

PRODUCT SPECIFICATION

Product Name	S62F LoRa Transceiver Module
Version	D
Doc No	901-12301
Date	2021/01/25



AcSiP Technology Corp.

www.acsip.com.tw

Document History

Date	Revised Contents	Revised By	Version
2020/01/17	Initial Version	PW	A
2020/03/24	Update supply current in Transmit mode	PW	B
2020/06/04	Update SiP and Tray Dimension	PW	C
2021/01/25	Modify electrical characteristics, block diagrams and mechanical dimensions	Kenny	D

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1. Description

The AcSiP S62F transceiver features the LoRa™ long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

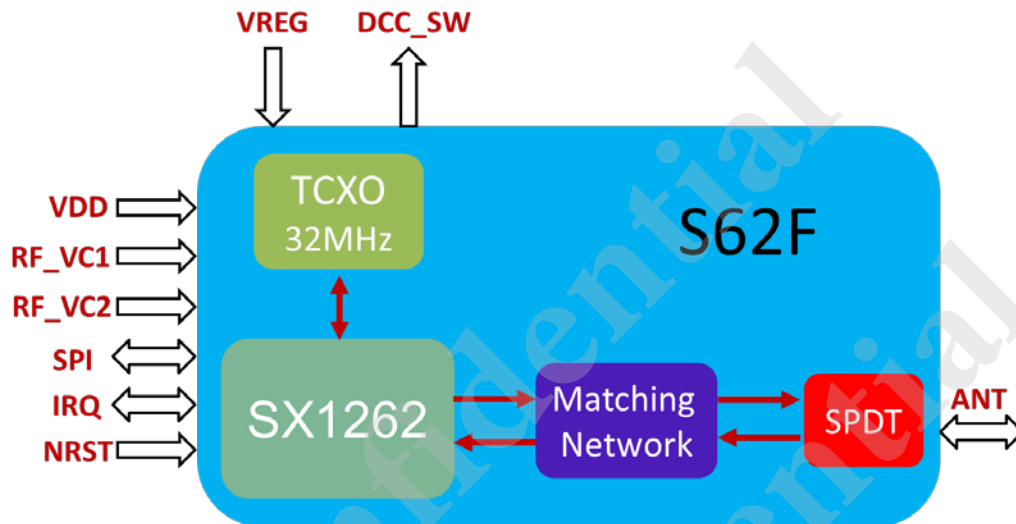
S62F can achieve a sensitivity of over -137dBm using a TCXO and the related bill of materials. The high sensitivity combined with the integrated +22 dBm(max.) power amplifier yields an industry-leading link budget making it optimal for any application requiring range or robustness. LoRa™ also provides 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 size : 9 mm x 8 mm x 1.26 mm (Typ.)
- LoRa Transceiver Module, +22 dBm Max. RF output power
- Programmable bit rate up to 62.5 kbps LoRa
- Programmable bit rate up to 300 kbps FSK
- High sensitivity: down to -137 dBm (@BW=125KHz, SF=12)
- Embedded TCXO of 32MHz

1-1. Block Diagram

A simplified block diagram of the S62F module is depicted in the figure below.



1-2. Product Version

Part Number	Frequency Range	Spreading Factor	Bandwidth	Sensitivity (dBm)
S62F	865MHz - 928MHz	5 - 12	7.8 - 500 kHz	- 137 @125KHz, SF12

1-3. Specification

Technical Specifications	
Model Name	S62F
Product Description	LoRa Transceiver Module
Network Standard	Suitable PHY for LoRaWAN
Host Interface	SPI
Operation Conditions	
Temperature	<ul style="list-style-type: none"> Storage : -50°C ~ +125°C Operating : -40°C ~ +85°C Low TX Duty cycle^(*Note) : -40°C ~ +95°C
Humidity	<ul style="list-style-type: none"> Operating : 10 ~ 95% (Non-Condensing) Storage : 5 ~ 95% (Non-Condensing)
Dimension	9 mm x 8 mm x 1.26 mm (Typ.)
Package	LGA type

*Note: Low power dissipation means low TX duty cycle and low GPIO driving and sinking current.

