

V850ES/Jx3-U - Plug it!

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

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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.

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- Availability of related technical literature
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Table of Contents

List of Figures 9

List of Tables 11

Chapter 1	Introduction	12
1.1	Main features of V850ES/Jx3-U - Plug it!	12
1.2	System requirements	13
1.3	Package contents	13
1.4	Trademarks	13
Chapter 2	V850ES/Jx3-U - Plug it! system configuration	14
2.1	V850ES/Jx3-U - Plug it!	14
2.2	Host computer	14
2.3	Power supply via USB interface	14
Chapter 3	V850ES/Jx3-U - Plug it! hardware	15
3.1	Hardware Components	15
3.1.1	SW1, Configuration Switch (DIP-Switch)	17
3.1.2	SW2, RESET button	18
3.1.3	SW3, Switch (INTP12)	18
3.1.4	SW4, Switch (INTP13)	18
3.1.5	JP2, Power Supply selector	18
3.1.6	JP1, Power supply selector for MIC input (CN8)	18
3.1.7	LED1, Bus Power LED	18
3.1.8	LED2, Power LED	18
3.1.9	CN1, Extension connector	19
3.1.10	CN2, MINICUBE2 connector	19
3.1.11	CN4, RJ-45 connector	19
3.1.12	CN7, Audio output	19
3.1.13	CN8, Audio input	19
3.1.14	CN9, AC power supply connector	19
3.1.15	J1, Optional power supply connector	19
3.1.16	NWIRE1, N-Wire connector	19
3.1.17	U20, Seven-segment-LED	20
3.1.18	U24, Infrared communication module	20
3.1.19	VR1, Volume control	20
3.1.20	USB1, Debug connector (Type Mini-B)	21
3.1.21	USB2, Universal serial bus connector (Host, Type A)	21
3.1.22	USB3, Universal serial bus connector (Type Mini-B)	22
3.1.23	DSUB1, RS-232C interface connector	22

3.2	On board peripherals	22
3.2.1	SRAM	22
3.2.2	Ethernet	22
3.2.3	IrDA infrared communication	22
3.2.4	Audio input.....	22
3.2.5	Audio output	23
3.2.6	RS-232C	23
3.2.7	External bus interface	24
3.2.8	External connector	25
3.3	Layout of solder-short pads	26
Chapter 4	On-Chip debugging	27
4.1	OCD via MINICUBE2 On-Board debug function.....	28
4.1.1	Resources used by MINICUBE2 OCD Interface.....	28
4.2	OCD via N-Wire emulator	29
Chapter 5	<i>V850ES/Jx3-U - Plug it!</i> installation and operation	30
5.1	Getting started	30
5.1.1	CD-ROM contents	30
Chapter 6	Hardware installation	31
Chapter 7	Software installation	31
7.1	IAR Systems Embedded Workbench for V850 installation	31
7.2	Device File Package installation	31
7.3	Sample program installation	32
7.4	Segger USB Eval Package installation	32
7.5	USB Driver Installation.....	32
7.5.1	Installation on Windows 2000	32
7.5.2	Installation on Windows XP.....	36
7.6	Confirmation of USB Driver Installation	39
Chapter 8	IAR sample session.....	40
Chapter 9	Troubleshooting	45
Chapter 10	Flash Programmer WriteEZ1	46
10.1	Device Setup	46
10.2	Using WriteEZ	47

Chapter 11	Sample programs	48
11.1	General Introduction	48
11.2	“Jx3U_PLUGIT_DEMO” sample program	49
11.2.1	How to run the sample program	49
11.3	“Jx3U_PLUGIT_COM” Serial Conversion sample program	50
11.3.1	Development Environment	51
11.3.2	System Structure	51
11.3.3	How to run the sample program	52
11.3.4	Communication Device Class (CDC)	54
11.3.5	Processing Flow	55
11.3.6	File Structure	58
11.3.7	Descriptor Information	58
11.4	“Jx3U_PLUGIT_STORAGE” Mass Storage sample program	61
11.4.1	Development Environment	63
11.4.2	System Structure	63
11.4.3	How to run the sample program	64
11.4.4	Mass Storage Class (MSC)	65
11.4.5	SCSI Command Process	65
11.4.6	Processing Flow	66
11.4.7	File Structure	70
11.4.8	Descriptor Information	70
Chapter 12	Cables	74
12.1	USB interface cable (Mini-B type)	74
Chapter 13	Schematics	75

List of Figures

Figure 1: V850ES/Jx3-U - Plug it! system configuration	14
Figure 2: V850ES/Jx3-U - Plug it! Connector Layout.....	15
Figure 3: V850ES/Jx3-U - Plug it! Function Layout.....	16
Figure 4: Seven-segment-LED U20	20
Figure 5: USB1, USB Mini-B Type Host Connector Pin Configuration	21
Figure 6: Address mapping of On-board peripherals	24
Figure 7: Solder-short pad opened shape.....	26
Figure 8: Solder-short pad shortened shape.....	26
Figure 9: On-Chip debugging	27
Figure 10: Device File Installation	31
Figure 11: Found New Hardware Wizard (Windows 2000).....	32
Figure 12: Search Method (Windows 2000).....	33
Figure 13: Driver File Location (Windows 2000)	33
Figure 14: Address Specification 2 (Windows 2000).....	34
Figure 15: Driver File Search (Windows 2000)	34
Figure 16: USB Driver Installation Completion (Windows 2000).....	35
Figure 17: Found New Hardware Wizard 1 (Windows XP).....	36
Figure 18: Found New Hardware Wizard 2 (Windows XP).....	36
Figure 19: Search Location Specification 1 (Windows XP).....	37
Figure 20: Search Location Specification 2 (Windows XP).....	37
Figure 21: Windows XP Logo Testing (Windows XP).....	38
Figure 22: USB Driver Installation Completion (Windows XP).....	38
Figure 23: Windows Device Manager	39
Figure 24: IAR Embedded Workbench.....	40
Figure 25: IAR Embedded Workbench Project Workspace	41
Figure 26: Device Selection.....	42
Figure 27: Include directory	42
Figure 28: IAR debugger options	43
Figure 29: Embedded Workbench Linker Configuration	43
Figure 30: MINICUBE Hardware Setup Dialogue	44
Figure 31: IAR C-SPY debugger	45
Figure 32: WriteEZ1 User Interface.....	46
Figure 33: WriteEZ1 Device Setup Dialogue.....	46
Figure 34: WriteEZ1 Device Menu	47
Figure 35: Project Window Jx3U_PLUGIT_DEMO	49
Figure 36: Project Window Jx3U_PLUGIT_COM.....	50
Figure 37: Development Environment.....	51
Figure 38: System Structure of the sample program.....	51
Figure 39: Jx3U_PLUGIT_COM-sample Debug Communication Port	52
Figure 40: Found New Hardware Wizard 1 (Windows XP).....	52
Figure 41: Found New Hardware Wizard 2 (Windows XP).....	53
Figure 42: Search Location Specification 1 (Windows XP).....	53
Figure 43: Jx3U_PLUGIT_COM-sample Application Communication Port	54
Figure 44: Flow Chart Jx3U_PLUGIT_COM application.....	55
Figure 45: Flow Chart Jx3U_PLUGIT_COM Endpoint 0 Monitoring Process.....	56
Figure 46: Flow Chart Jx3U_PLUGIT_COM Endpoint 1 Monitoring Process.....	57
Figure 47: Project Window Jx3U_PLUGIT_STORAGE	62
Figure 48: Development Environment.....	63
Figure 49: System Structure of the sample program.....	63
Figure 50: Jx3U_PLUGIT_STORAGE sample Mass Storage Device	64
Figure 51: Flow Chart Jx3U_PLUGIT_STORAGE USB Initialization Process	66
Figure 52: Flow Chart Jx3U_PLUGIT_STORAGE Endpoint 0 Monitoring process.....	67
Figure 53: Flow Chart Jx3U_PLUGIT_STORAGE Endpoint 0 Monitoring process.....	68
Figure 54: Flow Chart Jx3U_PLUGIT_STORAGE SCSI Command Process.....	69
Figure 55: USB interface cable (Mini-B type).....	74
Figure 56: V850ES/Jx3-U - Plug it! schematics 1/13	75

Figure 57: V850ES/Jx3-U - Plug it! schematics 2/13	76
Figure 58: V850ES/Jx3-U - Plug it! schematics 3/13	77
Figure 59: V850ES/Jx3-U - Plug it! schematics 4/13	78
Figure 60: V850ES/Jx3-U - Plug it! schematics 5/13	79
Figure 61: V850ES/Jx3-U - Plug it! schematics 6/13	80
Figure 62: V850ES/Jx3-U - Plug it! schematics 7/13	81
Figure 63: V850ES/Jx3-U - Plug it! schematics 8/13	82
Figure 64: V850ES/Jx3-U - Plug it! schematics 9/13	83
Figure 65: V850ES/Jx3-U - Plug it! schematics 10/13	84
Figure 66: V850ES/Jx3-U - Plug it! schematics 11/13	85
Figure 67: V850ES/Jx3-U - Plug it! schematics 12/13	86
Figure 68: V850ES/Jx3-U - Plug it! schematics 13/13	87

List of Tables

Table 1: Mode setting, switch SW1	17
Table 2: Power supply selector, JP2	18
Table 3: CN9 connector.....	19
Table 4: Display Examples	20
Table 5: Pin Configuration of Connector USB1.....	21
Table 6: Pin assignment of external connector CN1	25
Table 7: Solder-short pad connection	26
Table 8: OCD via MINICUBE2 On-Board debug function	28
Table 9: OCD via QB-V850MINI emulator	29
Table 10: <i>V850ES/Jx3-U - Plug it!</i> CD-ROM directory structure.....	30
Table 11: WriteEZ action buttons	47
Table 12: Sample directory structure	48
Table 13: Example directory structure.....	48
Table 14: Source Modules USB Serial Conversation Sample	58
Table 15: Header Files USB Serial Conversation Sample.....	58
Table 16: Device Descriptor Serial Conversion Sample	59
Table 17: Configuration Descriptor Serial Conversion Sample.....	59
Table 18: Interface Descriptor Serial Conversion Sample	60
Table 19: Endpoint Descriptor Serial Conversion Sample	61
Table 20: String Descriptor Serial Conversion Sample.....	61
Table 21: Source Modules USB Mass Storage Sample	70
Table 22: Header Files USB Mass Storage Sample	70
Table 23: Device Descriptor Mass Storage Sample.....	71
Table 24: Configuration Descriptor Mass Storage Sample	71
Table 25: Interface Descriptor Mass Storage Sample	72
Table 26: Endpoint Descriptor Serial Conversion Sample	73
Table 27: String Descriptor Mass Storage Sample	73

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 *V850ES/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

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

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

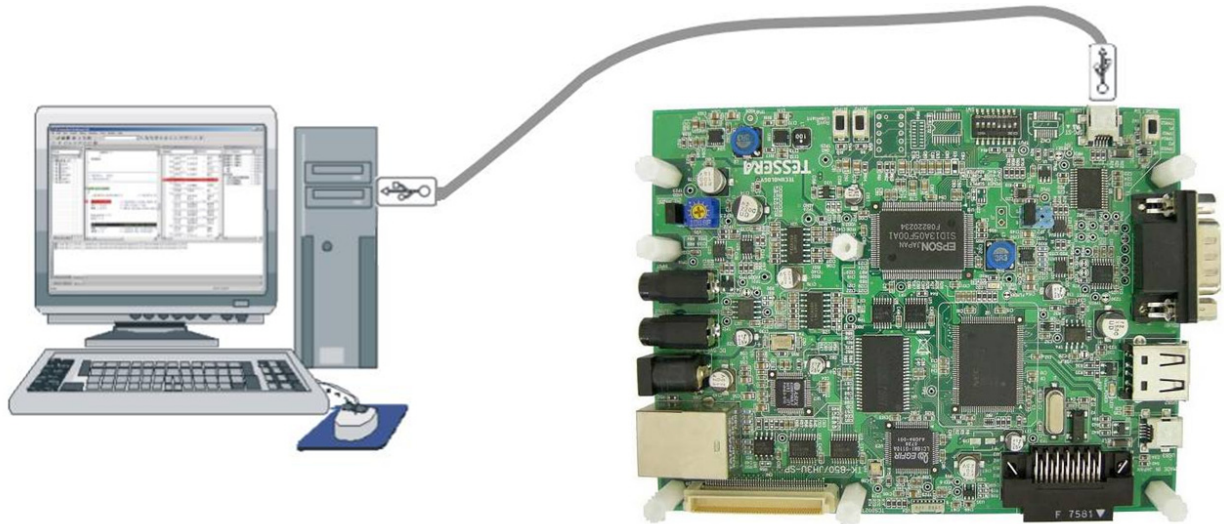


Figure 1: V850ES/Jx3-U - Plug it! system configuration

2.1 V850ES/Jx3-U - Plug it!

V850ES/Jx3-U - Plug it! is a USB-demonstration kit for the μ PD70F3769 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 μ PD78F0730 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.

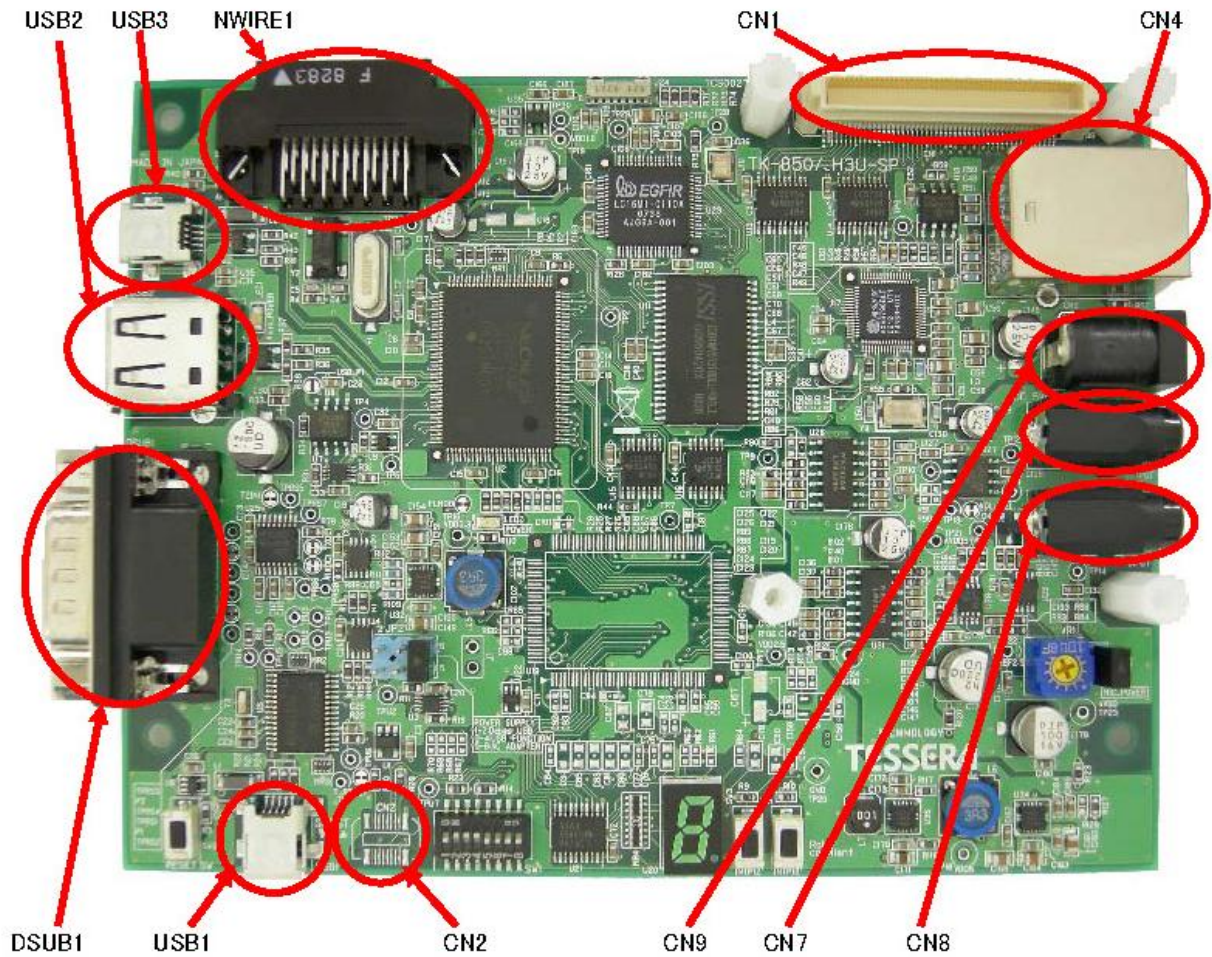


Figure 2: V850ES/Jx3-U - Plug it! Connector Layout

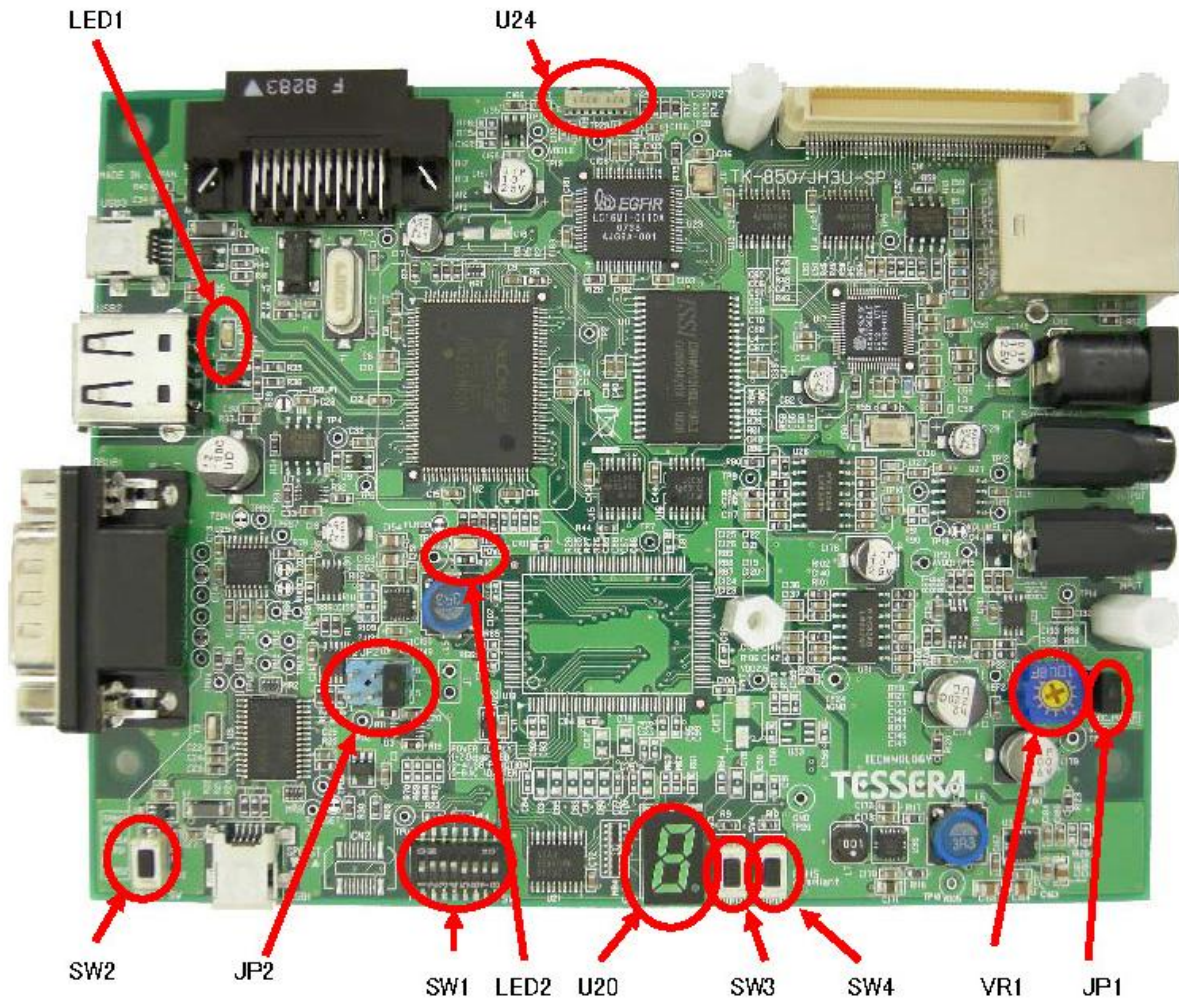


Figure 3: V850ES/Jx3-U - Plug it! Function Layout

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
 - o Start a debug session using the On-Board debug interface
- Flash-Programming Mode
 - o Program an application to the build-in flash memory of uPD70F3769 by WriteEZ1-programmer
- Stand alone mode
 - o Run a program stored in built-in flash memory of the uPD70F3769 device
- N-Wire debug mode
 - o Start a debug session using an N-Wire emulator, e.g. MINICUBE
- Virtual serial COM port mode
 - o 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 – 0x6FFFFFF. Output a zero to light the corresponding segment.

