Instruction

Z-Wave Module Selection Guideline

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Description:	**This document introduces the ZW0201, and ZW0301 Single Chip based Z-Wave Module families, and suggests which module to choose for a given application.**
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REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
01.00	20020822	TBA	All	First Release
02.00	20030409	TJO	All	New SW API's added and ZM1206 Z-Wave Module Added
03.00	20031112	TJO	All	New layout and a wide range of information has been added
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6	20070226	MVO SDH	All	Removed "Confidential" from footer Updated to include ZW0301 based modules. ZW0102 based modules removed.

Table of Contents

1 ABBREVIATIONS

Abbreviation	Explanation
ADC	Analog-to-Digital Converter
API	Application Programming Interface
EU	Europa
FSK	Frequency Shift Keying
GPIO	General Purpose Input/Output
HW	Hardware
I/O	Input/Output
MCU	Micro Controller Unit
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
POR	Power On Reset
RF	Radio Frequency
RTC	Real-Time-Clock
RX	Receive
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
SW	Software
TX	Transmit
UART	Universal Asynchronous Receive Transmit
US	United States
ZW0102	Z-Wave Single Chip, first generation
ZM1206	6 cm^2 Z-Wave Module based on the ZW0102 Single Chip
ZM1220	20 cm^2 Z-Wave Module based on the ZW0102 Single Chip
ZW0201	Z-Wave Single Chip, second generation
ZM2102	2 cm^2 Z-Wave Module based on the ZW0201 Singe Chip
ZM2106C	6 cm^2 Z-Wave Module based on the ZM2102 Module
ZM2120C	20 cm^2 Z-Wave Module based on the ZW0201 Single Chip
ZW0301	Z-Wave Single Chip, third generation
ZM3102N	2 cm^2 Z-Wave Module based on the ZW0301 Singe Chip
ZM3106C	6 cm^2 Z-Wave Module based on the ZM3102N Module
ZM3120C	20 cm^2 Z-Wave Module based on the ZM3102N Module
HK	Hong Kong
ANZ	Australia / New Zealand

2 INTRODUCTION

2.1 Purpose

The purpose of this document is to guide the developer in deciding which of the currently available Z-Wave Modules in the ZW0201 and ZW0301 Z-Wave Module Family to choose for a given application.

Each of the Z-Wave Modules exists in a 908.42MHz (US), 868.42 MHz (EU), 919.82 MHz (HK), 921.42 MHz (ANZ) version – the choice of frequency must be based on which region the final product will be used in and is therefore not within the scope of this document.

2.2   Audience and prerequisites

The audience is OEM developers responsible for deciding how to build and design Z-Wave enabled products.

Prerequisites are knowledge about Z-Wave API's [1] as well as the basic functionalities of how to configure and maintain the Z-Wave Network. Please refer to: [2]- Z-Wave Node Type Overview and Network Installation Guide.

3   Z-WAVE MODULES

The ZW0201/ZW0301 Single Chip based Z-Wave Modules have been developed by Zensys A/S and have been extensively tested with regards to both digital signal integrity and RF performances. The modules have been RF/EMC tested and have passed FCC part 15 and R&TTE Directives. Refer to the datasheet for ZW0201 [3], ZW0301 [4] for a detailed description of chip functionalities.

All necessary documentation for pre-production of the Z-Wave Modules, including schematics, BOM's, PCB documentation, production test documents, etc. is available as a Blueprint package. This enables OEM customers to reduce time to market for their Z-Wave enabled products. For further information on Blueprint content, please contact Zensys A/S.

3.1   Z-Wave Module Family

Three Z-Wave Module form factors currently exist. The Integrated Z-Wave Module called ZMxx20, which is a 20cm^2 single side mounted PCB having an integrated PCB antenna (other external antennas can be used) and some mounting options. The Small-Form-Factor Z-Wave Module called ZMxx06, which is a 6cm^2 single side mounted PCB used for small size applications. The ZMxx06 do not have an integrated antenna and therefore requires an external antenna, enabling flexible antenna design and mounting. The smallest Z-Wave Module called ZM2102/ZM3102N is a small pre-manufactured and pre-tested module in size 12.5mm. x 13.6mm. The ZM2102/ZM3102N can be mounted with a standard pick-and-place machine on the production line and undergo a re-flow process or be hand soldered to the Application PCB. The ZM2102/ZM3102N does not have an integrated antenna and therefore requires an external antenna, enabling flexible antenna design and mounting.
The following table describes features and mounting options of the available Z-Wave Modules.

