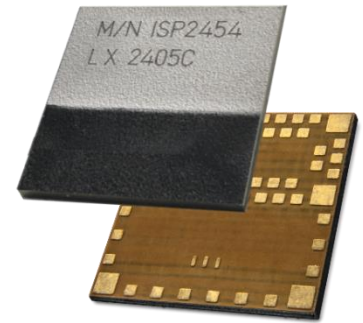


Bluetooth 6.0 Low Energy Module

Supporting Mesh, NFC

With built-in MCU & Antenna

This ultra-small LGA module, 8 x 8 x 1 mm, is based on the nRF54L15 Chip. Its powerful Cortex™ M33 with TrustZone technology CPU, 1524 KB nonvolatile memory (RRAM) and 256 KB memory RAM combined with an optimized antenna offers the perfect solution for Bluetooth connectivity. The solution is best in class for RF performance and low power consumption. Multiple digital and analogue interfaces give optimum flexibility for sensor integration.



Key Features

- Multi-protocol 2.4GHz Ultra Low Power
- Bluetooth 6.0 & Mesh
- 2.4 GHz proprietary protocol
- Matter, Thread
- NFC-A Tag for OOB pairing in option
- RF Transceiver based on Nordic Semiconductor nRF54L15
- PSA Certified Level 3
- Fully integrated RF matching and Antenna
- Integrated 32 MHz & 32 kHz Clock
- DC/DC converter with load circuit
- ARM Cortex M33 with TrustZone technology
- 1524 KB nonvolatile memory (RRAM) and 256 KB memory RAM
- Up to 32 GPIOs
- Interfaces SPI, I2C, I2S, UART, PWM, PDM
- Single 1.7 to 3.6 V supply
- Very small size 8.0 x 8.0 x 1 mm
- Temperature -40 to +105 °C

Applications

- Connected sensors for medical devices, healthcare, sport, fitness, industrial ...
- IoT applications, connected objects
- Wearable technology
- Home automation
- Beacons
- Matter, Thread

Certifications

- All certifications are pending:
- Bluetooth SIG
- CSA Matter and Thread
- CE
- FCC, IC
- TELEC
- RoHS, Reach & POP compliant
- Conflict Mineral Declaration
- Cyber Resilience Act Declaration

Document Revision History

Revision	Date	Ref	Change Description
R0	09/08/2024	er pg	Preliminary release
R1	11/03/2025	bh pg	Update based on information of Nordic datasheet v0.8
R2	05/06/2025	cr pg	Certification update

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1. Block Diagram & Features

Confidential File - Not Attached

2. Specifications

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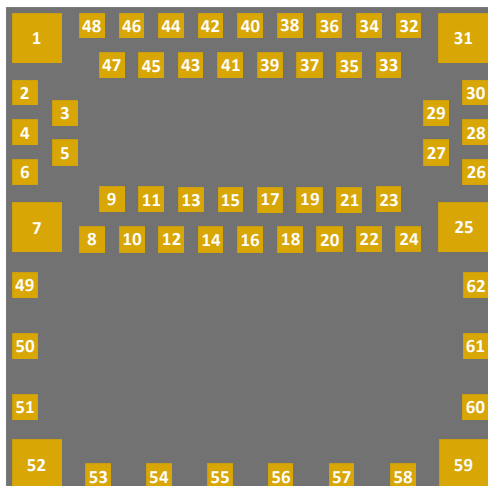
3. Pin Description

The module uses an LGA format with a double row of pads on a 0.65 mm pitch.
Not Connected pads must be connected to isolated metal pads on the application PCB.
Not Applicable pads are not available in the related module variant.

