Stereo Headphone Amplifier & Audio Line Amplifier IC

■GENERAL DESCRIPTION

The NJM2774 is a headphone amplifier and 2-channel audio line amplifier IC.

Each amplifier has a fixed DC Gain. Therefore, it is connectable directly to 3.3V operating device without input coupling capacitor.

The headphone amplifier and one of audio line amplifier (Amplifier 2) include Low-pass filter for PWM input signal. Further, another audio line amplifier (Amplifier 3) corresponds both single-end input and differential input.

Also, it includes 3-circuit voltage detector and mute transistor control circuit.

The NJM2774 is suitable for audio applications with a headphone and audio line outputs.

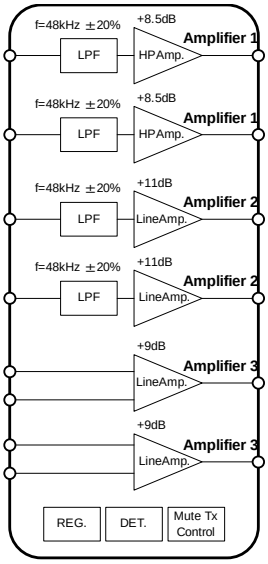
■PACKAGE

NJM2774V

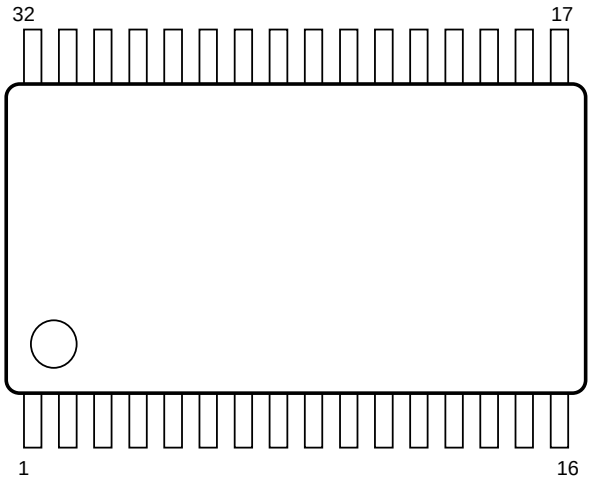
■FEATURE

◆Headphone Amplifier	48kHz LPF +8.5dB Fixed Gain
◆2-channel Audio Line Amplifier	Amplifier 2 : 48kHz LPF, +11dB Fixed Gain Amplifier 3 : +9dB Fixed Gain
◆Operating Voltage	V^{+1}=11.4 to 20V, V^{+2}=8.5 to V^{+1}V
◆Operating Current	10mA typ. (V^{+1}), 6mA typ. (V^{+2})
◆Voltage Detector (3 Circuits)	
◆Mute transistor control circuit	
◆Bipolar Technology	
◆Package Outline	SSOP32

■BLOCK DIAGRAM



■PIN CONFIGURATION



No.	Symbol	Function	No.	Symbol	Function
1	V^{+1}	Power Supply 1	17	X_PROTECT OUT	Logic Output for DC Detector
2	V^{+2}	Power Supply 2	18	X_MUTEC IN	Logic Input C for Mute Control of Amplifier Output
3	REG IN	External Reference Voltage Input “3.3V”	19	REC-MUTE OUT	Logic Output C for Mute Control of Amplifier Output
4	REG OUT	External Reference Voltage Output “3.3V”	20	REC-R OUT	Rch Line Amplifier2 “REC” Output
5	GND1	GND1	21	REC-L OUT	Lch Line Amplifier2 “REC” Output
6	HP-L IN	Lch Headphone Amplifier Input	22	LINE-MUTE OUT	Logic Output B for Mute Control of Amplifier Output
7	HP-R IN	Rch Headphone Amplifier Input	23	LINE-R OUT	Rch Line Amplifier1 “REC” Output
8	REF	Reference Voltage “1.6V”	24	LINE-L OUT	Lch Line Amplifier1 “REC” Output
9	LINE-L IN	Lch Line Amplifier1 Input	25	HP-MUTE OUT	Logic Output A for Mute Control of Amplifier Output
10	LINE-R IN	Rch Line Amplifier1 Input	26	HP-R OUT	Rch Headphone Amplifier Output
11	REC-L IN-	Lch Line Amplifier2 “REC (-)” Input	27	HP-L OUT	Lch Headphone Amplifier Output
12	REC-L IN+	Lch Line Amplifier2 “REC (+)” Input	28	SPR(-) IN	Rch Speaker Amplifier “-“ Input
13	REC-R IN+	Rch Line Amplifier2 “REC (+)” Input	29	SPR(+) IN	Rch Speaker Amplifier “+“ Input
14	REC-R IN-	Rch Line Amplifier2 “REC (-)” Input	30	SPL(-) IN	Lch Speaker Amplifier “-“ Input
15	X_MUTEA IN	Logic Input A for Mute Control of Amplifier Output	31	SPL(+) IN	Lch Speaker Amplifier “+“ Input
16	X_MUTEB IN	Logic Input B for Mute Control of Amplifier Output	32	ZERO IN	External Reference Voltage Input “0V”

