# xCORE VocalFusion 4-Mic Kit for Amazon AVS Hardware Manual

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The **xCORE VocalFusion 4-Mic Kit for Amazon AVS** is an application specific design for far-field voice capture and processing, targetted at Amazon Alexa Voice Service (AVS) applications.

The kit is based on the XMOS XVF3000 voice processor and includes:

- linear array of 4 omni-directional microphones
- low-jitter audio clock
- configurable user input buttons and LEDs
- I2S audio and I2C control connectivity
- USB powered, with optional USB2.0 device audio and control connectivity

The XVF3000 on the kit is pre-flashed with a software that implements the xCORE VocalFusion microphone capture and voice processing library, audio and control connectivity, user interfaces and system control.


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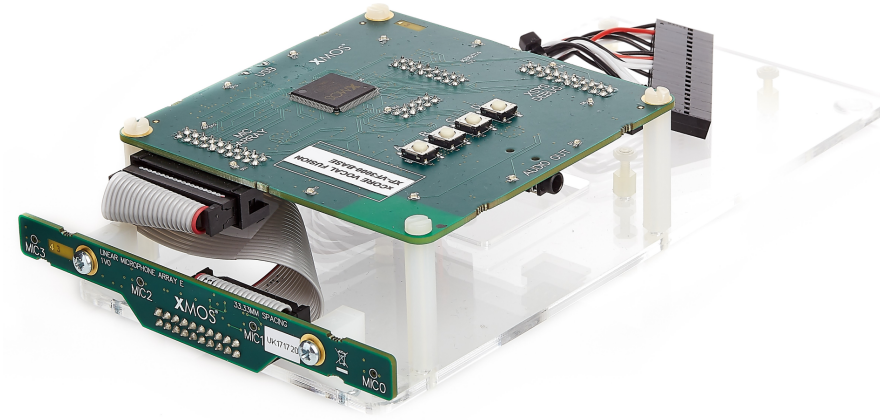


**Figure 1:** xCORE VocalFusion 4-Mic Kit for AVS

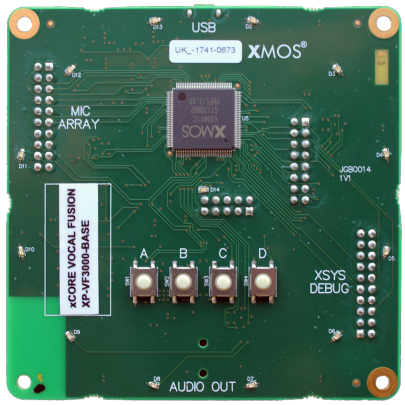


**Figure 2:** xCORE VocalFusion BaseBoard


**Figure 3:** xCORE VocalFusion Short Linear microphone board

# 1 Features

A block diagram for the **xCORE VocalFusion 4-Mic Kit for Amazon AVS** is shown in Figure 4 below. It includes:

- xCORE VocalFusion XVF3000 voice processor
- Four MEMS microphones (on a separate board)
- A micro-USB connector for power (and optionally USB2.0 device connectivity)
- Extension headers for I2S audio and I2C control connectivity
- Four general purpose push-button switches
- 13 user-controlled LEDs
- Low-jitter audio clock source
- An xSYS connector for an xTAG debug adapter

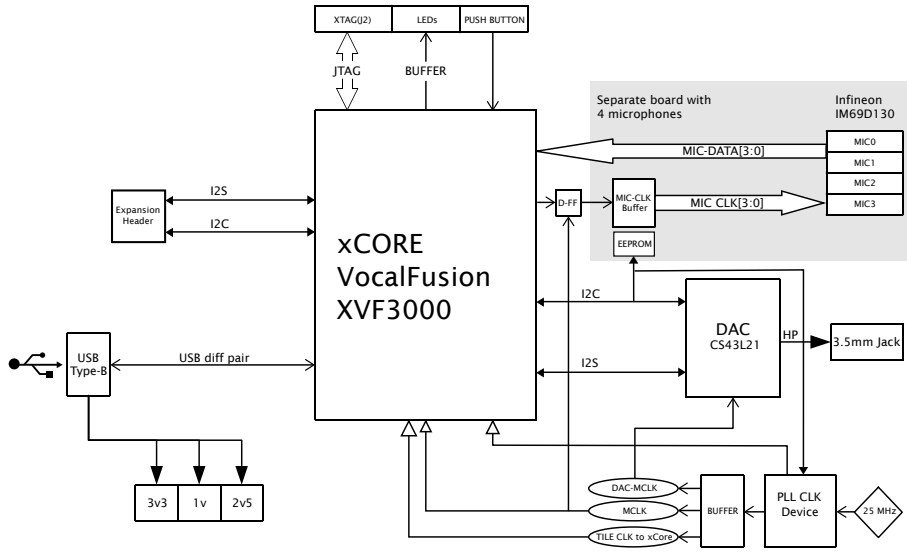


**Figure 4:** xCORE VocalFusion 4-Mic Kit for Amazon AVS block diagram

# 2 Introduction

The **xCORE VocalFusion 4-Mic Kit for Amazon AVS** (XK-VF3000-L33-AVS, Figure 1) consists of an xCORE VocalFusion BaseBoard (XP-VF3000-BASE, Figure 2) and a separate linear microphone array (LINEAR MICROPHONE ARRAY E, Figure 3) using Infineon IM69D130[1] MEMS microphones.

The VocalFusion BaseBoard is based on the XMOS XVF3000 device, running a software which integrates the xCORE VocalFusion microphone capture and voice processing library to provide: beamforming, acoustic echo cancellation, noise suppression, de-reverberation and automatic gain control.

The XVF3000 device has 16 32-bit logical processing cores and integrates 2MBytes Quad Serial Peripheral Interface (QSPI) flash in a TQ128 package.

For general information on the XVF3000 device see the xCORE-200 Architecture Overview[2]. For device specific information on the XVF3000 device see the XVF3000 Datasheet[3].

[1] http://www.infineon.com/microphones
[2] http://www.xmos.com/published/xcore-architecture
[3] http://www.xmos.com/published/xvf3000_3100-tq128-datasheet

# 3 Clock sources and distribution

The BaseBoard includes a single clock generator (Si5351A-B04486-GT, U25) that generates two clocks:

- XVF3000 reference clock - 24MHz oscillator
- Low jitter master audio clock - 24.576MHz oscillator, used for the DAC and (indirectly) the microphones

The clock generator is controlled by the XVF3000 over the I2C bus (see §6, below).

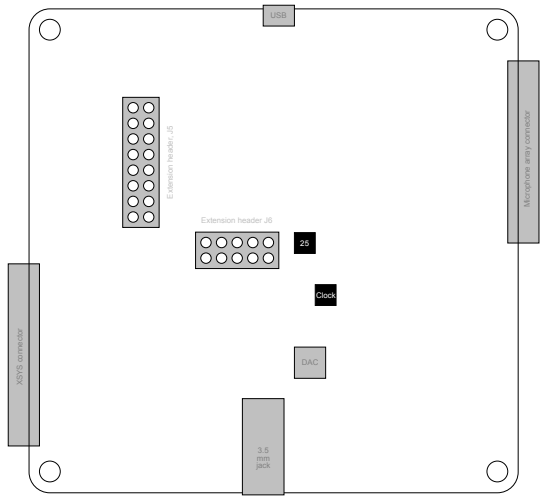


**Figure 5:** Clock and oscillator locations

# 4 Stereo DAC with headphone amplifier

A CS43L21 stereo DAC with integrated headphone amplifier is used to generate audio output on a 3.5mm audio jack. The CS43L21 is connected to the XVF3000 device through an I2S interface and is configured using the I2C bus (see §6, below).

