

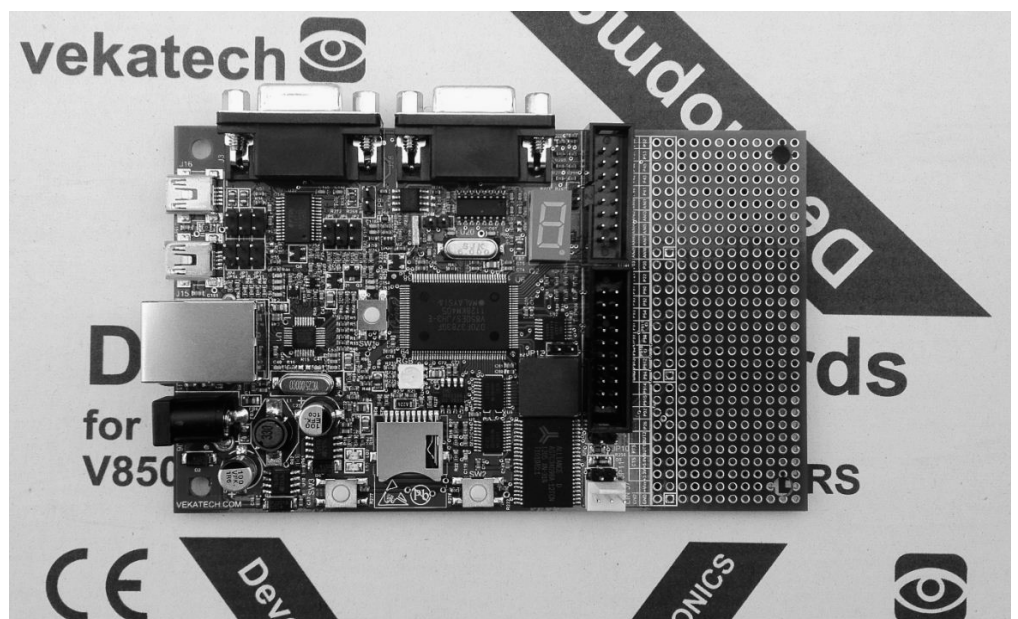
VK-Jx3-E Development Board

User Manual

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www.vekatech.com

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The document is intended to guide users with background in embedded systems to use VK-Jx3-E Development Board in their applications.

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Chapter 1: Introduction

VK-Jx3-E is a development board which uses MCU uPD70F3783GF from Renesas Electronics. This 32bit powerful MCU supports various serial interfaces such as ETHERNET,USB,CAN, UART/LIN, SPI, etc. Kit supports two USB communication channels provided for user application and programing/debug functions. In addition you will find also 20 pins N-WIRE debug interface and 16 pins programing and debugging interface for Minicube2. Mini SD card connector on the board and 512kB SRAM. User push buttons and RGB and 7 Seg leds. All this along with the DC/DC power supply on board and connected to pin headers unused pins of uPD70F3783GF allow you to build a diversity of powerful applications to be used in a wide range of embedded tasks.

1.1 Main features of VK-Jx3-E

- MCU: V850ES Jx3-E - uPD70F3783GF
- USB Mini-B device connector for Application/TK-Debugger (FT232RL)
- USB Mini-B device connector Function Device (uPD70F3783GF)
- CAN interface (BOSH CF160)
- LIN interface (ZMD30011)
- Micro SD card connector
- SRAM 512kB (AS7C34098A-12TCN)
- Ethernet, RJ-45 10/100Mb MAC (uPD70F3783GF)
- PHY SMSC LAN8710A
- Buzzer (Murrata PKLCS 1212E4001-R1)
- 16 pins Debug/programming connector (UART0)
- 20 pins N-WIRE connector.
- User RGB and 7 segment LED's.
- push buttons and RESET button.
- Power connector for DC/DC 7V-15V
- FR-4, 1.6 mm, Green/White solder mask, component print.
- Dimensions: 127.0mm x 78.75mm

1.2 Electrostatic warning

The VK-Jx3-E board is shipped in protective anti-static packaging. The board must not be subject to high electrostatic potentials. General practice for working with static sensitive devices should be applied when working with this board.

1.3 Processor Features

The VK-Jx3-E board use 32bit V850ES-Jx3 MCU uPD70F3783GF from Renesas Electronics with these features:

Operating Voltage: 2.85 to 3.6V

Max. frequency: 50 MHz

ROM capacities: 64 KB to 512 KB flash memory

RAM capacities: Internal 32KB to 64KB (Including 16 KB of data RAM area), 76 KB to 124 KB (Including 16/64 KB of data RAM area)

Package: 64-pin LQFP package, 64-pin FBGA package, 64-pin WQFN package, 80-pin LQFP package, 128-pin LQFP package, 144-pin LQFP package

10/100 Mbps Ethernet Media Access Controller (MAC) conforming to IEEE802.3, a FIFO controller for flow control, and a checksum calculation unit (only for received packets) conforming to RFC1071.

Number of instructions: 83

Minimum instruction execution time: 20 ns (@ 50 MHz operation with main clock (fXX))

Clock

- Main clock oscillation: $f_X = 3$ to 6.25 MHz
- Subclock oscillation: $f_{XT} = 32.768$ kHz
- Internal oscillation: $f_R = 220$ kHz (TYP.)

