Datasheet

TSRR250

Version 1.3

Revision History

Revision	Date	Change Description
1.0	Sep-2024	Preliminary version
1.1	Nov-2024	Updated antenna information
1.2	Nov-2024	Updated Radar information
1.3	Jun-2025	Updated the keep-out area for TSRR250 module

Table of Contents

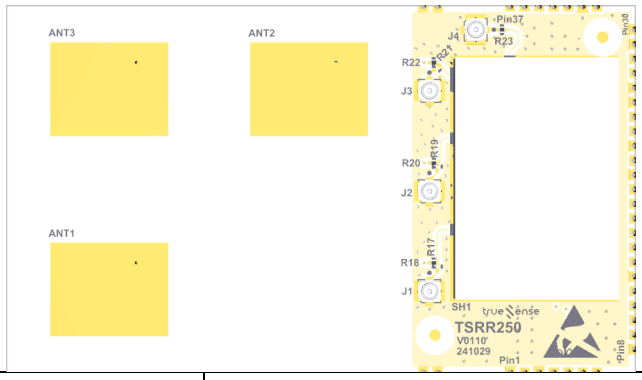
1. Introduction

TSRR250 is based on NXP Trimension™ SR250, with 3 embedded PCB Antennas +1 Radar antenna, power management, clock control, BPF filter and peripheral components.

TSRR250 module is a 3D AoA solution without extra-antenna overhead, no phase/amplitude skew, no SPST insertion loss and low-cost design.

TSRR250 supports Radar processing algorithm enabling Presence Detection & 2D pre- processed CIR streaming allowing advanced ML/AI applications.

1.1. Key Features



Name	TSRR250
Antenna Type & Number	Onboard PCB Patch Antenna x3; Optional 4 x I-PEX MHF-4L Receptacle Connector for external Ranging/Radar Antenna
Size	55mm * 32mm * 4.3mm
Communication Interface	SPI
Main Chip	SR250
Channel	5, 9
Frequency range	6.24GHz~8.24GHz

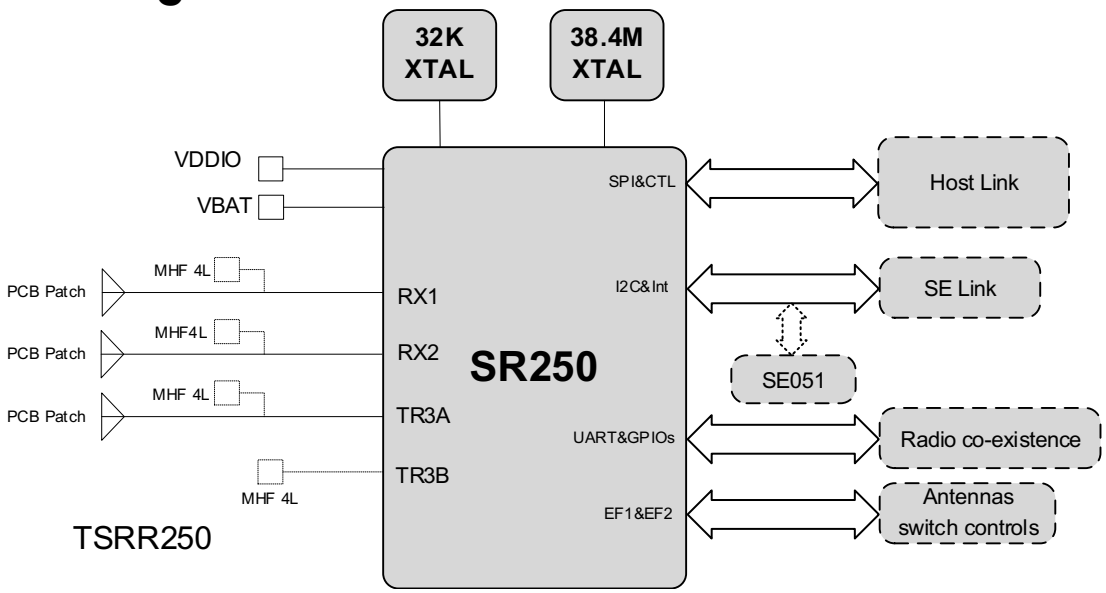
Supply Voltage	1.62V ~ 1.98V
Max Output Power (EIRP)	14dBm @ CH5&9
Ranging Mode	ToF, 3D AoA, 2D AOA, TDOA, RTLS
RADAR MODE	OCPD,CIRs & Off CRP

1.2. Applications

The perfect ANCHOR for High Precision RTLS (AoA), Industrial, Smart Home & Consumer applications. Smart Home Devices (Point & Trigger), Access Control (Physical and Logical) and Secure payments.

Advanced Radar sensing with ML/AI applications such as:
Breathing & Apnea Monitoring;
Fall Detection;
Behavior Analysis;
It supports 360° for 2 Way Ranging thanks to its 3 connectors for a 7 antennas kit add on.

