# DIGITAL ALARM CLOCK WITH LED DRIVER

## DESCRIPTION

The SC8560 is an alarm equipped digital clock IC with built-in drivers capable of directly driving LED display equipment.

## FEATURES

* Single chip P-channel ED MOS LSI
* LED direct drive using time division (duplex configuration)
* Wide operating power supply voltage range
* Built-in alarm function with 24-hour control
* Supports changeover between 12-hour AM/PM and 24-hour displays
* Built-in battery backup CR oscillator
* Built-in automatic fast forward function for hour and minute settings
* Built-in snooze function supporting repeat use
* Uses 50Hz as standard frequency
* Built-in sleep timer function (maximum intervals for 59 minutes or 1 hour and 59 minutes)
* Equipped with power failure display function
* 900Hz output for alarm tone
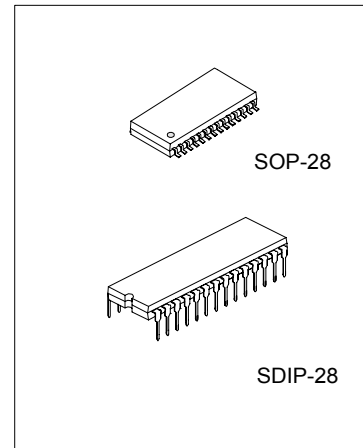
SOP-28
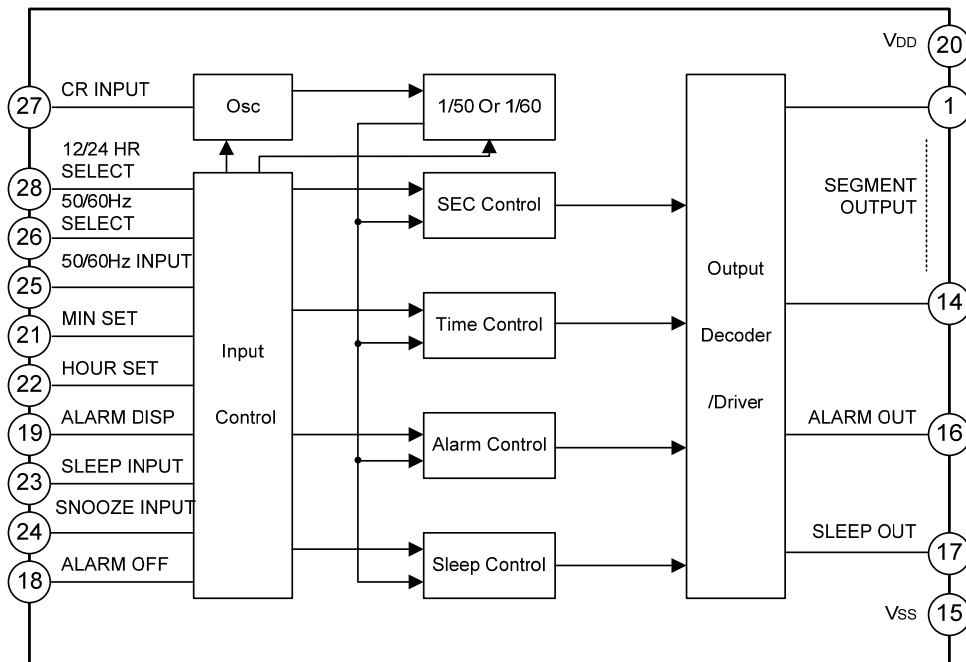
SDIP-28

## ORDERING INFORMATION

| Part No. | Package |
|----------|---------|
| SC8560 | SDIP-28-400-1.778 |
| SC8560S | SOP-28-375-1.27 |

## APPLICATIONS

* Alarm clocks
* Clock-radios

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS (Ta =25°C, Vss =0V)

| Characteristics | Symbol | Condition | Value | Unit |
|---|---|---|---|---|
| Maximum Supply Voltage | VDD max. | | -15.0 ~ + 0.3 | V |
| Input Voltage 1 | VIN(1) | 50/60Hz input | -15.0 ~ + 0.3 | V |
| Input Voltage 2 (except pin 26) | VIN(2) | Except 50/60Hz input | -15.0 ~ + 0.3 | V |
| Output Voltage | VOUT | | -15.0 ~ + 0.3 | V |
| Input Clamp current( pin 26) | IIN | 50/60Hz input | -0.4 ~ +0.4 | mA |
| Allowable Power Dissipation | PD | Ta=70°C | 700 | mW |
| Operating Temperature | Topr | | -30 ~ +70 | °C |
| Storage Temperature | Tstg | | -55～+125 | °C |

