

T-49-15-02

UM3217 6-Digit Multifunction Watch

PRELIMINARY

Features

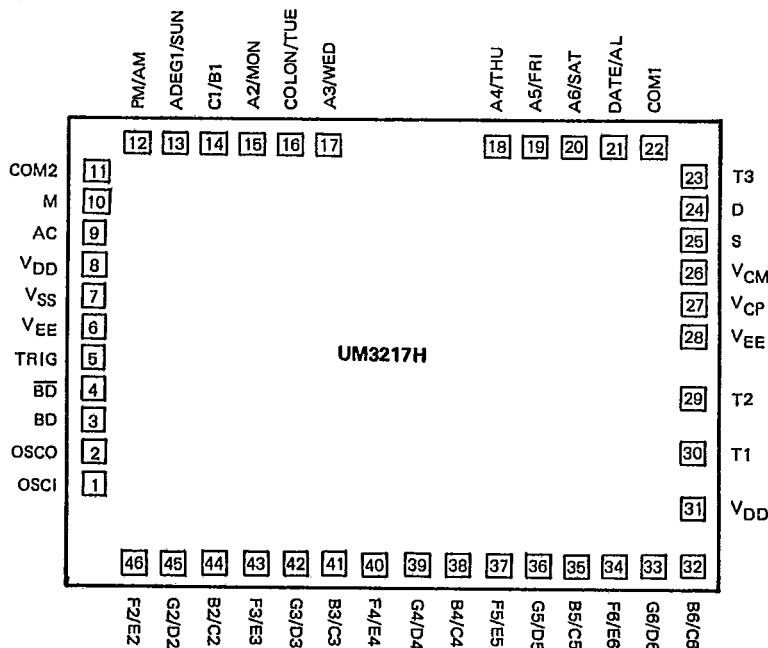
- Single 1.5 volt battery operation
- 32768Hz quartz crystal time base
- 6-digit LCD with 7-day mark, AM/PM mark, date mark, alarm mark and colon
- 6-digit autorange chronograph with 1/100 second resolution up to 24 hours
- 4 year calendar
- Chime on every hour
- Alarm with 4 to 5 minute snooze function
- Special alarm trigger output for switch control or for driving another melody IC such as UM3161
- Direct piezoelectric buzzer driving
- Low power consumption

General Description

The UM3217 is a CMOS six-function watch circuit with alarm and autoranging chronograph function. It is designed for use with a 6-digit LCD and 7-day mark, date mark, AM/PM mark and colon. It also has an alarm with a 4 to 5 minute snooze function, and a 6-digit chronograph, which shows minutes, seconds and 1/100 sec, then changes automatically to show hours, minutes and seconds. Its

12 or 24 hour format is user selectable and it has a 4-digit alarm which shows hours and minutes. One-touch error correction is accurate to within +30 seconds and three-switch sequential operation with fast advance can be used to set time and alarm. It will chime every hour. The UM3217 also has an alarm trigger output for melody IC, such as UM3161.

Pad Configuration





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Absolute Maximum Ratings*

Supply voltage, $V_{DD}-V_{SS}$ -0.3 to +2.0V
 Input voltage, V_{in} $V_{SS}-0.3$ to $V_{DD}+0.3V$
 Operating temperature, T_{opr} -20°C to +70°C
 Storage temperature, T_{stg} -55°C to +125°C

***Comments**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

D.C. Electrical Characteristics

($V_{SS} = 0V, V_{DD} = 1.5V, F_{OSC} = 32,768$ Hz, $T_A = 25^\circ C$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}		1.2	1.5	1.65	V
Voltage Doubler Supply	V_{EE}		-1.1	-1.44	-	V
Supply Current	I_{DD}	Without load & all switches are off	-	-	2.0	μA
Input low voltage	V_{INL}		V_{SS}	-	$V_{SS}+0.3$	V
Input high voltage	V_{INH}		$V_{DD}-0.3$	-	V_{DD}	V
Switch activation current	I_{SW}	$V_{IN} = V_{DD}$	-	1.0	-	μA
Osc. start voltage	V_{OSC1}		1.4	-	-	V
Osc. stop voltage	V_{OSC2}		1.2	-	-	V
Alarm drive current	I_{BD}	$V_{BD}-V_{SS} = 1V$, Both directions	200	-	-	μA
DC output drive current	I_{DCO}	$V_{DD} = 1.5V, V_{OH} = 1.2V$	-	20	-	μA
Oscillator frequency	F_{OSC}		32768	-	-	Hz
OSCI Built-In Cap.	C_{IN}		-	20	-	pF
OSCO Built-In Cap.	C_{OUT}		-	20	-	pF
LCD frequency	F_{LCD}		-	32	-	Hz
Switch debounce time	T_{DEB}		-	-	40	msec

