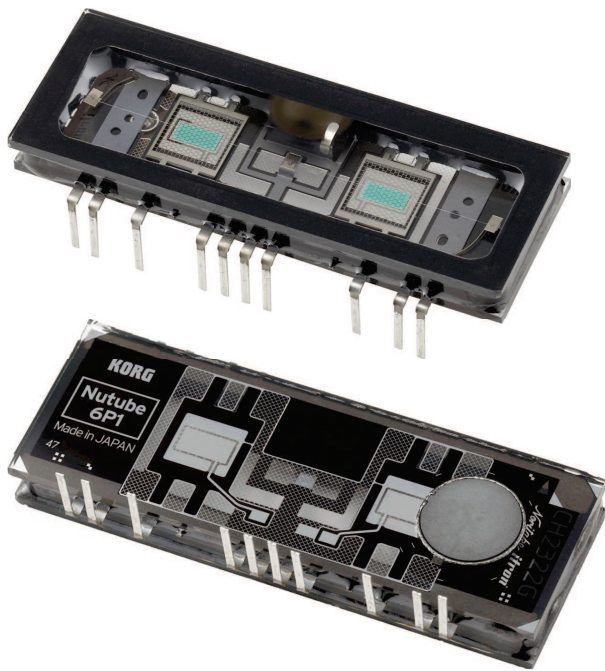


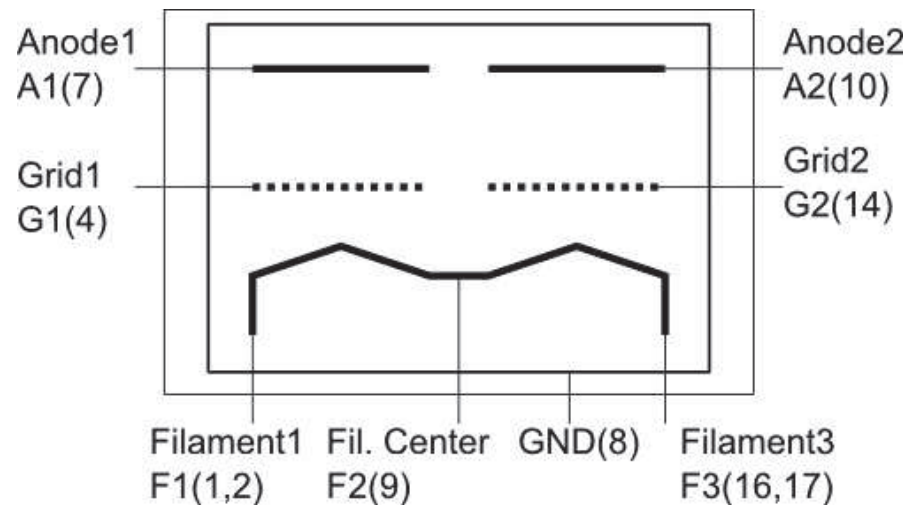
# Application notes for Nutube

**KORG**

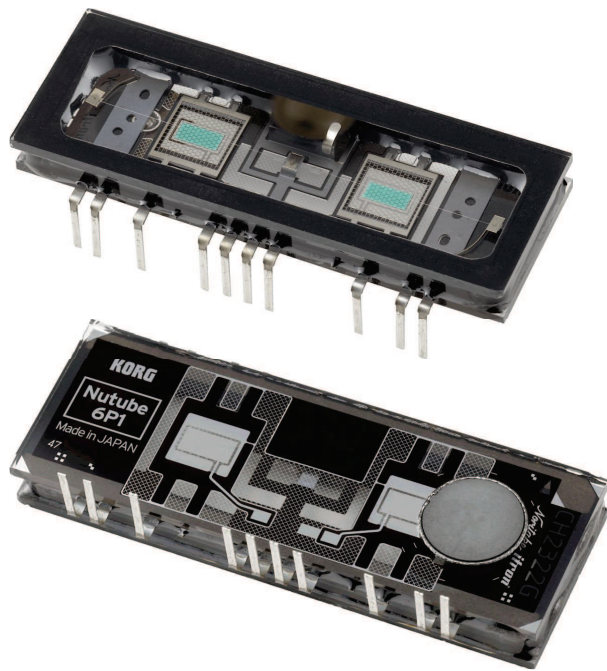
# Structure



## Direct-heating twin triode



# Advantages



Low power consumption  
Only 12mW per each channel

Low voltage  
Operating from 5V

High quality  
Made in Japan





# Pin assignments & hole sizes

## Pin assignments

| Pin No.    | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8   | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|------------|----|----|----|----|----|----|----|-----|----|----|----|----|----|----|----|----|----|
| Assignment | F1 | F1 | NP | G1 | NP | NP | A1 | GND | F2 | A2 | NP | NP | NP | G2 | NP | F3 | F3 |

F1 : Filament 1(Left)

F2 : Filament 2(Center)

F3 : Filament 3(Right)

