



Empowering Tomorrow's AI Computing

MXM-R1 RK3588 MXM Core Module

User Manual

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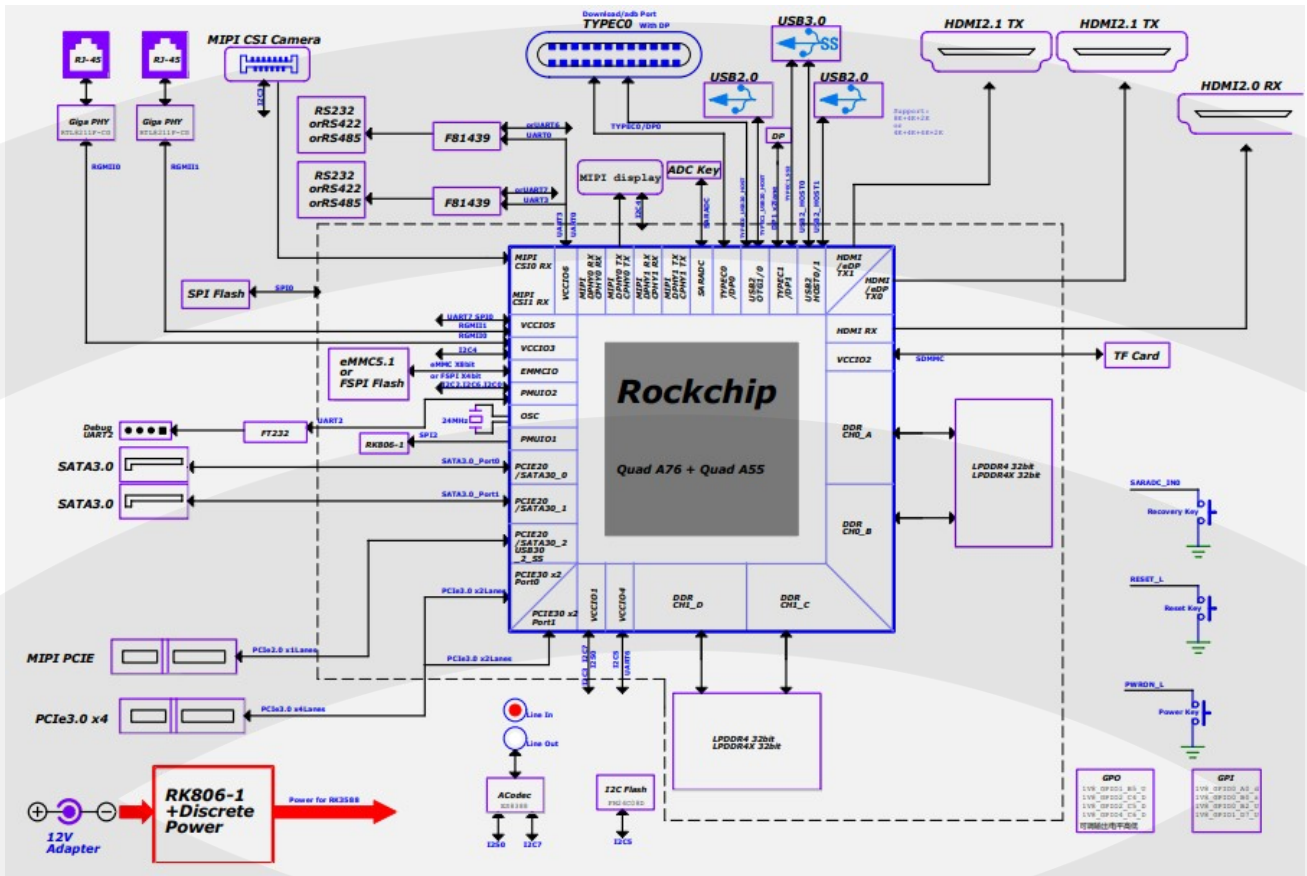
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1. Specifications:

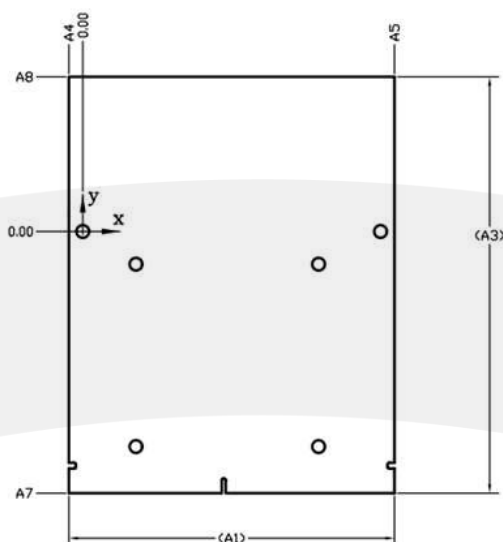
Model	MXM-R1
Processing Unit	RK3588
ARM Architecture	4 x Cortex-A76 2.4GHz + 4 x Cortex-A55 1.8GHz
ARM Core	8 Cores 64 bit, 8nm technology
NPU Core	6Tops neural network processing performance, support INT4/INT8/INT16 hybrid operation
GPU Core	ARM Mali-G610 MP4, Quad Core GPU, support OpenGL ES3.2 / OpenCL 2.2 / Vulkan1.1
Bus Type	MXM3 .1 / up to PCI Express 4.0 x4
RAM	8G 64bit LPDDR4
Memory Clock	2133MHz
Storage Size	EMMC 64GB
Speed Model	400MB/s at HS400 mode, dual channel
Display	Display output: HDMI 2.1、HDMI 2.0、DP 1.4 Display input: HDMI 2.0
Board Power	Board 4V±5% input
Board Dimensions	MXM Graphics Module Version 3.1 Type B (105x82mm)
Video Encoder	8K@30fps H.265/H.264 encoding
Video Decoder	8K@60fps H.265/H.264/VP9/AV1 decoding
JPEG Encoder	1080P@280fps
JPEG Decoder	1080P@280fps
Operation System	Support Android 12/debian 5.4/unbutu 20.04, etc
Operating Temperature	-20℃~55℃
Storage Temperature	-40℃~85℃
Operating Humidity	Operation environment: 5%~85% humidity, (0℃~45℃) non condensing
Storage Humidity	Storage environment: 5%~95% humidity, (-40℃~85℃) non condensing

2. Block Diagram:



3. MXM Board Outlines:

Figure 3.1 shows the board outlines (top side view) for Type B MXM modules. An additional system keep-out of 0.5mm[0.020] per side is allowed on the PCB to accommodate whatever means of production panelization is required. This additional clearance is above and beyond the dimensional limits presented here. The location of of these features is not specified or controlled.



TYPE B

Table 3.1: Board Outline Dimensions

Symbol	[mm]			[in]		
	min	nom	max	min	nom	max
A1		82.00			3.228	
A3		105.00			4.134	
A4	3.37	3.50	3.63	0.133	0.138	0.143
A5	78.37	78.50	78.63	3.085	3.091	3.096
A6	3.87	4.00	4.13	0.152	0.157	0.163
A7	65.87	66.00	66.13	2.593	2.598	2.604
A8	38.87	39.00	39.13	1.530	1.535	1.541

