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RayVio

RayVio LED Driver

July 17, 2017

Safety Guidelines

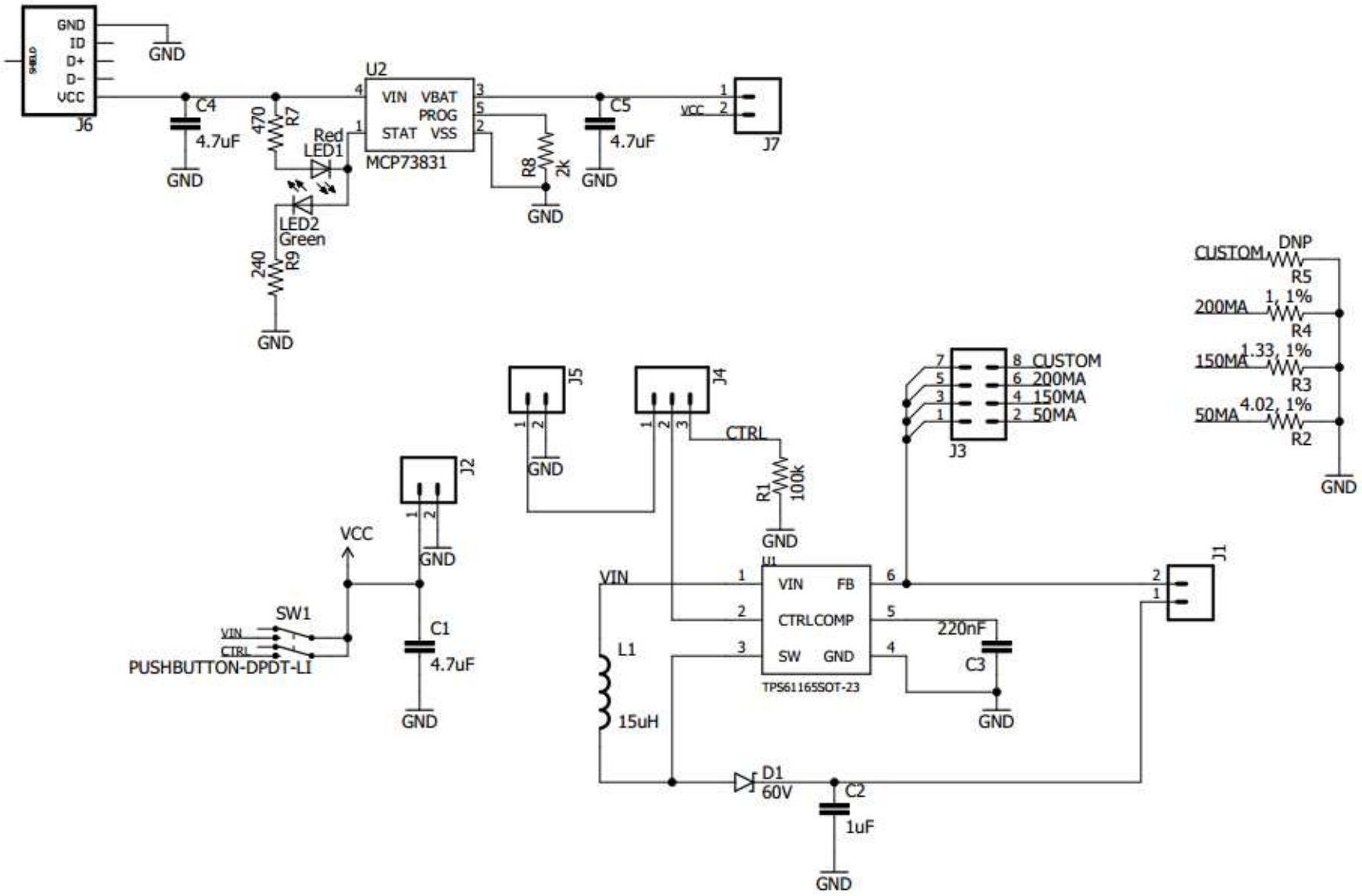
Eye and Skin Safety Guidelines

1. Use appropriate eye and skin protection when operating UV-C LEDs.
2. Do not directly look at the LED when it is powered on.
3. To avoid the risk of eye damage use caution when examining UV-C LEDs with optical instruments.

