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Power supply module for MPPC

C11204-01

OPERATION MANUAL

Be sure to read the operation manual carefully before this board is used.
If operated differently from the standard procedure in the manual,
a serious accident may occur.
Keep this manual for future reference.

Doc. No. K29-B61072

Rev. I Jul. 1, 2016

FormKXX-3513 B

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Ⅰ. OVERVIEW

The C11204-01 is a high-voltage power supply that is optimized for driving HAMAMATSU MPPC (multi-pixel photon counter) series. It can provide up to 90V output. By connecting an external analog temperature sensor, the C11204-01 has built-in temperature compensation function that MPPC can be operated optimumly even if an environment temperature is changed. It has built-in the output voltage monitor function and the output current monitor function. All functions can be controlled from a PC via the serial interface. The C11204-01 is available in a 16-lead hybrid board.

■ Features

- Wide output voltage range: 50V to 90V
- Low ripple noise: 0.1mVp-p typ.
- Good temperature stability: ±10ppm/°C typ.
- High setting resolution: 1.8mV
- MPPC current monitor
- Serial communication

Ⅱ. PRECAUTIONS FOR USE

- When using this product please be sure to comply with all caution items to avoid possible trouble or accidents. We are constantly making every effort to improve product quality and reliability but this does not guarantee complete safety when using this product. In particular, when this product is to be used in equipment or systems which might cause personal injury, fatal accident or damage to property if handled improperly, be sure to implement safety measures that take potential problems fully into account. In such applications, we bear no responsibility for problems or damage arising from use of this product.
- Do not disassemble any part of this module. Changing the adjustment or modifying this module may cause malfunctions and lead to fire or electrical shock. And, this module contains a place of high-voltage (DC ~90V), which is essential to operate the APD. If your hands or elsewhere come in contact with parts at a high voltage, shocks or injuries may result. If the circuit is shorted by mistake, it may be a source of problems.
- High-voltage power supply is installed in the product which is absolutely imperative to operate MPPC array. To avoid electric shock, you must not touch when turning on or 10 seconds after turning off the power.
-
- If this manual is lost or damaged, immediately contact our sales office to ask for an additional copy.

Ⅲ. FUNCTIONS

■ Setup

This function can set the output voltage to any value. The output voltage is decided by setting the reference voltage Vb[V], the reference temperature Tb[°C], the primary temperature coefficient ΔT[mV/°C], and the secondly temperature coefficient ΔT'[mV/°C^2]. It can be done a "temperature compensation" and "output voltage setting", by setting each parameter.

All setting of the C11204-01 uses serial communication (UART). The details of the communication are described for "C11204-01 Command Reference.pdf".

If you use an evaluation kit C12332, please refer to an operation manual of C12332.

1) Output voltage setup

This function can set the output voltage to any value. The output voltage is decided by setting the reference voltage Vb[V] (Cf. Fig. 1). Please use command of "Set the temperature correction factor" to set it (Cf. C11204-01Command Reference).

Please refer to Chapter Ⅴ for the output voltage range and the setting accuracy.

2) Temperature compensation

This function performs temperature compensation of the output voltage using the temperature T[°C] of the external temperature sensor.

The output voltage +HV[V] is determined by the following formula.

$$+HV = (\Delta T' * (T - Tb)^2 + \Delta T * (T - Tb)) / 1000 + Vb$$

Where ΔT[mV/°C] is temperature coefficient, T[°C] is temperature of the external temperature sensor. Temperature coefficient ΔT[mV/°C] can set to four parameters of high temperature side coefficient ΔT'1[mV/°C^2], ΔT1[mV/°C] and primary low temperature side coefficient ΔT'2[mV/°C^2], ΔT2[mV/°C] (Cf. Fig. 1). If you don't use this function, please input 0 into ΔT'1 and ΔT.

When B departs from the operating temperature limit greatly, the temperature compensation becomes OFF forcibly.

