Meshreen MS5168 ZigBee Module
MS5168-Mxx series

Content

1. Introduction

The MS5168-001-Myy family is a range of ultra-low power, high performance surface mount modules targeted at IEEE 802.15.4, JenNet-IP, ZigBee Light Link, ZigBee Smart Energy and RF4CE networking applications, enabling users to realize products with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules use NXP's MS5168 wireless microcontroller to provide a comprehensive solution with large memory, high CPU and radio performance and all RF components included. All that is required to develop and manufacture wireless control or sensing products is to connect a power supply and peripherals such as switches, actuators and sensors, considerably simplifying product development.

1.1   Variants

Variant	Description
MS5168-M00	JN5168 IEEE802.15.4/ZigBee Standard Power Module with embedded PCB antenna
MS5168-M03	JN5168 IEEE802.15.4/ZigBee Standard Power Module with μ-FL connector
MS5168-M04	JN5168 IEEE802.15.4/ZigBee High Power Module with μ-FL connector
MS5168-M05	JN5168 IEEE802.15.4/ZigBee High Power Module with embedded PCB antenna

Table 1 Meshreen module variants

2. Specification

There are differences between modules, the parameters are defined here.

VDD=3.3V @ +25°C

Typical DC Characteristics			Notes
	M00/03	**M04/05**	
Deep sleep current	100nA	100nA	
Sleep Current	0.70uA	0.70μA	With active sleep timer
Radio Transmit current	15.3mA	150mA	CPU + Protocol + radio transmitting
Radio receive current	17mA	22mA	CPU in doze + radio receiving
Centre frequency accuracy	+/-25ppm	+/-25ppm	Additional +/-15ppm allowance for temperature and ageing
Typical RF Characteristics			Notes
Receive sensitivity	-95dBm	-100dBm	Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 (Note 1)
Maximum Transmit power	+2.5dBm	+19dBm	
Maximum input signal	10dBm	+5dBm	For 1% PER, measured as sensitivity
RSSI range (dBm)	-95 ~ -10dBm	-105 ~ -20	
RF Port impedance – SMA/uFl connector	50 ohm	50 ohm	2.4 - 2.5GHz
Rx Spurious Emissions	-61dBm	-69dBm	Measured conducted into 50 ohms
Tx Spurious Emissions	-40dBm	-49dBm	Measured conducted into 50 ohms
VSWR (max)	2:1	2:1	2.4 - 2.5GHz
Peripherals			Notes
Master SPI port	3 selects	3 selects	250kHz - 16MHz
Slave SPI port	√	√	250kHz - 8MHz
Two UARTs	√	√	16550 compatible
Two-wire serial I/F (compatible with SMbus & I²C)	√	√	Up to 400kHz
5 x PWM (4 x timer, 1x timer/counter)	√	√	16MHz clock
Two programmable Sleep Timers	√	√	32kHz clock
Digital IO lines (multiplexed with UARTs, timers and SPI selects)	20	18	
Four channel Analogue-to-Digital converter	√	√	10-bit, up to 100ks/s
Programmable analogue comparators	√	√	Ultra low power mode for sleep
Internal temperature sensor and battery monitor	√	√	

