Discovery kit with STM32C011F6 MCU

Introduction

The STM32C0116-DK Discovery kit helps to discover features of the STM32C0 Series microcontroller in a UFQFPN20 package. This Discovery kit features one UFQFPN20 to DIL20 module designed with the STM32C011F6 microcontroller and allows the user to develop and share applications. It includes an on-board ST-LINK/V2-1 to debug and program the embedded STM32 microcontroller.

The STM32C0116-DK Discovery kit is operated by plugging it into a PC through a standard USB Type-A or USB Type-C® to Micro-B cable.
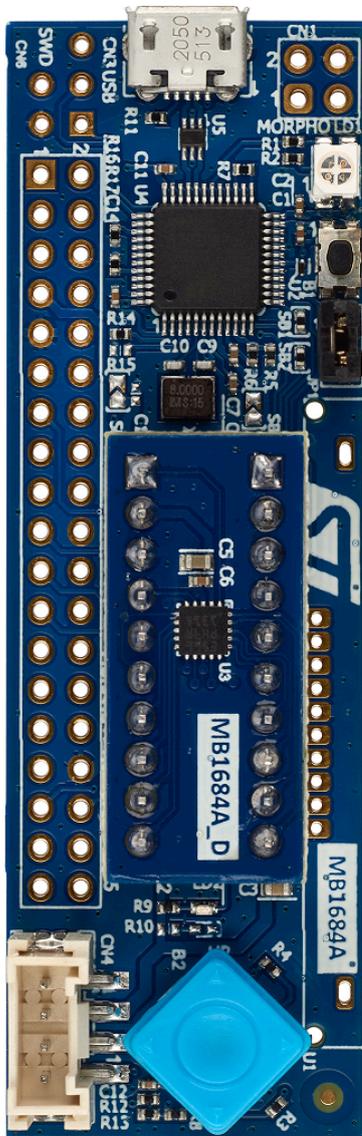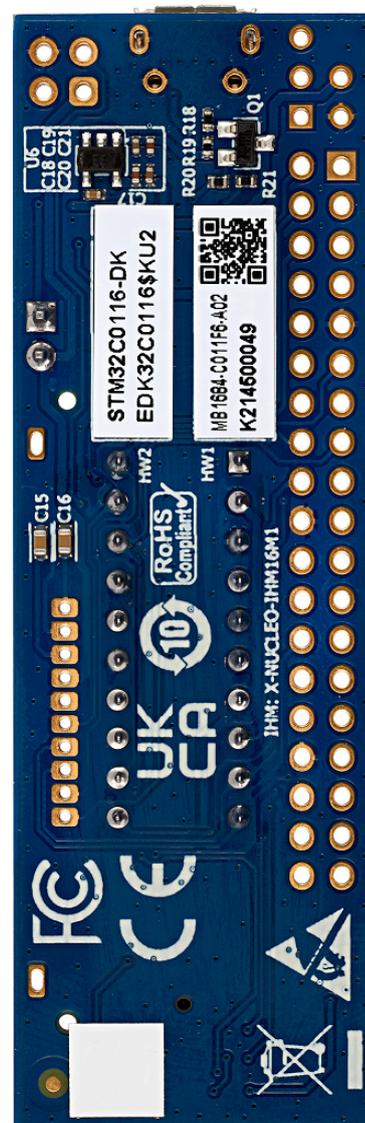
Figure 1. **STM32C0116-DK top view**

Figure 2. **STM32C0116-DK bottom view**

Pictures are not contractual.

