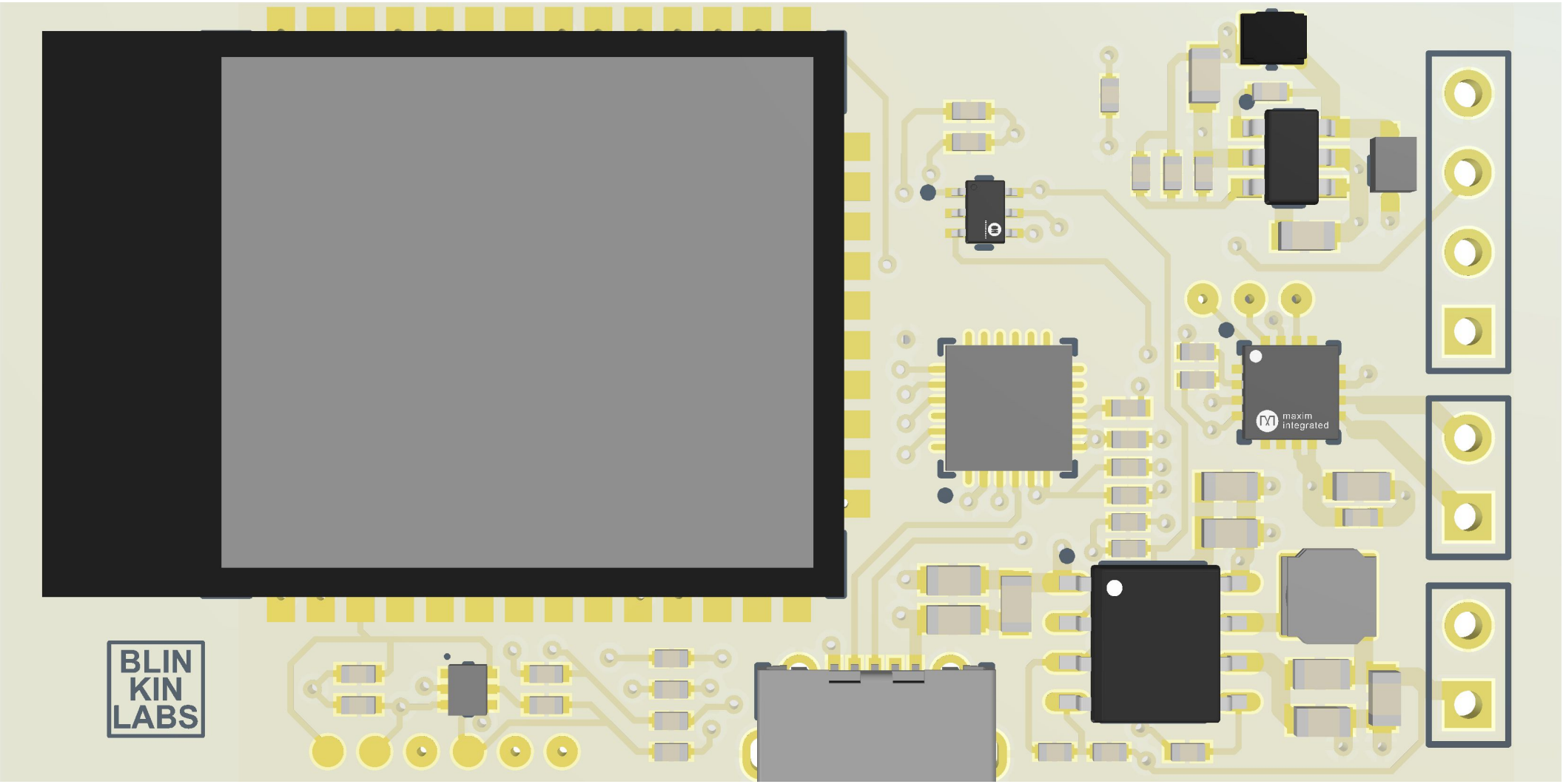

BLIN
KIN
LABS
maxim
integrated

Alles

11/23/2020
RevA

RELEASE

DESIGN CONSIDERATIONS

DESIGN NOTE:
Example text for informational design notes .

