

# HAMAMATSU

## FLAME SENSOR UVtron®



UVtron is an ultraviolet detector tube that uses the photoelectric effect of metal and gas multiplication effect of electric current by means of discharge. It has a very narrow range of sensitivity from 185 nm to 300 nm and is completely insensitive to visible light. Because it used the discharge phenomenon, its sensitivity is high and an adequate output voltage is obtained, making it possible to design a high-sensitivity, quick response ultraviolet detection with simple circuitry.

The UVtron reliably detects faint ultraviolet emissions from flames, making it ideal for applications such as fire alarms, arson surveillance, and burner combustion monitor devices. The UVtron can also detect discharges such as corona discharges from high-voltage power transmission lines.

### FEATURES

- Capability of Detecting Very Weak Ultraviolet Rays (from 1 pW)
- Not Sensitive to Visible and Infrared Light (Solar Blind Characteristics)
- High Reliability and long service life (10 000 hours of Continual Discharge Operation)
- High Speed Response (A Few Milliseconds)
- Low Current Operation
- Compact and Lightweight

### APPLICATIONS

- Combustion Monitoring Apparatus for Gas and Oil Burner
- Fire Alarm Apparatus
- Arson Watch Monitors
- Photoelectronic Counter
- Detection of Ultraviolet Ray Leakage
- Detection of Discharge Phenomenon

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# FLAME SENSOR UVtron®

| Type No. | Feature | Dimensional Outline | Bulb Material | Electrode Material | Weight (g) | Spectral Response (nm)<br>Symbol (Fig. 2) | Maximum Rating        |                                               |                                  |                                    |
|----------|---------|---------------------|---------------|--------------------|------------|-------------------------------------------|-----------------------|-----------------------------------------------|----------------------------------|------------------------------------|
|          |         |                     |               |                    |            |                                           | Supply Voltage (V dc) | Average Discharge Current (mA) <sup>(A)</sup> | Peak Current (mA) <sup>(B)</sup> | Operation Ambient Temperature (°C) |

## For Fire Detection

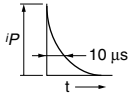
|                 |                                                |   |          |    |     |              |     |   |    |             |
|-----------------|------------------------------------------------|---|----------|----|-----|--------------|-----|---|----|-------------|
| <b>R244</b>     | High-voltage operation, standard type          | ❶ | UV Glass | Ni | 3   | 185 to 260/A | 575 | 3 | 50 | -20 to +125 |
| <b>R259</b>     | Low-voltage operation, standard type           | ❶ | UV Glass | Ni | 3   | 185 to 260/A | 420 | 3 | 50 | -20 to +125 |
| <b>R1753-01</b> | Low-voltage operation, high-sensitivity        | ❷ | UV Glass | Ni | 4   | 185 to 260/A | 420 | 3 | 50 | -20 to +125 |
| <b>R2868</b>    | Low-voltage operation, small size              | ❸ | UV Glass | Ni | 1.5 | 185 to 260/A | 400 | 1 | 30 | -20 to +60  |
| <b>R9454</b>    | Small size, resist mechanical shock            | ❹ | UV Glass | Ni | 1.5 | 185 to 260/A | 500 | 1 | 30 | -20 to +60  |
| <b>R9533</b>    | Low-voltage operation, resist mechanical shock | ❺ | UV Glass | Ni | 2.5 | 185 to 260/A | 400 | 1 | 30 | -20 to +125 |

## For Burner Monitoring

|                |                                      |   |          |    |   |              |                         |    |     |             |
|----------------|--------------------------------------|---|----------|----|---|--------------|-------------------------|----|-----|-------------|
| <b>R259-01</b> | Low-voltage operation, standard type | ❶ | UV Glass | Mo | 3 | 185 to 300/B | 420                     | 5  | 100 | -20 to +125 |
| <b>R1868</b>   | Low-voltage, high-current operation  | ❻ | UV Glass | W  | 4 | 185 to 280/C | 425 (300 <sup>Ⓒ</sup> ) | 10 | 200 | -20 to +125 |
| <b>R2121</b>   | High-voltage, high-current operation | ❻ | UV Glass | W  | 4 | 185 to 280/C | 575 (400 <sup>Ⓒ</sup> ) | 10 | 200 | -20 to +125 |

(A) Even at these current values, the electrodes are not consumed immediately, but the service life is noticeably reduced. Use the tube within the recommended current values.

(B) This is the maximum momentary current that can be handled if its full width at half maximum is less than 10  $\mu$ s.