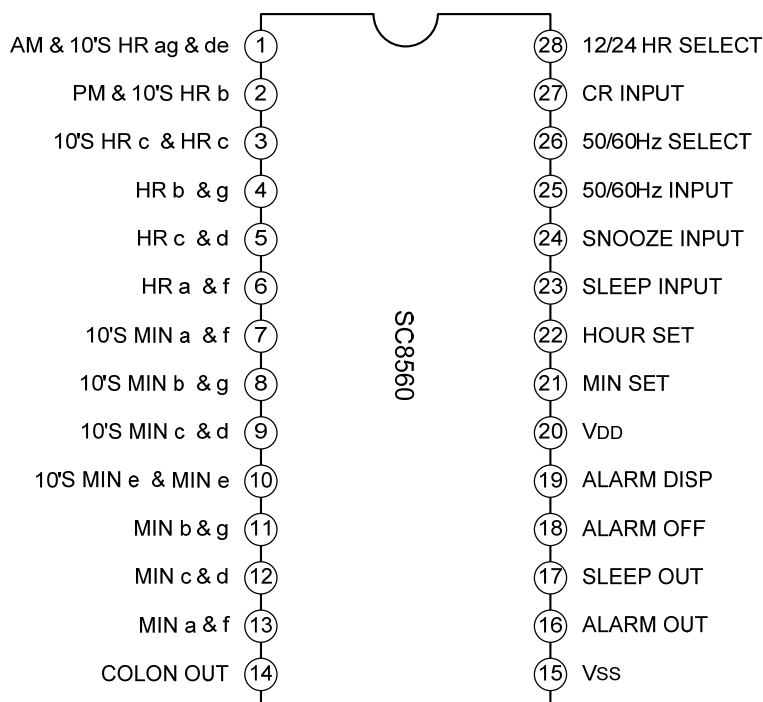## ELECTRICAL CHARACTERISTICS (Tamb=25°C, VDD=-12.0V, VSS=0V, Unless otherwise specified)

| Characteristics | Symbol | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage | VDD | | -14.0 | | -7.5 | V |
| Input "H" level Voltage | VIH(1) | 50/60Hz Input | -1.0 | | | V |
| Input "L" level Voltage | VIL(1) | 50/60Hz Input | | | VDD+2 | V |
| Input "H" level Voltage | VIH(2) | Except 50/60Hz input | -1.5 | | | V |
| Input "L" level Voltage | VIL(2) | Except 50/60Hz input | | | VDD+2 | V |
| 50/60 Hz input pin input voltage | VAC-IN | | VLED | | | V |
| Input "H" level current(1) | IIH1 | 50/60Hz Input, VIN=VSS | | | 10 | µA |

(To be continued)

(Continued)

| Characteristics | Symbol | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Input "L" level current(1) | $I_{IL1}$ | 50/60Hz Input, $V_{IN}=V_{DD}$ | | | 10 | μA |
| Input "H" level current(2) | $I_{IH2}$ | Input pins other than 50/60Hz Input, $V_{IN}=V_{SS}$ | | | 20 | μA |
| Input "L" level current(2) | $I_{IL2}$ | Input pins other than 50/60Hz Input, $V_{IN}=V_{DD}$ | | | 10 | μA |
| Output "H" level current(1) | $I_{OH1}$ | Alarm output and sleep output, $V_{OH}=V_{SS}-1V$ | 5 | | | mA |
| Output leakage current(1) | $I_{OF1}$ | Alarm output and sleep output, $V_{OUT}=V_{DD}$ | | | 10 | μA |
| Output "H" level current(2) | $I_{OH2}$ | AM& 10'S HR ag&de (24H mode),$V_{OUT}=V_{DD}-1V$ | 36 | | | mA |
| Output leakage current(2) | $I_{OF2}$ | AM& 10'S HR ag&de (24H mode),$V_{OUT}=V_{DD}$ | | | 20 | μA |
| Output "H" level current(3) | $I_{OH3}$ | Segment Output other than those listed above , $V_{OUT}=V_{SS}-1V$ | 18 | | | mA |
| Output leakage current(3) | $I_{OF3}$ | Segment Output other than those listed above, $V_{OUT}=V_{DD}$ | | | 20 | μA |
| Power failure detection voltage | $V_{DF}$ | | -7.5 | -5.0 | | V |
| Consumption current | $I_{CC}$ | Output set to off and pull-down attached input set to open | | 5 | 7 | mA |
| Backup oscillator stability factor | $f_s$ | Standard value,900Hz, $V_{DD}$= -9V$\pm$10% | -10 | | 10 | % |
| Backup oscillator accuracy | $f_a$ | Standard value,900Hz, $V_{DD}$= -9V | -10 | | 10 | % |