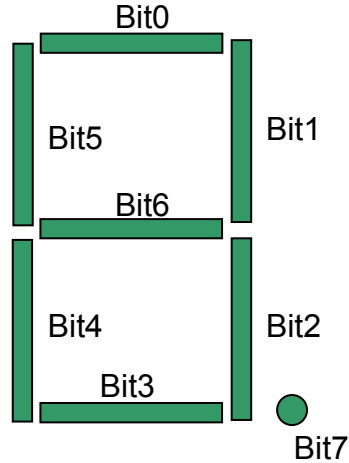


Figure 4: Seven-segment-LED U20

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.

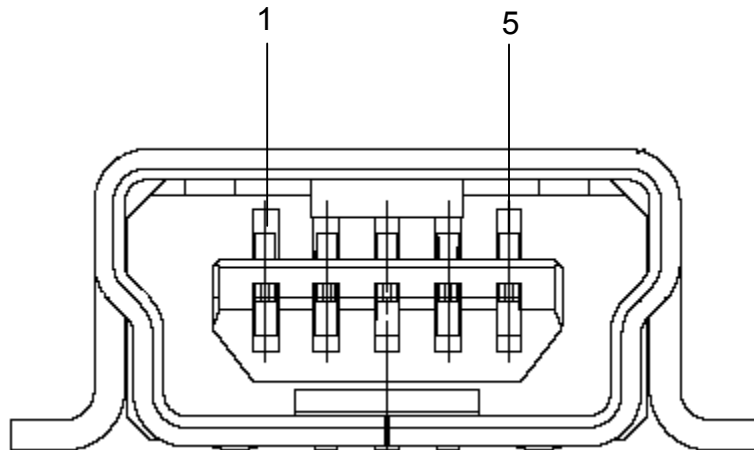


Figure 5: USB1, USB Mini-B Type Host Connector Pin Configuration

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 $F_c = 3.6$ 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 $F_c = 3.6$ 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.

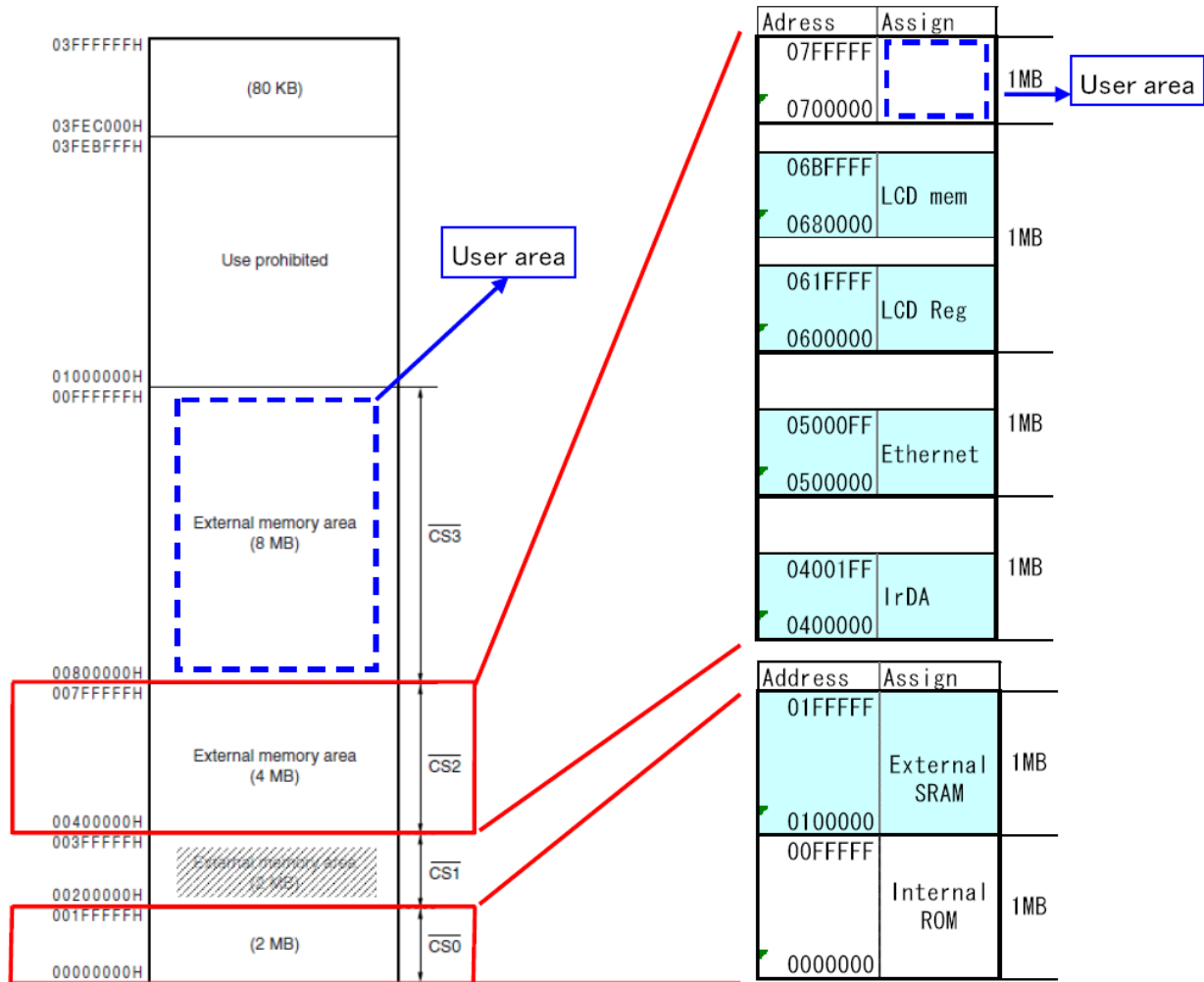


Figure 6: Address mapping of On-board peripherals

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	No.	V850ES/JH2-U pin	Bus
1	A0	●	2	PCM3/HLDRQ	●
3	A1	●	4	P00/INTP00	
5	A2	●	6	P01/INTP01	
7	A3	●	8	P02/NMI	
9	A4	●	10	P11/ANO1	
11	A5	●	12	P20/TIAB03/KR2/TOAB03/RTP02	
13	A6	●	14	P24/INTP05	
15	A7	●	16	P25/INTP06	
17	A8	●	18	P32/ASCKC0/SCKF4/TIAA00/TOAA00	
19	A9	●	20	P33/TIAA01/TOAA01/RTCDIV/RTCCCL	
21	A10	●	22	P36/TXDC3/SCL00/UDMARQ0	
23	A11	●	24	P37/RXDC3/SDA00/UDMAAK0	
25	A12	●	26	P40/SIF0/TXDC4/SDA01	
27	A13	●	28	P50/TIAB01/KR0/TOAB01/RTP00/UDMARQ1	
29	A14	●	30	P51/TIAB02/KR1/TOAB02/RTP01/UDMAAK1	
31	A15	●	32	P60/TOAB1T1/TIAB11/TOAB11	
33	PCM0/WAIT	●	34	P61/TOAB1B1/TIAB10/TOAB10	
35	PCM1/CLKOUT	●	36	P62/TOAB1T2/TIAB12/TOAB12	
37	CS_USER_n	●	38	P63/TOAB1B2/TRGAB1	
39	PCS2/CS2	●	40	P64/TOAB1T3/TIAB13/TOAB13	
41	PCS3/CS3	●	42	P65/TOAB1B3/EVTB1	
43	PCT0/WR0	●	44	P74/ANI4	
45	PCT1/WR1	●	46	P75/ANI5	
47	PCT4/RD	●	48	P76/ANI6	
49	PCT6/ASTB	●	50	P77/ANI7	
51	PDH0/A16	●	52	P90/KR6/TXDC1/SDA02/A0	
53	PDH1/A17	●	54	P91/KR7/RXDC1/SCL02/A1	
55	PDH2/A18	●	56	P92/TENC01/TIT01/TOT01/A2	
57	PDH3/A19	●	58	P93/TECR0/TIT00/TOT00/A3	
59	PDH4/A20	●	60	P94/TIAA31/TOAA31/TENC00/EVTT00/A4	
61	PDH5/A21	●	62	P95/TIAA30/TOAA30/A5	
63	PDH6/A22	●	64	P96/TIAA21/TOAA21/INTP11/A6	
65	PDH7/A23	●	66	P97/SIF1/TIAA20/TOAA20/A7	
67	PDL0/AD0	●	68	P914/TIAA51/TOAA51/INTP17/A14	
69	PDL1/AD1	●	70	P915/TIAA50/TOAA50/INTP18/A15	
71	PDL2/AD2	●	72	RESET	
73	PDL3/AD3	●	74	AGND	
75	PDL4/AD4	●	76	3.3V Analog (AVDD)	
77	PDL5/AD5/FLMD1	●	78	3.3VDigital (VDD3.3)	
79	PDL6/AD6	●	80	3.3VDigital (VDD3.3)	
81	PDL7/AD7	●	82	3.3VDigital (VDD3.3)	
83	PDL8/AD8	●	84	GND	
85	PDL9/AD9	●	86	GND	
87	PDL10/AD10	●	88	GND	
89	PDL11/AD11	●	90	GND	
91	PDL12/AD12	●	92	GND	
93	PDL13/AD13	●	94	VDD5V (VDD)	
95	PDL14/AD14	●	96	VDD5V (VDD)	
97	PDL15/AD15	●	98	VDD5V (VDD)	
99	PCM2/HLDAK	●	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	FLMD0 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.

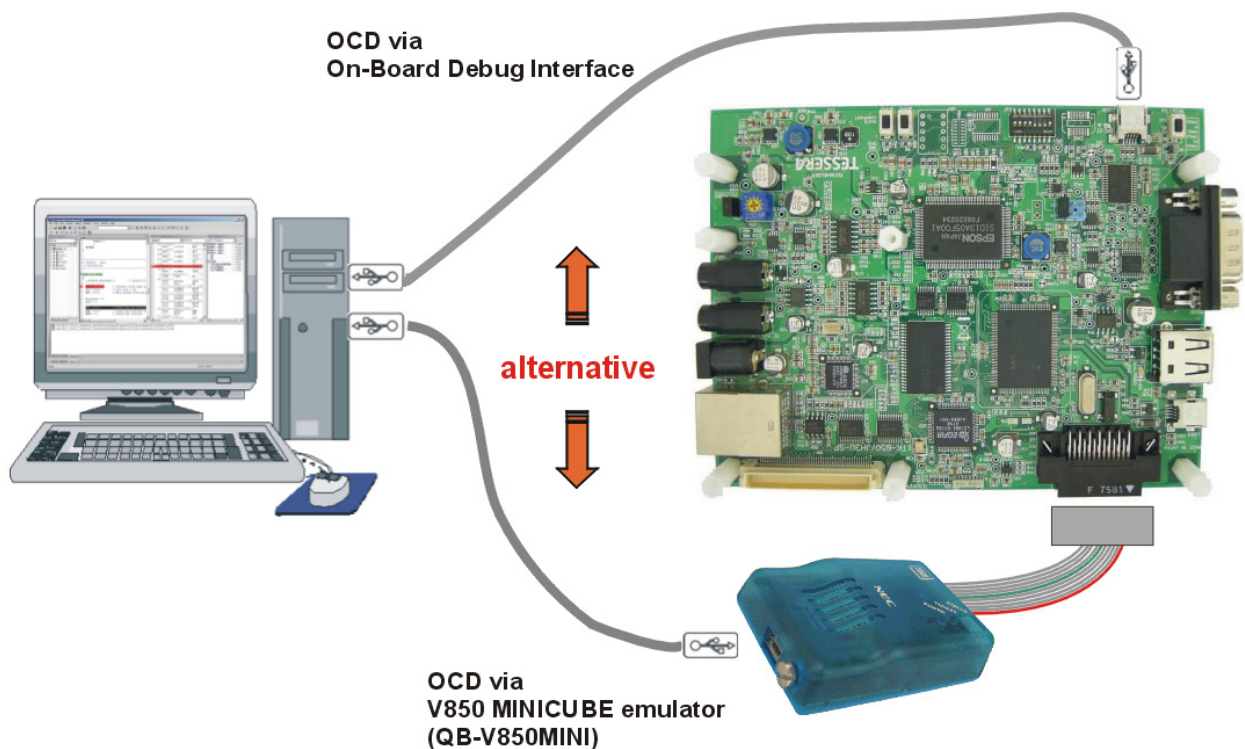


Figure 9: On-Chip debugging

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! <i>including:</i> <ul style="list-style-type: none"> ○ <i>Jx3U_PLUGIT_DEMO sample</i> ○ <i>Jx3U_PLUGIT_COM sample</i> ○ <i>Jx3U_PLUGIT_STORAGE sample</i>
 Segger	- <i>Segger USB Eval Package</i>
 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.

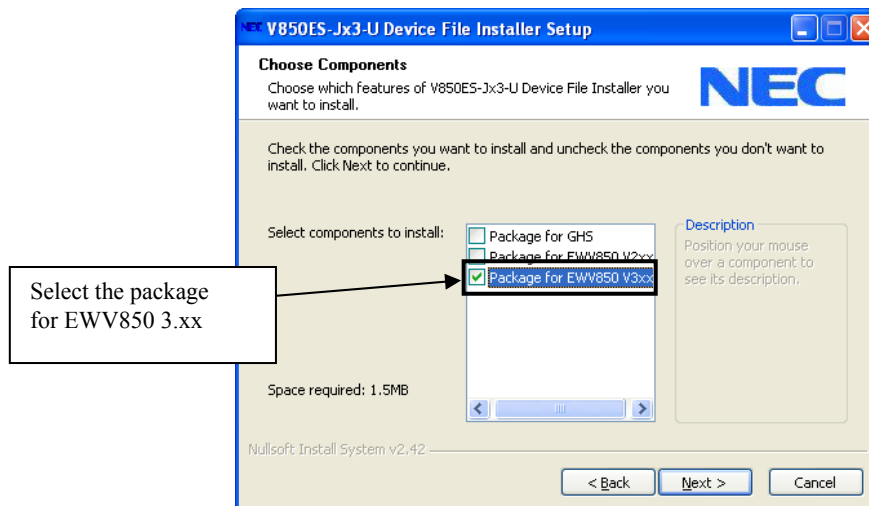


Figure 10: Device File Installation

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)

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

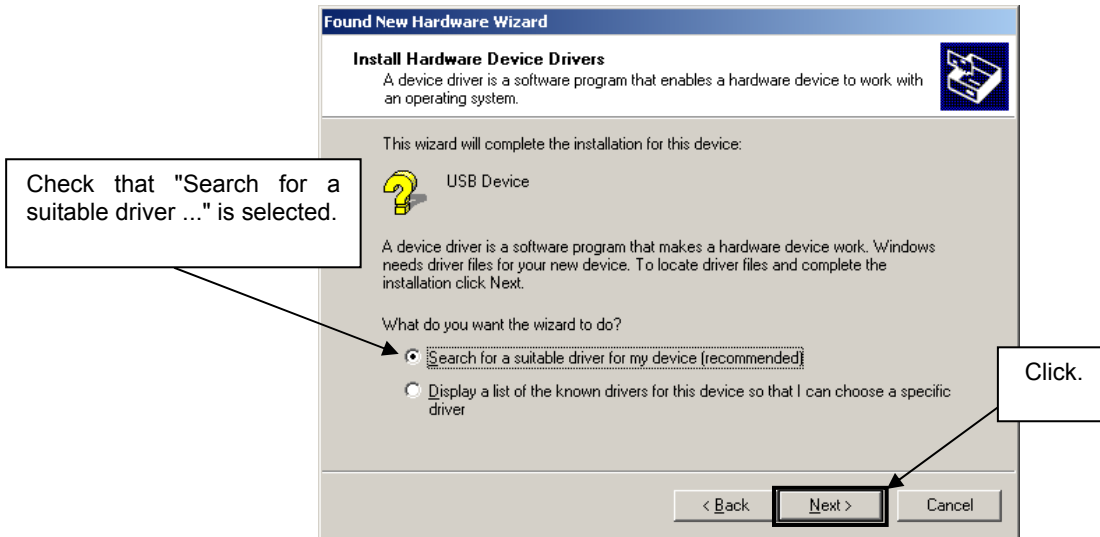


Figure 12: Search Method (Windows 2000)

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

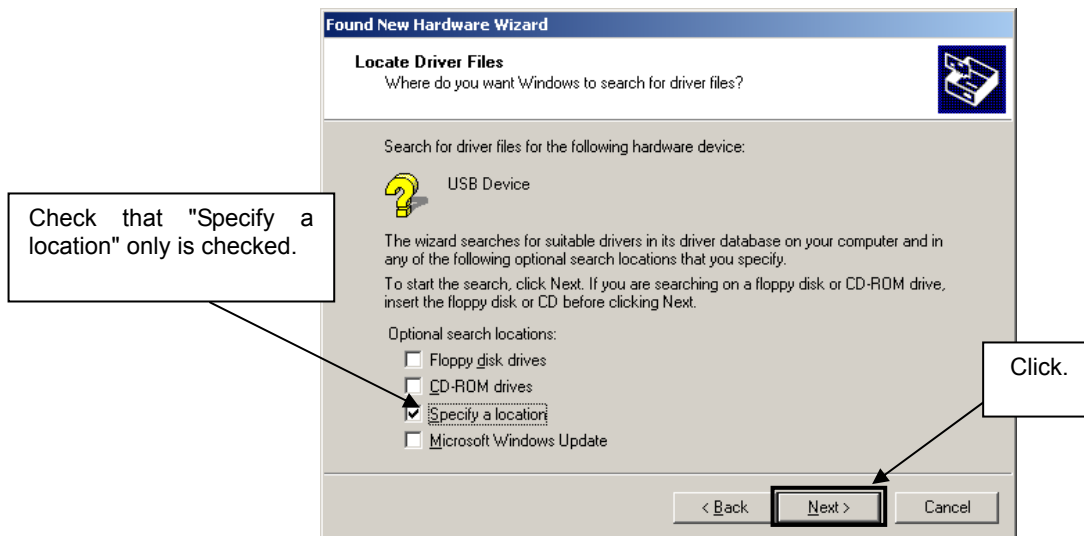


Figure 13: Driver File Location (Windows 2000)

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.

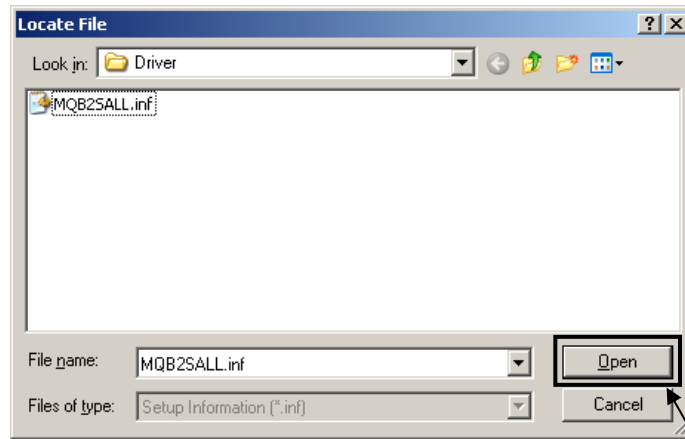


Figure 14: Address Specification 2 (Windows 2000)

Click.

6. After the location of the USB driver has been specified click **OK** to proceed.
7. Click **Next>**.

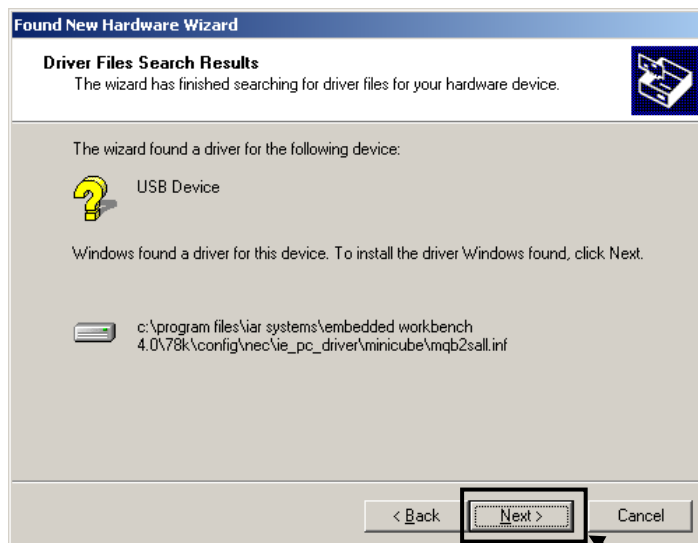


Figure 15: Driver File Search (Windows 2000)

Click.

