

正基科技股份有限公司

SPECIFICATION

PRODUCT NAME : AP6155G

REVISION : 0.5

DATE : Mar. 14th, 2022

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		

正基科技股份有限公司



AP6155G Datasheet

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Revision

Revision	Date	Description	Revised By
0.0	2020/10/28	Preliminary	Miller Hsieh
0.1	2020/11/17	Formal release	Miller Hsieh
0.2	2020/12/01	Modify Module Dimensions	Miller Hsieh
0.3	2020/12/07	Modify Power-Up sequence	Miller Hsieh
0.4	2020/12/25	Modify pin assignment	Miller Hsieh
0.5	2022/03/14	Modify Overview	Jetso Chen

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1. Introduction

1.1 Overview

The AMPAK Technology® AP6155G is a latest GPS functionality module. The module simultaneously supports GPS, GLONASS (GLO), BeiDou (BDS), Galileo (GAL), NAVIC, and QZSS in both the L1/B1/E1 and L5/E5a frequency bands. The GPS core host-base in the modules splits processing functions between the GPS device and the CPU on the host system. In addition, this module is a compact solution with low power consumption for GPS technologies. The module is specifically developed for wearable devices and mobile accessories.

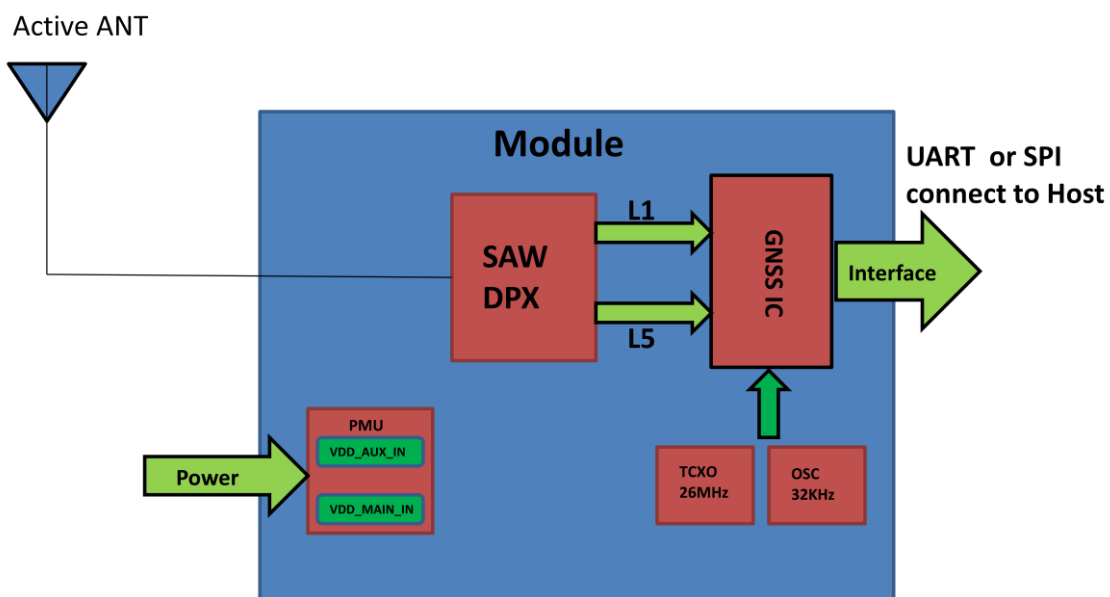


Figure 1

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/B1/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	AP6155G
Product Description	L1 + L5 GPS functionalities Module
Dimension	L x W x H: 22 x 17 x 1.9 (Max) mm
GPS Interface	UART/SPI
Operating temperature	-20°C to 75°C
Storage temperature	-40°C to 85°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	2.7	3.3	3.6	V
VDD_Main_IN	1.62	1.8	1.98	V

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

2.3 Power-Up sequence

RST_N is the AP6155G enable power-up signal. When RST_N transitions from low to high, the AP6155G is power up and the Power Management Logic (PML) block turns on the PMU regulators. Don't pull RST_N high until VDD_IO is on and CLK32K is running and stable. When RST_N transitions from high to low, the AP6155G enters Standby mode. In this mode, time keeping logic (RTC) is power by the AON regulator and uses the CLK_32K clock to keep track of the elapsed time. The power-up sequence with internally supplied I/O power is illustrated in Figure2.

