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## S1D13742 Mobile Graphics Engine

# S5U13742P00C100 Evaluation Board User Manual

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# 1 Introduction

This manual describes the setup and operation of the S5U13742P00C100 Evaluation Board. The evaluation board is designed as an evaluation platform for the S1D13742 Mobile Graphics Engine.

The S5U13742P00C100 evaluation board can be used with many native platforms via the host connector which provides the appropriate signals to support a variety of CPUs. The S5U13742P00C100 evaluation board can also connect to the S5U13U00P00C100 USB Adapter board so that it can be used with a laptop or desktop computer, via USB 2.0.

This user manual is updated as appropriate. Please check the Epson Research and Development Website at www.erd.epson.com for the latest revision of this document before beginning any development.

We appreciate your comments on our documentation. Please contact us via email at documentation@erd.epson.com.

# 2 Features

The S5U13742P00C100 Evaluation Board includes the following features:

- 121-pin FCBGA S1D13742 Mobile Graphics Engine
- Header with all S1D13742 Host Bus Interface signals
- Headers for connection to the S5U13U00P00C100 USB Adapter board
- Headers for connecting to LCD panels
- Header for S1D13742 GPIO pins (optional)
- On-board 4MHz oscillator
- 14-pin DIP socket (if a clock other than 4MHz must be used)
- 3.3V input power
- On-board voltage regulator with 1.5V output
- On-board voltage regulator with adjustable 6~24V output, 40mA max., to provide power for LED backlight of LCD panels.

# 3 Installation and Configuration

The S5U13742P00C100 evaluation board incorporates a DIP switch, jumpers, and 0 ohm resistors which allow it to be used with a variety of different configurations.

## 3.1 Configuration DIP Switch

The S1D13742 has 3 configuration inputs (CNF[2:0]). A DIP switch (SW1) is used to configure CNF[2:0] as described below.

*Table 3-1: Summary of Power-On/Reset Options*

| SDU13742P00C100 SW1-[4:1] Config | S1D13742 CNF[2:0] Config | Power-On/Reset State | |
|---|---|---|---|
| | | 1 (ON) | 0 (OFF) |
| SW1-[1] | CNF0 | Host Data lines are normal | Host data lines are swapped |
| SW1-[2] | CNF1 | Host Data is 16-bit | Host data is 8-bit |
| SW1-[3] | CNF2 | PIOVDD output current = 6.5mA | PIOVDD output current = 2.5mA |
| SW1-[4] | - | not used | |

= Required settings when using S5U13U00P00C100 USB Adapter board

The following figure shows the location of DIP switch SW1 on the S5U13742P00C100 board.

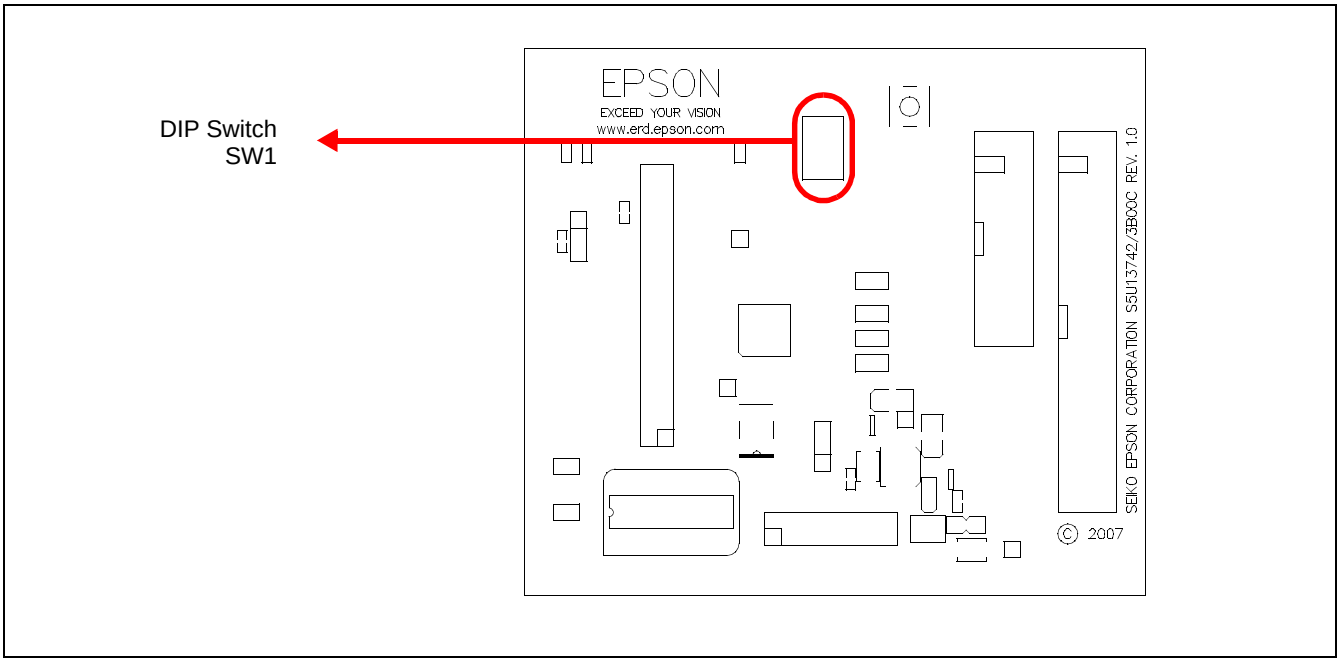


*Figure 3-1: Configuration DIP Switch (SW1) Location*

## 3.2 Configuration Jumpers

The S5U13742P00C100 has 6 jumpers which configure various board settings. The jumper positions for each function are shown below.

| Jumper | Function | Position 1-2 | Position 2-3 | No Jumper |
|---|---|---|---|---|
| JP1 | COREVDD | Normal | — | COREVDD current measurement |
| JP2 | PLLVDD | Normal | — | PLLVDD current measurement |
| JP3 | IOVDD | Normal | — | IOVDD current measurement |
| JP4 | IOVDD Source | H1 connector, pin 32 | 3.3VDD | — |
| JP5 | PIOVDD | Normal | — | PIOVDD current measurement |
| JP6 | PIOVDD Source | H4 connector, pin 8 | 3.3VDD | — |

= Required settings when using S5U13U00P00C100 USB Adapter board

### JP1, JP2, JP3, JP5 - Power Supplies for the S1D13742

JP1, JP2, JP3, JP5 can be used to measure the current consumption of each S1D13742 power supply.
When the jumper is at position 1-2, normal operation is selected.
When no jumper is installed, the current consumption for each power supply can be measured by connecting an ammeter to pin 1 and 2 of the jumper.

