



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

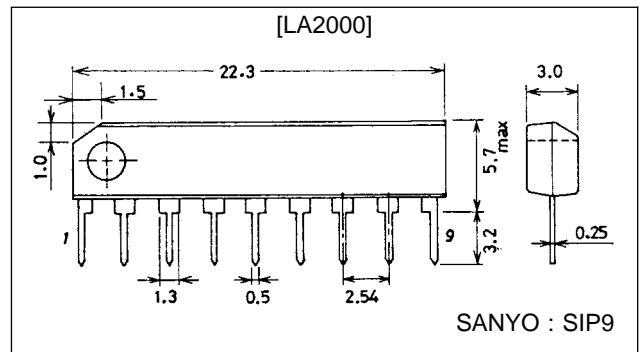
Features

- 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 | $V_{CC \text{ max}}$ | | 15 | V |
| Allowable power dissipation | $P_d \text{ max}$ | | 540 | mW |
| Flow-in current | $I_g \text{ max}$ | | 600 | mA |
| Operating temperature | T_{opr} | | -20 to +75 | °C |
| Storage temperature | T_{stg} | | -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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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 |

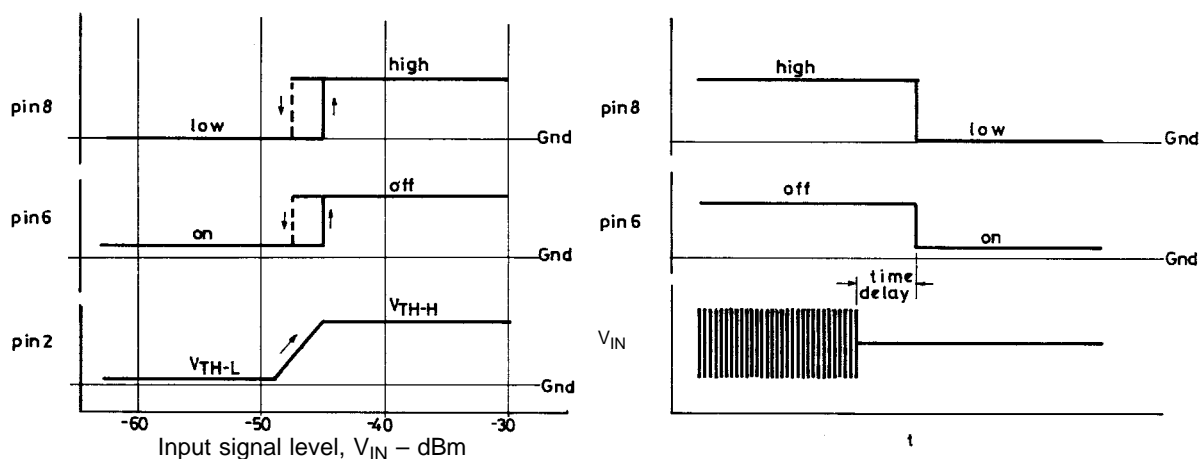
Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 9.0\ \text{V}$, $f = 1\ \text{kHz}$

| 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 | μA |
| Output diode leakage current | I_{L-Di} | | | | 100 | μA |

1. Description of external parts

| | | |
|--------|--------------------------------|--|
| C1 | Input coupling capacitor | 0.47 to 2.2 μF 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 μF . |
| 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 Ω 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 Ω 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
 τ : Time constant

