

## Evaluates: DS28E36 and DS2476

## DS28E36 Evaluation System

### General Description

The DS28E36 evaluation system (EV system) provides the hardware and software necessary to evaluate the DS28E36 and DS2476. The EV system consists of five DS28E36/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 on Windows<sup>®</sup> 10, Windows 8, and Windows 7 operating systems (64- and 32-bit versions). The EV system provides a handy user interface to exercise the features of the DS28E36 and DS2476.

### EV System Contents

QTY	DESCRIPTION
5	Includes five DS28E36BQ+ DeepCover Secure Authenticators (6-pin TDFN)
5	DS2476BQ+ DeepCover Secure Coprocessor (6-pin TDFN)
2	DS9121AQ+ socket boards (6-pin TDFN)
1	DS9481P-300# USB-to-I <sup>2</sup> C/1-Wire Adapter
1	USB Type-A to USB Mini Type-B cable

**Ordering Information** appears at end of data sheet.

### Features

- Demonstrates the Features of the DS28E36 DeepCover<sup>®</sup> Secure Authenticator
- Demonstrates the Features of the DS2476 DeepCover Secure Coprocessor
- I<sup>2</sup>C and 1-Wire Communication is Logged to Aid Firmware Designers Understanding of the DS2476 and DS28E36
- I<sup>2</sup>C/1W-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  $\pm$ 3% 1-Wire Operating Voltage
- Convenient On-Board Test Points and TDFN Socket
- Evaluation Software Available by Request
- Proven PCB Layout
- Fully Assembled and Tested

### DS28E36 EV System

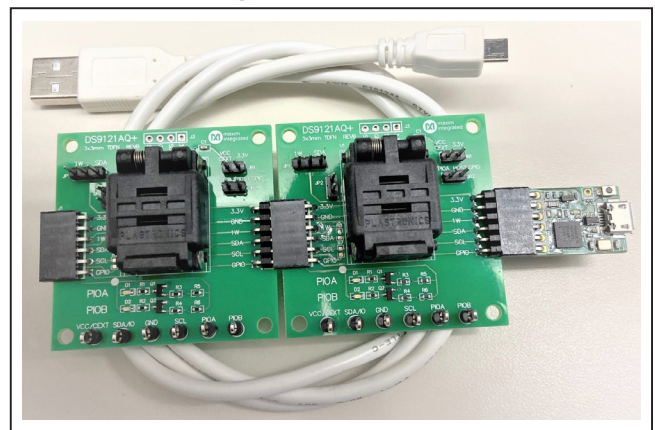


Figure 1. DS28E36EV with USB Cable

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

## Quick Start

This section is intended to give the DS28E36 evaluator a list of recommended equipment and instructions on how to set up a Windows-based computer for the evaluation software.

### Recommended Equipment

- DS28E36 EV system USB-to-I<sup>2</sup>C adapter with DS2476 secure coprocessor (included)
- Two DS9121AQ+ TDFN socket boards (included)
- Five DS28E36BQ+ (included, respectively)
- Five DS2476BQ+ (included)
- USB Type A to Micro-USB Type B cable (included)
- Computer with a Windows 10, Windows 8, or Windows 7 operating system (64- or 32-bit) and a spare USB 2.0 or higher port
- Download and install the latest [1-Wire Drivers](#).
- Download [DS28E36 EV kit software \(light version\)](#) or request full [DS28E36 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 system software. Text in **bold and underlined** refers to items from the Windows operating system.

### Hardware Setup and Driver Installation Quick Start Procedure

The EV system is fully assembled and tested. The following steps were performed on a Windows 7 PC to set up the DS28E36EVKIT hardware/software:

- 1) Obtain and unpack the zip of **DS28E36\_EVKIT\_REV\_1\_6\_Light\_version.zip** or newer version.
- 2) In a file viewer, double click on **DS28E36\_Installer.msi** to begin the installation ([Figure 2](#)).
- 3) The Setup Wizard opens. Click on **Next**, as shown in [Figure 3](#).
- 4) Read and check the box for the license agreement and click on **Next** again to install to the selected folder ([Figure 4](#)).

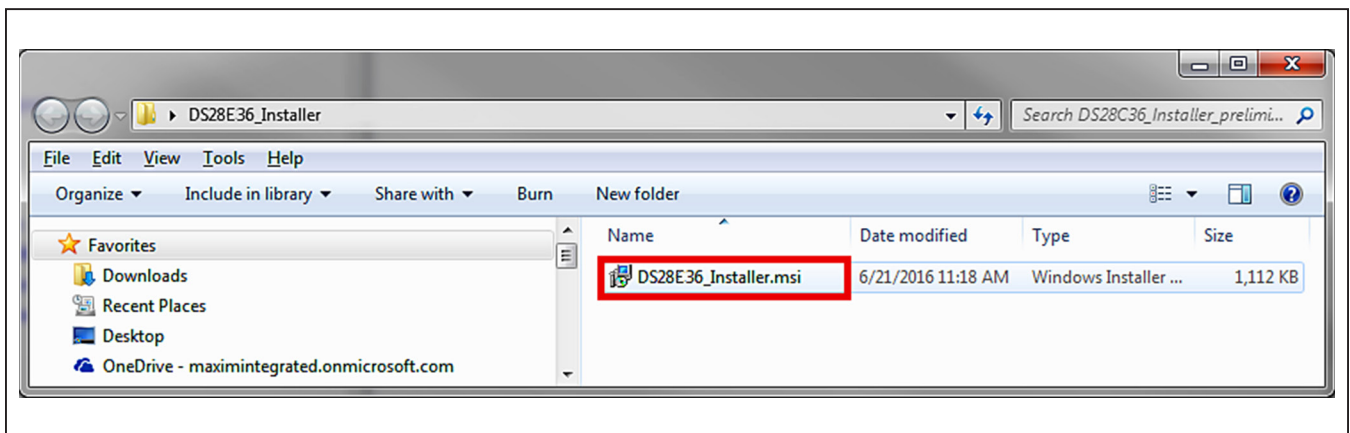


Figure 2. File Viewer

\*The full version of the software is called *DS28C36\_EVKIT\_REV\_1\_6\_released\_062317.zip* and it supports both DS28E36 and DS28C36.

