# GENERAL DESCRIPTION

EM32082 is a single chip talking clock/watch with a built in voice synthesizer that can produce high quality of speech. It contains low power consumption circuit, LCD driver and step motor driver. In addition, the function of time announcement is available which the voice data is programmable for user's specified language and both the speaker and buzzer driver are provided to meet diversed applications.

FEATURES

- Single power supply:2.4V - 3.6V.
- Low operating current:2 uA typical.(V_{DD}=3V).
- 2 operation modes(clock/watch mode) selectable.
- 1/2 duty multiplexed with 3 1/2 digits LCD driver is provided.
- Total 23 seconds voice capacity.
- Functions of time announcement,alarm with snooze,hourly report are provided.
- 24/12 hour format selectable.
- Three kinds of alarm sound selectable.
- Provide driver to drive analog clock directly.
- Driver to drive speaker and buzzer.

FUNCTION BLOCK DIAGRAM
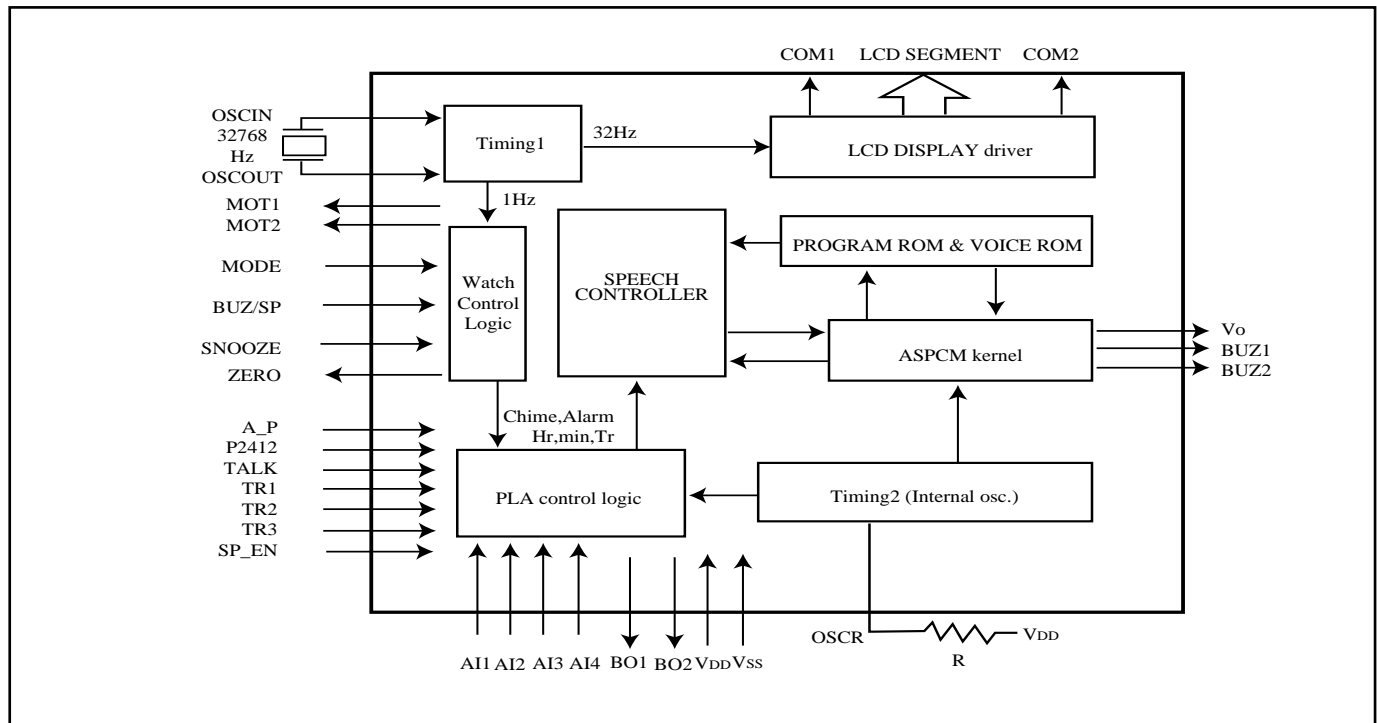
PIN DESCRIPTIONS

Symbol	I/O	Function
VO	O	Voice current output.
TALK	I	Trigger input for time report.
TR1	I	Reference to the function description.
TR2	I	Reference to the function description.
TR3	I	Reference to the function description.
A_P	I	Trigger intput for AM/PM selection.
OSCR	I	Oscillator resistor connection pin.
MODE	I	Watch/clock mode selection pin. V_{DD} for watch mode. V_{SS} for clock mode.
BUZ/SP	I	Buzzer/speaker output selection pin. V_{DD} for buzzer output. V_{SS} for speaker output.
SP_EN	I	Timing setting report enable/disable selection pin. V_{DD} to enable time setting report. V_{SS} to disable time setting report.
P2412	I	24/12 hour format selection pin. V_{DD} for 24 hour format. V_{SS} for 12 hour format.
SNOOZE	I	V_{DD} to enable snooze function. V_{SS} to disable snooze function.
AI1-AI4	I	Key scan matrix input.
TPAD	I	For testing only.
COM1	O	Display driver for LCD common.
CH/BE	O	Display driver for LCD segment.
C4/B4	O	Display driver for LCD segment.
G4/A4	O	Display driver for LCD segment.
