



## LM813 WiFi and Dual Mode Bluetooth® 4.2 Combi Module

Host Controller Interface (HCI) via USB Interface

Revised

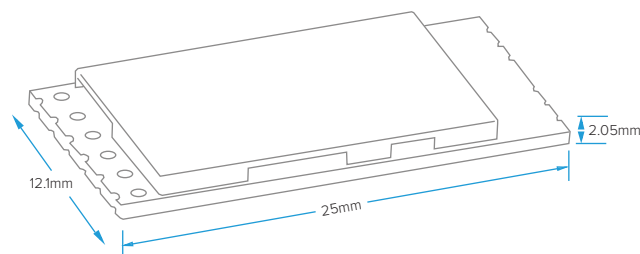
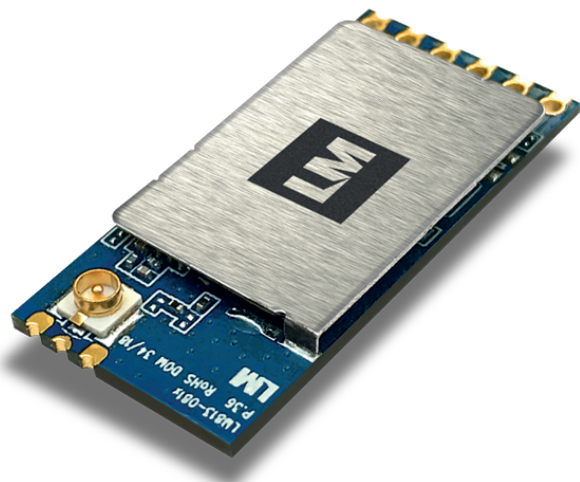
19/FEB/2021

Datasheet Version

1.2

Ordering Options

See last page



### Features

- 1T1R One IPEX Antenna Output
- 802.11ac MIMO solution for 5G band
- 433Mbps High Speed WLAN
- IEEE standards support: IEEE 802.11ac/a/b/g/n
- WPA/WPA2 certification for WiFi
- Bluetooth® 4.2 Dual Mode
- 5v or 3.3v Supply Options
- USB 2.0 and PCM interface

Support for WiFi/Bluetooth® Coexistence, with both technologies active a slight drop in Wi-Fi throughput is noted.

Bluetooth® adaptive power management mechanism

Linux Support Kernel : 2.6.24 ~ 4.15.17  
Supported for Windows 7, 8, 8.1 and 10

CE / FCC Certified Solution

SIG Certification & CCATS due shortly.

RoHS, REACH and WEEE Compliant Solution

### Overview

The LM813 Series Combination Module supports both WiFi 802.11ac with data rates up to 433Mbps and Bluetooth® 4.2.

USB Interface module with added terminals for enabling GPIO's and Bluetooth Functions to enable coexistence.

This IPEX, module operates under 2.4GHz or 5Ghz. LM813 is compliant to IEEE 802.11ac/ a/b/g/n, and Bluetooth® v2.1, v3.0 and v4.2 standards.

Currently Bluetooth® includes EDR transmission and supports bandwidths up to 2Mbps, or in HS Mode up to 3Mbps.

The module design is based on a Realtek reference, which LM engineer's have made some modifications, which include; Upgrading the PCB material to -40°C rated components and using a high quality -40°C low temperature crystal. The main IC from Realtek is only rated at 0°C

Our temperature testing is conducted up to -40°C and the module has achieved good results. Although the testing period is only subject to a 72h test period, we have run previous modules using the same brand of BOM material in longer periods of temperature testing. These tests are continuous and enable us to support for -20°C Operating and -30°C Storage Temperature under our own 24 month warranty, from date of dispatch.

We have added a heat resistant coating to the bottom of the module enabling higher temperature protection during the re-flow processing in production.



