VERSO

Entry-Level saber sound board
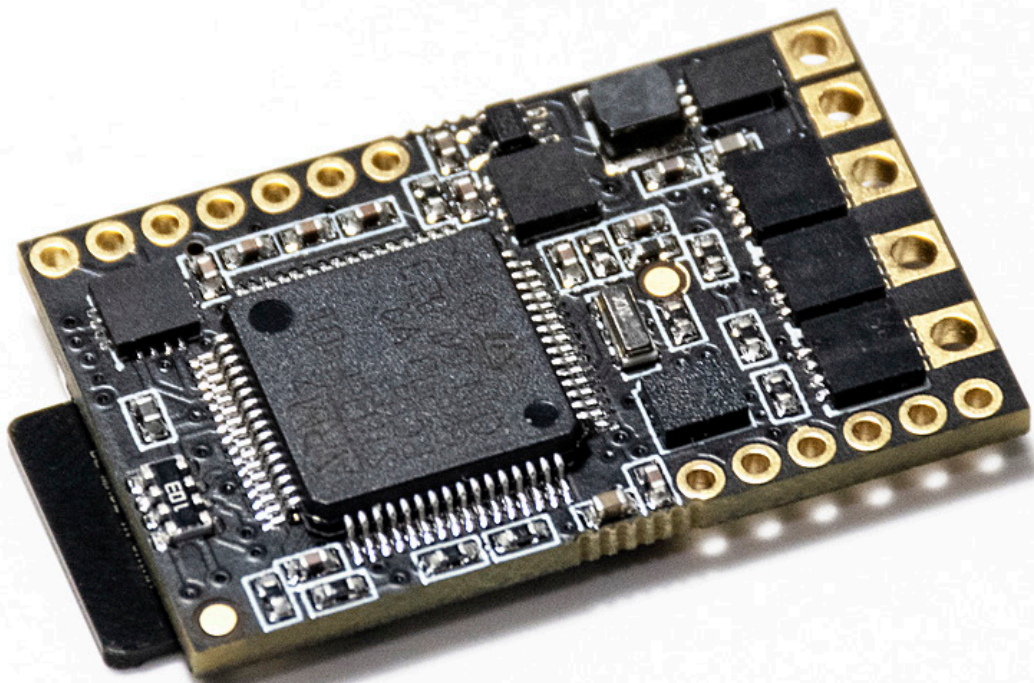
User Manual

by KR-sabers

2020

Contents

updated:
30.03.2020

FEATURES

Specifications and features:

– Dimensions: 18.9x29.9x4.5mm (+2.4mm longer with micro SD card)

– Power supply: 3-5 Volts, up to 10A per LED channel output; single Li-Ion 3.6-3.7V (low 2.6V, full 4.2V) battery recommended

– 0.55 mA current consumption in Deep Sleep

– 3 high power LED channels

– Speaker: 4 ohm or 8 ohm, 2W-5W

– 1 sound bank/font

– unlimited color profiles

– Sound FX (WAV sound files): boot, hum, swing, clash, ingnition, retraction

– Light FX: ramp up, ramp down, fade, blade flickering, flash on clash

– Micro SD card: 4-16Gb Class 4-10 by SanDisk brand recommended

– 3 Watts 5V powered sound amplifier, 16-bit digital output

– 44kHz or 22kHz WAV audio files sample rate

– "SmoothSwing", monophonic, polyphonic sound fonts support

– APA102 (RGB), WS2812B (RGB), SK6812 (RGB, WWA) Neopixel/Pixelblade support

– 1/2/3-color LED stars (Tri-Cree LED modules) support

– Easy and free firmware updates by user via micro-SD card

Demonstration videos:

[Link to the demonstration video by KR-sabers](#)
[Link to the demonstration video by ShtokCustomWorx](#)

How to operate the saber with 1 button:

– Single press to wake up

– Press again to ignite the blade

– Double click whilst blade is ignited (ON) to cycle through colours

– Hold button down to retract blade

– Hold whist blade is OFF to enter mute mode

– Hold whilst OFF again to exit mute mode

Mute mode:

To enter mute mode hold the activation button down whilst the blade is off for 3 seconds. You will hear a sound (*mute.wav*) to indicate the saber is now in mute mode. Pressing the activation button again will ignite the saber as normal but without any sound. Whilst in mute mode, with the blade off, hold the main activation button for 3 seconds to exit mute mode. You will hear a sound (*unmute.wav*) to indicate the saber has exited mute mode.

user manual made by KR-sabers and Dmitry Shtok

1

WHERE TO BUY

Parts links:

VERSO sound boards vendors

– KR-sabers (TheSaberArmory)

Neopixel strips

– Individual Neopixel LEDs
– Neopixel strips/connectors/other supplies (UK) – TheSaberArmory
– Neopixel strips/connectors/other supplies (USA) – TheCustomSaberShop

LEDs and wires

– Tri-Cree high power LEDs (USA) – TheCustomSaberShop
– Tri-Cree high power LEDs (USA) – SaberBay on Etsy
– Tri-Cree high power LEDs (UK) – TheSaberArmory
– Various Accent LEDs (UK) – TheSaberArmory
– PTFE Wires (UK) – TheSaberArmory

Batteries

– Various Batteries (UK) – TheSaberArmory
– Protected KeepPower 18650 15A 3120mAh battery (USA) – SaberBay on Etsy
– Protected KeepPower 18650 7A 3600mAh battery
– Protected KeepPower 18650 10A 3500mAh battery
– Protected KeepPower 18650 15A 3120mAh battery
– Unprotected Vapcell 21700 15A 5000mAh battery **– requires external PCM**
– Unprotected KeepPower 26650 15A 6000mAh battery **– requires external PCM**
– 15A Protection Circuit Module (PCM) (aliexpress)
– 18650 Protected Battery holder
– 18650 Protected Battery holder (USA) – SaberBay on Etsy

Recharge ports and Kill Switches

– High Power 1.3mm Recharge Port
– Recharge Ports (UK) – TheSaberArmory
– 2.1mm Recharge port (USA) – SaberBay on Etsy
– High Power Kill Switch (USA) – SaberBay on Etsy
– High Power Kill Switch
– Various Switches (UK) – TheSaberArmory

Blade connectors

– SCW NPXL blade connector (Russia) – ShtokCustomWorx
– SCW NPXL blade connector (USA) – SaberBay on Etsy
– SCW NPXL blade connector (UK) – TheSaberArmory
– TCSS Neopixel blade Pogo connector
– GX16 Neopixel/string blade connectors

Speakers

– Various speakers (UK) – TheSaberArmory
– Various speakers (USA) – TheCustomSaberShop
– 3W speakers

3D-printed chassis links:

– KR-sabers (TheSaberArmory) store
– ShtokCustomWorx on Shapeways
– GOTH-3Designs on Shapeways

1

HELPFUL LINKS

Tutorials and instructions

Video tutorials by KR-sabers:

[Video tutorials by KR-sabers on YouTube](#)
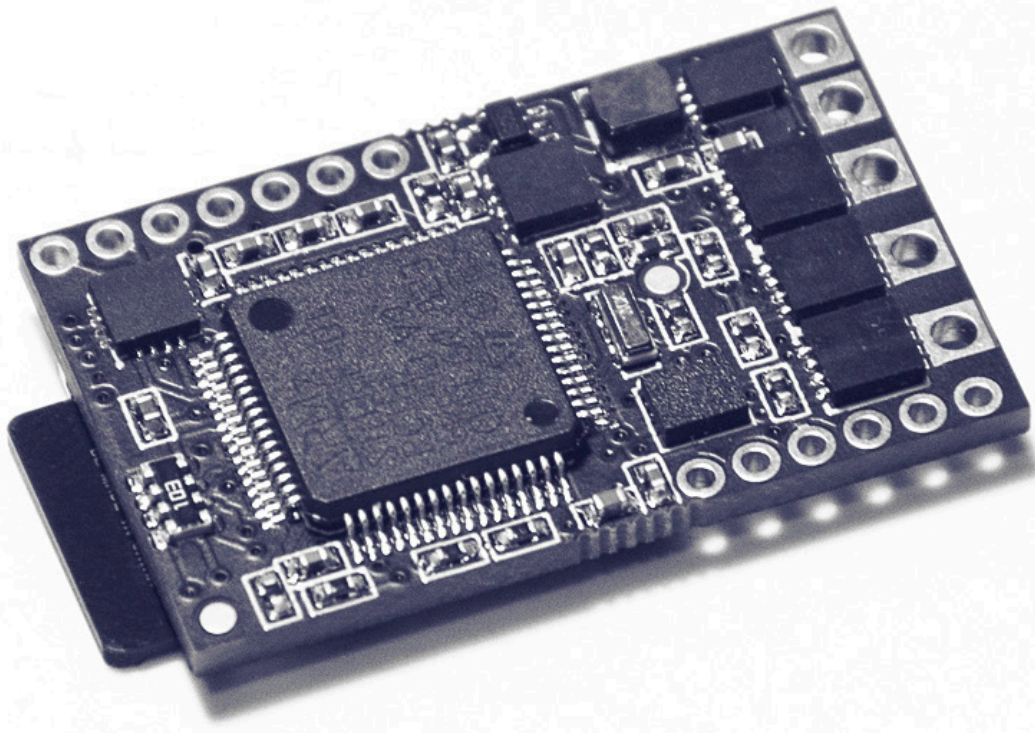
[LED Resistor Calculator](#)

Firmware update:

[>>>Get latest VERSO firmware here<<<](#)

user manual made by KR-sabers and Dmitry Shtok

VERSO
INSTRUCTIONS

1   ## GENERAL INFO

Tools and materials

– VERSO sound board

– micro SD-card

– a USB micro SD-card reader (to load sound files from PC to micro SD card)

– wires of various gauges (32-20 AWG) (PTFE coated copper stranded wires recommended), heat shrink

– ESD safe soldering station, solder wire, flux etc..

