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Evaluation Boards for the **AD7414/AD7415** SMBus/I²C, 10-Bit Digital Temperature Sensors

AD7414/AD7415 FEATURES

10-bit temperature-to-digital converter
Temperature range: –40°C to +125°C
Typical accuracy of ±0.5°C at +40°C
SMBus-/I²C-compatible serial interface
3 µA power-down current
Temperature conversion time: 29 µs typical
Space-saving, 6-lead SOT-23 (AD7414) and 5-lead SOT-23 (AD7415) packages
Pin selectable addressing via AS
Overtemperature indicator (AD7414 only)
SMBus alert function (AD7414 only)
4 versions allow 8 I²C addresses (AD7414)
2 versions allow 6 I²C addresses (AD7415)

APPLICATIONS

Hard disk drives
Personal computers
Electronic test equipment
Office equipment
Domestic appliances
Process controls
Cellular phones

GENERAL DESCRIPTION

The **AD7414/AD7415** evaluation board allows the **AD7414/AD7415** digital temperature sensors to be quickly and easily evaluated using a personal computer (PC).

Using the evaluation board and its accompanying software, the **AD7414/AD7415** evaluation board can be interfaced with any PC via a USB port. The software works on 32-bit Windows® 7 machines and earlier versions such as Windows XP.

The software allows a user to configure the board and monitor the temperature readings of the **AD7414/AD7415**.

THE **AD7414/AD7415**

This section gives a brief description of the **AD7414/AD7415** and the system overview. See the **AD7414/AD7415** data sheet for further details.

The **AD7414/AD7415** are complete temperature monitoring systems in a 6-lead SOT-23 package (**AD7414**) and a 5-lead SOT-23 package (**AD7415**). They each contain a band gap temperature sensor and a 10-bit ADC to monitor and digitize the temperature reading to a resolution of 0.25°C.

The **AD7414/AD7415** provide a 2-wire serial interface that is compatible with SMBus and I²C interfaces. The devices come in four versions: the **AD7414-0/AD7415-0**, the **AD7414-1/AD7415-1**, the **AD7414-2**, and the **AD7414-3**. The **AD7414-0/AD7415-0** and the **AD7414-1/AD7415-1** versions provide a choice of three different SMBus addresses for each version. All four **AD7414** versions give the possibility of eight different I²C addresses, while the two **AD7415** versions allow up to six I²C addresses to be used.

The 2.7 V supply voltage, low supply current, serial interface, and small package size of the **AD7414/AD7415** make them ideal for a variety of applications, including PCs, office equipment, cellular phones, and domestic appliances.

In the **AD7414**, on-chip registers can be programmed with high and low temperature limits, and an open-drain overtemperature indicator output (ALERT) becomes active when a programmed limit is exceeded. A configuration register allows programming of the state of the ALERT output (active high or active low). This output can be used as an interrupt or as an SMBus alert.

EVALUATION SYSTEM PACKAGE CONTENTS

The evaluation system package contains the following items:

- This document
- The **AD7414/AD7415** evaluation board
- The evaluation software CD
- A USB cable

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REVISION HISTORY

6/2016—Rev. 0 to Rev. A

Updated Format.....	Universal
Changes to General Description Section	1
Changes to Figure 11, Figure 12, and Figure 13	9
Changes to Table 2.....	10

3/2006—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

The AD7414/AD7415 evaluation board contains the following main components, which can also be identified in the printed circuit board silkscreen and schematic diagrams shown in Figure 9 through Figure 11:

- The AD7414 IC, U1
- The AD7415 IC, U2
- A USB microcontroller, U6
- An ALERT LED, D2
- A power LED, D1
- A connector for the USB interface, J1

USING THE HARDWARE

The hardware is simple to use. Before connecting the evaluation board to the USB port on the PC, using the USB A to mini-B cable provided, make sure that the software is installed. No external power supply is required.

MINI-B USB CONNECTOR J1

Table 1 shows the connections to J1.

Table 1. J1 Connections

J1 Pin	Mini-B Function
1	5 V
2	–Data
3	+Data
4	Key (not used; connected to ground)
5	Ground

The USB microcontroller, U6, handles the communication between the mini-B plug and the rest of the evaluation board.

