User Manual

32

V850ES/Jx3-U - Plug it!

Demonstration Kit for the V850ES/Jx3-U 32-bit RISC microcontroller

Renesas Electronics
www.renesas.com

R20UT0582ED0100, Rev. 2.00
March 16, 2011

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics.

8. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti- crime systems; safety equipment; and medical equipment not specifically designed for life support.

   “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems;medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.

9. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.

10. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.

11. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.

13. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

    (Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority- owned subsidiaries.

    (Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins
   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.
2. Processing at Power-on
   The state of the product is undefined at the moment when power is supplied.

   The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.

   The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products
   Before changing from one product to another, i.e. to one with a different part number, confirm that the change will not lead to problems.

   The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

Regional Information

Some information contained in this document may vary from country to country. Before using any Renesas Electronics product in your application, please contact the Renesas Electronics office in your country to obtain a list of authorized representatives and distributors. They will verify:

- • Device availability
- • Ordering information
- • Product release schedule
- • Availability of related technical literature
- • Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- • Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

Visit

http://www.renesas.com

to get in contact with your regional representatives and distributors.

Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction

V850ES/Jx3-U - Plug it! is an USB-demonstration kit for the Renesas V850 32-bit microcontroller family. It allows the development of an USB system based on the V850ES uPD70F3769 device. It supports onboard debugging and real time execution of application programs.

1.1 Main features of V850ES/Jx3-U - Plug it!

- Easy to use device demonstration capabilities
  V850ES/Jx3-U - Plug it! contains elements to easily demonstrate simple I/O-functions, i.e. I/O lines, USB interface, analog inputs and outputs, UART serial interface etc.

- On-Board debug function
  The *V850ES/Jx3-U - Plug it!* supports an On-Board debug function by using the IAR C-SPY debugger without a need of additional debug hardware. It allows FLASH downloading and standard debug functions like code execution, single stepping, breakpoints, memory manipulation etc.

- Power supply by USB interface or via external power supply

- Various input / output signals and communication capabilities available, such as

  - Seven Segment LED
  - Two Switches prepared for key interrupt generation
  - RS-232C interface
  - Ethernet interface
  - IrDA infrared communication module
  - Audio input/output

- The IAR Embedded Workbench for V850 and the IAR C-SPY debugger / simulator are included. These packages are restricted in such that maximum program code size is limited to 32 KB.

- Full documentation is included for the Renesas V850ES uPD70F3769 microcontroller, IAR Systems Embedded Workbench and IAR Systems C-SPY debugger / simulator.

1.2 System requirements

HOST PC A PC supporting Windows 2000, Windows XP or Windows Vista is required for the IAR Systems Embedded Workbench demo-version. A Pentium processor with at least 1 GHz CPU performance, with at least 256 Mbytes of RAM, allowing you to fully utilize and take advantage of the product features. 500 Mbytes of free disk space and an additional 10 Mbytes of free disk space on the Windows system drive.

A web browser and Adobe Acrobat Reader to be able to access all the product documentation.

Host interface USB interface that enables communication based on USB (Ver1.1 or later)

1.3 Package contents

Please verify that you have received all parts listed in the package contents list attached to the V*850ES/Jx3-U - Plug it!* package. If any part is missing or seems to be damaged, please contact the dealer from whom you received your *V850ES/Jx3-U - Plug it!*.

Note: Updates of the IAR Embedded Workbench for V850 documentation and/or utilities for *V850ES/Jx3-U - Plug it!*, available, may be downloaded from the Renesas WEB page(s) at **http://www2.renesas.eu/updates**

1.4 Trademarks

IAR Embedded Workbench, visualSTATE, IAR MakeApp and C-SPY are registered trademarks of IAR Systems AB. Microsoft and Windows are registered trademarks of Microsoft Corporation. Adobe and Acrobat Reader are registered trademarks of Adobe Systems Incorporated.

All other product names are trademarks or registered trademarks of their respective owners.

Chapter 2 *V850ES/Jx3-U - Plug it!* system configuration

The *V850ES/Jx3-U - Plug it!* system configuration is given in the diagram below:

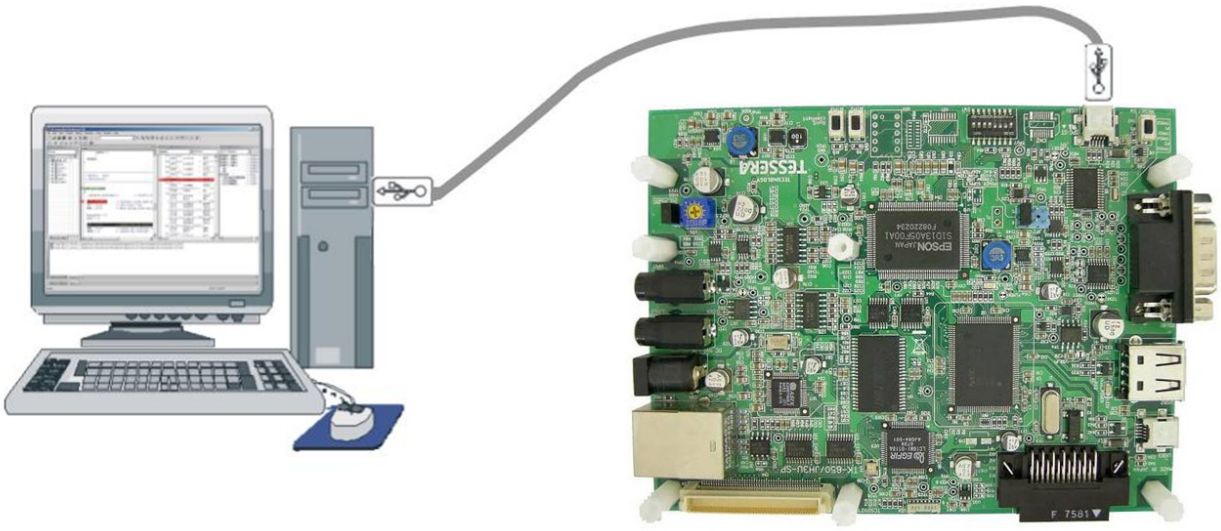


Figure 1: *V850ES/Jx3-U - Plug it!* system configuration

2.1 *V850ES/Jx3-U - Plug it!*

V850ES/Jx3-U - Plug it! is a USB-demonstration kit for the uPD70F3769 32-bit microcontroller of the V850 family. The demonstration board is connected to the host system via USB interface cable. The host system may be used for On-Chip debugging by using the IAR C-SPY debugger and to allow execution of application programs on the *V850ES/Jx3-U - Plug it!* starterkit.

2.2 Host computer

The USB host interface enables communication to the *V850ES/Jx3-U - Plug it!* board. The µPD78F0730 78K0 8-Bit microcontroller with on-chip USB interface and the Renesas virtual UART driver allows application software to access the USB device in the same way as it would access a standard RS232 interface.
The Renesas virtual UART driver appears to the windows system as an extra Com Port, in addition to any existing hardware Com Ports.

2.3 Power supply via USB interface

The *V850ES/Jx3-U - Plug it!* board is powered by the USB interface. Optional the power supply can be applied via the connector CN9.

Chapter 3 *V850ES/Jx3-U - Plug it!* hardware

3.1 Hardware Components

The *V850ES/Jx3-U - Plug it!* board is equipped with USB-connectors and with several connectors in order to be connected to host computers, FLASH programmer or any external target hardware.

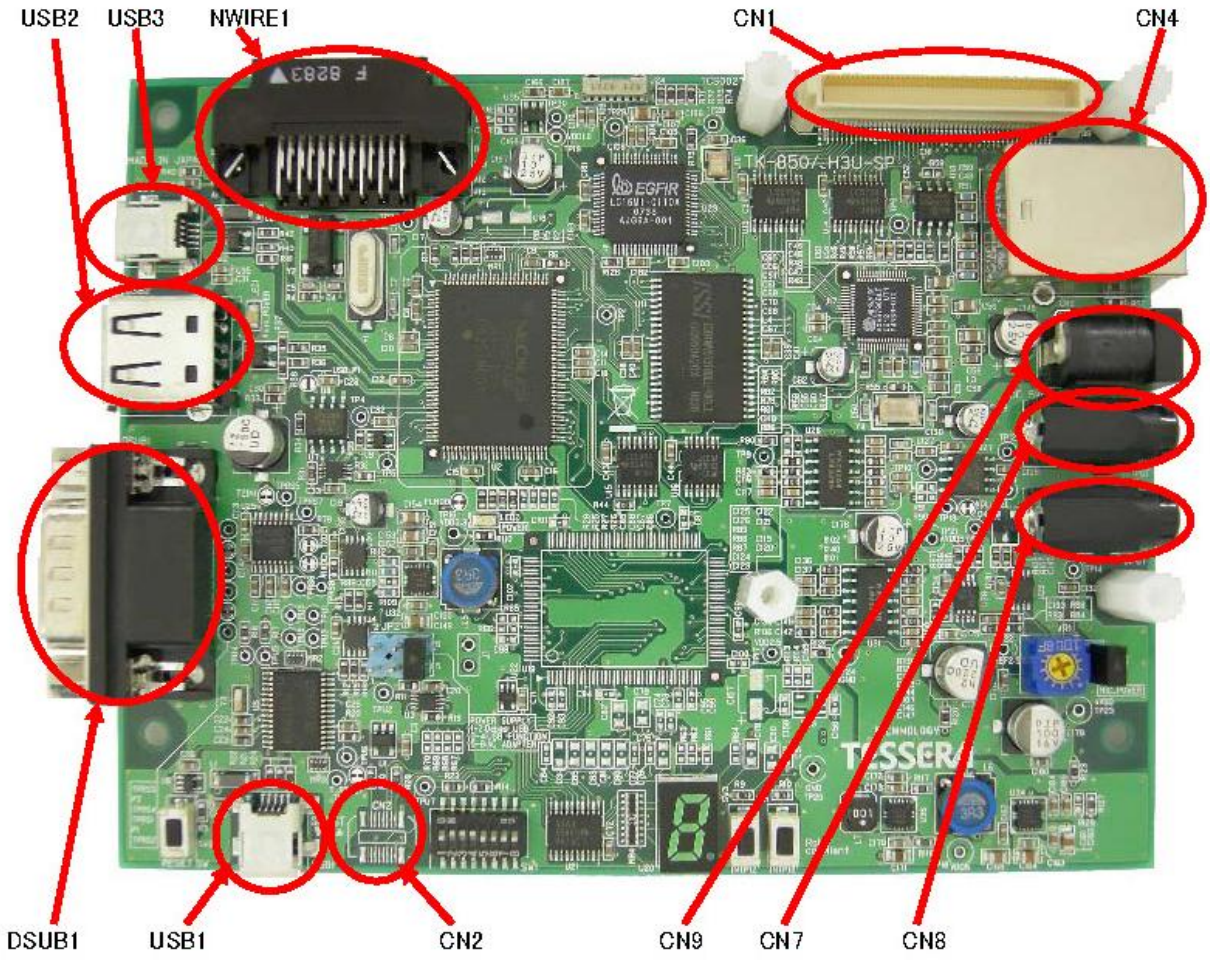


Figure 2: *V850ES/Jx3-U - Plug it!* Connector Layout

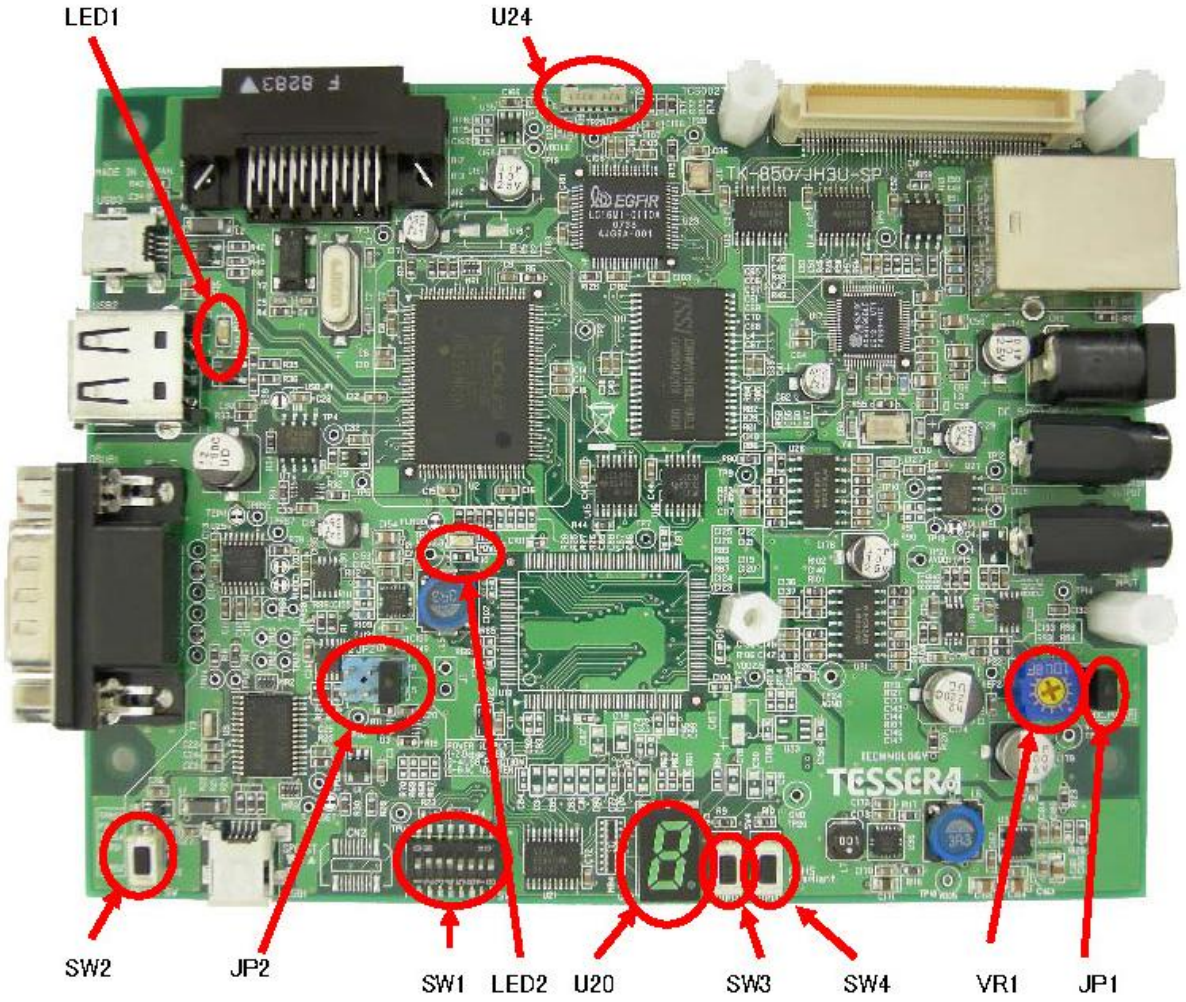


Figure 3: *V850ES/Jx3-U - Plug it!* Function Layout

Some of the *V850ES/Jx3-U - Plug it!* components are free for user application hardware and software. Please read the user's manual of the uPD70F3769 device carefully to get information about the electrical specification of the available I/O ports before you connect any external signals to the *V850ES/Jx3-U - Plug it!* board.

3.1.1 SW1, Configuration Switch (DIP-Switch)

The different operation modes of the *V850ES/Jx3-U - Plug it!* board can be set by switch SW1. The bits 1-4 of DIP switch SW1 are for the mode setting of the board, bits 5-8 are connected to the pins “P78/ANI8”, “P79/ANI9”, “P710/ANI10” and “P711/ANI11” of the V850 microcontroller and can be used for user application purpose.

The *V850ES/Jx3-U - Plug it!* starterkit can be used in the following operation modes:

- On-Board debug mode
  - Start a debug session using the On-Board debug interface
- Flash-Programming Mode
  - Program an application to the build-in flash memory of uPD70F3769 by WriteEZ1-programmer
- Stand alone mode
  - Run a program stored in built-in flash memory of the uPD70F3769 device
- N-Wire debug mode
  - Start a debug session using an N-Wire emulator, e.g. MINICUBE
- Virtual serial COM port mode
  - In this mode USB1 can be used as virtual serial COM port.

SW1 / bit	On-Board Debug Mode	Flash Programming Mode	Stand alone Mode	N-Wire Debug Mode	Virtual serial COM port Mode
1	OFF	OFF	OFF	OFF	OFF
2	ON	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	ON	ON	OFF	OFF	ON

Table 1: Mode setting, switch SW1

Note: After changing the configuration of SW1 bits 1-4 it is necessary to power-up the *V850ES/Jx3-U - Plug it!* board to make changing active. This can be done by simply dis- and reconnecting the USB interface cable.

3.1.2 SW2, RESET button

SW2 is the reset button and controls the reset input signal of the *V850ES/Jx3-U - Plug it!* microcontroller.

3.1.3 SW3, Switch (INTP12)

SW3 is a push button connecting VSS to external interrupt input INTP12 of the microcontroller. This is equal to port ”P98/INTP12” of the uPD70F3769 device. The port may be programmed to generate the external interrupt INTP12. The necessary initialization for this purpose is described in the user’s manual of the uPD70F3769 device.

3.1.4 SW4, Switch (INTP13)

SW4 is a push button connecting VSS to external interrupt input INTP13 of the microcontroller. This is equal to port ”P99/INTP13” of the uPD70F3769 device. The port may be programmed to generate the external interrupt INTP13. The necessary initialization for this purpose is described in the user’s manual of the uPD70F3769 device.

3.1.5 JP2, Power Supply selector

Jumper JP2 is the power supply selector of the *V850ES/Jx3-U - Plug it! board*.

JP2	Power Supply Source
1-2 short	USB connector USB1
3-4 short	USB connector USB3
5-6 short	AC/DC adapter via connector CN9

Table 2: Power supply selector, JP2

Note: If multiple connections made to USB1, USB3 and CN9/J1, set JP2 to the preferred power supply route.

3.1.6 JP1, Power supply selector for MIC input (CN8)

Set the jumper to short to connect an electret condenser microphone to the MIC input (CN8).

3.1.7 LED1, Bus Power LED

LED1 indicates whether line VBUS of connector USB2 is supplied with power.

3.1.8 LED2, Power LED

LED2 is the power LED of the *V850ES/Jx3-U - Plug it!* board. It indicates if power is applied to the *V850ES/Jx3-U - Plug it!* board.

3.1.9 CN1, Extension connector

CN1 is an 100-Pin extension connector (FX8C-100P-SV6 by Hirose Electric Co., Ltd.) and can be used to connect additional external hardware to the *V850ES/Jx3-U - Plug it!* board.

3.1.10 CN2, MINICUBE2 connector

CN2 (not assembled, solder pads) allows connecting a MINICUBE2 to the *V850ES/Jx3-U - Plug it!* board.

3.1.11 CN4, RJ-45 connector

RJ-45 connector socket which allows using the Ethernet functionality of the *V850ES/Jx3-U - Plug it!* board.

3.1.12 CN7, Audio output

Audio output connector for a 3.5mm mini plug. Outputs a low-pass filtered signal from analog output P10/ANO0 of the uPD70F3769.

3.1.13 CN8, Audio input

Audio input connector for a 3.5mm mini plug. The applied signal will be filtered through a low-pass and feed to analog input P72/ANI2 of the uPD70F3769.

3.1.14 CN9, AC power supply connector

CN9 is the AC power supply connector of the *V850ES/Jx3-U - Plug it! board*. Please connect only a power supply with an output of maximum +5V DC to the board.

JACK1	Input
Centre	VDD (+5V)
Ring	GND

Table 3: CN9 connector

3.1.15 J1, Optional power supply connector

J1 (not assembled) is an optional connector for an external power supply. Please connect only a power supply with an output of maximum +5V DC to the board.

3.1.16 NWIRE1, N-Wire connector

Connector NWIRE1 allows connecting an N-Wire On-Chip debug emulator, e.g. MINICUBE, to the *V850ES/Jx3-U - Plug it! board*. Please note, the QB-V850MINI On-Chip debug emulator is a separate product from Renesas and it is not included in this starterkit package.

3.1.17 U20, Seven-segment-LED

The seven-segment-LED U20 is connected to the external bus interface (see chapter 3.2.7) of the uPD70F3769 and can be accessed by writing to any address in the range of 0x600000 – 0x6FFFFF. Output a zero to light the corresponding segment.

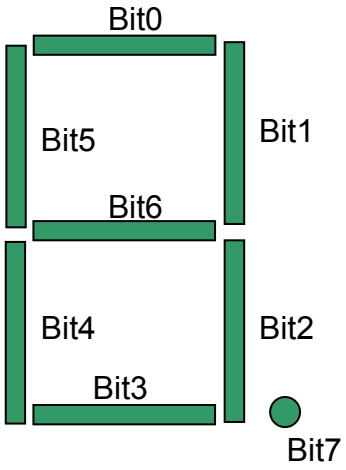


Figure 4: Seven-segment-LED U20

To display the characters ‘0’ to ‘9’ write the following values to the external memory address:

Character	Value
0	0xC0
1	0xF9
2	0xA4
3	0xB0
4	0x99
5	0x92
6	0x83
7	0xf8
8	0x80
9	0x98

Table 4: Display Examples

3.1.18 U24, Infrared communication module

Infrared communication module for communication related to the IrDA standard.

3.1.19 VR1, Volume control

Initial volume level control for the audio input (CN8) signal.

3.1.20 USB1, Debug connector (Type Mini-B)

This interface allows connecting the IAR C-SPY debugger to the *V850ES/Jx3-U - Plug it! board* in order to use the On-Board debug function. The interface supports On-board FLASH erasing / programming and standard debug features like code execution, single stepping, breakpoints, memory manipulation etc.

The power supply of the *V850ES/Jx3-U - Plug it!* board is also provided by the USB1 connector.

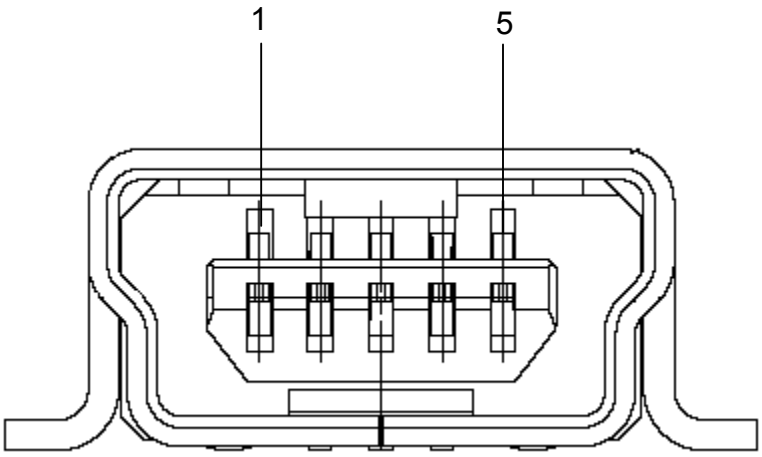


Figure 5: USB1, USB Mini-B Type Host Connector Pin Configuration

Connector USB1	Signal Name
1	VBUS
2	D-
3	D+
4	ID_NC
5	GND

Table 5: Pin Configuration of Connector USB1

For connection with the host machine, use a USB cable (Mini-B type). For confirmation, Renesas Electronics used only the USB cable delivered with the *V850ES/Jx3-U - Plug it!* board.

3.1.21 USB2, Universal serial bus connector (Host, Type A)

The interface allows connecting the built-in USB host controller of the uPD70F3769 with a function device.

For connection with the function device, use a USB cable (Type A). For confirmation, Renesas Electronics used only the USB cable delivered with the *V850ES/Jx3-U - Plug it!* board.

3.1.22 USB3, Universal serial bus connector (Type Mini-B)

The interface allows connecting the built-in USB function controller of the uPD70F3769 with a host system. It is also possible to provide the power supply of the *V850ES/Jx3-U - Plug it!* board by the USB3 connector.

For connection with the host machine, use a USB cable (Type Mini-B). For confirmation,
Renesas Electronics used only the USB cable delivered with the *V850ES/Jx3-U - Plug it!* board.

3.1.23 DSUB1, RS-232C interface connector

The 9-Pin D-Sub connector allows serial communication following the RS-232C protocol.
UARTC1 of the uPD70F3769 will be used for communication.

3.2 On board peripherals

3.2.1 SRAM

- 1MByte (8MBit) SRAM
- SRAM memory base address 0x100000

3.2.2 Ethernet

- LAN Controller: ASIX AX88796B
- RJ45 Jack with Magnetic Module: TAIMAG RJLBC-248TA1
- Ethernet controller register address: 0x500000

3.2.3 IrDA infrared communication

- IrDA controller: ITX E-Globaledge LC16MI-0110A
- IrDA module: ROHM RPM971-H14
- IrDA controller register base address 0x400000

3.2.4 Audio input

- Possibility to capture analog audio signals with the uPD70F3769 internal A/D converter
- Mono microphone level input (short JP1 to connect an electret condenser microphone)
- 3.5mm mono mini plug input
- Anti-aliasing filter Fc = 3.6 kHz
- Filter structure: Three 2nd order low pass filters (-36dB/oct)
- Variable gain amplifier: MicroChip MCP6S91

3.2.5 Audio output

- Possibility to output analog audio signals with the uPD70F3769 internal D/A converter
- Mono line level output
- 3.5mm mono/stereo mini plug output
- Anti-aliasing filter Fc = 3.6 kHz
- Filter structure: Three 2nd order low pass filters (-36dB/oct)
- Amplifier with volume control: National Semiconductor LM4865M

3.2.6 RS-232C

- Connector: 9-Pin D-Sub
- RS-232C driver IC: MAX3232
- Uses UARTC1 of the uPD70F3769

3.2.7 External bus interface

Some of the on-board peripherals of the *V850ES/Jx3-U - Plug it!* board are connected to the external address/data bus of the uPD70F3769. To access the peripherals it is necessary to write to the corresponding address in the external memory area. Figure 6 shows the address mapping.

