

NTE2062 Integrated Circuit PMOS Digital Alarm Clock

Features:

- Single-Chip ED MOS LSI
- LED Direct Drive by Time-Sharing (Duplex)
- Wide Operating Voltage Range
- Alarm on a 24-Hour Basis
- Two Selections of Time Format:
AM/PM 12-Hour Basis & 24-Hour Basis
- On-Chip CR Oscillator for Battery Backup
- 50Hz or 60Hz Reference Frequency
- Automatic Advance Capable:
"Hours", "Minutes"
- Sleep Timer:
Max. 59 Minutes or 1Hour, 59 Minutes
- Repeatedly Usable Snooze
- Power Failure Indicator
- 900Hz Output for Alarm Tone

Functions:

- Real Time Display
- Alarm with Snooze
- Sleep Timer

Applications:

- Alarm Clock
- Clock Radio

Absolute Maximum Ratings: ($V_{SS} = 0$, $T_A = +25^\circ\text{C}$ unless otherwise specified)

Maximum Supply Voltage, V_{DDmax}	–15 to +0.3V
Input Voltage, V_{IN}	
50/60Hz	–15 to +0.3V
Other Than 50/60Hz	–15 to +0.3V
Output Voltage, V_{OUT}	–15 to +0.3V
Input Clamp Current, I_{IN}	–0.4 to +0.4mA
Allowable Power Dissipation ($T_A = +70^\circ\text{C}$), P_{Dmax}	700mW
Operating Temperature Range, T_{opr}	–30° to +70°C
Storage Temperature Range, T_{stg}	–55° to +125°C

Allowable Operating Ranges: ($V_{SS} = 0$, $T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{DD}		–14	–	–7.5	V
Input "HIGH" Level Voltage	V_{IH}	50/60Hz Input	–1.0	–	–	V
		Other Than 50/60Hz Input	–1.5	–	–	V
Input "LOW" Level Voltage	V_{IL}	50/60Hz	–	–	$V_{DD}+2$	V
		Other Than 50/60Hz	–	–	$V_{DD}+2$	V
Input Voltage on 50/60Hz	V_{AC-IN}	Referenced to V_{SS}	V_{LED}	–	–	V

Electrical Characteristics: ($V_{DD} = -12V$, $T_A = +25^{\circ}C$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input "HIGH" Level Current	I_{IH}	$V_{IN} = V_{SS}$, 50/60Hz	–	–	10	μA
		$V_{IN} = V_{DD}$, Input Pins other than 50/60Hz	–	–	20	μA
Input "LOW" Level Current	I_{IL}	$V_{IN} = V_{DD}$, 50/60Hz	–	–	10	μA
		$V_{IN} = V_{DD}$, Input Pins other than 50/60Hz	–	–	10	μA
Output "HIGH" Level Current	I_{OH}	Alarm Out, Sleep Out, $V_{OH} = V_{SS}-1V$	5	–	–	mA
		10's Hr ag & de (24Hr Mode), $V_{OUT} = V_{SS}-1V$	36	–	–	mA
		Segment Outputs other than above, $V_{OUT} = V_{SS}-1V$	18	–	–	mA
Output Leakage Current	I_{OF}	Alarm Out, Sleep Out, $V_{OUT} = V_{DD}$	–	–	10	μA
		10's Hr ag & de (24Hr Mode), $V_{OUT} = V_{DD}$	–	–	20	μA
		Segment Outputs other than above, $V_{OUT} = V_{DD}$	–	–	20	μA
Power Failure Detect Voltage	V_{DD}		–7.5	–5.0	–	V
Current Dissipation	I_{CC}	Output: OFF, Input with Pull-Down Resistor: Open	–	5	7	mA
Stability of Oscillator for Backup	F_S	Typical value, 900Hz, $V_{DD} = -9V \pm 10\%$	–10	–	+10	%
Accuracy of Oscillator for Backup	F_A	Typical value, 900Hz, $V_{DD} = -9V \pm 10\%$	–10	–	+10	%

Operation Description:**50Hz/60Hz Input:**

The On-Chip Schmitt Trigger circuit allows a simple RC filter at the input to remove possible line voltage transients. An internal pull-up resistor is provided.

CR Input: (Note 1)

When AC power-down occurs, the time counter enters the "hold" mode and the on-chip clock oscillator starts operating immediately. If there is no input at "50/60Hz input" during 3-clock period, this oscillator controls the time counter advance instead of "50/60Hz input". The values of CR determine the frequency of the on-chip clock oscillator. All segment outputs are off during backup operation. If the backup OSC is used at the power-down mode, "50/60Hz input" must be open or at V_{SS} level.

