

Features

- Optical Path
- Integrated Optical Measurement Analog Front-End (AFE), ADC, LED Driver, Timing Control, and FIFO
- 129dB Dynamic Range (Receiver Link, Single Sampling)
- 4 Differential/Single-Ended or 8 Single-Ended Photodiode Inputs
- 60dB High Ambient Light Rejection Performance (DC~1KHz)
- 4 Independently Configurable Time Slots for Multi-Parameter Synchronous Measurement
- Configurable Sampling Rate from 0.002Hz to 16kHz
- Multi-Pulse Integration Mode: Suitable for Weak Signal Scenarios
- Multiple Conversion Modes: Up to 24-Bit Effective Data Output
- 3-Channel LED Driver
 - Programmable Constant Current Driving
 - Maximum 240mA Driving Current per Channel
- Standard I2C Communication Interface
- 1024-Byte FIFO
- Multiple Package Options for Different Application Scenarios
 - OLGA-24
 - OLGA Package with Integrated High-Performance Photodiode
- Wide Operating Temperature Range: -40°C to 85°C
- Supply Voltage
 - VDD1/VDD2 Voltage: 1.7V to 1.9V
 - IOVDD Voltage: 1.7V to 3.6V

Applications

- Fire Smoke Alarm
- Air Particulate Detection
- Ambient Light Measurement
- Gas Detection
- Other Colloidal Concentration Detection

Description

CBMPD188B is a highly integrated photoelectric detection module, integrating photoelectric measurement analog front-end (AFE), ADC, LED driver, timing controller, and FIFO functions into a single chip. It features 60dB high ambient light suppression capability, specifically designed for weak signal detection in complex light environments. Supporting multi-pulse integration and multiple conversion modes, it can output up to 24-bit effective data. As a system-level single-chip solution, it provides core support for the new generation of intelligent smoke alarm, air quality monitoring, and vital sign sensing devices.

Catalog

Features	- 1 -
Applications	- 1 -
Description	- 2 -
Revision History	- 4 -
Functional Block Diagram	- 5 -
Pin Configuration and Function Descriptions	- 6 -
Absolute Maximum Ratings	- 7 -
Specifications	- 8 -
Performance Parameters 1	- 10 -
Performance Parameters 2	- 14 -
Typical Performance	- 14 -
Outline Dimensions	- 15 -
Package/Ordering Information	- 16 -

Revision History

Version	Revision date	Change content	Reason for Change	Modified by	Reviewed By	Note
V1.0	2025.11.11					

