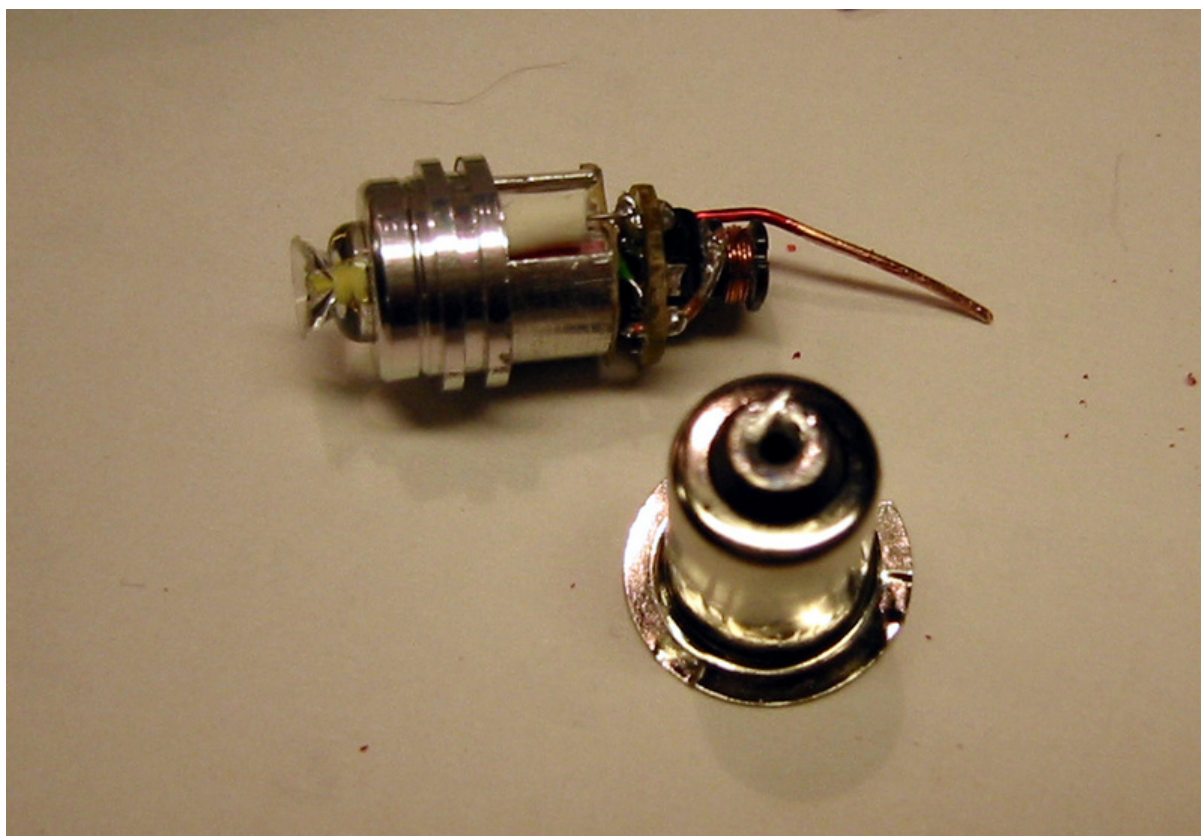




Matrix 2 Mod

Created by lady ada



<https://learn.adafruit.com/matrix-2-mod>

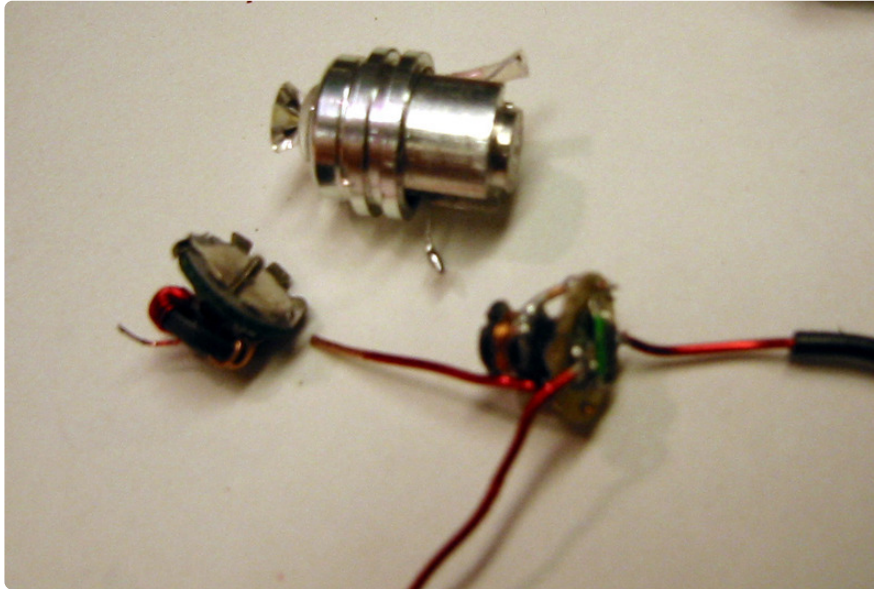
Last updated on 2024-06-03 01:18:50 PM EDT

