PRODUCT SPECIFICATION

Product Name	M500 MT6620 802.11b/g/n, BT 2.1+EDR, FM Rx, GPS 4in1 SiP Module
Version	B
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A RF SiP module Provider
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Document History

Date	Revise Contents	Revise by	Version
Sep 27th,2012 Nov 26th,2012 Jan 07th,2013	Initial Version Specification and mechanical dimensions Modify	Kenny Kenny Kenny	01 A B

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1. Description

AcSiP Technology Corp. introduces a low-cost and low-power consumption 4-in-1 SIP module. This SiP module integrate combine WLAN, Bluetooth, FM and GPS.

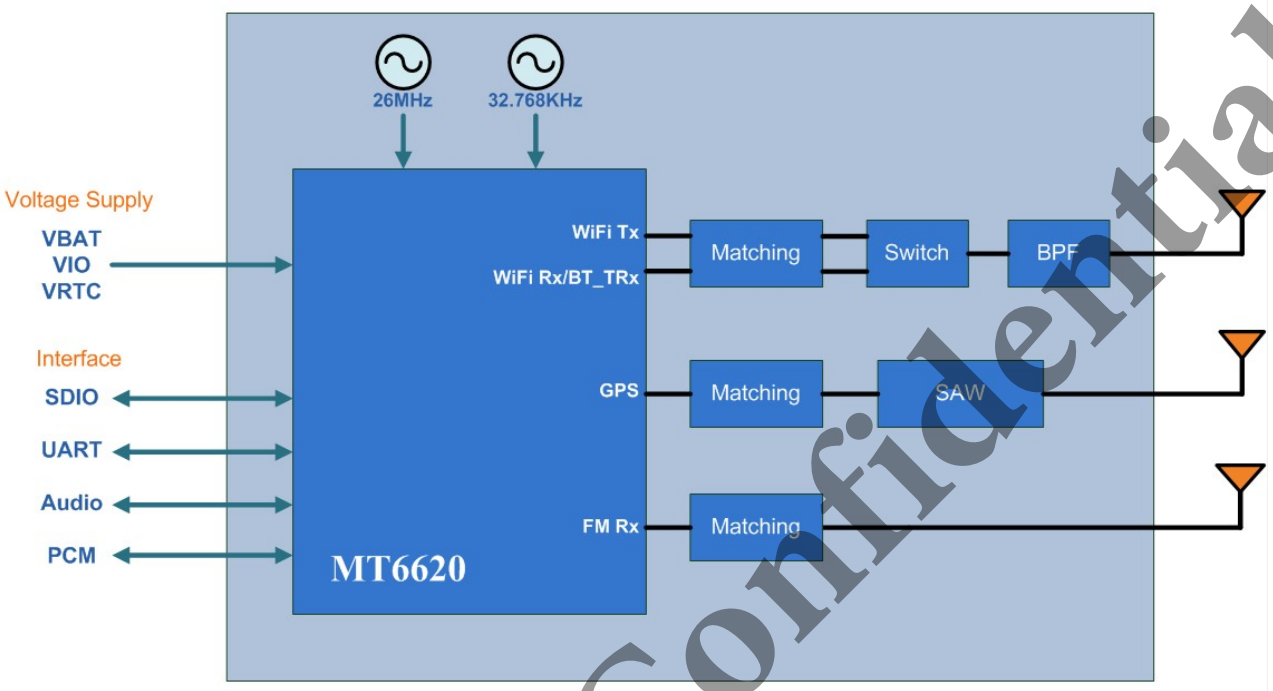
The WLAN function follow IEEE 802.11b/g/n standard. The Bluetooth function follow Bluetooth standard Bluetooth 2.1(EDR). The GPS function is host-based structure. The FM function support FM receiver.

Feature

- Small footprint : 15 mm X 15 mm X 1.6 mm
- Host interface :
  - WLAN : SDIO
  - Bluetooth :UART, PCM
  - FM : UART, Audio
  - GPS : UART
- 26MHz TCXO and 32KHz RTC included.
- Support ad-hoc and infrastructure modes
- IEEE 802.11 b/g/n.
- Support 802.11n optional features :STBC, A-MPDU, block ACK, RIFS, MCS feedback, 20/40 MHz coexistence(PCO)
- Support Bluetooth co-existence
- Support low power consumption sleep mode via 32 kHz clock
- GPS type : host based
- Support FM receiver.
- Bluetooth 2.1 + EDR
- Bluetooth 3.0 + HS compliance
- Bluetooth V4.0 LE
- Support WLAN and BT single antenna.
- RoHS compliant / Lead free
- Simple connection and work.

1-1. Block Diagram

A simplified block diagram of the M500 SiP module is depicted in the figure below.



