

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

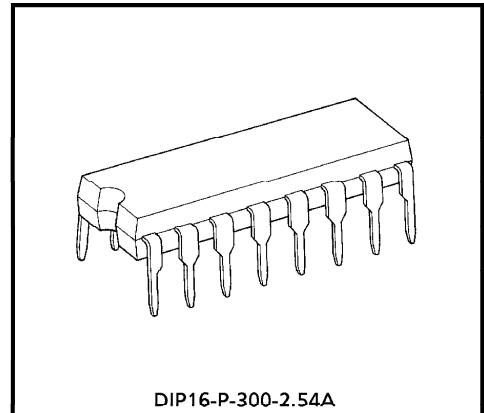
TC9184AP

HIGH PERFORMANCE ELECTRONIC TONE CONTROL

TC9184AP is electronic tone control ICs developed for audio equipment. These ICs can control bass and treble with serial data externally.

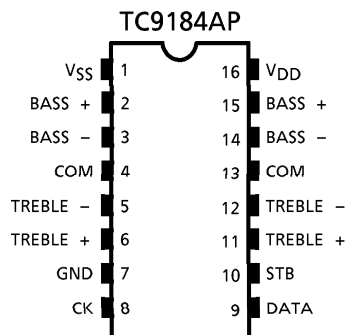
FEATURES

- Allows 13-step variable control 12~0~-12dB by 2dB step.
- Bass and treble of 2 channels are built in.
- Being in CMOS structure, wide dynamic ranges and low distortion rate are obtained.
- A dual power supply of (+) and (-) is applicable, and then the serial input data operates in a logic level of 0 to 5V, so the interface with a micro computer is easily available.
- Package type.
TC9184AP DIP-16pin



Weight : 1.00g (Typ.)

PIN CONNECTION



961001EBA1

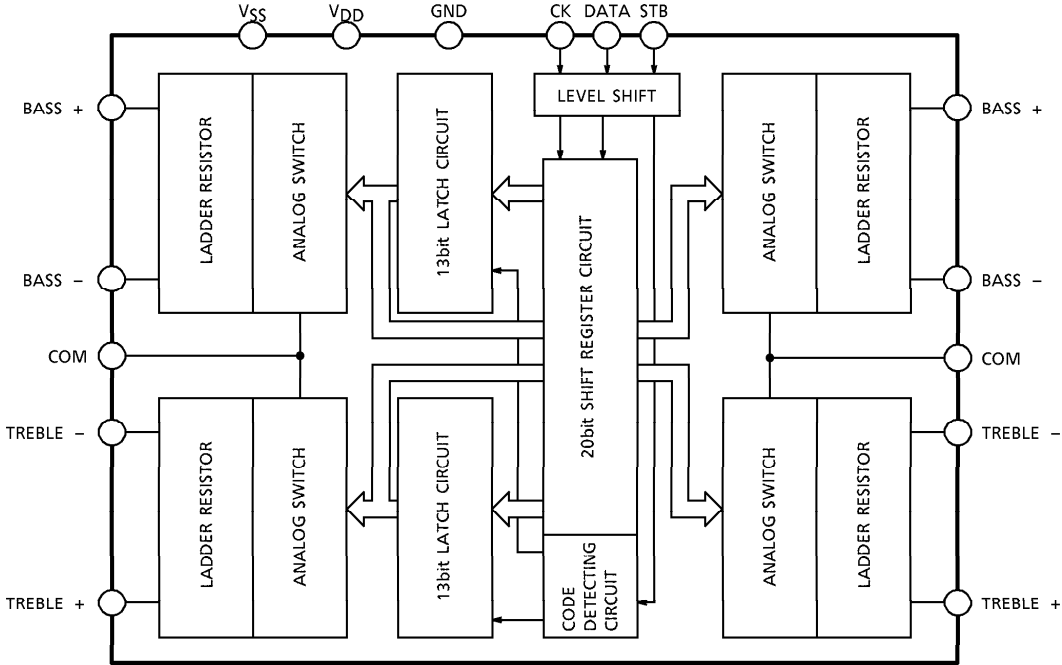
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BLOCK DIAGRAM
TC9184AP