– pliers, helping hands etc..

– isopropyl alcohol to clean pads after soldering to make sure no shorts will occur and make the board clean

– Digital Multimeter (VERY USEFUL!)

– computer running Windows, Linux or Mac OS with internet access

– 3.7V Li-Ion Protected rechargeable battery, switches, recharge port, speaker, LEDs, resistors, chassis etc..

– Smart Li-Ion CC-CV (Constant Current - Constant Voltage mode) battery charger for 3.7V (4.2V) cells

GENERAL INFO

Board pinout

Battery -
Battery +
LED 3 LED 2 LED 1

Reset
Prog. boot
AUX +3.3V pad
GND
Serial TX
Serial RX

Activation button
Button led -
LS Clock
LS Data
+3.3V pad
Speaker -
Speaker +

micro SD card
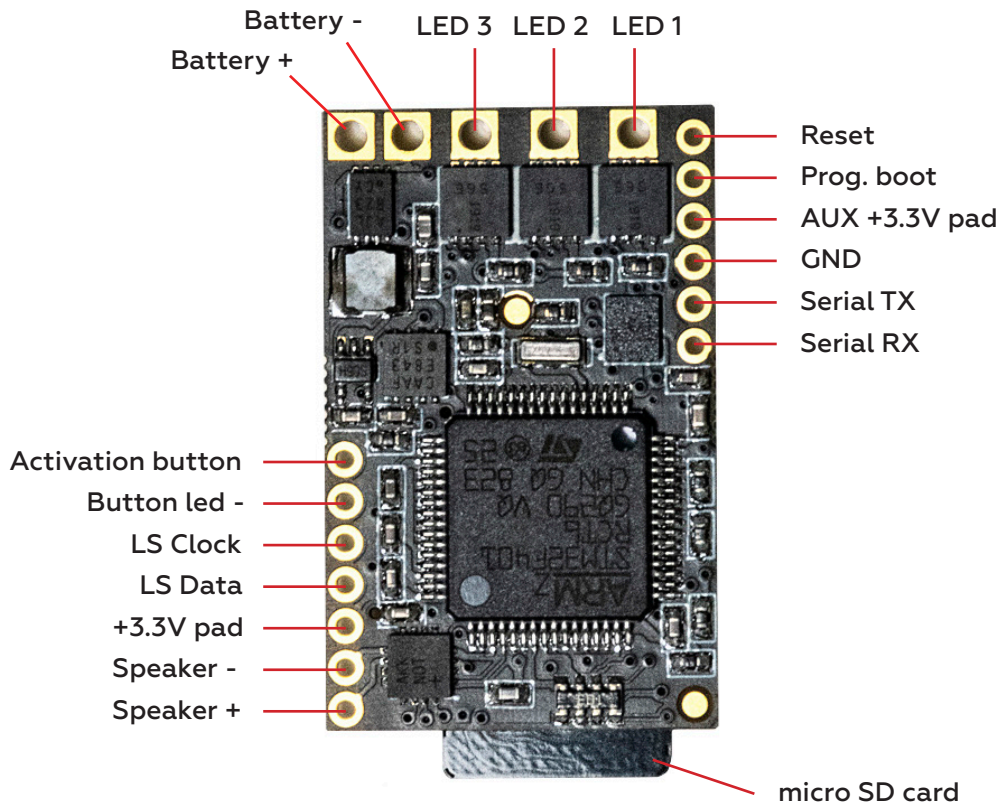
Battery + – battery Positive: 3 to 5 volt input

Battery - – battery Negative

LED 1, 2, 3 – hooks up to negative side of high power LED (positive side of LED hooks up directly to battery). These pads can handle up to 10 amps each. LED 1 = **Red**, LED 2 = **Green**, LED 3 = **Blue**

Speaker +/- – hooks up to speaker (4 Ohm or 8 Ohm 2W-5W)

+3.3V pad – generated by the board for powering satellite devices like accent leds etc.

LS Data – neopixel strip/led Data signal

LS Clock – neopixel strip/led Clock signal if required (some neopixel strips/leds have a Clock input, see datasheets)

Button led - – Negative side for the Activation button led return (also can be used for accent led outside the button), controls accent led effects, turns OFF in Deep Sleep

Activation button – hooks up to a momentary button (polarity doesn't matter)

Reset – used for board programming *(not for user)*

Prog. boot – used for board programming *(not for user)*

AUX +3.3V pad – used for board programming *(not for user)*

GND – ground for satellite devices except high power LEDs

Serial RX, TX – used for board programming *(not for user)*

Configuration file

The configuration file is an INI text file (config.ini) placed at the root of the SD card. It is subdivided into three main sections:

- **Settings**
- **Font**
- **Effects**

Refer to the config.ini file on SD card as an example.

Settings Section

blade_type – can have one of the following values:

hbled – for high-brightness LEDs
pixel – for addressable LED strips

strip_type – is valid only if blade_type = pixel and can have one of the following values:

ws2812 – for WS2812 LED strips
apa102 – for APA102C LED strips

pixel_count – is valid only if blade_type = pixel and is the number of LEDs in the LED strip, for example:

pixel_count = 144

hbledN – this configures each LED output being *N* the number of the LED: 1, 2 or 3, where 1 = RED, 2 = GREEN, 3 = BLUE. It is a series of values defined like:

hbledN = <maximum current>, <maximum voltage>, <resistor>, <current point 1>, <voltage point 1>

<maximum current> – is the maximum current the LED can withstand (in amperes)
<maximum voltage> – is the voltage at maximum current (in volts)
<resistor> – is the resistor connected to the LED (in Ohms)
<current point 1> – is a current value in amperes, lower than maximum current (usually 0.35A)
<voltage point 1> – is the voltage of the LED at current point 1 (LED voltage at 0.35A)

<current point 1> and *<voltage point 1>* are values used to estimate the current of the LED when the input voltage is higher than maximum voltage.
For example, for an LED connected to **LED output 1**, with maximum current = **1**A, maximum voltage = **2.7**V, a **1** Ohm resistor, current point 1 = **0.35**A and voltage point 1 = **2.2**V, the value should be:

hbled1 = 1, 2.7, 1, 0.35, 2.2

NOTE:

if **hbled1**, **hbled2** or **hbled3** values are missing in the configuration file, then the following values are taken by default (for a Cree XPE2 RGB LED):
hbled1 = 1, 2.7, 1, 0.35, 2.2 – (RED LED)
hbled2 = 1, 3.7, 0, 0.35, 3.2 – (GREEN LED)
hbled3 = 1, 3.4, 0.2, 0.35, 3.1 – (BLUE LED)
The **RED LED** has a 1 Ohm resistor, the **GREEN LED** has no resistor and the **BLUE LED** has no resistor.

NOTE:

After some current drain tests we noticed that **RED** led runs at 700mA (instead of desired 1000mA) with **1 Ohm** resistor and **"hbled1 = 1, 2.7, 1, 0.35, 2.2"** settings and **BLUE** led runs at 600mA (instead of desired 1000mA) with **0.22 Ohm** resistor and **"hbled3 = 1, 3.4, 0.22, 0.35, 2.2"** settings. So to run them both on desired 1000mA current for max brightness we recommend to keep drive settings values from the chart below but use a **0.47-0.5 Ohm** resistor for **RED (as well as DeepRed and RedOrange)** led and not use any resistor for **BLUE (as well as Green, RoyalBlue, Amber, Cyan and White)** led.

EDITING PARAMETERS

Tri-Cree LED	LED 1	LED 2	LED 3
Red/Green/Blue	hbled1 = 1, 2.7, 1, 0.35, 2.2	hbled2 = 1, 3.7, 0, 0.35, 3.2	hbled3 = 1, 3.4, 0.2, 0.35, 3.1
Red/Green/RoyalBlue	hbled1 = 1, 2.7, 1, 0.35, 2.2	hbled2 = 1, 3.7, 0, 0.35, 3.2	hbled3 = 1, 3.4, 0.2, 0.35, 3.1
Red/Red/White	hbled1 = 1, 2.7, 1, 0.35, 2.2	hbled2 = 1, 2.7, 1, 0.35, 2.2	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
Green/Green/White	hbled1 = 1, 3.7, 0, 0.35, 3.2	hbled2 = 1, 3.7, 0, 0.35, 3.2	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
Blue/Blue/White	hbled1 = 1, 3.4, 0.2, 0.35, 3.1	hbled2 = 1, 3.4, 0.2, 0.35, 3.1	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
Amber/Amber/White	hbled1 = 1, 3.3, 0.25, 0.35, 3.05	hbled2 = 1, 3.3, 0.25, 0.35, 3.05	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
DeepRed/DeepRed/White	hbled1 = 1, 2.5, 1.2, 0.35, 2.05	hbled2 = 1, 2.5, 1.2, 0.35, 2.05	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
RedOrange/RedOrange/White	hbled1 = 1, 2.7, 1, 0.35, 2.2	hbled2 = 1, 2.7, 1, 0.35, 2.2	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
Cyan/Cyan/White	hbled1 = 1, 3.4, 0.2, 0.35, 3.1	hbled2 = 1, 3.4, 0.2, 0.35, 3.1	hbled3 = 1, 3.15, 0.5, 0.35, 2.9
Other color combinations also possible, use values from examples above.			

