

MAXIM

MAX5915 Evaluation Kit

Evaluates: MAX5915

General Description

The MAX5915 evaluation kit (EV kit) is a fully assembled and tested surface-mount dual hot-swap controller circuit board for two PCI 2.2 server line cards. The circuit uses a MAX5915 IC in a 28-pin TSSOP package. The EV kit provides independent power control for the +3.3V, +5V, $\pm 12V$, and +3.3V auxiliary outputs to the PCI 2.2 connectors (A/B channels). The EV kit demonstrates the MAX5915 IC's overcurrent shutdown, output undervoltage monitoring, power-on reset (POR), and fault-reporting capabilities for channels A and B.

The MAX5915 IC controls the two separate external N-channel MOSFETs for the +5V and +3.3V outputs, respectively. The MAX5915 has internal MOSFETs that control the $\pm 12V$ and +3.3V auxiliary outputs of both channels. Isolation switches are provided for both channels' +3.3V and +3.3V auxiliary supplies and to enable/disable both channels independently.

The EV kit can also be configured to demonstrate a dual hot-swap design without using the PCI 3.3V/64-bit and 5V/64-bit PCI connectors.

Features

- ◆ Demonstrates PCI 2.2 Dual Hot-Swap Design (3.3V/5V PCI Card Designs)
- ◆ Independent Output Controls Provide for Each Channel
 - +3.3V and Up to 7.6A (Adjustable)
 - +5V and Up to 5A (Adjustable)
 - +12V and Up to 0.5A
 - 12V and Up to 0.1A
 - +3.3V AUX and Up to 0.375A
- ◆ Evaluates Hot Swapping 3.3V/64-Bit and 5V/64-Bit PCI Line Cards
- ◆ Demonstrates Overcurrent Protection with Status Report
- ◆ Monitors Output Undervoltage for +3.3V, +5V, $\pm 12V$, and +3.3V AUX with Status Report
- ◆ Independent 3.3V AUX Output with Separate ON/OFF Control
- ◆ Latched After-Fault Conditions (+3.3V, +5V, $\pm 12V$)
- ◆ Power-On Reset and Fault Status Reporting
- ◆ Independent On/Off Controls for Channels A/B
- ◆ Surface-Mount Components
- ◆ Fully Assembled and Tested

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX5915EVKIT	0°C to +70°C	28 TSSOP

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C3, C5, C7, C9	5	0.1 μ F $\pm 10\%$, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104KA01
C2, C4, C6, C8, C10	5	4.7 μ F $\pm 20\%$, 16V X5R ceramic capacitors (1206) Taiyo Yuden EMK316BJ475ML
C11–C16	6	47 μ F $\pm 20\%$, 16V tantalum capacitors (C case) AVX TPSC476M016R0350
C17–C20	4	470 μ F $\pm 10\%$, 6.3V tantalum capacitors (X case) Kemet T510X477K006AS
J1, J2	2	6-pin headers

DESIGNATION	QTY	DESCRIPTION
J3	1	PCI 5V/64-bit connector Amp 145166-4
J4	1	PCI 3.3V/64-bit connector Amp 145165-4
J5–J8	4	Uninsulated banana jacks
JU1–JU10	10	2-pin headers
N1–N4	4	30V, 13A N-channel MOSFETs (8-pin SO) Fairchild FDS6670A
R1–R4	4	0.005 Ω $\pm 1\%$, 0.25W sense resistors (1206) Dale-Vishay WSL1206 0.005 Ω $\pm 1\%$ B43

MAX5915 Evaluation Kit

Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AVX	843-946-0238	843-626-3123	www.avxcorp.com
Dale/Vishay	402-564-3131	402-563-6296	www.vishay.com
Fairchild	888-522-5372	—	www.fairchildsemi.com
Kemet	864-963-6300	864-963-6322	www.kemet.com
Murata	770-436-1300	770-436-3030	www.murata.com
Taiyo Yuden	800-348-2496	847-925-0899	www.t-yuden.com