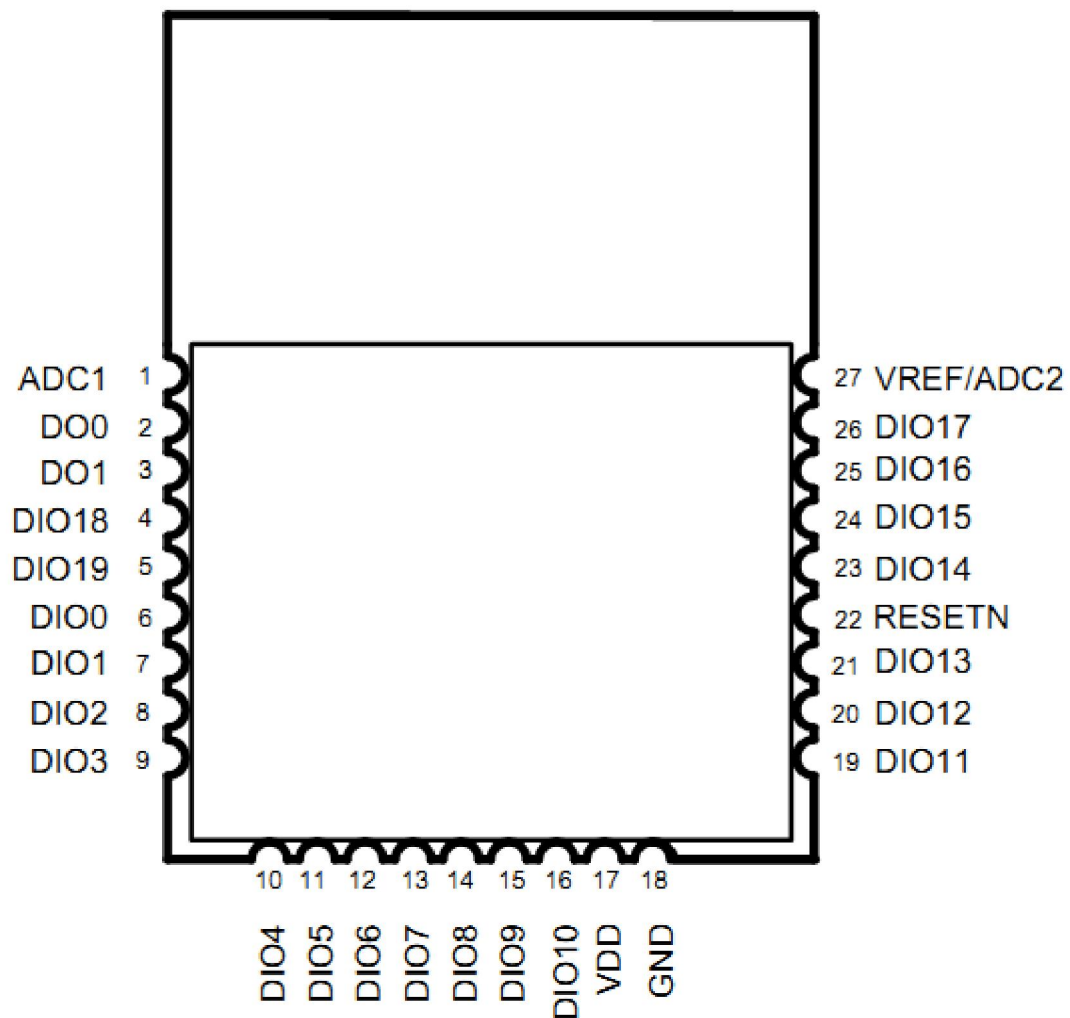Table 2 Module specification

2.1 Pin configurations

Figure 1 **Pin Configuration (top view)**

Note that the same basic pin configuration applies for all module designs. However, DIO3(pin9) and DIO2(pin8) are not available on the high power modules.

