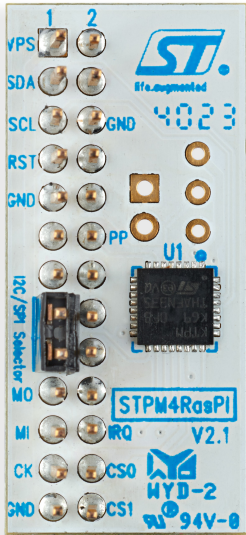


## Raspberry Pi<sup>®</sup> extension board for STSAFE-TPM ST33KTPM products



### Features

- Evaluation board for STSAFE-TPM ST33KTPM devices
- 26-pin female connector to plug on Raspberry Pi<sup>®</sup> or STM32MPx-DK
- I<sup>2</sup>C or SPI configurable interface
- TPM reset button to reset the TPM device without platform restart
- 26-pin male connector to ease probing and plug the same or another extension board
- Designed to solder an I2C/SPI selector button

### Description

The STPM4RasPIV21 is an extension board to connect the ST33KTPM products to the Raspberry Pi<sup>®</sup> and STM32 microprocessor development kits such as STM32MP157F-DK2, or STM32MP135F-DK. The board is designed for product evaluation, use case development and integration activities. The board is shipped with one trusted platform module soldered. For TPM product availability, refer to Section 4: Ordering information.

Product status link

[STPM4RasPIV21](#)

## 1 STPM4RasPIV21 main features

This section details the main features of STPM4RasPIV21, the extension board connecting the STSAFE-TPM products to the Raspberry Pi® device, STM32MP157-DK2 and STM32MP135F-DK.

### 1.1 STPM4RasPIV21 introduction

The STPM4RasPIV21 is a daughter board version 2.1 developed for STSAFE-TPM ST33KTPM device evaluation purposes.

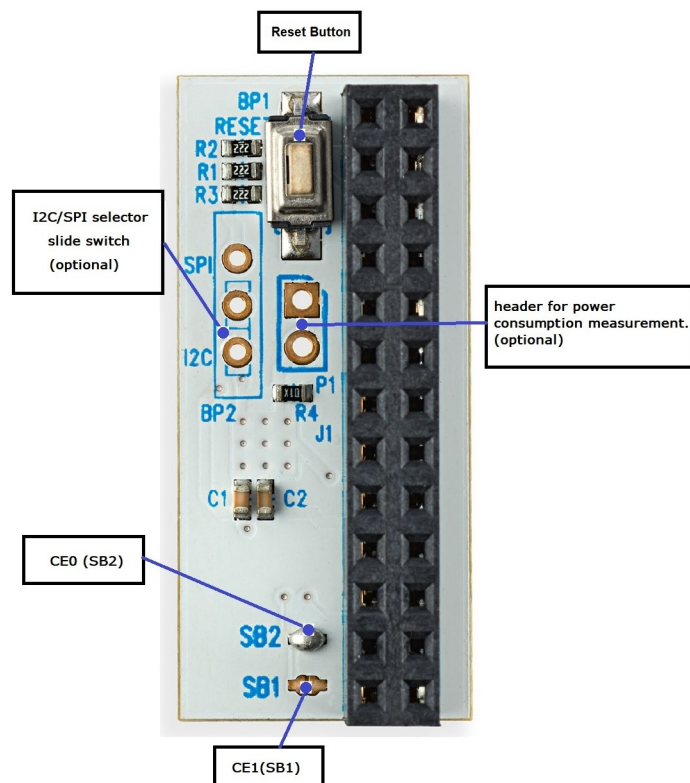
The STPM4RasPIV21 keeps all the legacy functionalities:

- Header for power consumption.
- Crossing pin to probe or to add a new extension board.

