

MAXIM

MAX1669 Evaluation System

General Description

The MAX1669 evaluation system consists of a MAX1669 evaluation kit (EV kit) and a companion Maxim SMBus™ interface board.

The MAX1669 EV kit is an assembled and tested PC board that demonstrates the MAX1669 fan controller and temperature sensor. The MAX1669, in conjunction with external power components, controls the speed of a DC brushless fan with either a PWM signal or a variable DC control voltage. A small fan is included with the EV kit.

The MAX1669 also monitors the temperature of an external diode-connected transistor and converts the temperature to an 8-bit, 2-wire serial data. A 2N3906 temperature-sensor transistor comes soldered to the board in a SOT23 package. Removing the transistor allows the board to connect through a twisted pair, to a remote diode closer to your system for more realistic experiments.

The Maxim SMBus interface board (MAXSMBUS) allows an IBM-compatible PC to use its parallel port to emulate an Intel (SMBus) 2-wire interface. Windows® 95/98/2000-compatible software provides a user-friendly interface to exercise the MAX1669 features. The program is menu driven and offers a graphics interface with control buttons and status display.

Order the MAX1669EVSYS for complete PC-based evaluation of the MAX1669. Order the MAX1669EVKIT if you already have an SMBus interface.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.1µF, 16V X7R ceramic capacitor Taiyo Yuden EMK107BJ104KA or Murata GRM39X7R104K016
C2	1	2200pF, 50V X7R ceramic capacitor
J1	1	2 x 10 right-angle female receptacle
J2, J3, JU1, JU2, JU3, JU5, JU7	7	3-pin headers
JU4, JU6	0	Not installed
N1	1	N-channel MOSFET (2.7A, 30V) Fairchild FDN359AN
P1	1	P-channel MOSFET (SO8) (-3.0A, 60V) Fairchild NDS9407

Features

- ◆ Measures and Displays Remote Sensor Temperature
- ◆ Flexible Fan-Speed Control: Linear or PWM
- ◆ Programmable Alarms and Configuration
- ◆ Operating Temperature Ranges
 - 55°C to +125°C (Remote Sensor)
 - 0°C to +70°C (Board)
- ◆ I²C™/SMBus Compatible
- ◆ Easy-to-Use Menu-Driven Software
- ◆ Assembled and Tested
- ◆ Includes Windows 95/98/2000-Compatible Software and Demo PC Board

Ordering Information

PART	SMBus	
	INTERFACE TYPE	IC PACKAGE
MAX1669EVKIT	User supplied	16 QSOP
MAX1669EVSYS	MAXSMBUS	16 QSOP

Note: The MAX1669 EV kit software is provided with the MAX1669EVKIT. However, to use the software, the MAXSMBUS board is required to interface the EV kit to the computer.

MAX1669EVSYS Component List

PART	QTY	DESCRIPTION
MAX1669EVKIT	1	MAX1669 EV kit
MAXSMBUS	1	SMBus interface board

Component Suppliers

SUPPLIER	PHONE	FAX
Central Semiconductor	515-435-1110	515-435-1824
Fairchild	408-822-2000	408-822-2102
General Semiconductor	631-847-3000	631-847-3236
Motorola	303-675-2140	303-675-2150
Taiyo Yuden	408-573-4150	408-573-4159
Vishay Liteon/Diodes Inc.	805-446-4800	805-446-4850

Note: Please indicate you are using the MAX1669 when contacting these manufacturers.

SMBus is a trademark of Intel Corp.

Windows is a registered trademark of Microsoft Corp.

I²C is a trademark of Philips Corp.

