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DIMM-Base Board Design

Application Note

Rev6 / 07.05.2014

Revision: **6 / 07.05.2014**

Rev	Date/Signature	Changes
1	12.05.2011/Mt	First revision
2	11.11.2011/Mt	- Added new possibility to switch between the LAN Transformer voltages - Added SODIMM module fixing - Changed mechanical connector placement drawing - Changed processor module mechanical drawing (J4 orientation) - Added periphery 3,3V and signal POWER_ON_BASE - Added SODIMM connector recommendation
3	17.01.2012/Mt	Added the second paragraph in chapter 1 Changed the FET T16 in the LAN power circuit in chapter 3.1
4	12.04.2012/Mt	Added the delayed RESI# feature
5	25.10.2012/Bue	CPU modules DIMM.EMEV2 and DIMM.AM335x added, several contents updated
6	07.05.2014/Ko	Updated Data for DIMM-MX6, DIMM-RZ, Cadun, Tarion

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1 Introduction

This Application Note helps baseboard development, if the baseboard shall be used with different Core modules. It helps to consider the differences if the developed baseboard shall be compatible for several DIMM modules.

This collection of data is based on our today´s state of knowledge. Support for customer- specific Baseboards available on request.

The emtrion DIMM interface between the emtrion DIMM Core modules and the emtrion baseboards is an emtrion internal standardized interface. This standard defines the interfaces on the SODIMM connector.

This standard is supported by the Core modules

- DIMM-SH7723
- DIMM-SH7724
- DIMM-MX257
- DIMM-MX53x
- DIMM-MX6
- DIMM-EMEV2
- DIMM-AM335x
- DIMM-RZ

It is also supported by the carrier boards

- HiCO.DIMM-Base
- DIMM-Eco-Base Verno
- DIMM-Eco-Base Cadun
- DIMM-Eco-Base Tarion
- DIMM-Base Lothron

2 Features

A couple of different DIMM Core modules are available from emtrion. Every Core module uses the SODIMM connector as the main interface. In general the Core modules are pin compatible, but not every module uses all interfaces, because they have sometimes different features. In the following table the Core modules features are listed.

The interfaces and features are described in more detail in the appropriate HW manuals of the modules. In this table only the general availability is shown.

Feature	DIMM-SH7723	DIMM-SH7724	DIMM-MX257	DIMM-MX53x	DIMM-EMEV2	DIMM-AM335x	DIMM-MX6	DIMM-RZ
Ethernet	X	X	X	X	X	X	X	X
USB Host	X	X	X	X	X	X	X	X
USB Device	X	X	X	X	X	X	X	X
TFT Display (generic)	X	X	X	X	X	X	X	X
Touch Screen	X	X	X	X	X	X	X	X
CMOS Camera Input 1	X	X	-	X	X	-	X	X
CMOS Camera Input 2	-	X	-	X	-	-	X	-
Video Input	X	X	-	X	X	-	X	X
Video Output	X	X	-	-	X	-	-	-
Analog Audio (I2S)	X	X	X	X	X	X	X	X
Digital Audio (SPDIF)	X	-	-	X	-	-	X	X
SD-Card 1	X	X	X	X	X	X	X	X
SD-Card 2	X	X	X	X	X	-	X	X
UART_A (RS232)	X	X	X	X	X	X	X	X
UART_B (LVTTL)	X	X	X	X	X	X	X	X
UART_C (LVTTL)	X	X		X	X	X	X	X
UART_D (LVTTL)	X	X	X	X	X	X	X	X

