Click here for production status of specific part numbers.

DS28E50 Evaluation Kit

Evaluates: DS28E50 and DS2477

General Description

The DS28E50 evaluation kit (EV kit) provides the hardware and software necessary to exercise the features of the DS28E50 and DS2477. The EV system consists of five DS28E50 and DS2477 devices in a 6-pin TDFN package, two DS9121BQ+ evaluation TDFN socket boards, and a DS9481P-300# USB-to-I²C/1-Wire[®] adapter. The evaluation software runs on Windows[®] 10 and Windows 7 operating systems. It provides a handy user interface to exercise the features of the DS28E50 and DS2477. Note that the evaluation software described herein is the lite version that is downloadable from Maxim's website. To request the full developer version, click the link at the top of the page.

Features

- Demonstrates the Features of the DS28E50 DeepCover[®] SHA3 1-Wire Authenticator
- Demonstrates the Features of the DS2477 DeepCover SHA3 Secure Coprocessor
- 1-Wire Communication Is Logged to Aid Firmware Designers Understanding of DS28E50 and DS2477
- 1-Wire/I²C USB Adapter Creates a Virtual COM Port on Any PC
- Fully Compliant with USB Specification v2.0
- Software Runs on Windows 10 and Windows 7
- Convenient On-Board Test Points, TDFN Socket

Quick Start

Required Equipment

This section includes a list of recommended equipment and instructions on how to set up the Windows-based PC for the evaluation software.

- DS9481P-300# USB to 1-Wire/I²C adapter (included)
- DS9121BQ+ TDFN socket board (two included)
- DS28E50Q+ (five devices included)
- DS2477Q+ (five devices included)
- USB Type A to Micro-USB Type B cable (included)
- PC with a Windows 10 or Windows 7 operating system and a spare USB 2.0 or higher port
- Download DS28E50 EV kit software (lite version) or request full DS28E50 EV kit developer software.

Note: In the following sections, software-related items are identified by **bolding**. Text in bold refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

EV Kit Contents

| QTY | DESCRIPTION |
|-----|---|
| 5 | DS28E50Q+ DeepCover SHA3 1-Wire Authenticator |
| 5 | DS2477Q+ DeepCover SHA3 Secure Coprocessor |
| 2 | DS9121BQ+ TDFN Socket Board |
| 1 | DS9481P-300# USB to 1-Wire/I ² C Adapter |
| 1 | USB Type-A to Micro-USB Type-B Cable |

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Ordering Information appears at end of data sheet.



Evaluates: DS28E50 and DS2477

Hardware Setup and Driver Installation Quick Start

The following steps were performed on a Windows 10 PC to set up the DS28E50 EV kit hardware/software:

- 1) Obtain and unpack the **DS28E50EVkit_Lite.zip file**, or the latest version.
- 2) Unplug any Maxim adapters before installing software.
- The DS9481P-300# driver is required to communicate through the USB via a virtual COM port. If DS9481 device driver is not installed:
 - a) Open folder DS9481_driver_Installer (Figure 1).
 - b) Run dpinst.exe (Figure 2).
 - c) Click <u>Next</u> on the Device Driver Installation Wizard window (Figure 3).
 - d) Click <u>Finish</u> on the Device Driver Installation Wizard window (Figure 4).
- 4) Plug in the DS9481 adapter.

| 0 Desktop | ^ | Name | Date modified | Туре | Size |
|-----------|---|---|--------------------|------------------|--------|
| Documents | | DS28E50_EVkitLite_Installer | 6/25/2018 10:38 AM | File folder | |
| | | BS9481_driver_Installer | 6/25/2018 10:38 AM | File folder | 7 |
| Music | | DS2477_DS28E50_EVkit SW quick start Lit | 6/21/2018 11:54 AM | Microsoft Word D | 426 KE |

