xE310
Global Form Factor Application Note

TELIT
TECHNICAL
DOCUMENTATION

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APPLICABILITY TABLE

PRODUCTS

- GE310-GNSS
- NE310H2-W1
- ME310G1-W1

CONTENTS

1.   INTRODUCTION

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1.1.   Scope

Scope of this document is the description of some hardware solutions useful for developing an application compatible with the products of the xE310 family in order to highlight the minor differences between the above mentioned products.

1.2.   Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.3. Text Conventions

STOP Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

⚠ Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

ℹ Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.4.   Related Documents

The following is a list of applicable documents downloadable from the Download Zone section of Telit's website http://www.telit.com

- 1VV0301564_GE310-GNSS_Hardware_Design_Guide_r6
- 1VV0301608_NE310H2_Hardware_Design_Guide_r8
- 1VV0301588_ME310G1_Hardware_Design_Guide_r2

2.   OVERVIEW

In this document all the basic functions of a mobile phone will be taken into account; for each one of them a proper hardware solution will be suggested and eventually the wrong solutions and common errors to be avoided will be evidenced. Obviously, this document cannot embrace the whole hardware solutions and products that may be designed. The wrong solutions to be avoided shall be considered as mandatory, while the suggested hardware configurations shall not be considered mandatory, instead the information given shall be used as a guide and a starting point for properly developing your product with the described modules. For further hardware details that may not be explained in this document refer to the Telit Product Description documents where all the hardware information is reported.

> ⚠️ The integration of the GE310-GNSS, NE310H2-W1 and ME310G1 cellular module within user application shall be done according to the design rules described in this manual.

The Unified Form Factor (UFF) is a concept of a products family characterized by the same mechanical and electrical form factor with different radio access technology.

This new approach protects customer's investment by giving you the possibility to migrate with the simple plug-and-play switch of your module with other wireless modules in the Unified Form Factor range without changing your application. In this way Telit offers easy access to different cellular technologies, certifications or bandwidth. For example if you develop applications based on today's mobile operator GSM/GPRS cellular technology if required it might be upgraded in the future to higher data speed capability such as UMTS/HSDPA.

The main advantages are summarized below:

- Increase of the efficiency in the use of the investments assigned to the development of the application (NRE), resulting in higher ROI, thus justifying the business choice of the UFF products;
- Products that are designed to bring technology enhancements to the integrators, such as higher data rates and new wireless standards while maintaining backwards compatibility in form factor and logical interfaces;
- Ease of integration;
- Telit as a single supplier of wireless modems;
- The customer can focus on its core business and application, not the management of operations and procurement required for wireless modems;
- One single application for different markets.

3.   AA13

The Telit xE310 family overall dimensions are:

MODULE	LENGTH [MM]	WIDTH [MM]	THICKNESS [MM]
GE310-GNSS	15	18	2.6
NE310H2-W1	15	18	2.3
ME310G1	14.3	13.1	2.6

In a common design application, which is going to use multiple models, we recommend to consider the highest dimensions as reference.

Note:

The 3D drawings/models versions are available separately, and they are provided in IGES format. Please contact the Telit Technical Support to get the models.

4.   MODULE COMMON PINOUT

The new NE310H2-W1 have 4 additional pads with respect to the other" products in the Xe310 family.
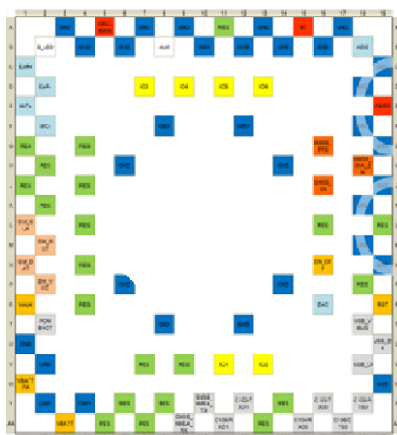
please refer to the physical pads red rectangular indicates the pin added for the NE310H2-W1.

