

SYSTEM CONTROLLER FOR TAPE DECK**DESCRIPTION**

The M54886P is an I^2L semiconductor integrated circuit consisting of a tape deck controller designed to control tape deck mechanisms and amplifier systems.

FEATURES

- Non-locking function keys can be used
- Built-in timing circuit
- Simultaneous depressing of a multiple number of input keys, depressing the keys too quickly and other incorrect operations are dealt with
- Easy configuration for timer operations for unattended recording, etc.
- Easy configuration for **PLAY** → **REW**, **REW** → **PLAY** and other auto repeat operations
- Direct drive possible for LEDs that indicate operational modes
- Stop function in about 1.6s when power is switched on

APPLICATION

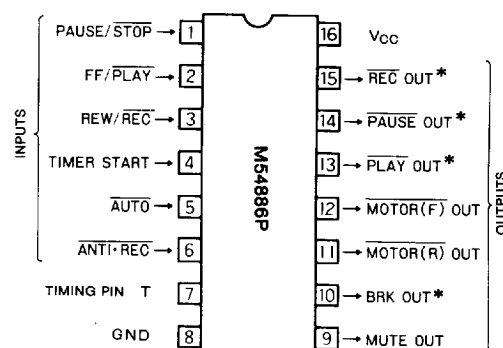
Tape decks and cassette recorders

FUNCTION

The M54886P is designed to control the operational sequence of a tape deck. The timing of the operations is controlled by the time which is determined by the RC elements making up the oscillator circuit.

The output sequence is designed to correspond with the operational sequence of the mechanism, and since the timing is provided for the rec/pb switching signal and the muting signals as well as other amplifier control signals, the external circuitry can be simplified.

Non-locking keys can be used for the function input keys and the desired operational mode is established simply

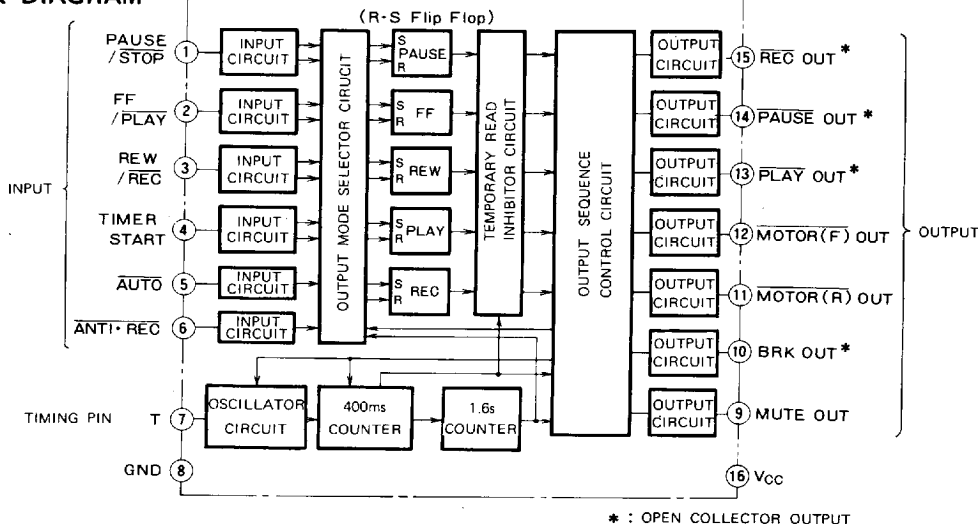
PIN CONFIGURATION (TOP VIEW)

* : Open collector output

Outline 16P4

when one of the keys is depressed. A change can be made from one mode to another directly, and with a mode change from **FF-REW** ↔ **PLAY (REC)** or vice versa, operation goes through the **STOP** mode for 0.4s (Note 1) automatically. Sufficient provision is made to deal with incorrect operation such as when a multiple number of input keys are depressed simultaneously or when the keys are depressed too quickly.

Operation goes through the **STOP** mode for 1.6s. (Note 1) when the power is switched on, and it is possible to use the **MUTE** output as the muting signal when the power is switched on. Unattended recording, wake-up playback and other timer operations can be easily configured using the **TIMER START** pin.

BLOCK DIAGRAM

SYSTEM CONTROLLER FOR TAPE DECK

(Note 1: The time can be changed with the time constants of the RC elements. This is the same for the times which are mentioned below.)