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

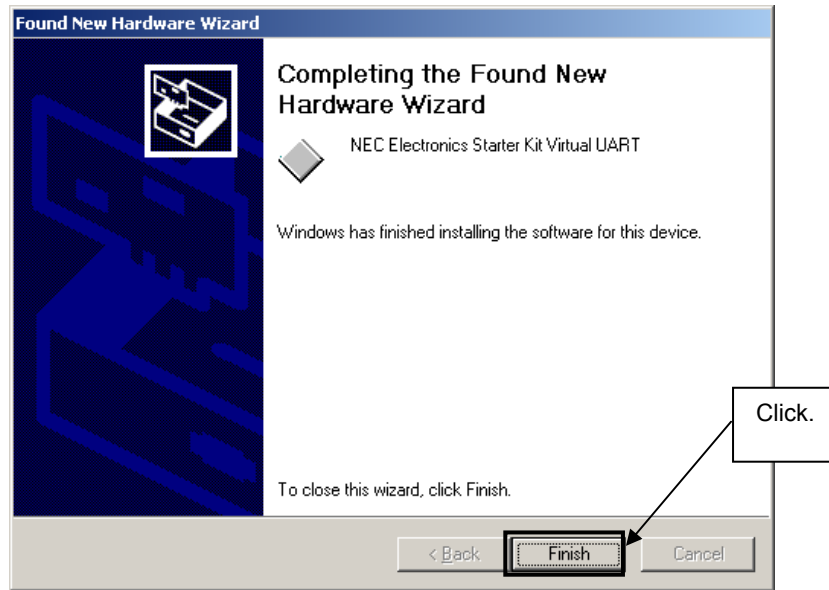


Figure 16: USB Driver Installation Completion (Windows 2000)

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>**.

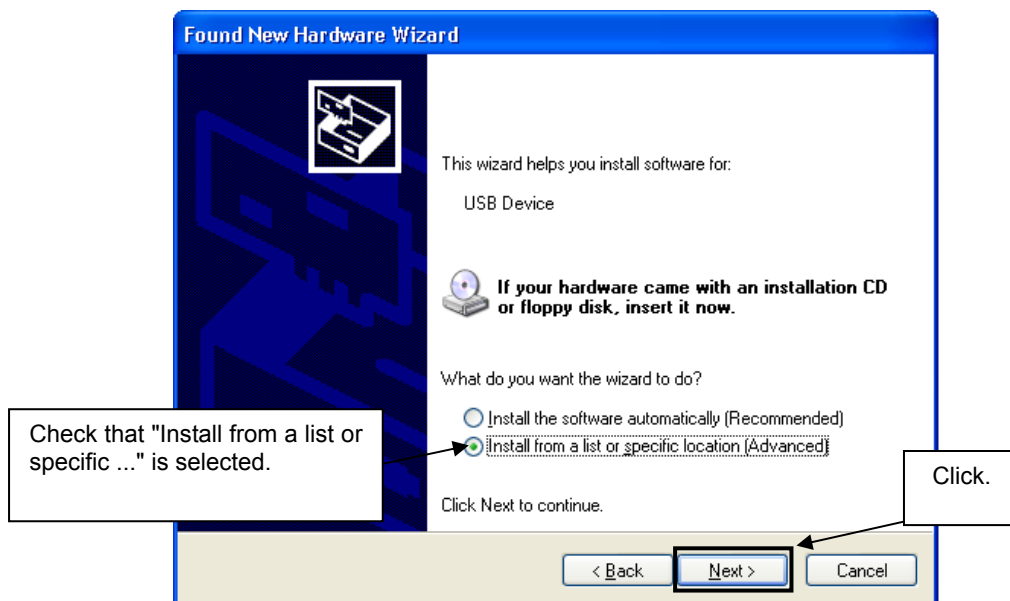


Figure 18: Found New Hardware Wizard 2 (Windows XP)

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**.

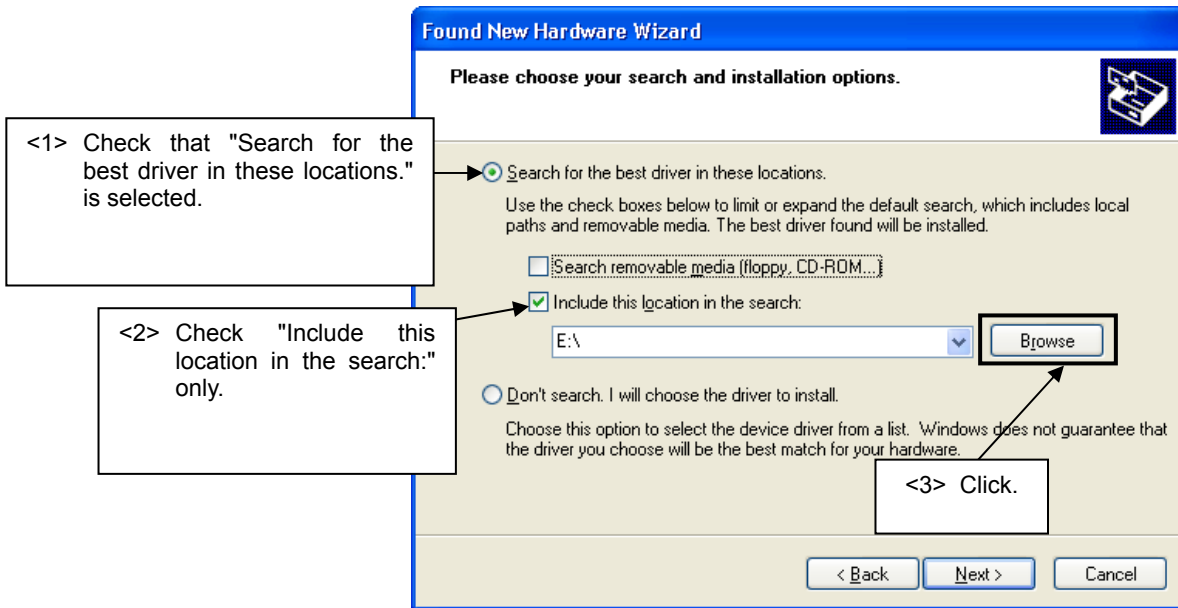


Figure 19: Search Location Specification 1 (Windows XP)

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.

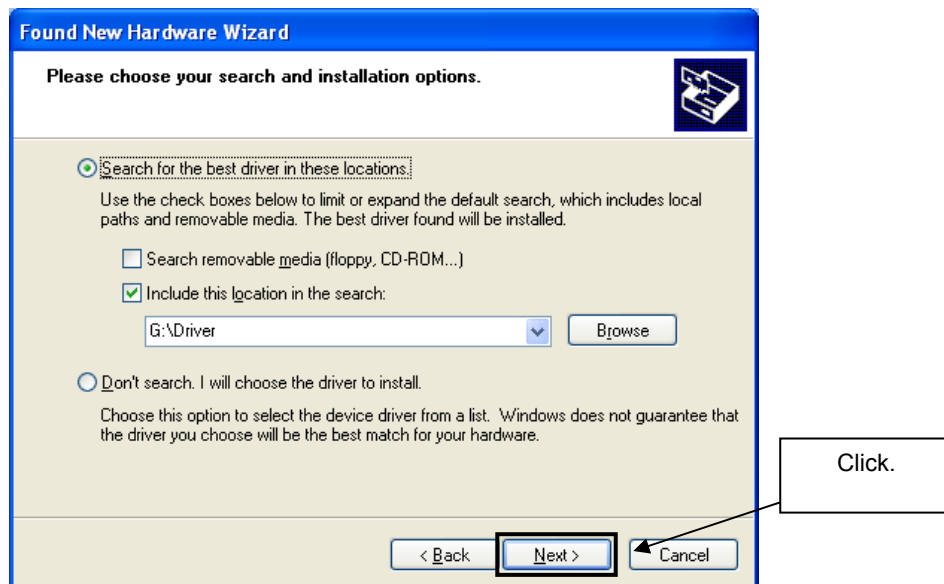


Figure 20: Search Location Specification 2 (Windows XP)

- 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**.

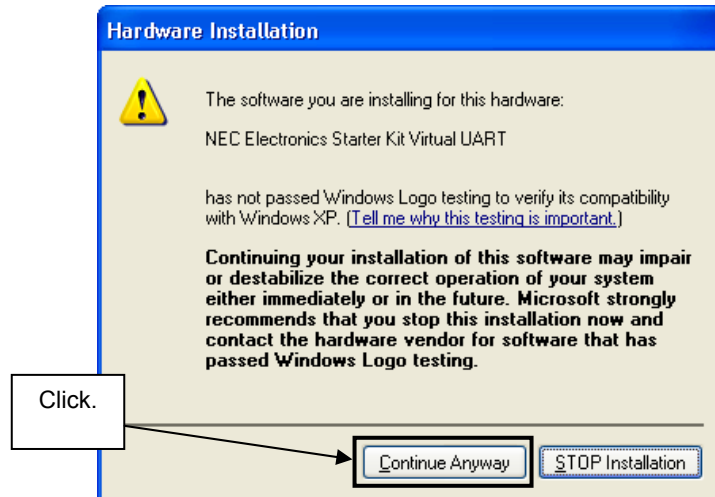


Figure 21: Windows XP Logo Testing (Windows XP)

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

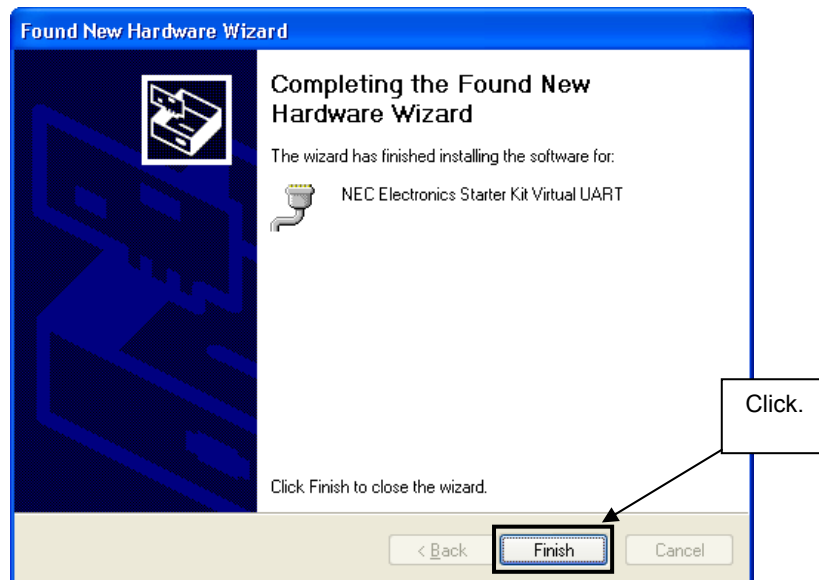


Figure 22: USB Driver Installation Completion (Windows XP)

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.

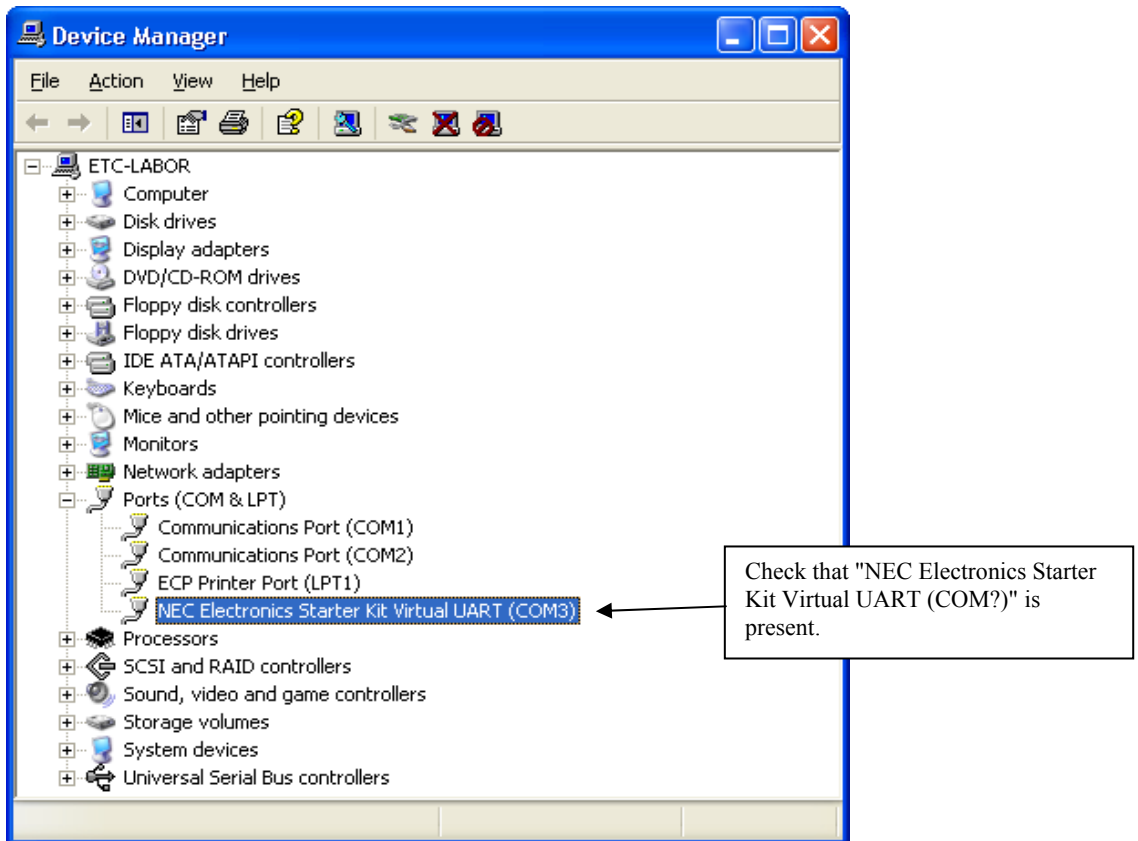


Figure 23: Windows Device Manager

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:

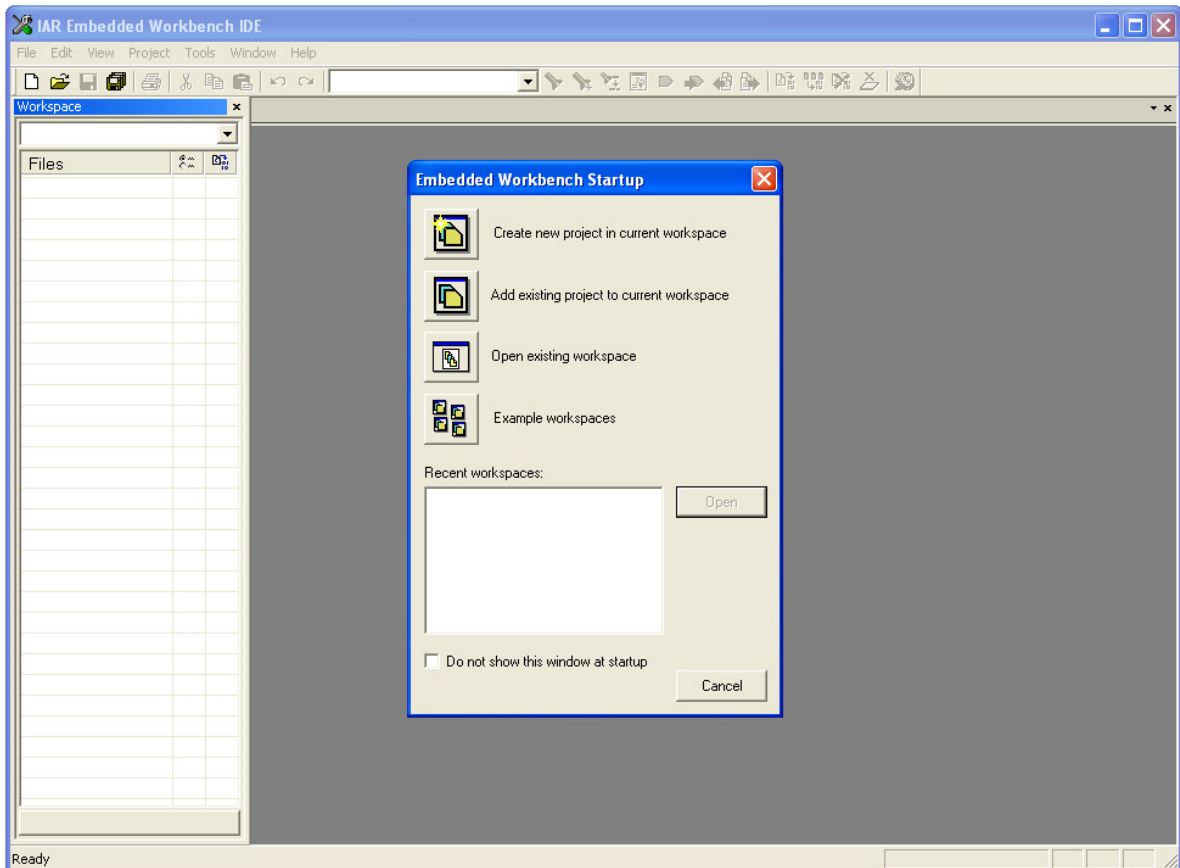


Figure 24: IAR Embedded Workbench

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:

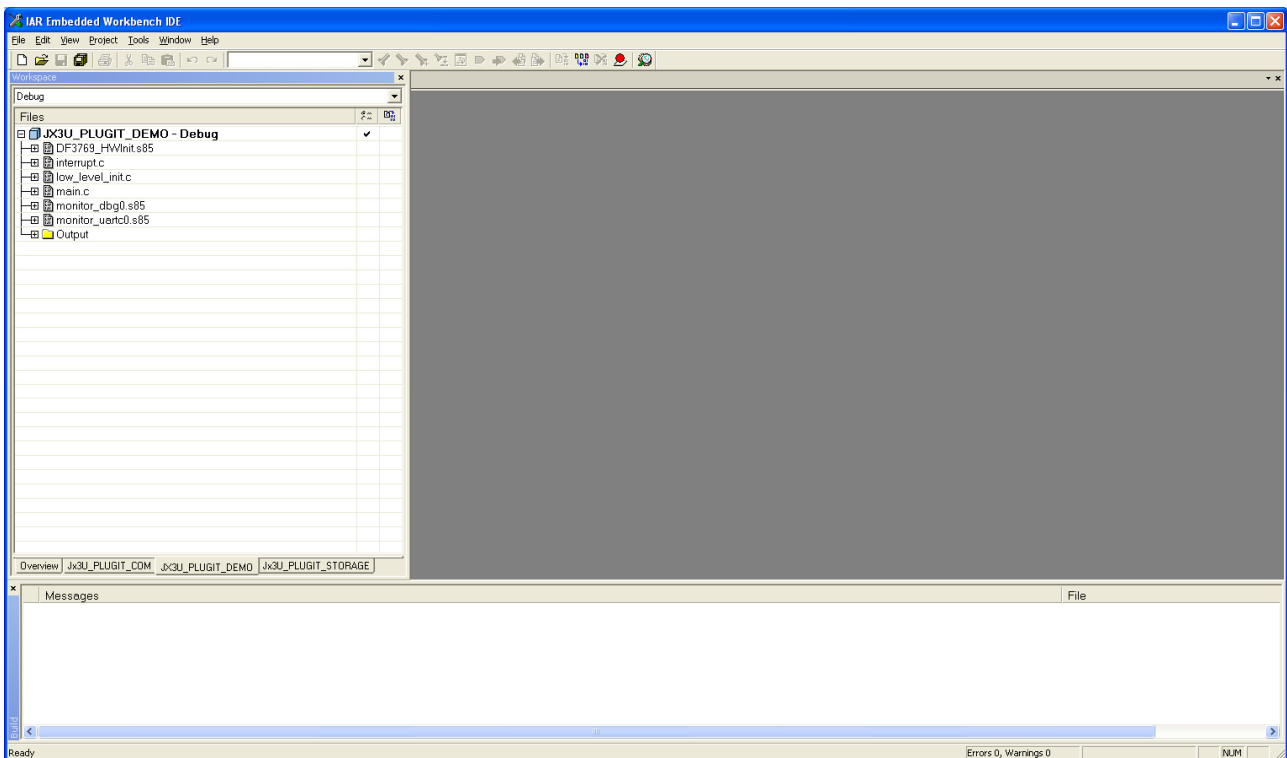


Figure 25: IAR Embedded Workbench Project Workspace

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).

