

DATA SHEET

Part No.	AN12944A
Package Code No.	HQFP048-P-0707

Contents

■ Applications	3
■ Package	3
■ Type	3
■ Application Circuit Example (Block Diagram)	4
■ Pin Descriptions	5
■ Absolute Maximum Ratings	6
■ Operating Supply Voltage Range	6
■ Electrical Characteristics	7
■ Control Pin Mode Table	11
■ Technical Data	12
■ Usage Notes	17

AN12944A

Monophonic audio power IC with built-in AGC

■ Applications

- For the notebook personal computer

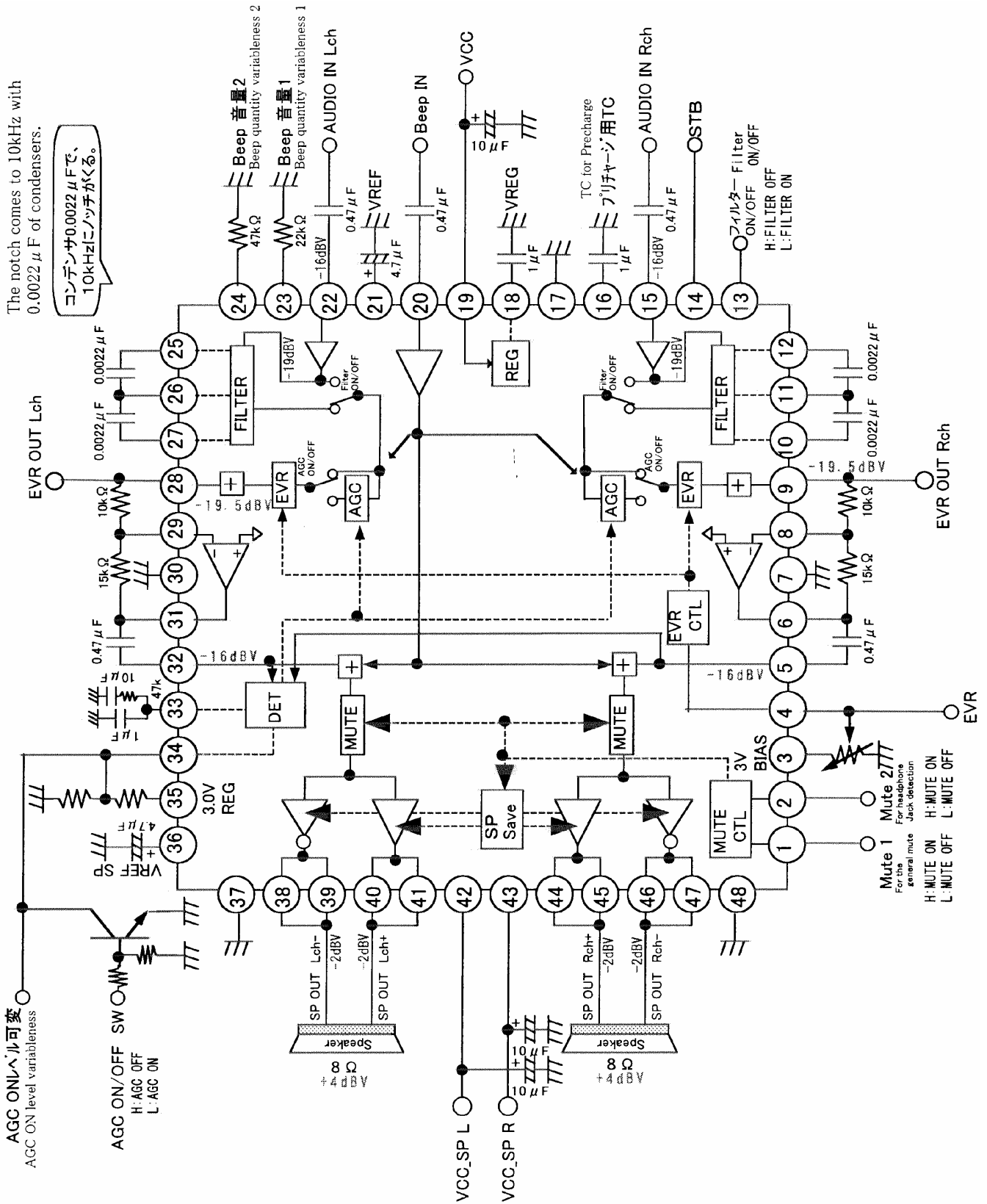
■ Package

- 48-pin four direction flat package (HQFP-48 type)

