



# **IDT® 89EBPES48H12G2 Evaluation Board Manual**

**(Eval Board: 18-677-000)**

**May 2009**

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Printed in U.S.A.  
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# Table of Contents

## Notes

### Description of the EB48H12G2 Eval Board

Introduction .....	1-1
Board Features .....	1-2
Hardware .....	1-2
Software.....	1-2
Other.....	1-2
Revision History .....	1-2

### Installation of the EB48H12G2 Eval Board

EB48H12G2 Installation.....	2-1
Hardware Description .....	2-1
Reference Clocks.....	2-1
Power Sources.....	2-2
External Power Source .....	2-2
PCI Express Analog High Power Voltage Converter .....	2-2
PCI Express Analog Power Voltage Converter .....	2-2
PCI Express Transmitter Analog Voltage Converter .....	2-2
Core Logic Voltage Converter .....	2-2
2.5V I/O Voltage Regulator.....	2-3
Power-up Sequence for PES48H12G2 (PCIe Gen2 device).....	2-3
Power-up Sequence for PES48H12 (PCIe Gen1 device).....	2-3
Reset .....	2-3
Fundamental Reset .....	2-3
Downstream Reset .....	2-3
Boot Configuration Vector.....	2-4
SMBus Interfaces.....	2-5
SMBus Slave Interface .....	2-5
SMBus Master Interface .....	2-6
JTAG Header .....	2-6
Attention Buttons.....	2-6
Miscellaneous Jumpers, Headers.....	2-7
LEDs .....	2-8
PCI Express Connectors.....	2-9
EB48H12G2 Board Figure.....	2-11

### Software for the EB48H12G2 Eval Board

Introduction .....	3-1
Device Management Software.....	3-1

### Schematics

Schematics .....	4-1
------------------	-----

**Notes**



# List of Tables

**Notes**

Table 2.1	Clock Source Selection .....	2-1
Table 2.2	SMA Connectors - Onboard Reference Clock .....	2-2
Table 2.3	External Power Connector - J4 .....	2-2
Table 2.4	Downstream Reset Selection .....	2-4
Table 2.5	Boot Configuration Vector Signals .....	2-4
Table 2.6	Boot Configuration Vector Switches S3 & S13 (ON=0, OFF=1) .....	2-5
Table 2.7	Slave SMBus Interface Connector .....	2-5
Table 2.8	JTAG Connector Pin Out .....	2-6
Table 2.9	Attention Buttons .....	2-6
Table 2.10	Miscellaneous Jumpers, Headers .....	2-7
Table 2.11	LED Indicators .....	2-8
Table 2.12	PCI Express x8 Connector Pinout .....	2-9

**Notes**



# List of Figures

## Notes

Figure 1.1 Function Block Diagram of the EB48H12G2 Eval Board ..... 1-1

**Notes**





# Description of the EB48H12G2 Eval Board

## Notes

## Introduction

The 89HPES48H12G2 switch (also referred to as PES48H12G2 in this manual) is a member of IDT's PCI Express® standard based line of products. It is a PCIe® Base Specification 2.0 compliant (Gen2) 12-port switch. There are twelve x4 lanes ports. Two x4 ports can be merged to form one x8 port in PES48H12G2. One upstream port is provided for connecting to the root complex (RC), and up to eleven downstream ports are available for connecting to PCIe endpoints or to another switch. More information on this device can be found in the 89HPES48H12G2 User Manual.

The 89EBPES48H12G2 Evaluation Board (also referred to as EB48H12G2 in this manual) provides an evaluation platform for the PES48H12G2 switch. It is also a cost effective way to add PCIe ports (slots) to an existing system with limited number of PCIe ports/slots. The EB48H12G2 board is designed to function as an add-on card to be plugged into a x8 PCIe slot available on a motherboard hosting an appropriate root complex and microprocessor(s). The EB48H12G2 is a vehicle to test and evaluate the functionality of the PES48H12G2 switch. It is also designed to work with the PES48H12 (Gen 1) switch. Refer to application note AN-550 for detail information on Designing Gen2-Ready boards for IDT's 48-lane, 12-port PCIe Switches. Customers can use this board to get a headstart on software development prior to the arrival of their own hardware. The EB48H12G2 is also used by IDT to reproduce system-level hardware or software issues reported by customers. Figure 1.1 illustrates the functional block diagram representing the main parts of the EB48H12G2 board.

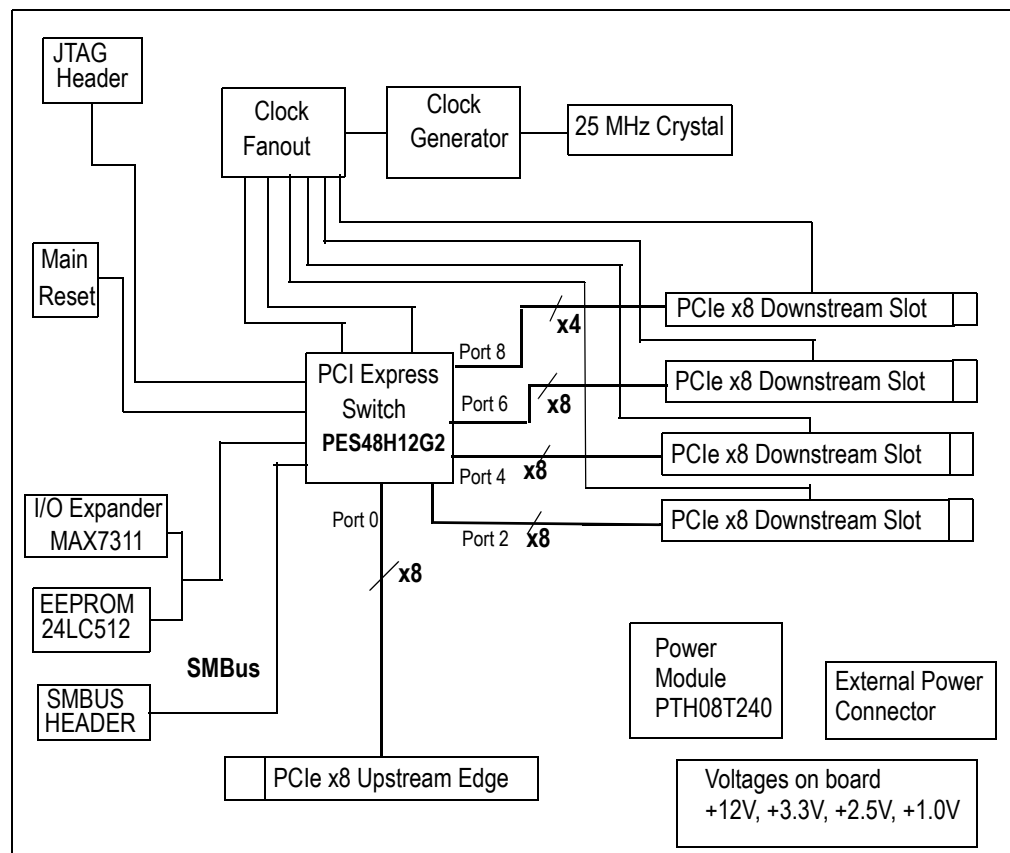


Figure 1.1 Function Block Diagram of the EB48H12G2 Eval Board

## Notes

## Board Features

### Hardware

- ◆ **PES48H12G2 PCIe Gen2 switch**
  - Up to twelve x4 or six x8 ports - 48 PCIe lanes
  - PCIe Base Specification Revision 2.0 compliant (Gen2 SerDes speeds of 5 GT/S)
  - Up to 2048 byte maximum Payload Size
  - Automatic lane reversal and polarity inversion supported on all lanes
  - Automatic per port link width negotiation to x8, x4, x2, x1
  - Load configuration from an optional serial EEPROM via SMBUS
- ◆ **Upstream, Downstream Port**
  - One edge connector on the upstream port, to be plugged into a slot with at least x8 capable on a host motherboard
  - Four slot connectors on the downstream ports, for PCIe endpoint add-on cards to be plugged in. These slot connectors are x8 mechanically and electrically connected as three x8 and one x4, but open-ended for card widths greater than x8 (e.g. x16).
- ◆ **Numerous user selectable configurations set using onboard jumpers and DIP-switches**
  - Source of clock - host clock or onboard clock generator
  - Two clock rates (100/125 MHz) from an onboard clock generator
  - Boot mode selection
- ◆ **SMBUS Slave Interface (4 pin header)**
- ◆ **SMBUS Master Interface connected to the Serial EEPROMs through I/O expander**
- ◆ **“Attention” button for each downstream port to initiate a hot swap event on each port**
- ◆ **Four pin connector for optional external power supply**
- ◆ **Push button for Warm Reset**
- ◆ **Several LEDs to display status, reset, power, “Attention”, etc.**
- ◆ **One 10-pin JTAG connector (pitch 2.54 mm x 2.54 mm)**

### Software

There is no software or firmware executed on the board. However, useful software is provided along with the Evaluation Board to facilitate configuration and evaluation of the PES48H12G2 within host systems running popular operating systems.

- ◆ **Installation programs**
  - *Operating Systems Supported: Windows Server 2003, Windows Server 2008, WindowsXP, Vista, Linux*
- ◆ **GUI based application for Windows and Linux**
  - *Allows users to view and modify registers in the PES48H12G2*
  - *Binary file generator for programming the serial EEPROMs attached to the SMBUS.*

### Other

- ◆ A metal bracket is provided to firmly hold in place three endpoints plugged into the EB48H12G2 board.
- ◆ An external power supply may be required under some conditions.
- ◆ SMBUS cable may be required for certain evaluation exercises.
- ◆ SMA connectors are provided on the EB48H12G2 board for clock outputs.

## Revision History

**January 5, 2009:** Initial publication of eval board manual.

**Notes**

**May 7, 2009:** On page 2-2, changed reference to 25MHz oscillator (Y1) to (X1). In PCI Express Analog Power Voltage Converter section, changed DC-DC Converter (U4) to (U14). In PCI Express Transmitter Analog Power Voltage Converter section, changed DC-DC converter (U14) to (U4). In the SMBus Slave Interface section of Chapter 2, the slave interface default address was changed to **0b1110111**. In Table 2.6, signal S3[1] was changed from ON to OFF. In Table 2.11, locations were changed for the following signals: port 4: power-is-good; port 6 power-is-good; port 4: power indicator; port 6: power indicator; port 4: attention indicator; port 6: attention indicator.

**Notes**



# Installation of the EB48H12G2 Eval Board

## Notes

### EB48H12G2 Installation

This chapter discusses the steps required to configure and install the EB48H12G2 evaluation board. All available DIP switches and jumper configurations are explained in detail.

The primary installation steps are:

1. Configure jumper/switch options suitable for the evaluation or application requirements.
2. Connect PCI Express endpoint cards to the downstream port PCIe slots on the evaluation board.
3. Make sure that the host system (motherboard with root complex chipset) is powered off.
4. Insert the evaluation board into the host system.
5. Apply power to the host system.

The EB48H12G2 board is typically shipped with all jumpers and switches configured to their default settings. In most cases, the board does not require further modification or setup.

### Hardware Description

The PES48H12G2 is a 48-lane, 12-port PCI Express® switch. It is a peripheral chip that performs PCI Express based switching with a feature set optimized for high performance applications such as servers and storage. It provides switching functions between a PCI Express upstream port and downstream ports or peer-to-peer switching between downstream ports.

The EB48H12G2 has four PCI Express downstream ports, accessible through four x8 connectors. Three ports are capable of negotiating a x1, x2, x4 and x8 link width and one port is capable of negotiating a x1, x2, or x4 link width. All endpoint cards connected to the PES48H12G2 must support one of these link widths.

Basic requirements for the board to run are:

- Host system with a PCI Express root complex supporting at least x8 configuration through a PCI Express x8 or larger slot.
- x1, x2, x4 or x8 PCI Express Endpoint Cards.

### Reference Clocks

The PES48H12G2 requires two differential reference clocks while the PES48H12 requires four. Also, AC coupling is not required on the PES48H12G2's reference input clocks, therefore capacitors C348, C350, C352, and C354 need to be removed and capacitors C347, C349, C351, and C353 should be replaced with 0 ohm resistors when the Gen2 part is installed. The EB48H12G2 derives these clocks from a common source which is user-selectable. The common source can be either the host system's reference clock or it can be the onboard clock generator. Selection is made by stuffing resistors as in Table 2.1.

Clock Configuration Stuffing Option	
W6 and W7	Clock Source
Pins 2 and 3	Onboard Reference Clock – Use onboard clock generator
Pins 1 and 2	Upstream Reference Clock – Host system provides clock (Default)

Table 2.1 Clock Source Selection

**Notes**

The source for the onboard clock is the ICS841484 clock generator device (U10) connected to a 25MHz oscillator (X1). When using the onboard clock generator, the output frequency is fixed at 100MHz, therefore FSEL0 (S2, pin 2) should be in the ON position as the default setting.

The outputs of the onboard clock generator and clock buffer (ICS9DB803) are accessible through two SMA connectors located on the Evaluation Board. See Table 2.2. This can be used to connect a scope for probing or capturing purposes and cannot be used to drive the clock from an external source.

<b>Onboard Reference Clock Output (Differential) – J7, J9, J10-J15</b>	
J7, J9, J12, J14	Positive Reference Clock
J10, J11, J13, J15	Negative Reference Clock

Table 2.2 SMA Connectors - Onboard Reference Clock

**Power Sources**

The EB48H12G2 and all downstream ports are powered from the upstream port slot power. If add-in cards require more power than the upstream slot can support, an external source is required to supply this extra power via an auxiliary 4-pin power connector on the board. Header W1, W2, and W3 (see Table 2.10) are used to select proper power source for the switch and all downstream ports.

**External Power Source**

If necessary, external power is supplied to the EB48H12G2 board through a 4-pin auxiliary power connector attached to J4. The external power supply provides +12V to the EB48H12G2 as described in Table 2.3. The +5V is unused.

<b>Pin</b>	<b>Signal</b>
1	+12V
2	GND
3	GND
4	+5V

Table 2.3 External Power Connector - J4

**PCI Express Analog High Power Voltage Converter**

A DC-DC converter (U5) provides a 2.5V PCI Express analog high power voltage (shown as  $V_{DD}PEHA$ ) to the PES48H12G2. Install R224 (56 ohm resistor) to provide a 1.5V PCI Express serial data transmit termination voltage (shown as  $V_{TTPE}$ ) when the PES48H12 is installed.

**PCI Express Analog Power Voltage Converter**

A separate DC-DC converter (U14) provides a 1.0V PCI Express analog power voltage (shown as  $V_{DD}PEA$ ) to the PES48H12G2.

**PCI Express Transmitter Analog Voltage Converter**

A separate DC-DC converter (U4) provides a 1.0V PCI Express transmitter analog voltage (shown as  $V_{DD}PETA$ ) to the PES48H12G2.

**Core Logic Voltage Converter**

A separate DC-DC converter (U3) provides the 1.0V core voltage ( $V_{DD}CORE$ ) to the PES48H12G2.

## Notes

### 2.5V I/O Voltage Regulator

This evaluation board can be stuffed to host the PES48H12G2 (PCIe Gen2) device or the PES48H12 (PCIe Gen1) device. Depending on which device is populated on the board, appropriate settings can be made. A 12V to 3.3V voltage regulator (VR2) provides the 2.5V I/O voltage ( $V_{DD}I/O$ ) to the PES48H12G2. Install R145 (2.49 ohm) to provide the 3.3V I/O voltage when the PES48H12 is installed instead.

### Power-up Sequence for PES48H12G2 (PCIe Gen2 device)

During power supply ramp-up,  $V_{DD}CORE$  must remain at least 1.0V below  $V_{DD}I/O$  at all times. There are no other power-up sequence requirements for the various operating supply voltages.

### Power-up Sequence for PES48H12 (PCIe Gen1 device)

The power -up sequence must be as following:

1.  $V_{DD}I/O$  — 3.3V
2.  $V_{DD}CORE$ ,  $V_{DD}PE$ ,  $V_{DD}APE$  — 1.0V
3.  $V_{TT}PE$  — 1.5V

When powering up, each voltage level must ramp up and stabilize prior to applying the next voltage in the sequence to ensure internal latch-up issues are avoided. There are no maximum time limitations between sequential valid power level requirements.

### Reset

The PES48H12G2 supports two types of reset mechanisms as described in the PCI Express specification:

- Fundamental Reset: This is a system-generated reset that propagates along the PCI Express tree through a single side-band signal PERST# which is connected to the Root Complex, the PES48H12G2, and the endpoints.
- Hot Reset: This is an In-band Reset, communicated downstream via a link from one device to another. Hot Reset may be initiated by software. This is further discussed in the PES48H12G2 User Manual. The EB48H12G2 evaluation board provides seamless support for Hot Reset.

### Fundamental Reset

There are two types of Fundamental Resets which may occur on the EB48H12G2 evaluation board:

- Cold Reset: During initial power-on, the onboard voltage monitor (TLC7733D) will assert the PCI Express Reset (PERSTN) input pin of the PES48H12G2.
- Warm Reset: This is triggered by hardware while the device is powered on. Warm Reset can be initiated by two methods:
  - Pressing a push-button switch (S1) located on EB48H12G2 board
  - The host system board IO Controller Hub asserting PERST# signal, which propagates through the PCIe upstream edge connector of the EB48H12G2. Note that one can bypass the onboard voltage monitor (TLC7733D) by moving the shunt from pin 1-2 to pin 2-3 (default) on W4.

Both events cause the onboard voltage monitor (TLC7733D) to assert the PCI Express Reset (PERSTN) input of the PES48H12G2 while power is on.

### Downstream Reset

The PES48H12G2 provides a a choice of either a software-controlled reset for each downstream port through GPIO pins or a fundamental reset through PERST#. Selection is made by jumpers described in Table 2.4.

Notes

Port #	Jumper	Selection
2	W9	[1-2] Software controlled reset through I/O Expander 0 [2-3] Fundamental reset PERST# (default)
4	W5	[1-2] Software controlled reset through I/O Expander 2 [2-3] Fundamental reset PERST# (default)
6	W19	[1-2] Software controlled reset through I/O Expander 2 [2-3] Fundamental reset PERST# (default)
8	W8	[1-2] Software controlled reset through I/O Expander 4 [2-3] Fundamental reset PERST# (default)

Table 2.4 Downstream Reset Selection

**Boot Configuration Vector**

A boot configuration vector consisting of the signals listed in Table 2.5 is sampled by the PES48H12G2 during a fundamental reset (while PERSTN is active). The boot configuration vector defines the essential parameters for switch operation and is set using DIP switches S3 and S13 as defined in Table 2.6.

Signal	Description
CCLKDS	<b>Common Clock Downstream (for 48H12).</b> The assertion of this pin indicates that all downstream ports are using the same clock source as that provided to downstream devices. This pin is used as the initial value of the Slot Clock Configuration bit in all of the Link Status Registers for downstream ports. The value may be overridden by modifying the SCLK bit in the downstream port's PCIELSTS register. <b>Default: 0x1</b>
CCLKUS	<b>Common Clock Upstream (for PES48H12).</b> The assertion of this pin indicates that the upstream port is using the same clock source as the upstream device. This pin is used as the initial value of the Slot Clock Configuration bit in the Link Status Register for the upstream port. The value may be overridden by modifying the SCLK bit in the P0_PCIESTS register. <b>Default: 0x1</b>
CLKMODE[2:0]	<b>Initial Port Clocking mode (for PES48H12G2). Default: 0x0</b> 0x0 - Global Clock mode on all ports. Port0/2/4/8 SCLK = 0 0x1 - Global Clock mode on all ports. Port0 SCLK =1, Port2 SCLK =0, Port4/8 SCLK =0 0x2 - Global Clock mode on all ports. Port0 SCLK =0, Port2 SCLK =1, Port4/8 SCLK =1 0x3 - Global Clock mode on all ports. Port0 SCLK =1, Port2 SCLK =1, Port4/8 SCLK =1 0x4 - Local Clock mode on Port0/1. Port0 SCLK =1, Port2 SCLK =1, Port4/8 SCLK =1 0x5 - Global Clock mode on Port0, Local Clock mode on Port1, Port0 SCLK =0, Port2 SCLK =1, Port4/8 SCLK =1 0x6 - Global Clock mode on Port0, Local Clock mode on Port1, Port0 SCLK =1, Port2 SCLK =1, Port4/8 SCLK =1 0x7 - Reserved
SWMODE[3:0]	<b>Switch Mode.</b> These configuration pins determine the PES48H12G2 switch operating mode. <b>Default: 0x0</b> 0x0 - Normal switch mode 0x1 - Normal switch mode with Serial EEPROM-based initialization 0x2 through 0xF - Reserved

Table 2.5 Boot Configuration Vector Signals



**Notes**

Signal	Description	Default
S13[1]	CLKMODE2	OFF
S13[2]	CLKMODE1/CCLKDS	OFF
S13[3]	CLKMODE0/CCLKUS	OFF
S3[1]	SWMODE[0]	OFF
S3[2]	SWMODE[1]	ON
S3[3]	SWMODE[2]	ON
S3[4]	SWMODE[3]	ON

**Table 2.6 Boot Configuration Vector Switches S3 & S13 (ON=0, OFF=1)**

**SMBus Interfaces**

The System Management Bus (SMBus) is a two-wire interface through which various system component chips can communicate. It is based on the principles of operation of I<sup>2</sup>C. Implementation of the SMBus signals in the PCI Express connector is optional and may not be present on the host system. The SMBus interface consists of an SMBus clock pin and an SMBus data pin.

