Ordering number : EN5710A

Monolithic Linear IC

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.

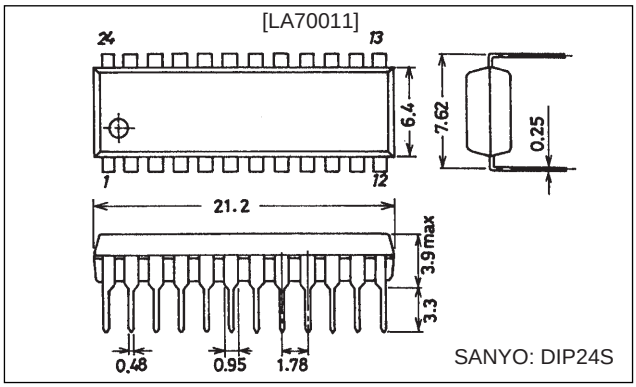
Features

- 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

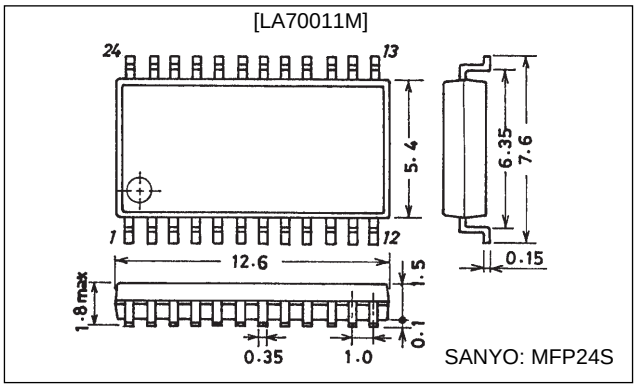
unit: mm

3067-DIP24S



unit: mm

3112-MFP24S



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V_{CC} 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	Topr		–10 to +65	°C
Storage temperature	Tstg		–40 to +150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended power supply voltage	V_{CC}		5.0	V
Operating power supply voltage range	V_{CC} 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_{CCP}	Current flowing into pin 13	44	53	60	mA
Voltage gain	SP-L CH1	$G_{VP}1$	V_{IN} = 38 mVp-p, f = 1 MHz	56	59	62	dB
	SP-H CH2	$G_{VP}2$		56	59	62	dB
	EP-L CH3	$G_{VP}3$		56	59	62	dB
	EP-H CH4	$G_{VP}4$		56	59	62	dB
Voltage gain difference		$\Delta G_{VP}1$	$G_{VP}1$ — $G_{VP}2$	–1	0	+1	dB
		$\Delta G_{VP}2$	$G_{VP}3$ — $G_{VP}4$	–1	0	+1	dB
Intermode gain difference		$\Delta G_{VP}3$	$G_{VP}3$ — $G_{VP}1$	–1	0	+1	dB
Converted input noise voltage	CH1 CH2 CH3 CH4	V_{NIN1} V_{NIN2} V_{NIN3} V_{NIN4}	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 CH2 CH3 CH4	$\Delta V_{fp}1$ ΔV_{fp2} ΔV_{fp3} ΔV_{fp4}	Ratios of the output for V_{IN} = 38 mVp-p and f = 7 MHz to the voltage gains $G_{VP}1$, $G_{VP}2$, $G_{VP}3$, and $G_{VP}4$.	–2.5	0		dB
Secondary harmonic distortion	CH1 CH2 CH3 CH4	$\Delta V_{HDP}1$ ΔV_{HDP2} ΔV_{HDP3} ΔV_{HDP4}	Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V_{IN} = 38 mVp-p and f = 4 MHz.		–40	–35	dB
Maximum output level	CH1 CH2 CH3 CH4	$\Delta V_{OMP}1$ ΔV_{OMP2} ΔV_{OMP3} ΔV_{OMP4}	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		$V_{CR}1$	Ratio of the output for V_{IN} = 38 mVp-p and f = 4 MHz to $G_{VP}1$.		–40	–35	dB
		$V_{CR}2$	Ratio of the output for V_{IN} = 38 mVp-p and f = 4 MHz to $G_{VP}2$.		–40	–35	dB
Crosstalk EP		$V_{CR}3$	Ratio of the output for V_{IN} = 38 mVp-p and f = 4 MHz to $G_{VP}3$.		–40	–35	dB
		$V_{CR}4$	Ratio of the output for V_{IN} = 38 mVp-p and f = 4 MHz to $G_{VP}4$.		–40	–35	dB
Output DC offset		$\Delta V_{ODC}1$	CH1 — CH2	–100	0	+100	mV
		$\Delta V_{ODC}2$	CH3 — CH4				
		$\Delta V_{ODC}3$	CH1 — CH3				
		$\Delta V_{ODC}4$	CH2 — CH4				
		$\Delta V_{ODC}5$	CH1 — CH4				
		$\Delta V_{ODC}6$	CH2 — CH3				
Envelope detector output pin voltage		V_{ENV}	T6 DC level with no signal input.	0.0	08	1.3	V
