



# LA70011, 70011M

## Recording/Playback Amplifier for VHS VCRs

### Overview

The LA70011 and LA70011M are recording/playback amplifiers for VHS VCR video signals. When used in combination with the LA71000M and LA71500M Series of video signal processing ICs, they permit Y/C recording without current adjustment.

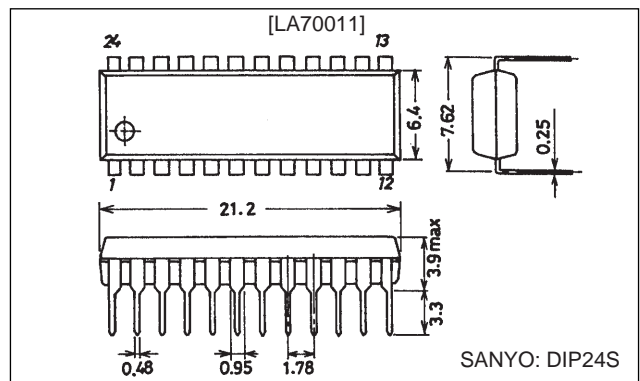
### Features

- Connecting the playback amplifier input directly to the head reduces the number of external elements required.
- The recording amplifiers use a fixed-current drive configuration that yields stable recording characteristics even under changing loads. They include built-in automatic gain control circuits.
- Using the same dimensions and pin assignments as the LA70001 and LA70001M permits the use of the same circuit boards as these earlier chips. The LA70011 can also be mounted at the right end of an LA70020 socket.

### Package Dimensions

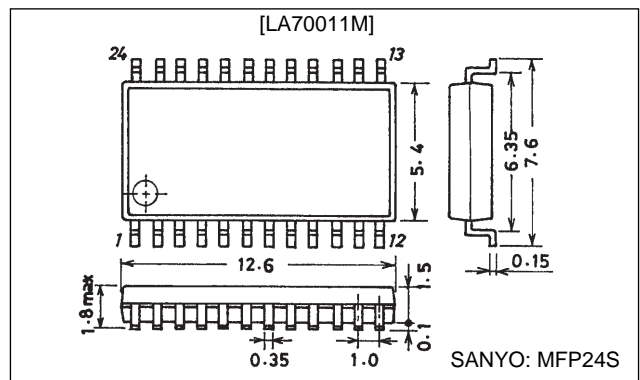
unit: mm

#### 3067-DIP24S



unit: mm

#### 3112-MFP24S



### Specifications

#### Maximum Ratings at Ta = 25°C

| Parameter                    | Symbol              | Conditions  | Ratings     | Unit |
|------------------------------|---------------------|---|-------------|------|
| Maximum power supply voltage | V <sub>CC</sub> max |   | 7.0         | V    |
| Maximum power dissipation    | Pd max              | Ta ≤ 65°C [LA70011]                                     | 600         | mW   |
|                              |                     | Ta ≤ 65°C [LA70011M] 114.3 × 76.1 × 1.6 mm: glass epoxy | 500         | mW   |
| Operating temperature        | T <sub>opr</sub>    |   | -10 to +65  | °C   |
| Storage temperature          | T <sub>stg</sub>    |   | -40 to +150 | °C   |

#### Operating Conditions at Ta = 25°C

| Parameter                            | Symbol             | Conditions | Ratings    | Unit |
|--------------------------------------|--------------------|------------|------------|------|
| Recommended power supply voltage     | V <sub>CC</sub>    |            | 5.0        | V    |
| Operating power supply voltage range | V <sub>CC</sub> op |            | 4.8 to 5.5 | V    |