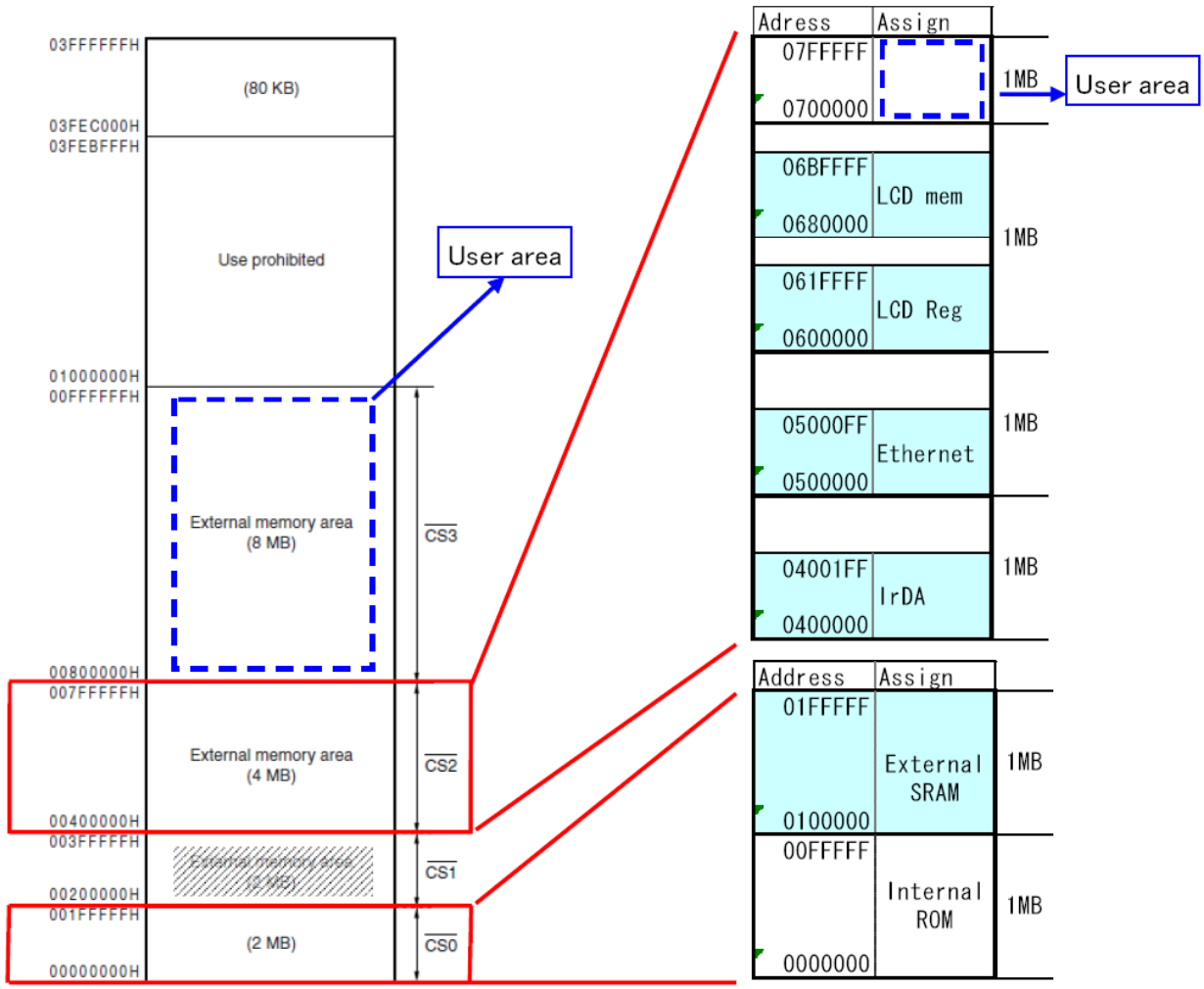


Figure 6: Address mapping of On-board peripherals

3.2.8 External connector

The 100-Pin extension connector (FX8C-100P-SV6 by Hirose Electric Co., Ltd.) can be used to connect additional external hardware to the *V850ES/Jx3-U - Plug it!* board.

No.	V850ES/JH2-U pin	Bus
1	A0	●
3	A1	●
5	A2	●
7	A3	●
9	A4	●
11	A5	●
13	A6	●
15	A7	●
17	A8	●
19	A9	●
21	A10	●
23	A11	●
25	A12	●
27	A13	●
29	A14	●
31	A15	●
33	PCM0/WAIT	●
35	PCM1/CLKOUT	●
37	CS_USER_n	●
39	PCS2/CS2	●
41	PCS3/CS3	●
43	PCT0/WR0	●
45	PCT1/WR1	●
47	PCT4/RD	●
49	PCT6/ASTB	●
51	PDH0/A16	●
53	PDH1/A17	●
55	PDH2/A18	●
57	PDH3/A19	●
59	PDH4/A20	●
61	PDH5/A21	●
63	PDH6/A22	●
65	PDH7/A23	●
67	PDL0/AD0	●
69	PDL1/AD1	●
71	PDL2/AD2	●
73	PDL3/AD3	●
75	PDL4/AD4	●
77	PDL5/AD5/FLMD1	●
79	PDL6/AD6	●
81	PDL7/AD7	●
83	PDL8/AD8	●
85	PDL9/AD9	●
87	PDL10/AD10	●
89	PDL11/AD11	●
91	PDL12/AD12	●
93	PDL13/AD13	●
95	PDL14/AD14	●
97	PDL15/AD15	●
99	PCM2/HLDAK	●

No.	V850ES/JH2-U pin	Bus
2	PCM3/HLDRQ	●
4	P00/INTP00	
6	P01/INTP01	
8	P02/NMI	
10	P11/ANO1	
12	P20/TIAB03/KR2/TOAB03/RTP02	
14	P24/INTP05	
16	P25/INTP06	
18	P32/ASCKC0/SCKF4/TIAA00/TOAA00	
20	P33/TIAA01/TOAA01/RTCDIV/RTCCL	
22	P36/TXDC3/SCL00/UDMARQ0	
24	P37/RXDC3/SDA00/UDMAAK0	
26	P40/SIF0/TXDC4/SDA01	
28	P50/TIAB01/KR0/TOAB01/RTP00/UDMARQ1	
30	P51/TIAB02/KR1/TOAB02/RTP01/UDMAAK1	
32	P60/TOAB1T1/TIAB11/TOAB11	
34	P61/TOAB1B1/TIAB10/TOAB10	
36	P62/TOAB1T2/TIAB12/TOAB12	
38	P63/TOAB1B2/TRGAB1	
40	P64/TOAB1T3/TIAB13/TOAB13	
42	P65/TOAB1B3/EVTB1	
44	P74/ANI4	
46	P75/ANI5	
48	P76/ANI6	
50	P77/ANI7	
52	P90/KR6/TXDC1/SDA02/A0	
54	P91/KR7/RXDC1/SCL02/A1	
56	P92/TENC01/TIT01/TOT01/A2	
58	P93/TECR0/TIT00/TOT00/A3	
60	P94/TIAA31/TOAA31/TENC00/EVTT00/A4	
62	P95/TIAA30/TOAA30/A5	
64	P96/TIAA21/TOAA21/INTP11/A6	
66	P97/SIF1/TIAA20/TOAA20/A7	
68	P914/TIAA51/TOAA51/INTP17/A14	
70	P915/TIAA50/TOAA50/INTP18/A15	
72	RESET	
74	AGND	
76	3.3VAnalog (AVDD)	
78	3.3VDigital (VDD3.3)	
80	3.3VDigital (VDD3.3)	
82	3.3VDigital (VDD3.3)	
84	GND	
86	GND	
88	GND	
90	GND	
92	GND	
94	VDD5V (VDD)	
96	VDD5V (VDD)	
98	VDD5V (VDD)	
100	VDD5V (VDD)	

Table 6: Pin assignment of external connectorCN1

3.3 Layout of solder-short pads

Several pins of the 70F3769 microcontroller are connected to solder short-pads. The pads can be opened by the user to add user specific functions. The signal connected to each solder-short pad is printed on the *V850ES/Jx3-U - Plug it!* board. To open a circuit, cut the narrow part of the pad with a knife. To short a circuit again, join the separated pad with a soldering iron.

Figure 7: Solder-short pad shortened shape

Figure 8: Solder-short pad opened shape

Solder-short pad name	Shipping state	Connection
T_RESET	Short	U1 Pin4 to T_RESET Open when the on-board Reset Circuit is not used.
FLMD0	Short	FLMDO to CPU port P37 Open pad if flash self programming is not used.
USB_P1	Open	USB Host bus power switch output to VBUS of USB2 Short when max. bus power output current is set to 1A
TXDC1	Short	P90/TXDC1 to U25 Pin11 (RS-232C driver) Open when P90 is used for other purposes
RXDC1	Short	P91/RXDC1 to U25 Pin12 (RS-232C driver) Open when P91 is used for other purposes
P1	Short	RTS with CTS of RS-232C Open to use fully handshaked communication
P2	Short	DSR with DTR of RS-232C Open to use fully handshaked communication
VOLUME1	Short	P11/ANO1 to U27 Pin4 (Audio output volume signal) Open when P11 is used for other purposes

Table 7: Solder-short pad connection

Chapter 4 On-Chip debugging

The *V850ES/Jx3-U - Plug it!* board offers two possibilities to use On-Chip debugging (OCD). The MINICUBE2 On-Board debug function of *V850ES/Jx3-U - Plug it!* allows On-Chip debugging without a need of external debug hardware. Within this mode the default USB connection to the Host computer based on the virtual UART driver is used as debug interface. All standard debug functions are available in the On-Board debugging mode like FLASH programming / downloading, code execution, single stepping, breakpoints, memory manipulation etc.

Additionally *V850ES/Jx3-U - Plug it!* supports the QB-V850MINI On-Chip debug emulator in order to use On-Chip debug function of the uPD70F3769 device. The system configuration for On-Chip debugging is shown in figure below.

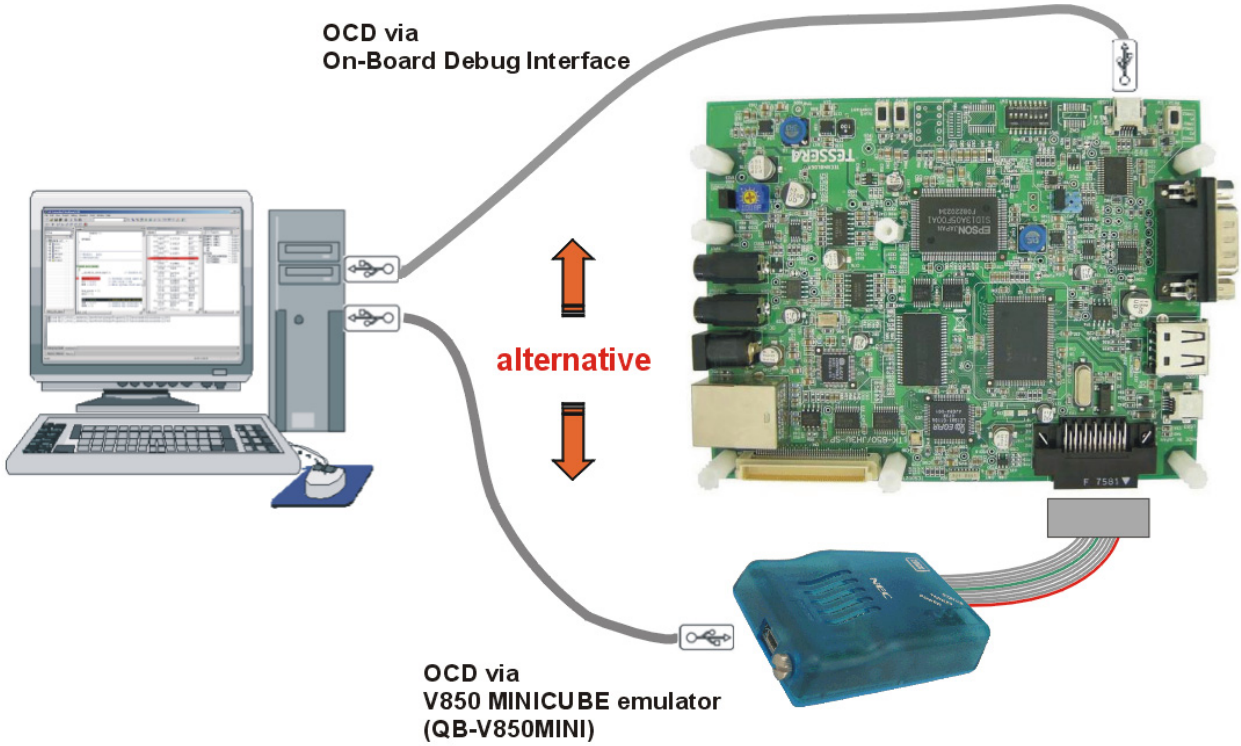


Figure 9: On-Chip debugging

4.1 OCD via MINICUBE2 On-Board debug function

To operate the *V850ES/Jx3-U - Plug it!* board within the On-Board debug mode, configure switch SW1 bits 1-4 as following:

SW1/bit	Configuration
1	OFF
2	ON
3	ON
4	ON

Table 8: OCD via MINICUBE2 On-Board debug function

4.1.1 Resources used by MINICUBE2 OCD Interface

Debugging via the On-board MINICUBE2 OCD Interface uses the user memory spaces to implement communication with the target device, or each debug functions. Refer to the following descriptions and secure these spaces in the user program. For more information about the On-Chip Debug Function please refer to the hardware user's manual of the uPD70F3769.

- Addresses 0x00000060 – 0x00000063: Interrupt vector of debug monitor
  This area is automatically reserved.
  It is not allowed to use this area for any application segment.

- Addresses 0x000004A0 - 0x000004A3: Interrupt vector of UARTC0
  UARTC0 is used for the communication with the debugger and must be reserved
  It is not allowed to use this area for any application segment.

- Addresses 0x00000070-0x00000079 Security ID
  The security ID must be defined to configure the OCD Interface. Details are described in the uPD70F3769 user's manual.

- Addresses 0x0003F800 – 0x0003FFFF: 2K Debug Monitor area (ROM)
  This area must be reserved in the linker control file (*.xcl).
  It is not allowed to use this area for any application segment.

- Addresses 0x3FFEFF0 – 0x3FFEFFFF: 16 Bytes Debug Monitor area (RAM)
  This area must be reserved in the linker control file (*.xcl).
  It is not allowed to use this area for any application segment.

4.2 OCD via N-Wire emulator

To operate the *V850ES/Jx3-U - Plug it!* board together with an N-Wire On-Chip debug emulator, e.g. QB-V850MINI, connected to NWIRE1, configure switch SW1 bits1-4 as following:

SW1/bit	Configuration
1	OFF
2	OFF
3	OFF
4	OFF

Table 9: OCD via QB-V850MINI emulator

Chapter 5 *V850ES/Jx3-U - Plug it!* installation and operation

5.1 Getting started

The IAR Embedded Workbench including the C-SPY debugger allows building and downloading application programs to the *V850ES/Jx3-U - Plug it!* starterkit. As communication interface between the PC host system and the *V850ES/Jx3-U - Plug it!* board a standard USB interface line is needed. Before you can download and run a program, software and hardware have to be installed properly.

5.1.1 CD-ROM contents

The CD-ROM shows following directory structure:

V850ES/Jx3-U - Plug it!	CD-ROM ROOT
Acrobat	- Acrobat Reader for 32Bit Windows OS
Device File Package	- Device File Package for V850ES/Jx3-U
Doc	- Documentation
IAR	- IAR Embedded Workbench for V850
SamplePrograms	- Sample programs for V850ES/Jx3-U - Plug it! *including:* ○ *Jx3U_PLUGIT_DEMO sample* ○ *Jx3U_PLUGIT_COM sample* ○ *Jx3U_PLUGIT_STORAGE sample*
Segger	- *Segger USB Eval Package*
WriteEZ1	- Flash Programmer WriteEZ1 incl. PRM files for uPD70F3769

Table 10: *V850ES/Jx3-U - Plug it!* CD-ROM directory structure

Chapter 6 Hardware installation

After unpacking *V850ES/Jx3-U - Plug it!,* connect the board via connector USB1 to your host computer using the provided USB interface cable. When *V850ES/Jx3-U - Plug it!* is connected, the USB driver needs to be installed on the host machine. Please refer to the following chapter 7.5 USB Driver Installation.

Chapter 7 Software installation

The *V850ES/Jx3-U - Plug it!* package comes with the following software demo packages:

- IAR Systems Embedded Workbench for V850, including C compiler, assembler, linker, librarian and IAR C-SPY debugger / simulator
- Sample programs
- Segger USB Eval Package

The IAR Systems Embedded Workbench must be installed on your PC. For detailed installation hints, refer to the following chapters and to the corresponding documentation of the IAR Embedded Workbench.

7.1 IAR Systems Embedded Workbench for V850 installation

To install the IAR Systems Embedded Workbench for V850 including C-SPY debugger / simulator, select the AUTORUN program in the directory \IAR\ of the CDROM. The setup dialogues will guide you through the installation process.

7.2 Device File Package installation

To use the IAR Embedded Workbench for V850 together with the uPD70F3769 , you have to install the latest device files. You will find the installer for the Device file package on the *V850ES/Jx3-U - Plug it!* CD. Select the file Setup_V850ES-JX3-U_V1.01.exe in the directory \Device File Package\. The setup dialogues will guide you through the installation process.

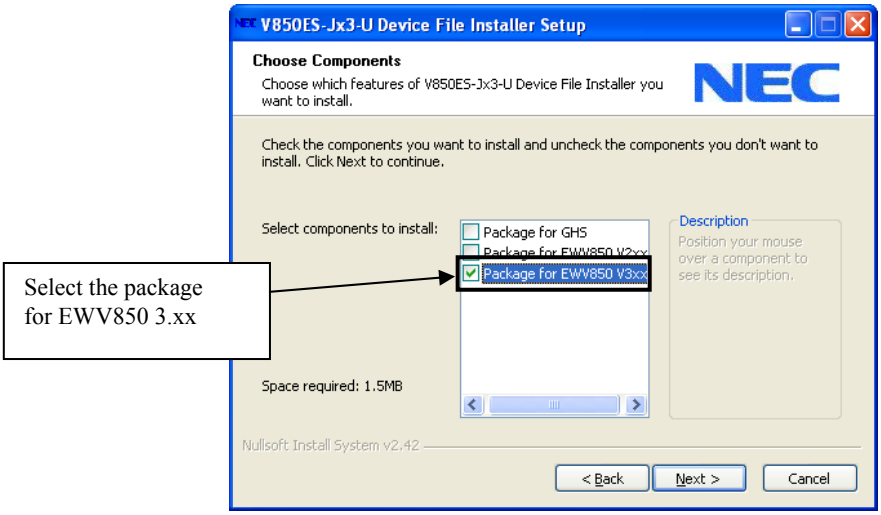


Figure 10: Device File Installation

7.3 Sample program installation

To install the sample/demonstration programs for the *V850ES/Jx3-U - Plug it!* board select the Jx3U-PLUGIT_Samples_V100.exe in the directory \SamplePrograms\ on the CDROM. The setup dialogues will guide you through the installation process.

7.4 Segger USB Eval Package installation

To install the Segger USB Eval Package for the *V850ES/Jx3-U - Plug it!* board select the SeggerEval_Jx3U_PLUGIT.exe in the directory \Segger\ on the CDROM. The setup dialogues will guide you through the installation process. After the installation you will find a detailed documentation of the Segger USB Eval Package in the installation directory.

7.5 USB Driver Installation

In order to use the *V850ES/Jx3-U - Plug it! board* for On-Chip debugging the USB driver needs to be installed on the host machine. Install the driver according to the following procedure:

Installation on Windows 2000 ..... Page 32
Installation on Windows XP ..... Page 36

Note: The USB driver is part of the IAR Embedded Workbench software package. Therefore please install the IAR Embedded Workbench first.

7.5.1 Installation on Windows 2000

1. When the *V850ES/Jx3-U - Plug it!* board is connected with the host machine, the board is recognized by <Plug and Play>, and the wizard for finding new hardware is started. Click Next>.

Figure 11: Found New Hardware Wizard (Windows 2000)

2. Following the window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next>.

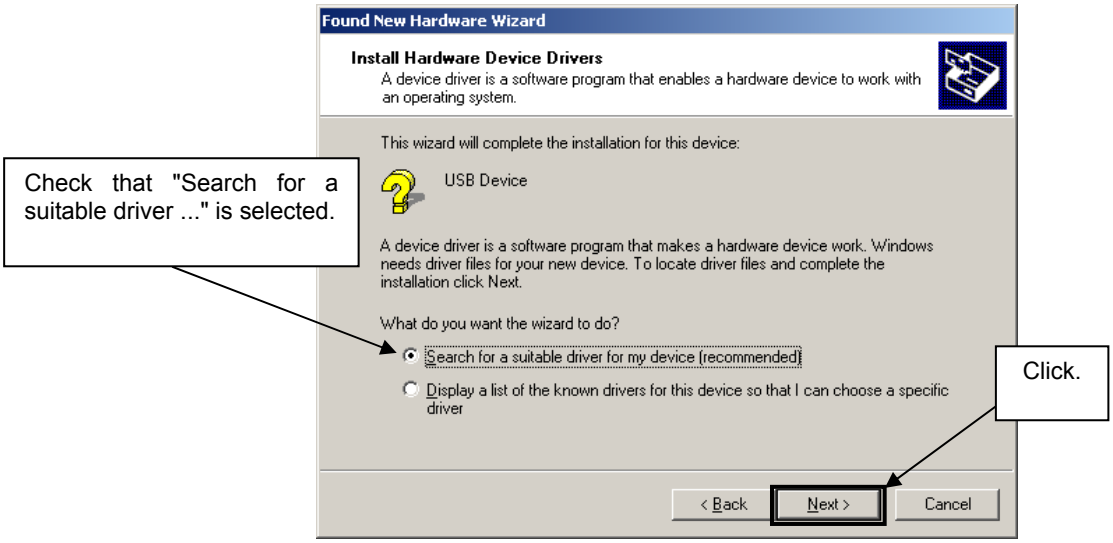


Figure 12: Search Method (Windows 2000)

3. Check the "Specify a location" check box only, then click Next>.

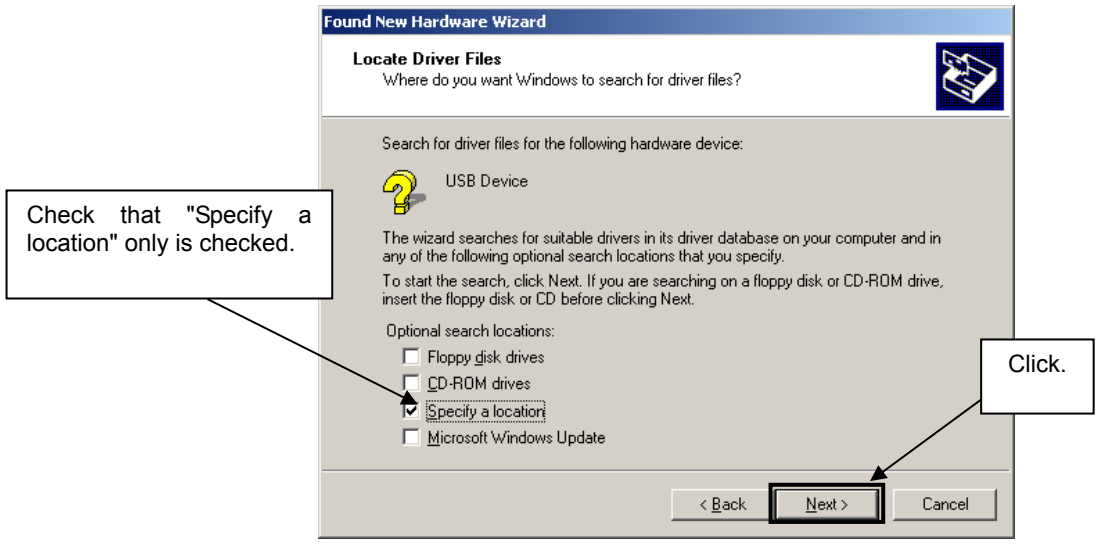


Figure 13: Driver File Location (Windows 2000)

4. Locate the folder " \Driver" on the CD-ROM.

5. The setup information file "MQB2SALL.inf" is automatic selected, then click Open to proceed within driver installation.

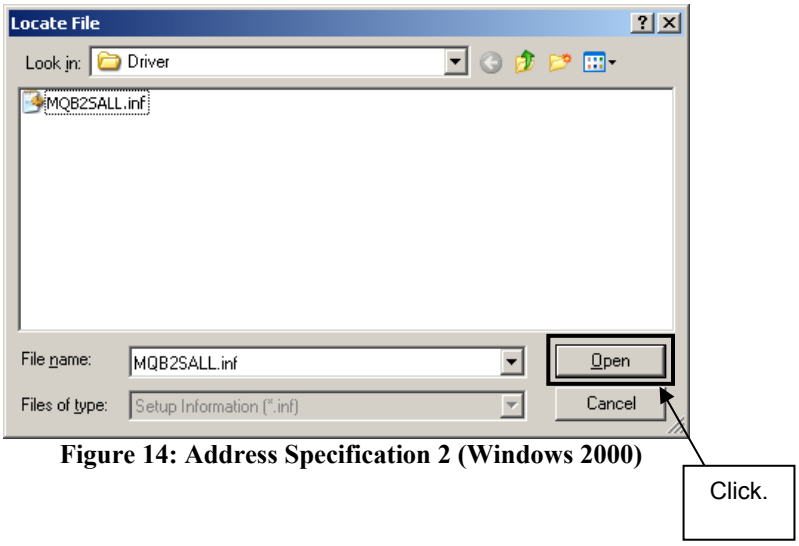


Figure 14: Address Specification 2 (Windows 2000)

6. After the location of the USB driver has been specified click OK to proceed.

7. Click Next>.

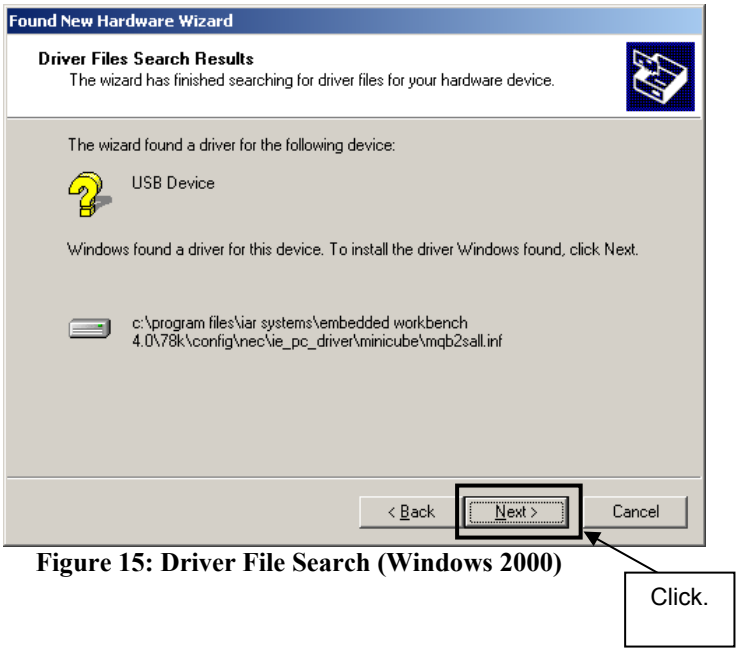


Figure 15: Driver File Search (Windows 2000)

8. Click Finish to complete the installation of the USB driver.

Figure 16: USB Driver Installation Completion (Windows 2000)

7.5.2 Installation on Windows XP

1. When the *V850ES/Jx3-U - Plug it*! board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for finding new hardware is started. At first the hardware wizard will ask if windows should search on the windows update web, check "No, not this time" and then click Next>.