1-2. Specification

Model Name	M500
Product Description	Combo SiP
Network Standard	IEEE 802.11b/g/n, BT 2.1+EDR, FM Rx, GPS
Host Interface	SDIO / UART / Audio / PCM
Operation Conditions	
Temperature	■ Storage : -60℃ ~ + 150℃ ■ Operating : -45℃ ~ +85℃
Humidity	■ Operating : 10 ~ 95% (Non-Condensing) ■ Storage : 5 ~ 95% (Non-Condensing)
Dimension	15 mm X 15 mm X 1.6 mm , tolerance ± 0.1mm
Package	LGA
WiFi Part	
Standard	IEEE 802.11 b/g/n
Host Interface	SDIO
Bluetooth Part	
Standard	Bluetooth 2.1+EDR 3.0 + HS compliance V4.0 Low Energy (LE)
Host Interface	■ UART ■ PCM
FM Part	
Function	■ Receiver
Host Interface	■ Audio out ■ UART
GPS Part	
Type	Host based
Host Interface	UART

2.Electrical Characteristics

2-1. Absolute Maximum Ratings

Symbol	Parameter	Min.	TYP.	MAX.	UNIT
VBAT		-0.3	3.6	5.5	V
VRTC		-0.3	2.8	3.6	V
VIO1		-0.3	2.8	3.6	V

2-2. DC CHARACTERISTICS

Symbol	Parameter	Min.	TYP.	MAX.	UNIT
VBAT	Supply Voltage	2.3	3.6	5.5	V
	Current(PMU_EN=0)		25	35	uA
VRTC	Supply Voltage	1.62	1.8	1.98	V
		2.52	2.8	3.08	V
	Current(typ.)		5		uA
VIO1	2.8V Digital Power Supply	2.0	2.8	3.6	V
	1.8V Digital Power Supply	1.6	1.8	2.0	V
	Current(typ.)		0.1		uA

2-3. RF CHARACTERISTICS

2-3-1. RF characteristics for 802.11b

802.11b Transmit					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Tx Power Level	DQPSK	15	17		dBm
Frequency tolerance		-10	5	10	ppm
Spectral Mask	11MHz→22MHz		40		dBr
	＞22MHz		53		dBr
Modulation accuracy	All data rate		15		%
802.11b Receiver					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Min. input	1Mbps PER<8%		-97		dBm
	11Mbps PER<8%		-89.5		dBm
Max. input level	PER<8%			0	dB

2-3-2. RF characteristics for 802.11g

802.11g Transmit					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Tx Power Level	OFDM	13	15		dBm
Frequency tolerance		-10	5	10	
Modulation accuracy	All data rate	-28	-30		dB
802.11g Receiver					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Min. input	6Mbps PER<10%		-93.5		dBm
	54 Mbps PER<10%		-75		dBm
Max. input level	PER<10%			-11	dBm

2-3-3. RF characteristics for 802.11n

802.11n Transmit(HT20)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Tx Power Level	OFDM	13	15		dBm
Frequency tolerance		-10	0	10	
Modulation accuracy	All data rate	-28	-30		dB
802.11n Transmit(HT40)					
Item	Condition	Min.	Typ.	Max.	Unit
Tx Power Level	OFDM	11	13		dBm
Frequency tolerance		-10	0	10	
Modulation accuracy	All data rate	-28	-30		dB
802.11n Receiver(HT20)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Min. input	MCS0 PER<10%		-93		dBm
	MCS7 PER<10%		-72		dBm
Max. input level	PER<10%			-8	dBm
802.11n Receiver(HT40)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 14	
Min. input	MCS0 PER<10%		-89.5		dBm
	MCS7 PER<10%		-69		dBm
Max. input level	PER<10%			-1.5	dBm

2-3-4. RF characteristics for Bluetooth

Parameter	Description	Min	Typ	Max	Unit
Basic Rate					
Frequency		2402		2480	MHz
Output Power		9	10	11	dBm
Gain Step		2	4		dB
Modulation characteristic	$\Delta f1_{avg}$	140	156	175	kHz
	$\Delta f2_{max}$	115	148		kHz
	$\Delta f2_{avg} / \Delta f1_{avg}$	0.8	0.98		
ICFT	Initial carrier frequency tolerance	-75	-3	75	kHz
Carrier frequency drift	DH1		4		kHz
	DH3		4		kHz
	DH5		5		kHz
	Max drift rate		180	400	Hz/uS
output spectrum	20 dB bandwidth		918		kHz
In-band spurious emission	±2MHz offset		-43	-20	dBm
	±3MHz offset		-47	-40	dBm
	>±3MHz offset		-47	-40	dBm
Sensitivity	BER<0.1%		-92.5		dBm
Max input	BER<0.1%	-20			dBm

EDR					
Frequency		2402		2480	MHz
Max transmit Power	π/4 DQPSK		6.5		dBm
	8PSK		6.5		dBm
Frequency stability	ω_0, π/4 DQPSK	-10	0	10	kHz
	ω_0, 8PSK	-10	0	10	kHz
	ω_i, π/4 DQPSK	-75	0	75	kHz
	ω_i, 8PSK	-75	0	75	kHz
	$\omega_0+\omega_i$, π/4 DQPSK	-75	0	75	kHz
	$\omega_0+\omega_i$, 8PSK	-75	0	75	kHz
Modulation accuracy	RMS DEVM		4		%
	99% DEVM		6		%
	Peak DEVM		9		%
n-band spurious emission	±1MHz offset		-43	-26	dBm
	±2MHz offset		-47	-20	dBm
	±3MHz offset		-47	-40	dBm
Sensitivity	π/4 DQPSK ,BER<0.1%		-93		dBm
	8PSK ,BER<0.1%		-86		dBm
Max input	π/4 DQPSK ,BER<0.1%	-20			dBm
	8PSK ,BER<0.1%	-20			dBm

