User Manual

ROM-5721

RISC-based SMARC 2.0/2.1 Module with NXP i.MX8 ARM® Cortex™ A53 Processor

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.

2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.

3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.

4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.

5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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Declaration of Conformity

FCC Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- 1 ROM-5721
- 4 Screws for ROM-5721

Optional Accessories

Part No.	Description
96PSA-A36W12R1	Power Adapter 100-240V 36W 12V
1700001524	Power cord 3P UL 180cm
170203183C	Power Code 3P EU 183cm
170203180A	Power Cord 3P UK 183cm
1700008921	Power Cord 3P PSE 183cm
1701100300	D-SUB 9P(M) 30cm for COM Port
1700019474	A cable D-SUB 9P for RS232/RS485
9696MEG510E	Audio daughter board
9680015491	PCIe to miniPCIe adapter card

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Development Board

Part No.	Description
ROM-DB5901	Development carrier board for SMARC 2.0 module

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Ordering Information

Model Number Description

■ **Commercial grade**

Part No.	ROM-5721CQ-REA1E	ROM-5721CD-RDA1E
CPU	i.MX8M Mini Quad	i.MX8M Mini Dual
Memory	2GB LPDDR4	1GB LPDDR4
eMMC	16GB eMMC	8GB eMMC
MIPI DSI	(Option)	1
HDMI	(Option)	(Option)
LVDS	1	(Option)
PCIe	1	1
USB Host	5	5
USB OTG	1	1
I2S	2	2
GPIO	12	12
Serial	4	4
CAN	1	1
I2C	4	4
SDIO	1	1
Operation temperature	0~60°C	0~60°C

iV

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equip-ment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
    - The power cord or plug is damaged.
    - Liquid has penetrated into the equipment.
    - The equipment has been exposed to moisture.
    - The equipment does not work well, or you cannot get it to work according to the user's manual.
    - The equipment has been dropped and damaged.
    - The equipment has obvious signs of breakage.

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive elec- tronic components.

Contents

ROM-5721 User Manual

Chapter 1

Product Overview

This chapter briefly introduces the ROM-5721 platform.

Sections include:

■ Introduction

■ Specification

1.1 Introduction

Advantech ROM-5721 SMARC 2.0/2.1 Computer-on-Module is powered by NXP i.MX8M Mini SOC which includes up to 4 Arm Cortex-A53 cores in combination with one Cortex-M4 real time processor and Vivante GC320 , GC NanoUltra 3D graphics engine. It provides USB2.0, Gigabit Ethernet, MIPI-CSI, PCI Express, Dual channel LVDS shared with MIPI-DSI for embedded applications

ROM-5721 is paired with Advantech ROM-DB5901 carrier board for faster end product peripheral integration and time-to-market. The reference schematics and layout checklists documentations for carrier board development will be provided along with the open-sourced Linux BSP, test utilities, hardware design utilities and reference drive

- HMI (Human Machine Interface)
- Industrial controller
- IoT gateway engine
- Medical Application

The main features of ROM-5721 as following

- NXP i.MX 8M Mini processor with up to 4 Arm Cortex A53 cores
- 1 x Arm Cortex-M4 cores
- Onboard 2GB LPDDR4 memory and eMMC 8GB
- 1 x Dual channel LVDS; 1 x 4 lane MIPI-CSI
- 4 x USB2.0, 1 x USB 2.0 OTG, 4 x UART, 4 x I2C, 12 x GPIO, 1 x PCIe2.0, 1x Gigabit LAN
- Support OpenGL ES 2.0/1.1 by hardware accelerators
- Low power consumption design
- Support Linux, Ubuntu and Android BSP

1.2 **Product Features**

Compatible Module		SMARC 2.1
Processor System	CPU	NXP ARM Cortex-A53 i.MX8M mini 1.8GHz
Memory	Technology	LPDDR4 1866
	Capacity	On-board 2GB/1GB
	Flash	8/ GB eMMC
Graphic	Graphics Engine	Vivante GC320, GC NanoUltra 3D GPU
	H/W Video Codec	Decoder:, H.265, H.264, VP8/9 1080p Encoder: H.264, VP8 1080p
	HDMI	-
	Display	1 dual channel 24bits LVDS or 1 x 4-lane MIPI-DSI or 1 Display Port up to 1080P
Ethernet	Chipset	NXP i.MX8M mini integrated RGMII
	Speed	1 10/100/1000 Mbps,
Watch Dog Timer		Yes
I/O	PCIe	PCIe x 1
	SATA	-
	USB	4 USB 2.0, 1 USB2.0 OTG
	Audio	I2S
	SDIO	1
	Serial Port	4
	CAN	-
	GPIO	12
	I2C	4 I2C
	-	-
O.S		Linux & Android
Power	Supply Voltage	+5 V
Environment	Operation	0 ~ 60° -40~85 C
	Operating Humidity	5% ~ 95% relative humidity, non-condensing
Physical Characteristics	Dimensions (WxD)	82 x 55 mm
Camera Input	MIPI CSI	1 MIPI-CSI 4 Lane

1.3 Mechanical Specifications

- **Dimensions:** SMARC 2.1 form factor size, 82mm (W) x 50 mm(D)
- **Height on Top:** Under 3.0 mm base on SPEC definition (without heatsink)
- **Height on Bottom:** Under 1.3 mm base on SPEC definition

1.4 Electrical Specifications

- **Power supply Voltage:**
  - Voltage requirements: +5 V
- **Power supply Current:**

Model	Kernel idle	Maximum mode
ROM-5721	0.841W	2.173W

Test Condition:

1. Test temperature: room temperature
2. Test voltage: rated voltage AC 110V/60Hz
3. Test loading:
   3.1 Maximum load mode: Running programs.
   3.2 Idle mode: DUT power management off and no running any program.
4. OS: Linux
5. Test software: cd ../tools/ ./power_run