Figure 17: Found New Hardware Wizard 1 (Windows XP)

2. Check that "Install from a list or specific location (Advanced)" is selected, then click Next>.

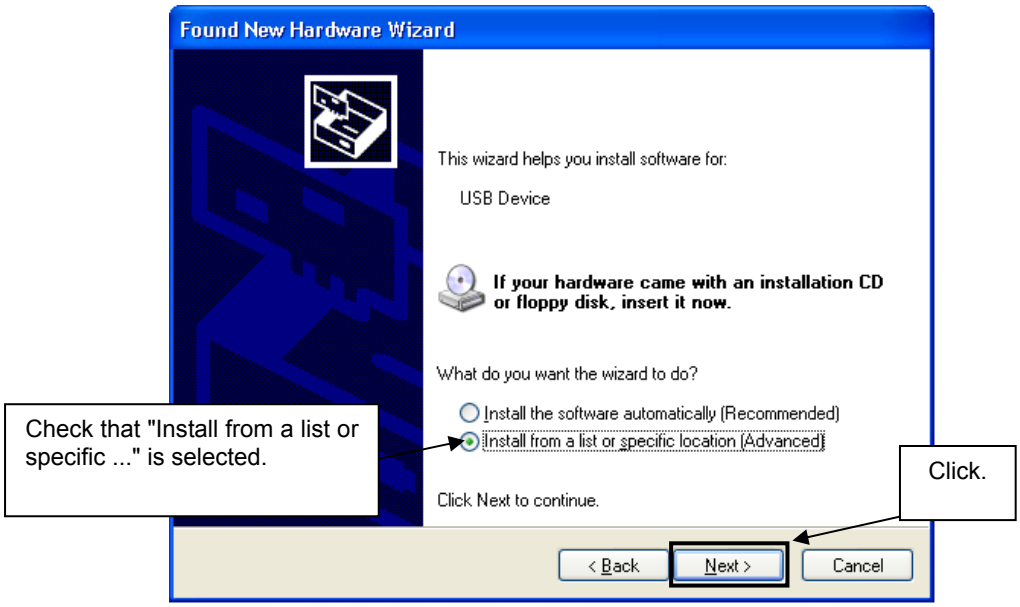


Figure 18: Found New Hardware Wizard 2 (Windows XP)

3. Check that "Search for the best driver in these locations." is selected. Select the "Include this location in the search:" check box and then click Browse.

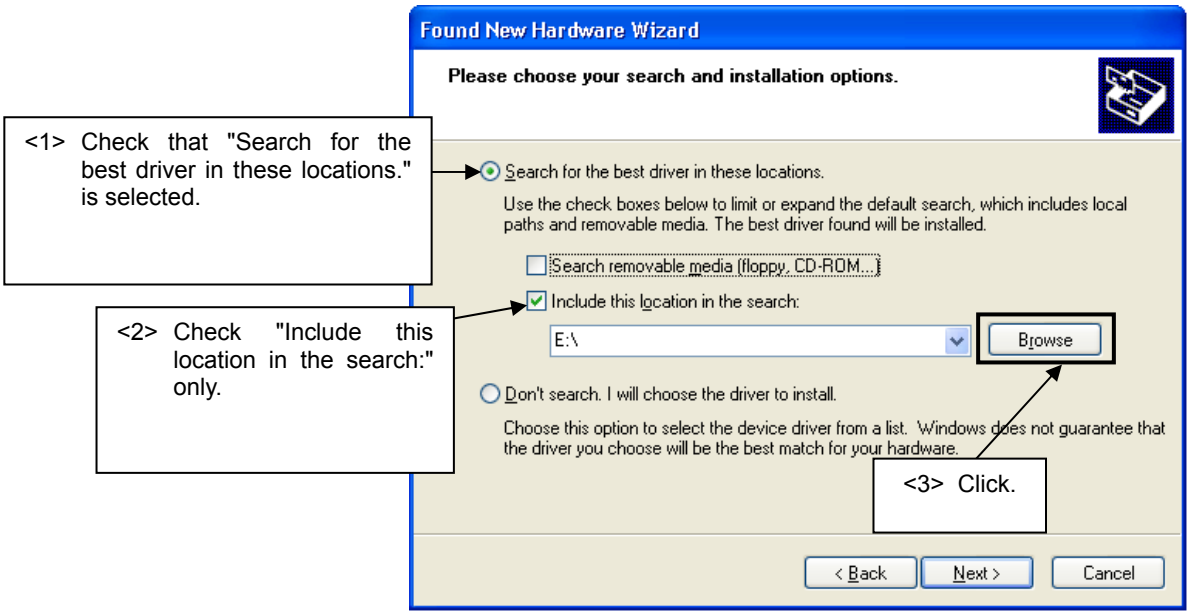


Figure 19: Search Location Specification 1 (Windows XP)

4. Locate the folder "\Driver" on the CD-ROM.

5. After the location of the USB driver has been specified click Next> to continue driver installation.

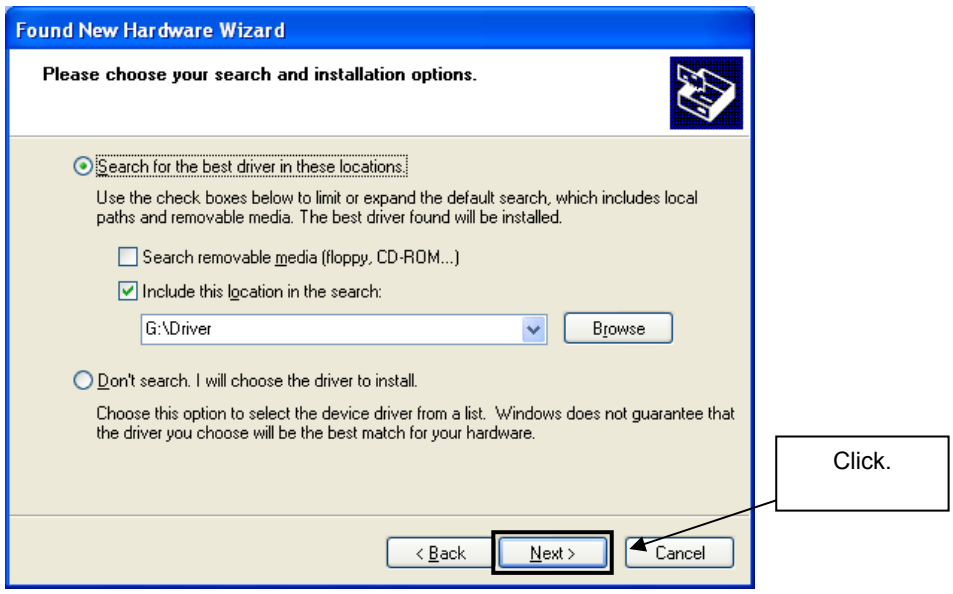


Figure 20: Search Location Specification 2 (Windows XP)

6. As shown below, "NEC Electronics Starter Kit Virtual UART has not passed Windows Logo testing to verify its compatibility with Windows XP." is displayed. Click Continue Anyway.

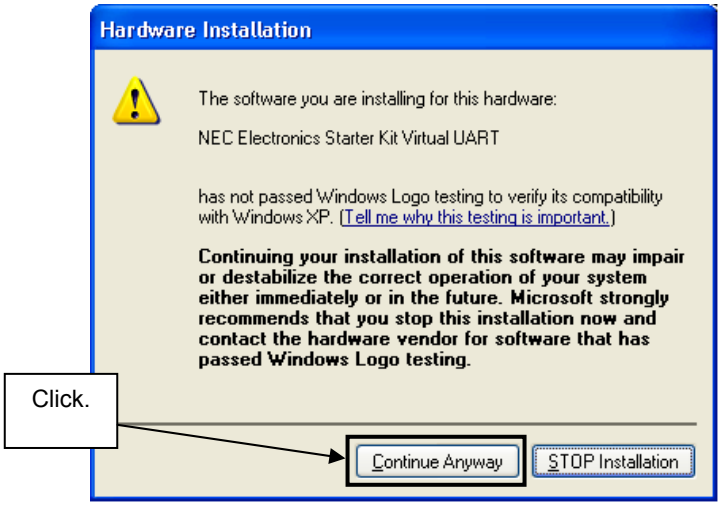


Figure 21: Windows XP Logo Testing (Windows XP)

7. After the installation of the USB driver is completed the window below is displayed. Click Finish to close the hardware wizard.

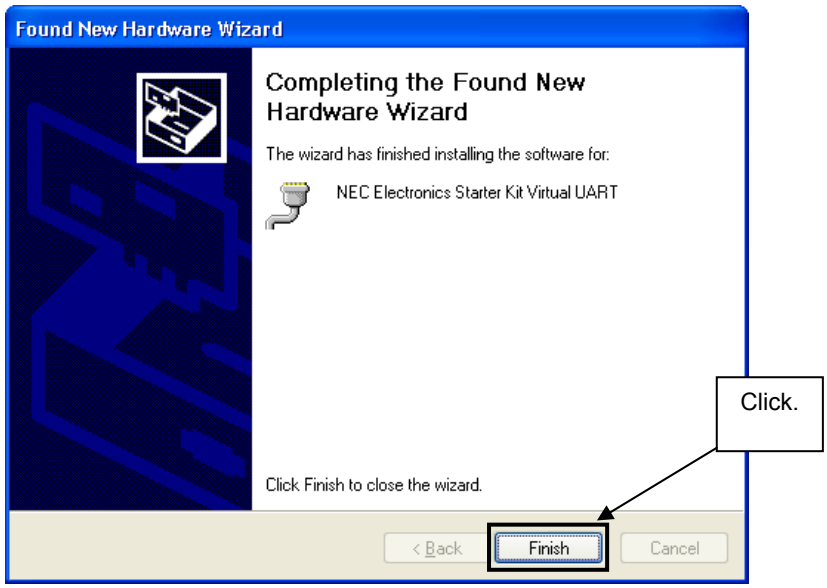


Figure 22: USB Driver Installation Completion (Windows XP)

7.6 Confirmation of USB Driver Installation

After installing the USB driver, check that the driver has been installed normally, according to the procedure below. When using the *V850ES/Jx3-U - Plug it!* board in combination with IAR C-SPY debugger the “NEC Electronics Starter Kit Virtual UART” should be present like in the figure below.

Please check in the Windows "Device Manager" within the Windows Properties (“Hardware” tab), that the driver is installed normally.

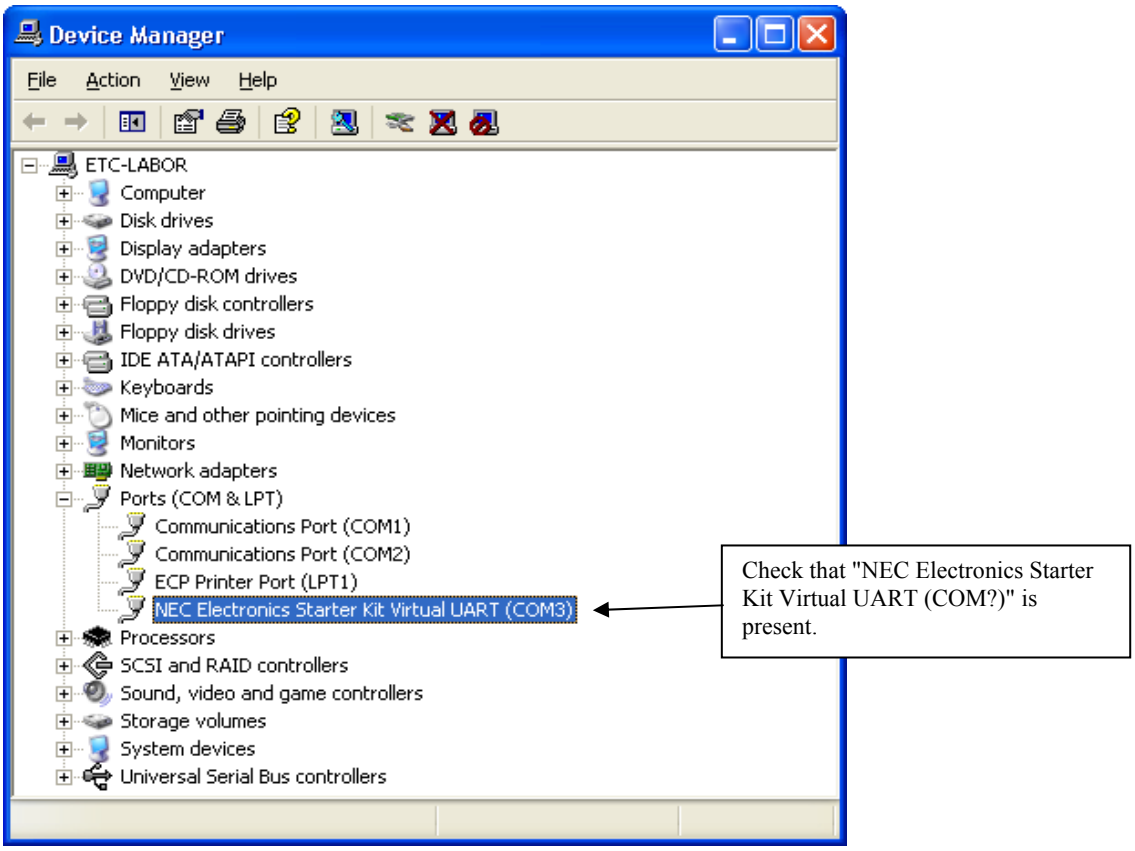


Figure 23: Windows Device Manager

Chapter 8 IAR sample session

When everything is set up correctly the IAR Embedded Workbench can be started. To do so, start the Embedded Workbench from Windows “Start” menu > “Programs” > folder “IAR Systems” > “IAR Embedded Workbench Kickstart for NEC V850”. The following screen appears:

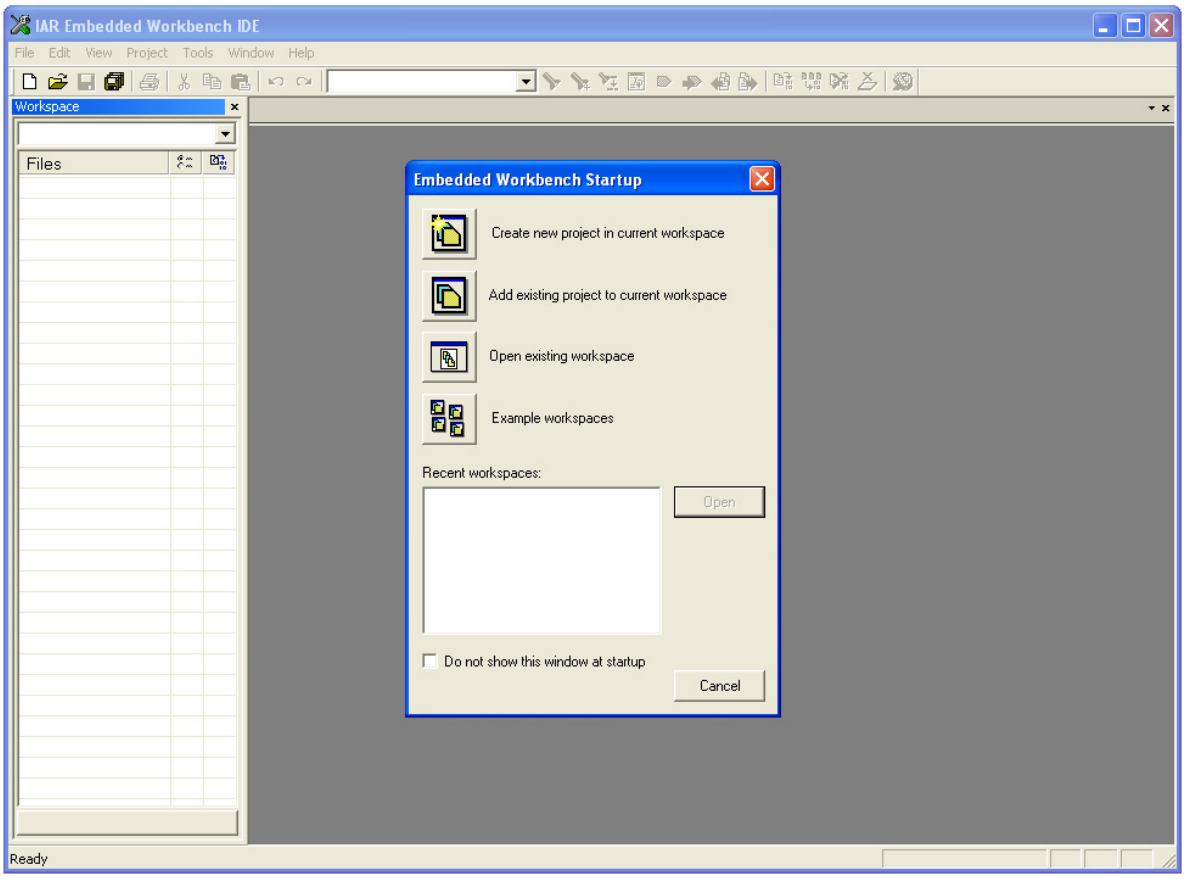


Figure 24: IAR Embedded Workbench

Now select the option “Open existing workspace” from the “File” menu and locate the sample project folder and open the file “Jx3U_PLUGIT.eww”. This is the workspace file that contains general information about all sample projects and corresponding settings.

After the sample workspace has been opened the projects included in the workspace are displayed. Please select the sample project “Jx3U_PLUGIT_DEMO”.The screen should now look similar to this one:

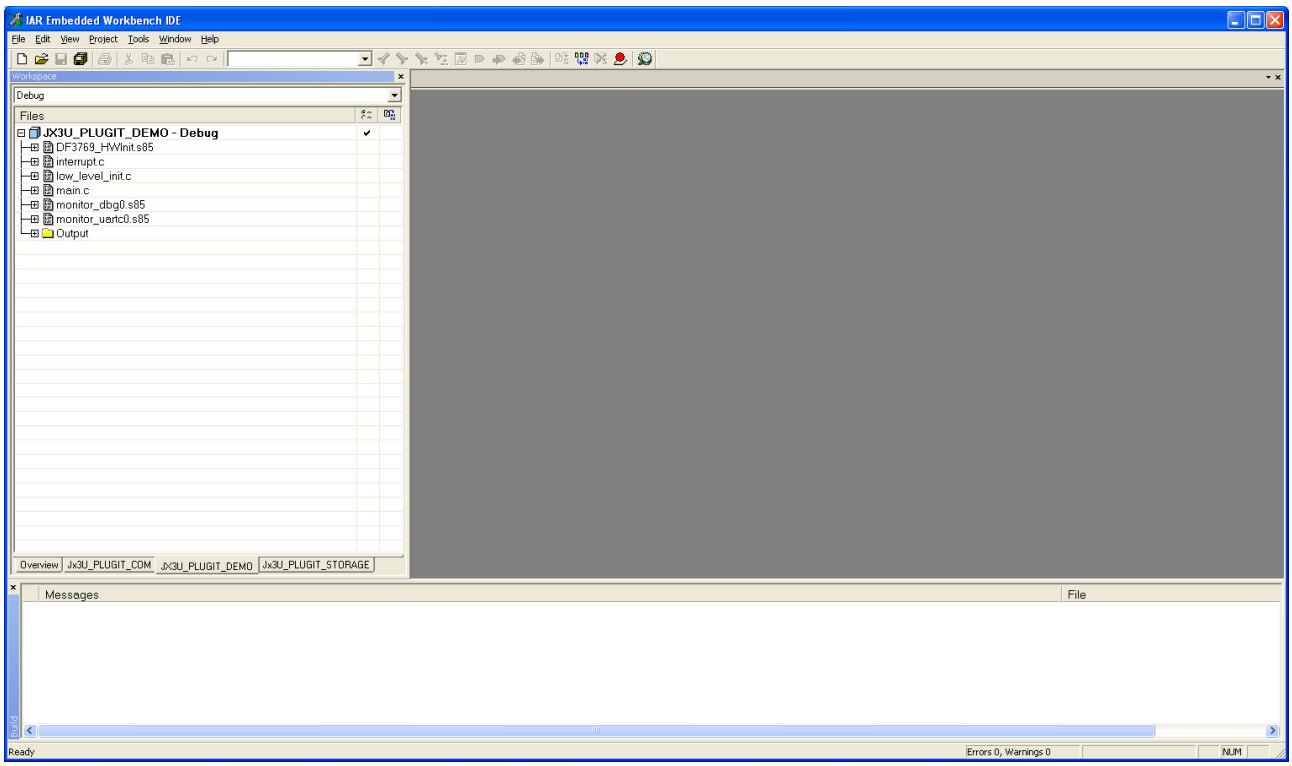


Figure 25: IAR Embedded Workbench Project Workspace

As a next step check some settings of the IAR Embedded Workbench that have to be made for correct operation of the demonstration samples and usage of the On-Board debug function of the *V850ES/Jx3-U - Plug it!* board. First highlight the upper project folder called “Jx3U_PLUGIT_DEMO – Debug” in the workspace window. Then select “Project” > “Options” from the pull-down menus. Go to “General Options” and select the device uPD70F3769 (V850ES → V850ES – Jx3-U → V850ES - uPD70F3769).

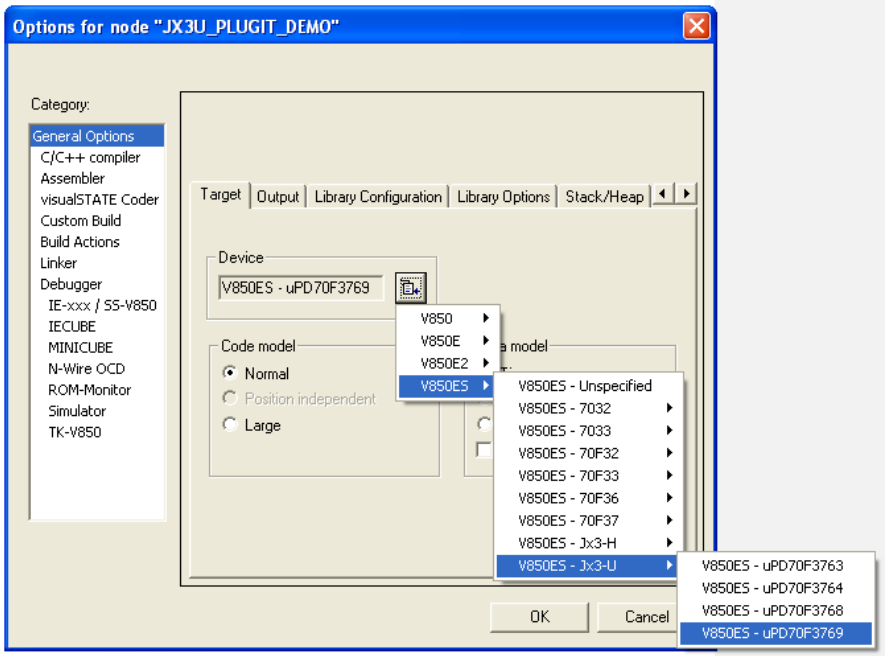


Figure 26: Device Selection

It is necessary to tell the compiler where the additional Header files of the demonstration samples are located. Select the category “C/C++ compiler” and then the tab “Preprocessor”. Now the additional Include path can be added to the field “Additional include directories”.

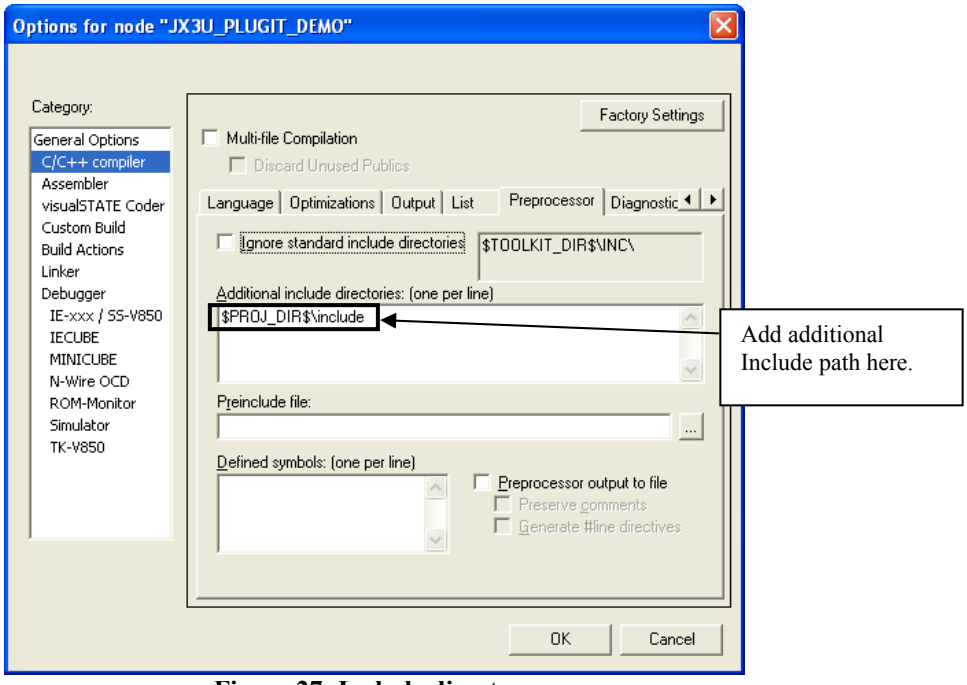


Figure 27: Include directory

As next step select the category “Debugger”. Make sure that the driver is set to “MINICUBE”. After this select the category “MINICUBE” down below and tick the box “Use MINICUBE2 (MINI2)” in order to use the On-Board debug function of the *V850ES/Jx3-U - Plug it!* board.