1.3. Block Diagram



2. Electrical characteristics

2.1. Recommended operating conditions

When the input voltage of the module is lower than the rated operating voltage, the operation will be unstable. Input voltage higher than the maximum rating will cause permanent damage to the module. At the same time, working under the maximum rating for a long time also affects the stability of the module.

Parameter	Min	Type	Max	Unit	Conditions/Notes
Operating Temperature	-30		+85	˚C	
Supply Voltage	1.62	1.8	1.98	V	
HIGH level input voltage (V_{IH})	1.26	1.8	2.3	V	
LOW level input voltage (V_{IL})	-0.6	-	0.54	V	
HIGH level output voltage (V_{OH})	1.4	-	1.8	V	
LOW level output voltage (V_{OL})	-	-	0.2	V	

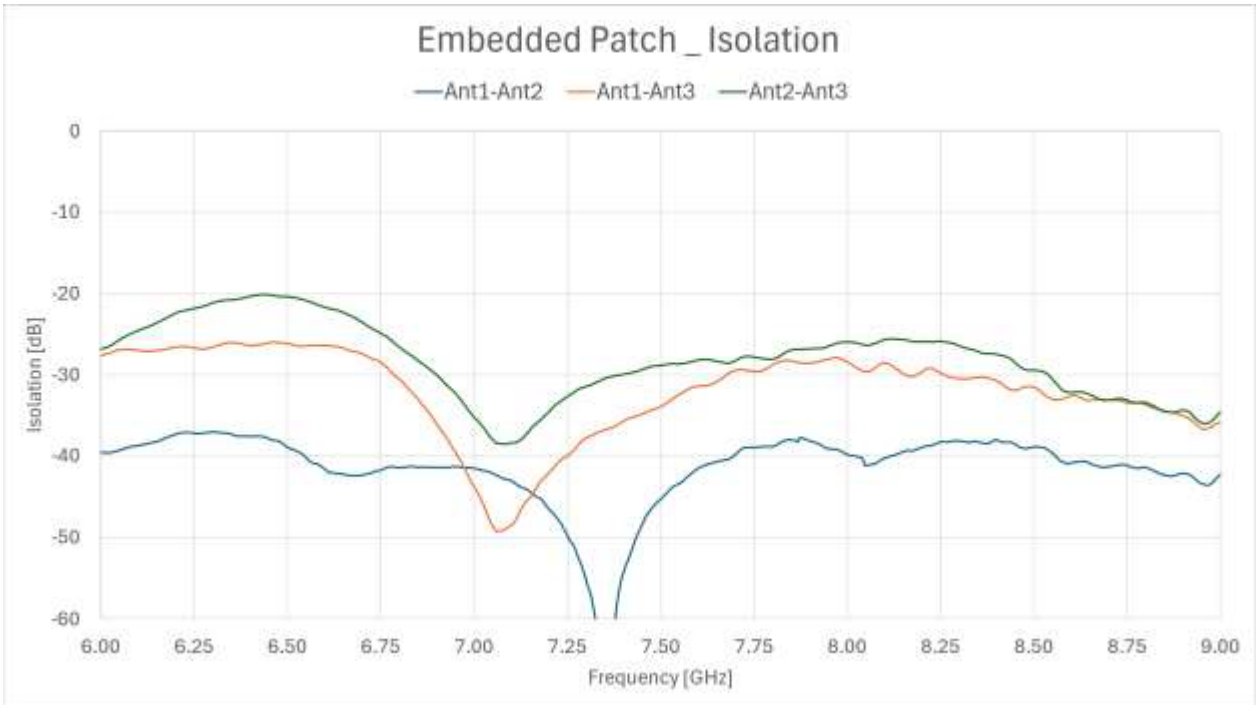
2.2. RF characteristics

Parameter		Min	Type	Max	Unit	Conditions/Notes
Frequency range		6240		8240	MHz	Channel 5 and 9
Channel bandwidth			500		MHz	
Power level range			32		dB	
Power level step			0.25		dB	
Rx Sensitivity (±10ppm carrier Offset)	Channel 5			-96.5	dBm	6.8 Mbit/s data rate, Dual RX, SP0 Frame with 20 byte payload, 1 % PER
	Channel 9			-96.5	dBm	6.8 Mbit/s data rate, Dual RX, SP0 Frame with 20 byte payload, 1 % PER

2.3.PCB patch Antenna information

Antenna Type	PCB Patch
Antenna Polarization	Linear
Return Loss	>10dB
Peak Gain	3.5dBi min @CH5 3.6dBi min @CH9
Efficiency	60%
Antennas Isolation	>20dB
Frequency range	6.0 ~ 8.5GHz

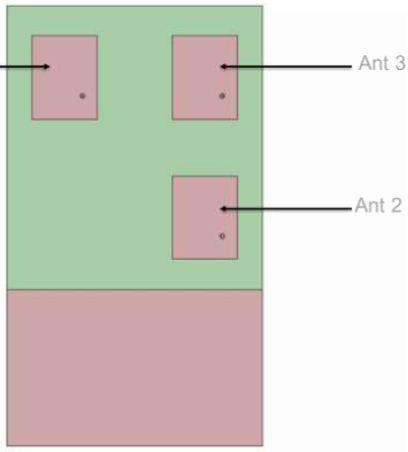
Isolation:

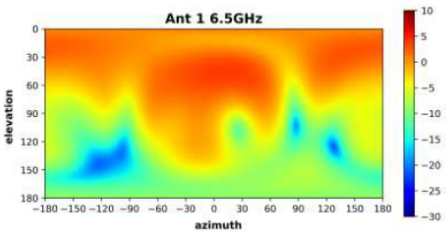


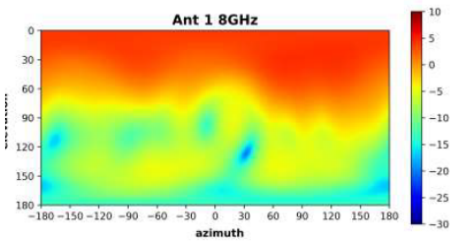
Return Loss:

Peak Gain & Efficiency:

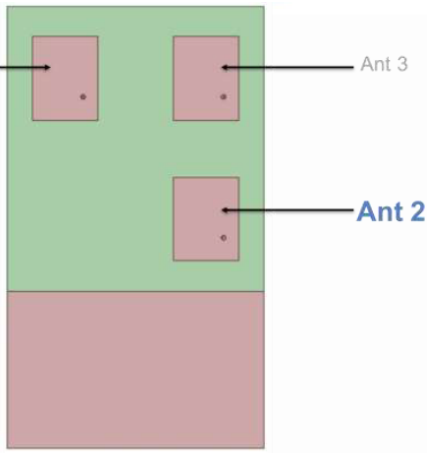
		Frequency [GHz]	Peak Gain [dBi]	Tot. Efficiency [%]
Ant 1	CH5	6.25	3.7	64.3
		6.50	3.9	60.0
		6.75	3.6	66.5
	CH9	7.75	4.4	70.7
		8.00	4.5	65.6
		8.25	4.2	62.4

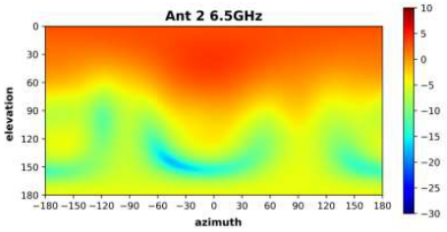


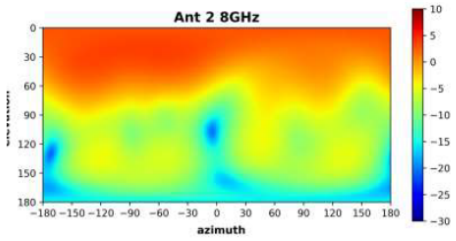




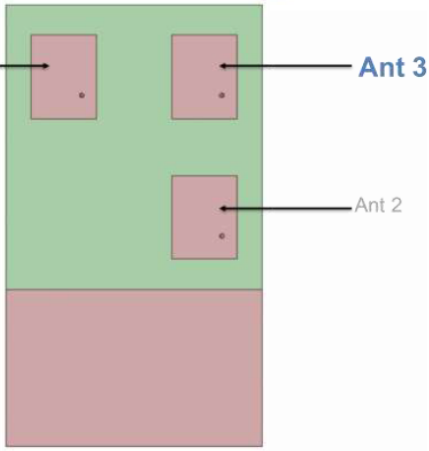
Ant 2		Frequency [GHz]	Peak Gain [dBi]	Tot. Efficiency [%]
	CH5	6.25	3.6	62.6
		6.50	4.2	61.7
		6.75	3.5	67.5
	CH9	7.75	4.2	67.0
		8.00	3.7	61.2
		8.25	3.9	60.0

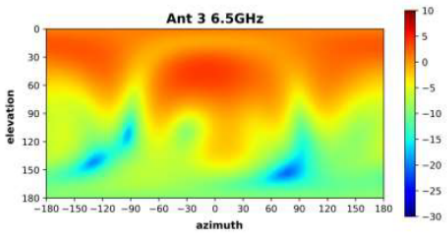


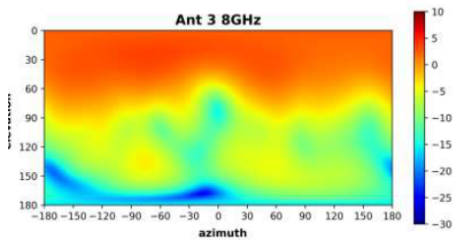




Ant 3		Frequency [GHz]	Peak Gain [dBi]	Tot. Efficiency [%]
	CH5	6.25	3.5	63.7
		6.50	4.1	60.0
		6.75	3.8	61.5
	CH9	7.75	4.5	65.5
		8.00	3.6	64.6
		8.25	3.7	62.3

