

**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

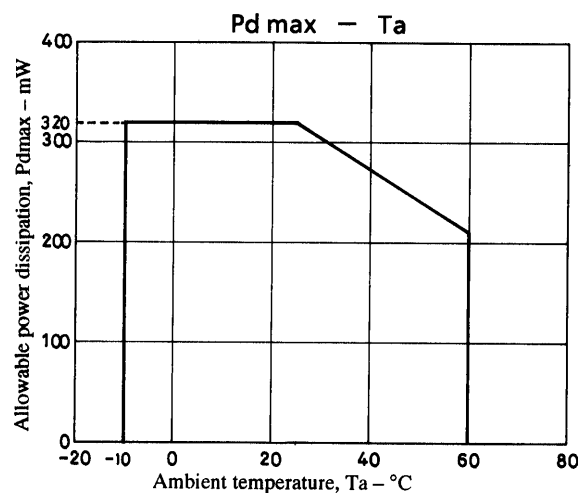
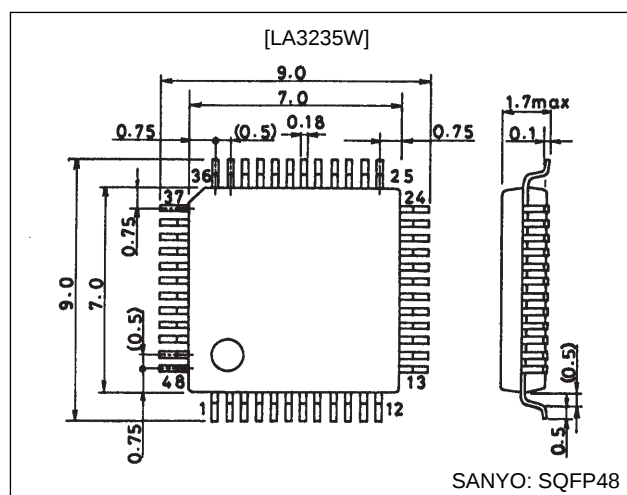
- Microphone amplifier (with ALC) ×2
- Microphone monitor amplifier ×2
- Radio amplifier (with ALC) ×2
- Record bias power supply
- Record amplifier ×4 (with forward/reverse switching and muting functions)
- Microphone power supply
- All control circuits, including electronic switching circuits, built 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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		4.5	V
Allowable power dissipation	$P_d\text{ max}$		320	mW
Operating temperature	T_{opr}		-10 to +65	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +125	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC1}, V_{CCRF}		1.5	V
	V_{CC2}		2.4	V
Operating supply voltage range	V_{CC1}, V_{CCRF}		0.9 to 2.2	V
	V_{CC2}		2.0 to 4.0	V

Operating Characteristics at $T_a = 25^\circ\text{C}$, V_{CC1} and $V_{CCRF} = 1.2\text{ V}$, $V_{CC2} = 2.4\text{ V}$, $f = 1\text{ kHz}$, $0\text{ dBm} = 0.775\text{ V}$, $R_{LMIC} = 10\text{ k}\Omega$, $R_{L\text{Radio}} = 10\text{ k}\Omega$, $R_{L\text{MON}} = 10\text{ k}\Omega$, $R_{L\text{REC}} = 3\text{ k}\Omega$