Table 1. Description of pins

Pin no.	Name	Function	
1	PAUSE/STOP	Function input	Input pin that selects the PAUSE mode at high and STOP mode at low; open when no input.
2	FF/PLAY		Input pin that selects the FF mode at high and PLAY mode at low
3	REW/REC		Input pin that selects the REW mode at high and REC mode at low; the REC input is effective only when fed in together with the PAUSE or PLAY input.
4	TIMER START		Input pin that selects the operational mode when the power is switched on. The PLAY mode is selected when kept high; the REC mode is selected when kept at low. When left open, the STOP mode is selected.
5	AUTO	Control input	Input pin that commands the PLAY → REW, REW → PLAY, FF → STOP mode changes by feeding in low-level pulses (L).
6	ANTI-REC		Input pin for inhibiting recordings; when kept at low, the recording input is inhibited.
7	T		Externally mounted resistor/capacitor connecting pin for oscillator circuit
8	GND		Ground
9	MUTE OUT	Output	Muting signal output; muting is effective at the high-level.
10	BRK OUT		Reel disc brake signal output; brake is released at high
11	MOTOR(R) OUT		Reel motor reverse rotation signal output
12	MOTOR(F) OUT		Reel motor forward rotation signal output
13	PLAY OUT		PLAY signal output; play solenoid drive signal
14	PAUSE OUT		Recording signal output; signal that selects the amplifier's recording and playback
15	REC OUT		PAUSE signal output; pause solenoid drive signal
16	Vcc		Supply voltage

Table 2. Output states in each mode

Mode \ Output	PAUSE	MUTE *	REC	PLAY	BRK *	MOTOR(F)	MOTOR(R)	Notes
STOP mode	H	H	H	H	L	H	H	Stop
FF mode	H	H	H	H	H	L	H	Fast forward
REW mode	H	H	H	H	H	H	L	Rewind
PLAY mode	H	L	H	L	H	L	H	Playback
REC mode	H	L	L	L	H	L	H	Recording
REC/PAUSE mode	L	L	L	H	L	H	H	Recording pause
PAUSE mode	L	H	H	H	L	H	H	Pause

Note 1: * indicates high-level active output; others outputs are low-level active.

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DESCRIPTION OF OPERATION

1. Operation timing

In Fig. 1 the timing from the STOP to PLAY mode is taken as an example.

About 50ms after the PLAY key is depressed, the play solenoid is attracted and 50ms later the reel motor starts to rotate and the brake is released simultaneously. Muting ceases to be effective 450ms after the operation and the sound is fed out from the amplifier.

Even with other mode changes, the output timing is aligned with the mechanism timing.

The output modes changes as shown in Table 3 when an input is applied. Timings during the changes are given in the timing chart.

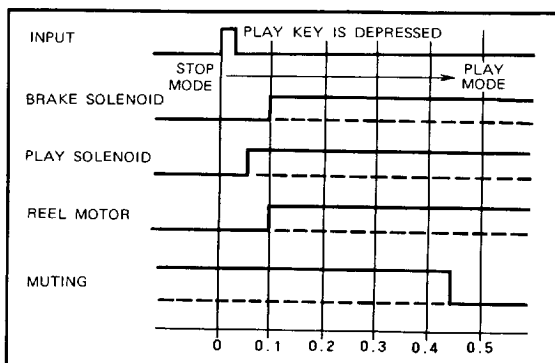


Fig.1 The timing from the STOP to PLAY mode

Table 3. Operations from output modes

Key input Present mode	STOP	PLAY	REC+PLAY	FF	REW	PAUSE	REC PAUSE	AUTO
STOP mode		PLAY mode	REC mode	FF mode	REW mode	PAUSE mode	REC/PAUSE mode	
PLAY mode	STOP mode		REC mode	FF mode	REW mode	PAUSE mode	REC/PAUSE mode	REW mode
REC mode	STOP mode			FF mode	REW mode	REC/PAUSE mode	REC/PAUSE mode	REW mode
FF mode	STOP mode	PLAY mode	REC mode		REW mode			STOP mode
REW mode	STOP mode	PLAY mode	REC mode	FF mode				PLAY mode
PAUSE mode	STOP mode	PLAY mode	REC mode	FF mode	REW mode		REC/PAUSE mode	
REC/PAUSE mode	STOP mode	REC mode	REC mode	FF mode	REW mode			

Note 1. □ indicates that the output mode does not change.