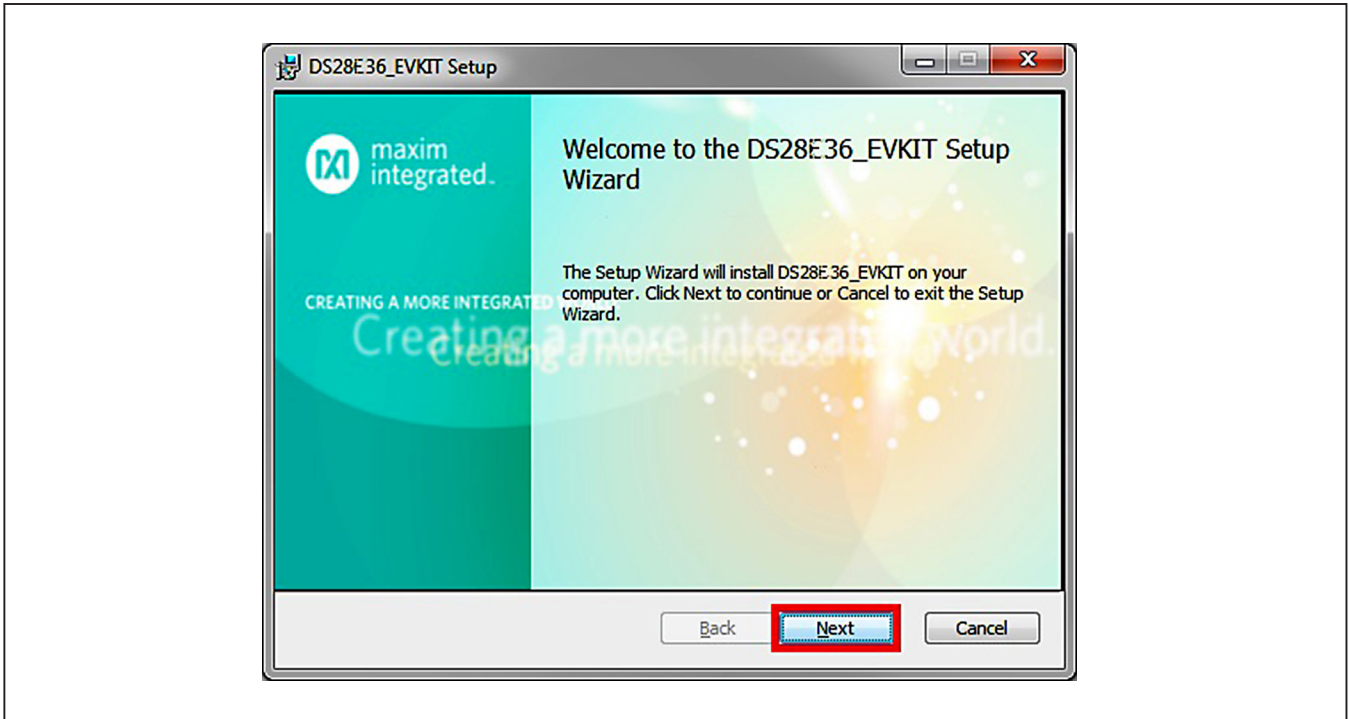


Figure 3. DS28E36 Setup Wizard

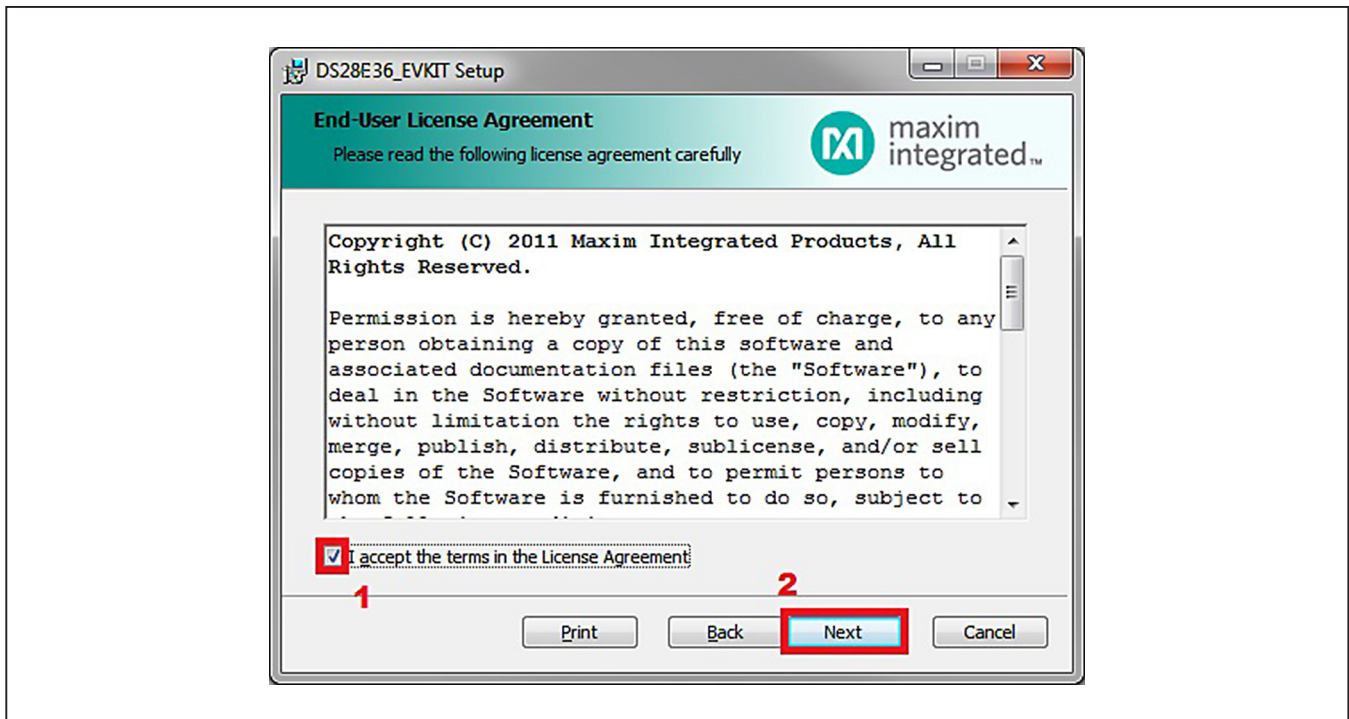


Figure 4. License Agreement Setup Wizard

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Evaluates: DS28E36 and DS2476

- 5) Click the **Next** button to install to the default folder (Figure 5).
- 6) Unplug all Maxim adapters and click the **Install** button (Figure 6).
- 7) When the **Windows Security** window appears, click the **Install** button (Figure 7).
- 8) Click the **Finish** button to exit the Setup Wizard (Figure 8).

