

# PRODUCT SPECIFICATION

Product Name	S68F LORA Transceiver Module
Version	A
Doc No	901-12401EN
Date	Feb 10, 2020



**AcSIP Technology Corp.**

*A wireless communication SiP Solution Provider*

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## Document History

Date	Revised Contents	Revised By	Version
Feb 10 ,2020	Initial Version	PW	A



## 1. Description

The AcSiP S68F transceiver features the LoRa™ long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

S68F can achieve a sensitivity of over -137dBm using a TCXO and the related bill of materials. The high sensitivity combined with the integrated +22 dBm Max. power amplifier yields industry leading link budget making it optimal for any application requiring range or robustness. LoRa™ also provides significant advantages in both blocking and selectivity over conventional modulation techniques, solving the traditional design compromise between range, interference immunity and energy consumption.

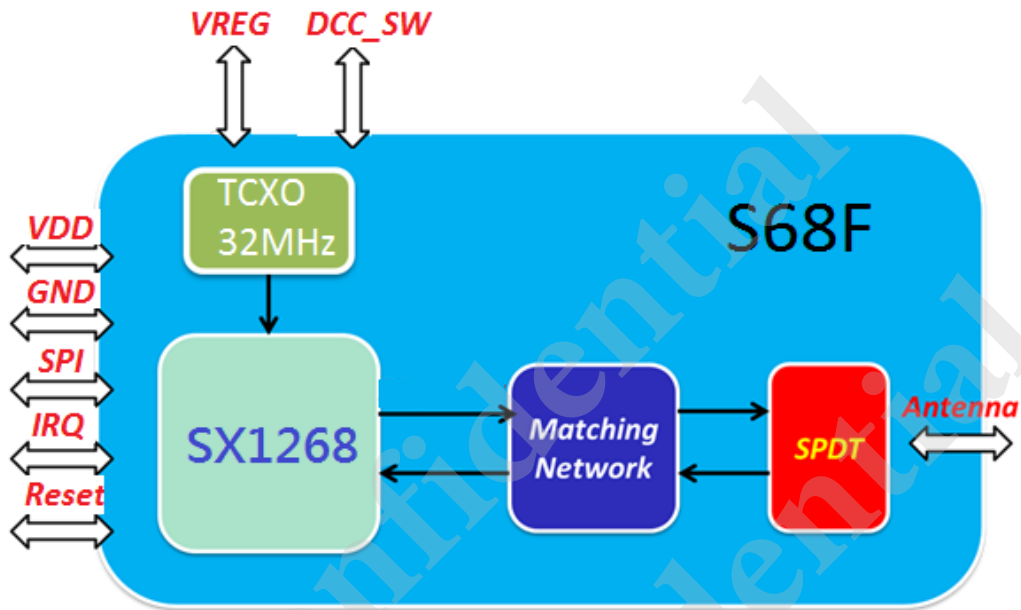
### Feature

- Small footprint : 9 mm x 8 mm x 1.1 mm
- LoRa Transceiver Module , +22 dBm Max. RF output power
- Programmable bit rate up to 62.5 kbps LoRa
- Programmable bit rate up to 150 kbps FSK
- High sensitivity: down to -137 dBm
- Embedded TCXO of 32MHz



### 1-1. Block Diagram

A simplified block diagram of the S68F module is depicted in the figure below.



### 1-2. Product Version

The features of S68F is detailed in the following table

Part Number	Frequency Range	Spreading Factor	Bandwidth	Sensitivity
S68F	433MHz - 510MHz	5 ~ 12	7.8 - 500 kHz	< 137 dBm

### 1-3. Specification

Model Name	S68F
Product Description	LoRa Transceiver Module
Network Standard	Suitable PHY for LoRaWAN
Host Interface	SPI
<b>Operation Conditions</b>	
Temperature	<ul style="list-style-type: none"> <li>■ Storage : -50°C ~ +105°C</li> <li>■ Operating : -40°C ~ +85°C</li> </ul>
Humidity	<ul style="list-style-type: none"> <li>■ Operating : 10 ~ 95% (Non-Condensing)</li> <li>■ Storage : 5 ~ 95% (Non-Condensing)</li> </ul>
Dimension	9 mm x 8 mm x 1.1 mm
Package	LGA type