## PIN CONFIGURATIONS

```
AM & 10'S HR ag & de    (1)        (28)   12/24 HR SELECT
     PM & 10'S HR b     (2)        (27)   CR INPUT
 10'S HR c  & HR c      (3)        (26)   50/60Hz SELECT
          HR b  & g     (4)        (25)   50/60Hz INPUT
          HR c  & d     (5)        (24)   SNOOZE INPUT
          HR a  & f     (6)        (23)   SLEEP INPUT
    10'S MIN a  & f     (7)  SC8560 (22)  HOUR SET
    10'S MIN b  & g     (8)        (21)   MIN SET
    10'S MIN c  & d     (9)        (20)   VDD
 10'S MIN e  & MIN e   (10)        (19)   ALARM DISP
        MIN b & g      (11)        (18)   ALARM OFF
        MIN c & d      (12)        (17)   SLEEP OUT
        MIN a & f      (13)        (16)   ALARM OUT
       COLON OUT       (14)        (15)   VSS
```

## DESCRIPTION OF OPERATIONS

| Terminal Description | Operating Description |
|---|---|
| 50/60 Hz Input: | Built-in Shumidt circuits enable noise elimination at 50/60Hz commercial frequencies with use of a simple CR filter. Built-in pull-up resistor. |
| CR Input | When the AC power supply is interrupted, the time counter switches to a holding state and a built-in oscillator promptly begins operation. If 50/60Hz input continuous for 3 clocks without arriving, this oscillator's output is activated and functions as the time counter clock in place of 50/60Hz input. The frequency level of this clock oscillator is determined according to the CK Value. While the above mentioned oscillator is operating using backup mode, all segment output is switched to OFF. (Note) When the backup oscillator is in use due to an AC power supply interruption, the 50/60Hz input pin must be maintained open or at a Vss level. |
| 50/60Hz Selective Input | When 50/60 selective input is connected to Vss,50Hz use is enable. When 50/60 selective input is left open, VDD is activated using an internal pull-down resistor and the setting is switched to enable use at 60Hz. |
| Display Mode Selective Input (Alarm Select/Sleep Select ) | Since the pull-down resistor is built-in, selection from four display modes is possible using two SPST switches (single-pole and single-throw switches). Table I shows these display mode selections. |
| Time Setting Input | There are two setting inputs for use with "hour" and "minute". Time content settings shown in Table 2 are possible by activating Vss to these pins. A pull-down resister is built-in. |
| 12/24H Select Input | Leaving this pin unconnected (VDD) causes the 12-hour basis to be selected, connecting this pin to VSS cause the 24-hour basis to be selected .An internal pull-down resistor is provided. |
| Power Failure Detection display | If the power supply voltage drops and is applied again, all the on-segments flash and the power failure indication mode is entered. The power failure indication mode is released by applying VSS to "hour set" or " minutes set". |
| Alarm Operation and Alarm Output | The alarm signal outputs when alarm content marches the time .When not reset by either snooze input or alarm off input, output continues after l hour and 59 minutes. This output signal consists of 900 Hz 2 Hz intermittent (50% duty) modulation signals. When the need arises, a filter can be applied to alter the alarm signal to a DC signal. |
| Snooze Input | When the alarm is sounding and instantly activating Vss to this pin, alarm output is set to OFF for a period between 8 and 9 minutes after which time the alarm signal is once again output .The snooze function can be used repeatedly in l hour and 59 minutes intervals. A pull-down resist is built-in. Activating Vss to the snooze pin when the alarm is OFF resets the sleep timer counter to [0:00].(This is known as the one-touch sleep timer reset function.) |
| Alarm Off Input | Activating this input pin to Vss instantly sets alarm output to OFF. A pull-down resistor is built-in. |
| Sleep Timer and Sleep Output: | Sleep output can turn on the radio and can be set for time intervals of 59 minutes or l hour and 59 minutes. Refer to Table 2 for the proper selection procedure (59 minutes or l hour and 59 minute selection). This sleep timer is constructed using a down counter and when the counter content arrives at [00], output is set to off and the radio turns off .Adding Vss to snooze input turns sleep output off, when sleep output is on. |

