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PHOTON IS OUR BUSINESS

Light-to-frequency converter photo IC



S9705 series

Converts light level to frequency of output pulse

The S9705 and S9705-01DT are photo ICs that combine a photodiode and a current-to-frequency converter on a CMOS chip. Output is a square wave (50% duty ratio) with frequency directly proportional to light level incident on the photodiode. The CMOS level digital output allows direct connection to a microcontroller or other logic circuitry. The S9705 series has wide dynamic range and light level can be easily measured when used with a digital counter.

Features

- **Converts light level to frequency**
- **Wide dynamic range: 5 orders of magnitude**
- **Excellent linearity**
- **Output timing reset function**
- **Digital output for direct interface to microcontroller**
- **4-pin plastic package**

Applications

- **Liquid crystal monitor backlight dimmer for mobile devices**
- **Brightness adjustment for large-screen liquid crystal TV**
- **Lighting dimmer**
- **Replacement for CdS photoconductive cells**

Absolute maximum ratings

Parameter		Symbol	Condition	Value	Unit
Supply voltage		Vdd	Ta=25 °C	-0.3 to +6	V
Load current		Io	Ta=25 °C	±2	mA
Power dissipation		P	Ta=25 °C	50	mW
Operating temperature		Topr	No dew condensation*1	-40 to +85	°C
Storage temperature		Tstg	No dew condensation*1	-40 to +100	°C
Reflow soldering conditions*1	S9705*2	Tsol		Peak temperature 250 °C max, 2times(see page 7)	-
	S9705-01DT*3			Peak temperature 240 °C max, 2 times	

*1: When there is a temperature difference betw een a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristicsand reliability.
*2: JEDEC level 4
*3: JEDEC level 5a
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

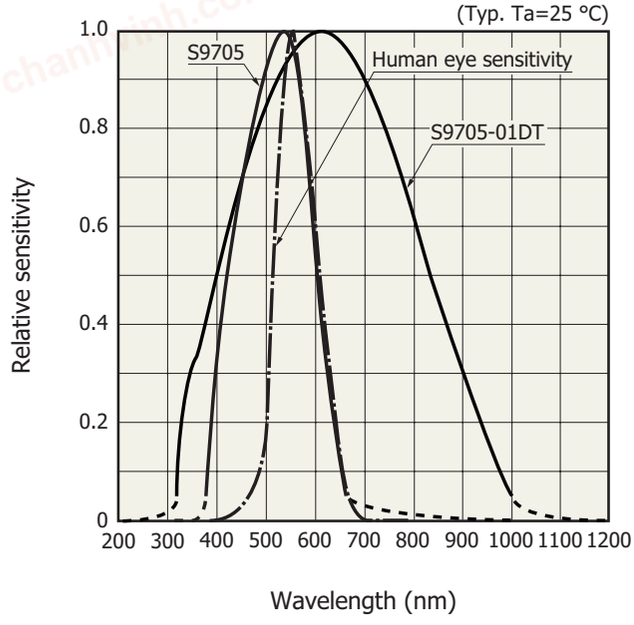
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Electrical and optical characteristics (RESET="L", Vdd=5 V, Ta=25 °C, unless otherwise noted)

Parameter	Symbol	Condition	S9705			S9705-01DT			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak sensitivity wavelength	λp		-	550	-	-	620	-	nm
Supply voltage	Vdd		2.7	-	5.5	2.7	-	5.5	V
Current consumption	Idd	Dark state, no load	-	1.5	3.0	-	1.5	3.0	mA
Output frequency	fo	2856 K*4	38	50	62	30	40	50	kHz
Maximum output frequency	fmax	DC light source*5	300	-	1000	300	-	1200	kHz
Response time	tfl	5 *lx* to 5 m*lx*, 90%	-	-	0.1	-	-	0.1	s
Dark frequency	fd		0	-	2	0	-	2	Hz
Linearity	-	fo=10 kHz*6	-3	-	+3	-3	-	+3	%
Power supply voltage dependence of output frequency	-	Vdd=5 V ± 10%	-	±0.5	-	-	±0.5	-	%
Temperature coefficient of output frequency	-	Ta=25 ± 10 °C, fo=10 kHz λ=λp	-	±0.02	-	-	±0.02	-	%/°C
Delay time	td		-	-	0.1	-	-	0.1	µs
High level output voltage	Voh	Ioh=-0.5 mA	4.5	-	-	4.5	-	-	V
Low level output voltage	Vol	Iol=0.5 mA	-	-	0.5	-	-	0.5	V
Output impedance	Ro	RESET="H"	1	-	-	1	-	-	MΩ
High level input voltage	Vih	RESET	4.0	-	-	4.0	-	-	V
Low level input voltage	Vil	RESET	-	-	1.0	-	-	1.0	V
Input pull-up resistance	Rin	RESET="L"	0.1	1	5	0.1	1	5	MΩ
Output pulse duty ratio	D	fo=10 Hz	40	50	60	40	50	60	%

