

### Quick Detection of Flame from Distance, Compact UV Sensor with High Sensitivity and Wide Directivity, Suitable for Flame Detectors and Fire Alarms.

Hamamatsu R2868 is a UV TRON ultraviolet detector that makes use of the photoelectric effect of metal and the gas multiplication effect. It has a narrow spectral sensitivity of 185 to 260 nm, being completely insensitive to visible light. Unlike semiconductor detectors, it does not require optical visible-cut filters, thus making it easy to use.

In spite of its small size, the R2868 has wide angular sensitivity (directivity) and can reliably and quickly detect weak ultraviolet radiations emitted from flame due to use of the metal plate cathode (eg. it can detect the flame of a cigarette lighter at a distance of more than 5 m.).

The R2868 is well suited for use in flame detectors and fire alarms, and also in detection of invisible discharge phenomena such as corona discharge of high-voltage transmission lines.

#### APPLICATIONS

- Flame detectors for gas/oil lighters and matches
- Fire alarms
- Combustion monitors for burners
- Inspection of ultraviolet leakage
- Detection of discharge
- Ultraviolet switching

#### GENERAL

Parameters	Rating	Units
Spectral Response	185 to 260	nm
Window Material	UV glass	—
Weight	Approx. 1.5	g
Dimensional Outline	See Fig. 3	—

#### MAXIMUM RATINGS

Parameters	Rating	Units
Supply Voltage	400	Vdc
Peak Current <sup>1)</sup>	30	mA
Average Discharge Current <sup>2)</sup>	1	mA
Operating Temperature	-20 to +60	°C

#### CHARACTERISTICS (at 25°C)

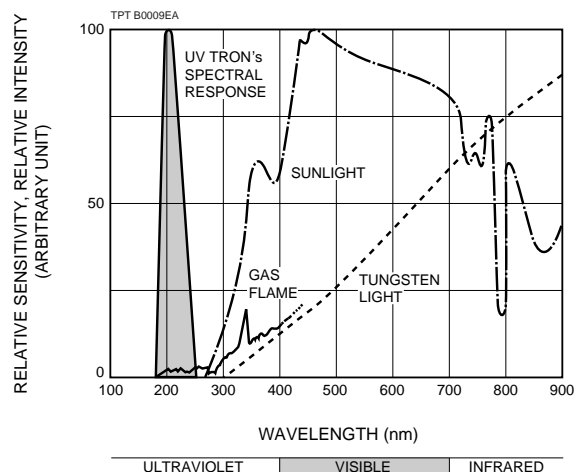
Parameters	Rating	Units
Discharge Starting Voltage (with UV radiation)	280	Vdc Max.
Recommended Operating Voltage	325±25	Vdc
Recommended Average Discharge Current	100	µA
Background <sup>3)</sup>	10	cpm Max
Sensitivity <sup>4)</sup>	5000	cpm Typ.



#### NOTES:

- 1) This is the maximum momentary current that can be handled if its full width at half maximum is less than 10 µs.
- 2) If the tube is operated near this or higher, the service life is noticeably reduced. Use the tube within the recommended current values.
- 3) Measured under room illuminations (approximately 500 lux) and recommended operating conditions. Note that these values may increase if the following environmental factors are present.
  1. Mercury lamps, sterilization lamps, or halogen lamps are located nearby.
  2. Direct or reflected sunlight is incident on the tube.
  3. Electrical sparks such as welding sparks are present.
  4. Radiation sources are present.
  5. High electric field (including static field) generates across the tube.
- 4) These are representative values for a wavelength of 200 nm and a light input of 10 pW/cm<sup>2</sup>. In actual use, the sensitivity will vary with the wavelength of the ultraviolet radiation and the drive circuitry employed.