■ ABSOLUTE MAXIMUM RATING(Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	+23	V
Maximum Input Voltage	V_{IM}	-0.3 to V^{+1}(*)	V
Power Dissipation	P_D	1200 NOTE: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting	mW
Operating Temperature Range	Topr	-40～+85	°C
Storage Temperature Range	Tstg	-40～+150	°C

(*) For the maximum input voltage less than -0.3 toV^{+1}

■ELECTRICAL CHARACTERISTICS (V^{+1}=15V, V^{+2}=9V, Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
GENERATIONAL CHARACTERISTICS						
Operating Voltage 1	V^{+1}		11.4	15	20	V
Operating Voltage 2	V^{+2}		8.5	9	V^{+1}	V
Operating Current 1	I_{CC1}	V^{+1}=15V, No Load, No Signal	-	10	15	mA
Operating Current 2	I_{CC2}	V^{+2}=9V, No Load, No Signal	-	6	10	mA
Cross Talk	CT	Rg=2.2kΩ, Vin=1.6V(DC), Vo=1Vrms, f=1kHz, BPF:400Hz to 30kHz	-	-	-70	dB
AMPLIFIER 1 "HEADPHONE AMPLIFIER" (V^{+2}=9V, Ta=25°C, unless otherwise specified)						
Input DC Voltage 1	V_{IDC1}		1.50	1.60	1.70	V
Output DC Voltage 1	V_{ODC1}	Vin=1.6V(DC)	-	4.26	-	V
Voltage Gain 1	G_{V1}	Vin=1.6V(DC), Vin=0.2Vrms, f=1kHz, R_L =100Ω	+7.5	+8.5	+9.5	dB
Maximum Output Voltage1	V_{OM1}	V^{+2}=8.75V , Vin=1.57 to 1.725V(DC), THD=1%, f=1kHz, BPF:400Hz to 30kHz, R_L =100Ω	2.0	2.2	-	Vrms
Output Noise 1	V_{NO1}	Rg=2.2k Ω, Vin=1.6V(DC), BPF:400Hz to 30kHz	-90 (31.6)	-97 (14.1)	-	dBV (μVrms)
Total Harmonic Distortion 1A	THD_{1A}	Vin=1.6V(DC), Vin=0.2Vrms, f=1kHz, BPF:400Hz to 30kHz, R_L =100Ω	-	0.02	-	%
Total Harmonic Distortion 1B	THD_{1B}	V^{+2}=8.75V, Vin=1.65V(DC), Vo=2.2Vrms, f=1kHz, BPF:400Hz to 30kHz, R_L =100Ω	-	1.0	7.0	%
Channel Separation 1	CS1	Rg=2.2kΩ, Vin=1.6V(DC), Vo=1Vrms, f=1kHz, BPF:400Hz to 30kHz	-	-	-70	dB
LPF Characteristics 1	LPF_1	-3dB	-	48	-	kHz
Input Impedance 1	R_{IN1}		70	100	-	kΩ
AMPLIFIER 2"LINE AMPLIFIER" (V^{+1}=15V, Ta=25°C, unless otherwise specified)						
Input DC Voltage 2	V_{IDC2}		1.50	1.60	1.70	V
Output DC Voltage 2	V_{ODC2}	Vin=1.6V(DC)	-	5.68	-	V
Voltage Gain 2	G_{V2}	Vin=1.6V(DC), Vin=0.2Vrms, f=1kHz, R_L =10kΩ	+10	+11	+12	dB
Maximum Output Voltage2	V_{OM2}	Vin=1.57 to 1.725V(DC), THD=1%, f=1kHz, BPF:400Hz to 30kHz, R_L =10kΩ	2.5	3.0	-	Vrms
Output Noise 2	V_{NO2}	Rg=2.2kΩ, Vin=1.6V(DC), BPF:400Hz to 30kHz	-90 (31.6)	-95 (17.8)	-	dBV (μVrms)
Total Harmonic Distortion 2A	THD_{2A}	Vin=1.6V(DC), Vin=0.2Vrms, f=1kHz, BPF:400Hz-30kHz, R_L =10kΩ	-	0.02	-	%
Total Harmonic Distortion 2B	THD_{2B}	V^{+1}=11.4V, Vin=1.65V(DC), Vo=3.0Vrms, f=1kHz, BPF:400Hz to 30kHz, R_L =10kΩ	-	0.15	7.0	%
Channel Separation 2	CS2	Rg=2.2kΩ, Vin=1.6V(DC), Vo=1Vrms, f=1kHz, BPF:400Hz to 30kHz	-	-	-70	dB
LPF Characteristics 2	LPF_2	-3dB	-	48	-	kHz
Input Impedance 2	R_{IN2}		70	100	-	kΩ

