

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA2009F, TA2009P

Filter IC For Σ - Δ Modulation System DA Converter

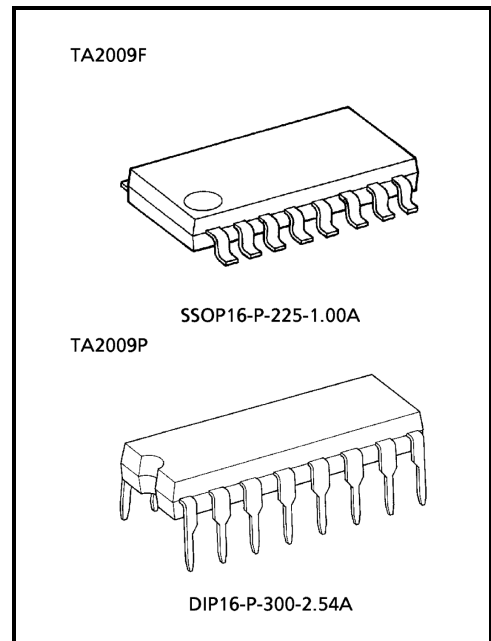
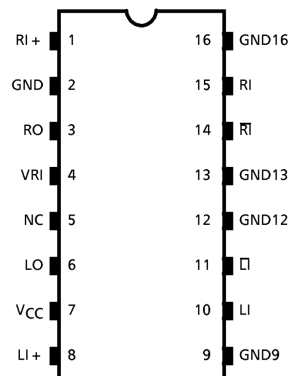
TA2009F, TA2009P are an analog filter IC for Σ - Δ modulation system DA converter.

Using the TA2009F, TA2009P in combination the TC9237BF, TC9237BN (the Σ - Δ modulation system DA converter with a built-in digital filter), it is possible to construct a DA conversion system with less external parts.

Features

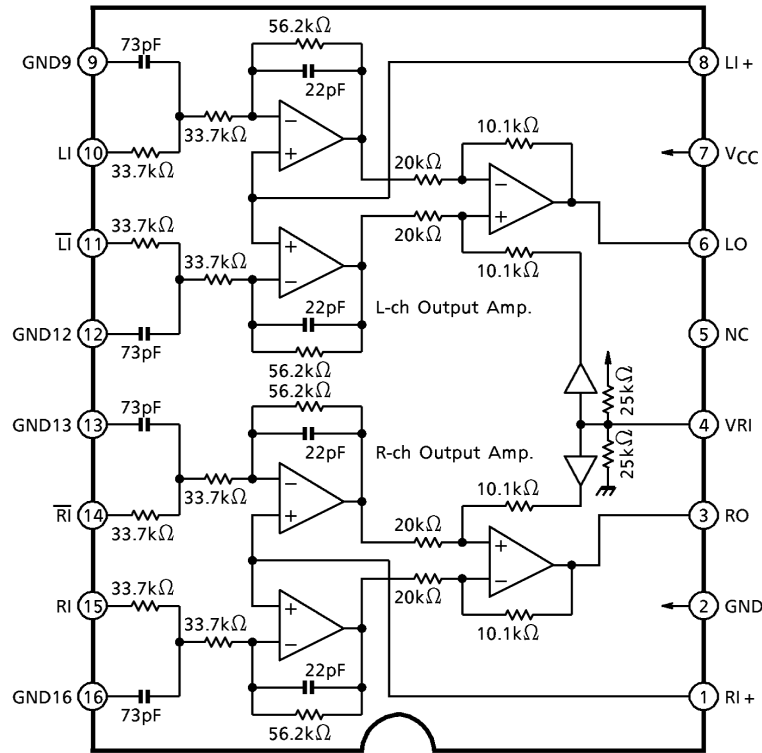
- Built-in CR for LPFs and output (differential) amplifiers for the left and right channel.
- Single power supply operation.
- Noise distortion factor and S / N ratio are as follows (when operating at +5V single power supply):
 Noise distortion factor: -93dB (typ.)
 S / N: 100dB (typ.)

Pin Connection (top view)



Weight
 SSOP16-P-225-1.00A: 0.14g (typ.)
 DIP16-P-300-2.54A: 1.00g (typ.)

