



# MAX6870 Evaluation System/Evaluation Kit

## General Description

The MAX6870 evaluation system (EV system) consists of a MAX6870 evaluation kit (EV kit) and a Maxim CMOD232 command module. The MAX6870 EEPROM-configurable, multivoltage supply sequencer/supervisor monitors several voltage-detector inputs, two auxiliary inputs, and four general-purpose logic inputs, and features programmable outputs for highly configurable power-supply sequencing applications. The evaluation software runs under Windows® 95/98/2000/XP, providing a handy user interface to exercise the features of the MAX6870.

Order the complete EV system (MAX6870EVCMOD2) for comprehensive evaluation of the MAX6870 using a PC. Order the EV kit (MAX6870EVKIT) if the command module has already been purchased with a previous Maxim EV system, or for custom use in other  $\mu$ C-based systems.

This system can also evaluate the MAX6871–MAX6875. Contact factory for a free sample of MAX6871ETJ, MAX6872ETJ, MAX6873ETJ, MAX6874ETJ, or MAX6875ETJ.

## MAX6870 Stand-Alone EV Kit

The MAX6870 EV kit provides a proven PC board layout to facilitate evaluation of the MAX6870. It must be interfaced to appropriate timing signals for proper operation. Connect power, ground return, and SCL/SDA interface signals to the breakout header pins (see Figure 9). The LEDs and load-switching FETs are optional circuits, which can be powered separately or disabled altogether. Refer to the MAX6870 data sheet for timing requirements.

## MAX6870 EV System

The MAX6870 evaluation system software runs under Windows 95/98/2000/XP on an IBM-compatible PC, interfacing to the EV system board through the computer's serial communications port. See the *Quick Start* section for setup and operating instructions.

Windows is a registered trademark of Microsoft Corp.

## Features

- ◆ Proven PC Board Layout
- ◆ Complete Evaluation System
- ◆ Convenient On-Board Test Points
- ◆ Fully Assembled and Tested

## Ordering Information

The MAX6870 EV software is designed for use with the complete EV system MAX6870EVCMOD2 (includes CMOD232 module together with MAX6870EVKIT). If the MAX6870 evaluation software will not be used, the MAX6870EVKIT board can be purchased by itself, without the CMOD232 module.

PART	TEMP RANGE	INTERFACE TYPE
MAX6870EVKIT	0°C to +70°C	User supplied
MAX6870EVCMOD2	0°C to +70°C	Windows software, RS-232 port

## Parts List

PART	QTY	DESCRIPTION
MAX6870EVKIT	1	MAX6870 evaluation kit
CMOD232	1	Command module

## Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	1 $\mu$ F, 6.3V X7R ceramic capacitors (0603) TDK C1608X7R0J105K
C3–C7	5	0.1 $\mu$ F, 25V X7R ceramic capacitors (0603) TDK C1608X7R1E104K
C8	0	Open (0603)
JU1–JU8	8	3-pin headers
JU9–JU14	0	Open
H1–H4	4	8-pin headers
D1	1	30V, 200mA Schottky diode (SOT23) Zetex BAT54CTA common cathode Diodes Incorporated BAT54C Fairchild BAT54C General Semiconductor BAT54C



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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
LED1-LED4, LED9, LED12, LED14, LED15	8	Red LEDs (T1-3/4)
LED5-LED8, LED10, LED11, LED13, LED16	8	Green LEDs (T1-3/4)
P1	1	2 x 10 right-angle receptacle
Q1-Q4	4	Logic-level FETs, 2.7A at 30V (SOT23) Fairchild FDN359AN

DESIGNATION	QTY	DESCRIPTION
R1, R2	2	100k $\Omega$ $\pm$ 5% resistors (0805)
R3-R18	16	1k $\Omega$ $\pm$ 5% resistors (0805)
R19	1	100 $\Omega$ $\pm$ 5% resistor (0805)
U1	1	MAX6870ETJ (32-pin QFN)
None	8	Shunts
None	1	PC board, MAX6870 EV kit

## Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
Diodes Inc	805-446-4800	805-446-4850	www.diodes.com
Fairchild	888-522-5372	Local rep only	www.fairchildsemi.com
General Semiconductor	760-804-9258	760-804-9259	www.gensemi.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com
Zetex USA	631-543-7100	631-864-7630	www.zetex.com

**Note:** Indicate you are using the MAX6870 when contacting these component suppliers.

## Quick Start

### Required Equipment

Before you begin, the following equipment is needed:

- Maxim MAX6870EVCMOD2 (contains MAX6870 EV kit board and CMOD232 module)
- DC power supply, 9VDC at 200mA (included with CMOD232 module)
- Windows 95/98/2000/XP computer with a spare serial (COM) port
- 9-pin I/O extension cable

### Procedure

Do not turn on the power until all connections are made:

- 1) Ensure that JU1-JU8 are in the 1-2 position. Jumper sites JU9-JU14 are empty. See the *Jumper Function Tables* section.
- 2) Carefully connect the boards by aligning the 20-pin header of the MAX6870 EV kit with the 20-pin connector of the CMOD232 module. Gently press them together. The two boards should be flush against one another.

- 3) Connect a cable from the computer's serial port to the CMOD232 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 will be 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 evaluation software on your computer by running the INSTALL.EXE program on the disk. The program files are copied and icons are created for them in the Windows Start menu.
- 5) Connect the DC power supply to the CMOD232 module at input jack P1.
- 6) Start the MAX6870 program by opening its icon in the Start menu.
- 7) After the software locates the CMOD232 module and the MAX6870EVKIT board, the software polls the device status, updating the status bar.

# MAX6870 Evaluation System/Evaluation Kit

## Detailed Description of Software

### Main Window

The evaluation software's main window shows a block diagram of the MAX6870, with many clickable features. Clicking on different parts of the block diagram leads to different feature tabs. Clicking **Back** returns to the main window's block diagram tab.

Configuration register changes made with the GUI are written when the **Apply** button is clicked. Configuration of the device may be reread by clicking **Refresh**.

Press function key F1 at any time to return to the block diagram tab sheet. Press function key F2 to pop up a window displaying registers pertinent to the selected feature. The software reads the data registers automatically, unless disabled by unchecking **poll inputs every 2s** under the **options** menu.

At startup, the evaluation software reads the device configuration from the device registers.

### Voltage Monitor Tab

The **voltage monitor** tab configures voltage monitor thresholds, selects the internal or external reference voltage (if applicable), and displays ADC conversion results (if applicable).

To configure one of the IN1–IN6 pins as a window comparator, first set the primary threshold (A) to the lower limit, then set the secondary threshold (B) to the upper limit, and finally, configure the secondary threshold (B) as an overvoltage detector. When configuring a PO<sub>–</sub> output to respond to this fault as a window comparator, select both the A and the B thresholds.