Note: Please indicate that you are using the MAX5915 when contacting these component suppliers.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R5–R11	7	10k Ω \pm 5% resistors (0805)
SW1–SW4	4	SPST DIP switches
SW5	1	SPDT slide switch
SW6	1	DPDT toggle switch
U1	1	MAX5915EUI (28-pin TSSOP)
None	10	Shunts (JU1–JU10)
None	1	MAX5915 data sheet
None	1	MAX5915 EV kit data sheet
None	6	Rubber bumpers

MAX5915 Configuration A/B Channel Outputs

- 1) Verify that shunts are on jumpers JU1–JU5 (channel A).
- 2) Verify that shunts are on jumpers JU6–JU10 (channel B).
- 3) Set switches SW1 (ON_A) and SW2 (AUX_ONA) to the OFF position (channel A).
- 4) Set switches SW3 (ON_B) and SW4 (AUX_ONB) to the OFF position (channel B).
- 5) Set switches SW5 (+3.3VAUXIN) and SW6 (+3.3V) to the OFF position.
- 6) Utilizing very short 20A rated banana leads (< 6in long), connect the +3.3VDC power supply to the +3.3V_VIN banana jack. Utilizing very short 20A-rated banana leads (< 6in long), connect the supply ground to the GND banana jack.
- 7) Utilizing very short 10A-rated banana leads (< 6in long), connect the +5VDC power supply to the +5V_VIN banana jack. Utilizing very short 10A-rated banana leads (< 6in long), connect the supply ground to the GND banana jack.
- 8) Connect the +12VDC and -12VDC power supplies to the +12V_VIN and -12V_VIN pads, respectively. Connect the +12VDC and -12VDC power supplies to the respective GND pad on the EV kit.
- 9) Connect a voltmeter to the +3.3V_A and GND pads.
- 10) Turn on all the power supplies in any sequence.
- 11) Turn switches SW5 and SW6 to the ON position to provide power to the +3.3V_AUX inputs and main +3.3V inputs, respectively.
- 12) Sliding switches SW1 and SW2 to the ON position enables channel A on MAX5915 EV kit dual hot-swap controller.

Quick Start

Required Equipment

One each of the following DC power supplies is required:

- +3.3V, 20A
- +5V, 10A
- +12V, 3A
- -12V, 0.25A

The +3.3V power supply can be used to power the main +3.3V and +3.3V_AUX inputs, which are independently switchable (SW5, SW6).

The MAX5915 EV kit is fully assembled and tested. Follow these steps to verify board operation. **Do not turn on the power supply until all connections are completed.**

Note: The banana leads connecting the +3.3V and +5V power supplies to the EV kit must be very short (< 6in long).

MAX5915 Evaluation Kit

13) Sliding switches SW3 and SW4 to the ON position enables channel B on the MAX5915 EV kit dual hot-swap controller.

14) Verify that the voltage at the following pads is as shown below:

- +3.3V_A, +3.3V_B = +3.3V
- +5V_A, +5V_B = +5V
- +12V_A, +12V_B = +12V
- 12V_A, -12V_B = -12V
- +3.3V_AUX_A, +3.3V_AUX_B = +3.3V

Detailed Description

The MAX5915 EV kit demonstrates a PCI 2.2 dual hot-swap controller circuit design. Two PCI channels (A and B) are provided to evaluate 5V/64-bit and 3.3V/64-bit line card designs independently. The EV kit can also be used to evaluate 32-bit PCI line cards. The EV kit uses a MAX5915 IC in a 28-pin TSSOP package to control output power and monitor faults.

The MAX5915 IC controls each channel's output power independently. External N-channel MOSFETs are used to control power to the +5V and +3.3V outputs of each channel. Current-sensing resistors are used for the +5V and +3.3V outputs of each channel. MOSFETs inside the MAX5915 IC control the ±12V and +3.3V auxiliary outputs of each channel.

Switches to isolate the +3.3V (SW6) and +3.3V auxiliary (SW5) power-supply inputs are provided. Slide switches are also provided to enable/disable each channel's main (SW1, SW3) and auxiliary (SW2, SW4) output independently. The enable/disable switches can provide a reset function for the respective channel, which latches off during a fault.