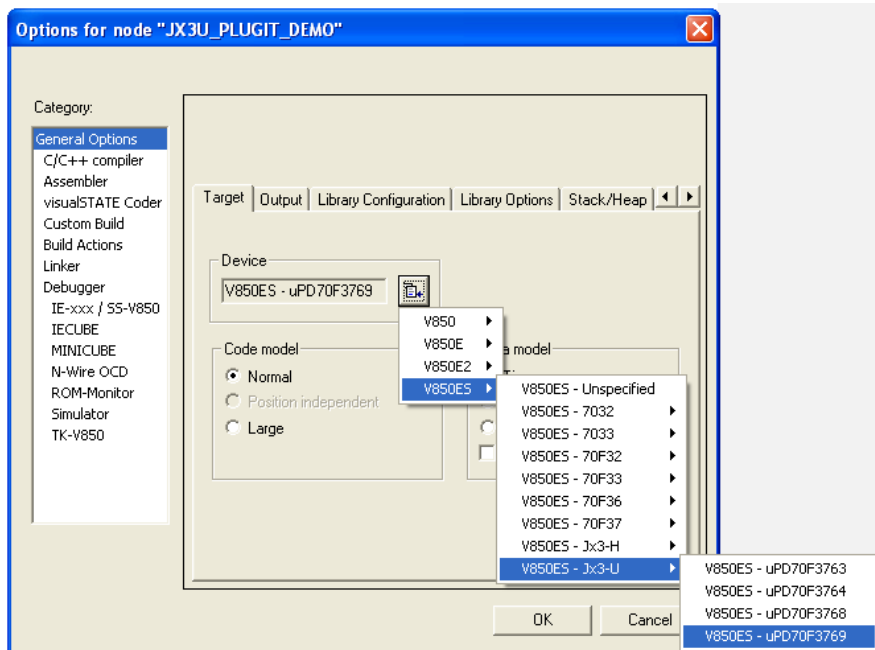


Figure 26: Device Selection

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”.

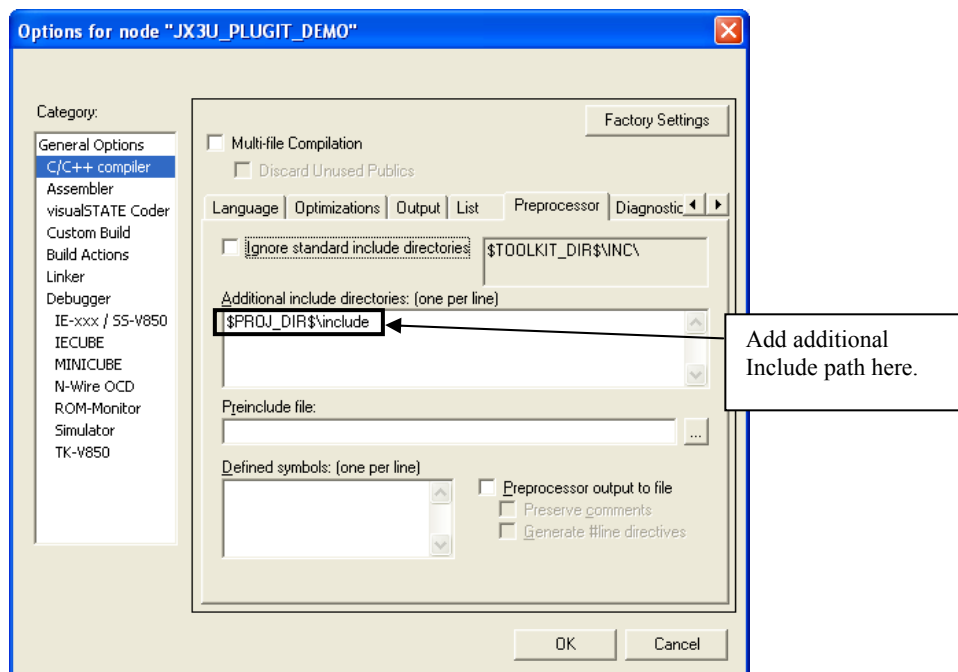


Figure 27: Include directory

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.

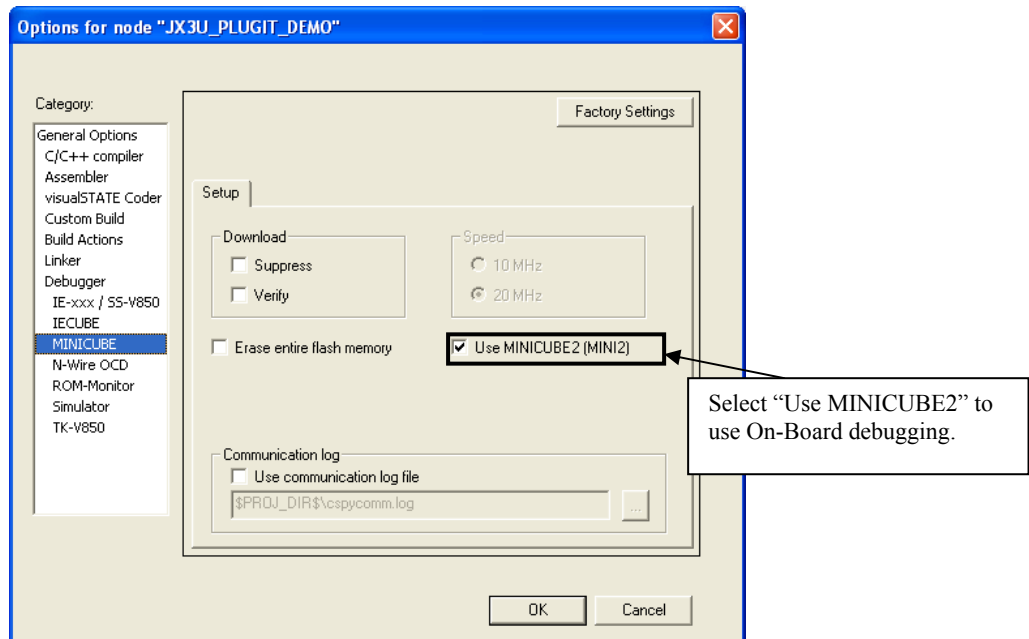


Figure 28: IAR debugger options

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:

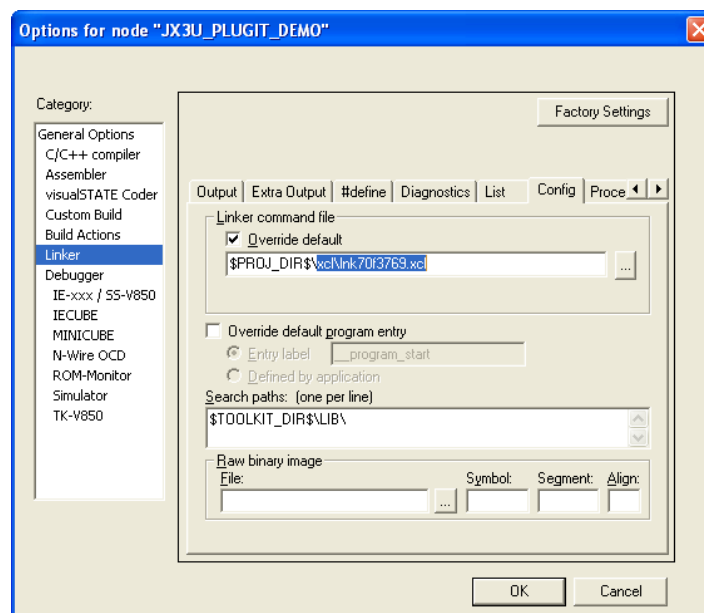



Figure 29: Embedded Workbench Linker Configuration

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.

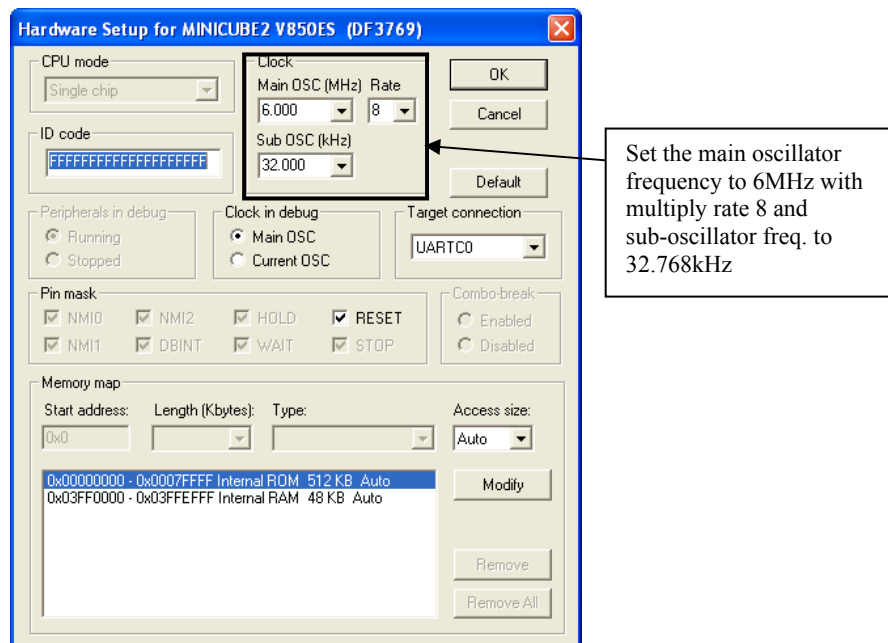



Figure 30: MINICUBE Hardware Setup Dialogue

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.

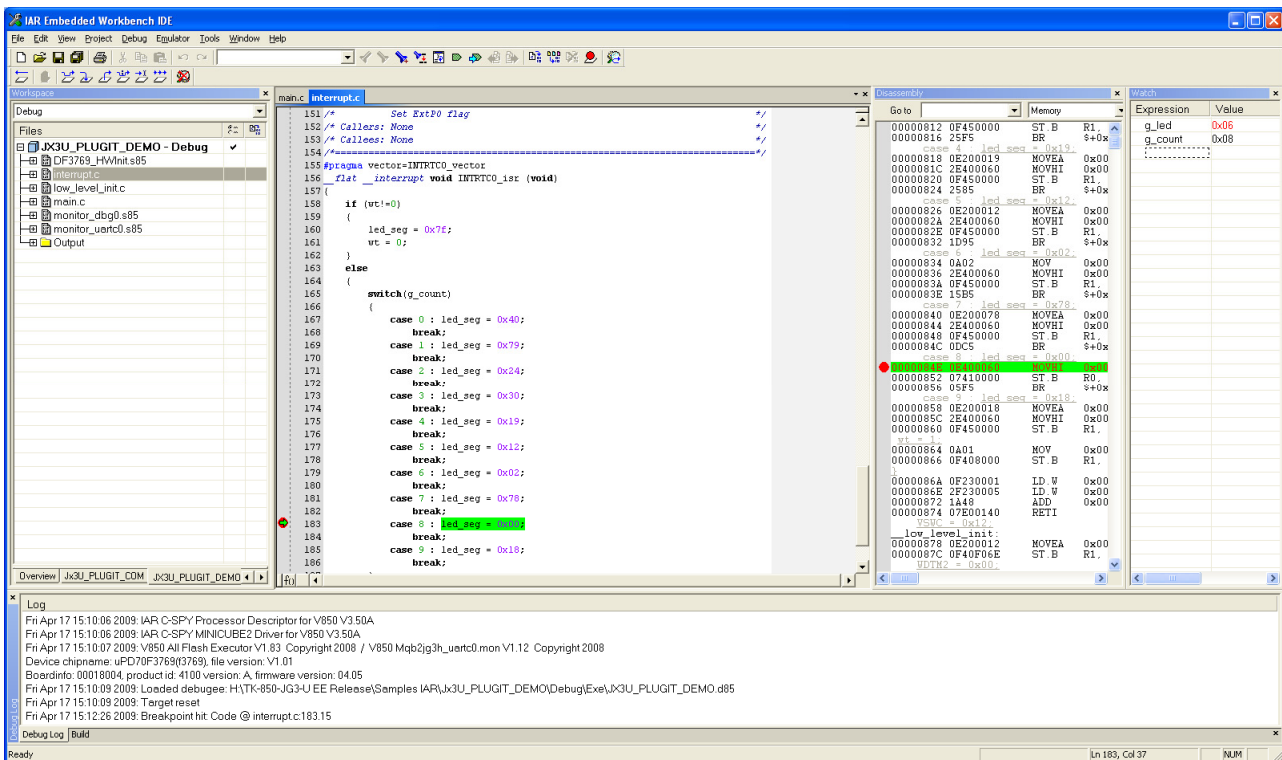


Figure 31: IAR C-SPY debugger

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.

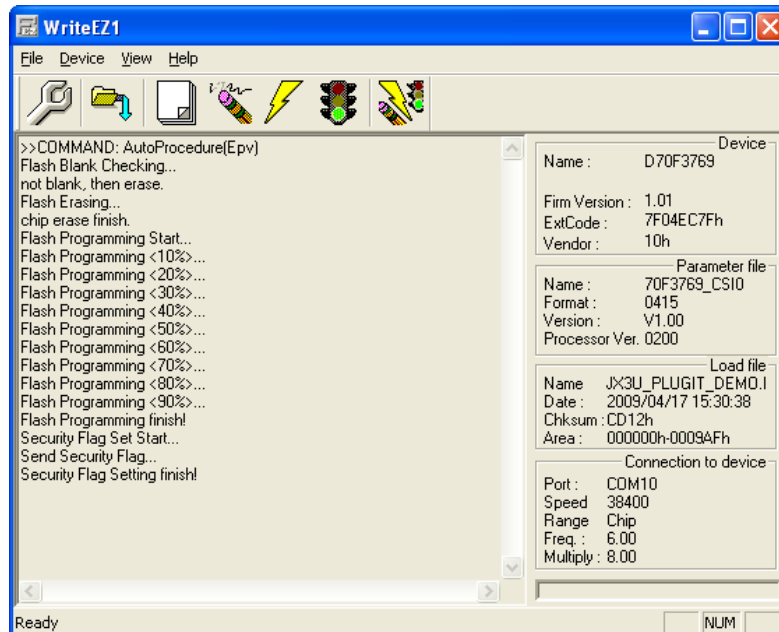


Figure 32: WriteEZ1 User Interface

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

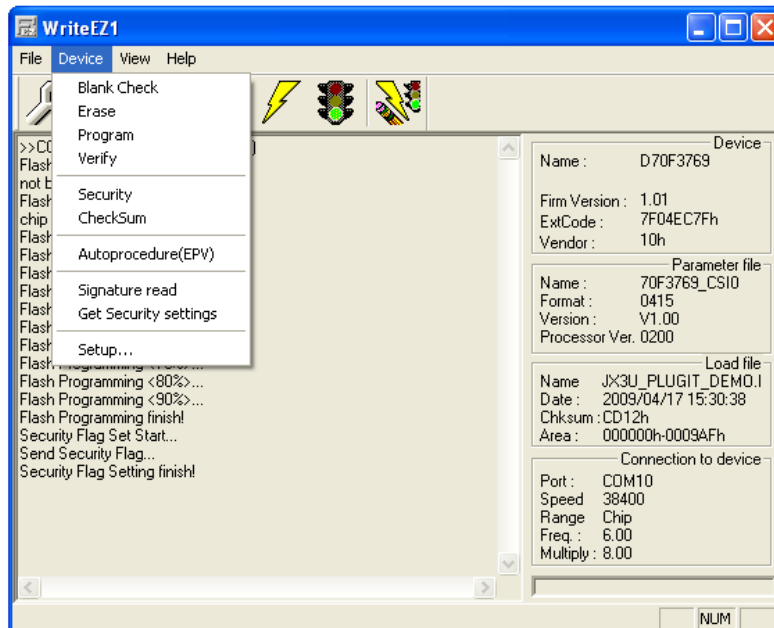


Figure 34: WriteEZ1 Device Menu








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

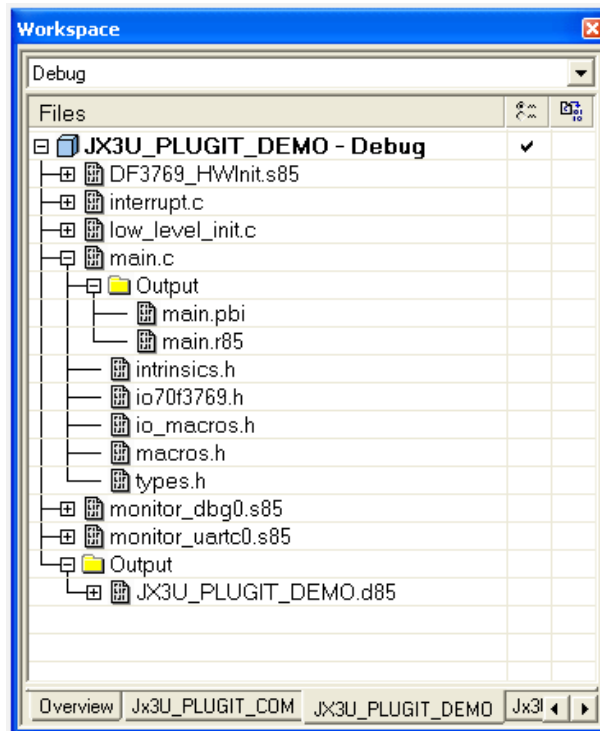


Figure 35: Project Window Jx3U_PLUGIT_DEMO

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.

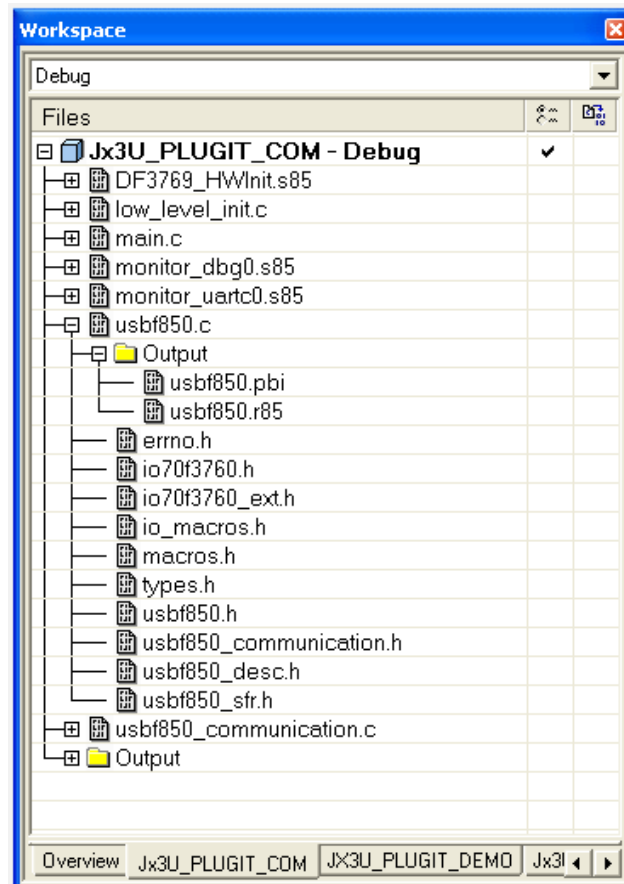


Figure 36: Project Window Jx3U_PLUGIT_COM

11.3.1 Development Environment

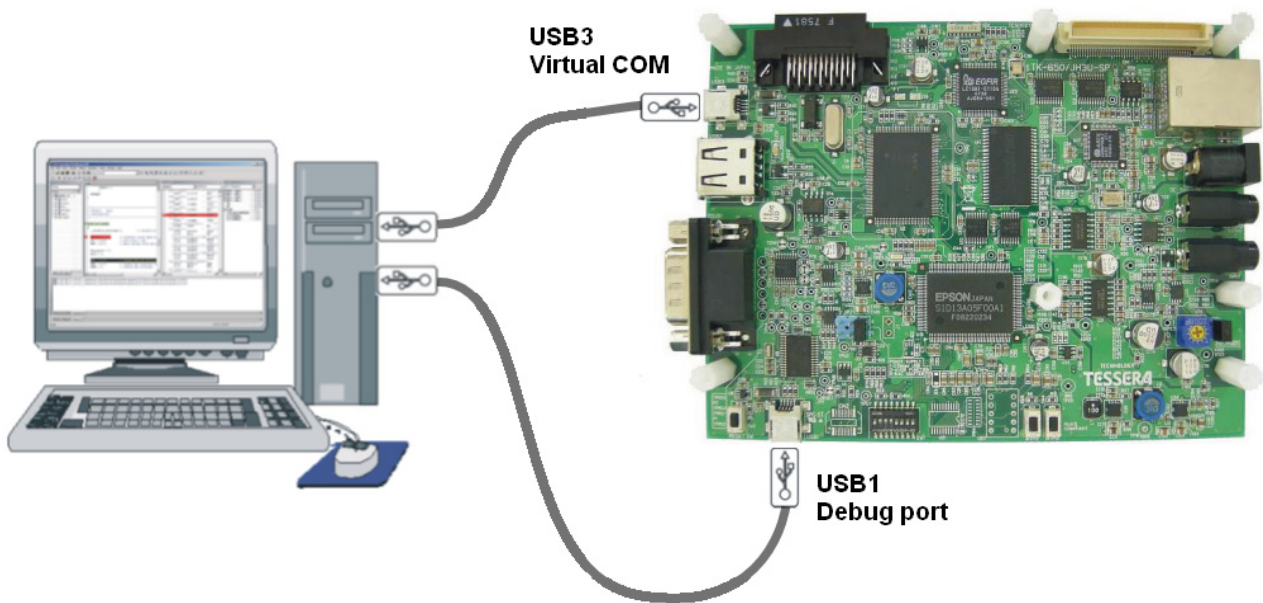


Figure 37: Development Environment

11.3.2 System Structure

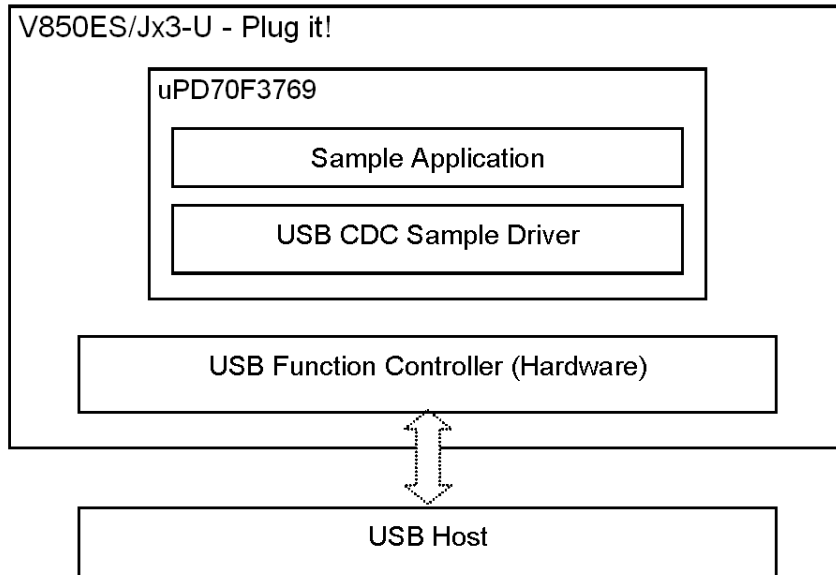


Figure 38: System Structure of the sample program

11.3.3 How to run the sample program

The sample application loads the communication data received by the built-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:

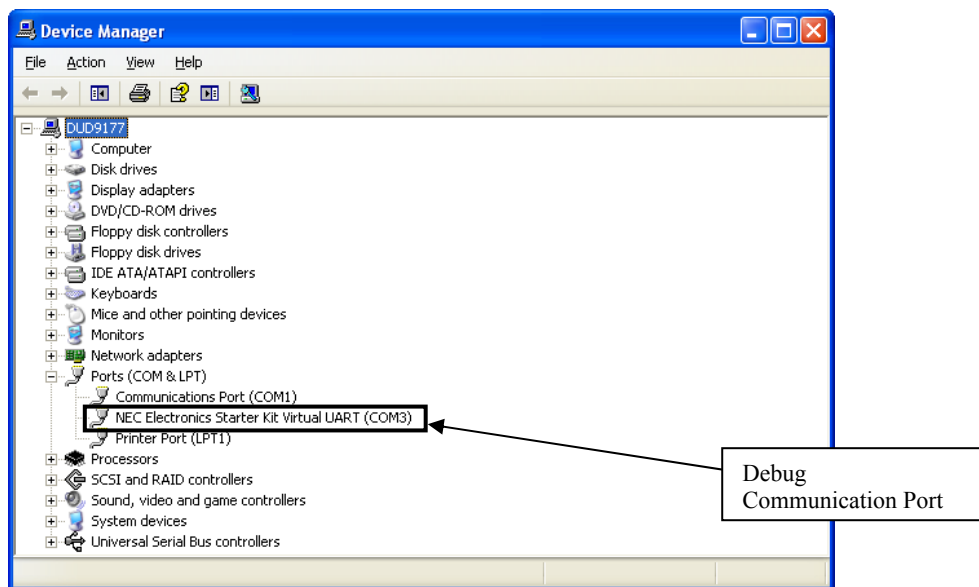


Figure 39: Jx3U_PLUGIT_COM-sample Debug Communication Port

- 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>**.

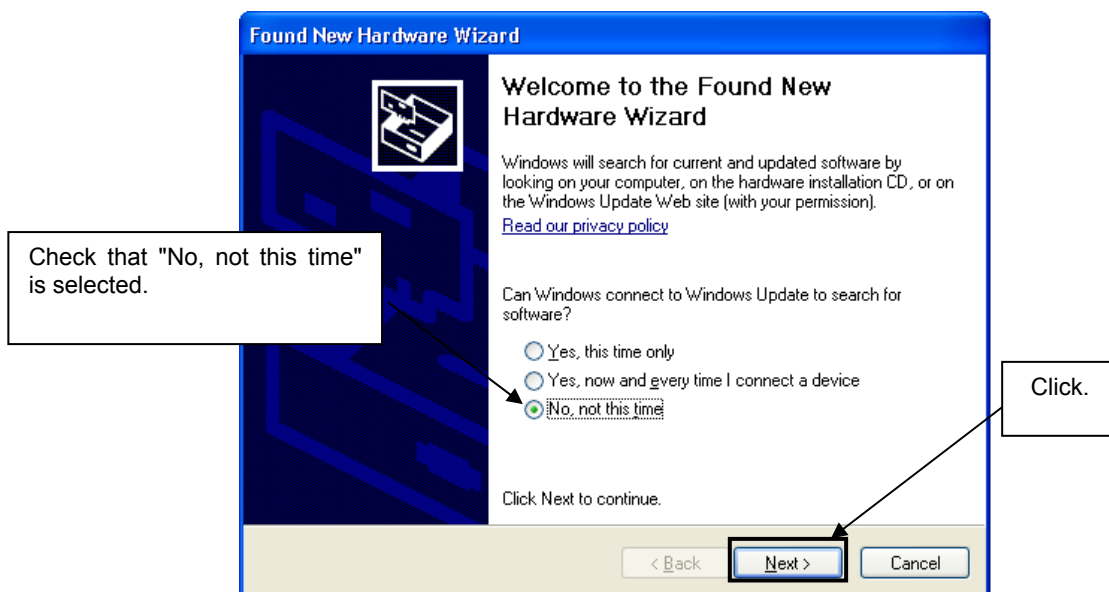


Figure 40: Found New Hardware Wizard 1 (Windows XP)

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

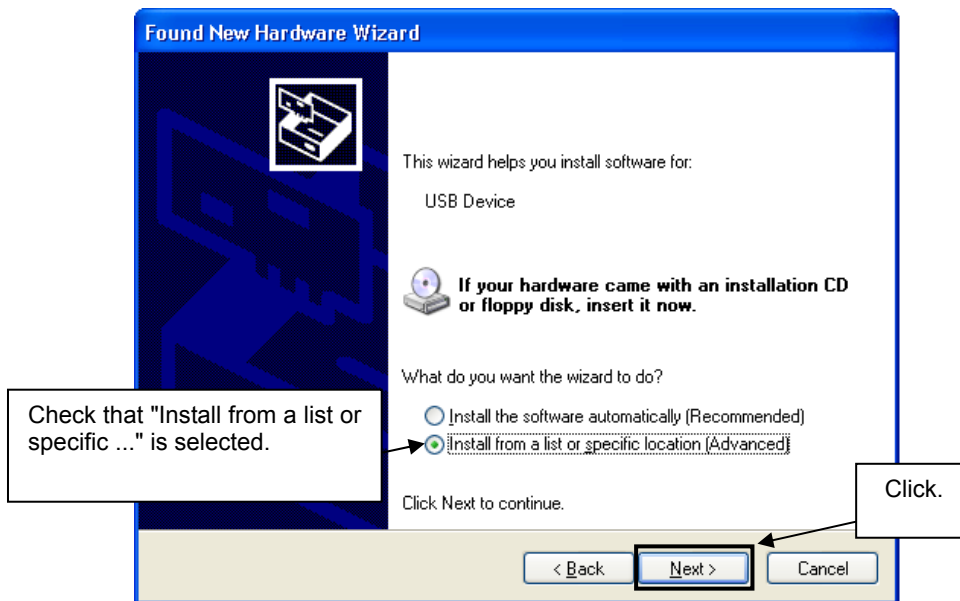


Figure 41: Found New Hardware Wizard 2 (Windows XP)

- 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**.

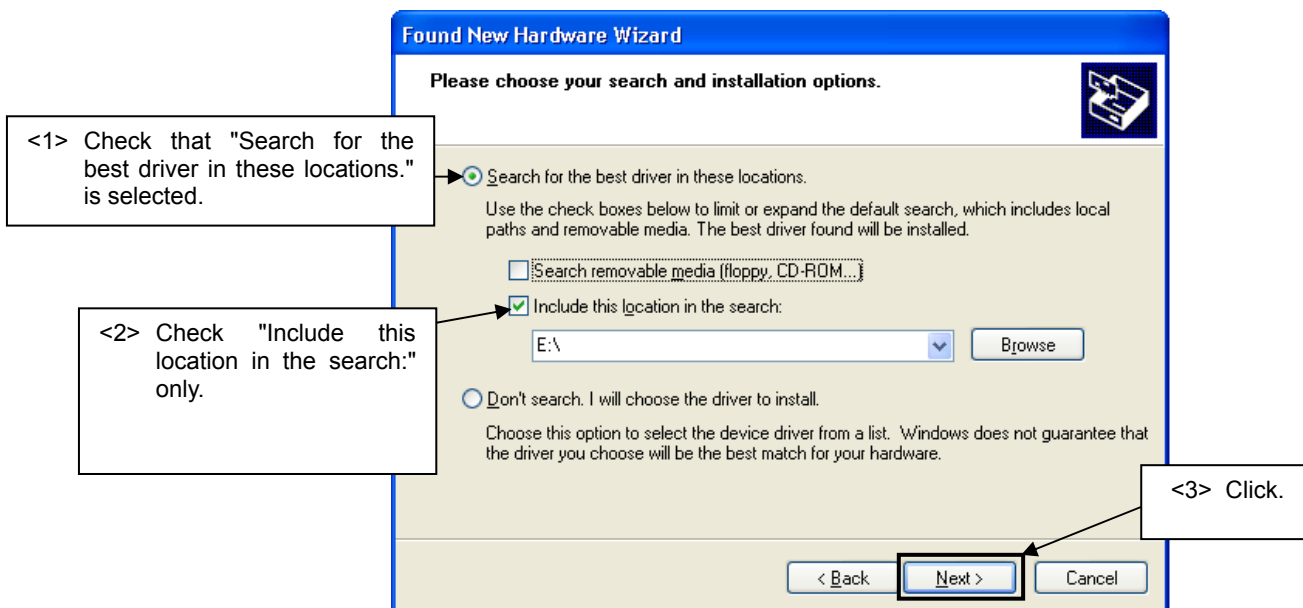


Figure 42: Search Location Specification 1 (Windows XP)

- 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:

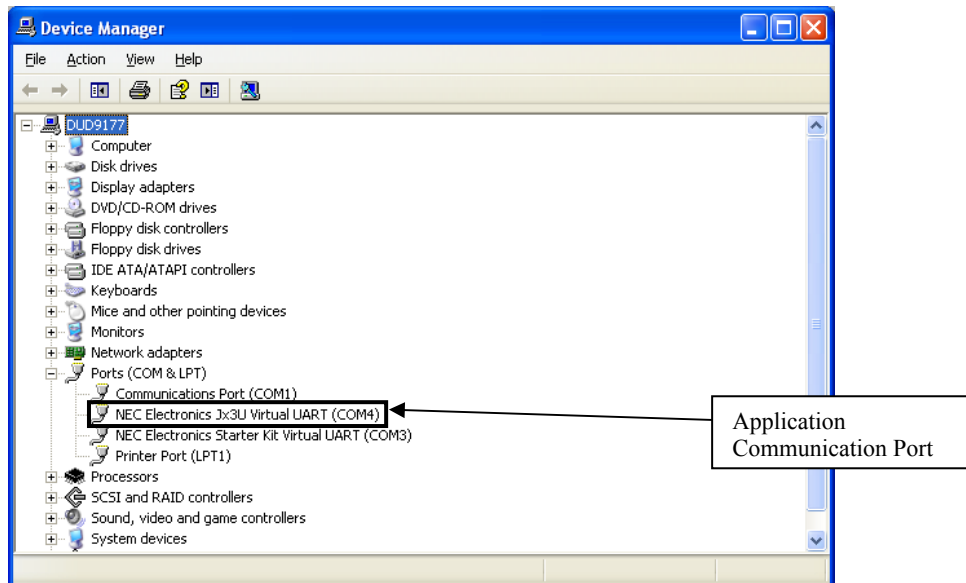


Figure 43: Jx3U_PLUGIT_COM-sample Application Communication Port

- 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

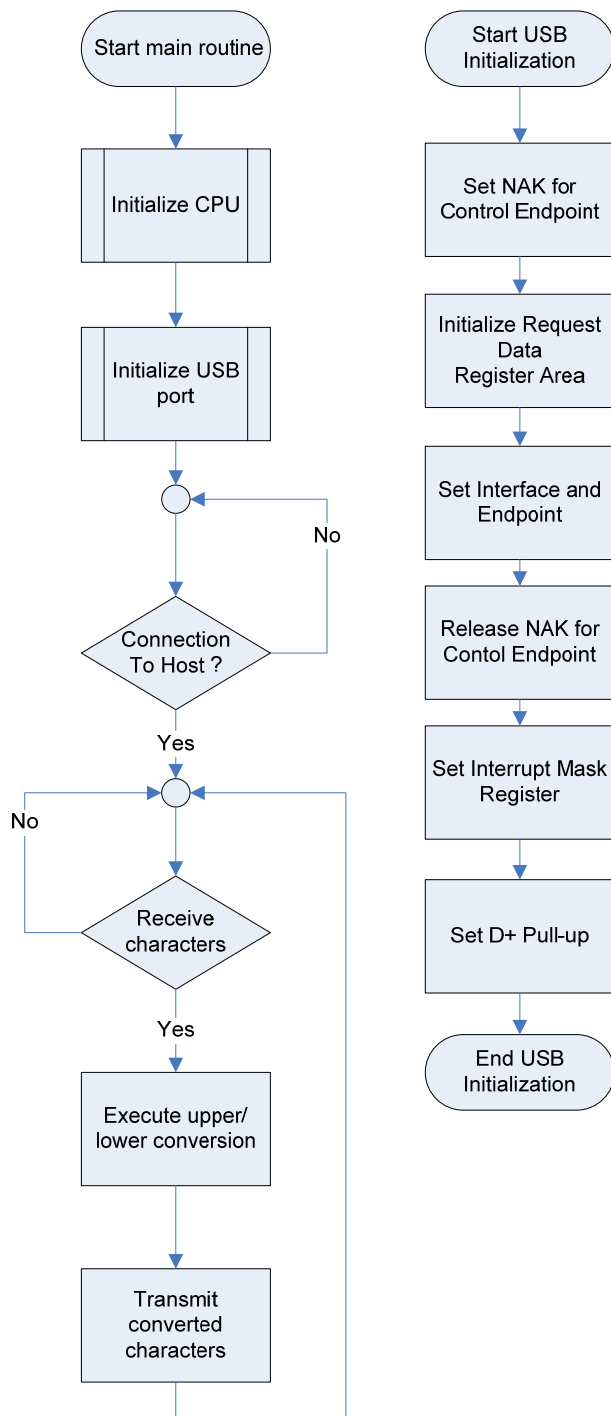
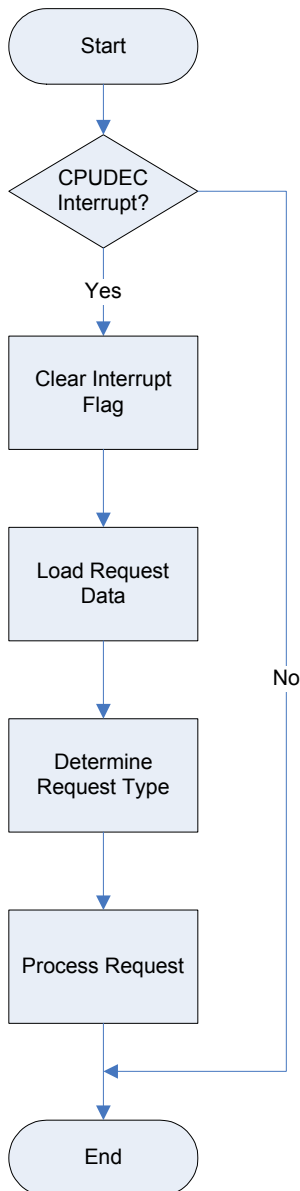


Figure 44: Flow Chart Jx3U_PLUGIT_COM application

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.

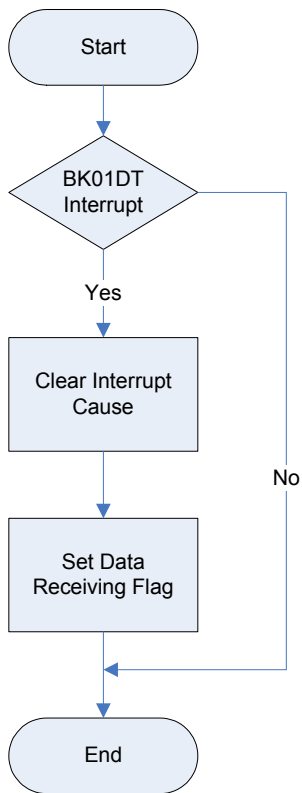
Endpoint 0 is the endpoint for control transferring. However, standard device requests, such as the request used by enumeration for plug-in, are automatically responded by hardware. Therefore, this should monitor standard requests that are not responded by hardware, class requests, and vendor requests.



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 BK01DT Interrupt
It detects the completion of receiving interrupt if BK01DT bit of UF0IS3 is ON (1).
- Clear Interrupt Cause
Clear the cause of interrupt by setting BK01DTC 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 8 μ 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.

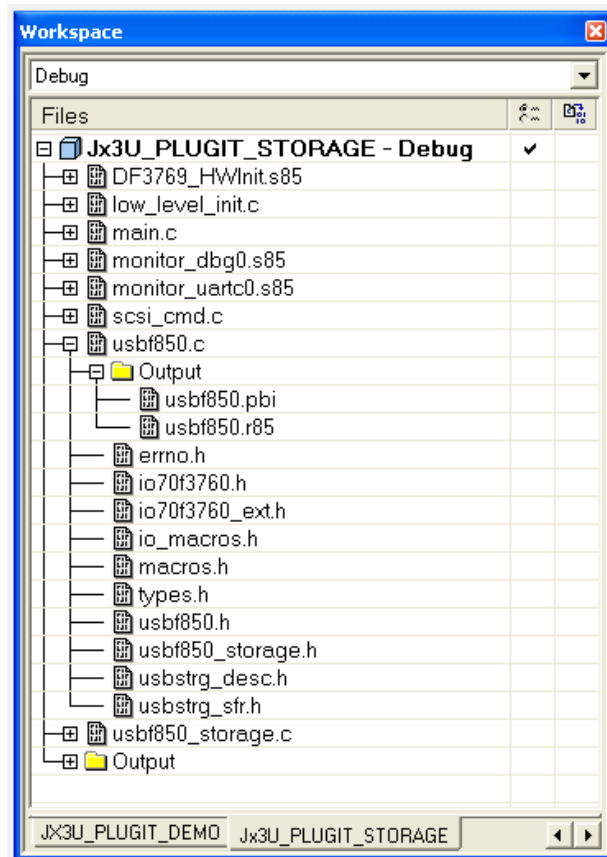


Figure 47: Project Window Jx3U_PLUGIT_STORAGE

11.4.1 Development Environment

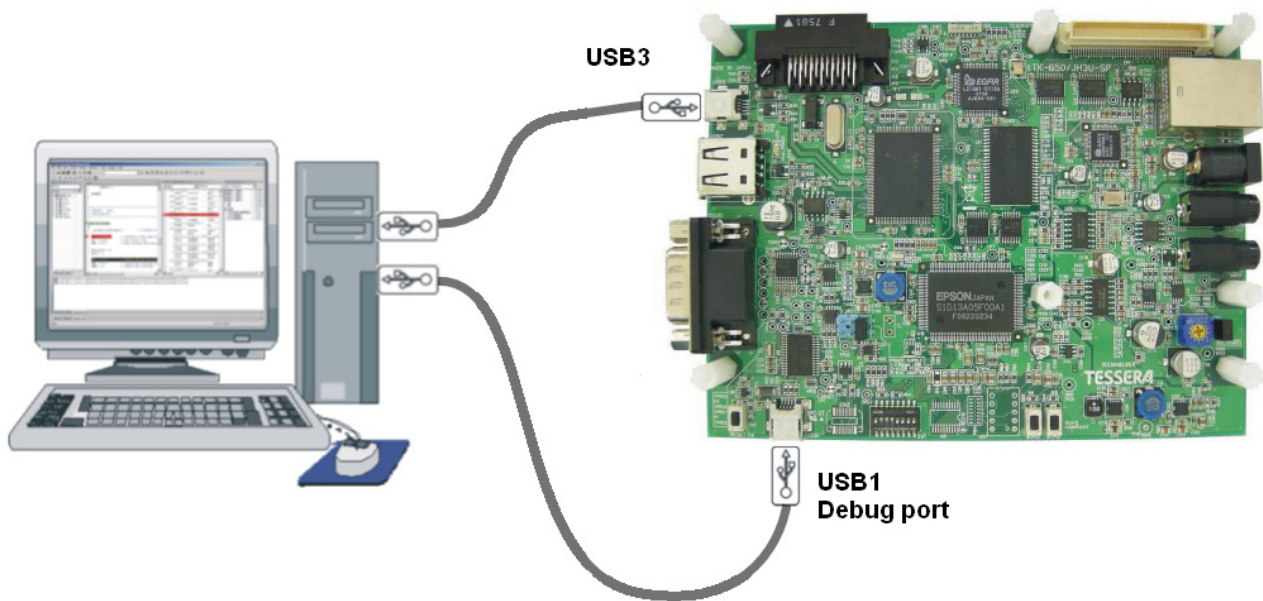


Figure 48: Development Environment

11.4.2 System Structure

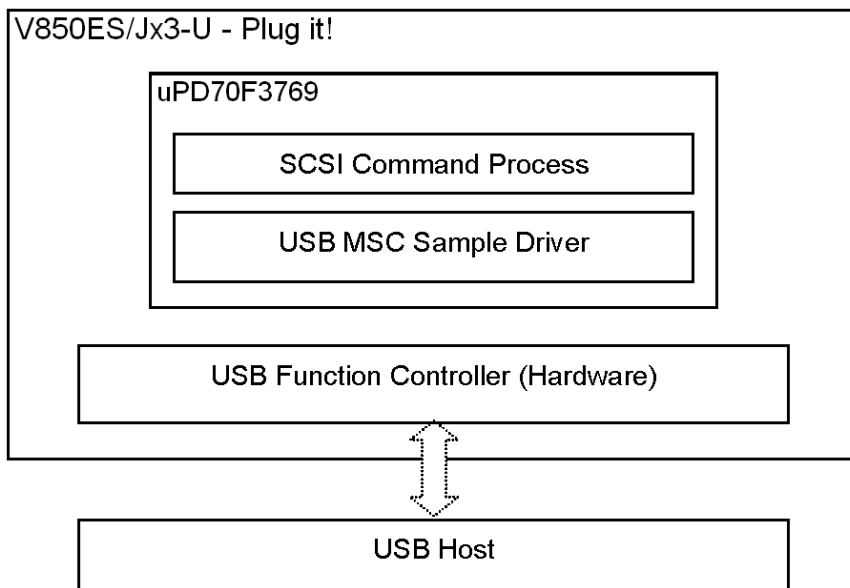


Figure 49: System Structure of the sample program

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.