Figure 1: UV TRON's Spectral Response and Various Light Sources



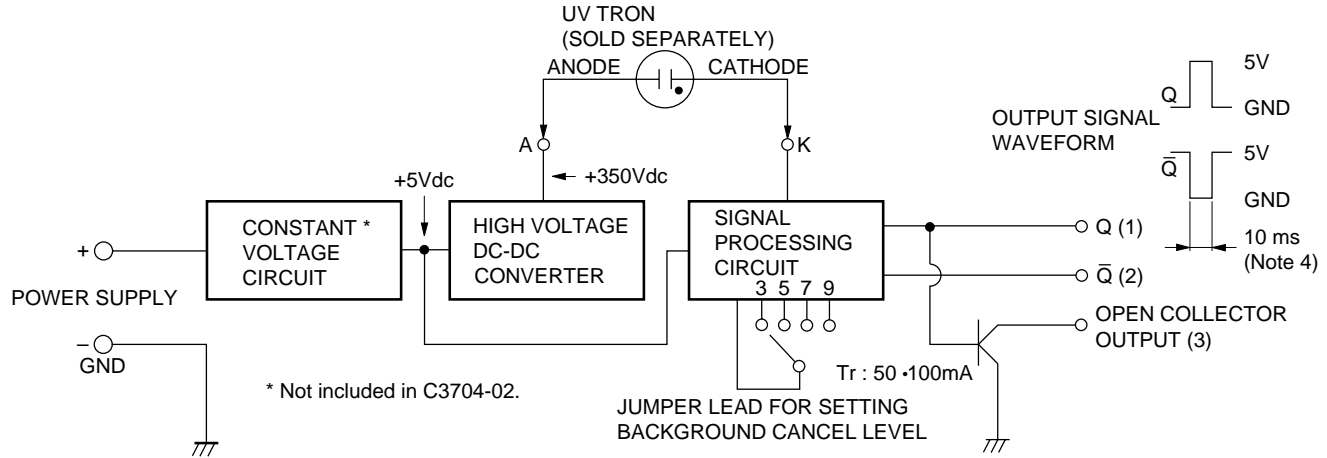
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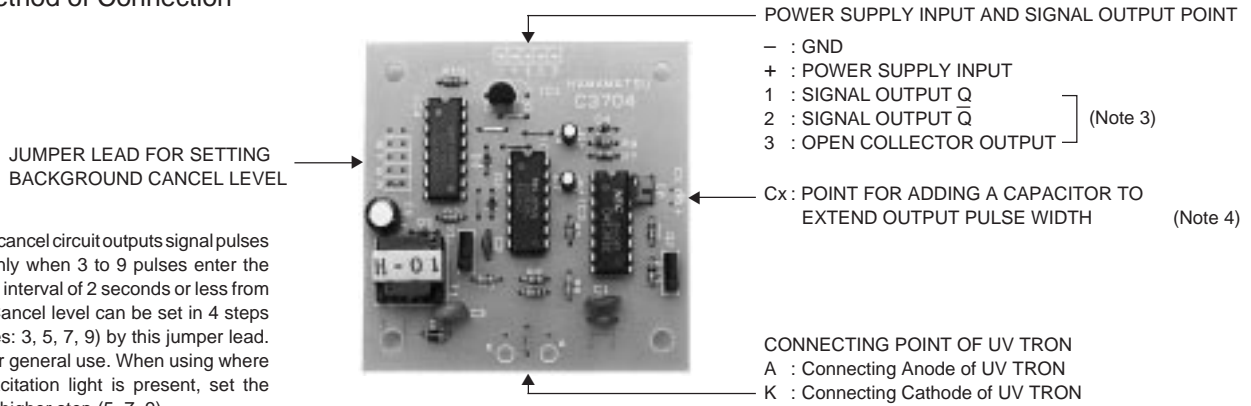
# UV TRON® DRIVING CIRCUIT C3704 SERIES

Figure 2: Schematic Diagram



TPT C0004EA

Figure 3: Method of Connection



This background cancel circuit outputs signal pulses of 10ms width only when 3 to 9 pulses enter the circuit with a time interval of 2 seconds or less from the UV TRON. Cancel level can be set in 4 steps (number of pulses: 3, 5, 7, 9) by this jumper lead. Connect to "3" for general use. When using where much natural excitation light is present, set the cancel level at a higher step (5, 7, 9).

Note 3: No load can be driven by an output from points "1" and "2" because these signals are output from the only C-MOS IC directly. When a load such as a buzzer and a relay is connected to this circuit, it should be connected to the point open collector output. The transistor ratings of the open collector is 50V, 100mA. Be careful not to exceed the ratings.

Note 4: The output pulse width is set to 10ms at shipping. If the pulse width needs to be extended, add a capacitor to this point. (When using an electrolytic condenser, make sure the polarity is correct.)  
e.g. CX = 1 μF: Pulse Width ≈ 1s, CX=10 μF: Pulse Width ≈ 10s

## PRECAUTIONS FOR USE

- Since the operation impedance is extremely high, the UV TRON should be connected as close as possible to the circuit board within 5 cm.
- Take care to avoid external noise since a C-MOS IC is used in the circuit. It is recommended that the whole PC board be put in the shield box when it is used.
- To reduce current consumption, oscillating frequency is very low (approx. 20 Hz) in this DC-DC converter. Thus, the output impedance of the high voltage power supply is extremely high. If the surrounding humidity is high, electrical leakage on the PC board surface may lead to a drop in the supply voltage to the UV TRON. This voltage drop may result in lowered detection performance, so a moistureproof material (silicone compound, etc.) should be applied at the connecting point of the UV TRON, etc., if using the unit in a humid environment.