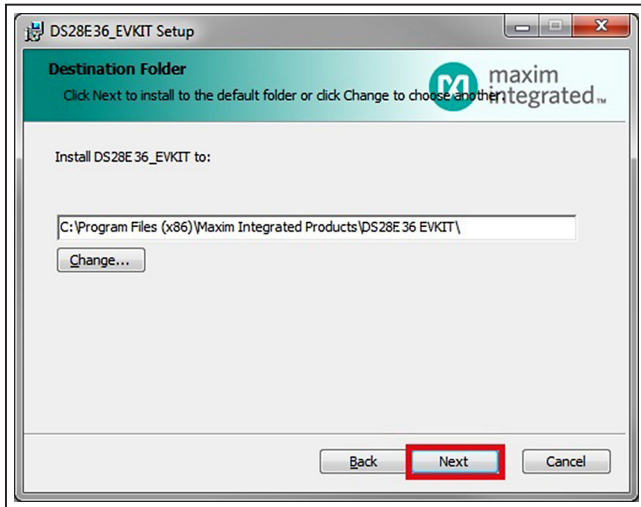


Figure 5. Install Folder Location

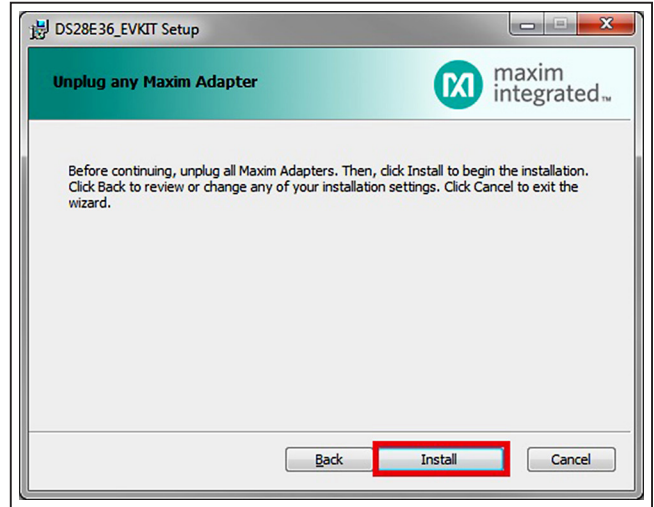


Figure 6. Installation

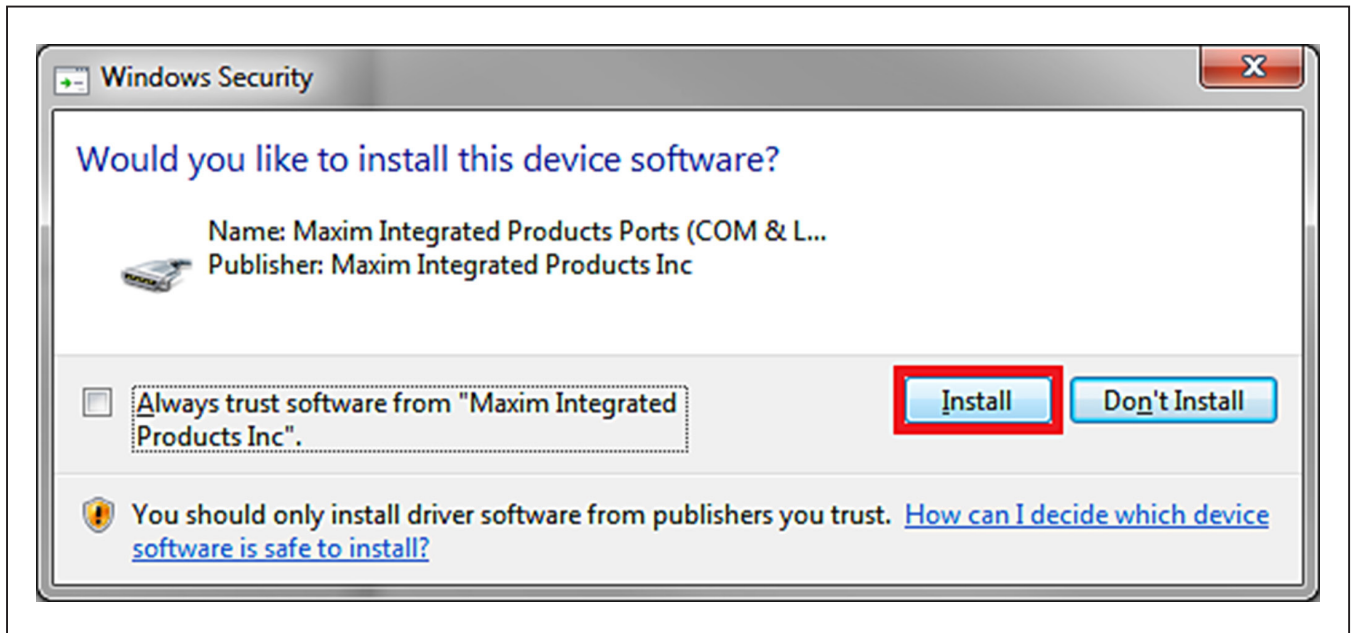


Figure 7. Windows Security Window



## DS28E36 Evaluation System

Evaluates: DS28E36 and DS2476

- 9) Plug in the DS9481P-300# to the PC with both DS9121AQ+ socket boards by doing the following:
  - a) Open the first burn-in socket and insert a DS2476BQ+ into one of the cavities, as shown in [Figure 9](#).  
**Note:** The plus (+) on the package must be be on the opposite side of the marker in the socket.
  - b) Open the second burn-in socket and insert a DS28E36BQ+ into one of the cavities, following the same orientation shown in [Figure 9](#).
  - c) Close both burn-in sockets.
  - d) Connect the first DS9121AQ J2, 6-pin male socket header to the DS9481P-300#, 6-pin female plug, as shown in [Figure 10](#).
  - e) Connect the first DS9121AQ J1, 6-pin female socket into the second DS9121AQ J2, 6-pin male plug. ([Figure 10](#)).

- f) For the first socket board with the DS2476, configure jumper JP1 to use SDA, jumper JP2 to use SCL, and JB1 to use 3.3V. With the DS28E36, configure the jumper JP1 to use 1W, and do not populate JP2 and JB1 ([Figure 10](#)).
- g) Plug the DS28E36 EV kit into the PC using a USB Type-A to Micro-USB Type-B cable.