LGA Pads Layout

NE310H2	GE310-GNSS	ME310G1

MODULE CONNECTIONS

4.1. Common Pin-out xE310

Pin	Signal	I/O	Function	Type	Comment
Asynchronous Serial Port (USIF0)					
Y16	TXD0	I	Serial data input (TXD) from DTE	CMOS 1.8V	*
AA15	RXD0	O	Serial data output (RXD) to DTE	CMOS 1.8V	*
Y18	RTS0	I	Input for Request to send signal (RTS) from DTE	CMOS 1.8V	*
AA17	CTS0	O	Output for Clear to send signal (CTS) to DTE	CMOS 1.8V	*
Asynchronous Serial Port (USIF1)					
Y12	TXD1	I	Serial data input (TXD) from DTE	CMOS 1.8V	*
AA11	RXD1	O	Serial data output (RXD) to DTE	CMOS 1.8V	*
Trace Port (USB)					
U19	USB_D+	I/O	USB differential Data (+)		
V18	USB_D-	I/O	USB differential Data (-)		
T18	USB_VBUS	-	Power sense for the internal USB transceiver		
GNSS Serial Port					
Y10	GNSS_NMEA_TX	O	GNSS UART UART (TX Data to DTE)	CMOS 1.8V	*
AA9	GNSS_NMEA_RX	I	GNSS UART (RX Data from DTE)	CMOS 1.8V	*
SIM card interface					
L1	SIM_CLK	O	External SIM signal – Clock	1.8 / 3V	
M2	SIM_RST	O	External SIM signal – Reset	1.8 / 3V	
N1	SIM_DAT	I/O	External SIM signal – Data I/O	1.8 / 3V	
P2	SIM_VCC	-	External SIM signal – Power supply for the SIM	1.8 / 3V	

X	SIMIN	I	Presence SIM input	CMOS 1.8V	See next chapters
DIGITAL IO					
V11	IO1	I/O	Configurable GPIO01	CMOS 1.8V	*
V13	IO2	I/O	Configurable GPIO02	CMOS 1.8V	*
D7	IO3	I/O	Configurable GPIO03	CMOS 1.8V	*
D9	IO4	I/O	Configurable GPIO04	CMOS 1.8V	*
D11	IO5	I/O	Configurable GPIO05	CMOS 1.8V	*
D13	IO6	I/O	Configurable GPIO06	CMOS 1.8V	* Usable to control GNSS_ON
ADC and DAC					
B18	ADC	I	Analog To Digital converter Input	A/D	
RF Section					
A5	CELL_MAIN ANTENNA	I/O	2G Main Antenna (50 ohm)	RF	
E19	GNSS ANTENNA	I	GNSS Antenna	RF	
GNSS Control Signals					
H18	GNSS_LNA _EN	O	GNSS external LNA enable	CMOS 1.8V	*
J16	GNSS_ON	I	GNSS Receiver Enable	CMOS 1.8V	*
G16	GNSS_PPS	O	1 Pulse per Second	CMOS 1.8V	*
Miscellaneous Functions					
B2	S_LED	O	Status LED	CMOS 1.8V	*
N16	ON_OFF	I	Input Command for Power ON/OFF	CMOS 1.8V	*
R1	VAUX	O	Supply Output for external accessories / Power ON Monitor	Power	
Audio Section					
C1	EAR+	AO	Analog Audio (EAR+)	Analog	Class AB

D2	EAR-	AO	Analog Audio (EAR-)	Analog	Class AB
E1	MIC+	AI	Analog Audio (MIC+)	Analog	
F2	MIC-	AI	Analog Audio (MIC-)	Analog	
Power Supply					
W1	VBATT_PA	-	Main power supply (Radio PA)	Power	*
AA3	VBATT	-	Main power supply (Baseband)	Power	*
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	
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		
V7	RESERVED	-	RESERVED		
V9	RESERVED	-	RESERVED		
L16	RESERVED	-	RESERVED		
P18	RESERVED	-	RESERVED		

Danger (*):

STOP In NE310H2-W1 module the nominal output of the power supply is 3.3V and the maximum voltage allowed is 3.63V.

Supply over the absolute maximum voltage can damage the module.
It is necessary that the customer foresees a DC at 3.3V to 3.6V in case a common design with this module is required

Warning(*):

GE310-GNSS digital pins are not CMOS 1.8V but CMOS 2.8V.

In order to design a board compatible with the other xE310 product , a level shifter should be considered.

Warning:

RESERVED pins reported above must not be connected.

The internal GPIO's pull up/pull down could be set to the preferred status for the application using the AT#GPIO command.

Please refer for the AT Commands User Guide for the detailed command Syntax..

