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MIXTILE Blade 3 Single Board Computer User Manual

MIXTILE

**Blade 3 Single Board Computer
User Manual**

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Changes

Version	Date	Changes	Name
1	2022-06-15	First version	VT

Contents

Introduction

1.1 Product Description
The Mixtape Blade 3 is a low-cost, low-power SBC based on the next-generation Rockchip RK3588 CPU. It allows you to cluster numerous Mix tile Blade 3 SBCs to expand your deployment, making it ideal for quick development, AI application prototyping, and edge computing.
Out-of-the-box, Mix tile Blade 3 is a stacking computer with an inbuilt PCIe Gen3 edge connector that enables the

integration of many high-performance hardware platforms into a tiny form factor.

That hardware, when combined, provides a network speed of up to 20 Gb/s and a memory bandwidth of up to 136 GB/s. A Mix tile Blade 3 cluster in a 19- inch 2U chassis can support up to 600 CPU cores and 1320 GHz of processing power while requiring less than 1500 W of power.

1.2 Package list

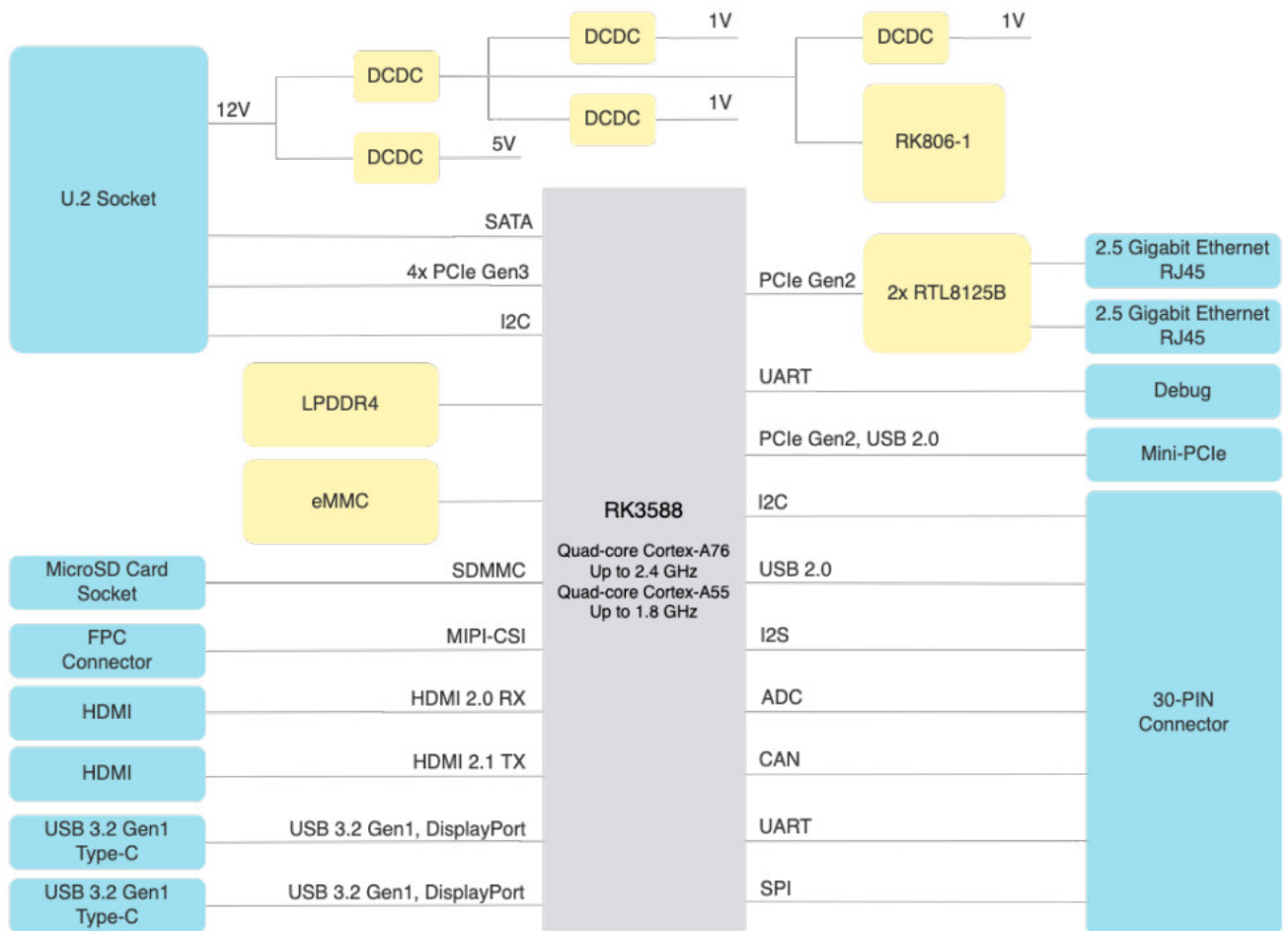- 1x Mix tile Blade 3 (heatsink installed)

