



LCD Display Controller Board Engineer Specification V1.2

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|-----------------|-------------|
| Model Name | KEC-MDB02-E |
| Release Date | 2020-1-9 |
| Release Version | V1.2 |

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|-------------|------------|-------------|
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Contents

1. Features.....2

2. Specification.....3

3. Function Layout.....4

4. Interface Definition.....5

5. Mechanical Dimension.....11

6. Configuration and Precautions.....12

7. Key Materials List.....13

Revision History

| Revision | Date | Page | Description Of Updated | Author |
|----------|----------|------|------------------------|---------|
| 1.0 | 2019.1.5 | All | First issued. | Joe Lee |
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1. Features

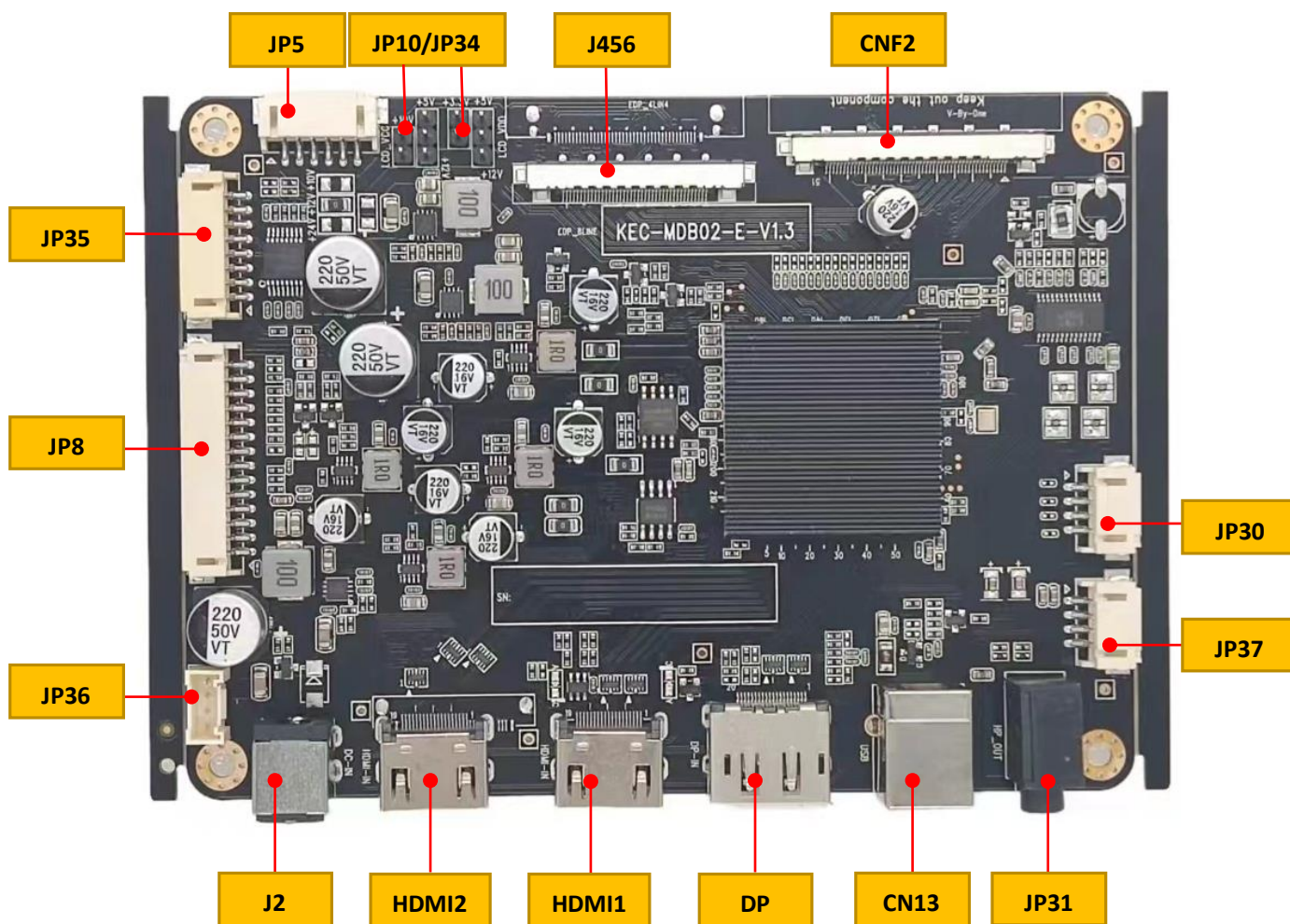
- ✚ Resolution up to 4096x2160/60Hz
- ✚ Support 8-bit/10-bit output through 8-lanes V-by-One/eDP(HBR) & 4-lanes eDP(HBR2)
- ✚ Support 3.3V/5V/10V/12V panel voltage(*)
- ✚ 2*HDMI2.0 input
- ✚ 1*DisplayPort1.2 input
- ✚ 2x10W Class-D AMP at 8ohm
- ✚ Headphones output
- ✚ Keypad & IR receiver(option)
- ✚ 12V~24V DC input
- ✚ Standby mode power consumption less than 0.5W
- ✚ Support DDC/CI/2B protocol
- ✚ Support RS-232 protocol

