Audio controller board

IO

- TRIGGER2{TRIG}
- TRIGGER1{TRIG}

File: IO.kicad_sch

L + R PDM Microphone Connectors + I2S Converter

- I2C{I2C}
- L−R−Mic{PDM}
- L−R−Mic{I2S}

File: PDM_Mic.kicad_sch

L + R I2S Microphone Connectors

- L−R−Mic{I2S}

File: Mic_Conn.kicad_sch

RP2040 − 1

- I2C1{I2C}
- PDM{PDM}
- TRIGGER{TRIG}
- I2C0{I2C}
- SPI0{SPI}
- USB{USB}
- I2S{I2S}

File: RP2040−1.kicad_sch

RP2040 − 2

- TRIGGER{TRIG}
- I2C0{I2C}
- SPI0{SPI}
- USB{USB}
- I2S{I2S}

File: RP2040−2.kicad_sch

AMP + Speaker Connector

- I2S{I2S}

File: amp.kicad_sch

2xUSB + Power

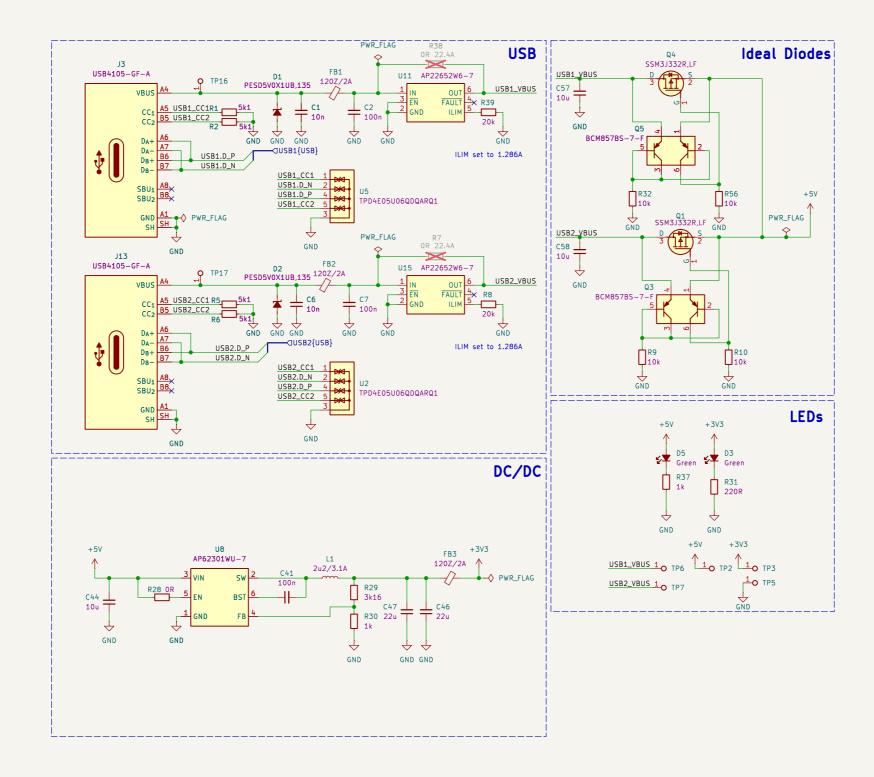- USB1{USB}
- USB2{USB}

File: usb.kicad_sch

MP1
MP_NPTH_Drill2.7mm

MP2
MP_NPTH_Drill2.7mm

MP3
MP_NPTH_Drill2.7mm

MP4
MP_NPTH_Drill2.7mm

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open source hardware

USB

J3
USB4105-GF-A

VBUS A4
CC1 A5 USB1_CC1 R1 5k1
CC2 B5 USB1_CC2
        R2 5k1
DA+ A6
DA- A7   USB1.D_P
DB+ B6   USB1.D_N
DB- B7
SBU1 A8
SBU2 B8
GND A1   PWR_FLAG
SH   SH
GND