Description	ZM2102 Z-Wave Module	ZM2106C Z-Wave Module	ZM2120C Z-Wave Module	ZM3102N Z-Wave Module	ZM3106C Z-Wave Module	ZM3120C Z-Wave Module
Z-Wave Single Chip	ZW0201	ZW0201	ZW0201	ZW0301	ZW0301	ZW0301
Number of GPIO's (dual functionality)	10(10)	10 (10)	10 (10)	10(10)	10 (10)	10 (10)
Interrupt Input[1]	2	2	2	2	2	2
Serial UART Interface[1]	1	1	1	1	1	1
SPI Interface[1]	1	1	1	1	1	1
Zerox Cross Input[1]	1	1	1	1	1	1
Triac Control Output[1]	1	1	1	1	1	1
PWM Output[1]	1	1	1	1	1	1
ADC Input (multiplexed)	4	4	4	4	4	4
Wake-Up-Timer Sleep period [sec]	1 1-256	1 1-256	1 1-256	1 7.8m-256	1 7.8m-256	1 7.8m-256
Support for ext PA Max rad. power.	No	No	No	Yes +6dBm	Yes +6dBm	Yes +6dBm
Mounting Options						
RTC Crystal	No	No	No	No	No	No
EEPROM	No	Yes	Yes	No	Yes	Yes
Push Button	No	No	Yes	No	No	Yes
External on-board Reset Device	No	No	No	No	No	No
On-board Voltage Regulator	No	No	Yes	No	No	Yes
Zerox and ADC signal 5V-to-3.3V level conversion	No	No	No	No	No	No

Description	ZM2102 Z-Wave Module	ZM2106C Z-Wave Module	ZM2120C Z-Wave Module	ZM3102N Z-Wave Module	ZM3106C Z-Wave Module	ZM3120C Z-Wave Module
Antenna Options						
PCB Antenna	No	No	Yes	No	No	Yes
SMA Connector	No	No	Yes	No	No	Yes
Wire Antenna mounting Hole	No	Yes	Yes	No	Yes	Yes
Antenna connector (to Application Module)	Cast. Notch	1x3 2mm pitch	No	Cast. Notch	1x3 2mm pitch	No
Mechanical						
Application Connector	Cast. Notches 18	Pin row 2x8	Pin row 2x10	Cast. Notches 18	Pin row 2x8	Pin row 2x10
Connector Pitch	-	2mm	2mm	-	2mm	2mm
PCB Size	~ 2cm^2 (12.5mm . x 13.6mm)	~ 6cm^2 (21x30mm)	~ 20cm^2 (40.5 x 50mm.)	~ 2cm^2 (12.5mm. x 13.6mm.)	~ 6cm^2 (21x30mm)	~ 20cm^2 (40.5 x 50mm.)
Support Post Hole	No	No	Yes	No	No	Yes
SMD Component Mount	Single Sided	Single Sided	Single Sided	Single Sided	Single Sided	Single Sided

(1) Can also be used as General Purpose Input/Output

Table 1 Z-Wave Module Overview

3.2 Module naming

Explanation of the ZW0201 based Z-Wave Module naming.
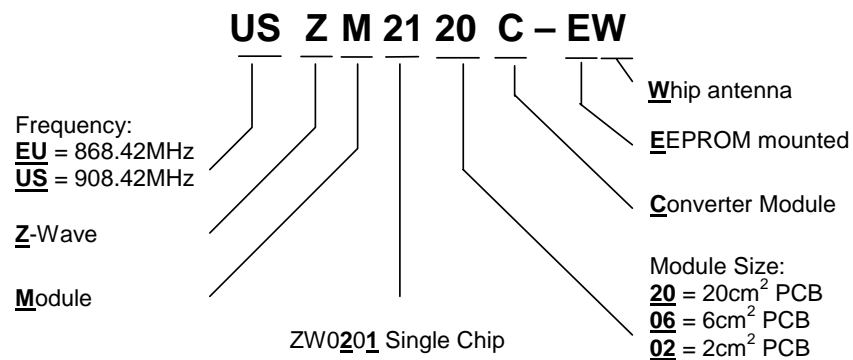

