Ordering number : EN4530A

Monolithic Linear IC

LA3235W

1.5 V Record Preamplifier

Overview

The LA3235W is a single-chip record system IC for use in 1.5 V headphone stereo products. While previous recording systems were implemented using a dedicated tape drive, by using the LA3235W, such a system can be implemented by adding electronic switching to a playback-only tape drive. Additionally, a compact record/playback system can be implemented with just two chips by combining this IC and the LA4590W 1.5 V preamplifier/power amplifier IC

Functions

- Microphone amplifier (with ALC) ×2
- Microphone monitor amplifier ×2
- Radio amplifier (with ALC) × 2
- Record bias power supply
- Record amplifier ×4 (with forward/reverse switching and muting functions)
- Microphone power supply
- All control circuits, including electronic switching circuits, built in

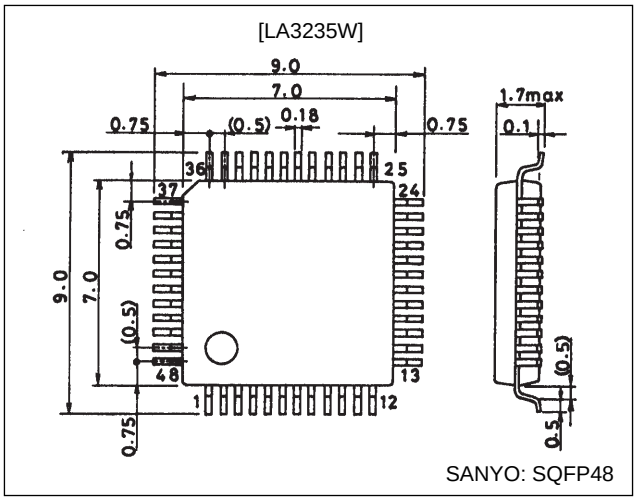
Features

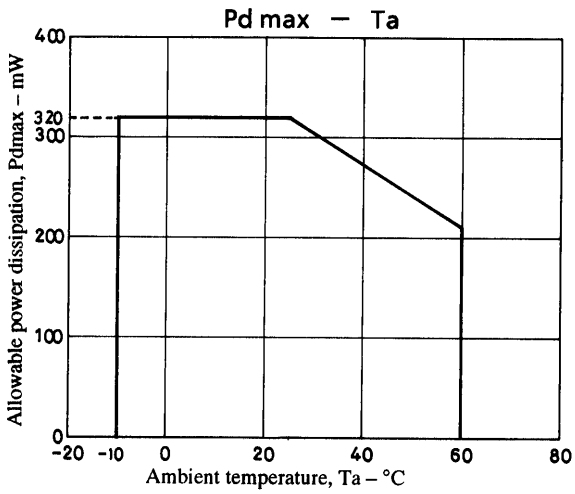
- Miniature package (48-pin SQFP)
- Built-in microphone and record bias power supplies
- Built-in radio amplifier with ALC circuit
- Systems can be easily controlled from a microprocessor using the built-in electronic switching, power supply, and amplifier block control circuits.

Package Dimensions

unit: mm

6134A-SQFP48





Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		4.5	V
Allowable power dissipation	Pd max		320	mW
Operating temperature	Topr		–10 to +65	°C
Storage temperature	Tstg		–40 to +125	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}1$, V_{CCRF}		1.5	V
	$V_{CC}2$		2.4	V
Operating supply voltage range	$V_{CC}1$, V_{CCRF}		0.9 to 2.2	V
	$V_{CC}2$		2.0 to 4.0	V

Operating Characteristics at Ta = 25°C, $V_{CC}1$ and V_{CCRF} = 1.2 V, $V_{CC}2$ = 2.4 V, f = 1 kHz, 0 dBm = 0.775 V, R_{LMIC} = 10 kΩ, R_{LRadio} = 10 kΩ, R_{LMON} = 10 kΩ, R_{LREC} = 3 kΩ

