# CD SERVO CONTROLLER WITH MCU
(WITH CLOCK AND RADIO FREQUENCY DISPLAY)

DESCRIPTION

The SC9638EP is a chip for CD player with clock and alarm clock. It has mature functions and provides the functions of CD play, radio frequency display, clock display, automatic sleep power off and double alarm bell power on and etc. The chip supports CD digital servo control, CD signal processing, frequency counting display for radio receiver, digital auto frequency DAC output, and LCD directly driving. The periphery circuit of the chip is simple and the cost is low.

FEATURES

* CD play function
  - Compatible with CD/CD-R/CD-RW
  - Support CD play /pause
  - Support CD previous track/next track
  - Support CD Fast forward/fast backward
  - Support CD single music, and whole disc repeat display.
  - Support CD random play display
  - Support program play for 20 music at most

* Clock function
  - Support clock display adjustment
  - Support double alarm bell, and can select CD play, radio receiving, or alarm clock.
  - Support nap function (6 minutes).
  - Supports sleep function.

* Radio receiving function
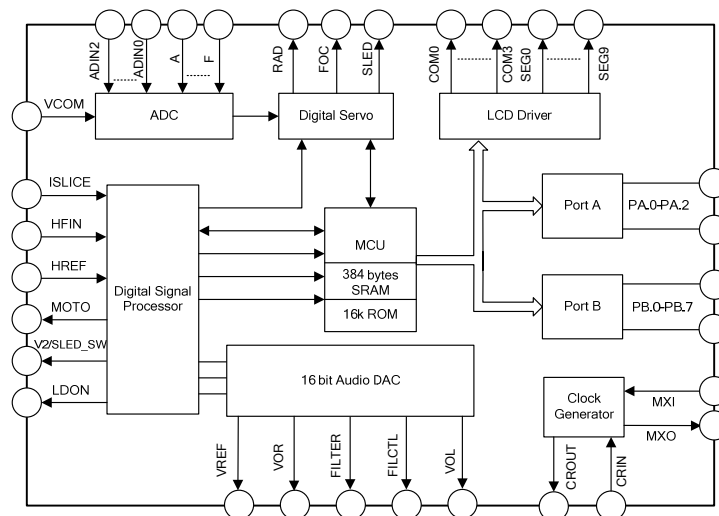 - Support FM/AM frequency display
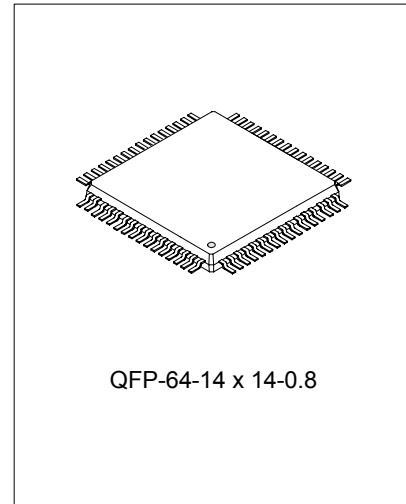
QFP-64-14 x 14-0.8

ORDERING INFORMATION

Device	Package
SC9638EP	QFP-64-14X14-0.8

APPLICATIONS

* Desktop CD audio

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS (Tamb=25°C)

Characteristics	Symbol	Ratings	Unit
Supply Voltage	VDD	-0.5 ~ +5.5	V
Input Voltage On Pins	VIN	-0.5 ~VDD + 0.5	V
Operating Temperature	Topr	-20 ~ +75	°C