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		0.57	0.7	μA
IDDSBR	Supply current in Standby RC mode	TCXO OFF	0.56		mA
IDDSBT	Supply current in Standby XOSC mode	TCXO ON	1.96		mA
IDDR	Supply current in Receive mode	RX Boosted LoRa 125kHz	5.6		mA
IDDT	Supply current in Transmit mode with impedance matching	RF SetPW = + 22 dBm RF SetPW = + 20 dBm RF SetPW = + 17 dBm RF SetPW = + 14 dBm	117 103 90 80	121 107 95 86	mA

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 = 868/915 MHz
- All RF impedances matched
- Transmit mode output power defined into a 50 ohm load 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 = 0.6 kb/s, FDA = 0.8 kHz, BW = 4 kHz BR = 1.2 kb/s, FDA = 5 kHz, BW = 20 kHz BR = 4.8 kb/s, FDA = 5 kHz, BW = 20 kHz BR = 38.4 kb/s, FDA = 40 kHz, BW = 160 kHz BR = 250 kb/s, FDA = 125 kHz, BW = 500 kHz		-125 -123 -118 -109 -104		dBm
RXS_LB	Sensitivity LoRa, Rx Boosted gain, split RF paths for Rx and Tx, RF switch insertion loss excluded	BW = 125 kHz, SF = 7 BW = 125 kHz, SF = 12 BW = 250 kHz, SF = 7 BW = 250 kHz, SF = 12 BW = 500 kHz, SF = 7 BW = 500 kHz, SF = 12		-124 -137 -121 -134 -117 -129		dBm
CCR_F	Co-channel rejection, FSK			-9		dB
CCR_L	Co-channel rejection, LoRa	SF = 7 SF = 12		5 19		dB
ACR_F	Adjacent channel rejection, FSK	Offset = ± 50 kHz		45		dB
ACR_L	Adjacent channel rejection, LoRa	Offset = $\pm 1.5 \times BW$, BW = 125 kHz, SF = 7 BW = 125 kHz, SF = 12		60 72		dB

Symbol	Description	Conditions	Min	Typ	Max	Unit
BI_F	Blocking immunity, FSK	BR = 4.8 kb/s, FDA = 5 kHz, BW = 20 kHz Offset = +/- 1 MHz Offset = +/- 2 MHz Offset = +/- 10 MHz		68 70 80		dB
BI_L	Blocking immunity, LoRa	BW = 125 kHz, SF = 12 Offset = +/- 1 MHz Offset = +/- 2 MHz Offset = +/- 10 MHz		88 90 99		dB
FERR_L	Maximum tolerated frequency offset between transmitter and receiver, no sensitivity degradation, SF5 to SF12	All bandwidths, $\pm 25\%$ of BW The tighter limit applies (see below)		$\pm 25\%$		BW
	Maximum tolerated frequency offset between transmitter and receiver, no sensitivity degradation, SF10 to SF12	SF12 SF11 SF10	-50 -100 -200		50 100 200	ppm

2-4.3. Transmit Mode Specifications

Symbol	Description	Conditions	Min	Typ	Max	Unit
TXOP	Maximum RF output power	Highest power step setting		+21	+22	dBm
TXDRP	RF output power drop versus supply voltage	+22 dBm, VDD = 2.7 V +22 dBm, VDD = 2.4 V +22 dBm, VDD = 1.8 V		2 3 6		dB
TXPRNG	RF output power range	Programmable in 31 steps, typical value	TXOP-31		TXOP	dBm
TXACC	RF output power step accuracy			± 2		dB
TXRMP	Power amplifier ramping time	Programmable	10		3400	μ s
TS_TX	Tx wake-up time	Frequency Synthesizer enabled @SF = 7		* 5 + PA ramping		ms

