



# TAOGLAS®



# Datasheet

## Multiband GNSS Front End

**Part No:**  
TFM.110A

### Description

Surface Mount GNSS Front End Active Electronics  
Covering the full Multiband GNSS Spectrum excluding the L-Bands

### Features:

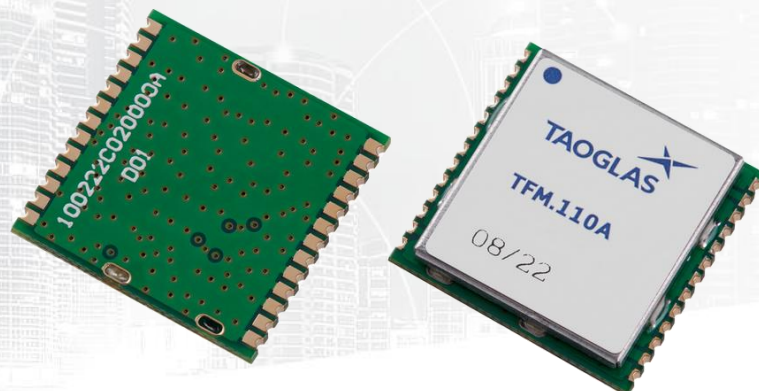
- Two-stage LNA providing >25 dB Gain across all bands
- Low Noise Figure: <3.5 dB in low bands and <4.0 dB in high bands
- Vin = +1.8 to +5.5 VDC
- Easy to integrate surface-mount
- Dimensions: 15 x 15 x 2.7 mm
- RoHS & Reach Compliant

|           |                              |           |
|-----------|------------------------------|-----------|
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# 1. Introduction



The Taoglas TFM.110A is a surface-mount active electronics GNSS front end which covers L1/L2/L5 for multiband multi-constellation high-precision applications. The TFM.110A is a single input, single output module and features a SAW/LNA/SAW/LNA topology in the signal path to prevent unwanted out-of-band interference from overdriving the GNSS LNAs or receiver. The SAW filters have been carefully selected and placed to provide excellent out-of-band rejection while also maintaining low noise figure.

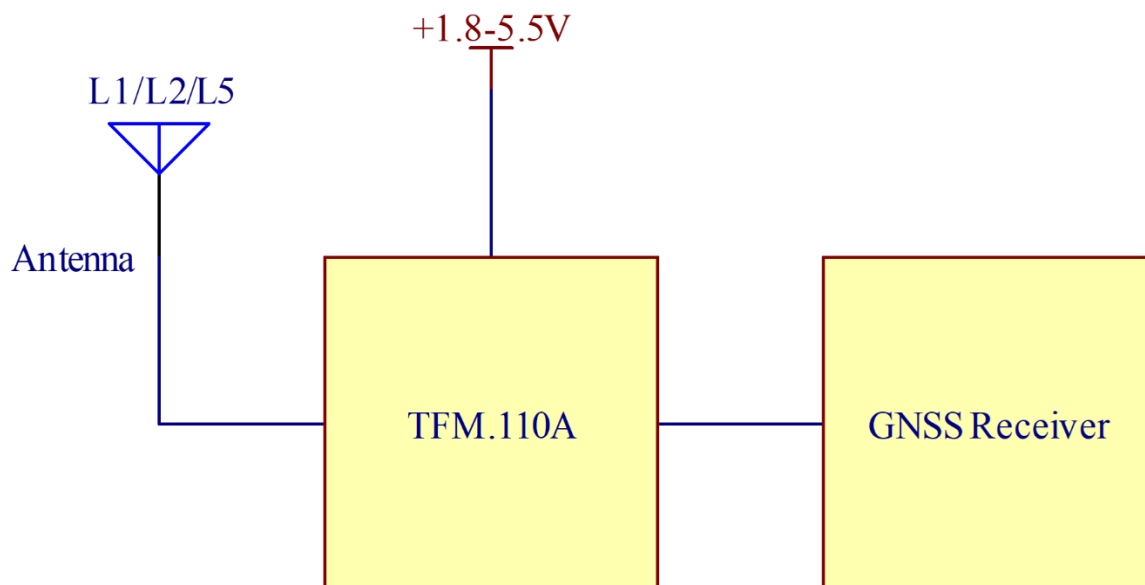
Many currently available dual-band GNSS receivers require additional RF circuits between the antenna and the receiver to properly set the overall system noise figure. This requires additional development time for an otherwise simple integration. Many organizations don't have the RF expertise to effectively design such a solution. The TFM.110A captures the required additional RF circuits in modular form, allowing the designer to simply place the TFM.110A between their GNSS antenna and GNSS receiver.

The TFM.110A offers > 25 dB gain across all applicable bands while maintaining a high Input P1dB of -25 dBm or better. Noise Figure is < 3.5 dB in the low bands and < 4.0 dB in the high bands. A wide input voltage of +1.8 to +5.5 VDC allows for easy integration in most GNSS systems.

## TFM.110A Features and Benefits:

- Ease-of-integration – Single-package solution combines impedance matching, filter efficiency and low noise design for easy, drop-in use with any antenna or GNSS receiver
- Low-noise System Design – Integrated pre-filters deliver exceptional out-of-band rejection across multiple band configurations and neighboring interference to properly set noise figure
- Dual-gain Stage Architecture – Cascaded LNAs, pre-filters and optimized impedance matching deliver sufficient gain to the GNSS receiver without signal-to-noise overload
- Low-profile Form Factor – Small footprint and low-profile design saves valuable real estate without the need for external components and routing
- Accelerated Development Cycles – 2+ years of development by antenna and RF design experts, delivering the highest levels of integration, manufacturability and robustness in a single package

For further information, please contact your regional Taoglas customer support team.



## Front End Active Electronics Module

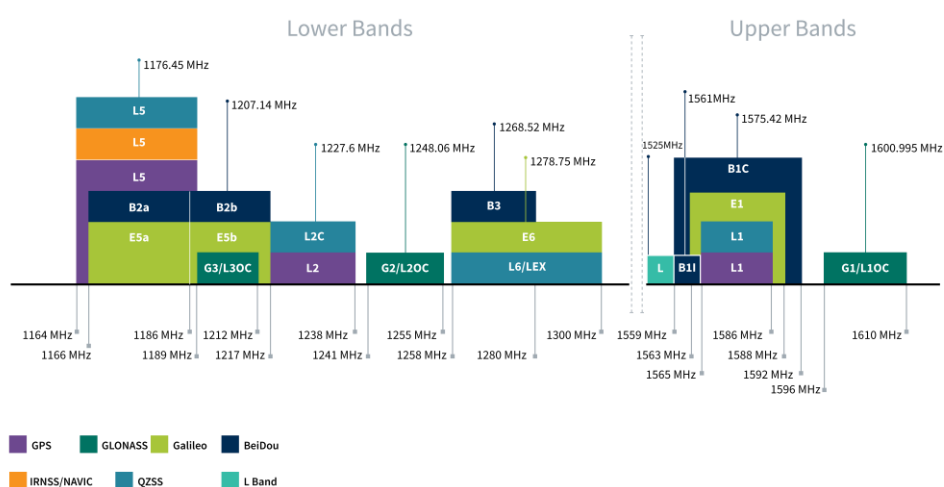
Block diagram of the integration for the TFM.110A.

