Click here for production status of specific part numbers.

### DS28E84 Evaluation System

### Evaluates: DS28E84 and DS2476

#### **General Description**

The DS28E84 evaluation system (EV system) provides the hardware and software necessary to exercise the features of the DS28E84. The EV system consists of five DS28E84/DS2476 devices in a 6-pin TDFN package, two DS9121AQ+ evaluation TDFN socket boards, and a DS9481P-300# USB-to-I<sup>2</sup>C/1-Wire<sup>®</sup> adapter. The evaluation software runs under Windows<sup>®</sup> 10, Windows 8, and Windows 7 operating systems, both 64-bit and 32-bit versions. It provides a handy user interface to exercise the features of the DS28E84 and DS2476.

#### **EV Kit Contents**

QTY	DESCRIPTION
5	DS28E84 DeepCover Radiation Resistant 1-Wire Authenticator (6 TDFN)
5	DS2476Q+ DeepCover Secure Coprocessor (6 TDFN)
2	DS9121AQ+ Socket Board (6 TDFN)
1	DS9481P-300# USB to 1W/I <sup>2</sup> C Adapter
1	USB Type-A to Micro-USB Type-B Cable

#### **Features**

- Demonstrates the Features of the DS28E84
  DeepCover<sup>®</sup> Radiation Resistant 1-Wire Authenticator
- Demonstrates the Features of the DS2476 DeepCover Secure Coprocessor
- 1-Wire/I<sup>2</sup>C Communication Is Logged to Aid Firmware Designers Understanding of DS28E84 and DS2476
- 1-Wire/I<sup>2</sup>C USB Adapter Creates a Virtual COM Port on Any PC
- Fully Compliant with USB Specification v2.0
- Software Runs on Windows 10, Windows 8, and Windows 7 for Both 64-Bit and 32-Bit Versions
- 3.3V ±3% 1-Wire Operating Voltage
- Convenient On-Board Test Points, TDFN Socket
- Evaluation Software Available by Request

Ordering Information appears at end of data sheet.

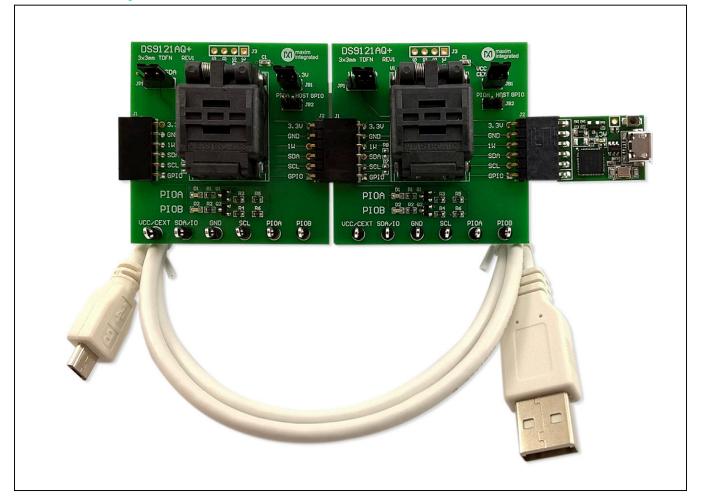
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Windows is a registered trademark and registered service mark of Microsoft Corporation.



### Evaluates: DS28E84 and DS2476

#### DS28E84 EV System



#### **Quick Start**

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

#### **Required Equipment**

- DS9481P-300# USB to 1-Wire/I<sup>2</sup>C adapter (included)
- DS9121AQ+ TDFN socket board (two included)
- DS28E84Q+ (five devices included)
- DS2476Q+ (five devices included)

- USB Type A to Micro-USB Type B cable (included)
- PC with a Windows 10, Windows 8, or Windows 7 operating system (64 bit or 32 bit) and a spare USB 2.0 or higher port
- Download <u>DS28E84 EV kit software (light version)</u> or request full DS28E84 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.