Parameter	Symbol	Conditions	min	typ	max	Unit
No signal supply current: record/$V_{CC}1$	I_{CCR1}	Microphone Rg = 6.8 kΩ	0.08	0.13	0.23	mA
No signal supply current: record/V_{CCRF}	I_{CCRR}	Microphone Rg = 6.8 kΩ	2.0	3.5	5.0	mA
No signal supply current: record/$V_{CC}2$	I_{CCR2}	Microphone Rg = 6.8 kΩ	0.85	1.5	2.1	mA
No signal supply current: playback/$V_{CC}1$	I_{CCP1}			0.1	5.0	µA
No signal supply current: playback/V_{CCRF}	I_{CCPR}		0.36	0.6	1.0	mA
No signal supply current: playback/$V_{CC}2$	I_{CCP2}		0.3	0.5	0.75	mA
[Microphone amplifier] (measured with ALC off)						
Voltage gain (closed)	VG_M	V_O = –20 dBm		35		dB
Maximum output voltage	$V_{O\ maxM}$	THD = 1%		320		mV
Total harmonic distortion	THD_M	V_O = 200 mV		0.1		%
Output noise voltage	V_{NOM}	Rg = 6.8 kΩ, BPF = 20 Hz to 20 kHz		130		µV
Crosstalk (interchannel)	CT_M	V_O = –20 dBm, TUNE 1 KHz		46		dB
Ripple rejection ratio	$SVRR_M$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –30 dBm		37		dB
[Radio Amplifier] (measured with ALC off)						
Voltage gain (closed)	VG_R	V_O = –20 dBm		14.5		dB
Maximum output voltage	$V_{O\ maxR}$	THD = 1%		320		mV
Total harmonic distortion	THD_R	V_O = 200 mV		0.1		%
Output noise voltage	V_{NOR}	Rg = 6.8 kΩ, BPF = 20 Hz to 20 kHz		30		µV
Crosstalk (interchannel)	CT_R	V_O = –20 dBm, TUNE 1 KHz		59		dB
Ripple rejection ratio	$SVRR_R$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –30 dBm		55		dB
[Monitor Amplifier]						
Voltage gain (closed)	VG_{MON}	V_O = –20 dBm		9.5		dB
Maximum output voltage	V_{OMON}	THD = 1%		260		mV
Total harmonic distortion	THD_{MON}	V_O = 100 mV		0.1		%
Output noise voltage	V_{NOMON}	BPF = 20 Hz to 20 kHz		11		µV
Crosstalk (interchannel)	CT_{MON}	V_O = –20 dBm		59		dB
Ripple rejection ratio	$SVRR_{MON}$	f_R = 100 Hz, V_R = –30 dBm		57		dB
[Record Amplifier]						
Voltage gain (closed)	VG_{REC}	V_O = –10 dBm		22		dB
Maximum output voltage	V_{OREC}	THD = 1%		670		mV
Total harmonic distortion	THD_{REC}	V_O = 300 mV		0.08		%
Output noise voltage	V_{NOREC}	BPF = 20 Hz to 20 kHz		46		µV
Crosstalk (interchannel)	CT_{REC}	V_O = –10 dBm		55		dB
Ripple rejection ratio	$SVRR_{REC}$	f_R = 100 Hz, V_R = –30 dBm		55		dB

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Parameter	Symbol	Conditions	min	typ	max	Unit
[Microphone + Record]						
Voltage gain (closed)	VG_{MR}	V_O = –10 dBm, ALC OFF	52	56.6	60	dB
Maximum output voltage	V_{OMR}	THD = 3%	500	700		mV
Total harmonic distortion	THD_{MR}	Vi = –40 dBm		0.55	1.3	%
ALC voltage	$ALCV_{MR}$	Vi = –40 dBm, Rg = 6.8 kΩ	300	400	500	mV
ALC balance	$ALCB_{MR}$	Vi = –40 dBm, Rg = 6.8 kΩ		0	1.5	dB
ALC start input	$ALCI_{MR}$		–65.5	–62.5	–59.5	dBm
ALC width	$ALCW_{MR}$	Input level relative to the ALC start point such that the output is +3 dB.	35	42		dB
Output noise voltage	V_{NOMR}	Rg = 6.8 kΩ, BPF = 20 Hz to 20 kHz		1.5	2.8	mV
Crosstalk (interchannel)	CT_{MR}	Vi = –40 dBm	11	19		dB
Ripple rejection ratio	$SVRR_{MR1}$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –30 dBm	10	16		dB
	$SVRR_{MR2}$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –20 dBm With ripple added to $V_{CC}2$, TUNE = 100 Hz	50	58		dB
[Radio + Record]						
Voltage gain	VG_{RR}	V_O = –10 dBm, ALC OFF	31.5	35.5	39.5	dB
Maximum output voltage	V_{ORR}	THD = 3%	470	570		mV
Total harmonic distortion	THD_{RR}	Vi = –30 dBm		0.55	1.3	%
ALC voltage	$ALCV_{RR}$	Vi = –30 dBm, Rg = 6.8 kΩ	300	410	500	mV
ALC balance	$ALCB_{RR}$	Vi = –30 dBm, Rg = 6.8 kΩ		0	1.5	dB
ALC start input	$ALCI_{RR}$		–45.5	–42.5	–39.5	dBm
ALC width	$ALCW_{RR}$	Input level relative to the ALC start point such that the output is +3 dB.	35	40		dB
Output noise voltage	V_{NORR}	Rg = 6.8 kΩ, BPF = 20 Hz to 20 kHz		340	610	μV
Crosstalk (interchannel)	CT_{RR}	Vi = –30 dBm	35	47		dB
Ripple rejection ratio	$SVRR_{RR}$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –30 dBm	25	32		dB
[Microphone + Monitor]						
Voltage gain (closed)	VG_{MMON}	V_O = –20 dBm, ALC OFF	39.5	43.5	47.5	dB
Maximum output voltage	V_{OMMON}	THD = 3%	150	310		mV
Total harmonic distortion	THD_{MMON}	Vi = –40 dBm		0.55	1.3	%
ALC voltage	$ALCV_{MMON}$	Vi = –40 dB, Rg = 6.8 kΩ	60	90	135	mV
Output noise voltage	V_{NOMMON}	Rg = 6.8 kΩ, BPF = 20 Hz to 20 kHz		350	650	μV
Crosstalk (interchannel)	CT_{MMON}	Vi = –40 dBm	11	19		dB
Ripple rejection ratio	$SVRR_{MMON}$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –30 dBm	21	27		dB
	$SVRR_{MMON}$	Rg = 6.8 kΩ, f_R = 100 Hz, V_R = –20 dBm With ripple added to $V_{CC}2$, TUNE = 100 Hz	60	70		dB
[Record Bias Power Supply]						
Output voltage	V_{RBR1}	I_{RBR} = –50 mA	0.92	1.0	1.08	V
Ripple rejection ratio	$SVRR_{RBR1}$	f_R = 100 Hz, V_R = –30 mA I_{RBR} = –50 mA, 2SB1295; using 6 ranks	45	53		dB
Output voltage	V_{RBR2}	$V_{CC}1$ = 1.0 V, I_{RBR} = 30 mA	0.89	0.93		V
Ripple rejection ratio	$SVRR_{RBR2}$	$V_{CC}1$ = 1.0 V, f_R = 100 Hz, V_R = –30 dBm I_{RBR} = 30 mA, 2SB1295; using 6 ranks	33	40		dB
[Microphone Power Supply]						
Output voltage	V_{MR}	I_{MR} = 3 mA	1.55	1.65	1.75	V
Ripple rejection ratio	$SVRR_{MR}$	f_R = 100 Hz, V_R = –20 dBm I_{MR} = 3 mA, with ripple added to $V_{CC}2$	55	70		dB
[Switching Control]: Record mode						
Forward: CONT A and C pins: source	I_{FA}, I_{FC}	Measured with R_L = 10 kΩ	20	35		μA
Forward: CONT B pin sink	V_{FB}	I_{IN} = 100 μA		64	150	mV
Forward: CONT D pin sink	V_{FD}	I_{IN} = 500 μA		110	230	mV
Reverse: CONT B and D pins source	I_{RB}, I_{RD}	Measured with R_L = 10 kΩ	20	35		μA
Reverse: CONT A pin sink	V_{RA}	I_{IN} = 100 μA		64	150	mV
Reverse: CONT C pin sink	V_{RC}	I_{IN} = 500 μA		110	230	mV
CONT E pin sink	V_E	I_{IN} = 100 μA		30	70	mV