Figure 3.2: Board Slots Detail

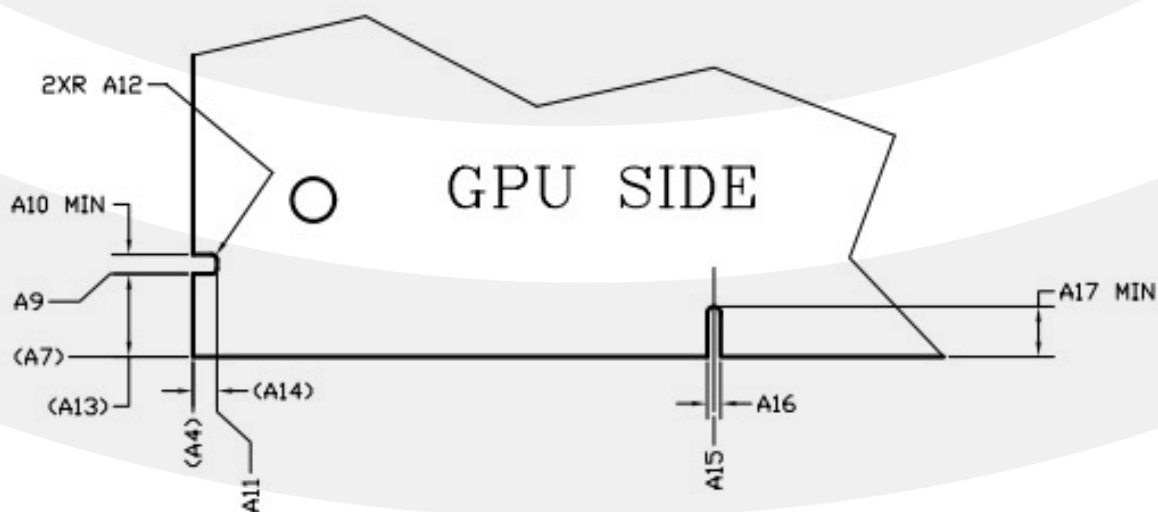


Table 3.2: Board Slots Dimensions

Symbol	[mm]			[in]		
	min	nom	max	min	nom	max
A4		3.50			0.138	
A7		66.00			2.598	
A9	59.67	59.80	59.93	2.349	2.354	2.359
A10	1.45			0.057		
A11	1.57	1.70	1.83	0.062	0.067	0.072
A12	0.32	0.50	0.58	0.013	0.020	0.023
A13		6.20			0.244	
A14		1.80			0.071	
A15	35.37	35.50	35.63	1.393	1.398	1.403
A16	0.95	1.00	1.05	0.037	0.039	0.041
A17	3.75			0.148		

4.MXM PCB Mounting Holes:

All MXM version 3.1 modules have 6 holes. Two are used to secure the board to the system and the other four to fasten the thermal solution to the module.

Figure 4.1: Mounting Holes

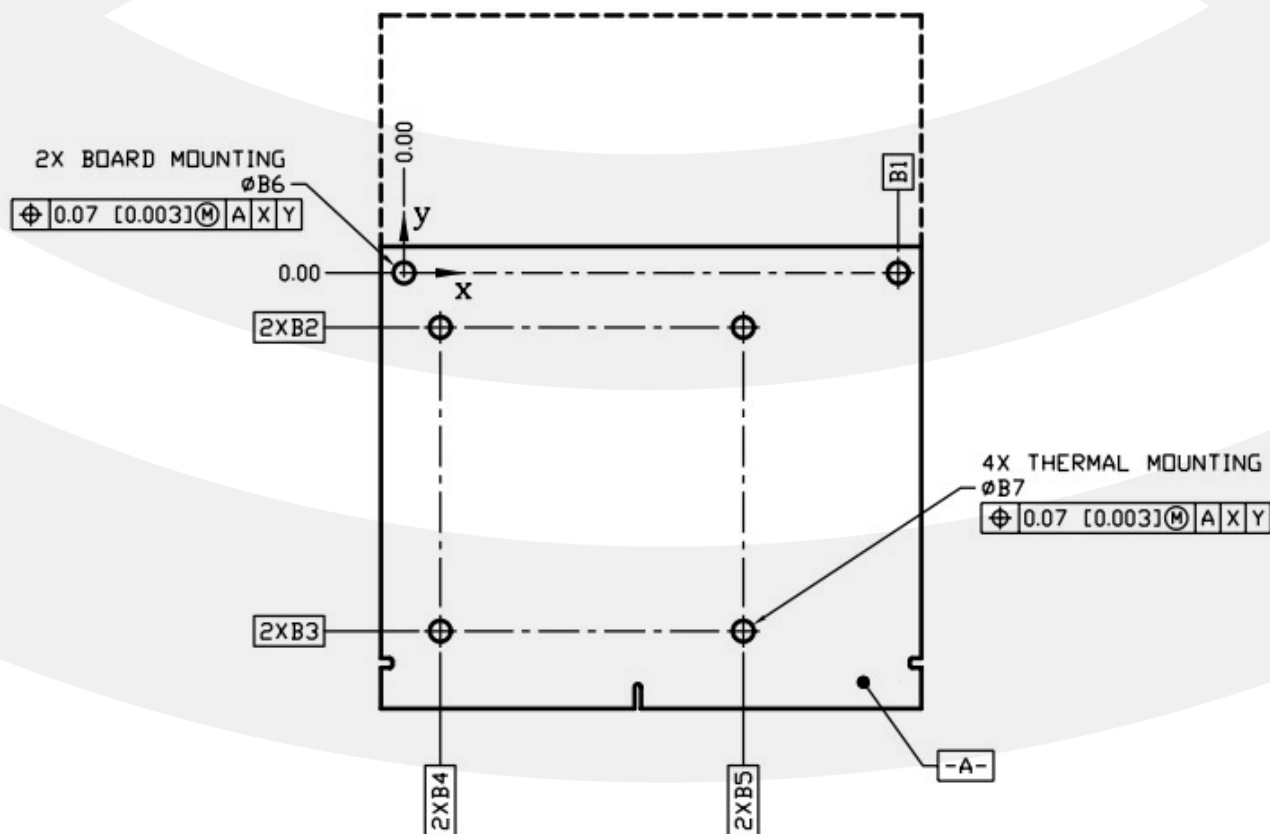


Table 4.1: Mounting Holes Dimensions

Symbol	[mm]			[in]		
	min	nom	max	min	nom	max
B1		75.00			2.953	
B2		8.25			0.325	
B3		54.25			2.136	
B4		5.50			0.217	
B5		51.50			2.028	
B6	3.07	3.20	3.33	0.121	0.126	0.131
B7	3.07	3.20	3.33	0.121	0.126	0.131