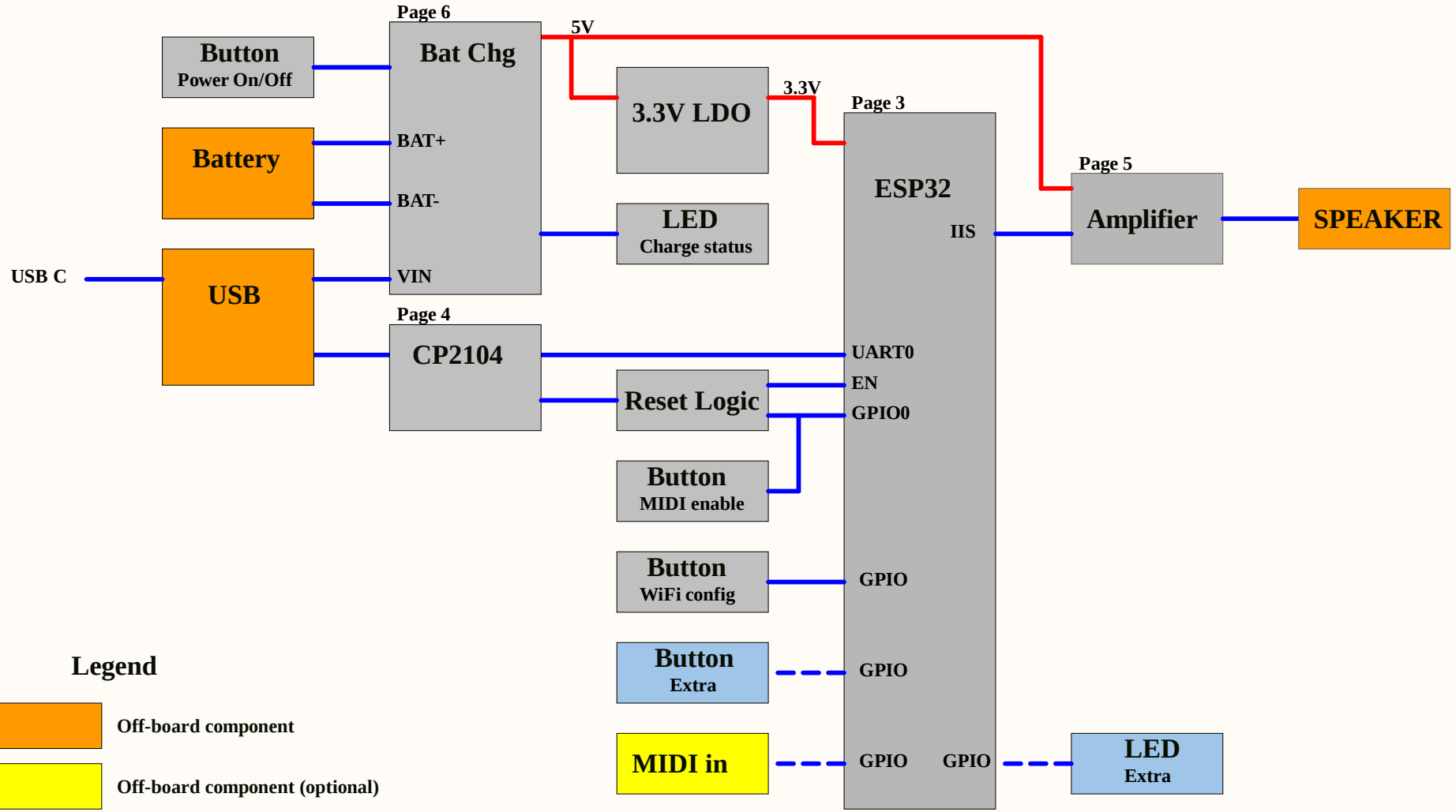
DESIGN NOTE:
Example text for critical design notes.

DESIGN NOTE:
Example text for cautionary design notes.

LAYOUT NOTE:
Example text for critical layout guidelines.

Title: Cover Page		BLIN KIN LABS
Project: Alles	Revision: RevA	
Date: 11/23/2020 Time: 12:30:58 PM	Sheet 1 of 7	