Figure 1. File Viewer with DS28E50 Installer and DS9481 Device Driver Installer

| | Desktop > DS2477_DS28E50EVkit_Lite > DS9481_dr | | | |
|-------------|--|-------------------|-------------------|---------|
| Desktop | ^ Name | Date modified | Туре | Size |
| Documents | 💐 dpinst.exe | 7/11/2017 4:49 PM | Application | 1,026 K |
| 🕹 Downloads | - 🧼 DS9481P-300.cat | 7/11/2017 4:49 PM | Security Catalog | 8 K |
| Music | DS9481P-300.inf | 7/11/2017 4:49 PM | Setup Information | 2 k |

Figure 2. File Viewer with DS9481 Device Driver Installation File

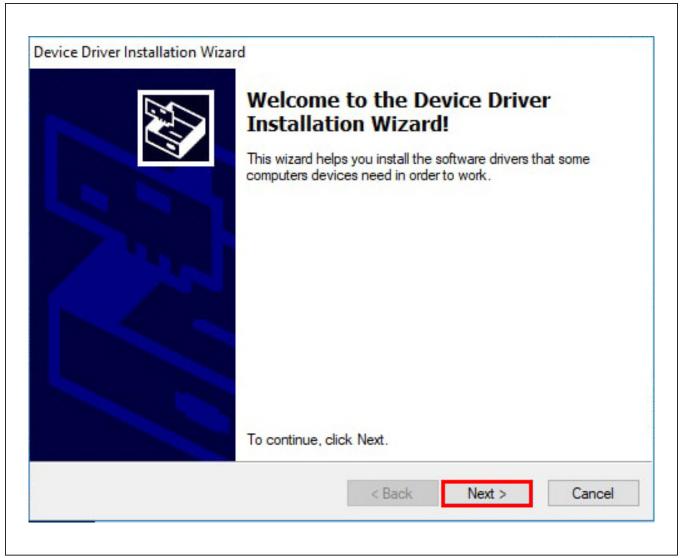


Figure 3. DS9481 Device Driver Installation Wizard

| Completing the Device Driver Installation Wizard | | |
|--|-------------------------------------|--|
| The drivers were successfully in You can now connect your devi came with instructions, please re | ce to this computer. If your device | |
| | | |
| Driver Name ✓ Maxim Integrated Produ | Status Ready to use | |

Figure 4. DS9481 Device Driver Installation Finished

Evaluates: DS28E50 and DS2477

- Go back to the <u>DS28E50EVkit_Lite</u> folder and open the <u>DS28E50_EVkitLite_Installer</u> folder and run <u>DS2477DS28E50GUILiteSetupV02.exe</u> (Figure 5).
- 6) The software license agreement will open. Read through the terms and select I accept the agreement and click **OK** to install the software (Figure 6).

| | | ^ | | | |
|------------------|---|----------------------------------|--------------------|-------------------|-------|
| - a state of the | | Name | Date modified | Туре | Size |
| Quick access | | Application Files | 6/25/2018 10:38 AM | File folder | |
| Desktop | Ж | DS28E50EVkitLite.application | 6/22/2018 4:10 PM | Application Manif | 14 KE |
| Downloads | × | DS2477DS28E50GUILiteSetupV02.exe | 6/22/2018 4:35 PM | Application | 605 K |