The PES48H12G2 contains two SMBus interfaces: a slave SMBus interface and a master SMBus interface. The slave SMBus interface allows a SMBus Master device full access to all software-visible registers. The Master SMBus interface provides connection to the external serial EEPROM used for initialization and the I/O expanders used for hot-plug signals.

**SMBus Slave Interface**

On the PES48H12G2 board, the slave SMBus interface is accessible through the PCI Express edge connector as well as a 4-pin header as described in Table 2.7.

**Note:** The SMBus signals to the PCI Express edge connector is disabled by default. To enable them, place 0-ohm resistors at locations R160 and R161.

Slave SMBus Interface Connector J8	
Pin	Signal
1	N/C
2	SCL
3	GND
4	SDA

**Table 2.7 Slave SMBus Interface Connector**

A fixed slave SMBus address specified by the SSMBADDR[5,2:1] pins is used. For a fixed address, the SMBus address of the PES48H12G2 slave interface is **0b1110111** by default.

The slave SMBus interface responds to the following SMBus transactions initiated by an SMBus master. Initiation of any SMBus transaction other than those listed above produces undefined results. See the SMBus 2.0 specification for a detailed description of the following transactions:

- Byte and Word Write/Read
- Block Write/Read

**Notes**

**SMBus Master Interface**

Connected to the master SMBus interface are seven 16-bit I/O Expanders (MAX7311) and a serial EEPROM (24LC512). Six I/O Expanders are used as the interface for the onboard hot-plug controllers (MIC2591B). The SMBus address for the I/O Expander0/2/4/8/12/13 are fixed as 0x20, 0x24, 0x22, 0x26, 0x28, 0x2A and 0x2C, respectively.

Note: Hot-plug is not implemented when PES48H12 is installed.

The seven bits address for the selected EEPROM device is fixed at 0**b1010**\_000 by default.

**JTAG Header**

The PES48H12G2 provides a JTAG connector J5 for access to the PES48H12G2 JTAG interface. The connector is a 2.54 x 2.54 mm pitch male 10-pin connector. Refer to Table 2.8 for the JTAG Connector J5 pin out.

JTAG Connector J5					
Pin	Signal	Direction	Pin	Signal	Direction
1	/TRST - Test reset	Input	2	GND	—
3	TDI - Test data	Input	4	GND	—
5	TDO - Test data	Output	6	GND	—
7	TMS - Test mode select	Input	8	GND	—
9	TCK - Test clock	Input	10	GND	—

Table 2.8 JTAG Connector Pin Out

**Attention Buttons**

The PES48H12G2 features three attention buttons, shown in Table 2.9. Each button corresponds to a particular port and is used to initiate hot-swapping events.

Button	Description
S7	Port 2 Attention Button
S12	Port 4 Attention Button
S6	Port 6 Attention Button
S11	Port 8 Attention Button

Table 2.9 Attention Buttons

**Notes**
**Miscellaneous Jumpers, Headers**

<b>Miscellaneous Jumpers, Headers</b>			
<b>Ref. Designator</b>	<b>Type</b>	<b>Default</b>	<b>Description</b>
W1-W3	Header	1-2 Shunted	1-2: 12.0V source from Upstream Port <b>(Default)</b> 2-3: 12.0V source from external power connector
W38	Header	Shunted	Disable EEPROM Write protect feature <b>(Default)</b>
S9[1]	Switch	ON	ON: Port2, Force hot-plug controller on <b>(Default)</b> OFF: Port2, Power Enable bit controls hot-plug controller
S10[1]	Switch	ON	ON: Port4, Force hot-plug controller on <b>(Default)</b> OFF: Port4, Power Enable bit controls hot-plug controller
S10[2]	Switch	ON	ON: Port6, Force hot-plug controller on <b>(Default)</b> OFF: Port6, Power Enable bit controls hot-plug controller
S9[2]	Switch	ON	ON: Port8, Force hot-plug controller on <b>(Default)</b> OFF: Port8, Power Enable bit controls hot-plug controller
W45	Header	2-3 Shunted	2-3: Port 2, +12V source from Upstream port <b>(Default)</b> 1-2: Port 2, +12V source from hot-plug controller
W51	Header	2-3 Shunted	2-3: Port 4, +12V source from Upstream port <b>(Default)</b> 1-2: Port 4, +12V source from hot-plug controller
W52	Header	2-3 Shunted	2-3: Port 6, +12 source from Upstream port <b>(Default)</b> 1-2: Port 6, +12 source from hot-plug controller
W46	Header	2-3 Shunted	2-3: Port 8, +12 source from Upstream port <b>(Default)</b> 1-2: Port 8, +12 source from hot-plug controller
W47	Header	2-3 Shunted	2-3: Port 2, +3.3V source from Upstream port <b>(Default)</b> 1-2: Port 2, +3.3V source from hot-plug controller
W53	Header	2-3 Shunted	2-3: Port 4, +3.3V source from Upstream port <b>(Default)</b> 1-2: Port 4, +3.3V source from hot-plug controller
W54	Header	2-3 Shunted	2-3: Port 6, +3.3V source from Upstream port <b>(Default)</b> 1-2: Port 6, +3.3V source from hot-plug controller
W48	Header	2-3 Shunted	2-3: Port 8, +3.3V source from Upstream port <b>(Default)</b> 1-2: Port 8, +3.3V source from hot-plug controller
W49	Header	2-3 Shunted	2-3: Port 2, +3.3AUX source from upstream port <b>(Default)</b> 1-2: Port 2, +3.3V source from hot-plug controller
W55	Header	2-3 Shunted	2-3: Port 4, +3.3AUX source from upstream port <b>(Default)</b> 1-2: Port 4, +3.3V source from hot-plug controller
W56	Header	2-3 Shunted	2-3: Port 6, +3.3AUX source from upstream port <b>(Default)</b> 1-2: Port 6, +3.3V source from hot-plug controller
W50	Header	2-3 Shunted	2-3: Port 8, +3.3AUX source from upstream port <b>(Default)</b> 1-2: Port 8, +3.3V source from hot-plug controller

**Table 2.10 Miscellaneous Jumpers, Headers**

## Notes

### LEDs

There are several LED indicators on the EB48H12G2 which convey status feedback. A description of each is provided in Table 2.11.

Location	Color	Definition
DS14	Green	Port 2: Power-is-good Indicator
DS20	Green	Port 4: Power-is-good Indicator
DS17	Green	Port 6: Power-is-good Indicator
DS24	Green	Port 8: Power-is-good Indicator
DS16	Green	Port 2: Power Indicator
DS23	Green	Port 4: Power Indicator
DS19	Green	Port 6: Power Indicator
DS26	Green	Port 8: Power Indicator
DS15	Yellow	Port 2: Attention Indicator
DS21	Yellow	Port 4: Attention Indicator
DS18	Yellow	Port 6: Attention Indicator
DS25	Yellow	Port 8: Attention Indicator
DS27	Green	Port 0: Activity Indicator
DS28	Green	Port 2: Activity Indicator
DS29	Green	Port 4: Activity Indicator
DS30	Green	Port 6: Activity Indicator
DS31	Green	Port 8: Activity Indicator
DS8	Green	Port 0: Linkup Indicator
DS9	Green	Port 2: Linkup Indicator
DS10	Green	Port 4: Linkup Indicator
DS11	Green	Port 6: Linkup Indicator
DS12	Green	Port 8: Linkup Indicator
DS3	Red	Port 2/8: Power Fault Indicator
DS7	Red	Port 4/6: Power Fault Indicator
DS33	Green	GPIO7
DS34	Green	GPIO6
DS35	Green	GPIO5
DS36	Green	GPIO4
DS37	Green	GPIO3
DS38	Green	GPIO2
DS39	Green	GPIO1
DS40	Green	GPIO0

**Table 2.11 LED Indicators**

**Notes**
**PCI Express Connectors**

Pin	Side A		Side B	
1	+12V	12V power	PRSNT1#	Hot-Plug presence detect
2	+12V	12V power	+12V	12V power
3	RSVD	Reserved	+12V	12V power
4	GND	Ground	GND	Ground
5	SMCLK	SMBus clock	JTAG2	TCK (Test Clock) JTAG if clk i/p
6	SMDAT	SMBus Data	JTAG	TDI (Test Data Input)
7	GND	Ground	JTAG	TDO (Test Data Output)
8	+3.3V	3.3V power	JTAG	TMS (Test Mode Select)
9	JTAG1	TRST# (Test/Reset) resets JTAG if	+3.3V	3.3V power
10	3.3Vaux	3.3V auxiliary power	+3.3V	3.3V power
11	WAKE#	Signal for Link reactivation	PERST#	Fundamental Reset
<b>Mechanical Key</b>				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	REFCLK Reference clock
14	PETp0	Transmitter differential	REFCLK-	(differential pair)
15	PETn0	pair, Lane 0	GND	Ground
16	GND	Ground	PERp0	Receiver differential
17	PRSNT2#	Hot-Plug presence detect	PERn0	pair, Lane 0
18	GND	Ground	GND	Ground
19	PETp1	Transmitter differential	RSVD	Reserved
20	PETn1	pair, Lane 1	GND	Ground
21	GND	Ground	PERp1	Receiver differential
22	GND	Ground	PERn1	pair, Lane 1
23	PETp2	Transmitter differential	GND	Ground
24	PETn2	pair, Lane 2	GND	Ground
25	GND	Ground	PERp2	Receiver differential
26	GND	Ground	PERn2	pair, Lane 2
27	PETp3	Transmitter differential	GND	Ground
28	PETn3	pair, Lane 3	GND	Ground
29	GND	Ground	PERp3	Receiver differential
30	RSVD	Reserved	PERn3	pair, Lane 3
31	PRSNT2#	Hot-Plug presence detect	GND	Ground
32	GND	Ground	RSVD	Reserved
33	PETp4	Transmitter differential	RSVD	Reserved

**Table 2.12 PCI Express x8 Connector Pinout (Part 1 of 2)**

**Notes**

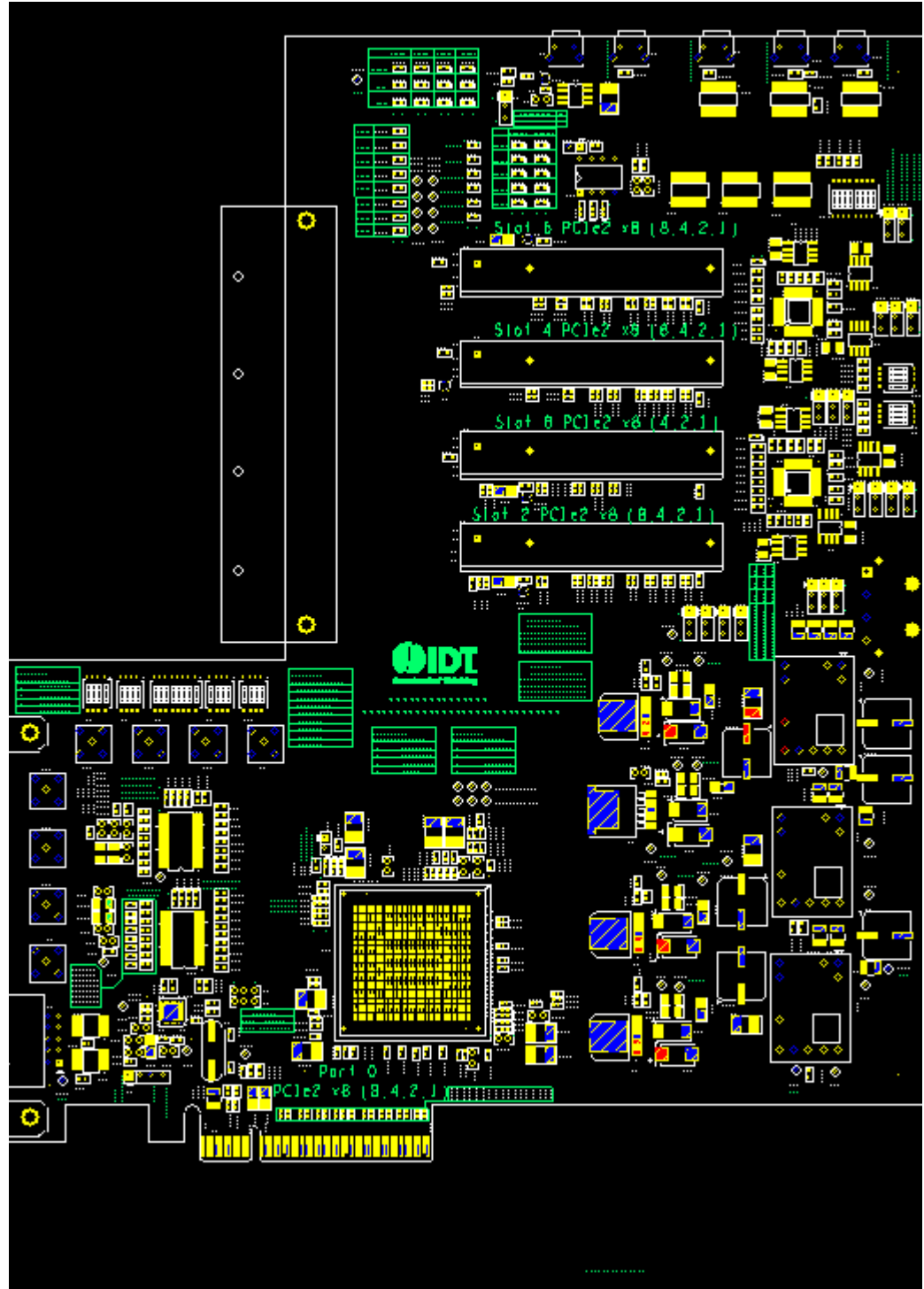
Pin	Side A		Side B	
34	PETn4	pair, Lane 4	GND	Ground
35	GND	Ground	PERp4	Receiver differential
36	GND	Ground	PERn4	pair, Lane 4
37	PETp5	Transmitter differential	GND	Ground
38	PETn5	pair, Lane 5	GND	Ground
39	GND	Ground	PERp5	Receiver differential
40	GND	Ground	PERn5	pair, Lane 5
41	PETp6	Transmitter differential	GND	Ground
42	PETn6	pair, Lane 6	GND	Ground
43	GND	Ground	PERp6	Receiver differential
44	GND	Ground	PERn6	pair, Lane 6
45	PETp7	Transmitter differential	GND	Ground
46	PETn7	pair, Lane 7	GND	Ground
47	GND	Ground	PERp7	Receiver differential
48	PRSNT2#	Hot-Plug presence detect	PERn7	pair, Lane 7
49	GND	Ground	GND	Ground

**Table 2.12 PCI Express x8 Connector Pinout (Part 2 of 2)**

**Note:** These x8 PCI Express connectors comply with the PCIe specification. According to the PCI Express specification, the PRSNT1# pin should be wired to the farthest available PRSNT2# pin on the connector. In the EB48H12G2, all PRSNT2# pins are tied together. This allows a board with a x1 or x4 width to be installed.

Notes

EB48H12G2 Board Figure









# Software for the EB48H12G2 Eval Board

## Notes

### Introduction

This chapter discusses some of the main features of the available software to give users a better understanding of what can be achieved with the EB48H12G2 evaluation board using the device management software.

Device Management Software and related user documentation are available on a CD which is included in the Evaluation Board Kit. This information is also available on IDT's FTP site. For more information, contact IDT at [ssdhelp@idt.com](mailto:ssdhelp@idt.com).

### Device Management Software

The primary use of the Device Management Software package is to enable users of the evaluation board to access all the registers in the PES48H12G2 device. This access can be achieved using the PCI Express in-band configuration cycles through the upstream port on the PES48H12G2.

This software also enables users to save a snapshot of the current register set into a dump file which can be used for debugging purposes. An export/import facility is also available to create and use "Configuration" files which can be used to initialize the switch device with specific values in specific registers.

A conversion utility is also provided to translate a configuration file into an EEPROM programmable data structure. This enables the user to program an appropriate serial EEPROM with desirable register settings for the PES48H12G2, and then to populate that EEPROM onto the Evaluation Board. It is also possible to program the EEPROM directly on the Evaluation Board using a feature provided by the software package.

The front end of the Device Management Software is a user-friendly Graphical User Interface which allows the user to quickly read or write the registers of interest. The GUI also permits the user to run the software in "simulation" mode with no real hardware attached, allowing the creation of configuration files for the PES48H12G2 in the absence of the actual device.

Much of the Device Management Software is written with device-independent and OS-independent code. The software will be guaranteed to work on Linux (/sys interface) and MS Windows XP. It may function flawlessly on various flavors of MS Windows, but may not be validated on all. The fact that the software is device-independent assures its scalability to future PCIe parts from IDT. Once users are familiar with the GUI, they will be able to use the same GUI on all PCIe parts from IDT. This software is customized for each device through an XML device description file which includes information on the number of ports, registers, types of registers, information on bit-fields within each register, etc.