## 2. Electrical Characteristics

### 2-1. Absolute Maximum Ratings

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD	Supply Voltage	-0.5		3.9	V
Pmr	RF Input Level			+10	dBm

### 2-2. Recommended Operating Range

Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD	Supply Voltage	1.8	3.3	3.7	V
Top	Temperature under bias	-40		85	°C

Note: VDD 3.3V for +22dBm , VDD 2.7 V for +20dBm , VDD 2.4 V for +19dBm

### 2-3. Power Consumption Specification

Symbol	Parameter	Conditions	Typ.	Max.	Unit
IDDSL	Supply current in Sleep mode		0.6	2	μA
IDDST	Supply current in Standby mode	XOSC ON	0.8		mA
IDDFS	Supply current in Synthesizer mode	FSRx	3.55		mA
IDDR	Supply current in Receive mode	RX Bootsted	10.1		mA
IDDT	Supply current in Transmit mode	+ 22 dBm	TBD		mA
		+ 20 dBm	105		
		+ 17 dBm	93		

## 2-4. RF Characteristics

### 2-4-1. Electrical Specifications

The electrical specifications are given with the following conditions unless otherwise specified:

- VDD = 3.3 V
- Temperature = 25 °C
- FRF = 433/510 MHz
- All RF impedances matched
- Transmit mode output power defined into a 50 ohmload impedance
- FSK BER = 0.1%, 2-level FSK modulation without pre-filtering, BR = 4.8 kb/s, FDA = ± 5 kHz, BW\_F = 20 kHz double-sided
- LoRa® PER = 1%, packet 64 bytes, preamble 8 symbols, CR = 4/5, CRC on payload enabled
- RX/TX specifications given using default RX gain step and direct tie connection between Rx and Tx

### 2-4-2. Receive Mode Specifications

Symbol	Description	Conditions	Min	Typ	Max	Unit
RXS_2FB	Sensitivity 2-FSK, RX Boosted gain, split RF paths for Rx and Tx, RF switch insertion loss excluded	BR_F = 0.6 kb/s, FDA = 0.8 kHz, BW_F = 4 kHz		-125		dBm
		BR_F = 1.2 kb/s, FDA = 5 kHz, BW_F = 20 kHz		-123		dBm
		BR_F = 4.8 kb/s, FDA = 5 kHz, BW_F = 20 kHz		-118		dBm
		BR_F = 38.4 kb/s, FDA = 40 kHz, BW_F = 160 kHz		-109		dBm
		BR_F = 250 kb/s, FDA = 125 kHz, BW_F = 500 kHz		-104		dBm
RXS_LB	Sensitivity LoRa, Rx Boosted gain, , split RF paths for Rx and Tx, RF switch insertion loss excluded	BW_L = 10.4 kHz, SF = 7		-134		dBm
		BW_L = 10.4 kHz, SF = 12		-148		dBm
		BW_L = 125 kHz, SF = 7		-124		dBm
		BW_L = 125 kHz, SF = 12		-137		dBm
		BW_L = 250 kHz, SF = 7		-121		dBm
		BW_L = 250 kHz, SF = 12		-134		dBm
		BW_L = 500 kHz, SF = 12		-117		dBm
CCR_F	Co-channel rejection, FSK			-9		dB
CCR_L	Co-channel rejection, LoRa	SF = 7		5		dB
		SF = 12		19		dB

Symbol	Description	Conditions	Min	Typ	Max	Unit
BI_F	Blocking immunity, FSK	BR_F = 4.8 kb/s, FDA = 5 kHz, BW_F = 20 kHz Offset = +/- 1 MHz Offset = +/- 2 MHz Offset = +/- 10 MHz		- 68 70 80		dB dB dB
BI_L	Blocking immunity, LoRa	BR_F = 4.8 kb/s, FDA = 5 kHz, BW_F = 20 kHz Offset = +/- 1 MHz Offset = +/- 2 MHz Offset = +/- 10 MHz		88 90 99		dB dB dB
FERR_L	Maximum tolerated frequency offset between transmitter and receiver, no sensitivity degradation, SF5 to SF12	All bandwidths, ±25% of BW		± 25%		BW
FERR_L	Maximum tolerated frequency offset between transmitter and receiver, no sensitivity degradation, SF10 to SF12	SF12 SF11 SF10	-50 -100 -200		-50 -100 -200	ppm ppm ppm