PIN FUNCTION

PIN No.	SYMBOL	FUNCTION DESCRIPTION	REMARKS
1	V _{SS}	Power supply voltage terminals (Analog section)	—
16	V _{DD}		
2 / 15	BASS +	<p>Volume terminal</p> <p>The diagram shows a central node connected to five terminals: BASS +, BASS -, COM, TREBLE -, and TREBLE +. BASS + and TREBLE + are connected to this node through resistors. BASS -, COM, and TREBLE - are connected to the node through switches.</p>	—
3 / 14	BASS -		
5 / 12	TREBLE -		
6 / 11	TREBLE +		
4 / 13 (—)	COM		
7	GND	GND terminal (Digital section)	—
8	CK	Clock input terminal. Clock input for receiving data from DATA terminal.	<ul style="list-style-type: none"> ● CMOS input ● Level shift circuit is built in.
9	DATA	Data input terminal. Input 20bit tone control data by synchronizing to the rise of CK signals.	
10	STB	Strobe input terminal. The tone control data received from DATA and CK terminals are transferred into IC by turning this terminal to "H" level. Previous data are kept stored so long as "H" level is not applied to this terminal.	

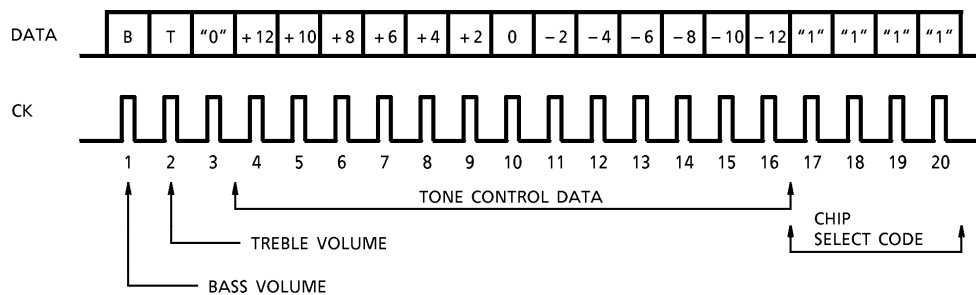
DESCRIPTION ON OPERATION

1. Setting of tone control position

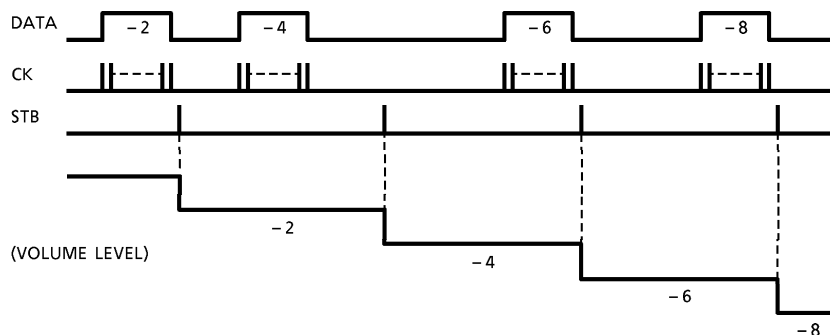
The tone control position can optionally be set by inputting specified data to DATA, CK, and STB terminals.

Input data are composed of 20 bits in the following manner :

● Serial data format



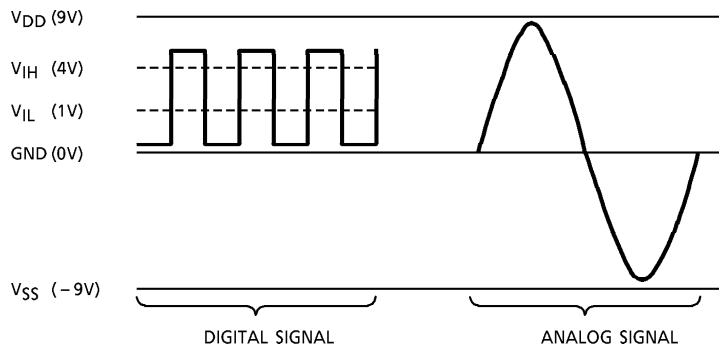
- The 4th to the 16th DATA are tone control data and can be used for setting in 13 steps for the range of 12~0~-12dB.
- The 1st and the 2nd DATA are for selecting data of BASS VOLUME / TREBLE VOLUME. When B = 1, BASS VOLUME is set, T = 1, TREBLE VOLUME, and B = T = 1, BASS + TREBLE VOLUME.
- Two channels of BASS / TREBLE VOLUME and change simultaneously.
(Note) The two channels of each BASS / TREBLE VOLUME can not be set independently.
- The received data are transferred into each volume synchronously to the rise of STB signals.



