

# PRODUCT SPECIFICATION

<b>Product Name</b>	<b>AI7688H</b> MT7688 IoT SiP Module
<b>Version</b>	<b>I</b>
<b>Doc No</b>	<b>901-09003</b>
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**AcSiP Technology Corp.**  
*An IoT Solution Company*

3F,-1 No 207,Fusing Rd., Taoyuan City,Taoyuan Dist.,Taoyuan City 33066, Taiwan(R.O.C)  
T. +886 3 286-8388 F. +886 3 347-5000

[www.acsip.com.tw](http://www.acsip.com.tw)

## Document History

Date	Revised Contents	Revised by	Version
Apr 07 <sup>th</sup> ,2016	Initial Version	Kevin	A
Apr 29 <sup>th</sup> ,2016	Modify PIN Description Modify Tray Dimension Add FCCID Number	Kevin	B
May 4 <sup>th</sup> ,2016	Modify Packing Information	Huiju	B01
Aug 18 <sup>th</sup> ,2016	Modify Specification	Kevin	C
Nov 11 <sup>th</sup> ,2016	Add SPI Pin Out Modify AI7688H Footprint Dimension	Kevin	D
Nov 16 <sup>th</sup> ,2016	Modify AI7688H Footprint Dimension	Kevin	E
Feb 08 <sup>th</sup> ,2017	Modify AI7688H Pin Description	Kevin/Ivan	F
Sep 18 <sup>th</sup> ,2017	Modify AI7688H POD pin description 512Mbit(64MByte) flash size module identification info. added	Ivan	G
Nov 06 <sup>th</sup> ,2017	Module dimension tolerance added	Ivan	H
Jan 22 <sup>nd</sup> ,2018	Shielding case illustration and relative picture modified	Ivan	I

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# 1. Description

AcSiP Technology Corp. introduces a low-cost and low-power consumption IoT module. The module is an operating system designed for wearable and Internet IoT devices that can connect to other smart devices or directly to cloud applications and services.

