



Evaluation Board for $\pm 0.5^{\circ}\text{C}$ Accurate PWM Temperature Sensor in 5-Lead SC-70

EVAL-TMP05/06EB

FEATURES

Modulated serial digital output, proportional to temperature

$\pm 0.5^{\circ}\text{C}$ accuracy at 25°C

$\pm 1.0^{\circ}\text{C}$ accuracy from 25°C to 70°C

Two grades available

Operation from -40°C to $+150^{\circ}\text{C}$ Operation from 3 V to 5.5 V

Power consumption 70 μW maximum at 3.3 V

CMOS/TTL-compatible output on TMP05

Flexible open-drain output on TMP06

Small, low cost 5-lead SC-70 and SOT-23 packages

APPLICATIONS

Isolated sensors

Environmental control systems

Computer thermal monitoring

Thermal protection Industrial process control

Power-system monitors

INTRODUCTION

The TMP05/TMP06 evaluation board allows the TMP05/TMP06 PWM temperature sensor to be quickly and easily evaluated using a personal computer. Using the evaluation board and its accompanying software, the TMP05/TMP06 evaluation board can be interfaced to any personal computer running Windows® 98 or later, via one of the computer's USB ports.

The evaluation board allows all the input and output functions of the TMP05/TMP06 to be exercised without the need for external components.

THE TMP05/TMP06

This section gives a brief description of the TMP05/TMP06 and the system overview. Further information can be found in the TMP05/TMP06 Data Sheet.

The TMP05/TMP06 are monolithic temperature sensors that

generate a modulated serial digital output (PWM), which varies in direct proportion to the temperature of the devices. The high period (T_H) of the PWM remains static over all temperatures, while the low period (T_L) varies. The B Grade version offers a higher temperature accuracy of $\pm 1^{\circ}\text{C}$ from 0°C to 70°C with excellent transducer linearity. The digital output of the TMP05/TMP06 is CMOS/TTL compatible, and is easily interfaced to the serial inputs of most popular microprocessors. The flexible open-drain output of the TMP06 is capable of sinking 5 mA.

The TMP05/TMP06 are specified for operation at supply voltages from 3 V to 5.5 V. Operating at 3.3 V, the supply current is typically 370 μA . The TMP05/TMP06 are rated for operation over the -40°C to $+150^{\circ}\text{C}$ temperature range. It is not recommended to operate these devices at temperatures above 125°C for more than a total of 5% (5,000 hours) of the lifetime of the devices. They are packaged in low cost, low area SC-70 and SOT-23 packages.

The TMP05/TMP06 have three modes of operation: continuously converting mode, daisy-chain mode, and one shot mode. A three-state FUNC input determines the mode in which the TMP05/TMP06 operate.

The CONV/IN input pin is used to determine the rate with which the TMP05/TMP06 measure temperature in continuously converting mode and one shot mode. In daisy-chain mode, the CONV/IN pin operates as the input to the daisy chain.

EVALUATION SYSTEM PACKAGE CONTENTS

The evaluation system package contains the following items:

- This document
- The TMP05/TMP06 evaluation board
- Evaluation software on CD-ROM
- USB cable