1.5 Environmental Specifications

- **Operating temperature:** 0 ~ 60° C / -40 ~85° C
  The operating temperature refers to the environmental temperature for the model.
- **Operating Humidity:** 5% ~ 95% relative humidity, non-condensing
- **Storage temperature:** -40~85° C
- **Storage Humidity:**
  - Relative humidity: 95% @ 60° C

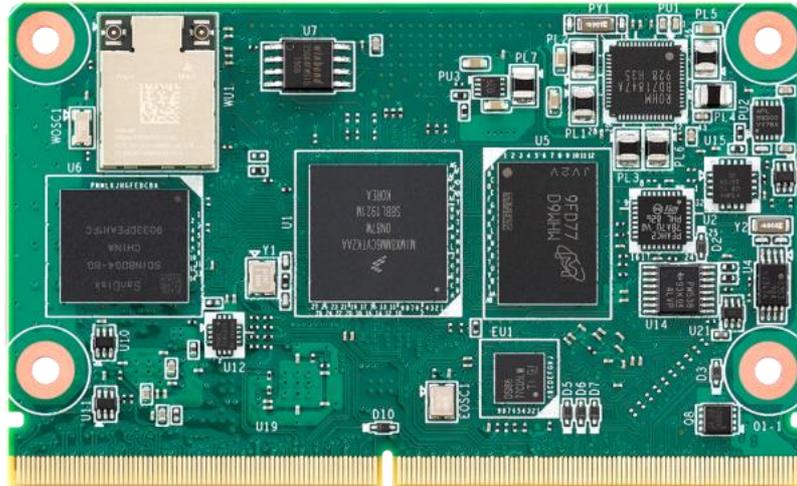# Chapter 2

H/W Installation

This chapter gives mechanical and connector information on the ROM-5721 Computer on Module.

Sections include:
- Connector Information
- Mechanical Drawing

2.1 Board Connectors

The board has four connectors that allow you to configure your system to your appli- cation.

2.2 Pin Out

P-Pin	SMARC 2.0	i.MX8M mini Quad
P1	SMB_ALERT_1V8#	SMB_ALERT_1V8#
P2	GND	
P3	CSI1_CK+	MIPI_CSI_CLKP
P4	CSI1_CK-	MIPI_CSI_CLKN
P5	GBE1_SDP	NA
P6	GBE0_SDP	NA
P7	CSI1_RX0+	MIPI_CSI_D0P
P8	CSI1_RX0-	MIPI_CSI_D0N
P9	GND	
P10	CSI1_RX1+	MIPI_CSI_D1P
P11	CSI1_RX1-	MIPI_CSI_D1N
P12	GND	
P13	CSI1_RX2+	MIPI_CSI_D2P
P14	CSI1_RX2-	MIPI_CSI_D2N
P15	GND	
P16	CSI1_RX3+	MIPI_CSI_D3P
P17	CSI1_RX3-	MIPI_CSI_D3N
P18	GND	
P19	GBE0_MDI3-	GBE0_MDI3-
P20	GBE0_MDI3+	GBE0_MDI3+
P21	GBE0_LINK100#	GBE0_LINK100#
P22	GBE0_LINK1000#	GBE0_LINK1000#
P23	GBE0_MDI2-	GBE0_MDI2-
P24	GBE0_MDI2+	GBE0_MDI2+
P25	GBE0_LINK_ACT#	GBE0_LINK_ACT#
P26	GBE0_MDI1-	GBE0_MDI1-
P27	GBE0_MDI1+	GBE0_MDI1+
P28	GBE0_CTREF	NA
P29	GBE0_MDI0-	GBE0_MDI0-

P30	GBE0_MDI0+	GBE0_MDI0+
P31	SPI0_CS1#	ECSPI2_SS1#
P32	GND	
P33	SDIO_WP	SD2_WP
P34	SDIO_CMD	SD2_CMD
P35	SDIO_CD#	SD2_CD#
P36	SDIO_CK	SD2_CLK
P37	SDIO_PWR_EN	SD2_PWR_EN
P38	GND	
P39	SDIO_D0	SD2_DATA0
P40	SDIO_D1	SD2_DATA1
P41	SDIO_D2	SD2_DATA2
P42	SDIO_D3	SD2_DATA3
P43	SPI0_CS0#	ECSPI2_SS0#
P44	SPI0_CK	ECSPI2_SCLK
P45	SPI0_DIN	ECSPI2_MISO
P46	SPI0_DO	ECSPI2_MOSI
P47	GND	
P48	SATA_TX+	NA
P49	SATA_TX-	NA
P50	GND	
P51	SATA_RX+	NA
P52	SATA_RX-	NA
P53	GND	
P54	ESPI_CS0#	ECSPI3_SS0#
P55	ESPI_CS1#	ECSPI3_SS1#
P56	ESPI_CK	ECSPI3_SCLK
P57	ESPI_IO_0	ECSPI3_MOSI
P58	ESPI_IO_1	ECSPI3_MISO
P59	GND	
P60	USB0+	USB1_OTG_DP
P61	USB0-	USB1_OTG_DN
P62	USB0_EN_OC#	USB1_OTG_EN_OC#
P63	USB0_VBUS_DET	USB1_OTG_DET
P64	USB0_OTG_ID	USB1_OTG_ID
P65	USB1+	USBDN3_DP
P66	USB1-	USBDN3_DM
P67	USB1_EN_OC#	USB3_EN_OC#
P68	GND	
P69	USB2+	USBDN2_DP
P70	USB2-	USBDN2_DM
P71	USB2_EN_OC#	USB2_EN_OC#
P72	RSVD	NA
P73	RSVD	NA
P74	USB3_EN_OC#	USB1_EN_OC#
<Key>	<Key>	
P75	PCIE_A_RST#	PCIE_A_RST#
P76	USB4_EN_OC#	USB4_EN_OC#
P77	RSVD	NA
P78	RSVD	NA
P79	GND	
P80	PCIE_C_REFCK+	NA
P81	PCIE_C_REFCK-	NA
P82	GND	
P83	PCIE_A_REFCK+	PCIE_A_REFCK_P
P84	PCIE_A_REFCK-	PCIE_A_REFCK_N
P85	GND	
P86	PCIE_A_RX+	PCIE_RXN_P
P87	PCIE_A_RX-	PCIE_RXN_N
P88	GND	
P89	PCIE_A_TX+	PCIE_TXN_P
P90	PCIE_A_TX-	PCIE_TXN_N
P91	GND	
P92	HDMI_D2+ / DP1_LANE0+	NA
P93	HDMI_D2- / DP1_LANE0-	NA
P94	GND	
P95	HDMI_D1+ / DP1_LANE1+	NA
P96	HDMI_D1- / DP1_LANE1-	NA
P97	GND	

