EightByEight Blinky Badge

Revision Notes/Changelog

Revision A:
-Diode mod required to power over USB

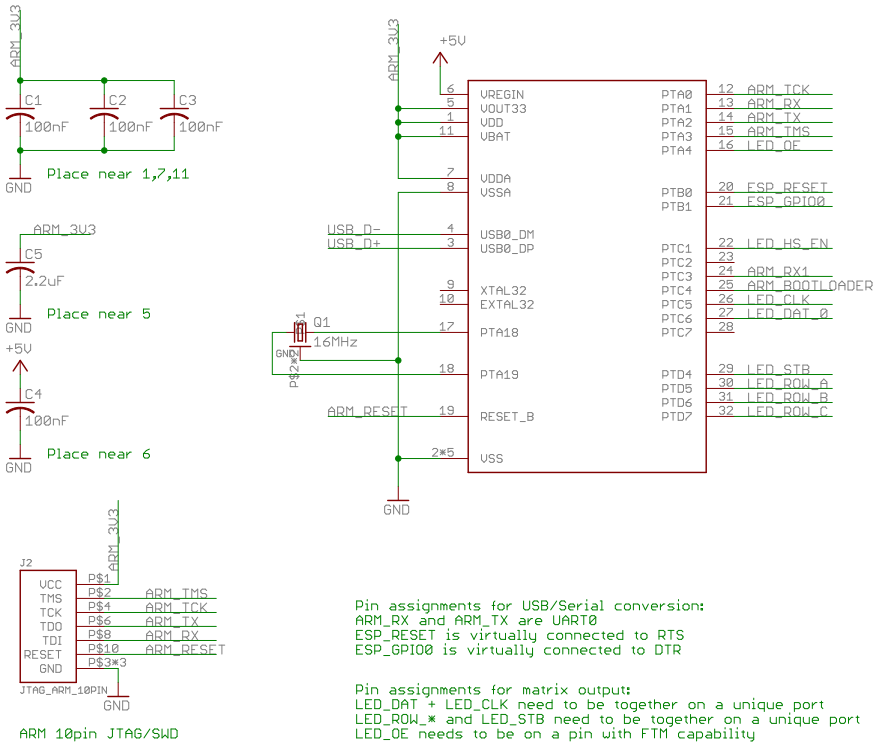
Revision B:
-Add diodes to enable power from USB
-Connect ESP reset and boot select pins to ARM for auto-programming
-Connect ESP TX1 pin to ARM for LED control
-Move I2C_SDA to ESP pin 12
-Connect accelerometer interrupt pin to ESP pin 13
-Remove ground planes under ESP8266 antenna area
-Add jumper pad for entering boot mode on ARM processor
-Hook LED_OE or similar to the row driver MUX
-Bring unused ESP pins to pads
-Add TS silkscreen

Revision C:
-Switch to ICN2012 high side driver
-Switch to QMA6981 accelerometer

TODO:
-Implement more user friendly expansion pads for the ESP
-Cosmetic: ESP8266 GPIO 18mislabeled, should be 16
-With LED_HS_EN, should LED_OE still be connected to the mux?
-Characterize the power situation
-Test a flush-mount USB connector

ARM microcontroller

Provides LED drive signal, USB/Serial conversion



ARM 10pin JTAG/SWD

Pin assignments for USB/Serial conversion:
ARM_RX and ARM_TX are UART0
ESP_RESET is virtually connected to RTS
ESP_GPIO0 is virtually connected to DTR

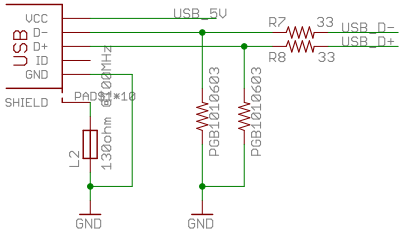
Pin assignments for matrix output:
LED_DAT + LED_CLK need to be together on a unique port
LED_ROW_* and LED_STB need to be together on a unique port
LED_OE needs to be on a pin with FTM capability

ARM boot select

If shorted during boot, the ARM will go directly into DFU mode. Useful if the application firmware becomes unstable. Note that this is a software feature- it is implemented by the bootloader firmware.

USB port

Battery charge, ARM programming using DFU, ESP programming using ACM



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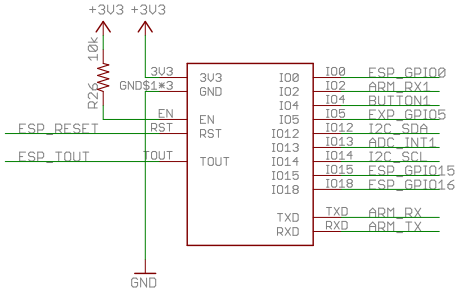
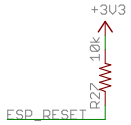
ESP8266

