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BRIGHTTEK (EUROPE) LIMITED

Brighten up The World With LED!



ISO/TS 16949:2009



BS EN ISO 14001:2004



QC 080000 IECQ HSPM

PRODUCT DATASHEET



- ▶ Time-of-Flight (ToF) Proximity Sensor
- ▶ 2x2 dToF 3622 1.00t
- ▶ 940nm VCSEL

NOS67S36 (BC3622) ToF Proximity Sensor



Release Date: 10 September 2024 Version: A1.1



BC3622 dToF Sensor

BC3622 dToF Sensor



FEATURES:

- **Package:** BC3622 Integrated Miniature Module with:
 - ✓ 940nm VCSEL
 - ✓ Histogram algorithms embedded
 - ✓ Low-power CPU with firmware running
- **Field of View (typ.):** $\pm 18.5^\circ$
- **Field of Illumination (typ.):** $\pm 10^\circ$
- **Single Power Supply:** 2.7~3.5V
- **FPS:** 30 max.
- **Interface:** I²C (up to 1MHz)
- **Eye Safety:** Class 1
- **Measure Ranging Distance:** 2~250cm
- **Soldering methods:** Reflow soldering
- **MSL Level:** acc. to J-STD 020 Level 3

APPLICATIONS:

- Augmented Reality (AR)/Mixed Reality (MR)/Virtual Reality (VR)
- Robot/AGV/Drone/UAV
- Laser Assisted Autofocus (AF)
- Distance Measurement
- Video Surveillance Equipment
- Smart Lighting
- Collision Avoidance
- AI/ML-on-Edges

CHARACTERISTICS:

Maximum Ratings ($T_a=25^\circ\text{C}$)

Parameter	Symbol	Ratings	Unit
VDD, VDDV, VDDC	V_{DD}	-0.3~3.6	V
GND, GNDV, GNDC	GND	0	V
GPIO0, GPIO1	$V_{I/O}$	-0.3~3.6	V
SCL, SDA, INT, EN	$V_{I/O}$	-0.3~3.6	V
ESD withstand Voltage (HBM: JEDEC JS-001-2017)	$V_{ESD-HBM}$	1500	V
ESD withstand Voltage (CDM: JEDEC EIA/JESD22-C101F)	$V_{ESD-CDM}$	500	V

- The reflow peak soldering temperature is specified according to IPC/JEDEC J-STD-020.

Recommended Operating Conditions ($T_a=25^\circ\text{C}$)

Parameter	Symbol	Ratings	Unit
VDD, VDDV, VDDC	V_{DD}	2.7~3.5	V
Operating Temperature	T_{OPR}	-40~+85	$^\circ\text{C}$

Control I²C Interface

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Clock Speed	---	---	100	1000	kHz

Clock signal (SCL) generation is performed by the master device. The master device initiates data transfer. The I²C bus on the EPSP1100 has a maximum speed of 1 Mbits/s and slave address "0x41".

Reference Registers

Register Name	Index	Default Value
BL revision	0x00	0x12
Sensor reset	0xE0	0x81
Device ID	0xE3	0x08

Power Consumption

Parameter	State	Values			Unit
		Min.	Typ.	Max.	
Power on, pin EN low	Power Down	---	0.8	---	mA
Power on, pin EN high	Wake-up	---	2.0	---	mA
CPU low-speed, ranging not active	Standby 1	---	26.6	---	mA
CPU high-speed, ranging not active	Standby 2	---	42.5	---	mA
CPU run, ranging active	Process	---	50.0	---	mA

Temperature and voltages are at nominal conditions (ambient and 3.0 V).