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Operating Characteristics at Ta = 25°C

| Parameter                               | Symbol   | Conditions   | Ratings |     |      | Unit  |
|---|--|--|---------|-----|------|-------|
|   |  |  | min     | typ | max  |       |
| Playback Mode                           |  |  |         |     |      |       |
| Current drain                           | I <sub>CCP</sub>   | Current flowing into pin 13  | 44      | 53  | 60   | mA    |
| Voltage gain                            | SP-L CH1<br>G <sub>VP1</sub>   | V <sub>IN</sub> = 38 mVp-p, f = 1 MHz  | 56      | 59  | 62   | dB    |
|   | SP-H CH2<br>G <sub>VP2</sub>   |  | 56      | 59  | 62   | dB    |
|   | EP-L CH3<br>G <sub>VP3</sub>   |  | 56      | 59  | 62   | dB    |
|   | EP-H CH4<br>G <sub>VP4</sub>   |  | 56      | 59  | 62   | dB    |
| Voltage gain difference                 | ΔG <sub>VP1</sub>  | G <sub>VP1</sub> — G <sub>VP2</sub>  | -1      | 0   | +1   | dB    |
|   | ΔG <sub>VP2</sub>  | G <sub>VP3</sub> — G <sub>VP4</sub>  | -1      | 0   | +1   | dB    |
| Intermode gain difference               | ΔG <sub>VP3</sub>  | G <sub>VP3</sub> — G <sub>VP1</sub>  | -1      | 0   | +1   | dB    |
| Converted input noise voltage           | CH1<br>V <sub>NIN1</sub><br>CH2<br>V <sub>NIN2</sub><br>CH3<br>V <sub>NIN3</sub><br>CH4<br>V <sub>NIN4</sub>     | Ratio of the output from a 1.1 MHz low pass filter to the output with no input under the same conditions as those used for measuring voltage gain.                     |         | 1.0 | 1.5  | μVrms |
| Frequency characteristic                | CH1<br>ΔV <sub>fp1</sub><br>CH2<br>ΔV <sub>fp2</sub><br>CH3<br>ΔV <sub>fp3</sub><br>CH4<br>ΔV <sub>fp4</sub>     | Ratios of the output for V <sub>IN</sub> = 38 mVp-p and f = 7 MHz to the voltage gains G <sub>VP1</sub> , G <sub>VP2</sub> , G <sub>VP3</sub> , and G <sub>VP4</sub> . | -2.5    | 0   |      | dB    |
| Secondary harmonic distortion           | CH1<br>ΔV <sub>HDP1</sub><br>CH2<br>ΔV <sub>HDP2</sub><br>CH3<br>ΔV <sub>HDP3</sub><br>CH4<br>ΔV <sub>HDP4</sub> | Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz.                                  |         | -40 | -35  | dB    |
| Maximum output level                    | CH1<br>ΔV <sub>OMP1</sub><br>CH2<br>ΔV <sub>OMP2</sub><br>CH3<br>ΔV <sub>OMP3</sub><br>CH4<br>ΔV <sub>OMP4</sub> | Output level, for f = 1 MHz, at which the ratio of the 3 MHz (tertiary) component to the 1 MHz (primary) component is -30 dB.  | 1.0     | 1.2 |      | Vp-p  |
| Crosstalk SP                            | V <sub>CR1</sub>   | Ratio of the output for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz to G <sub>VP1</sub> .   |         | -40 | -35  | dB    |
|   | V <sub>CR2</sub>   | Ratio of the output for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz to G <sub>VP2</sub> .   |         | -40 | -35  | dB    |
| Crosstalk EP                            | V <sub>CR3</sub>   | Ratio of the output for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz to G <sub>VP3</sub> .   |         | -40 | -35  | dB    |
|   | V <sub>CR4</sub>   | Ratio of the output for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz to G <sub>VP4</sub> .   |         | -40 | -35  | dB    |
| Output DC offset                        | ΔV <sub>ODC1</sub>   | CH1 — CH2  | -100    | 0   | +100 | mV    |
|   | ΔV <sub>ODC2</sub>   | CH3 — CH4  |         |     |      |       |
|   | ΔV <sub>ODC3</sub>   | CH1 — CH3  |         |     |      |       |
|   | ΔV <sub>ODC4</sub>   | CH2 — CH4  |         |     |      |       |
|   | ΔV <sub>ODC5</sub>   | CH1 — CH4  |         |     |      |       |
|   | ΔV <sub>ODC6</sub>   | CH2 — CH3  |         |     |      |       |
| Envelope detector output pin voltage    | V <sub>ENV</sub>   | T6 DC level with no signal input.  | 0.0     | 08  | 1.3  | V     |
| Envelope detector output pin voltage SP | V <sub>ENVSP1</sub>  | T6 DC level at which T7A output level is 175 mVp-p for f = 4 MHz.  | 2.0     | 2.5 | 3.0  | V     |
|   | V <sub>ENVSP2</sub>  | T6 DC level at which T7A output level is 400 mVp-p for f = 4 MHz.  | 4.0     | 4.5 | 5.0  | V     |
| Envelope detector output pin voltage EP | V <sub>ENVEP1</sub>  | T6 DC level at which T7A output level is 125 mVp-p for f = 4 MHz.  | 2.0     | 2.5 | 3.0  | V     |
|   | V <sub>ENVEP2</sub>  | T6 DC level at which T7A output level is 300 mVp-p for f = 4 MHz.  | 4.0     | 4.5 | 5.0  | V     |
| Comparator output voltage               | V <sub>COMP1</sub>   | T2 DC level for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz.  |         | 0.4 | 0.7  | V     |
|   | V <sub>COMP2</sub>   | T2 DC level for V <sub>IN</sub> = 38 mVp-p and f = 4 MHz.  | 4.5     | 4.8 |      | V     |
| SW-Tr on resistance during playback     | R <sub>PON17</sub><br>R <sub>PON22</sub>   | DC difference for 1 and 2 mA current inputs.   |         | 4   | 6    | Ω     |
| Trick threshold level                   | TR1-1  | Normal → Trick1 : *1   | 3.2     |     | 5.0  | V     |
|   | TR1-2  | Trick1 → Normal  | 1.2     |     | 2.8  | V     |
|   | TR2-1  | Normal → Trick2 : *1   | 0.0     |     | 0.8  | V     |
|   | TR2-2  | Trick2 → Normal  | 1.2     |     | 2.8  | V     |

