Ordering number : ENN6468

Monolithic Linear IC

LA9511W

AV Remote Coupler Transmitter

Overview

The LA9511W is a transmitter IC developed for free-space infrared transmission of stereo audio and video signals. It integrates all the required functions for transmission, including audio signal modulation, video signal modulation, LED drive, and other functions on a single chip. An AV coupler system can be implemented easily using this IC and a receiver IC (such as the LA9520V).

Functions

[Audio Block]

- Audio input block ALC with wide AGC operating range
- Integration of passive components used for preemphasis and time constants onto the chip.
- Deviation adjustment amplifier. Adjustable from an externally applied voltage: supports an electronic variable resistor function.
- Filter: Removes unneeded high-frequency components.
- Audio VCO. PLL circuit adopted for adjustment-free operation.

[Video Block]

- Video deviation amplifier. Adjustable from an externally applied voltage: supports an electronic variable resistor function.
- Video preemphasis
- Video VCO. f0 adjustment from an externally applied voltage: supports an electronic variable resistor function.
- Filter. Removes unneeded high-frequency components.

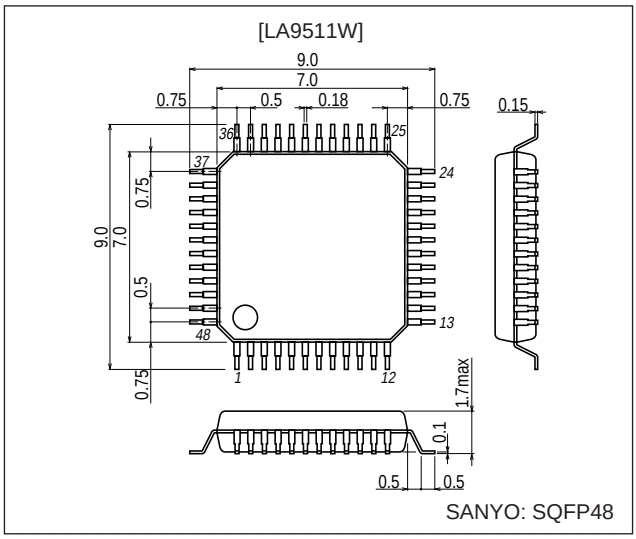
[Driver Block]

- Mixer and driver amplifier. Features excellent high-frequency characteristics and allows addition of external data (remote control).

Package Dimensions

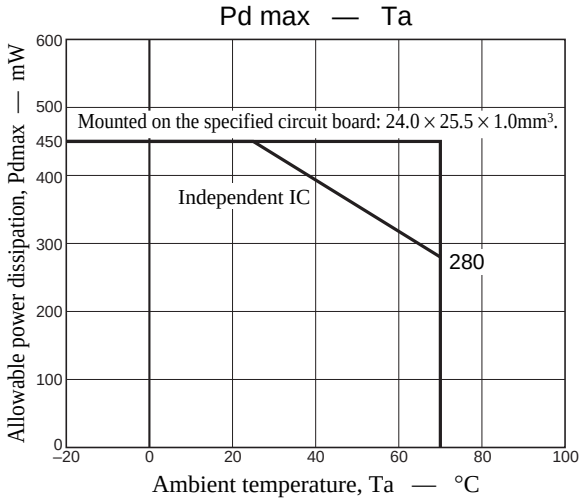
unit: mm

3163A-SQFP48



SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		5.5	V
Allowable power dissipation	Pd max	Mounted on the specified circuit board.	450	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +150	°C

Note: * Specified circuit board: 24.0 × 25.5 × 1.0 mm³.

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		4.8	V
Allowable operating voltage range	V_{CC} opg		4.5 to 5.2	V

Electrical Characteristics at Ta = 25°C, V_{CC} = 4.8 V

Carrier frequency (Audio left channel: 4.3 MHz, right channel: 4.8 MHz, video: 11.8 MHz)
Audio input frequency: 400 Hz, input level: –30 dBs,
video input: 0.5 Vpp NTSC composite video signal 0 dBs = 775 mVrms.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}1$	No input, except for the driver current Test pins: 12, 31, and 32	43	53	63	mA
	$I_{CC}2$	No input, driver current Test pin: 24	14.5	19	23.5	mA
	$I_{CC}3$	No input, current in standby mode Test pins: 12, 31, and 32		1.0	3	mA
[Audio Block]						
Deviation adjustment range	Vde-adj	Standard input, the control voltage for ±22.5 kHz Test pin: 45	0.1		1.25	V
Left channel preemphasis gain	GvpL	The gain difference between 400 Hz and 10 kHz with the AGC off Test pin: 3	11.7	13.7	15.7	dB
Right channel preemphasis gain	GvpR	The gain difference between 400 Hz and 10 kHz with the AGC off Test pin: 5	11.7	13.7	15.7	dB
ALC output level (L)	V_{ALC}L	AGC off, Test pin: 3	–32.0	–30	–28.0	dBs
ALC output level (R)	V_{ALC}R	AGC off, Test pin: 5	–32.0	–30	–28.0	dBs