- A model equipped with a flame sensor (R2868) is also available.

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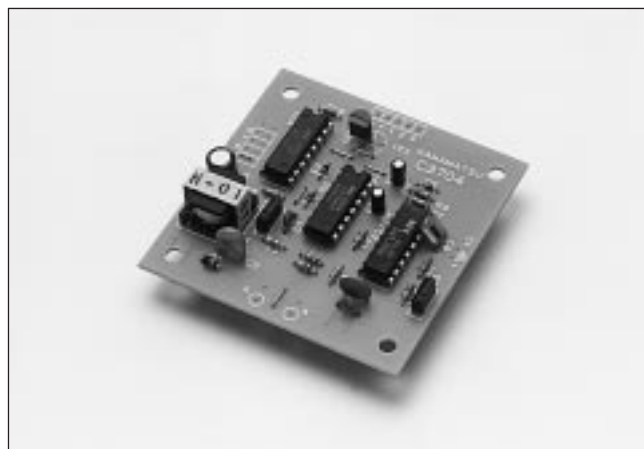
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JUL.1997 CR  
Created in Japan

### Compact, Lightweight, Low Current Consumption, Low Cost Operates as High Sensitivity UV Sensor with UV TRON Suitable for Flame Detectors and Fire Alarms

Hamamatsu C3704 series UV TRON driving circuits are low current consuming, signal processing circuits for the UV TRON, well known as a high sensitivity ultraviolet detecting tube. The C3704 series can be operated as a UV sensor by connecting the UV TRON and applying DC low voltage, as they have both a high-voltage power supply and a signal processing circuit on the same printed circuit board.

Since background discharges of the UV TRON caused by natural excitation lights (such as a cosmic ray, scattered sunlight, etc.) can be cancelled in the signal processing circuit, the output signals from the C3704 series can be used without errors.

When the high sensitivity sensor "UV TRON R2868" (sold separately) is used, the flame from a cigarette lighter (flame length: 25mm) can be detected even from a distance of more than 5m.



#### APPLICATIONS

- Flame detectors for gas and oil lighters
- Fire alarms
- Combustion monitors for burners
- Electric spark detector
- UV photoelectric counter

#### SPECIFICATIONS

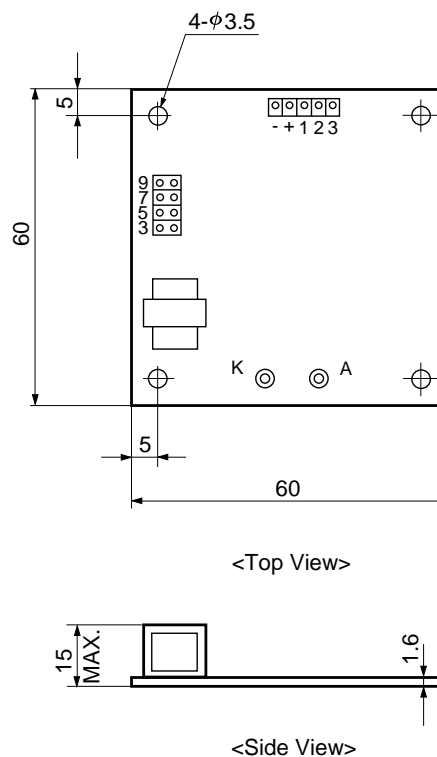
Dimensional outline ..... Figure 1  
 Weight ..... Approx. 20g  
 Output signal ..... Open collector Output (50 V, 100 mA Max.)  
 10 ms width pulse output (Note : 1)  
 UV TRON supply voltage ..... DC 350 V (Note : 2)  
 Quenching time ..... Approx. 50 ms  
 Operating temperature ..... -10 to +50°C  
 (with no condensation)  
 Suitable UV TRON ..... Low voltage operation UV TRON  
 (such as R2868)

	C3704	C3704-02	C3704-03
Input Voltage	10 to 30 Vdc	5Vdc ± 5%	6 to 9 Vdc
Current consumption	3 mA Max.	300µA Max.	300µA Max.

Note 1: The output pulse width can be extended up to about 100s by adding a capacitor to the circuit board.

Note 2: Since the output impedance of this power supply is extremely high, an ordinary voltmeter cannot be used. Use a voltmeter that has an input impedance of more than 10 GΩ.