RayVio LED Driver - Description

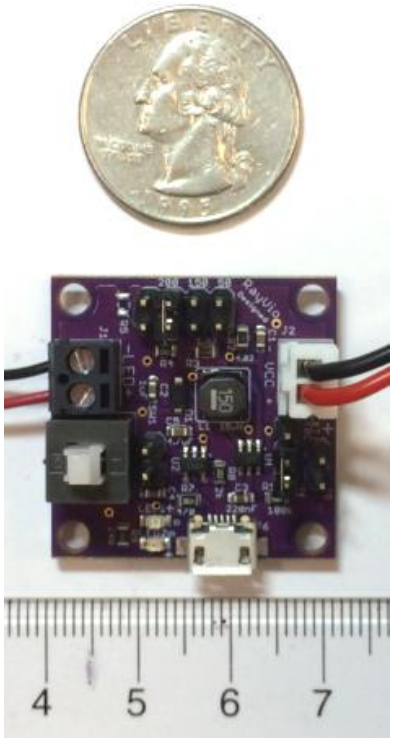
- Power supply – Driver IC TPS61165
  - Battery
    - The driver IC boosts input voltage up to LED operating voltage
      - Example: Li-Po battery – 3.7V, 300 mAh
  - Micro USB
    - Used to charge the battery from phone charger, computer and etc.
    - The driver can also operate without battery when USB is connected
  - External power supply
    - Battery connector can be used to connect an external power supply
      - Example, 30W Universal AC/DC Adapter with 3V to 12V Selectable Output
    - **Make sure Vin is equal to or less than Vout**
      - Vin: min. 3V – max. 18 V
      - Vout: min. Vin – max. 38 V
- Output current is user controllable
  - Presets: 50 mA, 150 mA or 200 mA
  - Plus a user configurable option by selecting appropriate resistor value
    - Output Current = 200 mV/resistor value
      - i.e. use a 2.49 ohm resistor for R5 to obtain 80 mA output current.
- LED On/Off control
  - Presets: on-board On/Off push button or
  - A user supplied external control signal

