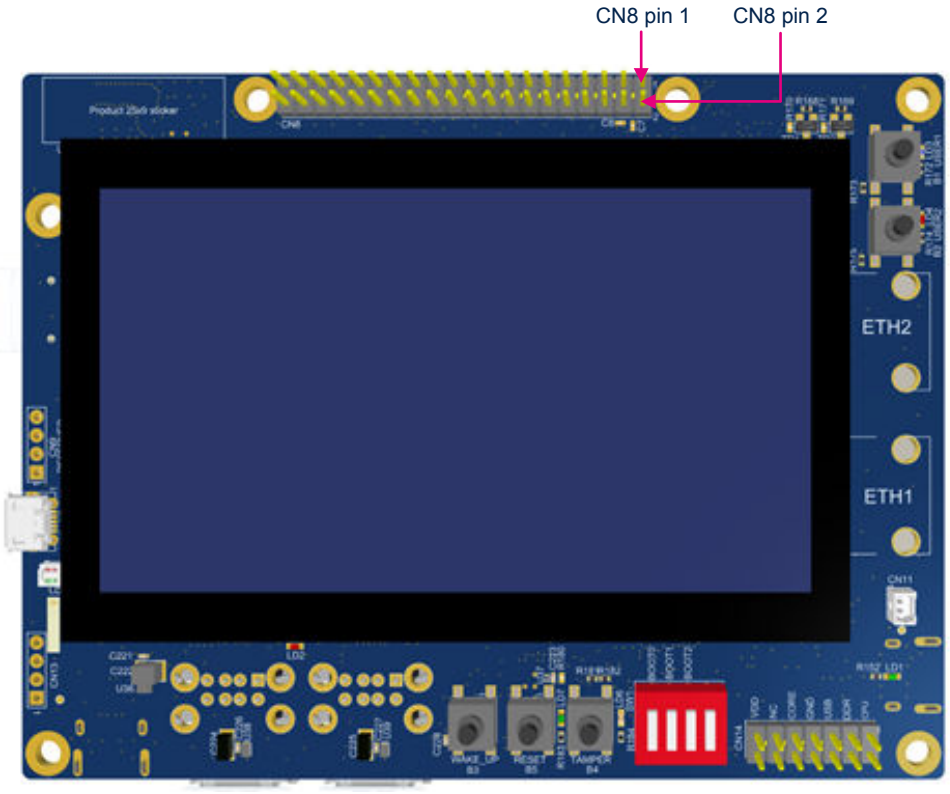


Table 18 describes the pinout of the CN8 GPIO connector.

Table 18. CN8 GPIO connector pinout

Function	STM32 pin	Pin	Pin	STM32 pin	Function
3V3	-	1	2	-	5V
GPIO2 / I2C5_SDA	PH6	3	4	-	5V
GPIO3 / I2C5_SCL	PD1	5	6	-	GND
GPIO4 / TIM3_CH4	PB1	7	8	PC0	GPIO14 / USART1_TX
GND	-	9	10	PB0	GPIO15 / USART1_RX
GPIO17 / USART1_RTS	PC2	11	12	PA4	GPIO18 / SAI1_SCKA
GPIO27 / DFSDM1_CKOUT	PC3	13	14	-	GND
GPIO22 / DFSDM1_DATIN3	PF13	15	16	PG1	GPIO23 / FDCAN2_TX
3V3	-	17	18	PG3	GPIO24 / FDCAN2_RX
GPIO10 / SPI5_MOSI	PH3	19	20	-	GND
GPIO9 / SPI5_MISO	PA8	21	22	PI0	GPIO25 / TAMP_IN8_OUT1
GPIO11 / SPI5_SCK	PH7	23	24	PH11	GPIO8 / SPI5_NSS
GND	-	25	26	PF10	GPIO7
I2C1_SDA	PE8	27	28	PD12	I2C1_SCL
GPIO5 / MCO2	PE6	29	30	-	GND
GPIO6 / TIM4_CH2	PD13	31	32	PE5	GPIO12 / TIM8_CH3
GPIO13 /TIM14_CH1	PF9	33	34	-	GND
GPIO19 / SAI1_FSA	PF11	35	36	PA7	GPIO16 / USART1_CTS
GPIO26 / UART8_TX	PE1	37	38	PA5	GPIO20 / SAI1_SDA
GND	-	39	40	PA0	GPIO21 / SAI1_SDB

7.18 VBAT connector

7.18.1 Description

The VBAT connector allows a power mode that maintains critical operations when a power loss occurs on VDD. The VBAT power domain contains the RTC, the backup registers, the retention RAM, and the backup SRAM. To enable VBAT mode, a back-up power source must be connected to the VBAT connector.