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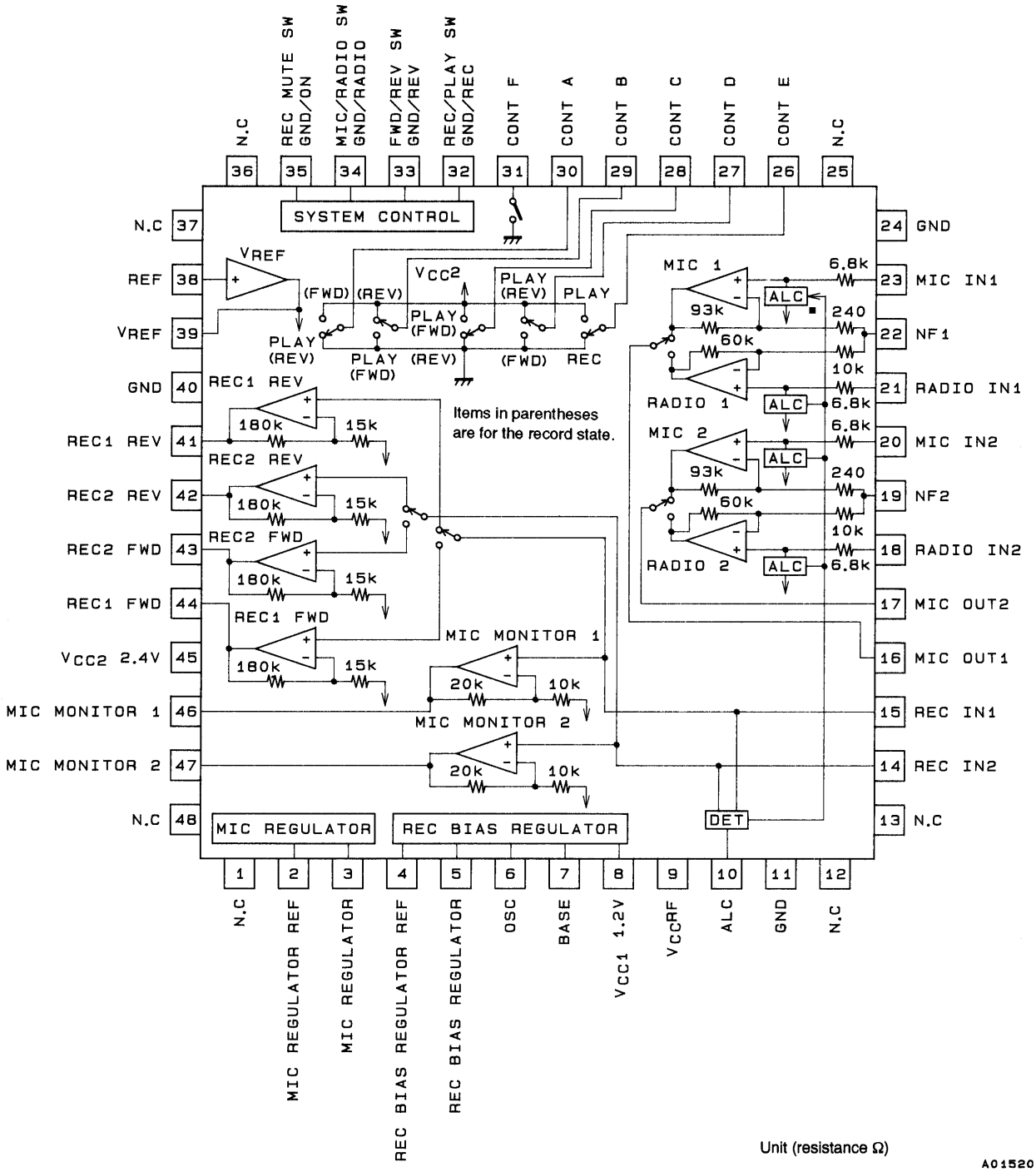
Parameter	Symbol	Conditions	min	typ	max	Unit
[Switching Control]: Playback mode						
CONT C and D pins source	I_{PC}, I_{PD}	Measured with R_L = 10 kΩ	20	35		μA
CONT E pin source	I_E	Measured with R_L = 10 kΩ	10	18		μA
CONT A and B pins sink	V_{PA}, V_{PB}	I_{IN} = 100 μA		64	150	mV
Radio CONT F pin sink	V_{RF}	I_{IN} = 100 μA		64	150	mV
Microphone CONT F pin	V_{MF}	Vi = –40 dBm, Rg = 6.8 kΩ	1.1	1.2		V

