

**SANYO****LA9520V****AV Coupler Receiver**

## Overview

The LA9520V is a receiver IC developed for free-space infrared transmission of stereo audio and video signals. It integrates all the required functions for reception, including I/V conversion for the received signal, a preamplifier, ALC, audio signal demodulation, and video signal demodulation functions, on a single chip. An AV coupler system can be implemented easily using this IC and a transmitter IC (such as the LA9511W or LA9512W).

## Functions and Features

### [Input Block]

- I/V conversion featuring excellent wideband characteristics
- Preamplifier ALC with wide ALC operating range

### [Audio Block]

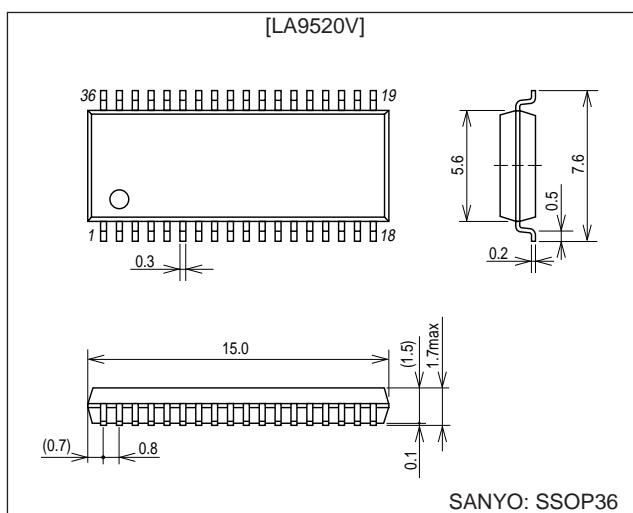
- Audio demodulator: Built-in 4.3 and 4.8 MHz demodulation circuits.
- Muting function: Mutes the output stage when there is no input signal. The muting function operating level can be adjusted from an input pin.
- Output amplifiers: The right and left levels can be adjusted by applying voltages to input pins. Electronic volume control support.

### [Video Block]

- Video demodulator
- Video amplifier: Supports  $75\ \Omega$  drive. Adjustable output level: supports an electronic volume control.
- Muting function: Mutes the output stage when there is no input signal. The muting function operating level can be adjusted from an input pin.
- Filter: Removes unneeded high-frequency components.

## Package Dimensions

unit: mm

**3247A-SSOP36**

## Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\ max}$		6.5	V
Allowable power dissipation	$P_d\ max$		550	mW
Operating temperature	$T_{opr}$		-20 to +70	°C
Storage temperature	$T_{stg}$		-40 to +150	°C

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## LA9520V

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		5.0	V
Allowable operating voltage range	$V_{CC \text{ opg}}$		4.8 to 6.0	V

### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 5 \text{ V}$

Representative input conditions: Carrier input frequency - Audio left channel: 4.3 MHz

Audio right channel: 4.8 MHz

Video: 11.8 MHz

Audio modulation frequency:  $f_m = 400 \text{ Hz}$ , 1 kHz, modulation  $\Delta f = \pm 22.5 \text{ kHz}$  (standard),  $\pm 75 \text{ kHz}$

Video signal input: Modulation of 2 MHz (standard) for a 0.5 Vp-p NTSC composite video signal

With the circuit adjusted to an audio demodulated output of 300 mVrms and a video demodulated output of 1 Vp-p for the above standard input.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}$	No input, $V_{CC} = 5 \text{ V}$ , Test pins: 3, 7, 2, 5, and 32	45	68	83	mA
[Preamplifier Block] *An unmodulated carrier input is used for preamplifier block testing.						
Preamplifier frequency characteristics	$F_{pre}$	Pin 9 input. The $-3 \text{ dB}$ frequency band, $f = 11.8 \text{ MHz}$ , $V_{IN} = 70 \text{ dB}\mu$ , Test pin: 31		20		MHz
Input impedance	$Z_{in}$	Pin 9 internal voltage conversion resistor, Test pin: 9	0.3	0.5	1.0	$\text{k}\Omega$
Output level	$V_{outpre}$	The output level when the AGC is on, $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 31	0.55	0.9	1.5	Vp-p
Gain (AGC off)	$G_{pre}$	$f = 11.8 \text{ MHz}$ , $V_{IN} = 70 \text{ dB}\mu$ , Test pin: 31	17	23	29	dB
Harmonic distortion 1	$TH1_{Pre}$	The second harmonic of 12.5 MHz, $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 31		-40		dB
[Video Block]						
Video amplifier gain adjustment voltage	$V_{vcont}$	Pin 9 input. For a 2 MHz modulated input, The voltage such that the pin 1 output level becomes 1 Vp-p, $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 35	0.05		1.15	Vdc
Demodulator linearity	$LIN_{deomo}$	Pin 36 input. The conversion voltage ratio linearity at the points $\pm 3.5 \text{ MHz}$ from the 12.5 MHz reference. $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 33	-7	0	+7	%
Demodulator demodulation leakage	$V_{leak}$	Pin 36 input. The pin 33 leakage when a carrier frequency of 12.5 MHz is applied. $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 33		-50		dB
Demodulator second harmonic distortion	$THD2$	Pin 36 input. The second harmonic leakage level when a carrier frequency of 12.5 MHz is applied. $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 33		-55		dB
Demodulator conversion output	$V_{conv.}$	Pin 36 input. The output value when a 2 MHz modulated waveform is input, $V_{IN} = 100 \text{ dB}\mu$ , Test pin: 33	0.1	0.23	0.4	Vp-p
Video amplifier gain	$G_{Vamp}$	Pin 34 input. With a $75 \Omega$ load on pin 1, the total gain after adjusting the output to be 1 Vp-p, $f = 150 \text{ kHz}$ . $V_{IN} = 0.1 \text{ Vp-p}$ , Test pin: 1		13		dB
Video harmonic distortion 1	$THD1V$	The second harmonic of 150 kHz, $V_{IN} = 0.1 \text{ Vp-p}$ , Test pin: 1		-50		dB
Video harmonic distortion 2	$THD2V$	The second harmonic of 11 MHz, $V_{IN} = 0.1 \text{ Vp-p}$ , Test pin: 1		-48		dB
Video driver frequency characteristics	$F_{vamp}$	The gain ratio for 150 kHz and 5 MHz. $V_{IN} = 0.1 \text{ Vp-p}$ , Test pin: 1	-6	-3	+3	dB
Driver maximum output voltage	$V_{outmax}$	$V_{CC} = 5 \text{ V}$ , the maximum output amplitude with a $75 \Omega$ load. Test pin: 1	1.2	1.5		Vp-p
DC clamp level difference	$V_{CLMP}$	The difference between the pin 4 and the pin 5 voltages with no input. Test pins: 4 and 5	0.05	0.5		Vdc