Pad Description

Pad	Designation	Function	Pad	Designation	Function
1	OSCI	Oscillator input pad	24	D	External switch
2	OSCO	Oscillator output pad	25	S	External switch
3	BD	Piezo buzzer driver	26	VCM	For voltage doubler capacitor
4	\overline{BD}	Piezo buzzer driver	27	VCP	For voltage doubler capacitor
5	DCO	DC level signal output	28	VEE	Voltage doubler supply
6	VEE	Voltage doubler supply	29	T2	Test pad
7	V_{SS}	Ground	30	T1	Test pad
8	V_{DD}	Positive voltage supply	31	V_{DD}	Positive voltage supply
9	AC	Chip reset	32	B6/C6	Segment drive

Timekeeping



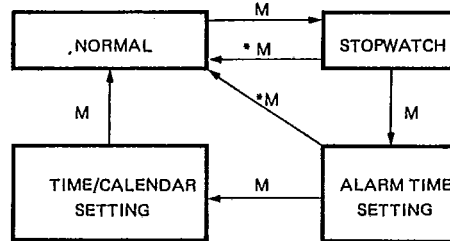
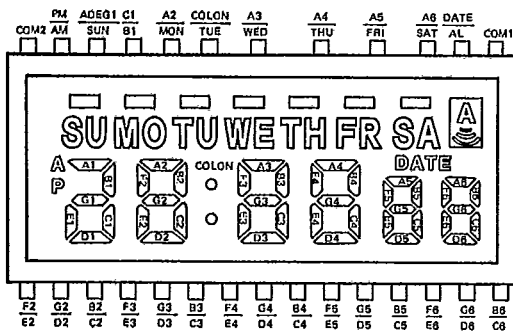
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Pad Description (Continued)

Pad	Designation	Function	Pad	Designation	Function
10	M	External switch	33	G6/D6	Segment drive
11	COM2	Backplane common 2	34	F6/E6	Segment drive
12	PM/AM	Segment drive	35	B5/C5	Segment drive
13	ADEG1/SUN	Segment drive	36	G5/D5	Segment drive
14	C1/B1	Segment drive	37	F5/E5	Segment drive
15	A2/MON	Segment drive	38	B4/C4	Segment drive
16	COLON/TUE	Segment drive	39	G4/D4	Segment drive
17	A3/WED	Segment drive	40	F4/E4	Segment drive
18	A4/THU	Segment drive	41	B3/C3	Segment drive
19	A5/FRI	Segment drive	42	G3/D3	Segment drive
20	A6/SAT	Segment drive	43	F3/E3	Segment drive
21	DATE/AL	Segment drive	44	B2/C2	Segment drive
22	COM1	Backplane Common 1	45	G2/D2	Segment drive
23	TEST	Test pad	46	F2/E2	Segment drive

LCD Format



*When S or D are used in either the stopwatch mode or the alarm time setting mode, normal mode is returned by depressing M.

Fig. 1. MODE TRANSFER

Functional Description

The UM3217 is designed to operate in four different modes: normal watch mode, stop-watch mode, alarm time setting mode and time/calendar setting mode.

Modes may be checked by a momentary depression of the "M" switch. After switch "S" or "D" has been used in the stopwatch mode or the alarm time setting mode, operation can be returned to normal mode by pressing the "M" switch. In every mode except the normal time mode, flags for the day-of-the-week will normally appear and the flag selected will flash at 2 Hz to indicate that it has been selected.