Pin	Name	Pin Description
1	VSS	Ground
2	P1.02_NFC1	General purpose I/O NFC Antenna Connection
3	P2.03	General purpose I/O
4	P1.03_NFC2	General purpose I/O NFC Antenna Connection
5	P2.10_TRACEDATA3	General purpose I/O Trace port output
6	P2.01	General purpose I/O
7	VSS	Ground
8	VSS	Ground
9	P2.08_TRACEDATA1	General purpose I/O Trace port output
10	P1.10	General purpose I/O
11	P2.07_TRACEDATA0	General purpose I/O Trace port output
12	VSS	Ground
13	nRESET	Pin Reset
14	VSS	Ground
15	P2.06_TRACECLK	General purpose I/O Trace port clock output
16	VSS	Ground
17	P1.15	General purpose I/O
18	VSS	Ground
19	P1.08	General purpose I/O
20	OUT_ANT	RF Output
21	VSS	Ground
22	OUT_MOD	Internal Antenna
23	VSS	Ground
24	VSS	Ground
25	VSS	Ground
26	VDD_nRF	Power supply (1.7 – 3.6V)
27	P0.01	General purpose I/O
28	SWDIO	Serial Wire Debug I/O
29	P0.00	General purpose I/O
30	SWDCLK	Serial Wire Debug Clock Input

Pin	Name	Pin Description
31	VSS	Ground
32	P0.02	General purpose I/O
33	P0.04	General purpose I/O
34	P0.03	General purpose I/O
35	P1.06_AIN2	General purpose I/O Analog input
36	P1.07_AIN3	General purpose I/O Analog input
37	P2.09_TRACEDATA2	General purpose I/O Trace port output
38	P1.05_AIN1	General purpose I/O Analog input
39	P1.09	General purpose I/O
40	P1.04_AIN0	General purpose I/O Analog input
41	P1.13_AIN6	General purpose I/O Analog input
42	P2.05	General purpose I/O
43	P1.12_AIN5	General purpose I/O Analog input
44	P2.04	General purpose I/O
45	P1.14_AIN7	General purpose I/O Analog input
46	P2.02	General purpose I/O
47	P2.00	General purpose I/O
48	P1.11_AIN4	General purpose I/O Analog input
49-62	NC	Mechanical Pads

