Ambient Light Detection Module

BME82M131
User Guide

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www.bestmodulescorp.com

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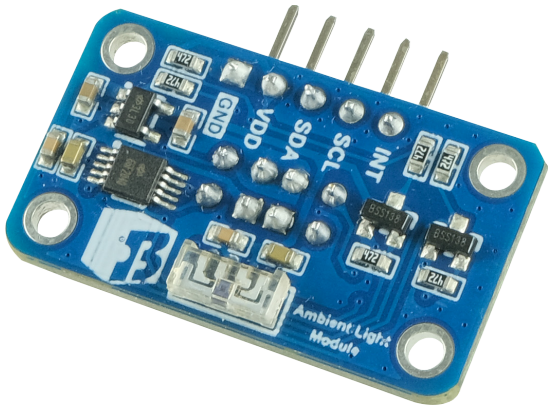
Introduction

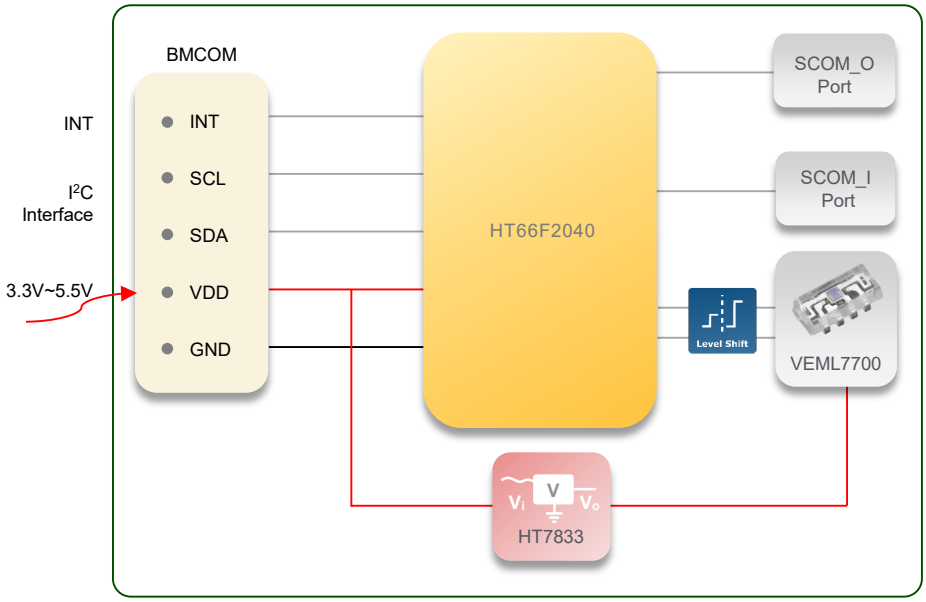
The Best Modules BME82M131 is an ambient light detection module, which is developed by using an MCU, the HT66F2040, and a sensor, the VEML7700. The module is high-accuracy ambient light with 16-bit resolution and the detectable range is from 0klx to 120klx. It is supported a wide range operating voltage from 3.3V to 5.5V. The module can be cascaded and uses the I²C communication method through the BMCOM interface to implement the read of the ambient light intensity. The module is suitable for use in products such as monitoring systems, agricultural cultivation.