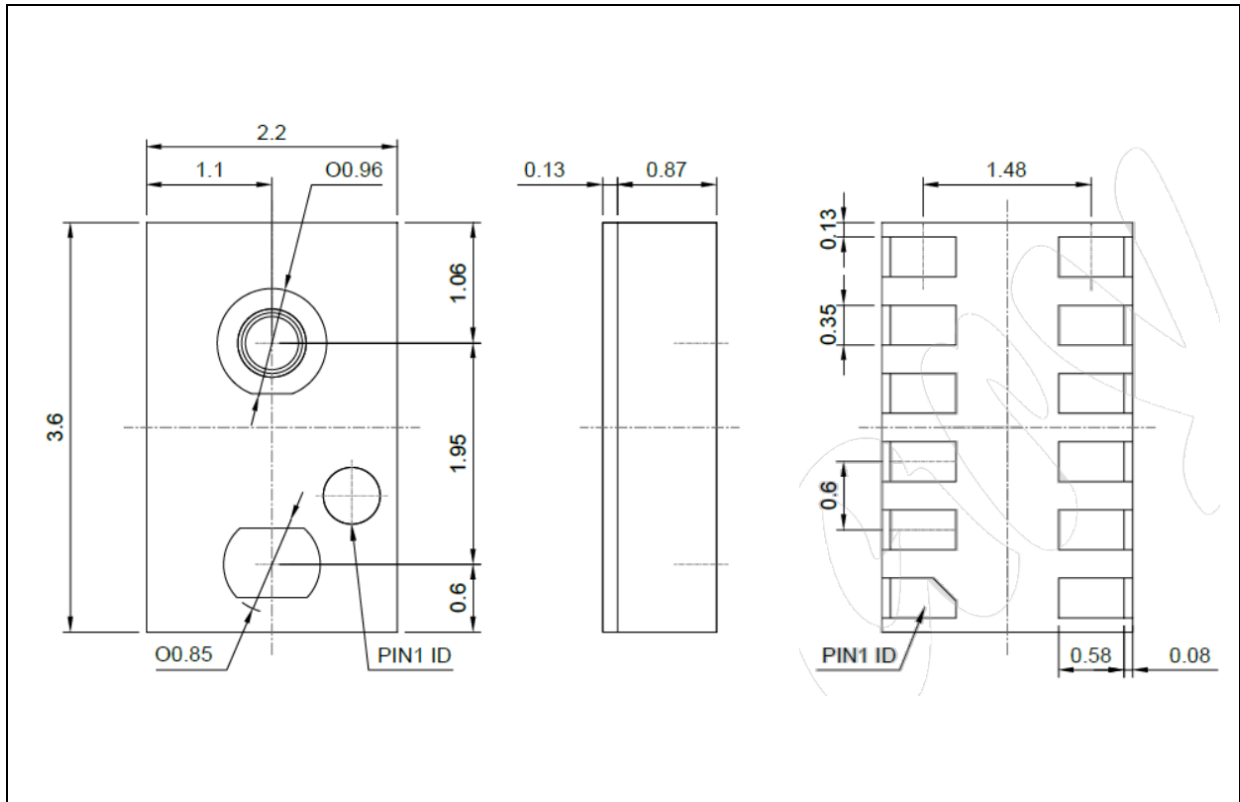
Function Timing

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Power on	---	---	---	5	ms
Ranging Processing	---	25	33	100	ms
Ranging Period	---	---	100	---	ms

Temperature and voltages are at nominal conditions (ambient and 3.0 V).

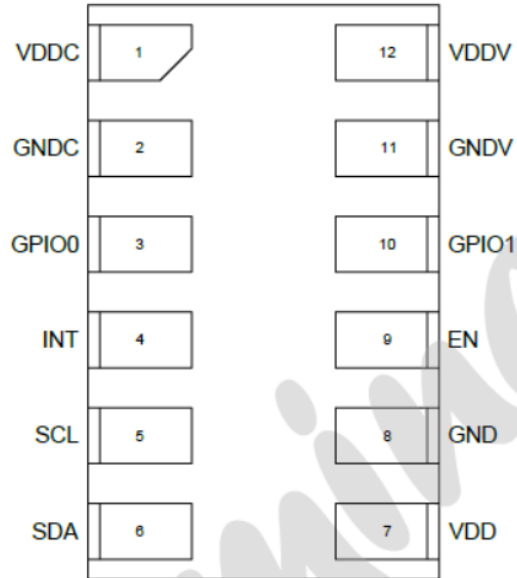
OUTLINE DIMENSION:

Package Dimension:



1. All dimensions are in millimetre (mm).
2. Tolerance ± 0.05 mm, unless otherwise noted.
3. Keep free of mechanical items which interfere with module operation in irradiate and receive area.

