

General Description

SY22312-H2 combines a photodiode and a current-to-frequency converter circuit on a single chip. Its output is a square wave (50% duty cycle) with frequency proportional to light intensity on the photodiode. This digital output allows direct interface to a microcontroller or other logic circuitry. The device has been temperature compensated for the ultraviolet-to-visible light range of 320 nm to 700 nm and can respond over the light range of 320 nm to 1050 nm.

SY22312-H2 is characterized for operation over the temperature range of -40°C to 85°C and is supplied in a compact side-looker package.

Features

- High-resolution Conversion of Light Intensity to Frequency without External Components
- Low Dark Frequency <1Hz at 50°C
- Single-supply Operation 2.7V to 3.6V
- Interfaces Directly to a Microcontroller
- RoHS Compliant

Application Schematic

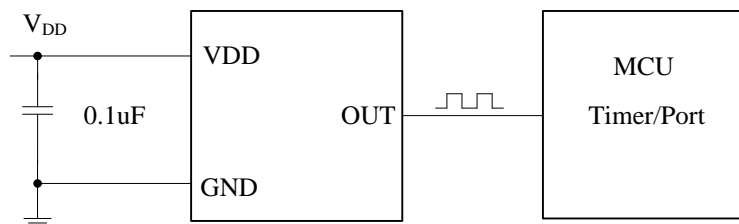


Figure 1. Typical Application

Pin Assignment

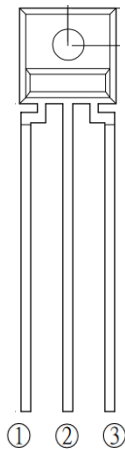


Figure 2. Pin-out

Pin Name	Pin number	Descriptions
GND	1	Power ground pin
VDD	2	Power supply input
OUT	3	Output frequency

Absolute Maximum Ratings [Note 1]($T_A=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Min	Max	Unit
V_{DD}	Supply Input Voltage		6	V
T_{STG}	Storage Temperature	-40	+85	$^{\circ}\text{C}$
ESD	Human Body Mode	±2000		V
	Machine Mode	±500		V

Recommended Operating Conditions ($T_A=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Min	Typ	Max	Unit
V_{DD}	Supply Input Voltage	2.7		3.6	V
T_{OPR}	Operating temperature	-40		+85	$^{\circ}\text{C}$

Block Diagram

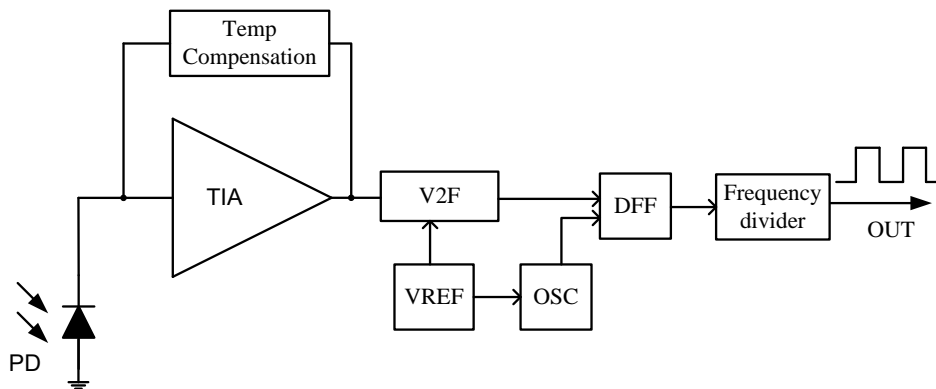


Figure 3. Function Block Diagram

Electrical Characteristics

($V_{DD} = 3.3V$, $T_A = 25^\circ C$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Input Voltage	V_{DD}		2.7		3.6	V
High-level Output Voltage	V_{OH}	$I_{OH} = -1 \text{ mA}$	2.3	3		V
Low-level Output Voltage	V_{OL}	$I_{OL} = 1 \text{ mA}$		0.1	0.4	V
Supply Current	I_{DD}			1	1.5	mA
Full-scale Frequency [Note2]			800	1000		kHz
Power Supply Suppression Ratio of Frequency Output	PSSR	$V_{DD} = 3.3V \pm 10\%$	-1		1	%/V

Operating Characteristics

($V_{DD} = 3.3V$, $T_A = 25^\circ C$, $\lambda_p = 660 \text{ nm}$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Frequency	f_O	$E_e = 18.1 \text{ uW/cm}^2$	40	50	60	kHz
Dark Frequency	f_D	$E_e = 0 \text{ uW/cm}^2$	0	0.1		Hz
Frequency Transfer Ratio	FTR			2.76		kHz/(uW/cm ²)
Nonlinearity [Note3]		$f_O = 0 \text{ kHz to } 10 \text{ kHz}$		$\pm 1\%$		%F.S.

Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

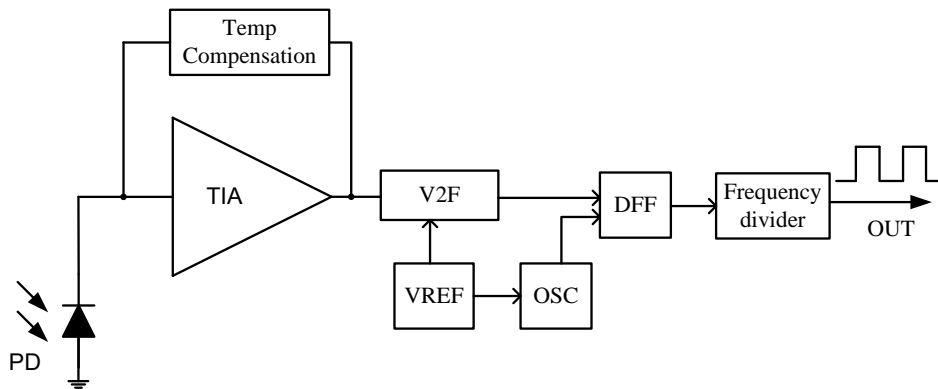
Note 2: Full-scale frequency is the maximum operating frequency of the device without saturation.

Note 3: Nonlinearity is defined as the deviation of f_O from a straight line between zero and full scale, expressed as a percent of full scale.

Operation Principles

When exposed at light, the photodiode can generate a current which flows through TIA (trans-impedance amplifier), and the voltage output of TIA is transferred into a frequency output proportionally. The OSC is used to align the frequency output by DFF gating, and the gating pulse is also fed into a frequency divider to generate a 50% duty cycle square wave.

Light current that PD generates is proportional to light intensity, so the higher light intensity on SY22312-H2 surface, the higher frequency will be given at the OUT terminal.



Power Supply Consideration

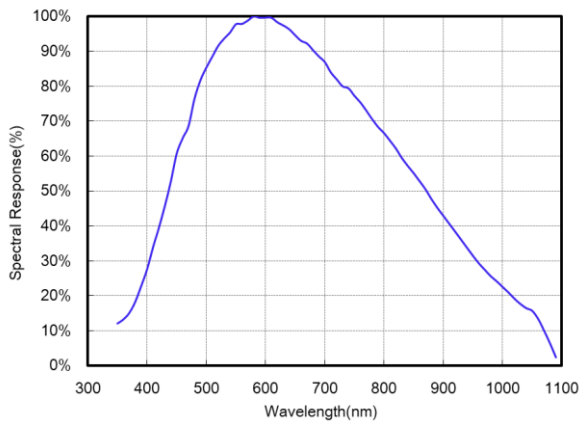
A typical capacitor with 0.1uF~1uF capacitance is recommended to place close to SY22312-H2 to decouple power line noise.

Output Interface

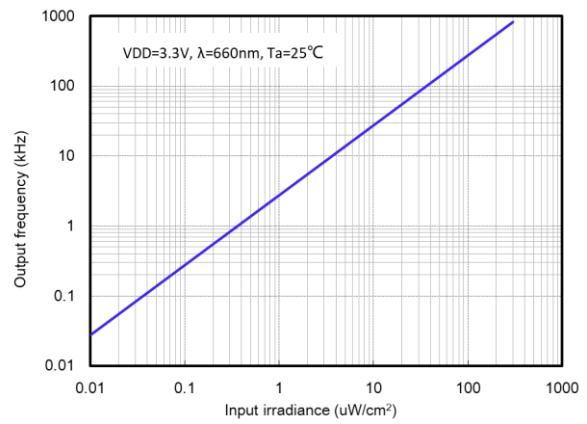
Output terminal of SY22312-H2 is designed to drive a CMOS logic input through short distances. For most applications, we can directly connect its output terminal to input pin of microcontroller. A buffer is recommended if the routing length between SY22312-H2 and microcontroller is longer than 250 mm.