**TABLE 1: DISPLAY MODES**

| Selective Input | | Display Mode | Digit No.1 | Digit No.2 | Digit No.3 | Digit No.4 |
|---|---|---|---|---|---|---|
| Alarm | Sleep | | | | | |
| NC | NC | Time display | 10's place for hour ,AM/PM | Hour | 10's place for minute | Minute |
| Vss | NC | Alarm display | 10's place for hour ,AM/PM | Hour | 10's place for minute | Minute |
| NC | Vss | Sleep display | -- | Hour | 10's place for minute | Minute |
| Vss | Vss | Second display | Clear | Minute | 10's place for second | Second |

**Note:** Activating Vss using two inputs simultaneously (alarm select and sleep select), the display mode is switched to display seconds.
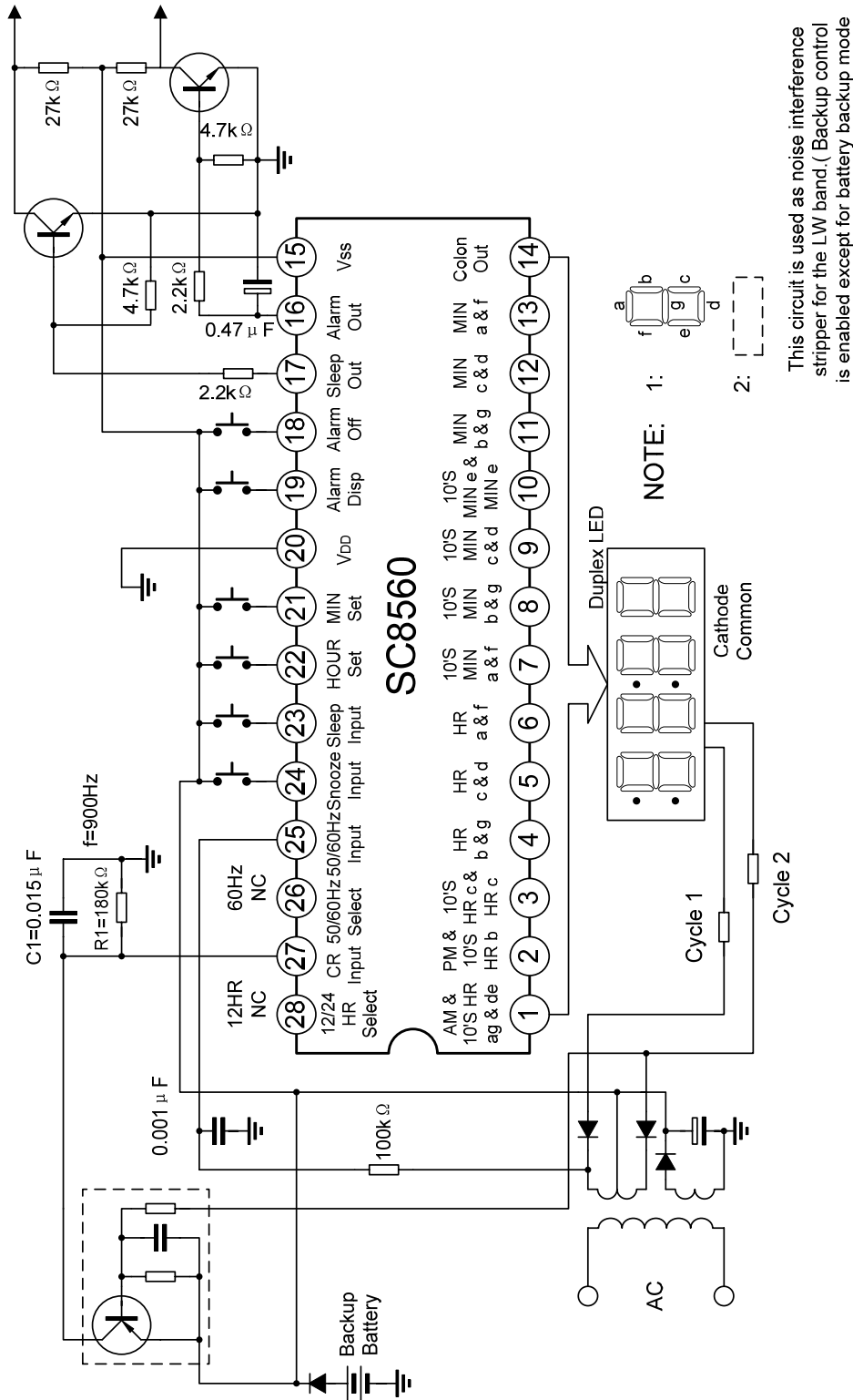
**TABLE 2: SETTING CONTENTS**