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| Parameter                                   | Symbol   | Conditions   | Ratings |      |     | Unit  |
|---|--|--|---------|------|-----|-------|
|   |  |  | min     | typ  | max |       |
| HA playback threshold level                 | HAP-1  | SP → EP : *1   | 1.7     |      | 5.0 | V     |
|   | HAP-2  | EPSP   | 0.0     |      | 1.3 | V     |
| SW30 threshold level                        | SW30-1   | Lch → Hch : *1   | 1.2     |      | 5.0 | V     |
|   | SW30-2   | Hch → Lch  | 0.0     |      | 0.8 | V     |
| <b>Recording Mode</b>                       |  |  |         |      |     |       |
| Current drain                               | I <sub>CCR</sub>                               | Current input at pin 13.   | 52      | 59   | 66  | mA    |
| REC AGC AMP output level                    | V <sub>RSP</sub>                               | Output level for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz.  | 127     | 135  | 143 | mVp-p |
|   | V <sub>REP</sub>                               |  | 104     | 111  | 119 | mVp-p |
| Intermode gain difference                   | ΔGVR   | VRSP/VREP  | 1.4     | 1.7  | 2.0 | dB    |
| REC AGC AMP control characteristic          | ΔV <sub>AGC1-SP</sub><br>ΔV <sub>AGC1-EP</sub> | Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 700 mVp-p.                              |         | 0.5  | 1.0 | dB    |
|   | ΔV <sub>AGC2-SP</sub><br>ΔV <sub>AGC2-EP</sub> | Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 100 mVp-p.                              | -1.0    | -0.5 |     | dB    |
| REC AGC AMP frequency characteristic        | ΔV <sub>FRS</sub><br>ΔV <sub>FRE</sub>         | Ratio of f = 7 MHz output to f = 1 MHz output for V <sub>IN</sub> = 400 mVp-p. *2  | -1      | 0    | +1  | dB    |
| REC AGC AMP secondary primary distortion    | ΔV <sub>HDRS</sub><br>ΔV <sub>HDRE</sub>       | Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz.   |         | -45  | -40 | dB    |
| REC AGC AMP maximum output level            | ΔV <sub>MOSP</sub><br>ΔV <sub>MOEP</sub>       | Output level, for f = 4 MHz, at which the secondary distortion is -35 dB.  | 20      | 22   |     | mApp  |
| REC AGC AMP muting attenuation              | ΔV <sub>MRS</sub><br>ΔV <sub>MRE</sub>         | Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 400 mVp-p.                              |         | -45  | -40 | dB    |
| REC AGC AMP cross modulation relative level | ΔV <sub>CYS</sub><br>ΔV <sub>CYE</sub>         | Output ratio (4M ± 629k)/4M for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz at T9A and V <sub>IN</sub> = 2.4 Vp-p and f = 629 kHz at T10A. |         | -45  | -40 | dB    |
| HA REC threshold level                      | HAR-1  | SP → EP : *1   | 1.7     |      | 5.0 | V     |
|   | HAR-2  | EP → SP  | 0.0     |      | 1.3 | V     |
| REC MUTE threshold level                    | MUTE-1   | MUTE OFF → MUTE ON *1  | 1.2     |      | 2.8 | V     |
|   | MUTE-2   | MUTE ON → MUTE OFF   | 3.2     |      | 5.0 | V     |
| REC PB threshold level                      | PB-REC   | PB → REC *1  | 1.2     |      | 5.0 | V     |
|   | REC-PB   | REC → PB   | 0.0     |      | 0.8 | V     |

