AN2904FHQ

Sound input/output interface IC for digital still camera

■ Overview

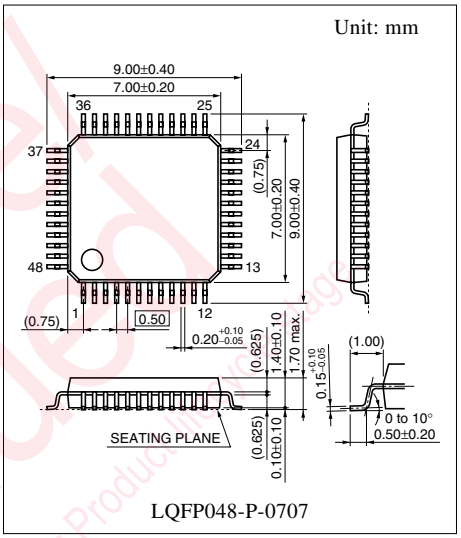
The AN2904FHQ is a sound input/output interface IC which is optimum for incorporation of sound functions in a digital still camera. The sound front-side processing prior to the digital processing and sound rear-side processing after DAC are integrated on a single chip. The IC is effective to make the equipment compact.

■ Features

- Functions required for a front and rear side sound processing are integrated on a single chip
- Built-in a microphone amp. and a microphone power source
- Built-in a 0.5 W BTL amp.
- Built-in a BTL amp. power save function
- Built-in an internal microphone amp. off function (Usable for an external microphone amp.)

■ Applications

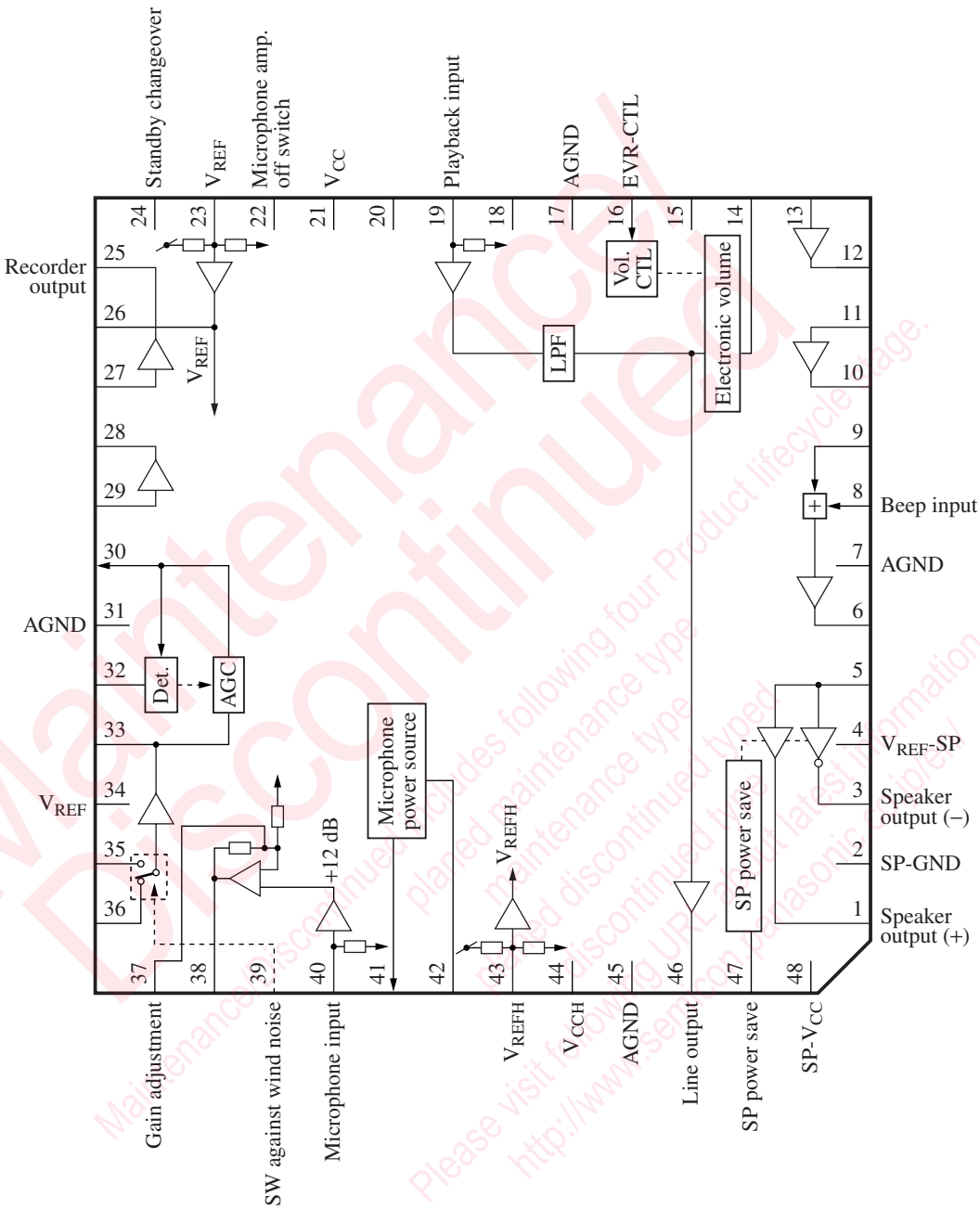
- Digital still camera (DSC)



LQFP048-P-0707

Note) The package of this product will be changed to lead-free type (LQFP048-P-0707A). See the new package dimensions section later of this datasheet.