2. REC+PLAY and REC+PAUSE indicates that the two keys are depressed simultaneously.

2. Operation with multiple key depressing simultaneously and over fast depressing of keys

Table 4 shows what happens when two input keys are depressed simultaneously. When the keys are released after having been depressed together, the mode designated by the key that was last released is established. Fig. 2 shows an example where the FF and REW input keys are depressed simultaneously.

When the input keys have been depressed too quickly, a change is made to the mode based on the key that was depressed second after the mode has changed based on the key that was depressed first.

The STOP mode is maintained for 0.4s when operation goes through this mode when the keys are depressed too quickly or two keys are depressed simultaneously.

Table 4. Operation when two keys are pressed simultaneously

Input Input	STOP	FF	REW	PLAY	REC	PAUSE
STOP		STOP mode	STOP mode	STOP mode	mode	
FF			STOP mode		mode	FF mode
REW				STOP mode		REW mode
PLAY					mode	mode
REC						REC/PAUSE mode
PAUSE						

Note: □ indicates that no signal can be entered because of the configuration of the input circuits.

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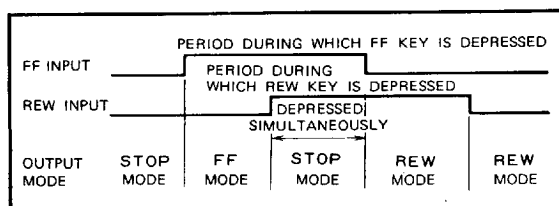


Fig. 2 FF and REW input keys depressed together

3. Operation when power is switched on

When the power is switched on, the STOP mode is established for about 1.6s and all inputs during this period are ignored. Subsequently, when the TIMER START input pin is open, the STOP mode is retained but when the pin has been to the high level, the PLAY mode is established automatically. When the pin has been set to the low, the REC mode is established automatically. The input signal cannot enter from the TIMER START input pin after that period.

4. Operation based on AUTO input

The AUTO input is normally open or high level is kept applied. When the tape-end or other signal is shaped into a pulse below 400ms and applied to the AUTO input, it is possible to order a change from the PLAY or REC mode to the REW mode, REW mode to PLAY mode and FF mode to STOP mode.

5. Determining the RC time constants of oscillator circuit

The operational timing inside the IC is determined by the clock pulses created by the oscillator circuit.

Fig. 3 shows the external connections of the oscillator circuit while Fig. 4 shows the oscillation waveform.

Oscillation is started by the input when the mode changes and after the operation it stops.

The oscillation period is approximately defined by the following relationship:

$$t_{osc} = 0.7 C_{ext} \times (R_{ext} + 5) \text{ (ms)}$$

(μF used for C_{ext} units, $\text{k}\Omega$ for R_{ext} units)

Delay times T_1 and T_2 (see timing chart) for the output with respect to the input keys and stopping time T_3 when the power is switched on are set as follows:

$$T_1 = 2 \times t_{osc}$$

$$T_2 = 16 \times t_{osc}$$

$$T_3 = 68 \times t_{osc}$$

If T_1 is set to 50ms, T_2 to 400ms and T_3 to 1.6s typically, then t_{osc} becomes 25ms which means that the RC constants are $0.33\mu\text{F}$ for C_{ext} and $100\text{k}\Omega$ for R_{ext} . Fig. 6 shows the relationship between C_{ext}/R_{ext} and t_{osc} .