PIN CONFIGURATION:



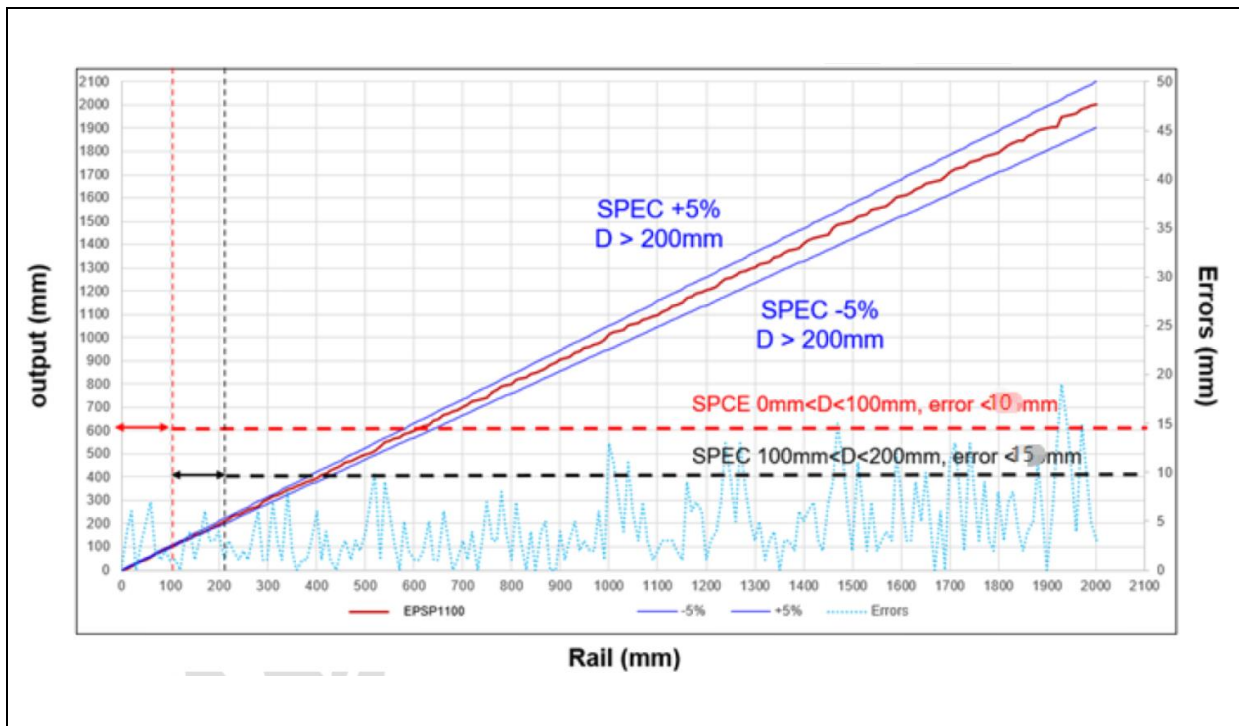
Pin num.	Pin name	Pin type	Description
1	VDDC	Power	Charge-pump supply, add a capacitor with 0.1uF to GNDC.
2	GNDC	Ground	Charge-pump ground, connected to GND together.
3	GPIO0	Input/Output	General purpose I/O, leave floating if not used.
4	INT	Output	Interrupt, open-drain output, connect to GND if not used.
5	SCL	Input	I ² C clock
6	SDA	Input/Output	I ² C data
7	VDD	Power	Chip supply, add a capacitor with 0.1uF to GND.
8	GND	Ground	Chip ground.
9	EN	Input	Enable active high, reset active low.
10	GPIO1	Input/Output	General purpose I/O, leave floating if not used.
11	GNDV	Ground	VCSEL ground, connected to GND together.
12	VDDV	Power	VCSEL supply, add a capacitor with 0.1uF to GNDV.

