



# LA2000

## Audio Level Sensor

### Overview

LA2000 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

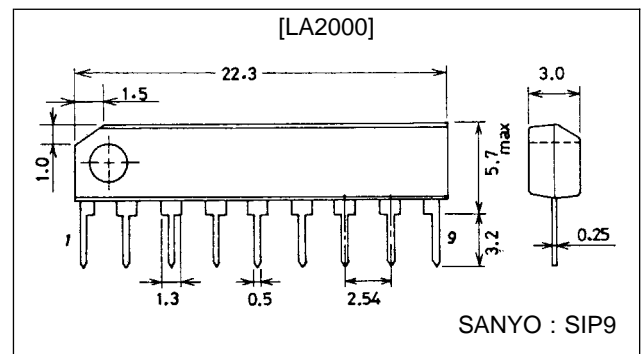
### Features

- Has transistors capable of driving plungers with maximum 600 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.

### Package Dimensions

unit : mm

#### 3017B-SIP9



### Specifications

#### Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		15	V
Allowable power dissipation	Pd max		540	mW
Flow-in current	I <sub>g</sub> max		600	mA
Operating temperature	T <sub>opr</sub>		-20 to +75	°C
Storage temperature	T <sub>stg</sub>		-40 to +125	°C

- Note: 1. The voltage at pin 8 must not exceed the supply voltage at pin 9.  
 2. The maximum current flowing into pin 8 should be no greater than 0.5 mA.

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## LA2000

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

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

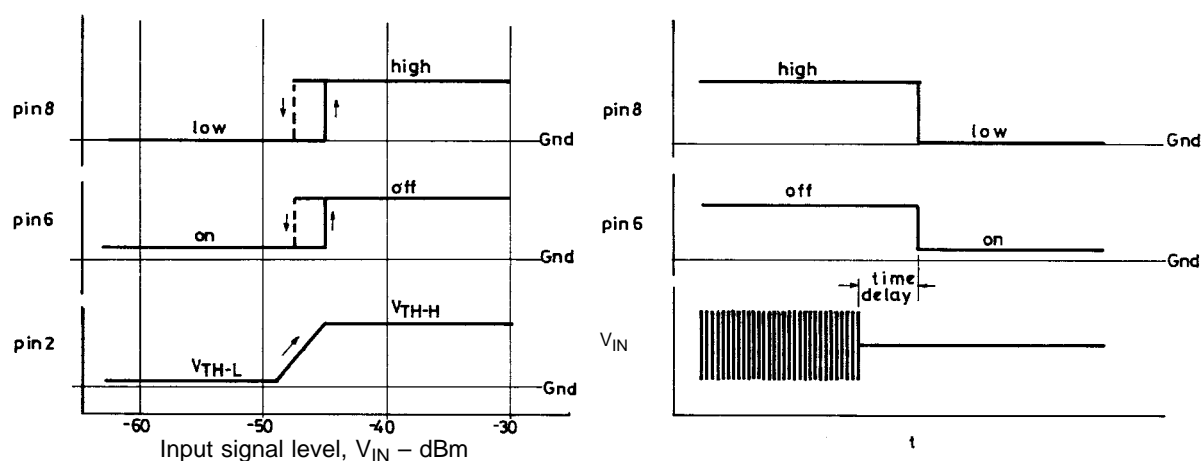
### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 9.0\text{ V}$ , $f = 1\text{ kHz}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Circuit current	$I_{CC}$	$f = 1\text{ kHz}$ , $V_{IN} = -45\text{ dB}$		6	12	mA
Output transistor saturating voltage	$V_{CE\ (sat)}$	$I_6 = 600\text{ mA}$		1.5	2.5	V
Output diode forward voltage	$V_F$	$I_F = 600\text{ mA}$		1.5	2.0	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 8 high level	$V_8\ \text{pin}$		0.45	0.55		V
Output transistor leakage current	$I_{L-TR}$				100	$\mu\text{A}$
Output diode leakage current	$I_{L-Di}$				100	$\mu\text{A}$

#### 1. Description of external parts

C1	Input coupling capacitor	0.47 to 2.2 $\mu\text{F}$ 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 $\mu\text{F}$ .
C3, R1	For designation of time delays	Any time delay can be obtained by adequate choice of C3 and R1. We recommend 150 k to 500 k $\Omega$ for R1.
C4, R3	Power supply ripple filter	
R2	Bias resistor	For diode when pin 8 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 6 and 8 turn over. ( $V_{IN} = -45\text{ dBm}$ ).