General-purpose registers: 32 bits x 32 registers

Instruction set:

- Signed multiplication
- Saturation operations
- 32-bit shift instructions
- bit manipulation instructions
- Load/store instructions

Memory space: 64 MB linear address space

External bus interface: Multiplexed bus mode, Separate bus mode

I/O ports: 29/41/64/84/100

Interrupts and exceptions:

- Non-maskable interrupts: 2 sources
- Maskable interrupts: 62/66/70/99/103/109/113 sources

Timer/counters

- 16-bit timer/event counter AA (TAA): 4/6 channels
- 16-bit timer/event counter AB (TAB): 1/2 channels
- Motor control function supported
- 16-bit interval timer M (TMM): 4 channels
- 16-bit encoder timer T (TMT): 1 channel
- Real-time counter: 1 channel
- Watchdog timer: 1 channel

Real-time output function: 0/6 channels

A/D converter: 10-bit resolution x 8/12 channels

Serial interface

- Ethernet controller: 1 channel
- USB function controller: 1 channel
- CAN :1 channel ((μ PD70F3829, μ PD70F3833, μ PD70F3837, μ PD70F3783, 70F3786 only)
- Asynchronous serial interface B with FIFO: 0/2 channels
- Asynchronous serial interface C(UARTC): 3/5/6/8 channels
- Clocked serial interface E(CSIE) with FIFO: 0/2 channels

- Clocked serial interface F(CSIF): 3/5/6 channels
- I2C bus interface: 2/3/4/5 channels

DMA controller: 4 channels

Power save function: HALT/IDLE1/IDLE2/STOP/subclock/sub-IDLE mode

On-chip debug function

For more information please visit www.renesas.eu

1.4 System requirements

Host PC A PC for the the IAR Systems Embedded Workbench demo-version supporting Windows 2000, Windows XP or Windows Vista is required.

Web browser.

Adobe Acrobat Reader.

Host interface USB interface Ver1.1 or higher.

Ethernet IEEE802.3 100BASE-TX/10BASE-T

1.5 Package contents

VK-Jx3-E board.

3M glue legs.

N-WIRE to E1 Debbuger converter board and flat cable.

CD with demo projects.

1.6 Trademarks

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Chapter 2: VK-Jx3-E System Configuration.

VK-Jx3-E can be used in general Ethernet, USB (function), CAN,LIN,UART and SPI, communications environment and other embedded task as MicroSD storage and motor control etc.

Power supply circuit

VK-Jx3-E is supplied by one of the following interfaces listed below.

Power consumption may varies and the maximum is 60mA.

Please note that only one options must be specified by the groups JP14-JP4, JP15-JP3 and JP13- JP7.

Via “USB Mini-B Application/TK-Debugger” interface

VK-Jx3-E is powered by USB Mini connector J16 and JP15 and JP3 must be **ON**.

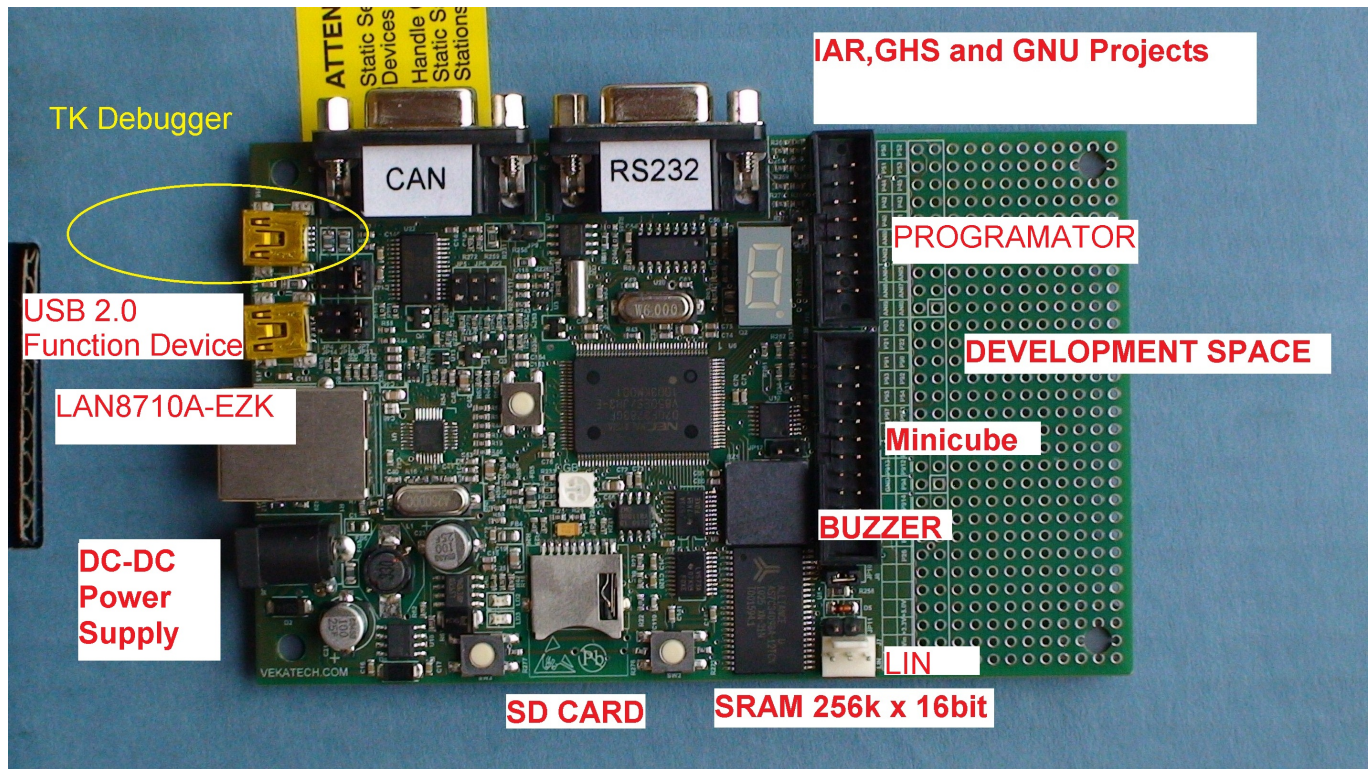
Via “USB Mini-B Function Device” interface

VK-Jx3-E is powered by USB Mini connector J15 ,JP14 and JP4 must be **ON**.

