

## MM53100, MM53105 Programmable TV Timers

### general description

The MM53100 and MM53105 programmable TV timers are monolithic CMOS integrated circuits utilizing P and N-channel low threshold enhancement devices. These circuits contain all the logic to give a 4 or 6-digit, 24-hour display from a 50 or 60 Hz input, and control the "ON" time of the TV. The duration of the viewing period is 5, 10, 20 or 30 mins, selected by 2 input pins. Manual "ON" and "OFF" inputs are also provided. The MM53100 and MM53105 have ultra-low power dissipation in the stand-by mode and are ideally suited to crystal controlled battery-operated systems. The MM53100 is designed for an optimum interface in TVs with a positive common reference voltage (e.g., +18V). The MM53105 is designed for an optimum interface for TVs with a 0V reference voltage. Both are packaged in a 24-lead dual-in-line epoxy package.

### features

- 50 or 60 Hz operation
- 24-hour display format
- Programmable TV on time
- Selectable view time
- Ultra-low power dissipation
- All counters resettable
- Low voltage operation
- Elimination of illegal time display at turn-on
- Daily repeat or non-repeating operating
- Fool-proof safety features
- Compatible with MM5840 display circuit

### applications

- TV time display
- Remote TV "ON"/"OFF" switch
- Computer clock
- Time data—logging systems

### block diagram

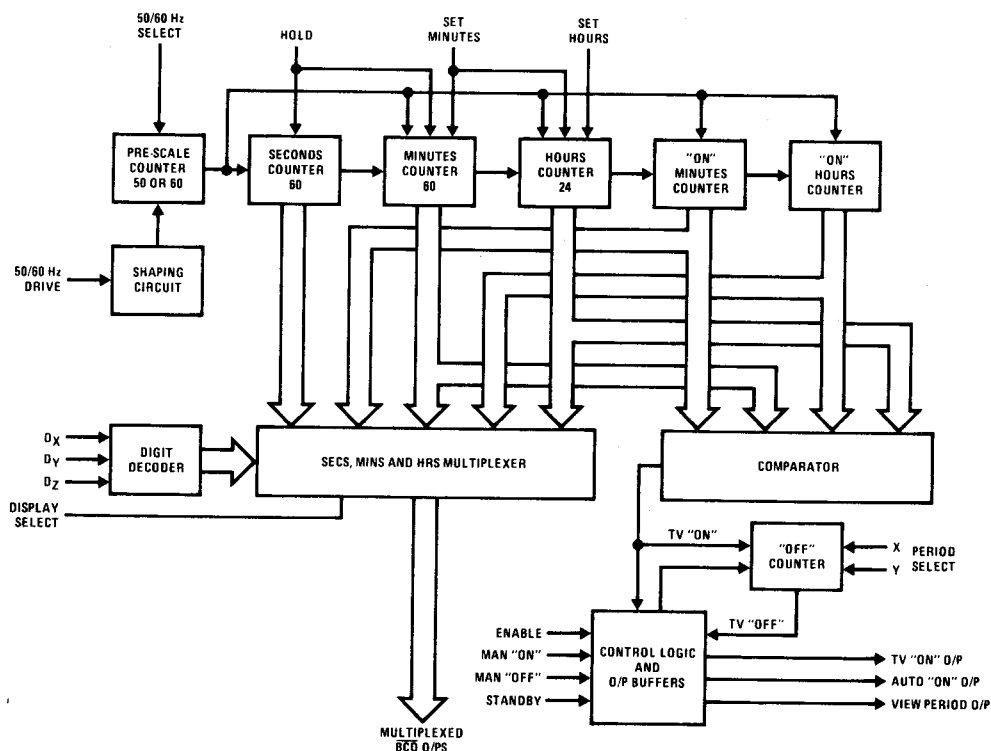


FIGURE 1. MM53100, MM53105 Block Diagram

**absolute maximum ratings** (MM53100) ( $V_{DD}$  common voltage reference)

Supply Voltage ( $V_{DD} - V_{SS}$ )	6V
Voltage at 50/60 Hz Select and Period Select Inputs	$V_{SS} - 0.3V$ to $V_{DD} + 0.3V$
Current Into or Out of Any Other Input	100 $\mu A$ max

**electrical characteristics** (MM53100)  $T_A = 25^\circ C$ ,  $V_{DD} = 4.5V$ ,  $V_{SS} = 0V$  unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage		2.8		5.0	V
Supply Current	$V_{DD} = 4.5V$		10	25	$\mu A$
Input Logic Levels					
50/60 Hz Input, Digit Select Inputs, Display Select, "ON", "OFF", Time Setting Control, Standby Control					
Logic "1"		$V_{DD}-0.5$		$V_{DD}$	V
Logic "0"	(Note 1)			$V_{SS}+0.5$	V
50/60 Hz Select, Period Select (X, Y)					
Logic "1"		$V_{DD}-0.5$		$V_{DD}$	V
Logic "0"		$V_{SS}$		$V_{SS}+0.5$	V
Display Select Input Delay		0.5		2.0	$\mu s$
Output Logic Levels					
BCD Outputs	External Resistor, 15 k $\Omega$ to $V_{DD} - 12V$ , $C_L = 15 pF$				
Logic "1"		$V_{DD}-0.8$			V
Logic "0"				$V_{DD}-11.2$	V