■**ELECTRICAL CHARACTERISTICS** (V^{+1}=15V, V^{+2}=9V, Ta=25°C, unless otherwise specified)

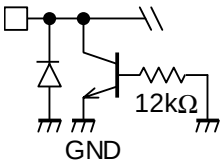
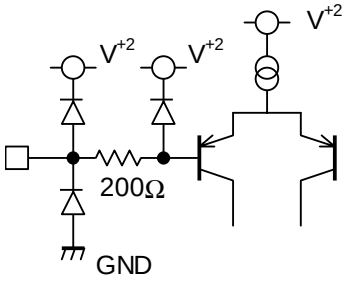
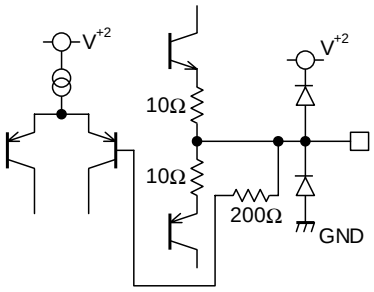
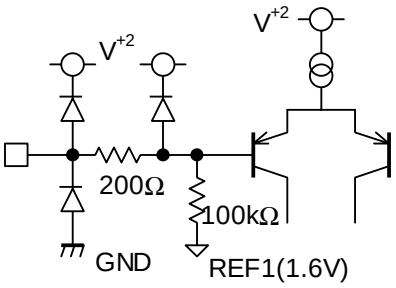
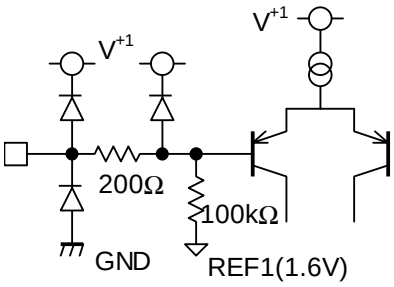
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
AMPLIFIER 3"LINE AMPLIFIER" (V^{+1}=15V, Ta=25°C, unless otherwise specified)						
Input DC Voltage 3	V_{IDC3}		1.50	1.60	1.70	V
Output DC Voltage 3	V_{ODC3}	Vin=1.5V(DC)	-	5.84	-	V
Voltage Gain 3	G_{V3}	Vin=1.5V(DC), Vin=0.2Vrms, f=1kHz, R_L =10kΩ	+8	+9	+10	dB
Maximum Output Voltage3	V_{OM3}	Vin=1.5V(DC), THD=1%, f=1kHz, BPF:400Hz to 30kHz, R_L =10kΩ	2.5	3.0	-	Vrms
Output Noise 3	V_{NO2}	Rg=2.2kΩ, Vin=1.6V(DC), BPF:400Hz to30kHz	-90 (31.6)	-95 (17.8)	-	dBV (μVrms)
Total Harmonic Distortion 3A	THD_{3A}	Vin=1.5V(DC), Vin=0.2Vrms, f=1kHz, BPF:400Hz to 30kHz, R_L =10kΩ	-	0.02	-	%
Total Harmonic Distortion 3B	THD_{3B}	V^{+1}=11.4V, Vin=1.5V(DC), Vo=2.8Vrms, f=1kHz, BPF:400Hz to 30kHz, R_L =10kΩ	-	0.15	7.0	%
Channel Separation 3	CS3	Rg=2.2kΩ, Vin=1.5V(DC), Vo=1Vrms, f=1kHz, BPF:400Hz to 30kHz	-	-	-70	dB
Common Mode Rejection Ratio	CMRR		35	-	-	dB
Input Impedance 3	R_{IN3}		40	65	-	kΩ
CONTROL DC CHARACTERISTICS						
Detection Voltage 1	V_{DET1}	Detection Voltage : V^{+1} ◆V_{DET1} < Listed Value X_MUTE OUT Current : ON, X_PROTECT OUT Voltage : LOW	10.1	10.7	11.0	V
V_{DET1} Release Voltage	V_{DET1U}	Detection Voltage : V^{+1} ◆V_{DET1U} > Listed Value X_MUTE OUT Current : OFF, X_PROTECT OUT Voltage : HIGH	-	-	11.4	V
Detection Voltage 2	V_{DET2}	Detection Voltage : V^{+2} ◆V_{DET2} < Listed Value X_MUTE OUT Current : ON X_PROTECT OUT Voltage : LOW	6.6	7	8.0	V
V_{DET2} Release Voltage	V_{DET2U}	Detection Voltage : V^{+2} ◆V_{DET2U} > Listed Value X_MUTE OUT Current : OFF, X_PROTECT OUT Voltage : HIGH	-	-	8.5	V
Detection Voltage 3	V_{DET3}	Detection Voltage : |SP(+) – SP(-)| ◆V_{DET3} < Listed Value X_PROTECT OUT Voltage : LOW	-	0.7	-	V
REG Voltage	V_{REG}	REGIN=3.3V, Io=10mA	3.25	3.30	3.35	V
X_PROTECT OUT Output Voltage : H	V_{OPROH}	Logic Output : High, R_L =1MΩ	2.8	2.95	3.1	V
X_PROTECT OUT Output Voltage : L	V_{OPROL}	Logic Output : Low, R_L =1MΩ	0	-	0.5	V
X_MUTE OUT Output Voltage : H	V_{OMUTEH}	Logic Output : High, V_{pullup} =3.3V, R_{pullup}=10kΩ	2.8	-	-	V
X_MUTE OUT Output Voltage : L	V_{OMUTEL}	Logic Output : Low, V_{pullup} =3.3V, R_{pullup}=10kΩ	1.3	1.75	2.2	V
X_MUTE IN Input Voltage : H	V_{IMUTEH}	Logic Input : High	2.5	-	5.5	V
X_MUTE IN Input Voltage : L	V_{IMUTEL}	Logic Input : Low	0	-	0.2	V