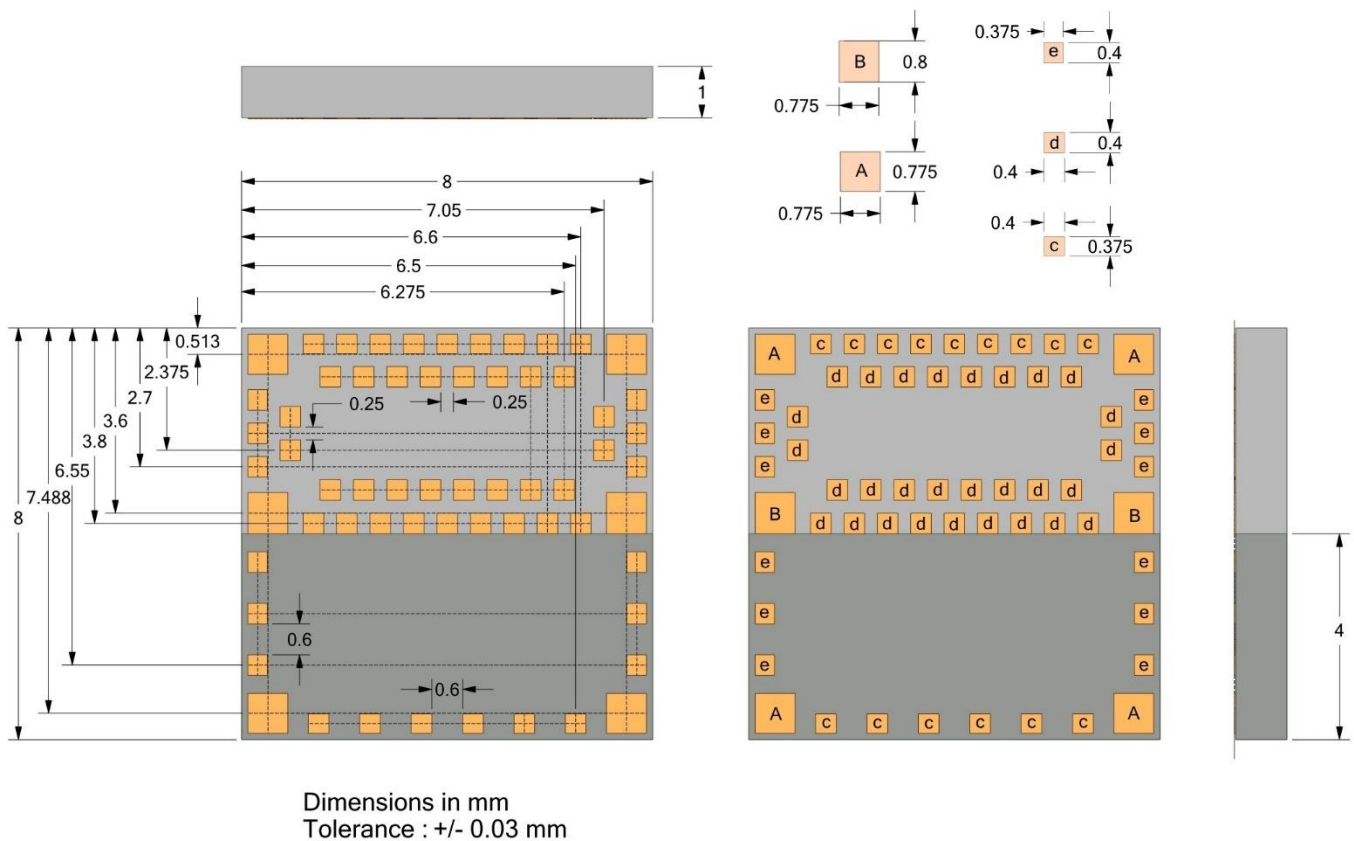
ISP2454 Pinout Top View



4. Mechanical Outlines

4.1. Mechanical Dimensions

Dimensional drawing for 8 x 8 x 1 mm, 62-Pad LGA Package



4.2. SMT Assembly Guidelines

For PCB Land Patterns and Solder Mask layout, Insight SiP recommends using the same dimensions as module pads.

For implementations in which most or all of the inner pads are used Insight SiP recommends the use of capped vias placed in the center of each pad.

For standard PCB types (no micro vias - all vias are top to bottom): we use nominal 0.4mm catch pads with 0.2mm vias. The vias should be plugged and capped to avoid solder wicking.

For HDI PCB types having micro vias on a layer-by-layer basis: we use 0.25mm catch pads and 0.1mm copper filled laser vias. Ideally the via is centered in the pad.

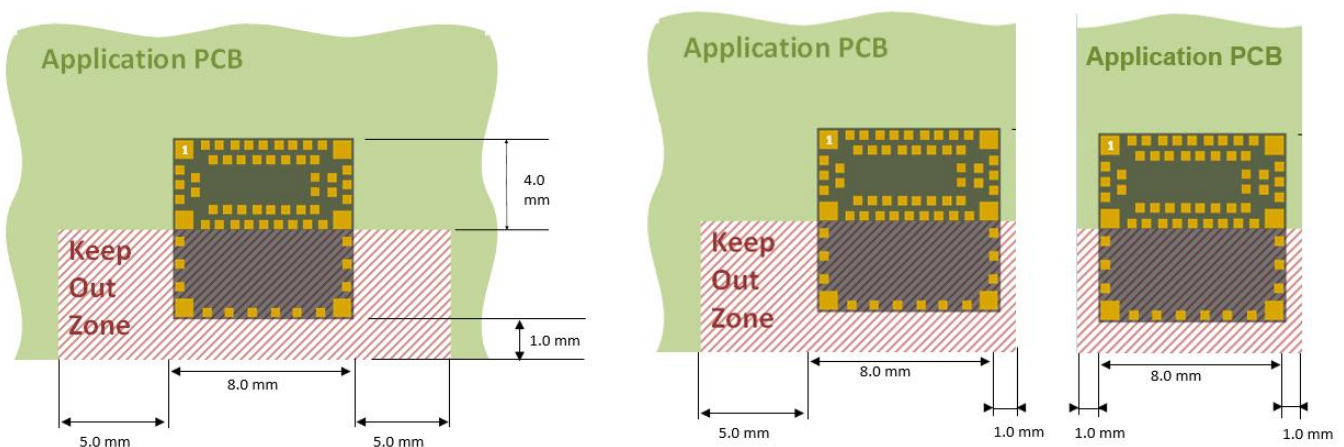
For reduced pinout implementations we recommend using external pads only. The use of a small number of internal pads can be accommodated by placing normal vias in the center of the device. In this case only the required pads should be Solder Mask opened and the vias tented with solder mask to prevent short circuits.