■ Type

- Silicon monolithic bipolar IC

Application Circuit Example (Block Diagram)



■ Pin Descriptions

Pin No.	Pin name	Description	Pin No.	Pin name	Description
1	MUTE_1	Activist the high Mute 1	25	FILT3_L	Filter terminal 3 Lch
2	MUTE_2	Activist the high Mute 2 (With a chattering prevention function)	26	FILT2_L	Filter terminal 2 Lch
3	BIAS30	3 V bias output	27	FILT1_L	Filter terminal 1 Lch
4	EVR_VTL	EVR control pin	28	EVROUT_L	EVR Lch output
5	SPIN_R	SP amp. Rch input	29	AMPI_L	The amplifier input for the gain adjustment Lch
6	AMPO_R	The amplifier output for the gain adjustment Rch	30	GND	GND
7	GND	GND	31	AMPO_L	The amplifier output for the gain adjustment Lch
8	AMPI_R	The amplifier input for the gain adjustment Rch	32	SPIN_L	SP amp. Lch input
9	EVROUT_R	EVR Rch output	33	DET_C	AGC demodulation pin
10	FILT1_R	Filter terminal 1 Rch	34	AGC_MOD	AGC ON/OFF SW & ON level control
11	FILT2_R	Filter terminal 2 Rch	35	REG3V	3.0 V reg. output
12	FILT3_R	Filter terminal 3 Rch	36	VREF_SP	The VREFSP C terminal
13	FILT_SW	Filter ON/OFF control	37	GNDSP_L	GND_SP Lch
14	STB_SW	Standby ON/OFF control	38	OUT_LN2	SP amp. Lch output (-)
15	AUDIN_L	Rch input	39	OUT_LN1	SP amp. Lch output (-)
16	TC	The timing condenser for Pri-charge	40	OUT_LP2	SP amp. Lch output (+)
17	GND	GND	41	OUT_LP1	SP amp. Lch output (+)
18	VREG_C	The VREG C terminal	42	VCCSP_L	VCC_SP Lch
19	VCC	VCC	43	VCCSP_R	VCC_SP Rch
20	BEEP_IN	Beep signal input	44	OUT_RP1	SP amp. Rch output (+)
21	VREF_C	The VREF C terminal	45	OUT_RP2	SP amp. Rch output (+)
22	AUDIN_L	Lch input	46	OUT_RN1	SP amp. Rch output (-)
23	BP_ADJ1	Beep signal level adjustment terminal 1	47	OUT_RN2	SP amp. Rch output (-)
24	BP_ADJ2	Beep signal level adjustment terminal 2	48	GNDSP_R	GND_SP Rch

■ Absolute Maximum Ratings

A No.	Parameter	Symbol	Rating	Unit	Note
1	Storage temperature	T_{stg}	-55 to +150	°C	*1
2	Operating ambient temperature	T_{opr}	-20 to +75	°C	*1
3	Operating ambient atmospheric pressure	P_{opr}	$1.013 \times 10^5 \pm 0.61 \times 10^5$	Pa	
4	Operating constant gravity	G_{opr}	9 810	m/S ²	
5	Operating shock	S_{opr}	4 900	m/S ²	
6	Supply voltage	VCC	5.75	V	*2
		VCC-SP	5.75		
7	Supply current	I_{CC}	—	A	
8	Power dissipation	P_D	355	mW	*3

Note) *1: Expect for the storage temperature and operating ambient temperature, all ratings are for $T_a = 25^\circ\text{C}$.

*2: The range under absolute maximum ratings, power dissipation.

When using this IC, refer to the $\bullet P_D - T_a$ diagram in the ■ Technical Data and use under the condition not exceeding the allowable value.

*3: Power dissipation shows the value of only package at $T_a = 75^\circ\text{C}$.

■ Operating Supply Voltage Range

Parameter	Symbol	Range	Unit	Note
Supply voltage range	VCC	4.00 to 5.50	V	*
	VCC-SP	4.00 to 5.50		

Note) *: The range under absolute maximum ratings, power dissipation.