Pin	Module	Signal	I/O	Function
R16	GE310-GNSS	Digital To Analog converter Output	D/A	PWM signal
R16	ME310G1	Digital To Analog converter Outpu	D/A	PWM signal
R16	NE310H2-W1	RESERVED	-	-
A15	GE310-GNSS	BT ANTENNA	I/O	Bluetooth Antenna
A15	ME310G1	RESERVED	-	-
A15	NE310H2-W1	RESERVED	-	-
E19	GE310-GNS	GNSS ANTENNA	I	GNSS Antenna
E19	ME310G1	GNSS ANTENNA	I	GNSS Antenna
E19	NE310H2-W1	RESERVED	-	-
H18	GE310-GNSS	GNSS_LNA_EN	O	GNSS external LNA enable
H18	ME310G1	GNSS_LNA_EN	O	GNSS external LNA enable
H18	NE310H2-W1	RESERVED	-	-
J16	GE310-GNSS	GNSS_ON	I	GNSS Receiver Enable
J16	ME310G1	RESERVED	-	-
J16	NE310H2-W1	RESERVED	-	-
G16	GE310-GNSS	GNSS_PPS	O	1 Pulse per Second
G16	ME310G1	GNSS_PPS	O	1 Pulse per Second
G16	NE310H2-W1	RESERVED	-	-
R19	GE310-GNSS	RST	I	Reset
R19	ME310G1	RESERVED	-	-
R19	NE310H2-W1	RST	I	Reset
B8	GE310-GNSS	ALM	O	Alarm - RTC Indicator
B8	ME310G1	RESERVED	-	-
B8	NE310H2-W1	RESERVED	-	-
Y6	GE310-GNSS	RESERVED	-	-

| Y6	ME310G1	SPI_CS	O/I	SPI - Circuit Select
Y6	NE310H2-W1	SPI_CS	O/I	SPI - Circuit Select
AA7	GE310-GNSS	RESERVED	-	-
AA7	ME310G1	SPI_CLK	O/I	SPI - Clock
AA7	NE310H2-W1	SPI_CLK	O/I	SPI - Clock
AA5	GE310-GNSS	RESERVED	-	-
AA5	ME310G1	SPI_MOSI	O/I	SPI - MOSI
AA5	NE310H2-W1	SPI_MOSI	O/I	SPI - MOSI
Y8	GE310-GNSS	RESERVED	-	-
Y8	ME310G1	DVI_MCLK	I/O	SPI - MISO
Y8	NE310H2-W1	DVI_MCLK	I/O	SPI - MISO
N4	GE310-GNSS	RESERVED	-	-
N4	ME310G1	CTANK	-	Internal supply domain pin for external tank capacitor
N4	NE310H2-W1	RESERVED	-	-
L4	GE310-GNSS	RESERVED	-	-
L4	ME310G1	RESERVED	-	-
L4	NE310H2-W1	DVI_MCLK	I/O	Digital Audio Interface I2S (MCLK)
AA13	GE310-GNSS	RESERVED	-	-
AA13	ME310G1	RTS	I	Request to Send
AA13	NE310H2-W1	RTS	I	Request to Send
Y14	GE310-GNSS	RESERVED	-	-
Y14	ME310G1	CTS	O	Clear to Send
Y14	NE310H2-W1	CTS	O	Clear to Send
T2	GE310-GNSS	RESERVED	-	-
T2	ME310G1	FORCED_USB_BOOT	I	Debug pin, connect to test point
T2	NE310H2-W1	RESERVED	-	-

5. LEGACY VS NEW XE310 FORM FACTOR

In order to host in the same PCB the legacy GE310-GNSS, ME310G1 and the new NE310H2-W1 pinout and form factor should be used.

Two different solder paste stencils are required in order to remove the solder paste from the pins E4,E16,U4,U16 in the products where they are not present as shown in the following picture.