Please contact Insight SiP for more detailed information.

4.3. Antenna Keep-Out Zone

For optimal antenna performance, the module should be placed 1 mm from the PCB edge. And it is recommended to respect a metal exclusion zone to the edge of the board: no metal, no traces and no components on any application PCB layer except mechanical LGA pads.

When the module is placed on a large PCB dimension, 5mm lateral keep out zone is recommended. But when the PCB size is smaller, it is possible to place the module in either corner and reduce the lateral keep out zone as described below.



5. Product Development Tools

5.1. Hardware

In order to assist clients in developing their Bluetooth Smart solutions based on the ISP2454, Insight SIP offers an Evaluation Board containing:

- One Interface Board with an integrated Segger J-Link.
- One Test Board

Using this evaluation board, product developers have a working solution as a starting point to develop their own products. Time to market is saved by avoiding starting from a blank sheet of paper.

5.2. Firmware

ISP2454 uses the nRFConnect SDK from Nordic Semiconductor running zephyr RTOS. The SDK supplies examples and is an ideal starting point for firmware development. More information can be found on Nordic Semiconductor website.

5.3. Development Tools

The following development tools and software are recommended for using and testing ISP2454 module:

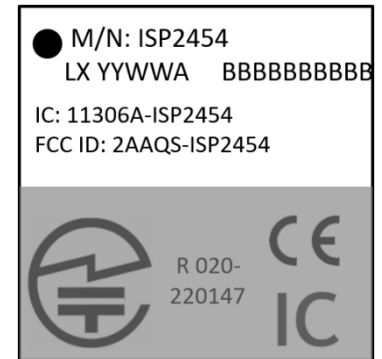
- nRFConnect SDK
- Microsoft Visual Studio Code.

6. Package & Ordering Information

6.1. Marking

M	/N	:	I	S	P	2	4	5	4										
T	T		Y	Y	W	W	R		B	B	B	B	B	B	B	B	B	B	B

ISP2454	Part Number
TT	2 letters Module Type
YY	2 digits year number
WW	2 digits week number
R	1 letter Hardware revision
BBBBBBBBBB	10 characters Build code



Certification labels for CE, FCC, IC and Telec are printed directly on the module when applicable.

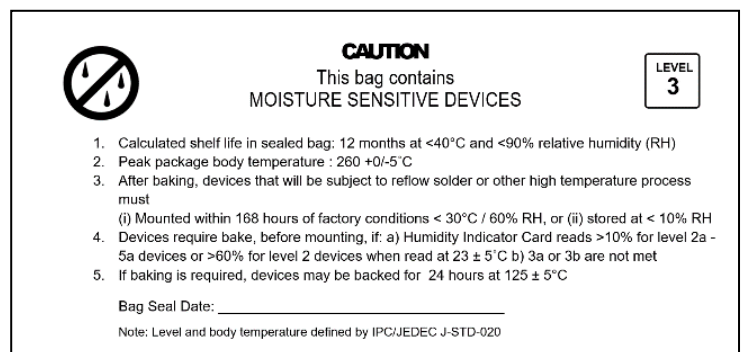
6.2. Package Labelling

A label indicating the Module Part Number, Quantity, Date Code, Lot Code and Country of Origin is applied to the bag, the reel and the box, whichever is applicable.