1. Normal Watch Mode

UM3217 will normally display hours with digits 1 and 2, minutes with digits 3 and 4, and seconds with digits 5 and 6. The day-of-the-week is displayed with the flags and display of the colon is fixed.

When the time-of-day and alarm time are identical to the nearest minute, the alarm output will be activated if the alarm has been set. Alarm output can be stopped by depressing switch "S", without resetting the alarm function. The alarm will go off again in 24 hours. If switch "D" is pressed while the alarm is active, the



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sound will be suppressed for four or five minutes and then reactivate. This snooze function can be repeated until the alarm is turned off. When switches "S" and "D" are depressed simultaneously in the normal time mode, the alarm time is displayed, the alarm output is demonstrated, and the alarm function is alternately set and reset. The alarm symbol will appear while the alarm function is on.

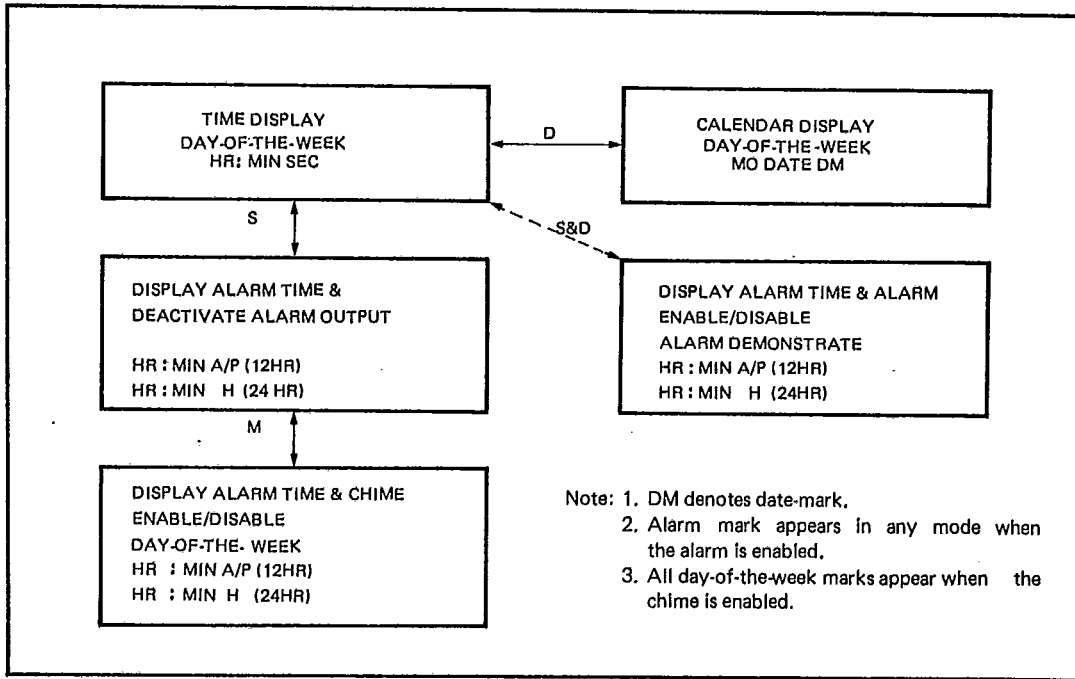
The chime function can be turned on and off by depressing the "M" and "S" switches in normal time mode and day-of-the-week symbols appear when the chime function is on. The chime function generates a 0.5 second

burst of sound every hour on the hour.

2. Display Control

Months are displayed in digits 1 and 2 and days in digits 3 and 4 while switch "D" is depressed in the normal time mode. While the date is being displayed, the date symbol will also be displayed.

When the "S" switch is pressed in normal time mode, the hour of the alarm will be displayed in digits 1 and 2, minutes in digits 3 and 4, and the letters "A" or "P" (for 12-hour format), or "H" (for 24-hour format), will appear in place of the fifth digit.