### Evaluates: DS28E84 and DS2476

# Hardware Setup and Driver Installation Quick Start

 In a file viewer (Figure 1), double click on <u>DS28E83</u> <u>DS28E84\_EV\_Kit\_Software\_Setup\_V1.2.0.exe</u> to begin the installation.

3) The setup wizard opens; click on Next.

The following steps were performed on a Windows 7 PC to set up the DS28E84 EV kit hardware/software:

1) Obtain and unpack the <u>DS28E83\_DS28E84\_EV\_Kit\_</u> <u>Software\_Setup\_V1.2.0.zip</u> file, or the latest version.

🔾 💭 🗢 📕 🕨 DS28E83_DS28E84 EV	КІТ	-	✓ Search DS2	8E83_DS28E84 EVKI	P
<u>File E</u> dit <u>V</u> iew <u>T</u> ools <u>H</u> elp					
Organize 👻 Include in library 👻	Share with 🔻 New folder			•	0
🔶 Favorites	Name	Date modified	Туре	Size	
👃 Downloads	DS28E83_DS28E84_Evaluation_Kit_Setup_V1.2.0.exe	10/9/2018 1:59 PM	Application	14,644 KB	
Recent Places					
🧮 Desktop					

Figure 1. File Viewer

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4) Click **Browse** to select a default folder location, and then click **Next** to install the EV kit software (Figure 2).

Select Destination Location Where should DS28E83_DS28E84 Evaluation Kit be installed?	
Setup will install DS28E83_DS28E84 Evaluation Kit into the fol	llowing folder.
To continue, dick Next. If you would like to select a different folder, di	lick Browse.
ram Files (x86) Waxim Integrated \DS28E83_DS28E84 Evaluation Kit	Browse
At least 21.5 MB of free disk space is required.	

Figure 2. Install Folder Location

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### Evaluates: DS28E84 and DS2476

5) Click <u>Next</u> to install shortcuts to the default folder (Figure 3).

Select Start Menu Folder Where should Setup place the pro	ogram's shortcuts?	
Setup will create the pro	ogram's shortcuts in the following Sta	rt Menu folder.
To continue, dick Next. If you we	ould like to select a different folder, c	lick Browse.
Maxim Integrated\DS28E83_DS2		Browse
Don't create a Start Menu fold	ler	

Figure 3. Program Shortcuts Location

### Evaluates: DS28E84 and DS2476

6) Unplug any Maxim adapter and click on <u>Next</u>, with the default settings checked. This selects and installs the DS9481P-300# driver, which is needed to communicate through the USB using a virtual COM port (Figure 4).

Select Additional Tasks Which additional tasks should be	performed?	
		(111
Select the additional tasks you w DS28E83_DS28E84 Evaluation Ki	ould like Setup to perform while installing t, then dick Next.	
🚺 İnstall DS9481P-300 driver		
Additional shortcuts:		
Create desktop icon		
Start menu icons:		
🔽 Create uninstall icon		

Figure 4.Select to Install the Driver

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### Evaluates: DS28E84 and DS2476

7) Next click on **Install**. A new window pops up to show the installing progression (Figure 5).

Ready to Install Setup is now ready to begin installing DS2	8E83 DS28E84 Evaluation Kit on your
computer.	
Click Install to continue with the installation change any settings.	n, or click Back if you want to review or
Destination location: C:\Program Files (x86)\Maxim Integra Start Menu folder: Maxim Integrated\DS28E83_DS28E84 Additional tasks: Install DS948 IP-300 driver Start menu icons: Create uninstall icon	ated\DS28E83_DS28E84 Evaluation Kit
	-
*	•

Figure 5. Ready to Install

### Evaluates: DS28E84 and DS2476

8) Click on <u>Next</u> when the Device Driver Installation Wizard appears (Figure 6).