UM2970 - Rev 2 - November 2022
For further information contact your local STMicroelectronics sales office.

www.st.com

1 Features

- STM32C011F6 Arm® Cortex®-M0+ core-based microcontroller with 32 Kbytes of flash memory and 6 Kbytes of RAM, in a UFQFPN20 package
- User LED
- Reset push-button
- 5-way joystick using a single ADC input pin
- Individual STM32 UFQFPN20 to DIL20 module
- Board connectors:
  - USB Micro-B
  - DIL20 socket
  - Dedicated LCD footprint
  - Grove (UART)
  - 2 x 10-pin headers for MCU daughterboard
  - Extension connectors
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage and debug port
- Comprehensive free software libraries and examples available with the STM32Cube MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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

arm

2 Ordering information

To order the STM32C0116-DK Discovery kit, refer to Table 1. For a detailed description, refer to its user manual on the product web page. Additional information is available from the datasheet and reference manual of the target microcontroller.

Table 1. List of available products

Order code	Board reference	User manual	Target STM32
STM32C0116-DK	• MB1684	UM2970	STM32C011F6U6

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

STM32C0XXY-DK	Description	Example: STM32C0116-DK
STM32C0	MCU series in STM32 32-bit Arm Cortex MCUs	STM32C0 Series
XX	MCU product line in the series	STM32C0x1 product line
Y	STM32 flash memory size: • 6 for 32 Kbytes	32 Kbytes
DK	Discovery kit	Discovery kit

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®
- 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

- IAR Systems® - IAR Embedded Workbench®[1]
- Keil® - MDK-ARM[1]
- STMicroelectronics - STM32CubeIDE

1. *On Windows® only.*

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*.

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 fitted between Pin 1 and Pin 2
Solder bridge SBx ON	SBx connections closed by 0 Ω resistor
Solder bridge SBx OFF	SBx connections left open
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered
Capacitor Cx ON	Capacitor soldered
Capacitor Cx OFF	Capacitor not soldered

5 Quick start

Before installing and using the product, accept the Evaluation Product License Agreement from the *www.st.com/epla* webpage. For more information on the STM32C0116-DK Discovery kit and demonstration software, visit the STM32C0116-DK product webpage.

5.1 Getting started

Follow the sequence below to configure the Discovery kit and launch the demonstration application (Refer to Figure 3 for component location):

1. Check the JP1 jumper position on the board (Refer to Table 4).
2. For the correct identification of the device interfaces from the host PC and before connecting the board, install the ST-LINK/V2-1 USB driver, available on the *www.st.com* website.
3. To power the board, connect the Discovery kit to a PC with a USB Type-A or USB Type-C$^®$ to Micro-B cable through the CN3 USB connector of the board.
4. Then, the LD1 COM red LED lights up, and the LD3 green LED blinks.
5. The demonstration software, as well as other software examples for exploring features, are available in STM32C0116-DK product web page.