Figure 1 ZW0201 Z-Wave Module Naming
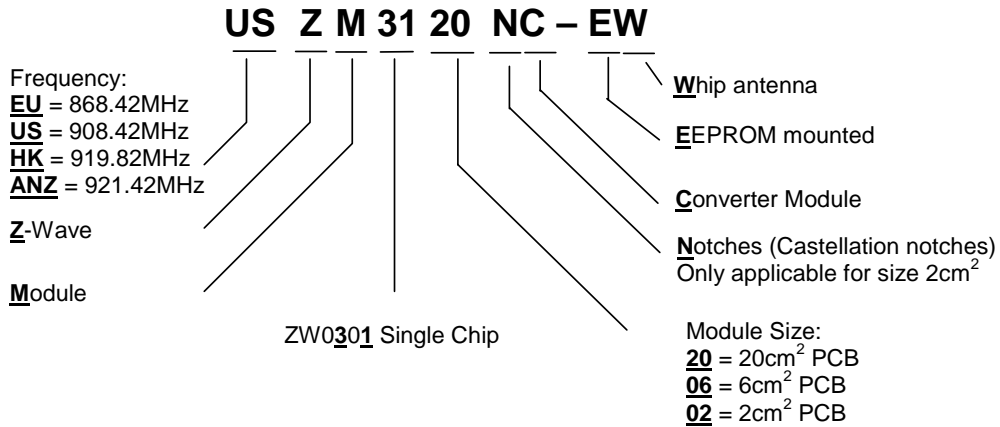
Explanation of the ZW0301 based Z-Wave Module naming.

Figure 2 ZW0301 Z-Wave Module Naming

Refer to Appendix A for a description of the 100 series Z-Wave modules naming.

3.3   Available Z-Wave Module Configurations

The above module configurations are based on Blueprints available from Zensys. Other configurations are of course possible by changing the BOM's to represent your needs
Note: additional mounting options such as Push Button and External On-board Reset Device, On-board Voltage Regulator" and Zerox and ADC signal 5V-to-3.3V level conversion" (see Table 1) are not specified as part of the module name but should be specified separately.

3.3.1   ZW0201 / ZW0301 Based Z-Wave Modules

The following Z-Wave Modules are based on the ZW0201 or ZW0301 Single Chips.

3.3.1.1   ZM2102 Z-Wave Module

The ZM2102 is the 2cm^2 Z-Wave Module based on ZW0201 having the necessary components mounted in order to operate as a Z-Wave Slave node. The ZM2102 is designed to be supplied as a "component", optionally with a top shield. The module, both with and without the top shield, can be mounted with a standard pick-and-place SMT machine. The electrical interface pads are designed as castellation notches.

3.3.1.2   ZM3102N Z-Wave Module

The ZM3102N is the 2cm^2 Z-Wave Module based on ZW0301 having the necessary components mounted in order to operate as a Z-Wave Slave node. The ZM3102N is designed to be supplied as a "component", optionally with a top shield. The module, both with and without the top shield, can be mounted with a standard pick-and-place SMT machine. The electrical interface pads are designed as castellation notches.

3.3.1.3   ZM2106C-E and ZM3106C-E Z-Wave Modules

The ZM2106C / ZM3106C are the "basic" 6cm^2 Z-Wave Module with the ZM2102 / ZM3102N Z-Wave Module mounted on it. The ZM2106C / ZM3106C are used for easy migration from the ZM1206 Z-Wave Module using the ZW0102 Z-Wave Single Chip to the ZW0201 or ZW0301 Z-Wave Single Chip platform. The ZM2106C-E / ZM3106C-E modules have also an external onboard EEPROM mounted. This enables the modules to run Z-Wave Controller and Enhanced Slave applications.