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
Q1	1	PNP bipolar transistor Fairchild MMBT3906, Central Semiconductor CMPT3906, General Semiconductor MMBT3906, Motorola MMBT3906, or Vishay Liteon/Diodes Inc. MMBT3906
Q2	1	NPN bipolar transistor Fairchild MMBT3904, Central Semiconductor CMPT3904, General Semiconductor MMBT3904, Motorola MMBT3904, or Vishay Liteon/Diodes Inc. MMBT3904
R1, R3, R7	3	100k Ω 5% resistors
R2	1	1M Ω \pm 5% resistor
R4	1	10k Ω \pm 5% resistor
R5	1	221k Ω \pm 1% resistor
R6	1	100k Ω \pm 1% resistor
R8	1	2.43k Ω \pm 1% resistor
R9	1	1.21k Ω \pm 1% resistor
SW1	1	Slide switch
U1	1	MAX1669EEE
None	5	Shunts
None	1	Fan, 40 x 40 x 20mm, 12V, 170mA
None	1	3.5in software disk (MAX1669 EV kit)

Quick Start

Required Equipment

The following equipment is needed before you begin:

- IBM PC-compatible computer running Windows 95/98/2000
- Parallel-printer port (25-pin socket on the back of the computer)
- Standard 25-pin, straight-through, male-to-female cable to connect the computer's parallel port to the Maxim SMBus interface board

- DC power supply capable of supplying +7V to +20V at 100mA for the SMBus interface board
- +5V, 100mA power supply for the MAX1669 IC
- +12V, 250mA power supply for the fan

Procedure

- 1) Carefully connect the boards by aligning the 20-pin connector of the MAX1669 EV kit with the 20-pin header of the MAXSMBUS interface board. Gently press them together. The two boards should be flush against each other.

Make sure switch SW1 on the MAX1669 EV kit is in the OFF position. **Do not turn on the power until all connections are made.**

- 2) Plug the fan into J3.
- 3) Connect a cable from the computer's parallel port to the SMBus interface board. Use a straight-through 25-pin male-to-female cable. To avoid damaging the EV kit or your computer, do not use a 25-pin SCSI port or any other connector that is physically similar to the 25-pin parallel printer port.
- 4) Run the MAX1669.EXE software program from the floppy or hard drive by using the Windows program manager to run the program. If desired, use the INSTALL.EXE program to copy the files and create icons for them in the Windows 95/98 Start menu. An uninstall program is included with the software. Click on the UNINSTALL icon to remove the EV kit software from the hard drive.
- 5) Connect a +7VDC to +20VDC power supply to the pads labeled POS9 and GND1 of the SMBus interface board.
- 6) Connect the +5V power supply to the pads labeled VCC and GND.
- 7) Connect the +12V supply to the pads labeled +12VSUP and SUPGND.
- 8) Turn on all power supplies.
- 9) Turn the EV kit on by moving SW1 to the ON position.
- 10) Start the MAX1669 program by opening its icon in the Start menu.
- 11) The program automatically detects the address of the MAX1669 and starts the main program. Figure 1 shows the main display for the MAX1669 EV kit.