(C) These are representative values for a wavelength of 200 nm and a light input of 10 pW/cm<sup>2</sup>. Think of these values as relative sensitivity values. In actual use, the sensitivity will vary with the wavelength of the ultraviolet radiation and the drive circuitry employed.

(D) Measured under room illuminations (approximately 500 lux) and recommended operating conditions. Note that these values will increase somewhat in outdoor uses due to the effect of sunlight.

(E) This is the service life under the recommended operating conditions. Since high ambient temperatures will reduce the service life, when using the tube in a high-temperature application, such as a burner monitor, consider using air-cooling.

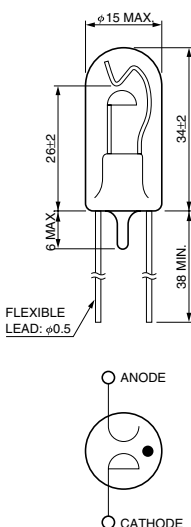
(F) When configuring the tube with an external quenching circuit, use circuit constants so that the quenching time becomes longer than these values listed. When using a pulse driven circuit using CR, if the applied voltage is in the recommended range, the quenching time  $t_q$  can be calculated with the following formula. (Refer to the diagram of the recommended operating circuit.)

$$t_q \approx 0.5 \times C_1 \cdot R_1$$

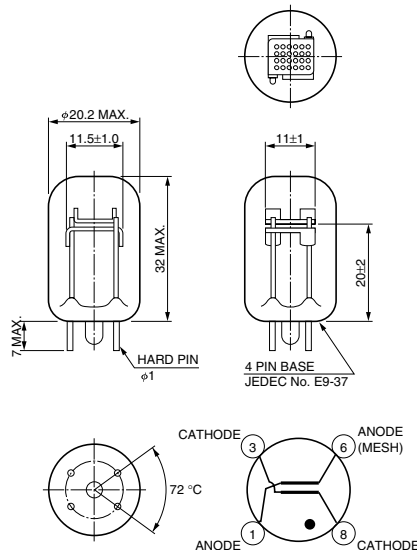
(G) The RMS voltage when pulsating current is supplied.

Figure 1: Dimensional Outline (Unit: mm)

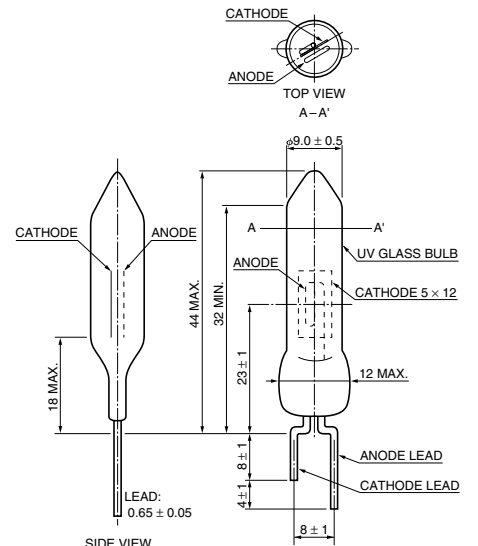
### ❶ R244, R259, R259-01



### ❷ R1753-01



### ❸ R2868



| Characteristics (at 25 °C)                      |                                                   |                                                          |                                                         |                                              | Recommended Operating Parameters |                                         |                                   | Socket<br>(Sold Separately)<br>(Fig. 3) | Type No. |
|-------------------------------------------------|---------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|----------------------------------------------|----------------------------------|-----------------------------------------|-----------------------------------|-----------------------------------------|----------|
| Discharge<br>Starting Voltage<br>Max.<br>(V dc) | Discharge<br>Sustaining Voltage<br>Typ.<br>(V dc) | Sensitivity <sup>③</sup><br>Typ.<br>(min <sup>-1</sup> ) | Background <sup>④</sup><br>Min.<br>(min <sup>-1</sup> ) | Service Life <sup>⑤</sup><br>Typ.<br>(hours) | Supply<br>Voltage<br>(V dc)      | Average<br>Discharge<br>Current<br>(mA) | Quenching<br>Time<br>Min.<br>(ms) |                                         |          |