### 2-4-3. Transmit Mode Specifications

Symbol	Description	Conditions	Min	Typ	Max	Unit
TXOP	Maximum RF output	Highest power step setting		+21	+22	dBm
TXDRP	RF output power drop versus supply voltage	SX1262, +22 dBm, VBAT = 2.7 V		2		dBm
		SX1262, +22 dBm, VBAT = 2.4		3		dBm
		SX1262, +22 dBm, VBAT = 1.8 V		6		dBm
TXPRNG	RF output power range	Programmable in 31 step	TXOP-3		TXOP	dBm
TXACC	RF output power step			± 2		dB
TXRMP	Power amplifier ramping	Programmable	10		3400	µs
TS_TX	Tx wake-up time	Frequency Synthesizer enabled		36 + PA ramping		µs

**2-4-4. Digital Specification**

Symbol	Description	Conditions	Min	Typ	Max	Unit
V <sub>IH</sub>	Input High Voltage		0.7*VDD		VDD+0.3	V
V <sub>IL</sub>	Input Low Voltage		-0.3		0.3*VDD	V
V <sub>IL-N</sub>	Input Low Voltage for pin		-0.3		0.2*VDD	V
V <sub>OH</sub>	Output High Voltage	I <sub>max</sub> = -2.5 mA	0.9*VDD		VDD	V
V <sub>OL</sub>	Digital output level low	I <sub>max</sub> = 2.5 mA	0		0.1*VDD	V
I <sub>leak</sub>	Digital input leakage current (NSS, MOSI, SCK)				1	μA

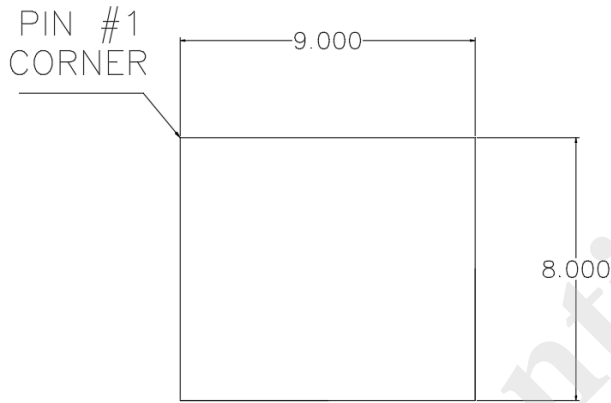




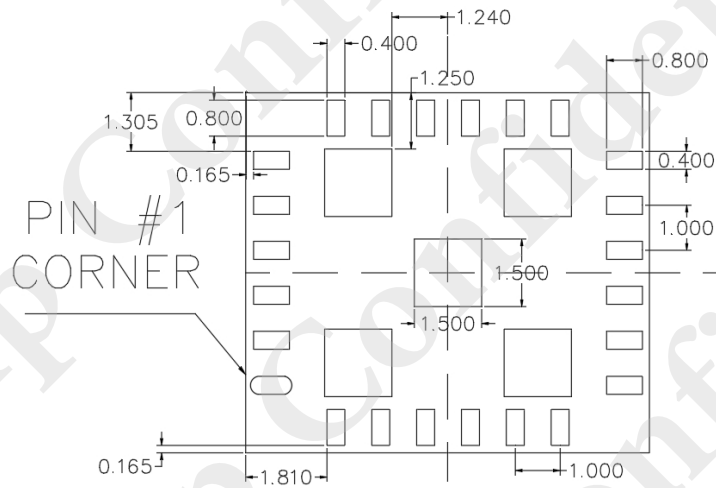


Pin	Definition	I/O	Description
1	GND	-	Ground
2	VREG	I	Regulated voltage from the internal DC-DC
3	DCC_SW	O	DC-DC Switcher Output
4	VDD	I	Power supply
5	DIO1	I/O	Multi-purpose digital IO
6	BUSY	O	Busy indicator
7	NRST	I	Reset signal, active low
8	DIO2 /RF_Switch_Control	I/O	Multi-purpose digital I/O / RF Switch control
9	MISO	O	SPI slave output
10	MOSI	I	SPI slave input
11	SCK	I	SPI clock
12	NSS	I	SPI Slave Select
13	RF_VC1	I	DC control voltage / Active "H" Receiver
14	GND	-	Ground
15	RF_ANT	I/O	RF Input / Output
16	GND	-	Ground
17	RF_VC2	I	DC control voltage / Active "H" Transceiver
18	GND	-	Ground
19	GND	-	Ground
20	GND	-	Ground
21	GND	-	Ground
22	GND	-	Ground
23	GND	-	Ground
24	GND	-	Ground
25~29	EGND	-	Ground

