

Getting started with the X-STM32MP-MSP01 expansion board for the STM32MP157F-DK2 discovery kit

Introduction

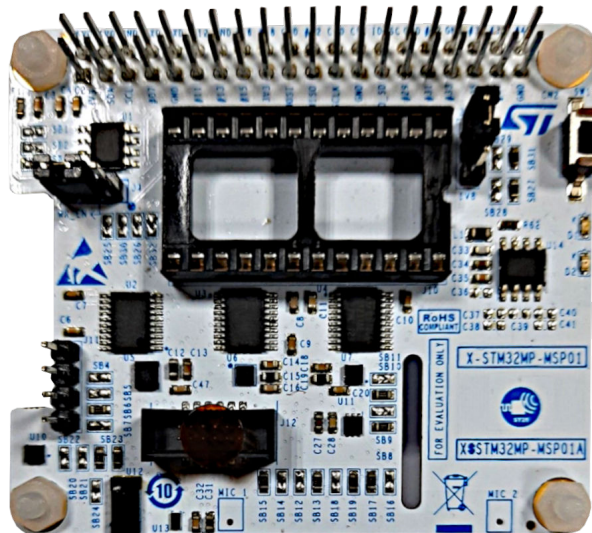
The X-STM32MP-MSP01 multisensor expansion board embeds the following devices:

- the ISM330DHCX iNEMO 3-axis accelerometer and 3-axis gyroscope
- the IIS2MDC 3-axis magnetometer
- the IIS2DLPC 3-axis accelerometer
- the MP23DB02MM digital microphone
- the LPS22HH pressure sensor
- the STTS22H temperature sensor
- the VL53L5CX Time-of-Flight sensor
- the VD6283TX ambient light sensor
- the ST25DV64KC NFC RFID tag

The X-STM32MP-MSP01 interfaces with the STM32MP157F-DK2 microprocessor via a 40-pin GPIO connector, using I²C, SPI, and GPIO peripherals.

The X-STM32MP-MSP01 expansion board is compatible with both the STM32MP157F-DK2 and Raspberry Pi GPIO expansion connector layout.

Figure 1. X-STM32MP-MSP01 expansion board



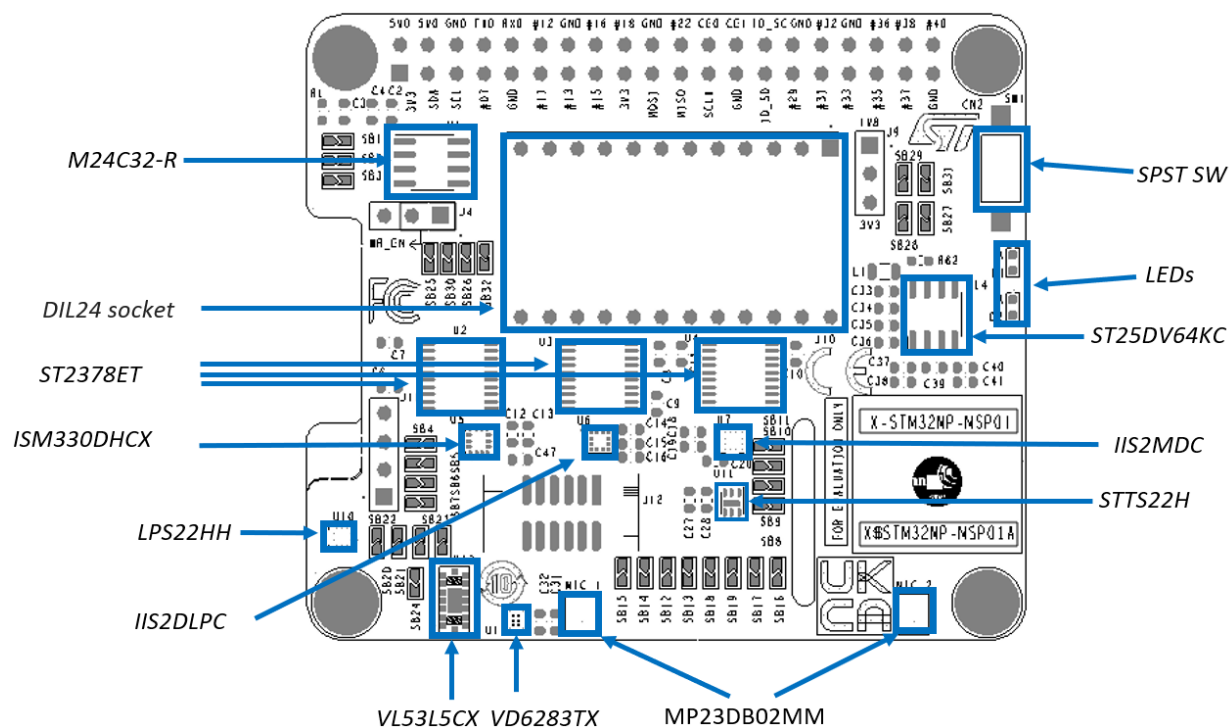
1 Getting started

1.1 Overview

The X-STM32MP-MSP01 is powered via a standard 3.3 V supply through the STM32MP157F-DK2 GPIO connector.

The figure below shows the component placement on the board.

Figure 2. X-STM32MP-MSP01 component placement details

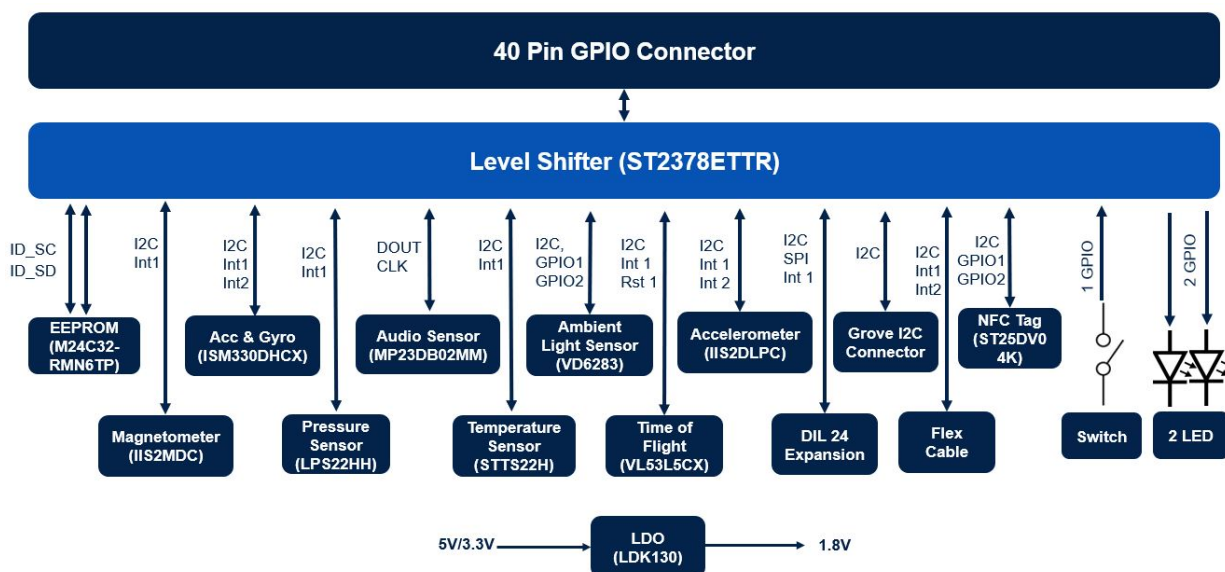


The X-STM32MP-MSP01 interfaces with the main board via an I²C interface along with some GPIO pins for interrupts. A DIL 24-pin socket is available for additional MEMS adapters and other sensors.

The I²C sensor hub features on the ISM330DHCX are also available by using solder bridges.

The expansion board mounts an LDO to generate 1.8 V for all the MEMS sensors. A level shifter between 1.8 V and 3.3 V translates all the signals between the sensors and the main board. Two LEDs and one switch are available on the board as the user interface.

Figure 3. System block diagram



1.2 System requirements

To test the **X-STM32MP-MSP01**, you need:

- an **X-STM32MP-MSP01** expansion board
- an **STM32MP157F-DK2** discovery kit
- a laptop/desktop (with Windows 10 or above)
- a USB Type-A to micro-B USB cable (for connection as a virtual serial device, if required)
- a USB PD compliant 5 V 3 A power supply with a USB Type-C® to Type-C® cable.

1.3 Board setup

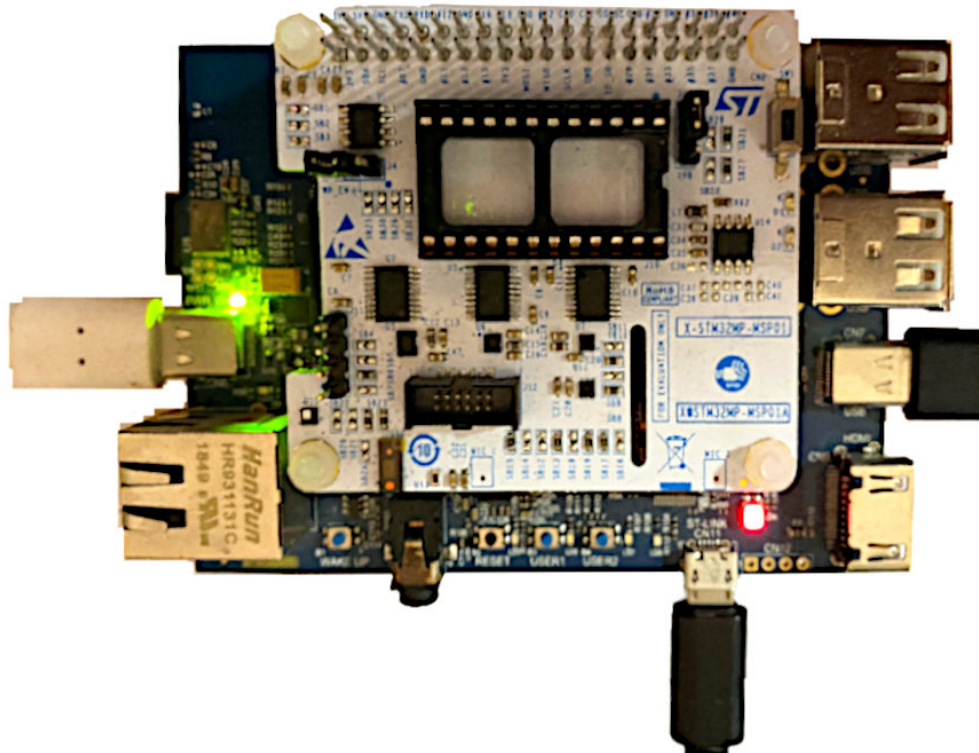
To set up the board, follow the steps below.

- Step 1.** Check the position of the jumper on the J4 connector.
This jumper enables the write operation for the EEPROM, if required.

- Step 2.** Connect the X-STM32MP-MSP01 to the STM32MP157F-DK2 from the top, as shown below. Ensure that pin 1 of the X-STM32MP-MSP01 board matches with the pin 1 of the STM32MP157F-DK2 board. Pin 1 can be identified as rectangular footprint pad on both the boards.

Note: Boards can damage if not connected properly.

Figure 4. X-STM32MP-MSP01 connected to STM32MP157F-DK2



- Step 3.** Power the STM32MP157F-DK2 using the USB Type-C® cable.
- Step 4.** Program the supported firmware in the microSD™ card of the STM32MP157F-DK2 board. The X-STM32MP-MSP01 board is ready for use.

2 Component description

2.1 EEPROM: M24C32-R

The **M24C32-R** is a 32-Kbit I²C-compatible EEPROM, organized as 4 K × 8 bits. It can operate with a supply voltage from 1.8 V to 5.5 V

Table 1. EEPROM details

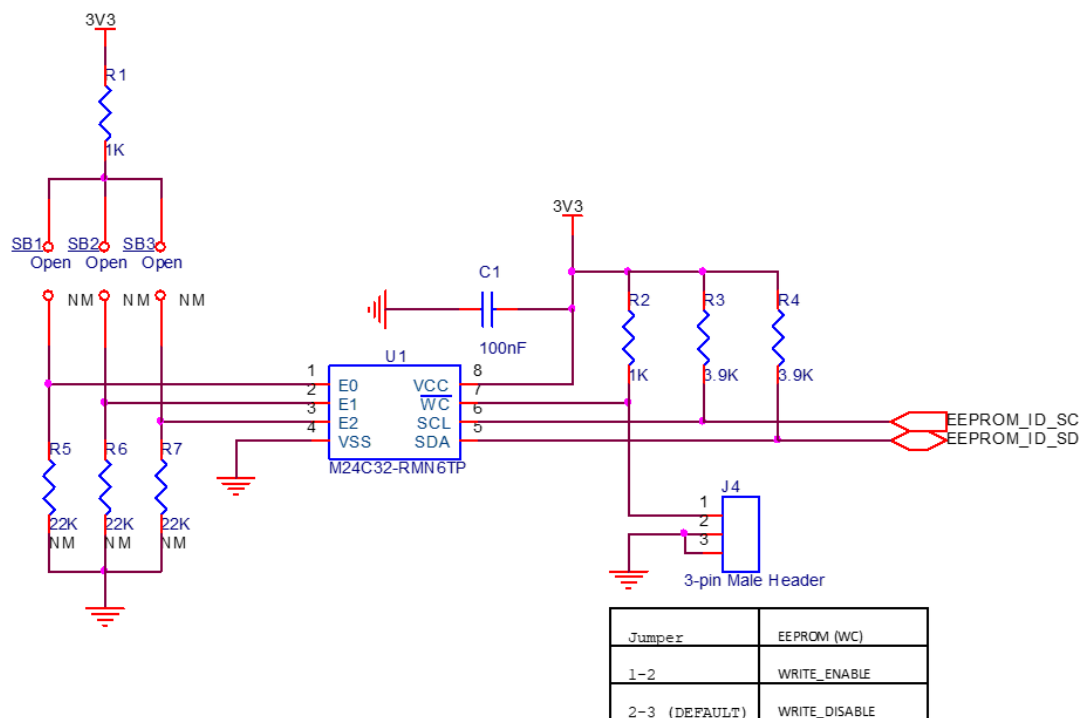
Features	Description
Order code	M24C32-RMN6TP
Package	SO8
Operating voltage	1.8 V to 5.5 V

The EEPROM communicates with the **X-STM32MP-MSP01** through I²C signals. The J4 jumper enables the write enable feature on the device. You can perform the read and write operation by setting the jumper as detailed in the following table.

