

**LA2000M****Audio Level Sensor**

## Overview

LA2000M is an IC for detecting interprogram spaces to pick out the starting point of a program immediately preceding or following a musical program recorded on tape, and to detect end of tape.

## Used in

- Radio-cassette recorders
- Cassette decks
- Car stereos

## Applications

- Detection of spaces between programs recorded on tape
- Detection of end of tape
- Other

## Features

- Has transistors capable of driving plungers with maximum 50 mA, and a protective diode to prevent induced reverse voltages.
- Can provide designated time delays by externally connected capacitors and resistors.
- Has a comparator with stable hysteresis to handle variations in power supply voltage.
- Detects unrecorded portions of tape.

## Specifications

### Maximum Ratings at $T_a = 25^\circ\text{C}$

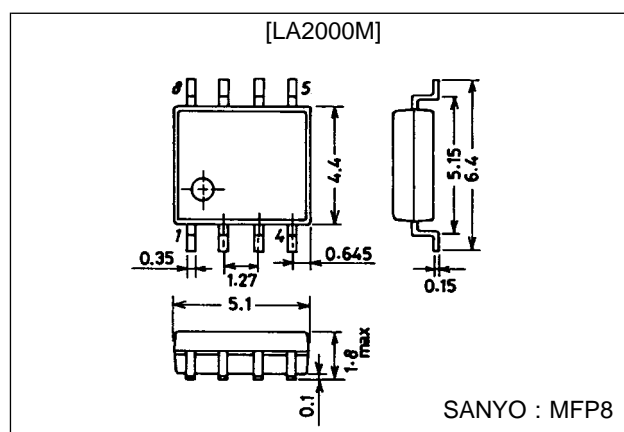
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max		15	V
Allowable power dissipation	$P_d$ max		300	mW
Flow-in current	$I_{\phi}$ max		50	mA
Operating temperature	$T_{opr}$		-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

- Note:1. The voltage at pin 7 must not exceed the supply voltage at pin 8.  
2. The maximum current flowing into pin 7 should be no greater than 0.5 mA.

## Package Dimensions

unit : mm

### 3032B-MFP8



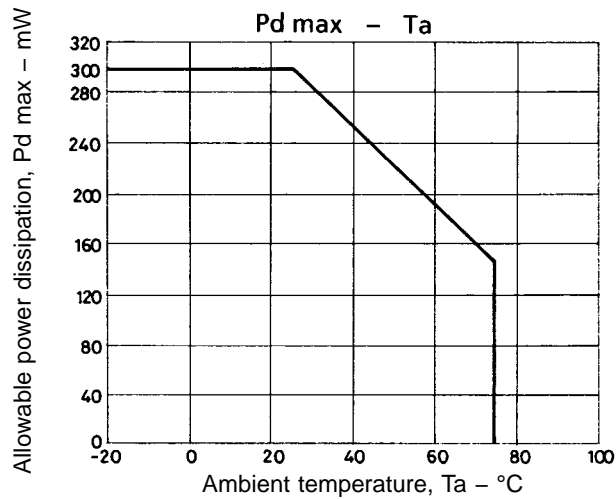
# LA2000M

## Operating Conditions at $T_a = 25^\circ\text{C}$

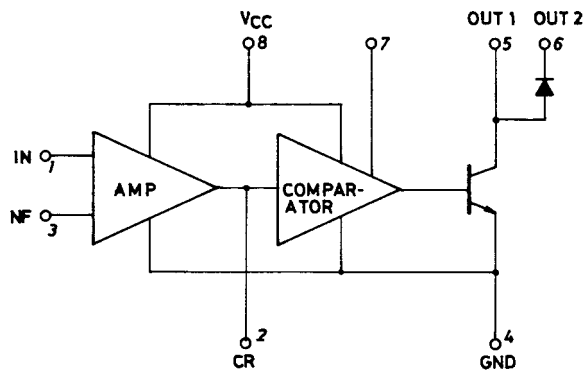
Parameter	Symbol	Conditions	Ratings	Unit
Operating supply voltage	$V_{CC\text{ op}}$		3.5 to 14	V

## Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 9.0\text{ V}$ , $f = 1\text{ kHz}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Circuit current	$I_{CC}$	$f = 1\text{ kHz}$ , $V_{IN} = -45\text{ dBm}$		6	12	mA
Output transistor saturating voltage	$V_{CE\text{ (sat)}}$	$I_6 = 50\text{ mA}$		0.5	1.8	V
Output diode forward voltage	$V_F$	$I_F = 50\text{ mA}$		0.7	1.5	V
Output-off level in input equivalent	$V_{IN}$	$f = 1\text{ kHz}$	-43	-50	-54	dBm
Comparator-on level	$V_{TH-H}$		3.0	3.5	4.0	V
Comparator-off level	$V_{TH-L}$		1.8	2.2	2.6	V
Pin 7 high level	$V_7\text{ pin}$		0.45	0.55		V
Output transistor leakage current	$I_{L-TR}$				100	$\mu\text{A}$
Output diode leakage current	$I_{L-Di}$				100	$\mu\text{A}$

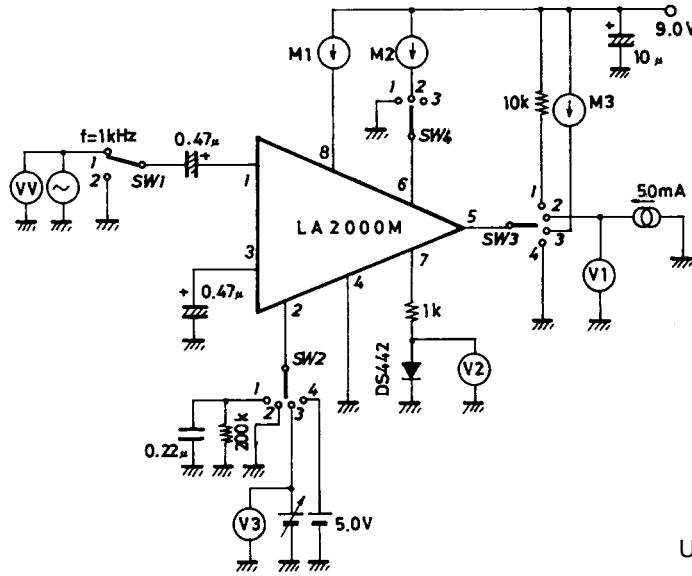


## Equivalent Circuit Block Diagram



# LA2000M

## Test Circuit

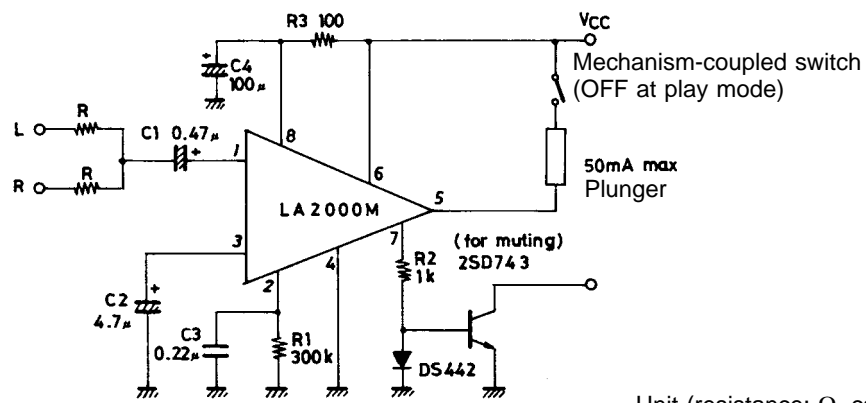


Unit (resistance:  $\Omega$ , capacitance: F)

## Test Conditions

Test items	Symbol	SW-1	SW-2	SW-3	SW-4	Conditions
Circuit current	$I_{CC}$	1	1	1	3	Measure current flowing into pin 8 at $V_{IN} = -45$ dB
Output transistor saturation voltage	$V_{CE(sat)}$	2	2	2	3	Measure $V_{IN}$ at pin 5
Output diode forward voltage	$V_F$	2	4	2	1	Measure $V_{IN}$ at pin 5
Output-off level in input equivalent	$V_{IN}$	1	1	1	3	Input level (v.v) when pin 5 turns over
Comparator-on level	$V_H$	2	3	1	3	Measure $V_3$ when pin 5 turns over
Comparator-off level	$V_L$	2	3	1	3	Measure $V_3$ when pin 5 turns over
Pin 7 high level	$V_{p-7}$	2	4	1	3	Measure $V_2$ at pin 7
Output transistor leakage current	$I_{TL}$	2	4	3	3	Measure M3
Output diode leakage current	$I_{DL}$	2	4	4	2	Measure M2