2-3-5. System performance for GPS

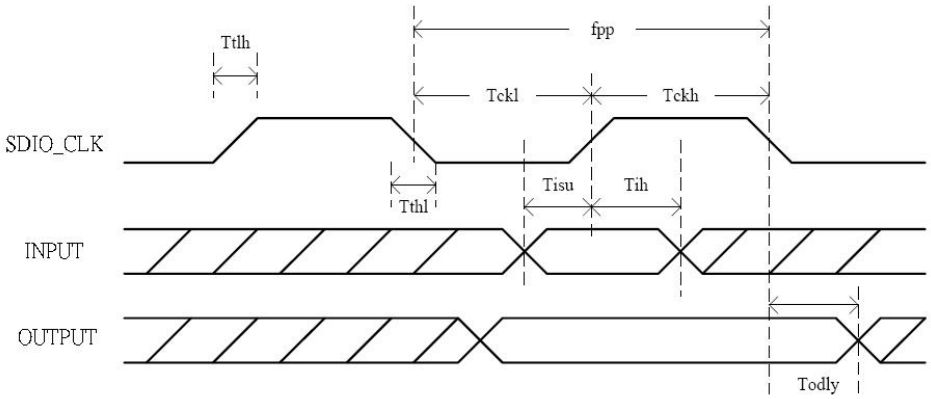
Parameter	Description	Performance	Unit
C/N @ -130		39	dB
Horizontal Position Accuracy	Without Aid	3.0	Meter
	DGPS	2.5	Meter
Velocity Accuracy	Without Aid	0.1	Meter/sec
	DGPS	0.05	Meter/sec
Sensitivity	Autonomous acquisition	-147	dBm
	Warm acquisition	-147	dBm
	Hot acquisition	-159	dBm
	Tracking	-164	dBm
TTFF	Cold start	< 35	Sec
	Warm start	< 34	Sec
	Hot start	< 1	Sec
	MS based : GSM coarse time	< 20	Sec
	MA based : GSM coarse time	< 20	Sec

2-3-6. RF characteristics for FM Receiver

Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		76		108	MHz
Sensitivity	DQPSK	-100	-110		dBm

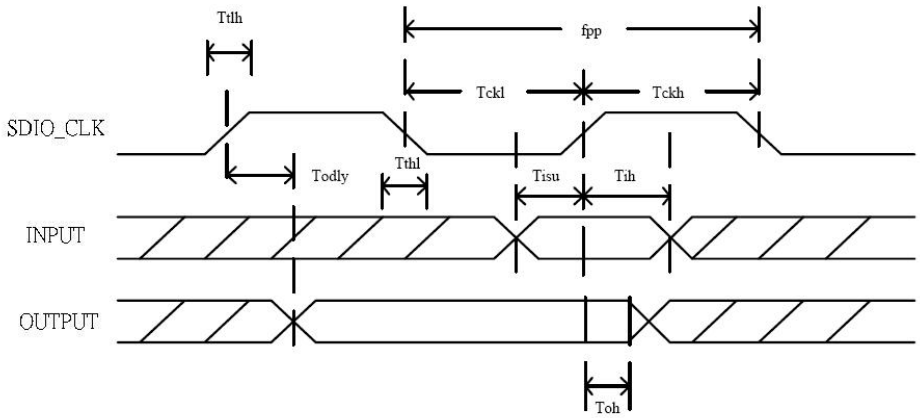
2-4. SDIO Host Interface Protocol Timing

2-4-1. SDIO 25MHz Timing Diagram



Symbol	Parameter	Min.	TYP.	MAX.	UNIT
fpp	Clock Frequency	0		25	MHz
Tckl	Clock Low Time	10			nS
Tckh	Clock High Time	10			nS
Ttlh	Clock Rise Time			10	nS
Tthl	Clock Fall Time			10	nS
Tisu	Input Setup Time	5			nS
Tih	Input Hold Time	5			nS
Todly	Output Delay Time	0		11	nS

2-4-2. SDIO 50MHz Timing Diagram



Symbol	Parameter	Min.	TYP.	MAX.	UNIT
fpp	Clock Frequency			50	MHz
Tckl	Clock Low Time	7			nS
Tckh	Clock High Time	7			nS
Ttlh	Clock Rise Time			3	nS
Tthl	Clock Fall Time			3	nS
Tisu	Input Setup Time	6			nS
Tih	Input Hold Time	2			nS
Toh	Output Hold Time	2.5			
Todly	Output Delay Time	0		12	nS