50/60Hz Select Input:

Connecting "50/60Hz select" to V_{SS} enables 50Hz operation. For 60Hz operating, "50/60Hz select" is left unconnected: Pull-down to V_{DD} is provided by the internal pull-down resistor.

Display Mode Select Input (Alarm Display/Sleep Display):

The internal pull-down resistor allows the use of 2 SPST (single-pole single-throw) switches to select 4 display modes listed in Table 1.

Table 1. Display Mode

Select Input		Display Mode	Digit No.1	Digit No. 2	Digit No. 3	Digit No. 4
Alarm	Sleep					
N.C.	N.C.	Time Display	10's Hour, AM/PM	Hour	10's Minute	Minute
V_{SS}	N.C.	Alarm Display	10's Hour, AM/PM	Hour	10's Minute	Minute
N.C.	V_{SS}	Sleep Display	Blanked	Hour	10's Minute	Minute
V_{SS}	V_{SS}	Seconds Display	Blanked	Minute	10's Second	Second

Note 1. If V_{SS} is applied to 2 input of "alarm display" and "sleep display" simultaneously, the seconds display mode is entered.

Operation Description (Cont'd):

Time Setting Input:

Two setting inputs for 'Hours' and 'Minutes' are provided. The application of V_{SS} causes the time setting in Table 2 to occur. An internal pull-down resistor each is provided.

Table 2. Setting Contents

Display Mode	Set Input	Functions
Time	Hour	'Hours' are incremented +1 immediately and advance at a 2Hz rate 1/4 to 3/4 seconds later.
	Minute	'Minutes' are incremented +1 immediately and advance at a 2Hz rate 1/4 to 3/4 seconds later.
	Both	Both operations shown above are preformed.
Seconds (Alarm & Sleep)	Hour (Note 2)	'Seconds' are cleared to [00].
	Minute	"Hold" mode.
	Both (Note 3)	'Hours' and 'Minutes' are reset to [0:00] (24-Hour basis) or [12:00] (12-Hour basis)
Alarm	Hour	'Hours' are incremented +1 immediately and advance at a 2Hz rate 1/4 to 3/4 seconds later.
	Minute	'Minutes' are incremented +1 immediately and advance at a 2Hz rate 1/4 to 3/4 seconds later.
	Both	'Hours' and 'Minutes' are reset to [0:00] (24-Hour basis) or [12:00] (12-Hour basis)
Sleep	–	The moment V_{DD} is applied to "Sleep Display", the sleep counter is set to [:59].
	Hour	The moment V_{DD} is applied to "Sleep Display" and "Hour Set" simultaneously, the sleep counter is set to [1:59].
	Minute	The sleep counter counts down at a 2Hz rate.
	Both	The sleep counter counts down at a 2Hz rate.

Note 2. When "Seconds" display is at 50 to 59, "Seconds" are reset to [00] and a carry occurs to increment "Minutes" +1.

Note 3. Once the reset mode or hold mode is entered, another function is locked until both "Hour Set" input and "Minute Set" inputs are released.

12/24-Hour Select Input:

Leaving this pin unconnected (V_{DD}) causes the 12-Hour basis to be selected; connecting this pin to V_{SS} causes the 24-Hour basis to be selected. An internal pull-down resistor is provided.

Power Failure Indicator:

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 V_{SS} to "Hour Set" or "Minute Set".

Alarm Operation and Alarm Output:

When the alarm set time is reached, the alarm signal is delivered. This signal continues to be delivered for 1 hour 59 minutes unless reset by "Alarm Off" or "Snooze Input". This signal is provided for the tone-signal of 900Hz with 50% duty of 2Hz gated. A simple LPF can be used to turn this alarm signal into DC signal as required.

Snooze Input:

By momentarily connecting this pin to V_{SS} at the alarm on-state, the alarm output is inhibited for 8 to 9 minutes, after which the alarm signal is delivered again. The snooze function can be used repeatedly for 1 hour 59 minutes. An internal pull-down resistor is provided. By connecting "Snooze Input" to V_{SS} at the alarm off-state, the sleep timer counter is reset to [0:00]. (The sleep timer is reset with one touch).

Operation Description (Cont'd):

Alarm Off Input:

Connecting this input pin to V_{SS} inhibits the alarm output momentarily. An internal pull-down resistor is provided.

Sleep Timer and Sleep Output:

The sleep output can be used to keep the radio turned on for any period of time up to 59 minutes or 1 hour 59 minutes. Table 2 shows how to select the period (59 minutes or 1 hour 59 minutes). This sleep timer uses a down counter. When the counter contents reach [00], the output stops being delivered, turning off the radio. By connecting "Snooze Input" to V_{SS} at the sleep output on-state, the sleep output is inhibited.

Pin Connection Diagram