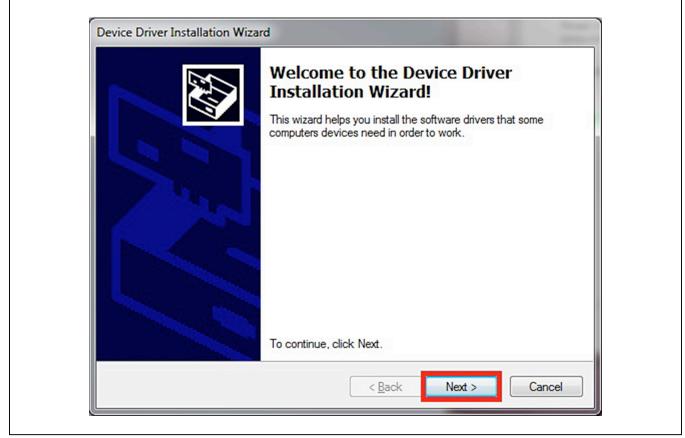


Figure 6. Device Driver

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### Evaluates: DS28E84 and DS2476

9) Click on Finish to close the final window and confim the driver is installed correctly (Figure 7).

The drivers were successfully installed on this computer.      You can now connect your device to this computer. If your device came with instructions, please read them first.      Driver Name    Status      Maxim Integrated Produ    Ready to use	Completing the De Installation Wizard	
came with instructions, please read them first.    Driver Name    Status	The drivers were successfully in	stalled on this computer.
	You can now connect your dev came with instructions, please re	ice to this computer. If your device ead them first.
✓ Maxim Integrated Produ Ready to use		
	Driver Name	Status

Figure 7. Device Driver Installation Finished

### Evaluates: DS28E84 and DS2476

- 10) Plug the DS9481P-300# into the PC with both DS9121AQ+ socket boards by doing the following:
  - a) (Optional—Perform only if using the coprocessor): Open the 1st socket and insert a DS2476 into one of the cavities, as shown in Figure 8.
    Note: The plus (+) on the package must be on the opposite side of the marker in the socket.
  - b) Open the 2nd socket and insert a DS28E84 into one of the cavities, per the same orientation shown in Figure 8.
  - c) Close both burn-in sockets.
  - d) Connect the 1st DS9121AQ J2, 6-pin female socket, into the DS9481P-300#, 6-pin male plug per Figure 9.

- e) Connect the 2nd DS9121AQ J2, 6-pin female socket, into the 1<sup>st</sup> DS9121AQ J1, 6-pin male plug per Figure 9.
- f) For the 1st DS9121AQ+ socket boards that contains DS2476, configure jumpers JP1 to use SDA and JB1 to use 3.3V per Figure 9.
- g) For the 2nd DS9121AQ+ socket boards that contains DS28E84, configure jumpers JP1 to use 1W and JB1 do not install per Figure 9.
- h) Plug the DS28E84 EV kit, using a USB Type-A to Micro-USB Type-B cable, into the PC.



Figure 8. Orientation of the DS28E84 and DS2476 in the Burn-In Socket

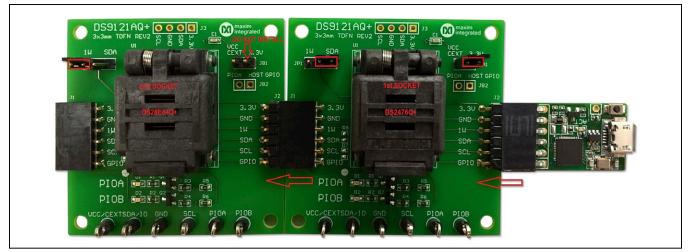


Figure 9. DS9481P-300 and DS9121AQ

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### Evaluates: DS28E84 and DS2476

11) Click on **<u>Finish</u>** to close the final window and confirm the software is installed correctly (Figure 10).

Setup Wizard
Setup has finished installing DS28E83_DS28E84 Evaluation Kit on your computer. The application may be launched by selecting the installed shortcuts.
 Click Finish to exit Setup.
Launch DS28E83_DS28E84 Evaluation Kit

Figure 10. Software Installation Finished

### Evaluates: DS28E84 and DS2476

12) The DS28E84 EV kit program opens and automatically connects to the COM port. This can be verified in the lower right corner of the window, as shown in Figure 11.