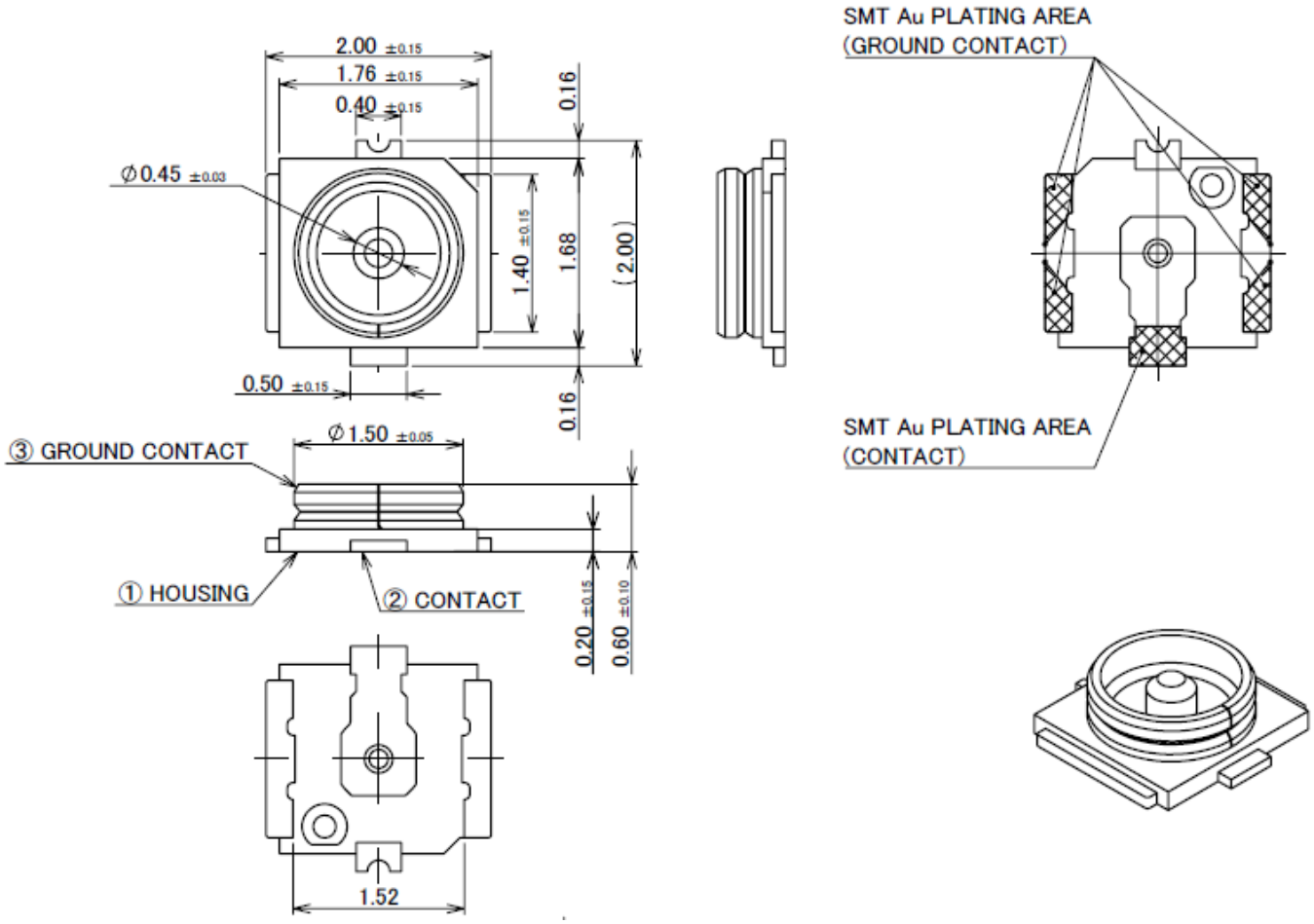






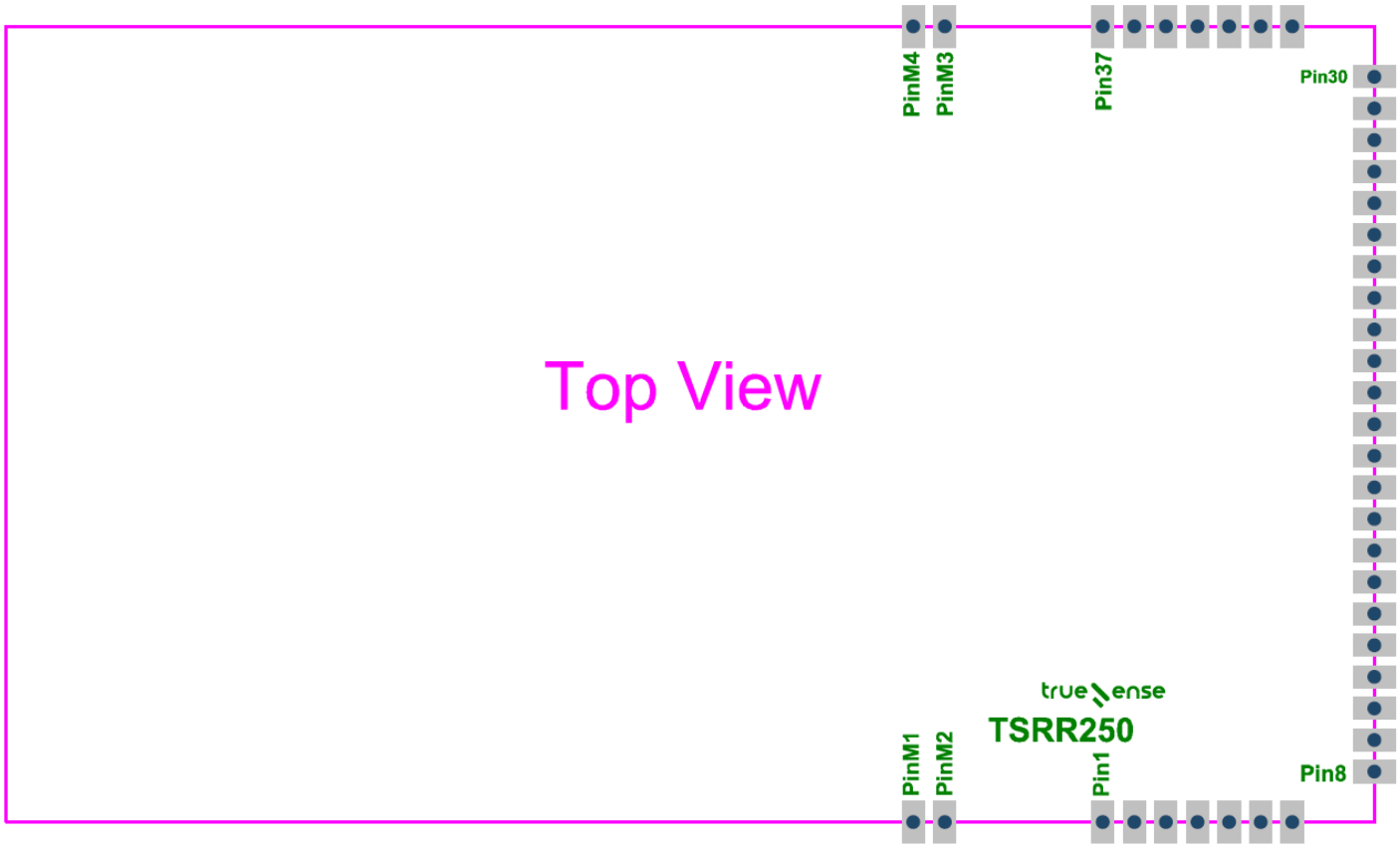
2.4. External Antenna Connector Size information

TSRR250 module adopts the fourth-generation external antenna connector shown in below figure, which is compatible with MHF-4 connector of I-PEX.