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### General Specification

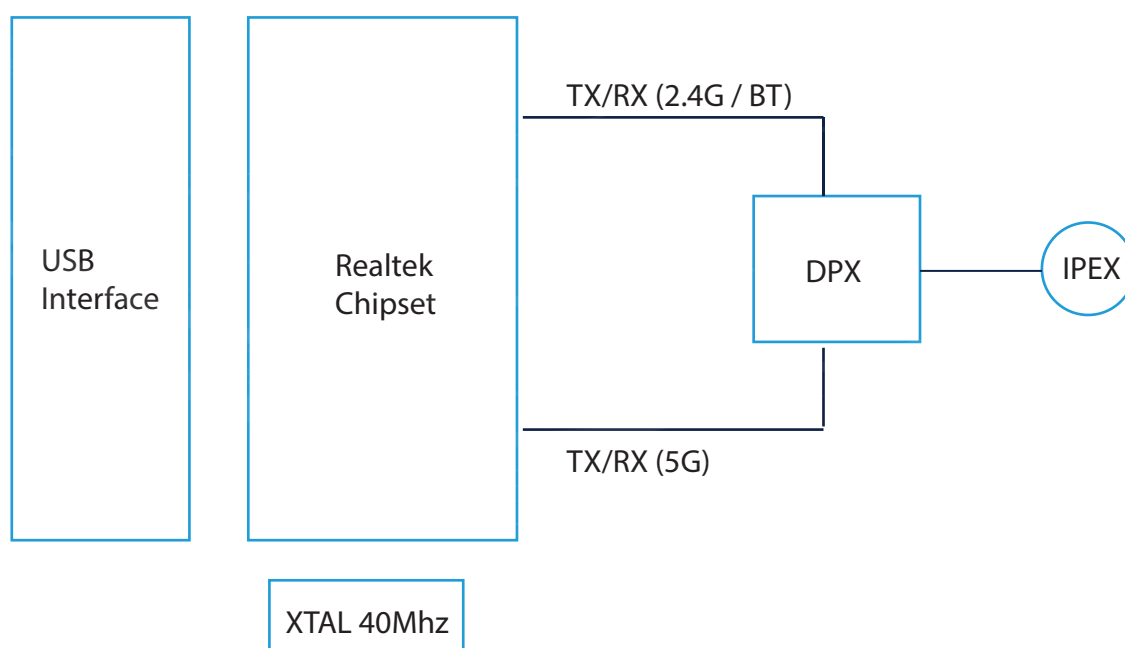
#### Wireless

|                      |                                                                                                                                                                        |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wireless Standard    | <b>WiFi:</b><br>802.11 a/b/g/n/ac<br><b>Bluetooth®:</b><br>v2.1+EDR/v3.0+HS/v4.0/4.2                                                                                   |
| Module Type          | Host Controller Interface (HCI)                                                                                                                                        |
| OS Compatibility     | Linux, and Windows versions to be confirmed.                                                                                                                           |
| Security             | <b>WiFi;</b><br>WPA, WPA-PSK, WPA2,<br><b>Bluetooth®;</b><br>Simple Paring                                                                                             |
| Network Architecture | <b>WiFi;</b><br>Ad hoc mode (Peer-to-Peer) and Infrastructure mode Software AP; WiFi Direct<br><b>Bluetooth®;</b><br>Pico Net; Scatter Net, Low Power Mode(Sniff Mode) |

#### Hardware

|            |                       |
|------------|-----------------------|
| Chipset    | Realtek Chipset       |
| Antenna    | Single IPEX Connector |
| Interfaces | USB 2.0               |

### Block Diagram



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### General Specification (Continued)

#### RF Characteristics

|                                         |                                                                                                                                                                                                                                                                       |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range (in open space)                   | <b>WiFi:</b><br>Up to 180m<br><br><b>Bluetooth®:</b><br>Up to 10m                                                                                                                                                                                                     |
| Data Transfer Rate                      | <b>WiFi:</b><br>802.11b: 1, 2, 5.5, 11Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 433Mbps;<br>802.11n MCS0 to 7 for HT20MHz, MCS0 to 7 for HT40MHz<br><br><b>Bluetooth®:</b><br>Basic Rate 1Mbps; Enhanced Rate 2, 3Mbps;<br>High Speed 6, 9, 12, 18, 24, 36, 48, 54Mbps |
| Frequency                               | 2.4GHz and 5GHz ISM Band                                                                                                                                                                                                                                              |
| Modulation Scheme                       | <b>WiFi:</b><br>CCK, DQPSK, DBPSK, BPSK, QPSK, 16QAM, 64QAM, 256QAM<br><br><b>Bluetooth®:</b><br>8DPSK, $\pi/4$ DQPSK, GFSKFSK                                                                                                                                        |
| Spread Spectrum                         | <b>WiFi:</b><br>IEEE 802.11b: CCK (Complementary Code Keying)<br>IEEE 802.11g/n/a/ac: OFDM (Orthogonal Frequency Division Multiplexing)<br><br><b>Bluetooth®:</b><br>FHSS (Frequency Hopping Spread Spectrum)                                                         |
| Antenna                                 | IPEX Antenna x 2                                                                                                                                                                                                                                                      |
| Security                                | WPA, WPA2                                                                                                                                                                                                                                                             |
| RF Output Power (tolerance $\pm 2$ dBm) | <b>WiFi</b><br>17dBm – 802.11b@CCK 11Mbps<br>15dBm – 802.11g@OFDM 54Mbps<br>13dBm – 802.11n@MCS7_HT20<br>13dBm – 802.11n@MCS7_HT40<br>13dBm – 802.11a@OFDM 54Mbps<br>9dBm – 802.11ac@NSS1 MCS9_BW20, BW40, BW80<br><br><b>Bluetooth</b><br>Max + 8dBm                 |

**LM813 WiFi and Dual Mode Bluetooth® Combination Module**

Host Controller Interface (HCI) via USB Interface

**Receiver Sensitivity****WiFi**

-80dBm – 802.11b@11Mbps  
 -71dBm – 802.11g@54Mbps  
 -67dBm – 802.11n@MCS7\_BW20  
 -64dBm – 802.11n@MCS7\_BW40  
 -57dBm – 802.11ac@NSS1\_MCS9\_BW20  
 -54dBm – 802.11ac@NSS1\_MCS9\_BW40  
 -51dBm – 802.11ac@NSS1\_MCS9\_BW80

