



SANYO Semiconductors

DATA SHEET

LA7473V

Monolithic Linear IC For Video Camera Stereo Microphone Amplifier

Overview

The LA7473V is a microphone amplifier IC for video cameras that supports stereo audio recording and features low power and the ability to operate from a 3V supply voltage. It achieves high audio quality by providing equalization circuits to improve the frequency characteristics of the microphone and a left/right mixing circuit to improve the spatial presence of the stereo image.

Features

- Low power (For a 3.3V supply voltage : 18mW, for 4.75V : 28mW)
- Low-voltage operation (2.7V minimum)
- Low noise
- Achieves high audio quality
 - Provides built-in equalization circuits to improve the frequency characteristics of the microphone
 - Provides a left/right mixing circuit to improve the spatial presence of the stereo image

Functions

- Two microphone amplifier channels
- Selector switch for internal and external microphones
- High-pass filter (with bypass function)
- Built-in microphone power supply
- Ripple filter
- External/internal microphone discrimination output
- Mono/stereo discrimination output

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SANYO Semiconductor Co., Ltd.

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

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Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}		7.0	V
Allowable power dissipation	$P_d \text{ max}$	$T_a \leq 65^\circ\text{C}$	110	mW
Operating temperature	T_{opr}		-10 to +65	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.3 to 4.75	V
Recommended operating supply voltage range	$V_{CC \text{ op}}$		2.7 to 3.6, 4.5 to 5.5	V

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 3.3\text{V}$, $f = 1\text{kHz}$, $R_L = 10\text{k}\Omega$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC1}	EXT MIC IN, L/Rch	2.7	3.9	5.1	mA
	I_{CC2}	INT MIC IN, L/Rch	3.8	5.4	7.0	mA
Voltage gain	V_{G1}	EXT MIC IN, L/Rch : $V_O = -10\text{dBs}$	27.5	28	28.5	dB
	V_{G2}	INT MIC IN, L/Rch : $V_O = -10\text{dBs}$	21	21.5	22	dB
Total harmonic distortion	THD	EXT MIC IN, INT MIC IN, $V_O = -10\text{dBs}$, L/Rch		0.05	0.2	%
Maximum output voltage	V_{OM}	EXT MIC IN, INT MIC IN, THD = 1%, L/Rch	0			dBs
Output noise voltage	V_{NO1}	EXT MIC IN, L/Rch, $R_g = 1\text{k}\Omega$, JIS-A		22	32	μVrms
	V_{NO2}	INT MIC IN, L/Rch, $R_g = 1\text{k}\Omega$, JIS-A		16	24	μVrms
Input switching crosstalk	SW_{CR}	INT MIC IN \rightarrow EXT MIC IN ($R_g = 1\text{k}\Omega$) $f = 10\text{kHz}$, L/Rch	70	80		dB
Inter-channel crosstalk	CH_{CR}	EXT/INT MIC, Lch \rightarrow Rch, Rch \rightarrow Lch, $f = 10\text{kHz}$	45	51		dB
Internal microphone power supply output voltage	V_{INM}	The pin 31 DC level with a $30\text{k}\Omega$ load	2.25	2.4	2.55	V
Input switching control voltage	CTL_H	High level, the pin 1/pin 30 DC voltage	1.3		V_{CC}	V
	CTL_L	Low level, the pin 1/pin 30 DC voltage	-0.3		+0.7	V
MIC MONO and EXT/INT output level	V_{CH}	High level, pin 15/pin 16	2.5			V
	V_{CL}	Low level, pin 15/pin 16			0.4	V
Input impedance	Z_{IN1}	EXT MIC IN, L/Rch	56	70	84	$\text{k}\Omega$
	Z_{IN2}	INT MIC IN, L/Rch	56	70	84	$\text{k}\Omega$
	Z_{IN3}	Pin 1/pin 30	100			$\text{k}\Omega$
Output impedance	Z_O	Pin 13/pin 18			130	Ω
Ripple rejection ratio	V_R	Output level at $f = 100\text{Hz}$ and $V_{IN} = -20\text{dBs}$			-50	dBs
Inrush current	I_{CT}	Pin 1/pin 30, with an applied voltage of 3.3V			47.5	μA
Power supply mode switching voltage	V_{CCLH}	The V_{CC} (pin 7) switching voltages: Mode 1 (3.3V typical)/mode 2 (4.75V typical)	3.65		4.45	V

