Discovery kit with STM32L4P5AG MCU

Introduction

The STM32L4P5G-DK Discovery kit is a complete demonstration and development platform for the STMicroelectronics Arm® Cortex®-M4 core-based STM32L4P5AGI6PU microcontroller with four I²C buses, three SPI and six USART ports, CAN port, two SAI ports, 12-bit ADC, 12-bit DAC, internal 320-Kbyte SRAM and 1-Mbyte Flash memory, two Octo-SPI memory interfaces, touch-sensing capability, USB OTG FS port, LCD-TFT controller, flexible memory controller (FMC), 8- to 14-bit DCMI interface and JTAG debugging support.

The STM32L4P5G-DK Discovery kit, shown in Figure 1 and Figure 2, is used as a reference design for user application development before porting to the final product.

The full range of hardware features available on the board helps users improve application development evaluating all the peripherals (USB OTG FS, Octo-SPI Flash and PSRAM memory device, eMMC, and others). ARDUINO® Uno V3 and STMod+ connectors provide easy connection to extension shields or daughterboards for specific applications.

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

Figure 1. STM32L4P5G-DK top view

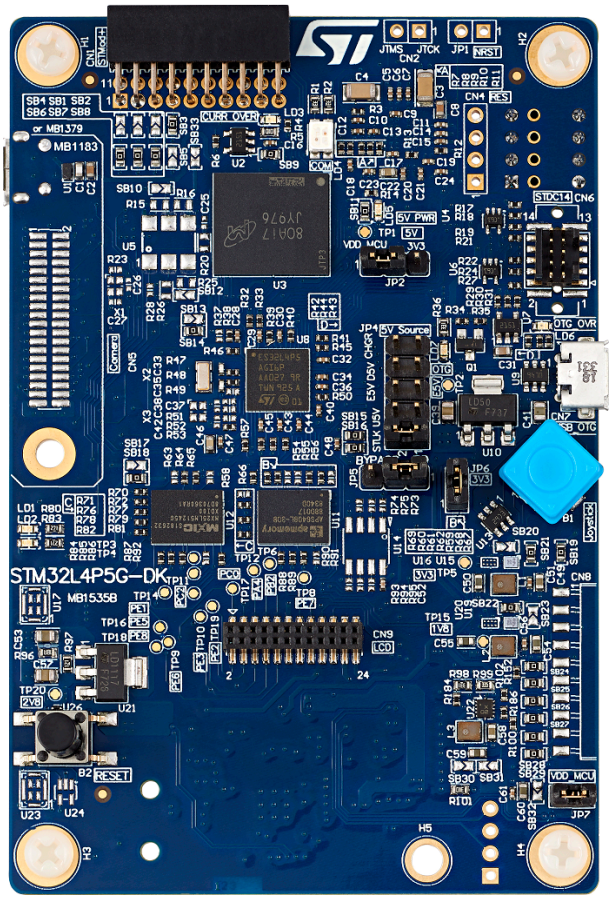
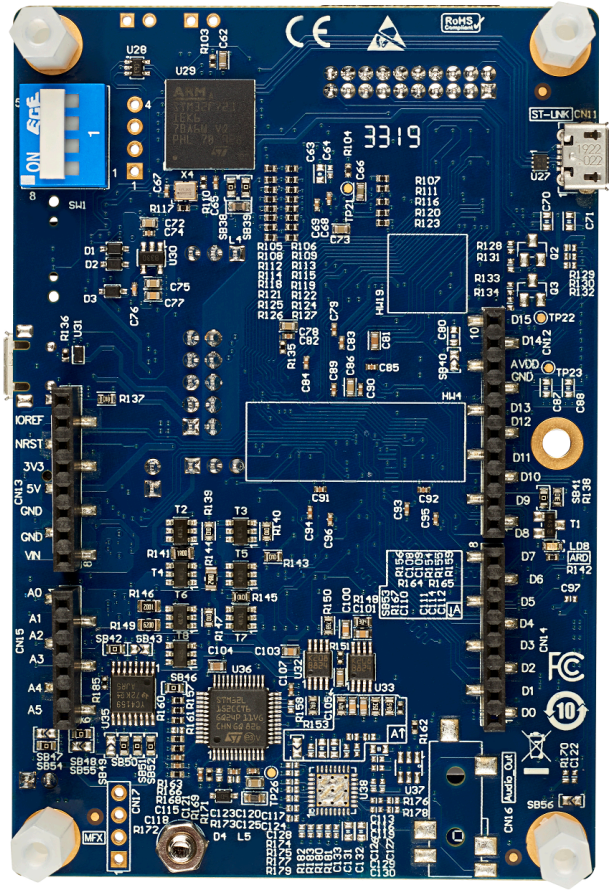


Figure 2. STM32L4P5G-DK bottom view



Pictures are not contractual.

1 Features

- STM32L4P5AGI6PU Arm® Cortex® core-based microcontroller featuring 1 Mbyte of Flash memory and 320 Kbytes of RAM in UFBGA169 package
- 240x240 64-color LCD with RGB interface (Connector only)
- 4-Gbyte onboard eMMC
- On-board current measurement
- SAI audio codec (Footprint only)
- ST-MEMS digital microphone (Footprint only)
- 512-Mbit Octo-SPI NOR Flash memory with DDR mode
- 64-Mbit Octo-SPI PSRAM memory with DDR mode
- 2 user LEDs
- Reset buttons
- 4-direction joystick with a selection button
- Board connectors:
  - 8-bit camera (Footprint only)
  - Stereo headset jack (Footprint only)
  - USB with Micro-AB
  - User interface through USB Virtual COM port
  - Arm® Cortex® 10-pin 1.27 mm-pitch debug connector over STDC14 footprint
  - ARDUINO® Uno V3 expansion connector
  - STMod+ expansion connector
- Flexible power-supply options:
  - ST-LINK USB V_{BUS}, USB OTG connector, or external sources
- On-board STLINK-V3E debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Microcontroller supply voltage: fixed 3.3 V and extern SMPS to generate Vcore logic supply
- Comprehensive free software libraries and examples available with the STM32CubeL4 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR™, Keil®, and GCC-based IDEs

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

2 Ordering information

To order the STM32L4P5G-DK Discovery kit, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board reference	Target STM32
STM32L4P5G-DK	MB1535	STM32L4P5AGI6PU

2.1 Product marking

Evaluation tools marked as “ES” or “E” are not yet qualified and therefore not ready to be used as reference design or in production. Any consequences deriving from such usage will not be at ST charge. In no event, ST will be liable for any customer usage of these engineering sample tools as reference designs or in production.

“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.

This board features 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.

In order to use the same commercial stack in his application, a developer may need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

2.2 Codification

The meaning of the codification is explained in Table 2. The order code is mentioned on a sticker placed on the top side of the board.

Table 2. Codification explanation

STM32TTXXY-DK	Description	Example: STM32L4P5G-DK
STM32TT	MCU series in STM32 32-bit Arm Cortex MCUs	STM32L4+ Series
XX	MCU product line in the series	STM32L4P5
Y	STM32 Flash memory size: • G for 1 Mbyte	1 Mbyte

3 Development environment

3.1 System requirements

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

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

3.2 Development toolchains

- Keil® MDK-ARM (see note)
- IAR™ EWARM (see note)
- GCC-based IDEs

Note: On Windows® only.

3.3 Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the onboard 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*.