TP16

D1
PESD5V0X1UB,135

FB1
120Z/2A

C1 10n
C2 100n

PWR_FLAG

R38
0R 22.4A

U11
AP22652W6-7
1 IN   OUT 6   USB1_VBUS
3 EN   FAULT 5
2 GND   ILIM 4   R39 20k
GND

ILIM set to 1.286A

<USB1{USB}

U5
TPD4E05U06QDQARQ1
USB1_CC1 1
USB1.D_N 2
USB1.D_P 4
USB1_CC2 5
          3

J13
USB4105-GF-A

VBUS A4
CC1 A5 USB2_CC1 R5 5k1
CC2 B5 USB2_CC2
        R6 5k1
DA+ A6
DA- A7   USB2.D_P
DB+ B6   USB2.D_N
DB- B7
SBU1 A8
SBU2 B8
GND A1
SH   SH
GND

TP17

D2
PESD5V0X1UB,135

FB2
120Z/2A

C6 10n
C7 100n

PWR_FLAG

R7
0R 22.4A

U15
AP22652W6-7
1 IN   OUT 6   USB2_VBUS
3 EN   FAULT 5
2 GND   ILIM 4   R8 20k
GND

ILIM set to 1.286A

<USB2{USB}

U2
TPD4E05U06QDQARQ1
USB2_CC1 1
USB2.D_N 2
USB2.D_P 4
USB2_CC2 5
          3

Ideal Diodes

Q4
SSM3J332R,LF
USB1_VBUS
C57 10u
GND

Q5
BCM857BS-7-F

R32 10k
GND

R56 10k
GND

+5V
PWR_FLAG

Q1
SSM3J332R,LF
USB2_VBUS
C58 10u
GND

Q3
BCM857BS-7-F

R9 10k
GND

R10 10k
GND

LEDs

+5V   +3V3

D5 Green   D3 Green

R37 1k   R31 220R

GND   GND

+5V   +3V3
USB1_VBUS 1 TP6   1 TP2   1 TP3
USB2_VBUS 1 TP7
                            1 TP5
GND

DC/DC

+5V

U8
AP62301WU-7
3 VIN   SW 1
5 EN   BST 6
  GND   FB 4
2

C44 10u
GND

R28 0R

C41 100n

L1
2u2/3.1A

R29 3k16
R30 1k
GND

C47 22u
C46 22u
GND GND

FB3
120Z/2A
+3V3
PWR_FLAG

GND

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open source hardware

Left Microphone Connector

1:1 Pinout with the Microphone Board
Use Opposite Side FFC

J1
501951-0550

1 L-PWR
2
3 L-BCLK
4 L-WS
5 L-DATA
MP

GND

+3V3

R18
0R

C5
100n

GND

Microphone (SPH0645LM4H-B)
Typ. current: 600μA
Datasheet

R20
0R

L-DATA

R-DATA

L-R-Mic.SD

0R
R21

R22
0R

L-BCLK

R-BCLK

L-R-Mic.SCK

0R
R23

R24
0R

L-WS

R-WS

L-R-Mic.WS

0R
R25

L-R-Mic.SD
L-R-Mic.SCK
L-R-Mic.WS

L-R-Mic{I2S}

Right Microphone Connector

1:1 Pinout with the Microphone Board
Use Opposite Side FFC

J2
501951-0550

1 R-PWR
2
3 R-BCLK
4 R-WS
5 R-DATA
MP

GND

+3V3

R4
0R

C4
100n

GND

Microphone (SPH0645LM4H-B)
Typ. current: 600μA
Datasheet

ESD

L-PWR 1
L-BCLK 2
L-DATA 4
L-WS 5
3

U1
TPD4E05U06QDQARQ1

GND

R-PWR 1
R-BCLK 2
R-DATA 4
R-WS 5
3

U6
TPD4E05U06QDQARQ1

GND

Debug I2S Connector

+3V3

R93
0R

C56
100n

GND

J8
BM05B-SURS-TF(LF)(SN)