**Bluetooth**

-89dBm@1Mbps  
 -90dBm@2Mbps  
 -83dBm@3Mbps

Operating Temperature -20°C to +85°C ambient temperature 0 to 95 % (non-condensing)

Storage Temperature -30°C to +95°C ambient temperature 0 to 95 % (non-condensing)

Dimensions (L x W x H) 25mm x 12mm x 2.05mm

Weight 0.82 g

Certifications See our website for certifications

Compliance RoHS, REACH and WEEE

**Power Consumption****DC power for 5V****Performance**

| Description                     | Typ | Units |
|---------------------------------|-----|-------|
| Off                             | 10  | uA    |
| Unassociated idle               | 40  | mA    |
| Associated idle for 2.4GHz band | 70  | mA    |
| Data transfer for 2.4GHz        | 103 | mA    |

**Note:** Data transfer test using the Linux driver: Linux\_v4.3.6\_11841.20140714

**DC power for 3.3V****Performance**

| Description                     | Typ | Units |
|---------------------------------|-----|-------|
| Off                             | 16  | uA    |
| Unassociated idle               | 90  | mA    |
| Associated idle for 2.4GHz band | 141 | mA    |
| Data transfer for 2.4GHz        | 168 | mA    |

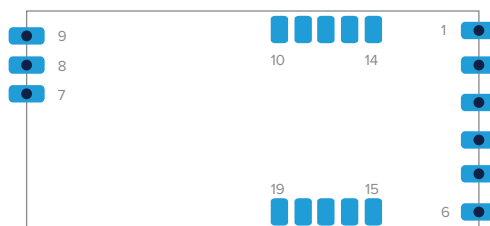
**Note:** Data transfer test using the Linux driver: Linux\_v4.3.6\_11841.20140714



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### Pin Outs



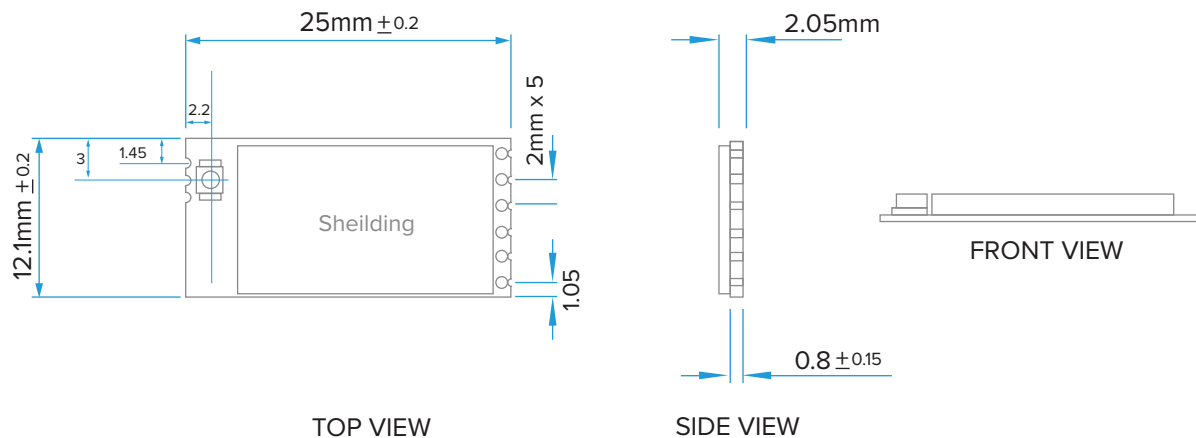
### Pin Assignments

| Pin | Signal       | Type   | Description                                                                                                                                                                                                                                                                             |
|-----|--------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | BT_LED       | Output | BT LED Pin(Active Low)                                                                                                                                                                                                                                                                  |
| 2   | VDD          | Power  | 3.3V or 5V by factory option                                                                                                                                                                                                                                                            |
| 3   | HSDM         | I/O    | High-Speed USB D- Signal                                                                                                                                                                                                                                                                |
| 4   | HSDP         | I/O    | High-Speed USB D+ Signal                                                                                                                                                                                                                                                                |
| 5   | GND          |        | Ground                                                                                                                                                                                                                                                                                  |
| 6   | WL_LED       | I/O    | WLAN LED Pin(Active Low), General Purpose Input/ Output Pin                                                                                                                                                                                                                             |
| 7   | GND          |        | Ground                                                                                                                                                                                                                                                                                  |
| 8   | RFIO_OUT     | RF     | WLAN(2.4G/5G)/BT RF port (if don't using IPEX connector)                                                                                                                                                                                                                                |
| 9   | GND          |        | Ground                                                                                                                                                                                                                                                                                  |
| 10  | BT_WAKE_HOST | Output | Signal from module to wake up host, refer driver source code for details.                                                                                                                                                                                                               |
| 11  | GPIO2        | I/O    | General Purpose Input/ Output Pin                                                                                                                                                                                                                                                       |
| 12  | CHIP_EN      | Input  | This Pin Can externally shut down the RTL8821CU-CG(No Extra Power Switch Required).                                                                                                                                                                                                     |
| 13  | GPIO1        | I/O    | General Purpose Input/ Output Pin                                                                                                                                                                                                                                                       |
| 14  | BT_DIS       | Input  | Shared with GPIO11. This pin can externally shut down the RTL8821CU-CG BT function when BT_DIS is pulled Low. When this pin is pulled low. USB interface will be also disabled. This pin can be also defined as the BT Radio-off function with host interface remaining connected       |
| 15  | GPIO8        | I/O    | WLAN LED Pin(Active Low), shared with GPIO8 General Purpose Input/ Output Pin                                                                                                                                                                                                           |
| 16  | HOST_WAKE_BT | Input  | Signal from host to wake up module, refer driver source code for details.                                                                                                                                                                                                               |
| 17  | WL_DIS       | Input  | Shared with GPIO9. This pin can externally shut down the RTL8821CU-CG WLAN function when WL_DIS is pulled Low. When this pin is pulled low. USB interface will be also disabled. This pin can also be configured as the WLAN Radio-off function with host interface remaining connected |
| 18  | HOST_WAKE_WL | Input  |                                                                                                                                                                                                                                                                                         |
| 19  | WL_WAKE_HOST | Output |                                                                                                                                                                                                                                                                                         |