P98	HDMI_D0+ / DP1_LANE2+	NA
P99	HDMI_D0- / DP1_LANE2-	NA
P100	GND	
P101	HDMI_CK+ / DP1_LANE3+	NA
P102	HDMI_CK- / DP1_LANE3-	NA
P103	GND	
P104	HDMI_HPD / DP1_HPD	NA
P105	HDMI_CTRL_CK / DP1_AUX+	NA
P106	HDMI_CTRL_DAT / DP1_AUX-	NA
P107	DP1_AUX_SEL	NA
P108	GPIO0 / CAM0_PWR#	GPIO0
P109	GPIO1 / CAM1_PWR#	CAM1_PWR#
P110	GPIO2 / CAM0_RST#	GPIO2
P111	GPIO3 / CAM1_RST#	CAM1_RST#
P112	GPIO4 / HDA_RST#	GPIO4
P113	GPIO5 / PWM_OUT	GPIO5
P114	GPIO6 / TACHIN	GPIO6
P115	GPIO7	GPIO7
P116	GPIO8	GPIO8
P117	GPIO9	GPIO9
P118	GPIO10	GPIO10
P119	GPIO11	GPIO11
P120	GND	
P121	I2C_PM_CK	I2C_PM_SCL
P122	I2C_PM_DAT	I2C_PM_SDA
P123	BOOT_SEL0#	BOOT_SEL0#
P124	BOOT_SEL1#	BOOT_SEL1#
P125	BOOT_SEL2#	BOOT_SEL2#
P126	RESET_OUT#	RESET_OUT#
P127	RESET_IN#	RESET_IN#
P128	POWER_BTN#	POWER_BTN#
P129	SER0_TX	UART3_TX
P130	SER0_RX	UART3_RX
P131	SER0_RTS#	UART3_RTS#
P132	SER0_CTS#	UART3_CTS#
P133	GND	
P134	SER1_TX	UART4_TX
P135	SER1_RX	UART4_RX
P136	SER2_TX	UART1_TX
P137	SER2_RX	UART1_RX
P138	SER2_RTS#	UART1_RTS#
P139	SER2_CTS#	UART1_CTS#
P140	SER3_TX	UART2_TX
P141	SER3_RX	UART2_RX
P142	GND	
P143	CAN0_TX	NA
P144	CAN0_RX	NA
P145	CAN1_TX	NA
P146	CAN1_RX	NA
P147	VDD_IN	+VDD_IN_MXM
P148	VDD_IN	+VDD_IN_MXM
P149	VDD_IN	+VDD_IN_MXM
P150	VDD_IN	+VDD_IN_MXM
P151	VDD_IN	+VDD_IN_MXM
P152	VDD_IN	+VDD_IN_MXM
P153	VDD_IN	+VDD_IN_MXM
P154	VDD_IN	+VDD_IN_MXM
P155	VDD_IN	+VDD_IN_MXM
P156	VDD_IN	+VDD_IN_MXM

S-Pin	SMARC 2.0	i.MX8M mini Quad
S1	CSI1_TX+/I2C_CAM1_CK	I2C_CAM_SCL
S2	CSI1_TX-/I2C_CAM1_DAT	I2C_CAM_SDA
S3	GND	
S4	RSVD	NA
S5	CSI0_TX-/I2C_CAM0_CK	NA
S6	CAM_MCK	CAM_MCLK
S7	CSI0_TX+/I2C_CAM0_DAT	NA
S8	CSI0_CK+	NA

S9	CSI0_CK-	NA
S10	GND	
S11	CSI0_RX0+	NA
S12	CSI0_RX0-	NA
S13	GND	
S14	CSI0_RX1+	NA
S15	CSI0_RX1-	NA
S16	GND	
S17	GBE1_MDI0+	NA
S18	GBE1_MDI0-	NA
S19	GBE1_LINK100#	NA
S20	GBE1_MDI1+	NA
S21	GBE1_MDI1-	NA
S22	GBE1_LINK1000#	NA
S23	GBE1_MDI2+	NA
S24	GBE1_MDI2-	NA
S25	GND	
S26	GBE1_MDI3+	NA
S27	GBE1_MDI3-	NA
S28	GBE1_CTREF	NA
S29	PCIE_D_TX+	NA
S30	PCIE_D_TX-	NA
S31	GBE1_LINK_ACT#	NA
S32	PCIE_D_RX+	NA
S33	PCIE_D_RX-	NA
S34	GND	
S35	USB4+	USBDN4_DP
S36	USB4-	USBDN4_DM
S37	USB3_VBUS_DET	NA
S38	AUDIO_MCK	SAI1_MCLK
S39	I2S0_LRCK	SAI1_LRCK
S40	I2S0_SDOUT	SAI1_SDOUT
S41	I2S0_SDIN	SAI1_SDIN
S42	I2S0_CK	SAI1_CK
S43	ESPI_ALERT0#	NA
S44	ESPI_ALERT1#	NA
S45	RSVD	NA
S46	RSVD	NA
S47	GND	
S48	I2C_GP_CK	I2C4_SCL
S49	I2C_GP_DAT	I2C4_SDA
S50	HDA_SYNC / I2S2_LRCK	SAI6_LRCK
S51	HDA_SDO / I2S2_SDOUT	SAI6_SDOUT
S52	HDA_SDI / I2S2_SDIN	SAI6_SDIN
S53	HDA_CK / I2S2_CK	SAI6_CK
S54	SATA_ACT#	NA
S55	USB5_EN_OC#	NA
S56	ESPI_IO_2	NA
S57	ESPI_IO_3	NA
S58	ESPI_RESET#	NA
S59	USB5+	NA
S60	USB5-	NA
S61	GND	
S62	USB3_SSTX+	NA
S63	USB3_SSTX-	NA
S64	GND	
S65	USB3_SSRX+	NA
S66	USB3_SSRX-	NA
S67	GND	
S68	USB3+	USBDN1_DP
S69	USB3-	USBDN1_DM
S70	GND	
S71	USB2_SSTX+	NA
S72	USB2_SSTX-	NA
S73	GND	
S74	USB2_SSRX+	NA
S75	USB2_SSRX-	NA
<Key>	<Key>	
S76	PCIE_B_RST#	NA
S77	PCIE_C_RST#	NA
S78	PCIE_C_RX+	NA
S79	PCIE_C_RX-	NA
S80	GND	
S81	PCIE_C_TX+	NA
S82	PCIE_C_TX-	NA
S83	GND	