BOTTOM SIDE
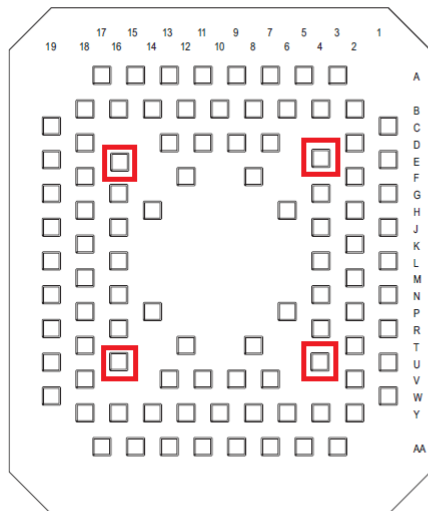
NE310H2
PAST STENCIL
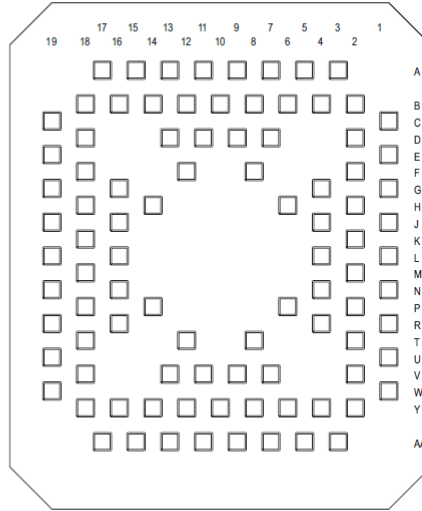
GE310-GNSS/ME310G1
PAST STENCIL

Warning:

GE310-GNSS digital pins are not CMOS 1.8V but CMOS 2.8V.

In order to design a board compatible with the other xE310 products , a level shifter shold be considered.

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6. LOGIC LEVEL SPECIFICATION

The following tables show the logic level specifications for GE310-GNSS, ME310G1 and NE310H2-W1:

Absolute Maximum Ratings -Not Functional

	GE310-GNSS (CMOS 2.8)		ME310G1 (CMOS 1.8)		NE310H2-W1 (CMOS 1.8)	
Parameter	Min	Max	Min	Max	Min	Max
Input level on any digital pin with respect to ground	-0.3V	3.1V	-0.3V	2.1V	-0.3V	2.1V

Operating Range - Interface levels (1.8V CMOS)

	GE310-GNSS (CMOS 2.8)		ME310G1 (CMOS 1.8)		NE310H2-W1 (CMOS 1.8)	
Parameter	Min	Max	Min	Max	Min	Max
Input high level	2.55V	2.9V	1.5V	1.9V	1.35V	1.98V
Input low level	0V	0.35V	0V	0.35V	0.3V	0.63V
Output high level	2.38V	2.8V	1.6V	1.9V	1.35V	1.98V
Output low level	0V	0.42V	0.0V	0.2V	0.0V	0.45V

Current characteristics

	GE310-GNSS (CMOS 2.8)	ME310G1 (CMOS 1.8)	NE310H2-W1 (CMOS 1.8)
Parameter	Typical	Typical	Typical
Output Current	2.7mA	1mA	1.6mA
Input Current	10µA	1µA	5µA

7.   USB PORT

The GE310_GNSS and NE310H2-W1 include an integrated universal serial bus (USB) transceiver, compliant with USB 2.0 specifications and supporting the USB trace only. The ME310G1 supports also High-Speed (480Mb/s) mode. For this reason the signal traces should be routed carefully: trace lengths, number of vias and capacitive loading should be minimized and the characteristic impedance value of USB_DPLUS and USB_DMINUS signals for ME310G1 should be as close as possible to 90 Ohms differential.

If not used we suggest routing pins U19, V18 and T18 of xE310 to test points (or better to a mini USB connector not mounted).

Pin	Signal	I/O	Function	Type	Comment
U19	USB_D+	I/O	USB differential Data (+)		
V18	USB_D-	I/O	USB differential Data (-)		
T18	USB_VBUS	-	Power sense for the internal USB transceiver		

⚠️ **Warning:**

The GE310_GNSS and NE310H2-W1 supporting the USB trace only.

8. SPI PORT

The ME310G1 Module is provided by a standard 3-wire master or slave SPI 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	

> ⚠ **Warning**:
> The module NE310H2-W1 is supporting one SPI port (Master Only).

> ⚠ **Warning**:
> In a common design xE310 the SPI port should not be used.

