# 正基科技股份有限公司

# SPECIFICATION

SPEC. NO.： _____　　　REV： ____1.9____

DATE： 　　07.20. 2012　　
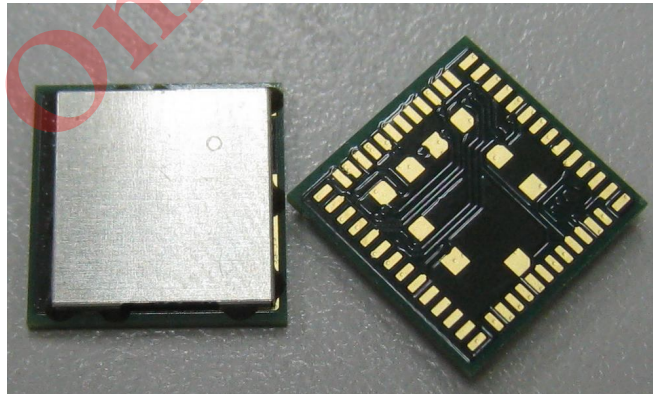
PRODUCT　NAME： 　　　　WL-211　　　　

*Only for TPV.*

| | APPROVED | CHECKED | PREPARED | DCC ISSUE |
|---|---|---|---|---|
| **NAME** | | | | |

# AMPAK

# WL-211
## Wi-Fi SIP Module
## Spec Sheet

Only for TPV.

# Revision History

| Date | Revision Content | Revised By | Version |
|---|---|---|---|
| 2011/08/22 | -Initial released | Andy | 1.0 |
| 2011/09/27 | -Modify physical dimensions | Andy | 1.1 |
| 2011/10/19 | -Modify block diagram | Andy | 1.2 |
| 2011/12/23 | -Add Power Consumption | Andy | 1.3 |
| 2012/01/12 | -Modify dimension | Andy | 1.4 |
| 2012/03/09 | -Add packing information | Andy | 1.5 |
| 2012/03/19 | -More info to recommended footprint | Andy | 1.6 |
| 2012/05/03 | -Pin description revised | Bart | 1.7 |
| 2012/05/18 | -Modify Recommended Footprint<br>-Modify Physical Dimensions | Bart | 1.8 |
| 2012/07/20 | -Modify Physical Dimensions | Bart | 1.9 |
|  |  |  |  |

Only for TPV

# Contents

# 1. Introduction

AMPAK Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi functionalities. The highly integrated WL-211 module makes the possibilities of web browsing, VoIP, headsets and other applications. With seamless roaming capabilities and advanced security, WL-211 can also interact with different vendors' 802.11b/g/n Access Points in the wireless LAN.

This wireless module complies with IEEE 802.11 b/g/n standard and it can achieve up to a speed of 72.2Mbps with single stream in 802.11n draft, 54Mbps as specified in IEEE 802.11g, or 11Mbps for IEEE 802.11b to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi.

This compact module is a total solution for Wi-Fi technologies. The module is specifically developed for Smart phones and Portable devices.

# 2. Features

- Single-band 2.4GHz IEEE 802.11b/g/n
- Supports standard interfaces SDIO v2.0(50MHz, 4-bit and 1-bit) and generic SPI(up to 50MHz)
- Integrated ARM Cortex-M3$^{TM}$ CPU with on-chip memory enables running IEEE802.11 firmware that can be field-upgraded with future features.
- Supports per packet Rx antenna diversity
- Security:
    i. Hardware WAPI acceleration engine
    ii. AES and TKIP in hardware for faster data encryption and IEEE 802.11i compatibility
    iii. WPA$^{TM}$ – and WPA2$^{TM}$ - (Personal) support for powerful encryption and authentication

A simplified block diagram of the module is depicted in the figure below.
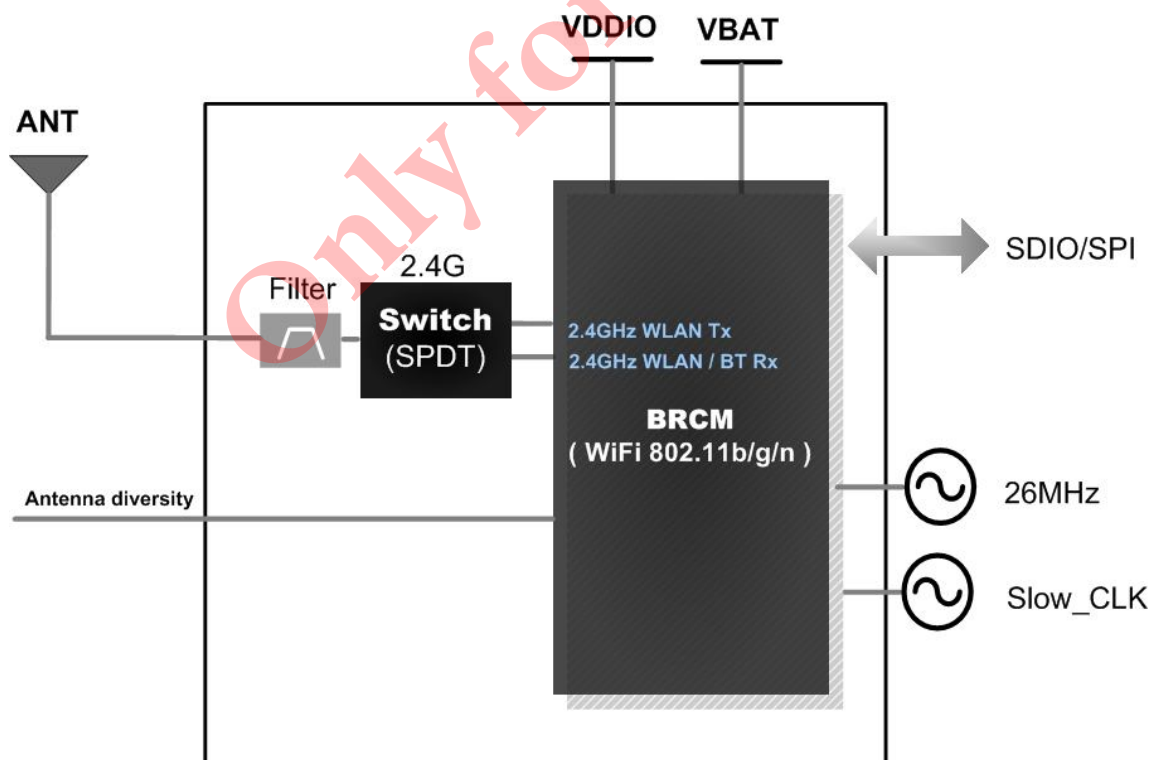
# 3. Deliverables

## 3.1 Deliverables

The following products and software will be part of the product.