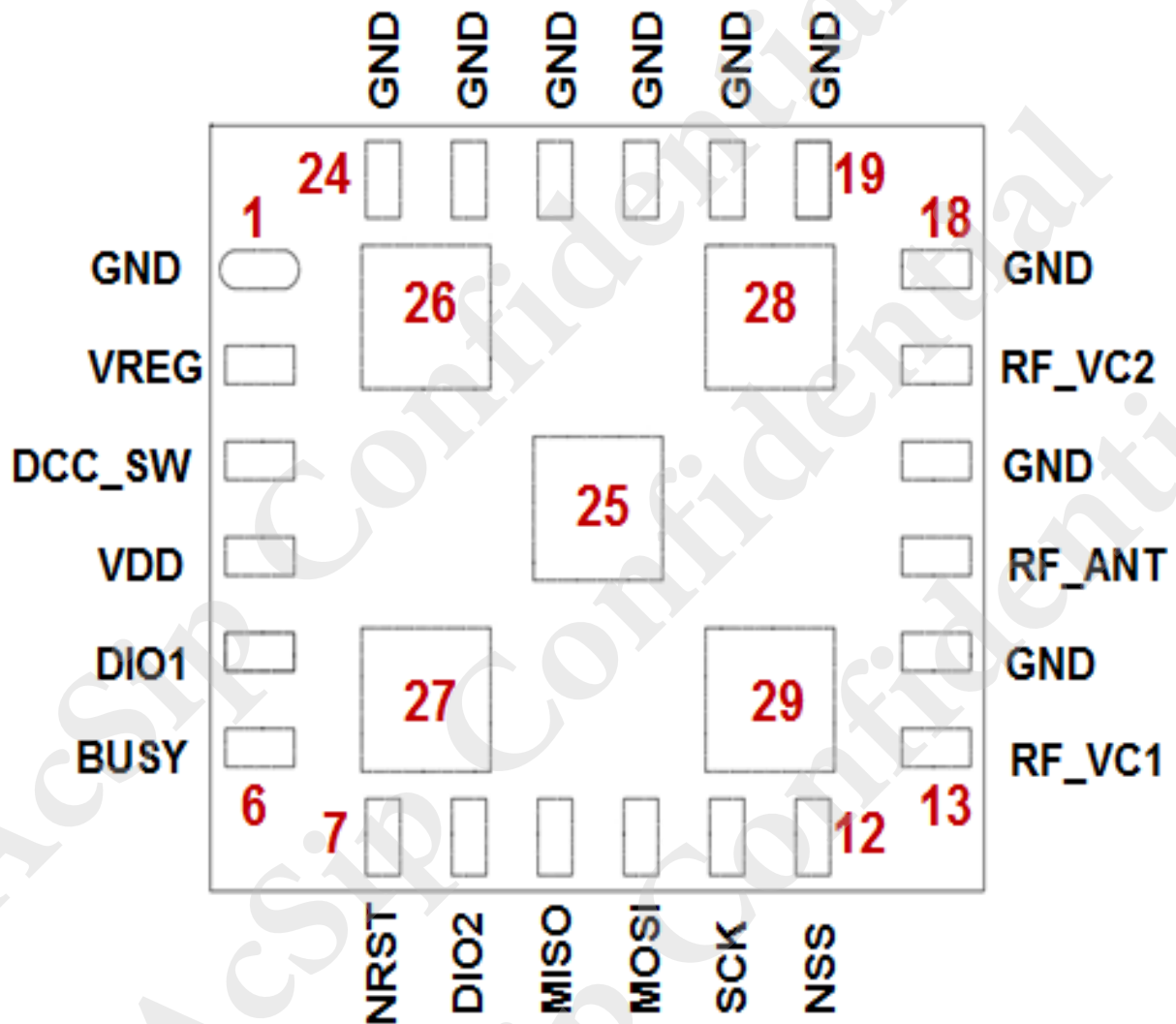
* (5ms + PA ramping) is verified under the condition of SF=7, the length of time will be fine-tuned by different SF conditions