1.3 Main Features

- CPU: Rockchip Octa-core Cortex-A76/A55 SoC processor RK3588
- NPU: Up to 6 TOPS
- Memory: Up to 32 GB LPDDR4 memory and up to 256 GB eMMC storage
- HDMI interface:
  - HDMI 2.1 output (8K @ 60 FPS or 4K @ 120 FPS)
  - HDMI 2.0 input (4K @ 60 FPS)
- Video encoder: H.264/H.265 video encoder up to 8K @ 30 FPS
- Video decoder: H.265/H.264/VP9 video decoder up to 8K @ 60 FPS
- Display: 4-lane MIPI-CSI
- Storage expansion:
  - 4-lane PCIe Gen 3 in U.2 port
  - SATA 3.0 in U.2 port
  - Micro-SD 3.0 flash socket
- PCIe expansion: Mini-PCIe socket with PCIe Gen 2.1 and USB 2.0 support
- Ethernet expansion: Dual 2.5 gigabit Ethernet ports
- USB: Dual USB 3.2 Gen 1 Type-C ports with DisplayPort 1.4 A
- GPIOs: 30-pin GPIO socket that can be used as Digital I/O, I²C, USB 2.0, TTL UART, SPI, I²S
- Software support: Preload customized Debian 11, also support other Linux distributions and Android 12
- Power: USB Type-C Port-1 Support USB PD 2.0 protocol (Optional: 12 V DC standard SATA power in via U.2 port)
- Dimensions: 2.5-inch Pico-ITX form factor, 100 x 72 mm
- Operating temperature: 0 to +80° C

1.4 Block diagram & Product Overview
1.4.1 Block Diagram
The Block diagram for the Blade 3 single-board computer is shown below with descriptions for each function.