S84	PCIE_B_REFCK+	NA
S85	PCIE_B_REFCK-	NA
S86	GND	
S87	PCIE_B_RX+	NA
S88	PCIE_B_RX-	NA
S89	GND	
S90	PCIE_B_TX+	NA
S91	PCIE_B_TX-	NA
S92	GND	
S93	DP0_LANE0+	DP0_LANE0P (SELECT)
S94	DP0_LANE0-	DP0_LANE0N (SELECT)
S95	DP0_AUX_SEL	NA
S96	DP0_LANE1+	DP0_LANE1P (SELECT)
S97	DP0_LANE1-	DP0_LANE1N (SELECT)
S98	DP0_HPD	DP0_HPD
S99	DP0_LANE2+	DP0_LANE2P (SELECT)
S100	DP0_LANE2-	DP0_LANE2N (SELECT)
S101	GND	
S102	DP0_LANE3+	DP0_LANE3P (SELECT)
S103	DP0_LANE3-	DP0_LANE3N (SELECT)
S104	USB3_OTG_ID	NA
S105	DP0_AUX+	DP0_AUXP (SELECT)
S106	DP0_AUX-	DP0_AUXN (SELECT)
S107	LCD1_BKLT_EN	NA
S108	LVDS1_CK+ / eDP1_AUX+ /	LVDS1_CLKP (only dual channel)
S109	LVDS1_CK- / eDP1_AUX- /	LVDS1_CLKN (only dual channel)
S110	GND	
S111	LVDS1_0+ / eDP1_TX0+ / DSI1_D0+	LVDS1_D0P (only dual channel)
S112	LVDS1_0- / eDP1_TX0- / DSI1_D0-	LVDS1_D0N (only dual channel)
S113	eDP1_HPD	NA
S114	LVDS1_1+ / eDP1_TX1+ / DSI1_D1+	LVDS1_D1P (only dual channel)
S115	LVDS1_1- / eDP1_TX1- / DSI1_D1-	LVDS1_D1N (only dual channel)
S116	LCD1_VDD_EN	NA
S117	LVDS1_2+ / eDP1_TX2+ / DSI1_D2+	LVDS1_D2P (only dual channel)
S118	LVDS1_2- / eDP1_TX2- / DSI1_D2-	LVDS1_D2N (only dual channel)
S119	GND	
S120	LVDS1_3+ / eDP1_TX3+ / DSI1_D3+	LVDS1_D3P (only dual channel)
S121	LVDS1_3- / eDP1_TX3- / DSI1_D3-	LVDS1_D3N (only dual channel)
S122	LCD1_BKLT_PWM	NA
S123	RSVD	NA
S124	GND	
S125	LVDS0_0+ / eDP0_TX0+ / DSI0_D0+	LVDS0_D0P / MIPI_DSI_D0P
S126	LVDS0_0- / eDP0_TX0- / DSI0_D0-	LVDS0_D0N / MIPI_DSI_D0N
S127	LCD0_BKLT_EN	LCD0_BKLT_EN
S128	LVDS0_1+ / eDP0_TX1+ / DSI0_D1+	LVDS0_D1P / MIPI_DSI_D1P
S129	LVDS0_1- / eDP0_TX1- / DSI0_D1-	LVDS0_D1N / MIPI_DSI_D1N
S130	GND	
S131	LVDS0_2+ / eDP0_TX2+ / DSI0_D2+	LVDS0_D2P / MIPI_DSI_D2P
S132	LVDS0_2- / eDP0_TX2- / DSI0_D2-	LVDS0_D2N / MIPI_DSI_D2N
S133	LCD0_VDD_EN	LCD0_VDD_EN
S134	LVDS0_CK+ / eDP0_AUX+ /	LVDS0_CLKP / MIPI_DSI_CLKP
S135	LVDS0_CK- / eDP0_AUX- /	LVDS0_CLKN / MIPI_DSI_CLKN
S136	GND	
S137	LVDS0_3+ / eDP0_TX3+ / DSI0_D3+	LVDS0_D3P / MIPI_DSI_D3P
S138	LVDS0_3- / eDP0_TX3- / DSI0_D3-	LVDS0_D3N / MIPI_DSI_D3N
S139	I2C_LCD_CK	I2C_LCD_SCL
S140	I2C_LCD_DAT	I2C_LCD_SDA
S141	LCD0_BKLT_PWM	LCD0_BKLT_PWM
S142	RSVD	NA
S143	GND	
S144	eDP0_HPD	NA
S145	WDT_TIME_OUT#	WDT_TIME_OUT#
S146	PCIE_WAKE#	PCIE_A_WAKE#
S147	VDD_RTC	VDD_RTC
S148	LID#	TBD
S149	SLEEP#	SLEEP#
S150	VIN_PWR_BAD#	VIN_PWR_BAD#
S151	CHARGING#	CHARGING#
S152	CHARGER_PRSNT#	CHARGER_PRSNT#
S153	CARRIER_STBY#	CB_STBY#
S154	CARRIER_PWR_ON	CB_PWR_ON
S155	FORCE_RECOV#	FORCE_RECOV#
S156	BATLOW#	BATLOW#
S157	TEST#	TEST#
S158	GND	