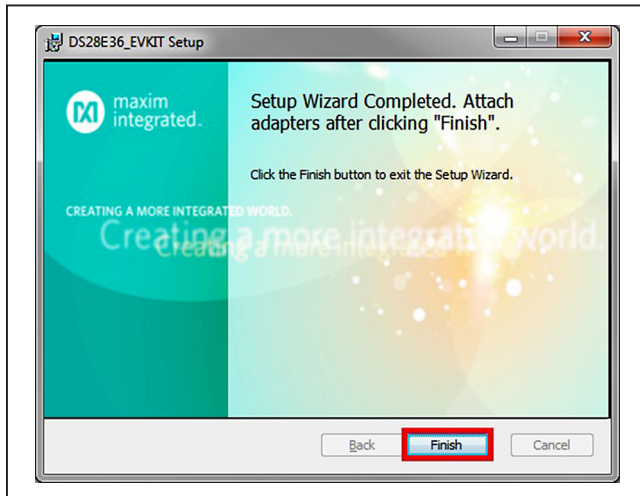


Figure 8. Finish Setup Wizard

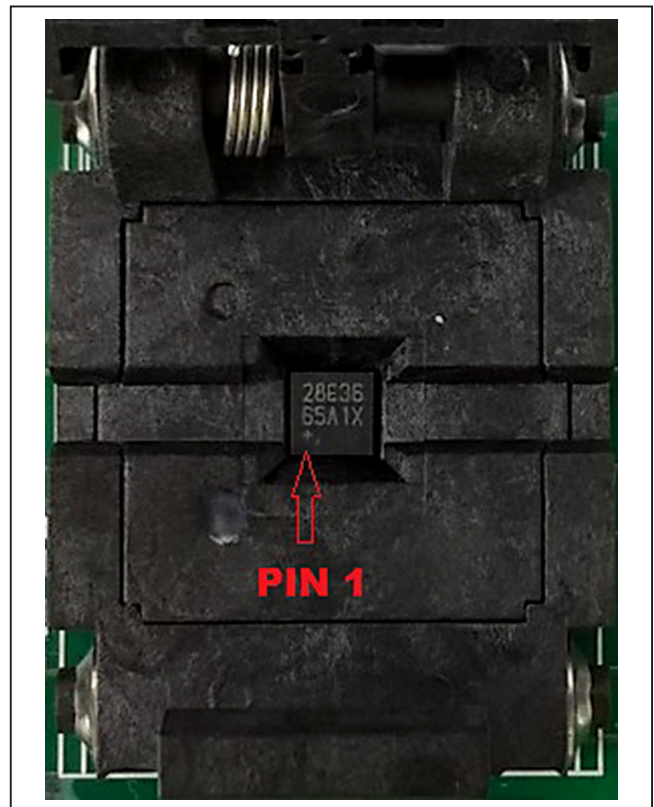


Figure 9. Orientation of the DS28E36 and DS2476 in the Burn-In Socket

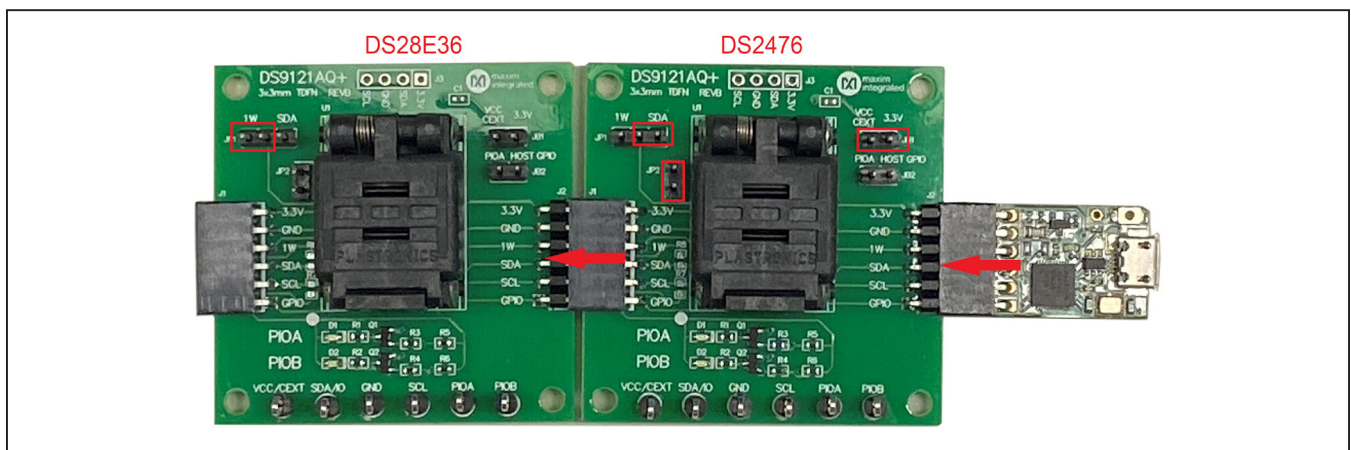


Figure 10. DS9481P-300 and DS9121AQ

- 10) The device driver now automatically installs and a pop-up window appears when complete (Figure 11).
- 11) Open the **DS28E36 EVKIT** from the start menu → **All Programs** → **Maxim Integrated** → **DS28E36 EVKIT (Light Version)**.
- 12) The DS28E36 EVKIT program opens automatically (Figure 13), finding the COM port and the DS28E36/DS2476.