NP : No Pin

GND : Internal shield, connect to GND

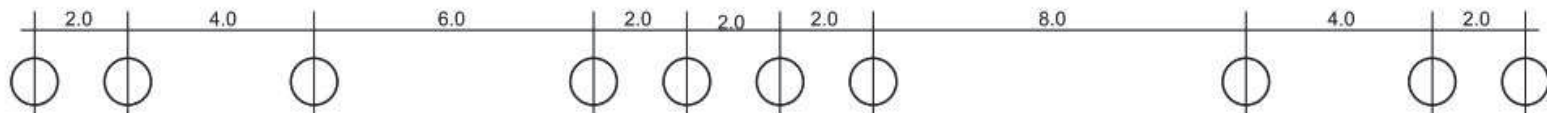
G1 : Grid 1

G2 : Grid 2

A1 : Anode 1

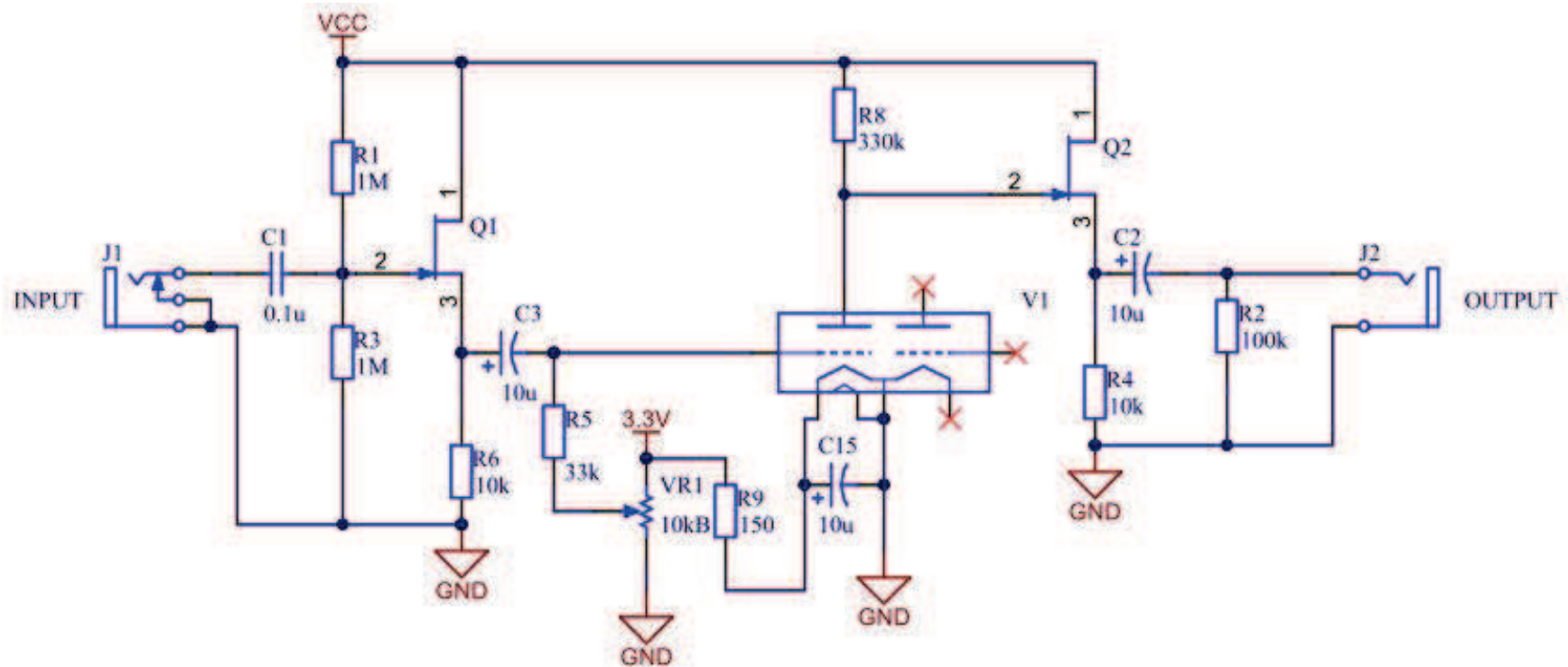
A2 : Anode 2

PCB hole arrangements.  $\phi=1.0\text{mm}$  recommended.