Auth w/ECDSA; Setup	
Auth w/ECDSA; Setup	Back Next Info Run Auth w/ECDSA; Setup
Auth w/ECDSA; Write Auth Key Pair  Auth w/ECDSA; Write App Key Pair  Auth w/HAC SHA-256; Setup  Auth w/HMAC SHA-256; Read  Auth w/HMAC SHA-256; Write  ECDH Encrypted; Setup  ECDH Encrypted; Setup  ECDH Encrypted; Read  Secure Boot w/ECDSA; Setup  Secure Boot w/ECDSA; Usage  Miscellaneous	This is an example to perform at a provisioning authority (e.g. a secure server at an equipment manufacturer) to setup for a read and write authentication with ECDSA. This example will compute three different key pairs. First, a Verify Authority Key Pair will be computed to create device unique certificates that later can be used to confirm the device (i.e. the authentication) is part of the system. Second, a Write Authority Key Pair is computed to authorize writes to an ECDSA-protected device. Thirdly, an Application Key Pair is computed and could be deployed in the application (e.g. the equipments firmware). In an actual provisioning authority, it is important to keep the private keys secure. After setting up the key pairs, this example also sets up the device and two certificates. The first certificate, called the Master Certificate and signed by the Write Authority Private Key, is used for authenticated writes with the Application key Pair. The second certificate (i.e. a device unique certificate) is a signature by the Verify Private Key of the Device Public Key plus ther satic data and certificate (i.e. a device unique certificate) as signature by the Verify Private Key of the Device Public Key plus ther satic data and certificate of confirm the equipment is part of a system. Lastly, the appropriate protection settings (e.g. ECW) are then set for the device.
1-Wire I2C	
RP	

Figure 11. DS28E84 EV Kit Program (Default View Upon Opening)

### Evaluates: DS28E84 and DS2476

#### **EV Kit Supported Functions**

The DS28E84 EV kit program is designed as a usage example. It includes the ability to either use the built-in software ECDSA engine or the DS2476Q+ coprocessor as the host compute engine. The default is to use the software ECDSA engine. To use the coprocessor, go under the **Settings** menu, then **ECDSA Engine**, and select **DS2476**. The GUI displays all the I<sup>2</sup>C and 1-Wire sequences for each step performed to assist the firmware engineer. See <u>Table 1</u> for descriptions of the functions in the GUI.

#### **Detailed Hardware Description**

The DS28E84 EV kit hardware includes the MAXQ1010 microcontroller with USB and two DS9121AQ socket adapters that are made to contain the DS28E84 device or DS2476 device. The MAXQ1010 is loaded with firmware to function as a virtual COM port that bridges UART signaling to I<sup>2</sup>C and 1-Wire. Optionally, the DS2476 functions to off load the ECDSA computations to perform signature. The DS28E84 1-Wire slave functions to perform ECDSA Public-Key signatures during authentication and contains memory space for the necessary elements.

#### DS2476 FLOW\* DESCRIPTION SUPPORT Auth w/ECDSA; Х Use at factory to set up ECDSA authentication. Setup Auth w/ECDSA; Х Use in field to authenticate with ECDSA for a read page of memory. Read Auth w/ECDSA: Change a page of memory using the Write Authority Key Pair by a write Х authentication with ECDSA. Write Auth KP Change a page of memory using the Application Key Pair by a write authentication Auth w/ECDSA: with ECDSA. Requires the master's certificate created with the Application Public Х Write App KP Keys and signed by the Write Authority Private key. Auth w/HMAC Use at factory to setup authentication with HMAC. SHA-256; Setup Auth w/HMAC Use in field to do an authentication with HMAC for a read page(s) of memory. SHA-256; Read Auth w/HMAC Use in field to do an authentication with HMAC for a write page of memory. SHA-256; Write ECDH Encrypted; Use at factory to setup the host system to decrypt an encrypted page on the device. Setup ECDH Encrypted; In the field, write an encrypted page to the device with ECDSA protected by ECH. Write ECDH Encrypted; In the field, read encrypted data from the device with ECDSA and decrypt with the host Read system. Secure Boot w/ Use to set up secure boot for the device in the factory. ECDSA; Setup Secure Boot w/ Usage select flow to be applied for secure boot of the device in the field. ECDSA; Usage Miscellaneous Miscellaneous features (e.g., RNG function, ROM options, GPIO control) of the device.