Parameter	Symbol	Conditions	min	typ	max	Unit
No signal supply current: record/ V_{CC1}	I_{CCR1}	Microphone $R_g = 6.8\text{ k}\Omega$	0.08	0.13	0.23	mA
No signal supply current: record/ V_{CCRF}	I_{CCR}	Microphone $R_g = 6.8\text{ k}\Omega$	2.0	3.5	5.0	mA
No signal supply current: record/ V_{CC2}	I_{CCR2}	Microphone $R_g = 6.8\text{ k}\Omega$	0.85	1.5	2.1	mA
No signal supply current: playback/ V_{CC1}	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_{CC2}	I_{CCP2}		0.3	0.5	0.75	mA
[Microphone amplifier] (measured with ALC off)						
Voltage gain (closed)	V_{GM}	$V_O = -20\text{ dBm}$		35		dB
Maximum output voltage	$V_{O\text{ maxM}}$	THD = 1%		320		mV
Total harmonic distortion	THD_M	$V_O = 200\text{ mV}$		0.1		%
Output noise voltage	V_{NOM}	$R_g = 6.8\text{ k}\Omega$, BPF = 20 Hz to 20 kHz		130		μV
Crosstalk (interchannel)	CT_M	$V_O = -20\text{ dBm}$, TUNE 1 KHz		46		dB
Ripple rejection ratio	$SVRR_M$	$R_g = 6.8\text{ k}\Omega$, $f_R = 100\text{ Hz}$, $V_R = -30\text{ dBm}$		37		dB
[Radio Amplifier] (measured with ALC off)						
Voltage gain (closed)	V_{GR}	$V_O = -20\text{ dBm}$		14.5		dB
Maximum output voltage	$V_{O\text{ maxR}}$	THD = 1%		320		mV
Total harmonic distortion	THD_R	$V_O = 200\text{ mV}$		0.1		%
Output noise voltage	V_{NOR}	$R_g = 6.8\text{ k}\Omega$, BPF = 20 Hz to 20 kHz		30		μV
Crosstalk (interchannel)	CT_R	$V_O = -20\text{ dBm}$, TUNE 1 KHz		59		dB
Ripple rejection ratio	$SVRR_R$	$R_g = 6.8\text{ k}\Omega$, $f_R = 100\text{ Hz}$, $V_R = -30\text{ dBm}$		55		dB
[Monitor Amplifier]						
Voltage gain (closed)	V_{GMON}	$V_O = -20\text{ dBm}$		9.5		dB
Maximum output voltage	V_{OMON}	THD = 1%		260		mV
Total harmonic distortion	THD_{MON}	$V_O = 100\text{ mV}$		0.1		%
Output noise voltage	V_{NOMON}	BPF = 20 Hz to 20 kHz		11		μV
Crosstalk (interchannel)	CT_{MON}	$V_O = -20\text{ dBm}$		59		dB
Ripple rejection ratio	$SVRR_{MON}$	$f_R = 100\text{ Hz}$, $V_R = -30\text{ dBm}$		57		dB
[Record Amplifier]						
Voltage gain (closed)	V_{GREC}	$V_O = -10\text{ dBm}$		22		dB
Maximum output voltage	V_{OREC}	THD = 1%		670		mV
Total harmonic distortion	THD_{REC}	$V_O = 300\text{ mV}$		0.08		%
Output noise voltage	V_{NOREC}	BPF = 20 Hz to 20 kHz		46		μV
Crosstalk (interchannel)	CT_{REC}	$V_O = -10\text{ dBm}$		55		dB
Ripple rejection ratio	$SVRR_{REC}$	$f_R = 100\text{ Hz}$, $V_R = -30\text{ dBm}$		55		dB

Continued on next page.

LA3235W

Continued from preceding page.