Functional Block Diagram

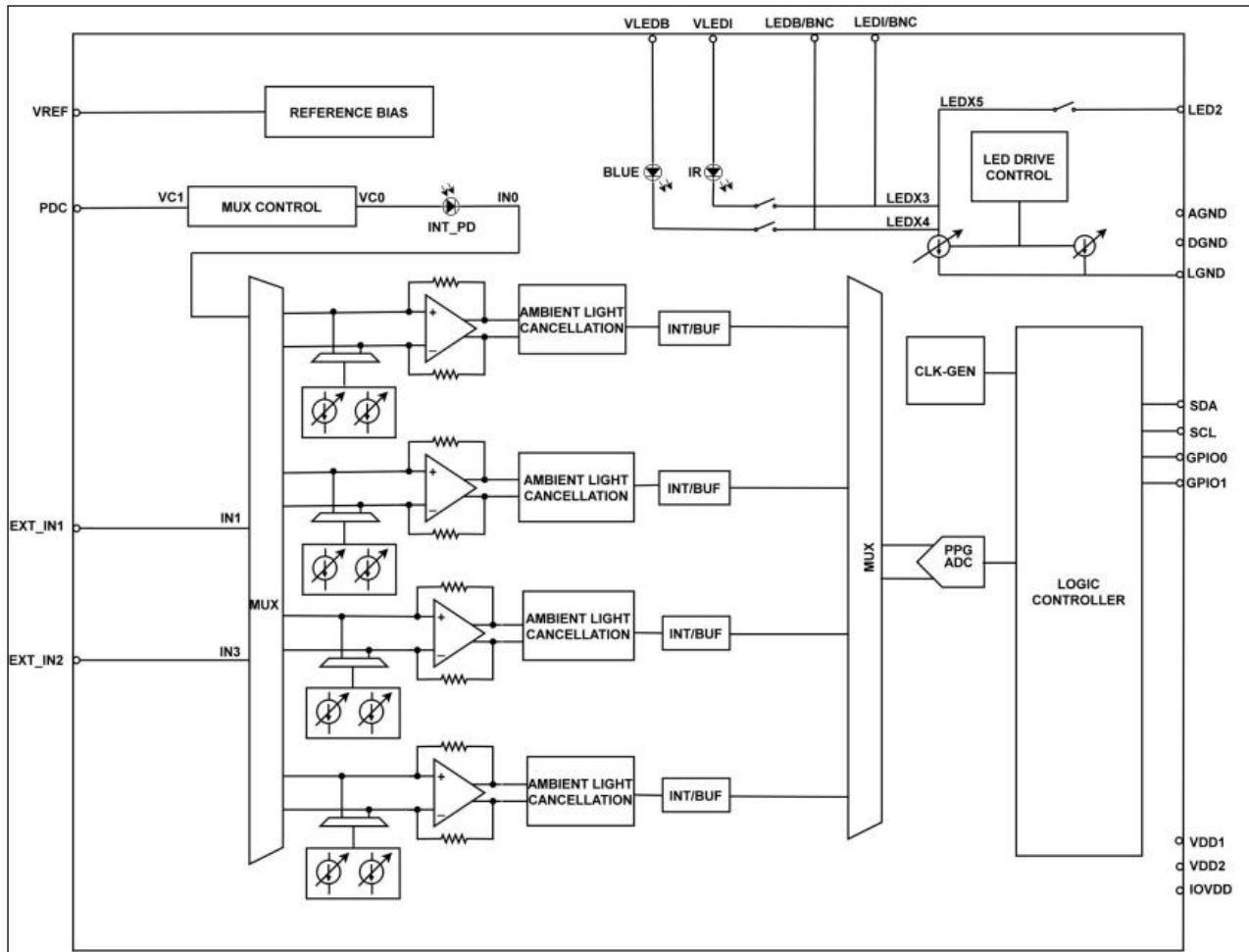


Figure 1 Functional Block Diagram

Pin Configuration and Function Descriptions

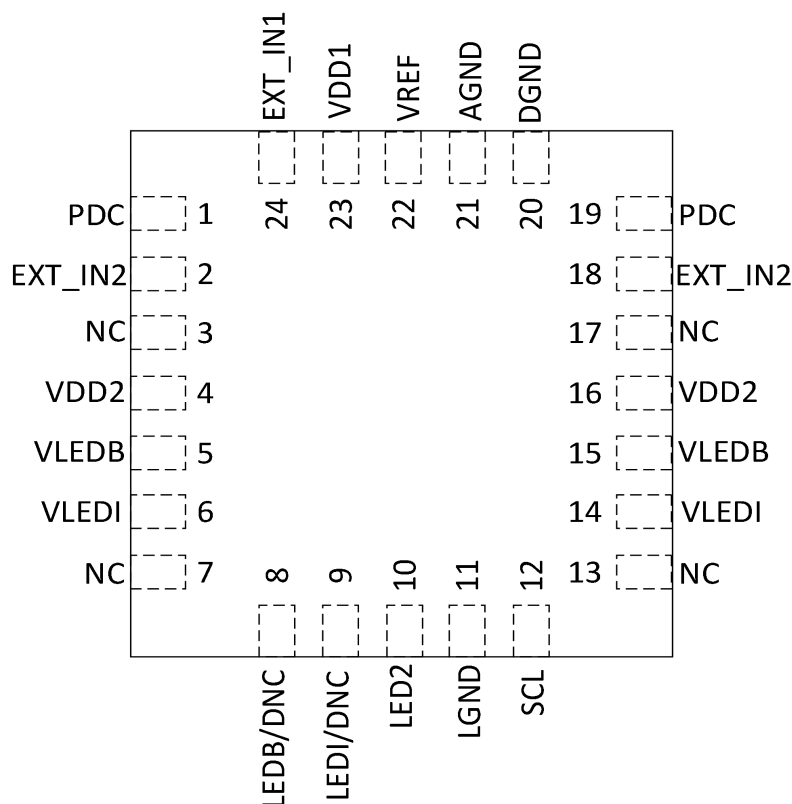


Figure 2 OLGA-24 Pin Configuration (Bottom View)