Information is available with bar code 1D according to Code 39 and bar code 2D according to Data Matrix ECC 200 from ECIA standard.



A second label on the bag is present to indicate the MSL level and packaging date.



6.3. Prototype Packaging

For engineering samples and prototype quantities up to 99 units, deliveries are provided in thermoformed trays.

They are delivered in vacuumed sealed pack with desiccant pack and humidity sensors. Please see section 7.2 for more information on moisture sensitivity.

Please order with “ST” code packaging suffix.

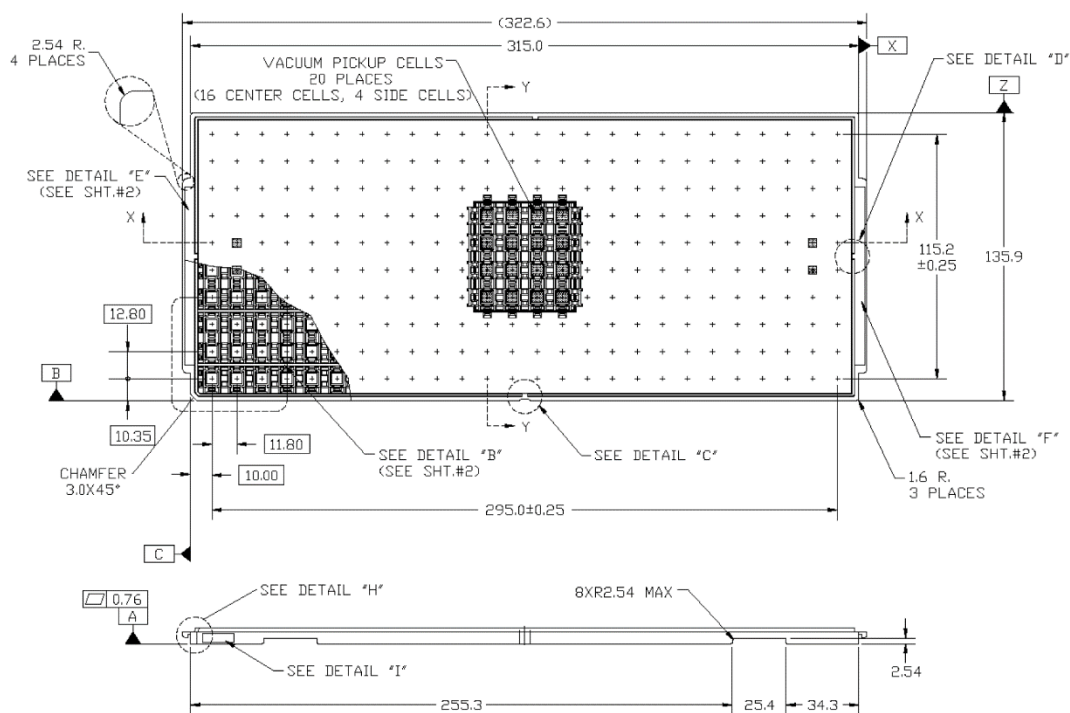


6.4. Jedec Trays

For pre-production volumes, ISP2454 are available in Jedec trays.

They are delivered in vacuumed sealed pack with desiccant pack and humidity sensors. These Jedec trays are also suitable for further baking at 125°C. Please see section 7.2 for more information on moisture sensitivity. Please order with “JT” code packaging suffix.

