

正基科技股份有限公司

SPECIFICATION

PRODUCT NAME : AP5168G

REVISION : 0.3

DATE : May. 02nd, 2023

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		



正基科技股份有限公司

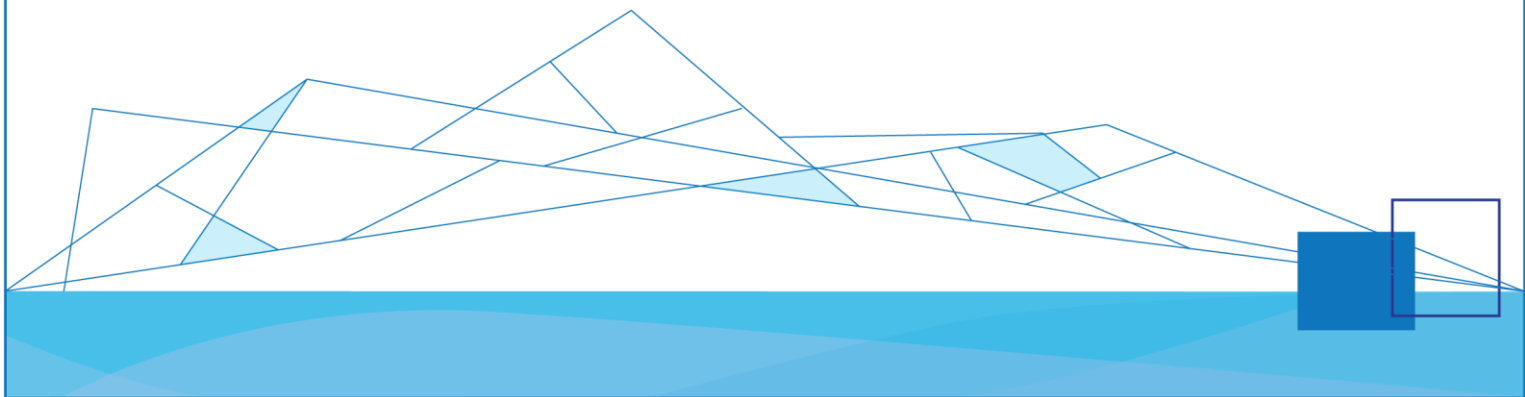


AP5168G

Data Sheet

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Revision

Revision	Date	Description	Revised By
0.1	2022/11/17	Formal release	Ali Chang
0.2	2023/01/05	Modify Block Diagram	Richard Wu
0.3	2023/05/02	Modify Operating temperature Range Modify GNSS Specification	Richard Wu

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1. Introduction

1.1 Overview

The AMPAK Technology® AP5168G is a latest GNSS functionality module. The module simultaneously supports GNSS, GLONASS (GLO), BeiDou (BDS), Galileo (GAL), NAVIC, and QZSS in both the L1/B1/E1 and L5/E5a/B2a frequency bands. The GNSS core host-base in the modules splits processing functions between the GNSS device and the CPU on the host system. In addition, this module is a compact solution with low power consumption for GNSS technologies. The module is specifically developed for wearable devices and mobile accessories.