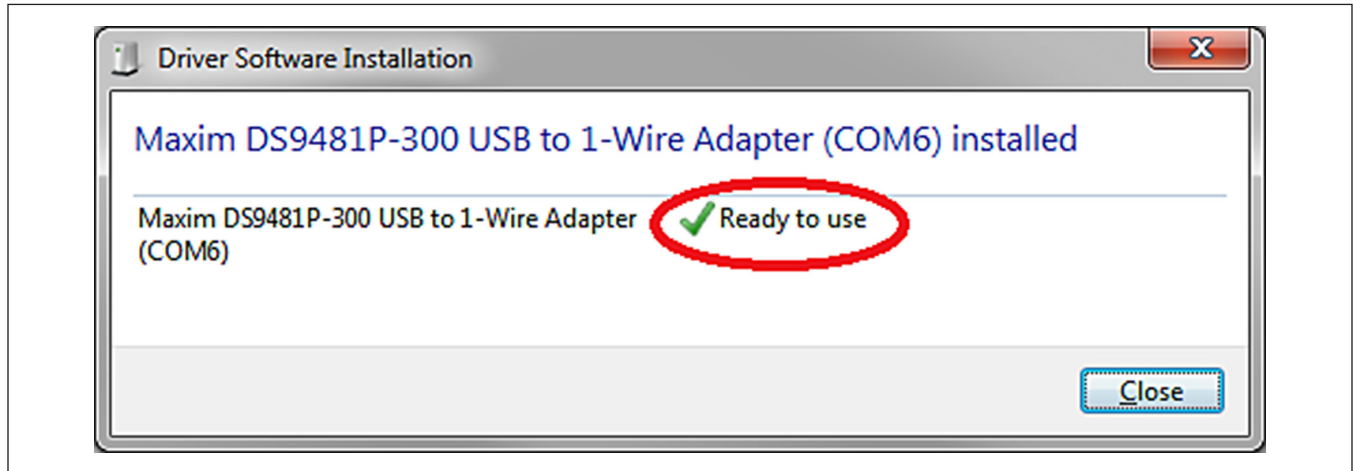


Figure 11. Driver Software Installation Notice

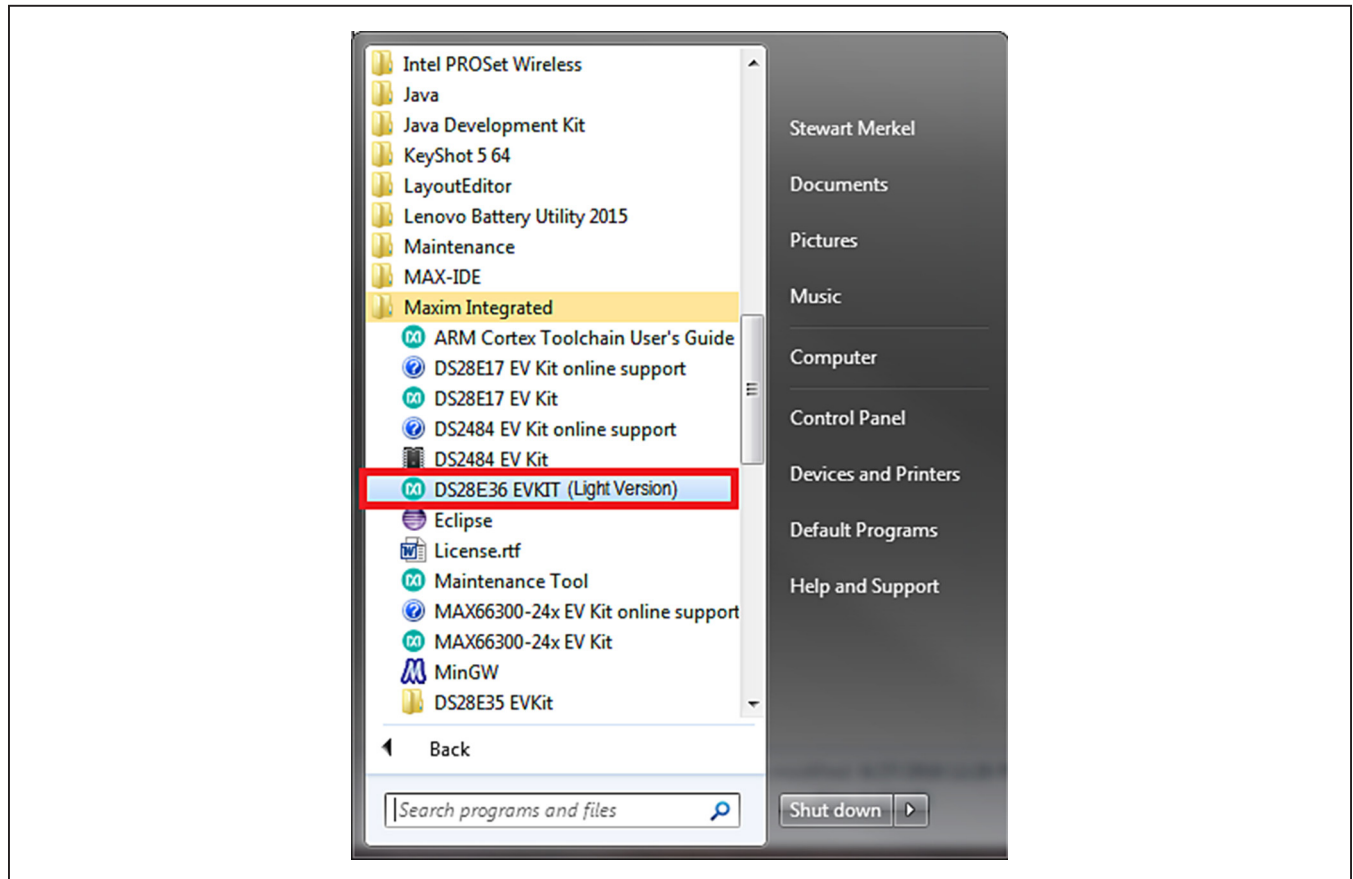


Figure 12. Open DS28E36 EVKIT Program

Detailed Description of Software

The DS28E36 evaluation program user interface (Figure 13) has four tabs, **General Commands**, **SHA2 Commands**, **ECDSA Commands**, and **Other Coprocessor Commands**. The **Setup** section is used to make the device selections that apply to the **General Commands**, **SHA2 Commands**, **ECDSA Commands**, and **Other Coprocessor Commands** tabs. Here is a summary of the function for each tab of the full developer software:

- General Commands is used as the main tool to evaluate the DS28E36/DS2476 general functions to write or read from the user memory pages, crypto-related memory pages, decrement counter, RNG, and protection registers.

- SHA2 Commands is used to evaluate the DS28E36/DS2476 symmetric (SHA-256) security function commands.
- ECDSA Commands is used to evaluate the DS28E36/DS2476 integrated asymmetric (ECC-P256) security function commands.
- Other Coprocessor Commands is used to evaluate the DS2476 coprocessor that computes any required HMACs or ECDSA signatures with its additional command set to do any operations on the DS28E36. Note: Grayed out when DS28E36 is selected.

All tabs include a communications **Log** area consisting of an I<sup>2</sup>C Log or 1-Wire Log output.

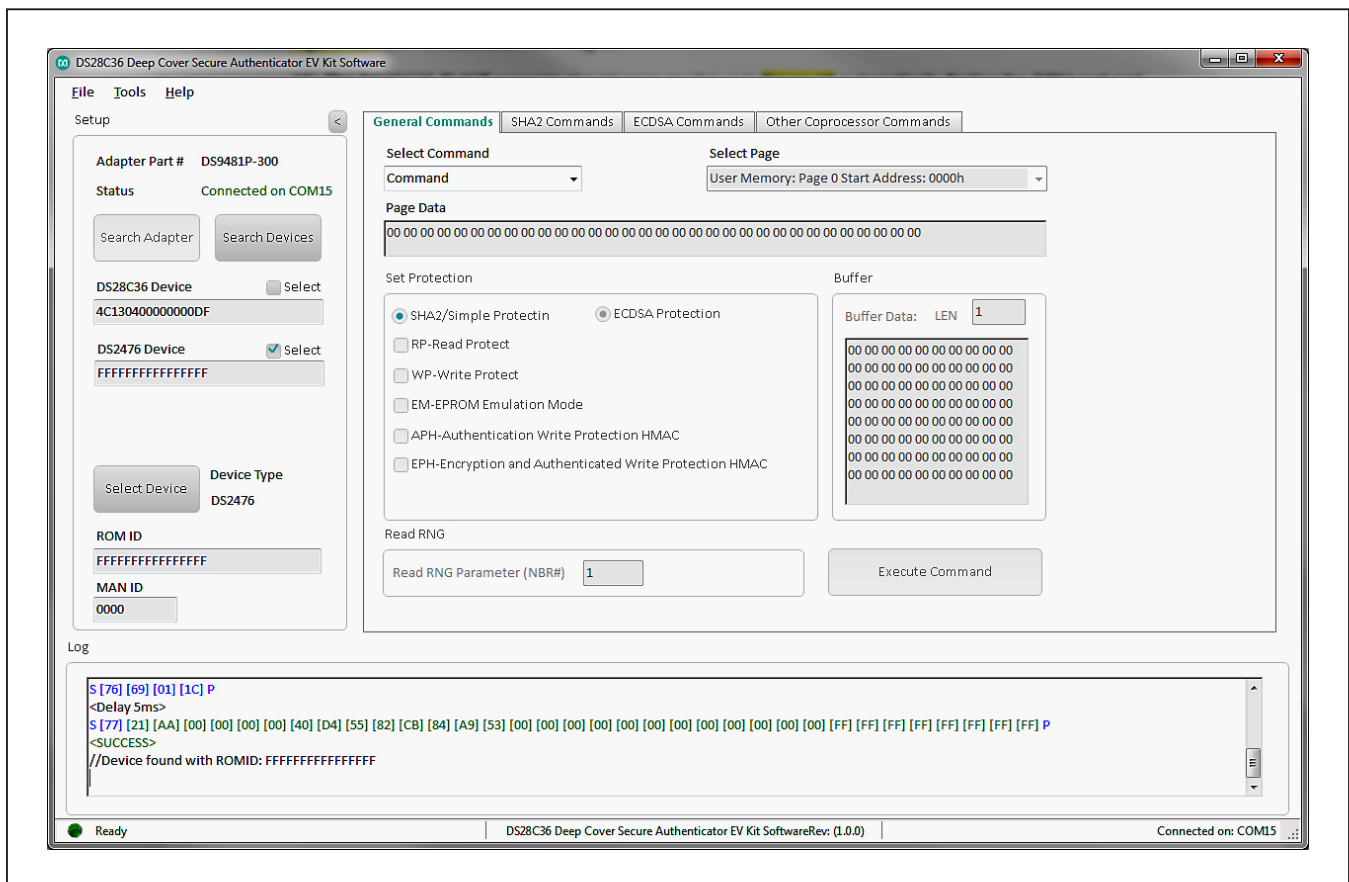


Figure 13. DS28E36 EVKIT Developer Software (Note: The light version is similar, but includes fewer features)

