

## M.2 Key B Expansion Module

Ziloo has an M.2 type B expansion port for SSD utility cards.

Features:

- 1 Lane PCIe (PExx0)
- USB 3.0 data multiplexed (USB2/Host, PExx1)
- USB 2.0 data multiplexed (USB2/Host)
- GNSS I2C (I2C3)
- MFG I2C (SYS I2C)
- AUDIO I2S MIC SAI5 4 channels (GPIO5..8 and COEX\*)
- SPI (ANTCTL\*)
- DAS/DSS broken out with activity LED + expander bit
- Additional signals via 16 bit I/O Expander
- Some are broken out with pads near connector (CONFIG 0/2/3, DPR)
- SIM pins are not connected, reserved for now

The USB is connected to T-USB (not the M.2 expansions) on boot to support NVMe SSD expansions by default. The USB data signals are multiplexed between T-USB Host (USB2) and M.2 Key B based on MUX\_USB2\_SEL & MUX\_USB3\_SEL.

Be aware the current pin plan is not final. Input/Output such as DIN/DOOUT RXD/TXD may be the wrong way around. It must be verified with reference hardware design/testing.

According to documentation: Type refers to the signal direction: • Type O means signal is an output from the MPU/MCU to the adapter. • Type I means signals is an input to the MPU/MCU from the adapter.

### Control pins mapped by I/O Expander

The system I/O expander controls mPCIe\_PERST which resets PCIe. PCIE\_CLKREQ\_B is a direct pin on the SoM. USB1\_SS\_SEL is a direct pin on the SoM.

TODO consider bootup default state of I/O Expanders. USB must not connect M.2 by default

TODO unallocated/GPIO pins from chipsets

A dedicated I/O Expander controls addition pins on Key B.

The development board uses a single Expander. The 909 and 801 uses 3x PCA9555 to control more states.

The EX2 expander input triggers interrupt via EX\_H\_nINT (GPIO1\_IO0). The pins relate to USB2 Host and M.2 Key B.

The EX2 expander allows controlling T-USB maps,

| Expander | Connected to  |
|----------|---------------|
| EX2.0    | USB_H_ALT_EN  |
| EX2.1    | USB_H_ALT_POL |

| Expander | Connected to            |
|----------|-------------------------|
| EX2.2    | USB_H_ALT_AMSEL         |
| EX2.3    | MUX_USB2_SEL            |
| EX2.4    | MUX_USB3_SEL            |
| EX2.5    | M2B_PWROFF              |
| EX2.6    | RESET#                  |
| EX2.7    | ALERT / I2C_IRQ         |
| EX2.8    | GPIO4 on 65988 (HPD2)   |
| EX2.9    | GPIO9 / LED / DAS / DSS |
| EX2.10   | GPIO10 / W_DISABLE_2#   |
| EX2.11   | W_DISABLE#              |
| EX2.12   | DEVSLP 3V3              |
| EX2.13   |                         |
| EX2.14   | CONFIG_1                |
| EX2.15   |                         |

## M.2 Key B Pin allocations

| Pin id. | Upper    | Lower      | Description                        | Counterpoint | Voltage Level |
|---------|----------|------------|------------------------------------|--------------|---------------|
| 1       | CONFIG_3 |            | Defines Module Type                | pad          |               |
| 2       |          | +3.3V      | 3.3 V power supply from main board |              | 3.3V          |
| 3       | GND      |            | Ground                             |              | GND           |
| 4       |          | +3.3V      | 3.3 V power supply from main board |              | 3.3V          |
| 5       | GND      |            | Ground (available?)                |              | GND           |
| 6       |          | M2B_PWROFF | Card PWR OFF                       | EX2.5        | 1.8/3.3       |
| 7       | USB D+   |            | USB data pair positive USB D+      | USB D+       |               |
| 8       |          | W_DIS1     | Wireless disable 1                 | EXB.3        |               |
| 9       | USB D-   |            | USB data pair negative USB D-      | USB D-       |               |
| 10      |          | DAS/DSS    | Device Actvty Signal               | LED / EX2.9  | 3.3V          |