■ Electrical Characteristics at VCC = 5.0 V, VCC-SP = 5.0V

Note) $T_a = 25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Note
				Min	Typ	Max		
Circuit current								
1	Circuit current 1A (VCC)	IVCCA	VCC = 5.00 V, Non-signal MUTE = Off, STB = Off	9.8	14.0	18.2	mA	
2	Circuit current 2A (VCC-SP)	IVCCSA	VCC = 5.00 V, Non-signal MUTE = Off, STB = Off	—	8.0	16.0	mA	
3	Circuit current 1B (VCC)	IVCCB	VCC = 5.00 V, Non-signal MUTE = On, STB = Off	9.1	13.0	16.9	mA	
4	Circuit current 2B (VCC-SP)	IVCCSB	VCC = 5.00 V, Non-signal MUTE = On, STB = Off	—	0.1	1.0	mA	
5	Circuit current 1C (VCC)	IVCCC	VCC = 5.00 V, Standby mode Non-signal, MUTE = On, STB = On	—	0.01	1.00	μA	
6	Circuit current 2C (VCC-SP)	IVCCSC	VCC = 5.00 V, Standby mode Non-signal, MUTE = On, STB = On	—	20	50	μA	
Supply for EVR								
7	Supply voltage for EVR	V3	Voltage for pin 3	2.75	3.00	3.25	V	
Supply for AGC								
8	Supply voltage for AGC	V35	Voltage for pin 35	2.80	2.95	3.10	V	
Speaker amplifier input/output characteristic at EVR = max. (Pin 22, Pin 15 → Pin 38 to Pin 41, Pin 44 to Pin 47) V4 = 3.0 V, V13 = 5 V								
11	Speaker amplifier audio output level L-ch.	VOSPL	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω	3.0	4.0	5.0	dBV	
12	Speaker amplifier audio output level R-ch.	VOSPR	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω	3.0	4.0	5.0	dBV	
13	Speaker amplifier audio output distortion L-ch.	THSPL	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω , to THD 5 th	—	0.04	0.50	%	
14	Speaker amplifier audio output distortion R-ch.	THSPR	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω , to THD 5 th	—	0.04	0.50	%	
15	Speaker amplifier audio output noise L-ch.	VNSPL	Non-signal RL = 8 Ω , A curve filter	—	-76	-69	dBV	
16	Speaker amplifier audio output noise R-ch.	VNSPR	Non-signal RL = 8 Ω , A curve filter	—	-76	-69	dBV	
17	Speaker amplifier maximum output electric power L-ch.	VM8SPL	Vin = 1kHz, THD = 10% RL = 8 Ω , to THD 5 th, AGC = Off	0.7	1.0	—	W	
18	Speaker amplifier maximum output electric power R-ch.	VM8SPR	Vin = 1kHz, THD = 10% RL = 8 Ω , to THD 5 th, AGC = Off	0.7	1.0	—	W	
19	Speaker amplifier cross talk R-ch. → L-ch.	VCTSPL	Vin = -16.0 dBV, 1 kHz RL = 8 Ω , A curve filter	70	78	—	dB	
20	Speaker amplifier cross talk L-ch. → R-ch.	VCTSPR	Vin = -16.0 dBV, 1 kHz RL = 8 Ω , A curve filter	70	78	—	dB	

■ Electrical Characteristics at VCC = 5.0 V, VCC-SP = 5.0V (continued)