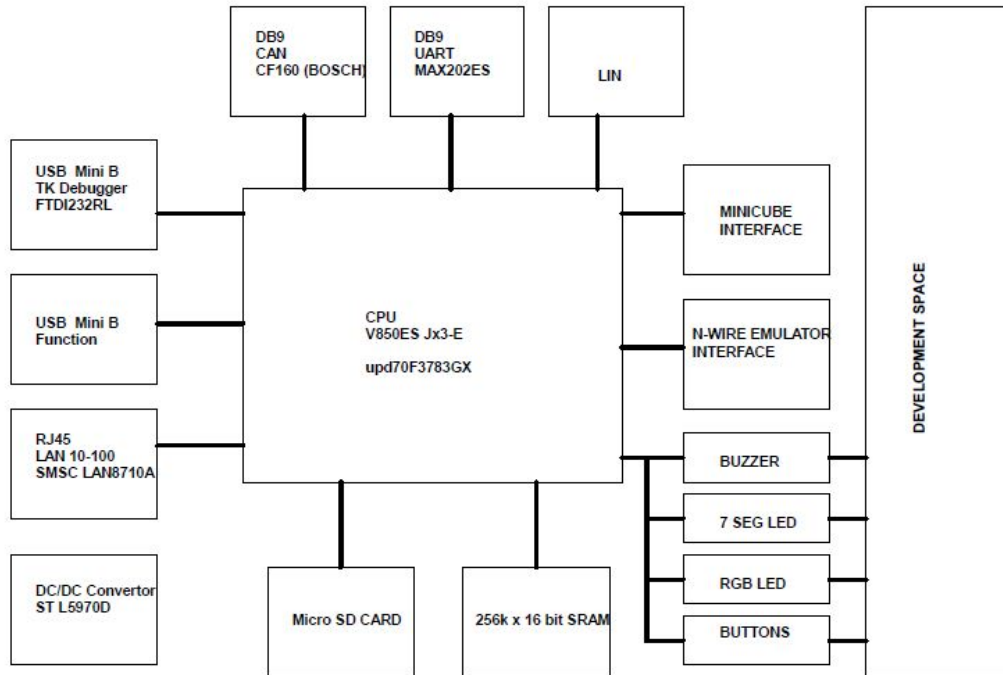
Via DC Power Adapter

VK-Jx3-E is powered by (7-15) VDC applied at the power jack and ,JP13 and JP7 must be ON.

Chapter 3: Hardware



3.1 Block Diagram



3.2 Hardware Components

Clock Circuits

Quartz crystal 6.0000 MHz is connected to uPD70F3783GF pin16 (X1) and pin17 (X2) .

Quartz crystal 32.768KHz is connected to 19(XT1) pin and 20(XT2) pin.

Quartz crystal 25.0000MHz is connected to Ethernet Phy - SMSC LAN8710A – 5(XTAL1)pin and 4(XTAL2)pin.

External SRAM Base Addresses

SRAM 256k x 16bit (AS7C34098A-12TCN).

xRAM : ORIGIN = 0x00400000, LENGTH = 256k.

No additional wait cycles required.

RGB LED:

D3 Red LED_R pin 69 (P94).

D3 Green LED_G pin 67 (P92).

D3 Blue LED_B pin 65 (P90).

7 SEG LED:

Signal Name	Pin name	Pin #
A 7	DDI	23
B 7	DDO	24
C 7	DCK	25
D 7	P02	21
E 7	P20	38
F 7	RTS B0	30
G 7	P22	80
DP 7	DMS	26

Piezo buzzer:

Murrata PKLCS 1212E4001-R1 buzzer is connected to P26 Pin 64 of MCU.

Push buttons:

SW1	RESET	RESET	18
*SW2	Button1	J12	11 (PIN HEADER)
*SW3	Button2	J12	13 (PIN HEADER)

*Push buttons shall be routed to any unused pin header.

Development space

Area of 290mils x 90mils is provided for customization.

Connectors Description:

PWR

Pin#	Signal Name	Pin#	Signal Name
1	Positive power	2	Negative power

The power input should be +(7-15VDC)

MiniCube2 Debug/Programming - 16 pins connector J10:

Pin#	Signal Name	Pin#	Signal Name
1	GND	2	RESET_OUT
3	TX0	4	VDD
5	RX0	6	N.C.
7	N.C.	8	N.C.
9	N.C	10	N.C.
11	N.C.	12	FLMD1
13	N.C	14	FLMD0
15	RESET_IN	16	N.C.

GND – negative power supply

RESET_OUT (OUT) - Pin used to output reset signal to the target device

TXD (OUT) - Pin used to send command/data to the target device

VDD – positive +5V power supply

RXD (IN) - Pin used to receive command/data from the target device

FLMD0 (OUT) - Pin used to set the target device to debug mode or programming

FLMD1 (OUT) - Pin used to set the target device to debug mode or
mode

mode

programming

RESET_IN (IN) - Pin used to input reset signal from the target system

N-WIRE interface - 20 pins connector J8:

Pin#	Signal Name	Pin#	Signal Name
1	GND	2	DCK
3	GND	4	DMS
5	GND	6	DDI
7	GND	8	!DRST
9	GND	10	N.C.
11	GND	12	!RESET
13	GND	14	FLMD0
15	GND	16	N.C
17	GND	18	DDO
19	GND	20	VDD

CAN – 9 pins DB9F connector J3

Pin#	Signal Name	Description
2	CAN_L	
3	GND	
7	CAN_H	

CTXD - P36 pin 36 of UPD70F3783GF.

CRXD - P37 pin 37 of UPD70F3783GF.

*Termination Jumper JP9.

UART– 9 pins DB9F connector J28

Pin#	Signal Name	Description
2	TX_RS	14 pin MAX202SA
3	RX_RS	13 pin MAX202SA
5	GND	
7	RTS_RS	7 pin MAX202SA
9	CTS_RS	8 pin MAX202SA

TXDB0 - P33 pin 31 of UPD70F3783GF.
RXDB0 - P34 pin 32 of UPD70F3783GF.

LIN 3 pin connectors J7

Pin#	Signal Name	Description
1	+VP	
2	LIN	
3	GND	

*Termination Jumper JP9.

Ethernet connector RJ45 type J1

*Transformer and integrated LEDS are connected/controlled to PHY interface LAN8710A.
*Respective signals from PHY are connected to MII interface of **UPD70F3783GF**.

USB device – USB MINI B connector J15

Pin#	Signal Name	Pin#	Signal Name
1	V_USB	3	UDPF
2	UDMF	5	GND

Note Pin#4 ID is unconnected.

V_USB Output USB device power.

UDMF and UDPF are connected to pins 9 and 10 of UPD70F3783GF.

USB device – USB MINI B connector J16

Pin#	Signal Name	Pin#	Signal Name
1	V_USB	3	USBP
2	USBN	5	GND

Note Pin#4 ID is unconnected.