Luxeon Tri-Rebel LED	LED 1	LED 2	LED 3
Red/Green/Blue	hbled1 = 0.7, 2.4, 2, 0.35, 2.1	hbled2 = 1, 3.2, 0.4, 0.35, 2.9	hbled3 = 1, 3.05, 0.7, 0.35, 2.8
Red/Green/RoyalBlue	hbled1 = 0.7, 2.4, 2, 0.35, 2.1	hbled2 = 1, 3.2, 0.4, 0.35, 2.9	hbled3 = 1, 3.05, 0.7, 0.35, 2.8
Red/Red/White	hbled1 = 0.7, 2.4, 2, 0.35, 2.1	hbled2 = 0.7, 2.4, 2, 0.35, 2.1	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
Green/Green/White	hbled1 = 1, 3.2, 0.4, 0.35, 2.9	hbled2 = 1, 3.2, 0.4, 0.35, 2.9	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
Blue/Blue/White	hbled1 = 1, 3.05, 0.7, 0.35, 2.8	hbled2 = 1, 3.05, 0.7, 0.35, 2.8	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
Amber/Amber/White	hbled1 = 0.7, 3.2, 1, 0.35, 3.0	hbled2 = 0.7, 3.2, 1, 0.35, 3.0	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
DeepRed/DeepRed/White	hbled1 = 0.7, 2.4, 2, 0.35, 2.1	hbled2 = 0.7, 2.4, 2, 0.35, 2.1	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
RedOrange/RedOrange/White	hbled1 = 0.7, 2.4, 2, 0.35, 2.1	hbled2 = 0.7, 2.4, 2, 0.35, 2.1	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
Cyan/Cyan/White	hbled1 = 1, 3.2, 0.4, 0.35, 2.9	hbled2 = 1, 3.2, 0.4, 0.35, 2.9	hbled3 = 1, 3.1, 0.5, 0.35, 2.8
Other color combinations also possible, use values from examples above.			

stand_by_after – is a value in seconds of the time to wait without user interaction to enter into stand-by (low power) mode.
mute_mode_after – is a value in milliseconds and represents the time the user has to keep the button pressed to enter and exit the mute mode.
retraction_after – is a value in milliseconds and represents the time the user has to keep the button pressed to produce a retraction.
double_click_time – is a value in milliseconds and represents the time in which two consecutive button clicks are considered a double click (for changing the color of the blade).
master_volume – defines the master output volume. Is a value between 0 and 2 (with decimal point), being 1 the default volume without any extra gain.
button_blink – describes the button LED blinking with two values (in milliseconds): the time the LED will stay ON, and the time the LED will stay OFF. For example, for a sequence of a LED staying ON for 250ms and staying OFF for 750ms, the values will be:

        button_blink = 250, 750

The sum of the two values represent the frequency and duty cycle of the blinking sequence (1 second frequency in the above case, with 25% duty cycle).
clash_sensitivity – is a value between 100 and 500. If this value is 0 or the parameter is not present, it will be set automatically to 300. Higher value - less sensitive.

There is an additional emergency procedure to avoid draining from the battery when this has a charge below the recommended operating conditions. This procedure is configured with the following parameters:
emergency_voltage – voltage in millivolts, a value between 3000 and 3700. If this parameter is missing or ignored, it takes the default 3500. Please note certain components on the circuit board have a minimum operational voltage of 3V. So please be sure to not leave the *emergency_timeout* parameter for too long. It's default to 180 seconds.
emergency_timeout – time in seconds the voltage is below *emergency_voltage*. If ignored it takes a value of 10 seconds.
When the battery drops below *emergency_voltage* for the time indicated by *emergency_timeout*, then the board will enter automatically in low-power (deep sleep) mode. If the LEDs are ON (strip or HBLED) then a retraction effect is executed before entering in low-power.

EDITING PARAMETERS

Font Section

font_type – describes the type of font. It can be:

monophonic – for a monophonic font
polyphonic – for a polyphonic font
smoothswing – for a smoothswing font

sampling_frequency – is the sampling frequency of all the sounds in a given font. The only two possible values are:

sampling_frequency = 22050
sampling_frequency = 44100

boot_count – is a number describing the quantity of boot sounds.
clash_count – is a number describing the quantity of clash sounds.
on_count – is a number describing the quantity of on (ignition) sounds. If this parameter is omitted or is set to 1, then *on.wav* will be played.
off_count – is a number describing the quantity of off (retraction) sounds. If this parameter is omitted or is set to 1, then *off.wav* will be played.
swing_count – is a number describing the quantity of swing sounds. It also describes the quantity of swing pairs of a smoothswing font.
smoothswing_threshold – is valid only when font_type = smoothswing, degrees/second needed to register as a swing.
smoothswing_sensitivity – is valid only when font_type = smoothswing, swing sensitivity, degrees of rotations per second required to reach full volume.
smoothswing_sharpness – is valid only when font_type = smoothswing, non-linear swing response, higher values makes it more non-linear.
smoothswing_hum_ducking – is valid only when font_type = smoothswing, how many percent the hum sound will decrease as swing increases.
smoothswing_max_volume – is valid only when font_type = smoothswing, swing volume multiplier defaults to 3x normal volume.
smoothswing_transition1 – is valid only when font_type = smoothswing, length of first transition in degrees.
smoothswing_transition2 – is valid only when font_type = smoothswing, length of second transition in degrees.

Effects Section

ignition_time – is the duration in milliseconds of the ignition effect.
retraction_time – is the duration in milliseconds of the retraction effect.
transition_time – is the duration in milliseconds of the transition between blade colors.
clash_type – is the type of clash effect. It can be:

static – for a static color with a duration defined by *clash_duration*
flash – for an intermittent flashing effect with a duration defined by *clash_duration* and frequency defined by *clash_frequency*

clash_duration – is the duration in milliseconds of the clash effect.
clash_frequency – is the frequency in *Hz* of the clash effect. Can be maximum 25.
clash_color – is the color of the clash. It's an RGB value. For example, a clash color of RED = 255, GREEN = 127 and BLUE = 45 would be:

clash_color = 255,127,45

flicker_type – is the kind of flicker effect. It can be:

random – for a flicker effect with random brightness values within the *flicker_range* values, with a frequency defined by *flicker_frequency*
pulse – for a flicker effect consisting in a brightness linear ramp with values within the *flicker_range* values, with a frequency defined by *flicker_frequency*

flicker_range – are two values (in percent) that define the range of available brightness for a flicker effect. For example, for a flicker effect that cycles between 90% brightness up to 100% brightness and back (*flicker_type = pulse*), it would be:

flicker_range = 90,100

flicker_frequency – is the update frequency of the flicker effect.
flicker_colorN – defines the color of the flicker. It's an RGB value. The *N* is a sequential number starting from 1. There can be unlimited flicker colors defines. The sole condition is that the colors are arranged in a sequential list (like in the example here below), without gaps.
The software will auto-detect the quantity of flicker colors. For example, to define 4 flicker colors (blade color profiles), make sure to leave a blank space line after the last flicker color line, otherwise the last color profile won't detect by the system:

flicker_color1 = 0,255,0
flicker_color2 = 255,255,0
flicker_color3 = 0,255,255
flicker_color4 = 0,0,255

VERSO
INSTRUCTIONS
EDITING PARAMETERS

Sound files

The sound files must be copied to the root of the SD card. Each kind of sound must follow this naming convention:

- Boot sounds must be named **boot.wav** or **bootN.wav** (where *N* is a number) if there are multiple boot files.
- Clash sounds must be named **clashN.wav** (where *N* is a number) to define multiple clash sounds.
- Swing sounds for monophonic or polyphonic fonts must be named **swingN.wav** (where *N* is a number) to define multiple swing sounds.
- Swing sounds for smoothswing fonts must be named **swingh0N.wav** and **swingl0N.wav** (where *N* is number).
- The sound file for the ignition must be named **on.wav**. If *on_count* is set to a value greater than 1, then the files must be named **onN.wav**, where *N* is a number between 1 and *on_count*. All files in the specified range must be present in the SD card.
- The sound file for the retraction must be named **off.wav**. If *off_count* is set to a value greater than 1, then the files must be named **offN.wav**, where *N* is a number between 1 and *off_count*. All files in the specified range must be present in the SD card.
- The sound file for the hum must be named **hum.wav**.
- The sound file played when changing flicker colors (blade color profiles) must be named **color.wav**.
- The sound file played when entering mute mode must be named **mute.wav**.
- The sound file played when exiting mute mode must be named **unmute.wav**.

Low Battery Indication

It is a mechanism that detects a low battery condition and plays WAV file to indicate the user about it.

The following parameters have been added to the configuration file:

lowbatt_thrs – indicates the low-battery threshold in millivolts. If the battery voltage is lower than this value for the time defined with the *lowbatt_timebelow* parameter, then a low battery condition is declared. If this value is 0, then the low battery detection is disabled. For example, setting to 3000, would mean the battery voltage would be 3V.

lowbatt_timebelow – time in seconds with a battery voltage below *lowbatt_thrs* to declare a low battery condition. For example if set to 10, the battery would need to be below the declared *lowbatt_thrs* parameter for 10 seconds to trigger low battery detection.

lowbatt_timeabove – time in seconds with a battery voltage above *lowbatt_thrs* to exit the low battery condition. This is an optional parameter. Setting this value to zero will make the low battery condition permanent until the next board reset. For example if set to 10, the battery would need to be above the declared *lowbatt_thrs* parameter for 10 seconds to disable low battery detection.

lowbatt_interval – WAV file interval time in seconds. If set to 0, the user indication WAV file is played a single time (when the low battery condition is detected). For example, if set to 10, the WAV file will repeat every 10 seconds.