Table 2. EEPROM jumper details

Jumper	EEPROM
1-2	WRITE_ENABLE
2-3 (default)	WRITE_DISABLE

Figure 5. EEPROM section



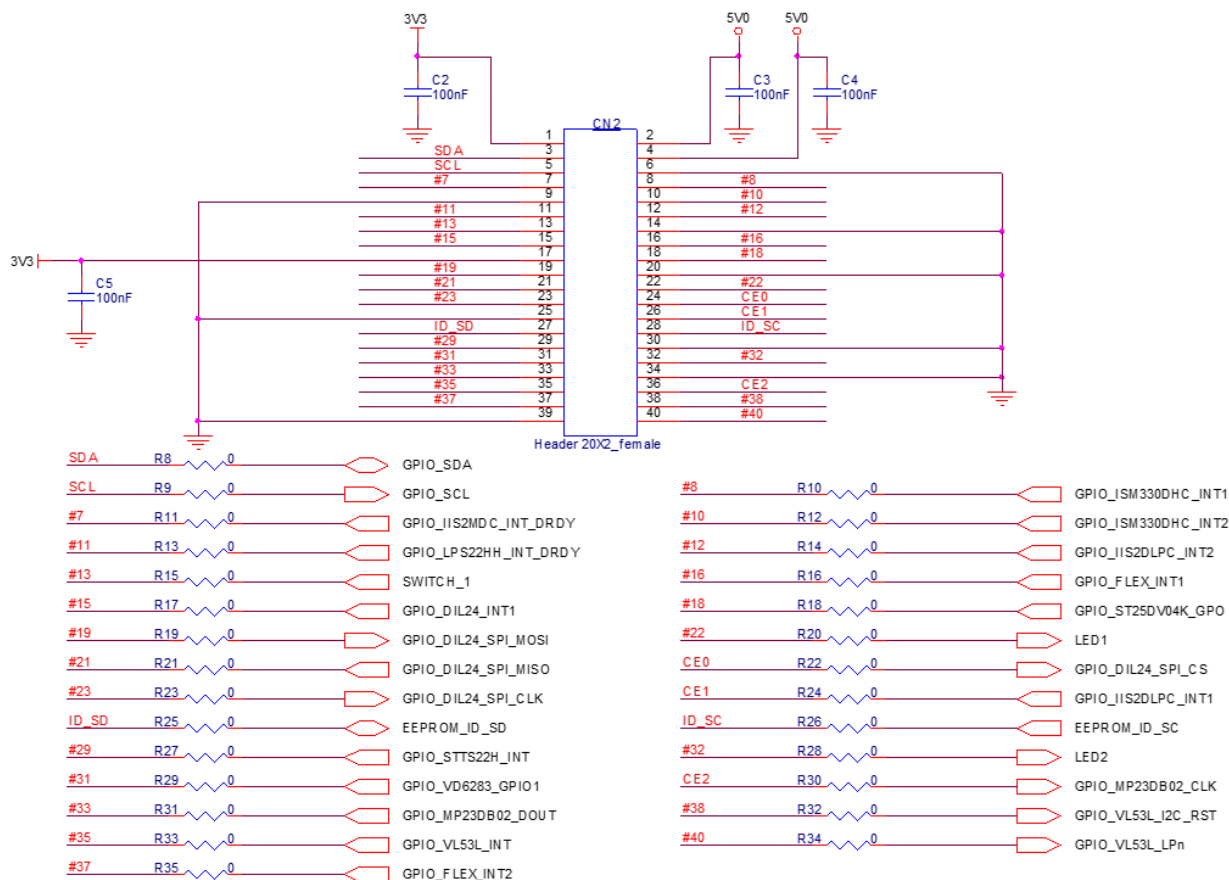
2.2 40-pin GPIO connector

The on-board devices are controlled through the main board using various peripheral pins available on a 40-pin GPIO connector. The series resistors are used to isolate the pins of the GPIO connector.

Table 3. GPIO connector pin configuration

Pin no.	Name	ST MPU	RPI	Pin no.	Name	ST MPU	RPI
1	3V3			2	5V0		
3	SDA	PA12 / I2C5_SDA	GPIO 2/ I2C1_SDA	4	5V0		
5	SCL	PA11 / I2C5_SCL	GPIO3 / I2C1_SCL	6	GND		
7	GPIO_IIS2MDC_INT_DRDY	PA8/ MCO1	GPIO4 / GPCLK0	8	GPIO_ISM330DHC_INT1	PB10 / USART3_TX	GPIO0 / USART3_TX
9	GND	GND		10	GPIO_ISM330DHC_INT2	PB12 / USART3_RX	GPIO0 / USART3_RX
11	GPIO_LPS22HH_INT_DRDY	PG8 / USART3_RTS	GPIO17 / UART1_RTS	12	GPIO_IIS2DLPC_INT2	PI5 / SAI2_SCKA	GPIO18 / PCM CLK
13	SWITCH_1	PD7 / SDMMC3_D3	GPIO27	14	GND		
15	GPIO_DIL24_INT1	PG15 / SDMMC3_CK	GPIO22	16	GPIO_FLEX_INT1	PF1 / SDMMC3_CMD	GPIO23 / SD0 CMD
17	3V3			18	GPIO_ST25DV04K_GPO	PF0 / SDMMC3_D0	GPIO24 / SD0 DAT0
19	GPIO_DIL24_SPI_MOSI	PF9/ SPI5_MOSI	GPIO10 / SPI0_MOSI	20	GND		
21	GPIO_DIL24_SPI_MISO	PF8 / SPI5_MISO	GPIO9 / SPI0_MISO	22	LED1	PF4 / SDMMC3_D1	GPIO25 / SD0 DAT1
23	GPIO_DIL24_SPI_CLK	PF7 / SPI5_SCK	GPIO11 / SPI0_SCK	24	GPIO_DIL24_SPI_CS	PF6 / SPI5_NSS	GPIO8 / SPI0 CE0
25	GND			26	GPIO_IIS2DLPC_INT1	PF3 / GPIO7	GPIO7 / SPI0 CE1
27	EEPROM_ID_SD	PF15/ I2C1_SDA	GPIO0/ I2C0_SDA	28	EEPROM_ID_SC	PD12 / I2C1_SCL	GPIO1 / I2C0_SCL
29	GPIO_STTS22H_INT	PG2/ MCO2	GPIO5 / GPCLK1	30	GND		
31	GPIO_VD6283_GPIO1	PH11 / TIM5_CH2	GPIO6 / GPCLK2	32	LED2	PD13 / TIM4_CH2	GPIO12 / PWM0
33	GPIO_MP23DB02_DOUT	PC7/ TIM3_CH2	GPIO13 / PWM1	34	GND		
35	GPIO_VL53L_INT	PI7 / SAI2_FSA	GPIO19 / PCM FS	36	GPIO_MP23DB02_CLK	PB13 / USART3_CTS	GPIO16 / UART1 CTS
37	GPIO_FLEX_INT2	PF5/ SDMMC3_D2	GPIO26 / SD0 DAT2	38	GPIO_VL53L_I2C_RST	PI6 / SAI2_SDA	GPIO20 / PCM DIN
39	GND			40	GPIO_VL53L_LPN	PF11 / SAI2_SDB	GPIO21 / PCM DOUT

Figure 6. GPIO connector circuit



2.3 Level translator: ST2378E

The **ST2378E** device is an 8-bit, dual supply, bidirectional level translator with ± 15 kV ESD protection on I/Os at VCC side. It is designed to interface data transfer between low voltage ASICs/PLDs and higher voltage systems. Externally applied voltage, VCC and VL, set logic levels at both sides with the range specified as $1.71 \text{ V} \leq \text{VL} \leq 5.5 \text{ V}$ and $\text{VL} \leq \text{VCC} \leq 5.5 \text{ V}$. For proper operation, VCC should be set higher than VL.

Using a transmission-gate-based design, this device allows bidirectional asynchronous data transfer. This means that each channel is allowed to have either VCC to VL or VL to VCC data transfer direction independently; no direction pin is required.

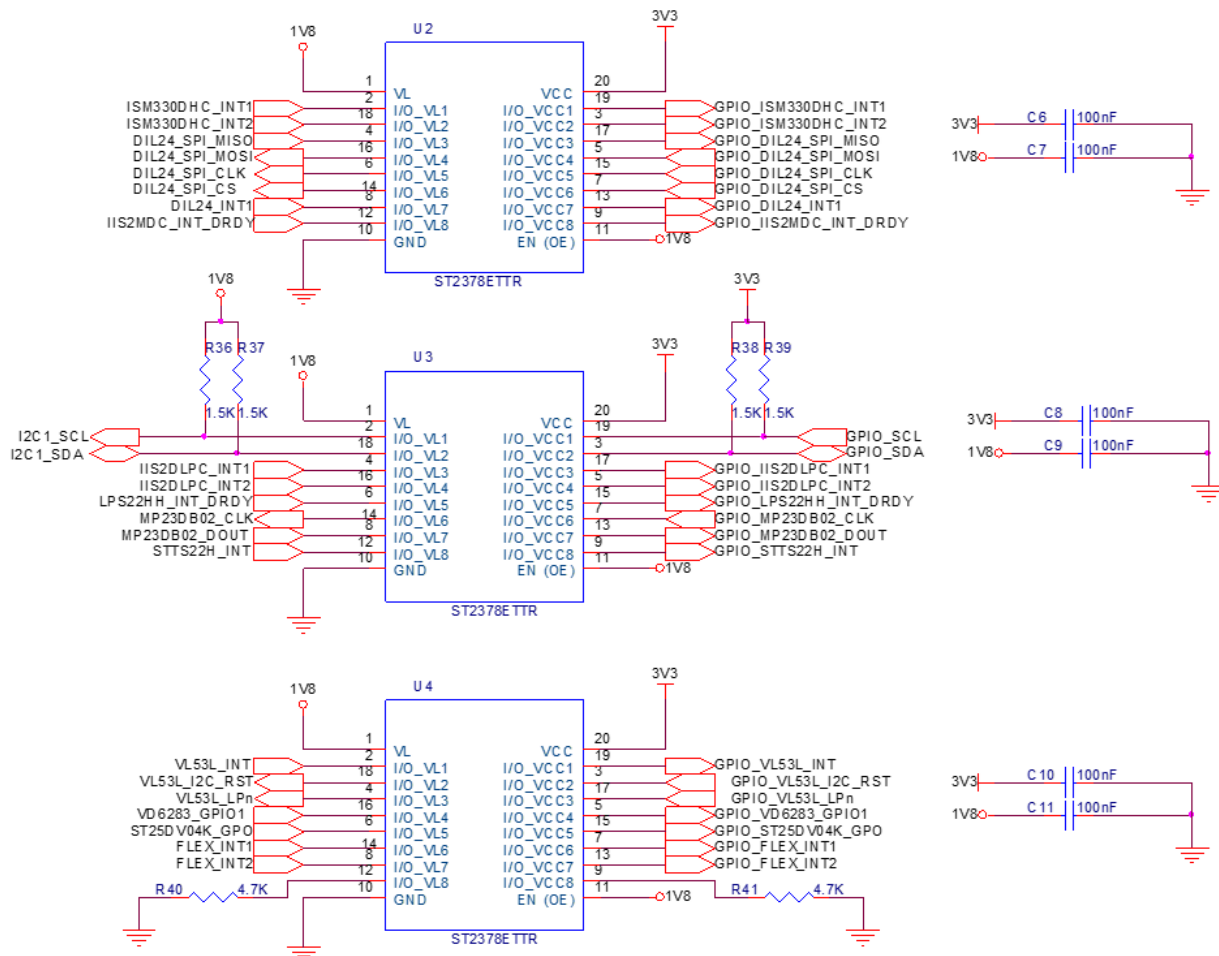
The **ST2378E** device operates at a guaranteed data rate of 13 Mbps over the entire specified operating voltage range. The OE pin allows the disable mode operation whereby the current consumption is reduced to less than 1 μA .

Table 4. ST2378E details

Features	Description
Order code	ST2378ETTR
Package	20-TSSOP
Operating voltage	1.71 V to 5.5 V

As all the on-board sensors operate at 1.8 V, the voltage is shifted before communicating with the 40-pin GPIO connector.

Figure 7. ST2378ETTR circuit



2.4

Accelerometer and gyroscope: ISM330DHCX

The **ISM330DHCX** is a system-in-package featuring a high-performance 3-axis digital accelerometer and 3-axis digital gyroscope tailored for Industry 4.0 applications. The sensing elements of the accelerometer and of the gyroscope are implemented on the same silicon die, thus guaranteeing superior stability and robustness.

The **ISM330DHCX** has a full-scale acceleration range of $\pm 2/\pm 4/\pm 8/\pm 16$ g and a wide angular rate range of $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000/\pm 4000$ dps that enable its usage in a broad range of applications.

An unmatched set of embedded features (machine learning core, programmable FSM, FIFO, sensor hub, event decoding, and interrupts) enable the implementation of smart and complex sensor nodes, which deliver a high performance at very low power.