3. Pin Definition

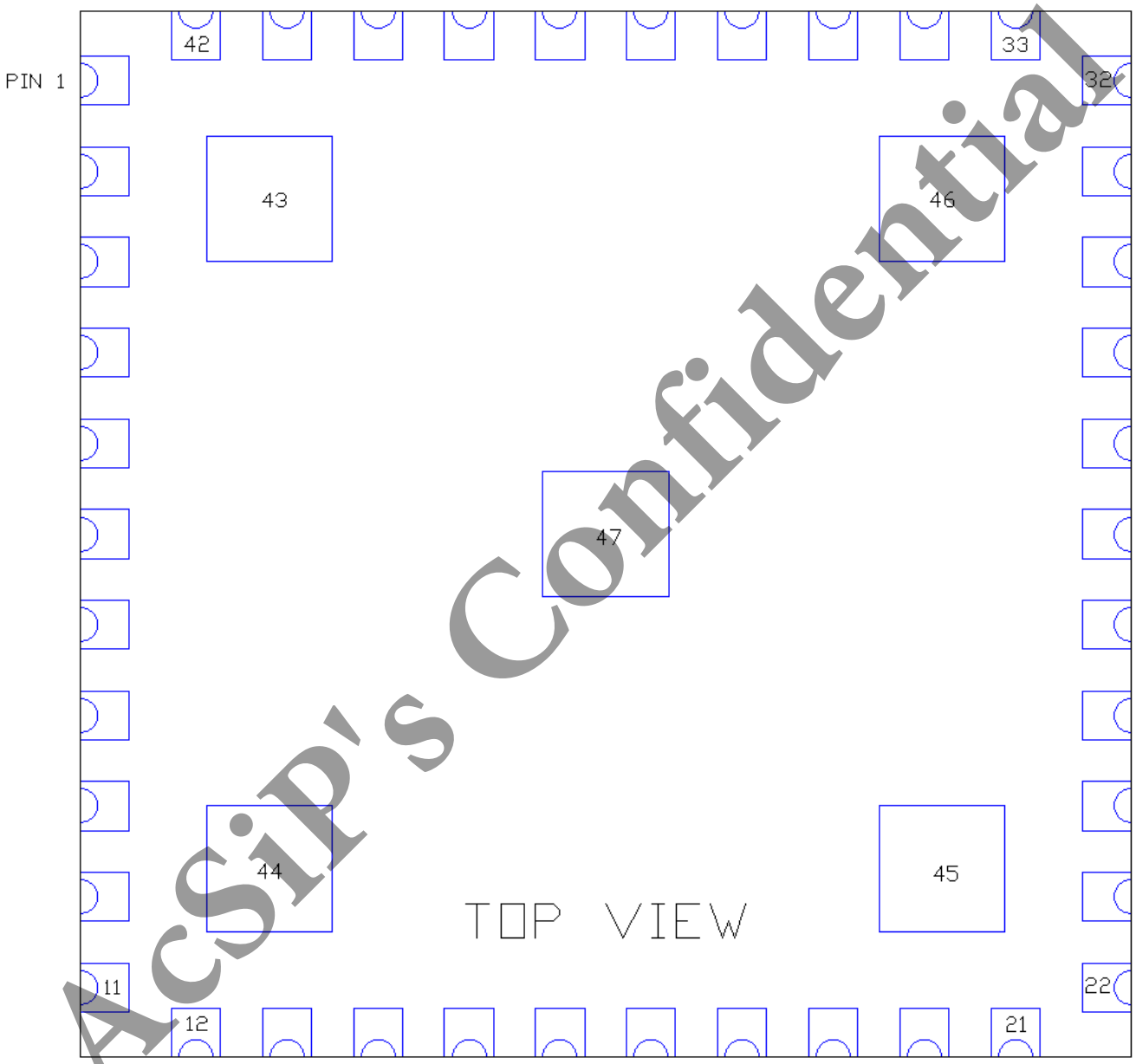
3-1. Pin Description

Pin	Definition	I/O	Power	Description
1	NC			
2	NC			
3	VBAT	VDD	VBAT	VBAT input pin.
4	GND	VSS		Ground Pin
5	VIO1	VDD	VIO1	VDD for digital interface IO
6	SD_DAT2	I/O	VIO1	Data pin of SDIO
7	SD_DAT3	I/O	VIO1	Data pin of SDIO
8	SD_CMD	I/O	VIO1	Command pin of SDIO
9	SD_CLK	I	VIO1	Clock pin of SDIO
10	SD_DAT0	I/O	VIO1	Data pin of SDIO
11	SD_DAT1	I/O	VIO1	Data pin of SDIO
12	UART_UTXD	O	VIO1	TX pin of UART interface
13	UART_URXD	I	VIO1	RX pin of UART interface
14	UART_CTS	I	VIO1	UART1 Flow Control
15	UART_RTS	O	VIO1	UART1 Flow Control
16	FM_AUOUT_R	O		FM analog output, R channel
17	FM_AUOUT_L	O		FM analog output, L channel
18	FM_SANT	I		FM short antenna input port
19	FM_LANT	I		FM long antenna input port
20	FM_LGND	I		FM long antenna differential input-N port
21	GPS_RF	I		GPS input port
22	SYSRST_B	I	VIO1	System reset pin
23	GND	VSS		Ground Pin
24	NC			
25	GND	VSS		Ground Pin
26	WIFI/BT ANT	I/O		WiFi/BT input/output port
27	GND	VSS		Ground Pin

28	EFUSE	VDD		Efuse enable pin
29	WIFI_INT_B	I/O	VIO1	WiFI interrupt pin
30	PMU_EN	I		PMU enable pin
31	NC			
32	NC			
33	GPS_SYNC	I/O	VIO1	external GPS SYNC signal
34	VRTC	VDD	VRTC	VDD of RTC domain
35	Ext_32K	I		external 32K clock input port
36	GPS_LNA_EN	O		external GPS LNA Enable PIN
37	PCM1CLK	I	VIO1	PCM CLK
38	PCM1IN	I	VIO1	PCM IN
39	PCM1OUT	O	VIO1	PCM OUT
40	PCM1SYNC	I	VIO1	PCM SYNC
41	BGF_INT_B	I/O	VIO1	BT/GPS/FM interrupt pin
42	TLDO_SW	VDD		2.8V Output for External TCXO VDD Supply
43~47	GND	VSS		Ground Pin