V_USB Output USB device power.

USBN- is connected to 16 pin of FT232RL.

USBP+ is connected to 15 pin of FT232RL.

TX0 - P30 pin 28 of UPD70F3783GF.

RX0 - P31 pin 29 of UPD70F3783GF.

Micro SD card slot:

Pin#	Signal Name	MCU PIN	MCU PORT
1	DAT2	-	-
3	CMD	109	PDH4/SOF4
5	CLK	110	PDH5/SCKF4
7	DAT0	108	PDH3/SIF4
9	!CARDEXIST	*	*
2	CD/DAT3	115	PCS0
4	VDD	-	-
6	GND	-	-
8	DAT1	-	-
10	NO-b	-	-

* !CARDEXIST signal is not connected to MCU.

•

DAT0-3 (IN/OUT) - I/O Memory Card Interface Data 0-4.

These are the data lines for the SD connector. They could be both input and output for the MCU depending on the data flow direction.

CMD (OUT) - Output Memory Card Interface Command.

This is a command sent from the processor to the memory card and as such it is output from the processor.

CLK (OUT) - Output Memory Card Interface Clock. This signal is output from the MCU and synchronizes the data transfer between the memory card and the MCU.

Unused Pin Headers

J9

Pin#	Signal Name	Pin#	Signal Name
1	ANI8	2	ANI9
3	ANI7	4	ANI6
5	ANI5	6	ANI4
7	ANI3	8	ANI2
9	ANI1	10	ANI0
11	P41	12	P40
13	P43	14	P42
15	P45	16	P44
17	DMS	18	DDO
19	DCK	20	DDI

J12

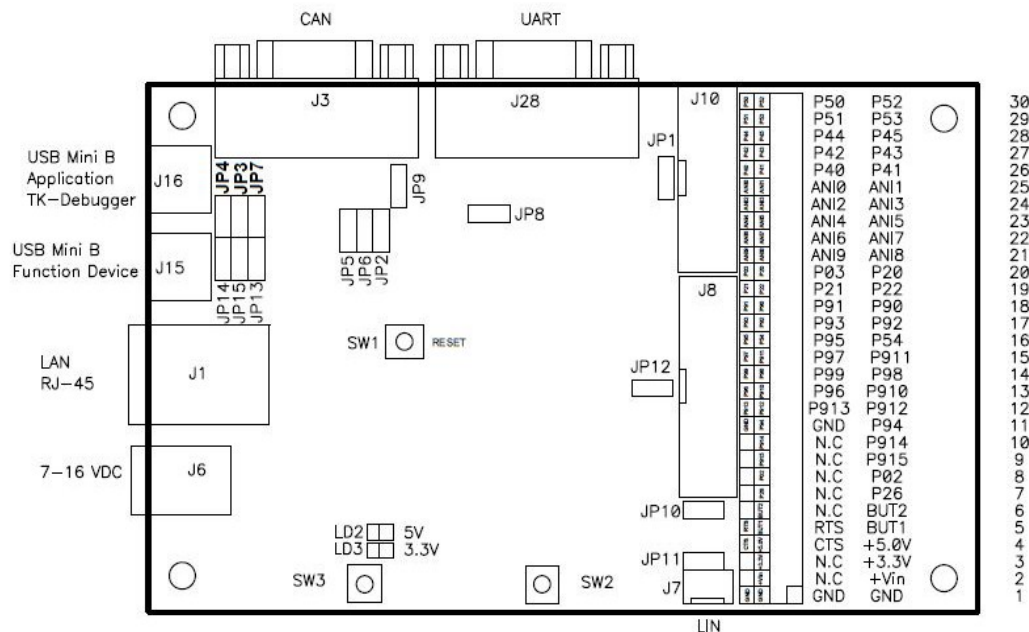
Pin#	Signal Name	Pin#	Signal Name
1	GND	2	GND
3	+VP	4	n.c
5	+3.3V	6	n.c
7	+5V	8	CTS B0
9	BUT1	10	RTS B0
11	BUT2	12	n.c
13	BUZZER	14	n.c
15	P02	16	n.c
17	P915	18	n.c
19	P914	20	n.c




J13

Pin#	Signal Name	Pin#	Signal Name
1	P01	2	P02
3	P32	4	P33
5	P34	6	P35
7	P62	8	P63
9	P64	10	P65
11	P66	12	P67
13	P68	14	P610
15	P611	16	P612
17	P613	18	P614
19	P615	20	P94

