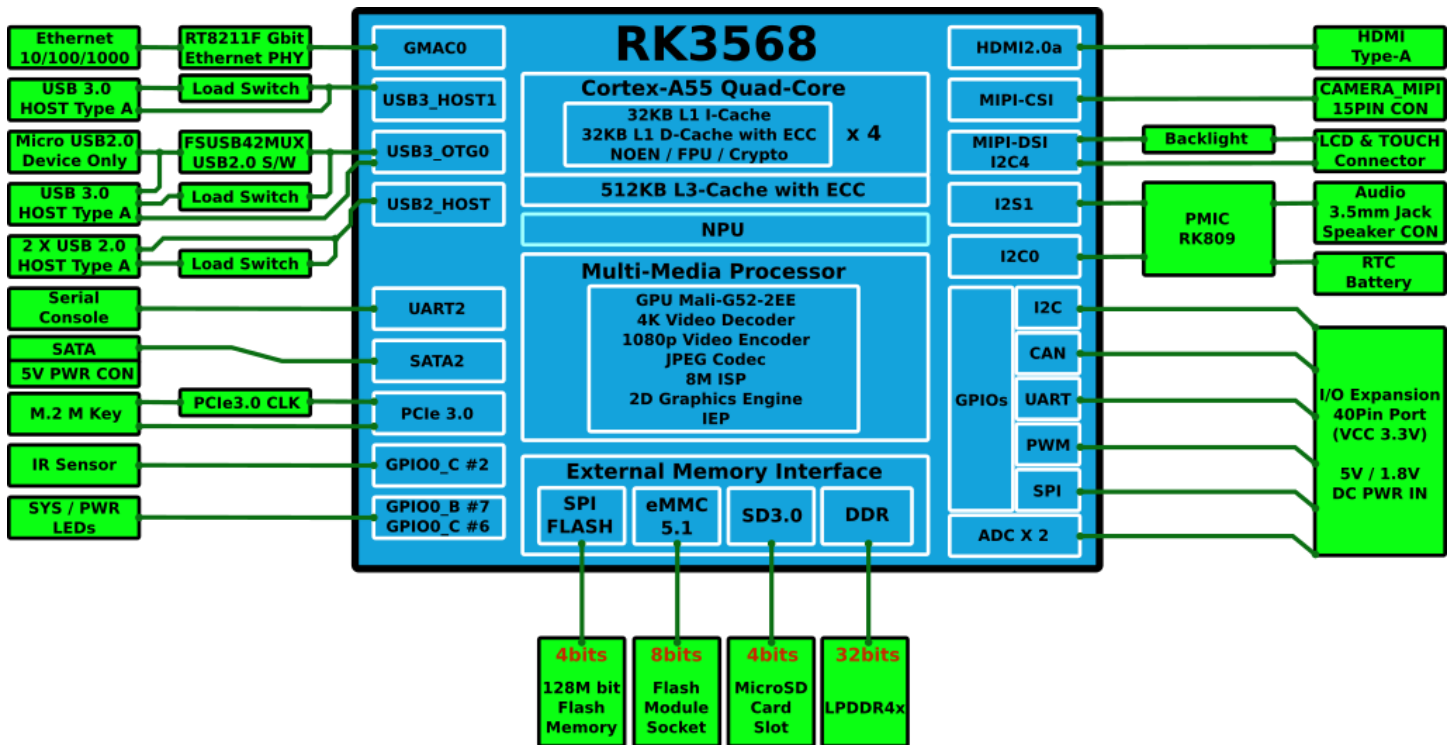


Odroid-M1

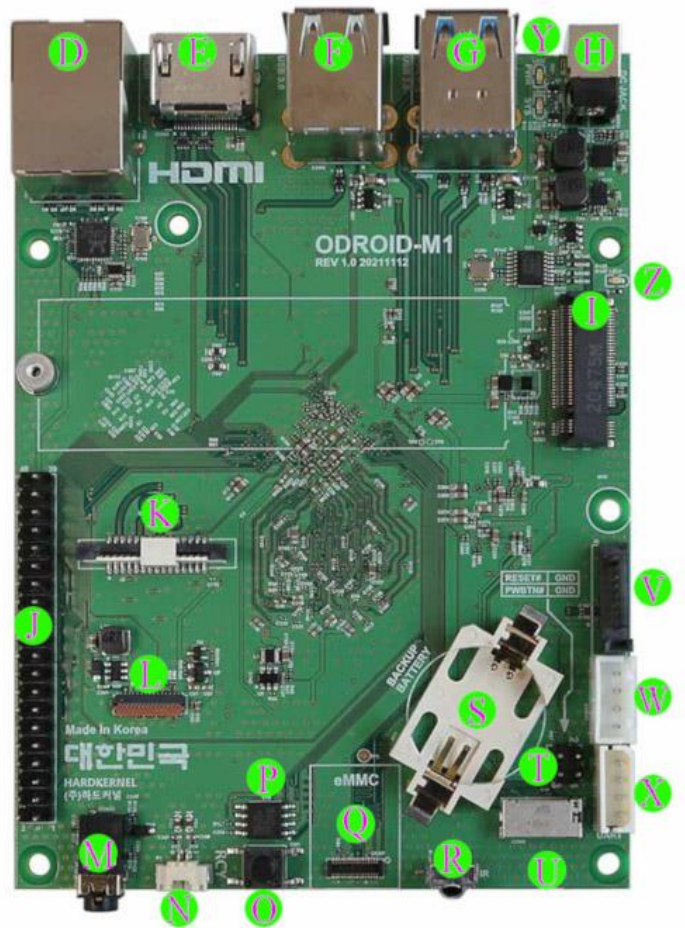
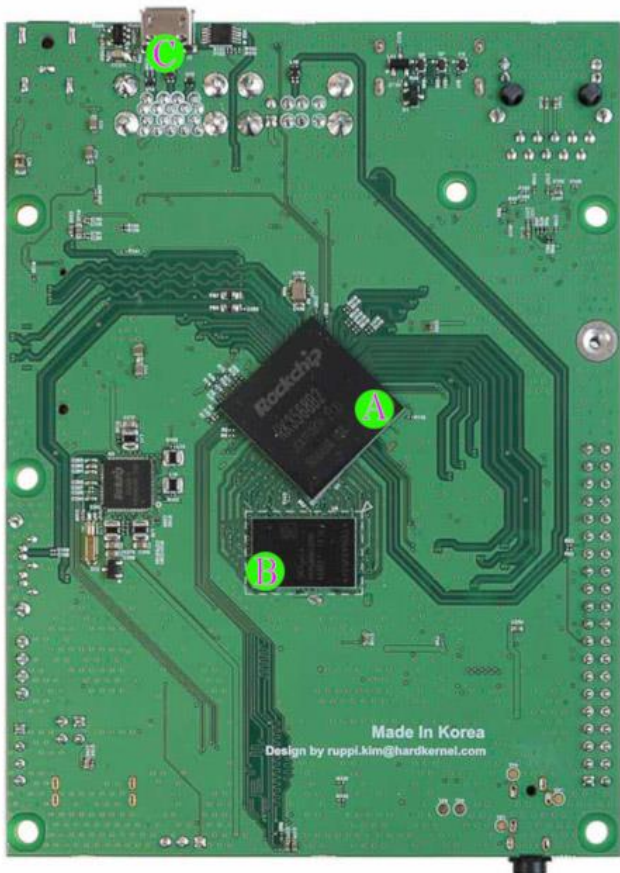
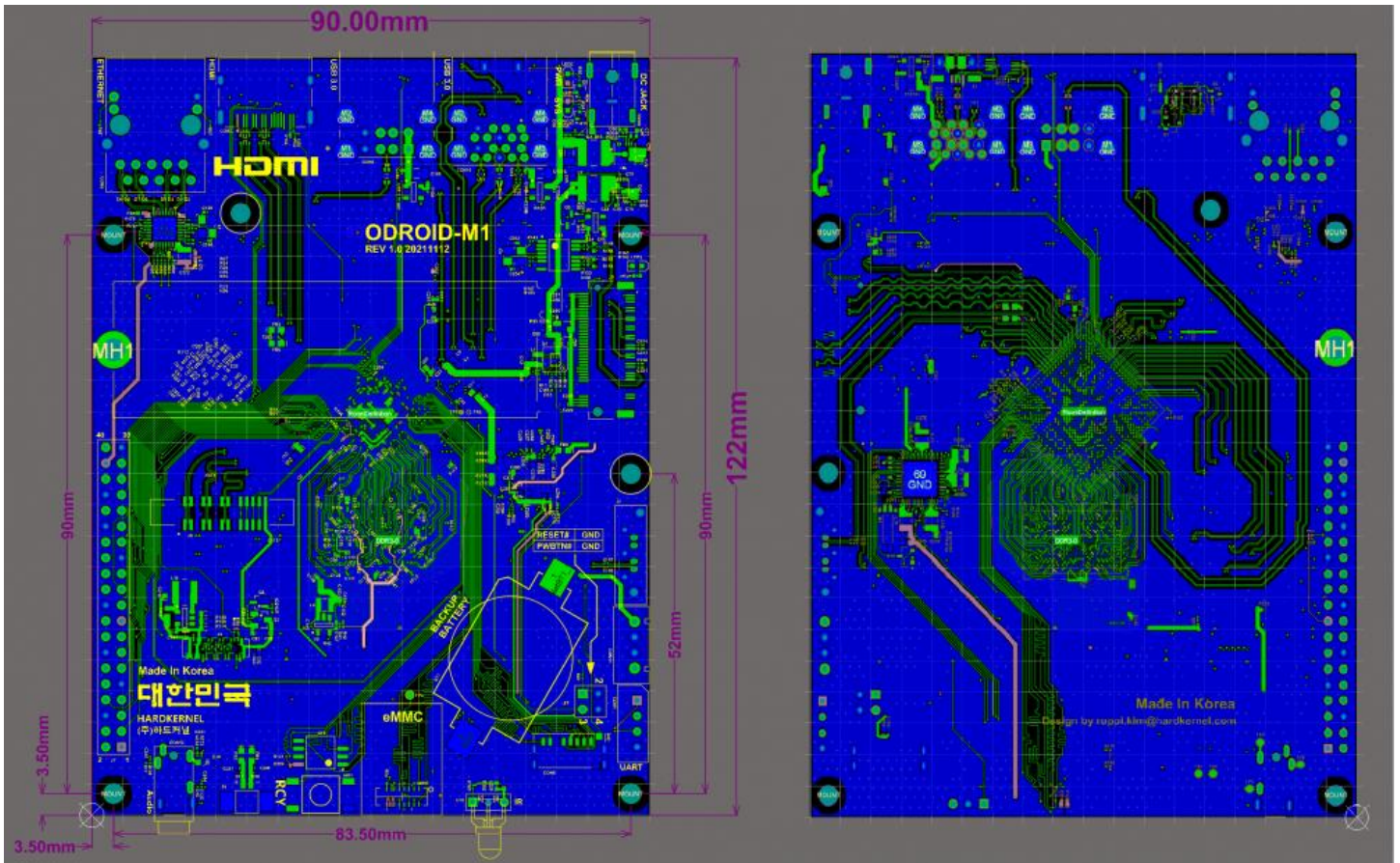
The ODROID-M1 is a single board computer developed for use in a wide variety of embedded system applications. To achieve this goal, we have developed various peripherals and device driver software over the past 10 months. In addition, RK3568B2, the core brain of ODROID-M1, is considered suitable for embedded application use as SoC manufacturer Rockchip guarantees supply for the next 15 years.