AI7688H is one of the most highly integrated SIP module for IoT prototyping

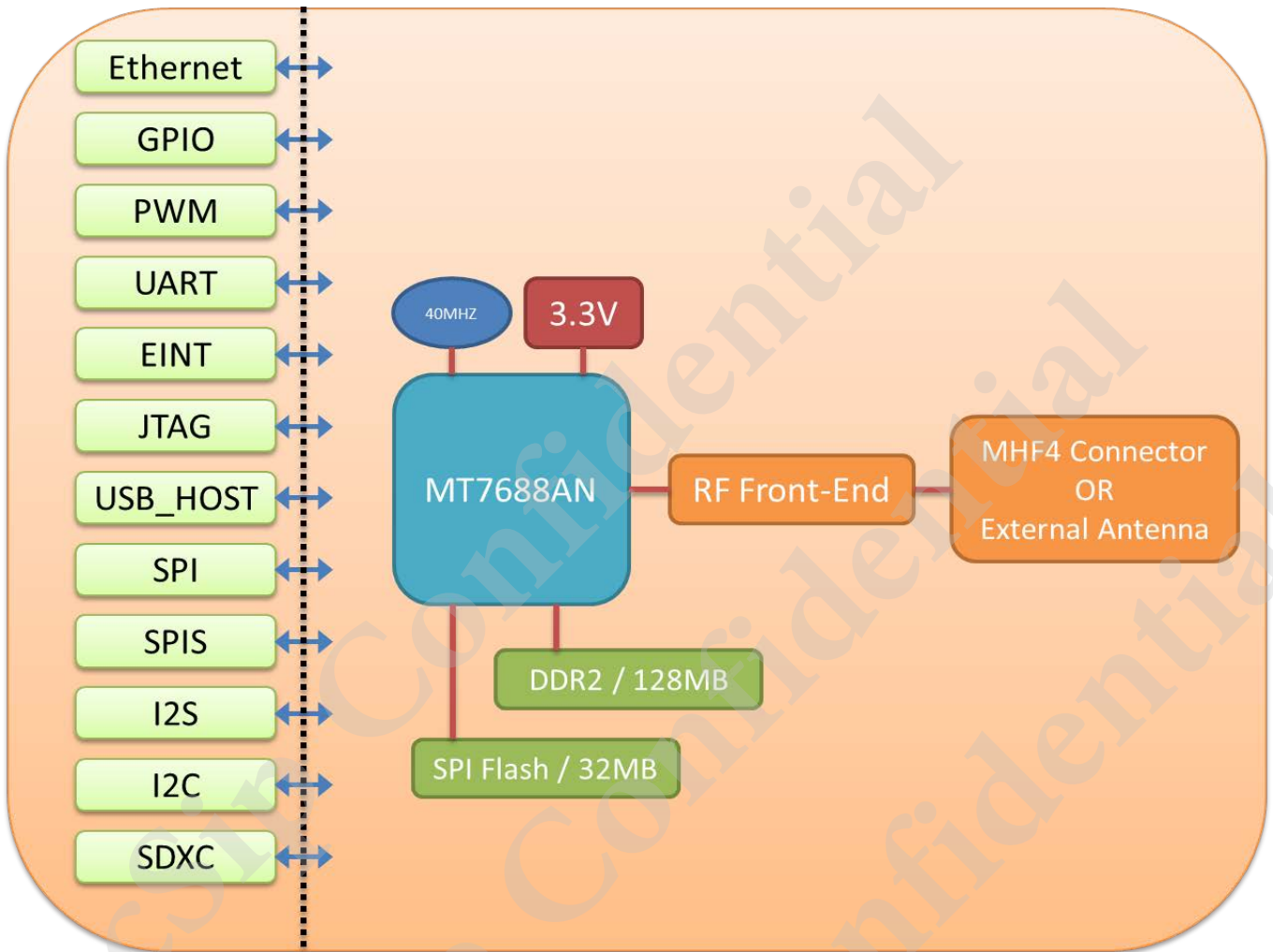
## 1.1. Platform Features

### General

- Embedded MIPS24KEc (575/580 MHz) with 64 KB I-Cache and 32 KB D-Cache
- 1T1R 2.4 GHz with 150 Mbps PHY data rate
- Legacy 802.11b/g and HT 802.11n modes
- 20/40 MHz channel bandwidth
- 802.11v
- Green AP/STA – Intelligent Clock Scaling (exclusive) – DDRII: ODT off, Self-refresh mode
