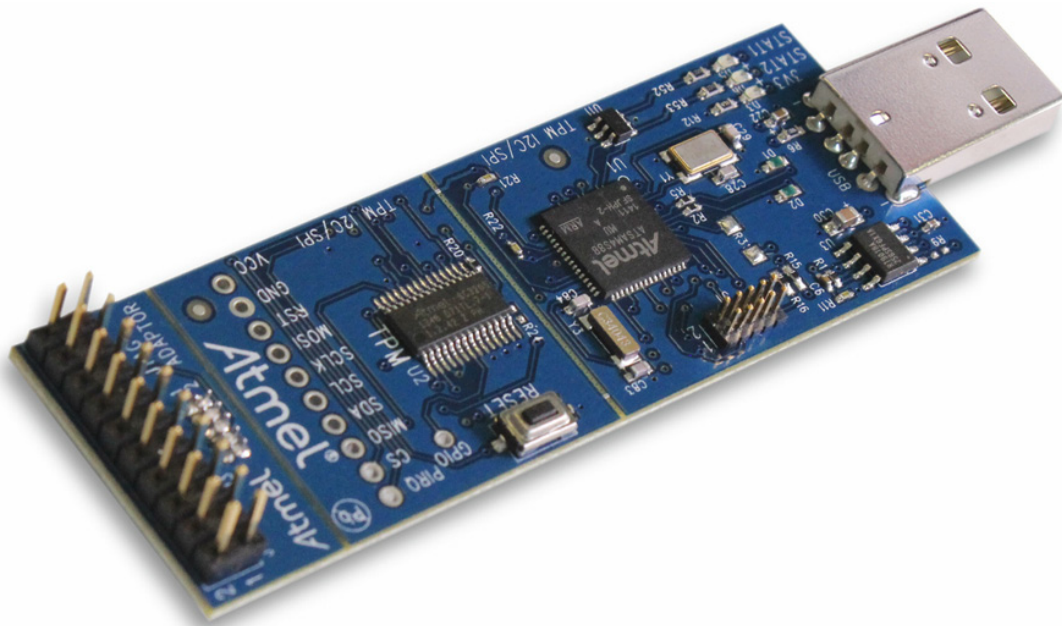


Atmel TPM I<sup>2</sup>C/SPI Development Kit

## USER GUIDE

Atmel I<sup>2</sup>C/SPI Demonstration Kit

## Introduction

The Atmel® TPM™ Development Kit includes examples of how to use the Trusted Platform Module (TPM) in an embedded and PC application. Source code is provided to enable an embedded designer to make quick progress in understanding and utilizing the TPM.

The TPM Development Kits are based on the Atmel SAM4S ARM® with an added I<sup>2</sup>C or SPI TPM device. The TPM demonstration code and evaluation software are included on a USB flash drive which comes with the kits. The board includes a SPI or I<sup>2</sup>C TPM, a SAM4S processor, a board reset button, a JTAG connector, and detachable segments to allow for engineering system integration as shown in [Figure 1](#).

Complete SAM4S ARM documentation can be found on the Atmel web site at the following link:

[http://www.atmel.com/Images/Atmel\\_11100\\_32-bit-Cortex-M4-Microcontroller\\_SAM4S\\_Datasheet.pdf](http://www.atmel.com/Images/Atmel_11100_32-bit-Cortex-M4-Microcontroller_SAM4S_Datasheet.pdf)

This TPM Development Kit User Guide documents the features specific to the TPM and references the SAM4S ARM documentation where appropriate.

## Features

The TPM kit is a custom board containing an I<sup>2</sup>C TPM or SPI TPM and related circuitry connected to the SAM4S ARM board. Interface signals on the board are:

- Power
- Ground
- PIRQ
- Chip Select (CS)
- MISO
- SDA
- SCL
- SCLK
- MOSI
- RST
- GND
- V<sub>CC</sub>

The following functional sections are provided on the Embedded TPM kit:

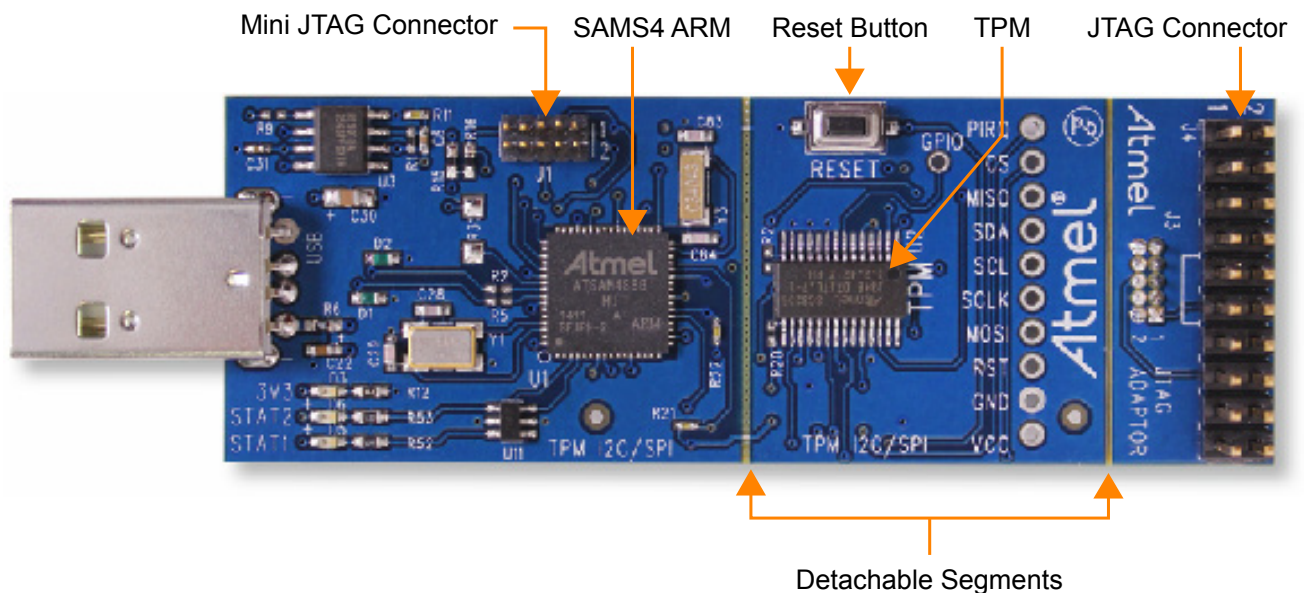
- AT97SC3205 I<sup>2</sup>C or SPI Atmel TPM
- TPM Reset Switch
- RC Reset Delay
- Decoupling Capacitors
- Pull-Up and Pull-Down Resistors
- Test Points

## USB Drive

The included USB drive includes the following:

- User Guide
- Source Code of the Demo
- Hex Images for Reloading the Demo (If Necessary)
- Kit Schematics

**Figure 1. Atmel I<sup>2</sup>C/SPI Demonstration Kit**



## Table of Contents

<b>TPM Overview .....</b>	<b>4</b>
Power .....	4
Reset Button .....	4
In-System Programming .....	4
Debugging .....	4
<b>Demonstration Software .....</b>	<b>5</b>
Initial One-Time Setup .....	6
Demo Menu Commands .....	6
Selection 1 - TPM_Startup (ST_CLEAR) .....	6
Selection 2 - TPM_ContinueSelfTest .....	7
Selection 3 - TPM_CreateEKPair .....	7
Selection 4 - TPM_TakeOwnership (Sequence) .....	7
Selection 5 - TPM_CreateWrapKey (Sequence) .....	8
Selection 6 - TPM_Loadkey (Sequence) .....	8
Selection 7 - TPM_Seal (Sequence) .....	9
Selection a - TPM_UnSeal (Sequence) .....	10
Selection b - TPM_Sign (Sequence) .....	10
Selection c - TPM_VerifySign (Sequence) .....	11
Selection d - TPM_GetPubKey (Sequence) .....	11
Selection t - getCapability_versionVal .....	12
Selection u - TPM_Reset (Clears authSessions) .....	12
Selection v - TPM_FlushSpecific (keyHandle) .....	12
Selection w - TPM_ForceClear (Sequence) .....	12
Selection x - Enable/Activate TPM (Sequence) .....	13
Selection y - Disable/Deactivate TPM (Sequence) .....	13
Selection z - Display Known Keys .....	13
<b>Technical Support .....</b>	<b>13</b>
<b>Hardware Reference Design .....</b>	<b>13</b>
Schematics .....	13
<b>Revision History .....</b>	<b>14</b>

## TPM Overview

---

### Power

The TPM receives power from the SAM4S ARM through the interface headers. During normal use, the SAM4S ARM is powered through the USB device connection, which doubles as both a power source and communication interface to the SAM4S ARM. The SAM4S ARM provides 5V to 3.3V regulated power for the TPM.