Schematics, Drawings and RK3568 datasheet

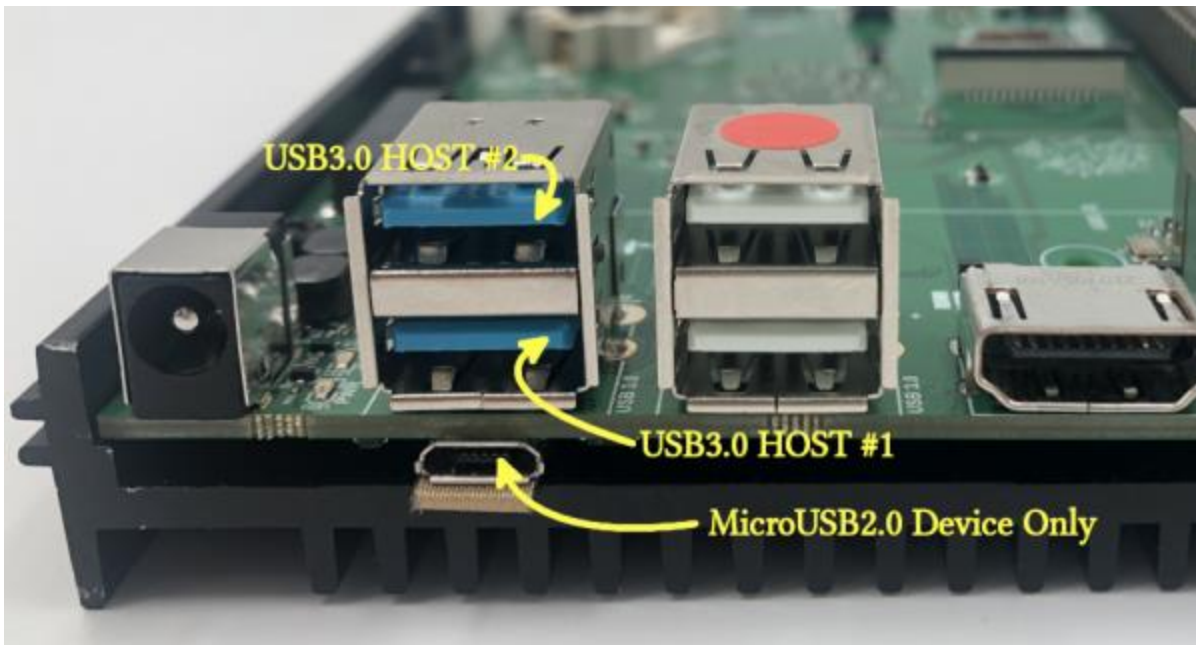
- [RockChip RK3568B2 Data Sheet](#)
- [M1 Schematics](#)
- [PCB Mechanical drawings \(DXF CAD format\)](#)
- [ODROID-M1 Fritzing part\(Breadboard view\)](#)
- [M1 Heatsink \(DXF CAD Format\)](#)
- [M1 Heatsink \(3D model\)](#)

Board Layout



A	Rockchip RK3568B2 CPU	N	1 x 0.5Mono Speaker Output 1.3watt 8Ω
B	LPDDR4 RAM	O	1 x SPI recovery switch
C	1 x Micro USB2.0 Device only	P	1 x SPI Flash 16MiB
D	1 x RJ45 Ethernet Port (10/100/1000)	Q	1 x eMMC Module Socket
E	1 x HDMI 2.0	R	1 x IR Receiver
F	2 x USB 2.0	S	1 x RTC Backup Battery Holder
G	2 x USB 3.0	T	1 x Reset jumper 1 x Power jumper
H	1 x DC Power Jack	U	1 x Micro SD Slot
I	1 x M.2. M-KEY PCIe3.0 2Lane	V	1 x SATA3
J	40 x GPIO Pins	W	1 x SATA Power(5volt)
K	1 x MIPI CSI 2Lane	X	1 x UART for System Console
L	1 x MIPI DSI 4Lane	Y	2 x System LED Indicators
M	1 x 3.5mm Headphone Jack	Z	1 x M.2 LED Indicator

Limitation of the MicroUSB 2.0 port



Due to shared resources, bottom USB 3 port and Micro USB 2.0 port cannot be used at the same time.

In the left picture, the arrows point at each USB port.

1. USB3.0 HOST #2

No effect on MicroUSB2.0 Device mode

2. USB3.0 HOST #1

When MicroUSB2.0 Device is connected, this port will be opened.

3. MicroUSB2.0 Device Only

This port can only be used in device mode.

If connected to both USB3.0 HOST #1 and MicroUSB2.0 Device, MicroUSB2.0 Device will work only.