ELECTRICAL CHARACTERISTICS (VDD=4.5~5.5V; VSS=0V; Tamb=-10~+50°C)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	VDD		4.5	5.0	5.5	V
Supply Current	IDD	5V(CD is working)	—	50	—	mA
RFIN Input Signal	VRFIN		—	1	—	V
Reference Voltage	VIr		—	0.5VDD	—	
Common Mode DC	Vcom		—	2.5	—	V
Input Current Of Central Diode B	IDB		0	—	9	μA
Input Current Of Central Diode A	IDA		0	—	9	μA
Input Current Of Central Diode C	IDC		0	—	9	μA
Input Current Of Central Diode D	IDD		0	—	9	μA
Input Current Of Satellite Diode F	IRF		0	—	4.5	μA
Input Current Of Satellite Diode E	IRE		0	—	4.5	μA
Low-level Output Current at PA Port	IIL(A)		—	10	—	mA
High-level Output Current at PA Port	IOH(A)		—	10	—	mA
Low-level Output Current at PB Port	IIL(B)		—	10	—	mA
High-level Output Current at PB Port	IOH(B)		—	10	—	mA
LDON Low-level Output Current	ILDON		0	—	2	mA
Load Resistance	RL	Left channel is the same as the right.	5	—	—	KΩ
Full-Scale DA Output Voltage	VFS	Left channel is the same as the right.	0.9	1.1	1.2	V
RAD Output Current	IRAD	High level is the same as the low level.	0	1	—	mA
FOC Output Current	IFOC	High level is the same as the low level.	0	1	—	mA
SLED Current	ISLED	High level is the same as the low level.	0	1	—	mA
MOTO Output Current	IMOTO	High level is the same as the low level.	0	5	10	mA
Low Level Output Voltage	VOLDRIVE1	RAD, FOC, SELD	0	—	0.4	V
High Level Output Voltage	VOHDRIVE1	RAD, FOC, SELD	VDD-0.4	—	VDD	V
Moto Low Level Output Voltage	VOLmoto		0	—	1.0	V
Moto High Level Output Voltage	VOHmoto		VDD-1	—	VDD	V

(To be continued)

(Continued)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
RAD, FOC, SLED, MOTO Output 3-State Leakage Current	I$_{ZODRIVE}$	RAD, FOC, SELD, MOTO	-10	0	+10	μA
DAC Total Harmonic Distortion Plus Noise	(THD+N)/S		60	65	70	dB
DA Filter Attenuation	Filter_DA	0 to 19 KHz	-	-	0.001	dB
		19 to 20 KHz	1	-	2	dB
		24KHz	25	-	-	dB
		25 to 35 KHz	40	-	-	dB
		35 to 64 KHz	50	-	-	dB
		64 to 68 KHz	31	-	-	dB
		68KHz	35	-	-	dB
		69~88KHz	40	-	-	dB
OSC Frequency	F$_{system}$		—	8.4672	—	MHz

PIN CONFIGURATIONS

Top pins (left to right): CROUT(64), CRIN(63), VDDA2(62), VSSA2(61), HFREF(60), HFIN(59), ISLICE(58), VCOM(57), E(56), F(55), D(54), C(53), A(52), B(51), VDDA1(50), VSSA1(49)

Left pins (top to bottom):
- PA.2/ADIN2 (1)
- PA.1/ADIN1 (2)
- PA.0/ADIN0 (3)
- PB.0/INT0 (4)
- PB.1/INT1 (5)
- PB.2/BUZZ (6)
- PB.4 (7)
- PB.5 (8)
- PB.6 (9)
- PB.7 (10)
- MVSS (11)
- AMIN (12)
- FMIN (13)
- MVDD (14)
- MRST (15)
- MTEST (16)

Right pins (top to bottom):
- LDON (48)
- V2/SLED_SW (47)
- GND (46)
- VDD (45)
- MOTO (44)
- SLED (43)
- FOC (42)
- RAD (41)
- VOL (40)
- FILTCL (39)
- FILTCR (38)
- VOR (37)
- VREF (36)
- VSS0 (35)
- VDD0 (34)
- VPP (33)

Bottom pins (left to right): MXI(17), MXO(18), COM0(19), COM1(20), COM2(21), COM3(22), SEG0(23), SEG1(24), SEG2(25), SEG3(26), SEG4(27), SEG5(28), SEG6(29), SEG7(30), SEG8(31), SEG9(32)