When a voltage monitor detects the (A) or (B) threshold is crossed, a fault condition is asserted. This fault register status is displayed in the status bar. V2A<sub>–</sub> indicates that IN2 is under its A threshold, V3<sub>–</sub>B indicates that IN3 has crossed its B threshold, and V6AB indicates that IN6 has crossed both its A and B thresholds.

The software uses the **reference voltage** value to calculate the threshold and ADC voltages.

The MAX6870 and MAX6871 include an analog-to-digital converter (ADC). The software automatically reads and displays channels selected under **ADC Conversion Results**.

### Digital Inputs Tab

Digital inputs GPI1–GPI4 can be configured for active-high or active-low logic. When a GPI<sub>–</sub> pin is configured active high, a logic-high level asserts the corresponding

GPI<sub>–</sub> condition in the fault register. This fault register status is displayed in the status bar.

### Outputs Tab

The PO<sub>–</sub> signals assert when a selected combination of other signals become asserted. Some PO<sub>–</sub> signals allow only a single combination (i.e., a single product term), while other PO<sub>–</sub> signals can be asserted by two different combinations (i.e., a sum of two product terms). The voltage monitors and the watchdog timers are internal signals. The GPI<sub>–</sub> pins are external inputs. Additionally, one PO<sub>–</sub> signal may depend on another PO<sub>–</sub>.

When a PO<sub>–</sub> signal is asserted, several actions can occur. The corresponding PO<sub>–</sub> pin can be driven to a high or low logic level. The pin driver can be configured as an open-drain or as a push-pull output. When in push-pull mode, several system power-supply voltages are available, including some charge-pump voltages that are higher than the IN<sub>–</sub> voltages.

The user EEPROM pages can optionally be locked out when the PO<sub>–</sub> is asserted.

The manual reset ( $\overline{MR}$ ) input forces the PO<sub>–</sub> signal to its asserted state. A programmable output cannot depend solely on  $\overline{MR}$ . Refer to the  $\overline{MR}$  section of the MAX6870 data sheet.

The  $\overline{MARGIN}$  signal allows user system testing by forcing the PO<sub>–</sub> signal to a logic-high or logic-low state, or holding the previously determined state. It is generally expected that  $\overline{MARGIN}$  will be high during normal operation.

### Watchdog Timers Tab

A watchdog timer asserts a fault condition after a period of time, unless the timer is periodically reset by an input pin being toggled. This fault register status is displayed in the status bar as WD1 or WD2.

During normal operation, an enabled watchdog timer must be serviced by toggling a GPI pin periodically. Typically, an external piece of firmware services the watchdog timer by toggling a GPI pin inside a loop, and watchdog timer assertion is configured to drive a PO<sub>–</sub> output pin. Any software defect that halts the firmware then causes the watchdog timer to assert.

The initial timeout period can be set to a longer value to allow time for software initialization. Alternatively, the watchdog timer can be held in reset by an optional clear input.

Refer to the MAX6870 data sheet for more information about watchdog timer operation.

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## Registers Tab

The **Registers** tab displays the volatile working registers of the MAX6870. Pressing **Refresh** reads and displays all register values. Individual register bytes can be modified by selecting the appropriate grid cell and typing zero-x prefix (0x) followed by two hexadecimal digits 0–9/A–F. If **options** menu item **Confirm REG Write when editing** is checked, a dialog box appears to confirm each byte written in this manner.

At power-up, the MAX6870 automatically loads its registers from the configuration EEPROM page. To store the active register values into the configuration EEPROM, press **Commit to EEPROM**. The **Re-load from EEPROM** command sends 88h, rebooting the MAX6870.

Register values can optionally be stored into a text file on disk for later retrieval, using the **Load from File** and **Save to File** buttons.

## EEPROM Tab

The **EEPROM** tab displays the nonvolatile EEPROM memory pages of the MAX6870. Pressing **Refresh** reads and displays the selected EEPROM page. Individual memory bytes can be modified by selecting the appropriate grid cell and typing zero-x prefix (0x) followed by two hexadecimal digits 0–9/A–F. If **options** menu item **Confirm EEPROM Write when editing** is checked, a dialog box appears to confirm each byte written in this manner.

EEPROM values can optionally be stored into a text file on disk for later retrieval, using the **Load from File** and **Save to File** buttons.

## Detailed Description of Hardware

The MAX6870 (U1) is surrounded by breakout header pins H1–H4. Two internally generated voltage sources are bypassed by capacitors C1 and C2. The user power-supply inputs IN1 and IN3–IN6 are bypassed by capacitors C3–C7.

If an external reference is used, capacitor site C8 should be loaded with a suitable bypass capacitor. Otherwise, C8 can be left open.

Connector P1 mates with the CMOD232 module, which enables communication with software running on a PC. (There are SCL/SDA pullup resistors on the module board.) As a convenience, the module also provides 5V DC power to U1 through D1, R19, and jumper JU13. This same 5VDC power supply also powers most of the EV kit LEDs through jumper JU14.

Programmable outputs PO1–PO4 drive an optional load-switching demonstration circuit. User-provided power supplies at IN3–IN6 can drive loads OUT3, OUT4, OUT5, and OUT6. The circuit can be demonstrated using LED10, LED11, LED13, LED16 as on-board loads, or by connecting external loads to the OUT3–OUT6 oval pads. Q1–Q4 are susceptible to ESD damage if gates are left floating.

Programmable outputs PO5–PO8 can be configured to drive LED indicators.

## Evaluating the MAX6871–MAX6875

With power off, replace U1 with a MAX6871ETJ, MAX6872ETJ, MAX6873ETJ, MAX6874ETJ, or MAX6875ETJ. The software automatically detects the device type and disables unused features accordingly.

## Diagnostics Window

The diagnostics window is used for factory testing prior to shipping the evaluation kit. It is not meant for customer use.

## Jumper Function Tables

Tables 1–13 are jumper function tables.

**Table 1. Jumper JU1**

JU1 SHUNT POSITION	FUNCTION
Open	PO1 available for user circuitry. LED11, LED12, OUT3, Q2 disconnected.
1-2	PO1 low lights LED12; Q2 gate is left floating.
2-3*	PO1 high turns on Q2, connecting OUT3 to IN3. LED11 lights if IN3 > 3V.

\*Indicates default configuration, set by an installed shunt.

**Table 2. Jumper JU2**

JU2 SHUNT POSITION	FUNCTION
Open	PO2 available for user circuitry. LED9, LED10, OUT4, Q1 disconnected.
1-2	PO2 low lights LED9; Q1 gate is left floating.
2-3*	PO2 high turns on Q1, connecting OUT4 to IN4. LED10 lights if IN4 > 3V.

\*Indicates default configuration, set by an installed shunt.

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Evaluate: MAX6870-MAX6875

**Table 3. Jumper JU3**

JU3 SHUNT POSITION	FUNCTION
Open	PO3 available for user circuitry. LED14, LED13, OUT5, Q3 disconnected.
1-2	PO3 low lights LED14; Q3 gate is left floating.
2-3*	PO3 high turns on Q3, connecting OUT5 to IN5. LED13 lights if IN5 > 3V.