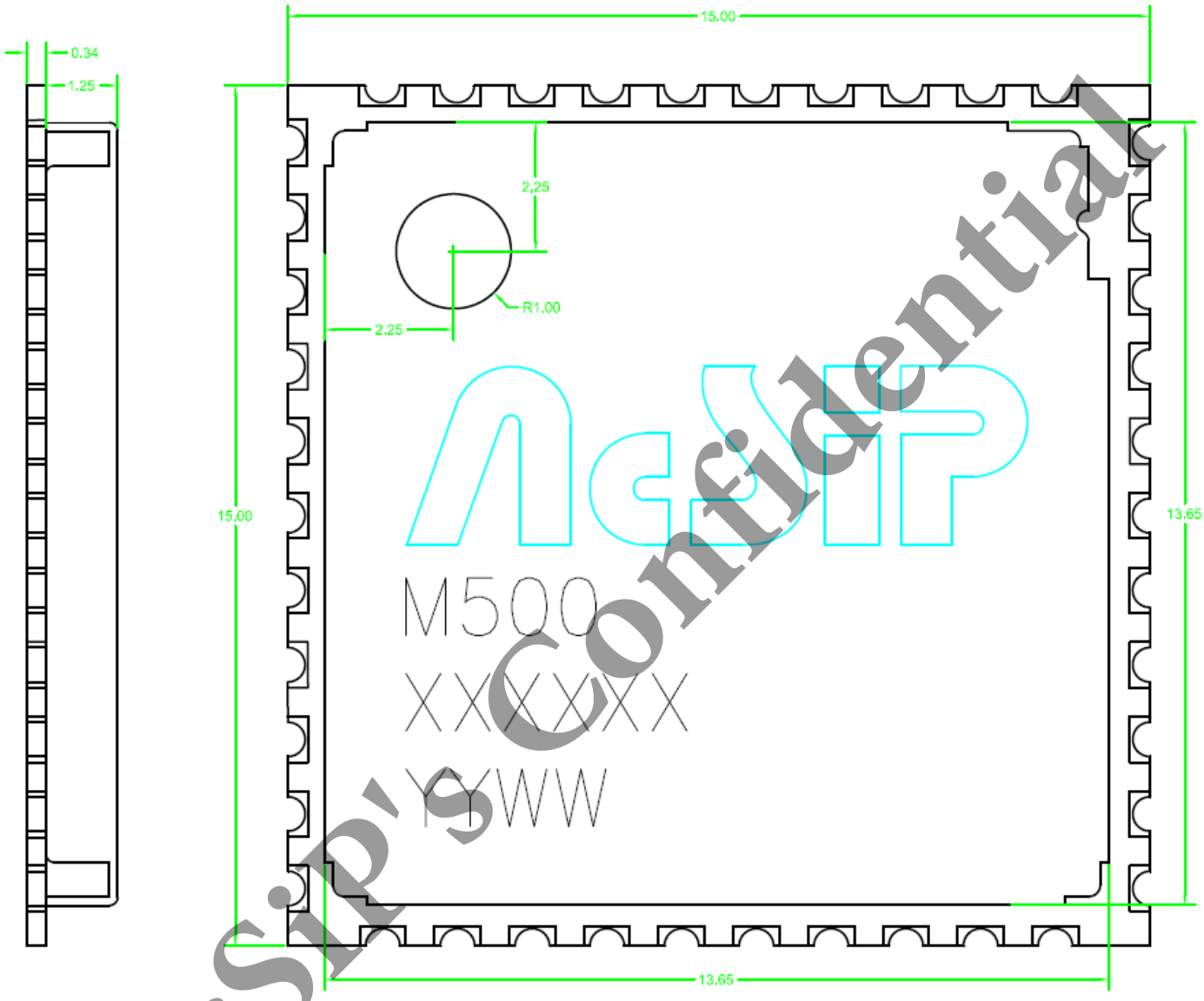
3-2. Pin Assignment

The SiP module will conform to the following pin map, shown in the following diagram (top view)