Pin No.	Pin Name	Type	Description
1	PDC	AO	Bias Voltage Output 1
2	EXT_IN2	AI	Photocurrent Input 2
3	NC	NC	No Internal Connection
4	VDD2	S	Digital Power Supply (1.8V)
5	VLEDB	S	Internal Blue LED Power Supply
6	VLEDI	S	Internal IR LED Power Supply
7	NC	NC	No Internal Connection
8	LEDB/DNC	AI	Internal Blue LED Driver / Do not connect when using internal LED
9	LED1/DNC	AIO	Internal IR LED Driver / Do not connect when using internal LED
10	LED2	AIO	LED Driver 5
11	LGND	S	LED Driver Ground

12	SCL	DI	I ² C Clock Input
13	SDA	DIO	I ² C Data Transceive
14	GPIO0	DIO	GPIO0
15	GPIO1	DIO	GPIO1
16	NC	NC	No Internal Connection
17	NC	NC	No Internal Connection
18	NC	NC	No Internal Connection
19	IOVDD	S	IO Power Supply
20	DGND	S	Digital Ground (DGND)
21	AGND	S	Analog Ground (AGND)
22	VREF	S	Connect external 1μF capacitor to AGND
23	VDD1	S	Analog Power Supply (1.8V)
24	EXT_IN1	AO	Photocurrent Input 1

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Note
Analog Supply Voltage	VDD1	-0.3	--	1.9	V	to VSS
Digital Supply Voltage	VDD2	-0.3	--	1.9	V	to DVSS
IO Supply Voltage	IOVDD	-0.3	--	3.6	V	to DVSS
Internal Blue LED Supply Voltage	VLADB	-0.3	--	5.5	V	to AVSS
Internal IR LED Supply Voltage	VLEDI	-0.3	--	4.2	V	to AVSS
IO Voltage	VIO	-0.3	--	IOVDD	V	to DVSS
Storage Temperature	TS	-45	--	125	°C	
Operating Temperature	TC	-40	--	85	°C	
HBM	ESD _{HBM}	4000	--	--	V	
CDM	ESD _{CDM}	500	--	--	V	

Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply						
Analog Supply Voltage	VDD1	1.7	1.8	1.9	V	to AVSS
Digital Supply Voltage	VDD2	1.7	1.8	1.9	V	to DVSS
IO Supply Voltage	IOVDD	1.7	1.8/3.3	3.6	V	to DVSS
Internal Blue LED Supply Voltage	VLEDB	--	5	5.5	V	to AVSS
Internal IR LED Supply Voltage	VLEDI	--	3.3	4.2	V	to AVSS
Operating Current	IVDD	--	8.3	--	μA	Single Time Slot, Single Channel, 25Hz Data Output Rate, TC = 25° C
Total System Current	ITC	--	10	--	μA	Single Time Slot, Single Channel, 25Hz Data Output Rate, TC = 25° C, Including LED Current (25mA@3V, 3μs Pulse)
Total System Power Consumption	ITPW	--	20	--	μW	Single Time Slot, Single Channel, 25Hz Data Output Rate, TC = 25° C, Including LED Current (25mA@3V, 3μs Pulse)
Standby Current	Istandby	--	1.5	--	μA	TC = 25°C
Peak Current	Ipeak	--	5.9	--	mA	TC = 25°C
Digital Input						
Input Voltage Range	VDI	0	--	IOVDD	V	
Schmitt Trigger Low-to-High (VIL→VIH)	VT+	--	1.6	--	V	IOVDD = 3.3V