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Evaluates: MAX1669

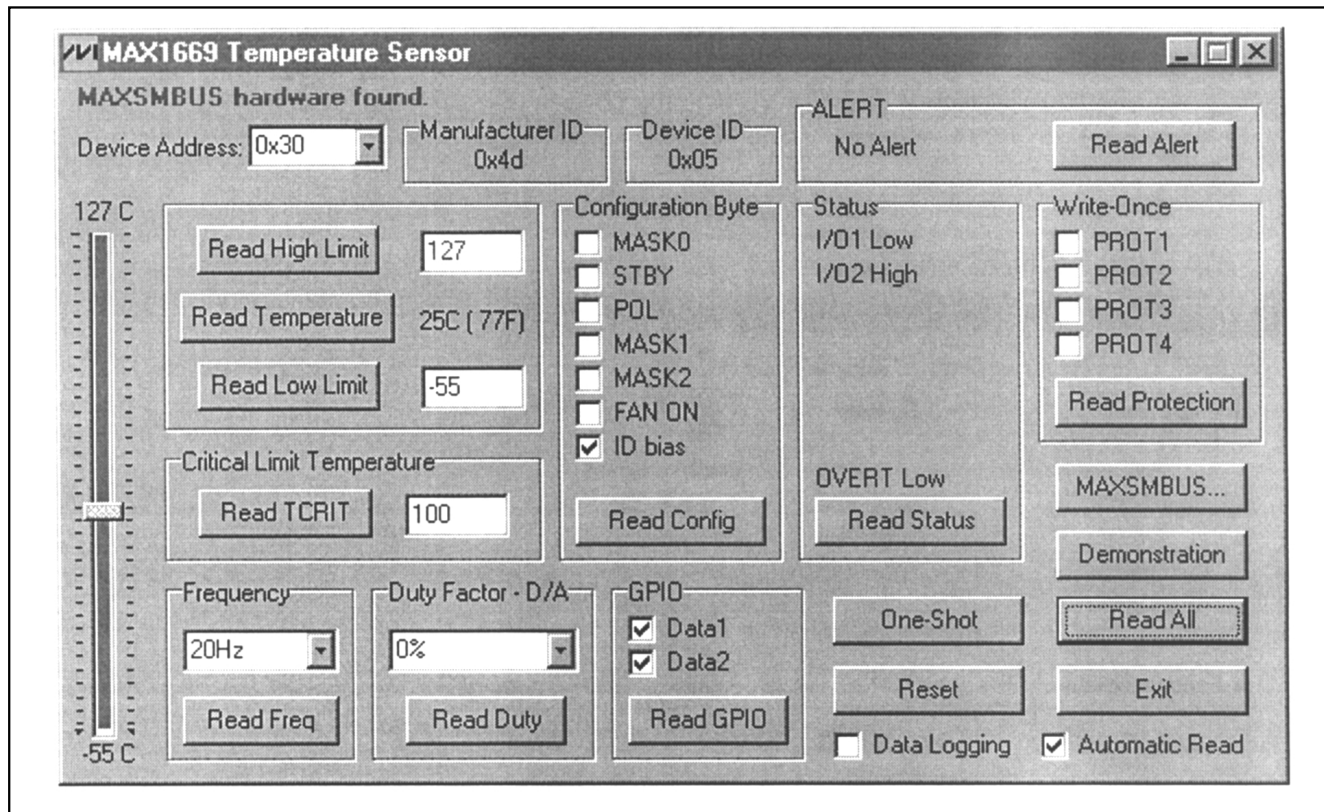


Figure 1. Main Display for MAX1669 EV Kit

Detailed Software Description

User-Interface Panel

The user interface is easy to operate; use the mouse, or press the Tab key to navigate with the arrow keys. Each of the buttons corresponds to bits in the command and configuration bytes. Clicking on them generates the correct SMBus write operation to update the internal registers. The program continually polls the device for new temperature data and status, and monitors for alert conditions. To change the THIGH, TLOW, and TCRT threshold comparison registers, select the appropriate data field, and type in the new value. After typing in the new values, press Enter to update the internal registers.

To make single-shot conversions, check the **STBY** checkbox under Configuration Byte, and then click on the **One-Shot** button. Single-shot conversions can also be performed while the device is autoconverting. The single-shot command overrides the automatic conversion. After the single shot is complete, the device returns to STBY mode.

If the temperature crosses one of the alarm threshold levels, an interrupt condition is generated, and a message appears in the alert box (ALERT). To clear the interrupt, first eliminate the condition that caused it, and then click on **Read Alert**. This action reads the Alert Response address, returns the value of the current MAX1669 slave address, and clears the interrupt.

Note: The least significant bit of the address is the read/write status bit; therefore, the address returned will be 1 higher.

Simple SMBus Commands

There are two methods for communicating with the MAX1669: through the normal user-interface panel, or through the SMBus commands available from pressing the **MAXSMBUS** button. A display will pop up that allows the SMBus protocols, such as Read-Byte and Write-Byte to be executed. To stop normal user-interface execution so that it does not override the manually set values, turn off the update timer that slaves the program to the conversion rate by unchecking the **Automatic Read** checkbox.