### Reset Button

The reset button resets the TPM. Pressing the reset button will only send a Power-On-Reset (POR) signal to the TPM.

### In-System Programming

The SAM4S ARM provided with the TPM differs from a standard SAM4S ARM in that the pre-programmed application software loaded in Flash memory is the TPM demonstration software, not the SAM4S ARM demonstration software.

The USB bootloader remains pre-programmed in ROM memory. This bootloader may be used to either reload the TPM demonstration software images or to load the SAM4S ARM demonstration software. The kit has a JTAG connector that can be detached from the kit and connected to the mini JTAG connector on the board. This will allow the reprogramming of the SAM4S ARM.



The TPM demonstration software must remain loaded in Flash memory in order to execute the I<sup>2</sup>C TPM demo.

Instructions on how to utilize the FLEXible In-system Programmer (“FLIP”) software in tandem with the USB bootloader to load SPI, I<sup>2</sup>C, or additional application software can be found in the [SAM4S ARM Datasheet](#). A copy of the FLIP installer is downloadable from [www.atmel.com](http://www.atmel.com).

For more advanced in-system programming techniques, the In-System Programmer SAM JTAG ICE combined with Atmel Studio<sup>®</sup> can be utilized over the provided JTAG interface port to exercise complete programming control over the processor.

If a software update is required on the TPM, and the customer does not have a SAM-ICE JAG, the SAM-BA tool can be downloaded using the following Atmel link:

<http://www.atmel.com/tools/atmelsam-bain-systemprogrammer.aspx>

Contact [crypto@atmel.com](mailto:crypto@atmel.com) for software update instructions.

### Debugging

For more advanced development and debugging techniques, the Atmel In-System Programmer SAM-ICE JTAG combined with the Atmel Studio and the Atmel Studio GCC C Compiler can be utilized over the provided JTAG interface port to exercise complete development and debugging control over the SAM4S processor.

## Demonstration Software

---

To start the demonstration software, follow the below steps:

1. Connect the TPM Demo Kit to an available USB port:
  - a. Insert the USB drive into the computer, and allow Windows to recognize the drive.
  - b. Install the **Atmel\_devices\_cdc.inf** file from the USB drive. The steps include the following:
    - Open **Device Manager**.
    - Select **CDC unknown device**.
    - From the **Device Manager** main menu, select **Action > Update Driver Software...**
    - Select **Browse my computer** for **Driver Software...button**.
    - Browse to the **.inf** file folder on the USB drive.
  - c. Install the TPM Demo Kit driver software. The TPM Demo Kit device should show as a COM PORT in the Device Manager.
2. Launch a terminal emulation software of your choice. The serial default connection default settings are:
  - Baud rate: 9,600
  - Data: 8 bit
  - Stop: 1 bit
  - Parity: None
  - Flow control: None
  - Echo Type Characters locally (*if available*).
3. Associate the terminal emulation software with the virtual COM port established by connecting the TPM Demo Kit to the system.
4. Activate the demonstration software by pressing any key while in the active terminal emulation software window. The below demonstration selection menu should appear.

---

### Demonstration Menu Selections

---

Available commands:

- 1) TPM\_Startup(ST\_CLEAR)
- 2) TPM\_ContinueSelfTest
- 3) TPM\_CreateEKPair
- 4) TPM\_TakeOwnership (sequence)
- 5) TPM\_CreateWrapKey
- 6) TPM\_Loadkey
- 7) TPM\_Seal (sequence)
  - a) TPM\_UnSeal (sequence)
  - b) TPM\_Sign (sequence)
  - c) TPM\_VerifySign
  - d) TPM\_GetPubKey
- t) TPM\_GetCapability(versionVal)
- u) TPM\_Reset (clears authSessions)
- v) TPM\_FlushSpecific - keyHandle
- w) TPM\_ForceClear (sequence)
- x) enable/activate TPM (sequence)
- y) disable/deactivate TPM (sequence)
- z) display known keys

Please pick a command:

Pressing the indicated numeral or letter beside each menu selection initiates transmission of a TPM command or command sequence to the TPM and reception of the TPM command response or responses back.

Details regarding these Trusted Computing Group (“TCG”) TPM Commands can be found in the “TPM Main Part 3 Commands” specification, located at: <https://www.trustedcomputinggroup.org/specs/TPM/> and on the USB drive located in the **TCG Docs** folder.

