NE310L2

HW Design Guide

1VV0301711 Rev. 3 – 2021-10-08

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS
NE310L2-W1
NE310L2-WW

CONTENTS

1. INTRODUCTION

1.1. Scope

This document introduces the NE310L2 module and presents possible and recommended hardware solutions to develop a product based on this module and all variants listed in the applicability table.

This document cannot include every hardware solution or every product that can be designed, so the information provided should be used as a guide and starting point.

1.2. Audience

This document is intended for system integrators that are using the NE310L2 modules in their products.

1.3. Contact Information, Support

For technical support services and general questions please e-mail:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
- *TS-SRD@telit.com*
- *TS-ONEEDGE@telit.com*

Alternatively, use:

https://www.telit.com/contact-us/

Product information and technical documents are accessible 24/7 on our web site:

https://www.telit.com

1.4. Symbol Conventions

	**Danger:** This information MUST be followed or catastrophic equipment failure or personal injury may occur.
	**Warning:** Alerts the user on important steps about the module integration.
	**Note/Tip:** Provides advice and suggestions that may be useful when integrating the module.
	**Electro-static Discharge:** Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

All dates are in ISO 8601 format, that is YYYY-MM-DD.

1.5. Related documents

- 80668ST11067A NE310L2 AT Commands Reference Guide

2. GENERAL PRODUCT DESCRIPTION

2.1. Overview

The NE310L2 module is a NBIoT communication product that allows integrators to plan for availability even for longer lifecycle applications, highly recommended for new designs specified for worldwide coverage.

The NE310L2 operates with 1.8 V GPIOs, minimizing power consumption and making it even more ideal for application with battery-powered and wearable devices.

2.2. Product Variants and Frequency Bands

Product	2G Band (MHz)	LTE CATM1	NBIoT	CS Voice VoLTE	Region
NE310L2-W1	-	-	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85	N	Worldwide
NE310L2-WW	850, 900, 1800, 1900	-	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85	N	Worldwide

Table 2: Product Variants and their Frequency Bands

Refer to "RF Section" for details information about frequencies.

Note: Cellular technologies and frequency bands may vary based on firmware version and firmware configuration used.

2.3. Target Market

NE310L2 can be used for Global IoT applications such as smart metering, healthcare monitoring, home automation, industrial sensors, smart agriculture, asset tracking, point of sale, portable devices and many more that benefit from low-power and low-data rate capabilities.

2.4. Main Features

Function	Features
Modem	• NBIoT technology • *SMS support (text and PDU)* • *Real Time Clock*

Function	Features
Interfaces	• USIF0 Main UART (AT command* and Log) • AUX UART (AT Command*, FW Uograde, LOg) • SPI** • 6 GPIOs • Antenna port

Table 3: Functional Features
** Functionality depending on ports configuration*
*** Functionality not available on MKT samples*

2.5. TX Output Power

2.5.1. NE310L2-W1

Band	Mode	Class	RF power (dBm) Nominal*
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85	(LTE) CAT-NB1	3	23

Table 4: Transmission Output Power
** Max output power tolerance range according to 3GPP TS 36.521-1 or better*

2.5.2. NE310L2-WW

Band	Mode	Class	RF power (dBm)Nominal*
850/900MHz	GPRS	4	32.5
1800/1900MHz	GPRS	1	29.5
B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B85	(LTE) CAT-NB1	3	23

Table 5: Transmission Output Power
** Max output power tolerance range according to 3GPP TS 36.521-1 and 3GPP TS 51.010-1 or better*

2.6. RX Sensitivity

2.6.1. NE310L2-W1

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band1	-114.2	-108.2

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band2	-114.2	-108.2
CAT NB2 / Band3	-114.7	-108.2
CAT NB2 / Band4	-114.3	-108.2
CAT NB2 / Band5	-114.6	-108.2
CAT NB2 / Band8	-114.5	-108.2
CAT NB2 / Band12	-114.4	-108.2
CAT NB2 / Band13	-114.3	-108.2
CAT NB2 / Band18	-114.5	-108.2
CAT NB2 / Band19	-114.5	-108.2
CAT NB2 / Band20	-114.0	-108.2
CAT NB2 / Band25	-114.1	-108.2
CAT NB2 / Band26	-114.2	-108.2
CAT NB2 / Band28	-114.2	-108.2
CAT NB2 / Band66	-114.2	-108.2
CAT NB2 / Band85	-114.4	-108.2

*Table 6: RX Sensitivity NE310L2-W1 * 3GPP TS 36.521-1 Release 15 Minimum performance requirement*

2.6.2. NE310L2-WW

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band1	-113.4	-108.2
CAT NB2 / Band2	-113.4	-108.2
CAT NB2 / Band3	-113.1	-108.2
CAT NB2 / Band4	-113.5	-108.2
CAT NB2 / Band5	-113.5	-108.2
CAT NB2 / Band8	-114.1	-108.2
CAT NB2 / Band12	-113.4	-108.2
CAT NB2 / Band13	-113.5	-108.2
CAT NB2 / Band18	-113.7	-108.2
CAT NB2 / Band19	-113.6	-108.2

Band	REFsens (dBm) Typical	REFsens (dBm)* 3GPP Limit
CAT NB2 / Band20	-113.0	-108.2
CAT NB2 / Band25	-113.6	-108.2
CAT NB2 / Band26	-113.2	-108.2
CAT NB2 / Band28	-113.2	-108.2
CAT NB2 / Band66	-113.3	-108.2
CAT NB2 / Band85	-113.3	-108.2
GPRS / GSM850	-108.2	-102
GPRS / GSM900	-108.1	-102
GPRS / DCS1800	-109.4	-102
GPRS / PCS1900	T-109.0	-102

*Table 7: RX Sensitivity NE310L2-WW * 3GPP TS 36.521-1 Release 15 and 51.010-1 Minimum performance requirement*

2.7. Mechanical Specifications

2.7.1. Dimensions

The overall dimensions of NE310L2-W1 are:

- Length: 14.3 mm
- Width: 13.1 mm
- Thickness: 2.6 mm

The overall dimensions of NE310L2-WW:

- Length: 18.0 mm
- Width: 15.0 mm
- Thickness: 2.6 mm

2.7.2. Weight

The nominal weight of the NE310L2-W1 is 1gr.

The nominal weight of the NE310L2-WW is 1.5gr.

2.8. Temperature Range

Temperature range		Note
Normal Operating Temperature Range	–30°C to +70°C	The module is fully functional and compliant according to regulatory standards.
Extended Operating Temperature Range	-40°C to +85°C	The module is fully functional (*)
Storage Temperature Range	–40°C to +105°C	The module is not powered and not connected to power supply

Table 8: Temperature Range

Note: (*) Functional: if applicable, the module is able to make and receive data calls, send and receive SMS and data traffic.

3. PINS ALLOCATION

3.1. Pin-out

Pin	Signal	I/O	Function	Type	Comment
Asynchronous Serial Port (USIF0) – Prog. / Data + HW Flow Control					
Y16	C103/TXD0	I	Serial data input (TXD) from DTE	CMOS 1.8V	Internal PU (TBD)
AA15	C104/RXD0	O	Serial data output (RXD) to DTE	CMOS 1.8V	
Y18	C105/RTS0	I	Input for Request to send signal (RTS) from DTE	CMOS 1.8V	Internal PU (TBD)
AA17	C106/CTS0	O	Output for Clear to send signal (CTS) to DTE	CMOS 1.8V	
Auxiliary Serial Port					
Y10	TX_AUX	O	Auxiliary UART (TX Data to DTE)	CMOS 1.8V	
AA9	RX_AUX	I	Auxiliary UART (RX Data to DTE)	CMOS 1.8V	Internal PU (TBD)
SIM card interface					
L1	SIM_CLK	O	External SIM signal – Clock	CMOS 1.8V	
M2	SIM_RST	O	External SIM signal – Reset	CMOS 1.8V	
N1	SIM_DAT	I/O	External SIM signal – Data I/O	CMOS 1.8V	
P2	SIM_VCC	-	Power supply for the SIM	1.8V	Only 1.8V simcard are supported
-	SIMIN	I	Presence SIM input	CMOS 1.8V	See par.5.8
SPI					
AA5	SPI_MOSI	I/O	SPI MOSI	CMOS 1.8V	
Y8	SPI_MISO	I/O	SPI MISO	CMOS 1.8V	
AA7	SPI_CLK	I/O	SPI Clock	CMOS 1.8V	
Y6	SPI_CS	I/O	SPI Chip Select	CMOS 1.8V	
DIGITAL IO					
V11	IO1	I/O	Configurable GPIO01/	CMOS 1.8V	Internal PU
V13	IO2	I/O	Configurable GPIO02/	CMOS 1.8V	Internal PU
D7	IO3	I/O	Configurable GPIO03	CMOS 1.8V	Internal PD (TBD)
D9	IO4	I/O	Configurable GPIO04	CMOS 1.8V	Internal PU (TBD)
D11	IO5	I/O	Configurable GPIO05	CMOS 1.8V	Internal PU (TBD)
D13	IO6	I/O	Configurable GPIO06	CMOS 1.8V	Internal PD (TBD)

Pin	Signal	I/O	Function	Type	Comment
ADC and DAC					
B18	ADC	I	Analog To Digital converter Input	A/D	
R16	DAC	O	Digital To Analog converter Output	D/A	PWM signal
RF Section					
A5	CELL_MAIN ANTENNA	I/O	Main Antenna (50 ohm)	RF	
Miscellaneous Functions					
B2	S_LED	O	Status LED	CMOS 1.8V	
N16	ON_OFF*/WAKE*	I	Input Command for Power ON/OFF and to wake from deep sleep mode	Internal Power Supply (MAX 1.6V low power mode)	Active Low, Internal PU (620K)
R19	HW_SHUTDOWN*	I	HW Unconditional Shutdown	Internal Power Supply (MAX 1.6V low power mode)	Active Low, Internal PU (620K)
1	PWRMON	O	Power ON Monitor	CMOS 1.8V	
Power Supply					
W1	VBATT_PA	-	Main power supply (Radio PA)	Power	
AA3	VBATT	-	Main power supply (Baseband)	Power	
N4	CTANK	-	Internal supply domain pin for external tank capacitor	1.8V	
A3	GND	-	RF Ground	Power	
A7	GND	-	RF Ground	Power	
A9	GND	-	RF Ground	Power	
A13	GND	-	RF Ground	Power	
A17	GND	-	RF Ground	Power	
B4	GND	-	RF Ground	Power	
B6	GND	-	RF Ground	Power	
B10	GND	-	RF Ground	Power	
B12	GND	-	RF Ground	Power	
B14	GND	-	RF Ground	Power	
B16	GND	-	RF Ground	Power	
C19	GND	-	RF Ground	Power	

Pin	Signal	I/O	Function	Type	Comment
D18	GND	-	RF Ground	Power	
F8	GND	-	Thermal Ground	Power	
F12	GND	-	Thermal Ground	Power	
F18	GND	-	Thermal Ground	Power	
G19	GND	-	Thermal Ground	Power	
H6	GND	-	Thermal Ground	Power	
H14	GND	-	Thermal Ground	Power	
J19	GND	-	Thermal Ground	Power	
K18	GND	-	Thermal Ground	Power	
M18	GND	-	Thermal Ground	Power	
N19	GND	-	Thermal Ground	Power	
P6	GND	-	Thermal Ground	Power	
P14	GND	-	Thermal Ground	Power	
T8	GND	-	Thermal Ground	Power	
T12	GND	-	Thermal Ground	Power	
U1	GND	-	Power Ground	Power	
V2	GND	-	Power Ground	Power	
W19	GND	-	Power Ground	Power	
Y2	GND	-	Power Ground	Power	
Y4	GND	-	Power Ground	Power	
RESERVED					
G1	RESERVED	-	RESERVED		
H2	RESERVED	-	RESERVED		
J1	RESERVED	-	RESERVED		
K2	RESERVED	-	RESERVED		
J4	RESERVED	-	RESERVED		
G4	RESERVED	-	RESERVED		
L19	RESERVED	-	RESERVED		
A11	RESERVED	-	RESERVED		
R4	RESERVED	-	RESERVED		

Pin	Signal	I/O	Function	Type	Comment
L4	RESERVED	-	RESERVED		
V7	RESERVED	-	RESERVED		
V9	RESERVED	-	RESERVED		
L16	RESERVED	-	RESERVED		
P18	RESERVED	-	RESERVED		
J16	RESERVED	-	RESERVED		
B8	RESERVED	-	RESERVED		
A15	RESERVED	-	RESERVED		
U19	RESERVED	-	RESERVED		
V18	RESERVED	-	RESERVED		
T18	RESERVED	-	RESERVED		
Y12	RESERVED	-	RESERVED		
AA11	RESERVED	-	RESERVED		
AA13	RESERVED	-	RESERVED		
Y14	RESERVED	-	RESERVED		
E19	RESERVED	-	RESERVED		
H18	RESERVED	-	RESERVED		
G16	RESERVED	-	RESERVED		
T2	RESERVED	-	RESERVED		
C1	RESERVED	-	RESERVED		
D2	RESERVED	-	RESERVED		
E1	RESERVED	-	RESERVED		
F2	RESERVED	-	RESERVED		

Table 9: Pin-out Information

Warning: Reserved pins must not be connected.

Warning: C104/RXD1 cannot have any PU or HIGH state during BOOTING UP phase.