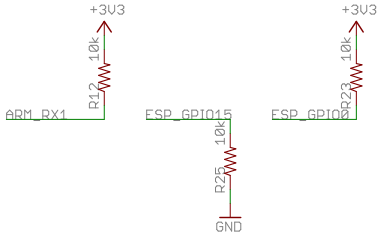
Provides WiFi





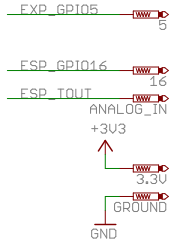
ESP826 Boot Select
UART Download:
GPIO15 Low, GPIO0 Low, GPIO2 High

Flash Boot:
GPIO15 Low, GPIO0 Hight, GPIO2 High



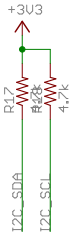
Extra IO

Unused pins from the ESP8266



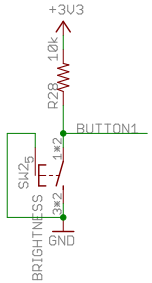
I2C pullups

Note: Check that these values are correct for 3.3V



Button input

Momentary, active low
Connected to ESP and ARM



3 axis accelerometer

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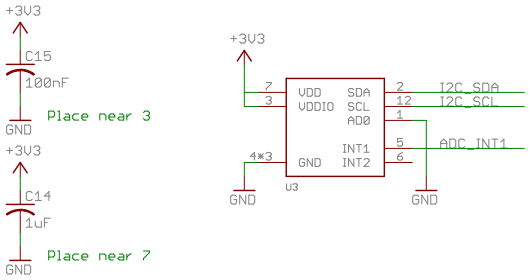

TODO: Update C14 in BOM

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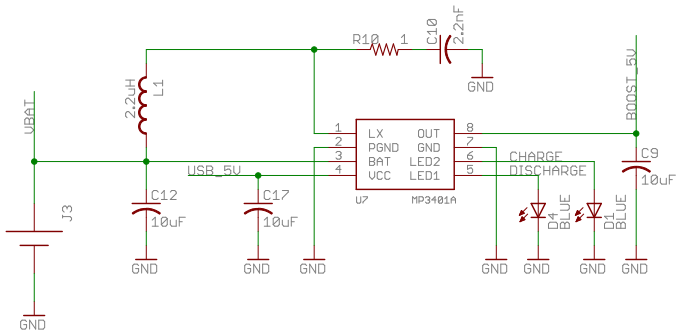
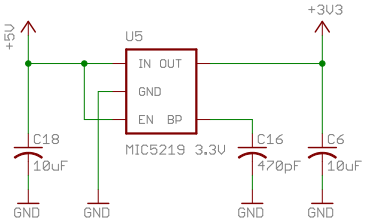
Battery Charger / 5v boost

Integrated charge circuit and 5v boost regulator.



3.3V Regulator

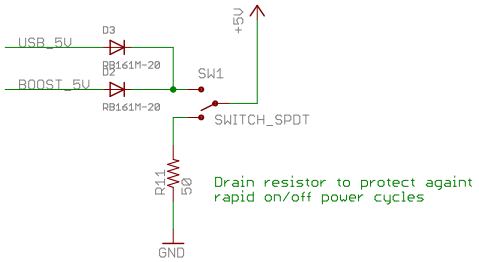
Powers the ESP8266 and other ICs



Note: LED constant current drivers are powered by a regulator built into the ARM part.

Power switch

Powers device from USB or battery



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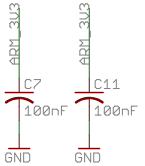
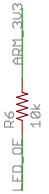
Low side (column) drivers

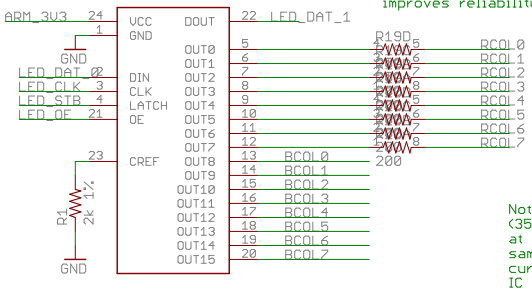
Constant current shift registers, PWM signal is generated by the processor



Place near U2, U4 pin 24

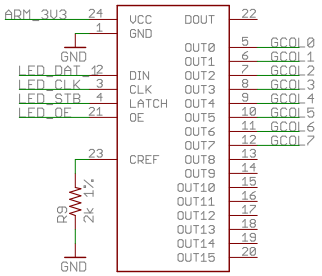


Voltage drop resistors:
Because the forward voltage of red LEDs is much lower than 5v, the initial surge of power when the current controller is enabled can cause damage to them. Adding a series resistor here improves reliability in both the current controller and the LEDs.