If an overcurrent or undervoltage fault persists on either channel, the MAX5915 shuts down the respective channel. The fault is reported to the channel's P_GOOD_X pad where X is A or B, which has the fault. The MAX5915's open-drain FAULT_X pin pulls down

the channel's P_GOOD_X pad during a fault condition. A pad (V_PULL) is provided for the user to connect a power supply (5.5V max) to the pullup resistor and P_GOOD_X pad. The P_GOOD_X pad also provides POR status during power-up.

The user can evaluate a 3.3V/64-bit and 5V/64-bit PCI line card simultaneously using the EV kit's PCI 2.2 compliant connectors. The EV kit can also be reconfigured to demonstrate a dual hot-swap design without using the PCI 3.3V/64-bit and 5V/64-bit PCI connectors and using the on-board capacitors as a "capacitive" load.

For evaluating external DC loads, the cables connecting the +3.3V and +5V outputs to the external DC load must be rated for at least 10A and be shorter than 12in long. Additionally, current-sense resistors R1–R4 are configured for the maximum allowable output current on the +3.3V and +5V outputs. The resistors can be reconfigured for lower output currents only.

Switch and Jumper Selection

Several switch and jumper selections in Tables 1–5 display the functions provided by the MAX5915 EV kit.

Channel A Enable/Disable Switches

The MAX5915 EV kit features switches to enable/disable the channel A main outputs and auxiliary +3.3V output. The switches can also be used to reset the EV kit's respective output. Table 1 lists the various switch options.

Channel B Enable/Disable Switches

The MAX5915 EV kit features switches to enable/disable the channel B main outputs and auxiliary +3.3V output. The switches can also be used to reset the EV kit's respective output. Table 2 lists the various switch options.

+3.3V Supply Isolation Switches

The MAX5915 EV kit features switches to isolate the +3.3V main supply (+3.3V) from the +3.3V auxiliary

Table 1. Channel A Switch Functions

SWITCH	SWITCH STATE	MAX5915 PIN CONNECTION	MAX5915 OPERATION
SW1	ON (closed)	ON_A pin pulled high	Enable channel A main outputs
SW1	OFF (open)	ON_A pin pulled low	Disable channel A main outputs
SW2	ON (closed)	AUX_ONA pin pulled high	Enable channel A +3.3V auxiliary outputs
SW2	OFF (open)	AUX_ONA pin pulled low	Disable channel A +3.3V auxiliary outputs

MAX5915 Evaluation Kit

supply (+3.3VAUXIN) for both channels. Table 3 lists the various switch options.

Channel A Capacitance Load (5V/64-Bit PCI Line Card)

The MAX5915 EV kit features several jumpers to select what supplies the “capacitive” load for the controller to regulate during evaluation. A 5V/64-bit PCI line card plugged into the PCI +3.3V/64-bit connector (J3) or the EV kit’s capacitors can supply this load. Jumpers JU1–JU5 are provided to disable/enable this feature independent of the channel B selection. Table 4 lists the various jumper options.

Channel B Capacitance Load (3.3V/64-Bit PCI Line Card)

The MAX5915 EV kit features several jumpers to select what supplies the “capacitive” load for the controller to regulate during evaluation. A 3.3V/64-bit PCI line card plugged into the PCI 3.3V/64-bit connector (J4) or the EV kit’s capacitors can supply this load. Jumpers JU6–JU10 are provided to disable/enable this feature independent of the channel A selection. Table 5 lists the various jumper options.

Table 2. Channel B Switch Functions

SWITCH	SWITCH STATE	MAX5915 PIN CONNECTION	MAX5915 OPERATION
SW3	ON (closed)	ON_B pin pulled high	Enable channel B main outputs
SW3	OFF (open)	ON_B pin pulled low	Disable channel B main outputs
SW4	ON (closed)	AUX_ONB pin pulled high	Enable channel B +3.3V auxiliary outputs
SW4	OFF (open)	AUX_ONB pin pulled low	Disable channel B +3.3V auxiliary outputs