5.Connector Pinout:
Table 5.1: MXM Connector Pinout

P1	SDMMC0_D1	S1	SDMMC_DET_L
P2	SDMMC0_D0	S2	HP_DET_L
P3	SDMMC0_CLK	S3	3V3_PWM0
P4	SDMMC0_CMD	S4	3V3_GPIO0
P5	SDMMC0_D3	S5	1V8_EN
P6	SDMMC0_D2	S6	HDMITX0_HPDIN
P7	GND0	S7	HDMITX0_SCL
P8	HDMI0_TX_SBDN	S8	HDMITX0_SDA
P9	HDMI0_TX_SBDP	S9	GND41
P10	HDMI0_TX3N	S10	HDMI_RX_CLKN
P11	HDMI0_TX3P	S11	HDMI_RX_CLKP
P12	GND1	S12	GND42
P13	HDMI0_TX0N	S13	HDMI_RX_D0N
P14	HDMI0_TX0P	S14	HDMI_RX_D0P
P15	GND2	S15	GND43
P16	HDMI0_TX1N	S16	HDMI_RX_D1N
P17	HDMI0_TX1P	S17	HDMI_RX_D1P

P18	GND3	S18	GND44
P19	HDMI0_TX2N	S19	HDMI_RX_D2N
P20	HDMI0_TX2P	S20	HDMI_RX_D2P
P21	GND4	S21	GND45
P22	HDMI1_TX_SBDP	S22	HDMI1RX_DET_L
P23	HDMI1_TX_SBDN	S23	HDMI_RX_SCL
P24	GND5	S24	HDMI_RX_SDA
P25	HDMI1_TX3N	S25	HDMI1RX_HPDPDOUT_H
P26	HDMI1_TX3P	S26	HDMI_RX_CEC
P27	GND6	S27	ADC0
P28	HDMI1_TX0N	S28	HDMITX1_HPDPIN
P29	HDMI1_TX0P	S29	HDMITX1_SCL
P30	GND7	S30	HDMITX1_SDA
P31	HDMI1_TX1N	S31	GND46
P32	HDMI1_TX1P	S32	USB20_HOST0_DP
P33	GND8	S33	USB20_HOST0_DM
P34	HDMI1_TX2N	S34	GND47
P35	HDMI1_TX2P	S35	USB_OTG_PWREN_H
P36	GND9	S36	USB_HOST_PWREN_H
P37	DP1_TX0N	S37	GND48
P38	DP1_TX0P	S38	USB20_HOST1_DM
P39	GND10	S39	USB20_HOST1_DP
P40	DP1_TX1P	S40	GND49
P41	DP1_TX1N	S41	TYPEC1_USB20_OTG_DM
P42	GND11	S42	TYPEC1_USB20_OTG_DP
P43	USB30_SSRXN	S43	GND50
P44	USB30_SSRXP	S44	DP1_HPDPIN
P45	GND12	S45	DP1_AUXN
P46	USB30_SSTXP	S46	DP1_AUXP
P47	USB30_SSTXN	S47	GND51
P48	GND13	S48	TYPEC0_USB20_OTG_DM
P49	TYPECO_SSRX1N	S49	TYPEC0_USB20_OTG_DP
P50	TYPECO_SSRX1P	S50	GND52
P51	GND14	S51	TYPECO_SBU1
P52	TYPECO_SSTX1P	S52	TYPECO_SBU2
P53	TYPECO_SSTX1N	S53	3V3_GPI01
P54	GND15	S54	TYPECO_SBU1_DC
P55	TYPECO_SSRX2N	S55	TYPECO_SBU2_DC
P56	TYPECO_SSRX2P	S56	TYPECO_USB20_VBUSDET
P57	GND16	S57	TYPEC5V_PWREN_H
P58	TYPECO_SSTX2P	S58	I2C0_SDA
P59	TYPECO_SSTX2N	S59	I2C0_SCL

