Click here for production status of specific part numbers.

### DS28E39 Evaluation System

# Evaluates: DS28E39 and DS2476

### **General Description**

The DS28E39 evaluation system (EV system) provides the hardware and software necessary to exercise the features of the DS28E39. The EV system consists of five DS28E39/DS2476 devices in a 6-pin TDFN package, a DS9121AQ+ evaluation TDFN socket board, 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 DS28E39 and DS2476.

### **EV Kit Contents**

QTY	DESCRIPTION
5	DS28E39Q+ DeepCover Secure Bidirectional Authenticator w/ChipDNA PUF protection (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 DS28E39
  DeepCover<sup>®</sup> Secure ChipDNA 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 DS28E39 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.

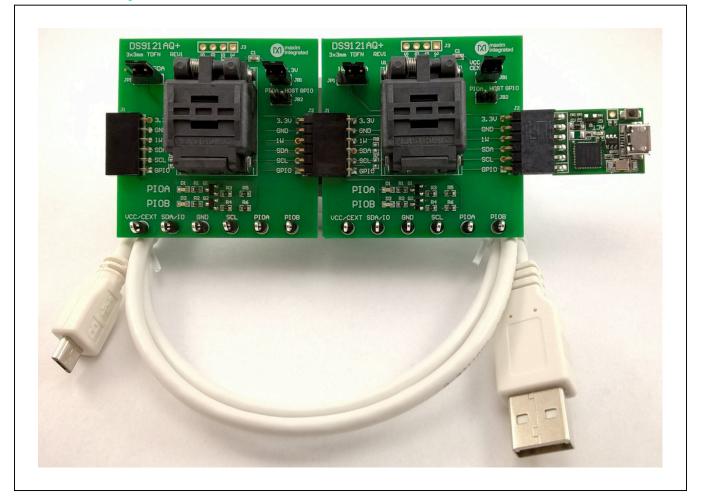
1-Wire and DeepCover are registered trademarks of Maxim Integrated Products, Inc.

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



### Evaluates: DS28E39 and DS2476

### DS28E39 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)
- DS28E39Q+ (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 DS28E39 EV kit software (light version) or request full DS28E39 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.

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# Hardware Setup and Driver Installation Quick Start

The following steps were performed on a Windows 7 PC to set up the DS28E39 EV kit hardware/software:

1) Obtain and unpack the DS28E39\_EV\_Kit\_Software\_

Setup\_V1.0.0.zip file, or the latest version.

- In a file viewer (Figure 1), double click on <u>DS28E39</u> <u>EV\_Kit\_Software\_Setup\_V1.0.0.exe</u> to begin the installation.
- The setup wizard opens; click on <u>Next</u>, as shown in <u>Figure 2</u>.

S28E39_Evaluation_Kit_Setu	p_V1.0.0		<b>→</b> 49	Search DS28E39_	Evaluation_Kit_S
ile <u>E</u> dit <u>V</u> iew <u>T</u> ools <u>H</u> elp					<b></b> <i>6</i>
Organize 🔻 💼 Open 👻 Share with		v folder			= - 🗖 🧕
🔆 Favorites	Â	Name	Date modified	Туре	Size
🚺 Downloads		DS28E39_Evaluation_Kit_Setup_V1.0.0.exe	12/4/2018 4:07 PM	Application	14,397 KB
🕮 Recent Places					
🧮 Desktop					

Figure 1. File Viewer

Г

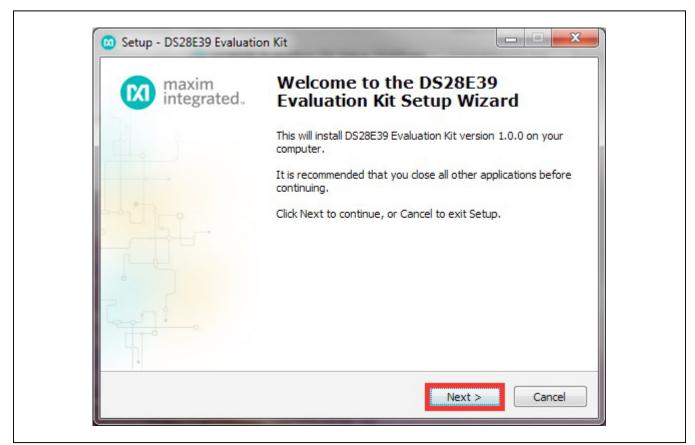


Figure 2. DS28E39 Setup Wizard

# Evaluates: DS28E39 and DS2476

4) Click **<u>Browse</u>** to select a default folder location, and then click <u>**Next**</u> to install the EV kit software (Figure 3).

Setup - DS28E39 Evaluation	n Kit	
Select Destination Location Where should DS28E39 Eva		
Setup will install D	S28E39 Evaluation Kit into the following f	folder.
	you would like to select a different folder, ixim Integrated\DS28E39 Evaluation Kit	, click Browse. B <u>r</u> owse
At least 18.1 MB of free dis	sk space is required.	
	< <u>B</u> ack Nex	xt > Cancel

Figure 3. Install Folder Location

# Evaluates: DS28E39 and DS2476

5) Click <u>Next</u> to install shortcuts to the default folder (Figure 4).