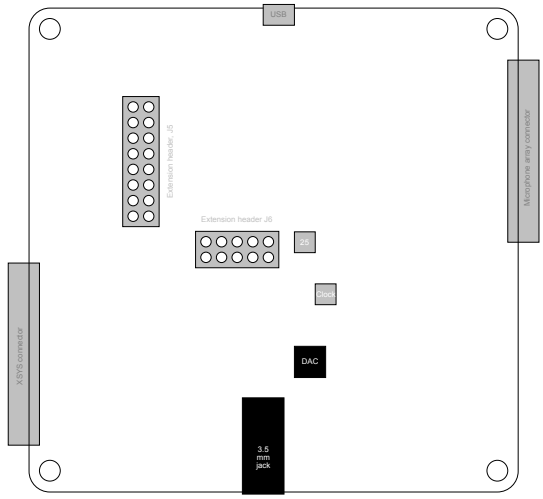


**Figure 6:** DAC and 3.5mm audio jack locations

The I2S interface of the CS43L21 stereo DAC/HPA is connected to the XVF3000 GPIO pins as shown in Figure 7.

| GPIO pin | Port | Signal |
|---|---|---|
| X1D28 | P4F0 | DAC_RST_N |
| X1D36 | P1M0 | I2S_BCLK |
| X1D37 | P1N0 | I2S_LRCK |
| X1D38 | P1O0 | MCLK_TILE1 |
| X1D39 | P1P0 | I2S_DAC_DATA |

**Figure 7:** Stereo DAC GPIO pins

# 5 MEMS microphone board

The microphone board is plugged into connector J3 on the BaseBoard using a ribbon cable. A short ribbon cable should be used for signal integrity.

The microphones should **not** be plugged into the xSYS connector.

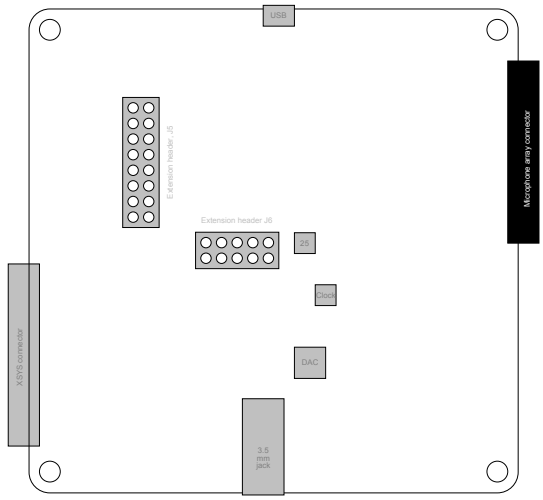


**Figure 8:** Microphone connector location

The microphone array consists of a linear array of four microphones (spaced 33mm apart), a clock buffer, voltage level shifters and an EEPROM for optional identification.

The microphone signals are connected to the XVF3000 GPIO pins as shown in Figure 9.

| Microphone | GPIO pin | Port |
|---|---|---|
| MIC_CLK | X0D12 | P1E0 |
| MCLK_IN | X0D13 | P1F0 |
| MIC_0 | X0D14 | P8B0 |
| MIC_1 | X0D15 | P8B1 |
| MIC_2 | X0D16 | P8B2 |
| MIC_3 | X0D17 | P8B3 |

**Figure 9:** Linear MEMS microphone board GPIO pins

# 6 I2C bus

The BaseBoard has a main I2C bus that is used to control the DAC, clock generator, and EEPROM. This main I2C bus is connected to tile 1 of the XVF3000, with the XVF3000 acting as a master on this I2C bus. See Figure 10 below.

**Figure 10:** I2C master GPIO pins

| GPIO pin | Port | Signal |
|---|---|---|
| X1D26 | P4E0 | I2C_SCL |
| X1D27 | P4E1 | I2C_SDA |

The addresses of devices on the I2C bus are shown in Figure 11 below.

**Figure 11:** I2C device addresses

| Device | Address | |
|---|---|---|
| Si5351A (Clock) | 0b1100010 | 0x62 |
| CS43L21 (DAC) | 0b1001010 | 0x4A |
| 24LC08B (EEPROM on microphone board) | 0b1010Xxx | 0x5x |

Please refer to the 24LC08B datasheet for details on how to set the address of the EEPROM.

The BaseBoard also has a secondary I2C bus, on which the XVF3000 is a slave - so allowing the XVF3000 to be controlled by an external I2C host. See Figure 12 below.

**Figure 12:** I2C slave GPIO pins

| GPIO pin | Port | Signal |
|---|---|---|
| X0D24 | P1I0 | I2C_SDA_SLAVE |
| X0D25 | P1J1 | I2C_SCL_SLAVE |

This slave I2C interface is wired up to the extension headers (see §8).

# 7 General purpose user interface

The BaseBoard has 13 LEDs that are controlled by the XVF3000 GPIO. LED_0 - LED_11 (D2-D13) are positioned around the edge of the BaseBoard. LED_12 (D14) is positioned in the middle of the BaseBoard. The LED GPIO output must be set low to light the corresponding LED.

Four general purpose push-button switches are provided. When pressed, each button creates a connection from the I/O to GND. To ensure correct behavior, the port connected to the buttons (P4A) must always be defined as an input.

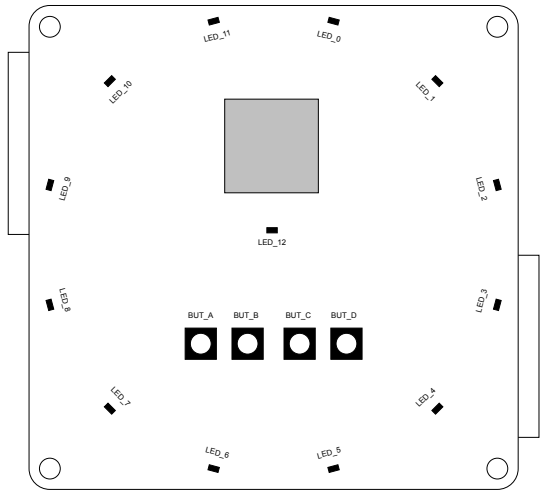


**Figure 13:** General purpose user interface component locations

The signal mapping of the user interface components to the XVF3000 GPIO is shown in Figure 14 and Figure 15.

| UI signal | GPIO pin | Port |
|---|---|---|
| BUTTON_A | X0D02 | P4A0 |
| BUTTON_B | X0D03 | P4A1 |
| BUTTON_C | X0D08 | P4A2 |
| BUTTON_D | X0D09 | P4A3 |

**Figure 14:** User interface GPIO pins

| UI signal | GPIO pins | Port |
|---|---|---|
| LED_0 | X0D26 | P16B0 |
| LED_1 | X0D27 | P16B1 |
| LED_2 | X0D28 | P16B2 |
| LED_3 | X0D29 | P16B3 |
| LED_4 | X0D30 | P16B4 |
| LED_5 | X0D31 | P16B5 |
| LED_6 | X0D32 | P16B6 |
| LED_7 | X0D33 | P16B7 |
| LED_8 | X0D34 | P1K0 |
| LED_9 | X0D35 | P1L0 |
| LED_10 | X0D36 | P16B8 |
| LED_11 | X0D37 | P16B9 |
| LED_12 | X0D38 | P16B10 |

**Figure 15:** User interface GPIO pins

A green LED (PGOOD) near the USB connector indicates 3V3 and 1V0 supplies are up.