- Pin 6 is for driving plungers, When it is on the "L" side, pin 6 turns on and can draw current up to 600 mA maximum (restricted by duty-cycle chart). It is not to be on continuously for more than 3 seconds.
- Pin 7 is a diode that prevents reverse voltages induced when the plunger is turned off from on.
- Pin 8 functions in phase with pin 6 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,

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

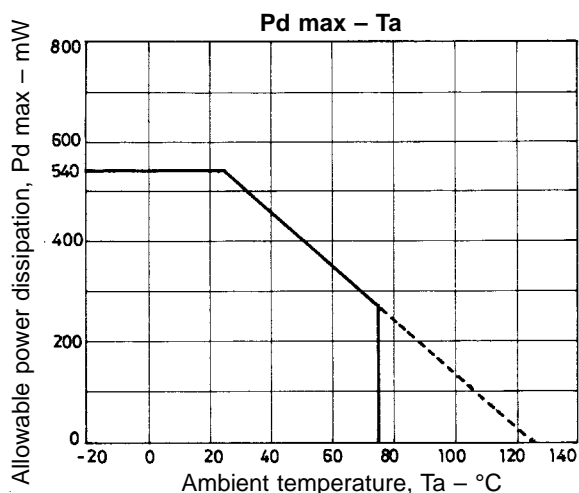
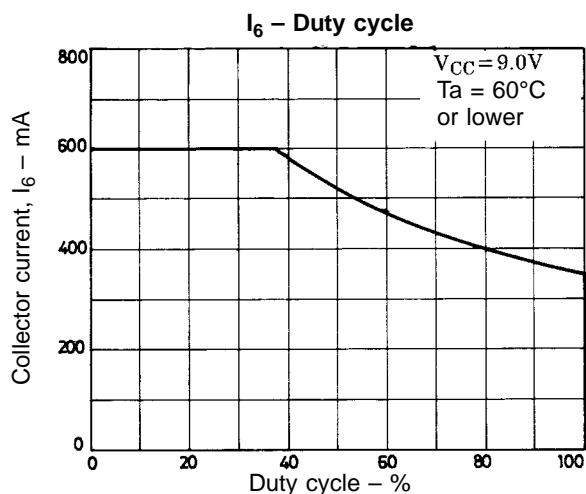
E1/E0, within the IC, is 0.26. A desired time is obtained by an appropriate choice of  $\tau$  ( $\tau = C3R1$ ). Therefore, the time delay is obtained by the following formula:

$$t = 1.34 \times C3R1 \text{ (sec)}$$

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

4. IC usage notes

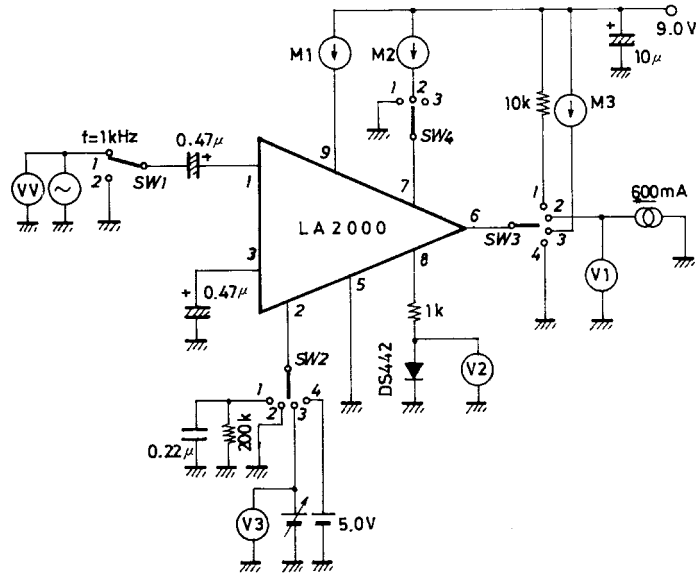
- Maximum ratings  
When maximum ratings are surpassed, destruction or deterioration may result. Use the IC in the range where the maximum rating is not exceeded.
- Interpin short circuits and reverse insertions  
These cause destruction or deterioration of the IC: be careful when mounting on circuit board.
- Voltage applied to pin 8 should never exceed pin 9 voltage.
- The current flowing into pin 8 is to be 0.5 mA maximum.
- Pin 4 is unconnected, but is not to be used for GND or an interconnecting terminal.