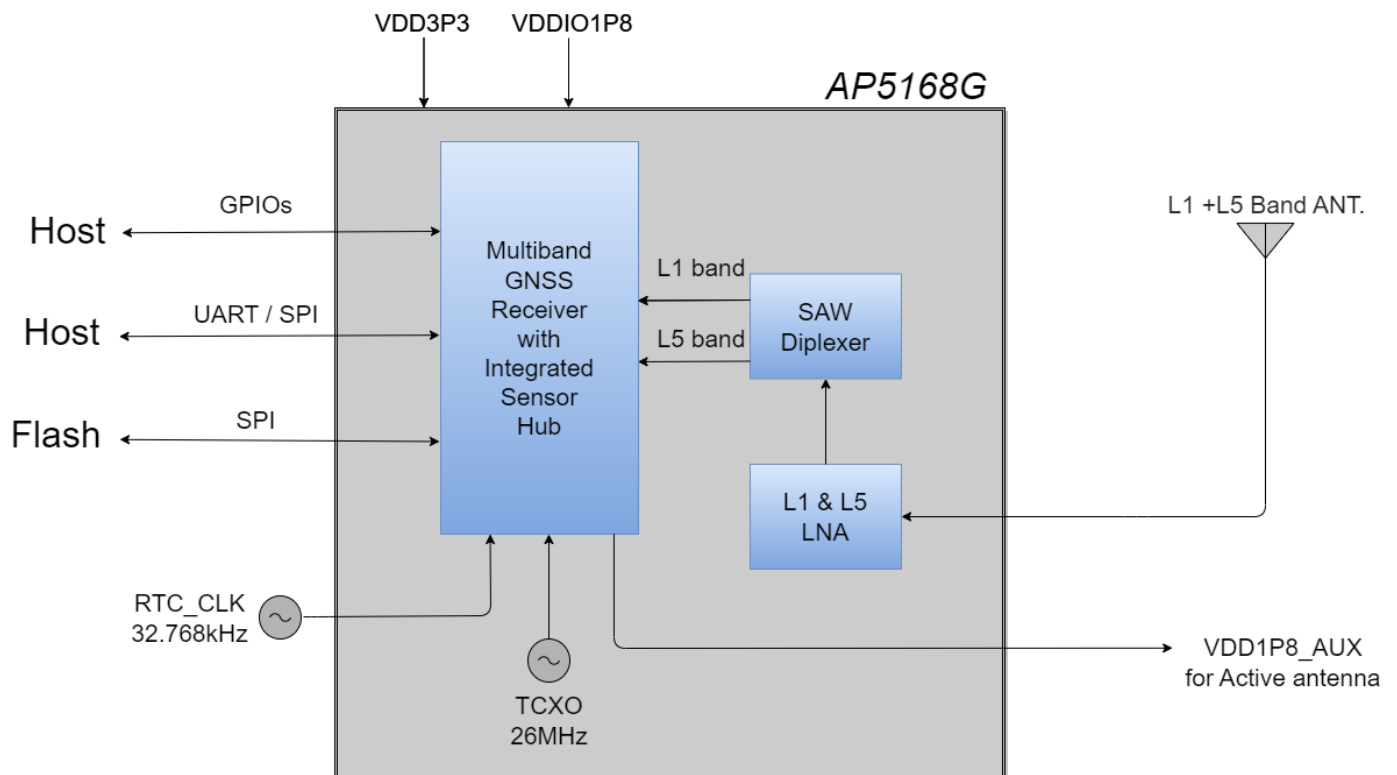


Figure 1.

1.2 Product Features

- Lead Free design which is compliant with ROHS requirements.
- Low system-level power consumption.
- Reduced application-processor load by performing on-chip computations
- Simultaneous reception of either GPS and GLONASS, or GPS and Galileo, or GPS and BeiDou, or GPS and QZSS or GPS and IRNSS depending on the chosen mode of operation
- Simultaneous reception of L1/E1 and L5/E5a
- High-speed system interface (to an application processor)
 - Serial streaming SPI slave (up to 50 MHz)
 - Alternate UART system interface supports rates up to 3.2Mbps

2. General Specification

2.1 General Specification

Model Name	AP5168G
Product Description	L1 + L5 GNSS functionalities Module
Dimension	L x W x H: 10 x 10 x 1.8 (Max) mm
GNSS Interface	UART/SPI
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +125°C
Humidity	Operating Humidity 10% to 95% Non-Condensing

2.2 DC Characteristics

2.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VDD_AUX_IN	Input supply Voltage		5.2	V
VDD_Main_IN	Main power and I/O Voltage		2.07	V

2.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

Voltage rails	Min.	Typ.	Max.	Unit
VDD_AUX_IN(3.3V)	2.7	3.3	3.6	V
VDD_Main_IN(1.8V)	1.62	1.8	1.98	V
VDDIO_1P8	1.62	1.8	1.98	V

VDD_AUX_IN current consumption 150mA(Peak), when VDD_Main_IN/VDDIO_1P8= 1.8V

2.3 Power-Up Sequence

RST_N is the main AP5168G enable power-up signal. When RST_N transitions from low to high, the AP5168G is powered up and the Power Management Logic (PML) block turns on the PMU regulators. Do not pull RST_N high until VDD_IO is on and CLK_32 is running and stable. When RST_N transitions from high to low, the AP5168G enters Standby mode. In this mode, time-keeping logic (RTC) is powered by the AON regulator and uses the CLK_32 clock to keep track of the elapsed time. The power-up sequence with internally supplied I/O power is illustrated in Figure 2.