E4/F4	O	Display driver for LCD segment.
C3/B3	O	Display driver for LCD segment.
G3/AD3	O	Display driver for LCD segment.
E3/F3	O	Display driver for LCD segment.
D4/Colon	O	Display driver for LCD segment.
C2/B2	O	Display driver for LCD segment.
G2/A2	O	Display driver for LCD segment.
E2/F2	O	Display driver for LCD segment.
D2/B1	O	Display driver for LCD segment.
C1/ADEG1	O	Display driver for LCD segment.
PM/AL	O	Display driver for LCD segment.
COM2	O	Display driver for LCD common.
V1	O	LCD voltage supply.
V_{SS}	I	Negative power supply.
ZERO	O	Output indicator when current count to 00:00 for 24 hour format or 12:00 AM for 12 hour format.
BUZ2-BUZ1	O	Buzzer driver output.
MOT2-MOT1	O	Step motor driver output

Symbol	I/O	Function
BO2-BO1	O	Key scan matrix output.
OSCO	O	Crystal connection output pin.
OSCI	I	Crystal connection input pin.
C8PP	I	Compensating capacitor.
V_{DD}	I	Postitive power supply.

FUNCTION DESCRIPTIONS

A). MODE selection:

EM32082 can be selected into "WATCH MODE" if MODE pin is connected to V_{DD}. On the other hand, it will be in "CLOCK MODE" if MODE pin is connected to V_{SS}.

1) Watch mode.

If EM32082 is selected to be watch mode, TR1 pin is used for operation mode selection and the sequence of operation mode change is as followed:
real time mode → real time setting mode →alarm time setting mode → real time mode
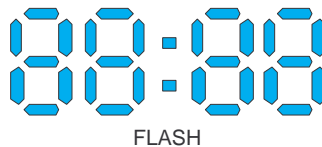
i) Real time mode.
Under this mode,the LCD display shows current time.
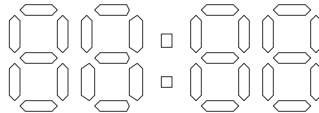
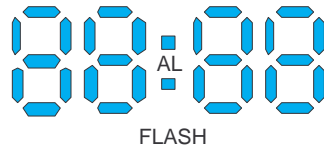| Pin Name	Description
TALK	Trigger pin for current time report
TR2	Trigger pin for alarm on/off selection Bi-Bi → Cuckoo → Cu-Cu → Alarm off → Bi-Bi
TR3	Trigger pin for hourly reprot on/off selection
A_P	Of no use.

ii) Real time setting mode.
Under this mode,the LCD display is flashing and wait for current time setting.If there is no current time adjustment during 10 seconds, it will back to real time mode automatically.