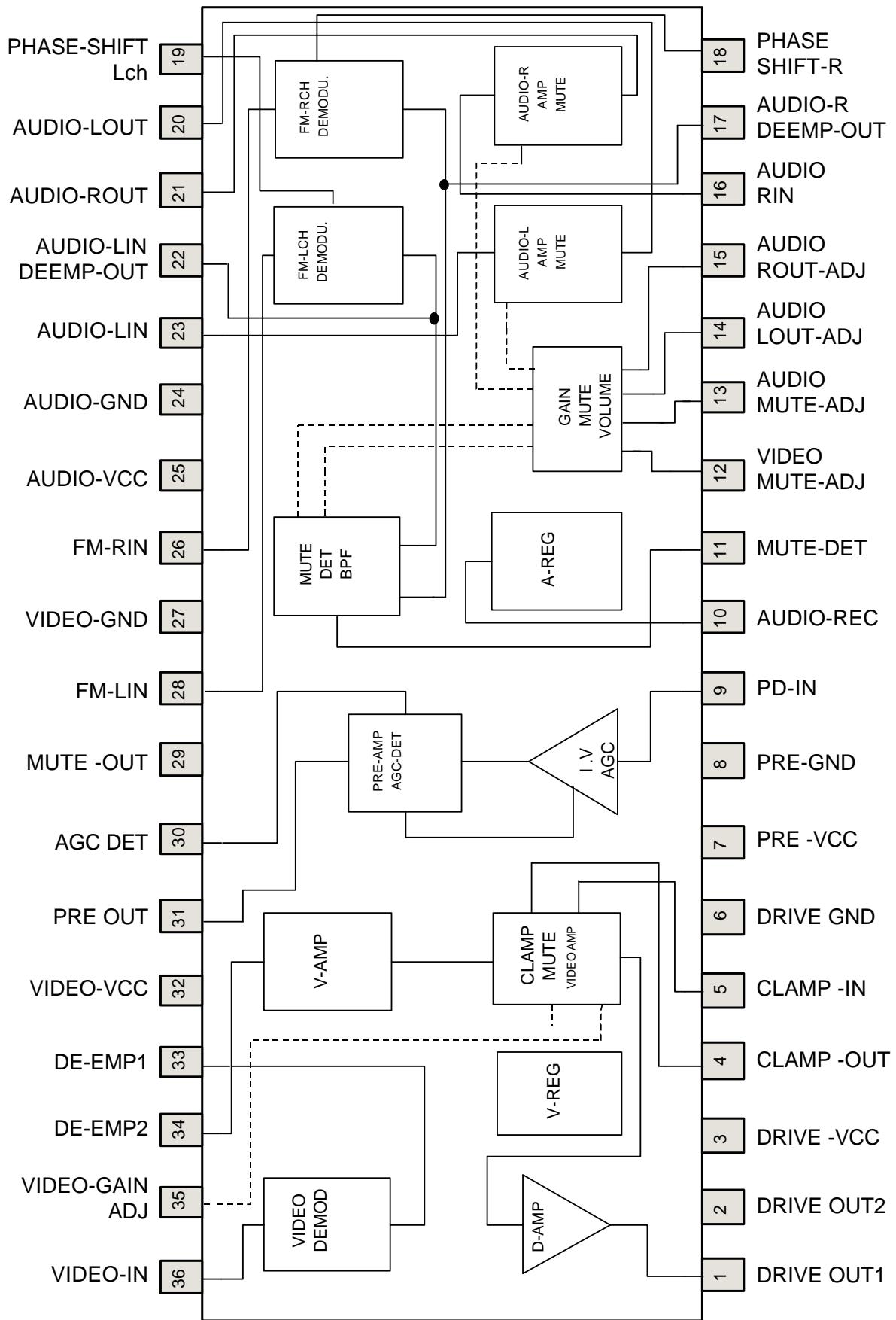
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## LA9520V

