ZLE38000-004 Evaluation Board
Hardware User Guide

Preliminary

Feb 2018

Microsemi

Power Matters.™

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1 Revision History

1.1 Revision 1.0

Revision 1.0 is the first publication of this document. This version supports the first generation ZLE38000-004 board (R201) that ships with the initial ZLK38AVS evaluation kit.

1.2 Revision 2.0

The following is a summary of the changes in revision 2.0 of this document.

- Item 1: Added information for the second generation ZLE38000-004 board (R401) that ships with the second generation ZLK38AVS2 evaluation kit.
- Item 2: Document title changed to reflect the new part number of the second generation board.

2 Overview

This document describes the features of the ZLE38000-004 circuit board. It focuses on the hardware circuit design and interfaces. This document supports two versions of this board. The R201 version is the first generation square design that ships with the ZLK38AVS evaluation kit. The R401 version is the second generation round design that ships with the ZLK38AVS2 evaluation kit.

The ZLE38000-004 is designed to interface with a Raspberry Pi 3 Model B development board. This connectivity is done through the P2 (40 pin) header. The boards support the following:

- four on-board digital MEMS microphones
- two mono Class D amplifiers
- headphone jack
- FTDI USB to UART interface (R201 only)
- on-board FLASH memory

The ZLE38000-004 R401 supports the following additional features:

- I2C LED Controller with 12 RGB LEDs.
- ZL38090 USB to I2S bridge.
- four-position DIP Switch for configuration options

Further information regarding the use of the ZLE38000-004 with the Raspberry Pi can be found in the documentation for the ZLK38AVS2 Evaluation Kit.

> ⚠ As with any circuit board, use an anti-static grounded wrist strap when handling the Evaluation Board.

The following figures show the ZLE38000-004 R201 Evaluation Board.

Figure 1 • ZLE38000-004 R201 Evaluation Board – Top

Figure 2 • ZLE38000-004 R201 Evaluation Board – Bottom

The following figures show the ZLE38000-004 R401 Evaluation Board.

Figure 3 • ZLE38000-004 R401 Evaluation Board – Top

Figure 4 • ZLE38000-004 R401 Evaluation Board – Bottom

2.1 USB/Power

When mounted on the Raspberry Pi, the ZLE38000-004 receives power from the P2 header. It can also be powered from the mini-USB connector (J3). On-board regulators convert either 5 V rail to 3.3 V and 1.2 V rails for the Timberwolf processor and associated circuitry.

2.2 RESET

The ZLE38000-004 has a single push button reset. This button is not populated by default, but is shown in silk on the topside of the board. Shorting the through holes on the board will reset the Timberwolf Processor.

2.3 UART

Control of the Timberwolf device may be done through the UART pins. On the first generation board (R201), these pins by default are routed to the on-board FTDI USB to UART interface. Use of the MiTuner GUI allows the Timberwolf processor to be configured and the FLASH programmed for operation.

By changing the location of two resistors the TX and RX UART pins can be routed to the JAIB1 and JAIB2 headers. This is provided for more advanced operation of the ZLE38000-004 (R201) board. R80 should be moved to RRX1 and R81 should be moved to RTX1 to effect this change. This will route the UART signals to pins 2 and 4 on JAIB1/2. The figure below shows the location of these connectors.

Figure 5 • ZLE38000-004 R201 AIB/UART Connection

On the second generation board (R401), the UART of both Timberwolf devices are routed out. U1 is routed to JAIB1 and U17 is routed to J4. The figure below shows the location of these connectors.

Figure 6 • ZLE38000-004 R401 AIB/UART Connection

2.4 Raspberry Pi 3.0

The ZLE38000-004 is designed to sit upon the Raspberry Pi 3.0 board. The P2 header, mounted on the bottom of the board, connects to the 40 pin header on the Raspberry Pi Board. Two mounting holes are also provided on the ZLE38000-004 board to allow for added stability.

The following figure shows the pin out of the Raspberry Pi header.

Figure 7 • Raspberry Pi Connector

This header brings up (as referenced from the Raspberry Pi):

- I2S Bus
  - BITCLK pin 12
  - LRCLK pin 35
  - DIN pin 38
  - DOUT pin 40
- SPI Bus
  - SCLK pin 23
  - MOSI pin 19
  - MISO pin 21
  - CS0 pin 24
  - CS1 pin 26

The SPI bus is directly connected to the Host Bus Interface (HBI) of the primary Timberwolf device using Chip Select 0 (CS0). Chip Select 1 (CS1), unused on the first generation (R201) board, is routed to the ZL38090 on the second generation (R401) board.

Several GPIOs are routed to the Raspberry Pi header. Note that the 5 V rail is routed through this connector, but the 3.3 V rail is not routed through this connector. The ZLE38000-004 can source 5 V power from the Raspberry Pi or from USB (refer to USB/Power (see page 4) for more information).

2.5 TDM Bus Routing

The Timberwolf device has two TDM bus interfaces, TDMA and TDMB. The ZLE38000-004 board routes the I²S bus from the Raspberry Pi header to the TDMA port on the Timberwolf device.

On the first generation board (R201), TDM bus interfaces are routed to the JAIB headers. TDMA is found on JAIB2 and TDMB is found on JAIB1.