The STPM4RasPIV21 brings new features:

- TPM reset button
- I2C/SPI selector
- SPI chip selection configuration
- Signals marking on PCB

Figure 1. STPM4RasPIV21



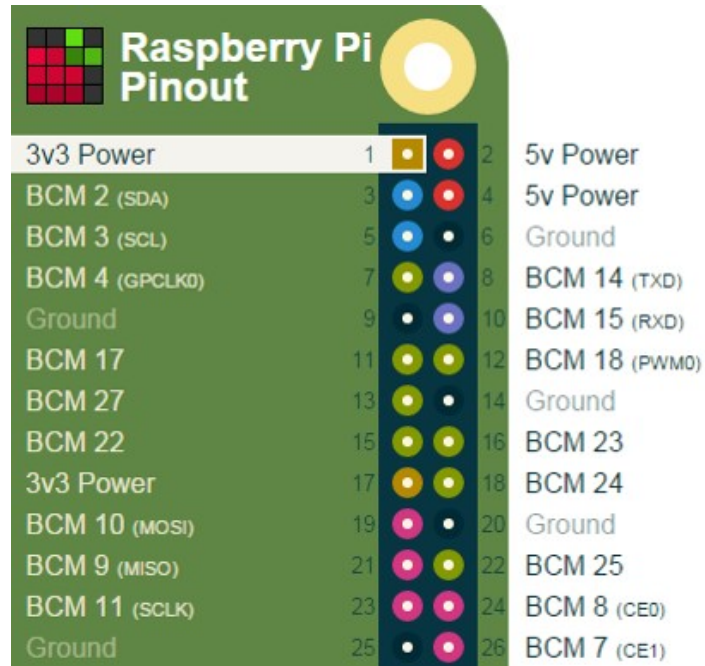
### 1.2 Raspberry SPI/I<sup>2</sup>C connectivity by GPIO

The ST33KTPM2X and ST33KTPM2XI2C products use the following signals:

- MOSI (pin 19)
- MISO (pin 21)
- SCLK (pin 23)
- CE0 (pin 24)
- VCC (pin 1 and 17)
- GND (pin 6, 9, 14, 20 and 25)

- RST (pin 7)
- PIRQ (pin 22)
- PP (pin 12)
- GPI\_I2C\_SELECT (pin 15)
- SDA (pin 3)
- SCL (pin 5)

Figure 2. Raspberry Pi GPIO

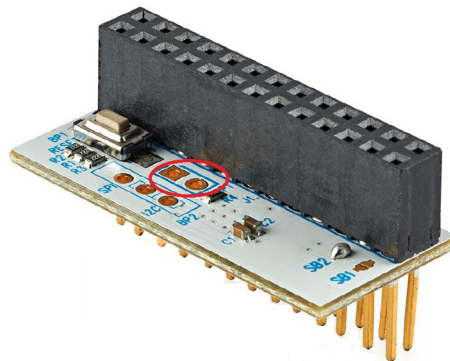


Note: The STPM4RasPIV21 features a GPIO pin extension reserved for probing or connecting another extension board.

### 1.3 TPM power consumption

The P1 pin header can be soldered to plug a multimeter over a 10 Ω resistor (R4) to measure the TPM power consumption.

Figure 3. P1 header location

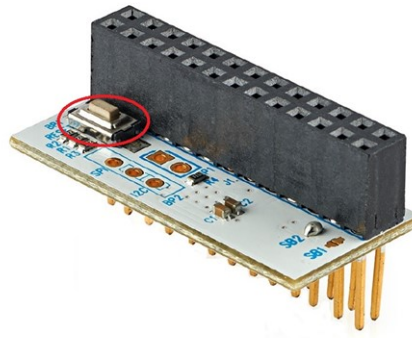


## 1.4 TPM reset button

The reset button is soldered by default at the bottom of the STPM4RasPIV21.

This button only restarts the TPM device and performs the TPM\_Init, as defined in [PTP standard specification]. After reset, users execute a new TPM initialization, such as TPM2\_Startup and TPM2\_SelfTest.

Figure 4. Reset button



## 1.5 Bus interface selection

ST33KTPM2X introduces a new functionality, which allows the support of both I2C and SPI bus interfaces on the same chip, with dedicated signals.