# 8 Extension headers

The BaseBoard has a two extension headers, J5 and J6, containing: digital audio signals, the secondary I2C bus (see §6) and several general purpose IOs controlled by the XVF3000.

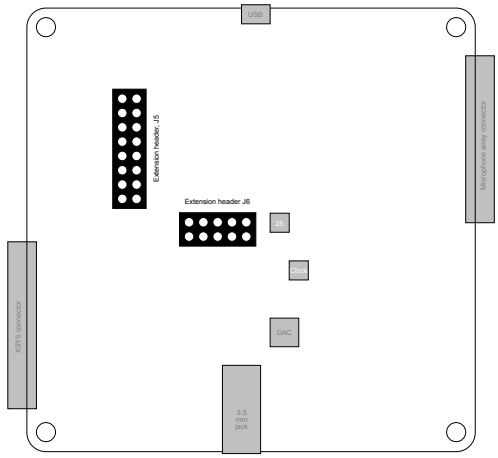


**Figure 16:** Extension header locations

These signals allow the XVF3000 to be connected to and controlled by an external applications processor host.

The software pre-flashed[4] in to the **xCORE VocalFusion 4-Mic Kit for Amazon AVS** configures the XVF3000 device and the BaseBoard hardware to use these extension headers to connect to an external applications processor host.

- Audio input/output connectivity via I2S signals available on J6.

  The XVF3000 is the I2S master.

- Control via I2C signals available on J5.

  The XVF3000 is an I2C slave.

The signal mapping of the extension headers to the XVF3000 GPIO is shown in Figure 17 and Figure 18.

[4]VocalFusion software build configuration: `1i0o0_lin33_i2s_only_master_48kHz_i2cctl`

| Pin | GPIO pin | Port | Signal | Notes |
|---|---|---|---|---|
| 1 | X0D22 | P1G0 | | *Not used* |
| 2 | | | GND | Ground |
| 3 | X0D23 | P1H0 | | *Not used* |
| 4 | X1D35 | P1L0 | | *Not used* |
| 5 | X0D00 | P1A0 | | *Not used* |
| 6 | | | GND | Ground |
| 7 | X0D11 | P1D0 | | *Not used* |
| 8 | | | GND | Ground |
| 9 | X0D24 | P1I0 | I2C_SDA_SLAVE | Add a pull-up resistor |
| 10 | X0D39 | P1P0 | | *Not used* |
| 11 | | | GND | Ground |
| 12 | X0D25 | P1J0 | I2C_SCL_SLAVE | Add a pull-up resistor |
| 13 | | | 3V3 | 3.3V from BaseBoard |
| 14 | | | GND | Ground |
| 15 | | | EXT_MCLK | MCLK input (not used) |
| 16 | | | GND | Ground |

**Figure 17:** Extension header J5 GPIO pins (XVF3000 an I2C slave)

| Pin | GPIO pin | Port | Signal | Notes |
|---|---|---|---|---|
| 1 | X1D37 | P1N0 | I2S_LRCK | I2S LRCLK from XVF3000 to host |
| 2 | | | GND | Ground |
| 3 | X1D39 | P1P0 | I2S_DAC_DATA | I2S data from host to XVF3000 and DAC |
| 4 | | | NC | *No connection* |
| 5 | | | GND | Ground |
| 6 | X1D36 | P1M0 | I2S_BCLK | I2S BLCK from XVF3000 to host |
| 7 | X1D38 | P1O0 | MCLK_TILE1 | MCLK output to host |
| 8 | | | GND | Ground |
| 9 | X1D11 | P1D0 | X1D11 | I2S data from XVF3000 to host |
| 10 | X1D10 | P1C0 | X1D10 | *Not used* |

**Figure 18:** Extension header J6 GPIO pins (XVF3000 the I2S master)

The XVF3000 device and BaseBoard hardware *can* support other modes of audio and control connectivity. Some of these other modes are mentioned below for example only - their use requires a different XVF3000 software.

**XVF3000 as the I2S master** (default software, as described above)

- Example VocalFusion build configuration: `1i0o0_lin33_i2s_only_master_48kHz_i2cctl`
- Audio input/output via I2S signals on J6. The XVF3000 is the I2S master.
- Control via I2C on J5. The XVF3000 is an I2C slave.
- Extension headers are mapped to the XVF3000 GPIO as shown in Figure 17 and Figure 18 above.

**XVF3000 as an I2S slave**

To use this mode, remove R67 and insert a 0R link into R17.

- Example VocalFusion build configuration: `1i0o0_lin33_i2s_only_48kHz_i2cctl`
- Audio input/output via I2S on J6. The XVF3000 is an I2S slave.
- Control via I2C on J5. The XVF3000 is an I2C slave.
- 24.576 MHz MasterClock generated externally and connected to J5 pin 15.
- Extension headers mapped to the XVF3000 GPIO as shown in Figure 17 above and Figure 19 below.

| J6 pin | GPIO pins | Port | Signal | Notes |
|---|---|---|---|---|
| 1 | X1D37 | P1N0 | I2S_LRCK | I2S LRCLK from host to XVF3000 |
| 2 | | | GND | Ground |
| 3 | X1D39 | P1P0 | I2S_DAC_DATA | I2S data from host to DAC |
| 4 | | | NC | *No connection* |
| 5 | | | GND | Ground |
| 6 | X1D36 | P1M0 | I2S_BCLK | I2S BLCK from host to XVF3000 |
| 7 | X1D38 | P1O0 | MCLK_TILE1 | MCLK output (not used) |
| 8 | | | GND | Ground |
| 9 | X1D11 | P1D0 | X1D11 | I2S data from XVF3000 to host |
| 10 | X1D10 | P1C0 | X1D10 | I2S data from host to XVF3000 |

**Figure 19:** Extension header J6 GPIO pins (XVF3000 as I2S slave)

**XVF3000 as an USB 2.0 device**

If using this mode, both extension headers should be left unconnected.

- Example VocalFusion build configuration: `1i1o2_lin33`
- Audio input/output via USB. The XVF3000 is a USB Audio Class 1 device.
- Control via USB. The XVF3000 is a custom class control device.

# 9 USB port

The USB micro-B port (J1) provides power for all the on-board circuits and is used to generate the following voltage rails:

- +1V0 (Core voltage to XMOS device)
- +2V5 (for headphone amplifier in DAC device)
- +3V3 for GPIOs and other accessory devices

Voltage tolerance should be as per USB VBUS specification values.

Proper power-on sequence is indicated by power good LED (D1) in bottom side of the board.