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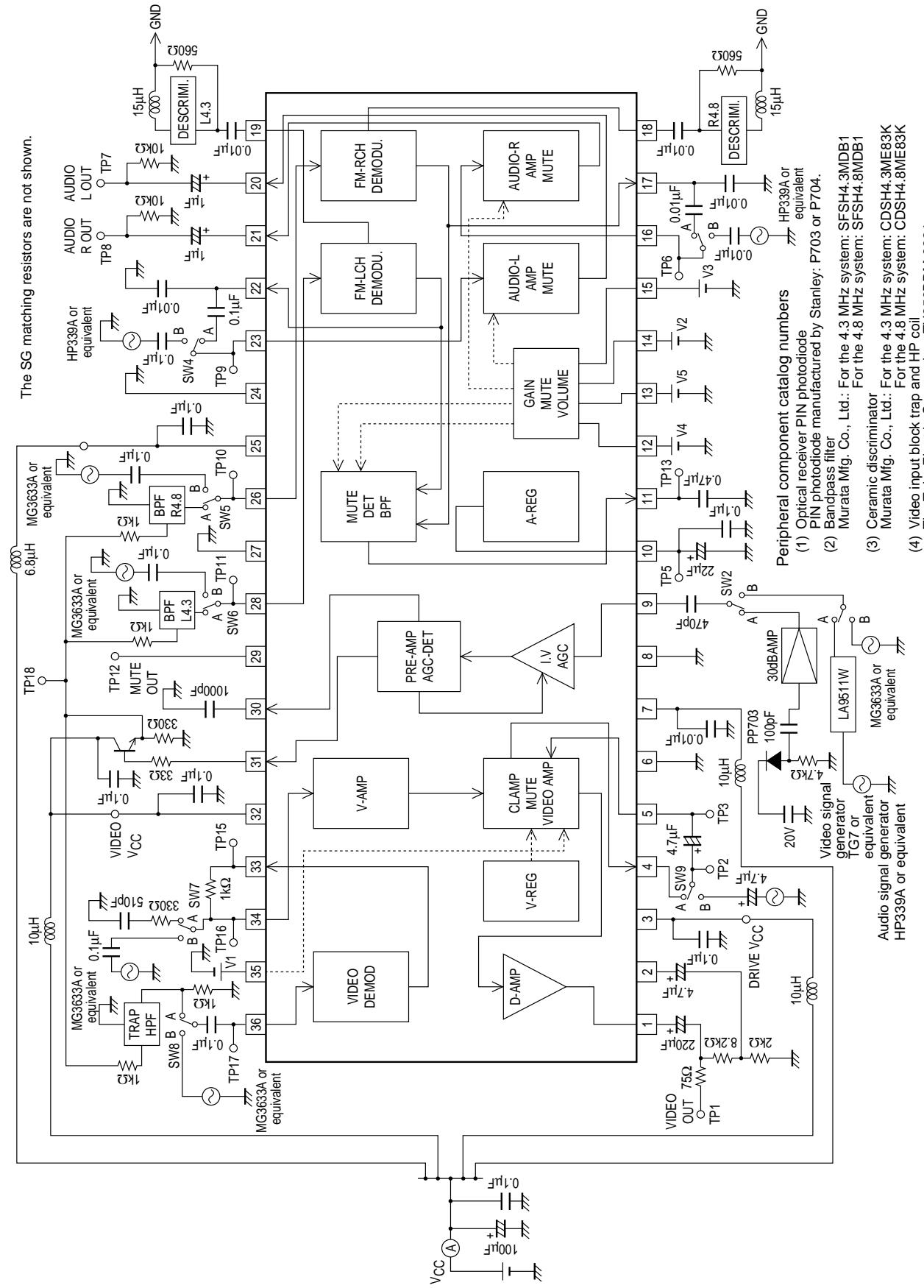
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>[Audio Block]</b> * Audio block initial output is adjusted with the pin 9 input.						
Audio left channel Output adjustment voltage	VacontL	For a 4.3 MHz, $\Delta f = \pm 22.5$ kHz, fm = 400 Hz input, the pin 14 adjustment voltage such that the pin 20 output is 30 mV rms. $V_{IN} = 80$ dB $\mu$ , Test pin: 14	0.05		1.15	Vdc
Audio right channel Output adjustment voltage	VacontR	For a 4.8 MHz, $\Delta f = \pm 22.5$ kHz, fm = 400 Hz input, the pin 15 adjustment voltage such that the pin 21 output is 30 mV rms. $V_{IN} = 80$ dB $\mu$ , Test pin: 15	0.05		1.15	Vdc
Audio right channel demodulator output	VdemR 75 kHz	After reference output adjustment, the pin 21 demodulator output when the input to pin 26 is 4.8 MHz $\pm 75$ kHz, fm = 1 kHz, $V_{IN} = 80$ dB $\mu$ , Test pin: 21	0.6	0.9	1.2	Vrms
Audio left channel demodulator output	VdemL 75 kHz	After reference output adjustment, the pin 20 demodulator output when the input to pin 28 is 4.3 MHz $\pm 75$ kHz, fm = 1 kHz, $V_{IN} = 80$ dB $\mu$ , Test pin: 20	0.6	0.9	1.2	Vrms
Audio left channel amplifier output	GvampL	The total amplifier gain (after output level adjustment) from the pin 23 input to the pin 20 output. $V_{IN} = 100$ mVrms, f = 400 Hz., Test pin: 20		10		dB
Audio right channel amplifier output	GvampR	The total amplifier gain (after output level adjustment) from the pin 16 input to the pin 21 output. $V_{IN} = 100$ mVrms, f = 400 Hz., Test pin: 21		10		dB
Audio amplifier frequency characteristics (L)	FA-AMP L	The frequency characteristics (after output level adjustment) from pin 23 to pin 20. The frequency such that the level is down $-3$ dB from the output reference at f = 400 Hz, Test pin: 20	15			kHz