Rev.Sp0

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REVISION HISTORY

Revision Sp0: Initial Version

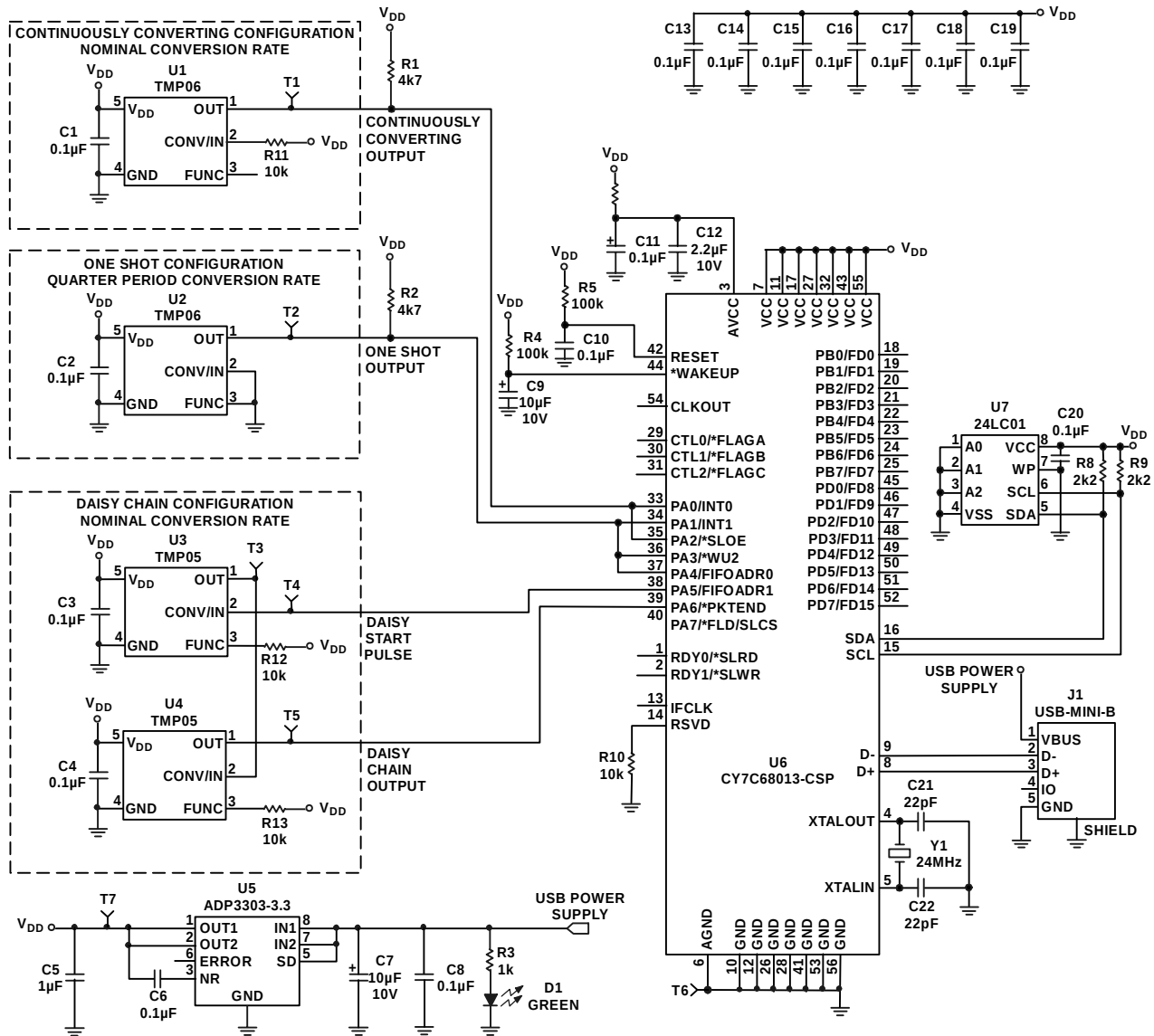
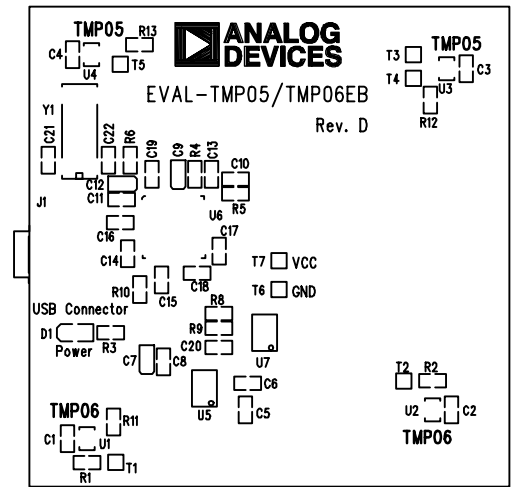


Figure 1. TMP05/TMP06 Evaluation Board Schematic

EVAL-TMP05/TMP06EB



Eval-TMP05/06EB Rev. D - Component Side View

Silkscreen

Figure 2. TMP05/TMP06 Evaluation Board Silkscreen

EVALUATION BOARD HARDWARE

The TMP05/TMP06 evaluation board contains the following main components, which can be identified from the schematic diagram of Figure 1 and the printed circuit board silkscreen of Figure 2:

- TMP06 PWM temperature sensor U1. This operates in continuously converting mode
- TMP06 PWM temperature sensor U2. This operates in single-shot mode.
- TMP05 PWM temperature sensors U3 and U4. These are daisy-chained.
- CY7C68013 USB interface U6.
- 24LC01 Serial EEROM U7. This stores the vendor ID and product ID values that are used by Windows to load the correct USB driver via the INF file.
- ADP3303 low dropout regulator.
- Power LED D1.