Note1 : In case of initial condition after turn ON
X_MUTE OUT Output Current : ON
(After turn ON, release the detection by changing the " V_{IMUTE}" level from "LOW" to "HIGH".)
X_PROTECT OUT : HIGH

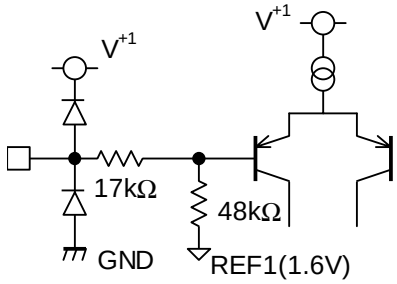
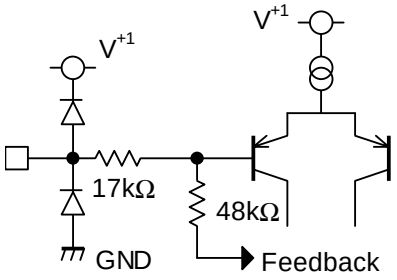
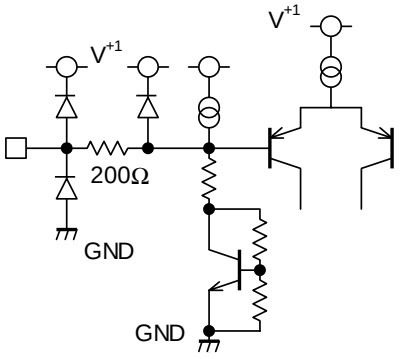
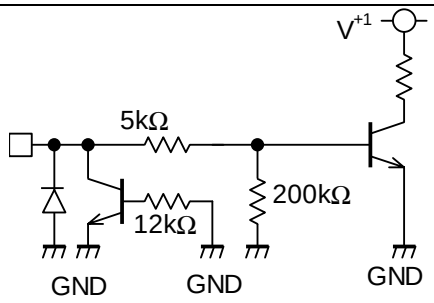
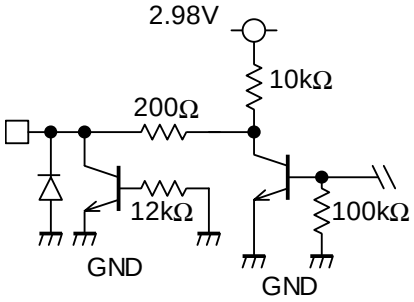
Note2 : In case of any condition "V_{DET1} > V^{+1}", "V_{DET2} > V^{+2}", or "V_{IMUTE} = LOW"
All X_MUTE OUT Output Current : ON
(X_MUTE OUT terminal voltage is 1.75V on the measurement circuit [V_{pullup} =3.3V, R_{pullup}=10kΩ])