■ Monitor

It can be measured the output voltage +HV[V], output current Id[mV], and external temperature sensor value T[°C]. (Cf. Fig. 2). Please refer to Chapter Ⅴ for the accuracy.

■ ON/OFF switch

It is a function to ON / OFF the output voltage. In the case of state [ON], the voltage is output. In the case of state [OFF], the output voltage becomes 0V.

■ Overcurrent protection

This function stops the output of the high voltage when the current flows from the greater than or equal to the threshold C11204-01.

When current load exceeded a threshold level more than four seconds, the output voltage becomes 0V. The threshold of the default is 3mA. When you want to output the high voltage again, please send a reset command or reboot the C11204-01.

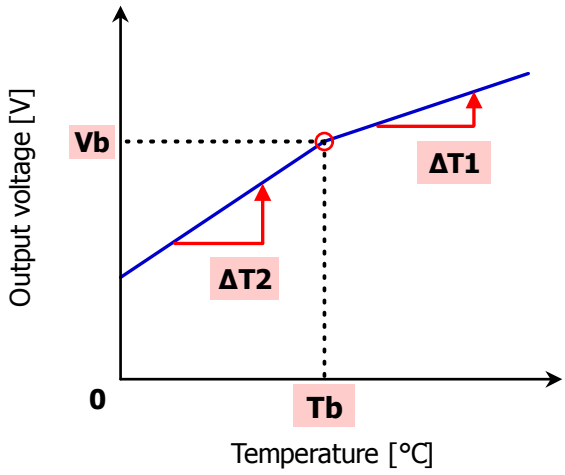


Fig. 1

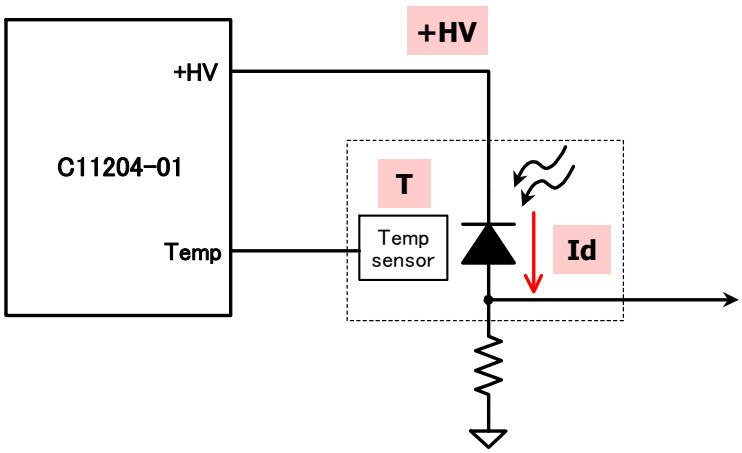


Fig. 2

Ⅳ. OPERATION METHOD

Note: If you use an evaluation kit C12332, please refer to an operation manual of C12332.

1. Power Supply Pin (Vcc)

Connect the power supply voltage to this pin. In this case, please connect a bypass capacitor between the GND. The bypass capacitor should be connected near the pin as possible.

2. High Voltage Output Pin (+HV)

Connect HAMAMATSU MPPC Series to this pin (Cf. Fig. 3). This pin must be connected to low pass filter to suppress the ripple noise (Cf. Fig. 3). Low ESR capacitors should be used at the output to minimize the output voltage ripple.

3. RXD Pin and TXD Pin (RXD, TXD)

These are used for serial communication. The RXD should be connected to a TXD of host. Similarly, the TXD should be connected to a RXD of host. Refer to Command Reference for the communication specification.

The details of the communication are described for "C11204-01 Command Reference.pdf".

4. Temperature sensor Pin (Temp)

Connect analog temperature sensor (Texas Instruments; LM94021) to this pin (Cf. Fig. 4). Put a low-pass filter near this pin to remove a noise from C11204-01 (Cf. Fig. 3). The pin 1 and pin 5 of the temperature sensor must be connected to GND. If you don’t use a temperature sensor, this pin must be connected to GND. A temperature compensation may malfunction when it is not connected.