On the second generation board (R401), TDMB of the Timberwolf Device (U1) is routed to TDMA of the ZL38090 (U17). This allows U17 to be used as a USB to I²S bridge.

2.6 SPI Control Bus

The Slave SPI port (Host Bus Interface) for the audio processor is fixed to be sourced by the Raspberry Pi. Both revisions of evaluation boards have Chip Select 0 (CS0) from the Raspberry Pi routed to the Host Bus Interface of the primary Timberwolf device (U1). Rev 401 has Chip Select 1 (CS1) routed to the ZL38090 USB device. Master SPI ports of all Timberwolf devices are routed to an on-board flash memory device. Application firmware and configuration can be stored in flash memory, allowing the Timberwolf to boot from flash. Refer to the Timberwolf device datasheet and firmware manual for more information.

2.7 Audio Input

The ZLE38000-004 has four digital MEMS microphones on-board. They are bottom ported microphones with small audio ports in the PCB to allow the acoustic audio signal to pass.

The first generation board has a population option for three small digital microphone boards to be mounted on the board. MICX1L, MICX1R, and MICX2L can be populated with a digital microphone riser board. When this option is implemented, the DMIC_CLK signal must be routed to these populations. This is done by moving the RCLK1 resistor to the RCLK2 location. The on-board microphones may unnecessarily load the DMIC1/2 signals when using the optional boards. It is recommended that the series resistors (R22, R25, R29, and R33) be removed in this configuration.

Additional microphone inputs are also supported through the JMMA1 header. Refer to JMMA1 Header (see page 7) for more information.

2.8 Audio Output

The ZLE38000-004 has a stereo headphone jack (P1), as well as two differential class D amplifiers. The amplifier output can be found at the through-holes at J1 on the ZLE38000-004 R201 version or J5 on the ZLE38000-004 R401. Nothing is populated here by default.

2.9 JMMA1 Header

The JMMA1 header delivers various GPIOs from the connected Timberwolf devices to be used as LED indicators or controls, DAC outputs, and digital microphone inputs. The pin out of the JMMA1 header is found in Figure 5. The audio output signals (labeled OUT1/2) are routed after the two class D amplifiers on the ZLE38000-004. When using the digital microphone interface on the JMMA1 header, it is recommended that the resistors to the on board microphones be removed to avoid contention. These resistors are RCLK1, R22, R25, R29, and R33 on the first generation (R201) board and R137, R138, and R139 on the second generation (R401) board. Refer to the appropriate schematics later in this guide.

If there is a need to have the DACs output come straight from the audio processor, a zero ohm resistor network option has been provided. By moving R11-R14 to the R7-R10 positions, the raw DAC output will be routed to the JMMA1 header.

> ⚠ The DAC signals at the JMMA1 connector have passed through a 100 µF DC blocking cap. It may be necessary to replace these with a zero ohm resistor or a capacitor of a different value, depending upon the architecture of the network connected to the JMMA1 board.

The following illustration shows the JMMA1 header.

Figure 8 • JMMA1 Header

2.10 Configuration Switch (R401 only)

The second generation (R401) board provides a 4 node two position dip switch array (SW2). These switches are routed to the Raspberry Pi header and can be read to enable specific software behavior. The default setting (all off) is used for the ZLK38AVS kit.

3 Evaluation Board Schematics

3.1 ZLE38000-004 R201 Schematics

The schematic that corresponds to the ZLE38000-004 R201 Evaluation Board is shown on the following pages.

Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
Title Block Diagram
Size B
Document Number 156575
ZLE38000-004
Designer VIPE
Rev 201
Date Friday, April 28, 2017
Sheet 2 of 8
RPi - Microphone Array Connectors
AcuEdge Device
Interface Connectors
Class D AMP
Microphones
ZL38000
USB_Power
USB/Power
DGND

To JMMA1 Connector
Optional:
For controller-less operation
NOTE:
GPIO0/1 pull-up allows
bootmode clock options.
Optional:
Used for auto-tuning
TDMB not in use:
connect to GND
ANALOG OUT
DIGITAL MIC IN
GPIO
UART
USB
SPI Master
SPI/I2C Slave
TDM/I2S PortA
TDM/I2S PortB
Oscillator
Reference
ZLE38000
Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
ZLE38000-004
Friday, April 28, 2017

USB Interface
RPi 5Volt
MMA 5Volt
Power Supply
Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
Title Usb/Power
Size B
Document Number 156575
ZLE38000-004
Rev 201
Date Friday, April 28, 2017
Sheet 4 of 8

1. On Board Microphones for AVS Demo
J2 on pin 1,2 - Mic boards not installed
2. Mic Board Microphones for STB Demo
J2 on pin 2,3, Mics boards are installed
3. JMMA1 Microphones J2 not installed
Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
Title Microphones
Size B
Document Number 156575
ZLE38000-004
Designer VIPE
Rev 201
Date Friday, April 28, 2017
Sheet 5 of 8
Right Angle LED Mount with Thru Hole Microphone
SMD LED Mount with SMD Microphone
GPIO 5 LED
GPIO 10 LED
067 - Command
Word Detected
GPIO 8 LED
067 - Trigger
Word Detected
3.3V Power On
DMIC1
DMIC2
DMCLK
DM_CLK1
DM_CLK2
DGND