Accordingly,

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

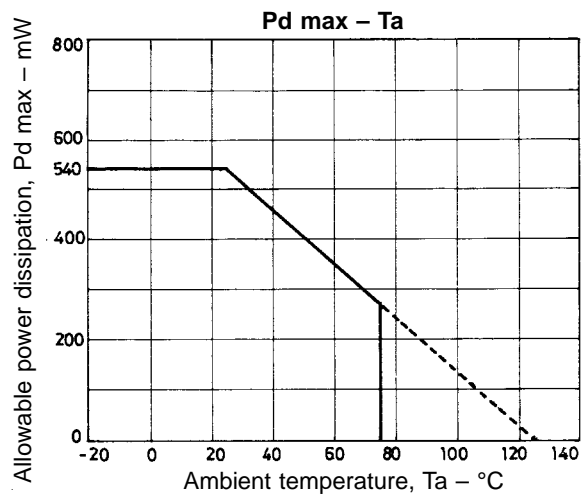
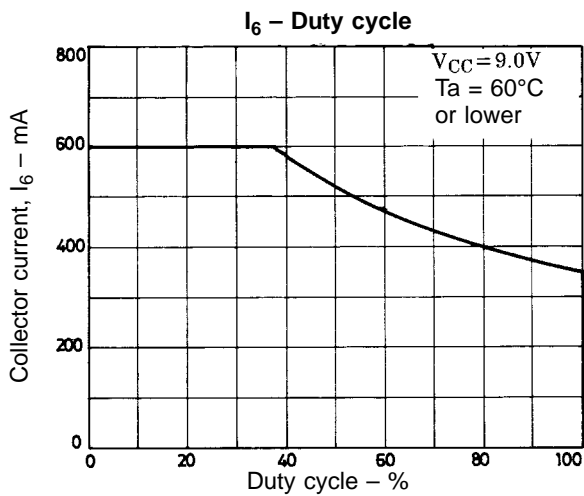
E1/E0, within the IC, is 0.26. A desired time is obtained by an appropriate choice of τ (τ = C3R1). Therefore, the time delay is obtained by the following formula:

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

We recommend 150 k to 500 kΩ for R when determining CR.

4. IC usage notes

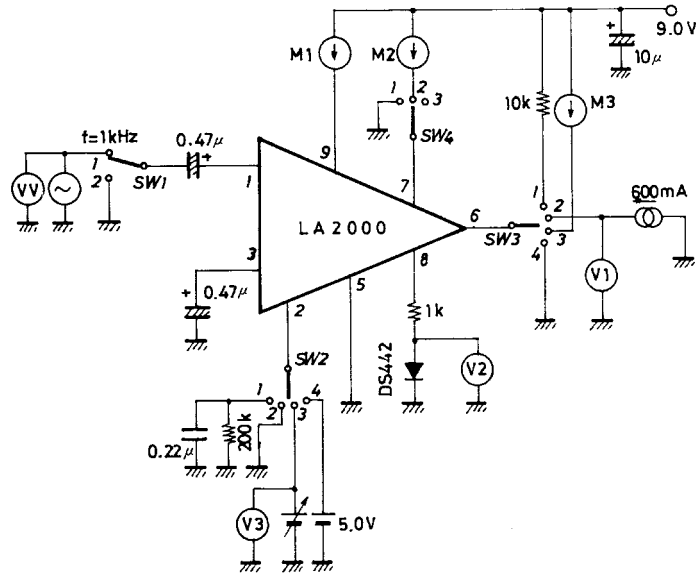
- Maximum ratings
When maximum ratings are surpassed, destruction or deterioration may result. Use the IC in the range where the maximum rating is not exceeded.
- Interpin short circuits and reverse insertions
These cause destruction or deterioration of the IC: be careful when mounting on circuit board.
- 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_C = 600 mA continuous is within 3 seconds
 I_C = 300 mA continuous is within 30 seconds
 I_C = 100 mA or less can be left on at all times.

