AI02 SP&PIR Specification

1 Description

This leaf is equipped with a buzzer and an IR motion sensor. The buzzer is controlled by PWM and their motion sensor is communicated with I2C. This motion sensor has motion detect interrupt function.

2 Leaf specification

2.1 Block diagram

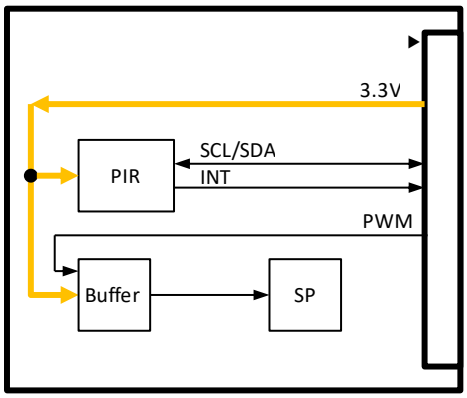

Figure 2.1 Block diagram

2.2 Power supply specification

Symbol	Parameter	Condition	Min.	Typ.	Max.
Vdd	Power Supply Voltage	_	2.71V	3.3V	3.6V
Idd	Operating current	Active	-	37uA	-
		Sleep	-	1.3uA	-

2.3 Main parts

Reference No.	Part name	Part number	Vendor name	note
BZ480	Buzzer	CMT-1203-SMT	CUI	_
IC490	IR motion sensor	AK9754AE	AKM Semiconductor	_

2.4 Appearance

Top Side	Back Side
	

2.5 Pin assignment

Name	Function
D2	Motion sensor interrupt L: interrupt
SCL	I2C Clock
SDA	I2C Data
D5	Buzzer (This pin can be set to D10 by changing chip resistance.)

3V3	3.3V
GND	GND

3 Buzzer (CMT-1203-SMT)Specifications

3.1 Description

Item	Description
dimensions	12 x 12 x 3mm
rated frequency	4kHz(typ)
sound pressure level	81dB(min) at 10 cm, 5 Vp-p, 4,000 Hz square wave
Current consumption	5mA(max) at 5 Vp-p, 4,000 Hz square wave

3.2 Electrical characteristics

Absolute Maximum Retings

Parameter	Value
Operating Temperature	-40℃ to +120℃
Maximum Operation Voltage	25Vp-p

3.3 Link destination of data sheet

https://www.jp.cui.com/product/audio/buzzers/audio-transducers/piezo/cmt-1203-smt

3.4 Main functions and libraries

・Buzzer tone

Definition	Description
tone(pin, frequency, duration)	Output 50% duty ratio pulse wave by setting frequency and output duration time. Without duration option, wave output continues until noTone() function called. 【Example】 tone(pin, frequency) tone(pin, frequency, duration) 【Arguments】 pin: Output pin frequency: Output frequency (Hz) duration: Output time duration (ms) (Optional) 【Return】 None
noTone()	Stop tone output. 【Argument】 pin: pin to stop output wave. 【Return】 None

4 IR Motion Sensor (AK9754AE)Specifications

4.1 Description

Item	Description
Sensor	Quantum-type IR Sensor
Integrated Digital Filters	IR Sensor ：Cut-off Frequency 0.9Hz,0.445Hz Temperateure Sensor ：Cut-off Frequency 0. 9Hz,0.445Hz *Only with 10Hz of Data Output Rate(ODR)
Interfaces	I2C

4.2 Electrical characteristics

Absolute Maximum Ratings

Parameter	Value
Operating Temperature	-30℃ to +85℃
Maximum Operation Voltage	4.3V

Specification

Symbol	Parameter	Condition	Min.	Typ.	Max.
Vdd	supply voltage	Internal Oscillator	1.71V	3.3V	3.63V
Idd	Average Current consumption	10Hz,Low-noise Mode ON	-	35uA	100uA
		10Hz,Low-noise Mode OFF	-	5uA	10uA
		Stand-by Mode	-	1.1uA	3.0uA

4.3 Link destination of data sheet

https://www.akm.com/akm/jp/product/detail/0002/

4.4 Register

Name	Add	D7	D6	D5	D4	D3	D2	D1	D0
WIA1	00h	0	1	0	0	1	0	0	0

WIA1 description

WIA1[7:0]	Company Code = 48h (Read Only Resister)

Name	Add	D7	D6	D5	D4	D3	D2	D1	D0
WIA2	01h	0	0	0	1	0	1	0	1

WIA2 description

WIA2[7:0]	Device ID=15h (Read Only Resister)

Name	Add	D7	D6	D5	D4	D3	D2	D1	D0
ST1	04h	1	1	1	HBDR1	1	1	1	DRDY

ST1 description

HBDR1	Human Approach Detection result 1 HBDR1 bit becomes “1” when detecting a human approach. It returns to “0” when readout of the measurement data buffer is completed. 0: Initial Value (default) 1: Human Approach Detect
DRDY	Data ready DRDY bit changes to “1” when measurement data is ready to be read. This bit returns to “0” when ST2 resister is read out. 0: Normal State (default) 1: Data Ready