We used the [GVLB258.A](#) to demonstrate the integration of this module but please note that we have other compatible antennas that can also be used alongside the TFM.110A please see table below.

| Compatible Antennas              |
|----------------------------------|
| <a href="#">GVLB258.A</a>        |
| <a href="#">GGBLA.125.A</a>      |
| <a href="#">GGSFTP.50.7.A.08</a> |
| <a href="#">GPSF.36.7.A.30</a>   |
| <a href="#">HP5010A</a>          |
| <a href="#">GPVBSF.25.8.A</a>    |
| <a href="#">GPVSF.25.8.A.08</a>  |
| <a href="#">FXP612.07.0095A</a>  |
| <a href="#">TFX125.A</a>         |
| <a href="#">HP2258.A</a>         |

## 2. Specification

| GNSS Frequency Bands |                         |                           |                    |                    |                   |
|----------------------|-------------------------|---------------------------|--------------------|--------------------|-------------------|
| GPS                  | L1<br>1575.42 MHz       | L2<br>1227.6 MHz          | L5<br>1176.45 MHz  |                    |                   |
|                      | ■                       | ■                         | □                  |                    |                   |
| GLONASS              | G1<br>1602 MHz          | G2<br>1248 MHz            | G3<br>1207 MHz     |                    |                   |
|                      | ■                       | □                         | □                  |                    |                   |
| Galileo              | E1<br>1575.24 MHz       | E5a<br>1176.45 MHz        | E5b<br>1201.5 MHz  | E6<br>1278.75 MHz  |                   |
|                      | ■                       | □                         | □                  | □                  |                   |
| BeiDou               | B1C<br>1575.42 MHz      | B1I<br>1561 MHz           | B2a<br>1176.45 MHz | B2b<br>1207.14 MHz | B3<br>1268.52 MHz |
|                      | ■                       | □                         | □                  | □                  | □                 |
| L-Band               | L-Band<br>1542 MHz      |                           |                    |                    |                   |
|                      | □                       |                           |                    |                    |                   |
| QZSS (Regional)      | L1<br>1575.42 MHz       | L2C<br>1227.6 MHz         | L5<br>1176.45 MHz  | L6<br>1278.75e6    |                   |
|                      | ■                       | ■                         | □                  | □                  |                   |
| IRNSS (Regional)     | L5<br>1176.45 MHz       |                           |                    |                    |                   |
|                      | □                       |                           |                    |                    |                   |
| SBAS                 | L1/E1/B1<br>1575.42 MHz | L5/B2a/E5a<br>1176.45 MHz | G1<br>1602 MHz     | G2<br>1248 MHz     | G3<br>1207 MHz    |
|                      | ■                       | □                         | ■                  | □                  | □                 |



GNSS Bands and Constellations

| Electrical              |                  |      |      |      |      |      |      |         |      |
|-------------------------|------------------|------|------|------|------|------|------|---------|------|
| Frequency (MHz)         | 1166             | 1176 | 1186 | 1197 | 1227 | 1249 | 1559 | 1575.42 | 1606 |
| Noise Figure (dB)       | 2.9              | 2.7  | 2.6  | 2.5  | 3.1  | 3.1  | 3.3  | 3.1     | 3.6  |
| Gain (dB)               | 29               | 30   | 30   | 31   | 30   | 31   | 27   | 26      | 25   |
| Group Delay (ns)        | 22               | 20   | 18   | 19   | 17   | 23   | 16   | 16      | 23   |
| Input P1dB (dBm)        | -23              | -24  | -24  | -24  | -22  | -23  | -18  | -18     | -17  |
| Input Return Loss (dB)  | -10              | -11  | -12  | -13  | -11  | -14  | -11  | -11     | -13  |
| Output Return Loss      | -9               | -9   | -10  | -14  | -14  | -17  | -24  | -31     | -25  |
| Vin                     | +1.8 to +5.5 VDC |      |      |      |      |      |      |         |      |
| Typical Current (@1.8V) | 7.5 – 9.0mA      |      |      |      |      |      |      |         |      |

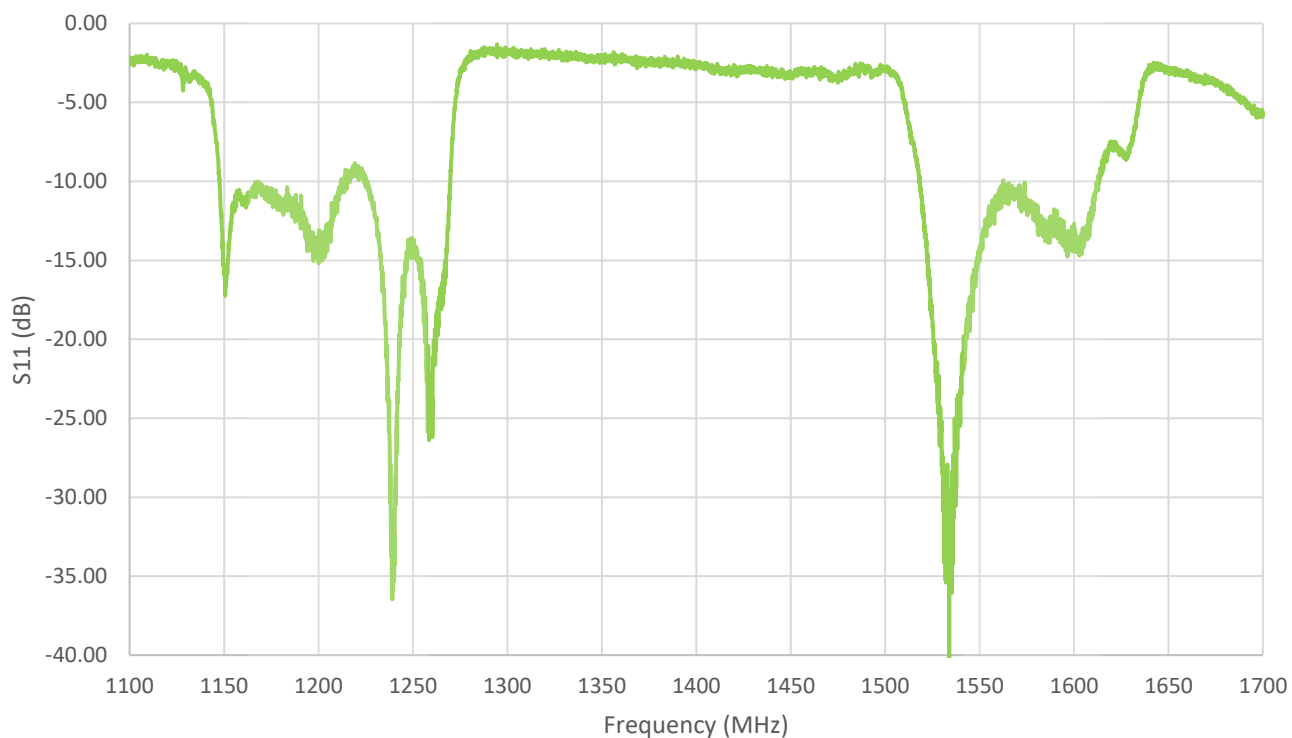
**\*Note: Tested on evaluation board. Board losses removed.**

| Mechanical       |                 |
|------------------|-----------------|
| Height           | 2.76mm          |
| Planar Dimension | 15.50 x 15.50mm |