The jumper associated with each power supply is as follows:

JP1 for COREVDD
JP2 for PLLVDD
JP3 for IOVDD
JP5 for PIOVDD

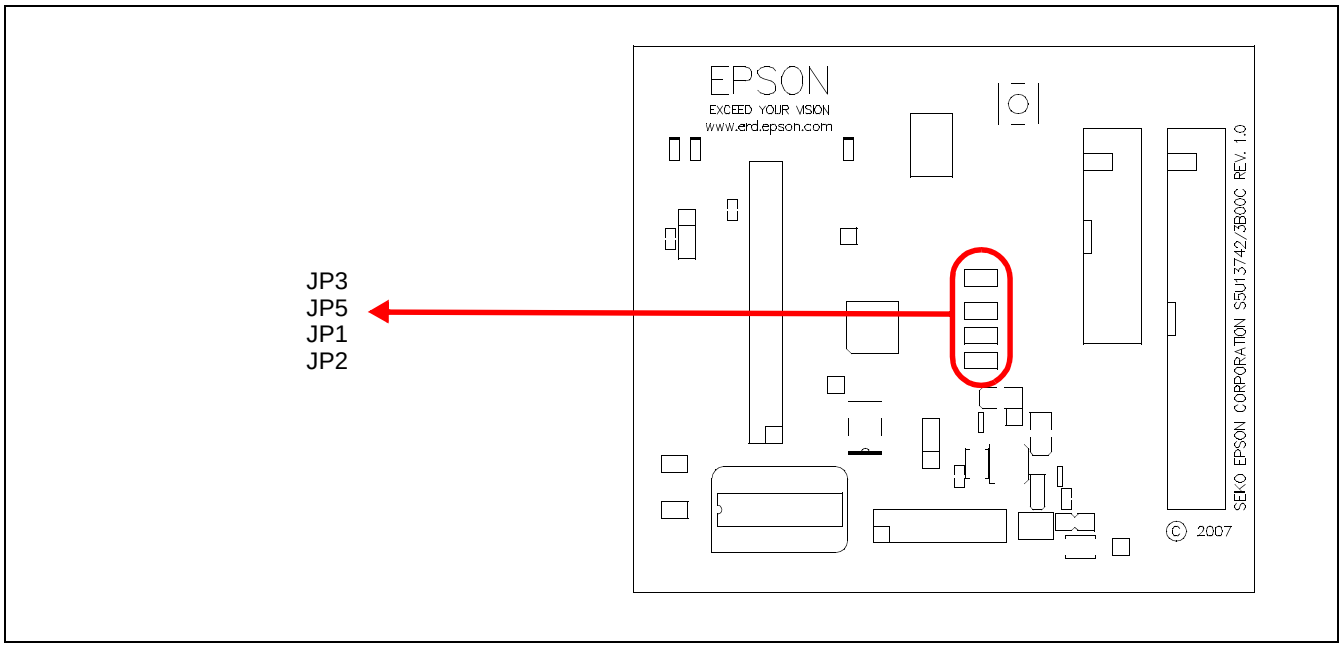


*Figure 3-2: Configuration Jumper Locations (JP1, JP2, JP3, JP5)*

### JP4 - IOVDD Source

JP4 is used to select the source for the IOVDD supply voltage.
When the jumper is at position 1-2, the IOVDD voltage must be provided to the H1 connector, pin 32.
When the jumper is at position 2-3, the IOVDD voltage is provided by the 3.3V power supply of the board.

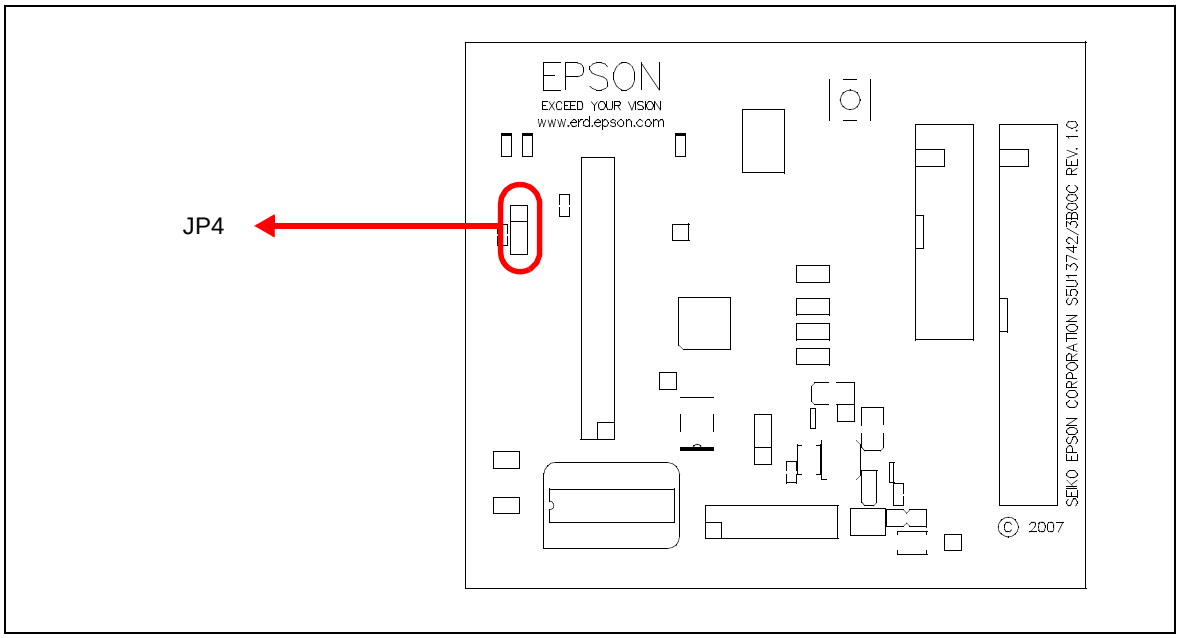


*Figure 3-3: Configuration Jumper Location (JP4)*

### JP6 - SIOVDD Source

JP6 is used to select the source for the PIOVDD supply voltage.
When the jumper is at position 1-2, the PIOVDD voltage must be provided to the H4 connector, pin 8.
When the jumper is at position 2-3, the PIOVDD voltage is provided by the 3.3V power supply of the board.

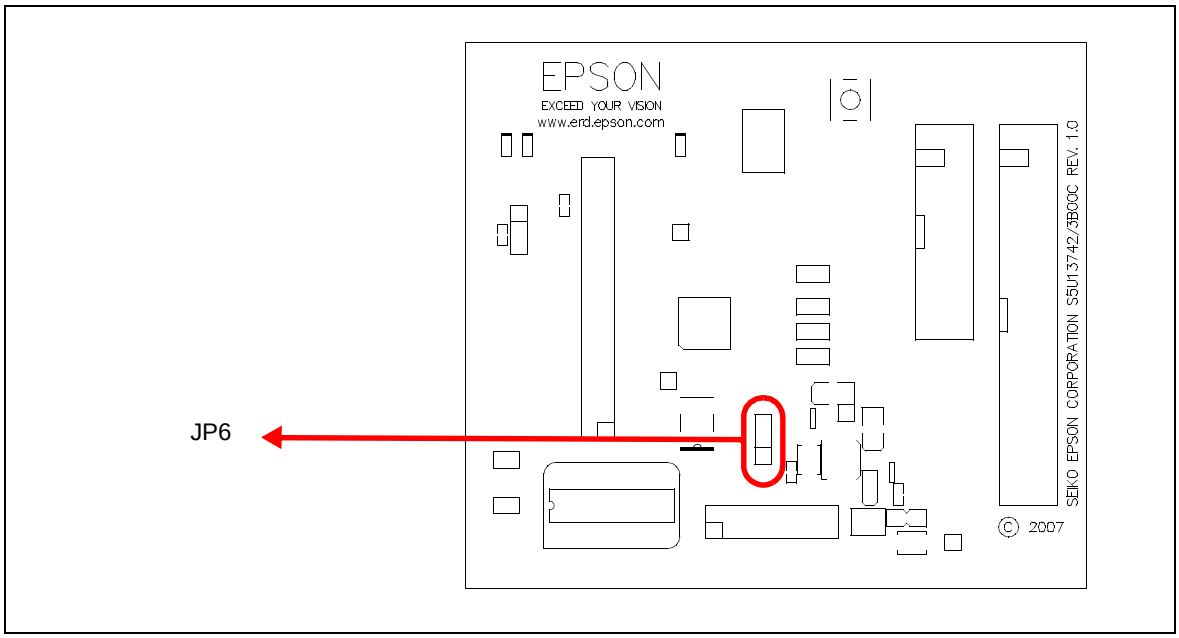


*Figure 3-4: Configuration Jumper Location (JP6)*

# 4 Technical Description

## 4.1 Power

### 4.1.1 Power Requirements

The S5U13742P00C100 evaluation board requires an external regulated power supply (3.3V / 0.5A). The power is supplied to the evaluation board through pin 34 of the H1 header, or pin 5 of the P2 header.