1.4.2 Product Overview

U.2
12V DC / 4x PCIe Gen3 / SATA

30-Pin GPIO
12C / I2S / SPI / CAN /USB 2.0

Debug

Mini PCIe
PCIe Gen2
/ USB 2.0

Micro-SD

RJ45

HDMI
TX / RX

USB3.2 Gen1
Type-C / DP / ADB

USB3.2 Gen1
Type-C / DP / PD 2.0

BLADE3 V1.0.1

Rock-chip
RK3588
SACKA2C41 2147
B037501 000

MIXTILE

MIPI-CSI
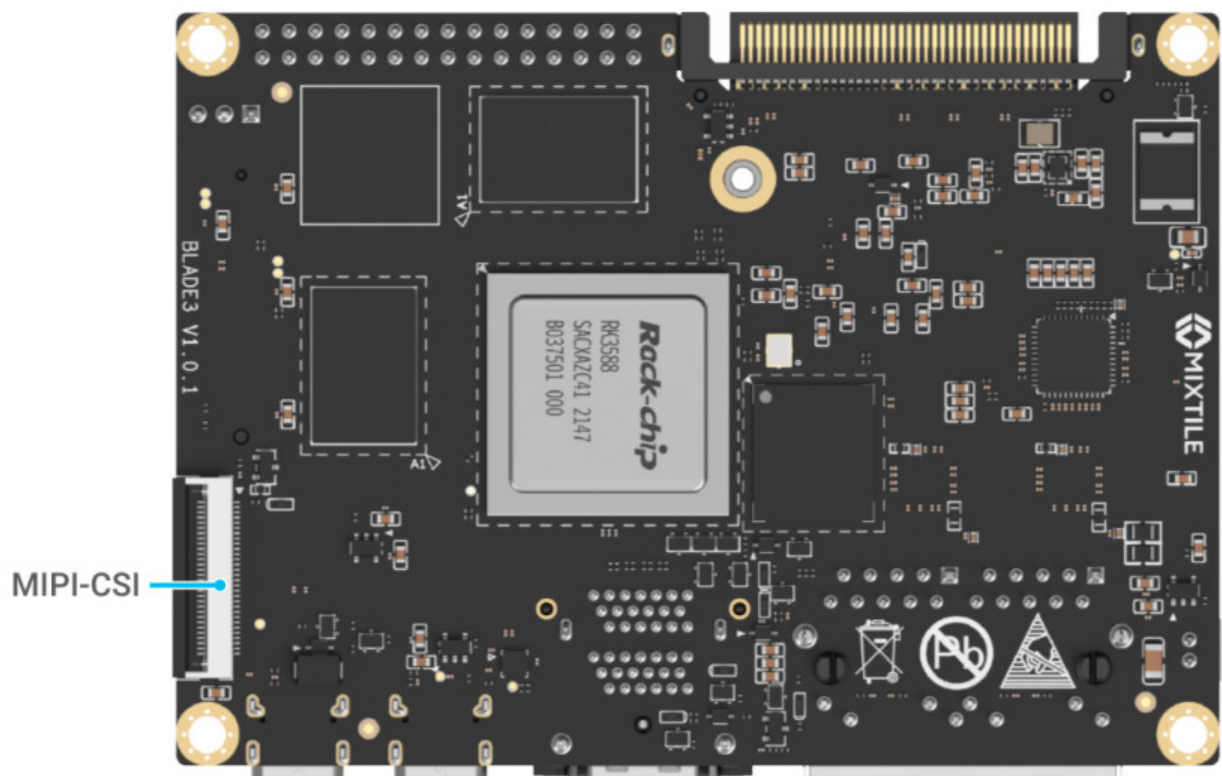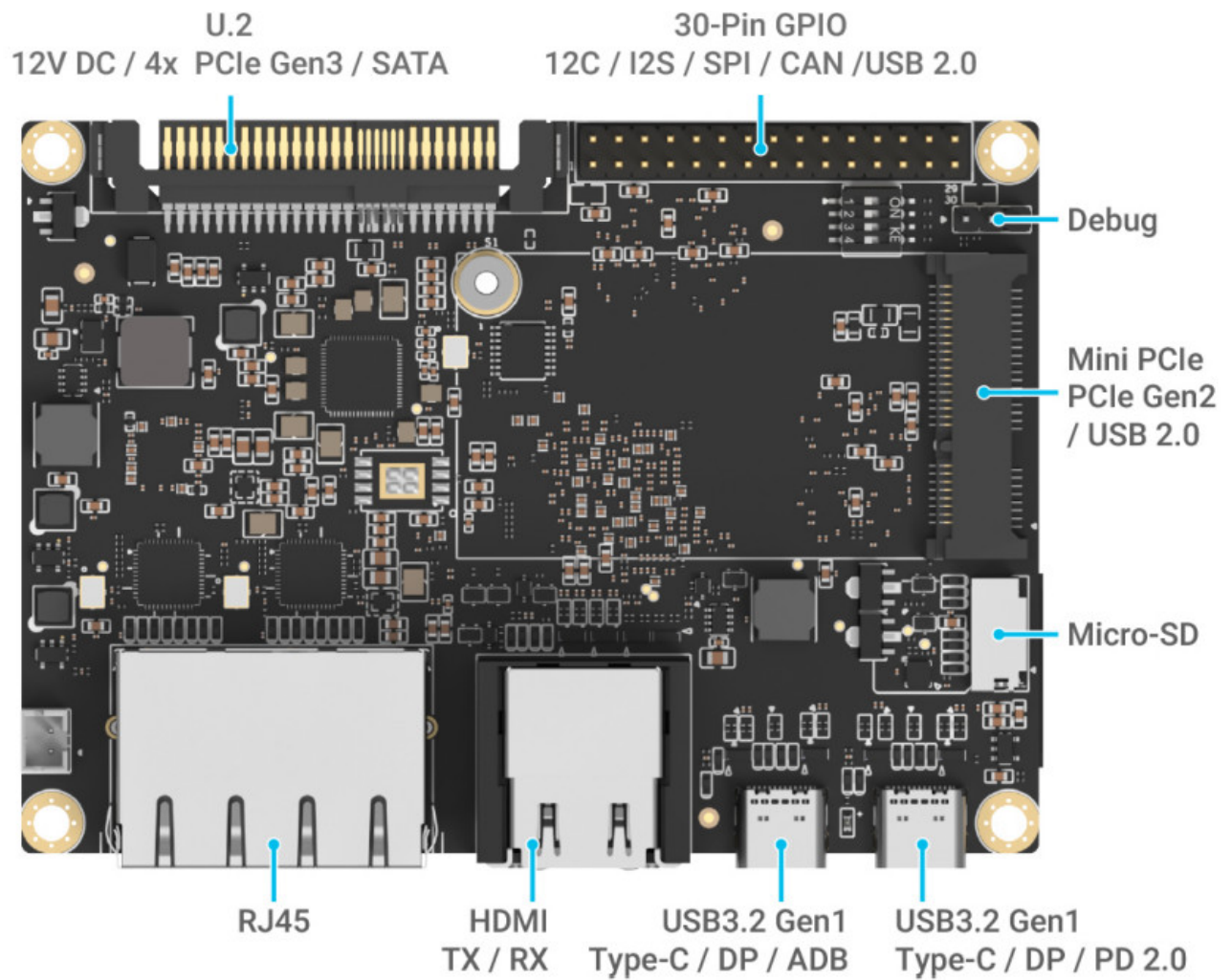
1.4.3Physical Dimensions
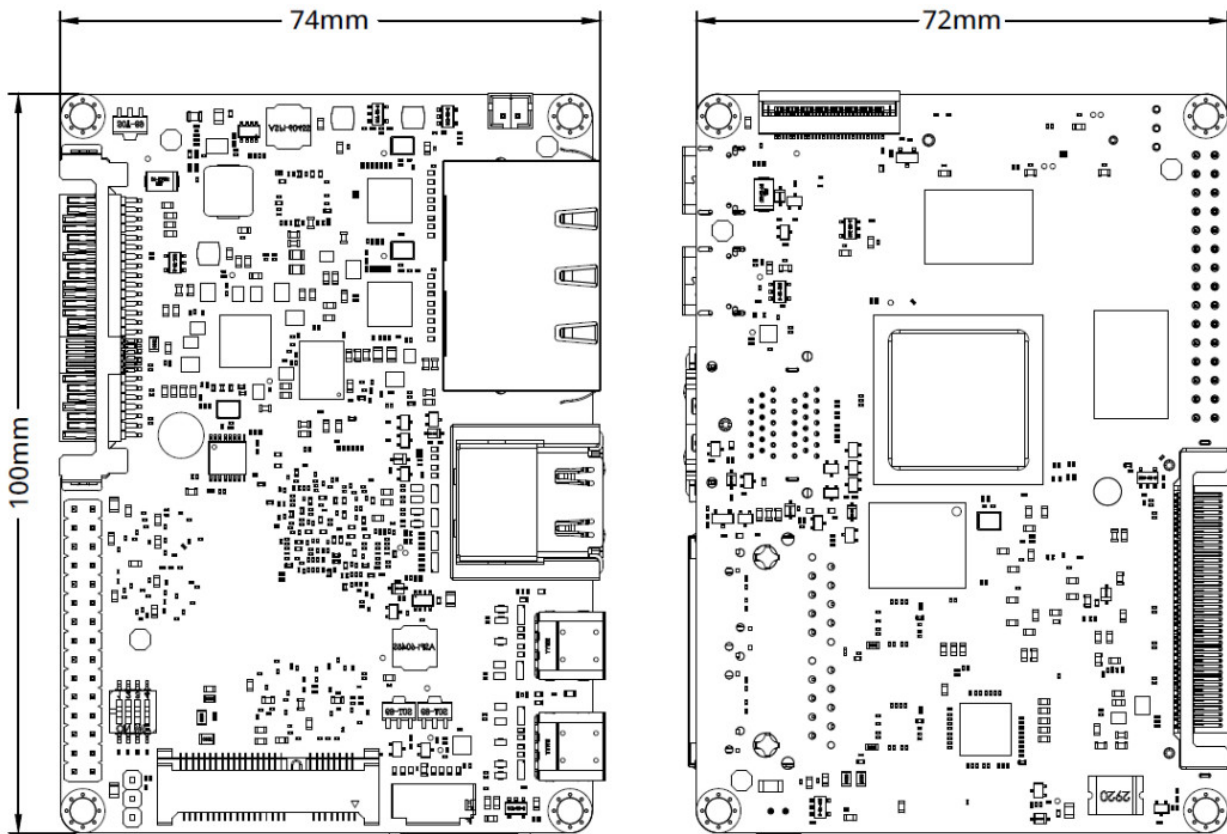
1.5 Key Component Specifications