- Module with packaging
- Evaluation Kits
- Software utility for integration, performance test.
- Product Datasheet.
- Agency certified pre-tested report with the adapter board.

## 3.2 Regulatory certifications

The product delivery is a pre-tested module, without the module level certification. For module approval, the platform's antennas are required for the certification.

# 4. General Specification

## 4.1 Wi-Fi RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25°C

| Feature | Description |
|---|---|
| Product Name | WL-211 Wi-Fi SIP Module |
| WLAN Standard | IEEE 802.11b/g/n, WiFi compliant |
| Host Interface | SDIO |
| Dimension | L x W x H: 9.5 x 9.5 x 1.5 (typical) mm |
| Frequency Range | 2.412 GHz ~ 2.4835 GHz (2.4 GHz ISM Band) |
| Number of Channels | 11 for North America, 13 for Europe, and 14 for Japan |
| Modulation | 802.11b : DQPSK, DBPSK, CCK<br>802.11g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK |
| Output Power | 802.11b /11Mbps : 16 dBm ± 1.5 dB @ EVM ≤ -9dB<br>802.11g /54Mbps : 15 dBm ± 1.5 dB @ EVM ≤ -25dB<br>802.11n /65Mbps : 14 dBm ± 1.5 dB @ EVM ≤ -28dB |
| Receive Sensitivity (11n,20MHz) @10% PER | - MCS=0     PER @ -85 ± 1dBm, typical<br>- MCS=1     PER @ -84 ± 1dBm, typical<br>- MCS=2     PER @ -82 ± 1dBm, typical<br>- MCS=3     PER @ -80 ± 1dBm, typical<br>- MCS=4     PER @ -77 ± 1dBm, typical<br>- MCS=5     PER @ -73 ± 1dBm, typical<br>- MCS=6     PER @ -71 ± 1dBm, typical<br>- MCS=7     PER @ -69 ± 1dBm, typical |
| Receive Sensitivity (11g) @10% PER | - 6Mbps     PER @ -87 ± 1dBm, typical<br>- 9Mbps     PER @ -86 ± 1dBm, typical<br>- 12Mbps     PER @ -85 ± 1dBm, typical<br>- 18Mbps     PER @ -83 ± 1dBm, typical<br>- 24Mbps     PER @ -81 ± 1dBm, typical<br>- 36Mbps     PER @ -78 ± 1dBm, typical<br>- 48Mbps     PER @ -74 ± 1dBm, typical<br>- 54Mbps     PER @ -72 ± 1dBm, typical |
| Receive Sensitivity (11b) @8% PER | - 1Mbps     PER @ -90 ± 1dBm, typical<br>- 2Mbps     PER @ -89 ± 1dBm, typical<br>- 5.5Mbps     PER @ -87 ± 1dBm, typical<br>- 11Mbps     PER @ -84 ± 1dBm, typical |

| Data Rate | 802.11b : 1, 2, 5.5, 11Mbps |
| --- | --- |
| | 802.11g : 6, 9, 12, 18, 24, 36, 48, 54Mbps |
| Data Rate (20MHz ,Long GI,800ns) | 802.11n: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps |
| Data Rate (20MHz ,short GI,400ns) | 802.11n : 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65,72.2Mbps |
| Maximum Input Level | 802.11b : -10 dBm |
| | 802.11g/n : -20 dBm |
| Operating temperature | -30°C to 85°C |
| Storage temperature | -40°C to 85°C |
| Humidity | Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing |

## 4.2 Voltages

### 4.2.1 Absolute Maximum Ratings

| Symbol | Description | Min. | Max. | Unit |
| --- | --- | --- | --- | --- |
| VBAT | Input supply Voltage | -0.5 | 6.5 | V |
| VDDIO | Digital/Bluetooth/SDIO/SPI I/O Voltage | -0.5 | 4.1 | V |

### 4.2.2 Recommended Operating Ratings

| Test conditions: At room temperature 25°C | | | | |
| --- | --- | --- | --- | --- |
| Symbol | Min. | Typ. | Max. | Unit |
| VBAT | 3.0 | 3.6 | 4.8 | V |
| VDDIO | 1.7 | 1.8 | 1.92 | V |
| | 2.97 | 3.3 | 3.6 | V |

Note: The voltage of VDDIO is depended on system I/O voltage.

| Test conditions: At operating temperature -10°C ~65°C | | | | |
| --- | --- | --- | --- | --- |
| Symbol | Min. | Typ. | Max. | Unit |
| VBAT | 3.0 | 3.6 | 4.8 | V |
| VDDIO | 1.7 | - | 3.35 | V |

Note: VDDIO operating voltage range from 1.7V to 3.35V at operating temperature is guaranteed.