Parameter	Symbol	Conditions	min	typ	max	Unit
[Microphone + Record]						
Voltage gain (closed)	V_{GMR}	$V_O = -10$ dBm, ALC OFF	52	56.6	60	dB
Maximum output voltage	V_{OMR}	THD = 3%	500	700		mV
Total harmonic distortion	THD_{MR}	$V_i = -40$ dBm		0.55	1.3	%
ALC voltage	$ALCV_{MR}$	$V_i = -40$ dBm, $R_g = 6.8$ k Ω	300	400	500	mV
ALC balance	$ALCB_{MR}$	$V_i = -40$ dBm, $R_g = 6.8$ k Ω		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}	$R_g = 6.8$ k Ω , BPF = 20 Hz to 20 kHz		1.5	2.8	mV
Crosstalk (interchannel)	CT_{MR}	$V_i = -40$ dBm	11	19		dB
Ripple rejection ratio	$SVRR_{MR1}$	$R_g = 6.8$ k Ω , $f_R = 100$ Hz, $V_R = -30$ dBm	10	16		dB
	$SVRR_{MR2}$	$R_g = 6.8$ k Ω , $f_R = 100$ Hz, $V_R = -20$ dBm With ripple added to V_{CC2} , TUNE = 100 Hz	50	58		dB
[Radio + Record]						
Voltage gain	V_{GRR}	$V_O = -10$ 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}	$V_i = -30$ dBm		0.55	1.3	%
ALC voltage	$ALCV_{RR}$	$V_i = -30$ dBm, $R_g = 6.8$ k Ω	300	410	500	mV
ALC balance	$ALCB_{RR}$	$V_i = -30$ dBm, $R_g = 6.8$ k Ω		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}	$R_g = 6.8$ k Ω , BPF = 20 Hz to 20 kHz		340	610	μ V
Crosstalk (interchannel)	CT_{RR}	$V_i = -30$ dBm	35	47		dB
Ripple rejection ratio	$SVRR_{RR}$	$R_g = 6.8$ k Ω , $f_R = 100$ Hz, $V_R = -30$ dBm	25	32		dB
[Microphone + Monitor]						
Voltage gain (closed)	V_{GMMON}	$V_O = -20$ 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}	$V_i = -40$ dBm		0.55	1.3	%
ALC voltage	$ALCV_{MMON}$	$V_i = -40$ dB, $R_g = 6.8$ k Ω	60	90	135	mV
Output noise voltage	V_{NOMMON}	$R_g = 6.8$ k Ω , BPF = 20 Hz to 20 kHz		350	650	μ V
Crosstalk (interchannel)	CT_{MMON}	$V_i = -40$ dBm	11	19		dB
Ripple rejection ratio	$SVRR_{MMON}$	$R_g = 6.8$ k Ω , $f_R = 100$ Hz, $V_R = -30$ dBm	21	27		dB
	$SVRR_{MMON}$	$R_g = 6.8$ k Ω , $f_R = 100$ Hz, $V_R = -20$ dBm With ripple added to V_{CC2} , 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}	$V_{CC1} = 1.0$ V, $I_{RBR} = 30$ mA	0.89	0.93		V
Ripple rejection ratio	$SVRR_{RBR2}$	$V_{CC1} = 1.0$ 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_{CC2}	55	70		dB
[Switching Control]: Record mode						
Forward: CONT A and C pins: source	I_{FA}, I_{FC}	Measured with $R_L = 10$ k Ω	20	35		μ A
Forward: CONT B pin sink	V_{FB}	$I_{IN} = 100$ μ A		64	150	mV
Forward: CONT D pin sink	V_{FD}	$I_{IN} = 500$ μ A		110	230	mV
Reverse: CONT B and D pins source	I_{RB}, I_{RD}	Measured with $R_L = 10$ k Ω	20	35		μ A
Reverse: CONT A pin sink	V_{RA}	$I_{IN} = 100$ μ A		64	150	mV
Reverse: CONT C pin sink	V_{RC}	$I_{IN} = 500$ μ A		110	230	mV
CONT E pin sink	V_E	$I_{IN} = 100$ μ A		30	70	mV

Continued on next page.

LA3235W

Continued from preceding page.