2-4.4. Digital Specification

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

3. Pin Definition

3-1. Pin Description

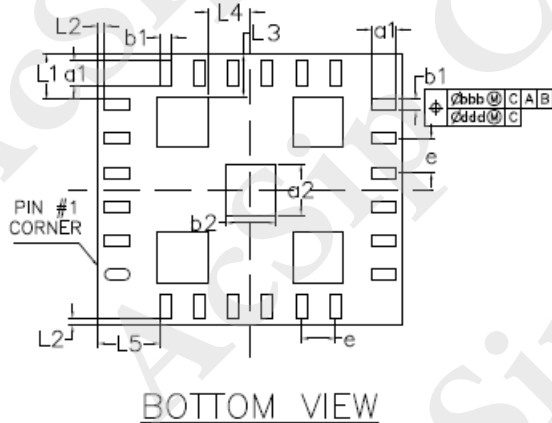
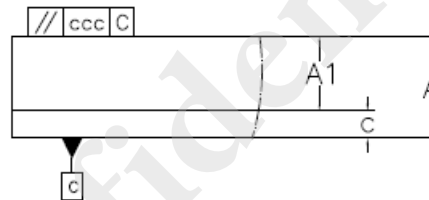
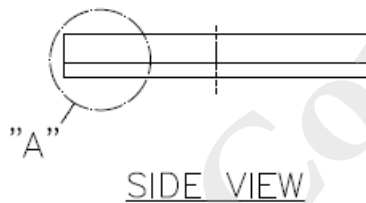
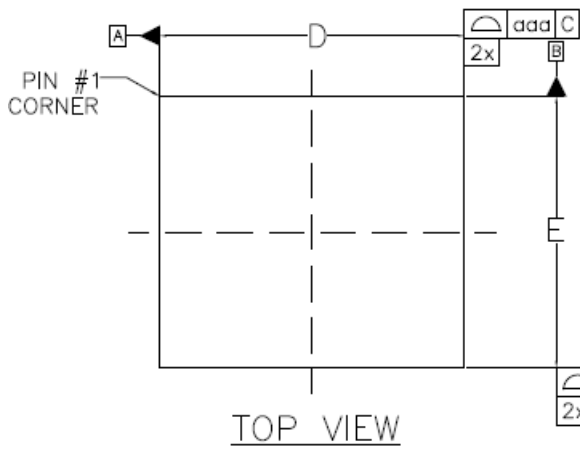


Top_View

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	I/O	* Multi-purpose digital IO / 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	RF Switch control / Active "H" Receiver
14	GND	-	Ground
15	RF_ANT	I/O	RF Input / Output
16	GND	-	Ground
17	RF_VC2	I	RF Switch control / 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