The key component specifications are described below with relevant hardware information and developing notices. For more information, pin assignments and signal descriptions are listed in Chapter 2, Connectors & Pin Assignments.

1.5.1 Rockchip 3588
The Rockchip RK3588 ARM64 CPU contains many peripherals to support multi-purpose.

- Octa Cortex-A76/A55 SoC processing cores
- Core operating frequencies up to 2.4GHz
- Neural Process Unit with processing performance up to 6 TOPS
- Support 8k@60 FPS H.265/H.264/VP9 decoder; 8K@30 FPS H.264/H.265 encoder
- Supports up to 32 GB LPDDR4 memory and up to 256 GB eMMC storage

The SDRAM is 32bits data width, 4 ranks LPDDR4 memory capacities from 4GBytes to 32GBytes.
The system flash memory supports eMMC 5.1 memory capacities from 32GBytes to 256GBytes.
The default memory setting is 4/16GBytes LPDDR4 and 32/128GBytes eMMC for Blade 3.

1.5.2 MicroSD Socket
The MicroSD socket accepts standard 11mm x 15mm Micro-SD cards with capacities up to 256GBytes. The 4bits data interface supports the SDMMC3.0 protocol. While the default boot setting is the eMMC Flash which can change to the MicroSD card.

1.5.3 Mini-PCIe Socket
The mini-PCIe is a PCI card interface with a small form factor that uses a standard 52-pin mini-PCIe socket. It also contains a USB 2.0 interface.
The mini-PCIe socket supports the module sizes of 3052.
The module supporting configuration, including power, reset, and interrupt signals, is under software control by

Core 3588. Since each module needs specific configuration definitions, check the configuration setting before connecting the module.

USB Support

The mini-PCIe socket supports a standard USB 2.0 interface.

1.5.4 Gigabit Ethernet

The IEEE802.3 compliant Ethernet supports auto-negotiation of 10/100/1000/2500Mb half-duplex and full-duplex. The RGMII interface from the processor connects the 2.5GbE to an external PHY, RTL8125BG-CG. The RJ45 connector has some status and speed lights. The green light indicates that you are connected, and the flashing light indicates that data is being sent. The yellow light indicates 2500Mbps and is turned off for 10/100/1000Mbps.

1.5.5 Power Input

Power Delivery (PD)

The power port is a USB-C port that supports USB Power Delivery 2.0. A Power Delivery controller on board allows for a maximum power input of 20V @ 3A.

12V DC

DC power inputs from a DC SATA power via U.2 port require 12V @ 3A.