The green LED '3.3V Power' is turned on when 3.3V power is applied to the board.

### 4.1.2 Voltage Regulators

The S5U13742P00C100 evaluation board has an on-board linear regulator to provide the 1.5V power required by the S1D13742 Mobile Graphics Engine. It also has a step-up switching voltage regulator to generate adjustable 6~24V, which can be used to power the LED backlight on some LCD panels.

### 4.1.3 S1D13742 Power

The S1D13742 Mobile Graphics Engine requires 1.5V and 1.65~3.6V power supplies.

1.5V power for COREVDD and PLLVDD is provided by an on-board linear voltage regulator.

IOVDD can be in the range of 1.65~3.6V. When JP4 is set to the 2-3 position, IOVDD is connected to 3.3V. If a different voltage is required for IOVDD, set JP4 to the 1-2 position and connect the external power supply to pin 32 of connector H1.

**Note**
If the IOVDD voltage is less than 3.0V, an oscillator working at the selected IOVDD voltage must be used.

PIOVDD is the power used by the LCD interface and can be in the range of 1.65~3.6V. When JP6 is set to the 2-3 position, PIOVDD is connected to 3.3V. If a different voltage is needed for PIOVDD because of the LCD panel requirements, set JP6 to the 1-2 position and connect the external power supply to pin 8 of connector H4.

## 4.2 Clocks

The clock for the S1D13742 Mobile Graphics Engine is provided by a 4MHz oscillator.

The S5U13742P00C100 evaluation board has a DIP14 footprint for an optional second oscillator, Y2. This is provided for cases requiring a different clock frequency for the S1D13742 Mobile Graphics Engine. To use Y2, an oscillator must be populated in the Y2 footprint and the following board modifications must be made.

1. Remove R10 (33 ohm resistor, size 0402) to cut the output of Y1.
2. Populate R13 with a 33 ohm resistor, size 0402, to connect the output of Y2 to the CLKI input of the S1D13742 Mobile Graphics Engine.

**Note**
If the board is configured for an IOVDD voltage below 3.0V, an oscillator working at the selected IOVDD voltage must be used at Y2. The on-board 4MHz oscillator is not specified to work below a 3.0V supply voltage.

The S1D13742 MGE can output the input clock on the CLKOUT pin depending on the state of the CLKOUTEN input. Both these signals are available on the H4 connector: CLKOUT on pin 1 and CLKOUTEN on pin 4. On the board the CLKOUTEN pin is pulled down which disables the CLKOUT signal. Note that connector H4 is not populated on the S5U13742P00C100 evaluation board.

## 4.3 Reset

The S1D13742 Mobile Graphics Engine on the S5U13742P00C100 evaluation board can be reset using a push-button (SW2), or via an active low reset signal from the host development platform (pin 33 on the H1 connector).

## 4.4 Power Save

The S1D13742 chip has an input called PWRSVE that will enable (when high) or disable (when low) the power save mode. This signal is available on pin 5 of the H4 connector. On the board the PWRSVE pin is pulled down which means power save mode is controlled only by the S1D13742 register setting. Note that connector H4 is not populated on the S5U13742P00C100 evaluation board.

## 4.5 Host Interface

### 4.5.1 Direct Host Bus Interface Support

All S1D13742 host interface pins are available on connector H1 which allows the S5U13742P00C100 evaluation board to be connected to a variety of development platforms. For detailed S1D13742 pin mapping, refer to the *S1D13742 Hardware Functional Specification*, document number X63A-A-001-xx.

The following figure shows the location of host bus connector H1. H1 is a 0.1x0.1" 34-pin header (17x2).

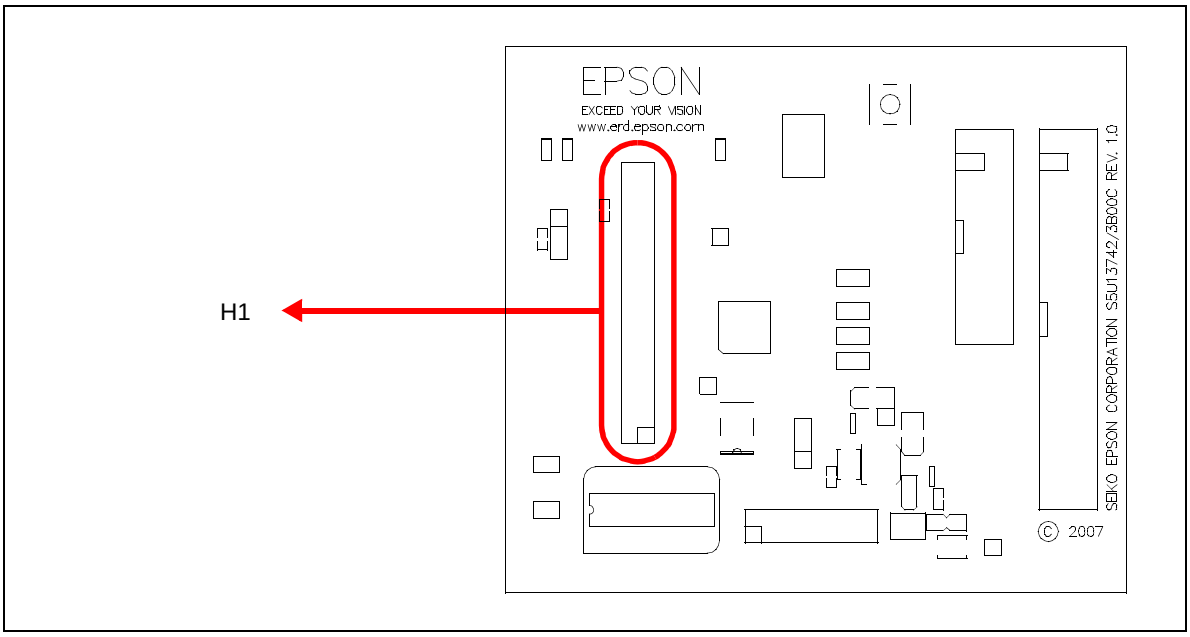


*Figure 4-1: Host Bus Connector Location (H1)*

For the pinout of connector H1, see "Schematic Diagrams" on page 21.

### 4.5.2 Connecting to the Epson S5U13U00P00C100 USB Adapter Board

The S5U13742P00C100 evaluation board is designed to connect to a S5U13U00P00C100 USB Adapter Board. The USB adapter board provides a simple connection to any computer via a USB 2.0 connection. The S5U13742P00C100 directly connects to the USB adapter board through connectors P1 and P2.

The USB adapter board also supplies the 3.3V power required by the S5U13742P00C100. IOVDD should be selected for 3.3V and JP4 should be set to the 2-3 position.