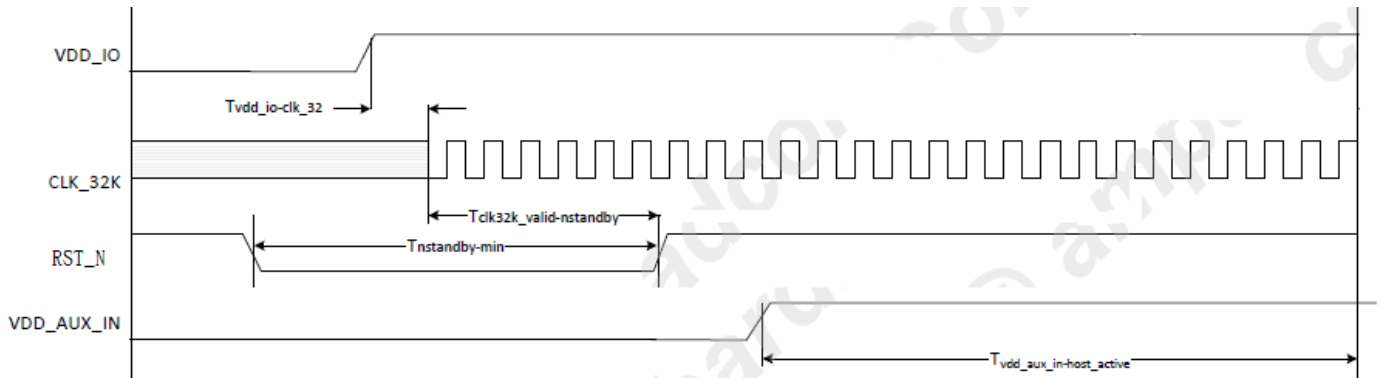


Figure 2

2.3.1 Power Sequence Timing Parameters

Power sequence timing parameters for the AP6155G are described in table.

Parameter	Description	Min.	Typ.	Max.	Unit	Notes
T _{vdd-io-CLK_32K}	VDD_IO to CLK_32 turn on	0	--	--	mS	VDD_IO must be on before CLK_32K can be driven.
T _{CLK_32K_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. GPS Specification

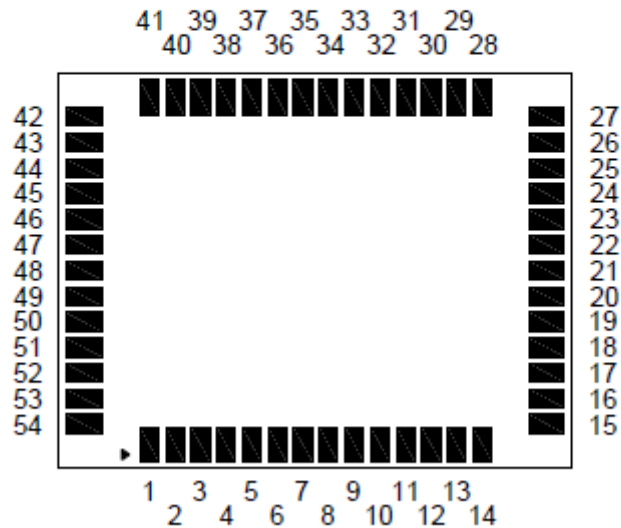
Conditions : VDD_Main_IN=1.8V and VDD_AUX_IN=3.3V ; Temp:25°C

Feature	Description				
GNSS Band	L1/E1 and L5/E5a				
Host Interface	UART and SPI				
Number of Channels	36 Channels				
Antenna Gain (with LNA)	21~25 dBi				
Tracking Sensitivity	-140 dBm				
Characteristic	Condition	Min	TYP	MAX	Unit
C/N	Without/LNA (-130dBm)	30			
Autonomous Cold Start	Average TTFF		30.7	<60	s
Autonomous Warm Start	Average TTFF		29.5		s
Autonomous Hot Start	Average TTFF		3.9		s

4. Pin Definition

4.1 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/ RF Input.
3	GND	G	Connect to GND.
4	ANT_Detect	I	Active antenna detect - default active high. It can be floating.
5	ANT_OFF	O	External LNA disable - default active high
6	ANT_SHORT_N	I	Active antenna short detect - default active low.
7	VCC_RF	O	Power for external LNA or Active ANT DC_IN.
8	M_SPI_CLK	I	Connect to SPI flash CLK.
9	M_SPI_NCS	I	Connect to SPI flash chip select.
10	M_SPI_IO_0	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 0.
11	M_SPI_IO_1	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 1.
12	GND	G	Connect to GND.
13	M_SPI_IO_2	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 2.
14	GND	G	Connect to GND.