**Notes**



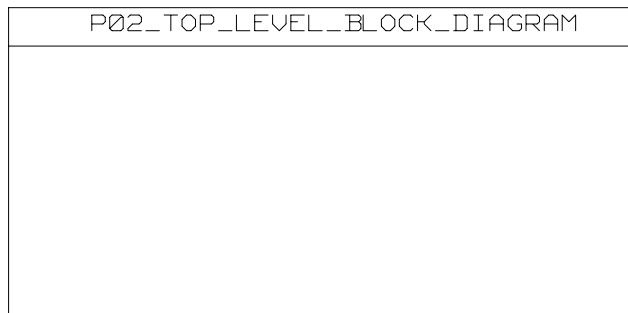
# Schematics


**Notes**

**Schematics**

Page number	Page title
1	Table of Contents
2	Top Level Block Diagram
3	DUT Top
4	DUT Control, Misc
5	DUT Serial ports
6	DUT Power
7	DUT Ground
8	Clock Tree
9	Downstream Clock G1
10	DUT Clock G2 Reference
11	Upstream Port 0,1
12	Downstream Port 2, 4, 6, 8
13	Downstream Port 2
14	Downstream Port 4
15	Downstream Port 6
16	Downstream Port 8
17	Hot Swap Controller Port 2,4
18	Hot Swap Controller Port 6,8
19	Port Wake Buffers
20	I/O Expander Top / Port Status LEDS
21	I/O Expander Ports 0-7
22	Reset / Power Conectors
23	Power Regulators

REVISIONS				
DCN	REV	DESCRIPTION	DATE	CHANGE BY
PCB-0171R01	1.0	89HPES48H12G2 EVAL BOARD	JULY 31 2008	JHU



		TITLE		
		89HPES48H12G2 Eval Board		
SIZE	DRAWING NO.	FAB P/N	REV.	
B	SCH-00172	18-677-000	1.0	
AUTHOR		CHECKED BY		
JHU		B. Le		
Tue Sep 23 14:23:33 2008			SHEET 1 OF 23	

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D

D

C

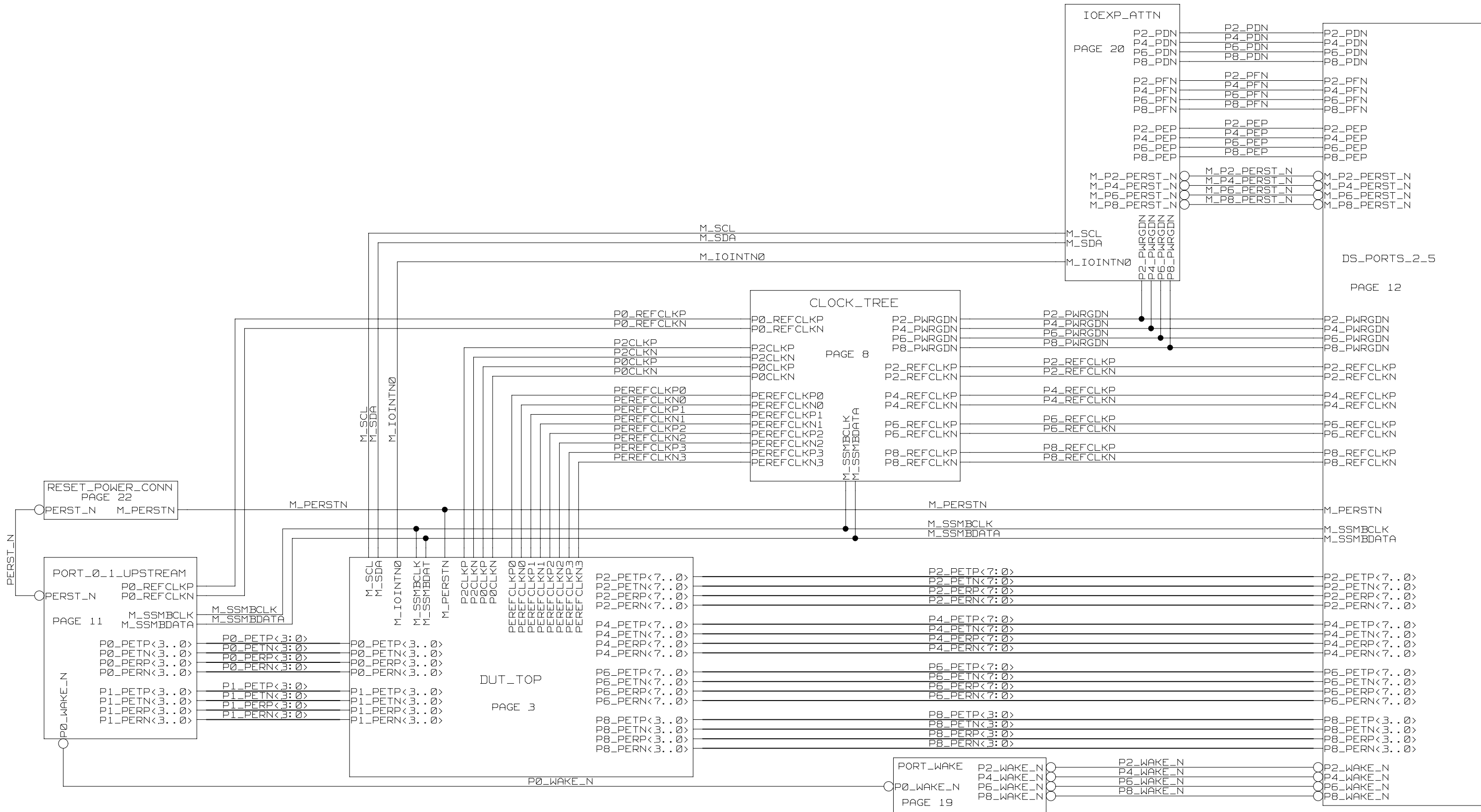
C

B

B

A

A



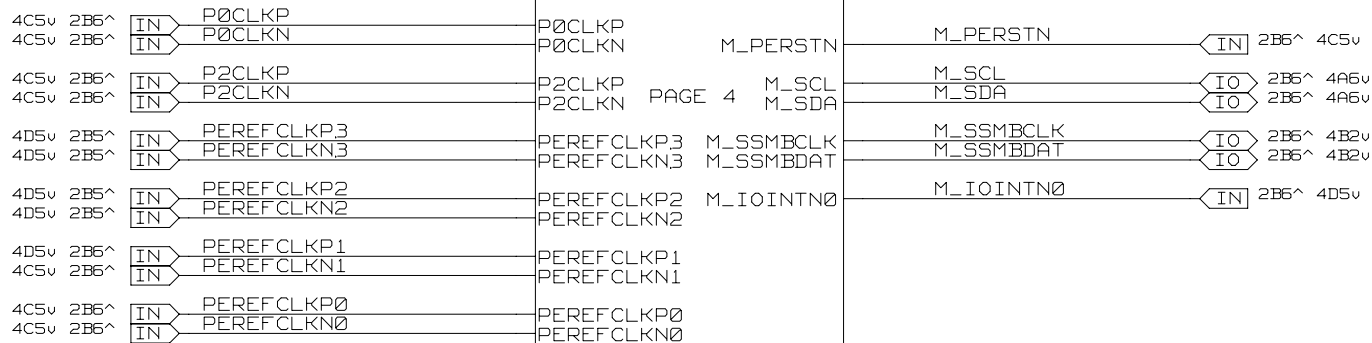
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TITLE 89HPES48H12G2 Eval Board

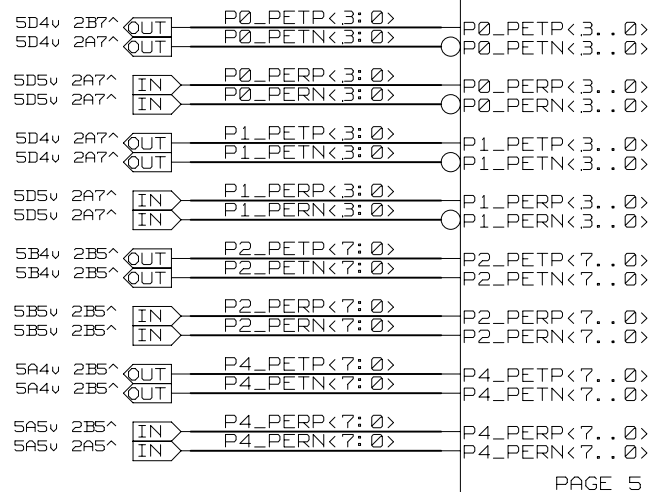
TOP LEVEL BLOCK DIAGRAM

SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Mon Aug 11 11:41:08 2008			SHEET 2 OF 23

DUT\_CONTROL\_MISC



DUT\_SERIAL\_PORTS

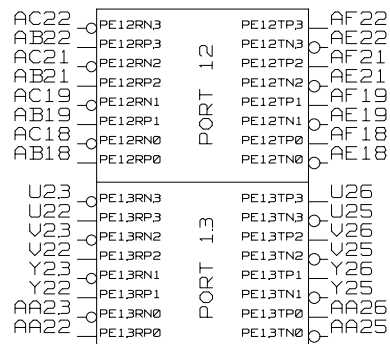
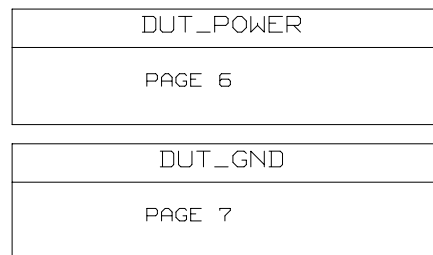
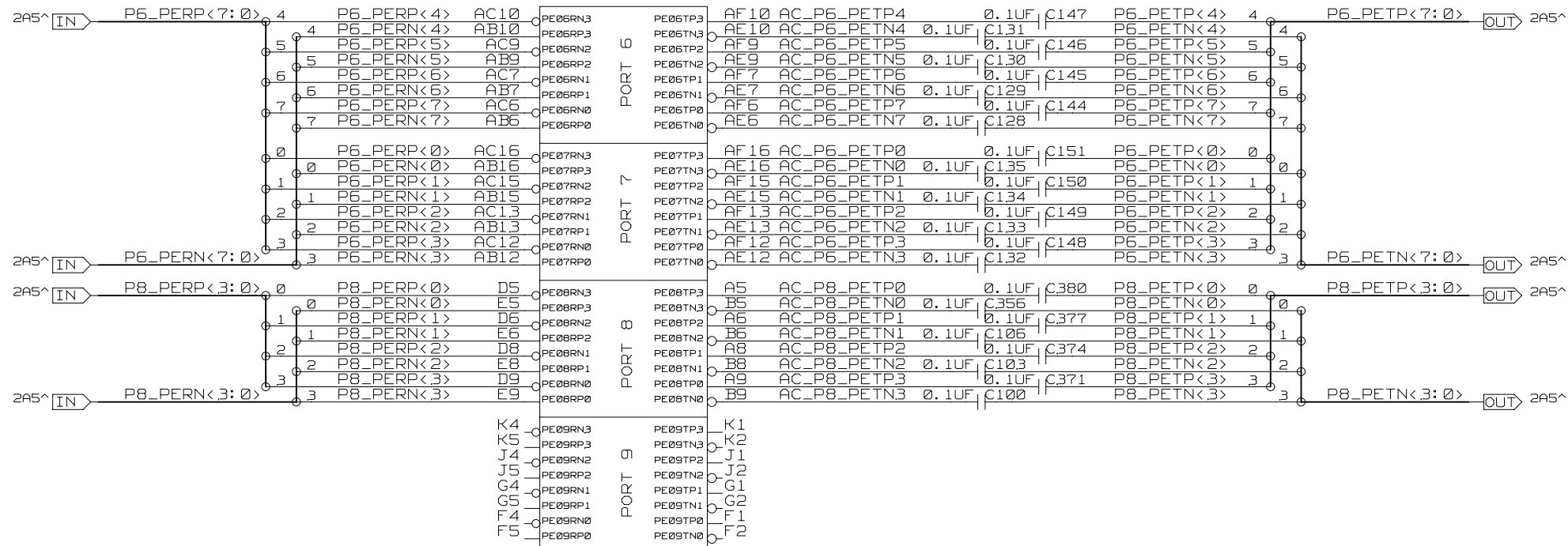



PAGE 5

LANE REVERSED FOR IMPROVED ROUTING DOWNSTREAM PORTS

ALL AC CAPS ARE TO BE PLACED AT THE ASSOCIATED CONNECTORS

LANE REVERSED FOR IMPROVED ROUTING





TITLE 89HPES48H12G2 Eval Board

**DUT TOP**

SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
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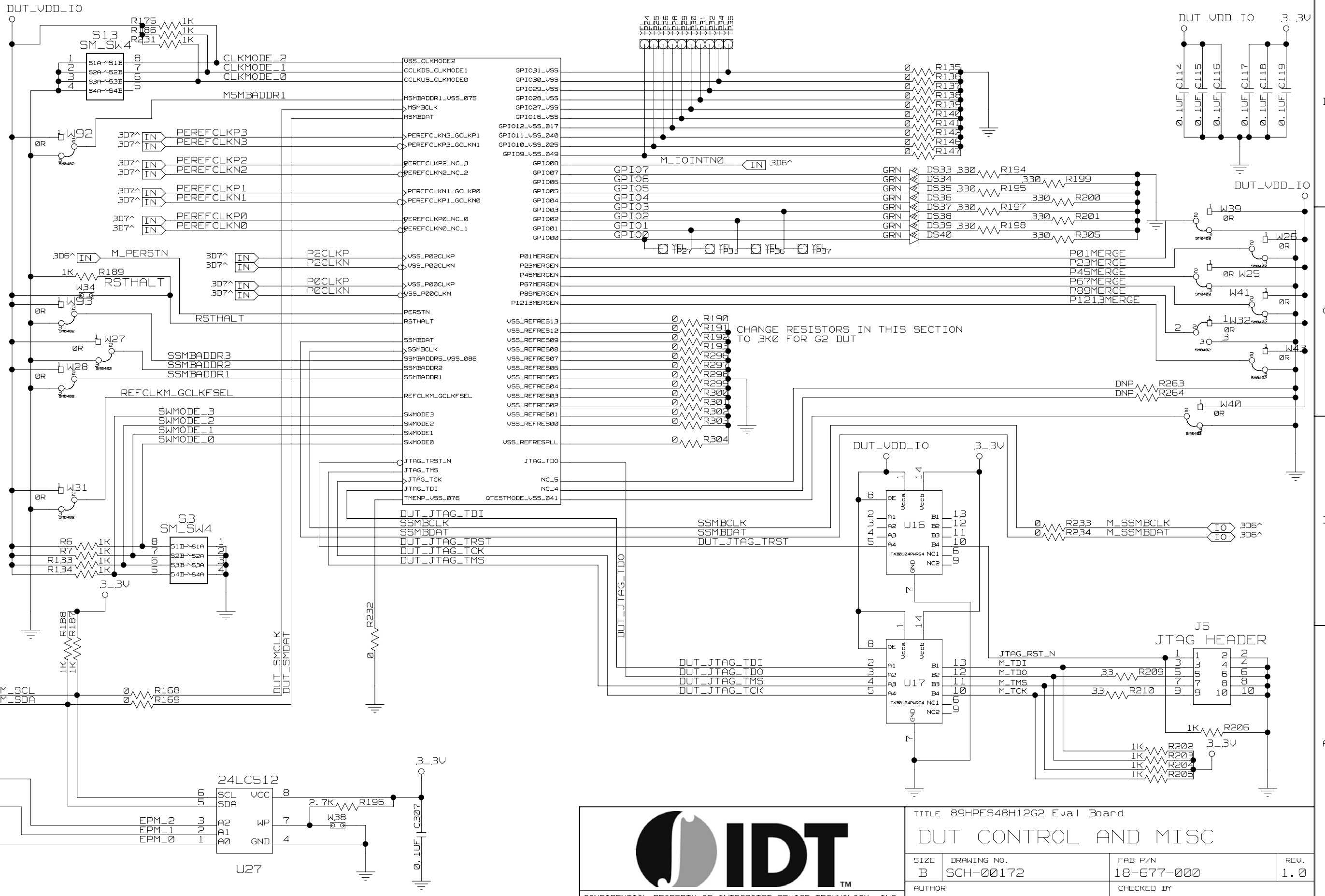
SWITCH S13  
POS DESCRIPTION

POS	DESCRIPTION
1	CLKMODE_2
2	CLKMODE_1
3	CLKMODE_0
4	SPARE

SILKSCREEN LABEL:

SWITCH S3  
POS DESCRIPTION

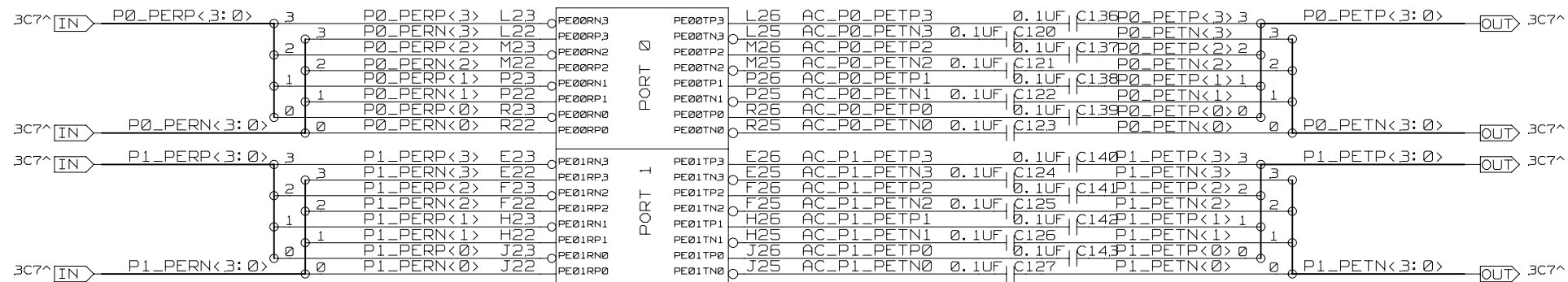
POS	DESCRIPTION
1	SWMODE_0
2	SWMODE_1
3	SWMODE_2
4	SWMODE_3



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TITLE 89HPES48H12G2 Eval Board			
DUT CONTROL AND MISC			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Wed Sep 24 16:24:13 2008			SHEET 4 OF 23