Table 4. Jumper configuration

Jumper	Definition	Position[1]	Comment
JP1	IDD	**ON**	For current measurement

1. *Default jumper state is in bold.*

6 Hardware layout and configuration

Figure 3 and Figure 4 show the location of the STM32C0116-DK features. The mechanical dimensions of the board are shown in Figure 5.
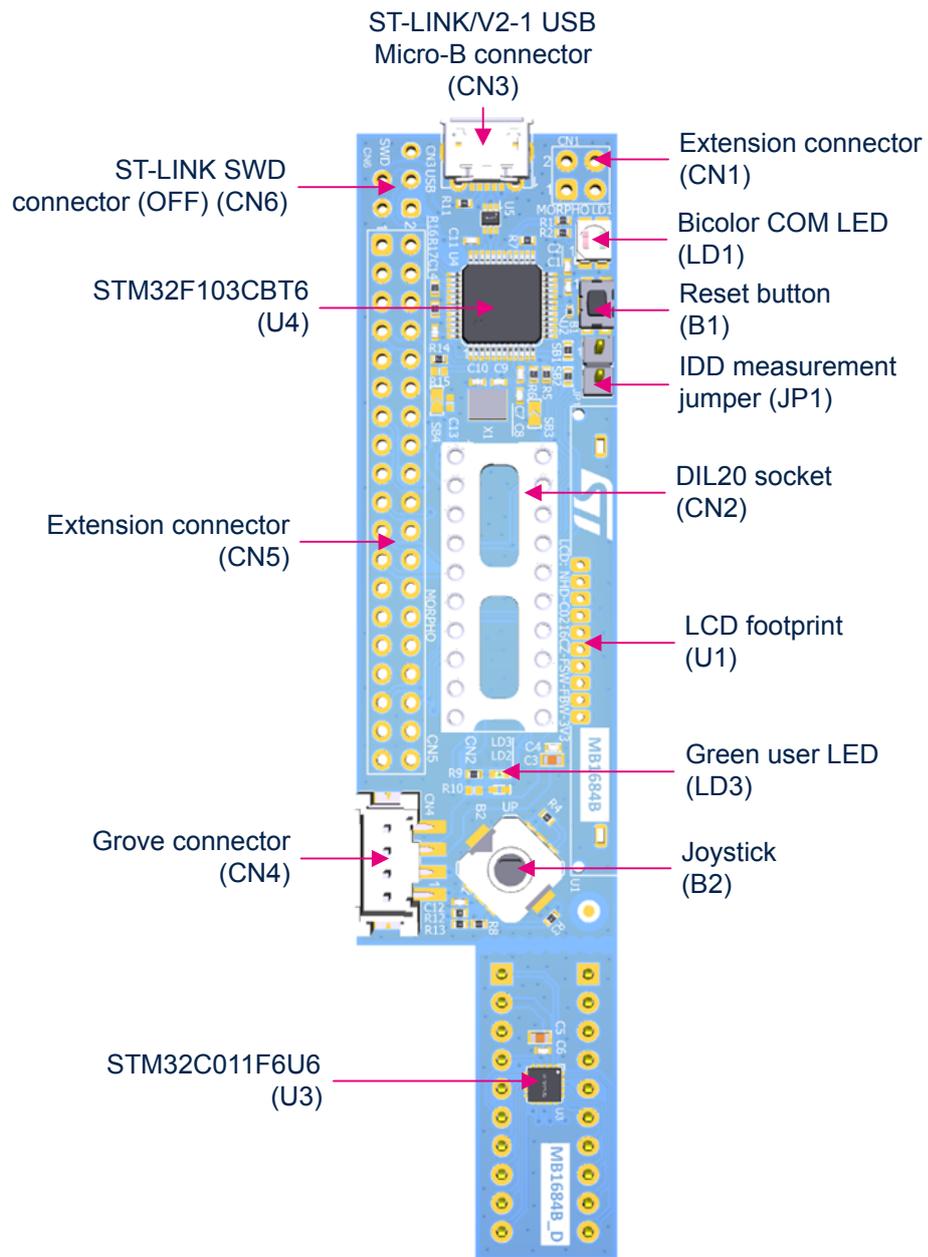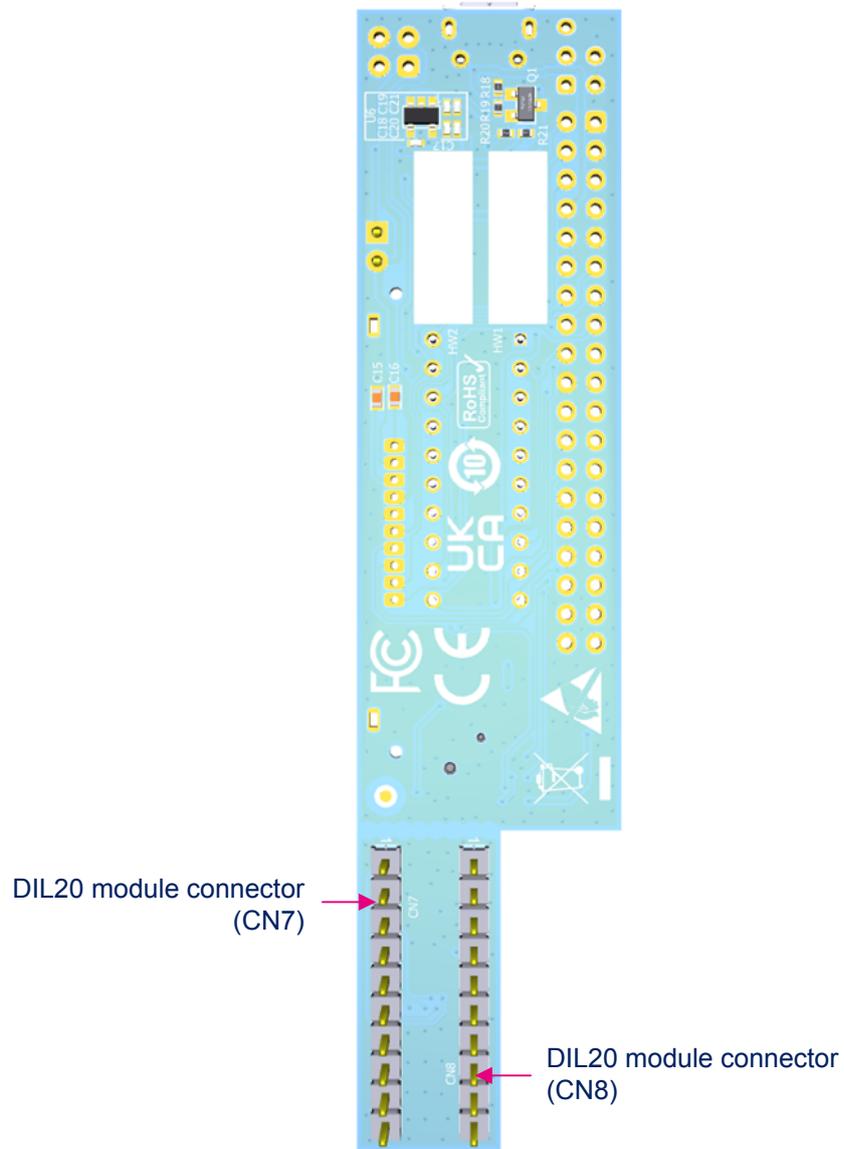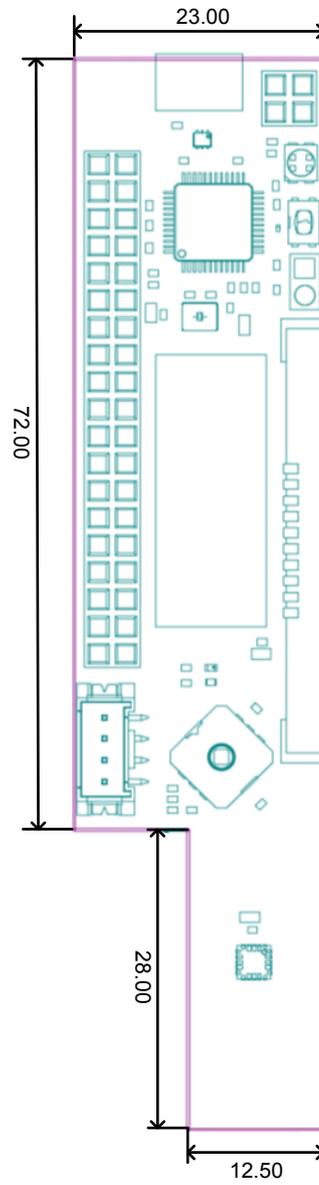
6.1 PCB layout