Class D Amp 1
Class D Amp 2
SPEAKER 1
3.5mm Jack
U3
U4
NCP2820
AMPOUT1+
AMPOUT1-
AMPOUT2+
AMPOUT2-
DAC1_P
DAC1_M
DAC2_P
DAC2_M
POUT
MOUT
100uF
37.4K
10K
4.7uF
100uF
16V
5V
3.3V
DGND
Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
Title Class D Amp
Size B
Document Number 158575
ZLE38000-004
Designer VIPE
Rev 201
Date Friday, April 28, 2017
Sheet 6 of 8

Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Microsemi Proprietary Document
Title: Connector Interfaces
(RPi, Microphone Array Connectors)
Document Number: 156575
ZLE38000-004
Designer: WPE
Rev: 201
Friday, April 28, 2017
Sheet 7 of 8
Key
Power (5 Volts)
Power (3.3 Volts)
Ground
General Inputs/Outputs
I2C Interface
SPI Interface
UART Interface
ID EEPROM Interface
R-Pi HAT EEPROM Circuit
Note: Populate R157 to WP EEPROM
Multi Microphone Array Connector
GPIO10 (067 Command Word Detected)
GPIO8 (067 Trigger Word Detected)
NOTE:
Default is to have pins 5-8 of JMMA1 be sourced from
Class D amplifiers (backward compatible with JMARRY1).
Change resistors to source straight from DACs
Rasperry Pi Header

Rev101 to Rev 201Changes

Layout:
U23 U4 and U5 changed pins to assist manufacturer in QI
Fixed short on DMICLK to 3.3V rail.
Updated silk screen.

4x M2.5 MOUNTING HOLES
DRILLED TO 2.75 +/- 0.05mm

Raspberry Pi
www.raspberrypi.org
© Raspberry Pi 2015

TITLE	RASPBERRY PI 3 MODEL B		
DATE	06/10/2015	REF	RPI-3B-V1_2
DRAWN	James Adams	APVD	James Adams

Microsemi-PPC
2136 North 13th St
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Microsemi Proprietary Document

Title Change History

Size	Document Number		Designer	Rev
B	158575	ZLE38000-004	WPE	201

Date: Friday, April 28, 2017 Sheet 8 of 8

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC
TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING
NAME
DATE
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
TITLE:
SIZE
B
DWG. NO.
ZLE38000-004_REV101
REV
SCALE: 1:1
WEIGHT:
SHEET 1 OF 1
NEXT ASSY
USED ON
APPLICATION
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Microsemi-PPC
2136 North 13th St
Suite D
Reading, Pa 19604
Designer = WPE
RevCode = 201
Title = AVS demonstration platform.
Doc = 158575
OPN = ZLE38000-004