3.2. LGA Pads Layout

TOP VIEW

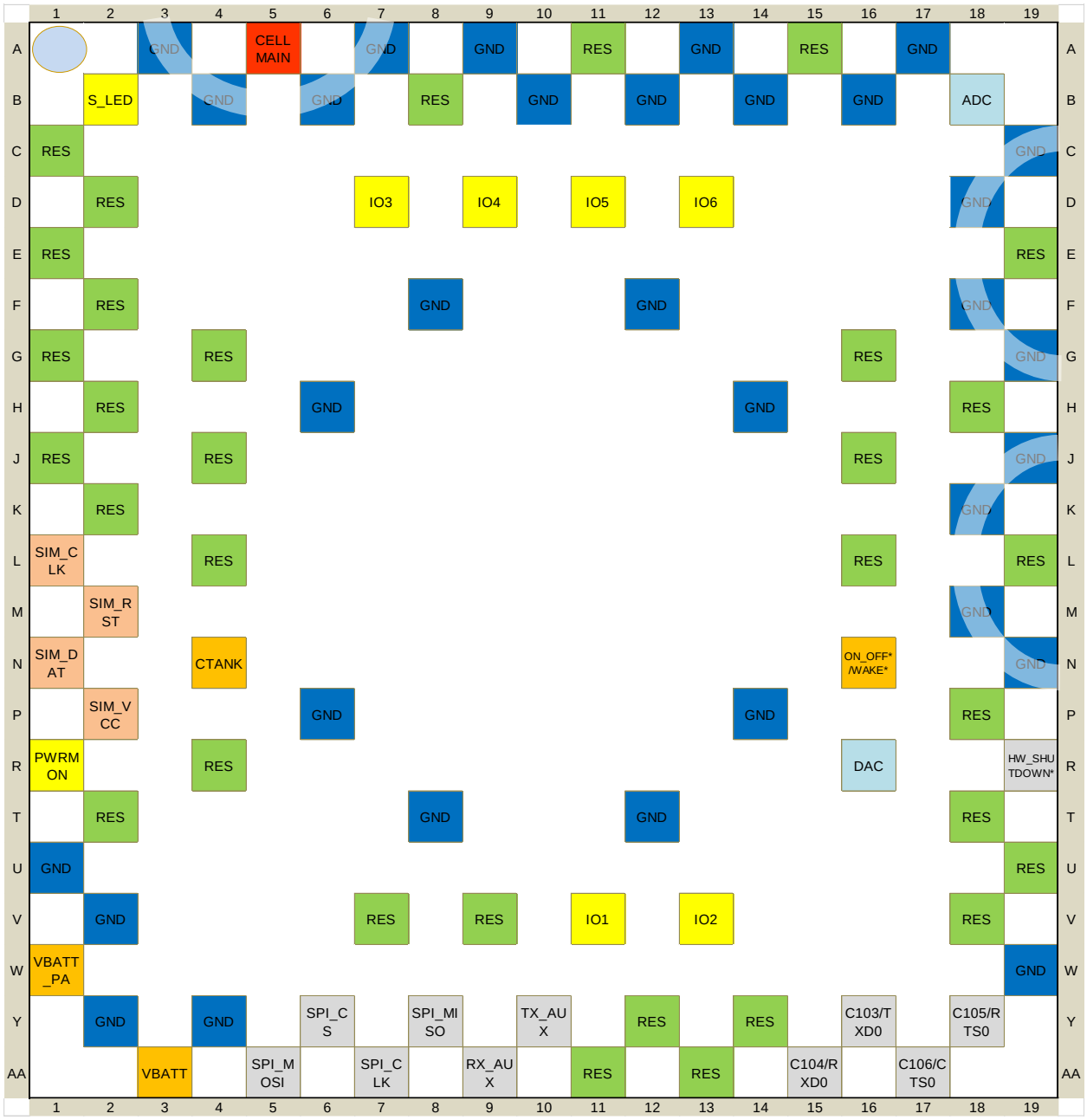

Figure 1: LGA Pads Layout

	SUPPLY AND CONTROL
	SIM CARD
	ANALOG FUNCTIONALITY
	GROUND
	DIGITAL FUNCTIONALITY
	DIGITAL COMMUNICATION
	RF SIGNALS
	RESERVED/NOT ASSIGNED/ RESERVED FOR FUTURE USE
	GNSS

4. POWER SUPPLY

Power supply circuitry and the board layout are a very important part in the full product design and strongly reflect on the overall performance of the product, so the requirements and guidelines that will follow should be read carefully for a proper design.

4.1. Power Supply Requirements

The external power supply must be connected to VBATT & VBATT_PA signals and must fulfil the following requirements:

Power Supply	Value
Nominal Supply Voltage	3.8V
Operating Voltage Range	3.2 V - 4.2 V
Extended Voltange Range	2.1 V - 4.5 V
VBATTmin	2.2V

Table 10: Power Supply Requirements

Warning: The supply voltage of the modem must never exceed the Extended Operating Voltage Range.

Improper implementation of the power supply guidelines described in this document can cause module failure.

Note: For PTCRB approval on the final products the power supply is required to be within the "Normal Operating Voltage Range".

Note: Note: The power supply section of the application must be carefully designed to avoid an excessive voltage drop during transmission peak current absorptions. If the voltage drops beyond the limits of the Extended Operating Voltage range, an unintentional module power off can occur.

Note: **Note:** When turning on the modem, the voltage must be at least VBATTmin.

Note: The HW User Guide specifications shall be fully acknowledged and implemented correctly in order to use the module in its "Extended Operating Voltage Range".

4.2. Power Consumption

4.2.1. NE310L2-W1, NE310L2-WW Idle Mode

Mode	Measure (Typical)			Mode Description
IDLE mode	CATM (mA)	NBIoT (mA)	2G (mA)	
AT+CFUN=1		TBD	–	Normal mode: full functionality of the module
AT+CFUN=4				Disabled TX and RX; module is not registered on the network
AT+CFUN=5		TBD	–	Paging cycle #256 frames (2.56s DRx cycle)
		TBD	–	81.92s eDRx cycle length (PTW=2.56s, DRX=1.28s)
		TBD	–	327.68s eDRx cycle length (PTW=2.56s, DRX=1.28s)
		TBD	–	655.36s eDRx cycle length (PTW=2.56s, DRX=1.28s)
		TBD	–	1310.72s eDRx cycle length (PTW=2.56s, DRX=1.28s)
		TBD	–	2621.44s eDRx cycle length (PTW=2.56s, DRX=1.28s)
		-	–	Paging Multiframe 9
PSM mode	Typical (mA)			
AT+CPSMS=1				No current source or sink by any connected pin

Table 11: Idle and PSM mode

Note: The reported LTE CAT NB1 idle mode values are an average among all the product variants and bands for each network wireless technology.

The support for a specific network wireless technology depends on the product variant configuration.

4.2.2. NE310L2-W1 Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
NBIoT	330	490	3.75KHz, 1 SC MCS-0 BPSK, 23dBm (bands 12, 28, 85)
	55	410	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 12, 28, 85)
	350	510	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 5,8,13,20)
	55	415	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 5,8,13,20)
	35	470	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 1,2,3,4,25,66)
	60	430	15kHz, 12 SC MCS-5 QPSK, 21 dBm (bands 1,2,3,4,25,66)

Table 12: NE310L2-W1 connected mode

4.2.3. NE310L2-WW Connected Mode

Mode	Measure (Typical)		Mode Description
Connected mode	Average (mA)	Peak (mA)	
NBIoT	312	460	3.75KHz, 1 SC MCS-0 BPSK, 23dBm (bands 12, 28, 85)
	55	420	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 12, 28, 85)
	350	530	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 5,8,13,20)
	60	440	15kHz, 12 SC MCS-5 QPSK, 21dBm (bands 5,8,13,20)
	350	470	3.75kHz, 1 SC MCS-0 BPSK, 23dBm (bands 1,2,3,4,25,66)
	60	440	15kHz, 12 SC MCS-5 QPSK, 21 dBm (bands 1,2,3,4,25,66)
GPRS	270	2300	1TX + 1RX, CS1, GMSK, Band 850, 900

	180	1500	1TX + 1RX, CS1, GMSK, Band 1800, 1900

Table 13: NE310L2-WW connected mode

4.3. General Design Rules

The main guidelines for the Power Supply Design embrace three different design steps:

- the electrical design
- the thermal design
- the PCB layout

4.3.1. Electrical Design Guidelines

The electrical design of the power supply is highly dependent on the power source from which this power is drained. We will distinguish them into three categories:

- +5V input (typically PC internal regulator output)
- +12V input (typically automotive)
- Battery

4.3.1.1. +5V Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, so there is not much difference between the input source and the desired output and a linear regulator can be used. A switching power supply will not be suited due to the low drop out requirements.
- When using a linear regulator, a proper heat sink shall be provided in order to dissipate the power generated.
- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks close to the Module, a 100µF capacitor is usually suitable.
- Make sure the low ESR capacitor on the power supply output is rated at least 10V.

An example of linear regulator with 5V input is:

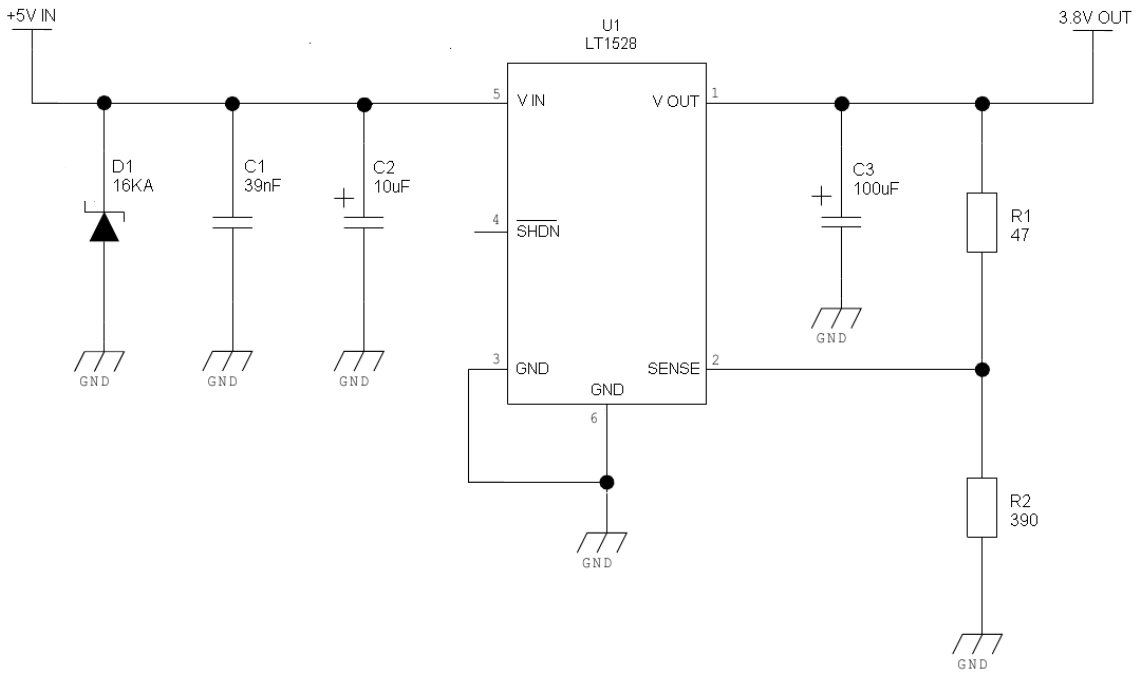

Figure 2: example of linear regulator with 5V input

4.3.1.2. +12V Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, so due to the big difference between the input source and the desired output, a linear regulator is not suited and shall not be used. A switching power supply will be preferable because of its better efficiency.
- When using a switching regulator, a 500kHz or higher switching frequency regulator is preferable due to its smaller inductor size and its faster transient response. This allows the regulator to respond quickly to the current peaks absorption.
- In any case the frequency and Switching design selection is related to the application to be developed since the switching frequency could also generate EMC interferences.
- For car PB battery the input voltage can rise up to 15,8V and this should be kept in mind when choosing components: all components in the power supply must withstand this voltage.
- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks, a 100µF capacitor is usually suitable.

- Make sure the low ESR capacitor on the power supply output has a nominal voltage of at least 10V.
- For Car applications a spike protection diode should be inserted close to the power input, in order to clean the power supply from the spikes.

An example of switching regulator with 12V input is in the below schematic:

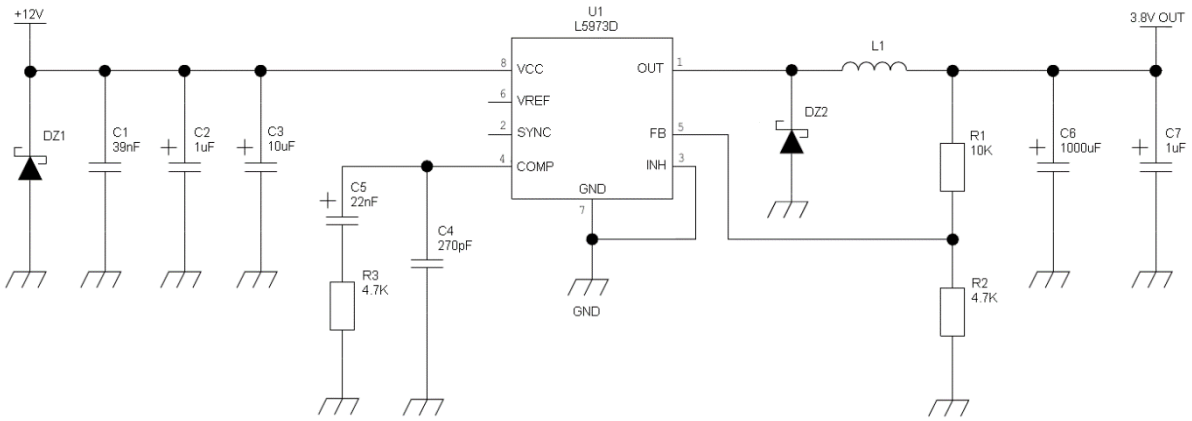

Figure 3: Recommended Circuit

4.3.1.3. Battery Source Power Supply Design Guidelines

The desired nominal output for the power supply is 3.8V and the maximum voltage allowed is 4.2V, hence a single 3.7V Li-Ion cell battery type is suitable to supply the power to the Telit NE310L2 module.

- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks, a 100µF tantalum capacitor is usually suited.
- Make sure the low ESR capacitor (usually a tantalum one) is rated of at least 10V.
- A protection diode should be inserted close to the power input, in order to save the NE310L2 from power polarity inversion. Otherwise, the battery connector should be done in a way to avoid polarity inversions when connecting the battery.
- The battery must be rated to supply current peaks up to TBD A.

Note: DO NOT USE any type of Ni-Cd, Ni-MH, and Pb battery directly connected to NE310L2. Their use can lead to overvoltage on the NE310L2 and damage it. USE ONLY Li-Ion battery types.

4.3.2. Thermal Design Guidelines

Worst case as reference values for thermal design of NE310L2 are:

- Average current consumption: TBD mA (LTE CAT NB1)
- Supply voltage: 4.50V

Note: Make PCB design in order to have the best connection of GND pads to large surfaces of copper.

Note: The NE310L2 includes a function to prevent overheating.

4.3.3. Power Supply PCB Layout Guidelines

As seen in the guidelines for electrical design, the power supply shall have a low ESR capacitor on the output to cut the current peaks on the input to protect the supply from spikes. The placement of this component is essential for the correct functioning of the circuitry. A misplaced component can be useless or can even decrease the performance of the power supply.

- The Bypass low ESR capacitor must be placed close to the Telit NE310L2 power input pads or, if the power supply is a switching type, it can be placed close to the inductor to cut the ripple, provided the PCB trace from the capacitor to the NE310L2 is wide enough to ensure a dropless connection even during an TBD current peak.
- The protection diode must be placed close to the input connector where the power source is drained.
- The PCB's traces to the NE310L2 and the Bypass capacitor must be wide enough to ensure that no significant voltage drops occur. This is for the same reason as previous point. Try to keep this trace as short as possible.
- To reduce the EMI due to switching, it is important to keep the mesh involved very small; therefore the input capacitor, the output diode (if not incorporated in the IC) and the regulator shall form a very small loop.This is done in order to reduce the radiated field (noise) to the switching frequency (100-500 kHz usually).
- A dedicated ground for the Switching regulator separated by the common ground plane is suggested.