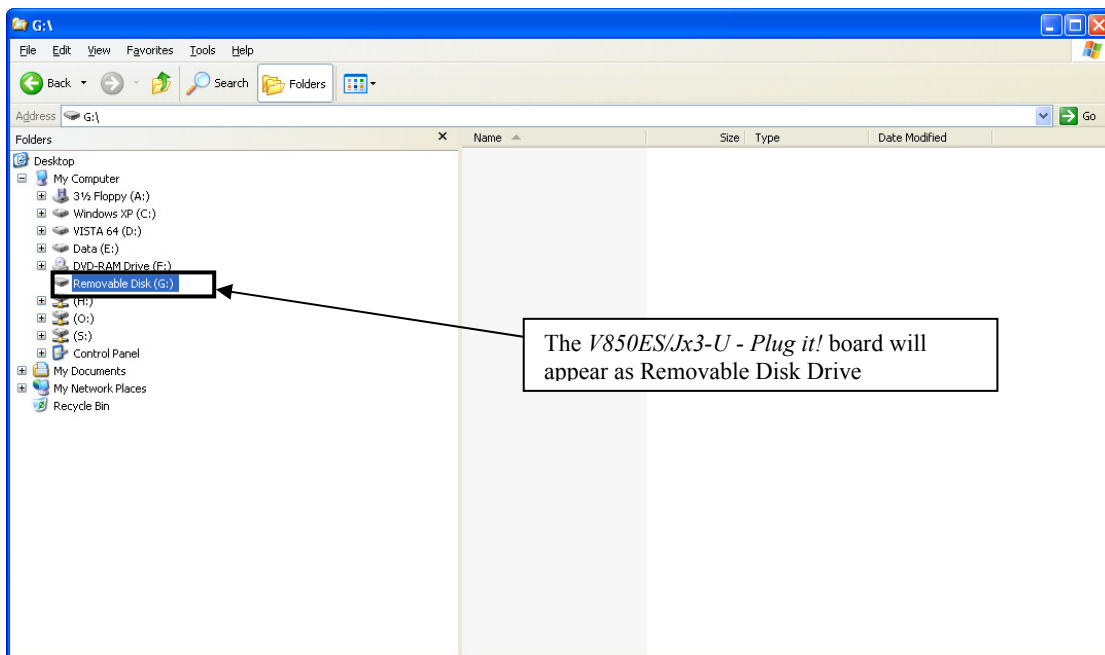


Figure 50: Jx3U_PLUGIT_STORAGE sample Mass Storage Device

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

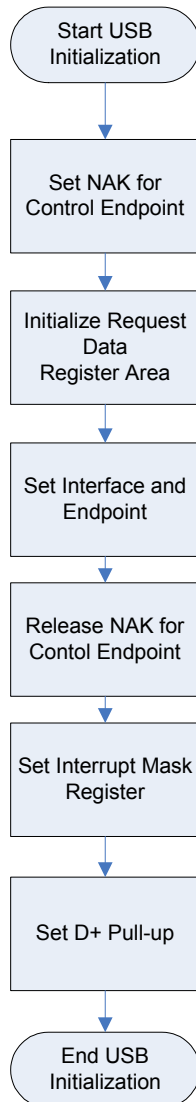
In the sample program, SCSI command process is structured on the MSC sample driver. It processes encapsulated SCSI commands to the Command Block Wrapper (CBW).

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

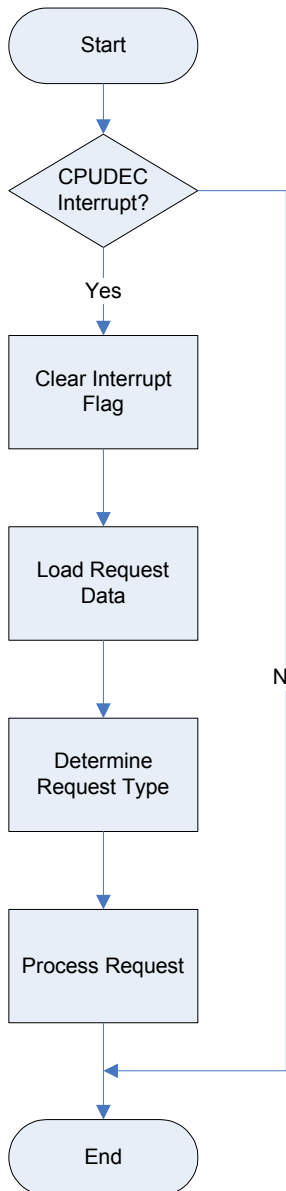


Process Description USB Initialization

- 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**

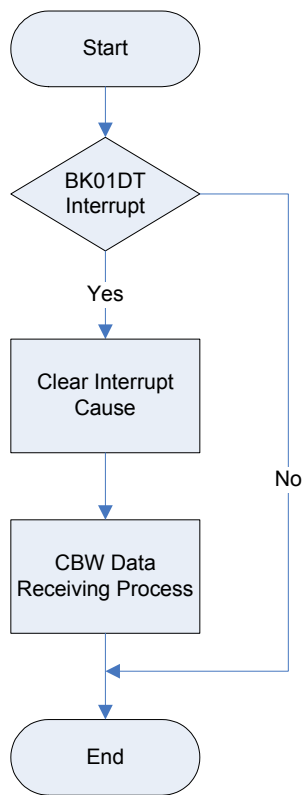
Endpoint 0 is the endpoint for control transferring. However, standard device requests, such as the request used by enumeration for plug-in, are automatically responded by hardware. Therefore, this should monitor standard requests that are not responded by hardware, class requests, and vendor requests.



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.

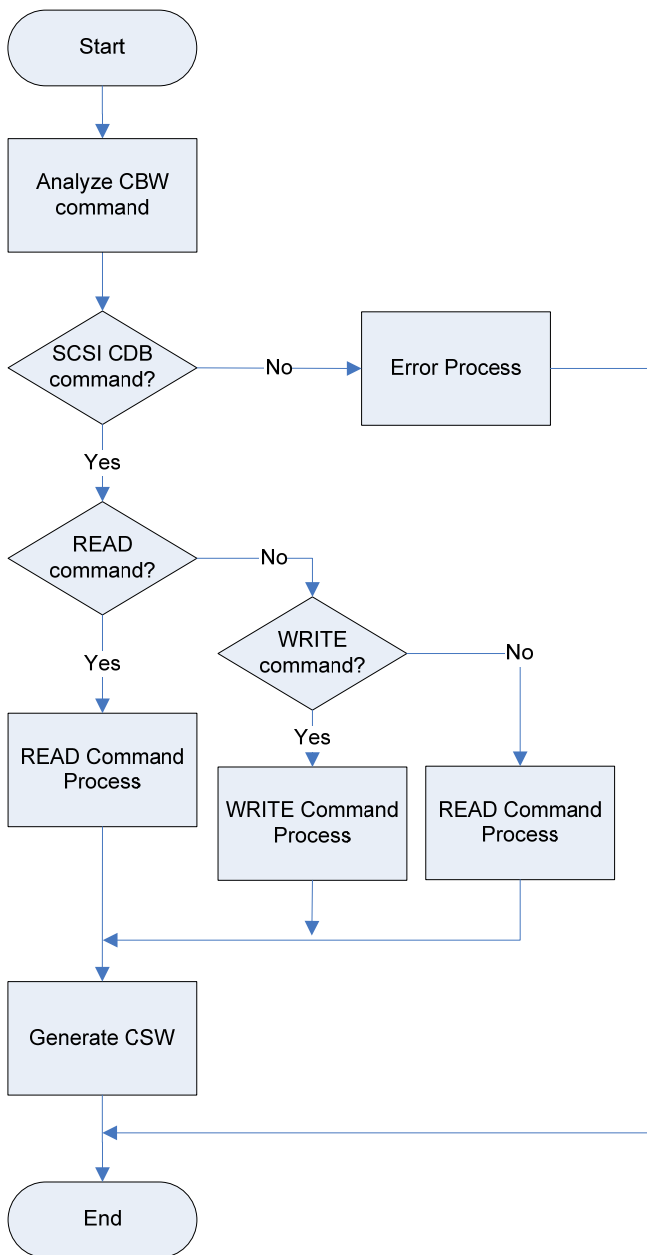
**Figure 52: Flow Chart Jx3U_PLUGIT_STORAGE
Endpoint 0 Monitoring process**



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 receiving CBW 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
usb850.c	USB initialization. Interrupt process. Bulk transfer. Control transfer.
usb850_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
usb850.h	Macro definitions for USB function register setting
usb850_sfr.h	Macro definitions for USB function controller register access
usb850_desc.h	Descriptor definitions
usb850_storage.h	usb850_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	<p>Polling interval for data transfer endpoint</p> <p>Full/low speed interrupt: specify with unit of ms (number of frames)</p> <p>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)</p> <p>Full-speed isochronous: specify N for 2 raised to the power of N-1 with unit of 1ms</p> <p>High-speed bulk/control: specify the maximum NAK rate for endpoint with unit of μ frame</p> <p>0 means that it does not respond NAK on OUT/DATA transaction</p>	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)

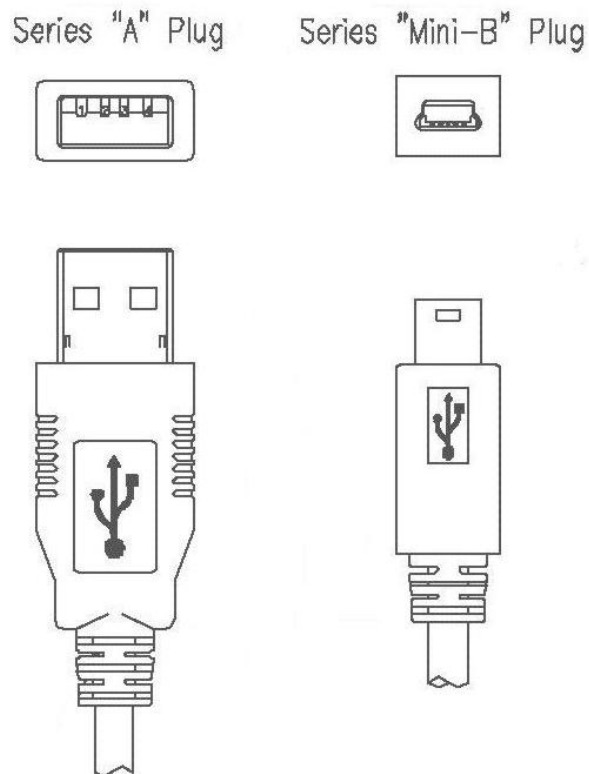
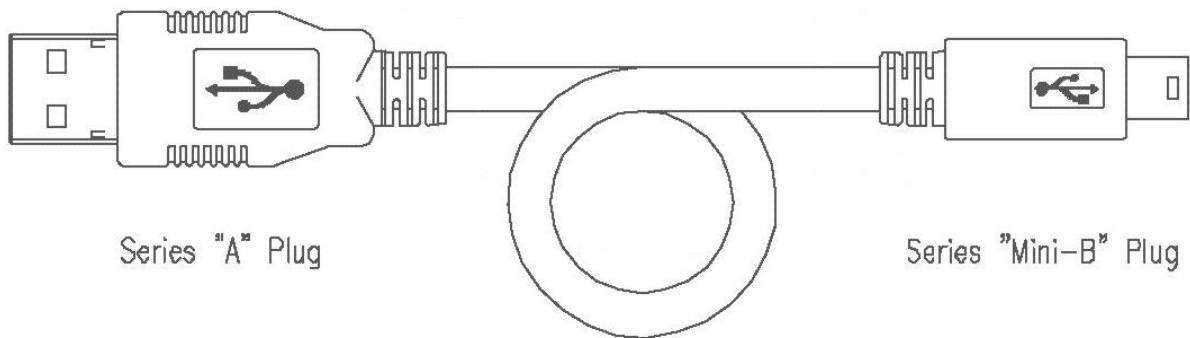


Figure 55: USB interface cable (Mini-B type)