# 5. Pin Assignments

## 5.1 PCB Pin Outline
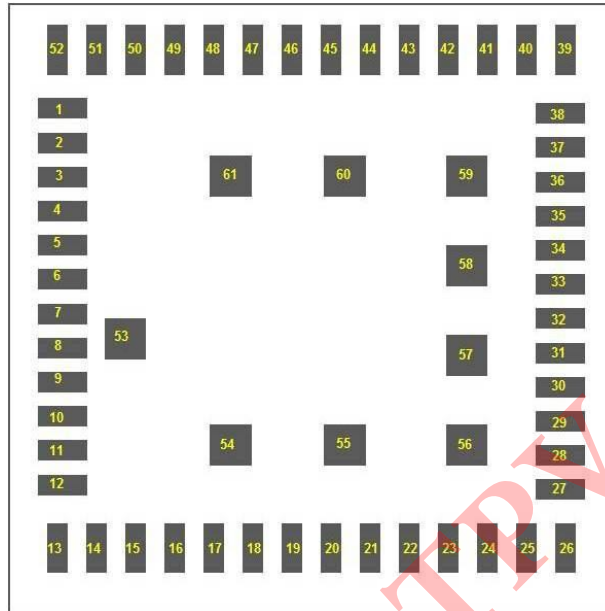


< TOP VIEW >

## 5.2 Pin Definition

| NO | Name | Type | Description |
|----|------|------|-------------|
| 1 | WLAN_ANT | I/O | RF signal I/O port |
| 2 | GND | — | Ground |
| 3 | JTAG_TRST_L | I | JTAG interface, if JTAG not used unconnected (NC) |
| 4 | JTAG_TDO_UART_TX | O | JTAG interface, if JTAG not used unconnected (NC) this pin. This pin is also muxed with UART_TX, which can be enabled by software |
| 5 | JTAG_TDI_UART_RX | I | JTAG interface, if JTAG not used unconnected (NC) this pin. This pin is also muxed with UART_RX, which can be enabled by software |
| 6 | JTAG_TCK | I | JTAG interface, if JTAG not used unconnected (NC) |
| 7 | JTAG_TMS | I | JTAG interface, if JTAG not used unconnected (NC) |
| 8 | GND | — | Ground |
| 9 | OSC_IN | I | XTAL oscillator input |
| 10 | OSC_OUT | I/O | XTAL oscillator output |
| 11 | GND | — | Ground |
| 12 | RF_SW_CTRL0 | — | Floating (Don't connected to ground) |
| 13 | RF_SW_CTRL3 | — | Floating (Don't connected to ground) |

| 14 | GND | — | Ground |
|---|---|---|---|
| 15 | GND | — | Ground |
| 16 | GND | — | Ground |
| 17 | GND | — | Ground |
| 18 | VIO | I | Digital I/O Voltage input |
| 19 | CLK_32K | I | Sleep clock (32.768KHz) input |
| 20 | SDIO_DATA_2 | I/O | SDIO data line 2 |
| 21 | SDIO_DATA_0 | I/O | SDIO data line 0 |
| 22 | SDIO_CLK | I | SDIO clock |
| 23 | SDIO_CMD | I/O | SDIO command line |
| 24 | SDIO_DATA_1 | I/O | SDIO data line 1 |
| 25 | SDIO_DATA_3 | I/O | SDIO data line 3 |
| 26 | VIN_LDO | I | Internal DC-DC regulator input |
| 27 | GND | — | Ground |
| 28 | SR_VLX | O | Internal DC-DC regulator output |
| 29 | GND | — | Ground |
| 30 | VBAT | I | DC voltage input |
| 31 | WL_RST_N | I | Active low WLAN reset signal |
| 32 | GND | — | Ground |
| 33 | GND | — | Ground |
| 34 | GND | — | Ground |
| 35 | GND | — | Ground |
| 36 | XTAL_PU | O | Floating (Don't connected to ground) |
| 37 | GND | — | Ground |
| 38 | GND | — | Ground |
| 39 | GND | — | Ground |
| 40 | GND | — | Ground |
| 41 | GND | — | Ground |
| 42 | GND | — | Ground |
| 43 | VDD_TCXO | — | Floating (Don't connected to ground) |
| 44 | GND | — | Ground |
| 45 | TCXO_IN | — | Floating (Don't connected to ground) |
| 46 | GPIO_5 | — | Floating (Don't connected to ground) |
| 47 | GPIO_4 | — | Floating (Don't connected to ground) |
| 48 | GPIO_3 | — | Floating (Don't connected to ground) |
| 49 | GPIO_1 | O | WL_Host Wake, |
| 50 | GPIO_0 | — | Mode selection, Low for SDIO, High for SPI mode |
| 51 | WRF_GPIO_OUT | — | Floating (Don't connected to ground) |

| 52 | GND | — | Ground |
|----|-----|---|--------|
| 53 | GND | — | Ground |
| 54 | GND | — | Ground |
| 55 | GND | — | Ground |
| 56 | GND | — | Ground |
| 57 | GND | — | Ground |
| 58 | GND | — | Ground |
| 59 | GND | — | Ground |
| 60 | GND | — | Ground |
| 61 | GND | — | Ground |

Only for TPV.

# 6. Dimensions

## 6.1 Physical Dimensions

(Unit: mm)