- The placement of the power supply on the board should be done in such a way to guarantee that the high current return paths in the ground plane are not overlapped to any noise sensitive circuitry as the microphone amplifier/buffer or earphone amplifier.
- The power supply input cables should be kept separate from noise sensitive lines such as microphone/earphone cables.
- The insertion of the EMI filter on the VBATT pins is recommended in those designs where the antenna is placed close to battery or power supply lines. For this purpose a ferrite bead like Murata BLM18EG101TN1 or Taiyo Yuden P/N FBMH1608HM101 can be used.

The below figure shows the recommended circuit:

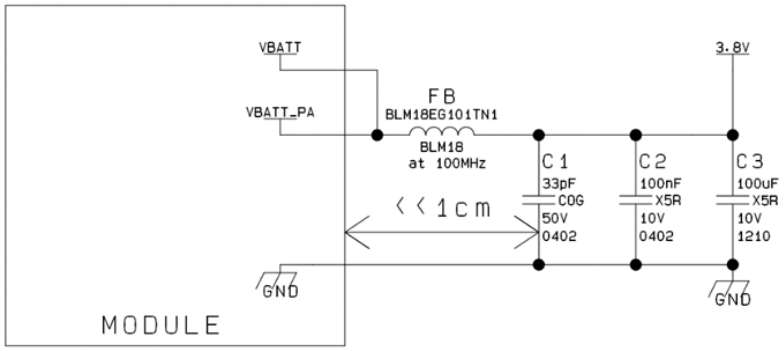

Figure 4: recommended circuit

4.4. RTC Supply

RTC is functional when NE310L2 is in PSM or OFF state and VBATT pin is supplied.

RTC settings are lost when VBATT supply is removed.

4.5. PWRMON Power-on Monitor

PWRMON is always active (output high) when the module is powered ON (module powered ON indication) and cannot be set to LOW level by any AT command.

This signal is present on pin R1.The operating range characteristics of PWRMON signal are:

Item	Min	Typical	Max
Output voltage	1.35V	1.8V	1.8V
Output current	-	1mA	3mA

Table 14: Operating range characteristics of PWRMON signal

	Note: PWRMON during PSM period is LOW (PSM must be previously enabled by AT+CPSMS command)
	Note: The Output Current MUST never be exceeded; care must be taken when designing the application section to avoid an excessive current consumption. If the Current exceeds the limits it may cause a module shutdown.
	Warning:This signal is NOT provided to supply small devices from the module. PWRMON is only a module power-on indicator.

5. DIGITAL SECTION

NE310L2 has four main operation states:

- **OFF state:** Vbatt is applied and only RTC is running. The Baseband is switched OFF and the only possible change is the ON state.
- **ON state:** the baseband is fully switched on and NE310L2 is ready to accept AT commands. NE310L2 can be idle or connected.
- **Sleep mode state:** the main baseband processor is intermittently switched ON and AT commands can be processed with some latency. NE310L2 is idle with low current consumption.
- **Deep sleep mode state:** PSM defined in 3GPP Release 12. Baseband is switched OFF most of the time.

5.1. Logic Levels

Parameter	Min	Max
ABSOLUTE MAXIMUM RATINGS – NOT FUNCTIONAL		
Input level on any digital pin (CMOS 1.8) with respect to ground	-0.3V	2.1V
Operating Range - Interface levels (1.8V CMOS)		
Input high level	1.26V	1.9V
Input low level	0V	0.54V
Output high level	1.44V	1.9V
Output low level	0V	0.36V

Table 15: Logic levels Minimum and maximum

Parameter	Max
Current characteristics:	
Output Current	1mA
Input Current	1uA

Table 16: Logic levels average

5.2. Communication Ports

5.2.1. SPI

The NE310L2 Module is provided by a standard 3-wire SPI master or slave interface with chip select control.

The following table is listing the available signals:

PAD	Signal	I/O	Function	Type	NOTE
AA5	SPI_MOSI	I/O	SPI MOSI	CMOS 1.8V	
Y8	SPI_MISO	I/O	SPI MISO	CMOS 1.8V	
AA7	SPI_CLK	I/O	SPI Clock	CMOS 1.8V	
Y6	SPI_CS	I/O	SPI Chip Select	CMOS 1.8V	

Table 17: Available signals

Note: The SPI interface is supported through the Telit AppZone APIs.

5.2.2. Serial Ports

The NE310L2 module is provided by 3 Asynchronous serial ports:

- Asynchronous Serial Port (USIF0)
- Asynchronous Serial Port (USIF1)*
- Auxiliary Serial Port
- Several configurations can be designed for the serial port on the OEM hardware, but the most common are:
- RS232 PC com port
- microcontroller UART @ 1.8V (Universal Asynchronous Receive Transmit)
- microcontroller UART @ 5V or other voltages different from 1.8V

Depending on the type of serial port on the OEM hardware, a level translator circuit may be needed to make the system work. On the NE310L2 the ports are CMOS 1.8.

Note:*The USIF1 is currently NOT supported by NE310L2 firmware.

5.2.2.1. Asynchronous Serial Port (USIF0)

The serial port 0 on the NE310L2 is a +1.8V UART with 5 RS232 signals. It differs from the PC-RS232 in the signal polarity (RS232 is reversed) and levels.

The following table lists the available signals:

RS232 Pin	Signal	Pad	Name	Usage
2	C104/RXD0	AA15	Transmit line	Output transmit line of NE310L2 UART
3	C103/TXD0	Y16	Receive line	Input receive of the NE310L2 UART Pull-up default during ON state
4	DTR	(*)	Data Terminal Ready	Input to the NE310L2 that controls the DTE READY condition
5	GND	A3, A7, A9, A13, A17, B4, B6, B10, B12, B14, B16, C19, D18, F8, F12, F18, G19, H6, H14, J19, K18, M18, N19, P6, P14, T8, T12, U1, V2, W19, Y2, Y4	Ground	Ground
8	C106/CTS0	AA17	Clear to Send	Output from the NE310L2 that controls the Hardware flow control
7	C105/RTS0	Y18	Request to Send	Input to the NE310L2 that controls the Hardware flow control Pull-up default during ON state
9	RING	(*)	Ring Indicator	Output from the NE310L2 that indicates the incoming call condition

Table 18: Available signs ** Alternate function with GPIO, refer to par. General Purpose I/O*

Note: According to V.24, some signal names are referred to the application side, therefore on the NE310L2 side these signal are in the opposite direction:

TXD on the application side will be connected to the receive line (here named C103/TXD0)

RXD on the application side will be connected to the transmit line (here named C104/RXD0)

For a reduced implementation, only the TXD, RXD lines can be connected, the other lines can be left open as long as a software flow control is implemented.

To avoid a back powering it is recommended to prevent any HIGH logic level signal applied to the digital pins of the NE310L2 when the module is powered off or during an ON/OFF transition (RESET included).

5.2.2.2. Asynchronous Serial Port (USIF1)

The serial port 1 on the NE310L2 is a +1.8V UART with 5 RS232 signals. It differs from the PC-RS232 in the signal polarity (RS232 is reversed) and levels.

Warning: C104/RXD1 cannot have any PU or HIGH state during BOOTING UP phase.

The following table lists the available signals:

RS232 Pin	Signal	Pad	Name	Usage
2	C104/RXD1	AA11	Transmit line	Output transmit line of NE310L2 UART
3	C103/TXD1	Y12	Receive line	Input receive of the NE310L2 UART Pull-up default during ON state
5	GND	A3, A7, A9, A13, A17, B4, B6, B10, B12, B14, B16, C19, D18, F8, F12, F18, G19, H6, H14, J19, K18, M18, N19, P6, P14, T8, T12, U1, V2, W19, Y2, Y4	Ground	Ground

RS232 Pin	Signal	Pad	Name	Usage
8	C106/CTS1	Y14	Clear to Send	Output from the NE310L2 that controls the Hardware flow control
7	C105/RTS1	AA13	Request to Send	Input to the NE310L2 that controls the Hardware flow control Pull-up default during ON state

Table 19: NE310L2 port signals

5.2.2.3. Auxiliary Serial Port

The auxiliary serial port on the NE310L2 is a CMOS 1.8V with only the RX and TX signals.

The signals of the NE310L2 serial port are:

PAD	Signal	I/O	Function	Type	NOTE
Y10	TX_AUX	O	Auxiliary UART (TX Data to DTE)	CMOS 1.8V	
AA9	RX_AUX	I	Auxiliary UART (RX Data from DTE)	CMOS 1.8V	

Table 20: NE310L2 serial port signals

5.3. General Purpose I/O

The NE310L2 module is equipped with a set of Configurable Digital Input / Output pins (CMOS 1.8V). The Input pads can only be read; they report the digital value (high or low) present on the pad at the read time of. The Output pads can only be written or queried and set the value of the pad output.

An alternate function pad is internally controlled by the NE310L2 firmware and acts depending on the implemented function.

The following table shows the available GPIO on the NE310L2:

PAD	Signal	I/O	Drive Strength	Default State	NOTE
V11	GPIO_01	I/O	1 mA	INPUT - PD	Alternate function DTR
V13	GPIO_02	I/O	1 mA	INPUT - PD	Alternate function RING
D7	GPIO_03	I/O	1 mA	INPUT - PD	
D9	GPIO_04	I/O	1 mA	INPUT - PD	
D11	GPIO_05	I/O	1 mA	INPUT - PD	
D13	GPIO_06	I/O	1 mA	INPUT - PD	

Table 21: NE310L2 available GPIO

5.3.1. Using a GPIO as INPUT

GPIO pads, when used as inputs, can be connected to another device's digital output and report its status, provided that this device has interface levels compatible with the 1.8V CMOS levels of the GPIO.

Note: To avoid a back powering, it is recommended to avoid having any HIGH logic level signal applied to the digital pins of the NE310L2 when the module is powered off or during an ON/OFF transition.

5.3.2. Using a GPIO as OUTPUT

The GPIO pads, when used as outputs, can drive 1.8V CMOS digital devices or compatible hardware. When set as outputs, the pads have a push-pull output and therefore the pull-up resistor may be omitted.

5.4. External SIM Holder

Please refer to the related User Guide (SIM Holder Design Guides, 80000NT10001a).

Note: There is no dedicated signal (SIMIN) for "Presence SIM" in the NE310L2 pinout. This feature can be performed by connecting GPIO_01 (Pad **V11**) or of GPIO_02 (Pad **V13**) or of GPIO_03 (Pad **D7**) or of GPIO_04 (Pad **D9**) to the switch embedded in the sim-holder.

SIM detection can be configured by a specific AT Command.

Refer to the SW User Guide or the AT Commands Reference Guide for the full description of this function.

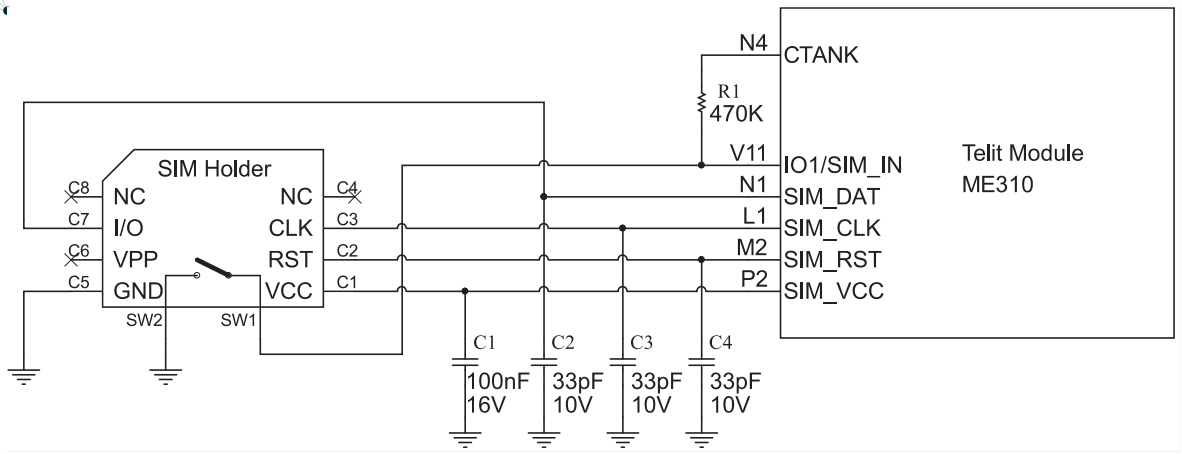

Figure 5: SIM Holder schematic

Warning:Pull-up 470K is required across CTANK (ball N4) and switch embedded in the sim-holder.

5.5. ADC Converter

The NE310L2 is provided by one AD converter. It is able to read a voltage level in the range of 0÷1.8 volts applied on the ADC pin input, store and convert it into 10 bit word.

The input lines are named as **ADC** (available on Pad **B18**).

The following table is showing the ADC characteristics:

Item	Min	Typical	Max	Unit
Input Voltage range	0	-	1.8	Volt
AD conversion	-	-	10	bits

Table 22 ADC Characteristics

5.6. DAC Converter

The NE310L2 provides a Digital to Analog Converter. The signal (named DAC) is available on pin **R16** of the NE310L2.