TEST POINTS

Various system logic signals, ground, and the power rail are available at the test points on the board.

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The software allows the functions of the [AD7414/AD7415](#) to be controlled from a PC via an easy to use interface operating under Windows XP, Windows 2000, or higher. The contents of the internal registers of the device can be easily read or altered through a user friendly interface, while the **Visual Display** window gives a graphical display of the temperature and allows the overtemperature and undertemperature limits to be altered using a slider control.

INSTALLING THE SOFTWARE

To install the software,

- Insert the CD.
- Click **Start > Run**.
- Enter **x: AD7414_15_Eval_v2.0.0.exe**, where x is the letter of your CD drive.
- Click **OK**.

Alternatively, run **Windows Explorer** or **My Computer**, select the CD drive, and double-click **AD7414_15_Eval_v2.0.0.exe**.

The installer extracts the files needed to install the software and the **InstallShield Wizard** dialog box opens (see Figure 1).

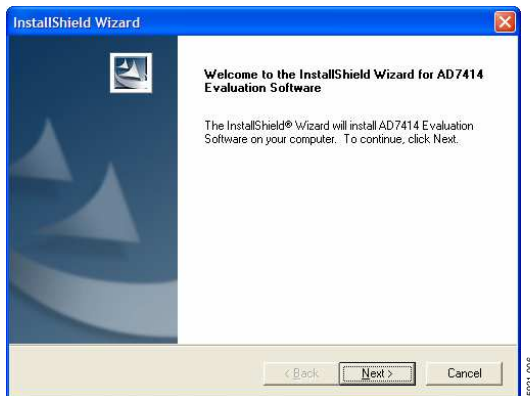


Figure 1. **InstallShield Wizard** Dialog Box

Click **Next >** to continue the installation. Various installation options are available, depending on whether a version of the software is already installed. If this is a new installation, a license agreement appears. Click **Yes** to accept the agreement and continue with the installation.

If you want to install the software in the default folder shown, click **Next >**. Otherwise, click **Browse...** and choose a different folder. The folder chosen is where the program is installed. Once you have chosen, click **OK**.

You are now given the three software installation options: **Typical**, **Compact**, and **Custom**.

Select the desired option, then click **Next >**. If **Custom** is selected, a window appears that allows individual components to be installed.

Uncheck any component you do not wish to install and click **Next >**. If **Typical** or **Compact** is selected, this step is omitted, and the **Select Program Folder** dialog box appears. This allows you to select the program folder to which program icons are added. Select the desired folder and click **Next >**.

The InstallShield Wizard now installs the program files to the selected folders. Click **Finish** to complete the installation.

If an existing version of the software is found during installation, you can modify the existing installation by adding or removing components, repair the installation by replacing existing files with ones from the CD (useful if a file has been corrupted), or uninstall the entire software package.

Select the desired option and click **Next >**. If **Modify** is selected, you can add or remove components. If **Repair** is selected, the installed files are replaced with new files from the CD.

If **Remove** is selected, you are prompted to confirm the complete removal of the software. Click **OK** to confirm removal of the software. During removal of the software, you may need to confirm removal of some files.

These files can be used by other Analog Devices, Inc., software. If no other Analog Devices software is installed on the system, it is safe to delete them. To remove all shared files without further prompting, select **Don't display this message again** before clicking **Yes**.

Click **Finish** to complete the maintenance procedure.

USING THE SOFTWARE FOR TESTING

When using the software, first ensure that the evaluation board is powered up and connected to the USB port.

To start the software, click: **Start > All Programs > Analog Devices > AD7414 / AD7415 Evaluation Software > AD7414 Evaluation Software**. The software searches for the evaluation board and initializes it.



Figure 2. **AD7414/AD7415 Found**

If the evaluation board is not found, the following message appears:

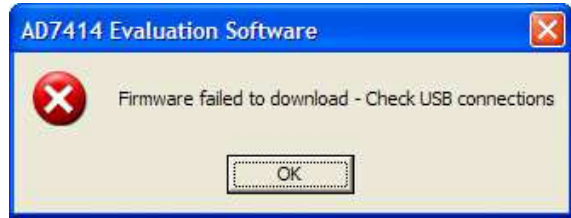


Figure 3. AD7414/AD7415 Not Found

If this happens, check that the evaluation board is correctly connected, that D1 is lit, and try again.