< TOP VIEW >                    < Side View >

9.5+/-0.1

9.5+/-0.1

1.7 (MAX)
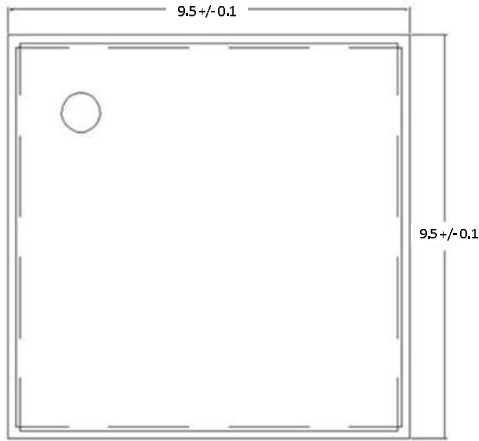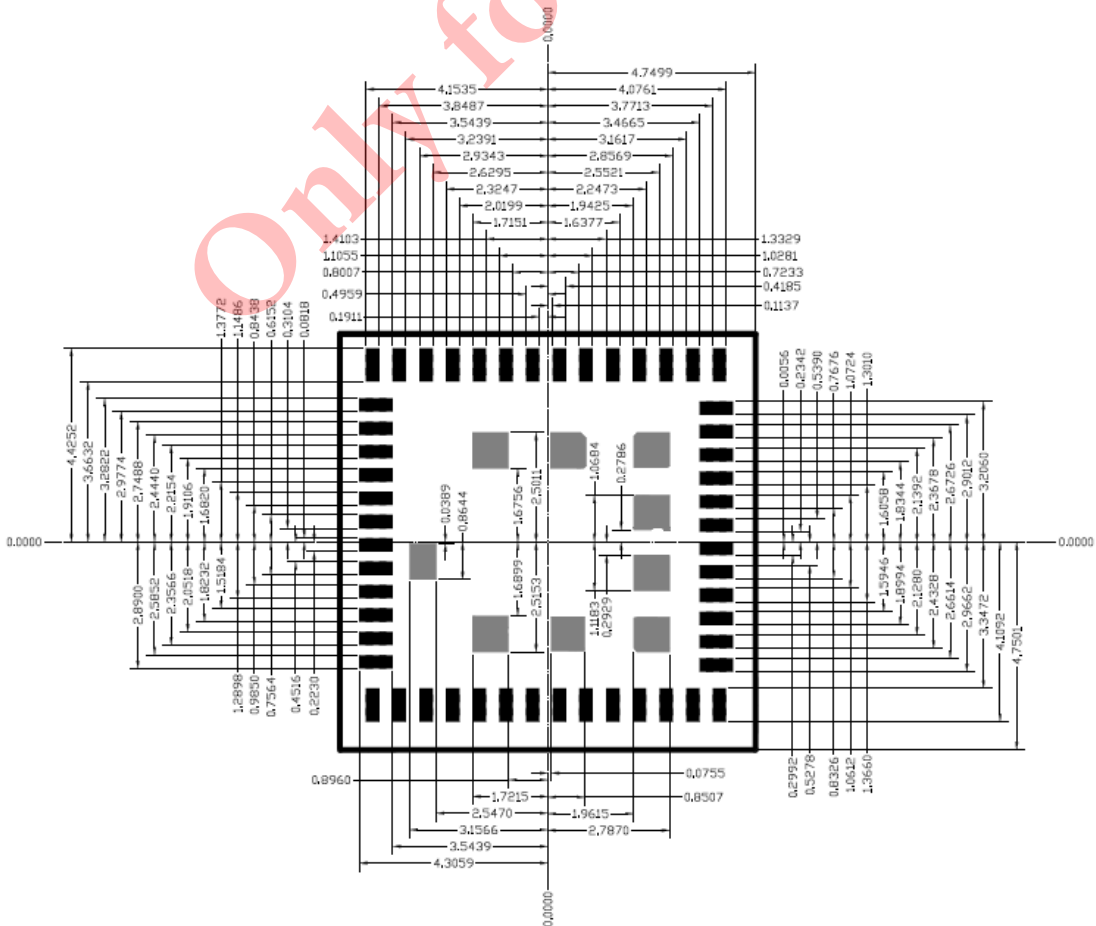
< TOP VIEW >

# 6.2 Recommended Footprint

(Unit: mm)

< TOP VIEW >
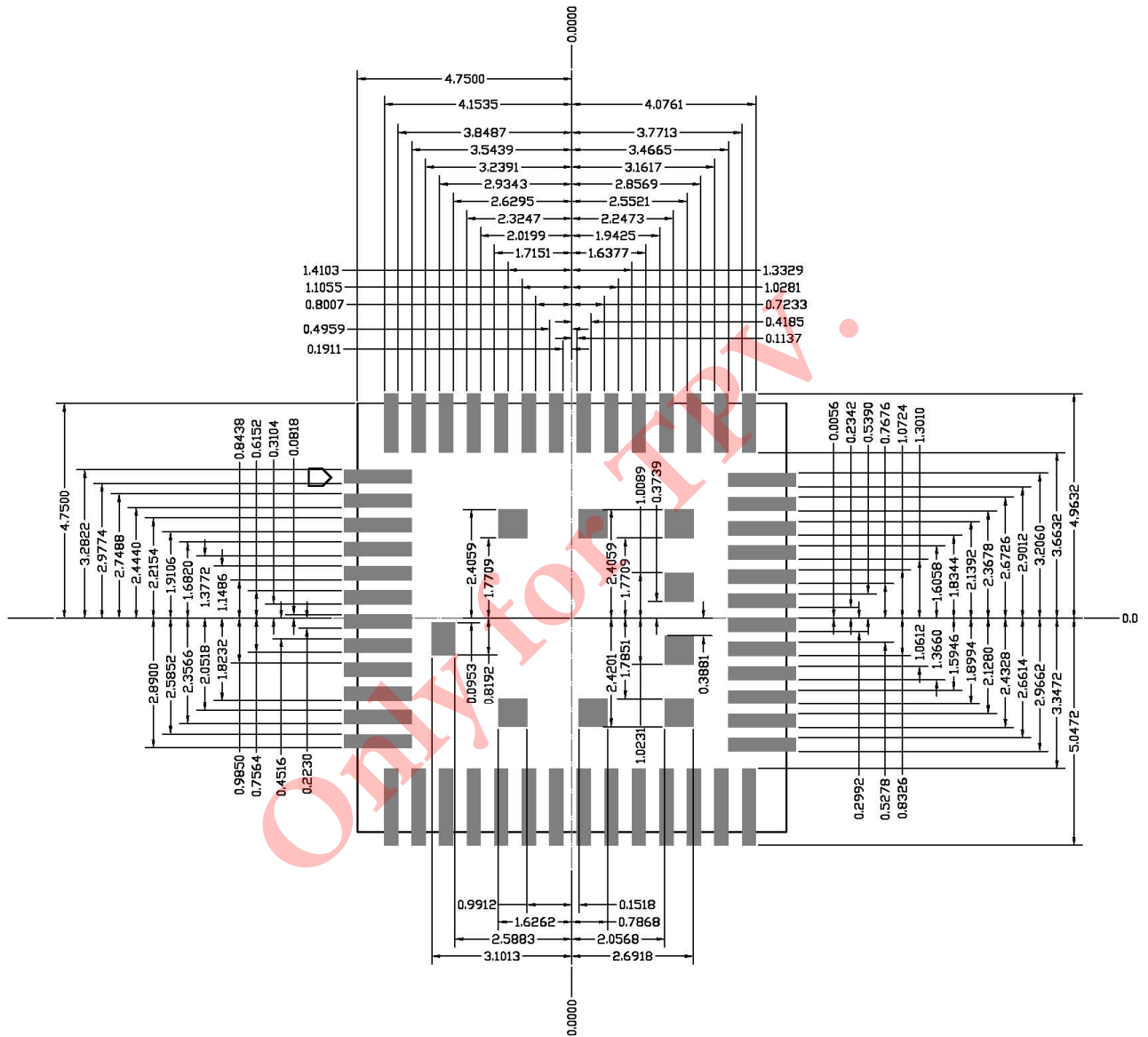
# 7. External clock reference