■ Block Diagram



■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	Speaker output (+)	25	Rec. output
2	GND (for SP)	26	HPF operational amp. output
3	Speaker output (–)	27	HPF operational amp. input
4	1/2 V_{CC-SP}	28	LPF output
5	Speaker amp. input	29	LPF operational amp. input
6	Mix. amp. output	30	AGC output
7	GND	31	GND
8	Beep input	32	AGC detection pin
9	Mix. amp. input	33	Wind noise HPF output
10	SP block HPF output	34	Wind noise HPF bias output
11	SP block HPF operational amp. input	35	Wind noise HPF operational amp. input
12	Buffer amp. output	36	Wind noise HPF through input
13	Buffer amp. input	37	Microphone amp. negative feedback pin
14	Electrotonic volume output	38	Microphone amp. output
15	N.C.	39	SW against wind noise
16	Electrotonic volume control	40	Microphone amp. input
17	GND	41	Microphone power source
18	N.C.	42	Microphone power source smoothing pin
19	Playback input	43	1/2 V_{CCH} (V_{REFH})
20	N.C.	44	V_{CCH}
21	V_{CC}	45	GND
22	Microphone amp. power save SW	46	Line output
23	1/2 V_{CC} (V_{REF})	47	Speaker power save SW
24	Standby changeover	48	V_{CC-SP} (for speaker drive)

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage *2	V_{CCH}	5.2	V
	V_{CC}	3.5	
	V_{CC-SP}	5.2	
Supply current	I_{CC}	—	A
Power dissipation *3	P_D	361	mW
Operating ambient temperature *1	T_{opr}	−20 to +70	°C
Storage temperature *1	T_{stg}	−55 to +150	°C

Note) ∗1: Except for the operating ambient temperature and storage temperature, all ratings are for T_a = 25°C.
∗2: When used within the range not exceeding the absolute maximum ratings and the power dissipation.
∗3: The power dissipation shown is for the independent IC without a heat sink at T_a = 70°C.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CCH}	4.50 to 5.00	V
	V_{CC}	2.70 to 3.30	
	$V_{CC\text{-}SP}$ *	2.70 to 5.00	

Note) ∗: When used within the range not exceeding the absolute maximum ratings and the power dissipation.

■ Electrical Characteristics at V_{CCH} = 4.9 V, V_{CC} = 3.1 V, $V_{CC\text{-}SP}$ = 4.1 V, T_a = 25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit current						
Circuit current without signal (1A) (V_{CC}-system)	I_{VCCA}	V_{CC} = 3.10 V, without signal	2.2	3.2	4.2	mA
Circuit current without signal (2A) (V_{CCH}-system)	I_{VCCHA}	V_{CCH} = 4.90 V, without signal	1.1	2.1	3.1	mA
Circuit current without signal (3A) ($V_{CC\text{-}SP}$-system)	I_{VCCSA}	$V_{CC\text{-}SP}$ = 4.10 V, without signal	1.0	4.0	8.0	mA
Circuit current without signal (1B) (V_{CC}-system)	I_{VCCB}	V_{CC} = 3.10 V at I/O power save	—	0.3	1.5	mA
Circuit current without signal (2B) (V_{CCH}-system)	I_{VCCHB}	V_{CCH} = 4.90 V at I/O power save	—	1.4	2.4	mA
Circuit current without signal (3B) ($V_{CC\text{-}SP}$-system)	I_{VCCSB}	$V_{CC\text{-}SP}$ = 4.10 V at SP power save	—	0.6	1.6	mA
Circuit current without signal (3C) (V_{CCH}-system)	I_{VCCHC}	$V_{CC\text{-}SP}$ = 4.10 V at SP power save	—	1.5	2.5	mA
Circuit current without signal (3D) (V_{CCH}-system)	I_{VCCHD}	$V_{CC\text{-}SP}$ = 4.10 V at SP, I/O power save	—	0.6	1.5	mA
Circuit current without signal (1C) (V_{CC}-system)	I_{VCCC}	V_{CC} = 3.10 V with mic.amp. off	—	1.8	2.8	mA
Power supply for microphone						
Microphone supply voltage	V_{MIC}	V_{CC} = 3.10 V with output current −5 mA	1.8	2.0	2.2	V
Microphone amp. characteristics		Microphone amp. input → Microphone amp. output				
Microphone amp. output level	VROM	V_{IN} = −37 dBS, 1 kHz	−9	−8	−7	dBS
Microphone amp. output distortion factor 1	THROM1	V_{IN} = −37 dBS, 1 kHz up to 5th THD	—	0.02	0.10	%
Microphone amp. output noise	NROM	Without input, using A-curve filter	—	−89	−84	dBS
Microphone amp. output distortion factor 2	THROM2	V_{IN} = −33 dBS, 1 kHz up to 5th THD, Load = 22 kΩ	—	0.02	1.0	%

