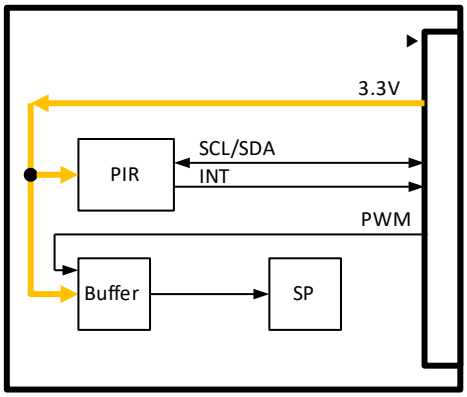
AI02A SP&PIR

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



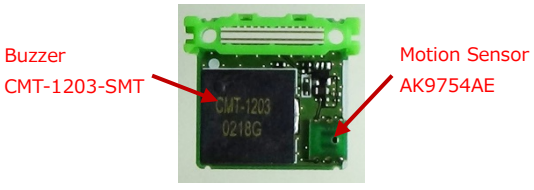
2-2. Power supply specification

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. 外観

Top Side	Back Side
	

2-5. Pinout

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