2.2 Pin Assignment

Pin No	Pin Functions					Signal Type	Description
	Primary	Alternate Functions					
1	ADC1					3.3V	Analogue to Digital Input
2	DO0	SPICLK			PWM2	CMOS	SPI Master Clock Output or PWM2 Output
3	DO1	SPIMISO				CMOS	SPI Master In Slave Out Input
4	DIO18	SPIMOSI			PWM3	CMOS	SPI Master Out Slave In Output or PWM3 Output
5	DIO19	SPISEL0				CMOS	SPI Select From Module – SS0 Output
6	DIO0	SPISEL1	ADC3			CMOS	DIO0, SPI Slave Select Output 1 or ADC input 3
7	DIO1	SPISEL2	ADC4	PC0		CMOS	DIO1, SPI Slave Select Output 2, ADC input 4 or Pulse Counter 0 input
8	DIO2*		RFRX	TIM0CK_GT		CMOS	DIO2, Radio Receive Control Output or Timer0 Clock/Gate Input
9	DIO3*		RFTX	TIM0CAP		CMOS	DIO3, Radio Transmit Control Output or Timer0 Capture
10	DIO4	CTS0	JTAG_TCK	TIM0OUT	PC0	CMOS	DIO4, UART 0 Clear To Send Input, JTAG CLK Input, Timer0 PWM output, or Pulse Counter 0 Input
11	DIO5	RTS0	JTAG_TMS	PWM1	PC1	CMOS	DIO5, UART 0 Request To Send Output, JTAG Mode Select Input, PWM1 Output or Pulse Counter 1 Input
12	DIO6	TXD0	JTAG_TDO	PWM2		CMOS	DIO6, UART 0 Transmit Data Output, JTAG Data Output or PWM2 Output
13	DIO7	RXD0	JTAG_TDI	PWM3		CMOS	DIO7, UART 0 Receive Data Input, JTAG Data Input or PWM 3 Output
14	DIO8	TIM0CK_GT	PC1	PWM4		CMOS	DIO8, Timer0 Clock/Gate Input, Pulse Counter1 Input or PWM 4 Output
15	DIO9	TIM0CAP	32KXTALIN	RXD1	32KIN	CMOS	DIO9, Timer0 Capture Input, 32K External Crystal Input, UART 1 Receive Data Input or 32K External Clock Input
16	DIO10	TIM0OUT	32KXTALOUT			CMOS	DIO10, Timer0 PWM Output or 32K External Crystal Output
17	VDD					3.3V	Supply Voltage
18	GND					0V	Digital Ground
19	DIO11	PWM1		TXD1		CMOS	DIO11, PWM1 Output or Timer1 Data Output
20	DIO12	PWM2	CTS0	JTAG_TCK	ADO or SPISMOSI	CMOS	DIO12, PWM2 Output, UART0 Clear To Send Input, JTAG CLK Input, Antenna Diversity Odd Output or SPI Slave Master Out Slave In Input
21	DIO13	PWM3	RTS0	JTAG_TMS	ADE or SPIMISO	CMOS	DIO13, PWM3 Output, UART0 Request To Send Output, JTAG Mode Select Input, Antenna Diversity Even output or SPI Slave Master In Slave Out Output
22	RESETN					CMOS	Reset input
23	DIO14	SIF_CLK	TXD0 TXD1	JTAG_TDO	SPISEL1 or SPISSEL	CMOS	DIO14, Serial Interface Clock, UART 0 Transmit Data Output, UART1 Transmit Data Output, JTAG Data Output, SPI Master Select Output 1 or SPI Slave Select Input
24	DIO15	SIF_D	RXD0 RXD1	JTAG_TDI	SPISEL2	CMOS	DIO15, Serial Interface Data or Intelligent Peripheral Data Out
25	DIO16	COMP1P	SIF_CLK	SPISMOSI		CMOS	DIO16, Comparator Positive Input, Serial Interface clock or SPI Slave Master Output Slave In Input
26	DIO17	COMP1M	PWM4	I2C DATA	SPISIMO	CMOS	DIO17, Comparator Negative Input, Serial Interface Data or SPI Slave Master In Slave Out Output
27	ADC2					3.3V	Analogue to Digital Input

Table 3   Pin Assignment

* These two pins are not connected for JN5168-001-M04 & JN5168 -001-M05 modules.

2.3　.Pin Description

All pins behave as described in the DS- MS5168 Wireless Microcontroller Datasheet, with the exception of the following:

2.4　Power Supplies

A single power supply pin, VDD is provided.

3. Electrical Characteristics

In most cases, the Electrical Characteristics are the same for both module and chip. They are described in detail in the chip datasheet. Where there are differences, they are detailed below

3.1   Maximum Ratings

Exceeding these conditions will result in damage to the device.

Parameter	Min	Max
Device supply voltage VDD	-0.3V	3.6V
All Pins	-0.3V	VDD + 0.3V
Storage temperature	-40ºC	150ºC

