Light-to-frequency converter photo IC
S9705

Converts light intensity to frequency of output pulse

S9705 is a photo IC that combines 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 intensity incident on the photodiode. The CMOS level digital output allows direct connection to a microcontroller or other logic circuitry. S9705 has wide dynamic range and light intensity can be easily measured when used with a digital counter.

Features

- Converts light intensity 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 (Ta=25 °C)

Parameter	Symbol	Value	Unit
Supply voltage	Vdd	-0.3 to 6	V
Load current	Io	±2	mA
Power dissipation	P	50	mW
Operating temperature	Topr	-40 to +85	°C
Storage temperature	Tstg	-40 to +100	°C

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Peak sensitivity wavelength	λp		-	550	-	nm
Supply voltage	Vdd		2.7	-	5.5	V
Current consumption	Idd	Dark state, no load	-	1.5	3.0	mA
Output frequency	fo	2856 K, 100 *lx*	38	50	62	kHz
Maximum output frequency	fmax	10 k*lx*, DC light source	300	-	1000	kHz
Response time	tfl	5 *lx* to 5 m*lx*, 90 %	-	-	0.1	s
Dark frequency	fd		0	-	2	Hz
Linearity	-	fo=10 kHz *1	-3	-	+3	%
Power supply voltage dependence of output frequency	-	Vdd=5 V ± 10 %	-	±0.5	-	%/V
Temperature coefficient of output frequency	-	Ta=25 ± 10 °C, fo=10 kHz λ=λp	-	±0.02	-	%/°C
Delay time	td		-	-	0.1	μs
High level output voltage	Voh	Ioh= -0.5 mA	4.5	-	-	V
Low level output voltage	Vol	Iol=0.5 mA	-	-	0.5	V
Output impedance	Ro	RESET="H"	1	-	-	MΩ
High level input voltage	Vih	RESET	4.0	-	-	V
Low level input voltage	Vil	RESET	-	-	1.0	V
Input pull-up resistance	Rin	RESET="L"	0.1	1	5	MΩ
Output pulse duty ratio	D	fo=10 Hz	40	50	60	%

*1: Deviation from the straight line connecting the origin point to the fmax point, normalized by the fmax value.

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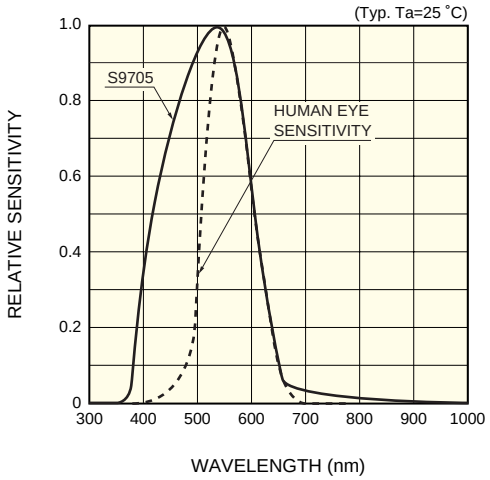
■ Spectral response



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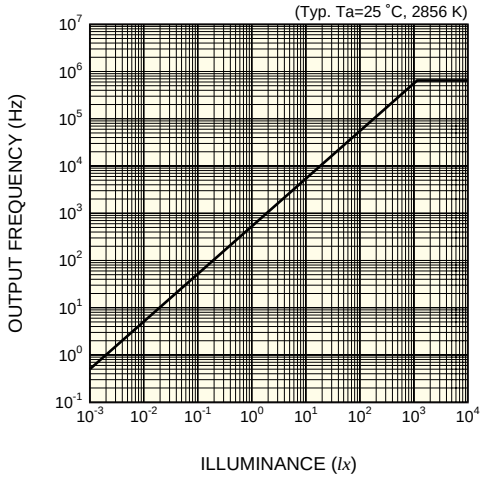
■ Output frequency vs. illuminance



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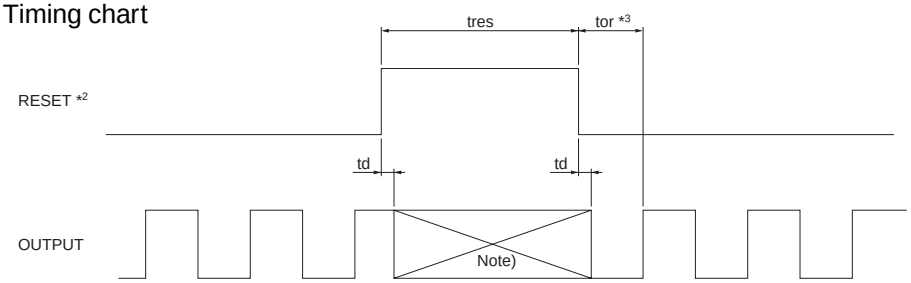
■ Timing chart



*2: OUTPUT terminal is at High impedance during RESET period ("High" state).
*3: Output starts with "Low" after releasing RESET. Illuminance can be obtained by measuring the time (tor) required before the first output transition after releasing RESET. (tres is recommended to be longer than 1 µs.)

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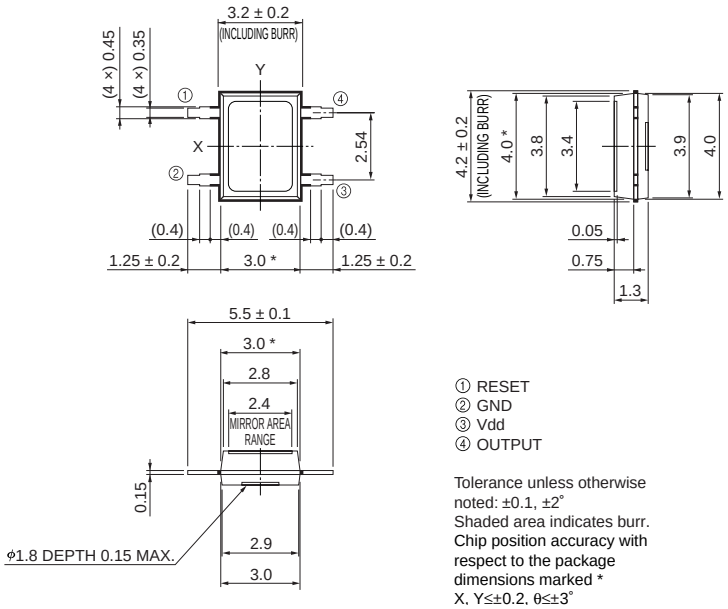
■ Dimensional outline (unit: mm)



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≤±3˚

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■ Pin connection

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)

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