1
2
3
4
5
MP

L-R-Mic.SCK
L-R-Mic.WS
L-R-Mic.SD

GND

U4
TPD4E02B04DQAR

L-R-Mic.SD 1
L-R-Mic.WS 2
L-R-Mic.SCK 4
5
3

GND

MCU

U9
RP2040

C10 close to
MCU pin 44

+3V3

C10	C13	C15	C28
1u	100n	100n	100n

GND GND GND GND

C59	C11	C14	C16	C29
100n	100n	100n	100n	100n

GND GND GND GND GND

44 VREG_VIN
48 USB_VDD
43 ADC_AVDD
1 IOVDD

+1V1_MCU1

C17	C30
100n	100n

GND GND

23 DVDD

VREG_VOUT 45 — +1V1_MCU1

RESET

+3V3

SW1
B3U-1000P

1 2

GND

R40
10k

26 RUN
TP10 1 RUN
TP11 1 SWDIO 25 SWDIO
TP12 1 SWCLK 24 SWCLK

SPI FLASH

+3V3 +3V3

U7
W25Q128JVSIQ

R43
10k

+3V3

8 VCC   SI(D0) 5
        SO(D1) 2
        WP(D2) 3
        HOLD(D3) 7
        SCK 6
4 GND   CS 1

C8
100n

GND

R44
1k

USB{USB}D

| R47 | 27R |
| R46 | 27R |

USB.D_P
USB.D_N

USB_DP 47
USB_DM 46

QSPI_SD0
QSPI_SD1
QSPI_SD2
QSPI_SD3
QSPI_SCLK
QSPI_CSn

QSPI_SD0 53
QSPI_SD1 55
QSPI_SD2 54
QSPI_SD3 51
QSPI_SCLK 52
QSPI_CSn 56

BOOTSEL

SW2
B3U-1000P

1 2 BOOTSEL

GND

NC   - Boot from SPI Flash
Press - USB bootloader

XIN 20 XIN
XOUT 21 XOUT

R58
1M

R48
1k

19 TESTEN

Y1
12 MHz

XOUT_R

C9	C12
18p	18p

GND GND GND

57 GND

GND

GPIO0 2
GPIO1 3
GPIO2 4
GPIO3 5
GPIO4 6
GPIO5 7
GPIO6 8
GPIO7 9
GPIO8 11
GPIO9 12
GPIO10 13
GPIO11 14
GPIO12 15
GPIO13 16
GPIO14 17
GPIO15 27
GPIO16 28
GPIO17 29
GPIO18 30
GPIO19 31
GPIO20 32
GPIO21 34
GPIO22 35
GPIO23 36
GPIO24 38
GPIO25 39
GPIO26 40
GPIO27 41
GPIO28
GPIO29