1. Pin locations drawing is top view, no scale.
2. GPIO0/1 are push-pull output.
3. EN can be connected to pin VDD, if not controlled.

1. Algorithm and Package Performance:

Parameter	Condition	Values
Reflectivity	object at 940nm	min. 18 %
		max. 88 %
Accuracy	20mm < distance ≤ 100mm	max. ± 10 mm
	100mm < distance ≤ 200mm	typ. ± 10 mm
		max. ± 15 mm
	distance > 200mm	typ. 3 %
max. 5 %		

Test conditions: temperature and voltages are at nominal conditions (ambient and 3.0 V), oscillator tuned to 5.0MHz, test object 100cm*100cm white card with 88% reflection.



88% white card, x-axis is truly distance, y-axis is output by EPSP1100. (Mar.2023)

2. General Register (valid at App1 Mode)

Addr : 0x00		APP Position Register		
Field	Name	Reset	Type	Description
7:0	App position	0	RW	0x80 : bootloader running 0xC0 : App1 running

Addr : 0x01		APP Major Register		
Field	Name	Reset	Type	Description
7:0	App major	0	RW	App major revision

Addr : 0x12		APP Minor Register		
Field	Name	Reset	Type	Description
7:0	App minor	0	RW	App minor revision

Addr : 0x13		APP Patch Register		
Field	Name	Reset	Type	Description
7:0	App patch	0	RW	App patch revision

Addr : 0x0E		Iteration LSByte Register		
Field	Name	Reset	Type	Description
7:0	iteration lsb	0x14	RW	Iterations of VCSEL pulses. (unit : ms)

Addr : 0x0F		Iteration MSByte Register		
Field	Name	Reset	Type	Description
7:0	iteration msb	0	RW	Not available, keeps 0x00.

Addr : 0x1D		Last Status Register		
Field	Name	Reset	Type	Description
7:0	command status	0	R	Get result for last executed command.

Addr : 0x20		Frame ID Register		
Field	Name	Reset	Type	Description
7:0	frame id	0	R	An unique ID for each ranging result, repeat from 0 to 255.

Addr : 0x22		Distance Result 0 Register		
Field	Name	Reset	Type	Description
7:0	Distance [7:0]	0	R	Peak distance in (mm) of the object, LSByte.

Addr : 0x23		Distance Result 1 Register		
Field	Name	Reset	Type	Description
7:0	Distance [15:8]	0	R	Peak distance in (mm) of the object, MSByte.



Addr : 0xE0		Enable Register		
Field	Name	Reset	Type	Description
7	cpu reset	0	RW_W	Write "1" to reset CPU. It's fully resetting and no need to clear it.
6	cpu ready	0	RO	CPU is ready to communication via I ² C.
0	power on	1	RO	"1" standby

Addr : 0xE1		INT Status Register		
Field	Name	Reset	Type	Description
1	int2	0	R	INT2 status, write "1" to clear.
0	int1	0	R	INT1 status, write "1" to clear

Addr : 0xE2		INT Enable Register		
Field	Name	Reset	Type	Description
1	int2 enable	0	RW	Asserted INT2 when a ranging result available. "0" disable, "1" enable.
0	int1 enable	0	RW	Asserted INT1 when a ranging result available. "0" disable, "1" enable.

Addr : 0xE3		Device ID Register		
Field	Name	Reset	Type	Description
3 : 0	device id	0	R	Device ID, reads 08h.

Addr : 0xE4		Chip ID Register		
Field	Name	Reset	Type	Description
1:0	chip id	0	R	Chip revision ID.