Envelope detector output pin voltage SP		$V_{ENVSP}1$	T6 DC level at which T7A output level is 175 mVp-p for f = 4 MHz.	2.0	2.5	3.0	V
		$V_{ENVSP}2$	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		$V_{ENVEP}1$	T6 DC level at which T7A output level is 125 mVp-p for f = 4 MHz.	2.0	2.5	3.0	V
		$V_{ENVEP}2$	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		$V_{COMP}1$	T2 DC level for V_{IN} = 38 mVp-p and f = 4 MHz.		0.4	0.7	V
		$V_{COMP}2$	T2 DC level for V_{IN} = 38 mVp-p and f = 4 MHz.	4.5	4.8		V
SW-Tr on resistance during playback		$R_{PON}17$ $R_{PON}22$	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
Recording Mode						
Current drain	I_{CCR}	Current input at pin 13.	52	59	66	mA
REC AGC AMP output level	V_{RSP}	Output level for V_{IN} = 400 mVp-p and f = 4 MHz.	127	135	143	mVp-p
	V_{REP}		104	111	119	mVp-p
Intermode gain difference	ΔGVR	VRSP/VREP	1.4	1.7	2.0	dB
REC AGC AMP control characteristic	ΔV_{AGC}1-SP ΔV_{AGC}1-EP	Output level divided by V_{RSP} or V_{REP} for f = 4 MHz and V_{IN} = 700 mVp-p.		0.5	1.0	dB
	ΔV_{AGC}2-SP ΔV_{AGC}2-EP	Output level divided by V_{RSP} or V_{REP} for f = 4 MHz and V_{IN} = 100 mVp-p.	–1.0	–0.5		dB
REC AGC AMP frequency characteristic	ΔV_{FRS} ΔV_{FRE}	Ratio of f = 7 MHz output to f = 1 MHz output for V_{IN} = 400 mVp-p. *2	–1	0	+1	dB
REC AGC AMP secondary primary distortion	ΔV_{HDRS} ΔV_{HDRE}	Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V_{IN} = 400 mVp-p and f = 4 MHz.		–45	–40	dB
REC AGC AMP maximum output level	ΔV_{MOSP} ΔV_{MOEP}	Output level, for f = 4 MHz, at which the secondary distortion is –35 dB.	20	22		mApp
REC AGC AMP muting attenuation	ΔV_{MRS} ΔV_{MRE}	Output level divided by V_{RSP} or V_{REP} for f = 4 MHz and V_{IN} = 400 mVp-p.		–45	–40	dB
REC AGC AMP cross modulation relative level	ΔV_{CYS} ΔV_{CYE}	Output ratio (4M ± 629k)/4M for V_{IN} = 400 mVp-p and f = 4 MHz at T9A and V_{IN} = 2.4 Vp-p and f = 629 kHz at T10A.		–45	–40	dB
HA REC threshold level	H_{AR}-1	SP → EP : *1	1.7		5.0	V
	H_{AR}-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.

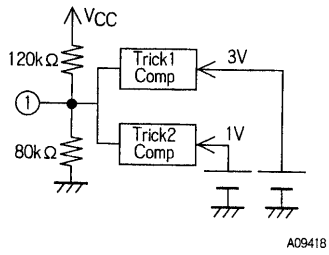
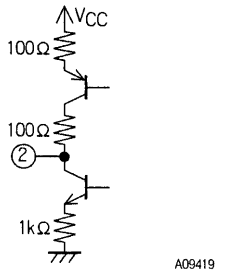
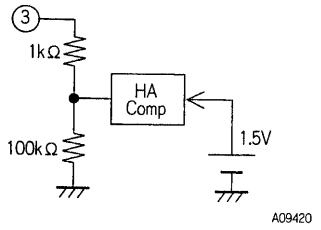
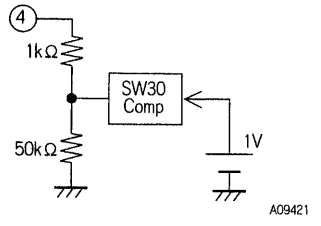
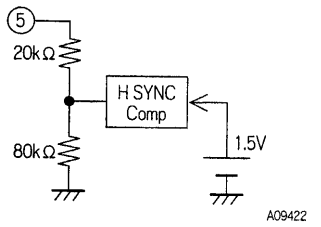
* The resistance between pins 13 and 14 must be accurate to within 1.0%.

*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.