External LPO signal characteristics

| Parameter | LPO Clock | Units |
|---|---|---|
| Nominal input frequency | 32.768 | kHz |
| Frequency accuracy | $\pm 30$ | ppm |
| Duty cycle | 30 - 70 | % |
| Input signal amplitude | 1600 to 3300 | mV, p-p |
| Signal type | Square-wave or sine-wave | - |
| Input impedance | >100k | $\Omega$ |
| | <5 | pF |
| Clock jitter (integrated over 300Hz – 15KHz) | <1 | Hz |

## 7.1 SDIO Pin Description

The WL-211 supports SDIO version 1.2 for both 1-bit (25 Mbps), 4-bit modes (100 Mbps), and high speed 4-bit (50 MHz clocks – 200 Mbps). It has the ability to stop the SDIO clock and map the interrupt signal into a GPIO pin. This 'out-of-band' interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force the control of the gated clocks from within the WLAN chip is also provided.

  ※ Function 0 Standard SDIO function (Max BlockSize / ByteCount = 32B)
  ※ Function 1 Backplane Function to access the internal System On Chip (SOC) address space (Max BlockSize / ByteCount = 64B)
  ※ Function 2 WLAN Function for efficient WLAN packet transfer through DMA (Max BlockSize / ByteCount = 512B)

SDIO Pin Description

| SD 4-Bit Mode | | SD 1-Bit Mode | | SPI Mode | |
|---|---|---|---|---|---|
| DATA0 | Data Line 0 | DATA | Data Line | DO | Data Output |
| DATA1 | Data Line 1 or Interrupt | IRQ | Interrupt | IRQ | Interrupt |
| DATA2 | Data Line 2 or Read Wait | RW | Read Wait | NC | Not Used |
| DATA3 | Data Line 3 | NC | Not Used | CS | Card Select |
| CLK | Clock | CLK | Clock | SCLK | Clock |
| CMD | Command Line | CMD | Command Line | DI | Data Input |

# 8. Host Interface Timing Diagram

## 8.1 Power-up Sequence Timing Diagram
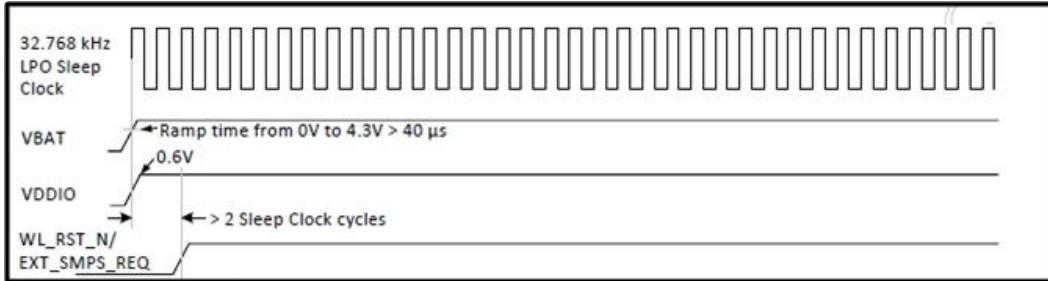


※ WL_RST_N: Low asserting Reset for WLAN Core. This pin must be driven high or low (not left floating).