3. Bootloader:

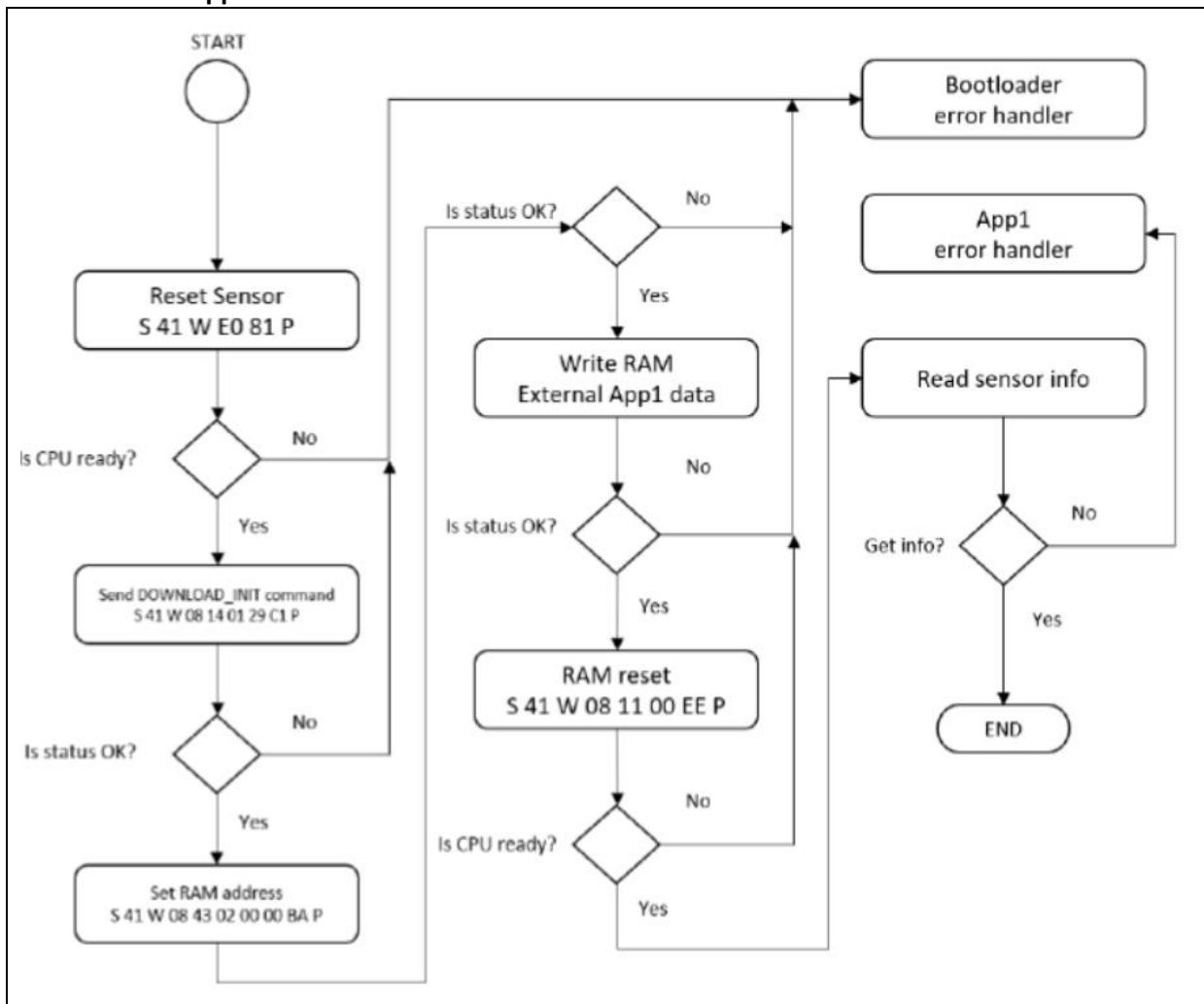
Bootloader Commands:

Command	Value	Description
RAM re-map reset	0x11	Re-map RAM to address 0x0 and do reset.
Download init	0x14	Initialize download procedure
Write RAM	0x41	Write RAM position/area
Add RAM address	0x43	Set RAM pointer to a indicated address

3.1 Checksum Calculation

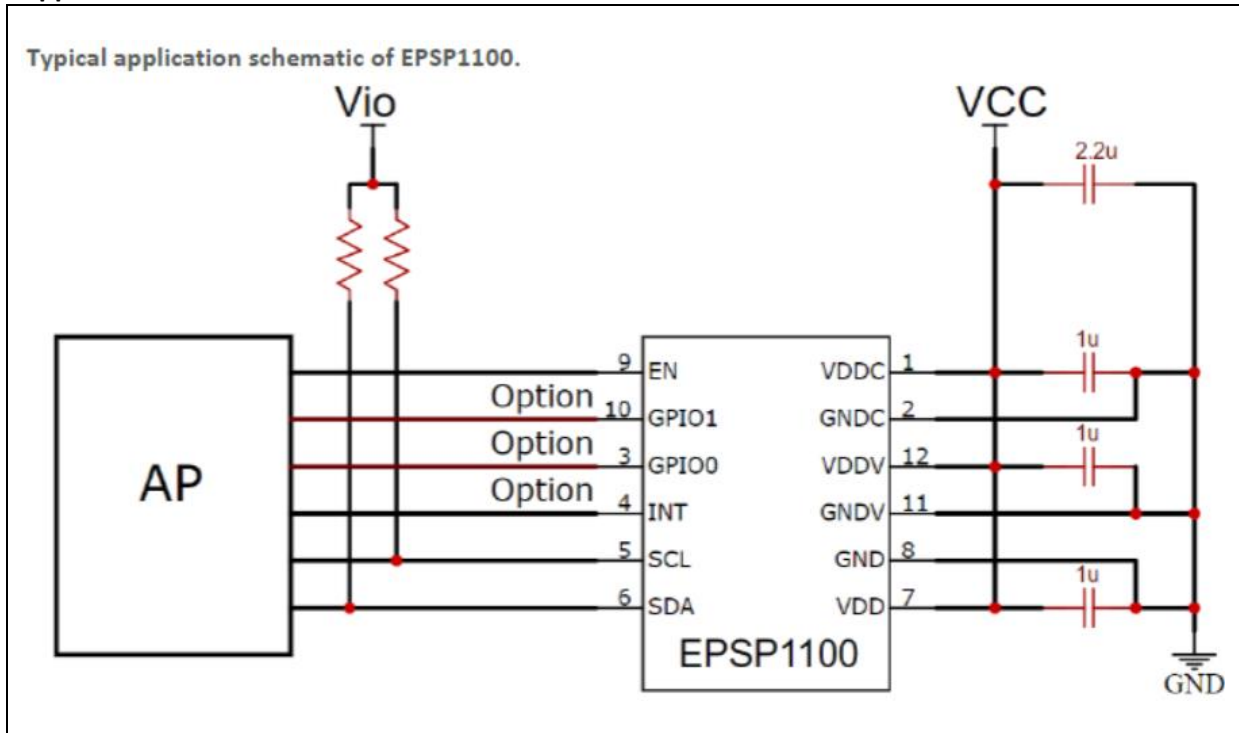
1. Take sum of all data bytes and do XOR.
2. e.g. $(0x10+0x01)^{0xFF}=0xEE$

