2m Micro 3D ToF Camera Sensor Module

Key Properties

- Range: 0.1~2m
- Resolution: 64 pixel (8x8)
- Accuracy: 4cm @ <1m
  4% @ ≥1m
- Frequency: 1~30Hz
- Wavelength: 940nm
- FOV: 32°
- Laser Safety: Class 1
- Communication Interface: TTL(UART)

Function

- Distance / Amplitude Measurement
- Manual / Adaptive Integration Time Setting
- Period Frequency Setting

Introduction

The LDA2M64S is a micro 3D distance measurement module utilizing a 3D TOF (Time of Flight) sensor. It features a resolution of 64 pixels arranged in an 8x8 grid, providing depth and intensity information for each pixel. The module can measure distances up to 2 meters and is suitable for both indoor and outdoor environments. It also complies with laser safety Class 1 standards.

In terms of control, the LDA2M64S uses standard TTL-UART communication, allowing each pixel's depth and intensity data to be obtained through commands. The integration time parameters can also be set automatically or manually to adapt to different environments and requirements. With its compact design and weight of less than 1 gram, it is suitable for integration into a wide range of applications.

1. Specifications

Technical specifications	
Model Name	LDA2M64S
Range*1	0.1~2m
Resolution	64 pixel (8x8)
Frequency	1~30 Hz
Distance Resolution*2	0.1~0.5m: 1cm 0.5~1.5m: 2cm 1.5~2.0m: 4cm
Accuracy*2	<1m: ±4cm ≥1m: ±4%
Repeatability*3	<0.5m: ±1cm ≥0.5m: ±2%
Optical Design	
Wavelength	940 nm
FOV	32°
Laser Safety	Class 1
Communication	
Communication Interface	3.3V TTL (UART)
Baud rate	115200 bps
Interface Connector	Soldering: Solder pad FPC: HRS FH26W-15S-0.3SHW or Similar
Power Consumption	
Input Voltage	DC 5V
Power Consumption	Typ.: 360mW Max: 420mW
Mechanical	
Dimension	18 × 12 × 4.5 mm
Weight	0.9±0.1g
Environmental	
Operating Temperature	-10 ~ +55 °C
Storage Temperature	-20 ~ +80 °C

Note:

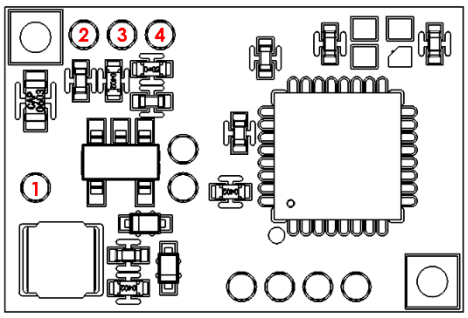
1. Conditions of measurement range: Reflectivity ≥ 85%
2. Resolution and Accuracy are based upon the average of 50 measurements.
3. Repeatability is based upon 50 measurements, 1σ.
4. Power Consumption is based upon 10fps typ., measured by –SMD.

2. Pin Assignment

LDA2M64S offers both soldering and FPC options. The soldering points provide Vcc, GND, TX, and RX solder pad. The FPC uses the HRS FH26W-15S-0.3SHW connector, allowing you to connect with a 15-pin, 0.3mm pitch FPC cable.

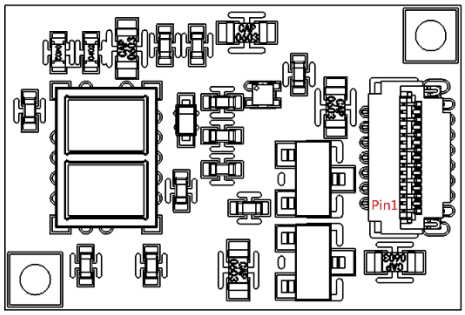
2.1 Soldering

Pin	Function	Description
1	Vcc	DC 5V
2	GND	Ground
3	TX	3.3V TTL (UART)
4	RX	3.3V TTL (UART)