5. Turn the power on

After the power is turned on, check whether excessive current is flowing the device and whether the device is operating abnormally, for example if smoke is coming out.

If any abnormal operation occurs, immediately power off.

Note1: High voltage is output immediately after the power is turned on.

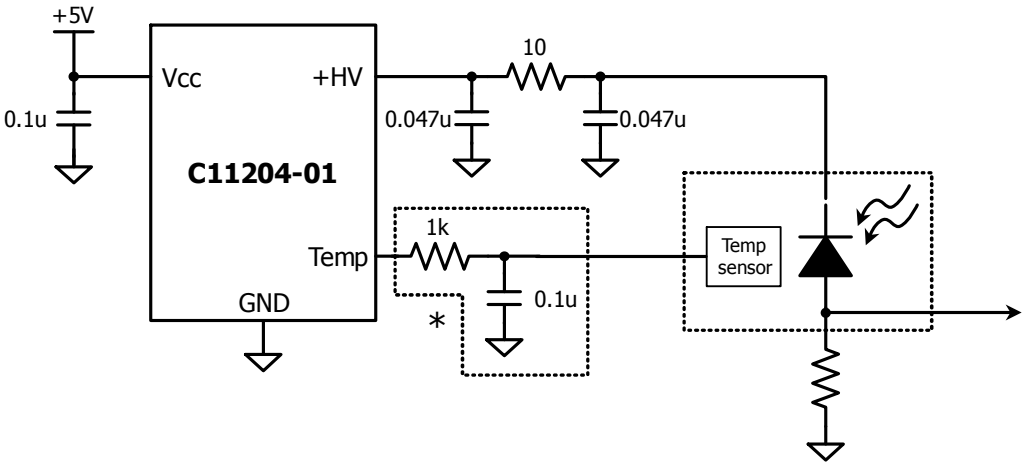


Fig. 3

*: It is recommended to be put near Temperature sensor Pin.

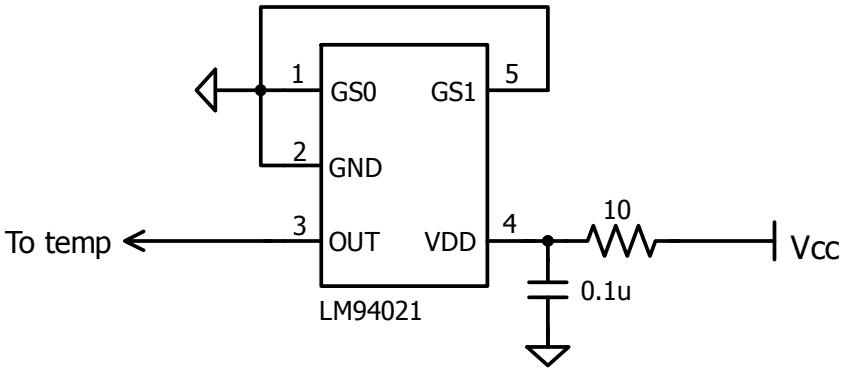


Fig. 4

Ⅴ. SPECIFICATIONS

■ Specifications

■ Absolute maximum ratings

Parameter	Condition	Value	Unit
Power supply		6	V
Operating temperature	No condensation	0 to 50	°C
Storage temperature	No condensation	-20 to 70	°C

■ Specification(Typ. Ta=25°C, Vcc=+5V,unless otherwise noted)

Parameter	Condition	Min.	Typ.	Max.	Unit
Output voltage	No load	-	50 to 90	-	V
Output current		0	-	2	mA
Ripple noise (*Note 2*)	+HV=72V, No load	-	0.1	0.2	mVp-p
Setting accuracy	+HV=72V, No load	-	±10	±40	mV
Setting resolution		-	1.8	-	mV
Temperature stability	25±10°C, +HV=72V, No load	-	±10	±20	ppm/°C
Output voltage monitor accuracy	+HV=72V, No load	-	±10	-	mV
Output current monitor accuracy	+HV=72V, Id=1.0mA	-	±0.05	-	mA
Interface (*Note 3*)		Serial communication (UART)			
RXD, Input Low Voltage		0	-	0.2Vcc	V
RXD, Input High Voltage		0.65Vcc	-	Vcc	V
RXD, Input setup		90	-	-	ns
RXD, Input hold time		90	-	-	ns