Audio amplifier frequency characteristics (R)	FA-AMP R	The frequency characteristics (after output level adjustment) from pin 16 to pin 21. The frequency such that the level is down $-3$ dB from the output reference at f = 400 Hz, Test pin: 21	15			kHz
Left channel total harmonic distortion	THDL	The left channel distortion when a 4.3 MHz, $\Delta f = \pm 22.5$ kHz, fm = 1 kHz signal is input to pin 28. $V_{IN} = 80$ dB $\mu$ , Test pin: 20		1.0	3	%
Right channel total harmonic distortion	THDR	The right channel distortion when a 4.8 MHz, $\Delta f = \pm 22.5$ kHz, fm = 1 kHz signal is input to pin 26. $V_{IN} = 80$ dB $\mu$ , Test pin: 21		1.0	3	%
Left channel output noise voltage	VNLch	With no modulation, the standard output reference signal-to-noise ratio IHFA filter, the LA9520V independent signal-to-noise ratio, $V_{IN} = 80$ dB $\mu$ , Test pin: 20	45	55		dB
Right channel output noise voltage	VNRch	With no modulation, the standard output reference signal-to-noise ratio IHFA filter, the LA9520V independent signal-to-noise ratio, $V_{IN} = 80$ dB $\mu$ , Test pin: 21	45	55		dB
<b>[Muting Block]</b>						
Audio muting operating input level 1 (Muting level adjustment voltage)	Vmcont1	With no carrier input, the value of the voltage adjusted to mute the audio output. * With an external 30 dB amplifier connected to pin 9. $R_g = 4.7$ k $\Omega$ Test pin: 13	0.05		1.05	Vdc
Video muting operating input level 2 (Muting level adjustment voltage)	Vmcont2	With no carrier input, the value of the voltage adjusted to mute the audio output. * With an external 30 dB amplifier connected to pin 9. $R_g = 4.7$ k $\Omega$ Test pin: 12	0.05		1.05	Vdc
Muted signal output Low level	VmuteL	The pin 29 output when the muting function is off. Test pin: 29			0.5	Vdc
Muted signal output High level	VmuteH	The pin 29 output when the muting function is on. Test pin: 29	$V_{CC} - 1$			Vdc
Noise detection voltage level	VDET	The pin 11 voltage with no carrier input. With an external 30 dB amplifier connected to pin 9.		3.0		Vdc

