Simblee™ IoT 3D ToF Sensor Module RFD77402

DATASHEET

Features

- Fully Integrated microelectronic device with an embedded sensor and VCSEL(Vertical Cavity Surface Emitting Laser)
  - 850 nm VCSEL and electronic driver
  - Optical receiver sensor and optics
  - Microelectronic controller
- Time-of-Flight (ToF) is a highly accurate distance mapping and 3D imaging technology
- Eye safe invisible infrared (IR) illumination using a class 1 laser emitter
- High accuracy and high repeatability
- I2C interface for device control and data transfer
- Ultra-small SMD package
- Standard solder reflow compatible
- Lead-free, RoHS compliant
- Small size 4.8mm x 2.8mm x 1mm

Applications

- Absolute and highly accurate distance measurement at distances ranging from 100 mm to 2000 mm
- User detection for IoT devices
- Robotics applications such as obstacle detection and obstacle avoidance
- White goods type of applications such as hand detection in automatic faucets and soap dispensers
- 1D gesture recognition
- Directional movement detection along Z-axis
- Volume or height control

1. General Characteristics

1.1   Technical Specifications

| Parameter	Description	Units
Package Size	4.8 x 2.8 x 1.0 (LxWxH)	mm
Interface	I2C (up to 1 MHz)	
I2C address	0x4C	hex
Light source (type/wavelength)	VCSEL / 850 nm	nm
Field of Illumination	29° @1/e2	degree
Field of View	55° @1/e2	degree
Measurement range	100 mm to 2000 mm (*)	mm
Maximum refresh rate	10	Hz
Precision	+/-10 (*)	%
Laser eye safety	Class 1 laser product	
MSL	Class 3	

(*) target with 90% reflectivity in dark environment and with no cover glass

1.2   Electrical Specifications

Parameter	Min	Typ	Max	Units	Notes
Standby current	9.3	9.7	15	μA	
Current consumption (@ full range, 10 Hz –worst case)	-	7	15	mA	
Operating Voltage	2.7	3.0	3.3	V_{dd}	
Pull-up Voltage	1.8	-	V_{dd}	$V_{pull-up}$	
Operating Temperature	-10	-	60	°C	
Temperature not to exceed	-	-	245	°C	
I2C: SDA and SCL					
V_{IL}	0	-	0.9	V	
V_{IH}	1.2	-	-	V	
V_{OL} (@ 3mA)	-	0.02	-	V	
I_{OL} (@ V_{OL} = 0.4V)	-	8	-	mA	

2. Device Pinout

2.1   IoT 3D Tof Module Pinout
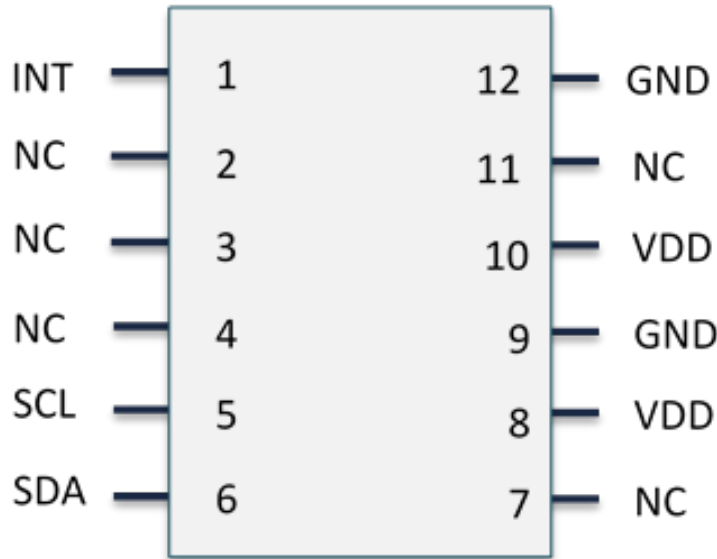
2.2   Pin Descriptions

Name	Pin	Type	Signal	Comments
1	INT	Digital output	Reserved	
2	NC	NC	DO NOT CONNECT	
3	NC	NC	DO NOT CONNECT	
4	NC	NC	DO NOT CONNECT	
5	SCL	Digital input	I2C serial clock	
6	SDA	Digital input/output	I2C serial data	
7	NC	NC	DO NOT CONNECT	
8	VDD	Supply	Power Supply	
9	GND	Ground	To be connected to main ground	
10	VDD	Supply	Power Supply	
11	NC	NC	DO NOT CONNECT	
12	GND	Ground	To be connected to main ground	