# Basic circuit of Nutube

An example of single amplifier

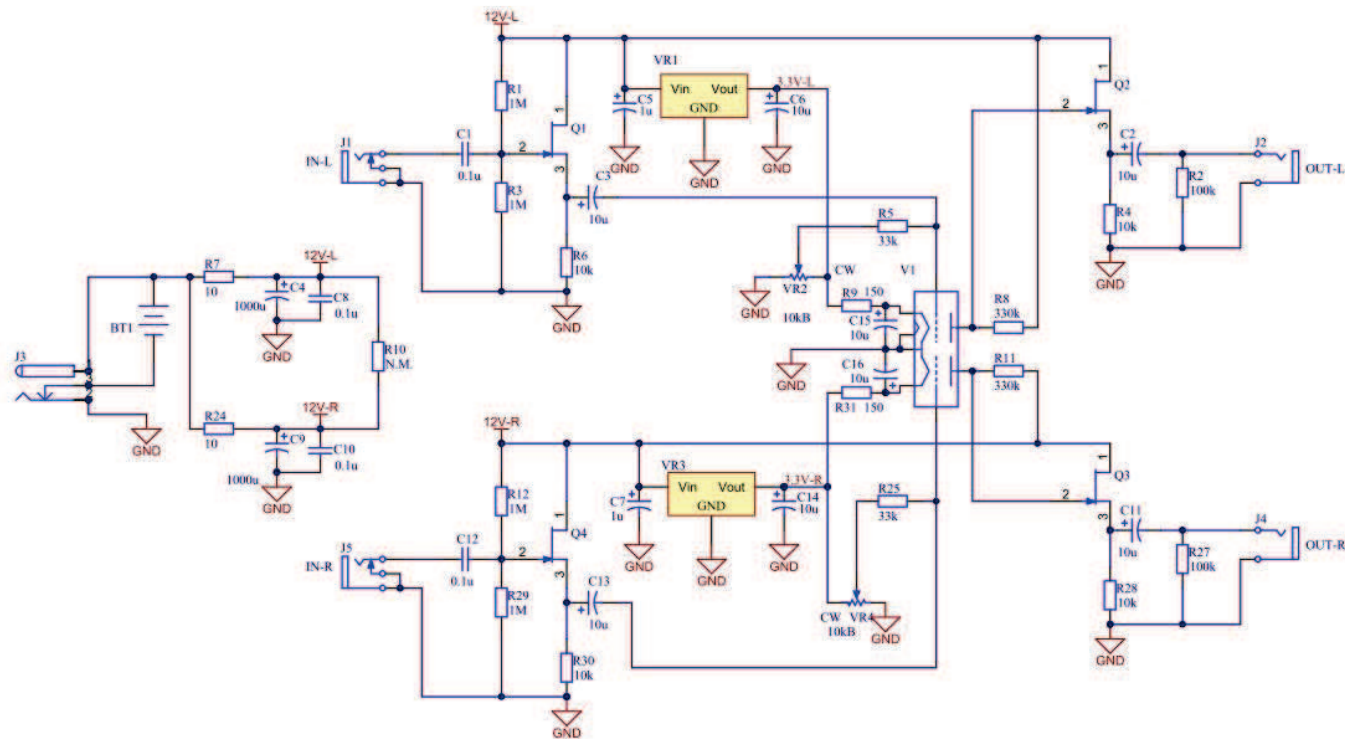


# Audio characteristics(1)

VCC=12V  
Anode load=330kΩ

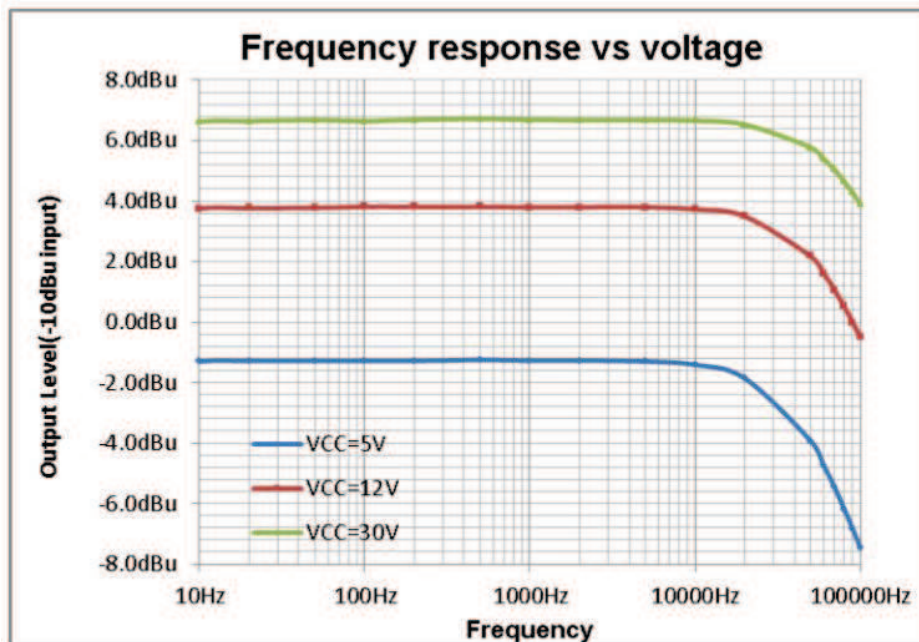
|                       |       |
|-----------------------|-------|
| Gain                  | 14dB  |
| Maximum output        | 10dBV |
| S/N ratio(A-weighted) | 102dB |
| Cut-off frequency     | 75kHz |
| Crosstalk 1kHz        | -79dB |
| Crosstalk 10kHz       | -70dB |
| Crosstalk 100kHz      | -55dB |