Timekeeping

Fig 2. Normal Mode

3. Stopwatch Mode

Pressing switch "M" in normal time mode will activate the stopwatch mode. Digits 1 and 2 will show minutes, digits 3 and 4 seconds, and digits 5 and 6 hundredths-of-a-second. The stopwatch symbol (SU) will flash at a

rate of 2 Hz when the watch is in this mode. The lap symbol (TH), the stop symbol (FR) and the hundredth-of-a-second symbol (SA) will each generate a beep signal on outputs BD and \overline{BD} with every depression of the "S" or "D" switches.

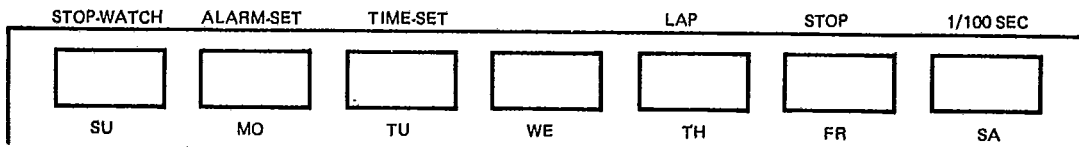


Fig 3 Flag Assignment



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Start and Stop

Pressing the "D" switch will start the stopwatch if it is not counting, or stop it, if it is counting. The stop symbol (FR) will flash at a rate of two Hz. when the counting has stopped. Pressing the "S" switch while the stopwatch is in the stop mode will clear the memory and the display will show "0:00 00"

Autoranging

The stopwatch will count up to a maximum of 23 hours, 59 minutes and 59 seconds. After the first 30 minutes, the display will show the hour in digits 1 and 2, the minute in digits 3 and 4, and the second in digits 5 and 6 (autoranging). When the maximum count has been exceeded, the counter will restart from "0:00 00" again. During the first 30 minutes, the hundredth-of-a-second symbol (SA) will flash at a rate of two Hz. This indicates that digits 5 and 6 are displaying the hundredth-of-a-second.

Lap

Pressing the "S" switch while the stopwatch is running will activate the lap mode. In this mode, the display will freeze the time shown at the instant the "S" switch was depressed and the lap symbol (TH) will flash at a rate of two hertz. While the display is frozen in the lap mode, the stopwatch is still counting and pressing the "D" switch will stop or start the counting as usual, but the display will continue to show the previously captured time. Pressing the "S" switch again will release the lap mode and the display will continue from either the point where the stopwatch is currently counting or the time when the function was stopped by pressing the "D" switch.

Return to Normal

Pressing the "M" switch while in the stopwatch mode will return the watch to normal time mode.

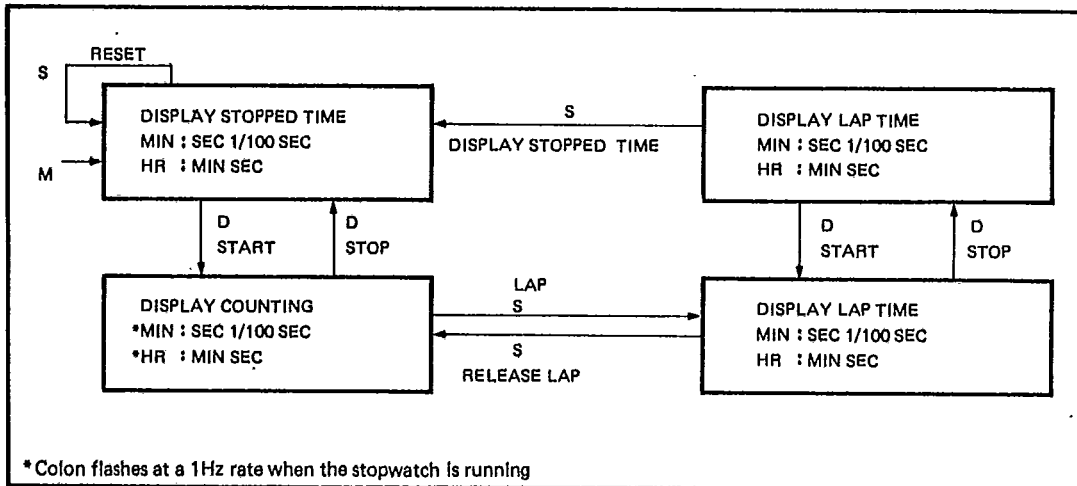


Fig. 4 Stopwatch Mode

4. Alarm Setting Mode

Pressing the "M" switch twice while in the normal time mode will put the watch in the alarm setting mode and the alarm set symbol (MO) will flash at a rate of two hertz. Pressing either the "S" or "D" switch in this mode will set the alarm.