UART_E(LVTTL)	X	X	X	X	-	(X)	X	X
CAN1	-	X	X	X	X	X	X	X
CAN2	-	-	X	X	-	(X)	X	X
SPI	X	X	X	X	X	X	X	X
I²C	X	X	X	X	X	X	X	X
IrDA	X	X	X	X	-	-	X	-
GPIO_0	X	X	X	X	X	X	X	X
GPIO_1	X	X	X	X	X	X	X	X
GPIO_2	X	X	X	X	X	X	X	X
GPIO_3	X	X	X	X	X	X	X	X
GPIO_4	X	X	-	X	X	X	X	X
GPIO_5	X	X	X	X	X	X	X	X
GPIO_6	X	X	-	X	X	X	X	X
GPIO_7	X	X	X	X	X	X	X	X
GPIO_8	X	X	X	-	X	X	X	X
GPIO_9	X	X	X	-	X	X	X	X
ANA_IN1	X	-	X	-	X	X	-	X
ANA_IN2	X	-	X	-	X	X	-	X
ANA_IN3	X	-	X	-	-	X	-	X
ANA_IN4	X	-	X	-	-	X	-	X
CPU-Bus Interface	X	-	X	X	X	-	-	-
IRQ-A	X	X	X	X	X	X	X	X
IRQ-B	X	X	X	X	X	X	X	X
NMI	X	X	X	X	X	X	X	X
BAT	X	X	X	X	X	X	X	X
RESI	X	X	X	X	X	X	X	X
RESO	X	X	X	X	X	X	X	X
DMA	-	X	-	-	-	-	X	-
Extension connector 1	-	X	-	X	X	-	X	-
Extension connector 2	-	-	-	X	-	-	X	X
VOU_DEST	X	-	-	-	X	-	-	-

VOU_RST#	X	X	-	X	X	-	X	X
VIO_RST#	X	X	X	X	X	-	X	X
VIO_SRC	X	X	X	X	X	-	X	X
SATA	-	-	-	X	-	-	X	-
LVDS	-	-	-	X	-	-	X	X
KPP	-	-	-	X	-	-	-	-
miniPCIe	-	-	-	-	-	-	(X)	-
HDMI	-	-	-	-	-	-	(X)	-

Symbol Explanation:

X: feature or interface is fully supported

(X): availability depends on pin multiplexing

- This feature or interface is not supported

3 Special circuits and differences between CPU modules

Although the Core modules are pin compatible, there some little differences which must be considered at a Base board design if different modules shall be supported.

Also some special circuits will be explained in the following chapters.

3.1 Ethernet

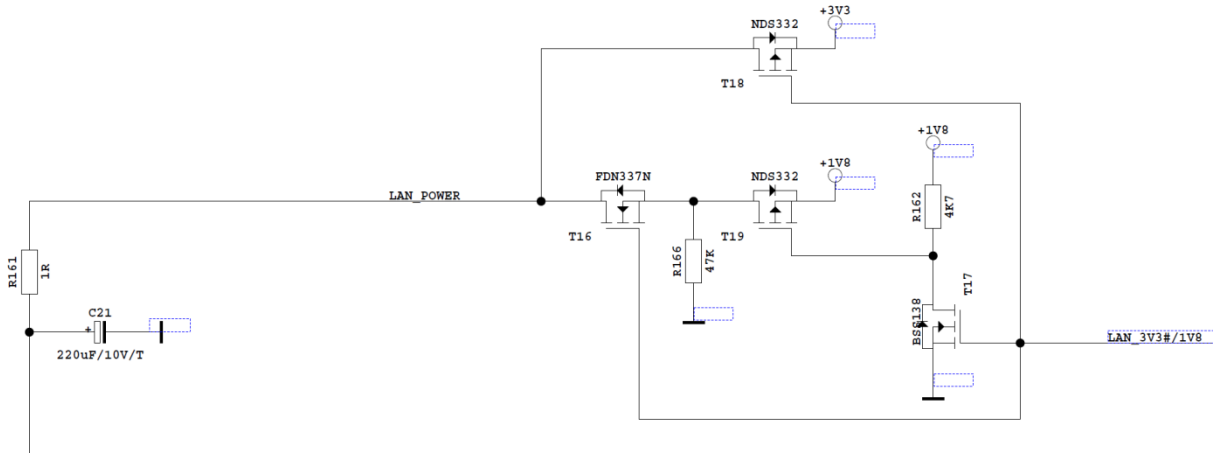
The Core modules use different Ethernet Controllers. The Ethernet controllers demand different supply voltages for the transformer. Actually two different voltages are needed by different modules, 1.8 V and 3.3 V.