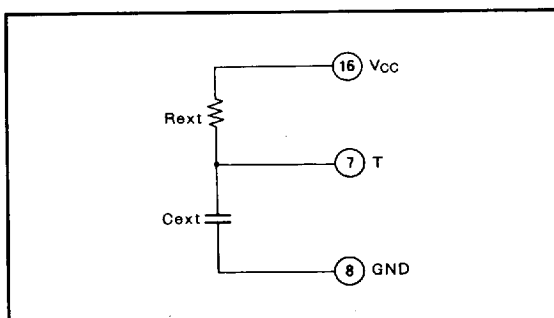


Fig. 3 Oscillator circuit external connection diagram

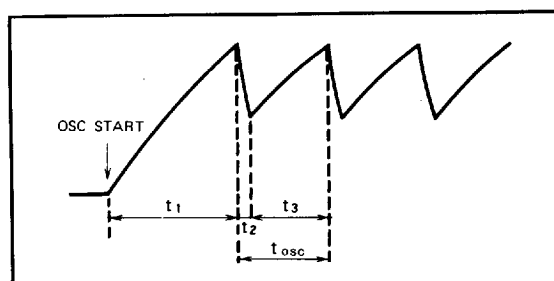
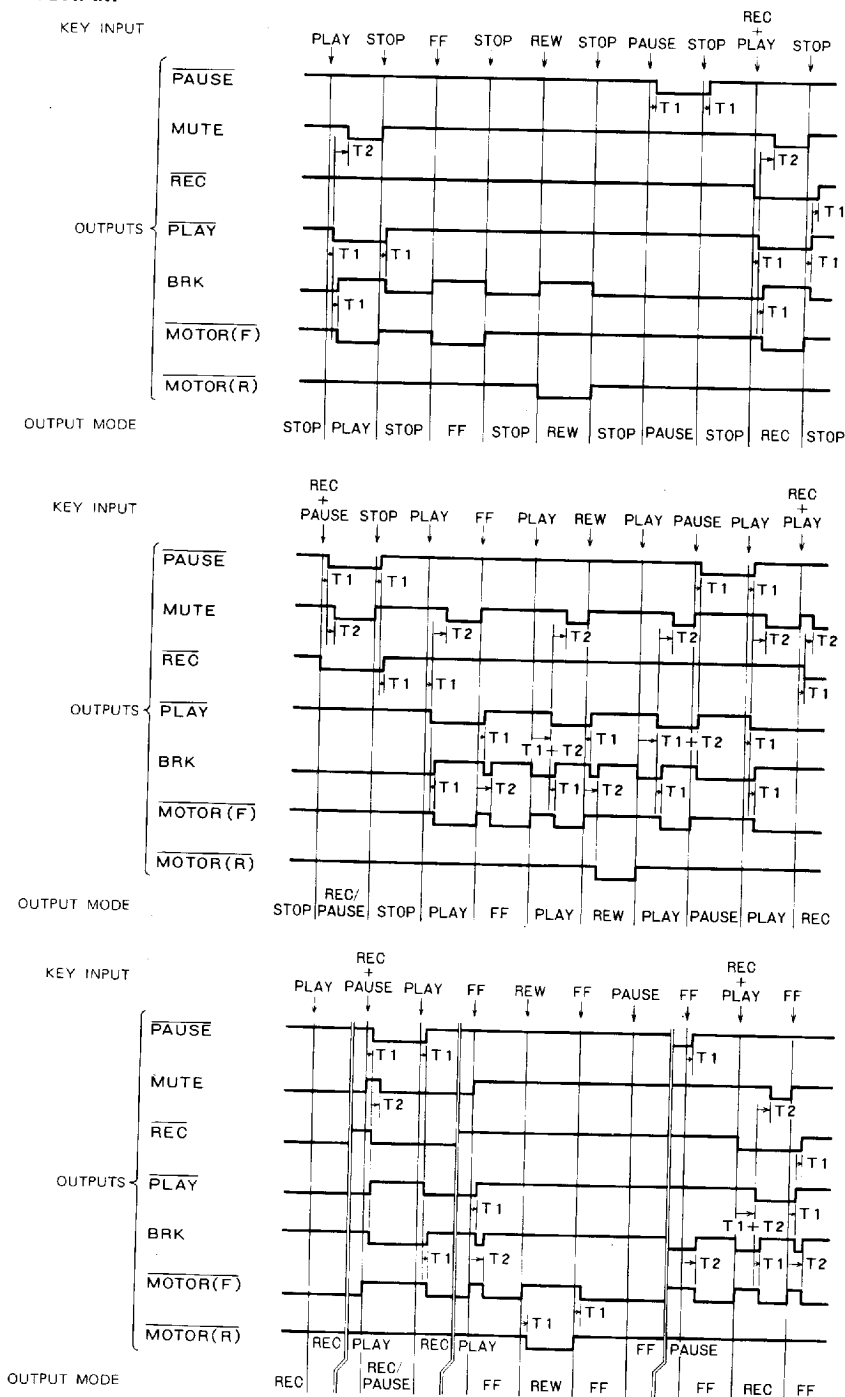