Measurement circuit

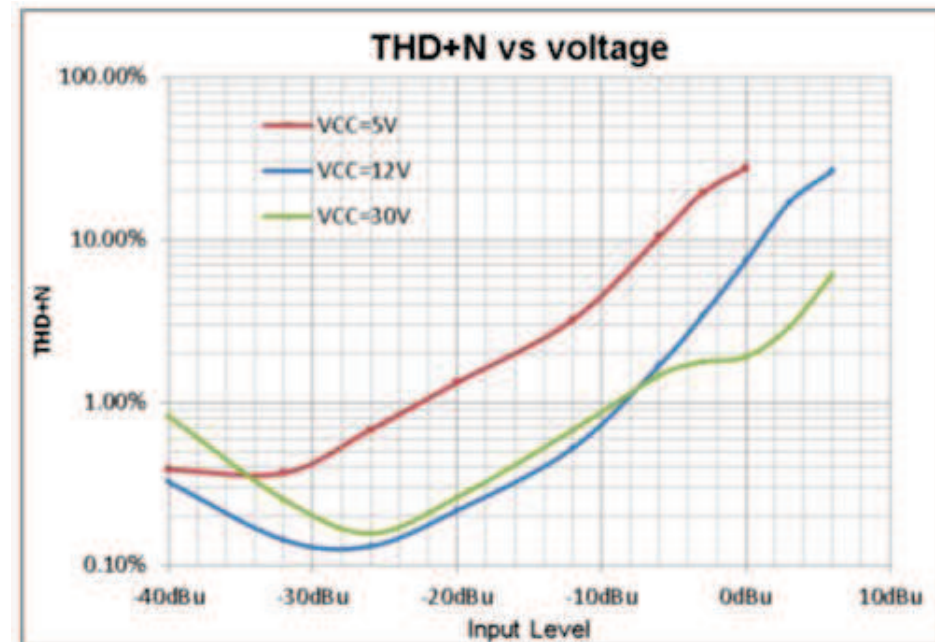


# Audio characteristics(2)

Frequency responses



THD+N



# Power supply / Anode load

Power supply voltage(VCC) : 5 - 80V

Exceeded power supply is out of warranty.

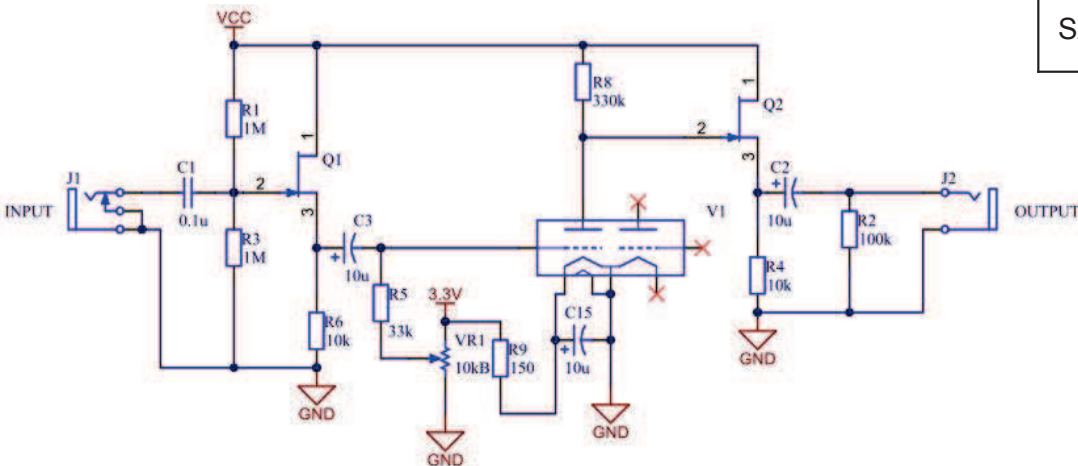
Recommended anode load resistances :  
100k - 330k $\Omega$