Note) T_a = 25°C±2°C unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Note
				Min	Typ	Max		
Speaker amplifier AGC characteristic at EVR = max. (Pin 22, Pin 15 → Pin 38 to Pin 41, Pin 44 to Pin 47) V13 = 5 V, V4 = 3 V								
31	Speaker amplifier AGC output level 1	VAGSPL1	Vin = -6.0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 2.0 V	5.2	6.2	7.2	dBV	
32	Speaker amplifier AGC output level 1	VAGSPR1	Vin = -6.0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 2.0 V	5.2	6.2	7.2	dBV	
33	Speaker amplifier AGC output level 2	VAGSPL2	Vin = 0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 2.0 V	5.5	6.5	7.5	dBV	
34	Speaker amplifier AGC output level 2	VAGSPR2	Vin = 0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 2.0 V	5.5	6.5	7.5	dBV	
35	Speaker amplifier AGC output THD 2	TAGSPL2	Vin = 0 dBV, 1 kHz, RL = 8 Ω to THD 5 th, AGC level V34 = 2.0 V	—	0.1	0.5	%	
36	Speaker amplifier AGC output THD 2	TAGSPR2	Vin = 0 dBV, 1 kHz, RL = 8 Ω to THD 5 th, AGC level V34 = 2.0 V	—	0.1	0.5	%	
37	Speaker amplifier AGC output level 3	VAGSPL3	Vin = 0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 1.0 V	-0.5	0.5	1.5	dBV	
38	Speaker amplifier AGC output level 3	VAGSPR3	Vin = 0 dBV, 1 kHz, RL = 8 Ω AGC = On, AGC level V34 = 1.0 V	-0.5	0.5	1.5	dBV	
41	Speaker amplifier AGC output level 1	VAGSPL11	Vin = -6.0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 2.0 V	4.5	5.9	7.0	dBV	
42	Speaker amplifier AGC output level 1	VAGSPR11	Vin = -6.0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 2.0 V	4.5	5.9	7.0	dBV	
43	Speaker amplifier AGC output level 2	VAGSPL12	Vin = 0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 2.0 V	4.5	5.9	7.0	dBV	
44	Speaker amplifier AGC output level 2	VAGSPR12	Vin = 0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 2.0 V	4.5	5.9	7.0	dBV	
45	Speaker amplifier AGC output level 3	VAGSPL13	Vin = 0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 1.0 V	-0.5	0.5	1.5	dBV	
46	Speaker amplifier AGC output level 3	VAGSPR13	Vin = 0 dBV, 1 kHz, VCC = 4.4 V RL = 8 Ω, AGC = On, AGC level V34 = 1.0 V	-0.5	0.5	1.5	dBV	

■ Electrical Characteristics at VCC = 5.0 V, VCC-SP = 5.0V (continued)

Note) T_a = 25°C±2°C unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Note
				Min	Typ	Max		
Speaker amplifier EVR characteristic (Pin 22, Pin 15 → Pin 38 to Pin 41, Pin 44 to Pin 47) V13 = 5 V, V24 = 5 V								
51	Speaker amplifier audio output level L-ch.	VOEV1L	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Typ., V4 = 3.0 V	3.0	4.0	5.0	dBV	
52	Speaker amplifier audio output level R-ch.	VOEV1R	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Typ., V4 = 3.0 V	3.0	4.0	5.0	dBV	
53	Speaker amplifier audio output level L-ch.	VOEV2L	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Typ., V4 = 2.0 V	-8.0	-6.0	-4.0	dBV	
54	Speaker amplifier audio output level R-ch.	VOEV2R	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Typ., V4 = 2.0 V	-8.0	-6.0	-4.0	dBV	
55	Speaker amplifier audio output level L-ch.	VOEV3L	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Min., V4 = 0 V	—	-76	-68	dBV	
56	Speaker amplifier audio output level R-ch.	VOEV3R	Vin = -16.0 dBV, 1 kHz, RL = 8 Ω EVR = Min., V4 = 0 V	—	-76	-68	dBV	
Speaker amplifier BEEP characteristic (Pin 20 → Pin 38 to Pin 41, Pin 44 to Pin 47) R23 = 22 kΩ								
61	Speaker amplifier BEEP output level 1 L-ch.	VOBES1L	Vin = Rectangular wave, 3.0 V[p-p] 1 kHz, RL = 8 Ω, R23 = 22 kΩ	1.2	1.5	1.8	V[p-p]	
62	Speaker amplifier BEEP output level 1 R-ch.	VOBES1R	Vin = Rectangular wave, 3.0 V[p-p] 1 kHz, RL = 8 Ω, R23 = 22 kΩ	1.2	1.5	1.8	V[p-p]	
63	Speaker amplifier BEEP output level 2 L-ch.	VOBES2L	Vin = Rectangular wave, 1.5 V[p-p] 1 kHz, RL = 8 Ω, R23 = 22 kΩ	1.2	1.5	1.8	V[p-p]	
64	Speaker amplifier BEEP output level 2 R-ch.	VOBES2R	Vin = Rectangular wave, 1.5 V[p-p] 1 kHz, RL = 8 Ω, R23 = 22 kΩ	1.2	1.5	1.8	V[p-p]	
65	Speaker amplifier BEEP output level 3 L-ch.	VOBES3L	Vin = Sine wave, 0.5 V[p-p], 1 kHz A curve filter, RL = 8 Ω	—	-75	-68	dBV	
66	Speaker amplifier BEEP output level 3 R-ch.	VOBES3R	Vin = Sine wave, 0.5 V[p-p], 1 kHz A curve filter, RL = 8 Ω	—	-75	-68	dBV	
EVR out BEEP characteristic (Pin 20 → Pin 9, Pin 28) R24 = 47 kΩ								
67	EVR out BEEP output level 1 L-ch.	VOBEE1L	Vin = Rectangular wave, 3.0 V[p-p] 1 kHz, R24 = 47 kΩ	0.09	0.11	0.13	V[p-p]	
68	EVR out BEEP output level 1 R-ch.	VOBEE1R	Vin = Rectangular wave, 3.0 V[p-p] 1 kHz, R24 = 47 kΩ	0.09	0.11	0.13	V[p-p]	
69	EVR out BEEP output level 2 L-ch.	VOBEE2L	Vin = Rectangular wave, 1.5 V[p-p] 1 kHz, R24 = 47 kΩ	0.09	0.11	0.13	V[p-p]	
70	EVR out BEEP output level 2 R-ch.	VOBEE2R	Vin = Rectangular wave, 1.5 V[p-p] 1 kHz, R24 = 47 kΩ	0.09	0.11	0.13	V[p-p]	
71	EVR out BEEP output level 3 L-ch.	VOBEE3L	Vin = Sine wave, 0.5 V[p-p], 1 kHz A curve filter	—	-86	-78	dBV	
72	EVR out BEEP output level 3 R-ch.	VOBEE3R	Vin = Sine wave, 0.5 V[p-p], 1 kHz A curve filter	—	-86	-78	dBV	