Table 3. +3.3V Switch Functions

SWITCH	SWITCH STATE	MAX5915 PIN CONNECTION	MAX5915 OPERATION
SW5	ON (closed)	+3.3VAUXIN	Supply +3.3V to channel A/B auxiliary input
SW5	OFF (open)	+3.3VAUXIN	0V at channel A/B auxiliary inputs
SW6	ON (closed)	Supply +3.3V to MOSFETs N2 and N4	Supply +3.3V to external MOSFETs
SW6	OFF (open)	Supply 0V to MOSFETs N2 and N4	Disconnect supply to external MOSFETs

MAX5915 Evaluation Kit

Evaluates: MAX5915

Table 4. Channel A Jumpers JU1–JU5 Functions

JUMPER	SHUNT LOCATION	PIN CONNECTION	MAX5915 OPERATION
JU1	Installed	C11 connected to +3.3VAUXOA pin	C11 provides capacitance
JU1	None	+3.3VAUXOA pin floating	+5V PCI card supplies capacitance
JU2	Installed	C12 connected to +12VOA pin	C12 provides capacitance
JU2	None	+12VOA pin floating	+5V PCI card supplies capacitance
JU3	Installed	C13 connected to -12VOA pin	C13 provides capacitance
JU3	None	-12VOA pin floating	+5V PCI card supplies capacitance
JU4	Installed	C17 connected to +5V_A pad	C17 provides capacitance
JU4	None	+5V_A pad floating	+5V PCI card supplies capacitance
JU5	Installed	C18 connected to +3.3V_A pad	C18 provides capacitance
JU5	None	+3.3_A pad floating	+5V PCI card supplies capacitance

Table 5. Channel B Jumpers JU6–JU10 Functions

JUMPER	SHUNT LOCATION	PIN CONNECTION	MAX5915 OPERATION
JU6	Installed	C14 connected to +3.3VAUXOB pin	C14 provides capacitance
JU6	None	+3.3VAUXOB pin floating	+3.3V PCI card supplies capacitance
JU7	Installed	C15 connected to +12VOB pin	C15 provides capacitance
JU7	None	+12VOB pin floating	+3.3V PCI card supplies capacitance
JU8	Installed	C16 connected to -12VOB pin	C16 provides capacitance
JU8	None	-12VOB pin floating	+3.3V PCI card supplies capacitance
JU9	Installed	C19 connected to +5V_B pad	C19 provides capacitance
JU9	None	+5V_B pad floating	+3.3V PCI card supplies capacitance
JU10	Installed	C20 connected to +3.3V_B pad	C20 provides card capacitance
JU10	None	+3.3_B pad floating	+3.3V PCI card supplies capacitance

Control Modes

Fault Resetting

The MAX5915 EV kit features two slide switches to reset a fault for each channel. The switch resets the EV kit and unlatches faults when toggled from ON to OFF.

See Table 1 for resetting channel A or Table 2 for channel B. Refer to the MAX5915 data sheet for additional functions of the ON_X pin.