Table 4 Maximum Ratings

3.2   Operation Conditions

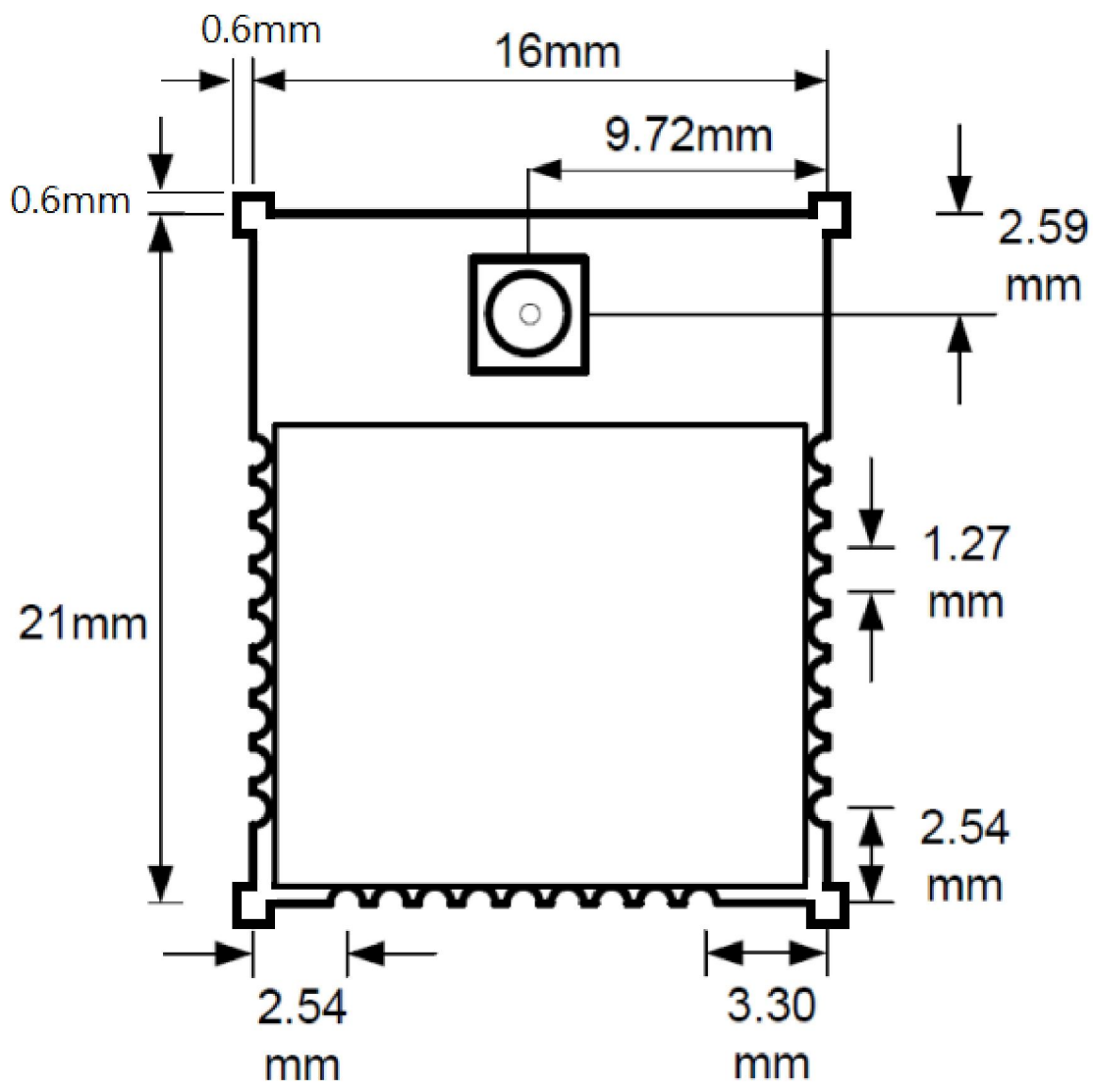| Supply	Min	Max
VDD	2.0V	3.6V
Ambient temperature range	-40˚C	85˚C