Item	Quantity	Part Reference	Value	Part Number	Manufacturer	Distributor	Dist Part Number	Current	Power	Voltage	Tolerance	Type	Note	PCB Footprint
1	2	1.2V1,3.3V1	151-206-RC_TestPoint_NoPb	151-206-RC	Kobicon	Mouser	151-206-RC						DNP	TP52
2	5	C1,C5,C16,C23,C51	4.7uF	C0805C475K8RACTU	Kemet	DigiKey	399-7416-1-ND			10V	10%	X7R		CAP0805
3	28	C2,C6,C7,C8,C9,C10,C11,C12,C14,C24,C25,C29,C34,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48,C49,C50	100nF	C0402C104K4RACTU	Kemet	Mouser	80-C0402C104K4R			16V	10%	X7R		CAP0402
4	6	C3,C4,C26,C27,C28,C30	100uF	C3216X5R1A107M160AC	TDK	Digikey	445-6007-1-ND			10V	20%	X5R		CAP1206
5	3	C13,C15,C17	10nF	C0402C103K4RACTU	Kemet	Digikey	399-1038-1-ND			16V	10%	X7R		CAP0402
6	7	C18,C19,C20,C21,C22,C31,C35	1uF	C0603C105K4RACTU	Kemet	Mouser	80-C0603C105K4R			16V	10%	X7R		CAP0603
7	2	C32,C33	18pF	C0402C180J3GACAUTO	Kemet	Digikey	399-6831-1-ND			25V	5%	NPO		CAP0402
8	2	CUSB1,CUSB2	47pF	GRM1555C1H470JZ01D	Murata	Digikey	490-1287-2-ND			50V	5%	COG		CAP0402
9	1	CUSB3	100nF	C0603C104K3RACTU	Kemet	Digikey	399-1281-1-ND			25V	10%	X7R		CAP0603
10	2	D1,D4	LS L29K-G1J2-1-Z_Red	LS L29K-G1J2-1-Z	Osram	Digikey	475-2506-1-ND	2mA		1.8Vf				LED0603
11	2	D2,D15	LO L29K-J2L1-24-Z_Orange	LO L29K-J2L1-24-Z	Osram	Digikey	475-1194-1-ND	2mA		1.8Vf				LED0603
12	1	D3	LG L29K-G2J1-24-Z_Green	LG L29K-G2J1-24-Z	Osram	Digikey	475-2709-6-ND	2mA		1.7Vf				LED0603
13	2	D5,D8	RED	5511109F	Dialight	Digikey	350-1677-ND	2mA		1.7V			DNP	LED_551-xx09F
14	1	D6	YLW	5511209F	Dialight	Digikey	350-1679-ND	2mA		1.8V			DNP	LED_551-xx09F
15	1	D7	GRN	5511309F	Dialight	Digikey	350-1681-ND	2mA		1.9V			DNP	LED_551-xx09F
16	3	D9,D10,D16	B130	B130LAW-7-F	Diodes Inc	Digikey	B130LAW-FDICT-ND			30V		Schottky		SOD123_KA
17	1	D11	TVS	TPD2EUSB30DRTR	TI	Digikey	296-25509-1-ND			5.5V				SOT3
18	1	D13	B0530W	B0530W-7-F	Diodes Inc	Digikey	B0530W-FDICT-ND			30V		Schottky		SOD123_KA
19	1	D14	1N4148WS	1N4148WS-7-F	Diodes Inc	Digikey	1N4148WS-FDITR-ND	150mA		75Vr				SOD323_AK
20	2	GND1,GND2	151-208-RC_TestPoint_NoPb	151-208-RC	Kobicon	Mouser	151-208-RC						DNP	TP52
21	1	J1	TSW-104-07-L-S	TSW-104-07-L-S	Samtec								DNP	TSW-104-07-L-S
22	1	J3	USB_Mini_B	0513870578	Molex	Digikey	WM5462TR-ND							Molex_513870578_USB
23	2	JAIB1,JAIB2	TSW-105-14	TSW-105-14-L-D-010	Samtec								DNP	TSW-105-14-L-D-010
24	3	JM1,JM2,JM3	Digital Mic	LeVNA380400255	Microsemi								Rev3 - DNP	HDR6_DIGITAL_MIC
25	1	JMMA1	TSW-109-14-D	TSW-109-14-L-D-010	Samtec								DNP	TSW-109-14-L-D-010
26	1	L1	40 Ohm	MI0805K400R-10	Laird Technologie	Digikey	240-2389-1-ND	1.5 Amp						IND0805
27	1	P1	3.5mm Jack	SJ-43514	CUI	Digikey	CP-43514-ND							TRRS_SJ-4351
28	1	P2	ESW-120-12-L-D	ESW-120-12-L-D	Samtec									ESW-120-12-L-D
29	4	R1,R2,R4,R5	37.4K	ERJ-2RKF3742X	Panasonic	Digikey	P37.4KLCT-ND		0.063 Watt	50V	1%			RES0402
30	7	R3,R6,R16,R17,R20,R44,R75	10K	ERJ-2GEJ103X	Panasonic	Digikey	P10KJTR-ND		0.063 Watt	50V	5%			RES0402
31	4	R7,R8,R9,R10	0 OHM	ERJ-3GEY0R00V	Panasonic	Digikey	P0.0GCT-ND		0.1 Watt	100V	5%		DNP	RES0603
32	14	R11,R12,R13,R14,R67,R69,R71,R72,R73,R74,R76,R77,R78,R79	0 OHM	ERJ-3GEY0R00V	Panasonic	Digikey	P0.0GCT-ND		0.1 Watt	100V	5%			RES0603
33	2	R15,R18	3.9K	ERJ-2RKF3901X	Panasonic	Digikey	P3.90KLTR-ND		0.1 Watt	50V	1%			RES0402
34	1	R19	1K	ERJ-2RKF1001X	Panasonic	Digikey	P1.00KLCT-ND		0.1 Watt	50V	1%		DNP	RES0402
35	29	R22,R25,R29,R33,R45,R50,R51,R52,R53,R55,R56,R58,R59,R60,R61,R64,R65,R66,R68,R70,R81,R82,R83,R84,R85,R89,R90,R91,R92	33.2	ERJ-2RKF33R2X	Panasonic	Digikey	P33.2LTR-ND		0.063 Watt	50V	1%			RES0402
36	7	R23,R24,R26,R27,R28,R30,R34	22.1	ERJ-2RKF22R1X	Panasonic	Digikey	P22.1LCT-ND		0.063 Watt	50V	1%			RES0402
37	10	R32,R35,R47,R48,R49,R54,R86,R87,R88,R93	100K	ERJ-2GEJ104X	Panasonic	Digikey	P100KJCT-ND		0.063 Watt	50V	1%			RES0402
38	7	R36,R37,R38,R40,R41,R42,R80	0 Ohm	ERJ-2GE0R00X	Panasonic	Digikey	P0.0JCT-ND		0.063 Watt	50V	5%			RES0402
39	3	R39,R43,R46	750	ERJ-2RKF7500X	Panasonic	Digikey	P750LTR-ND		0.063 Watt	50V	1%			RES0402
40	2	R57,R62	3.3K	ERJ-3GEY332X	Panasonic	Digikey	P3.3KGTR-ND		0.1 Watt	50V	5%		DNP	RES0603
41	1	R63	3.3K	ERJ-3EKF3301V	Panasonic	Digikey	P3.30KHCT-ND		0.1 Watt	100V	1%			RES0603
42	4	R94,R95,R96,RTX1	33.2	ERJ-2RKF33R2X	Panasonic	Digikey	P33.2LTR-ND		0.063 Watt	50V	1%		DNP	RES0402
43	1	RCLK1	0 Ohm	ERJ-6GEY0R00V	Panasonic	Digikey	P0.0ACT-ND		0.1 Watt	150V	1%			RES0805