## Pin Assignment and Block Diagram



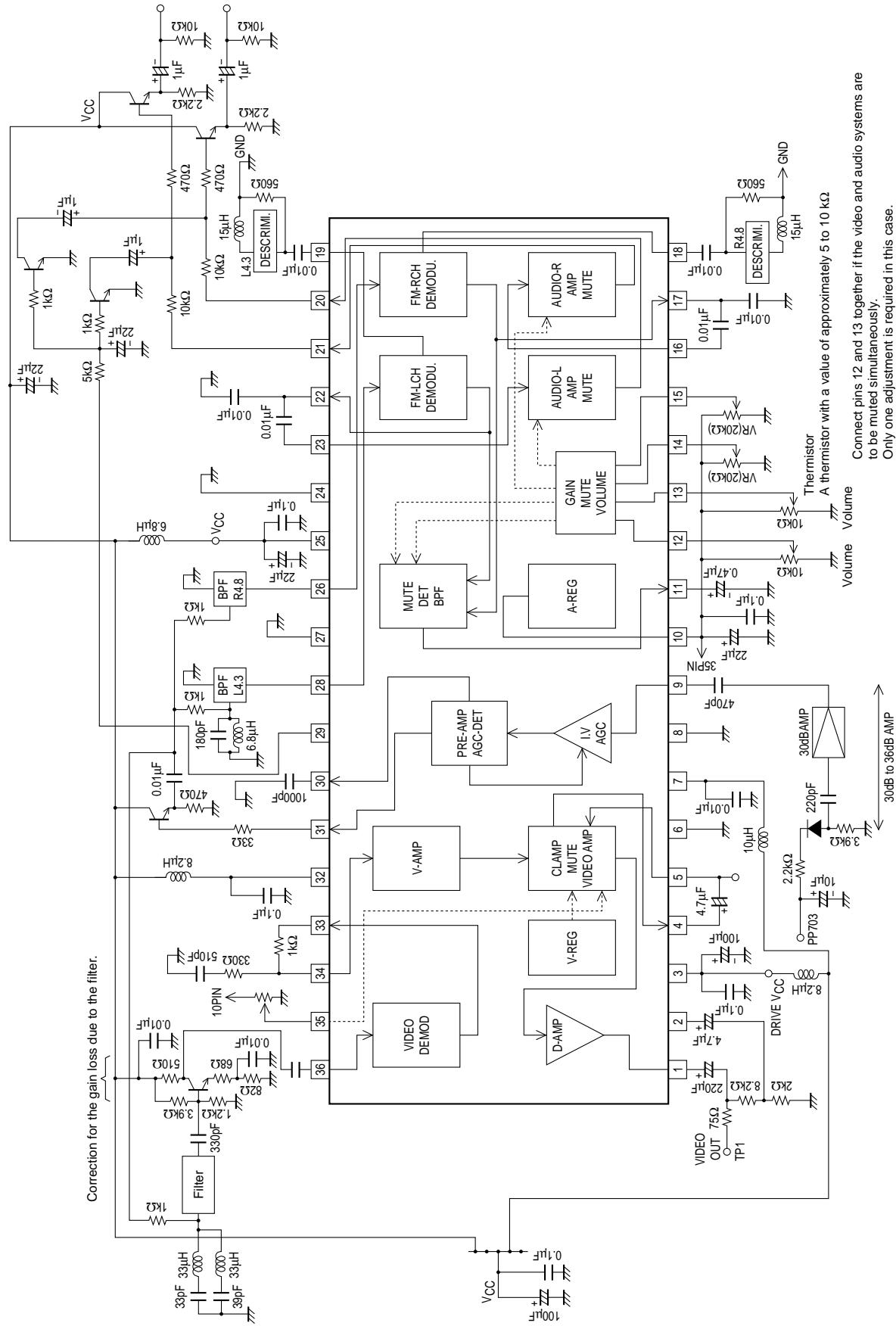
## Test Circuit Diagram

This circuit diagram is provided for reference purposes. Applications adopting this design may require optimization.



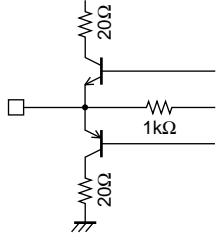
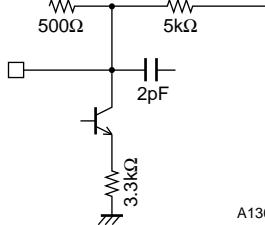
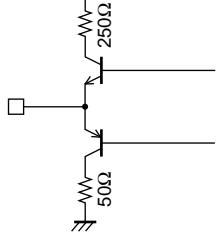
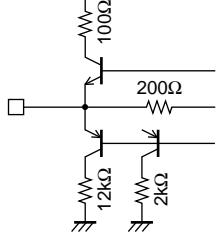
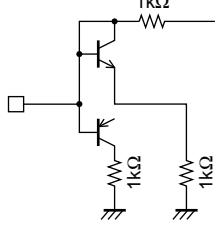
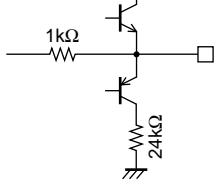
## Application Circuit Diagram

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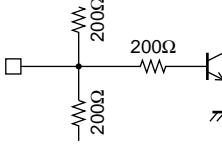
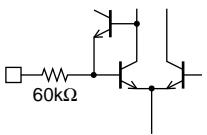
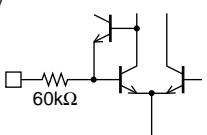
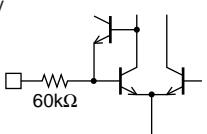
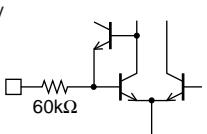
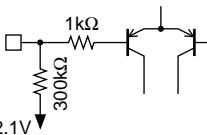
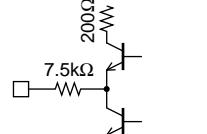
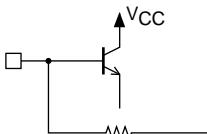
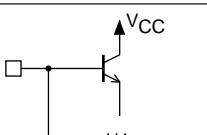
## Pin Functions