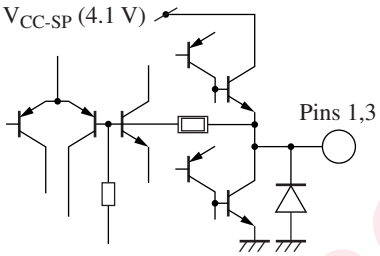
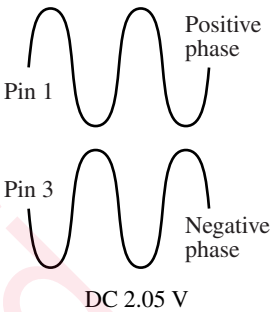
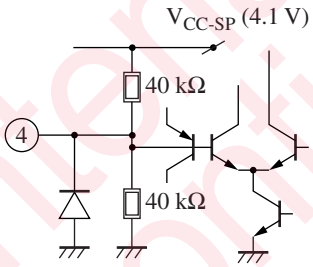
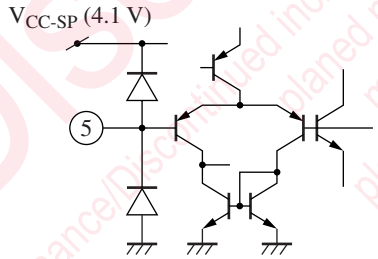
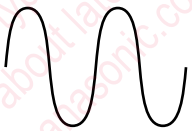
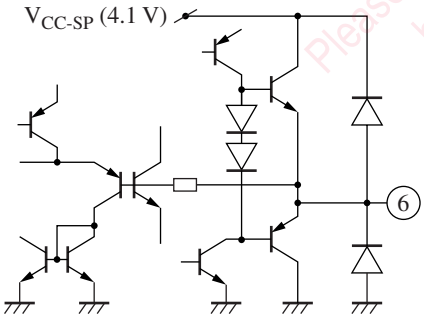
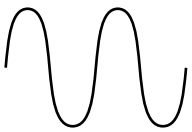
■ Electrical Characteristics at V_{CCH} = 4.9 V, V_{CC} = 3.1 V, V_{CC-SP} = 4.1 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rec. AGC characteristics	AGC input → Rec. input					
Rec. reference output level A (Input: microphone amp.)	VROA	V_{IN} = −38 dBS, 1 kHz	−13.3	−12.3	−11.3	dBS
Rec. reference output distortion factor 1A (Input: microphone amp.)	THROA	V_{IN} = −38 dBS, 1 kHz up to 5th THD	—	0.02	0.10	%
Rec. output noise voltage A	VNROA	Without input signal, using A-curve filter	—	−80	−75	dBS
Microphone AGC characteristics 1 Reference +5 dB	VAGCML1	V_{IN} = −33 dBS, 1 kHz	−9.3	−7.3	−5.3	dBS
Microphone AGC characteristics 2 Reference +10 dB	VAGCML2	V_{IN} = −28 dBS, 1 kHz	−9.0	−6.0	−3.0	dBS
Microphone AGC characteristics 3 Reference +16 dB	VAGCML6	V_{IN} = −22 dBS, 1 kHz	−8.8	−5.8	−2.8	dBS
Microphone AGC characteristics 3 distortion factor. Reference +16 dB	THAGCML3	V_{IN} = −22 dBS, 1 kHz up to 5th THD	—	0.15	0.40	%
Microphone AGC characteristics 4 Reference +34 dB	VAGCM4	V_{IN} = −4 dBS, 1 kHz	−8.0	−5.0	−2.0	dBS
Microphone AGC characteristics 4 distortion factor. Reference +34 dB	THAGCML4	V_{IN} = −4 dBS, 1 kHz up to 5th THD, Load = 22 kΩ	—	0.2	1.0	%
AGC-DC offset voltage	V_{DROM}	Without input signal, difference from V_{REF} voltage	−30	0	+30	mV
PB line output characteristics	PB input → Line output					
Line reference output level at playback	VLOPS	V_{IN} = −12.3 dBS, 1 kHz	−8.0	−7.0	−6.0	dBS
Line reference output distortion factor at playback	THLOPS	V_{IN} = −12.3 dBS, 1 kHz up to 5th THD	—	0.02	0.10	%
Line reference output noise at playback	VNOPS	Without input signal, using A-curve filter, up to 5th THD	—	−83	−78	dBS
Line maximum output level at playback	VLMAPS	f = 1 kHz, Load = 22 kΩ input level THD = 1% (up to 5th)	2.8	5.7	—	dBS
Line crosstalk Mic.-in → Line-out	VSOPS1	V_{IN} = −61 dBS, 1 kHz using A-curve filter at PB	—	−83	−78	dB
Rec. crosstalk 1 PB-in → Rec.-out	VNOM	V_{IN} = −7.3 dBS, 1 kHz using A-curve filter	—	−77	−73	dB
Electronic volume characteristics	PB input → EVR output					
Electronic volume maximum (+10 dB) gain	VEV_{MA}	V_{IN} = −12.3 dBS, 1 kHz Vol. = max. (+10 dB) (V_{16} = 3.1 V)	−6.0	−5.0	−4.0	dBS
Electronic volume typical (0 dB) gain	VEV_{TP}	V_{IN} = −12.3 dBS, 1 kHz Vol. = center (0 dB) (V_{16} = 1.55 V)	−18.0	−15.0	−12.0	dBS
Electronic volume minimum (maximum attenuation) gain	VEV_{MI}	V_{IN} = −12.3 dBS, 1 kHz, Vol. = min. (V_{16} = 0 V), using A-curve filter	—	−90.0	−80.0	dBS