*: Hardware reserved for other panel voltage.

2. Specification

| | | | | |
|--------------------------|---|---|---------------------------|--|
| Chipset | Realtek | | | |
| Target Market | Medical Display(5MP/6MP/8MP)、Industrial Display | | | |
| OSD Language | English、Simplified Chinese | | | |
| Panel | Voltage | 3.3V/5V/10V/12V/others | | |
| | Interface | 8-lanes V-by-One/eDP(HBR) & 4-lanes eDP(HBR2) | | |
| | Resolution | 4096x2160/60Hz | | |
| Video Input | HDMI 2.0 | 19P Type-A, Max. resolution is 3840x2160/60Hz | | |
| | DisplayPort 1.2 | 20P, Max. resolution is 3840x2160/60Hz | | |
| Audio Output | 3.5mm phone-Jack | Headphones | | |
| | Class-D AMP | 2x10W(8ohm) THDN<10%@1KHz | | |
| Power | Power Input | 12V~24V DC | | |
| | Normal Consumption | Max. 6W(not include panel consumption) | | |
| | Standby Consumption | < 0.5W | | |
| User Key Function | Power、Menu、Right、Left、Exit | | | |
| Special Function | Chip | 12-bit video processor | Color processing | |
| | | 12-bit 3D LUT | Grayscale processing | |
| | | FRC+RTC | | |
| | | 180 degree Video Rotate | | |
| | Software | Support DICOM | DICOM3.0 Part14(GSDF) | |
| | | Support Color Temp. Cal. | Default 2-groups | |
| | | Support Gamma Cal. | Default 7-groups | |
| | | Support Gamut Cal. | sRGB/Adobe RGB/DCI-P3 | |
| | | Support BLT function | Option(Need Light Sensor) | |
| | | Support 一键灯箱 | Option | |

3. Function Layout

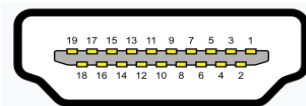


| | | |
|-----------|------------------------|------------------------------------|
| JP8 | Keypad & IR Receiver | OSD menu control, LED & IR control |
| JP35 | Peripheral IO Control | RS-232/IIC/PWM/GPIO/3.3V/5V DC |
| JP5 | Backlight Control | Backlight power and control |
| JP10/JP34 | Panel Voltage Selector | 3.3V/5V/10V/12V panel voltage |
| J456 | 8-lanes eDP(HBR) | FI-RE41S-HF |
| CNF2 | 8-lanes V-by-One | FI-RE51S-HF |
| JP30 | Speaker Output | 2x10W at 8ohm speaker |
| JP37 | Touch Interface | Interface for touch |
| JP31 | Headphones Output | 3.5mm phone jack |
| CN13 | USB Interface | USB2.0 type-B for touch |
| DP | DP Signal Input | Support DP 1.2 |
| HDMI1/2 | HDMI Signal Input | Support HDMI 2.0 |
| J2 | DC Jack Input | 12V~24V DC input |
| JP36 | Power Input | 12V~24V DC input |

4. Interface Definition

4.1 HDMI Signal Input

Location - HDMI1-IN/HDMI2-IN: 19P Type-A

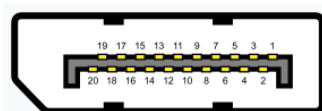


Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------|---------|---------|------------------|
| 1 | Data2+ | TMDS data2+ | 11 | GND | Ground |
| 2 | GND | Ground | 12 | Clock- | TMDS clock- |
| 3 | Data2- | TMDS data2- | 13 | CEC | CEC |
| 4 | Data1+ | TMDS data1+ | 14 | NC | NC |
| 5 | GND | Ground | 15 | DDC SCL | IIC serial clock |
| 6 | Data1- | TMDS data1- | 16 | DDC SDA | IIC serial data |
| 7 | Data0+ | TMDS data0+ | 17 | GND | Ground |
| 8 | GND | Ground | 18 | +5V | +5V |
| 9 | Data0- | TMDS data0- | 19 | HPD | Hot plug detect |
| 10 | Clock+ | TMDS clock+ | | | |