| Display Mode | Set Input | Functions |
|---|---|---|
| Time | HOUR | Immediately adds 1 to hour digits and then assigns an additional 1. at a speed of 2 Hz , after each 1/4 to 3/4 second . |
| | MIN | Immediately adds 1 to minute digits and then assigns an additional 1. at a speed of 2 Hz, after each 1/4 to 3/4 second . Seconds are reset. |
| | BOTH | Operates both as outline above. |
| Second (Alarm&Sleep) | HOUR(Note) | Second digits are cleared to [00]. |
| | MIN | Time holds. |
| | BOTH | Resets hour and minute digits as [0:00] when operating in 24-Hmode or [12:00] when operating in 12-H mode. |
| Alarm | HOUR | Immediately adds 1to hour digits and then assigns an additional 1, at a speed of 2 Hz, after each 1/4to 3/4 second. |
| | MIN | Immediately adds 1 to minute digits and then assigns an additional 1, at a speed of 2 Hz, after each 1/4to 3/4 second. |
| | BOTH | Resets hour and minute digits to [0:00] when operating in 24-hour mode or [12:00] when operating in, 12-hour mode. |
| Sleep | - | Sets sleep counter to [0:59] instantly when VDD is activated to sleep select. |
| | HOUR | Sets sleep counter to [1:59] instantly when VDD is activated to sleep select and hour at the same time. |
| | MIN | Sleep counter looses 1 at a speed of 2 Hz |
| | BOTH | Sleep counter looses 1 at a speed of 2 Hz |