Audio characteristics on each VCC voltage

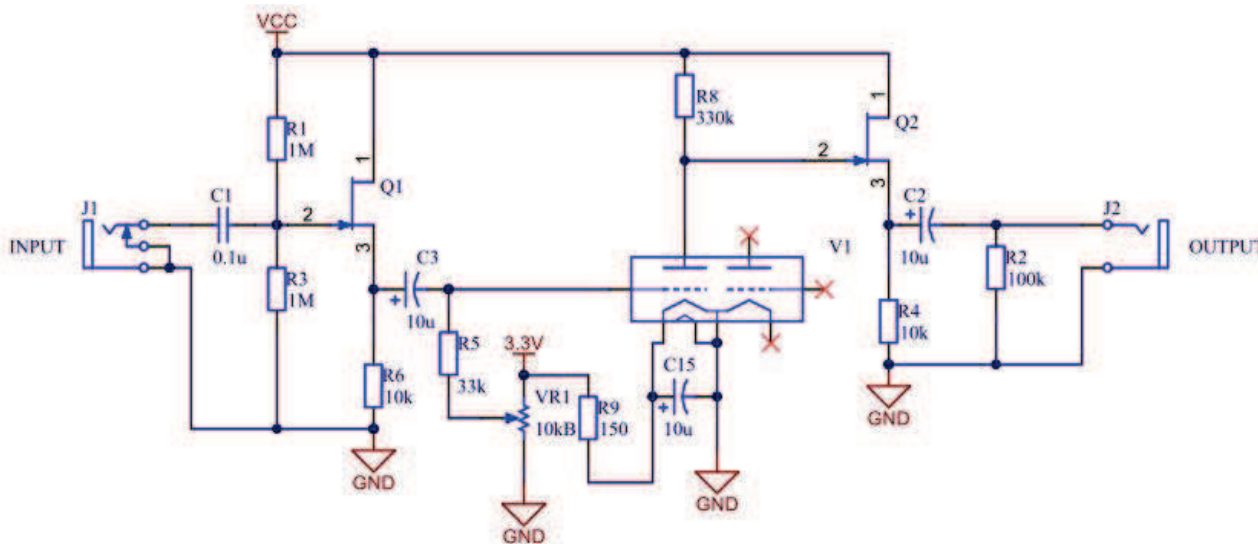
|            | 5V    | 9V   | 12V   | 30V   |
|------------|-------|------|-------|-------|
| Gain       | 8dB   | 13dB | 14dB  | 17dB  |
| Max Output | -2dBV | 7dBV | 10dBV | 20dBV |
| S/N        | 91dB  | 99dB | 102dB | 110dB |

Audio characteristics  
on each anode load resistance(VCC=12V)

|               | 100k   | 220k   | 330k  |
|---------------|--------|--------|-------|
| Gain          | 9dB    | 13dB   | 14dB  |
| Cut-off Freq. | 380kHz | 100kHz | 75kHz |



# Biasing voltage / resistance



Grid biasing: 2 - 3V (VCC=12V)

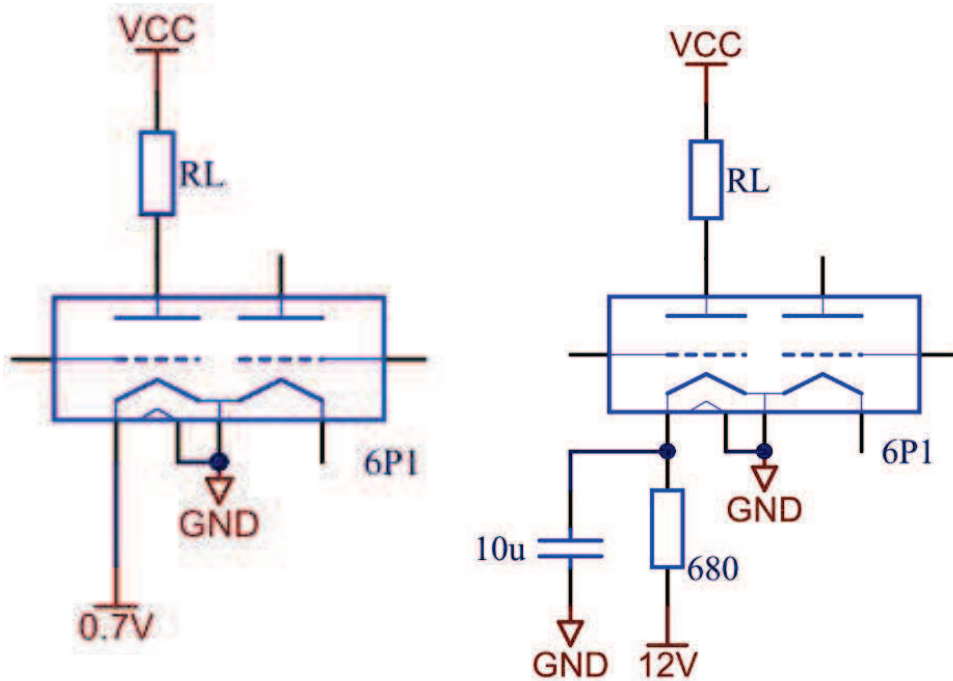
Using trimmer pot is recommended for precise adjustment of biasing voltage.