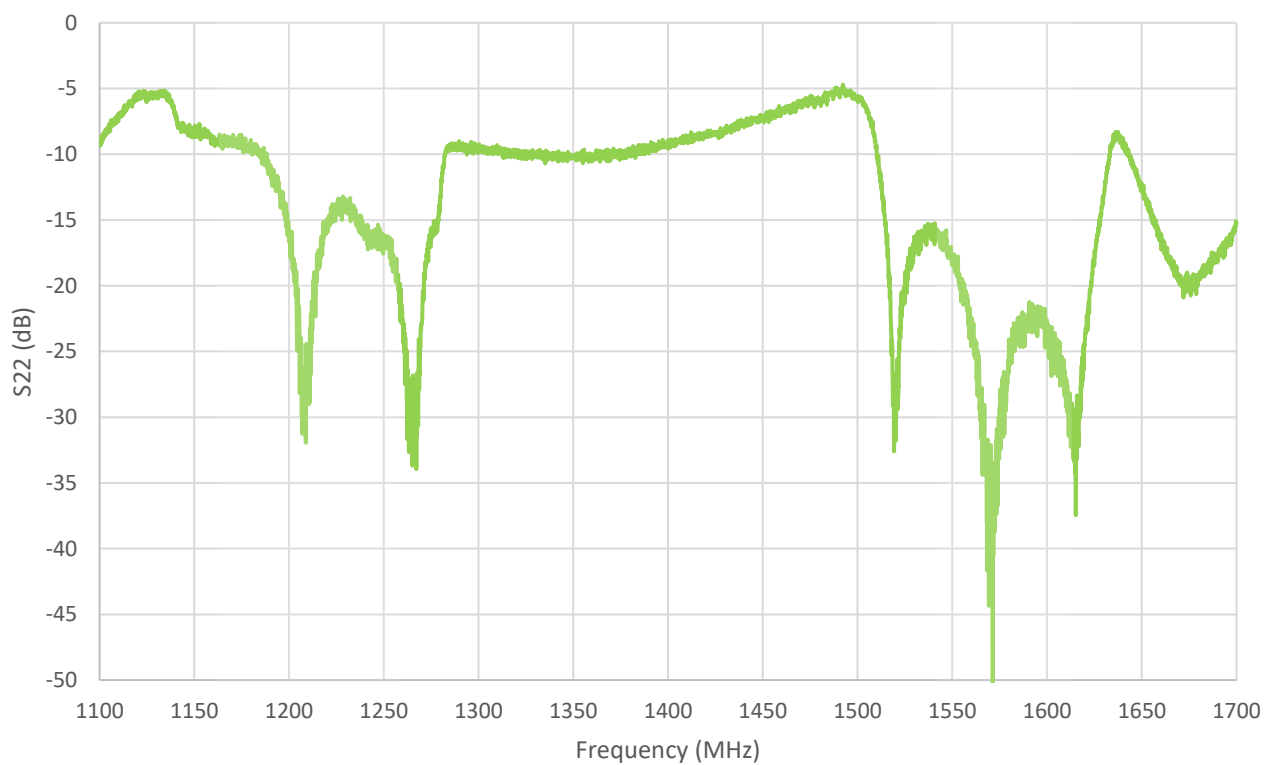
| Environmental     |               |
|-------------------|---------------|
| Temperature Range | -40°C to 85°C |
| RoHS Compliant    | Yes           |
| REACH Compliant   | Yes           |

