

APPLICATION NOTE 5548

Evaluating the DS28E05

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Abstract: This application note explains how to evaluate the DS28E05 1-Wire® EEPROM on a Windows® PC. The following discussion outlines the hardware and software required along with step-by-step setup instructions. Useful links to download hardware data sheets, evaluation software, and the correct device drivers are provided, and a detailed description of the evaluation software is given.

Introduction

The DS28E05 can be evaluated on a PC without the need for a specialized evaluation (EV) kit. The hardware required to evaluate the DS28E05 in a TSOC package can be readily obtained through Maxim Integrated's [online store](#). The hardware consists of an evaluation (EV) board with RJ11 cable (DS9120P), a Maxim 1-Wire® adapter module that connects the board to the PC (DS9481R-3C7), and a DS28E05 in a TSOC package. All three hardware components are listed in **Table 1**.

Table 1. Required Hardware for PC Evaluation	
Qty	Description
1	DS9120P+ EV board with RJ11 cable
1	DS9481R-3C7+ 1-Wire USB adapter with cable*
1	DS28E05+ in a TSOC package

+Denotes lead(Pb)-free and RoHS compliant.

*The DS9481R-3C7+ is the only 1-Wire adapter electrically compatible with the DS28E05.

See **Figure 1** for a picture of the stand-alone EV board with RJ11 cable and **Figure 2** for a picture of the EV board with USB cable that plugs into the PC.



Figure 1. The DS9120P EV board with RJ11 cable.



Figure 2. The DS9481R-3C7 1-Wire USB adapter with cable.

The DS28E05 features 112 bytes of user memory organized as seven pages of 16 bytes. Each page can be write-protected or set into EPROM emulation mode. The evaluation software runs under Windows® 8, Windows 7, Windows Vista®, or Windows XP®, providing a handy user interface to exercise the features of the DS28E05. The evaluation software is available for [download](#).

Note: In this application note, text in **bold** refers to either references, such as figures or tables, or to items directly from the EV kit software. Text in **bold and italicized** refers to items from the Windows operating system.

Driver Installation Quick Start

1. Before beginning, make sure the following equipment is available:

- o DS9481R-3C7 1-Wire adapter with USB cable
 - o DS9120P EV board with RJ11 cable
 - o DS28E05 in a TSOC package
 - o PC with a Windows 8, Windows 7, Windows Vista, or Windows XP operating system and a spare USB port
2. Do the following before connecting to the PC:
 - a. Insert the DS28E05 in the TSOC socket on the DS9120P EV board.
 - b. Connect the EV board to the DS9481R-3C7 1-Wire adapter with the RJ11 cable.
 - c. Wait to insert the DS9481R-3C7 into the PC until prompted by the software installation.
 3. Follow the steps below to install the PL-2303 Prolific Driver (for the DS9481R-3C7). Many Microsoft® operating systems have a version of the PL-2303 Prolific Driver preloaded. Plugging in the device for the first time often completes the installation. If the Microsoft operating system in question cannot install the device driver, then do the following:
 - a. Unplug the DS9481R-3C7.
 - b. [Download the Prolific Driver](#).
 - c. **Unzip** the archive and **Run** the executable file that begins with “PL2303_Prolific_DriverInstaller”.
 - d. Follow the directions of the **Install Wizard** until the PL-2303 USB-to-serial driver install is finished. Close by clicking the **Finish** button.
 4. Follow the steps below to install the 1-Wire Drivers software package. For expanded installation details, see tutorial 4373, “[OneWireViewer and iButton Quick Start Guide](#)”.
 - a. [Download the 1-Wire Drivers software package](#).
 - b. When prompted with the question **Do you want to run or save this file?**, select **Run**.
 - c. When you get a security warning that reads **Do you want to run the software?**, select **Run**.
 - d. Read and check the box if you accept the license agreement. Click **Install**.
 - e. Click the **Finish** button to exit the Setup Wizard.
 5. Microsoft .NET Framework Version 3.5 SP1 is required for the program to run. To check whether it is installed, look in the **Control Panel** under **Add/Remove Software**. If .NET is not listed, it is not installed. Download and installation instructions, go to <http://msdn.microsoft.com/en-us/netframework/aa569264.aspx>.
 6. Insert the DS9481R-3C7 into a spare USB port on the computer.