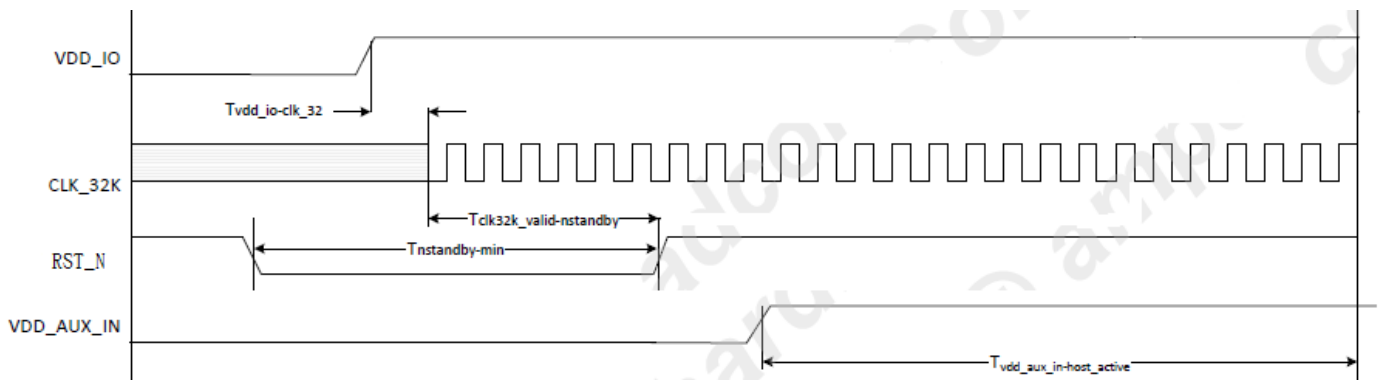


Figure 2.

2.3.1 Power Sequence Timing Parameters

Power sequence timing parameters for the AP5168G are described in table.

Parameter	Description	Min.	Typ.	Max.	Unit	Notes
T_vdd_io-clk_32	VDD_IO to CLK_32 turn on	0	--	--	mS	VDD_IO must be on before CLK_32K can be driven.
T_clk32k_valid-nstandby	CLK_32K valid to RST_N high	0	--	--	mS	CLK_32K must be valid before RST_N goes high.
T_nstandby-min	Minimum duration of RST_N high or low	6	--	--	CLK_32K cycles	
T_vdd_aux_in-host_active	VDD_AUX_IN to host active	--	--	2	mS	Time that the host must wait to become active after VDD_AUX_IN is active.

3. GNSS Specification

Conditions : VDD_Main_IN/VDDIO_1P8=1.8V and VDD_AUX_IN=3.3V ; Temp:25°C

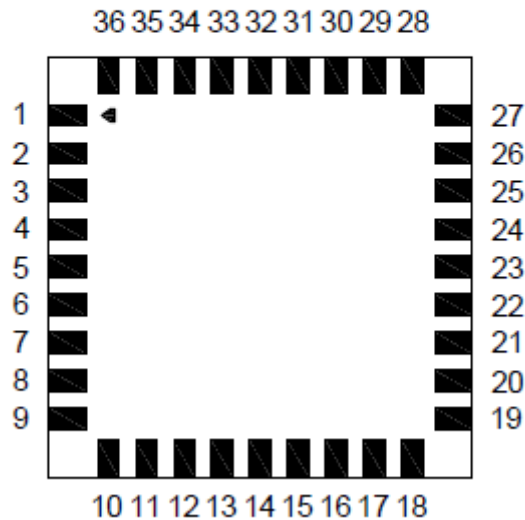
Feature	Description				
GNSS Band	L1/E1 and L5/E5a				
Host Interface	UART and SPI				
Number of Channels	36 Channels				
Tracking Sensitivity	-158 dBm				
Characteristic	Condition	Min	TYP	MAX	Unit
C/N	(Input level = -130dBm)		40		
Autonomous Cold Start	Average TTFF		35	<60	s
Autonomous Warm Start	Average TTFF		32		s
Autonomous Hot Start	Average TTFF		3.9		s