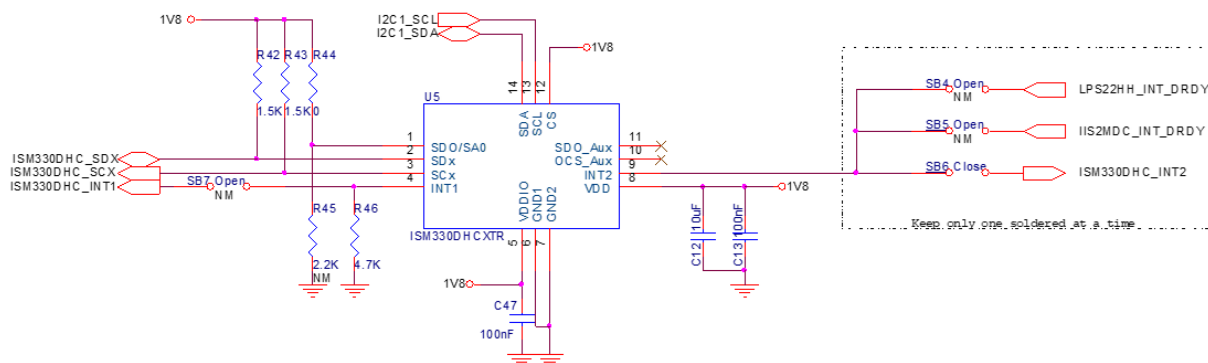
Table 5. ISM330DHCX details

Features	Description
Order code	ISM330DHCXTR
Package	14-LGA
Operating voltage	1.71 V to 3.6 V

All the design aspects and the calibration of the **ISM330DHCX** have been optimized to reach superior accuracy, stability, extremely low noise, and full data synchronization.

The **ISM330DHCX** has an I²C sensor hub, which allows it to behave as the I²C master for other slave devices connected via an I²C auxiliary bus. Various configurations are possible for different I²C bus connections with or without the **ISM330DHCX** sensor hub.

Figure 8. ISM330DHCXTR circuit



2.5 Linear accelerometer: IIS2DLPC

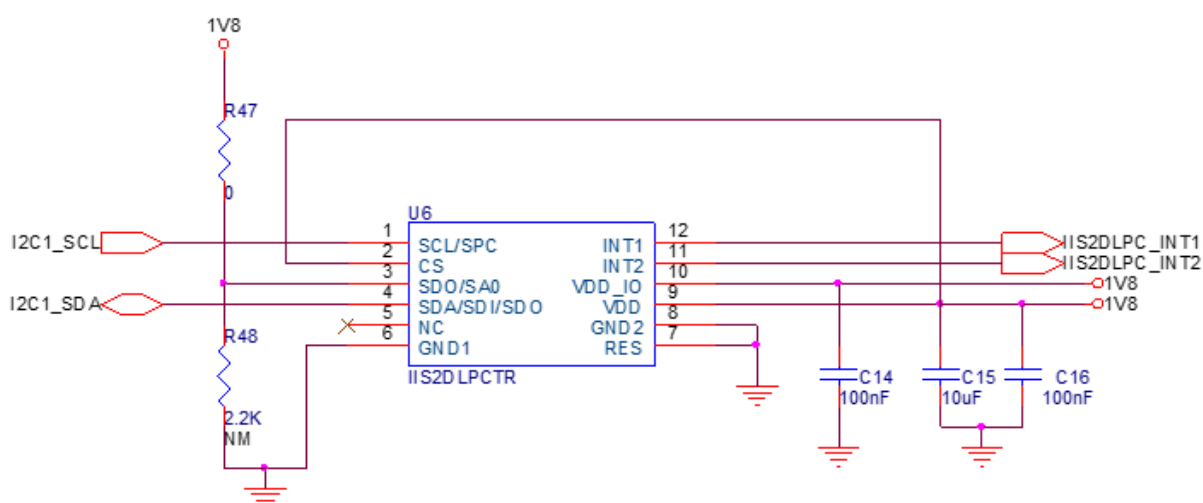
The **IIS2DLPC** is an ultra-low-power high-performance three-axis linear accelerometer with digital I²C/SPI output interface, which leverages on the robust and mature manufacturing processes already used for the production of micromachined accelerometers. The **IIS2DLPC** has user-selectable full scales of $\pm 2g/\pm 4g/\pm 8g/\pm 16g$ and is capable of measuring accelerations with output data rates from 1.6 Hz to 1600 Hz.

The **IIS2DLPC** has dedicated embedded features to process motion and acceleration detection including free-fall, wakeup, highly configurable single/double-tap recognition, activity/inactivity, stationary/motion detection, portrait/landscape detection, and 6D/4D orientation. It features a data-ready signal, which indicates when a new set of measured acceleration data is available, thus simplifying data synchronization in the digital system that uses the device.

Table 6. IIS2DLPCTR details

Features	Description
Order code	IIS2DLPCTR
Package	12-LGA
Operating voltage	1.62 V to 3.6 V

Figure 9. IIS2DLPCTR circuit



2.6 Magnetic sensor: IIS2MDC

The **IIS2MDC** is a high-accuracy, ultra-low-power 3-axis digital magnetic sensor. The **IIS2MDC** has a magnetic field dynamic range up to ± 50 gauss.

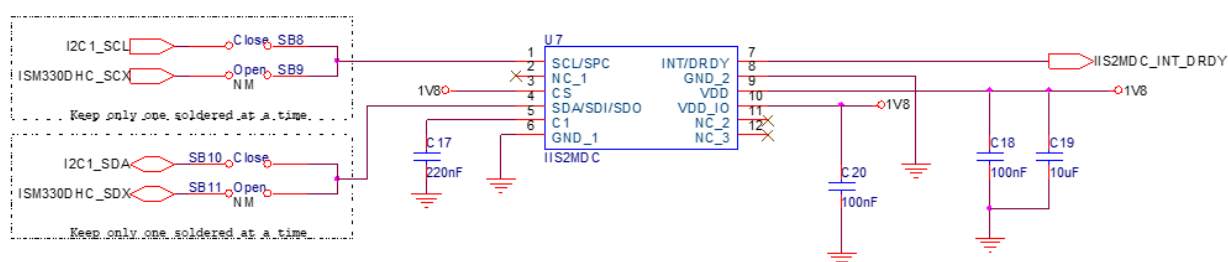
The **IIS2MDC** includes an I²C serial bus interface that supports standard, fast mode, fast mode plus, and high-speed (100 kHz, 400 kHz, 1 MHz, and 3.4 MHz).

The device can be configured to generate an interrupt signal for magnetic field detection. It can be used as a slave device with the **ISM330DHCX** device configured as a master using the solder bridge configuration.

Table 7. IIS2MDC details

Features	Description
Order code	IIS2MDCTR
Package	12-LGA
Operating voltage	1.71 V to 3.6 V

Figure 10. IIS2MDC circuit



2.7

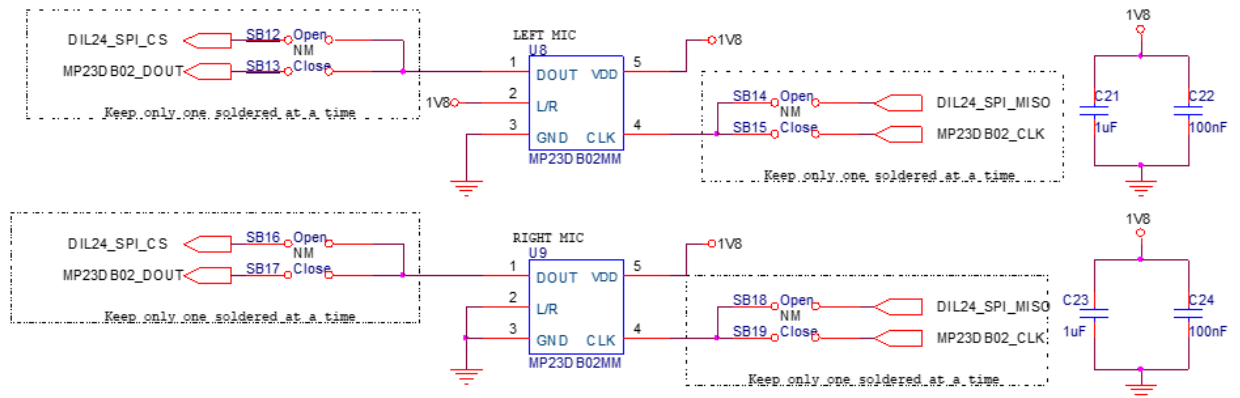
Microphone: MP23DB02MM

The **MP23DB02MM** is an ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface with optional stereo configuration. The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process dedicated to produce audio sensors. It has a narrow sensitivity range of ± 1 dB, high SNR, and low distortion for all operative modes.

Table 8. MP23DB02MM details

Features	Description
Order code	MP23DB02MMTR
Package	RHLGA 5LD

Two digital microphones are available on the board to give flexibility for different configurations. Both are mounted from the bottom with hole on the PCB to input the audio signal. **MP23DB02MM** offers multiple performance modes enabled by different clock frequency ranges (power down, low power, and normal mode).

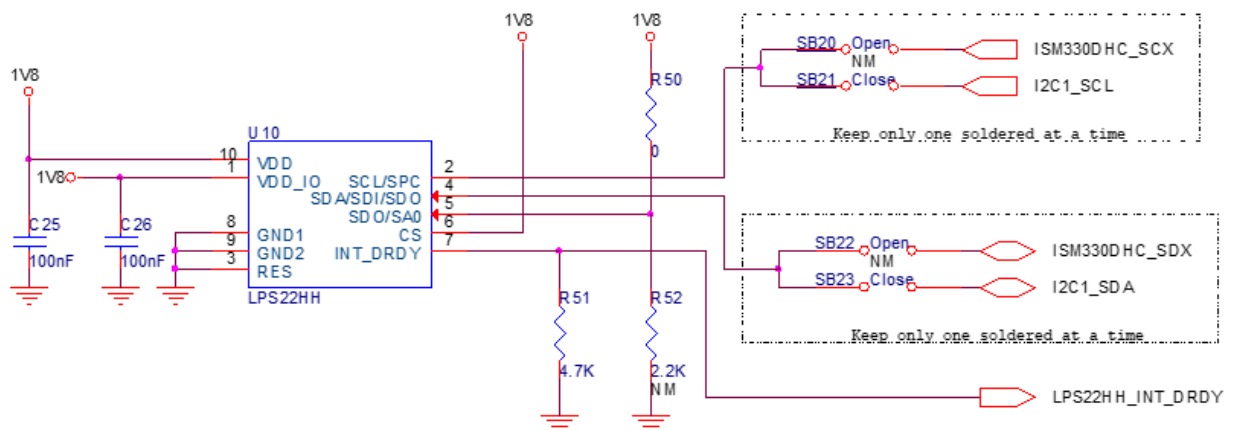
Figure 11. MP23DB02MM circuit


2.8 Pressure sensor: LPS22HH

The **LPS22HH** is an ultra-compact piezoresistive absolute pressure sensor, which functions as a digital output barometer. The device comprises a sensing element and an IC interface, which communicates through I²C, MIPI I3CSM, or SPI from the sensing element to the application. It can be used as a slave device with the **ISM330DHCX** device configured as a master using the solder bridge configuration.

Table 9. LPS22HH details

Features	Description
Order code	LPS22HHTR
Package	10-HLGA
Operating voltage	1.7 V to 3.6 V

Figure 12. LPS22HH circuit


2.9 Temperature sensor: STTS22H

The **STTS22H** is an ultra-low-power, high accuracy, digital temperature sensor offering high performance over the entire operating temperature range. The **STTS22H** is a band gap temperature sensor coupled with an A/D converter, signal processing logic, and an I²C/SMBus 3.0 interface all in a single ASIC.

The **STTS22H** is factory-calibrated and requires no additional calibration efforts on the customer side.

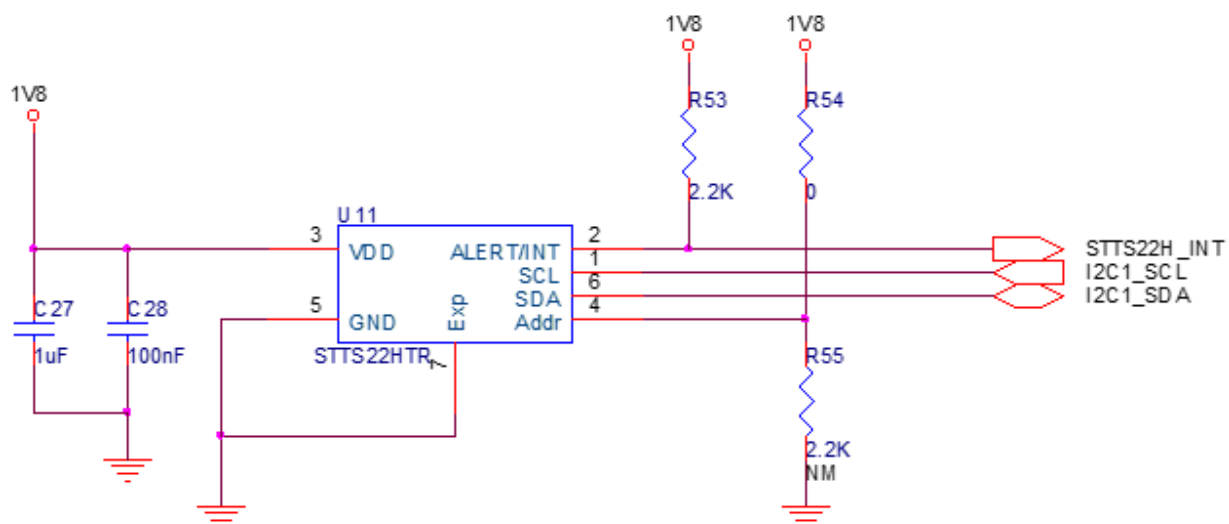
The **STTS22H** units are 100% tested on a production setup that is NIST traceable and verified with equipment that is calibrated in accordance with the IATF 16949:2016 standard.

