

S1D13U11 Display Controller

# **S5U13U11 Evaluation Board User Manual**

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# Chapter 1 Introduction

This manual describes the setup and operation of the S5U13U11 Evaluation Board. This evaluation board is designed as an evaluation platform for the S1D13U11 Display Controller.

The S5U13U11 evaluation board can connect to a variety of embedded CPU boards and a personal computer via USB 2.0. This evaluation board includes a touch screen controller, serial flash ROM and buzzer. This evaluation board can connect to external devices such as LCD panel with touch screen, key matrix circuit, and expansion serial devices via connector.

This user manual is updated as appropriate. Please check the Epson Research and Development Website at [www.erd.epson.com](http://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](mailto:documentation@erd.epson.com).

This manual applies to the following evaluation boards.

- S5U13U11P00C100 (no LCD panel)
- S5U13U11P10C100 (with LCD panel)

## Chapter 2 Features

The S5U13U11 Evaluation Board includes the following features:

- S1D13U11 Display Controller (144-pin QFP)
- Integrated Silicon Solution, Inc. IS42S16800E-7TLI 128M-bit SDRAM (54-pin TSOP)
- USB mini B connector for S1D13U11 USB2.0 High-speed device port
- Headers for S1D13U11 LCD interface pins
- Built-in Ortustech TFT panel with touch screen (S5U13U11P10C100 only)
- Header for S1D13U11 GPIO, SPI and I2C pins (need to add the connector)
- Resistive type touch screen controller with SPI interface
- 1Mbit serial flash ROM with SPI interface (for configuration data storage)
- Buzzer and Wake-up key
- 24MHz oscillator
- VBUS 5V power input or external DC5V power input can be selected
- Voltage regulator with 1.8V and 3.3V
- Voltage regulator with adjustable 6~24V output, 40mA max., to provide power for LED backlight of LCD panels.
- LED backlight circuit with PWM control

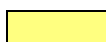
## Chapter 3 Installation and Configuration

The S5U13U11 evaluation board incorporates jumpers and 0 ohm resistors which allow it to be used in a variety of different configurations.

### 3.1 Configuration Jumpers

The S5U13U11 has 15 jumpers which configure various board settings. The jumper positions for each function are shown below. JP5, JP6, JP7, JP8, JP9, JP10, JP11, JP14 and JP15 are solder bridges to reduce power noise. To change the jumper position remove the solder.

| Jumper | Function                           | Position 1-2   | Position 2-3        | No Jumper           |
|--------|------------------------------------|----------------|---------------------|---------------------|
| JP1    | Board current measurement          | Normal         | —                   | Current measurement |
| JP2    | Board power supply                 | VBUS 5V input  | External DC5V       | —                   |
| JP3    | VBUS input signal                  | VBUS 5V input  | External DC5V       | —                   |
| JP4    | Power-on reset source              | VBUS 5V input  | External DC5V       | —                   |
| JP5    | COREVDD current measurement        | Normal         | —                   | Current measurement |
| JP6    | PLLVDV current measurement         | Normal         | —                   | Current measurement |
| JP7    | PIOVDD current measurement         | Normal         | —                   | Current measurement |
| JP8    | USBVDD current measurement         | Normal         | —                   | Current measurement |
| JP9    | MIOVDD current measurement         | Normal         | —                   | Current measurement |
| JP10   | Touch screen power                 | 5V             | 3.3V (Position 1-3) | —                   |
| JP11   | External 3.3V current measurement  | Normal         | —                   | Current measurement |
| JP12   | LED Backlight 12V power control    | ON             | —                   | OFF                 |
| JP13   | Ortustech panel control            | ON/OFF control | Always ON           | —                   |
| JP14   | 3.3V regulator current measurement | Normal         | —                   | Current measurement |
| JP15   | 1.8V regulator current measurement | Normal         | —                   | Current measurement |

 = Default setting

#### JP1 - Current Measurement of the S5U13U11 Evaluation Board

JP1 can be used to measure the current consumption of the S5U13U11 power supply.

When the jumper is at position 1-2, normal operation is selected.

When no jumper is installed, the current consumption for power supply can be measured by connecting an ammeter between pins 1 and 2 of the jumper.

## JP2 - Power Supply Select for the S5U13U11 Evaluation Board

JP2 can be used to select the S5U13U11 power supply.

When the jumper is at position 1-2, VBUS 5V input is selected. The external power supply is not needed.

When the jumper is at position 2-3, external DC5V input is selected. The external power supply is needed.

The supply current of VBUS is specified as a maximum 500mA in the USB specification.

## JP3 - VBUS Input Signal Select

JP3 can be used to select the signal of the S1U13U11 VBUS input pin.

When the jumper is at position 1-2, VBUS input is selected.

When the jumper is at position 2-3, external DC5V input is selected.

## JP4 - Power-on Reset Source Select

JP4 can be used to select the source of the power-on reset circuit.

When the jumper is at position 1-2, VBUS input is selected.

When the jumper is at position 2-3, external DC5V input is selected.

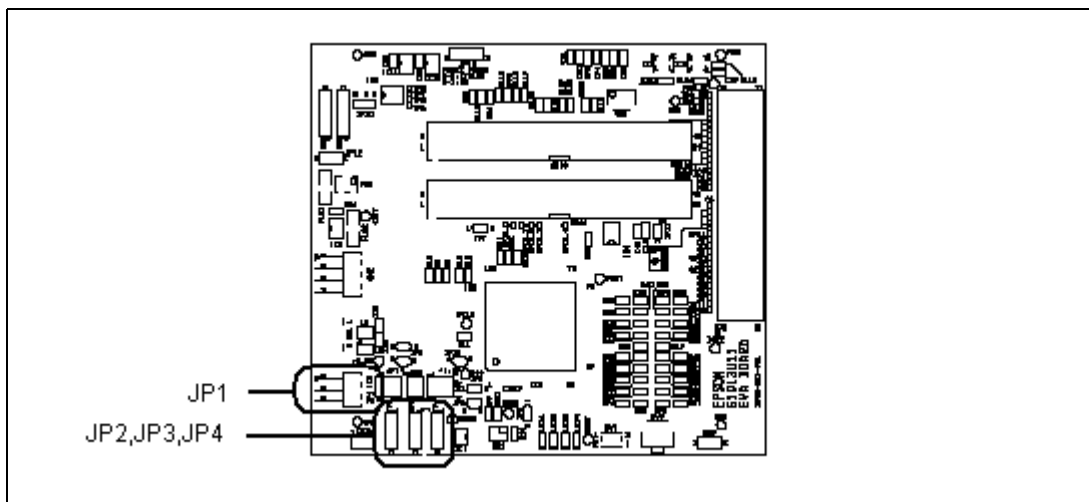


Figure 3-1: Configuration Jumper Locations (JP1, JP2, JP3, JP4)



## JP5, JP6, JP7, JP8, JP9 - Current Measurement of the S1D13U11 Power Supplies

JP5, JP6, JP7, JP8, JP9 can be used to measure the current consumption of the S1D13U11 power supplies.

When the jumper is at position 1-2, normal operation is selected.