Software Quick Start

1. After downloading the software from the URLs listed above in the [Driver Installation Quick Start](#) section and unzipping the files into a folder, start the EV kit software by double-clicking the file DS28E05_Evaluation_Program.exe. Note: Make sure that the hardware has been correctly connected.
2. Software quick setup
 - a. In the **1-Wire Adapter** group box on the **Setup** tab, the **Adapter Port Type** is fixed at **USB (COM)** with the **Adapter Part #** of **DS9481R-3C7**. The **Adapter Port** is a COM port mapped by the Prolific device. Click on **Open Adapter/Port** or use the **Auto-Search** button. If successful, the **Status** field next to the **Open Adapter/Port** button displays **Success**.
 - b. The device selection options are displayed in the **Device Selection Methods** group box in the **Setup** tab.
 - c. The default setting for the EV kit software is **Match-ROM** in the **ROM Selection Method** drop-down list. Also, the **Use Search-ROM to find first available EVKit device** is checked by default. Leave these default selections for quick setup.
 - d. Once the adapter/port has successfully been opened, the **Device Selection** drop-down list is automatically populated with the unique ROM ID of the available DS28E05s. If no device is found on the 1-Wire, the selection is blank. In that case, insert the device and click the **Refresh Selection** button. A device must be present in order to proceed to the **Memory** tab to exercise the device.
 - e. Once the device has been selected, click on the **Memory** tab. Select the memory range in the **Memory Resource Selection** drop-down list.
 - f. Once a memory range has been selected, the available commands appear in the **Commands** group box below the **Memory Resource Selection**. The commands appear as buttons.
 - g. Select a command by clicking on one of the command buttons. The button is highlighted in yellow to indicate which command is selected.
 - h. Once a command has been selected, the **Options** group box below the command buttons is displayed with the required options for the command. Select the options and click the **Execute Command** button to execute the selected command with the options provided.
 - i. The output of the selected command is displayed in the **Log** group box in a scrollable field. The **Key** describing the output in the log is provided at the bottom of the **Log** group box. The window can be resized or maximized to enlarge the **Log** group box.
 - j. The log can be copied to the clipboard through the **File→Copy Log to Clipboard** menu item. The log can be cleared through the **File→Clear Log** menu item.
 - k. The program can be ended through the **File→Exit** menu item.

Detailed Description of Software

The software program's main window (**Figure 3**) contains three tabs: **Setup**, **Memory**, and **Raw 1-Wire**. The starting tab is **Setup**, which contains the 1-Wire adapter/port and device selection options. The **Memory** tab (**Figure 4**) contains the main demo with four areas from top to bottom: **Memory Resource Selection**, **Commands**, **Options**, and **Log**. The **Raw 1-Wire** tab (**Figure 8**) contains buttons and fields to send and receive raw 1-Wire communication.