Figure 5. DS28E50/DS2477 EV Kit Installer File

| 22 COMPARING AND A REPORT TO A CONTRACT OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A | |
|---|---|
| Please read the following License Agreement. You must accept the terms of this agreement before continuing the use of the software. | |
| MAXIM INTEGRATED PRODUCTS, INC. SOFTWARE LICENSE TERMS AND CONDITIONS | ^ |
| The Software described in Table 1 above is provided pursuant to these Software License Terms and Conditions ("Agreement"). By responding to this email with your acceptance and agreement, you are entering into, agreeing to, and consenting to be bound by all of the terms of this Agreement, which is between you and Maxim Integrated Products, Inc. on behalf of itself and its affiliates and subsidiaries (collectively, "Maxim"). This Agreement is effective as of the date of your response (the "Effective Date"). You represent and warrant that you are at least eighteen (18) years of age if you are a resident of the United States, or the age of majority in the jurisdiction of your residence. If you are accepting these terms on behalf of the company identified in Table 2 above ("Company"), you represent and warrant that you have full authority to bind the Company to these terms. You and, if applicable, the Company may hereinafter be collectively referenced in this Agreement as the "Customer." | t |
| _Recitals_ A. Maxim, among other things, develops, manufactures, and sells semiconductor products and offers software consisting of certain software development tools, operating systems, driver software, firmware, and example application code. The provided software contains software or features representative or illustrative of those that can be used with Maxim ICs and can be used for development of software application programs to operate with Maxim ICs or products containing Maxim ICs. B. Customer desires to license the software from Maxim, under the terms and conditions of this Agreement. C. This Agreement permits Customer to license the software from Maxim or its distributors, representatives, or other partners who are duly authorized by Maxim to offer such licenses | |
| and sets forth the basic terms and conditions under which the software will be delivered. 1. Definitions. | ~ |
| I accept the agreement | |
| I do not accept the agreement OK | |

Figure 6. DS28E50 EV Kit Software License Agreement

Evaluates: DS28E50 and DS2477

7) Go to the <u>Windows Start</u> menu and click on DS28E50EVkitLite under the Maxim Integrated Products folder to launch the DS28E50 EV Kit program (Figure 7).

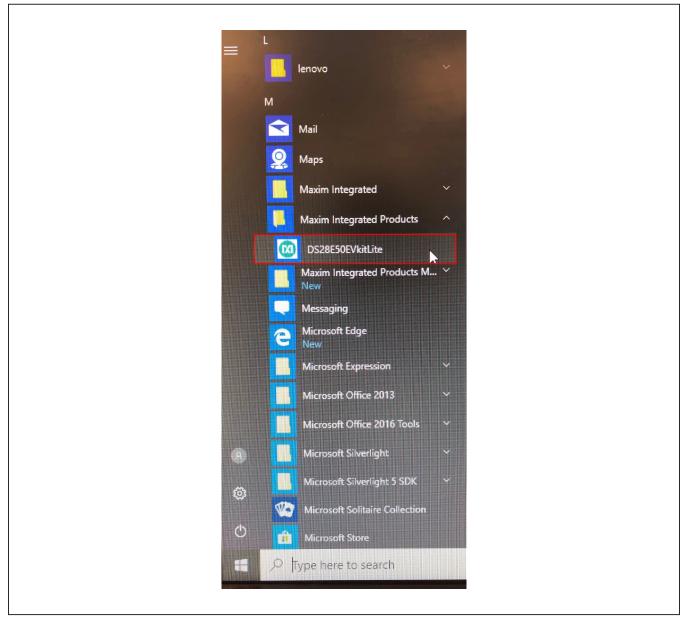


Figure 7. DS28E50 EV Kit Lite Software Program File in Windows Start in the Maxim Integrated Products Folder.

Evaluates: DS28E50 and DS2477

- 8) Plug the DS9481P-300# into the PC with one or both DS9121BQ+ socket boards by doing the following:
 a) (Optional—Perform only if using the coproces-
 - (Optional—) enormony in dang the coprocession: Open the 1st socket and insert a DS2477 into one of the cavities, as shown in <u>Figure 8</u>.
 Note: The plus (+) must be oriented in the bottom left corner of the socket.
- b) Open the 2nd socket and insert a DS28E50 into the cavity, per the same orientation shown in <u>Figure 8</u>, with the plus (+) oriented in the bottom left corner of the socket.
- c) Close both burn-in sockets.