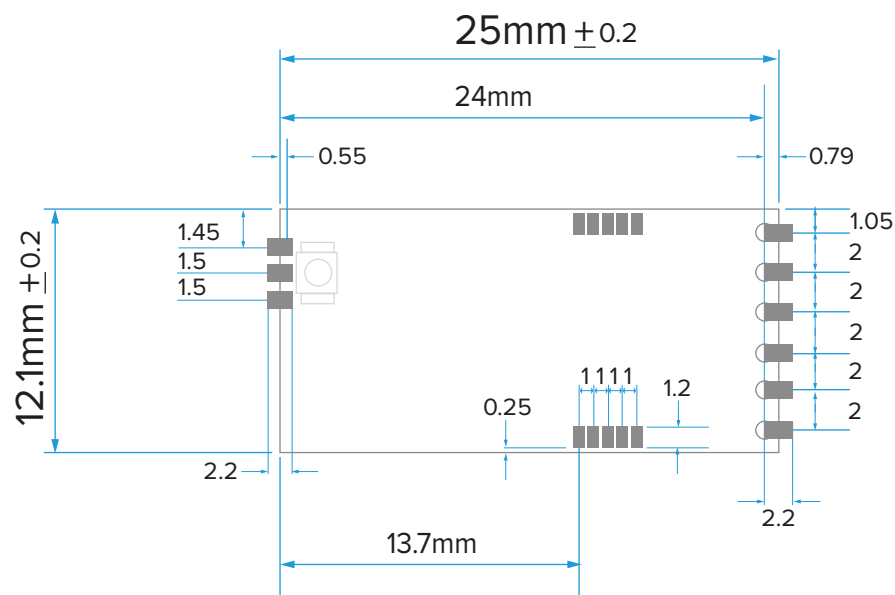
## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### Physical Dimensions



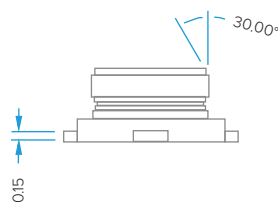
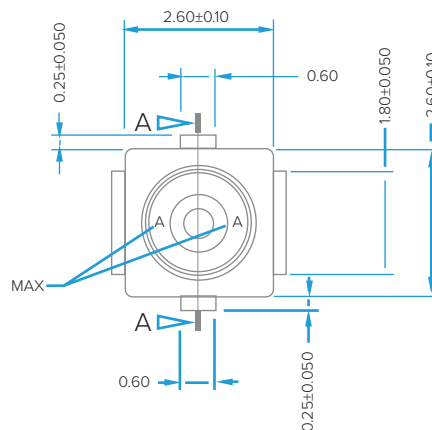
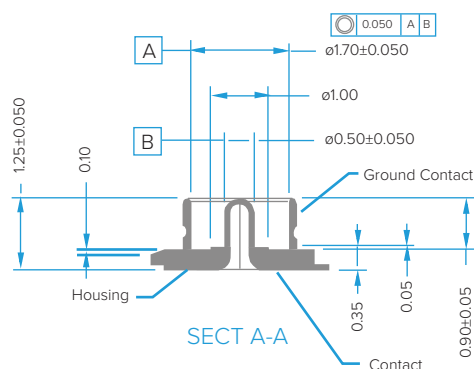
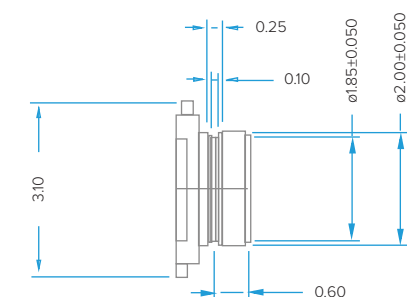
### PCB Layout



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

### Host Controller Interface (HCI) via USB Interface

## RF Connector Dimensions



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### PCB Drying Conditions

Please refer below to the conditions for drying before the solder reflow processes. (Extracted from IPC/JEDEC J-STD-033B.1)

1. If the system PCBA is double side design please reflow the side without this module first.
2. Don't let the solder machine temperature over 250 °C or follow solder paste vender's recommended temperature.
3. The Ramp-up temperature speed is 1~4 °C per second, the Ramp-down temperature speed is 1~4 °C per second.
4. This temperature reflow chart is for reference only, it depends on the manufacturing machine's characters requirement.