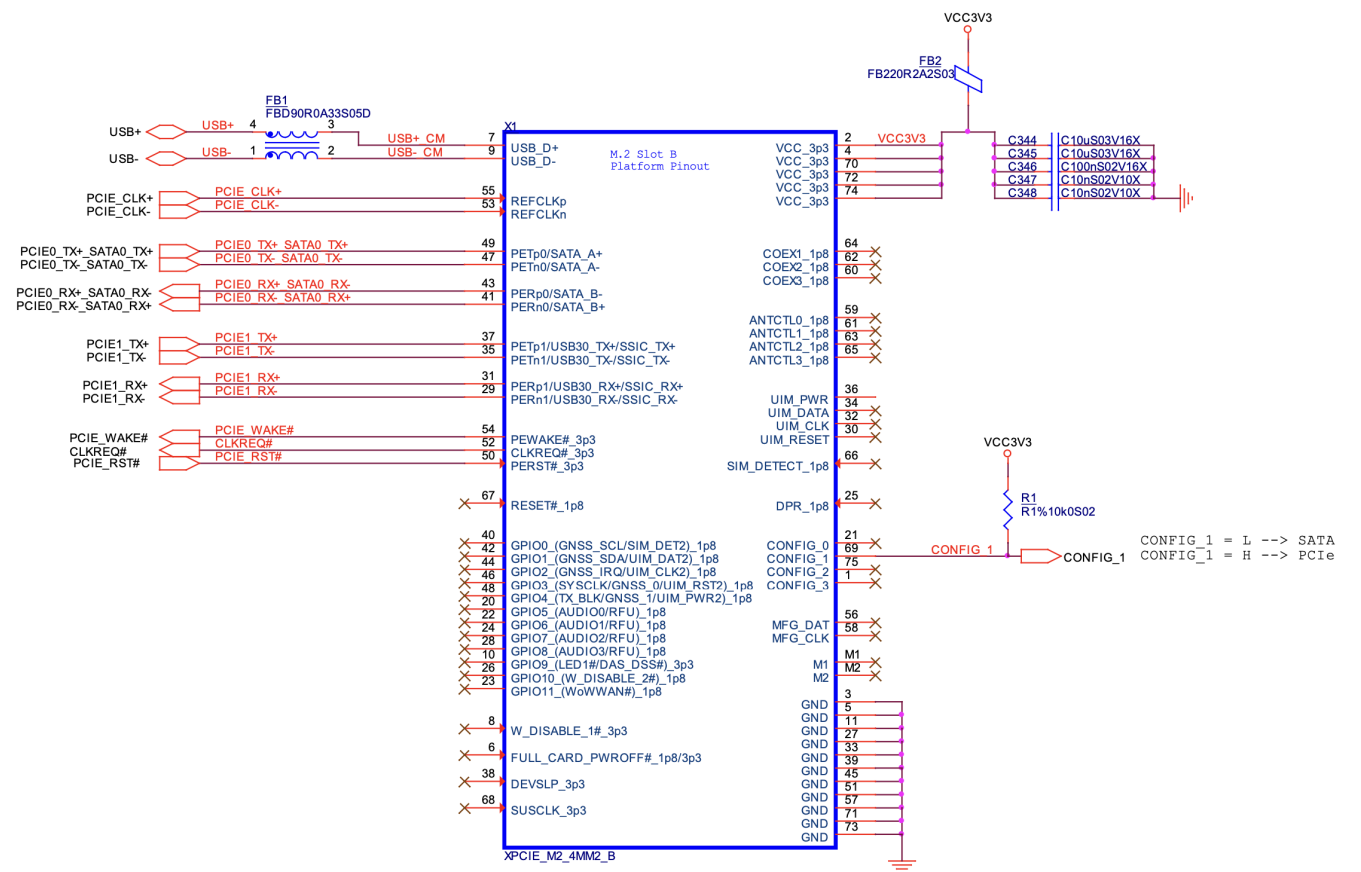
| Pin id. | Upper     | Lower       | Description                        | Counterpoint  | Voltage Level |
|---------|-----------|-------------|------------------------------------|---------------|---------------|
| 11      | GND       |             | Ground (available?)                |               | GND           |
| 12 - 19 |           |             |                                    |               |               |
| 20      |           | M2_I2S_CLK  | GPIO5 M2_I2S_CLK                   | MIC I2S       | 1.8V          |
| 21      | CONFIG_0  |             |                                    | pad           |               |
| 22      |           | M2_I2S_DIN  | GPIO6 M2_I2S_DIN                   | MIC I2S DATA0 | 1.8V          |
| 23      | GPIO11    |             | NC                                 | MIC I2S MCLK  | 1.8V          |
| 24      |           | M2_I2S_DOUT | GPIO7 M2_I2S_DOUT                  | PWM_OUT1      | 1.8V          |
| 25      | DPR       |             |                                    | pad           |               |
| 26      |           | GPIO10      |                                    | EX2.10        | 1.8V          |
| 27      | GND       |             | Ground                             |               | GND           |
| 28      |           | M2_I2S_WS   | GPIO8 M2_I2S_WS                    | MIC I2S WS    | 1.8V          |
| 29      | USB3 RX-  |             | PER-1 / SSIC<br>M2_USB3_SSRXN      | M2_USB3_SSRX- |               |
| 30      |           | SIM_RST     | UIM RESET                          | -             |               |
| 31      | USB3 RX+  |             | PER+1 / SSIC<br>M2_USB3_SSRXP      | M2_USB3_SSRX+ |               |
| 32      |           | SIM_CLK     | UIM CLK                            | -             |               |
| 33      | GND       |             | Ground                             |               | GND           |
| 34      |           | SIM_DATA    | UIM DATA                           | -             |               |
| 35      | USB3 TX-  |             | PET-1 / SSIC<br>M2_USB3_SSTX-      | M2_USB3_SSTX- |               |
| 36      |           | SIM_PWR     | UIM PWR                            | -             |               |
| 37      | USB3 TX+  |             | PET+2 / SSIC<br>M2_USB3_SSTX+      | M2_USB3_SSTX+ |               |
| 38      |           | DEVSLP      | Device Sleep, input.<br>high=sleep | EX2.12        | 3.3V          |
| 39      | GND       |             | Ground                             |               | GND           |
| 40      |           | M2 SMB SCL  | SMB_CLK M2 SMB SCL                 | I2C3 SCL      | 1.8V          |
| 41      | PCIE RXN- |             | PCIE RXN- / PER-0 / SATA-B+        | PCIE RXN-     |               |
| 42      |           | M2 SMB SDA  | SMB_DATA M2 SMB SDA                | I2C3 SDA      | 1.8V          |