4.2 DisplayPort Signal Input

Location - DP-IN: 20P



Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|---------------|-------------------|---------|---------------|-------------------------|
| 1 | ML_Lane 3 (n) | Lane 3 (negative) | 11 | GND | Ground |
| 2 | GND | Ground | 12 | ML_Lane 0 (p) | Lane 0 (positive) |
| 3 | ML_Lane 3 (p) | Lane 3 (positive) | 13 | CONFIG1 | Connected to ground |
| 4 | ML_Lane 2 (n) | Lane 2 (negative) | 14 | CONFIG2 | Connected to ground |
| 5 | GND | Ground | 15 | AUX CH (p) | Auxiliary CH (positive) |
| 6 | ML_Lane 2 (p) | Lane 2 (positive) | 16 | GND | Ground |
| 7 | ML_Lane 1 (n) | Lane 1 (negative) | 17 | AUX CH (n) | Auxiliary CH (negative) |
| 8 | GND | Ground | 18 | Hot Plug | Hot plug detect |
| 9 | ML_Lane 1 (p) | Lane 1 (positive) | 19 | Return | Return for power |
| 10 | ML_Lane 0 (n) | Lane 0 (negative) | 20 | DP_PWR | Power for connector |

4.3 8-lanes eDP(HBR) Interface Connector

Location - J456: 41P FPC connector pitch = 0.5mm(FI-RE41S-HF)

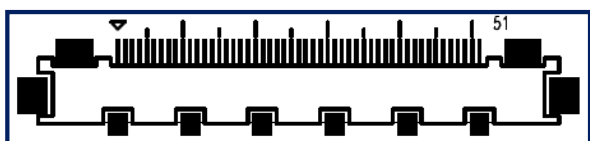


Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|------------|--------------------------|---------|------------|--------------------------|
| 1 | PANEL_VCC | Panel power supply | 22 | TX5P | 2 nd Lane1_P |
| 2 | PANEL_VCC | Panel power supply | 23 | TX5N | 2 nd Lane1_N |
| 3 | PANEL_VCC | Panel power supply | 24 | GND | Ground |
| 4 | NC | | 25 | TX4P | 2 nd Lane0_P |
| 5 | GND | Ground | 26 | TX4N | 2 nd Lane0_N |
| 6 | GND | Ground | 27 | VTX_HPD_1 | 1 st HPD |
| 7 | GND | Ground | 28 | AUX_CH_N_1 | 1 st AUX_CH_N |
| 8 | NC | | 29 | AUX_CH_P_1 | 1 st AUX_CH_P |
| 9 | NC | | 30 | GND | Ground |
| 10 | NC | | 31 | TX3P | 1 st Lane3_P |
| 11 | NC | | 32 | TX3N | 1 st Lane3_N |
| 12 | VTX_HDP_2 | 2 nd HPD | 33 | GND | Ground |
| 13 | AUX_CH_N_2 | 2 nd AUX_CH_N | 34 | TX2P | 1 st Lane2_P |
| 14 | AUX_CH_P_2 | 2 nd AUX_CH_P | 35 | TX2N | 1 st Lane2_N |
| 15 | GND | Ground | 36 | GND | Ground |
| 16 | TX7P | 2 nd Lane3_P | 37 | TX1P | 1 st Lane1_P |
| 17 | TX7N | 2 nd Lane3_N | 38 | TX1N | 1 st Lane1_N |
| 18 | GND | Ground | 39 | GND | Ground |
| 19 | TX6P | 2 nd Lane2_P | 40 | TX0P | 1 st Lane0_P |
| 20 | TX6N | 2 nd Lane2_N | 41 | TX0N | 1 st Lane0_N |
| 21 | GND | Ground | | | |

4.4 8-lanes V-by-One Interface Connector

Location - CNF2: 51P FPC connector pitch = 0.5mm(FI-RE51S-HF)



Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------|---------|--------|-----------------|
| 1 | GND | Ground | 27 | HTPDN | Hot plug detect |

| | | | | | |
|----|-------|-----------------|----|-----------|---------------------|
| 2 | TX7P | Vx1 data lane7+ | 28 | 8b/10b | 8-bit/10-bit select |
| 3 | TX7N | Vx1 data lane7- | 29 | NC | |
| 4 | GND | Ground | 30 | NC | |
| 5 | TX6P | Vx1 data lane6+ | 31 | NC | |
| 6 | TX6N | Vx1 data lane6- | 32 | NC | |
| 7 | GND | Ground | 33 | SCL | IIC serial clock |
| 8 | TX5P | Vx1 data lane5+ | 34 | SDA | IIC serial data |
| 9 | TX5N | Vx1 data lane5- | 35 | NC | |
| 10 | GND | Ground | 36 | NC | |
| 11 | TX4P | Vx1 data lane4+ | 37 | NC | |
| 12 | TX4N | Vx1 data lane4- | 38 | NC | |
| 13 | GND | Ground | 39 | NC | |
| 14 | TX3P | Vx1 data lane3+ | 40 | NC | |
| 15 | TX3N | Vx1 data lane3- | 41 | GND | Ground |
| 16 | GND | Ground | 42 | GND | Ground |
| 17 | TX2P | Vx1 data lane2+ | 43 | NC | |
| 18 | TX2N | Vx1 data lane2- | 44 | PANEL_VCC | Panel power supply |
| 19 | GND | Ground | 45 | PANEL_VCC | Panel power supply |
| 20 | TX1P | Vx1 data lane1+ | 46 | PANEL_VCC | Panel power supply |
| 21 | TX1N | Vx1 data lane1- | 47 | PANEL_VCC | Panel power supply |
| 22 | GND | Ground | 48 | PANEL_VCC | Panel power supply |
| 23 | TX0P | Vx1 data lane0+ | 49 | PANEL_VCC | Panel power supply |
| 24 | TX0N | Vx1 data lane0- | 50 | PANEL_VCC | Panel power supply |
| 25 | GND | Ground | 51 | PANEL_VCC | Panel power supply |
| 26 | LOCKN | Lock detect | | | |

4.5 4-lanes eDP(HBR2) Interface Connector

Location - J457: 40P FPC connector pitch = 0.5mm

Pin assignment and definition:



| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------|---------|--------|-----------------|
| 1 | NC | | 22 | NC | |
| 2 | GND | Ground | 23 | GND | Ground |
| 3 | TX0N | Link lane0- | 24 | GND | Ground |
| 4 | TX0P | Link lane0+ | 25 | GND | Ground |
| 5 | GND | Ground | 26 | NC | |
| 6 | TX1N | Link lane1- | 27 | HPD | Hot plug detect |

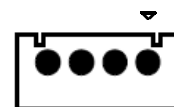
| | | | | | |
|----|----------|--------------------|----|--------|--------------------------|
| 7 | TX1P | Link lane1+ | 28 | GND | Ground |
| 8 | GND | Ground | 29 | GND | Ground |
| 9 | TX2N | Link lane2- | 30 | GND | Ground |
| 10 | TX2P | Link lane2+ | 31 | NC | |
| 11 | GND | Ground | 32 | BL_ENA | Backlight on/off control |
| 12 | TX3N | Link lane3- | 33 | BL_DIM | PWM signal for dimming |
| 13 | TX3P | Link lane3+ | 34 | NC | |
| 14 | GND | Ground | 35 | NC | |
| 15 | AUX_CH_P | Auxiliary Channel+ | 36 | NC | |
| 16 | AUX_CH_N | Auxiliary Channel- | 37 | BL_PWR | Backlight power supply |
| 17 | GND | Ground | 38 | BL_PWR | Backlight power supply |
| 18 | LCD_VCC | Panel power supply | 39 | BL_PWR | Backlight power supply |
| 19 | LCD_VCC | Panel power supply | 40 | BL_PWR | Backlight power supply |
| 20 | LCD_VCC | Panel power supply | | | |
| 21 | LCD_VCC | Panel power supply | | | |

4.6 Power Input(External) Connector

Location - J2: DC-005 2.5MM

4.7 Power Input(Internal) Connector

Location - JP36: 4P wafer pitch = 2.0mm



Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------|---------|--------|------------------|
| 1 | GND | Ground | 3 | VIN | 12V~24V DC input |
| 2 | GND | Ground | 4 | VIN | 12V~24V DC input |