#### Bake @ 125 °C

Exceeding floor Life by  
> 72h

9 hours

Exceeding floor Life by  
≤ 72h

7 hours

#### Bake @ 90 °C

Exceeding floor Life by  
> 72h

33 hours

Exceeding floor Life by  
≤ 72h

23 hours

#### Bake @ 40 °C

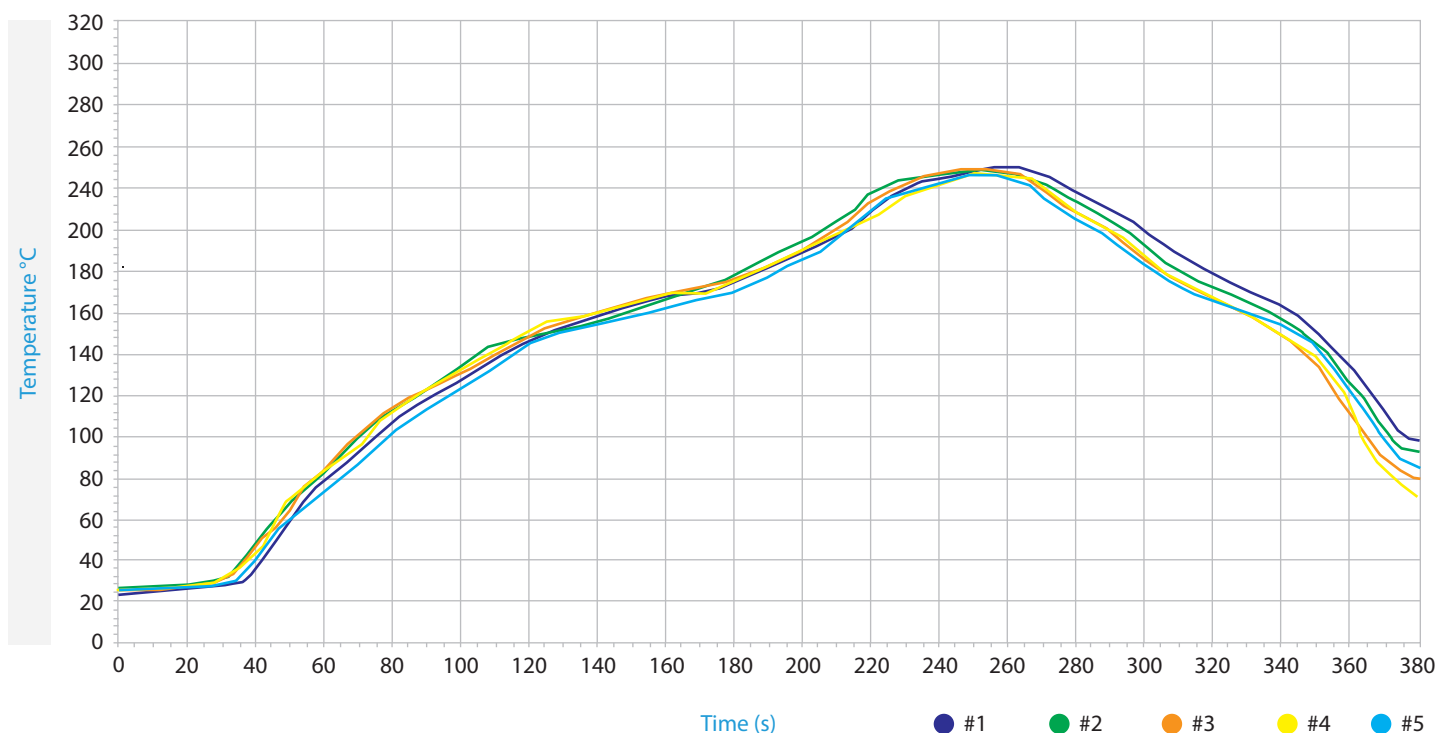
Exceeding floor Life by  
> 72h

13 days

Exceeding floor Life by  
≤ 72h

9 days

### Soldering Reflow Chart



| Name   | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | Zone 8 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Max    | 180.0  | 180.0  | 170.0  | 170.0  | 180.0  | 210.0  | 260.0  | 245.0  |
| Min    | 180.0  | 180.0  | 170.0  | 170.0  | 180.0  | 210.0  | 260.0  | 245.0  |
| Length | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    | 1.0    |