3.3.1.4   ZM2120C-E and ZM3120C-E Z-Wave Modules

The ZM2120C / ZM3120C are used to convert the smaller ZM2102 / ZM3102N Z-Wave Modules to a platform with a size of 20cm^2. This allows easy migration from the ZM1220 Z-Wave Module family to the ZM2120C / ZM3120C Z-Wave Modules, which consists of the ZW0201 / ZW0301 Z-Wave Single Chips. The modules have mounted EEPROM for Z-Wave controller and enhanced slave applications. The ZM2120C / ZM3120C Z-Wave modules are RF matched and connected to the onboard PCB antenna.

3.3.1.5   ZM2120C-EW and ZM3120C-EW Z-Wave module

The ZM2120C-W and ZM3120C-W are prepared for use with the whip antenna connected to the SMA connector. Otherwise, these modules are similar to ZM2120C-E / ZM3120C-E Z-Wave Modules with EEPROM

3.3.1.6   ZW0201 / ZW0301 Based Z-Wave Module Application Connector Specification

The Application Connector interfacing the ZM2106C / ZM3106C Z-Wave Modules with the OEM Application is a 2mm pitch 2x8 pin row. The ZM2120C / ZM3120C use a 2mm pitch 2x10 pin row. ZM2102 / ZM3102N Z-Wave Module have 18 castellation notches interfacing the module with the Application PCB.

ZM2102 / ZM3102N			
Notch no.	Signal name	Notch No.	Notch Name
1	GND	2	RESET_N
3	P1.7 / INT1	4	P1.6 / PWM / INT0
5	P1.5 / SS_N[1]	6	GND
7	P1.2 / MISO	8	P1.4 / SCK
9	P1.3 / MOSI	10	P1.1 / ADC3 / RXD
11	VCC	12	GND
13	P0.1 / ADC1 / TRIAC	14	P0.0 / ADC0 / ZEROX
15	P1.0 / ADC2 / TXD	16	GND
17	GND	18	RF in/out

ZM2106C / ZM3106C			
Pin No.	Pin Name	Pin No.	Pin Name
1	GND	2	+3.3V
3	TRIAC (P0.1/ADC1)	4	SCK (P1.4)
5	ZEROX (P0.0/ADC0)	6	MOSI (P1.3)
7	TXD (P1.0/ADC2)	8	P1.5 (SS_N)
9	RXD (P1.1/ADC3)	10	INT1_N (P1.7)
11	PWM (P1.6/INT0)	12	ADC (ADC0 or ADC2)
13	VPP[1]	14	MISO (P1.2)
15	GND	16	RESET_N

1. VPP is available for programming of future Z-Wave Modules. VPP is not connected when used together with ZM2102 / ZM3102N.

ZM2120C / ZM3120C			
Pin No.	Pin Name	Pin No.	Pin Name
1	VPP[1]	2	N.C.
3	ZEROX (P0.0/ADC0)	4	PWM (P1.6/INT0)
5	TRIAC (P0.1/ADC1)	6	INT1_N (P1.7)
7	ADC[2] (ADC0 or ADC2)	8	P1.5
9	N.C.	10	MISO (P1.2)
11	VCC	12	SCK (P1.4)
13	GND	14	MOSI (P1.3)
15	RESET_N	16	TXD (P1.0/ADC2)
17	+3.3V	18	RXD (P1.1/ADC3)
19	N.C.	20	ADC2[3] (RXD/P1.1/ADC3)

1. VPP is available for programming of future Z-Wave Modules. VPP is not connected when used together with ZM2102 / ZM3102N.
2. ADC0 or ADC2 can be selected by resistor R9 or R11. By default none of the two resistors are mounted.
3. Pin 20 is per default not connected to the RXD/ADC3 signal.