Setup - DS28E39 Evaluation Kit		- C X
Select Start Menu Folder Where should Setup place the prog	gram's shortcuts?	
	gram's shortcuts in the following Start Mer Ild like to select a different folder, click Bru ation Kit	
Don't create a Start Menu folde	er	
	< <u>B</u> ack Next >	Cancel

Figure 4. Program Shortcuts Location

# Evaluates: DS28E39 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 via a virtual COM port (Figure 5).

Select Additional Tasks		
Which additional tasks should be	e performed?	(111
Evaluation Kit, then click Next.	vould like Setup to perform while installing DS28	539
🔽 İnstall DS9481P-300 driver		
Additional icons:		
Create desktop icon		
Start menu icons:		
Create uninstall icon		
	< Back Next >	Cancel

Figure 5.Select to Install the Driver

# Evaluates: DS28E39 and DS2476

7) Next click on **Install**. A new window pops up to show the installing progression (Figure 6).

Ready to Install		
	alling DS28E39 Evaluation Kit on your cor	nputer.
Click Install to continue with the change any settings.	installation, or click Back if you want to re	eview or
Destination location: C:\Program Files (x86)\Max	im Integrated\DS28E39 Evaluation Kit	*
Start Menu folder:		
Maxim Integrated \DS28E39	9 Evaluation Kit	
Additional tasks: Install DS9481P-300 driver		
Start menu icons: Create uninstall icon		
4		+
	< <u>B</u> ack <u>I</u> nstall	Cancel

Figure 6. Ready to Install

# Evaluates: DS28E39 and DS2476

8) Click on <u>Next</u> when the Device Driver Installation Wizard appears (Figure 7).

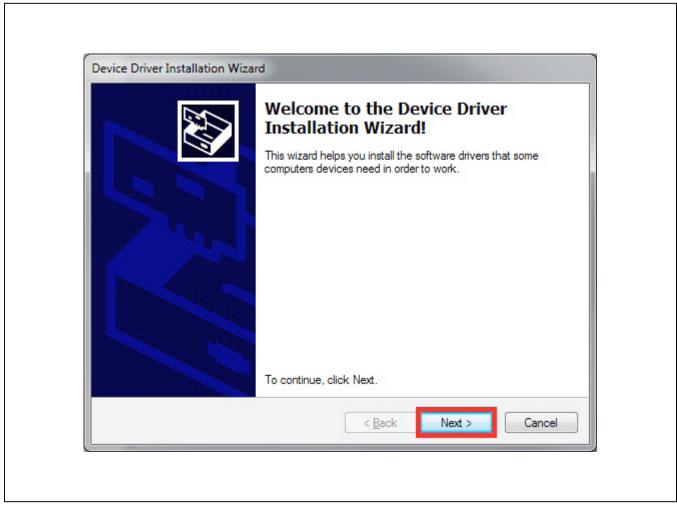


Figure 7. Device Driver

# Evaluates: DS28E39 and DS2476

9) Click on **Finish** to close the final window and confirm the driver is installed correctly (Figure 8).



Figure 8. Device Driver Installation Finished

### Evaluates: DS28E39 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 9.
    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 DS28E39 into one of the cavities, per the same orientation shown in Figure 9.
  - 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 10.
- e) Connect the 2nd DS9121AQ J2, 6-pin female socket, into the 1<sup>st</sup> DS9121AQ J1, 6-pin male plug per <u>Figure 10</u>.
- f) For the 1st DS9121AQ+ socket boards that contains DS2476, configure jumpers JP1 to use SDA and JB1 to use 3.3V per Figure 10.
- g) For the 2nd DS9121AQ+ socket boards that contains DS28E39, configure jumpers JP1 to use 1W and JB1 do not install per Figure 10.
- h) Plug the DS28E39 EV kit, using a USB Type-A to Micro-USB Type-B cable, into the PC.



Figure 9. Orientation of the DS28E39 and DS2476 in the Burn-In Socket

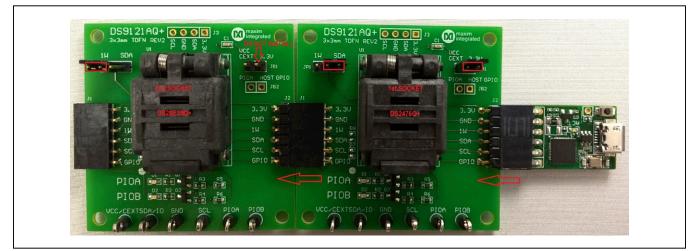


Figure 10. DS9481P-300# and DS9121AQ+

# Evaluates: DS28E39 and DS2476

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

Setup has finished installing DS28E39 Evaluation Kit on yo computer. The application may be launched by selecting to installed icons. Click Finish to exit Setup. I aunch DS28E39 Evaluation Kit	maxim integrated.	Completing the DS28E39 Evaluation Kit Setup Wizard
		Setup has finished installing DS28E39 Evaluation Kit on your computer. The application may be launched by selecting the installed icons.
Launch DS28E39 Evaluation Kit		Click Finish to exit Setup.
		Launch DS28E39 Evaluation Kit

Figure 11. Software Installation Finished

# Evaluates: DS28E39 and DS2476

12) The DS28E39 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 12.