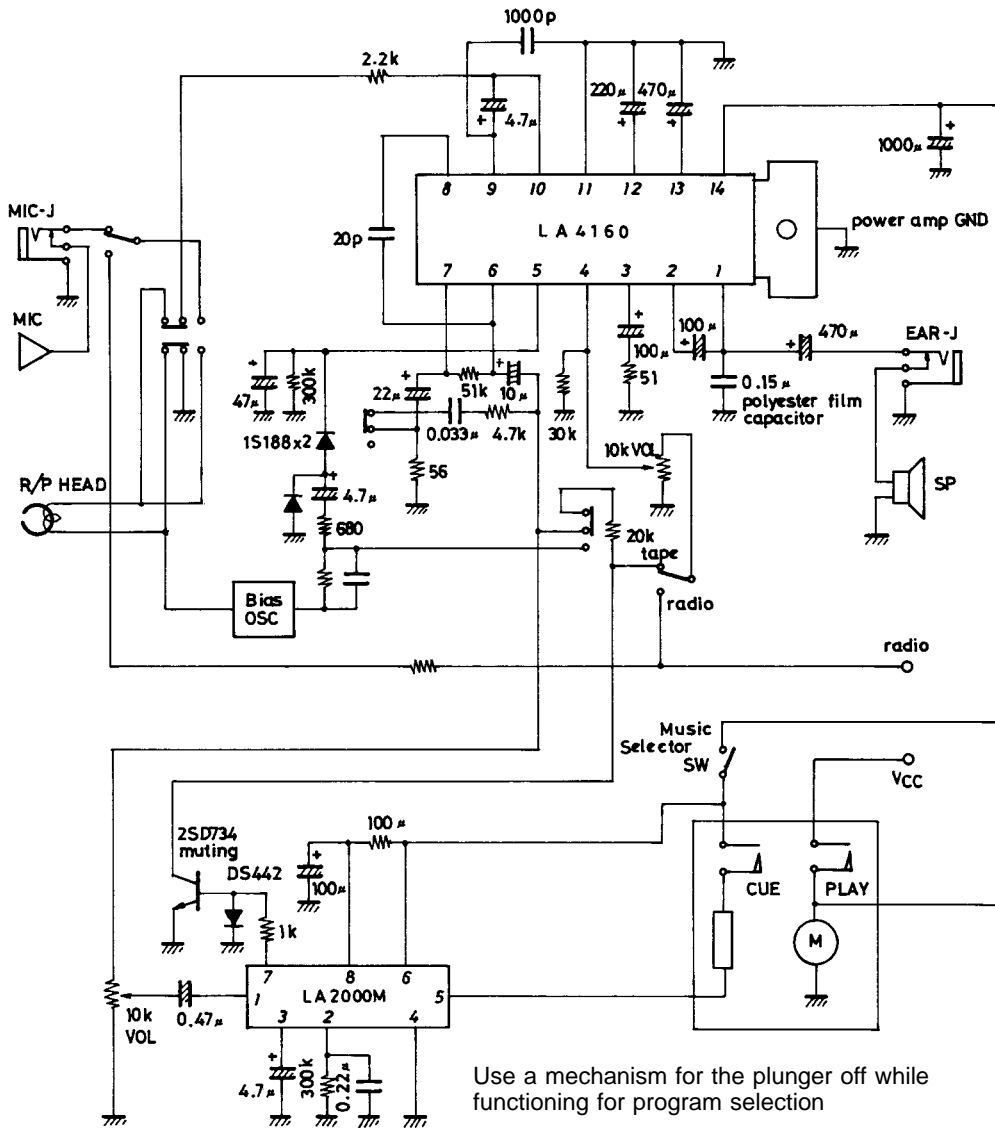
## Sample Application Circuit 1



Unit (resistance:  $\Omega$ , capacitance: F)