■ Electrical Characteristics at VCC = 5.0 V, VCC-SP = 5.0V (continued)

Note) T_a = 25°C±2°C unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	No te
				Min	Typ	Max		
Voltage holding mode								
73	Active mute 1 voltage holding mode ON	V1H	—	2.5	—	5.0	V	
74	Active mute 1 voltage holding mode OFF	V1L	—	0.0	—	1.0	V	
75	Active mute 2 voltage holding mode ON	V2H	—	2.5	—	5.0	V	
76	Active mute 2 voltage holding mode OFF	V2L	—	0.0	—	1.0	V	
77	Filter ON/OFF SW voltage holding mode OFF	V13H	—	2.5	—	5.0	V	
78	Filter ON/OFF SW voltage holding mode ON	V13L	—	0.0	—	1.0	V	
79	Standby ON/OFF SW voltage holding mode OFF	V17H	—	2.5	—	5.0	V	
80	Standby ON/OFF SW voltage holding mode ON	V17L	—	0.0	—	0.5	V	
81	AGC ON/OFF SW voltage holding mode ON	V34H	—	1.0	—	3.0	V	
82	AGC ON/OFF SW voltage holding mode OFF	V34L	—	0.0	1.5	0.5	V	

■ Control Pin Mode Table

Note) See parameters B No. 31 to B No. 46 in the ■ Electrical Characteristics for control voltage retention ranges.

Pin No.	Description	Pin voltage		Remarks
		Low	High	
1	Active mute 1	Mute OFF	Mute ON	When a mute is ONed with either the pin, it becomes mute ON.
2	Active mute 2	Mute OFF	Mute ON	
13	Filter ON/OFF	Filter ON	Filter OFF	—
14	Standby ON/OFF	STB ON	STB OFF	—
34	AGC ON/OFF	AGC OFF	AGC ON	—

Pin No.	Description	Pin voltage		Remarks
		Low ↔ High		
4	Electronic volume control terminal	Low gain ↔ High gain		—
34	AGC level variable terminal	Low level ↔ High level		—

Pin No.	Description	Connected resistance		Remarks
		Low ↔ High		
23	BEEP volume control pin	High level ↔ Low level		—