More detailed explanation. <https://forum.odroid.com/viewtopic.php?p=345991#p345991>

USB3.0 HOST #1 and MicroUSB2.0 OTG port share the same USB2.0 data line (D+/D-), this makes both ports cannot be used at the same time. It appears in the specification of the RK3568 CPU. For that reason, There can be either used only USB2.0 OTG or USB3.0 HOST.

By placing the USB2.0 switch(U22 in the ODROID-M1 schematics) in the middle, ODROID-M1 has one MicroUSB 2.0 DEVICE role and two USB3.0 HOST. but there are still other restrictions.

USB3.0 HOST works as usual. But, when the microUSB2.0 is connected, the USB2.0 switch makes unlinks the USB2.0 D+/D- lines of the USB3.0 HOST, and links to the microUSB2.0 data lines. (MicroUSB2.0 has a high priority than USB3.0 HOST). Simultaneously, it becomes the DEVICE role.

It is the same result that supplies power 5.0V in the VBUS of the microUSB2.0 port alone. That means connecting a USB dumb charger (without data lines) has the same behaviour.

Again, the MicroUSB2.0 OTG port has only a DEVICE role present in the ODROID-M1. And the bottom USB 3.0 HOST will stop working when MicroUSB2.0 is connected.

Specifications

Form Factor	Board Dimensions: 90mm x 122mm x 16mm Heatsink Dimensions: 100mm x 123mm x 19mm Weight: 253 g including heatsink
Processor	Rockchip RK3568B2 Processor L1 instruction cache: 32 KB, 4-way set associative (128 sets), 64 byte lines, shared by 1 processor L1 data cache: 32 KB, 4-way set associative (128 sets), 64 byte lines, shared by 1 processor L3 data cache: 512KB , 16-way set associative (512 sets), 64 byte lines, shared by 4 processors Quad-Core Cortex-A55 (1.992GHz) ARMv8-A architecture with Neon and Crypto extensions Mali-G52 MP2 GPU with 4 x Execution Engines (650Mhz)
NPU	0.8Tops@INT8, integrated high-performance AI accelerator RKNN NPU Supports one-click switching of Caffe/TensorFlow/TFLite/ONNX/PyTorch/Keras/Darknet
Memory	LPDDR4x 4/8GiB with 32-bit bus width, , supports all-data-link ECC Data rate: 3400 MT/s, up to 1,560MHz
Storage	1 x eMMC slot 1 x Micro SD slot (DS/HS mode up to UHS-I SDR104) 1 x NVME M.2 SSD (PCIe 3.0 x 2) 1 x SATA3.0
Networking	1 x GbE LAN ports (RJ45, supports 10/100/1000 Mbps) - Realtek RTL8211F (Ethernet transceiver) - LED indicators * Green LED: Flashing by data traffics at 100Mbps connection * Amber LED: Flashing by data traffics at 1000Mbps connection
Video	1 x HDMI 2.0 (up to 4K@60Hz with HDR, EDID)
Audio	1 x 3.5mm phone jack, 1 x mono line output
External I/O	2 x USB 2.0 host port 2 x USB 3.0 host port or 1 x USB 3.0 host port when USB 2.0 OTG port is dedicated 1 x Debug serial console (UART) 1 x SATA Connector

	1 x Camera Serial Interface (15 pin) 1 x 40 pin GPIO
Other features	IR receiver for remote controller System LED Indicators: - Red (POWER) – Solid light when DC power is connected - Blue (ALIVE) – Flashing like heartbeat while Kernel is running. Solid On in the u-boot stage.
Power	1 x DC jack : outer (negative) diameter 5.5mm, inner (positive) diameter 2.1mm DC input : 7.5V ~ 15.5V - DC 12V/2A power adapter is recommended - IDLE : $\approx 1.25W$ - CPU Stress : $\approx 4.44W$ (Performance governor) - Power Off : $\approx 0W$

We recommend powering the ODROID-M1 with a good quality 12V/2A power adapter.

The ODROID-M1 provides 40-pin dual row expansion header “**J1**”.

The location and pinout of these connectors are illustrated below. (**Board Revision 1.0 : 2021/11/12**)

All signals on the expansion headers are 3.3V except for the analog input signal.