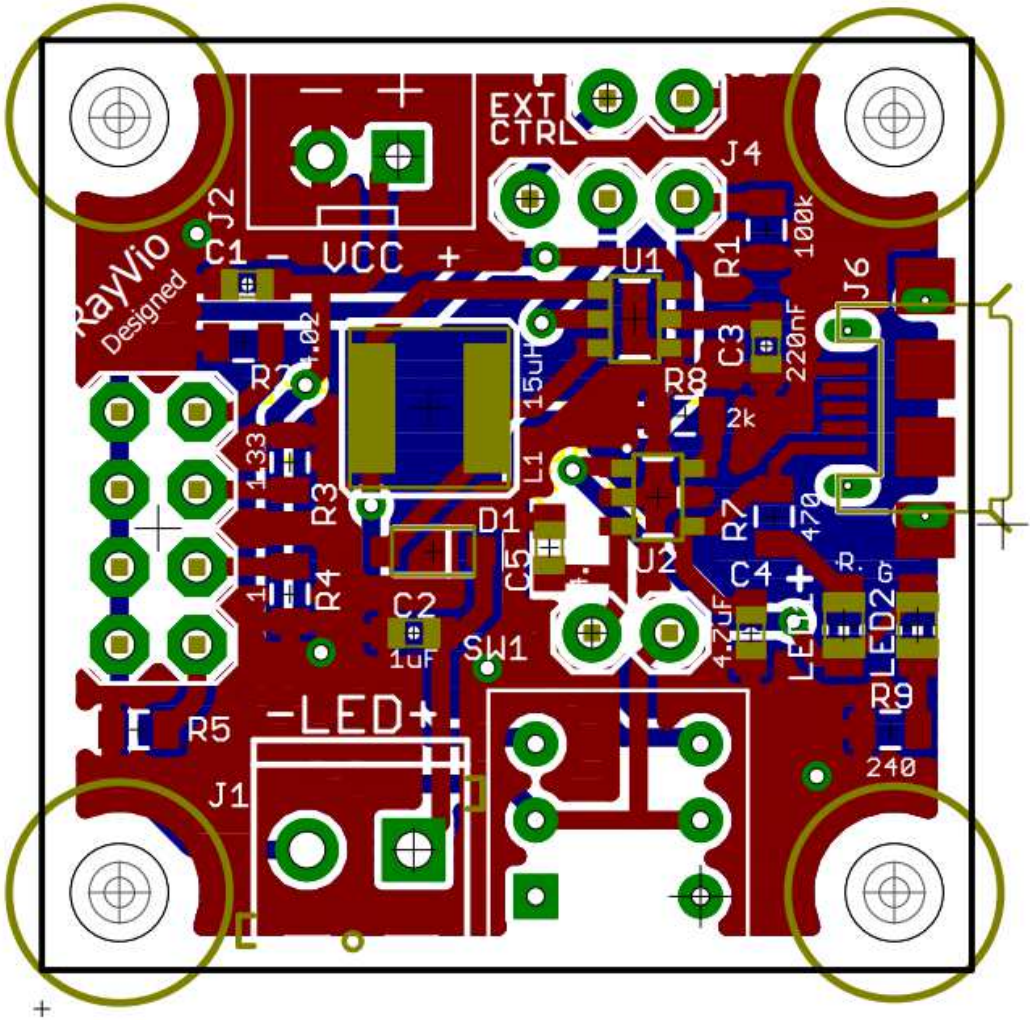
LED Driver Schematic



LED Driver Layout

- 30 mm x 30 mm board size
- Two-layer PCB board
- Four 3 mm diameter mounting holes on the corners





LED Driver BOM

RayVio Corp.

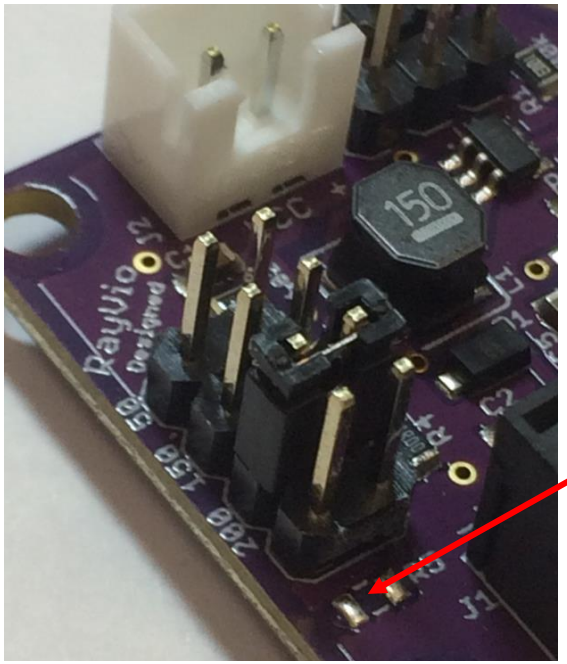
Project RayVio LED Driver revD
Date 5/2/2017