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Test Circuit

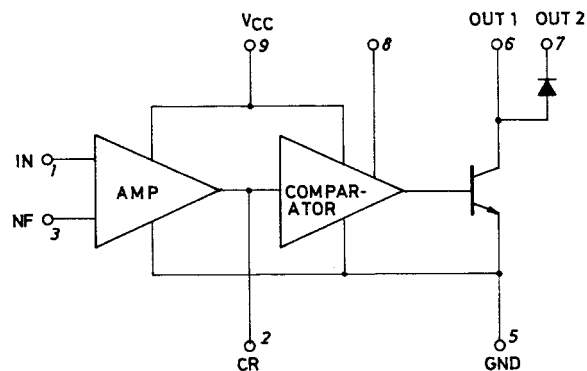


Unit (resistance: Ω, capacitance: F)

Test Conditions

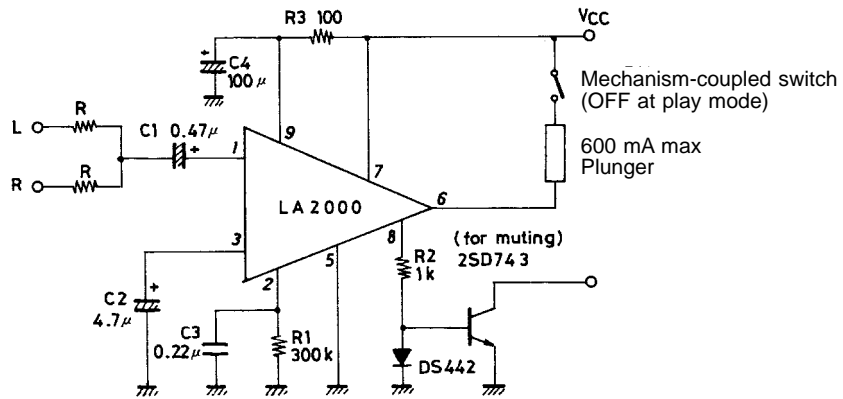
| Test items | Symbol | SW-1 | SW-2 | SW-3 | SW-4 | Conditions |
|--------------------------------------|---------------|------|------|------|------|---|
| Circuit current | I_{CC} | 1 | 1 | 1 | 3 | Measure current flowing into pin 9 at $V_{IN} = -45$ dB |
| Output transistor saturation voltage | $V_{CE(sat)}$ | 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



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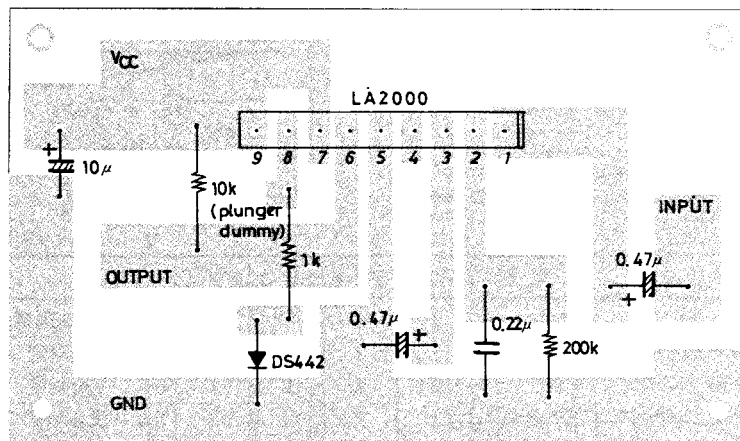
Sample Application Circuit 1



Unit (resistance: Ω , capacitance: F)