Pin Descriptions

Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
1	TRICK-H				Trick1 3.0 V NORMAL 1.0 V Trick2
2	COMP-OUT	PB	H: min. 4.5 V L: max. 0.7 V		EP > SP ENV High
		REC	Open		
3	HA (EP/SP)				EP 1.0 V SP
4	SW30				Hch 1.0 V Lch
5	H-SYNC				SYNC H 1.5 V L

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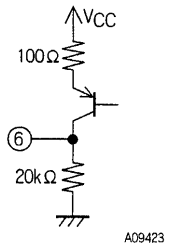
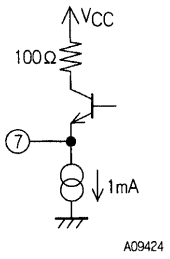
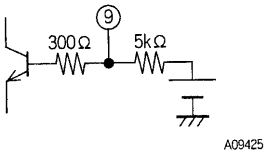
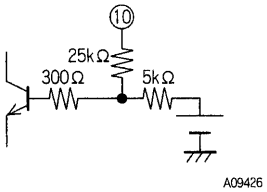
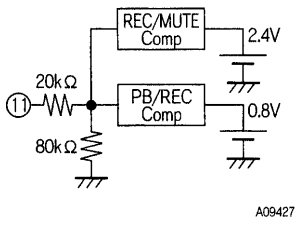
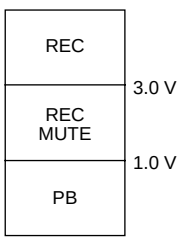
Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
6	ENVDET-OUT	PB	See relevant documents.		
		REC	0		
7	PB-OUT	PB	1.7		
		REC	2.1		
8 20	GND				
9	REC-Y-IN	PB	4.0		
		REC	3.7		
10	REC-C-IN	PB	4.0		
		REC	3.7		
11	REC/MUTE/PB				

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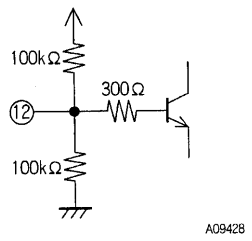
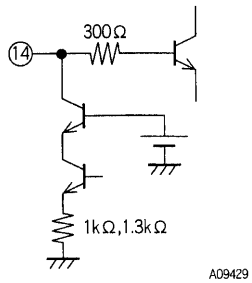
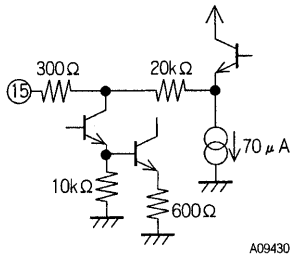
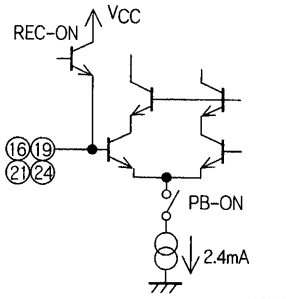
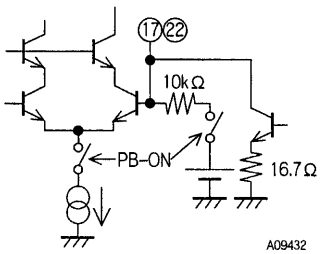
Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
12	REC-CURRENT-ADJ2	PB	2.5 V		
		REC	2.5 V		
13	V_{CC}				
14	REC-CURRENT-ADJ1	PB	5.0		
		REC	4.5		
15	REC-AGC-FILT	PB	0		
		REC	1.6		
16 19 21 24	SP L-IN SP H-IN EP L-IN EP H-IN	PB	2.1		
		REC	4.1		
17 22	REC SP OUT EP OUT	PB	2.1		
		REC	4.1		

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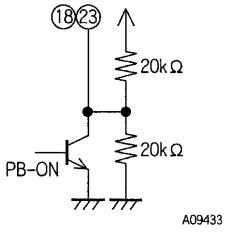
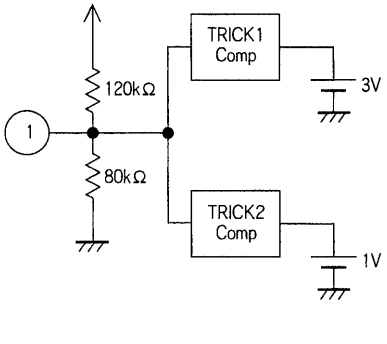
Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
18 23	PB FILT	PB	0		
		REC	2.5		

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

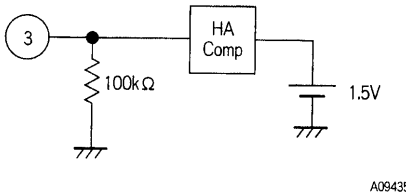
Difference between TRICK1 and TRICK2 modes (See the Block Diagram.)
TRICK1 is a special playback mode using the following path

Envelope comparator OUT (pin 2) → Servo (microcontroller) → Pin 3 (HA) → HA-SW

TRICK2 provides SP searching

Envelope comparator OUT → HA-SW

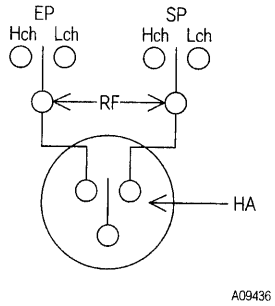
HA-SW (EP/SP mode switch): Pin 3



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

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.)