(the WAV file to play has to be named "*lowbatt.wav*" and has to have the same sampling frequency of the current font)

Bootloader

When the board resets, the bootloader is executed. This bootloader will check if there is a "*firmware.bin*" file in the root of the SD card. If it is present, then the bootloader will copy its contents into the MCU flash and verify the copy. The "*firmware.bin*" file is deleted from the SD card when the copy is completed.

When the copy starts, the bootloader will play a "*prog.wav*" file. When the firmware programming is completed, the bootloader will play a "*progsuccess.wav*" file or "*progerror.wav*" if there was an error.

When the programming is completed, the board resets and executes the new firmware. If there is an error, the bootloader will not do any other operation and will wait for the next board reset (power cycle).

All the WAV files played by the bootloader have to have 22050 Hz sampling frequency and have to be placed at the root of the SD card.

WIRING DIAGRAMS

Beginner Tri-Cree wiring diagram (In-hilt LED)

in case a momentary button with 4 legs is used, trim 2 legs on one side and use 2 legs on the other side

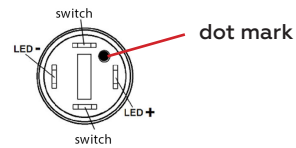AV activation button without accent LED (non-illuminated)

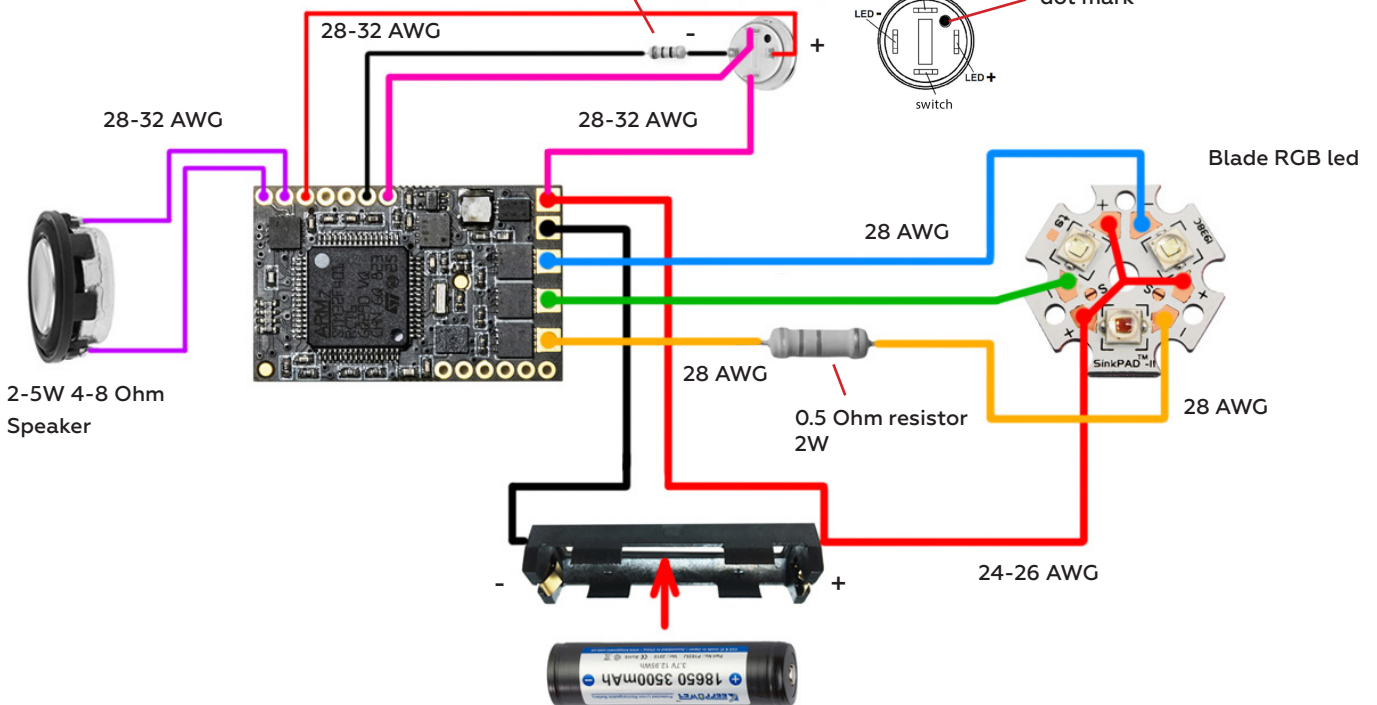polarity doesn't matter because there is no polarity in switches

to **Activation button** pad   to **Battery +** pad

LED resistor

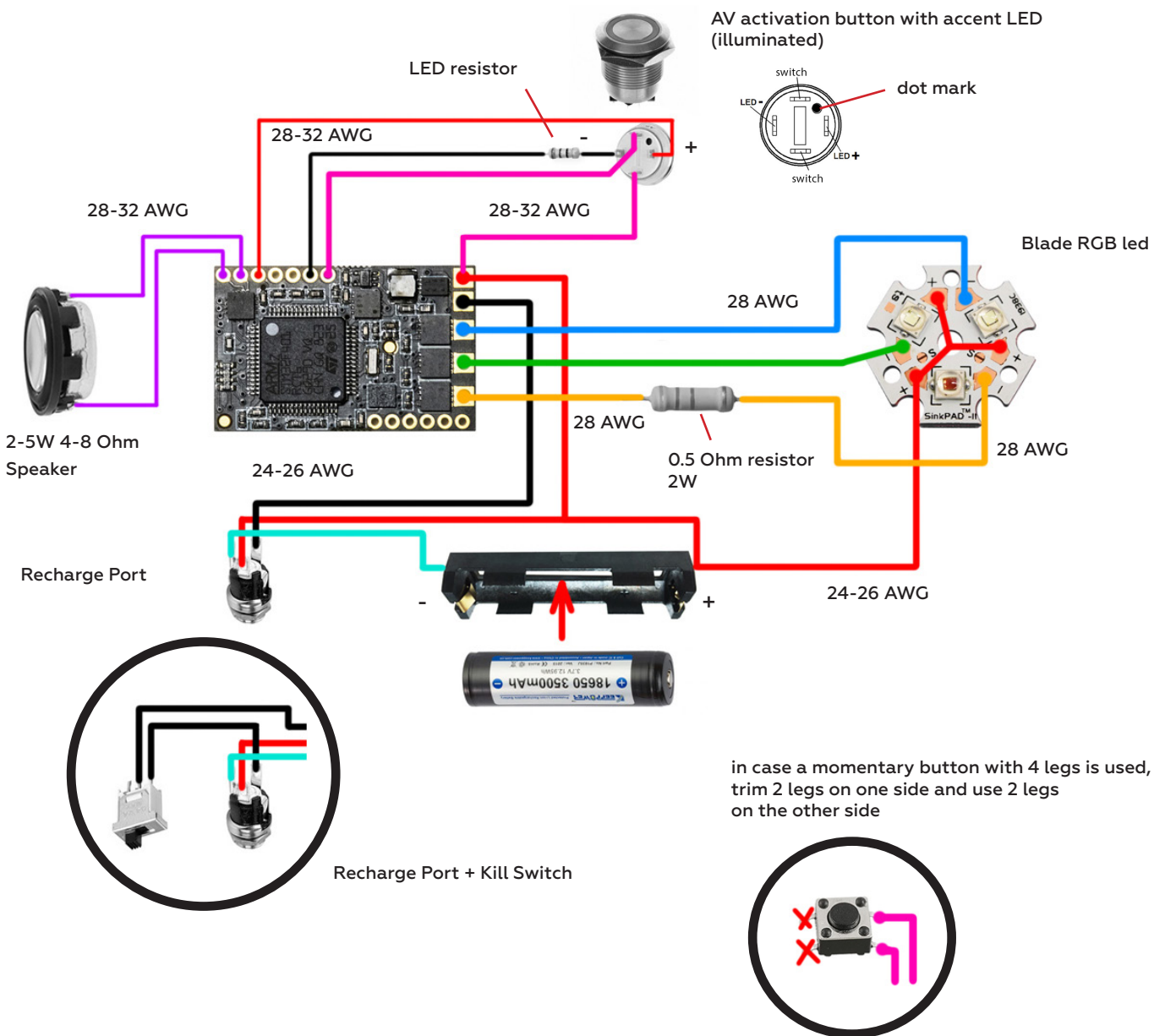AV activation button with accent LED (illuminated)

switch

dot mark

LED −

LED +

switch

28-32 AWG

−   +

28-32 AWG

28-32 AWG

28-32 AWG

Blade RGB led

28 AWG

2-5W 4-8 Ohm Speaker

28 AWG

0.5 Ohm resistor 2W

28 AWG

−   +

24-26 AWG

18650 3500mAh

[LED Resistor Calculator](#)

WIRING DIAGRAMS

Basic Tri-Cree wiring diagram (In-hilt LED)

LED resistor

AV activation button with accent LED (illuminated)

28-32 AWG

switch

dot mark

LED −

LED +

switch

28-32 AWG

28-32 AWG

Blade RGB led

28 AWG

2-5W 4-8 Ohm Speaker

24-26 AWG

28 AWG

0.5 Ohm resistor 2W

28 AWG

Recharge Port

24-26 AWG

18650 3500mAh

−

+

Recharge Port + Kill Switch

in case a momentary button with 4 legs is used, trim 2 legs on one side and use 2 legs on the other side