6. RF SECTION

6.1. Antenna Requirements

The antenna connection and board layout design are the most important aspect in the full product design as they strongly affect the general performance of the product, so read carefully and follow the requirements and the guidelines for a proper design. The antenna and antenna transmission line on PCB for a Telit NE310L2 device shall fulfil the following requirements:

Item	Value
Frequency range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
Bandwidth	250 MHz in LTE Band 1 140 MHz in LTE Band 2 and PCS1900 170 MHz in LTE Band 3 and DCS1800 445 MHz in LTE Band 4 70 MHz in LTE Band 5 and GSM850 80 MHz in LTE Band 8 and GSM900 47 MHz in LTE Band 12 41 MHz in LTE Band 13 60 MHz in LTE Band 18 60 MHz in LTE Band 19 71 MHz in LTE Band 20 145 MHz in LTE Band 25 80 MHz in LTE Band 26 100 MHz in LTE Band 28 490 MHz in LTE Band 66 48 MHz in LTE Band 85
Impedance	50 ohm
Input power	NE310L2-W1: > 24dBm Average power NE310L2-WW: > 35dBm Peak power
VSWR absolute max	≤ 10:1 (limit to avoid permanent damage)
VSWR recommended	≤ 2:1 (limit to fulfill all regulatory requirements)

Table 23: NE310L2 Antenna and Antenna transmission line on PCB

6.1.1. PCB Design Guidelines

When using the NE310L2, since there's no antenna connector on the module, the antenna must be connected to the NE310L2 antenna pad by means of a transmission line implemented on the PCB. This transmission line shall fulfil the following requirements:

Item	Value
Characteristic Impedance	50 ohm (+-10%)
Max Attenuation	0.3 dB

Item	Value
Coupling	Coupling with other signals shall be avoided
Ground Plane	Cold End (Ground Plane) of antenna shall be equipotential to the NE310L2 ground pins

Table 24: NE310L2 Antenna pad requirements

The transmission line should be designed according to the following guidelines:

- make sure that the transmission line's characteristic impedance is 50ohm;
- keep line on the PCB as short as possible, since the antenna line loss shall be less than about 0.3 dB;
- line geometry should have uniform characteristics, constant cross section, avoid meanders and abrupt curves;
- any kind of suitable geometry / structure (Microstrip, Stripline, Coplanar, Grounded Coplanar Waveguide...) can be used to create the printed transmission line afferent the antenna;
- if a Ground plane is required in line geometry, that plane shall be continuous and sufficiently extended, so that the geometry can be as similar as possible to the related canonical model;
- keep, if possible, at least one layer of the PCB used only for the Ground plane; If possible, use this layer as reference Ground plane for the transmission line;
- it is advisable to surround (on both sides) the PCB transmission line with Ground, avoiding that other signal tracks face directly the antenna line track;
- avoid crossing any un-shielded transmission line footprint with other signal tracks on different layers;
- the ground surrounding the antenna line on PCB shall be strictly connected to the main Ground Plane by means of via holes (at least once per 2mm), placed close to the ground edges facing the line track;
- place the noisy EM devices as far as possible from NE310L2 antenna line;
- keep the antenna line far away from the NE310L2 power supply lines;
- if EM noisy devices (such as fast switching ICs, LCD and so on) are present on the PCB hosting the NE310L2, take care of the shielding of the antenna line by burying it in an inner layer of PCB and surrounding it with the Ground planes, or shield it with a metal frame cover;
- if the noisy EM devices are not present around the line, the use of geometries such as Microstrip or Grounded Coplanar Waveguide is preferable, since they typically ensure less attenuation than a Stripline of the same length.

7. MECHANICAL DESIGN

7.1. Drawing

7.1.1. NE310L2-W1

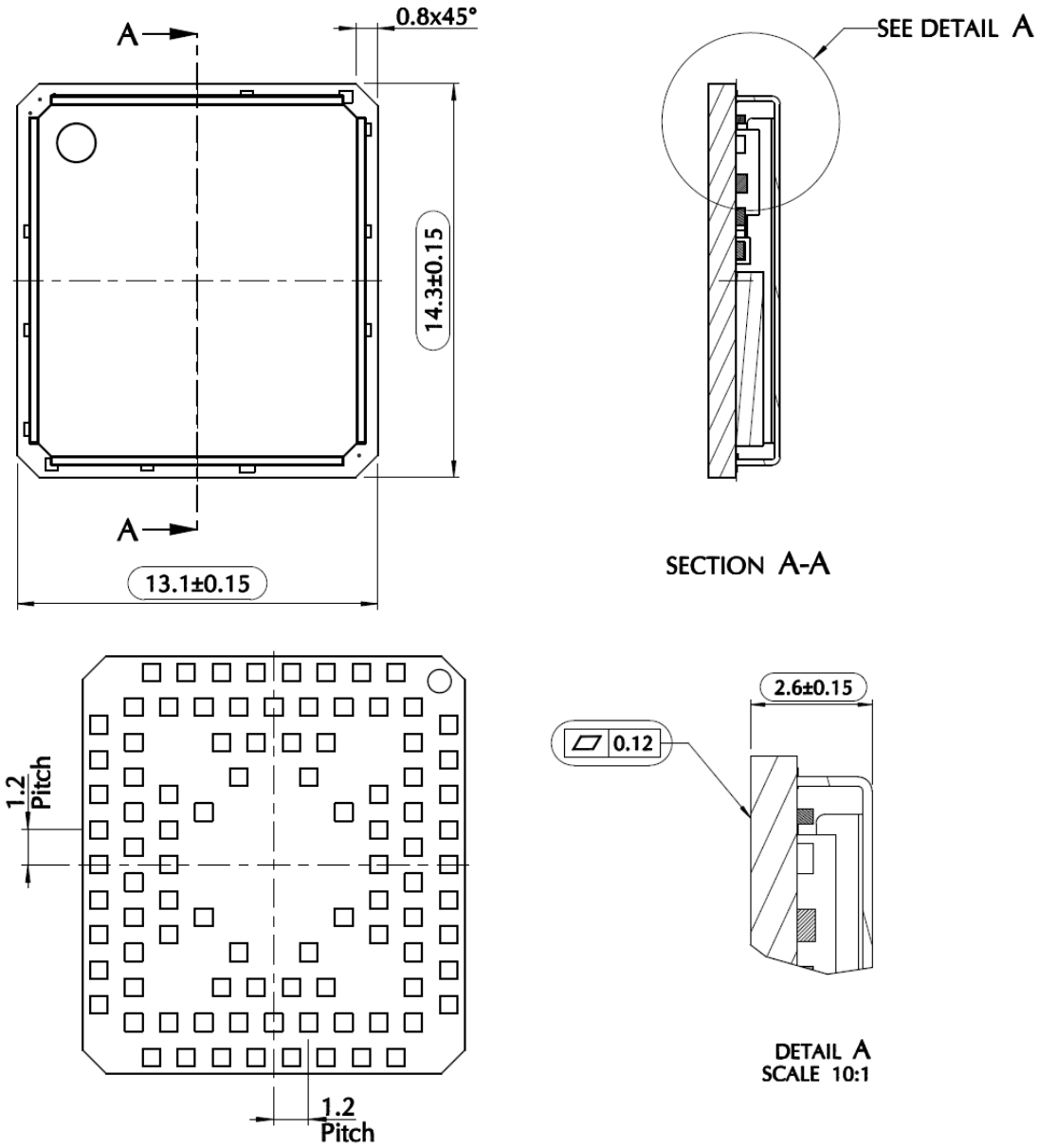

Figure 6: Mechanical Drawing NE310L2-W1

7.1.2. NE310L2-WW

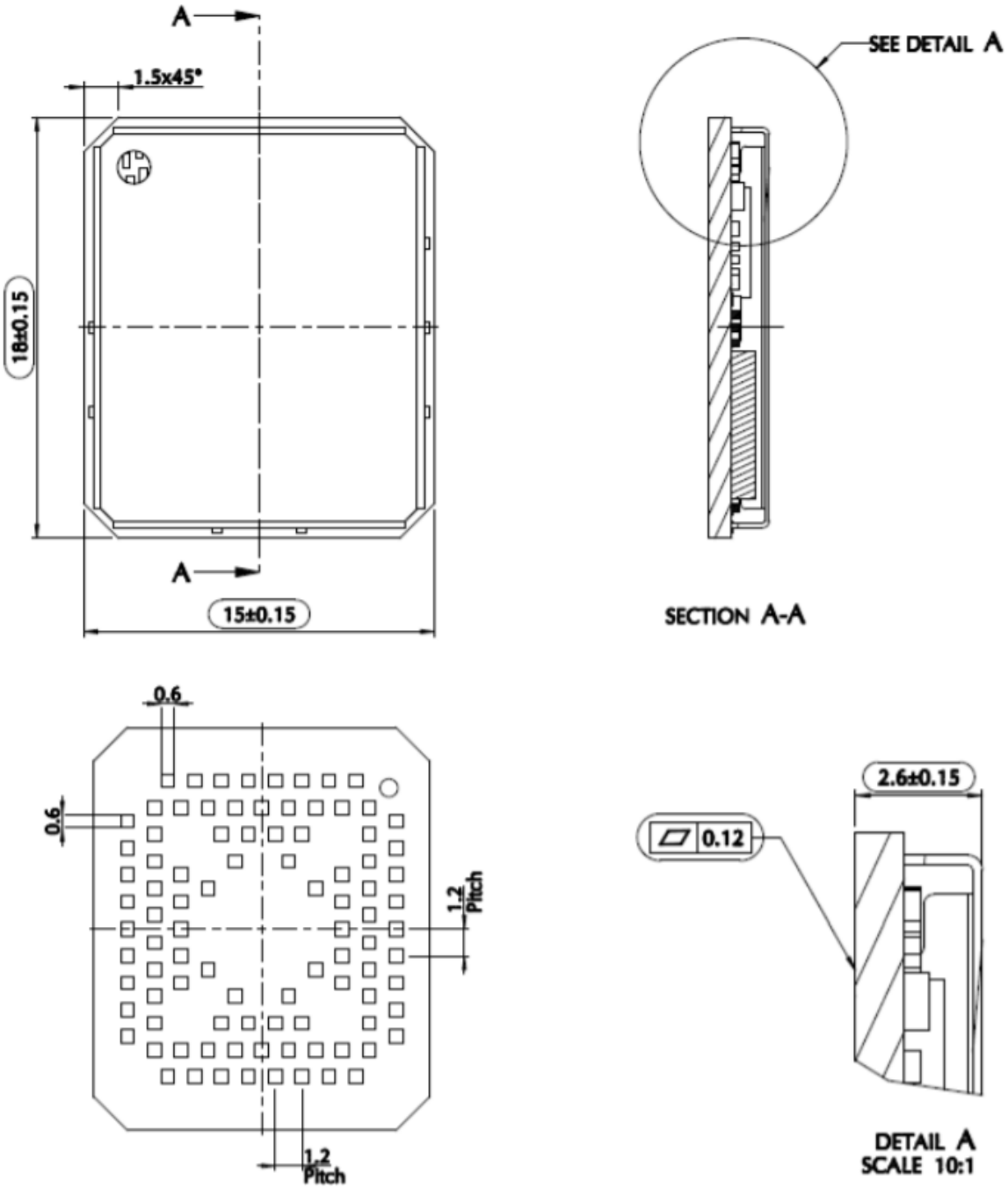

Figure 7: Mechanical Drawing NE310L2-WW

Note: Dimensions in mm. General Tolerance ±0.1, Angular Tolerance ±1°, The tolerance is not cumulative.

8. APPLICATION PCB DESIGN

The NE310L2 modules have been designed in order to be compliant with a standard lead-free SMT process.

8.1. Footprint

8.1.1. NE310L2-W1

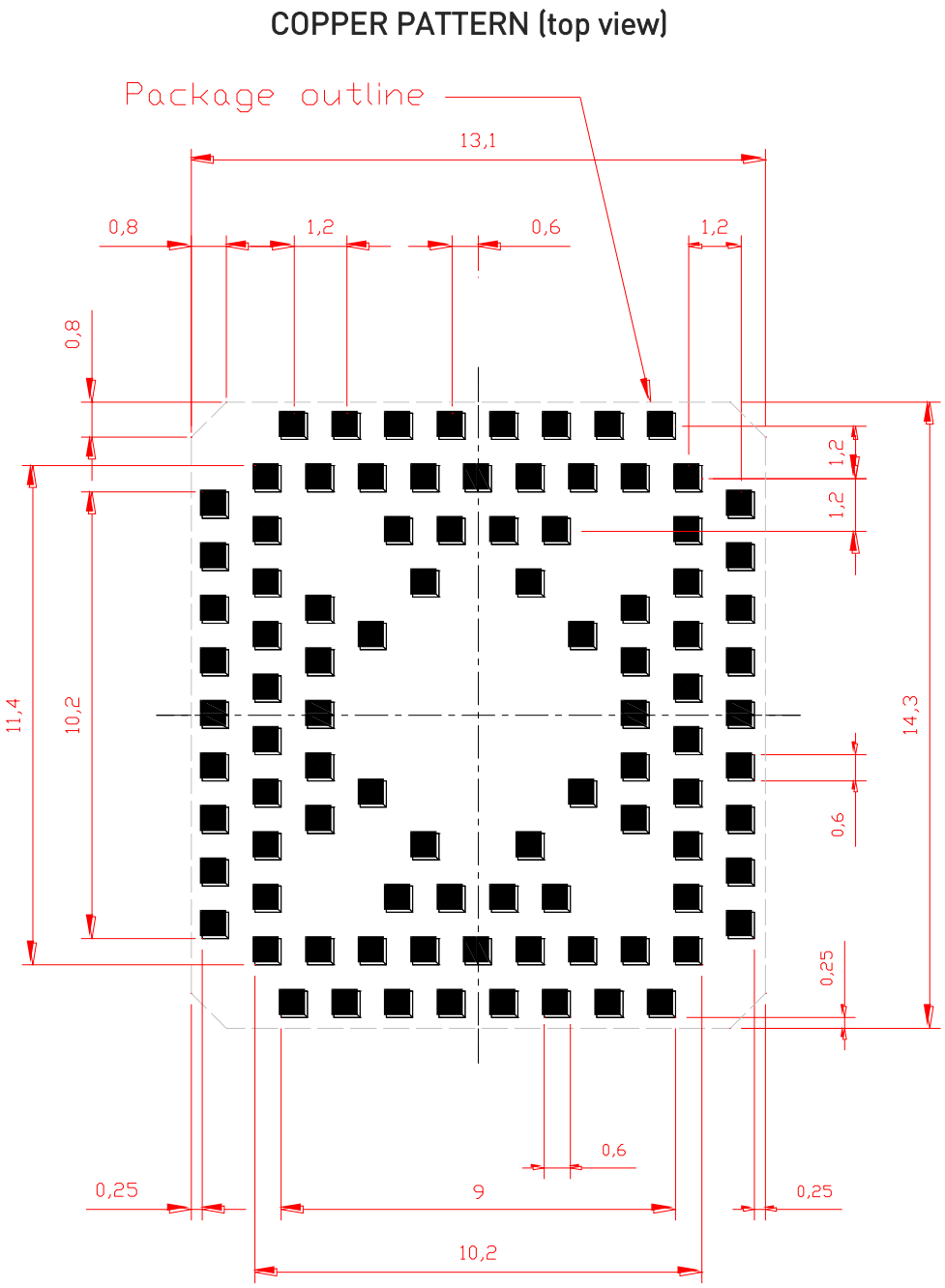

Figure 7: NE310L2-W1 Copper Pattern (top view)

SOLDER RESIST PATTERN (top view)