\*Indicates default configuration, set by an installed shunt.

**Table 4. Jumper JU4**

JU4 SHUNT POSITION	FUNCTION
Open	PO4 available for user circuitry. LED15, LED16, OUT6, Q4 disconnected.
1-2	PO4 low lights LED15; Q4 gate is left floating.
2-3*	PO4 high turns on Q4, connecting OUT6 to IN6. LED16 lights if IN6 > 3V.

\*Indicates default configuration, set by an installed shunt.

**Table 5. Jumper JU5**

JU5 SHUNT POSITION	FUNCTION
Open	PO5 available for user circuitry. LED1, LED8 disconnected.
1-2*	PO5 low lights LED1.
2-3	PO5 high lights LED8 (unless configured in open-drain mode or insufficient pullup source voltage).

\*Indicates default configuration, set by an installed shunt.

**Table 6. Jumper JU6**

JU6 SHUNT POSITION	FUNCTION
Open	PO6 available for user circuitry. LED2, LED7 disconnected.
1-2*	PO6 low lights LED2.
2-3	PO6 high lights LED7 (unless configured in open-drain mode or insufficient pullup source voltage).

\*Indicates default configuration, set by an installed shunt.

**Table 7. Jumper JU7**

JU7 SHUNT POSITION	FUNCTION
Open	PO7 available for user circuitry. LED3, LED6 disconnected.
1-2*	PO7 low lights LED3.
2-3	PO7 high lights LED6 (unless configured in open-drain mode or insufficient pullup source voltage).

\*Indicates default configuration, set by an installed shunt.

**Table 8. Jumper JU8**

JU8 SHUNT POSITION	FUNCTION
Open	PO8 available for user circuitry. LED4, LED5 disconnected.
1-2*	PO8 low lights LED4.
2-3	PO8 high lights LED5 (unless configured in open-drain mode or insufficient pullup source voltage).

\*Indicates default configuration, set by an installed shunt.

**Table 9. Jumpers JU9, JU10 (Device Address Selection)**

JU9 SHUNT POSITION	JU10 SHUNT POSITION	A0	A1	DEVICE ADDRESS
Closed*	Closed*	0	0	1010 00x r/w
Open	Closed	1	0	1010 01x r/w
Closed	Open	0	1	1010 10x r/w
Open	Open	1	1	1010 11x r/w

\*Indicates default configuration, which is a trace on the PC board.

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**Table 10. Jumper JU11 ( $\overline{MR}$ )**

JU11 SHUNT POSITION	$\overline{MR}$	FUNCTION
Open*	1	Normal operation
Closed	0	Manual reset

\*Indicates default configuration.

**Table 11. Jumper JU12 ( $\overline{MARGIN}$ )**

JU12 SHUNT POSITION	$\overline{MARGIN}$	FUNCTION
Open*	1	Normal operation.
Closed	0	User test mode: PO outputs are set to their configured $\overline{MARGIN}$ state. Refer to the MAX6870 data sheet.

\*Indicates default configuration.

**Table 12. Jumper JU13 (Device Power)**

JU13 SHUNT POSITION	FUNCTION
Open	U1 must be powered by a user-supplied external supply connected to IN1, IN3-IN6.
Closed*	U1 input IN1 is powered from connector P1 5V supply (the CMOD232 module).

\*Indicates default configuration, which is a trace on the PC board.

**Table 13. Jumper JU14 (LED Power)**

JU14 SHUNT POSITION	FUNCTION
Open	LED1-LED16 are unused, or can be externally powered.
Closed*	LED1-LED16 are powered from connector P1 5V supply (the CMOD232 module).

\*Indicates default configuration, which is a trace on the PC board.



# MAX6870 Evaluation System/Evaluation Kit

Evaluate: MAX6870-MAX6875

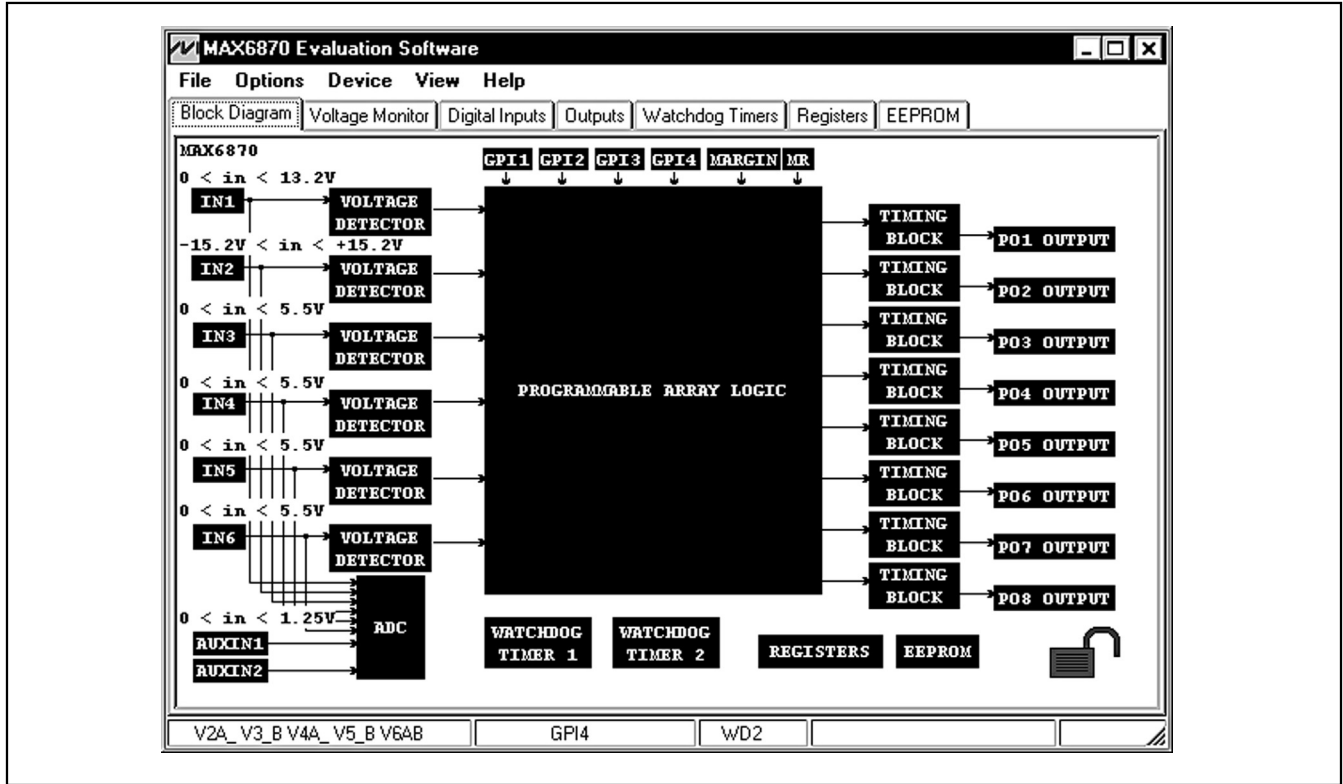


Figure 1. Block Diagram (Can Be Brought Up Anytime by Pressing Function Key F1)