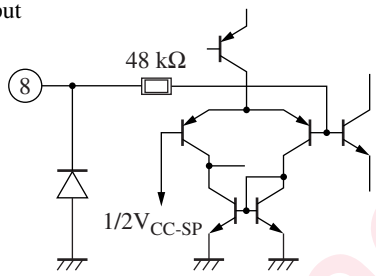
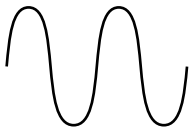
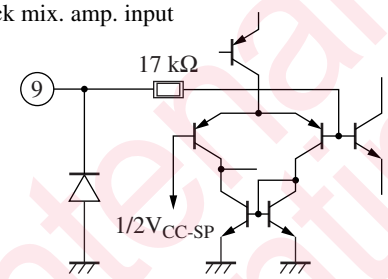
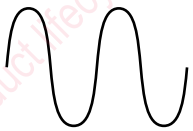
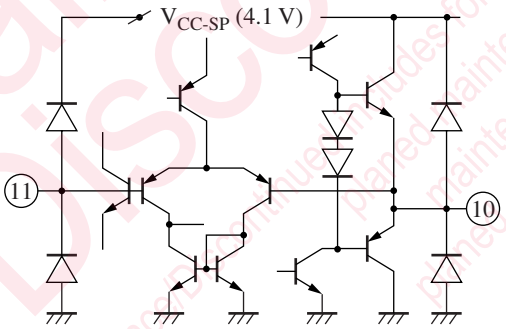
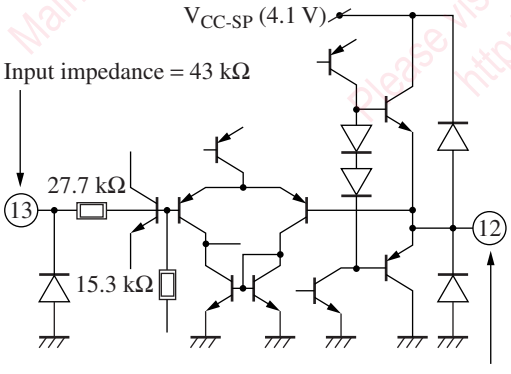
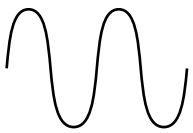
■ Electrical Characteristics at V_{CCH} = 4.9 V, V_{CC} = 3.1 V, $V_{CC\text{-}SP}$ = 4.1 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Speaker output-system characteristics						
SP reference output level at playback	VSPPS	V_{IN} = −14.3 dBS, 1 kHz Vol. = max. (+10 dB), R_{OUT} = 8 Ω	0.0	1.5	3.0	dBS
SP reference output distortion factor at playback	THSPPS	V_{IN} = −14.3 dBS, 1 kHz Vol. = max. (+10 dB), R_{OUT} = 8 Ω	—	0.2	0.9	%
SP reference output noise voltage at playback	VNSPPS	Vol. = center (0 dB), using A-curve filter, R_{OUT} = 8 Ω, without signal	—	−78	−74	dBS
SP maximum rating output at playback	VMSPPS	Vol. = max. (+10 dB), f = 1 kHz Power consumption at R_{OUT} = 8 Ω TDH = 10%	300	500	—	mW
SP output at power save and playback	VPSPPS	V_{IN} = −14.3 dBS, 1 kHz, Vol. = max. (+10 dB), using A-curve filter, R_{OUT} = 8 Ω	—	−93	−90	dBS
SP reference output level 2 Beep input-system	VSPPSB	V_{IN} = −7 dBS, 1 kHz Vol. = max. (+10 dB), R_{OUT} = 8 Ω	0.0	1.5	3.0	dBS
Mode selection hold voltage						
HPF on/off. Off hold voltage range	V_{39L}		0.0	—	0.5	V
HPF on/off. On hold voltage range	V_{39H}		2.6	—	3.1	V
SP output on/off On hold voltage range	V_{47L}		0.0	—	0.5	V
SP output on/off Off hold voltage range	V_{47H}		2.6	—	4.1	V
Standby on/off On hold voltage range	V_{24L}		0.0	—	0.5	V
Standby on/off Off hold voltage range	V_{24H}		2.6	—	3.1	V
Microphone amp. on/off On hold voltage range	V_{22L}		0.0	—	0.5	V
Microphone amp. on/off Off hold voltage range	V_{22H}		2.6	—	3.1	V

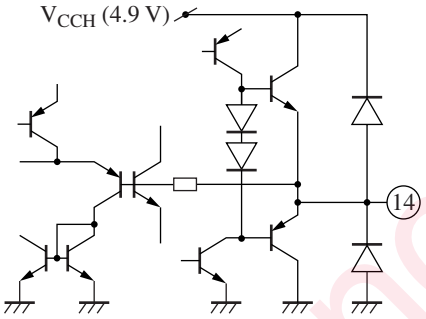
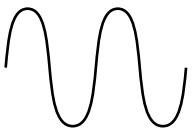
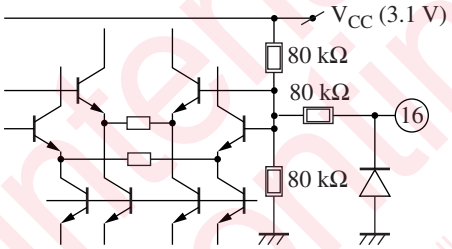
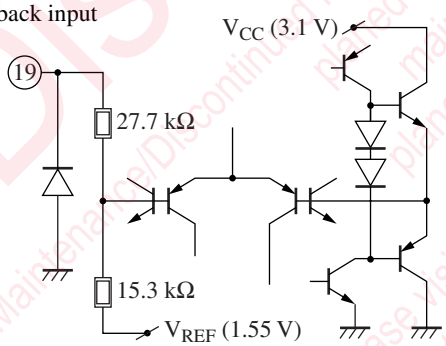
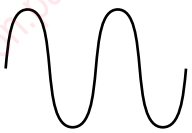
■ Terminal Equivalent Circuits

Pin No.	Equivalent circuit	Voltage/waveform
1	Speaker output  Output impedance = 10 Ω or less	 DC 2.05 V AC 1.5 dBS
2	GND	—
3	Speaker output Refer to pin 1	Refer to pin 1
4	1/2 V_{CC-SP}  Input impedance = 20 kΩ	DC 2.05 V
5	SP amp. input  Input impedance = high impedance	 High impedance
6	SP block mix. amp. output  Output impedance = 10 Ω or less	 DC 2.05 V AC −24 dBS