Once conditions have been switched to reset or hold, input of other functions is locked until HOUR and MIN input have separated.
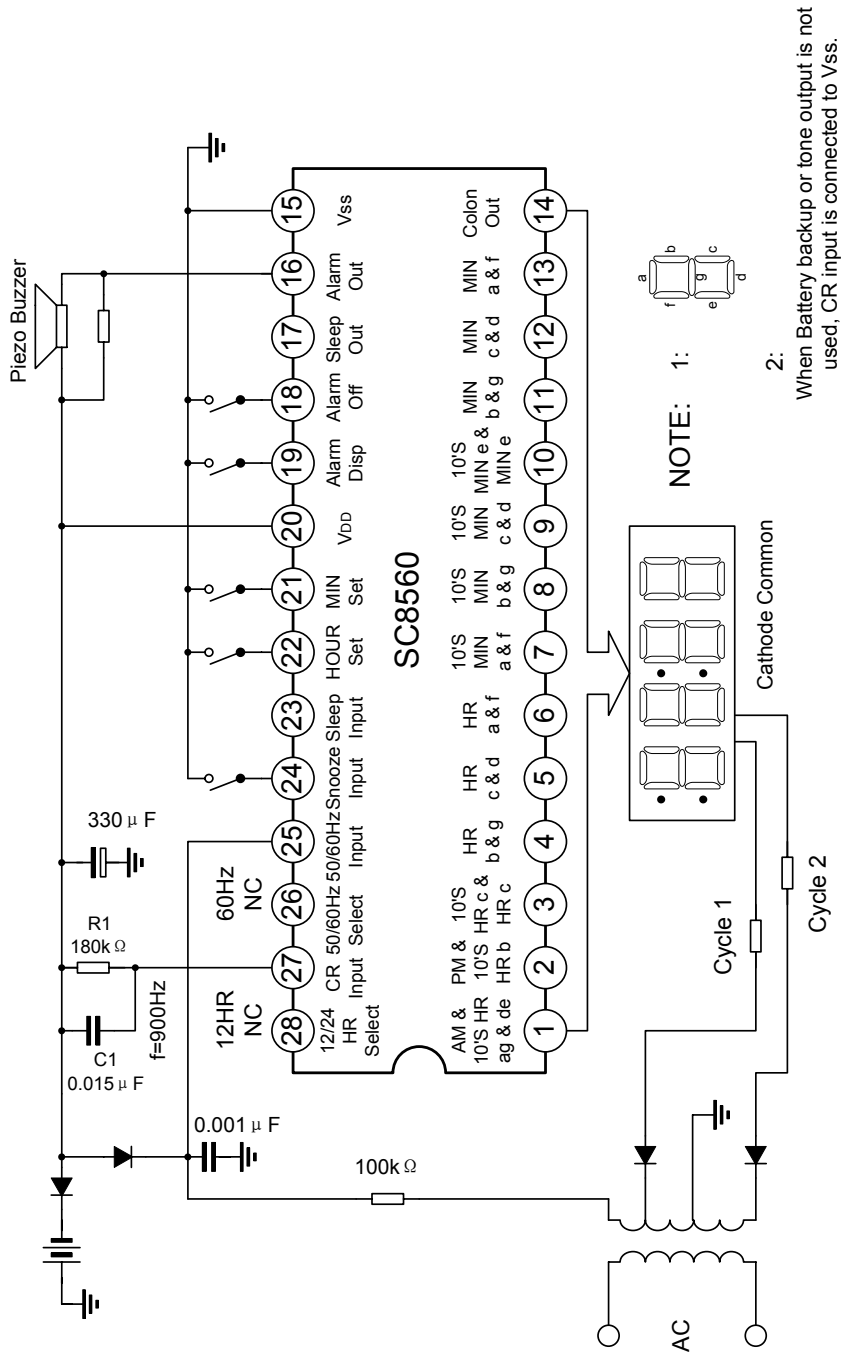
**Note:**

When the digital reading for seconds is between 30 and 59 seconds, 1 is added to digits for minutes as the digital reading for seconds resets to [00]

## CLOCK-RADIO APPLICATION CIRCUIT (Positive Power Supply)



NOTE:
1:
2:

This circuit is used as noise interference stripper for the LW band.( Backup control is enabled except for battery backup mode

12 Hour Display and 60Hz Circuit Diagram

## CLOCK APPLICATION CIRCUIT (Negative Power Supply)



12 Hours Display and 60Hz Circuit diagram

NOTE: 1:
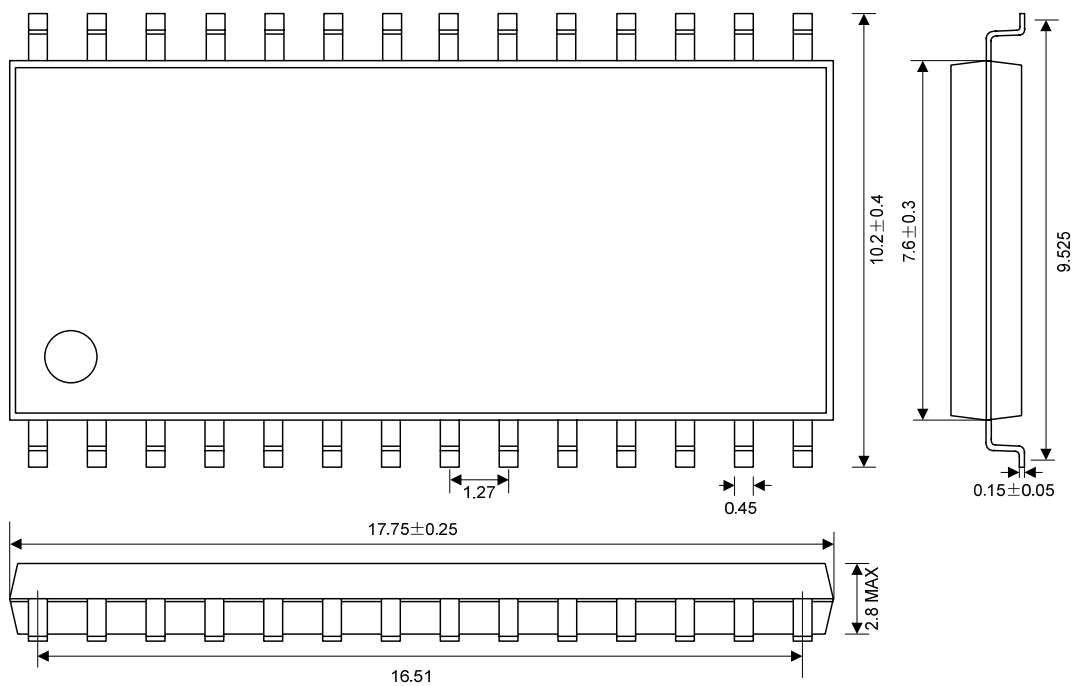
2: When Battery backup or tone output is not used, CR input is connected to Vss.