When the S5U13742P00C100 is connected to the S5U13U00P00C100 USB Adapter board, there are 2 LEDs on S5U13742P00C100 which provide a quick visual status of the USB adapter. LED1 blinks to indicate that the USB adapter board is active. LED2 turns on to indicate that the USB has been enumerated by the PC.

The following diagram shows the location of connectors P1 and P2. P1 and P2 are 40-pin headers (20x2).

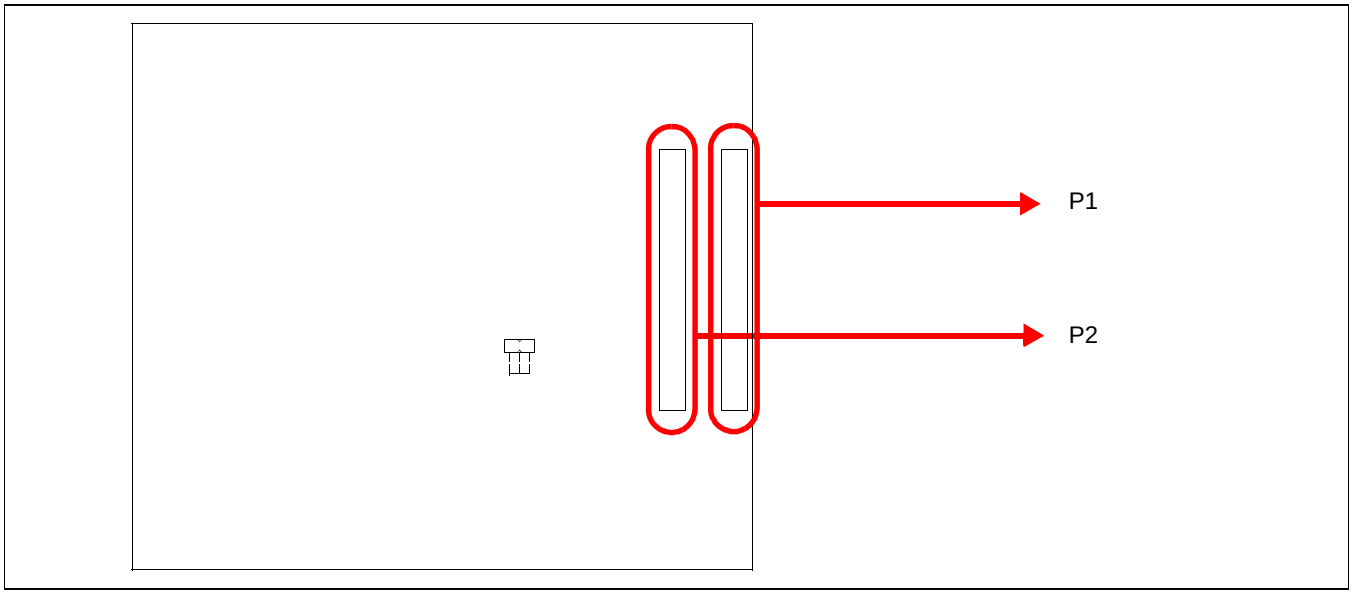


*Figure 4-2: USB Adapter Connector Locations (P1 and P2)*

For the pinout of connectors P1 and P2, see “Schematic Diagrams” on page 21.

**Note**

A windows driver must be installed on the PC when the S5U13742P00C100 is used with the S5U13U00P00C100 USB Adapter Board. The S1D13xxxUSB driver is available at www.erd.epson.com.

## 4.6 LCD Panel Interface

The LCD interface signals are available on connectors H2 and H3. For S1D13742 LCD interface pin mapping, refer to the *S1D13742 Hardware Functional Specification*, document number X63A-A-001-xx.

Connector H2 is 0.1x0.1" 20-pin header (10x2) and connector H3 is 0.1x0.1" 40-pin header (20x2). For the pinout of connectors H2 and H3, see "Schematic Diagrams" on page 21.

On the evaluation board there is an adjustable 6~24V, 40mA max. power supply. This voltage is provided only on connector H3 (it is not used elsewhere on the board). It is intended for use to power the LED backlight on some LCD panels. The voltage is adjusted by the R24 pot.

**Note**

For LCD panels that use a CCFL backlight, an external power supply must be used to provide power to the inverter for the CCFL backlight. Usually, the inverter current consumption is higher than the maximum 40mA current available from the on-board voltage regulator.

The following diagram shows the location of the LCD panel connectors H2 and H3.

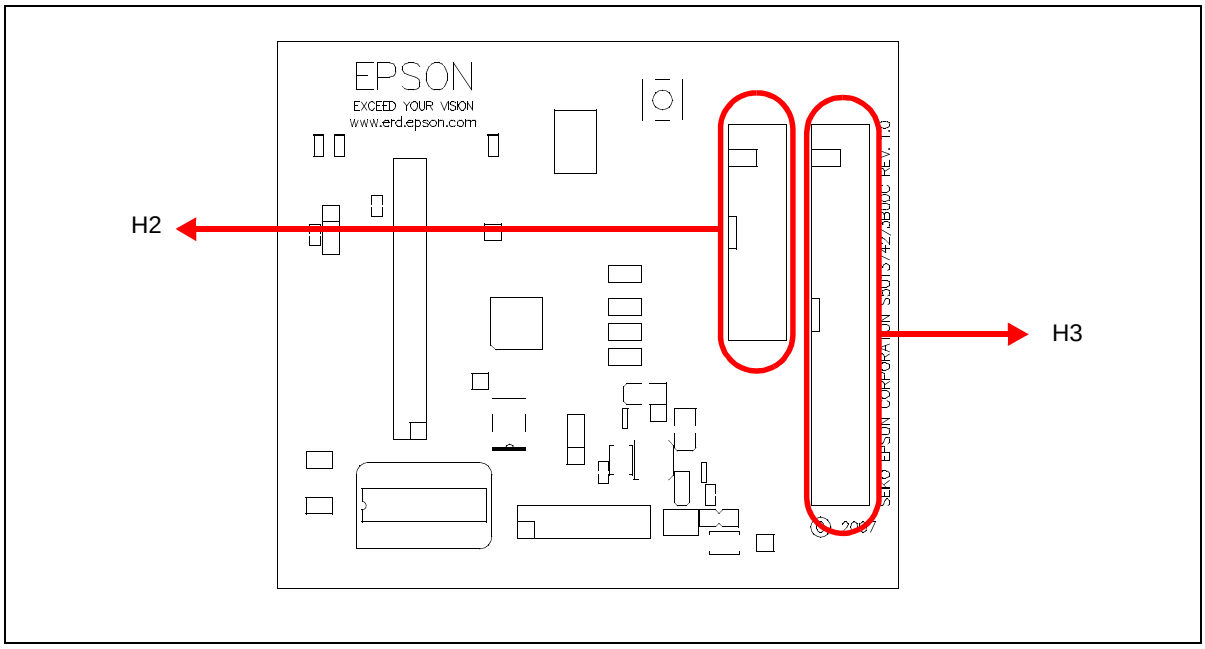


*Figure 4-3: LCD Panel Connectors Location (H2, H3)*

For the pinout of connectors H2 and H3, see "Schematic Diagrams" on page 21.

## 4.7 GPIO Connections

The S1D13742 Mobile Graphics Engine has 8 GPIO pins. All the GPIO pins are routed to the H4 connector. Note that connector H4 is not populated on the S5U13742P00C100 evaluation board.