J1 - 2X20 PINS

Default Pin State	GPIO & Export No	Net Name	Pin Number	Pin Number	Net Name	GPIO & Export No	Default Pin State
-	-	3.3V	1	2	5.0V	-	-
I(P/D)	GPIO3B.6 (#110)	I2C0_SDA	3	4	5.0V	-	-
I(P/U)	GPIO3B.5 (#109)	I2C0_SCL	5	6	GND	-	-
I(P/D)	GPIO0B.6 (#14)		7	8	UART1_TX	GPIO3D.6 (#126)	I(P/U)
-	-	GND	9	10	UART1_RX	GPIO3D.7 (#127)	I(P/U)
I(P/U)	GPIO0C.0 (#16)	UART0_RX	11	12		GPIO3D.0 (#120)	I(P/U)

Default Pin State	GPIO & Export No	Net Name	Pin Number	Pin Number	Net Name	GPIO & Export No	Default Pin State
I(P/U)	GPIO0C.1 (#17)	UART0_TX	13	14	GND	-	-
I(P/U)	GPIO3B.2 (#106)		15	16		GPIO3C.6 (#118)	I(P/U)
-	-	3.3V	17	18		GPIO3C.7 (#119)	I(P/U)
I(P/U)	GPIO2D.1 (#89)	SPI0_MOSI	19	20	GND	-	-
I(P/U)	GPIO2D.0 (#88)	SPI0_MISO	21	22		GPIO3D.1 (#121)	I(P/U)
I(P/U)	GPIO2D.3 (#91)	SPI0_SCLK	23	24	SPI0_CS0	GPIO2D.2 (#90)	I(P/U)
-	-	GND	25	26		GPIO3D.2 (#122)	I(P/D)
I(P/U)	GPIO0B.4 (#12)	I2C1_SDA	27	28	I2C1_SCL	GPIO0B.3 (#11)	I(P/U)
I(P/U)	GPIO4C.1 (#145)	UART1_CTS	29	30	GND	-	-
I(P/U)	GPIO4B.6 (#142)	UART1_RTS	31	32		GPIO3D.3 (#123)	I(P/D)
I(P/U)	GPIO0B.5 (#13)		33	34	GND	-	-
I(P/D)	GPIO3D.5 (#125)		35	36		GPIO3D.4 (#124)	-
		ADC.AIN1	37	38	REF 1.8V		
-	-	GND	39	40	ADC.AIN0		

3.3V Power	1			2	5.0V Power
I2C3_SDA_M1/GPIO3_B.6	3			4	5.0V Power
I2C3_SCL_M1/GPIO3_B.5	5			6	Ground
PWM2_M1/GPIO0_B.6	7			8	GPIO3_D.6/UART1_TX_M1
Ground	9			10	GPIO3_D.7/UART1_RX_M1
PWM1_M0/UART0_RX/GPIO0_C.0	11			12	GPIO3_D.0
PWM2_M0/UART0_TX/GPIO0_C.1	13			14	Ground
PWM9_M0/GPIO3_B.2	15			16	GPIO3_C.6
3.3V Power	17			18	GPIO3_C.7
SPI0_MOSI_M1/GPIO2_D.1	19			20	Ground
SPI0_MISO_M1/GPIO2_D.0	21			22	GPIO3_D.1
SPI0_CLK_M1/GPIO2_D.3	23			24	GPIO2_D.2/SPI0_CS0_M1
Ground	25			26	GPIO3_D.2
I2C1_SDA/CAN0_RX_M0/GPIO0_B.4	27			28	GPIO0_B.3/CAN0_TX_M0/I2C1_SCL
UART1_CTSn_M1/GPIO4_C.1	29			30	Ground
UART1_RTSn_M1/GPIO4_B.6	31			32	GPIO3_D.3
PWM1_M1/GPIO0_B.5	33			34	Ground
GPIO3_D.5	35			36	GPIO3_D.4
SARADC_VIN.7	37			38	VDDIO_A01V8
Ground	39			40	SARADC_VIN.6