The window displays a list of related registers with their addresses, values, and names.

address	value	register
0x0E	[0 1 1 1 0 1 0 1]	PO1_prod1a
0x0F	[0 1 1 1 0 1 0 1]	PO1_prod1b
0x10	[0 1 1 1 0 1 0 1]	PO1_prod1c
0x11	[0 1 1 1 0 1 0 1]	PO1_config
0x3A	[0 0 0 0 1 0 1 0]	PO_ACTIVE_HIGH
0x40	[0 0 0 1 1 0 1 0]	PO_MR_STATE
0x41	[1 0 0 0 1 0 1 0]	PO_MARGIN_ENABLE
0x42	[1 1 0 1 0 1 0 0]	PO_MARGIN_STATE
0x43	[0 0 0 0 0 0 0 0]	USER_EE_LOCKOUT
0x75	[0 0 0 0 0 0 0 0]	ID
0x45	[0 0 0 0 0 0 0 0]	CONFIGURATION_LOCK
0x0D	[1 1 0 1 0 0 0 0]	VIN_RANGE

Figure 2. Related Registers Adjunct Window (Shown by Pressing Function Key F2)

# MAX6870 Evaluation System/Evaluation Kit

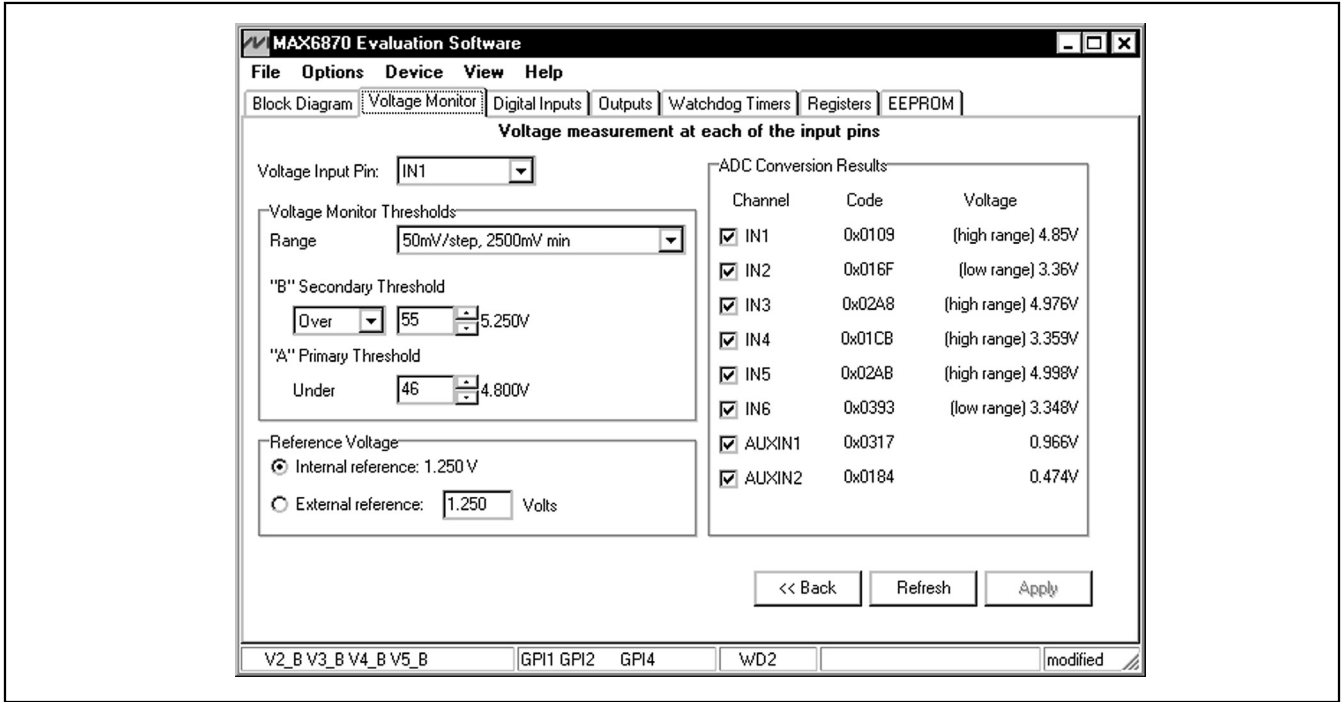


Figure 3. Voltage Monitor Tab

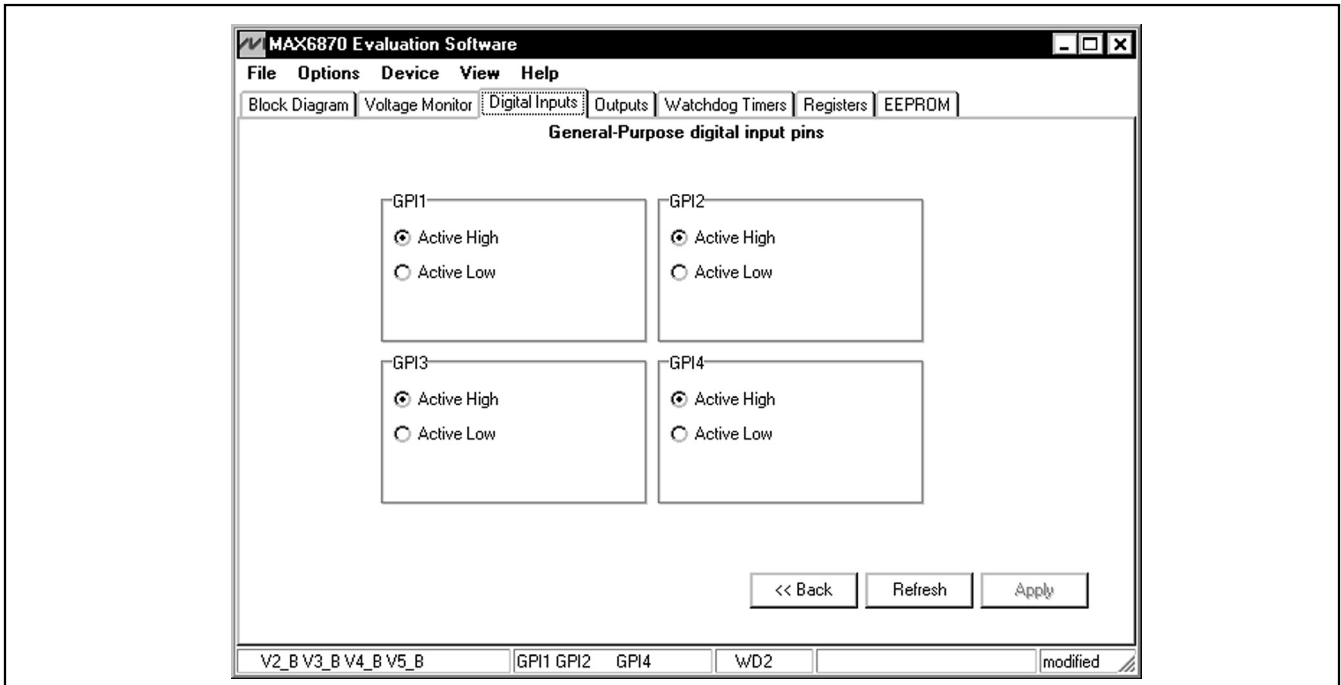