Note: I<sub>C</sub> = 600 mA continuous is within 3 seconds  
 I<sub>C</sub> = 300 mA continuous is within 30 seconds  
 I<sub>C</sub> = 100 mA or less can be left on at all times.

# LA2000

## Test Circuit

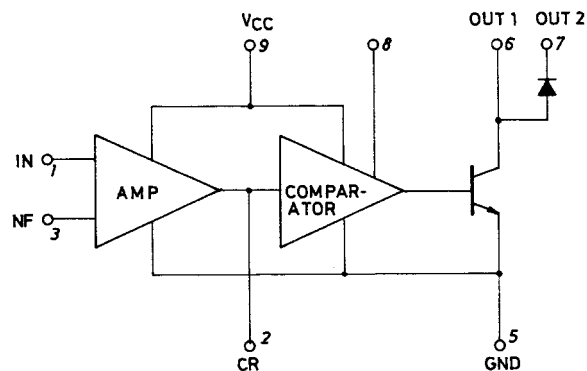


Unit (resistance: Ω, capacitance: F)

## Test Conditions

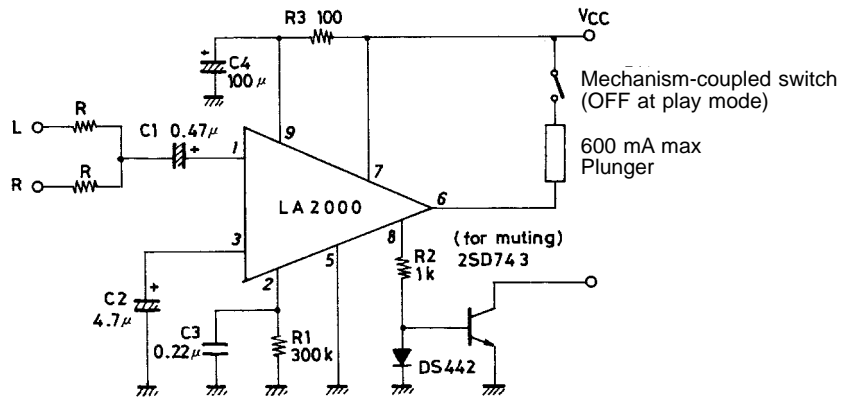
Test items	Symbol	SW-1	SW-2	SW-3	SW-4	Conditions
Circuit current	$I_{CC}$	1	1	1	3	Measure current flowing into pin 9 at $V_{IN} = -45$ dB
Output transistor saturation voltage	$V_{CE(sat)}$	2	2	2	3	Measure $V_{IN}$ at pin 6
Output diode forward voltage	$V_F$	2	4	2	1	Measure $V_{IN}$ at pin 6
Output-off level in input equivalent	$V_{IN}$	1	1	1	3	Input level (V.V) when pin 6 turns over
Comparator-on level	$V_H$	2	3	1	3	Measure V3 When pin 6 turns over
Comparator-off level	$V_L$	2	3	1	3	Measure V3 When pin 6 turns over
Pin 8 high level	$V_{p-8}$	2	4	1	3	Measure V2 at pin 8
Output transistor leakage current	$I_{TL}$	2	4	3	3	Measure M3
Output diode leakage current	$I_{DL}$	2	4	4	2	Measure M2