1.5.6 USB 2.0/3.0 Host Ports

The Blade 3 features two USB Type-C ports. Both ports can support the USB-OTG capability as well as DisplayPort via USB Type-C. DisplayPort over USB Type-C enables the USB Type-C connector and cable to offer audio/video (AV) transfer via the DisplayPort interface.

It supports DisplayPort 1.4 and has a maximum resolution of 7680×4320@30Hz.

USB Type-C Port-1 supports USB PD2.0 but not USB 2.0 for ADB.

Although USB Type-C Port-0 does not support USB PD2.0, it does support USB 2.0 for ADB debugging and firmware updates.

1.5.7 Display Support

The video output processor supports the resolution from 1920×1080@60Hz to 7680×4320@60Hz.

The default main display is HDMI.

HDMI-OUT

HDMI display compliant HDMI 1.4 and HDMI 2.1 with HDCP 2.3. It supports up to 1920×1080@120Hz and 7680×4320@60Hz/3840×2160@120Hz resolution.

HDMI-IN

HDMI input compliant HDMI 1.4 and HDMI 2.0 with HDCP 2.3. It supports input sources up to 1920×1080@120Hz and 3840×2160@60Hz resolution.

1.5.8 U.2 Connector

The U.2 interface employs a 68-pin U.2 connector with a standard SATA 3.0 signal, a PCIe 3.0 X4 signal (four lanes PCIe 3.0), and 12V power input.

1.5.9 LEDs and Dip Switch

The power LED indicates the status of the power supply. There is one SPST four-position dip switch that can be used to determine the system booting mode of the Blade 3 board. Only one position can be turned ON at a time; please keep in mind that you cannot switch two positions to ON at the same time.

When position 1 is set to ON, the Blade 3 will boot from eMMC.

When position 2 is set to ON, the Blade 3 will boot from the MicroSD card.

When position 3 is turned ON, the Blade 3 will boot from SPI Flash.

When position 4 is activated, Blade 3 enters MaskROM mode for firmware development.
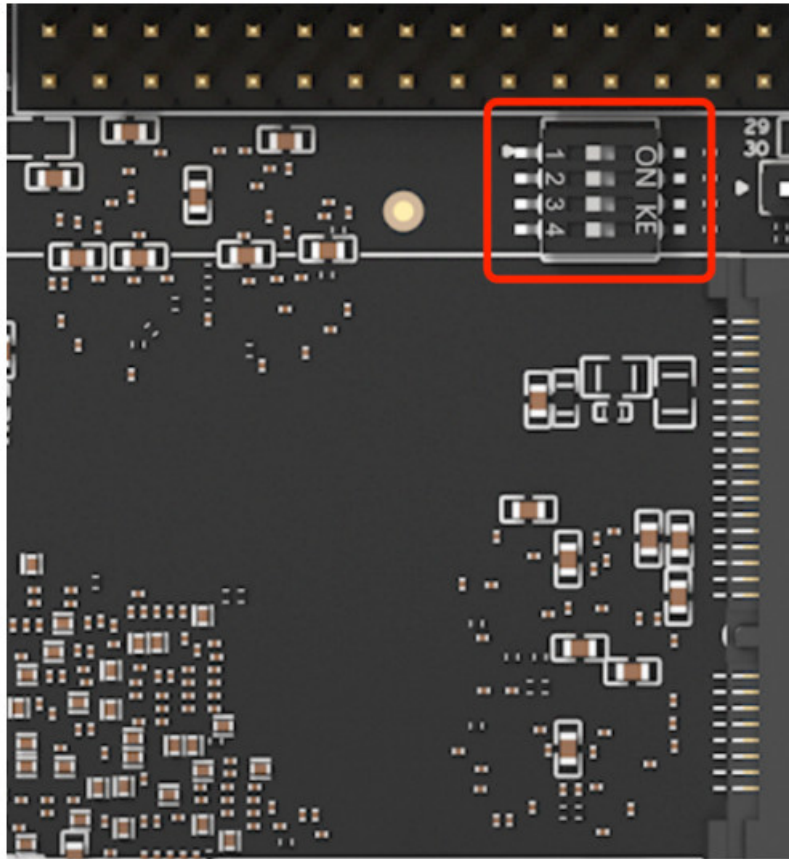
Connectors & Pin Assignments

The following section lists the interface connector pin assignments and pin types with corresponding signal descriptions. The interface connectors on Blade 3 are listed in the table below.