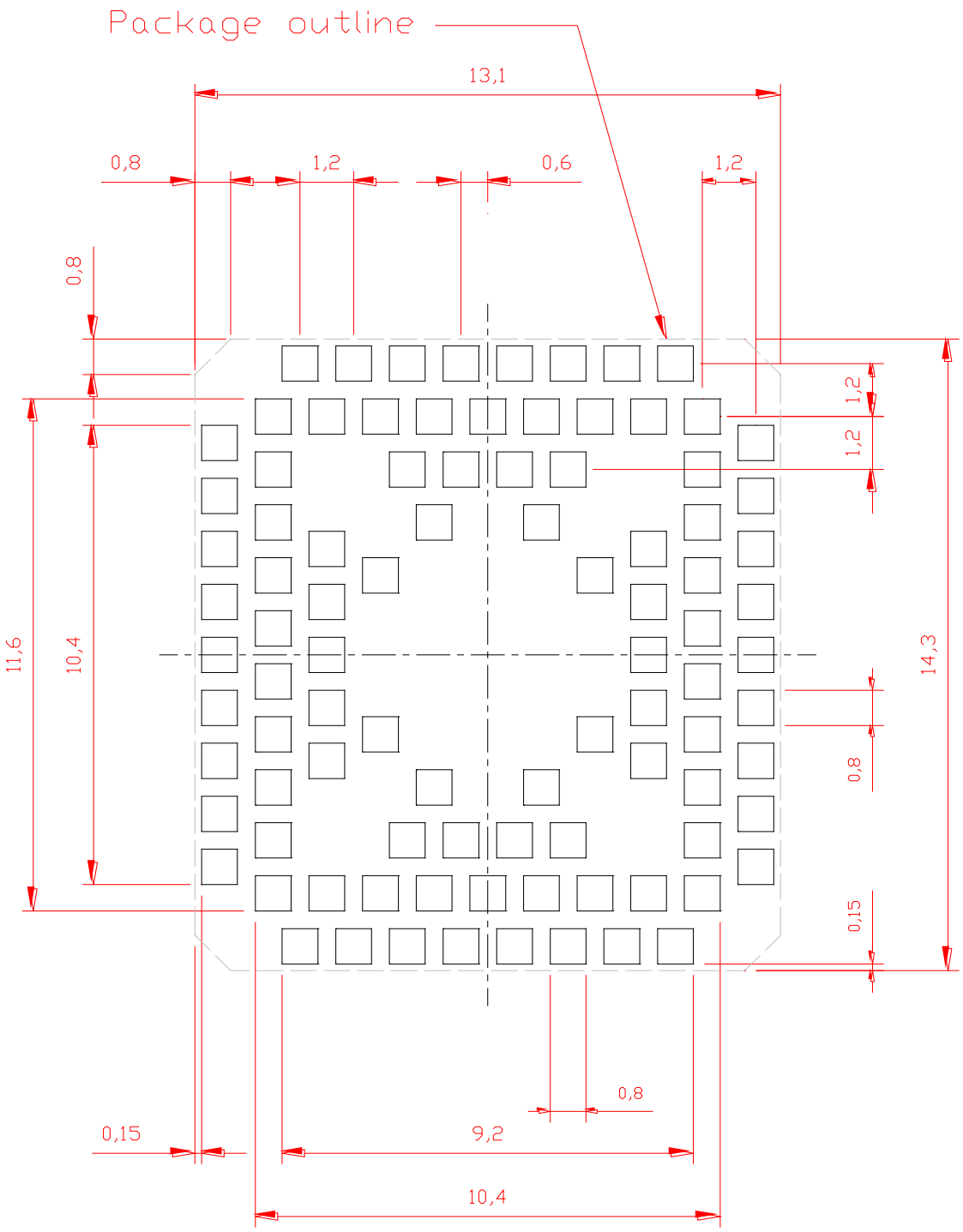

Figure 8: NE310L2-W1 Solder resist pattern (top view)

8.1.2. NE310L2-WW

COPPER PATTERN (top view)

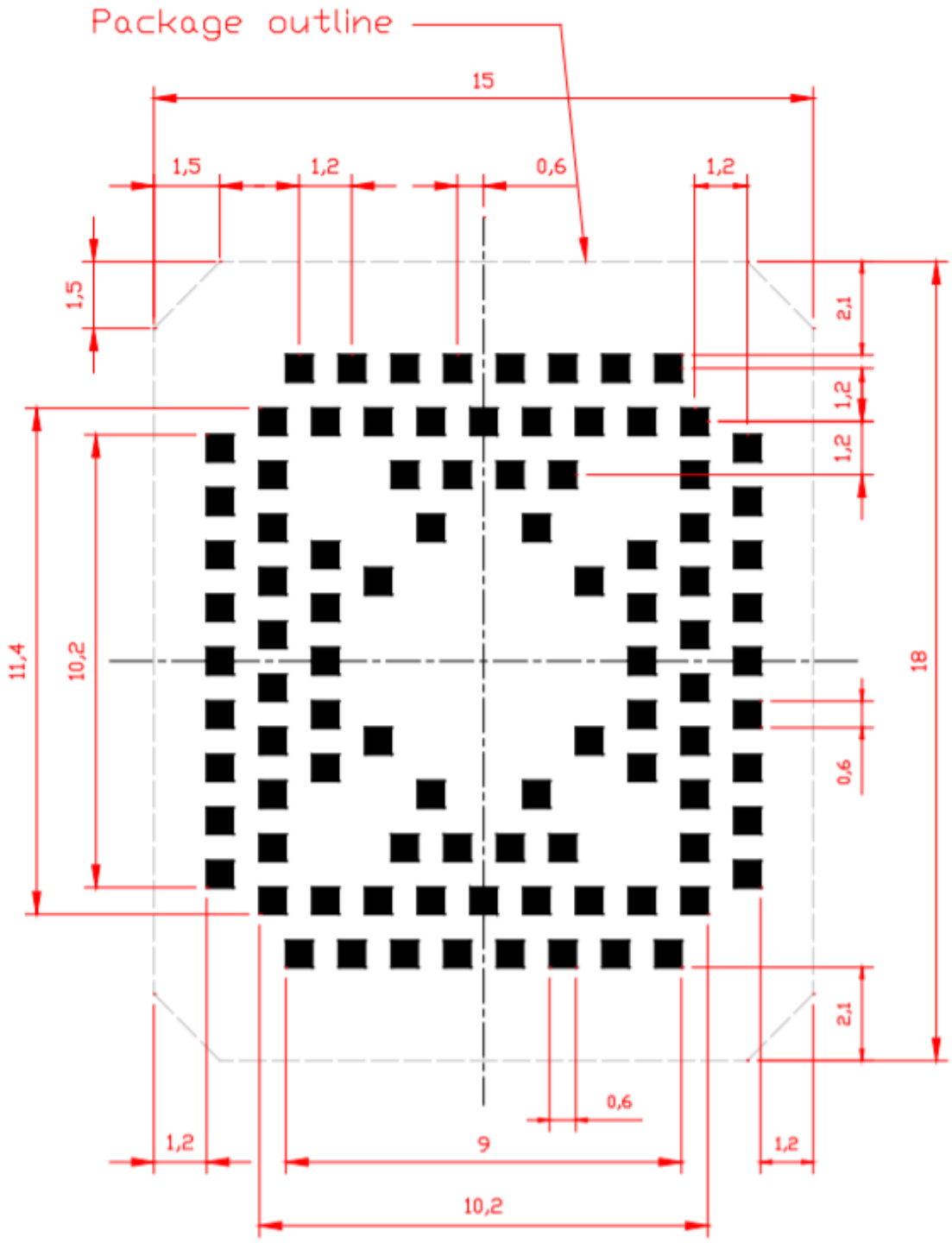

Figure 9: NE310L2-WW Copper Pattern top view

SOLDER RESIST PATTERN (top view)

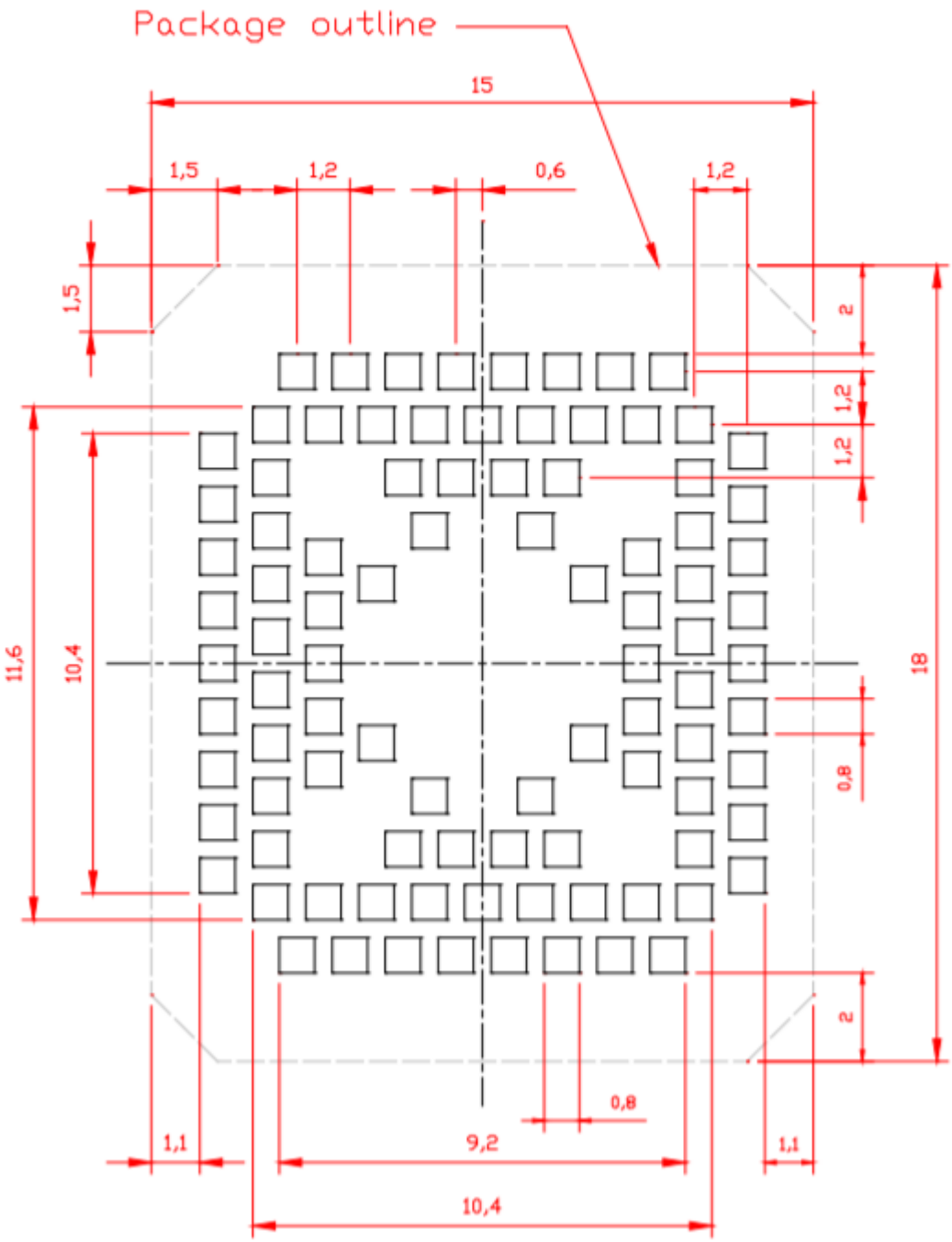

Figure 10: NE310L2-WW Solder resist pattern top view

8.1.3. Recommendations for NE310L2-W1

In order to easily rework the NE310L2-W1, it is recommended to consider in the application a positioning inhibition area of 2 mm around the module.

It is also suggested, as a common rule for an SMT component, to avoid having a mechanical part of the application in direct contact with the module.

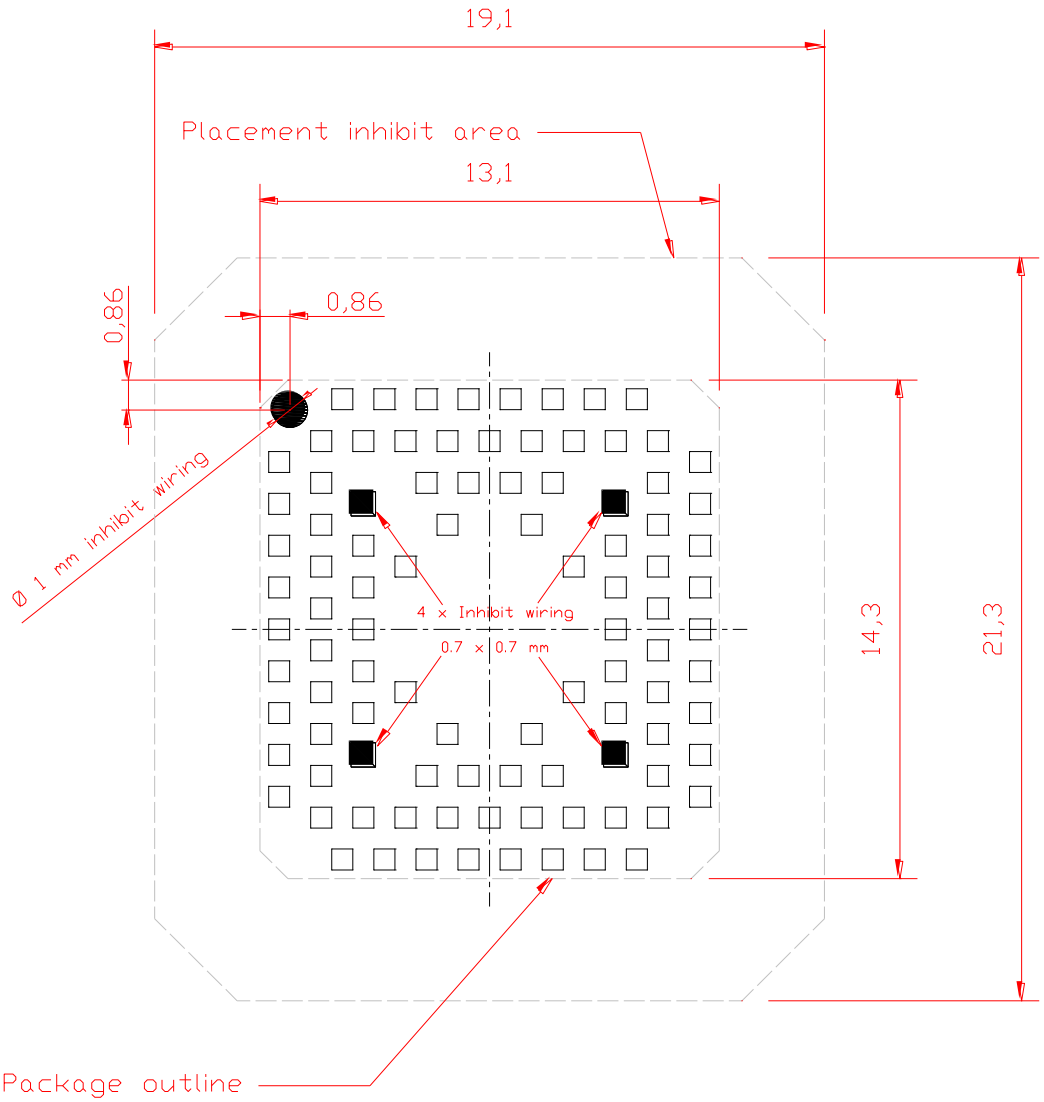

Figure 11: NE310L2-W1 Recommendations

Note: In the customer application, the region under WIRING INHIBIT (see the figure above) must be clear from signal or ground paths.