P60	GND17	S60	3V3_GPI02
P61	MIPI_TX_D0N	S61	TYPECO_USB20_OTG_ID
P62	MIPI_TX_D0P	S62	RTCIC_INT_L
P63	GND18	S63	I2C1_SDA
P64	MIPI_TX_D1N	S64	I2C1_SCL
P65	MIPI_TX_D1P	S65	LCD_RESET
P66	GND19	S66	UART0_TX
P67	MIPI_TX_CLKN	S67	UART0_RX
P68	MIPI_TX_CLKP	S68	UART1_RX
P69	GND20	S69	UART1_TX
P70	MIPI_TX_D2N	S70	UART2_TX
P71	MIPI_TX_D2P	S71	UART2_RX
P72	GND21	S72	UART3_TX
P73	MIPI_TX_D3N	S73	UART3_RX
P74	MIPI_TX_D3P	S74	UART4_TX
		S75	UART4_RX
P75	MIPI_CSIO_RX_CLK1P	S76	MIPI_CAM3_CLKOUT
P76	MIPI_CSIO_RX_CLK1N	S77	MIPI_CAM3_PDN_L
P77	GND22	S78	MIPI_CAM3_PWREN_H
P78	MIPI_CSIO_RX_D3P	S79	I2C3_SDA_MO_MIPI
P79	MIPI_CSIO_RX_D3N	S80	I2C3_SCL_MO_MIPI
P80	GND23	S81	MIPI_CSIO_RST
P81	MIPI_CSIO_RX_D2P	S82	VCC_3V3_EN
P82	MIPI_CSIO_RX_D2N	S83	CAN_RX
P83	GND24	S84	CAN_TX
P84	MIPI_CSIO_RX_CLK0P	S85	PMIC_EXT_EN_OUT
P85	MIPI_CSIO_RX_CLK0N	S86	3V3_PWM1
P86	GND25	S87	SARADC_VIN3_HP_HOOK
P87	MIPI_CSIO_RX_D1P	S88	PCIEx1_CLKREQn_L
P88	MIPI_CSIO_RX_D1N	S89	PCIEx1_PERSTn
P89	GND26	S90	PCIEx1_WAKEn_L
P90	MIPI_CSIO_RX_D0P	S91	3V3_GPI03
P91	MIPI_CSIO_RX_D0N	S92	GMAC1_TXCLK
P92	GND27	S93	GMAC1_MCLKINOUT
P93	GMACO_MCLKINOUT	S94	GMAC1_TXEN
P94	GND28	S95	GMAC1_TXD0
P95	GMACO_TXCLK	S96	GMAC1_TXD1
P96	GMACO_TXEN	S97	GMAC1_TXD2
P97	ETH0_REFCLKO_25M	S98	GMAC1_TXD3
P98	GND29	S99	GMAC1_RXDV_CRS
P99	GMACO_TXD0	S100	GMAC1_RXD0
P100	GMACO_TXD1	S101	GMAC1_RXD1

P101	GMACO_TXD2	S102	GMAC1_RXD2
P102	GMACO_TXD3	S103	GMAC1_RXD3
P103	GMACO_MDIO	S104	GMAC1_RXCLK
P104	GMACO_MDC	S105	ETH1_REFCLKO_25M
P105	GMACO_RSTn_L	S106	GMAC1_MDC
P106	GMACO_RXDV_CRS	S107	GMAC1_MDIO
P107	GMACO_RXD0	S108	GMAC1_RSTn_L
P108	GMACO_RXD1	S109	3V3_GPI04
P109	GMACO_RXD2	S110	3V3_GPI05
P110	GMACO_RXD3	S111	GND53
P111	GMACO_RXCLK	S112	NC
P112	GND30	S113	NC
P113	SATA30_0_RXN	S114	GND54
P114	SATA30_0_RXP	S115	NC
P115	GND31	S116	NC
P116	SATA30_0_TXP	S117	GND55
P117	SATA30_0_TXN	S118	SPI0_MISO
P118	GND32	S119	SPI0_MOSI
P119	SATA30_1_TXP	S120	SPI0_CLK
P120	SATA30_1_TXN	S121	SPI0_CS
P121	GND33	S122	GND56
P122	SATA30_1_RXP	S123	PCIE20_2_RXP
P123	SATA30_1_RXN	S124	PCIE20_2_RXN
P124	GND34	S125	GND57
P125	PCIE30_PORT0_RX0P	S126	PCIE20_2_TXP
P126	PCIE30_PORT0_RX0N	S127	PCIE20_2_TXN
P127	PCIE30_PORT0_RX1P	S128	GND58
P128	PCIE30_PORT0_RX1N	S129	PCIE20_2_REFCLKP
P129	GND35	S130	PCIE20_2_REFCLKN
P130	PCIE30_PORT0_REFCLKP_IN	S131	GND59
P131	PCIE30_PORT0_REFCLKN_IN	S132	I2S0_MCLK
P132	GND36	S133	I2S0_SCLK_TX
P133	PCIE30_PORT0_TX0P	S134	I2S0_LRCK_TX
P134	PCIE30_PORT0_TX0N	S135	I2S0_SD00
P135	PCIE30_PORT0_TX1P	S136	I2S0_SDIO
P136	PCIE30_PORT0_TX1N	S137	GND60
P137	GND37	S138	I2C2_SDA
P138	PCIE30_PORT1_RX2P	S139	I2C2_SCL
P139	PCIE30_PORT1_RX2N	S140	LCD_PWREN_H
P140	PCIE30_PORT1_RX3P	S141	USBCC_INT_L
P141	PCIE30_PORT1_RX3N	S142	3V3_GPI06
P142	GND38	S143	I2C7_SDA_M0_CODEC