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Overview

Upgrading a "Matrix2" Headlamp



Matrix2 Headlamp

This is a Princeton Tec product, basically a somewhat waterproof headlamp that takes 2 alkaline AA batteries and has a "1W Luxeon white side-emitter" as the light source.

Upgrading

The problem with this product is that either there is no feedback system in place for the driver circuitry: the lamp must be run off of 3V (2 alkaline batteries) and will not work off of 2.4V (2 rechargeable batteries). The upgrade replaces the driver circuitry and allows the lamp to be run on anywhere from 1.2V to 3.3V. Unfortunately, due to the unpleasantness of running a boost converter at 90 duty cycle, it's more efficient to run the lamp at 2.4V (90% efficient) than 3.0V (70% efficient)

Fun

This project is not fun, it's rather difficult and shouldn't be done unless you are:

1. Desperate
2. Skilled at smt soldering (TSSOP-8, 0603, etc)

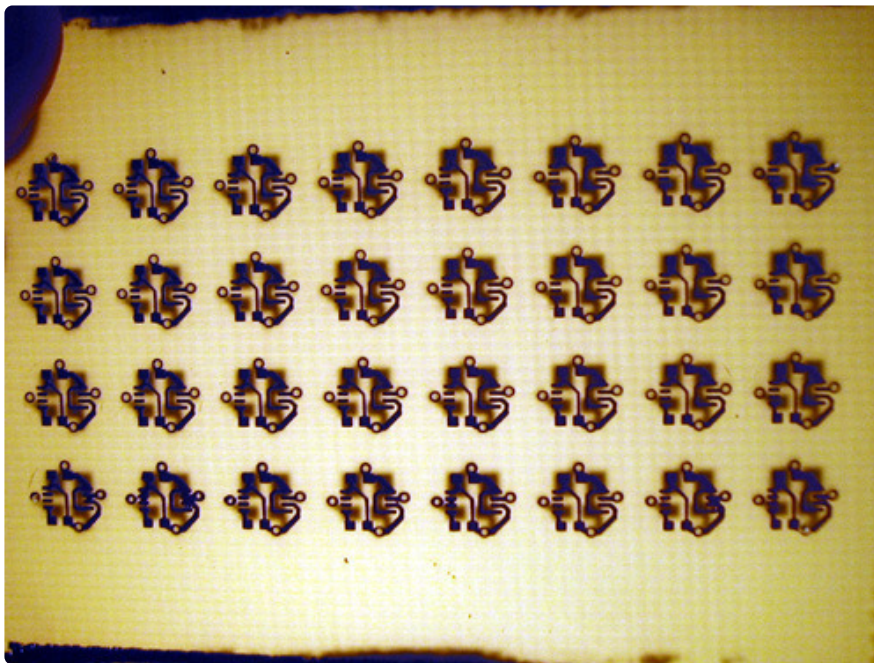
3. Have time to kill

Profit

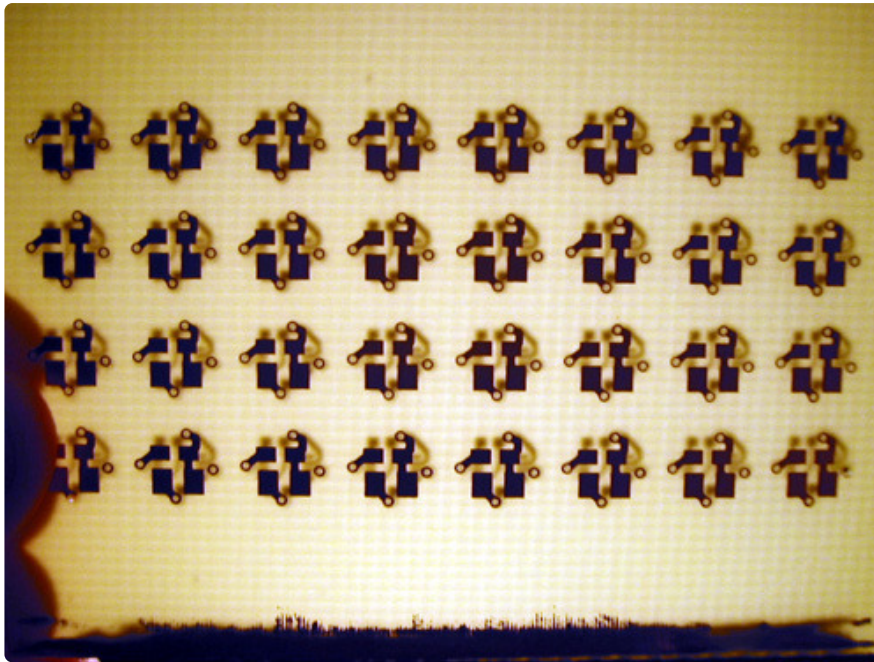
This project is not profitable. Depending on how cheap you can get the PCB, it is about \$10 to upgrade. You might also break your bulb.

DIY

1. Disassemble the headlamp and extract the LED bulb. Heat up the tip of the bulb and soldersuck it away. Slide the LED and aluminum heatsink out of the casing. Put it away until the replacement board is made.
2. Use your expensive wet-etch fabrication system (or order PCBs or whatever) to make the PCB. Make the PCB on halfthickness (32mil) substrate. The final PCB is a .3" diameter circle.