The following figure shows the location of the GPIO connector, H4.

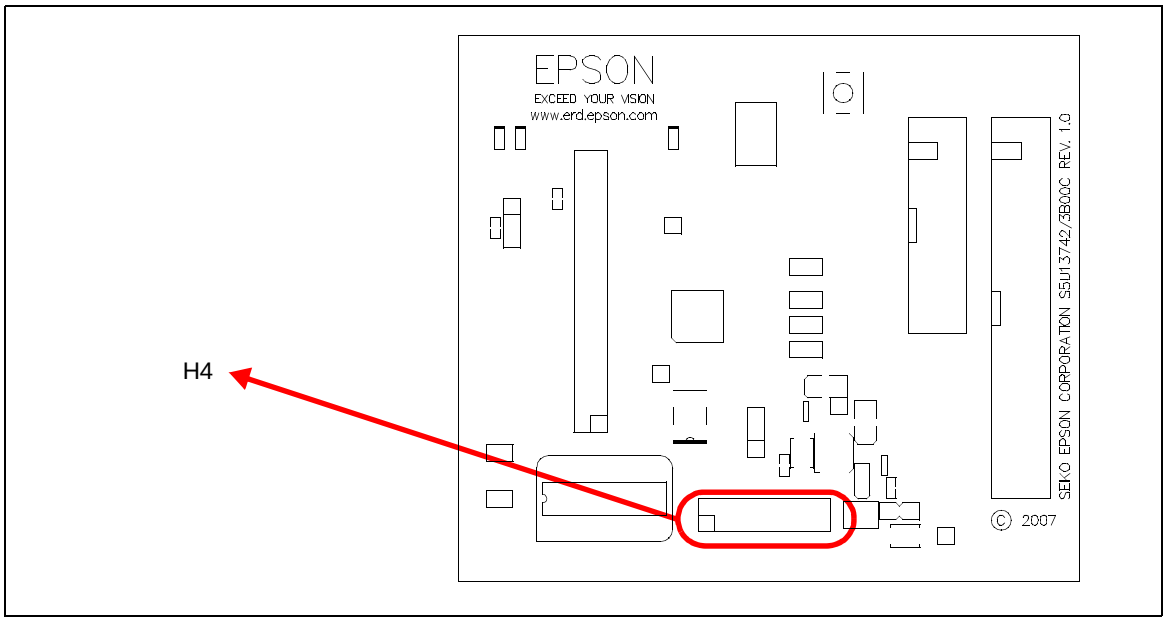


*Figure 4-4: GPIO Connector Location (H4)*

For the pinout of connector H4, see “Schematic Diagrams” on page 21.

# 5 Parts List

*Table 5-1: Parts List*

| Item | Qty | Reference | Part | Description | Mfg / Mfg PN / Notes |
|---|---|---|---|---|---|
| 1 | 16 | C1, C2, C3, C4, C9, C12, C13, C14, C18, C19, C20, C21, C26, C27, C28, C30, C32 | 0.1uF | C0402 | Yageo America 04022F104Z7B20D |
| 2 | 12 | C5, C6, C7, C8, C15, C16, C17, C22, C23, C24, C25, | 0.01uF | C0402 | Yageo America 0402ZRY5V7BB103 |
| 3 | 1 | C10 | 1nF | C0402 | Yageo America 04022R102K9B20D |
| 4 | 1 | C11 | 10uF | C0805 | Panasonic - ECG ECJ-CV50J106M |
| 5 | 1 | C29 | 100uF 4V T | C3528 | Kemet T494B107M004AS |
| 6 | 2 | C31, C33 | 0.01uF | C0402 | Kemet C0402C103K4RACTU |
| 7 | 1 | C34 | 4.7uF 10V T | C3528 | Kemet T491B475K010AS |
| 8 | 1 | C35 | 10pF | C0402 | Panasonic - ECG ECJ-0EC1H100D |
| 9 | 1 | C36 | 1uF 50V | C1206 | TDK C3216X7R1H105K |
| 10 | 3 | D1, D2, D3 | | LED0603 | Panasonic - SSG LNJ308G8LRA<br><br>LED GREEN SS TYPE LOW CUR SMD |
| 11 | 1 | D4 | MBR0530 | SOD-123 | Micro Commercial Co. MBR0530-TP |
| 12 | 2 | F1, F2 | ACF451832-222 | | TDK ACF451832-222<br><br>FILTER 3-TERM 60MHZ 300MA SMD |
| 13 | 1 | H1 | HEADER_17X2 | | AMP 1-87215-7 |
| 14 | 1 | H2 | Extended LCD Connector | | Samtec TST-110-01-G-D |
| 15 | 1 | H3 | LCD Connector | | Samtec TST-120-01-G-D |
| 16 | 0 | H4 | HEADER 8X2 | | Samtec TSW-108-07-G-D |
| 17 | 4 | JP1, JP2, JP3, JP5 | | SIP2 | CONN HEADER VERT 2POS .100 TIN or GENERIC |
| 18 | 2 | JP4, JP6 | | SIP3 | CONN HEADER VERT 3POS .100 TIN or GENERIC |
| 19 | 2 | L1, L2 | Ferrite | R0603 | Steward HZ0603B751R-10<br><br>FERRITE 200MA 938 OHMS 0603 SMD |

*Table 5-1: Parts List*

| Item | Qty | Reference | Part | Description | Mfg / Mfg PN / Notes |
|---|---|---|---|---|---|
| 20 | 1 | L3 | 10uH | IND_ELL6 | Panasonic - ECG<br>ELL-6SH100M<br><br>COIL 10UH 1300MA<br>CHOKE SMD |
| 21 | 2 | P1, P2 | HEADER_20X2 | HDR2X20/2MM | 3M 151240-8422-RB |
| 22 | 3 | R1, R2, R3 | 10k | R0402 | |
| 23 | 3 | R4, R7, R19 | 0 | R0603 | |
| 24 | 1 | R5 | 150k 1% | R0402 | |
| 25 | 5 | R6, R8, R9, R11, R20 | 0 | R0402 | |
| 26 | 1 | R10 | 33 1% | R0402 | |
| 27 | 0 | R12, R13 | NP | R0402 | |
| 28 | 3 | R14, R15, R16 | 270 1% | R0402 | |
| 29 | 3 | R17, R18, R23 | 47k | R0402 | |
| 30 | 1 | R21 | 887k 1% | RC0603 | |
| 31 | 1 | R22 | 22k | R0402 | |
| 32 | 1 | R24 | 200k | | Panasonic - ECG<br>EVN-5ESX50B25 |
| 33 | 6 | SH1, SH2, SH3, SH4, SH5, SH6 | .100 in. Jumper Shunt | Not Applicable | Sullins Electronics Corp.<br>STC02SYAN<br><br>JUMPER SHORTING TIN |
| 34 | 1 | SW1 | SW4_DIPSW4 | DIPSW4 | CTS Corp 218-4LPST<br><br>SWITCH DIP HALF<br>PITCH 4POS |
| 35 | 1 | SW2 | SW TACT-SPST | SW_EVQQW | ITT Industries<br>KSC241GLFS<br><br>SWITCH TACT SILVER<br>PLT GULLWING |
| 36 | 2 | TPGND1, TP3.3VDD1 | TP_SMT | TP_1206 | Keystone 5015<br><br>PC TEST POINT<br>MINIATURE SMT |
| 37 | 0 | TP1, TP2, TP3, TP4 | T POINT F | SIP1 | |
| 38 | 1 | U1 | S1D13742 | | |