When no jumper is installed, the current consumption for each power supplies can be measured by connecting an ammeter between pins 1 and 2 of the jumper.

The jumper associated with each power supply is as follows:

JP5 for COREVDD

JP6 for PLLVDD

JP7 for PIOVDD

JP8 for USBVDD

JP9 for MIOVDD

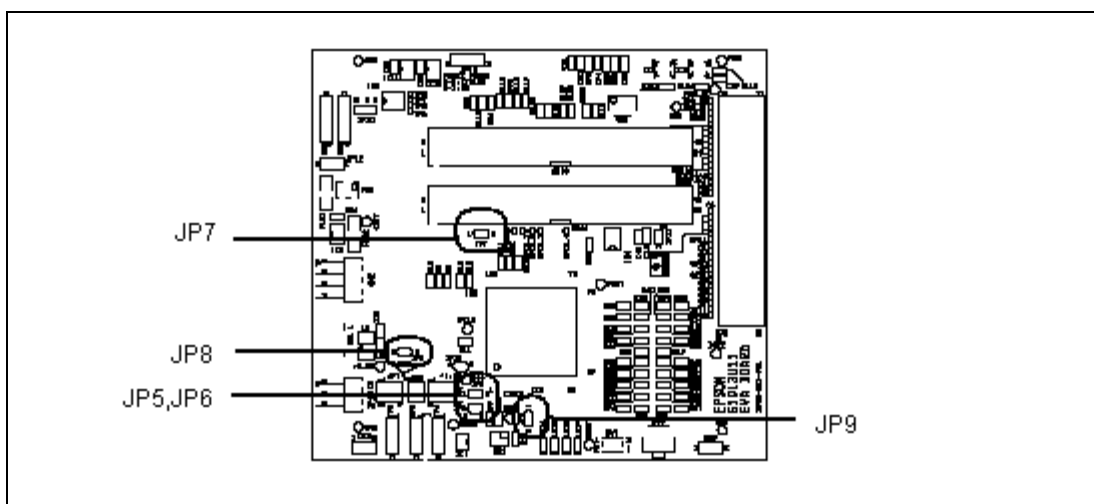


Figure 3-2: Configuration Jumper Locations (JP5, JP6, JP7, JP8, JP9)

## JP11, JP14, JP15 - Current Measurement of the On-board Power Supplies

JP11, JP14, JP15 can be used to measure the current consumption of on-board power supplies.

When the jumper is at position 1-2, normal operation is selected.

When no jumper is installed, the current consumption for each power supplies can be measured by connecting an ammeter between pins 1 and 2 of the jumper.

The jumper associated with each power supply is as follows:

JP11 for external 3.3V power

JP14 for 3.3V regulator

JP15 for 1.8V regulator

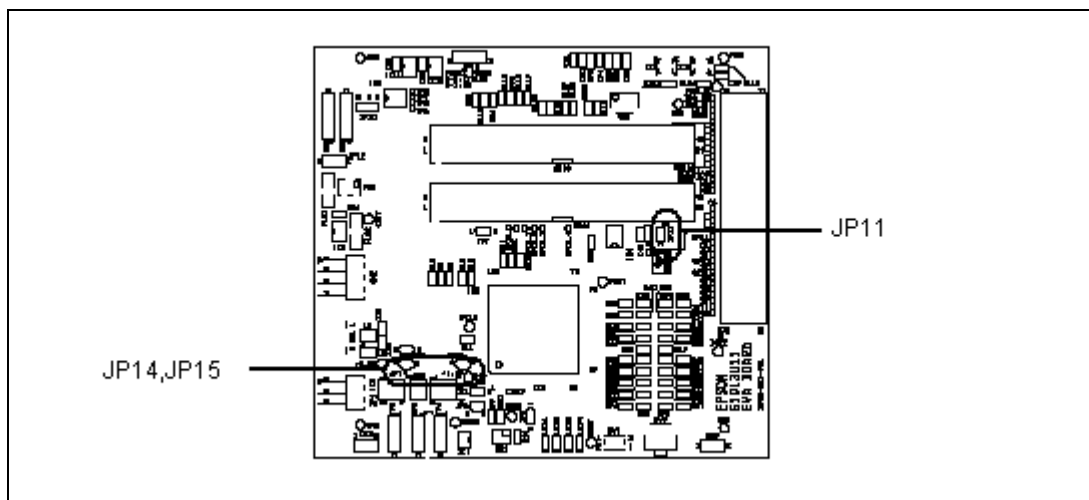


Figure 3-3: Configuration Jumper Locations (JP11, JP14, JP15)

### JP10 - Touch Screen Power Select

JP10 can be used to select the power of the touch screen.

When the jumper is at position 1-3, the power of touch screen signals (X+, Y+) is selected 3.3V.

When the jumper is at position 1-2, the power of touch screen signals (X+, Y+) is selected 5V.

### JP12 - LED Backlight 12V Power Control

JP12 can be used to control the LED backlight 12V power.

When the jumper is at position 1-2, the 12V power is always on.

When no jumper is installed, the 12V power is always off.

### JP13 - Ortustech Panel Power Control

JP13 can be used to control Ortustech panel power (S5U13U11P10C100 only).

When the jumper is at position 1-2, the GPO7 pin of the S1D13U11 can be used to control the Ortustech panel power.

When the jumper is at position 2-3, the Ortustech panel power is always on.

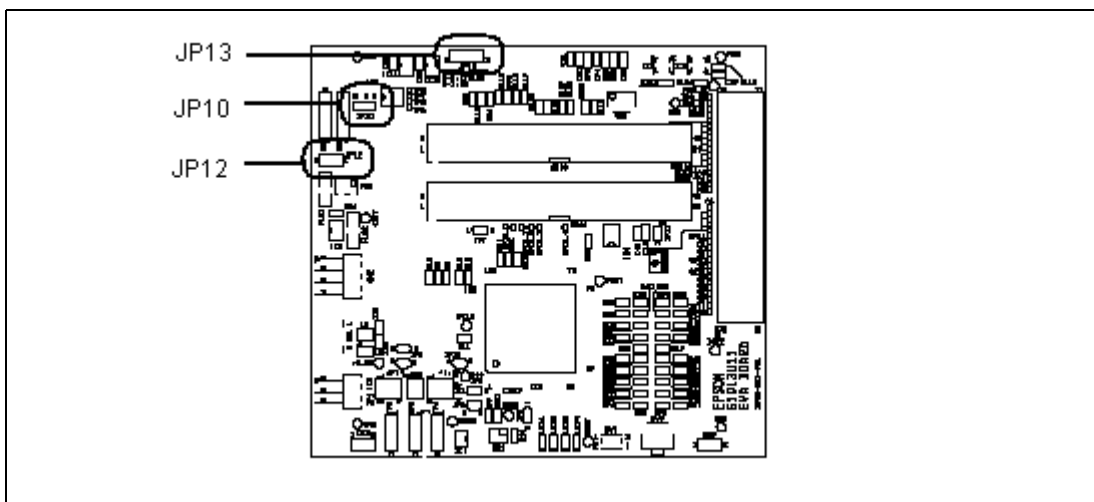


Figure 3-4: Configuration Jumper Locations (JP10, JP12, JP13)

# Chapter 4 Technical Description

## 4.1 Power

### 4.1.1 Power Requirements

The S5U13U11 evaluation board operates only by the USB bus power (VBUS 5V) of the USB cable. When the current supply of VBUS 5V is needed the power consumption over 500mA, the external DC5V power supply must be selected. Because the current supply of VBUS 5V is specified max 500mA in the USB specification.