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
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper should be 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

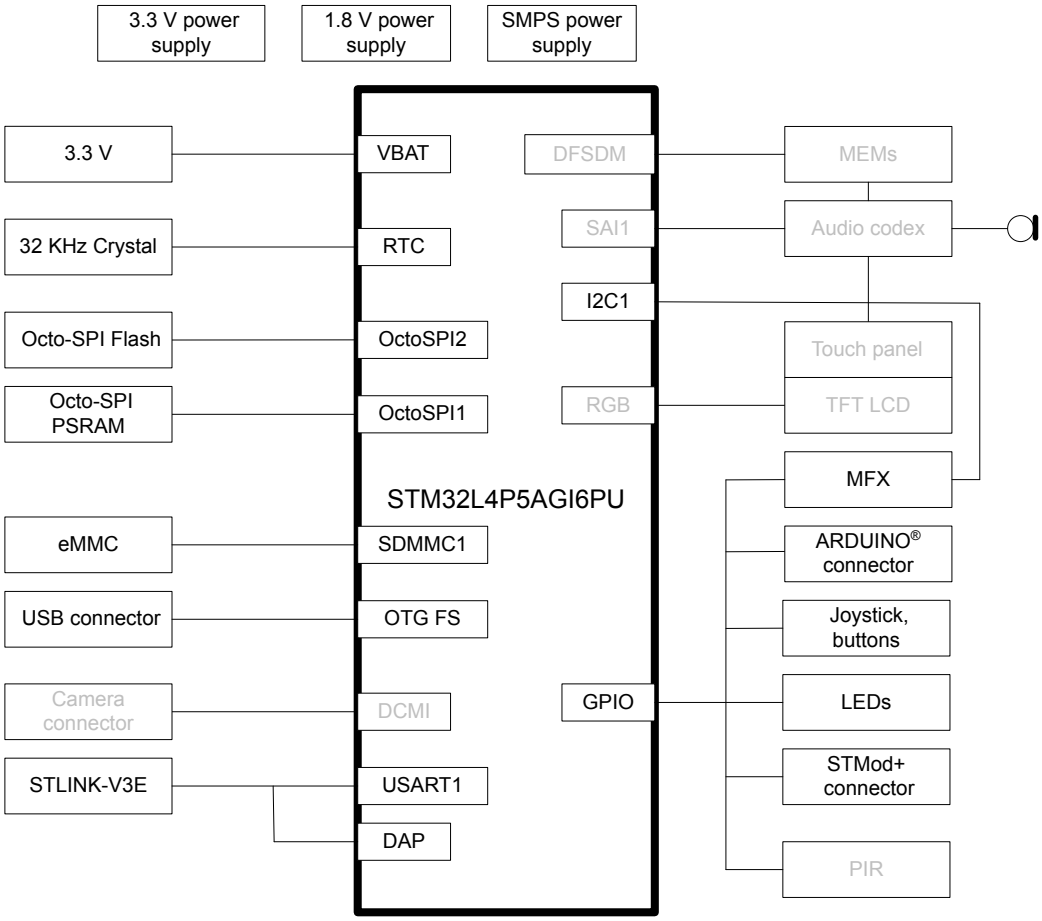
5 Delivery recommendations

Before the first use, make sure that no damage occurred to the board during shipment and no socketed components are not firmly fixed in their sockets or loose in the plastic bag.

6 Hardware layout and configuration

The STM32L4P5G-DK Discovery kit is designed around the STM32L4P5AGI6PU target microcontroller. Figure 3 illustrates STM32L4P5AGI6PU connections with peripheral components. Figure 4 shows the location of the main components on the top side of the Discovery board and Figure 5 shows the location of the main components on the bottom side of the Discovery board.

Figure 3. STM32L4P5G-DK hardware block diagram



Note: The grey features are not soldered, only footprints are present on the board.