P143	PCIE30_PORT1_TX2P	S144	I2C7_SCL_M0_CODEC
P144	PCIE30_PORT1_TX2N	S145	SDMMC_PWREN
P145	PCIE30_PORT1_TX3P	S146	PCIE_PWREN_H
P146	PCIE30_PORT1_TX3N	S147	3V3_GPI07
P147	GND39	S148	PCIE30X4_PRSENT_L
P148	PCIE30_PORT1_REFCLKN_IN	S149	3V3_GPI08
P149	PCIE30_PORT1_REFCLKP_IN	S150	LCD_BL_PWM1
P150	GND40	S151	3V3_GPI09
P151	VCC4V0_SYS0	S152	PCIE30X4_CLKREQn_L
P152	VCC4V0_SYS1	S153	PCIE30X4_PERSTn_L
P153	VCC4V0_SYS2	S154	PCIE30x4_PWREN_H
P154	VCC4V0_SYS3	S155	PCIE30X4_WAKEn_L
P155	VCC4V0_SYS4	S156	RECOVERY_KEY
P156	VCC4V0_SYS5	S157	RESET_L
		S158	PWRON_L

6. MXM Connector:

Figure 6.1 MXM Connector (Card Top)

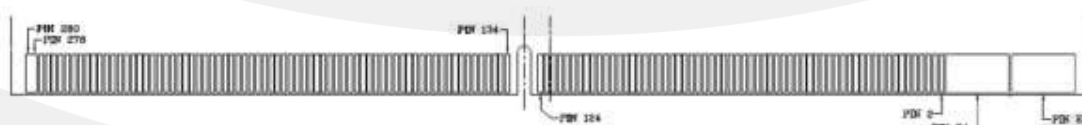
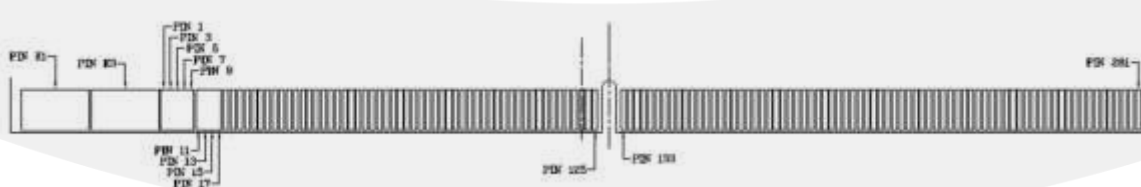
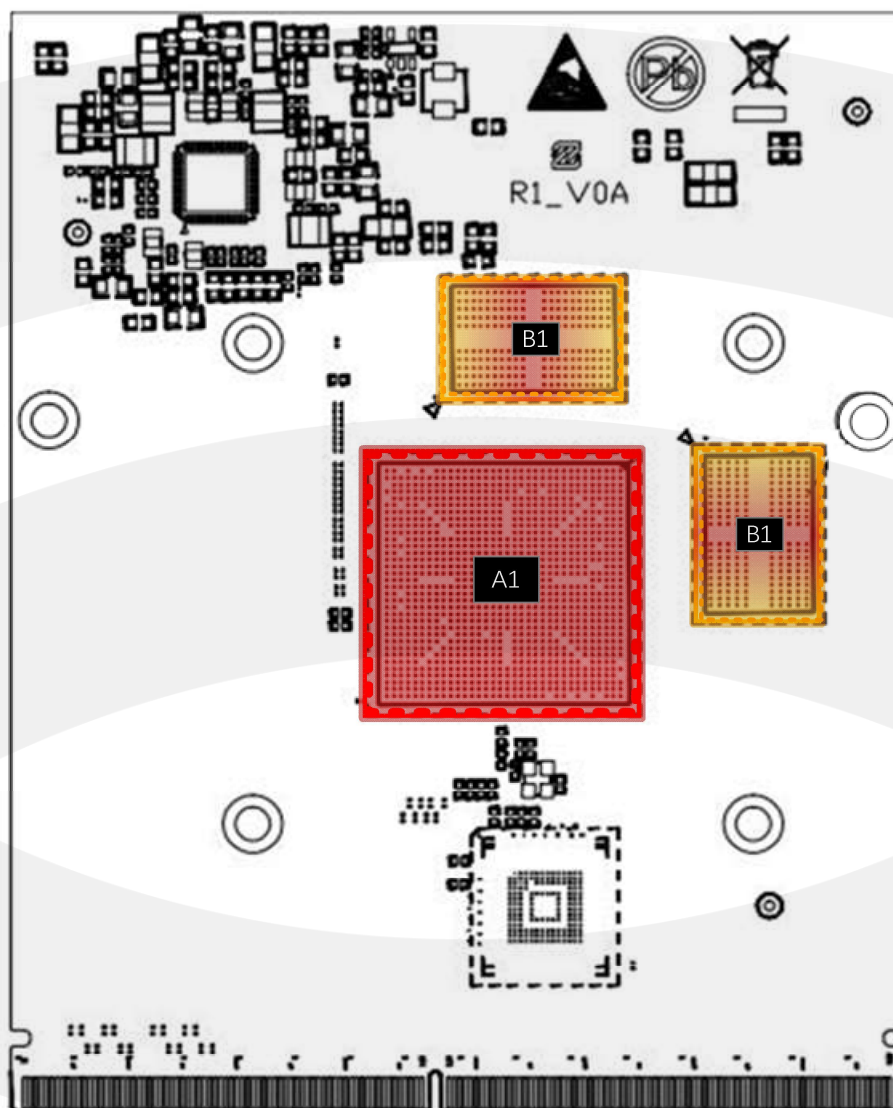