*4: 100 *lx* (S9705), 20 *lx* (S9705-01DT)
*5: 10 k*lx* (S9705), 2 k*lx* (S9705-01DT)
*6: Deviation from the straight line connecting the origin point to the fmax point, normalized by the 10 kHz value.

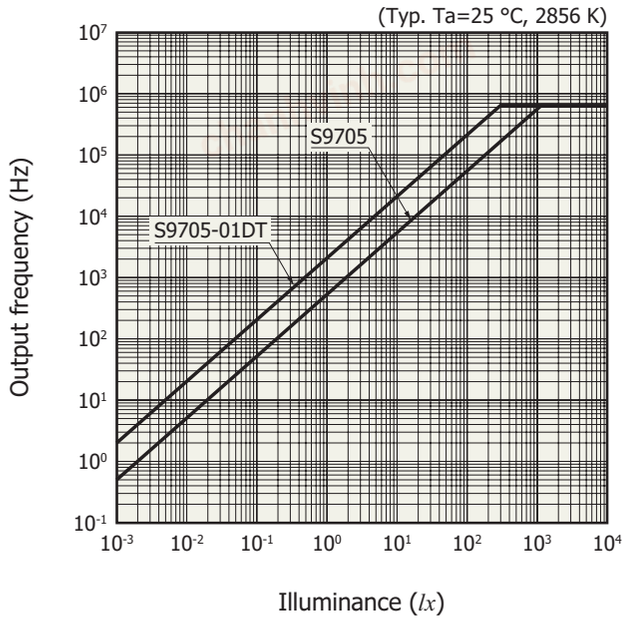
Spectral response



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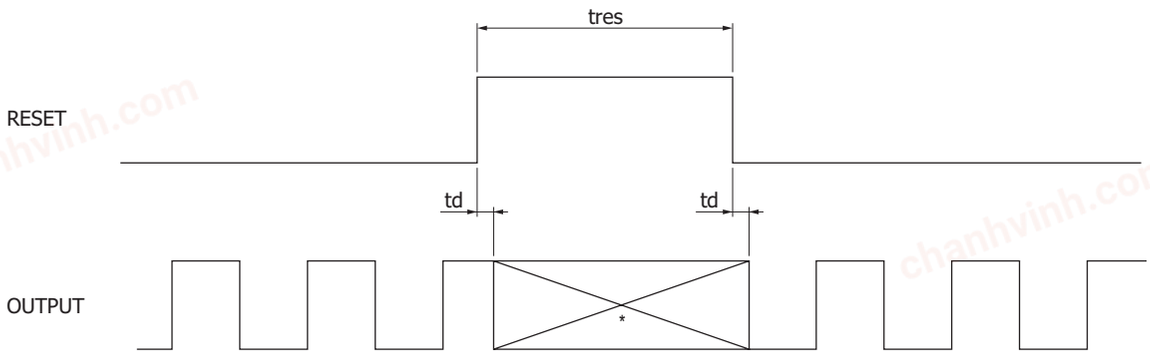
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Output frequency vs. illuminance