7.18.2 Operating voltage

The VBAT connector allows external supply from 1.2 V to 3.6 V.

7.18.3 VBAT interface

Table 19 describes the I/O configuration of the VBAT interface.

Table 19. I/O configuration of the CN11 VBAT interface

I/O	Configuration
1	VBAT
2	GND

Figure 11 shows the pinout of the CN11 VBAT connector.

Figure 11. CN11 VBAT connector pinout

Table 20 describes the VBAT interface and pinout of connector CN11.

Table 20. CN11 VBAT connector pinout

Pin	Pin name	Function
1	VBAT	VBAT supply.
2	GND	Ground.

8 STM32MP135F-DK product 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.

"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 STM32MP135F-DK product history

Table 21. Product history

Order code	Product identification	Product details	Product change description	Product limitations
STM32MP135F-DK	DK32MP135F$MT1	MPU: • STM32MP135FAF7 silicon revision "Y"	Initial revision	No limitation
		MPU errata sheet: • *STM32MP131x/3x/5x device errata* (ES0539)		
		Boards: • MB1635-MP135F-E02 (main board) • MB1897-CSI-B01 (camera module board)		

8.3 Board revision history

Table 22. **Board revision history**

Board reference	Board variant and revision	Board change description	Board limitations
MB1635 (main board)	MP135F-E02	Initial revision	No limitation
MB1897 (camera module board)	CSI-B01	Initial revision	No limitation

9 STM32MP135F-DK I/O assignment

Table 23. **STM32MP135 Discovery kit I/O assignment**

Ball	Pin	Assignment
A2	PA9	DCMI_D0
B2	PE11	USART2_CTS
B3	PF5	LCD_INT
C2	PD3	DCMI_D5
C3	PE14	DCMI_D7
B1	PD0	DCMI_D1
D3	PH12	USART2_TX
C1	PB6	LCD_B6
D2	PD6	UART4_TX
E3	PH8	DCMI_HSYNC
D1	PB8	DCMI_D6
F4	PA12	ETH2_CRS_DV
E2	PH2	LCD_RST
F3	PD11	DCMI_D4
F2	PG9	DCMI_VSYNC
F1	PF8	PF8_WKUP
H5	PG8	ETH2_CLK
G3	PG5	ETH2_MDC
H4	PG15	ETH2_MDINT
G2	PG10	DCMI_D2
H3	PF10	EXP_GPIO7
G1	PF6	ETH2_TX_EN
J5	PF9	TIM14_CH1
H2	PE4	DCMI_D3
J3	PB2	ETH2_MDIO
J1	PH7	SPI5_SCK
K3	PH11	SPI5_NSS
J2	PD13	TIM4_CH2
L4	PI3	ETH1_MDINT
M3	PC13	PMIC_WAKEUP
N5	PI2	STM32G0_INTN
P4	PI1	LPO_32
P5	PI0	TAMP_IN8_OUT1
L3	PC15-OSC32_OUT	OSC32_OUT
M2	PC14-OSC32_IN	OSC32_IN
N2	PF4	ETH2_RXD0
P2	PA8	SPI5_MISO
N1	PE2	ETH2_RXD1

Ball	Pin	Assignment
P3	PF7	ETH2_TXD0
R2	PG11	ETH2_TXD1
N3	PH6	I2C5_SDA
R1	PG1	FDCAN2_TX
T2	PE6	MCO2
T3	PH0-OSC_IN	HSE_IN
U2	PH1-OSC_OUT	HSE_OUT
R3	PH3	SPI5_MOSI
W1	PG3	FDCAN2_RX
V3	PG2	ETH1_MDC
W2	PG12	MCP_INT
V1	PD7	MCO1
T4	PA13	PA13 (user button 2)
Y1	PA11	ETH1_CLK
AA2	PB11	ETH1_TX_EN
Y2	PF14	STLINK_SWCLK
Y3	PA0	SAI1_SDB
W4	PF13	DFSDM1_DATIN3
AA3	PA1	ETH1_RX_CLK
Y4	PA2	ETH1_MDIO
Y5	PA5	SAI1_SDA
W5	PC0	USART1_TX
AA4	PF12	USB_PWR_CC1
V6	PA7	USART1_CTS
Y6	PF11	SAI1_FSA
AA6	PA4	SAI1_SCKA
Y7	PC4	ETH1_RXD0
W6	PC3	DFSDM1_CKOUT
AA7	PC5	ETH1_RXD1
W8	PB0	USART1_RX
W9	PA3	USB_PWR_CC2
Y8	PB1	TIM3_CH4
Y9	PC1	ETH1_CRS_DV
U10	PA6	TAMP_BTN
AA9	PG13	ETH1_TXD0
W10	PE5	TIM8_CH3
Y10	PG14	ETH1_TXD1
AA10	PC2	USART1_RTS
AA13	USB_DP2	USB_DP2
Y13	USB_DM2	USB_DM2
Y12	PF15	STLINK_SWDIO