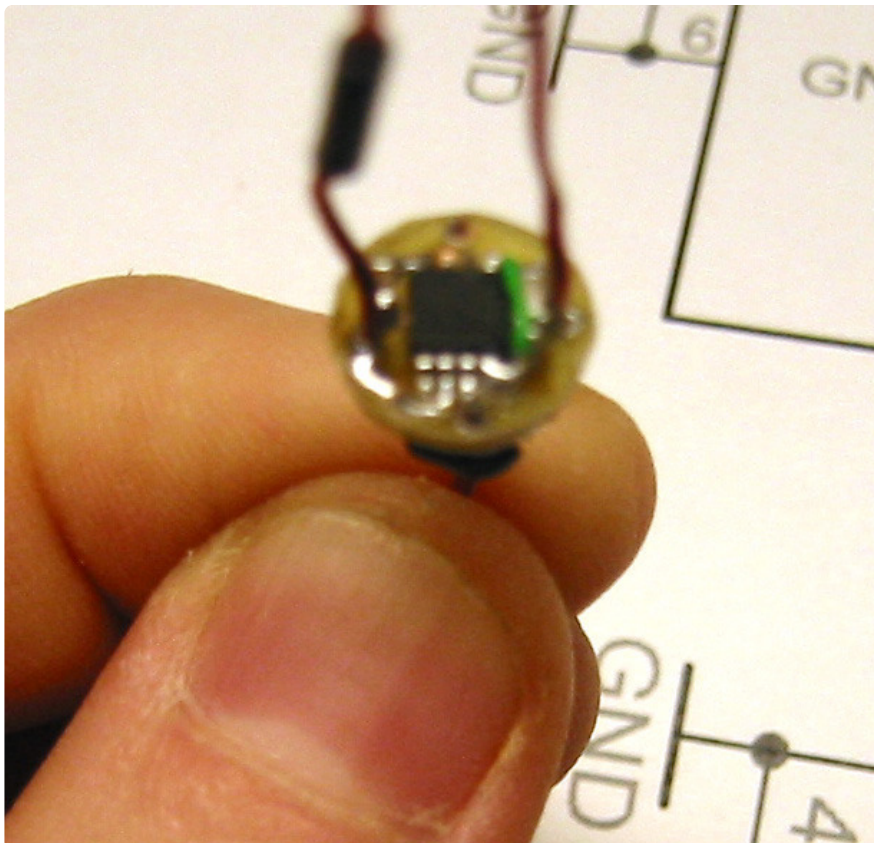


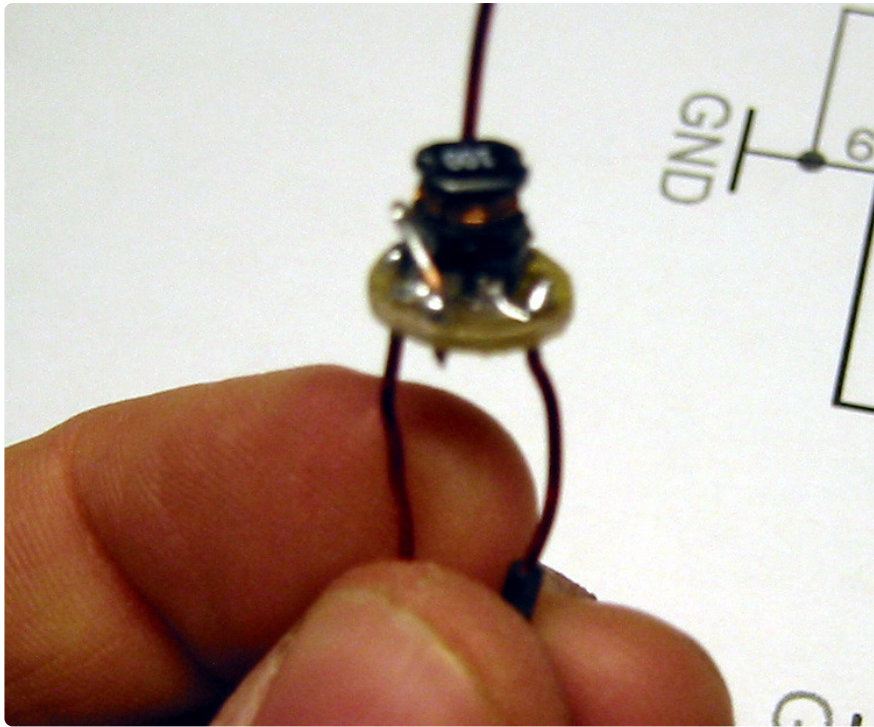
The side for the boost chip and small filter caps, this is V1 which did 5V boost, the 3.3V boost will look slightly different.



The side for the two larger capacitors.

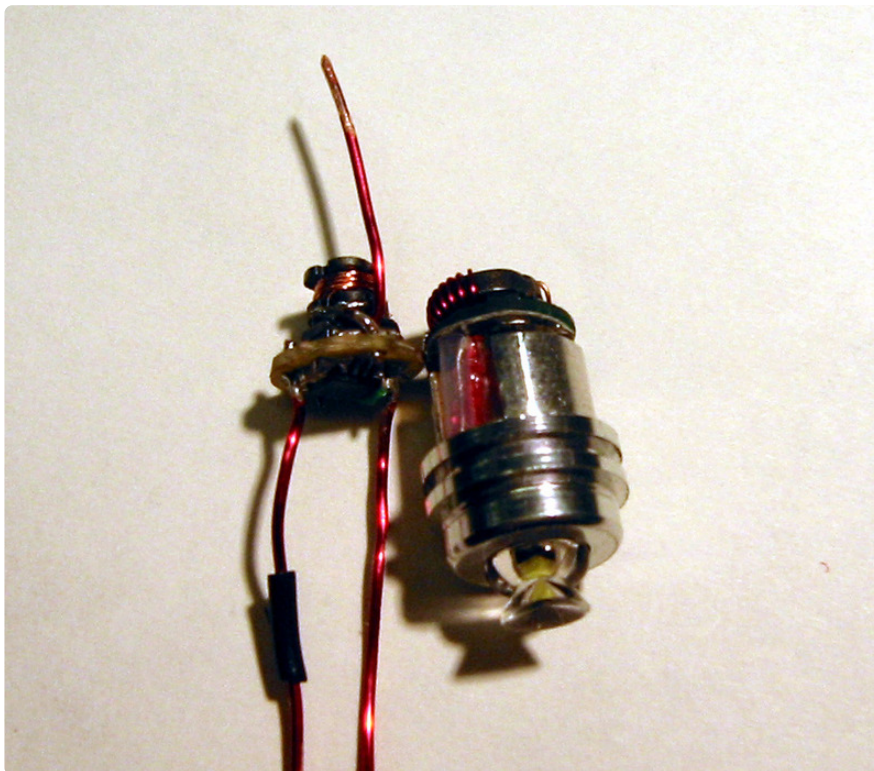
3. Solder the components on, use the MAX1675 only, it has a 1/2A current limit which helps us out. The inductor goes ON TOP of the capacitors. Use magnet wire or something to connect it. The inductor goes between pin L+ and the Batt+ hole (see the data sheet for more detail.) Don't forget to get the capacitor polarity right, tantalums mark the + not the -.