8.1.4. Recommendations for NE310L2-WW

In order to easily rework the NE310L2-WW, it is recommended to consider in the application a positioning inhibition area of 2 mm around the module. It is also suggested, as a common rule for an SMT component, to avoid having a mechanical part of the application in direct contact with the module.

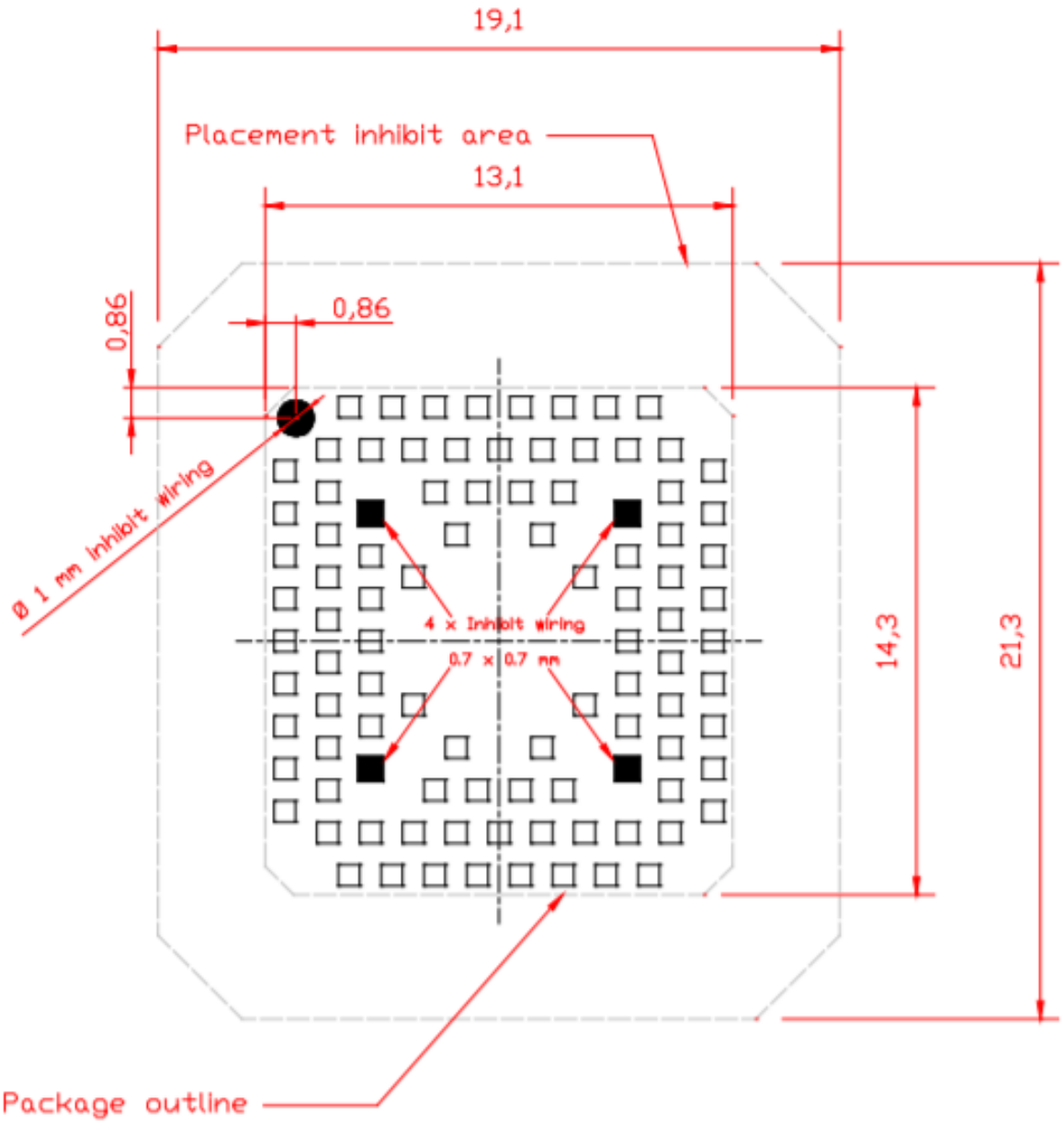

Figure 12: NE310L2-WW Recommendations

8.2. PCB Pad Design

Non solder mask defined (NSMD) type is recommended for the solder pads on the PCB.

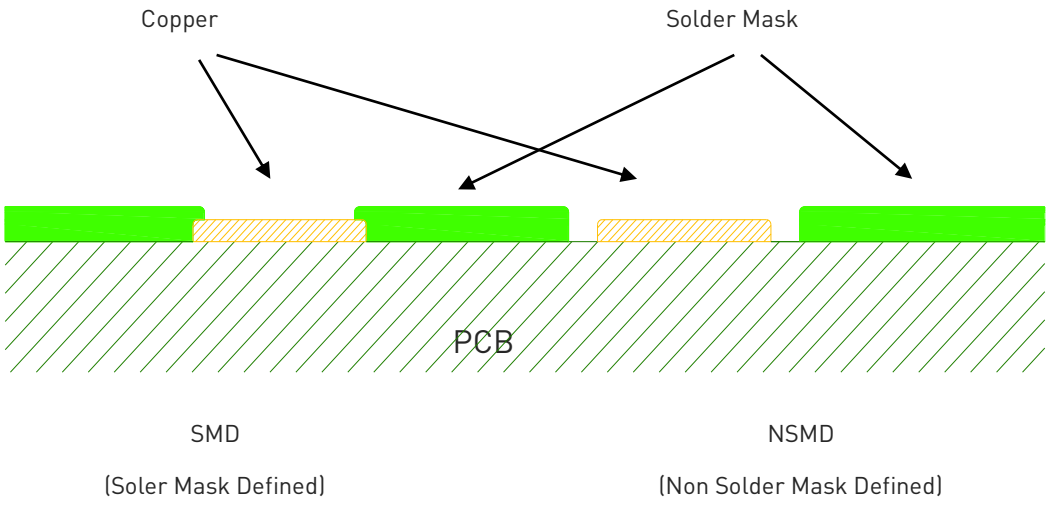

Figure 13: PCB solder pad recommendations

The recommendation for the PCB pads dimensions are 1:1 with module pads.

It is not recommended to place via or micro-via not covered by solder resist in an area of 0.3 mm around the pads unless it carries the same signal of the pad itself

Holes in pad are allowed only for blind holes and not for through holes.

Recommendations for PCB pad surfaces:

Finish	Layer Thickness (um)	Properties
Electro-less Ni / Immersion Au	3 –7 / 0.03 – 0.15	good solder ability protection, high shear force values

Table 25 Recommendations for PCB pad surfaces

The PCB must be able to resist the higher temperatures which are occurring during the lead-free process. This issue should be discussed with the PCB-supplier. In general, the wettability of tin-lead solder paste on the described surface plating is better than the lead-free solder paste.

It is not necessary to panel the application's PCB, however in that case it is recommended to use milled contours and pre-drilled board breakouts; scoring or v-cut solutions are not recommended.

8.3. Stencil

The layout of the stencil apertures can be the same as the recommended footprint (1:1), we suggest a thickness of stencil foil ≥ 120 µm.

8.4. Solder Paste

Item	Lead Free
Solder Paste	Sn/Ag/Cu

Table 26: Solder paste

We recommend using only "no clean" solder paste to avoid the cleaning of the modules after assembly.

8.5. Solder Reflow

Recommended solder reflow profile:

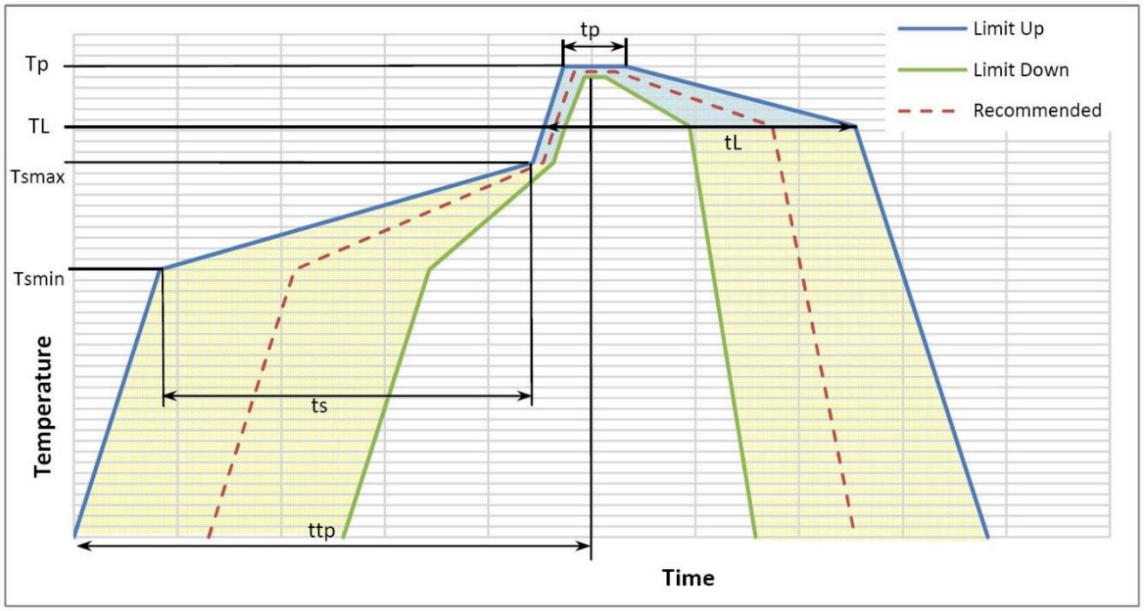

Figure 14: Recommended Solder reflow profile

Warning: The aforementioned solder reflow profile represents the typical SAC reflow limits and does not guarantee the adequate adherence of the module to the customer application throughout the temperature range. The customer must optimize the reflow profile based on the overall system considering factors such as thermal mass and warpage.

Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max
Preheat – Temperature Min (Tsmin) – Temperature Max (Tsmax) – Time (min to max) (ts)	150°C 200°C 60-180 seconds
Tsmax to TL – Ramp-up Rate	3°C/second max
Time maintained above: – Temperature (TL) – Time (tL)	217°C 60-150 seconds
Peak Temperature (Tp)	245 +0/-5°C
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Table 27 Profile feature recommendations

Note: All temperatures refer to topside of the package, measured on the package body surface

Warning: THE NE310L2 MODULES WITHSTANDS ONE REFLOW PROCESS ONLY.

Warning: The aforementioned solder reflow profile represents the typical SAC reflow limits and does not guarantee the adequate adherence of the module to the customer application throughout the temperature range. The customer must optimize the reflow profile depending on the overall system, considering factors such as thermal mass and warpage.