Alles



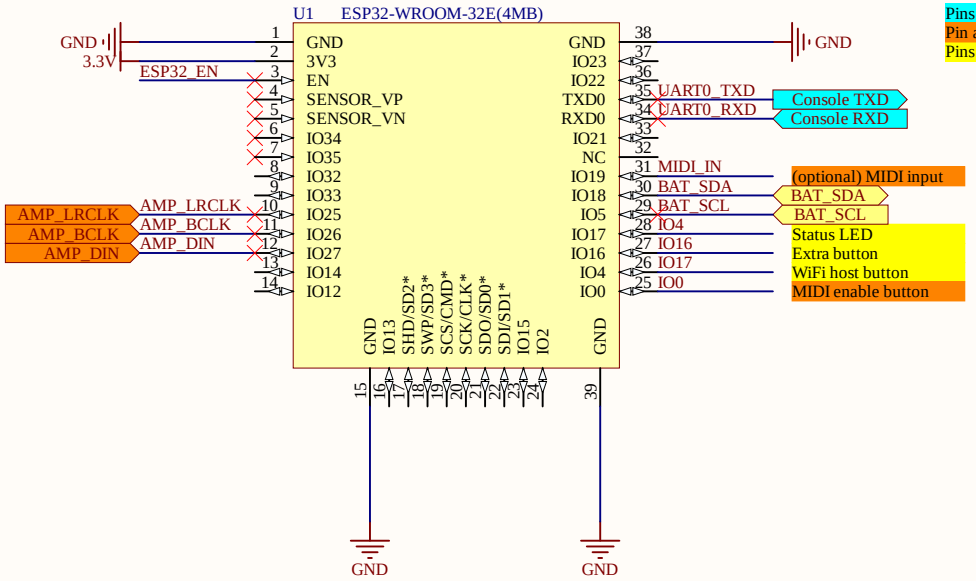
Legend

- Off-board component
- Off-board component (optional)
- On-board component
- On-board component (optional)

Title: Block Diagram		
Project: Alles	Revision: RevA	
Date: 11/23/2020 Time: 12:30:58 PM	Sheet 2 of 7	

BLIN KIN LABS

ESP32



Pins are fixed function, can't change
Pin assignment for project firmware
Pins assigned through GPMUX, can change

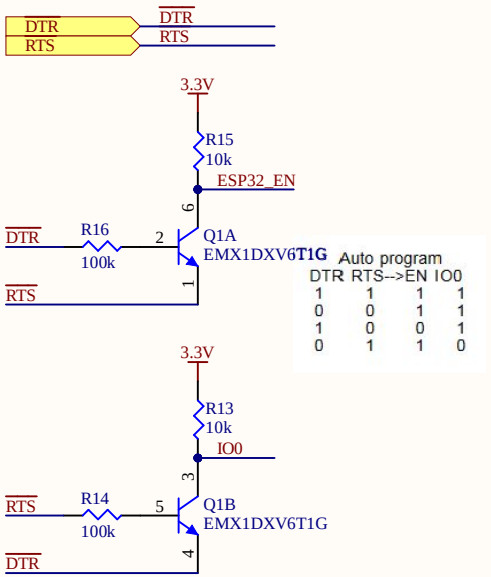
Test points

AMP_BCLK	TP4
AMP_LRCLK	TP5
AMP_DIN	TP3
ESP32_EN	TP13
IO0	TP6
UART0_TXD	TP17
UART0_RXD	TP18
DTR	TP19
RTS	TP16

Reference connections

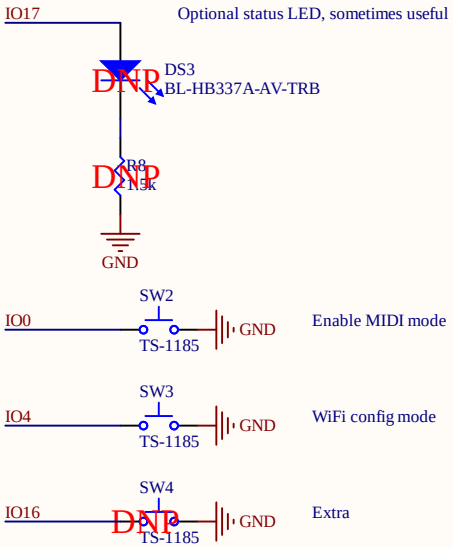
ESP32	MAX98357A	What
25	14	LRC
26	16	BCLK
27	1	DIN
5V	2	GAIN
5V	8	Vin
GND	11	GND
	9	Speaker +
	10	Speaker -
3.3V		3.3V
EN		programming RTS
TX		programming RX
RX		programming TX
0		programming DTR
3.3V		programming VCC
GND		programming GND
GND		GND

Q1 is for 'Node MCU' automatic programming over serial



Auto program

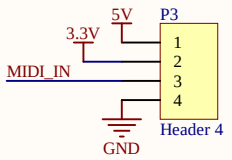
DTR	RTS	--> EN	IO0
1	1	1	1
0	0	1	1
1	0	0	1
0	1	1	0