3-3. Mechanical Dimensions

3-3-1.M500

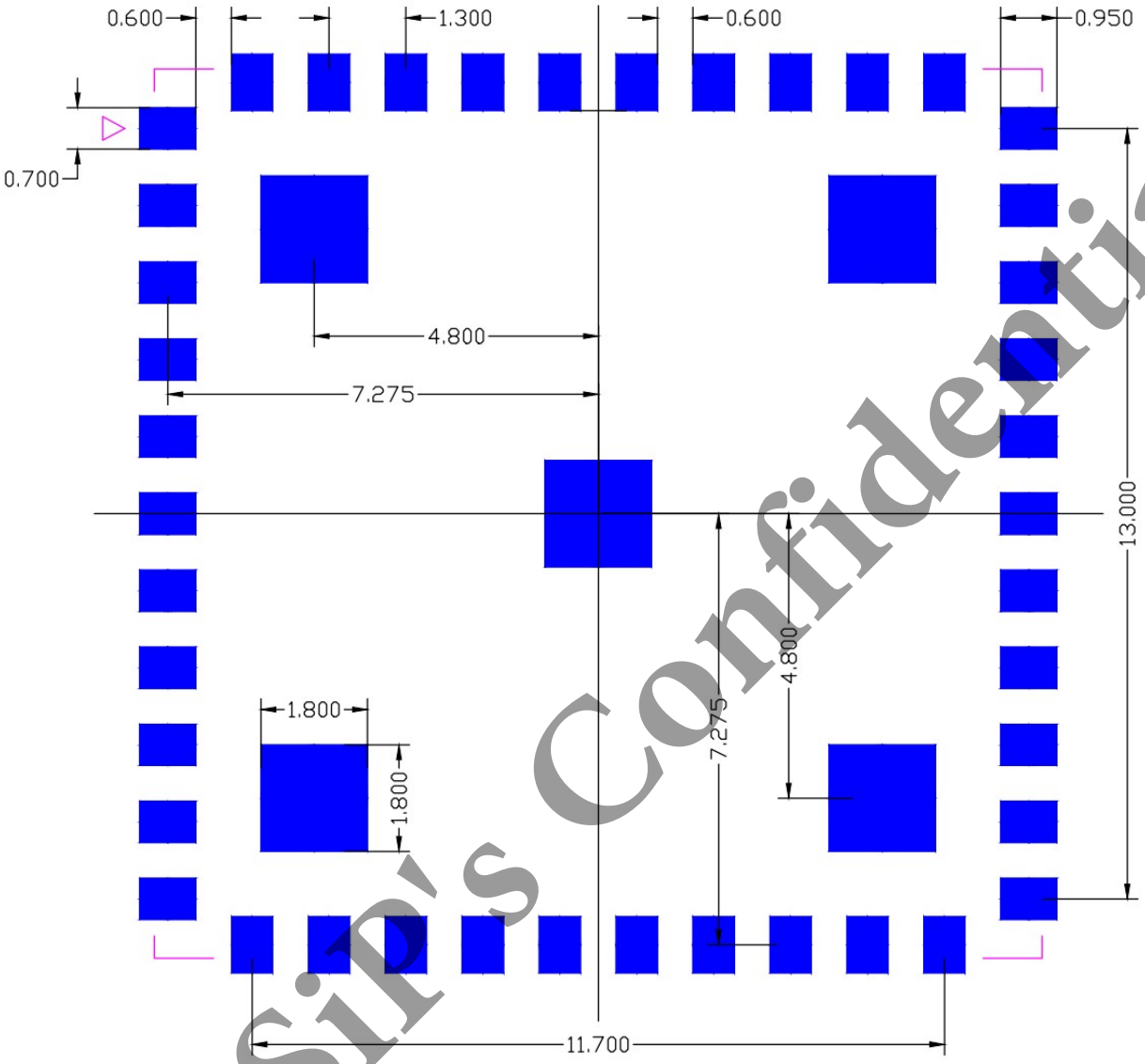


UNIT: mm
Tolerance：.xx ± 0.10mm

ESD Level :
HBM : MIL-STD-883E Method 3015.7 class 1A
MM : ESD-STM5.2-1999 class A
SDM : ANSI/ESD SP5.3.2-2004 class II

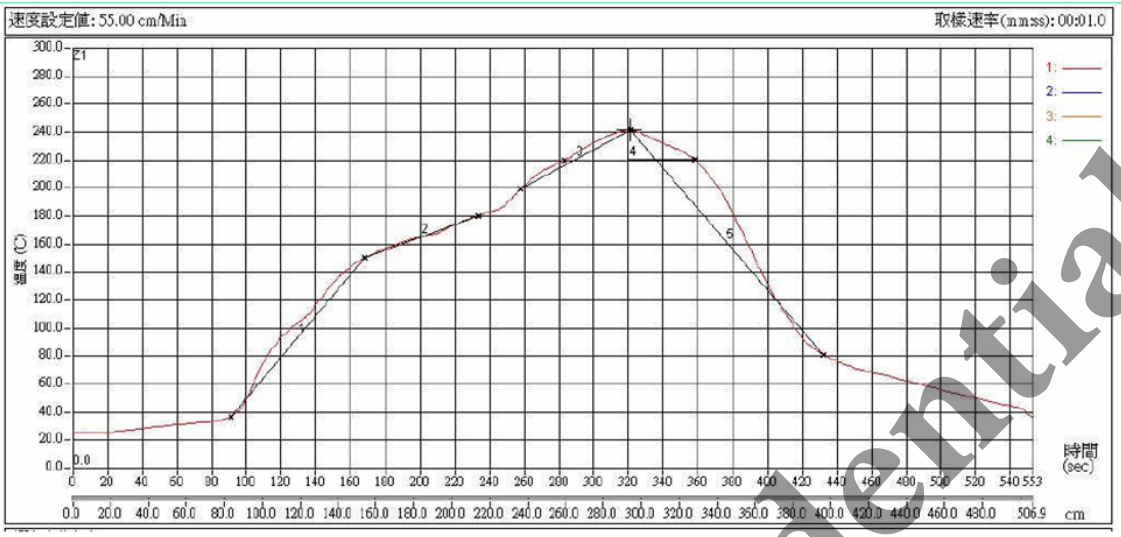
3-4. Recommended Footprint

TOP VIEW



UNIT: mm

4. Recommended Reflow Profile



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

5. SiP Module Preparation

5-1. Handling

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

Base on reliability test result pass MRT L3 criteria, M500 refers to MSL3 criterion.

5-2. SMT Preparation

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

6. Package Information

6-1. Product Making

Figure 1 below details the standard product marking for all AcSiP Corp. products. Cross reference to the applicable line number and table for a full detail of all the variables.