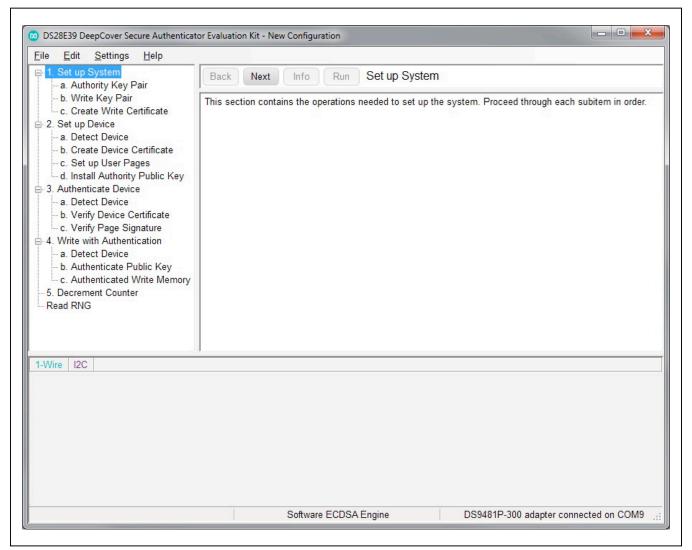


Figure 12. DS28E39 EV Kit Program (Default View Upon Opening)

### Evaluates: DS28E39 and DS2476

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

The DS28E39 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 DS28E39 EV kit hardware includes the MAXQ1010 microcontroller with USB and two DS9121AQ socket adapters that are made to contain the DS28E39 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. The DS28E39 1-Wire slave functions to perform ECDSA Public-Key signatures during authentication and contains memory space for the necessary elements.

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

FLOW*	DS2476 SUPPORT	DESCRIPTION
Set Up System		This is an example to perform at a provisioning authority. This contains the operations needed to set up the system Authority Key pair, Write Key pair, and the Write Certificate.
Set Up Device		At a provisioning authority (e.g., a secure server at an equipment manufacturer), this contains the operations needed to set up the DS28E39 device.
Authenticate Device	x	This is an example to be used to authenticate with ECDSA for a read page of memory of the DS28E39 device.
Write and Authentication		This is an example to change a page of memory to the DS28E39 device with authentication using ECDSA.
Decrement Counter		This performs the operations to decrement the 17-bit decrement counter when the DC protection is set on page 4. The count value is decremented by one for each call. Once the count value reaches a value of 0, no additional decrements are possible.
Read RNG		Performs the operations to generate a random number from the DS28E39 device. This is a FIPS/NIST compliant true random number generator (TRNG).

\*Software supports all flows in Table 1.

# Evaluates: DS28E39 and DS2476

# **Ordering Information**

PART	TYPE	
DS28E39EVKIT#	EV Kit	

#Denotes RoHS compliant.

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

DESIGNATOR	QTY	DESCRIPTION	MANURACTURER	PART NO.
J3	1	4 Pin 100mil Female Connector	Samtec	SSQ-104-02-T-S-RA
R3, R4	2	RES 3.3K OHM 1/10W 1% 0603 SMD	Panasonic Electronic Components	ERJ-3EKF3301V
R1, R2, R5, R6	4	RES SMD 1K OHM 1% 1/10W 0603, RES SMD 10K OHM 1%	Panasonic Electronic Components	ERJ-3EKF1002V
R7, R8	2	RES SMD 10K OHM 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	2Kb EEPROM PUF Bidirectional 1W Authenticator	Maxim Integrated	DS28E39Q+
Pack Out	3	SHUNT+,LP W/HANDLE 2 POS 30AU	Tyco Electronics	881545-2

# Evaluates: DS28E39 and DS2476

#### o be DS9121AQ+. 1) PCB Part Number Design Notes: 0.4 QI BSSI38LTIG CHIPS SHOWN ARE FOR REFERENCE ONLY DS28E36Q+T DS28E380+T DS28C36Q+T DS24760+T -l+g DS28E84Q+ 50 4 F 5 00 . Ξ 810 DS28C36Q+7 DS2476Q+T 23 ≥I JUMPER LEGEND BI BI **Å** - 0.0 l+8 Host GPIO connects to PIOA ĕ**o**− ۲<u>۰</u> ₫**O** Host GPIO NC PIOB PIOA VCC/Cext JB2 SCL VCC SDATO GND P F - 7 e SDA/IO SDA/I 2**0**-Ë**⊙**-ĒO l+g ≳⊦ -l+g -SND ≷⊢

### **DS28E39 EV Kit Schematic**