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Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 4.75\text{V}$, $f = 1\text{kHz}$, $R_L = 10\text{k}\Omega$

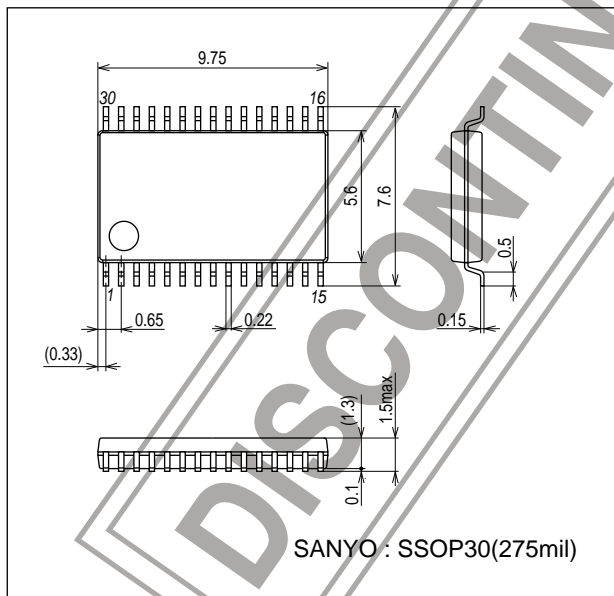
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain*	I_{CC1}	EXT MIC IN, L/Rch	3.0	4.5	5.9	mA
	I_{CC2}	INT MIC IN, L/Rch	4.1	5.8	7.5	mA
Voltage gain	VG1	EXT MIC IN, L/Rch : $V_O = -10\text{dBs}$	27.5	28	28.5	dB
	VG2	INT MIC IN, L/Rch : $V_O = -10\text{dBs}$	21	21.5	22	dB
Total harmonic distortion	THD	EXT MIC IN, INT MIC IN, $V_O = -10\text{dBs}$, L/Rch		0.05	0.2	%
Maximum output voltage	V_{OM}	EXT MIC IN, INT MIC IN, THD = 1%, L/Rch	0			dBs
Output noise voltage	V_{NO1}	EXT MIC IN, L/Rch, $R_g = 1\text{k}\Omega$, JIS-A		22	32	μV_{rms}
	V_{NO2}	INT MIC IN, L/Rch, $R_g = 1\text{k}\Omega$, JIS-A		16	24	μV_{rms}
Input switching crosstalk	SW_{CR}	INT MIC IN \rightarrow EXT MIC IN ($R_g = 1\text{k}\Omega$) $f = 10\text{kHz}$, L/Rch	70	80		dB
Inter-channel crosstalk	CH_{CR}	EXT/INT MIC, Lch \rightarrow Rch, Rch \rightarrow Lch, $f = 10\text{kHz}$	45	51		dB
Internal microphone power supply output voltage*	V_{INM}	The pin 31 DC level with a $30\text{k}\Omega$ load	2.15	2.3	2.45	V
Input switching control voltage	CTLH	High level, the pin 1/pin 30 DC voltage	1.3		V_{CC}	V
	CTL _L	Low level, the pin 1/pin 30 DC voltage	-0.3		+0.7	V
MIC MONO and EXT/INT output level*	V_{CH}	High level, pin 15/pin 16	3.8			V
	V_{CL}	Low level, pin 15/pin 16			0.4	V
Input impedance	Z_{IN1}	EXT MIC IN, L/Rch	56	70	84	$\text{k}\Omega$
	Z_{IN2}	IXT MIC IN, L/Rch	56	70	84	$\text{k}\Omega$
	Z_{IN3}	Pin 1/pin 30	100			$\text{k}\Omega$
Output impedance	Z_O	Pin 13/pin 18			130	Ω
Ripple rejection ratio	V_R	Output level at $f = 100\text{Hz}$ and $V_{IN} = -20\text{dBs}$			-50	dBs
Inrush current*	I_{CT}	Pin 1/pin 30, with an applied voltage of 4.75V			47.5	μA

Note * : Items for which the ratings differ in 3.3V mode.