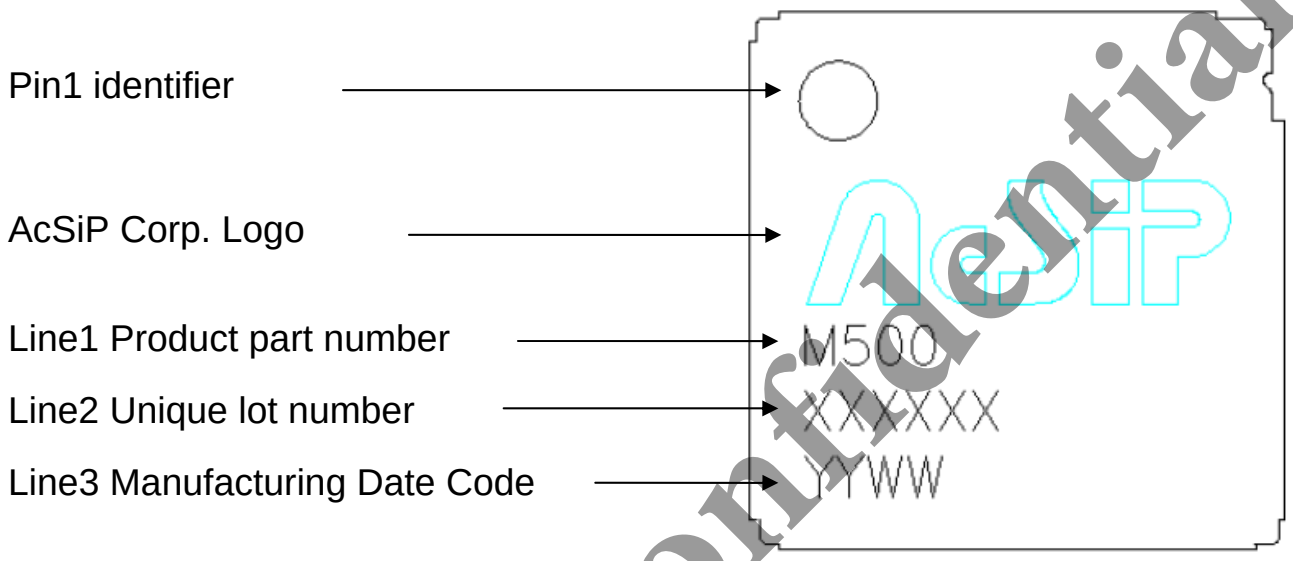
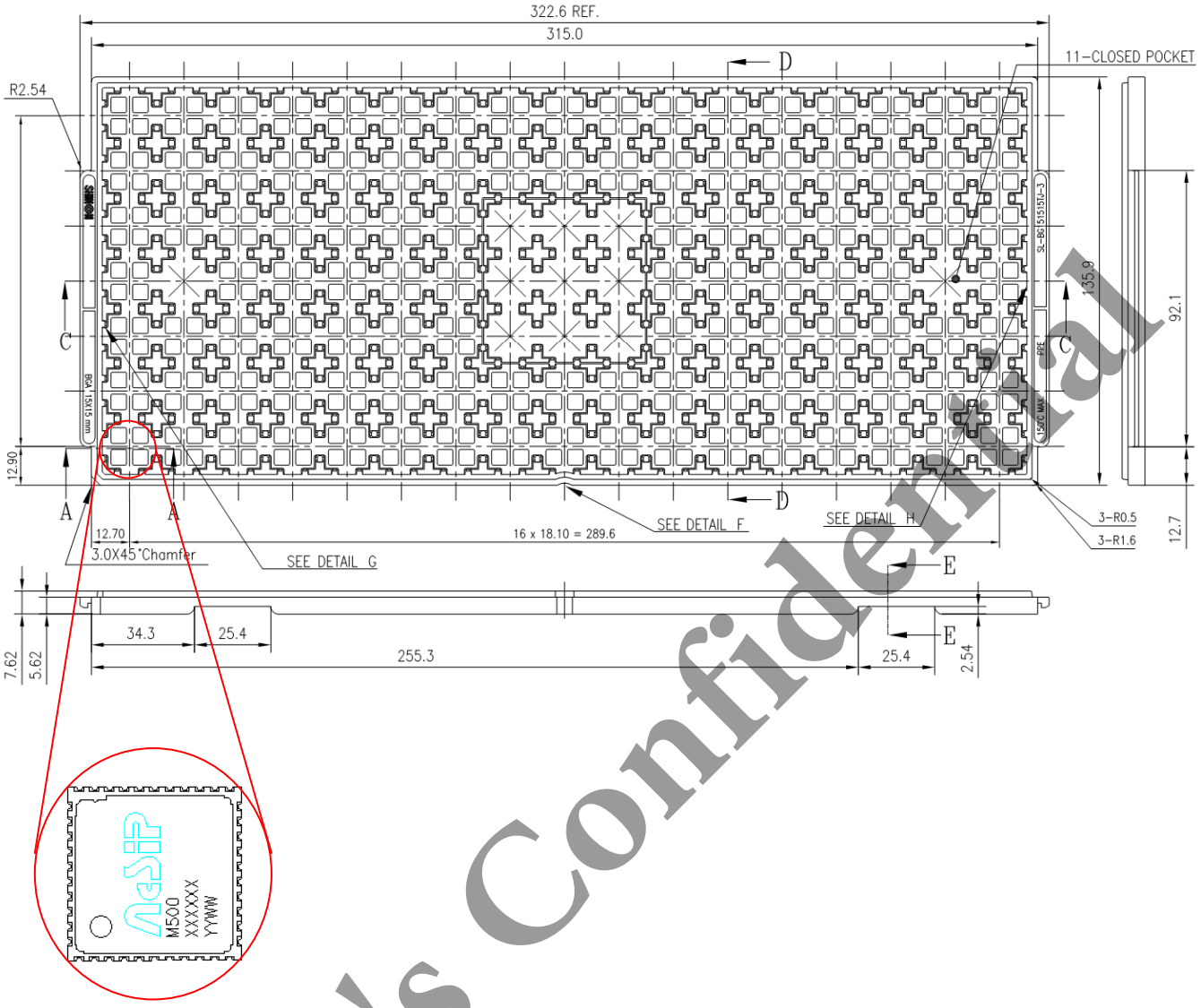