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
ALC on output (L)	$V_{ALON}L$	AGC on, V_{IN} = –15 dBs (1 kHz), Left and right input Test pin: 3	–25.5	–22.0	–19.0	dBs
ALC on output (R)	$V_{ALON}R$	AGC on, V_{IN} = –15 dBs (1 kHz), Left and right input Test pin: 5	–25.5	–22.0	–19.0	dBs
ALC on output L/R deviation	$V_{ALON}L/R$	AGC on, V_{IN} = –15 dBs (1 kHz), The output difference for left and right input, Test pins: 3 and 5	–2.5	0	2.5	dB
THDL (ALCOUT)	THDL1	V_{IN} = –22 dBs (1 kHz), Test pin: 3		0.5	1.5	%
THDR (ALCOUT)	THDR1	V_{IN} = –22 dBs (1 kHz), Test pin: 5		0.5	1.5	%
THDL (ALCOUT)	THDL2	V_{IN} = –3 dBs (1 kHz), Test pin: 3		1.0	3.0	%
THDR (ALCOUT)	THDR2	V_{IN} = –3 dBs (1 kHz), Test pin: 5		1.0	3.0	%
Left channel oscillator frequency 1	f_OLN	No signal, SIG (pin 7), with a 3.579545 MHz input Test pin: 15	4.298	4.300	4.302	MHz
Right channel oscillator frequency 1	f_ORN	No signal, SIG (pin 7), with a 3.579545 MHz input Test pin: 15	4.798	4.800	4.802	MHz
Left channel oscillator frequency 2	f_OLP	No signal, SIG (pin 7), with a 4.433619 MHz input, Test pin: 15	4.298	4.300	4.302	MHz
Right channel oscillator frequency 2	f_ORP	No signal, SIG (pin 7), with a 4.433619 MHz input, Test pin: 15	4.798	4.800	4.802	MHz
Oscillator amplitude (L)	VL	Audio VCO output, Test pin: 15	150	220	300	mVpp
Oscillator amplitude (R)	VR	Audio VCO output, Test pin: 15	150	230	300	mVpp
Oscillator output R/L deviation	ΔVR/L	The R/L difference for the audio VCO outputs	–3.5	0	+3.5	dB
Left second harmonic level	2HL	No input, the level difference with the fundamental, Test pin: 15		–39		dB
Right second harmonic level	2HR	No input, the level difference with the fundamental, Test pin: 15		–39		dB
Left third harmonic level	3HL	No input, the level difference with the fundamental, Test pin: 15		–28		dB
Right third harmonic level	3HR	No input, the level difference with the fundamental, Test pin: 15		–28		dB
[Video Block]						
Carrier frequency adjustment range	Vcar-aj	No input, the pin 35 voltage when adjusted to be f0 = 11.8 MHz, Test pin: 35	0.1		1.25	Vdc
Deviation frequency adjustment range	Vdev-aj	V_{IN} = 0.5 Vpp, the pin 39 voltage when the deviation is adjusted to 2 MHz, Test pin: 39	0.1		1.25	Vdc
DC clamp level	V_{CLAMP}	No input, the voltage V36 - V37 Test pins: 36 and 37	5	80		mVdc
Preemphasis gain	GVpre	The gain difference between 10 kHz and 5 kHz Test pin: 33		12		dB
Video amplitude	Vv	No input, the 11.8 MHz oscillator level Test pin: 16	280	385	510	mVpp
Second harmonic level	2HV	No input, the level difference with the fundamental Test pin: 16		–32		dB
Third harmonic level	3HV	No input, the level difference with the fundamental Test pin: 16		–35		dB
[Mixer and Driver Block]						
AC gain	GVMD	SIG16 = 0.38 Vpp (12 MHz), Test pin: 22		6.6		dB
Frequency characteristics	FC	The gain difference between 20 MHz and 1 MHz Test pin: 22	–3.0	–0.5		dB
Second harmonic	2HMD	SIG16 = 0.38 Vpp (12 MHz), Test pin: 22		–34		dB
Third harmonic	3HMD	SIG16 = 0.38 Vpp (12 MHz), Test pin: 22		–35		dB

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Control Voltages]						
Xtal SELECT [L]	V4L	The voltage applied to pin 4 when a 4.43 MHz band crystal is used. Test pin: 4			0.4	Vdc
Xtal SELECT [H]	V4H	The voltage applied to pin 4 when a 3.58 MHz band crystal is used. Test pin: 4	1.1			Vdc
STANBY SW [L]	V14L	The voltage applied to pin 14 to perform a standby operation. Test pin: 14			0.8	Vdc
STANBY SW [H]	V14H	The voltage applied to pin 14 to clear standby. Test pin: 14	2.0			Vdc
DRIVE SW [L]	V21L	The voltage applied to pin 21 to perform a LED off operation. Test pin: 21			0.8	Vdc
DRIVE SW [H]	V21H	The voltage applied to pin 21 to perform a LED on operation. Test pin: 21	2.0			Vdc
[In Combination with a Demodulator] Using the IFR-C1 (4 MHz version) Sony receiver IC						
Audio left channel amplitude	V_{AL}	V_{IN} = –30 dBs (400 Hz) Deviation ±22.5 kHz, demodulator output		250		mVrms
Audio right channel amplitude	V_{AR}	V_{IN} = –30 dBs (400 Hz) Deviation ±22.5 kHz, demodulator output		250		mVrms
L/R output difference	VAL/R	V_{IN} = –30 dBs (400 Hz), simultaneous L/R inputs Deviation ±22.5 kHz, demodulator output	–3	0	+3	dB
Audio left channel distortion	THDLT	V_{IN} = –3 dBs (1 kHz), demodulator output		1.5		%
Audio right channel distortion	THDRT	V_{IN} = –3 dBs (1 kHz), demodulator output		1.5		%
Audio left channel noise	V_{N}L	No input, Rg = 3 kΩ, IHFA filter Demodulator output		–56		dBs
Audio right channel noise	V_{N}R	No input, Rg = 3 kΩ, IHFA filter Demodulator output		–56		dBs