# LA2000M

## Sample Application Circuit 2

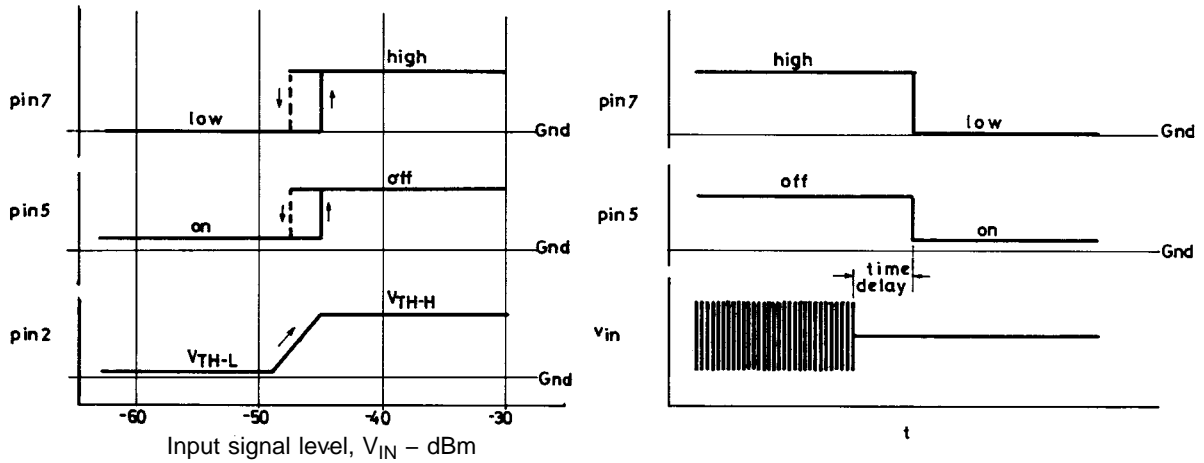


Unit (resistance:  $\Omega$ , capacitance: F)

### 1. Externally connected components

C1	Input coupling capacitor	0.47 to 2.2 $\mu$ F recommended.
C2	NF capacitor	Capacitance is reduced, so the off level in input equivalent becomes lower in the bass frequency range. We recommend 1 to 10 $\mu$ F.
C3, R1	For designation of time delays	Any time delay can be obtained by adequate choice of C3 and R1. We recommend 150 k $\Omega$ to 500 k $\Omega$ for R1.
C4, R3	Power supply ripple filter	
R2	Bias resistor	For diode when pin 7 is used to drive external transistors. A 1 k $\Omega$ resistor is recommended.

2. Individual pins and their operations



As shown above, when input level is raised and the pin 2 voltage reaches the  $V_{TH-H}$  level of the comparator, pins 5 and 7 turn over. ( $V_{IN} = -45$  dBm).

- pin 5 is for driving plungers. When it is on the “L” side, pin 5 turns on and can draw current up to 50 mA maximum.
- Pin 6 is a diode that prevents reverse voltages induced when the plunger is turned off from on.
- Pin 7 functions in phase with pin 5 and can drive external transistors (such as for MUTE).

3. Time delays and obtaining CRs

When input signals that have been applied at a level not less than  $-45$  dBm are removed, discharging occurs through the CR connected at pin 2, lowering pin 2 potential. A time delay is provided before the hysteresis comparator turns over.