Figure 4. Digital Inputs



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Evaluate: MAX6870-MAX6875

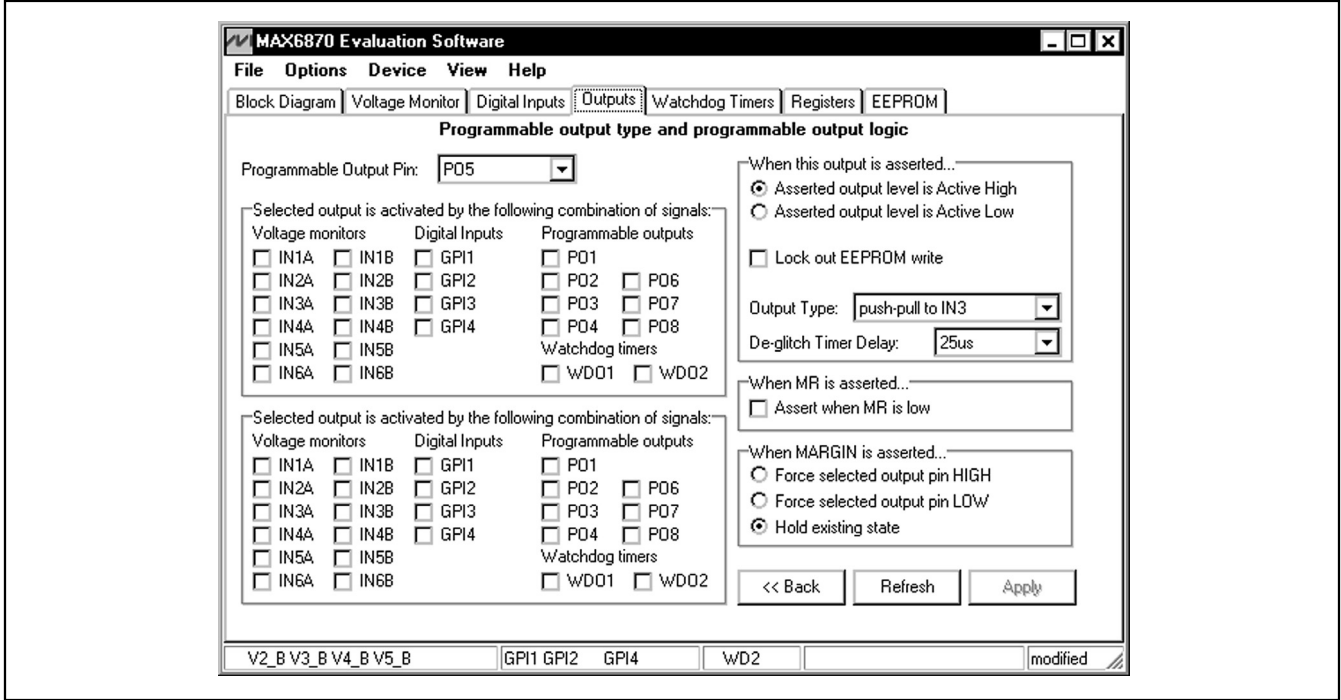


Figure 5. Programmable Outputs

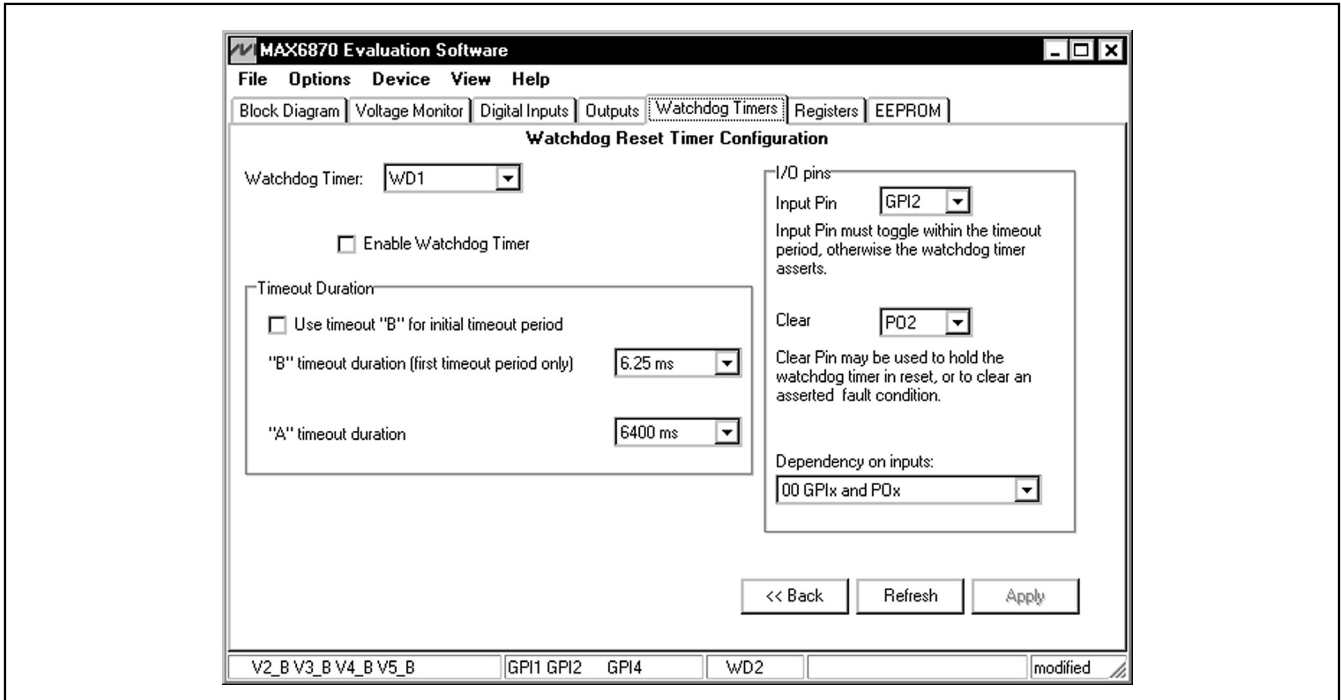


Figure 6. Watchdog Timers

# MAX6870 Evaluation System/Evaluation Kit

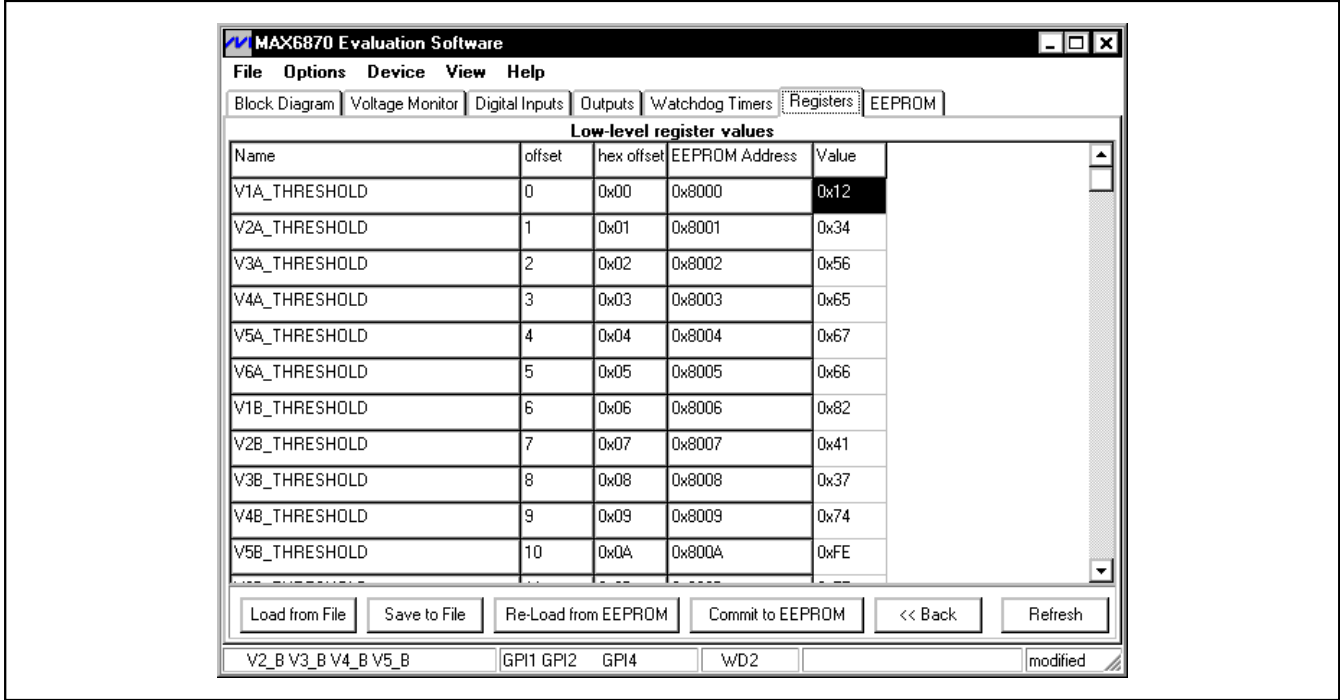


Figure 7. Registers