Table 2 Z-Wave Module Application Connector Layout

Name	I/O	Description
+3.3V	Power	Module 3.3V supply input.
ADC[3:0]	I	Analog-to-Digital Converter input. The ADC is 12/8 bit and can use VCC, an internal or an external voltage as reference. ADC3: input ADC2: input ADC1: input/lower reference ADC0: input/higher reference
GND	Power	Ground signal
INT[1:0]	I/O	Interrupt: The signal can be either level or edge trigged. When in power down mode, the ZM2102 Z-Wave Module's MCU can be woken up by asserting the interrupt signal.
P[0.1-0.0], P[1.7-1.0]	I/O	In/Out: General purpose I/O signal.
MISO[1]	I/O	Master-In-Slave-Out SPI interface: output in slave mode operation and input in master mode operation.
MOSI[1]	I/O	Master Out Slave In SPI interface: input in slave mode operation and output in master mode operation.
PWM	I/O	Pulse Width Modulator Output: Used for frequency variation applications.
RESET_N	I	Reset: Active low reset. The ZW0201 Single Chip has an integrated Power-On-Reset and Brown-out detection circuitry.
RXD	I/O	UART Receive Data: Supports 9.6kbaud, 37.4kbaud, 115.2kbaud.
SCK[1]	I/O	SPI Clock: Can be used as either master SPI clock output or slave SPI clock input.
P1.5 / SS_N[1]	I/O	Slave Select: Active low SPI slave select input. When in SPI slave mode the input acts as chip select input.
TRIAC	I/O	TRIAC Control: A triac controller is implemented in the ZW0201 Single Chip that can controls a triac on the Application Module like light dimmer modules etc.
TXD	I/O	UART Transmit Data: Supports 9.6kbaud, 37.4kbaud, 115.2kbaud.
VPP	Program supply	Reserved for programming of future modules. Not connected when used together with ZM2102 or ZM3102N.
ZEROX	I/O	Zero Cross Detection: Zero cross detection signal used on dimmer modules detecting 120/240V zero crossing.

Please note that the SPI interface (MISO, MOSI, SCK and SS_N) is not available for the Application SW in some Z-Wave protocol API's, see [1].

Table 3 Application Connector Signal Description

3.4   ZM2106C/ZM3106C Physical Specification

Physical	Description
Dimension (H x W x D)	8 mm x 21 mm x 30 mm

Table 4 Physical Specifications

Figure 3 ZM2106C/ZM3106C Z-Wave Module PCB outline (TOP VIEW – not to scale)

The Application Connector is a standard 2mm pitch 2x8 pin-row. When implementing the Z-Wave Module in a product, a 2mm pitch 1x3 pin-row (marked as C in figure 3) can be used for mechanical stability. Another 2mm pitch 1x3 pin row (marked as D in figure 3) can be used to connect the Z-Wave Module to a PCB antenna or a SMA connector on the Application Module. Alternatively a wire antenna can be mounted directly in the middle hole of pin row D

3.5   ZM2120C/ZM3120C Physical Specification

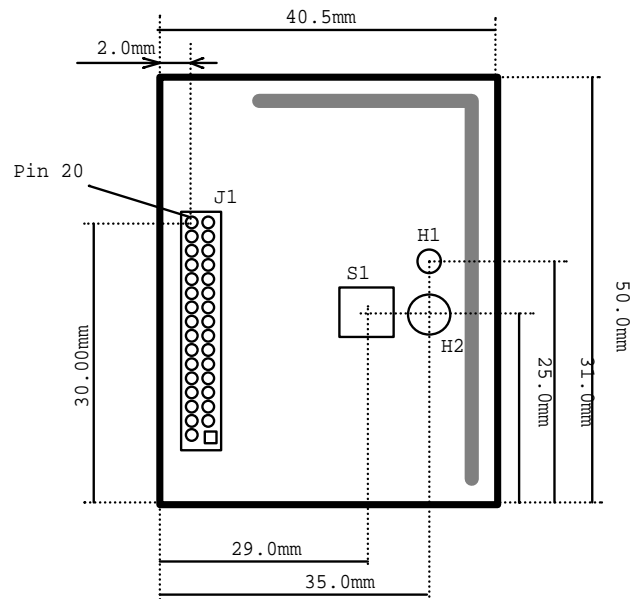| Physical	Description
Dimension (H x W x D)	7 mm x 50 mm x 40.5 mm
Mounting holes	Two holes.

Table 5 Physical Specifications

Figure 3 ZM2120C/ZM3120C Z-Wave Module PCB outline

The Application Connector is a standard 2mm pitch 2x10 pin-row. The holes H1 and H2 are un-plated holes that can be used for support attachment or other mechanical stability mechanisms. S1 is the optional on-board push button.