The following table shows the LAN transformer voltage of the CPU modules:

CPU module	LAN transformer voltage
DIMM-SH7723	1.8 V
DIMM-SH7724	3.3 V
DIMM-MX257	3.3 V
DIMM-MX53x	3.3 V
DIMM-MX6	3.3 V
DIMM-EMEV2	1.8 V
DIMM-Am335x	3.3 V
DIMM-RZ	3.3 V

If the baseboard shall be compatible for all DIMM Core modules, the LAN transformer voltage on the baseboard must be switchable between 3.3 V and 1.8 V. This can be done via a jumper or via resistors that are fit optionally.

The following circuit shows a third solution which enables the voltage to be switched by software.



LAN_POWER will be 3,3V if the signal LAN_3V3#/1V8 is low. LAN_POWER will be 1,8V if the signal LAN_3V3#/1V8 is high. The baseboard designer must set the default value of the signal LAN_3V3#/1V8 via a resistor for example.

Actually voltage switching by software is not supported by the CPU modules.

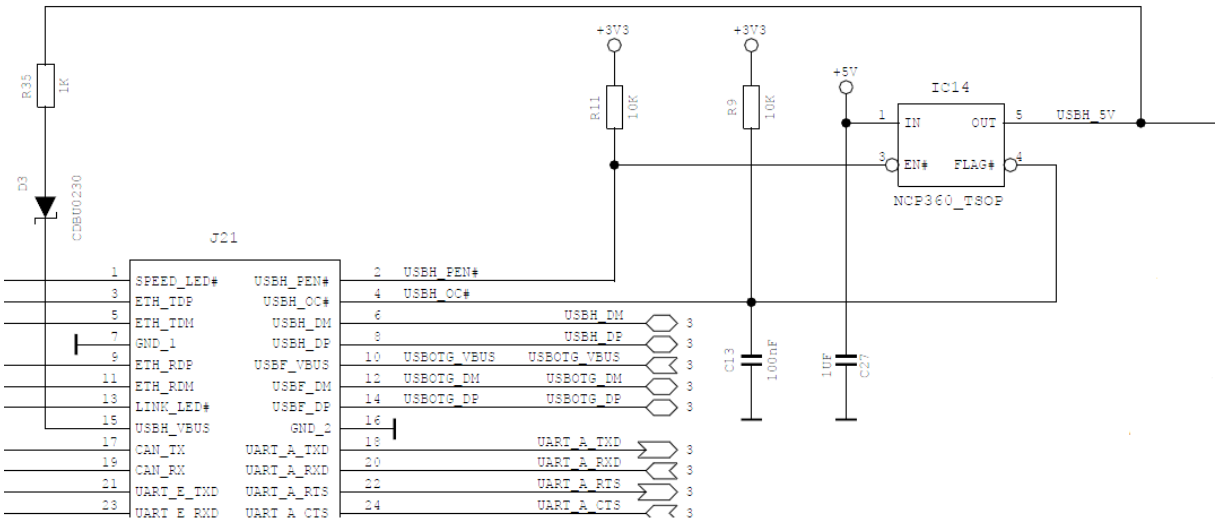
To be more robust against mechanical stress the CPU module should be fixed with screws. Two mounting holes at the opposite edge of the SODIMM connector are provided. The mounting holes vary between the CPU modules according to upper table. Also the hole diameters vary between the Base boards from emtrion.

To use M2x8 screws and 3mm high plastic spacers between the CPU module and the Base board fits for all boards.

3.2 USB Host VBUS Voltage

The use of pin 15 of the SODIMM connector was changed from 3V3 supply to USB Host VBUS. This was necessary because some newer CPUs demand to watch the USB Host VBUS signal.

To be compatible to all CPU modules the following circuit should be realized on the Base board:



The VBUS output voltage of the USB Host interface on the Base board is connected to pin 15 of the SODIMM connector by a small schottky diode and a 1k series resistor. This circuit conforms to all CPU modules.