**Note 1:** If input voltages go more negative than  $V_{SS}$ , the input current must be limited to a maximum of 100  $\mu A$  by the use of external series resistors. No resistors are required on the  $D_X$ ,  $D_Y$ ,  $D_Z$  inputs when interfacing with the MM5840.

**absolute maximum ratings** (MM53105) ( $V_{SS}$  common voltage reference)

Supply Voltage ( $V_{DD} - V_{SS}$ )	6V
Voltage at 50/60 Hz Select and Period Select Inputs	$V_{SS} + 6V$
Voltage at Any Other Pin	$V_{SS} + 13V$

**electrical characteristics** (MM53105)  $T_A = 25^\circ C$ ,  $V_{DD} = 4.5V$ ,  $V_{SS} = 0V$  unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage		2.8		5.0	V
Supply Current	$V_{DD} = 4.5V$		10	25	$\mu A$
Input Logic Levels					
50/60 Hz Input, Digit Select Inputs, "ON", "OFF", Display Select, Time Setting Controls, Standby Control					
Logic "1"		$V_{DD}-0.5$		13	V
Logic "0"		$V_{SS}$		$V_{SS}+0.5$	V
50/60 Hz Select, Period Select (X, Y)					
Logic "1"		$V_{DD}-0.5$		$V_{DD}$	V
Logic "0"		$V_{SS}$		$V_{SS}+0.5$	V
Display Select Input Delay		0.5		2.0	$\mu s$

**electrical characteristics** (Continued) (MM53105)  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 4.5\text{V}$ ,  $V_{SS} = 0\text{V}$  unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Logic Levels					
BCD Outputs	External Resistor $15\text{ k}\Omega$ to $12\text{V}$ , $C_L = 15\text{ pF}$				
Logic "1"		11.2			V
Logic "0"				0.8	V
TV "ON" Output, Auto "ON" Output, View Period Output					
Logic "1"	Loaded $2.7\text{ k}\Omega$ to $V_{SS}$	0.5			mA
Logic "0"	Loaded $2.7\text{ k}\Omega$ to $V_{DD}$	1.0			mA

Note 1: Input voltages to go more positive than  $V_{DD}$ .

## functional description

A block diagram of the MM53100, MM53105 TV timers is shown in *Figure 1*. A connection diagram is shown in *Figure 2*. Unless otherwise indicated, the following discussions are based on *Figure 1*. *Figures 5a and 5b* illustrate the system configuration for a crystal controlled TV display system using both circuits.

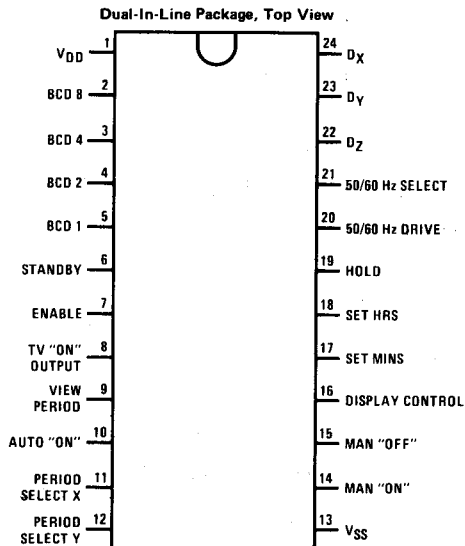


FIGURE 2.

Order Number MM53100N or MM53105N  
See Package 22

**50 or 60 Hz Drive:** This input is applied to a Schmitt trigger shaping circuit which allows use of a filtered sine wave input. A simple RC filter should be used to remove possible line voltage transients that could either cause the clock to gain time or damage the device. The input should swing between  $V_{SS}$  and  $V_{DD}$ . The shaper output drives a counter chain which performs the time-keeping function.

Alternatively, in a crystal controlled battery operated system, an oscillator and prescaler such as the MM53107 could be used as a time base.

**50 or 60 Hz Select Input:** This input programs the prescale counter to divide by either 50 or 60 to obtain a 1 pps time base. The counter is programmed for 60 Hz operation by connecting this input to  $V_{DD}$ . An internal  $1\text{ M}\Omega$  pull-down resistor is common to this pin; simply leaving this input unconnected programs the clock for 50 Hz operation.