Ball	Pin	Assignment
W13	PA14	PA14 (user button 1)
AA15	PI5-BOOT1	BOOT1
Y15	PI6-BOOT2	BOOT2
Y17	PI4-BOOT0	BOOT0
AA16	USB_DM1	USB_DM1
Y16	USB_DP1	USB_DP1
AA19	PA10	STM32G0_WAKE
AA20	PI7	LCD_DISP
Y19	PH4	uSD_DETECT
W18	PH5	STLINK_SWO
A20	PC9	SDMMC1_D1
C18	PC8	SDMMC1_D0
C19	PD2	SDMMC1_CMD
A19	PC12	SDMMC1_CK
A18	PC10	SDMMC1_D2
B18	PC11	SDMMC1_D3
C17	PG6	SDMMC2_CMD
B17	PE3	SDMMC2_CK
C16	PB4	SDMMC2_D3
B16	PB14	SDMMC2_D0
B15	PB15	SDMMC2_D1
C14	PB3	SDMMC2_D2
A16	PF0	WL_HOST_WAKE
A15	PB9	I2C4_SDA
E14	PH10	BT_PCM_SDO
D14	PB13	BT_PCM_WS
E13	PB10	BT_PCM_CK
B14	PC6	LCD_HSYNC
B13	PB5	BT_PCM_SDI
C13	PC7	LCD_G6
A13	PF3	LCD_G3
C12	PH9	LCD_DE
B11	PF1	LCD_B7
A12	PH13	LCD_G2
A10	PG7	LCD_R2
B10	PG4	LCD_VSYNC
C11	PB12	LCD_R3
D11	PF2	LCD_B3
C10	PE10	BT_HOST_WAKE
A9	PE15	I2C4_SCL
B8	PH14	LCD_B4

Ball	Pin	Assignment
B9	PE8	I2C1_SDA
E9	PD15	USART2_RX
C9	PD9	LCD_CLK
A7	PG0	LCD_G5
C8	PD5	LCD_G4

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

10.1 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 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.

Note: Use only shielded cables for USB, Ethernet, HDMI® cables. Use added ferrite clamp on audio cable (one turn).

Responsible party (in the USA)

Terry Blanchard
Americas Region Legal | Group Vice President and Regional Legal Counsel, The Americas
STMicroelectronics, Inc.
750 Canyon Drive | Suite 300 | Coppell, Texas 75019
USA
Telephone: +1 972-466-7845

10.2 ISED Compliance Statement

This device complies with FCC and ISED Canada RF radiation exposure limits set forth for general population for mobile application (uncontrolled exposure). This device must not be collocated or operating in conjunction with any other antenna or transmitter.

Compliance Statement

Notice: This device complies with ISED Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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

Déclaration de conformité

Avis: Le présent appareil est conforme aux CNR d'ISDE Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

10.3 Additional FCC and ISED Canada Compliance Statements

Contains module from Murata model: LBEE5KL1DX-977
FCC ID: VPYLB1DX
IC: 772C-LB1DX

ISED Licence-Exempt Radio Apparatus

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Appareils radio exempts de licence ISDE

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage ;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus

To satisfy FCC and ISED Canada RF Exposure requirements for mobile devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Pour satisfaire aux exigences FCC et ISDE Canada concernant l'exposition aux champs RF pour les appareils mobile, une distance de séparation de 20 cm ou plus doit être maintenu entre l'antenne de ce dispositif et les personnes pendant le fonctionnement. Pour assurer la conformité, il est déconseillé d'utiliser cet équipement à une distance inférieure. Cet émetteur ne doit pas être co-situé ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

11 CE conformity

11.1 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.

11.2 Simplified declaration of conformity

Hereby, STMicroelectronics declares that the radio equipment types and STM32MP135F-DK are in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available from their product web page.

Revision history

Table 24. **Document revision history**

Date	Revision	Changes
01-Mar-2023	1	Initial release.
06-Mar-2023	2	Updated cover pictures. Updated board variant references in Table 21. Product history and Table 22. Board revision history. Updated Section 10 Federal Communications Commission (FCC) and ISED Canada Compliance Statements.

Contents

List of tables

List of figures

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2023 STMicroelectronics – All rights reserved