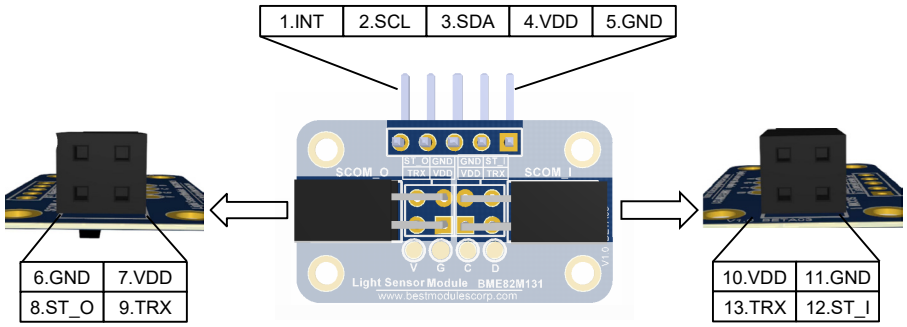
Features

- Operating voltage: 3.3V~5.5V
- Operating current: 6.76mA @ 5V
- MCU: HT66F2040
- Ambient light sensor: VEML7700
  - Range: 0klx~120klx
  - Accuracy: 0.0036lx/ct
- Obtains the ambient light values, adjustable gain and integration time
- Cascade interface:
  - SCOM_I×1 (GND, VDD, ST_I, TRX)
  - SCOM_O×1 (GND, VDD, ST_O, TRX)
  - Cascade maximum number: 8
- Communication interface:
  - BMCOM1×1 (INT, SCL, SDA, VDD, GND)
  - Communication method: I²C (Address: 0x48)
- Provides Arduino Library support
- Module size: 29.50mm×16.95mm×8.34mm

Block Diagram



Pin Description



BMCOM pins:

Pin	Function	Description
1	INT	Interrupt pin. When the ALS is above or below the corresponding threshold, the INT pin is low, vice versa.
2	SCL	I²C clock line
3	SDA	I²C data line
4	VDD	Positive power supply
5	GND	Negative power supply, ground

Cascade SCOM_O pins:

Pin	Function	Description
6	GND	Negative power supply, ground
7	VDD	Positive power supply
8	ST_O	Cascade status output pin
9	TRX	Cascade single-bus communication pin

Cascade SCOM_I pins:

Pin	Function	Description
10	VDD	Negative power supply, ground
11	GND	Positive power supply
12	ST_I	Cascade status input pin
13	TRX	Cascade single-bus communication pin

Technical Specification

Recommended Operating Conditions

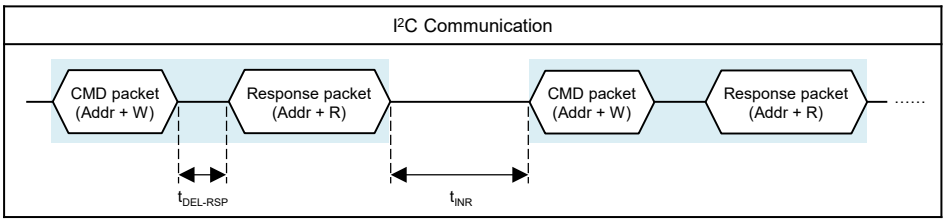
Ta=25°C

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	—	3.3	—	5.5	V
I_{DD}	Operating Current	V_{DD}=5V	—	6.76	—	mA
	Ambient Light Detection Range	V_{DD}=5V	0	—	120	klx
	Ambient Light Detection Accuracy	V_{DD}=5V	0.0036	—	—	lx/ct
	Cascade Number	—	1	—	8	