Notes: \* Before measuring the items under Playback Mode, input a 0 to 5.0 V trigger pulse to T5 (H-SYNC), the pin from which the LA70011 takes its T3 (HA) control switch timing.

\* The resistance between pins 13 and 14 must be accurate to within 1.0%.

\*1. These are voltage application points.

\*2. Apply a DC voltage of approximately 1.8 V to the AGC wave detector filter pin (pin 15) to fix the AGC amplifier gain.

\*3. Apply a DC voltage to the REC-CUR-Adj pin (pin 12) and adjust the output level.

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Pin Descriptions

| Pin Number | Pin Name   | Standard DC Voltage (V) |                                | Equivalent Circuit                       | Notes  |           |       |        |        |       |
|------------|------------|-------------------------|--------------------------------|--|--|-----------|-------|--------|--------|-------|
| 1          | TRICK-H    |                         |                                | <p style="text-align: right;">A09418</p> | <table border="1"> <tr> <td>Trick1</td> <td rowspan="3" style="vertical-align: middle;">3.0 V</td> </tr> <tr> <td>NORMAL</td> </tr> <tr> <td>Trick2</td> <td>1.0 V</td> </tr> </table> | Trick1    | 3.0 V | NORMAL | Trick2 | 1.0 V |
| Trick1     | 3.0 V      |                         |                                |  |  |           |       |        |        |       |
| NORMAL     |            |                         |                                |  |  |           |       |        |        |       |
| Trick2     |            | 1.0 V                   |                                |  |  |           |       |        |        |       |
| 2          | COMP-OUT   | PB                      | H: min. 4.5 V<br>L: max. 0.7 V | <p style="text-align: right;">A09419</p> | EP > SP ENV High   |           |       |        |        |       |
| 3          | HA (EP/SP) |                         |                                | <p style="text-align: right;">A09420</p> | <table border="1"> <tr> <td>EP</td> <td rowspan="2" style="vertical-align: middle;">1.0 V</td> </tr> <tr> <td>SP</td> </tr> </table>   | EP        | 1.0 V | SP     |        |       |
| EP         | 1.0 V      |                         |                                |  |  |           |       |        |        |       |
| SP         |            |                         |                                |  |  |           |       |        |        |       |
| 4          | SW30       |                         |                                | <p style="text-align: right;">A09421</p> | <table border="1"> <tr> <td>Hch</td> <td rowspan="2" style="vertical-align: middle;">1.0 V</td> </tr> <tr> <td>Lch</td> </tr> </table>   | Hch       | 1.0 V | Lch    |        |       |
| Hch        | 1.0 V      |                         |                                |  |  |           |       |        |        |       |
| Lch        |            |                         |                                |  |  |           |       |        |        |       |
| 5          | H-SYNC     |                         |                                | <p style="text-align: right;">A09422</p> | <table border="1"> <tr> <td>SYNC<br/>H</td> <td rowspan="2" style="vertical-align: middle;">1.5 V</td> </tr> <tr> <td>L</td> </tr> </table>  | SYNC<br>H | 1.5 V | L      |        |       |
| SYNC<br>H  | 1.5 V      |                         |                                |  |  |           |       |        |        |       |
| L          |            |                         |                                |  |  |           |       |        |        |       |