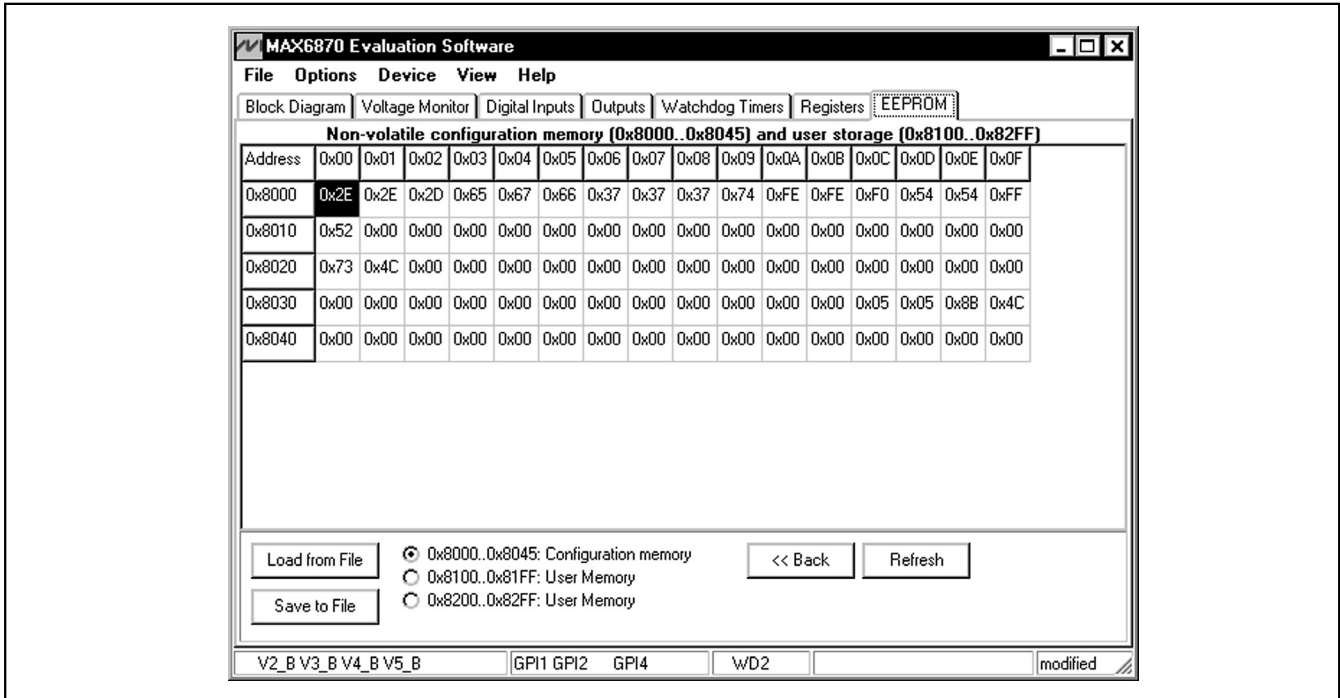


Figure 8. EEPROM Memory

# MAX6870 Evaluation System/Evaluation Kit

Evaluate: MAX6870-MAX6875

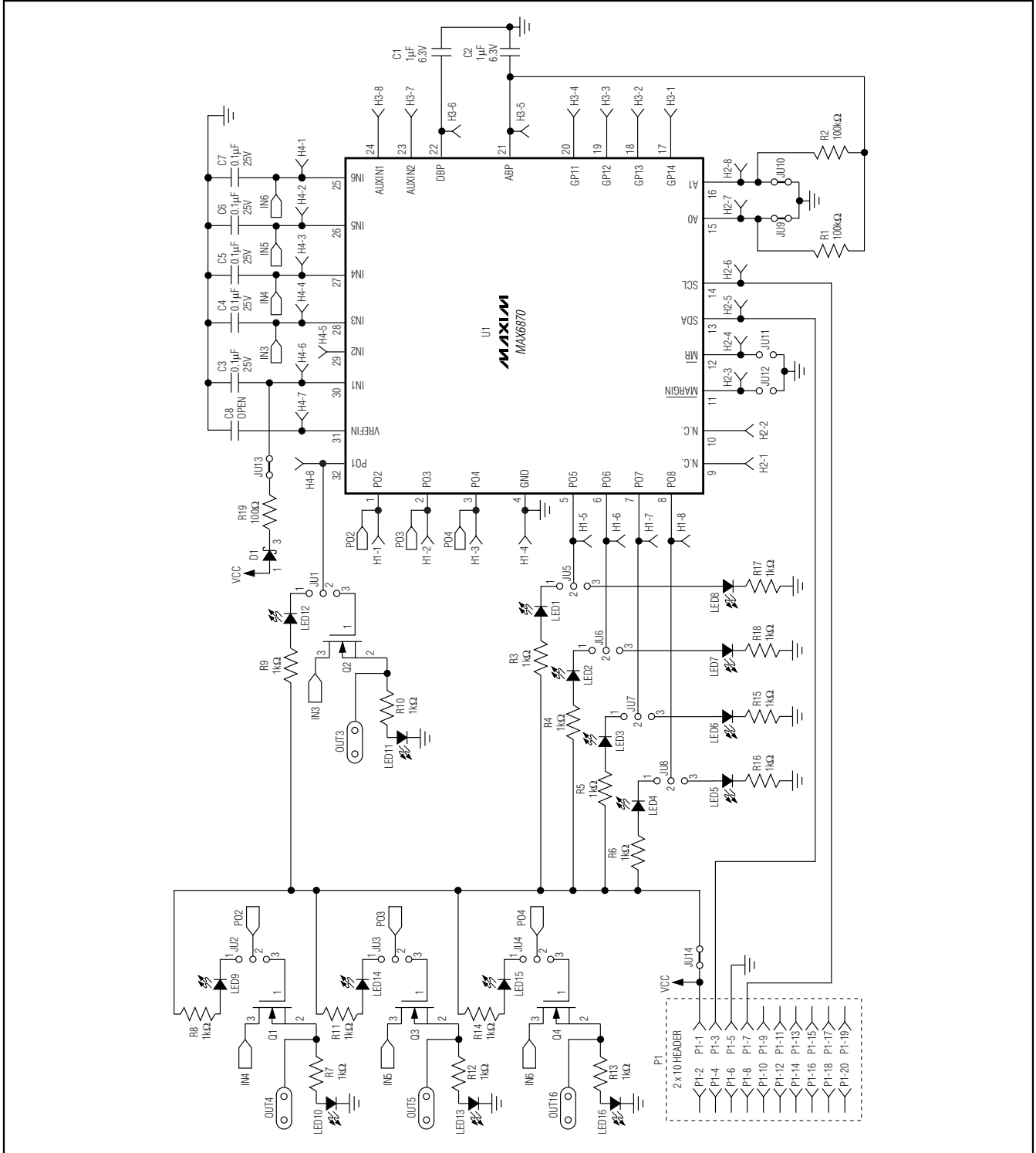


Figure 9. MAX6870 EV Kit Schematic

# MAX6870 Evaluation System/Evaluation Kit

Evaluate: MAX6870-MAX6875

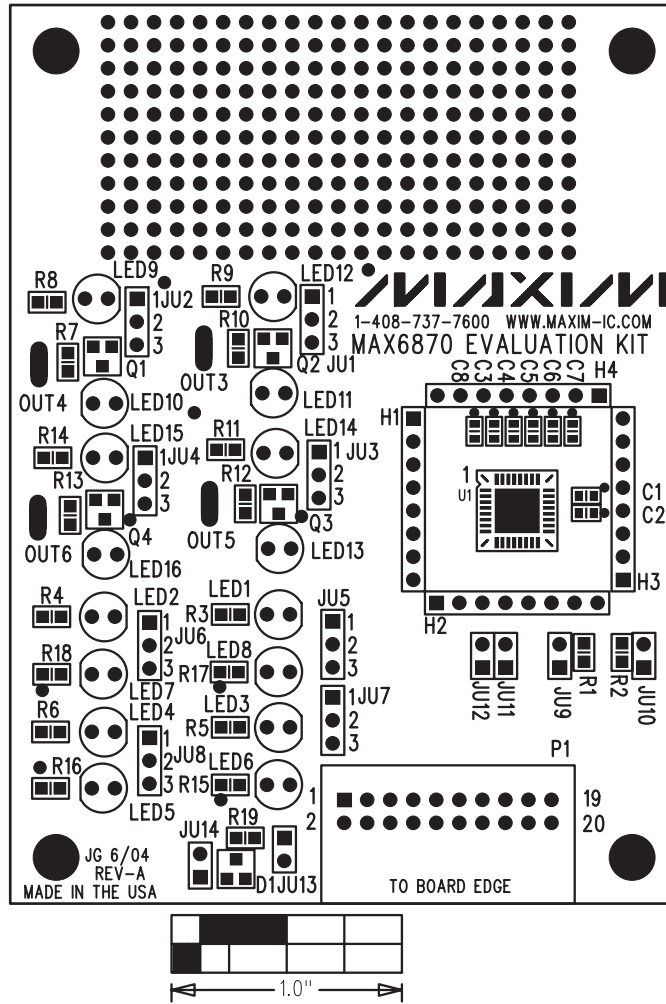


Figure 10. MAX6870 EV Kit Component Placement Guide—Component Side