Block Diagram



Description Of Pin Functions

Pin No.	Symbol	I / O	Function & Operation	Remarks
1	RI +	I	R channel operational amplifier forward input terminal. Connect to VRI.	—
2	GND	—	Ground terminal.	—
3	RO	O	R channel analog output terminal.	—
4	VRI	—	Reference voltage terminal. ($V_{CC} / 2$)	See the block diagram
5	NC	—	Non-connecting terminal.	—
6	LO	O	L channel analog output terminal.	—
7	V _{CC}	—	Supply voltage terminal.	—
8	LI +	I	L channel operational amplifier forward input terminal. Connect to VRI.	—
9	GND9	—	Ground terminal for L channel reverse input side filter.	—
10	LI	I	L channel forward input terminal.	Connect to LO of TC9237BF, TC9237BN
11	$\overline{\text{LI}}$	I	L channel reverse input terminal.	Connect to $\overline{\text{LO}}$ of TC9237BF, TC9237BN
12	GND12	—	Ground terminal for L channel forward input side filter.	—
13	GND13	—	Ground terminal for R channel forward input side filter.	—

Pin No.	Symbol	I / O	Function & Operation	Remarks
14	$\overline{\text{RI}}$	I	R channel reverse input terminal.	Connect to $\overline{\text{RO}}$ of TC9237BF, TC9237BN
15	RI	I	R channel forward input terminal.	Connect to RO of TC9237BF, TC9237BN
16	GND16	—	Ground terminal for R channel reverse input side filter.	—

Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V _{CC}	11	V
Power dissipation	TA2009F	350 (*)	mW
	TA2009P	1388 (**)	
Operating temperature	T _{opr}	-35~85	°C
Storage temperature	T _{stg}	-55~150	°C

(*) Reduce 2.8mW / °C at Ta = above 25°C.

(**) Reduce 11.2mW / °C at Ta = above 25°C.

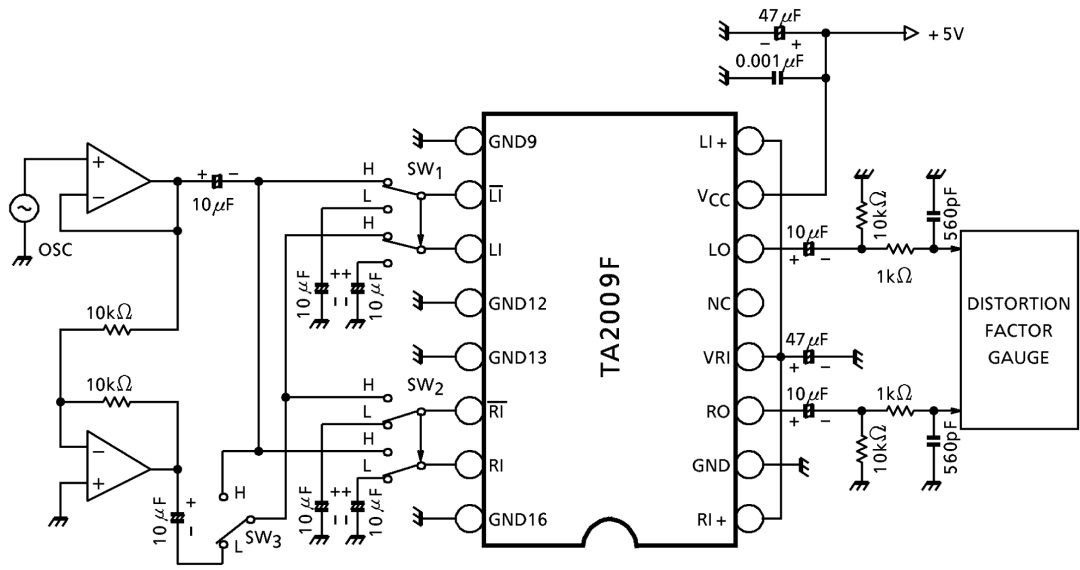
Electrical Characteristics (unless otherwise specified, V_{CC} = 5V, Ta = 25°C)

Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Operating supply voltage	V _{CC}	—	Ta = -35~85°C	4.5	5.0	10	V
Operating supply current	I _{CCQ} (1)	—	At no signal	7.5	10.0	12.5	mA
	I _{CCQ} (2)	—	At signal, V _{CC} = 10V	8.2	11.0	13.8	
Reference voltage	V _{RI}	—	—	2.45	2.50	2.55	V
Noise distortion factor	THD (1)	1	1kHz, V _O = 970mV _{rms}	—	-93	-90	dB
	THD (2)		10kHz, V _O = 970mV _{rms}	—	-93	-90	
	THD (3)		1kHz, V _O = 97mV _{rms}	—	-78	-75	
Cross talk	CT	1	1kHz, V _O = 970mV _{rms}	—	-100	-95	dB
Attenuation	ATT (1)	1	40kHz, V _O = 10dBV _{rms}	0.51	0.71	1.41	dB
	ATT (2)		80kHz, V _O = 10dBV _{rms}	1.50	2.70	4.50	
Max. output level	V _{omax}	1	1kHz, THD = 1%	1.20	1.25	—	V _{rms}
Differential balance	G _{VB}	1	1kHz, 1.1dBV _{rms} In-phase input	—	—	-40	dB
LR output difference	G _{VD}	1	1kHz, 1.1dBV _{rms} Differential input	—	0	0.5	dB

(Note 1) When the TC9237BF, C9237BN and +5V single power supply are operated
: Full scale = 970mV_{rms} (typ.)

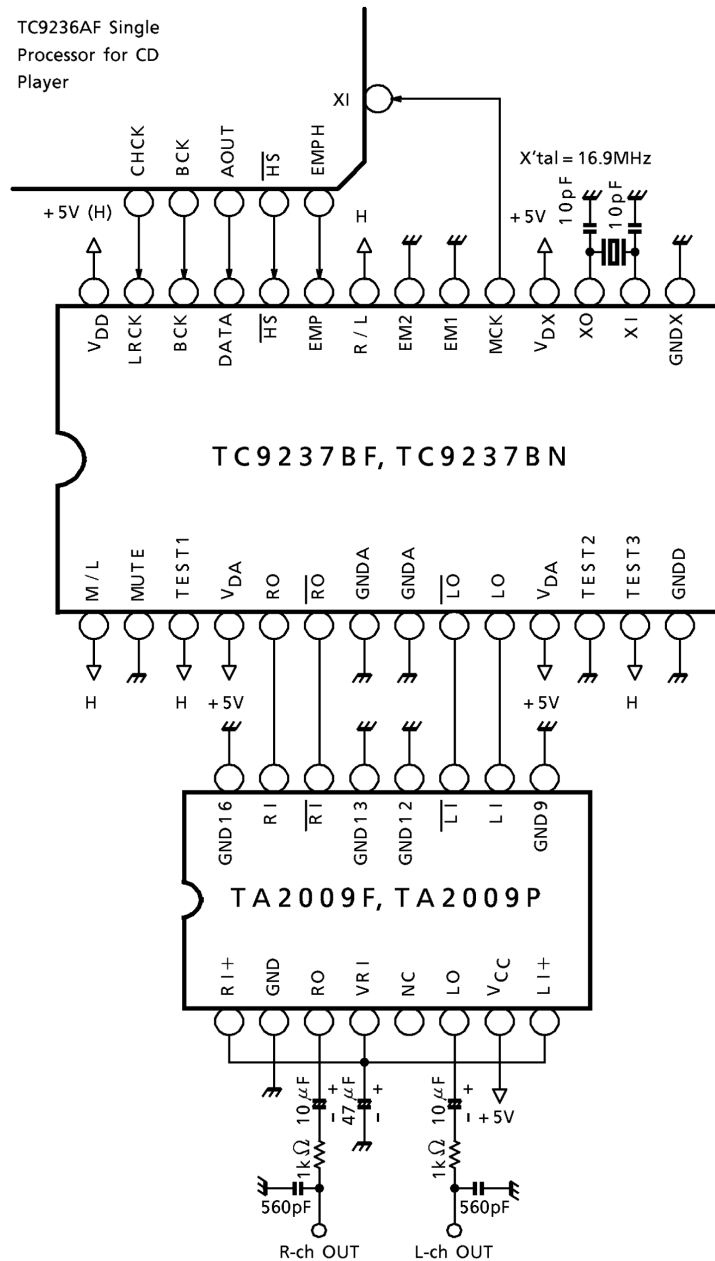
(Note 2) Measuring circuit-1: Indicates the measuring circuit.