The corresponding port where the *V850ES/Jx3-U - Plug it!* board is connected to the host PC will be detected automatically by the IAR C-SPY debugger.

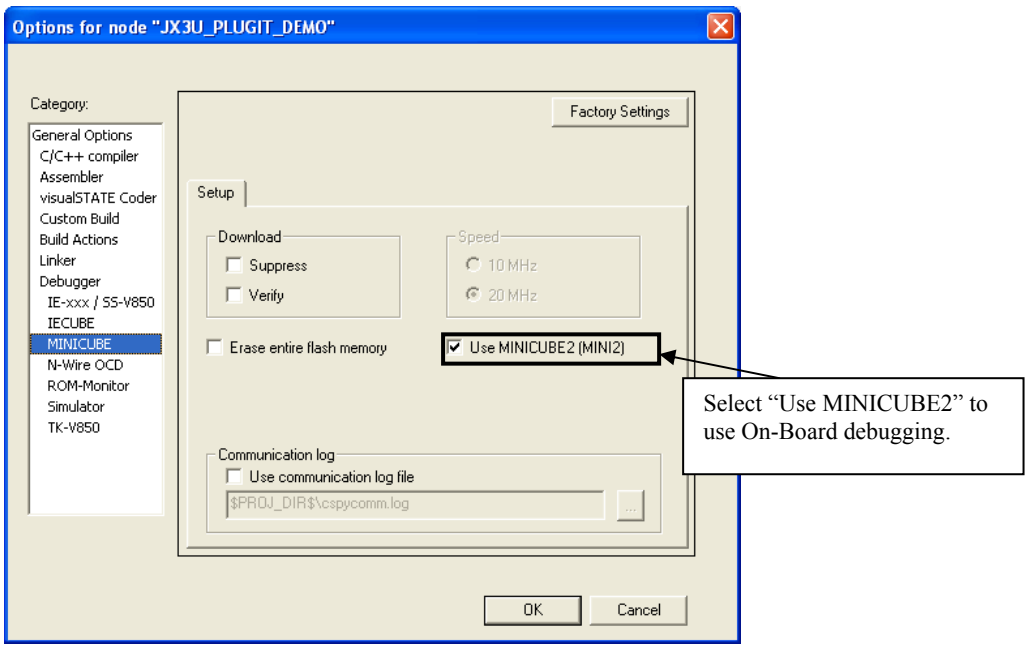


Figure 28: IAR debugger options

Note: Although the On-board debug interface is used, the MINICUBE2 C-Spy driver must be selected instead of the standard driver TK-V850 used for other starter kits. If the debug session via MINICUBE (QB-V850MINI) and the N-Wire connector shall be started, the MINICUBE C-Spy driver must be selected.

Next the correct linker settings of the demo project will be checked. This can be done in the “Linker” category as shown below. Select the “Config” tab and check that the linker command file “lnk70F3769.xcl” is selected. This file is used by the linker and contains information on where to place the different sections of code, data and constants that may be used within the demo project:

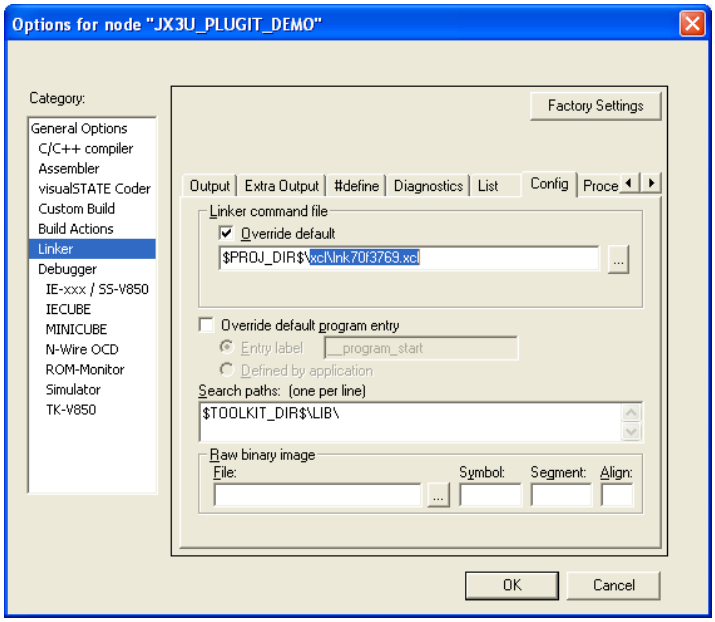


Figure 29: Embedded Workbench Linker Configuration

Now after everything has been setup correctly it's time to compile and link the demonstration project. Close the Options menu and select "Rebuild All" from the "Project" menu. If the project is compiled and linked without errors or warnings it can now be downloaded to the *V850ES/Jx3-U - Plug it!* board and debugged.

To start the IAR C-SPY debugger select the option "Debug" from the "Project" menu or press the () "Debugger" button.

In the next step the Emulator has to be configured before downloading a new application. Press the OK button to enter the emulator hardware setup. Set the configuration as show in the figure below and start the download by pressing the OK button.

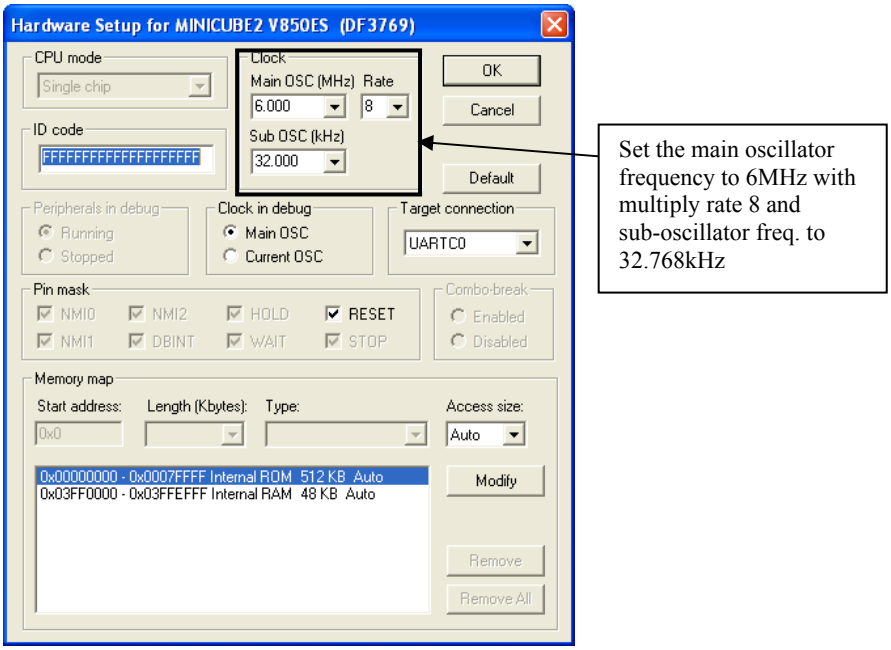


Figure 30: MINICUBE Hardware Setup Dialogue

Now the debugger is started and the demo project is downloaded to the *V850ES/Jx3-U - Plug it!* board. The progress of downloading is indicated by a blue bar in the MINICUBE Emulator window. Please note that downloading of larger executables may take some time.

After the download was completed all debug features of IAR C-SPY debugger are available, i.e. Single Stepping, Step Over/-In/-Out, Go-Execution, Breakpoints, Register / Memory view etc.
To run the sample application select the option "Go" from the "Debug" menu or press the () "Go" button.

To get more details on the debugger configuration and capabilities please refer to the "IAR Embedded Workbench IDE User Guide" of the IAR installation.

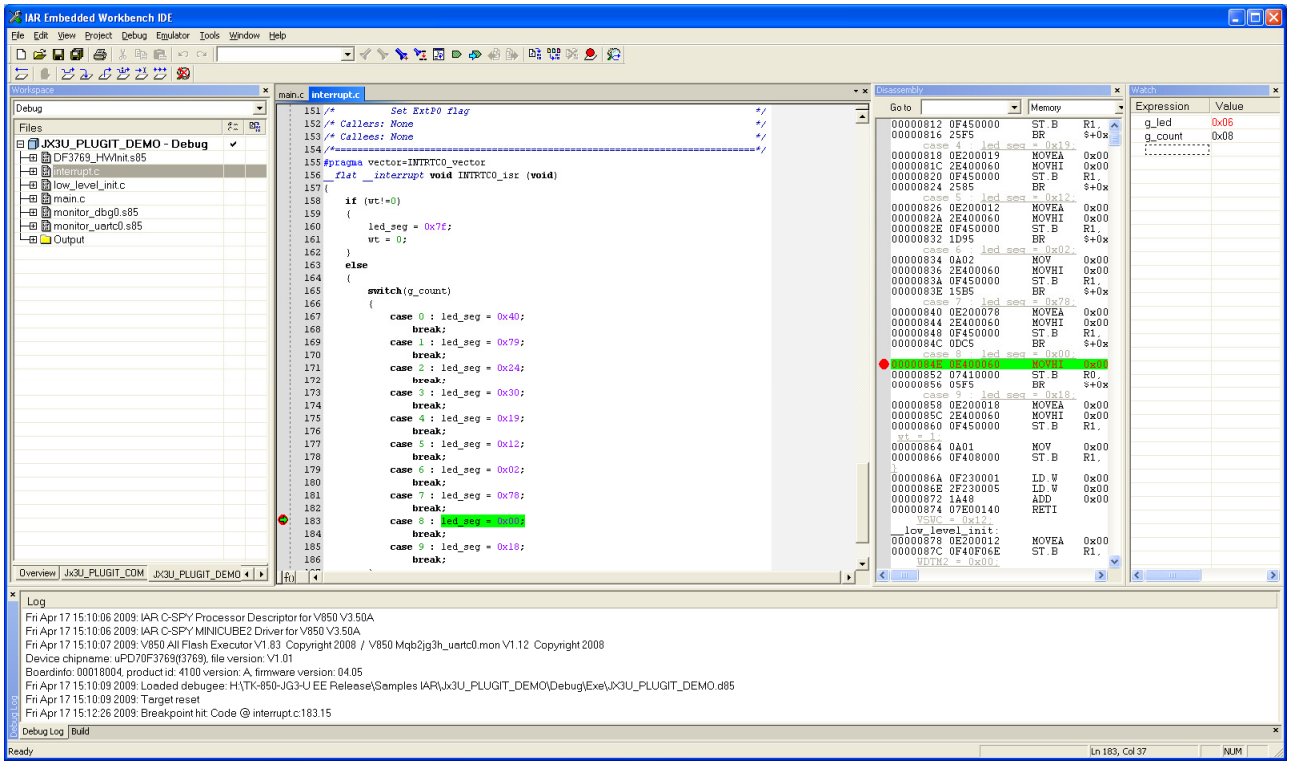


Figure 31: IAR C-SPY debugger

Chapter 9 Troubleshooting

In some cases it might happen that the connection to the *V850ES/Jx3-U - Plug it!* board can not be established. This can be caused by the following three situations:

- ***Wrong security ID***: The security ID is required to prevent the FLASH memory of the uPD70F3769 microcontroller from being read by an unauthorized person. The security ID is located in the internal flash memory at addresses 0x0070-0x0079 of the uPD70F3769 microcontroller. The IAR C-SPY debugger starts only when the security ID that is set during debugger start-up and the security ID set at addresses 0x0070 to 0x0079 do match. In the above mentioned case it is necessary to erase the internal flash memory of the uPD70F3769 microcontroller to restore the security ID. Details about erasing and programming the internal flash memory of the uPD70F3769 are described in chapter 10 “Flash Programmer WriteEZ1”

- ***Wrong Emulator Driver:*** Make sure that the driver in the category “Debugger” of the project options menu is set to “MINICUBE”. After this select the category “MINICUBE” down below and tick the box “Use MINICUBE2 (MINI2)” in order to use the right driver settings for the *V850ES/Jx3-U - Plug it!* board.

- ***Wrong Oscillator Frequency:*** Make sure that the clock settings in the Emulator Hardware Setup fit to the used oscillators on the board. In case of *V850ES/Jx3-U - Plug it!* the main oscillator frequency is 6 MHz with multiply rate 8. The sub-oscillator frequency is 32.768 kHz.

Chapter 10 Flash Programmer WriteEZ1

The flash programmer Write EZ1 doesn't need to be installed, but can be directly started from the CDROM.

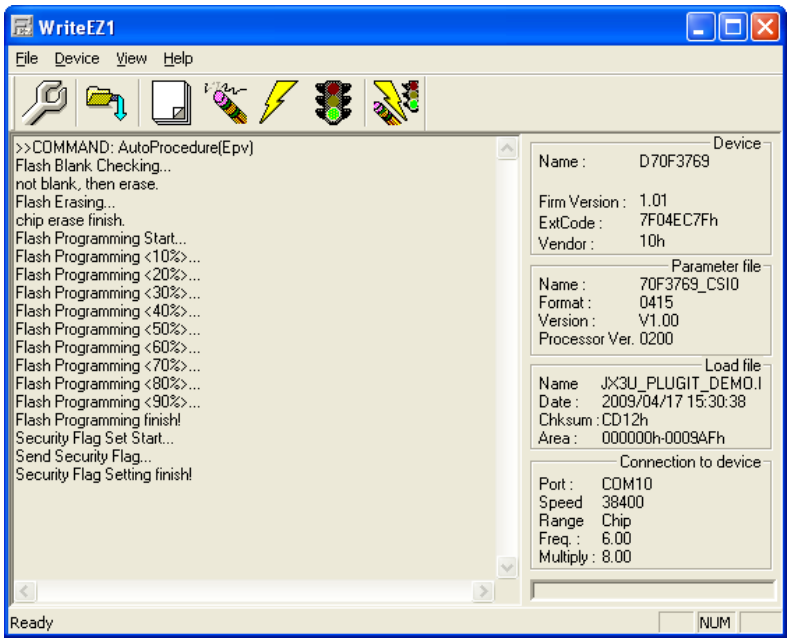


Figure 32: WriteEZ1 User Interface

10.1 Device Setup

To provide all necessary information about the device to be programmed, only the corresponding flash parameter file must be loaded. The parameter file (*.prm) for the uPD70F3769 is located on the CDROM in the folder \WriteEZ1\PRM-70F3771_V100\. Please use the menu "Device -> Setup… " to open the following dialogue and the button "PRM File Read" to select the parameter file. Select the file 70F3769_CSI0.prm.

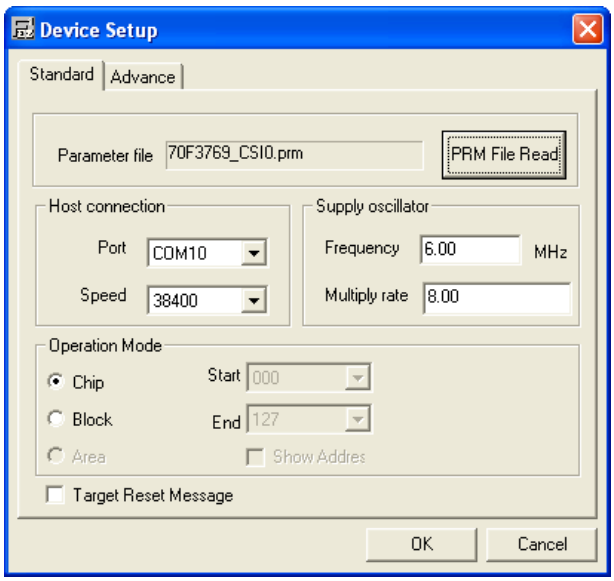


Figure 33: WriteEZ1 Device Setup Dialogue

Please check that the correct host communication port is selected. The used communication port can be seen in the Windows Device Manager.

10.2 Using WriteEZ

After a successful device selection the internal flash memory can be blank-checked, erased, programmed or verified. WriteEZ can be controlled either by menu or by buttons

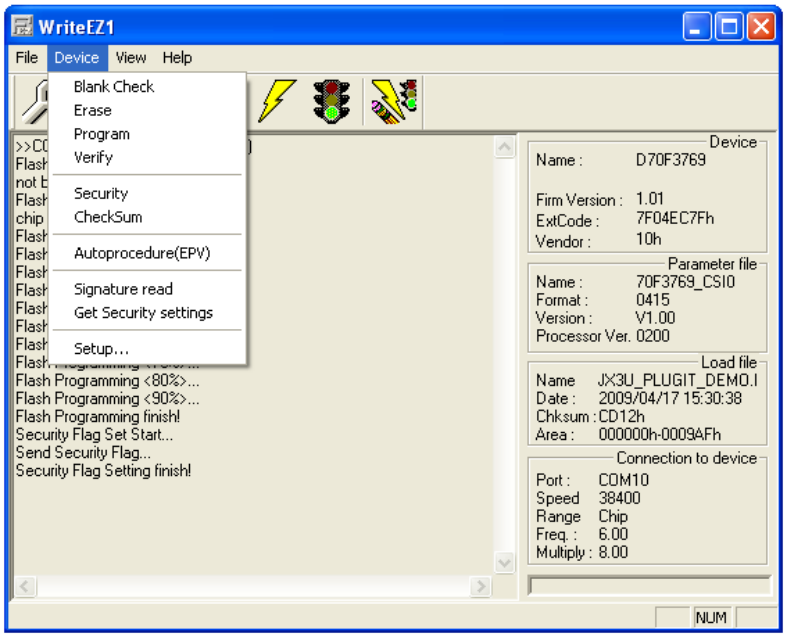


Figure 34: WriteEZ1 Device Menu

	device setup button
	load file button
	blank check button
	erase button
	program button
	verity button
	erase / program / verify button

Table 11: WriteEZ action buttons

WriteEZ1 supports Intel-Hex and Motorola S-record file formats as input file.

Chapter 11 Sample programs

11.1 General Introduction

Each of the sample programs is located in a single directory, which will be called main-directory of the sample. This main directory of each sample contains the complete project inclusive all output files of the development tool. In the root directory of all sample programs the workspace file "**Jx3U_PLUGIT.eww**" is located. The sample workspace includes all sample projects.

settings	Workspace configuration files, IAR Embedded Workbench
Jx3U_PLUGIT_COM	Serial Conversion sample project
Jx3U_PLUGIT_DEMO	Demonstration sample project
Jx3U_PLUGIT_STORAGE	Mass Storage Device sample project
Jx3U_PLUGIT.eww	Workspace file, IAR Embedded Workbench

Table 12: Sample directory structure

As an alternative to open the sample-workspace each project file "<name>.ewp" can be added to any user created workspace.

All sample programs use the same directory structure:

Jx3U_PLUGIT_COM	Serial Conversion sample project
Jx3U_PLUGIT_DEMO	Demonstration sample project
Debug	debug output files for IAR C-SPY debugger
include	C header files
settings	configuration files, IAR Embedded Workbench
source	C source files
xcl	Linker control file
Jx3U_PLUGIT_DEMO.dep	dependency information file, IAR Embedded Workbench
Jx3U_PLUGIT_DEMO.ewd	project setting file, IAR C-SPY debugger
Jx3U_PLUGIT_DEMO.ewp	project file, IAR Embedded Workbench
Jx3U_PLUGIT_STORAGE	Mass Storage Device sample project

Table 13: Example directory structure

The main directory contains only the project files for the IAR Systems Embedded Workbench for NEC V850. All source files are located in the subdirectory /source. The /include subdirectory contains the header files. The /xcl subdirectory contains the linker control file of the uPD70F3769 device. All output files including the object files, list files, debug information and finally the executable file are stored in the directory /Debug.

For details of using the IAR Embedded Workbench and the IAR C-SPY debugger please refer to the "V850 IAR Embedded Workbench IDE User Guide".

11.2 “Jx3U_PLUGIT_DEMO” sample program

This sample program is a simple random number generator between 0 and 9 to demonstrate the usage of the Jx3U_PLUGIT_DEMO starterkit. After starting the generator by pressing SW3 the segments of the seven-segment-LED are flashing until a random number is generated by pressing SW4. The generated number is displayed and flashes at the seven-segment-LED U20. To start a new generation loop, please press again SW3.

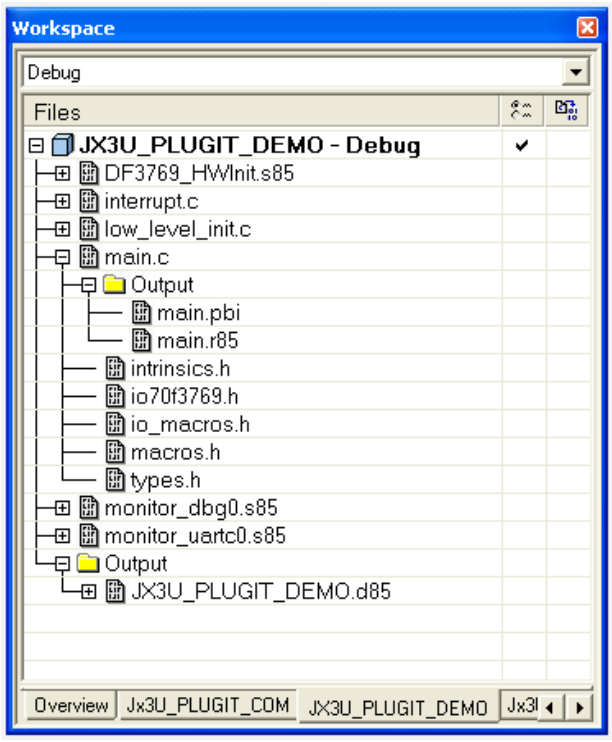


Figure 35: Project Window Jx3U_PLUGIT_DEMO

11.2.1 How to run the sample program

After starting the application, the switches SW3, SW4 and the seven-segment LED are the user interface to the sample program.

- Switch SW3

  By pressing this switch, the generation of a new random number is started. In this state the segments of the seven-segment display are flashing.

- Switch SW4

  By pressing this switch, the generation of a new random number is stopped. The newly generated number is displayed and flashes at the seven-segment display.

11.3 “Jx3U_PLUGIT_COM” Serial Conversion sample program

The USB serial conversion driver is a communication device class (CDC) sample driver for built-in USB function controller that is built of the uPD70F3769. It is detected as communication device class (virtual COM port) when it connects with the host. The sample Application loads the user data received by the USB function controller and converts it to uppercase characters or to lowercase characters (only ASCII character data), and outputs the result on the USB to the virtual COM-Port.