**3-2. Mechanical Dimension**



**Top View**



**Bottom View**

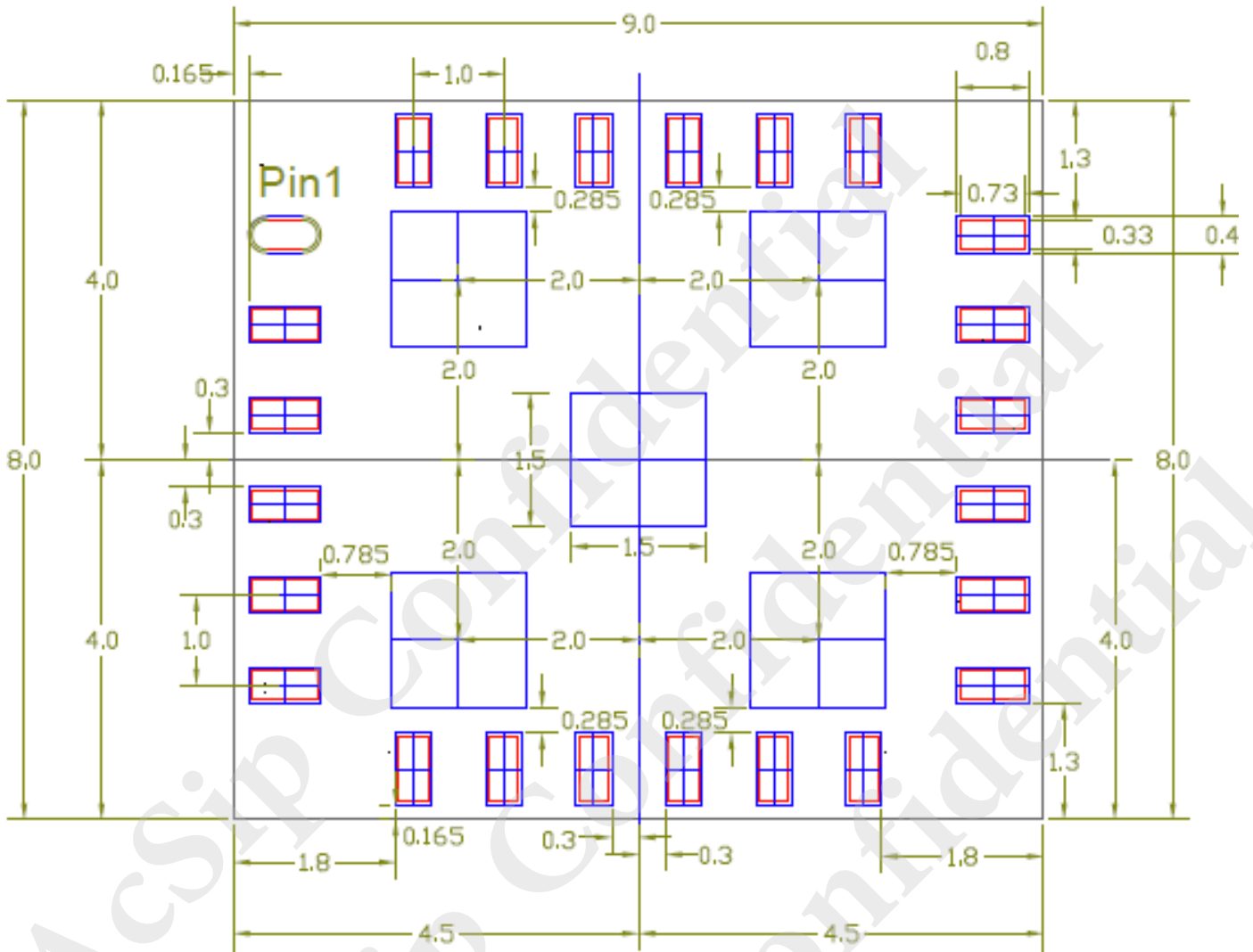


**Side View**

Unit: mm



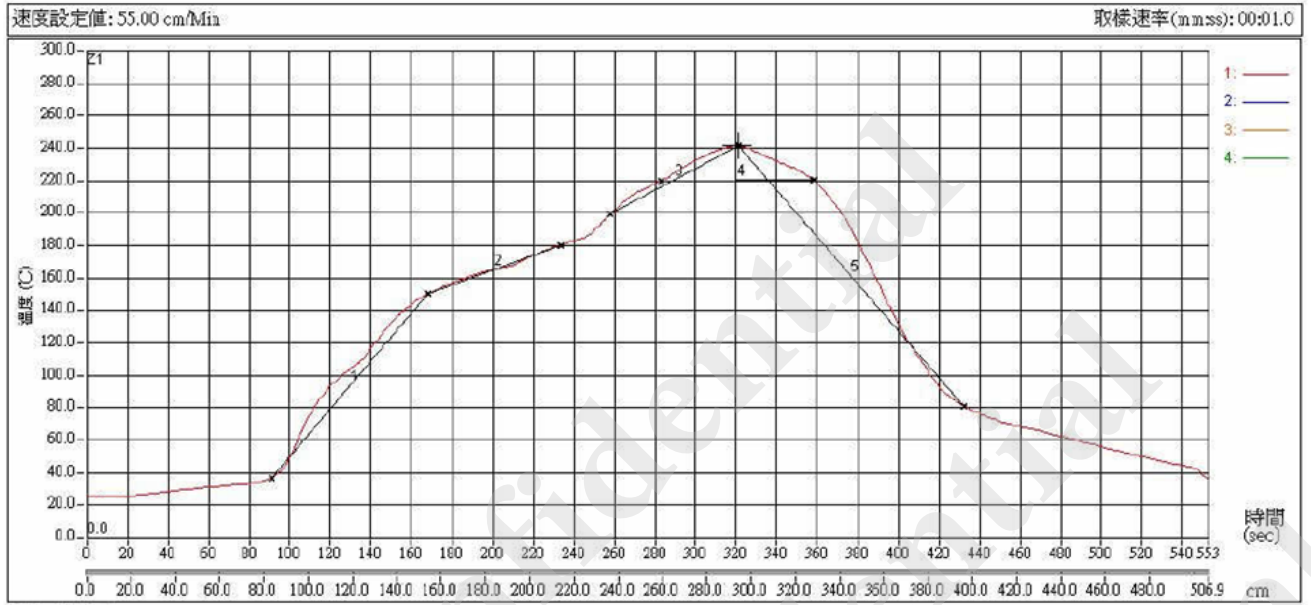
**3-3 Recommended Footprint**



Unit: mm



## 4. Recommended Reflow Profile



~ 150 °C < 2 °C/s	150 ~ 180 °C 55 ~ 65 sec	200°C ~ peak < 1 °C/s	above 220°C 65 ~ 75 sec	Peak Temp. 235~245 °C
1.47	65	0.66	75	241.5

## 5. Module Preparation

### 5-1. Handling

Handling the module, operator must wear the anti-static wrist strap to avoid ESD damage. After each module was aligned and tested, it should be transported and stored with anti-static tray and packing. This protective package must be remained in the suitable environment until the module is assembled and soldered onto the main board.

Base on reliability test result, Module passed MSL3 criterion.