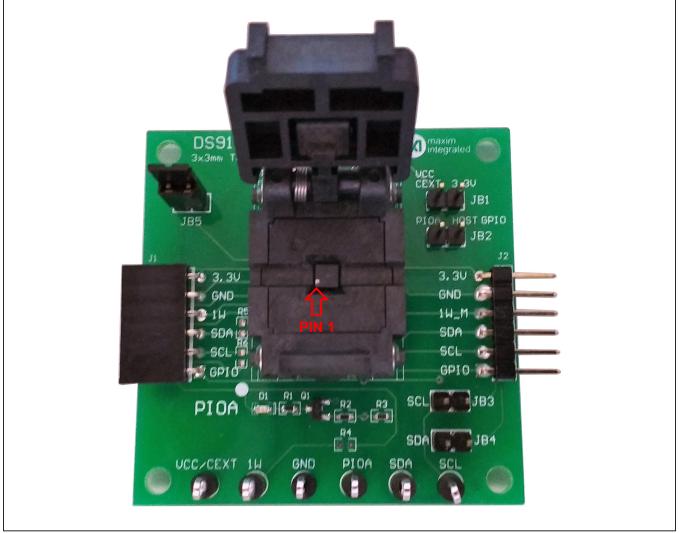


Figure 8. DS28E50 and DS2477 Orientation in Burn-In Socket

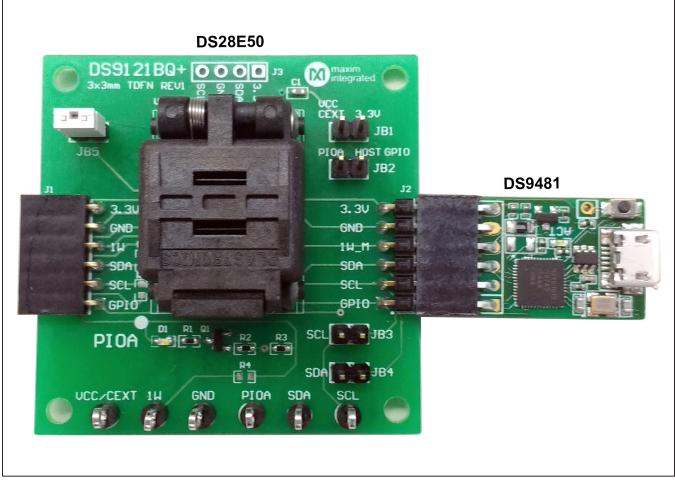


Figure 9. DS9481 Connected to DS28E50

Evaluates: DS28E50 and DS2477

- d) Connect the 1st DS9121BQ J2, 6-pin male plug, into the DS9481P-300#, 6-pin female socket per Figure 10.
- e) Connect the 2nd DS9121BQ J2, 6-pin male plug, into the 1st DS9121BQ J1, 6-pin female socket per Figure 10.
- f) For the 1st DS9121BQ+ socket boards that contains the DS2477, configure jumpers JB3 to

use SCL, JB4 to use SDA and JB1 to use 3.3V per Figure 10.

- g) For the 2nd DS9121BQ+ socket board that contains the DS28E50, configure jumpers JB5 to use 1W per Figure 10.
- h) Plug the DS28E50 EV kit, using a USB Type-A to Micro-USB Type-B cable, into the PC.

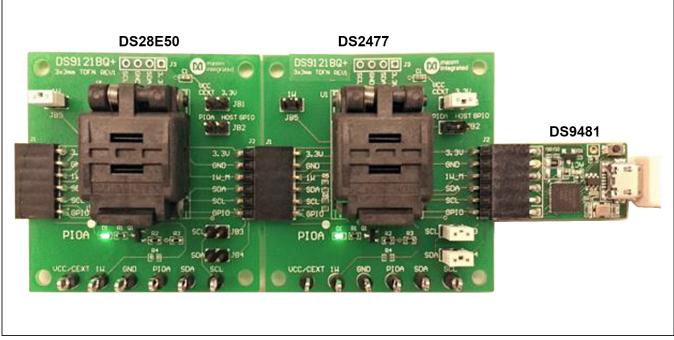


Figure 10. DS9481 Connected to DS2477 and DS28E50

Evaluates: DS28E50 and DS2477

9) Choose the DS28E50 or DS2477 under the **Device** tab, shown in Figure 11 and click **Run** to complete the detection process.