■ General ratings

Parameter	Condition	Min.	Typ.	Max.	Unit
Power supply		4.75	5	5.25	V
Consumption current	+HV=72V, No load	15	20	25	mA

Note 2: In use recommended circuit.
Note 3: Need PC communication module.

Applicable standards

EMC	EN61326-1:2013 Group 1 Class B
SAFETY	EN61010-1:2010
RoHS	EN50581

■ Dimensional outlines (Unit: mm)

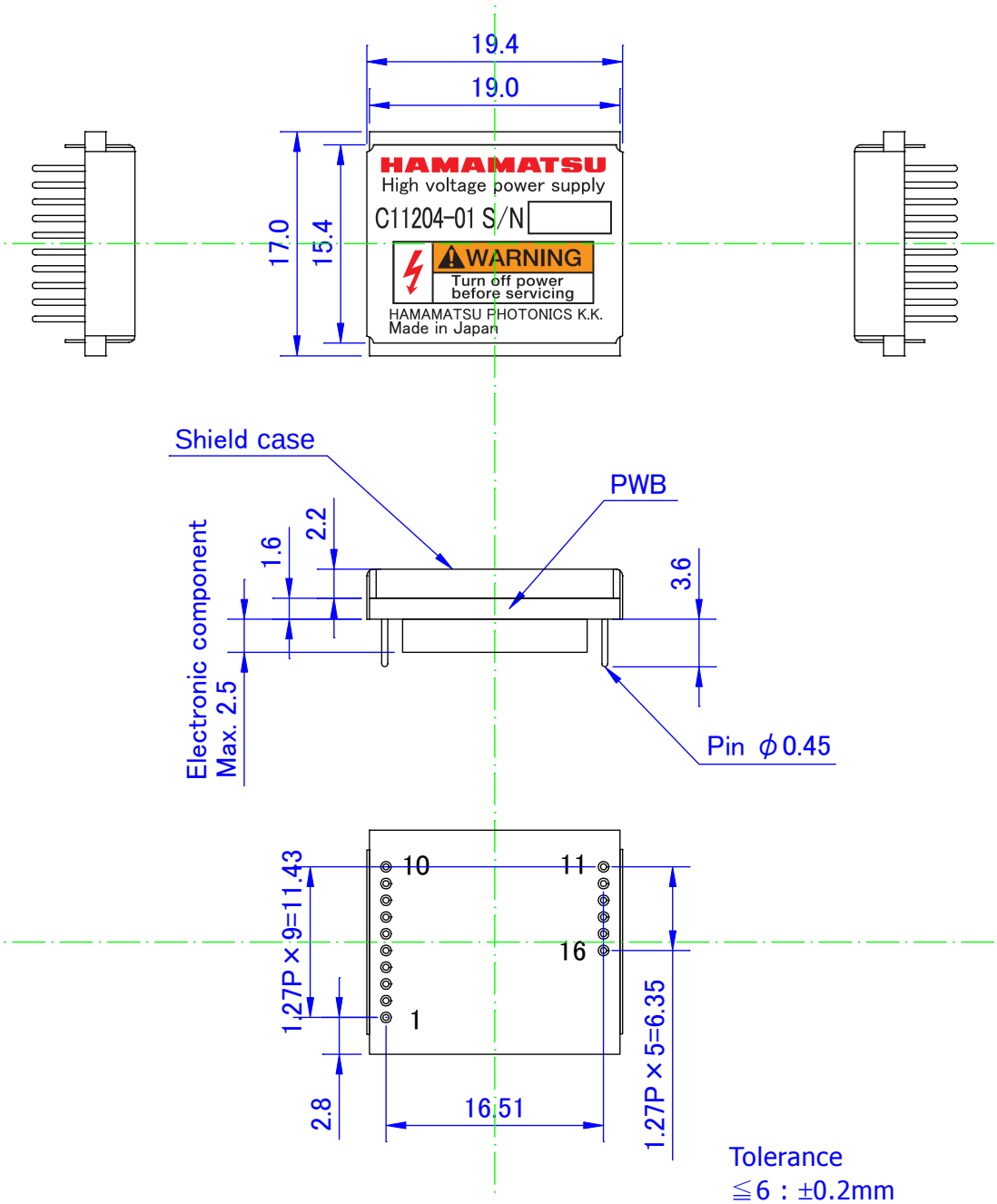


Fig. 5

■ Pin configuration

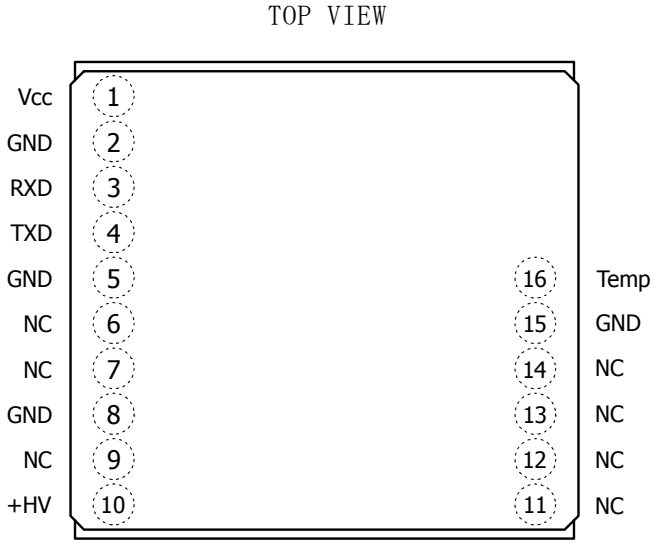


Fig. 6

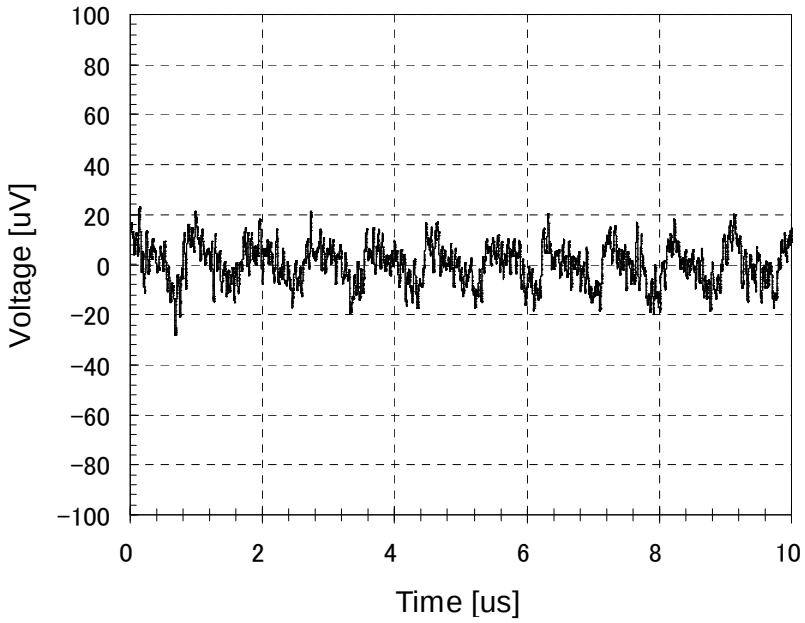
Pin function descriptions

Pin No.	Symbol	Description
1	Vcc	Power Supply Pin. Please supply +5V. This pin should be decoupled to GND by a bypass capacitor.
2, 5, 8, 15	GND	Ground. Pins are connected internally. For best performance, connect both pins to board ground.
3	RXD	Serial Data Input Pin.
4	TXD	Serial Data Output Pin.
6, 7, 9, 11-14	NC	No Connection.
10	+HV	High Voltage Output Pin. (*Note 4*)
16	Temp	Analog temperature sensor connection pin. (*Note 4*)

Note 4: Please refer to Chapter Ⅲ.