### Ordering Information

PART	TYPE
DS28E36EVKIT#	EV System

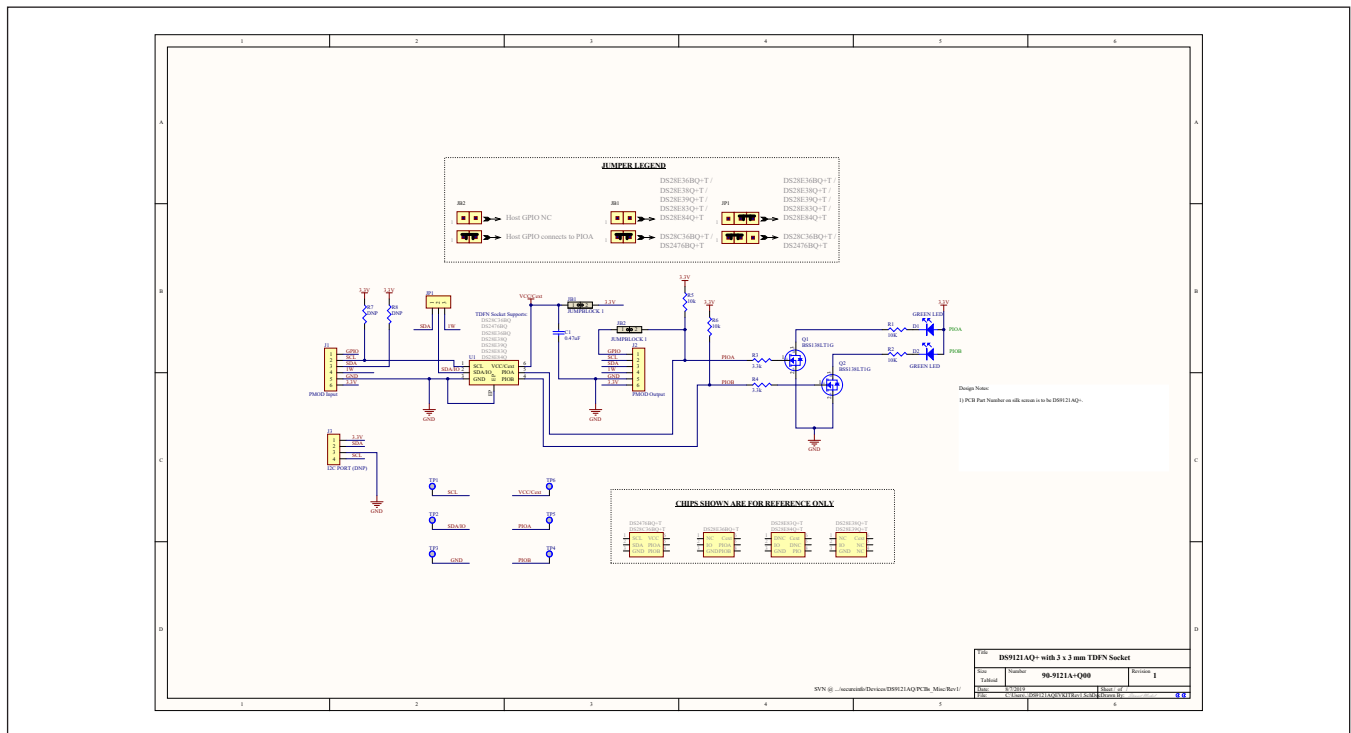
#Denotes RoHS compliant.