TEST POINTS

Six test points and a ground are provided for monitoring the outputs of the temperature sensors, the daisy-chain start pulse, and the supply voltage.

Table 1. Test Points

Test Point	Monitors
1	U1 OUT
2	U2 OUT
3	U3 OUT
4	U3 CONV/IN (Daisy Start Pulse)
5	U4 OUT
6	VDD
7	GND

EVALUATION BOARD SOFTWARE

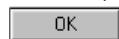
The software allows the TMP05/TMP06's functions to be controlled from a PC via an easy-to-use interface operating under Windows 95 or higher. The contents of the device's internal registers can be easily read or altered through a user friendly interface, while the Visual Display window gives a graphical display of temperature and voltage and allows the overtemperature limit to be altered using a "slider" control.

INSTALLING THE SOFTWARE

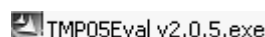
The software should be installed before the evaluation board is connected to the USB port. Other Analog Devices' software that uses a USB port may conflict with the TMP05 evaluation

software. All other such software should be de-installed before installing the TMP05 software

To install the software, insert the CD-ROM into the CD-ROM drive. Click on   and enter "X:TMP05Eval v2.05.exe," where "X" is the letter of your CD-ROM drive. Click



Alternatively, run Windows Explorer or My Computer, select the CD-ROM drive, and double-click on:



The installer will extract the files needed to install the software and start the InstallShield Wizard.

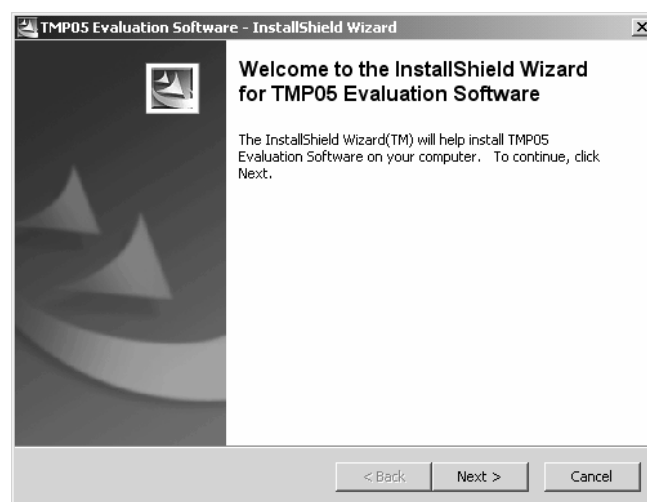
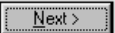
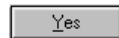
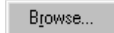
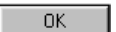


Figure 3. InstallShield Wizard Startup Screen

Click  to continue the installation. Various installation options will be available, depending on whether a version of the software is already installed. If this is a completely new installation, a license agreement will appear. Click



to accept the agreement and continue with the installation.

If you want to install the software in the default folder shown, click . Otherwise, click  and choose a different folder. Select the folder in which to install the program and click .

You will now be given the option of a typical, compact, or custom installation of the software.

Select the desired option, then click . If Custom is selected, a window appears allowing individual components to be installed.

Uncheck any components you do not wish to install, and click

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. If Typical or Compact installation is selected, this step will be omitted, and the Select Program Folder window appears immediately. This allows you to select the program folder to which program icons will be added. Select the desired folder and click .

InstallShield will now install the program files to the selected folders.

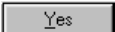
In order to use the software immediately, you must restart your computer so that Windows can update the setup files. To do this, select the Yes option. If you do not wish to use the software immediately, select the No option. No matter which option is selected, click  to complete the installation.