Table 5 Operation Conditions

4. Outline Drawing
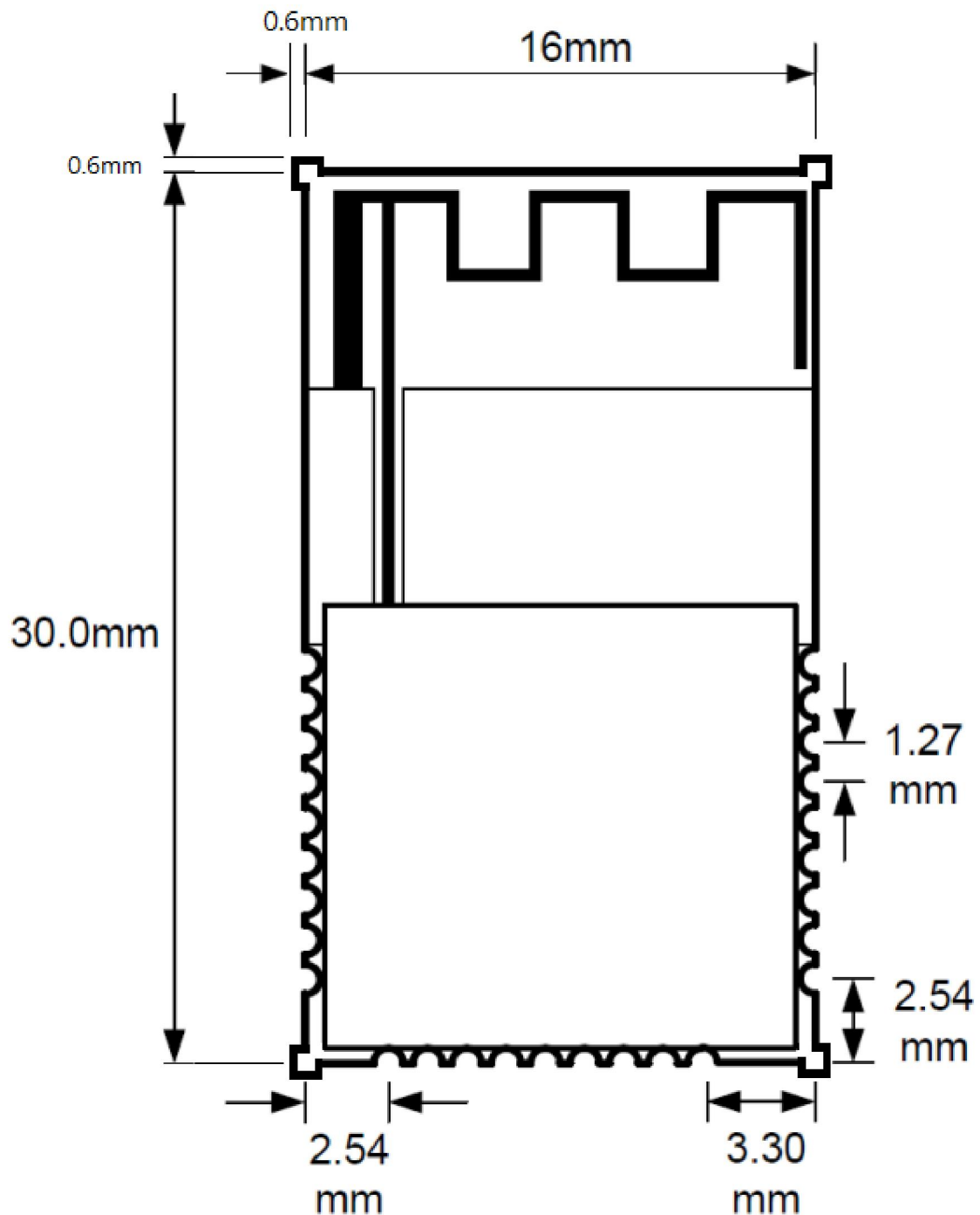
Thickness: 2.8mm

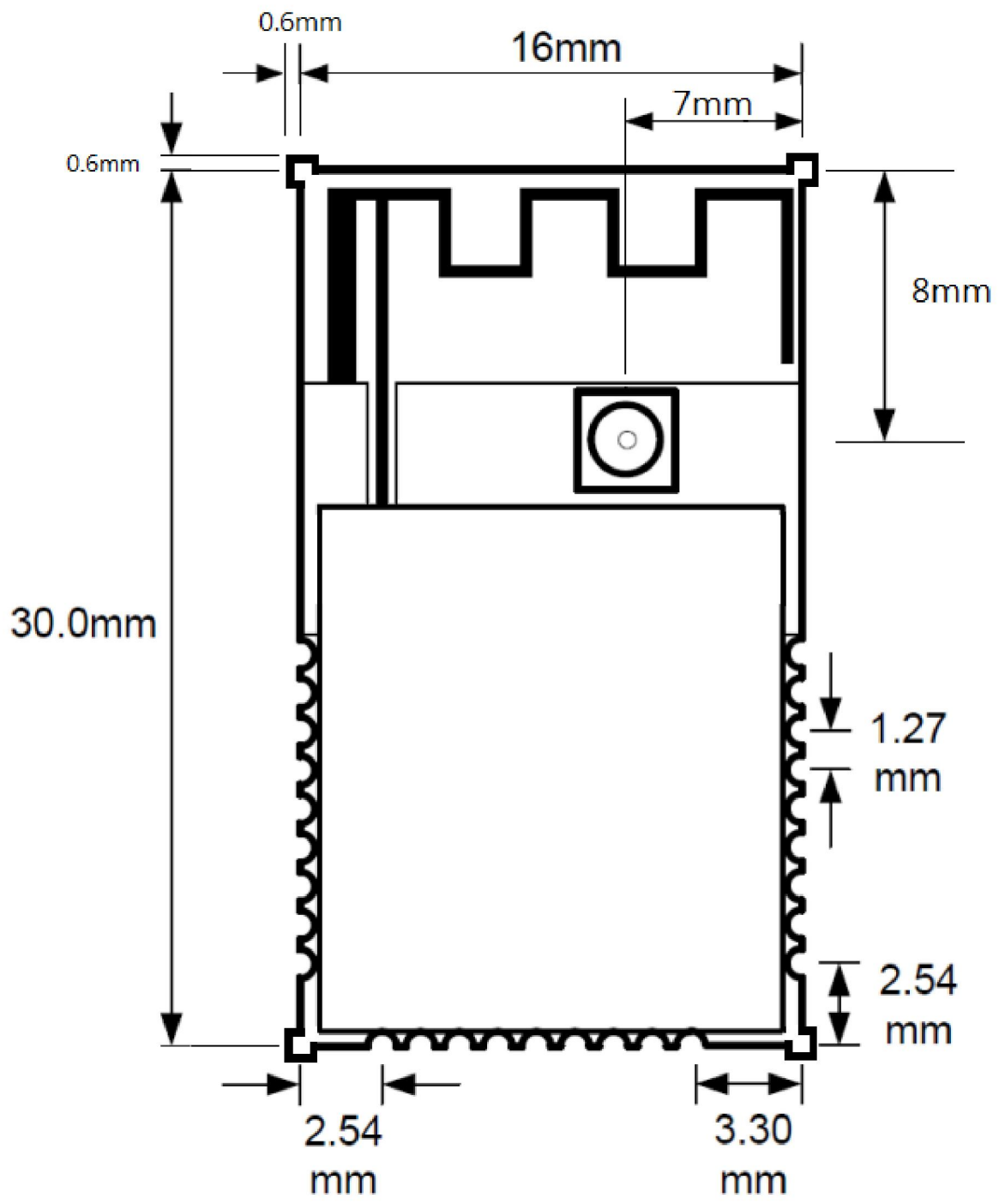Four corner of PCB are PCB V-Cut tolerance