Figure 4. **STM32L4P5G-DK PCB layout (Top view)**

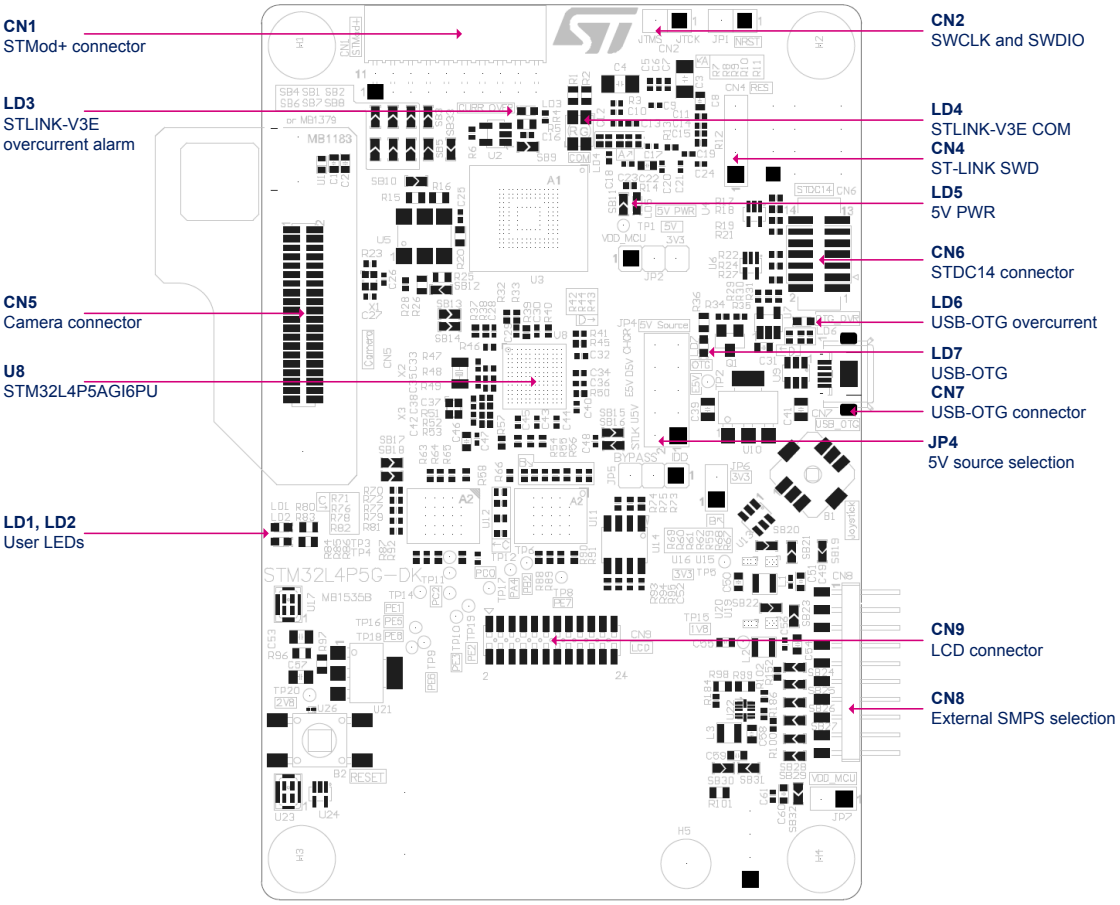


Figure 5. **STM32L4P5G-DK PCB layout (Bottom view)**

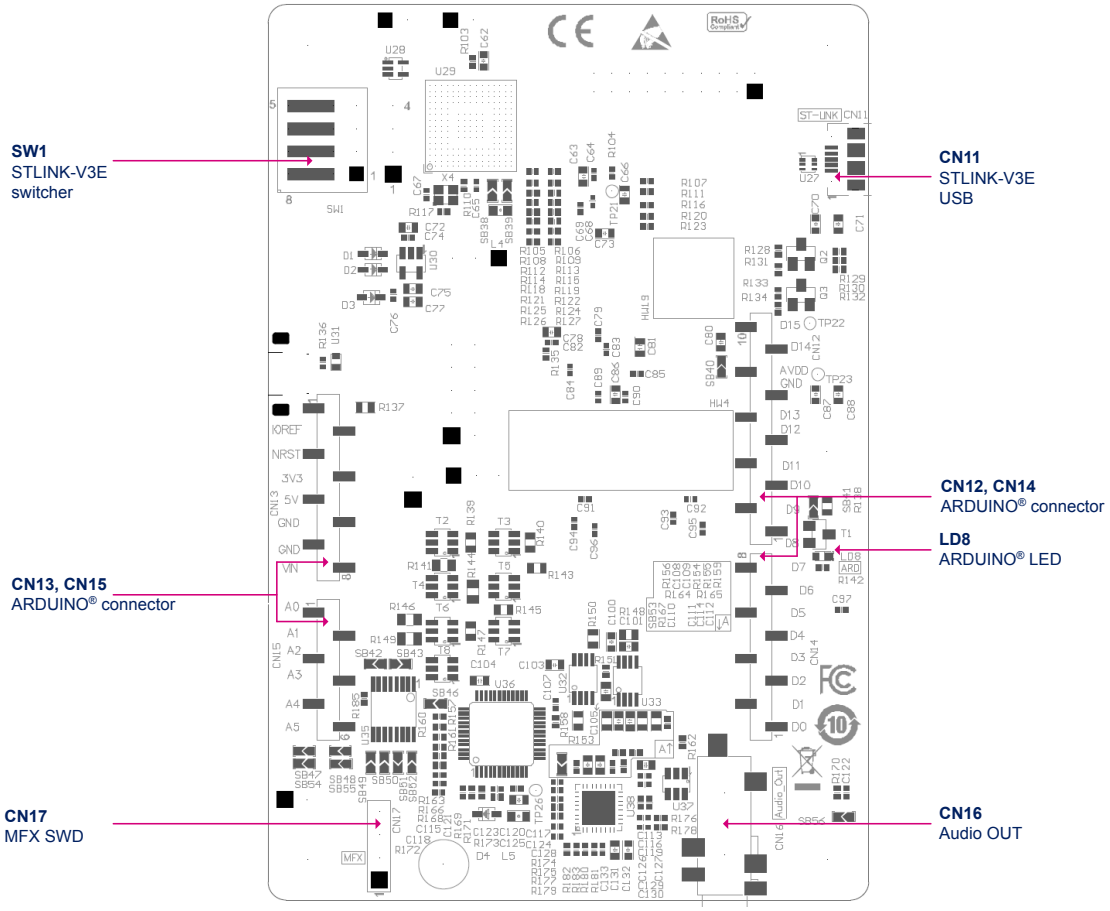
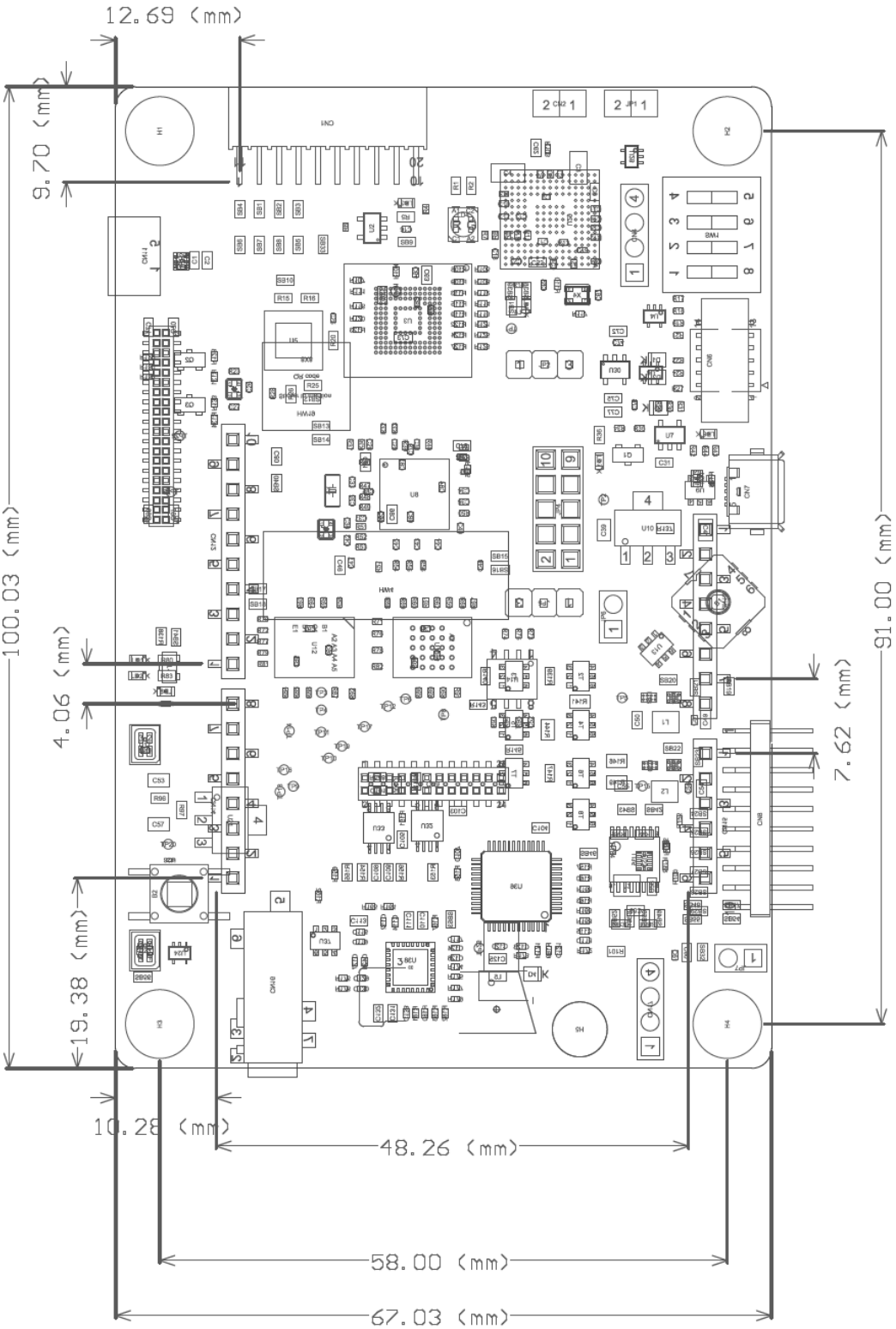


Figure 6 provides the mechanical dimensions of the STM32L4P5G-DK board.

Figure 6. STM32L4P5G-DK board mechanical dimensions (Top view)



6.1 Embedded STLINK-V3E

6.1.1 Description

The STLINK-V3E facility for debugging and programming the STM32L4P5AGI6PU is integrated into the STM32L4P5G-DK board. It supports the following features:

- Self-powered through a USB connector (Micro-B)
- USB 2.0 high-speed compatible interface
- Direct firmware update support (DFU)
- SWD and serial wire viewer (SWV) communication support
- Drag-and-drop Flash programming
- Two colored LEDs: communication and power

USB connector CN11 can be used to power the STM32L4P5G-DK regardless of the STLINK-V3E facility used for debugging or programming STM32L4P5AGI6PU. This holds also when the STLINK-V3E stand-alone tool is connected to the CN6 connector and used for debugging or programming STM32L4P5AGI6PU. Section 6.2 Power supply provides more detail about powering STM32L4P5G-DK. Refer to *www.st.com* for details about STLINK-V3E.

6.1.2 Drivers and firmware upgrade

The STLINK-V3E requires drivers to be installed on Windows®. It embeds a firmware that needs to be updated in order to benefit from new functionalities or corrections. Refer for details to the technical note *Overview of ST-LINK derivatives* TN1235.