The user can select any of the I2C or the SPI bus interfaces, by using a jumper or a switch slide.

### 1.5.1 Bus interface selection using a jumper

The user can use a jumper to select the I2C or the SPI bus interface. When using a jumper, place it as follows.

Table 1. Interface selection by jumper

Interface	Selection method
I2C	GPI_I2C_SELECT (pin 15) with Low level
SPI	GPI_I2C_SELECT (pin 15) with High level

Figure 5. Use of the I2C/SPI jumper for the SPI interface selection

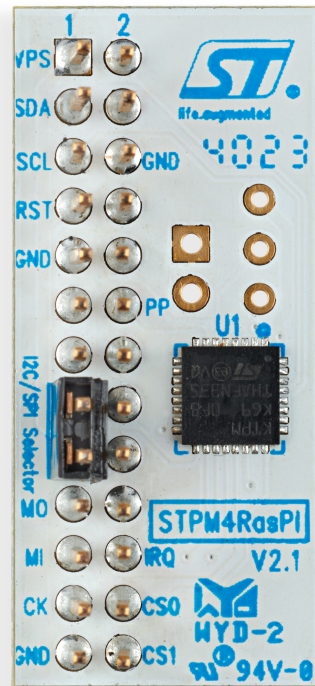


Figure 6. Use of the I2C/SPI jumper for the I2C interface selection

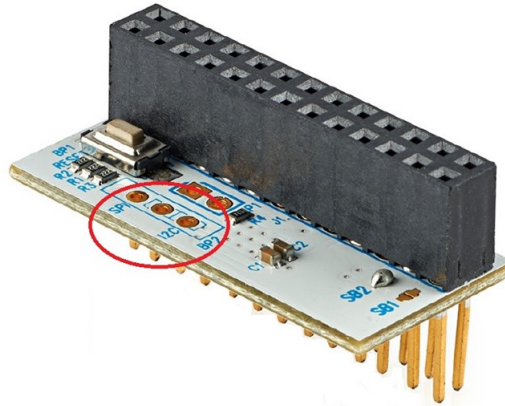


### 1.5.2 Bus interface selection using a switch slide

The switch slide can be soldered at the bottom of the STPM4RasPIV21 to easily select the TPM bus interface.

*Note:* Using a switch slide is optional.

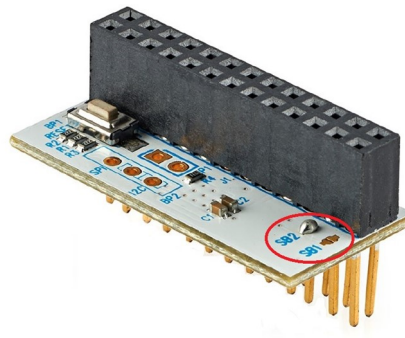
**Figure 7. Use of the switch slide for interface selection**



### 1.6 Configuration of the SPI chip selection

Raspberry Pi® and STPM32MP1xx could drive 2 SPI slave through CE0 and CE1. STPM4RasPIV21 is configured by default to CE0 (SB2 soldered). However, the user could configure CE1 by soldering SB1 and unsoldering SB2.

**Figure 8. SPI chip selection configuration**



### 1.7 Signal marking on PCB

All signals are marked on the PCB to facilitate end-user probing with a logic analyzer.