**Time Setting Inputs:** Inputs to set hours and set minutes as well as hold input, are provided. Internal  $1\text{ M}\Omega$  pull-down resistors provide the normal timekeeping function. Switching any 1 of these inputs (1 at a time) to "1" results in the desired time setting function. Set Hours advances hours information at 1 hour/second and Set Minutes advances minutes information at 1 minute/second, without roll over into the hours counter. Set Minutes also resets the seconds counter to 0. The hold input stops the clock to the minutes counter and resets the seconds counter. Activating Set Minutes and Set Hours simultaneously resets the displayed counters to all 0's.

**Display:** This input controls the display and time-setting operation. It has an internal  $1\text{ M}\Omega$  pull-down resistor to  $V_{SS}$ . When taken to Logic "0" or in open circuit condition, the real time is displayed and the Set Hours and Set Minutes inputs operate the real time counters. When taken to logic "1", the "ON" time is displayed and the time-setting inputs operate on the "ON" counters.

**Digital Select Inputs (DX, DY, DZ):** These 3 inputs are used to determine which digit will be displayed. Table IA shows the code for each digit. Seconds will be displayed as "00" when the "ON" time is being displayed.

**Enable:** This input has an internal resistor to  $V_{SS}$ . When taken to logic "1", this input disables the programmed "ON" time for the TV output.

**Period Select Inputs (X, Y):** These inputs have pull-down resistors to  $V_{SS}$ . They determine the view period, i.e., 5, 10, 20 or 30 mins. Table IB shows the Period Select Code.

**functional description** (Continued)

**Standby Control Input:** This input has an internal resistor to  $V_{SS}$ . Its function is to sense when the line generated 12V supply is turned off and to then disable the outputs. In the TV, this input should be connected to the 12V supply.

**Manual "ON" Input:** This input has an internal resistor to  $V_{SS}$ . When taken to logic "1", this input turns the TV output to the "0" state. It is designed to have typically 0.75 second debounce time to prevent mal-operation.

**Manual "OFF" Input:** This input has an internal resistor to  $V_{SS}$ . When taken to logic "1", this input turns the TV output to the "1" state. It is designed to have typically 0.75 second debounce time to prevent mal-operation.

**TV "ON" Output:** Figure 3 illustrates the CMOS inverter output circuit used.

In the manual mode of operation, the manual "ON" input sets this output to "0", the manual "OFF" input resets this output to "1". The manual "ON" input inhibits the auto "ON" output.

In the programmable mode, this output goes to "0" when the programmed "ON" time coincides with the real time (unless enable = 1). The output will then stay at "0" for the selected period of 5, 10, 20 or 30 minutes before returning to "1" state. During this

period, a signal on the manual "ON" input will prevent the automatic switch-off.

Manual "OFF" input will always reset the output to a logic "1" state.

**Auto "ON" TV Output:** An additional output is provided to indicate that the TV is "ON" in the automatic mode of operation. This output goes to a logic "0" for the duration of the auto "ON" time. Manual "ON" switches this output back to a logic "1".

**View Period Indicator:** This output normally is a logic "1". When the TV switches on at the programmed time, this output transmits a 1 Hz waveform for the duration of the selected view period. Hence, it can be used to indicate that the TV is switched on for a limited period only by means of a flashing on-screen and/or off-screen display. The output will permanently return to "1" at the end of the viewing period or when a valid manual "ON" or "OFF" input signal is received during the view period.

**BCD Outputs:** Figure 4 illustrates the open drain output circuits used, a) MM53100, b) MM53105.

With the use of the external respective pull-up and pull-down resistors, these outputs are designed to be compatible with the MM5840 and MM5841 TV display circuits.

Note. Case (a) for common  $V_{DD}$ , case (b) for common  $V_{SS}$  when used with the MM5840.

TABLE IA. Digit Select Code

DIGIT SELECT LINES	DIGIT DISPLAYED							
	S1	S10	*	M1	M10	*	H1	H10
Dx	1	0	0	1	1	0	0	1
Dy	1	1	0	0	0	0	1	1
Dz	0	0	0	0	1	1	1	1

TABLE IB. Period Select Code

PERIOD SELECT INPUTS		VIEW PERIOD PROGRAMMED
X	Y	
0	0	5 mins
0	1	10 mins
1	0	20 mins
1	1	30 mins

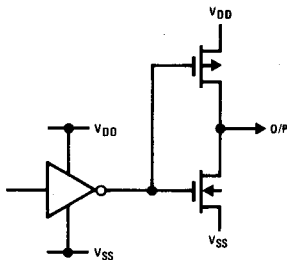


FIGURE 3. CMOS Output (TV "ON", Auto "ON", Indicator)