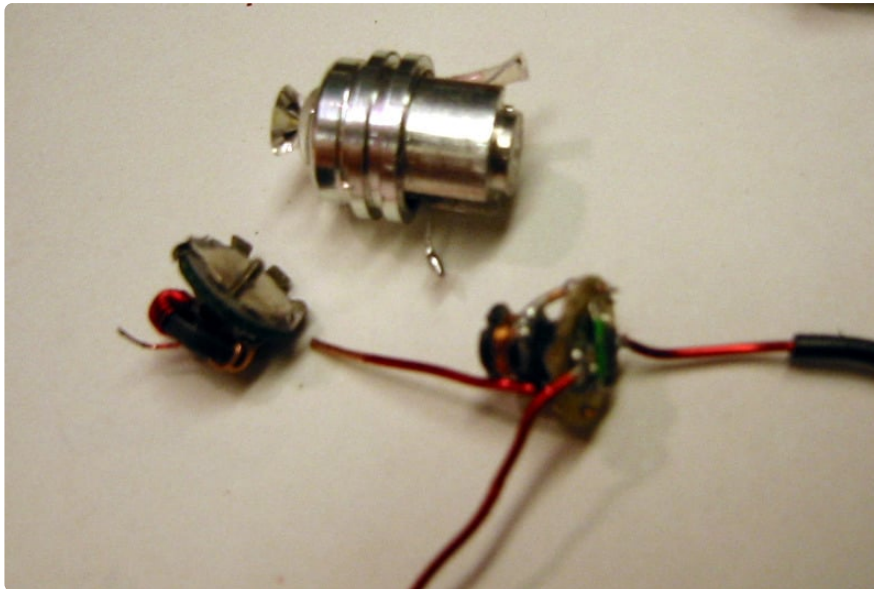


Fuzzy images of the top and bottom. There are three wires coming out: GND (with a black tape around it), LED+ (the other across from gnd), and BATT+ (on the other size).

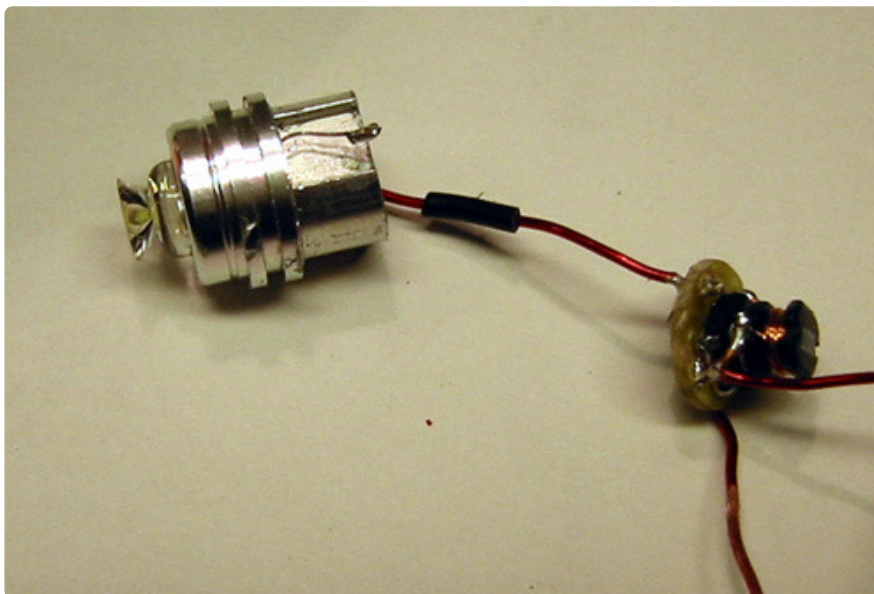
4. Try to keep the PCB as small as possible, it has to fit in a small space.