| Pin id. | Upper        | Lower      | Description                     | Counterpoint  | Voltage Level |
|---------|--------------|------------|---------------------------------|---------------|---------------|
| 43      | PCIE RXN+    |            | PCIE RXN+ / PER+0 / SATA-B-     | PCIE RXN+     | 1.8V          |
| 44      |              | GPIO2      | GPIO2 / ALERT                   | EX2.7         | 1.8V          |
| 45      | GND          |            | Ground                          |               | GND           |
| 46      |              | GPIO3      |                                 | PWM2_OUT      | 1.8V          |
| 47      | PCIE TXN-    |            | PCIE TXN- / PET-0 / SATA-A-     | PCIE TXN-     | 1.8V          |
| 48      |              | GPIO4      |                                 | PWM3_OUT      | 1.8V          |
| 49      | PCIE TXN+    |            | PCIE TXN+ / PET-0 / SATA-A+     | PCIE TXN+     | 1.8V          |
| 50      |              | PERST      | PCI Reset                       | mPCIE_PERST   |               |
| 51      | GND          |            | Ground                          |               | GND           |
| 52      |              | CLKREQ     | Reference clock request         | PCIE_CLKREQ_B | 3.3V          |
| 53      | PCIE REFCLK- |            | PCIE REFCLK-                    | REFCLK-       |               |
| 54      |              | WAKE       | PCIe WAKE# Active Low.          | USB1_SS_SEL   |               |
| 55      | PCIE REFCLK+ |            | PCIE REFCLK+                    | REFCLK+       |               |
| 56      |              | MFG_DAT    | SDA                             | SYS I2C SDA   |               |
| 57      | GND          |            | Ground                          |               |               |
| 58      |              | MFG_CLK    | SCL                             | SYS I2C SCL   |               |
| 59      | ANTCTL0      |            |                                 | ECSPI2_MISO   |               |
| 60      |              | COEX3      |                                 | MIC I2S DATA3 |               |
| 61      | ANTCTL1      |            |                                 | ECSPI2_SS0    |               |
| 62      |              | COEX_TXD   |                                 | MIC I2S DATA2 | 1.8V          |
| 63      | ANTCTL2      |            |                                 | ECSPI2_SCLK   |               |
| 64      |              | COEX_RXD   |                                 | MIC I2S DATA1 | 1.8V          |
| 65      | ANTCTL3      |            |                                 | ECSPI2_MOSI   |               |
| 66      |              | SIM DETECT | SIM CD                          | -             |               |
| 67      | RESET#       |            | RESET                           | EX2.6         | 1.8V          |
| 68      |              | SUSCLK     | 32.768 kHz provided by Platform | -             |               |