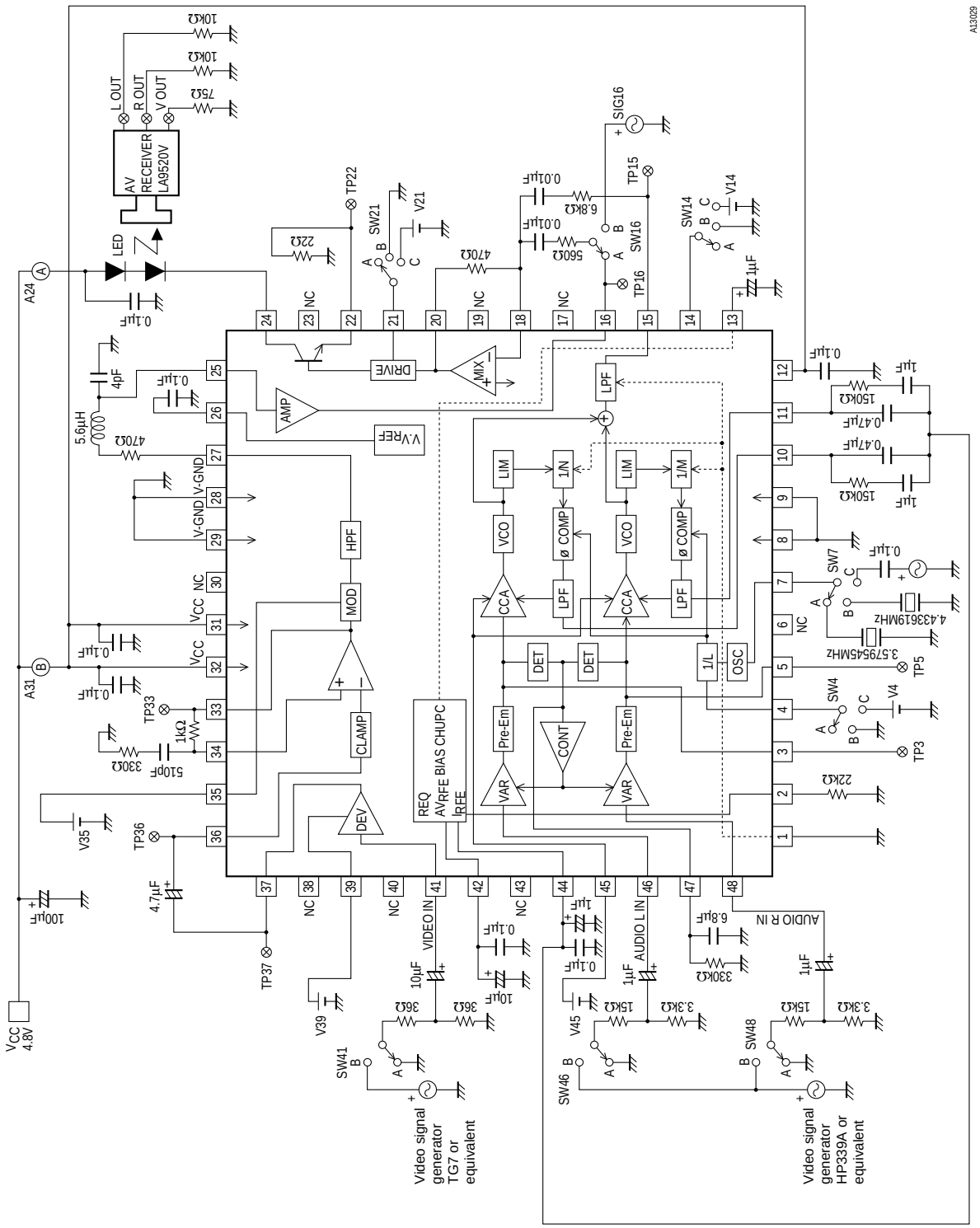
Switch Position Table

*: The bias values Va, Vb, and Vc, indicate the voltage values after adjustment.

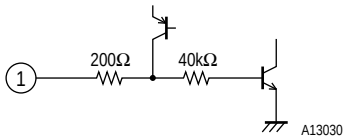
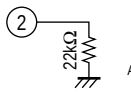
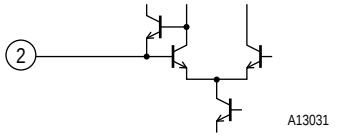
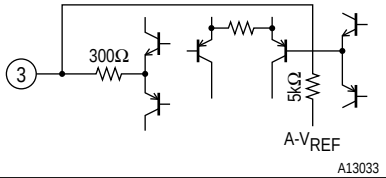
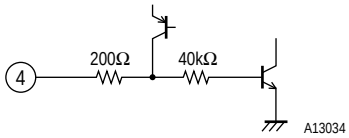
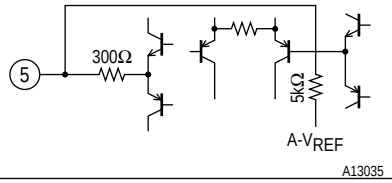
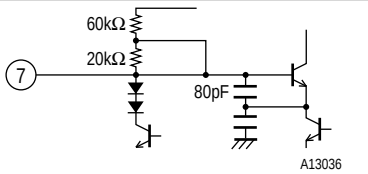
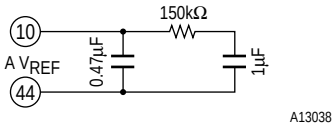
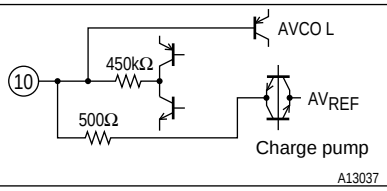
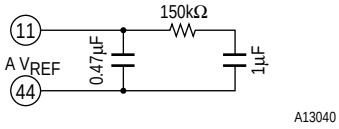
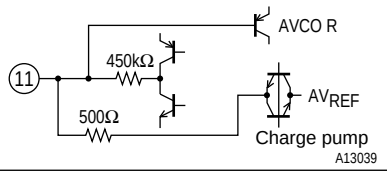
Units: Vdc