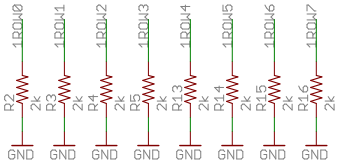
Note: Based on the datasheet for the LED we are using (3528RGB1C-CA), R and B have similar luminous intensity at the same forward current so they can be driven from the same driver. Ideally each color would have an independent current setpoint, however that would require an extra drive IC

Note: Tune CREF resistors for each color



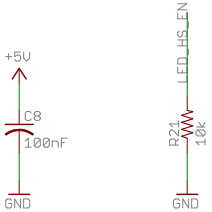
Ghostbusting resistors

Reduces ghosting by draining row capacitance

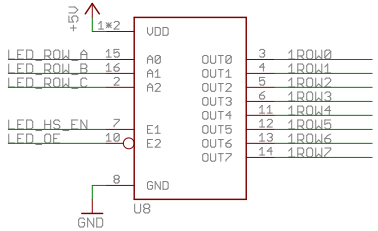


High side (column) driver

3 to 8 de-multiplexer with integrated P-MOSFETs



Place near pin 1, 9



Note: LED_HS_EN prevents the first row of LEDs from flashing briefly during poweron.

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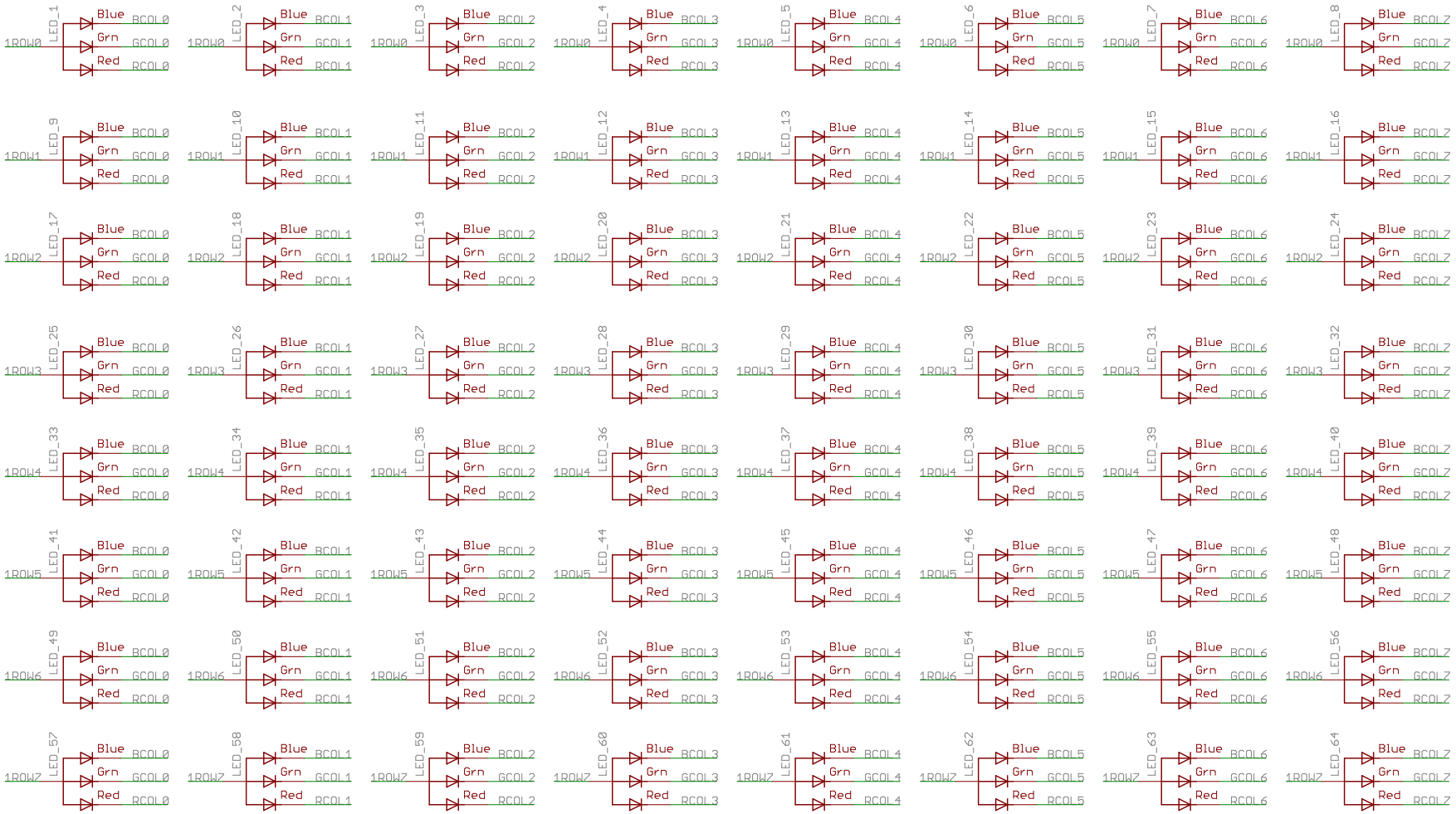
LED array

RGB, 3528, common anode LEDs. Arranged as an 24x8 matrix



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