4.8 Keypad & IR Connector

Location - JP8: 14P wafer pitch = 2.0mm



Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------------|---------|--------|-------------|
| 1 | 3.3V | 3.3V power for IR | 8 | K1 | Key1 input |
| 2 | IR | IR input | 9 | K2 | Key2 input |
| 3 | GND | Ground | 10 | K3 | Key3 input |
| 4 | K0 | Key0 input | 11 | K4 | Key4 input |
| 5 | R-L | Red LED control | 12 | K5 | Key5 input |

| | | | | | |
|---|-----|-------------------|----|----|------------|
| 6 | G-L | Green LED control | 13 | K6 | Key6 input |
| 7 | GND | Ground | 14 | K7 | Key7 input |

4.9 Peripheral IO Control Connector

Location - JP35: 8P wafer pitch = 2.0mm

Pin assignment and definition:

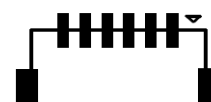


| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|---------|----------------------|---------|---------|------------------|
| 1 | GND | Ground | 5 | IIC_SCL | IIC serial clock |
| 2 | 3.3V/5V | 3.3V/5V power output | 6 | IIC_SDA | IIC serial data |
| 3 | PWM | PWM output | 7 | 232_Tx | RS-232 TXD |
| 4 | GPIO | GPIO output | 8 | 232_Rx | RS-232 RXD |

4.10 Backlight Control Connector

Location - JP5: 6P wafer pitch = 2.0mm

Pin assignment and definition:

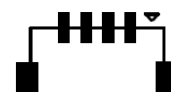


| Pin No. | Symbol | Description | Parameter |
|---------|--------|----------------------------|-----------------------|
| 1 | BL-VCC | Power output for backlight | DC 12V/24V |
| 2 | BL-VCC | Power output for backlight | DC 12V/24V |
| 3 | EN | Backlight on/off control | High: > 4V, Low: < 1V |
| 4 | ADJ | PWM signal for dimming | DC 0~5V |
| 5 | GND | Ground | |
| 6 | GND | Ground | |

4.11 Speaker Output Connector

Location - JP30: 4P wafer pitch = 2.0mm

Pin assignment and definition:

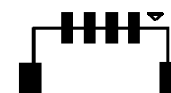


| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------------------|---------|--------|--------------------------|
| 1 | L-OUT+ | Speaker output left ch+ | 3 | R-OUT+ | Speaker output right ch+ |
| 2 | L-OUT- | Speaker output left ch- | 4 | R-OUT- | Speaker output right ch- |

4.12 Panel Touch Interface Connector

Location - JP37: 4P wafer pitch = 2.0mm

Pin assignment and definition:



| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|-------------|---------|--------|-------------|
|---------|--------|-------------|---------|--------|-------------|

| | | | | | |
|---|--------|--------------|---|-----|-----------|
| 1 | USB_5V | USB 5V power | 3 | D+ | USB data+ |
| 2 | D- | USB data- | 4 | GND | Ground |

4.13 Headphones Output

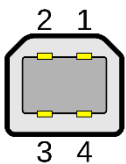
Location - JP31: 5P PJ-325 black

Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|----------|------------------------|---------|----------|-------------------------|
| 1 | HP_OUT_L | HP left channel output | 4 | HP_OUT_R | HP right channel output |
| 2 | HP_DET | HP plug detection | 5 | GND | Ground |
| 3 | NC | | | | |