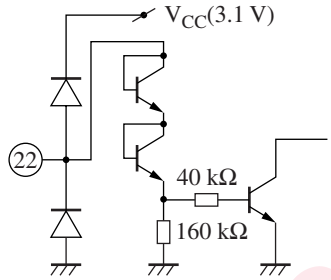
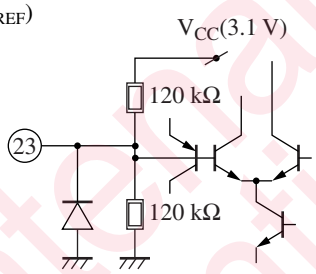
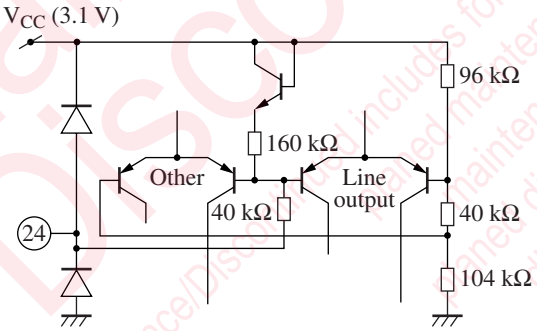
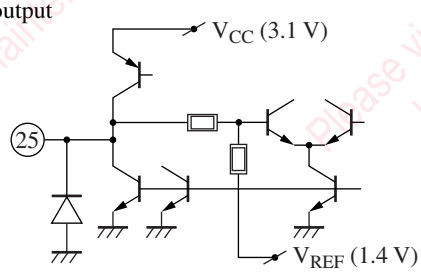
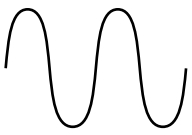
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
7	GND	—
8	Beep input  Input impedance = 48 kΩ	 DC 2.05 V AC −15 dBS
9	SP block mix. amp. input  Input impedance = 17 kΩ	 DC 2.05 V AC −24 dBS
10 11	SP block HPF buffer circuit  Output impedance = 10 Ω or less	 DC 2.05 V AC −24 dBS
12 13	Buffer circuit  Output impedance = 10 Ω or less	 DC 2.05 V AC −15 dBS

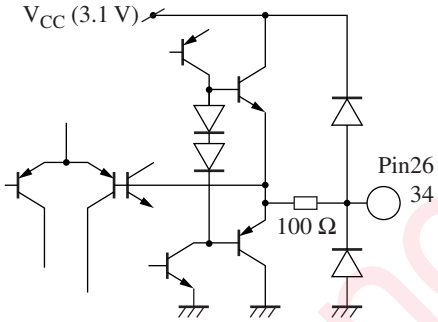
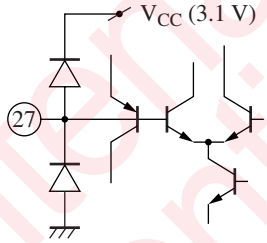
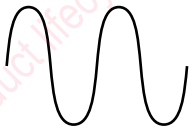
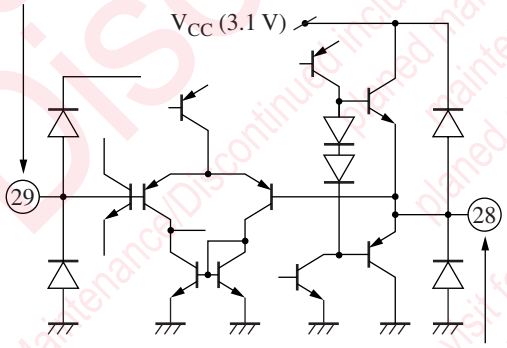
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
14	Electronic volume output  Output impedance = 10 Ω or less	 DC 2.45 V AC −15 dBS
15	N.C.	—
16	Electronic volume control  Input impedance = 120 kΩ	DC 1.55 V
17	GND	—
18	N.C.	—
19	Playback input  Input impedance = 43 kΩ	 DC 1.55 V AC −12.3 dBS
20	GND	—
21	V_{CC}	DC 3.1 V

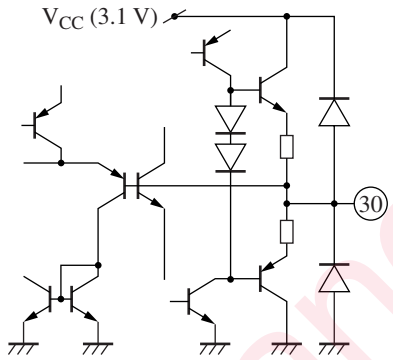
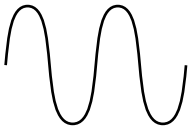
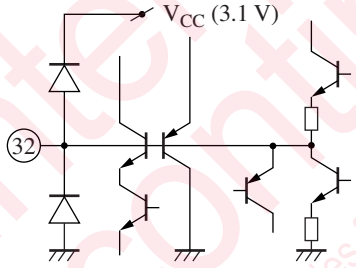
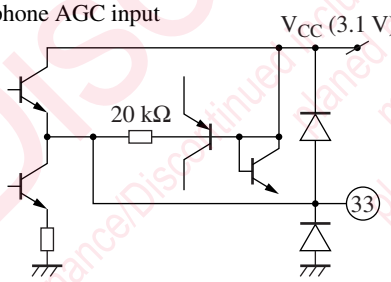
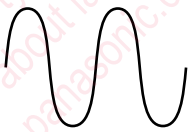
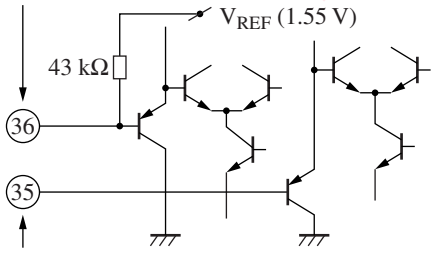
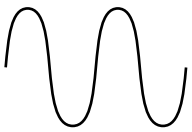
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
22	Microphone amp. off switch  Input impedance = 32 kΩ	—
23	1/2 V_{CC} (V_{REF})  Input impedance = 60 kΩ	DC 1.55 V
24	Standby changeover  Input impedance = 200 kΩ	DC 1.55 V
25	Rec. output  Output impedance = 10 Ω or less	 DC 1.55 V AC –12.3 dBS