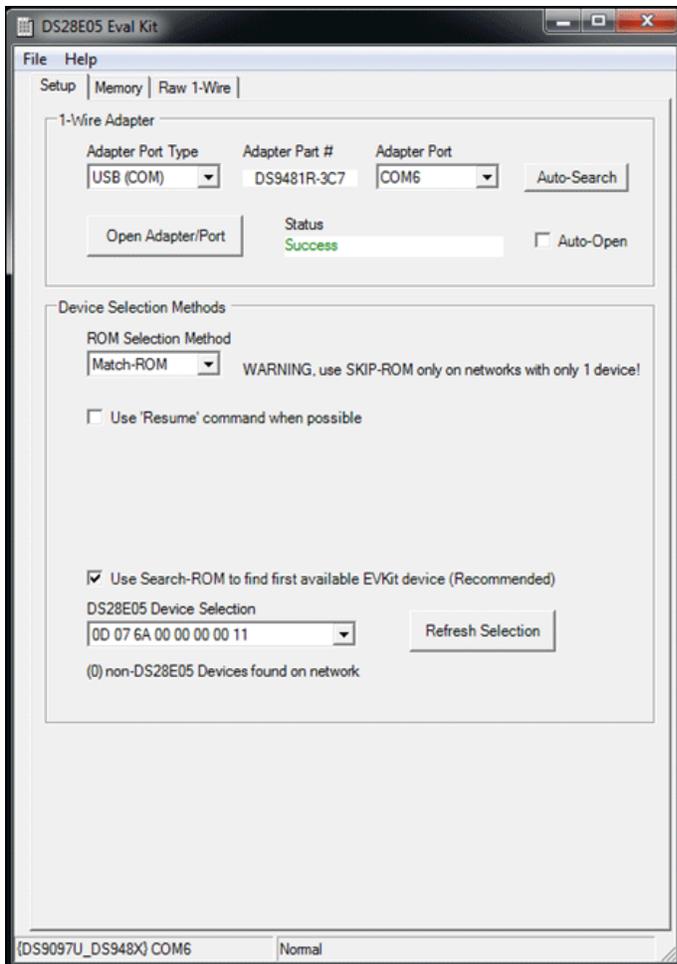


Figure 3. The DS28E05 EV kit software: main window Setup tab.

The software window contains a menu at the top as seen in Figure 3. The log can be copied to the clipboard through the **File→Copy Log to Clipboard** menu item. The log can be cleared through the **File→Clear Log** menu item. The **Help** menu displays the version of the software. The **File→Exit** menu exits the EV kit software.

Setup Tab

The **Setup** tab (Figure 3) contains two sections: **1-Wire Adapter** and **Device Selection Methods**.

1-Wire Adapter

The **1-Wire Adapter** group box includes adapter type and port selections. This setup is required before performing operations on a connected device. Only the **Adapter Port Type** of **USB (COM)** is supported with **Adapter Part # of DS9481R-3C7**. Once the **Adapter Port** is selected, click on the **Open Adapter/Port** button. If the adapter is detected, **Success** is displayed in the status field to the right of the button. If the adapter is not detected, an error message is displayed. If this happens, fix the problem and click the button again. Optionally, the **Auto-Search** button can be used to search through all available COM ports to find the DS9481R-3C7.

The **Auto-Open** checkbox instructs the program to automatically open the selected adapter and port when the program starts. This should be used if the adapter port combination is not expected to change often. The **Open Adapter/Port** button does not need to be clicked if the **Auto-Open** was checked when the application started and **Success** is displayed in the status field.

Device Selection Methods

The **Device Selection Methods** group box in the **Setup** tab instructs the **Memory** tab operations on how to select the device using the ROM (read-only memory) level 1-Wire commands. The 1-Wire protocol uses the unique 64-bit ROM ID as the network address of the device.

The **ROM Selection Method** drop-down list has two options: **Match-ROM** and **Skip-ROM**. **Match-ROM** uses the ROM ID to select the device with the Match-ROM command. Because this operation uses the ROM ID, it needs to know this number in advance. Consequently, when

selecting **Match-ROM**, the **Use Search-ROM to find first available EVKit device (Recommended)** is automatically checked. This operation finds the available DS28E05 on the network and populates the drop-down list. The first device found is selected by default. If the contents of the 1-Wire network are changed, the **Refresh Selection** button can be clicked to refresh the list. Note that the message below the device list indicates if there are other non-DS28E05 devices present on the network found during the search. The **Skip-ROM** option calls on the Skip-ROM command to select any device present. This option should only be used if there is only one device present on the 1-Wire. If multiple devices are present, they are all selected at once, potentially causing collisions. A warning message to that effect is displayed if potential conflicts are detected when changing to the **Memory** tab.

The **Use 'Resume' command when possible** checkbox instructs the **Memory** tab operations to use the Resume command. The Resume command is a shortcut command to select the same device that was previously selected with the ROM level command.

Overdrive speed is used at all times since the DS28E05 is an overdrive-only device.