Figure 6.2 MXM Connector (Card Bottom)



7. Thermal:



Components	Area	TDP	Height
CPU-RK3588	A1	7W	1.74mm
Memory	B1	1.8W*2	0.9mm

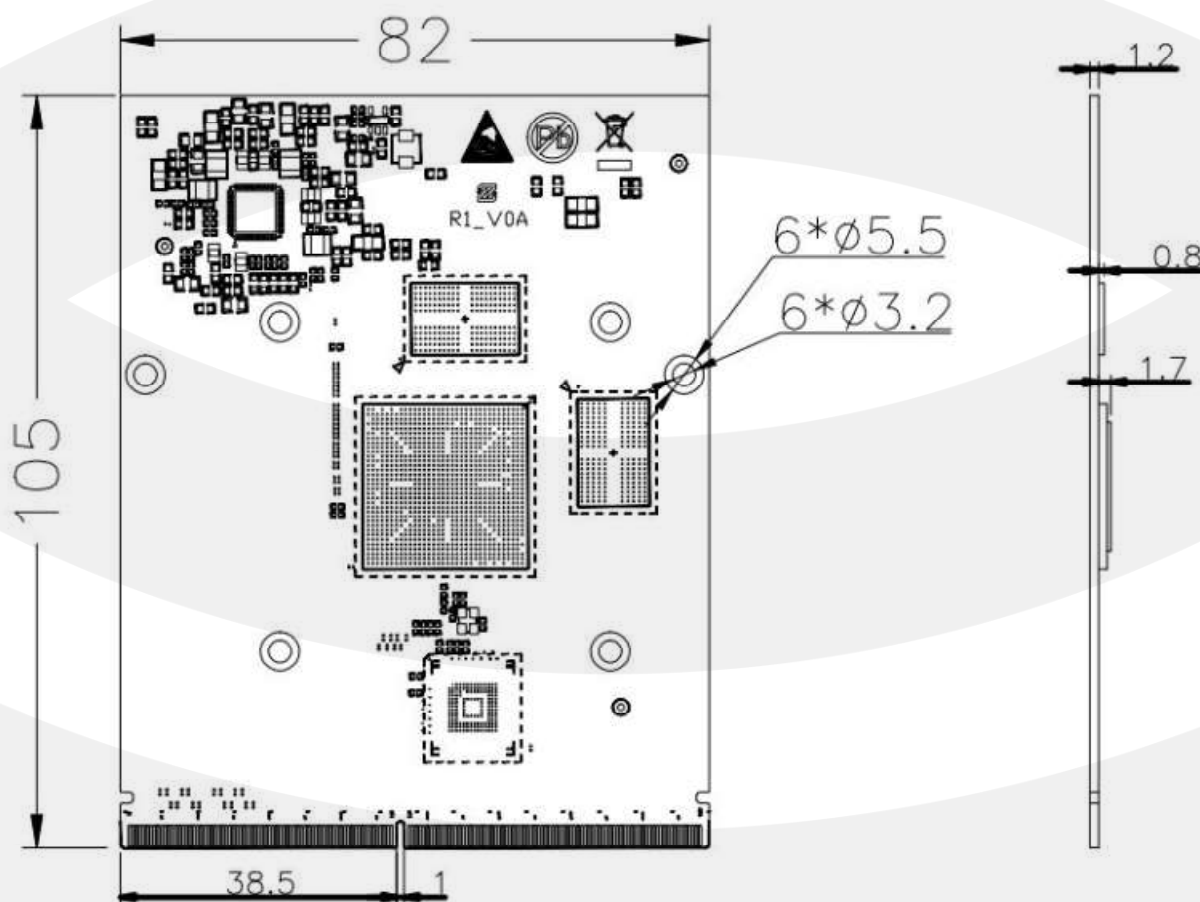
Chipset		Specification
Dimensions		23*23*1.74mm
Stress	Maximum	75 PSI
	Normal	30-40 PSI