There are three tabs at the top of the program window: **General**, **Readings**, and **Settings**. These can be used to access the various functions of the software.

The **General** tab shows the software version.

Temperature Reading

The **Readings** tab allows the temperature to be displayed as a rolling graph. Measurement limits are also displayed for the AD7414 only. To view the graphic data in more or less detail, move the arrow pointers on the x-axis and y-axis to zoom in or zoom out (see Figure 4).

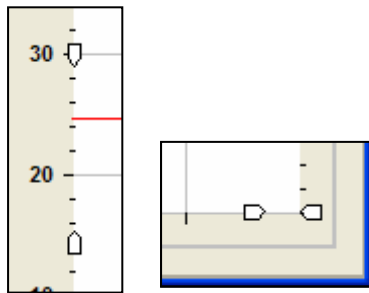


Figure 4. Zoom Controls

Temperature Limits

The upper and lower alert limits can be set by dragging the blue and grey sliders to the desired temperature values.

The current temperature reading is represented by the red bar as well as in text at the bottom of the dialog box.

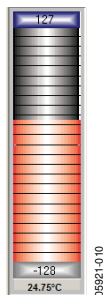


Figure 5. Temperature Reading

Settings

Click the **Settings** tab to access the **Settings** dialog box. This dialog box allows you to select which device is being read, the AD7414 or the AD7415 (see Figure 6).

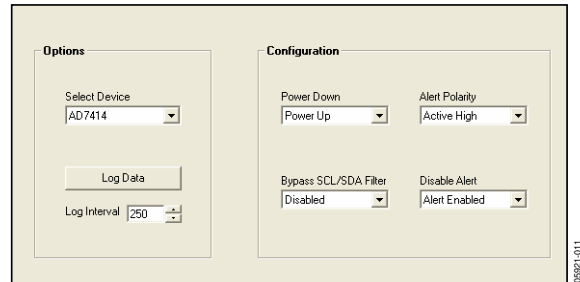


Figure 6. Device Options

You can select or enable/disable various options within this dialog box, including the following:

- **Power Up/Power Down.**
- **Alert Polarity (AD7414 only).**
- **Active Low.** Alert Diode D2 is lit when an overtemperature condition happens (current temperature reading higher than the temperature set by the blue slider).
- **Active High.** Alert Diode D2 is lit when an under-temperature condition happens (that is, when the current temperature reading is lower than the temperature set by the grey slider).
- **Bypass SCL/SDA Filter.** Switching off the input filters improves the transfer rate but has a negative effect on the EMC behavior of the device.
- **Disable Alert (AD7414 only).**

Data Logging

The **Settings** dialog box also allows you to log data into a file.

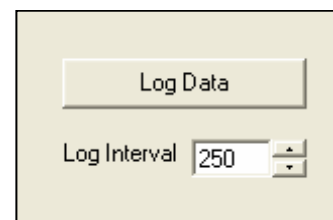


Figure 7. Data Logging

Log Interval sets the time in milliseconds between samples. Once this has been set, click **Log Data**. The dialog box in Figure 8 then appears.

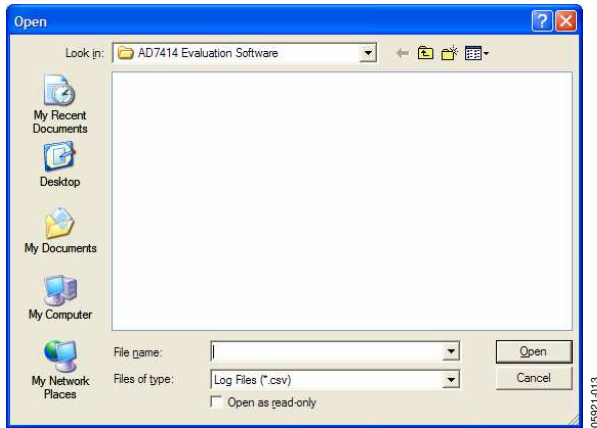


Figure 8. Opening or Creating a Log File

You can use this dialog box to open an existing log file or to create a new log file by typing in a new file name.