Chapter 13 Schematics

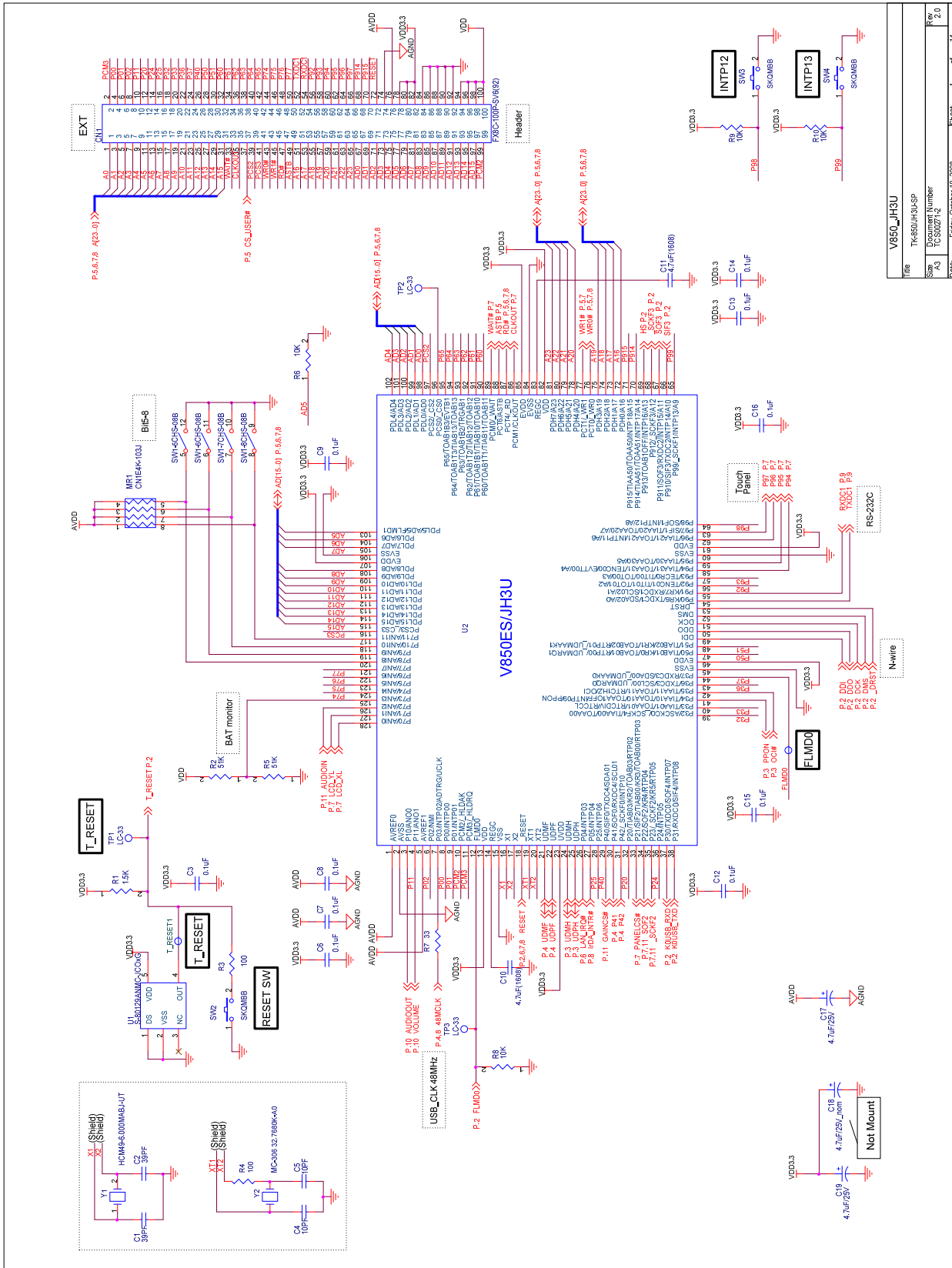


Figure 56: V850ES/Jx3-U - Plug it! schematics 1/13

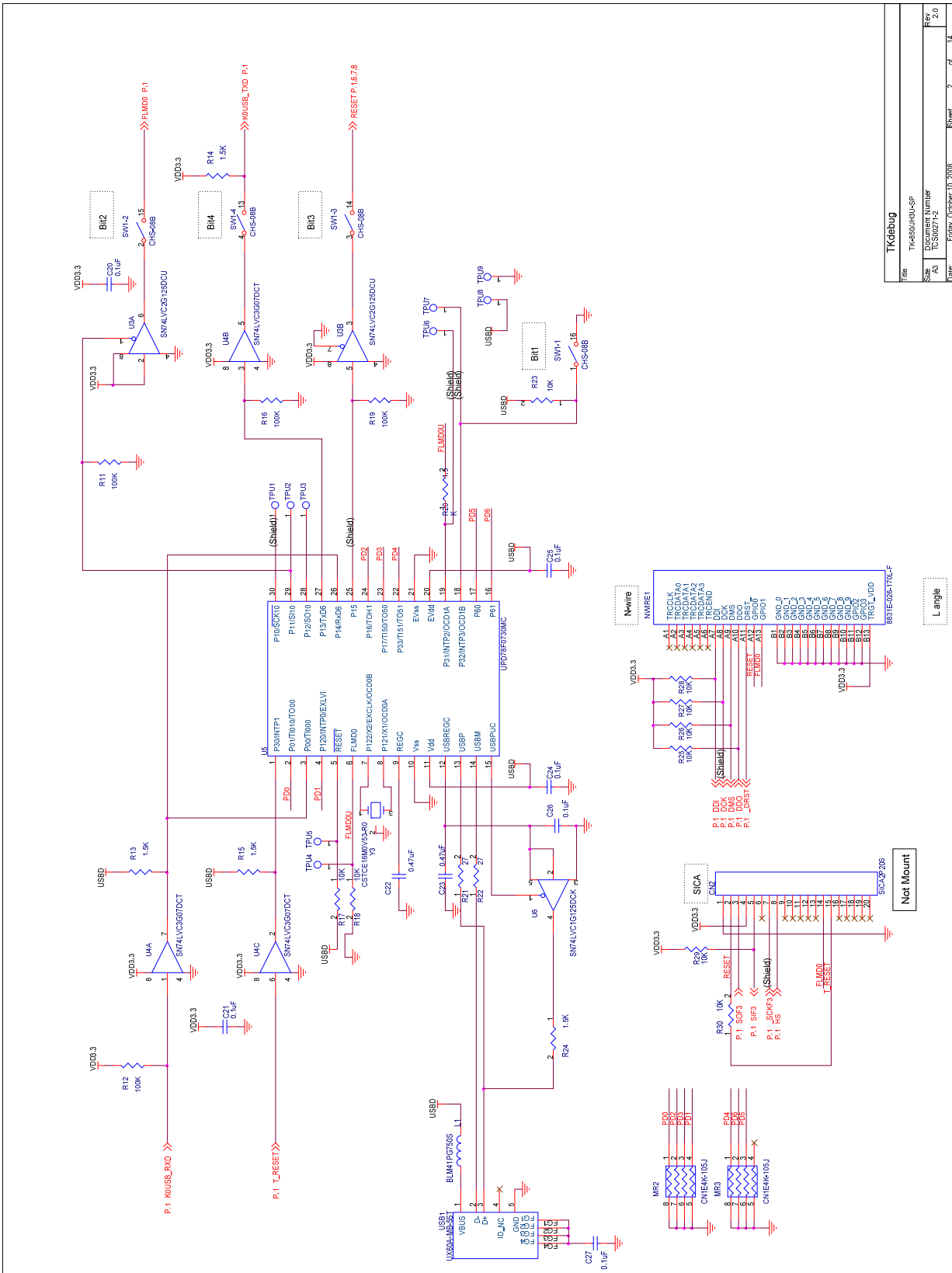
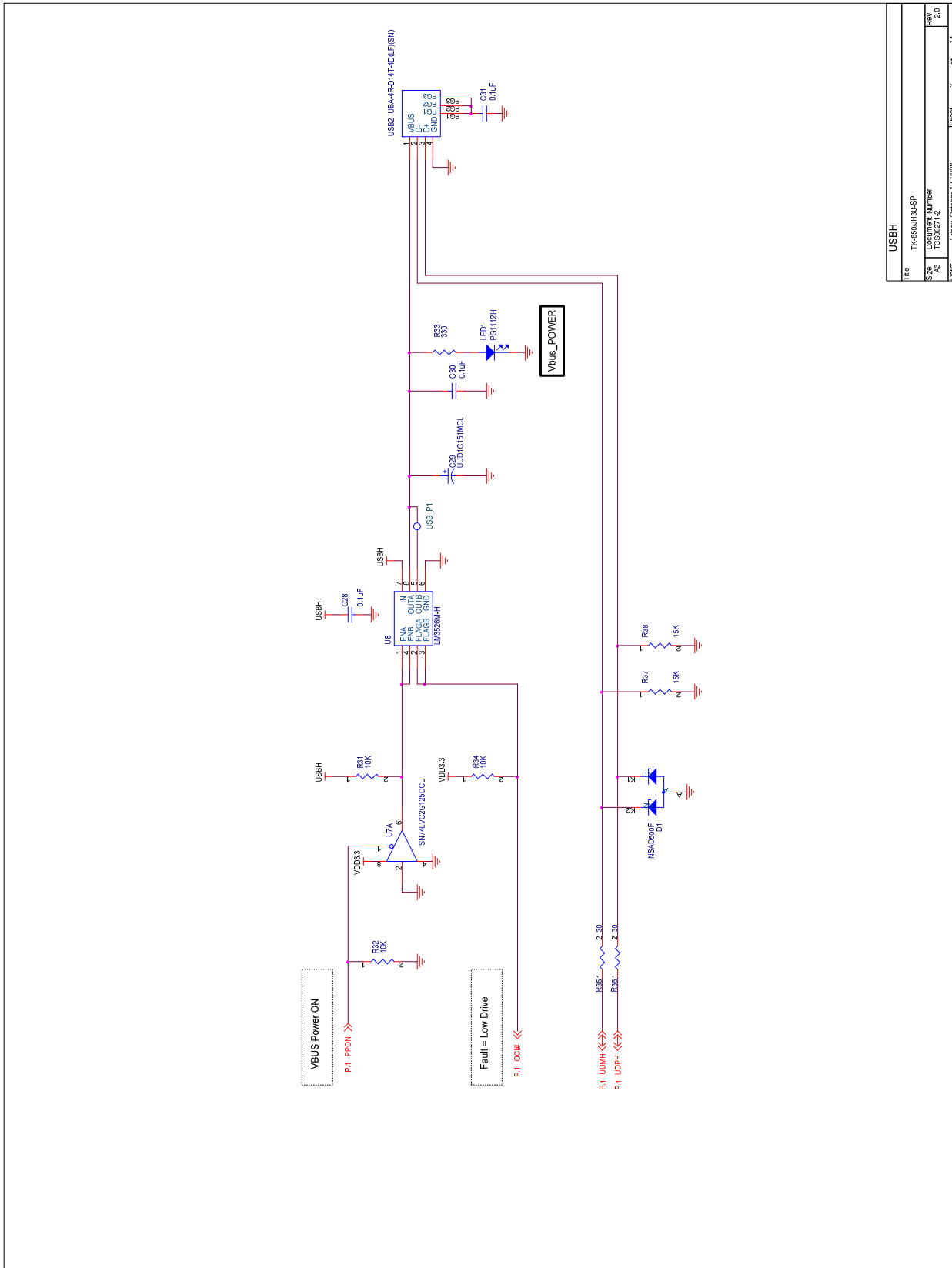
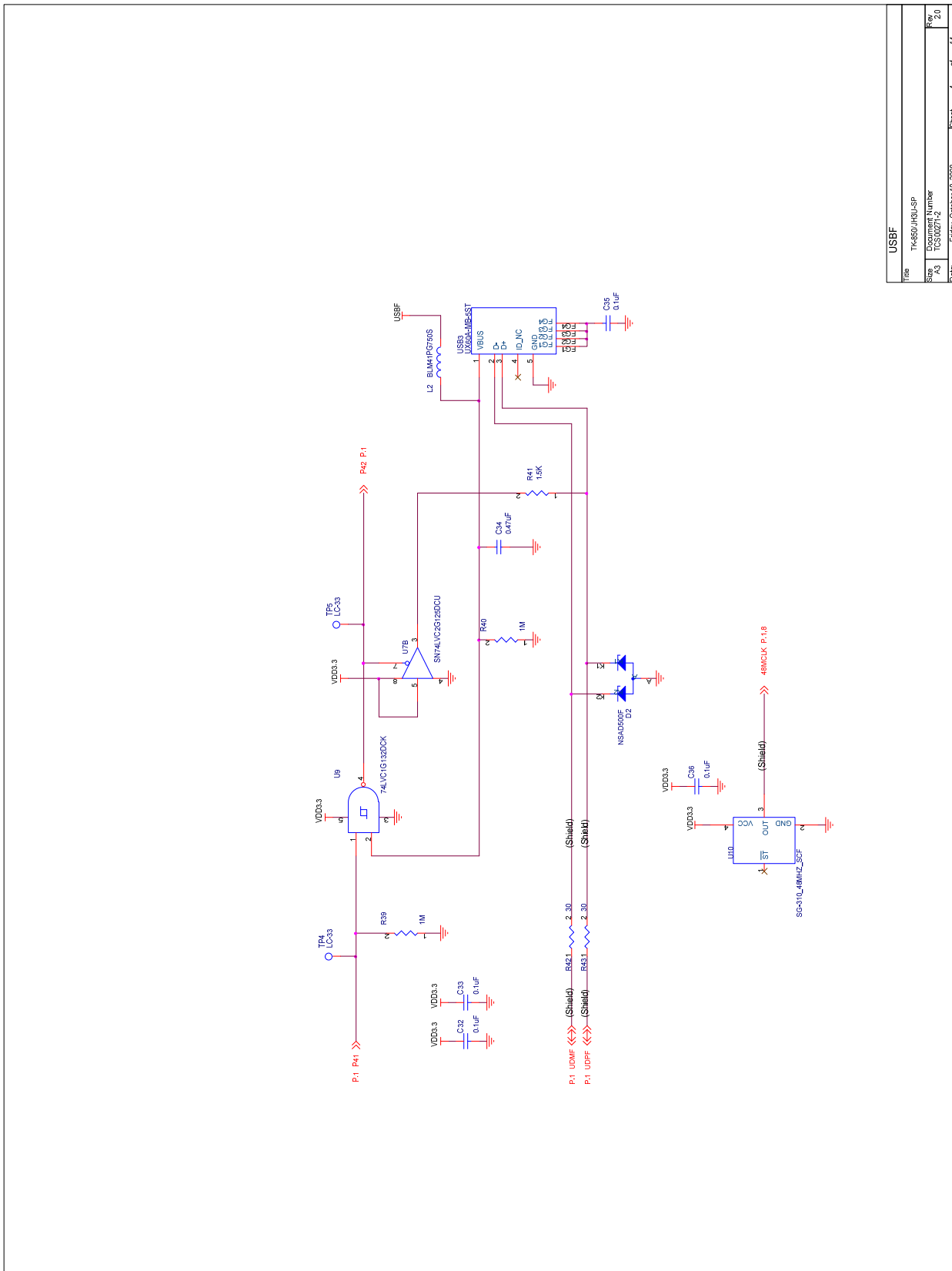


Figure 57: V850ES/Jx3-U - Plug it! schematics 2/13



USBH			
Title	TK-4500134USP	Sheet	3 of 14
Size	Document Number	Rev	2.0
A3	TCS0027142	Doc	
Date	Friday, October 10, 2008		

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



USB F			
Title	Tx-850/Jx3-U-SP	Rev	2.0
Size	A3	Document Number	TCS00271-2
Date	Friday, October 10, 2008	Sheet	4 of 14

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

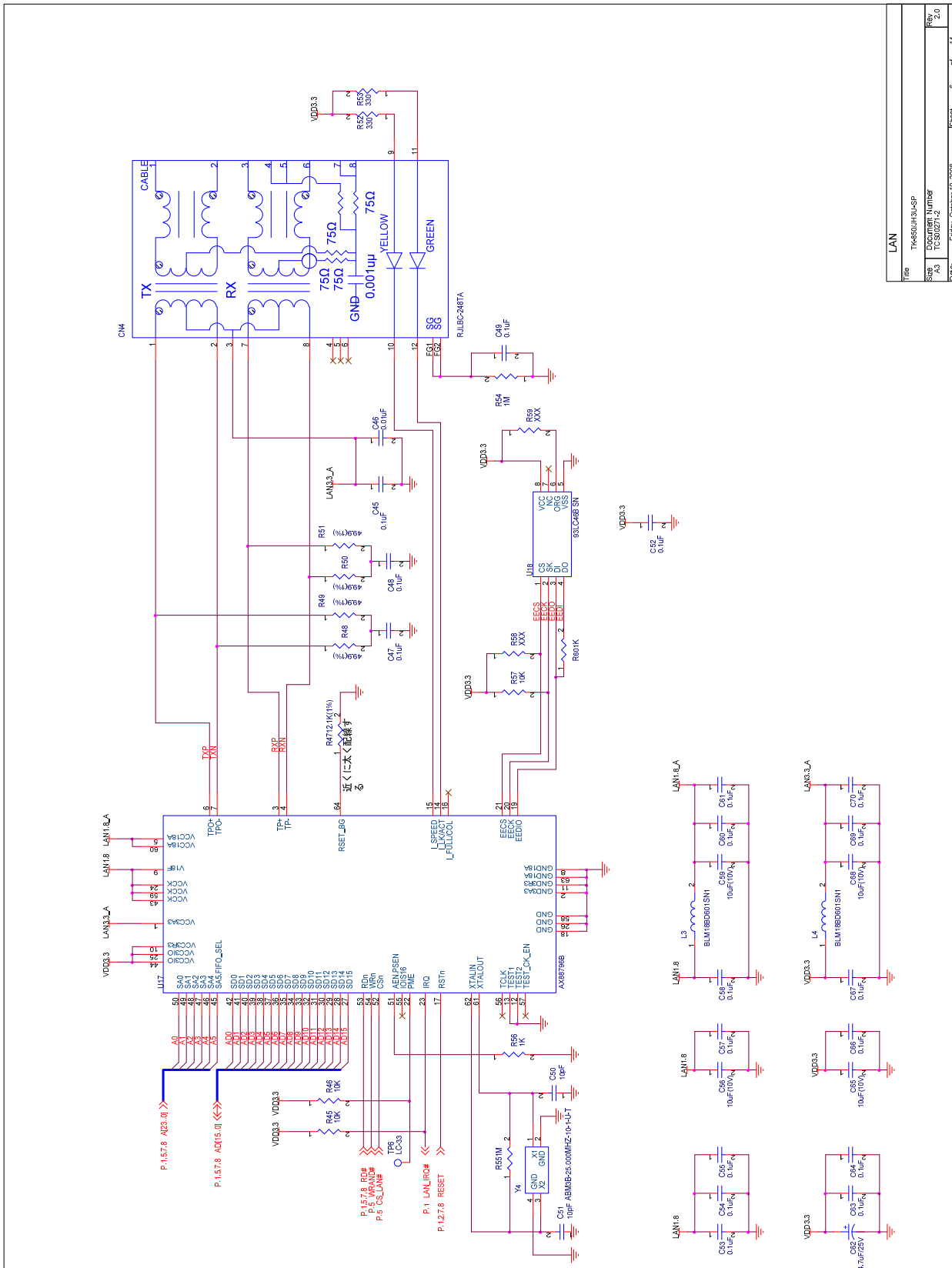


Figure 61: V850ES/Jx3-U - Plug it! schematics 6/13

File	LAN
Doc. Number	TK680UJx3-SP
Doc. Number	A3
Doc. Number	TC580271-2
Date	Friday, October 10, 2008
Sheet	6 of 14
Rev.	2.0

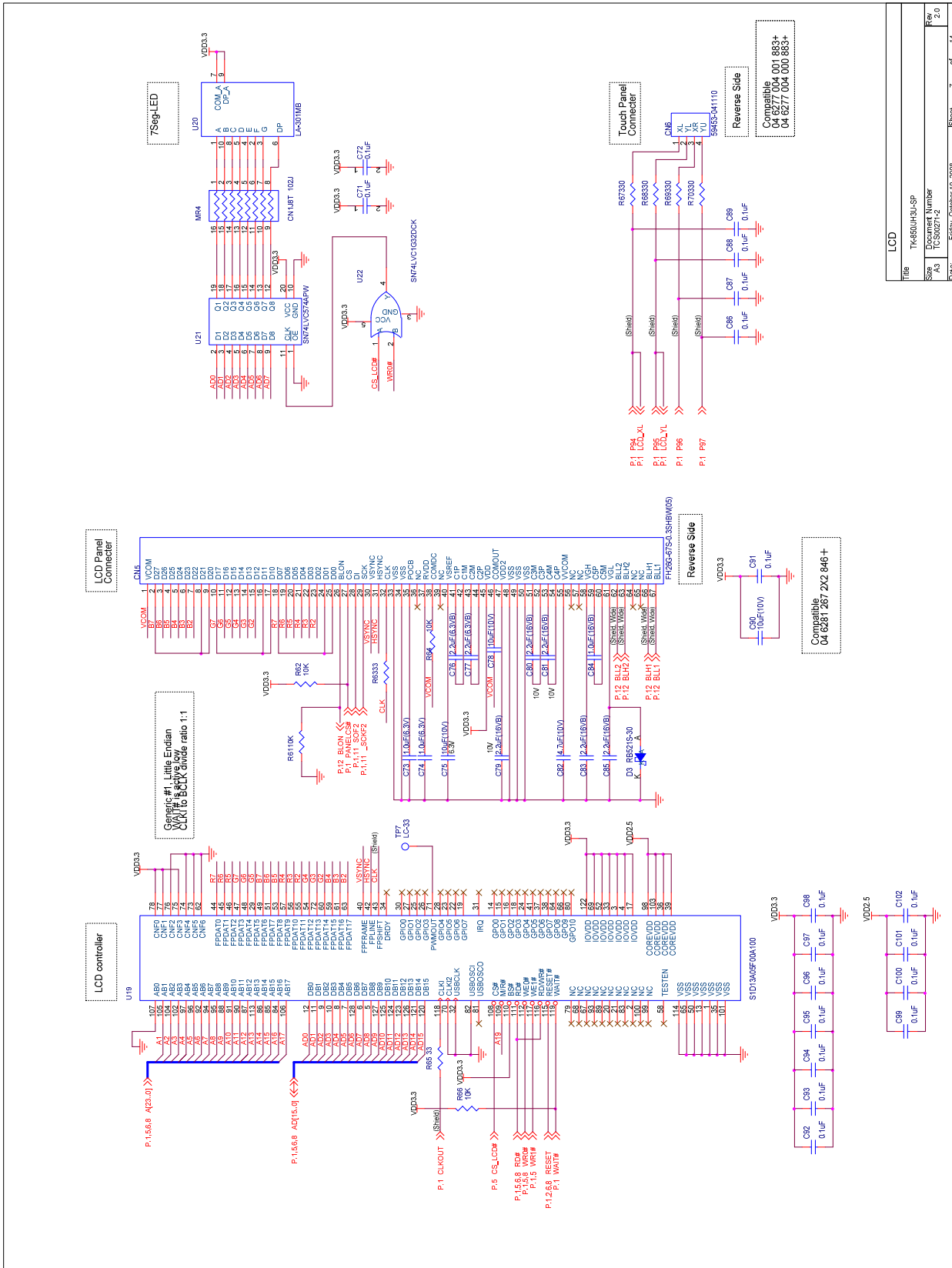
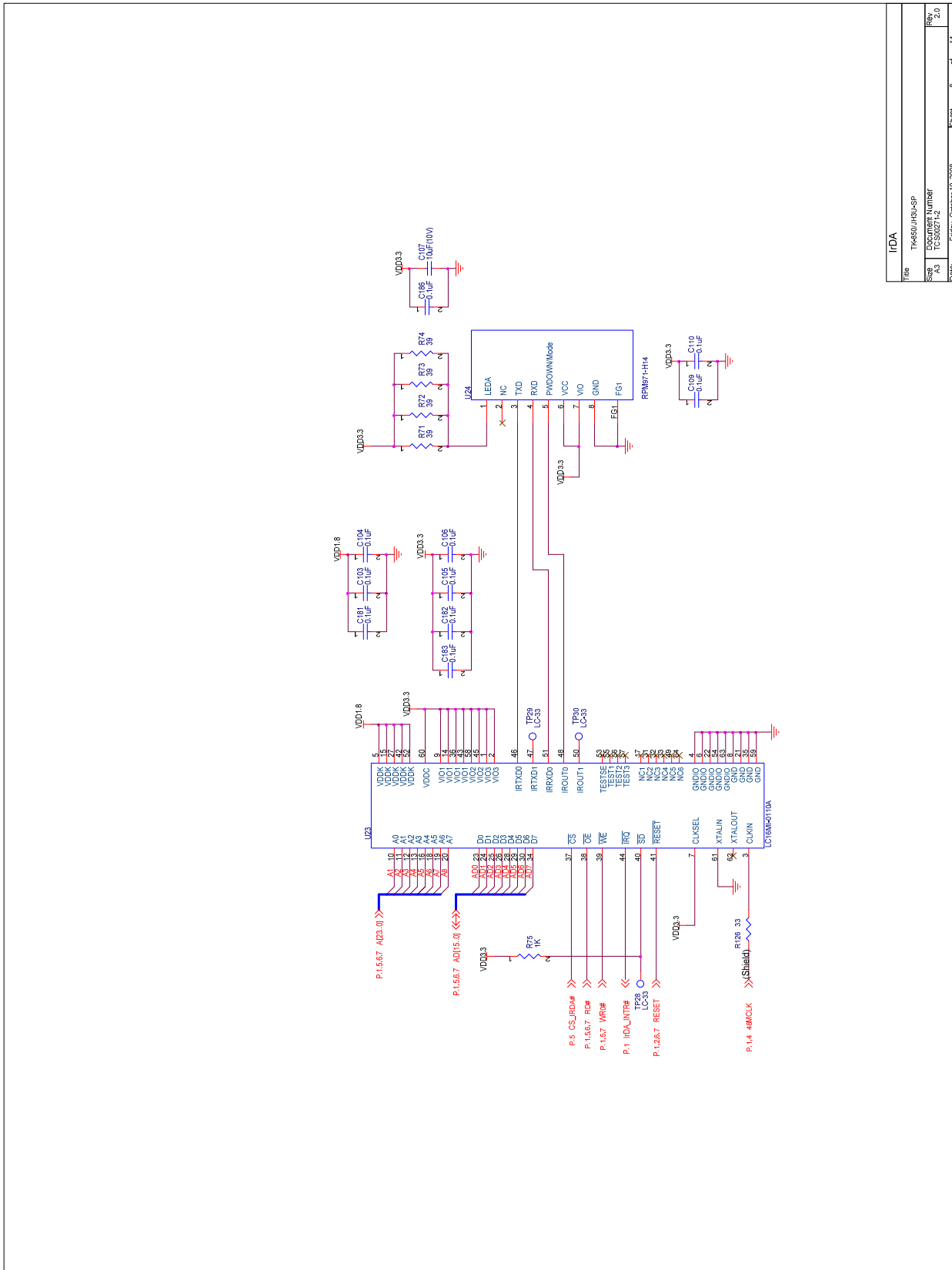
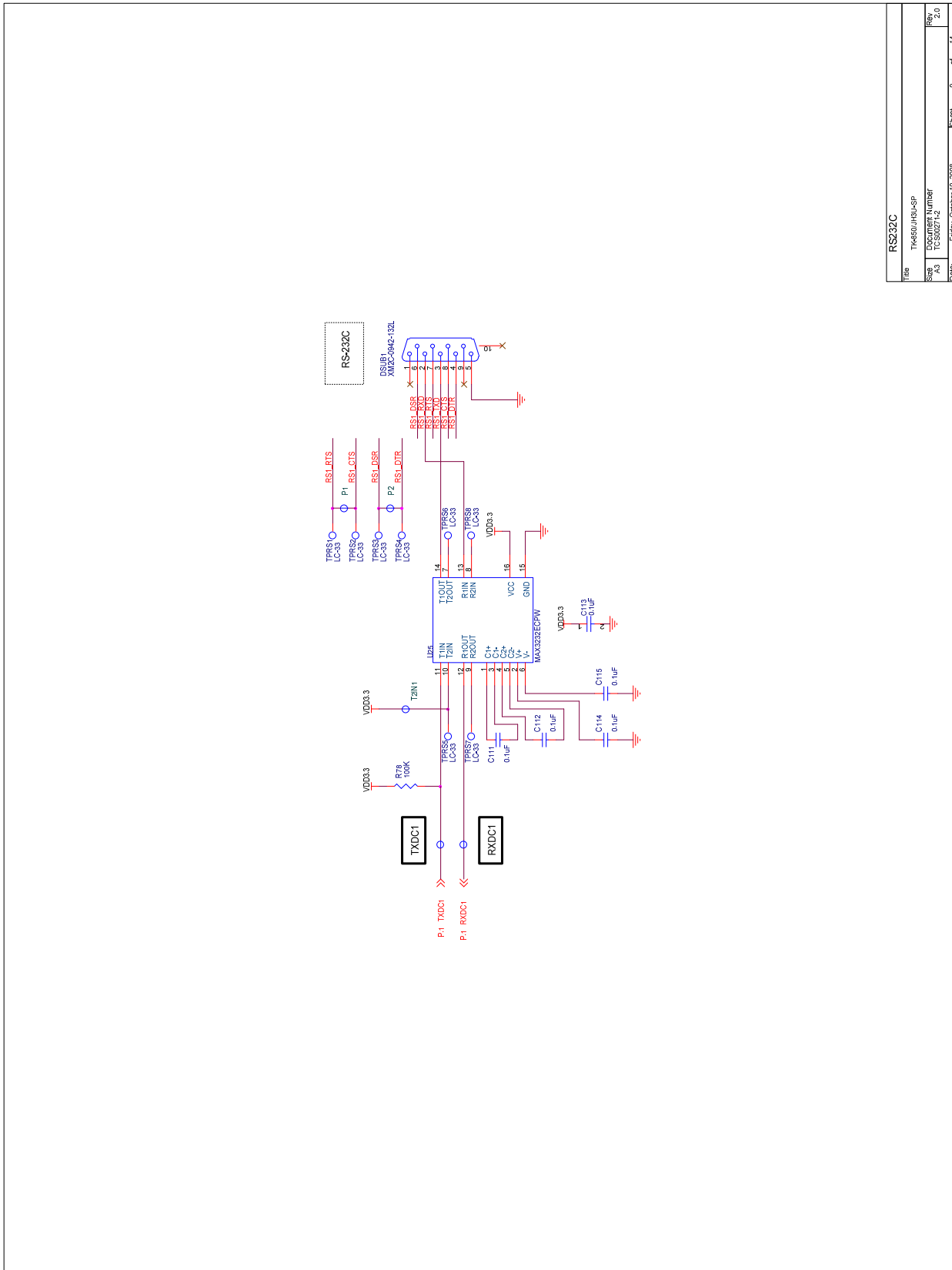