Setting the Hour

Initially, while digits 1 and 2 are flashing at two hertz and "A" or "P" (for 12-hour format) or "H" (for 24-hour format) appears in place of the fifth digit, the hour can be incremented by pressing the "D"

switch momentarily. If the "D" switch is held down continuously for more than two seconds, the counter automatically starts advancing at eight hertz (fast advance).

Setting the Minute

Pressing the "S" switch will activate the minute setting for the alarm and digits 3 and 4 will begin flashing at two hertz. The "D" switch will advance the minutes in the same manner as the paragraph above and pressing the "S" switch will return the watch to the hour setting mode. Pressing the "M" switch in either state will return the watch to the normal time mode.



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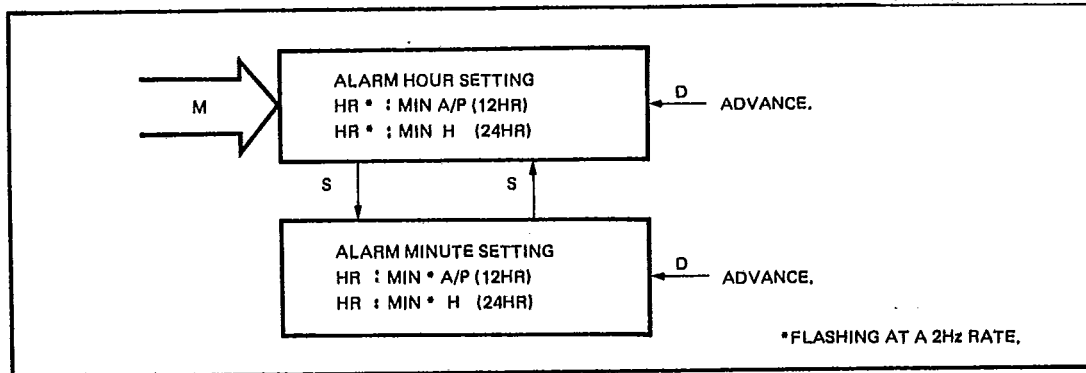


Fig. 5 Alarm Time Setting Mode

5. Setting the Time and the Calendar

Pressing the "M" switch three times in succession will activate the "setting" mode for the time and the calendar. The time/calendar SET symbol (TU) will flash at a rate or two Hz.

Seconds

Digits 5 and 6 will flash at two hertz as soon as the time/calendar setting mode has been activated. The "D" switch can be used to advance the numbers to within ±30 seconds of the correct time.

Minutes

Pressing the "S" switch in this mode will cause digits 3 and 4 to flash at two hertz to show that you are now in the minute setting mode. Holding down the "D" switch for more than two seconds will cause the numbers to advance at eight hertz in the Fast Advance mode.

Hours

A second depression of the "S" switch will cause the first and second digits to begin flashing. The numbers can be advanced more quickly by holding down the "D" switch, just as they were for the minutes. The hours will advance sequentially through the 12-hour and 24-hour formats (0H will follow 11P and 12A will follow 23H). The selection of a format is made by stopping when the correct hour is in the proper format. During the setting process, the segments for the fifth digit will display "A" or "P" for the 12-hour format, or "H" for the 24-hour format.

Date

A third depression of the "S" switch will activate the date setting mode. The month will be displayed in the first and second digits, the date in the third and fourth digits, and the day-of-the-week and date symbol will show up in their normal positions. When the date is flashing, it can be advanced in the same

manner as the hours and minutes.

Month

Another depression of the "S" switch will move the mode to "month", and the first two digits will begin to flash. Advance the numbers with the "D" switch and return to normal with the "M" switch.