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Timming chart

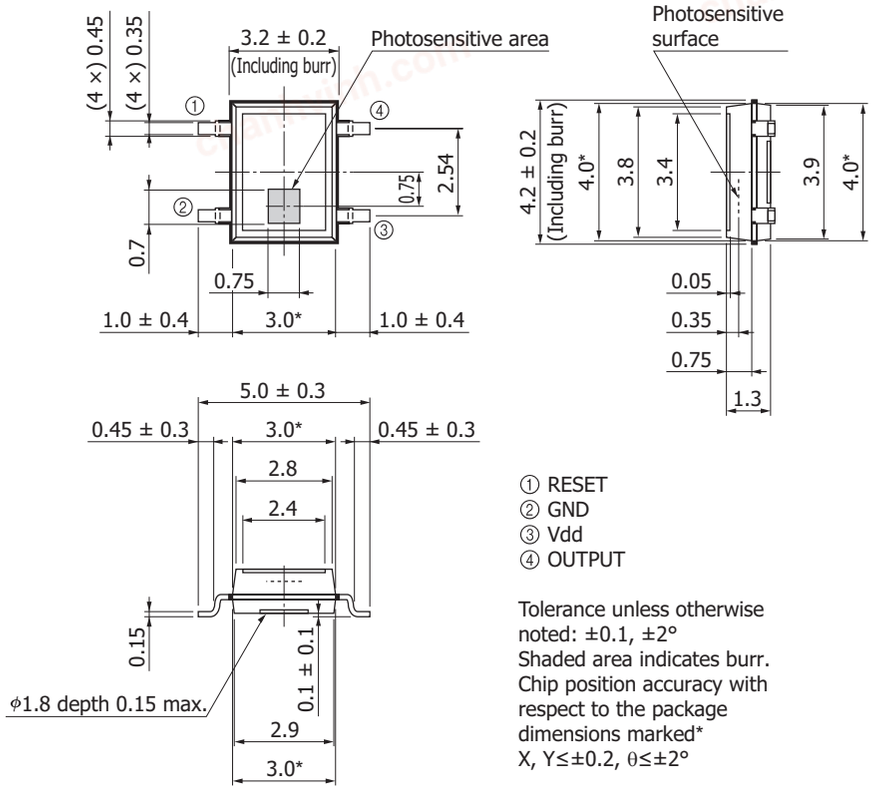


* OUTPUT terminal is at High impedance during RESET period ("High" state).

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Dimensional outline (unit: mm)



① RESET
② GND
③ Vdd
④ OUTPUT

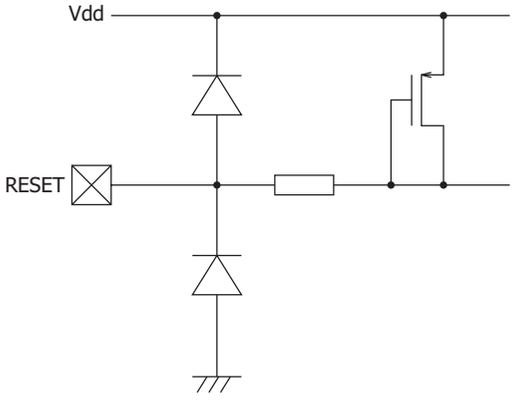
Tolerance unless otherwise noted: ±0.1, ±2°
Shaded area indicates burr.
Chip position accuracy with respect to the package dimensions marked*
X, Y≤±0.2, θ≤±2°

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Pin connections

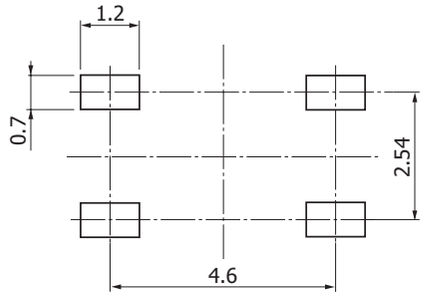
Pin no.	Symbol	Function	Input/Output
1	RESET	Out disable	Input (digital)
2	GND	Ground	-
3	Vdd	Supply terminal	-
4	OUTPUT	Output terminal	Output (digital)

Equivalent input circuit



KPICC0276EA

Recommended land pattern (unit: mm)