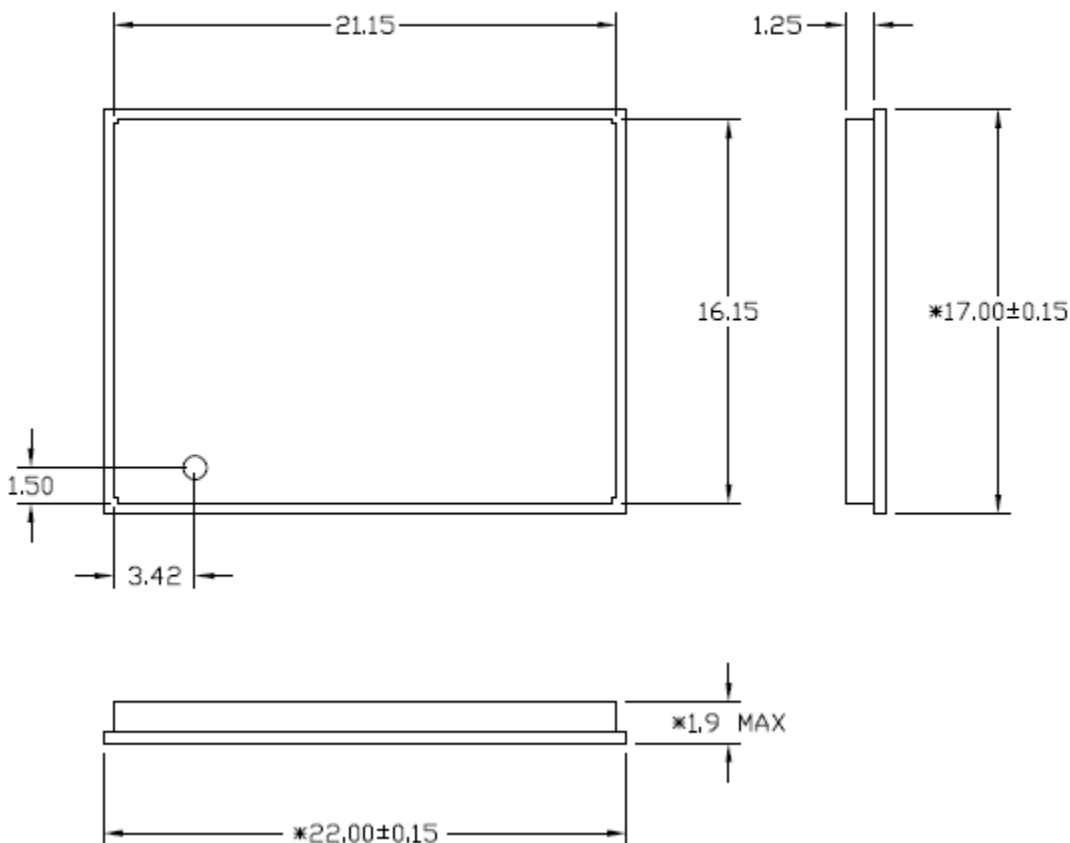
15	M_SPI_IO_3	I/O	Connect to SPI flash data pin. Quad SPI I/O bit 3.
16	Boot_SEL	I	Default N.C. If flash boot (self boot). Use a 10K pull-down.
17	Reserved	-	Reserved
18	Reserved	-	Reserved
19	GNSS_IF_TEST_OUT	O	Highly advised to bring to test point.
20	H_HOST_REQ	O	AP6155G uses H_HOST_REQ as output to generate interrupt to AP for waking up AP or indicating data ready to send.
21	MCU_RDY	O	AP6155G uses H_MCU_RDY as output which indicating AP6155G sleep status. Low means AP6155G in sleep status and high means AP6155G in active status.
22	SENSOR_SDA_1P8	I/O	I2C data connect to I2C sensor.
23	SENSOR_SCL_1P8	O	I2C CLK connect to I2C sensor.
24	Reserved	-	Reserved
25	Reserved	-	Reserved
26	Reserved	-	Reserved
27	Reserved	-	Reserved
28	GND	G	Connect to GND.
29	VDD_IO	P	Connect to 1.8V
30	VDD_IO	P	Connect to 1.8V
31	GND	G	Connect to GND.
32	GND	G	Connect to GND.
33	VDD_AUX_IN	P	Connect to 3.3V
34	VDD_AUX_IN	P	Connect to 3.3V
35	Reserved	-	Reserved
36	V_BACK	P	Connect to 3.3V
37	GND	G	Connect to GND.
38	Reserved	-	Reserved
39	Reserved	-	Reserved
40	Reserved	-	Reserved
41	GND	G	Connect to GND.
42	UART_TXD/S_SPI_CLK	O/I	GPS UART_TXD or SPI_CLK interface.
43	UART_RXD/S_SPI_NCS	I	GPS UART_RXD or SPI_NCS interface.
44	UART_CTS/S_SPI_MOSI	I	GPS UART_CTS or SPI_MOSI interface.
45	UART_RTS/S_SPI_MISO	O	GPS UART_RTS or SPI_MISO interface.
46	TX_READY	O	TX_Buffer full and ready for TX of data
47	D_SEL	I	It can be floating.