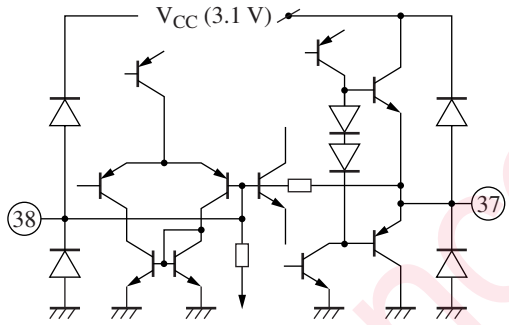
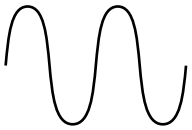
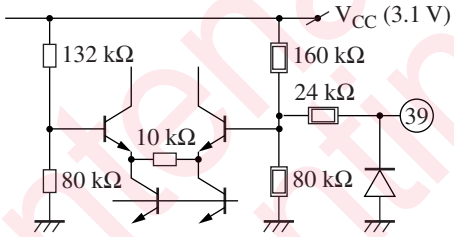
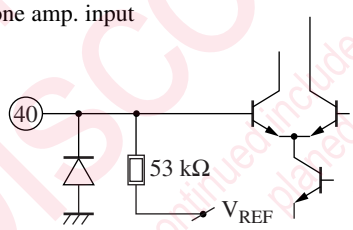
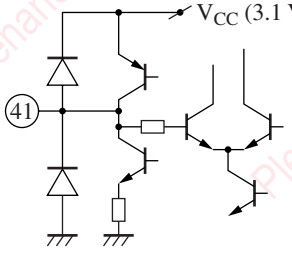
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
26	V_{REF} output  Output impedance = 100 Ω	DC 1.55 V
27	Input to amp. for rec.-system HPF  Input impedance = high impedance	 DC 1.55 V AC −26 dBS
28 29	Input to amp. for rec.-system LPF Input impedance = high impedance  Output impedance = 10 Ω or less	 DC 1.55 V AC −26 dBS

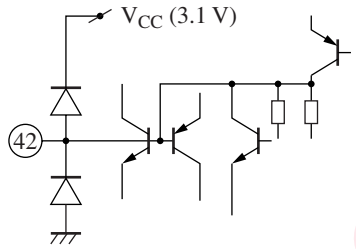
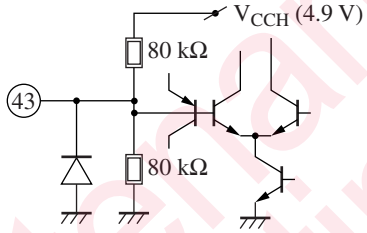
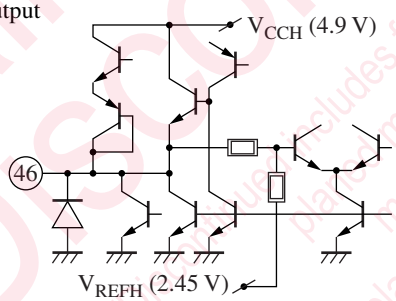
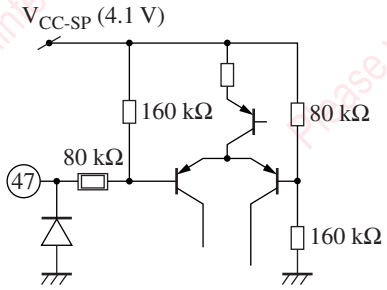
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
30	Microphone AGC output  Output impedance = 10 Ω or less	 DC 1.55 V AC −26 dBS
31	GND	—
32	Microphone AGC detection pin 	DC 0 ~ 1 V
33	Microphone AGC input  Output impedance = 10 Ω or less	 DC 1.55 V AC −38 dBS
34	Refer to pin 26	Refer to pin 26
35 36	Input changeover circuit for microphone HPF Input impedance = 43 kΩ  Input impedance = high impedance	 DC 1.55 V AC −38 dBS

■ Terminal Equivalent Circuits (continued)

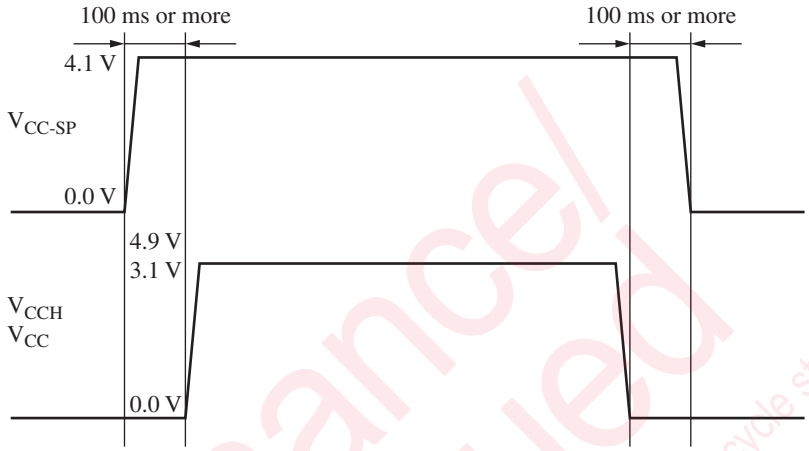
Pin No.	Equivalent circuit	Voltage/waveform
37 38	Microphone amp. gain changeover  Output impedance = 10 Ω or less	 DC 1.55 V AC −38 dBS
39	Measure against wind noise  Input impedance = 53 kΩ	DC 1.03 V
40	Microphone amp. input  Input impedance = 53 kΩ	 DC 1.55 V AC −71 dBS
41	Microphone supply voltage  Output impedance = 10 Ω or less	DC 2.0 V

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Voltage/waveform
42	Smoothing C pin for reg. 	DC 1.25 V
43	1/2 V_{CCH} (V_{REFH})  Input impedance = 40 kΩ	DC 2.45 V
44	V_{CCH}	DC 4.9 V
45	GND	—
46	Line output  Output impedance = 10 Ω or less	 DC 2.45 V AC –7 dBS
47	SP-block power save SW  Input impedance = 240 kΩ	—
48	V_{CC-SP}	DC 4.1 V

■ Usage Notes

• About the power-on order, and the pop noise at SP power source on/off

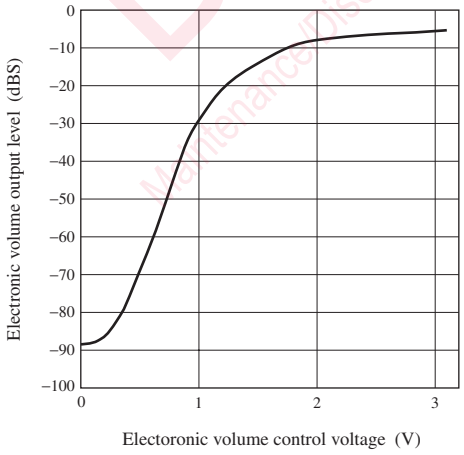


At this time, make power save work, interlocking the SP power save of pin 47 with V_{CC-SP} , or by applying high level to that pin earlier than V_{CC-SP} .