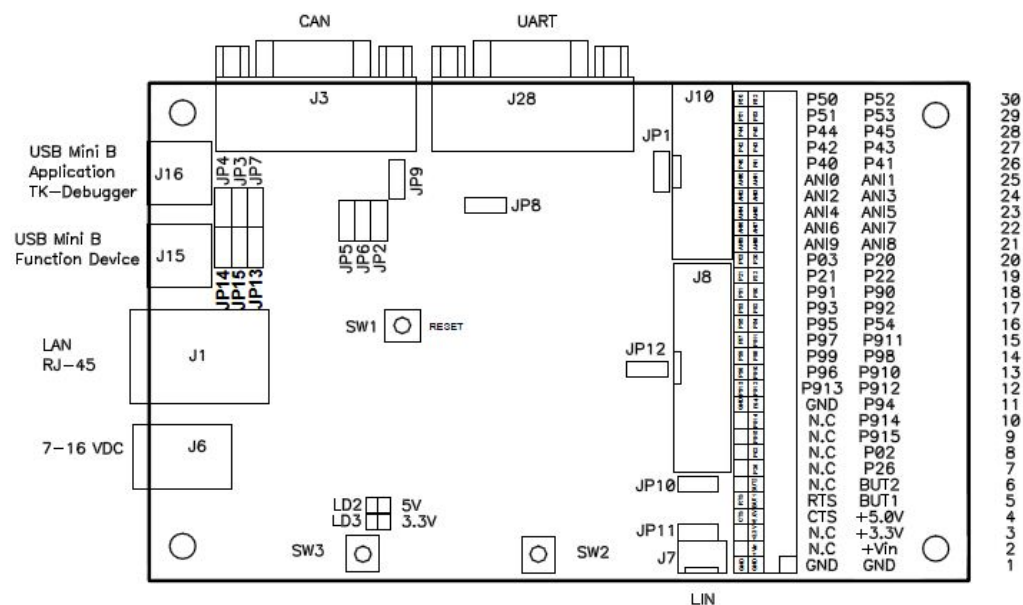
3.3 Jumper's Configuration




DC/DC Convertor power source



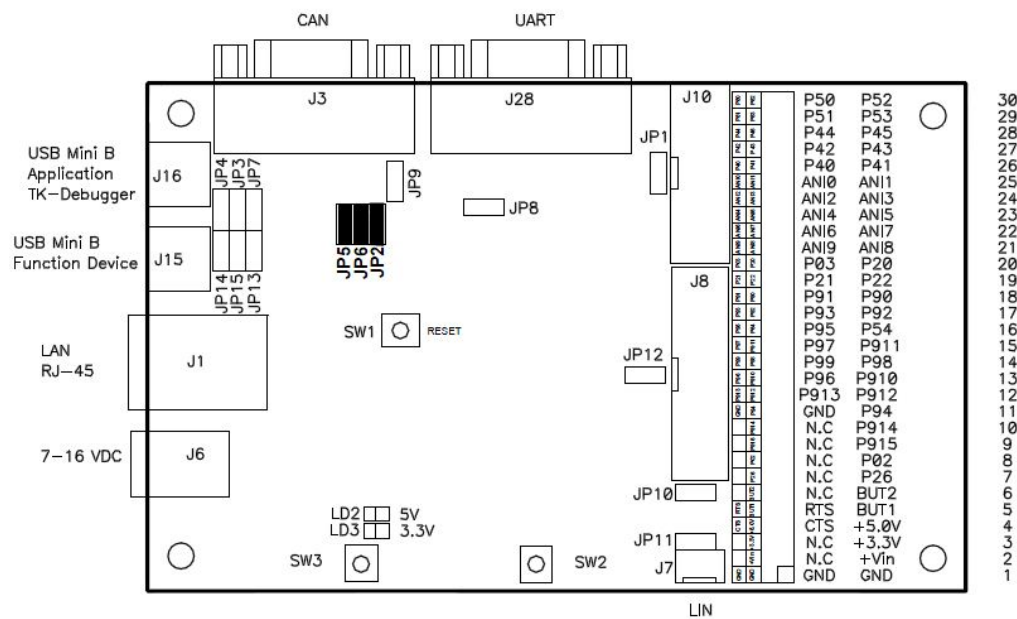
VK-Jx3-E		DC/DC CONVERTOR POWER SOURCE	
WARNING !!! PLEASE MAKE SURE THAT ONLY ONE JUMPER IS CONNECTED AT THE SAME MOMENT !!! REDUNDANT SHORTS WILL CAUSE DAMAGE OF USB HOST.			
	JP4	ON	USB Mini FUNCTIONAL DEVICE POWER SUPPLY IS CONNECTED TO DC/DC CONVERTOR
	JP3	ON	USB Mini B APPLICATION/TK DEBBUGER POWER SUPPLY IS CONNECTED TO DC/DC CONVERTOR
	JP7	ON	UNREGULATED DC INPUT CONNECTED TO DC/DC CONVERTOR

System +5V power source



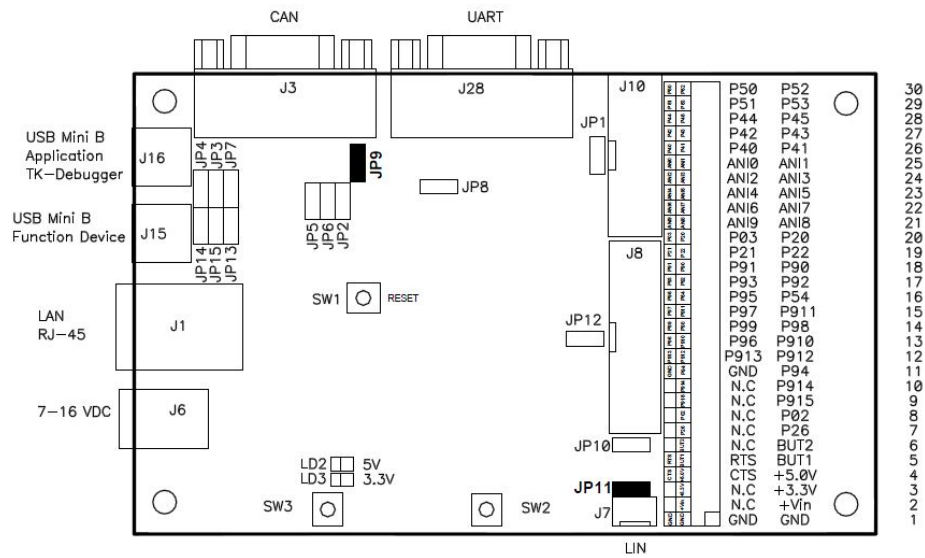
VK-Jx3-E SYSTEM +5V POWER SOURCE			
WARNING !!! PLEASE MAKE SURE THAT ONLY ONE JUMPER IS CONNECTED AT THE SAME MOMENT !!! REDUNDANT SHORTS WILL CAUCE DAMAGE OF USB HOST.			
	JP14	ON	POWER SUPPLY OF FUNCTIONAL DEVICE IS CONNECTED TO SYSTEM +5V
	JP15	ON	POWER SUPPLY OF TK DEBBUGER IS CONNECTED TO SYSTEM +5V
	JP13	ON	OUTPUT OF LINEAR REGULATOR IS CONNECTED TO SYSTEM +5V

TK DEBUGGER SETTINGS:



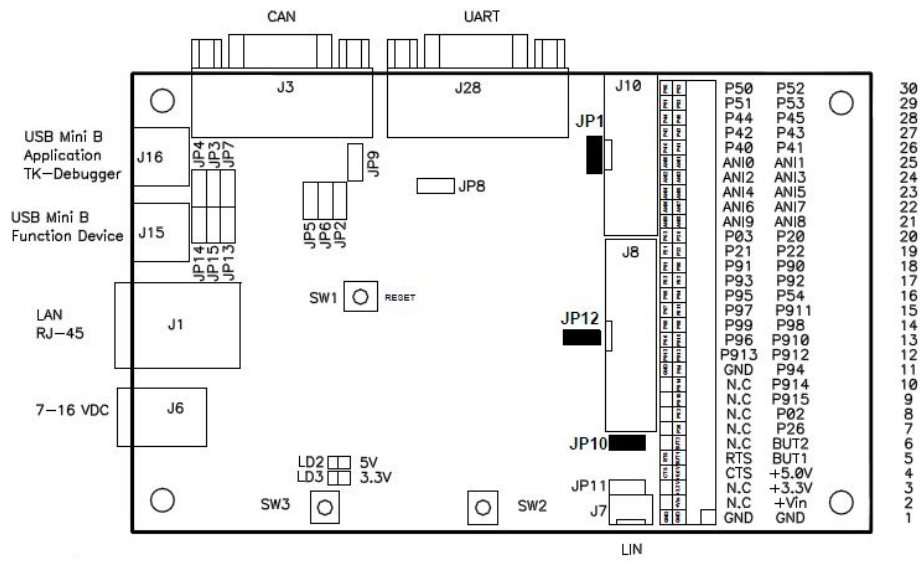
VK-Jx3-E TK DEBUGGER SIGNALS		
WARNING !!! PLEASE MAKE SURE THAT SETTINGS BELOW IS TRUE FOR TK DEBUGGER USAGE.		
JP5	ON	FTDI 232 DTR CONNECTED FLMD0 OF MCU
JP6	ON	FTDI 232 TXD CONNECTED RXD OF MCU
JP2	ON	FTDI 232 RTS CONTROL MCU RESET

LIN and CAN Termination



VK-Jx3-E		LIN AND CAN TERMINATION
WARNING !!! PLEASE REFER TO LIN AND CAN STANDADTS.		
JP11	ON	LIN TERMINATED
JP9	ON	CAN TERMINATED

Power supply for BUZZER,RGB LED AND 7 SEG LED.



VK-Jx3-E POWER SUPPLY LED, 7 SEG LED AND BUZZER		
WARNING !!! IF THE RESPECTIVE SIGNALS ARE USED FOR DIFFERENT PURPOSE VIA PIN HEADER EXTENTION, MAKE SURE THAT IT'S JUMPER IS OFF.		
JP1	ON	7 SEG POWER
JP12	ON	BUZZER POWER
JP10	ON	RGB LED POWER

Chapter 4: On-Chip Debugging and Flash Program

4.1 OCD via TK-V850 On-Board debug function

Check that JP5,JP6 and JP2 are **ON**.

Choose one of options below for powering the board:

Connect USB Mini B cable to connector J16 and choose from one of the poweing options below.

- Powering via J15 USB Mini B connector – JP14 and JP4 short.

- Powering via J16 USB Mini B connector – JP15 and JP3 short.

- Powering via J6 Power Jack connector – JP13 and JP7 short.

Please make sure that only one powering option is selected!

* Please make sure that your project is compiled for Minicube2 Debugger!!

*Please check that in Assembler and C/C++ compiler Preprocessor Options `__DBG_UARTC0__` is defined instead of `__NWIRE__`.

4.2 OCD via E1 Debbuger

Use adapter board and cable supplied with the VK-Jx3-E board and connect to N-WIRE emulator interface connector J8.

Check that JP5,JP6 and JP2 are **OFF**.

Choose one of options below for powering the board:

- Powering via J15 USB Mini B connector – JP14 and JP4 short.

- Powering via J16 USB Mini B connector – JP15 and JP3 short.

- Powering via J6 Power Jack conenctor – JP13 and JP7 short.

Please make sure that only one powering option is selected!

* Please make sure that your project is not compiled for Minicube2 Debugger, in Assembler and C/C++ compiler Preprocessor Options `__NWIRE__` must be defined instead of `__DBG_UARTC0__`.

4.3 OCD via N-WIRE Debbuger

Download and install N-WIRE driver from www.renesas.eu.

Connect N-WIRE Debbuger to N-WIRE emulator interface connector J8.

Check that JP5,JP6 and JP2 are **OFF**.

Choose one of options below for powering the board:

- Powering via J15 USB Mini B connector – JP14 and JP4 short.

- Powering via J16 USB Mini B connector – JP15 and JP3 short.

- Powering via J6 Power Jack conenctor – JP13 and JP7 short.

Please make sure that only one powering option is selected!

* Please make sure that your project is not compiled for Minicube2 Debugger, in Assembler and C/C++ compiler Preprocessor Options `__NWIRE__` must be defined instead of `__DBG_UARTC0__`.

4.4 OCD via MINICUBE2 On-Chip debugger

Download and install Minicube2 driver/software from www.renesas.eu.

Download and install latest PRM files from www.renesas.eu .

Connect Minicube2 Debugger to connector J10.

Set Minicube2 power switch to target.

Check that JP5,JP6 and JP2 are OFF.

Choose one of options below for powering the board:

-Powering via J15 USB Mini B connector – JP14 and JP4 short.

-Powering via J16 USB Mini B connector – JP15 and JP3 short.

-Powering via J6 Power Jack connector – JP13 and JP7 short.

Please make sure that only one powering option is selected!

* Please make sure that your project is compiled for Minicube2 Debugger!!

*Please check that in Assembler and C/C++ compiler Preprocessor Options `__DBG_UARTC0__` is defined instead of `__NWIRE__` .

4.5 WriteEZ5 programator

Download and install WriteEZ5 programator software from www.renesas.eu.

Download and install latest PRM files from www.renesas.eu . Please use file 70F3783_CSI0.prm.

Make sure that your OS use latest FT232RL drivers.

Check that JP5,JP6 and JP2 are shorted as shown in **TK DEBUGGER SETTINGS**.

Connect USB mini B cable to J16 and make sure that JP15 and JP3 are shorted (power supply for system +5V and DC/DC convertor.)

*note Please make sure that your project is **not** compiled for Minicube2 Debugger!!