■ Technical Data

- I/O block circuit diagrams and pin function descriptions

Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit	Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit
1	アクティブ HIGH ミュート1 at Open DC -V	 入力インピーダンス=100kΩ以上 input impedance=100kΩ or more	5 32	スピーカ アンプ 入力 Speaker amplifier entry DC 2.25V AC -16dBV	 入力インピーダンス=約25kΩ Input impedance=about 25kΩ
2	アクティブ HIGH ミュート2 チャタリング 防止回路付 at Open DC 4.5V	 入力インピーダンス=約50kΩ Input impedance=about 50kΩ	6 31	ゲイン調整 アンプ出力 DC 2.25V AC -16dBV	 出力インピーダンス=10Ω以下 Output impedance=10Ω or less
3	3V BIAS DC 3.00V	 出力インピーダンス=10Ω以下 Output impedance=10Ω or less	8 29	ゲイン調整 アンプ入力 DC 2.25V 仮想接地	 入力インピーダンス=500kΩ以上 input impedance=500kΩ or more
4	電子 ボリューム 制御ピン DC 0.0V	 入力インピーダンス=約200kΩ Input impedance=about 200kΩ	7 17 30	GND DC 0.0V	

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit	Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit
9 28	電子 ボリウム 出力 Electronic volume output 逆相 Antiphase DC 2.25V AC -19.5dBV	VREG (4.5V) 出力インピーダンス=10Ω以下 Output impedance=10Ω or less	13	フィルター ON/OFF スイッチ at Open DC 1.5V	VREG(4.5V) 200kΩ, 160kΩ, 80kΩ, 80kΩ, 9kΩ
10 27	フィルター 端子 1 DC 2.25V AC -25.0dBV at peak point	VREG (4.5V) 30kΩ 出力インピーダンス=10Ω以下 Output impedance=10Ω or less	14	スタンバイ ON/OFF 切換 STB ON/OFF SW OPEN DC 0.0V	80kΩ, 240kΩ 入力インピーダンス=約80kΩ Input impedance= about 80kΩ
11 26	フィルター 端子 2 DC 2.25V AC -43.5dBV	VREG (4.5V) 30kΩ 出力インピーダンス=10Ω以下 Output impedance=10Ω or less	15 22	音声入力 Audio signal input DC 2.25V AC -16.0dBV	VREG(4.5V) 15 / 22 14.6kΩ, 35.4kΩ, VREF(2.25V) 入力インピーダンス=約50kΩ Input impedance= about 50kΩ
12 25	フィルター 端子 3 DC 2.25V 仮想接地	VREG (4.5V) 30kΩ 入力インピーダンス=500kΩ以上 input impedance=500kΩ or more	16	プリチャージ用 タイミング コンデンサ端子 定常時 DC 4.0V	VREG (4.5V) 400kΩ

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

(Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit	Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit
18	REG用 平滑C端子 Ripple removal condenser terminal for the regulator DC 2.25V		23	Beep音量 調整端子 (SP出力用) DC 1.75V	
19	VCC DC 5.0V	/	24	Beep音量 調整端子 (EVR出力 用) DC 1.37V	
20	BEEP入力 Beep Input DC 2.55V		33	AGC DET DC 0.4V	
21	VREF DC 2.25V		34	AGC ON Level Variable and AGC ON/OFF input impedance=500kΩ or more	

■ Technical Data (continued)

