Intelligent Distributed Controls Limited

ZB110 Multifunctional Wireless Keypad

Multifunctional Keypad/Keyfob for use with IEEE 802.15.4 / ZigBee Wireless Networks

Product Datasheet

Document Revision

Version	Date	Checked	Date	Approved	Date	Client	Date
1.0	28/07/11						
1.1	02/08/11						
1.2	15/08/11						

Document History

Version	Date	Author	Description of Changes
1.0	28/07/11	S.Barnett	Release
1.1	02/08/11	S.Barnett	Website/Email change
1.2	15/08/11	S.Barnett	Correction to FCC statement

Contents

Introduction

The ZB110 Wireless Keypad / Keyfob from Intelligent Distributed Controls Limited has been designed around the CC2530 System on Chip (SoC) single chip solutions from Texas Instruments. The multifunctional keypad has been tested to conform to FCC radio standards in its fully populated build, and with both keypad membrane overlay choices.

The ZB110 is capable of supporting the industry leading ZigBee protocol stack (Z-Stack™) from Texas Instruments, for wireless point-to-point, star, tree and mesh networks based on the IEEE 802.15.4 compliant PHY and MAC layers, and providing 16 channels in the 2.45GHz license-free ISM band. The ZB110 has been tested for use with channels 11 – 25 (15 channels), whilst avoiding the restricted channel 26.

The ZB110 being battery driven functions as an end-device only.

The ZB110 Wireless Keypad is powered by two 3V Lithium coin cells (CR2450).

Key Features

- 256kB FLASH, 8kB SRAM (4kB with data retention in all power modes)
- 32MHz high speed 8051 core MCU with wide range of configurable IO interfaces
  - Powerful DMA
  - Watchdog Timer
  - 802.15.4 MAC timer, 16 bit timer and two 8 bit timers, random number gen.
  - Battery monitor and chip temperature sensor
- Deep sleep state with only 0.3µA current drain
- Can wake up on event driven basis (i.e. key operation) or on a regular programmed time interval basis
- Industry leading CC2420 RF transceiver core, IEEE 802.15.4 compliant
- Programmable output power up to +4.5dBm into 50Ω load
- Receiver sensitivity typically -97dBm
- Wireless data rate to 250kbps
- In excess of 150m operating distance in free space
- FCC CFR 47 Part 15 (US) Certified for Unlicensed Operation
- 256kB FLASH, 8kB SRAM (4kB with data retention in all power modes)
- 32.768kHz crystal controlled RTC
- 15 Channels (Ch11 to Ch25) FCC restricted Ch26 unavailable
- AES security coprocessor
- Over-the-air (OTA) programming capability
- LED indication Radio Message OK and Radio Message failed
- Compact Design - 70 x 44 x 18mm (HxWxD)
- Optional case and intermediate ring colours
- ABS UL94 HB rated flammability, IP41
- FCC Class B
- Firmware can be written to customer's specific needs
- 3V Lithium coin cell powered 2 x CR2450 Preferred - Panasonic type as these give 620mAh each

Build Options

The ZB110 Multifunctional Keypad provides the following build options:

Model: ZB110 Basic Wireless Keypad

- Up to 6 small keys/buttons (8.4mm dome) the purpose and configuration of which can be dedicated to a customer's needs, including the graphic overlay. Any combination of the six key positions can be employed. Example shown in Section?
- Alternative keypad arrangement of 2 small keys (8.4mm dome) and one large key (20mm dome) can also be provided. Example shown in Section?
- Bi-colour LED indicator
- 2 x CR2450 Lithium Battery clips

Model: ZB110(P) Sounder Option

- As Model ZB110 Basic Wireless Keypad with the addition of sounder circuitry
- Piezo transducer frequency set at 4.6kHz

Model: ZB110(T) Temperature and Humidity Option

- As Model ZB110 Basic Wireless Keypad plus temperature and humidity sensor
- Contains a filter cap which exits through the back wall of the keyfob housing for humidity sensing
- Sensor Temperature range -40ºC to +120ºC (-40ºF to 248ºF)

  Note!! - See temperature restriction for Lithium Batteries – "Physical Dimension and Environmental Conditions" table
- Humidity range 0% to 100%
- Dewpoint measurement

Model: ZB110(TL) Temperature and Humidity with Logging Option

- As ZB110(T) with extra SPI Flash/FRAM/EEPROM memory included for logging or configuration purposes

Model: ZB110(A) Accelerometer Option

- Tri-axis accelerometer
- Programmable g-range ±2g/ ±4g/ ±8g
- Programmable bandwidth 25 – 1500Hz
- Tilt, motion and shock/vibration sensing
- Ultra-low power (1µA) sleep mode with fast wake-up