Switching Control Block: Operating Mode Table

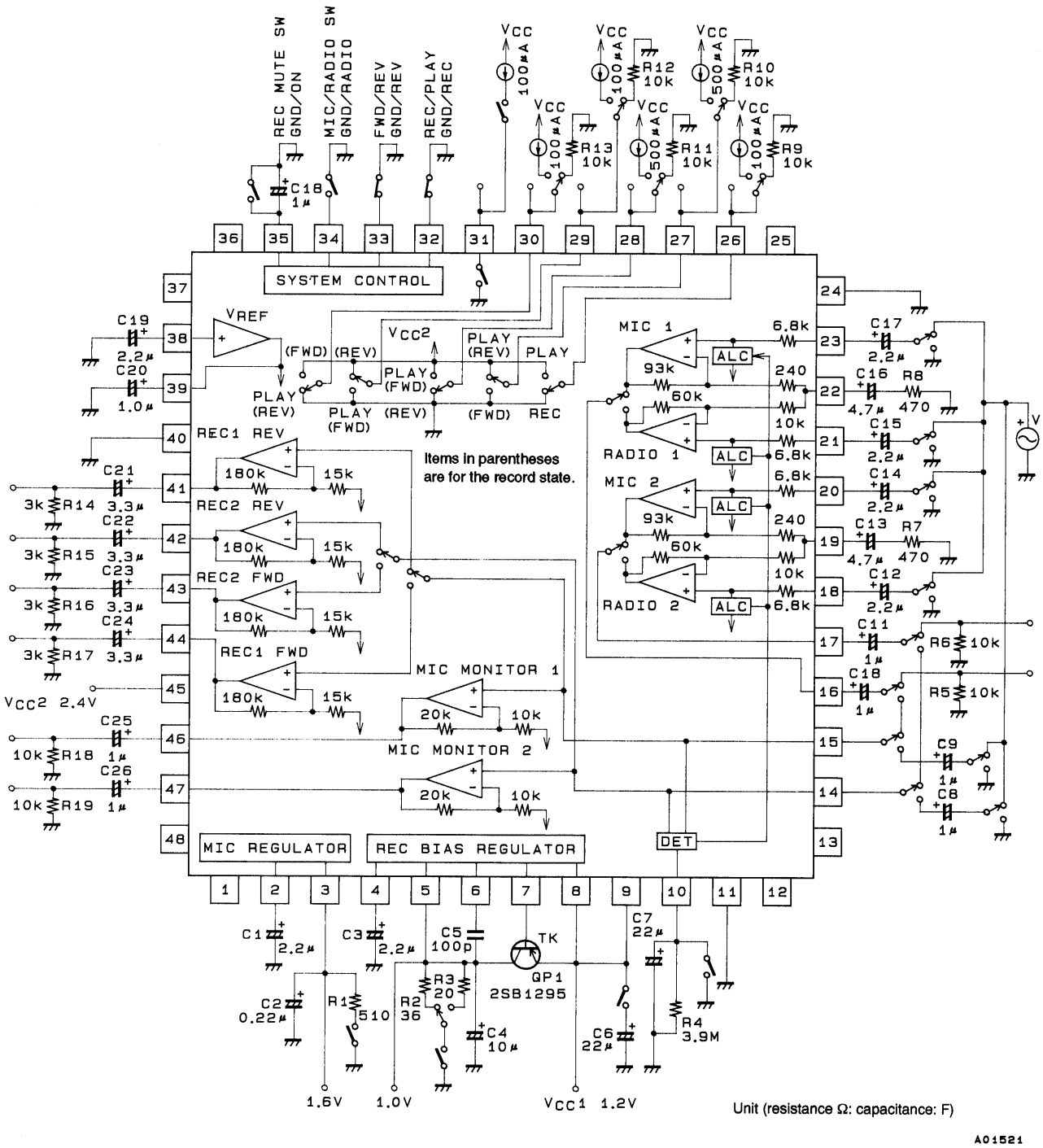
Item		A*1	B*1	C*1	D*1	E*1	F*2
REC/MIC/RADIO	FWD	H	L	H	L	L	L
	REV	L	H	L	H	L	L
PLAY	MIC	L	L	H	H	H	H
	RADIO	L	L	H	H	H	L

Note: 1. The high-level voltage for A, B, C, D, and E is close to the $V_{CC}2$ voltage.
2. The high-level voltage for F is close to the V_{CCRF} voltage.