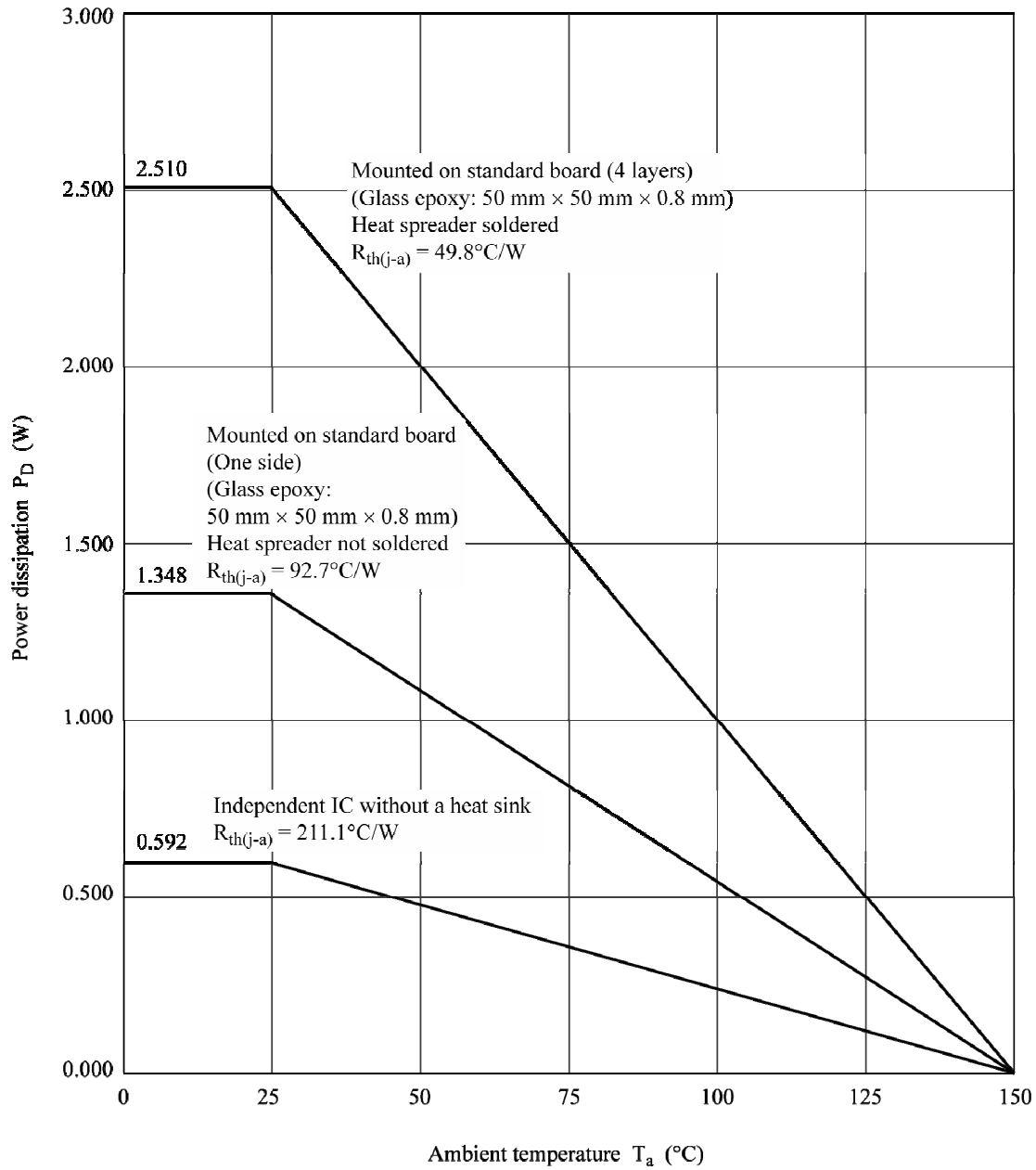
- I/O block circuit diagrams and pin function descriptions (continued)

Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit	Pin No.	波形・電圧 Waveform・Voltage	内部回路 Internal circuit
35	3.0V BIAS DC 3.0V	 出力インピーダンス=約100Ω Output impedance=about 100Ω	37	GND_SP DC 0.0V	/
36	VREF (SP) DC 2.20V	 入力インピーダンス=約50kΩ Input impedance= about 50kΩ	42	VCC_SP DC 5.0V	
38 39 46 47	スピーカ 出力 Speaker output opposite 38. 39PIN 44. 45PIN 逆相 opposite DC 2.20V AC 4dBV	 出力インピーダンス=1Ω以下 Output impedance=1Ω or less	38/39 46/47		/
40 41 44 45	スピーカ 出力 Speaker output positive 38. 39PIN 44. 45PIN 正相 positive DC 2.20V AC 4dBV	 出力インピーダンス=1Ω以下 Output impedance=1Ω or less	40/41 44/45		

■ Technical Data (continued)

- $P_D - T_a$ diagram



■ Usage Notes

1. Avoid power line short and ground short of the terminal.
2. Especially, as pin 40, pin 41, pin 44 and pin 45 (SP output positive phase), pin 38, pin 39, pin 46 and pin 47 (SP output negative phase), when turn on the power supply under the condition of power line short, ground short or load short, it doesn't break because of protection circuit operating.
But those pins can drive high current, so when those pins are shorted power line, ground or load, break may be caused by pulse noise which exceeds power supply voltage or below ground voltage.
3. Break may be caused by mounting the IC at the 90°, 180°, 270° direction.
Please be sure to avoid mounting at the 90°, 180°, 270° direction.

Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products, and no license is granted under any intellectual property right or other right owned by our company or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
Consult our sales staff in advance for information on the following applications:
 - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
 - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
 - Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.