By connecting the Addr pin to either GND or VDD, two different addresses can be specified. An interrupt pin is also available to signal the application whenever the user-selectable high and low threshold have been exceeded.

Table 10. STTS22HTR details

Features	Description
Order code	STTS22HTR
Package	6-UDFN
Operating voltage	1.5 V to 3.6 V

Figure 13. STTS22HTR circuit



2.10 Time-of-Flight sensor: VL53L5CX

The **VL53L5CX** is a state of the art, Time-of-Flight (ToF), multizone ranging sensor, housed in a miniature reflowable package. It integrates a SPAD array, physical infrared filters, and diffractive optical elements (DOE) to achieve the best ranging performance in various ambient lighting conditions with a range of cover glass materials.

This sensor uses the direct ToF technology to allow absolute distance measurement whatever the target color and reflectance. It provides accurate ranging up to 400 cm and can work at fast speeds (60 Hz).

Insert the following information of the ToF sensor:

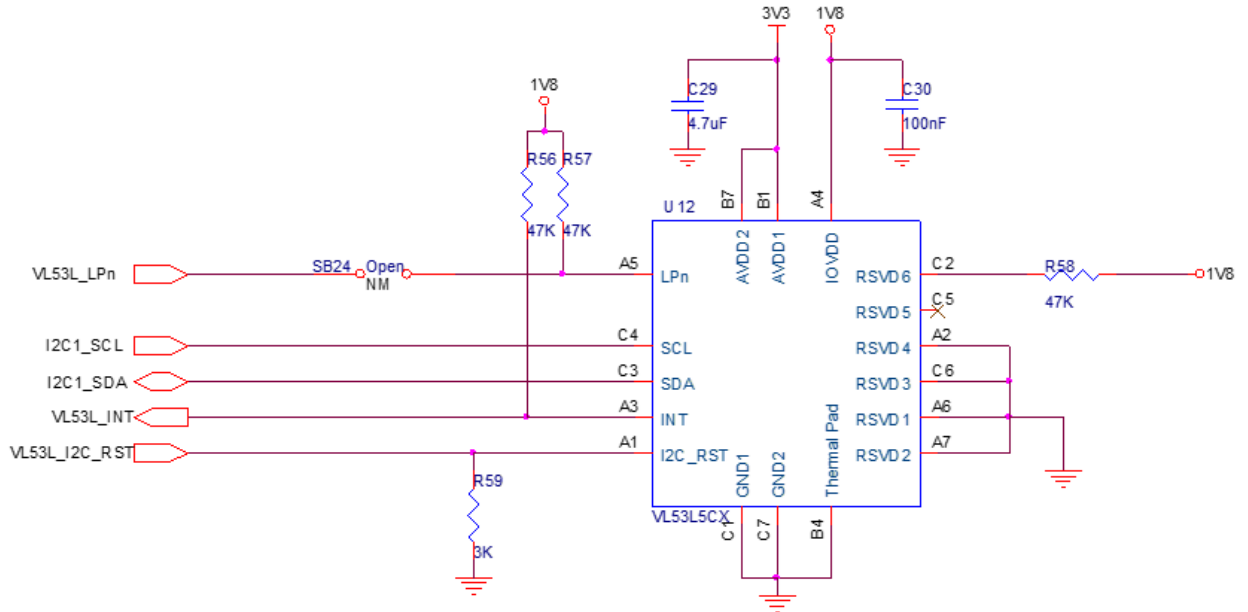
The **VL53L5CX** characteristics are:

- laser wavelength: 940 nm
- invisible laser radiation
- maximum laser power emitted: 130 mW
- pulse duration: 2 ns with intervals of 28/32 ns

Table 11. VL53L5CX details

Features	Description
Order code	VL53L5CXV0GC/1
Package	Optical LGA16
Operating voltage	1.8 V to 3.3 V

Figure 14. VL53L5CX circuit



2.10.1 Laser safety considerations

The VL53L5CX contains a laser emitter and corresponding drive circuitry. The laser output is designed to remain within Class 1 laser safety limits under all reasonably foreseeable conditions including single faults in compliance with IEC 60825-1:2007 and IEC 60825-1:2014.

The laser output power must not be increased by any means and no optics should be used with the intention of focusing the laser beam.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

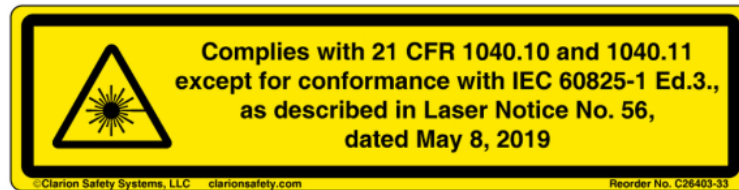
Figure 15. Class 1 laser product label



Figure 16. Laser notice 50: applies to IEC 60825-1:2007



Figure 17. Laser notice 56: applies to IEC 60825-1:2014



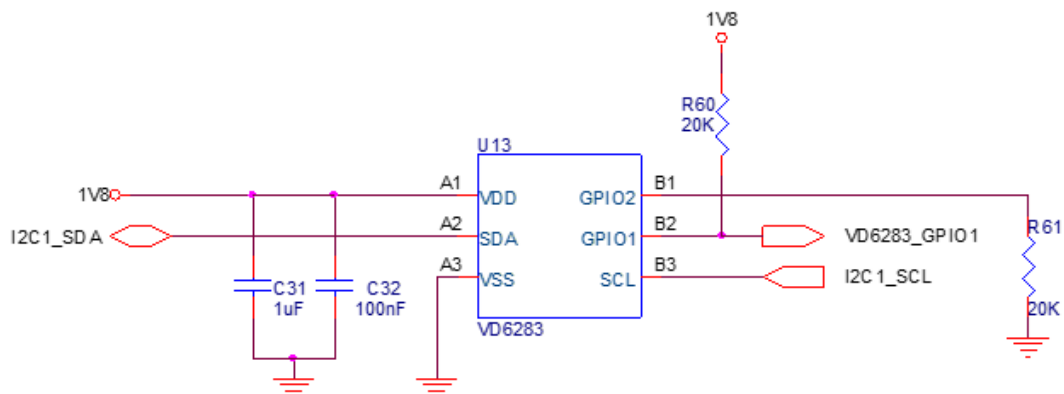
2.11 Ambient light sensor: VD6283TX

The **VD6283TX** is a color sensor with advanced light flicker extraction. The light measurement is fast and accurate, thanks to an individual ADC and a readout for each color channel. The **VD6283TX** uses hybrid color filters with precise responses, allowing accurate computation of the correlated color temperature (CCT) and lux information. Additionally, the **VD6283TX** has the ability to extract different light flicker waveforms from 100 Hz and 2 kHz, including LED square signals, that can run flicker operations simultaneously with ALS operations.

Table 12. VD6283TX details

Features	Description
Order code	VD6283TX
Package	Optical BGA
Operating voltage	1.8 V

Figure 18. VD6283TX circuit



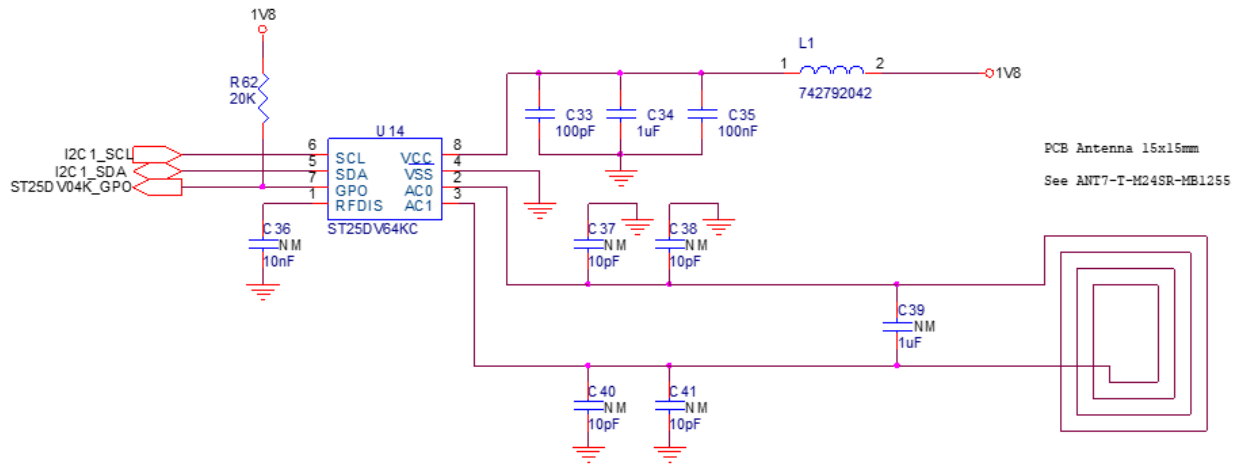
2.12 NFC tag: ST25DV64KC

The **ST25DV64KC** is NFC RFID tag that includes 64-Kbit of electrically erasable programmable memory (EEPROM) with two interfaces. The first one is an I²C serial link and can be operated from a DC power supply. The second one is an RF link activated when it acts as a contactless memory powered by the received carrier electromagnetic wave. In the I²C mode, the **ST25DV64KC** user memories contain 8192 bytes, which could be split into four flexible and protectable areas.

A GPO pin for interruption pin configurable on multiple RF events (field change, memory write, activity, Fast Transfer end, user set/reset/pulse) is available.

Table 13. ST25DV64KC details

Features	Description
Order code	ST25DV64KC-IE6S3
Package	8-SOIC
Operating voltage	1.8 V to 5.5 V

Figure 19. ST25DV64KC circuit


As the **ST25DV64KC** is a tag, it does not generate any power. It is activated with the power of a reader. It is tuned to work at 13.56 Mhz. There is no channel. The reader emits a 13.56 radio frequency. The **ST25DV64KC** is powered by this electromagnetic field and modulates it to exchange data.

2.13

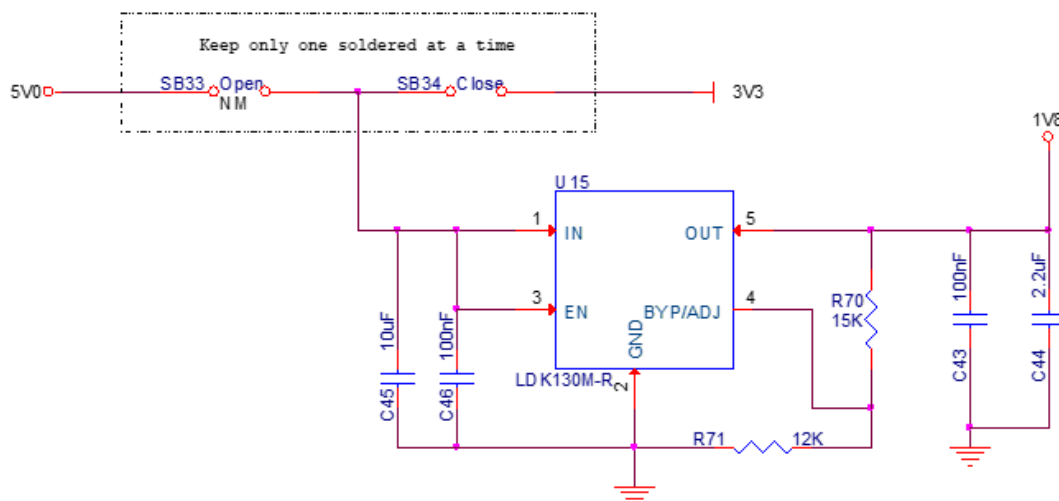
LDO: LDK130

The **LDK130** low drop voltage regulator provides 300 mA of maximum current from an input supply voltage in the range of 1.9 V to 5.5 V, with a typical dropout voltage of 100 mV. It is stabilized with a ceramic capacitor on the output. The very low drop voltage, low quiescent current and low-noise features make it suitable for low-power battery-powered applications. An enable logic control function puts the **LDK130** in shutdown mode, allowing a total current consumption lower than 1 μ A. The device also includes the short-circuit constant current limiting and thermal protection.

On-board sensors operate on a 1.8 V power supply. The **LDK130** is used to generate 1.8 V power supply for the various sections.

Table 14. LDK130 details

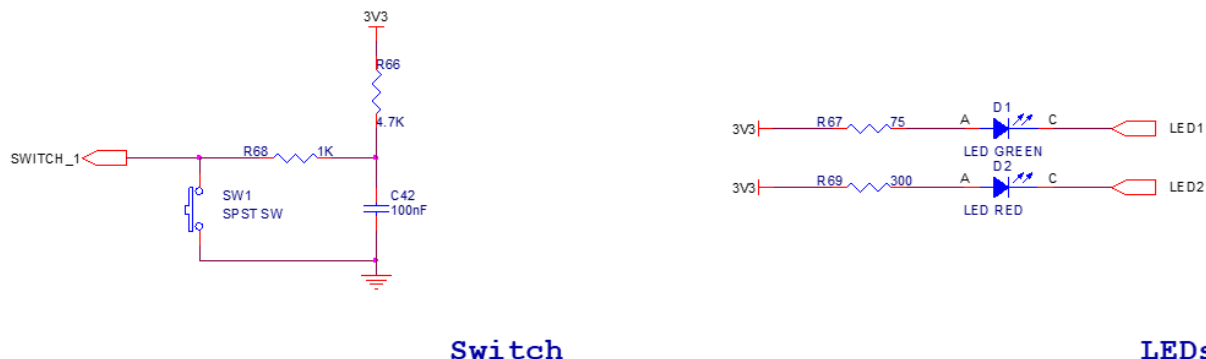
Features	Description
Order code	LDK130M-R
Package	SOT23-5
Operating voltage	1.9 V to 5.5 V

Figure 20. LDK130 circuit


2.14 LEDs and switches

On-board LEDs are available for visual indication. A push button switch is used for the user inputs.