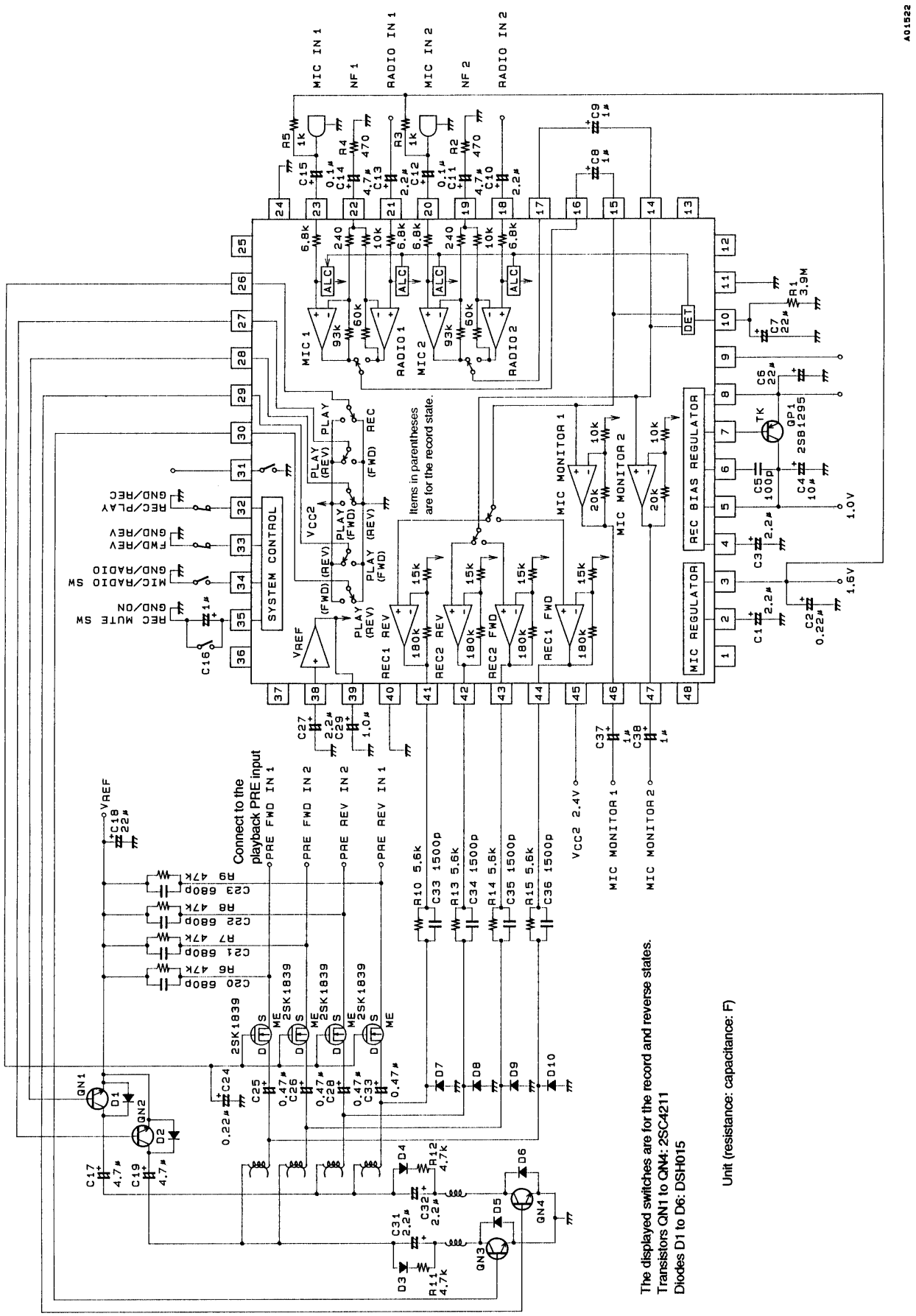
Block Diagram



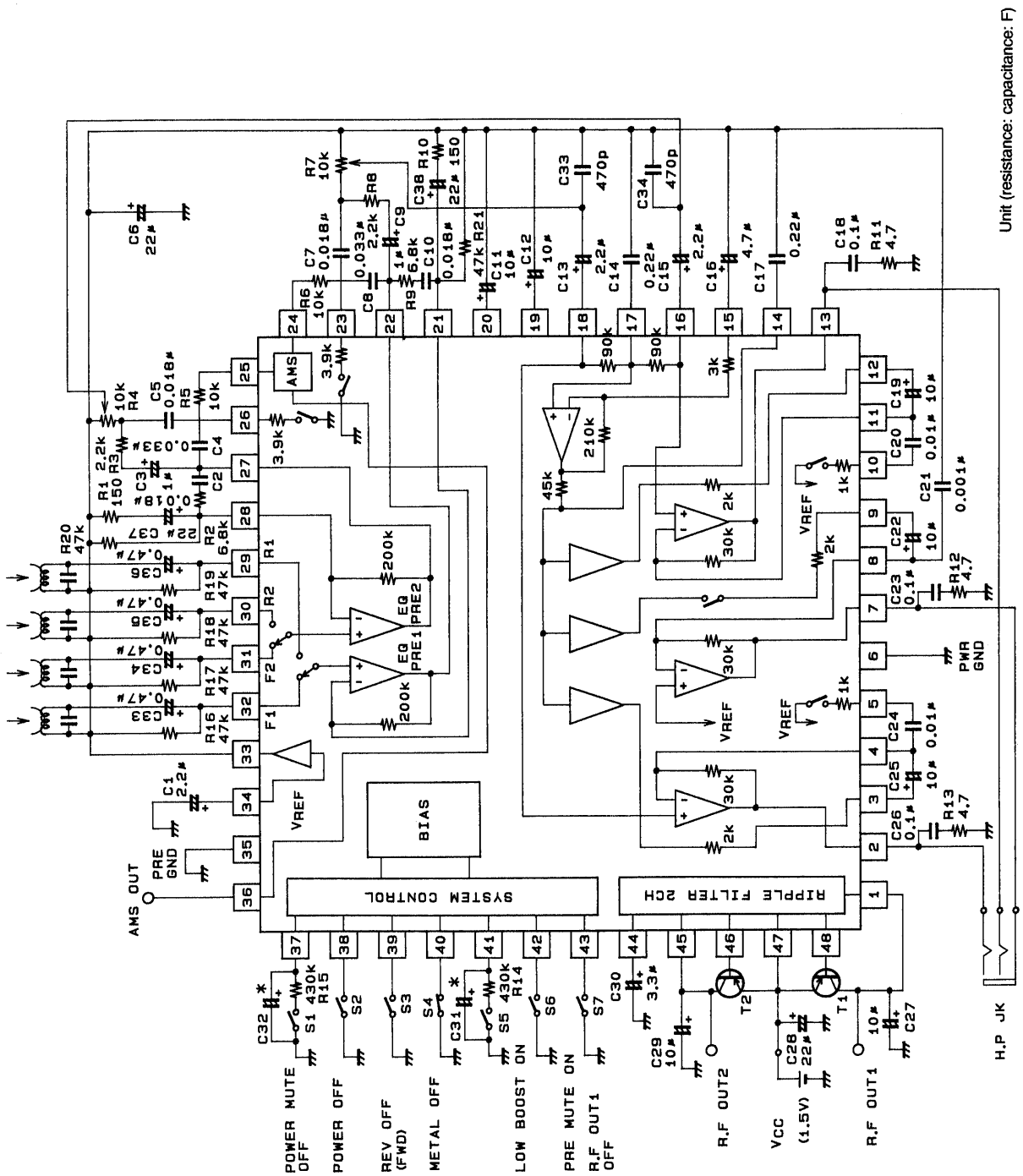
Test Circuit Diagram



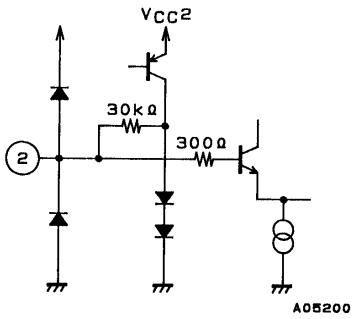
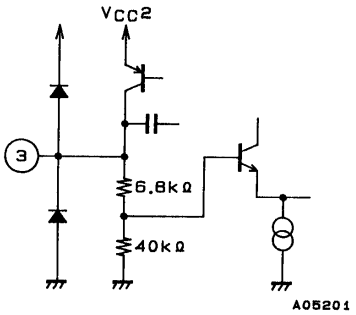
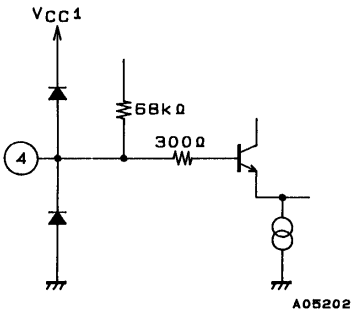
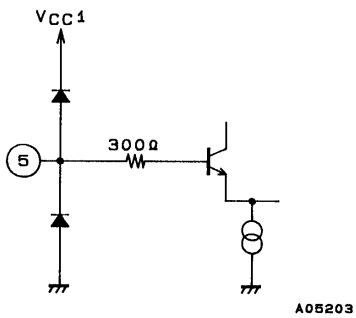
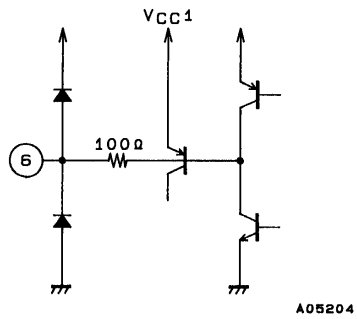
Application Circuit Example 1



Application Circuit Example 2: Circuit using the LA4590W



Pin Functions : The indicated pin voltages are for $V_{CC}1$ and RF = 1.2 V and $V_{CC}2$ = 2.4 V.

Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
2	MIC REGULATOR REF	1.4		• Microphone power supply reference bias low-pass filter connection
3	MIC REGULATOR	1.65		• Microphone power supply output • Always on in record mode
4	REC BIAS REGULATOR REF	1.0		• Record bias power supply reference bias low-pass filter connection • The value of the capacitor connected to this pin determines the SVRR.
5	REC BIAS REGULATOR	1.0		• Record bias power supply output • Always on in record mode
6	OSC	0.5		• Oscillation suppression capacitor connection

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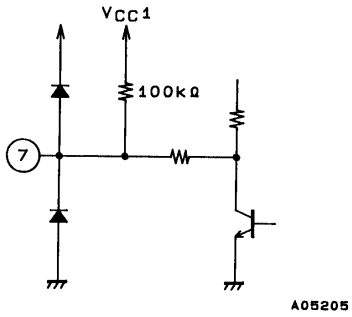
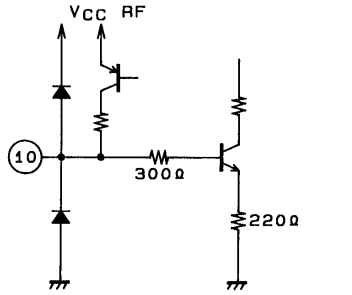
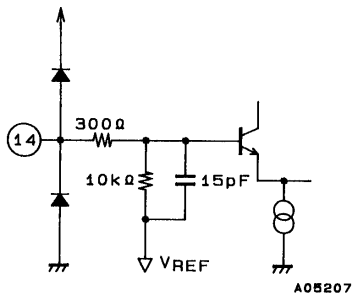
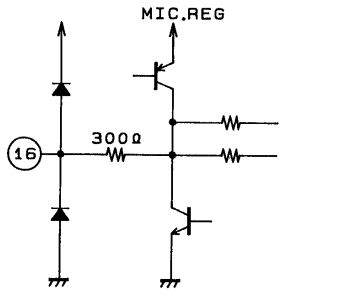
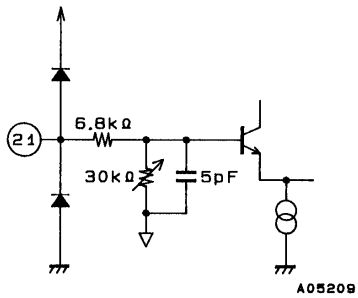
Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
7	BASE	0.55		• External pnp transistor base drive connection
10	ALC	0.7		• Microphone and radio ALC rectifier connection • The external resistor and capacitor connected to this pin determine the ALC attack and recovery times.
14 15	REC IN2 REC IN1	0.8		• Record amplifier and microphone monitor amplifier inputs • A buzz reduction capacitor is incorporated in these pin circuits. • The input resistance is 10 kΩ.
16 17	MIC OUT1 IMC OUT2	0.8		• Microphone and radio amplifier outputs
18 21	RADIO IN2 RADIO IN1	0.8		• Radio amplifier inputs • The input resistance is variable over the range 6.8 to 36.8 kΩ.

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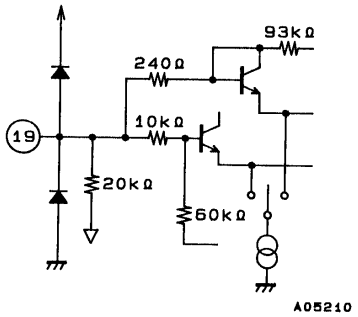
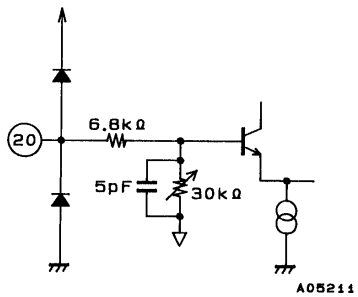
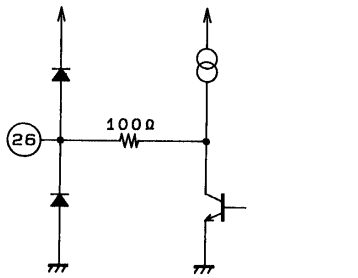
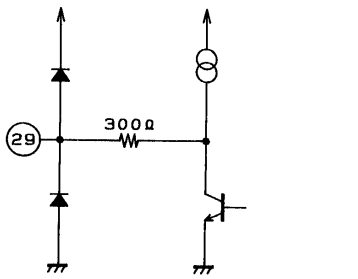
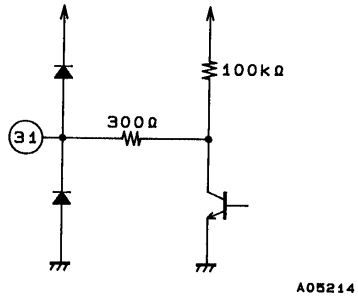
Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
19 22	NF2 NF1	0.8		• Microphone and radio amplifier noise filter connections
20 23	MIC IN2 MIC IN1	0.8		• Microphone amplifier inputs • The input resistance is variable over the range 6.8 to 36.8 kΩ.
26 27 28	CONT E CONT D CONT C	V_{CC}2 to 0		• Fixed-current pull-up current sources Pin 26.....18 µA Pins 27 and 28.....35 µA
29 30	CONT B CONT A	V_{CC}2 to 0		• 35-µA fixed-current pull-up current sources
31	CONT F	V_{CC}RF to 0		• The pull-up resistor has a value of 100 kΩ ±20%.