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| Pin Number | Pin Name    | Standard DC Voltage (V) |                         | Equivalent Circuit | Notes  |     |       |          |    |
|------------|-------------|-------------------------|-------------------------|--------------------|--|-----|-------|----------|----|
| 6          | ENVDET-OUT  | PB                      | See relevant documents. | <p>A09423</p>      |  |     |       |          |    |
|            |             | REC                     | 0                       |                    |  |     |       |          |    |
| 7          | PB-OUT      | PB                      | 1.7                     | <p>A09424</p>      |  |     |       |          |    |
|            |             | REC                     | 2.1                     |                    |  |     |       |          |    |
| 8<br>20    | GND         |                         |                         |                    |  |     |       |          |    |
| 9          | REC-Y-IN    | PB                      | 4.0                     | <p>A09425</p>      |  |     |       |          |    |
|            |             | REC                     | 3.7                     |                    |  |     |       |          |    |
| 10         | REC-C-IN    | PB                      | 4.0                     | <p>A09426</p>      |  |     |       |          |    |
|            |             | REC                     | 3.7                     |                    |  |     |       |          |    |
| 11         | REC/MUTE/PB |                         |                         | <p>A09427</p>      | <table border="1"> <tr> <td>REC</td> <td rowspan="3">3.0 V</td> </tr> <tr> <td>REC MUTE</td> </tr> <tr> <td>PB</td> </tr> </table> | REC | 3.0 V | REC MUTE | PB |
| REC        | 3.0 V       |                         |                         |                    |  |     |       |          |    |
| REC MUTE   |             |                         |                         |                    |  |     |       |          |    |
| PB         |             |                         |                         |                    |  |     |       |          |    |

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| Pin Number           | Pin Name                                 | Standard DC Voltage (V) |       | Equivalent Circuit | Notes |
|----------------------|--|-------------------------|-------|--------------------|-------|
| 12                   | REC-CURRENT-ADJ2                         | PB                      | 2.5 V | <p>A09428</p>      |       |
|                      |  | REC                     | 2.5 V |                    |       |
| 13                   | V <sub>CC</sub>                          |                         |       |                    |       |
| 14                   | REC-CURRENT-ADJ1                         | PB                      | 5.0   | <p>A09429</p>      |       |
|                      |  | REC                     | 4.5   |                    |       |
| 15                   | REC-AGC-FILT                             | PB                      | 0     | <p>A09430</p>      |       |
|                      |  | REC                     | 1.6   |                    |       |
| 16<br>19<br>21<br>24 | SP L-IN<br>SP H-IN<br>EP L-IN<br>EP H-IN | PB                      | 2.1   | <p>A09431</p>      |       |
|                      |  | REC                     | 4.1   |                    |       |
| 17<br>22             | REC SP OUT<br>EP OUT                     | PB                      | 2.1   | <p>A09432</p>      |       |
|                      |  | REC                     | 4.1   |                    |       |