3.2 Download app1 flow via bootloader



4. Application Circuit:

Application Schematic

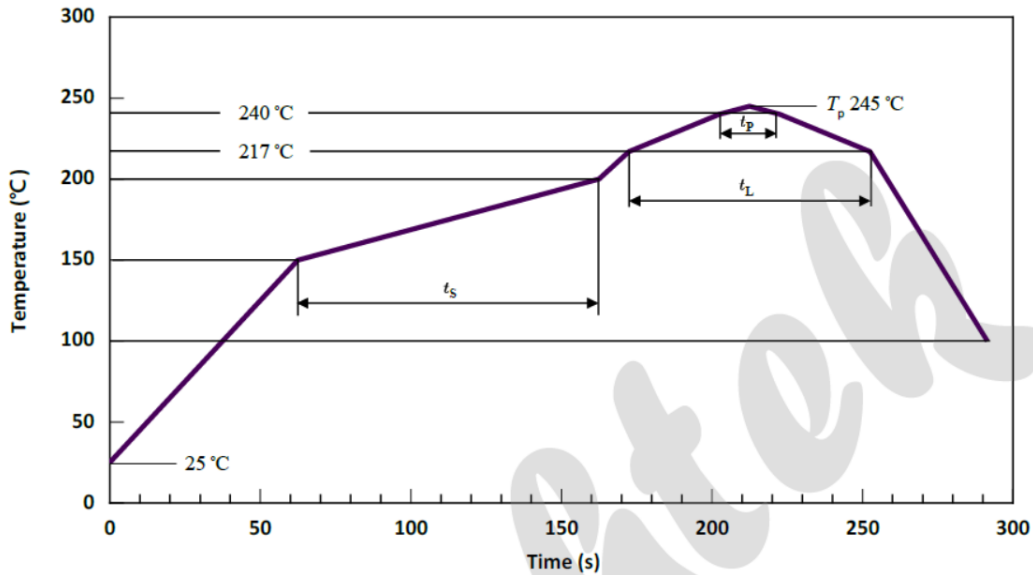


Note:

1. Capacitors recommend placed as close as possible to the VDD/VDDV/VDDC.
2. GPIO0/1 to be left unconnected if not used.
3. The SCL/SDA/INT need an external pull-up resistor to the Vio supply (Vio < 3.5V).
4. EN pin can be connected to VDD directly.

RECOMMENDED SOLDERING PROFILE:

Lead-free Solder IR Reflow:



Profile Feature	Symbol	Pb-Free (SnAgCu) Assembly			Unit
		Minimum	Recommendation	Maximum	
Ramp-up rate to preheat 25 °C to 150 °C			2	3	K/s
Time t_s T_{Smin} to T_{Smax}	t_s	60	100	120	s
Ramp-up rate to peak T_{Smax} to T_P			2	3	K/s
Liquidus temperature	T_L		217		°C
Time above liquidus temperature	t_L		80	100	s
Peak temperature	T_P			245	°C
Time within 5 °C of the specified peak temperature $T_P - 5$ K	T_P	10	20	30	s
Ramp-down Rate T_P to 100 °C			3	4	K/s
Time 25 °C to T_P				480	s

Note:

1. We recommend the reflow temperature 240°C ($\pm 5^\circ\text{C}$). The maximum soldering temperature should be limited to 245°C.
2. Maxima reflow soldering: 2 times.
3. Before, during, and after soldering, should not apply stress on the components and PCB board.

PRECAUTIONS OF USE:

Storage:

It is recommended to store the products in the following conditions:

- Humidity: 60% R.H. Max.
- Temperature: 5°C~30°C (41°F ~86°F).

Shelf life in sealed bag: 12 months at 5°C~30°C and <60% R.H.

Once the package is opened, the products should be used within 1 week. Otherwise, they should be kept in a damp-proof box with desiccating agent stored at R.H.<10% and apply baking before use.

ESD (Electrostatic Discharge):

Static Electricity or power surge will damage the LED. Use of a conductive wrist band or anti-electrostatic glove is recommended when handling the LED all time. All devices, equipment, machinery, work tables, and storage racks must be properly grounded.

REVISION RECORD:

Version	Date	Summary of Revision
A1.0	13/09/2023	Datasheet set-up.
A1.1	10/09/2024	Update ranging distance.