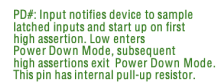
| Pin id. | Upper    | Lower | Description            | Counterpoint | Voltage Level |
|---------|----------|-------|------------------------|--------------|---------------|
| 69      | CONFIG_1 |       | Defines module type +  | EX2.14       |               |
| 70      |          | VRES  | Power VRES             |              | +3.3V         |
| 71      | GND      |       | Ground                 |              | GND           |
| 72      |          | VRES  | Power VRES             |              | +3.3V         |
| 73      | GND      |       | Ground                 |              | GND           |
| 74      |          | VRES  | Power VRES             |              | +3.3V         |
| 75      | CONFIG_2 |       | Defines Module Type NC |              |               |

Reference designs

3.2 Reference Design



Congatec reference design



## M.2 Key E Expansion Module

TODO consider bootup default state of I/O Expanders. USB must not connect M.2 by default

TODO unallocated/GPIO pins from chipsets

A dedicated I/O Expander controls addition pins on Key E.

The development board uses a single Expander. The 909 and 801 uses 3x PCA9555 to control more states.

The EX1 expander input triggers interrupt via EX\_O\_nINT (GPIO1\_IO1). The pins relate to USB1 Host and M.2 Key E.

The EX1 expander allows controlling T-USB maps,

| Expander | Connected to            |
|----------|-------------------------|
| EX1.0    | USB_O_ALT_EN            |
| EX1.1    | USB_O_ALT_POL           |
| EX1.2    | USB_O_ALT_AMSEL         |
| EX1.3    | MUX_USB2_SEL            |
| EX1.4    | MUX_USB3_SEL            |
| EX1.5    | COEX4                   |
| EX1.6    | DEV_WLAN_WAKE           |
| EX1.7    | ALERT / I2C_IRQ         |
| EX1.8    | GPIO3 on 65988 (HPD1)   |
| EX1.9    | GPIO9 / LED / DAS / DSS |
| EX1.10   | W_DISABLE2#             |
| EX1.11   | W_DISABLE1#             |
| EX1.12   | UART WAKE               |
| EX1.13   | SDIO WAKE               |
| EX1.14   | LED2#                   |
| EX1.15   |                         |

## M.2 Key E Pin allocations

| Pin id. | Upper  | Lower | Description                        | Counterpoint | Voltage Level |
|---------|--------|-------|------------------------------------|--------------|---------------|
| 1       | GND    |       | Ground                             |              |               |
| 2       |        | +3.3V | 3.3 V power supply from main board |              | 3.3V          |
| 3       | USB D+ |       | USB data pair positive             | USB D+       |               |

| Pin id. | Upper       | Lower       | Description                        | Counterpoint  | Voltage Level |
|---------|-------------|-------------|------------------------------------|---------------|---------------|
| 4       |             | +3.3V       | 3.3 V power supply from main board |               | 3.3V          |
| 5       | USB D-      |             | USB data pair negative             | USB D-        |               |
| 6       |             | M2B_PWROFF  | Card PWR OFF                       | EX2.5         | 1.8/3.3       |
| 7       | GND         |             | Ground                             |               | GND           |
| 8       |             | M2_I2S_CLK  | GPIO5 M2_I2S_CLK                   | MIC I2S       | 1.8V          |
| 9       | SDIO CLK    |             | SDIO                               | SD1 CLK       | 1.8V          |
| 10      |             | M2_I2S_WS   | GPIO8 M2_I2S_WS                    | MIC I2S WS    | 1.8V          |
| 11      | SDIO CMD    |             | SDIO                               | SD1 CMD       | 1.8V          |
| 12      |             | M2_I2S_DIN  | GPIO6 M2_I2S_DIN                   | MIC I2S DATA0 | 1.8V          |
| 13      | SDIO DATA0  |             | SDIO                               | SD1 DATA0     | 1.8V          |
| 14      |             | M2_I2S_DOUT | GPIO7 M2_I2S_DOUT                  | PWM_OUT1      | 1.8V          |
| 15      | SDIO DATA1  |             | SDIO                               | SD1 DATA1     | 1.8V          |
| 16      |             | LED2#       |                                    |               |               |
| 17      | SDIO DATA2  |             | SDIO                               | SD1 DATA2     | 1.8V          |
| 18      |             | GND         | Ground                             |               | GND           |
| 19      | SDIO DATA3  |             | SDIO                               | SD1 DATA3     | 1.8V          |
| 20      |             | UART WAKE#  | Bluetooth uses to wake up platform | EX1.12        | 3.3V          |
| 21      | SDIO WAKE#  |             | WiFi uses to wake up platform      | EX1.13        | 1.8V          |
| 22      |             | UART RxD    |                                    | UART2_RXD     | 1.8V          |
| 23      | SDIO RESET# |             | Signal to independently reset WiFi | SD1_RESET_B   | 1.8V          |
| 24 - 31 |             |             |                                    |               |               |
| 32      |             | UART TxD    |                                    | UART2_TXD     | 1.8V          |
| 33      | GND         |             | Ground                             |               | GND           |
| 34      |             | UART CTS    |                                    | UART4_RXD     | 1.8V          |