4. Pin Definition

4.1 Pin Outline

PIN OUTLINE

<TOP VIEW>



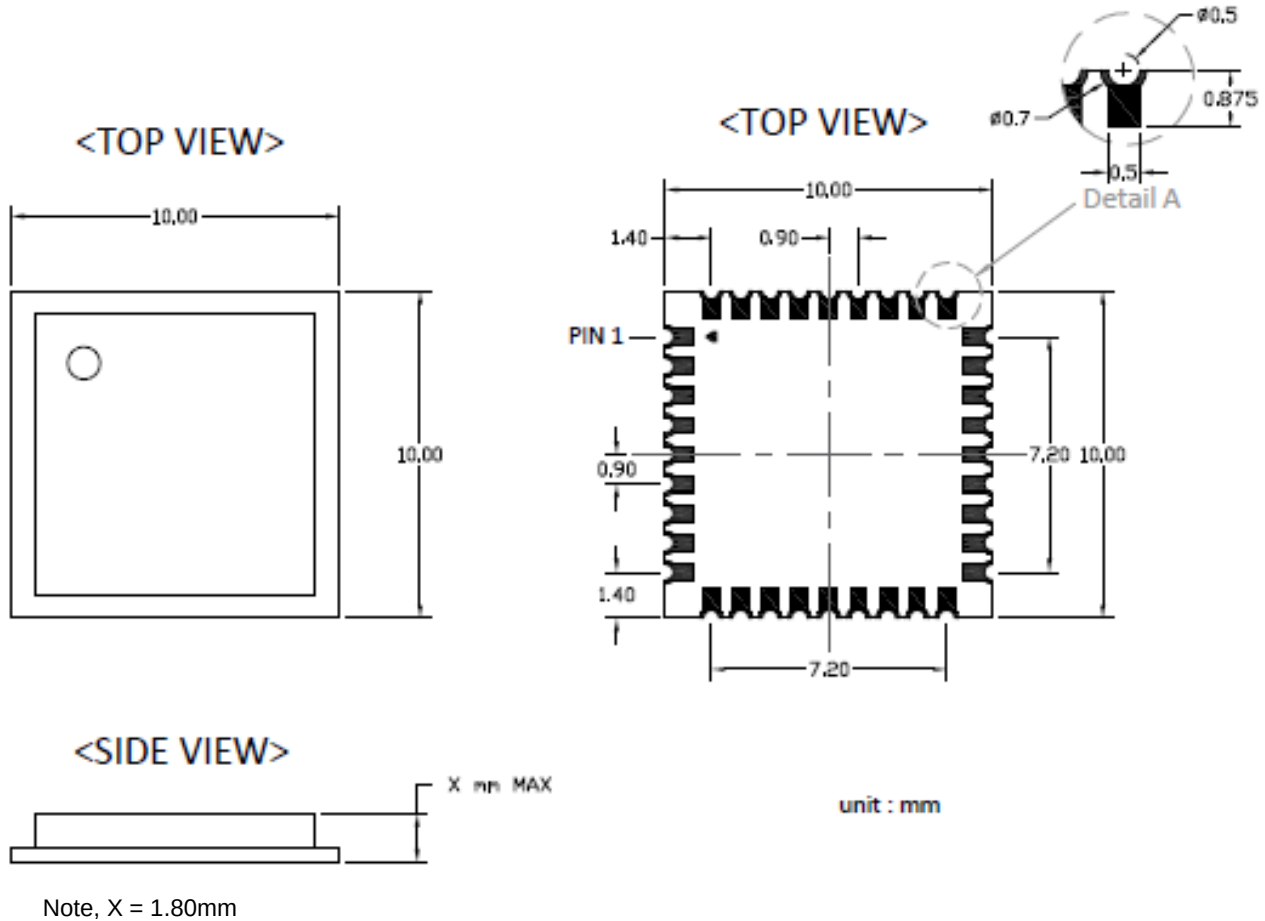
4.2 Pin Assignment

Pin No.	Name	Type	Description
1	GND	G	Connect to GND.
2	GNSS_RFIN_L1/L5	I	GNSS L1/L5 RF Input.
3	GND	G	Connect to GND.
4	GND	G	Connect to GND.
5	GND	G	Connect to GND.
6	GND	G	Connect to GND.
7	GND	G	Connect to GND.
8	TIMEPULSE	O	Time pulse
9	Boot_SEL	I	Default N.C. If flash boot (self boot). Use a 10K pull-down.