OPN = ZLE38000-004

Item	Quantity	Part Reference	Value	Part Number	Manufacturer	Distributor	Dist Part Number	Current	Power	Voltage	Tolerance	Type	Note	PCB Footprint
44	1	RCLK2	0 Ohm	ERJ-6GEY0R00V	Panasonic	Digikey	P0.0ACT-ND		0.1 Watt	150V	1%		DNP	RES0805
45	1	RRX1	0 Ohm	ERJ-2GE0R00X	Panasonic	Digikey	P0.0JCT-ND		0.063 Watt	50V	5%		DNP	RES0402
46	2	RU1,RU2	27	ERJ-2RKF27R0X	Panasonic	Digikey	P27.0LCT-ND		0.063 Watt	50V	1%			RES0402
47	1	SW1	EVQ-11L04M	EVQ-11L04M	Panasonic	Digikey	P8078STB-ND						DNP	SW_200
48	1	U1	ZLE38000	ZLE38000	Microsemi								MTS	QFN64_TW
49	1	U2	MX25L1606EZUI	MX25L1606EZUI-12G	Macronix	Digikey	1092-1056-ND			3.3V				USON8_4x4mm
50	2	U3,U4	NCP2820	NCP2820MUTBG	On Semi	Digikey	NCP2820MUTBGOSCT-ND		2.65Watt	5.5 Volt		Class D		DFN8
51	1	U5	CAT24C32	CAT24C32HU4I-GT3	ON Semi	Digikey	CAT24C32HU4I-GT3OSCT-ND			3.3V				UDFN8_E
52	4	U6,U7,U8,U9	Digital_MIC	SPH1668LM4H-1	Knowles	Mouser	721-SPH1668LM4H-1							KNOWLES_SPH_MIC
53	1	U10	FT234XD	FT234XD-R	FTDI	Digikey	768-1178-1-ND							DFN12
54	1	U11	LX8213-33	LX8213-33ISE	Microsemi	Digikey	LX8213-33ISECT-ND	300mA		3.3Vout				SOT23-5
55	1	U12	LX8213-12	LX8213-12ISE	Microsemi	Digikey	LX8213-12ISECT-ND	300mA		1.2Vout				SOT23-5
56	1	Y1	12MHz	8Z-12.000MAAJ-T	TXC Corporation	Digikey	887-1487-1-ND				+/- 30ppm			TXC_8Z_OSC

3.2 ZLE38000-004 R401 Schematics

The schematic that corresponds to the ZLE38000-004 R401 Evaluation Board is shown on the following pages.

Microsemi
Power Matters.
Microsemi
4509 Friedrich Lane
Suite 200
Austin, TX 78744
Microsemi Proprietary Document
Title Block Diagram
Size B
Document Number 155575
ZLE38000-004
Designer Chip
Rev 401
Date Monday, December 18, 2017
Sheet 2 of 11
RPi_Microphone Array Connectors
3-Interface Connectors
AcuEdge Device
2-ZL38063
USB-I2S
9-ZL38090
USB_Power
8-USBPower
5V 3.3V/1.8V
DGND
1.2V 3.3V
1.2V/3.3V
1.2V/1.8V/3.3V 5V
Possible Future
Option for ZL38090
to control ZL38063

Rev101 to Rev 201Changes

Layout:
U23 U4 and U5 changed pins to assist manufacturer in QI
Fixed short on DMICLK to 3.3V rail.
Updated silk screen.

Rev201 to Rev 301Changes

Schematics:
1. Added LED Light Ring w/ IS31FL3731 controller and 12 tri-color LEDs.
2. Removed FTDI USB->UART.
3. Added Second TW to be used as USB -> I2S bridge chip.
4. Brought UART pins to optional header.
5. Removed one of the AIB headers.
6. Added low pass filter on D-Amp inputs.
7. Added optional circuit to support Pico-Pi headers. Requires 12 pin I2S header and level translator.

Layout:
1. Make it round to accomodate LED Ring, Keeping RPi header in correct position
2. Align Pico-Pi 12 pin header to interface according to Pico-Pi's mechanical dimensions.
3. Update necessary components above.

Rev301 to Rev 401Changes

Schematics:
1. Fixed I2C signals by swapping signals going to P2.3 (SDA) and P2.5 (SCL).
2. Connected GPIO_6 (U17.40) to USB_DP (U17.27) to allow USB SUSPEND to function correctly.