FLASH

Pin Name	Description
TALK	Trigger pin for current time report
TR2	Trigger pin for current time hour setting.
TR3	Trigger pin for current time minute setting.
A_P	Trigger pin for current time AM/PM selection. Current time will increment by 12 hours if EM32082 receives a pulse from A_P pin.

iii) Alarm time setting mode.

Under this mode,the LCD display is flashing and wait for alarm time setting.If there is no alarm time adjustment during 10 seconds, it will back to real time mode automatically.
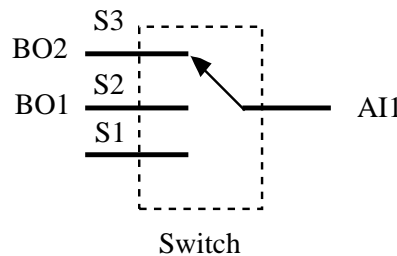

Pin Name	Description
TALK	Trigger pin for current time report
TR2	Trigger pin for current time hour setting.
TR3	Trigger pin for current time minute setting.
A_P	Trigger pin for current time AM/PM selection. Alarm time will increment by 12 hours if EM32082 receives a pulse from A_P pin.

2). Clock mode.

If EM32082 is selected to be clock mode, the matrix scan I/O pins AI1-AI4,BO1-BO2 are used for mode and function selection and will be described below.
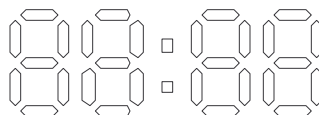
a). Operation mode selection.

Switch

Position	Mode
S1	Real Time Mode
S2	Real Time setting mode
S3	Alarm time setting mode

i) Real time mode.

Under this mode,the LCD display shows current time.

Pin Name	Description
TALK	Trigger pin for current time report
TR2,TR3	Of no use.
A_P	Of no use.

ii) Real time setting mode.
Under this mode,the LCD display is flashing and wait for current time adjusting.

FLASH

| Pin Name	Description
TALK	Trigger pin for current time report
TR2	Trigger pin for current time hour setting.
TR3	Trigger pin for current time minute setting.
A_P	Trigger pin for current time AM/PM selection. Current time will increment by 12 hours if EM32082 receives a pulse from A_P pin.

iii) Alarm time setting mode.
Under this mode,the LCD display is flashing and wait for alarm time adjusting.

FLASH
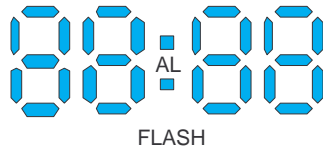
| Pin Name	Description
TALK	Trigger pin for alarm time report
TR2	Trigger pin for alarm time hour setting.
TR3	Trigger pin for alarm time minute setting.
A_P	Trigger pin for alarm time AM/PM selection. Alarm time will increment by 12 hours if EM32082 receives a pulse from A_P pin.

b). Alarm sound selection.
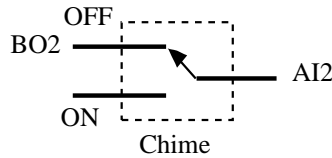There are three alarm sounds that can be selected as followed:

Switch
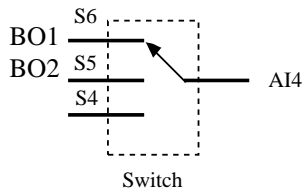
Position	Selection
S4	Sound1(Bi-Bi)
S5	Sound2(Cuckoo)
S6	Sound3 (Cu-Cu)

c). Alarm ON/OFF selection.
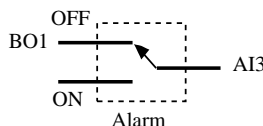
d). Chime ON/OFF selection.

B). Speech enable/disable option for time setting mode

In real time setting mode or alarm time setting mode,if pin SP_EN is high, EM32082 will report on each hour/ minute increment when trigger pin TR2/TR3 is pressed continuously. On the other hand, if pin SP_EN is low, EM32082 will not report on each hour/minute increment and the real time/alarm time will advance at about 4 Hz rate.

C). 24/12 hour format Selection

If P2412 pin is high (V_{DD}) ,EM32082 is selected to be 24 hour format, otherwise, EM32082 is selected to be 12 hour format. In 24 hour format, PM indicator is always off and LCD time display will be from 00:00 to 23:59. In 12 hour format, PM indicator is on from 12:00 PM to 11:59 PM,off from 12:00 AM to 11:59 AM.