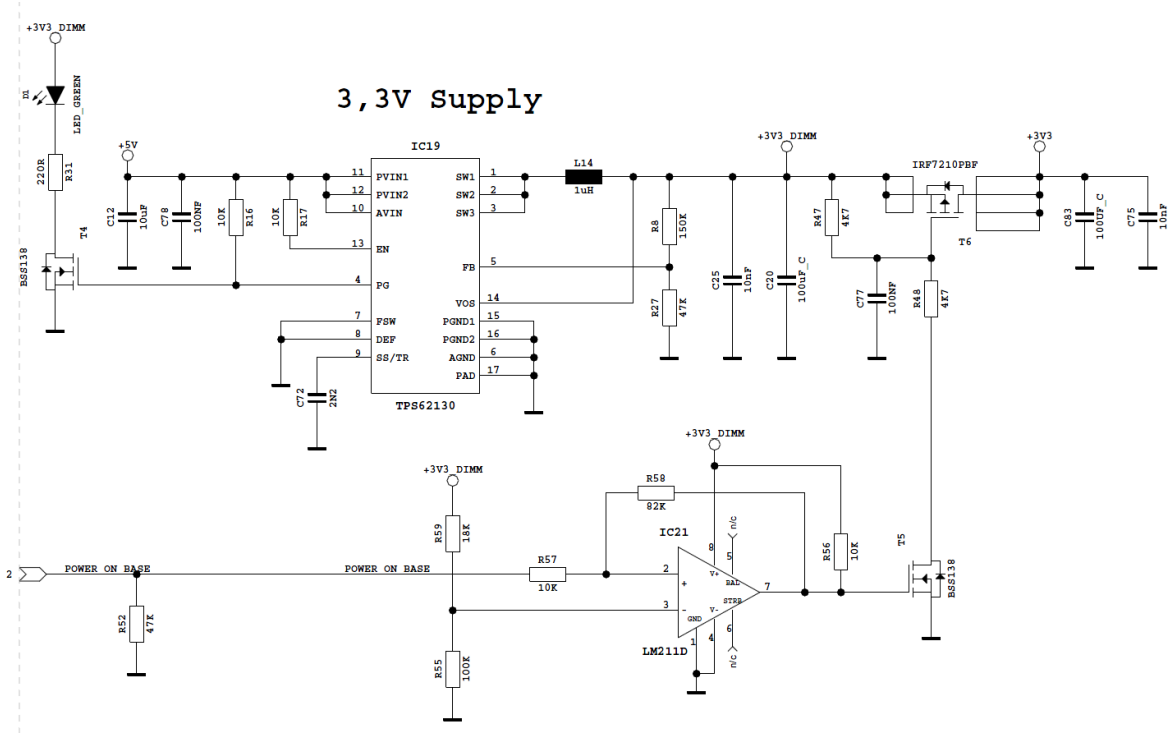
3.3 3V3 supply for peripheral parts on Base board

The use of pin 135 of the SODIMM connector was changed from 3V3 supply to signal POWER_ON_BASE. This was necessary because some newer CPUs demand that during the power on sequence the 3.3 V supply is switched on at the end. If peripheral parts on the Base board are

powered from the beginning a current flow from the I/O pins into unpowered areas of the CPU might cause problems.

The 3.3 V power supply pins at the SODIMM connector are only used to supply the CPU module. The 3.3 V supply of the peripheral parts on the Base board must be separated from it. The signal POWER_ON_BASE is provided to control the separated power supply by the CPU module. A high level switches the supply of the peripherals on the Base board on.

The following circuit shows a possible solution for the 3.3 V supplies:



The 3.3 V supply +3V3_DIMM is connected to the SODIMM connector. The local peripheral supply +3V3 is separated by the P-MOSFET T6 which is driven by the comparator IC21 and the N-MOSFET T5. The comparator is used since the falling slope of the signal POWER_ON_BASE is very slow on some CPU boards. The comparator ensures hard switching at power on and off.

According to the Base boards needs the above circuit around T6 can also be replaced by an integrated high side switch.

3.4 CPU-bus Interface

The characteristics of the CPU-bus interface are CPU board specific. While DIMM-SH7724 even supports DMA transfers DIMM-Am335x does not have a bus interface at all.

More details about the characteristics of the interface can be found in the HW manual of the CPU modules.