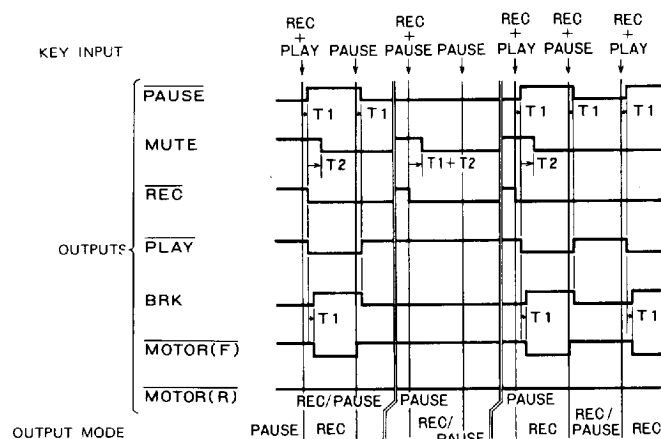
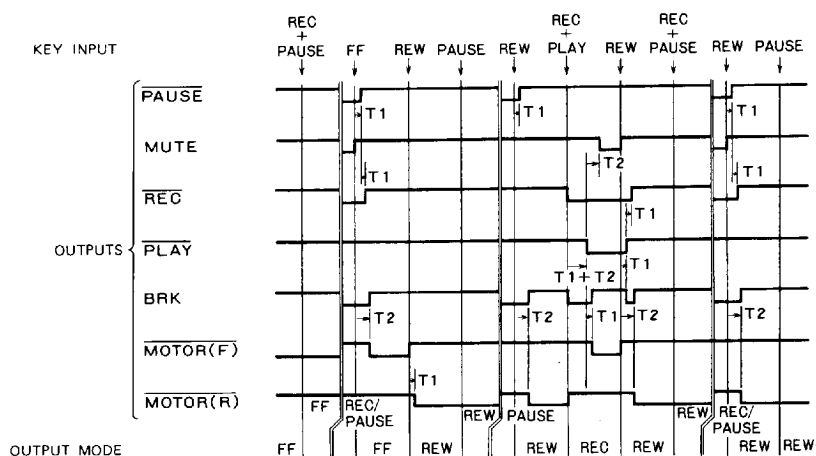
Fig. 4 Oscillation waveform

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TIMING DIAGRAM



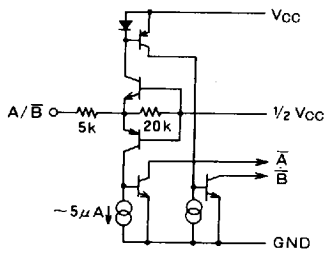
SYSTEM CONTROLLER FOR TAPE DECK



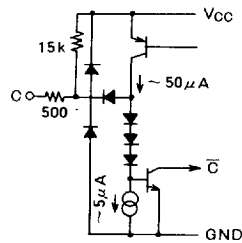
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INPUT/OUTPUT CIRCUITS

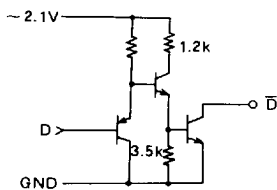
Input 2 circuit (pin 1~4)



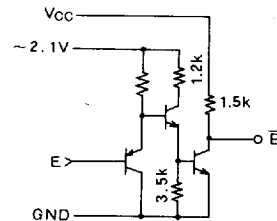
Input 1 circuit (pins 5, 6)



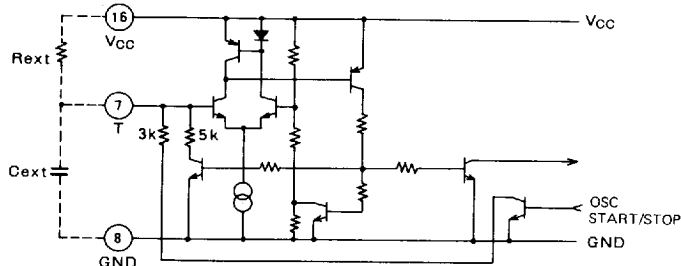
Open collector outputs (pins 10, 13~15)



Output with pull-up resistor (pins 9, 11, 12)



Oscillator circuit



ABSOLUTE MAXIMUM RATINGS ($T_a = -10 \sim +60^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Condition	Ratings	Unit
V_{CC}	Supply voltage		$-0.5 \sim +7.5$	V
V_I	Input voltage		$-0.5 \sim V_{CC} + 0.5$	V
V_O	Output voltage	When output is high	V_{CC}	V
P_d	Power dissipation		500	mW
T_{opr}	Operating temperature		$-10 \sim +60$	$^\circ\text{C}$
T_{stg}	Storage temperature		$-55 \sim +125$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = -10 \sim +60^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4	5	6	V
R_{ext}	External timing resistor for oscillator circuit	20	100	200	k Ω