## 8.2 SDIO Default Mode Timing Diagram
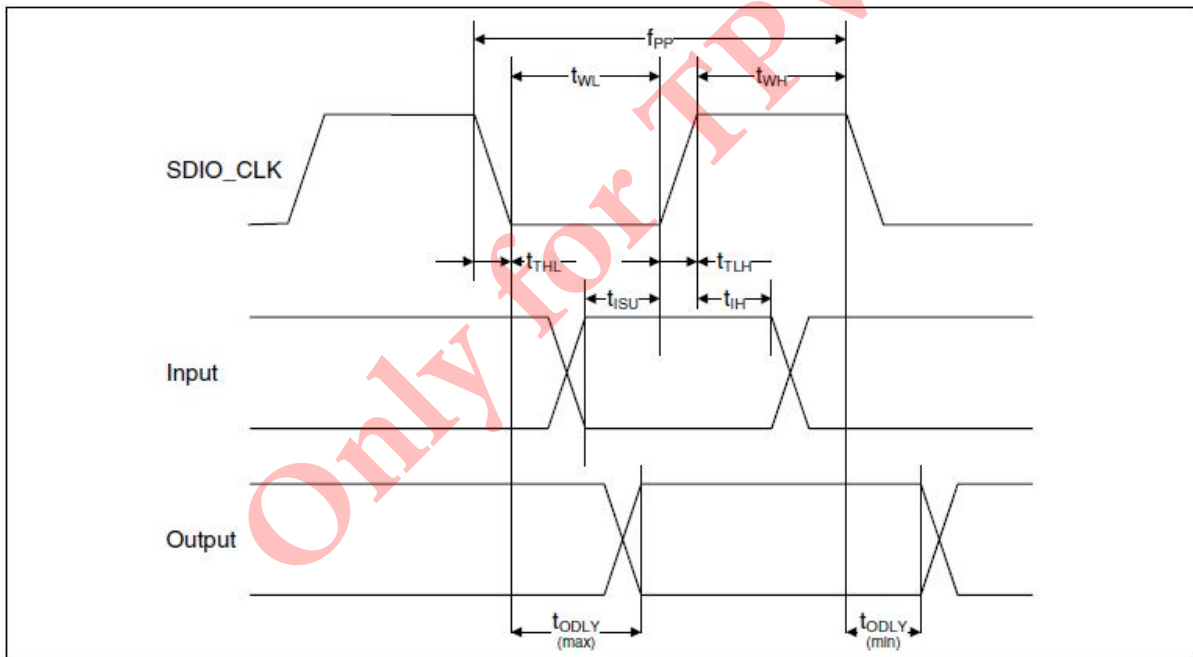


| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **SDIO CLK (All values are refferred to minimum VIH and maximum VIL[b] )** | | | | | |
| Frequency-Data Transfer mode | fPP | 0 | - | 25 | MHz |
| Frequency-Identification mode | fOD | 0 | - | 400 | kHz |
| Clock low time | tWL | 10 | - | - | ns |
| Clock high time | tWH | 10 | - | - | ns |
| Clock rise time | tTLH | - | - | 10 | ns |
| Clock low time | tTHL | - | - | 10 | ns |
| **Inputs: CMD, DAT (referenced to CLK)** | | | | | |
| Input setup time | tISU | 5 | - | - | ns |
| Input hold time | tIH | 5 | - | - | ns |
| **Outputs: CMD, DAT (referenced to CLK)** | | | | | |
| Output delay time – Data Transfer mode | tODLY | 0 | - | 14 | ns |
| Output delay time – Identification mode | tODLY | 0 | - | 50 | ns |

a. Timing is based on CL ≤ 40pF load on CMD and Data.
b. min(Vih) = 0.7 x VDDIO and max(Vil) = 0.2 x VDDIO.

## 8.3 SDIO High Speed Mode Timing Diagram
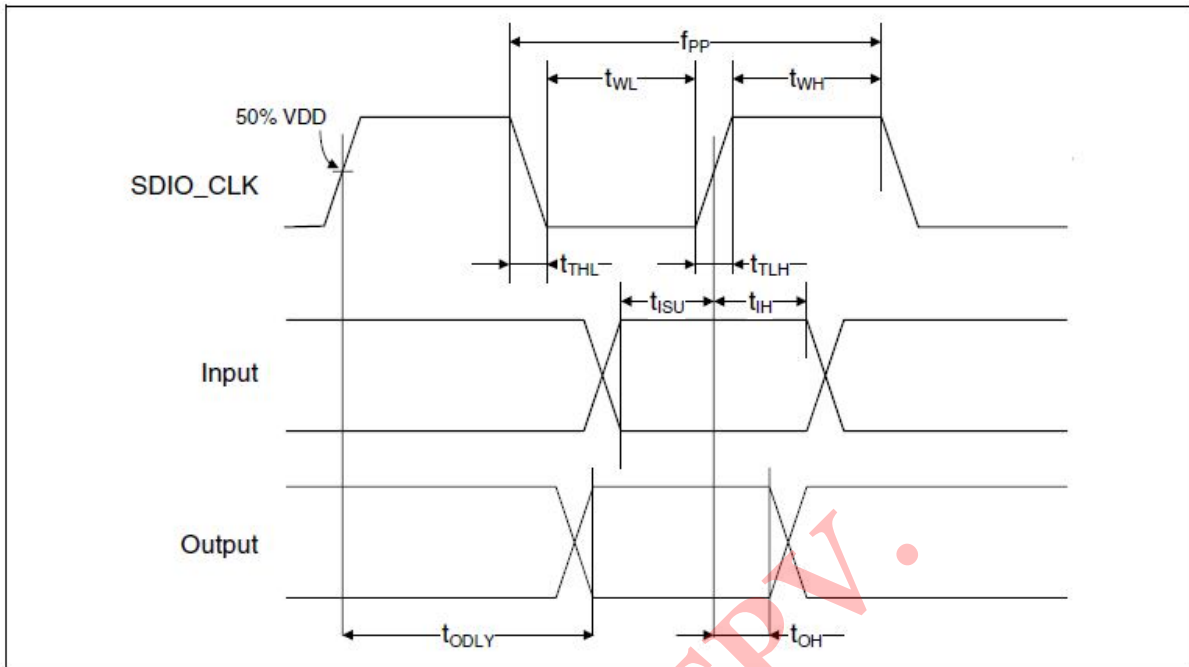


| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **SDIO CLK (All values are refferred to minimum VIH and maximum VIL[b] )** | | | | | |
| Frequency-Data Transfer mode | fPP | 0 | - | 50 | MHz |
| Frequency-Identification mode | fOD | 0 | - | 400 | kHz |
| Clock low time | tWL | 7 | - | - | ns |
| Clock high time | tWH | 7 | - | - | ns |
| Clock rise time | tTLH | - | - | 3 | ns |
| Clock low time | tTHL | - | - | 3 | ns |
| **Inputs: CMD, DAT (referenced to CLK)** | | | | | |
| Input setup time | tISU | 6 | - | - | ns |
| Input hold time | tIH | 2 | - | - | ns |
| **Outputs: CMD, DAT (referenced to CLK)** | | | | | |
| Output delay time – Data Transfer mode | tODLY | - | - | 14 | ns |
| Output hold time | tOH | 2.5 | - | - | ns |
| Total system capacitance (each line) | CL | - | - | 40 | pF |

a. Timing is based on CL ≤ 40pF load on CMD and Data.
b. min(Vih) = 0.7 x VDDIO and max(Vil) = 0.2 x VDDIO.