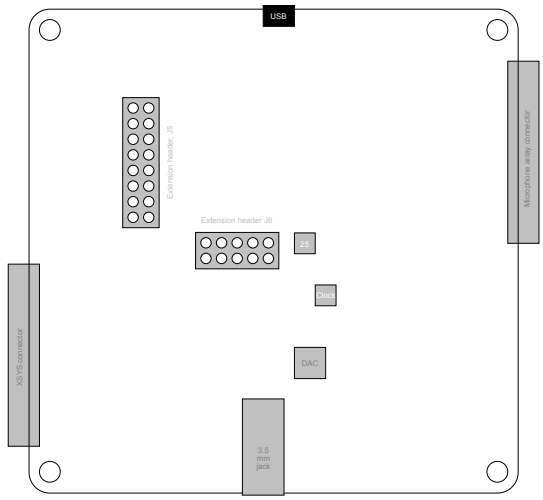


**Figure 20:** USB components

The data lines from the USB micro-B port (J1) are connected to the XVF3000's integrated USB PHY, and so (with a different XVF3000 software) *can* be used to provide USB audio and/or control connectivity to the XVF3000 and the BaseBoard.

**Note:**

- the software pre-flashed in to the **xCORE VocalFusion 4-Mic Kit for Amazon AVS** does **not** provide any USB connectivity.
- J1 must be connected at all times to provide power to the BaseBoard, even though the USB interface is not used.

# 10 Flash memory

The XVF3000 device includes 2MBytes of QSPI flash memory, which is internally interfaced to the XVF3000 by the GPIO connections shown in Figure 21:

| QSPI signal | GPIO pin | Port |
|---|---|---|
| QSPI_SS | X0D01 | P1B |
| QSP_D0 | X0D04 | P4B0 |
| QSP_D1 | X0D05 | P4B1 |
| QSP_D2 | X0D06 | P4B2 |
| QSP_D3 | X0D07 | P4B3 |
| SPI_CLK | X0D10 | P1C |

**Figure 21:** QSPI Flash GPIO pins

# 11 xSYS connector

A standard XMOS xSYS interface (J2) is provided. The can connect to an XMOS xTAG debug adaptor, allowing host debug of the board via JTAG.

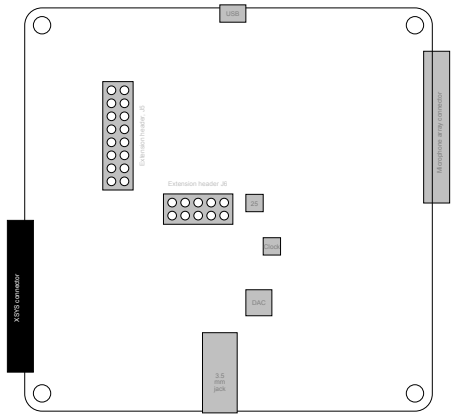


**Figure 22:** XSYS connector

| xSYS signal | GPIO pin | Header pin | Description |
|---|---|---|---|
| TMS | See note | 7 | JTAG Test Mode Select |
| TCK | See note | 9 | JTAG Test Clock |
| TDI | See note | 5 | JTAG Test Data In - from debug adapter to xCORE |
| TDO | See note | 13 | JTAG Test Data Out - from xCORE to debug adapter |
| RST_N | See note | 15 | System Reset - active low, resets xCORE device |
| GND | | 4, 8, 12, 16, 20 | Ground |
| XL_UP1 | X0D43 | 6 | XMOS link, uplink bit 1 |
| XL_UP0 | X0D42 | 10 | XMOS link, uplink bit 0 |
| XL_DN0 | X0D40 | 14 | XMOS link, downlink bit 0 |
| XL_DN1 | X0D41 | 18 | XMOS link, downlink bit 1 |

**Figure 23:** xSYS Connector Pinout

Notes:

- JTAG connections occupy dedicated connections

# 12 xCORE VocalFusion BaseBoard portmap

The tables below detail the port-pin mappings for the xCORE VocalFusion BaseBoard, as programmed with the default software.

| Pin | 1-bit | 4-bit | 8-bit | 16-bit | 32-bit | Signal |
|---|---|---|---|---|---|---|
| X0D00 | $1A^0$ | | | | | |
| X0D01 | $1B^0$ | | | | | QSPI_CS |
| X0D02 | | $4A^0$ | $8A^0$ | $16A^0$ | $32A^{20}$ | BUTTON_A |
| X0D03 | | $4A^1$ | $8A^1$ | $16A^1$ | $32A^{21}$ | BUTTON_B |
| X0D04 | | $4B^0$ | $8A^2$ | $16A^2$ | $32A^{22}$ | QSPI_D0 |
| X0D05 | | $4B^1$ | $8A^3$ | $16A^3$ | $32A^{23}$ | QSPI_D1 |
| X0D06 | | $4B^2$ | $8A^4$ | $16A^4$ | $32A^{24}$ | QSPI_D2 |
| X0D07 | | $4B^3$ | $8A^5$ | $16A^5$ | $32A^{25}$ | QSPI_D3 |
| X0D08 | | $4A^2$ | $8A^6$ | $16A^6$ | $32A^{26}$ | BUTTON_C |
| X0D09 | | $4A^3$ | $8A^7$ | $16A^7$ | $32A^{27}$ | BUTTON_D |
| X0D10 | $1C^0$ | | | | | QSPI_CLK |
| X0D11 | $1D^0$ | | | | | |
| X0D12 | $1E^0$ | | | | | MIC_CLK |
| X0D13 | $1F^0$ | | | | | MCLK_IN |
| X0D14 | | $4C^0$ | $8B^0$ | $16A^8$ | $32A^{28}$ | MIC_0 |
| X0D15 | | $4C^1$ | $8B^1$ | $16A^9$ | $32A^{29}$ | MIC_1 |
| X0D16 | | $4D^0$ | $8B^2$ | $16A^{10}$ | | MIC_2 |
| X0D17 | | $4D^1$ | $8B^3$ | $16A^{11}$ | | MIC_3 |
| X0D18 | | $4D^2$ | $8B^4$ | $16A^{12}$ | | MIC_4 |
| X0D19 | | $4D^3$ | $8B^5$ | $16A^{13}$ | | MIC_5 |
| X0D20 | | $4C^2$ | $8B^6$ | $16A^{14}$ | $32A^{30}$ | MIC_6 |
| X0D21 | | $4C^3$ | $8B^7$ | $16A^{15}$ | $32A^{31}$ | MIC_7 |
| X0D22 | $1G^0$ | | | | | |
| X0D23 | $1H^0$ | | | | | |
| X0D24 | $1I^0$ | | | | | I2C_SDA_SLAVE |
| X0D25 | $1J^0$ | | | | | I2C_SCL_SLAVE |
| X0D26 | | $4E^0$ | $8C^0$ | $16B^0$ | | LED_0 |
| X0D27 | | $4E^1$ | $8C^1$ | $16B^1$ | | LED_1 |
| X0D28 | | $4F^0$ | $8C^2$ | $16B^2$ | | LED_2 |
| X0D29 | | $4F^1$ | $8C^3$ | $16B^3$ | | LED_3 |
| X0D30 | | $4F^2$ | $8C^4$ | $16B^4$ | | LED_4 |
| X0D31 | | $4F^3$ | $8C^5$ | $16B^5$ | | LED_5 |
| X0D32 | | $4E^2$ | $8C^6$ | $16B^6$ | | LED_6 |
| X0D33 | | $4E^3$ | $8C^7$ | $16B^7$ | | LED_7 |
| X0D34 | $1K^0$ | | | | | LED_8 |
| X0D35 | $1L^0$ | | | | | LED_9 |
| X0D36 | $1M^0$ | | $8D^0$ | $16B^8$ | | LED_10 |
| X0D37 | $1N^0$ | | $8D^1$ | $16B^9$ | | LED_11 |
| X0D38 | $1O^0$ | | $8D^2$ | $16B^{10}$ | | LED_12 |
| X0D39 | $1P^0$ | | $8D^3$ | $16B^{11}$ | | |
| X0D40 | | | $8D^4$ | $16B^{12}$ | | XL_DN1 |
| X0D41 | | | $8D^5$ | $16B^{13}$ | | XL_DN0 |
| X0D42 | | | $8D^6$ | $16B^{14}$ | | XL_UP0 |
| X0D43 | | | $8D^7$ | $16B^{15}$ | | XL_UP1 |