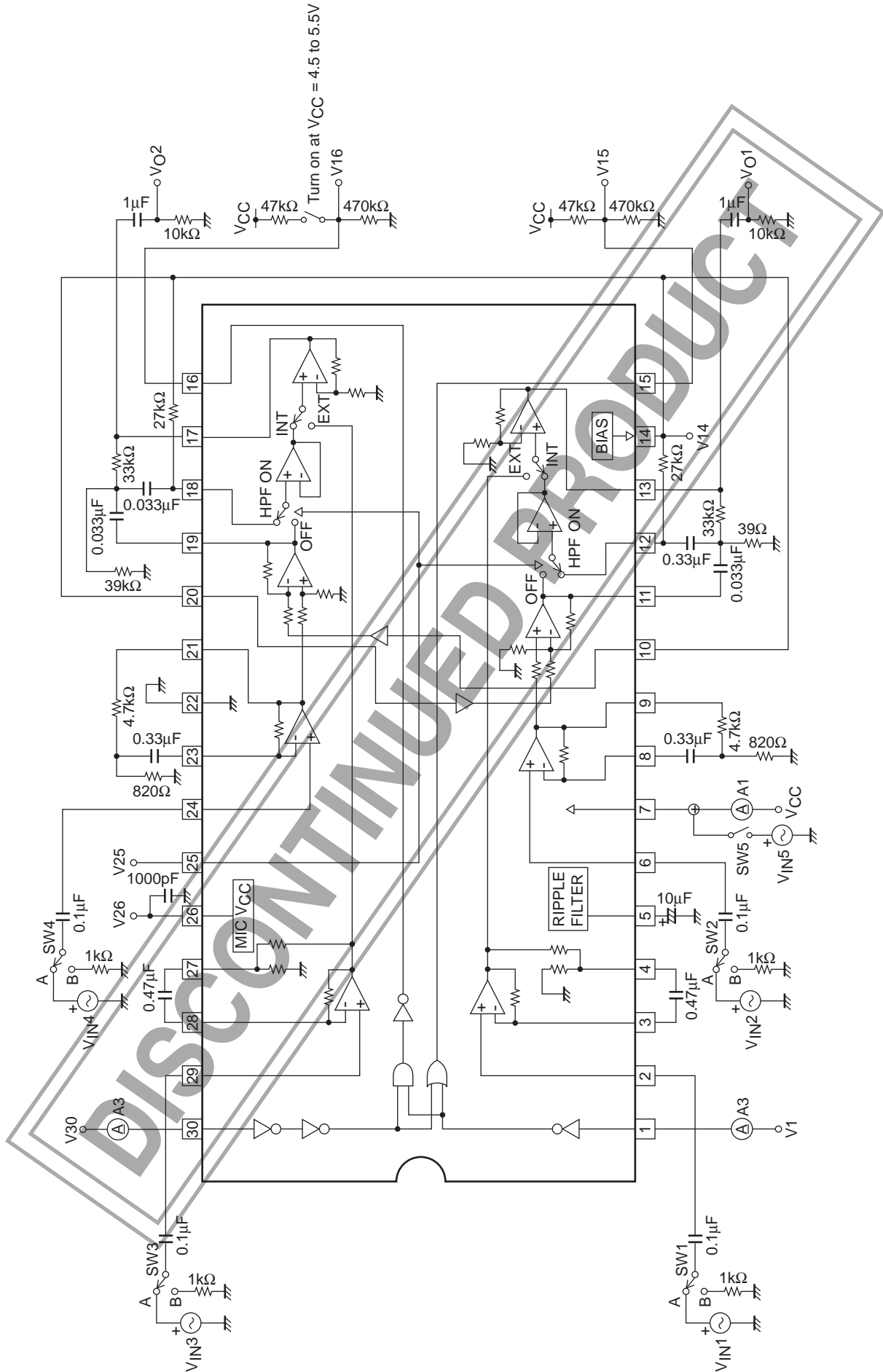
Package Dimensions

unit : mm (typ)