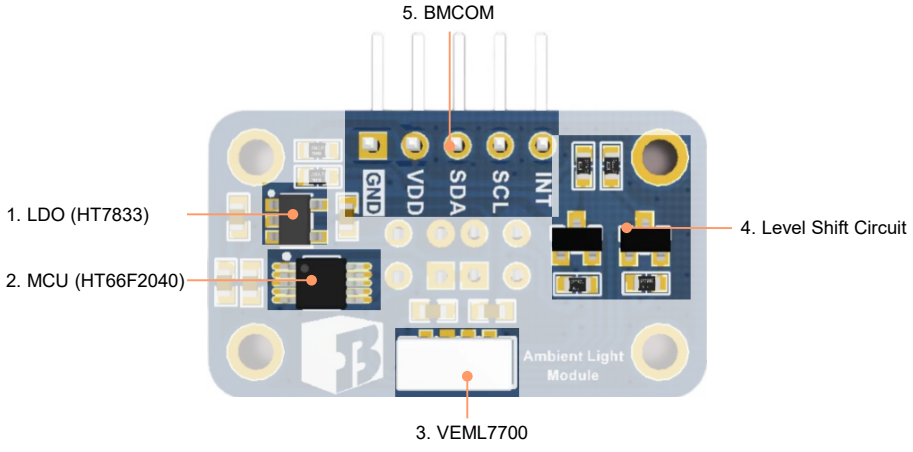
Timing Specification

Ta=25°C

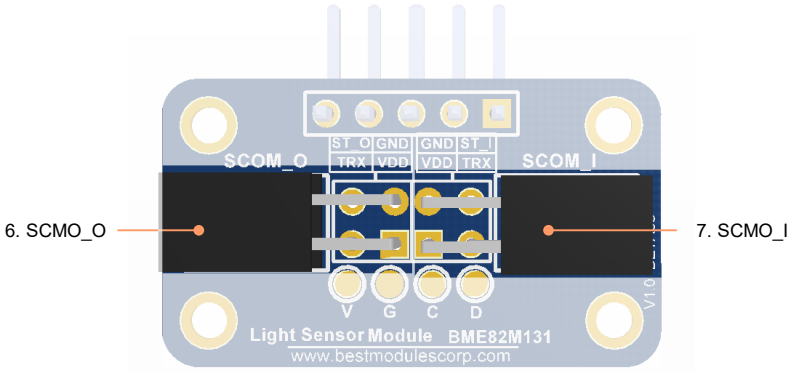
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$t_{DEL-RSP}$	Response Delay Time	V_{DD}=5V	15	—	—	ms
t_{INR}	Interval Time	V_{DD}=5V	—	15	—	ms



Hardware Overview

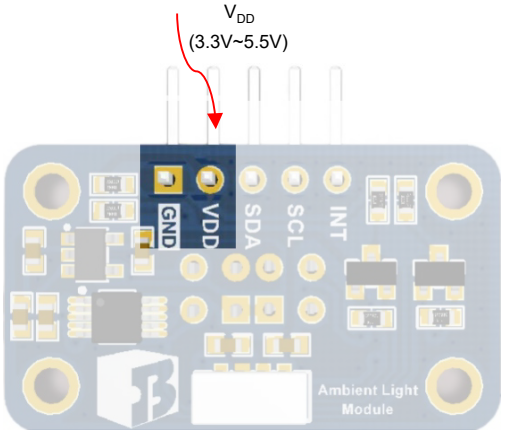


PCBA Front View



PCBA Back View

Power Supply



- BMCOM Pin: Enter 3.3V~5.5V through VDD

INT Pin

- The ALS interrupt status can be selected. When the ALS interrupt is disabled, the INT pin is always high level; when the ALS interrupt is enabled, the INT pin level is as follows:

ALS	INT pin level
The ALS is between the high threshold and low threshold	High level
The ALS is above the high threshold or below the low threshold	Low level

Communication Interface

- Communication method: I²C
  - ♦ I²C address: 0x48

    I²C address format:

MSB LSB

A6	A5	A4	A3	A2	A1	A0	R/W
1	0	0	1	0	0	0	

Slave address (0x48)

Note: R/W=1: Read direction
=0: Write direction

- Communication logic reference voltage: 3.3V~5.5V
- Module SCL/SDA pin with an internal 4.7kΩ pull-high resistor

Communication Protocol

There are two instruction frame formats, known as parameter set instruction frame and parameter obtain instruction frame.

Parameter set instruction frame

- **Master → Slave**

Start	Addr+W	MID	ID	LEN	CMD	Data	CheckSum	Stop
1-bit	1-byte	0x48	1-byte	1-byte	1-byte	N-byte	1-byte	1-bit

- **Slave → Master**

Start	Addr+R	MID	ID	LEN	Status	CheckSum	Stop
1-bit	1-byte	0x48	1-byte	1-byte	1-byte	1-byte	1-bit

Frame content introduction:

- ♦ Start: Start bit signal
- ♦ Addr+R: I²C address read
- ♦ Addr+W: I²C address write
- ♦ MID: Module type ID, the MID of the different type module is different. For this module, MID=0x48
- ♦ ID: It is automatically assigned ID when the same modules are cascaded
  – ID=N: Cascade Nth module (1≤N≤8)
- ♦ LEN: CMD/Status, Data and CheckSum byte length
- ♦ CMD: Command code. Each command code corresponds to a different function

- Status: Command execution
  - 0x00: Command sent successful
  - 0x40: CheckSum error
  - 0x80: Command error
  - 0x0A: Cascade slaves do not respond
- Data: Data
- CheckSum: CheckSum=MID+ID+LEN+CMD/Status+Data
- Stop: Stop bit signal

Parameter obtain instruction frame

• Master → Slave

Start	Addr+W	MID	ID	LEN	CMD	CheckSum	Stop
1-bit	1-byte	0x48	1-byte	1-byte	1-byte	1-byte	1-bit