Name	Add	D7	D6	D5	D4	D3	D2	D1	D0
IR	06h	IR[15]	IR[14]	IR[13]	IR[12]	IR[11]	IR[10]	IR[9]	IR[8]
	05h	IR[7]	IR[6]	IR[5]	IR[4]	IR[3]	IR[2]	IR[1]	IR[0]

IR description

IR[15:8]	Upper 8-bit of output datat
IR[7:0]	Lower 8-bit of output data

Measurement data of IR Sensor

IR[15:0]			Output current of IR Sensor	unit
bin	hex	dec		
0111 1111 1111 1111	7FFF	32767	15000 or more	pA
:	:	:	:	
0010 0111 0001 0000	2710	10000	4578	
:	:	:	:	
0000 0011 1110 1000	03E8	1000	457.8	
:	:	:	:	
0000 0000 0110 0100	0064	100	45.78	
:	:	:	:	
0000 0000 0000 0001	0001	1	0.4578	
0000 0000 0000 0000	0000	0	0	
:	:	:	:	
1111 1111 1111 1111	FFFF	-1	-0.4578	
:	:	:	:	
1111 1111 1001 1100	FF9C	-100	-45.78	
:	:	:	:	
1111 1100 0001 1000	FC18	-1000	-457.8	
:	:	:	:	
1101 1000 1111 0000	D8F0	-10000	-4578	
:	:	:	:	
1000 0000 0000 0001	8001	-32767	-15000 or less	

Output current of IR Sensor [pA]=0.4578 x Measurement data of IR Sensor (Decimal)

Name	Add	7	6	5	4	3	2	1	0
TMP	08h	TMP[15]	TMP[14]	TMP[13]	TMP[12]	TMP[11]	TMP[10]	TMP[9]	TMP[8]
	07h	TMP[7]	TMP[6]	TMP[5]	TMP[4]	TMP[3]	TMP[2]	TMP[1]	TMP[0]

TMP description

TMP[15-8]	Upper 8-bit of temperature sensor data
TMP[7-0]	Lower 8-bit of temperature sensor data

Measurement data of Temperature Sensor

TMP[15:0]			Temperature	unit
bin	hex	dec		
0111 1111 1111 1111	7FFF	32767	90 or more	℃
:	:	:	:	
0011 0001 0011 1011	313B	12603	50	
:	:	:	:	
0000 0000 0000 0001	0001	1	25.00198	

0000 0000 0000 0000	0000	0	25	
:	:	:	:	
1111 1111 1111 1111	FFFF	-1	24.99802	
:	:	:	:	
1001 0011 1011 0010	93B2	-27726	-30	
:	:	:	:	
1000 0000 0000 0001	8001	-32767	-40 or less	

Name	Add	D7	D6	D5	D4	D3	D2	D1	D0
ST2	09h	1	1	1	HBDR2	1	1	1	DOR

ST2 description

HBDR2	Human Approach Detection result 2 HBDR2 bit indicates Human Approach Detection result when finish receiving measurement buffer data. 0: Initial Value (default) 1: Human Approach Detect
ODR	Data Overrun DOR changes to “1” when data skipping happens, and returns to “0” after reading out ST2 resister. 0: Nomal State (default) 1: Data Overrun

Name	Add	7	6	5	4	3	2	1	0
CNTL6	25h	1	1	1	IRGAIN[4]	IRGAIN[3]	IRGAIN[2]	IRGAIN[1]	IRGAIN[0]

CNTL6 description

IRGAIN[4-0]	IR sensor gain value

IR sensor gain value

IRGAIN[4:0]			Gain	unit
bin	hex	dec		
0 1111	0F	15	205	%
0 1110	0E	14	200	
:	:	:	:	
0 0001	01	1	135	
0 0000	00	0	130	
1 1111	1F	-1	125	
:	:	:	:	
1 1010	1A	-6	100	
:	:	:	:	
1 0000	10	-16	50	

IR sensor gain [%]=5 x IRGAIN (decimal) + 130

Name	Add	7	6	5	4	3	2	1	0
CNTL8	27h	1	DTCT[6]	DTCT[5]	DTCT[4]	DTCT[3]	DTCT[2]	DTCT[1]	DTCT[0]

CNTL8 description

DTCT[6-0]	The AK9754 detects a human approach when the Human Approach Detection signal exceeds the threshold of internal algorithm for the number of samles set by DTCT[6:0] bits.

Detection Time Settings

DTCT[6:0]			Time	unit
bin	hex	dec		
00 0000	00	1	1	time(s)
00 0001	01	1	1	
00 0010	02	2	2	
:	:	:	:	
11 1111	3F	127	127	

4.5 Power saving control

AK9754 can be changed its running mode.

Register name : MODE

Address : 2B

bit : 0

mode 0: Stand-by Mode (default)

1: Continuous Measurement Mode

5 Revision history

Rev A1.0: First edition, August 2019