- 1-port 10/100 FE PHY
- x1 USB 2.0 Host,
- SPI/SD-XC/eMMC
- SPI,I2C, I2S,PCM, UART, JTAG, GPIO
- Internet Of Thing
- An optimized PMU
- 16 Multiple BSSID
- WEP64/128, TKIP, AES, WPA, WPA2, WAPI
- QoS: WMM, WMM-PS
- AP/STA Firmware: Linux 2.6.36 SDK, OpenWrt

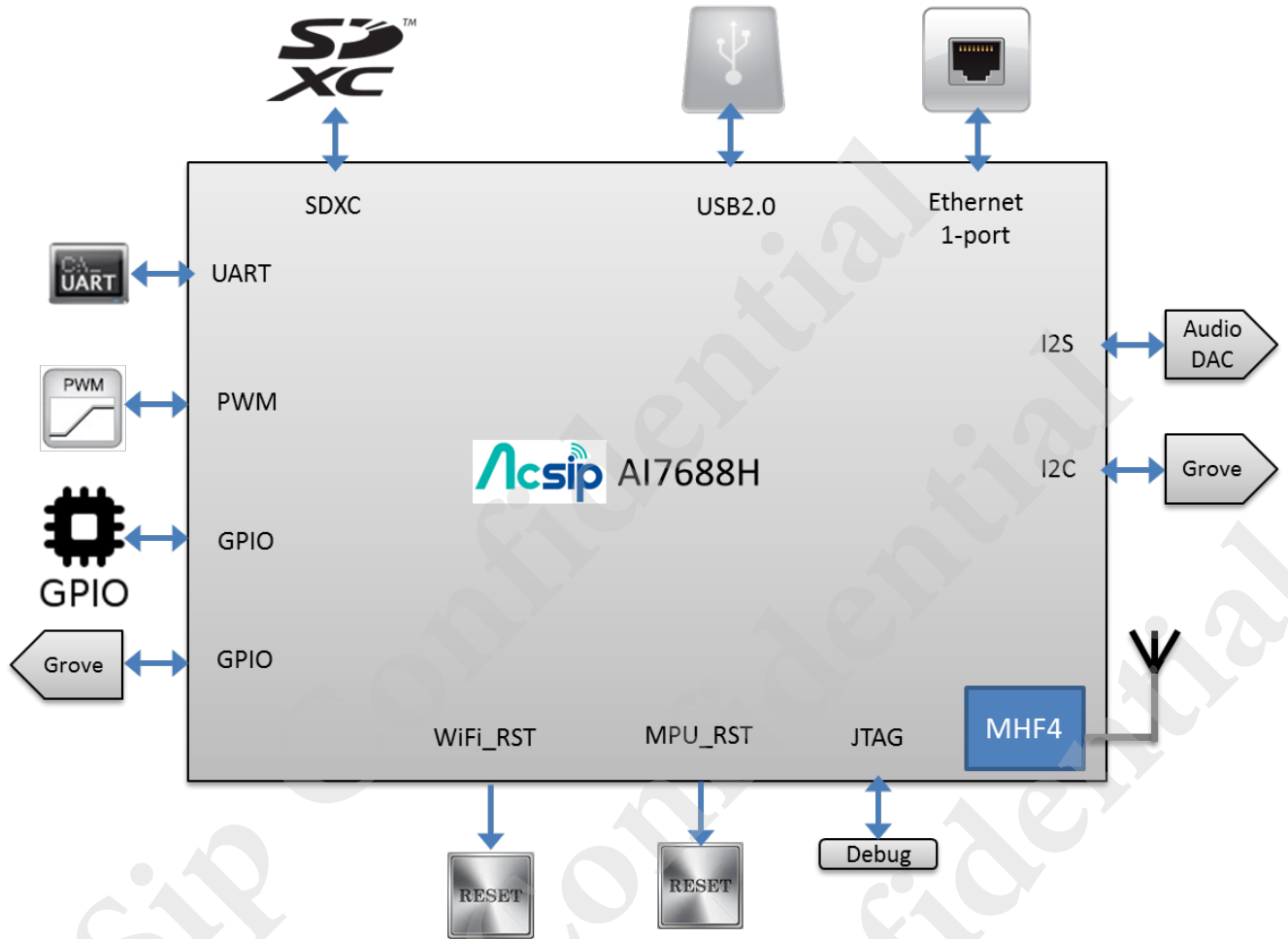


## 2. Block Diagram



\*512Mbit(64MByte) flash size is optional.