2.1 30-Pin Connector

Pin #	Pin Name	Pin Type	Input/Output	Signal Description
1	VCC_SVO	Power	Output	Power supply for USB,5V output MAX 500mA.
2	GND	Power	NA	Power and signal reference ground.
3	USB2O_HOSTO_DM	LVDS	BI	USB20 HOST PortO Data Minus
4	I2S2_SDI_M1	signal	Input	1252 data input
5	USB2O_HOSTO_DP	LVDS	BI	USB20 HOST Port() Data Plus
6	I2S2_SDO_M1	signal	Output	I2S2 data output
7	GND	Power	NA	Power and signal reference ground.
8	1252_MCLK_M1	signal	Output	I2S2 Master clock
9	I2C5_SDA_M3	signal	EH	I2C5 Bus Date
10	I2S2_SCLK_M1	signal	BI	1252 serial clock or BCLK
11	I2C5_SCL_M3	signal	Output	I2C5 Bus clock

12	I2S2_LRCK_MI	signal	BI	1252 Left/Right channel clock
13	GND	Power	NA	Power and signal reference ground.
14	GND	Power	NA	Power and signal reference ground.
15	SPI4_MISO_M2	signal	Input	SPI4 Master input,Slave output
16	CAN2_RX	signal	Input	CAN2 receive data
17	SPI4_MOSI_M2	signal	Output	SPI4 Master output, Slave input
18	CAN2_TX	signal	Output	CAN2 transmit data
19	SPI4_CLK_M2	signal	Output	SPI4 clock
20	GND	Power	NA	Power and signal reference ground.
21	SPI4_CSO_M2	signal	Output	SPI4 Chip Select 0
22	GPIOO_BO	signal	BI	GPIO bank 0 port BO
23	GPIOLA4	signal	BI	GPIO bank 1 port A4
24	SARADC_VIN7	Analog	Input	SAR AX Channel 7 input
25	GND	Power	NA	Power and signal reference ground.
26	SARADC_VIN6	Analog	Input	SAR AX Channel 6 input
27	PWM14	signal	BI	Pulse Width Modulation 14 input or output
28	GND	Power	NA	Power and signal reference ground.
29	PWM15	signal	BI	Pulse Width Modulation 15 input or output
30	VCC_3V330	Power	Output	Power supply for peripheral, 3.3V output MAX 500mA.

2.2 Fan Connector

Pin #	Pin Name	Pin Type	Input/Output	Signal Description
1	VCC5V_FAN	Power	Output	Power supply for FAN,5V output MAX 400mA.Control by GPI03_CO
2	GND	Power	NA	Power reference ground.

2.3 Mini-PCIe

Pin #	Pin Name	Pin Type	Input/Output	Signal Description
1	MINIPCIE2O_WAKEN_3V3_L	signal	Input	Wake-up the signal from the mini-PCIe device
2	VCC3V3_MINIPCIE	Power	Output	Power supply for the mini-PCIe device,3.3V output MAX 3A in all pins

3	NC	float	NA	No connected to this pin
4	GND	Power	NA	Power and signal reference ground.
5	NC	float	NA	No connected to this pin
6	NC	float	NA	No connected to this pin
7	MINIPCIE2O_CLKREQN_3V3_L	signal	Input	PCIe2.0 Channel Reference clock request
8	NC	float	NA	No connected to this pin
9	GND	Power	NA	Power and signal reference ground.
10	NC	float	NA	No connected to this pin
11	PCIE20_2_REFCLKN	LVDS	Output	PCIe20 Port2 differential clock Negative
12	NC	float	NA	No connected to this pin
13	PCIE20_2_REFCLKP	LVDS	Output	PCIe20 Port2 differential clock Positive
14	NC	float	NA	No connected to this pin
15	GND	Power	NA	Power and signal reference ground.
16	NC	float	NA	No connected to this pin
17	NC	float	NA	No connected to this pin
18	GND	Power	NA	Power and signal reference ground.
19	NC	float	NA	No connected to this pin
20	W_DISABLEN	signal	Output	PCI-E device wireless disable
21	GND	Power	NA	Power and signal reference ground.
22	MINIPCIE2O_PERSTN	signal	Output	PCI-E devise reset
23	PCIE20_2_RXN	LVDS	Input	PCIe20 receives differential Negative
24	VCC3V3_MINIPCIE	Power	Output	Power supply for the mini-PCIe device,3.3V output MAX 3A in all pins
25	PCIE20_2_RXP	LVDS	Input	PCIe20 receives differential Positive
26	GND	Power	NA	Power and signal reference ground.
27	GND	Power	NA	Power and signal reference ground.
28	NC	float	NA	No connected to this pin
29	GND	Power	NA	Power and signal reference ground.
30	NC	float	NA	No connected to this pin
31	MINIPCIE2O_TX_N	LVDS	Output	PCIe20 transmit differential Negative

32	NC	float	NA	No connected to this pin
33	MINIPCIE2O_TX_P	LVDS	Output	PCIe20 transmit differential Positive
34	GND	Power	NA	Power and signal reference ground.
35	GND	Power	NA	Power and signal reference ground.
36	MINIPCIE_USB_DM	LVDS	BI	USB20 HOST Portal Data Minus
37	GND	Power	NA	Power and signal reference ground.
38	MINIPCIE_USB_DP	LVDS	BI	USB20 HOST Portal Data Plus
39	VCC3V3_MINIPCIE	Power	Output	Power supply for the mini-PCIe device,3.3V output MAX 3A in all pins
40	GND	Power	NA	Power and signal reference ground.
41	VCC3V3_MINIPCIE	Power	Output	Power supply for the mini-PCIe device,3.3V output MAX 3A in all pins
42	NC	float	NA	No connected to this pin
43	GND	Power	NA	Power and signal reference ground.
44	NC	float	NA	No connected to this pin
45	NC	float	NA	No connected to this pin
46	NC	float	NA	No connected to this pin
47	NC	float	NA	No connected to this pin
48	NC	float	NA	No connected to this pin
49	NC	float	NA	No connected to this pin
50	GND	Power	NA	Power and signal reference ground.
51	NC	float	NA	No connected to this pin
52	VCC3V3_MINIPCIE	Power	Output	Power supply for the mini-PCIe device,3.3V output MAX 3A in all pins