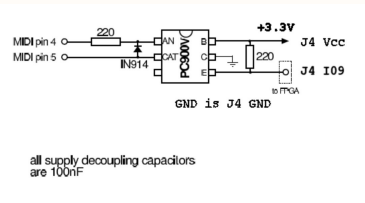


Optional status LED, sometimes useful for IDing a device

Note: use 2.5mm tall buttons

Support for optional MIDI input

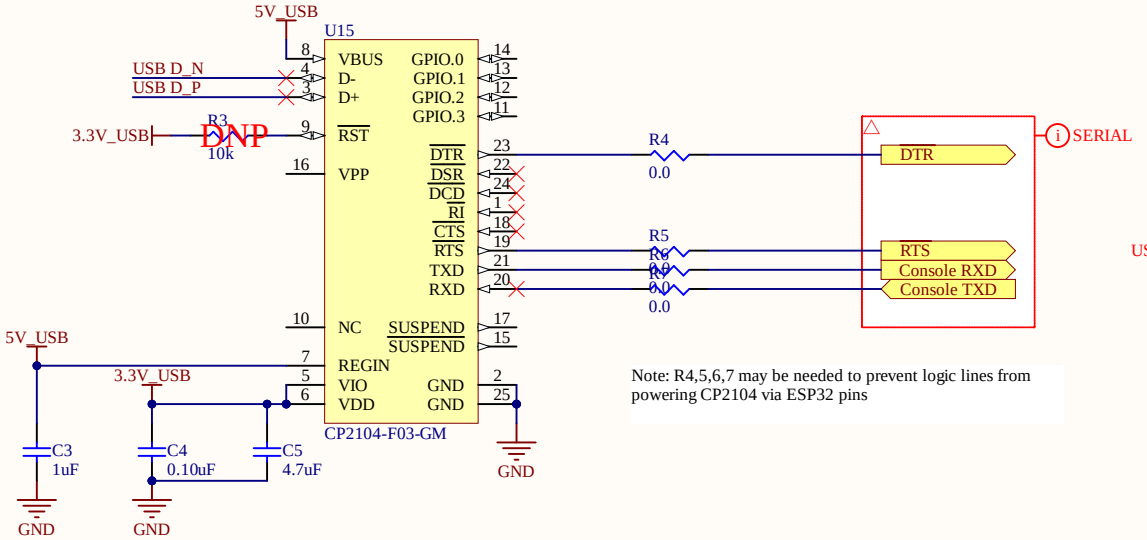




Title: ESP32			
Project: Alles		Revision: RevA	
Date: 11/23/2020	Time: 12:30:59 PM	Sheet 3 of 7	

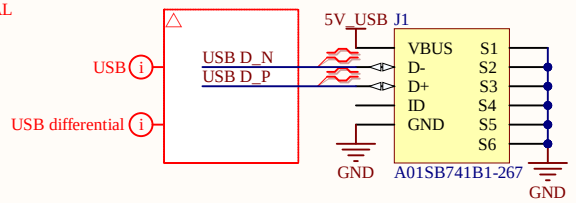
BLINKINLABS

USB-to-Serial converter



Note: CP2104 configured in 'bus powered' mode

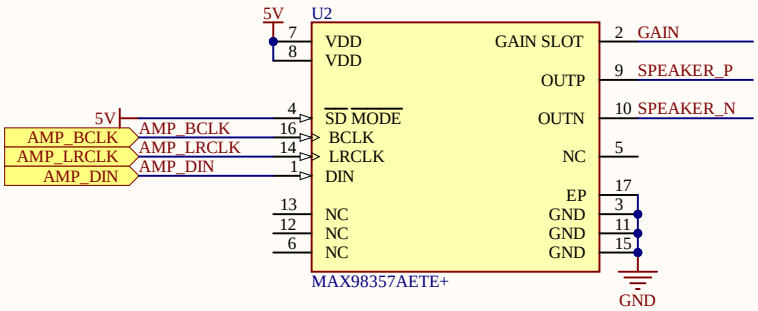
Note: R4,5,6,7 may be needed to prevent logic lines from powering CP2104 via ESP32 pins

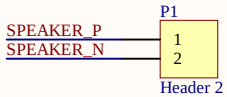


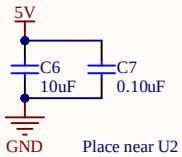
Title: USB-to-Serial converter		
Project: Alles	Revision: RevA	
Date: 11/23/2020 Time: 12:30:59 PM	Sheet 4 of 7	

BLIN KIN LABS

Amplifier







Place near U2

Expected power usage

Quiescent Current	I_{DD}	T_A = +25°C	2.75	3.35	mA
		T_A = +25°C, V_{DD} = 3.7V	2.4	2.85	
Shutdown Current	I_{SHDN}	SD_MODE = 0V, T_A = +25°C	0.6	2	µA
Standby Current	I_{STNDBY}	SD_MODE = 1.8V, no BCLK, T_A = +25°C	340	400	µA

Maximum power calculation:

Speaker is 4ohm
Gain is set to 6dB

According to the datasheet 'electrical characteristics' table, maximum power output with 12dB setting into 4ohm load is 3.2W. From the 'efficiency vs output power' section, the efficiency with a 4ohm speaker is roughly 80%, so the input power would need to be 4W. Finally, to derate the power output to a 6dB setting, the maximum output would be 1/4 of the 12dB setting, or 1W.