Cooling Suggestion:

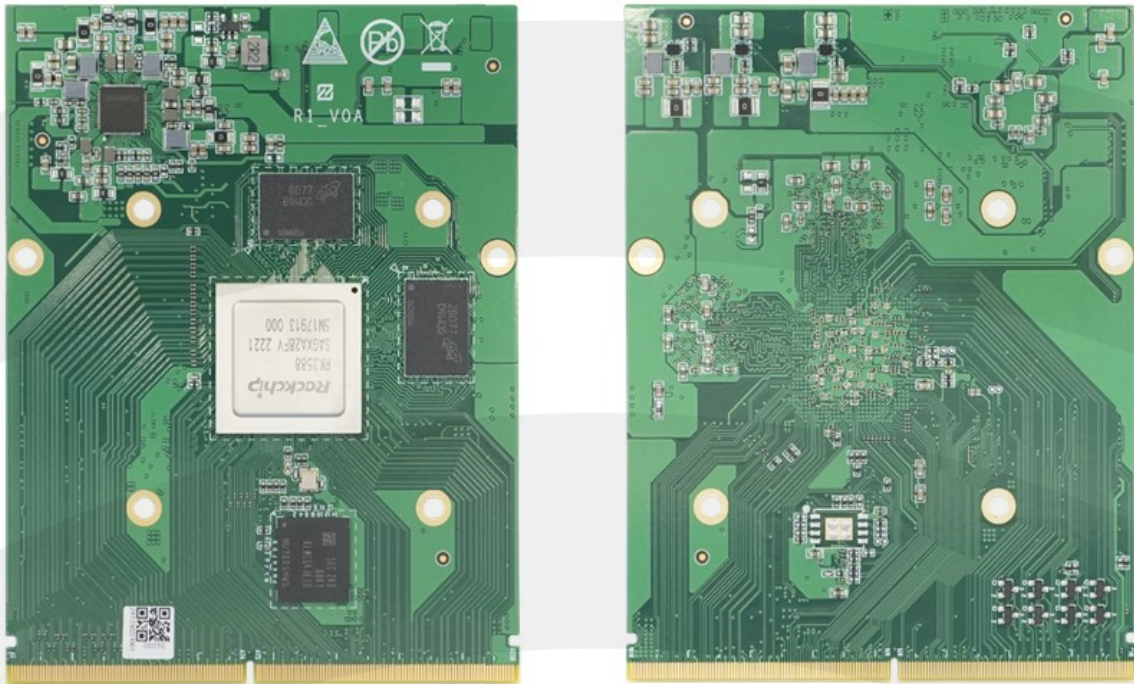
1. Fix the board onto heat sink, the heat sink external diameter is 4mm, M2 screw bolt.
2. The weight of heat sink should be supported and fastened by the case.
3. RAM and MOS should be added thermal pad.

Components	Temp. Limitation When Fully Loaded (Environment Temp. 45 °C)
CPU-RK3588	95 °C
Memory	85 °C
Mosfet	105 °C

8. Dimensions:



9. Photo:



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