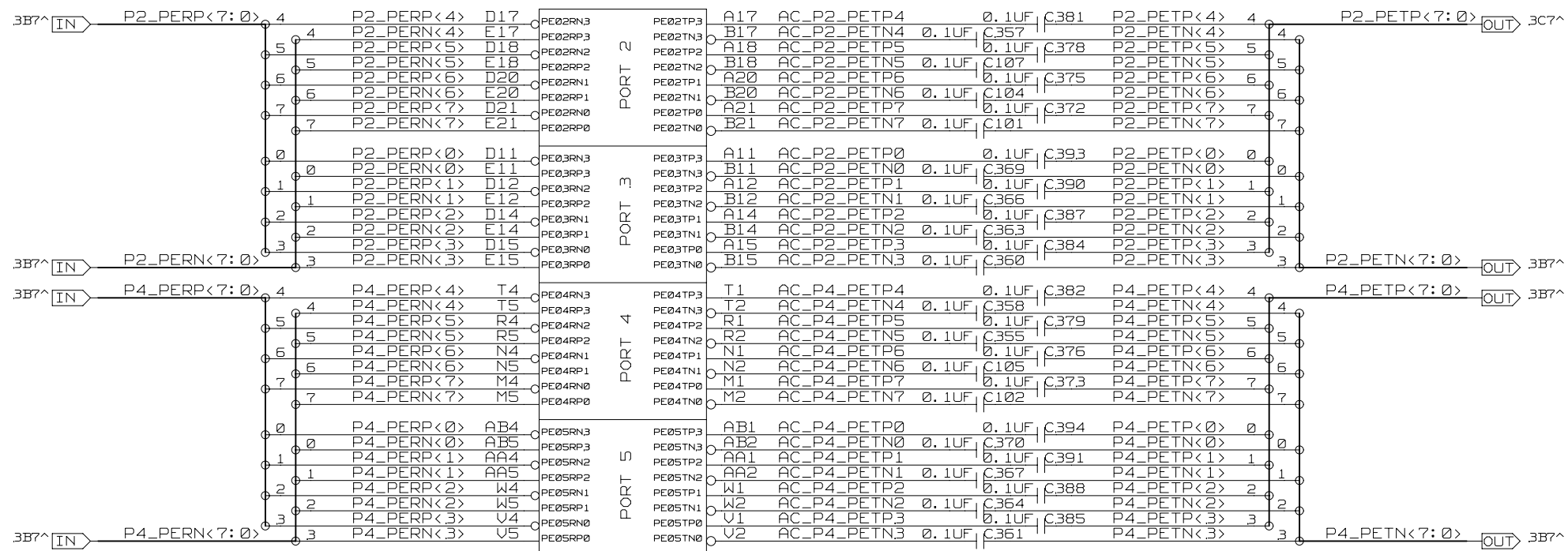
UPSTREAM PORTS



ALL AC CAPS ARE TO BE PLACED AT THE ASSOCIATED CONNECTORS

LANE REVERSED FOR IMPROVED ROUTING

LANE REVERSED FOR IMPROVED ROUTING



DOWNSTREAM PORTS



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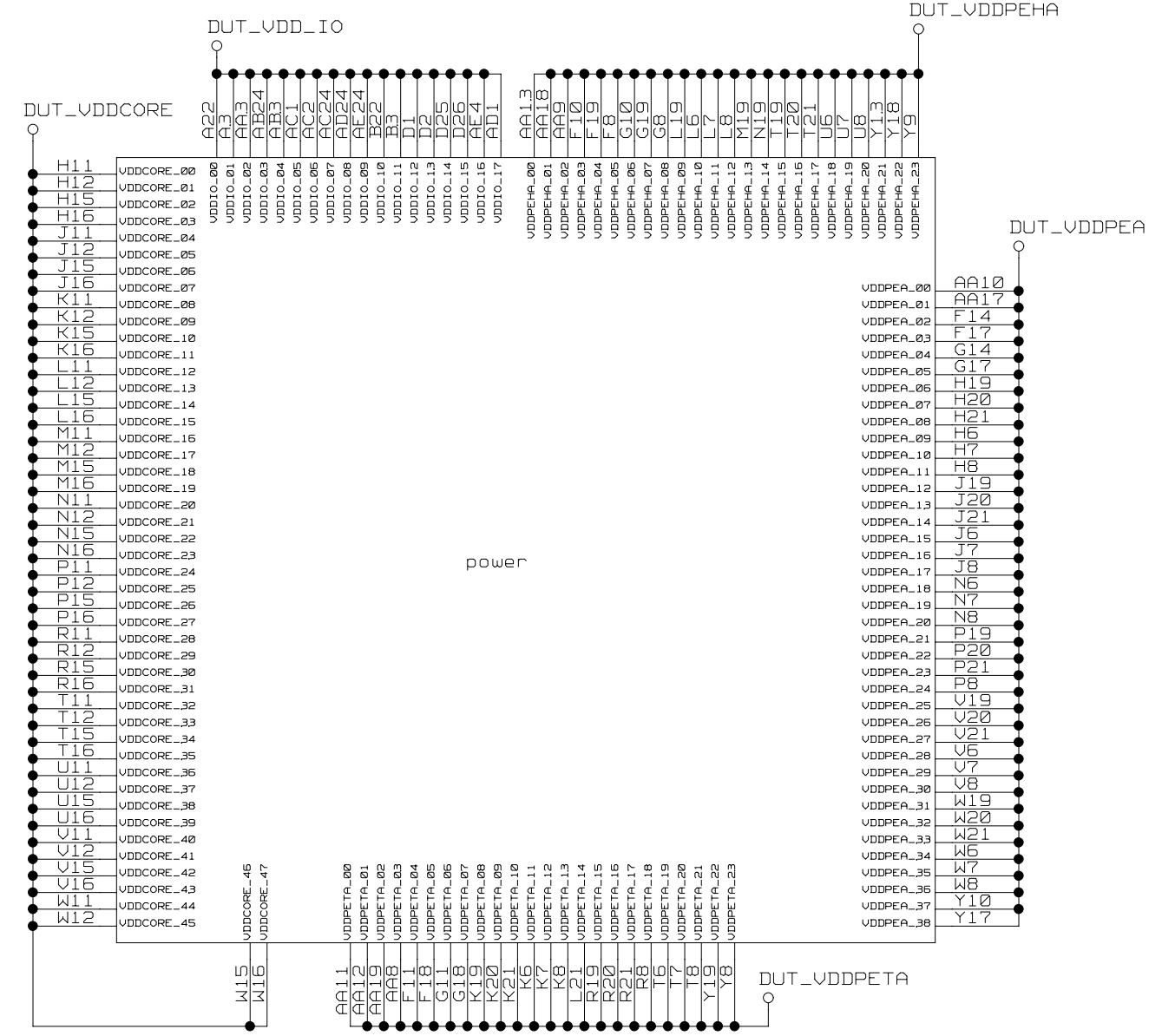
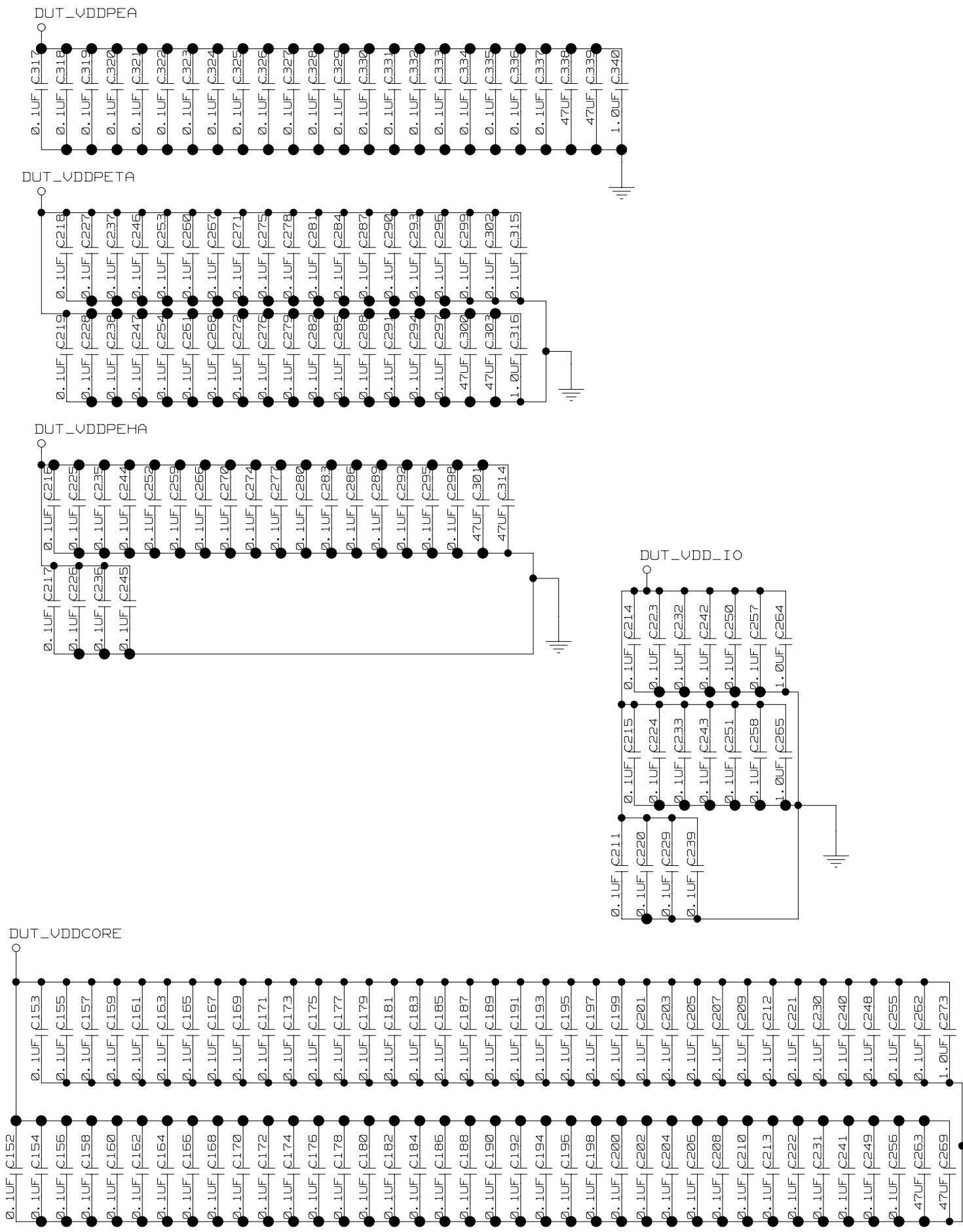
DUT SERIAL PORTS

SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0

AUTHOR	CHECKED BY
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DUT POWER SUPPLY			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Wed Sep 24 16:24:20 2008			SHEET 6 OF 23

D

C

B

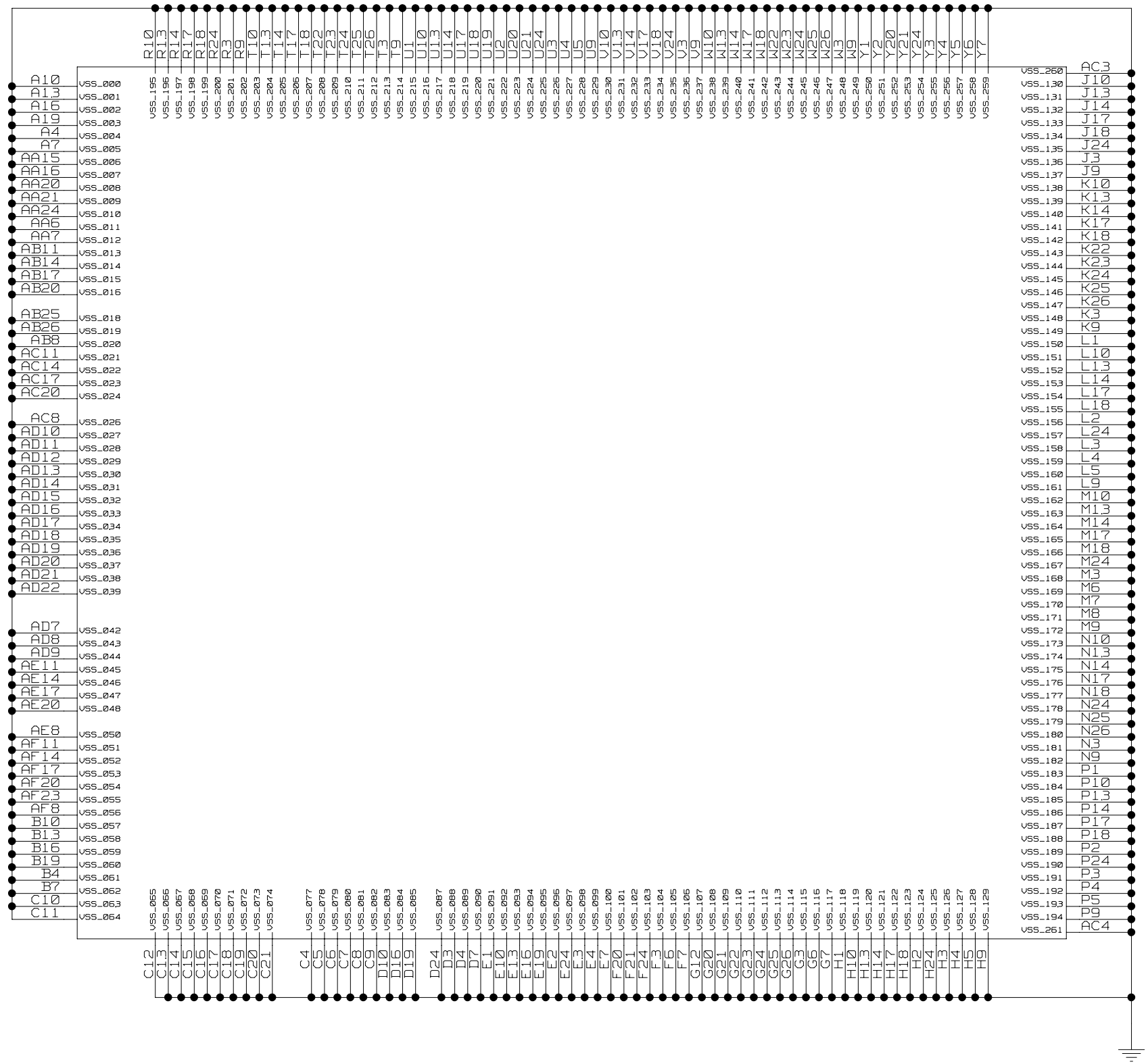
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D

C

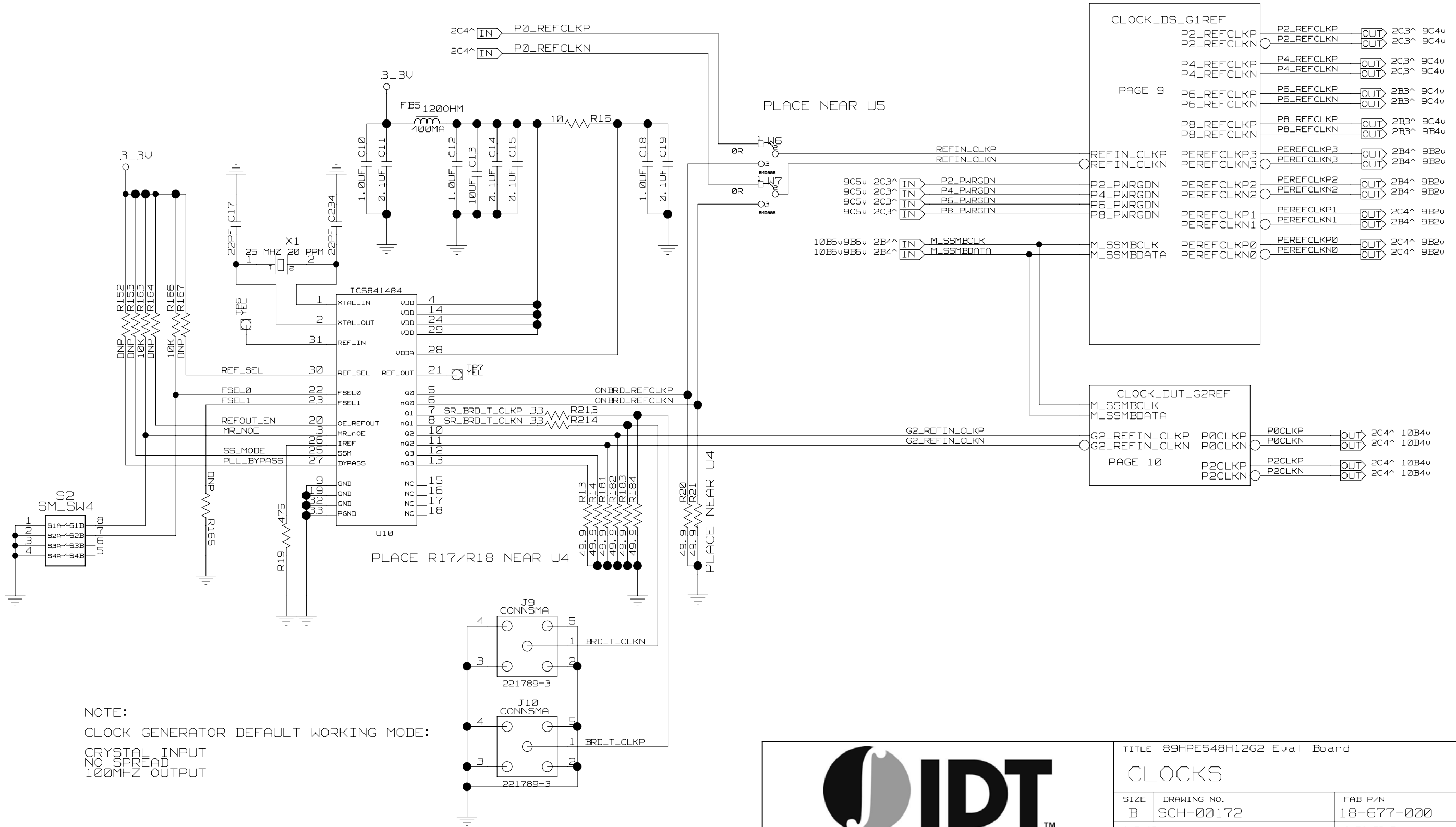
B

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				TITLE 89HPES48H12G2 Eval Board			
				DUT GROUND			
SIZE	DRAWING NO.	FAB P/N	REV.				
B	SCH-00172	18-677-000	1.0				
AUTHOR			CHECKED BY				
JHU			B. Le				
Wed Sep 24 16:24:34 2008				SHEET 7 OF 23			

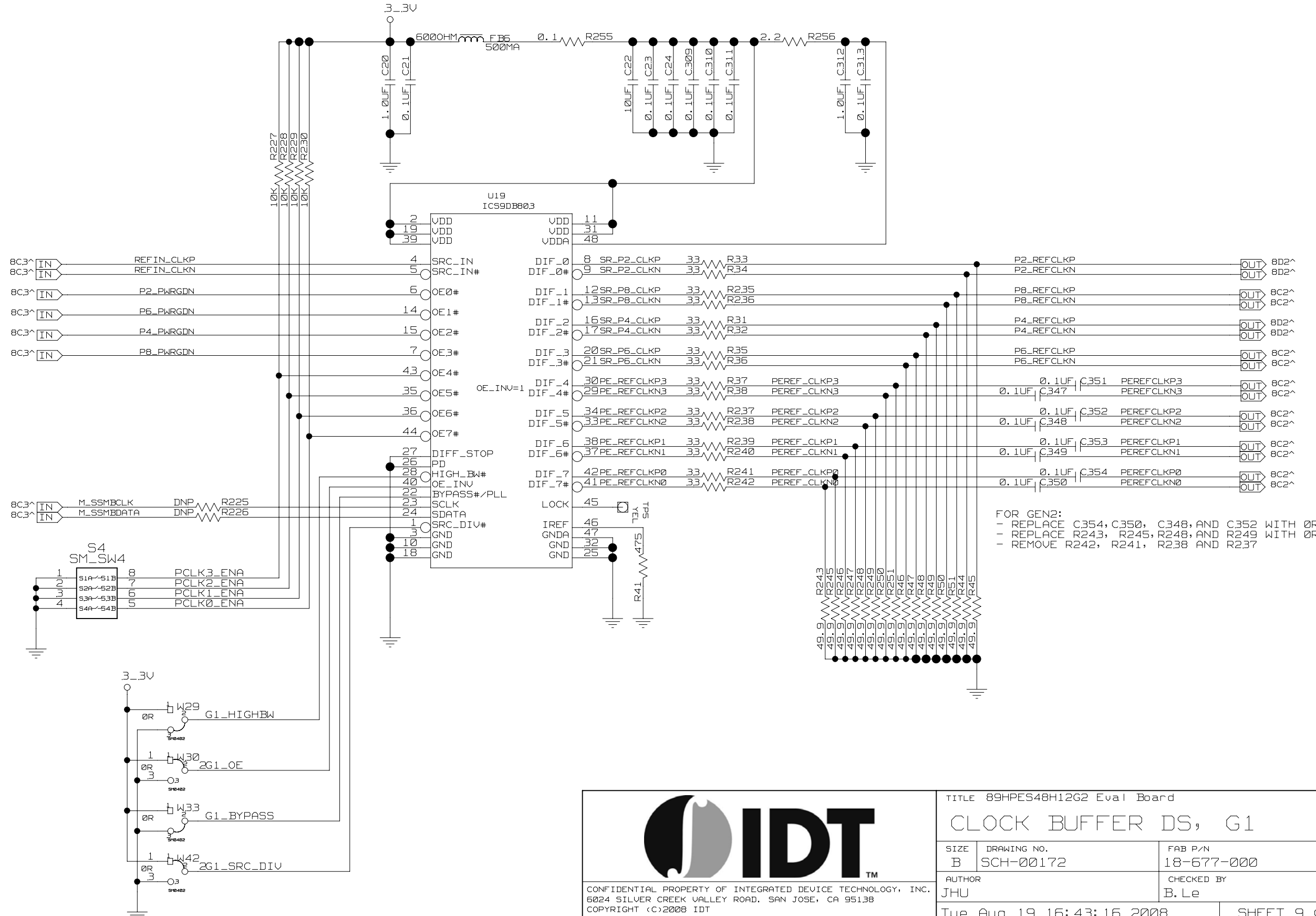
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NOTE:  
 CLOCK GENERATOR DEFAULT WORKING MODE:  
 CRYSTAL INPUT  
 NO SPREAD  
 100MHZ OUTPUT

		TITLE 89HPES48H12G2 Eval Board		
		CLOCKS		
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0	
AUTHOR JHU		CHECKED BY B. Le		
Tue Aug 19 16:43:10 2008			SHEET 8 OF 23	

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SILKSCREEN LABEL:

SWITCH S4  
POS DESCRIPTION

POS	DESCRIPTION
1	PCLK3_ENA
2	PCLK2_ENA
3	PCLK1_ENA
4	PCLK0_ENA

SILKSCREEN LABEL:

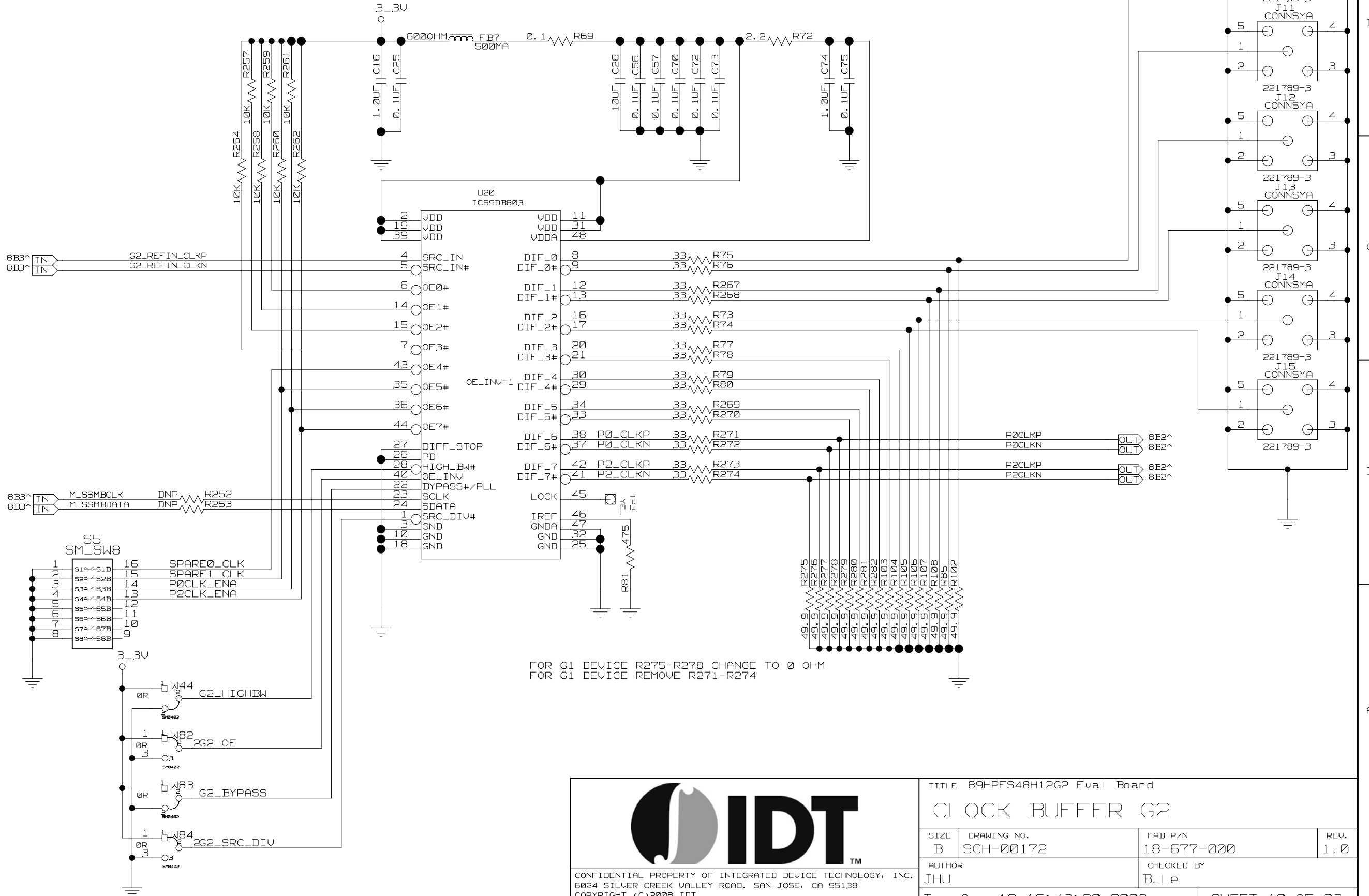
W	DESCRIPTION
W29	HIGHBW
W30	G1_OE
W33	BYPASS
W42	SRC_DIV