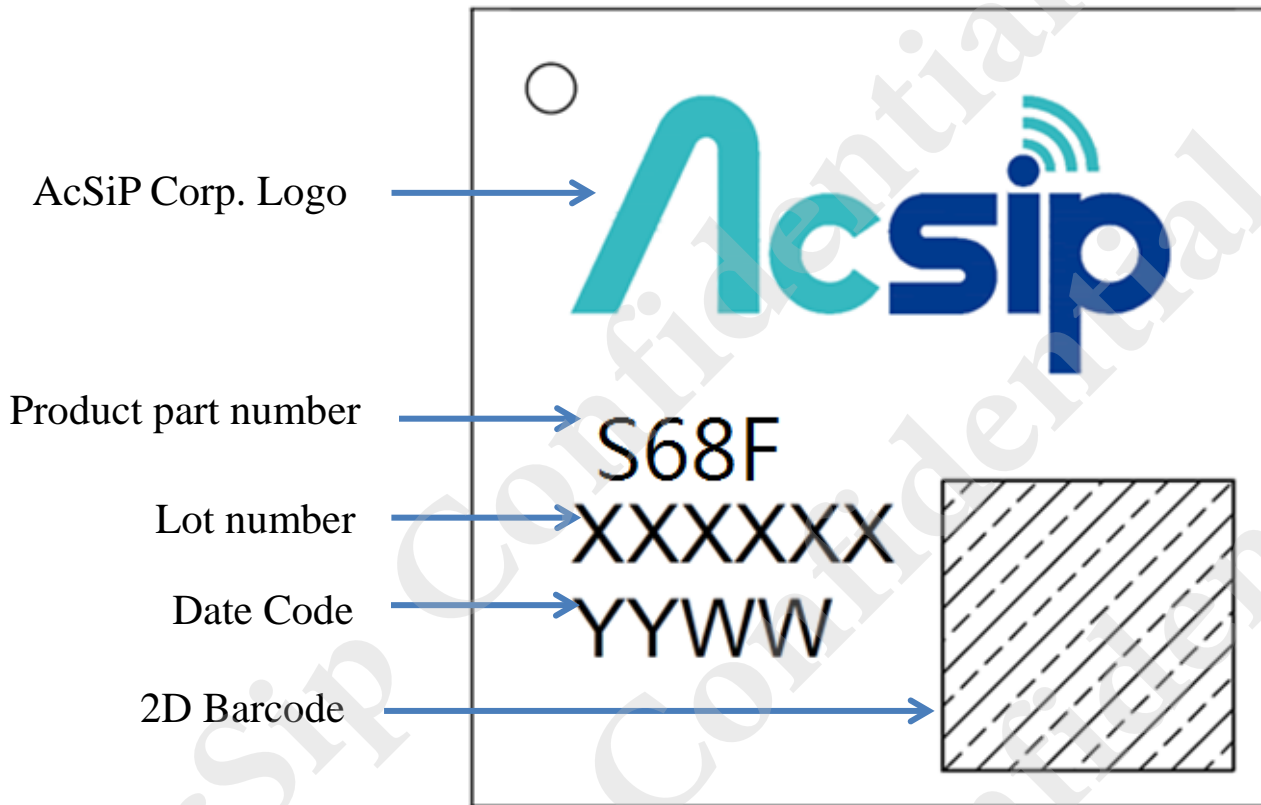
### 5-2. SMT Preparation

1. Calculated shelf life in sealed bag: 6 months at <40 degree and <90% relative humidity (RH).
2. Peak package body temperature: 250 degree.
3. After bag was opened, devices that will be subjected to reflow solder or other high temperature process must be
  - A. Mounted within: 168 hours of factory conditions <30 degree / 60% RH.
  - B. Stored at  $\leq 10\%$  RH with N2 flow box.
4. Devices require baking, before mounting process, if:
  - A. Package bag does not be kept in vacuumed while first time opening.
  - B. Humidity Indicator Card is >10% when read at  $23 \pm 5$  degree.
  - C. Exposed at 3A condition over 8 hours or Exposed at 3B condition over 24 hours.
5. If baking is required, devices should be baked for 12 hours at  $125 \pm 5$  degree.



## 6. Package Information

### 6-1 Product Marking









### 6-3 Packing Information

第一聯方向  
Part orientation

承載盤  
Tray

斜角  
Chamfer

產品與盤子之方向關係  
TFBGA and tray orientation.

Tray 標籤排列由大到小  
Tray label order of rank from big to small

打包裝帶  
Packing Band

抗靜電泡棉  
Extra anti-static foam

打包裝帶  
Packing Band

使用抗靜電泡棉包裹承載盤角處,再以打包裝帶固定。  
Add extra anti-static foam cushioning at the corners and fit by packing band.