When the external DC5V power is selected, JP2 and JP4 should be switched jumper position 2-3 and the DC5V power is supplied through the CN3 header.

### 4.1.2 Voltage Regulators

The S5U13U11 evaluation board has an on-board linear regulator (IC6, IC7) to provide the 1.8V and 3.3V power required by the S1D13U11 Display Controller.

### 4.1.3 LED Backlight Voltage Regulators

The S5U13U11 evaluation board has an on-board switching voltage regulator (IC8) to generate adjustable 6~24V, which can be used to 12V power the LED backlight on some LCD panels. When the 12V power is used, the JP12 jumper must be selected position 1-2.

### 4.1.4 LED Backlight Power Circuit

The S5U13U11 evaluation board has an on-board LED backlight power circuits (IC9, IC10). The luminous of the LED backlight can be controlled by the S1D13U11 PWM. The LED backlight power is output through the CN7 header.

## 4.2 Clock

The S5U13U11 evaluation board is operated by the on-board 24MHz oscillator (CR1).

## 4.3 Reset

The S5U13U11 evaluation board can be reset using a push-button (SW1), or on-board power-on reset circuit. The power-on reset circuit is designed the target specification which the threshold voltage is typ 2.7V and the rising delay time is typ 10ms.

## 4.4 Wake-up Key

The S5U13U11 evaluation board has a wake-up key (SW2) which is used to return from sleep mode. The wake-up key is connected to the S1D13U11 INT1 pin.

## 4.5 Buzzer

The S5U13U11 evaluation board has a buzzer (BZ1) which is used for the beep sound. The buzzer is connected to the S1D13U11 BUZZER pin.

## 4.6 Touch Screen

The S5U13U11 evaluation board has a resistive type touch screen controller (IC3). Chip select pin (S1D13U11 SS0#) and interrupt pin (S1D13U11 INT0) are connected to the LED3 and LED4.

The analog signals (X+, X-, Y+, Y-) of the touch screen controller are connected to the CN6 header.

## 4.7 Serial Flash ROM

The S5U13U11 evaluation board has a serial flash ROM (IC4) which is stored the configuration data and start-up display data.

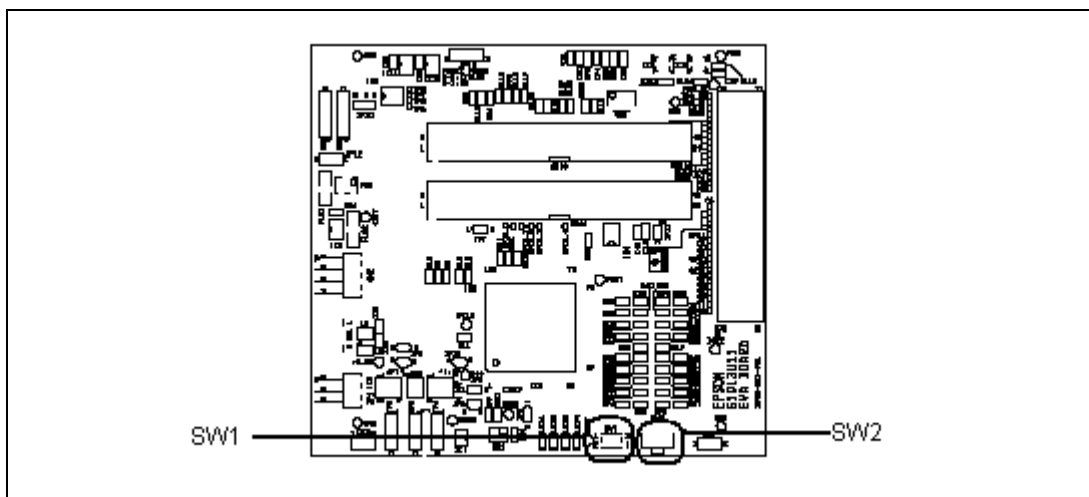
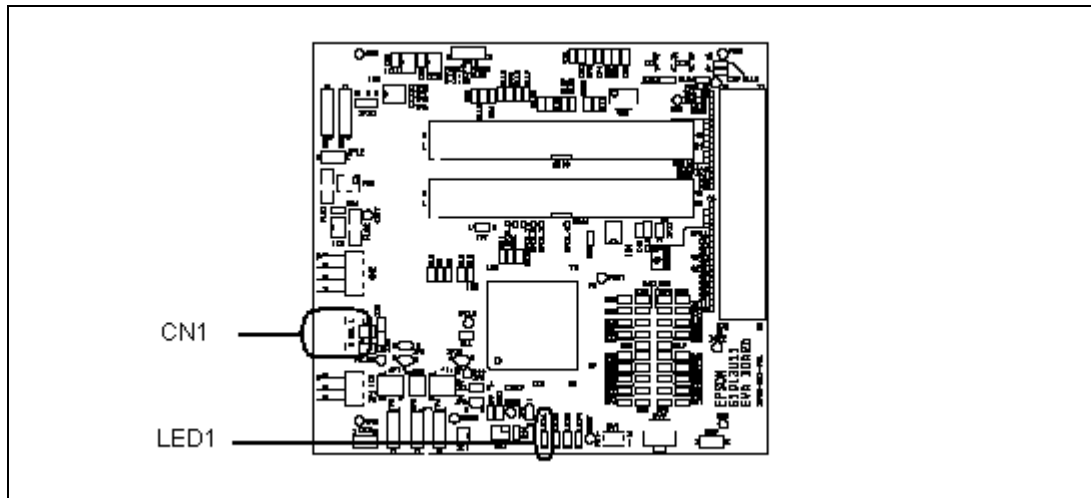


Figure 4-1: Reset Switch and Wake-up Key Locations (SW1, SW2)

## 4.8 Host CPU Interface

The S1D13U11 host interface (USB2.0 High-speed device port) is available on connector CN1 which allows the S5U13U11 evaluation board to be connected to a variety of development platforms.

The LED1 turns on when VBUS power is supplied.



*Figure 4-2: USB Connector and LED1 Locations (CN1, LED1)*

## 4.9 Generic LCD Panel Interface

The S1D13U11 LCD interface signals are available on connectors CN10 and CN11.

Both connector are 0.1x0.1 inch 40-pin header (20x2). For the pinout of connectors CN10 and CN11, see Chapter 6, “Schematic Diagrams” on page 20.

On the evaluation board there is an adjustable 6~24V, 40mA max. power supply. This voltage is provided only on connector CN10 (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 VR2 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.

## 4.10 Ortustech LCD Panel Interface

The S1D13U11 LCD interface signals are connected to the Ortustech LCD panel (COM41T4M17XTC) by connectors CN10 and CN11 (S5U13U11P10C100 only).