$$\frac{E1}{E0} = - \frac{t}{e^\tau}$$

$E0$  : Initial voltage  
 $E1$  : Threshold voltage  
 $\tau$  : Time constant

Accordingly,

$$t = -\tau \ln \frac{E1}{E0}$$

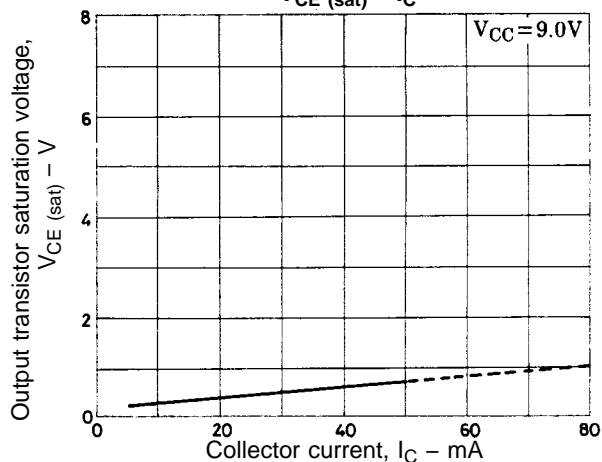
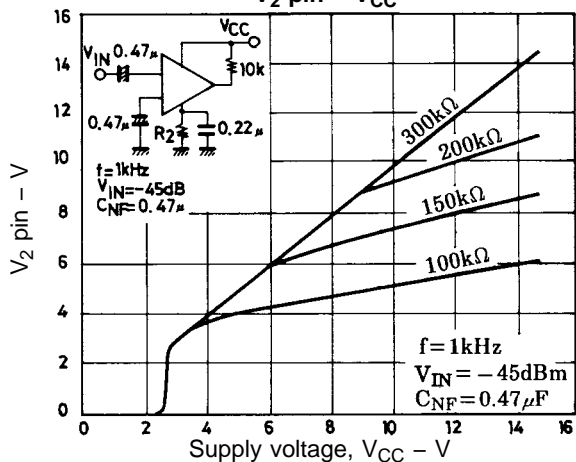
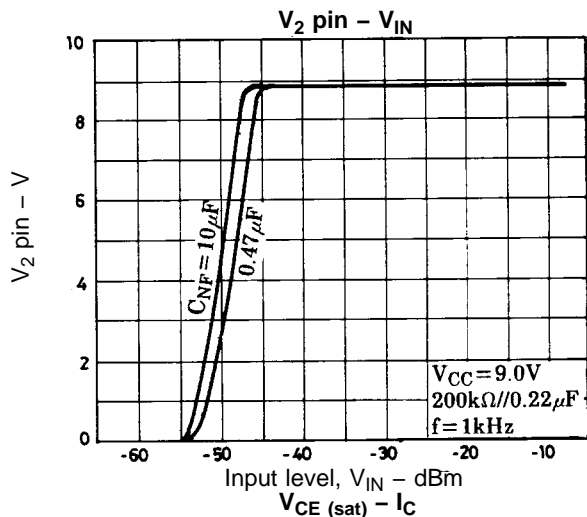
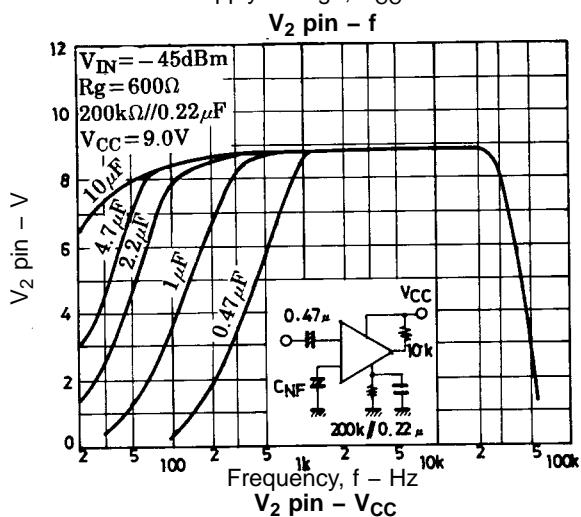