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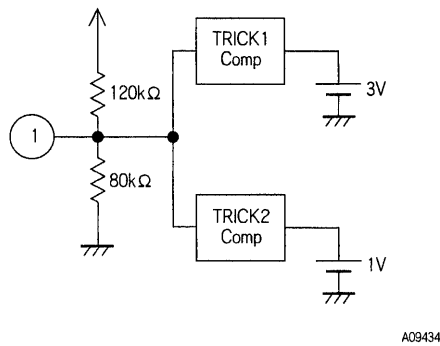
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| Pin Number | Pin Name | Standard DC Voltage (V) | Equivalent Circuit | Notes |
|------------|----------|-------------------------|--------------------|-------|
| 18<br>23   | PB FILT  | PB<br>0                 |                    |       |
|            |          | REC<br>2.5              |                    |       |

### Usage Notes

#### Control Pin Logic

#### Switching Trick Mode with Pin 1



GND < pin 1 level - DC < 1.0 V: TRICK2  
 1.0 V < pin 1 level - DC < 3.0 V: NORMAL  
 3.0 V < pin 1 level - DC < 5.0 V: TRICK1

#### NORMAL Mode

Two channels selected with pin 3 (EP/SP): ON

Envelope comparator: OFF

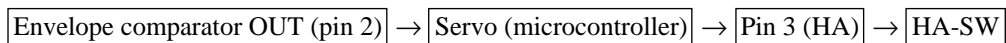
#### TRICK1 and TRICK2 Modes

All four channels: ON

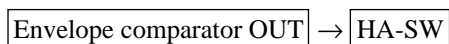
Envelope comparator: OFF

Difference between TRICK1 and TRICK2 modes (See the Block Diagram.)

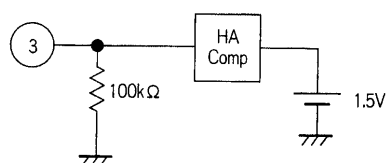
TRICK1 is a special playback mode using the following path



TRICK2 provides SP searching



HA-SW (EP/SP mode switch): Pin 3

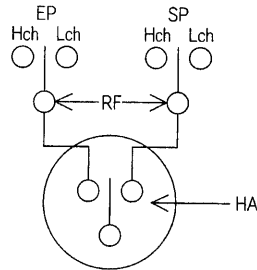


GND < pin 3 level - DC < 1.5 V: SP mode  
 1.5 V < pin 3 level - DC < 5 V: EP mode

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### Synchronization of HA Switching Timing during Playback with H-SYNC Signal

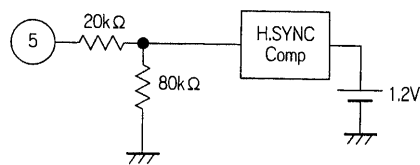
During playback, the LA70011's video circuits synchronize the HA-SW switching timing shown in the following figure with the H-SYNC signal from pin 5. (Other EP/SP switching takes place in real time.)



#### Comparator Output: Pin 2

- EP envelope > SP envelope: High (min. 4.0 V)
- EP envelope < SP envelope: Low (max. 0.7 V)

#### H-SYNC Input: Pin 5



Pin 5 level - DC > 1.5 V: H-SYNC interval

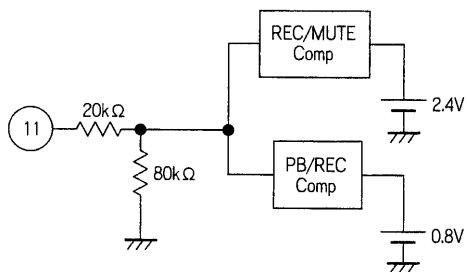
#### Playback:

- Determines timing of HA switching (EP/SP)
- Determines timing of special playback