## Initial One-Time Setup

To ensure the TPM is in a known state, the below sequence is recommended. This sequence will clear any data that may have been loaded during manufacturing and testing of the kit. It will allow the user to complete the first steps that would have been completed during the initial manufacturing process of a TPM device.

1. Selection 1 - TPM\_Startup (ST\_CLEAR)
2. Selection w - TPM\_ForceClear (Sequence)
3. Selection x - Enable/Activate TPM (Sequence)
4. Selection 3 - TPM\_TakeOwnership (Sequence)

It is important that these four demo commands be executed in the order listed above. See Section, “Demo Menu Commands” below, for additional details on each command.



The kits are shipped with a pre-generated Endorsement Key which includes an X.509 certificate.

*Only one* Endorsement Key can be created during the lifetime of a TPM. Attempting to execute Selection 3 - TPM\_CreateEKPair command will respond with TPM\_DISABLED\_CMD return code of 0x00000008 indicating that an Endorsement Key already resides on the TPM.

After TPM\_TakeOwnership, the user should create and load keys that will enable the user to sign, verify signatures, seal and unseal data, along with exploring other demo functionality. See section, “Demo Menu Commands” below for more detailed information regarding the available options.

## Demo Menu Commands

### Selection 1 - TPM\_Startup (ST\_CLEAR)

The TPM\_Startup command initiates a startup on the TPM. This is the first command that must be executed after a TPM is powered-up or reset. In this case, the demo provided version of TPM\_Startup is TPM\_ST\_CLEAR.

TPM\_Startup(TPM\_ST\_CLEAR) does not actually clear the TPM. It is a fresh start where all variables go back to their default or non-volatile state.

TPM\_Startup can only be executed once after the TPM is powered-up or reset, returning a TPM\_SUCCESS return code of 0x00000000. If TPM\_Startup is executed again, it will return a TPM\_INVALID\_POSTINIT return code of 0x00000026. Any attempt to execute other commands prior to the TPM\_Startup command will also return the error code TPM\_INVALID\_POSTINIT.

## Selection 2 - TPM\_ContinueSelfTest

The `TPM_ContinueSelfTest` command requests the TPM to complete the self-test of all TPM cryptographic resources when convenient (i.e. when no other commands are being issued to the TPM). This command is not required on the I<sup>2</sup>C TPM since the I<sup>2</sup>C TPM automatically completes all self-test functions on a power-up or reset.

This command is required after a `TPM_Startup` on the SPI Interface TPM and is provided in the demo as an example of how to execute it on the TPM.

The expected return code after executing the `TPM_ContinueSelfTest` command is `TPM_SUCCESS 0x00000000`.

## Selection 3 - TPM\_CreateEKPair

The `TPM_CreateEndorsementKeyPair` command self-generates the Endorsement Key Pair (EK) on the TPM.

While the EK is being generated, the message ***waiting for TPM response...*** is displayed. Although normally only a few seconds, since key generation is non-deterministic, EK generation can take up to five minutes.

The first time `TPM_CreateEndorsementKeyPair` is executed, resulting in the generation of an Endorsement Key Pair, the TPM will return a `TPM_SUCCESS` return code of `0x00000000`.

Subsequent executions of `TPM_CreateEndorsementKeyPair` will return a `TPM_DISABLED_CMD` return code of `0x00000008`. The inclusion of this command sequence is to demonstrate and verify that an Endorsement Key is present on the TPM.

## Selection 4 - TPM\_TakeOwnership (Sequence)

The `TPM_TakeOwnership` command takes or establishes the owner of the TPM, generating a new Storage Root Key (SRK). The demo command, `TPM_TakeOwnership`, is a sequence comprised of the following:

1. A check is made to ensure the EK has been generated on the TPM. If not, then `TPM_CreateEndorsementKeyPair` is executed first.
2. The `TPM_GetCapability` command is executed to ensure that an owner is not currently present on the TPM.
3. Enter a value for the Owner authorization at the prompt ***enter owner Auth:***. Choose a passphrase of up to 40 characters.
4. The `TPM_BindV20` command is utilized to encrypt the Owner Auth.
5. Enter a value for the SRK authorization at the prompt ***enter SRK Auth:***. Choose a passphrase of up to 40 characters.
6. The `TPM_BindV20` command is utilized to encrypt the SRK Auth.
7. A `TPM_OIAP` command is executed to establish an authorization session.
8. The `TPM_TakeOwnership` command is executed.
9. While the SRK is being generated, the message ***Please wait. Generating SRK...*** is displayed. Since key generation is non-deterministic, SRK generation can take seconds or up to five minutes.
10. If `TPM_TakeOwnership` is successful, the TPM responds back with the public portion of the SRK and a `TPM_SUCCESS` return code of `0x00000000`.