*Table 5-1: Parts List*

| Item | Qty | Reference | Part | Description | Mfg / Mfg PN / Notes |
|---|---|---|---|---|---|
| 39 | 1 | U2 | TPS76915DBVT | SOT23-5 | Texas Instruments<br>TPS76915DBVT<br><br>IC 1.5V 100MA LDO REG SOT-23-5 |
| 40 | 1 | U3 | TPS61040 | SOT23-5 | TI TPS61040DVBR<br><br>IC CONV DC/DC BOOST LP SOT-23-5 |
| 41 | 1 | Y1 | 4M OSC | | Connor-Winfield<br>CWX823-4.0M<br><br>OSC 4.0000MHz 3.3V 50ppm SMD |
| 42 | 0 | Y2 | 14-Pin DIP | | AMP 2-641609-1 |

# 6 Schematic Diagrams

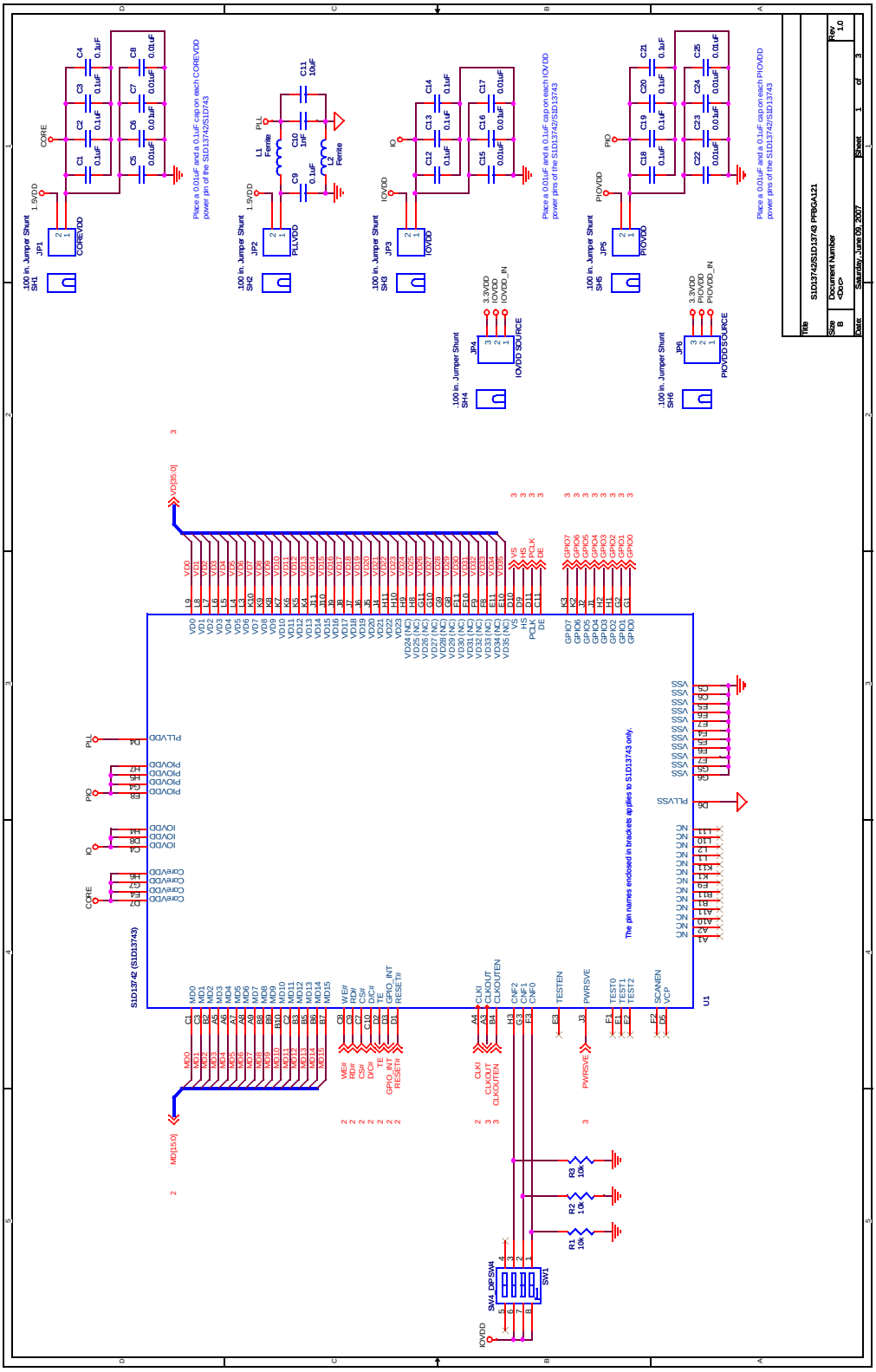

*Figure 6-1: S5U13742P00C100 Schematics (1 of 3)*

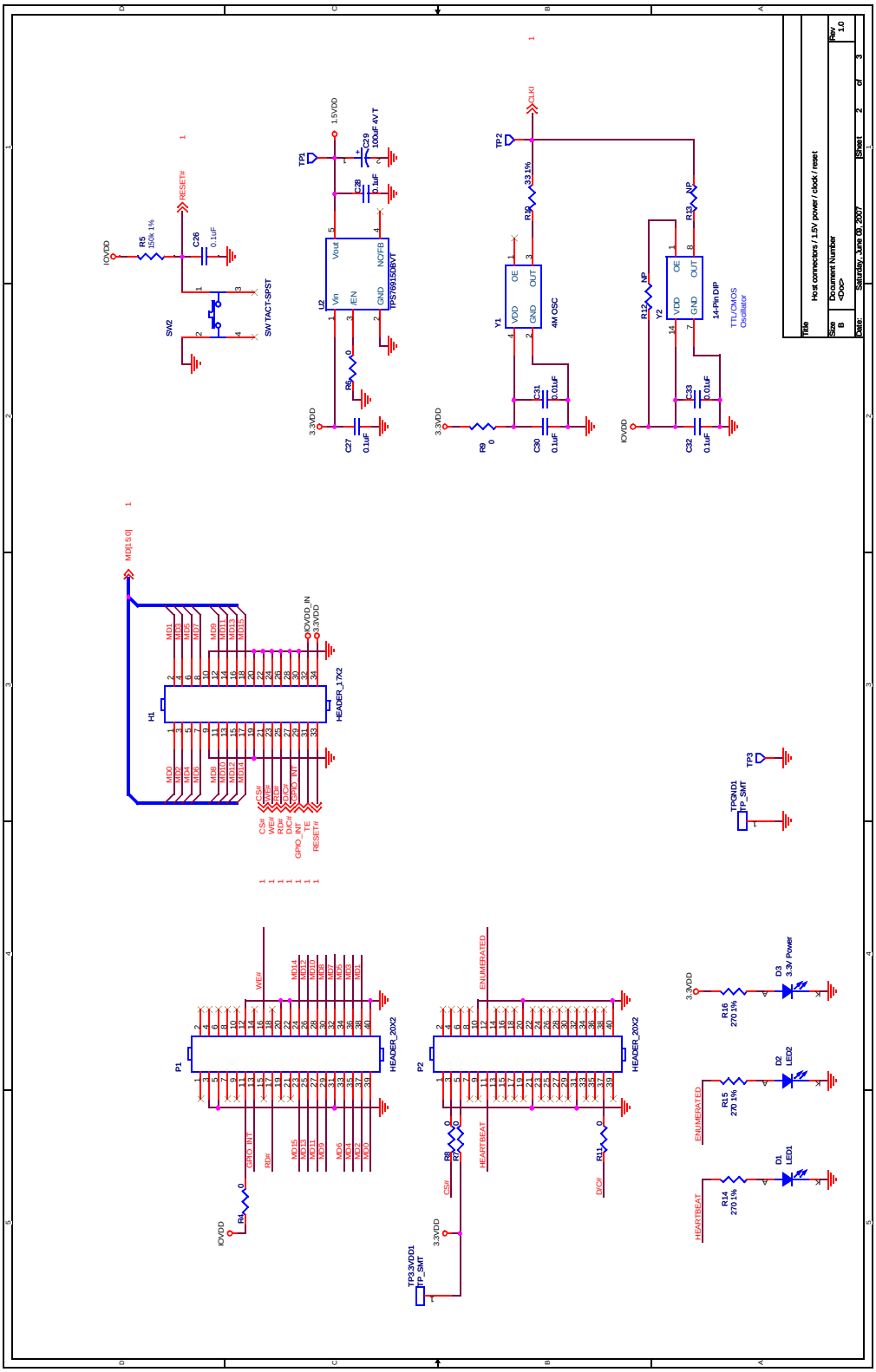

*Figure 6-2: S5U13742P00C100 Schematics (2 of 3)*

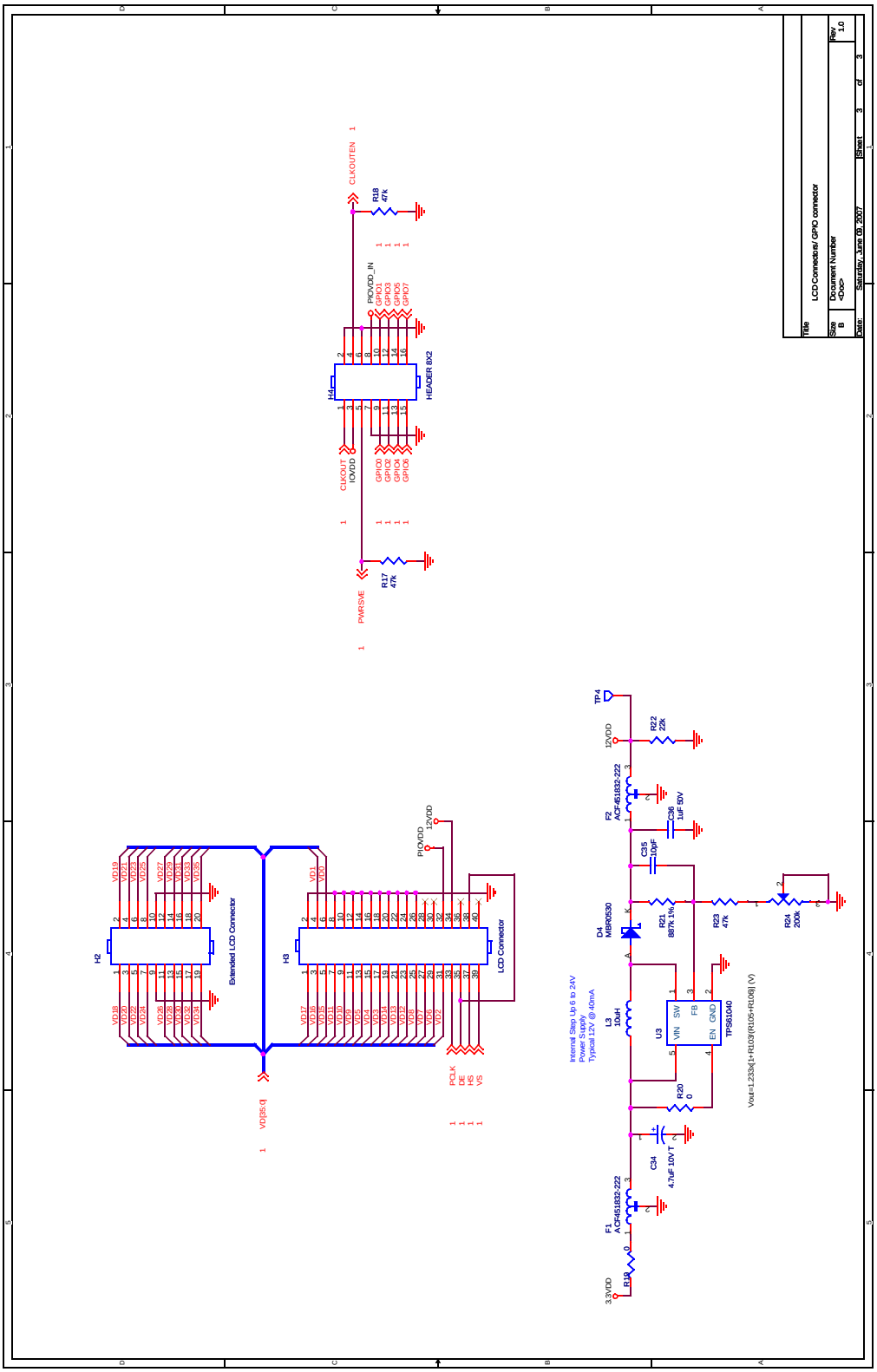


*Figure 6-3: S5U13742P00C100 Schematics (3 of 3)*

# 7 Board Layout

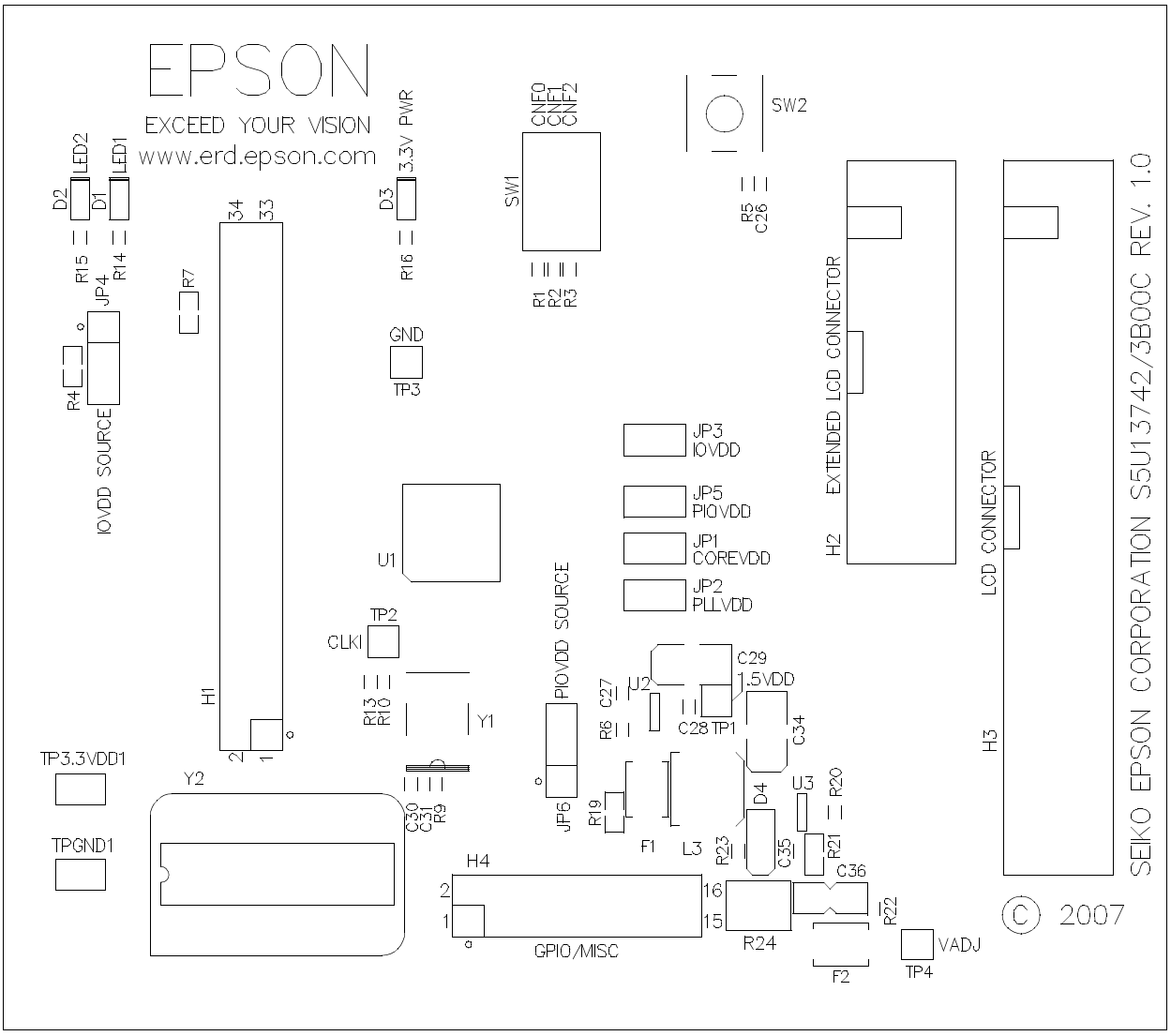


*Figure 7-1: S5U13742P00C100 Board Layout - Top View*