Figure 62: V850ES/Jx3-U - Plug it! schematics 7/13



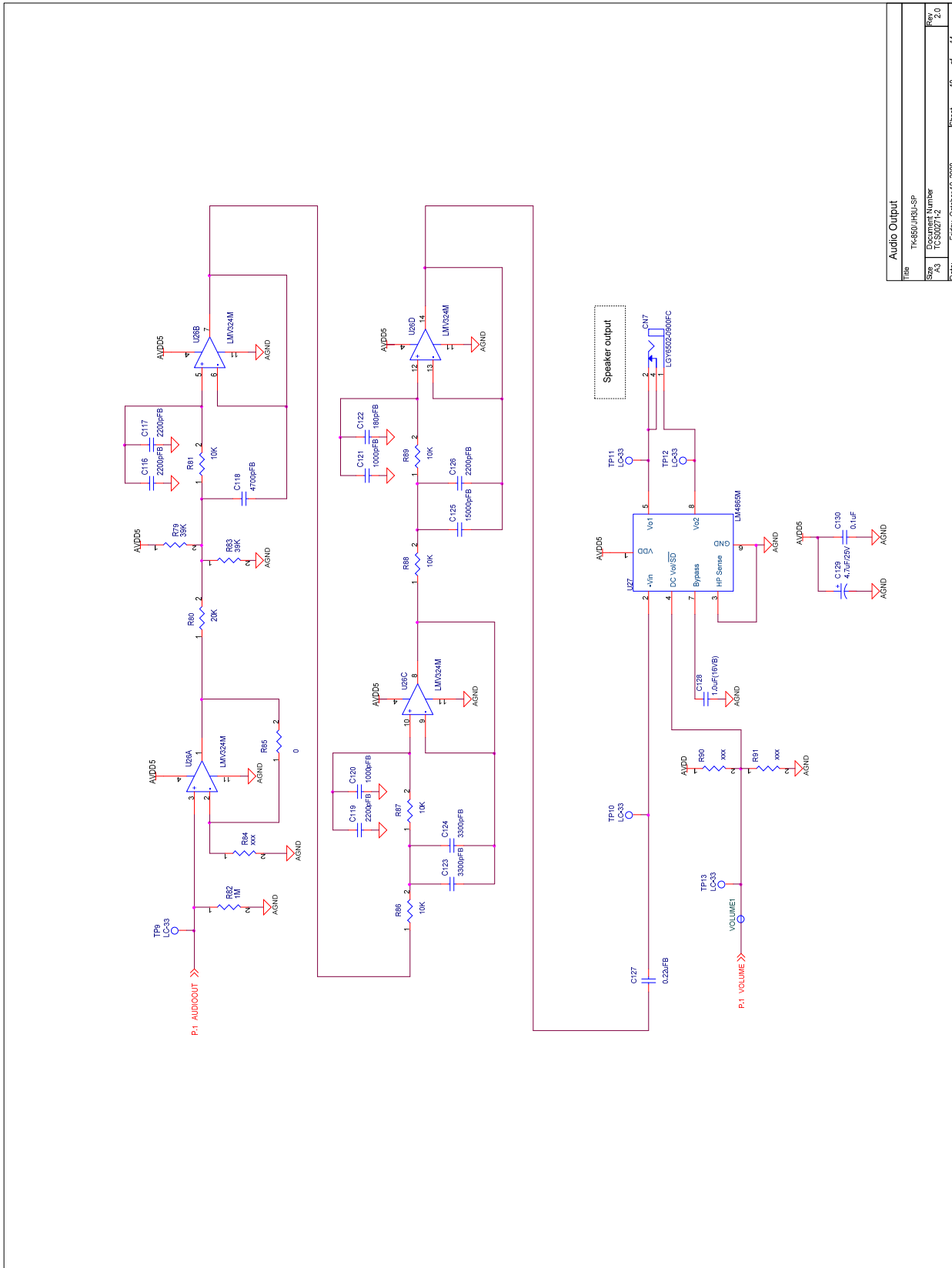
Title	IrDA
File	TK450/Jx3U-SP
Sheet	Document Number
	A3
Rev	2.0
Date	Friday, October 10, 2008
Sheet	8 of 14

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



Title		RS232C	
File		T8450/J3U-SP	
Sheet	Document Number	Rev.	
A3	YCS00271-2	2.0	
Date	Filename	Page	of
	October_10_2008	9	14

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



File	TK-850JBU-SP
Size	Document Number
A3	TC500271-2
Date	Friday, October 10, 2008
Sheet	10 of 14

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

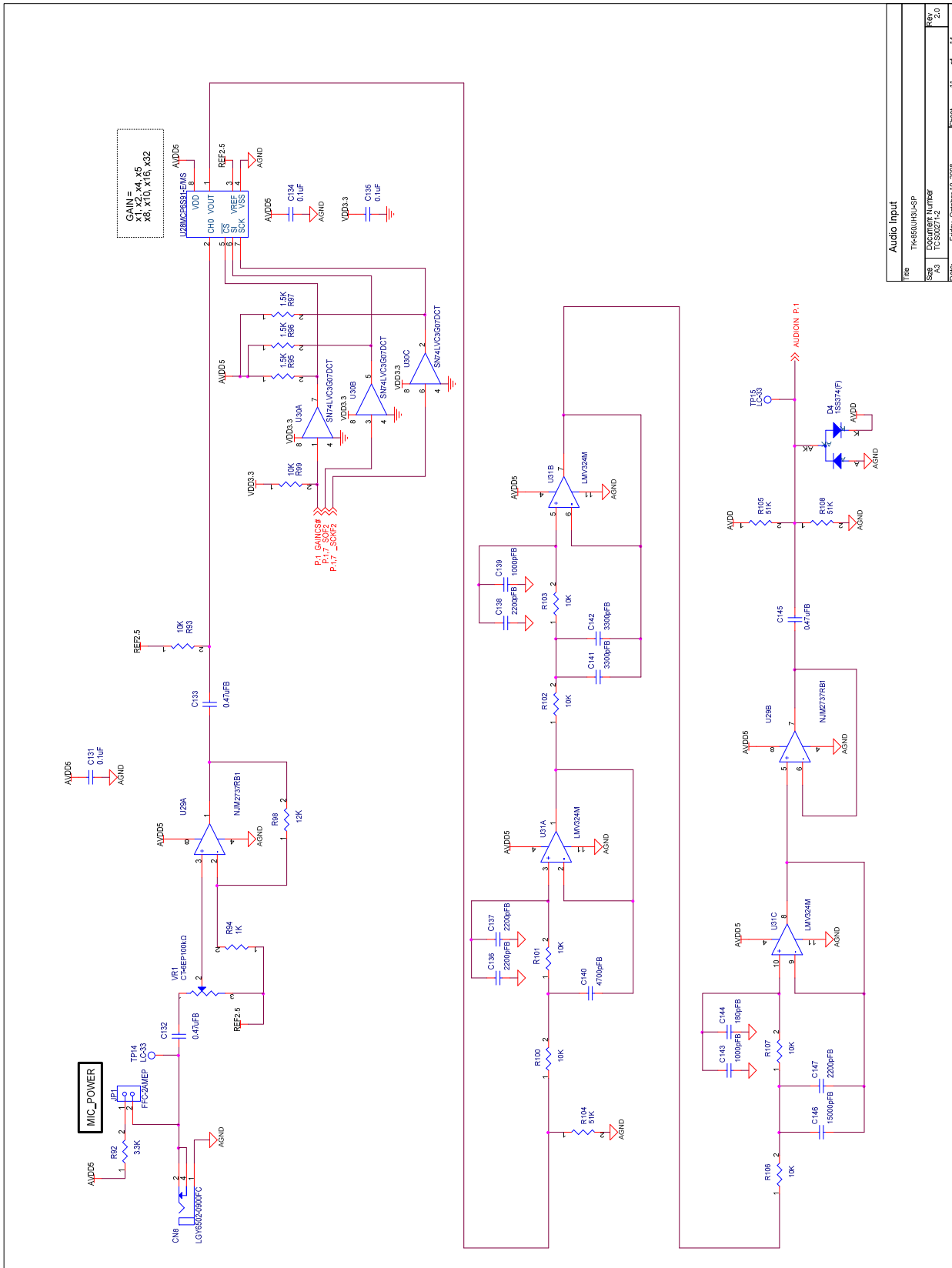
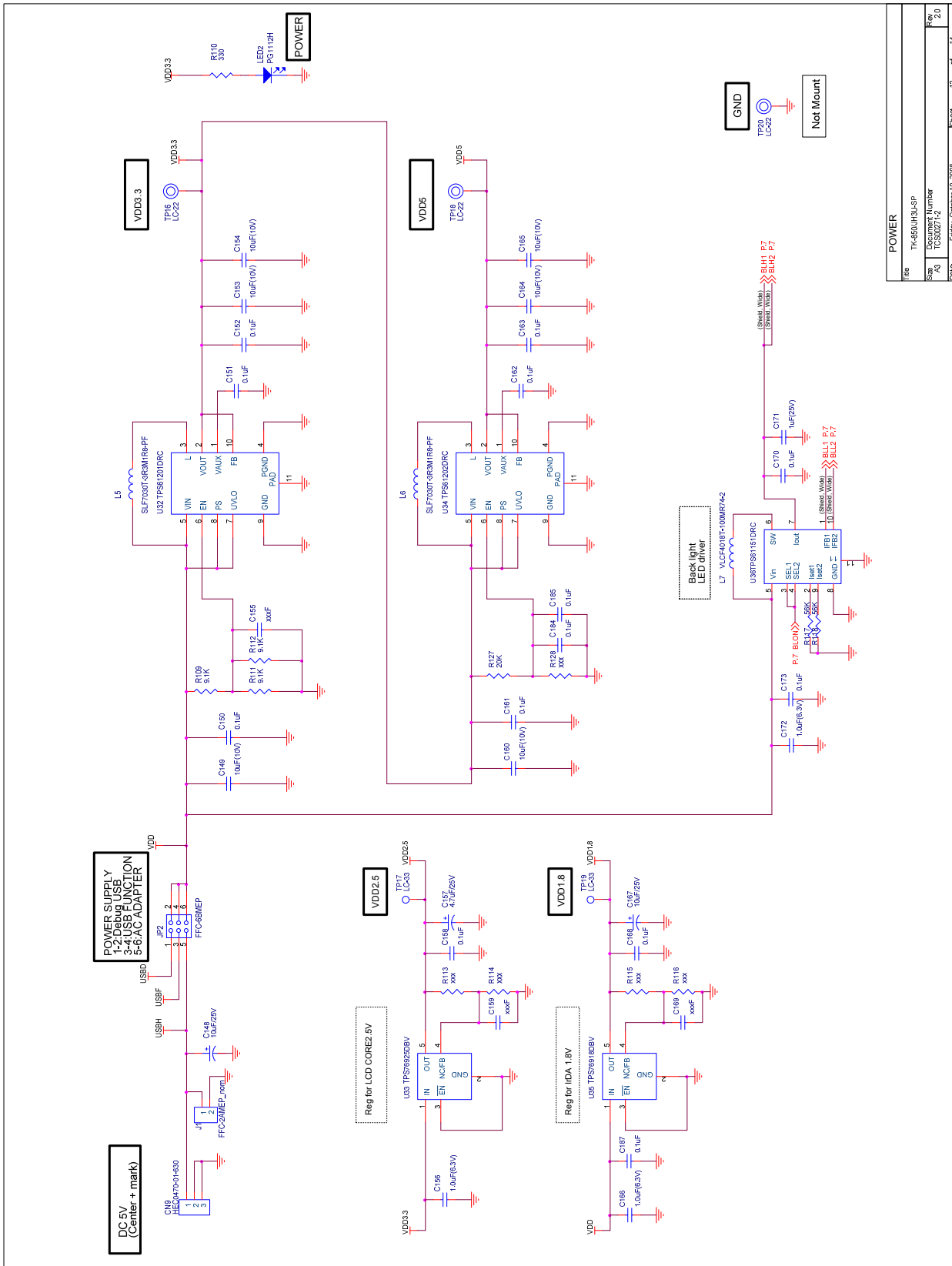


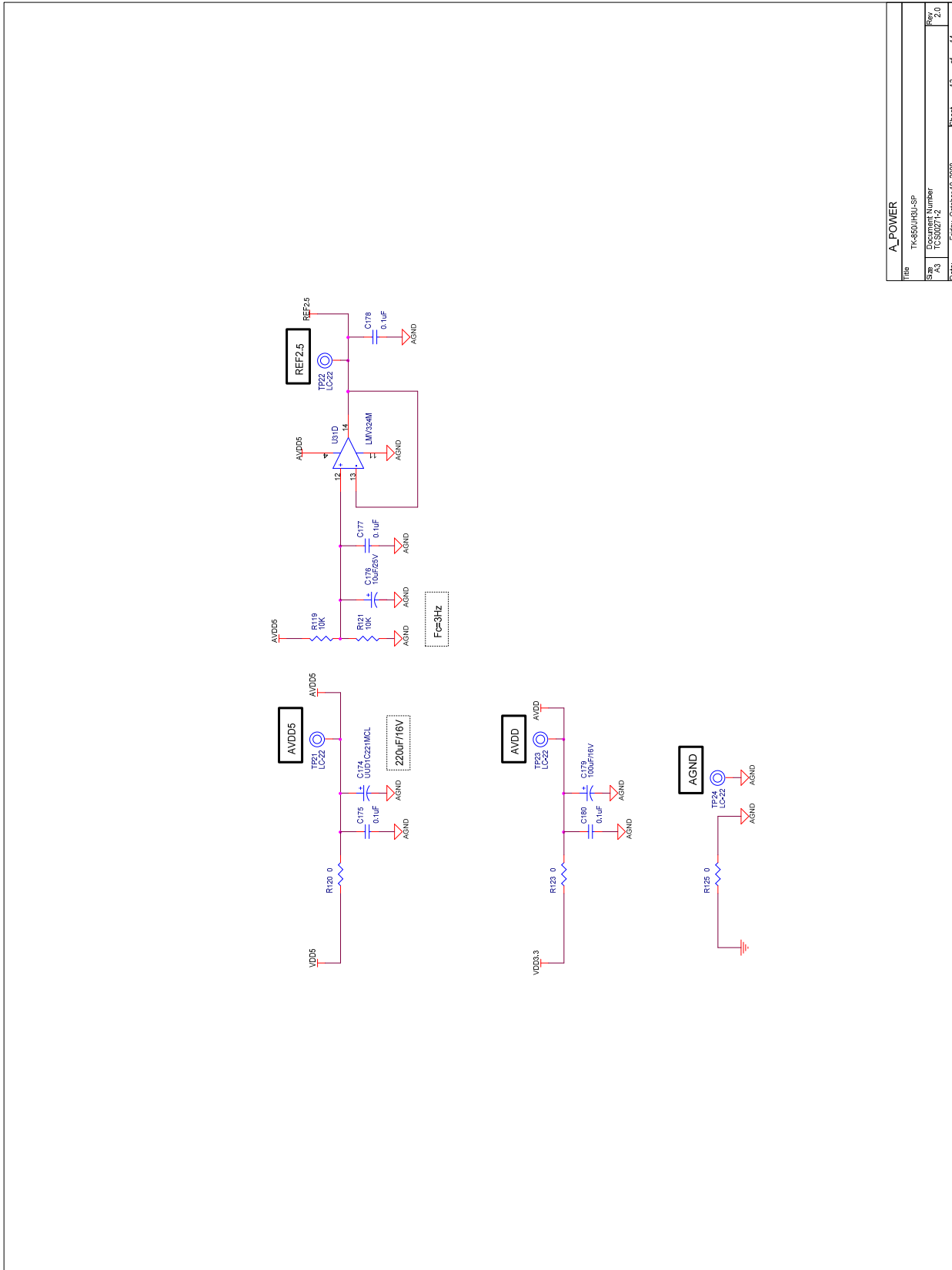
Figure 66: V850ES/Jx3-U - Plug it! schematics 11/13

Title		TK6504H0U-SP	
Size		Document Number	
A3		TC500271-2	
Date		E0404_0208	
Sheet		11 of 14	
Rev		2.0	



POWER			
File	TX-850UH0U-SP	Sheet	12 of 14
Size	Document Number	Rev	2.0
	TCS00071-2		
Date	February, October 10, 2008		

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



A_POWER			
Title	T1-850UJ1-SP		
Size	Document Number		
	A3 TC-S0071-2		
Rev	2.0		
Date	Friday, October 10, 2008	Sheet	13 of 14

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

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

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