3. Module package

3.1. Pinout Description

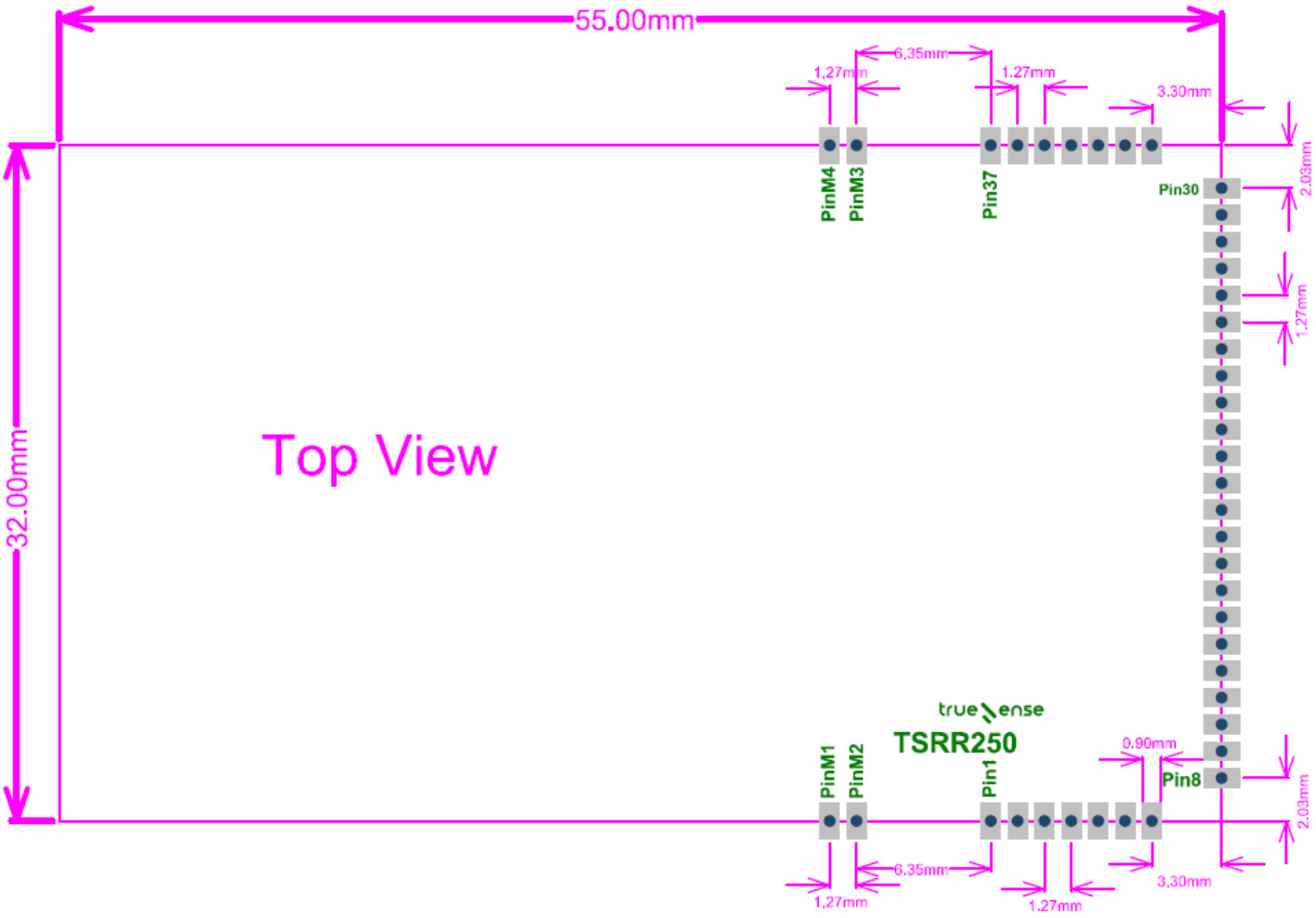


3.2. Pin Description Box

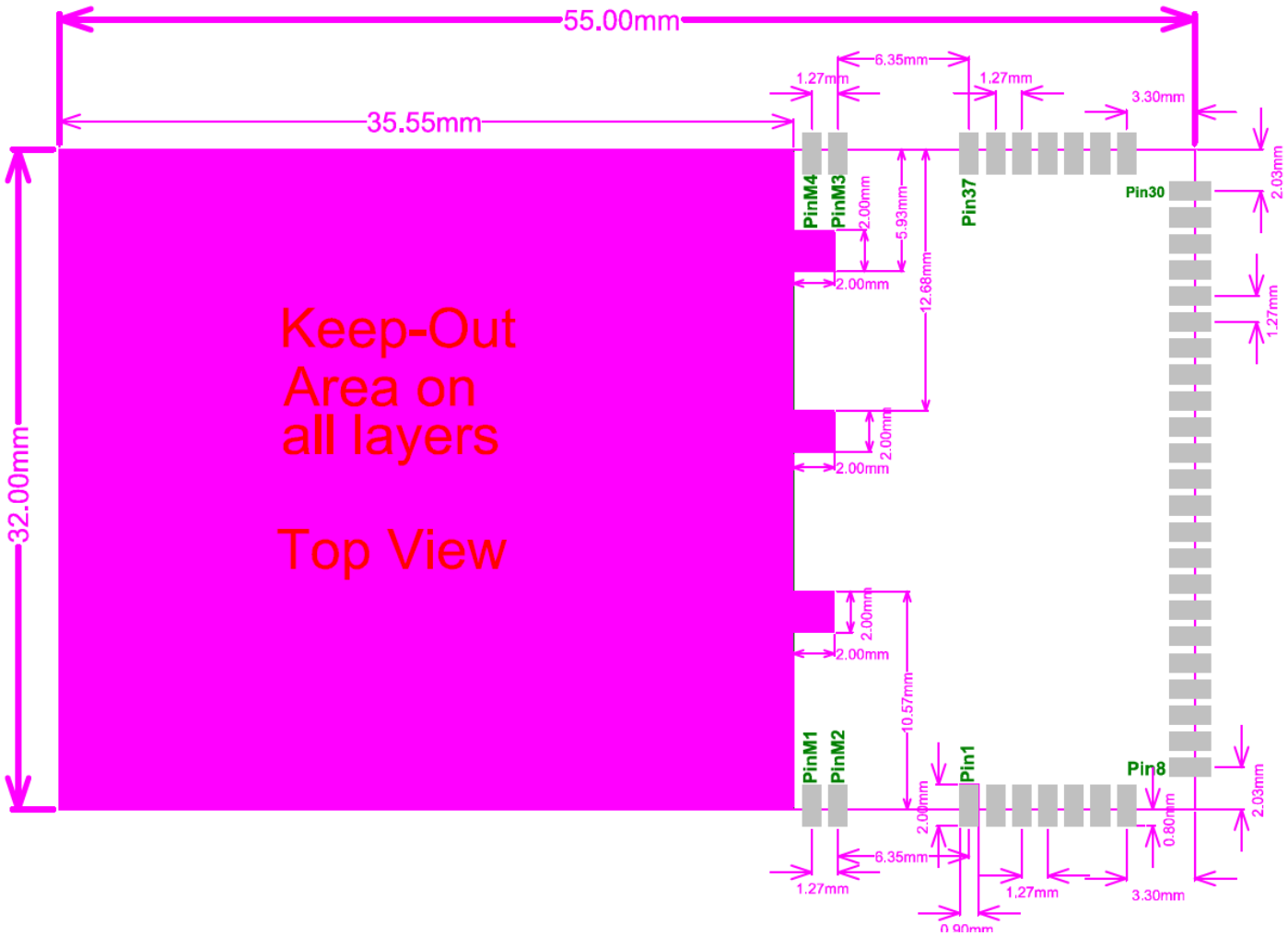
Pin	Pin Name	Pin Type	Description
1	GND	G	Ground
2	CLK_EXT_UWB	I	External 38.4MHz Clock input
3	GND	G	Ground
4	UWB_CLK_REQ2	O	Use for clock request when using system clock for high frequency external clock
5	EXT_OSC_EN/AFC	I	Use for oscillator enable or AFC
6	EF2	I/O	High switching speed general purpose I/O used for antenna external switches
7	EF1	I/O	High switching speed general purpose I/O used for antenna external switches
8	GND	G	Ground
9	SE051_ENA	I	SE051 Enable
10	SE_I2C_SDA	I/O	SDA (I2C Data) with 2.2K pull-up to VDDIO
11	SE_I2C_SCL	I/O	SCL (I2C clock) with 2.2K pull-up to VDDIO
12	SE_INT	I	Host Secure Element interrupt (IRQ flag to indicate that data are ready to be shared via I2C)
13	GND	G	Ground
14	UWB_RSTN	I	Reset pin
15	UWB_WAKEUP	I	HOST interface wakeup input
16	UWB_HOST_IRQ	I/O	Host IRQ pin
17	UWB_SPI_CS	I/O	Host interface line 2 as SPI Target Select (SS) connection
18	UWB_SPI_MISO	I/O	Host interface line 3 as SPI IO0 connection
19	UWB_SPI_MOSI	I/O	Host interface line 4 as SPI IO1 connection
20	GND	G	Ground
21	UWB_SPI_SCK	I/O	Host interface line 1 as SPI clock (SCK) line
22	GND	G	Ground
23	VDDIO_UWB	P	Power Supply input for the Host Interface
24	VDDIO_UWB	P	Power Supply input for the Host Interface
25	GND	G	Ground
26	GND	G	Ground
27	VDD_UWB	P	VDD Supply (1.8V, Legacy power supply mode)
28	VDD_UWB	P	VDD Supply (1.8V, Legacy power supply mode)
29	GND	G	Ground
30	GND	G	Ground
31	CLK_EXT_32K	I	External 32.768KHz Clock input
32	GND	G	Ground