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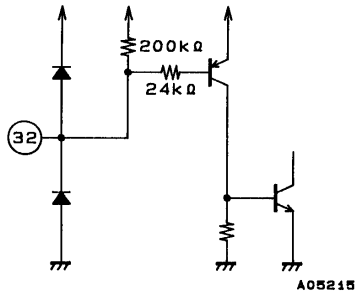
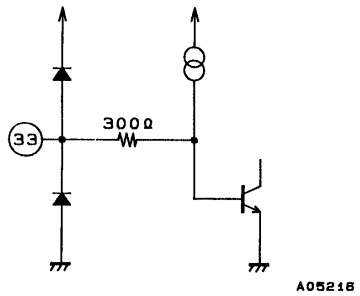
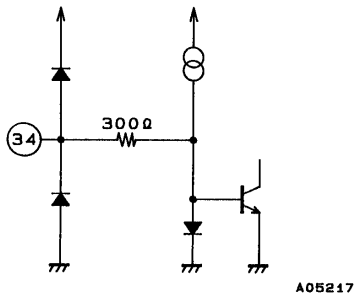
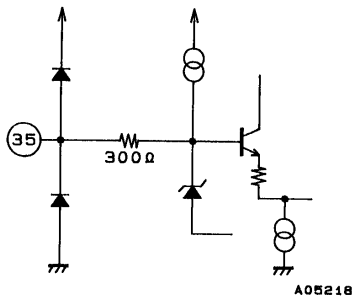
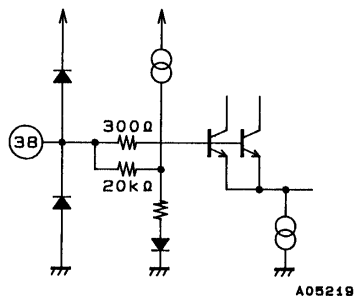
Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
32	REC/PLAY SW	V_{CC}RF to 0		• Sets the system to record mode when pulled down and to playback mode when open. Record mode condition: V32 ≤ 0.1 V
33	FWD/REV SW	0.7 to 0		• Output source current I_{33} ≈ 4 µA • Sets the system to reverse mode when pulled down. Reverse mode condition: V33 ≤ 0.4 V
34	MIC/RADIO SW	0.7 to 0		• Output source current I_{34} ≈ 8 µA • Sets the system to radio mode when pulled down. Radio mode condition: V34 ≤ 0.4 V
35	REC MUTE SW	V_{CC}RF to 0		• Output source current I_{35} ≈ 13 µA • Sets the system to muted mode when pulled down. Muted mode condition: V35 ≤ 0.1 V
38	REF	0.8		• V_{REF} amplifier reference bias low-pass filter connection

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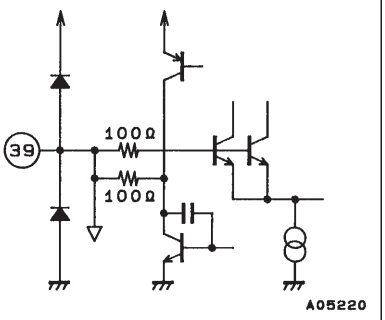
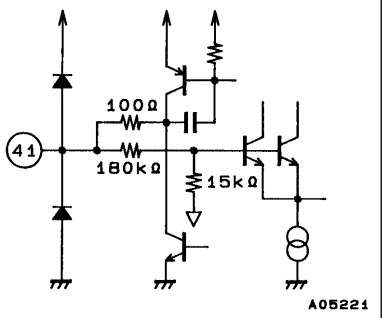
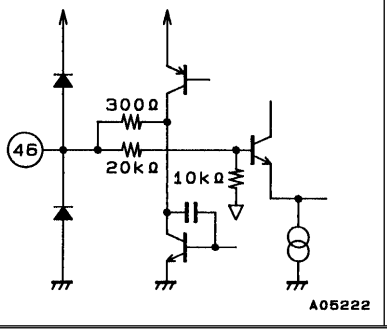
Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
39	V_{REF}	0.8		• V_{REF} amplifier output • Virtual ground bias for all amplifier blocks • The V_{REF} amplifier makes this a low-impedance circuit.
41 42 43 44	REC1 REV REC2 REV REC2 FWD REC1 FWD	1.0		• Record amplifier outputs • The output impedance in playback mode is 195 kΩ ±20%.
46 47	MIC MONITOR 1 MIC MONITOR 2	0.8		• Microphone monitor amplifier output