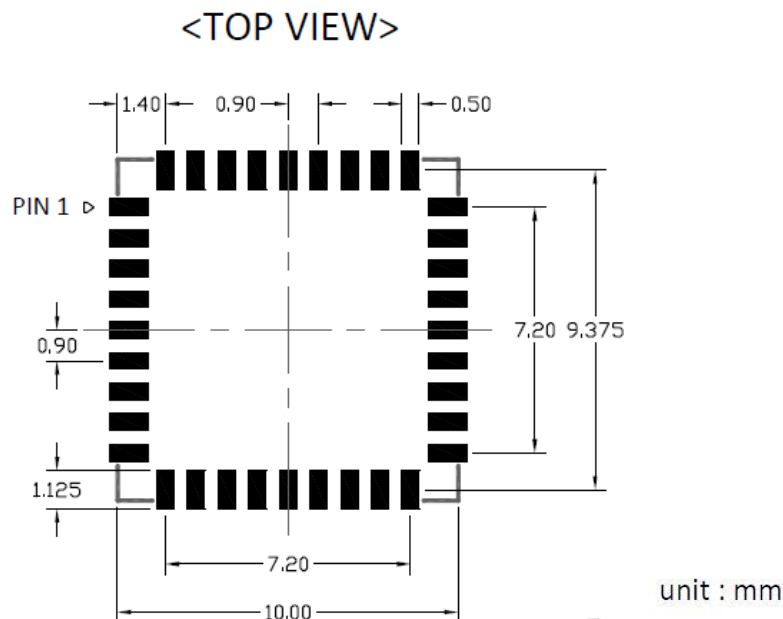
10	ANT_OFF	O	External LNA disable - default active high
11	GNSS_IF_TEST_OUT	O	Highly advised to bring to test point.
12	MCU_REQ	I	AP5168G uses MCU_REQ as input that AP5168G will not go into sleep when MCU_REQ is high.
13	GND	G	Connect to GND.
14	GND	G	Connect to GND.
15	LPO	I	32KHz input
16	GND	G	Connect to GND.
17	VDD_AUX_IN	P	Connect to 3.3V
18	VDD_AUX_IN	P	Connect to 3.3V
19	VCC_RF	O	Power for external LNA or Active ANT DC_IN.
20	GNSS_EN	I	Power-up control signal
21	MCU_RDY	O	AP5168G uses H_MCU_RDY as output which indicating AP5168G sleep status. Low means AP5168G in sleep status and high means AP5168G in active status.
22	SENSOR_SCL_1P8	O	I2C CLK connect to I2C sensor.
23	SENSOR_SDA_1P8	I/O	I2C data connect to I2C sensor.
24	H_HOST_REQ	O	AP5168G uses H_HOST_REQ as output to generate interrupt to AP for waking up AP or indicating data ready to send.
25	VDD_IO	P	Connect to 1.8V
26	UART_TXD/S_SPI_CLK	O/I	GNSS UART_TXD or SPI_CLK interface.
27	UART_RXD/S_SPI_NCS	I	GNSS UART_RXD or SPI_NCS interface.
28	UART_CTS/S_SPI_MOSI	I	GNSS UART_CTS or SPI_MOSI interface.
29	UART_RTS/S_SPI_MISO	O	GNSS UART_RTS or SPI_MISO interface.
30	M_SPI_IO_0	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 0.
31	M_SPI_IO_3	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 3.
32	M_SPI_IO_1	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 1.
33	M_SPI_NCS	I	Connect to SPI flash chip select.
34	M_SPI_IO_2	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 2.
35	M_SPI_CLK	I	Connect to SPI flash CLK.
36	GND	G	Connect to GND.