Using that number, the maximum input current to the device with a 5V power supply can be calculated as:

P=V*I so I = 1/5 = .2A

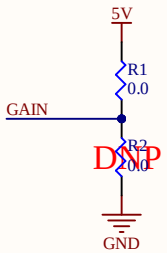


Table 8. Gain Selection

GAIN_SLOT	I²S/LJ GAIN (dB)
Connect to GND through 100kΩ ±5% resistor	15
Connect to GND	12
Unconnected	9
Connect to V_{DD}	6
Connect to V_{DD} through 100kΩ ±5% resistor	3

Note: GAIN tied high in project description, possible to change with resistor jumper

Title: DAC		
Project: Alles		Revision: RevA
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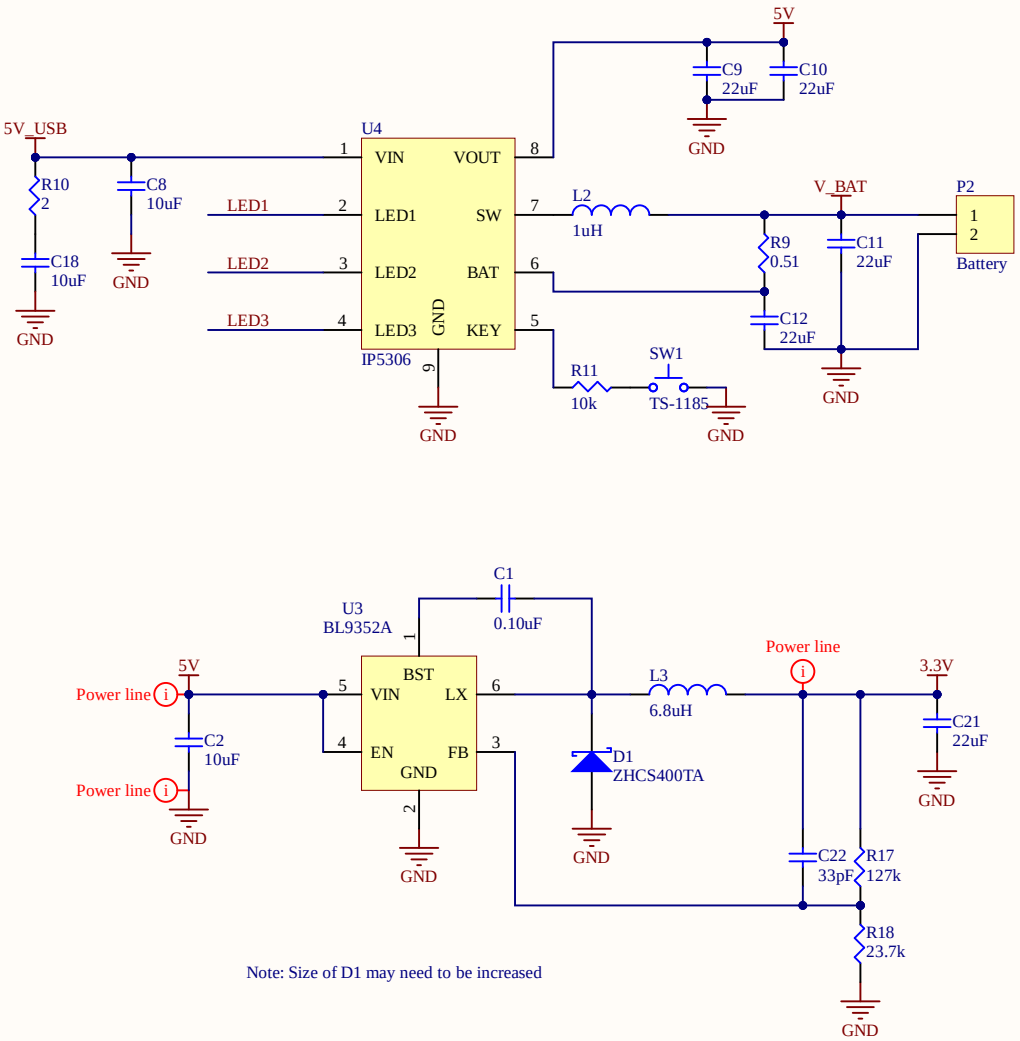
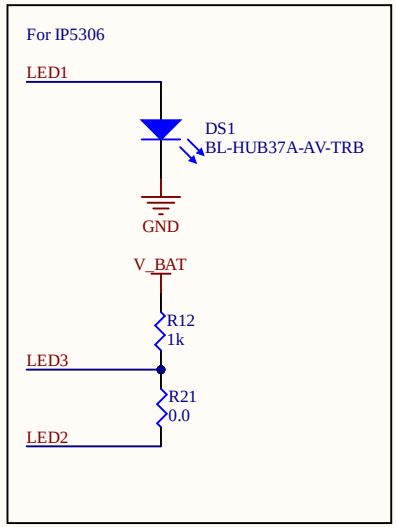
BLIN KIN LABS