2.2 Board Block Diagram
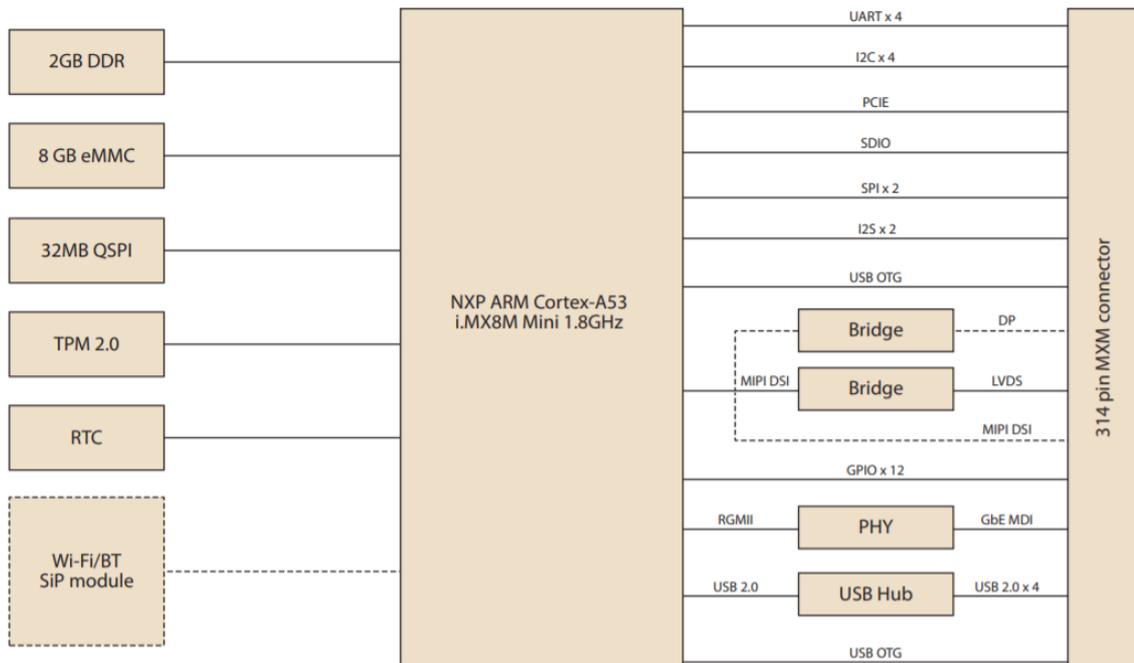
Below is the block diagram of ROM-5721.

Figure 2.1 ROM-5721 Block Diagram

Chapter 3

Software Functionality

This chapter details the software programs on the ROM-5721 platform.

3.1 Test Tools

All test tools must be verified on the ROM-5721 Evaluation kit. Please prepare the required test fixtures before verifying each specified I/O. If you have any problems with testing, please contact your Advantech contact window for help.

3.1.1 Display Test

Login to device:

```
Step 1.  Connect LVDS panel(eg. auo.g070vw01)
Step 2.  Power on
Step 3.  Weston UI will be displayed on the screen.
```

3.1.2   Audio Test

Check audio codec

```
# cat /proc/asound/cards
 0 [sgtl5000    ]: sgtl5000 - sgtl5000
              sgtl5000
```

Audio codec(sgtl5000):
- audio codec module connected to I2S_CN3(ROM-DB5901)
- Set MIC and headphone

```
# amixer set Mic 100%

# amixer set Headphone 100%
```

- Record and playback

```
# arecord -t wav -c 1 -r 44100 -d 5 /tmp/mic.wav

# aplay /tmp/mic.wav
```

3.1.3 PCI-e Test

Test Wifi card(EWM-W163M201E)

```
# killall wpa_supplicant

# ifconfig wlan0 up

# wpa_passphrase "SSID" "PASSWORD" > /tmp/wpa.conf

# wpa_supplicant -BDwext -iwlan0 -c/tmp/wpa.conf

# udhcpc -b -i wlan0
```

Check wlan0 working or not

```
# ifconfig wlan0
# ping 8.8.8.8
```

```
ping 8.8.8.8

PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.

64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=2.10 ms

64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=2.10 ms
```

3.1.4 RS-232 Test

Loopback test (eg. ttymxc0)

Connect loopback test tool

```
#stty -F /dev/ttymxc0 115200

#stty -F /dev/ttymxc0 -echo

#cat /dev/ttymxc0 &

#echo test > /dev/ttymxc0
```

Loopback test (eg. ttymxc0)

Connect loopback test tool

3.1.5 I2C Test

Loopback test (eg. ttymxc0)

I2c set and get

```
root@imx8mmrom5721a1:~# i2cset -f -y 3 0x0a 0 0xff00 w
root@imx8mmrom5721a1:~# i2cget -f -y 3 0x0a 0 w
0x11a0
```

3.1.6 USB Test

Insert a USB disk first.