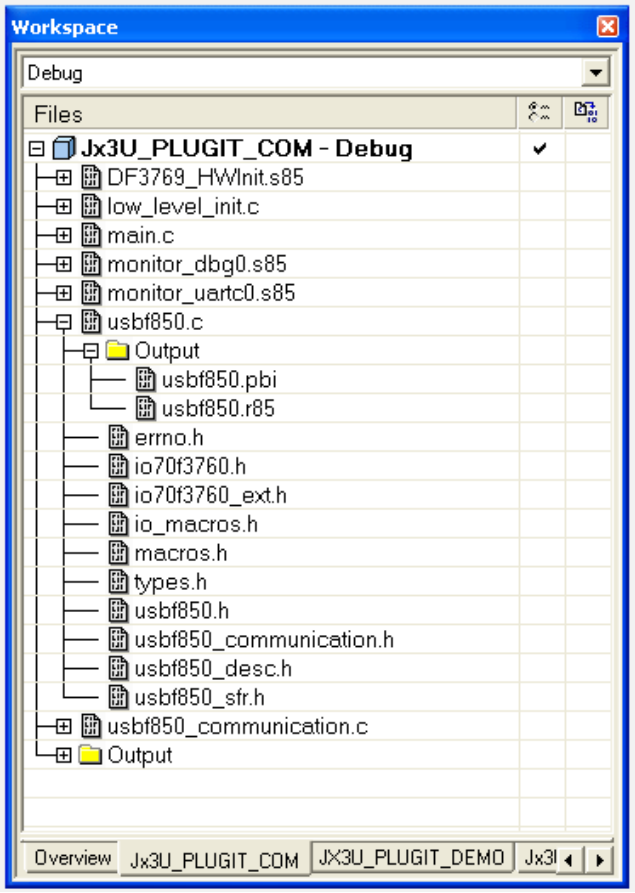


Figure 36: Project Window Jx3U_PLUGIT_COM

11.3.1 Development Environment

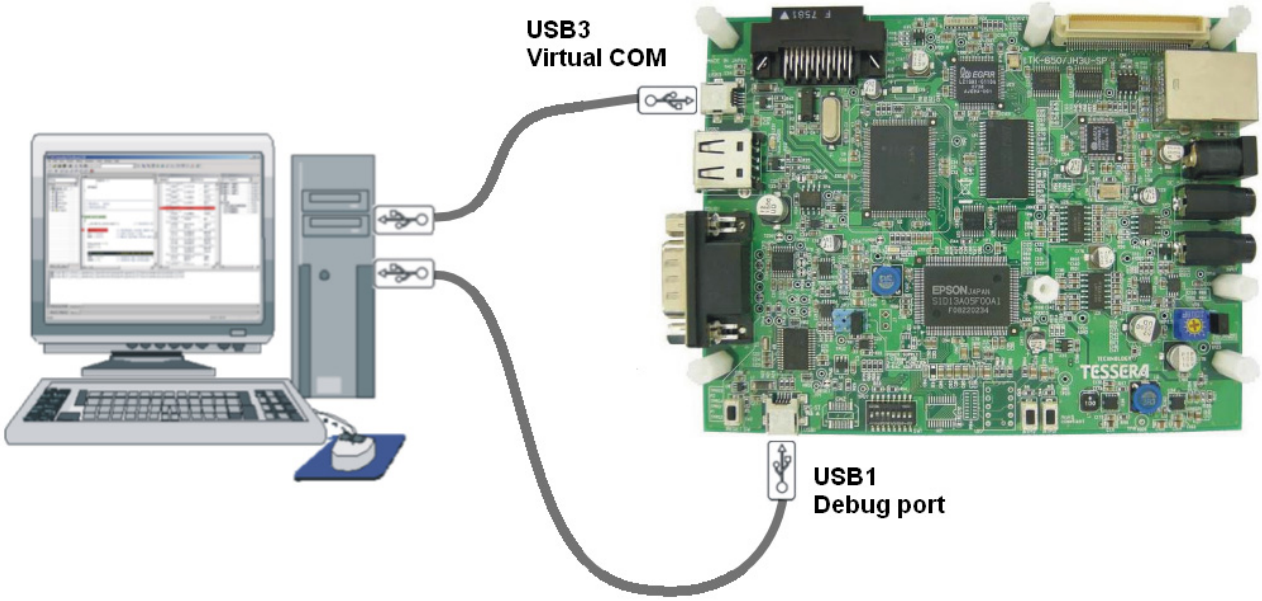


Figure 37: Development Environment

11.3.2 System Structure

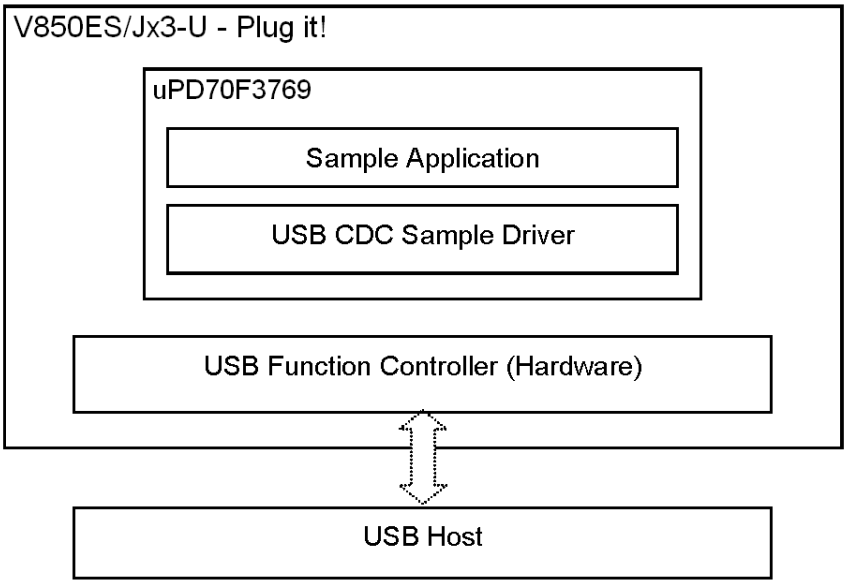


Figure 38: System Structure of the sample program

11.3.3 How to run the sample program

The sample application loads the communication data received by the buil-in USB function controller of the uPD70F3769. It converts the data to uppercase characters or to lowercase characters (only ASCII character data), and then executes the sending process by calling USB function controller sending process. The sample application process monitors the data receiving flag to start the process. As communication tool running on the host PC any terminal program supporting virtual communication ports can be used. To establish a connection and run the sample please use the following procedure:

- Connect port USB1 and start a debug session. In the Windows Device Manager the debug port can be seen:

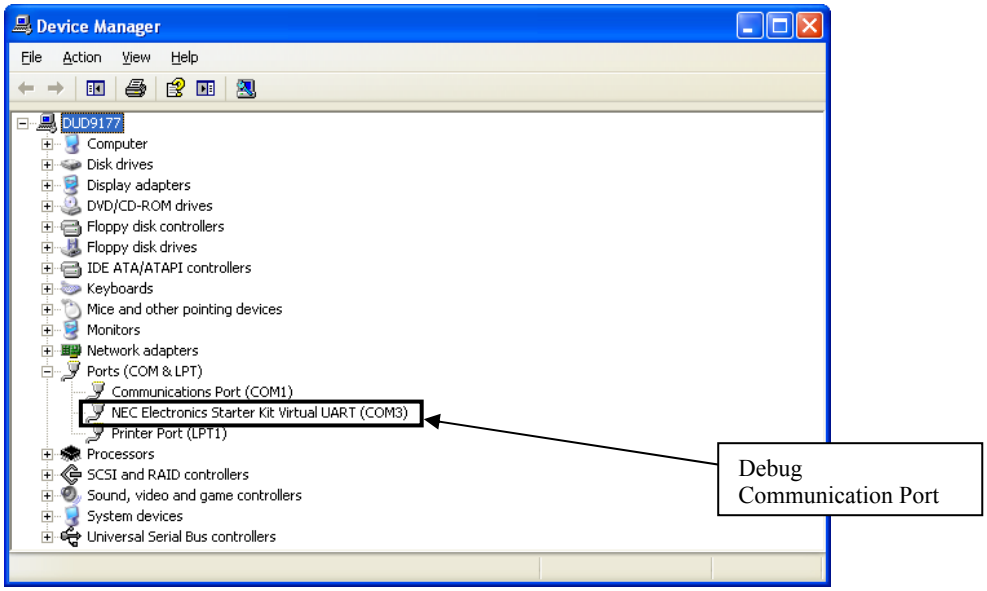


Figure 39: Jx3U_PLUGIT_COM-sample Debug Communication Port

- Connect port USB3 and run the sample application. The Windows “Found New Hardware Wizard” will pop up. Check that “No, not this time” is selected and click Next>.

Figure 40: Found New Hardware Wizard 1 (Windows XP)

- Check that "Install from a list or specific location (Advanced)" is selected, then click Next>.

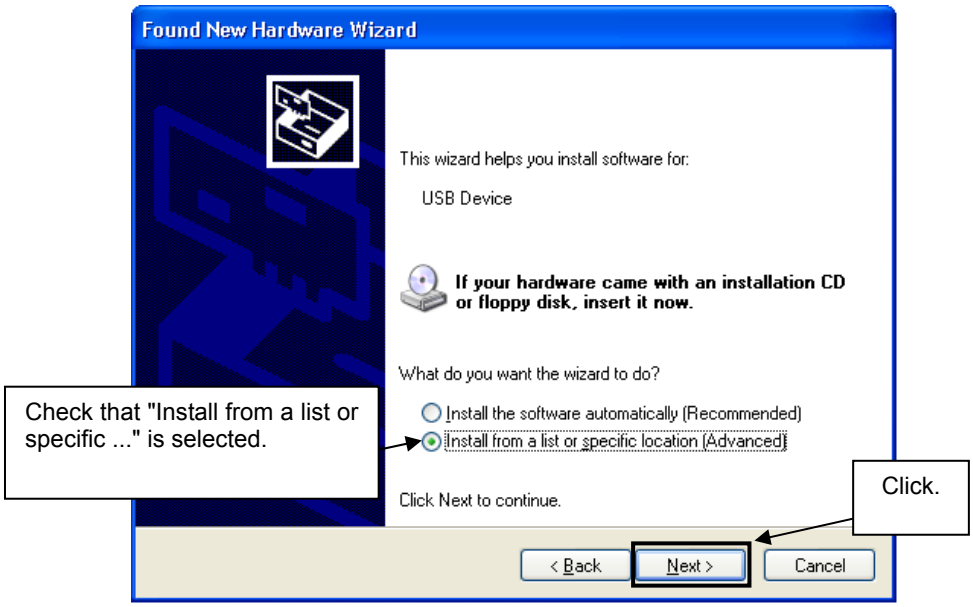


Figure 41: Found New Hardware Wizard 2 (Windows XP)

- Check that "Search for the best driver in these locations." is selected. Select the "Include this location in the search:" check box and then click Browse.

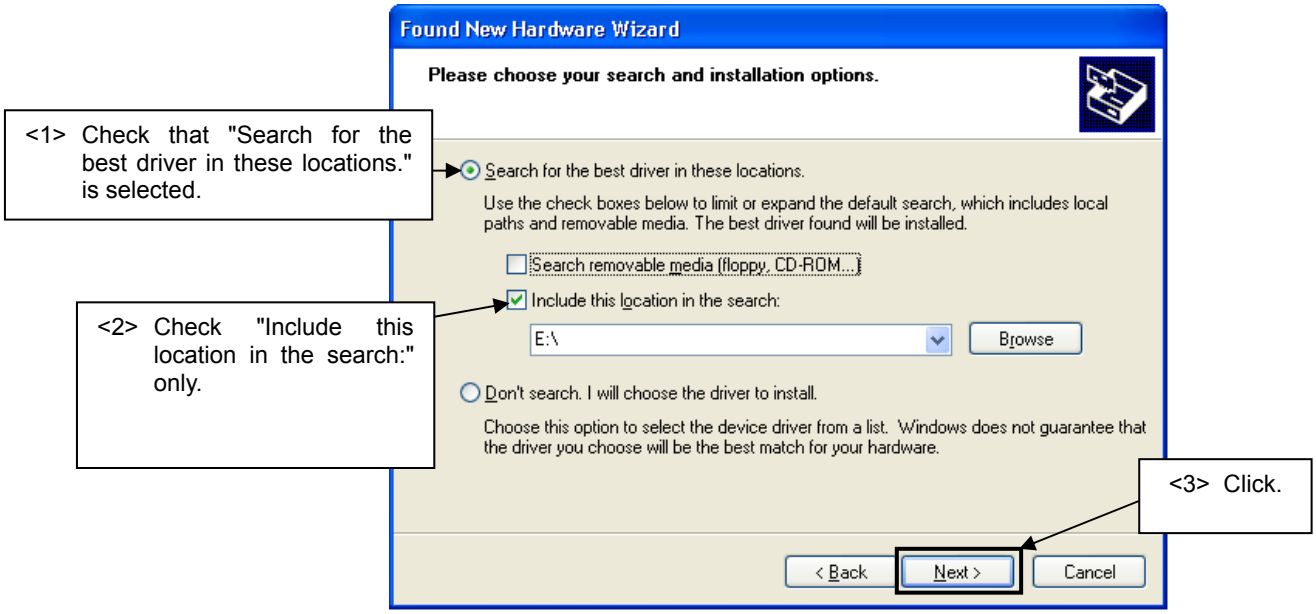


Figure 42: Search Location Specification 1 (Windows XP)

- Locate the folder \SamplePrograms\Jx3U_PLUGIT_COM\drivers\XP\ for Windows XP or \SamplePrograms\Jx3U_PLUGIT_COM\drivers\VISTA\ for Windows Vista on the CD-ROM and click OK.

- In the Windows Device Manager a new virtual communication port named ‘NEC Electronics Jx3U Virtual UART‘ will appear:

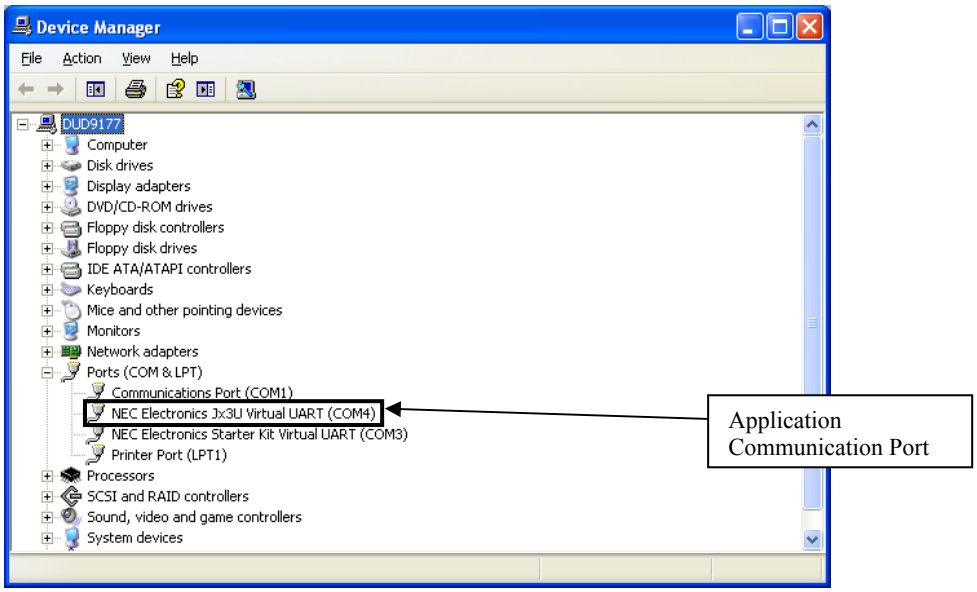


Figure 43: Jx3U_PLUGIT_COM-sample Application Communication Port

- Start a terminal program, e.g. Hyperterminal, and setup a connection to the application virtual communication port (9600 Baud, 8/N/1, no handshaking).
- Send some test characters.

11.3.4 Communication Device Class (CDC)

For information about USB Communication Device Class (CDC), please refer to the USB CDC specification “Universal Serial Bus Class Definitions for Communication Devices Version 1.1”.

The sample is CDC Abstract Control Model, and responds to the following class requests.

- SendEncapsulatedCommand
  To format the communication class interface control protocol for sending commands.

- GetEncapsulatedResponse
  To format the communication class interface control protocol for requesting responses.

- SetLineCoding
  Request for specifying the serial communication format.

- GetLineCoding
  Request for retrieving the serial communication format.

- SetControlLineState
  Request for control signals with RS-232/V.24 format.

11.3.5 Processing Flow

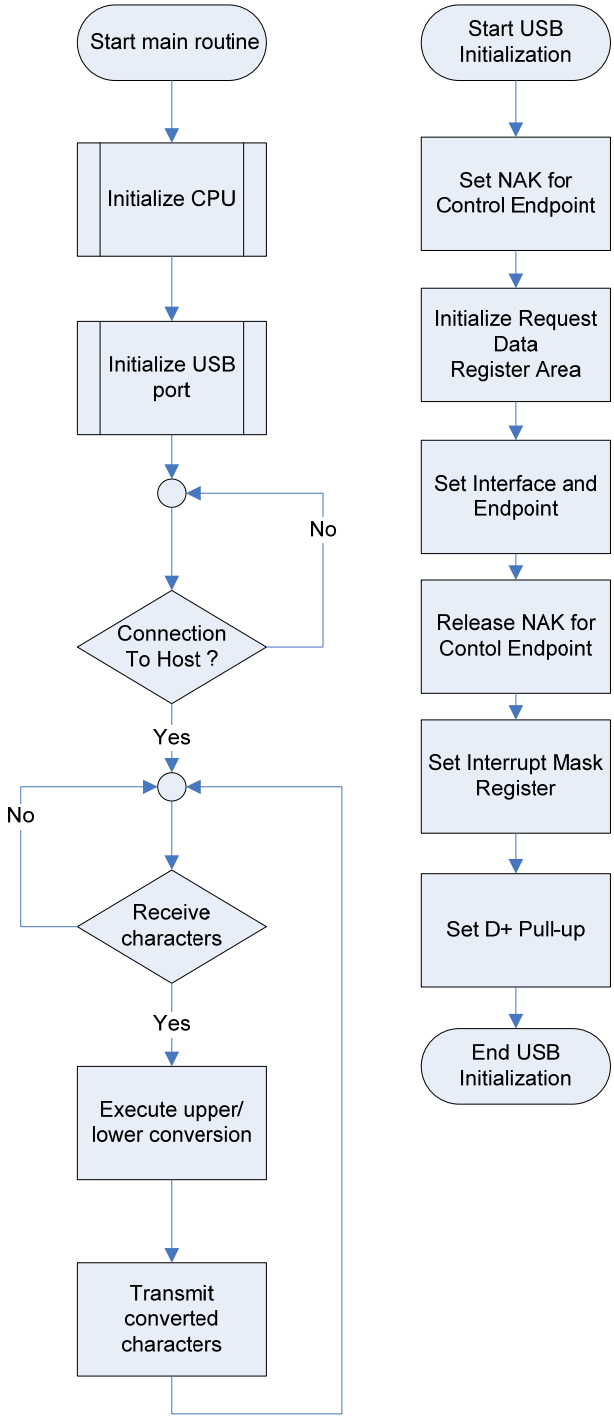
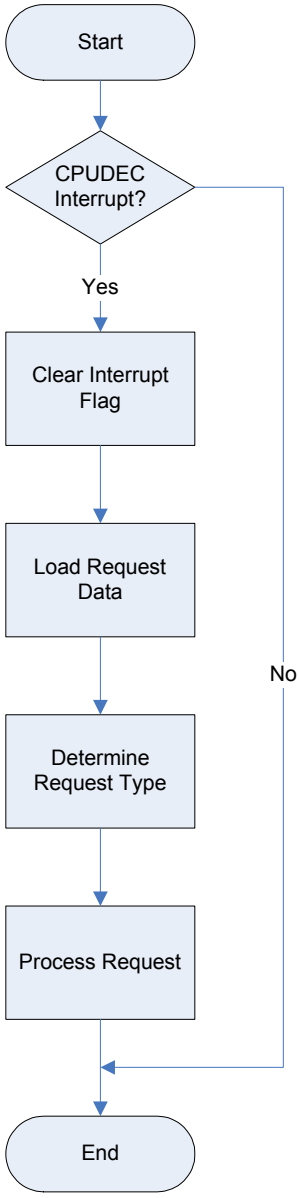


Figure 44: Flow Chart Jx3U_PLUGIT_COM application

Process Description USB Initialization

- Set NAK for Control Endpoint
  A NAK response is sent to all the requests including automatic execution requests.
  It sets for hardware not to return unexpected data in response to an automatic execution request until registration of data used for the automatic execution request is complete.
- Initialize Request Data Register Area
  Descriptor data used to respond to a "Get Descriptor" request is registered in a register. Those data include device status, endpoint 0 status, device descriptor, configuration descriptor, interface descriptor, and endpoint descriptor.
- Set Interface and Endpoint
  Set the number of supported interfaces, the status of alternative settings, and the relationship between the interface and endpoints.
- Release NAK for Control Endpoint
  The NAK setting at control endpoint is released during registration of data for an automatic execution request is complete.
- Set Interrupt Mask Register
  Set the mask for each interrupt source indicated in the interrupt status register of the USB function controller.
- Set D+ Pull-up
  Pull-up the D+ signal, and let the host recognize a device is connected.

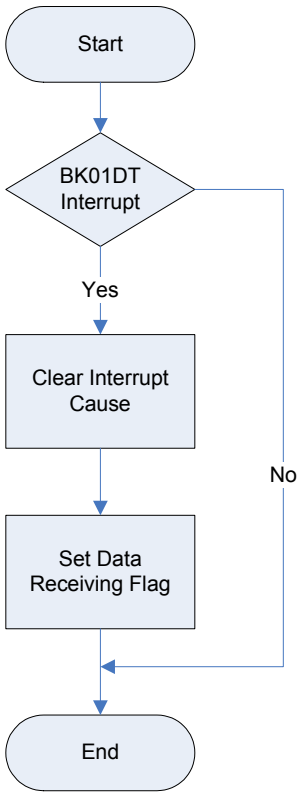
Endpoint 0 is the endpoint for control transferring. However, standard device requests,such as the request used by enumeration for plug-in, are automatically responded by hardware. Therefore, this should monitor standard requests that are not responded by hardware, class requests, and vendor requests.



Endpoint 0 Monitoring Process

- Check CPUDEC Interrupt
  If an interrupt is occurred, CPUDEC bit of UF0IS1 becomes ON (1).
- Clear Interrupt Flag
  Clear the interrupt flag by setting the CPUDEC bit of UF0IC1 to OFF (0).
- Load Request Data
  Load received data from FIFO, and structure the request data.
- Determine Request Type
  It distinguishes whether the request is standard request that is not responded by hardware automatically, class request, or vendor request.
- Process Request
  Process the request depending on the request type.

Figure 45: Flow Chart Jx3U_PLUGIT_COM Endpoint 0 Monitoring Process



Endpoint 1 Monitoring Process

- Check BKO1DT Interrupt
  It detects the completion of receiving interrupt if BKO1DT bit of UF0IS3 is ON (1).
- Clear Interrupt Cause
  Clear the cause of interrupt by setting BKO1DTC bit of UF0IC3 to OFF (0).
- CBW Data Receiving Process
  Execute CBW Data Receiving Process.

Figure 46: Flow Chart Jx3U_PLUGIT_COM Endpoint 1 Monitoring Process

11.3.6 File Structure

File	Description
main.c	Main routine
low_level_init.c	CPU and board initialization
usbf850.c	USB initialization. Interrupt process. Bulk transfer. Control transfer.
usbf850_communication.c	CDC specific process
DF3769_HWinit.s85	Security-ID setting
monitor_dbg0.s85	Secures interrupt vector for Debugging
monitor_uartc0.s85	Secures interrupt vector of serial interface

Table 14: Source Modules USB Serial Conversation Sample

File	Description
main.h	Function prototypes defined in main.c
errno.h	Error code definitions
types.h	Datatype definitions
usbf850.h	Macro definitions for USB function register setting
usbf850_sfr.h	Macro definitions for USB function controller register access
usbf850_desc.h	Descriptor definitions
usbf850_communication.h	usbf850_communication.c function prototype declaration

Table 15: Header Files USB Serial Conversation Sample

11.3.7 Descriptor Information

Field	Size	Description	Value
bLength	1	Descriptor size	0x12
bDescriptor	1	Descriptor type	0x01
bcdUSB	2	BCD format of USB release number	0x0200
bDeviceClass	1	Class code 0x00H: no class 0xFFH: vendor 0x01-0xFEH: specific	0x02
bDeviceSubClass	1	Sub-class code	0x00
bDeviceProtocol	1	Protocol code 0x00: no specific protocol 0xFF: vendor-specific protocol	0x00
bMaxPacketSize0	1	Maximum packet size at endpoint 0	0x40
idVendor	2	Vendor ID (USB IF assigns)	0x0409
idProduct	2	Product ID (vendor assigns)	0x01D0
bcdDevice	2	BCD format of device release number	0x0001

iManufacture	1	Index to string descriptor to indicate manufacturer	0x01
iProduct	1	Index to string descriptor to indicate product	0x02
iSerialNumber	1	Index to string descriptor to indicate serial number	0x03
bNumConfigurations	1	Number of devices that can be configured	0x01

Table 16: Device Descriptor Serial Conversion Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x09
bDescriptor	1	Descriptor type	0x02
wTotalLength	2	Total length of the configuration (configuration, interface, endpoint, and other descriptors)	0x0030
bNumInterfaces	1	Number of interfaces supported in the configuration	0x02
bConfigurationValue	1	Input value (>= 1) for selecting this configuration with SetConfiguration	0x01
iConfiguration	1	Index to string descriptor to indicate descriptor	0x00
bmAttributes	1	Configuration attributes with the unit of bit D7: "1" D6: self-powered D5: remote wake-up D4-D0: reserved (0)	0x80
bMaxPower	1	Maximum power consumption of bus with the unit of 2mA	0x1B

Table 17: Configuration Descriptor Serial Conversion Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x09
bDescriptor	1	Descriptor type	0x04
bInterfaceNumber	1	Index Number (0 based) to indicate this interface in the configuration	0x00
bAlternateSetting	1	Input value to select alternate setting in SetInterface	0x00
bNumEndpoints	1	Interface endpoint number (excluding endpoint 0)	0x01
bInterfaceClass	1	Class Code 0x00: no class 0xFF: vendor 0x01 – 0xFE: specific	0x02

bInterfaceSubclass	1	Subclass code	0x02
bInterfaceProtocol	1	Protocol code 0x00: no specific protocol 0xFF: vendor specific protocol	0x00
iInterface	1	Index to string descriptor to indicate interface	0x00

Table 18: Interface Descriptor Serial Conversion Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x07
bDescriptor	1	Descriptor type	0x05
bEndpointAddress	1	Endpoint address bits: D7: Direction 0: OUT, 1: IN D6-D4: Reserved (0) D4-D0: Endpoint number	0x87
bmAttributes	1	Attribute bits: D1-D0: Transfer type 0: Control 1: Isochronous 2: Bulk 3: Interrupt *D5-D2 is used only by isochronous endpoint D3-D2: Synchronization type 0: No synchronization 1: Asynchronous 2: Adaptive 3: Synchronous D5-D4: Usage type 0: Data endpoint 1: Feedback endpoint 2: Dependant feedback endpoint 3: (reserved)	0x03
wMaxPacketSize	2	Payload size bits: D10-D0: Maximum packet size D12-D11: auditory transaction number per μ frame (only high-speed isochronous and interrupt) 0: No addition (1 transaction / μ frame) 1: 1 (2 transaction / μ frame) 2: 2 (3 transaction / μ frame) 3: Not in use (reserved)	0x0008

Field	Size	Description	Value
bInterval	1	Polling interval for data transfer endpoint Full/low speed interrupt: specify with unit of ms (number of frames) High-speed isochronous/interrupt: specify N for 2 raised to the power of N-1 with unit of μ frame (for example, 1 polling in 8μ frames when bInterval is 4) Full-speed isochronous: specify N for 2 raised to the power of N-1 with unit of 1ms High-speed bulk/control: specify the maximum NAK rate for endpoint with unit of μ frame 0 means that it does not respond NAK on OUT/DATA transaction	0x0A

Table 19: Endpoint Descriptor Serial Conversion Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x07
bDescriptor	1	Descriptor type	0x05
bString	41	Language Code: 0x09 0x04	
		Manufacture: “NEC Electronics Co.”	
		Product: “CDCDrv”	
		Serial Number: “0_98765432”	

Table 20: String Descriptor Serial Conversion Sample

11.4 “Jx3U_PLUGIT_STORAGE” Mass Storage sample program

This sample program is a mass storage class (MSC) sample driver for the built-in USB function controller of the uPD70F3769. It is detected as bulk-only mass storage class device when it connects with the host and the Windows standard driver for mass storage devices will be used. It can be formatted by the host system with the FAT file system. Data such as files and directories can be written to an area of 24Kbyte to the built-in RAM. The stored data will be lost by pressing the Reset SW or turning off the power of the device.