Model: ZB110(AL) Accelerometer with Logging Option

- As ZB110(A) with extra SPI FLASH/FRAM/EEPROM memory included for logging or configuration purposes

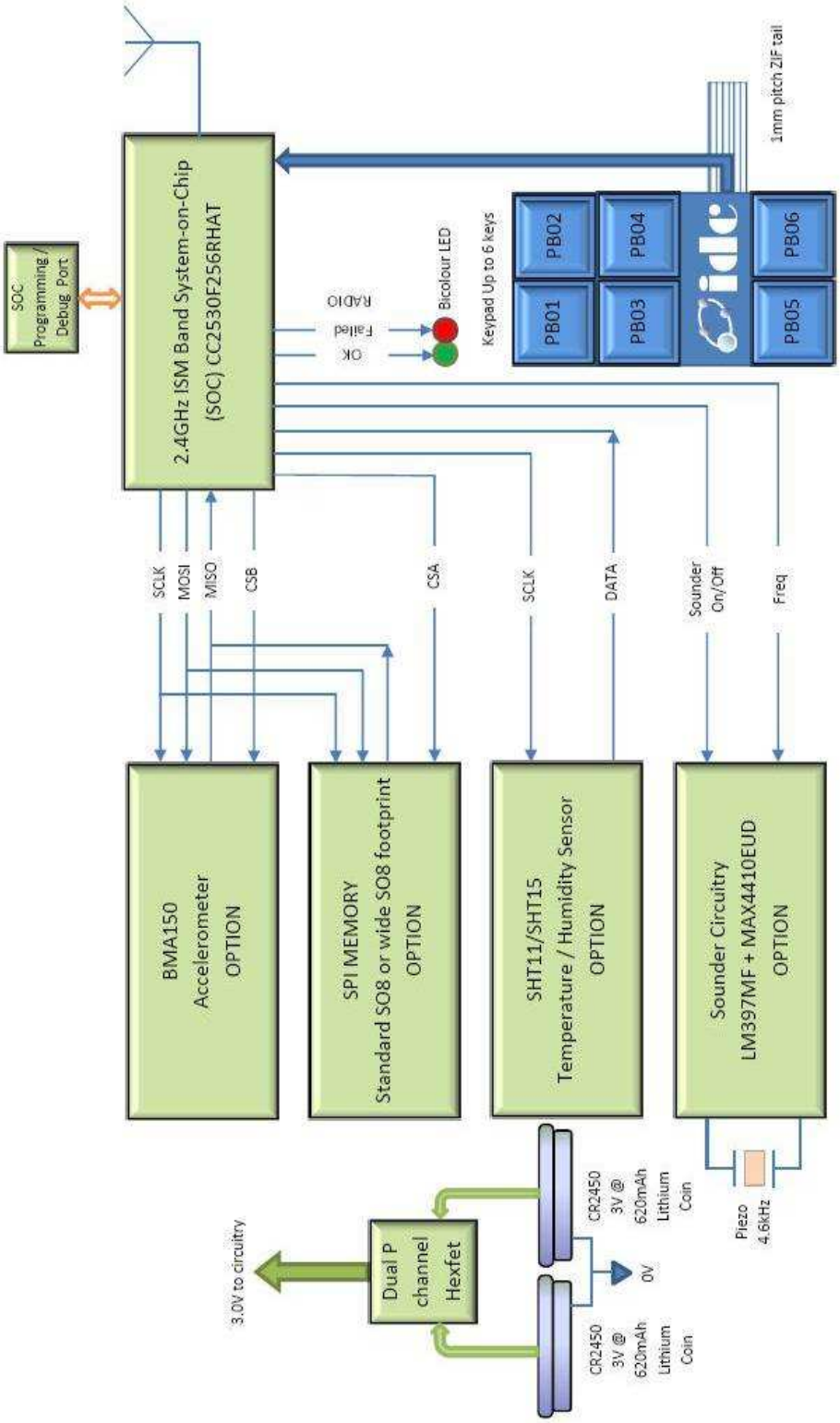
Applications

- Home control
  - Remote control
  - Security Alarm requirements
  - Senior citizen panic button
  - Warden controlled housing
- Industrial monitoring / control
  - Machinery condition monitoring – vibration, temperature etc.
  - Environmental monitoring – temperature, humidity
  - Fridge Plant and Chill storage monitoring
  - Remote control
  - Lighting control
- Asset tracking and inventory management
  - Pallet tracking / location
  - Mobile machinery tracking / location
  - Car park management / location
  - Drop / damage detection
- Building automation / management
  - Lighting
  - Temperature
  - Smoke/CO detectors
- Security –
  - Access control
  - Role calling
  - Personnel tracking
  - Man-down detection