Biasing resistance: 10k - 33k $\Omega$

Considerable grid current would not allow large biasing resistance. Grid current is around 30 $\mu$ A at maximum.

# Filament ratings

Filament circuits



Filament rating : 0.7V 17mA(41Ω)

Direct current is recommended.

Inserting capacitor(10μF or more) between filament and GND improves residual noise.

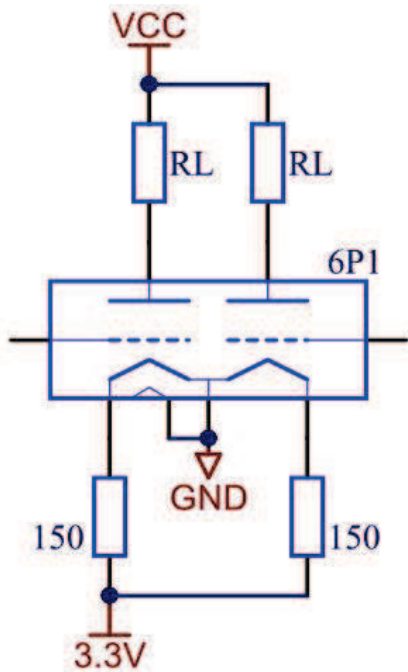
8pin(GND) should be connected to GND to maintain shielding effect.

Recommended resistance values connecting to filament on each VCC voltage.

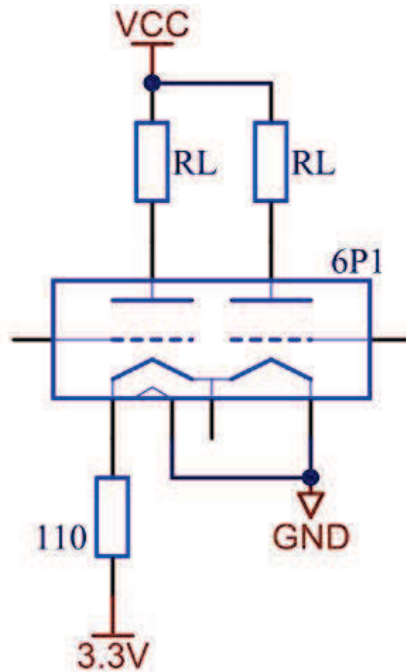
|      |      |
|------|------|
| 12V  | 680Ω |
| 9V   | 470Ω |
| 5V   | 240Ω |
| 3.3V | 150Ω |

# Using both circuits

Parallel connection



Series connection



Parallel connection of filaments enables to have each filament voltage same.

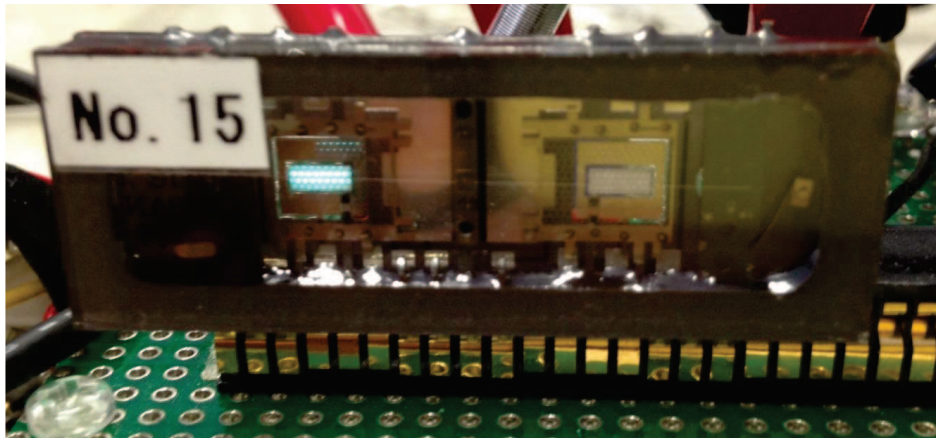
In series connection, filament current is half of that of parallel connection, which would improve battery life.