Figure 9. Signal marking on PCB

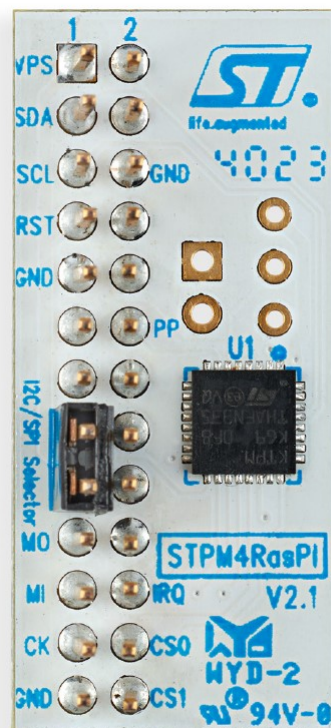


Table 2. Signal definition

Signal	Definition
VPS	Power supply at 3.3 V
SDA	Bidirectional I <sup>2</sup> C serial data
SCL	Input I <sup>2</sup> C serial clock
GND	Ground
RST	Reset, active low, used to reinitialize the device
PP	Physical Presence, active high, internal pull-down
I2C/SPI selector	GPIO 15 to connect VPS (SPI) GPIO15 to connect GND (I2C)
MO	MOSI SPI Master Output, Slave Input (output from master)
MI	MISO SPI Master Input, Slave Output (output from TPM)
IRQ	Active low, open drain, used by the TPM to generate an interrupt.
CK	SPI Serial Clock (output from master)
CS0	SPI Chip (or Slave) Select number 1, internal pull-up (active low; output from master)
CS1	SPI Chip (or Slave) Select number 2, internal pull-up (active low; output from master)

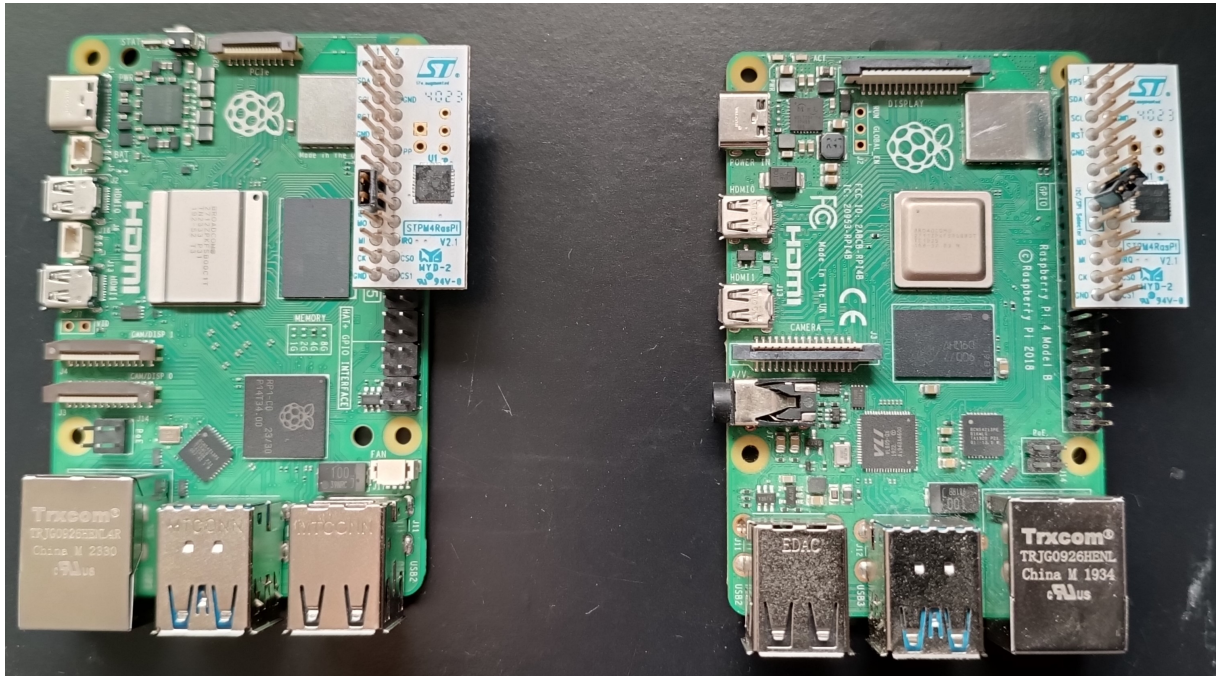
## 1.8 STPM4RasPIV21 connection

### 1.8.1 Raspberry Pi<sup>®</sup> 3, 4, and 5

The 40 GPIO header has the same definition and direction on the different versions (Raspberry Pi<sup>®</sup> 3, 4 or 5).