6.1.3 Virtual COM port

The serial interface USART2 (PA2 and PA3 ports) is directly available as a Virtual COM port of the PC, connected to the CN11 STLINK-V3E USB connector. The Virtual COM port settings are 115200 bps, 8-bit data, no parity, 1 stop bit, no flow control.

6.2 Power supply

The STM32L4P5G-DK Discovery kit is designed to be powered from a 5 V DC power source. One of the following four 5 V DC power inputs can be used, upon appropriate board configuration:

- Micro-B USB receptacle CN11 of STLINK-V3E with enumeration. Up to 500mA can be supplied to the board (JP4 jumper setting on STLK on the silkscreen). This offers the enumeration feature described in Section 6.2.1 .
- Micro-B USB receptacle CN11 of STLINK-V3E without enumeration. Up to 1000mA can be supplied to the board directly without enumeration (JP4 jumper setting on CHGR on the silkscreen).
- Micro-AB USB receptacle CN7 of the USB OTG FS interface. Marked USB_OTG on the board (JP4 jumper setting on U5V on the silkscreen). Up to 500 mA can be supplied to the board in this way.
- 7-12V DC power from CN13 pin8: Named VIN on silkscreen, the extension connectors for ARDUINO® Uno shields (JP4 setting on external power source on silkscreen (E5V)).

The LD5 green LED turns on when the voltage on the power line marked as 5 V is present. All supply lines required for the operation of the components on the STM32L4P5G-DK are derived from that 5 V line.

Table 4 describes the settings of all jumpers related to powering the STM32L4P5G-DK and extension board. VDD_MCU is STM32L4P5AGI6PU digital supply voltage line. It can be connected to a fixed 3.3 V voltage supply.

6.2.1 Supplying the board through STLINK-V3E USB port

In order to power the STM32L4P5G-DK this way, the PC USB host gets connected to the Micro-B USB receptacle of the STM32L4P5G-DK board via a USB cable. The connection event starts with the USB enumeration procedure. In its initial phase, the host USB port current supply capability is limited to 100 mA. It is enough because only the STLINK-V3E part of the STM32L4P5G-DK draws power at that time: The U2 STMPS2151 power switch is set to the OFF position, which isolates the rest of the STM32L4P5G-DK from the power source. In the next phase of the enumeration procedure, the host PC informs the STLINK-V3E facility of its capability to supply current up to 300 mA. If the answer is positive, the STLINK-V3E sets the U2 STMPS2151 switch to ON position to supply power to the rest of the STM32L4P5G-DK board. If the PC USB port is not capable of supplying current up to 300 mA, the CN13 pin8 (VIN) can be used to supply the board instead.

If a short-circuit occurs on the board, the STMPS2151 power switch protects the USB port of the host PC against a current demand exceeding 500 mA. In such an event, the LD3 LED lights up.

The STM32L4P5G-DK board can also be supplied from a USB power source not supporting enumeration, such as a USB charger. In this particular case, jumper JP4 must be fitted as shown in Table 4. Power-supply related jumper and solder bridge settings. STLINK-V3E bypasses STMPS2151 power, regardless of enumeration procedure results, and passes the power unconditionally to the board.

The LD5 green LED turns on whenever the whole board is powered.

6.2.2 Using STLINK-V3E along with powering through external power

It can happen that the board requires more than 300 mA of supply current. It cannot be supplied by host PC connected to the STLINK-V3E USB port for debugging or programming the STM32L4P5AGI6PU. In such a case, the board can be supplied through CN13 pin8 (Marked VIN on the board).

To do this, it is important to power the board before connecting it with the host PC, which requires the following sequence to be respected:

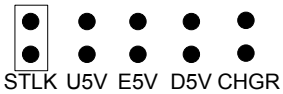
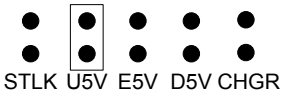
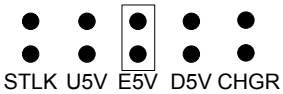
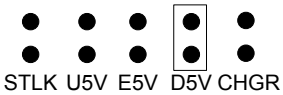
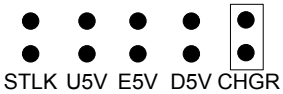
1. Set the jumper JP4 in the E5V position,
2. Connect the external power source to CN13 pin8,
3. Check that the LD5 green LED is turned on,
4. Connect host PC to the CN11 USB connector.

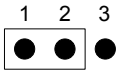
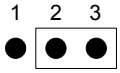
Caution: In case the board demands more than 300 mA and the host PC is connected via USB before the board is powered from CN13 pin8, there is a risk that the following events to occur (Listed in reverse severity order):

1. The host PC is capable of supplying 300 mA (The enumeration succeeds) but it features no over-current protection on its USB port. It is damaged due to over-current.
2. The host PC is capable of supplying 300 mA (The enumeration succeeds) and it has a built-in over-current protection on its USB port, limiting or shutting down the power out of its USB port when the excessive current demand from the is detected. This causes an operating failure of the STM32L4P5G-DK.
3. The host PC is not capable of supplying 300 mA (The enumeration fails). The STLINK-V3E does not supply the rest of the from its USB port V_{BUS} line.

Table 4 details the jumper and solder bridge settings used for the power-supply configuration of the STM32L4P5G-DK.

Table 4. Power-supply related jumper and solder bridge settings

Jumper /solder bridge	Setting	Configuration(1)
JP4 5 V source selector		**Default setting.** STM32L4P5G-DK is supplied through the CN11 Micro-B USB receptacle. It depends on host PC USB port's powering capability declared in the enumeration.
		STM32L4P5G-DK is supplied through CN7 Micro-AB USB receptacle.
		STM32L4P5G-DK is supplied through CN13 pin 8.
		STM32L4P5G-DK is supplied through CN13 pin 5.
		STM32L4P5G-DK is supplied through CN11 Micro-B USB receptacle. This setting is applied to power the board through CN11 using USB charger.

Jumper /solder bridge	Setting	Configuration[1]
R46 V_{BAT} connection	**R46 ON**	**Default setting.** V_{BAT} is connected to VDD_MCU.
	R46 OFF	V_{BAT} is not connected to VDD_MCU.
JP2 VDDA / VDDUSB connection		**Default setting.** VDDA and VDDUSB terminal of STM32L4P5AGI6PU are connected to VDD_MCU.
		VDDA and VDDUSB terminal of STM32L4P5AGI6PU are connected to 3V3.
JP6 3V3		**Default setting.** Board is connected to fixed 3V3.
		The device is connected to measure current consumption.

1. *On all STLINK-V3E boards, the target application is now able to run even if the STLINK-V3E is either not connected to an USB host, or is powered through a USB charger, or through a not-enumerating USB host.*

6.2.3 SMPS power supply

V_{DD12} is the external power supply bypassing the internal regulator when connected to an external SMPS. Board is populated with DC-DC regulator mounted on U22 ST1PS02D1QTR, which allows to dynamically supply the V_{DD12} pins in Run, Sleep and Stop 0 modes at voltage range from 1.0 to 1.35 V by configured STM32L4P5AGI6PU GPIOs (PH2, PH4, and PH13).

6.3 Clock references

Two clock references are available on STM32L4P5G-DK for the STM32L4P5AGI6PU target microcontroller.

- 32.768 kHz crystal X2, for embedded RTC
- 24 MHz crystal X3, for main clock generator (Footprint only)

The main clock generation is possible via an internal RC oscillator (Default) or from STLK_MCO, disconnected by removing resistors R49, R51, and R52 when the internal RC clock is used.