*note Please check that in Assembler and C/C++ compiler Preprocessor Options `__NWIRE__` is defined instead of `__DBG_UARTC0__`

Chapter 5: VK-Jx3-E Installation and Operation

Getting started

tbd

Chapter 6: Hardware Installation

tbd

Chapter 7: Software Installation

This manual is not intended to guide you through installation procedures of any development or application software. Please refer to relevant sources.

Chapter 8: Demo Projects

The available projects are prepared to compile with IAR, GHS and GNU Tool chains

8.1 FreeRTOS(TM) ported for VK-Jx3-E development board

General introduction

tbd

Sample Programs overview

tbd

8.2 Driver for SMSC LAN8710A

General introduction

tbd

Sample Programs overview

tbd

8.3 CNET V2.0

General introduction

Please refer to Renesas Electronics website for PDF document:

[Application Development Manual U19108EE1V0UM00.PDF](#) describing C-NET API for HTTP, SMTP, POP3, and DHCP.

Sample Programs overview

HTTP server responds at :192.168.2.99:8088. The boards are shipped with this application loaded.

8.4 OBD2 simulator

General introduction

tbd

Sample Programs overview

tbd

8.5 USB- Mass storage device class (MSD)

General introduction

tbd

Sample Programs overview

tbd

8.6 Test of external SRAM

General introduction

tbd

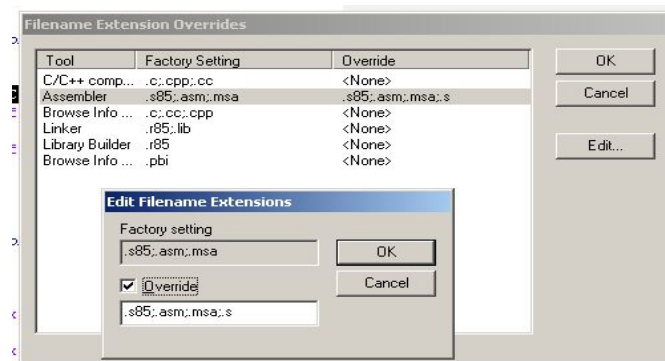
Sample Programs overview

tbd

Chapter 9: Setting IAR Workbench

9.1 Setting IAR V850 Assembler for use with the demo projects

Go to Tools/Filename extensions and Assembler/Edit.
Update the list of assembler files with .s extension.



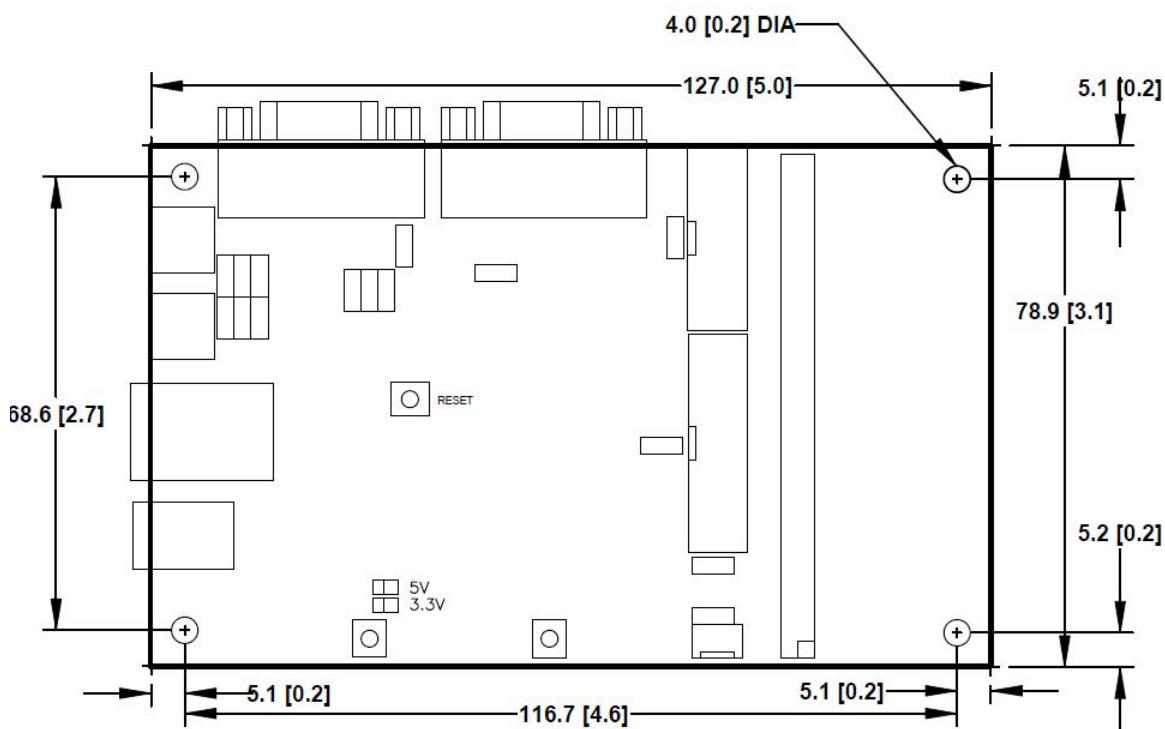
9.2 Settings TK-V850 debugger

Please open the file ex850o32mon.ini (located in C:\Program Files\IAR Systems\Embedded Workbench 6.0\v850\config\renesas) and add the following definitions:

```
;V850ES/Jx3-E  
F3783=mqb2jh3e
```