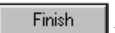
If an existing version of the software is found during installation, you may modify the existing installation by adding or removing components, repair the installation by replacing existing files with ones from the CD (useful if a file has been corrupted), or uninstall the entire software package.

Select the desired option and click . If Modify is selected, you may add or remove components. If Repair is selected, all of the installed files are replaced with new files from the CD-ROM. If Remove is selected, you will be prompted to confirm the complete removal of the software.

Click  to confirm removal of the software.

During removal of the software, you may need to confirm removal of some files.

These files may be used by other Analog Devices 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, check "Don't display this message again" before clicking .

Click  to complete the maintenance procedure.

USING THE SOFTWARE

Before the software can be used, Windows must find and add the evaluation board to its hardware. When the evaluation board is plugged into a USB port, Windows should find it and display the following messages:



Figure 4. Found New Hardware Messages

Click on the message and the "Found New Hardware Wizard" will start. You can let Windows find the previously installed

software (this is easiest but make take a little time if you have a large hard disk) or you can choose the advanced option and direct Windows to the folder where the software is installed.

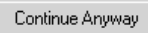


Figure 5. Found New Hardware Wizard

If using Windows XP, the following warning may appear:



Figure 6. Windows Logo Testing Warning

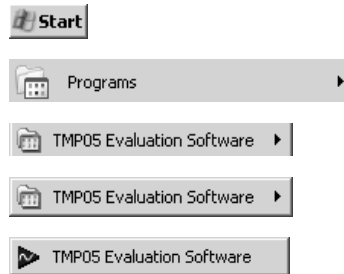
Choose .

Once the installation is successfully complete, the following message will appear:



Figure 7. Installation Completed Successfully.

To start the software, click :



The software window will appear as a set of four index cards, any of which can be selected by clicking on the relevant tab. The Version card shows the version of the software:



Figure 8. TMP05/TMP06 SoftwareVersion

The TMP05 card is used for monitoring the TMP05s:

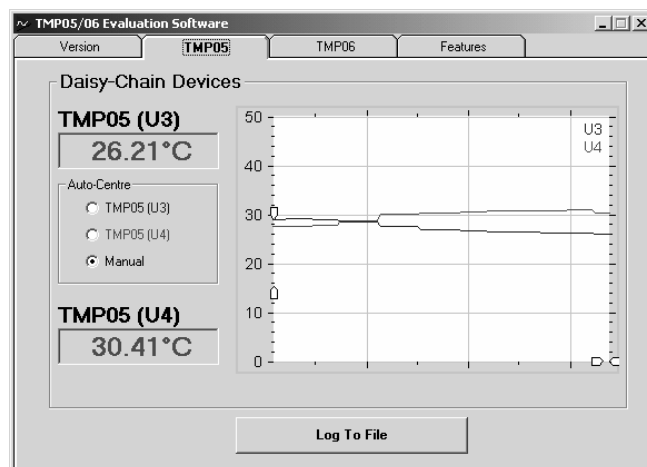


Figure 9. Monitoring TMP05s

The TMP06 card is used for monitoring the TMP06s:

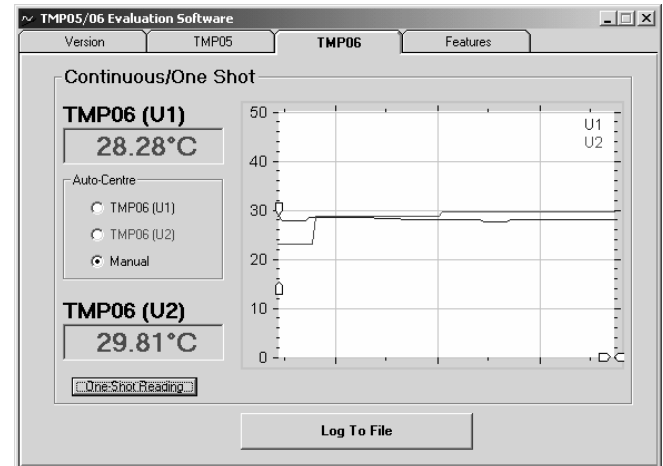


Figure 10. Monitoring TMP06s

U1 takes continuous readings, but U2 only takes a single-shot reading by clicking on **One-Shot Reading**.