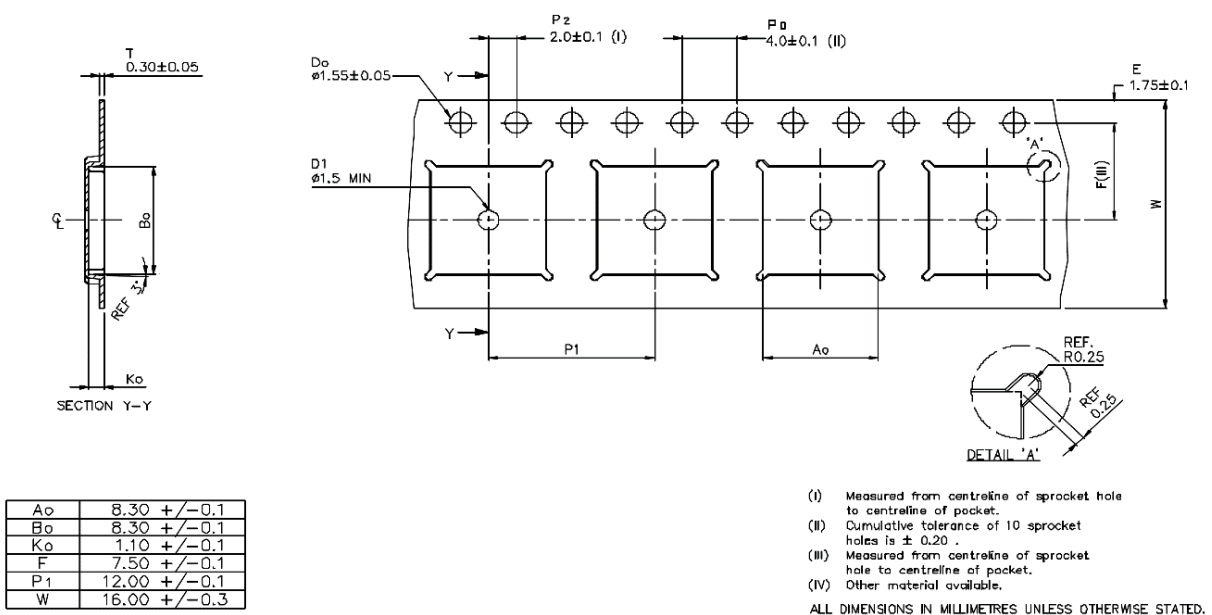
Refer to tray sizes below. Complete information on Jedec trays is available on request.



6.5. Tape and Reel

ISP2454 are also available in Tape & Reel. They are delivered in vacuumed sealed pack with desiccant pack and humidity sensors. Reels are proposed in standard quantities of 500 units (180mm / 7" reel). Please order with "RS" code packaging suffix for 500-unit reel.

This packaging is not suitable for high temperature baking. Should it be necessary to recover MSL level, low temperature baking at 40°C as per Jedec-J-STD-033 is recommended.



Reels are packed in a box of approximately 220 x 220 x 50 mm.



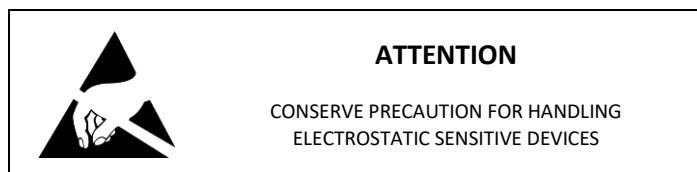
6.6. Ordering Information

I	S	P	2	4	5	4	-	T	T	-	Z	Z	
								▼	▼		▼	▼	
								▼	▼		▼	▼	
								▼	▼		▼	▼	
I	S	P	2	4	5	4							Part Number
							-	L	X				Type
							-	E	B				Evaluation Board
							-	T	B				Test board
							-	S	T				Standard Tray
							-	J	T				Jedec Tray Packaging
							-	R	S				Reel of 500 units

7. Storage and Soldering Information

7.1. Storage and Handling

- Keep this product away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- Do not expose the module to the following conditions:
 - Corrosive gasses such as Cl₂, H₂S, NH₃, SO₂, or NO_x
 - Extreme humidity or salty air
 - Prolonged exposure to direct Sunlight
 - Temperatures beyond those specified for storage
- Do not apply mechanical stress.
- Do not drop or shock the module.
- Avoid static electricity, ESD and high voltage as these may damage the module.