**Figure 24:** xCORE VocalFusion BaseBoard Portmap: Tile0

| Pin | 1-bit | 4-bit | 8-bit | 16-bit | 32-bit | Signal |
|---|---|---|---|---|---|---|
| X1D00 | $1A^0$ | | | | | |
| X1D01 | $1B^0$ | | | | | |
| X1D02 | | $4A^0$ | $8A^0$ | $16A^0$ | $32A^{20}$ | |
| X1D03 | | $4A^1$ | $8A^1$ | $16A^1$ | $32A^{21}$ | |
| X1D04 | | $4B^0$ | $8A^2$ | $16A^2$ | $32A^{22}$ | |
| X1D05 | | $4B^1$ | $8A^3$ | $16A^3$ | $32A^{23}$ | |
| X1D06 | | $4B^2$ | $8A^4$ | $16A^4$ | $32A^{24}$ | |
| X1D07 | | $4B^3$ | $8A^5$ | $16A^5$ | $32A^{25}$ | |
| X1D08 | | $4A^2$ | $8A^6$ | $16A^6$ | $32A^{26}$ | |
| X1D09 | | $4A^3$ | $8A^7$ | $16A^7$ | $32A^{27}$ | |
| X1D10 | $1C^0$ | | | | | |
| X1D11 | $1D^0$ | | | | | *I2S_VOICE_DATA** |
| X1D14 | | $4C^0$ | $8B^0$ | $16A^8$ | $32A^{28}$ | |
| X1D15 | | $4C^1$ | $8B^1$ | $16A^9$ | $32A^{29}$ | |
| X1D16 | | $4D^0$ | $8B^2$ | $16A^{10}$ | | |
| X1D17 | | $4D^1$ | $8B^3$ | $16A^{11}$ | | |
| X1D18 | | $4D^2$ | $8B^4$ | $16A^{12}$ | | |
| X1D19 | | $4D^3$ | $8B^5$ | $16A^{13}$ | | |
| X1D20 | | $4C^2$ | $8B^6$ | $16A^{14}$ | $32A^{30}$ | |
| X1D21 | | $4C^3$ | $8B^7$ | $16A^{15}$ | $32A^{31}$ | |
| X1D26 | | $4E^0$ | $8C^0$ | $16B^0$ | | I2C_SCL |
| X1D27 | | $4E^1$ | $8C^1$ | $16B^1$ | | I2C_SDA |
| X1D28 | | $4F^0$ | $8C^2$ | $16B^2$ | | DAC_RST_N |
| X1D29 | | $4F^1$ | $8C^3$ | $16B^3$ | | |
| X1D30 | | $4F^2$ | $8C^4$ | $16B^4$ | | |
| X1D31 | | $4F^3$ | $8C^5$ | $16B^5$ | | |
| X1D32 | | $4E^2$ | $8C^6$ | $16B^6$ | | |
| X1D33 | | $4E^3$ | $8C^7$ | $16B^7$ | | |
| X1D35 | $1L^0$ | | | | | |
| X1D36 | $1M^0$ | | $8D^0$ | $16B^8$ | | I2S_BCLK |
| X1D37 | $1N^0$ | | $8D^1$ | $16B^9$ | | I2S_LRCK |
| X1D38 | $1O^0$ | | $8D^2$ | $16B^{10}$ | | MCLK_TILE1 |
| X1D39 | $1P^0$ | | $8D^3$ | $16B^{11}$ | | *I2S_PLAYBACK_DATA** |
| X1D40 | | | $8D^4$ | $16B^{12}$ | | |
| X1D41 | | | $8D^5$ | $16B^{13}$ | | |
| X1D42 | | | $8D^6$ | $16B^{14}$ | | |
| X1D43 | | | $8D^7$ | $16B^{15}$ | | |

**Figure 25:** xCORE VocalFusion BaseBoard Portmap: Tile1

Notes*:

- Pin `X1D11` is the I2S data pin for the captured voice audio from the XVF3000 to the host. The hardware schematic labels this signal `X1D11`. The VocalFusion software calls this port `I2S_DAC`, because it is an output from the software.

- Pin X1D39 is the I2S data pin for the playback audio from the host to the XVF3000 and the DAC. The hardware schematic labels this signal I2S_DAC_DATA. The VocalFusion software calls this port I2S_ADC, because it is an input to the software.

## 13 Raspberry Pi interface cable

The **xCORE VocalFusion 4-Mic Kit for Amazon AVS** is supplied with a cable to interface the BaseBoard (via J5 and J6 - see §8) to a Raspberry Pi.

The interface cable makes the connections as shown in the table below.

| Raspberry Pi | | cable | BaseBoard | | | XVF3000 | | Notes |
|---|---|---|---|---|---|---|---|---|
| Signal | J8 | color | J5 | J6 | Signal | Pin | Port | |
| SDA | 3 | white | 9 | | X0D24 | X0D24 | P1I0 | I2C SDA between Pi (master) and XVF3000 (slave) |
| SCL | 5 | white | 12 | | X0D25 | X0D25 | P1J0 | I2C SCL between Pi (master) and XVF3000 (slave) |
| GND | 6 | black | | 2 | GND | | | Ground |
| GND | 9 | black | | 5 | GND | | | Ground |
| I2S_BCLK | 12 | white | | 6 | I2S_BCLK | X1D35 | P1M0 | I2S BLCK from XVF3000 to Pi |
| GND | 14 | black | | 8 | GND | | | Ground |
| SPI_MOSI | 19 | white | 7 | | X0D11 | X0D11 | P1D0 | *not used* |
| GND | 20 | black | 2 | | GND | | | Ground |
| SPI_MISO | 21 | white | 5 | | X0D00 | X0D00 | P1A0 | *not used* |
| SPI_SCLK | 23 | red | 1 | | X0D22 | X0D22 | P1G0 | *not used* |
| SPI_CE0 | 24 | white | 3 | | X0D23 | X0D23 | P1H0 | *not used* |
| GND | 25 | black | 6 | | GND | | | Ground |
| GND | 30 | black | 8 | | GND | | | Ground |
| GND | 34 | black | 11 | | GND | | | Ground |
| I2S_LRCLK | 35 | red | | 1 | I2S_BCLK | X1D37 | P1N0 | I2S LRCLK from XVF3000 to Pi |
| I2S_DIN | 38 | white | | 9 | X1D11 | X1D11 | P1D0 | I2S data from XVF3000 to Pi |
| GND | 39 | black | 14 | | GND | | | Ground |
| I2S_DOUT | 40 | white | | 3 | I2S_DAC_DATA | X1D39 | P1P0 | I2S data from Pi to XVF3000 and DAC |

**Figure 26:** Raspberry Pi interface cable

For more details on how to connect and setup a Raspberry Pi, see:

- http://www.xmos.com/vocalfusion-avs

## 14 Operating requirements

A USB 2.0 high-speed compliant cable of less than 3m in length should be used when operating the **xCORE VocalFusion 4-Mic Kit for Amazon AVS**. XMOS cannot guarantee correct operation of the base board should any other cable be used.