Parameter		Switch position								Bias					
No.	Symbol	SW4	SW7	SW14	SW16	SW21	SW41	SW46	SW48	V4	V14	V21	V45	V35	V39
1	$I_{CC}1$	A	A	A	A	A	A	A	A	—	—	—	—	—	—
2	$I_{CC}2$	A	A	A	A	A	A	A	A	—	—	—	—	—	—
3	$I_{CC}3$	A	A	B	A	A	A	A	A	—	—	—	—	—	—
4	Vde-adj	A	A	A	A	A	A	B	B	—	—	—	Va	—	—
5	GvpL	A	A	A	A	A	A	B	A	—	—	—	Va	—	—
6	GvpR	A	A	A	A	A	A	A	B	—	—	—	Va	—	—
7	$V_{ALC}L$	A	A	A	A	A	A	B	A	—	—	—	Va	—	—
8	$V_{ALC}R$	A	A	A	A	A	A	A	B	—	—	—	Va	—	—
9	$V_{ALON}L$	A	A	A	A	A	A	B	A	—	—	—	Va	—	—
10	$V_{ALON}R$	A	A	A	A	A	A	A	B	—	—	—	Va	—	—
11	$V_{ALON}L/R$	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
12	THDL1	A	A	A	A	A	A	B	A	—	—	—	Va	—	—
13	THDR1	A	A	A	A	A	A	A	B	—	—	—	Va	—	—
14	THDL2	A	A	A	A	A	A	B	A	—	—	—	Va	—	—
15	THDR2	A	A	A	A	A	A	A	B	—	—	—	Va	—	—
16	foLN	A	C	A	A	A	A	A	A	—	—	—	Va	—	—
17	foRN	A	C	A	A	A	A	A	A	—	—	—	Va	—	—
18	foLP	B	C	A	A	A	A	A	A	—	—	—	Va	—	—
19	foRP	B	C	A	A	A	A	A	A	—	—	—	Va	—	—
20	VL	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
21	VR	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
22	ΔVR/L	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
23	2HL	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
24	2HR	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
25	3HL	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
26	3HR	A	A	A	A	A	A	A	A	—	—	—	Va	—	—
27	Vcar-aj	A	A	A	A	A	A	A	A	—	—	—	Va	Vb	—
28	Vdev-aj	A	A	A	A	A	B	A	A	—	—	—	Va	Vb	Vc
29	VCLAMP	A	A	A	A	A	A	A	A	—	—	—	Va	Vp	Vc
30	GVpre	A	A	A	A	A	B	A	A	—	—	—	Va	Vb	Vc
31	Vv	A	A	A	A	A	A	A	A	—	—	—	Va	Vb	Vc
32	2HV	A	A	A	A	B	A	A	A	—	—	—	Va	Vb	Vc
33	3HV	A	A	A	A	B	A	A	A	—	—	—	Va	Vb	Vc
34	GVMD	A	A	A	B	A	A	A	A	—	—	—	Va	Vb	Vc
35	FC	A	A	A	B	A	A	A	A	—	—	—	Va	Vb	Vc
36	2HMD	A	A	A	B	A	A	A	A	—	—	—	Va	Vb	Vc
37	3HMD	A	A	A	B	A	A	A	A	—	—	—	Va	Vb	Vc
38	V4L	C	B	A	A	A	A	A	A	0.4	—	—	Va	Vb	Vc
39	V4H	C	A	A	A	A	A	A	A	1.1	—	—	Va	Vb	Vc
40	V14L	A	A	C	A	A	A	A	A	—	0.8	—	Va	Vb	Vc
41	V14H	A	A	C	A	A	A	A	A	—	2.0	—	Va	Vb	Vc
42	V21L	A	A	A	A	C	A	A	A	—	—	0.8	Va	Vb	Vc
43	V21H	A	A	A	A	C	A	A	A	—	—	2.0	Va	Vb	Vc
44	VAL	A	A	A	A	A	A	B	B	—	—	—	Va	Vb	Vc
45	VAR	A	A	A	A	A	A	B	B	—	—	—	Va	Vb	Vc
46	VAL/R	A	A	A	A	A	A	B	B	—	—	—	Va	Vb	Vc
47	THDLT	A	A	A	A	A	A	B	B	—	—	—	Va	Vb	Vc
48	THDRT	A	A	A	A	A	A	B	B	—	—	—	Va	Vb	Vc
49	VNL	A	A	A	A	A	A	A	A	—	—	—	Va	Vb	Vc
50	VNR	A	A	A	A	A	A	A	A	—	—	—	Va	Vb	Vc