7.2. Moisture Sensitivity

All plastic packages absorb moisture. During typical solder reflow operations when SMDs are mounted onto a PCB, the entire PCB and device population are exposed to a rapid change in ambient temperature. Any absorbed moisture is quickly turned into superheated steam. This sudden change in vapor pressure can cause the package to swell. If the pressure exerted exceeds the flexural strength of the plastic mold compound, then it is possible to crack the package. Even if the package does not crack, interfacial delamination can occur.

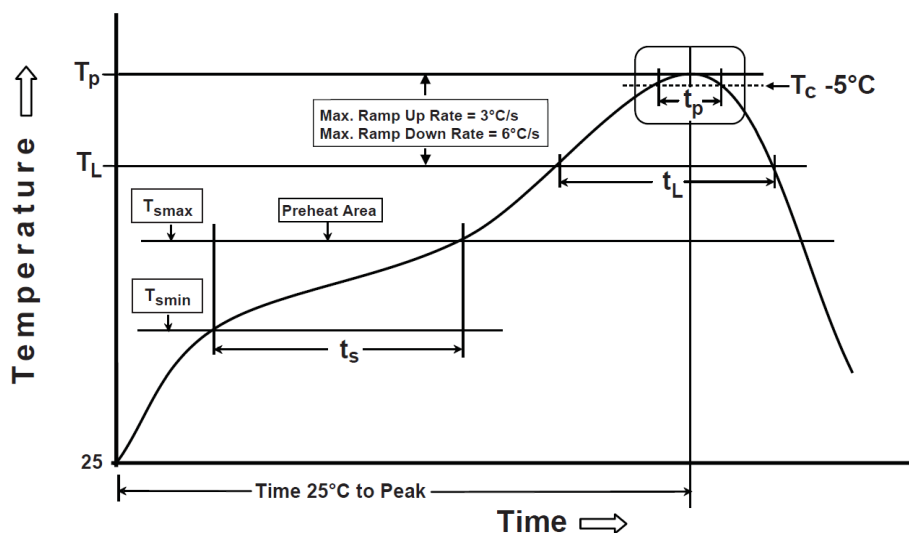
Since the device package is sensitive to moisture absorption, it is recommended to bake the product before assembly. The baking process for dry packing is 24 hours at 125°C.

ISP2454 has been tested MSL-3 according to standards. After baking, modules can be exposed to ambient room conditions (approximately 30 °C/60%RH) during 168 hours before assembly on the PCB.



7.3. Soldering information

Recommendation for RoHS reflow process is according to Jedec J-STD-020 and 033 standard profiles.



Preheat/Soak	
Temperature Min (T_{smin})	150 °C
Temperature Max (T_{smax})	200 °C
Time (t_s) from (T_{smin} to T_{smax})	60-120 sec
Ramp-up rate (T_L to T_p)	3 °C/sec max
Liquidous temperature (T_L)	217 °C
Time (t_L) maintained above T_L	60-150 sec

Peak package body temperature (T_p)	260°C (+0/-5°C)
Classification Temperature (T_c)	260 °C
Time (t_p) maintained above $T_c - 5$ °C	30 sec
Ramp-down rate (T_p to T_L)	6 °C/sec max
Time 25 °C to peak temperature	8 mn max

8. Quality and User information

8.1. Certifications

- CE – Certification pending
- FCC – FCC ID: 2AAQS-ISP2454 - Certification pending (Part 15.247)
- ISED– IC: 11306A-ISP2454, Model: ISP2454 - Certification pending (RSS-247)
- TELEC – Certification pending
- Bluetooth SIG – Certification pending
- RoHS3 compliant
- Reach compliant
- Minerals responsible initiative compliant

Further paragraphs will be added to this data sheet once the product is fully certified.