6.4 Reset source

The general reset of the STM32L4P5G-DK Discovery kit is active LOW. Sources of reset are:

- B2 RESET button
- CN6 STDC14 connector (Reset from debug tools)
- ARDUINO® Uno shield board through CN13 connector
- Embedded STLINK-V3E

6.5 Boot option

After reset, the STM32L4P5AGI6PU MCU can boot from the following embedded memory locations:

- Main (User, non-protected) Flash memory
- System (Protected) Flash memory
- RAM, for debugging

The boot option is configured by setting PH3 (BOOT0) and the boot base address programmed in the nBOOT1, nBOOT0, and nSWBOOT0 of FLASH_OPTR option bytes.

Table 5 describes the HW configuration for the BOOT mode.

Table 5. Boot selection switch

Resistor	Setting[1]	Description
R37 and R38	**R37 OFF** **R38 ON**	**BOOT0 line is tied LOW. STM32L4P5AGI6PU boots from Main Flash memory.**
	R37 ON R38 OFF	BOOT0 line is tied HIGH. STM32L4P5AGI6PU boots from system Flash memory (nBOOT1 bit of FLASH_OPTR register is set HIGH) or from RAM (nBOOT1 is set LOW).

1. *The default configuration is shown in bold.*

6.6 Audio (Footprint only)

A Cirrus codec CS42L51-CNZ, connected to the SAI interface of STM32L4P5AGI6PU, offers the possibility to connect a stereo headphone or headset with a mono analog microphone. The codec communicates with STM32L4P5AGI6PU via the I2C1 bus, which is shared with MFX and JDI LCD.

The I²C-bus addresses of CS42L51-CNZ are 0x95 and 0x94.

6.7 Digital microphones (Footprint only)

Two ST-MEMS IMP34DT05TR digital microphones, U17 and U23, are available on STM32L4P5G-DK. The two microphones are located at a distance of 21 mm from each other. They are connected to the STM32 DFSDM by the PE9 port, generating the clock, and by PD3 port, collecting the PDM interleaved data.

6.8 USB FS port

The STM32L4P5G-DK Discovery kit supports USB OTG FS, full-speed communication, via the CN7 USB Micro-AB receptacle and U7 USB power switch connected to V_{BUS}.

An LD7 green LED lits up in one of the following cases:

- The U7 power switch is ON and STM32L4P5G-DK works as a USB host.
- V_{BUS} is powered by another USB host when STM32L4P5G-DK works as a USB device.

The LD6 red LED is lit in case of overcurrent.

6.9 User LEDs

Two general-purpose color LEDs, LD1 and LD2, are available as light indicators. Each LED is in light-emitting state with a low level of the corresponding ports of the STM32L4P5AGI6PU MCU.

6.10 Physical input devices

The STM32L4P5G-DK board provides a number of input devices for physical human control.

- A four-way joystick controller with select key (B1)
- A reset button (B2)

6.11 Octo-SPI device

U12, a 512-Mbit Octo-SPI user Flash memory MX25LM51245GXDI00 from MACRONIX, is connected to the OCTOSPIM_P2 interface of STM32L4P5AGI6PU.

U11, a 64-Mbit Octo-SPI PSRAM memory APS6408L-3OBx-BA from APMemory, is connected to the OCTOSPIM_P1 interface of STM32L4P5AGI6PU.

By default, U14 is the footprint of a Quad-SPI interface for the SO8 package, like APMemory APS1604M-3SQR-SN. Note that U11 and U14 share the same GPIO port for Octo-SPI and Quad-SPI interface usage.

6.12 eMMC

The STM32L4P5G-DK Discovery kit embeds a 4-Gbyte eMMC chip. It is connected to the STM32L4P5AGI6PU SDMMC1 port.

6.13 MFX MCU

The MFX MCU is used as an MFX multi-function expander and an IDD measurement calculator.

6.13.1 MFX

The MFX circuit on the STM32L4P5G-DK Discovery kit acts as IO-expander. The communication interface between MFX and STM32L4P5AGI6PU is the I2C1 bus. The signals connected to MFX are listed in Table 6.

Table 6. MFX signals

MFX pin number	MFX pin name	MFX function	STM32L4P5G-DK function	MFX direction	Terminal device
15	PA5	MFX_GPIO5	Camera_Flash	Output	Camera
16	PA6	MFX_GPIO6	Camera_STANDBY	Output	Camera
17	PA7	MFX_GPIO7	Camera_PLUG	Input	Camera
18	PB0	MFX_GPIO0	USB_PSON	Output	USB OTG FS
19	PB1	MFX_GPIO1	USB_OVRCR	Input	USB OTG FS
20	PB2	MFX_GPIO2	Audio_RST	Input	Audio
26	PB13	MFX_GPIO13	-	-	-
27	PB14	MFX_GPIO14	-	-	-
28	PB15	MFX_GPIO15	-	-	-
29	PA8	MFX_GPIO8	-	-	-
30	PA9	MFX_GPIO9	-	-	-
31	PA10	MFX_GPIO10	-	-	-
32	PA11	MFX_GPIO11	-	-	-
33	PA12	MFX_GPIO12	-	-	-
39	PB3	MFX_GPIO3	Camera_RST	Output	Camera
40	PB4	MFX_GPIO4	Camera_Shutter	Output	Camera

6.13.2 IDD measurement

STM32L4P5AGI6PU has a built-in circuit to measure its own current consumption (IDD) in Run and Low-power modes, except Shutdown mode. It is strongly recommended for the MCU supply voltage (VDD_MCU line) to not exceed 3.3 V, because there are components on the STM32L4P5G-DK supplied from 3.3 V that communicate with the MCU through I/O ports. Voltage exceeding 3.3 V on the MCU output port may inject current into 3.3 V supplied peripheral I/Os and distort the MCU current-consumption measurement.

Table 7 shows the setting of the jumper associated with the IDD measurement on the board.

Table 7. IDD measurement related jumper setting

HW	Setting(1)	Configuration
JP5	**JP5 [1-2]**	**STM32L4P5AGI6PU has a built-in circuit to measure its own current consumption.**
	JP5 [2-3]	IDD measurement is not available, bypass mode only for STM32L4P5AGI6PU VDD_MCU power supply.

1. *The default configuration is shown in bold.*

6.14 LCD interface (Connector only)

The STM32L4P5G-DK supports a 6-bit RGB interface and a touch-panel interface. A reference board B-LCD12-MIP1 (MB1609) is used for display applications. The daughterboard is plugged into the CN9 connector.

Table 8. **CN9 LCD connector**

Terminal	Terminal name	MCU port	Terminal	Terminal name	MCU port
1	LCD_DE	PC0	2	LCD_R7	PE2
3	LCD_DISP	PG8	4	LCD_R6	PE3
5	LCD_HSYNC	PC2	6	LCD_G7	PE5
7	LCD_VSYNC	PE1	8	LCD_G6	PE6
9	LCD_CLK	PA4	10	LCD_B7	PE8
11	GND	-	12	LCD_B6	PE7
13	TP_INT	PI1	14	GND	-
15	TP_RST	PB4	16	LCD_PWM_EN	PA15
17	I2C1_SDA	PB7	18	LCD_RTC_OUT2	PB2
19	I2C1_SCL	PB6	20	BL_EN	PD13
21	3V3	-	22	5V	-
23	GND	-	24	GND	-

6.15 Camera connector (Footprint only)

A CN5 connector for 8- to 12-bit DCMI signals on STM32L4P5G-DK Discovery kit supports a camera module daughterboard MB1183 or MB1379. The camera shares the I2C4 bus with STMod+ connector and ARDUINO® connector.