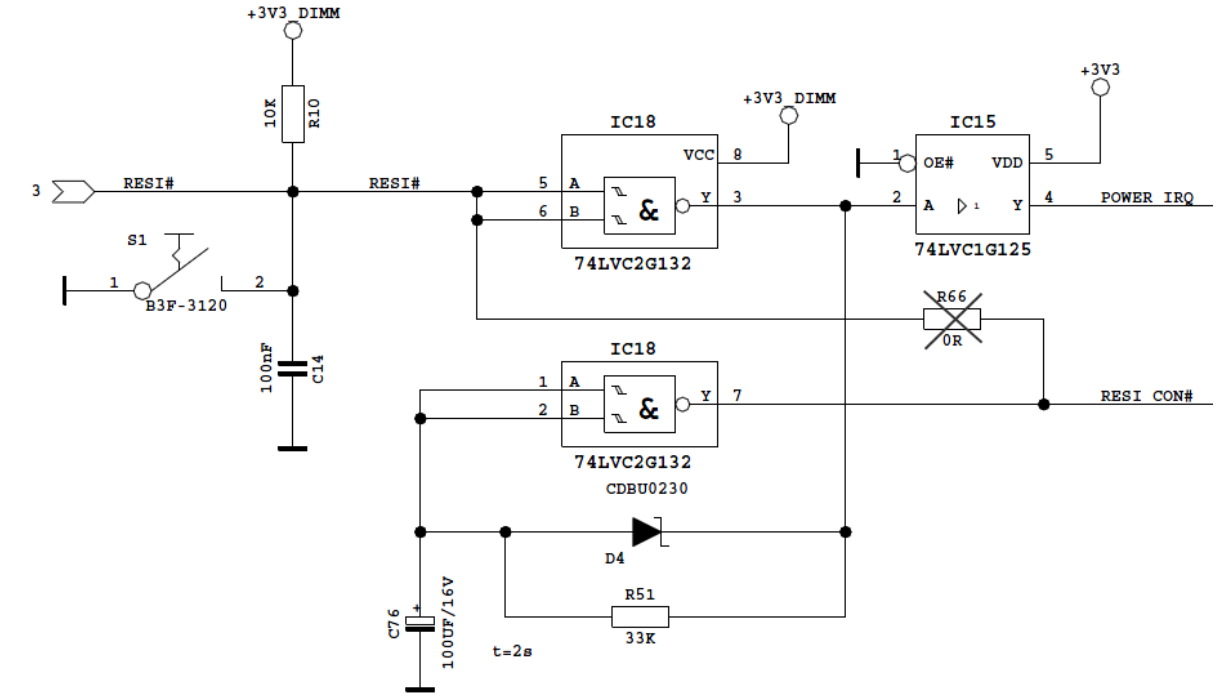
If necessary ask emtrion for further support.

3.5 Power Fail Warning, Reset Delay

Some operating systems, like Android, demand that the CPU closes the file system before it is stopped. Otherwise the system might be corrupted at the next start. Such critical stops can be caused by an unexpected power fail or simply by pressing the reset button during operation.

To avoid system corruptions the CPU should get an early power fail warning or the information that a reset will follow within a short time.

An example how a reset warning can be realized is shown in the following circuit:



In this circuit the signal POWER_IRQ is driven high immediately if the reset button S1 is pressed or the signal RESI# becomes low. If R66 is not fit the rising edge of POWER_IRQ is delayed by the circuit comprised of R51, C76 and D4 and causes an active low reset signal RESI_CON# some time later. The delay between POWER_IRQ and RESI_CON# becoming active can be used by the software to close the necessary tasks.

The above circuit is realized on the Base board DIMM-Eco-Base Verno. The values of R51 and C76 must be adapted to the software demands. The signal POWER_IRQ is connected to IRQB of the SODIMM connector.

Watch that the reset button must be pressed as long as given delay time before a reset happens.

3.6 Extension connectors

Some CPUs are rich of interfaces that are not provided at the SODIMM connector. Within these are 2nd camera interface, LVDS display output, SATA interface and others.

To give access to these additional interfaces two extension were added. The pin usage if described in the following chapter.