■ Characteristic example

● Ripple noise (+HV=72V)



Note 1: In use recommended

Fig. 7

● Temperature dependence

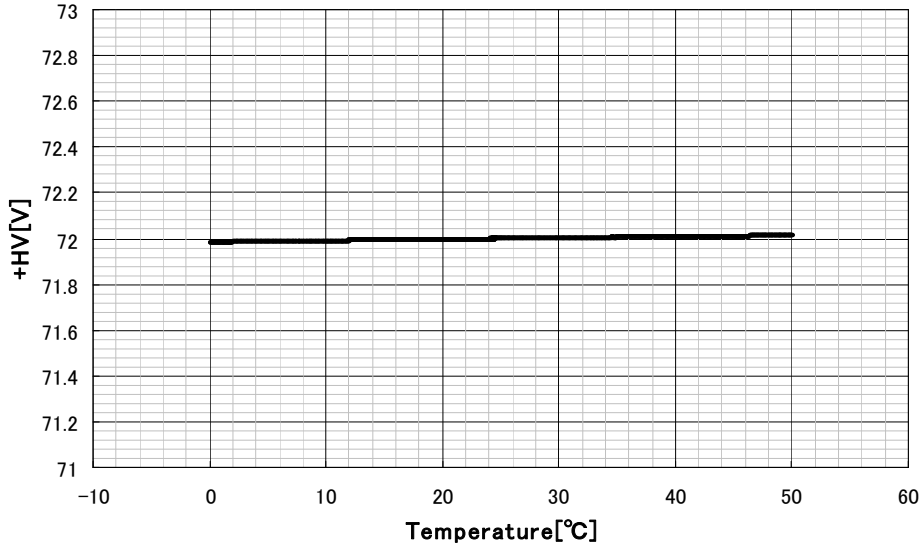


Fig. 8

● Current load

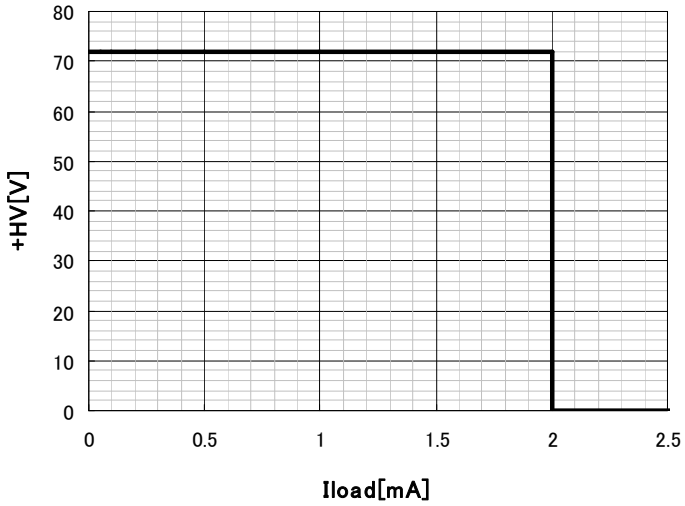


Fig. 9

● Consumption current (+HV=72V)