When monitoring either the TMP05s or the TMP06s, if **Manual** is selected you can zoom in or out on the temperature or time axis by moving the arrow pointers located on these axes. Alternatively, the temperature axis can be centered on one of the temperature traces by selecting one of the devices.

The Features card allows you to view features of the TMP05, TMP06 and other Analog Devices temperature sensors.

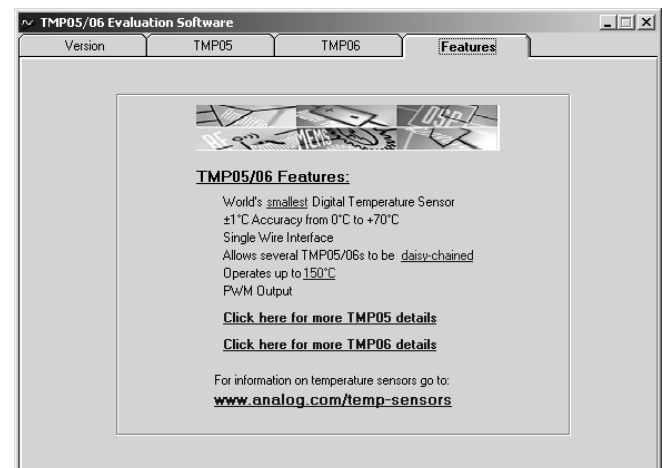


Figure 11. Features

The first three options on this card display graphics of key features of the TMP05 and TMP06. If you have an Internet connection, the next three options take you to the Analog Devices website to view more details of the TMP05, TMP06 or other temperature sensors.

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Data Logging

When monitoring either the TMP05s or the TMP06s, you can log the output data to a file by clicking on

Log To File

The following window will open:

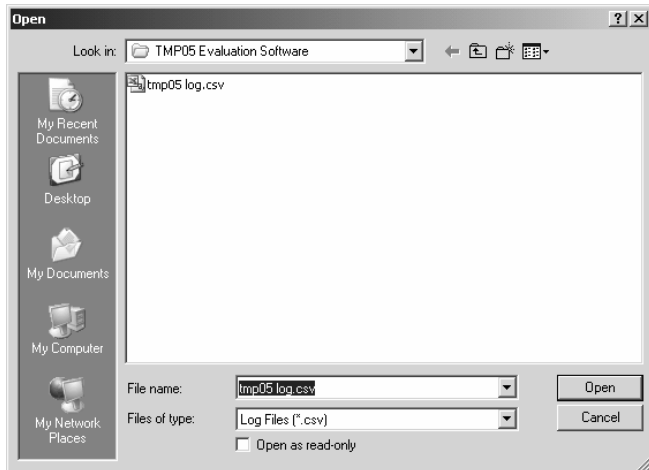


Figure 12. Opening or Creating A Log File

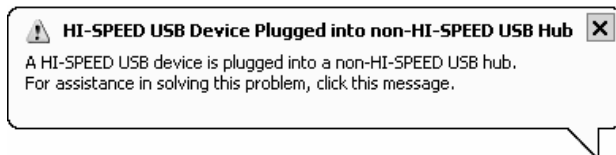
You can use this window to open an existing log file, or create a new log file by typing in a new file name.

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

TROUBLESHOOTING

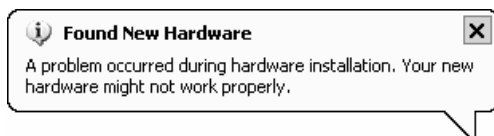
The evaluation board should work first time, but occasionally problems may occur.

1. If you are using Windows XP, the following message may appear whenever Windows find the evaluation board:



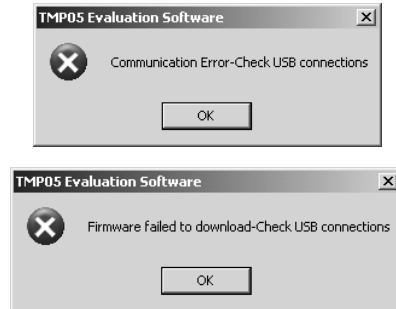
This message may be ignored, just click on **X** to close it.