| Pin id. | Upper        | Lower       | Description                       | Counterpoint | Voltage Level |
|---------|--------------|-------------|-----------------------------------|--------------|---------------|
| 35      | PCIE TXN-    |             | PCIE TXN- / PET-0 / SATA-A-       | -            | 1.8V          |
| 36      |              | UART RTS    |                                   | UART4_TXD    | 1.8V          |
| 37      | PCIE TXN+    |             | PCIE TXN+ / PET-0 / SATA-A+       | -            | 1.8V          |
| 38      |              | JTAG_TDO    | Debugging                         |              | 1.8V          |
| 39      | GND          |             | Ground                            |              | GND           |
| 40      |              | COEX4       | Wake up the WiFi                  | EX1.5        | 1.8V          |
| 41      | PCIE RXN-    |             | PCIE RXN- / PER-0 / SATA-B+       | -            |               |
| 42      |              | DEV_BT_WAKE | Wake up the Bluetooth             | EX1.6        | 1.8V          |
| 43      | PCIE RXN+    |             | PCIE RXN+ / PER+0 / SATA-B-       | -            | 1.8V          |
| 44      |              | JTAG_TDI    | Debugging                         |              | 1.8V          |
| 45      | GND          |             | Ground                            |              | GND           |
| 46      |              | JTAG_TCK    | Debugging                         |              | 1.8V          |
| 47      | PCIE REFCLK+ |             | PCIE REFCLK+                      | -            |               |
| 48      |              | JTAG_TMS    | Debugging                         |              | 1.8V          |
| 49      | PCIE REFCLK- |             | PCIE REFCLK-                      | -            |               |
| 50      |              | SUSCLK      | 32.768 kHz provided by Platform   | -            |               |
| 51      | GND          |             | Ground                            |              | GND           |
| 52      |              | PERST0#     | PCI Reset                         | -            |               |
| 53      | CLKREQ0#     |             | Reference clock request           | -            | 3.3V          |
| 54      |              | W_DISABLE2# | Independently reset the Bluetooth | EX1.10       | 1.8V          |
| 55      | PE WAKE#     |             | PCle uses to wake up platform     | -            | 1.8V          |
| 56      |              | W_DISABLE1# | Full power down Bluetooth + WiFi  | EX1.11       | 1.8V          |
| 57      | GND          |             | Ground                            |              | GND           |

| Pin id. | Upper    | Lower    | Description                   | Counterpoint  | Voltage Level |
|---------|----------|----------|-------------------------------|---------------|---------------|
| 58      |          | I2C_DATA | I2C DATA                      | I2C3 SDA      | 1.8V          |
| 59      | USB3 TX+ |          | PET+1 / SSIC<br>M2_USB3_SSTX+ | M2_USB3_SSTX+ |               |
| 60      |          | I2C_CLK  | I2C CLK                       | I2C3 SCL      | 1.8V          |
| 61      | USB3 TX- |          | PET-1 / SSIC<br>M2_USB3_SSTX- | M2_USB3_SSTX- |               |
| 62      |          | ALERT#   |                               | EX1.7         | 1.8V          |
| 63      | GND      |          | Ground                        |               | GND           |
| 64      |          | Reserved |                               |               |               |
| 65      | USB3 RX+ |          | PER+1 / SSIC<br>M2_USB3_SSRXP | M2_USB3_SSRX+ |               |
| 66      |          | SIM_SWP  | UIM SWP                       | -             |               |
| 67      | USB3 RX- |          | PER-1 / SSIC<br>M2_USB3_SSRXN | M2_USB3_SSRX- |               |
| 68      |          | SIM_PWR  | UIM PWR                       | -             |               |
| 69      | GND      |          | Ground                        |               | GND           |
| 70      |          | SIM_PWR  | UIM PWR / PEWAKE1#            | -             |               |
| 71      | REFCLK+1 |          |                               | -             |               |
| 72      |          | VRES     | Power VRES                    |               | +3.3V         |
| 73      | Reserved |          |                               |               |               |
| 74      |          | VRES     | Power VRES                    |               | +3.3V         |
| 75      | GND      |          | Ground                        |               | GND           |