: In case of any condition "V_{DET1} > V^{+1}", "V_{DET2} > V^{+2}", or "V_{DET3} < |SP(+) – SP(-)|"
X_PROTECT OUT : LOW

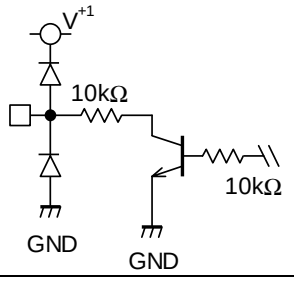
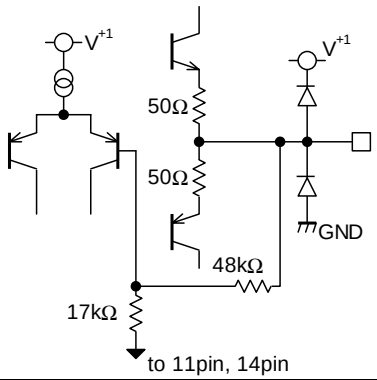
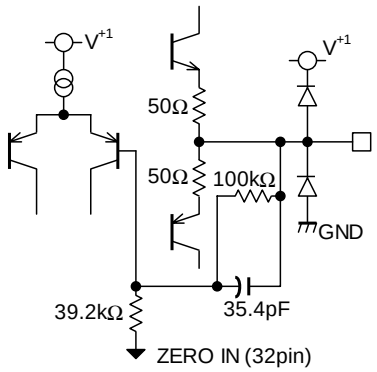
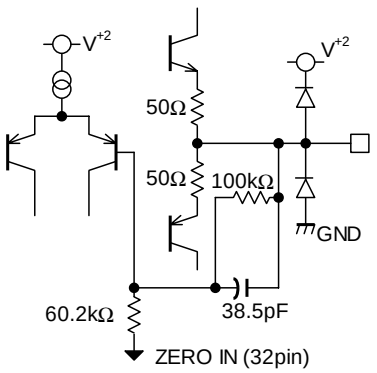
■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	DC VOLTAGE
1 2	V^{+1} V^{+2}	Power Supply 1 Power Supply 2		11.4 to 20V 8.5 to V^{+1}V
3	REG IN	External Reference Voltage Input “3.3V”		-
4	REG OUT	External Reference Voltage Output “3.3V”		REG IN
6 7	HP-L IN HP-R IN	Lch Headphone Amplifier Input Rch Headphone Amplifier Input		1.6V
9 10	LINE-L IN LINE-R IN	Lch Line Amplifier1 Input Rch Line Amplifier1 Input		1.6V

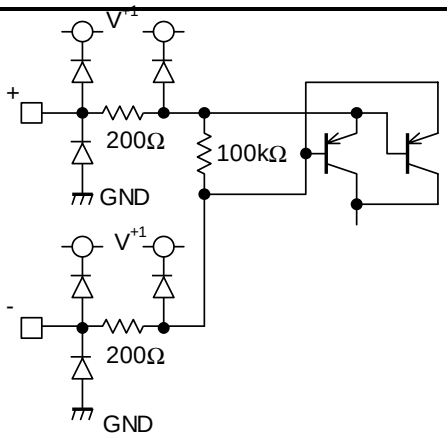
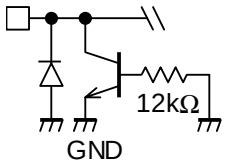
■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	DC VOLTAGE
12 13	REC-L IN+ REC-R IN+	Lch Line Amplifier2 “REC (+)” Input Rch Line Amplifier2 “REC (+)” Input		1.6V
11 14	REC-L IN- REC-R IN-	Lch Line Amplifier2 “REC (-)” Input Rch Line Amplifier2 “REC (-)” Input		1.6V
8	REF	Reference Voltage “1.6V”		1.6V
15 16 18	X_MUTEA IN X_MUTEB IN X_MUTEC IN	Logic Input A for Mute Control of Amplifier Output Logic Input B for Mute Control of Amplifier Output Logic Input C for Mute Control of Amplifier Output		0V
17	X_PROTECT OUT	Logic Output for DC Detector		2.95V