Test Circuit-1



SW ₁	SW ₂	SW ₃	Measuring Item
L	L	—	Operating supply voltage, reference voltage
L	H	L	Cross talk (R→L)
H	L	L	Cross talk (L→R)
H	H	L	Noise distortion factor, attenuation, maximum output level, LR output difference
H	H	H	Difference balance

Application Circuit Example



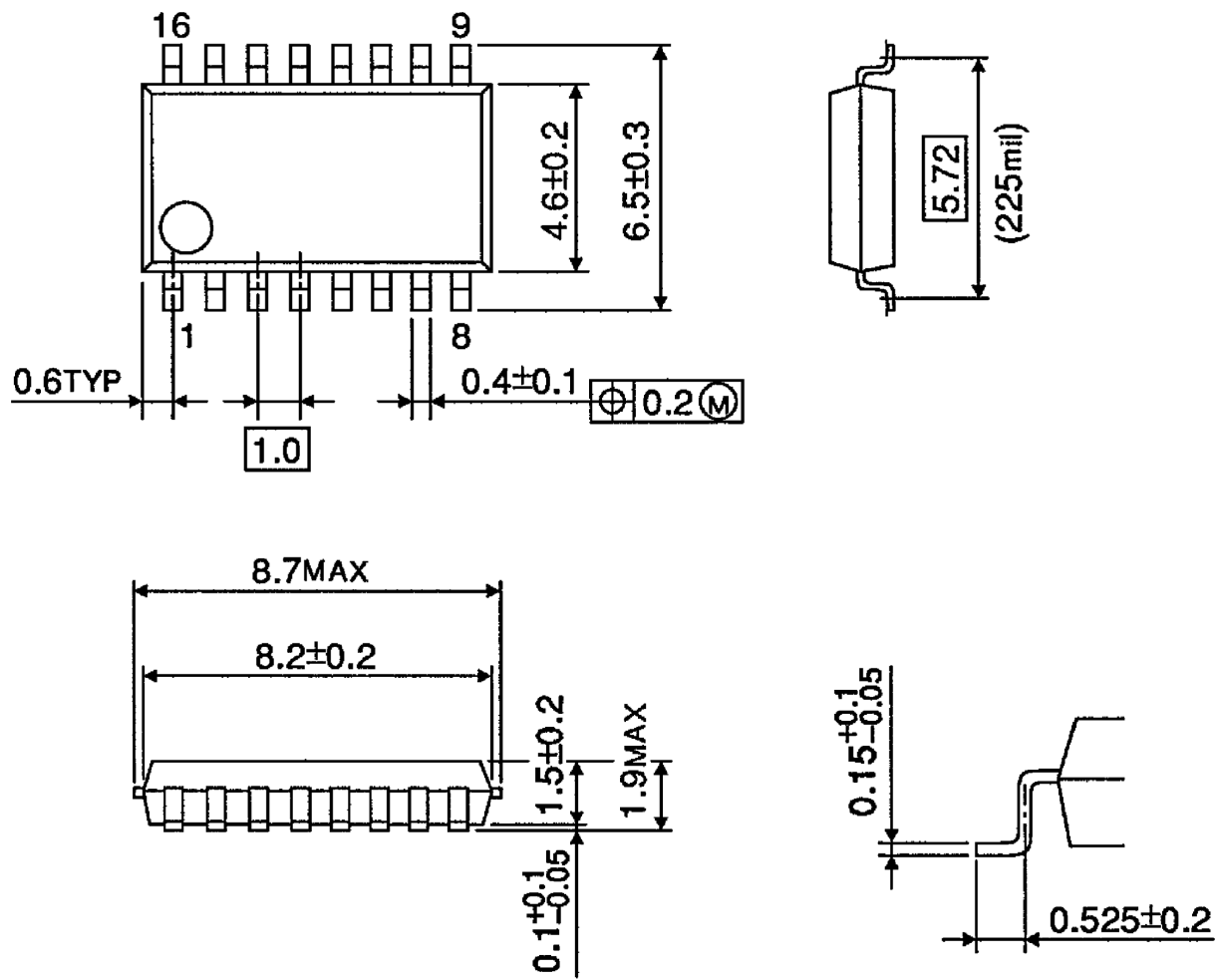
(Cautions)

- Quality of crystal oscillation waveform largely effects S/N ratio. Further, this is also true when system clock is input externally through the XI terminal of pin(16).
- Suppress glitch of input signals (LRCK, BCK, DATA) as could as possible.
- The wiring between the TC9237BF, TC9237BN output and the analog filter amplifier input must be made the shortest
- The capacitor between VDA and GNDA shall be connected as close to the pin as possible.