3.7 Mechanical Characteristics

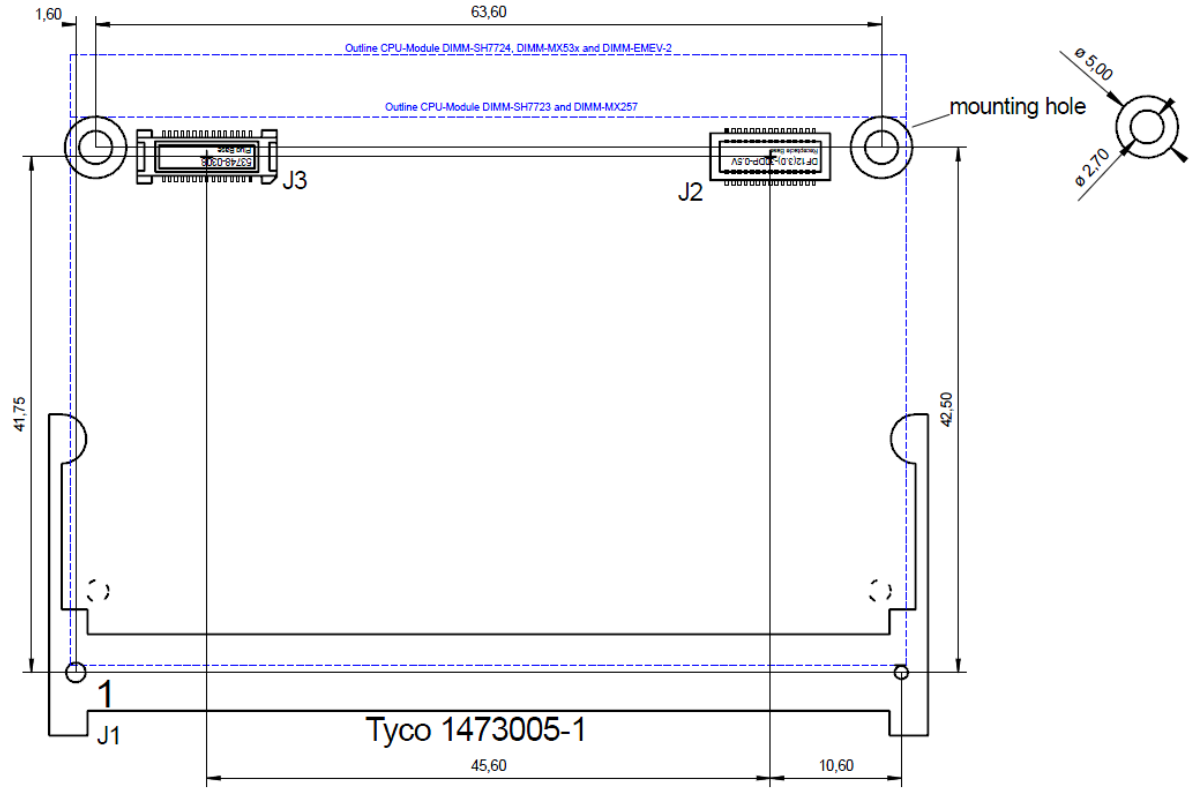
Some of the CPU modules have one or two extension connectors which incorporate additional interfaces that are not available at the SODIMM connector. These modules are wider than the other modules.

The Base board should provide enough space if various CPU modules shall be supported. The following table shows the dimensions of the CPU modules:

CPU module	Dimensions	Mounting Hole Diameter
DIMM-SH7723	67,6mm x 45mm	2.8 mm
DIMM-SH7724	67,6mm x 50mm	2.8 mm
DIMM-MX257	67,6mm x 45mm	2.5 mm
DIMM-MX53x	67,6mm x 50mm	2.8 mm
DIMM-MX6	67,6mm x 50mm	2.8 mm
DIMM-EMEV2	67,6mm x 50mm	2.8 mm
DIMM-Am335x	67,6mm x 45mm	2.2 mm
DIMM-RZ	67,6mm x 45mm	2.8 mm

Watch that even if the interfaces at the extension connectors shall not be used on a Base board no other parts should be located at the position of the connectors. Otherwise if the CPU board is changed later its extension connectors might conflict with the parts.