[LED Resistor Calculator](#)

Beginner Neopixel/Pixelblade wiring diagram

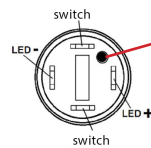in case a momentary button with 4 legs is used, trim 2 legs on one side and use 2 legs on the other side

AV activation button without accent LED (non-illuminated)

polarity doesn't matter because there is no polarity in switches

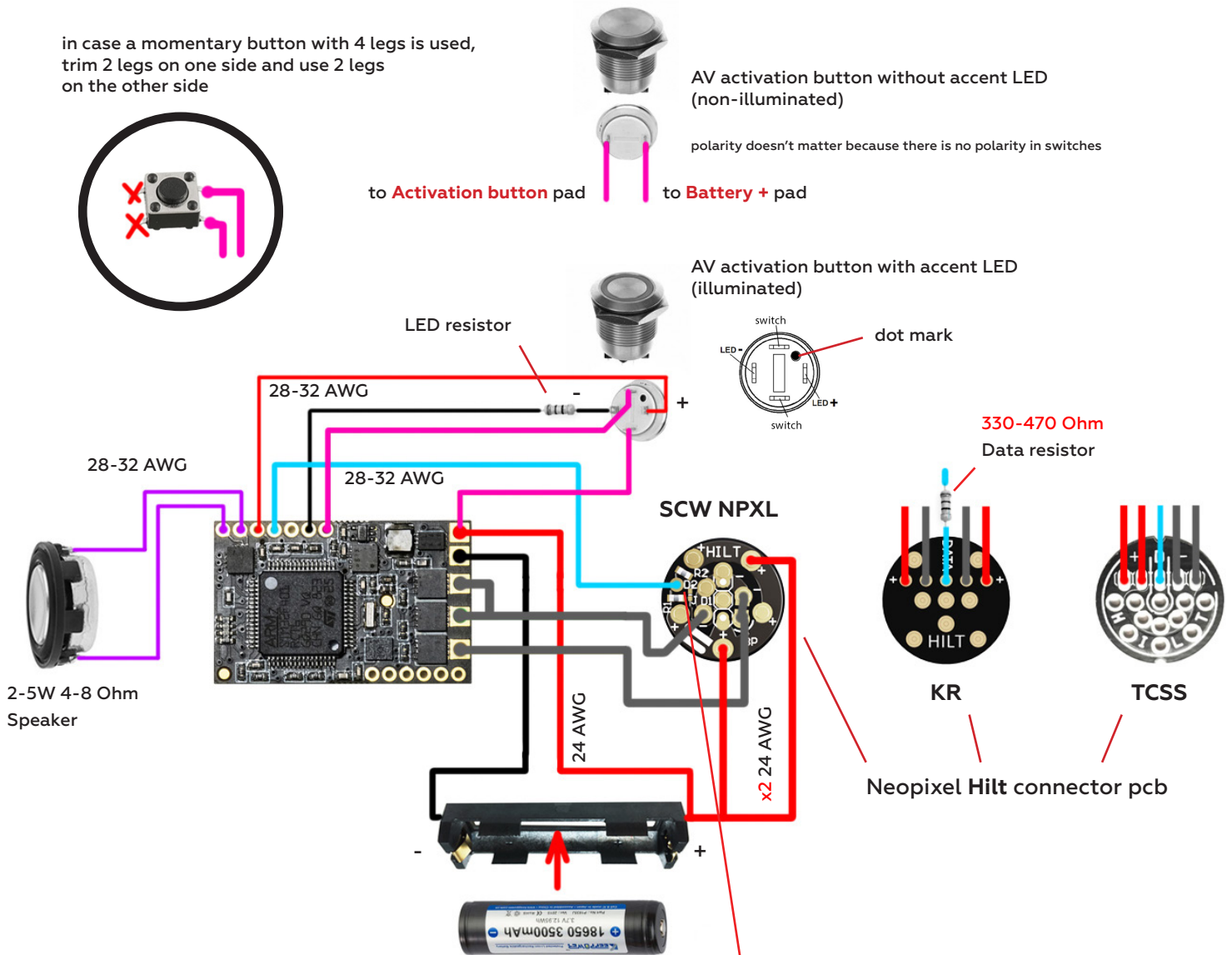to **Activation button** pad   to **Battery +** pad

AV activation button with accent LED (illuminated)

LED resistor

switch

LED –

LED +

switch

dot mark

28-32 AWG

–   +

28-32 AWG

28-32 AWG

28-32 AWG

330-470 Ohm
Data resistor

SCW NPXL

2-5W 4-8 Ohm Speaker

24 AWG

x2 24 AWG

KR

TCSS

Neopixel **Hilt** connector pcb

18650 3500mAh

–   +

Use the V2 resistors option from the ShtokCustomWorx NPXL connector manual:

>SCW NPXL connector PDF manual download link<
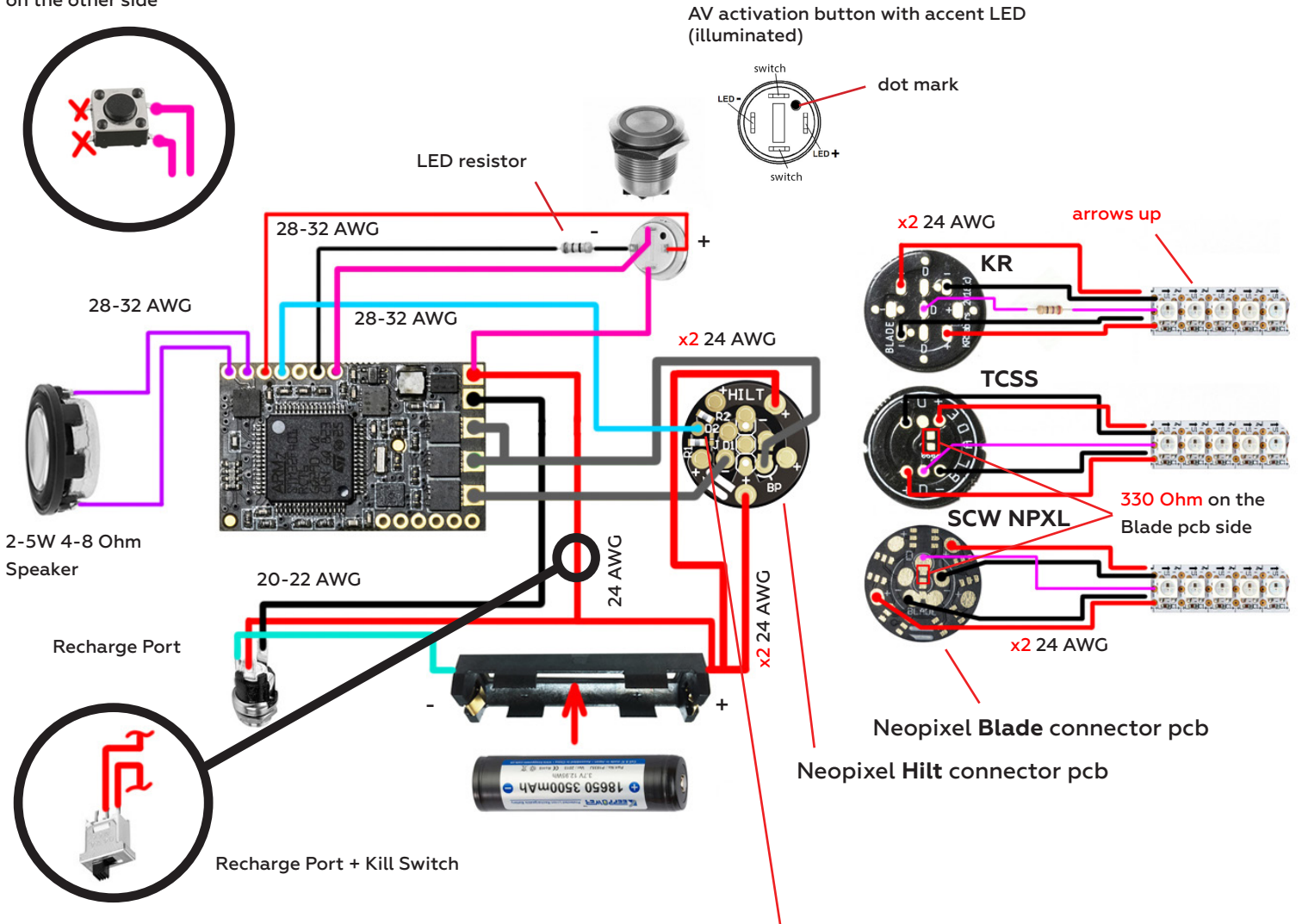
WIRING DIAGRAMS

Basic Neopixel/Pixelblade wiring diagram
with SCW NPXL connector

in case a momentary button with 4 legs is used,
trim 2 legs on one side and use 2 legs
on the other side

AV activation button with accent LED
(illuminated)

switch

LED −

dot mark

LED +

switch

LED resistor

28-32 AWG

−

+

x2 24 AWG

arrows up

KR

28-32 AWG

28-32 AWG

x2 24 AWG

TCSS

2-5W 4-8 Ohm
Speaker

+HILT

330 Ohm on the
Blade pcb side

SCW NPXL

20-22 AWG

Recharge Port

24 AWG

x2 24 AWG

−

+

x2 24 AWG

Neopixel **Blade** connector pcb

Recharge Port + Kill Switch

Neopixel **Hilt** connector pcb

Use the V2 resistors option from the ShtokCustomWorx NPXL
connector manual:

>SCW NPXL connector PDF manual download link<

Recommended power wire gauges (22 AWG) are given for 2-strip blade. For 3-strip blade you gonna need
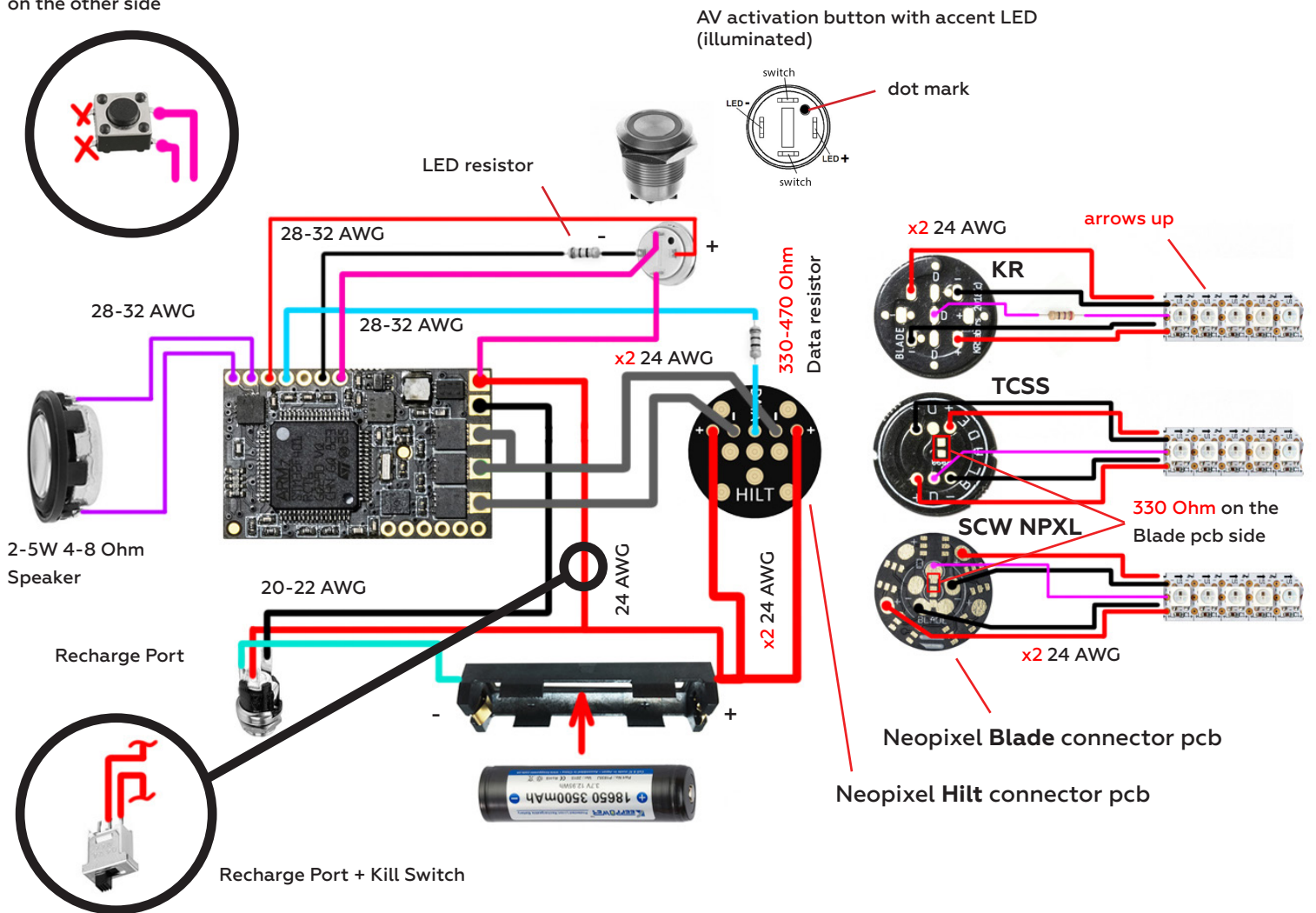at least 20 AWG wires.

WIRING DIAGRAMS
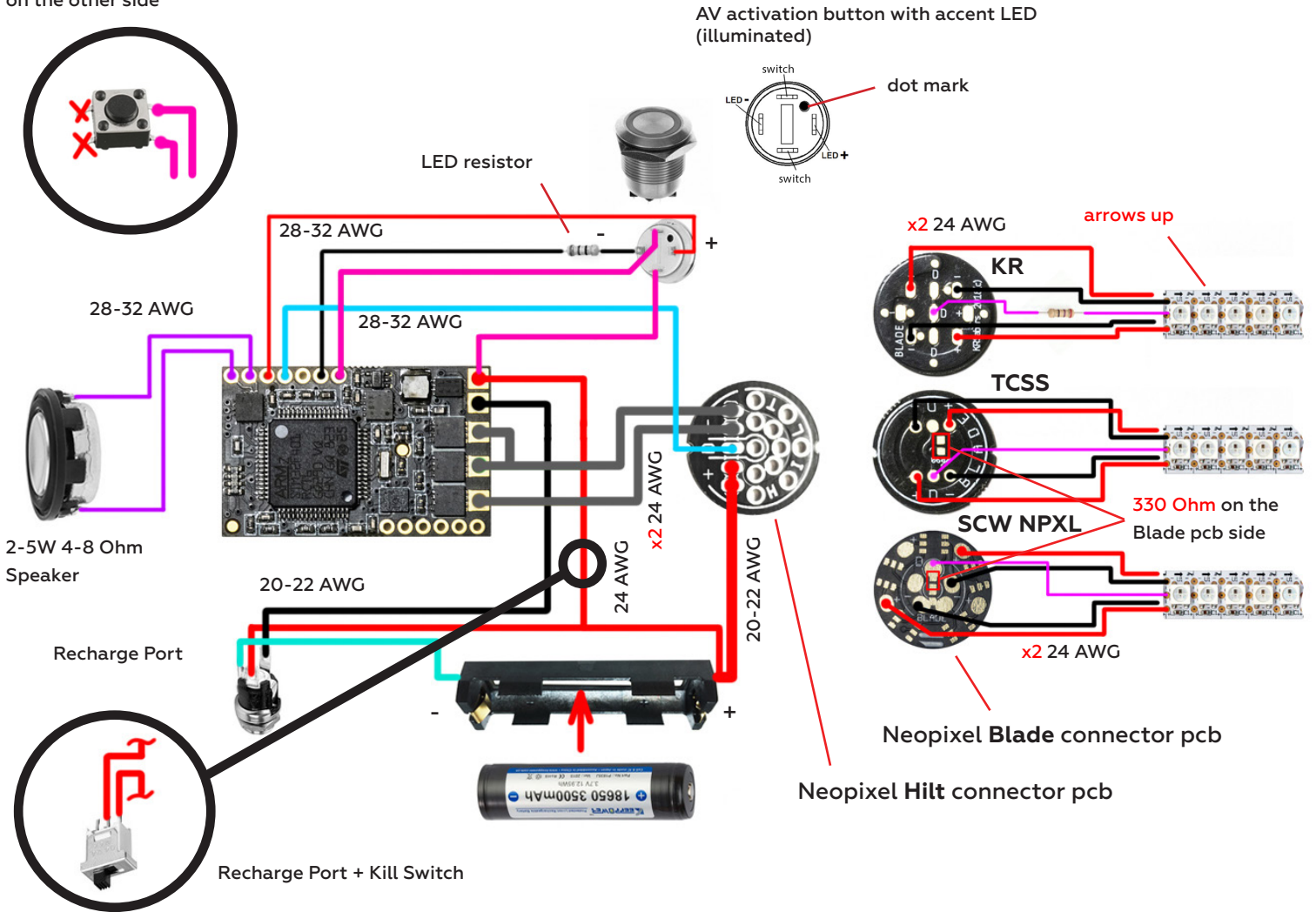
Basic Neopixel/Pixelblade wiring diagram
with KR-sabers connector

in case a momentary button with 4 legs is used,
trim 2 legs on one side and use 2 legs
on the other side

AV activation button with accent LED
(illuminated)

switch

LED −

dot mark

LED +

switch

LED resistor

28-32 AWG

−

+

x2 24 AWG

arrows up

KR

28-32 AWG

28-32 AWG

330-470 Ohm

Data resistor

x2 24 AWG

TCSS

2-5W 4-8 Ohm
Speaker

24 AWG

x2 24 AWG

330 Ohm on the
Blade pcb side

SCW NPXL

20-22 AWG

Recharge Port

x2 24 AWG

HILT

−

+

Neopixel **Blade** connector pcb

Recharge Port + Kill Switch

Neopixel **Hilt** connector pcb

Recommended power wire gauges (22 AWG) are given for 2-strip blade. For 3-strip blade you gonna need
at least 20 AWG wires.

WIRING DIAGRAMS

Basic Neopixel/Pixelblade wiring diagram
with TCSS connector

in case a momentary button with 4 legs is used,
trim 2 legs on one side and use 2 legs
on the other side

AV activation button with accent LED
(illuminated)

switch

LED −

dot mark

LED +

switch

LED resistor

28-32 AWG

−

+

x2 24 AWG

KR

arrows up

28-32 AWG

28-32 AWG

TCSS

2-5W 4-8 Ohm
Speaker

24 AWG

x2 24 AWG

20-22 AWG

330 Ohm on the
Blade pcb side

SCW NPXL

20-22 AWG

Recharge Port

x2 24 AWG

−

+

Neopixel **Blade** connector pcb

Neopixel **Hilt** connector pcb

Recharge Port + Kill Switch

Recommended power wire gauges (22 AWG) are given for 2-strip blade. For 3-strip blade you gonna need
at least 20 AWG wires.