Note that the component placement coordinates for the SMA connector are different between the ZM1220 and ZM2120C / ZM3120C modules. The SMA connector is shifted by 1.75mm on the ZW2120C / ZW3120C modules compared to ZM1220. Refer to the PCB documentation for precise coordinates.

3.6   ZM2102/ZM3102N Physical Specification

Physical Specification	Description
Size	12.5mm. x 13.6mm. x 2.4mm (0.492" x 0.535" x 0.094")
Weight	TBD g (TBD oz)
Castellation Notches	18

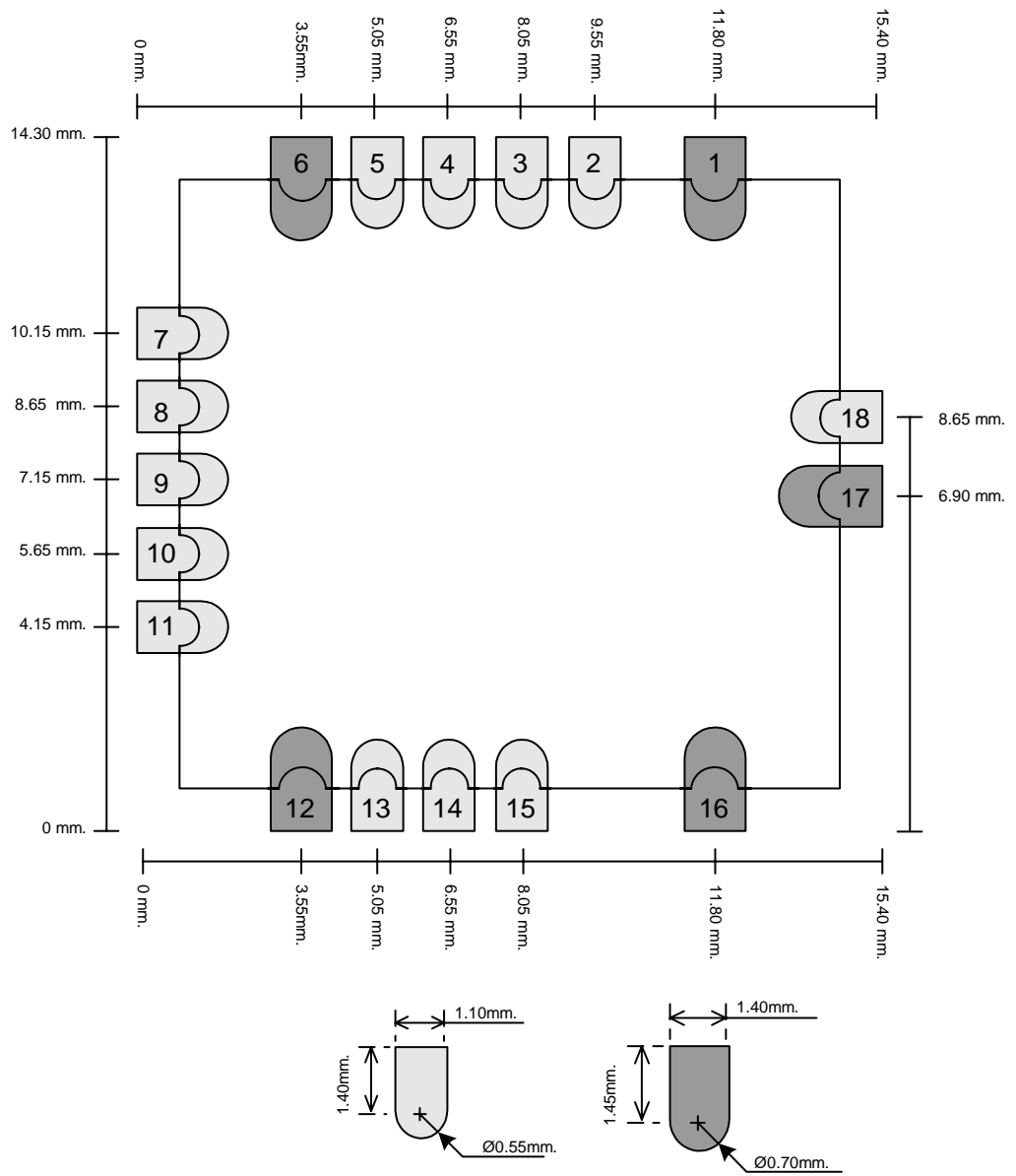**Table 6** Physical Specifications

Figure 4 ZM2102/ZM3102N Z-Wave Module PCB outline

4 Z-WAVE API'S AND Z-WAVE MODULE SELECTION

The table below lists which Z-Wave Modules that can be used when using the available Z-Wave SW API's for the application in question. Please refer to [1] for information on how to choose which of the six API's listed in Table 7 to use.