Part	Value	Device	Package	Digikey Part #	Description
C1	4.7uF	CAP0603	0603	445-9042-1-ND	CAP CER 4.7UF 35V X5R 0603
C2	1uF	CAP0603	0603	445-11263-1-ND	CAP CER 1UF 50V JB 0603
C3	220nF	CAP0603	0603	445-7408-1-ND	CAP CER 0.22UF 50V X7R 0603
C4	4.7uF	CAP0603	0603	445-9042-1-ND	CAP CER 4.7UF 35V X5R 0603
C5	4.7uF	CAP0603	0603	445-9042-1-ND	CAP CER 4.7UF 35V X5R 0603
D1	60V	Diode Schottky	SMA	RB060M-60TR-ND	Diode Schottky 60V 2A Surface Mount PMDU
J1		ED2740-ND	BULK	ED2740-ND	2 Position Wire to Board Terminal Block Horizontal with Board 0.138" (3.50mm) Through Hole
J2		455-2247-ND	BULK	455-2247-ND	2 Positions Header, Shrouded Connector 0.098" (2.50mm) Through Hole Tin
J3		M04X2	2X4	952-2123-ND	8 Positions Header, Unshrouded, Breakaway Connector 0.100" (2.54mm) Through Hole Tin
J4		M03PTH	1X03	952-2264-ND	3 Positions Header, Unshrouded, Breakaway Connector 0.100" (2.54mm) Through Hole Tin
J5		M02PTH	1X02	952-2262-ND	2 Positions Header, Unshrouded, Breakaway Connector 0.100" (2.54mm) Through Hole Tin
J6		USB_MICROB_PLUGRA-LI	USB-MICROB-RA	609-4618-2-ND	CONN USB MICRO B RECPT SMT R/A
J7		M02PTH	1X02	952-2262-ND	2 Positions Header, Unshrouded, Breakaway Connector 0.100" (2.54mm) Through Hole Tin
L1	15uH	INDUCTORCR54	CR54	587-2366-2-ND	15µH Shielded Wirewound Inductor 1.8A 104 mOhm Max Nonstandard
LED1	Red	LEDCHIP-LED0805	0805	HT17-2102SURC	Red 638nm LED Indication - Discrete 1.8V 0805 (2012 Metric)
LED2	Green	LEDCHIP-LED0805	0805	HQ17-2102SYGC	Green 569nm LED Indication - Discrete 2.1V 0805 (2012 Metric)
R1	100k	RESISTOR0805-RES	0805	311-100KCRTR-ND	RES SMD 100K OHM 1% 1/8W 0805
R2	4.02, 1%	RESISTOR0805-RES	0805	541-4.02CCCT-ND	RES SMD 4.02 OHM 1% 1/8W 0805
R3	1.33, 1%	RESISTOR0805-RES	0805	541-1.33CCCT-ND	RES SMD 1.33 OHM 1% 1/8W 0805
R4	1.0, 1%	RESISTOR0805-RES	0805	541-1.00CCTR-ND	RES SMD 1 OHM 1% 1/8W 0805
R5	DNP	RESISTOR0805-RES	0805		Custom Define
R7	470	RESISTOR0805-RES	0805	311-470ARTR-ND	RES SMD 470 OHM 5% 1/8W 0805
R8	2k	RESISTOR0805-RES	0805	311-2.00KCRTR-ND	RES SMD 2K OHM 5% 1/10W 0603
R9	240	RESISTOR0805-RES	0805	311-240ARTR-ND	RES SMD 240 OHM 5% 1/8W 0805
SW1	PUSHBUTTON-D	PUSHBUTTON-DPST	BULK	CW179-ND	Pushbutton Switch DPDT Standard Through Hole
U1	TPS61165SOT-	TPS61165DBVR	SOT23-6	296-27597-2-ND	LED Driver IC 1 Output DC DC Regulator Step-Up (Boost) PWM Dimming 1.2A (Switch) SOT-23-6
U2	MCP73831	MCP73831T-2ACI/OT	SOT23-5	MCP73831T-2ACI/OTCT-ND	Charger IC Lithium-Ion/Polymer SOT-23-5