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ANALOG OUT
DIGITAL MIC IN
GPIO
UART
USB
SPI Master
SPI/I2C Slave
TDM/I2S PortA
TDM/I2S PortB
Oscillator
Reference
ZLE38063
Optional: For controller-less operation
NOTE: GPIO0/1 pull-up allows bootmode clock options.
Optional: For controller-less operation
Optional: Used for auto-tuning
TDMB Inputs should be tied to ground when interface is not being used.
RESETN
12MHz
AGND
VSS
1.2V
3.3V

Pico Pi Level Translator Circuit. Requires 1.8V regulator.
Pico Pi uses P2 for SPI signals and P3 for I2S (1.8V).
When using Pico Pi, Remove R104, R109, R110, and R111
Option for swapping which CS controls which TW device.
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NOTE:
Default is to have pins 5-8 of JMMA1 be sourced from Class D amplifiers (backward compatible with JMARRY1).
Change resistors to source straight from DACs
Multi Microphone Array Connector
Remove R137, R138, and R138 if using JMMA1 expansion header.
Option for waking RPi, default is LED Ring Control.
Rasperry Pi Header
R-Pi HAT EEPROM Circuit
Optional Feature Control

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U19
IS31FL3731
VCC
GND
IN
R_EXT
C_FILT
SCL
SDA
AD
INTB
SDB
CA1
CA2
CA3
CA4
CA5
CA6
CA7
CA8
CA9
CB1
CB2
CB3
CB4
CB5
CB6
CB7
CB8
CB9
R163 18.0K
C85 100nF
C87 100nF
C88 1uF 16V
R158 4.7K
R159 4.7K
R160 4.7K
R161 4.7K
R162 4.7K
LED_RING
CA[1..9]
5-LED_RING
I2C_SCL
I2C_SDA
5V
3.3V
DGND

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RGB - Microphone Array, Connectors/LED Fanout/LED_RING
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Designer Chip
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CA[1..9]
Tri_Color_LED D1
Tri_Color_LED D2
Tri_Color_LED D3
Tri_Color_LED D4
Tri_Color_LED D5
Tri_Color_LED D6
Tri_Color_LED D7
Tri_Color_LED D8
Tri_Color_LED D9
Tri_Color_LED D10
Tri_Color_LED D11
Tri_Color_LED D12

GPIO 5 LED
GPIO 8 LED
Trigger
Word Detected
GPIO 10 LED
Command
Word Detected
Remove R137, R138 and R139 if using microphones on the JMMA1 expansion header.
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Class D Amp 1
Class D Amp 2
SPEAKER 1
3.5mm Jack
U24
U25
NCP2820
J5
TSW-104-07-L-S
DNP
AMPOUT1+
AMPOUT1-
AMPOUT2+
AMPOUT2-
DAC1_P
DAC1_M
DAC2_P
DAC2_M
POUT
MOUT
DGND
5V
3.3V

Reset
1.8V Power Supply
Populate for Pico-Pi Only
USB Interface
3.3V Power On
3.3V Power Supply
1.2V Power Supply
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ZL38090 used as USB to I2S bridge.
Flash required to store associated configuration record.
U17A
ZL38090LD
ANALOG OUT
DIGITAL MIC IN
GPIO
UART
USB
SPI Master
SPI/I2C Slave
TDM/I2S Port
Oscillator
Reference
U16
MX25L1606EZUI
8-USON (4x4)
U17B
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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILS
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING
NEXT ASSY
USED ON
APPLICATION
NAME
DATE
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
TITLE:
SIZE
B
DWG. NO.
ZLE38000-004_REV401
REV
SCALE: 1:2
WEIGHT:
SHEET 1 OF 1
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158575 Revision: 401