After selecting an existing file or typing in a new file name, click **Open** to begin data logging. To stop data logging, click **Stop Logging...**

EVALUATION BOARD SCHEMATICS AND ARTWORK

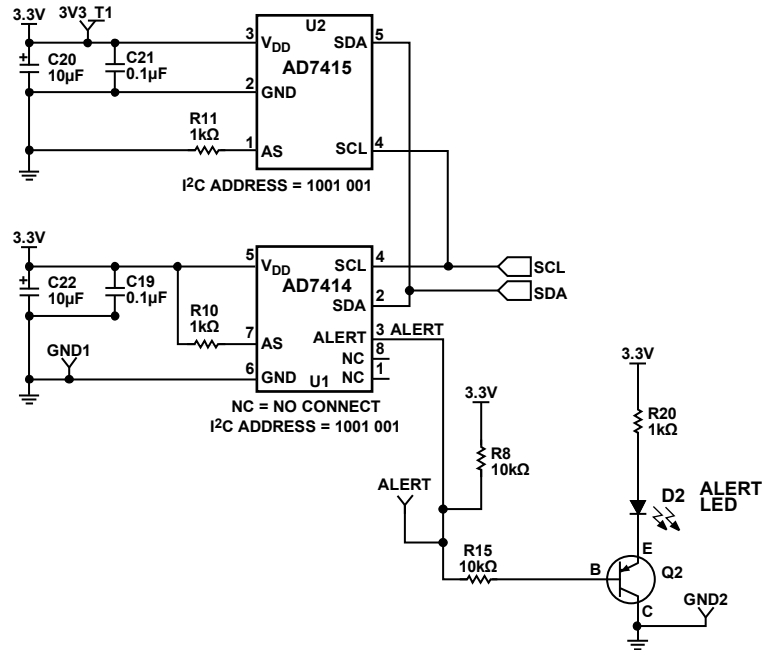


Figure 9. AD7414/AD7415 Evaluation Board Schematic (Page 1)

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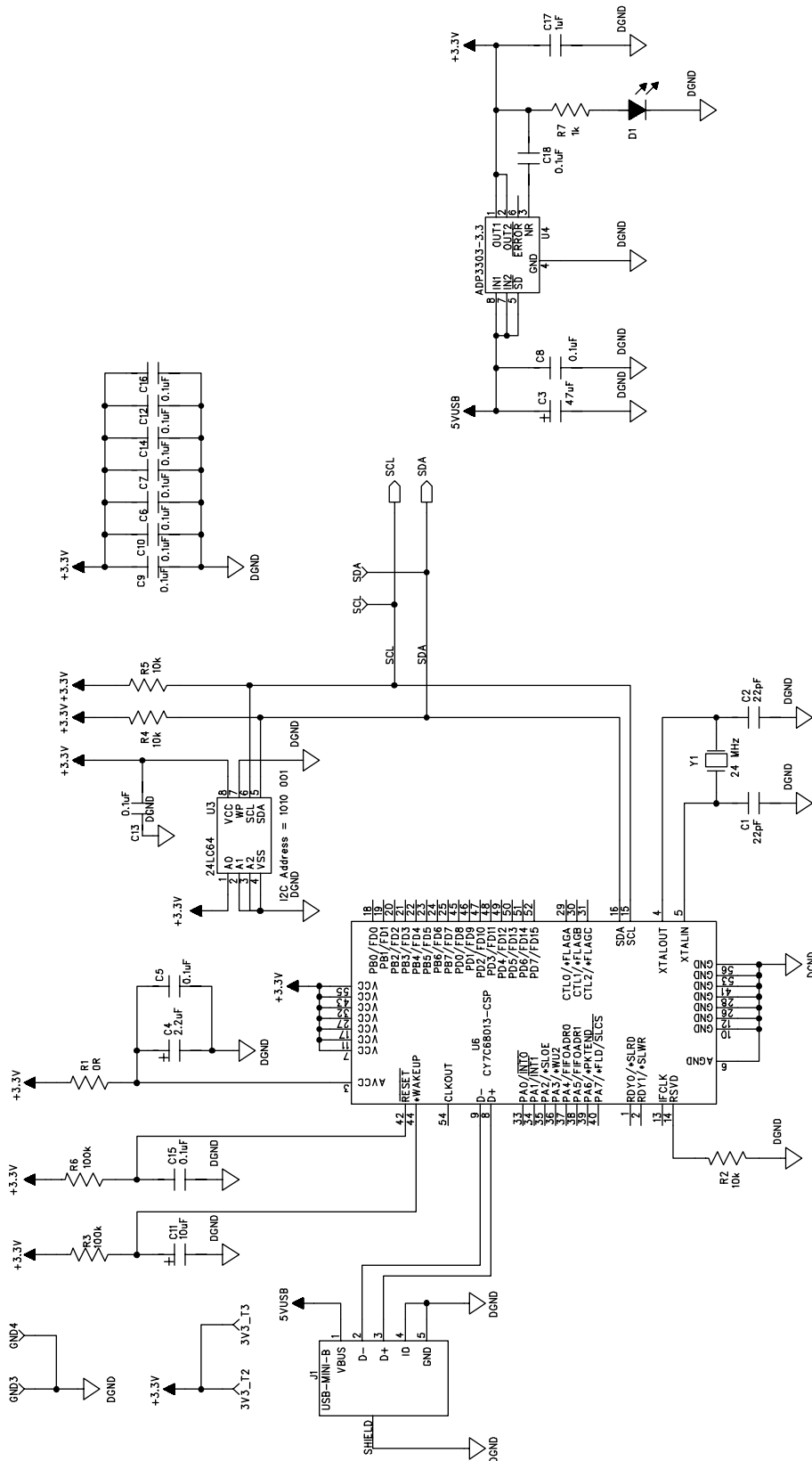