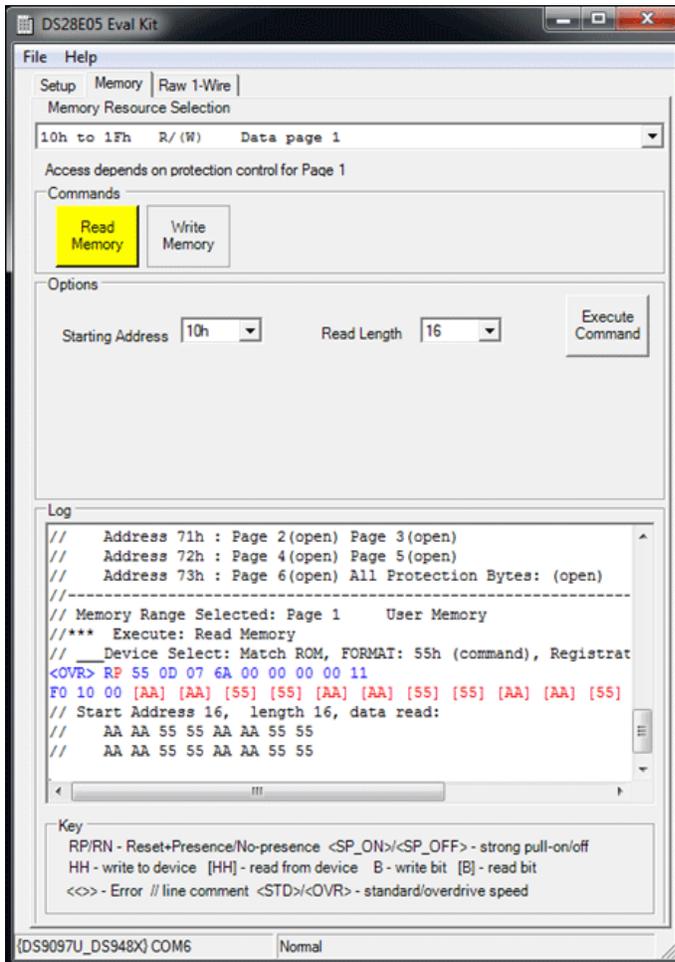


Figure 4. The DS28E05 EV kit software: main window Memory tab.

Memory Tab

The **Memory** tab (Figure 4) contains five sections: **Memory Resource Selection**, **Commands**, **Options**, **Log**, and **Key**.

Memory Resource Selection

The contents of this drop-down list mirror the memory resources described in the DS28E05 data sheet. Selecting a memory resource automatically displays the commands available to operate on this memory in the **Commands** group box. Most ranges at a minimum provide the **Read** command.

Commands/Options

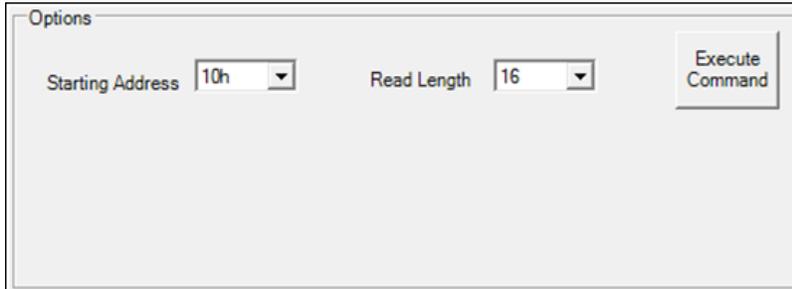
Once a memory range has been selected, one or more command buttons appear in the **Commands** group box depending on the properties of the memory range. Clicking on one of the command buttons highlights it in yellow. Clicking on the command button also populates the **Options**

group box with fields and/or components representing the options offered for the command. The options offered change depending on the command selected and the selected memory range's properties. Once the options have been set, the command can be performed by clicking on the **Execute Command** button in the **Options** group box.

The following sections list all possible commands and the corresponding options.

Read Memory

The **Read Memory** command (Figure 5) is applicable to all memory ranges. Possible options are the **Starting Address** and **Read Length** in the drop-down lists. The **Starting Address** list is populated with all possible addresses in the selected memory range. The **Read Length** is populated from one to the maximum size of the memory range.

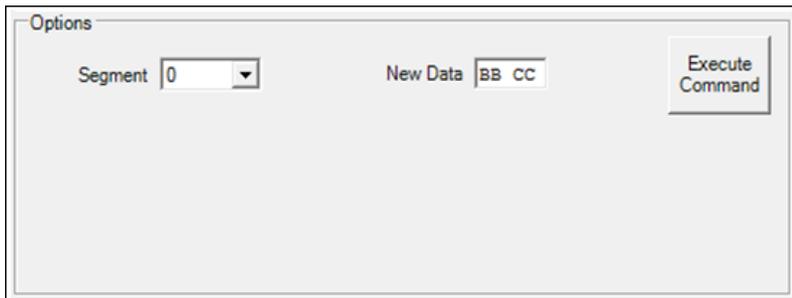


The screenshot shows a dialog box titled "Options" for the Read Memory command. It contains two dropdown menus: "Starting Address" with the value "10h" and "Read Length" with the value "16". To the right of these fields is a button labeled "Execute Command".