D). Alarm match and Snoozing

When the current time matchs the alarm time, if the function of alarm is selected to be 'ON',EM32082 will play alarm sound and last for about one minute unless the pin TALK is triggered. Ten minutes later, it will alarm again if the snooze function is selected to be 'ON'. There are totally six times for the snooze function if the SNOOZE pin is "High".

E). Analog driver function and other control signals

a) EM32082 provides two pulses to drive motor of the analog clock directly if necessary. The pulses provided are shown below.
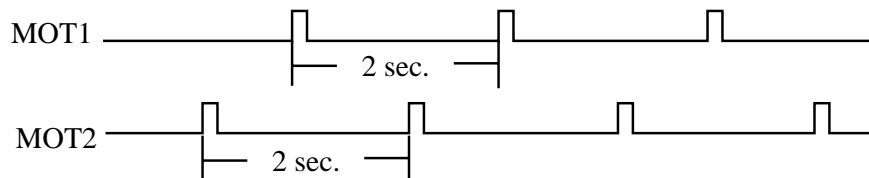
b) EM32082 will send a pulse with pulse width 5 seconds to ZERO pin if the current time counts to 00:00 for 24 hour format or 12:00 AM for 12 hour format.

F). Debounce
To prevent mistaken action due to bounce of trigger switch, any bounce pulse shorter than 20 ms of pin TALK, TR1, TR2, TR3, A_P will be ignored by the debounce circuit of EM32082.

ABSOLUTE MAXIMUM RATINGS

Items	Sym.	Min.	Max.	Unit
Supply Voltage	$V_{DD}-V_{SS}$	-0.5	+5.4	V
Input Voltage	V_{IN}	$V_{SS}-0.2$	$V_{DD}+0.2$	V
Operating Temperature	T_{OP}	0	50	°C
Storage Temperature	T_{STG}	-55	+125	°C

ELECTRICAL CHARACTERISTICS

(OSC=32768 Hz, T_A=25°C, V_{DD}=3.0 V unless otherwise specified)