Test Circuit



Pin Functions

Pin No.	Pin	Voltage	Function	Equivalent circuit
1	BNDSEL	1.2	Must be connected to ground in normal operation.	
2	REF-R	1.25	Sets the external reference current. Typical value (1% metal film resistor) 	
3	ALC L OUT	$V_{CC}/2$	Left channel ALC monitor output	
4	Xtal-SEL	1.2	Selects 3.58 or 4.43 MHz for the Xtal-IN pin. Open or high: 3.58 MHz Low: 4.43 MHz	
5	ALC R OUT	$V_{CC}/2$	Right channel ALC monitor output	
6	NC	—		
7	Xtal-IN	$V_{CC}/2$	Crystal element connection. Alternatively, an external fsc clock signal may be input. The fsc signal must have an amplitude greater than 0.2 Vpp.	
8	A-GND	0	Audio system ground	
9	A-GND	0	Audio system ground	
10	LPF-L	$V_{CC}/2$ (When PLL locked)	Audio PLL loop filter 	
11	LPF-R	$V_{CC}/2$ (When PLL locked)	Audio PLL loop filter 	
12	OSC-V_{CC}	V_{CC}	Crystal oscillator power supply	

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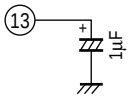
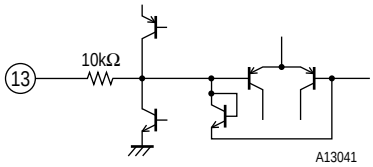
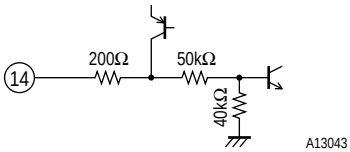
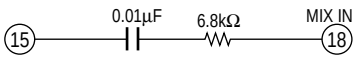
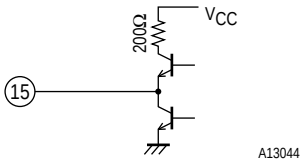
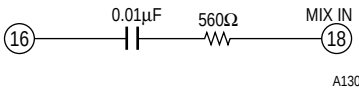
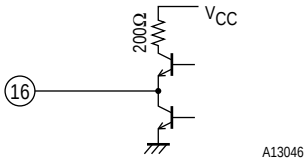
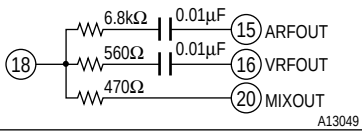
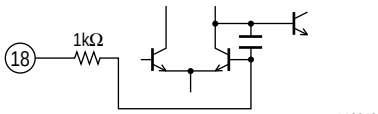
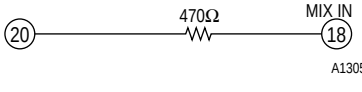
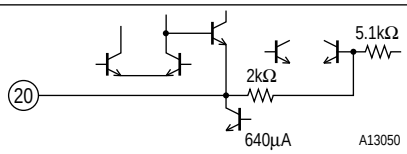
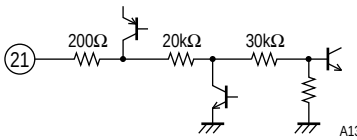
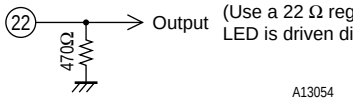
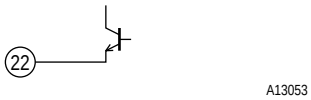
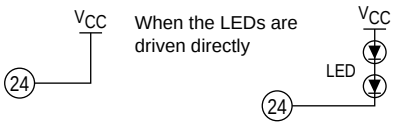
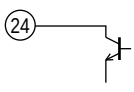
Pin No.	Pin	Voltage	Function	Equivalent circuit
13	CHUPC	3.2	Audio PLL loop filter capacitor charge pump time constant setting capacitor connection 	
14	STBY	2.2	Sets the IC to standby mode. Open or high: normal operation Low: Standby mode operation	
15	ARF-OUT	$V_{CC}/2$	Audio RF output 	
16	VRF-OUT	$V_{CC}/2$	Video RF output 	
17	NC	—		
18	MIX-IN	1.3	Drive mixer amplifier inverting input 	
19	NC	—		
20	MIX-OUT	1.3	Drive mixer amplifier output and driver amplifier inverting input 	
21	DRV-SW	2.2	Sets the driver amplifier to the standby state. (LED off) Open or high: normal operation Low: Standby mode operation	
22	DRV EM-OUT	0.6	Driver amplifier output stage transistor emitter 	
23	NC	—		
24	DRV CL OUT	V_{CC}	Driver amplifier output stage transistor collector 	