Figure 3. PCB layout (top view)

Figure 4. PCB layout (bottom view)

DIL20 module connector
(CN7)

DIL20 module connector
(CN8)

6.2 Mechanical drawing

Figure 5. Board mechanical drawing (in millimeters)

6.3 Embedded ST-LINK/V2-1

The embedded ST-LINK/V2-1 supports only the SWD for STM32 devices.

The ST-LINK/V2-1 programming and debugging tool is integrated into the STM32C0116-DK Discovery kit. For information about debugging and programming features, refer to the user manual *ST-LINK/V2 in-circuit debugger/ programmer for STM8 and STM32* (UM1075), and the technical note *Overview of ST-LINK derivatives* (TN1235), which describe in detail all the ST-LINK/V2 features.

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

•   USB software re-enumeration

•   Mass storage interface on USB

•   USB power management request for more than 100 mA power on USB

Known limitation:

•   Activating the readout protection on the STM32 target prevents the target application from running afterward. The target readout protection must be kept disabled on ST-LINK/V2-1 boards.

6.3.1 Drivers

The ST-LINK/V2-1 requires a dedicated USB driver, which, for Windows 7® and Windows 8®, is found at *www.st.com*. For Windows 10®, it is not necessary to install the driver, as the ST-LINK is automatically identified.

In case the STM32C0116-DK Discovery kit is connected to the PC before the driver is installed, some Discovery board 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 as shown in Figure 6.

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

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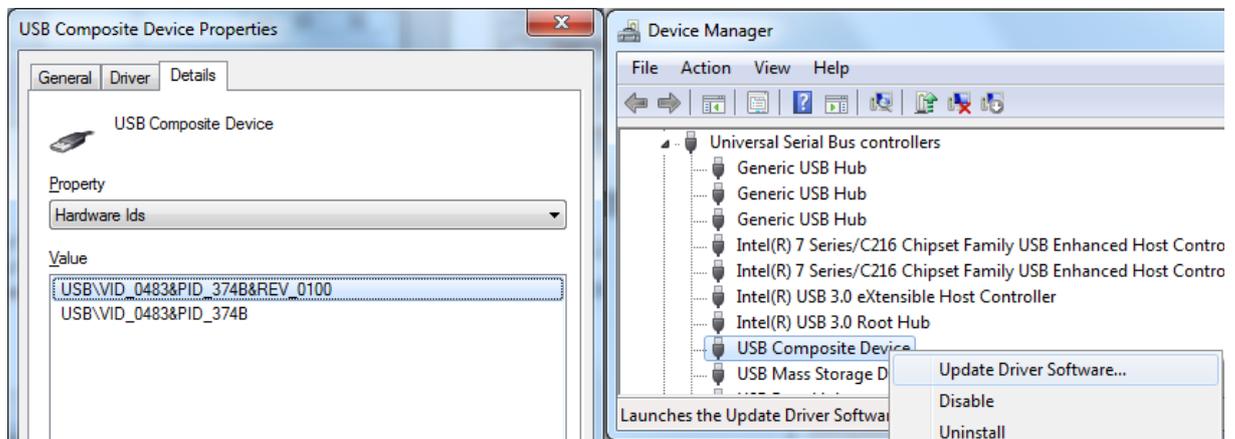
6.3.2 ST-LINK/V2-1 firmware upgrade

The ST-LINK/V2-1 embeds a firmware upgrade mechanism for the in-situ upgrade through the USB port. As the firmware may evolve during the lifetime of the ST-LINK/V2-1 product (for example new functionalities, bug fixes, support for new microcontroller families), it is recommended to visit the www.st.com website before starting to use the STM32C0116-DK Discovery kit and periodically, to stay up-to-date with the latest firmware version.

6.4 Power supply

The STM32C0116-DK Discovery kit is designed to be powered using the CN3 ST-LINK/V2-1 USB connector.

6.5 Board functions

6.5.1 LEDs

LD1 ST-LINK COM LED

The LD1 green and red bicolor LED provides information about the ST-LINK communication status. LD1 default color is red. LD1 turns green to indicate that the communication is in progress between the PC and ST-LINK, with the following setup:

- Blinking red: The first USB enumeration with the PC is taking place
- Red LED ON: When the initialization between the PC andST-LINK is complete
- Blinking red or green: During programming and debugging with target
- Orange ON: Communication failure

LD3 user LED

This green LED is connected to the PB6 GPIO of the STM32C011F6 microcontroller. To light this LED, a LOW logic state must be written in the corresponding GPIO.