Figure 3 MS5168-M04 Outline Drawing

Thickness: 2.8mm

Four corner of PCB are PCB V-Cut tolerance
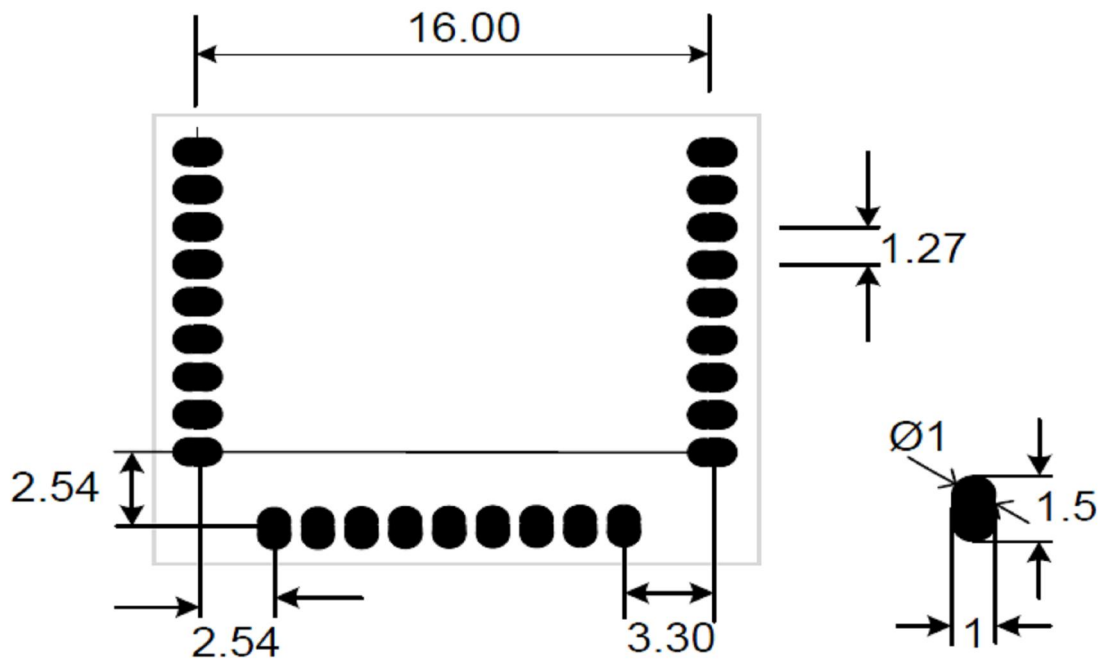
Figure 4 MS5168-M03 outline drawing