FOR GEN2:  
 - REPLACE C354, C350, C348, AND C352 WITH 0R  
 - REPLACE R243, R245, R248, AND R249 WITH 0R  
 - REMOVE R242, R241, R238 AND R237



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TITLE 89HPES48H12G2 Eval Board			
CLOCK BUFFER DS, G1			
SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
JHU		B. Le	
Tue Aug 19 16:43:16 2008			SHEET 9 OF 23



SILKSCREEN LABEL:

SWITCH S5

POS	DESCRIPTION
1	SPARECLK_0
2	SPARECLK_1
3	P0CLKENA
4	P2CLKENA
5	SPARE
6	SPARE
7	SPARE
8	SPARE

SILKSCREEN LABEL:

W44	HIGHBW
W82	G1_OE
W83	BYPASS
W84	SRC_DIV

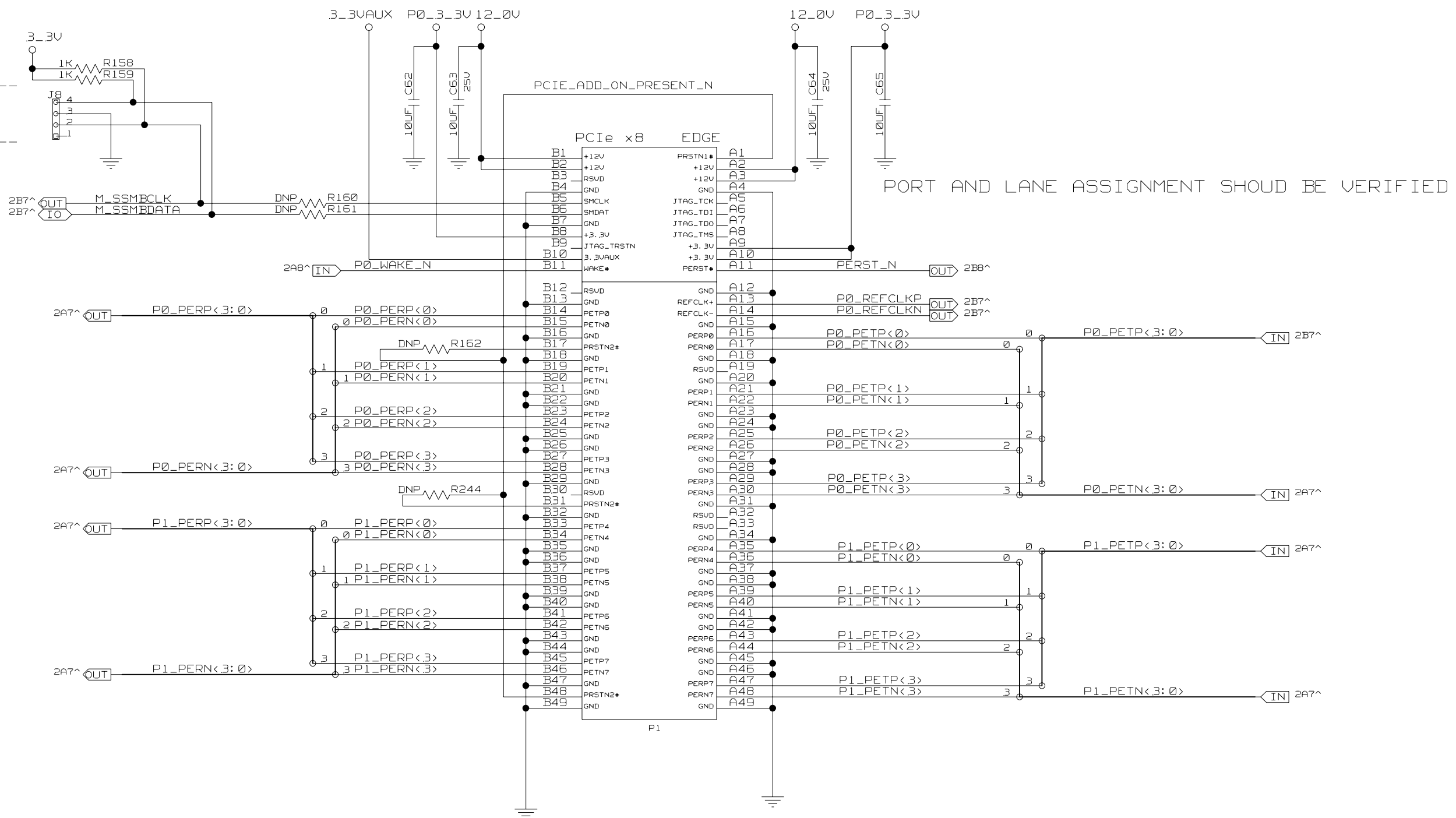
FOR G1 DEVICE R275-R278 CHANGE TO 0 OHM  
FOR G1 DEVICE REMOVE R271-R274

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TITLE 89HPES48H12G2 Eval Board			
CLOCK BUFFER G2			
SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
JHU		B. Le	
Tue Aug 19 16:43:20 2008			SHEET 10 OF 23

SILKSCREEN LABEL:

POS	DESCRIPTION
4	SMBDATA
3	GND
2	SMBCLK
1	NC



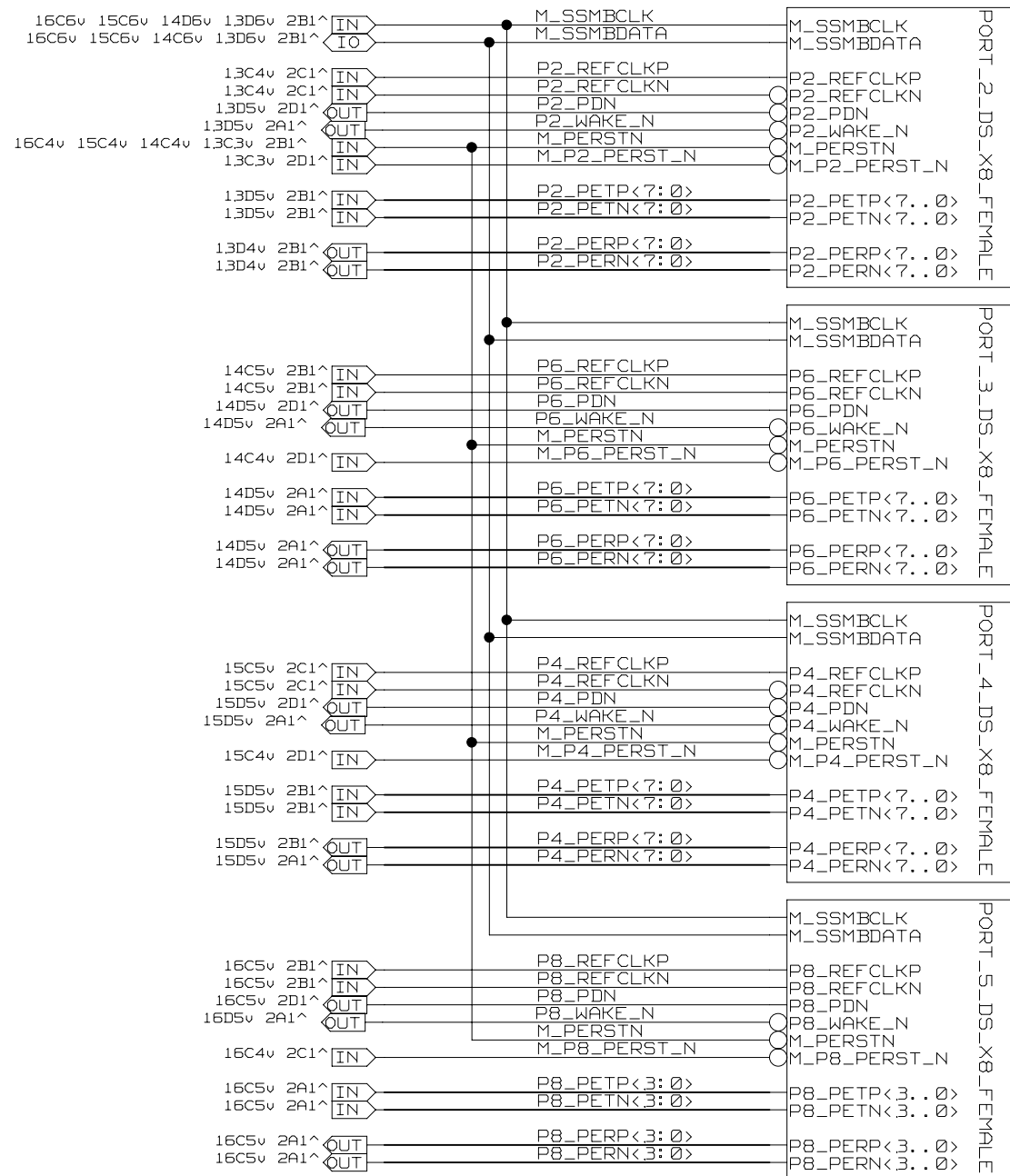
PORT AND LANE ASSIGNMENT SHOULD BE VERIFIED

SILKSCREEN LABEL:  
 CONECTOR P1  
 PORT 0 PCIE2 X8(8, 4, 2, 1)



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TITLE 89HPES48H12G2 Eval Board			
CONNECTOR EDGE US PCIE X8			
SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
JHU		B. Le	
Tue Aug 19 16:43:28 2008			SHEET 11 OF 23

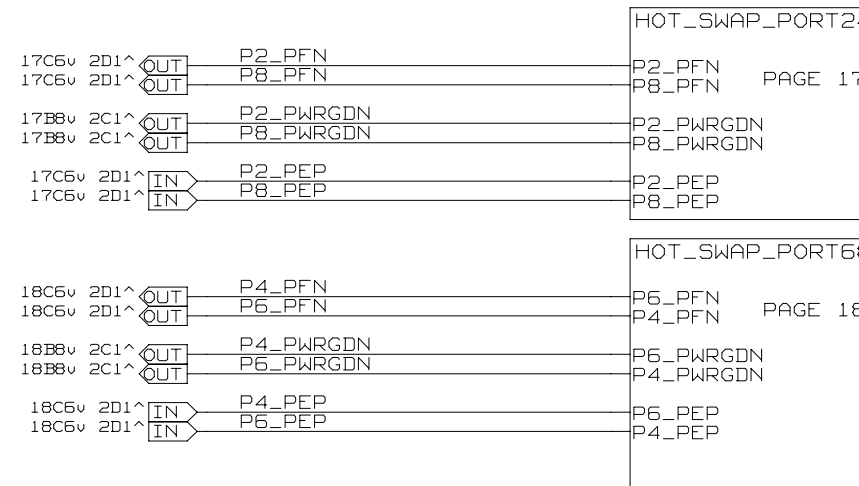


PAGE 13

PAGE 14

PAGE 15

PAGE 16



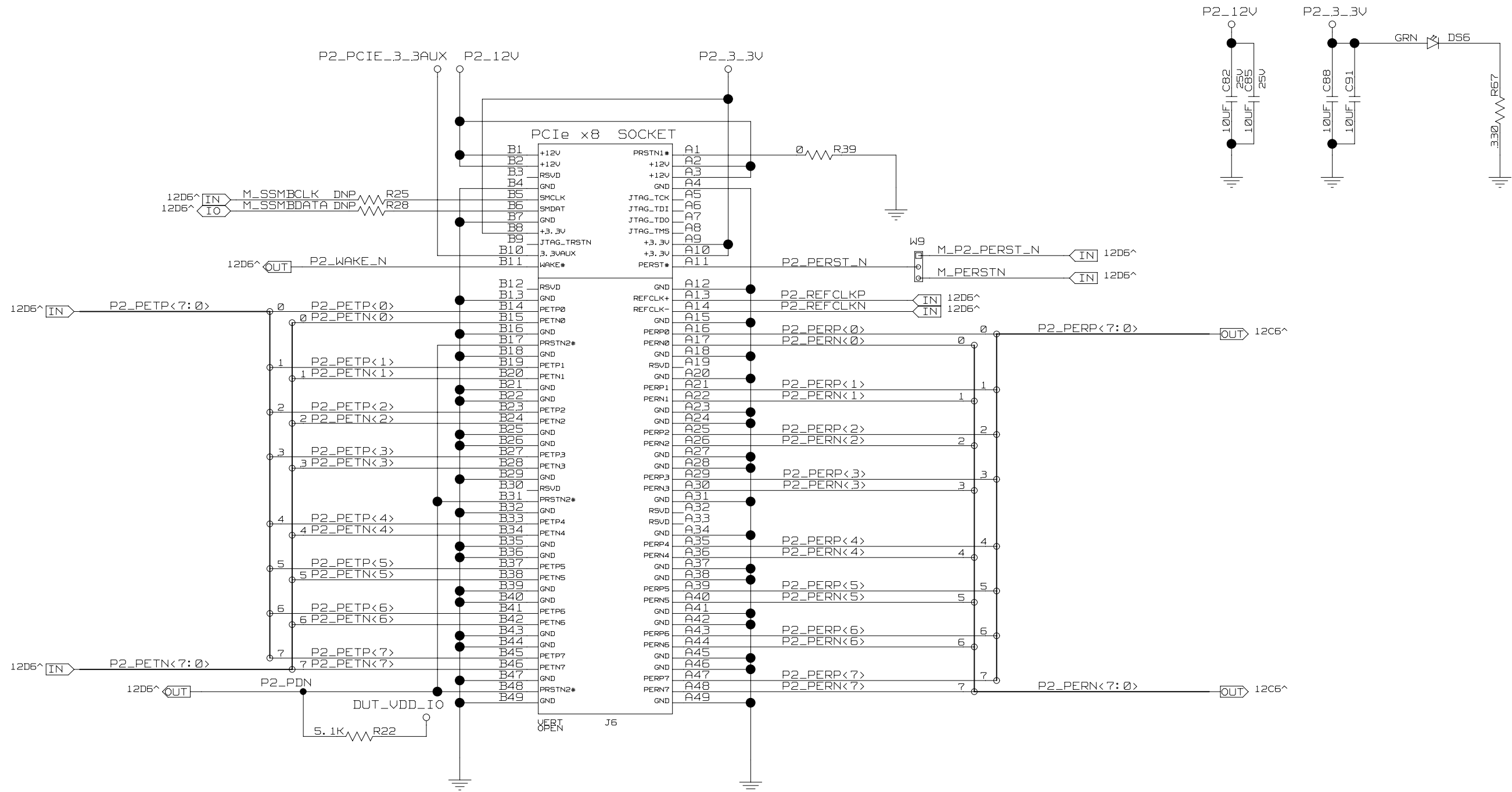
PAGE 17

PAGE 18



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TITLE 89HPES48H12G2 Eval Board			
PCIE DOWNSTREAM PORTS 2-5			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Wed Aug 13 23:28:50 2008			SHEET 12 OF 23



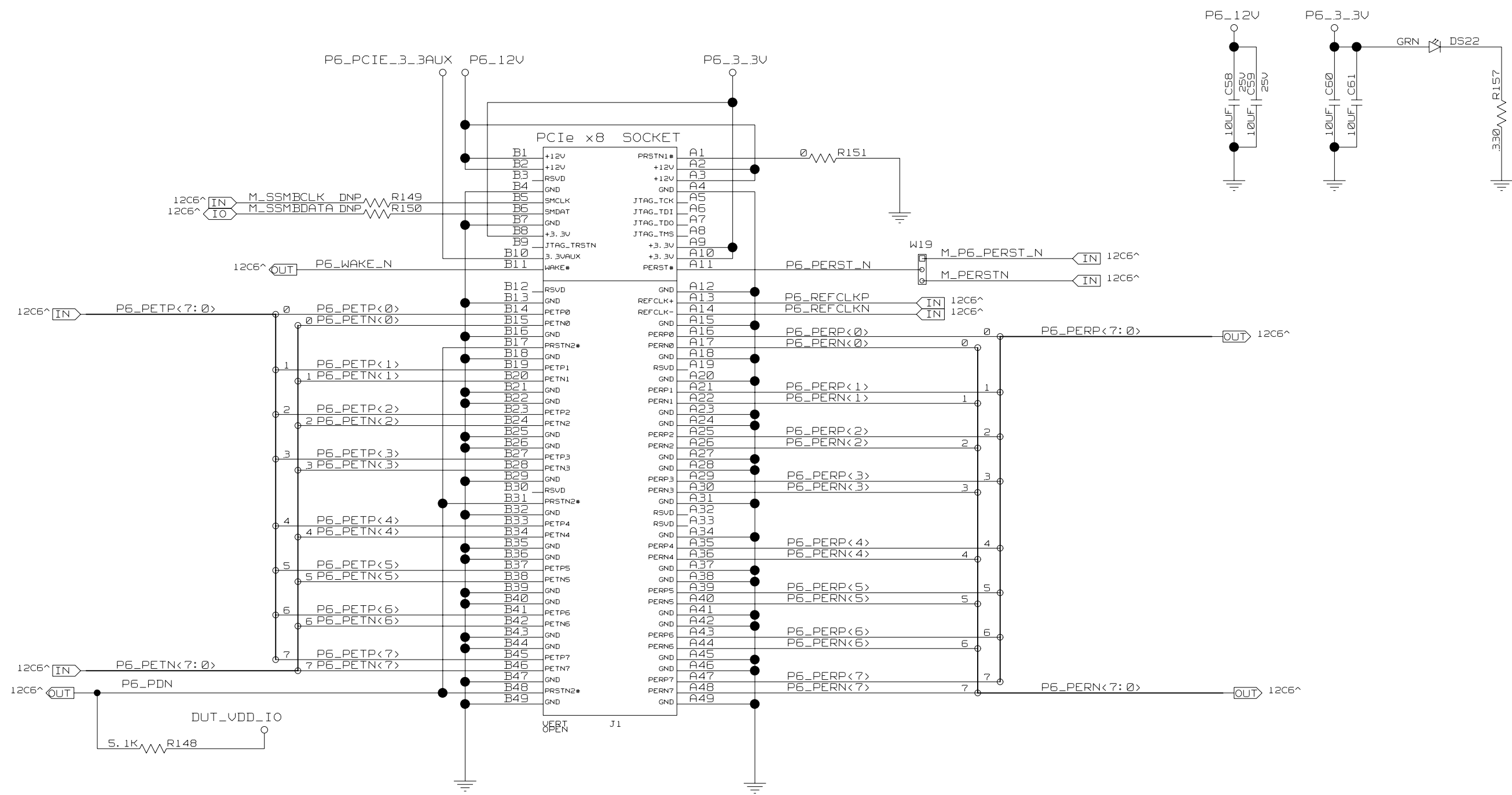
SILKSCREEN LABEL:  
 CONECTOR J6  
 SLOT 2 PCIE2 X8(8, 4, 2, 1)




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TITLE 89HPES48H12G2 Eval Board			
PORT 2 PCIE X8 CONNECTOR			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:44:21 2008			SHEET 13 OF 23