## 3. FEM Characteristics

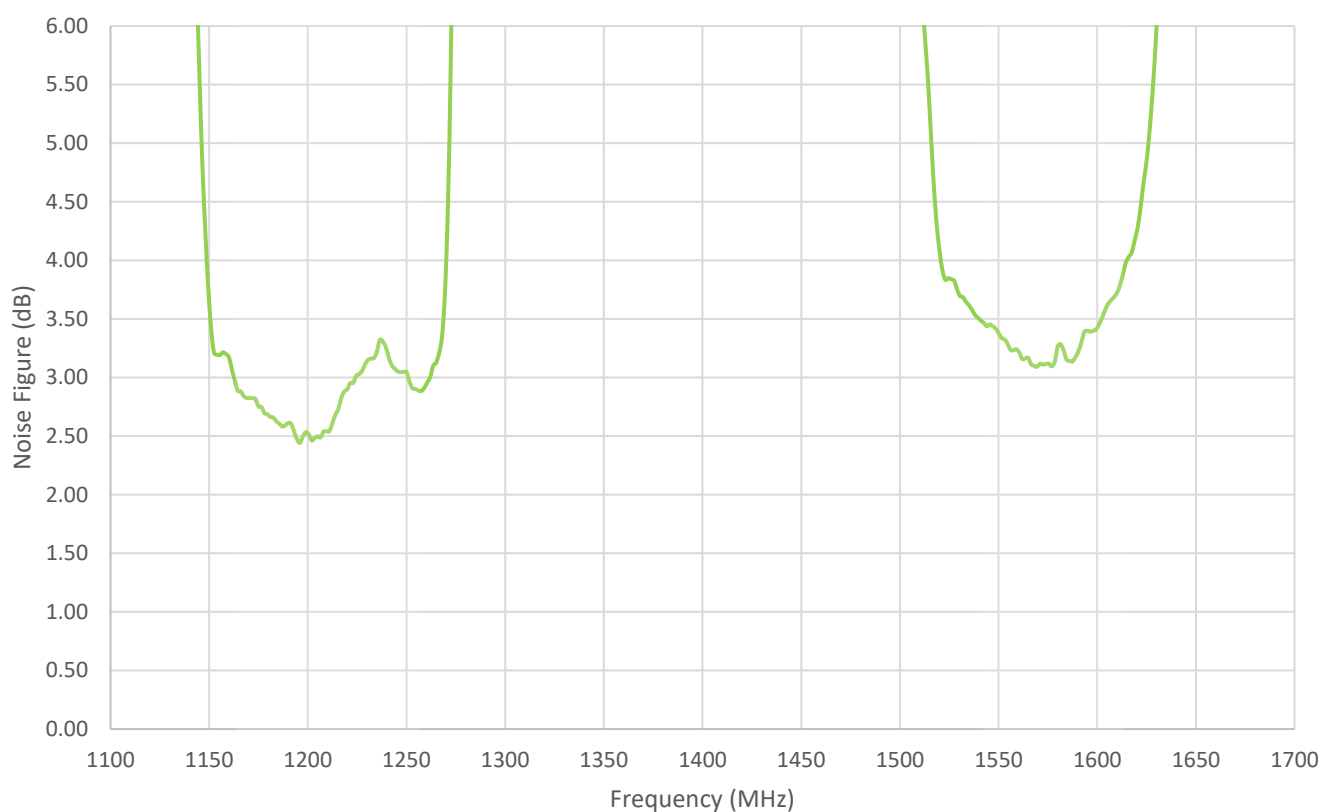
### 3.1 Input Return Loss



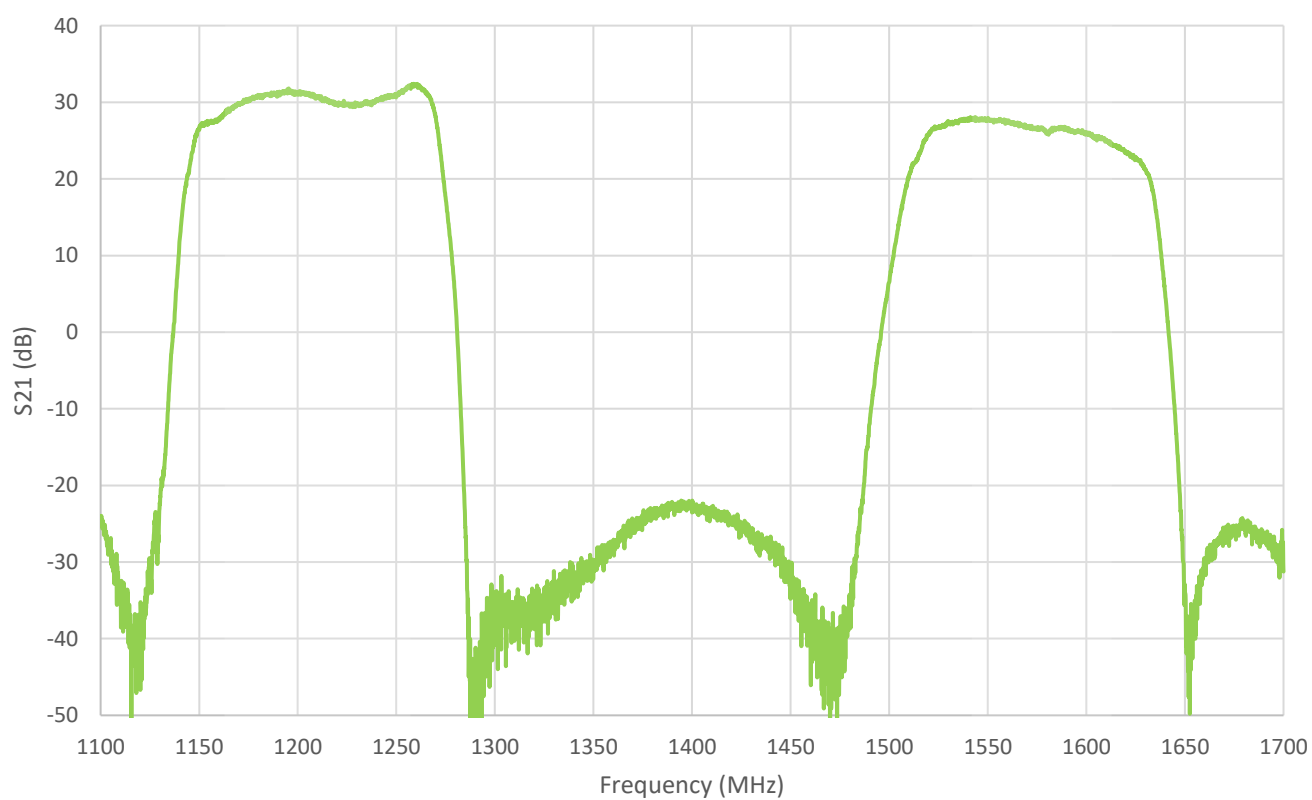
### 3.2 Output Return Loss



### 3.3 Noise Figure

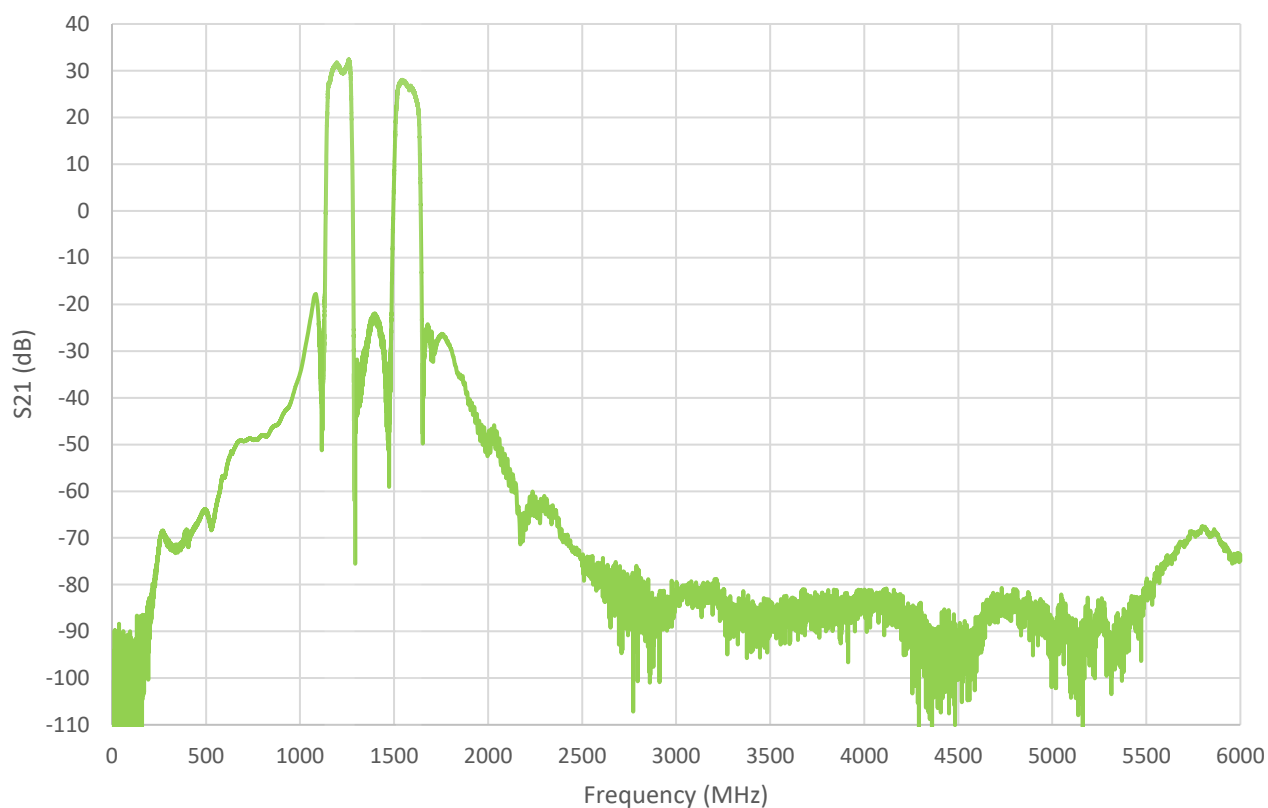


### 3.4 In-Band Gain

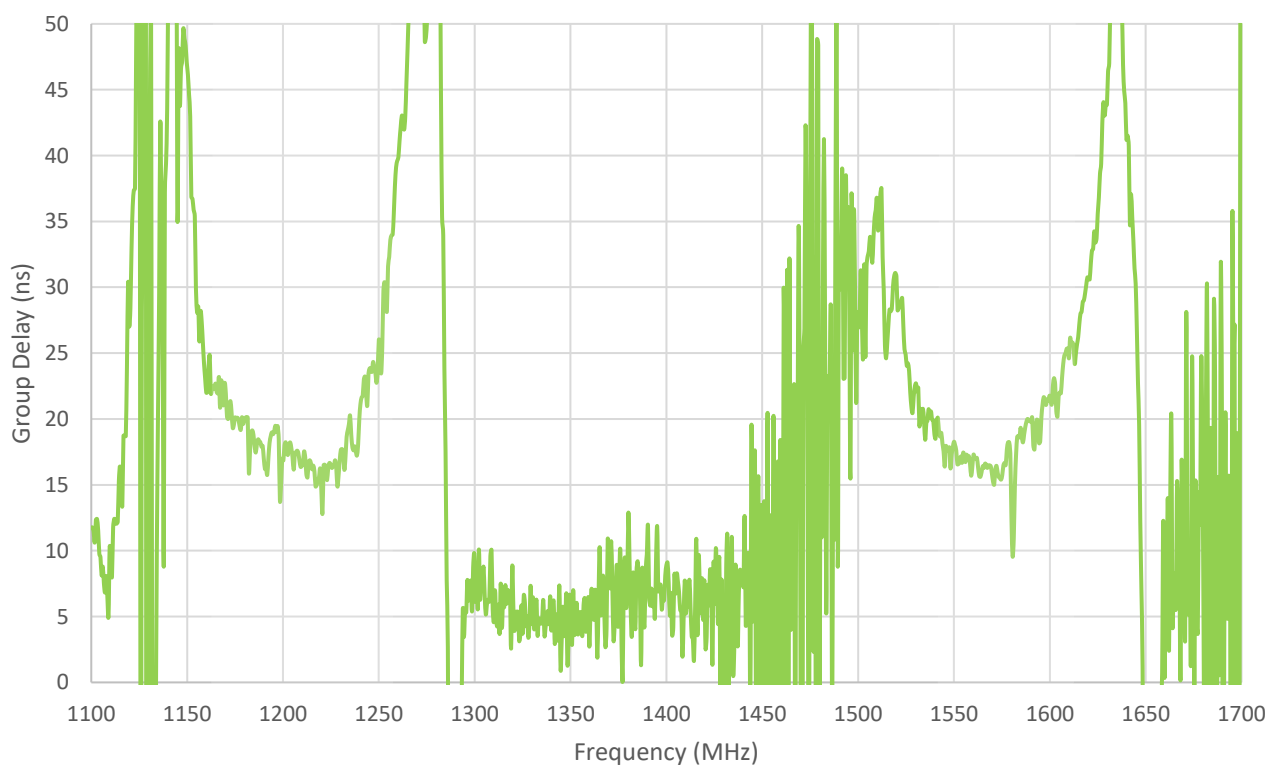




### 3.5 Wideband Gain



### 3.6 Group Delay



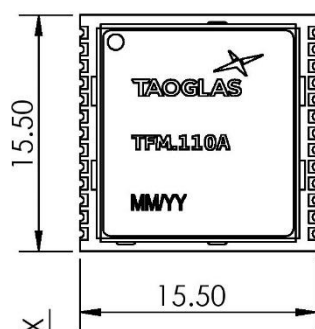
## 4. Mechanical Drawing

ISO NO.: EDW-22-8-0862

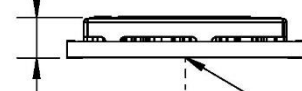
STATE: RELEASE

NOTES:  
1. ALL MATERIAL MUST BE ROHS COMPLIANT.  
2. CRITICAL DIMENSIONS ARE INDICATED BY AN INSPECTION SYMBOL  $\square$ .

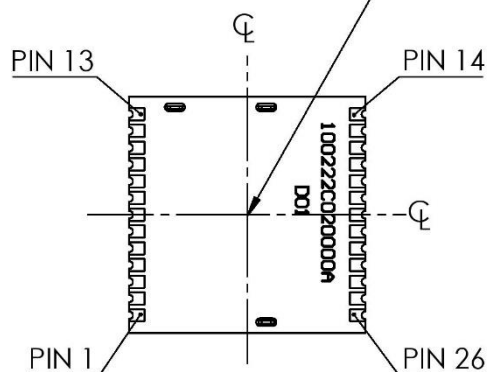
| REV | ZONE | DESCRIPTION           | ENG       | APPROVED  | DATE      |
|-----|------|-----------------------|-----------|-----------|-----------|
| D01 | All  | Initial design        | G. Samson | I. Mendez | 8/1/2022  |
| D02 | All  | Revised Drawing Title | G. Samson | I. Mendez | 9/20/2022 |



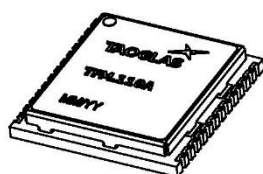
TOP VIEW



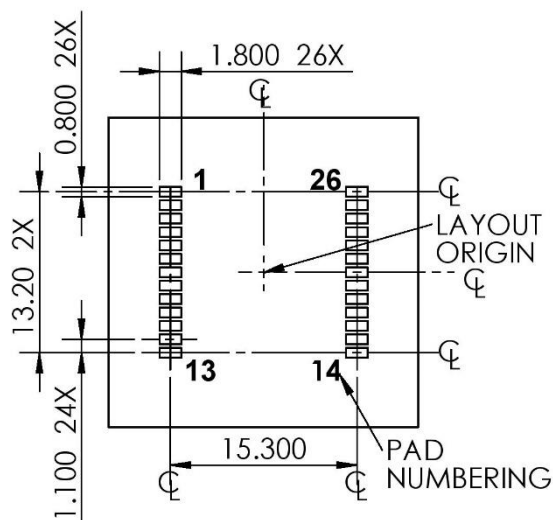
SIDE VIEW



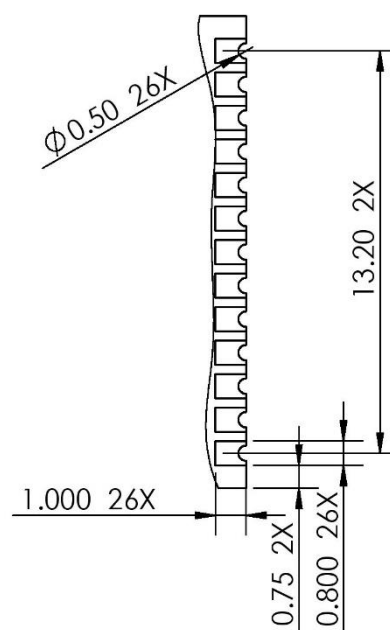
BOTTOM VIEW



ISO VIEW



PCB FOOTPRINT

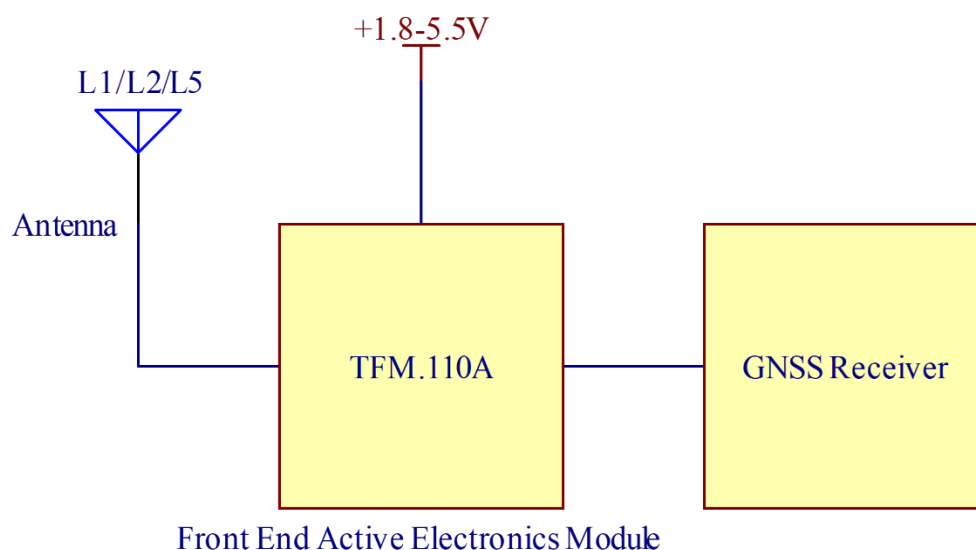


BOTTOM VIEW  
SOLDER PAD DETAIL

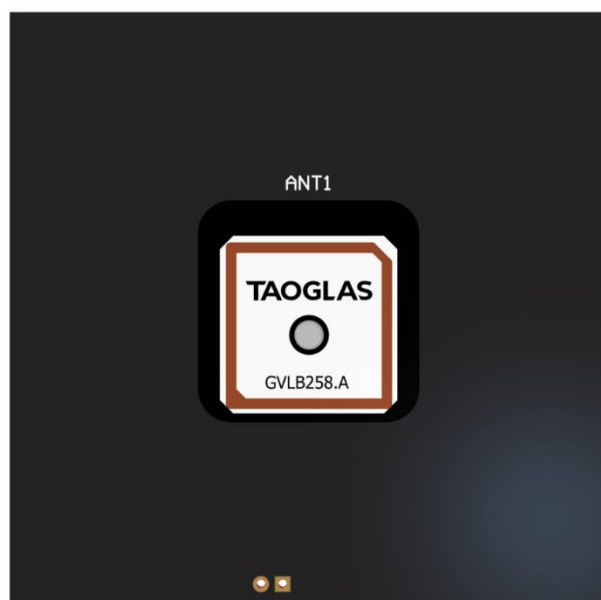
|   |   |   |            |            |          |
|---|---|---|------------|------------|----------|