Parameter	Sym.	Min.	Typ.	Max.	Unit	Condition
Supply Voltage	Vdd	2.4	3.0	3.6	V	
Operating Current	Idd1	-	2.0	5	μA	Output open, notspeaking
Operating Currnet	Idd2	-	150	200	μA	Output open, speaking
Input Current (TALK,TR1-TR3,A_P)	Ii	1.0	3.0	10	μA	
LCD Frequency	Flcd	-	32	-	Hz	
Voice Output (VO)	Ivo	2.0	3.0	4.5	mA	Vo=0.7V
Buzzer Output (BUZ1,BUZ2)	Ibz	5.0	10.0	15.0	mA	Vbz=1.5V
Oscillator Start Time	Tosc	-	0.5	3	sec	
OSCI Instrinsic Capacitance	C1	-	12	-	pF	
OSCI Instrinsic Capacitance	C2	-	20	-	pF	Pad option
OSCO Instrinsic Capacitance	Cout	-	20	-	pF	
Frequency Stability		-	1	3	ppm	
Motor Driver Current (MOT1, MOT2)	Imi	5	8	15	mA	Vmi=2.5V
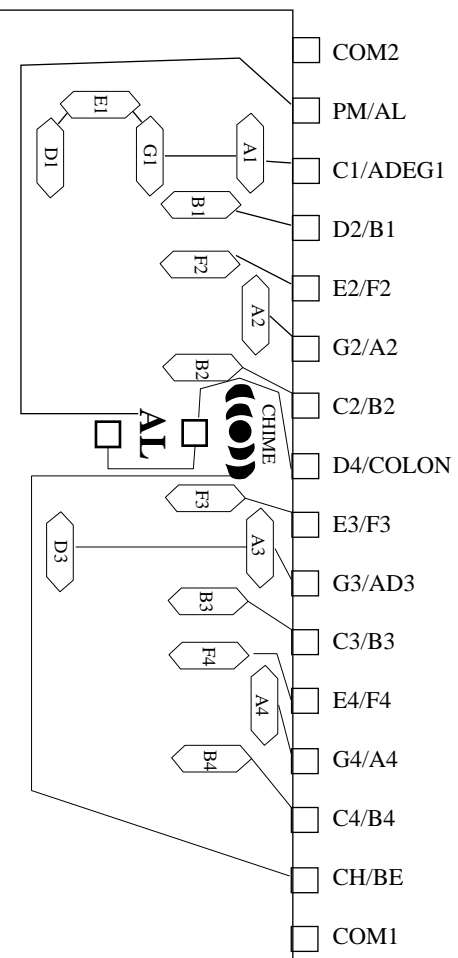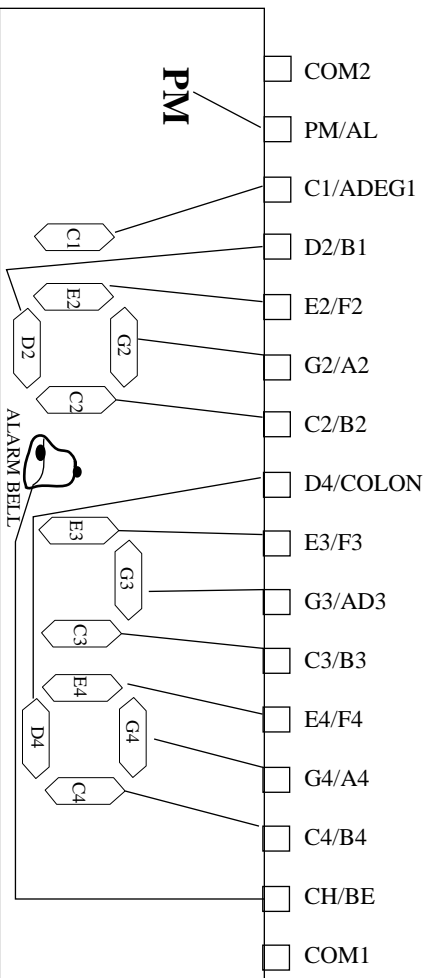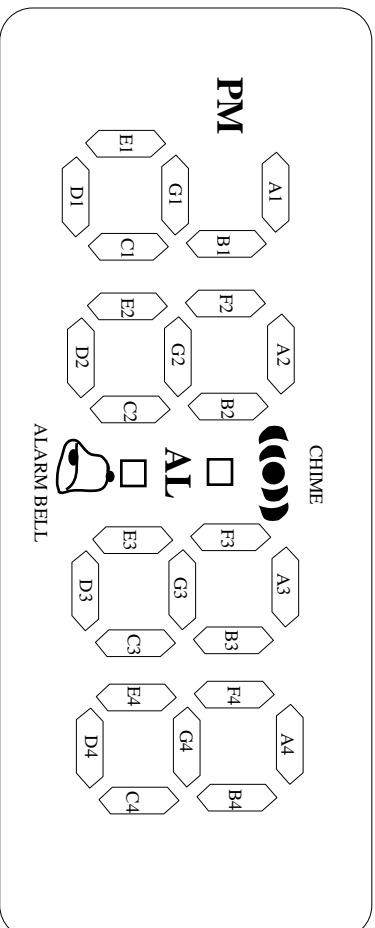