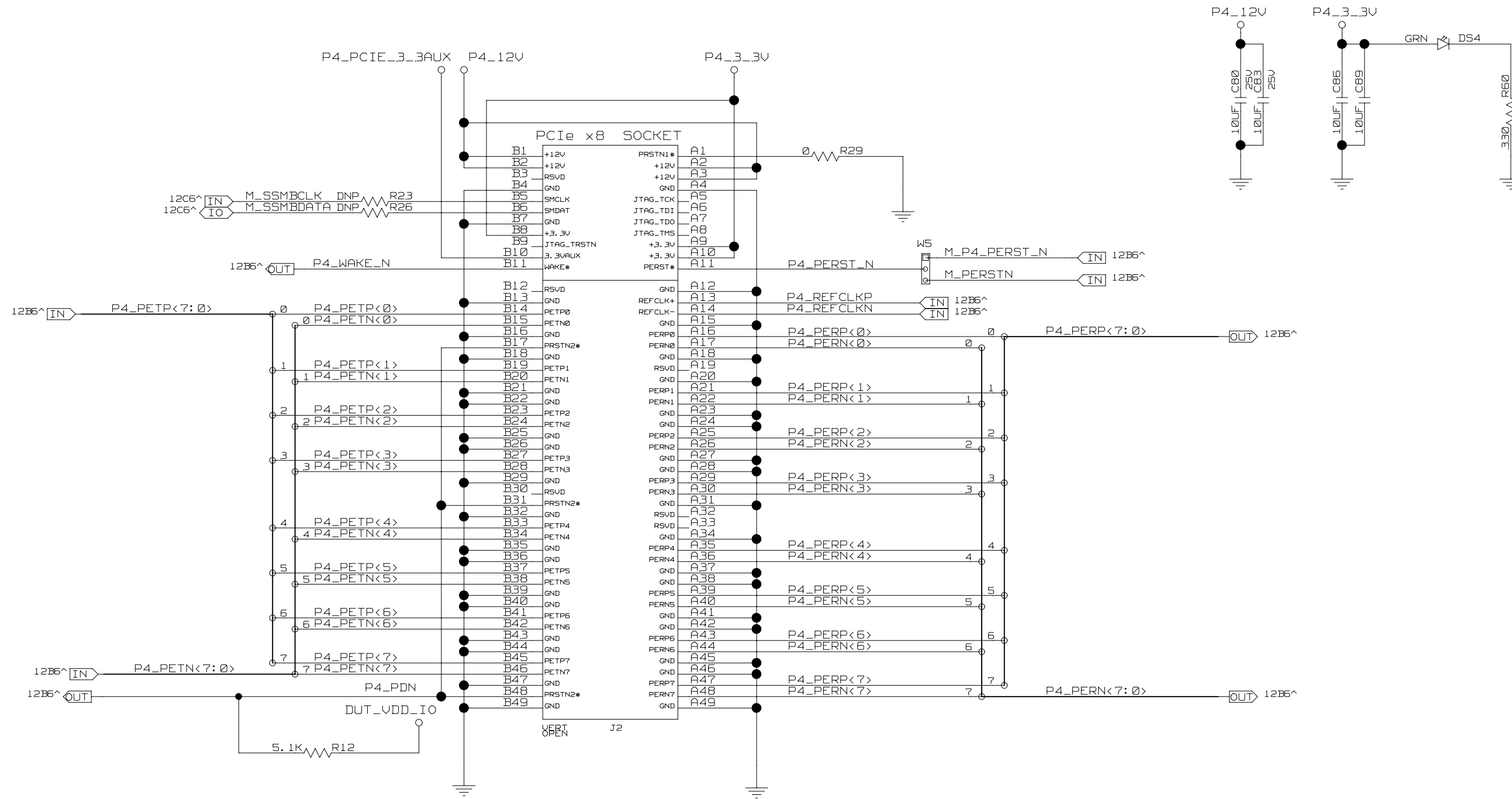




SILKSCREEN LABEL:  
 CONECTOR J1  
 SLOT 6 PCIE2 X8(8, 4, 2, 1)

		TITLE 89HPES48H12G2 Eval Board		
		PORT 6 PCIE X8 CONNECTOR		
SIZE	DRAWING NO.	FAB P/N	REV.	
B	SCH-00172	18-677-000	1.0	
AUTHOR		CHECKED BY		
JHU		B. Le		
Tue Aug 19 16:43:54 2008		SHEET 14 OF 23		

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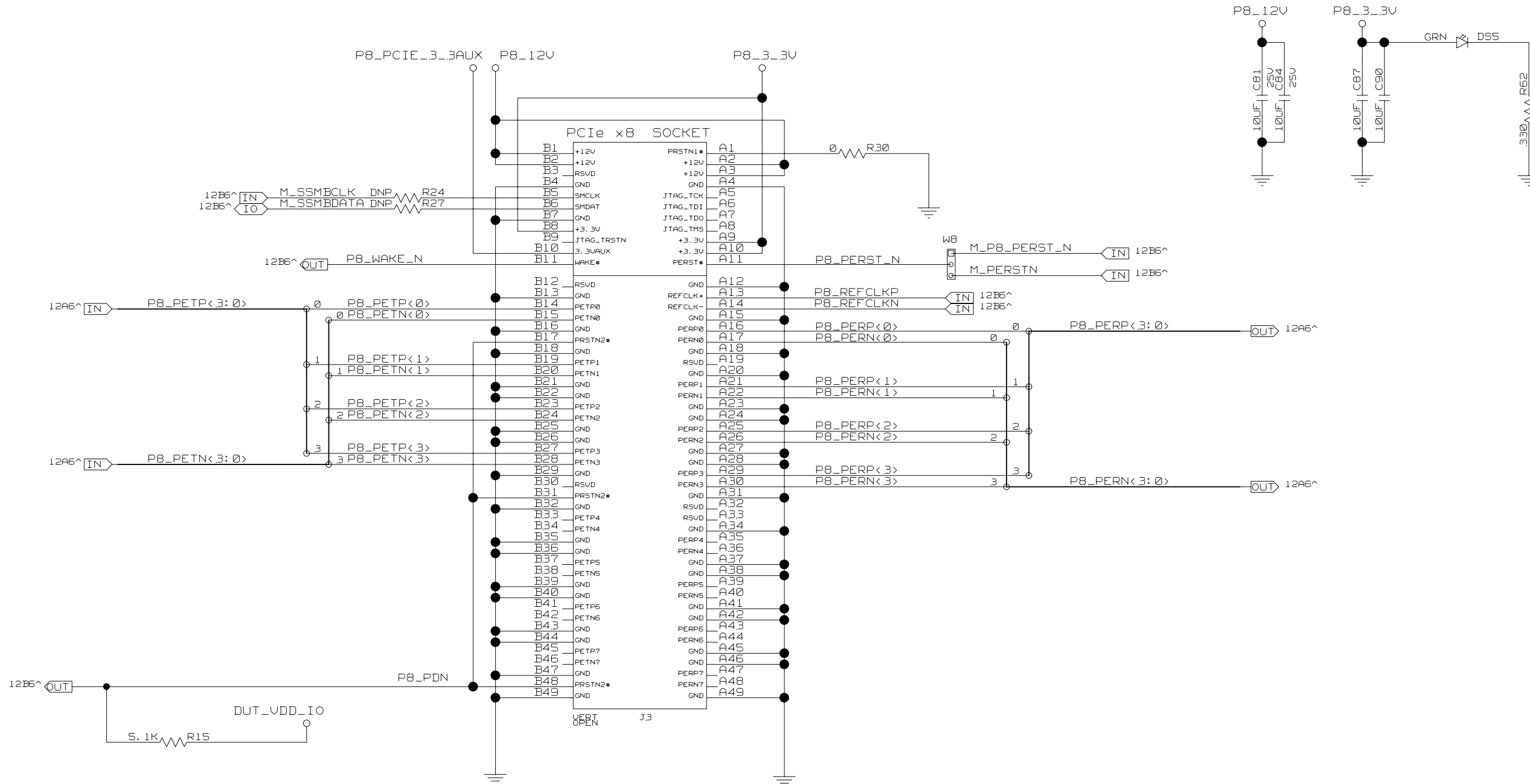


SILKSCREEN LABEL:  
 CONECTOR J2  
 SLOTT 4 PCIE2 X8<8, 4, 2, 1>



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TITLE 89HPES48H12G2 Eval Board			
PORT 4 PCIE X8 CONNECTOR			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:44:03 2008			SHEET 15 OF 23



SILKSCREEN LABEL:  
 CONECTOR J3  
 SLOT 8 PCIE2 X8(4, 2, 1)



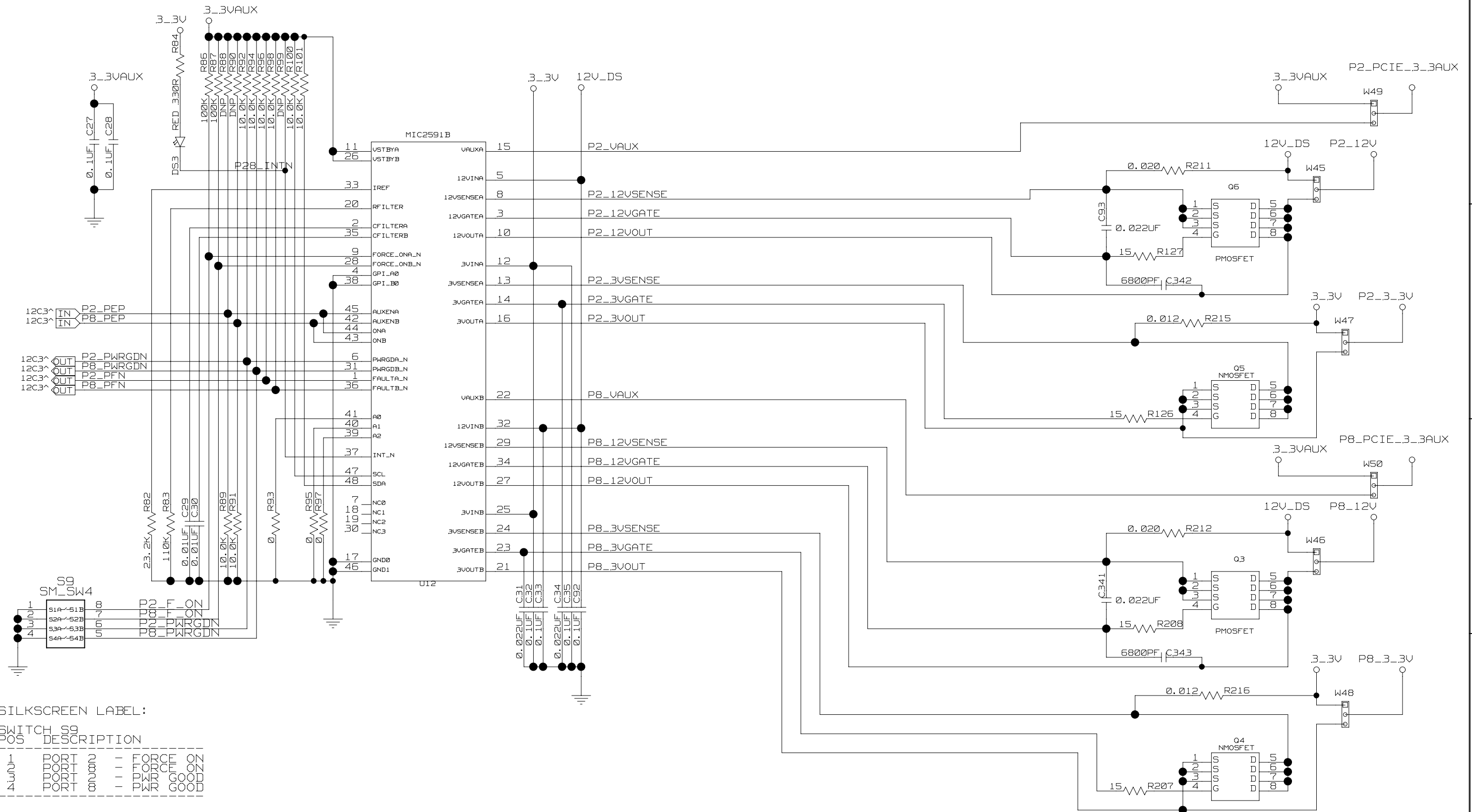
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TITLE 89HPES48H12G2 Eval Board  
 PORT 8 PCIE X8 CONNECTOR

SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
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AUTHOR JHU	CHECKED BY B. Le
---------------	---------------------

Tue Aug 19 16:44:06 2008 SHEET 16 OF 23



SILKSCREEN LABEL:

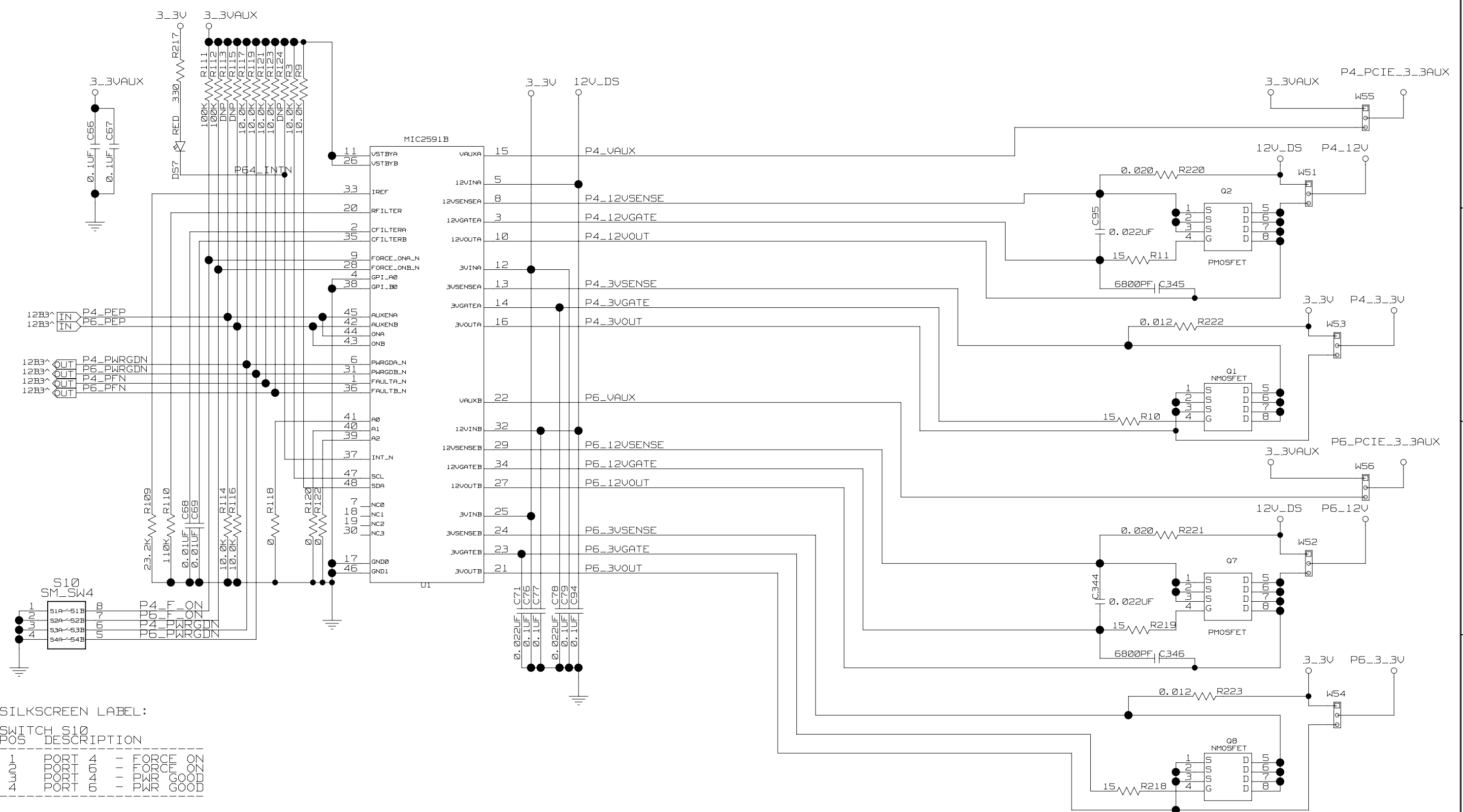
POS	DESCRIPTION
1	PORT 1 FOR ON
2	PORT 2 FOR ON
3	PORT 3 FOR ON
4	PORT 4 FOR ON



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TITLE 89HPES48H12G2 Eval Board  
**HOT SWAP PORT 2, 8**

SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:43:59 2008			SHEET 17 OF 23



SILKSCREEN LABEL:

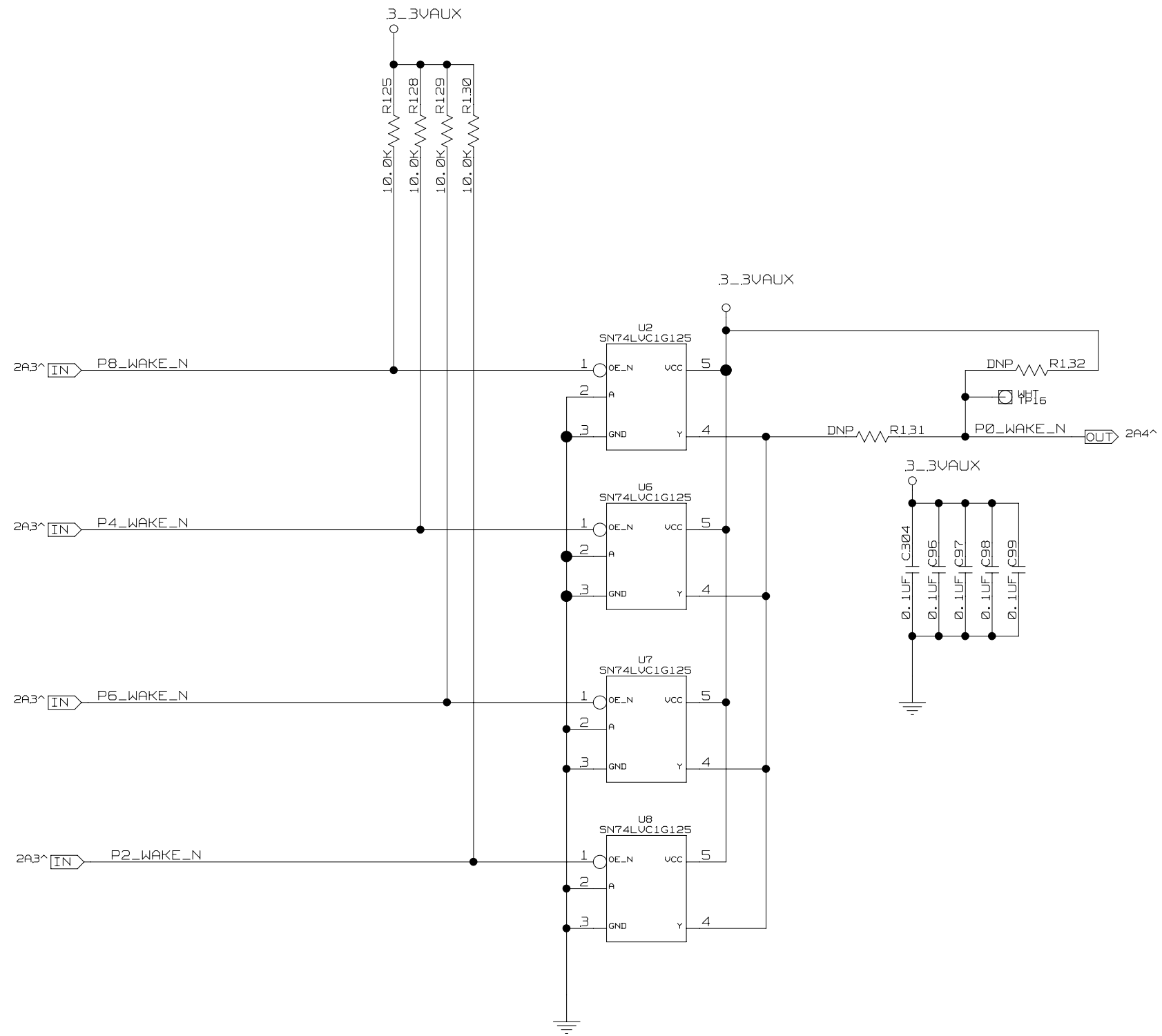
POS	DESCRIPTION
1	PORT 4 - FOR CFF ON
2	PORT 4 - FOR CFF ON
3	PORT 4 - PWR GOOD
4	PORT 4 - PWR GOOD