Note: You can configure different hardware settings of the *X-STM32MP-MSP01* board through several solder bridges, which can be left open (not mounted) or closed (mounted).

Figure 21. LED and switch circuit


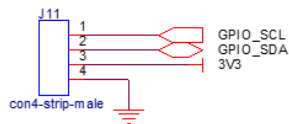
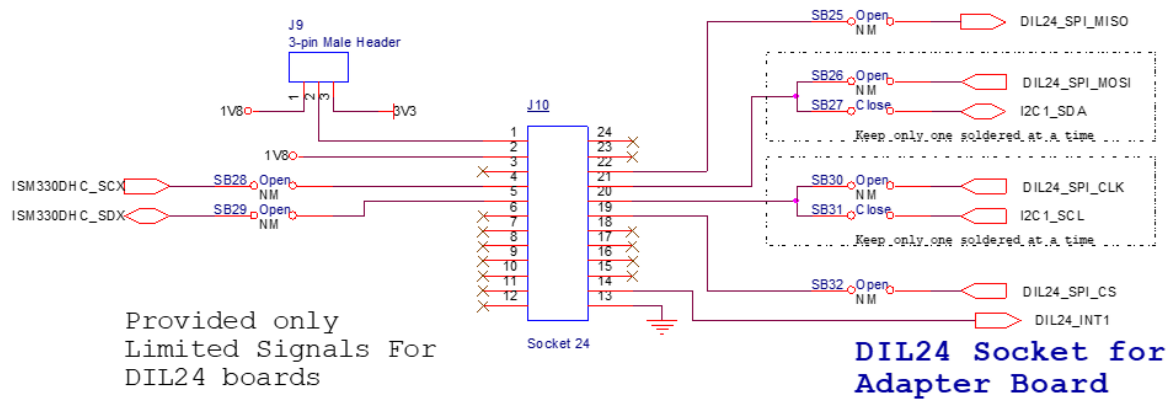
Switch

LEDs

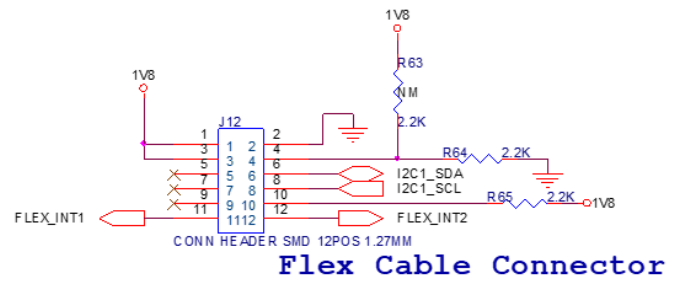
2.15 Other connectors: DIL 24-pin socket, flexible cable, I²C groove connector

Several connectors are available on the board to connect external boards:

- a DIL 24-pin socket (J10) for additional adapter boards
- a flexible cable connector (J12) for various probe kits
- an I²C groove connector (J11) for external modules (twigs) using I²C connectivity

Figure 22. DIL-24, flexible cable, I²C groove connector circuit


I2C Grove Connector



Schematic diagrams

Figure 23. X-STM32MP-MSP01 circuit schematic (1 of 11)

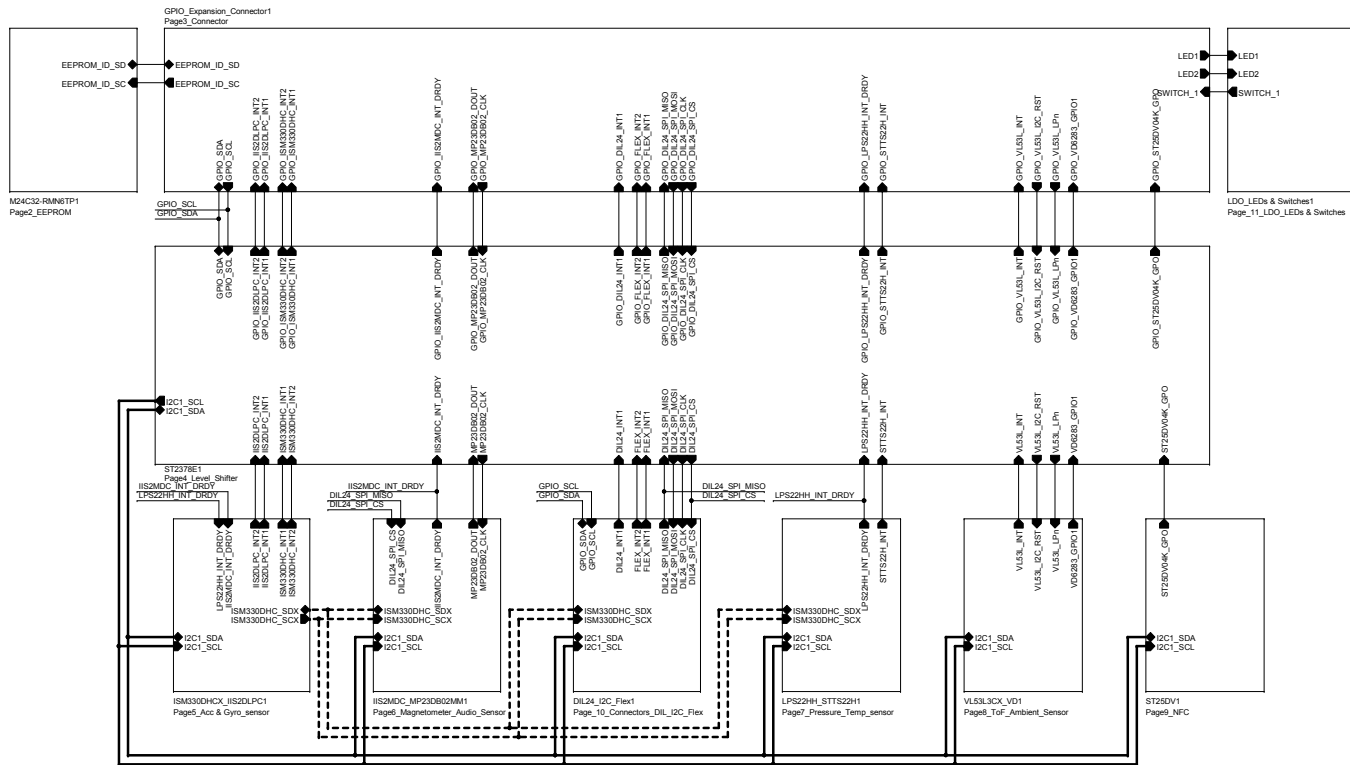


Figure 24. X-STM32MP-MSP01 circuit schematic (2 of 11)

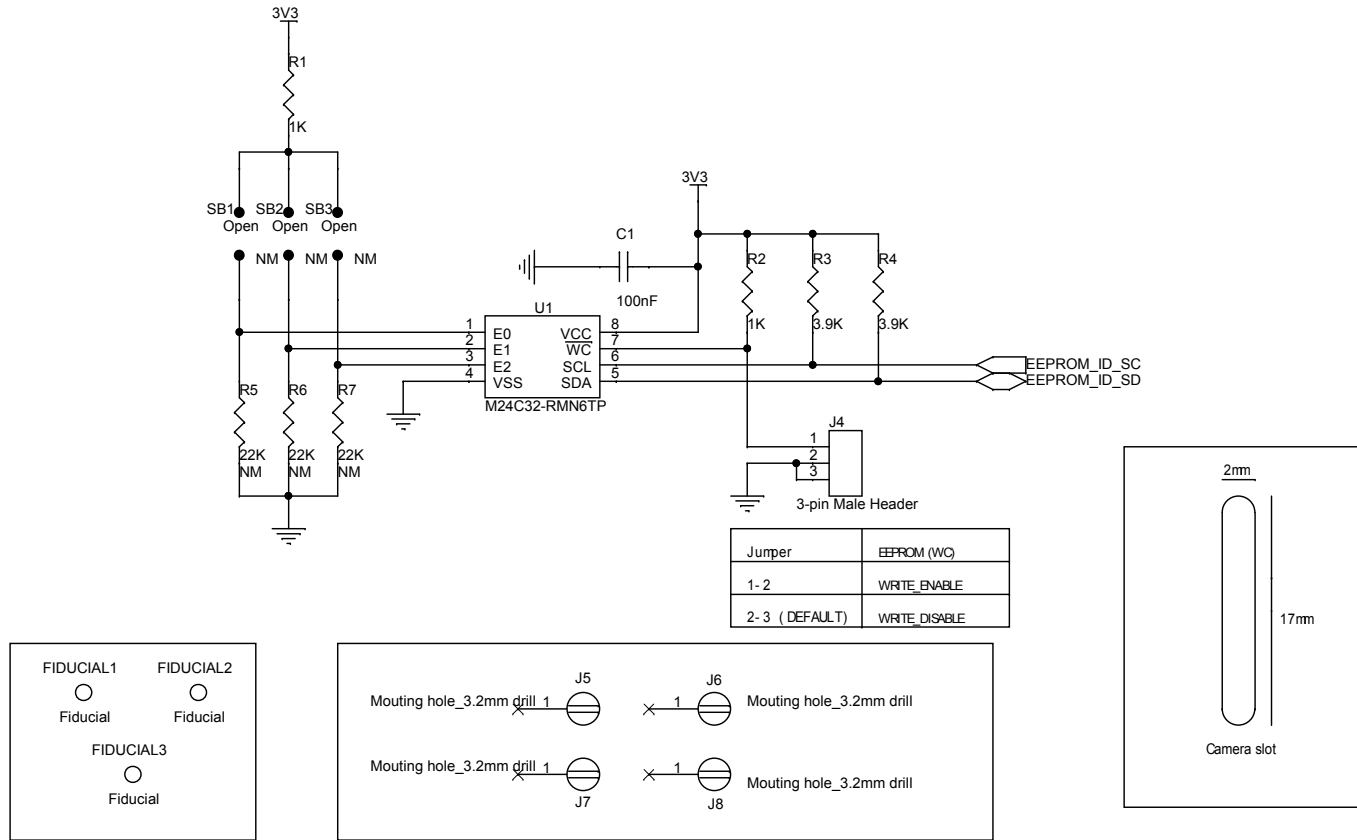


Figure 25. X-STM32MP-MSP01 circuit schematic (3 of 11)

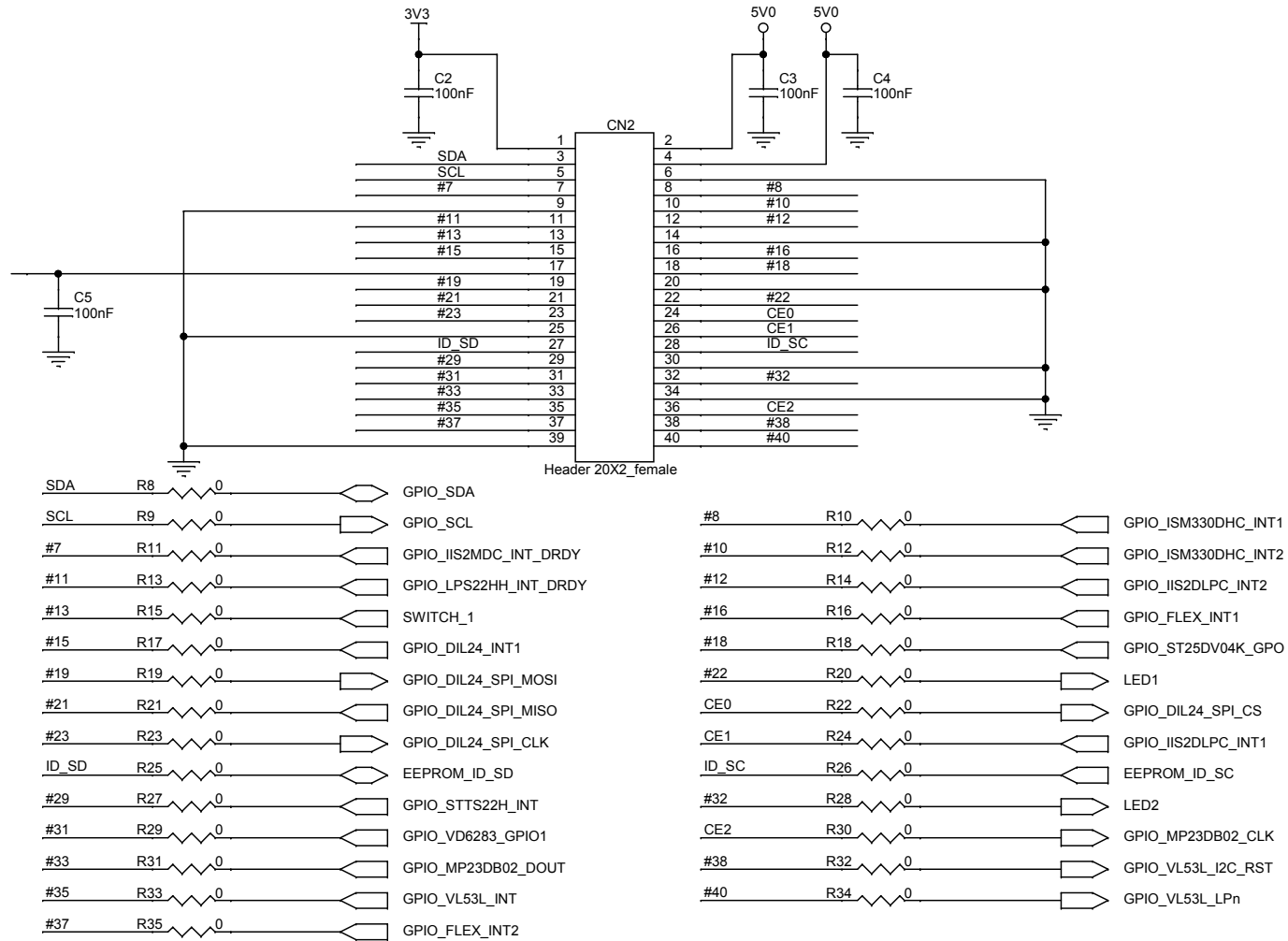


Figure 26. X-STM32MP-MSP01 circuit schematic (4 of 11)