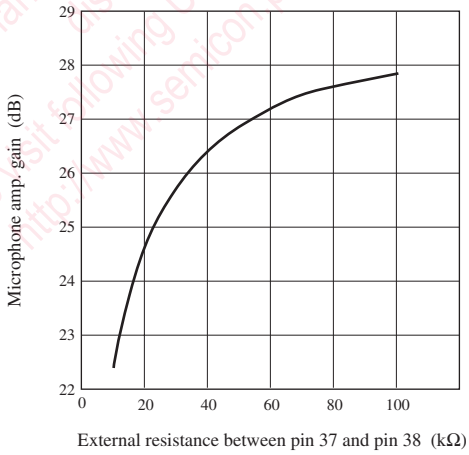
As mentioned above, apply V_{CC-SP} at the time of power on, and remove V_{CC-SP} lastly at the power off. This is because an SP power save circuit uses V_{CC-SP}-system power source. This operation prevents the speaker from generating a pop noise at turning the power on/off.

■ Application Notes

• Electronic volume control curve

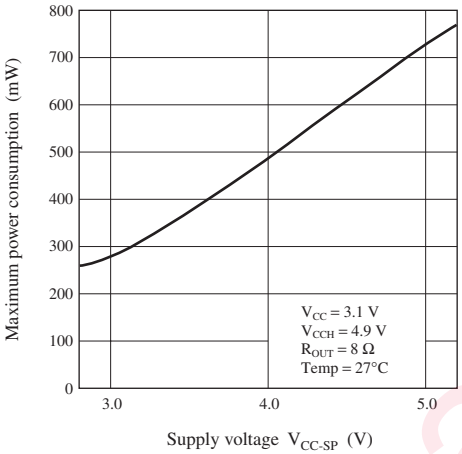


• External resistor vs. microphone gain



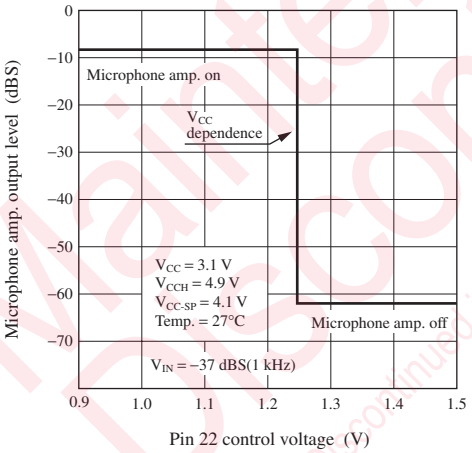
■ Application Notes (continued)

• $V_{CC\text{-}SP}$ vs. maximum power consumption

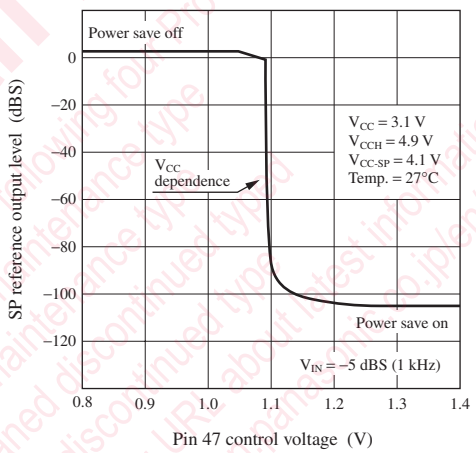


• Changeover voltage of each control pin

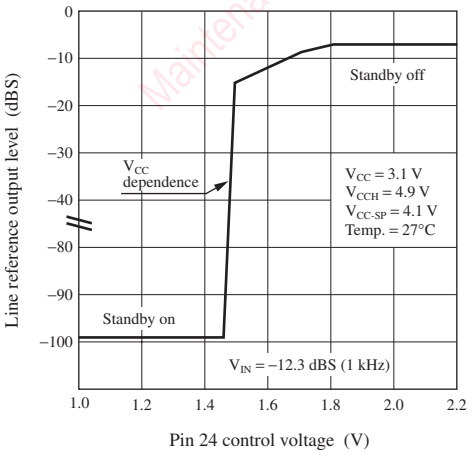
Microphone amp. on/off changeover voltage