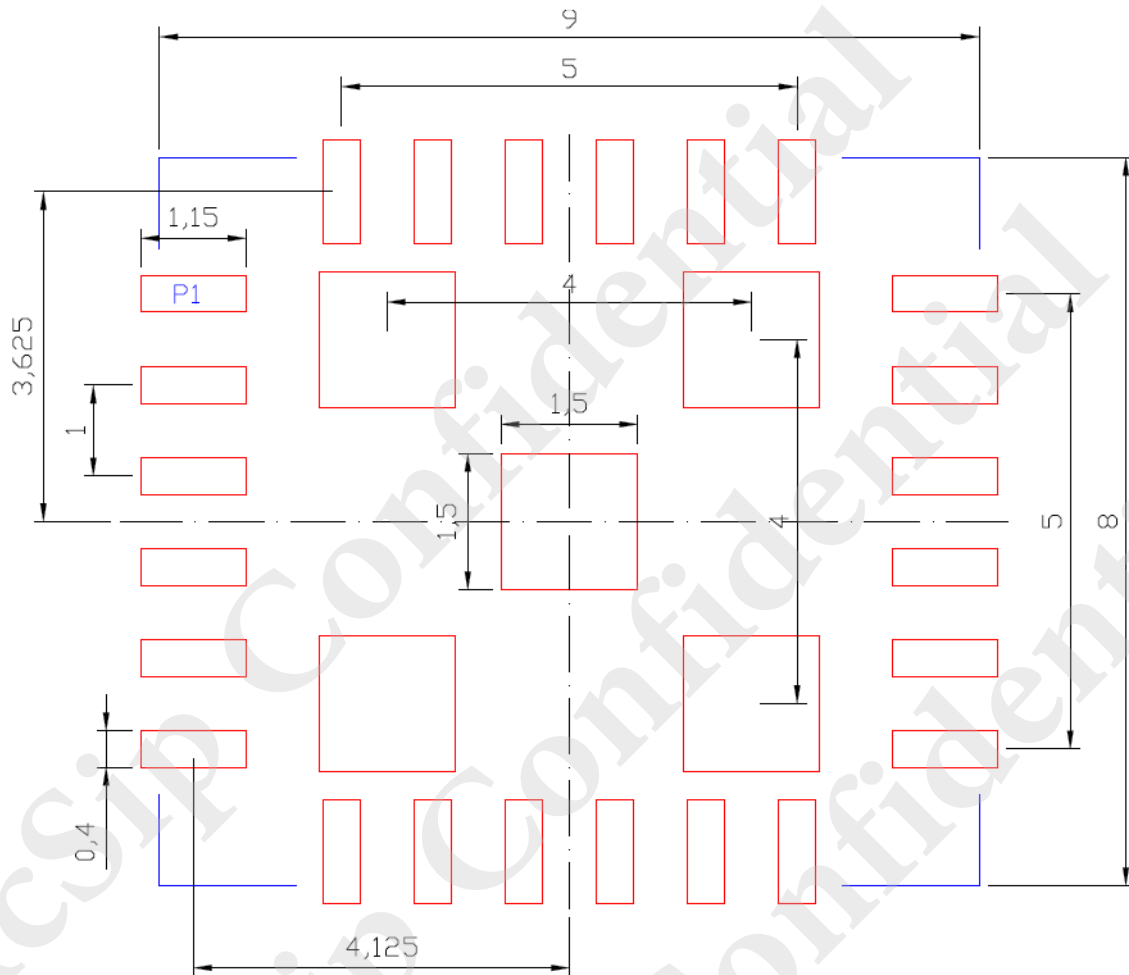
*DIO2 has a double functionality. As DIO2 can be used as a generic IRQ line and any IRQ can be routed through this pin. Also, DIO2 can be configured to drive an RF switch through the use of the command `SetDio2AsRfSwitchCtrl(...)`. In this mode, DIO2 will be at a logical 1 during Tx and at a logical 0 in any other mode.

3-2. Mechanical Dimension



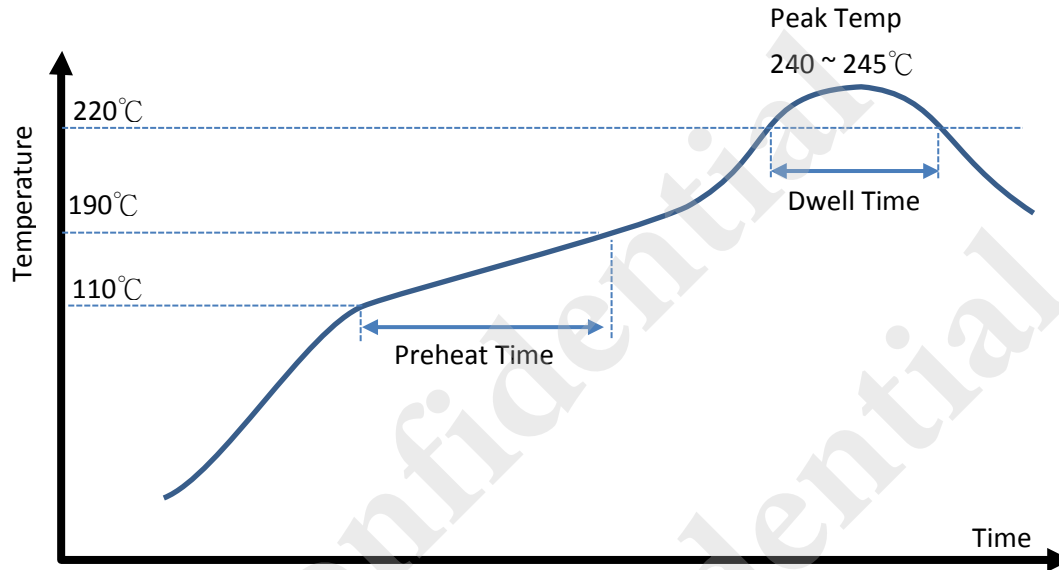
Symbol	Dimension in mm		
	MIN	NOM	MAX
A	1.19	1.26	1.31
c	0.36	0.41	0.44
A1	0.83	0.85	0.87
D	8.90	9.00	9.10
E	7.90	8.00	8.10
a1	0.73		
b1	0.33		
a2	1.50		
b2	1.50		
e	1.00		
L1	1.335		
L2	0.20		
L3	1.25		
L4	1.25		
L5	1.835		
aaa	0.15 BSC		
bbb	0.10 BSC		
ccc	0.10 BSC		
ddd	0.05 BSC		