3. Block Diagram

Ranging	Light Sensor

Microcontroller

OTP Memory	RAM

VCSEL Driver

RFD77402
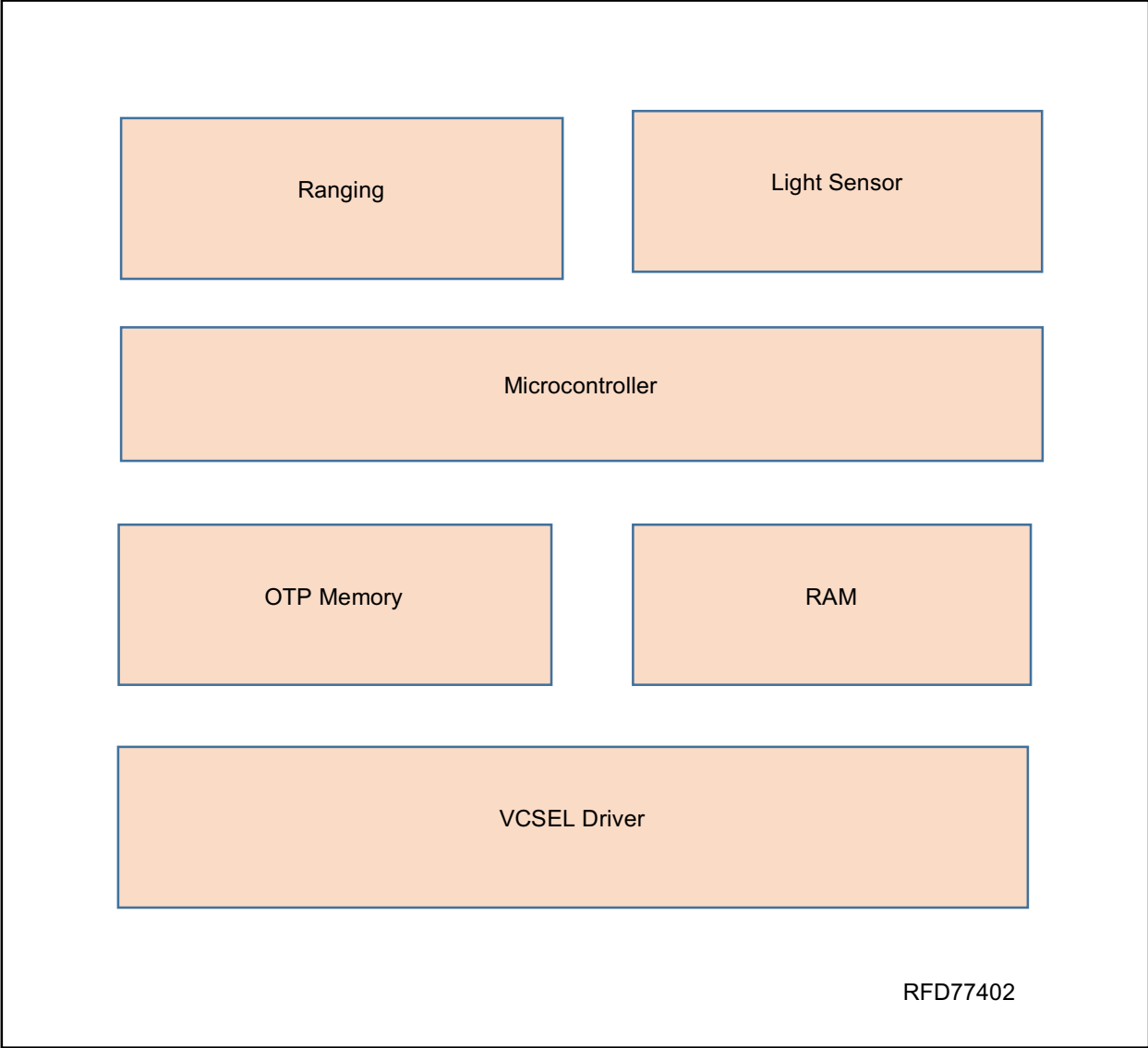
4. Example Circuit Diagrams

4.1   Basic Circuit

5. Mechanical Specifications

5.1   Physical Dimension

5.2   PCB Land Pattern

RECOMMENDED LANDING PADS   RECOMMENDED SOLDER MASK OPENING

5.3   Field of View (FoV) and Field of Illumination (FoI)

FoV = 55 degrees @1/e2

FoI = 29 degrees @1/e2

RFD77402 DATASHEET v1.0
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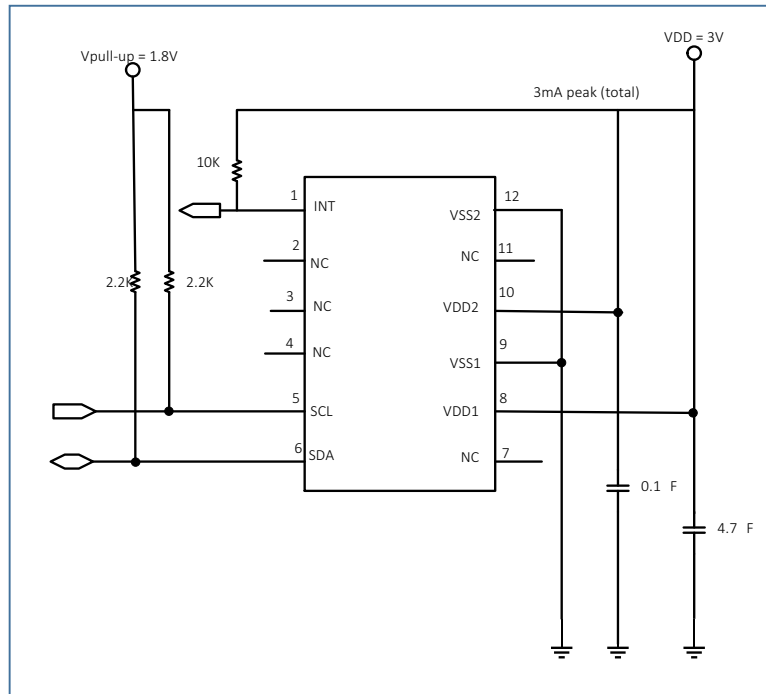
6. Cover Glass

The module supports use behind a cover glass under certain defined conditions. This might be done for cosmetic or protective purposes. Sensor performance can be the same as without cover glass so long as the correct cover glass material is selected and the calibration procedure is followed.

6.1   Selection Guide

In order to obtain the best performances, the following rules should be taken into account for the Cover Glass:

- -   Material: PMMA, Acrylic
- -   Spectral transmittance: T < 5% for λ < 770nm, T > 90% for λ > 820nm
- -   Air gap: < 100μm
- -   Thickness < 1mm, thinner is better
- -   Dimensions: bigger than 6x8mm
- -   All the surfaces of the CG not relevant for the VCSEL emission and signal detection (e.g. lateral faces) should be absorbing (e.g. by applying black non-reflective color on the edges (short sides) of the cover glass.).

7. Reflow Temperature Profile

7.1   Solder Profile
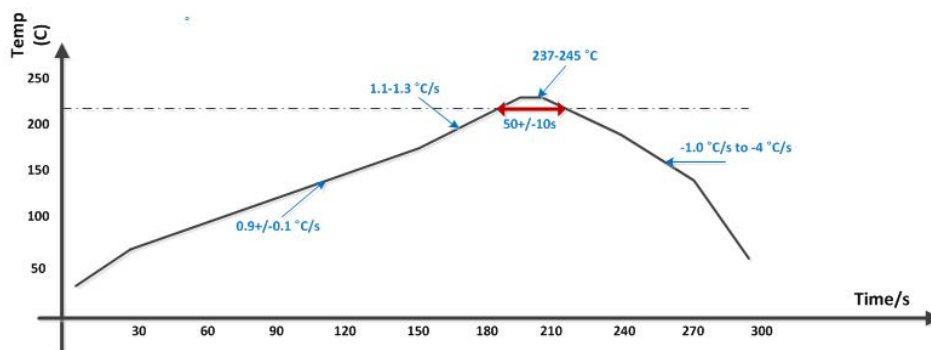
7.2   Recommended Reflow Profile

Profile	Ramp to strike		
Temperature gradient in preheat	(T= 70 - 180°C):		0.9 +/- 0.1°C/s
Temperature gradient	(T= 200 - 225°C):		1.1 - 3.0°C/s
Peak temperature in reflow	237°C - 245°C		