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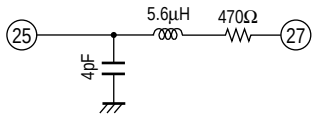
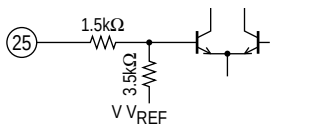
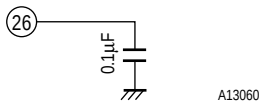
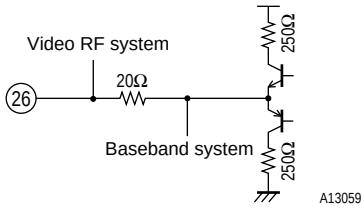
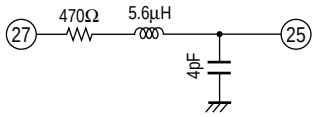
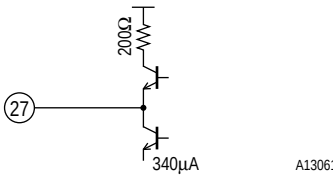
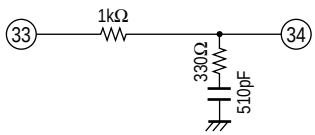
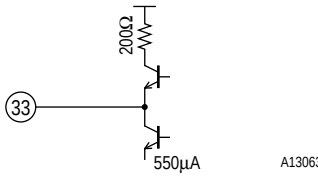
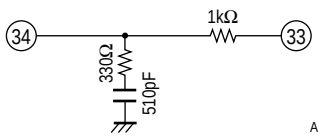
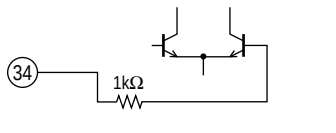
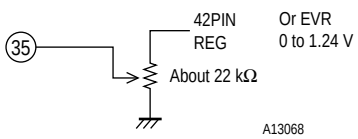
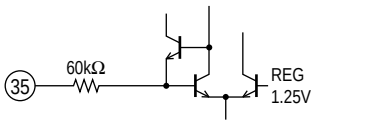
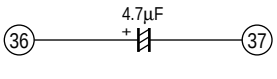
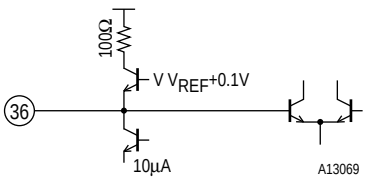
Pin No.	Pin	Voltage	Function	Equivalent circuit
25	VRF IN	$V_{CC}/2$	FAMP input 	
26	V V_{REF}	$V_{CC}/2$	Video system $V_{CC}/2$ line bypass capacitor connection The pin voltage approaches the supply voltage in standby mode. 	
27	HPF OUT	$V_{CC}/2$	VCO + HPF output 0.29 Vpp 	
28	V GND	0	Video system ground	
29	V GND	0	Video system ground	
30	NC	—		
31	V V_{CC}	V_{CC}	Video V_{CC}	
32	A V_{CC}	V_{CC}	Audio V_{CC}	
33	PREEM OUT	$V_{CC}/2$	Video preemphasis amplifier output 	
34	PREEM IN	$V_{CC}/2$	Video preemphasis amplifier input 	
35	CAR ADJ	1.25	Video VCO free-running adjustment 	
36	CLAMP C2	$V_{CC}/2$ +0.1	Clamp side of the sync tip clamp 	

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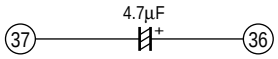
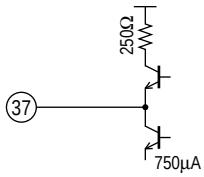
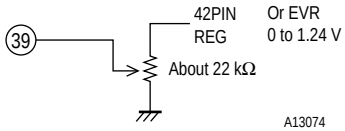
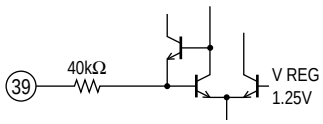
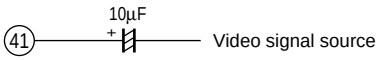
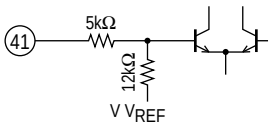
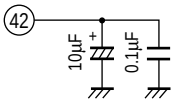
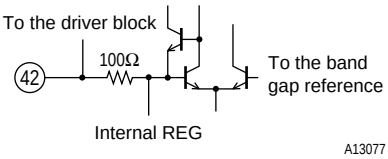
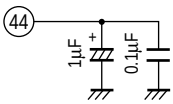
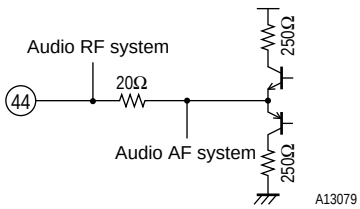
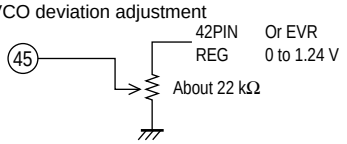
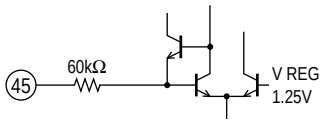
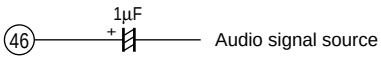
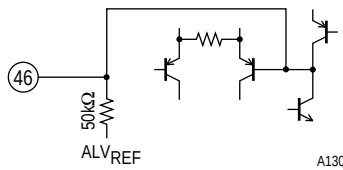
Pin No.	Pin	Voltage	Function	Equivalent circuit
37	CLAMP C1	$V_{CC}/2$	Sync tip clamp output  A13072	 A13071
38	NC	—		
39	V DEV ADJ	1.25	Video VCO deviation adjustment  A13074	 A13073
40	NC	—		
41	V_{IN}	$V_{CC}/2$	Video input Reference input level: 0.5 Vpp Input impedance: 17 kΩ  A13076	 A13075
42	REG	1.25	Reference voltage supply bypass capacitor connection Discharges in standby mode.  A13078	 A13077
43	A GND	0	Audio ground	
44	A V_{REF}	$V_{CC}/2$	Audio system $V_{CC}/2$ line bypass capacitor The pin voltage approaches the V_{CC} voltage in standby mode.  A13080	 A13079
45	A DEV ADJ	1.25	Audio VCO deviation adjustment  A13082	 A13081
46	L CH IN	$V_{CC}/2$	Audio left channel input Reference input level: –30 dBs Input impedance: 10 kΩ  A13084	 A13083