Reference designs

## 2.2 Reference Design

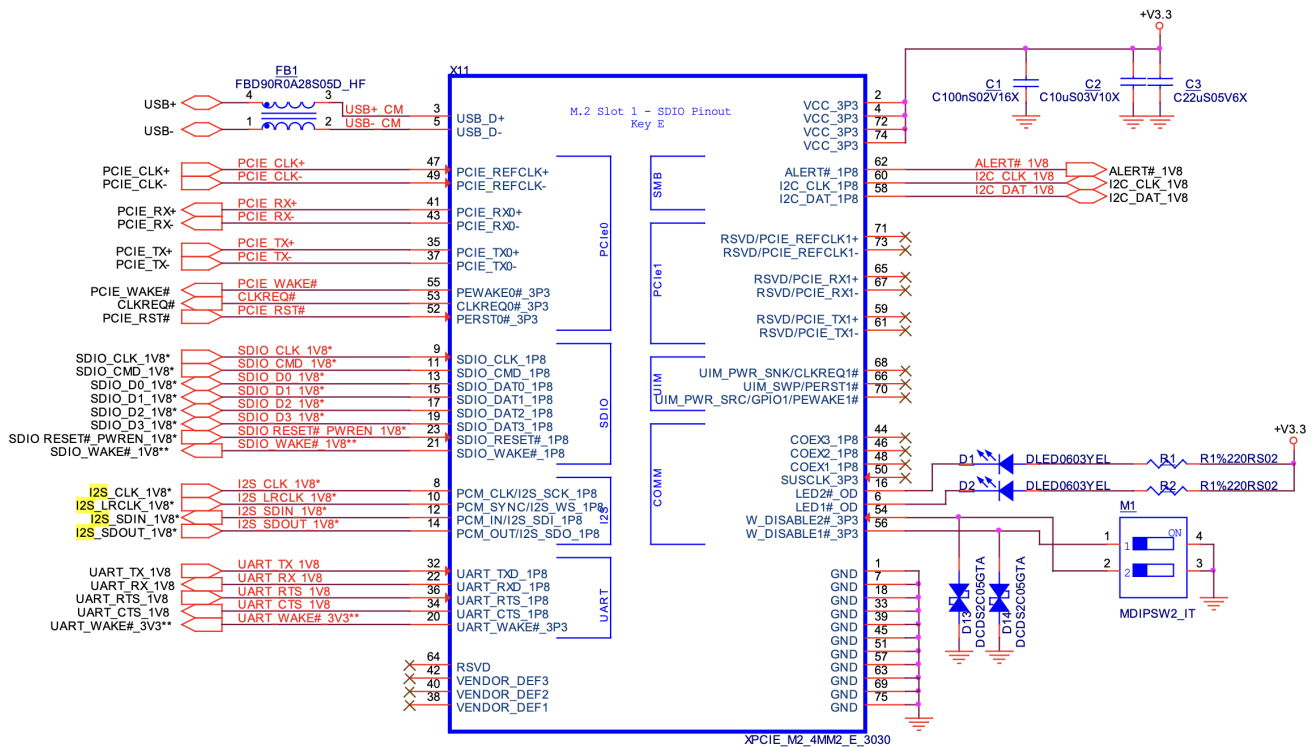


Figure 1: Socket 1 - Key E Reference Design

Congatec reference design

## Future Expansion connection

### UIM / SIM / eSIM

M.2 Connectors have pins reserved for SIM (UIM) cards. A connector or eSIM may be added in the future.

i.MX 8 only provides PCIe x1 so Key M is not relevant. This leaves A, B and E.

- B is good for USB3, Audio, SATA
- E is good for SDIO, UART and PCM
- [ATP M.2 key info page](#)
- [Congatec AN43](#)