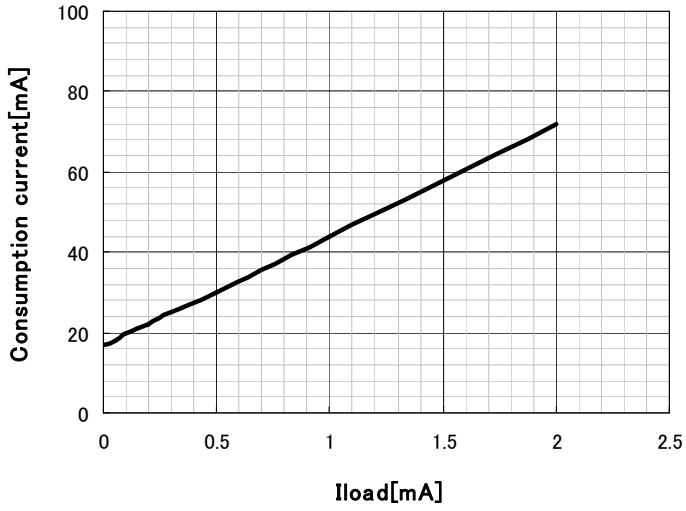


Fig. 10

Ⅵ. NOTICE

Hamamatsu products should not be used in excess of their absolute maximum ratings. Attention must be paid to all documented precautions.

Hamamatsu continually makes efforts to improve the quality and reliability of its products; however these efforts cannot ensure 100% compliance with the manufacturing specifications. Sufficient safety design (such as redundant safety, fire preventative, and malfunction preventative features) are to be implemented in the development of equipment manufactured with the Hamamatsu product so that personal injury, fire, or damage to public property or welfare does not occur in the unlikely event of a malfunction of the Hamamatsu product. A dangerous condition could be created if sufficient consideration is not given to safety design that addresses potential problems, especially in the design of equipment where the failure or malfunction of the Hamamatsu product within the equipment could result in bodily harm, life-threatening injury, or serious property damage during the use of the equipment.

Appropriate descriptions of the functions, performance, and methods of operation of the Hamamatsu product and the equipment within which the Hamamatsu product is incorporated are to be provided to end-users of the equipment. All accompanying warnings and cautionary labeling are also to be provided to the end-user.

Warranty of the Hamamatsu product is limited to the repair or replacement of a product in which a defect is discovered within 1 year of delivery of the product and notification is made to Hamamatsu within that period, otherwise certain warranty is specified. However, even within the warranty period Hamamatsu shall not be responsible for damages caused by either natural disaster or improper use of the product (such as modification of the product or any use that contravenes the operating conditions, intended applications, operating instructions, storage method, disposal method, or any other term or condition described in our products' documents).

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型　号	C11204-01

环保使用期限

本标志中的年数，是根据 2016 年 1 月 21 日公布的「电器电子产品有害物质限制使用管理办法」和 SJ / T 11364－2014 「电子电气产品有害物质限制使用标识要求」，适用于在中华人民共和国生产或进口的电器电子产品的「环保使用期限」。在遵守有关本产品安全和使用上的注意事项的情况下，在从生产日开始的上述年限内，使用该产品不会对环境造成严重污染或对使用者人身、财产造成严重损害。此年限是「环保使用期限」，而不是「产品质量保证期限」。

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产品中有害物质的名称及含量

部件名称	有害物质					
	铅（Pb）	汞（Hg）	镉（Cd）	六价铬（Cr(VI)）	多溴联苯（PBB）	多溴二苯醚（PBDE）
C11204-01	×	○	○	○	○	○

本表格依据SJ/T 11364 的规定编制。
○：表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572 规定的限量要求以下。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572 规定的限量要求。

Type Number	C11204-01

Environment-friendly Use Period

The number of year in the marking is “Environment-friendly Use Period” applying to electrical and electronic products that are manufactured in or imported into People’s Republic of China, based on “Management methods for the restriction of the use of hazardous substances in electrical and electronic products (issued on January 21th, 2016)” and “Marking for the restriction of the use of hazardous substances in electronic and electrical products (SJ/T11364-2014)”. It does not cause serious environmental contamination and injuries to body or property of the user during the year from the date of manufacture ONLY if under normal use following with operation and safety precautions of this product. It is the number of years for "Environment-friendly Use Period", NOT quality assurance period.

When disposing of this product, please follow applicable local rules and regulations for collection and recycling of electrical and electronic products.

Names and Contents of the Hazardous Substances in product

Part Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr (VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
C11204-01	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.
O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.
X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.