| APPROVED BY:                              | P. Frank  | <p>This drawing is Taoglas Confidential Information and its inherent design concepts are property of Taoglas. This is not to be copied or shared with third parties without the prior written consent of Taoglas.</p> |            |            |          |
| CHECK BY:                                 | I. Mendez   |   |            |            |          |
| DRAWN BY:                                 | G. Samson   | TITLE: TFM.110A_GNSS Front End  |            |            |          |
| DATE:                                     | 8/2/2022  | covering L1+B1+G1/L2/L5   |            |            |          |
| UNLESS OTHERWISE SPECIFIED TOLERANCES ON: | 3X: ±0.5<br>4X: ±0.3<br>6X: ±0.2<br>10X: ±0.1<br>15X: ±0.05 | PART NO.: TFM.110A  |            |            |          |
| THIRD ANGLE PROJECTION                    |   | UNIT: mm  | SCALE: 5:1 | PAGES: 1/1 | REV: D02 |

## 5. Module Integration

The following is an example on how to integrate the TFM.110A into a design. In this example, the [GVLB258.A](#) is used as the antenna. This antenna has one pin, which is used for the L1/L2/L5 bands. The TFM.110A is powered from a separate power DC supply (1.8V-5.5V). The output of the TFM.110A can then be fed to a relevant GNSS receiver module. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.



