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MAX1270 EV Kit/EV System

_____*General Description*

The MAX1270 evaluation system (EV system) is a complete, 8-channel data-acquisition system, consisting of a MAX1270 evaluation kit (EV kit) and a Maxim 68HC16MODULE-DIP microcontroller (µC) module. It is designed to evaluate the MAX1270/MAX1271, a multi-range, 8-channel, 12-bit data-acquisition system. Windows 3.1™/Windows 95™ software provides a handy user-interface to exercise the MAX1270's features.

Order the complete EV system (MAX1270EVC16) for comprehensive evaluation of the MAX1270 or MAX1271, using a personal computer. Order the EV kit (MAX1270EVKIT) if you have already purchased the µC module (68HC16MODULE-DIP) with another Maxim EV system or for custom use in other µC-based systems.

The MAX1270 EV kit can also be used to evaluate the MAX127 and MAX128.

_____*Features*

♦ **Proven PC Board Layout**

♦ **Complete Evaluation System Samples to 12ksps**

♦ **Convenient Test Points Provided On-Board**

♦ **Data-Logging Software with FFT Capability**

♦ **Fully Assembled and Tested**

_____*Ordering Information*

PART	TEMP. RANGE	INTERFACE TYPE
MAX1270EVKIT	0°C to +70°C	User-Supplied
MAX1270EVC16	0°C to +70°C	Windows Software

Note: *The MAX1270 software can be used only with the complete evaluation system (MAX1270ECV16), which includes the 68HC16MODULE-DIP module with the MAX1270EVKIT.*

_____*Component Lists*

MAX1270EVKIT Component List

DESIGNATION	QTY	DESCRIPTION
C1, C12, C13, C14	4	0.1µF ceramic capacitors
C2–C9	8	0.01µF ceramic capacitors
C10	1	0.01µF ceramic capacitor
C11, C15	2	4.7µF, 10V tantalum capacitors
C16	1	22µF, 50V aluminum electrolytic capacitor
D1	1	Dual common-cathode Schottky diode
JU1	1	3-pin header
JU2, JU3	2	2-pin headers
R1	1	10Ω ±5% resistor
R2–R5	0	Open
R6–R13	8	300Ω ±5% resistors
R14	1	1MΩ ±5% resistor
TP1	1	8-pin header
U1	1	28-pin socket, 0.300in. width
U1	1	MAX1270ACNG

DESIGNATION	QTY	DESCRIPTION
U2, U3	2	14-pin sockets
U2, U3	2	14-pin headers with four jumper wires (2–3, 5–6, 9–10, 12–13)
U4	1	4.096V voltage reference MAX6141BCSA
U5	1	5V at 30mA linear regulator MAX1615EUK
None	1	PC board
None	1	Software disk, "MAX1270 Evaluation Kit"

MAX1270EVC16 Component List

PART	QTY	DESCRIPTION
MAX1270EVKIT	1	MAX1270 evaluation kit
68HC16MODULE-DIP	1	68HC16 µC module with 16-bit parallel interface

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For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Windows Application Program Files

MAXADC.EXE	Application program that runs under Window 3.1 or Windows 95
MAX1270.HLP	Help file
MAX1270.DLL	MAXADC personality module for MAX1270
MAXADC.INI	Program settings file
MAX1270.C16	Software loaded into 68HC16 microcontroller

Install/Uninstall Program Files

INSTALL.EXE	Installs the EV kit files on your computer
INSTALL16.EXE	Installs the EV kit files on your computer
UNINST.EXE	Removes the EV kit files from your computer
UNINST32.EXE	Removes the EV kit files from your computer
UNINST.INI	Database for uninstall program
UN-MAXIM.PIF	Windows program information file for uninstall

MAX1270 Evaluation System

The MAX1270 EV system operates from a user-supplied +8V to +12V DC power supply. Windows 3.1/95 software running on an IBM PC interfaces to the EV system board through the computer's serial-communications port. The software can be operated with or without a mouse. Refer to the *Quick Start* section for setup and operating instructions.

MAX1270/MAX1271 Stand-Alone EV Kit

The MAX1270 EV kit provides a proven PC board layout to facilitate evaluation of the MAX1270. Apply your system's ±12V power-supply rails to the OPAMP+ and OPAMP- terminals. Connect GND to your system ground return. The OPAMP+ input powers a MAX1615 linear regulator and a MAX6141 voltage reference. It must be interfaced to appropriate timing signals for proper operation.