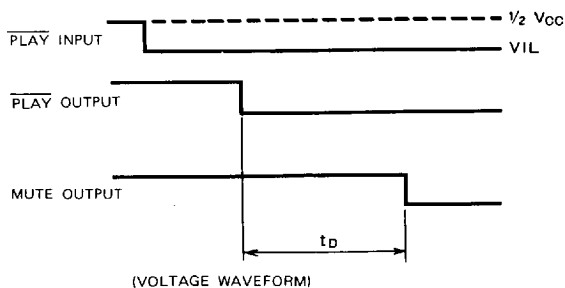
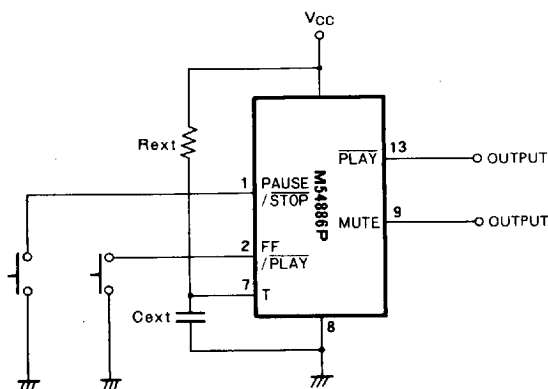
SYSTEM CONTROLLER FOR TAPE DECK

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ*	Max	
V_{IH}	High-level input voltage (pins 5, 6)		2.4			V
V_{IL}	Low input voltage (pins 5, 6)				1.5	V
V_{TH}	High-level threshold voltage (pins 1, 2, 3, 4)			$\frac{V_{CC}}{2} + 0.9$		V
V_{TL}	Low-level threshold voltage (pins 1, 2, 3, 4)			$\frac{V_{CC}}{2} - 0.9$		V
V_{IOP1}	Input open voltage	Pins 5, 6 $V_{CC} = 5\text{V}$	4.7			V
V_{IOP2}		Pins 1, 2, 3, 4 $V_{CC} = 5\text{V}$	2.25	2.5	2.75	V
I_{IH2}	High-level input current (pins 1, 2, 3, 4)	$V_{CC} = 6\text{V}$, $V_{IH} = 5.8\text{V}$		0.45	0.7	mA
I_{IL1}	Low-level input current	Pins 5, 6 $V_{CC} = 6\text{V}$, $V_{IL} = 0.2\text{V}$		-0.4	-0.6	mA
I_{IL2}		Pins 1, 2, 3, 4 $V_{CC} = 6\text{V}$, $V_{IL} = 0.2\text{V}$		-0.45	-0.7	mA
V_{OL}	Low-level output voltage (pins 9, 10, 11, 12, 13, 14, 15)	$V_{CC} = 4\text{V}$, $I_{OL} = 30\text{mA}$		0.2	0.4	V
V_{OH}	High-level output voltage (pins 9, 10, 11)	$V_{CC} = 4\text{V}$, $I_{OH} = -0.4\text{mA}$	3.1	3.4	3.7	V
I_{CC1}	Circuit current	$V_{CC} = 6\text{V}$, STOP Mode			6	mA
I_{CC2}		$V_{CC} = 6\text{V}$, REC/PAUSE Mode		13	20	mA
t_D	Delay time	$V_{CC} = 5\text{V}$, $R_{ext} = 100\text{k}\Omega$, $C_{ext} = 0.33\mu\text{F}$ (See test circuit figure)	280	400	520	ms

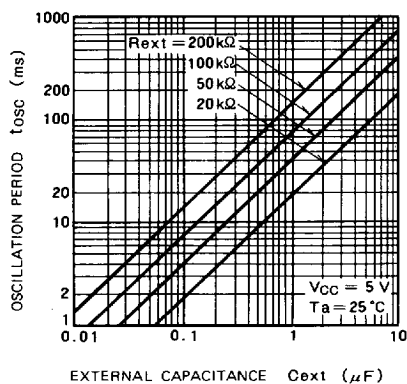
* : Typical values are at $T_a = 25^\circ\text{C}$.

TEST CIRCUIT



Note: The time is measured until the change to the MUTE output from the PLAY output when the mode changes from STOP to PLAY.

OSCILLATION PERIOD OF OSCILLATOR CIRCUIT



SYSTEM CONTROLLER FOR TAPE DECK

APPLICATION EXAMPLE