|     |     |       |    |       |        |     |   |         |          |
|-----|-----|-------|----|-------|--------|-----|---|---------|----------|
| 440 | 330 | 600   | 5  | 10000 | 500±50 | 0.3 | 1 | —       | R244     |
| 260 | 220 | 600   | 5  | 10000 | 325±25 | 0.3 | 1 | —       | R259     |
| 260 | 185 | 10000 | 5  | 10000 | 325±25 | 0.3 | 2 | E678-9C | R1753-01 |
| 280 | 240 | 5000  | 10 | 10000 | 325±25 | 0.3 | 2 | —       | R2868    |
| 360 | 300 | 4000  | 10 | 10000 | 400±25 | 0.3 | 2 | —       | R9454    |
| 280 | 230 | 10000 | 10 | 10000 | 350±25 | 0.3 | 1 | E678-8F | R9533    |

|                            |     |      |    |       |                                  |     |   |         |         |
|----------------------------|-----|------|----|-------|----------------------------------|-----|---|---------|---------|
| 260                        | 200 | 200  | 10 | 10000 | 325±25                           | 0.5 | 1 | —       | R259-01 |
| 240<br>(170 <sup>⑥</sup> ) | 170 | 1500 | 10 | 10000 | 310±30<br>(220±20 <sup>⑥</sup> ) | 2   | 2 | E678-9C | R1868   |
| 440<br>(310 <sup>⑥</sup> ) | 310 | 1500 | 10 | 10000 | 500±50<br>(350±35 <sup>⑥</sup> ) | 2   | 2 | E678-9C | R2121   |

Figure 2: Spectral Response

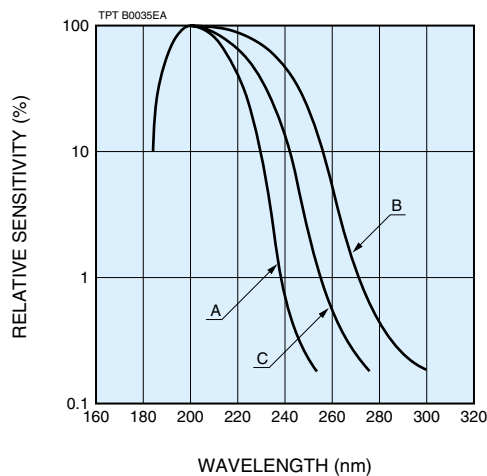
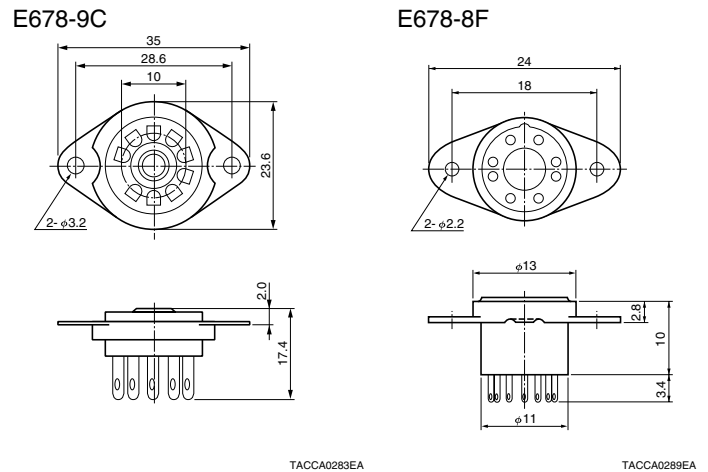
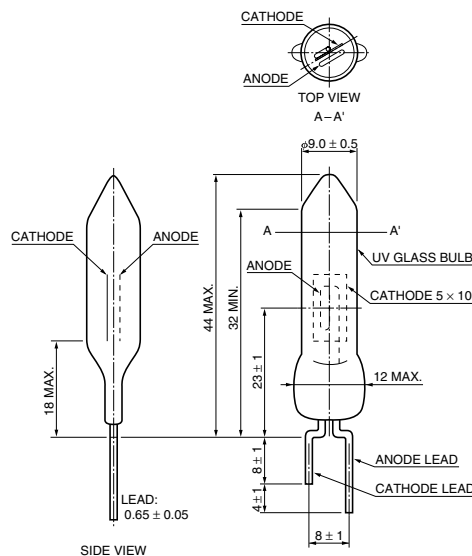


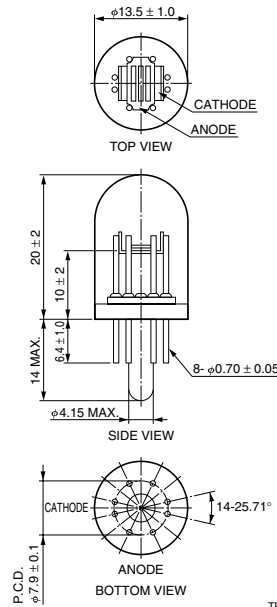
Figure 3: Sockets (Unit: mm)