溫度卡  
Humidity Card

2包乾燥包  
2 Desiccant

封口  
Seal line

內箱  
Inner Box

標籤 A  
Label A

抗靜電袋  
Anti-static aluminum foil bag

斜角  
CHAMFER

將承載盤與1張溫度指示卡與2包乾燥劑與產品進入抗靜電鋁箔袋中。  
Put 1 humidity card and 2 desiccant and tray into anti-static aluminum foil bag.

將已真空包裝產品貼上標籤A,再以氣泡袋包裹後放入內箱內。  
Paste label A and ESD symbol on the Anti-static aluminum foil bag. Put packed product with bubble cushion into inner box.

內箱標籤A  
Inner Label A

週期碼標籤F  
Weekly code Label F

膠帶  
Tape

封箱貼紙  
Seal Tag

注意:  
NOTE:

- 不是整數箱部份,需派人填充物避免碰撞損壞。  
Squeeze Fillings Into The Unfilled Space Of The Inner Box And Carton To Void The Collision And Damage.
- 二條打包裝帶應打於盤上之凹槽處。(Tray 標籤排列由大到小)  
Packing Band Shall Be Packed On The Dint Of Tray (Tray label order of rank from big to small)
- 真空包裝完需平放靜待30分鐘  
Vacuum packing finished be flat and wait 30 minutes

封箱貼紙外黏透明膠帶和貼上標籤。  
Adhere labels and tape as shown.

封箱貼紙(上/下)  
seal Tape (Top/Bottom)

外箱標籤C  
Shipping label C

外箱標籤G  
Shipping label G

外箱標籤B  
Shipping label B

重量標籤  
Weight Label

週期碼標籤F  
Weekly code Label F

週期碼標籤F  
Weekly code Label F

膠帶  
Tape

外箱貼透明膠帶和貼上標籤。  
Adhere labels and tape as shown.

外箱選擇依實際數量四盒或六盒裝  
Carton selected according to the actual number of four boxes or six boxes.

REVISION HISTORY			
REV	DESCRIPTION	RELEASED BY	DATE
1	Original	Josh	2014/12/10

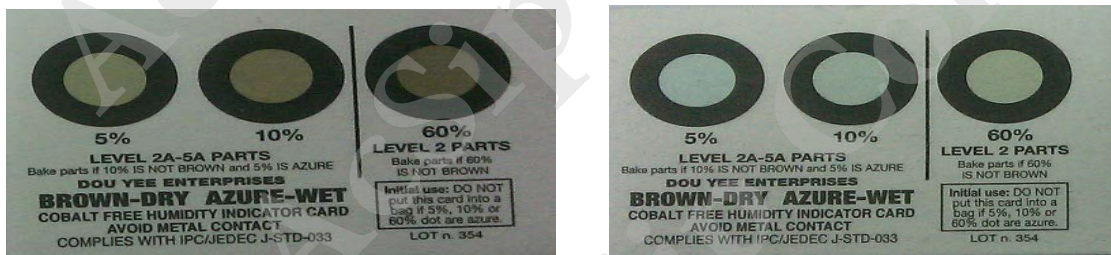
  

PROJECTION			
DIMENSIONING UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MM ALL PROJECTIONS ARE THIRD ORDER. TOLERANCES: LINEAR X.X = ±0.1 X.XX = ±0.05 X.XXX = ±0.02 ANGULAR ±1°	APPROVALS	SIGN	DATE
	DRAWING	Josh	2014/12/10
	CHECKED	Kidd	2014/12/10
	APPROVED	Jackson	2014/12/10
CUSTOMER			

HEADQUARTER 3F-1, No207, Fusing Rd, Taoyuan City, Taoyuan Country, 330, TAIWAN, R.O.C. TEL:886-3-2868388 FAX:886-3-3475000	207 3 TEL:(03)-2868388 FAX:(03)-3475000
CUSTOMER DRAWING NO.	
TITLE PACKING SPEC. PACKING FOR M214	
DWG. NO.: M214 PKG	REV 01
SIZE: A4	SCALE: N/A
SHEET 1 of 1	

### 6-4 Humidity Indicator Card



Dry

Wet

Indicates :

5%, 10%, 60% relative humidity

Color Change :

Brown (Dry) → Blue (Wet)