Basic Crystal Chamber LED wiring diagrams

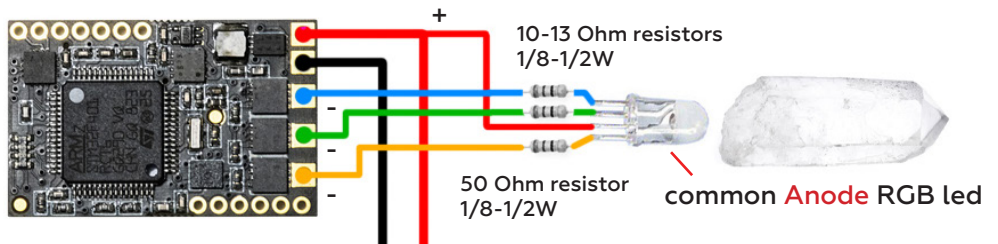### With regular single color accent LED

Using 1 (or multiple) LED/LEDs connected to **+3.3V** and **Button led -** pads.
Crystal LED has it's own "accent" effects.
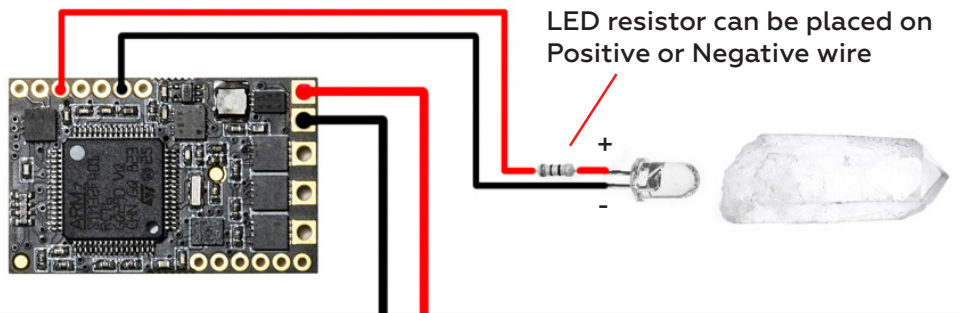
LED resistor can be placed on Positive or Negative wire

+

-

With RGB accent led

Using 1 (or multiple) RGB LED/LEDs connected to **Battery +** and **LED channel 1-3** pads.
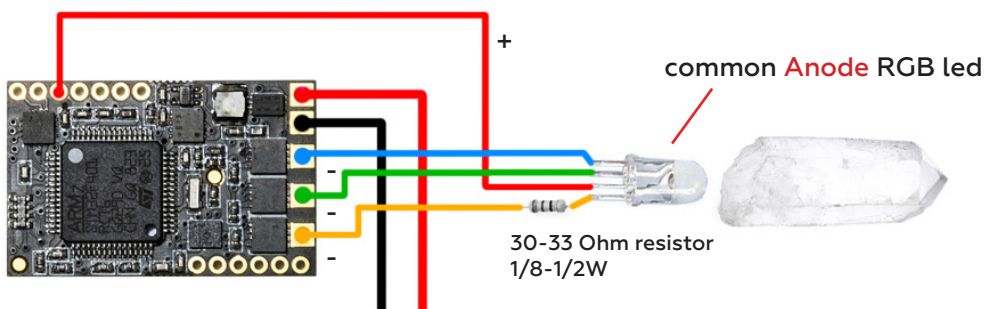Crystal LED mirrors all blade effects.

+

10-13 Ohm resistors 1/8-1/2W

-
-
-

50 Ohm resistor 1/8-1/2W

common **Anode** RGB led

With RGB accent led

Using 1 (or multiple) RGB LED/LEDs connected to **+3.3V** and **LED channel 1-3** pads.
Crystal LED mirrors all blade effects.
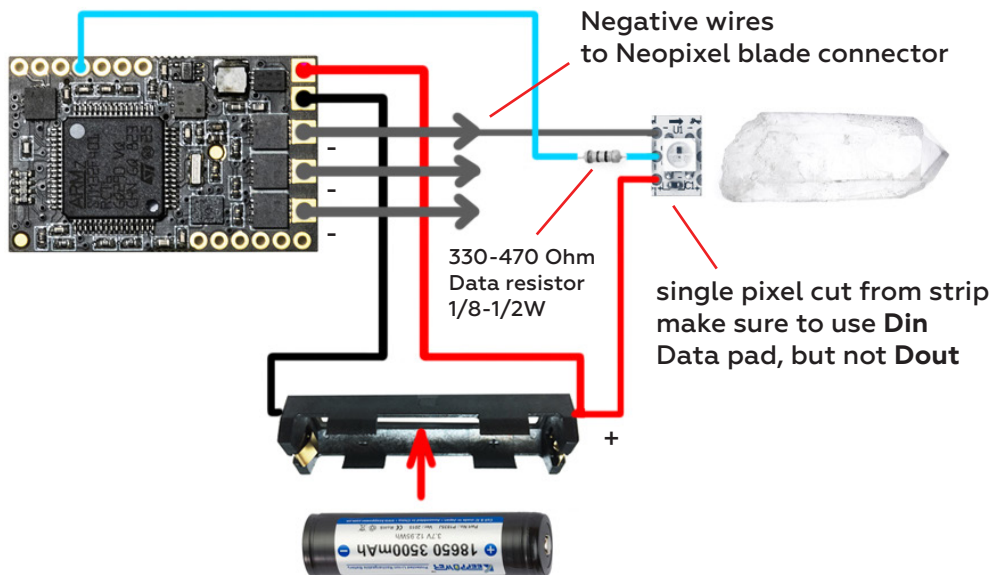**NOTE: Green and Blue colors will be slightly dimmer due to 3.3V limit.**

+

common **Anode** RGB led

-
-
-

30-33 Ohm resistor 1/8-1/2W

With RGB pixel/pixels

Using 1 (or multiple) pixel/pixels connected to same Positive, Negative and Data wires as the main blade.
Crystal pixel mirrors all blade effects.

Negative wires to Neopixel blade connector

-
-
-

330-470 Ohm Data resistor 1/8-1/2W

single pixel cut from strip make sure to use **Din** Data pad, but not **Dout**

+

18650 3500mAh

WIRE GAUGE GUIDE

Which wire gauge is recommended to use for Positive and Negative power leads for maximum blade brightness efficiency

Chart from PowerStream.com

AWG gauge	Conductor Diameter Inches	Conductor Diameter mm	Conductor cross section in mm²	Ohms per 1000 ft.	Ohms per km	Maximum amps for chassis wiring	
14	0.0641	1.62814	2.08	2.525	8.282	32	
15	0.0571	1.45034	1.65	3.184	10.44352	28	
16	0.0508	1.29032	1.31	4.016	13.17248	22	
17	0.0453	1.15062	1.04	5.064	16.60992	19	
18	0.0403	1.02362	0.823	6.385	20.9428	16	**Neopixel strips**
19	0.0359	0.91186	0.653	8.051	26.40728	14	**Battery**
20	0.032	0.8128	0.519	10.15	33.292	11	**Recharge Port**
21	0.0285	0.7239	0.412	12.8	41.984	9	**Kill Switch**
22	0.0253	0.64516	0.327	16.14	52.9392	7	
23	0.0226	0.57404	0.259	20.36	66.7808	4.7	
24	0.0201	0.51054	0.205	25.67	84.1976	3.5	**Tri-Cree LED**
25	0.0179	0.45466	0.162	32.37	106.1736	2.7	**Battery**
26	0.0159	0.40386	0.128	40.81	133.8568	2.2	**Recharge Port**
27	0.0142	0.36068	0.102	51.47	168.8216	1.7	**Kill Switch**
28	0.0126	0.32004	0.080	64.9	212.872	1.4	
29	0.0113	0.28702	0.0647	81.83	268.4024	1.2	
30	0.01	0.254	0.0507	103.2	338.496	0.86	**Everything else**
31	0.0089	0.22606	0.0401	130.1	426.728	0.7	
32	0.008	0.2032	0.0324	164.1	538.248	0.53	

Neopixel strips build (3-17 amperes load)			Tri-Cree LED build (1-4 amperes load)
2-strip	3-strip	4-strip	**28-24 AWG recommended for battery wiring, choose regarding particular build** *30 AWG possible for single 3W Cree LED wiring (one wire per die)*
22 AWG single or **24 AWG** dual in parallel	**20 AWG** single or **23 AWG** dual in parallel	**18 AWG** single or **22 AWG** dual in parallel	

For all other components except Neopixel blade strips, high power Tri-Cree LEDs, battery and recharge port/Kill Switch — a 30-32 AWG wire can be used because they are low current circuits (5-500mA) (accent leds, activation and AUX switches, speaker, bluetooth module, RICE port etc.).

RECHARGE PORTS AND KILL SWITCHES

	3 Amps	5 Amps	6 Amps	7 Amps	8 Amps	11 Amps
2.1mm Switchcraft 721A Recharge port	OK	OK	OK	OK	OK	96%
1.3mm Recharge port CUI PJ-013D Martin Beyer 1.3mm Recharge port	OK	OK	OK	98%	97%	95.5%
Martin Beyer Kill Switch	OK	OK	OK	OK	OK	98%
1.3mm Recharge port CUI PJ-075DH	OK	OK	OK	97%	95%	94%
regular cheap 1.3mm Recharge port	75%	melted	melted	melted	melted	melted
3A Kill Switch CK TS01CQE	OK	OK	OK	OK	OK	98%
Mini 6pin SMD Slide Switch MSS22D18	OK	OK	70%	melted	melted	melted

OK — safe to use

1-96% — efficiency (less than 95% not recommended!)