2.4 MIPI-CSI

Pin #	Pin Name	Pin Type	Input/Output	Signal Description
1	GND	Power	NA	Power and signal reference ground.
2	MIPI_CSIO_RX_DON	LVDS	Input	MIPI CSIO receives differential data lane 0 Negative

3	MIPI_CSIO_RX_DOP	LVDS	Input	MIPI CSIO receives differential data lane 0 Positive
4	GND	Power	NA	Power and signal reference ground.
5	MIPI_CSIO_RX_D1N	LVDS	Input	MIPI CSIO receives differential data lane 1 Negative
6	MIPI_CSIO_RX_D1P	LVDS	Input	MIPI CSIO receives differential data lane 1 Positive
7	GND	Power	NA	Power and signal reference ground.
8	MIPI_CSIO_RX_CLKON	LVDS	Input	MIPI CSIO receives differential Clock 0 Negativ€
9	MIPI_CSIO_RX_CLKOP	LVDS	Input	MIPI CSIO receives differential Clock 0 Positive
10	GND	Power	NA	Power and signal reference ground.
11	MIPI_CSIO_RX_D2N	LVDS	Input	MIPI CSIO receives differential data lane 2 Negative
12	MIPI_CSIO_RX_D2P	LVDS	Input	MIPI CSIO receives differential data lane 2 Positive
13	GND	Power	NA	Power and signal reference ground.
14	MIPI_CSIO_RX_D3N	LVDS	Input	MIPI CSIO receives differential data lane 3 Negative
15	MIPI_CSIO_RX_D3P	LVDS	Input	MIPI CSIO receives differential data lane 3 Positive
16	GND	Power	NA	Power and signal reference ground.
17	MIPI_CAM_PWM2	signal	Output	PWM2 for LENS
18	NC	float	NA	No connected to this pin
19	VCC_3V3_S0	Power	Output	Power supply for sensor board,3.3V output
20	MIPI_CAM_RESETN	signal	Output	GPIO out for sensor reset
21	NC	float	NA	No connected to this pin
22	MIPI_CAM_PDN	signal	Output	GPIO out for sensor power down
23	I2C3_SDA_M3_MIPI	signal	III	I2C5 Bus data
24	I2C3_SCL_M3_MIPI	signal	Output	I2C5 Bus clock
25	GND	Power	NA	Power and signal reference ground.
26	MIPI_CAM2_CLK_M1_3V3	signal	Output	Camera Master clock output
27	GND	Power	NA	Power and signal reference ground.
28	VCC_SVO	Power	Output	Power supply for sensor board, SV output
29	VCC_SVO	Power	Output	Power supply for sensor board, SV output
30	VCC_SVO	Power	Output	Power supply for sensor board, SV output

2.5 U.2

Pin#	Pin Name	Pin Type	Input/Output	Signal Description
El	PCIE30 REFCLKP SLOT	LVDS	Output	RC PCIe30 differential clock Positive
E2	PCIE3O_REFCLKN_SLOT	LVDS	Output	RC PCIe30 differential clock Negative
E3	VCC_3V3_SO	Power	Output	Power supply for JO
E4	PCIE30X4 CLKREQN_MI_L	signal	Output	DM PCIe30 Channel Reference clock request
E5	PCIE30X4 PERSTN_MUL	signal	Input	DM PCIe30 Channel reset
E6	PCIE30X4 CLKREQN_M3	signal	Input	RC PCIe30 Channel Reference clock request
E7	PCIE30 PORT1 REFCLKP	LVDS	Input	DM PCIe30 differential clock Positive
E8	PCIE3O_PORTI_REFCLKN	LVDS	Input	DM PCIe30 differential clock Negative
E9	GND	Power	NA	Power and signal reference ground.
E10	PCIE3O_PORTI_TX2P	LVDS	Output	DM PCIe30 transmit differential Positive
E11	PCIE30 PORT1 TX2N	LVDS	Output	DM PCIe30 transmit differential Negative
E12	GND	Power	NA	Power and signal reference ground.
E13	PCIE30 PORT1 RX2N	LVDS	Input	DM PCIe30 receives differential Negative
E14	PCIE30 PORT1 RX2P	LVDS	Input	DM PCIe30 receives differential Positive
E15	GND	Power	NA	Power and signal reference ground.
E16	NC	float	NA	No connected to this pin
E17	PCIE30 PORTO RX1P	LVDS	Input	RC PCIe30 receives differential Negative
E18	PCIE30 PORTO RX1N	LVDS	Input	RC PCIe30 receives differential Positive
E19	GND	Power	NA	Power and signal reference ground.
E20	PCIE30 PORTO TX1N	LVDS	Output	RC PCIe30 transmit differential Positive
E21	PCIE30 PORTO TX1P	LVDS	Output	RC PCIe30 transmit differential Negative
E22	GND	Power	NA	Power and signal reference ground.
E23	I2C4 SCL MO	signal	Output	I2C4 Bus clock
E24	I2C4 SDA MO	signal	BI	I2C4 Bus data
E25	DUALPORT_EN#	signal	Output	GPIO for Enable dual port, default low
P1	PCIE30X4_WAKEN_M I_L	signal	Output	DM PCIE30 Wake-up signal from RC
P2	PCIE30X4_WAKEN_M3	signal	Input	RC PCIE30 Wake up the signal from DM
P3	PWRDIS	signal	Output	GPIO for power disable to device
P4	IFDET	signal	Input	GPIO for detecting the interface of the device