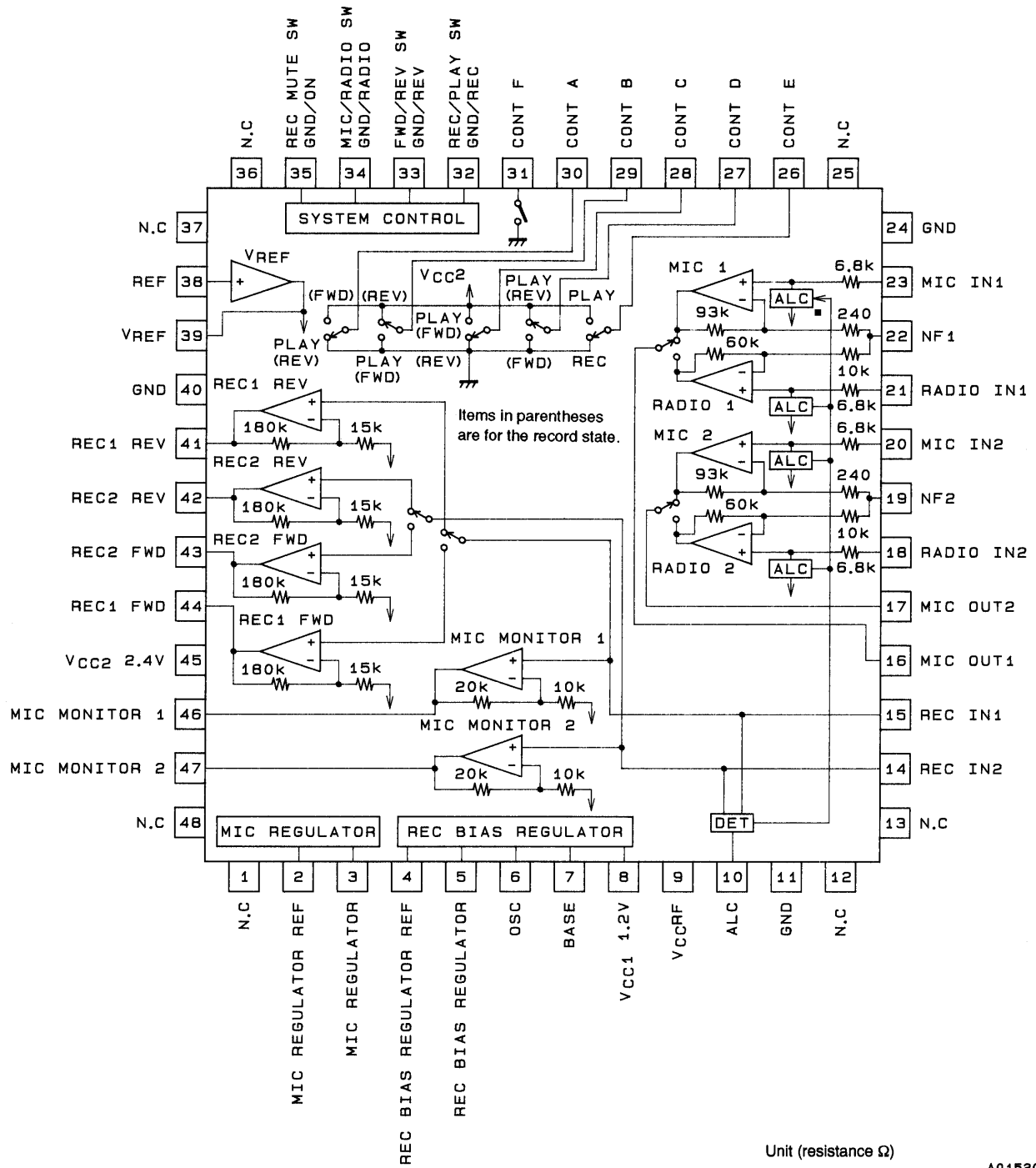
Parameter	Symbol	Conditions	min	typ	max	Unit
[Switching Control]: Playback mode						
CONT C and D pins source	I_{PC}, I_{PD}	Measured with $R_L = 10\text{ k}\Omega$	20	35		μA
CONT E pin source	I_E	Measured with $R_L = 10\text{ k}\Omega$	10	18		μA
CONT A and B pins sink	V_{PA}, V_{PB}	$I_{IN} = 100\text{ }\mu\text{A}$		64	150	mV
Radio CONT F pin sink	V_{RF}	$I_{IN} = 100\text{ }\mu\text{A}$		64	150	mV
Microphone CONT F pin	V_{MF}	$V_i = -40\text{ dBm}$, $R_g = 6.8\text{ k}\Omega$	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