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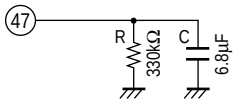
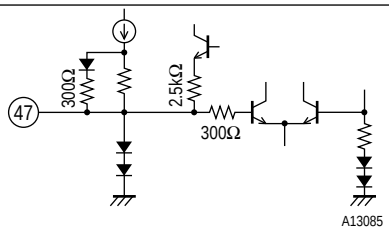
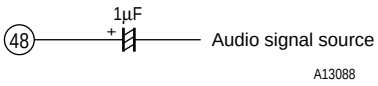
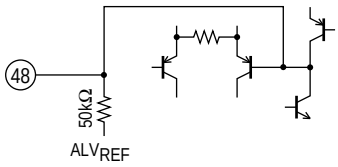
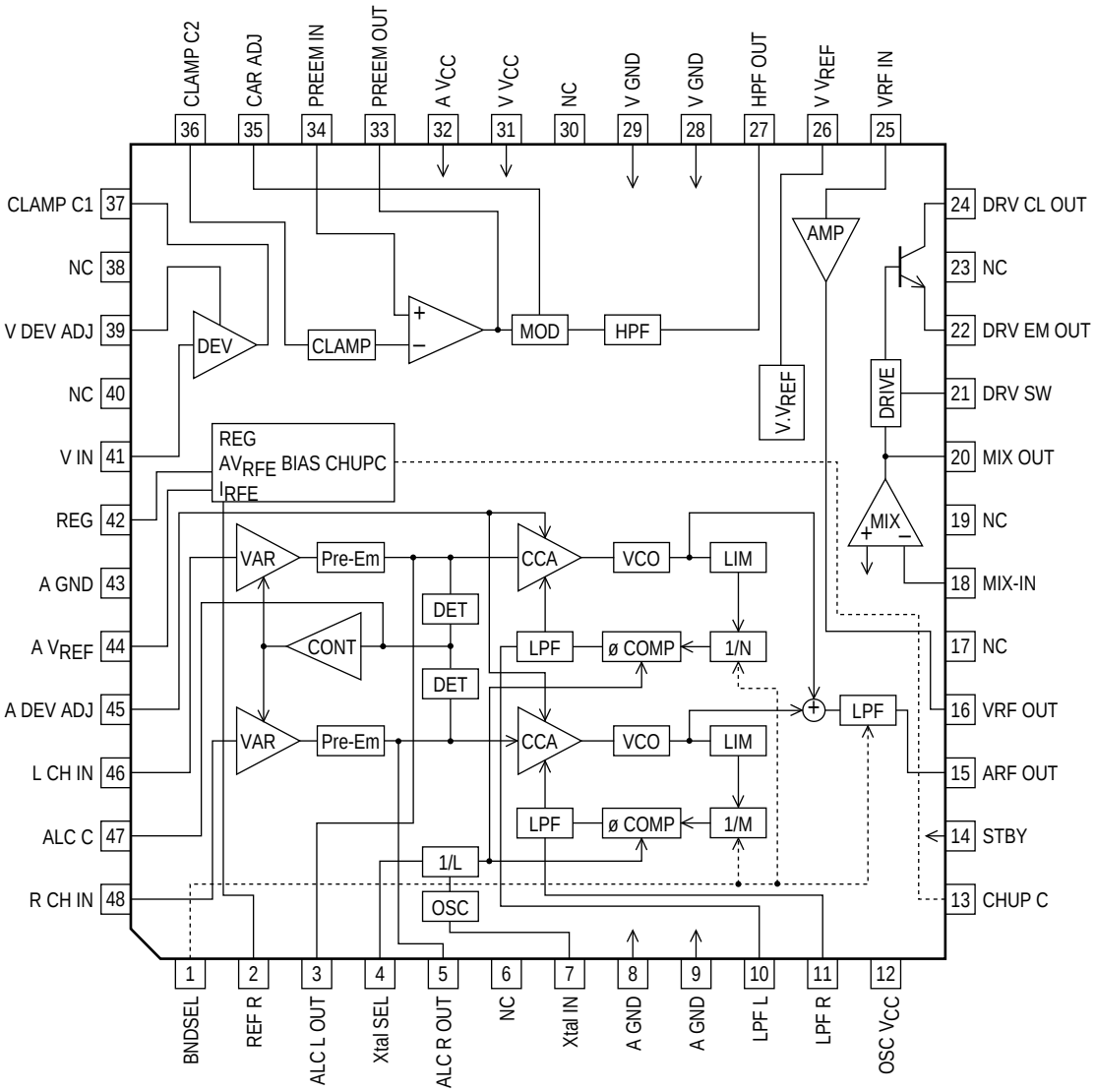
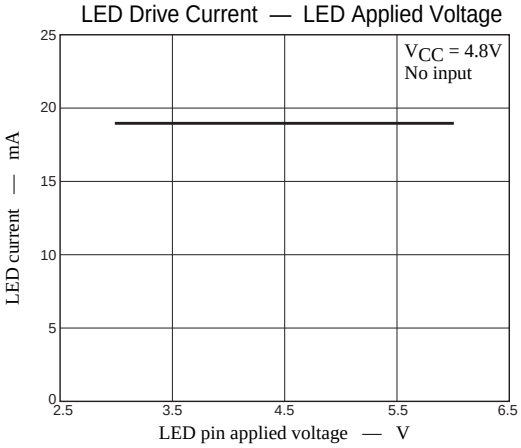
Pin No.	Pin	Voltage	Function	Equivalent circuit
47	ALC C	0.7	Audio ALC capacitor connection The attack and recovery times can be adjusted with the resistor and capacitor. 	
48	R CH IN	$V_{CC}/2$	Audio right channel input Reference input level: –30 dBs Input impedance: 10 kΩ 	