`TPM_TakeOwnership` cannot be successfully executed again unless the owner has been cleared by the `TPM_ForceClear` command.



## Selection 5 - TPM\_CreateWrapKey (Sequence)

The TPM\_CreateWrapKey command generates a RSA Key pair. Ownership must be taken or established on the TPM before TPM\_CreateWrapKey can generate a RSA Key pair.

The demo command, TPM\_CreateWrapKey, is a sequence comprised of the following:

1. If no keys are loaded on the TPM, the TPM\_CreateWrapKey automatically uses the SRK as the parent key. If keys are loaded on the TPM, then choose either a previously loaded key or the SRK as the parent key.

Make the selection at the prompt:

```
known keyHandles:
  1: XX XX XX XX
  2: XX XX XX XX
  X: XX XX XX XX
pick a parent key (0=SRK):
```

2. A TPM\_OSAP command is executed to establish an authorization session.
3. Enter a value for the key migration Auth at the prompt **enter key migration Auth:**. Choose a passphrase of up to 40 characters.
4. Enter a value for the key usage Auth at the prompt **enter key usage Auth:**. Choose a passphrase of up to 40 characters.
5. Choose a type for the key, storage, or signing, at the prompt **please pick a key type:**.
6. Choose whether the key is migrateable or non-migrateable, at the prompt **please pick a key option:**.
7. Choose whether the key's authDataUsage is TPM\_AUTH\_ALWAYS or TPM\_AUTH\_NEVER, at the prompt **please pick a key option:**.
8. While the key is being generated, the message **waiting for TPM response...** is displayed. Since key generation is non-deterministic, key generation can take seconds or up to five minutes.
9. If the TPM\_CreateWrapKey command is successful, the TPM responds back with the public portion of the key, the encrypted private portion of the key, and a TPM\_SUCCESS return code of 0x00000000.
10. The key is now generated, but must be stored so it can be later loaded by TPM\_LoadKey2. The demo supports five cache slots 1 thru 5 in the SAM4S FLASH memory for the temporary storage of keys or other data. Choose a cache slot for storage of the key at the prompt **store key in which cacheSlot (1-5)?**.  
These five cache slots are Last In First Out ("LIFO") and may be overwritten when the stored data is no longer needed.

## Selection 6 - TPM\_Loadkey (Sequence)

The TPM\_LoadKey2 command loads a previously created key into the TPM for further use. The demo command, TPM\_Loadkey, is a sequence comprised of the following:

1. Choose a cache slot from which to load the key at the prompt **load key from which cacheSlot (1-5)?**.
2. A TPM\_OIAP command is executed to establish an authorization session.



3. If no keys are loaded on the TPM, TPM\_LoadKey2 automatically uses the SRK as the parent key. If keys are loaded on the TPM, then choose either a previously loaded key or the SRK as the parent key.

```
Make the selection at the prompt:
known keyHandles:
    1: XX XX XX XX
    2: XX XX XX XX
    X: XX XX XX XX
pick a parent key (0=SRK):
```

Selecting the incorrect parent key will result in a TPM\_LoadKey2 failure, and the TPM will return a TPM\_DECRYPT\_ERROR return code of 0x00000021.

4. The key is then loaded from the selected cache slot.
5. A successful execution of TPM\_LoadKey2 returns a TPM\_SUCCESS return code of 0x00000000, along with the TPM\_KEY\_HANDLE.

### Selection 7 - TPM\_Seal (Sequence)

The TPM\_Seal command encrypts private objects that can only be decrypted on the current platform by using the TPM\_Unseal command. Optional current or future configuration information indicated by the PCR registers can be included in the Seal operation. PCR configuration included in the Seal process is presently not supported in this demo. The demo command, TPM\_Seal, is a sequence comprised of the following:

1. If no keys are loaded on the TPM, TPM\_Seal automatically uses the SRK as the sealing key. If keys are loaded on the TPM, then choose either a previously loaded key or the SRK as the sealing key.

```
Make the selection at the prompt:
known keyHandles:
    1: XX XX XX XX
    2: XX XX XX XX
    X: XX XX XX XX
pick a sealing key (0=SRK):
```

The only allowed sealing keys are non-migrate able storage keys. Selecting a non-storage key as a sealing key will result in a TPM\_Seal failure, and the TPM will return a TPM\_INVALID\_KEYUSAGE return code of 0x00000024.