Figure 1: Dimensional Outline (Unit : mm)



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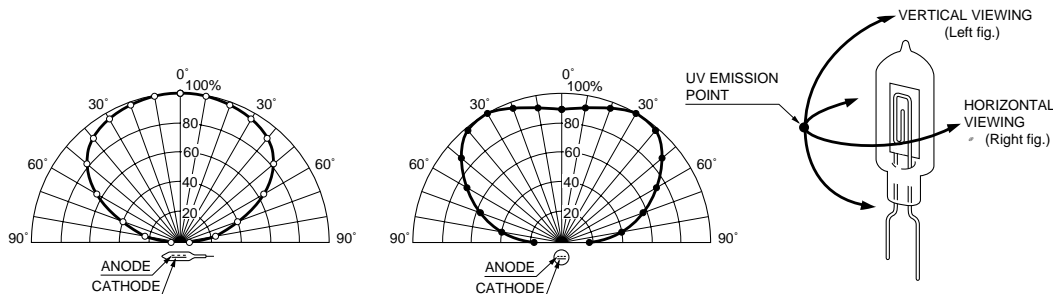
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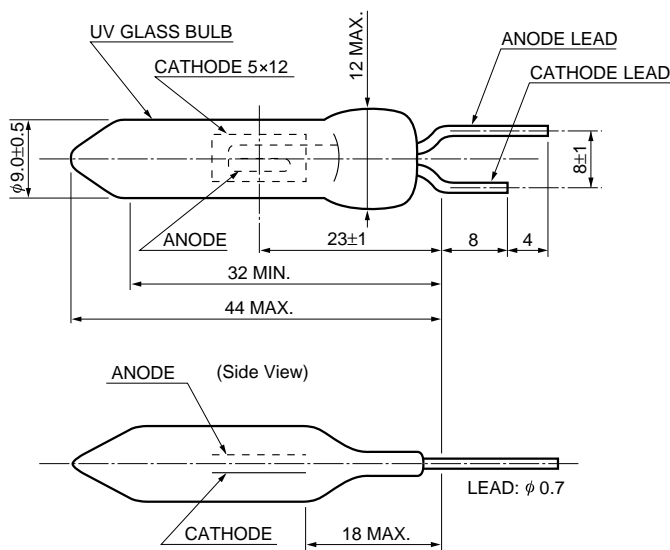
# FLAME SENSOR UV TRON® R2868

Figure 2: Angular Sensitivity (Directivity)



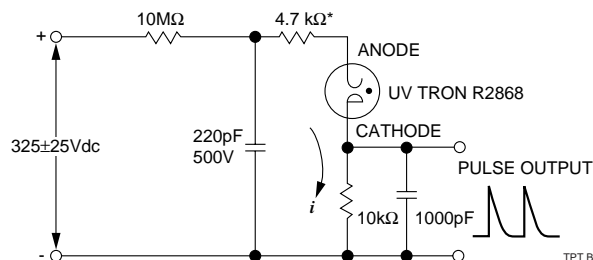
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Figure 3: Dimensional Outline (Unit: mm)



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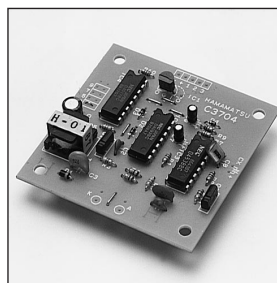
Figure 4: Recommended Operating Circuit



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\* Be sure to connect the 4.7 kΩ resistor within 2.5 cm from the anode lead end of UV TRON.

• UV TRON Driving Circuit C3704 series (Option)



Hamamatsu also provide the driving circuit C3704 series for R2868 operation. C3704 series include a high voltage power supply and a signal processing circuit in printed circuit board, which allows to operate R2868 easily as a flame sensor with the low input voltage (DC 6 to 30 V) only. For the details, please refer to the datasheet of C3704 series.

## PRECAUTIONS FOR USE

• **Ultraviolet Radiation**

The UV TRON itself emits ultraviolet radiation in operation. When using two or more UV TRONs at the same time in close position, care should be taken so that they do not optically interfere with each other.

• **Vibration and Shock**

The UV TRON is designed in accordance with the standards of MIL-STD-202F (Method 204D/0.06 inch or 10g, 10- 500Hz, 15 minutes, 1 cycle) and MIL-STD-202F (Method 213B/100g, 11ms, Half-sine, 3 times). However, should a strong shock be sustained by the UV TRON (e.g. if dropped), the glass bulb may crack or the internal electrode may be deformed, resulting in deterioration of electrical characteristics. So extreme care should be taken in handling the tube.

• **Polarity**

Connect the UV TRON with correct polarity. Should it be connected with reverse polarity, operating errors may occur.

## 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.

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