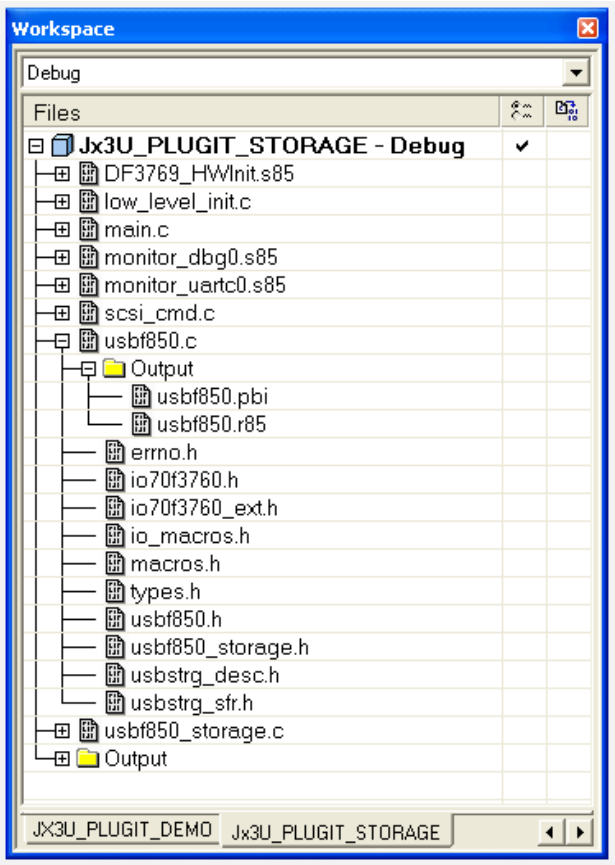


Figure 47: Project Window Jx3U_PLUGIT_STORAGE

11.4.1 Development Environment

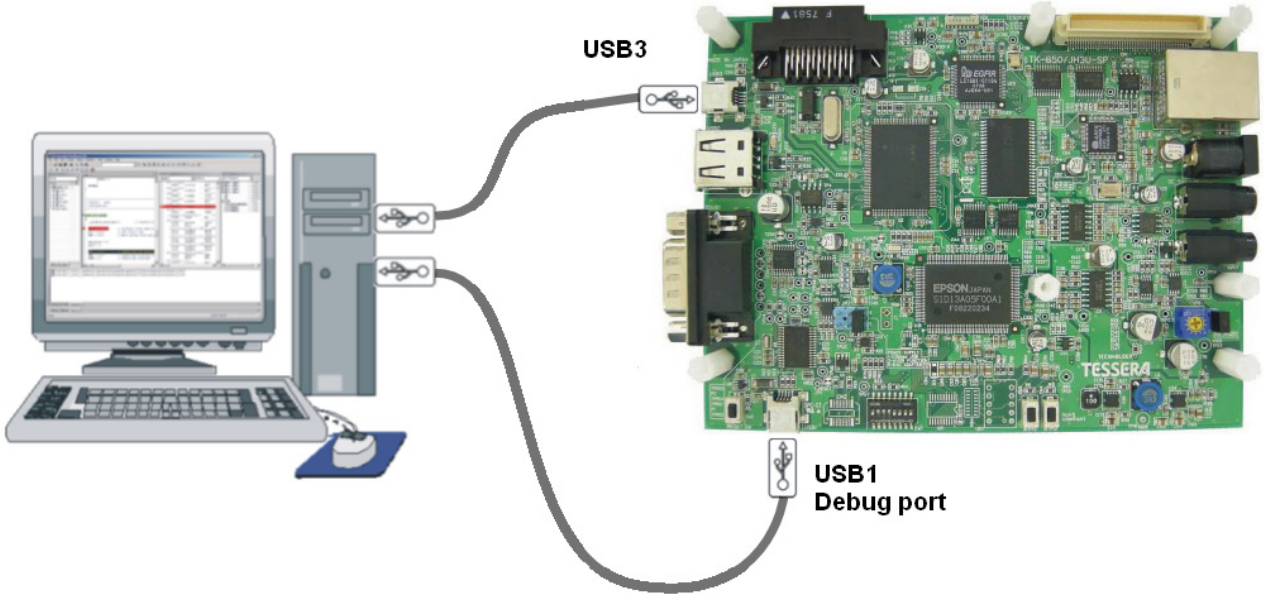


Figure 48: Development Environment

11.4.2 System Structure

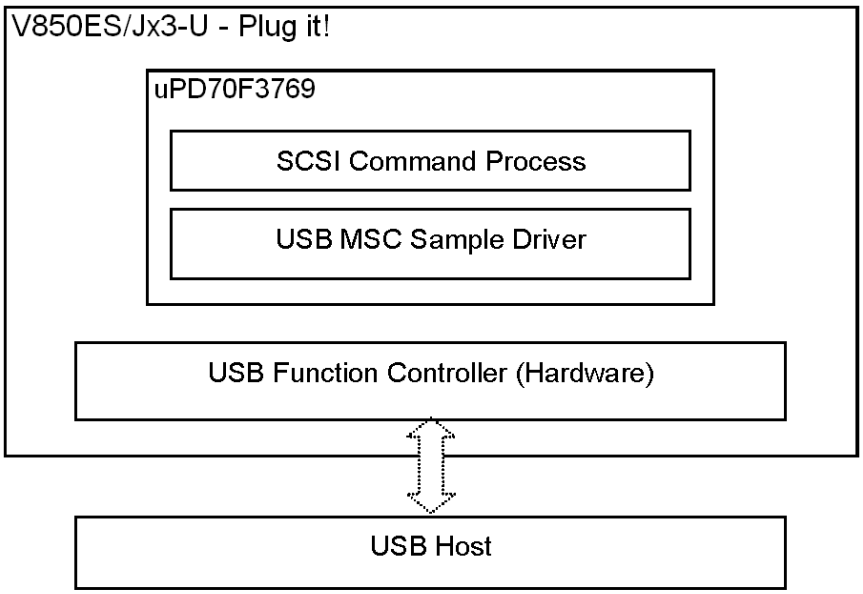


Figure 49: System Structure of the sample program

11.4.3 How to run the sample program

The mass storage class (MSC) sample driver uses the Windows standard drivers for mass storage devices.
To run the sample please use following procedure:

- Connect port USB1 and start a debug session.
- Connect port USB3 and run the sample application. The driver will be automatically installed and a new Removable Disk Drive will appear in the Windows Explorer.
- Format the drive with the FAT file system and store some test files on it.

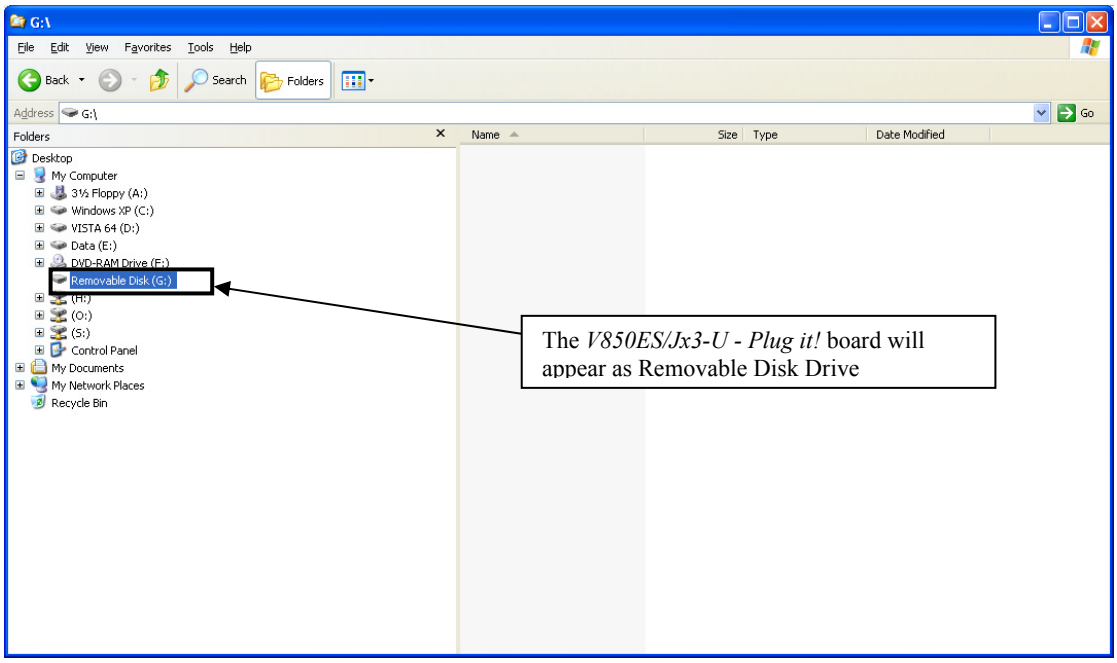


Figure 50: Jx3U_PLUGIT_STORAGE sample Mass Storage Device

11.4.4 Mass Storage Class (MSC)

The sample driver is a bulk-only mass storage class (MSC) driver. Bulk-only transport transfers commands,
status, and data with bulk transferring. Commands are sent from host to device with bulk-out transferring. This is defined in the Command Block Wrapper (CBW) Format . When the command needs to transfer data as well, it executes to input/output the data with bulk-in and bulk-out transferring.
The status data is transferred from device to host with bulk-in transferring. This is defined in the Command Status Wrapper (CSW) Format. For information about USB mass storage class (MSC), please refer to the MSC specification "Universal Serial Bus Mass Storage Class Bulk-Only Transport Revision 1.0". The sample driver responds to the following class requests:

- GET_MAX_LUN
  To retrieve the logical unit number for the mass storage device.

- MASS_STORAGE_RESET
  To reset the interface that is related to the mass storage device.

11.4.5 SCSI Command Process

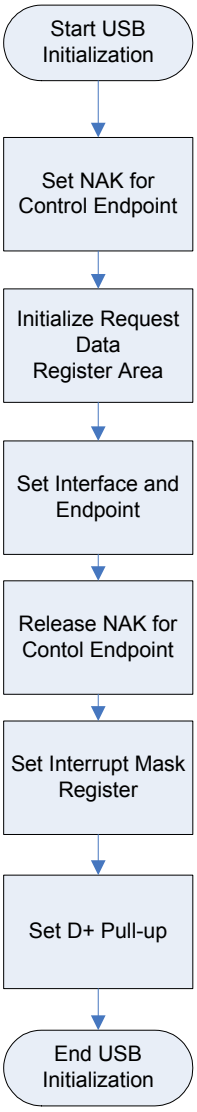
In the sample program, SCSI command process is structured on the MSC sample driver. It processes capsulated SCSI commands to the Command Block Wrapper (CBW).

The sample driver supports following SCSI commands:

- TEST_UNIT_READY
- START_STOP_READY
- REQUEST_SENSE
- READ6
- MODE_SENSE6
- READ_FORMAT_CAPACITIES
- WRITE6
- MODE_SELECT
- VERIFY
- WRITE_BUFF
- SEEK
- SYNCHRONIZE_CACHE
- INQUIRY
- READ10
- MODE_SENSE10
- READ_CAPACITY
- WRITE10
- MODE_SELECT10
- WRITE_VERIFY
- PREVENT

*Responds STALL when it receives commands other than above.

11.4.6 Processing Flow

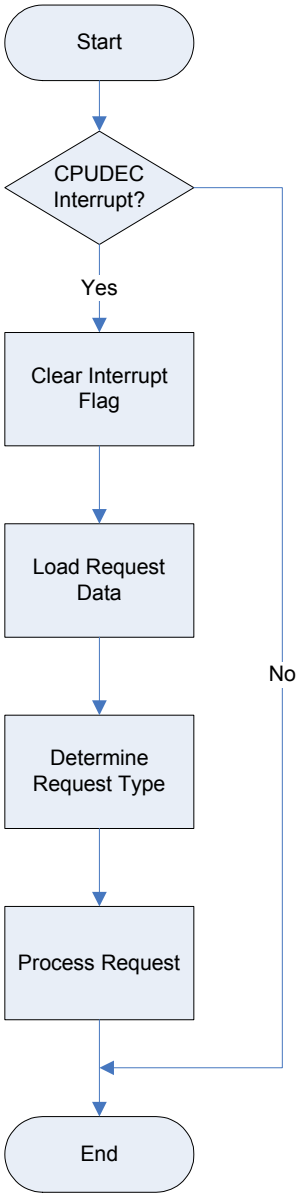


Process Description USB Initialization

- Set NAK for Control Endpoint
  A NAK response is sent to all the requests including automatic execution requests.
  It sets for hardware not to return unexpected data in response to an automatic execution request until registration of data used for the automatic execution request is complete.
- Initialize Request Data Register Area
  Descriptor data used to respond to a "Get Descriptor" request is registered in a register. Those data include device status, endpoint 0 status, device descriptor, configuration descriptor, interface descriptor, and endpoint descriptor.
- Set Interface and Endpoint
  Set the number of supported interfaces, the status of alternative settings, and the relationship between the interface and endpoints.
- Release NAK for Control Endpoint
  The NAK setting at control endpoint is released during registration of data for an automatic execution request is complete.
- Set Interrupt Mask Register
  Set the mask for each interrupt source indicated in the interrupt status register of the USB function controller.
- Set D+ Pull-up
  Pull-up the D+ signal, and let the host recognize a device is connected.

Figure 51: Flow Chart Jx3U_PLUGIT_STORAGE USB Initialization Process

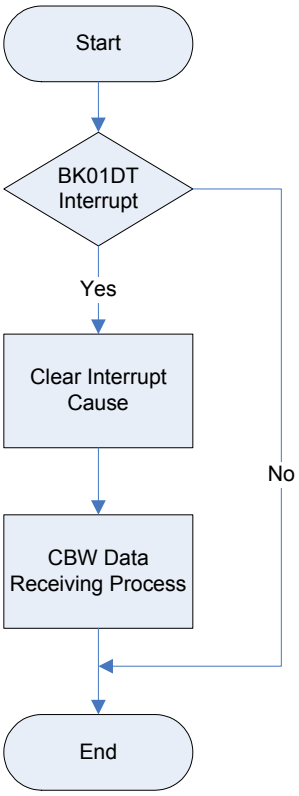
Endpoint 0 is the endpoint for control transferring. However, standard device requests,such as the request used by enumeration for plug-in, are automatically responded by hardware. Therefore, this should monitor standard requests that are not responded by hardware, class requests, and vendor requests.



Endpoint 0 Monitoring Process

- Check CPUDEC Interrupt
  If an interrupt is occurred, CPUDEC bit of UF0IS1 becomes ON (1).
- Clear Interrupt Flag
  Clear the interrupt flag by setting the CPUDEC bit of UF0IC1 to OFF (0).
- Load Request Data
  Load received data from FIFO, and structure the request data.
- Determine Request Type
  It distinguishes whether the request is standard request that is not responded by hardware automatically, class request, or vendor request.
- Process Request
  Process the request depending on the request type.

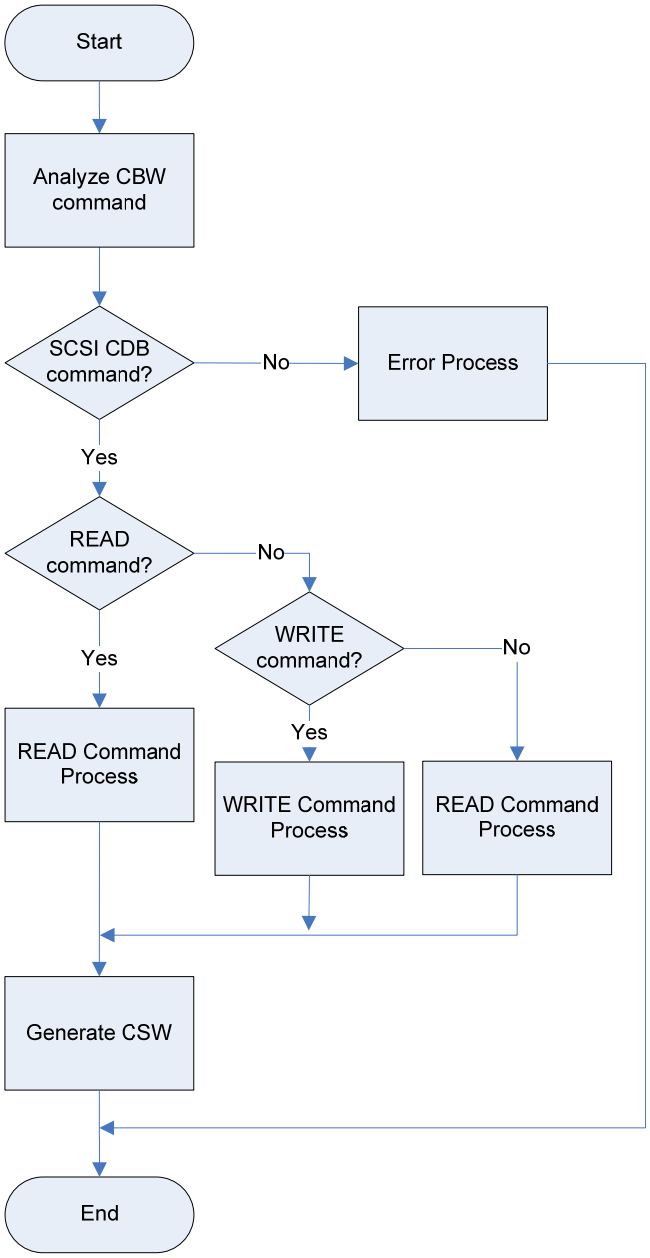
Figure 52: Flow Chart Jx3U_PLUGIT_STORAGE Endpoint 0 Monitoring process



Endpoint 1 Monitoring Process

- Check BKO1DT Interrupt
  It detects the completion of receiving interrupt if BKO1DT bit of UF0IS3 is ON (1).
- Clear Interrupt Cause
  Clear the cause of interrupt by setting BKO1DTC bit of UF0IC3 to OFF (0).
- CBW Data Receiving Process
  Execute CBW Data Receiving Process.

Figure 53: Flow Chart Jx3U_PLUGIT_STORAGE Endpoint 0 Monitoring process



SCSI Command Process

- Analyze CBW Command
  Analyze the content of CBW after receivingCBW data. It saves CBW tag and checks valid data number for CBWCB and command direction, and then executes READ, WRITE, or NO DATA process.
- Error Process
  Process for errors such as invalid command.
- READ Command Process
  Process READ related commands in SCSI commands.
- WRITE Command Process
  Process WRITE related commands in SCSI commands.
- NO DATA Command Process
  Process NO DATA related commands in SCSI commands.
- Generate CSW
  Generate and send CSW data with results from command processes.

Figure 54: Flow Chart Jx3U_PLUGIT_STORAGE SCSI Command Process

11.4.7 File Structure

File	Description
main.c	Main routine
low_level_init.c	CPU and board initialization
usbf850.c	USB initialization. Interrupt process. Bulk transfer. Control transfer.
usbf850_storage.c	MSC specific process
scsi_cmd.c	SCSI command process
DF3769_HWinit.s85	Security-ID setting
monitor_dbg0.s85	Secures interrupt vector for Debugging
monitor_uartc0.s85	Secures interrupt vector of serial interface

Table 21: Source Modules USB Mass Storage Sample

File	Description
main.h	Function prototypes defined in main.c
errno.h	Error code definitions
types.h	Datatype definitions
scsi.h	SCSI macro declaration
usbf850.h	Macro definitions for USB function register setting
usbfstrg_sfr.h	Macro definitions for USB function controller register access
usbfstrg_desc.h	Descriptor definitions
usbf850_storage.h	usbf850_storage.c function prototype declaration

Table 22: Header Files USB Mass Storage Sample

11.4.8 Descriptor Information

Field	Size	Description	Value
bLength	1	Descriptor size	0x12
bDescriptor	1	Descriptor type	0x01
bcdUSB	2	BCD format of USB release number	0x0200
bDeviceClass	1	Class code 0x00H: no class 0xFFH: vendor 0x01-0xFEH: specific	0x00
bDeviceSubClass	1	Sub-class code	0x00
bDeviceProtocol	1	Protocol code 0x00: no specific protocol 0xFF: vendor-specific protocol	0x00
bMaxPacketSize0	1	Maximum packet size at endpoint 0	0x40
idVendor	2	Vendor ID (USB IF assigns)	0x0409
idProduct	2	Product ID (vendor assigns)	0x01D2

bcdDevice	2	BCD format of device release number	0x0001
iManufacture	1	Index to string descriptor to indicate manufacturer	0x01
iProduct	1	Index to string descriptor to indicate product	0x00
iSerialNumber	1	Index to string descriptor to indicate serial number	0x00
bNumConfigurations	1	Number of devices that can be configured	0x01

Table 23: Device Descriptor Mass Storage Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x09
bDescriptor	1	Descriptor type	0x02
wTotalLength	2	Total length of the configuration (configuration, interface, endpoint, and other descriptors)	0x0020
bNumInterfaces	1	Number of interfaces supported in the configuration	0x01
bConfigurationValue	1	Input value (>= 1) for selecting this configuration with SetConfiguration	0x01
iConfiguration	1	Index to string descriptor to indicate descriptor	0x00
bmAttributes	1	Configuration attributes with the unit of bit D7: "1" D6: self-powered D5: remote wake-up D4-D0: reserved (0)	0x80
bMaxPower	1	Maximum power consumption of bus with the unit of 2mA	0x1B

Table 24: Configuration Descriptor Mass Storage Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x09
bDescriptor	1	Descriptor type	0x04
bInterfaceNumber	1	Index Number (0 based) to indicate this interface in the configuration	0x00
bAlternateSetting	1	Input value to select alternate setting in SetInterface	0x00
bNumEndpoints	1	Interface endpoint number (excluding endpoint 0)	0x02

bInterfaceClass	1	Class Code 0x00: no class 0xFF: vendor 0x01 – 0xFE: specific	0x08
bInterfaceSubclass	1	Subclass code	0x06
bInterfaceProtocol	1	Protocol code 0x00: no specific protocol 0xFF: vendor specific protocol	0x50
iInterface	1	Index to string descriptor to indicate interface	0x00

Table 25: Interface Descriptor Mass Storage Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x07
bDescriptor	1	Descriptor type	0x05
bEndpointAddress	1	Endpoint address bits: D7: Direction 0: OUT, 1: IN D6-D4: Reserved (0) D4-D0: Endpoint number	0x81
bmAttributes	1	Attribute bits: D1-D0: Transfer type 0: Control 1: Isochronous 2: Bulk 3: Interrupt *D5-D2 is used only by isochronous endpoint D3-D2: Synchronization type 0: No synchronization 1: Asynchronous 2: Adaptive 3: Synchronous D5-D4: Usage type 0: Data endpoint 1: Feedback endpoint 2: Dependant feedback endpoint 3: (reserved)	0x02
wMaxPacketSize	2	Payload size bits: D10-D0: Maximum packet size D12-D11: auditory transaction number per µ frame (only high-speed isochronous and interrupt) 0: No addition (1 transaction / µ frame) 1: 1 (2 transaction / µ frame) 2: 2 (3 transaction / µ frame) 3: Not in use (reserved)	0x0040

Field	Size	Description	Value
bInterval	1	Polling interval for data transfer endpoint Full/low speed interrupt: specify with unit of ms (number of frames) High-speed isochronous/interrupt: specify N for 2 raised to the power of N-1 with unit of µ frame (for example, 1 polling in 8µ frames when bInterval is 4) Full-speed isochronous: specify N for 2 raised to the power of N-1 with unit of 1ms High-speed bulk/control: specify the maximum NAK rate for endpoint with unit of µ frame 0 means that it does not respond NAK on OUT/DATA transaction	0x00

Table 26: Endpoint Descriptor Serial Conversion Sample

Field	Size	Description	Value
bLength	1	Descriptor size	0x07
bDescriptor	1	Descriptor type	0x05
bString	41	Language Code: 0x09 0x04	
		Manufacture: “NEC Electronics Co.”	