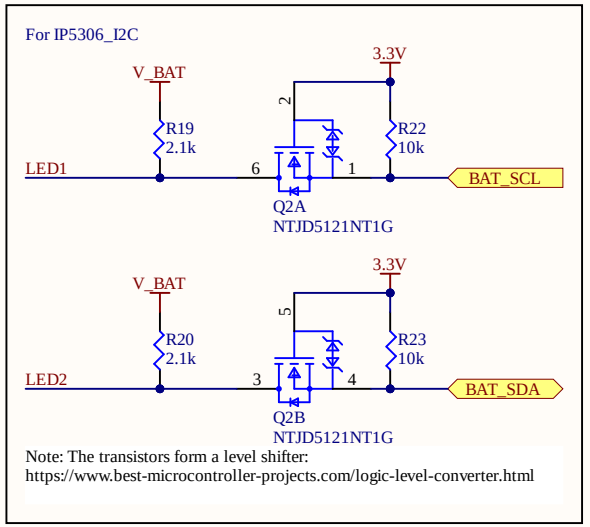
Power Supply



Note: There are two versions of IP5306. The standard version is fully standalone, but has a load detection mechanism for auto power-on / shut-off that is permanently enabled.
The IP5306_I2C variant exposes an I2C interface, which should allow the MCU to disable the auto shut-off feature.

Place only one of the following variants:





Note: The transistors form a level shifter:
https://www.best-microcontroller-projects.com/logic-level-converter.html

Power delivery requirements:

.2A @ 5V (amplifier)
.25A @ 3.3V (esp32, WiFi TX, periodic)
.1A @ 3.3V (esp32, WiFi RX)

Title: Power Supply		
Project: Alles		Revision: RevA
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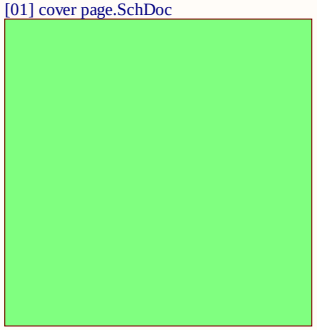
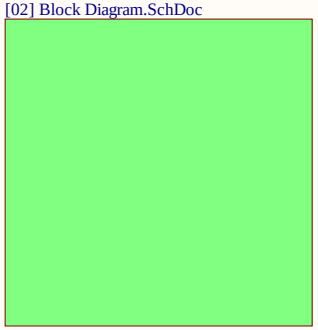
BLIN KIN LABS