4.14 USB Connector

Location - CN13: USB2.0 Type-B

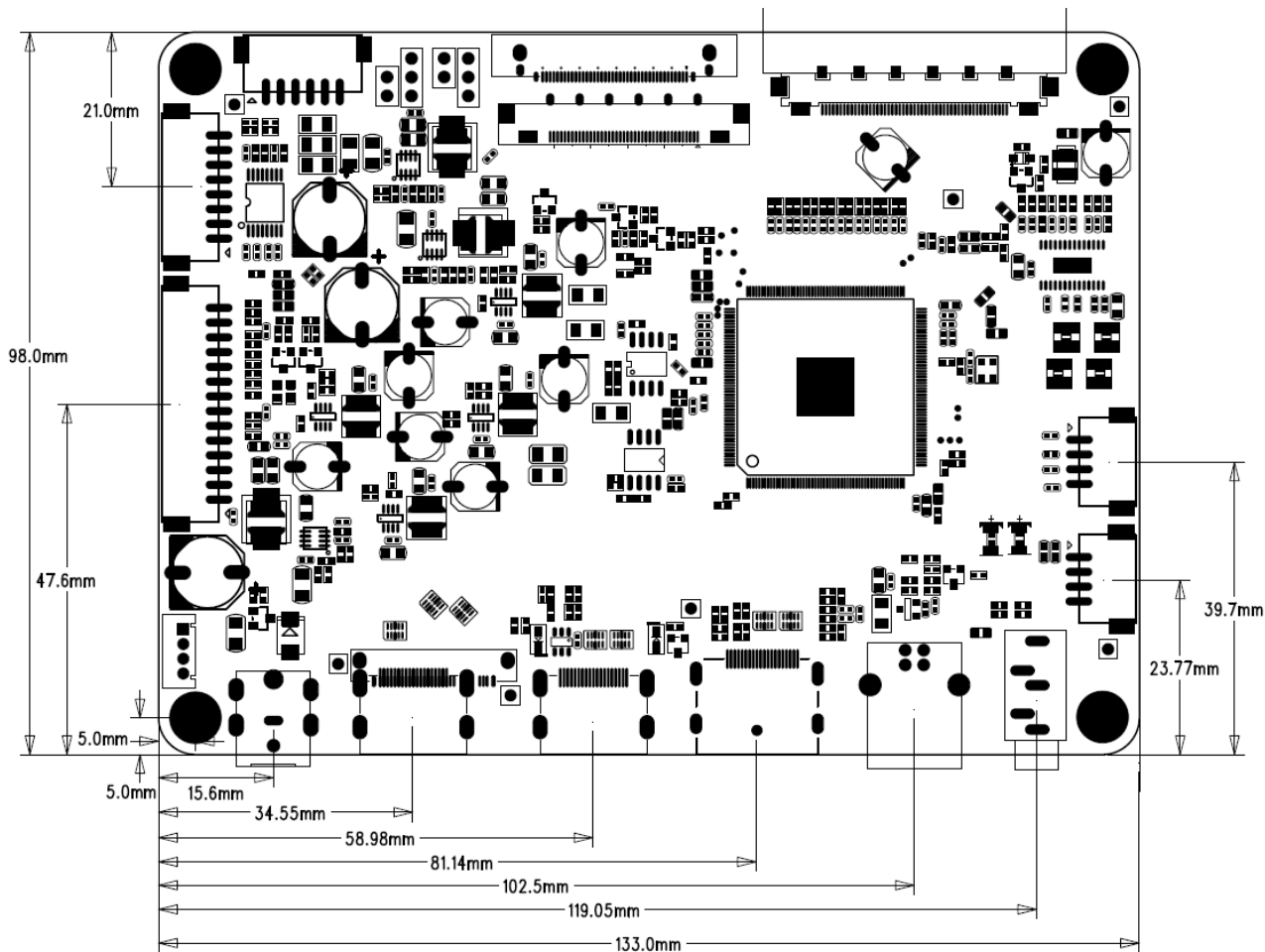


Type-B

Pin assignment and definition:

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|------------------|-------------|---------|--------|-------------|
| 1 | V _{BUS} | +5V | 3 | Data+ | USB data+ |
| 2 | Data- | USB data- | 4 | GND | Ground |

5. Mechanical Dimension





PCB Dimension

- ✚ PCB Length = 133.0mm
- ✚ PCB Width = 98.0mm
- ✚ PCB Thickness = 1.6mm
- ✚ PCBA(PCB + Component) Thickness ≤ 16.0mm
- ✚ Screw Hole Diameter = 3.5mm


6. Configuration and Precautions


6.1 Temperature

 Storage: -20°C~+80°C


 Operation: -10°C~+70°C


6.2 Humidity

 Storage: 5%~95%(non-condensing)

 Operation: 10%~90%(non-condensing)

6.3 Altitude

 Storage: 20000ft(Max.)

 Operation: 10000ft(Max.)

7. Key Materials List

| No. | Part Number | Function Description | Vendor |
|-----|----------------|---|---------|
| 1 | RTD27xx | Scaler | Realtek |
| 2 | MP9943AGQ-Z | DC-DC | MPS |
| 3 | MP2143DJ-LF-Z | DC-DC | MPS |
| 4 | W25Q16JVSSIQ | SPI flash | Winbond |
| 5 | CAT24C16WI-GT3 | System EEPROM | ON |
| 6 | 7U14318E20UCG | SMD Crystal | SJK |
| 7 | AD52068 | Class-D AMP | ESMT |
| 8 | PCB | 1.6mm FR-4 E=4.2 ±10% 4-Layers 1.0oz 133.0x98.0mm | BYF |