Block Diagram of integration of the TFM.110A



Top and bottom view of PCB.

Please find the Integration files in Altium, 2D formats and the 3D model for the TFM.110A here:  
<https://www.taoglas.com/product/tfm-110a-gnss-front-end-multiband-gnss/>

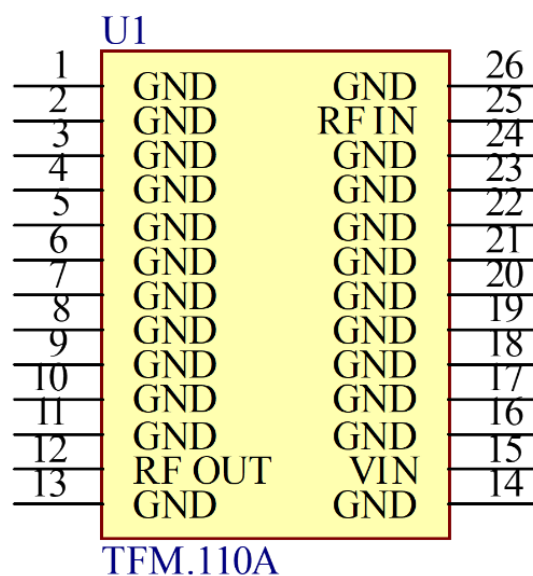
## 5.1 Schematic Symbol and Pin Definitions



Above is a 3D model of the TFM.110A on a PCB.

The circuit symbol for the TFM.110A is shown below. The front-end module has 26 pins as indicated below.

| Pin                    | Description   |
|------------------------|---------------|
| 1-11, 13-14, 16-24, 26 | Ground        |
| 12                     | Signal Output |
| 15                     | Voltage Input |
| 25                     | Signal Input  |



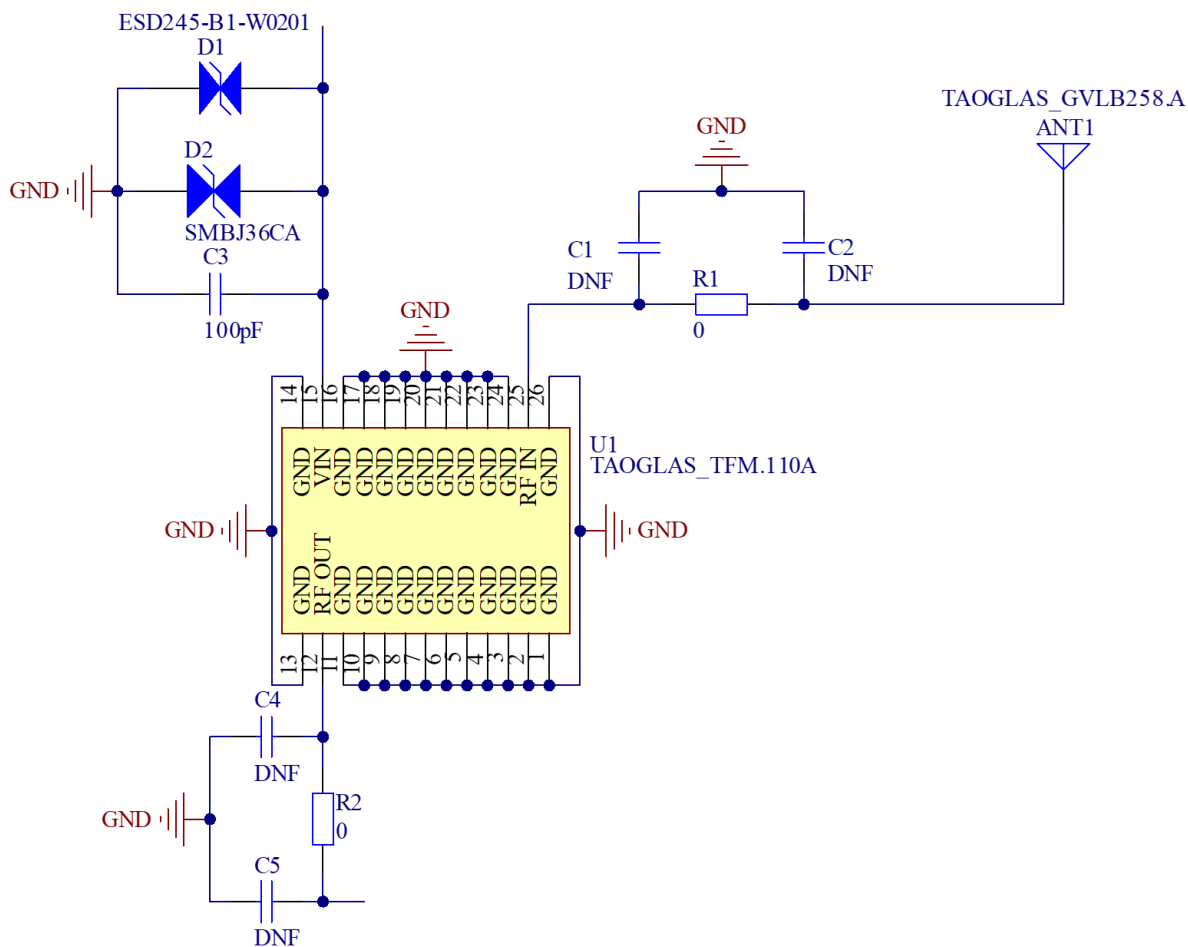
Above is a schematic symbol of TFM.110A and a table of the pin definitions.

## 5.2 Schematic Layout

Matching components with the TFM.110A are required for the module to have optimal performance in the spaces specified in the schematic below. Additional matching components may be necessary for your device, Taoglas recommends incorporating extra component footprints, forming a “pi” network, between the TFM.110A and the antenna. Matching components should also be placed between the RF output pin and the GNSS receiver module input pin.

Taoglas recommends placing an ESD diode and decoupling capacitor (100pF) on the input pin of the supply rail.