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Bill Of Mat› Page1

Item	Quantity	Reference	Part	Manufacturer	Part Number	Distributor	Distributor Part Number	Voltage	Current	Power	Type	Note	PCB Footprint
1	2	C3,C4	100uF	TDK	C3216X5R1A107M160AC	Digikey	445-6007-1-ND	10V			X5R		CAP1206
2	46	C7,C12,C14,C29,C34,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48,C49,C50,C53,C63,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81,C82,C88,C89,C90,C91,C93,C95,C96,C99,C104	100nF	Kemet	C0402C104K4RACTU	Mouser	80-C0402C104K4R	16V			X7R		CAP0402
3	2	C1.8V,C52	100nF	Kemet	C0402C104K4RACTU	Mouser	80-C0402C104K4R	16V			X7R	DNP	CAP0402
4	2	C13,C15	10nF	Kemet	C0402C103K4RACTU	Digikey	399-1038-1-ND	16V			X7R		CAP0402
5	7	C26,C27,C28,C30,C35,C67,C86	1uF	Kemet	C0603C105K4RACTU	Mouser	80-C0603C105K4R	16V			X7R		CAP0603
6	4	C32,C33,C64,C65	18pF	Kemet	C0402C180J3GACAUTO	Digikey	399-6831-1-ND	25V			NPO		CAP0402
7	4	C59,C60,C61,C62	33nF	Kemet	C0402C333K4RACTU	Mouser	80-C0402C333K4R	16V			X7R		CAP0402
8	4	C83,C84,C92,C94	4.7uF	Kemet	C0805C475K8RACTU	DigiKey	399-7416-1-ND	10V			X7R		CAP0805
9	2	C85,C87	100nF	Kemet	C0603C104K3RACTU	Digikey	399-1281-1-ND	25V			X7R		CAP0603
10	2	C97,C102	4.7uF	Kemet	C0603C475K9PACTU	Digikey	399-3482-1-ND	6.3V			X5R		CAP0603
11	2	C98,C103	22uF	Murata	ZRB186R60J226ME11L	Digikey	490-13254-1-ND	6.3V			X5R		CAP0603
12	2	C100,C101	1uF	Kemet	C0603C105K4RACTU	Digikey	399-7847-1-ND	16V			X7R		CAP0603
13	12	D1,D2,D3,D4,D5,D6,D7,D8,D9,D10,D11,D12	Tri_Color_LED		CLP6C-FKB-CM1Q1H1BB7R3R3	Digikey	CLP6C-FKB-CM1Q1H1BB7R3R3TR-ND						PLCC6
14	1	D13	TVS	TI	TPD2EUSB30DRTR	Digikey	296-25509-1-ND	5.5V					SOT3
15	3	D14,D15,D19	B130	Diodes Inc	B130LAW-7-F	Digikey	B130LAW-FDICT-ND	30V			Schottky		SOD123_KA
16	1	D16	LS L29K-G1J2-1-Z_Red	Kingbright	APT1608LSECK/J3-PRV	Digikey	754-1930-1-ND	1.8Vf	2mA				LED0603
17	1	D17	LO L29K-J2L1-24-Z_Orange	Kingbright	APT1608LSECK/J4-PRV	Digikey	754-1353-1-ND	1.8Vf	2mA				LED0603
18	1	D18	LG L29K-G2J1-24-Z_Green	Kingbright	APT1608LZGCK	Digikey	754-1934-1-ND	2.65Vf	2mA				LED0603
19	1	D20	LS L29K-G1J2-1-Z_Red	Osram	LS L29K-G1J2-1-Z	Digikey	475-2506-1-ND	1.8Vf	2mA				LED0603
20	6	GND1,GND2,5V,1.2V,1.8V,3.3V	151-208-RC_TestPoint_NoPb	Kobicon	151-208-RC	Mouser	151-208-RC					DNP	TP52
21	1	JAIB1	TSW-105-14	Samtec	TSW-105-14-L-D-010							DNP	TSW-105-14-L-D-010
22	1	JMMA1	TSW-109-14-D	Samtec	TSW-109-14-L-D-010							DNP	TSW-109-14-L-D-010
23	1	J3	USB_Mini_B	Molex	513870578	Digikey	WM5462TR-ND						Molex_513870578_USB
24	1	J4	TSW-103-07-L-S_100mil_3pin_alt2	Samtec	TSW-103-07-L-S							DNP	TSW-103-07-L-S
25	1	J5	TSW-104-07-L-S	Samtec	TSW-104-07-L-S							DNP	TSW-104-07-L-S
26	1	L1	40 Ohm	Laird Technologies	MI0805K400R-10	Digikey	240-2389-1-ND		1.5 Amp				IND0805
27	2	L2,L3	2.2uH	Murata	LQH32PN2R2NNCL	Digikey	490-12036-6-ND		1.85Amp				IND_1210_MUR
28	1	P1	3.5mm Jack	CUI	SJ-43514	Digikey	CP-43514-ND						TRRS_SJ-4351
29	1	P2	ESW-120-33-L-D	Samtec	ESW-120-33-L-D								ESW-120-33-L-D
30	1	P3	ESW-120-33-L-D	Samtec	ESW-120-33-L-D							DNP	ESW-106-33-L-D
31	6	RRX1,R104,R109,R110,R111,R193	0 Ohm	Panasonic	ERJ-2GE0R00X	Digikey	P0.0JCT-ND	50V		0.063 Watt			RES0402
32	37	RTX1,R50,R51,R52,R53,R55,R56,R58,R59,R60,R61,R64,R65,R66,R68,R70,R89,R90,R91,R92,R125,R126,R127,R129,R130,R132,R133,R134,R135,R145,R146,R147,R148,R164,R166,R169,R171	33.2	Panasonic	ERJ-2RKF33R2X	Digikey	P33.2LTR-ND	50V		0.063 Watt			RES0402
33	15	R7,R8,R9,R10,R94,R95,R97,R149,R150,R151,R155,R189,R190,R191,R192	0 OHM	Panasonic	ERJ-3GEY0R00V	Digikey	P0.0GCT-ND	100V		0.1 Watt		DNP	RES0603
34	19	R11,R12,R13,R14,R67,R69,R71,R72,R73,R74,R76,R77,R78,R79,R96,R137,R138,R139,R154	0 OHM	Panasonic	ERJ-3GEY0R00V	Digikey	P0.0GCT-ND	100V		0.1 Watt			RES0603
35	6	R16,R17,R20,R153,R176,R179	10K	Panasonic	ERJ-2GEJ103X	Digikey	P10KJTR-ND	50V		0.063 Watt			RES0402
36	2	R18,R152	3.9K	Panasonic	ERJ-2RKF3901X	Digikey	P3.90KLTR-ND	50V		0.1 Watt			RES0402
37	1	R19	1K	Panasonic	ERJ-2RKF1001X	Digikey	P1.00KLCT-ND	50V		0.1 Watt		DNP	RES0402
38	2	R36,R37	680 Ohm	Panasonic	ERJ-2GEJ681X	Digikey	P680JCT-ND	50V		0.063 Watt			RES0402
39	1	R38	330 Ohm	Panasonic	ERJ-2GEJ331X	Digikey	P330JCT-ND	50V		0.063 Watt			RES0402
40	6	R49,R54,R93,R124,R128,R156	100K	Panasonic	ERJ-2GEJ104X	Digikey	P100KJCT-ND	50V		0.1 Watt			RES0402
41	2	R57,R62	3.3K	Panasonic	ERJ-3GEY332X	Digikey	P3.3KGTR-ND	50V		0.1 Watt		DNP	RES0603
42	1	R63	3.3K	Panasonic	ERJ-3EKF3301V	Digikey	P3.30KHCT-ND	100V		0.1 Watt			RES0603
43	4	R100,R101,R102,R103	0 Ohm	Panasonic	ERJ-2GE0R00X	Digikey	P0.0JCT-ND	50V		0.063 Watt		DNP	RES0402
44	4	R105,R106,R107,R108	10K	Panasonic	ERJ-3EKF1002V	Digikey	P10.0KHCT-ND	100V		0.1 Watt			RES0603
45	4	R120,R121,R122,R123	221	Panasonic	ERJ-2RKF33R2X	Digikey	P221LTR-ND	50V		0.1 Watt			RES0402
46	1	R131	3.3K	Panasonic	ERJ-2RKF3301X	Digikey	P3.30KLCT-ND	50V		0.063 Watt			RES0402
47	1	R136	43.2	Panasonic	ERJ-2RKF43R2X	Digikey	P43.2LCT-ND	50V		0.063 Watt			RES0402
48	2	R157,R158	51.1	Panasonic	ERJ-3EKF51R1V	Digikey	P51.1HCT-ND	100V		0.1 Watt			RES0603
49	4	R159,R160,R161,R162	4.7K	Panasonic	ERJ-3EKF4701V	Digikey	P4.70KHCT-ND	100V		0.1 Watt			RES0603
50	1	R163	18.0K	Panasonic	ERJ-3EKF1802V	Digikey	P18.0KHCT-ND	100V		0.1 Watt			RES0603