3-3. Recommended Footprint



Unit: mm

4. Recommended Reflow Profile



Preheat time	110 ~ 190 °C : 90 ~ 120 sec
Dwell time	above 220 °C : 50 ~ 70 sec
Peak Temp	240 ~ 245 °C
Ramp Up/Down Rate	Up : 1~3 °C/sec Down: 1~5 °C/sec

The recommended reflow profile is provided as a guideline. Optimal profile may differ due to oven type, assembly layout or other process variables. Nitrogen atmosphere is strongly recommended for best soldering result.

5. Module Preparation

5-1. Handling

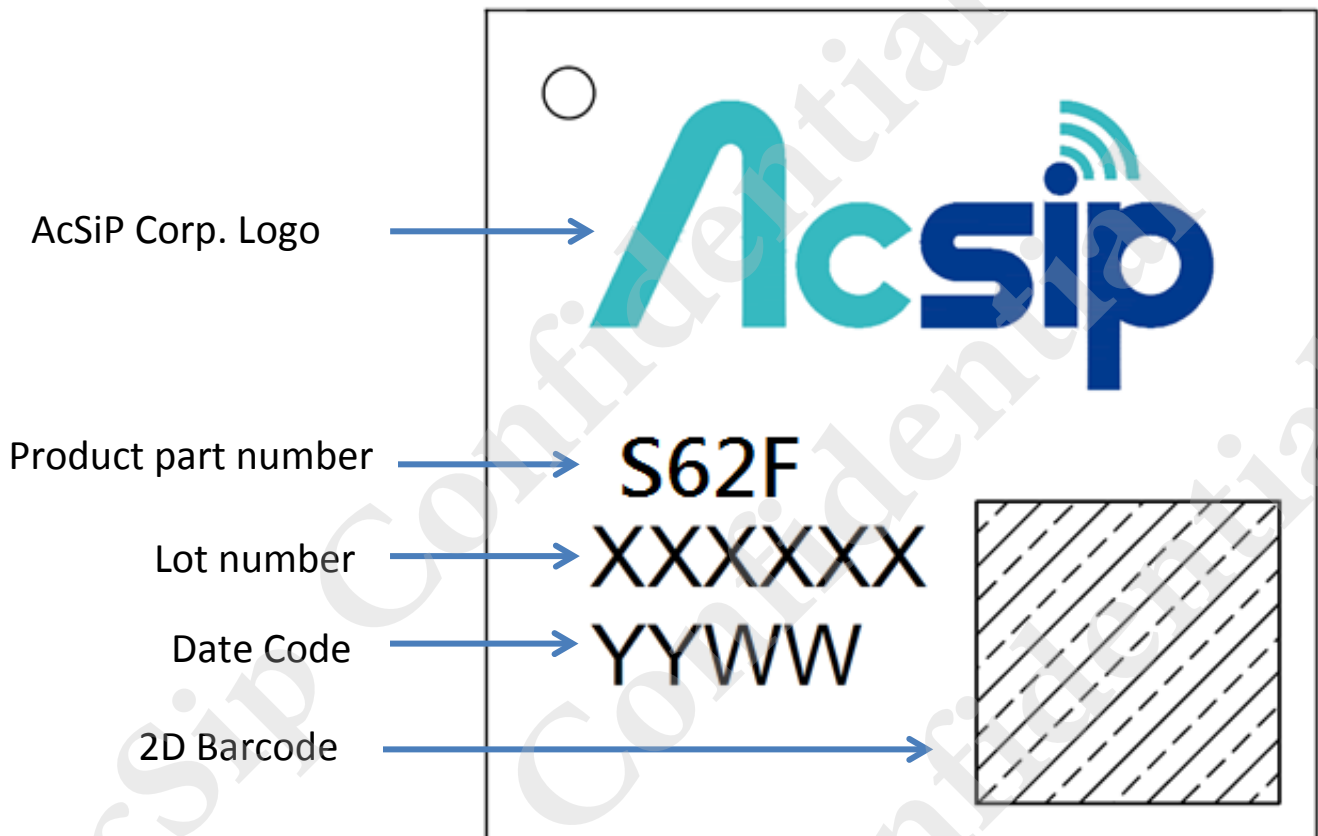
Handling the module, operator must wear the anti-static wrist strap to avoid ESD damage. After each module was aligned and tested, it should be transported and stored with anti-static tray and packing. This protective package must be remained in the suitable environment until the module is assembled and soldered onto the main board. Base on reliability test result, Module passed MSL3 criterion.