R54 0R
R60 0R   SPI0.SCK
R61 0R   SPI0.MOSI
R59 0R   SPI0.MISO
            SPI0.CS0

SPI0.SCK — QSPI0{SPI}

PDM.DATA
PDM.CLOCK — PDM{PDM}

R95 51R

R66 0R   I2S.SD
R65 51R I2S.SCK
R64 51R I2S.WS

I2S{I2S}

R74 0R I2C0.SDA
R75 0R I2C0.SCL

I2C0{I2C}

R72 0R I2C1.SDA
R73 0R I2C1.SCL

I2C1{I2C}

1 TP21

R68 0R TRIGGER.TRIG1
R69 0R TRIGGER.TRIG2
R70 0R TRIGGER.TRIG3
R11 0R TRIGGER.TRIG4

TRIGGER{TRIG}

TP15 1

+1V1_MCU1

C35
1u

GND

R52
1k

+3V3

D6
Green

R67
270R

Q2
BC817-25W

GND

+3V3

R79
2k7

R80
2k7

MCU

+3V3

C33 close to
MCU pin 44

C33	C37	C39	C43
1u	100n	100n	100n
GND	GND	GND	GND

C60	C34	C38	C40	C50
100n	100n	100n	100n	100n
GND	GND	GND	GND	GND

+3V3
D7
Green
R53
270R

U12
RP2040

TP14

+1V1_MCU2

R33
1k

Q6
BCB17-25W

C52
1u

GND

+1V1_MCU2

C42	C51
100n	100n
GND	GND

44 VREG_VIN   VREG_VOUT 45
48 USB_VDD
43 ADC_AVDD
1 IOVDD
23 DVDD

GPIO0 2
GPIO1 3   SPI0.SCK
GPIO2 4   SPI0.MOSI   ◁QSPI0{SPI}
GPIO3 5   SPI0.MISO
GPIO4 6   SPI0.CS0
GPIO5 7
GPIO6 8
GPIO7 9
GPIO8 11   SPI1.MISO
GPIO9 12   SPI1.CS0
GPIO10 13   SPI1.SCK
GPIO11 14   SPI1.MOSI
GPIO12 15
GPIO13 16
GPIO14 17
GPIO15 18
GPIO16 27   R76   0R   I2S.SD   ◁I2S{I2S}
GPIO17 28   R77   51R I2S.SCK
GPIO18 29   R78   51R I2S.WS
GPIO19 30   TP24
GPIO20 31   R84   0R   I2C0.SDA ◁I2C0{I2C}
GPIO21 32   R85   0R   I2C0.SCL
GPIO22 34   I2C1.SDA   TP4
GPIO23 35   I2C1.SCL   TP25
GPIO24 36   TP22
GPIO25 37   TP23
GPIO26 38   R81   0R   TRIGGER.TRIG1 ◁TRIGGER{TRIG}
GPIO27 39   R82   0R   TRIGGER.TRIG2
GPIO28 40   R83   0R   TRIGGER.TRIG3
GPIO29 41   R12   0R   TRIGGER.TRIG4

+3V3
R91   R92
2k7   2k7

RESET
+3V3
SW3
B3U-1000P
R41
10k
GND

26 RUN   RUN
25 SWDIO TP8   SWDIO
24 SWCLK TP9   SWCLK
        TP13

USB{USB}▷

USB.D_P   R50   27R
USB.D_N   R49   27R

47 USB_DP
46 USB_DM

SPI FLASH
+3V3
R42
10k
U10
W25Q128JVSIQ
+3V3
8 VCC   SI(D0) 5
        SO(D1) 2
        WP(D2) 3
        HOLD(D3) 7
        SCK 6
4 GND   CS 1
C31
100n
GND
R45
1k

QSPI_SD0   53 QSPI_SD0
QSPI_SD1   55 QSPI_SD1
QSPI_SD2   54 QSPI_SD2
QSPI_SD3   51 QSPI_SD3
QSPI_SCLK 52 QSPI_SCLK
QSPI_CSn   56 QSPI_CSn

BOOTSEL
SW4
B3U-1000P
1 2 BOOTSEL
GND

NC - Boot from SPI Flash
Press - USB bootloader

XIN 20 XIN
XOUT 21 XOUT

R62
1M
R51
1k

Y3
12 MHz

XOUT_R
C32   C36
18p   18p
GND GND GND

19 TESTEN

57 GND
GND

SPI RAM

U16
IS66WVS4M8BLL-104NLI
+3V3

SPI1.MOSI 5 SI/SIO0   VDD 8
SPI1.MISO 2 SO/SIO1
           7 SIO2   C61
           3 SIO3   100n
SPI1.SCK   6 CLK
SPI1.CS0   1 CS   VSS 4
GND

AMP

+5V

C19
10u

C18
100n

GND GND

U17
MAX98357AETE+T

7 VDD	
SD_MODE	4 SD_MODE
I2S.SCK	16 BCLK
I2S.WS	14 LRCLK
I2S.SD	1 DIN
	17 EP
	11 GND

I2S{I2S}

OUT_P 9 SPK_P
OUT_N 10 SPK_N

GAIN_SLOT 2 GAIN

GND

Speaker Connector

3.2W (4Ω at 5V)
1.8W (8Ω at 5V)

SPK_P 1
SPK_N 2
MP

J12
SM02B-SRSS-TB(LF)(SN)

GND

Selectable Audio Input Channel

+5V

R27
1M

SD_MODE

R17
0R

GND

0Ω Pullup -> Left channel
390kΩ Pullup -> Right channel
1MΩ Pullup -> 50%/50% RL
0Ω Pulldown -> Shutdown

Shutdown
RLARGE (kΩ) = 222.2 x 5 - 100 = 1011kΩ =~ 1MΩ
RSMALL (kΩ) = 94.0 x 5 - 100 = 370kΩ =~ 390kΩ

datasheet pg.17

Selectable Audio Output Gain

+5V

R99
0R

GAIN

R36
0R

GND

100kΩ Pullup -> 15dB
0Ω Pulldown -> 12dB
Unconnected -> 9dB
0Ω Pullup -> 6dB
100kΩ Pulldown -> 3dB

datasheet pg.28

Debug I2S Connector

+3V3

J9
BM05B-SURS-TF(LF)(SN)

1	
2	I2S.SCK
3	I2S.WS
4	I2S.SD
5	
MP	

C53
100n

GND

U3
TPD4E02B04DQAR

I2S.SD 1
I2S.WS 2
4
I2S.SCK 3

GND

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hardware

External Triggers

+3V3

TRIGGER1{TRIG}

1	
2	
3	TRIGGER1.TRIG1
4	TRIGGER1.TRIG2
5	TRIGGER1.TRIG3
6	TRIGGER1.TRIG4
MP	

J6
SM06B-SRSS-TB(LF)(SN)