9. PACKAGING

9.1. Tray

9.1.1. NE310L2-W1

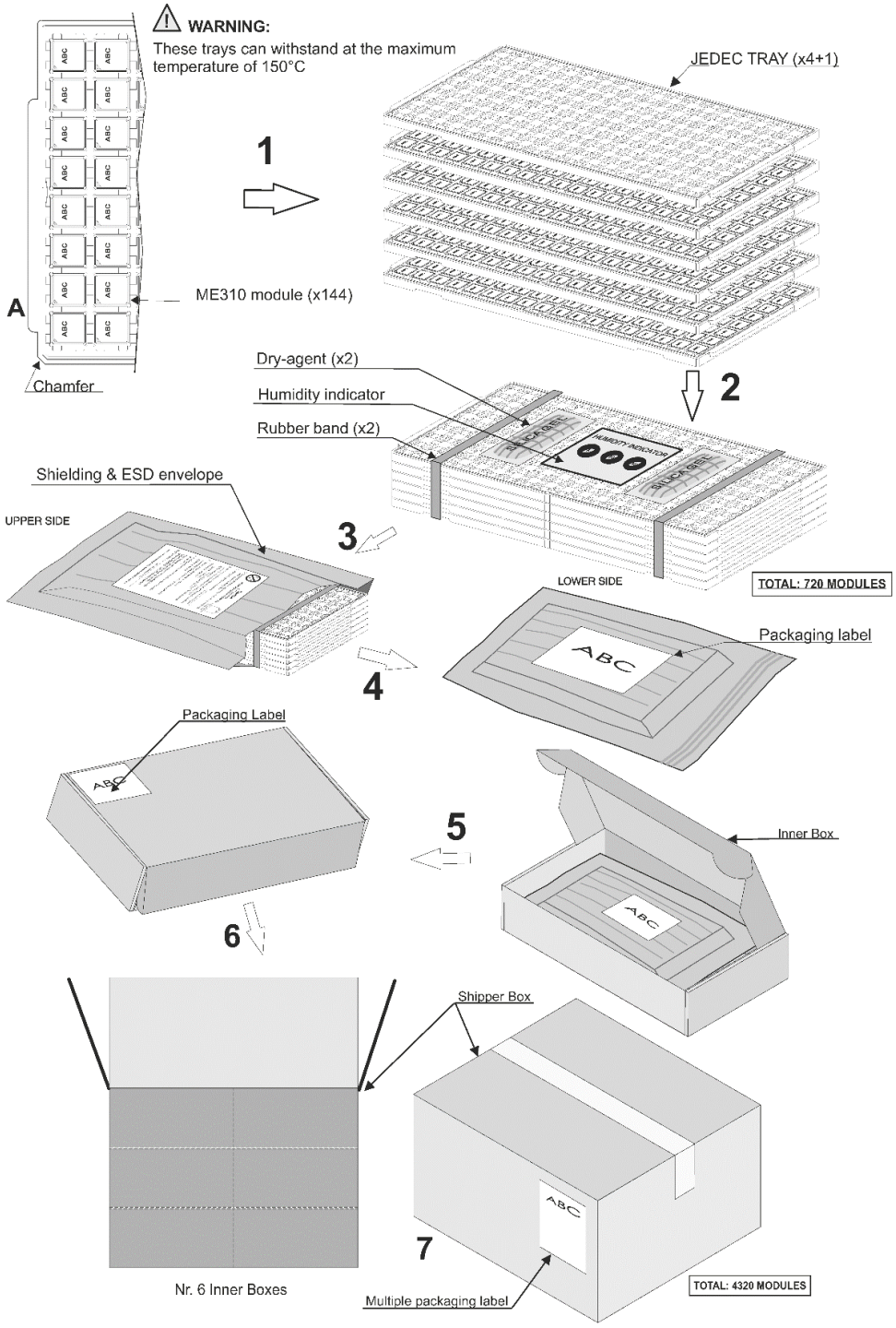

Figure 15: NE310L2-W1 tray packaging

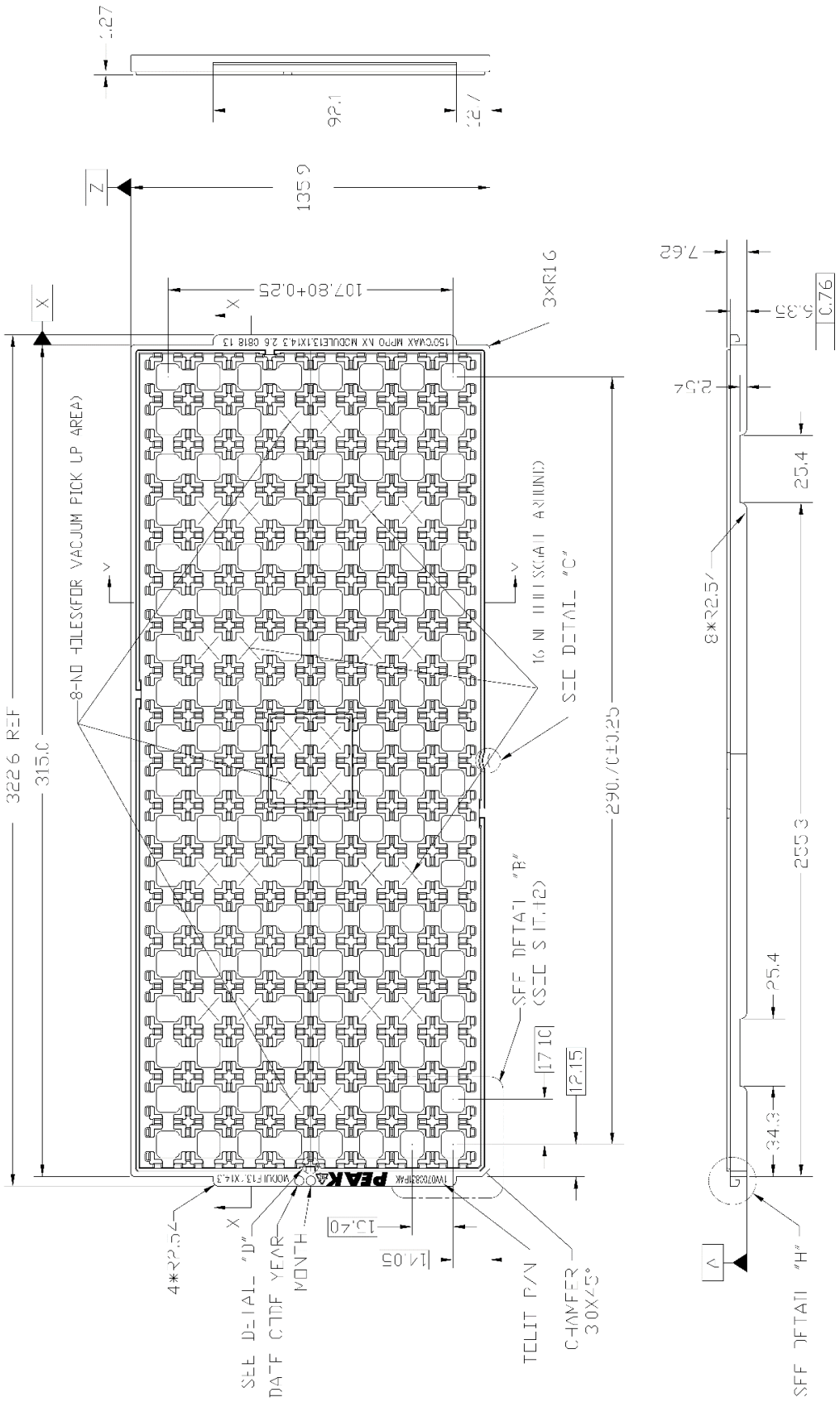

Figure 16: NE310L2-W1 tray

9.1.2. NE310L2-WW

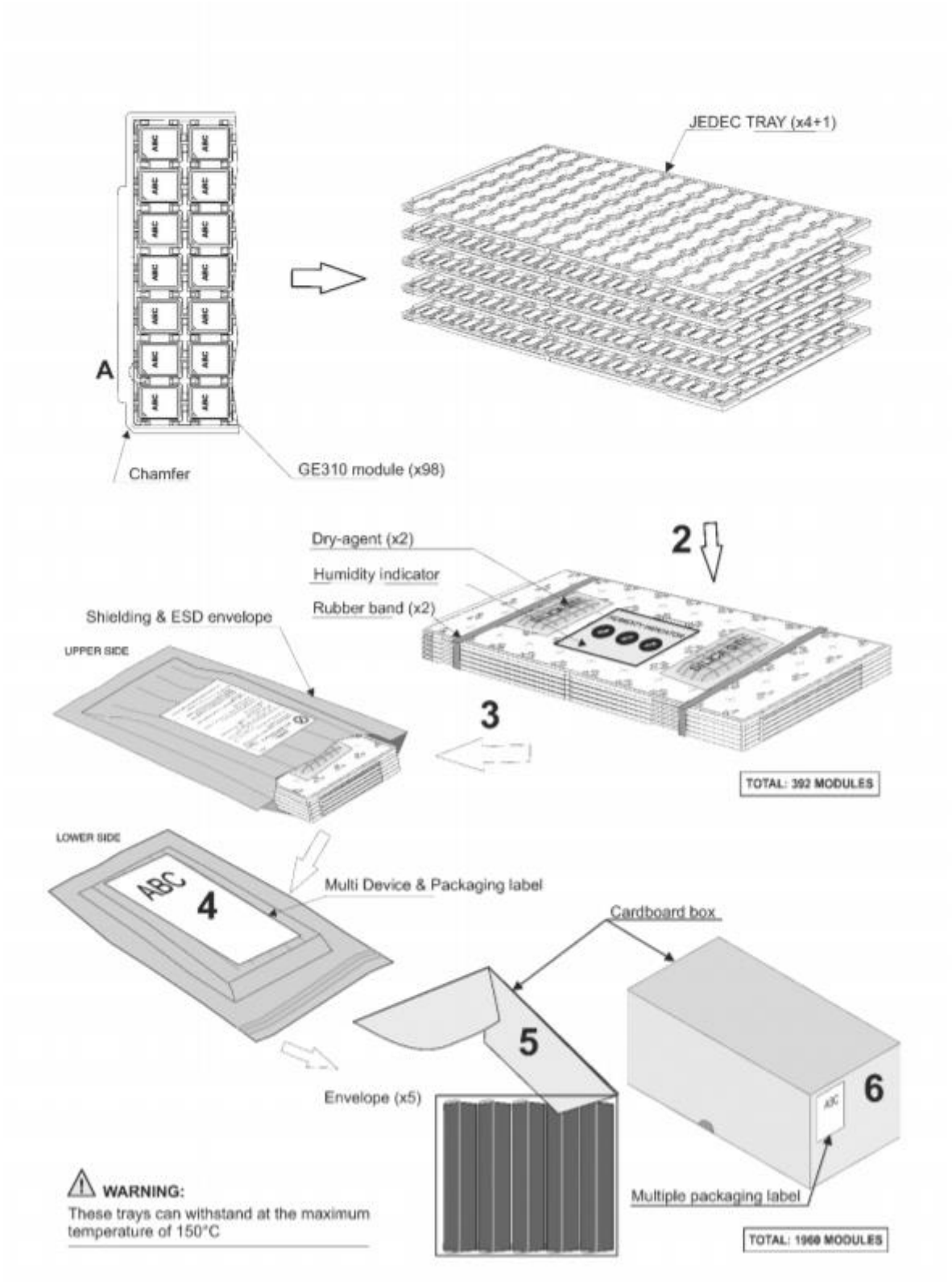

Figure 17: NE310L2-WW tray packaging

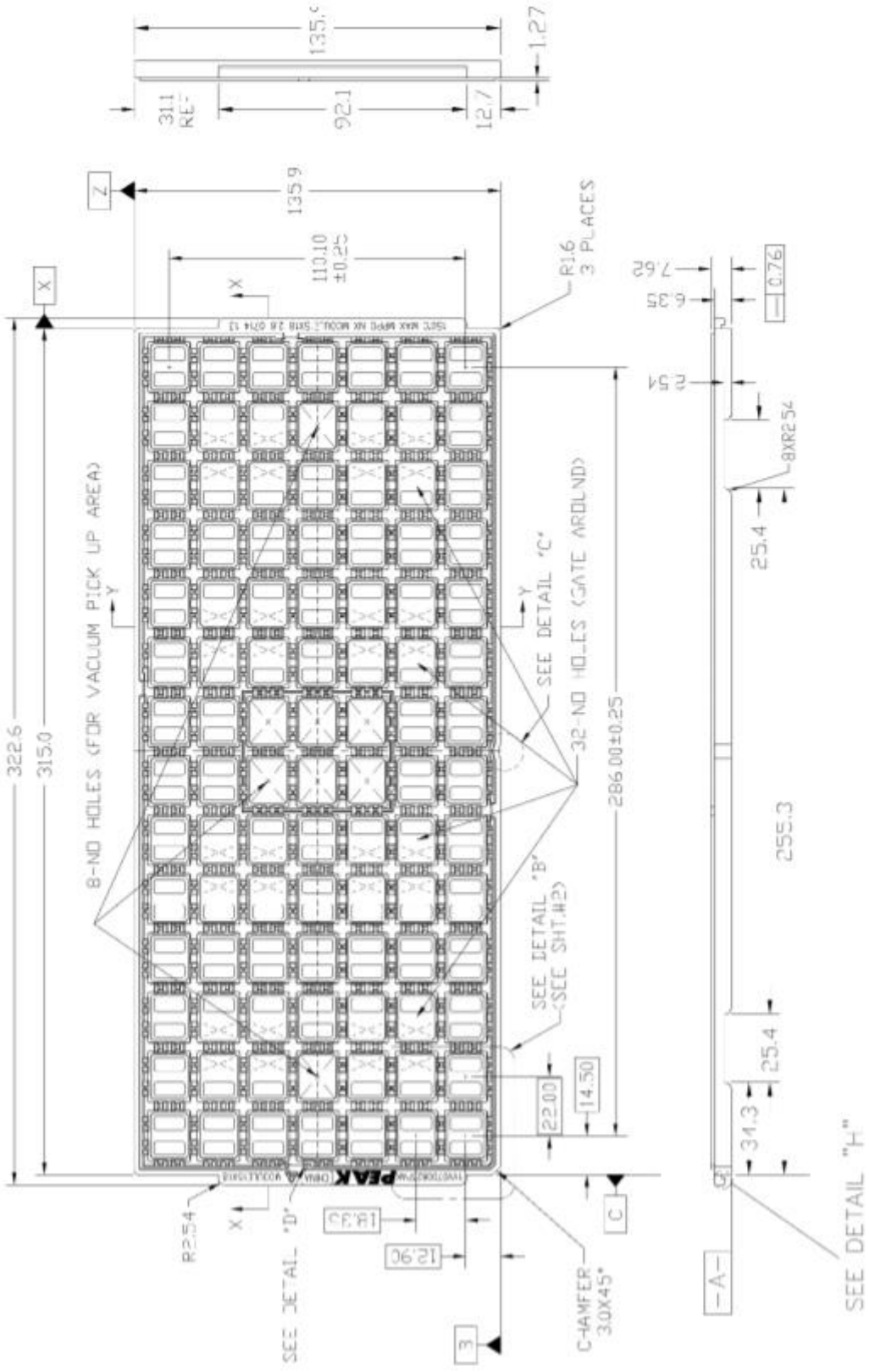

Figure 18: NE310L2-WW tray

9.2. Reel

9.2.1. NE310L2-W1

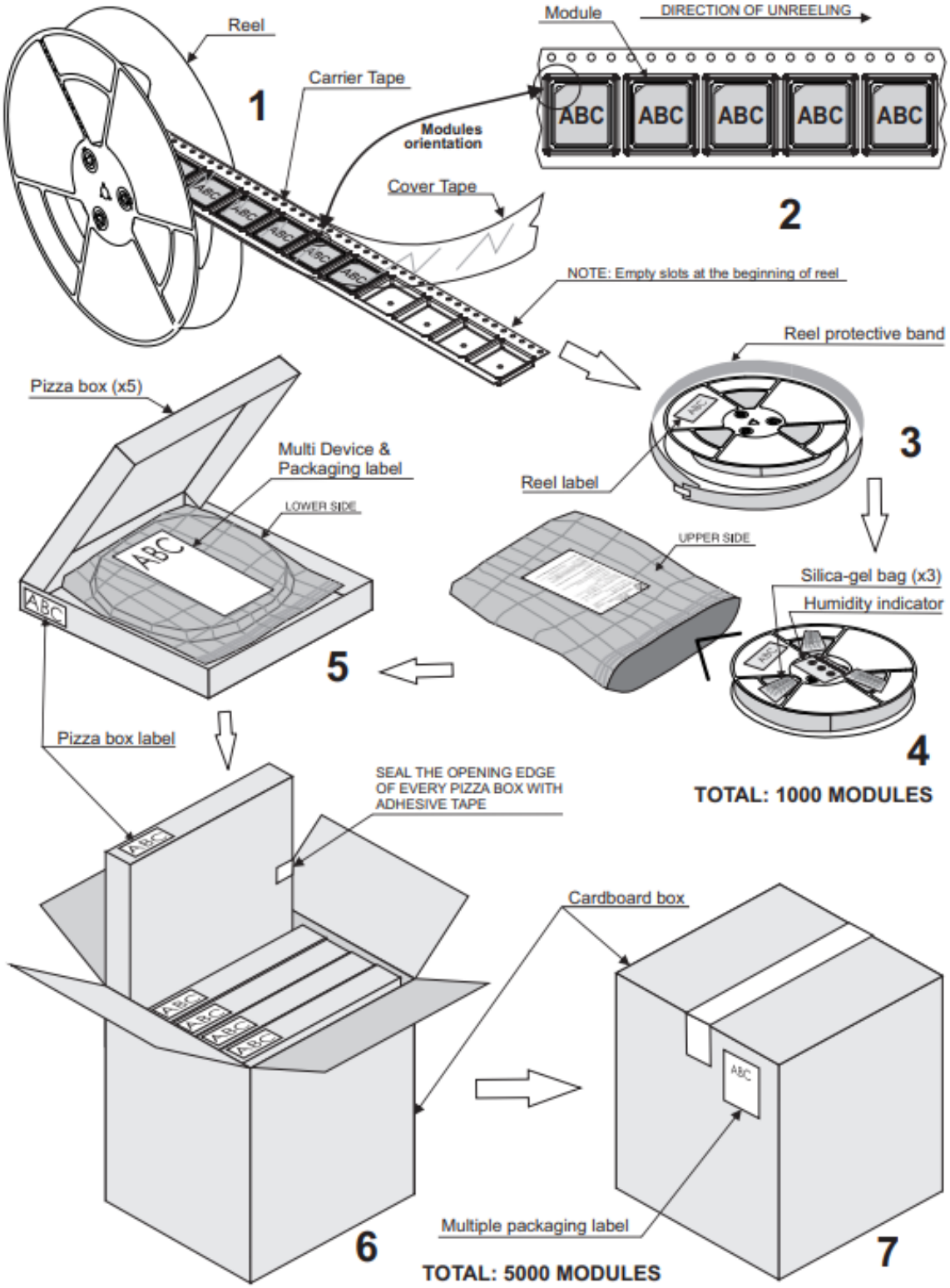

Figure 19: NE310L2-W1Module Positioning into the Carrier

9.2.2. NE310L2-WW

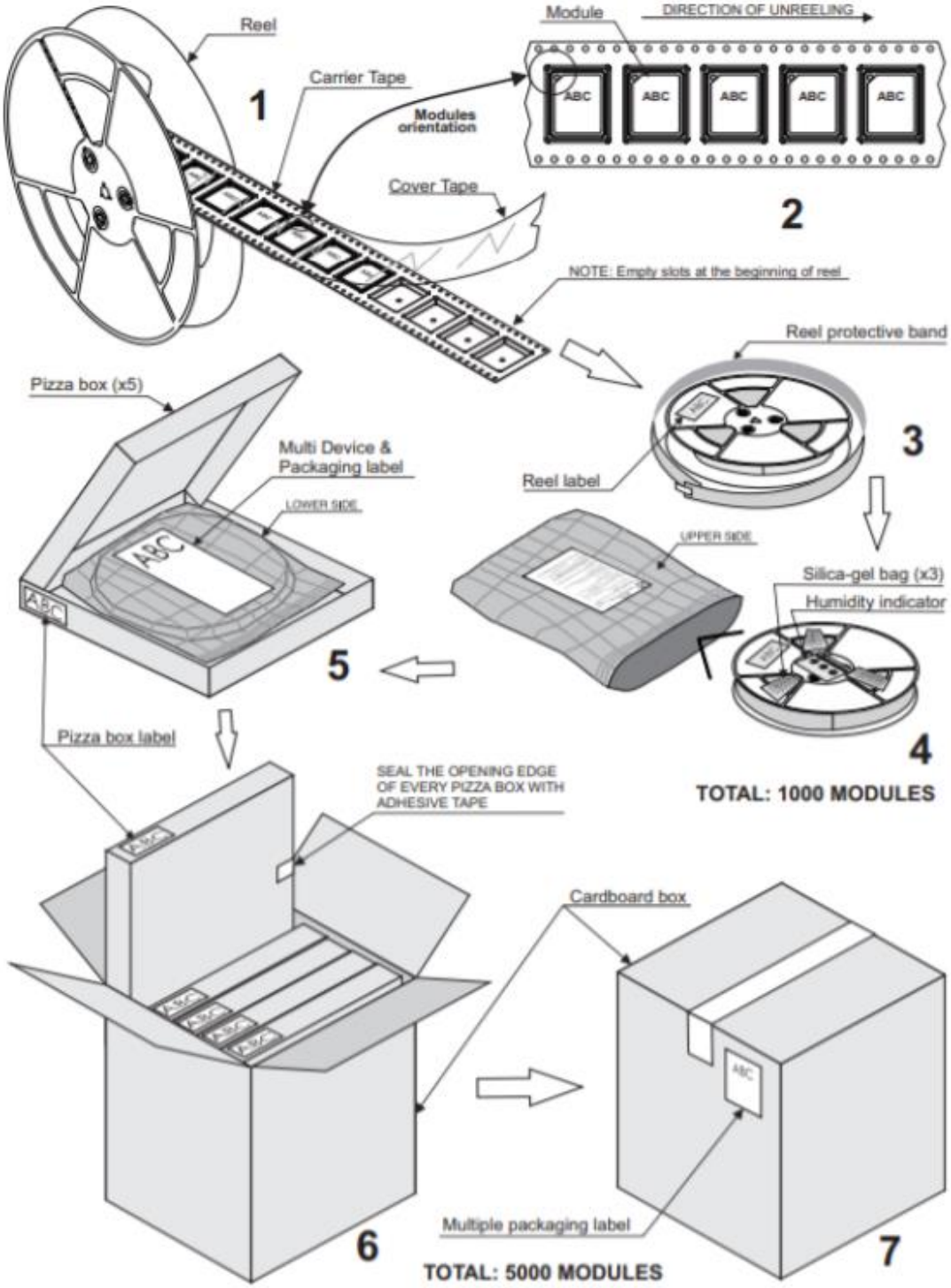

Figure 20: NE310L2-WW Module Positioning into the Carrier

10. CONFORMITY ASSESSMENT ISSUES

10.1. Approvals Summary

Type Approval	NE310L2-W1	NE310L2-WW
EU RED	YES	YES
US FCC	YES	YES
CA ISED	YES	YES

Table 28: Type approvals summary

10.2. RED Approval

10.2.1. RED Declaration of Conformity

Hereby, Telit Communications S.p.A declares that the NE310L2-W1 and NE310L2-WW Modules are in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: *http://www.telit.com/red* Text of 2014/53/EU Directive (RED) can be found here:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0053

10.2.2. RED Antennas

This radio transmitter has been approved under RED to operate with the antenna types listed below with the maximum permissible gain indicated. The usage of a different antenna in the final hosting device may need a new assessment of host conformity to RED.

Model	Antenna Type
NE310L2-W1	Omnidirectional Antenna Gain 2.14 dBi
NE310L2-WW	

Table 29: RED Antenna Type

Max Gain for RED (dBi)		
Band	NE310L2-W1	NE310L2-WW
GPRS 900	---	6.0
GPRS 1800	---	9.0
FDD 1	11.8	11.8

Max Gain for RED (dBi)		
Band	NE310L2-W1	NE310L2-WW
FDD 3	11.3	11.3
FDD 8	8.4	8.4
FDD 20	8.2	8.2
FDD 28	7.4	7.4

Table 30: Max Gain for RED

10.3. FCC and ISED Approval / *FCC et ISDE Approbation*

10.3.1. FCC Certificates

The FCC Certificate is available here*:*

https://www.fcc.gov/oet/ea/fccid

10.3.2. ISED Certificate / *ISDE Certificates*

The ISED Certificate is available here /*Le certificat ISDE est disponible ici*:

https://sms-sgs.ic.gc.ca/equipmentSearch/searchRadioEquipments?execution=e1s1&lang=en

10.3.3. Applicable FCC and ISED Rules / *Liste des Règles FCC et ISDE Applicables*

Model *Modèle*	Applicable FCC Rules	Applicable ISED Rules *Règles ISDE applicables*
NE310L2-W1	47 CFR Part 2, 22, 24, 27, 90	RSS: 132 Issue3, 133 Issue 6, 130 Issue 2, 139 Issue 3; RSS-Gen Issue 5
NE310L2-WW		

Table 31: Applicable FCC and ISED rules

10.3.4. FCC and ISED Regulatory Notices / *Avis Réglementaires de FCC et ISDE*

Modification statement / *Déclaration de modification*

Telit does not approve any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

Telit n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Interference statement / *Déclaration d'interférence*

This device complies with Part 15 of the FCC Rules and Industry Canada licence-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.

Wireless notice / *Wireless avis*

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules. This transmitter must not be co-located or operate in conjunction with any other antenna or transmitter. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur. L'antenne doit être installée de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps.

FCC Class B digital device notice (FCC only)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the

user is encouraged to try to correct the interference by taking one or more of the following measures:

Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAN ICES-3 (B) / NMB-3 (B) (ISED only) / *(ISDE seulement)*

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

10.3.5. FCC/ISED Antennas / *FCC/ISDE Antennes*

FCC

This radio transmitter has been approved by FCC and ISED to operate with the antenna types listed below with the maximum allowable gain indicated. Antenna types not included in this list, with a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Model	Antenna Type
NE310L2-W1	Omnidirectional Antenna Gain 2.14 dBi
NE310L2-WW	

Table 32 FCC Antenna Type

Max Gain for FCC (dBi)		
Band	NE310L2-W1	NE310L2-WW
GPRS 850	---	6.9
GPRS 1900	---	2.5
FDD 2	8.0	8.0
FDD 4	5.0	5.0
FDD 5	9.4	9.4
FDD 12	8.6	8.6
FDD 13	9.1	9.1
FDD 25	8.0	8.0

Max Gain for FCC (dBi)		
Band	NE310L2-W1	NE310L2-WW
FDD 26	9.3	9.3
FDD 66	5.0	5.0
FDD 85	8.6	8.6

Table 33: Max Gain for FCC (dBi)

ISED / *ISDE*

This radio transmitter has been approved by ISED to operate with the antenna types listed below with the maximum allowable gain indicated. Antenna types not included in this list, with a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio a été approuvé par ISDE pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Model *Modèle*	Antenna Type *Type d'Antenne*
NE310L2-W1	Omnidirectional Antenna Gain 2.14 dBi Omnidirectionelle Gain de l'antenne 2.14 dBi
NE310L2-WW	

Table 34: ISED Antenna Type

Gain maximum for ISED (dBi) / *Gain maximum pour ISDE (dBi)*		
Bande	NE310L2-W1	NE310L2-WW
GPRS 850	---	3.6
GPRS 1900	---	2.5
FDD 2	8.0	8.0
FDD 4	5.0	5.0
FDD 5	6.1	6.1
FDD 12	5.6	5.6
FDD 13	5.9	5.9
FDD 25	8.0	8.0
FDD 26	6.0	6.0
FDD 66	5.0	5.0

Gain maximum for ISED (dBi) / *Gain maximum pour ISDE (dBi)*		
Bande	**NE310L2-W1**	**NE310L2-WW**
FDD 85	5.6	5.6

Table 35: Gain maximum for ISED (dBi)

10.3.6. FCC Label and Compliance Information