9. SIM CONNECTION

The figure below illustrates in particular how the application side should be designed, and what values the components should have.
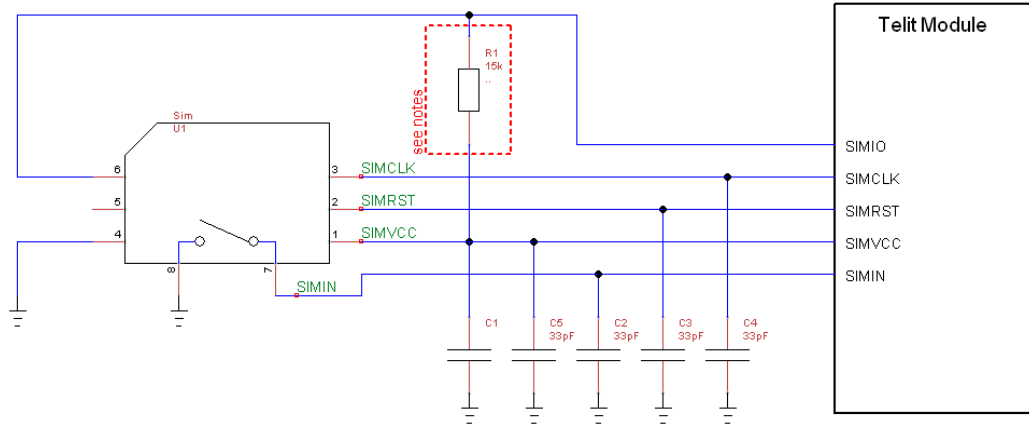
The minimum value of C1 can vary depending on the module; in the table below you have the recommended values. The maximum for all modems is 1uF.

Module	C1
GE310-GNSS	220nF
ME310G1	100nF
NE310H2-W1	1uF

10. FREQUENCY BANDS

Module + Region Variant	LTE CATM1	NBIOT	3G	2G
GE310-GNSS	-	-	-	GSM850, 900 1800,1900
ME310G1-W1	B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85		GSM850,900 1800,1900
ME310G1-WW	B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85	B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85		GSM850,900 1800,1900
NE310H2-W1		B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85		

11.   POWER SUPPLY

The power supply circuitry and board layout are a very important part in the full product design and they strongly reflect on the product overall performances, hence read carefully the requirements and the guidelines that will follow for a proper design.

To improve EMI filtering an EMI suppression circuitry must be added on modem's VBATT_PA, and if possible also on VBATT. Follow schematic on figure below.
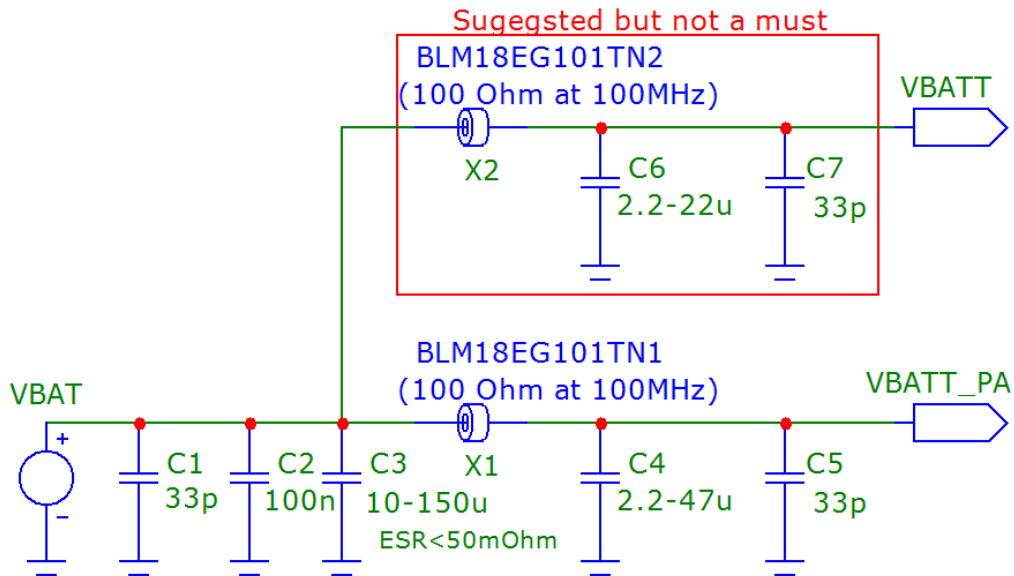
12. DOCUMENT HISTORY

Revision	Date	Changes
0	2019-10-06	Initial release
1	2020-01-19	Updated overall document
2	2020-05-11	Updated NE310H2_Hardware_Design_Guide_r8 Maximum voltage allowed is 3.63V
3	2020-05-27	Updated new code request number 80617NT11846A

SUPPORT INQUIRIES

Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

www.telit.com

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Mod. 0809 2020-05 Rev.3