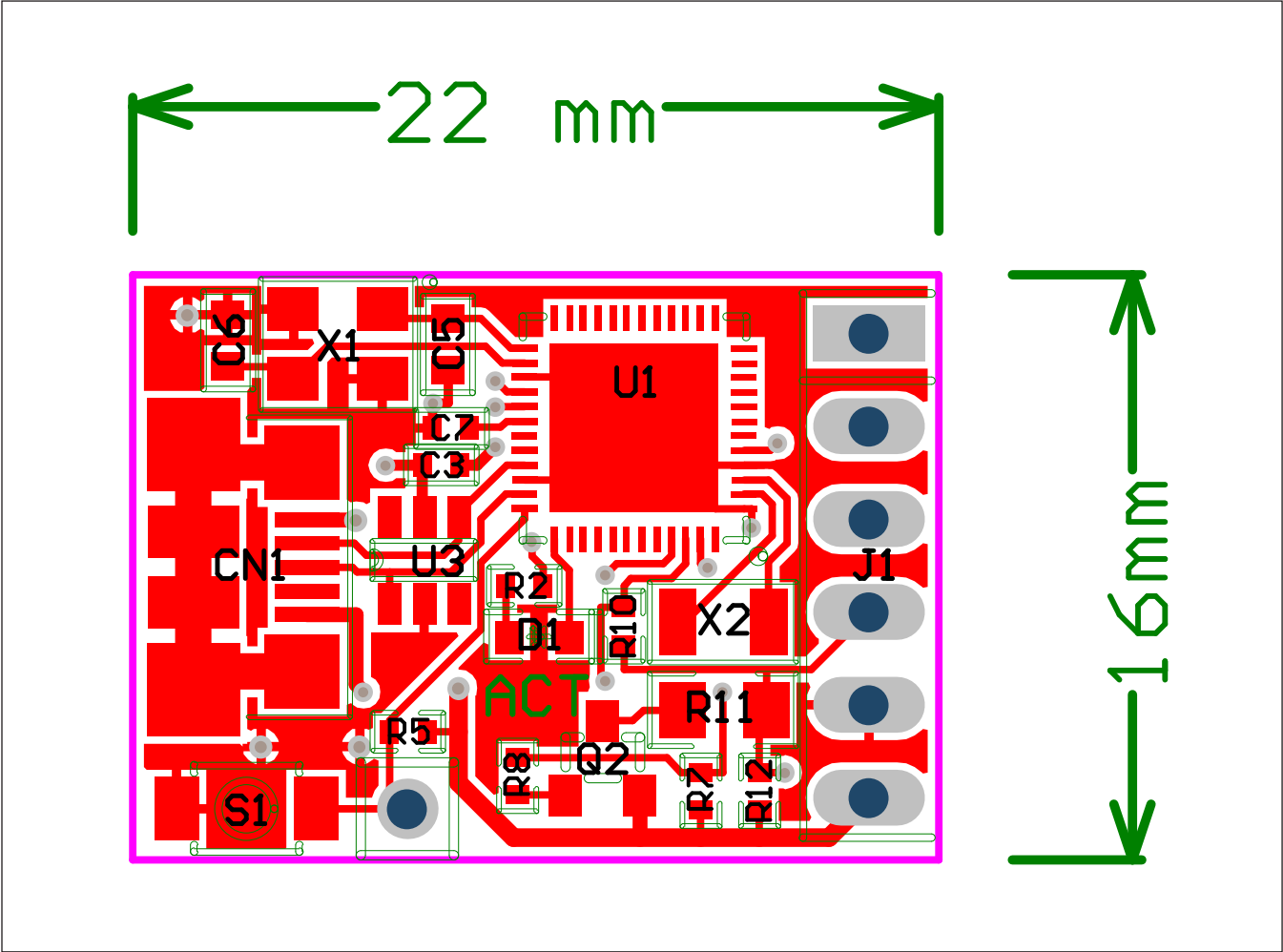
## DS9481P-300 Bill of Materials

Designator	Quantity	Description	Manufacturer	Part Number
C1, C2, C4, C7, C9, C11, C12	7	1uF Ceramic Capacitor (0402)	TDK Corporation	C1005X5R0J105M050BB
C3, C8, C13	3	0.1uF Ceramic Capacitor (0402)	TDK Corporation	C1005X5R0J104K050BA
C5, C6	2	10pF Ceramic Capacitor (0603)	TDK Corporation	C1608C0G1H100D080AA
C10	1	10pF Ceramic Capacitor (0402)	MURATA	GRM1555C1H100J
CN1	1	USB Micro B Connector	FCI	10103594-0001LF
D1	1	Orange LED (0603)	Panasonic	LNJ826W83RA
FB1, FB2	2	Ferrite (0603)	Murata Electronics North	BLM18KG221SN1D
J1	1	PMOD Receptacle	Samtec	SSW-106-02-T-S-RA
Q1	1	N-Channel MOSFET(SOT-23)	Diodes Inc.	2N7002-7
Q2	1	P-Channel MOSFET (SOT-23)	International Rectifier	PMV65XP,215
R1	1	10Ω Resistor (0603)	Vishay Dale	CRCW060310R0JNEA
R2	1	1.5kΩ Resistor (0402)	Vishay Dale	CRCW04021K50JNED
R3, R6, R7	3	100kΩ 1% Resistor (0402)	Vishay Dale	CRCW0402100KFKEA
R4	1	32.4kΩ 1% Resistor (0402)	Vishay Dale	CRCW040232K4FKED
R5	1	4.7kΩ Resistor (0402)	Panasonic	ERJ-2GEJ472X
R8	1	1kΩ Resistor (0402)	Vishay Dale	CRCW04021K00JNED
R9	1	2.2kΩ Resistor (0402)	Panasonic	ERJ-2GEJ222X
R10	1	499Ω Resistor (0402)	Vishay Dale	CRCW0402499RFKED
R11	1	4.99Ω 1% 1/8W Resistor (0805)	Vishay Dale	CRCW08054R99FKEA
R12	1	680Ω Resistor (0402)	Panasonic	ERJ-2GEJ681X
R13, R14	2	1.74kΩ Resistor (0402)	Panasonic Electronic Co	ERJ-2RKF1741X
RT1	1	PTC Fuse (1206)	Bourns Inc.	MF-NSMF012-2
S1	1	Tactile Switch	Omron Electronics Inc	B3U-1000P
U1	1	Security Token Microcontroller with RTC and USB	Maxim Integrated	MAXQ1010-A01+
U2	1	High PSRR, Low-Dropout, 150mA Linear Regulator	Maxim Integrated	MAX8891EXK33+
U3	1	Dual High-Speed Differential ESD-Protection IC	Maxim Integrated	MAX3207EAUT+
U4	1	40ns Single-Supply Comparator	Maxim Integrated	MAX9140AAXK+
U5	1	4 Channel +/- 30kv ESD Protector	Maxim Integrated	MAX13204EALT+
X1	1	12MHz Crystal	EPSON	FA-238V 12.0000MB-K3
X2	1	Do Not Populate (3.20x1.50mm)		