6.5.2 Push-buttons

B1 Reset/user button

This push-button is connected to NRST (PF2-NRST) and is used to reset the STM32C0 Series microcontroller or to generate a user event.

B2 joystick

This joystick is a 5-way rock switch using a single ADC input pin (PA8). Push-in "Select" can be used as a digital user button and EXTI wakeup interrupt. The joystick position for the ADC value refers to Table 5.

Table 5. Joystick position versus ADC value

Joystick position	Measurement ratio	ADC value (in volts)
Select	0	0
Left	0.20	0.67
Down	0.40	1.32
Up	0.61	2.01
Right	0.80	2.65
No key pressed	1.0	3.3

6.5.3 IDD current consumption measurement

The IDD-labeled JP1 jumper is used to measure the STM32C0 Series microcontroller consumption by removing the jumper and by connecting an ammeter.

- JP1 ON: The STM32C0 Series microcontroller is powered by 3V3 voltage (default).
- JP1 OFF: An ammeter must be connected to measure the STM32C0 Series microcontroller current. If there is no ammeter, the microcontroller is not powered.

6.5.4 Solder bridges

The solder bridges are located on the top layer of STM32C0116-DK. Their configuration appears in Table 6.

Table 6. Solder bridge configuration

Solder bridge control	Solder bridge (SB)	State[1]	Description
ST-LINK reset	SB3	ON	ST-LINK in the Reset state
		OFF	ST-LINK in normal operation
VCP interface	SB1/SB2	**ON**	VCP connect STLK and MCU on board
		OFF	VCP is used as GPIO
AVDD	SB4	ON	VDD provides power to AVDD
		OFF	VDD does not provide power to AVDD

1. *Default solder bridge state is in bold*

7 Board connectors

7.1 CN2 DIL20 socket

An STM32 device mounted on a DIL20 module can be programmed or debugged by plugging it into the CN2 socket. The DIL20 socket pinout is detailed in Table 7.

Table 7. DIL20 socket pinout

Connector	Pin number	Pin name	Port
CN2	1	PC15-OSCX_OUT	Not used
	3	VDD	Power supply
	5	GND	Ground
	7	PF2-NRST	RESET or USER button
	9	PA0	Not used
	11	PA1	Not used
	13	PA2	Grove_USART2_TX
	15	PA3	Grove_USART2_RX
	17	PA4	LCD_SPI1_NSS
	19	PA5	LCD_SPI1_SCK
	2	PA6	LCD_SPI1_MISO
	4	PA7	LCD_SPI1_MOSI
	6	PA8	Joystick with ADC
	8	PA11 [PA9]	VCP_USART1_TX remap to PA9
	10	PA12 [PA10]	VCP_USART1_RX remap to PA10
	12	PA13	Serial wire debug I/O
	14	PA14-BOOT0	Serial wire clock
	16	PB6	User LED
	18	PB7	Not used
	20	PC14-OSCX_IN	Not used

7.2 CN4 Grove connector

The CN4 Grove connector is a 4-pin UART connector. It is described in Table 8.

Table 8. CN4 Grove connector pinout

Connector	Pin number	Pin name	Port
CN4	1	PA3	USART2_RX for receiver
	2	PA2	USART2_TX for transmitter
	3	VDD	3.3 V power supply
	4	GND	Ground

7.3 CN1/CN5 extension connectors

The extension connectors are available on the STM32C0116-DK Discovery kit to support flexibility in user applications. It is described in Table 9.