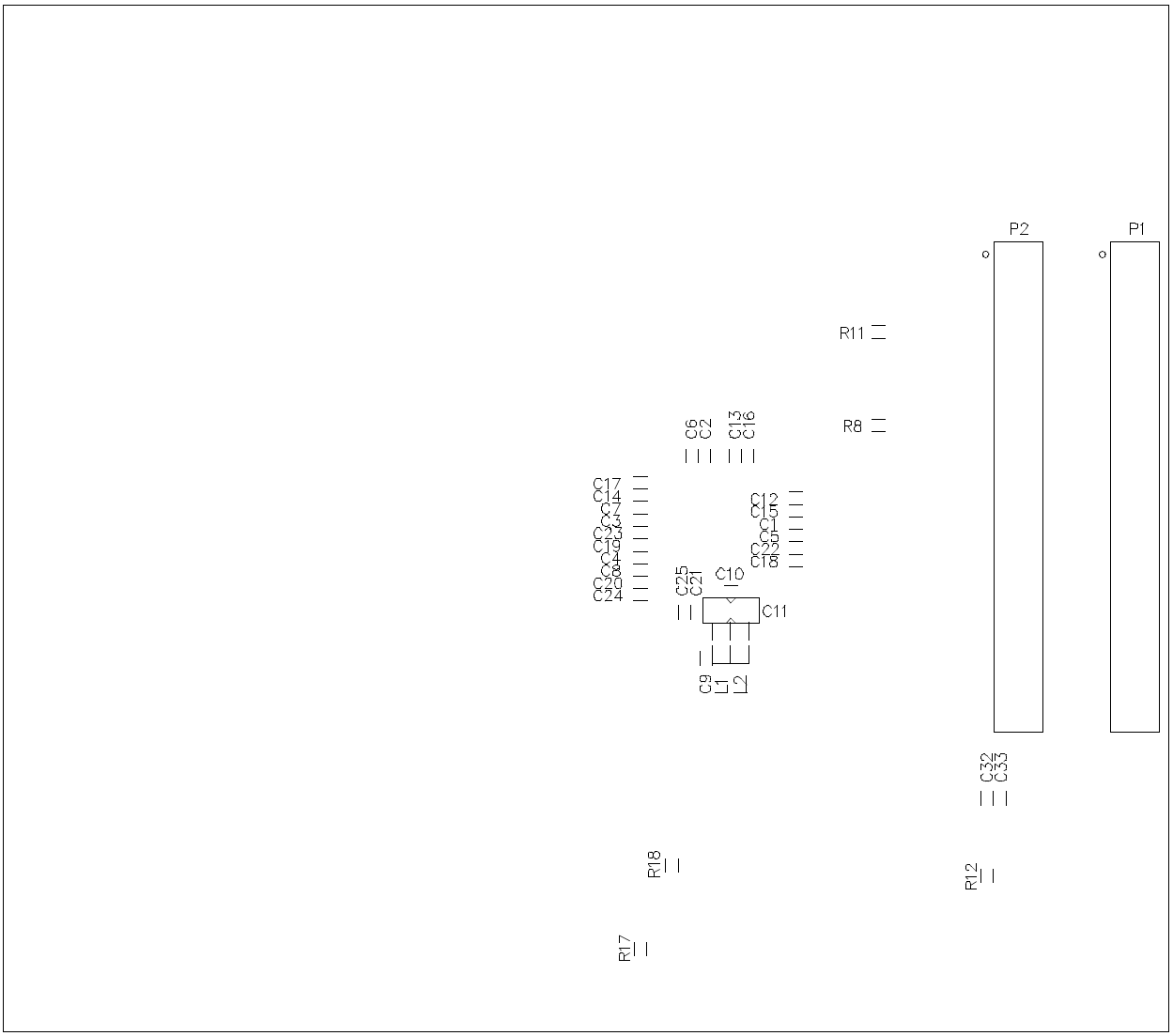


*Figure 7-2: S5U13742P00C100 Board Layout - Bottom View*

# 8 References

## 8.1 Documents

- Epson Research and Development, Inc., *S1D13742 Hardware Functional Specification*, document number X63A-A-001-xx.

## 8.2 Document Sources

- Epson Research and Development Website: http://www.erd.epson.com.

# 9 Technical Support

## 9.1 EPSON Display Controllers (S1D13742)

**Japan**
Seiko Epson Corporation
IC International Sales Group
421-8, Hino, Hino-shi
Tokyo 191-8501, Japan
Tel: 042-587-5812
Fax: 042-587-5564
http://www.epson.co.jp/

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San Jose, CA 95131, USA
Tel: (408) 922-0200
Fax: (408) 922-0238
http://www.eea.epson.com/

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## 9.2 Ordering Information

To order the S5U13742P00C100 Evaluation Board, contact the Epson sales representative in your area and order part number **S5U13742P00C100**.

# Change Record

X63A-G-002-01 Revision 1.0 - Issued: August 15, 2007

- section 5, changed C26 from 0.01uF part to 0.1uF part (changed from item 2 to item 1)
- section 5, changed item 24 (R5) from 1.5k 1% to 150k 1%
- section 6, updated schematic 2 of 3 with updated values for C26 and R5

X63A-G-002-00 Revision 0.02 - Issued: June 26, 2007

- removed section 4.5.3

X63A-G-002-00 Revision 0.01 - Issued: June 25, 2007

- minor editing
- section 5, added parts list
- section 6, added schematics
- section 7, added board layout

# OCEAN CHIPS
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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
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- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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