## 2.1. Typical application



## 2.2. Specification

Model Name	AI7688H
Chipset	MT7688AN
Core	MIPS24KEc
Clock Speed	580MHz
Memory	DDR2 128MB
Flash	256Mbit(32MByte) ; optional:512Mbit(64MByte)*
<b>Operation Conditions</b>	
Temperature	Operating : -40°C ~ +85°C Storage : -40°C ~ +85°C
Humidity	Operating : 10 ~ 95% (Non-Condensing) Storage : 5 ~ 95% (Non-Condensing)
Dimension	24mm X 32mm X1.8mm (±0.1mm)
Package	LGA 65Pin

\*Please see section 8.1 Product Marking for more details.

### 3. Electrical Characteristics

#### 3.1. Absolute Maximum Ratings

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>BAT</sub>	Supply Voltage	3	3.3	3.6	V
I/O Voltage	I/O supply voltage	3	3.3	3.6	V

#### 3.2. RF Characteristics

**Test Condition :**

Temperature	26.8° C
Humidity	30%

##### 3.2.1. RF Characteristics for 802.11b 11M

802.11b Transmit (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Tx Power Level	DQPSK	18.0	20.0	22.0	dBm
Frequency Tolerance		-15	0	15	ppm
Spectral Mask	11MHz→22MHz		40		dBr
	> 22MHz		53		dBr
Modulation Accuracy	All Data Rate		15		%
802.11b Receiver (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Min. Input	11Mbps PER<8%	-91.5	-89.5	-87.5	dBm



### 3.2.2. RF Characteristics for 802.11g 54M

802.11g Transmit (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Tx Power Level	OFDM	15.0	17.0	19.0	dBm
Frequency Tolerance		-15	0	15	ppm
Modulation Accuracy	All data rate		-31	-28	
802.11g Receiver (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Min. Input	54Mbps PER<10%	-78.0	-76.0	-74.0	

### 3.2.3. RF Characteristics for 802.11n MCS7(HT20)

802.11n_HT20 Transmit (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 13	
Tx Power Level	OFDM	15.0	17.0	19.0	dBm
Frequency Tolerance		-15	0	15	ppm
Modulation Accuracy	All Data Rate		-31	-28	dB
802.11n_HT20 Receiver (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Min. Input	MCS7 PER<10%	-76.5	-74.5	-72.5	dBm

### 3.2.4. RF Characteristics for 802.11n MCS7(HT40)

802.11n_HT40 Transmit (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency range		Channel 1		Channel 13	
Tx Power Level	OFDM	15.0	17.0	19.0	dBm
Frequency Tolerance		-15	0	15	ppm
Modulation Accuracy	All Data Rate		-31	-28	dB
802.11n_HT40 Receiver (Conductive)					
Item	Condition	Min.	Typ.	Max.	Unit
Frequency Range		Channel 1		Channel 13	
Min. Input	MCS7 PER<10%	-76.5	-74.5	-72.5	dBm

## 4. Pin Definition

### 4.1. Detailed Pin Description

	SD_D2	SD_D3	SD_CMD	SD_CLK	SD_D0	SD_D1	SD_CD	SD_WP	USB_DM	USB_DP	UART_RXD0	UART_TXD0	GPIO0	MDI_TN_P0	MDI_TP_P0	MDI_RN_P0	MDI_RP_P0			
	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14			
GND	31																	13	GND	
UART_RXD2	32																		12	I2C_SD
UART_TXD2	33	GND																	11	I2C_SCLK
MDI_RN_P2	34																		10	I2S_CLK
MDI_RP_P2	35																		9	I2S_WS
MDI_RN_P1	36																		8	I2S_SDO
MDI_RP_P1	37																		7	I2S_SDI
MDI_TN_P1	38																		6	UART_RXD1
MDI_TP_P1	39																		5	UART_TXD1
GND	40																		4	JTAG_RST_N
GND	41	GND																	3	JTAG_TDO
GND	42																		2	JTAG_TMS
GND	43			P1	P2	P3	P4												1	GND
	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60			
	GND	WLED_N	REF_CLKO	PERST_N	WDT_RST_N	PORST_N	PCIE_TXP0	PCIE_TXN0	PCIE_RXP0	PCIE_RXN0	3V3	PCIE_CKN0	PCIE_CKP0	JCLK	JTDI	GND	WiFi_RF_OUT			