33	UWB_CLK_REQ1	O	Use for clock request when using system clock for low frequency external clock
34	GPIO00	I/O	General-Purpose I/O
35	GPIO01	I/O	General-Purpose I/O
36	CX_UART_RX	I	RX connection of the UART for external radio interface
37	CX_UART_TX	O	TX connection of the UART for external radio interface
M1	GND	G	Ground
M2	GND	G	Ground
M3	GND	G	Ground
M4	GND	G	Ground

3.3.Package outline

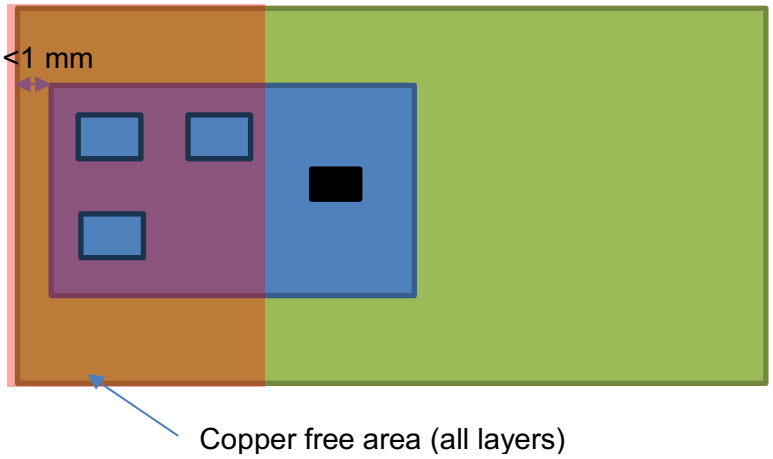


3.4. Recommended PCB Footprint



3.5. Host Board mounting

TSRR250 is designed to be mounted onto a host board and it is preferably mounted close to the host board edge, as shown next. Maximum distance to the edge should be up to 1mm.

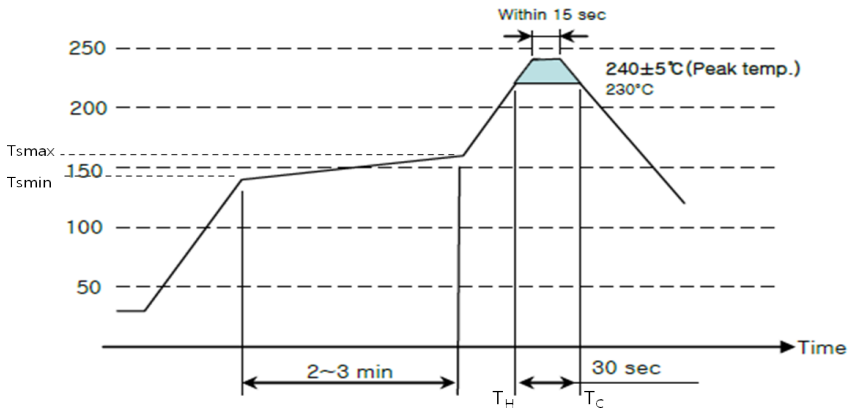


4. Soldering Condition

4.1. Manual Soldering – Pb Free

Soldering Temperature: 360°C ± 5°C, 5sec max.