5. Dimensions

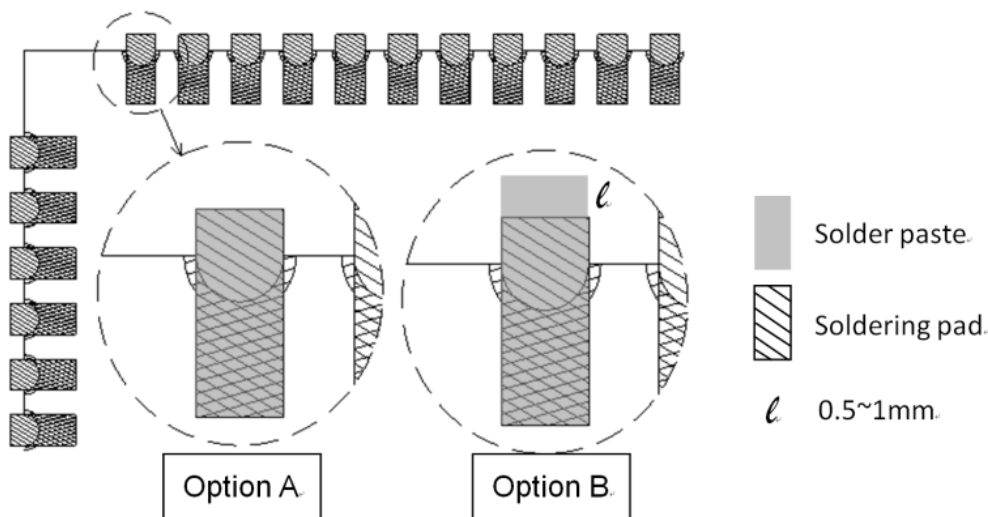
5.1 Module Dimensions



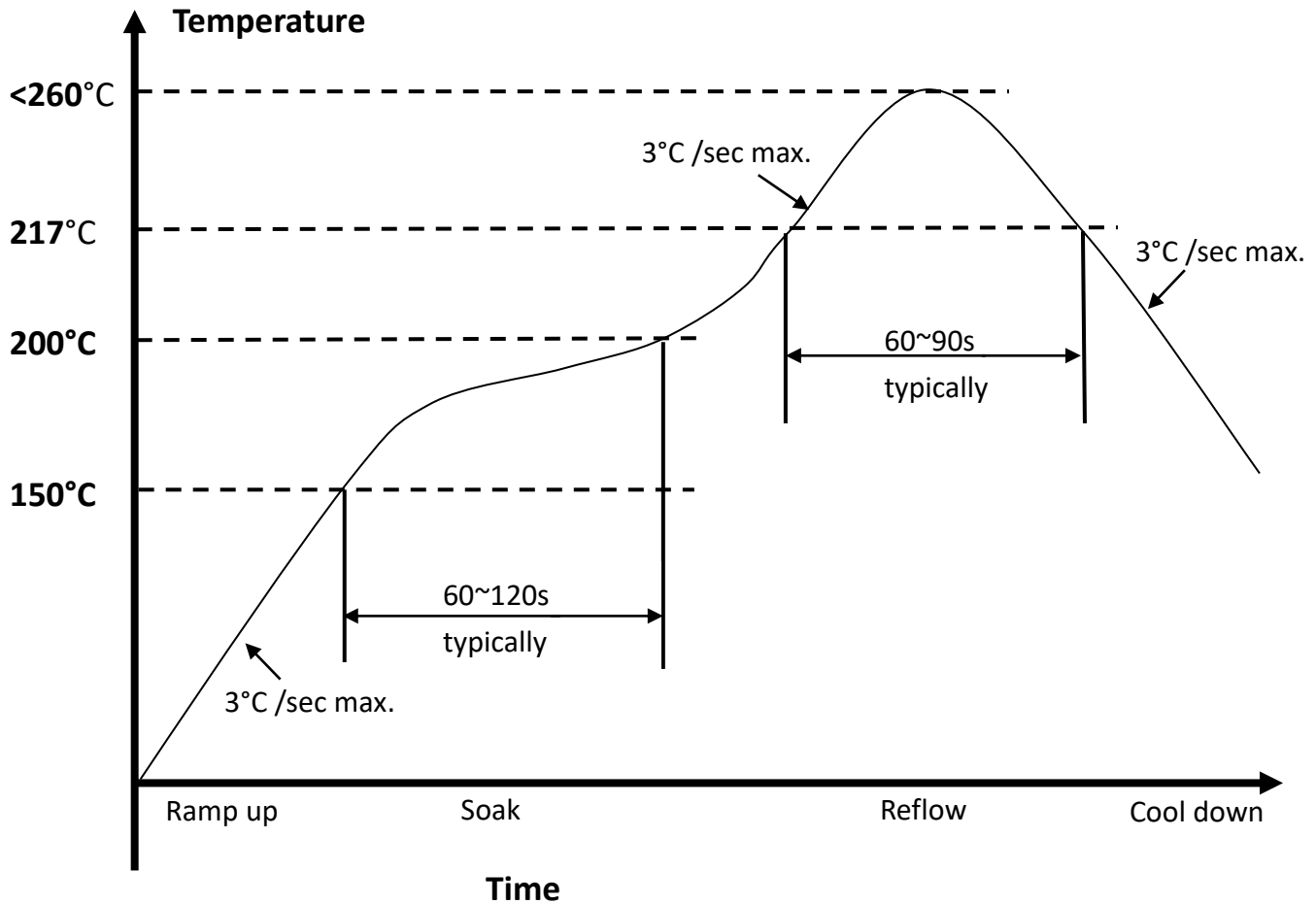
5.2 Recommended footprint



- Solder paste layer design is generally the same as recommended footprint.
(錫膏層設計通常建議和焊墊尺寸相同)
- If soldering quality with good wetting on upright side is essential for PQC, how to optimize the aperture design in the stencil to adjust the amount of solder paste would be crucial.
In addition, a kind of stencil design with stepped thickness in partial area would be considered if the thickness of stencil is about 0.1mm or thinner. Please optimize the stencil design by manufacture engineer or contact AMPAK FAE for assistance.
(如果模組吃錫品質考量側面爬錫，如何優化鋼網開孔設計以調整適當的錫膏量是非常重要的。尤其鋼網的厚度大約是 0.1mm 或更薄時，可考慮局部加厚鋼網的設計。請諮詢製程工程師以優化鋼網的設計,或是聯絡正基科技技術支持團隊)。



6. Recommended Reflow Profile

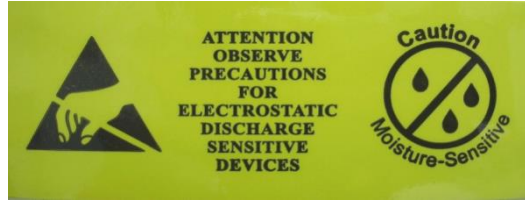


1. Referred to IPC/JEDEC standard.
2. Peak Temperature : <260°C (Time within 5°C of actual Peak Temperature 20-40 seconds)
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N₂) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, be sure baking step to remove the moisture from the component.