Note: The RF In & RF out of the TFM module are all DC-blocked internally. External DC block capacitors are not required.



| Designator     | Type      | Value      | Manufacturer | Manufacturer Part Number |
|----------------|-----------|------------|--------------|--------------------------|
| C1, C2, C4, C5 | Capacitor | Not Fitted | -            | -                        |
| C3             | Capacitor | 100pF      | Murata       | GRM1555C1H101JA01D       |
| D1             | Diode     | -          | Infineon     | ESD245B1W0201E6327XTSA1  |
| D2             | Diode     | -          | Littelfuse   | SMBJ36CA                 |
| R1, R2         | Resistor  | 0 Ohms     | YAGEO        | RC0402JR-070RL           |

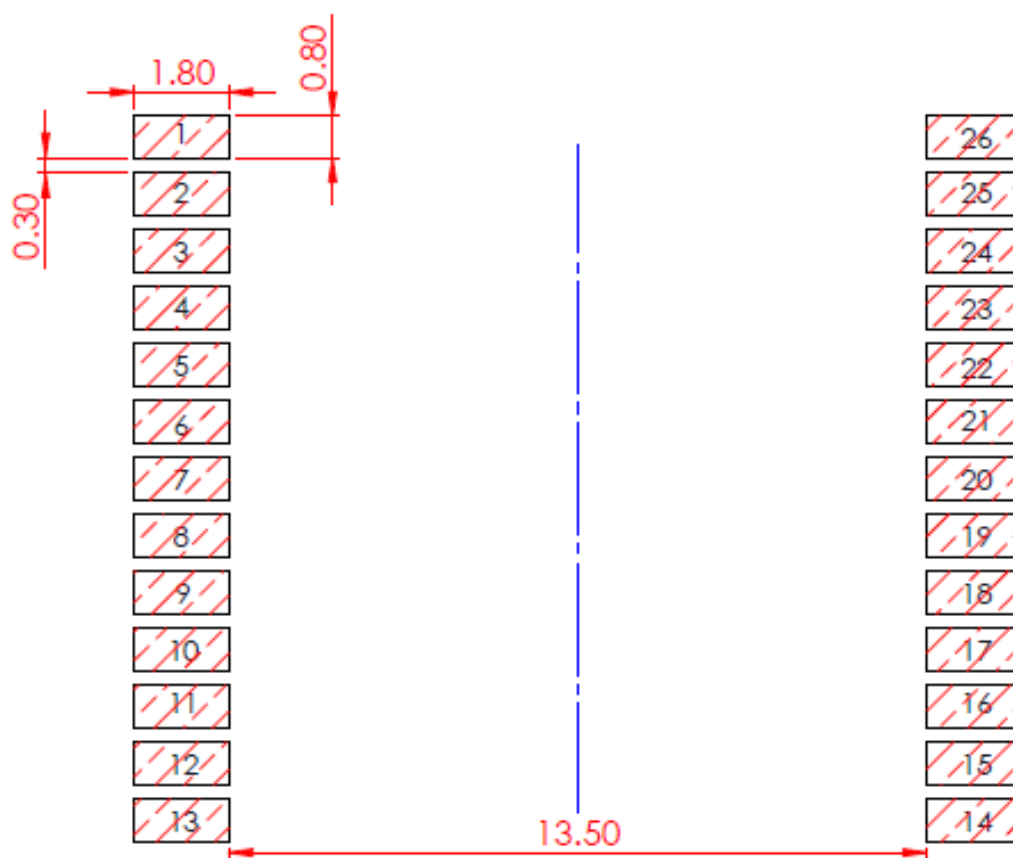
### 5.3 Module Integration

The TFM.110A should be placed as close to the signal input and output as possible to shorten the length of the transmission lines. The RF IN/OUT traces must maintain a 50 Ohm transmission line. A Pi Matching Network is recommended for the RF IN transmission line, the values and components for the matching circuit will depend on the tuning needed. Ground vias should be placed beside each ground pad and the DC Voltage input should be between +1.8 and +5.5 VDC. It's recommended that the DC Voltage input should be coupled with a 100pF Capacitor and an ESD Diode.



TFM.110A module mounted on a PCB, showing transmission lines and integration notes.

## 5.4 Module Footprint



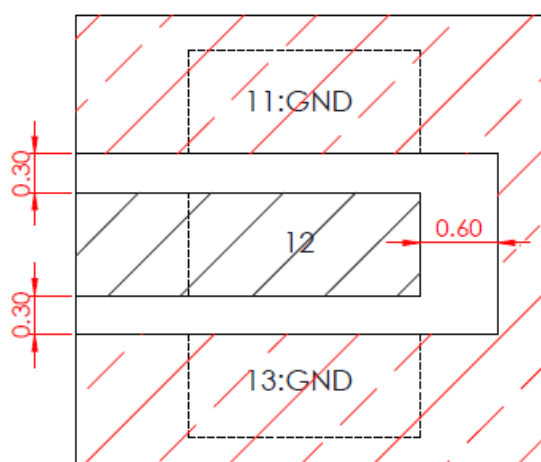
| PIN | DESCRIPTION | PIN | DESCRIPTION |
|-----|-------------|-----|-------------|
| 1   | GND         | 14  | GND         |
| 2   | GND         | 15  | VIN         |
| 3   | GND         | 16  | GND         |
| 4   | GND         | 17  | GND         |
| 5   | GND         | 18  | GND         |
| 6   | GND         | 19  | GND         |
| 7   | GND         | 20  | GND         |
| 8   | GND         | 21  | GND         |
| 9   | GND         | 22  | GND         |
| 10  | GND         | 23  | GND         |
| 11  | GND         | 24  | GND         |
| 12  | RF OUT      | 25  | RF IN       |
| 13  | GND         | 26  | GND         |

## 5.5 Copper Clearance for TFM.110A

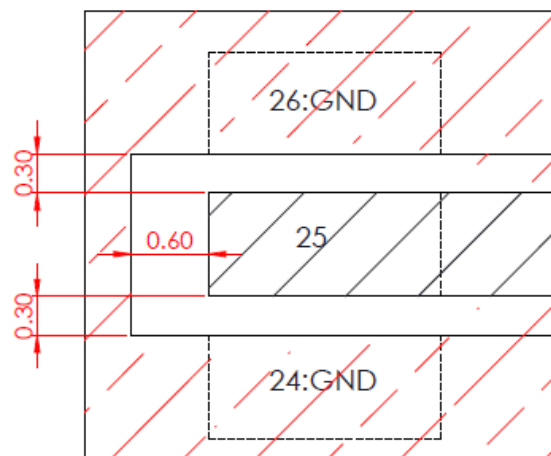
The footprint and clearance on the PCB must comply with the front-end module's specification. The PCB layout shown in the diagrams below demonstrates the TFM.110A clearance area for Pin 12 (RF OUT Pad) and Pin 25 (L1/L2/L5 IN Pad). The copper keep out area only applies to the same layer that the TFM110.A has been placed on. There should be 0.3mm copper clearance between the feed pad and ground pads with at least a 0.6mm copper clearance from the ground plane.



3D Image of Copper Clearance TFM.110A.



Copper Clearance for Pin 12 (RF OUT PAD) of the TFM.110A

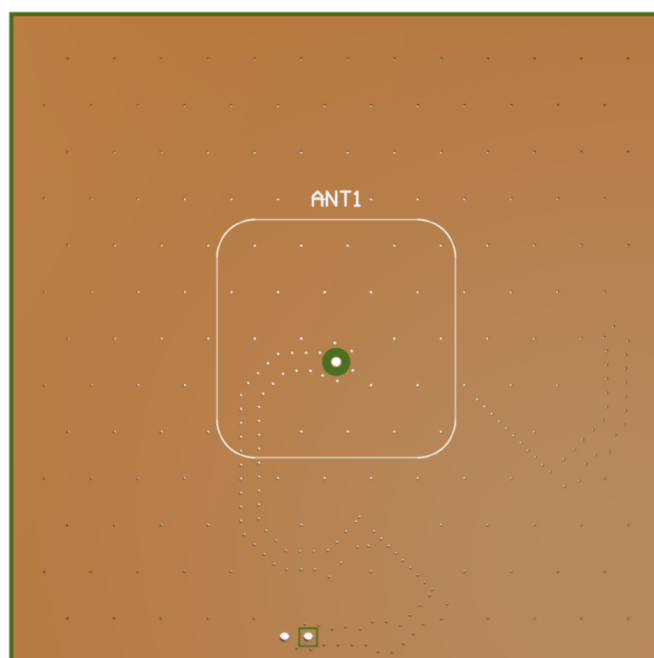
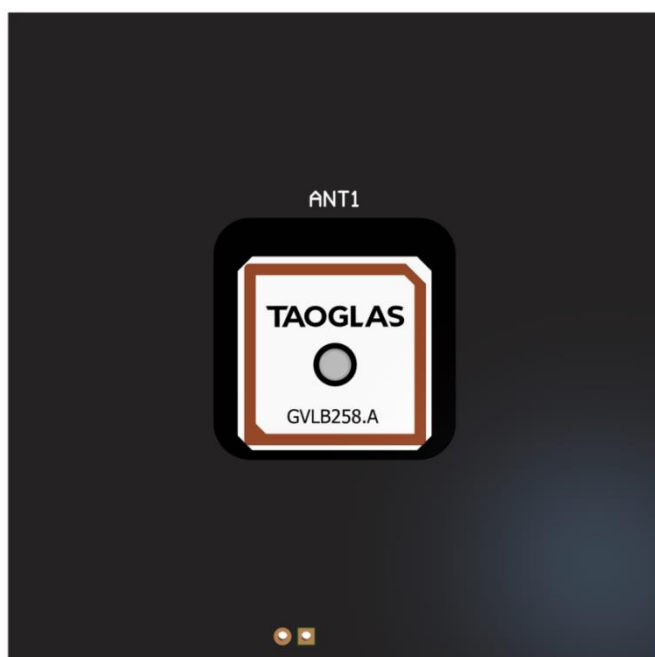