MAX5915 Evaluation Kit

Evaluates: MAX5915

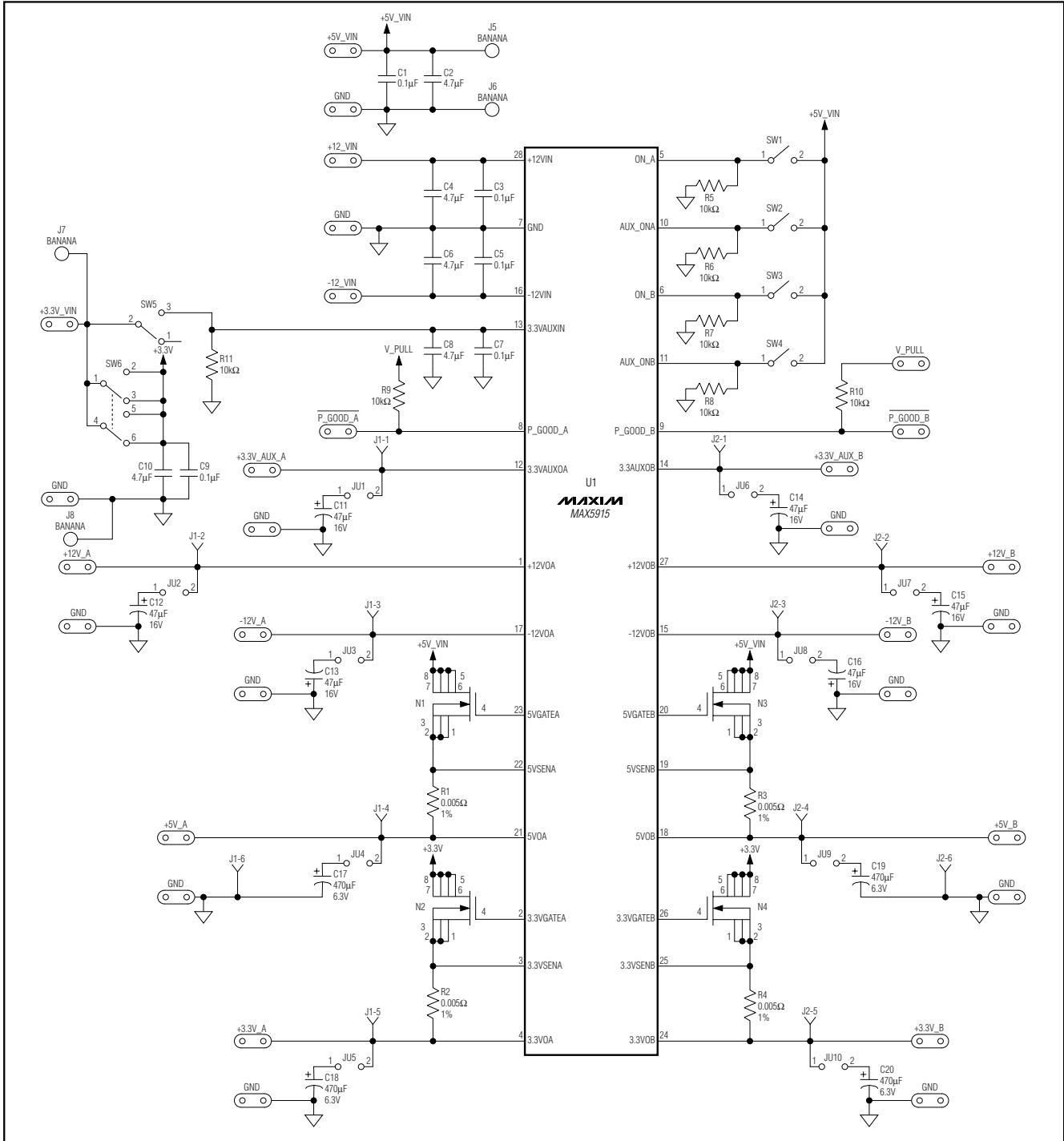


Figure 1. MAX5915 EV Kit Schematic

MAX5915 Evaluation Kit

Evaluates: MAX5915

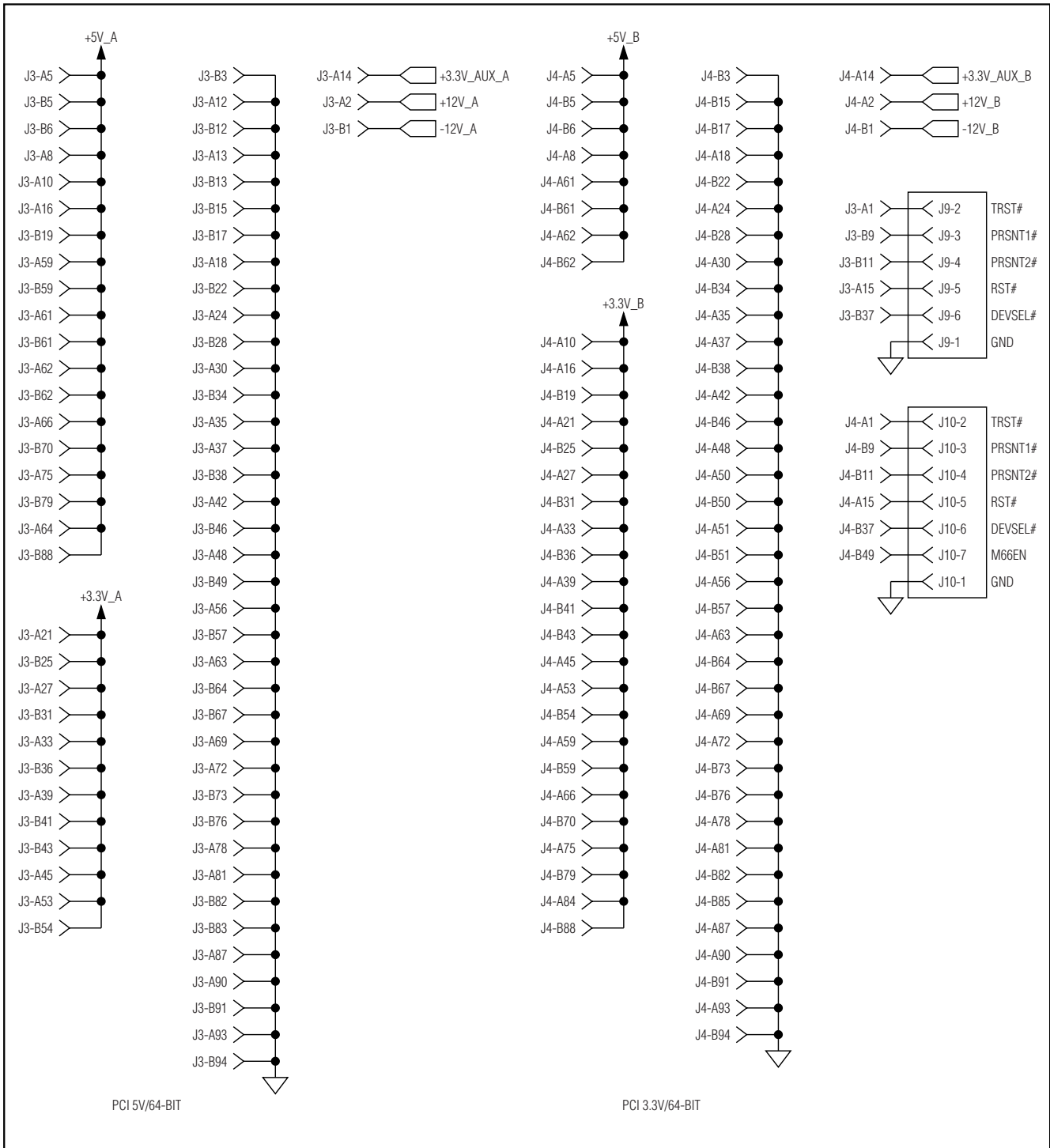