Time above 220°C	50 +/- 10 seconds		
Temperature gradient in cooling	-1 to -4 °C/s (-6°C/s maximum)		
Time from 50 to 220°C	160 to 220 seconds		

8. Packaging

8.1 Tape and Reel Dimensions

Ao	3.10	+/- 0.1
Bo	5.10	+/- 0.1
Ko	1.30	+/- 0.1
F	5.50	+/- 0.05
P1	8.00	+/- 0.1
W	12.00	+0.3/-0.1

(I)   Measured from centreline of sprocket hole
      to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket
      holes is ± 0.20 .
(III) Measured from centreline of sprocket
      hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

8.2 Storage Conditions

MSL Level	Floor Life (out of bag) at Factory Ambient <30oC/60% RH
3	**1 week**

After this limit, dry bake to be done; 6 hours at 85°C.

9. Certifications

9.1 RoHS & REACH Compliance

The RFD77402 module is compliant with the European RoHS Directive 2002/95/EC (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) and REACH (Registration, Authorization and Restriction of Chemicals, European Union Regulation (EC) 1907/2006).

10. Considerations

10.1 Eye Safety

The RFD77402 module contains a laser emitter and corresponding drive circuitry. The laser output is Class 1 laser safety under all reasonably foreseeable conditions including single faults in compliance with IEC 60825-1:2014. The laser output will remain within Class 1 limits as long as the Simblee recommended device settings are used and the operating conditions specified in this datasheet are respected. The laser output power must not be increased by any means and no optics should be used with the intention of focusing the laser beam.

10.2 Class 1 Laser Product Label

11. Revision Control

11.1   Revision Table

Revision No.	Date	Notes
1.0	02.06.17	Initial release

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