• Slave → Master

Start	Addr+R	MID	ID	LEN	Status	Data	CheckSum	Stop
1-bit	1-byte	0x48	1-byte	1-byte	1-byte	N-byte	1-byte	1-bit

Parameter Set Instruction Frame

No.	Function Description	CMD	Data	Note
1	ALS configuration	0x02	D_2D_1: ALS configuration Bit15~Bit13: Fixed at 0 Bit12~Bit11: ALS gain setting 00=ALS gain×1; 01=ALS gain×2; 10=ALS gain×(1/8); 11=ALS gain×(1/4) Bit10: Fixed at 0 Bit9~Bit6: ALS integration time setting 1100=25ms; 1000=50ms 0000=100ms; 0001=200ms 0010=400ms; 0011=800ms Bit5~Bit4: ALS number of protection setting 00=1; 01=2; 10=4; 11=8 Bit3~Bit2: Fixed at 0 Bit1: ALS interrupt setting 0: Disable 1:Enable Bit0: ALS switch setting 0: Open 1: Close	
2	Set ALS high threshold	0x03	D_2D_1: ALS high threshold	
3	Set ALS low threshold	0x04	D_2D_1: ALS low threshold	
4	Set power-saving mode	0x05	D_2D_1: Power-saving mode Bit15~Bit3: Fixed at 0 Bit2~Bit1: Power-saving mode setting 00=mode 1 01=mode 2 10=mode 3 11=mode 4 Bit0: Power-saving mode enable/disable setting 0: Disable 1: Enable	Mode 4 is the strongest; Mode 1 is the weakest

Parameter Obtain Instruction Frame

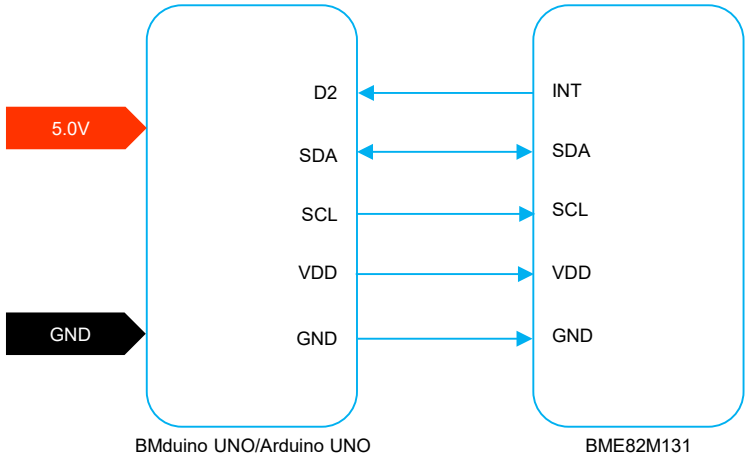
No.	Function Description	CMD	Response Data	Note
1	Obtain the cascade module number	0x01	D_1: Cascade module number	ID=1
2	Obtain ALS configuration	0x06	D_2D_1: ALS configuration Bit15~Bit13: Fixed at 0 Bit12~Bit11: ALS gain 00=ALS gain×1; 01=ALS gain×2; 10=ALS gain×(1/8); 11=ALS gain×(1/4) Bit10: Fixed at 0 Bit9~Bit6: ALS integration time 1100=25ms; 1000=50ms 0000=100ms; 0001=200ms 0010=400ms; 0011=800ms Bit5~Bit4: ALS number of protection 00=1; 01=2; 10=4; 11=8 Bit3~Bit2: Fixed at 0 Bit1: ALS interrupt 0: Disable 1: Enable Bit0: ALS switch 0: Open 1: Close	
3	Obtain ALS high threshold	0x07	D_2D_1: ALS high threshold	
4	Obtain ALS low threshold	0x08	D_2D_1: ALS low threshold	
5	Obtain power-saving mode configuration	0x09	D_2D_1: Power-saving mode configuration Bit15~Bit3: Fixed at 0 Bit2~Bit1: Power-saving mode setting 00=mode 1 01=mode 2 10=mode 3 11=mode 4 Bit0: Power-saving mode enable/disable setting 0: Disable 1: Enable	
6	Obtain ALS value	0x0A	D_2D_1: ALS value (Note)	
7	Obtain white-balance value	0x0B	D_2D_1: White-balance value	
8	Obtain ALS interrupt flag	0x0C	D_2D_1: ALS interrupt flag Bit15: Low threshold interrupt flag 1: ALS value<low threshold, interrupt generated 0: No interrupt generated Bit14: High threshold interrupt flag 1: ALS value>high threshold, interrupt generated 0: No interrupt generated Bit13~Bit0: Fixed at 0	