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The SMBus dialog boxes accept numeric data in binary, decimal, or hexadecimal. Hexadecimal numbers should be prefixed by \$ or 0x. Binary numbers must be exactly eight digits.

Note: In places where the slave address asks for an 8-bit value, it must be the 7-bit slave address of the MAX1669 as determined by ADD0, ADD1, and ADD2 with the last read/write bit always set to zero (Table 1).

Demonstration Routine

A demonstration routine is provided that shows the changes of fan speed with changes in temperature. To open the demonstration routine, click on the **Demonstration** button. First, two temperature parameters will need to be set; the temperature that the fan turns on (6.67% Duty Factor or $0.0625 \times V_{CC}$), and the temperature that the fan is on full speed (100% Duty Factor or $0.9375 \times V_{CC}$). As the sensor temperature varies between these two temperatures, the speed of the fan will change proportionally (Figure 2).

Note: Some fans will not start at low PWM duty factors or low voltages. The fan included with the EV kit will start up at low duty factors.

Data Logging

Data logging is activated by checking the **Data Logging** checkbox. Data logging saves temperature and status data to a text file that includes a time/date stamp next to each data point. If Automatic Read is enabled, data is sampled at 2Hz. The data is logged to the file only if the temperature or status change. This slows the growth of the data-logging file. When Automatic Read is disabled, the data is logged each time the **Read All** button is clicked. To stop data logging, uncheck the **Data Logging** checkbox.

Table 1. JU1, JU2, and JU3 Shunt Settings for SMBus Address

SHUNT LOCATION			MAX1669 ADDRESS	
JU1	JU2	JU3	BINARY	HEX
2-3	2-3	2-3	0011	0x30
2-3	2-3	1-2	0011	0x32
2-3	1-2	2-3	0011	0x34
2-3	1-2	1-2	0101	0x52
1-2	2-3	2-3	0101	0x54
1-2	2-3	1-2	0101	0x56
1-2	1-2	2-3	1001	0x98
1-2*	1-2*	1-2*	1001 101	0x9A

*Default

Detailed Hardware Description

Jumper and Switch Settings

Three jumpers set the MAX1669 slave address. The default address is 1001 101 (ADD0 = ADD1 = ADD2 = V_{CC}). JU1 corresponds to ADD0, JU2 corresponds to ADD1, and JU3 corresponds to ADD2; see Table 1 for a complete list of addresses.

Jumper JU5 connects pin 11 (FAN) of the MAX1669 to either the PWM or linear fan control portion of the EV kit (Table 2).

Jumper position 2-3 is for linear operation. Position 1-2 is for PWM operation. See the *Linear and PWM Fan Control* section.

Jumpers JU6 and JU7 provide a feedback path from the fan to pin 1 (I/O1) of the IC for monitoring the fan. Jumper JU7, position 1-2, connects the linear portion of the EV kit to the feedback. Position 2-3 connects the PWM portion to the path.

This path can be broken and I/O1 used for other purposes by cutting the trace that shorts the two pins of JU6 and using the pad labeled I/O1.

A slide switch, SW1, is provided as a means to force a power-on reset of the MAX1669. This switch disables power to the device.