Typical Characteristic Curves

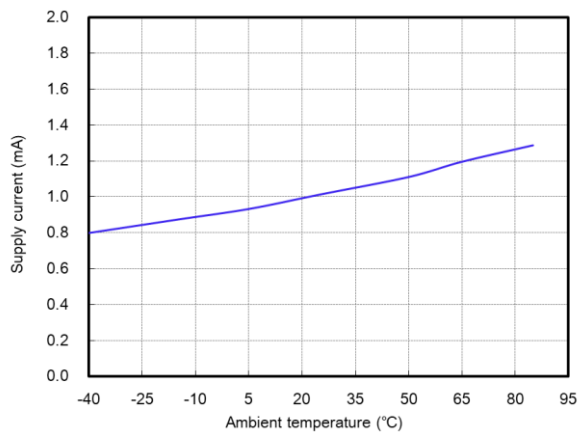
Relative Spectral Response



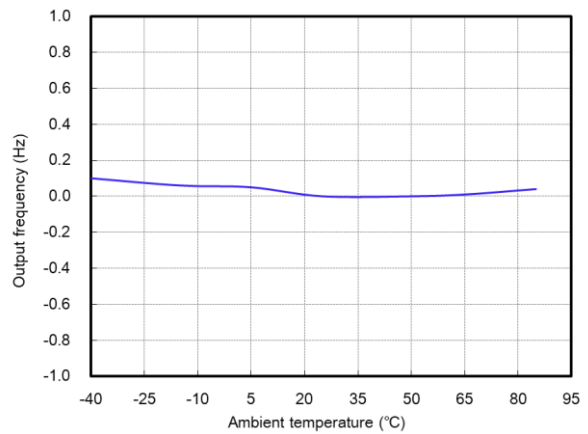
Output Frequency vs. Irradiance



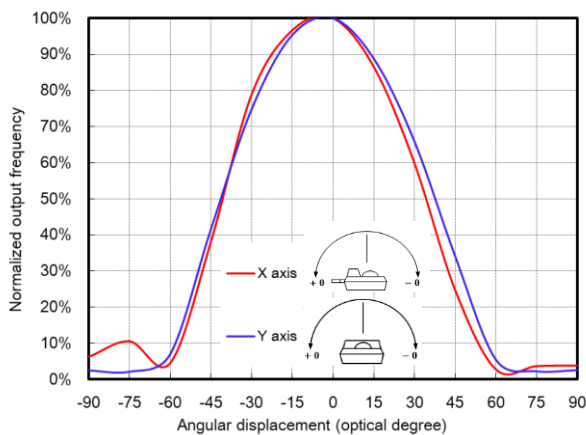
Current Consumption vs. Ambient Temperature



Dark Frequency vs. Ambient Temperature



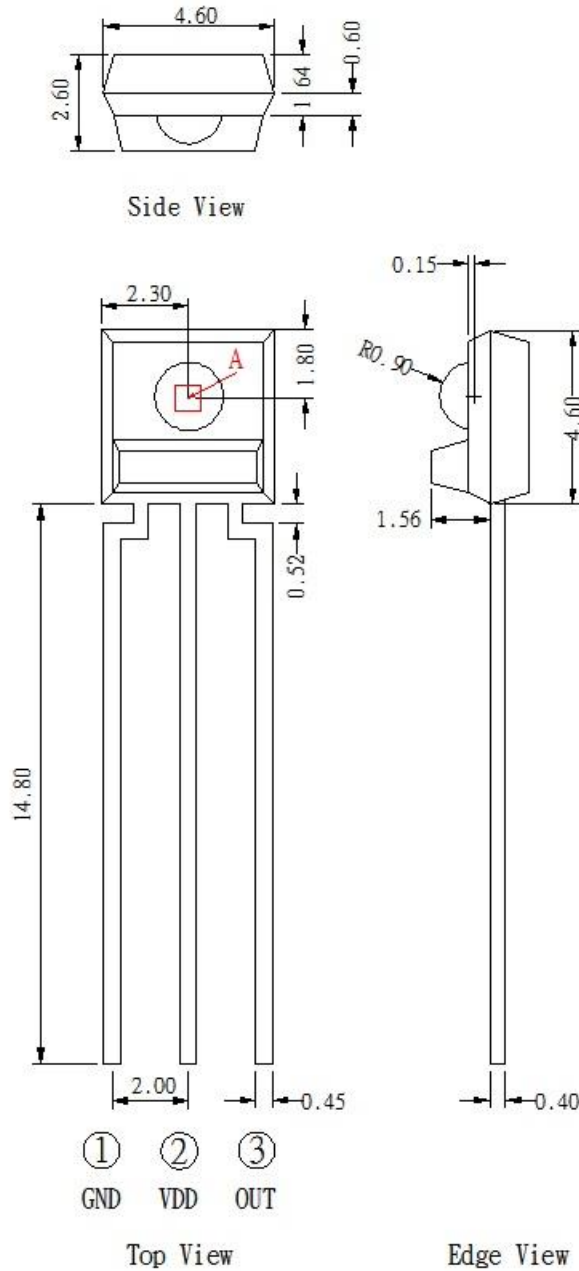
Output Frequency vs. Angular Displacement





Package Information

SY22312-H2 is supplied in a clear plastic three-lead through-hole package.



Notes:

- [1]. Unit is in mm; all tolerances are ± 0.1 mm unless otherwise noted.
- [2]. Photodiode center is at point A (x,y) = (2.30, 1.80).
- [3]. The photodiode active area is located 1.22mm below the top of the lens surface.

Revision History

The revision history provided is for informational purposes only and is believed to be accurate; however, not warranted. Please make sure that you have the latest revision.

Revision Number	Revision Date	Description
Rev 0.9	Oct. 19, 2020	Initial Release
Rev 1.0	Oct. 19, 2021	Production Release

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