Figure 5. The Read Memory command Options.

Write Memory

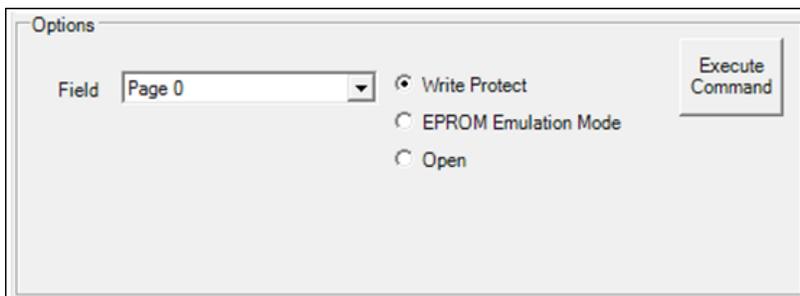
The **Write Memory** command is applicable to those memory locations that are not read-only. For the DS28E05, this is the address range of 0000h to 0073h. There are two sets of options for the **Write Memory** command. The first set of options pertains to a general-purpose memory write, which writes a 2-byte segment on a data page (Figure 6). The page written to must not have **Write Protect** enabled. If it is enabled, the write fails. The **New Data** must be 2 bytes of hex digits.



The screenshot shows a dialog box titled "Options" for the Write Memory command, specifically for general-purpose writing. It contains a dropdown menu for "Segment" with the value "0" and a text input field for "New Data" containing the hex digits "BB CC". To the right of these fields is a button labeled "Execute Command".

Figure 6. The Write Memory command Options for general-purpose writing.

The second set of **Write Memory** options pertains to the memory range of 0070h to 0073h. When these memory locations are written, they turn on special options associated with each page of the DS28E05's memory on a page-by-page basis. The **Write Protect** option (Figure 7) uses the standard, general-purpose **Write Memory** command but formats that data to set the desired protection. The following options are provided as radio buttons: **Write Protect**, **EPROM Emulation Mode**, and **Open**. **Open** selects no protection and is the default state. Once protection has been set on a page, it cannot be changed.



The screenshot shows a dialog box titled "Options" for the Write Memory command, specifically for Write Protect and EPROM Emulation Mode. It contains a dropdown menu for "Field" with the value "Page 0" and three radio buttons: "Write Protect" (which is selected), "EPROM Emulation Mode", and "Open". To the right of these fields is a button labeled "Execute Command".

Figure 7. The Write Memory command Options for Write Protect and EPROM Emulation Mode.

Log

The **Log** group box consists of a scrollable output field and a **Key** to explain the output. The output field displays all communication with the

DS28E05, along with comments to describe the operations. The log contents can be copied to the system clipboard for pasting into a document or email message through the **File→Copy Log to Clipboard** menu item. The **Log** can also be cleared with the **File→Clear Log** menu item. The program window can be resized to expand the **Log** group box for easier viewing. The text in the **Log** group box is also color-coded. This color coding is preserved when copying to another program. See **Table 2** for a detailed explanation of the key to the log contents.

Table 2. Log Key	
Key	Description
RP	1-Wire reset and presence pulse response. Color-coded blue for the reset pulse and red for the response.
RN	1-Wire reset and no presence pulse response. Color-coded blue for the reset pulse and red for the response.
<SP_ON>/<SP_OFF>	1-Wire strong pullup on/1-Wire strong pullup off. Strong pullup is used to provide additional current to the device during operations such as EEPROM write.
HH - write to device	1-Wire write from master to device represented by a pair of hex digits showing the byte that was transmitted. Valid for a line that does not begin with a comment symbol "//". Color-coded blue.
[HH] - read to device	1-Wire read from device represented by a pair of hex digits bounded by brackets "[]" showing the byte that was received. Valid for a line that does not begin with a comment symbol "//". Color-coded red.
B	1-Wire write bit from master to device represented by a single binary digit (1/0). Valid for a line that does not begin with a comment symbol "//". Color-coded blue.
[B]	1-Wire read bit from master to device represented by a single binary digit (1/0) bounded by brackets "[]" showing the bit that was received. Valid for a line that does not begin with a comment symbol "//". Color-coded red.
<<>>	Indicates an error with the error message between the "<< >>". Color-coded purple.
<STD>/<OVR>	Indicates 1-Wire line speed: <STD> for standard and <OVR> for overdrive. This symbol is logged before every 1-Wire reset pulse and when the speed changes as in an Overdrive Match command. Color-coded blue.
// line comment	Indicates a line that is not 1-Wire communication, but is instead commentary on the operation performed. Color-coded black.