The STPM4RasPIV21 connection from pin 1 is broader than the Raspberry Pi® .  
The Raspberry Pi® box cannot be embedded. The button access at the bottom is improved.

**Figure 10. Raspberry Pi® 3, 4, and 5.**



### 1.8.2

#### **STM32MP135F-DK**

The STM32MP135F-DK Discovery kit (STM32MP135F-DK) leverages the capabilities of the 1 GHz STM32MP135 microprocessors to allow users to develop easily applications using STM32 MPU OpenSTLinux Distribution software.

STPM4RASPIV21 is plugged on 40 GPIO header as shown in the figure below.

Figure 11. STM32MP135F-DK



### 1.8.3 STPM32MP157F-DK2

STM32MP157-DK2 Discovery kits leverage the capabilities of the increased-frequency 800 MHz microprocessors in the STM32MP157 product line to allow users to develop applications easily using STM32 MPU OpenSTLinux Distribution software for the main processor, and STM32CubeMP1 software for the coprocessor.

The STM32MP157F 800MHz Discovery kit board include an ST-LINK embedded debug tool, LEDs, push-buttons, one Ethernet 1-Gbit/s connector, one USB Type-C® OTG connector, four USB Host Type-A connectors, one HDMI® transceiver, one stereo headset jack with analog microphone, and one microSD™ connector.

Figure 12. STPM32MP157F-DK2



To expand the functionality of the and STM32MP157F-DK2 Discovery kits, two GPIO expansion connectors are also available for ARDUINO® and Raspberry Pi® shields.

STPM4RasPIV21 is connected to a Raspberry Pi® shield as shown in the figure below.

Figure 13. STPM32MP157F-DK2



## 2 Linux®TPM activation

The table below describes TPM activation according to the Linux® kernel.

**Table 3. Linux®TPM activation**

Linux® kernel	TPM
6.1 and above	[TCG-TPM-I2C-DRV main]
5.10 to 6.0	[TCG-TPM-I2C-DRV 5.10 ]
5.4 to 5.9	[TCG-TPM-I2C-DRV 5.4]

TPM activation over STM32MP1x is facilitated. X-LINUX-TPM is a Yocto layer to support TPM driver and applications in I2C and SPI.

For further information on TPM integration, refer to the X-LINUX-TPM wiki and to the AN5714 application note in [Section 3: Linux®TPM application](#).

### 3 Linux®TPM application

For further information on the Linux®TPM application, refer to the following documentation.

**Table 4. Reference documentation**

Resource type	Resource location
Application note	AN5714 application note
Databrief	STPM4RasPI
GitHub	[TCG-TPM-I2C-DRV main]
GitHub	[TCG-TPM-I2C-DRV 5.4]
GitHub	[TCG-TPM-I2C-DRV 5.10 ]
PTP standard specification	PTP standard specification
Databrief	ST33KTPM2X
Databrief	ST33KTPM2XSPI
Wiki article	X-LINUX-TPM
GitHub	X-LINUX-TPM

*Note: Some of the above-mentioned URLs belong to a third-party. Active at document publication, STMicroelectronics shall not be liable for any change, move, or inactivation of the URL or the referenced material.*

## 4 Ordering information

The **STPM4RasPIV21** extension board can be ordered using the commercial product names listed in the table below.

**Table 5. Ordering information**

Commercial product	Description	TPM part numbers
SC-KTPM-RASPIKG9	TCG TPM2.0 spec 1.59, firmware version 9.257, SPI, and I2C interface.	ST33KTPM2X32DKG9

*Note:* For the description of the soldered products and details on how to order them, refer to the data briefs of the corresponding TPM devices (TPM part numbers defined in the above table).

## Revision history

**Table 6. Document revision history**

Date	Revision	Changes
30-Jan-2024	1	Initial release.

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