Day-of-the-Week

Pressing the "S" switch again will change the mode to "day-of-the-week." The day flag for the current day will begin flashing. Pressing the "D" switch will advance the display to subsequent days and pressing the "M" switch will return you to the normal time mode.

If you keep on pressing the "S" switch, the modes will go back to the beginning and move through the entire cycle again. It will keep doing this until you press the "M" switch and return to the normal time mode.

6. Applications

The voltage doubler circuit is formed by connecting a 0.047 μF to 0.1 μF capacitor between the VCM pad and the VCP pad, and between the VDD pad and the VEE pad.

The Oscillator circuit is formed by connecting a crystal between the OSC1 pad and OSC0 pad and a trimmer between the OSC1 pad and the VDD pad.

The substrate is connected directly to VDD, the most positive voltage.

The circuit has a power-on reset function which is activated by an on-chip capacitor. Should the circuit fall when power is applied, it can be reset by connecting the AC pad to VDD.

The UM3217 has two alarm outputs. BD and \overline{BD} each output an electrical sound waveform to directly drive





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a piezo-electric buzzer at three volts, peak to peak. DCO provides level-hold output to drive a melody IC, such as those in the UM3161 series. Used in conjunction with a UM3161 series IC, it is possible to have a wide variety of melodies for the alarm function. The alarm output waveforms are shown in Figure 7.

T1, T2 and a TEST pad are provided for testing. They are not used in normal operations and should be kept open.

The TEST pad, three switches and AC are all pulled down by internal resistors.