Connect your three-wire interface to SCLK, DIN, DOUT, and GND. Leave R3 and R4 open. If you do not drive $\overline{CS}$, install a 100Ω resistor at R5. If you do not drive $\overline{SHDN}$, install a 100Ω resistor at R2. Make sure JU1 is in position 2-3 (factory setting). Refer to the MAX1270 data sheet for waveforms and timing requirements.

MAX1270 EV KIT Software

68HC16 Source Code Files

KIT1270.ASM	Main source code for the KIT1270.C16 program, provided for reference. Compiled with Motorola 68HC Macro Assembler, version 4.1. Maxim holds the copyright but allows customers to adapt the program for their own use without charge.
EVKIT.ASM	Source code defining the program interface with the Maxim 68HC16 module ROM (rev. 1)
UPGRADE1.INC	Source code adding enhanced services (rev. 2) for the older Maxim 68HC16 module ROM (rev. 1)
QSPI.ASM	Source code defining the program interface with the Motorola QSPI™ (Queued Serial Peripheral Interface)
GPT.ASM	Source code defining the program interface with the Motorola GPT peripheral. Provides general-purpose I/O pins.

Evaluating the MAX127/MAX128

The MAX1270 EV board may be used to evaluate the MAX127 or MAX128 with a user-supplied, 2-wire controller and software. Replace U1 with the MAX127ACNG or MAX128ACNG. Cut the default trace on the back of the board under JU1 (marked with an arrow). Short pins 1 and 2 of jumper JU1. Connect your two-wire interface to SCL, SDA, and GND. Install 100Ω resistors at R2, R3, R4, and R5. With the address select pins pulled down by R3, R4, and R5, the two-wire device address is 01010000 for writing commands to the part and 01010001 for reading data from the part. Refer to the MAX127 data sheet for waveforms and timing requirements.

Note: The MAX1270 EV system software does not support the MAX127 or MAX128.

Quick Start

Recommended Equipment

You will need the following equipment before you begin:

• A small DC power supply, +8V to +12V at 200mA

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- An IBM PC-compatible computer running Windows 3.1 or Windows 95

- A spare serial communications port, preferably a 9-pin plug

- A serial cable to connect the computer's serial port to the Maxim 68HC16MODULE-DIP module

Procedure

1) Carefully connect the boards by aligning the 40-pin header of the MAX1270 EV kit with the 40-pin connector of the 68HC16MODULE-DIP module. Gently press them together. The two boards should be flush against one another.

2) Connect an +8V to +12V DC-power source to the µC module at terminal block J2, located next to the ON/OFF switch, along the top edge of the µC module. Observe the polarity marked on the board.

3) Connect a cable from the computer's serial port to the µC module. If using a 9-pin serial port, use a straight-through, 9-pin female-to-male cable. If the only available serial port uses a 25-pin connector, a standard 25-pin to 9-pin adapter is required. The EV kit software checks the modem status lines (CTS, DSR, DCD) to confirm that the correct port has been selected.

4) Install the software on your computer by running the INSTALL.EXE program on the floppy disk. The program files are copied and icons are created in the Windows 3.1 Program Manager (or the Windows 95 Start Menu). The EV kit software evaluates both the MAX1270 and the MAX1271.

5) Start the MAX1270 program by opening its icon in the Program Manager (or Start Menu).

6) The program will prompt you to connect the µC module and turn its power on. Slide SW1 to the "ON" position. Select the correct serial port, and click OK. The program will automatically download KIT1270.C16 to the module.

   When the software successfully establishes communication with the EV kit board, you will see a Device Characteristics Tool and some other windows. The default device setting is for the MAX1270. If you are using the MAX1271, select MAX1271 in the Device Characteristics dialog box, and click the Apply button.

7) Apply input signals to the inputs labeled CH0–CH7, at the right edge of the MAX1270 EV kit board. Observe the readout on the screen.

Using Op Amp Buffers

Applications measuring high-impedance sources may require buffers to ensure full measurement accuracy. The MAX1270EVKIT can be used with optional user-supplied quad op amp buffers. Simply unplug the 14-pin headers at U2 and U3 and install a suitable unity-gain-stable quad op amp.