The product has a FCC ID label on the device itself. In addition, the OEM host end product manufacturer will be informed to display a label referring to the enclosed module The external label will read as follows: "Contains Transmitter Module FCC ID: RI7NE310L2W1" or "Contains FCC ID: RI7NE310L2W1" for NE310L2-W1 and : "Contains Transmitter Module FCC ID: RI7NE310L2WW" or "Contains FCC ID: RI7NE310L2WW" for NE310L2-WW.

Below list of all the models and related FCC ID:

Model	FCC ID
NE310L2-W1	RI7NE310L2W1
NE310L2-WW	RI7NE310L2WW

Table 36: FCC ID

10.3.7. ISED Label and Compliance Information/ *Étiquette et Informations de Conformité ISDE*

The host product shall be properly labelled to identify the modules within the host product.

The ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:

Contains IC: XXXXXX-YYYYYYYYYY

In this case, XXXXXX-YYYYYYYYYY is the module's certification number.

Le produit hôte devra être correctement étiqueté, de façon à permettre l'identification des modules qui s'y trouvent.

L'étiquette d'homologation d'un module d'ISDE devra être apposée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'ISDE, précédé

du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit:

Contient IC : XXXXXX-YYYYYYYYYY

Dans ce cas, XXXXXX-YYYYYYYYYY est le numéro d'homologation du module.

Model *Modèle*	ISED Certification Number *Num. de certification ISDE*
NE310L2-W1	5131A-NE310L2W1
NE310L2-WW	5131A-NE310L2WW

Table 37: ISED Certification Number

10.3.8. Information on Test Modes and Additional Testing Requirements / *Informations sur les Modes de Test et les Exigences de Test Supplémentaires*

The module has been evaluated in mobile stand-alone conditions. For different operational conditions other than a stand-alone modular transmitter in a host (multiple, simultaneously transmitting modules or other transmitters in a host), additional testing may be required (collocation, retesting...)

If this module is intended for use in a portable device, the user is responsible for separate approval to meet the SAR requirements of FCC Part 2.1093 and IC RSS-102.

Le module a été évalué dans des conditions autonomes mobiles. Pour différentes conditions de fonctionnement d'un émetteur modulaire autonome dans un hôte (plusieurs modules émettant simultanément ou d'autres émetteurs dans un hôte), des tests supplémentaires peuvent être nécessaires (colocalisation, retesting...)

Si ce module est destiné à être utilisé dans un appareil portable, vous êtes responsable de l'approbation séparée pour satisfaire aux exigences SAR de la FCC Partie 2.1093 et IC RSS-102.

10.3.9. FCC Additional Testing, Part 15 Subpart B Disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (that is, FCC transmitter rules) listed in the license, and that the host product manufacturer is responsible for compliance with any other FCC rules that apply to the uncovered host by the modular certification release module to the transmitter. If the beneficiary markets its product as compliant with Part 15 Subpart B (when it also contains unintentional-

radiator digital circuity), then the beneficiary must communicate that the final host product still requires compliance tests of Part 15 Subpart B with the modular transmitter installed. The final product with an embedded module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized in accordance with FCC Part 15.

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11.3. Safety Recommendations

Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and has to be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering_en

12. GLOSSARY

ADC	Analog – Digital Converter
BPSK	Modulation used for in OFDM symbols
CLK	Clock
CMOS	Complementary Metal – Oxide Semiconductor
CS	Chip Select
DAC	Digital – Analog Converter
DTE	Data Terminal Equipment
DVI	Digital Voice Interface
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESR	Equivalent Series Resistance
FDD	Frequency Division Duplexing
GPIO	General Purpose Input Output
HS	High Speed
HSDPA	High Speed Downlink Packet Access
HSIC	High Speed Inter Chip
HSUPA	High Speed Uplink Packet Access
I/O	Input Output
LTE	Long Term Evolution
MISO	Master Input – Slave Output
MOSI	Master Output – Slave Input
MRDY	Master Ready
NAS	Non-Access Stratum
PCB	Printed Circuit Board
PSM	Power Saving Mode according to 3GPP Rel.12
QPSK	Modulation used for in OFDM symbols

RB	Resource Block; the smallest unit of resources that can be allocated to a user
RF	Radio Frequency
RMC	Reference Measurement Channel; it refers to a 3GPP standardized setting for the channel. For more details, refer to 3GPP TS 36.521-1
RTC	Real Time Clock
RU	Resource Unit (NB IoT Only); the time reported is the length for the specific configuration SC - SC Spacing
SC	Sub Carriers: indicates the number of Sub-Carriers used
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
SRDY	Slave Ready
TBS	Transport Block Size
UART	Universal Asynchronous Receiver Transmitter
UMTS	Universal Mobile Telecommunication System
USB	Universal Serial Bus
VNA	Vector Network Analyzer
VSWR	Voltage Standing Wave Radio
WCDMA	Wideband Code Division Multiple Access

13. DOCUMENT HISTORY

Revision	Date	Changes
3	2021-10-08	Updated Table 15 – Updated Chapter 10
2	2021-08-09	Minor changes on the language and on the layout Legal Notices updated
1	2021-06-10	Par 10 Conformoty Assessment Issues updated
0	2021-03-31	First issue

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