7. Testing

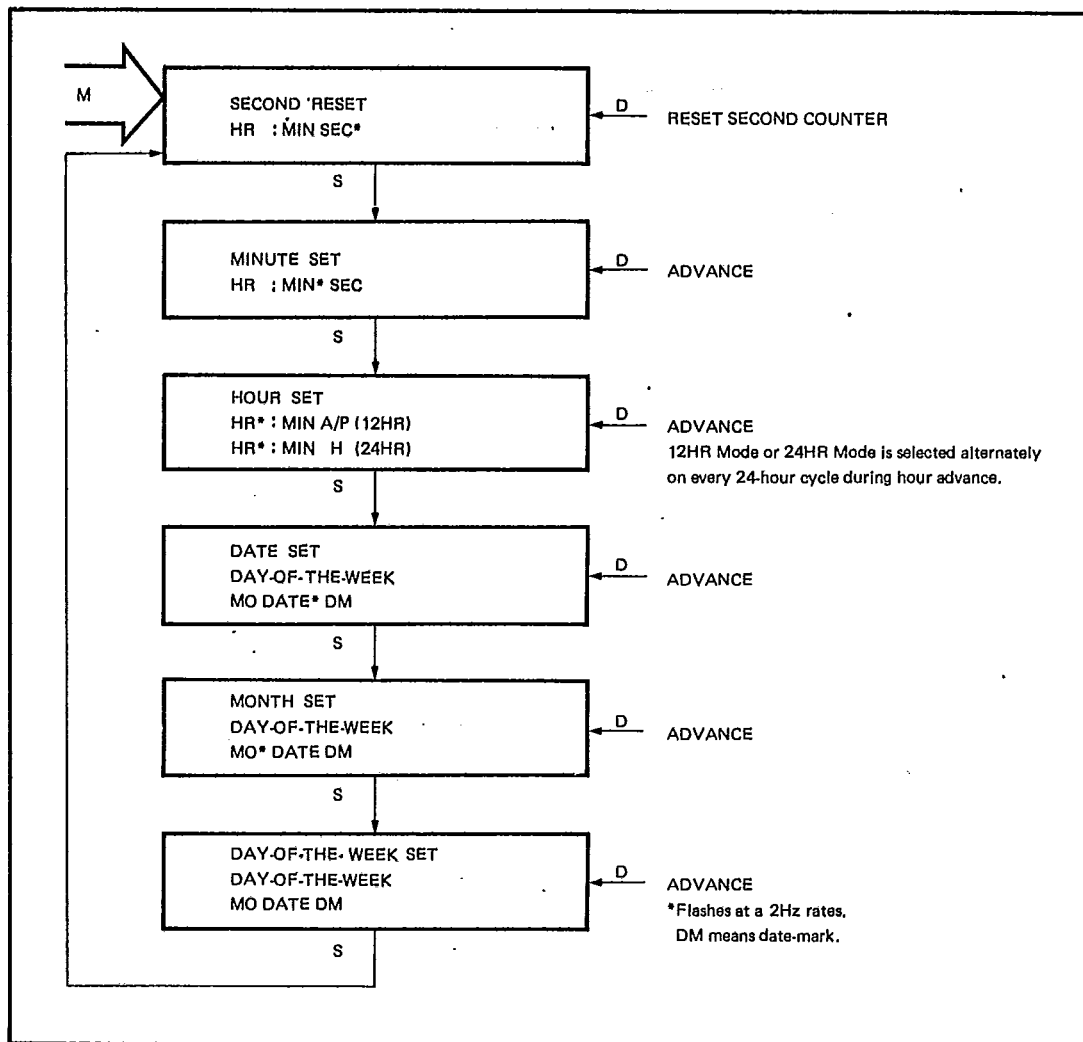


Fig 6. Time/Calendar Setting



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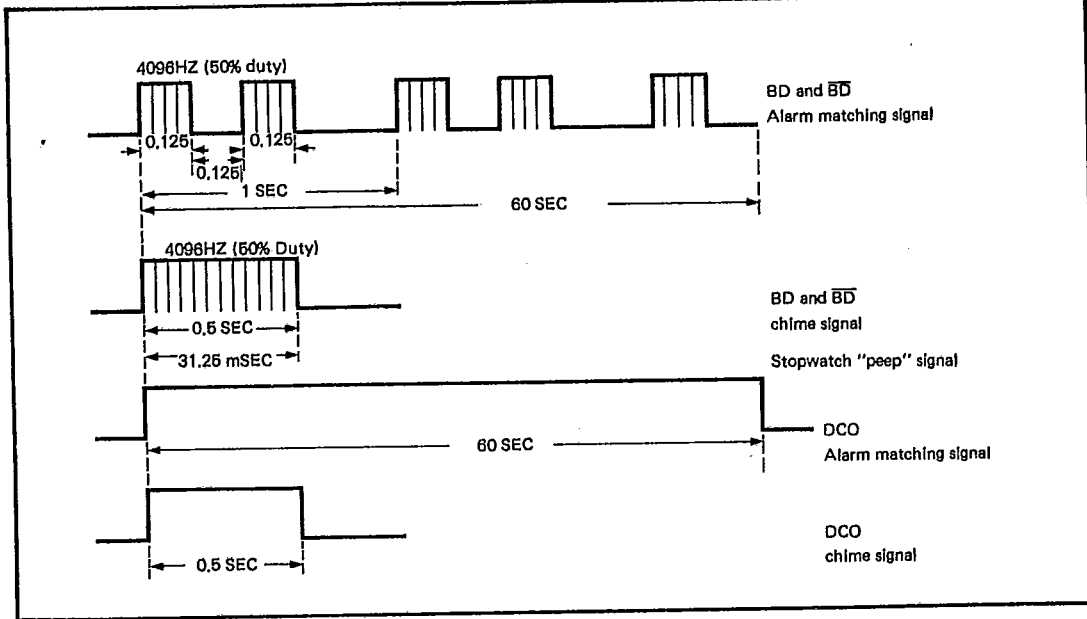