The following drawing shows the mechanical position of the extension connectors on the baseboard.



Watch: This drawing is only valid when the specified connector types are used!!

The complete drawing can be found on the emtrion support homepage:

http://www.support.emtrion.de/doku.php?id=hw:baseboards_hicodimm

4 Pin Assignments

4.1 SODIMM connector

Type 200 pin SODIMM socket, 0.6 mm Pitch, 2,5V keying

Pin	Signal	Interface		Signal	Pin
1	SPEED_LED#	Ethernet	USB Host	USBH_PEN#	2
3	ETH_TDP			USBH_OC#	4
5	ETH_TDM			USBH_DM	6
7	GND			USBH_DP	8
9	ETH_RDP		USB Device	USBF_VBUS	10
11	ETH_RDM			USBF_DM	12

13	LINK_LED#			USBF_DP	**14**
15	USBH_VBUS	**USB Host**	**Power**	GND	**16**
17	CAN_TX	**CAN**	**UART-A**	UART-A_TXD#	**18**
19	CAN_RX			UART-A_RXD#	**20**
21	UART-E_TXD	**UART-E**		UART-A_RTS#	**22**
23	UART-E _RXD			UART-A_CTS#	**24**
25	UART-D_TXD	**UART-D**	**Touch**	Touch_XP	**26**
27	UART-D_RXD			Touch_XM	**28**
29	UART-C_TXD	**UART-C**		Touch_YP	**30**
31	UART-C_RXD			Touch_YM	**32**
33	UART-B_TXD	**UART-B**	**A/D**	ANA1	**34**
35	UART-B_RXD			ANA2	**36**
37	ANA4	**A/D**		ANA3	**38**
39	+3V3	**Power**		GND	**40**
41	LCD_D22	**LCD**		LCD_D23	**42**
43	LCD_D20			LCD_D21	**44**
45	LCD_D18			LCD_D19	**46**
47	LCD_D16			LCD_D17	**48**
49	LCD_D14			LCD_D15	**50**
51	LCD_D12			LCD_D13	**52**
53	LCD_D10			LCD_D11	**54**
55	LCD_D8			LCD_D9	**56**
57	LCD_D6			LCD_D7	**58**
59	LCD_D4			LCD_D5	**60**
61	LCD_D2			LCD_D3	**62**
63	LCD_D0			LCD_D1	**64**
65	+3V3	**Power**		GND	**66**
67	LCDRD#	**LCD**		LCD_LCLK	**68**
69	LCD_DISP			LCD_DCK	**70**
71	LCD_HSYN			LCD_DON	**72**
73	LCD_VSYN			LCD_VCPWC	**74**

75	VOU_DEST			LCD_VEPWC	**76**
77	VOU_RST#	**VIO0, VOU**		VIO0_D7	**78**
79	VIO0_FLD			VIO0_D6	**80**
81	VIO_CKO			VIO0_D5	**82**
83	VIO0_CLK			VIO0_D4	**84**
85	VIO0_HD			VIO0_D3	**86**
87	VIO0_VD			VIO0_D2	**88**
89	VIO_SRC			VIO0_D1	**90**
91	VIO_RST#			VIO0_D0	**92**
93	+3V3	**Power**		GND	**94**
95	SDC2_D0	**SDC2**	**SDC1**	SDC1_D0	**96**
97	SDC2_D1			SDC1_D1	**98**
99	SDC2_D2			SDC1_D2	**100**
101	SDC2_D3			SDC1_D3	**102**
103	SDC2_CMD			SDC1_CMD	**104**
105	SDC2_CLK			SDC1_CLK	**106**
107	SDC2_CD#			SDC1_CD#	**108**
109	SDC2_WP#			SDC1_WP#	**110**
111	SPI_SS#	**SPI**		SPI_MISO	**112**
113	SPI_SCK			SPI_MOSI	**114**
115	SCL	**I2C**	**Audio**	AUDIO_BCK	**116**
117	SDA			AUDIO_LRC	**118**
119	SPDI	**SPDIF**		AUDIO_DATI	**120**
121	SPDO			AUDIO_DATO	**122**
123	GND	**Power**		AUDIO_MCLK	**124**
125	GPIO8	**GPIO**		GPIO9	**126**
127	GPIO6			GPIO7	**128**
129	GPIO4			GPIO5	**130**
131	GPIO2			GPIO3	**132**
133	GPIO0			GPIO1	**134**
135	POWER_ON_BASE	**Power**		GND	**136**
137	A22	**Address A[23:0]**		A23	**138**