2. A TPM\_OSAF command is executed to establish an authorization session.
3. Enter an authorization value for the sealed blob at the prompt **enter auth value for sealed blob:**. Choose a passphrase of up to 40 characters.
4. Enter the data to seal at the prompt **enter data to seal (40 chars max):**. Choose data to seal of up to 40 characters.
5. A successful execution of the TPM\_Seal command returns a TPM\_SUCCESS return code of 0x00000000, along with the encrypted data blob.
6. The encrypted data blob must be stored so it can be later decrypted by the TPM\_Unseal command. The demo supports five cache slots 0 thru 4 in SAM4S FLASH memory for the temporary storage of keys or other data. Choose a cache slot for storage of the data blob at the prompt **store data blob in which cacheSlot (1-5)?**. These five cache slots are LIFO (Last In First Out) and may be overwritten when the stored data is no longer needed.

### Selection a - TPM\_UnSeal (Sequence)

The TPM\_Unseal command decrypts private objects which been encrypted on the current platform by TPM\_Seal. If optional current or future configuration information indicated by the PCR registers were included in the Seal operation, then there must be a match with the present PCR values in order for the TPM\_Unseal command to succeed. The demo command, TPM\_UnSeal, is a sequence comprised of the following:

1. If no keys are loaded on the TPM, TPM\_Unseal automatically uses the SRK as the sealing key. If keys are loaded on the TPM, then choose either the previously loaded storage key or the SRK that was used to seal the data blob as the sealing key.

Make the selection at the prompt:

```
known keyHandles:
```

```
1: XX XX XX XX
```

```
2: XX XX XX XX
```

```
X: XX XX XX XX
```

```
pick a sealing key (0=SRK):
```

2. A TPM\_OIAP command is executed to establish an authorization session.
3. A TPM\_OIAP command is executed to establish an authorization session.
4. Enter an Auth value for the sealed blob at the prompt **enter auth value for sealed blob:**. This must be the same passphrase of up to 40 characters used to seal the blob.
5. Choose a cache slot from which to load the data blob to unseal at the prompt **unseal blob from which Slot (1-5)?**.
6. A successful execution of the TPM\_Unseal command returns a TPM\_SUCCESS return code of 0x00000000, along with the unsealed data. An unsuccessful decryption of the data blob returns a TPM\_DECRYPT\_ERROR return code of 0x00000021.

### Selection b - TPM\_Sign (Sequence)

The TPM\_Sign command signs an input digest and returns the resulting digital signature. The demo command, TPM\_Sign, is a sequence comprised of the following:

1. A TPM\_OIAP command is executed to establish an authorization session.
2. TPM\_Sign requires a signing key be created with the TPM\_CreateWrapKey command and loaded on the TPM with TPM\_LoadKey2 before a digest can be signed. Choose a previously loaded signing key.

Make the selection at the prompt:

```
known keyHandles:
```

```
1: XX XX XX XX
```

```
2: XX XX XX XX
```

```
X: XX XX XX XX
```

```
pick a signing key:
```

The only allowed keys for signing are signing keys. Selecting a non-signing key as a signing key will result in a TPM\_Sign failure, and the TPM will return a TPM\_INVALID\_KEYUSAGE return code of 0x00000024.

3. Enter the digest to sign at the prompt **enter data to sign (40 chars max):**. Choose data to sign of up to 40 characters.
4. A successful execution of TPM\_Sign returns a TPM\_SUCCESS return code of 0x00000000, along with the digital signature.

5. The signature must be stored so it can be later verified by `TPM_VerifySignature`. The demo supports five cache slots 1 thru 5 in the EEPROM memory for the temporary storage of keys or other data. Choose a cache slot for storage of the signature at the prompt **store signature in which cacheSlot (1-5)?**. These five cache slots are LIFO and may be overwritten when the stored data is no longer needed.