# 9. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times
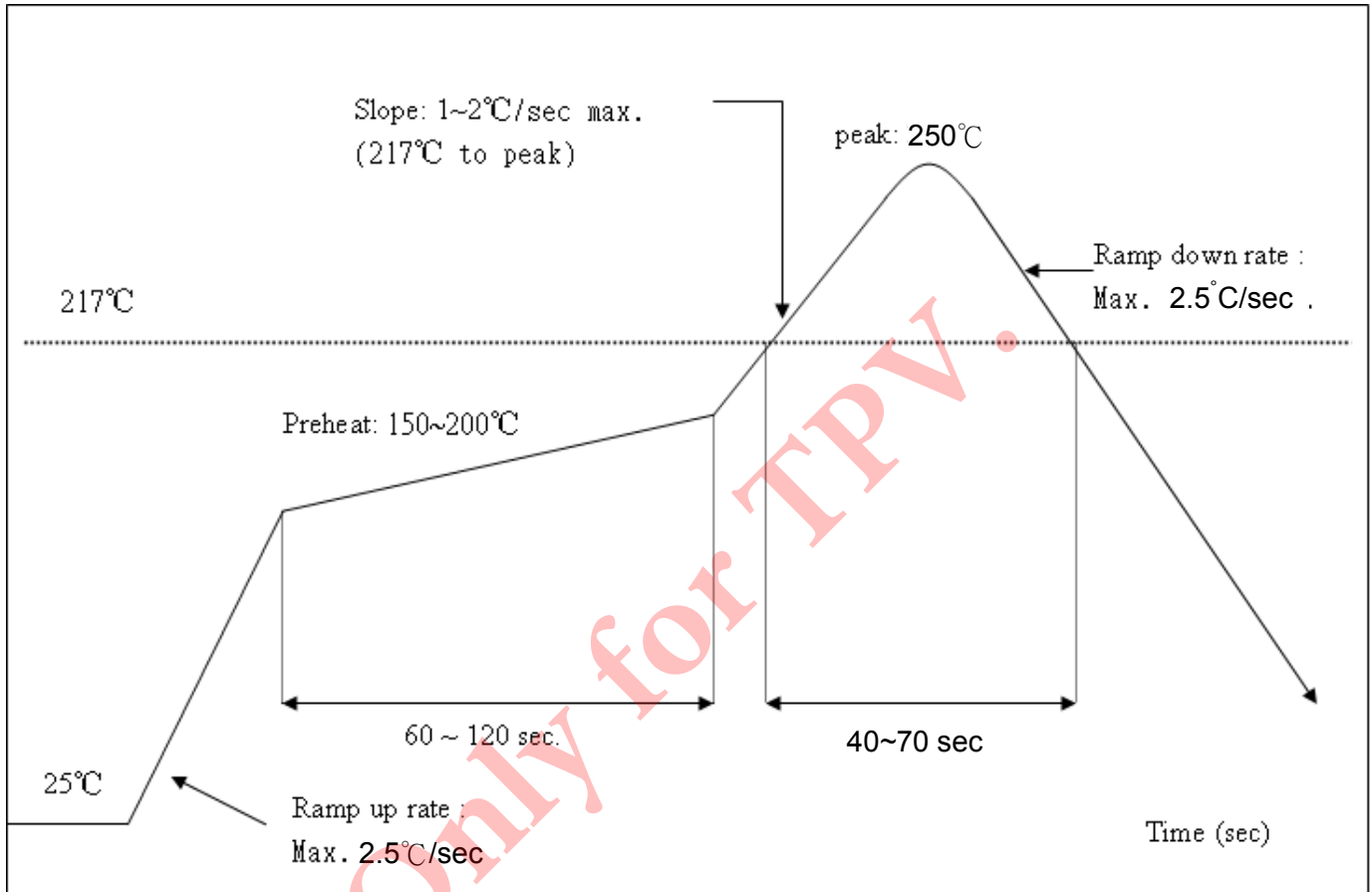
# 10. Packing Information

## 10.1 Label

Label A → Anti-static and humidity notice
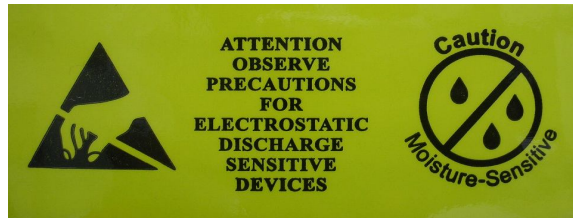


Label B → MSL caution / Storage Condition



Label C → Inner box label .



Label D → Carton box label .

## 10.2 Dimension



1. 10 sprocket hole pitch cumulative tolerance ±0.20.
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481-D requirements.
5. Thickness : 0.30±0.05mm.
6. Packing length per 22" reel : 98.5 Meters.(1:3)
7. Component load per 13" reel : 1500 pcs.