GPIO Map for WiringPi Library

GPIO	WiringPi	Name	Mode	Initial Level	Header Pin	Header Pin	Initial Level	Mode	Name	WiringPi	GPIO
		3.3V			1	2			5v		
110	8	I2C.SDA0	IN	1	3	4			5v		
109	9	I2C.SCL0	IN	1	5	6			GND		
14	7	GPIO.14	IN	1	7	8	1	IN	TxD1	15	126
		GND			9	10	1	IN	TxR1	16	127
16	0	GPIO.16	IN	1	11	12	1	IN	GPIO.120	1	120
17	2	GPIO.17	IN	1	13	14			GND		
106	3	GPIO.106	IN	1	15	16	1	IN	GPIO.118	4	118
		3.3v			17	18	1	IN	GPIO.119	5	119
89	12	SPIO_MOSI	IN	1	19	20			GND		
88	13	SPIO_MISO	IN	1	21	22	1	IN	GPIO.121	6	121
91	14	SPI_CLK	IN	1	23	24	1	IN	SPI_CEO	10	90
		GND			25	26	1	IN	GPIO.122	11	122
12	30	I2C.SDA1	IN	1	27	28	1	IN	I2C_SCL1	31	11
145	21	GPIO.145	IN	1	29	30			GND		
142	22	GPIO.142	IN	1	31	32	0	IN	GPIO.123	26	123
13	23	GPIO.13	IN	0	33	34			GND		
125	24	GPIO.125	IN	0	35	36	1	OUT	GPIO.124	27	124
	25	AIN.2			37	38			1.8V	28	
		GND			39	40			AIN.0	29	

UART Console Connector

```

____UART____
|Pin 4 - GND|
|Pin 3 - RXD|
|Pin 2 - TXD|
|Pin 1 - VCC|
\_____|

```

CON1

3.3V LVTTTL

SATA POWER Connector

Note that this board **does NOT support 3.5inch HDD** 12Volt power rail.
You need a separated 12Volt SATA power supply if you want to use a 3.5" HDD.

```
_____CON11_____
|Pin 4 - NC |
|Pin 3 - GND|
|Pin 2 - GND|
|Pin 1 - 5V |
\          |
```

RESET/POWER PIN HEADER

```
_____J7 2.54mm HEADER_____
|(RESET#)Pin 1 + + Pin 2(GND)|
|(POWER#)Pin 3 + + Pin 4(GND)|
\          |
```

Regulatory Compliance Documents

- [ODROID-M1 KC Certification](#)
- [ODROID-M1 CE Certification](#)
- [ODROID-M1 FCC Certification](#)

EMI Gasket

The purpose of EMI Gasket of between the Heatsync and the Micro-USB Connector is to prevent electromagnetic interference(EMI) and electrostatic discharge(ESD).



Power consumption and thermal characteristics with many peripherals

We attached the following peripherals to the M1 board and logged power consumption and CPU temperature.