5-2. SMT Preparation

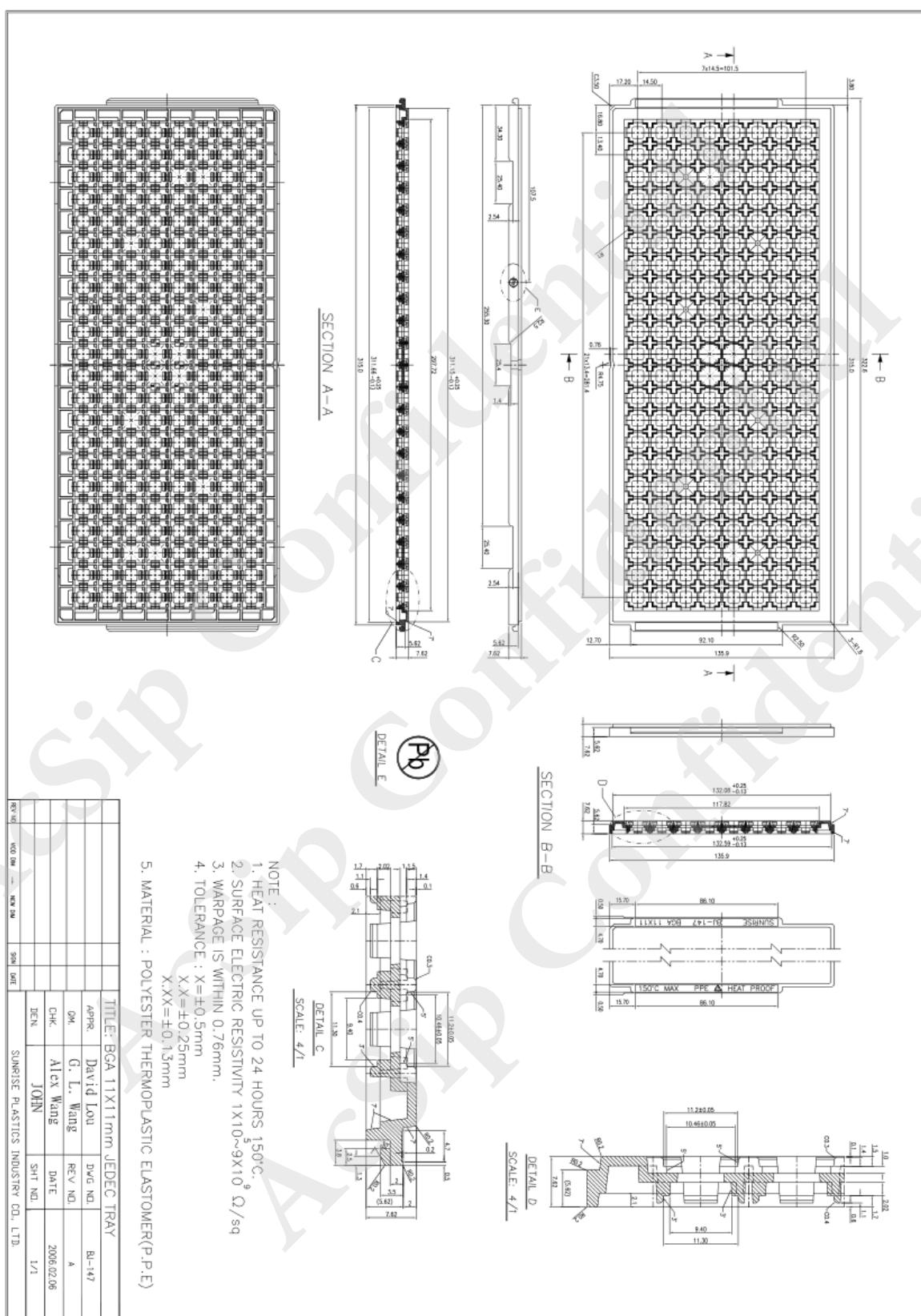
1. Calculated shelf life in sealed bag: 6 months at <40 degree and <90% relative humidity (RH).
2. Peak package body temperature: 250 degree.
3. After bag was opened, devices that will be subjected to reflow solder or other high temperature process must be
 - A. Mounted within: 168 hours of factory conditions <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 ± 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 ± 5 degree.

