

Nebulae Module V2

Datasheet



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Module Version: 1C
Document Version: 1.4
Document Date: June 2018

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Revision History

Table below shows the revision history of Nebulae Module V2's datasheet.

Version	Date	Description
1.4	June 2018	<ul style="list-style-type: none"> Update Table 1.1 in Chapter 1 Added Annexure A: FCC Statement and Annexure B: Module Statement
1.3	April 2018	<ul style="list-style-type: none"> Update Figure 1.1 and Table 1.1 in Chapter 1
1.2	November 2017	<ul style="list-style-type: none"> Updated Table 1.1 in Chapter 1 Updated Table 2.1 in Chapter 2
1.1	October 2017	Update Figure 1.1 and 1.2 in Chapter 1
1.0	March 2017	First publication

How to Find Information

- The Adobe Acrobat Find feature allows you to search the contents of a PDF file. Use Ctrl + F to open the Find dialog box. Use Shift + Ctrl + N to open to the Go To Page dialog box.
- Bookmarks serve as an additional table of contents.
- Thumbnail icons, which provide miniature preview of each page, provides a link to the pages.
- Numerous links shown in Navy Blue color allow you to jump to related information.





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Typographic Conventions

This datasheet uses the typographic conventions as shown below:

Visual Cue	Meaning
Bold Type with Initial Capital letters	All headings and Sub headings Titles in a document are displayed in bold type with initial capital letters; Example: General Description, Features.
Bold Type with Italic Letters	All Definitions, Figure and Table Headings are displayed in Italics. Examples: <i>Figure 1-1. Nebulae Module V2, Table 1-1. Nebulae Module V2 Specifications.</i>
1., 2.	Numbered steps are used in a list of items, when the sequence of items is important. such as steps listed in procedure.
•	Bullets are used in a list of items when the sequence of items is not important.
	The hand points to special information that requires special attention
 CAUTION	The caution indicates required information that needs special consideration and understanding and should be read prior to starting or continuing with the procedure or process.
 WARNING	The warning indicates information that should be read prior to starting or continuing the procedure or processes.
	The feet direct you to more information on a particular topic.

<i>About this Manual</i>	<i>iii</i>
Revision History	iii
How to Find Information	iii
How to Contact SLS	iii
Typographic Conventions	iv
1. Overview	1
General Description	1
Benefits	1
Specifications	3
2. Pin-Out Information	6
3. Package Information	8
<i>Annexure A: FCC Statement</i>	9
<i>Annexure B: Module Statement</i>	11

General Description

The Nebulae Module V2 provides a means for any electronic device to implement low cost wireless connectivity. This module inter operates with either Zigbee or 6LoWPAN devices depending on the programmed stack.

Nebulae Module V2 is ideal for applications in the energy and controls markets where manufacturing efficiencies are critical.

The Nebulae Module V2, built around the NXP JN5169 SoC (system on a chip) radio IC, integrates an 802.15.4 radio along with a powerful programmable 32-bit RISC CPU. The architecture isolates the wireless software without sacrificing RF performance or security for applications. Quickly and efficiently create customized applications with the Nebulae Module V2.

Benefits

The main benefits of the Nebulae Module V2 are:

- Customizable Zigbee and 6LoWPAN applications with a programmable CPU
- A rich set of hardware peripherals such as GPIO, UART, SPI, I2C, ADC, and PWM
- A great choice for battery oriented applications with various sleep modes
 - Sleep with IO wake up
 - RAM Retention
 - Low Power mode
 - Deep Sleep mode
- Provides an OTA (Over the Air) Firmware update mechanism
- Supports Mesh networking for both Zigbee and 6LoWPAN
- Supports deployment of a dense network with 6LoWPAN

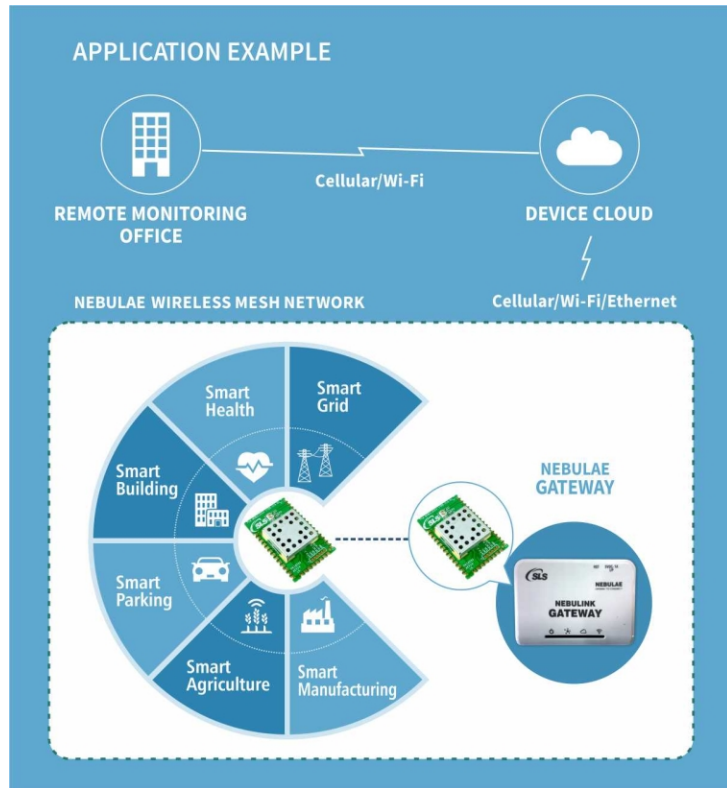
Figure 1-1. shows the Nebulae Module V2.