SC9638EP

Silan
Microelectronics

PIN DESCRIPTION

| Pin No.	Symbol	I/O	Description
1	PA.2/ADIN2	I/O	I/O port is duplex as input channel 2 of ADC.
2	PA.1/ADIN1	I/O	I/O port is duplex as input channel 1 of ADC.
3	PA.0/ADIN0	I/O	I/O port is duplex as input channel 0 of ADC.
4	PB.0/INT0	I/O	I/O port is duplex as external interrupt input INT0.
5	PB.1/INT1	I/O	I/O port is duplex as external interrupt input INT1.
6	PB.2/BUZZ	O	BUZZ state detecting and buzz signal output
7	PB.4	O	Common I/O port
8	PB.5	O	Common I/O port
9	PB.6	O	Common I/O port
10	PB.7	O	Common I/O port
11	MVSS	--	Analog Ground for Frequency counting of radio receiver.
12	AMIN	--	AM local oscillator signal input
13	FMIN	--	FM local oscillator signal input
14	MVDD	--	MCU Power Supply
15	MRST	--	MCU Reset
16	MTEST	--	MCU Test pin which is connected to the ground.
17	MXI	I	The crystal oscillator (75KHz) input pin.
18	MXO	O	The crystal oscillator (75KHz) output pin.
19	COM0	--	LCD COM0 Port
20	COM1	--	LCD COM1 Port
21	COM2	--	LCD COM2 Port
22	COM3	--	LCD COM3 Port
23	SEG0	--	LCD SEG0 Port
24	SEG1	--	LCD SEG1 Port
25	SEG2	--	LCD SEG2 Port
26	SEG3	--	LCD SEG3 Port
27	SEG4	--	LCD SEG4 Port
28	SEG5	--	LCD SEG5 Port
29	SEG6	--	LCD SEG6 Port
30	SEG7	--	LCD SEG7 Port
31	SEG8	--	LCD SEG8 Port
32	SEG9	--	LCD SEG9 Port
33	VPP	--	OTP Power Supply
34	VDD0	--	+5V DAC Power Supply
35	VSS0	--	DAC GND
36	VREF	--	Internal reference voltage whose typical value is 0.5VDD
37	VOR	--	DAC right channel output
38	FILTCR	--	DAC right channel filter capacitor.

(To be continued)

(Continued)

Pin No.	Symbol	I/O	Description
39	FILTCL	--	DAC left channel filter capacitor.
40	VOL	--	DAC left channel filter capacitor.
41	RAD	--	Tracking drive output
42	FOC	--	Focus drive output
43	SLED	--	Sled drive output
44	MOTO	--	Spindle drive output
45	VDD	--	Servo Supply Voltage
46	GND	--	Servo Ground
47	V2/SLED_SW	--	Sled motor position monitor signal input
48	LDON	--	Laser control signal output with built-in pull up resistor
49	VSSA1	--	Analog Ground of Servo Module ADC.
50	VDDA1	--	Analog Supply Voltage of Servo Module ADC.
51	B	--	Central diode current signal input B
52	A	--	Central diode current signal input A
53	C	--	Central diode current signal input C
54	D	--	Central diode current signal input D
55	F	--	Satellite diode current signal input F
56	E	--	Satellite diode current signal input E
57	VCOM	--	DC Voltage Input
58	ISLICE	--	Data Slice feed-back current output
59	HFIN	--	EFM signal input
60	HFREF	--	Reference signal
61	VSSA2	--	Servo module HF and the analog ground of PLL
62	VDDA2	--	Servo module HF and the analog source supply of PLL
63	CRIN	I	8.4672MHz crystal oscillator input
64	CROUT	O	8.4672MHz crystal oscillator output

FUNCTION DESCRIPTION

1. LCD illustration

The circuit adopts LCD of 4×16, 5V, 1/4duty, and 1/3bias, and the panel is as follows:
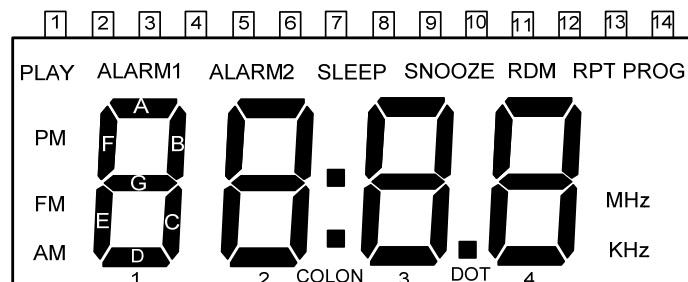
Corresponding truth table:

	COM0(PIN1)	COM1(PIN2)	COM2(PIN3)	COM3(PIN4)
SEG0(5)	1A	1F	1E	1D
SEG1(6)	PM	1B	1G	1C
SEG2(7)	2A	2F	2E	2D
SEG3(8)	:(two points)	2B	2G	2C
SEG4(9)	3A	3F	3E	3D
SEG5(10)	PLAY	3B	3G	3C
SEG6(11)	4A	4F	4E	4D
SEG7(12)	RDM	4B	4G	4C
SEG8(13)	ALARM1	ALARM2	AM/KHZ	FM/MHZ/DOT
SEG9(14)	SLEEP	SNOOZE	RPT	PROG

2. Jumpers

Function description:

Flag	Function description	
24/12CLK	Select 12-hour time system or 24-hour time system.	
	24/12CLK	**Function**
	0	24-hour time system
	1	12-hour time system

Note: Connect to the pull up resistor when the flag is 1.

3. Keyboard

Keyboard Arrangement:

ADIN1	ADIN2
PLAY/PAUSE	POWER
STOP	DISPLAY
UP/FF	CLOCK
DOWN/REW	ALARM1
PROG/RPT	ALARM2
RAND	SLEEP
TIMER	SNOOZE

4. Mode Switch

4.1 AUTO/BUZZ: Select the alarm clock mode and the current state will not change when power on normally, it is active in alarm power on.

4.2 CD/RADIO（FM, AM）: Switch to CD, radio (FM, AM) mode when power on;

4.3 In boot-strap mode, when press the key DISPLAY, switch to the time and current state display. If there is no operation when in current state display within 5 seconds, return to the time display.

5. CD mode

5.1 CD Key Functions

1） STOP

This key will stop the CD play.

2） PLAY/PAUSE

✧ When CD stops, it will play if press this key, and display the CD track;

✧ When CD plays, it will pause if press this key, and the display flashes.

3） NEXT/FF

✧ Short press less than 1 second: next track

Skip to next track. If the current track is the last one, then skip to the first track to play.

✧ Long press more than 1 second: fast forward

Fast forward till the key is released, and if fast forward to the end, then play the first track.

4） PREV/FW

✧ Short press less than 1 second: last track

When the time of current track is less than 1s, skip to the previous track. If the current track is the first one, then skip to the last one.

When the time of current track is more than 1s, skip to the head of the current track.

✧ Long press more than 1 second: fast backward

Fast backward till release this key, if come to the first one, then play normally.

5） RDM

Switch to random play state. When this function is open, display "RDM".

6） PROG/RPT

When CD is in stop state, enter the program state, and the "PROG" flashes;

✧ Press REW/FF to select the track, and PROG stores the track, the program number adds by 1, and it can store 20 tracks at most. If no operation in 8 seconds, then exit the program state, but the tracks are saved; After completing the program, press PLAY to enter the program play state, and the "PROG" lights;

✧ Press STOP to clear the program tracks, and then exit the program state;

✧ When CD is in play state, enter the RPT function;

✧ When switch to single track or replay the whole disk, press RPT to replay the current track, and "RPT" flashes; then press RPT again to replay the whole disk, and "RPT" lights.
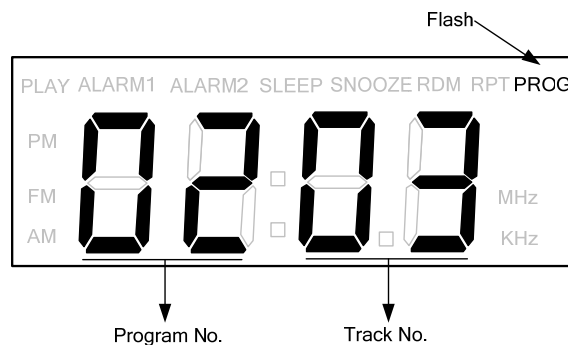
5.2 CD display