6. Package Information

6-1. Product Marking



6-2. Tray Dimension



6-3. Packing Information

第一腳方向
Pin1 orientation

打色帶, 3短1長
Packing Band
3 Short and 1 Long.

承載盤
Tray

封角
Chamfer

溫度卡或置乾燥包下
Place the humidity card under the Desiccant

1包乾燥包/33g
1 Desiccant/33g

封袋封口後左右向下折
After sealing the aluminum bag, fold it down left and right. Fold the sealing part down again.

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

內包裝盒有間隙時添加墊片
Add pads when there is a gap in the inner box.

內箱
Inner Box

內箱金屬標籤
Inner box label

氣泡墊
Bubble cushion

MSL警告標籤
MSL warning label

以氣泡墊包圍後放入內盒
Use bubble sheet cloth and put into inner box. Fill the space of partial box with bubble sheet.

QA封條貼紙
QA Mark

QA SEALED

外箱
CARTON

每箱六小盒, 內盒標籤朝外標籤放入外箱
There are six boxes in one carton. All box and carton labels face the same side while placing in the carton. Fill the space of carton with empty boxes which stamp "EMPTY" placed in the upper.

外箱上方以透明帶H型封箱
The carton at the top use scotch tape "H" shape

QA封條貼紙
QA Mark

外箱標籤
Carton label

標籤
label

拼貼時, 大箱內有幾個客就貼幾張標籤
When combine, each customer lot stick one label. The label can be neatly pasted on the outer box.

REVISION HISTORY			
REV	DESCRIPTION	RELEASED BY	DATE
1	Original	Susan	2020/10/13

HEADQUARTER

3F-1, No.707, Fushing Rd., Taoyuan City, 330, TAIWAN, R.O.C.

TEL: 886-3-2666366 FAX: 886-3-3475000

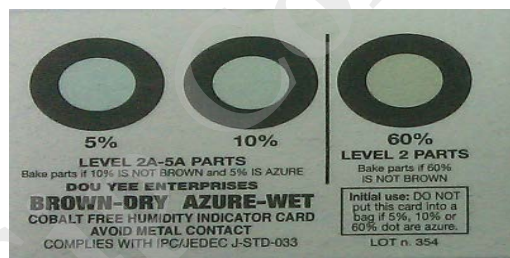
TEL: (03)-7866366 FAX: (03)-3475000

PROJECTION	APPROVALS	SIGN	DATE	CUSTOMER DRAWING NO.
	DRAWING	Susan	2020/10/26	TITLE: PACKING SPEC. PACKING FOR S68F
	CHECKED	Mark	2020/10/26	
	APPROVED	Mark	2020/10/26	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MM. ALL PROJECTIONS ARE THIRD ORDER. TOLERANCES LINEAR X.X = X.XX = X.XXX = ANGULAR ±°	CUSTOMER			DWG. NO.: S68F PKG REV 01

6-4. Humidity Indicator Card



Dry



Wet

Indicates :

5%, 10%, 60% relative humidity

Color Change :

Brown (Dry) → Blue (Wet)