Module Description

The ZB110 ……

Block Diagram



Keyfob – Top View showing LED Indication

ACTUAL SIZE

Green	OK:	Wireless transmission successful
Red	Fail:	Wireless transmission failed
Amber	Search:	Device searching for a network

Keyfob – Bottom View showing Filter for the Temperature / Humidity Option

Case and Intermediate Ring Options

Case Colours

- Off-white

- Lava Grey

- Black

Intermediate Ring Colours and Styles

- With End Loop for carry strap, key ring or lanyard

- With Side Loops for a wrist strap

Keypad Layout Options

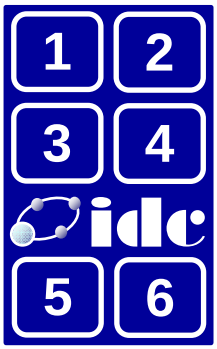
Two membrane key options are available, both of which can be graphically tailored to suite a customer's requirements:

a) Six key keypad. 11.5 x 10mm key size designed for 8.4mm domes. Any permutation of the six keys and positions can be defined starting with a one key in any of the six positions through to all six keys fitted. Alternative key shape can be accommodated.
b) Three key keypad. Two 11.5 x 10mm keys for 8.4mm dome size, and the third key 25 x 22mm is designed for a larger 20mm dome. Alternative key shape can be accommodated.

In both cases, the membranes can be provided with pillow embossing.

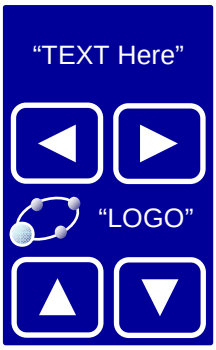
Key Position References

6 – button layout



3 – button layout

Examples:



Specifications

DC Characteristics

Parameter	Min	Typ	Max	Unit	Condition/Note
Operating Supply Voltage	2.0	3.0	3.6	V	2 x CR2450 Lithium coin cell @ 620mAh each
CC2530 Operating Current		34		mA	Radio in Tx @ 4.5dBm, 32MHz oscillator running, no peripherals, CPU idle
CC2530 Power mode 1		0.2		mA	4 µs to wake
CC2530 Power mode 2		1		µA	Sleep timer running
CC2530 Power mode 3		0.4		µA	Deep sleep – external interrupts to wake
Accelerometer option	1	-	200	µA	Min=Standby, Max=running mode
Temp/humidity option	0.3	28	550	µA	Sleep / Average / Measuring
Pager (Sounder) option		<10		mA	Sounder On
Logging (SPI memory)		15		µA	Example AT25DF041A (4Mbit FLASH) Deep power down mode 10mA approx.. average for read/write/erase activity

RF Frequency, Output Power Levels and Data Rates

Parameter	Min	Typ	Max	Unit	Condition/Note
RF Frequency Range	2400		2483.5	MHz	Programmable in 1 MHz steps, 5 MHz between channels for compliance with [1]
No. of channels		16			** – See RF channel table and [2]
Channel Spacing		5		MHz	**
Radio bit rate		250		kbps	**
Radio Chip Rate		2.0		MChip/s	**
Receiver Sensitivity		-97		dBm	PER = 1%, as specified by [1]
CC2530 Nominal Output power		+4.5		dBm	Delivered to a single ended 50 Ω load through a balun and output power control set to 0xF5 (TXCTRLL register)
Programmable output power range		32		dBm	The output power is programmable in 16 steps from typically -27.5 to +4.5 dBm
Antenna nominal RX / TX impedance		50		Ω	Built in chip antenna

The RF channels and associated frequencies defined by the IEEE 802.15.4 standard are as follows:

RF Channel	Frequency	RF Channel	Frequency	RF Channel	Frequency
11	2405 MHz	17	2435 MHz	23	2465 MHz
12	2410 MHz	18	2440 MHz	24	2470 MHz
13	2415 MHz	19	2445 MHz	25	2475 MHz
14	2420 MHz	20	2450 MHz	26 [2]	2480 MHz
15	2425 MHz	21	2455 MHz		
16	2430 MHz	22	2460 MHz		

[1] IEEE std. 802.15.4 - 2003: Wireless Medium Access Control (MAC) and Physical Layer (PHY) specifications for Low Rate Wireless Personal Area Networks (LR-WPANs).

[2] Channel 26 is a restricted channel and for the ZB110 is unavailable.

Physical Dimension and Environmental Conditions

All modules are RoHS Compliant in construction.