GND

+3V3
C54
100n
GND

+3V3

TRIGGER2{TRIG}

1	
2	
3	TRIGGER2.TRIG1
4	TRIGGER2.TRIG2
5	TRIGGER2.TRIG3
6	TRIGGER2.TRIG4
MP	

J7
SM06B-SRSS-TB(LF)(SN)

GND

+3V3
C55
100n
GND

Trigger

TRIGGER1.TRIG1	R86 OR	TRIGGER2.TRIG1
TRIGGER1.TRIG2	R87 OR	TRIGGER2.TRIG2
TRIGGER1.TRIG3	R88 OR	TRIGGER2.TRIG3
TRIGGER1.TRIG4	R3 OR	TRIGGER2.TRIG4

ESD

U14
TPD4E05U06QDQARQ1

TRIGGER1.TRIG1	1
TRIGGER1.TRIG2	2
TRIGGER1.TRIG3	4
TRIGGER1.TRIG4	5
	3

GND

U13
TPD4E05U06QDQARQ1

TRIGGER2.TRIG1	1
TRIGGER2.TRIG2	2
TRIGGER2.TRIG3	4
TRIGGER2.TRIG4	5
	3

GND

+3V3   +3V3

D4
TPD1E0B04DPYR

D8
TPD1E0B04DPYR

GND   GND

Left Microphone Connector

1:1 Pinout with the Microphone Board
Use Opposite Side FFC

J4
501951-0550

R13 0R

+3V3

C3 100n

L-PWR
PDM-CLK
L-PDM-DATA

R63 0R
GND
GND

Microphone (SPH0644LM4H-1)
Datasheet

Right Microphone Connector

1:1 Pinout with the Microphone Board
Use Opposite Side FFC

J5
501951-0550

R14 0R

+3V3

C20 100n

R-PWR
PDM-CLK
R-PDM-DATA

R71 0R
GND
GND

Microphone (SPH0644LM4H-1)
Datasheet

ESD

L-PWR
PDM-CLK
L-PDM-DATA

U18
TPD4E05U06QDQARQ1

GND

R-PWR
PDM-CLK
R-PDM-DATA

U19
TPD4E05U06QDQARQ1

GND

I2C.SCL
I2C.SDA

+3V3

D11 TPD1E0B04DPYR
D10 TPD1E0B04DPYR
D9 TPD1E0B04DPYR

GND GND GND

PDM Destination Selection

L-PDM-DATA
R16 0R
R89 0R
L-R-Mic.DATA
L-R-Mic{PDM}

R-PDM-DATA
R19 0R
R94 0R
PDM-CONV-DATA
PDM-CONV-CLOCK

PDM-CLK
R15 0R
R96 0R
L-R-Mic.CLOCK

PDM to I2S

+1V8

C21 100n
+3V3
GND
C22 100n
GND

U21
ADAU7118ACPZRL

14 DVDD
16 IOVDD
13 EN

R26 1k

PDM-CONV-CLOCK
R90 51R
1 PDM_CLK0
4 PDM_CLK1

PDM-CONV-DATA
2 PDM_DAT0
TP10
3 PDM_DAT1
5 PDM_DAT2
6 PDM_DAT3

12 ADDR
R57 0R
GND

10 BCLK
9 FSYNC
11 SDATA

R34 0R L-R-Mic.SCK
R35 0R L-R-Mic.WS
R55 0R L-R-Mic.SD

L-R-Mic{I2S}

7 SCL
8 SDA
I2C.SCL
I2C.SDA
I2C{I2C}

17 EP
15 GND
GND

+3V3
U20
TLV73318PDBVT
+1V8

C24 100n

1 VIN VOUT 5
3 EN GND 2

C23 100n

GND GND

+3V3

J10
BM04B-SRSS-TB(LF)(SN)

I2C.SDA
I2C.SCL

GND

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Sheet: /L + R PDM Microphone Connectors + I2S Converter/
File: PDM_Mic.kicad_sch
Title: Audio controller board
Size: A3   Date: 2025-04-03   Rev: 1.3.2:97833
KiCad E.D.A. 8.0.7   Id: 8/8