After insert USB disk…

Test (eg. if usb disk is /dev/sda)

```
# dd if=/dev/urandom of=data bs=1 count=1024
# dd if=/dev/sda of=backup bs=1 count=1024 skip=4096
# dd if=data of=/dev/sda bs=1 seek=4096
# dd if=/dev/sda of=data1 bs=1 count=1024 skip=4096
# diff data data1
# dd if=backup of=/dev/sda bs=1 seek=4096
```

3.1.7 RTC Test

Set system time to current, then write to RTC

Disable rtc sync service (Default:)

```
root@imx8mqrom5720a1:~#  systemctl stop systemd-timesyncd
root@imx8mqrom5720a1:~#  systemctl stop ntpdate.service
```

Set system time to current, then write to RTC

```
root@imx8mqrom5720a1:~# date 021710452016 && hwclock -w && date
Wed Feb 17 10:45:00 UTC 2016
Wed Feb 17 10:45:00 UTC 2016
```

Set one incorrect time, then read time from RTC to verify

```
root@imx8mqrom5720a1:~# date 010100002000 && hwclock -r && date
Sat Jan  1 00:00:00 UTC 2000
Wed Feb 17 10:46:25 2016  0.000000 seconds
Sat Jan  1 00:00:00 UTC 2000
```

Restore the RTC time to system time

```
root@imx8mqrom5720a1:~# hwclock -s && date
Wed Feb 17 10:46:43 UTC 2016
```

3.1.8 Storage Test

Below is the storage system path

```
eMMC:       /dev/mmcblk2
SD:         /dev/mmcblk1
QSPI1:      /dev/mtd0
```

Test (eg. emmc)

```
# dd if=/dev/urandom of=data bs=1 count=1024
# dd if=/dev/mmcblk2 of=backup bs=1 count=1024 skip=4096
# dd if=data of=/dev/mmcblk2 bs=1 seek=4096
# dd if=/dev/mmcblk2 of=data1 bs=1 count=1024 skip=4096
# diff data data1
# dd if=backup of=/dev/mmcblk2 bs=1 seek=4096
```

3.1.9 Ethernet Test

Check Ethernet device

```
root@imx8mmrom5721a1:~# ifconfig
eth0      Link encap:Ethernet  HWaddr 74:fe:48:53:11:3b
          inet addr:172.22.28.5  Bcast:172.22.31.255  Mask:255.255.252.0
          inet6 addr: fe80::76fe:48ff:fe53:113b/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST DYNAMIC  MTU:1500  Metric:1
          RX packets:128950 errors:0 dropped:15186 overruns:0 frame:0
          TX packets:5469 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:14167098 (13.5 MiB)  TX bytes:8981058 (8.5 MiB)

eth0:0    Link encap:Ethernet  HWaddr 74:fe:48:53:11:3b
          inet addr:192.168.0.1  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST DYNAMIC  MTU:1500  Metric:1

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:84731 errors:0 dropped:0 overruns:0 frame:0
          TX packets:84731 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:5764628 (5.4 MiB)  TX bytes:5764628 (5.4 MiB)
```

Connect cable and ping test(eg. eth0)

```
root@imx8mmrom5721a1:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=115 time=3.28 ms
^C
--- 8.8.8.8 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 3.289/3.289/3.289/0.000 ms
```

i

3.1.10 GPIO Test

3.1.10.1 GPIO Pin define:

SMARC Pin #	SMARC Pin NAME	CPU Ball NAME	Kernel GPIO	Default Direction
p108	GPIO0	i2c/7-0073, pca9538 P0	496	in
p110	GPIO2	i2c/7-0073, pca9538 P1	497	In
p112	GPIO4	i2c/7-0073, pca9538 P2	498	In
p113	GPIO5	MX8MM_IOMUXC_SPDIF_EXT_CLK_GPIO5_IO5	133	In
p114	GPIO6	i2c/7-0073, pca9538 P3	499	In
p115	GPIO7	i2c/7-0073, pca9538 P4	500	In
p116	GPIO8	i2c/7-0073, pca9538 P5	501	In
p117	GPIO9	i2c/7-0073, pca9538 P6	502	In
p118	GPIO10	i2c/7-0073, pca9538 P7	503	In
p119	GPIO11	MX8MM_IOMUXC_SPDIF_TX_GPIO5_IO3	131	in

3.1.10.2 GPIO Test method:
Loopback test(take GPIO0 and GPIO2 as an example)

Step 1: Connect GPIO0 and GPIO2 on ROM-DB5901

Step 2: Export GPIO interface

```
root@imx8mmrom5721a1:~# echo 496 > /sys/class/gpio/export
root@imx8mmrom5721a1:~# echo 497 > /sys/class/gpio/export
```

Step 3: Set direction

```
root@imx8mmrom5721a1:~# echo out > /sys/class/gpio/gpio1/direction
root@imx8mmrom5721a1:~# echo in > /sys/class/gpio/gpio2/direction
```

Step 4: Read value and set output value than check

```
root@imx8mmrom5721a1:~# cat /sys/class/gpio/gpio2/value
1
root@imx8mmrom5721a1:~# echo 0 > /sys/class/gpio/gpio1/value
root@imx8mmrom5721a1:~# cat /sys/class/gpio/gpio2/value
0
```

3.1.11 Watchdog Test

After enable watchdog, system will reboot after timeout.

```
root@imx8mmrom5721a1:~# /unit_tests/Watchdog/wdt_driver_test.out 1 2 0

---- Running < /unit_tests/Watchdog/wdt_driver_test.out > test ----

Starting wdt_driver (timeout: 1, sleep: 2, test: ioctl)
Trying to set timeout value=1 seconds
The actual timeout was set to 10 seconds
Now reading back -- The timeout is 10 seconds
```

Chapter 4

System Recovery

This chapter introduces how to recover Linux operating system if it is damaged accidentally.

4.1 How to recovery ROM-5721 system?

This section provides detail procedures of restoring the eMMC image.

If you destroy the onboard flash image by accident, you can recover a system following these steps.