Figure 10. AD7414/AD7415 Evaluation Board Schematic (Page 2)

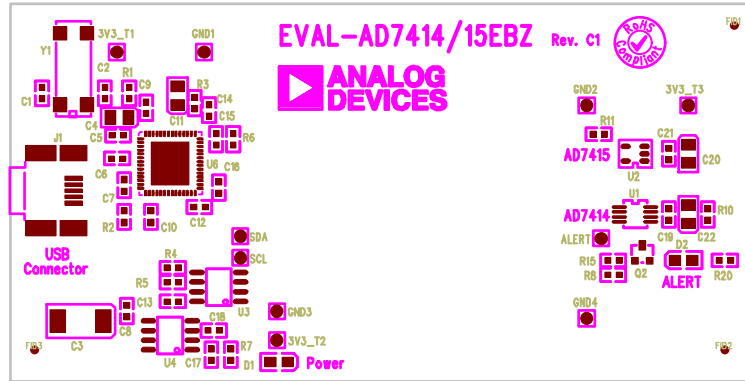


Figure 11. AD7414/AD7415 Evaluation Board Silkscreen

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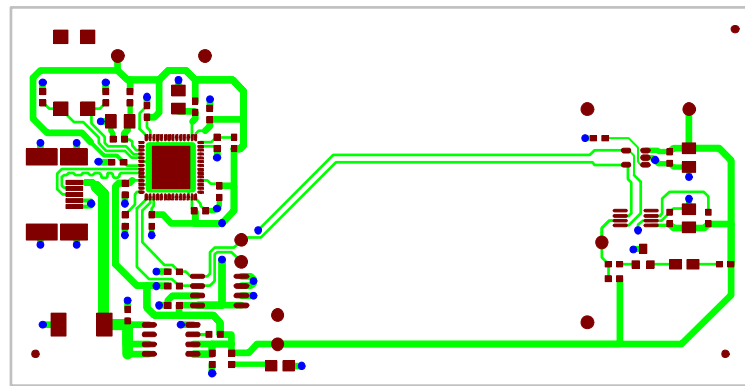