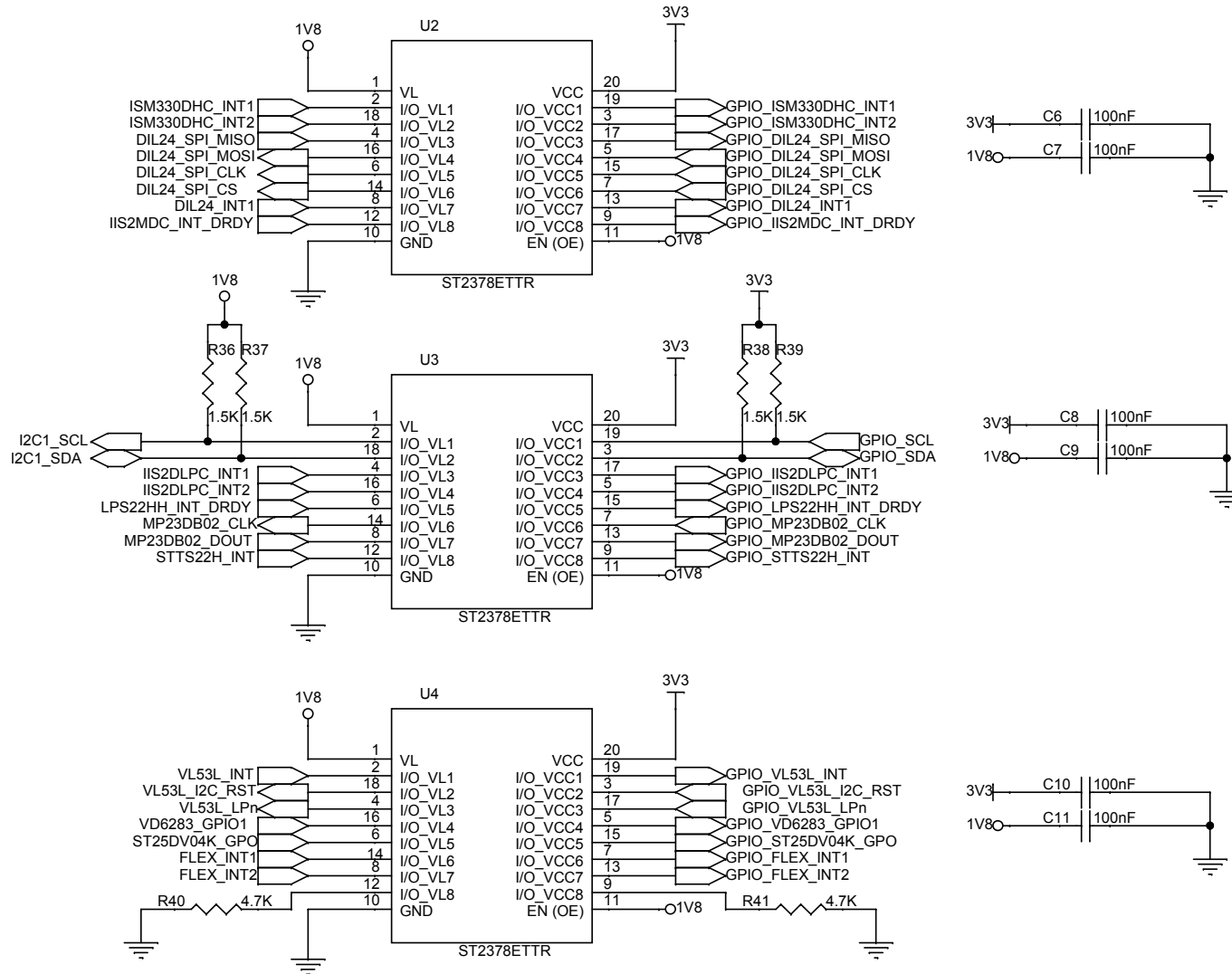


Figure 27. X-STM32MP-MSP01 circuit schematic (5 of 11)

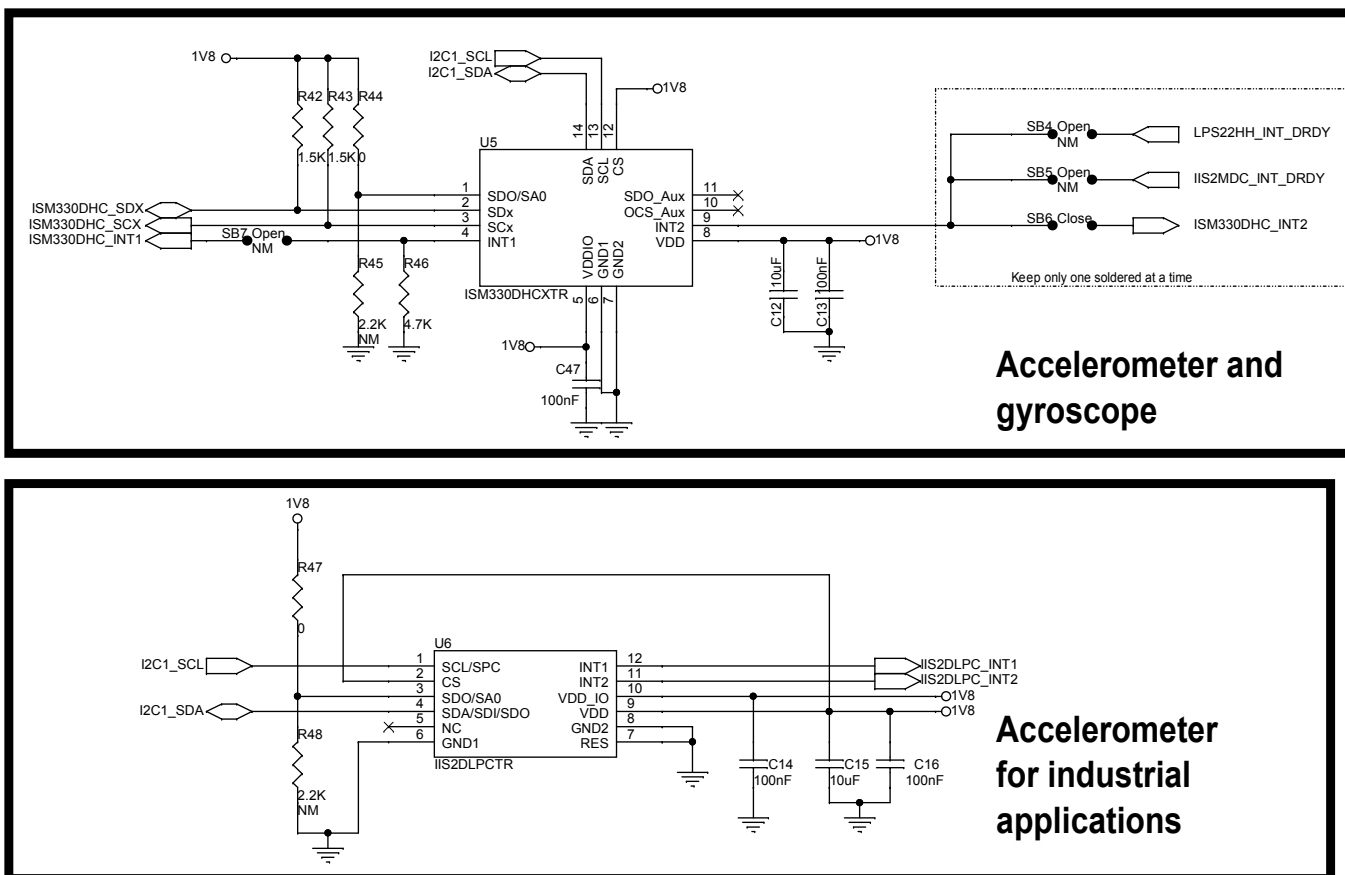


Figure 28. X-STM32MP-MSP01 circuit schematic (6 of 11)

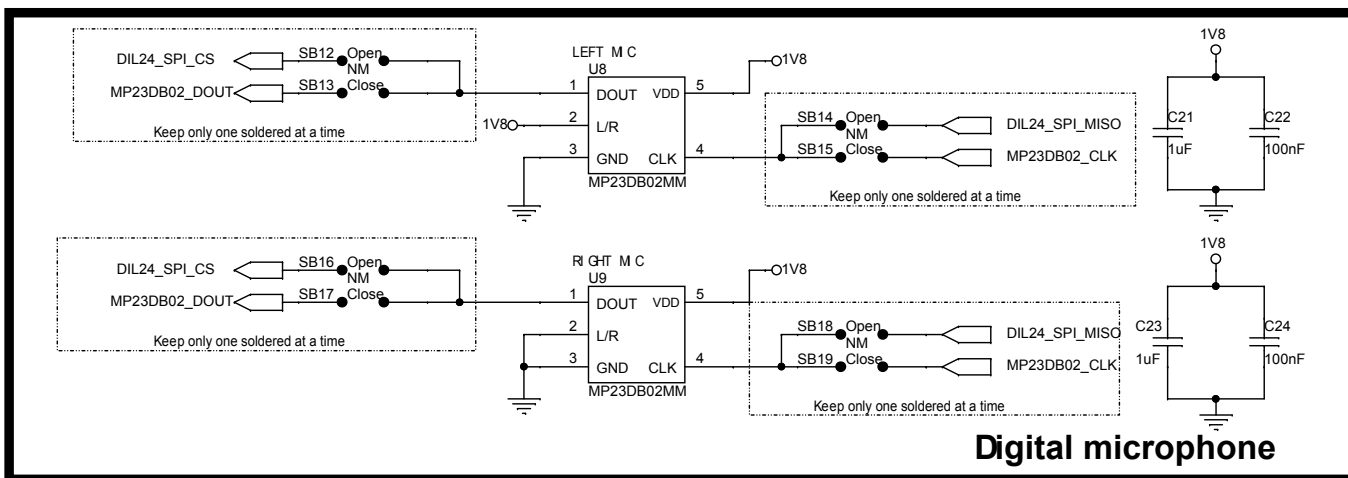
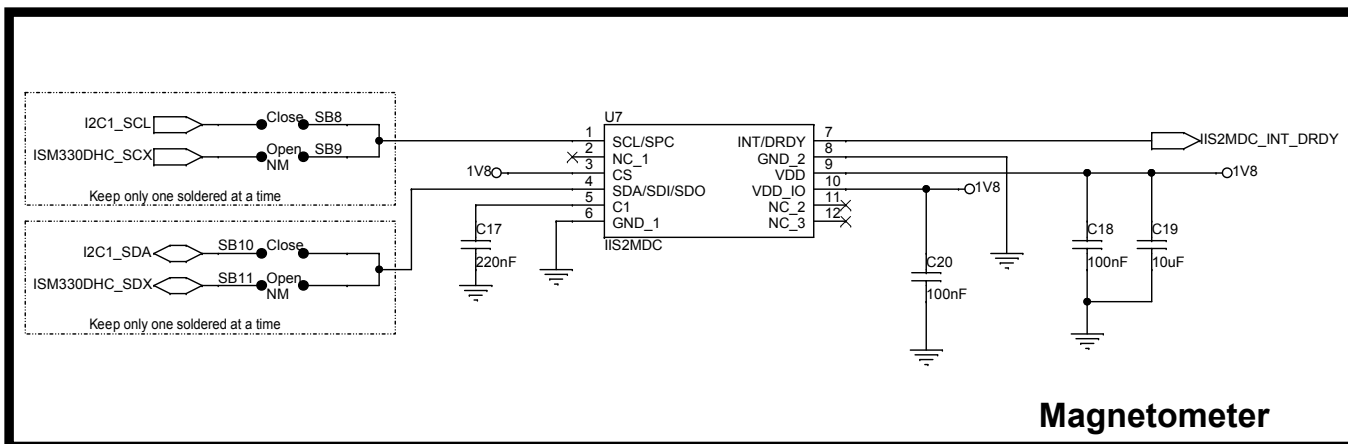


Figure 29. X-STM32MP-MSP01 circuit schematic (7 of 11)