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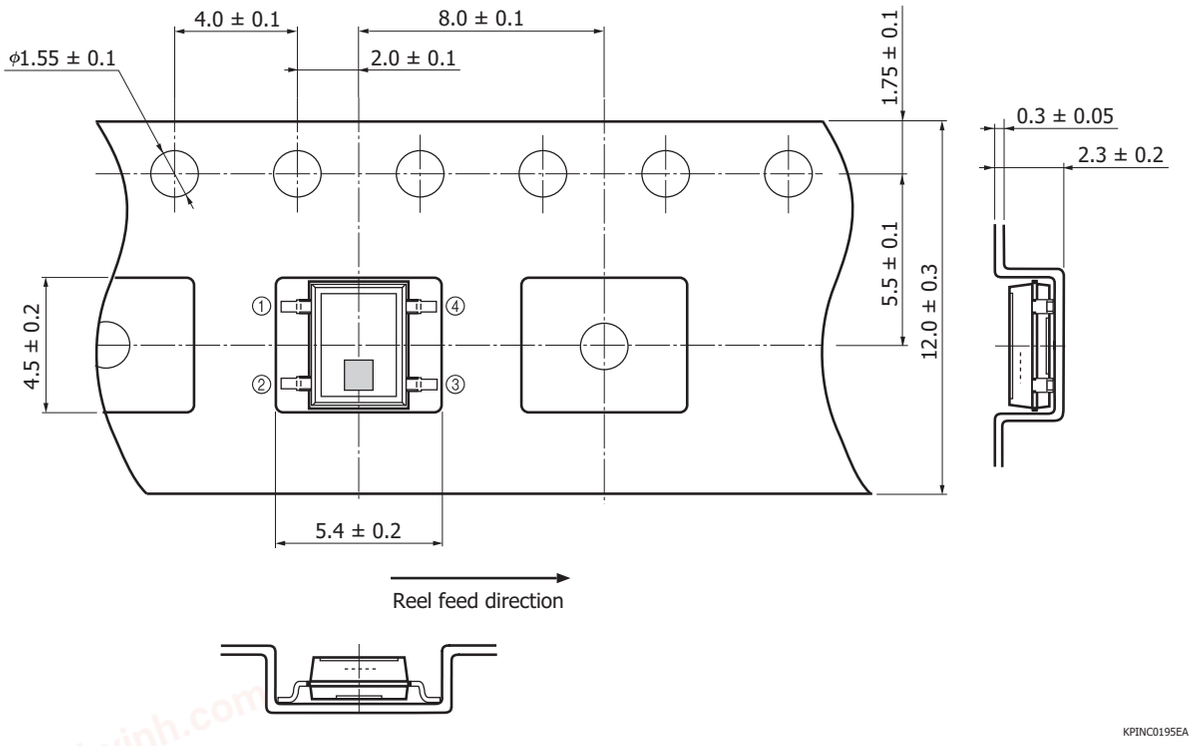
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Standard packing specifications

■ Reel (conforms to JEITA ET-7200)

Dimensions	Hub diameter	Tape width	Material	Electrostatic characteristics
254 mm	80 mm	12 mm	PS	Conductive

■ Embossed tape (unit: mm, material: PS, conductive)

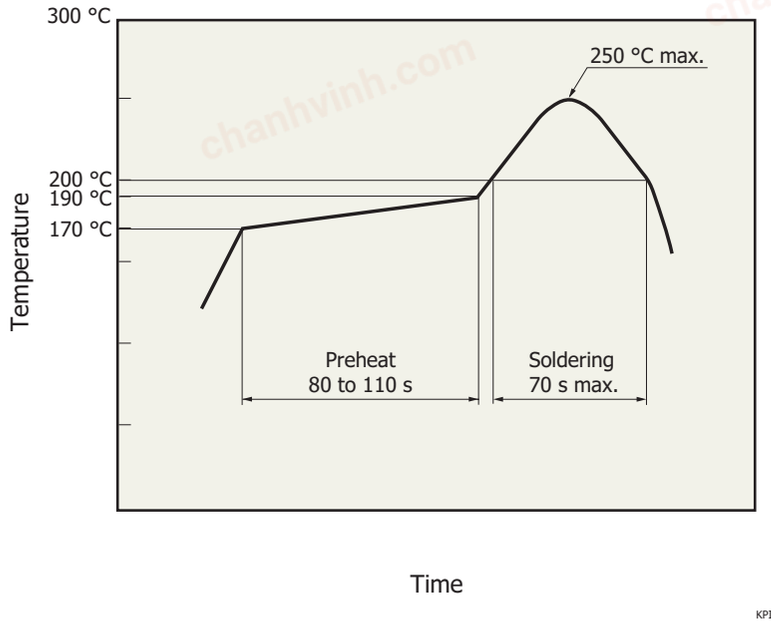


■ Packing quantity
2000 pes/reel

■ Packing type
Reel and desiccant in moisture-proof packaging (vacuum-sealed)

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Measured example of temperature profile with our hot-air reflow oven for product testing (S9705)



- This product supports lead-free soldering. After unpacking, store it in an environment at a temperature of 30 °C or less and a humidity of 60% or less, and perform soldering within 72 hours.
- The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. Before actual reflow soldering, check for any problems by testing out the reflow soldering methods in advance.

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions
- Disclaimer
- Surface mount type products

Information described in this material is current as of March 2019.
Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.
The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use.
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