Figure 2. MAX5915 EV Kit Schematic, PCI Connectors

MAX5915 Evaluation Kit

Evaluates: MAX5915

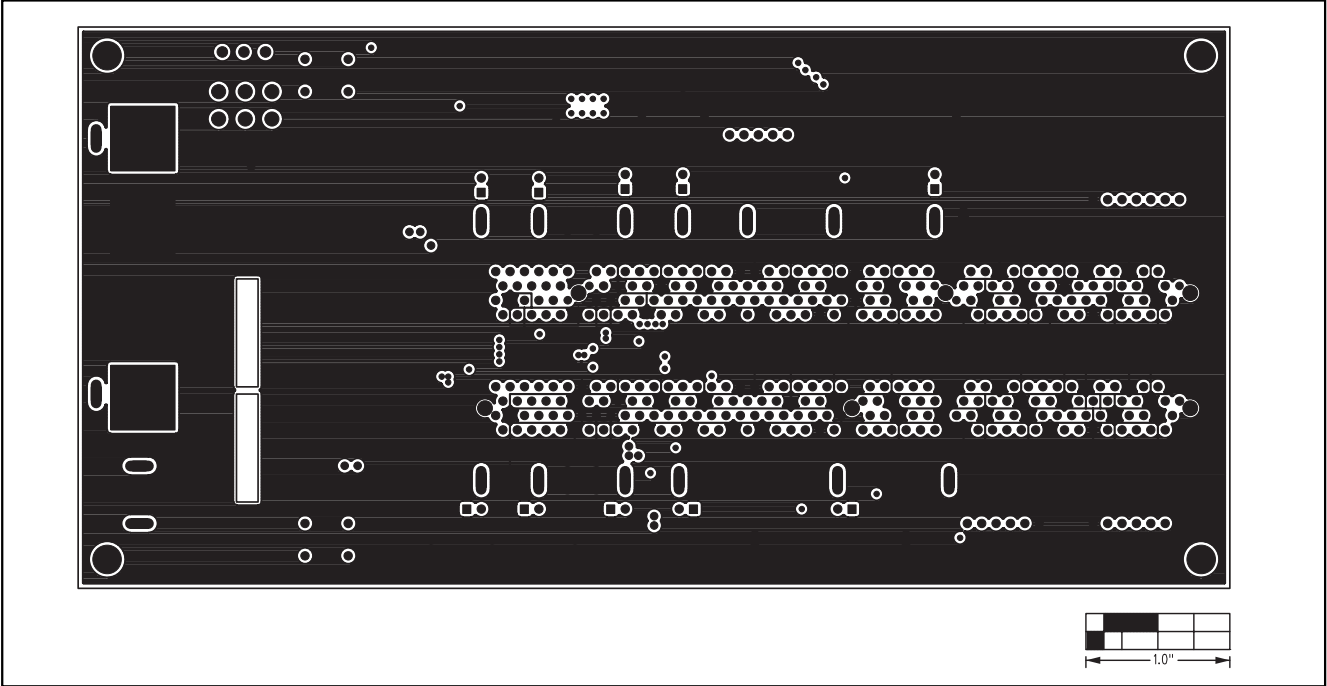


Figure 5. MAX5915 EV Kit PC Board Layout—Inner Layer, Ground Plane