APPLICATION CIRCUIT
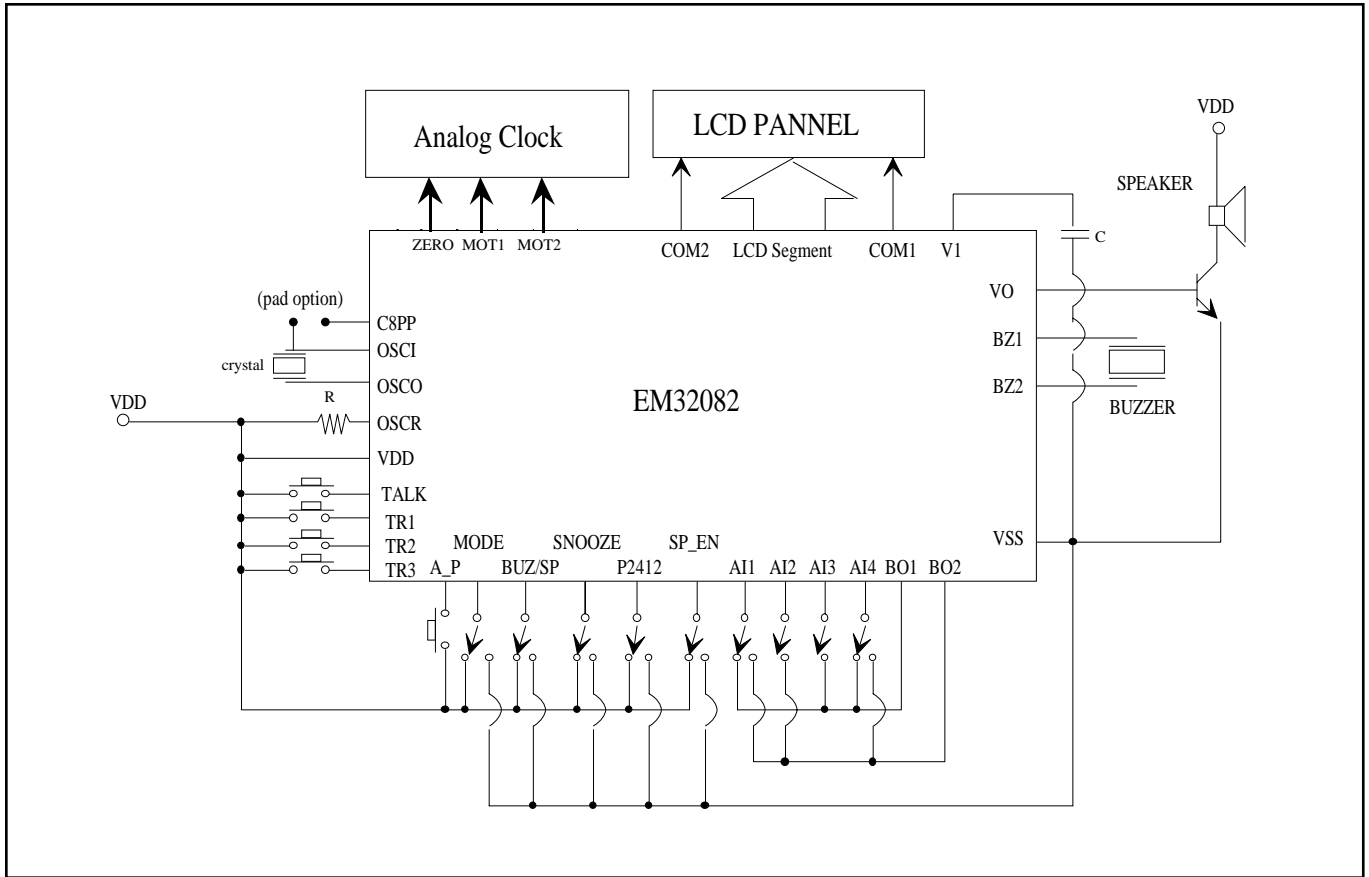
PAD DIAGRAM
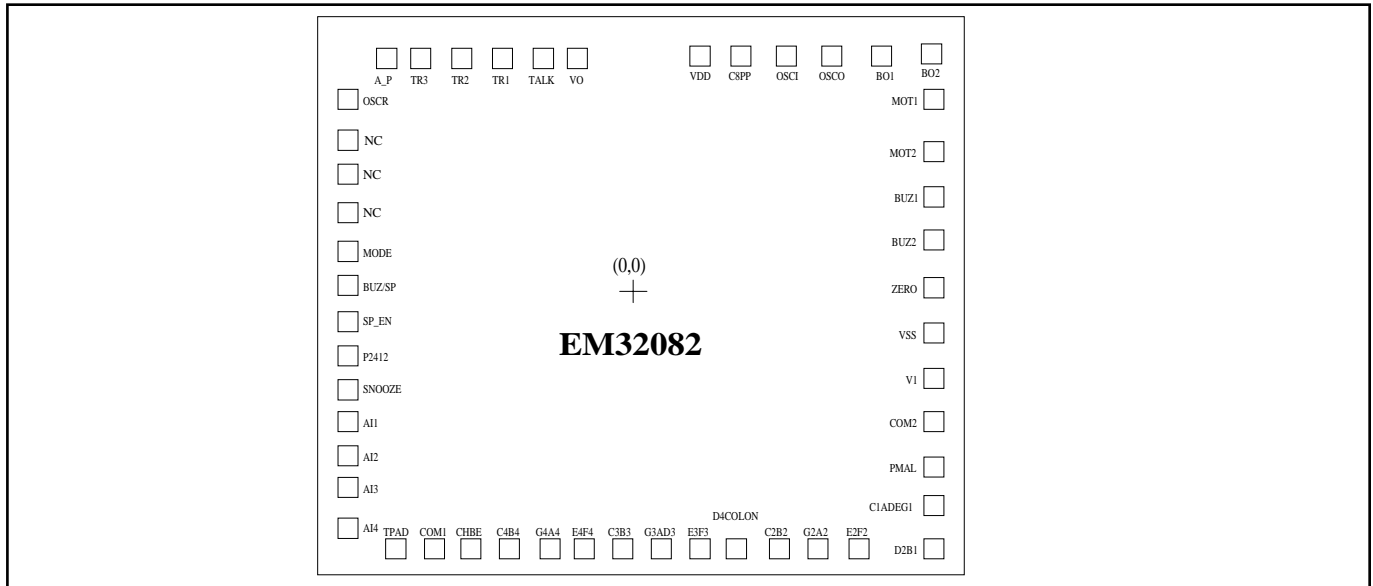
Pad No.	Symbol	X	Y
1	VO	-292.7	1143.6
2	TALK	-442.7	1143.6
3	TR1	-623.4	1143.6
4	TR2	-773.4	1143.6
5	TR3	-951.2	1143.6
6	A_P	-1101.2	1143.6
7			
8	OSCR	-1346.3	848.7
9	NC	-1346.3	673.9
10	NC	-1346.3	523.9
11	NC	-1346.3	346.1
12	MODE	-1346.3	196.1
13	BUZ/SP	-1346.3	21.3
14	SP_EN	-1346.3	-128.7
15	P2412	-1346.3	-297.7
16	SNOOZE	-1346.3	-447.7
17	AI1	-1346.3	-621.1
18	AI2	-1346.3	-771.1
19	AI3	-1346.3	-948.9
20	AI4	-1346.3	-1117.2
21	TPAD	-983.5	-1206.4
22	COM1	-813.2	-1233.1
23	CH/BE	-616.2	-1235.1
24	C4/B4	-462.2	-1235.1
25	G4/A4	-276.1	-1235.1