Figure 1-1. Nebulae Module V2



Figure 1-2. shows Nebulae Module V2 application example.

Figure 1-2. Nebulae Module V2 Application Example



Specifications

Table 1-1 describes specifications of the Nebulae Module V2.

Table 1-1. Nebulae Module V2 Specifications

Performance	
Data Rate	Up to 250Kbps
Range	80 Meters Line of Sight (LoS)
TX Current Consumption	23.3mA@ +10dBm; 19.6mA@ +8.5dBm; 14mA @ +3dBm
RX Current Consumption	15mA@ +10dBm; 13mA@ 0dBm
RX Sensitivity	-96 dBm

Table 1-1. Nebulae Module V2 Specifications

Features			
Serial Interface	SPI	1 SPI	3 Selects
	I2C	1 Interface	2 Wire
	UART	2 UART	
Configuration Method	API local and from cloud		
Frequency Band	ISM 2.4 GHz		
Interference Immunity	DSSS (Direct Sequence Spread Spectrum)		
ADC Inputs	Up to 6-input 10-bit		
Digital IO	Up to 20		
Antenna Options	U.FL Connector		
Size (LxWxH in mm)	21.99 x 34 x 3.05		
PWM	Up to 5 PWM	4 Timers	1 Counter
Modes	Active	Sleep	Deep Sleep
CPU Processing	1 MHz – 2.5mA	0.6 uA	50 nA
	32 MHz – 7.8 mA	-	-
Programmability			
Memory	512 kB Flash	32 kB RAM	4 kB EEPROM
Clock/ Speed	1 MHz to 32 MHz		
CPU	32 Bit RISC		
Networking and Security			
Protocol	6LoWPAN	Zigbee	
Encryption	AES 128 Bit		
Reliable Packet Delivery	Retries, Acknowledgements		
IDs	PAN ID		
Address	IPv6 Address to all nodes		
Channels	16		
Power Requirement			
Supply Voltage	2.0V to 3.6V DC		
Temperature	-40 °C to 125 °C		
Module Software Stack			
Zigbee	Zigbee Pro Stack		

Table 1-1. Nebulae Module V2 Specifications

6LoWPAN	Nebulae 6LoWPAN Stack Features : Three tier security Time synchronization Self healing Remote firmware update IPv6 enabled full IP networking Smart network management Easy network installation and deployment Supports dense network with flexible routing Power management, long battery life Design to withstand failure Highly scalable network
Module Accessories	
Model	TLB-2400-3.0BQ
Manufacturer	Shenzhen Gerbole Elec. Technology Co., Ltd.
Gain	3dBi
Type	Whip-Tilt
Connection Type	RP-SMA
Frequency Range	2400 +/-100
Module to Antenna Connection Type	U.FL to RP-SMA Cable

2. Pin-Out Information

Table 2-1 shows the Nebulae Module V2 Pin-Out.

Table 2-1. Nebulae Module V2 Pin-Out				
Pin No #	Signal Name	Direction	Default State	Description
1	GND	-	-	Ground
2	VCC	-	-	Power supply
3	DIO11/PWM1/TXD1	Bidirectional	Output	DIO6/ UART 0 transmit data output
4	DIO9/TIM0CAP/32KXTALIN/RXD1/32KIN(1)	Bidirectional	Input	DIO7/ RXD0 - UART 0 receive data input
5	DIO16/SPISMOSI/SIF_CLK/COMP1P	Bidirectional	-	DIO16/ COMP1P - comparator plus input
6	RESET_N	Input	-	Reset input
7	DIO8/TIM0CK_GT/PC1/PWM4	Bidirectional	Output	DIO8/RX signal strength indicator
8	DIO6/TXD0/JTAG_TDO/PWM2	Bidirectional	-	DIO11/ PWM1 output
9	DIO19/SPISEL0	Bidirectional	-	DIO19/ SPI - bus master select output 0
10	DIO7/RXD0/JTAG_TDI/PWM3	Bidirectional	Input	DIO9/Pin sleep control line
11	GND	-	-	Ground
12	DIO3/RFTX/TIM0CAP/ADC6	Output	Output	DIO3
13	GND	-	-	Ground
14	DIO15/SIF_D/RXD0/RXD1/JTAG_TDI/SPISEL2/SPISCLK	Input	Input	DIO15/ SPI - bus slave clock input
15	DIO14/SIF_CLK/TXD0/TXD1/JTAG_TDO/SPISEL1/SPISEL	Input	Input	DIO14/ SPI - bus slave select input
16	DIO12/PWM2/CTS0/JTAG_TCK/ADO/SPISMOSI	Input	Input	DIO12/ SPI - bus slave master out, slave in input
17	DIO13/PWM3/RTS0/JTAG_TMS/ADE/SPISMISO	Output	Output	DIO13/ SPI - bus slave master in slave out output
18	Reserved	-	Disabled	Do not connect