48	GND	G	Connect to GND.
49	RST_N	I	Connect to host GPIO for AP6155G reset.
50	SAFEBOOT_N	I	SAFEBOOT_N (for future service, updates and reconfiguration, leave OPEN)
51	MCU_REQ	I	AP6155G uses MCU_REQ as input that AP6155G will not go into sleep when MCU_REQ is high.
52	Reserved	-	Reserved
53	TIMEPULSE	O	Time pulse
54	Reserved	-	Reserved
55~102	GND	G	Connect to GND.

5. Dimensions

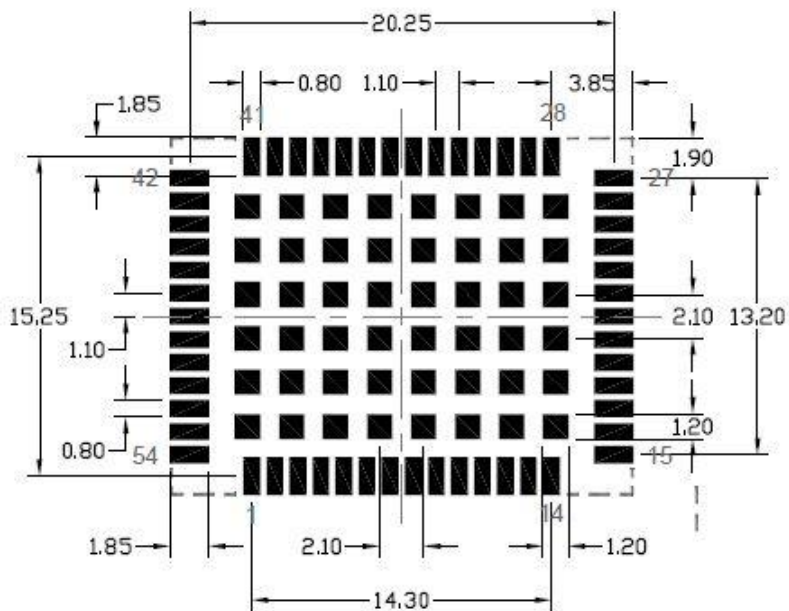
5.1 Module Dimensions

<TOP VIEW>



unit : mm

<TOP VIEW>

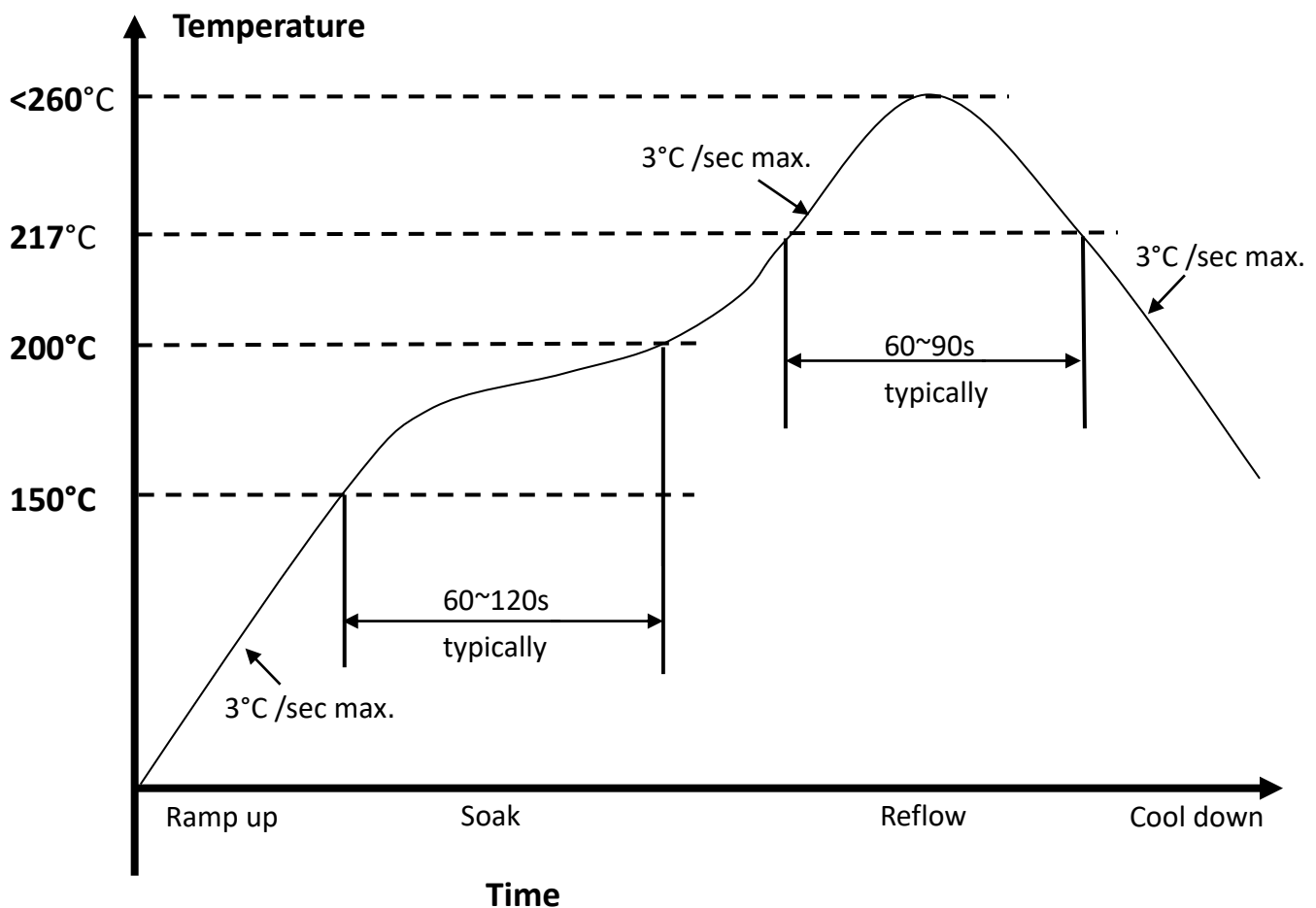


unit : mm



- 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

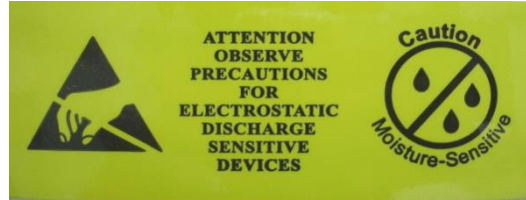


1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N₂) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, be sure baking step to remove the moisture from the component

7. Package Information

7.1 Label

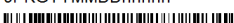
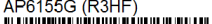
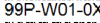
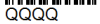
Label A → Anti-static and humidity notice



Label B → MSL caution / Storage Condition

	Caution This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 
	If blank, see adjacent bar code label	
1. Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH) 2. Peak package body temperature: _____ °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: _____ hours of factory conditions If blank, see adjacent bar code label ≤30°C/60% 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 ± 5°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		

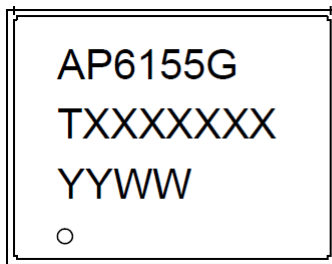
Label C → Inner box label .