## Equivalent Circuit Block Diagram



# LA2000

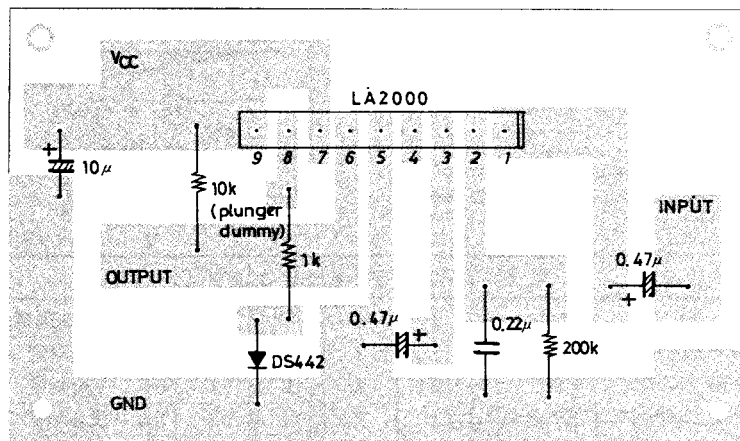
## Sample Application Circuit 1



Unit (resistance: Ω, capacitance: F)

Pin 4 is unconnected but is not be used for GND or an interconnection terminal.

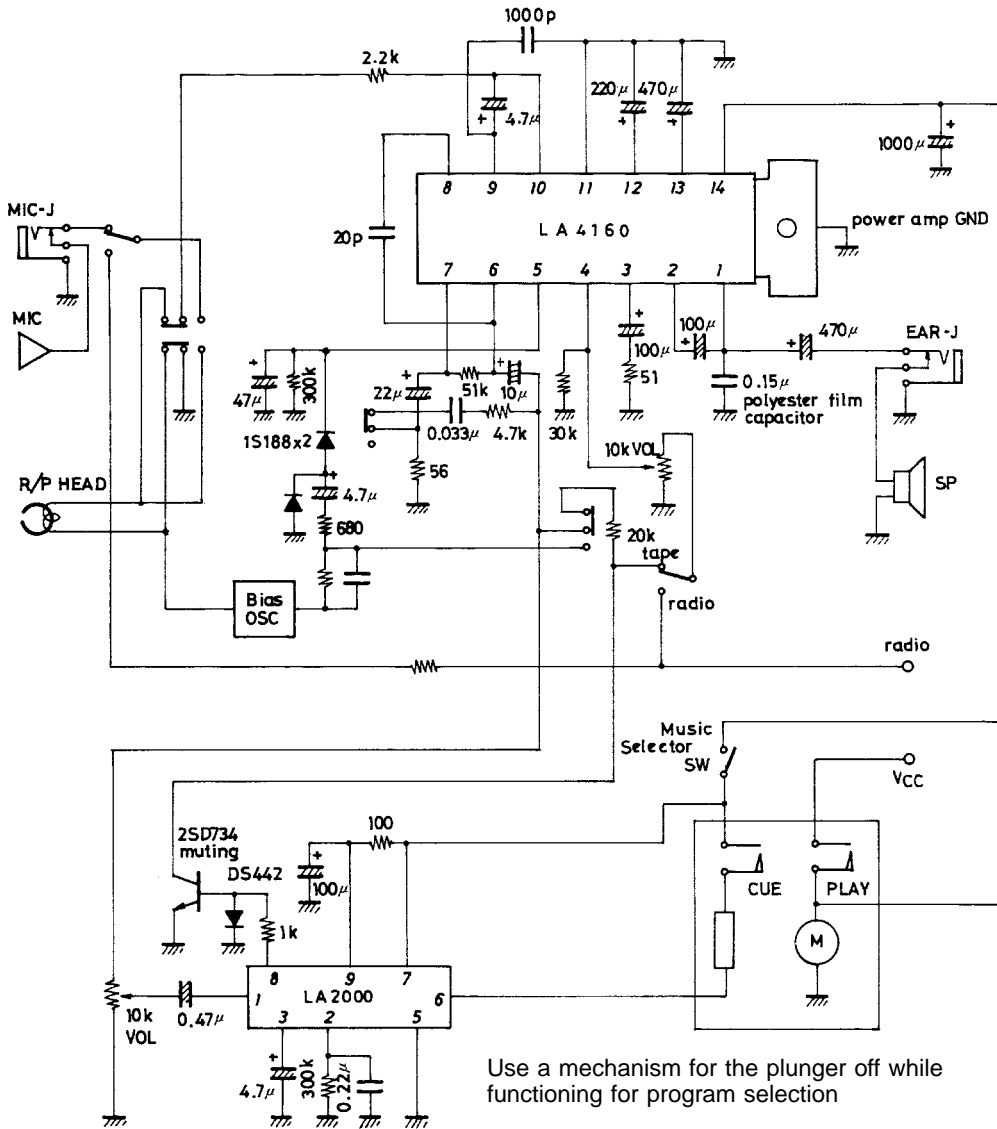
## Sample Printed Pattern (copper foil side)