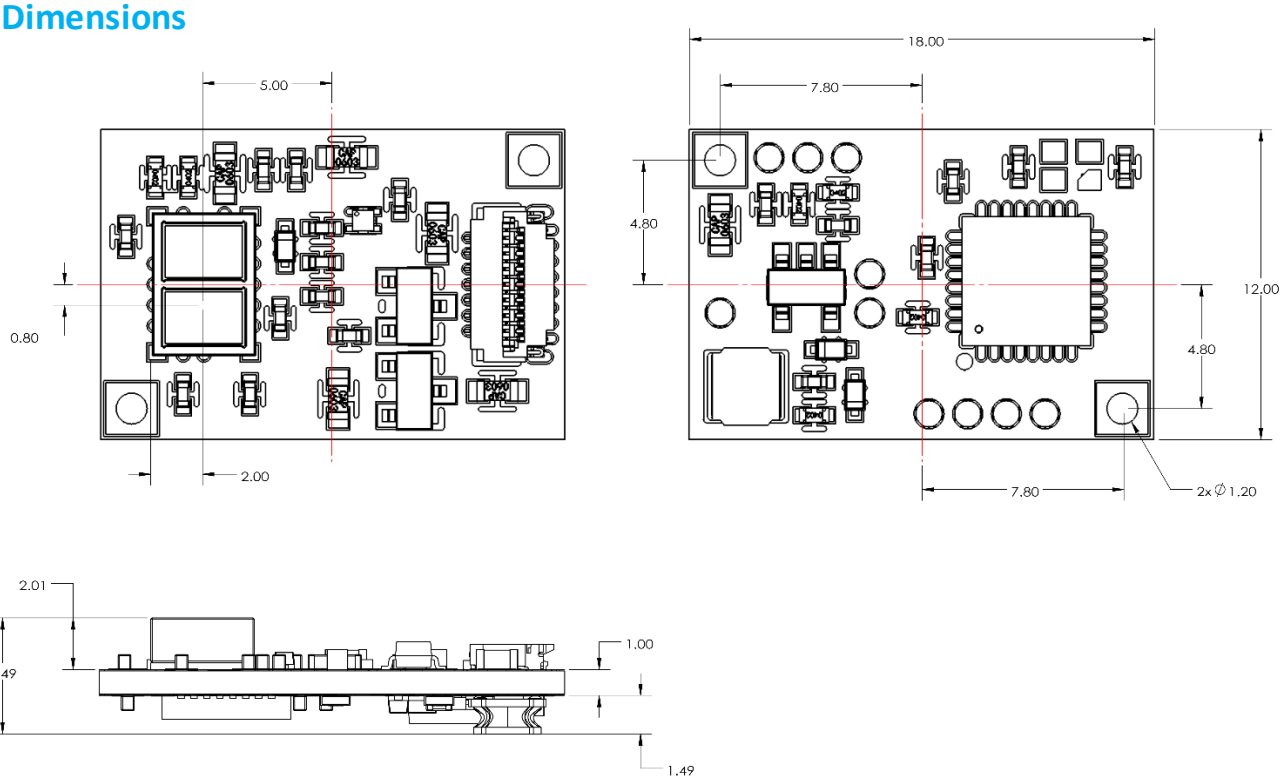


2.2 FPC Connector

Pin	Function	Description
1	NC	No Connection
2	GND	Ground
3	GND	Ground
4	NC	No Connection
5	NC	No Connection
6	GND	Ground
7	NC	No Connection
8	NC	No Connection
9	GND	Ground
10	RX	3.3V TTL (UART)
11	GND	Ground
12	TX	3.3V TTL (UART)
13	Vcc	DC 5V
14	Vcc	DC 5V
15	NC	No Connection



3. Dimensions



4. Communication

4.1 UART configuration parameters:

At a baud rate of 115200 bps, the protocol is set to 8N1, and byte data is in hexadecimal.

*Baud rate: 115200 bps

*Data bits: 8

*Parity bits: None

*Stop bits: 1

4.2 Data Frame Format:

4.2.1 Send Format:

The command packet sent has a fixed length of 14 bytes. It starts with a fixed byte of 0xF5, followed by 1 byte for command ID (CMD), 8 bytes for the command parameters, and 4 bytes for CRC32, The data order is the lower-order bits (LSB) are at the front, and the higher-order bits (MSB) are at the back.