P5	GND	Power	NA	Power and signal reference ground.
P6	GND	Power	NA	Power and signal reference ground.
P7	NC	float	NA	No connected to this pin
P8	NC	float	NA	No connected to this pin
P9	NC	float	NA	No connected to this pin
P10	PRSNT#	signal	Input	GPIO for detecting device if present
P11	ACTIVITY#	signal	Input	GPIO for detecting device if the activity
P12	GND	Power	NA	Power and signal reference ground.
P13	U2_12V	Power	Input	Power supply for blade3, input 12V
P14	U2_12V	Power	Input	Power supply for blade3, input 12V
P15	U2_12V	Power	Input	Power supply for blade3, input 12V
S1	GND	Power	NA	Power and signal reference ground.
S2	SATAO TXP	LVDS	Output	SATA30 Port() transmit differential Positive
S3	SATAO TXN	LVDS	Output	SATA30 Port() transmit differential Negative
S4	GND	Power	NA	Power and signal reference ground.
S5	SATAO RXN	LVDS	Input	SATA30 Port() receive differential Positive
S6	SATAO RXP	LVDS	Input	SATA30 Port() receive differential Negative
S7	GND	Power	NA	Power and signal reference ground.
S8	GND	Power	NA	Power and signal reference ground.
S9	NC	float	NA	No connected to this pin
S10	NC	float	NA	No connected to this pin
S11	GND	Power	NA	Power and signal reference ground.
S12	NC	float	NA	No connected to this pin
S13	NC	float	NA	No connected to this pin
S14	GND	Power	NA	Power and signal reference ground.
S15	PCIE30X4_PERSTN_M3	signal	Output	RC PCIe30 Channel reset

S16	GND	Power	NA	Power and signal reference ground.
517	PCIE30 PORTI_TX3P	LVDS	Output	DM PCIe30 transmit differential Negative
518	PCIE30 PORTI_TX3N	LVDS	Output	DM PCIe30 transmit differential Positive
519	GND	Power	NA	Power and signal reference ground.
S20	PCIE30 PORT1 RX3N	LVDS	Input	DM PCIe30 receives differential Negative
S21	PCIE30 PORT1 RX3P	LVDS	Input	DM PCIe30 receives differential Positive
S22	GND	Power	NA	Power and signal reference ground.
S23	PCIE30 PORTO RXOP	LVDS	Input	RC PCIe30 receives differential Negative
S24	PCIE30 PORTO RON	LVDS	Input	RC PCIe30 receives differential Positive
S25	GND	Power	NA	Power and signal reference ground.
S26	PCIE30 PORTO_TXON	LVDS	Output	RC PCIe30 transmit differential Negative
S27	PCIE30 PORTO_TXOP	LVDS	Output	RC PCIe30 transmit differential Positive
S28	GND	Power	NA	Po+A137:E196wer and signal reference ground.

2.6 Debug

Pin#	Pin Name	Pin Type	Input/Output	Signal Description
1	UART2_RX_MO_DEBUG	signal	Input	UART2 Receive Data for debug
2	UART2_TX_MO_DEBUG	signal	Output	UART2 Transmit Data for debug
3	GND	signal	NA	Signal reference ground.

Specifications

3.1 Environmental

Parameter	Specifications
Operating Temperature	0 ° to +80 °C
Storage Temperature	0 ° to +80 °C

3.2 Mechanical

Parameter	Specifications
2.5-inch Pico-ITX	100 x 72mm
Weight	160g

Support

4.1 Technical Support
MIX TILE technical support team assists you with the questions you may have. Contact us with the following methods below.
Email: support@mixtile.com
Website: https://www.mixtile.com

Documents / Resources

MIXTILE Blade 3 | Single Board Computer User Manual Get Started with https://www.mixtile.com/wiki	**MIXTILE Blade 3 Single Board Computer** [pdf] User Manual Blade 3, Single Board Computer, Blade 3 Single Board Computer, Board Computer, Computer

References

- ◈ **ARM Single Board Computer IoT Edge Computing Solutions | Mixtile**