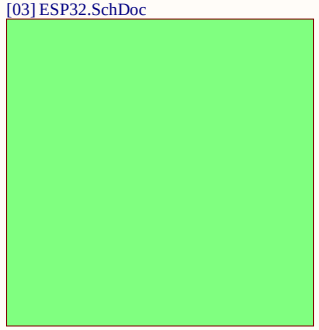
Designator
[01] cover page.SchDoc



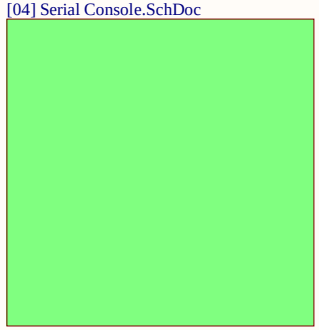
Designator
[02] Block Diagram.SchDoc



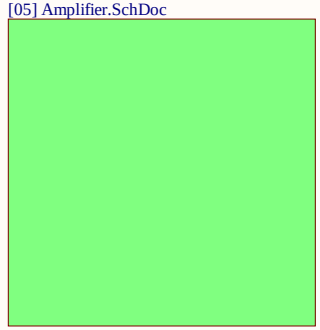
Designator
[03] ESP32.SchDoc



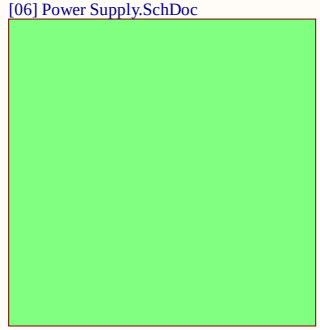
Designator
[04] Serial Console.SchDoc



Designator
[05] Amplifier.SchDoc



Designator
[06] Power Supply.SchDoc



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Title: *		BLIN KIN LABS
Project: Alles.PrjPcb	Revision: RevA	
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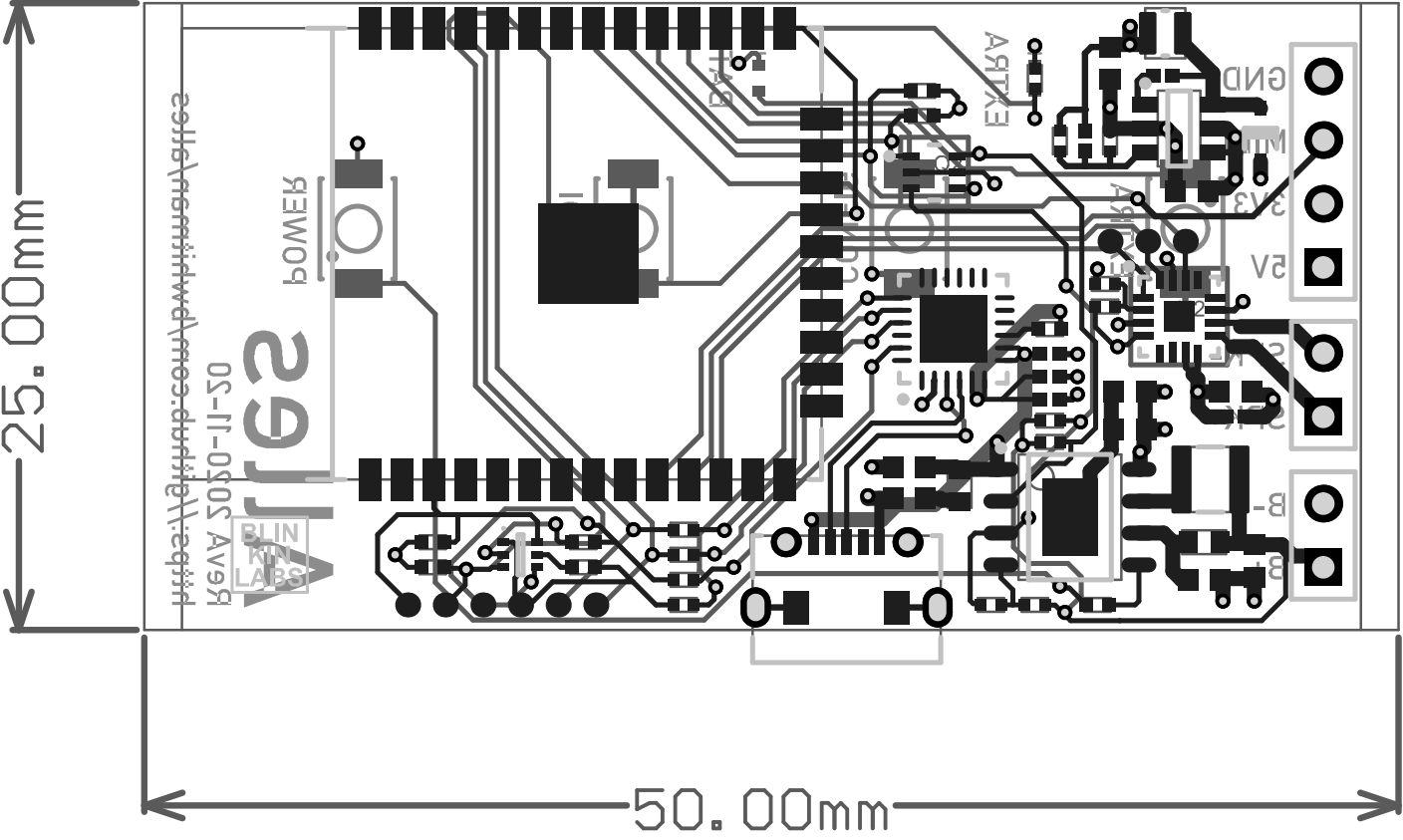

Layer	Name	Material	Thickness	Constant
	Top Overlay			
	Top Solder	SM-001	0.013mm	4
1	Top Layer	Copper	0.035mm	
	Dielectric 2	PP-022	0.200mm	4.6
2	Layer 1	Copper	0.018mm	
	Dielectric 3	Core-039	0.665mm	4.8
3	Layer 2	Copper	0.018mm	
	Dielectric 4	PP-022	0.200mm	4.6
4	Bottom Layer	Copper	0.035mm	
	Bottom Solder	SM-001	0.013mm	4
	Bottom Overlay			
Total board thickness:			1.195mm	