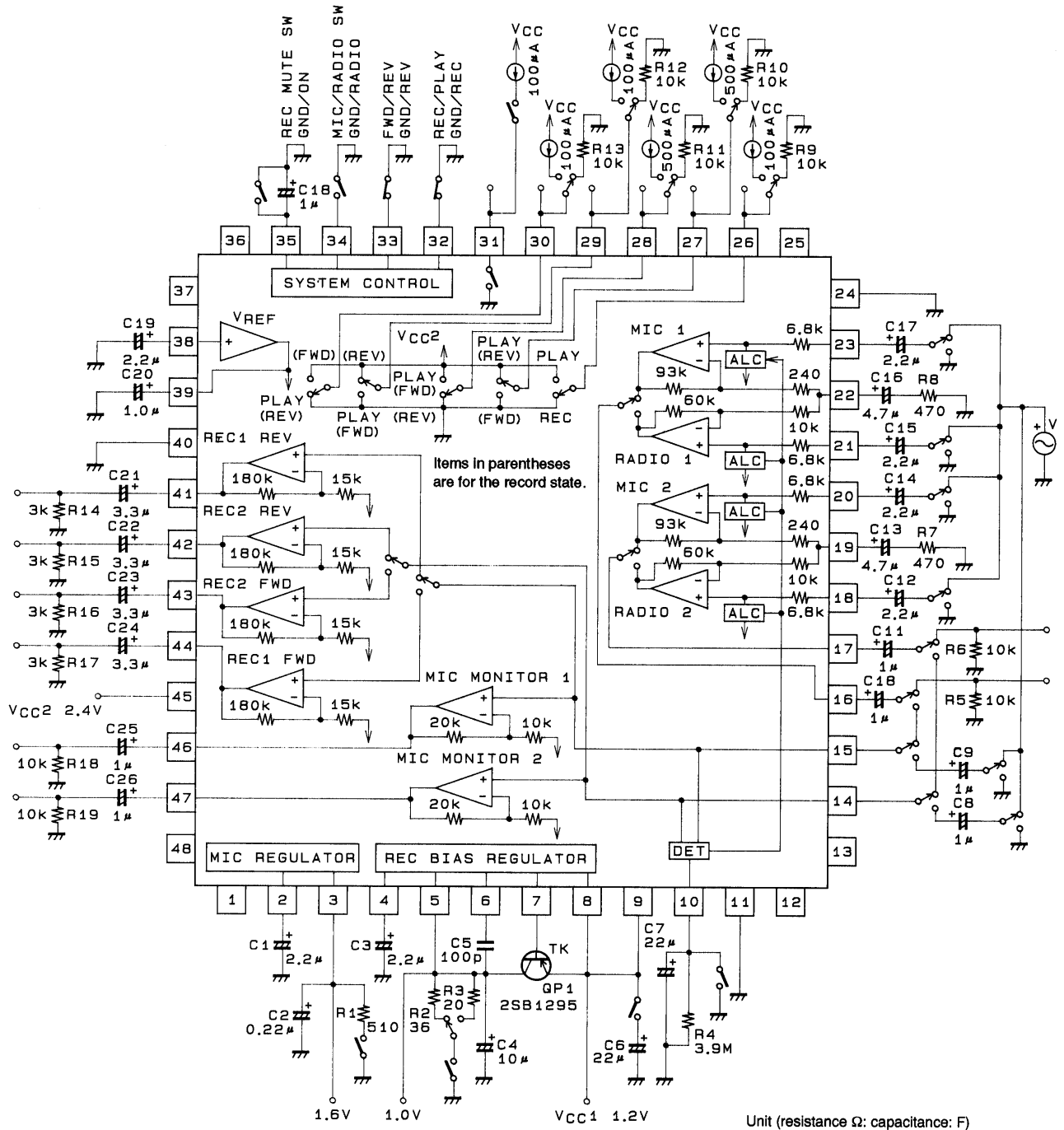
Note: 1. The high-level voltage for A, B, C, D, and E is close to the V_{CC2} voltage.
 2. The high-level voltage for F is close to the V_{CCRF} voltage.