Pin No.	Pin	Voltage (V)	Function	Equivalent circuit
1	DRIVEOUT	2.1	Video output	 A13092
2	DRIVEOUT2	2.1	Video output 2	 A13093
3	DRIVE-V <sub>CC</sub>	V <sub>CC</sub>	Driver power supply	
4	CLAMP-OUT	2.7	Sync tip clamp output	 A13094
5	CLAMP-IN	1.8	Sync tip clamp input	 A13095
6	DRIVE-GND	0	Driver ground	
7	PRE-V <sub>CC</sub>	V <sub>CC</sub>	Preamplifier power supply	
8	PRE-GND	0	Preamplifier ground	
9	PD-IN	1.3	PIN photodiode input The amplifier should have a gain between 30 and 36 dB.	 A13096
10	AUDIO-REG	1.25	Reference voltage supply bypass capacitor connection	 A13097

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## LA9520V

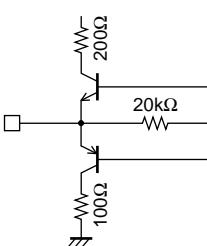
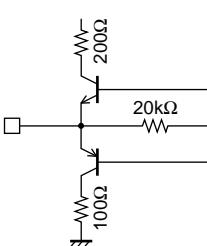
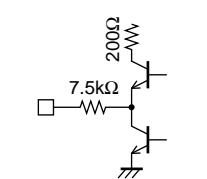
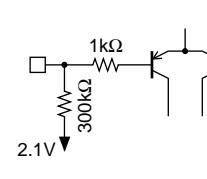
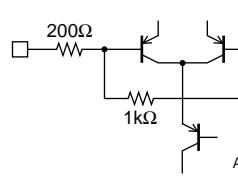
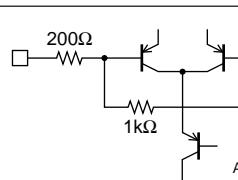
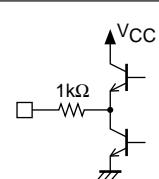
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Pin No.	Pin	Voltage (V)	Function	Equivalent circuit
11	MUTE-DET	1.25	Mute detection	 A13098
12	VIDEO-MUTE ADJ	1.25	Video muting level adjustment	$\text{REG} = 1.25 \text{ V}$  A13099
13	AUDIO-MUTE ADJ	1.25	Audio muting level adjustment	$\text{REG} = 1.25 \text{ V}$  A13100
14	AUDIO-LOUT ADJ	1.25	Audio left channel output level adjustment	$\text{REG} = 1.25 \text{ V}$  A13101
15	AUDIO-ROUT ADJ	1.25	Audio right channel output level adjustment	$\text{REG} = 1.25 \text{ V}$  A13102
16	AUDIO-RIN	2.2	Audio right channel input	 A13103
17	AUDIO-R DEEMP-OUT	1.5	Audio right channel deemphasis output	 A13104
18	PHASE-SHIFT Rch	3.1	Right channel phase shift	 A13105
19	PHASE-SHIFT Lch	3.1	Left channel phase shift * Pins 18 and 19 are used to connect ceramic discriminators.	 A13106

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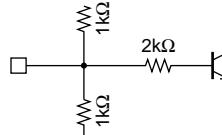
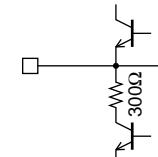
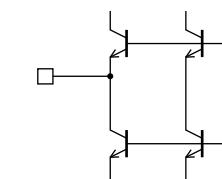
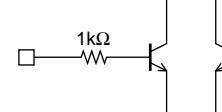
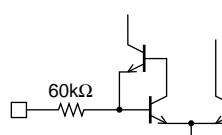
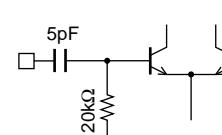
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Pin No.	Pin	Voltage (V)	Function	Equivalent circuit
20	AUDIO-LOUT	2.1	Audio left channel output	 A13107
21	AUDIO-ROUT	2.1	Audio right channel output	 A13108
22	AUDIO-L DEEMP-OUT	1.5	Audio left channel deemphasis output	 A13109
23	AUDIO-LIN	2.2	Audio left channel input	 A13110
24	AUDIO-GND	0	Audio ground	
25	AUDIO-Vcc	Vcc	Audio power supply	
26	FM-RIN	2.1	FM right channel demodulator input * Ceramic bandpass filter: 4.8 MHz	 A13111
27	VEDEO-GND	0	Video ground	
28	FM-LIN	2.1	FM left channel demodulator input * Ceramic bandpass filter: 4.3 MHz	 A13112
29	MUTEOUT	0.03	Muting output Outputs a low level when a carrier is present and a high level when there is no carrier present.	 A13113