4.1.1 Recovery by SD card

1. Copy 5721A1AIM20LIV90113_iMX8MM_flash_tool.tgz package to your desktop.

2.Insert SD card to PC

3. Make a bootable sd card

```
# tar zxvf 5721A1AIM20LIV90113_iMX8MM_flash_tool.tgz
# cd 5721A1AIM20LIV90113_iMX8MM_flash_tool/mk_inand/
# sudo ./mksd-linux.sh /dev/sdg
```

4. Insert SD card and copy 5721A1AIM20LIV90113_iMX8MM_flash_tool to USB disk

5. Insert USB disk and SD card then Boot from SD

6. Enter usb disk folder, make a bootable emmc

```
# cd /run/media/sda1/
# cd 5721A1AIM20LIV90113_iMX8MM_flash_tool/mk_inand/
# sudo ./mksd-linux.sh /dev/mmcblk0
```

4.1.2 Recovery by UUU tool (USB OTG)

1. Download uuu tool from
(https://github.com/ADVANTECH-Corp/uuu/releases/tag/v20200619)

2. Create a folder with below files
- uuu
- imx-boot-imx8mmrom5721a1-sd.bin-flash_evk
- fsl-image-validation-imx-imx8mmrom5721a1-20200508182440.rootfs.sdcard
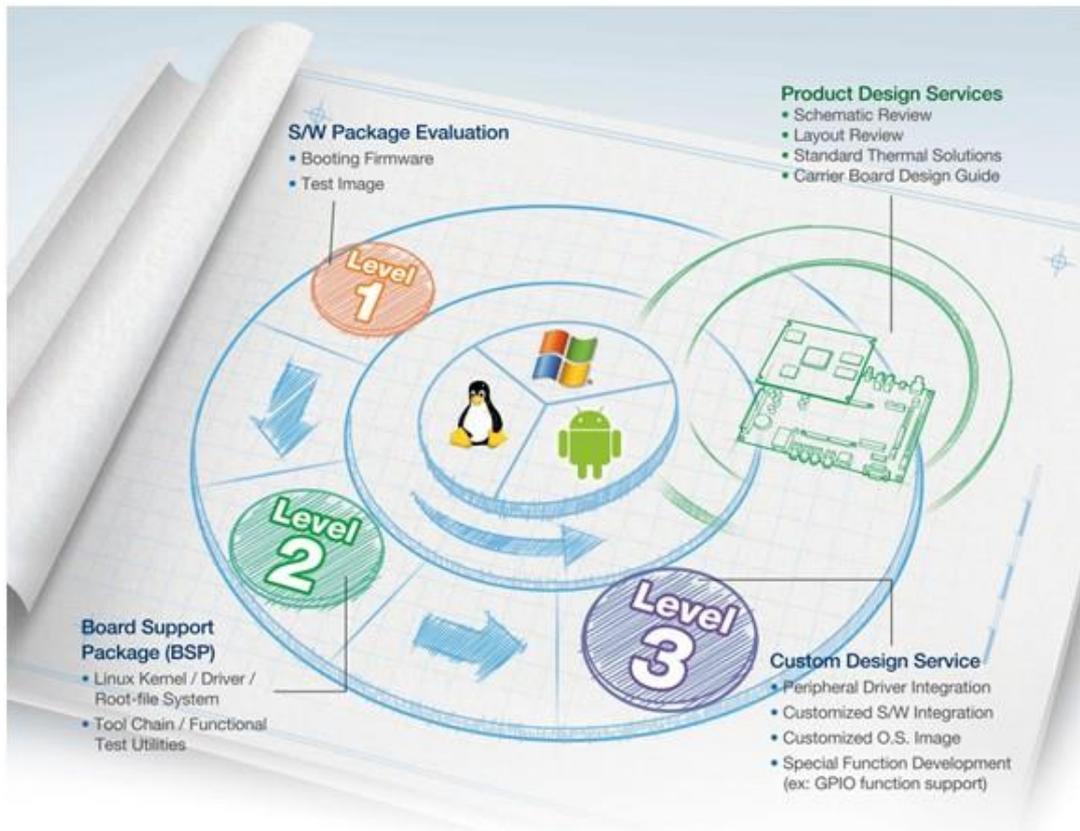
3. Connect USB OTG cable from PC to device

4. Set the correct boot mode, then power on

Chapter 5

Advantech Services

This chapter introduces Advantech design in serviceability, technical support and warranty policy for ROM-5721 evaluation kit.

5.1 Design-in Services

Advantech RISC Design-in Services help customers to reduce the time and work involved with designing new carrier boards. We handle the complexities of technical research and greatly minimize the development risk associated with carrier boards.

Easy Development

Advantech has support firmware, root file-system, BSP or other develop tools for customers. It helps customers to easy develop their carrier board and differentiate their embedded products and applications.

- Full Range of RISC Product Offerings
- Comprehensive Document Support

Design Assistance Service

Advantech provides a check list for engineers to check their schematics and also review service based on customer carrier board schematics. Those services are preventative, and help to catch design errors before they happen. This helps to save a lot of time and cost with regard to development of carrier boards.

- Schematic Review
- Placement and Layout Review
- Debugging Assistance Services
- General/Special Reference Design Database.

Thermal Solution Services

In order to provide quicker and more flexible solutions for customer's thermal designs. Advantech provides a thermal solution service including modularized thermal solutions and customized thermal solutions.

- Standard Thermal Solutions
- Customized Thermal Solutions

Embedded Software Services

Supports driver, software integration or customized firmware, root file-system and

Linux image. Customer can save lot of time and focus on their core development.

- Embedded Linux/ Android OS
- Advantech boot loader Customization

With the spread of industrial computing, a whole range of new applications have been developed, resulting in a fundamental change in the IPC industry. In the past System Integrators (SI) were used to completing projects without outside assistance but now such working models have moved on. Due to diverse market demands and intense competition, cooperation for (both upstream and downstream) vertical integration has become a much more effective way to create competitive advantages. As a result, ARM-based CPU modules were born out of this trend. Concentrating all necessary components on the CPU module and placing other parts on the carrier board in response to market requirements for specialization, provides greater flexibility while retaining its low power consumption credentials.

Advantech has been involved in the industrial computer industry for many years and found that customers usually have the following questions when implementing modular designs.