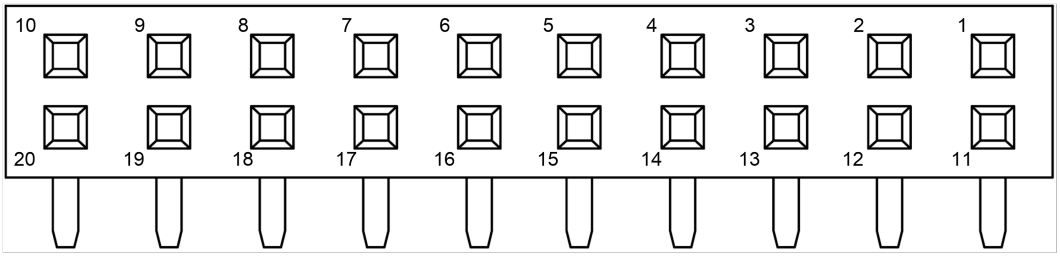
7 Connectors

7.1 CN1 STMod+ connector

The standard 20-pin STMod+ connector is available on the STM32L4P5G-DK Discovery kit to increase compatibility with external boards and modules from the Ecosystem of microcontrollers. By default, it is designed to support an ST-dedicated fanout board to connect different modules or board extensions from different manufacturers. The fanout board also embeds a 3.3 V regulator and I^2C level shifter (Footprint only). Schematics of the fanout board is available at the *www.st.com* website.

For details about STMod+ interface, refer to the technical note *STMod+ interface specification* TN1238.

Figure 7. CN1 STMod+ connector



Front view

Table 9. CN1 STMod+ connector pinout

Pin number	Description	Pin number	Description
1	SPI1_NSS/USART3_CTS (PG5/PD11)	11	INT (PD10)
2	SPI1_MOSI/ USART3_TX (PG4/PD8)	12	RESET (PF11)
3	SPI1_MISO/ USART3_RX (PG3/PD9)	13	ADC (PA5)
4	SPI1_SCK/ USART3_RTS (PG2/PD12)	14	PWM (PG11)
5	GND	15	5V
6	5V	16	GND
7	I2C4_SCL (PF14)	17	DFSDM1-CKOUT (PF10)
8	SPI1_MOSIs (PE15)	18	DFSDM1- DATIN1 (PB12)
9	SPI1_MISOs (PE14)	19	GPIO3 (PD0)
10	I2C4_SDA (PF15)	20	GPIO4 (PD1)

7.2 CN4 STLINK-V3E programming connector

The CN4 connector is only used for embedded STLINK-V3E programming during board manufacturing. It is not populated by default and not for the end-user.

7.3 CN5 camera module connector (Footprint only)

Figure 8. **CN5 camera module connector (Top view)**

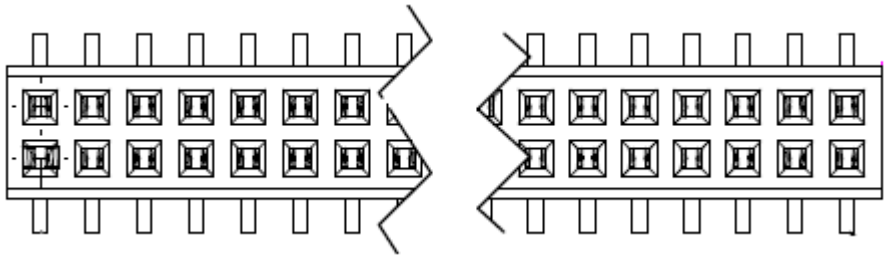


Table 10. **CN5 camera module connector pinout**

Pin number	Description	Pin number	Description
1	1V8	2	1V8
3	GND	4	GND
5	DCMI_D10 (PI3)	6	DCMI_D11 (PH15)
7	GND	8	GND
9	DCMI_D8 (PH6)	10	DCMI_D9 (PH7)
11	GND	12	GND
13	I2C4_SCL (PF14)	14	I2C4_SDA (PF15)
15	Camera_PLUG (MFX GPIO7)	16	GND
17	Camera_RST (MFX GPIO3)	18	-
19	Camera_STANDBY (MFX GPIO6)	20	Camera_CLK
21	GND	22	GND
23	DCMI_D0 (PH9)	24	DCMI_D1 (PH10)
25	DCMI_D2 (PE0)	26	DCMI_D3 (PH12)
27	DCMI_D4(PH14)	28	DCMI_D5 (PI4)
29	DCMI_D6 (PI6)	30	DCMI_D7 (PI7)
31	DCMI_HSYNC (PH8)	32	DCMI_VSYNC (PI5)
33	DCMI_PIXCLK (PH5)	34	-
35	Camera_Shutter (MFX GPIO4)	36	Camera_Flash (MFX GPIO5)
37	GND	38	GND
39	2V8	40	2V8

7.4 CN6 STDC14 connector

Figure 9. **CN6 STDC14 debugging connector (Top view)**

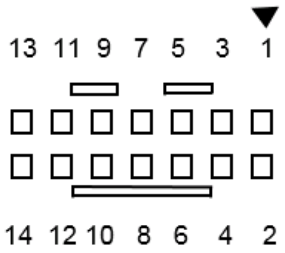


Table 11. **CN6 STDC14 debugging connector pinout**

Terminal	Function / MCU port	Terminal	Function / MCU port
1	-	2	-
3	VDD	4	SWDIO/TMS (PA13)
5	GND	6	SWDCLK/TCK (PA14)
7	GND	8	SWO/TDO (PB3)
9	-	10	-
11	GND	12	RESET#
13	VCP_RX_STDC (PA3)	14	VCP_TX_STDC (PA2)

7.5 CN7 USB OTG FS Micro-AB connector

A USB OTG Full Speed communication link is available at CN7 USB Micro-AB receptacle connector. Micro-AB receptacle enables USB Host and USB Device features.

Figure 10. **CN7 USB OTG FS Micro-AB connector**

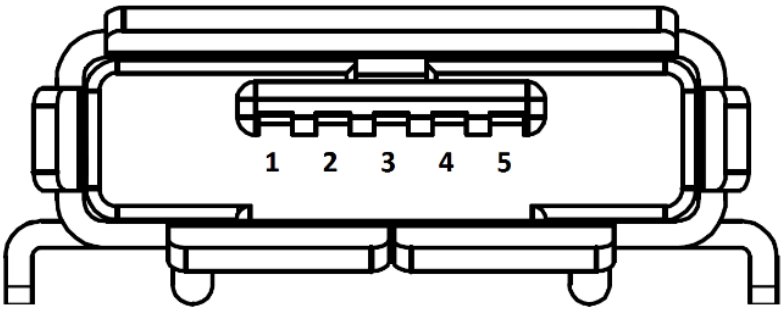


Table 12. **CN7 USB OTG FS Micro-AB connector pinout**

Pin number	Description	Pin number	Description
1	VBUS	4	ID
2	DM	5	GND

Pin number	Description	Pin number	Description
3	DP	-	-

7.6 CN11 STLINK-V3E USB Micro-B connector

The CN11 USB connector is used to connect onboard STLINK-V3E facility to PC for flashing and debugging software.

Figure 11. CN11 Micro-B connector (Top view)

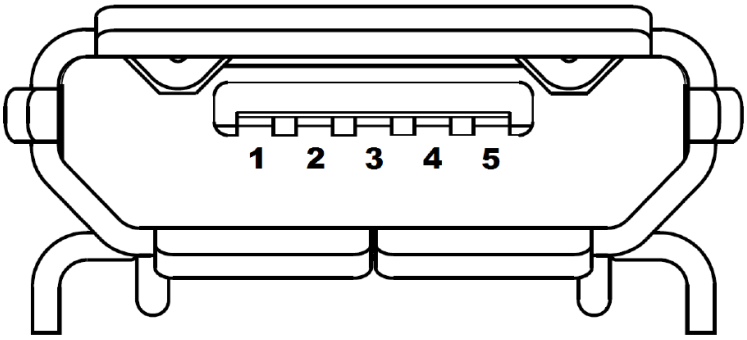


Table 13. CN11 USB Micro-B connector pinout

Terminal	Description	Terminal	Description
1	VBUS (Power)	4	ID
2	DM	5	GND
3	DP	6 - 11	Shield

7.7 CN12, CN13, CN14, and CN15 ARDUINO® Uno V3 connectors

CN12, CN13, CN14, and CN15 ARDUINO® Uno V3 connectors are female connectors compatible with ARDUINO® Uno Revision 3 standard. Most of the shields designed for ARDUINO® Uno V3 fit STM32L4P5G-DK board.