| File Device Options Help | | |
|---|--|---|
| DS28E50 DS2477 3 . Compute HMAC 4 . DS2477 to DS28E50 cmds | Back Next Run Info Detect DS247 Read ROM Option Page to get MAN ID and ROM ID. ROM ID MAN ID | 7 |
| [47] [0A] [AA] [00] [00] [00] [00] [01] [01] [0 [46] [44] [01] [00] P Delay 50ms> | | ▲ [F3] [96] [3E] [75] [98] [B0] [BA] [1B] [BD] [FC] [0D] P |

Figure 11. DS28E50 EV Kit Main Program Screen. Choose a Device from the Device Pulldown Menu.

Evaluates: DS28E50 and DS2477

10) Wait for the green **Device Detected** message to appear and the ROMID and MANID fields to populate as shown in Figure 12. If this message does not appear, check your hardware connections.

| ile Device Options Help | | |
|--|--|-------------------|
| 1. Detect DS2477 2. Generic Commands | Back Next Run Info Detect DS | \$2477 |
| 3. Compute HMAC 4. DS2477 to DS28E50 cmds | Read ROM Option Page to get MAN ID and ROM ID. | |
| | ROM ID 20 00 01 02 03 04 05 C5 | |
| | MAN ID CD AB | Device Detected |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| 7] [01] [AA] P 6] [88] [02] [00] [80] P | | |
| lay 50ms> | | |
| 7] [02] [AA] [0A] P | | |
| DS2477 Connected | | Connected To COM8 |

Figure 12. DS2477 Successfully Detected by the EV Kit Software

Evaluates: DS28E50 and DS2477

EV Kit Supported Functions

The DS28E50 EV kit program is designed as a usage example.

The software can be used to evaluate the DS28E50 independently or in conjunction with the DS2477.

To evaluate the DS28E50 by itself, use the hardware configuration shown in Figure 9. In this case, select **DS28E50** from the **Device** drop-down menu. If **DS2477** is selected from the device menu, the coprocessor (DS2477) is used to communicate with the DS28E50. The hardware configuration in <u>Figure 10</u> is used for evaluation of the DS28E50 combination.

The GUI displays all the I^2C and 1-Wire sequences for each step performed to assist the firmware engineer. See <u>Table 1</u> and <u>Table 2</u> for descriptions of the limited functions provided in the lite version of the EV kit GUI for both the DS28E50 and DS2477, respectively. To request the full developer version of the program, click the link at the top of page 1.

Table 1. GUI Setup and Usage Flows Supported in DS28E50

| FLOW* | DESCRIPTION |
|---|--|
| Detect Device | Reads page 7 to get ROMID and MANID. |
| Compute and Read Page Authentication | Creates authentication response based on given challenge. Results in a SHA-3 signature. CRPA sequence can be done on pages 0-5. Use in field to do an authentication with HMAC for a read page(s) of memory. |
| Authenticated SHA3 Write Memory | Use at factory to do an authenticated write to a page of memory. |
| Read Status | Read page protections set on each page. |
| Read Memory | Read any page of memory without RP or EPH protection set. |
| Write Memory | Write data to any page (0-8) without WP, APH, or EPH protection set. |
| 1-Wire Read ROM | Read device ROMID. |

*Software supports all DS28E50 flows in Table 1.