Copper Clearance for Pin 25 (L1/L2/L5 IN PAD) of the TFM.110A.



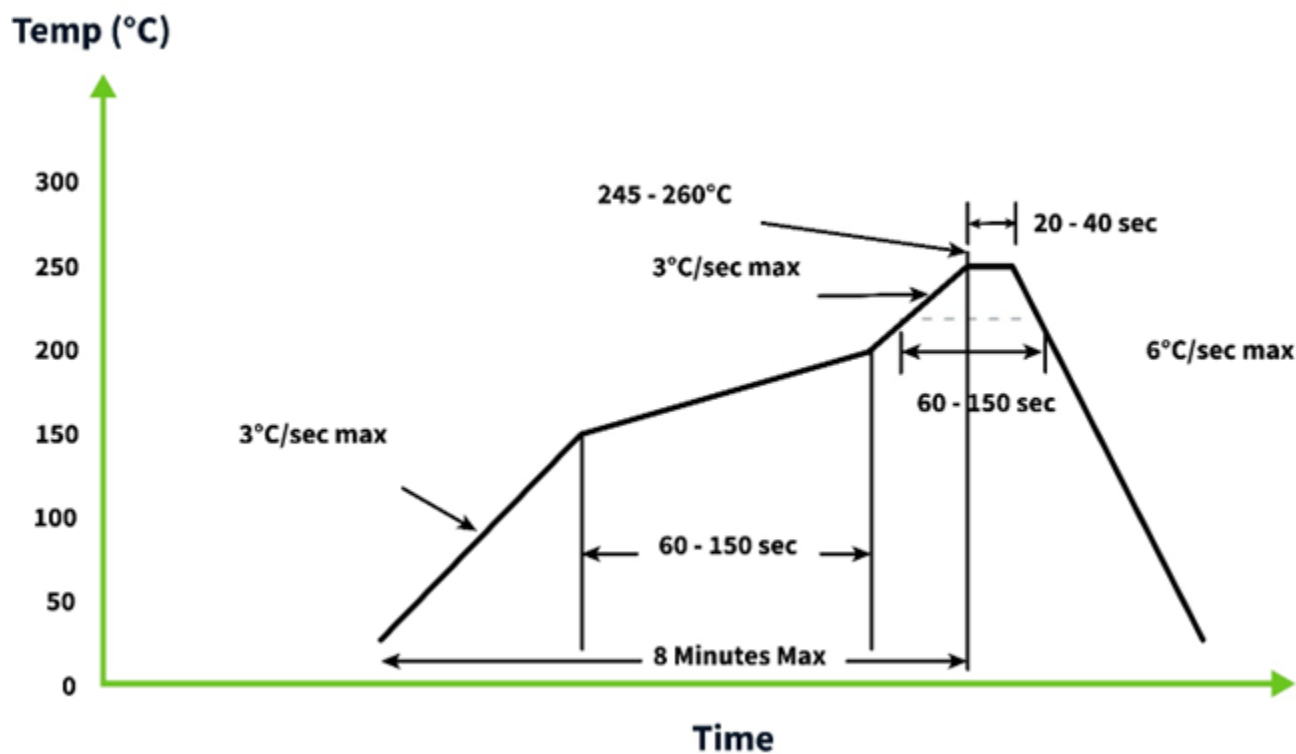
## 5.6 Final Integration

The bottom side image shown below highlights the antenna connection to the TFM.110A module. It demonstrates the output of the TFM.110A module that needs to be connected to a GNSS receiver input. It displays the DC connection required with ESD diode and decoupling capacitor. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.



## 6. Solder Reflow Profile

The TFM.110A can be assembled by following the recommended soldering temperatures are as follows:



\*Temperatures listed within a tolerance of +/- 10° C

Smaller components are typically mounted on the first pass, however, we do advise mounting the TFM.110A when placing larger components on the board during subsequent reflows.

## 7. Packaging

800 PCS / Reel  
SPQ Label



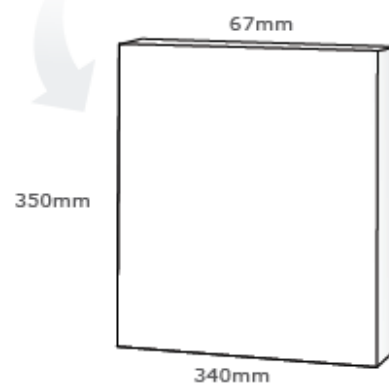
800 PCS / Vacuum bag  
2 PCS / 3g Desiccant  
1 PCS / Humidity test paper  
SPQ Label



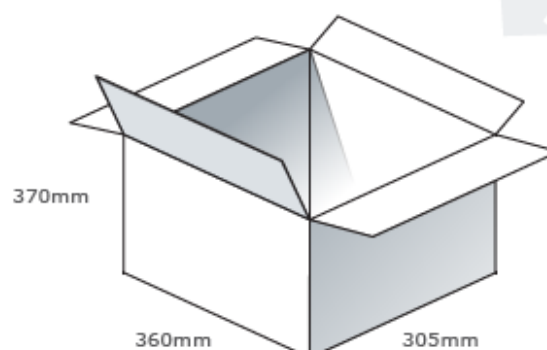
Caution Label  
Product Label  
SPQ Label



1 PCS / Box  
Box(mm): 350x340x67  
Weight (Kg): 2  
SPQ Label



3200 PCS / Carton  
Carton(mm): 370x360x305  
Weight (Kg): 8.8  
Carton Label



## Changelog for the datasheet

### SPE-22-8-149 – TFM.110.A

#### Revision: E (Current Version)

|         |  |
|---------|--|
| Date:   | 2023-08-18                                     |
| Notes:  | Updated module integration guide & ME Drawings |
| Author: | Gary West                                      |

#### Previous Revisions

##### Revision: D

|         |                                       |
|---------|---------------------------------------|
| Date:   | 2023-08-18                            |
| Notes:  | Added power consumption to spec table |
| Author: | Gary West                             |

##### Revision: C

|         |  |
|---------|--|
| Date:   | 2023-06-09   |
| Notes:  | Updated Module Integration Guide Added Packaging & Solder Reflow Profile |
| Author: | Gary West  |

##### Revision: B

|         |                                 |
|---------|---------------------------------|
| Date:   | 2022-10-28                      |
| Notes:  | Added antenna integration guide |
| Author: | Gary West                       |

##### Revision: A (Original First Release)

|         |                 |
|---------|-----------------|
| Date:   | 2022-09-26      |
| Notes:  | Initial Release |
| Author: | Gary West       |



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