Fig 7. Alarm Output Waveforms

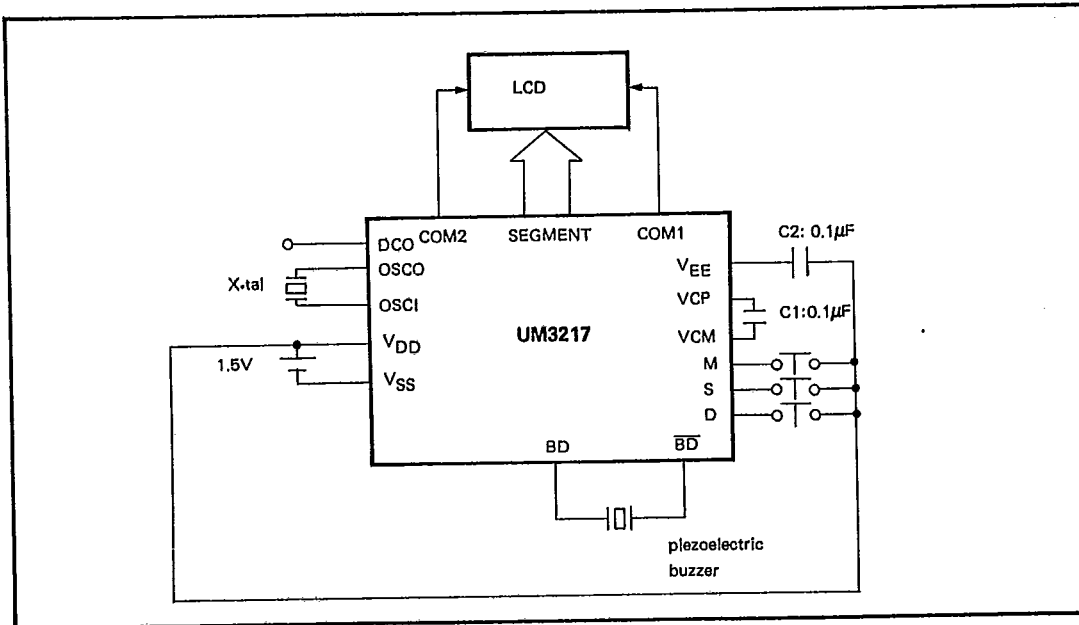


Fig 8. Typical Application Circuit

Timekeeping



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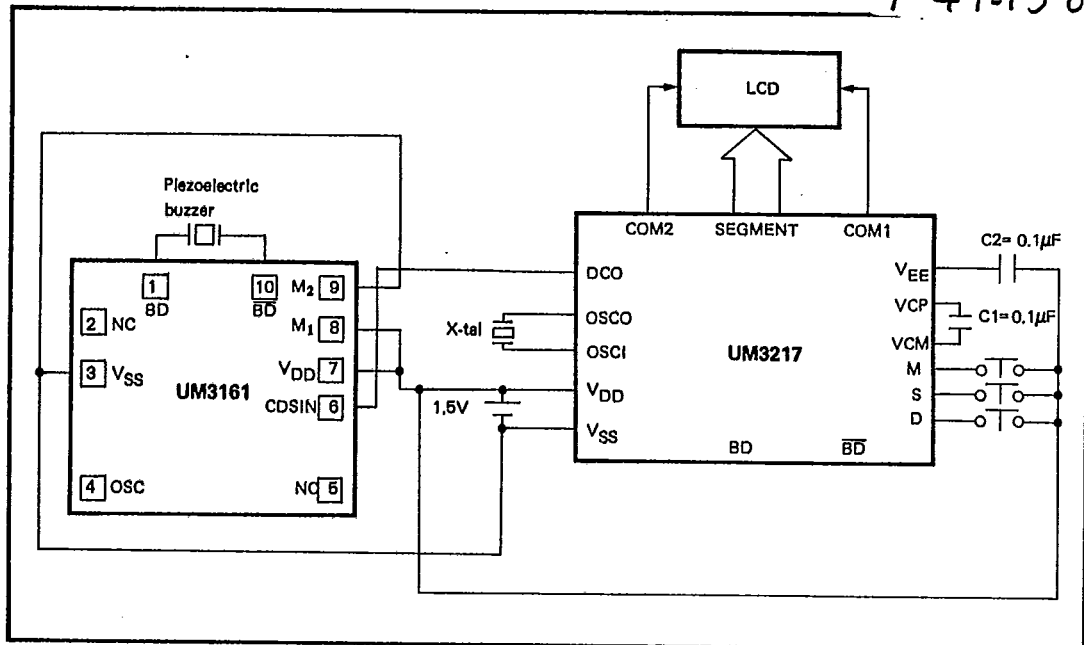


Fig 9. Typical Application Circuit with Melody IC