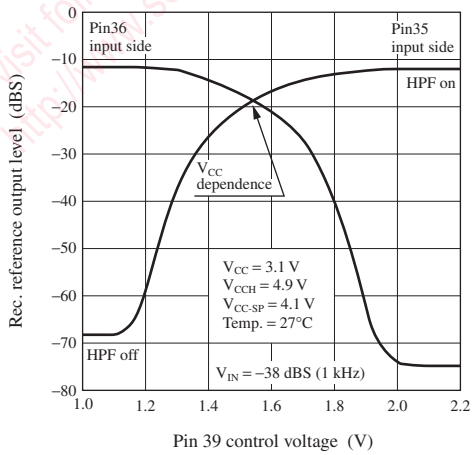
SP power save on/off changeover voltage



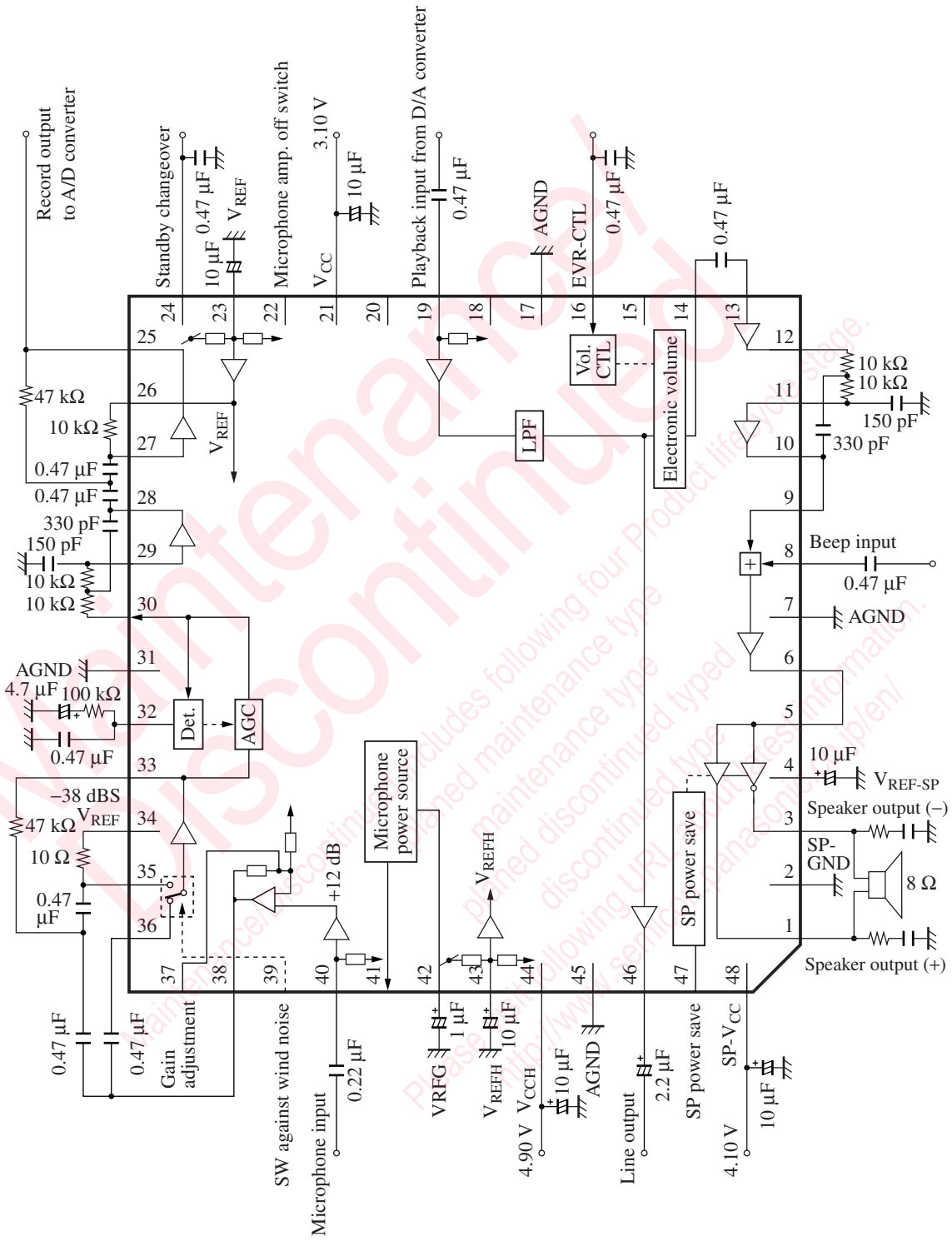
Standby on/off changeover voltage



Wind noise HPF on/off changeover voltage

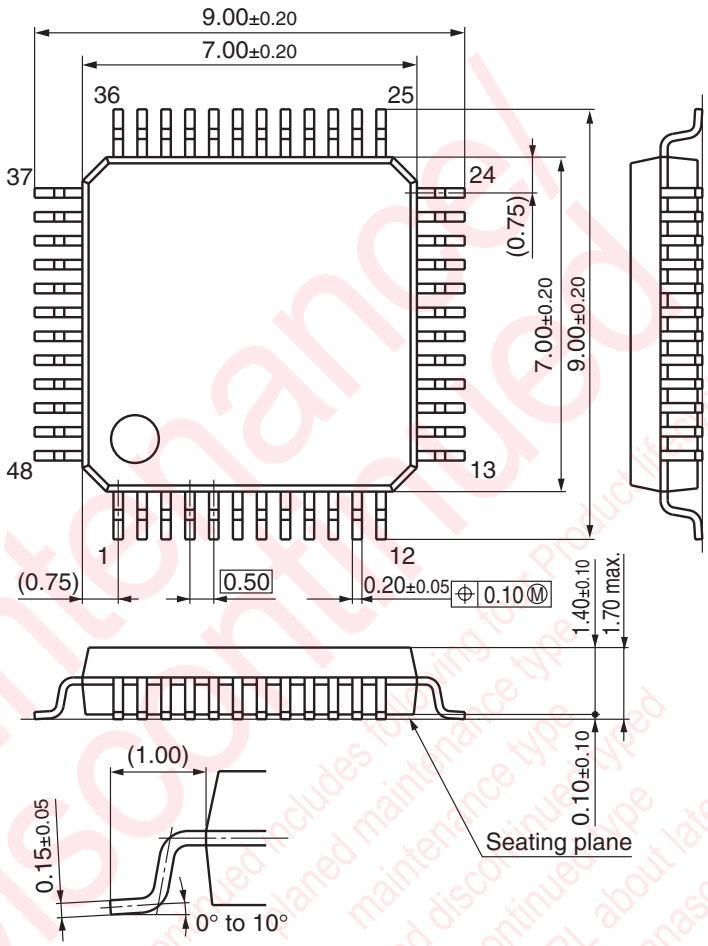


■ Application Circuit Example



■ New Package Dimensions (Unit: mm)

• LQFP048-P-0707A (Lead-free package)



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