## DS9481P-300 Schematics



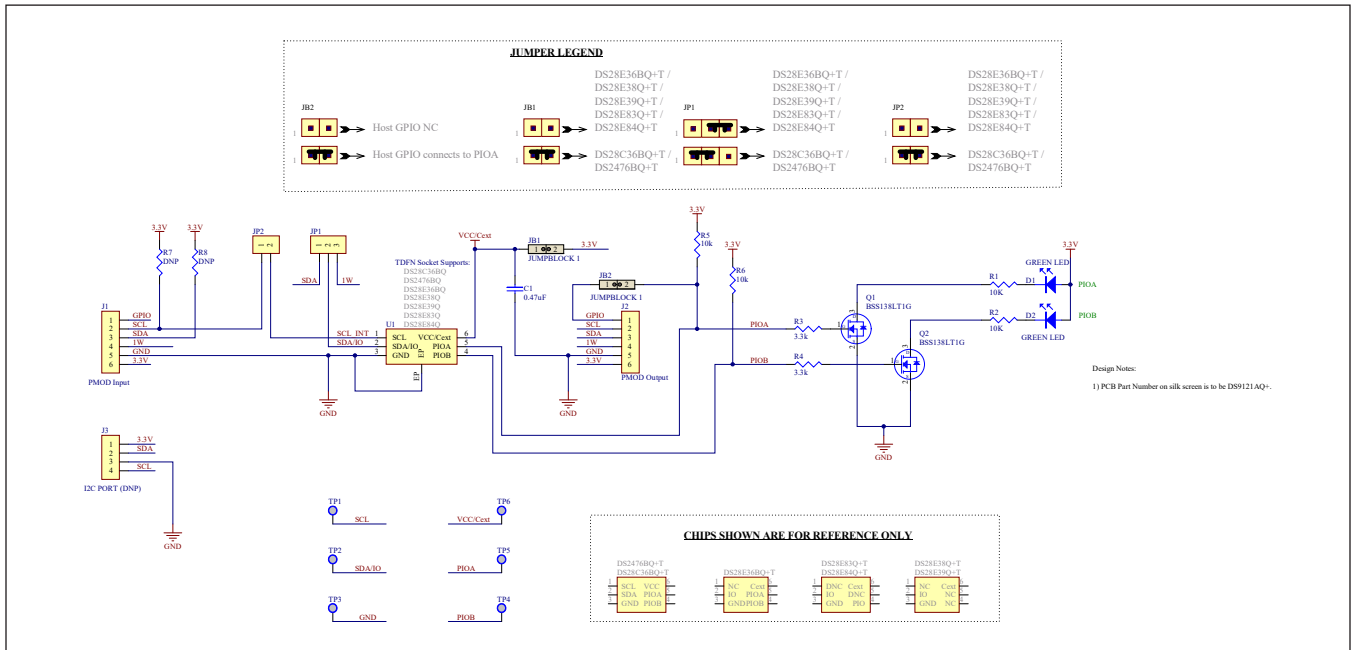
DS9481P-300 PCB Layout



DS9121AQ Bill of Materials

Comment	Description	Designator	Footprint	LibRef	Quantity
0.47uF		C1	CAP0603-3D	CAP	1
GREEN LED	LED INGAN GREEN CLEAR 0603 SMD	D1, D2	0603LED-3DGREEN	LED	2
PMOD Input	CONN HEADER FEMALE 6POS .1" GOLD	J1	SIP6-SOCKET2-LA-3D	CON6	1
PMOD Output	CONN HEADER FEMALE 6POS .1" GOLD	J2	SIP6-HEADER-RA-LH-3D	CON6	1
I2C PORT (DNP)	4 Pin 100mil Female Connector	J3	SIP4	CON4	1
JUMPBLOCK 1		JB1, JB2	SIP2SHUNT-3D	JUMPBLOCK 1	2
JUMPER	HDR_BRKWAY,,100 3POS VERT,0.318"	JP1	SIP3SHUNT1-2-3D	CON3	1
CON2		JP2	SIP2	CON2	1
BSS138LT1G	MOSFET N-CH 50V 200MA SOT-23	Q1, Q2	16001-3D	NCHAN FET	2
10K	RES SMD 1K OHM 1% 1/10W 0603, RES SMD 10K OHM 1% 1/10W 0603	R1, R2, R5, R6	0603-3D	RESISTOR	4
3.3k	RES 3.3K OHM 1/10W 1% 0603 SMD	R3, R4	0603-3D	RESISTOR	2
DNP	RES SMD 10K OHM 1% 1/10W 0603	R7, R8	0603-3D	RESISTOR	2
TDFN Socket Supports:	TDFN,3MM,x2,CLAMSHE	U1	TDFN3X2BURN	TDFN Socket 3x3mm	1

DS9121AQ Schematics





DS9121AQ PCB Layout (continued)

DS9121AQ+				
Part Number: 89-9121A+000				
Property of				Rev
maxim integrated				B
Drill and Mechanical Layer				
Date: APR 27 2016 Units in mils				
SIZE	QTY	SYM	PLATED	TOLERANCE
18	17	*	YES	+/- 0.003
39	26	*	YES	+/- 0.003
59	6	*	YES	+/- 0.003
59	1	*	NO	+/- 0.003
66	1	*	NO	+/- 0.003
125	4	*	NO	+/- 0.003

Notes:

- 1 Material: RoHS Compliant FR-4 or similar laminate material
- 2 Board Dimensions: (2000 x 2000 mils)
- 3 Board Thickness: 62 mils +/- 10%
- 4 Layers: 2 (Top, Bottom)
- 5 Minimum Trace/Spacing: 10mil / 7mil
- 6 Copper Thickness: 1oz on all layers
- 7 Surface mount pads:28 Through Hole Pads:32 Nonplated through holes:6
- 8 Soldermask: GREEN
- 9 Legend: On top side only and in white
- 10 Plating: Must be Lead free and RoHS Compliant
- 11 Finish: Most Economical Lead free and RoHS compliant process
- 12 Vendor Logo & date code: Allowed on bottom side only
- 13 Through holes: quantity 55, Slot holes 0, minimum size 18 mil
- 14 Tolerances:
  - Plated-through holes +/- 3 mil
  - Pattern to pattern +/- 6 mil
  - Legend to legend no preference
  - Soldermask to pattern +/- 6 mil
- 15 Electrical testing needed: YES

62mil PCB  
Bottom Metal

DS9121AQ+				
Part Number: 89-9121A+000				
Property of				Rev
maxim integrated				B
Drill and Mechanical Layer				
Date: APR 27 2016 Units in mils				
SIZE	QTY	SYM	PLATED	TOLERANCE
18	17	□	YES	+/- 0.003
39	26	▽	YES	+/- 0.003
59	6	⊗	YES	+/- 0.003
59	1	○	NO	+/- 0.003
66	1	○	NO	+/- 0.003
125	4	⊗	NO	+/- 0.003

Notes:

- 1 Material: RoHS Compliant FR-4 or similar laminate material
- 2 Board Dimensions: (2000 x 2000 mils)
- 3 Board Thickness: 62 mils +/- 10%
- 4 Layers: 2 (Top, Bottom)
- 5 Minimum Trace/Spacing: 10mil / 7mil
- 6 Copper Thickness: 1oz on all layers
- 7 Surface mount pads:28 Through Hole Pads:32 Nonplated through holes:6
- 8 Soldermask: GREEN
- 9 Legend: On top side only and in white
- 10 Plating: Must be Lead free and RoHS Compliant
- 11 Finish: Most Economical Lead free and RoHS compliant process
- 12 Vendor Logo & date code: Allowed on bottom side only
- 13 Through holes: quantity 55, Slot holes 0, minimum size 18 mil
- 14 Tolerances:
  - Plated-through holes +/- 3 mil
  - Pattern to pattern +/- 6 mil
  - Legend to legend no preference
  - Soldermask to pattern +/- 6 mil
- 15 Electrical testing needed: YES

62mil PCB



DS9121AQ PCB Layout (continued)

DS9121AQ+				
Part Number: 89-9121A+000				
Property of				Rev
				B
Drill and Mechanical Layer				
Date: APR 27 2016 Units in mils				
SIZE	QTY	SYM	PLATED	TOLERANCE
18	17	+	YES	+/- 0.003
39	26	+	YES	+/- 0.003
59	6	+	YES	+/- 0.003
66	1	+	NO	+/- 0.003
125	4	+	NO	+/- 0.003

Notes:

- 1 Material: RoHS Compliant FR-4 or similar laminate material
- 2 Board Dimensions: (2000 x 2000 mils)
- 3 Board Thickness: 62 mils +/- 10%
- 4 Layers: 2 (Top, Bottom)
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- 11 Finish: Most Economical Lead free and RoHS compliant process
- 12 Vendor Logo & date code: Allowed on bottom side only
- 13 Through holes: quantity 55, Slot holes 0, minimum size 18 mil
- 14 Tolerances:
  - Plated-through holes +/- 3 mil
  - Pattern to pattern +/- 6 mil
  - Legend to Legend no preference
  - Soldermask to pattern +/- 6 mil
- 15 Electrical testing needed: YES

62mil PCB

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/17	Initial release	—
0.1		Updated broken hyperlinks	2
1	5/18	Updated <i>Recommended Equipment</i> section and Figure 10	2, 5
2	7/18	Updated <i>DS9121AQ Bill of Materials</i> and <i>DS9121AQ Schematics</i>	11
3	9/18	Updated part numbers in <i>Recommended Equipment</i> section and Figure 10 caption	2, 5
4	10/18	Updated <i>General Description</i> , <i>EV System Contents</i> , <i>Recommended Equipment</i> , and <i>Hardware Setup and Driver Installation Quick Start Procedure</i> sections	1, 2, 5
5	5/19	Updated <i>Quick Start</i> section	2
6	7/19	Updated part numbers in <i>EV System Contents</i> , <i>Recommended Equipment</i> , and <i>Hardware Setup and Driver Installation Quick Start Procedure</i> sections	1, 2, 5
7	8/19	Updated part numbers in <i>EV System Contents</i> , <i>Recommended Equipment</i> , and <i>Hardware Setup and Driver Installation Quick Start Procedure</i> sections, and <i>DS9121AQ Schematics</i>	1, 2, 5, 11
8	1/20	Updated Figure 1, <i>Quick Start</i> , Figure 10, <i>DS9121AQ Bill of Materials</i> , <i>DS9121AQ Schematics</i> , and <i>PCB Layout</i>	1, 5, 11–14



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