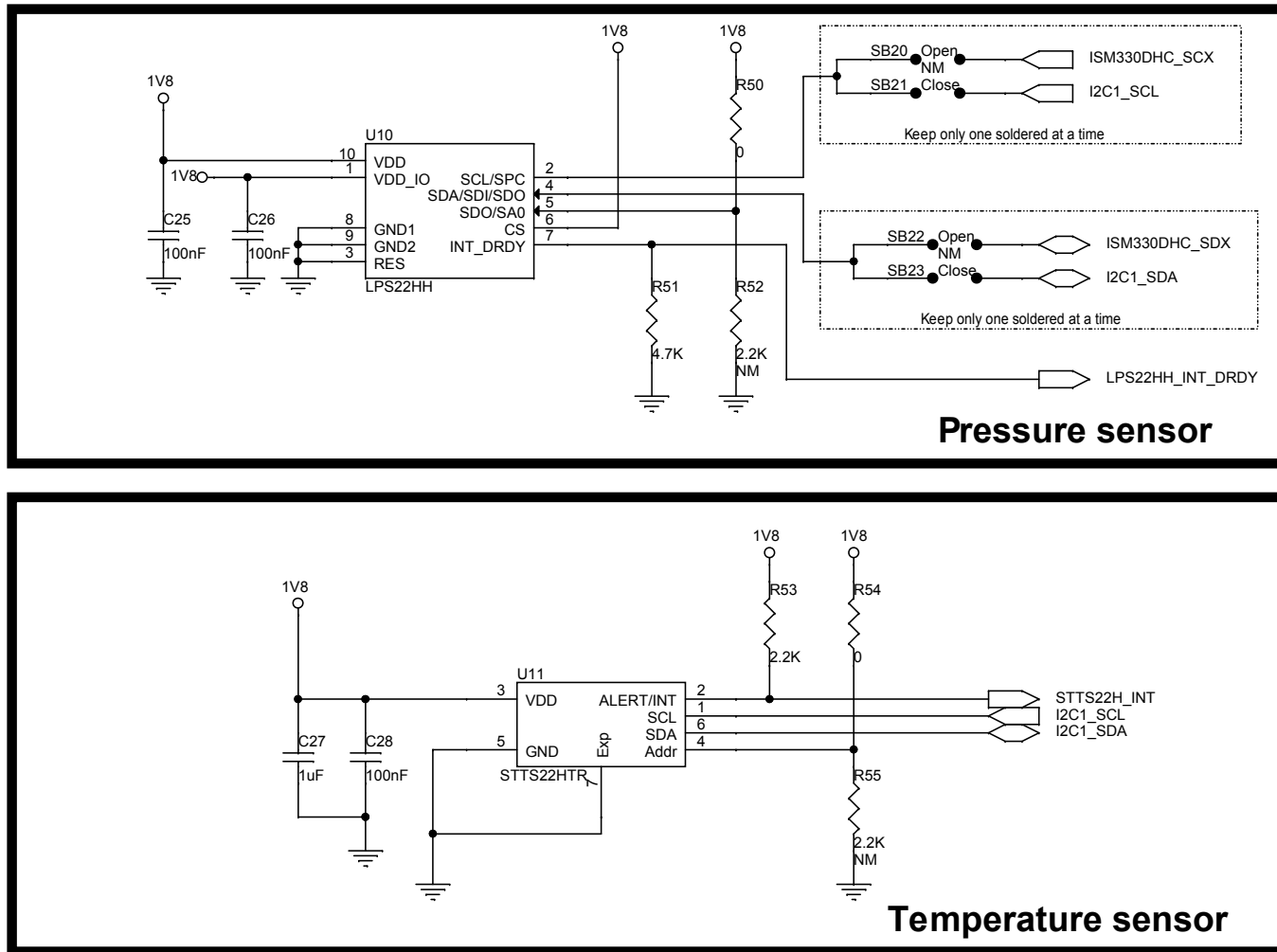


Figure 30. X-STM32MP-MSP01 circuit schematic (8 of 11)

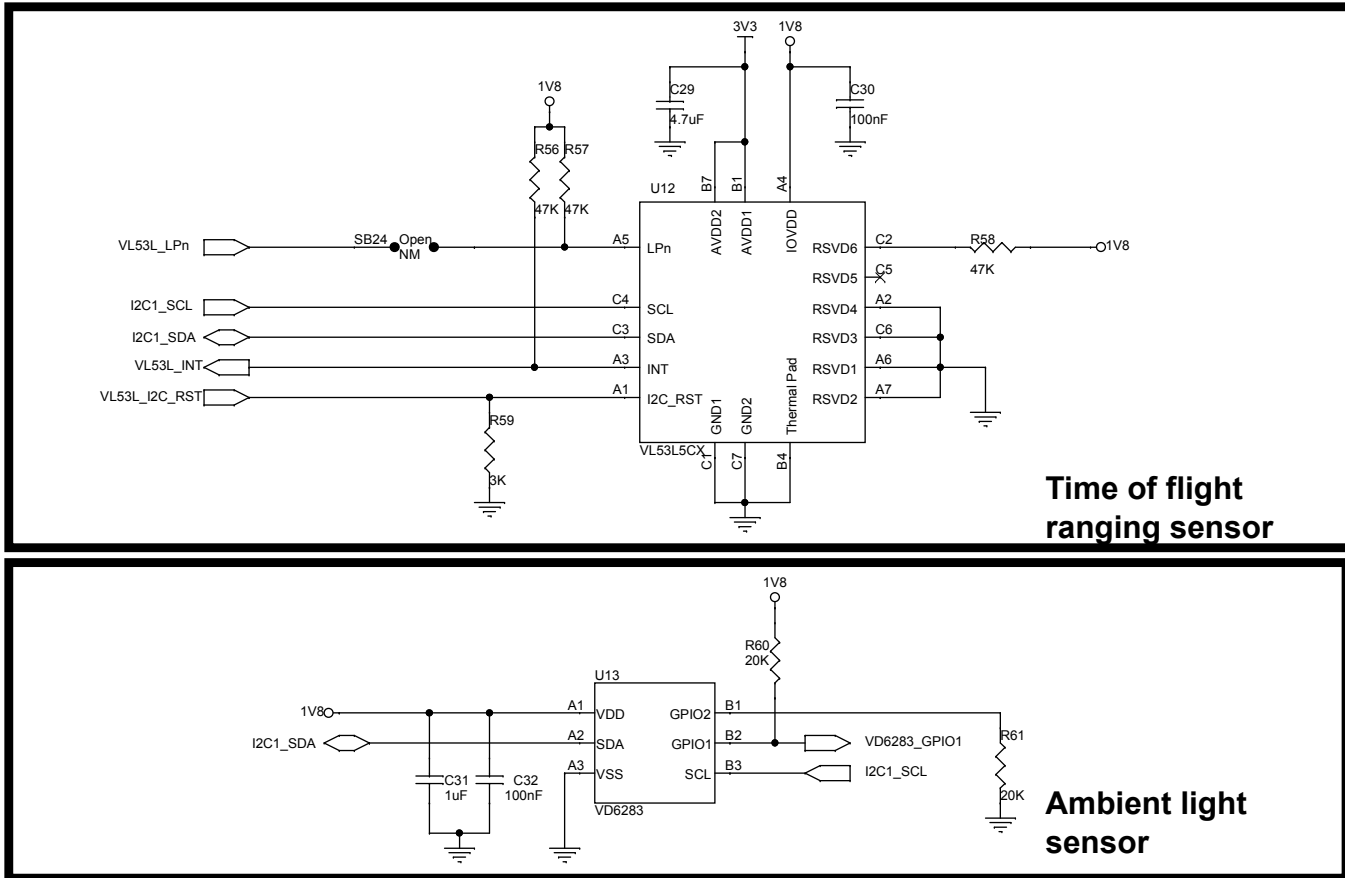


Figure 31. X-STM32MP-MSP01 circuit schematic (9 of 11)

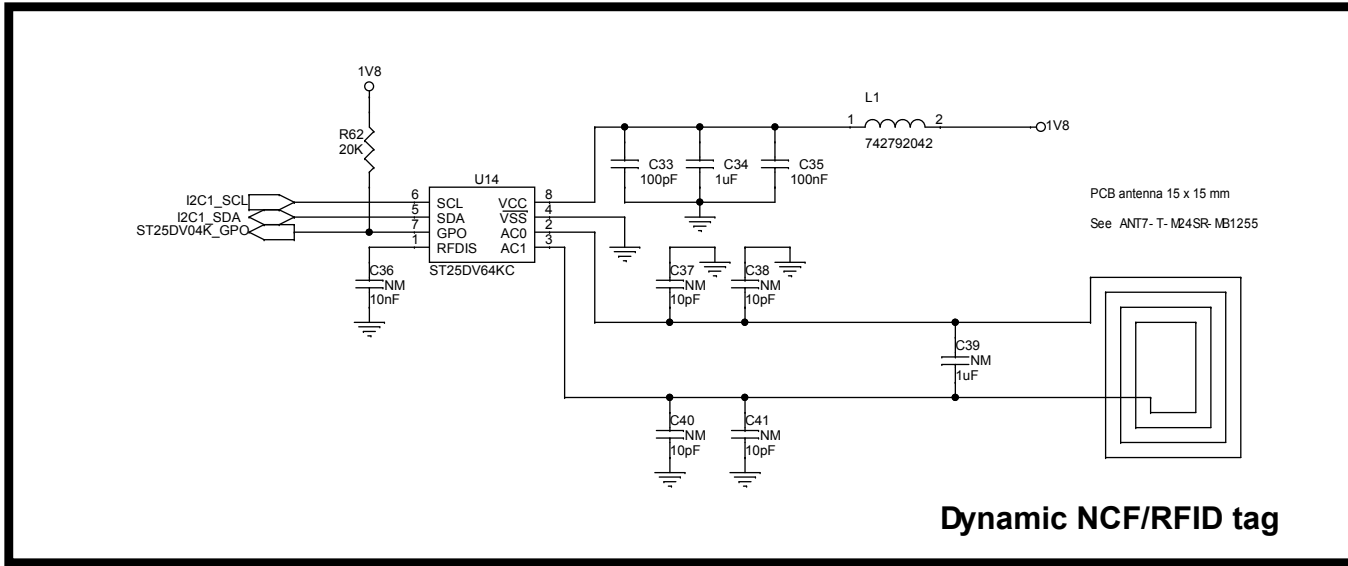


Figure 32. X-STM32MP-MSP01 circuit schematic (10 of 11)

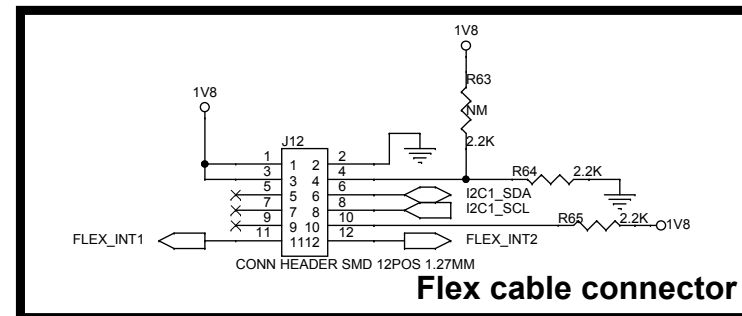
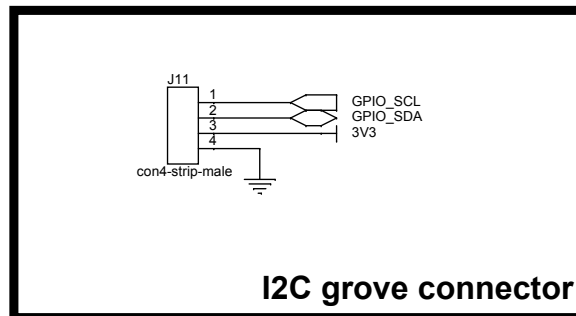
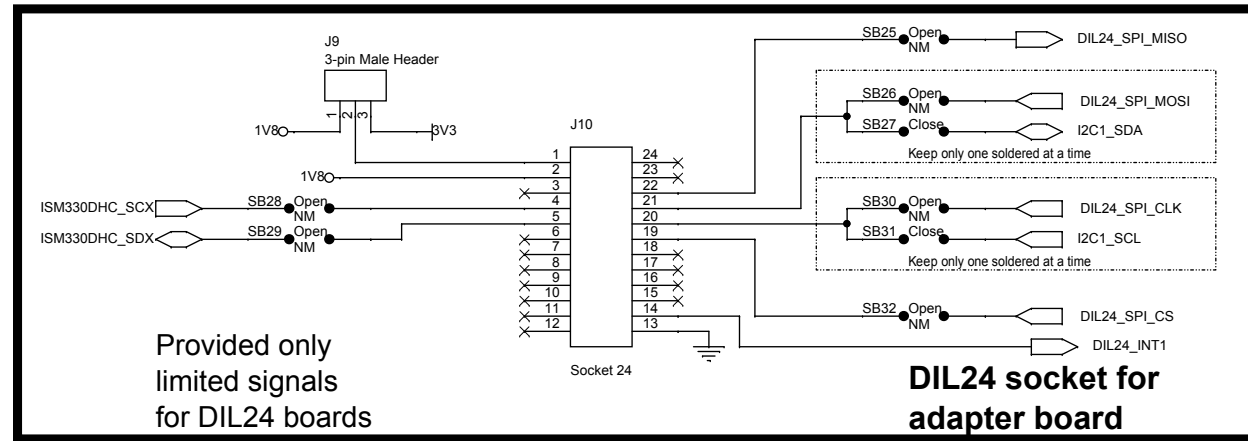
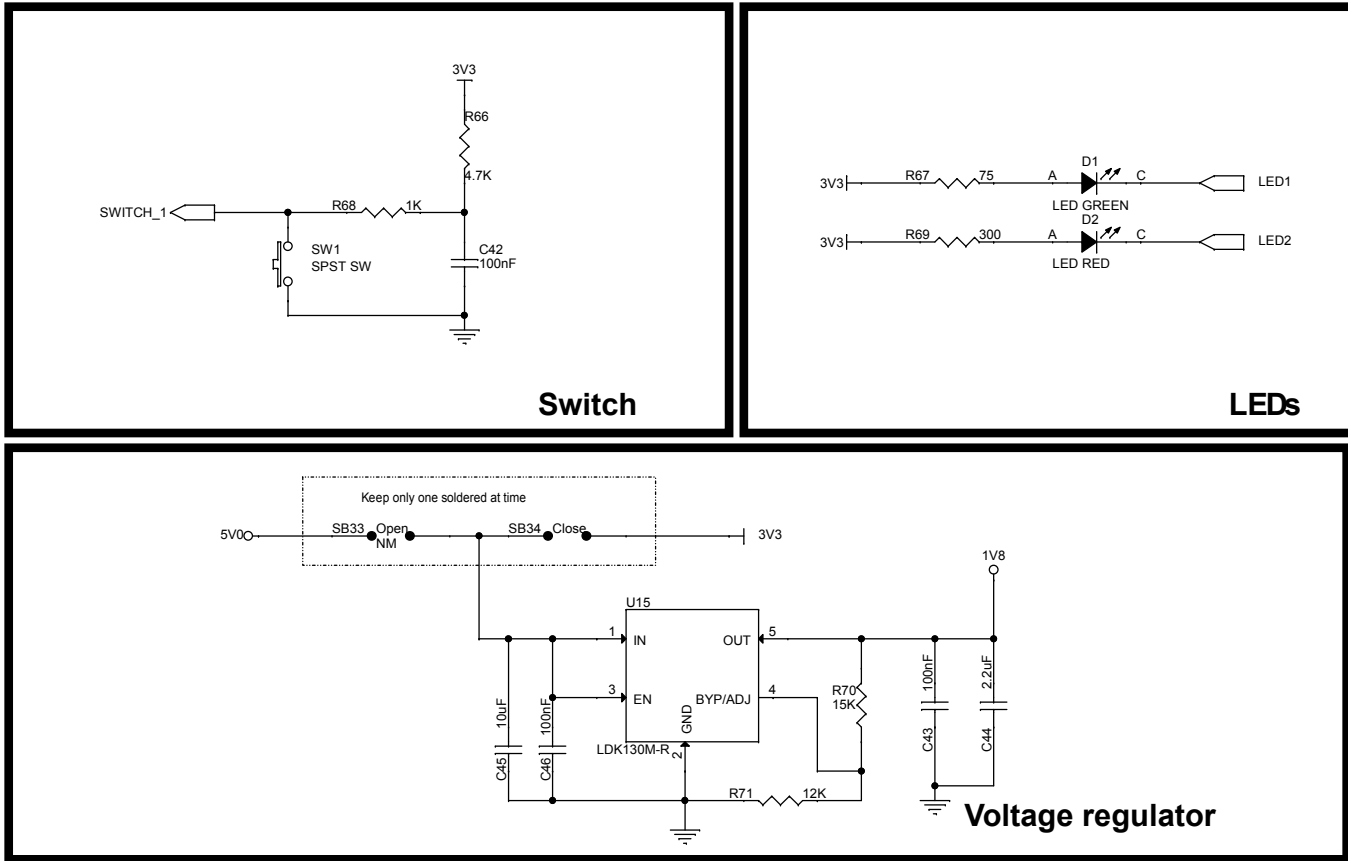