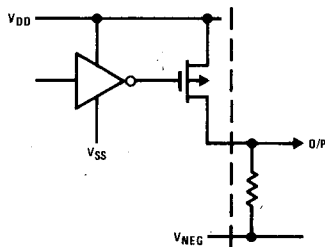


FIGURE 4a. BCD Outputs, MM53100

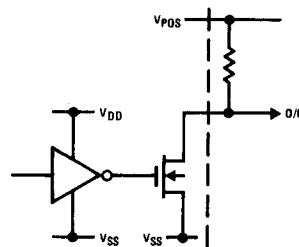


FIGURE 4b. BCD Outputs, MM53105

functional description (Continued)

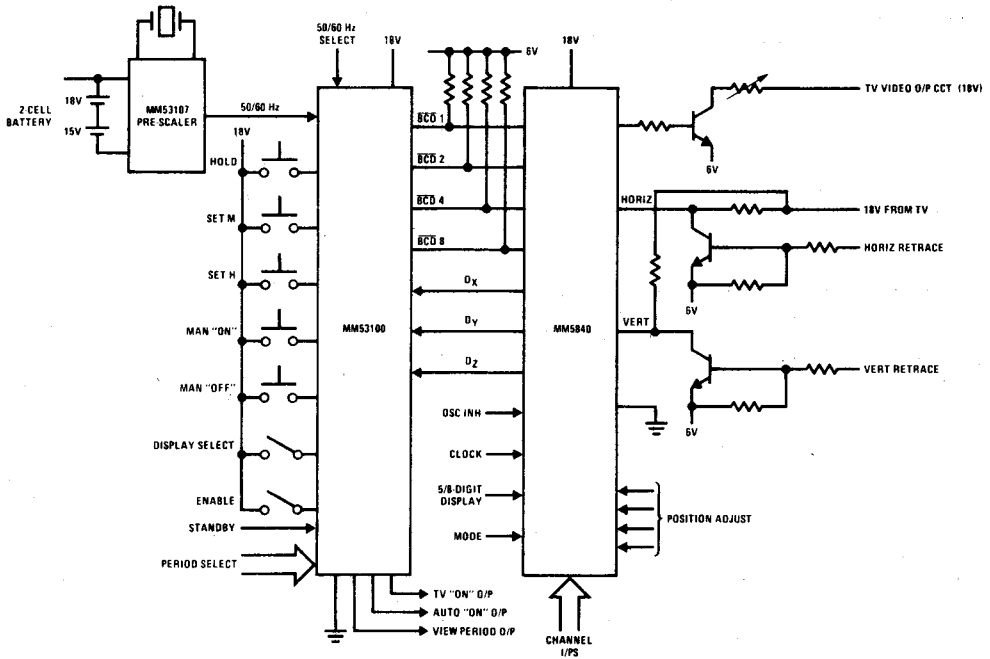


FIGURE 5a. Typical System Diagram, MM53100

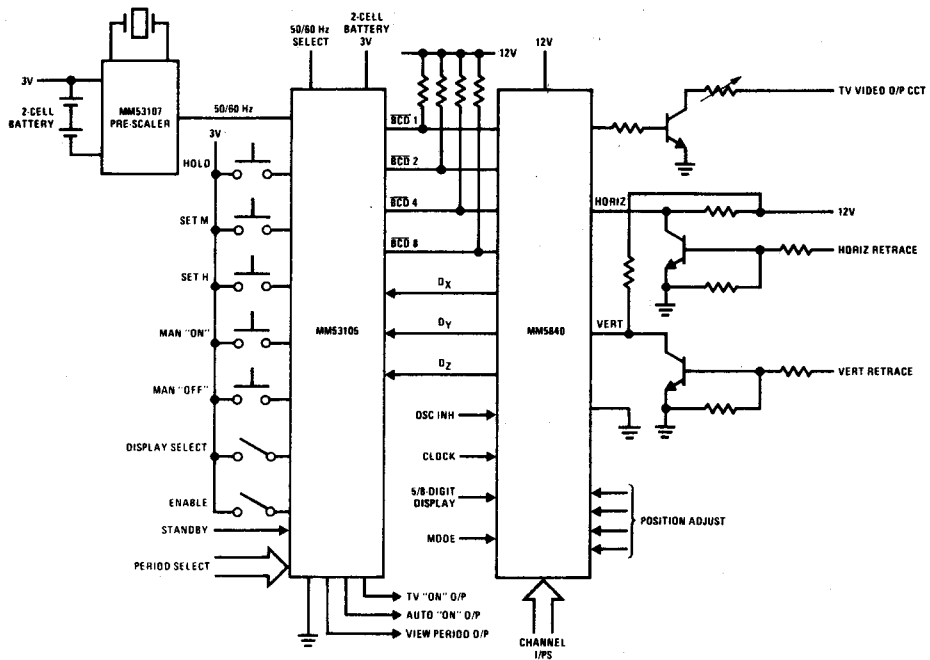


FIGURE 5b. Typical System Diagram, MM53105