Package Dimensions

SSOP16-P-225-1.00A

Unit : mm

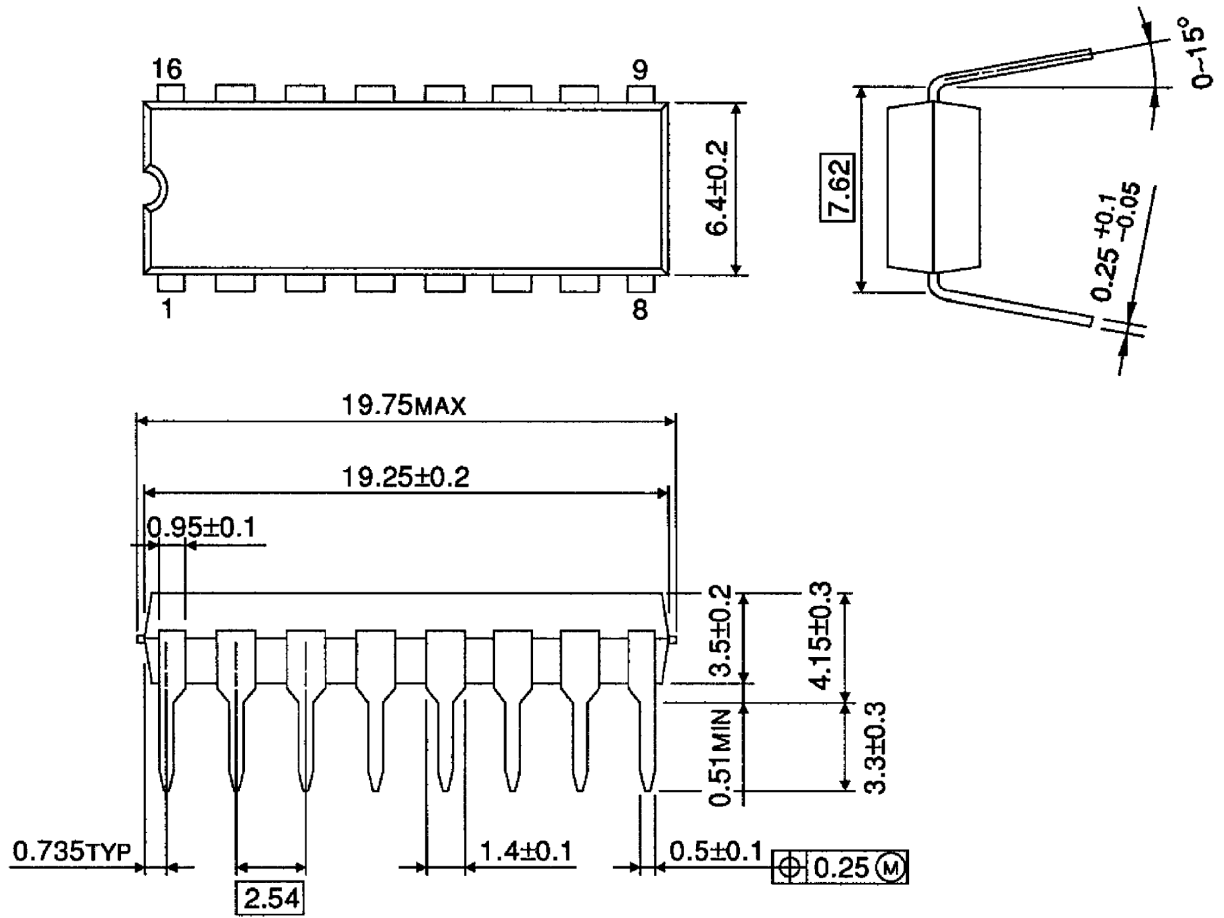


Weight: 0.14g (typ.)

Package Dimensions

DIP16-P-300-2.54A

Unit : mm



Weight: 1.00g (typ.)

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000707EBA

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