7. Package Information

7.1 Label

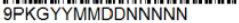
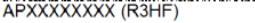
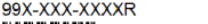
Label A → Anti-static and humidity notice



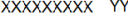
Label B → MSL caution / Storage Condition

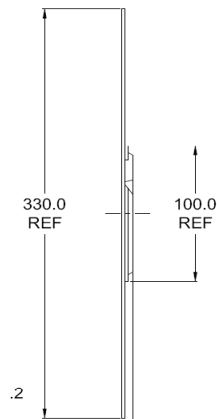
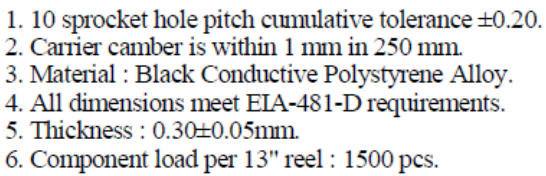
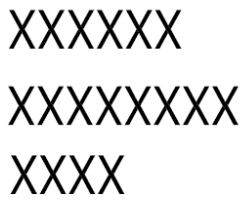
	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL  If blank, see adjacent bar code label
	- Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH) - Peak package body temperature: _____ °C If blank, see adjacent bar code label - After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be - Mounted within: _____ hours of factory conditions If blank, see adjacent bar code label - Stored per J-STD-033 - Devices require bake, before mounting, if: - Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at 23 ± 5°C 3a or 3b are not met - If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure	
Bag Seal Date: _____ If blank, see adjacent bar code label		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