### Selection c - TPM\_VerifySign (Sequence)

The Atmel Specific `TPM_VerifySignature` TPM command verifies an input digital signature and returns success or failure. The TPM is provided with the digital signature, the digest that was signed, and the public key needed to verify the signature. The demo command, `TPM_VerifySign`, is a sequence comprised of the following:

1. A `TPM_OIAP` command is executed to establish an authorization session.
2. Choose the signing key that was used to create the signature.  
Make the selection at the prompt:  
known keyHandles:  
    1: XX XX XX XX  
    2: XX XX XX XX  
    X: XX XX XX XX  
select a keyHandle:
3. Enter the digest that was signed at the prompt **enter signature verification data (40 chars max)**: This must be the same digest of up to 40 characters that was signed.
4. Choose the cache slot from which to load the signature to verify at the prompt **verify sign using signature from which cacheSlot (1-5)?**.
5. A successful execution of the `TPM_VerifySignature` command returns a `TPM_SUCCESS` return code of `0x00000000`, along with the message **signature verification complete!**. An unsuccessful verification of the digital signature returns a `TPM_INAPPROPRIATE_SIG` return code of `0x00000027`.

### Selection d - TPM\_GetPubKey (Sequence)

The `TPM_GetPubKey` command returns the public portion of a loaded key. The demo command, `TPM_GetPubKey`, is a sequence comprised of the following:

1. An `OIAP` is executed to establish an authorization session.
2. If no keys are loaded on the TPM, `TPM_GetPubKey` will abort with the failure message **getPubKey failed!**. If keys are loaded on the TPM, then read the public portion of a loaded key by selecting the keyHandle.  
Make the selection at the prompt:  
known keyHandles:  
    1: XX XX XX XX  
    2: XX XX XX XX  
    X: XX XX XX XX  
select a keyHandle:
3. A successful execution of `TPM_GetPubKey` returns a `TPM_SUCCESS` return code of `0x00000000`, along with the public portion of the selected loaded key.

### Selection t - getCapability\_versionVal

The `TPM_GetCapability` command returns current information regarding the TPM. The demo version of `TPM_GetCapability` has a `TPM_CAPABILITY_AREA` of `TPM_CAP_VERSION_VAL` and returns a `TPM_CAP_VERSION_INFO` structure.

A successful execution of `TPM_GetCapability` (`TPM_CAP_VERSION_VAL`) returns a `TPM_SUCCESS` return code of `0x00000000`, along with the `TPM_CAP_VERSION_INFO` structure.

### Selection u - TPM\_Reset (Clears authSessions)

The `TPM_Reset` command releases all resources associated with existing authorization sessions.

A successful execution of `TPM_Reset` returns a `TPM_SUCCESS` return code of `0x00000000`, along with releasing all authorization session resources.

If another command sequence returns an error code of `0x000015`, which indicates that all of the authorization sessions are active, this command must be executed to clear those existing authorization sessions.

### Selection v - TPM\_FlushSpecific (keyHandle)

The `TPM_FlushSpecific` command flushes a specific handle from the TPM, releasing the associated resources. The demo command, `TPM_FlushSpecific`, is limited to the flushing of key handles:

1. If no keys are loaded on the TPM, the `TPM_FlushSpecific` command will abort with the failure message ***flushKey failed!***. If keys are loaded on the TPM, then choose the key that needs to be flush.

Make the selection at the prompt:

known keyHandles:

0: XX XX XX XX

1: XX XX XX XX

X: XX XX XX XX

pick a key to flush:

2. A successful execution of `TPM_FlushSpecific` flushes the selected key and returns a `TPM_SUCCESS` return code of `0x00000000`.

### Selection w - TPM\_ForceClear (Sequence)

The `TPM_ForceClear` command performs the Clear operation under physical presence. All TPM state information will be cleared. The demo command, `TPM_ForceClear`, is a sequence comprised of the following:

1. Assert Physical Presence by executing the `TSC_PhysicalPresence` command, setting `TPM_STCLEAR_FLAGS.physicalPresence` to ***TRUE***.
2. Execute the `TPM_ForceClear` command, clearing the ***TPM***.
3. A successful execution of `TPM_ForceClear` returns a `TPM_DISABLED` return code of `0x00000007`, along with clearing the TPM, disabling the TPM, and requesting deactivation of the TPM at the next reset.

### Selection x - Enable/Activate TPM (Sequence)

This demo sequence will enable and activate the TPM.

1. Assert Physical Presence: Execute the `TSC_PhysicalPresence` command, setting `TPM_STCLEAR_FLAGS.physicalPresence` to **TRUE**.
2. Enable the TPM: Execute the `TPM_PhysicalEnable` command setting `TPM_PERMANENT_FLAGS.disable` to **FALSE**.
3. Request activation of the TPM at the next reset. Execute the `TPM_PhysicalSetDeactivated (FALSE)` command, setting `TPM_PERMANENT_FLAGS.deactivated` to **FALSE**.