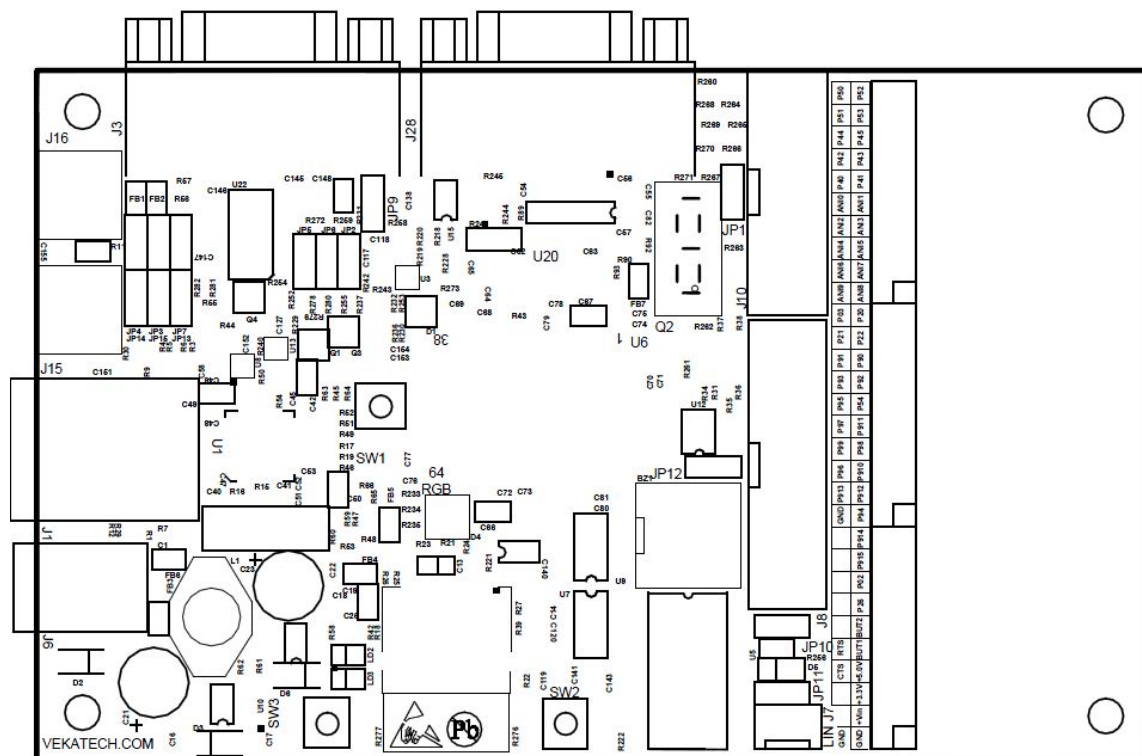
```
;V850ES/Jx3-E  
[mqb2jh3e]  
Port1=UARTC0
```

Chapter 10: Mechanical Dimmensions

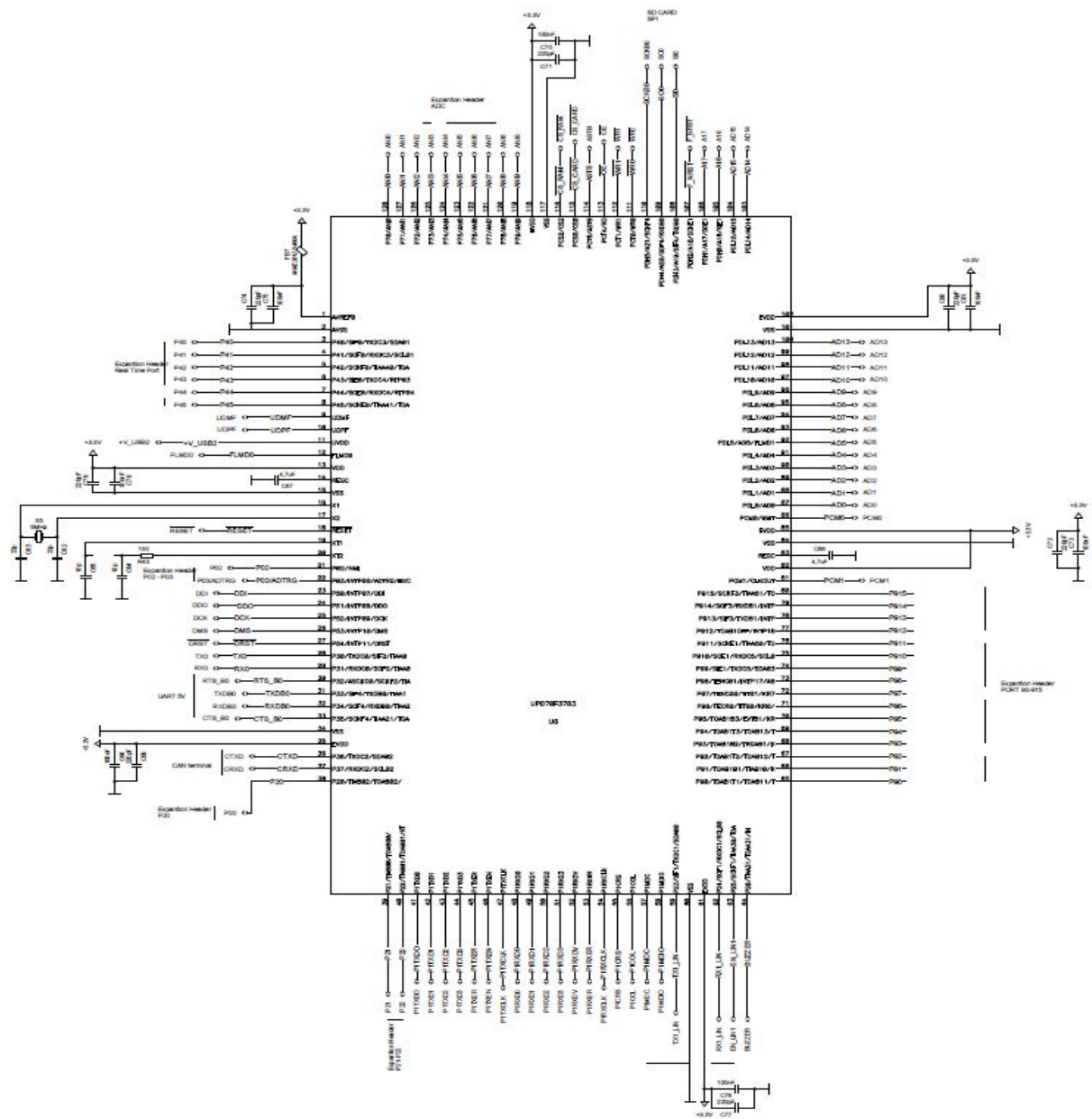


All measures are in mm[Inch].

Chapter 11: Reference Designators



Chapter 12: Schematics



Chapter 13: Troubleshooting

Chapter 14: End