General I/O design capability

Although customers possess the ability for vertical integration and have enough know-how and core competitiveness in the professional application field, the lack of expertise and experience in general power and I/O design causes many challenges for them, especially integrating CPU modules into their carrier board.

The acquisition of information

Even if the individual client is able to obtain sufficient information to make the right decision for the specialized vertical application, some customers encounter difficult problems dealing with platform design in general and communicating with CPU or chipset manufacturers, thereby increasing carrier board design difficulties and risk as well as seriously impacting on Time-to-market and lost market opportunities.

Software development and modification

Compared to x86 architectures, RISC architectures use simpler instruction sets, therefore the software support for x86 platforms cannot be used on RISC platforms. System integrators need to develop software for their system and do the hardware and software integration themselves. Unlike x86 platforms, RISC platforms have less support for Board Support Packages (BSP) and drivers as well. Even though driver support is provided, SI still have to make a lot of effort to integrate it into the system core. Moreover, the BSP provided by CPU manufacturers are usually for carrier board design, so it's difficult for SI to have an environment for software development.

In view of this, Advantech proposed the concept of Streamlined Design-in Support Services for RISC-based Computer On Modules (COM). With a dedicated professional design-in services team, Advantech actively participates in carrier board design and problem solving. Our services not only enable customers to effectively distribute their resources but also reduce R&D manpower cost and hardware investment.

By virtue of a close interactive relationship with leading original manufacturers of CPUs and chipsets such as ARM, TI and NXP, Advantech helps solve communication and technical support difficulties, and that can reduce the uncertainties of product development too. Advantech's professional software team also focuses on providing a complete Board Support Package and assists customers to build up a software development environment for their RISC platforms.

Advantech RISC design-in services helps customers overcome their problems to achieve the most important goal of faster time to market through a streamlined RISC Design-in services.

Along with our multi-stage development process which includes: planning, design, integration, and validation, Advantech's RISC design-in service provides comprehensive support to the following different phases:

Planning stage

Before deciding to adopt Advantech RISC COM, customers must go through a complete survey process, including product features, specification, and compatibility testing with software. So, Advantech offers a RISC Customer Solution Board (CSB) as an evaluation tool for carrier boards which are simultaneously designed when developing RISC COMs. In the planning stage, customers can use this evaluation board to assess RISC modules and test peripheral hardware. What's more, Advantech pro- vides standard software Board Support Package (BSP) for RISC COM, so that customers can define their product's specifications as well as verifying I/O and performance at the same time. We not only offer hardware planning and technology consulting, but also software evaluation and peripheral module recommendations (such as WiFi, 3G, BT). Resolving customer concerns is Advantech's main target at this stage. Since we all know that product evaluation is the key task in the planning period, especially for performance and specification, so we try to help our customers conduct all the necessary tests for their RISC COM.

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Design stage

When a product moves into the design stage, Advantech will supply a design guide of the carrier

board for reference. The carrier board design guide provides pin definitions of the COM connector with limitations and recommendations for carrier board design, so customers can have a clear guideline to follow during their carrier board development. Regarding different form factors, Advantech offers a complete pin-out check list for different form factors such as Q7, ULP and RTX2.0, so that customers can examine the carrier board signals and layout design accordingly. In addition, our team is able to assist customers to review the placement/layout and schematics to ensure the carrier board design meets their full requirements. For software development, Advantech RISC software team can assist customers to establish an environment for software development and evaluate the amount of time and resources needed. If customers outsource software development to a 3rd party, Advantech can also cooperate with the 3rd party and provide proficient consulting services. With Advantech's professional support, the design process becomes much easier and product quality will be improved to meet their targets.

Integration stage

This phase comprises HW/SW integration, application development, and peripheral module implementation. Due to the lack of knowledge and experience on platforms, customers need to spend a certain amount of time on analyzing integration problems. In addition, peripheral module implementation has a lot to do with driver designs on carrier boards, RISC platforms usually have less support for ready-made drivers on the carrier board, therefore the customer has to learn from trial and error and finally get the best solution with the least effort. Advantech's team has years of experience in customer support and HW/SW development knowledge. Consequently, we can support customers with professional advice and information as well as shortening development time and enabling more effective product integration.

Validation stage

After customer's ES sample is completed, the next step is a series of verification steps. In addition to verifying a product's functionality, the related test of the product's efficiency is also an important part at this stage especially for RISC platforms.

As a supportive role, Advantech primarily helps customers solve their problems in the testing process and will give suggestions and tips as well. Through an efficient verification process backed by our technical support, customers are able to optimize their applications with less fuss. Furthermore, Advantech's team can provide professional consulting services about further testing and equipment usage, so customers can find the right tools to efficiently identify and solve problems to further enhance their products quality and performance.

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5.2 Contact Information

Below is the contact information for Advantech customer service

Region/Country	Contact Information
America	1-888-576-9688
Brazil	0800-770-5355
Mexico	01-800-467-2415
Europe (Toll Free)	00800-2426-8080
Singapore & SAP	65-64421000
Malaysia	1800-88-1809
Australia (Toll Free)	1300-308-531
China (Toll Free)	800-810-0345 800-810-8389 Sales@advantech.com.cn
India (Toll Free)	1-800-425-5071
Japan (Toll Free)	0800-500-1055
Korea (Toll Free)	080-363-9494 080-363-9495
Taiwan (Toll Free)	0800-777-111
Russia (Toll Free)	8-800-555-01-50

You can also reach our service team through the website below; our technical support engineer will provide quick response once the form is filled out:

http://www.advantech.com.tw/contact/default.aspx?page=contact_form2&subject=Technical+Support

5.3 Technical Support and Assistance

For more information about this and other Advantech products, please visit our website at:

http://www.advantech.com/

http://www.advantech.com/ePlatform/

For technical support and service, please visit our support website at:

<http://support.advantech.com.tw/support/>

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer Service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

www.advantech.com