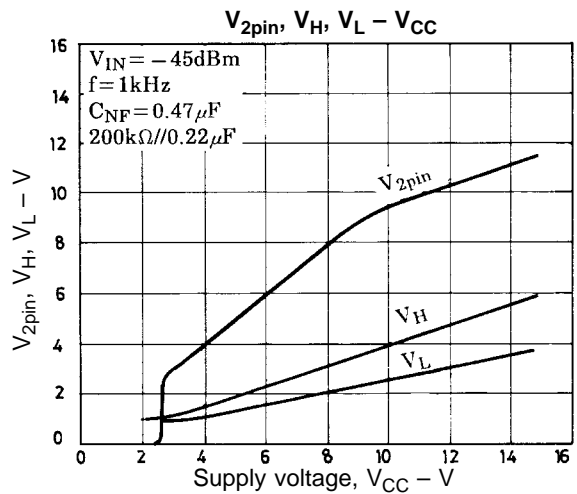
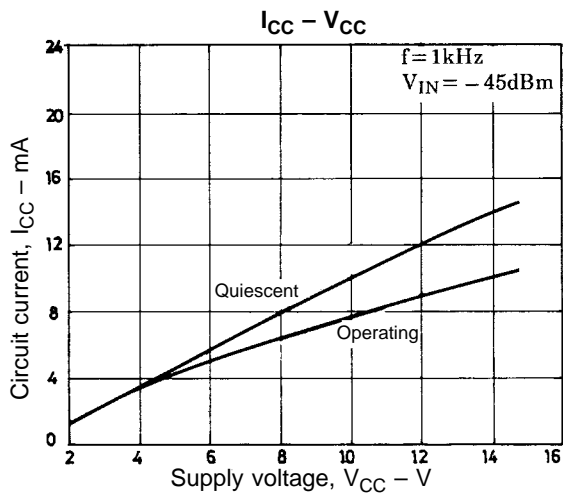
Unit (resistance: Ω, capacitance: F)