# Warning

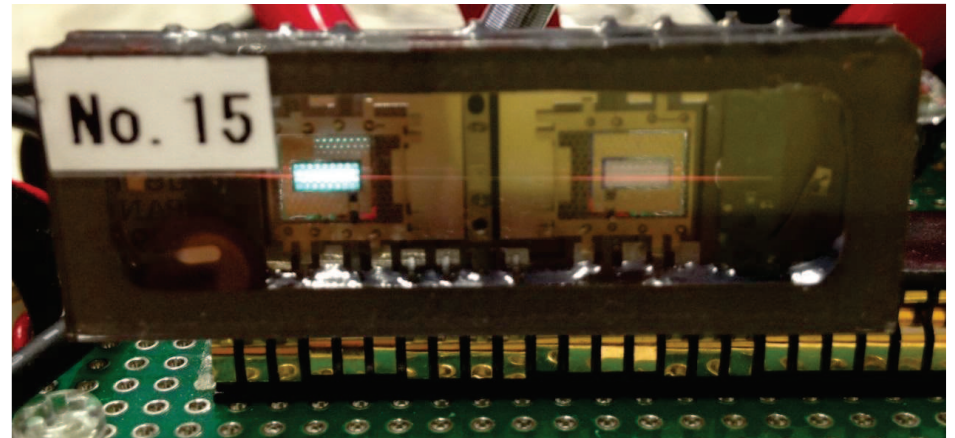
**DO NOT exceed filament rating (0.7V 17mA).**

Exceeded filament voltage would easily burn out the filament !  
The red-heated filament shows the overcurrent of the filament.

Normal state  
Filament 0.7V 17mA



Exceeded filament current(25mA)



# To prevent microphonic noise

A Nutube is a direct-heating tube which means it tends to cause microphonic noise. The external vibration reaches the tube mainly through the mounted circuit board as well as the air around the tube.

## 1.To prevent the vibration from the circuit board (Fig.1)

Insert cushion(sponge or something soft) between Nutube(or the board mounting Nutube) and the main circuit board. The harness connecting Nutube and the main circuit board should be soft and thin enough.

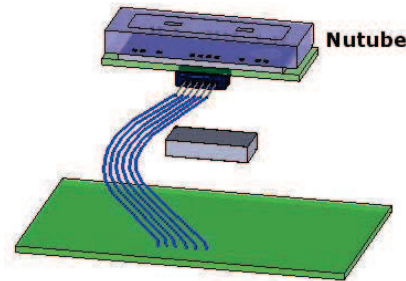


Fig.1

## 2.To prevent the vibration from the air (Fig.2)

The vibration of the air(sound) reaching the surface glass of Nutube causes the microphonic noise. Especially, a Nutube tends to catch the sound contains high frequencies(Ex. metallic sound) .

Putting Nutube in a box helps prevent such vibrations.

Filling chassis with acoustic material would help further reducing of the noise.

Putting heavy metal plate(Ex. plate of lead) on the surface of a Nutube may also works.

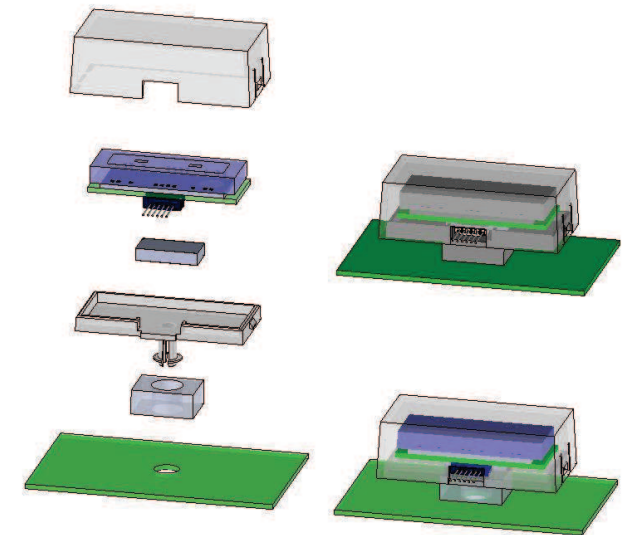


Fig.2