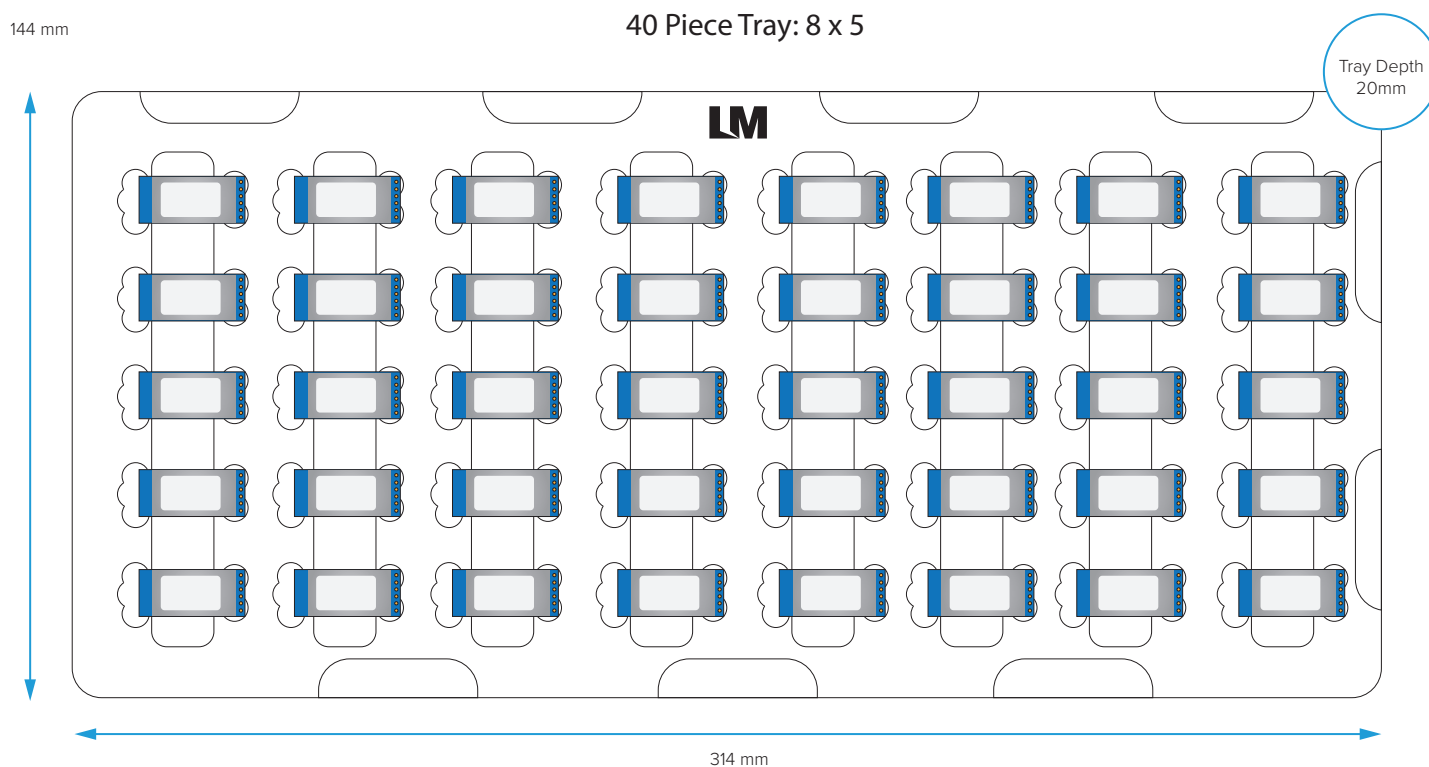
| Probe | Liquidus Line        |             | Maximum / Minimum |       | Slope    |          |
|-------|----------------------|-------------|-------------------|-------|----------|----------|
|       | Rising 110.00-190.00 | Above 230.0 | Max               | Min   | Positive | Negative |
| #1    | 119.00               | 47.50       | 245.50            | 27.30 | 2.56     | -1.69    |
| #2    | 116.50               | 49.00       | 247.10            | 27.70 | 2.69     | -1.60    |
| #3    | 116.00               | 46.50       | 245.80            | 29.30 | 2.04     | -1.57    |
| #4    | 117.00               | 46.50       | 244.90            | 29.20 | 2.60     | -1.31    |
| #5    | 119.50               | 50.00       | 248.10            | 29.60 | 2.44     | -1.64    |

## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### Tray Packaging

#### Tray Dimensions



#### Quantities

- 40 modules per Tray
- 3 Trays per Inner Box
- 120 modules per Inner Box
- 8 Inner Boxes per Outer Carton
- 960 modules per Outer Carton