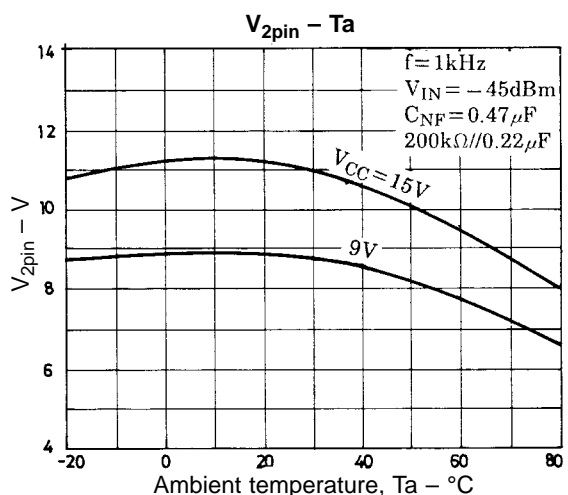
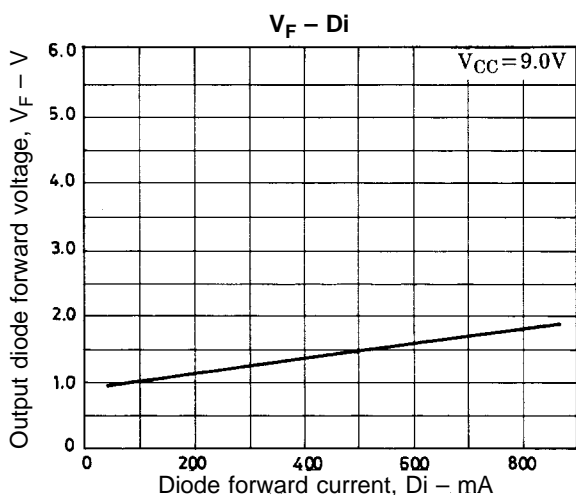
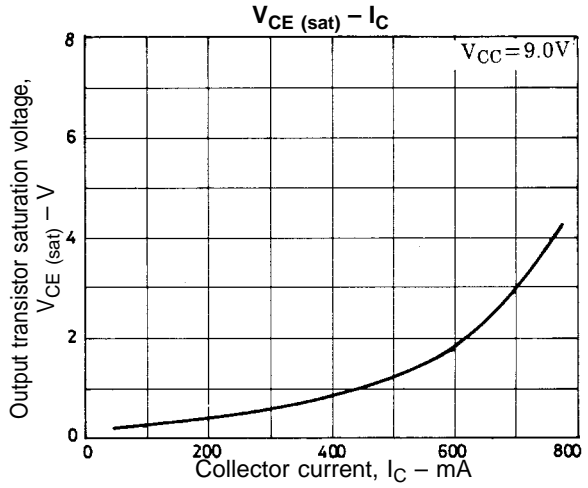
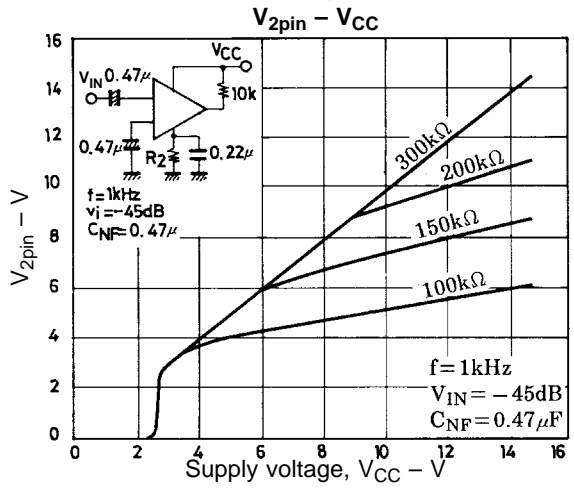
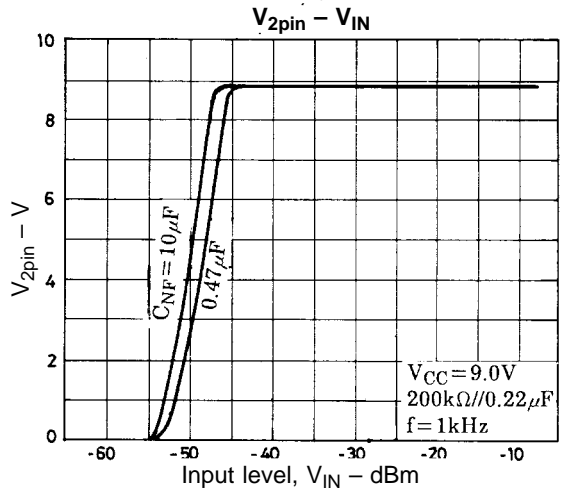
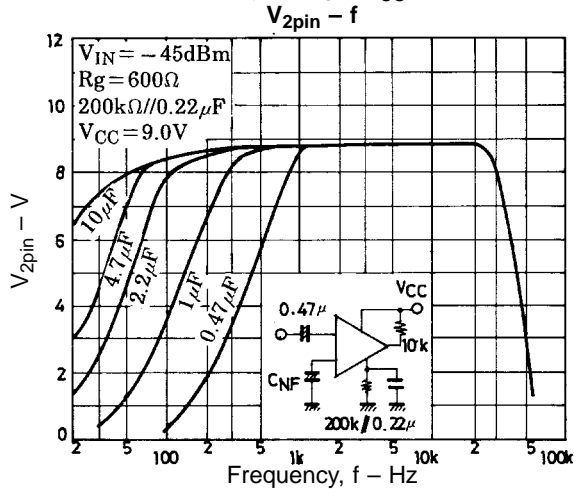
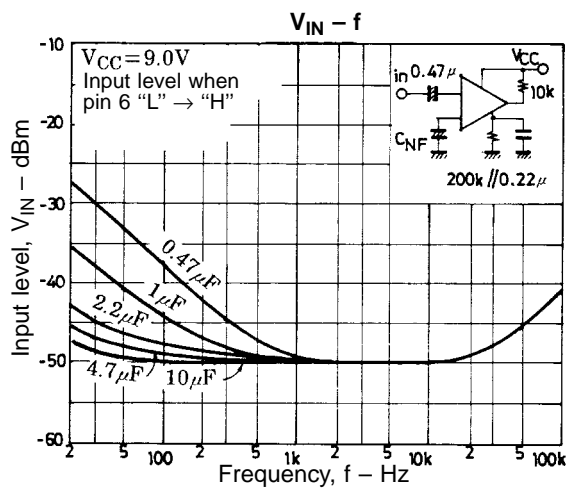
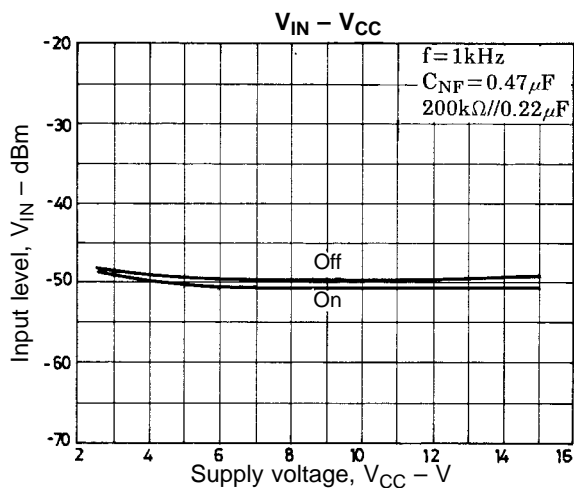