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

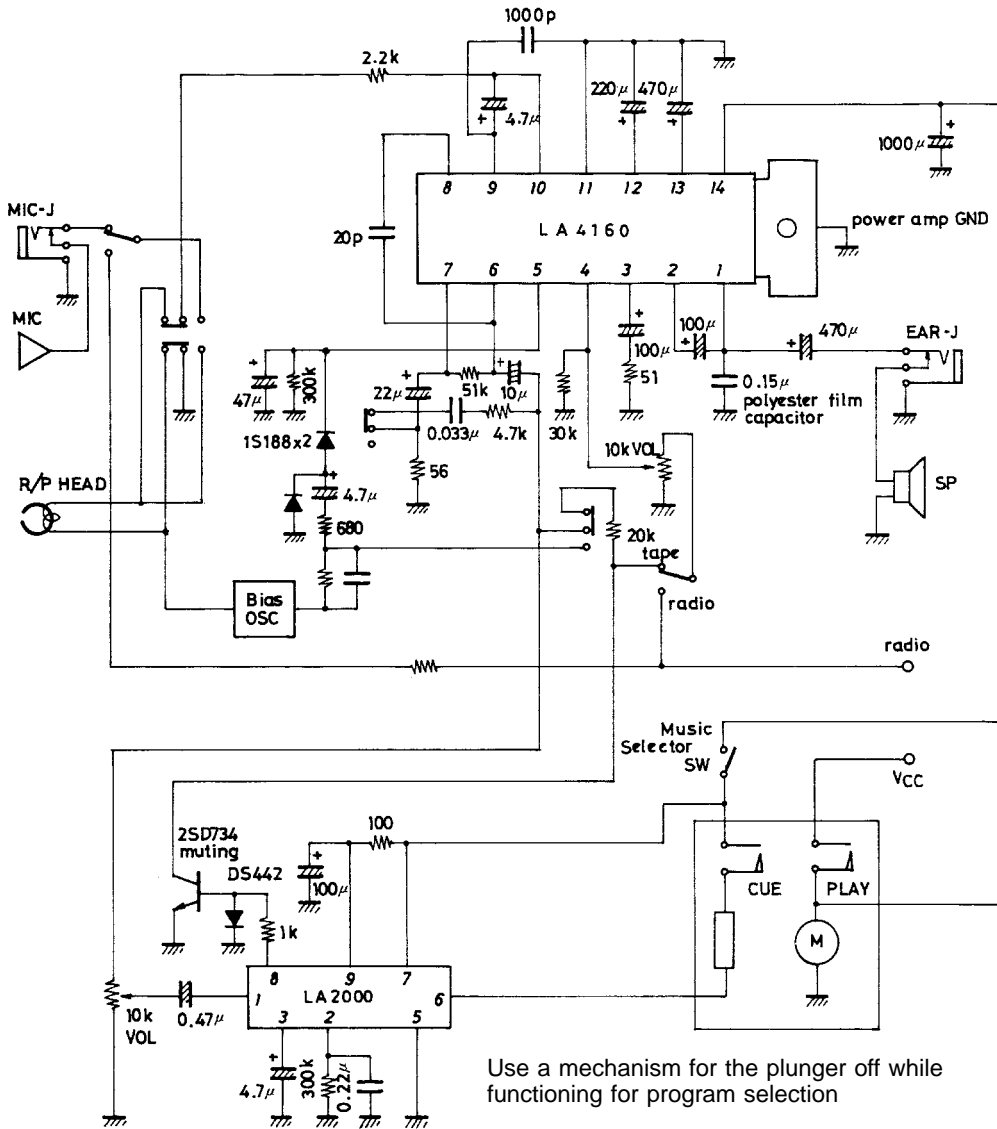
Sample Printed Pattern (copper foil side)