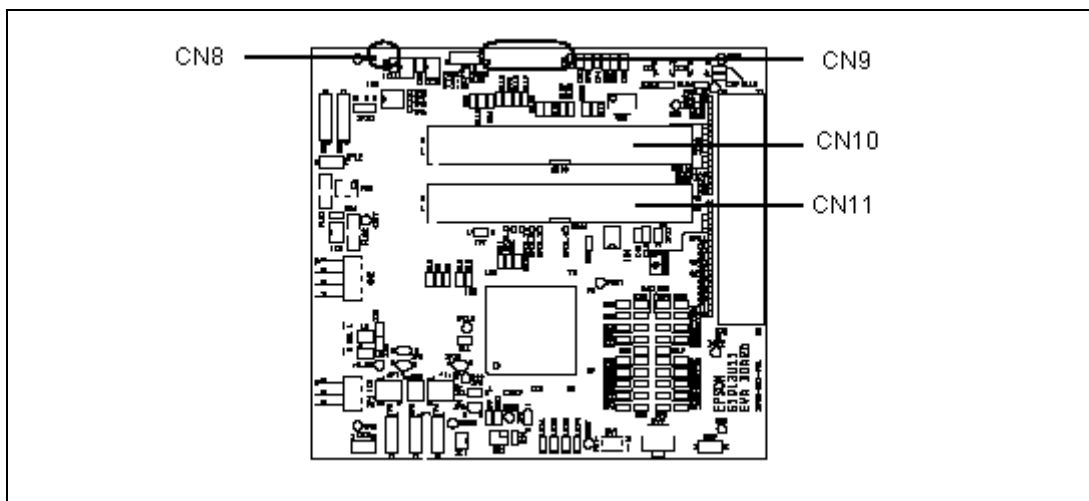
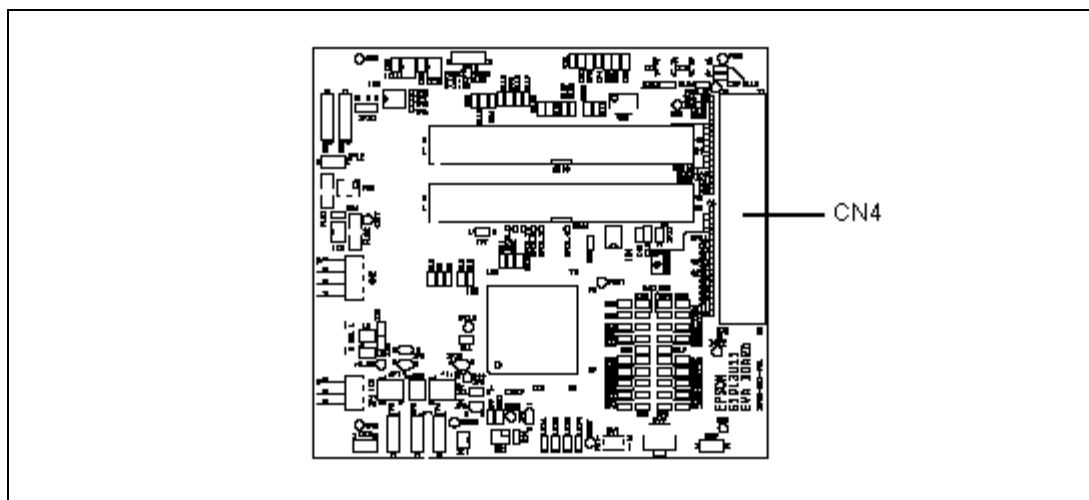


Figure 4-3: LCD Panel Connector Locations (CN8, CN9, CN10, CN11)

## 4.11 Peripheral Interface

The S1D13U11 peripheral interface signals are available on connector CN4. Connector CN4 is 0.1x0.1 inch 40-pin header (20x2). For the pinout of connectors CN4, see Chapter 6, “Schematic Diagrams” on page 20.

The S5U13U11P00C100 evaluation board has a SPI interface, I2C interface, GPIO interface and Key-scan interface.



*Figure 4-4: Peripheral Connector Location (CN4 : no assembly)*



## Chapter 5 Parts Lists

Table 5-1: Parts Lists

| Quantity | Value  | Reference   | Part                    | Manufacturer |
|----------|--------|---|-------------------------|--------------|
| 1        | -      | BZ1   | PKLCS1212E2000-R1       | Murata       |
| 6        | 1u     | C1,C21,C64*,C80*,C81*,C87**   | GRM188F11C105ZA01       | Murata       |
| 1        | 2200p  | C2  | UMK107B222KZ            | Taiyo Yuden  |
| 25       | 0.01u  | C3,C8,C11,C13,C16,C18,C20,C24,<br>C26,C28,C30,C33,C35,C38,C40,<br>C42,C44,C48,C50,C51,C53,C55,<br>C57,C59,C61 | GRM155B11E103KA         | Murata       |
| 1        | 1000p  | C5  | GRM188B11H102KA01       | Murata       |
| 2        | 9p     | C9,C14  | UMK107CH090DZ           | Taiyo Yuden  |
| 23       | 0.1u   | C7,C10,C12,C15,C17,C19,C22,C25,<br>C27,C29,C32,C34,C37,C39,C41,<br>C43,C47,C49,C52,C54,C56,C58,C60            | GRM155B31C104K          | Murata       |
| 4        | 10u    | C6,C45,C83,C84  | GRM21BB10J106ME01       | Murata       |
| 4        | 10uZ-C | C62,C68,C71,C73   | EMK325F106ZH            | Taiyo Yuden  |
| 2        | 2.2u   | C63*,C65*   | GRM21BF11E225ZA01       | Murata       |
| 2        | 4.7u   | C66,C67*  | GRM31MF11C475ZA12B      | Murata       |
| 5        | 2.2u   | C70*,C72*,C74*,C76*,C77*  | GRM188B31A225KE33       | Murata       |
| 3        | 10u    | C69*,C75*,C78*  | C3225JB1A106M           | TDK          |
| 1        | 10p    | C79   | GRM1882C1H100JA01       | Murata       |
| 1        | 1u     | C82   | GRM32RB11H105KA01B      | Murata       |
| 9        | 0.1u   | C4,C23,C31,C36,C46,C85,C86,C88,<br>C89  | GRM188R11H104JA01       | Murata       |
| 1        | -      | CN1   | 54819-0572              | MOLEX        |
| 1        | -      | CN2**   | A2-4PA-2.54DS(71)       | Hirose       |
| 1        | -      | CN4**   | PS-40SD-D4T1-1          | JAE          |
| 3        | -      | CN3,CN5**,JP12  | WL-1-2                  | Mac8         |
| 2        | -      | CN6,CN7   | WL-1-4                  | Mac8         |
| 1        | -      | CN8*  | 59453-041110EALF        | FCI          |
| 1        | -      | CN9*  | 046281267202846+        | Kyocera Elco |
| 2        | -      | CN10,CN11   | HIF3FC-40PA-2.54DSA(71) | Hirose       |
| 1        | -      | CR1   | FA-238 (24MHz)          | EPSON_QD     |
| 1        | -      | D1  | MBR0530                 | Fairchild    |
| 2        | -      | D2,D3   | 1SS421                  | Toshiba      |
| 1        | -      | DM1   | DF3A6.8FU               | Toshiba      |
| 1        | -      | DM2   | HRW0202B                | Renesas      |
| 2        | -      | FLS1,FLS2   | ACF451832-222           | TDK          |
| 1        | -      | IC1   | S-80927CNNB             | SII          |
| 1        | -      | IC2   | S1D13U11                | EPSON        |
| 1        | -      | IC3   | TSC2046IPW              | TI           |