This product is, like most electronic equipment, sensitive to Electrostatic Discharge (ESD) events. Users should operate the **xCORE VocalFusion 4-Mic Kit for Amazon AVS** with appropriate ESD precautions in place.

## 15 Dimensions

The BaseBoard is 90x90mm square with a board thickness of 1.6mm.

# 16 RoHS and REACH

The **xCORE VocalFusion 4-Mic Kit for Amazon AVS** complies with appropriate RoHS2 and REACH regulations and is a Pb-free product.

The **xCORE VocalFusion 4-Mic Kit for Amazon AVS** is subject to the European Union WEEE directive and should not be disposed of in household waste. Alternative requirements may apply outside of the EU.

# 17 Schematics

The schematics for the Base Board included in the kit, are shown in the first five figures below, followed by the schematics for the linear array board.

For full reference schematics please contact XMOS:

- https://www.xmos.com/contact/enquiries

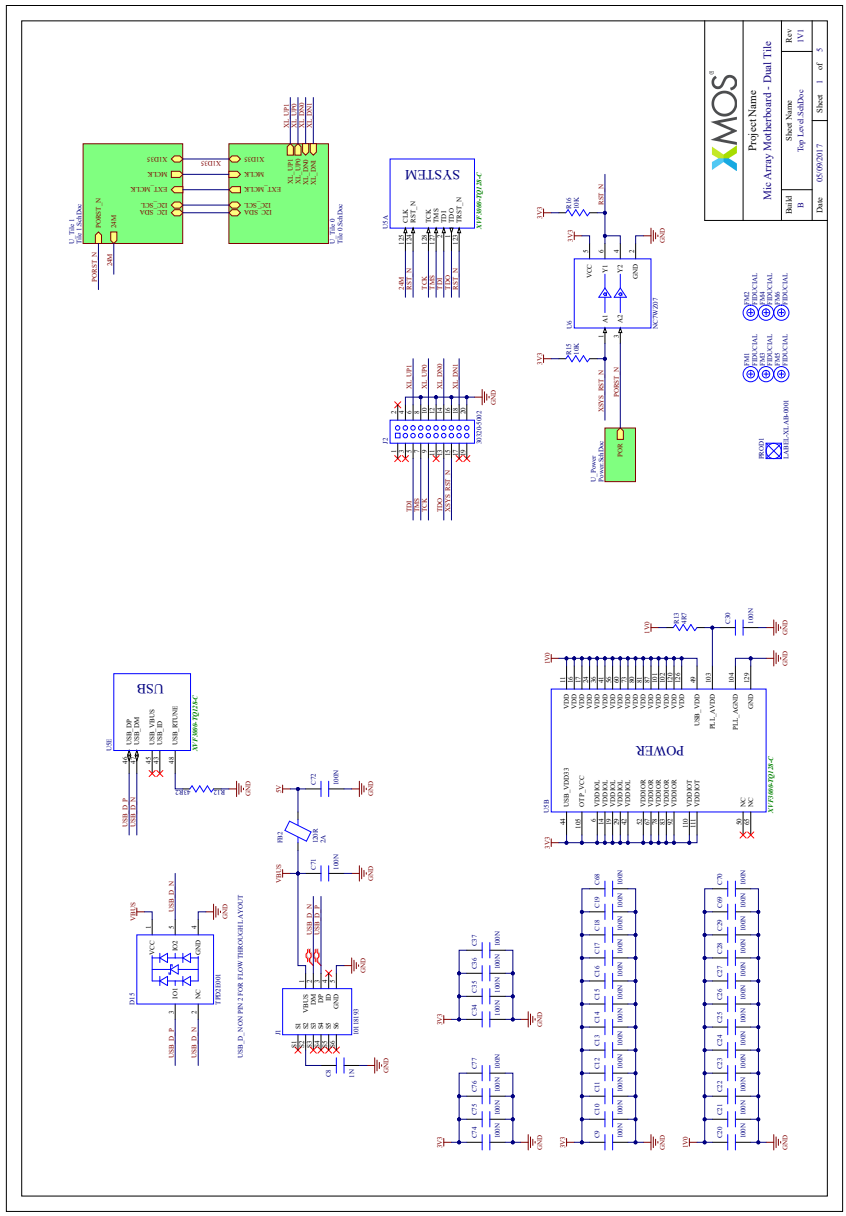


**Figure 27:** xCORE VocalFusion BaseBoard - XVF3000 configuration

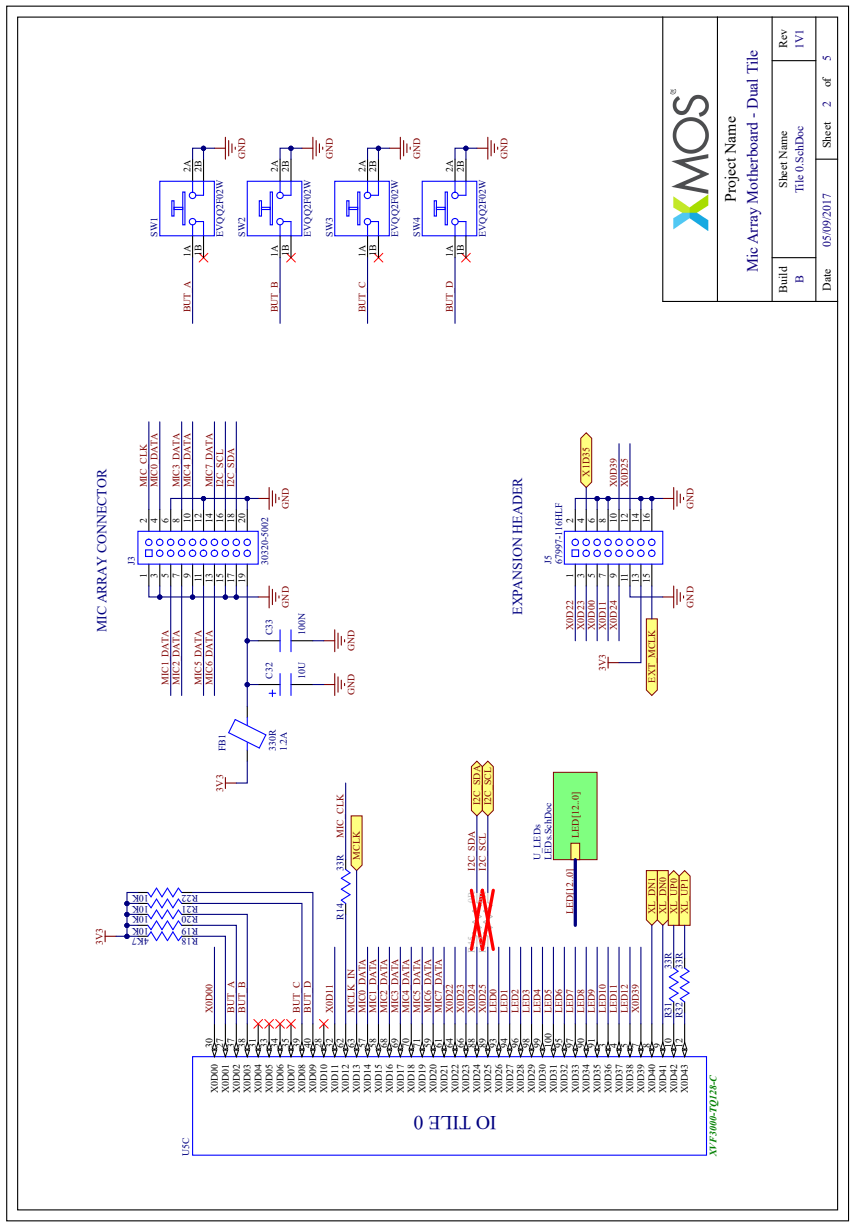