### Selection y - Disable/Deactivate TPM (Sequence)

This demo sequence will disable and deactivate the TPM.

1. Assert Physical Presence: Execute the `TSC_PhysicalPresence` command, setting `TPM_STCLEAR_FLAGS.physicalPresence` to **TRUE**.
2. Request deactivation of the TPM at the next reset. Execute the `TPM_PhysicalSetDeactivated (TRUE)` command, setting `TPM_PERMANENT_FLAGS.deactivated` to **TRUE**.
3. Disable the TPM. Execute the `TPM_PhysicalDisable` command, setting `TPM_PERMANENT_FLAGS.disable` to **TRUE**.

### Selection z - Display Known Keys

This demo command displays the handles for all loaded keys. The resulting keyHandles display is as follows:

```
known keyHandles:  
0: XX XX XX XX  
1: XX XX XX XX  
X: XX XX XX XX
```

## Technical Support

---

For technical support on the TPM Development Kit please contact the local [Atmel Field Sales](#) representative or email [crypto@atmel.com](mailto:crypto@atmel.com).

For technical support on the Atmel SAM4S ARM, please reference the, “[Atmel SAM4S ARM Hardware User Guide](#)” for technical support information.

## Hardware Reference Design

---

### Schematics

Schematics of the I<sup>2</sup>C and SPI TPM kit PCB in PDF format are found on the included USB Flash Drive in the **Documentation** folder, and are also available on the [Atmel website](#). Please reference the “[SAM4S ARM Hardware User Guide](#)” for the SAM4S ARM schematics.

## ATMEL EVALUATION BOARD/KIT IMPORTANT NOTICE AND DISCLAIMER

This evaluation board/kit is intended for user's internal development and evaluation purposes only. It is not a finished product and may not comply with technical or legal requirements that are applicable to finished products, including, without limitation, directives or regulations relating to electromagnetic compatibility, recycling (WEE), FCC, CE or UL. Atmel is providing this evaluation board/kit "AS IS" without any warranties or indemnities. The user assumes all responsibility and liability for handling and use of the evaluation board/kit including, without limitation, the responsibility to take any and all appropriate precautions with regard to electrostatic discharge and other technical issues. User indemnifies Atmel from any claim arising from user's handling or use of this evaluation board/kit. Except for the limited purpose of internal development and evaluation as specified above, no license, express or implied, by estoppel or otherwise, to any Atmel intellectual property right is granted hereunder. ATMEL SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RELATING TO USE OF THIS EVALUATION BOARD/KIT.

ATMEL CORPORATION  
1600 Technology Drive  
San Jose, CA 95110  
USA

### Revision History

Doc Rev.	Date	Comments
8528D	05/2014	Update template, logos, disclaimer, and overall user guide to include the AT97SC3205T/P kits.



**Atmel Corporation** 1600 Technology Drive, San Jose, CA 95110 USA T: (+1)(408) 441.0311 F: (+1)(408) 436.4200 | [www.atmel.com](http://www.atmel.com)

© 2014 Atmel Corporation. / Rev.:Atmel-8528D-TPM-I2C-SPI-Development-Kit-UserGuide\_052014.

Atmel®, Atmel logo and combinations thereof, Enabling Unlimited Possibilities®, and others are registered trademarks or trademarks of Atmel Corporation in U.S. and other countries. ARM®, ARM Connected® logo, and others are the registered trademarks or trademarks of ARM Ltd. Other terms and product names may be trademarks of others.

DISCLAIMER: The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. EXCEPT AS SET FORTH IN THE ATMEL TERMS AND CONDITIONS OF SALES LOCATED ON THE ATMEL WEBSITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS AND PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and products descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

SAFETY-CRITICAL, MILITARY, AND AUTOMOTIVE APPLICATIONS DISCLAIMER: Atmel products are not designed for and will not be used in connection with any applications where the failure of such products would reasonably be expected to result in significant personal injury or death ("Safety-Critical Applications") without an Atmel officer's specific written consent. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Atmel products are not designed nor intended for use in military or aerospace applications or environments unless specifically designated by Atmel as military-grade. Atmel products are not designed nor intended for use in automotive applications unless specifically designated by Atmel as automotive-grade.





## Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331