# MAX6870 Evaluation System/Evaluation Kit

Evaluate: MAX6870-MAX6875

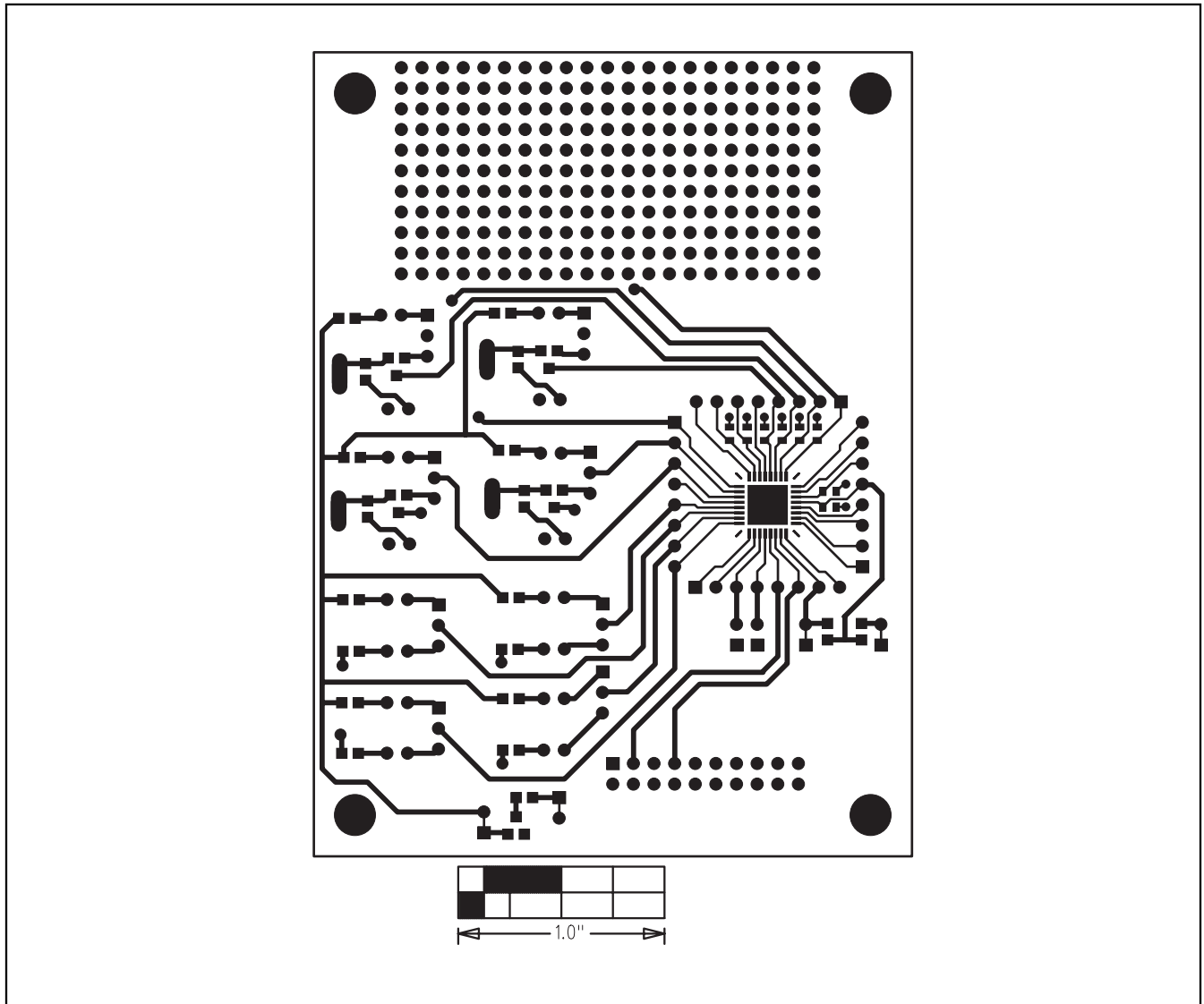


Figure 11. MAX6870 EV Kit PC Board Layout—Component Side

# MAX6870 Evaluation System/Evaluation Kit

**Evaluate: MAX6870-MAX6875**

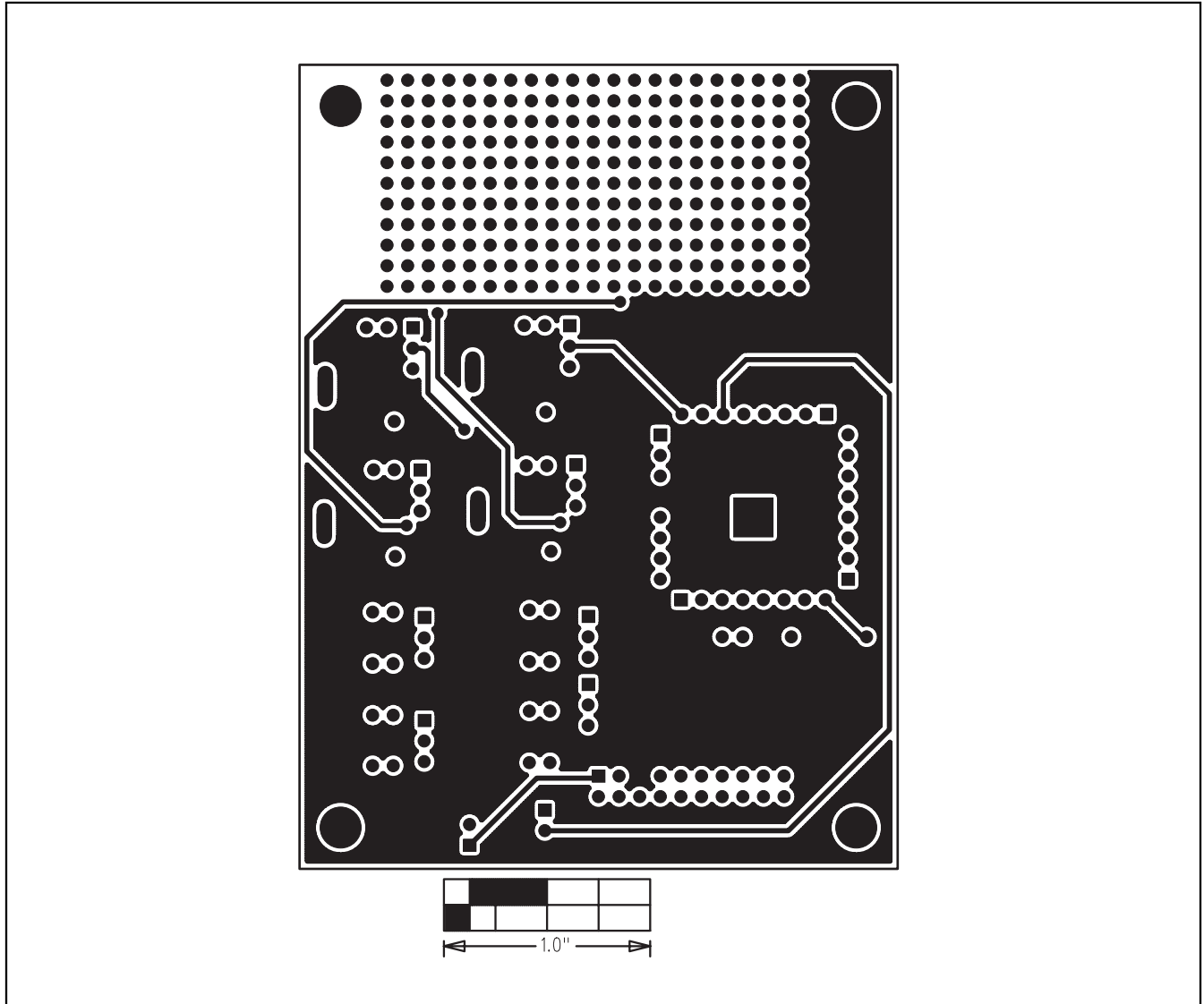


Figure 12. MAX6870 EV Kit PC Board Layout—Solder Side

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