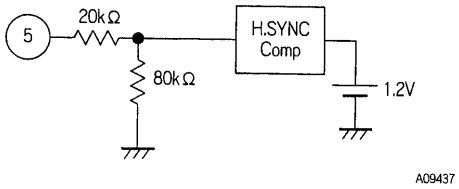


Comparator Output: Pin 2

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:

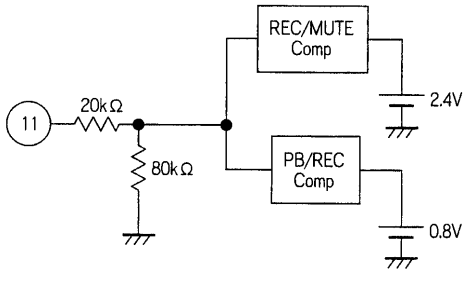
— Determines timing of HA switching (EP/SP)

— Determines timing of special playback

Recording:

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

REC/REC-MUTE/PB Switching: Pin 11



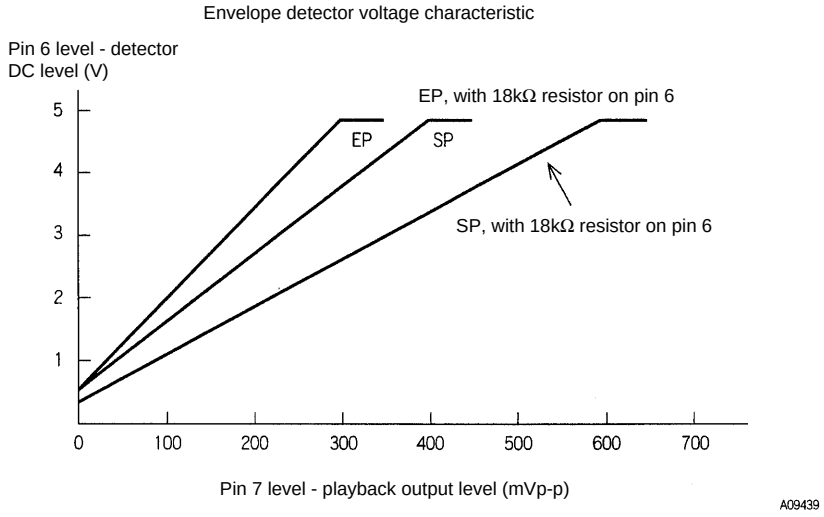
GND < pin 11 level - DC < 1.0 V: PB mode

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

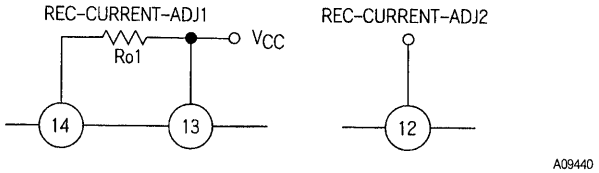
Envelope Detector Characteristic: Pin 6

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.

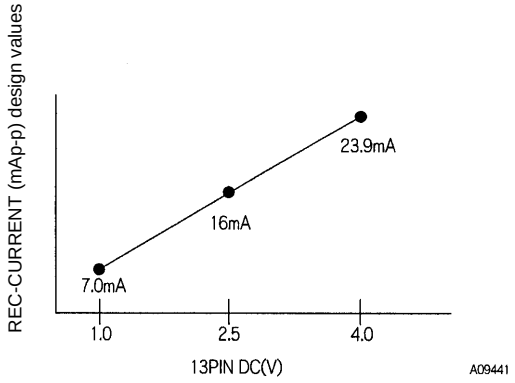
Design values

R_O1 = 1.5 kΩ = 16.0 mA (SP) (per channel)

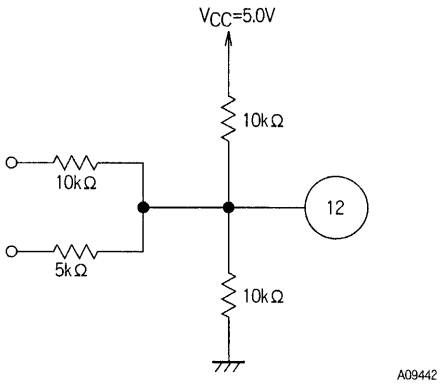
R_O1 = 1.5 kΩ =12.7 mA (EP)

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 dB and +3.5 dB.



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



Block Diagram