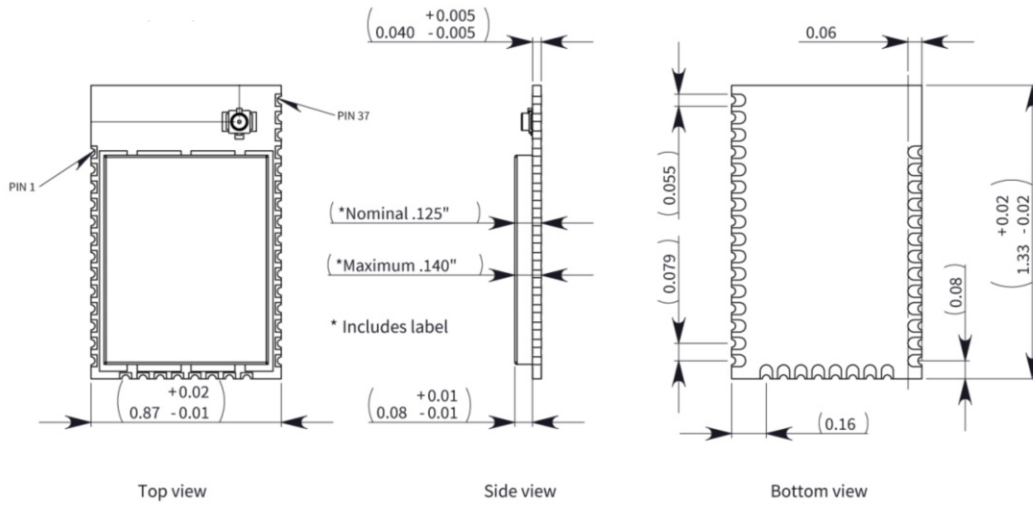
Table 2-1. Nebulae Module V2 Pin-Out

Pin No #	Signal Name	Direction	Default State	Description
19	Reserved	-	Disabled	Do not connect
20	Reserved	-	Disabled	Do not connect
21	Reserved	-	Disabled	Do not connect
22	GND	-	-	Ground
23	DIO18/SPI MOSI	Bidirectional	-	DIO18/ SPI - bus master out slave in output
24	DIO17/SPISMISO/SIF_D/COMP1M/PWM4	Bidirectional	-	DIO17/ comparator minus input
25	DIO4/CTS0/JTAG_TCK/TIM0OUT/PC0	Bidirectional	Output	DIO4/ UART 0 clear to send input
26	DIO10/TIM0OUT/32KXTALOUT	Bidirectional	Output	DIO10/Device status indicator
27	VREF	Input	-	Analog peripheral reference voltage/ ADC input 2
28	DO0/SPICLK/PWM2	Bidirectional	Output	DO0/ SPI - bus master clock output
29	DIO5/RTS0/JTAG_TMS/PWM1/PC1	Bidirectional	Input	DIO5/ UART 0 request to send output
30	DIO0/ADO/SPISEL1/ADC3	Bidirectional	-	DIO0/ ADC input : ADC3
31	DIO1/ADE/SPISEL2/ADC4/PC0	Bidirectional	-	DIO1/ ADC input : ADC4
32	DIO2/RFRX/TIM0CK_GT/ADC5	Bidirectional	-	DIO2/ ADC input : ADC5
33	ADC1	Bidirectional	Input	ADC input
34	DO1/SPIMISO/PWM3	Bidirectional	-	DO1/ SPI - bus master in, slave out input
35	GND	-	-	Ground
36	RF_IO	Bidirectional	-	RF antenna
37	Reserved	-	Disabled	Do not connect
Note:				
(1) Default: Pull down				

3. Package Information

Figure 3-1. shows Physical Dimensions of the Nebulae Module V2.

Figure 3-1. Nebulae Module V2 Physical Dimensions



Annexure A: FCC Statement

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.107) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is “integrated” has to be labelled with an auxilliary label stating the FCC ID of the RF Module, such as “Contains FCC ID:2AO93PI0NL02000100”

“This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.”

Note: 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 one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and 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.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Annexure B: Module Statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

- 3). The radio elements have the radio frequency circuitry shielded.
- 4). The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
- 5). The module contains power supply regulation on the module.
- 6). The module contains a permanently attached antenna.
- 7). The module demonstrates compliance in a stand-alone configuration.
- 8). The module is labeled with its permanently affixed FCC ID label
- 9). The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
- 10). The module complies with RF exposure requirements.

This transmitter/module must not be collocated or operating in conjunction with any other antenna or transmitter.