SHTOK CUSTOM WORX

How to wire Recharge Ports

High power Recharge Port

+
-

From the Battery

+
-

To the Sound Board

CUI PJ-075DH-SMT
High power 1.3mm recharge port wiring diagram

2 (-) in

3 (-) out   1 (+)

battery pack   sound board   battery pack and sound board

SCHEMATIC	
Model	PJ-075DH-SMT
Center Pin	Ø1.3 mm

] tested at 6 Amps

2 and 3 are the so-called "Kill Switch"
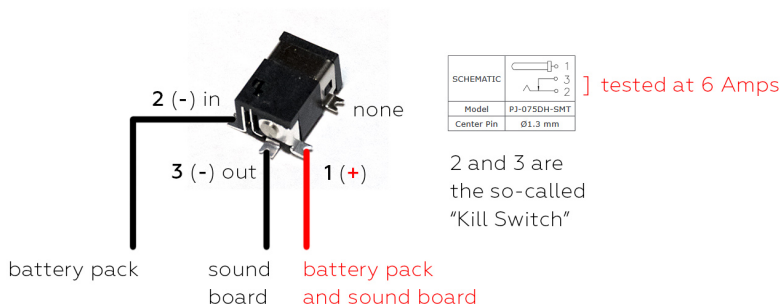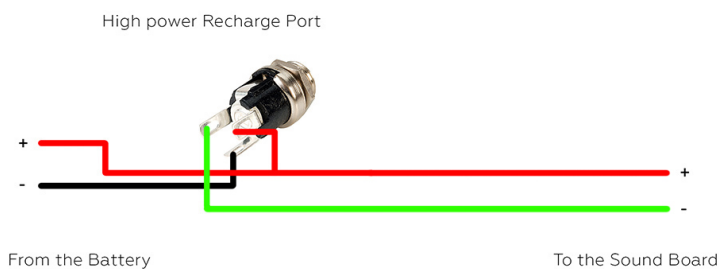
NEOPIXEL STRIPS CURRENT DRAW

Neopixel WS2812B/SK6812 strips
tested approximate current consumption chart

Tested at 3.7V, 143 leds per strip, at max brightness

№ of strips	current	1 color without flicker / with flicker	2 colors mixed without flicker / with flicker	3 colors mixed for white without flicker / with flicker
1	Total	2 / 1.9 A	3.6 / 3.3 A	5.2 / 4.9 A
	Per LED	14 / 12.9 mA	12.6 / 11.5 mA	12.1 / 11.4 mA
2	Total	3.7 / 3.5 A	6.9 / 6.4 A	9.9 / 9.3 A
	Per LED	13 / 12.2 mA	12 / 11.1 mA	11.5 / 10.8 mA
3	Total	5.4 / 4.5 A	10.1 / 9.5 A	14.4 / 13.5 A
	Per LED	12.6 / 11.6 mA	11.8 / 11.1 mA	11.2 / 10.5 mA
4	Total	7.1 / 6.7 A	13 / 12.4 A	17.7 / 16.6 A
	Per LED	12.4 / 11.8 mA	11.4 / 10.8 mA	10.3 / 9.7 mA
5	Total	8.8 / 8.4 A	15.7 / 15 A	20.6 / 19.5 A
	Per LED	12.3 / 11.7 mA	11 / 10.5 mA	9.6 / 9.1 mA

user manual made by KR-sabers and Dmitry Shtok

RECOMMENDED BATTERIES CHART

Best batteries for sabers

SHTOK CUSTOM WORX

| SIZE	BRAND/MODEL	
18350	Keeppower 1200mAh 8A Protected	Keeppower 1200mAh 10A Unprotected (requires external protection pcb)
14500	Keeppower P1450C2 1000mAh 4A Protected	Efest IMR14500 V2 650mAh 9A Unprotected (requires external protection pcb)
14650	Efest IMR14650 950mAh 5A Unprotected (requires external protection pcb)	Keeppower 1100mAh 2-3A Protected
16650	Keeppower 2500mAh 5A Protected	Sanyo UR16650ZTA 2500mAh 5A Unprotected (requires external protection pcb)
18500	Keeppower P1850J2 2000mAh 4A Protected	Keeppower IMR18500 1100mAh 10A Unprotected (requires external protection pcb)
18650	Keeppower 3500mAh 10A Protected	Keeppower 3120mAh 15A Protected
21700	Acebeam 5100mAh 20A Protected	Keeppower 5000mAh 10A Protected
26650	Keeppower 6000mAh 10-15A Protected	Keeppower 5500mAh 10A Protected
26800	QueenBattery 6800mAh 30A Unprotected (requires external protection pcb)	

These batteries work for both Tri-Cree and Neopixel setups.

For Tri-Cree LED setup choose the one with highest capacity value (**mAh**), for Neopixel setup choose the one with highest max drain value (**A**).

mAh – *milliamperes per hour: the battery energy capacity rating, means how long the battery will run at a single charge* – ***run time***

A – *Amperes: the battery energy max drain rating, means how much Amperes this battery can provide continuousl* – ***blade brightness performance under high current load***

For Tri-Cree LED setup batteries with 2-3A drain rating are OK (can be higher, but lower are not recommended). For Neopixel setup batteries with 10-15A drain rating are recommended (can be higher, but lower are not recommended). For battery sizes 14500, 14650, 16650, 18350, 18500 it's hard or impossible to find a good capacity with high drain rating, so 5-8A examples from the chart above are best options.
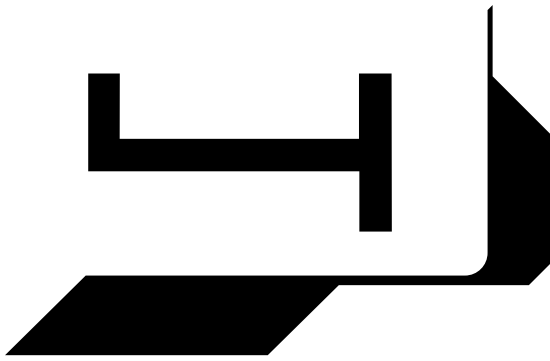
TROUBLESHOOTING

Quick troubleshooting tips

How to solve most common issues

My last color profile is not displaying
– The config.ini files must have a blank line at the end of them. Please be sure to press ENTER after the last color profile has been added ensuring a blank line is at the end of the text file.

The saber will not wake up from Deep Sleep mode
– This is due to the activation switch being wired incorrectly. The Verso has a different wiring method for the switch to other boards on the market. Be sure to study the manual and diagram carefully ensuring you have wired the switch correctly.

**I have loaded a new font, but some sounds aren't playing**
– Please check you have the counts of the files correct in the config.ini file. If you load a new font and do not check or change the counts in that file, it will result in the font not performing correctly. Remember, the swings are in pairs. For example, if there are 4 swing pairs, the count is 4, not 8.

The saber is automatically shutting off
– This is the default Low Battery safety feature working on the board. It will shut the saber off if the battery is below a defined value in the config.ini file. You can disable this feature or adjust the minimum thresholds for activation. Please see Page 10 for more information on this.

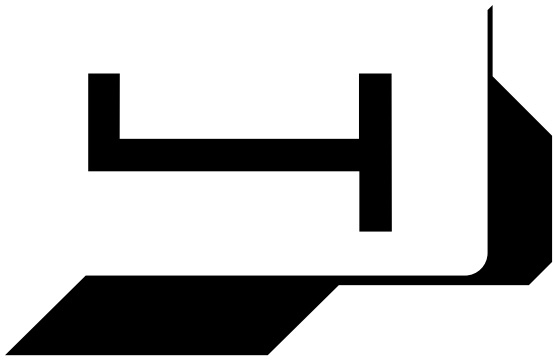**What does the sound "Crystal Core Unstable" mean**
– This is the Low battery notification sound on the default sound font.

user manual made by KR-sabers and Dmitry Shtok
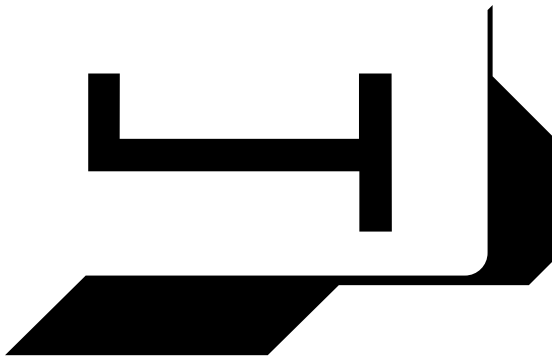
TROUBLESHOOTING

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About this document

Revision history

The table below displays the revision history for the chapters in this manual.

Chapter	Date	Revision	Changes made
All	Jan 2020	1.0	First draft.
- Features - Editing parameters - Wiring diagrams - Recommended batteries - Troubleshooting	Mar 2020	1.1	- added 1-button operation instructions - troubleshooting help - added wiring diagrams for illuminated and non-illuminated AV switches - changes to KR Neopixel connector wiring diagram - changes to "Features" list - changes to "Low Battery" information - added "Emergency Shutdown" section - added Crystal Chamber wiring diagrams - updated "Recommended Batteries" section info