139	A20			A21	**140**
141	A18			A19	**142**
143	A16			A17	**144**
145	A14			A15	**146**
147	A12			A13	**148**
149	A10			A11	**150**
151	A8			A9	**152**
153	A6			A7	**154**
155	A4			A5	**156**
157	A2			A3	**158**
159	A0			A1	**160**
161	+3V3	**Power**		GND	**162**
163	D14	**Data D[15:0]**		D15	**164**
165	D12			D13	**166**
167	D10			D11	**168**
169	D8			D9	**170**
171	D6			D7	**172**
173	D4			D5	**174**
175	D2			D3	**176**
177	D0			D1	**178**
179	CKIO	**Bus Control**		DREQ	**180**
181	BS#			DACK	**182**
183	RD#			IRQ_A	**184**
185	RD/WR#			IRQ_B	**186**
187	WE0#			NMI	**188**
189	WE1#			RESO#	**190**
191	ICIORD#			RESI#	**192**
193	ICIOWR#			CE1B#	**194**
195	WAIT#			CE2B#	**196**
197	CS#			IOIS16#	**198**
199	BAT	**Power**		GND	**200**

4.2 SODIMM Extension Connector 1

Type: 30-pin Header on Base: Hirose DF12(3.0)-30DP-0.5V
30-pin Receptacle on CPU module: Hirose DF12(3.0)-30DS-0.5V

Pin	Signal	Pin	Signal
1	GND	2	+3.3 V
3	VOU_D7	4	VIO1_D7
5	VOU_D6	6	VIO1_D6
7	VOU_D5	8	VIO1_D5
9	VOU_D4	10	VIO1_D4
11	VOU_D3	12	VIO1_D3
13	VOU_D2	14	VIO1_D2
15	VOU_D1	16	VIO1_D1
17	VOU_D0	18	VIO1_D0
19	GND	20	GND
21	VOU_CLKI	22	VIO1_CLK
23	VOU_CLK	24	VIO1_FLD
25	VOU_VSYNC	26	VIO1_VD
27	VOU_HSYNC	28	VIO1_HD
29	GND	30	+3.3 V

4.3 SODIMM Extension Connector 2

Type 30-pin Header on Base: Molex 537480308
30-pin Receptacle on CPU module: Molex 529910308

Pin	Signal	Pin	Signal
1	SATA_RXN	2	LVDS_TX2_N
3	SATA_RXP	4	LVDS_TX2_P
5	SATA_TXP	6	LVDS_TX0_N
7	SATA_TXN	8	LVDS_TX0_P

9	GND	**10**	GND
11	KPP_ROW1/HDMI_D2_P	**10**	LVDS_TX1_N
13	KPP_COL1/HDMI_D2_N	**10**	LVDS_TX1_P
15	KPP_ROW0/HDMI_D1_P/PCIE_RXP	**10**	GND
17	KPP_COL0/HDMI_D1_N/PCIE_RXM	**18**	LVDS_CLK_N
19	KPP_ROW2/HDMI_D0_P/PCIE_TXM	**20**	LVDS_CLK_P
21	KPP_ROW3/HDMI_D0_N/PCIE_TXP	**22**	GND
23	KPP_COL3/HDMI_CLK_P/PCIE_CLK1_P	**24**	LVDS_TX3_N
25	KPP_COL2/HDMI_CLK_N/PCIE_CLK1_N	**26**	LVDS_TX3_P
27	HDMI_SCL	**28**	GND
29	HDMI_SDA	**30**	HDMI_HPD

5 References

[1] DDR1 & DDR2 SODIMM Socket 0.6 mm Pitch 200 Pos Standard Profile
Standard Type
Tyco Electronics
Part Number: 1473005-1