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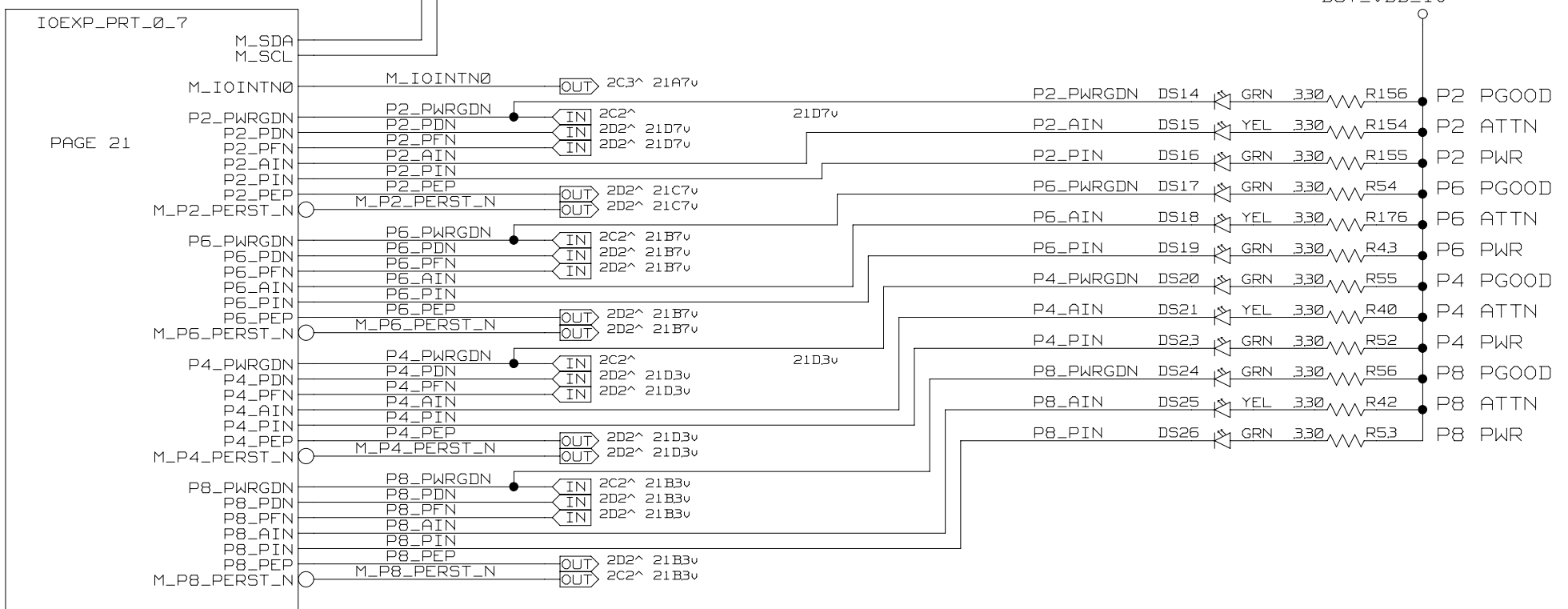
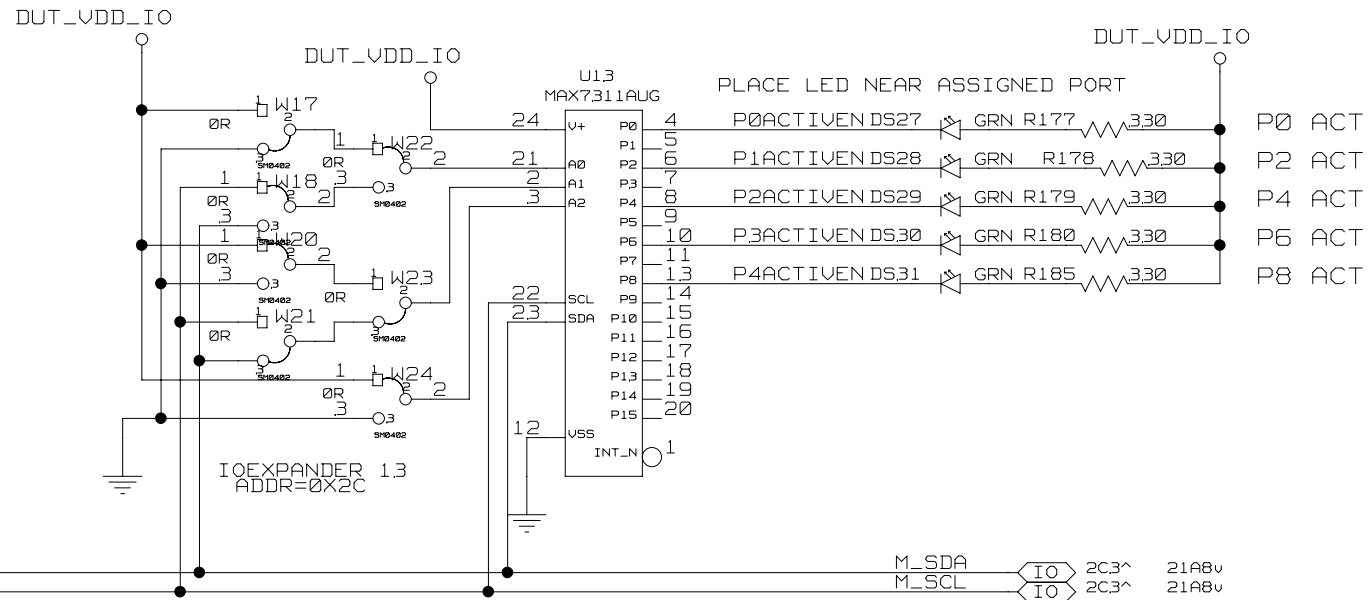
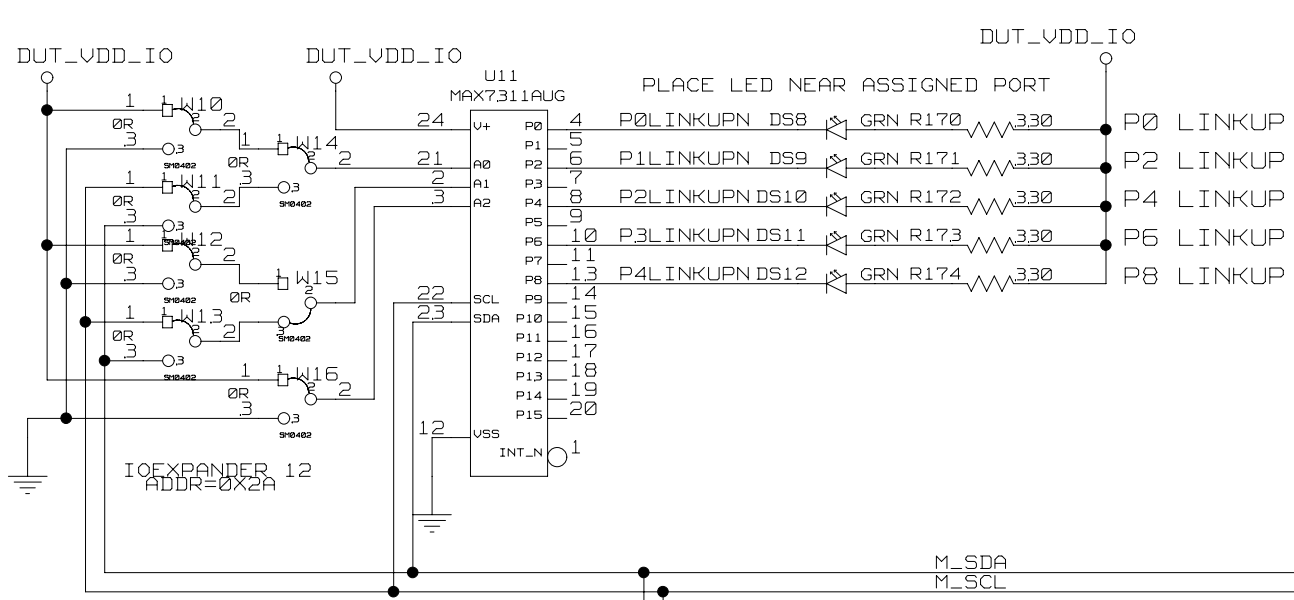
TITLE 89HPES48H12G2 Eval Board  
**HOT SWAP PORT 6, 4**

SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:44:13 2008			SHEET 18 OF 23



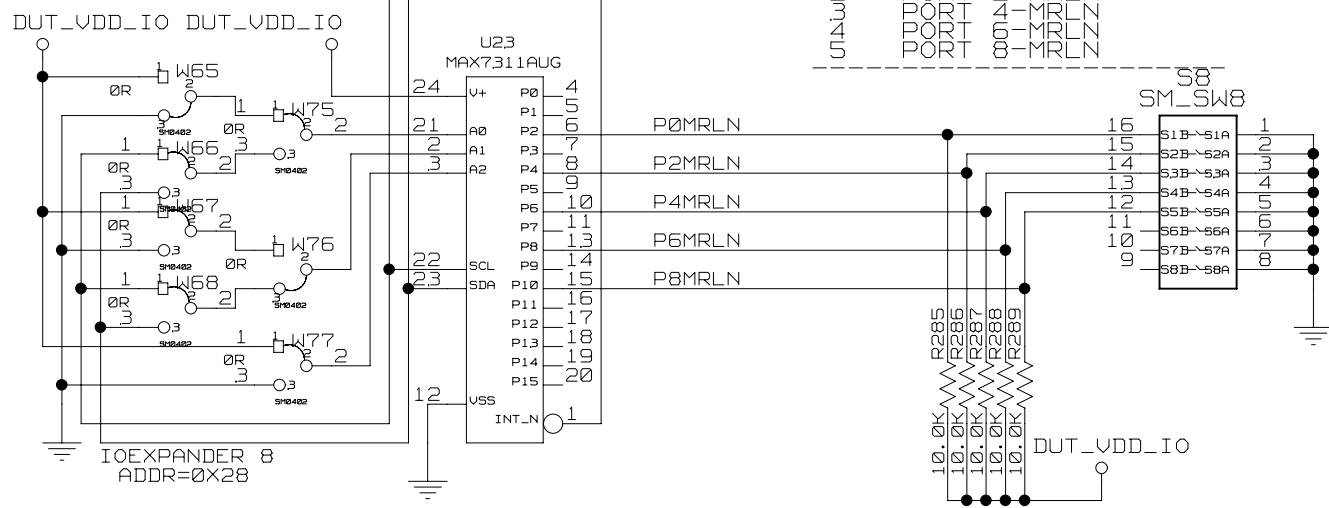
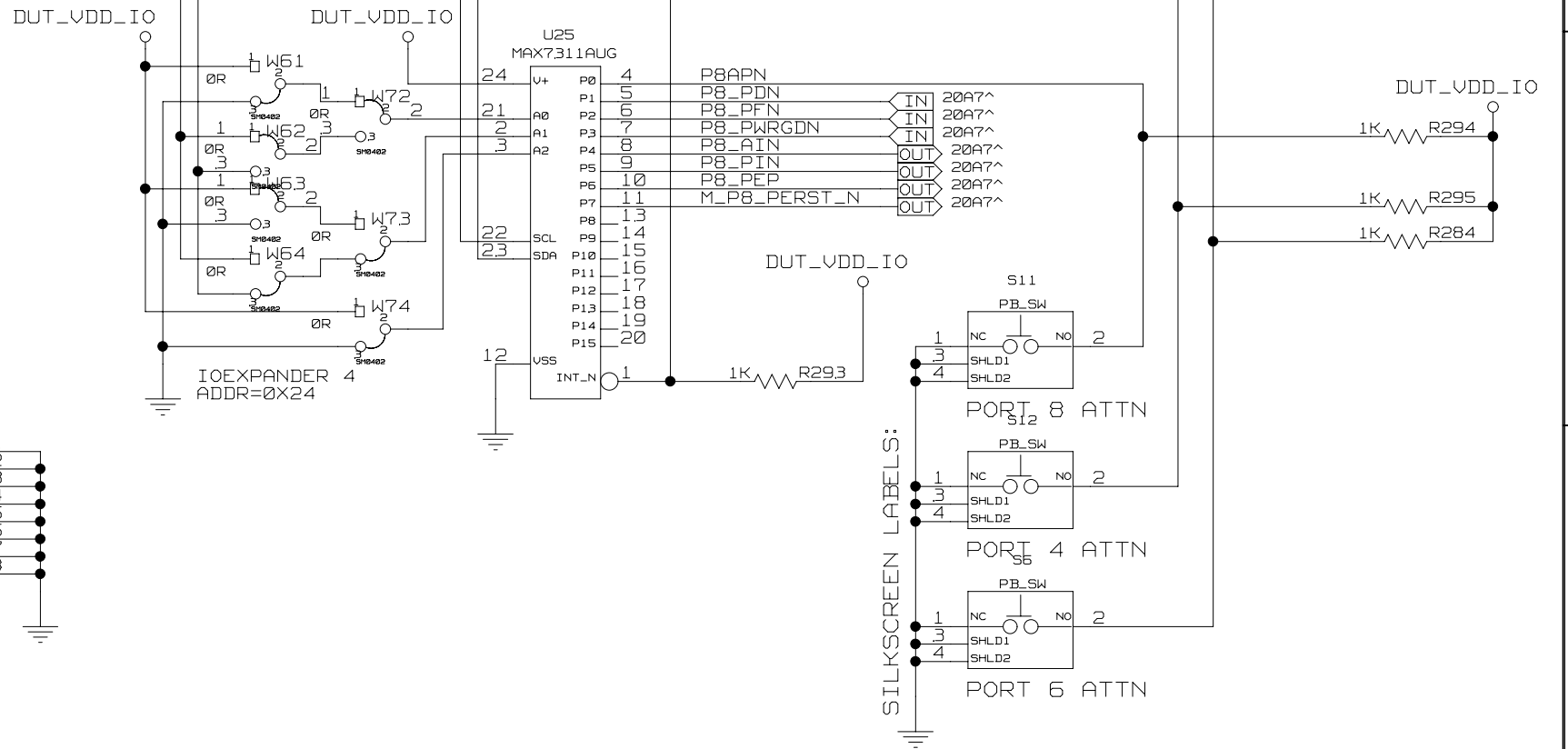
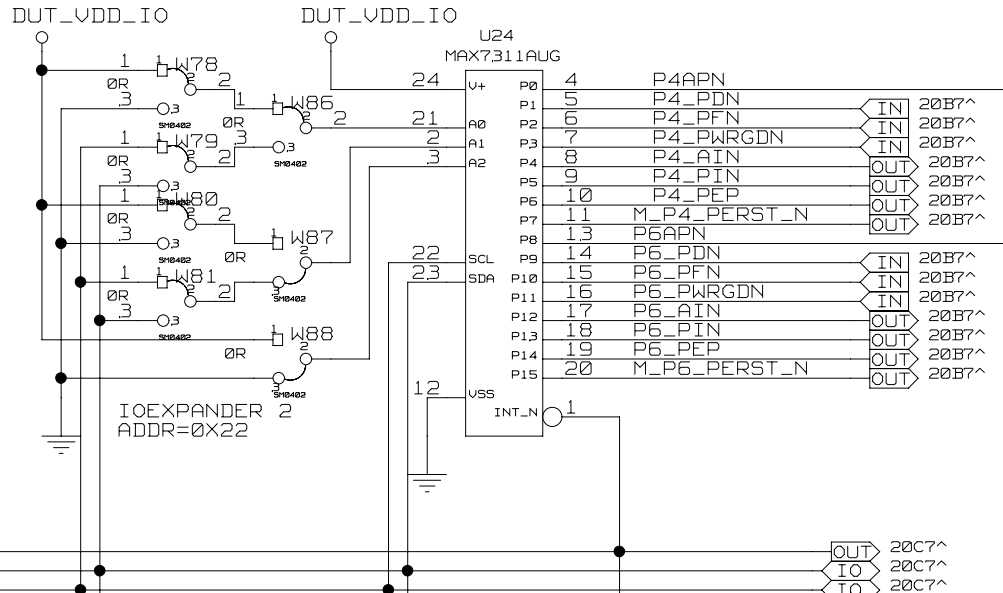
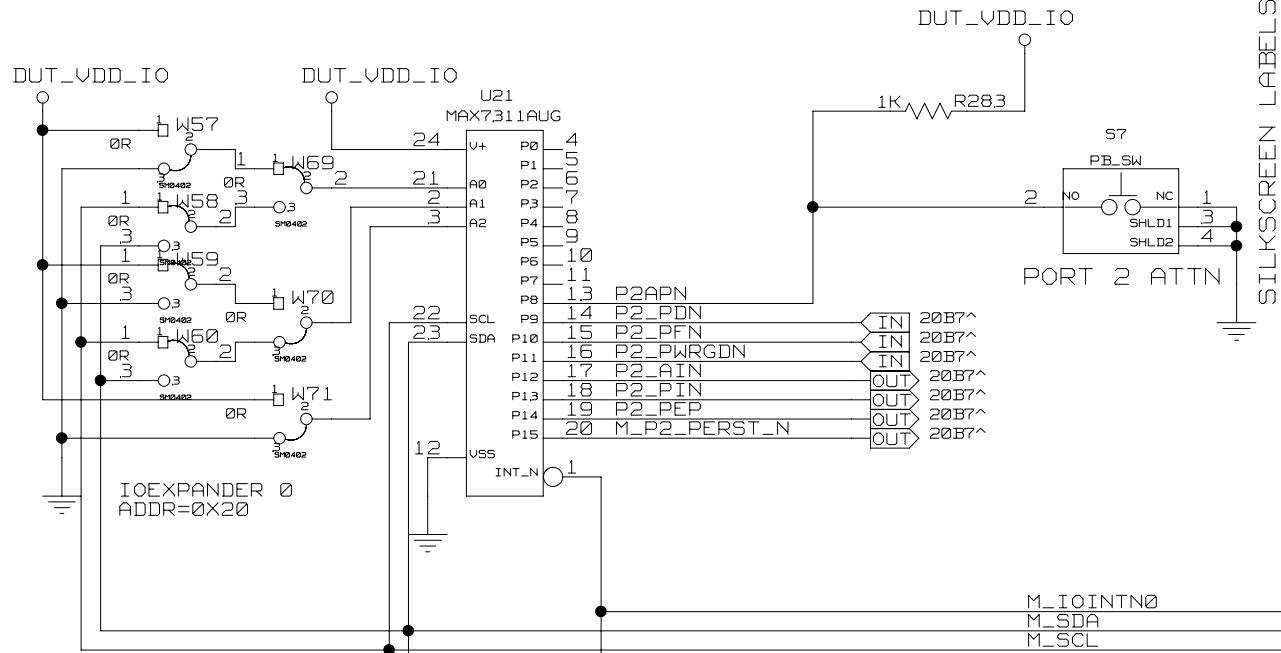
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TITLE 89HPES48H12G2 Eval Board			
PORT WAKE BUFFER			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:43:31 2008			SHEET 19 OF 23



	TITLE 89HPES48H12G2 Eval Board		
	IO EXP, WAKE, ATTN BUTTONS		
SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
JHU		B. Le	
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SILKSCREEN LABEL:  
SWITCH S8

POS	DESCRIPTION
1	PORT 0-MRLN
2	PORT 2-MRLN
3	PORT 4-MRLN
4	PORT 6-MRLN
5	PORT 8-MRLN
6	PORT 0-MRLN

TITLE 89HPES48H12G2 Eval Board

I/O EXPANDER 0-4

SIZE	DRAWING NO.	FAB P/N	REV.
B	SCH-00172	18-677-000	1.0
AUTHOR		CHECKED BY	
JHU		B. Le	
Tue Aug 19 16:43:26 2008			SHEET 21 OF 23