Raw 1-Wire Tab

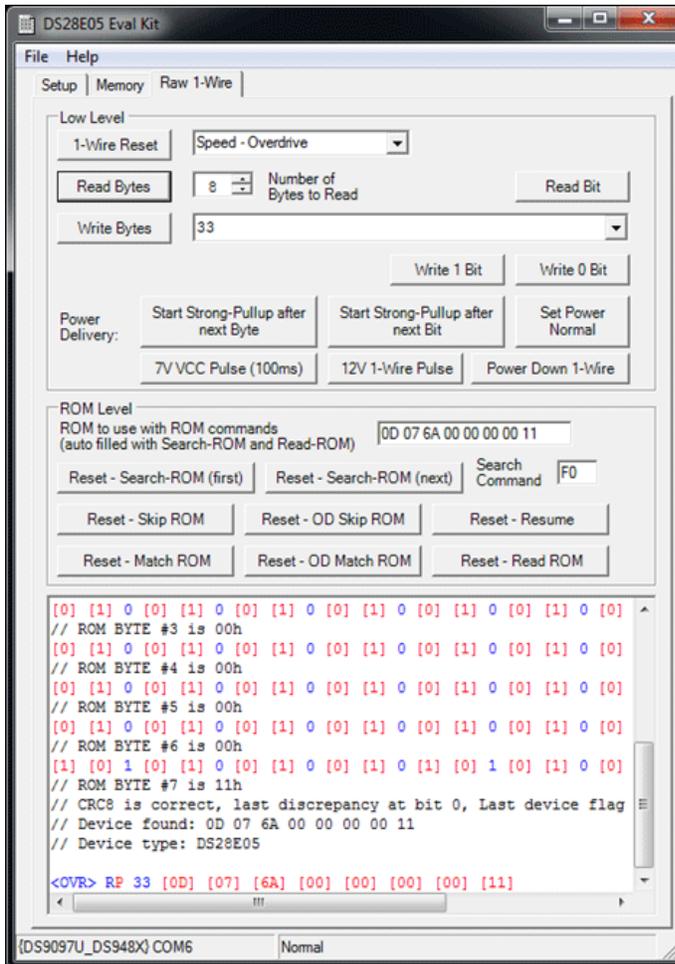


Figure 8. The DS28E05 EV Kit software: main window Raw 1-Wire tab.

The **Raw 1-Wire** tab (Figure 8) provides the facilities to send and receive any raw 1-Wire communication. This can be used to recreate some of the operations seen on the **Memory** tab or to experiment with other operations. It can also be used on 1-Wire devices other than the DS28E05 since it provides direct access to the 1-Wire network. All of the operations are recorded in the Log group box on the **Memory** tab as well as on the bottom of the **Raw 1-Wire** tab for later examination and copying. The operations available on the **Raw 1-Wire** tab are divided into two group boxes: **Low Level** and **ROM Level**.

Low Level

The **Low Level** group box provides the low-level 1-Wire primitives that can be used to construct any 1-Wire communication sequence. The **1-Wire Reset** button issues a reset low presence at the speed specified in the drop-down list to the right of the **1-Wire Reset** button. The **Read Bytes** button reads the number of bytes specified in the input field to the right of the button. The **Write Bytes** button writes the bytes displayed in the input field to the right of the button. The **Write Bytes** input field is also a drop-down list that remembers all previous write byte sequences. The **Write 1 Bit** and **Write 0 Bit** buttons write the indicated bit to the 1-Wire network.