Linear and PWM Fan Control

The linear portion of the MAX1669 EV kit consists of the MOSFET P1, transistor Q2, and resistors R4, R7, R8, and R9. The MAX1669 controls the fan speed through a DC control voltage, which can vary from 0 to $0.9375 \times V_{CC}$ in 16 steps. Note that V_{CC} is the reference voltage

Table 2. JU5 and JU7 Shunt Settings

JUMPER	SHUNT LOCATION	
	PWM	LINEAR
JU5	1-2*	2-3
JU7	2-3*	1-2

*Default

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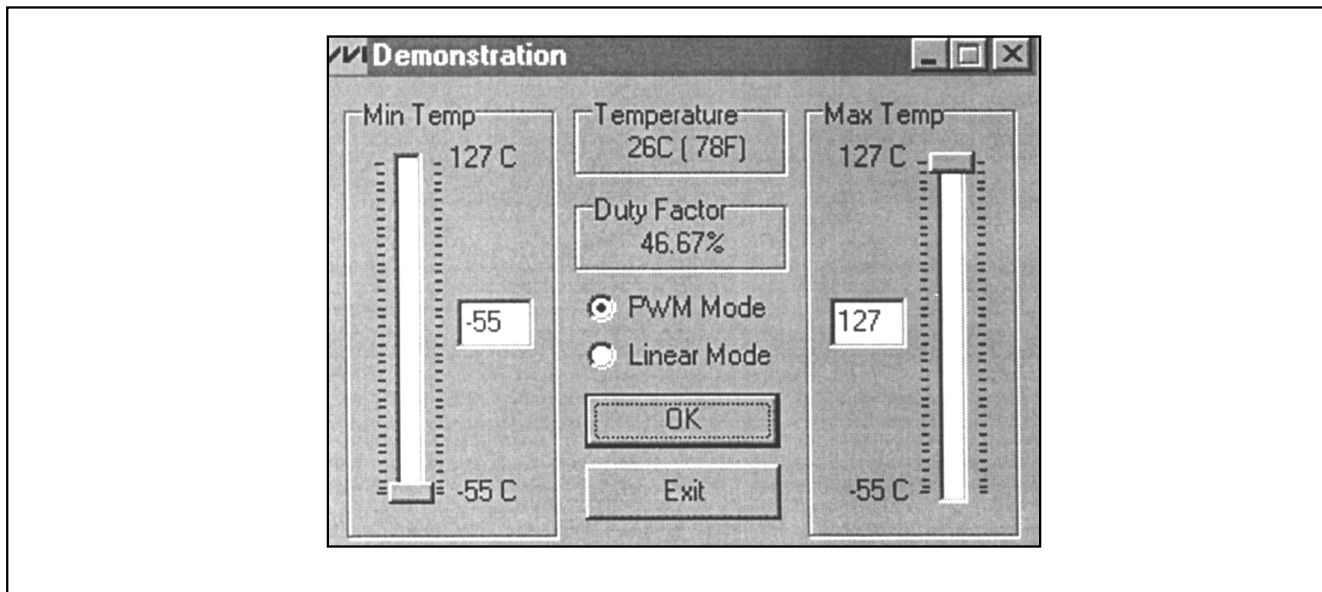


Figure 2. Demonstration Routine

for the DAC, and the EV kit has been set up for a V_{CC} of +5V.

To evaluate the MAX1669 with a different V_{CC} , resistor R8 must be changed to compensate for the change to the DAC output voltage. Use the equation below to calculate the value.

Let $V_{FAN} = 12V$ (the voltage for the fan), $R9 = 1.21k\Omega \pm 1\%$:

$$R8 = R9 \left(\frac{V_{FAN}}{0.9375 \times V_{CC} - 0.7} \right)$$

Example: For $V_{CC} = 3.3V$, $R8 = 4856\Omega$, use a $4.87k\Omega \pm 1\%$ resistor.

Connect the fan supplied with the EV kit to J3 for linear operation. If desired, a different fan can be used by connecting to the pads labeled LINFAN+ and LINFAN-; however, it should not exceed 600mA at 12V.

The PWM portion consists of the MOSFET N1. The MAX1669 controls the fan speed through a low-fre-

quency PWM signal where the duty factor can vary from 0% to 100% in 16 steps.

For PWM operation, connect the fan supplied with the EV kit to J2. If desired, a different fan can be used by connecting to the pads labeled PWMFAN+ and PWMFAN-; however, the current it demands should not exceed 2.7A.