Module_pinout	Pin NAME	DIGITAL Pin	SERIAL Pin	Other
1	GND			
2	JTAG_TMS			
3	JTAG_TDO	GPIO#43	EPHY LED	
4	JTAG_RST_N			
5	UART_TXD1	GPIO#45	UART_TXD1	
6	UART_RXD1	GPIO#46	UART_RXD1	
7	I2S_SDI	GPIO#0	I2S_SDI	
8	I2S_SDO	GPIO#1	I2S_SDO	
9	I2S_WS	GPIO# 2	I2S_WS	
10	I2S_CLK	GPIO#3	I2S_CLK	
11	I2C_SCLK	GPIO#4	I2C SCL	
12	I2C_SD	GPIO#5	I2C SDA	
13	GND			
14	MDI_RP_P0		ETHY RD+	
15	MDI_RN_P0		ETHY RD-	
16	MDI_TP_P0		ETHY TD+	
17	MDI_TN_P0		ETHY TD-	
18	GPIO0			
19	UART_TXD0	GPIO#12	UART_TXD0	
20	UART_RXD0	GPIO#13	UART_RXD0	
21	USB_DP		USB D+	
22	USB_DM		USB D-	
23	SD_WP			
24	SD_CD			
25	SD_D1			
26	SD_D0			
27	SD_CLK			
28	SD_CMD			
29	SD_D3			
30	SD_D2			

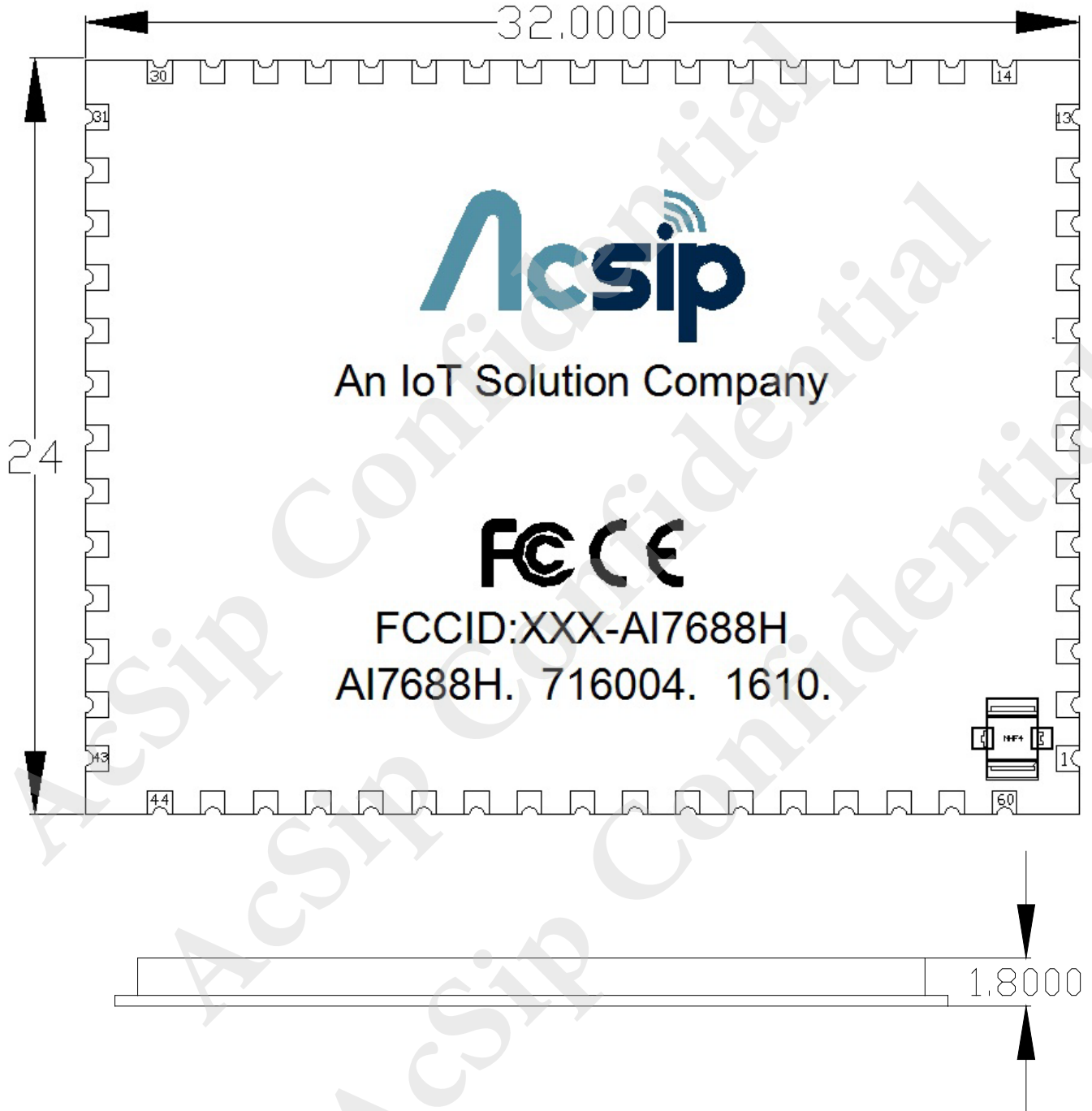
Module_pinout	Pin NAME	DIGITAL Pin	SERIAL Pin	Other
31	GND			
32	UART_RXD2	GPIO#21	UART_RXD2	
33	UART_TXD2	GPIO#20	UART_TXD2	
34	MDI_RN_P2	GPIO#19		PWM1
35	MDI_RP_P2	GPIO#18		PWM0
36	MDI_RN_P1	GPIO#17		
37	MDI_RP_P1	GPIO#16		
38	MDI_TN_P1	GPIO#15		
39	MDI_TP_P1	GIPO#14		
40	GND			
41	GND			
42	GND			
43	GND			
44	GND			
45	WLED_N			Wi-Fi LED
46	REF_CLKO	GPIO#37		REF_CLK
47	PERST_N			
48	WDT_RST_N			WiFi RESET
49	PORST_N			MPU RESET
50	PCIE_TXP0			
51	PCIE_TXN0			
52	PCIE_RXP0			
53	PCIE_RXN0			
54	3V3			
55	PCIE_CKN0			
56	PCIE_CKP0			
57	JCLK			
58	JTDI			
59	GND			
60	2.4G_RF			
P1 *	SPI_CLK	GPIO#7	SPI_CLK	
P2 *	SPI_MOSI	GPIO#8	SPI_MOSI	
P3 *	SPI_MISO	GPIO#9	SPI_MISO	
P4 *	SPI_CS1	GPIO#6	SPI_CS1	