Thickness: 2.8mm

Four corner of PCB are PCB V-Cut tolerance

Figure 5 MS5168-M04/M05 Outline Drawing

4.1 Module PCB Footprint

Figure 6 PCB footprint (diagram)

Note 1: All modules have the same footprint

Note 2: All Dimensions are mm

Figure 6 PCB footprint

5. Optimal PCB placement of the MS5168-M00/M05 Module

The JN5168-M00/M05 module features an optimized, low cost, integrated, inverted F, printed PCB antenna. The antenna has a vertically polarized near omnidirectional radiation pattern and up to 1.6 dBi of peak gain. The PCB design has been elongated in order to increase the ground plane area which increases the antenna efficiency. This allows standalone operation without any additional ground plane however care must be taken when mounting this module onto another PCB. The area around the antenna must be kept clear of conductors or other metal objects for an absolute minimum of 20 mm. This is true for all layers of the PCB and not just the top layer. Any conductive objects close to the antenna could severely disrupt the antenna pattern resulting in deep nulls and high directivity in some directions.

The diagrams below show various possible scenarios. The top 3 scenarios are correct; ground plane may be placed beneath MS5168-M00/M05 module as long as it does not protrude beyond the edge of the top layer ground plane on the module PCB.

The bottom 3 scenarios are incorrect; the left hand side example because there is ground plane underneath the antenna, the middle example because there is insufficient clearance around the antenna (it is best to have no conductors anywhere near the antenna), finally the right hand example has a battery's metal casing in the recommended keep out area.
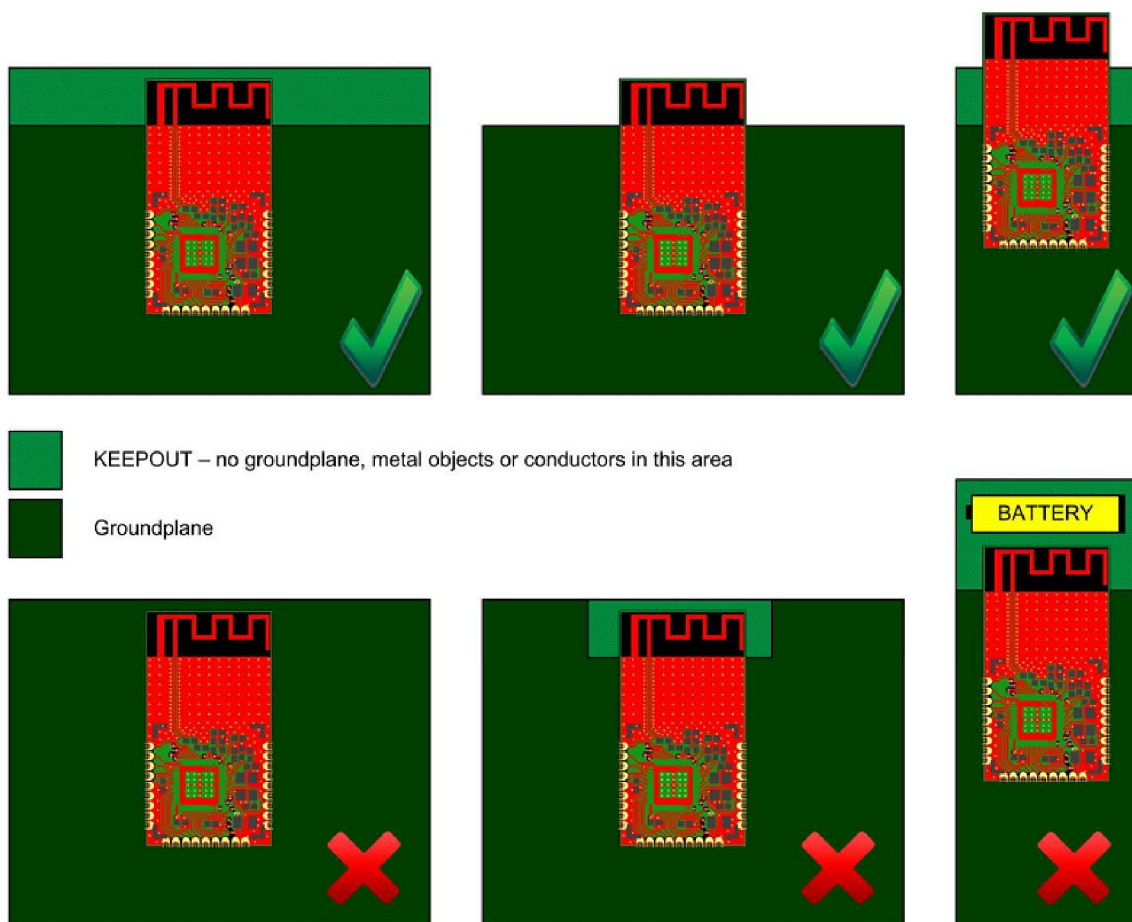