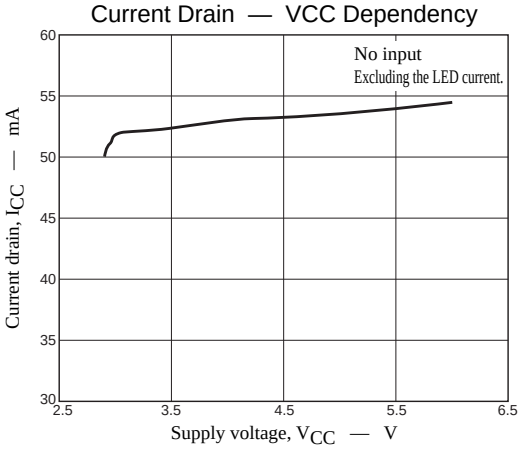
Block Diagram



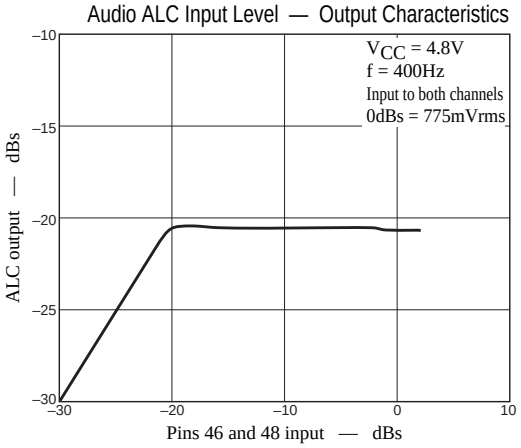
LED Drive Current — LED Applied Voltage



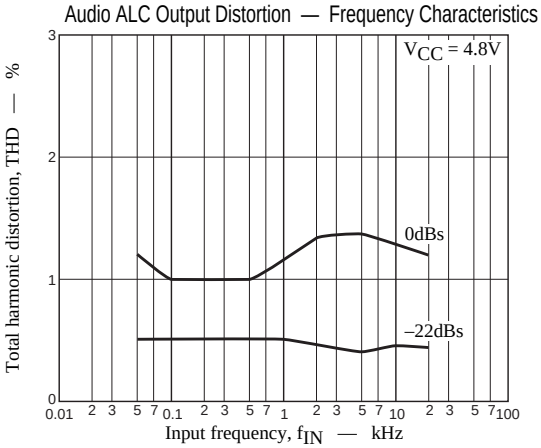
Current Drain — VCC Dependency



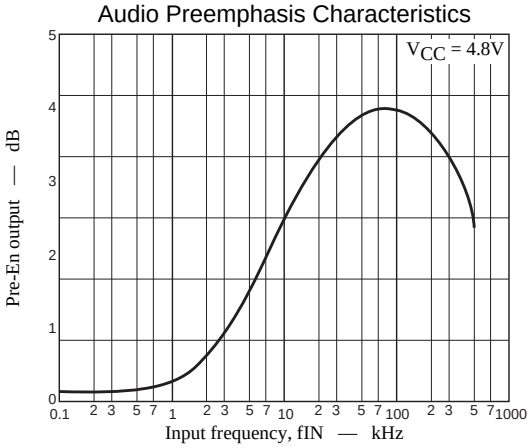
Audio ALC Input Level — Output Characteristics



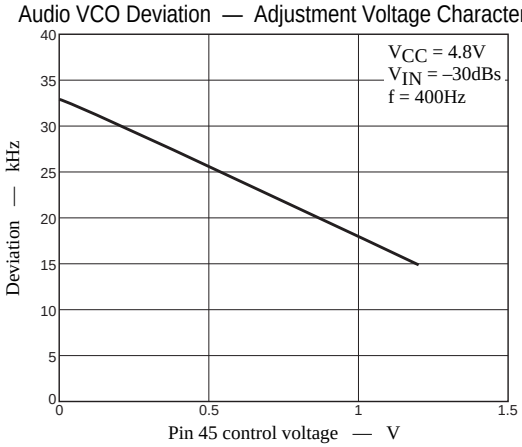
Audio ALC Output Distortion — Frequency Characteristics



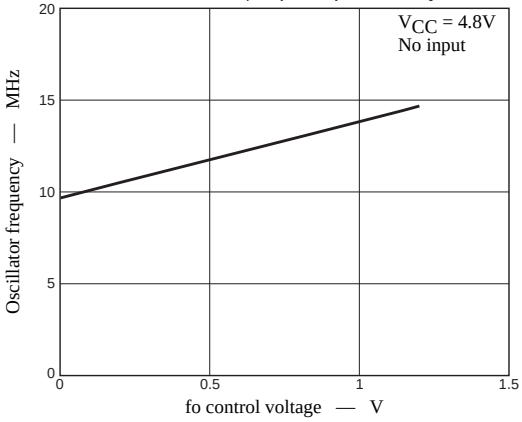
Audio Preemphasis Characteristics



Audio VCO Deviation — Adjustment Voltage Characteristics



Video VCO Oscillator Frequency — Adjustment Voltage Characteristics



Video Input — Preemphasis Characteristics