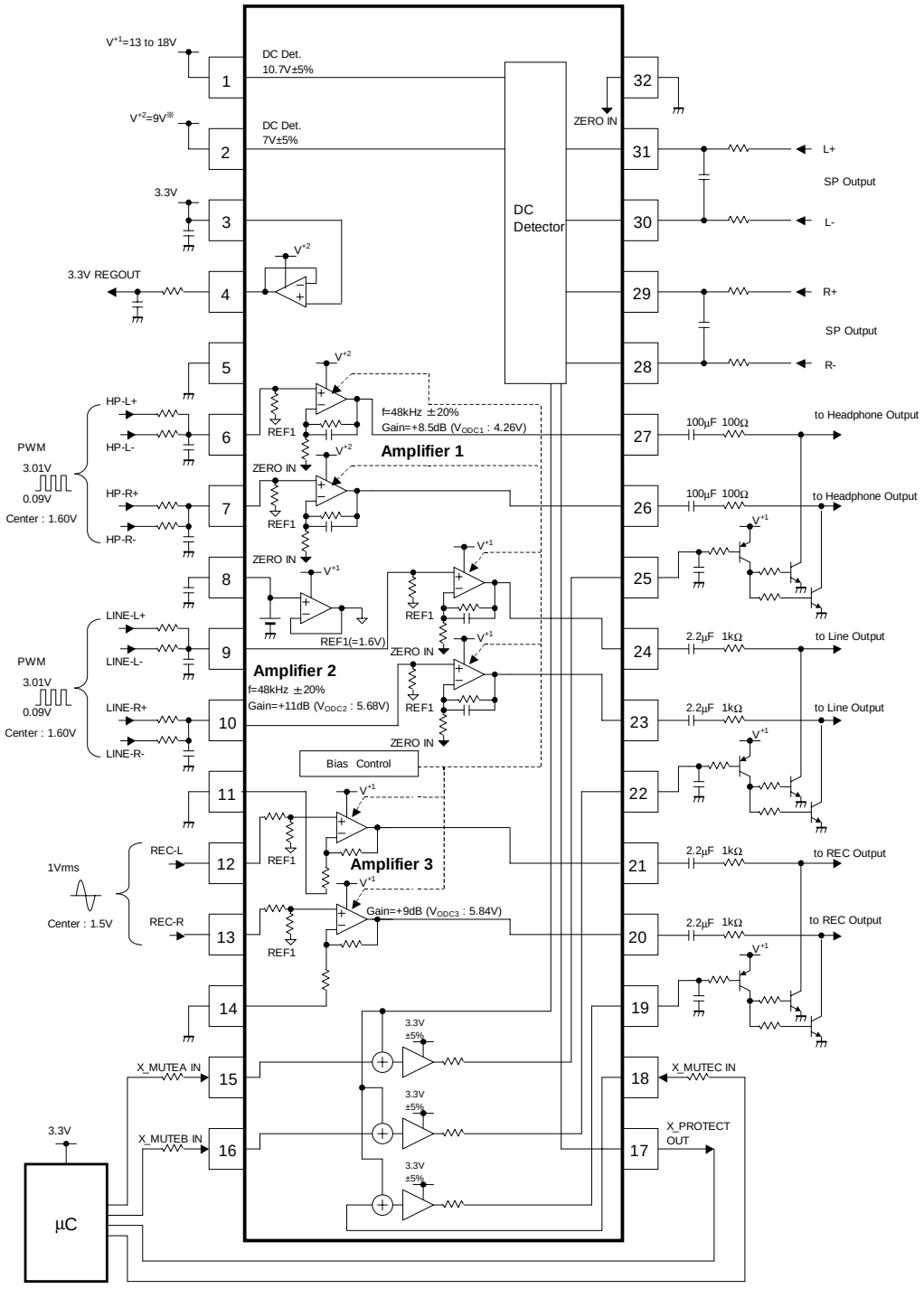
■ TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	DC VOLTAGE
19 22 25	REC-MUTE OUT LINE-MUTE OUT HP-MUTE OUT	Logic Output C for Mute Control of Amplifier Output Logic Output B for Mute Control of Amplifier Output Logic Output A for Mute Control of Amplifier Output		-
20 21	REC-R OUT REC-L OUT	Rch Line Amplifier2 “REC” Output Lch Line Amplifier2 “REC” Output		5.84V
23 24	LINE-R OUT LINE-L OUT	Rch Line Amplifier1 “REC” Output Lch Line Amplifier1 “REC” Output		5.68V
26 27	HP-R OUT HP-L OUT	Rch Headphone Amplifier Output Lch Headphone Amplifier Output		4.26V

■TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	DC VOLTAGE
28 29 30 31	SPR(-) IN SPR(+) IN SPL(-) IN SPL(+) IN	Rch Speaker Amplifier "-" Input Rch Speaker Amplifier "+" Input Lch Speaker Amplifier "-" Input Lch Speaker Amplifier "+" Input		-
32	ZERO IN	External Reference Voltage Input "0V"		-

■ APPLICATION CIRCUIT 1

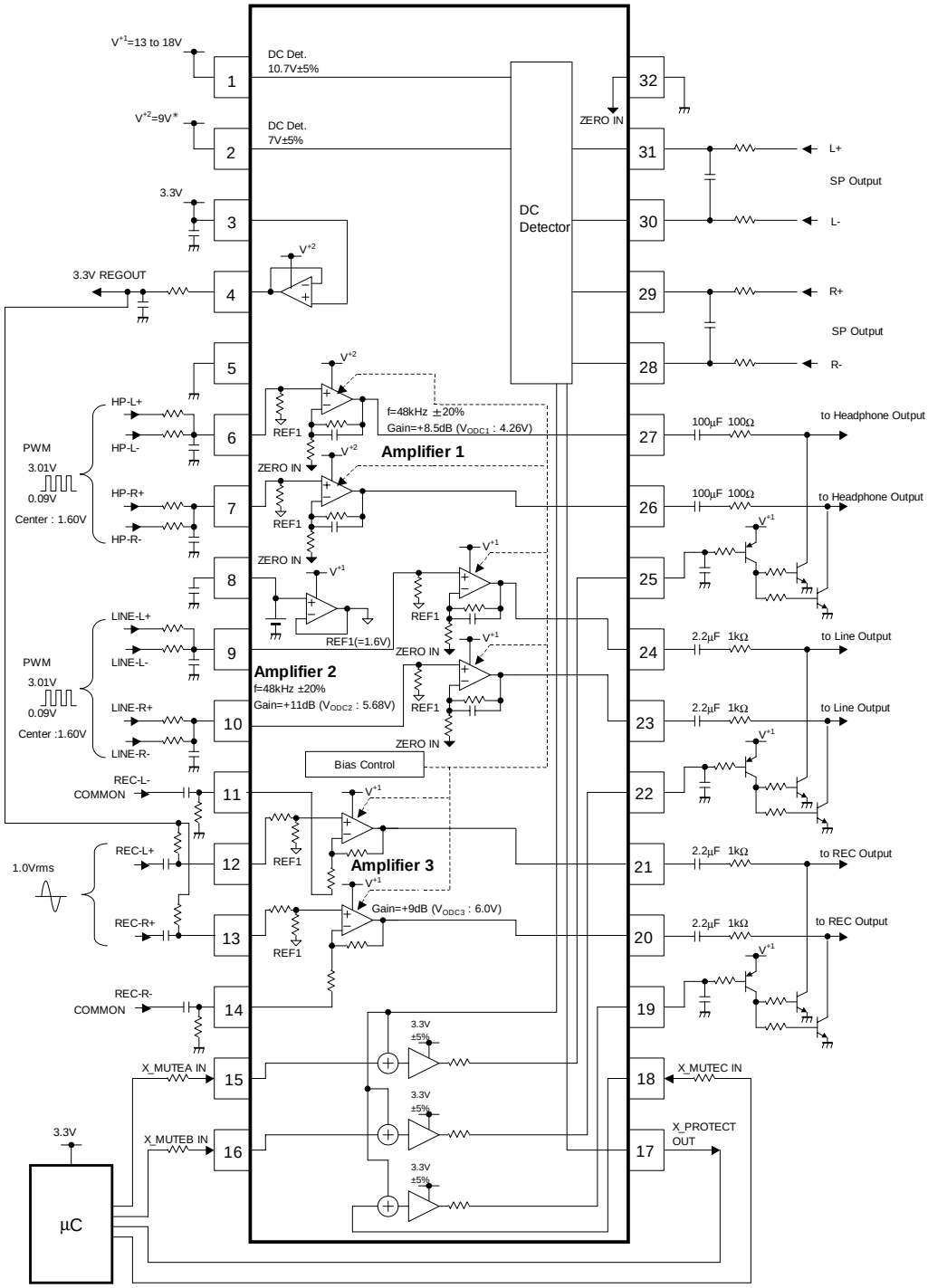


Note)

Use 9V-supply voltage to V^{+2}, because it is a supply voltage for high power circuit block.

In case of a V^{+2} exceeds 9V [for example, it will be the common voltage as a V^{+1}], there is possibility to be not able to satisfy the package power on these components value of the current application circuit. The maximum limitation of power dissipation should be taken into consideration. For example, adjust the load resistances of " Headphone Amplifier " and/or " 3.3V Regulator".