PO:	
AMK DEVICE:	
PKG S/N:	 9PKGYYMMDDnnnnn
Model Name:	 AP6155G (R3HF)
P/N:	 99P-W01-0XXXR
Quantity:	 QQQQ
Date Code:	 YYWW
Lot Code:	 XXXXXXXX
Made in XXXXXX	

Label D → Carton box label .

AMPAK Technology Inc.	
PO:	
AMK DEVICE:	
Model Name:	 AP6155G (R3HF)
Part No.:	 99P-W01-0XXXR
Quantity:	 QQQQ
Lot D/C:	 XXXXXXXX YYWW QQQQ
Manufacture:	 YYYY/MM/DD
Made in XXXXXX	

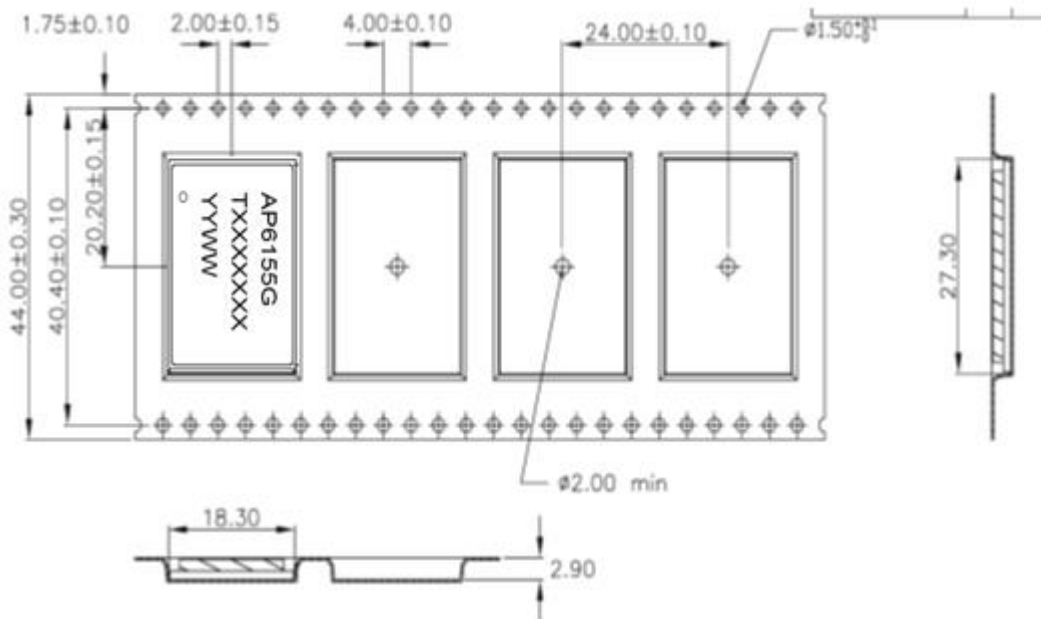
7.2 Packing



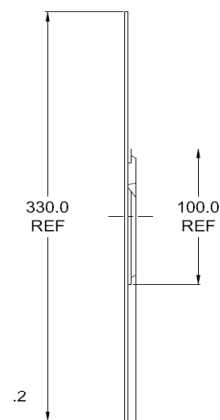
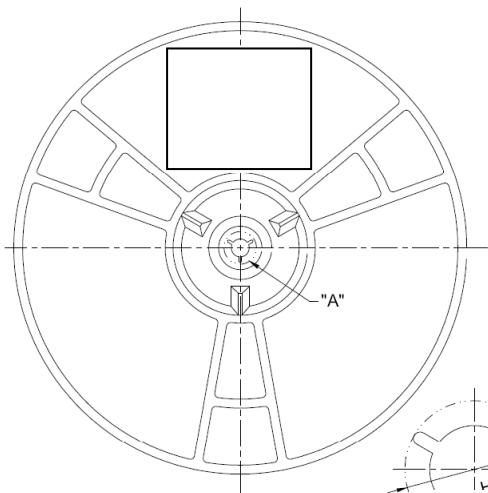
Part Number