**\*IF P1、P2、P3、P4 are not used, please do not connect them (DNC)**

**4.2. AI7688H Dimension**

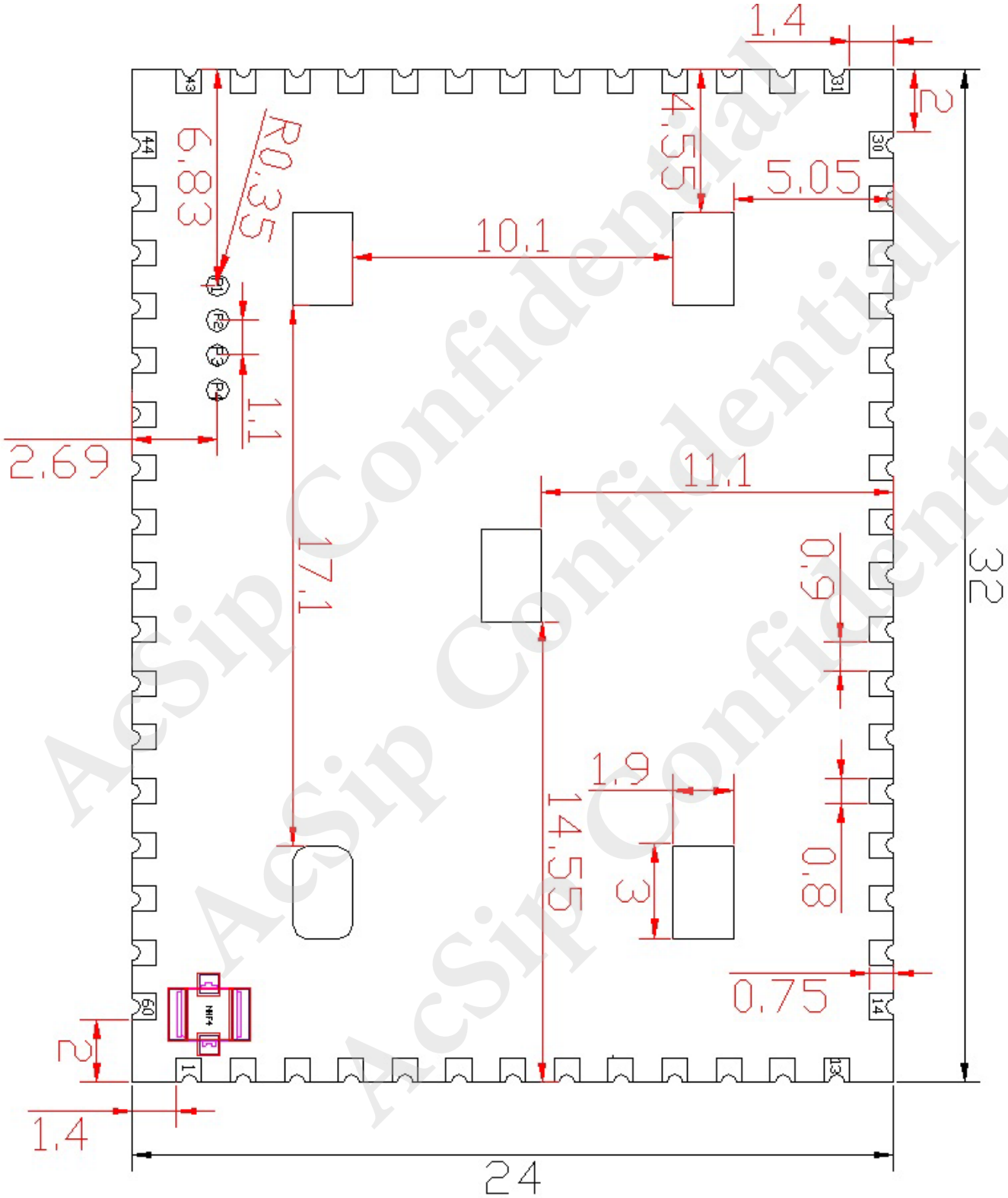
UNIT : mm

TOP VIEW

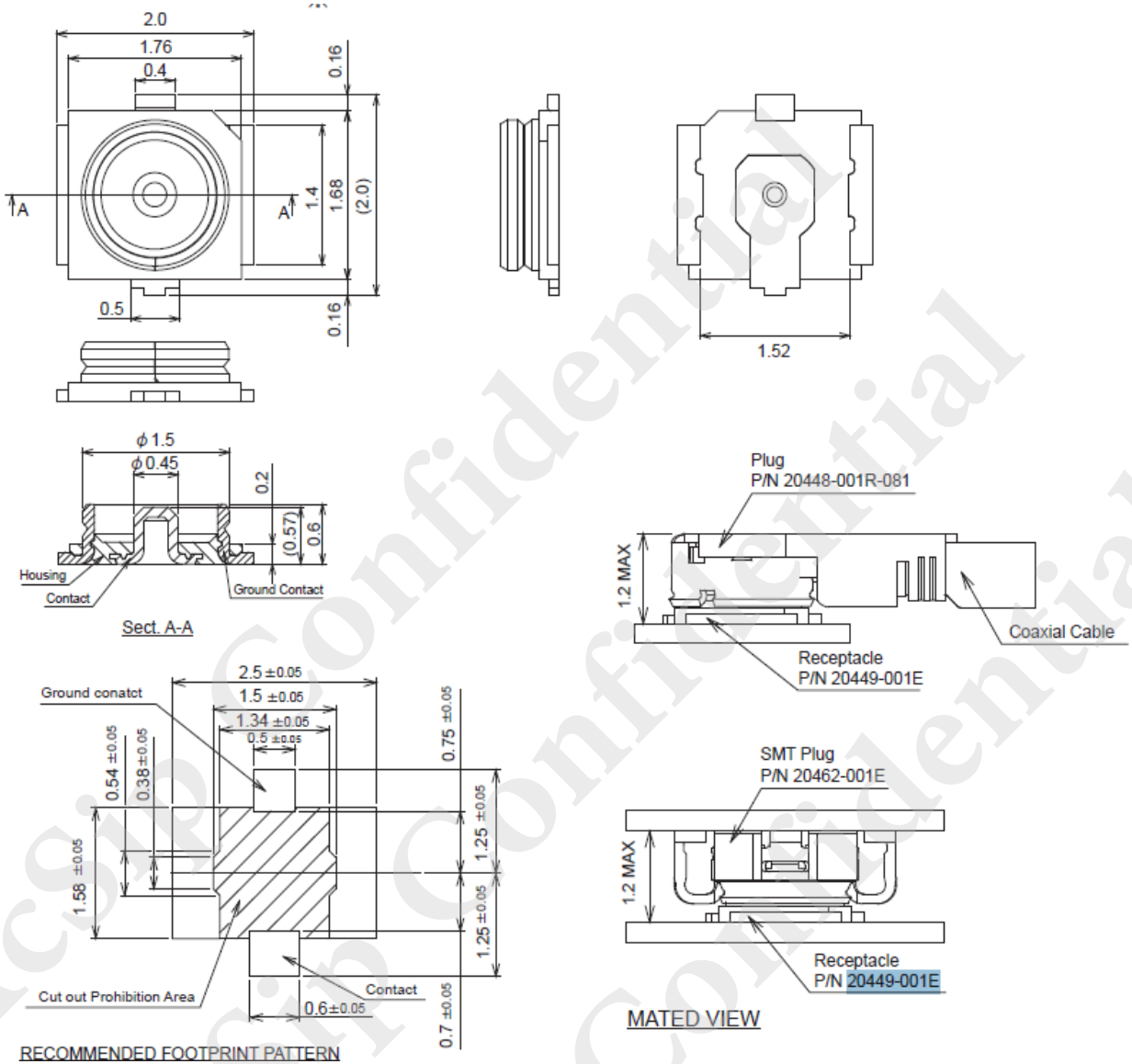


## AI7688H Footprint Dimension

UNIT : :mm (TOPVIEW)