Head	CMD	Parameter	CRC32
0xF5	1 byte	8 bytes	4 bytes

4.2.1 Receive Format:

The receive packet has a variable length. It starts with a fixed byte of 0xFA, followed by 1 byte for command ID (CMD), a 2 byte length definition indicating the length of n bytes of data, and 4 bytes for CRC32, The data order is the lower-order bits (LSB) are at the front, and the higher-order bits (MSB) are at the back.

Head	CMD	Length	Data	CRC32
0xFA	1 byte	2 bytes	n bytes	4 bytes

4.3 CRC32

The Cyclic Redundancy Check (CRC) calculation includes all bytes of the packet except for the CRC itself, using the CRC-32-MPEG-2 algorithm. The calculation parameters are as follows:

*Init value: 0xFFFFFFFF

*Xor value: 0x00000000

*Polynom: 0x04C11DB7

4.4 Command code list

Command code	Description
0x40	Set Power
0x57	Get Region Size
0x29	Get Distance Amplitude
0x55	Set Adaptive Integration Time
0x58	Set Period Frequency
0x00	Set Integration Time
0x4A	Get Temperature

Command code	Description
0x00	Confirmation of receive
0x01	Unrecognized command
0x0C	Return region size
0x0B	Return measurement result
0xFC	Return temperature
0xFF	Data error

4.5 Command description

4.5.1 Set Power [0x40]

Set module in power-up or power-down mode, and return after process is complete. Make sure to power-up the device before executing any acquisition commands.

Send			
0xF5	0x40	8 bytes*1	4 bytes
*1. Parameter byte 0: 0x00 is power-down, 0x01 is power-on, other is 0x00 *2. Example: Set power-on is F5 40 01 00 00 00 00 00 00 00 9C D7 D6 91 Set power-off is F5 40 00 00 00 00 00 00 00 00 56 0B 77 CA			

*Response time power-up: <200ms

*Response time power-down: <30µs

Receive				
0xFA	0x00	0x00 0x00	0 byte	0xB2 0xAB 0xFC 0xE8

4.5.2 Get Region Size [0x57]

Get the length and width of the sensor pixel area.

Send			
0xF5	0x57	0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00	0xD7 0x7C 0xB3 0x05

*Response time: ~ 40 µs

Receive				
0xFA	0x0C	0x02 0x00	0x08 0x08	0x7B 0xA5 0x60 0x0F
*8x8 pixels, length = 8 and width = 8				

4.5.3 Get Distance Amplitude [0x29]

Start a new measurement frame. Once completed, return the distance and amplitude, with the distance in units of 0.1 mm and the amplitude as a quality indicator of the distance measurement (unit LSB).

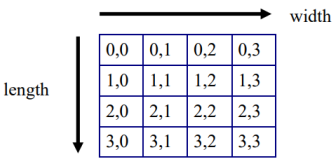
Send			
0xF5	0x29	0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00	0xCB 0xFA 0xAB 0xE7

*Response time: <25ms

Receive				
0xFA	0x0B	0x00 0x02*	512 bytes*	4 bytes

*The length of the distance data is Length × width × 4 bytes, followed by the amplitude length, which is also Length × width × 4 bytes. Therefore, the total length of the returned data is 2 × . Length × width × 4 bytes = 2 × 8 × 8 × 4 = 512 bytes.

*The data order corresponds to the coordinates as follows: (0,0), (0,1),..., (0,8), (1,0),..., and ends with (8,8).



Distance:
*Each pixel is 4 bytes, distance (unit 0.1 mm) or status, represented as 32-bit unsigned integer.

Amplitude:
*Each pixel is 4 bytes, amplitude (unit LSB), represented as 32-bit unsigned integer.
*The ToF amplitude data below indicate that if the pixel is too "dark" or too "bright," the distance data may be inaccurate.
-Amplitude < 100 LSB: Significant distance noise.
-Amplitude > 1900 LSB: Potential considerable error in distance.
-Amplitude between 100 and 1900 LSB: Good distance data.