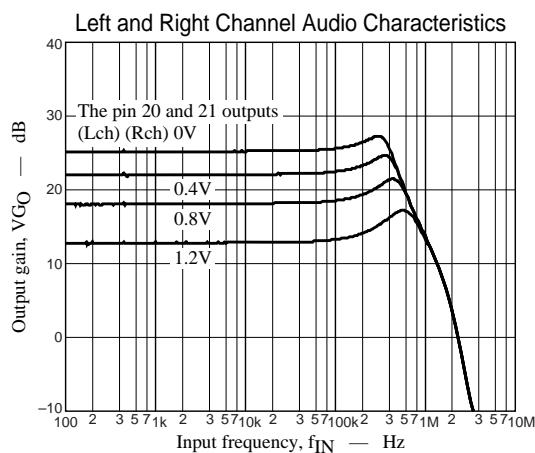
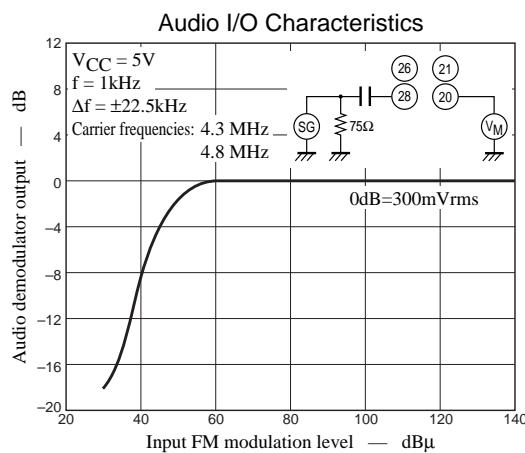
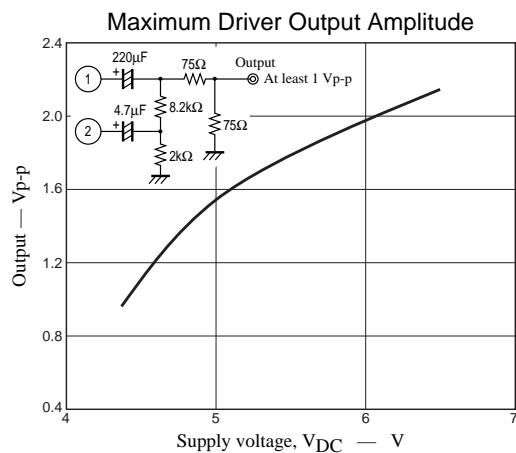
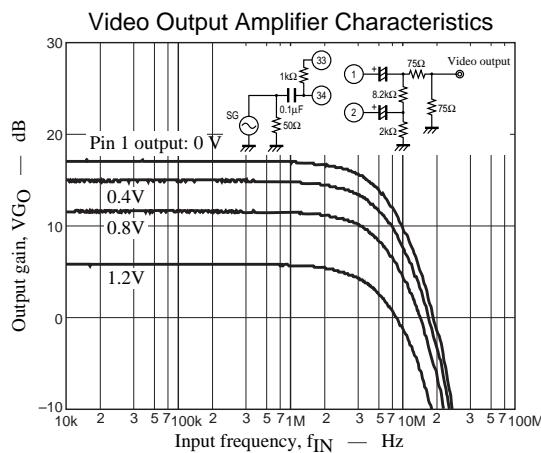
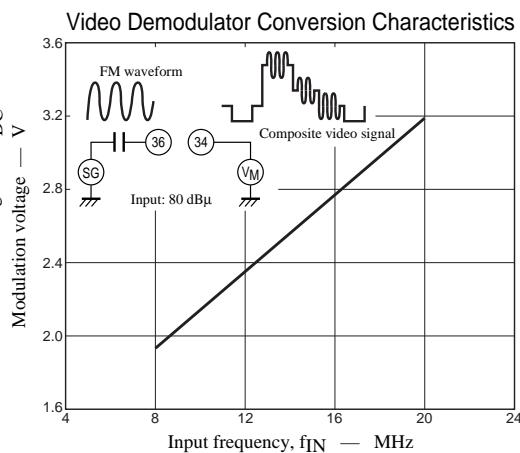
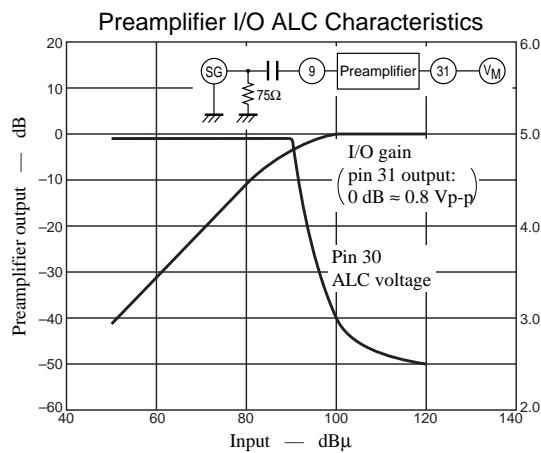
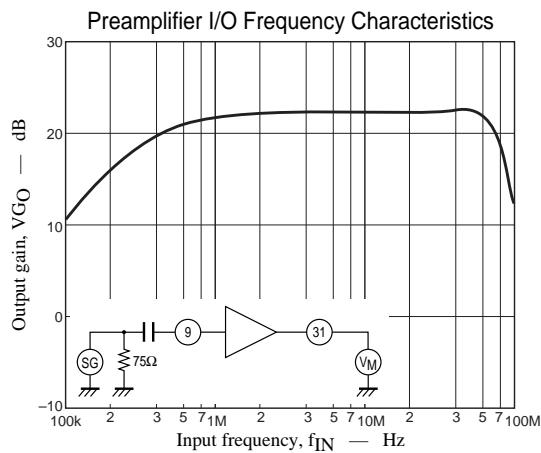
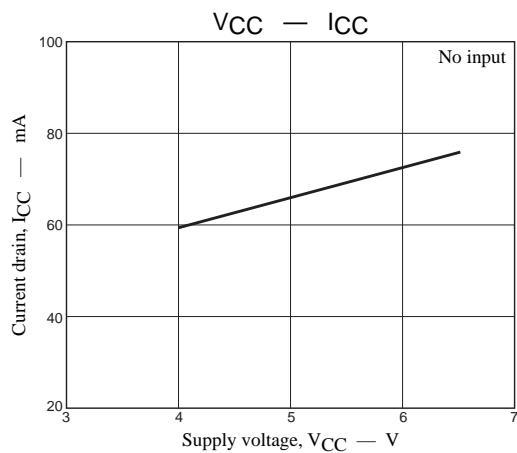
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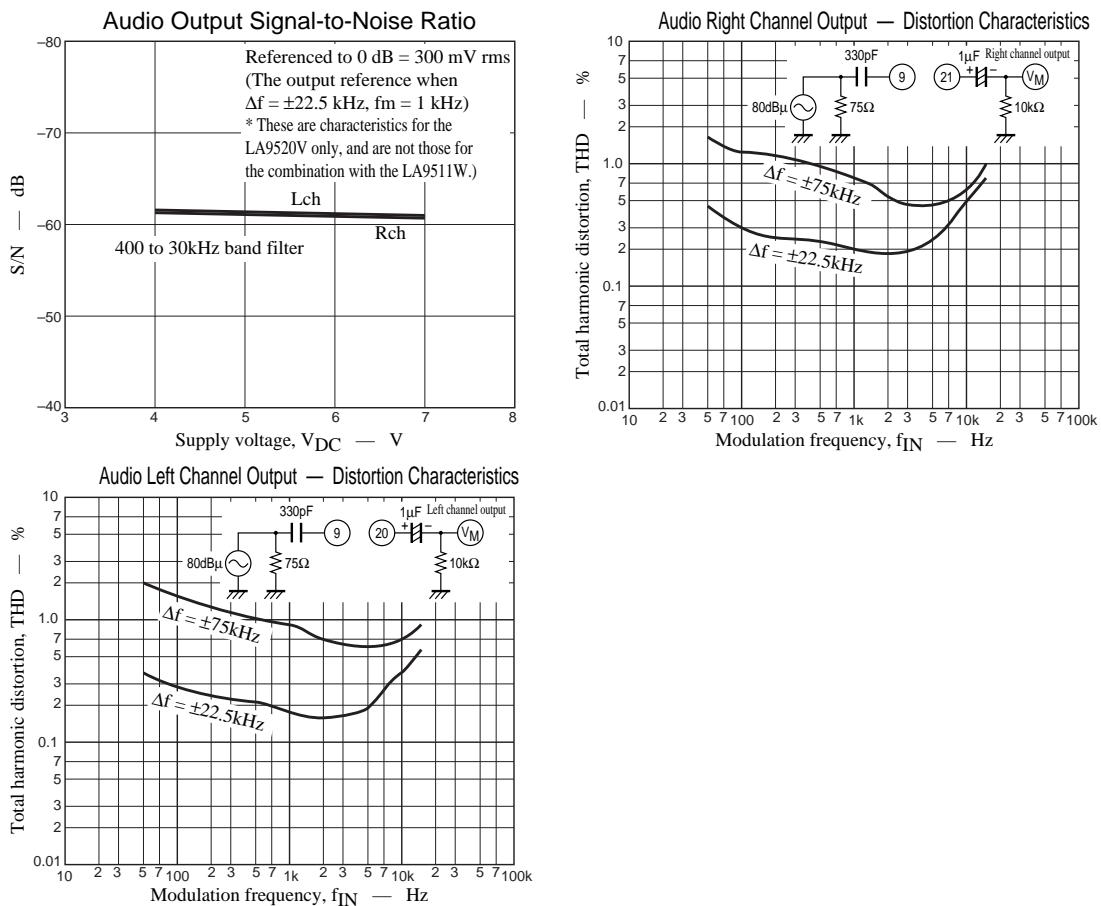
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Pin No.	Pin	Voltage (V)	Function	Equivalent circuit
30	AGCDET	4.9	AGC detector	 A13114
31	PREOUT	5.0		 A13115
32	VIDEO-V <sub>CC</sub>	V <sub>CC</sub>	Video power supply	
33	DE-EMP1	2.7	Video deemphasis amplifier output	 A13116
34	DE-EMP2	2.7	Video deemphasis amplifier input	 A13117
35	VIDEO-GAIN ADJ	0.7	Video gain adjustment	 A13118
36	VIDEO-IN	0.7	Video input	 A13119

# LA9520V





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