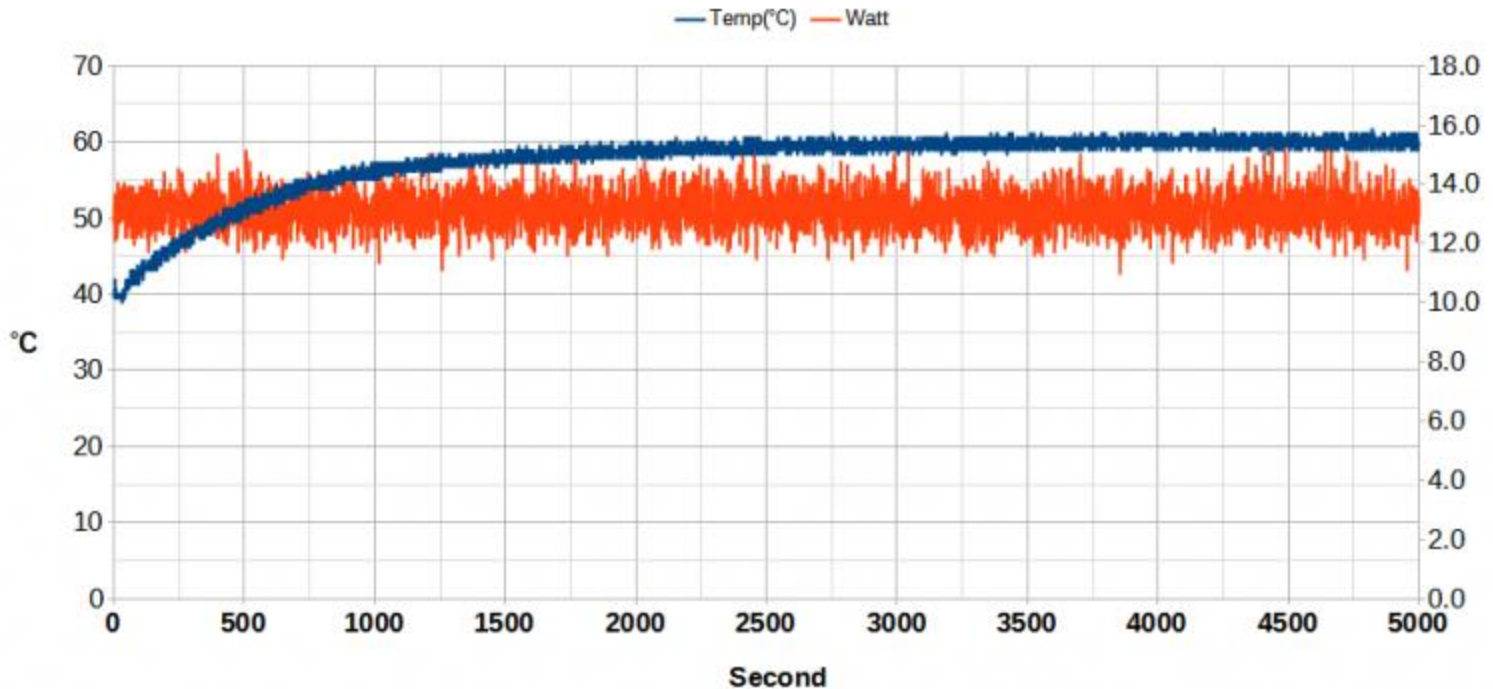
1. eMMC Module
2. M.2 SSD
3. SATA SSD
4. MIPI CSI Camera
5. MIPI DSI Display Vu8M (with maximum backlight brightness)
6. USB mouse and keyboard
7. 4K HDMI display
8. WiFi Module 5B

Software setup

1. Android 11
2. CPU and GPU stress test app showing on the Vu8M
3. MIPI CSI Camera preview app showing on the HDMI TV
4. Continuous 'dd' access from/to NVMe and SATA SSD devices in background

SmartPower3 for power transient logging

ODROID-M1 Power Consumption & Temperature



We ran the relatively heavy load test for a few hours.

The average power consumption was 13.5Watt and the CPU temperature was 61°C.

Ambient temperature was around 22~24°C.

Observed peak values were 15.7Watt and 63°C.

Therefore, we believe the recommended 12V/2A (24Watt) PSU and the stock heatsink must be sufficient for typical applications.

When we didn't connect any peripherals and ran a CPU stress program on a headless configuration, the power consumption was 4.5Watt and the SoC temperature was 51°

Using Internal Peripherals

- [External power button](#)

GPIO

- [ADC](#)
- [Enhancement of 40pin GPIO](#)
- [I2C](#)
- [PWM](#)
- [SPI](#)
- [UART](#)
- [WiringPi and Python Wrapper](#)
- [How to Enable SPI/I2C/UART Using DTBO](#)

Software Side

- [How to set cpu frequency and cores](#)

- [Device Tree Overlay](#)
- [Control the ISP](#)
- [How to use NPU](#)
- [Running MIPI Camera](#)

Misc

- [Flashing OS image](#)
- [Display - Vu8M](#)
- [Tested/verified compatible M.2 NVMe](#)

Software Platform

Information

- [Boot sequence](#)
- [Partition Table](#)
- [UART debugging port](#)

Build

- [U-boot](#)
- [Linux](#)
- [Android](#)

Software(OS) Release

Please read [**THIS**](#) once before you start to download and flashing S/W release on your ODROID device.

- [Android](#)
- [Ubuntu](#)
- [Third Party OS Images](#)