8.2. EC – CE Certification

This device can be operated in at least one Member State without infringing applicable requirements on the use of radio spectrum.

8.3. USA – User information

This intends to inform how to specify the FCC ID of our module “ISP2454” on the product. Based on the Public Notice from FCC, the host device should have a label which indicates that it contains our module. The label should use below example wording or any similar wording that expresses the same meaning:

“Contains FCC ID: 2AAQS-ISP2454”

The label of the host device should also include the below FCC Statement. When it is not possible, this information should be included in the User Manual of the host device:

<i>“This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions.</i> <i>(1)This device may not cause harmful interference</i> <i>(2)This device must accept any interference received, including interference that may cause undesired operation.</i> <i>Caution: Any Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.”</i>

8.4. Canada – User information

This intends to inform how to specify the IC of our module “ISP2454” on the product. According to Canadian standards “RSS-Gen” the host device should have a label which indicates that it contains our module. The label should use below example wording or any similar wording that expresses the same meaning:

"Contains IC: 11306A-ISP2454"

The label of the host device should also include the below IC Statement. When it is not possible, this information should be included in the User Manual of the host device:

"This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device."

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

8.5. RF Exposure Information

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65 and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE).

This device should be installed and operated with minimum 10 mm between the radiator and your body.

8.6. Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans-fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Ce module a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles et/ou portables.

Cet appareil doit être installé et utilisé avec un minimum de 10 mm entre le radiateur et votre corps.

8.7. Discontinuity

Normally a product will continue to be manufactured as long as all of the following are true:

- The manufacturing method is still available.
- There are no replacement products.
- There is demand for it in the market.

In case of obsolescence, Insight SiP will follow Jedec Standard JSD-48. A Product Discontinuation Notice (PDN) will be sent to all distributors and made available on our website. After this, the procedure goes as follows:

- Last Order Date will be 6 months after the PDN was published.
- Last Shipment Date will be 6 months after Last Order Date, i.e. 12 months after PDN.

8.8. Disclaimer

Insight SiP's products are designed and manufactured for general consumer applications, so testing and use of the product shall be conducted at customer's own risk and responsibility. Please conduct validation and verification and sufficient reliability evaluation of the products in actual condition of mounting and operating environment before commercial shipment of the equipment. Please also pay attention (i) to apply soldering method that don't deteriorate reliability, (ii) to minimize any mechanical vibration, shock, exposure to any static electricity, (iii) not to overstress the product during and after the soldering process.

The products are not designed for use in any application which requires especially high reliability where malfunction of these products can reasonably be expected to result in personal injury or damage to the third party's life, body or property, including and not limited to (i) aircraft equipment, (ii) aerospace equipment, (iii) undersea equipment, (iv) power plant control equipment, (v) medical equipment, (vi) transportation equipment, (vii) traffic signal equipment, (viii) disaster prevention / crime prevention equipment.

The only warranty that Insight SiP provides regarding the products is its conformance to specifications provided in datasheets. Insight SiP hereby disclaims all other warranties regarding the products, express or implied, including without limitation any warranty of fitness for a particular purpose, that they are defect-free, or against infringement of intellectual property rights. Insight SiP customers agree to indemnify and defend Insight SiP against all claims, damages, costs and expenses that may be incurred, including without any limitation, attorney fees and costs, due to the use of products.

Note- Additional testing, FCC Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The host product may need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the multi-transmitter procedures.

Since only Grantees are permitted to make permissive changes, a new FCC ID may be required if the module is used in a manner different from the certified configuration.

8.8 Limited module procedures

-Not applicable