Detailed Description
of Software

The various program functions are grouped into dialog boxes that are accessible from the Window menu on the main menu bar.

Keyboard Navigation

If a mouse or other pointing device is not available, operate the program using the following keyboard shortcuts.

- Press ALT+W to bring up the Window menu and then select a tool window.

- Press the TAB key to select controls within the selected tool window.

- Activate buttons by pressing the space bar.

- Use the up/down arrow keys for check boxes, radio buttons, and combo boxes.

Scan Tool

You can take readings automatically from selected channels at regular intervals up to 10 samples per second by selecting Scan Tool from the Window menu. The Channel Selection and Configuration group controls which channels will be scanned.

The Scan-Rate combo box controls the rate at which measurements are made. Readings are displayed in the Recent Values text area.

Table 1. Keyboard Navigation Shortcuts

KEY	FUNCTION
TAB	Select next control
ALT + W	Window menu
ALT + space	System menu of main program window
ALT + minus	System menu of child window
Space Bar	Click on the selected button
ALT + Print Screen	Copy the image of main window onto the clipboard

Low-Speed Data Logging

You may optionally record readings into a data log file. Click on the New Log button to begin or end data logging. The Log File Format dialog box is displayed. One complete line of data is written after all enabled channels have been sampled. The first line of the log file contains the column headings. Each subsequent line contains all enabled channels, separated by commas, tabs, or spaces (previously selected in the Log File Format dialog box). Once a log file has been opened, it can be paused or resumed with the Pause button. The program continues to write data to the log file until the Stop Log button is clicked.

One-Shot Read Tool

The One-Shot Read Tool allows direct control of the A/D configuration. Select the channel and mode of operation to update the Control Byte display, or change individual bits within the Control Byte directly, and observe the change in the channel selection control. The Read Now button writes the configuration information to the A/D and performs one reading.

Power-Cycling Tool

When using its internal reference, the MAX1270 can be shut down between measurements to reduce average supply-current demand. From the Window menu, select Power-Cycling Tool. The amount of power savings depends primarily on how long the part is off between conversions. The accuracy of the conversions depends on the power-up delay, the reference capacitor, and the time in power-down. Adjust the off-time with the Delay-Between-Samples command. Adjust the on-time with the Power-Up Delay command.

Using an adequate power-up delay will ensure the desired conversion accuracy during power-cycling modes. The reference must be allowed enough time to stabilize before the measurement is performed. Start with zero Power-Up Delay and increase the delay time until no further change in accuracy is observed. The power-up delay requirement depends on the value of the reference capacitor and the off-time (delay between samples).

The MAX1270 EV kit software performs power-up by writing a configuration selecting standby mode. After powering-up, the power-up delay is executed to allow time for the reference voltage to stabilize for an accurate measurement.

Internal-Clock Mode

To operate in internal-clock mode (13 clocks per conversion), select Internal Clock from the list of choices under Power-Up Mode.

External-Clock Mode

To operate in external-clock mode (18 clocks per conversion), select External Clock from the list of choices under Power-Up Mode.

Sampling Tool

To sample data at rates up to 12ksps (samples per second), select Sampling Tool from the Window menu, make your selections, and click on the Start button. Adjust the timing delays as appropriate to control the sample rate. Estimate the effective sample rate by taking the reciprocal of the sum of the delay between samples, the power-up delay, and the conversion time. Sample size is restricted to a power of two, so that the Fast Fourier Transform Tool (FFT) can process the data. Sample Size controls the number of samples collected on each selected channel. After the samples have been collected, the data automatically uploads to the host and is graphed. Once displayed, the data can be saved to a file.

FFT Tool

The MAX1270 evaluation software includes an FFT Tool that can display the spectral content of data collected with the Sampling Tool.

To view the spectral content of a waveform, first select a data sample that was previously collected with the Sampling Tool, then select FFT Tool from the Window menu. Check the output plots desired, and click on the Start button.

A data-windowing function preprocesses the data sample before performing an FFT. When the input signal is not synchronized to the sampling clock, spectral energy appears to leak into nearby frequency bins. A suitable data window tapers the raw data to zero amplitude at the beginning and end, reducing the spectral energy leak. For more information on the Fast Fourier Transform and data-windowing functions, refer to W. H. Press, et al., Numerical Recipes in Pascal: The Art of Scientific Computing, Cambridge University Press, 1989, ISBN 0-521-37516-9.