Table 9. CN1/CN5 extension connectors

Connector	Pin number	Pin name	Port
CN1	1	VDD	-
	2	GPIO	PA2
	3	NC	-
	4	GND	-
CN5	1	NC	-
	3	NC	-
	5	NC	-
	7	AVDD	-
	9	GND	-
	11	GPIO	PA7
	13	GPIO	PA4
	15	GPIO	PA8
	17	NC	-
	19	GPIO	PC14
	21	GPIO	PA1
	23	GPIO	PA0
	25	NC	-
	27	NC	-
	29	NC	-
	31	NC	-
	33	GPIO	PB6
	35	NC	-
	37	NC	-
	2	GPIO	PC15
	4	GPIO	PB7
	6	GPIO	PA9
	8	5V	-
	10	NC	-
	12	NC	-
	14	NC	-
	16	GPIO	PA6
	18	GPIO	PA3
	20	GND	-
	22	NC	-
	24	NC	-
	26	GPIO	PA5
	28	NC	-
	30	NC	-
	32	GND	-
	34	GPIO	PA10
	36	NC	-
	38	NC	-

7.4 U1 LCD connector

The LCD connector described in Table 10 is a footprint example for the NHD-C0216CZ-FSW-FBW-3V3.

Table 10. LCD connector

Connector	Pin number	Pin name	Port
U1	1	NRST	Reset signal
	2	PA6	LCD_SPI1_MISO for the register select signal
	3	PA4	LCD_SPI1_NSS for the chip select signal
	4	PA5	LCD_SPI1_SCK for the serial clock
	5	PA7	LCD_SPI1_MOSI for the data serial input
	6	GND	Ground
	7	VDD	3.3 V power supply
	8	VOUT	DC/DC voltage converter
	9	C1+	Voltage booster circuit
	10	C1-	Voltage booster circuit
	A	A	No connection
	K	K	No connection

8   STM32C011F6 I/O assignment

The STM32C011F6 pin-out can be directly transposed to the DIL20 module pin-out, as shown in Table 11.

Table 11. STM32C011F6 I/O assignment

Pin number	Pin name	Description
1	PC15-OSCX_OUT	Not used
2	VDD	Power supply
3	VSS	Ground
4	PF2-NRST	RESET or USER button
5	PA0	Not used
6	PA1	Not used
7	PA2	Grove_USART2_TX
8	PA3	Grove_USART2_RX
9	PA4	LCD_SPI1_NSS
10	PA5	LCD_SPI1_SCK
11	PA6	LCD_SPI1_MISO
12	PA7	LCD_SPI1_MOSI
13	PA8	Joystick with ADC
14	PA11 [PA9]	VCP_USART1_TX remap to PA9
15	PA12 [PA10]	VCP_USART1_RX remap to PA10
16	PA13	Serial wire debug I/O
17	PA14-BOOT0	Serial wire clock
18	PB6	User LED
19	PB7	Not used
20	PC14-OSCX_IN	Not used

9 STM32C0116-DK product information

9.1 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.

9.2 STM32C0116-DK product history

Table 12. Product history

Order code	Product identification	Product details	Product change description	Product limitations
STM32C0116-DK	DK32C0116$KU1	MCU: • STM32C011F6U6 silicon revision "Z" MCU errata sheet: • *STM32C011xx device errata* (ES0569) Board: • MB1684-C0116-B01 (main board)	Initial revision	No limitation

9.3 Board revision history

Table 13. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1684 (main board)	C0116-B01	Initial revision	No limitation

UM2970

Federal Communications Commission (FCC) and Innovation, Science and Economic Development Canada (ISED) Compliance Statements

10 Federal Communications Commission (FCC) and Innovation, Science and Economic Development Canada (ISED) 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 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 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 (in the USA)

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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 (B) / NMB-3 (B).

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 (B) / NMB-3 (B).

Revision history

Table 14. Document revision history

Date	Revision	Changes
16-Feb-2022	1	Initial release.
3-Nov-2022	2	Updated description of CN1 and CN5 connectors in Figure 3. PCB layout (top view) and Section 7.3 CN1/CN5 extension connectors.
		Updated Section 9 STM32C0116-DK product information.

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