Table 14. ARDUINO® Uno V3 compatible connectors pinout

Left connectors					Right connectors				
CN number	Pin number	Pin name	MCU pin	Function	Function	MCU pin	Pin name	Pin number	CN number
-					I2C4_SCL	PF14	D15	10	CN12 digital
					I2C4_SDA	PF15	D14	9	
					AREF	-	AVDD	8	
					Ground	-	GND	7	
CN13 power	1	5V_EXT	-	5 V output	SPI2_SCK	PB13	D13	6	
	2	IOREF	-	3.3 V Ref.	SPI2 _MISO	PB14	D12	5	
	3	RESET	NRST	RESET	TIM1_CH3N || SPI2_MOSI	PB15	D11	4	
	4	+3V3	-	3.3V(1)input/ output	TIM5_CH4 || SPI2_NSS	PI0	D10	3	
	5	+5V	-	5 V output	TIM8_CH4	PI2	D9	2	
	6	GND	-	Ground	-	PD1	D8	1	
	7	GND	-	Ground	-				
	8	VIN	-	Power input(2)	-	PD0	D7	8	CN14 digital
-					TIM4_CH4	PD15	D6	7	
CN15 analog	1	A0	PC1	ADC12_IN2	TIM4_CH3	PD14	D5	6	
	2	A1	PA1	ADC12_IN6	-	PF13	D4	5	
	3	A2	PB0	ADC12_IN15	TIM4_CH2	PD13	D3	4	
	4	A3	PB1	ADC3_IN16	-	PF11	D2	3	
	5	A4	PC4 || PF15	ADC3_IN13 || I2C4_SDA(3)	USART3_TX	PB10	D1	2	
	6	A5	PC5 || PF14	ADC12_IN10 || I2C4_SCL(3)	USART3_RX	PB11	D0	1	

1. *The +3V3 on ARD connector Pin4 of CN13 is not a power input for the STM32L4P5G-DK board, to simplify power architecture.*
2. *The external voltage applied to pin VIN on Pin8 of CN13 should be in the range 6 to 9V at 25°C ambient temperature. If a higher voltage is applied on the regulator U10, it may overheat and could be damaged.*
3. *By default, pin 5 and pin 6 of CN15 connector are connected to ADC MCU input ports PC4 and PC5 respectively, thanks to configuration of solder bridges: SB48 and SB54 ON, SB47 and SB55 OFF. In case it is necessary to connect the I^2C interface signals on pins 5 and 6 of CN15 instead of ADC inputs, the user must open SB48 and SB54, and close SB47 and SB55.*

Before using any ARDUINO® Uno V3 shield, it is important to refer to Section 6.2 for a correct configuration of JP4.

Caution: The STM32 MCU I/Os are 3.3 V compatible instead of 5 V for ARDUINO® Uno V3.

7.8 CN16 audio green jack - line out (Footprint only)

A 3.5 mm stereo audio green jack output CN16 is available on the STM32L4P5G-DK board to support headphones.

Figure 12. CN16 stereo headset with a microphone jack

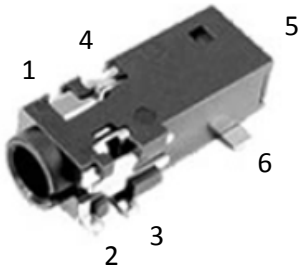


Table 15. CN16 audio jack connector pinout (Onboard)

Pin number	Description	Stereo headset with microphone pinning	
3	GND	GND	
4	OUT_Right	SPK_R (33 Ω typical)	
6	OUT_Left	SPK_L (33 Ω typical)	
1	NC	-	
2	MIC_IN	MIC	
5	NC	-	

7.9 CN17 MFX programming connector

The CN17 connector is only used for embedded MFX (Multi-Function eXpander) programming during the board manufacturing. It is not populated by default and not for the end-user.

Appendix A STM32L4P5G-DK I/O assignment

Table 16. **STM32L4P5G-DK I/O assignment**

Pin name	UFBGA169 + ext SMPS	Type	Input level	STM32 pinout assignment
PI10	A1	I/O	FT	JOY_RIGHT
PH2	A2	I/O	FT	SMPS_V1
VDD	A3	S	-	-
PE0	A4	I/O	FT	DCMI_D2/D2
PB4	A5	I/O	FT_fa	TP_RST
PB3	A6	I/O	FT_la	JTDO/TRACESWO
VSS	A7	S	-	-
VDD	A8	S	-	-
PA15	A9	I/O	FT	LCD_PWM_EN
PA14	A10	I/O	FT	JTCK/SWCLK
PA13	A11	I/O	FT	JTMS/SWDIO
PI0	A12	I/O	FT	ARD_SPI2_NSS_TIM5_CH4
PH14	A13	I/O	FT	DCMI_D4/D4
PI9	B1	I/O	FT	JOY_DOWN
PI7	B2	I/O	FT	DCMI_D7/D7
VSS	B3	S	-	-
PE1	B4	I/O	FT	LCD_VSYNC
PB5	B5	I/O	FT_la	SAI1_SD_B
VDDIO2	B6	S	-	-
PG9	B7	I/O	FT_s	OCTOSPIM_P2_IO6
PD0	B8	I/O	FT	ARD_D7_STMOD_GPIO3
PI6	B9	I/O	FT	DCMI_D6/D6
PI2	B10	I/O	FT	ARD_TIM8_CH4
PI1	B11	I/O	FT	TP_INT
PH15	B12	I/O	FT	SMPS_SW || DCMI_D11/D11
PH12	B13	I/O	FT	DCMI_D3/D3
VDD	C1	S	-	-
VSS	C2	S	-	-
PI11	C3	I/O	FT	JOY_LEFT
PB8	C4	I/O	FT_fl	SDMMC1_D4
PB6	C5	I/O	FT_fa	I2C1_SCL
VDD12	C6	-	-	-
PD4	C7	I/O	FT	OCTOSPIM_P1_IO4
PD1	C8	I/O	FT	ARD_D8_STMOD_GPIO4
PH13	C9	I/O	FT	SMPS_V3
PI3	C10	I/O	FT	DCMI_D10/D10