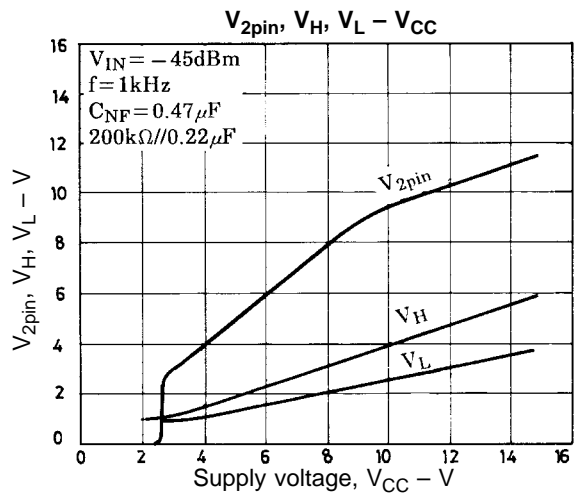
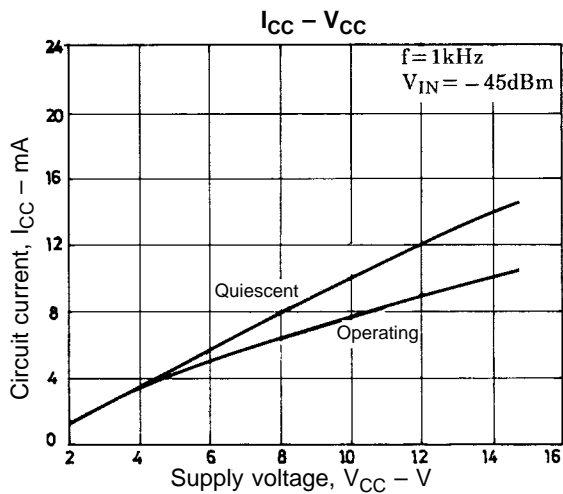
Unit (resistance: Ω , capacitance: F)