1) Read TOC
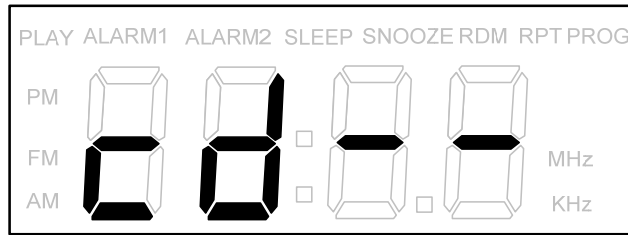
2) After CD tray is closed, begin to read TOC, and enter STOP state when completing the reading. If no operation in 5 seconds, then return to the time display.
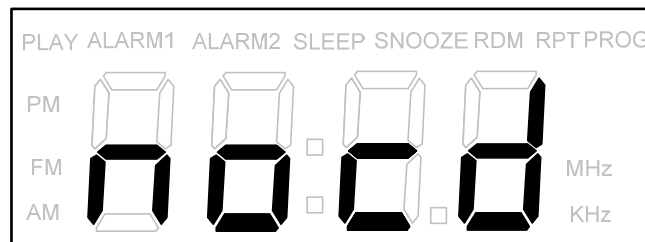

3) CD play

4) Program state

Program No.   Track No.

5) When there is error in CD play

```
PLAY ALARM1  ALARM2  SLEEP  SNOOZE RDM  RPT
PM
FM          E  r  r            MHz
AM                             KHz
```

6) When there is no disk in CD

```
PLAY ALARM1   ALARM2  SLEEP  SNOOZE RDM  RPT PROG
PM
FM        n  o  c  d            MHz
AM                              KHz
```

After the above states, if no operation in 5 seconds, then return to the time display.

6. RADIO mode

In RADIO mode, display the radio frequency, if no operation in 5 seconds, then returns to the time display; when the frequency is changed, switch to the frequency display automatically.

1) FM frequency display

```
PLAY ALARM1   ALARM2  SLEEP  SNOOZE RDM  RPT PROG
PM
FM        1  0  4. 3            MHz
AM                              KHz
```

2) AM frequency display

```
PLAY ALARM1   ALARM2  SLEEP  SNOOZE RDM  RPT PROG
PM
FM          8  1  0             MHz
AM                              KHz
```

7. CLOCK mode

Clock key function

1) CLOCK

✧ When short press is less than 1 second, display the time, and if no operation in 5 seconds return to the original state;

✧ Press CLOCK and FW/HOUR or FF/MIN to adjust the time. When short press, corresponding hour/minute adds by 1; while long press, it will increase continuously;

✧ After it resets and before the time is adjusted, the display time flashes, and after completes the adjustment of the time, the display is normal.

2) ALARM1/ALARM2

✧ When ALARM closes, short press less than 1 second, then open ALARM1 or ALARM2 function, and display ALARM time, if on operation in 5 minutes, return to the original state; When ALARM function is open, the "ALARM" light is open;

✧ When display ALARM time, short press ALARM1/ALARM2 key, to cancel corresponding function of ALARM1 or ALARM2, and "ALARM" light is off;

✧ Press ALARM1/ALARM2 and FW/HOUR or FF/MIN to adjust ALARM time. When short press, the corresponding ALARM hour/minute adds by 1; while long press, it will increase continuously;

✧ When in power off mode, alarm bell rings when the time is up. If in AUTO state, play CD automatically in CD mode; if in TUNER state, then power on and play the radio, and display the radio frequency; if in BUZZ state, then output the BUZZ sound. At this time switch the AUTO/BUZZ can switch to output MUSIC or BUZZ; and press POWER or corresponding ALARM can power off directly, and cancel the alarm state.

✧ When the alarm ring bell output, the corresponding ALARM1 or ALARM2 flashes, and press the corresponding key ALARM to cancel the alarm ring, and power off, the ALARM indicator light is open all the time.

✧ Power off automatically after ALARM rings for an hour in CD mode; When in BUZZ output, close the BUZZ output after 5 minutes. Unless the users switch to BUZZ/AUTO mode or press ALARM and POWER, it will clear the one hour timing.

✧ ALARM has memory function, and only clears the ALARM time memory when it is electrified again.