3191B

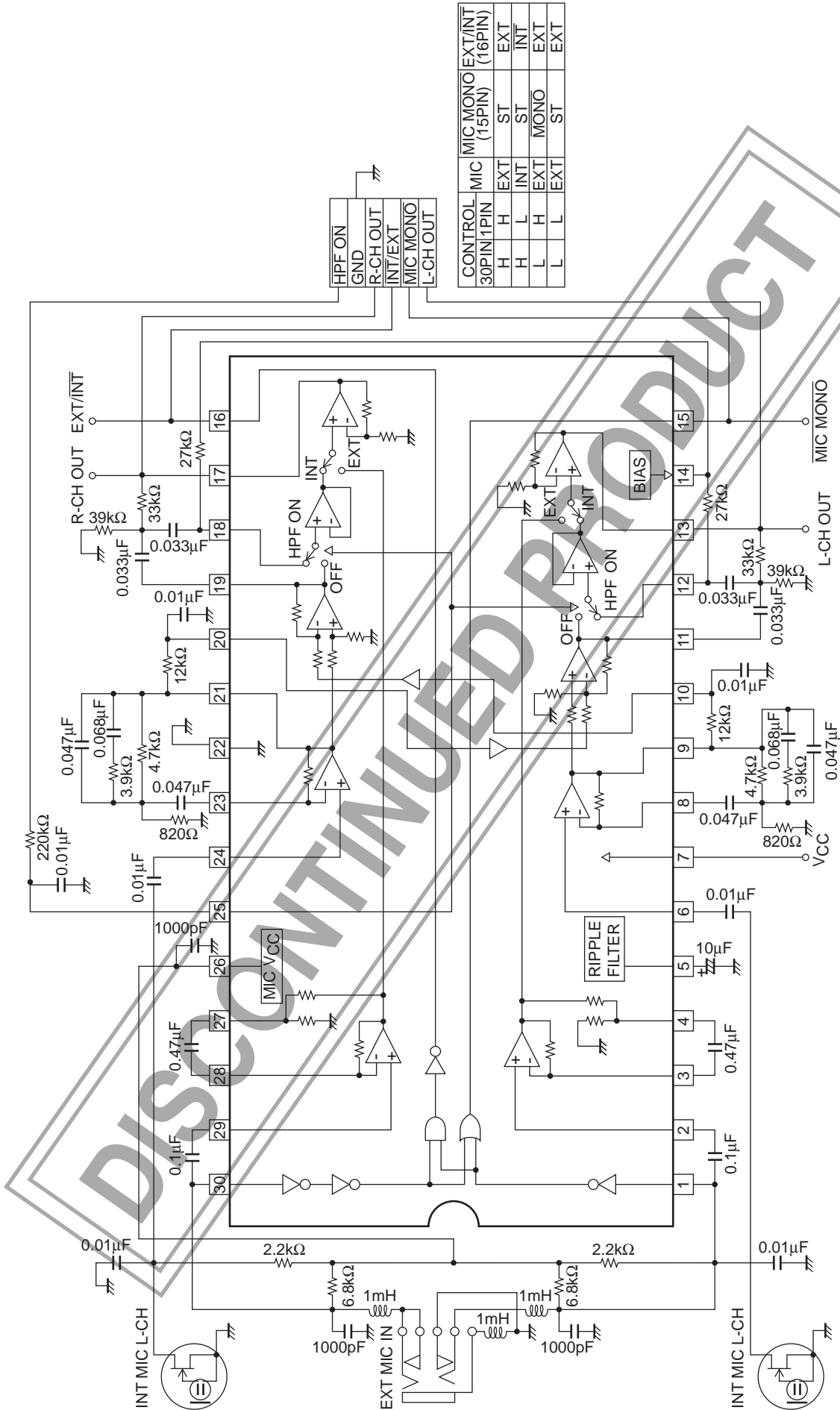


Block Diagram and Test Circuit



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Sample Application Circuit



CONTROL		MIC MONO (15PIN)		EXT/INT (16PIN)	
30PIN/1PIN	H	L	EXT	INT	EXT
H	L	EXT	INT	EXT	INT
L	L	EXT	MONO	EXT	EXT
L	L	EXT	ST	EXT	EXT

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Pin Functions

Pin No.	Pin Name	DC voltage	Description	Equivalent circuit
1 30	INPUT SELECT CTL-1 INPUT SELECT CTL-2		Internal/external switching Stereo/mono discrimination control	
2 29	EXT IN-L EXT IN-R	1.45V (V _{CC} = 3.3V) 2.2V (V _{CC} = 4.75V)	External microphone input Input impedance : 70kΩ	
3 28	EXT AMP NFB1-L EXT AMP NFB1-R	1.45V (V _{CC} = 3.3V) 2.2V (V _{CC} = 4.75V)	External amplifier NFB	
4 27	EXT AMP NFB2-L EXT AMP NFB2-R	0.1V (V _{CC} = 3.3V) 0.15V (V _{CC} = 4.75V)	External amplifier output attenuation output	
5	RIPPLE FILTER	2.4V (V _{CC} = 3.3V) 2.3V (V _{CC} = 4.75V)	Used to exclude ripple from internal circuits. Ripple is removed with a filter consisting of an external capacitor and 75kΩ resistor.	

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Pin No.	Pin Name	DC voltage	Description	Equivalent circuit
6 24	INT IN-L INT IN-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Internal microphone input Input impedance : 70k Ω	
7	V_{CC}	V_{CC}	Mode 1 : 3.3V typical (2.7V to 3.6V) Mode 2 : 4.75V typical (4.5V to 5.5V) * : This IC cannot be used in the range 3.6 to 4.5V.	
8 23	INT AMP NFB-L INT AMP NFB-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Internal amplifier NFB	
9 21	INT AMP OUT-L INT AMP OUT-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Internal amplifier output These are low-impedance outputs.	
10 20	MIX BUFF IN-R MIX BUFF IN-L	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Mixer buffer input These are high-impedance inputs.	
11 19	MIX AMP OUT-L MIX AMP OUT-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Mixer amplifier output These are low-impedance outputs.	

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Pin No.	Pin Name	DC voltage	Description	Equivalent circuit
12 18	HPF IN-L HPF IN-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Amplifier input for high-pass filter These are high-impedance inputs.	
13 17	OUT-L OUT-R	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	External/internal mode 5.5dB amplifier outputs	
14	BIAS	1.45V ($V_{CC} = 3.3V$) 2.2V ($V_{CC} = 4.75V$)	Reference voltage	
15	MIC MONO		Goes low only when the external microphone is monaural.	
16	EXT/INT		This pin is high in external mode and low in internal mode.	
22	GND	0		