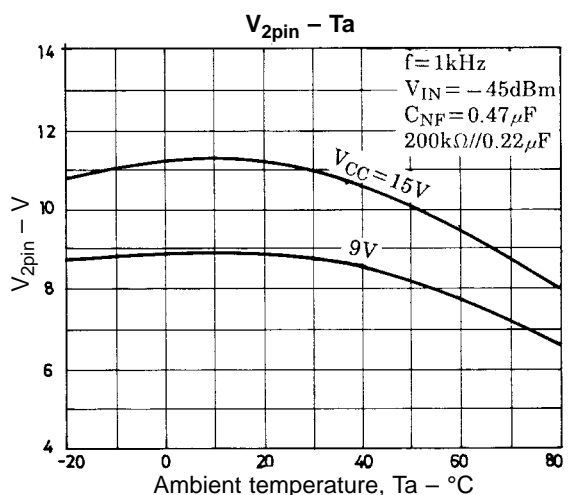
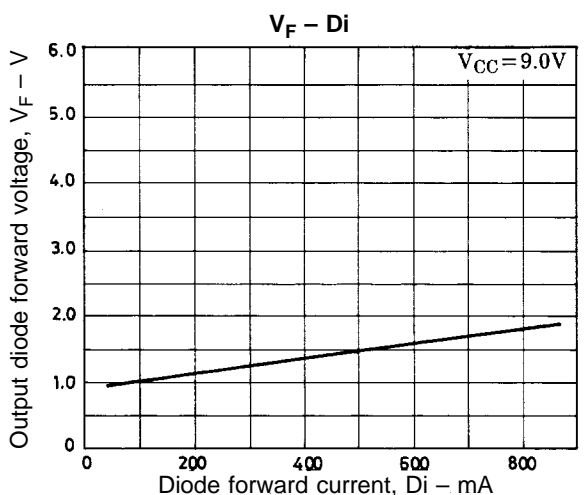
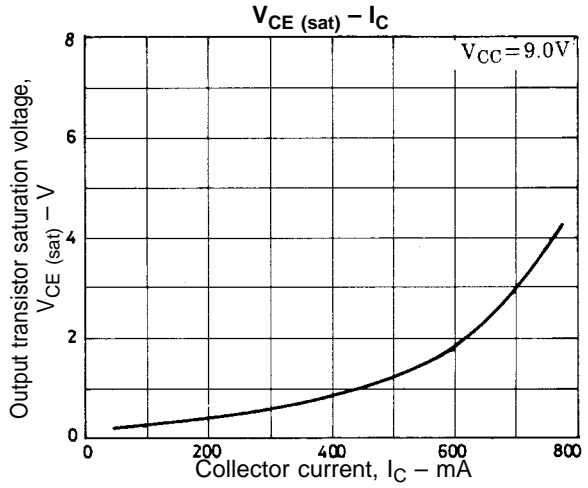
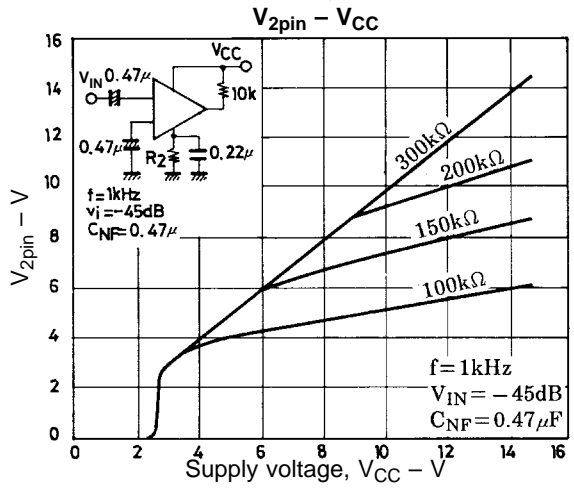
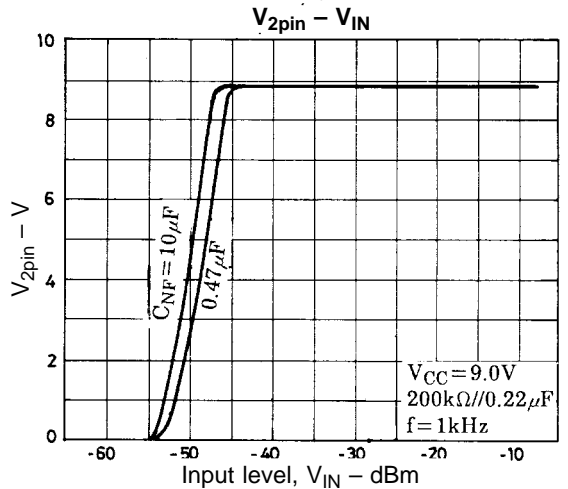
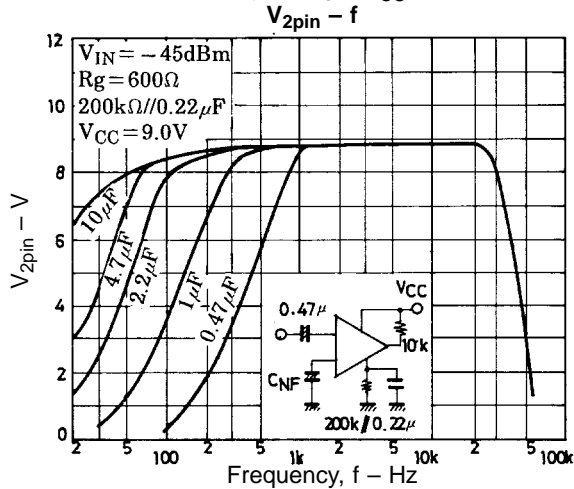
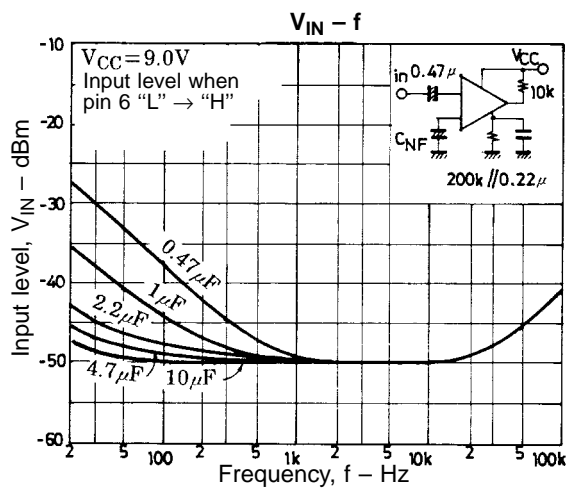
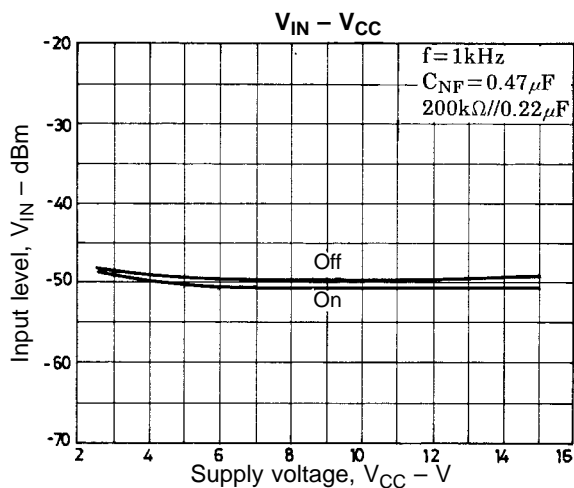