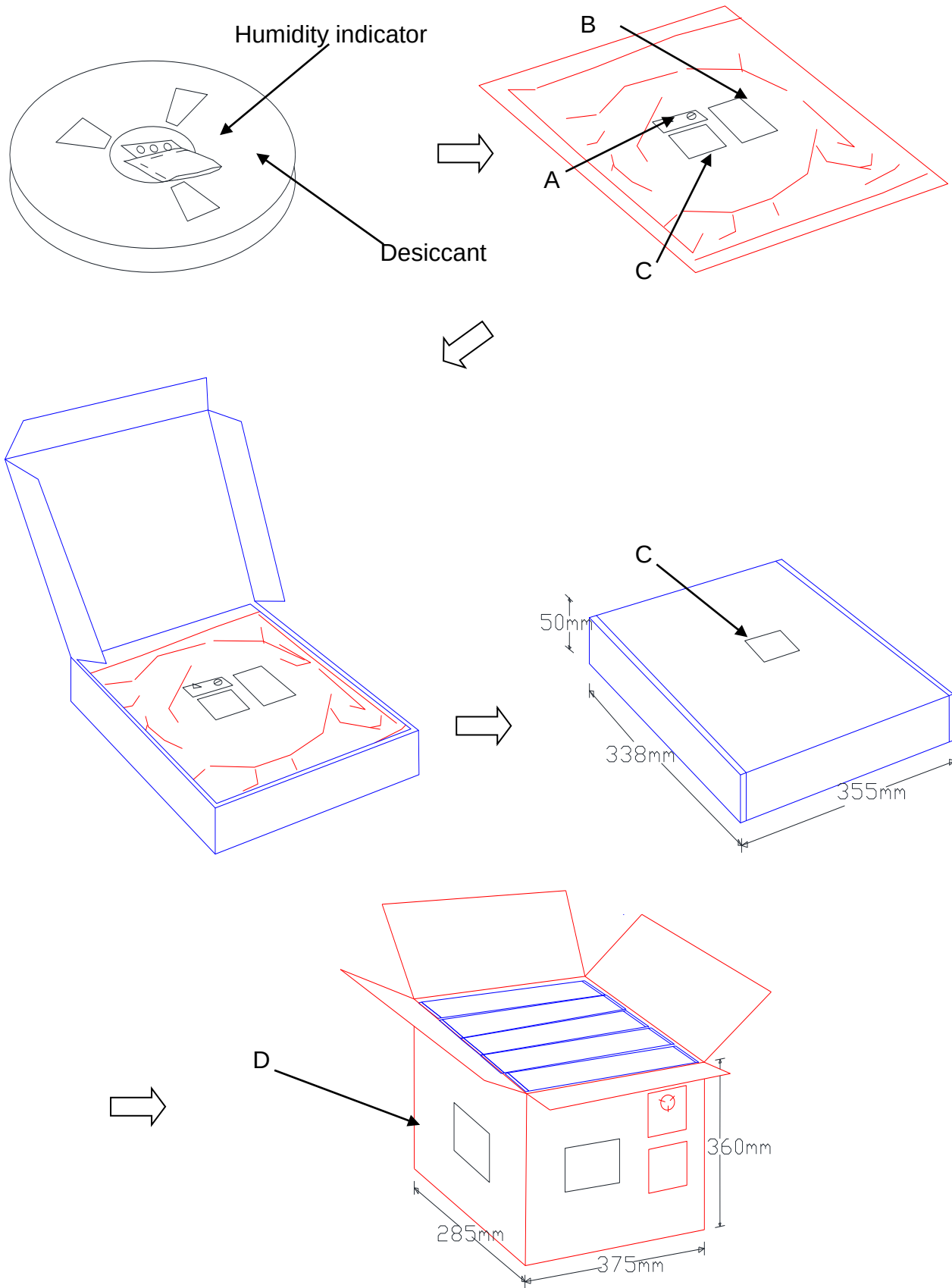
Label C → Inner box label .

PO:	
AMK DEVICE:	
PKG S/N:	 9PKGYYMMDNNNNN
Model Name:	 APXXXXXXXX (R3HF)
P/N:	 99X-XXX-XXXXR
Quantity:	 QQQQ
Date Code:	 YYWW
Lot Code:	 XXXXXXXX

Label D → Carton box label .

AMPAK Technology Inc.	
PO:	
AMK DEVICE:	
Model Name:	 APXXXXXXXX (R3HF)
Part No.:	 99X-XXX-XXXXR
Quantity:	 QQQQ
Lot D/C:	 XXXXXXXX YYWW QQQQ
Manufacture:	 YYYY/MM/DD





7.3 MSL Level / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 4 If blank, see adjacent bar code label
1. Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH) 2. Peak package body temperature: <u>250</u> $^{\circ}\text{C}$ If blank, see adjacent bar code label 3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be a) Mounted within: <u>72</u> hours of factory conditions If blank, see adjacent bar code label $\leq 30^{\circ}\text{C} / 60\% \text{ RH}$, or b) Stored per J-STD-033 4. Devices require bake, before mounting, if: a) Humidity Indicator Card reads $>10\%$ for level 2a-5a devices or $>60\%$ for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$ b) 3a or 3b are not met. 5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure.		
Bag Seal Date: _____ If blank, see adjacent bar code label		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		