Status:
The data below indicate an "error" related to the pixel (not distance or amplitude data).
E8 27 F4 00: Low ToF amplitude
D0 2B F4 00: Overflow
B8 2F F4 00: Saturation
A0 33 F4 00: Reserved
88 37 F4 00: Underflow
70 3B F4 00: High ToF amplitude

*Example: FA 0B 00 02 24 0F 00 00... E8 04 00 00.....
Distance is 387.6mm..., total is 256 bytes (0x24 + 0x0F*256 = 36 + 15*256 = 3876 = 387.6mm)
Amplitude is 1256 LSB..., total is 256 bytes (0x E8 + 0x04*256 = 232 + 4*256 = 1256 = 1256 LSB)

4.5.4 Set Adaptive Integration Time [0x55]

Enable the adaptive integration time function. The integration time will be automatically adjusted during measurements. Each measurement may have a different integration time based on the object being measured. After turning on the module, the adaptive integration time function is enabled by default (no respond command confirm this time). With the adaptive integration time function enabled, the typical acquisition speed is approximately 12fps, meaning the module can handle about 12 acquisition commands, such as Get Distance Amplitude [0x29], per second.

Send			
0xF5	0x55	8 bytes*1	4 bytes
*1. Parameter byte 0: 0x00 is enable, 0x01 is disable, other is 0x00 *2. Example: Enables adaptive integration time is F5 55 00 00 00 00 00 00 00 00 AC 35 73 E5 Disable adaptive integration time is F5 55 01 00 00 00 00 00 00 00 66 E9 D2 BE			

*Response time: ~ 40 µs

Receive				
0xFA	0x00	0x00 0x00	0 bytes	0xB2 0xAB 0xFC 0xE8
*The module does not respond when the function is enabled by default upon powering on the module.				

4.5.6 Set Period Frequency [0x58]

The purpose of this function is to increase the fps when Adaptive Integration Time is enabled. Since the integration time is recalculated and updated with each measurement, this function allows without recalculated in specified times, thus improving the fps. For example, if parameter is set to 5, the integration time will be adaptively updated during the first measurement, and the same integration time will be used for the next 4 measurements without recalculation. The parameter setting range is from 1 to 9. This function can enhance the fps up to a maximum of 30fps.

Send			
0xF5	0x58	8 bytes*1	4 bytes
*1. Parameter byte 0 set range is 1~9, other is 0x00 *2. Example: Set the parameter to 0 is F5 58 00 00 00 00 00 00 00 00 BE 13 70 5C Set the parameter to 5 is F5 58 05 00 00 00 00 00 00 00 EB A1 97 6D			

*Response time: ~ 40 µs

Receive				
0xFA	0x00	0x00 0x00	0 bytes	0xB2 0xAB 0xFC 0xE8

4.5.7 Set Integration Time [0x00]

Set the integration time manually for distance measurements, and it will be used until the module is turned off or new integration time is set. The integration time ranges from 1 to 1600 µs. To set the integration time manually, the adaptive integration function must be disabled first.

Send			
0xF5	0x00	8 bytes*1	4 bytes
*1. Parameter byte 0~1 set integration time, range is 1~1600µs, other is 0x00 *2. Example: Set integration time to 30µs is F5 00 00 1E 00 00 00 00 00 00 D9 85 1A 99 Set integration time to 100µs is F5 00 00 64 00 00 00 00 00 00 17 D2 53 CE			

*Response time: ~ 40 µs

Receive				
0xFA	0x00	0x00 0x00	0 bytes	0xB2 0xAB 0xFC 0xE8

4.5.8 Get Temperature [0x4A]

Get the chip temperature during last distance measurement.

Send			
0xF5	0x4A	0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00	0x18 0x41 0xF5 0xA4

*Response time: ~ 40 µs

Receive				
0xFA	0x00	0x02 0x00	2 bytes	4 bytes
*Unit 0.01°C *Example: FA FC 02 00 47 13 4F EE 12 1F, temperature is 0x47 + 0x13*256 = 71 + 19*256 = 4935 = 49.35°C				

4.5.9 Unrecognized command

System response only: Command not accepted or unknown.

Receive				
0xFA	0x01	0x00 0x00	0 bytes	0x35 0x07 0x24 0xE9

4.5.10 Data error

System response only: Error occurred during the execution of the command. Response instead of the required data.

Receive				
0xFA	0xFF	0x02 0x00	2 bytes	4 bytes
Please contact us via email if the error continues to occur.				