Assembled LED Driver

- PCB operation with RayVio LEDs is discussed in slide 9-13

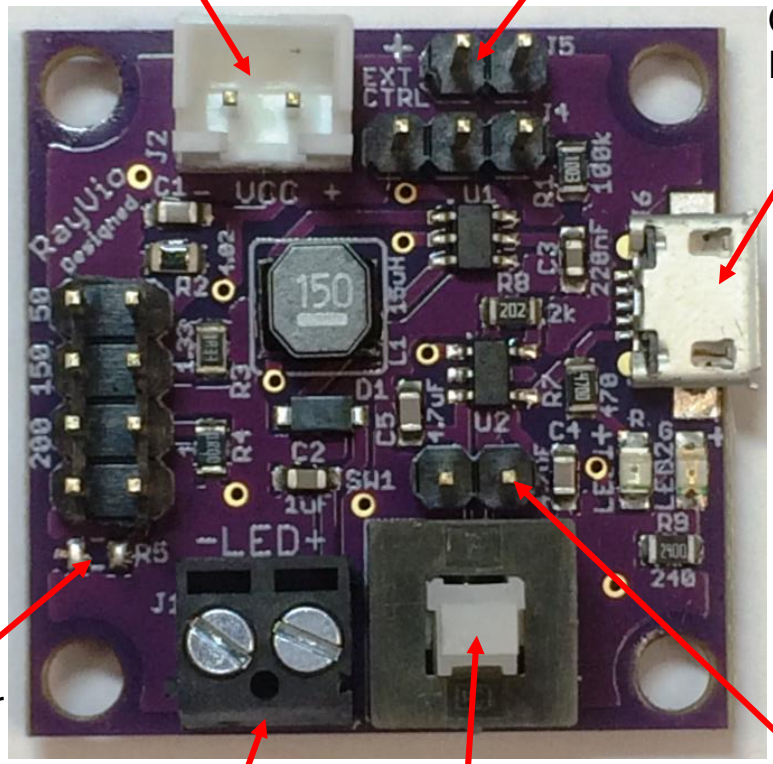
Use a jumper cap to select current



Connector to battery or external power supply

Headers for external On/Off control

USB Charging Port



50 mA
150 mA
200 mA
Custom

R5, reserved for custom current

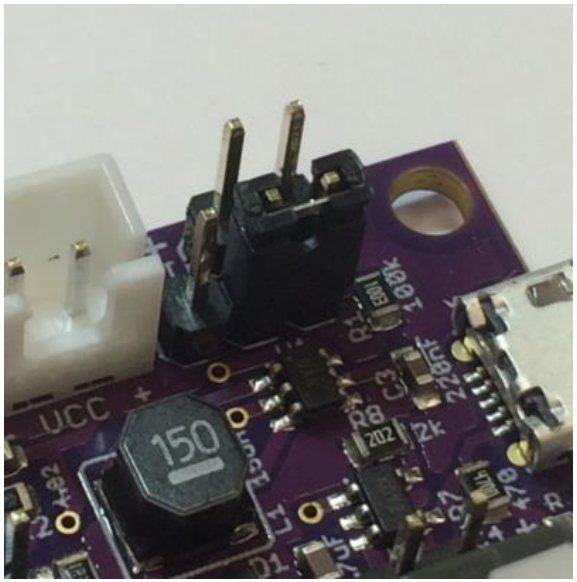
UV-C LED Connector

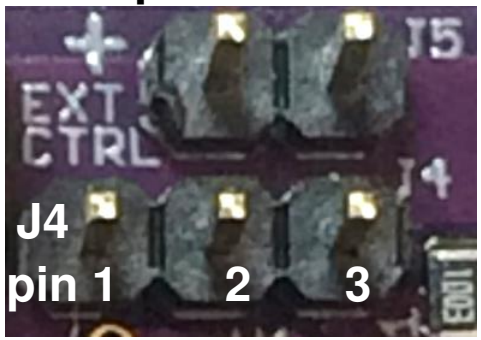
On/Off Button

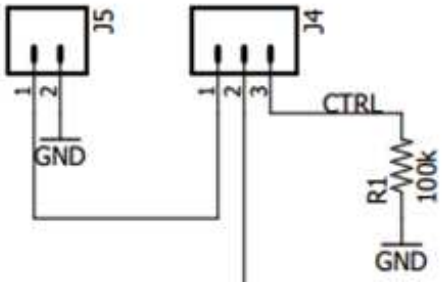
Short pins with jumper cap for battery operation

How to Use Push Button and External On/Off Control

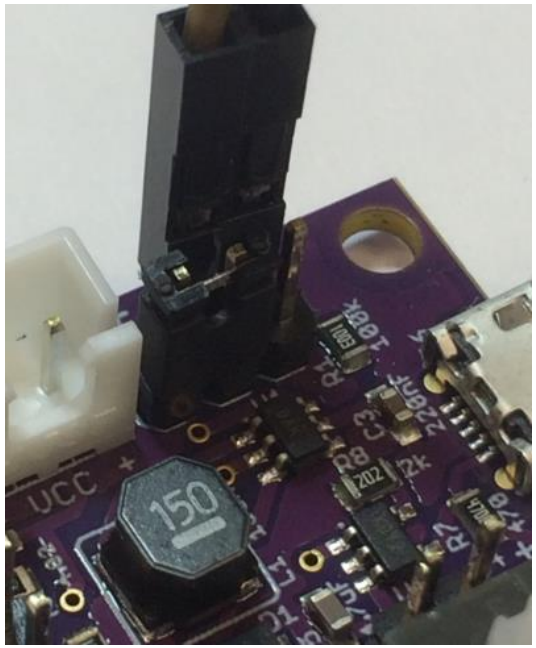
- Use push button for on/off control (default config.)
  - Use jumper cap to short pin 2 and pin 3 on header labelled “J4”.