Please note that while applications using the Slave API will be able to run on all the available module types the Application SW will not be able to access the additional HW mounted on the modules if you do not use one of the API's that support the additional HW (e.g. Enhanced Slave API).

Z-Wave Module Selection Guide								
API Selection						Z-Wave Module Name	HW Options	
Portable Controller API	Static Controller API	Installer API	Slave API	Routing Slave API	Enhanced Slave API		External EEPROM	Push Button
			X	X		ZM2102		
X	X	X	X	X	X	ZM2106C-E	X	
X	X	X	X	X	X	ZM2120C-E	X	X
X	X	X	X	X	X	ZM2120C-EW	X	X
			X	X		ZM3102N		
X	X	X	X	X	X	ZM3106C-E	X	
X	X	X	X	X	X	ZM3120C-E	X	X
X	X	X	X	X	X	ZM3120C-EW	X	X

Table 7 Z-Wave Module Selection Guide

Z-Wave Module	Zensys BOM P/N[1]			
Z-Wave Module Name	EU 868.42MHz	US 908.42MHz	ANZ 921.42MHz	HK 919.82MHz
ZM2102	370100621	370100620	NA	NA
ZM2106C-E	370100681	370100660	NA	NA
ZM2120C-E	370100711	370100632	NA	NA
ZM2120C-EW	370100710	370100630	NA	NA
ZM3102N	370100770	370100760	370100830	370100830
ZM3106C-E	370100860	370100850	370100870	370100870
ZM3120C-E	370100811	370100801	370100840	370100840
ZM3120C-EW	370100810	370100800	370100820	370100820

1. Please contact Zensys A/S for information about the latest revision numbers of these BOM's.

Table 8 Z-Wave Module BOM P/N

APPENDIX A NAMING OF 100 SERIES MODULES

Explanation of the ZW0102 based Z-Wave Module naming. These modules are not recommended to be used in new products.
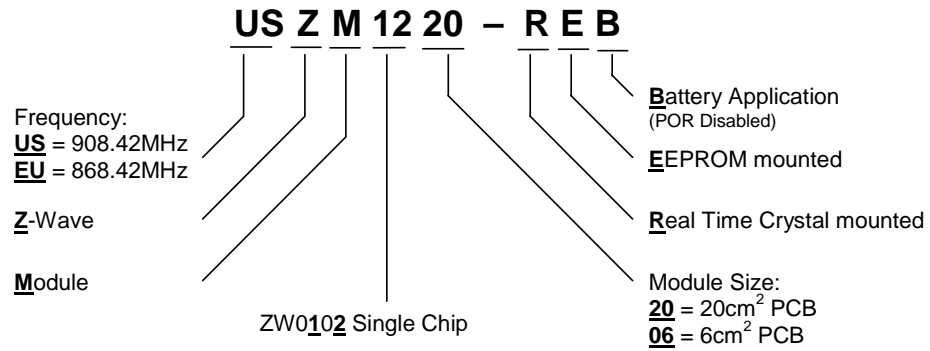

Figure 5 ZW0102 Z-Wave Module Naming

5 REFERENCES

[1]   Zensys, INS10247, Instruction, Z-Wave ZW0102/ZW0201/ZW0301 Appl. Prg. Guide v5.00 (Beta1)
[2]   Zensys, INS10244, Instruction, Z-Wave Node Type Overview and Network Installation Guide
[3]   Zensys, DSH10560, Datasheet, ZW0201 With Developers Kit v5.0x
[4]   Zensys, DSH10717, Datasheet, ZW0301 With Developers Kit v5.0x