Schmitt Trigger High-to-Low (VIH→VIL)	VT-	--	1.2	--	V	IOVDD = 3.3V
Output Low Level (VOL)	VOL	--	--	0.4	V	IOVDD = 3.3V
Output High Level (VOH)	VOH	2.6	--	--	V	IOVDD = 3.3V
Low-Level Output Current (IOL)	IOL					IOVDD = 3.3V VOL = Maximum Value, Dependent on GPIO_DS[1:0] Configuration
		5.2	6.7	--	mA	GPIO_DS[1:0]:2' b00
		10.4	13.4	--	mA	GPIO_DS[1:0]:2' b01
		15.7	20.3	--	mA	GPIO_DS[1:0]:2' b10
		20.9	27.1	--	mA	GPIO_DS[1:0]:2' b11
						IOVDD = 3.3V VOH = Minimum Value, Dependent on GPIO_DS[1:0] Configuration
		8.4	10.6	--	mA	GPIO_DS[1:0]:2' b00
		16.9	21.2	--	mA	GPIO_DS[1:0]:2' b01
		25.1	31.5	--	mA	GPIO_DS[1:0]:2' b10
		33.5	42.1	--	mA	GPIO_DS[1:0]:2' b11
Output Low Level (VOL)	VOL	--	--	0.4	V	IOVDD = 1.8V
Output High Level (VOH)	VOH	1.4	--	--	V	IOVDD = 1.8V
Low-Level Output Current (IOL)	IOL					IOVDD = 1.8V VOL = Maximum Value, Dependent on GPIO_DS[1:0] Configuration
		2.2	2.9	--	mA	GPIO_DS[1:0]:2' b00
		4.3	5.8	--	mA	GPIO_DS[1:0]:2' b01
		6.6	8.9	--	mA	GPIO_DS[1:0]:2' b10
		8.7	11.8	--	mA	GPIO_DS[1:0]:2' b11

High-Level Output Current (IOH)	IOH					IOVDD = 1.8VVOH = Minimum Value, Dependent on GPIO_DS[1:0] Configuration
		2.4	3.2	--	mA	GPIO_DS[1:0]:2' b00
		4.9	6.5	--	mA	GPIO_DS[1:0]:2' b01
		7.3	9.6	--	mA	GPIO_DS[1:0]:2' b10
		9.7	12.9	--	mA	GPIO_DS[1:0]:2' b11
I2C Communication						
Frequency	FSCL	--	--	1000	Kbps	
Bus Load	Cload	--	--	30	pF	
External Pull-Up Resistor	REPU	800	--	--	Ω	

Performance Parameters 1

Parameter	Symbol	Min	Typ	Max	Unit
ADC Resolution	--	16	24	bit	Dependent on NUM_REPEAT_T SX Configuration
Sampling Rate	0.002	--	16000	Hz	Single Time Slot Operation, TIA Feedback Resistor: 12.5KΩ
Signal Chain					
Input Current Resolution (3μs Single Pulse, 4μs Integration Window)	--	1.6	--	nA/LSB	TIA Feedback Resistor 12.5KΩ
	--	0.8	--		TIA Feedback Resistor 25KΩ
	--	0.4	--		TIA Feedback Resistor 50KΩ

	--	0.2	--		TIA Feedback Resistor 100K Ω
	--	0.1	--		TIA Feedback Resistor 200K Ω
	--	0.05	--		TIA Feedback Resistor 400K Ω
	--	0.025	--		TIA Feedback Resistor 800K Ω
	--	0.012	--		TIA Feedback Resistor 1.6M Ω
ADC Saturation Current (3 μ s Single Pulse, 4 μ s Integration Window)	--	53	--	μ A	TIA Feedback Resistor 12.5K Ω
	--	27	--		TIA Feedback Resistor 25K Ω
	--	13	--		TIA Feedback Resistor 50K Ω
	--	6.7	--		TIA Feedback Resistor 100K Ω
	--	3.3	--		TIA Feedback Resistor 200K Ω
	--	1.7	--		TIA Feedback Resistor 400K Ω
	--	6.7	--		TIA Feedback Resistor 800K Ω
	--	3.3	--		TIA Feedback Resistor 1.6M Ω
TIA Saturation Current	--	100	--	μ A	TIA Feedback Resistor 12.5K Ω
	--	50	--		TIA Feedback Resistor 25K Ω
	--	25	--		TIA Feedback Resistor 50K Ω
	--	12.5	--		TIA Feedback Resistor 100K Ω