✧ ALARM1 ring bell's frequency is 600Hz;

✧ ALARM2 ring bell's frequency is 1200Hz.

3) SLEEP

Press SLEEP to power on and play the CD automatically.

SLEEP sets the time as 90-80-70-60-50-40-30-20-10-0; After 0 minute it will cancel SLEEP mode. The SLEEP flash display when set the timer, and after the timer is open, display SLEEP.

4) SNOOZE

When the bell rings, press this key to enter SNOOZE mode, and after 6 minutes, the alarm clock will ring again.

## 8. POWER OFF mode

Display the clock in power off mode.

9. POWER DOWN mode

1) Switch to power down mode automatically when the power supply is only DC, and the AC backlight is off, DC backlight is open then off after 5 seconds.

2) In power down mode, only the clock control key is active, and at this time, only the CLOCK and ALARM can be adjusted, while the other keys are of no effect; Press the key, the DC backlight is open for 5 seconds then off.

TYPICAL APPLICATION CIRCUIT

PACKAGE OUTLINE

QFP-64-14X14-0.8   **UNIT: mm**
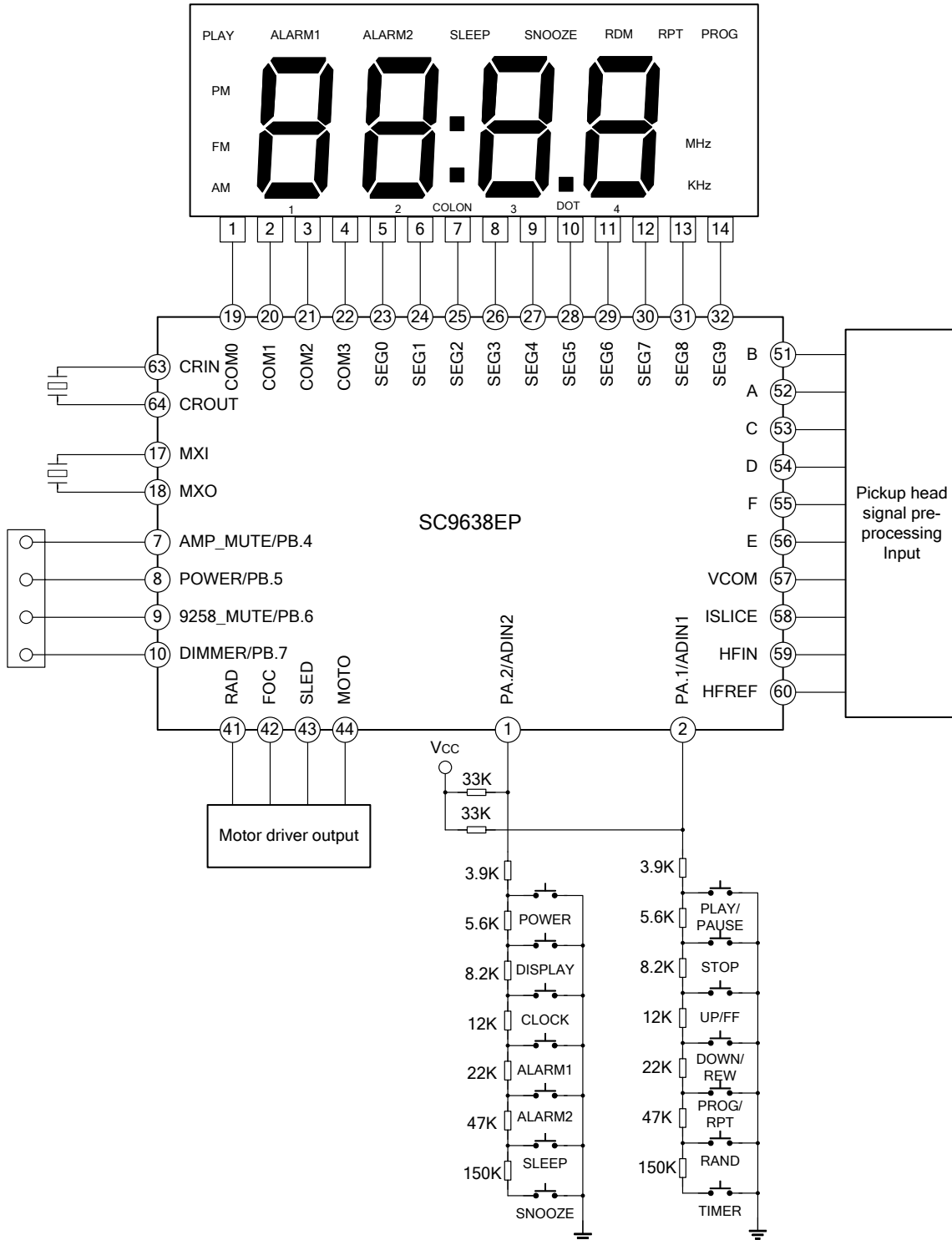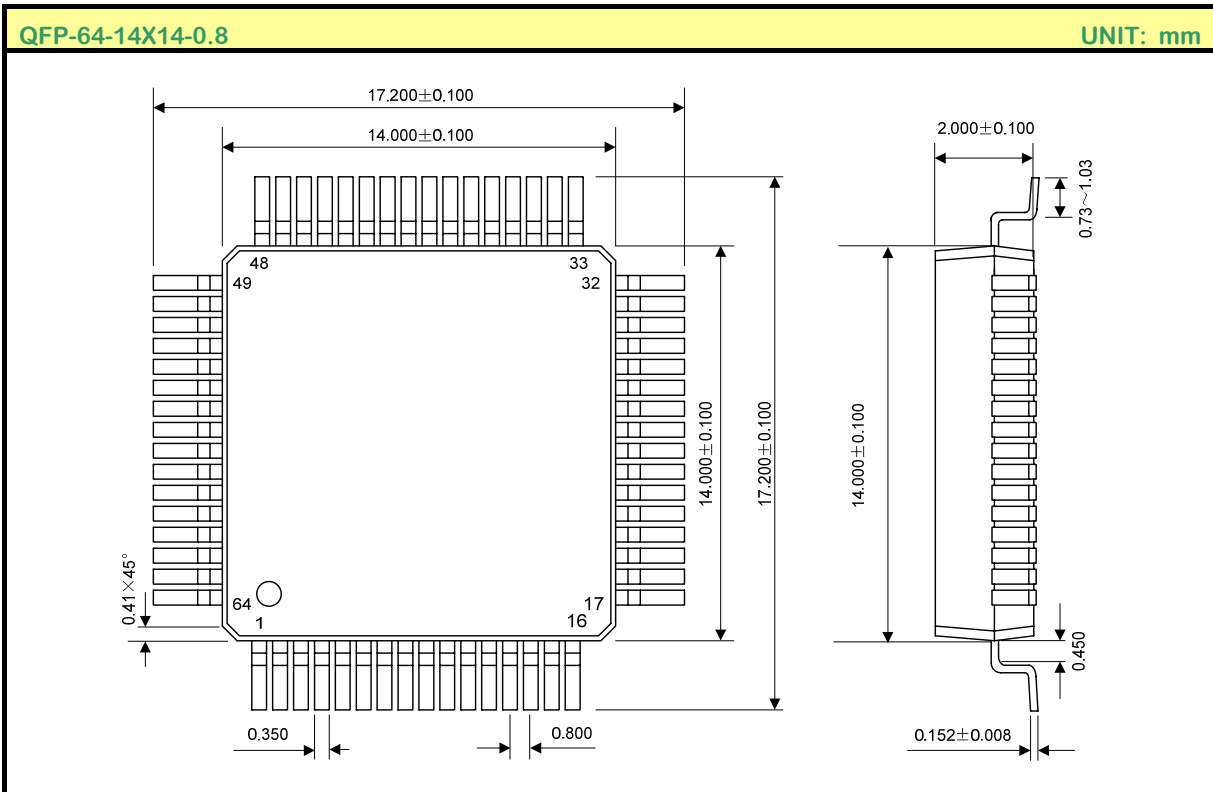
HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.

Note: Silan reserves the right to make changes without notice in this specification for the improvement of the design and performance. Silan will supply the best possible product for customers.