Table 5-1: Parts Lists

| Quantity | Value | Reference   | Part              | Manufacturer |
|----------|-------|---|-------------------|--------------|
| 1        | -     | IC4   | LE25FU106BMA      | Sanyo        |
| 1        | -     | IC5   | IS42S16800E       | ISSI         |
| 1        | -     | IC6   | R1170H331B        | RICOH        |
| 1        | -     | IC7   | R1170H181B        | RICOH        |
| 1        | -     | IC8   | TPS61040DBVR      | TI           |
| 2        | -     | IC9,IC10  | TPS61042DRB       | TI           |
| 2        | -     | IC11,IC12   | TC7SZ04F          | Toshiba      |
| 1        | -     | JP1   | A2-3PA-2.54DS(71) | Hirose       |
| 4        | -     | JP2,JP3,JP4,JP13*   | WL-1-3            | Mac8         |
| 4        | 60    | L1,L2,L4,L5   | BLM21PG600SN1     | Murata       |
| 1        | 90    | L3**  | DLW21SN900SQ2L    | Murata       |
| 1        | 10uH  | L6  | LQH32CN100K23     | Murata       |
| 2        | 4.7uH | L7,L8   | LQH32CN4R7M23L    | Murata       |
| 4        | -     | LED1,LED2*,LED3,LED4  | SML-310MTT86      | ROHM         |
| 1        | uctor | QF1*  | NTF3055L108       | OnSemicond   |
| 1        | 33    | R1  | MCR03EZHJ330      | ROHM         |
| 1        | 820   | R2  | MCR03EZHJ821      | ROHM         |
| 1        | 10    | R3  | MCR03EZHJ100      | ROHM         |
| 1        | 6.2k  | R11   | RR0816P-622-D     | SSM          |
| 3        | 1k    | R20,R77,R87*  | MCR03EZHJ102      | ROHM         |
| 1        | 1.8k  | R26   | MCR03EZHJ182      | ROHM         |
| 2        | 2.2k  | R36,R37   | MCR03EZHJ222      | ROHM         |
| 100      | 0     | R5**,R6,R7,R8,R9,R10,R12,R13,<br>R14,R15,R16**,R17,R18,R19,R21,<br>R22,R23,R24,R25,R27,R28,R29,<br>R30,R31,R32,R33,R34,R35,R38,<br>R39,R40,R41,R42,R43,R44,R45,<br>R46,R47,R48,R49,R50,R51,R52,<br>R53,R54,R55,R56,R57,R58,R59,<br>R60,R61,R62,R63,R64,R65,R66,<br>R67,R68,R69,R70,R71,R72,R73,<br>R74,R75,R76,R78,R79,R80,R81,<br>R82,R84,R93,R94**,R96*,R97**,<br>R98**,R99**,R100**,R101**,R102**,<br>R105*,R106*,R107*,R108*,R109*,<br>R110*,R111,R114*,R117**,R118**,<br>R119**,R120**,R121,R122,R123**,<br>R124**,R125**,R126 | MCR03EZHJ000      | ROHM         |
| 1        | 20k   | R83*  | RR0816P-203-D     | SSM          |
| 1        | 100   | R85*  | MCR03EZHJ101      | ROHM         |
| 1        | 6.8k  | R86*  | RR0816P-682-D     | SSM          |
| 2        | 10k   | R89**,R115**  | MCR03EZHJ103      | ROHM         |
| 1        | 820k  | R90   | MCR03EZHJ824      | ROHM         |
| 1        | 68k   | R91   | RR0816P-683-D     | SSM          |

Table 5-1: Parts Lists

| Quantity | Value | Reference                                 | Part           | Manufacturer |
|----------|-------|---|----------------|--------------|
| 1        | 47k   | R92                                       | MCR03EZHZ473   | ROHM         |
| 1        | 22k   | R95                                       | MCR03EZHZ223   | ROHM         |
| 2        | 12    | R103,R104                                 | MCR03EZHZ120   | ROHM         |
| 4        | 100k  | R4,R112**,R113**,R116**                   | MCR03EZHZ104   | ROHM         |
| 3        | 220   | R88*,R127,R128                            | MCR03EZHZ221   | ROHM         |
| 1        | -     | SW1                                       | SKRSPACE010    | ALPS         |
| 1        | -     | SW2                                       | SKHLLB         | ALPS         |
| 3        | -     | TP47,TP48,TP49                            | LC-33-S-Red    | Mac8         |
| 4        | -     | TP51,TP52,TP56,TP58                       | ST-1-2         | Mac8         |
| 8        | -     | TP1,TP2,TP3,TP9,TP10,TP50,<br>TP60**,TP61 | LC-33-S-Yellow | Mac8         |
| 1        | 10k   | VR1*                                      | RJ-5W103       | Copal        |
| 1        | 200k  | VR2                                       | SM-42X(204)    | Copal        |
| 2        | -     | ZD1**,ZD2**                               | AVRL161A6R8G   | TDK          |
| 1        | -     | LCD panel*                                | COM41T4M17XTC  | Ortustech    |

**Note**

\* not populated on S5U13U11P00C100

\*\* not populated on S5U13U11P00C100 and S5U13U11P10C100.