	--	6.3	--		TIA Feedback Resistor 200K Ω
	--	3.1	--		TIA Feedback Resistor 400K Ω
	--	1.6	--		TIA Feedback Resistor 800K Ω
	--	0.78	--		TIA Feedback Resistor 1.6M Ω
Equivalent Input Noise (LED Off, 4 μ s Integration Window)	--	4.5	--	nA rms	TIA Feedback Resistor 12.5K Ω
	--	2.4	--		TIA Feedback Resistor 25K Ω
	--	1.1	--		TIA Feedback Resistor 50K Ω
	--	0.58	--		TIA Feedback Resistor 100K Ω
	--	0.33	--		TIA Feedback Resistor 200K Ω
	--	0.19	--		TIA Feedback Resistor 400K Ω
	--	0.10	--		TIA Feedback Resistor 800K Ω
	--	0.06	--		TIA Feedback Resistor 1.6M Ω
Equivalent Input Noise (90% Full-Scale Signal, 4 μ s Integration Window) (Including Photodiode Noise)	--	7.5	--	nA rms	TIA Feedback Resistor 12.5K Ω
	--	3.8	--		TIA Feedback Resistor 25K Ω
	--	2.3	--		TIA Feedback Resistor 50K Ω
	--	1.3	--		TIA Feedback Resistor 100K Ω
	--	0.83	--		TIA Feedback Resistor 200K Ω

	--	0.54	--		TIA Feedback Resistor 400K Ω
	--	0.36	--		TIA Feedback Resistor 800K Ω
	--	0.25	--		TIA Feedback Resistor 1.6M Ω
Signal-to-Noise Ratio (SNR) (90% Full-Scale Signal, 4 μ s Integration Window) (Including Photodiode Noise)	--	80	--	dB	TIA Feedback Resistor 12.5K Ω
	--	78	--		TIA Feedback Resistor 25K Ω
	--	76	--		TIA Feedback Resistor 50K Ω
	--	75	--		TIA Feedback Resistor 100K Ω
	--	74	--		TIA Feedback Resistor 200K Ω
	--	73	--		TIA Feedback Resistor 400K Ω
	--	70	--		TIA Feedback Resistor 800K Ω
	--	67	--		TIA Feedback Resistor 1.6M Ω
Ambient Light Rejection Ratio (ALRR)	--	60	--	dB	
LED Pulse Current	1	--	240	mA	Per Channel
LED Driver Port Voltage	--	--	3.6	V	Note: The driver port voltage is not equivalent to the LED anode voltage
Leakage Current of LED Driver When Turned Off	--	--	57	nA	
LED Driver Voltage Drop					IOVDD = 3.3V
	--	65	--	mV	I LED = 25mA
	--	80	--	mV	I LED = 100mA
	--	220	--	mV	I LED = 230mA

Oscillator					
32K Oscillator Error	--	± 0.5	--	%	After Calibration
24M Oscillator Error	--	± 1	--	%	After Calibration

Performance Parameters 2

Parameter	Symbol	Min	Typ	Max	Unit
Package Light Transmittance	99	--	--	%	OLGA Package, 450-950nm
On-Chip Photodiode Sensitivity	--	0.6	--	A/W	CBMPD188B, @940nm