#### Notes

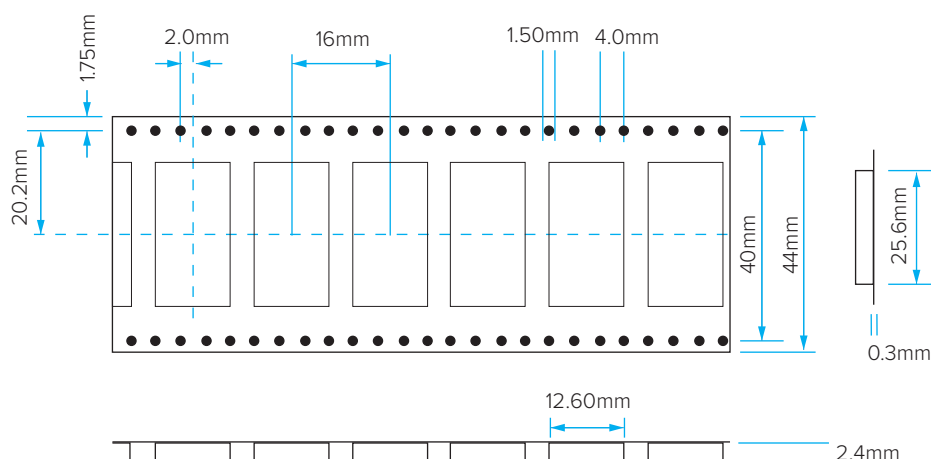
- Anti-Static PS Tray, Black.
- Material Thickness: 1mm
- Height of Tray: 20mm
- Carton Dimensions (L x W x H):  
340mm x 290mm x 385mm

## LM813 WiFi and Dual Mode Bluetooth® Combination Module

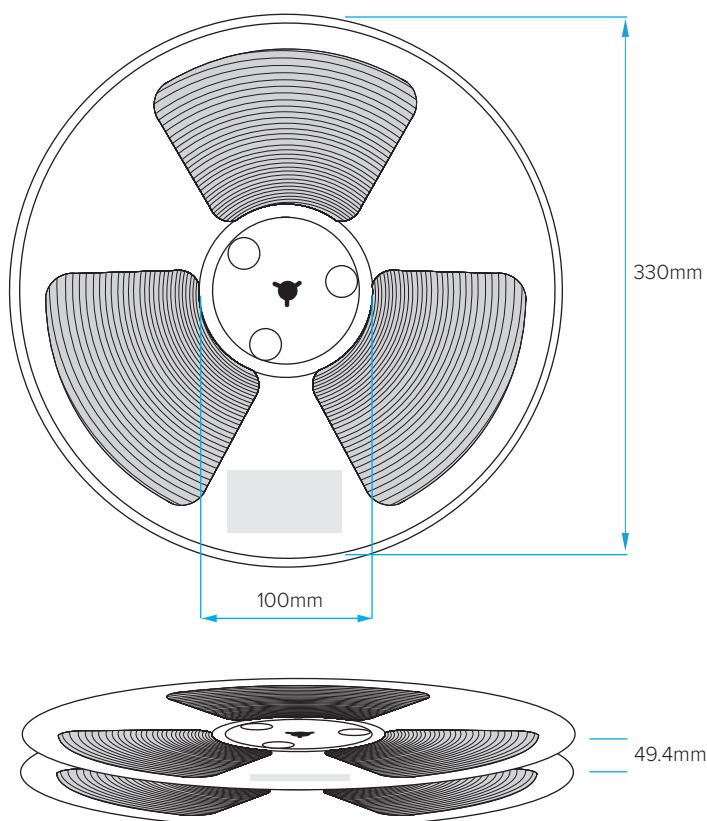
Host Controller Interface (HCI) via USB Interface

### Tape and Reel Packaging

#### Tape Dimensions



#### Reel Dimensions



#### Quantities

- 1500 modules per Tape & Reel
- 1 Tape & Reel per Inner Box
- 5 Inner Boxes per Outer Carton
- 7500 modules per Outer Carton

#### Notes

- Inner Box Dimensions (L x W x H):  
360mm x 360mm x 60mm
- Outer Carton Dimensions (L x W x H):  
395mm x 360mm x 305mm

## LM813 WiFi and Dual Mode Bluetooth® Combination Module

### Host Controller Interface (HCI) via USB Interface

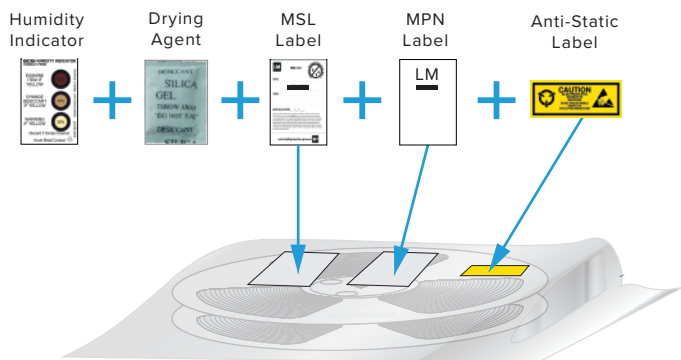
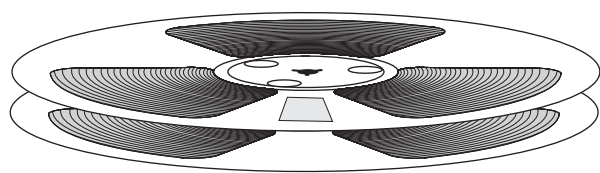
#### Packaging for Tape & Reel / Tray

The Tape & Reel / Tray are inserted into an anti-static vacuum bag with a Humidity Indicator Card and Drying Agent.