Design Rules Verification Report

Filename : C:\Users\blinkinlabs\Blinkinlabs-Repos\alles-pcb\pcb\Alles.PcbDoc

Warnings 0
Rule Violations 0

Warnings	
Total	0

Rule Violations	
Clearance Constraint (Gap=0.2mm) (All),(All)	0
Short-Circuit Constraint (Allowed=No) (All),(All)	0
Un-Routed Net Constraint ((All))	0
Modified Polygon (Allow modified: No), (Allow shelved: No)	0
Width Constraint (Min=0.2mm) (Max=0.6mm) (Preferred=0.254mm) (All)	0
Power Plane Connect Rule(Relief Connect)(Expansion=0.508mm) (Conductor Width=0.254mm)	0
Hole Size Constraint (Min=0.025mm) (Max=2.54mm) (All)	0
Hole To Hole Clearance (Gap=0.254mm) (All),(All)	0
Net Antennae (Tolerance=0mm) (All)	0
Component Clearance Constraint (Horizontal Gap = 0.254mm, Vertical Gap = 0.254mm)	0
Height Constraint (Min=0mm) (Max=25.4mm) (Prefered=12.7mm) (All)	0
Total	0

Electrical Rules Check Report

Class	Document	Message
		Successful Compile for Alles.PrjPcb

L3
C21
R8
C1
R23
R22
R17
C22
R18
U3
D1
P3
Q2
C2
U1
TP3
TP4
TP5
R2
R1
U2
U15
R3
C3
C5
C4
R20
R19
C10
C6
C7
C9
P1
C8
C18
R10
L2
U4
P2
R9
C11
C12
L1
R15
R13
Q1
R16
R14
R7
R6
R4
R5
J1
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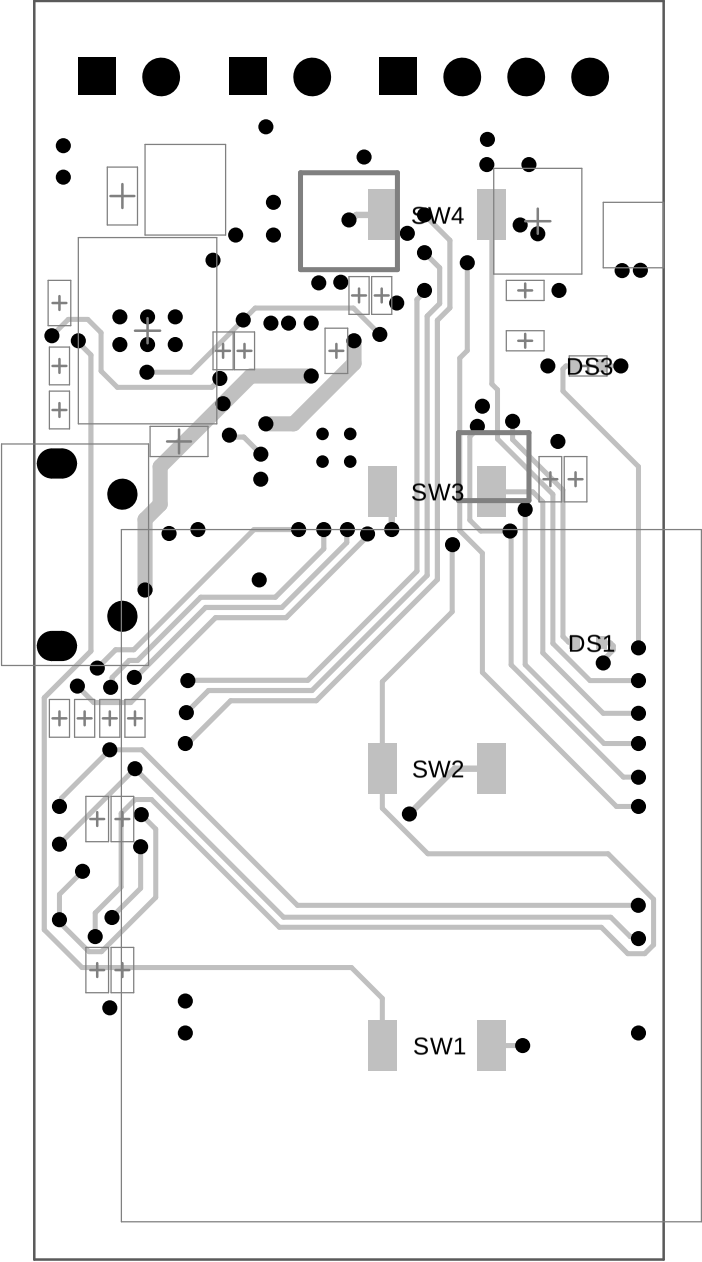
R12
R11
TP13
TP6
TP19
TP16
TP17
TP18


SW4
DS3
SW3
DS1
SW2
SW1