Typical Performance

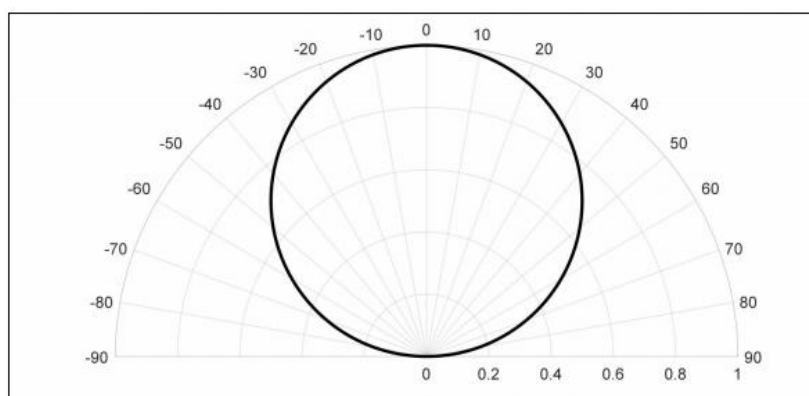


Figure 3: Relative Sensitivity vs. Incident Angle

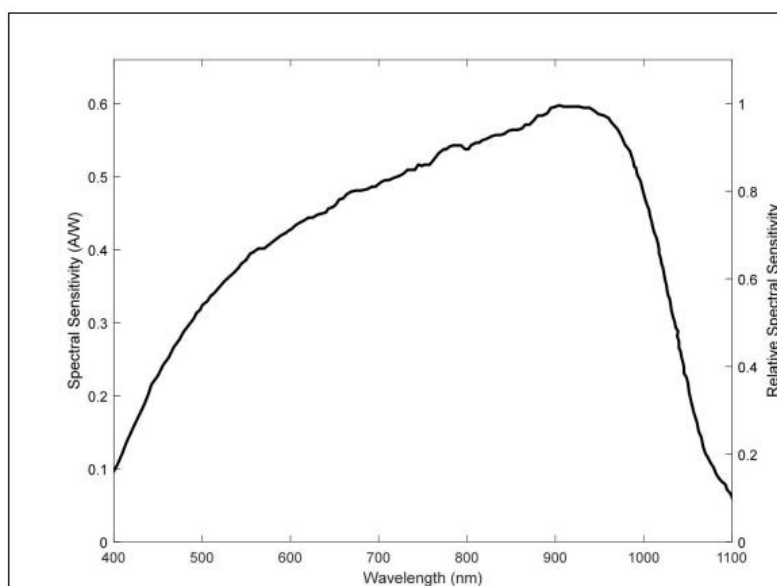


Figure 4: Sensitivity vs. Wavelength

Outline Dimensions

OLGA-24

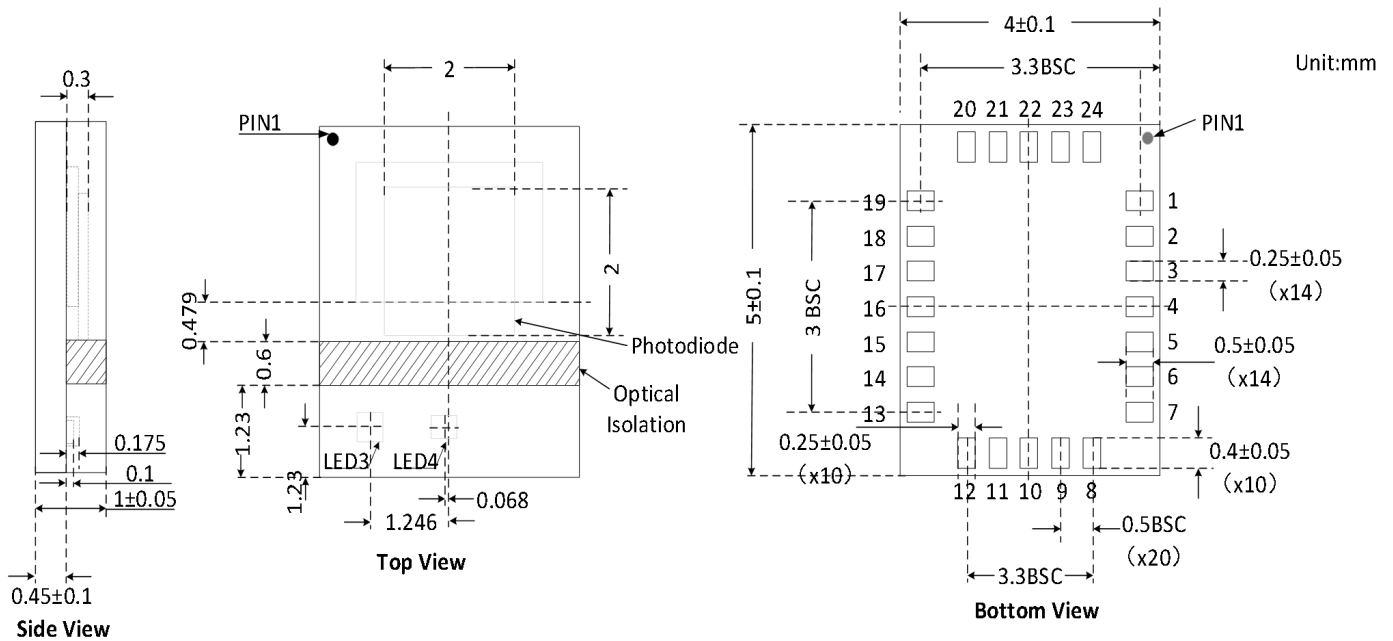


Figure 5: OLGA-24 Package Dimensions Drawing

Package/Ordering Information

MODEL	ORDERI NG NUMBER	TEMPERATURE	PACKAGE DESCRIPTION	PACKAGE OPTION	MAKING INFORMATION
CBMPD188B		-40°C~85°C	OLGA-24		