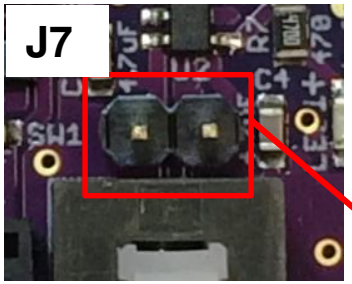
- Use external on/off control (e.g. control signal from Arduino)
  - Push down the built-on-board on/off button.
  - Use jumper cap to short pin 1 and pin 2 on header labelled “J4”;
  - Connect “J5” to control signal
    - Pin 1 for “+”
    - Pin 2 for “-” or “GND”

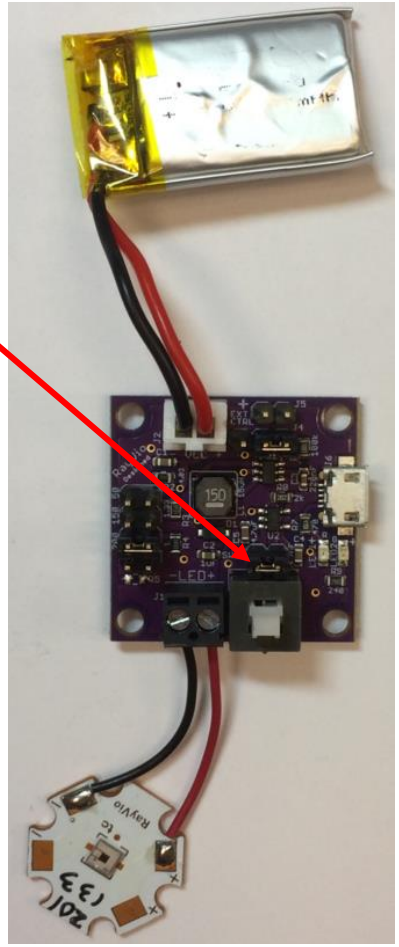


User Instruction
for Driving Single XE or XP1 LED

Single XE or XP1 LED

- **Note: pin 1 and pin 2 of J7 must be shorted (e.g. with a jumper cap) for battery operation and must be disconnected when using an external power supply in order to protect the charging IC.**