Figure 12. AD7414/AD7415 Evaluation Board Component Side

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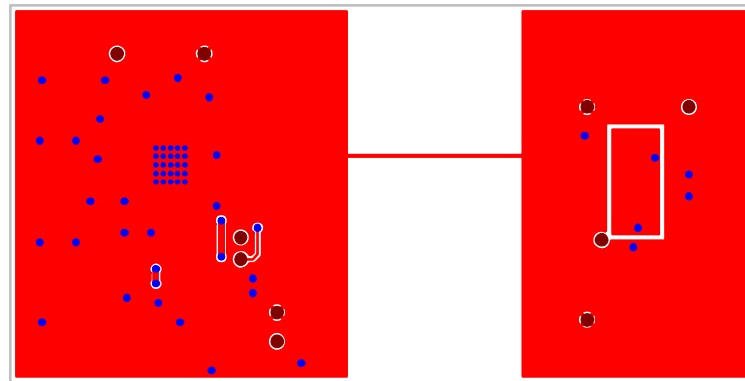


Figure 13. AD7414/AD7415 Evaluation Board Solder Side

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ORDERING INFORMATION

BILL OF MATERIALS

Table 2. Parts List for [EVAL-AD7414EBZ](#)/[EVAL-AD7415EBZ](#) Evaluation Board

Name	Part Type	Tolerance	Part Description
ALERT	Test point		Red test point
3V3_T1	Test point		Red test point
3V3_T2	Test point		Red test point
3V3_T3	Test point		Red test point
C1	Capacitor	5%	Capacitor, 0603, 22 pF, 50 V
C2	Capacitor	5%	Capacitor, 0603, 22 pF, 50 V
C3	Capacitor+	10%	Capacitor, Case D, 47 μ F, 10 V
C4	Capacitor+	10%	Capacitor, Case A, 2.2 μ F, 10 V
C5	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C6	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C7	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C8	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C9	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C10	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C11	Capacitor+	10%	Capacitor, Case A, 10 μ F, 10 V
C12	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C13	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C14	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C15	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C16	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C17	Capacitor	(+80%, -20%)	Capacitor, 0603, 1 μ F, 10 V
C18	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C19	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C20	Capacitor+	10%	Capacitor, CASE A, 10 μ F, 10 V
C21	Capacitor	(+80%, -20%)	Capacitor, 0603, 100 nF, 25 V
C22	Capacitor+	10%	Capacitor, Case A, 10 μ F, 10 V
D1	LED		LED, green SMD
D2	LED		LED, red SMD
GND1	Test point		Black test point
GND2	Test point		Black test point
GND3	Test point		Black test point
GND4	Test point		Black test point
J1	USB Mini-B		Socket, USB Mini-AB SMT (USB-OTG)
Q2	BC807-40LT1		Transistor, PNP, SOT-23
R1	Resistor	1%	Resistor, 0603, 0 Ω
R2	Resistor	1%	Resistor, 0603, 10 k Ω
R3	Resistor	1%	Resistor, 0603, 100 k Ω
R4	Resistor	1%	Resistor, 0603, 10 k Ω
R5	Resistor	1%	Resistor, 0603, 10 k Ω
R6	Resistor	1%	Resistor, 0603, 100 k Ω
R7	Resistor	1%	Resistor, 0603, 1 k Ω
R8	Resistor	1%	Resistor, 0603, 10 k Ω
R10	Resistor	1%	Resistor, 0603, 1 k Ω
R11	Resistor	1%	Resistor, 0603, 1 k Ω
R15	Resistor	1%	Resistor, 0603, 10 k Ω
R20	Resistor	1%	Resistor, 0603, 1 k Ω
SCL	Test point		Red test point

Name	Part Type	Tolerance	Part Description
SDA	Test point		Red test point
U1	AD7414		AD7414ARMZ-0, SMBus/I ² C digital temperature sensor
U2	AD7415		AD7415ARTZ-0, digital output temperature sensor
U3	24LC64		IC, SM EEPROM SERIAL, 64 kΩ
U4	ADP3303-3.3		Precision low dropout voltage regulator
U6	CY7C68013-CSP		IC MCU USB PERIPH HI SPD 56QFN (CY7C68013A-56LFXC)
Y1	XTAL-CM309S		Crystal, SMD, 24.000000 MHz



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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