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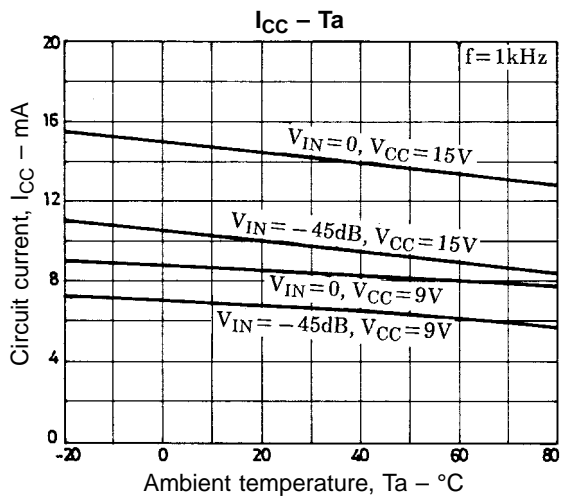
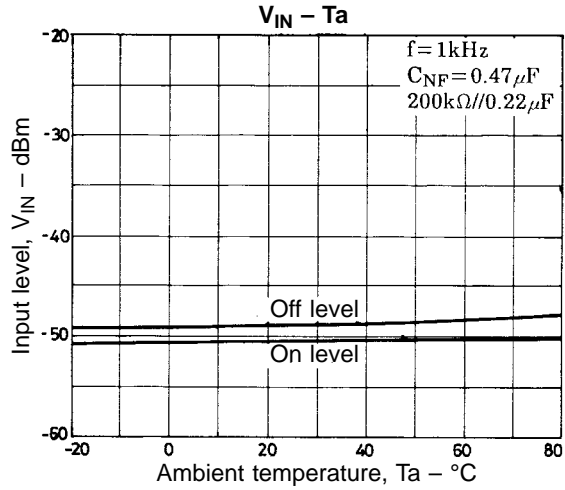
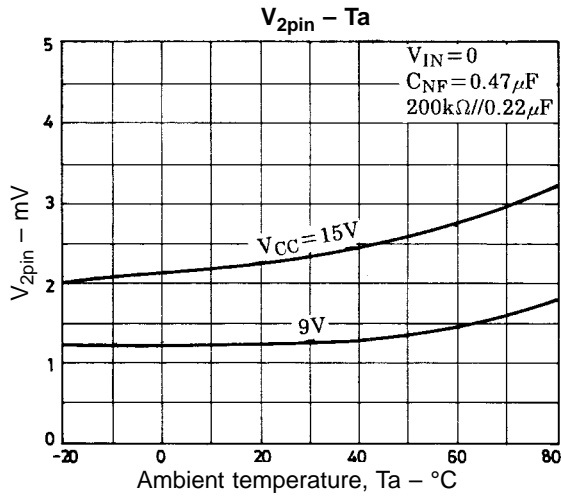
Sample Application Circuit 2



Unit (resistance: Ω , capacitance: F)







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