Table 27: String Descriptor Mass Storage Sample

Chapter 12 Cables

12.1 USB interface cable (Mini-B type)

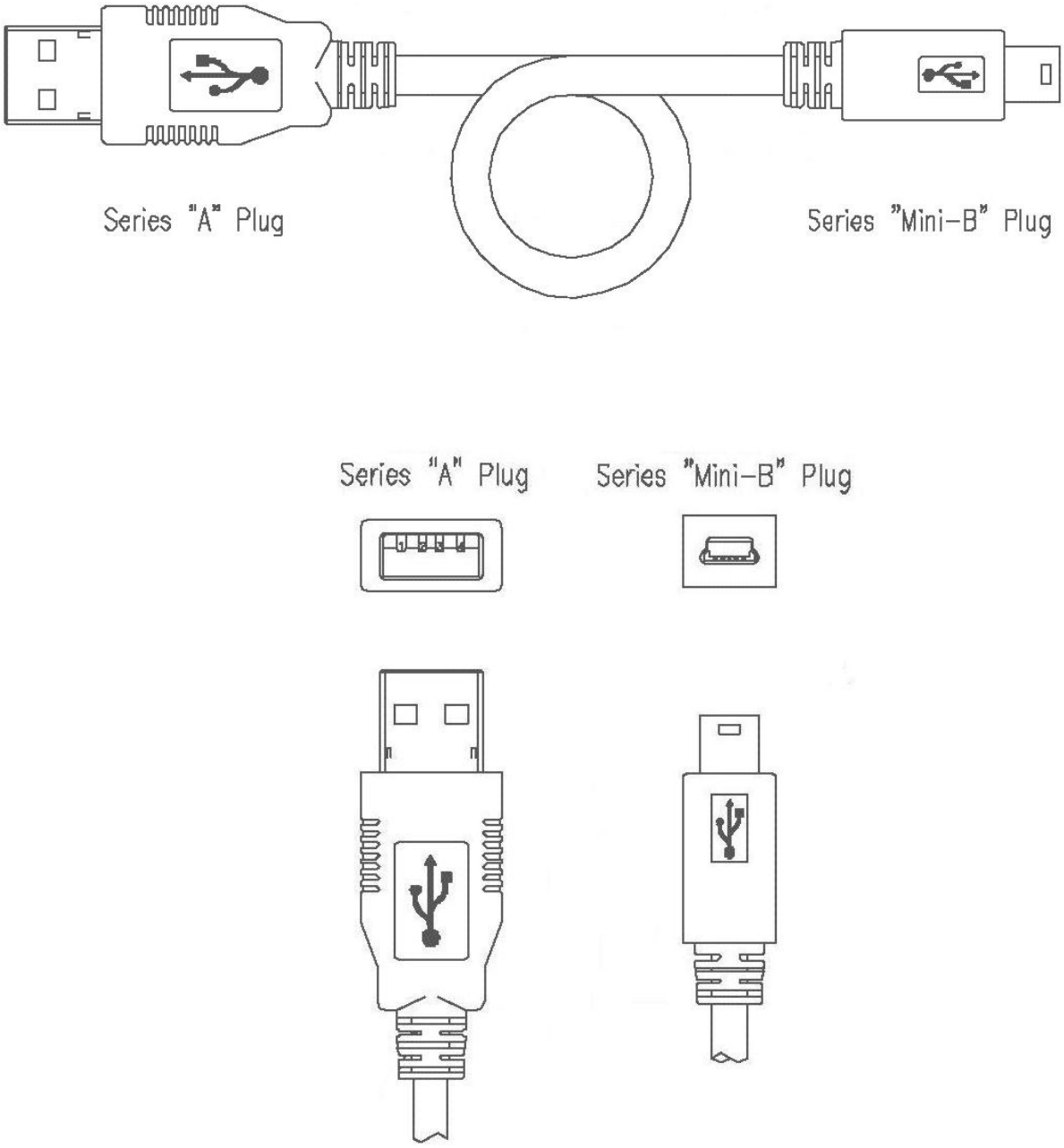


Figure 55: USB interface cable (Mini-B type)