### 4.3. Antenna Connector Dimension



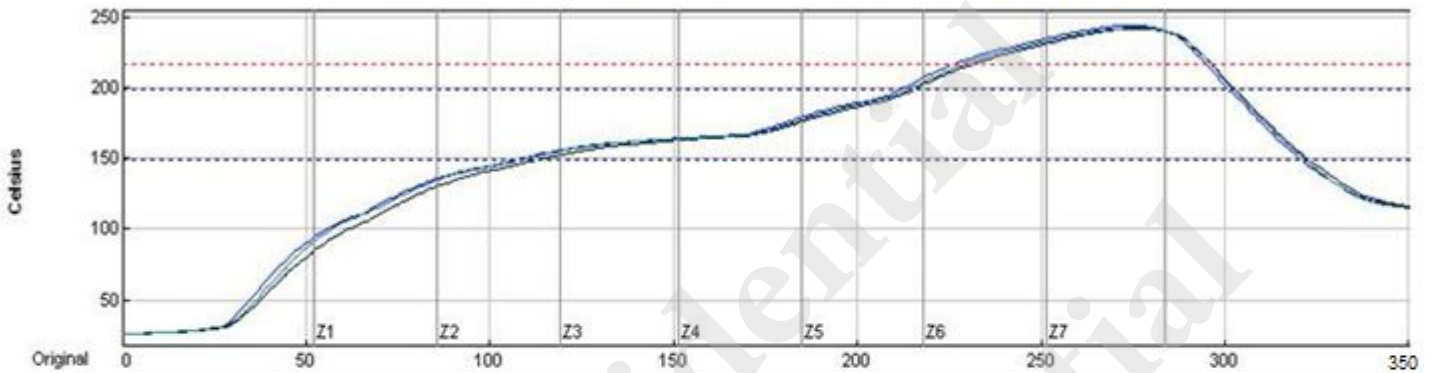
## 5. Regulator

This SiP module is pre-scanned on module level to comply with following standards:

- FCC IDENTIFIER : 2ADWC-AI7688H
- CE Test Report No. : LD160513C24

## 6. Recommended Reflow Profile

Reflow Profile for SiP on board Assembly



<b>Preheat time</b>	<b>150°C—200°C : 105+/-15sec</b>
<b>Dwell time</b>	<b>Over 220°C : 70+5/-10 sec</b>
<b>Peak Temp</b>	<b>240 +10/-5°C</b>
<b>Ramp Up/Down Rate</b>	<b>Up: 3 +0/-2 °C/ sec Down: 2 +0/-1°C/ sec</b>



## 7. SiP Module Preparation

### 7.1. 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.

### 7.2. SMT Preparation

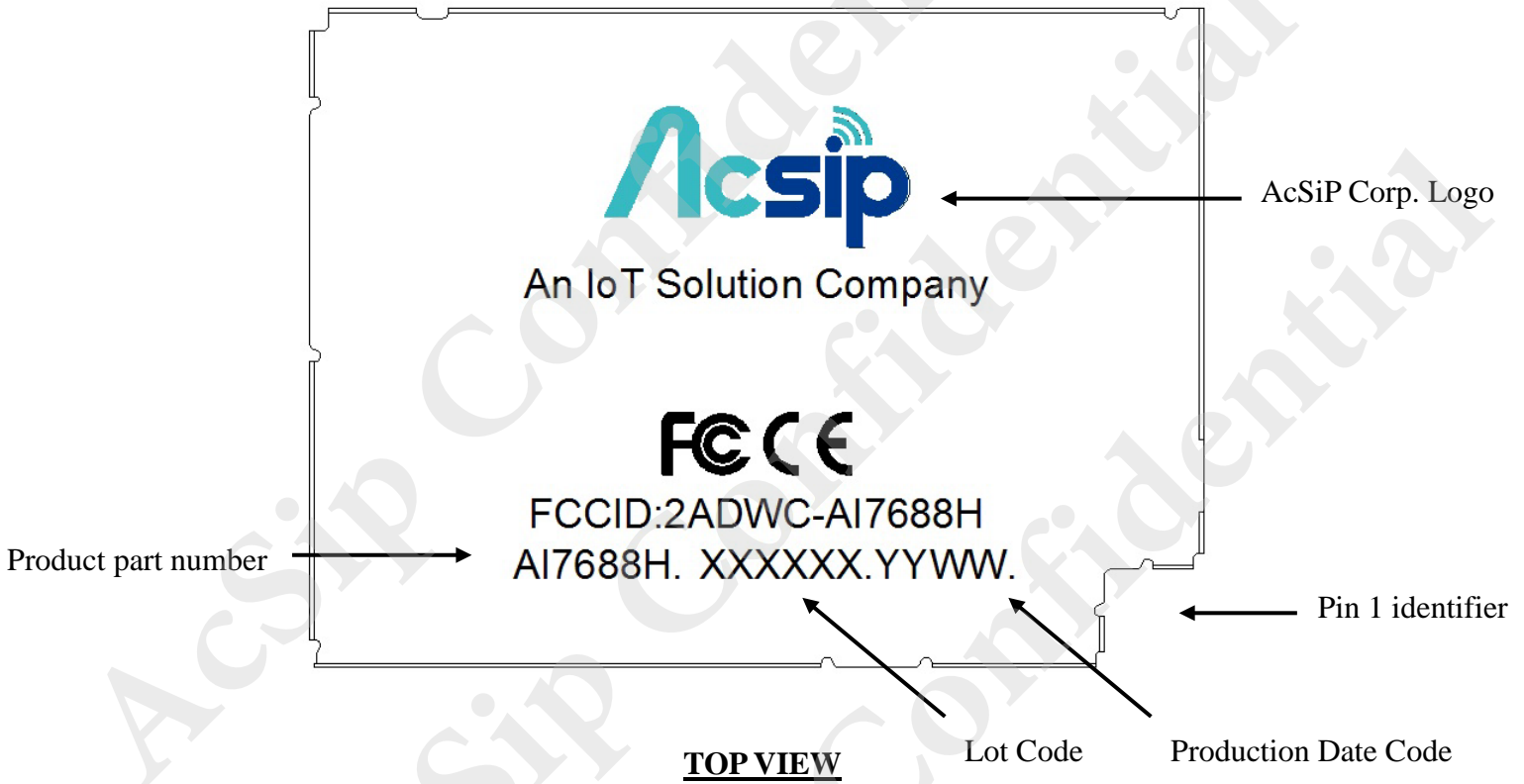
1. Calculated shelf life in sealed bag: 6 months at <math>40^{\circ}\text{C}</math> and <math>90\%</math> relative humidity (RH).
2. Peak package body temperature:  $250^{\circ}\text{C}$ .
3. After bag was opened, devices that will be subjected to reflow solder or other high temperature process must.
  - A. Mounted within: 168 hours of factory conditions <math>30^{\circ}\text{C}</math> /60% RH.
  - B. Stored at  $\leq 10\%$  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  $23\pm 5^{\circ}\text{C}$ .
  - 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  $125\pm 5^{\circ}\text{C}$ .