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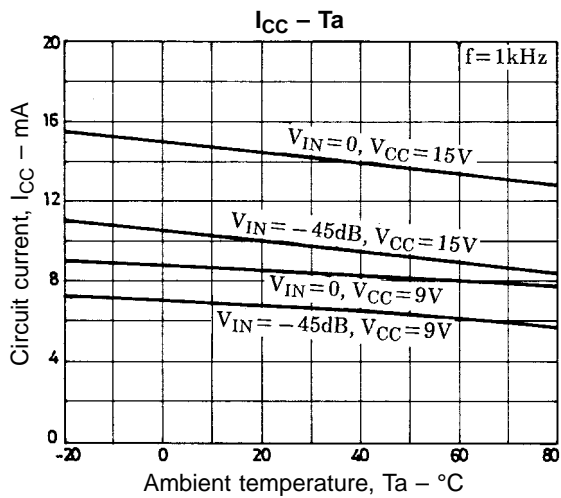
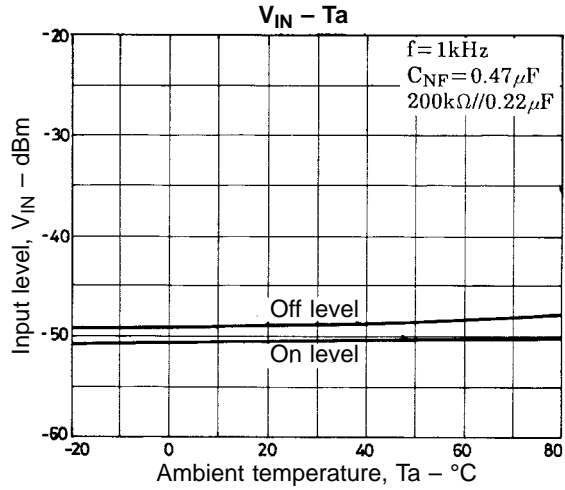
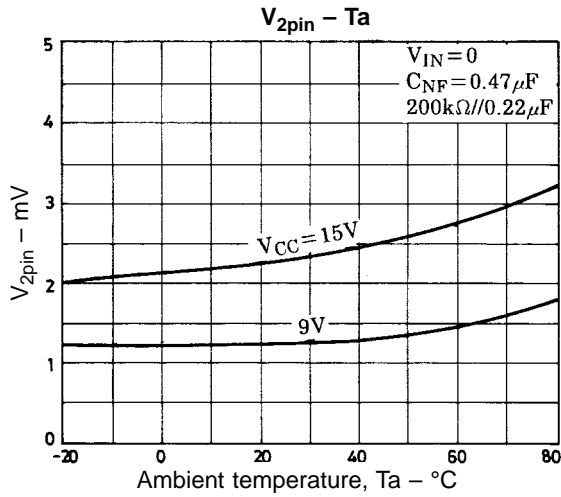
## Sample Application Circuit 2



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







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