4.2. Recommended Reflow Condition – Pb Free

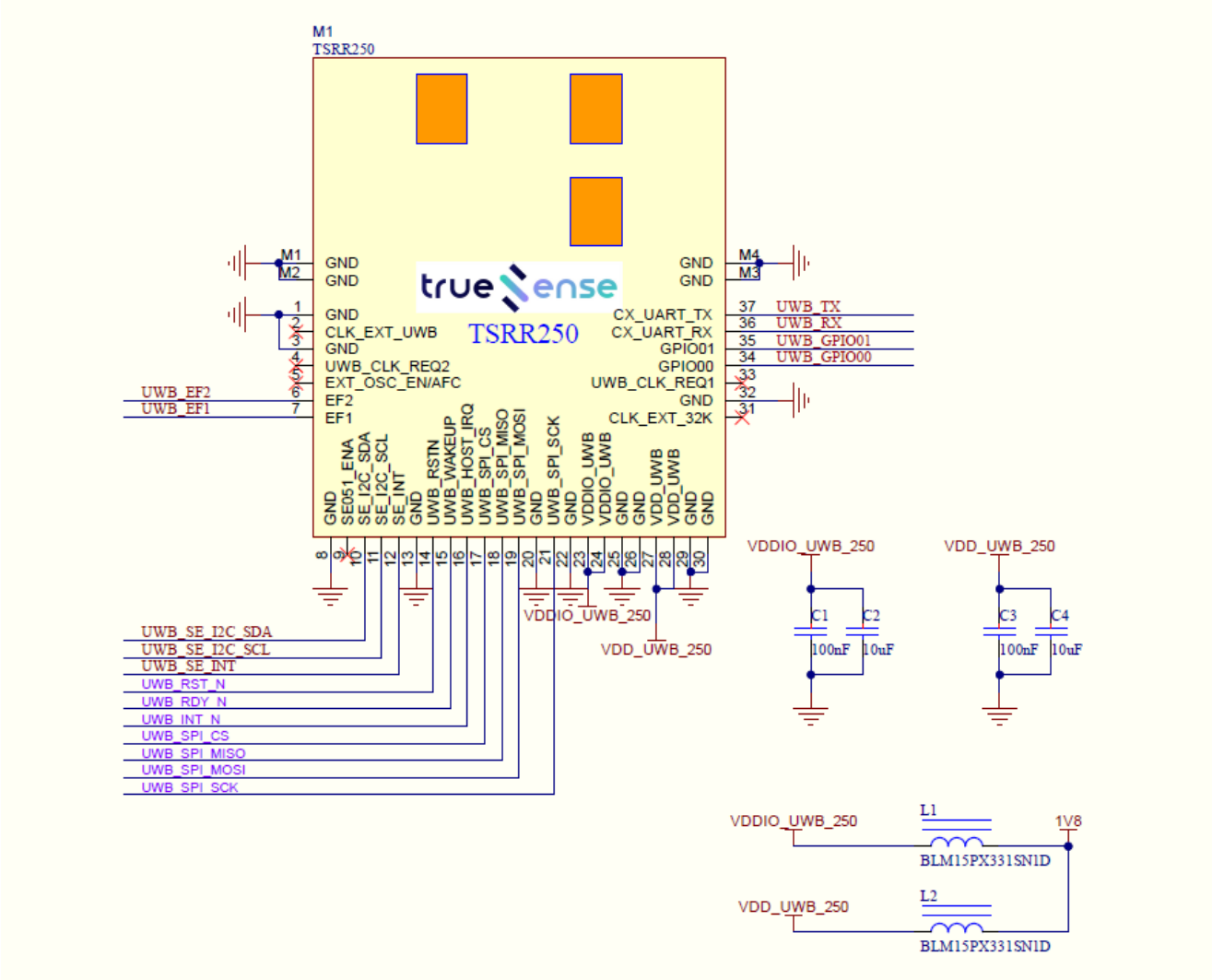


Profile Feature	Pb-Free Assembly
Preheat	
-Temperature Min (Tsmin)	140˚C
-Temperature Typical (Tstypical)	150˚C
-Temperature Max (Tsmax)	160˚C
-Time Tsmin to Tsmax	2 ~ 3 min

Peak Temperature	240±5˚C
Time of actual peak temperature	Max. 15 seconds
Heating to Cool -Temperature Heating (TH) -Temperature Cool (TC) -Time TH to TC	 230˚C 230˚C 30 seconds

5. Application design-in information

5.1. Reference schematics for TSRR250



6. Regulatory information

Regulatory approvals are ongoing.