# Chapter 6 Schematic Diagrams

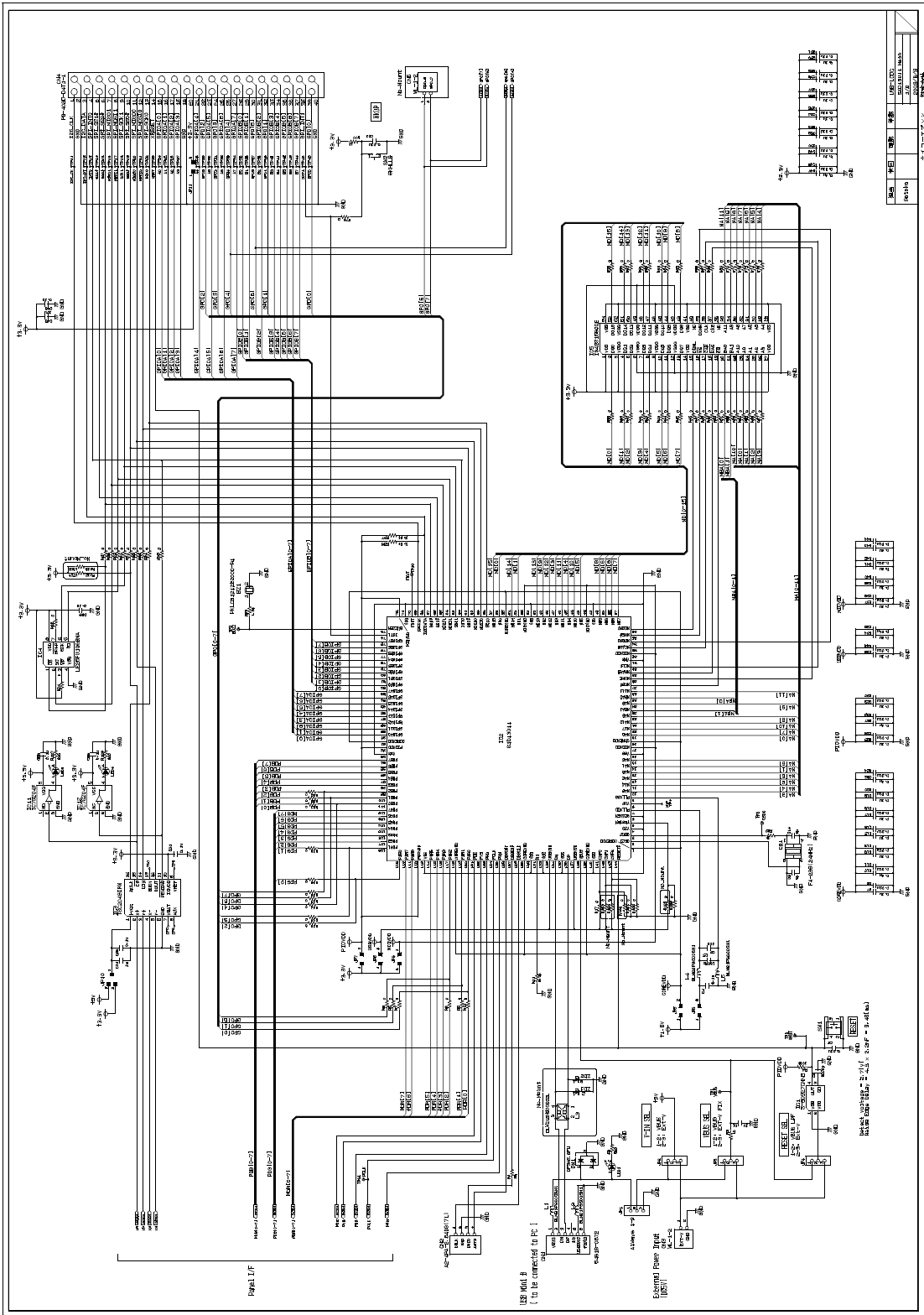


Figure 6-1: S5U13U11P00C100 Schematic Diagram (1 of 2)

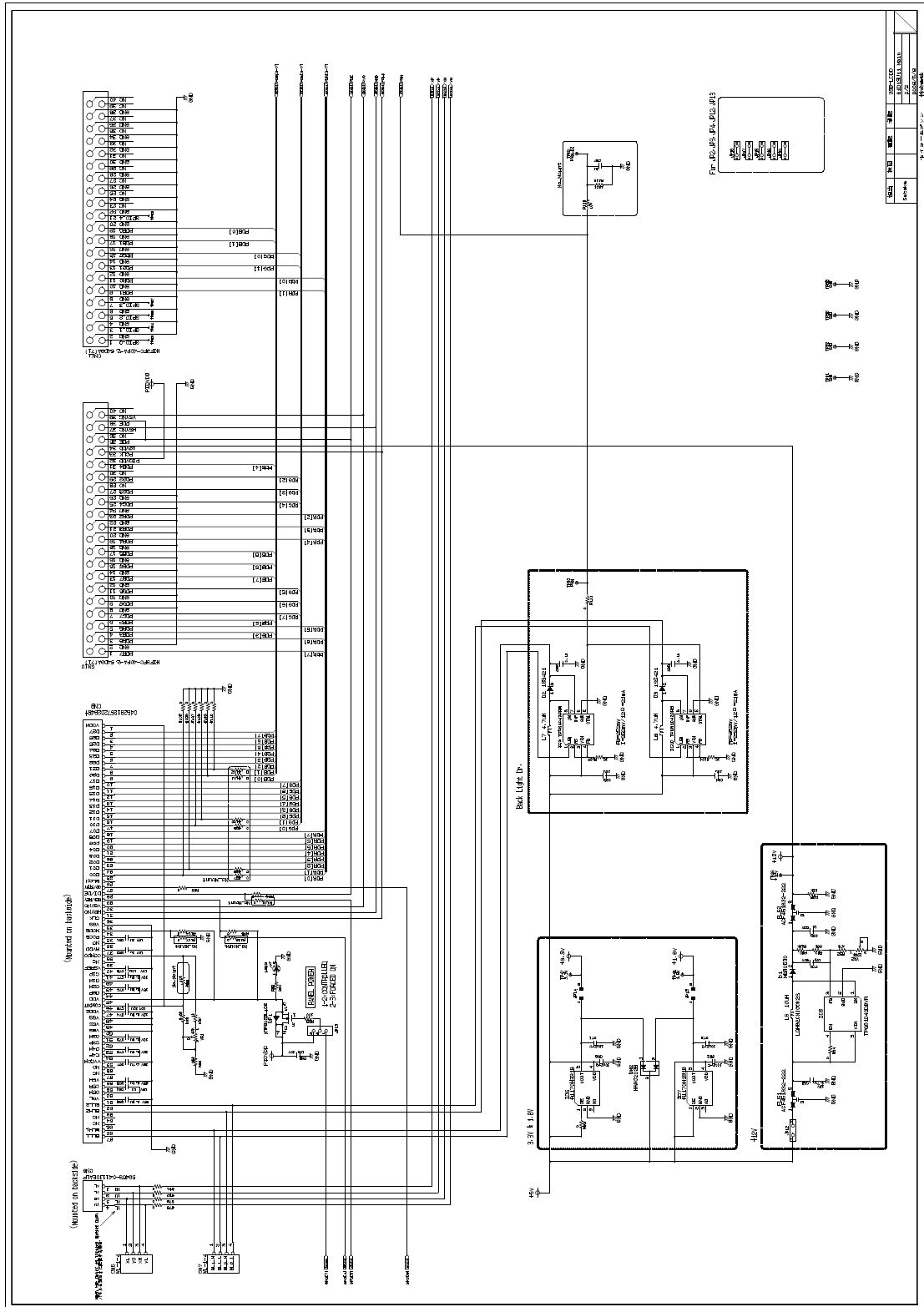


Figure 6-2: S5U13U11P00C100 Schematic Diagram (2 of 2)