Parameter	Value	Notes / Module Codes
Module Dimensions	70mm (H)	Excluding Intermediate Ring loops
	44mm (W)	
	18mm (D)	
Weight (max.)	36 g	Including batteries
Operating Temperature	Nominal -20ºC to +55ºC	Storage and Operational with minor degradation of clock stability / accuracy: -40ºC to +85ºC Lithium Battery restriction temperature range: -30ºC to +60ºC
Operating Relative Humidity	80% RH	

Other than battery exchange, there are no user serviceable parts inside

Battery Exchange

Battery Type:	CR2450	24.5mm dia x 5mm thick Lithium Manganese Dioxide
Recommend Panasonic		CR2450/BE or CR2450/BN 3V, 620mAh

1. Remove single screw from the rear of the enclosure
2. Ease the front half from the intermediate ring and fold back on the membrane tail as shown →
3. The PCB will ease out of the bottom half of the enclosure
4. Using a non-metallic point, push the old battery cells out from the back of the clips
5. Replace with new cells observing the correct orientation – the larger diameter of the cell is positive and should be marked as such "+" – this should face up and mate with the top of the battery clip also marked "+"
6. The negative contact is provided by the PCB itself
7. Push well home into the clip as far as it will go
8. Replace PCB back into the bottom enclosure – two small locating pegs provide the correct location
9. Ensure the intermediate ring is seated correctly both on the bottom and top case pieces when replacing the front
10. Ensure the top "clips" in to the bottom before replacing the single screw in the back

Do not recharge batteries
Do not deform batteries
Do not mix different types of batteries
Do not solder directly onto batteries

Disposal Considerations

When the batteries are worn out dispose of them under the ordinance of each local government or the law issued by relating government.

NOTE:

In California only, packages that contain CR lithium coin cells and the Owners/Operating Instructions of products that contain CR lithium coin cells must include the following statement:

"Perchlorate Material - special handling may apply"

Agency Certification

UNITED STATES (FCC)

This equipment complies with Part 15 of the FCC rules and regulations.

FCC ID: V7OZB110

- **This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i) this device may not cause harmful interference, and (ii) this device must accept any interference received, including interference that may cause undesired operation.**
- **This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.**
- **Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

Case Labeling

MOD: ZB110(T)
001B0Axxxxxxxxxx
FCC ID: V7OZB110

Line1: MOD: = Model Type

Model: ZB110	Basic Wireless Keypad (included for all models)
Model: ZB110(P)	Sounder Option included
Model: ZB110(T)	Temperature and Humidity Option included
Model: ZB110(TL)	Temperature and Humidity with Logging Option included
Model: ZB110(A)	Accelerometer Option included
Model: ZB110(AL)	Accelerometer with Logging Option included

NOTE: More than one option may be applied - E.g.:

Model: ZB110(PT) Sounder Option and Temperature and Humidity Option included

Line2: MAC address

001B0A is the IEEE UID for Intelligent Distributed Controls
xxxxxxxxxx = is the remaining unique MAC address
This is also used as the serial number

Line3: FCC ID:

V7OZB110 is the identifier for all variants

Glossary

ABS	Acrylonitrile Butadiene Styrene - plastic
AES	Advanced Encryption Standard
bps	Bits per Second
CO	Carbon Monoxide
CPU	Central Processing Unit
DC	Direct Current
DMA	Direct Memory Access
EEPROM	Electrically Erasable Read only memory
FCC	Federal Communications Commission
FLASH	Non-volatile memory which can be electrically erased and re-programmed
FRAM	Ferro RAM – non-volatile RAM which does not require battery support
IEEE	Institute of Electrical and Electronic Engineers
ISM	Industrial, Scientific and Medical frequency band - a part of the radio spectrum that can be used by anybody without a license in most countries
kByte	1024 bytes
LED	Light emitting Diode
MAC	Medium Access Control layer
OTA	Over-the-Air – upgrade/programming
PER	Packet Error Rate
PHY	Physical Layer
RAM	Random Access Memory
RF	Radio Frequency
RH	Relative Humidity
ROM	Read only memory
RoHS	Restriction on Hazardous Substances
RTC	Real Time Clock
RX	Receive, Radio
SoC	System-on-Chip
SPI	Serial Peripheral Interface bus – synchronous serial data link between master/slave integrated circuits
SRAM	Static Random Access Memory
TI	Texas Instruments
TX	Transmit, Radio
UID	Unique Identifier
UL	Underwriters Laboratories Inc.
802.15.4	The IEEE 802.15.4-2003 standard applicable to low-rate wireless Personal Area Networks

Disclaimer

Intelligent Distributed Controls Limited believes that at the time of issue, all information contained herein to be accurate. Intelligent Distributed Controls Limited reserves the right to make changes to this product or documentation without prior notice. Latest available revisions shall be provided on the Website.

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