KEEPOUT – no groundplane, metal objects or conductors in this area

Groundplane

Figure 7 Optimal PCB placement

Note: The antenna radiation pattern is same as JN5168-001-M00

6. Reflow Profile

For reflow soldering, it is recommended to follow the reflow profile in figure 6 as a guide, as well as the paste manufacturer's guidelines on peak flow temperature, soak times, time above liquid and ramp rates.
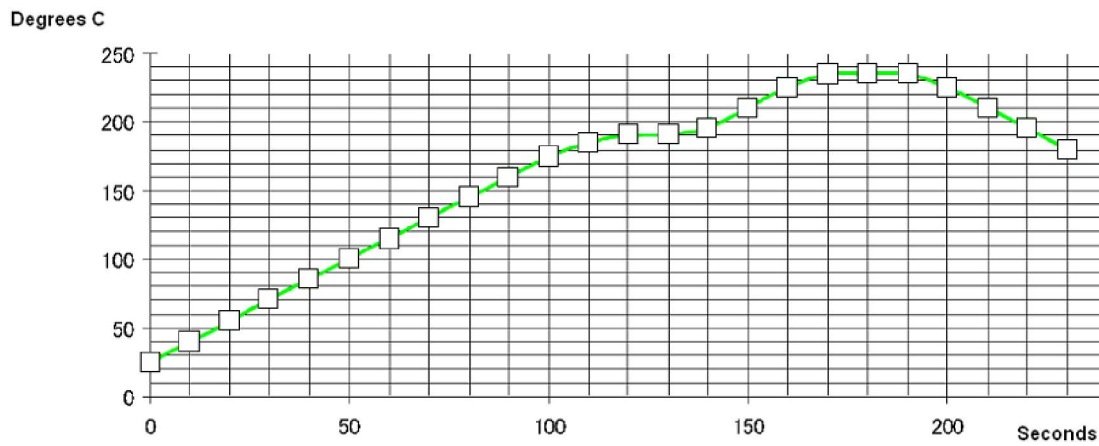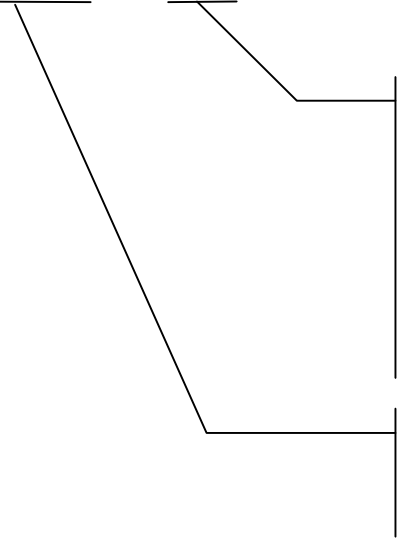

Temperature	25~160 ℃	160~190 ℃	> 220° C	230~Pk.	Pk. Temp (235℃)
Target Time (s)	90~130	30~60	20~50	10~15	150~270

Figure 8 Module Reflow profile reference

7. Ordering Information

MS5168-Mxx

Module Type:

00: Standard Power, Ceramic Antenna

03: Standard Power, µFl connector

04: High Power, µFl connector

05: High Power, PCB Antenna

Main Chip Variant:

5168: MS5168-001

PLEASE NOTE: There is no Label in MS5168 series

8. Version Control

Version	Date	Notes
1.0	2013.11.05	1st Issue
1.3	2014.03.21	Update PIN I/O names
1.4	2014.05.12	Add Picture, update thickness
1.5	2014.07.02	Modify module outline, Delete Label definition

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