**Figure 28:** xCORE VocalFusion BaseBoard - extension header, buttons, Microphone header, Tile 0 IO

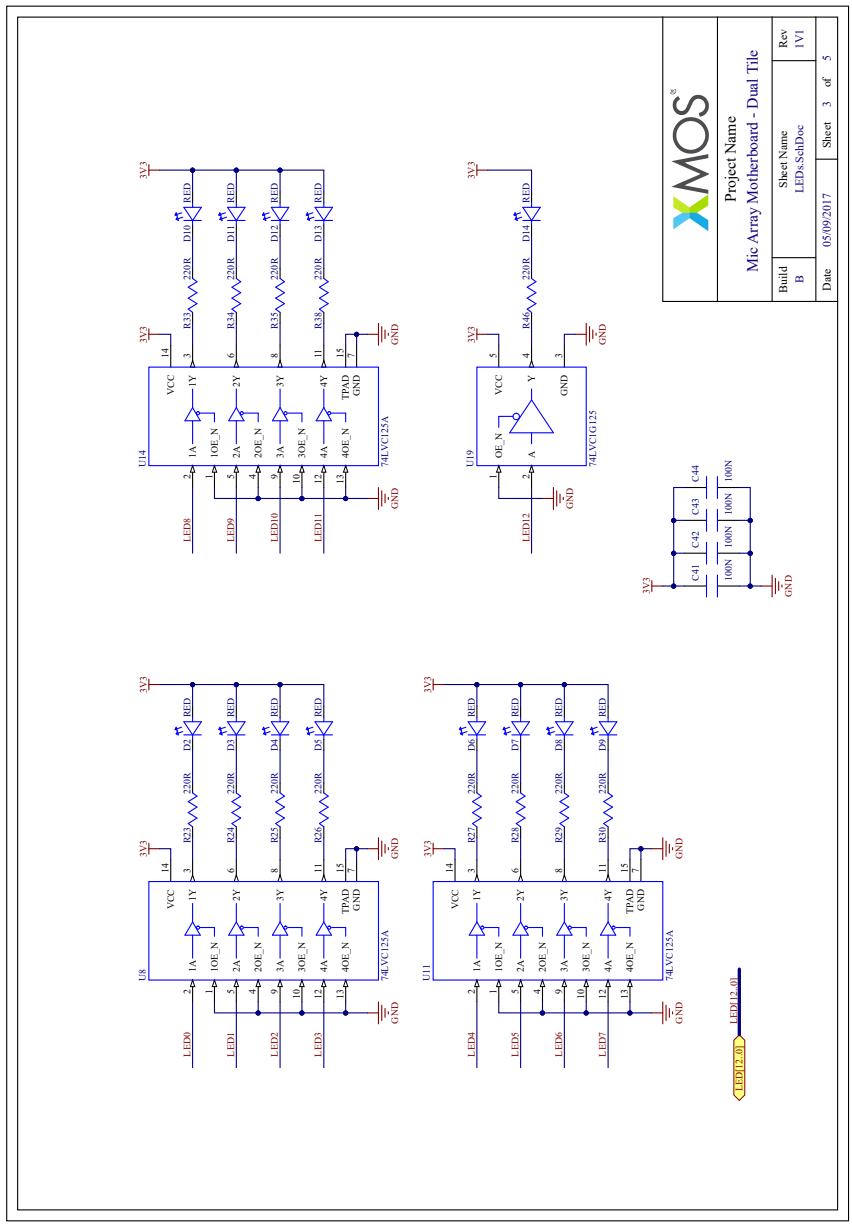


**Figure 29:** xCORE VocalFusion BaseBoard - LEDs

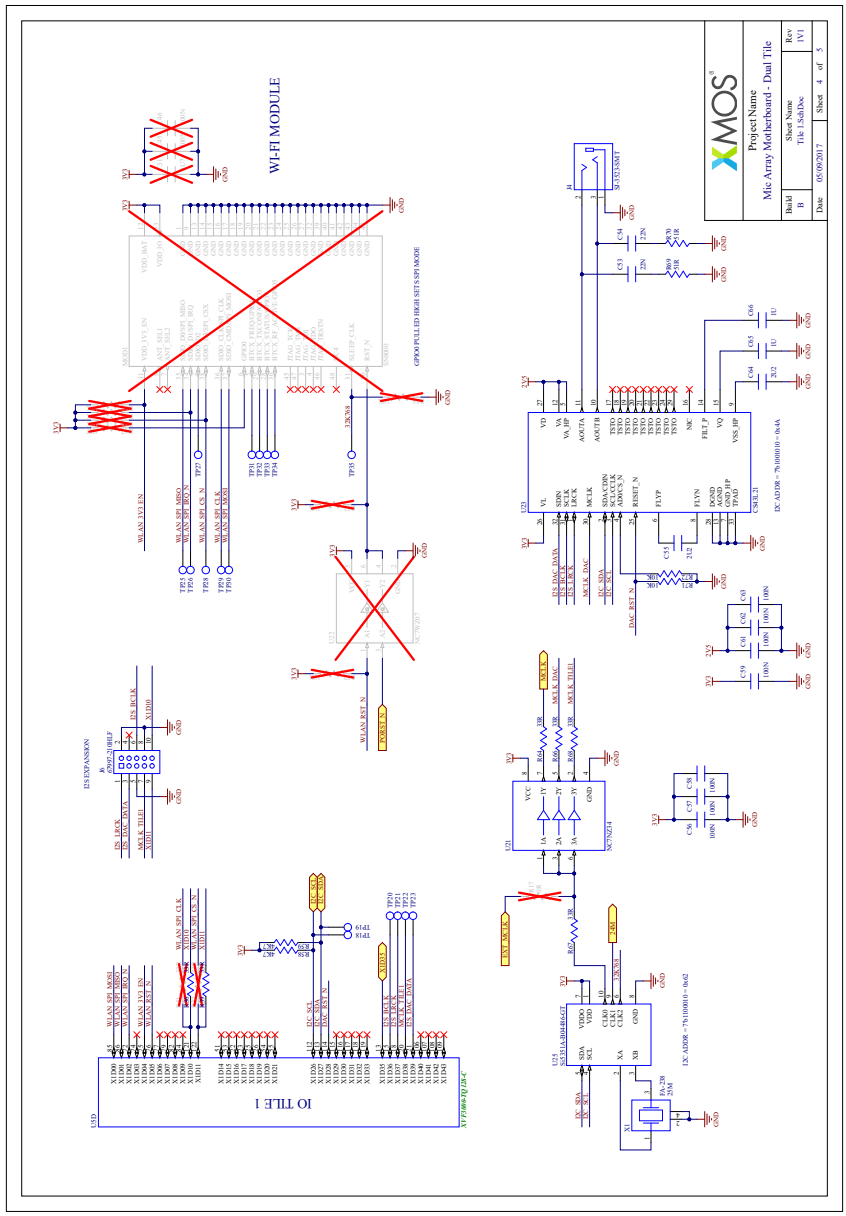


**Figure 30:** xCORE VocalFusion BaseBoard - Clock and stereo DAC with headphone jack circuitry, tile 1 IO

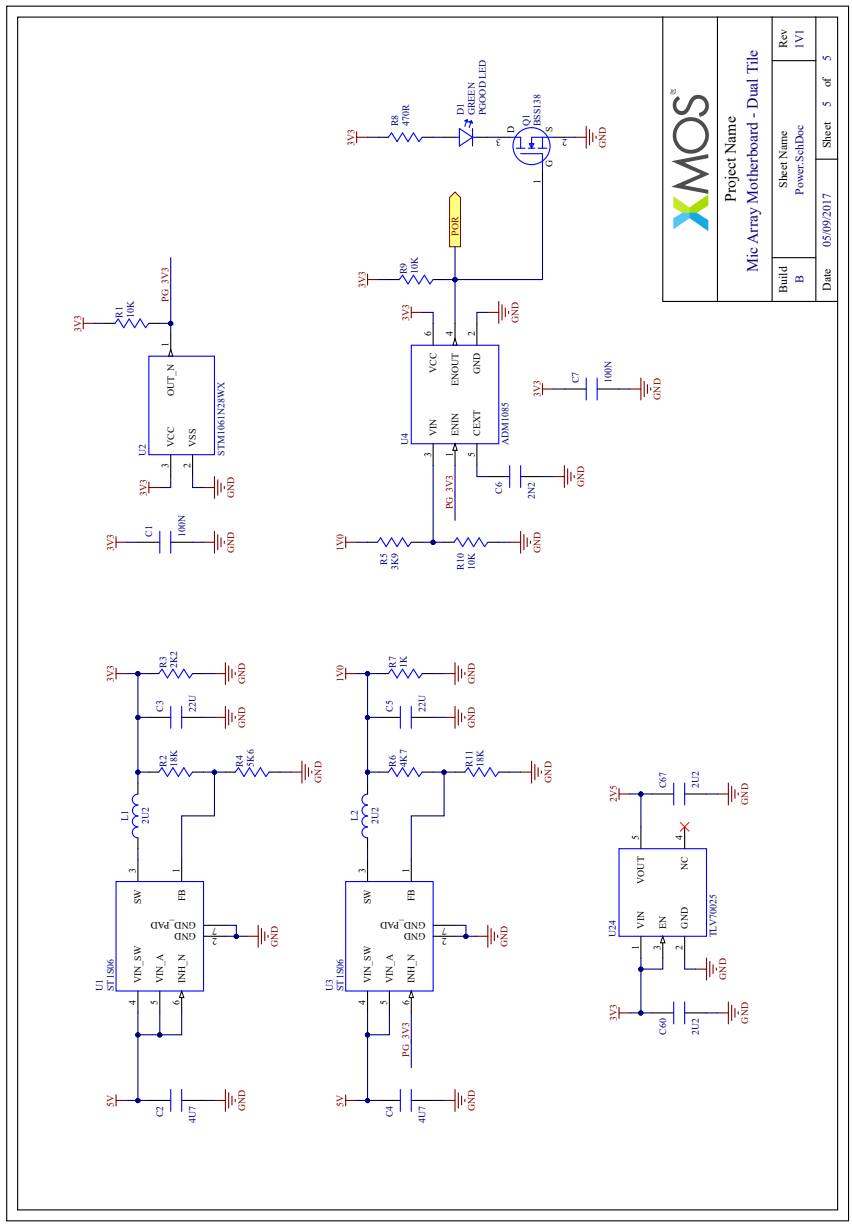


**Figure 31:** xCORE VocalFusion BaseBoard - voltage rail LDOs and reset circuit

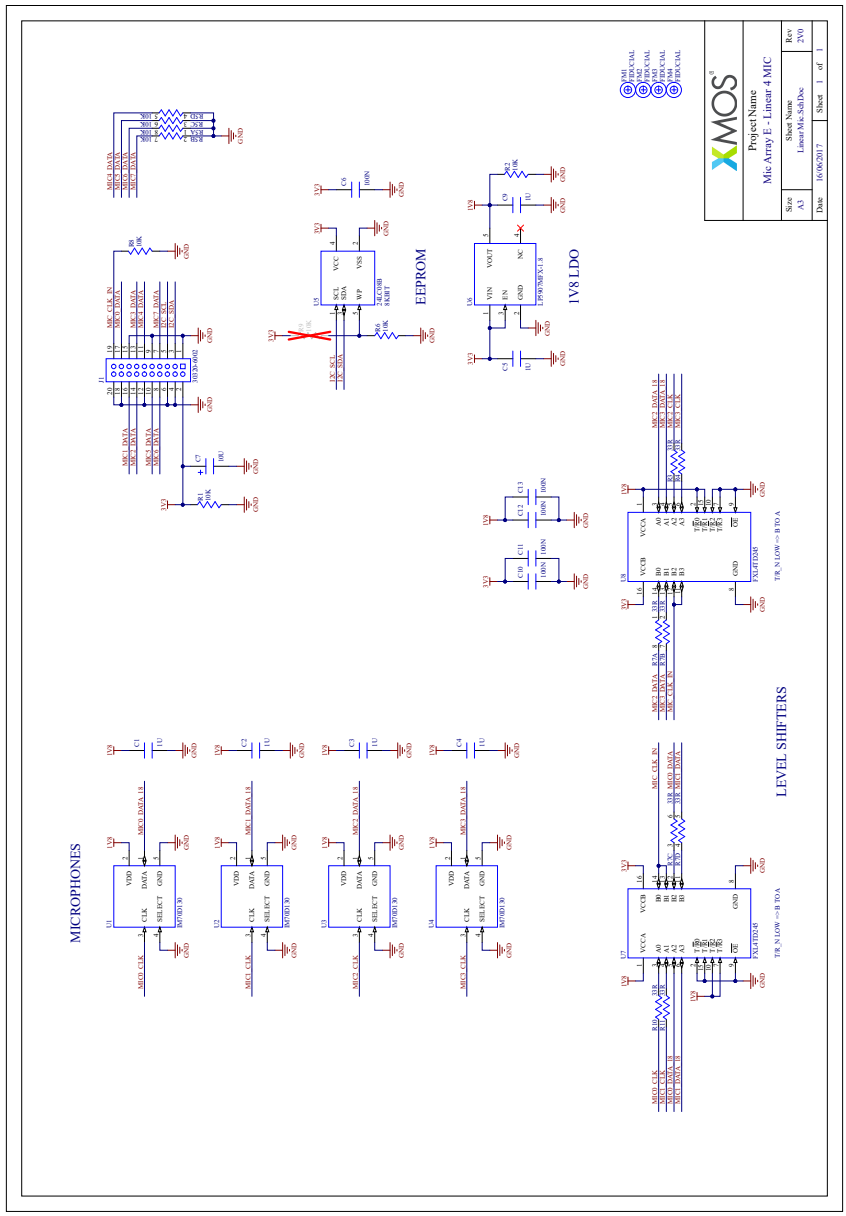


**Figure 32:** xCORE VocalFusion - Linear Microphone Board