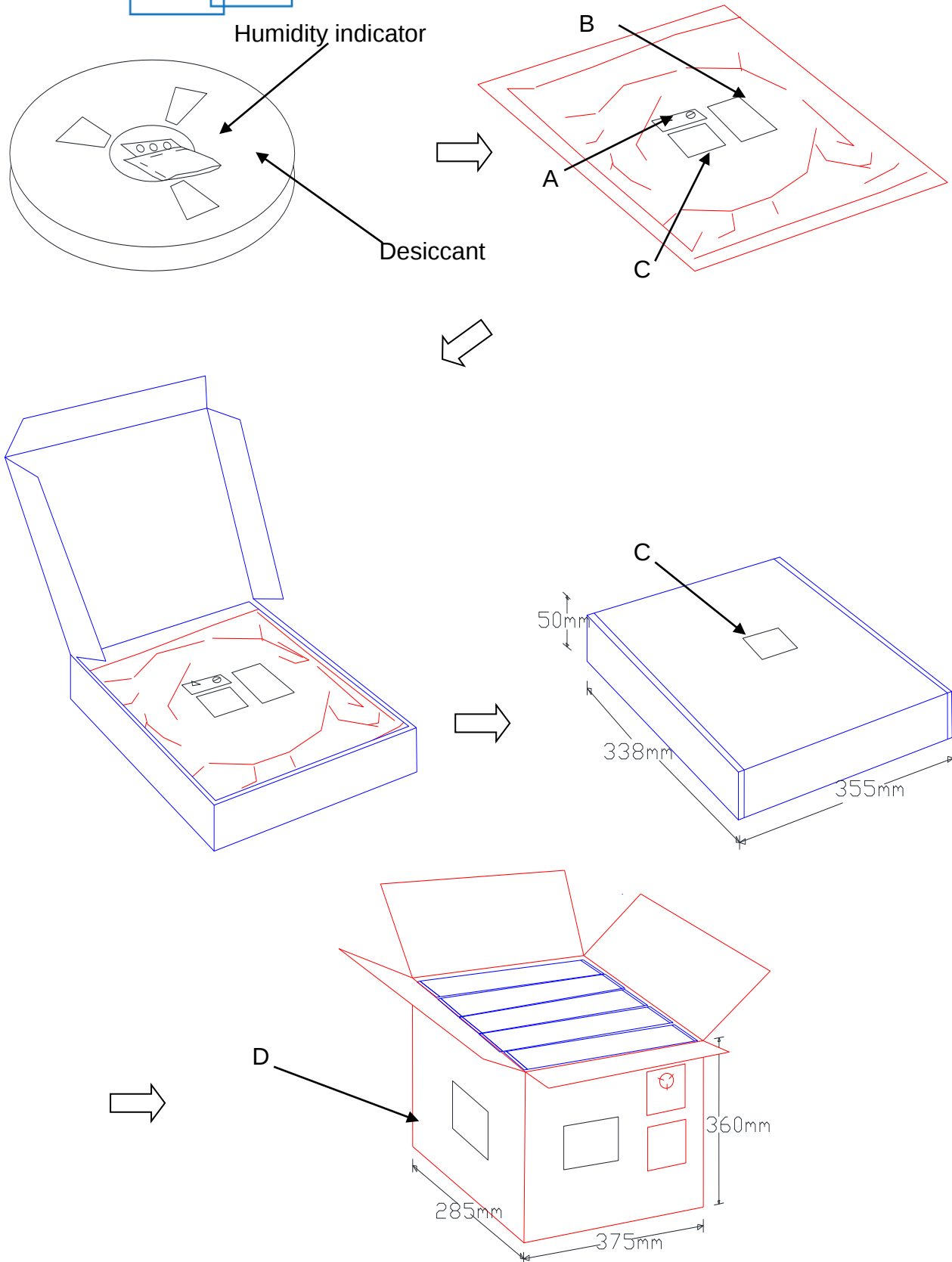
Lot Code

Date Code



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 : $0.30 \pm 0.05 \text{ mm}$.
6. Packing length per 22" reel : 60.0 Meters.(1:3)
7. Component load per 13" reel : 500PCS





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		