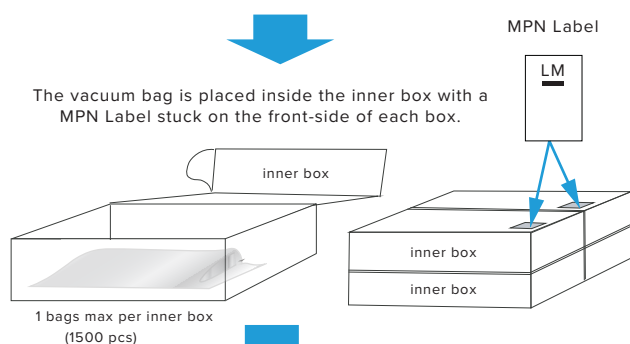
On the outside of the vacuum bag are MSL (Moisture Sensitivity Levels), MPN and an Anti-Static Labels.

#### Tape & Reel

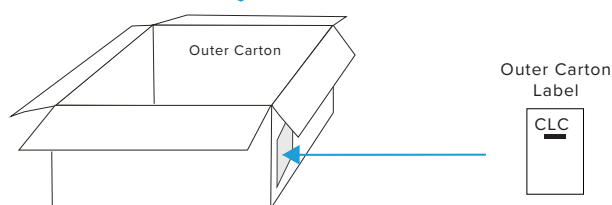
Reels are placed within a vacuum bag.



Vacuum bag.



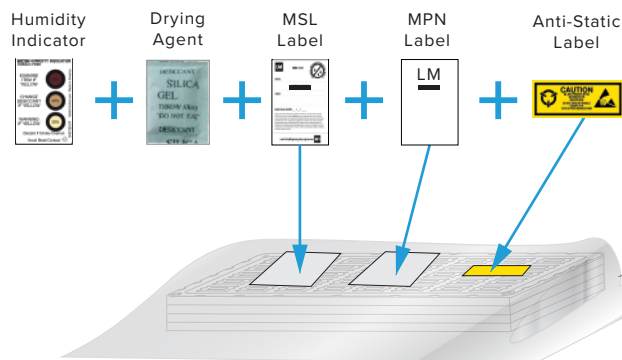
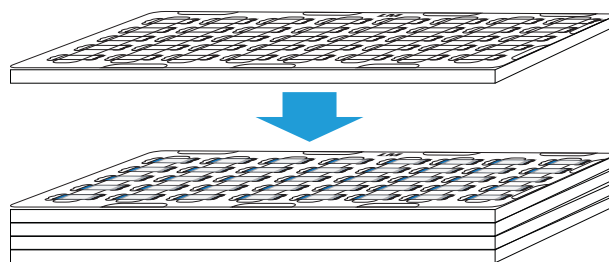
1 bags max per inner box  
(1500 pcs)



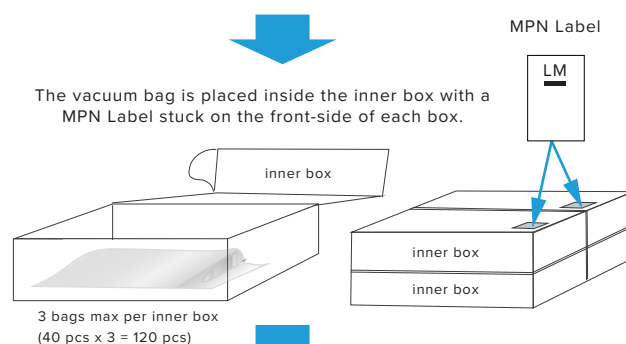
Each Outer Carton contain 5 inner boxes max  
(7500 pcs)

#### Tray

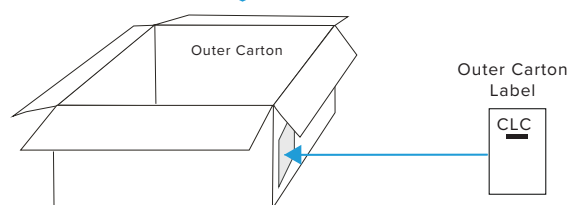
Trays are stacked with an empty tray on the top and placed within a vacuum bag.



Vacuum bag.



3 bags max per inner box  
(40 pcs x 3 = 120 pcs)



Each Outer Carton contain 8 inner boxes max  
(120 pcs x 8 = 960 pcs)



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### Datasheet Version Notes

|      |             |                                                     |
|------|-------------|-----------------------------------------------------|
| v1.2 | 22 JAN 2021 | Added version notes to datasheet, branding updates. |
|------|-------------|-----------------------------------------------------|



## LM813 WiFi and Dual Mode Bluetooth® Combination Module

Host Controller Interface (HCI) via USB Interface

### Ordering Options



813-0813

TRAY

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX TRAY

ETSI



813-0814

SAMPLE PACK

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX TRAY SP

ETSI



813-0815

TAPE & REEL

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX T&R

ETSI



813-0816 US

TRAY

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX TRAY

US



813-0817 US

SAMPLE PACK

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX TRAY SP

US



813-0818 US

TAPE & REEL

5V Module with IPEX Connector

MOD SMT HCI 802.11ac 1T1R - BT4.2 -20c 5v IPEX T&R

US

- Product User Guides, Manuals and Configuration Software can be downloaded via our website - <http://www.lm-technologies.com/downloads>