51	4	R165,R167,R170,R172	22.1	Panasonic	ERJ-2RKF22R1X	Digikey	P22.1LCT-ND	50V		0.063 Watt			RES0402
52	2	R173,R182	100K	Panasonic	ERJ-2GEJ104X	Digikey	P100KJCT-ND	50V		0.063 Watt			RES0402
53	4	R174,R175,R177,R178	37.4K	Panasonic	ERJ-2RKF3742X	Digikey	P37.4KLCT-ND	50V		0.063 Watt			RES0402
54	2	R180,R181	3	Vishay	CRCW04023R00FKED	Digikey	541-3.00LLCT-ND	50V		0.063 Watt			RES0402
55	1	R183	107K	Panasonic	ERJ-2RKF1073X	Digikey	P107KLCT-ND	50V		0.063 Watt			RES0402
56	3	R184,R187,R188	24.3K	Panasonic	ERJ-2RKF2432X	Digikey	P24.3KLCT-ND	50V		0.063 Watt			RES0402
57	1	R185	750	Panasonic	ERJ-2RKF7500X	Digikey	P750LTR-ND	50V		0.063 Watt			RES0402
58	1	R186	49.9K	Panasonic	ERJ-2RKF4992X	Digikey	P49.9KLCT-ND	50V		0.063 Watt			RES0402
59	1	SW1	EVQ-11L04M	Panasonic	EVQ-11L04M	Digikey	P8078STB-ND					DNP	SW_200
60	1	SW2	BD04AV	C&K	BD04AV	Digikey	CKN3013-ND						BD04AV
61	1	U1	ZLE38063	Microsemi	ZLE38000							MTS	QFN64_TW
62	2	U2,U16	MX25L1606EZUI	Macronix	MX25L1606EZUI-12G	Digikey	1092-1056-ND	3.3V					USON8_4x4mm
63	2	U3,U4	LX7186A	Microsemi	LX7186AILU-TR	Digikey	LX7186AILU-TRCT-ND	5.5V	1 Amp				UDFN6
64	1	U5	CAT24C32	ON Semi	CAT24C32HU4I-GT3	Digikey	CAT24C32HU4I-GT3OSCT-ND	3.3V					UDFN8_E
65	1	U6	APX823	Diodes Inc	APX823-31W5G-7	Digikey	APX823-31W5GDICT-ND	3.08V					SOT753
66	1	U7	AP2127K		AP2127K-1.8TRG1	Digikey	AP2127K-1.8TRG1DICT-ND	2.5~6V	300mA			DNP	SOT23-5
67	1	U13	74AVC4TD245	NXP	74CBTLV3257BQ	Digikey	1727-6899-1-ND	3.6V				DNP	DHVQFN16
68	1	U17	ZL38090LD	Microsemi	ZL38090LD								qfn64_TW
69	1	U18	XC7SHU04G	Nexperia	XC7SHU04GV,125	Digikey	1727-4381-1-ND	2~5.5V	8mA			DNP	SOT23-5
70	1	U19	IS31FL3731	ISSI	IS31FL3731-SALS2	Digikey	706-1412-5-ND	2.7~5.5V					SSOP28
71	4	U20,U21,U22,U23	Digital_MIC	Knowles	SPH1668LM4H-1	Mouser	721-SPH1668LM4H-1						KNOWLES_SPH_MIC
72	2	U24,U25	NCP2820	On Semi	NCP2820MUTBG	Digikey	NCP2820MUTBGOSCT-ND	5.5 Volt		2.65Watt	Class D		DFN8
73	2	Y1,Y2	12MHz	TXC Corporation	8Z-12.000MAAJ-T	Digikey	887-1487-1-ND						TXC_8Z_OSC

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