## PACKAGE OUTLINE

**SDIP-28-400-1.778**  **UNIT: mm**
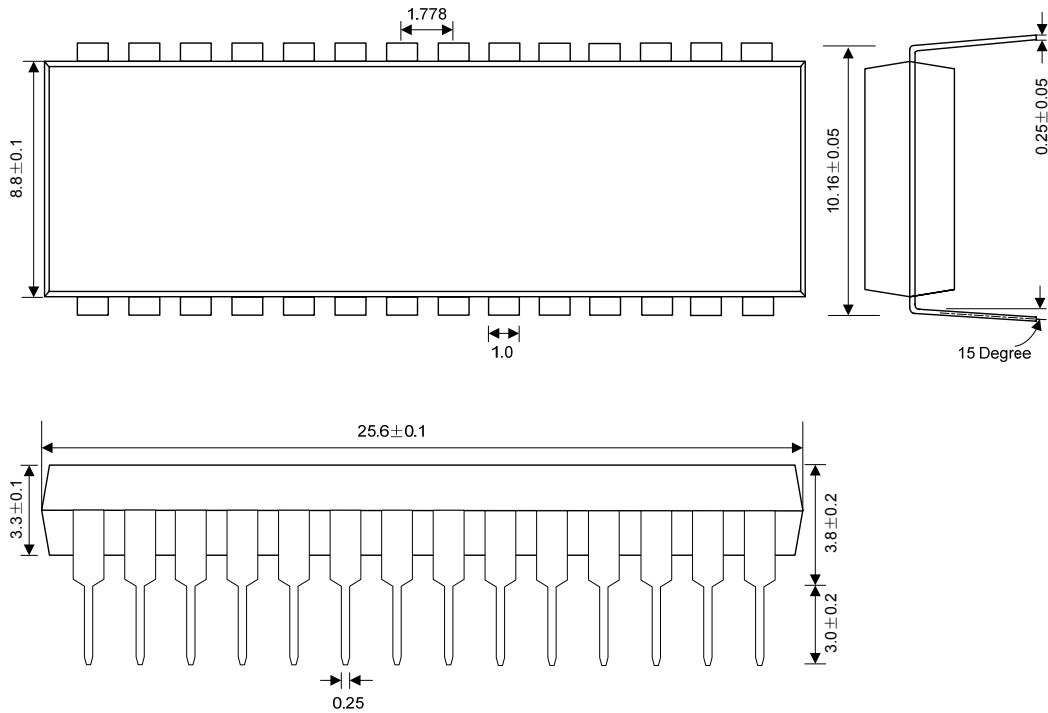


**SOP-28-375-1.27**  **UNIT: mm**

**MOS DEVICES OPERATE NOTES:**

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

● The operator must put on wrist strap which should be earthed to against electrostatic.

● Equipment cases should be earthed.

● All tools used during assembly, including soldering tools and solder baths, must be earthed.

● MOS devices should be packed in antistatic/conductive containers for transportation.

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.

## ATTACHMENT

### Revision History

| Data | REV | Description | Page |
|------|-----|-------------|------|
| 2000.12.31 | 1.0 | Original | |
| 2008.06.02 | 1.1 | Modify the "CLOCK-RADIO APPLICATION CIRCUIT (Positive Power Supply)" and "CLOCK APPLICATION CIRCUIT (Negative Power Supply)". | |