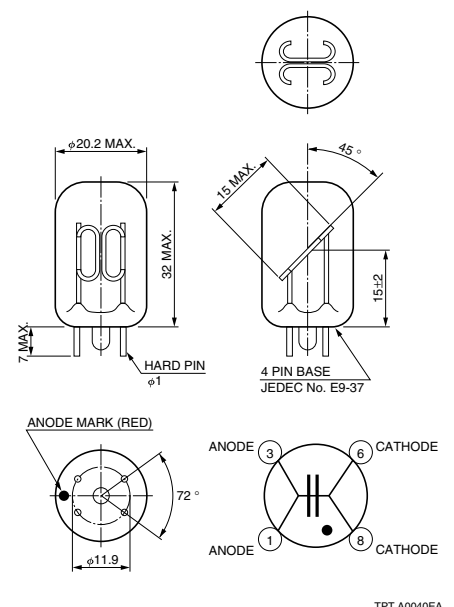
## ④ R9454



## ⑤ R9533

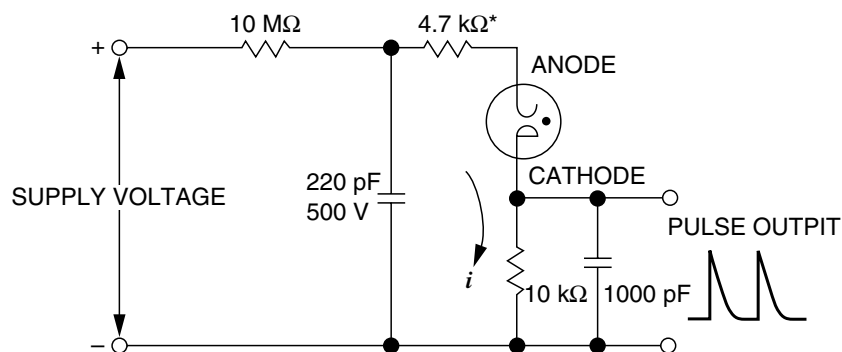


## ⑥ R1868, R2121



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Figure 4: Recommended Driver Circuits



\* This 4.7 kΩ resistor must be connected within 2.5 cm from the tip of the UVtron anode lead.

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## ■ PRECAUTIONS FOR USING THE UV TRON

### ● UV TRON light emission

When the UVtron discharges, it emits ultraviolet radiation. If a number of UVtron are used in close proximity, they must be arranged so that they will not interfere with each other optically.

### ● Humidity

Humidity around the leads for the UVtron generates leak current, dropping the anode voltage, and stopping the tube from operating. In particular, if dirt, dust etc. get on the leads, that makes it easier for humidity to be absorbed, so keep the area around the leads clean.

### ● Dirt on the window

Since the UVtron operates at high voltage, static electricity causes dust to build up on the surface of the glass bulb. This invites lowering of the ultraviolet transmissivity and sensitivity of the UVtron, so periodic maintenance, such as wiping off with gauze dipped in alcohol, is necessary.

### ● Soldering

For mounting the UVtron on a printed circuit board, solder it quickly (350 °C for less than 5 seconds). If the leads are heated excessively, the glass can crack or the characteristics of the UVtron deteriorate. After soldering, wipe away the solder flux with alcohol or a similar agent. If the leads are left dirty, current leak due to humidity will lower the voltage applied to the UVtron socket available from HAMAMATSU.

### ● Vibration and shock

UVtrons have passed vibration and shock tests in compliance with JIS C 60068-2-6 (sinusoidal vibration test - R9454, R9533: 3.0 mm peak to peak, 200 m/s<sup>2</sup>, 10 Hz to 2000 Hz; other types: 1.5 mm peak to peak, 100 m/s<sup>2</sup>, 10 Hz to 500 Hz) and JIS C 60068-2-27 (shock test - R9454, R9533: 10000 m/s<sup>2</sup>, 1 ms; other types: 1000 m/s<sup>2</sup>, 11 ms). However Cif subjected to strong mechanical shocks such as drop impacts, the glass envelope may crack or internal electrodes may deform resulting in poor electrical characteristics. So use extreme caution when handling the UVtron.

### ● Polarity

Connect the UVtron with correct polarity. Reverse polarity connection will cause malfunction or breakdown.

## ■ WARRANTY

The UV TRON is covered by a warranty for a period of one year after delivery. The warranty is limited to replacement of any defective tube due to defects traceable to the manufacturer.

# HAMAMATSU

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