Note: Ambient light intensity=ALS value/ALS gain×Responsivity, unit: lx

Responsivity=Output digital signal current/input light signal power, related to ALS integration time

ALS integration time (ms)	25	50	100	200	400	800
Responsivity	0.2304	0.1152	0.0576	0.0288	0.0144	0.0072

Application Circuit



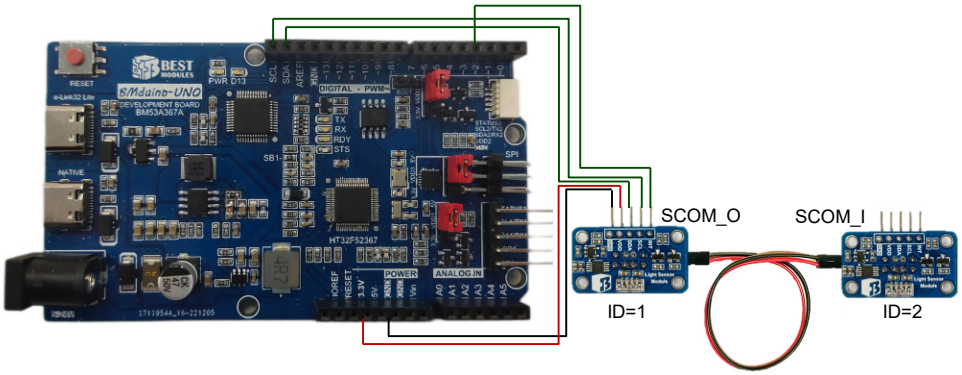
Connection Diagram

Multi-board Cascade

This module can be cascaded up to 8, the corresponding ID=1~8. The cascade ID of the module directly connected with the Bmduino UNO development board is 1.

Multiple modules are cascaded using a 2.54mm, double-row, 2P and male-to-male DuPont line or pin headers in series. The former module SCOM_O interface should be connected to the latter module SCOM_I interface.

Take the case of 2 modules cascading as an example.

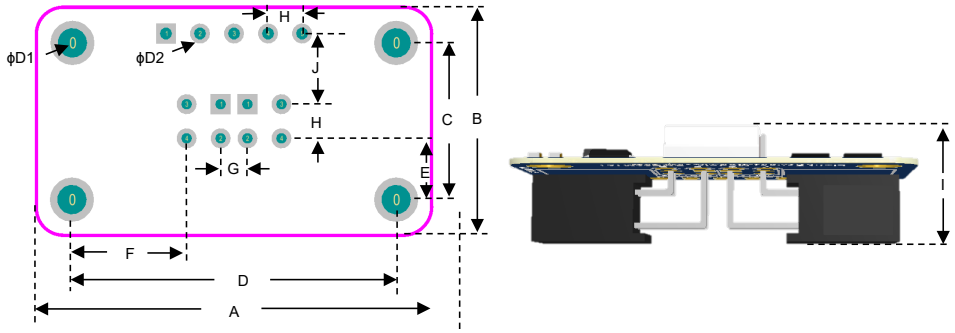


Cascade Diagram

Note:

1. The module ID is only assigned once when the overall modules are initially powered on, it should be ensured that the cascade module connection is completed before power-on, otherwise it will affect the module ID assignment. Modules cannot be plugged and unplugged during use.
2. When cascading multiple modules, the SCOM_I and SCOM_O interfaces should be connected. The module that is connected to the host has an ID of 1. This module SCOM_O interface should be connected to the next module SCOM_I interface. When connecting two modules, pay attention to the connection to ensure that there is no wrong connection.

Dimensions



Dimension Information

No. \ Unit	mm	inch
A	29.50	1.16
B	16.95	0.67
C	11.56	0.46
D	24.20	0.95
E	4.55	0.18
F	8.56	0.34
G	2.00	0.08
H	2.54	0.10
J	5.25	0.21
D1	2.20	0.09
D2	1.50	0.06
I	8.34	0.33

Dimension List