5. Remove the old circuit board by desoldering two of the mini-transformer leads, unbending the metal bits, and using a size #00 phillips to unscrew the board.

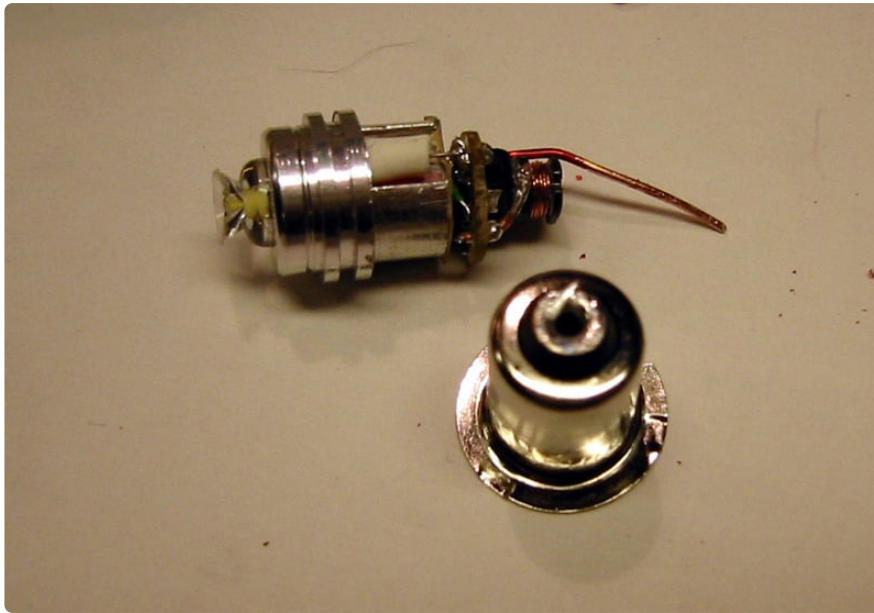


6. Grind down the heatsink a few mm to allow the new board some space in the casing.



7. Now would be a good time to test that the circuit works. Hook up BATT+ and GND to a powersupply, verify that LED+ is at 3.3V. Make a fake load with an extra white luxeon you have kicking around or a 1W 10ohm resistor (or 4 40ohm resistors in parallel, whichever). Verify you still get 3.3V out, you should be sinking ~300mA through the load.

8. Put a piece of doublesided tape on the heatsink to keep from shorting the pcb on the aluminium. Clip the leads and solder them to the LED. Get the polarity right, LED+ is marked with a bit of red glue on the heatsink. LED- is GND is case so dont worry about shorting them together. With a hot iron, solder LED- to the heatsink, in the indentation, so that it doesnt jut out but is a solid connection.



LED+ is protected from touching the heatsink (GND) with a small piece of heatsink, the board sits flush against the heatsink, hopefully will cool the boost converter a little as well as the LED.

9. Carefully reassemble the bulb (test it again?) and solder the bulb bottom back with a big glob of solder. Depending on how much you ground off the heatsink it won't fit together as well as before since the boost is a bit larger than the previous circuit.

Downloads & More Info

PCB Files

- The 3.3V [miniboost pcb files](https://adafru.it/cnp) (<https://adafru.it/cnp>) in Eagle 4.1 format (a free PCB editor for windows & linux)

Datasheets

- [MAX1675](https://adafru.it/c85) (<https://adafru.it/c85>) boost converter
- Smallest [inductor](https://adafru.it/c87) (<https://adafru.it/c87>) digikey sells
- [Luxeon 1W White](https://adafru.it/c89) (<https://adafru.it/c89>) side emitter

Parts list

These parts are all available from [DigiKey \(https://adafru.it/c8b\)](https://adafru.it/c8b).

- MAX1675 (You can [sample \(https://adafru.it/c8d\)](https://adafru.it/c8d) this from [Maxim \(https://adafru.it/c8f\)](https://adafru.it/c8f) for free.)
- 10-22uH SMD inductor, at least 1A current capacity, such as the CDRH6D28
- 2 .1-1uF 0603 capacitors
- Size-code A 47uF, 4V tantalum capacitor
- Size-code B 47uF, 10V tantalum capacitor