26	E4/F4	-122.1	-1235.1
27	C3/B3	64.0	-1235.1

Pad No.	Symbol	X	Y
28	G3/AD	218.0	-1235.1
29	E3/F3	404.1	-1235.1
30	D4/COLON	558.1	-1235.1
31	C2/B2	744.2	-1235.1
32	G2/A2	898.2	-1235.1
33	E2/F2	1084.3	-1235.7
34			
35	D2/B1	1369.0	-1235.7
36	C1/ADEG1	1369.0	-1050.5
37	PMAL	1369.0	-896.5
38	COM2	1378.1	-652.2
39	V1	1401.5	-401.2
40	V_{SS}	1392.0	-251.2
41	ZERO	1403.1	-31.8
42	BUZ2	1403.2	180.1
43	BUZ1	1403.2	440.9
44	MOT2	1403.2	652.3
45	MOT1	1403.2	963.9
46			
47	BO2	1374.3	1209.2
48	BO1	1138.1	1209.2
49	OSCO	897.7	1209.2
50	OSCI	684.5	1214.9
51	C8PP	432.0	1214.9
52	V_{DD}	281.2	1214.9

Unit : μm
Chip Size : 3040 x 2730 μm
Note : The substrate must be connceted to V_{SS} in PCB layout artwork.