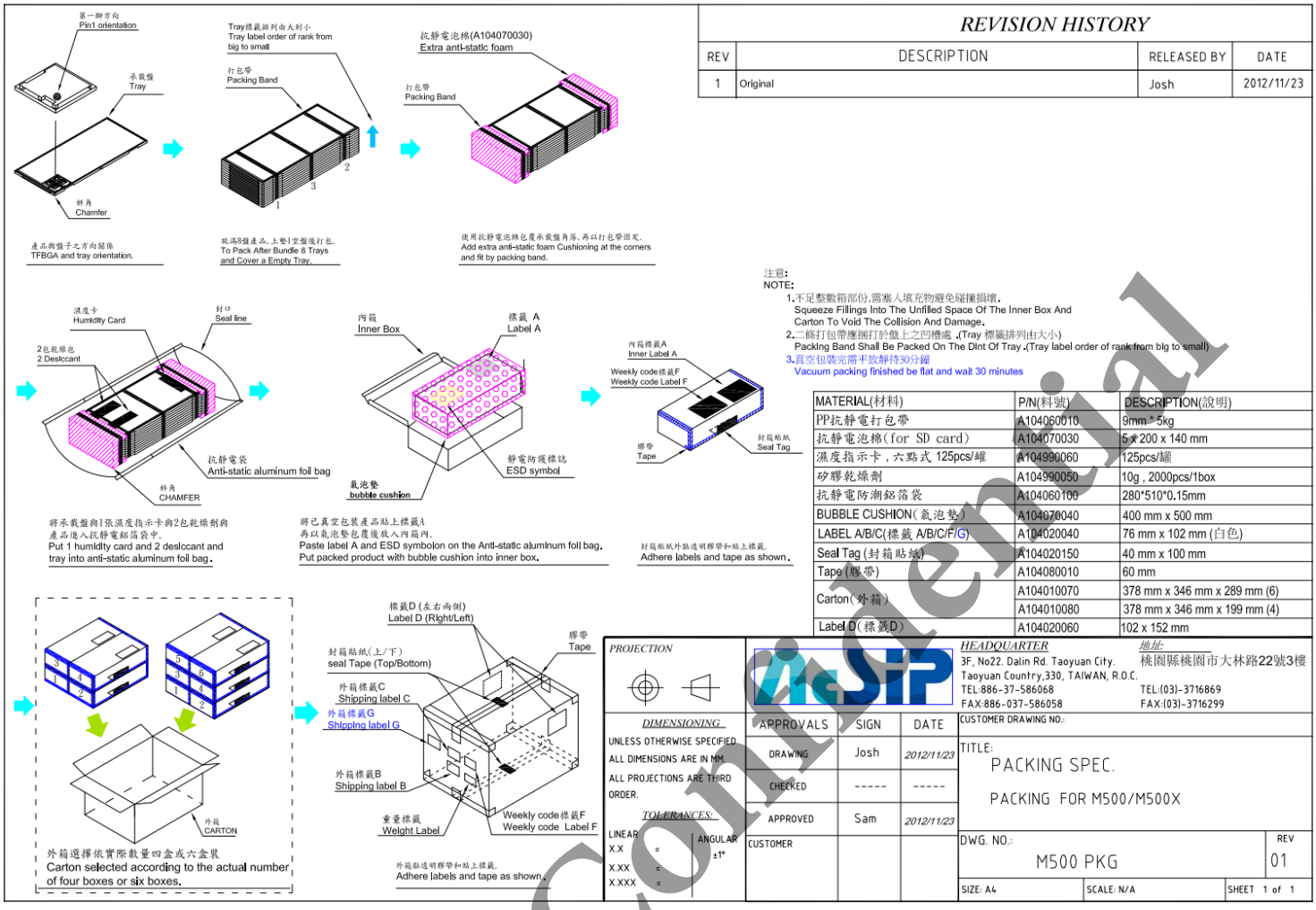
Figure 1 Standard Product Marking Diagram- TOP VIEW

The lines identified above are detailed below in the following tables on a line-by-line basis. This information is based on a 3 line product marking availability.

6-2. Tray Dimension



6-3. Packing Information



6-4. Humidity Indicator Card

Dry（乾燥）

Wet（潮濕）

Indicates 指示點：

5%, 10%, 60% relative humidity

5%, 10%, 60% 相對濕度

Color Change 顏色變化：

Brown（Dry）→ Blue（Wet）

棕色（乾燥）→ 藍色（潮濕）