Table 2. GUI Setup and Usage Flows Supported in DS2477

| FLOW* | DESCRIPTION |
|----------------------------|---|
| Detect DS2477 | Reads page 7 to get ROMID and MANID. |
| Compute HMAC | Write the Master Secret, Bind Data, and Partial Secret and issue the Compute and Lock Secret Command to generate an HMAC. |
| Read Status | Read page protections set on each page. |
| Read Memory | Read any page of memory without RP or EPH protection set. |
| Write Memory | Write data to any page (0-8) without WP, APH, or EPH protection set. |
| 1-Wire Search ROM | Search for the slave ROMID values on the 1-Wire line. |
| DS2477 to DS28E50 Commands | Send the following commands to the DS28E50: Read Status, Read Memory and Write Memory |

*Software supports all DS2477 flows in Table 2.

Ordering Information

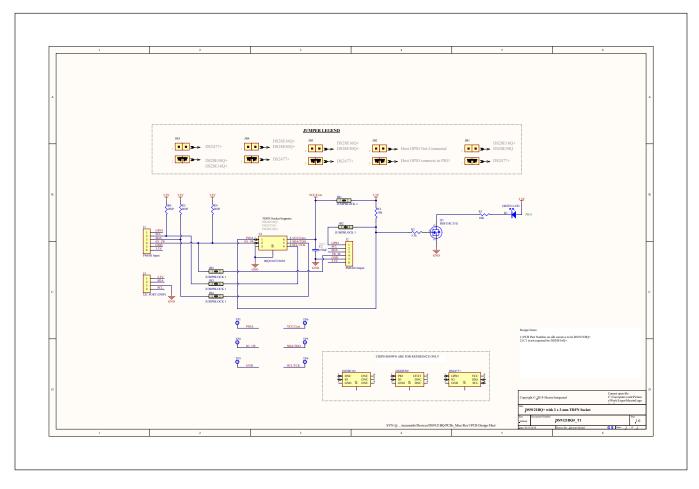
| PART | TYPE |
|---------------|--------|
| DS28E50EVKIT# | EV Kit |

#Denotes RoHS compliant.

Evaluates: DS28E50 and DS2477

| DESIGNATOR | QTY | DESCRIPTION | MANUFACTURER | PART NO. |
|------------|-----|--|-----------------------------|--------------------|
| J1 | 1 | CONN FEMALE 6POS .100" R/A GOLD | Sullins Connector Solutions | PPPC061LGBN-RC |
| J2 | 1 | CONN HEADER 6 POS RA 2.54 | Wurth Electronics Inc. | 61300611021 |
| TP1-TP6 | 6 | TEST POINT PC MULTI PURPOSE BLK | Keystone Electronics | 5011 |
| U1 | 1 | SOCKET+, IC TDFN, 3MM, 3x2, CLAMSHELL | PLASTRONICS | 06QN10T23030 |
| C1 | 1 | CAP CER 0.47UF 16V X7R 0603 | KEMET | C0603C474K4RACTU |
| D1 | 1 | LED GREEN CLEAR 0603 SMD | Dialight | 5988081107F |
| JB1-JB5 | 5 | CONN HEADER 2 POS 2.54 | Wurth Electronics Inc. | 61300211121 |
| Q1 | 1 | MOSFET N-CH 50V 200MA SOT-23 | ON Semiconductor | BSS138LT1G |
| R1, R3 | 2 | RES SMD 10K OHM 0.1% 1/10W 0603 | Bourns Inc. | CRT0603-BY-10R0ELF |
| R2 | 1 | RES SMD, 3.3K OHM, 1%, 0603 | Yageo | RC0402JR-071K5L |

DS9121 BQ EV Kit Bill of Materials



DS28E50/DS2477 EV Kit Schematic

Evaluates: DS28E50 and DS2477

Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|--------------------|------------------|---|---------------------------|
| 0 | 8/18 | Initial release | _ |
| 1 | 10/18 | Added DS2477 | 1–15 |
| 2 | 2/19 | Updated General Description, Quick Start, Hardware Setup and Driver Installation Quick Start, Figure 6 caption, Figure 7 caption, Figure 11 caption, EV Kit Supported Functions section, Ordering Information, and replaced schematic | 1, 5, 6, 9, 10, 12, 14 |

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