Humidity indicator

Desiccant

B

A

C

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C

50mm

338mm

355mm

D

360mm

285mm

375mm
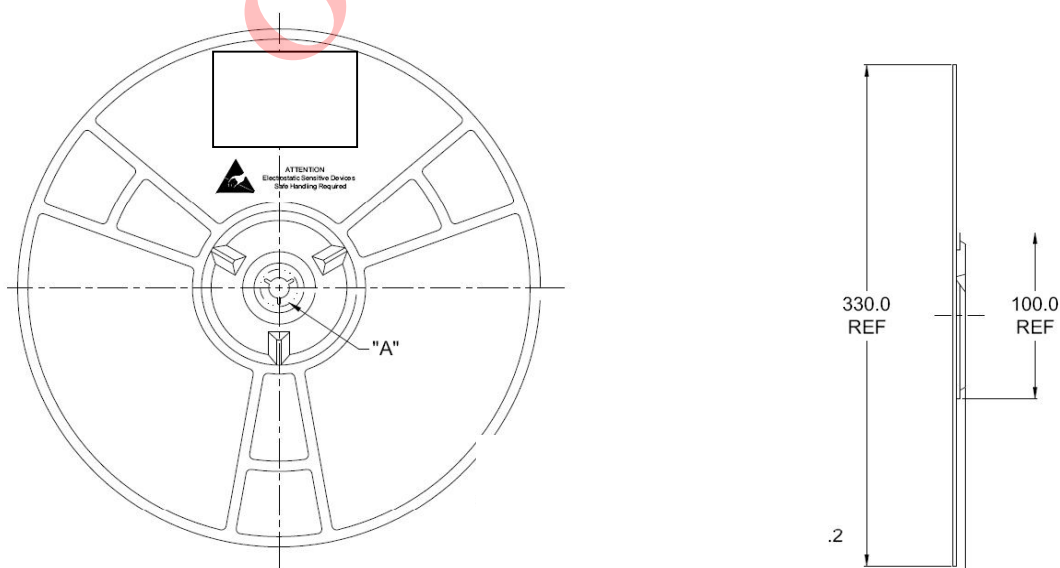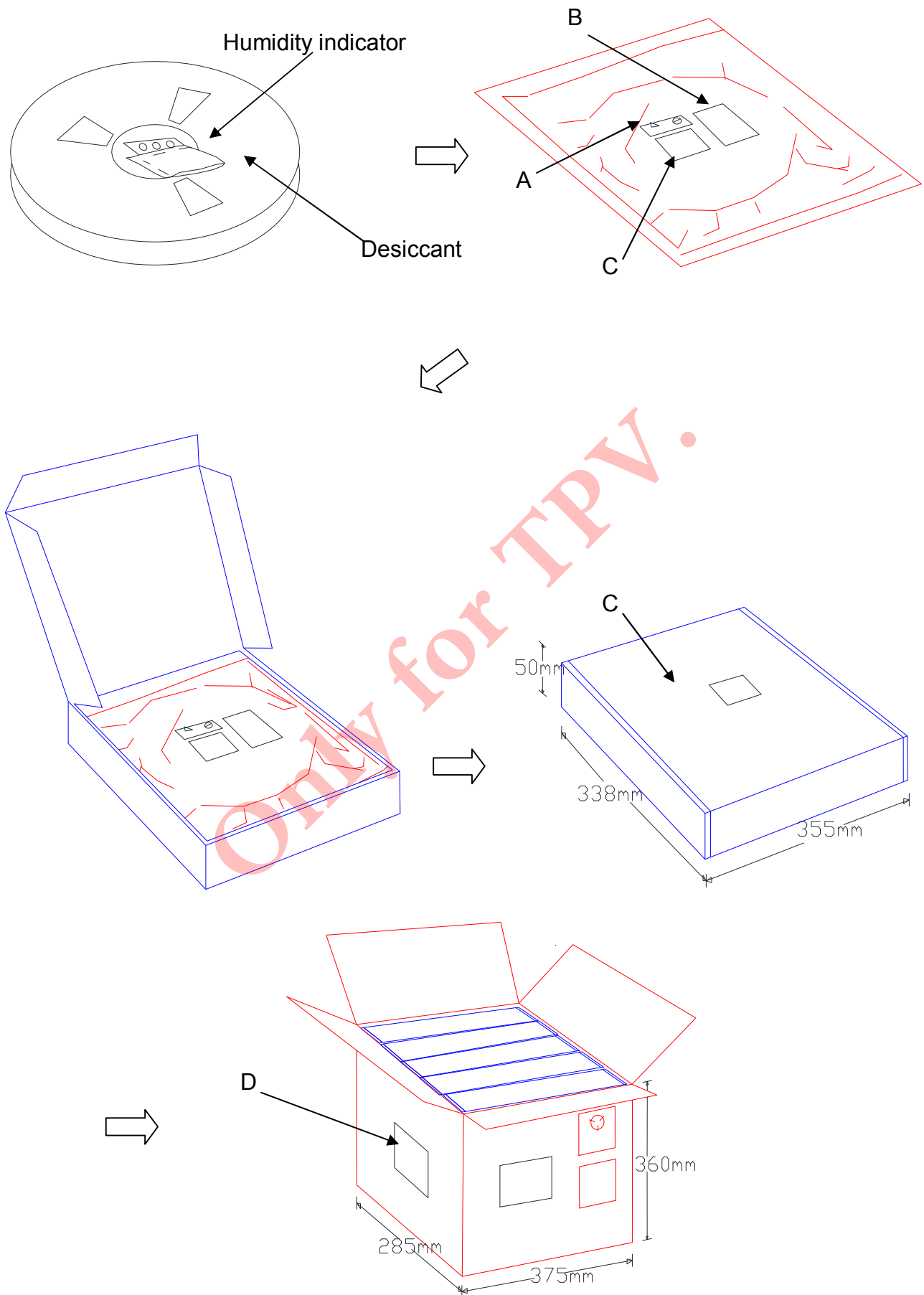
# 10.3 MSL Level / Storage Condition



⚠️ **Caution**
This bag contains
**MOISTURE-SENSITIVE DEVICES**
Do not open except under controlled conditions

**LEVEL 4**

1. Calculated shelf life in sealed bag: 12 months at< 40℃ and < 90% relative humidity(RH)

2. Peak package body temperature: 225℃ ☐ 240℃ ☐ 250℃ ☑ 260℃ ☐

3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
   a) Mounted within: 48 hours of factory conditions <30℃/60% RH, OR
   b) Stored at <10% RH

4. Devices require bake, before mounting, if:
   a) Humidity Indicator Card is>10%when read at 23±5℃
   b) 3a or 3b not met

5. If baking is required, devices may be baked for 24 hours at 125±5℃

   Note : If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: _____ **See-SEAL DATELABEL** _____

Note:Level and body temperature defined by IPC/JEDED J-STD-020

**※NOTE : Accumulated baking time should not exceed 96hrs**

**Federal Communication Commission Interference Statement**

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.

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

**This device is intended only for OEM integrators under the following conditions:**

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **2** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

**IMPORTANT NOTE:** In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End Product Labeling**
**FOR MOBILE DEVICE USAGE (>20cm/low power)**
This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID:Y9E-IAD18002". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

**Manual Information To the End User**
The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.