#### Recording:

- Serves as gate pulse for REC-AGC-AMP SYNC unit

#### REC/REC-MUTE/PB Switching: Pin 11



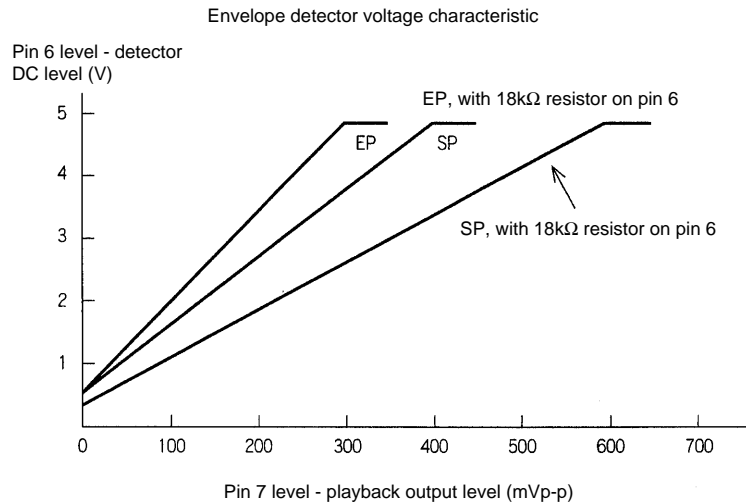
- GND < pin 11 level - DC < 1.0 V: PB mode
- 1.0 V < pin 11 level - DC < 3.0 V: REC mode, REC-MUTE
- 3.0 V < pin 11 level - DC < 5.0 V: REC mode



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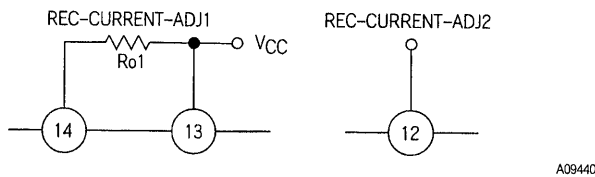
### Envelope Detector Characteristic: Pin 6

The LA70011 includes a built-in playback signal envelope detector circuit for use in automating tracking adjustment.



### REC AMP Gain Control

The LA70011 eliminates recording current adjustment by adding an automatic gain control circuit to the recording amplifier. It is also possible to change the recording current with the following methods.



### REC-CURRENT-ADJ2 Open

The internal bias forces the DC level at pin 12 to  $1/2 V_{CC}$  (that is, approximately 2.5 V), and  $R_{O1}$  determines the recording current.

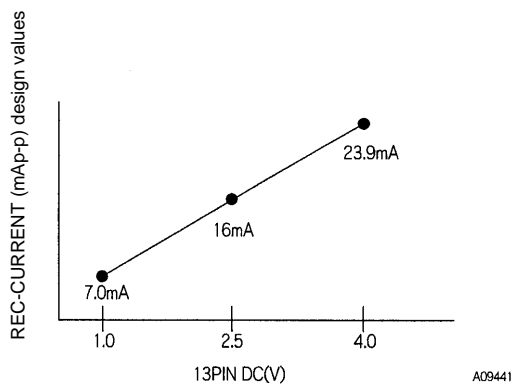
#### Design values

$R_{O1} = 1.5 \text{ k}\Omega = 16.0 \text{ mA}$  (SP) (per channel)

$R_{O1} = 1.5 \text{ k}\Omega = 12.7 \text{ mA}$  (EP)

### REC-CURRENT-ADJ2 Used

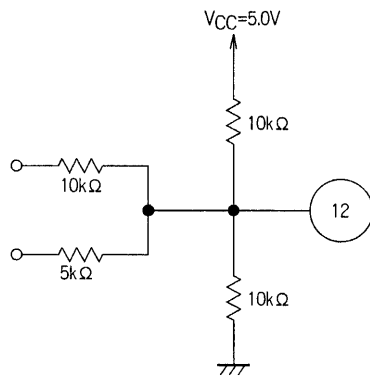
Applying a DC control voltage between 1 and 4 V to pin 12 adjusts the figure determined by  $R_{O1}$  between  $-6.0 \text{ dB}$  and  $+3.5 \text{ dB}$ .



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Note: One possible circuit for applying this voltage is the following, which provides 9 modes between 1 and 4 V.



A09442