The **Start Strong-Pullup after next Byte** button starts the 1-Wire strong pullup power delivery after the next communication byte (either read or write). The **Start Strong-Pullup after next Bit** button starts the 1-Wire strong pullup power delivery after the next communication bit (either read or write). The **Set Power Normal** button disables the 1-Wire strong pullup power delivery. The **Power Down 1-Wire** button powers down the 1-Wire. Any 1-Wire operation returns the 1-Wire to a normal state.

Note: The following items in the **Low Level** group box of the **Raw 1-Wire** tab can be used for other 1-Wire products, but are not used for evaluating the DS28E05.

- The **7V VCC Pulse (100ms)** button enables a 7V pulse on the PULSE pin of the DS9481R-3C7. This is not necessary to evaluate the DS28E05.
- The **12V 1-Wire Pulse** button enables a 512µs pulse on the 1-Wire to support EPROM programming. A warning message displays before the operation completes. **Do not use this feature when evaluating DS28E05 as it could result in damage to the DS28E05.**

ROM Level

The **ROM Level** group box has 1-Wire macros that implement the 1-Wire ROM commands. These commands use the 64-bit unique ROM ID that each 1-Wire device is embedded with for device discovery and selection. The **ROM to use with ROM commands (auto filled with Search-ROM and Read-ROM)** input field is used with the ROM macros to select a device. This field can be manually edited to input the ROM ID of the device selected or the field is autofilled by clicking on the following buttons: **Reset - Search-ROM (first)**, **Reset - Search-ROM (next)**, and **Reset - Read ROM**.

The **Reset - Search-ROM (first)** button performs the Search ROM command sequence to discover the first device on the network. The ROM ID and the binary search sequence, not physical location, determine the order of the devices discovered. See application note 187, "[1-Wire Search Algorithm](#)" for details.

The **Reset - Search-ROM (next)** button continues where the last binary search left off and finds the next device. Both of these search buttons use the command entered in the **Search Command** input field. The default command is F0 (hex) Search ROM. Alternately, this can be filled in with the Conditional Search ROM command EC (hex). However, this command is not valid for the DS28E05.

The **Reset - Skip ROM** button sends a 1-Wire reset followed by the CC (hex) Skip ROM command. This selects all devices on the 1-Wire. It should only be used if there is only one DS28E05 on the network.

The **Reset - OD Skip ROM** button sends a 1-Wire reset followed by the Overdrive-Skip ROM command 3C (hex) and changes the 1-Wire speed to overdrive.

The **Reset - Resume** button sends a 1-Wire reset followed by the Resume command A5 (hex).

The **Reset - Match ROM** button sends a 1-Wire reset followed first by the Match ROM command 55 (hex) and then by the 8 bytes of the ROM ID in the ROM input field at the top of the **ROM Level** group box. If there is no ROM ID in the input field, a warning displays.

The **Reset - OD Match ROM** button sends a 1-Wire reset followed by the Overdrive-Match ROM command 69 (hex), changes the 1-Wire speed to overdrive, and then sends the 8 bytes of the ROM ID in the ROM input field at the top of the **ROM Level** group box.

The **Reset - Read ROM** button sends a 1-Wire reset followed by the Read ROM command 33 (hex) and then reads the 64-bit ROM ID of the device. The CRC-8 within the number is checked to verify a valid ROM ID. A warning is logged if the CRC-8 is not valid. The ROM ID is also loaded into the ROM input field to be used by the other ROM macro buttons.

Summary

This application note covered how to setup and connect the hardware and install the appropriate software and drivers. It also included a detailed description of the evaluation software with screenshots. We found that the software covered in this application note, in combination with the DS9120P and the DS9481R-3C7, made an excellent evaluation system for the DS28E05 on a computer running Microsoft Windows 8, Windows 7, Windows Vista, or Windows XP.

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Related Parts

DS28E05	1-Wire EEPROM	Free Samples
DS9120P	Socket Boards for Evaluating 1-Wire Devices	
DS9481R-3C7	USB-to-1-Wire@iButton® Adapter	

More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>

Other Questions and Comments: <http://www.maximintegrated.com/contact>

Application Note 5548: <http://www.maximintegrated.com/an5548>

APPLICATION NOTE 5548, AN5548, AN 5548, APP5548, Appnote5548, Appnote 5548

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