Note: Some fans will not start at low PWM duty factors or low voltages.

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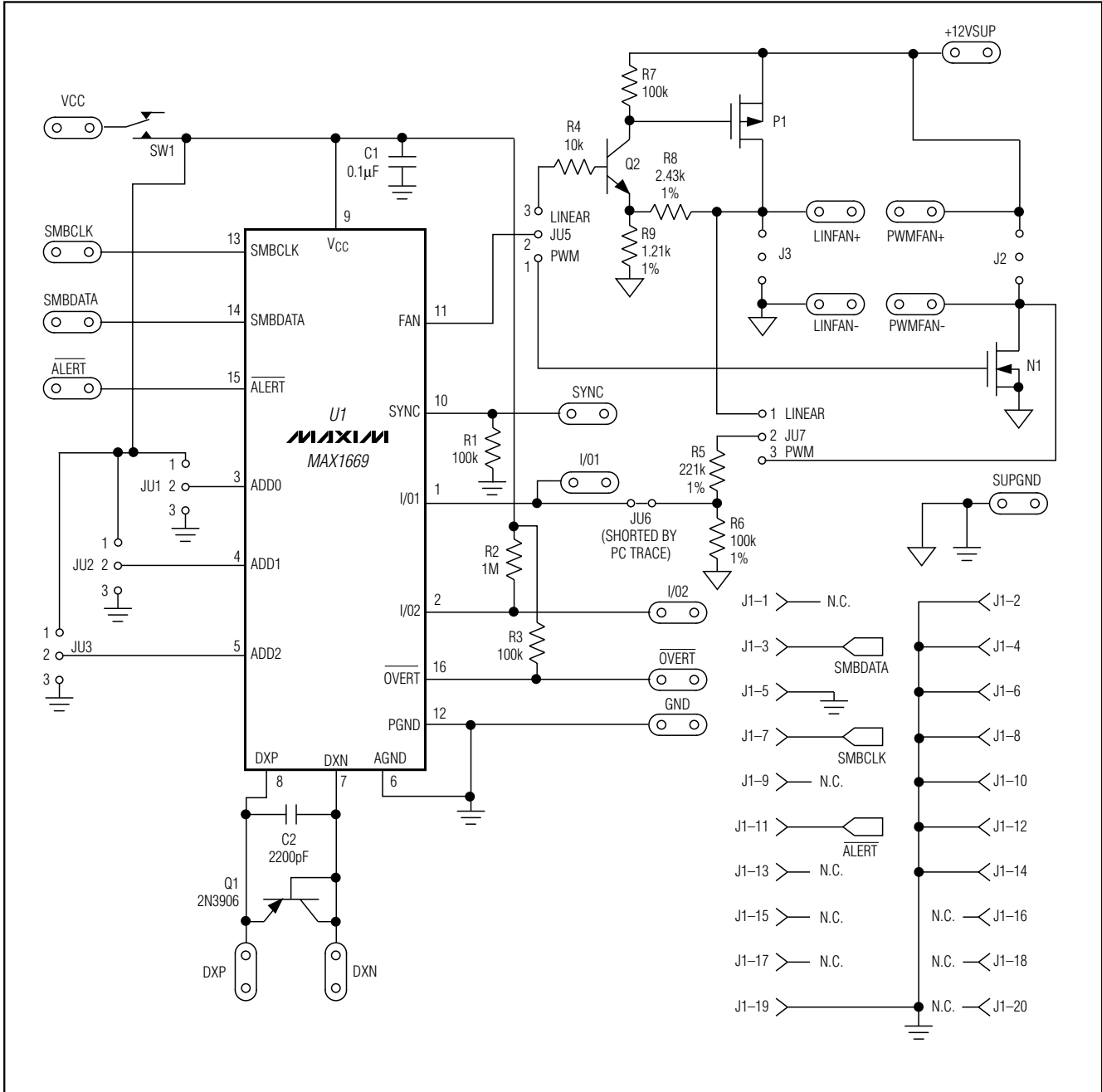