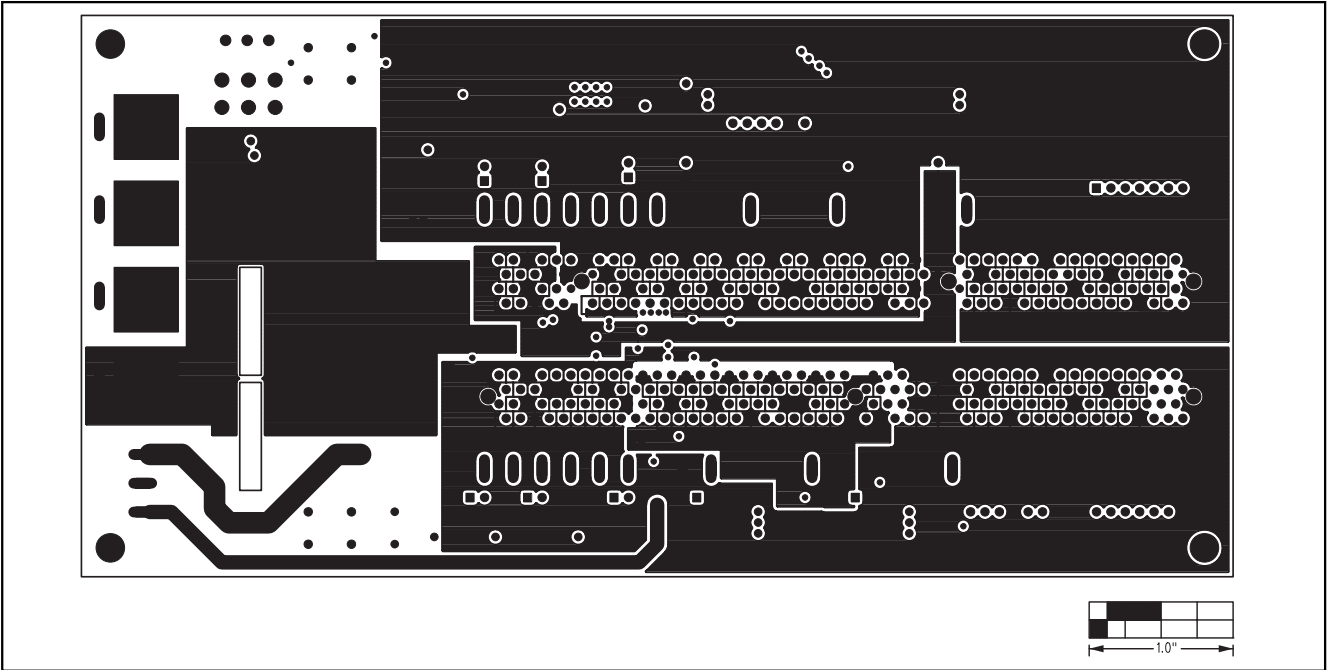


Figure 6. MAX5915 EV Kit PC Board Layout—Inner Layer, Power Plane

MAX5915 Evaluation Kit

Evaluates: MAX5915

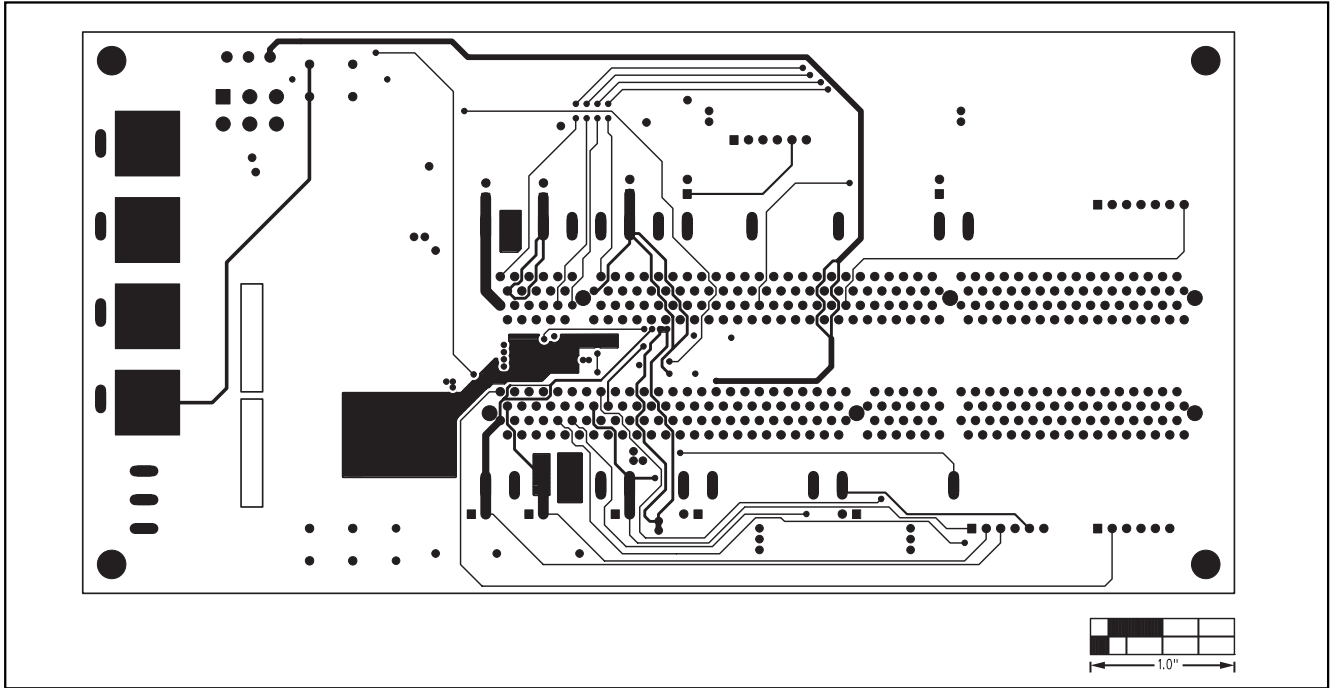


Figure 7. MAX5915 EV Kit PC Board Layout—Solder Side

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

10 _____ **Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600**