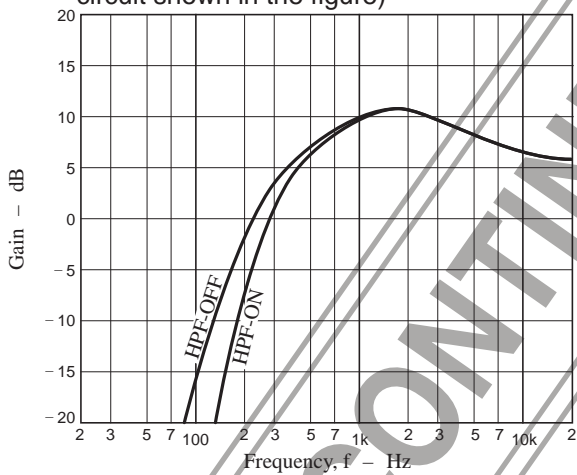
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Pin No.	Pin Name	DC voltage	Description	Equivalent circuit
25	HPF ON		High-pass filter on/off control	
26	MIC V _{CC}	2.4V (V _{CC} = 3.3V) 2.3V (V _{CC} = 4.75V)	Internal microphone power supply	

Frequency Characteristics in Mixer Mode
(Characteristics measured in the application circuit shown in the figure)



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Parameter Measurement Switch Settings

Parameter	Symbol	SW1	SW2	SW3	SW4	SW5	V1	V30	V25	Test point
Current drain 1	I _{CC1}	B	B	B	B	OFF	L	L	H	A1
Current drain 2	I _{CC2}	B	B	B	B	OFF	L	H	H	A1
Voltage gain 1	VG1-1	A	B	B	B	OFF	L	L	H	V _{O1}
	VG1-2	B	B	A	B	OFF	L	L	H	V _{O2}
Voltage gain 2	VG2-1	B	A	B	B	OFF	L	H	H	V _{O1}
	VG2-2	B	B	B	A	OFF	L	H	H	V _{O2}
Total harmonic distortion	THD1	A	B	B	B	OFF	L	L	H	V _{O1}
	THD2	B	B	A	B	OFF	L	L	H	V _{O2}
	THD3	B	A	B	B	OFF	L	H	H	V _{O1}
	THD4	B	B	B	A	OFF	L	H	H	V _{O2}
Maximum output voltage	V _{OM1}	A	B	B	B	OFF	L	L	H	V _{O1}
	V _{OM2}	B	B	A	B	OFF	L	L	H	V _{O2}
	V _{OM3}	B	A	B	B	OFF	L	H	H	V _{O1}
	V _{OM4}	B	B	B	A	OFF	L	H	H	V _{O2}
Output noise voltage 1	V _{NO1-1}	A	B	B	B	OFF	L	L	H	V _{O1}
	V _{NO1-2}	B	B	B	B	OFF	L	L	H	V _{O2}
Output noise voltage 2	V _{NO2-1}	B	A	B	B	OFF	L	H	H	V _{O1}
	V _{NO2-2}	B	B	B	A	OFF	L	H	H	V _{O2}
Input switching crosstalk	SW _{CR1}	B	A	B	B	OFF	L	L	H	V _{O1}
	SW _{CR2}	B	B	B	A	OFF	L	L	H	V _{O2}
Inter-channel crosstalk	CH _{CR1}	A	B	B	B	OFF	L	L	H	V _{O2}
	CH _{CR2}	B	B	A	B	OFF	L	L	H	V _{O1}
	CH _{CR3}	B	A	B	B	OFF	L	H	H	V _{O2}
	CH _{CR4}	B	B	B	A	OFF	L	H	H	V _{O1}
Internal microphone power supply output voltage	V _{INM}	B	B	B	B	OFF	L	H	H	V26
MIC MONO and EXT/INT output level	V _{CH1}	B	B	B	B	OFF	L	L	H	V15
	V _{CL1}	B	B	B	B	OFF	H	L	H	V15
	V _{CH2}	B	B	B	B	OFF	L	L	H	V16
	V _{CL2}	B	B	B	B	OFF	L	H	H	V16
Ripple rejection ratio	V _{R1}	A	B	B	B	ON	L	L	H	V _{O1}
	V _{R2}	B	A	B	B	ON	L	H	H	V _{O1}
Inrush current	I _{CT1}	B	B	B	B	OFF	H	L	H	A2
	I _{CT1}	B	B	B	B	OFF	L	H	H	A3

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