2. If a problem occurs when using the “Found New Hardware Wizard”, the following message may appear after the installation completes:



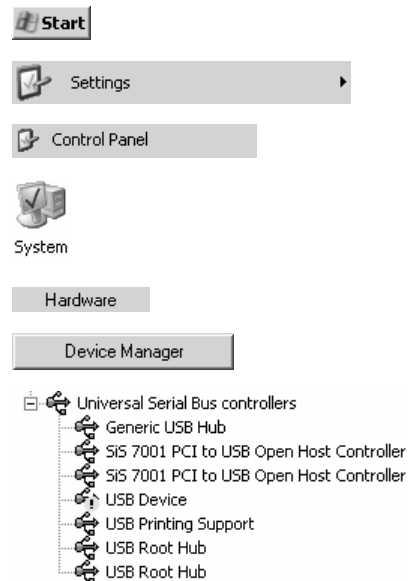
In this case the evaluation board may not work properly. This usually happens only if the installation procedure was interrupted for some reason. In this case it will be necessary to uninstall the evaluation board and re-install it, see below.

3. If the software cannot communicate with the evaluation board, the following error messages may appear:



Check that the connections to the evaluation board are OK and try again. If this does not fix the problem, try the following:

Select



If there is a USB device displaying an exclamation mark this means it is not working properly. If working properly it should be identified as “TMP05 Evaluation Board”. Right click on the non-working device and select **Uninstall** from the pop-up menu.

Click on **OK** to confirm, then close down Control Panel . Unplug the evaluation board then reconnect it, and run the “Found New Hardware Wizard” again. If this still does not work, then try uninstalling both the USB device and the evaluation board software, and start again from the beginning.

Appendix A

Table 2. Parts List for EVAL-TMP05/TMP06EB Evaluation Board

Name	Part Type	Value	Tolerance	Description
C1	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C2	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C3	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C4	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C5	CAP	1μF		10V DC Y5V Ceramic Capacitor
C6	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C7	CAP+	10μF		10V TAJ-A Tantalum Capacitor
C8	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C9	CAP+	10μF		10V TAJ-A Tantalum Capacitor
C10	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C11	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C12	CAP+	2.2μF		10V TAJ-A Tantalum Capacitor
C13	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C14	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C15	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C16	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C17	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C18	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C19	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C20	CAP	0.1μF		16V DC X7R Ceramic Capacitor
C21	CAP	22pF		50V DC NPO Ceramic Capacitor
C22	CAP	22pF		50V DC NPO Ceramic Capacitor
D1	LED			Green LED
J1	USB-MINI-B			Mini-AB USB Connector
R1	RES	4k7	1%	0.063W Resistor
R2	RES	4k7	1%	0.063W Resistor
R3	RES	1k	1%	0.063W Resistor
R4	RES	100k	1%	0.063W Resistor
R5	RES	100k	1%	0.063W Resistor
R6	RES	0R	1%	0.063W Resistor

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Name	Part Type	Value	Tolerance	Description
R8	RES	2k2	1%	0.063W Resistor
R9	RES	2k2	1%	0.063W Resistor
R10	RES	10k	1%	0.063W Resistor
R11	RES	10k	1%	0.063W Resistor
R12	RES	10k	1%	0.063W Resistor
R13	RES	10k	1%	0.063W Resistor
T1	TESTPOINT			Testpoint
T2	TESTPOINT			Testpoint
T3	TESTPOINT			Testpoint
T4	TESTPOINT			Testpoint
T5	TESTPOINT			Testpoint
T6	TESTPOINT			Testpoint
T7	TESTPOINT			Testpoint
U1	TMP06			Temperature Sensor
U2	TMP06			Temperature Sensor
U3	TMP05			Temperature Sensor
U4	TMP05			Temperature Sensor
U5	ADP3303-3.3			3.3V Regulator
U6	CY7C68013-CSP			EZ USB Microcontroller
U7	24LC01			Microchip 8 pin Serial EEPROM
Y1	XTAL1	24 MHz		CM309S SMD Crystal Oscillator