■ APPLICATION CIRCUIT 2

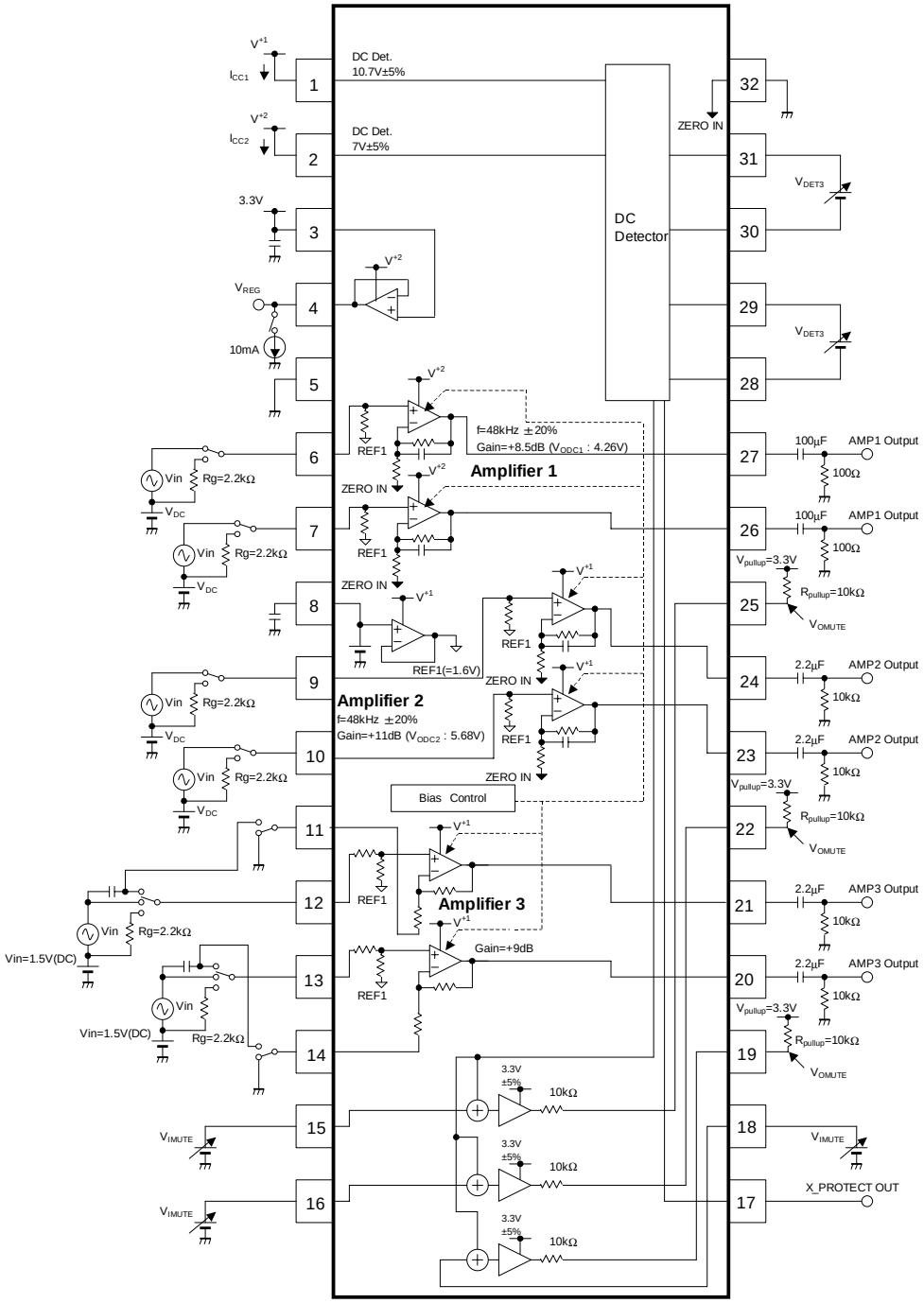


Note)

Use 9V-supply voltage to V^{+2}, because it is a supply voltage for high power circuit block.

In case of a V^{+2} exceeds 9V [for example, it will be the common voltage as a V^{+1}], there is possibility to be not able to satisfy the package power on these components value of the current application circuit. The maximum limitation of power dissipation should be taken into consideration. For example, adjust the load resistances of " Headphone Amplifier " and/or " 3.3V Regulator".

■ MEASUREMENT CIRCUIT



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