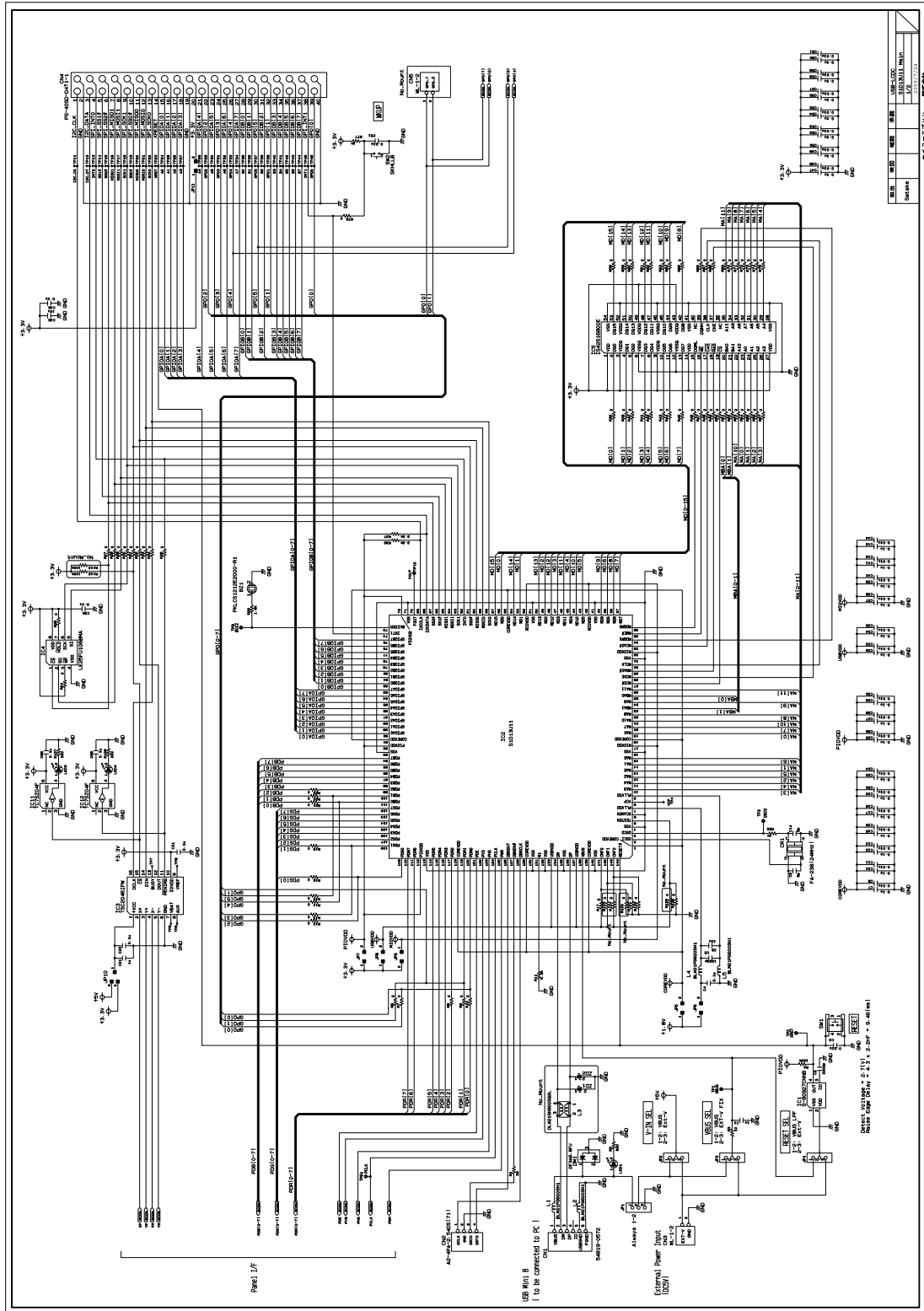


Figure 6-3: S5U13U11P10C100 Schematic Diagram (1 of 2)

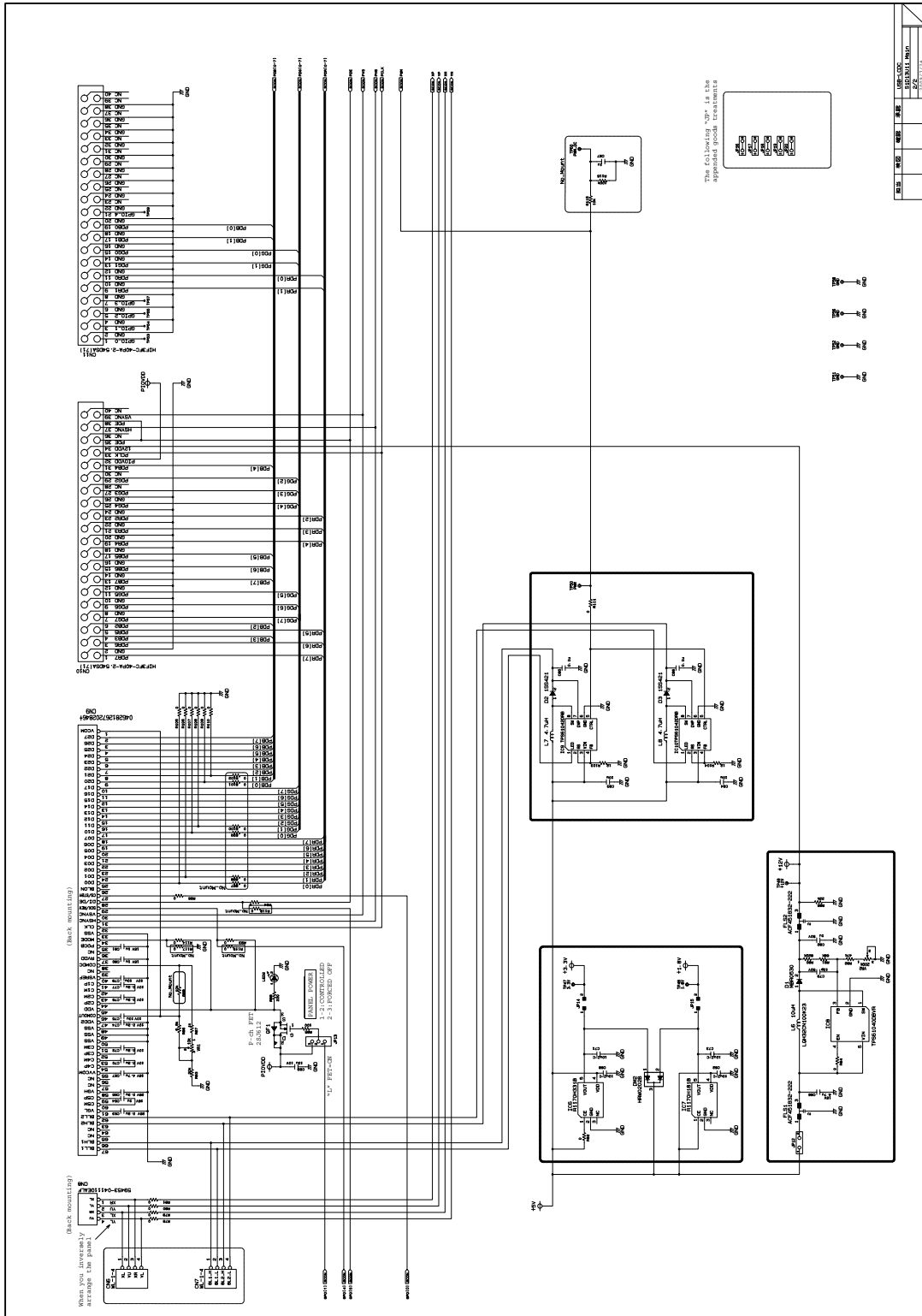


Figure 6-4: S5U13U11P10C100 Schematic Diagram (2 of 2)