#### Table 1. GUI Setup and Usage Flows Supported

\*Software supports all flows in Table 1

### Evaluates: DS28E84 and DS2476

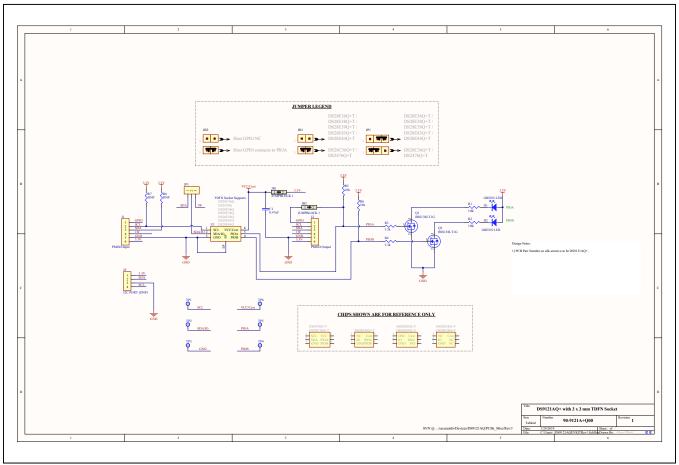
## **Ordering Information**

PART	ТҮРЕ
DS28E84EVKIT#	EV Kit

#Denotes RoHS compliant.

### **DS9121AQ EV Kit Bill of Materials**

DESIGNATOR	QUANTITY	DESCRIPTION	MANUFACTURER	PART NUMBER
J3	1	4 Pin 100mil Female Connector	Samtec	SSQ-104-02-T-S-RA
R3, R4	2	RES 3.3KΩ 1/10W 1% 0603 SMD	Panasonic Electronic Components	ERJ-3EKF3301V
R1, R2, R5, R6	4	RES SMD 1KΩ 1% 1/10W 0603, RES SMD 10KΩ 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF1002V
C1	1	CAP CER 0.47UF 16V X7R 060	Kemet	C0603C474K4RACTU
Q1, Q2	2	MOSFET N-CH 50V 200MA SOT-23	ON SEMICONDUCTOR	BSS138LT1G
D1, D2	2	LED INGAN GREEN CLEAR 0603 SMD	Dialight	598-8081-107F
J1	1	CONN HEADER FEMALE 6POS .1" GOLD	TE Connectivity	9-146285-0
J2	1	CONN HEADER FEMALE 6POS .1" GOLD	TE Connectivity	9-146285-0
JP1	1	HDR,BRKWAY, 100 3POS VERT, 0.318"	Tyco Electronics	9-146276-0
U1	1	TDFN,3MM,x2,CLAMSHELL,BURNIN	PLASTRONICS	06QN10T23030
JB1, JB2	2	JUMPER BLOCK, .100 2POS VERT,0.318"	Tyco Electronics	22-28-4363
Pack Out	5	DEEPCOVER SECURE COPROCESSOR	Maxim Integrated	DS2476Q+
Pack Out	5	10K OTP/15K FRAM ECC/SHA2 SECURE AUTH	Maxim Integrated	DS28E84Q+
Pack Out	3	SHUNT+,LP W/HANDLE 2 POS 30AU	Tyco Electronics	881545-2



### DS28E84 EV Kit Schematic

### Evaluates: DS28E84 and DS2476

#### **Revision History**

REVISION	REVISION	DESCRIPTION	PAGES
NUMBER	DATE		CHANGED
0	3/19	Initial release	—

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