Figure 33. X-STM32MP-MSP01 circuit schematic (11 of 11)



4 Bill of materials

Table 15. X-STM32MP-MSP01 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	26	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C13 C14 C16 C18 C20 C22 C24 C25 C26 C28 C30 C32 C35 C42 C43 C46 C47	100nF	CAP CER 0.1UF 16V X7R 0603	KEMET	C0603C104K4RACTU
2	4	C12 C15 C19 C45	10uF	CAP CER 10UF 16V X5R 0603	Murata Electronics	ZRB18AR61C106ME01L
3	1	C17	220nF	CAP CER 0.22UF 16V X7R 0603	Walsin Technology Corporation	0603B224K160CT
4	5	C21 C23 C27 C31 C34	1uF	CAP CER 1UF 16V X5R 0603	Murata Electronics	GRM188R61C105KA12D
5	1	C29	4.7uF	CAP CER 4.7UF 16V X5R 0603	Murata Electronics	GRM188R61C475ME11D
6	1	C33	100pF	CAP CER 100PF 16V C0G/NP0 0603	Würth Elektronik	885012006023
7	1	C36	10nF	CAP CER 0603 10NF 16V ULTRA STAB	KEMET	C0603X103J4HAC7867
8	4	C37 C38 C40 C41	10pF	CAP CER 10PF 16V NP0 0603	KEMET	C0603C100J4GAC7867
9	1	C39	1uF	CAP CER 1UF 16V X5R 0603	Murata Electronics	GRM188R61C105KA12D
10	1	C44	2.2uF	CAP CER 2.2UF 16V X6S 0603	TDK Corporation	C1608X6S1C225M080AC
11	1	CN2	Header 20X2_female	Double Row_Vertical_.1 00" _Extended Tail Connector	Samtec	SSQ-120-03-T-D
12	1	D1	LED GREEN	LED GREEN CLEAR 0603 SMD	Würth Elektronik	150060GS75000
13	1	D2	LED RED	LED RED CLEAR 0603 SMD	Würth Elektronik	150060RS75000
14	2	J4 J9	3-pin Male Header	CONN HEADER .100 STR 3POS	Samtec Inc.	TSW-103-07-F-S
15	1	J10	Socket 24	DIP Socket, 24 Position, Through Hole	MULTICOMP	SPC15503
16	1	J11	con4-strip-male	CONN HEADER .100 STR 4POS	Samtec Inc.	TSW-104-07-F-S

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
17	1	J12	CONN HEADER SMD 12POS 1.27MM	Connector Header Surface Mount 12 position 0.050" (1.27mm)	Samtec	SHF-106-01-L-D-SM
18	1	L1	742792042	FERRITE BEAD 600 OHM 0805 1LN	Würth Elektronik	742792042
19	3	R1 R2 R68	1K	RES SMD 1K OHM 1% 1/10W 0603	Vishay Dale	CRCW06031K00FKEA
20	2	R3 R4	3.9K	RES SMD 3.9K OHM 1% 1/10W 0603	Yageo	RT0603FRE073K9L
21	3	R5 R6 R7	22K	RES SMD 22K OHM 5% 1/10W 0603	Vishay Dale	CRCW060322K0JNEA
22	32	R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R44 R47 R50 R54	0	RES SMD 0 OHM JUMPER 1/10W 0603	TE Connectivity Passive Product	CRG0603ZR
23	6	R36 R37 R38 R39 R42 R43	1.5K	RES SMD 1.5K OHM 1% 1/10W 0603	TE Connectivity Passive Product	CRG0603F1K5
24	5	R40 R41 R46 R51 R66	4.7K	RES SMD 4.7K OHM 1% 1/10W 0603	Yageo	RC0603FR-074K7P
25	4	R45 R48 R52 R55	2.2K	RES 2.2K OHM 1% 1/10W 0603	Stackpole Electronics Inc	RMCF0603FT2K20
26	4	R53 R64 R65	2.2K	RES 2.2K OHM 1% 1/10W 0603	Stackpole Electronics Inc	RMCF0603FT2K20
27	1	R63	2.2K	RES 2.2K OHM 1% 1/10W 0603	Stackpole Electronics Inc	RMCF0603FT2K20
28	4	R56 R57 R58	47K	RES SMD 47K OHM 1% 1/10W 0603	Yageo	RC0603FR-0747KL
29	1	R59	3K	RES SMD 3K OHM 1% 1/10W 0603	Yageo	RC0603FR-073KL
30	3	R60 R61 R62	20K	RES SMD 20K OHM 1% 1/10W 0603	Yageo	RT0603FRE0720KL
31	1	R67	75	RES SMD 75 OHM 1% 1/10W 0603	Yageo	RC0603FR-0775RL
32	1	R69	300	RES SMD 300 OHM 5% 1/4W 0603	Rohm Semiconductor	ESR03EZPJ301

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
33	1	R70	15K	RES SMD 15K OHM 1% 1/10W 0603	Yageo	RT0603FRE0715KL
34	1	R71	12K	RES SMD 12K OHM 0.5% 1/10W 0603	Yageo	RT0603DRE0712KL
35	22	SB1 SB2 SB3 SB4 SB5 SB7 SB9 SB11 SB12 SB14 SB16 SB18 SB20 SB22 SB24 SB25 SB26 SB28 SB29 SB30 SB32 SB33	Open	RES 0 OHM JUMPER 1/10W 0603	Rohm Semiconductor	SFR03EZPJ000
36	12	SB6 SB8 SB10 SB13 SB15 SB17 SB19 SB21 SB23 SB27 SB31 SB34	Close	RES 0 OHM JUMPER 1/10W 0603	Rohm Semiconductor	SFR03EZPJ000
37	1	SW1	SPST SW	SWITCH TACTILE SPST- NO 0.05A 24V	TE Connectivity ALCOSWITCH Switches	1437566-3
38	1	U1	M24C32- RMN6TP, SO8	32 Kbit serial I2C bus EEPROM	ST	M24C32-RMN6TP
39	3	U2 U3 U4	ST2378ETTR, TSSOP-20	8-bit Dual supply 1.71 V to 5.5 V level translator with I/O VCC ±15 kV ESD protection	ST	ST2378ETTR
40	1	U5	ISM330DHCXT R, VFLGA2.5X3X. 86 14L P.5 L.475X.25	INEMO INERTIAL MODULE: 3D digital accelerometer and 3D digital gyroscope	ST	ISM330DHCXTR
41	1	U6	IIS2DLPCCTR, LGA2X2X0.7 12 LEADS	MEMS digital output motion sensor: high- performance ultra-low-power 3-axis accelerometer for industrial applications	ST	IIS2DLPCCTR
42	1	U7	IIS2MDCTR, LGA2X2X0.7 12 LEADS	High accuracy, ultra-low-power, 3-axis digital output magnetometer	ST	IIS2MDCTR
43	1	U8	MP23DB02MM TR, RHLGA 3.5X2.65X0.98 MM 4L	MEMS audio sensor multi performance mode digital microphone	ST	MP23DB02MMTR

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
44	1	U9	MP23DB02MMTR, RHLGA 3.5X2.65X0.98 MM 4L	MEMS audio sensor multi performance mode digital microphone	ST	MP23DB02MMTR
45	1	U10	LPS22HHTR, HLGA 2X2X.8 10L EXP. SILIC.91SQ	High-performance MEMS nano pressure sensor	ST	LPS22HHTR
46	1	U11	STTS22HTR, UDFN 2X2X.55 6L PITCH0.65	Low-voltage, ultra-low-power, 0.5°C accuracy I ² C/SMBus 3.0 temperature sensor	ST	STTS22HTR
47	1	U12	VL53L5CXV0G C/1, OPTICAL LGA 6.40X3.03 16 PINS	Time-of-Flight 8x8 multizone ranging sensor with wide field of view	ST	VL53L5CXV0GC/1
48	1	U13	VD6283TX45/1, WLCSP T-SHAPE	Hybrid filter multispectral sensor with light flicker engine	ST	VD6283TX45/1
49	1	U14	ST25DV64KC-IE6S3, SO8	Dynamic NFC/RFID tag IC with 64-Kbit EEPROM	ST	ST25DV64KC-IE6S3
50	1	U15	LDK130M-R, SOT23-5L	300 mA low quiescent current very low noise LDO	ST	LDK130M-R
51	4	Nut	709940300	M3x0.5 Hex Nut 0.217" (5.50mm) Nylon	Würth Elektronik	709940300
52	4	Spacer	36M30MF012	Hex Standoff Threaded M3x0.5 Nylon 0.472" (12.00mm) Natural	Essentra	36M30MF012
53	1	Jumper cap	CONN SHUNT 2POS	2 (1 x 2) Position Shunt Connector Black Open Top 0.100" (2.54mm) Gold	Samtec Inc.	SNT-100-BK-G

5 X-STM32MP-MSP01 versions

Table 16. X-STM32MP-MSP01 versions

PCB version	Schematic diagrams	Bill of materials
X\$STM32MP-MSP01A ⁽¹⁾	X\$STM32MP-MSP01A schematic diagrams	X\$STM32MP-MSP01A bill of materials

1. This code identifies the X-STM32MP-MSP01 expansion board first version. It is printed on the board PCB.

6 Regulatory compliance information

Formal Notice Required by the U.S. Federal Communications Commission

Responsible party's contact located in the United States: name: Francesco Doddo; address: STMicroelectronics Inc, 30 Corporate Drive, Suite 300, Burlington MA, 01803, U.S.A.; e-mail: francesco.doddo@st.com

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. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Note: 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 instructions, 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 the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Standard applied: FCC CFR 47 Part 15 Subpart B. Test method applied: ANSI C63.4 (2014).

Formal Product Notice Required by Industry Canada

Responsible party's contact located in Canada: name: John Langner; address: STMicroelectronics, Inc., 350 Burnhamthorpe Road West, Suite 303 L5B 3J1, Mississauga, ON, Canada; e-mail: john.langner@st.com

Innovation, Science and Economic Development Canada Compliance

This device complies with Innovation, Science and Economic Development RSS standards. 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. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Conformité à Innovation, Sciences et Développement Économique Canada

Cet appareil est conforme aux normes RSS d'Innovation, Science et Développement économique. L'utilisation est soumise aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences nuisibles, et (2) cet appareil doit accepter de recevoir tous les types d'interférence, y comprises les interférences susceptibles d'entraîner un fonctionnement indésirable. Les changements ou les modifications non expressément approuvés par le fabricant pourraient annuler le permis d'utiliser l'équipement.

Notice for the European Union

The X-STM32MP-MSP01 is in conformity with the essential requirements of the Directive 2014/53/EU (RED) and of the Directive 2015/863/EU (RoHS). Harmonized standards applied are listed in the EU Declaration of Conformity.

Notice for the United Kingdom

The X-STM32MP-MSP01 is in compliance with the UK Radio Equipment Regulations 2017 (UK SI 2017 No. 1206 and amendments) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK SI 2012 No. 3032 and amendments). Applied standards are listed in the UK Declaration of Conformity

Revision history

Table 17. Document revision history

Date	Revision	Changes
12-Oct-2022	1	Initial release.
03-Mar-2023	2	Updated Section 1.3 Board setup and Section 2.10.1 Laser safety considerations.

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