# Chapter 7 Board Layout

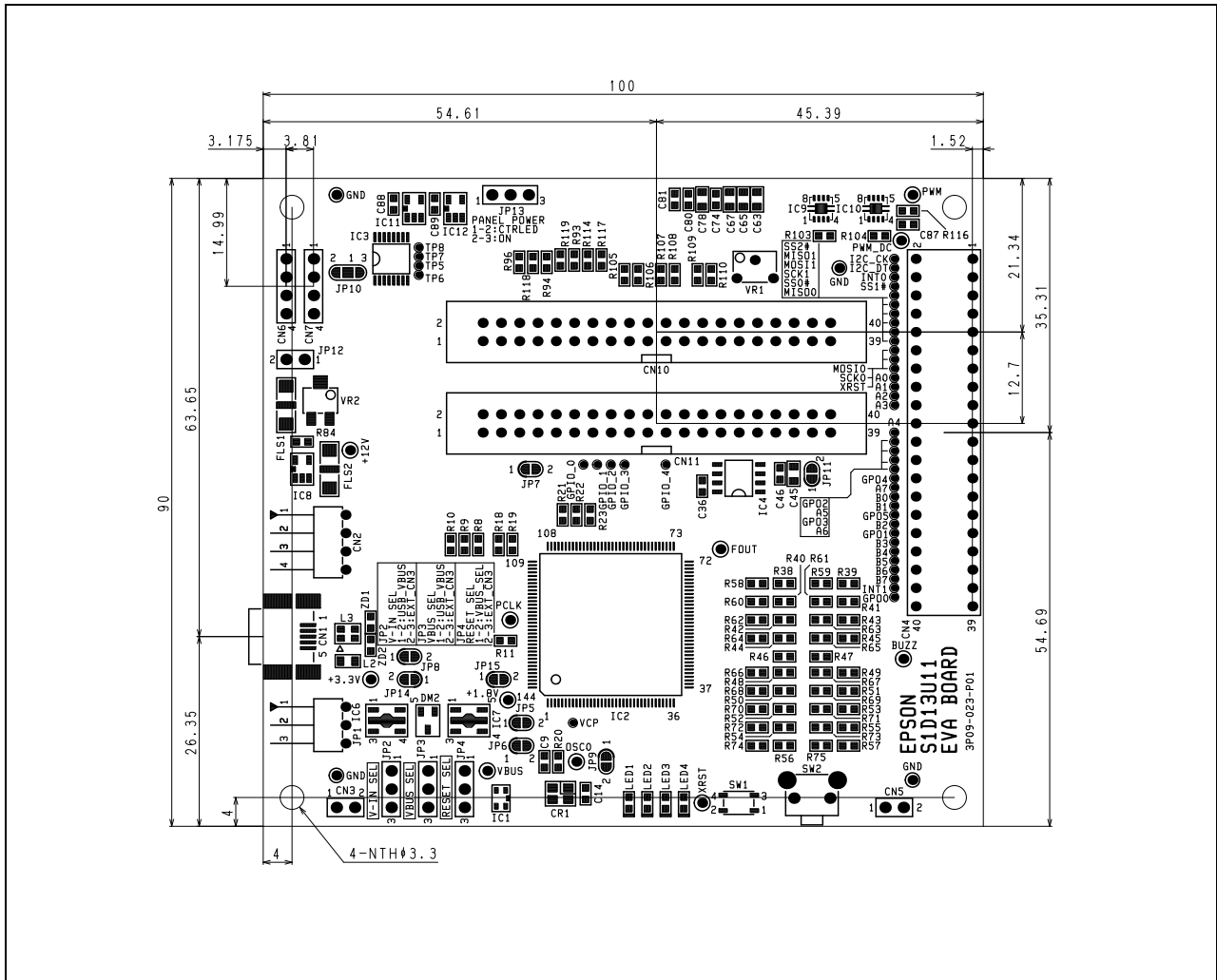


Figure 7-1: Board Layout (Top View)



## 7.1 Peripheral Expansion Board

If a peripheral expansion board is required for development, assemble connector CN4 on the S5U13U11 evaluation board. The mating connector to CN4 is PS-40PE-D4LT1-PN1 (Japan Aviation Electronics Industry, Limited). Assemble the PS-40PE-D4LT1-PN1 connector with 2mm of clearance from the PCB edge to the mold edge.

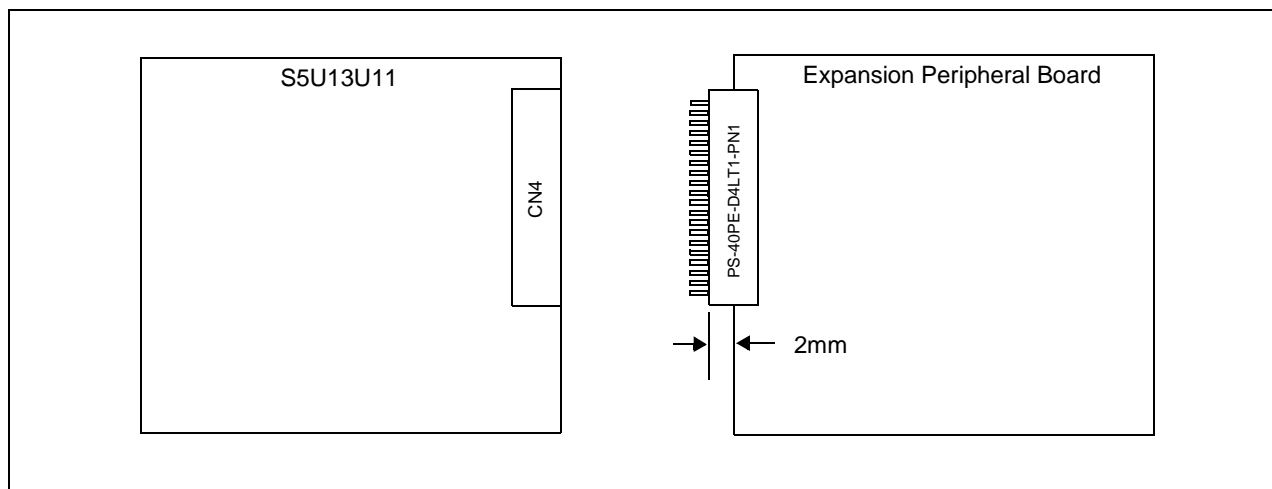


Figure 7-2: Peripheral Expansion Board Connection

## Chapter 8 References

### 8.1 Documents

- Epson Research and Development, Inc., *S1D13U11 Hardware Functional Specification*, document number X96A-A-001-xx
- Epson Research and Development, Inc., *S1D13U11 Software Functional Specification*, document number X96A-A-002-xx

### 8.2 Document Sources

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

## Chapter 9 Change Record

### **X96A-G-001-01 Revision 1.1 - Issued: April 21, 2011**

- globally replace “Casio” with “Ortustech”
- add Evaluation board/kit and Development tool important notice above Copyright notice
- chapter 6 Schematic Diagrams - add S5U13U11P10C100 Schematic Diagrams

### **X96A-G-001-01 Revision 1.0 - Issued: September 9, 2009**

- Initial release

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