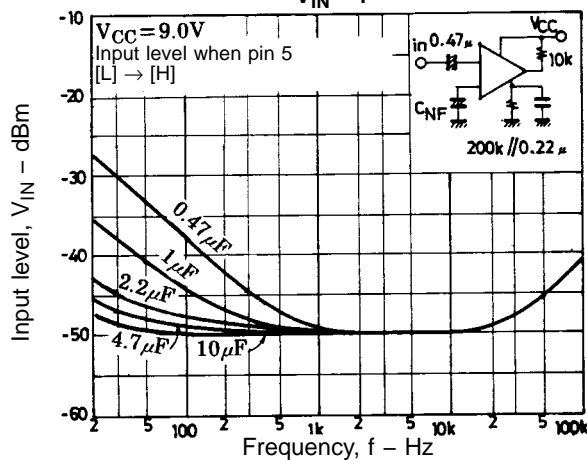
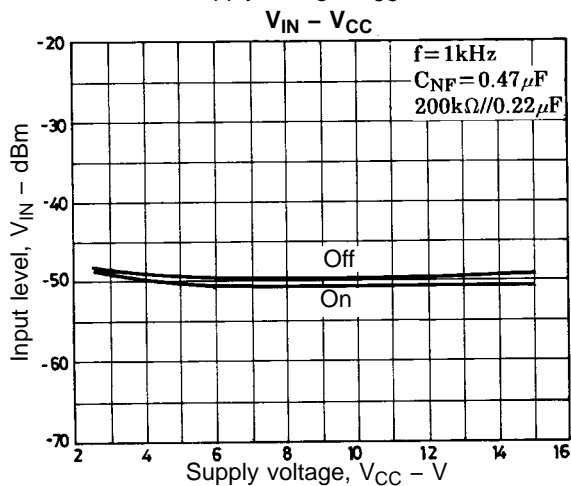
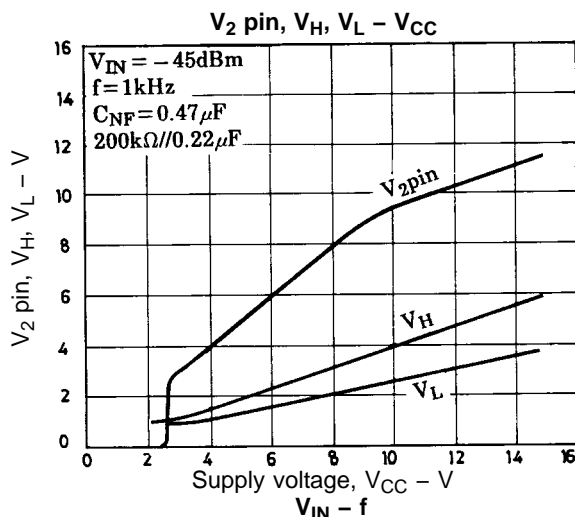
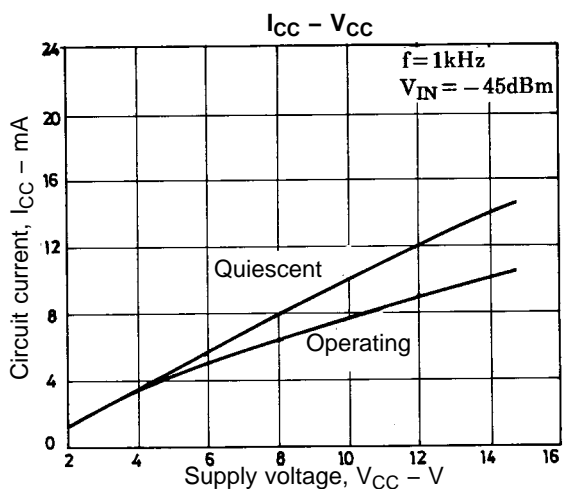
$E1/E0$ , within the IC, is 0.26. A desired time delay is obtained by an appropriate choice of  $\tau$  ( $\tau = C_3R_1$ ). Therefore, the time delay is obtained by the following formula:

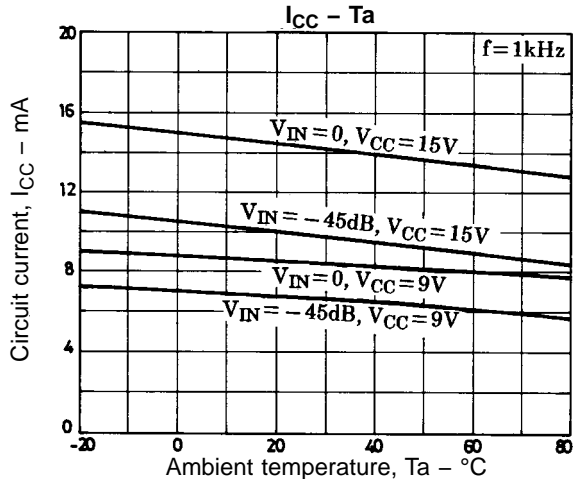
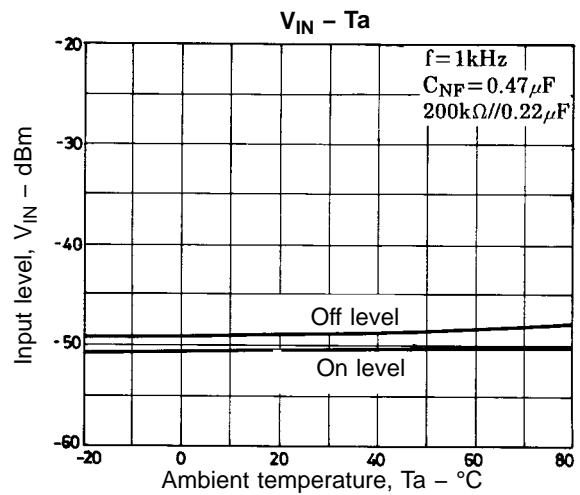
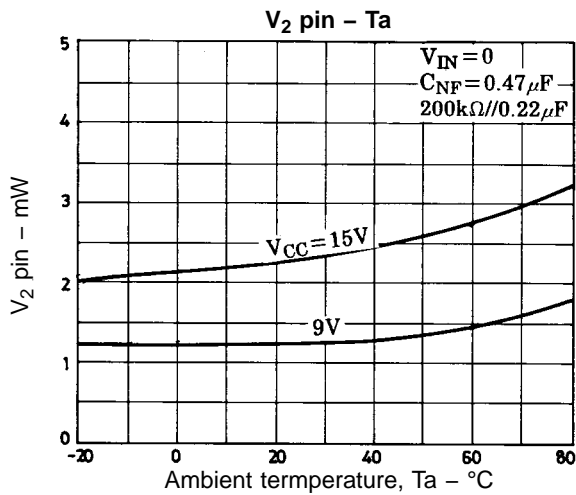
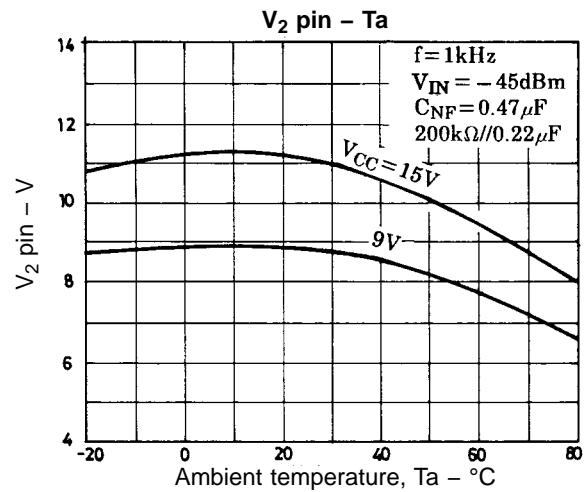
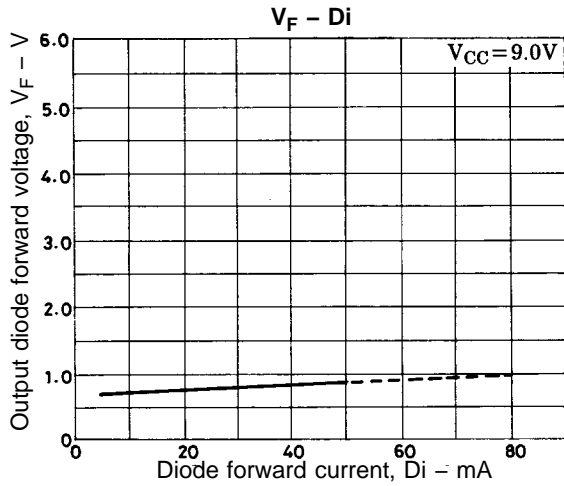
$$t = 1.34 \times C_3R_1 \text{ (sec)}$$

We recommend 150 k $\Omega$  to 500 k $\Omega$  for R when determining CR.

4. IC usage notes

- Maximum ratings  
When maximum ratings are surpassed, destruction or deterioration may result.
- Interpin short circuits and reverse insertions  
These cause destruction or deterioration of the IC: be careful when mounting on circuit board.
- Voltage applied to pin 7 should never exceed pin 8 voltage.
- The current flowing into pin 7 is to be 0.5 mA maximum.





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