Noise-Analysis Tool

The evaluation software includes a Noise-Analysis Tool that calculates some statistics of data collected with the Sampling Tool.

To view a statistical analysis, first select a data sample previously collected with the Sampling Tool, then select Noise-Analysis Tool from the Window menu.

Minimum and maximum values are the smallest and largest values that occur in the data record. Peak-to-peak voltage is calculated as the difference between minimum and maximum values.

Average value is the arithmetic mean; i.e., the sum of all values divided by the number of samples. Standard deviation is used as an approximation to RMS voltage.

Device Characteristics

The Device Characteristics dialog box is used to select between the MAX1270 and MAX1271.

Evaluating the MAX1271

The MAX1270 software can evaluate the MAX1271 directly. From the Window menu, pick *Device Characteristics*. Next, change the device type from MAX1270 to MAX1271 and click the Apply button. This tells the program that the input voltage span is $\pm V_{REF}$ instead of $\pm 10V$.

Changing the Reference Voltage

The MAX1270 EV kit software assumes a 4.096V reference voltage, unless otherwise specified by the user. To use the on-board MAX6141 reference ($V_{REF} = 4.096V$) close JU2 and JU3. For an external, user-supplied reference, close JU2, open JU3, and apply the reference to the V_{REF} pad. To use the internal reference, open JU2 and JU3. See the MAX1270 data sheet for more information. From the Window menu, select Device Characteristics, then type the new reference voltage into the Reference Voltage edit box.

Detailed Description of Hardware

U1 is a MAX1270/MAX1271/MAX127/MAX128 analog-to-digital converter. C10 bypasses the internal bandgap reference, and C11 bypasses the 4.096 volt reference output. Sockets U2 and U3 accommodate optional unity-gain-stable quad op amp buffers. C2–C9 and R6–R13 form anti-aliasing input filters for the eight input channels. U4 is an optional MAX6141 external reference. U5 is a linear regulator that provides +5V to U1 when used in stand-alone mode.

Measuring Supply Current

Supply current can be monitored by measuring the voltage across resistor R1. This resistor is $10\Omega \pm 5\%$, so every 1mV across R1 represents 100µA of supply current.

Table 2. Jumper Functions

JUMPER	STATE	FUNCTION
JU1	1-2	U1 = MAX127 or MAX128. Use 2-wire interface signals on TP1 test points.
	2-3*	U1 = MAX1270 or MAX1271. Use 3-wire interface signals on TP1 test points, or use 68HC16 module and supplied software.
JU2	Open	Enable U1's internal reference. JU3 must be open.
	Closed*	Disable U1's internal reference. Refer to Table 3, Voltage Reference Truth Table.
JU3	Open	If JU2 is open, selects internal reference. If JU2 is closed, user must provide reference at VREF input pad. Refer to Table 3, Voltage Reference Truth Table.
	Closed*	Use voltage reference U4. Jumper JU2 must be closed.

Table 3. Voltage Reference Truth Table

JU2	JU3	FUNCTION
Open	Open	Enable U1's internal reference
Open	Closed	Invalid operating configuration
Closed	Open	User must provide a reference at the
Closed	Closed	Use voltage reference U4

Troubleshooting

Problem: No output measurement. System seems to report zero voltage or fails to make a measurement.

- Check the +5V supply voltage. Check the buffer op-amp supply voltages if applicable.
- Check the V_{REF} and REFADJ reference voltages using a digital voltmeter.
- Use an oscilloscope to verify that pin 5 (SCLK/SCL) is receiving clock strobe pulses.
- Verify that $\overline{SHDN}$ is not being pulled low.

Problem: Erratic, unstable measurement. Use an oscilloscope to measure:

- V_{REF}—increase reference capacitor if necessary.
- $\overline{SHDN}$—ensure that shutdown mode is not activated.
- Analog input (while triggering on DIN)—large voltage disturbances can be cured by using an op amp buffer (see *Op Amp Buffers section*).

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MAX1270 EV Kit/EV System

Figure 1. MAX1270 EV Kit Schematic

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