Pin name	UFBGA169 + ext SMPS	Type	Input level	STM32 pinout assignment
PI8	C11	I/O	FT	JOY_UP
VSS	C12	S	-	-
VDD	C13	S	-	-
PE4	D1	I/O	FT	SAI1_FS_A
PE3	D2	I/O	FT_l	LCD_R6
PE2	D3	I/O	FT_l	LCD_R7
PB9	D4	I/O	FT_fl	SDMMC1_D5
PB7	D5	I/O	FT_fla	I2C1_SDA
PG10	D6	I/O	FT_s	OCTOSPIM_P2_IO7
PD5	D7	I/O	FT	OCTOSPIM_P1_IO5
PD2	D8	I/O	FT	SDMMC1_CMD
PC10	D9	I/O	FT	SDMMC1_D2
PI4	D10	I/O	FT	DCMI_D5/D5
PH9	D11	I/O	FT	DCMI_D0/D0
PH7	D12	I/O	FT_f	SMPS_PG || DCMI_D9/D9
PA12	D13	I/O	FT_u	OTG_FS_DP
PC13	E1	I/O	FT	JOY_SEL
VBAT	E2	S	-	-
PE6	E3	I/O	FT	LCD_G6
PE5	E4	I/O	FT	LCD_G7
PH3-BOOT0	E5	I/O	FT	BOOT0
PG11	E6	I/O	FT_s	STMOD_TIM15_CH2
PD6	E7	I/O	FT	SAI1_SD_A
PD3	E8	I/O	FT	DFSDM1_DATIN0
PC11	E9	I/O	FT	SDMMC1_D3
PI5	E10	I/O	FT	DCMI_VSYNC/RDY
PH6	E11	I/O	FT	SMPS_EN || DCMI_D8/D8
VDDUSB	E12	S	-	-
PA11	E13	I/O	FT_u	OTG_FS_DM
PC14-OSC32_IN	F1	I/O	FT	OSC32_IN
VSS	F2	S	-	-
PF2	F3	I/O	FT	OCTOSPIM_P2_IO2
PF1	F4	I/O	FT_f	OCTOSPIM_P2_IO1
PF0	F5	I/O	FT_f	OCTOSPIM_P2_IO0
PG12	F6	I/O	FT_s	OCTOSPIM_P2_NCS
PD7	F7	I/O	FT	OCTOSPIM_P1_IO7
PC12	F8	I/O	FT	SDMMC1_CK
PA10	F9	I/O	FT_flu	OTG_FS_ID
PA9	F10	I/O	FT_flu	OTG_FS_VBUS
PC6	F11	I/O	FT	SDMMC1_D6

Pin name	UFBGA169 + ext SMPS	Type	Input level	STM32 pinout assignment
VDDIO2	F12	S	-	-
VSS	F13	S	-	-
PC15-OSC32_OUT	G1	I/O	FT	OSC32_OUT
VDD	G2	S	-	-
PF3	G3	I/O	FT	OCTOSPIM_P2_IO3
PF4	G4	I/O	FT	OCTOSPIM_P2_CLK
PF5	G5	I/O	FT	MFX_WAKEUP
PG14	G6	I/O	FT_fs	LED2
PG13	G7	I/O	FT_fs	LED1
PA8	G8	I/O	FT_f	SAI1_SCK_A
PC9	G9	I/O	FT_fl	SDMMC1_D1
PC8	G10	I/O	FT	SDMMC1_D0
PG6	G11	I/O	FT_s	OCTOSPIM_P1_DQS
PC7	G12	I/O	FT	SDMMC1_D7
VDD	G13	S	-	-
PH0-OSC_IN	H1	I/O	FT	OSC_IN
VSS	H2	S	-	-
NRST	H3	I-O	RST	NRST
PF10	H4	I/O	FT	STMOD_DFSDM1_CKOUT
PC4	H5	I/O	FT_a	ARD_ADC12_IN13
PG1	H6	I/O	FT	OCTOSPIM_P2_IO5
PE10	H7	I/O	FT	OCTOSPIM_P1_CLK
PB11	H8	I/O	FT_fl	ARD_USART3_RX
PG8	H9	I/O	FT_fs	LCD_DISP
PG7	H10	I/O	FT_fs	SAI1_MCLK_A
PD15	H11	I/O	FT	ARD_TIM4_CH4
VSS	H12	S	-	-
VDD	H13	S	-	-
PH1-OSC_OUT	J1	I/O	FT	OSC_OUT
PC0	J2	I/O	FT_fla	LCD_DE
PC1	J3	I/O	FT_fla	ARD_ADC12_IN2
PC2	J4	I/O	FT_la	LCD_HSYNC
PC5	J5	I/O	FT_a	PIR_WAKEUP
PG0	J6	I/O	FT	OCTOSPIM_P2_IO4
PE9	J7	I/O	FT	DFSDM1_CKOUT
PE15	J8	I/O	FT	STMOD_SPI1_MOSI2
PG5	J9	I/O	FT_s	STMOD_SPI1_NSS
PG4	J10	I/O	FT_s	STMOD_SPI1_MOSI
PG3	J11	I/O	FT_s	STMOD_SPI1_MISO
PG2	J12	I/O	FT_s	STMOD_SPI1_SCK

Pin name	UFBGA169 + ext SMPS	Type	Input level	STM32 pinout assignment
PD10	J13	I/O	FT	STMOD_INT
PC3	K1	I/O	FT_a	OCTOSPIM_P1_IO6
VSSA/VREF-	K2	S	-	-
PA0	K3	I/O	FT_a	MFX_IRQ_OUT
PA5	K4	I/O	TT_a	ARD_STMOD_ADC12_IN10
PB0	K5	I/O	TT_la	ARD_ADC12_IN15
PF15	K6	I/O	FT_f	I2C4_SDA
PE8	K7	I/O	FT	LCD_B7
PE14	K8	I/O	FT	STMOD_SPI1_MISO2
PH4	K9	I/O	FT_f	SMPS_V2
PD14	K10	I/O	FT	ARD_TIM4_CH3
PD12	K11	I/O	FT_fl	STMOD_USART3_RTS_DE
PD11	K12	I/O	FT	STMOD_USART3_CTS_NSS
PD13	K13	I/O	FT_fl	ARD_TIM4_CH2 || LPTIM2_OUT
VREF+	L1	S	-	-
VDDA	L2	S	-	-
PA4	L3	I/O	TT_a	LCD_CLK
PA7	L4	I/O	FT_fla	OCTOSPIM_P1_IO2
PB1	L5	I/O	FT_a	ARD_ADC12_IN16
PF14	L6	I/O	FT_f	I2C4_SCL
PE7	L7	I/O	FT	LCD_B6
PE13	L8	I/O	FT	OCTOSPIM_P1_IO1
PH5	L9	I/O	FT_f	DCMI_PIXCLK/PDCK
PD9	L10	I/O	FT	STMOD_USART3_RX
PD8	L11	I/O	FT	STMOD_USART3_TX
VDD	L12	S	-	-
VSS	L13	S	-	-
OPAMP1_VINM	M1	I	TT	-
PA3	M2	I/O	TT_a	USART2_RX
VSS	M3	S	-	-
PA6	M4	I/O	FT_a	OCTOSPIM_P1_IO3
PF11	M5	I/O	FT	ARD_D2_STMOD_RST
PF13	M6	I/O	FT	ARD_D4_PIR_OEN
VSS	M7	S	-	-
PE12	M8	I/O	FT	OCTOSPIM_P1_IO0
PH10	M9	I/O	FT	DCMI_D1/D1
VDD12	M10	S	-	-
VSS	M11	S	-	-
PB15	M12	I/O	FT	ARD_SPI2_MOSI_TIM1_CH3N
PB14	M13	I/O	FT_fl	ARD_SPI2_MISO

Pin name	UFBGA169 + ext SMPS	Type	Input level	STM32 pinout assignment
PA2	N1	I/O	FT_la	USART2_TX
PA1	N2	I/O	FT_la	ARD_ADC12_IN6
VDD	N3	S	-	-
OPAMP2_VINM	N4	I	TT	-
PB2	N5	I/O	FT_a	LCD_RTC_OUT2
PF12	N6	I/O	FT	OCTOSPIM_P2_DQS
VDD	N7	S	-	-
PE11	N8	I/O	FT	OCTOSPIM_P1_NCS
PB10	N9	I/O	FT_fl	ARD_USART3_TX
PH8	N10	I/O	FT_f	DCMI_HSYNC/DE
VDD	N11	S	-	-
PB12	N12	I/O	FT	STMOD_DFSDM1_DATIN1
PB13	N13	I/O	FT_fl	ARD_SPI2_SCK

Revision history

Table 17. **Document revision history**

Date	Revision	Changes
19-Dec-2019	1	Initial release

Contents

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