Chapter 13 Schematics

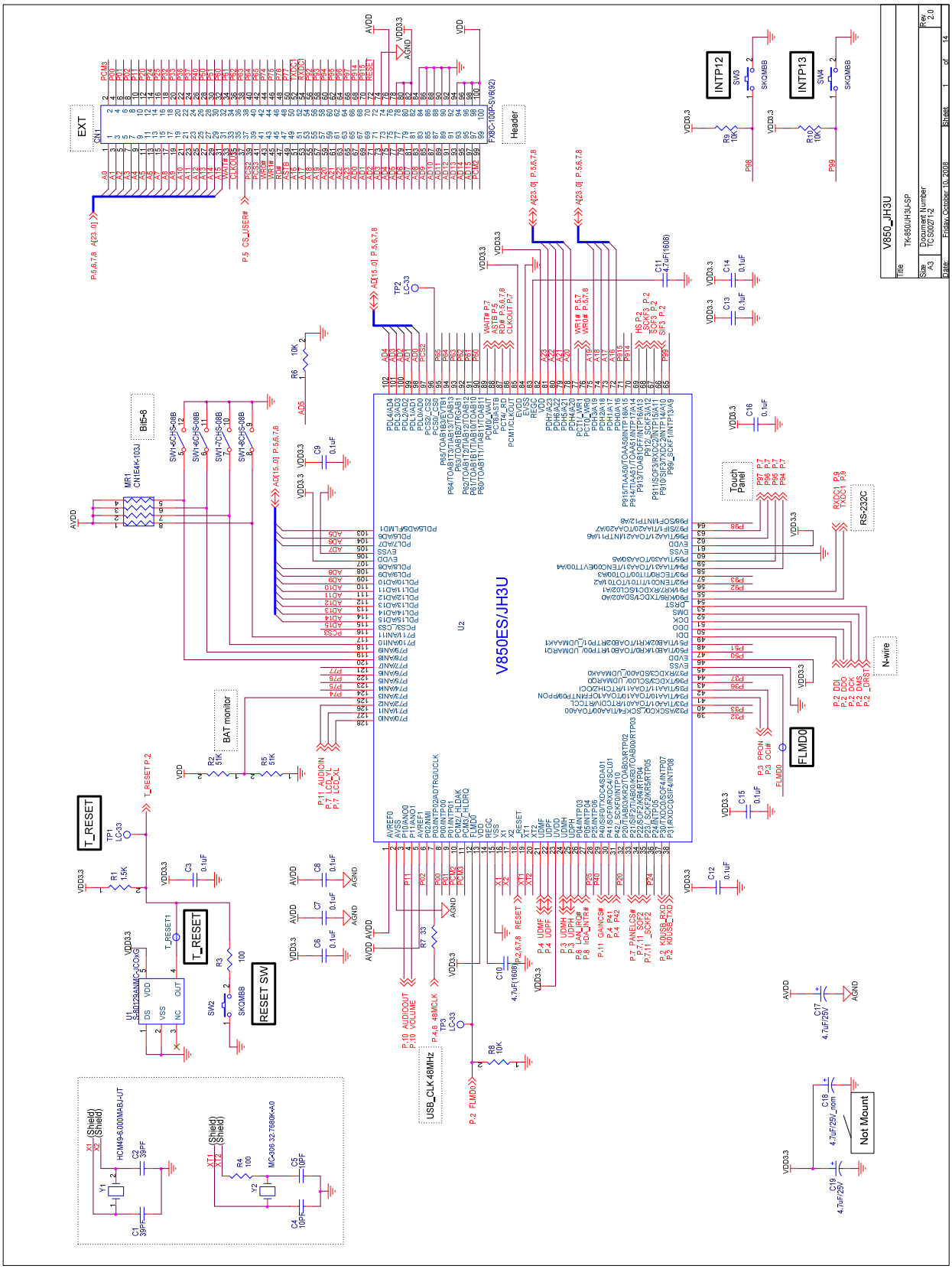


Figure 56: V850ES/Jx3-U - Plug it! schematics 1/13

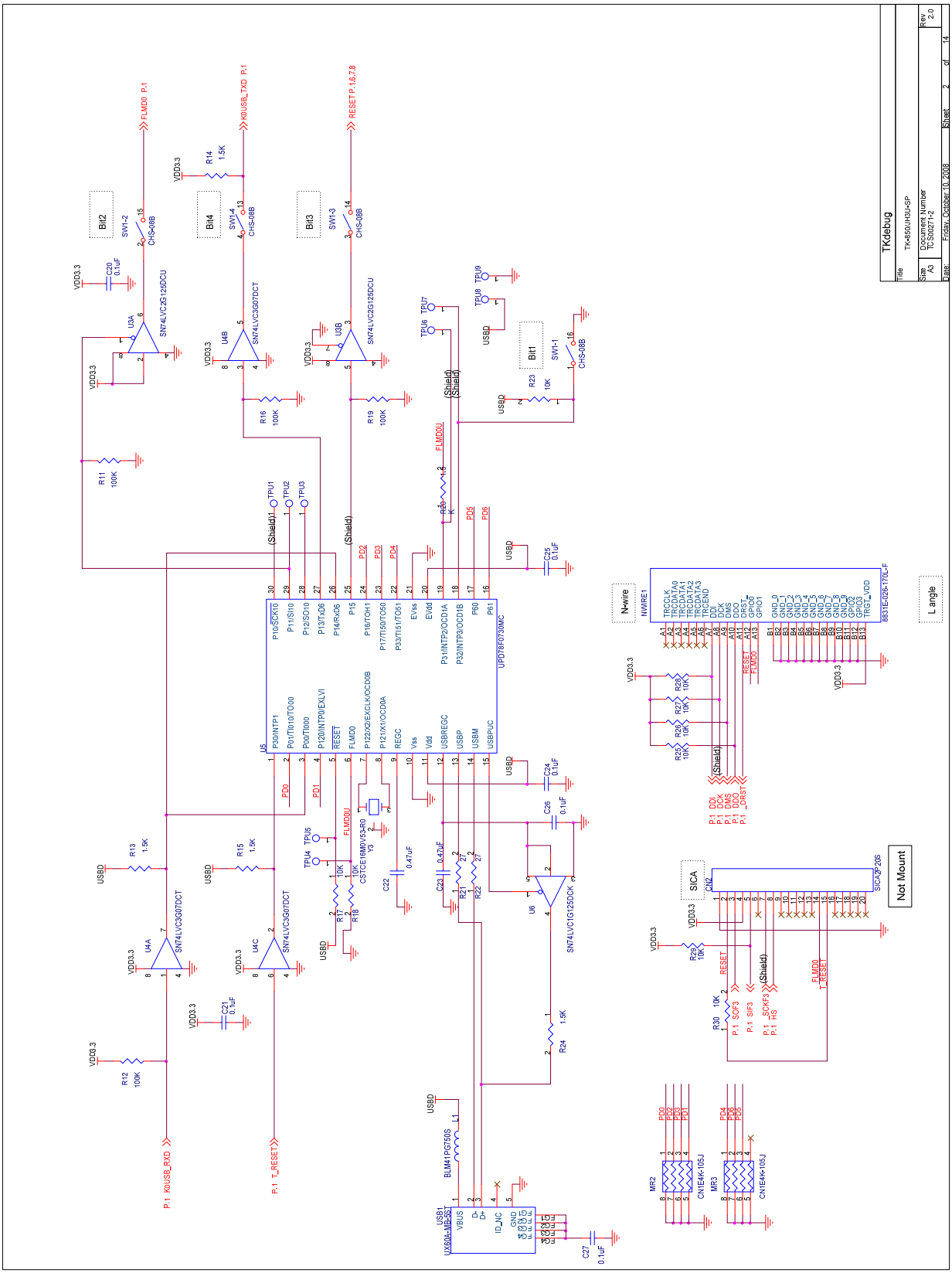


Figure 57: V850ES/Jx3-U - Plug it! schematics 2/13

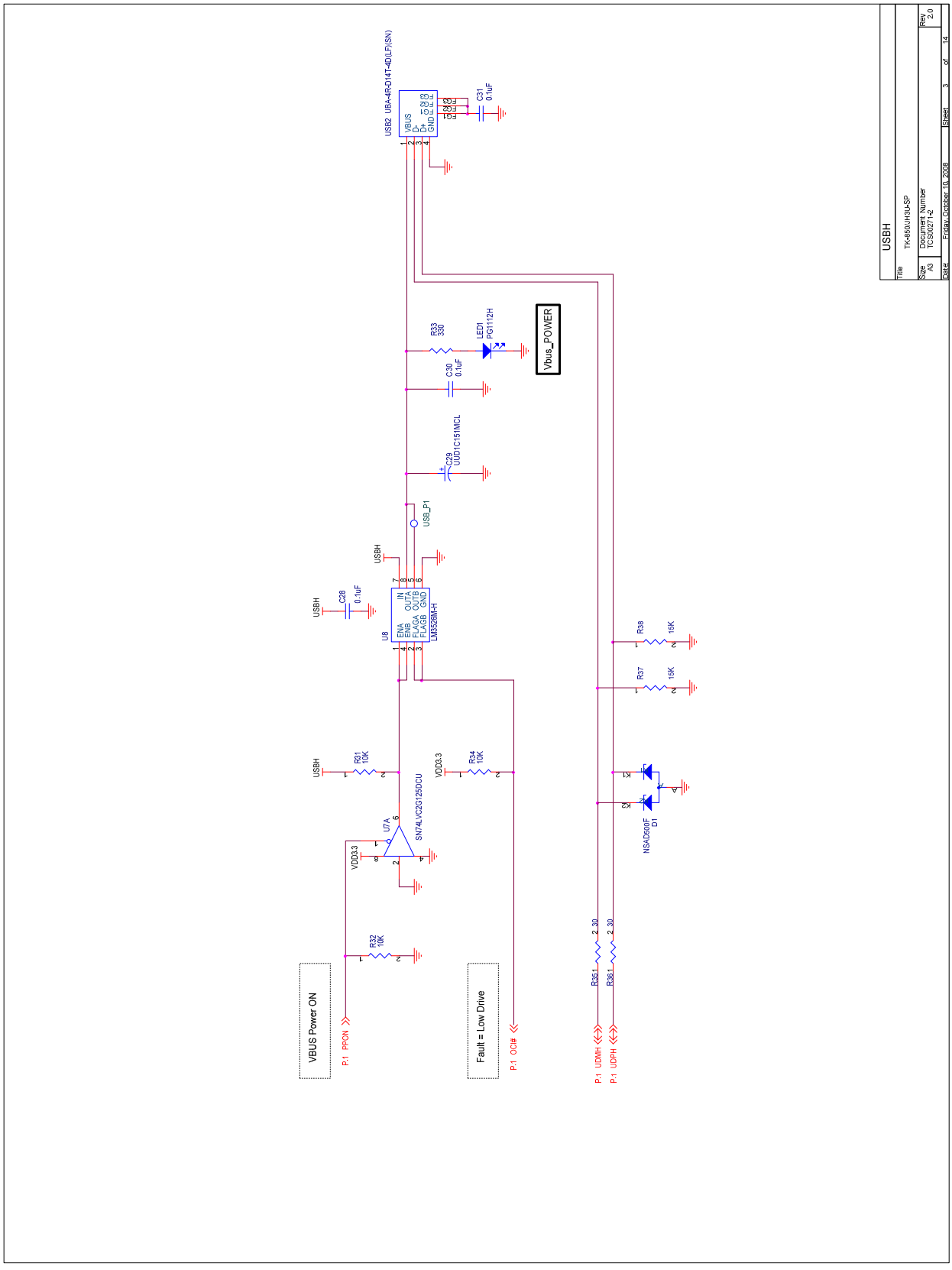


Figure 58: V850ES/Jx3-U - Plug it! schematics 3/13

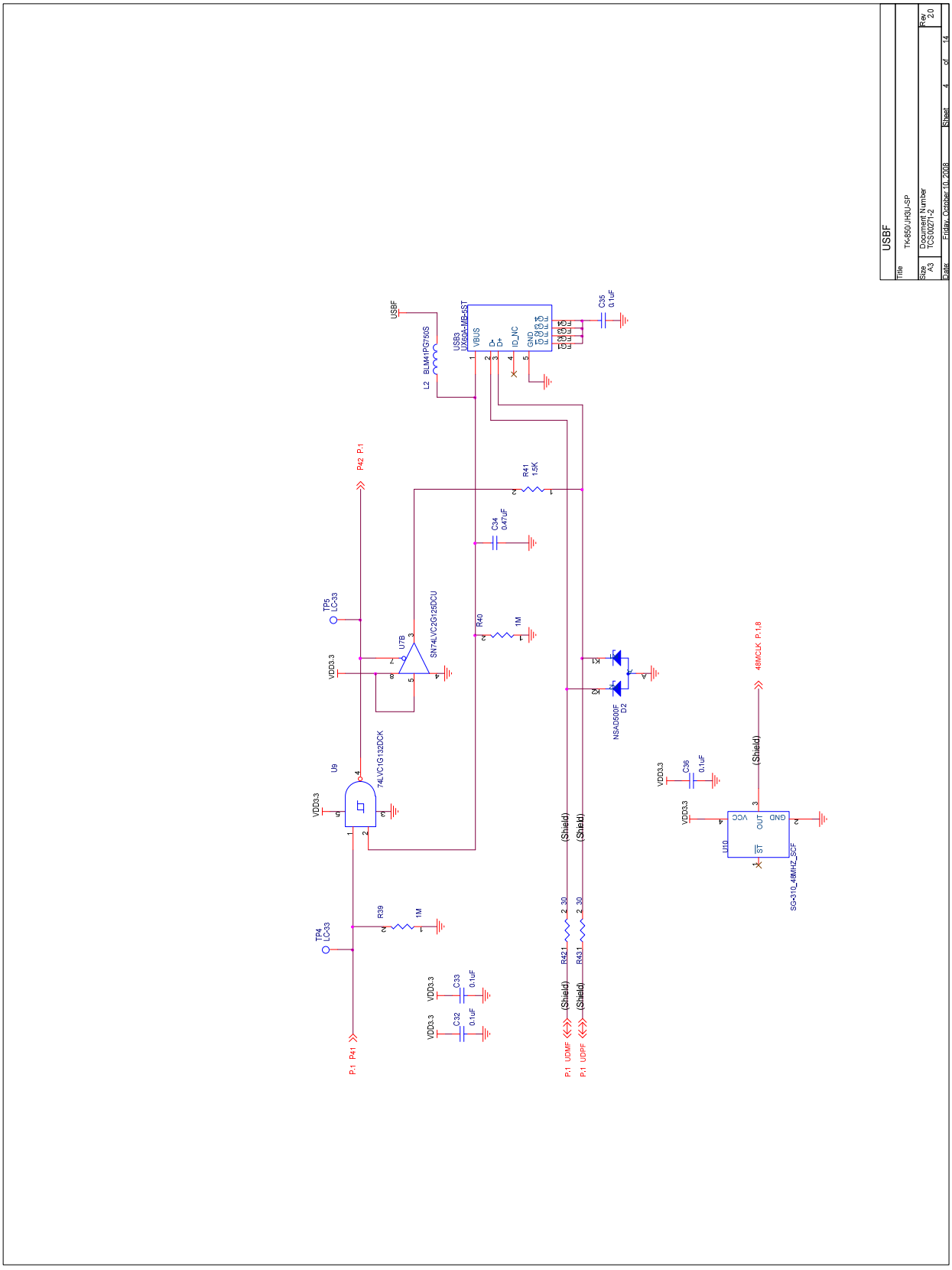


Figure 59: V850ES/Jx3-U - Plug it! schematics 4/13

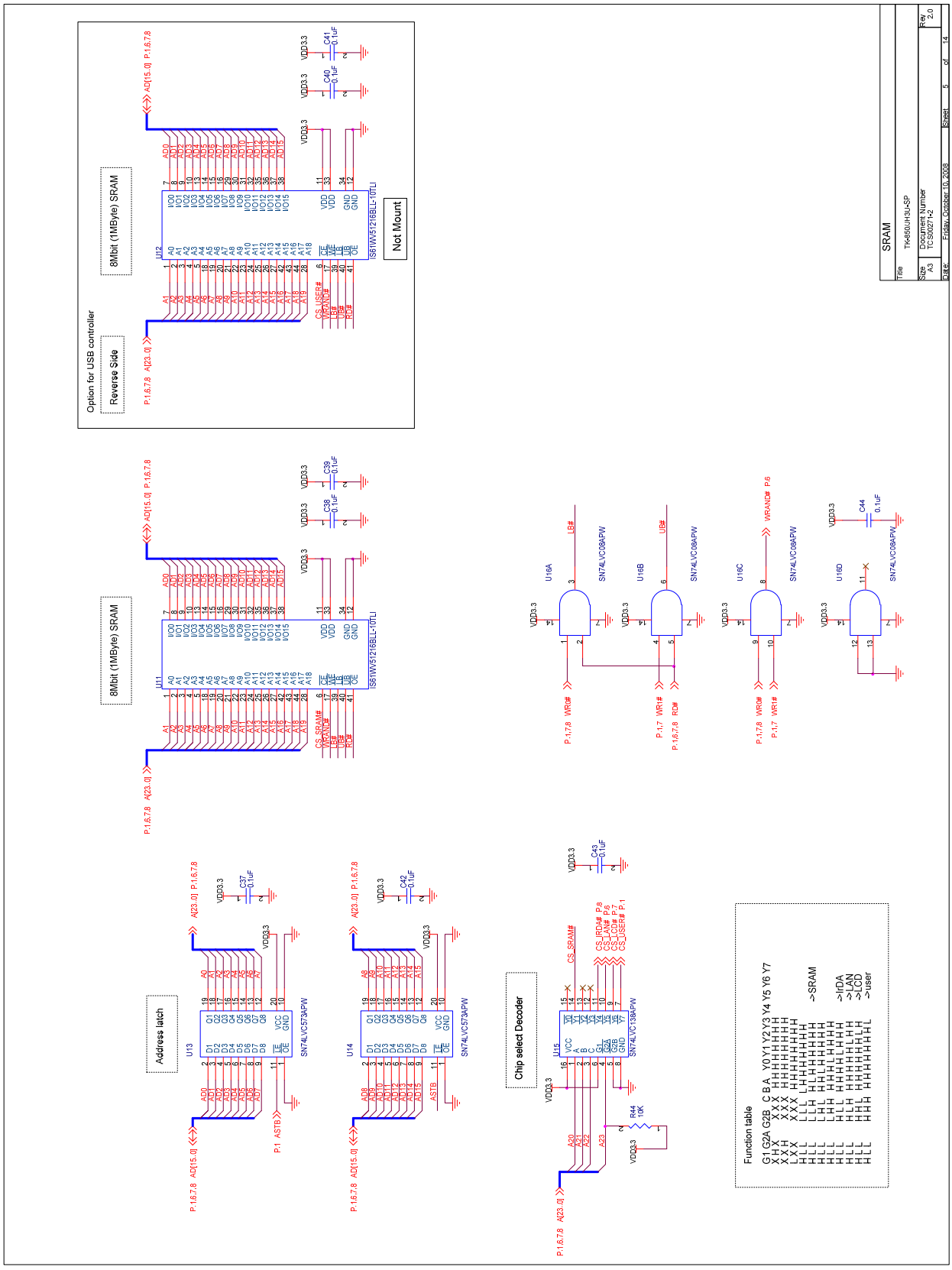


Figure 60: V850ES/Jx3-U - Plug it! schematics 5/13

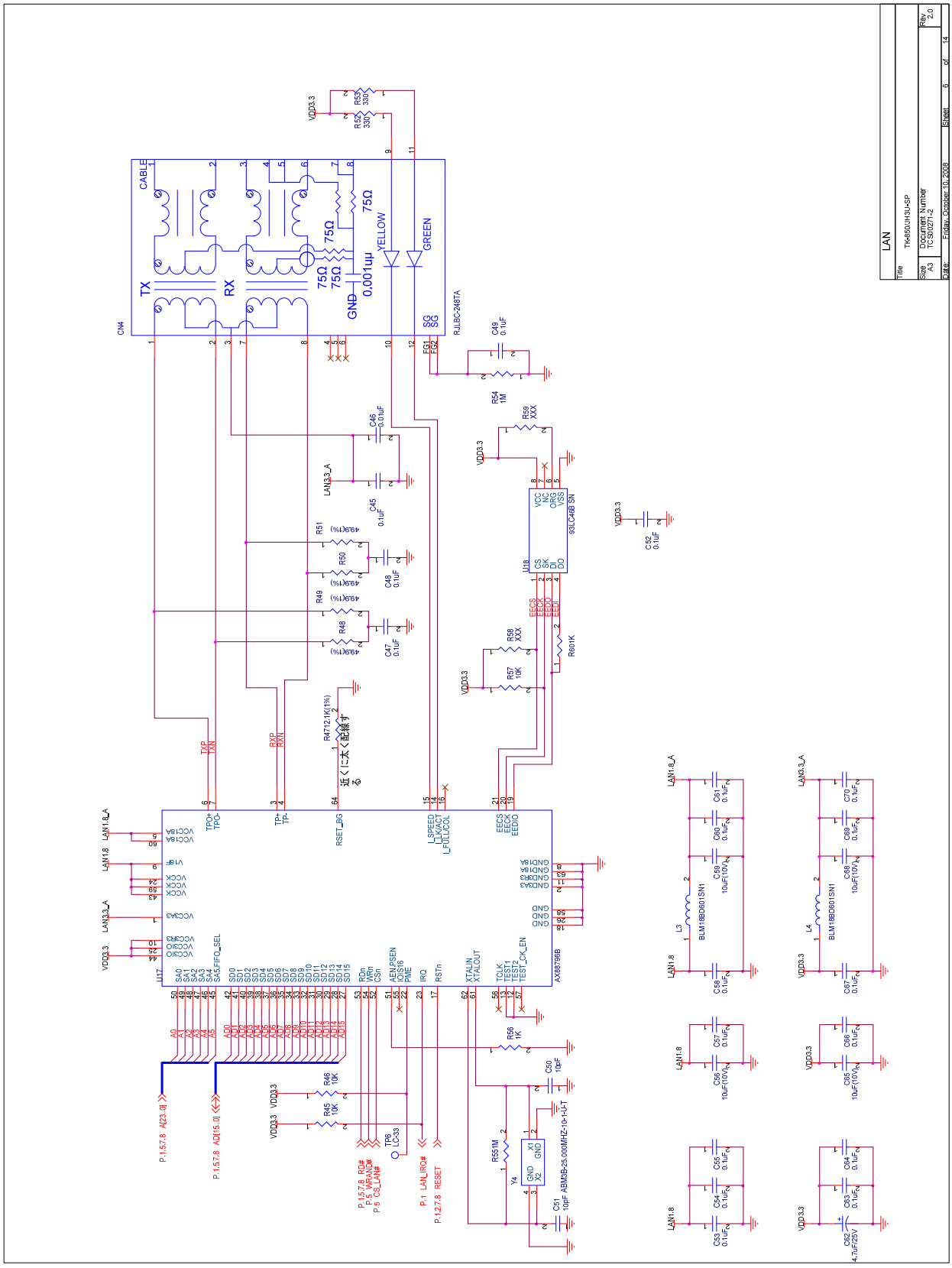


Figure 61: V850ES/Jx3-U - Plug it! schematics 6/13

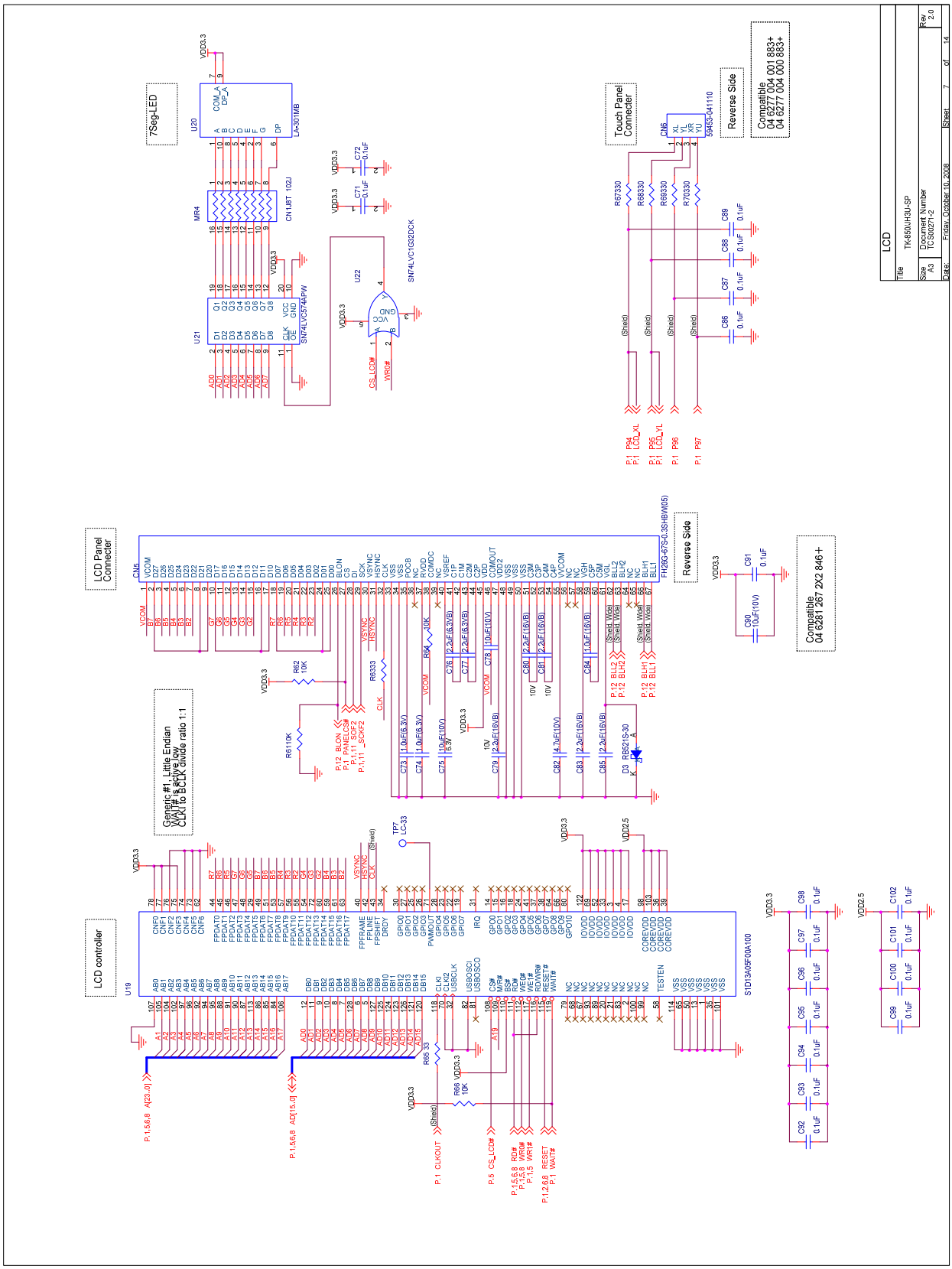


Figure 62: V850ES/Jx3-U - Plug it! schematics 7/13

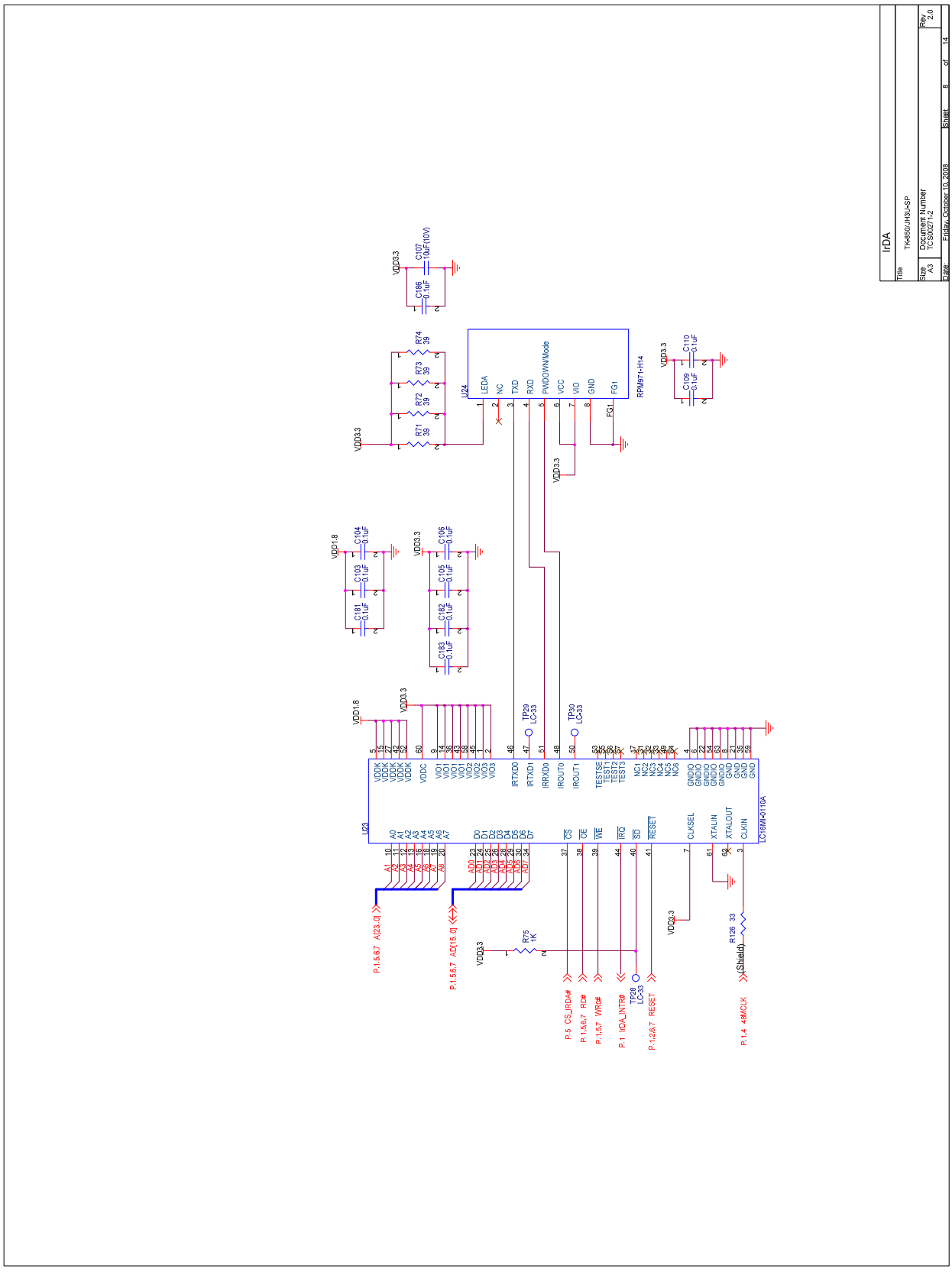


Figure 63: V850ES/Jx3-U - Plug it! schematics 8/13

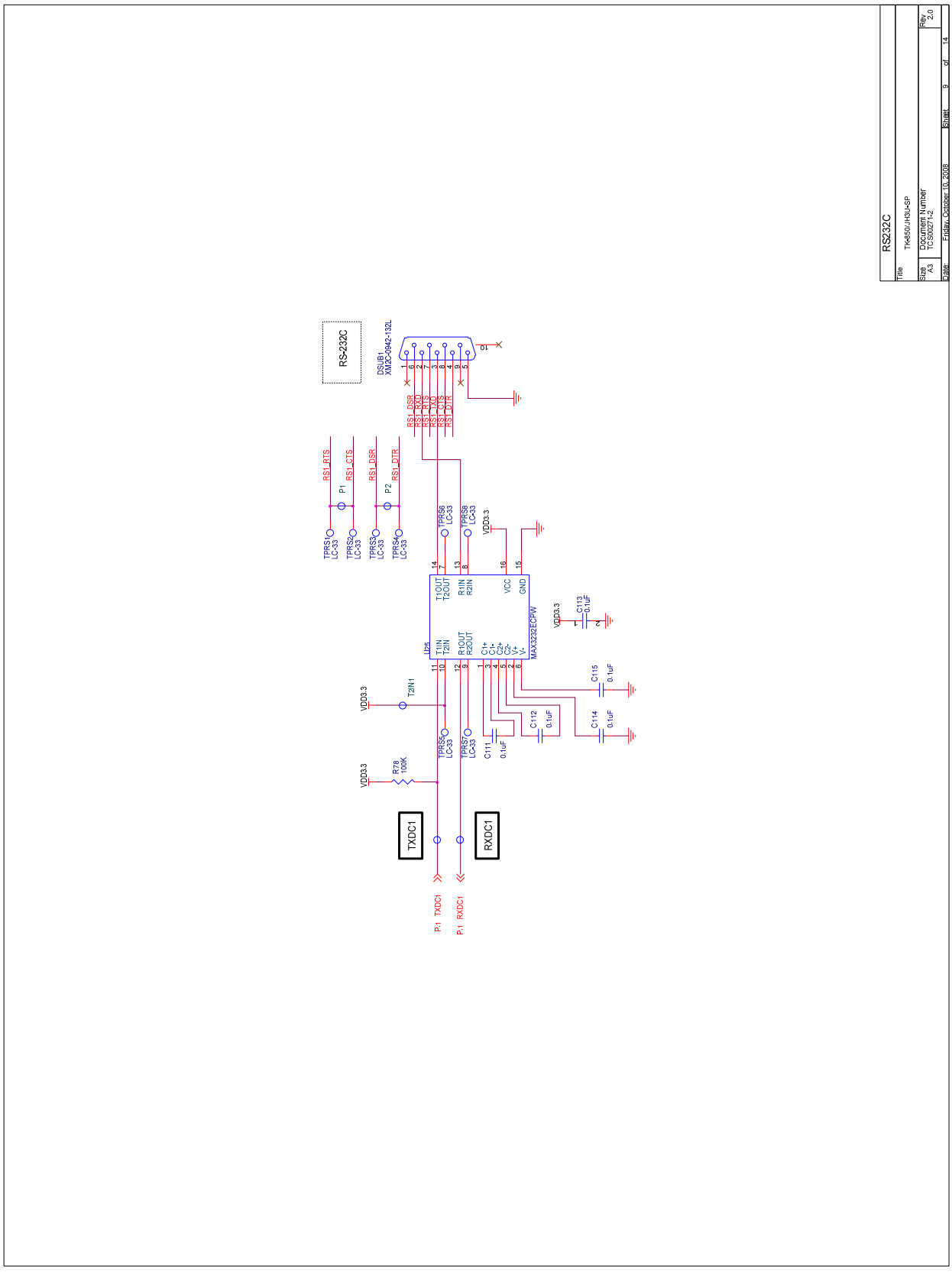


Figure 64: V850ES/Jx3-U - Plug it! schematics 9/13

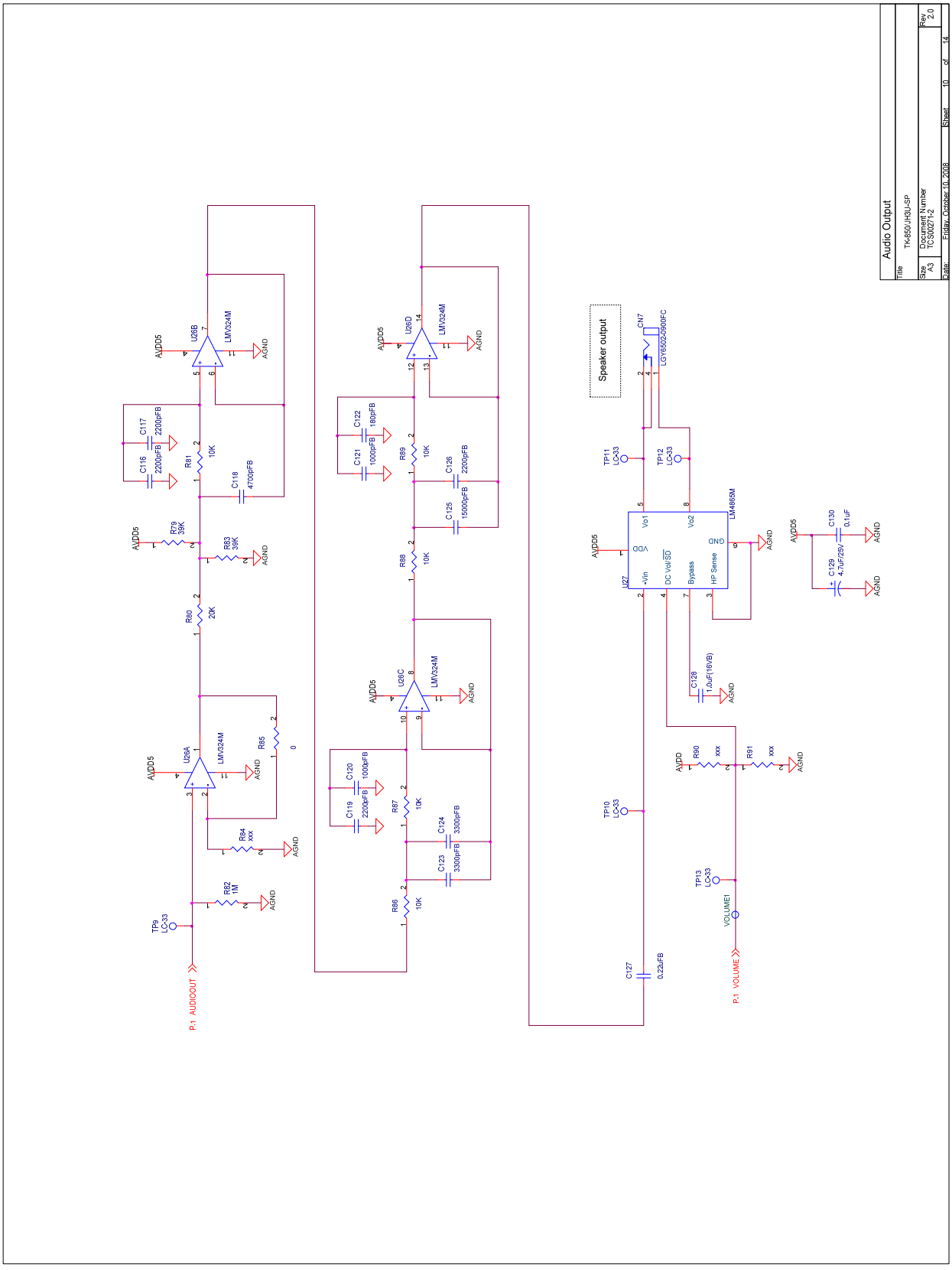


Figure 65: V850ES/Jx3-U - Plug it! schematics 10/13

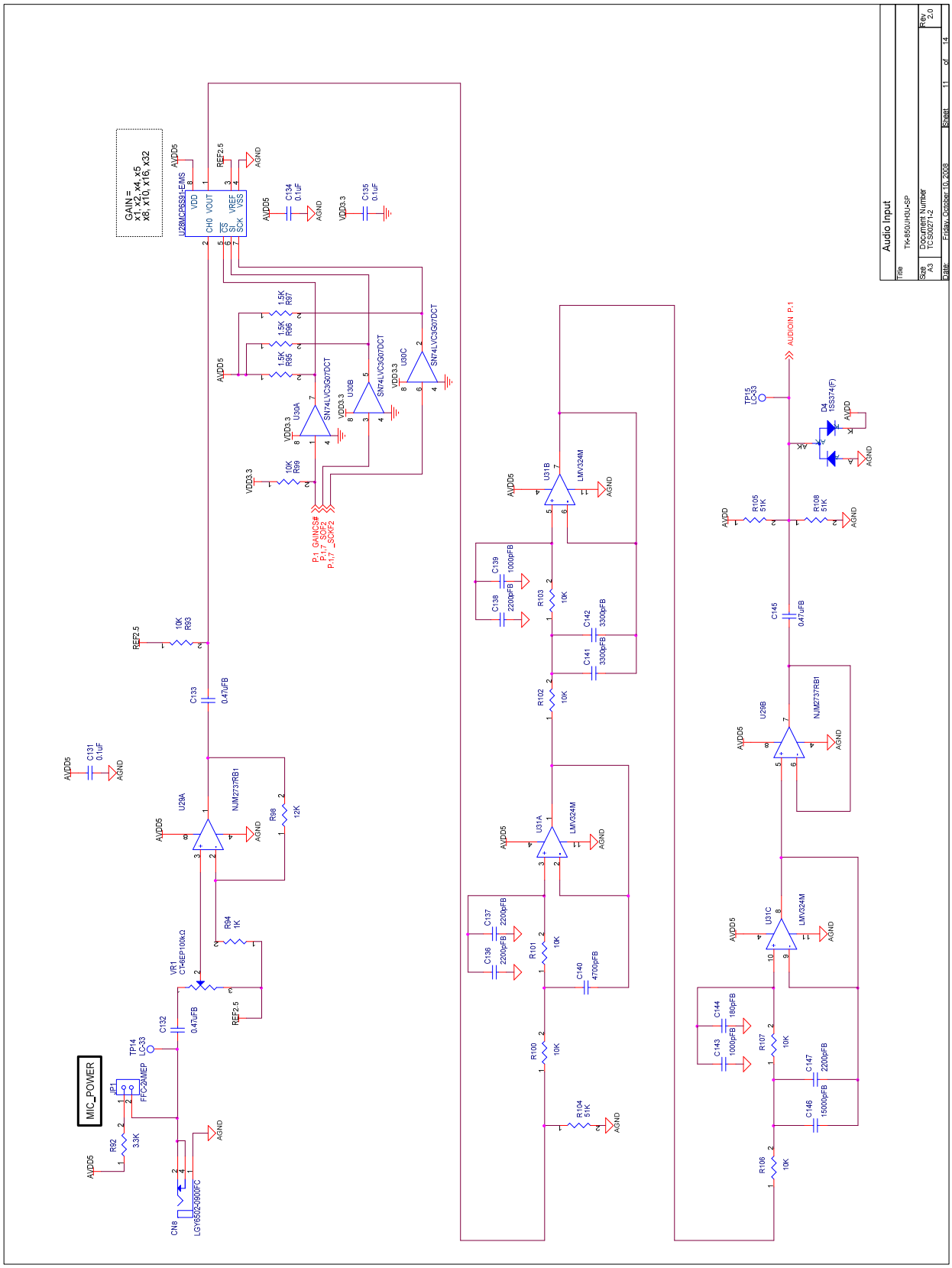


Figure 66: V850ES/Jx3-U - Plug it! schematics 11/13

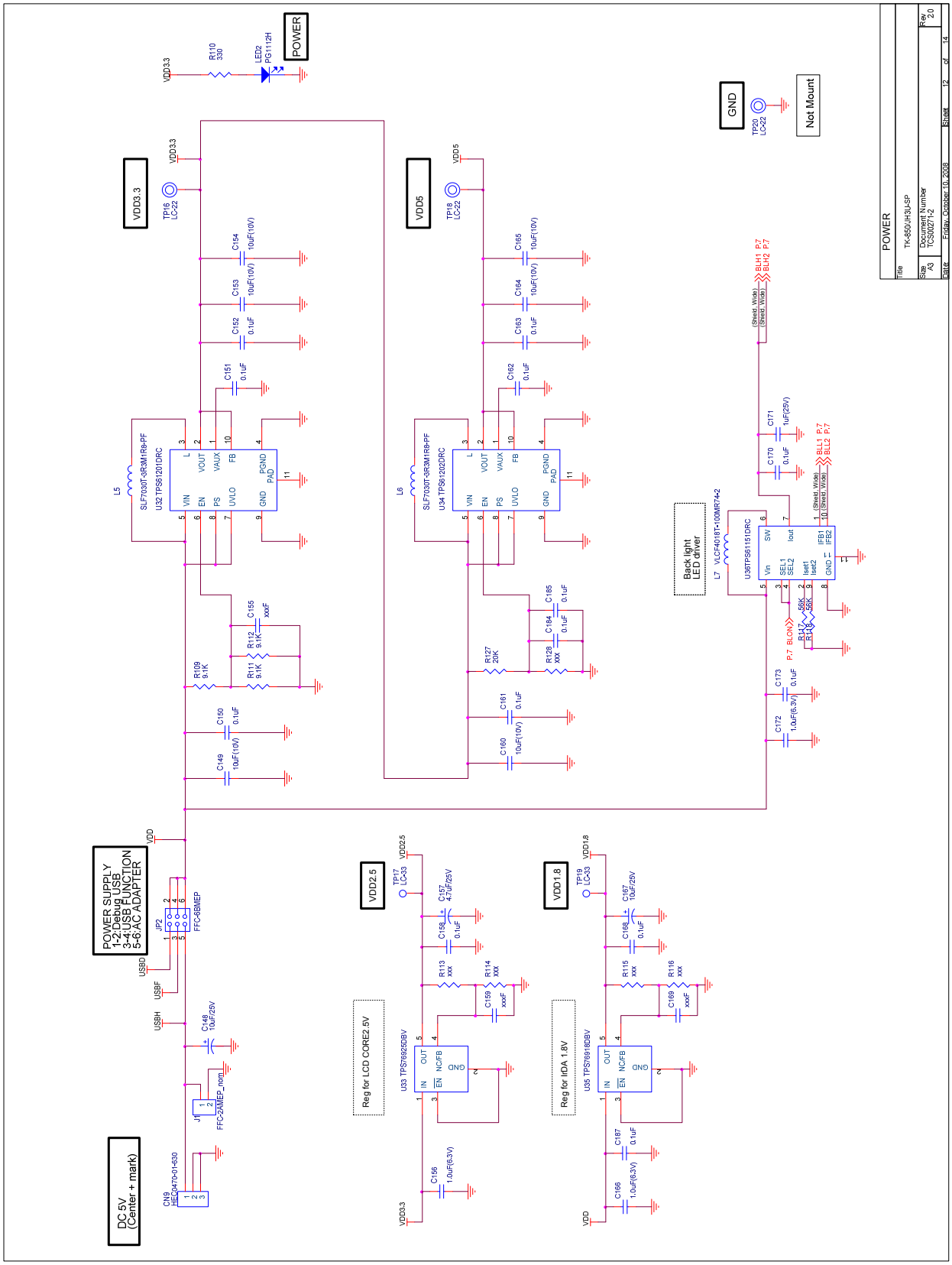


Figure 67: V850ES/Jx3-U - Plug it! schematics 12/13

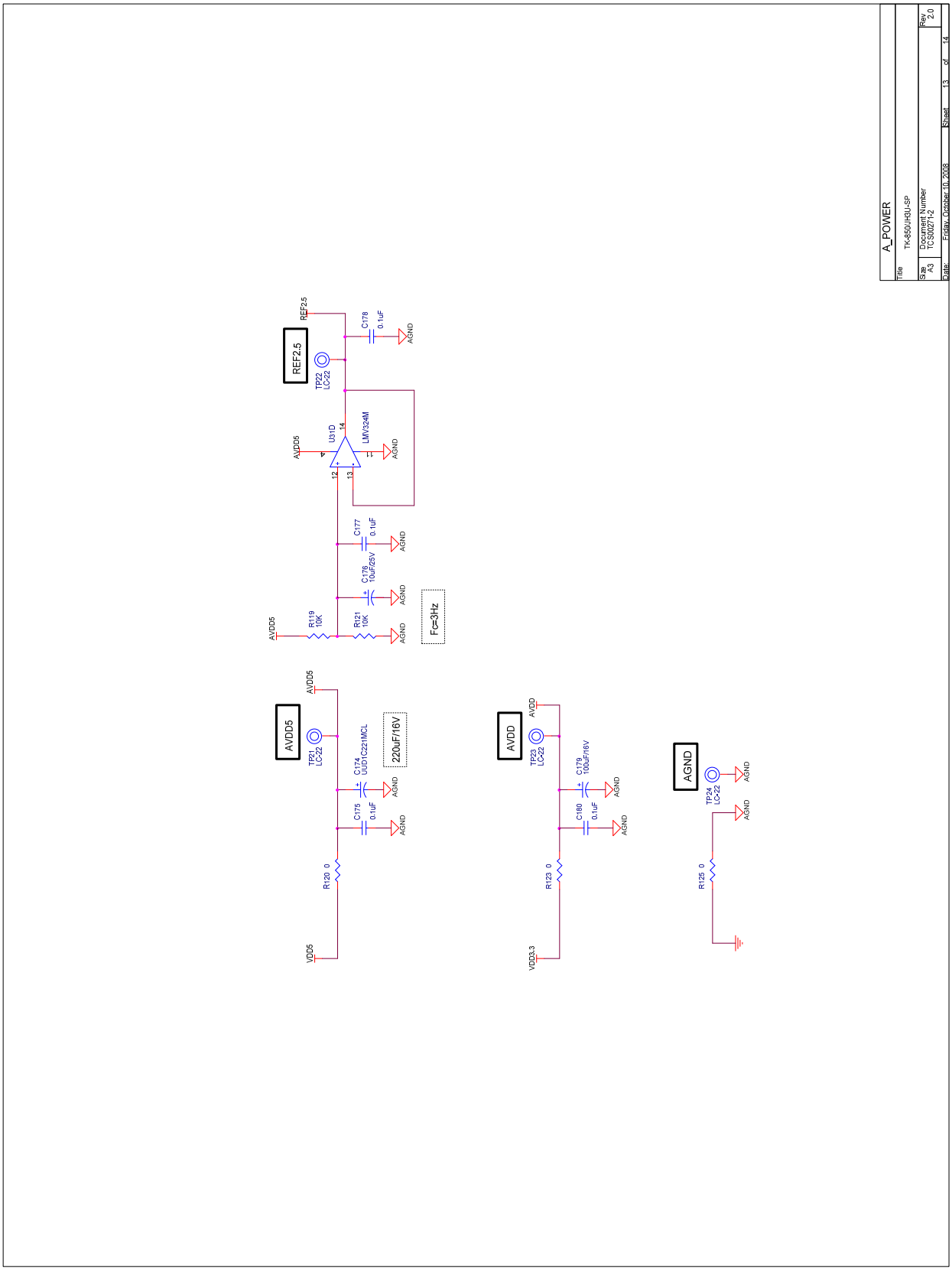


Figure 68: V850ES/Jx3-U - Plug it! schematics 13/13

V850ES/Jx3-U Plug it! User's Manual

Publication Date: Rev.1.00 Aug 18, 2009
Rev.2.00 Mar 16, 2011

Published by: Renesas Electronics Europe GmbH

Renesas Electronics Corporation

http://www.renesas.com

SALES OFFICES

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130
Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220
Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900
Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327
Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679
Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898
Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044
Renesas Electronics Taiwan Co., Ltd.
7F, No. 363 Fu Shing North Road Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670
Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001
Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510
Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 1.0

V850ES/Jx3-U - Plug it!

Renesas Electronics Corporation

R20UT0582ED0100
(Previous number: U19787EE1V0UM00)