Figure 3. MAX1669 EV Kit Schematic

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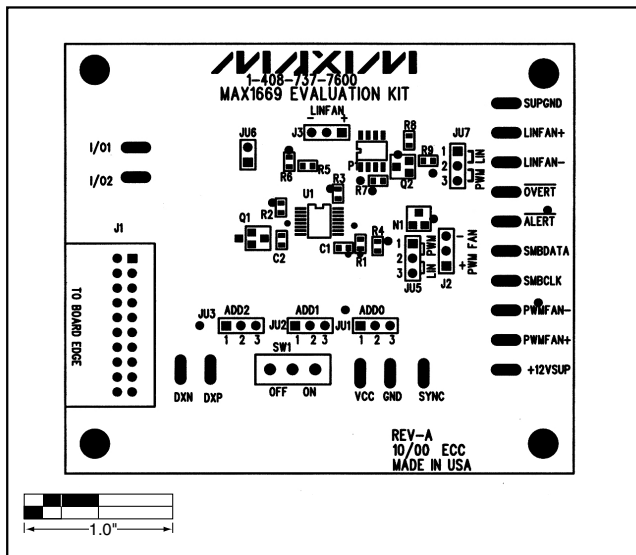


Figure 4. MAX1669 EV Kit Component Placement Guide—Component Side

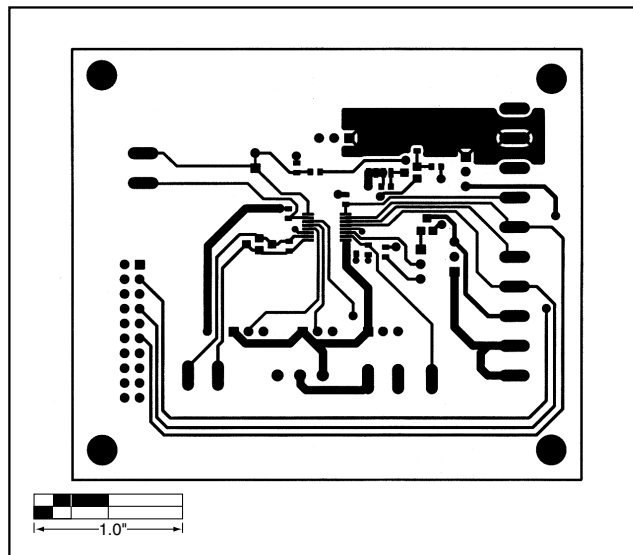


Figure 5. MAX1669 EV Kit PC Board Layout—Component Side

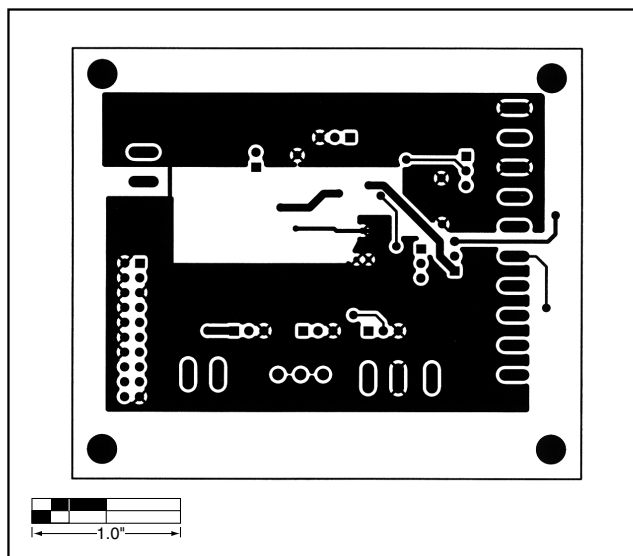


Figure 6. MAX1669 EV Kit PC Board Layout—Solder Side

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