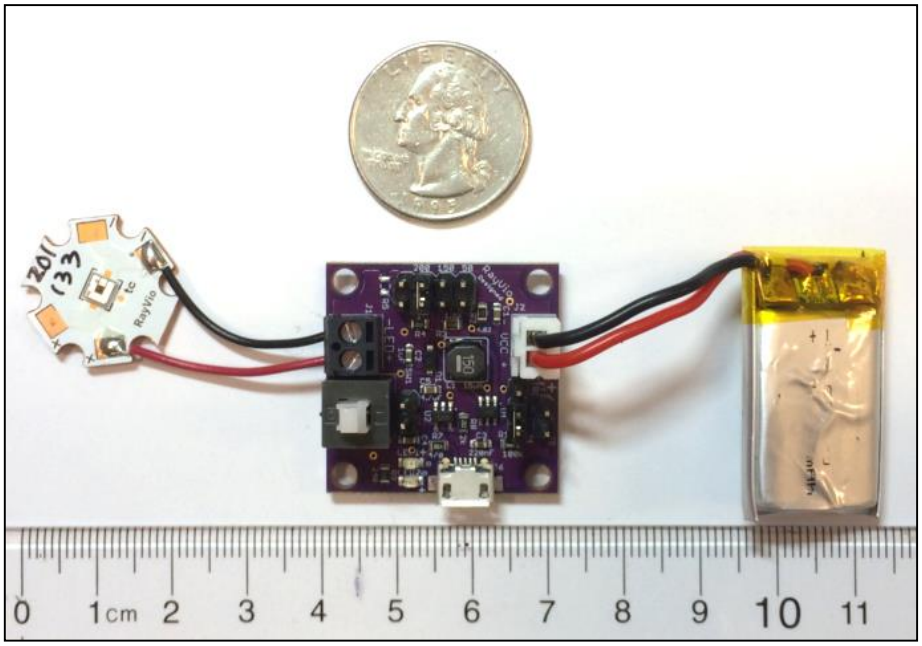


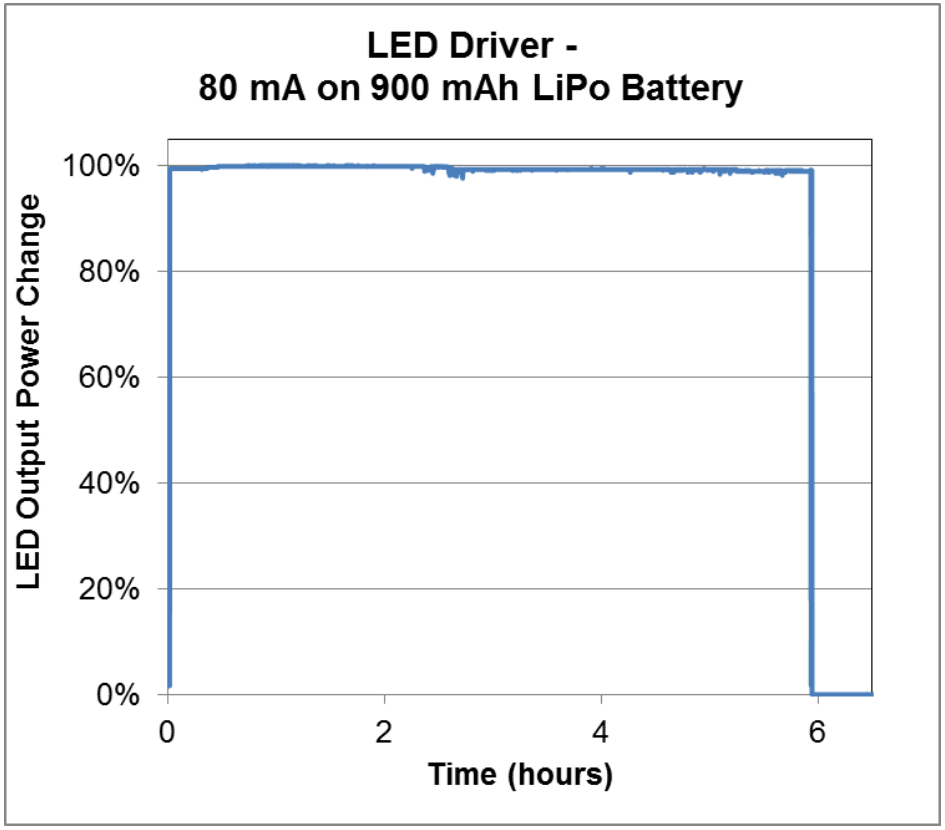


- Power Supply
  - Option 1 – Battery
    - For example, Li-Po battery – 3.7V, 300 mAh
    - The driver IC boosts 3.7 V input voltage up to LED operating voltage.
    - Use standard micro USB cable to charge the battery from computer or phone charger.
    - During charging, red indicator light is on. Green will be on once battery is fully charged.
    - **Note: driver board can only charge a single cell Li-Po battery (3.7 V)**. Dual cell Li-Po batteries cannot be charged thus should not be used.
  - Option 2 – Micro USB
    - With no battery, the driver can also operate when the USB is connected.
    - Use proper USB power adapter. For example, common USB charging adapters are rated 5 V, 2 A output.
  - Option 3 – External Power Supply
    - Connect external power supply to power input port, J2.
      - For example, 30W Universal AC/DC Adapter with 3V to 12V Selectable Output.
    - Limit max. supply voltage to **5 V** for single XE or XP1 operation.

Battery Life Example

- An XE LED driven at 80 mA.
  - Using a fully charged 900 mAh battery.
- Data shows the relative LED output over time.
  - **6 hours** of continuous use.





User Instruction
for Driving a Single XP4 LED
(Must Use an External Power Supply)

Single XP4 LED (Use External Power Supply)

- **Note: pin 1 and pin 2 of J7 must be disconnected for external power supply in order to protect the charging IC.**
- Connect external power supply to power input port, J2.
  - For example, 30W Universal AC/DC Adapter with 3V to 12V Selectable Output.
- Data in the table below is based on driving a single RayVio XP4 LED with an external power supply at room temperature.
  - Actual measurements may vary as result of component variation (i.e. values of precision resistors)

Supply Voltage (V)	Preset LED Current (mA)	Measured LED Current (mA)
9	50	50.3
	150	143.7
	200	192.7
10	50	50.1
	150	138.8
	200	192.1
11	50	50.2
	150	135.2
	200	185.6
12	50	50.2
	150	133.8
	200	180.9


RayVio
UV for Life