Block Diagram



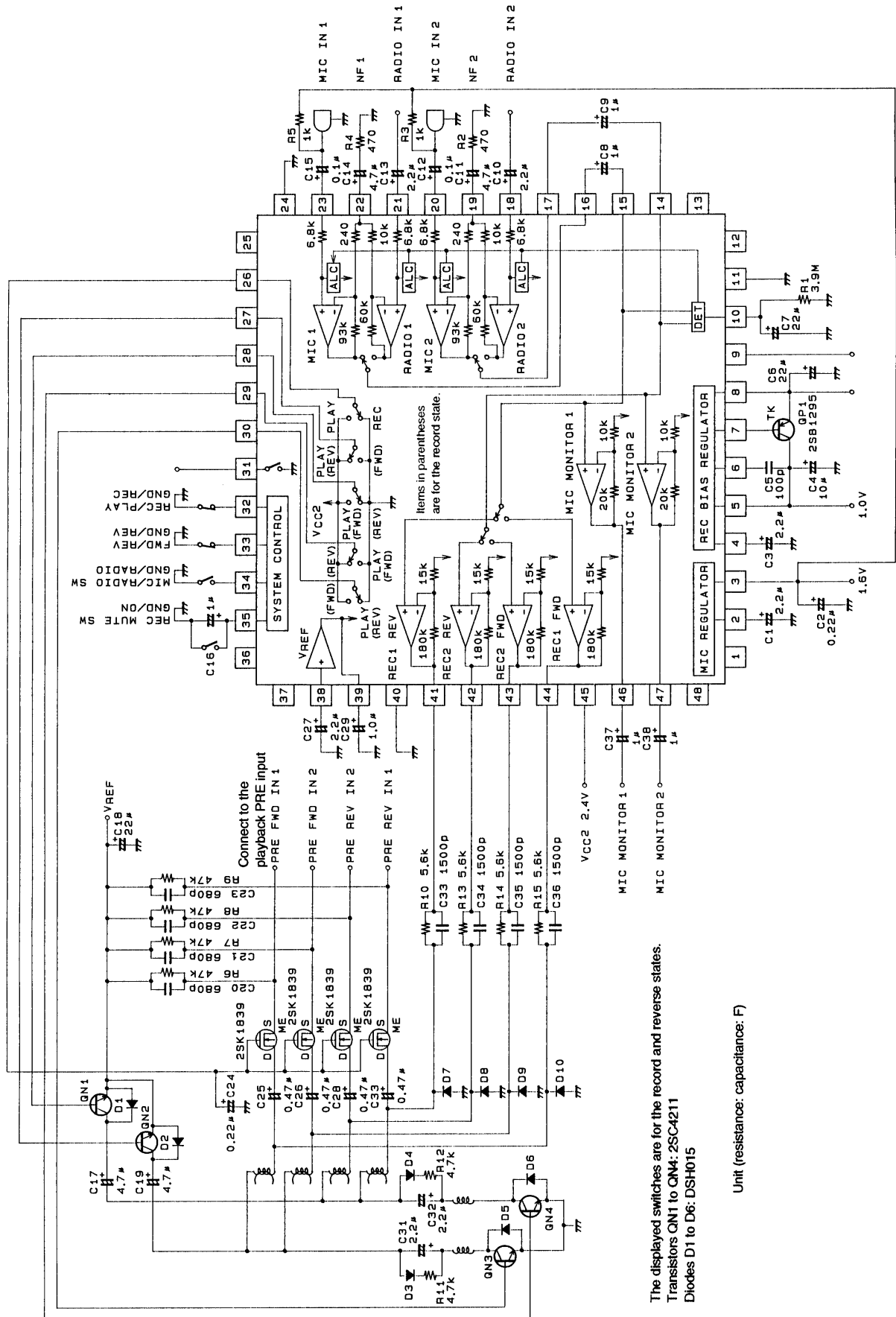
A01520

Test Circuit Diagram



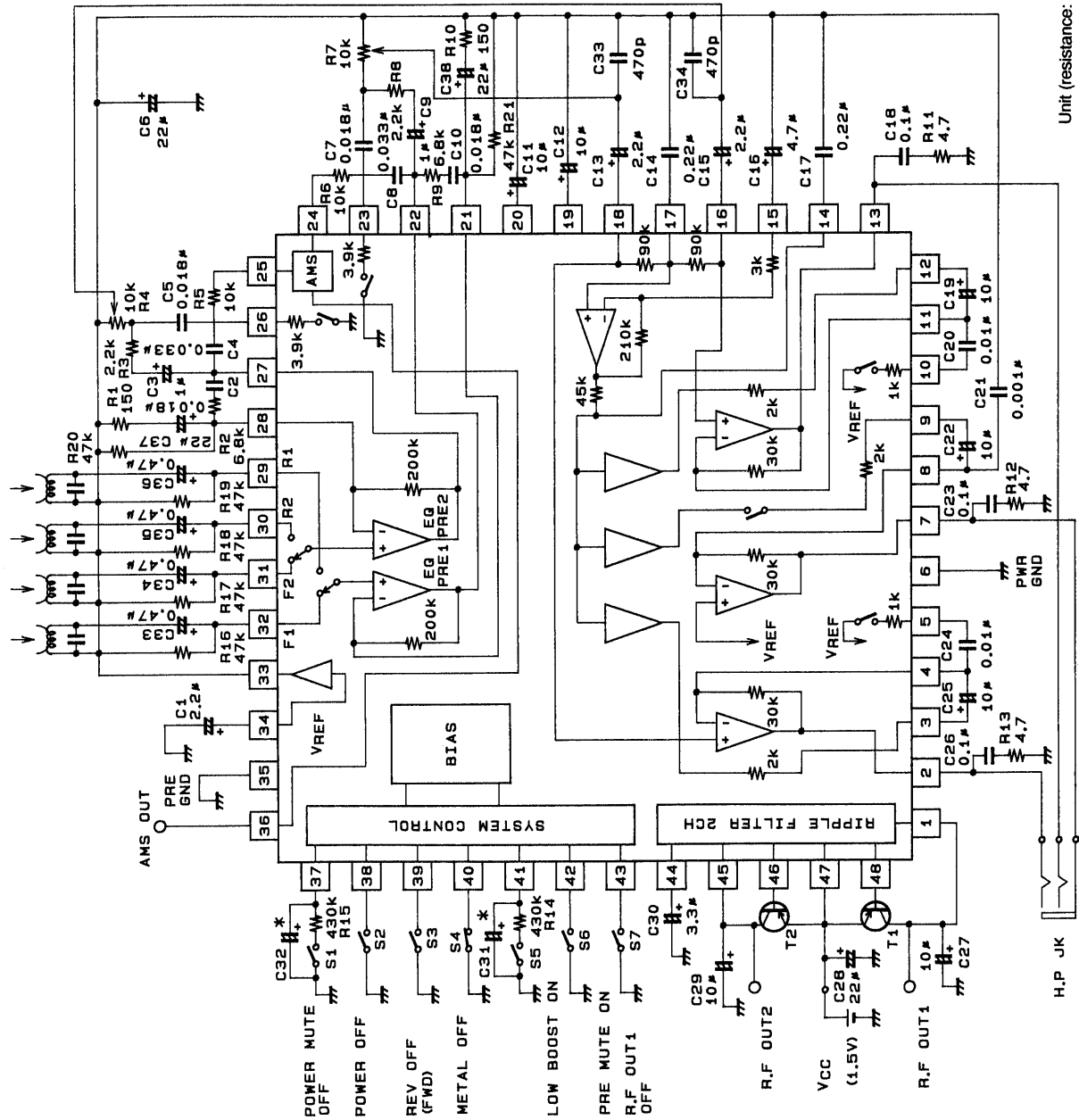
A01521

Application Circuit Example 1



The displayed switches are for the record and reverse states.
 Transistors QN1 to QN4: 2SC4211
 Diodes D1 to D6: DSH015

Application Circuit Example 2: Circuit using the LA4590W



LA3235W

Pin Functions : The indicated pin voltages are for V_{CC1} and $R_F = 1.2\text{ V}$ and $V_{CC2} = 2.4\text{ V}$.

Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
2	MIC REGULATOR REF	1.4	A05200	Microphone power supply reference bias low-pass filter connection
3	MIC REGULATOR	1.65	A05201	- Microphone power supply output - Always on in record mode
4	REC BIAS REGULATOR REF	1.0	A05202	- 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	A05203	- Record bias power supply output - Always on in record mode
6	OSC	0.5	A05204	Oscillation suppression capacitor connection

Continued on next page.

LA3235W

Continued from preceding page.

Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
7	BASE	0.55	A05205	External pnp transistor base drive connection
10	ALC	0.7	A05206	- 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	A05207	- 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	A05208	Microphone and radio amplifier outputs
18 21	RADIO IN2 RADIO IN1	0.8	A05209	- Radio amplifier inputs - The input resistance is variable over the range 6.8 to 36.8 kΩ.

Continued on next page.

LA3235W

Continued from preceding page.

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_{CC2} 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_{CC2} to 0		35-μA fixed-current pull-up current sources
31	CONT F	V_{CCRF} to 0		The pull-up resistor has a value of 100 kΩ $\pm$20%.

Continued on next page.

Continued from preceding page.

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

Continued on next page.

LA3235W

Continued from preceding page.

Pin No.	Pin	Pin voltage (V)	Internal equivalent circuit	Notes
39	V _{REF}	0.8	A05220	- 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	A05221	- Record amplifier outputs - The output impedance in playback mode is 195 kΩ ±20%.
46 47	MIC MONITOR 1 MIC MONITOR 2	0.8	A05222	Microphone monitor amplifier output

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use:
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of May, 1996. Specifications and information herein are subject to change without notice.