## 8. Package Information

### 8.1. Product Making

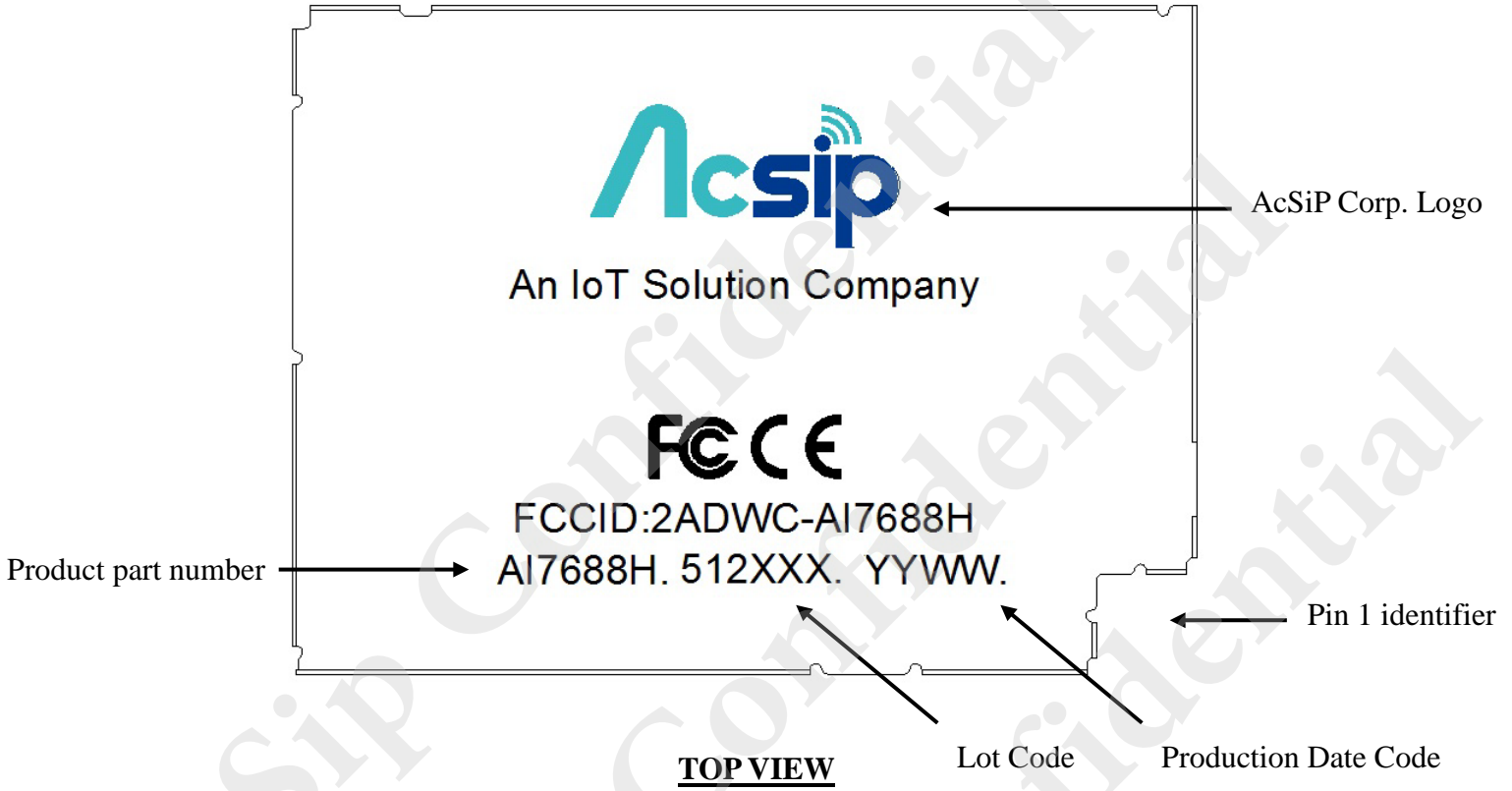
Figures below detail the standard product marking for all AcSiP Corp. products. Cross reference to the applicable line number and table for a full detail of all the variables.

<A> Marking for 256Mbit(32MByte) Flash size module:



<B> Marking for 512Mbit(64MByte) Flash size module:

The first three digits of Lot code will be 512 for 512Mbit Flash size AI7688H.



## 8.2. Tray Dimension