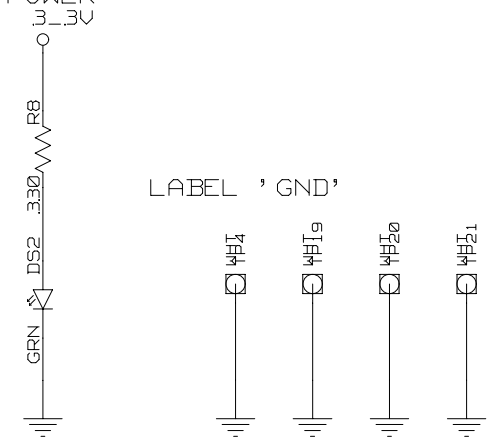
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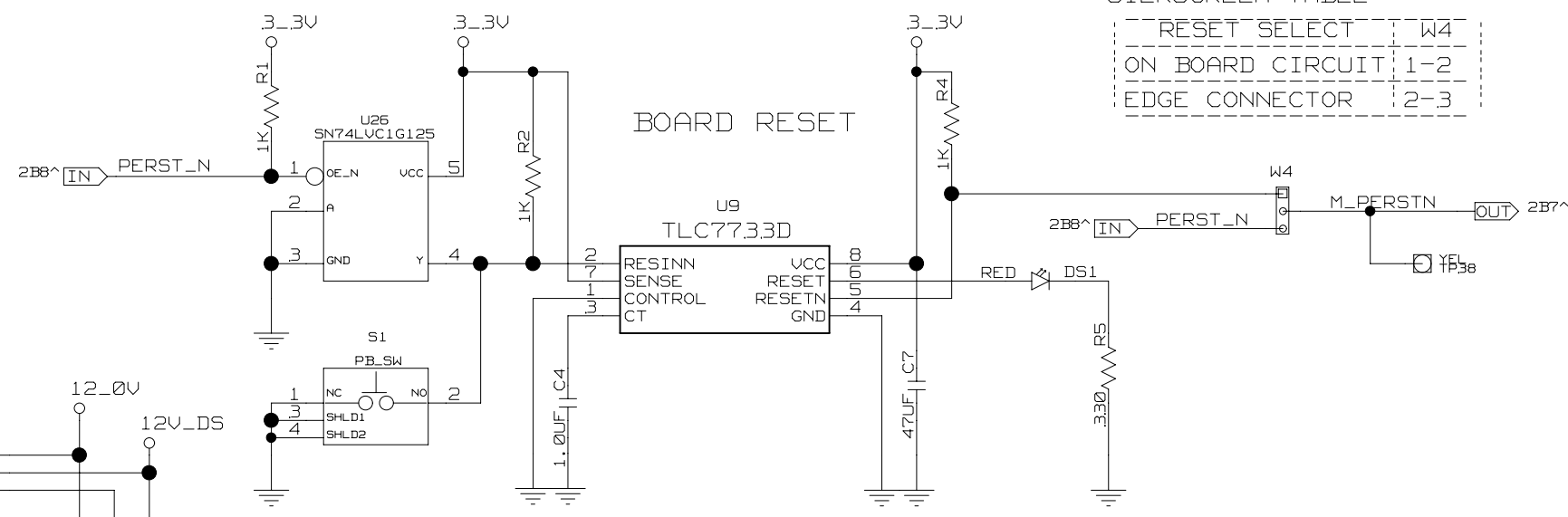
SILKSCREEN TABLE

RESET SELECT	W4
ON BOARD CIRCUIT	1-2
EDGE CONNECTOR	2-3

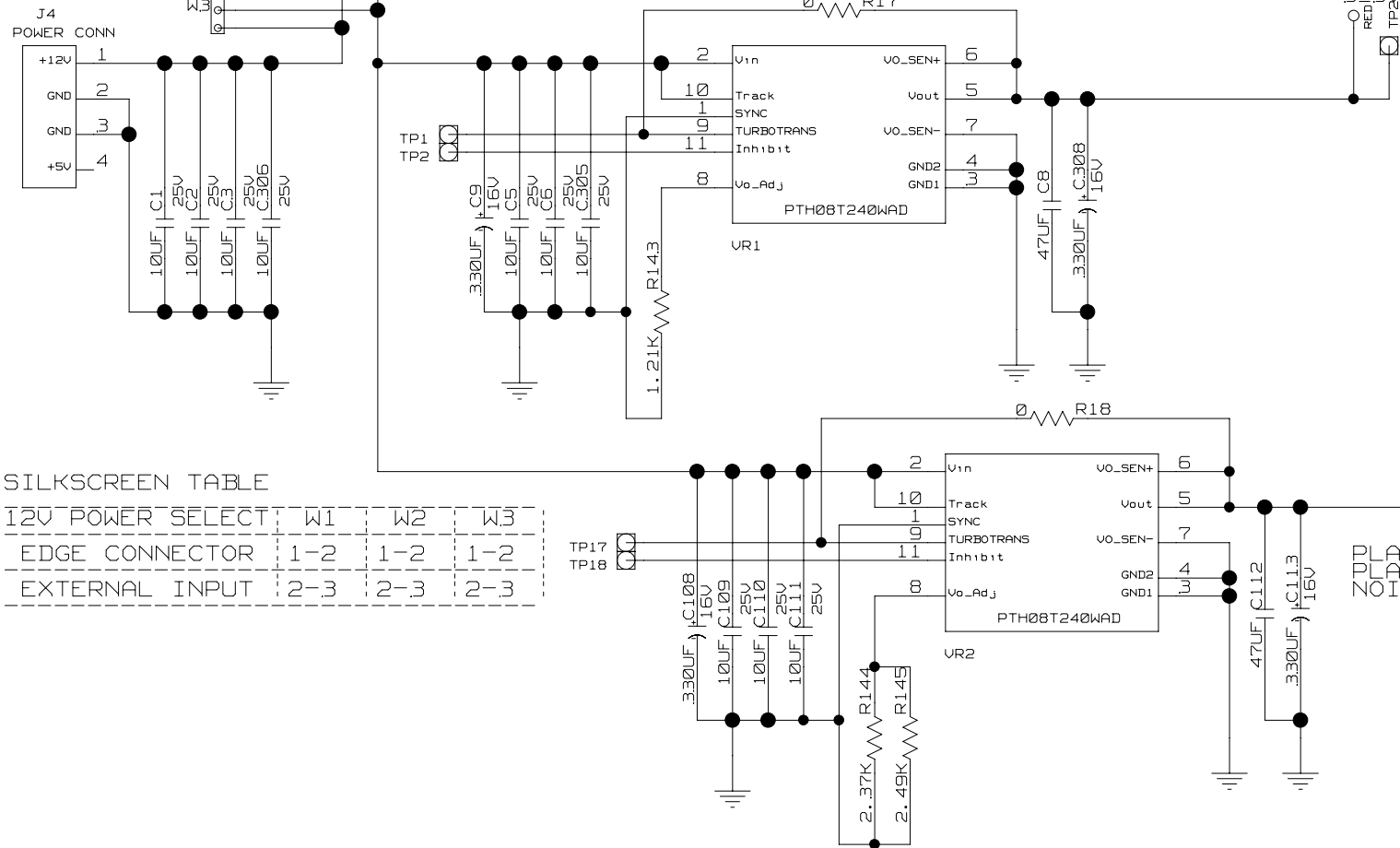
POWER INDICATOR  
PLACE NEAR TOP EDGE  
LABEL 'POWER'



BOARD RESET



THIS SUPPLIES ONLY 30 WATTS TO THE DOWN STREAM PORTS  
+12.0V -> +3.3V



SILKSCREEN TABLE

12V POWER SELECT	W1	W2	W3
EDGE CONNECTOR	1-2	1-2	1-2
EXTERNAL INPUT	2-3	2-3	2-3

PLACE R17 NEAR U1  
PLACE R18 NEAR VR1  
NOISE-FREE ROUTING

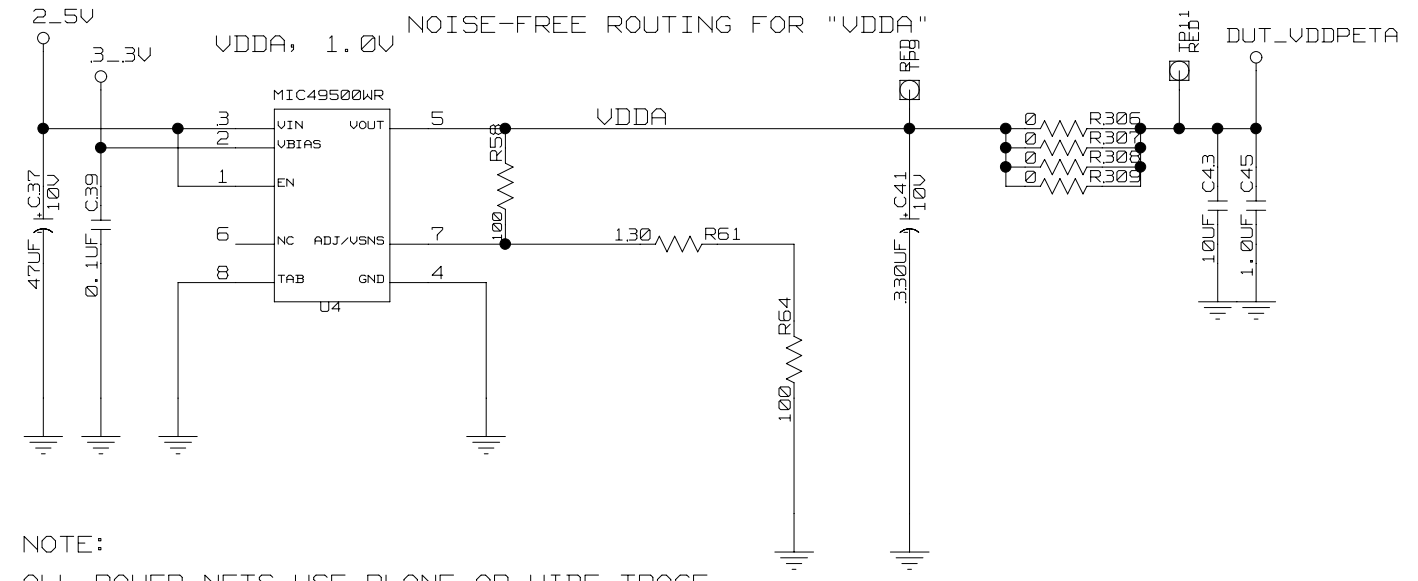
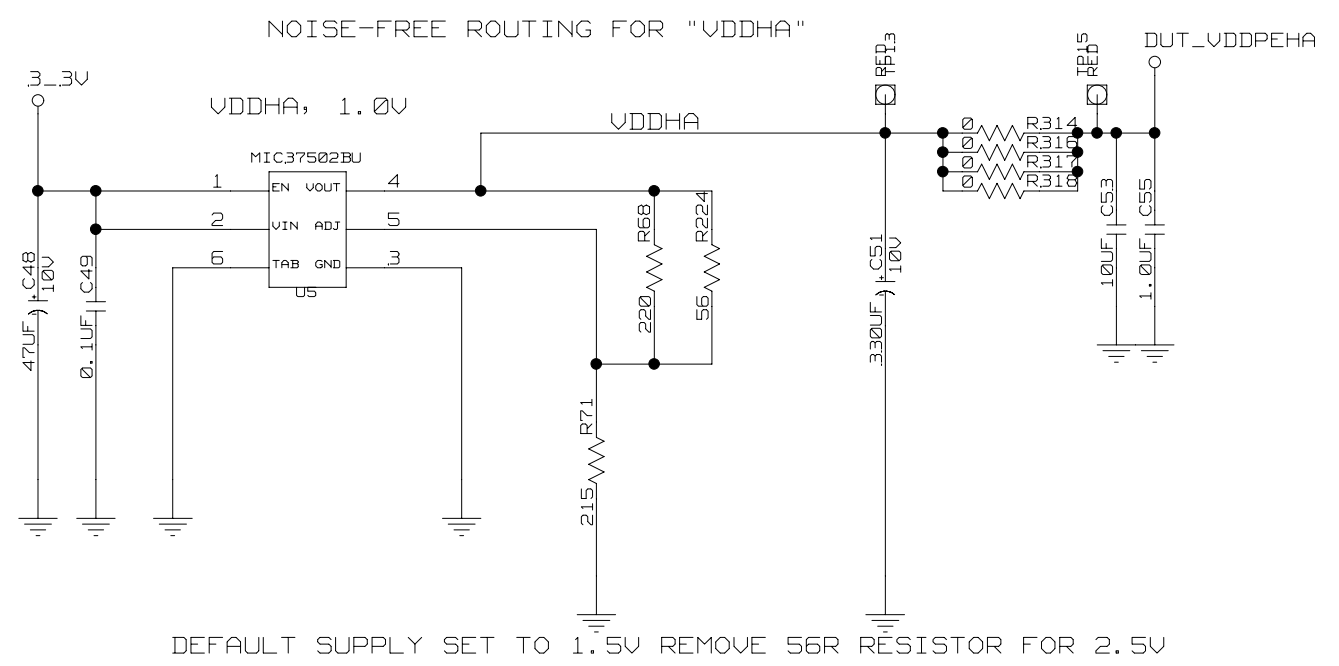
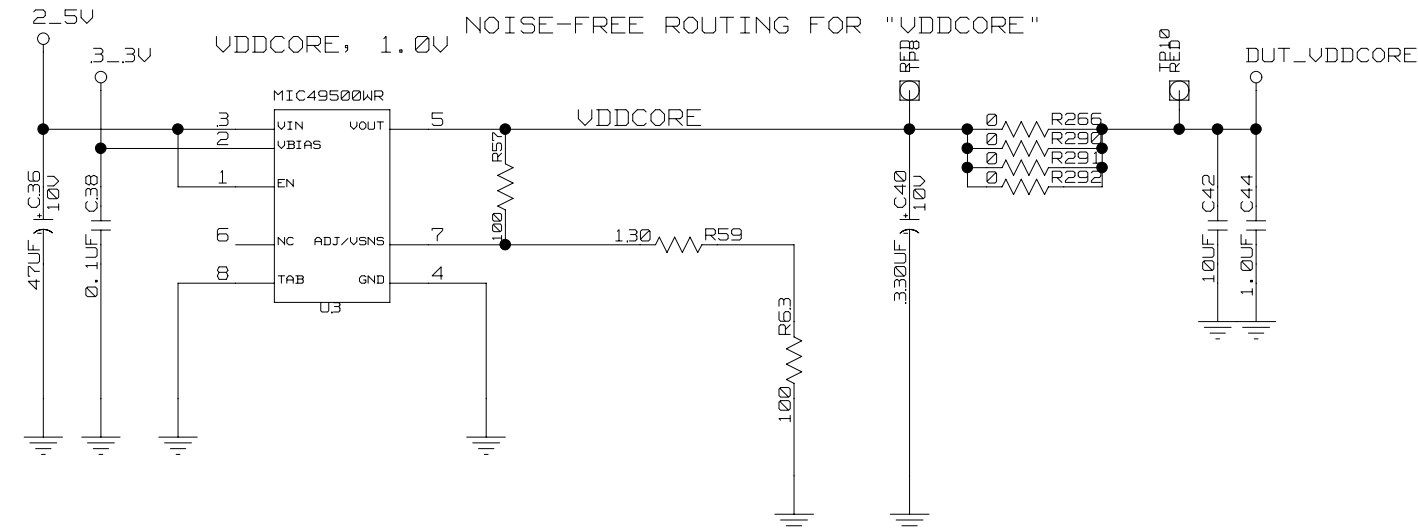
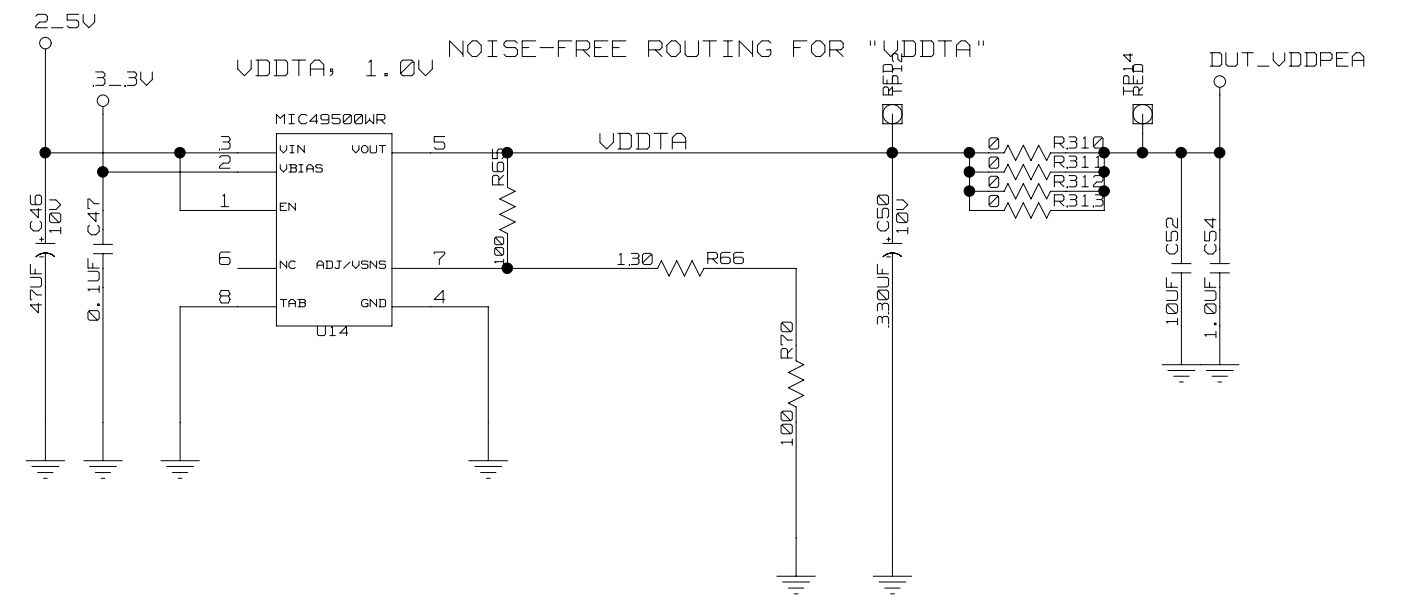
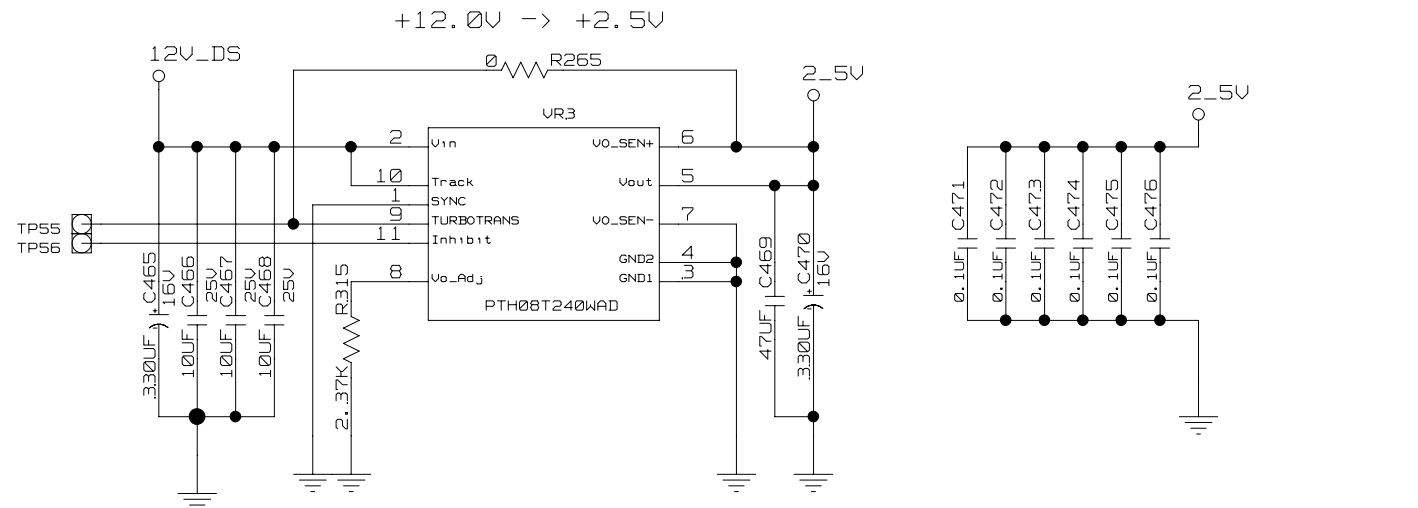
REMOVE 2.49K TO SET VDD\_IO TO 2.5V

POWER\_SUPPLIES  
PAGE 23



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TITLE 89HPES48H12G2 Eval Board			
SWITCHING REGULATORS			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
Tue Aug 19 16:43:02 2008			SHEET 22 OF 23



DEFAULT SUPPLY SET TO 1.5V REMOVE 56R RESISTOR FOR 2.5V

COPPER AREA AS LARGE AS POSSIBLE

NOTE:  
ALL POWER NETS USE PLANE OR WIDE TRACE

NOTE:  
ALL POWER NETS USE PLANE OR WIDE TRACE



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TITLE 89HPES48H12G2 Eval Board			
SWITCHING REGULATORS			
SIZE B	DRAWING NO. SCH-00172	FAB P/N 18-677-000	REV. 1.0
AUTHOR JHU		CHECKED BY B. Le	
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