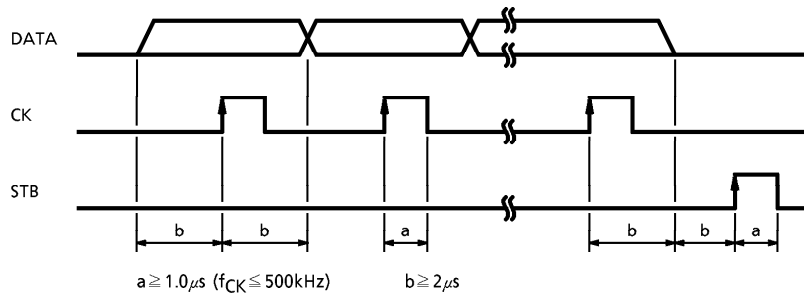
2. Input to DATA, CK, and STB

Although TC9184AP is usually used in a dual power supply of (+) and (-), DATA CK, and STB terminals are operated only by the single power supply of (+) by means of a built-in level shift circuit.

Furthermore, the threshold level of the input to these three terminals is designed to low, they can be operated at a logical level of 5V.



Input data to DATA, CK, and STB in the following timing.



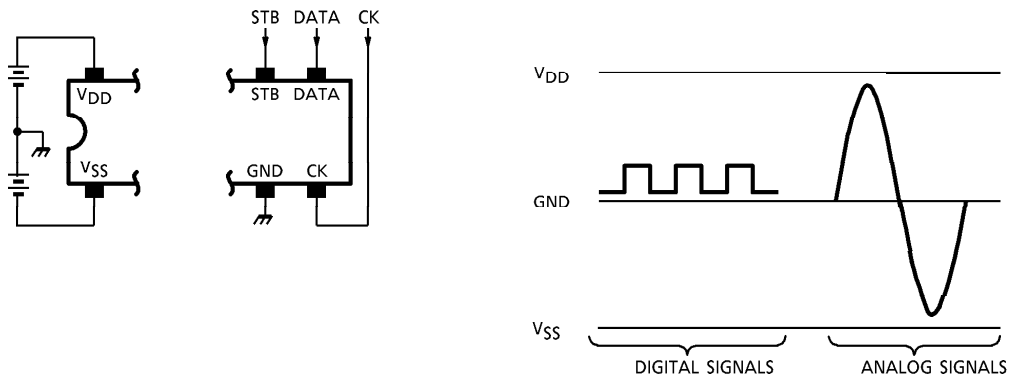
- DATA signals are read at the rise of CK.
- The input data are latched inside at the rise of STB and change the volume values.

3. Power supply and correlations

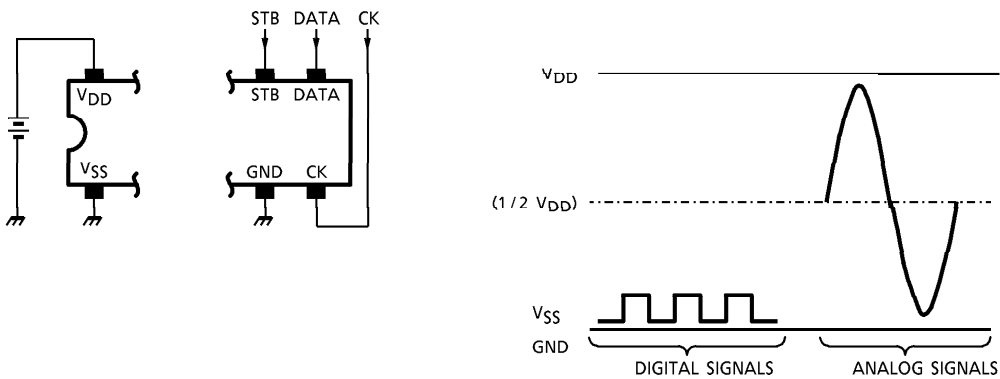
Although TC9184P is usually used in dual power supply, they can be operated even in a single power supply, where it should be noted that when $V_{DD} - GND > 9.0V$, the threshold input voltage level (V_{IH} / V_{IL}) at DATA, CK, and STB terminals becomes as follows :

$$\left. \begin{aligned} V_{IH} &\cong V_{DD} \times 0.5 (V) \\ V_{IL} &\cong V_{DD} \times 0.1 (V) \end{aligned} \right\} \begin{aligned} 18V &\cong V_{DD} - GND > 9V \\ GND &= V_{SS} = 0V \end{aligned}$$

- Use of dual power supply



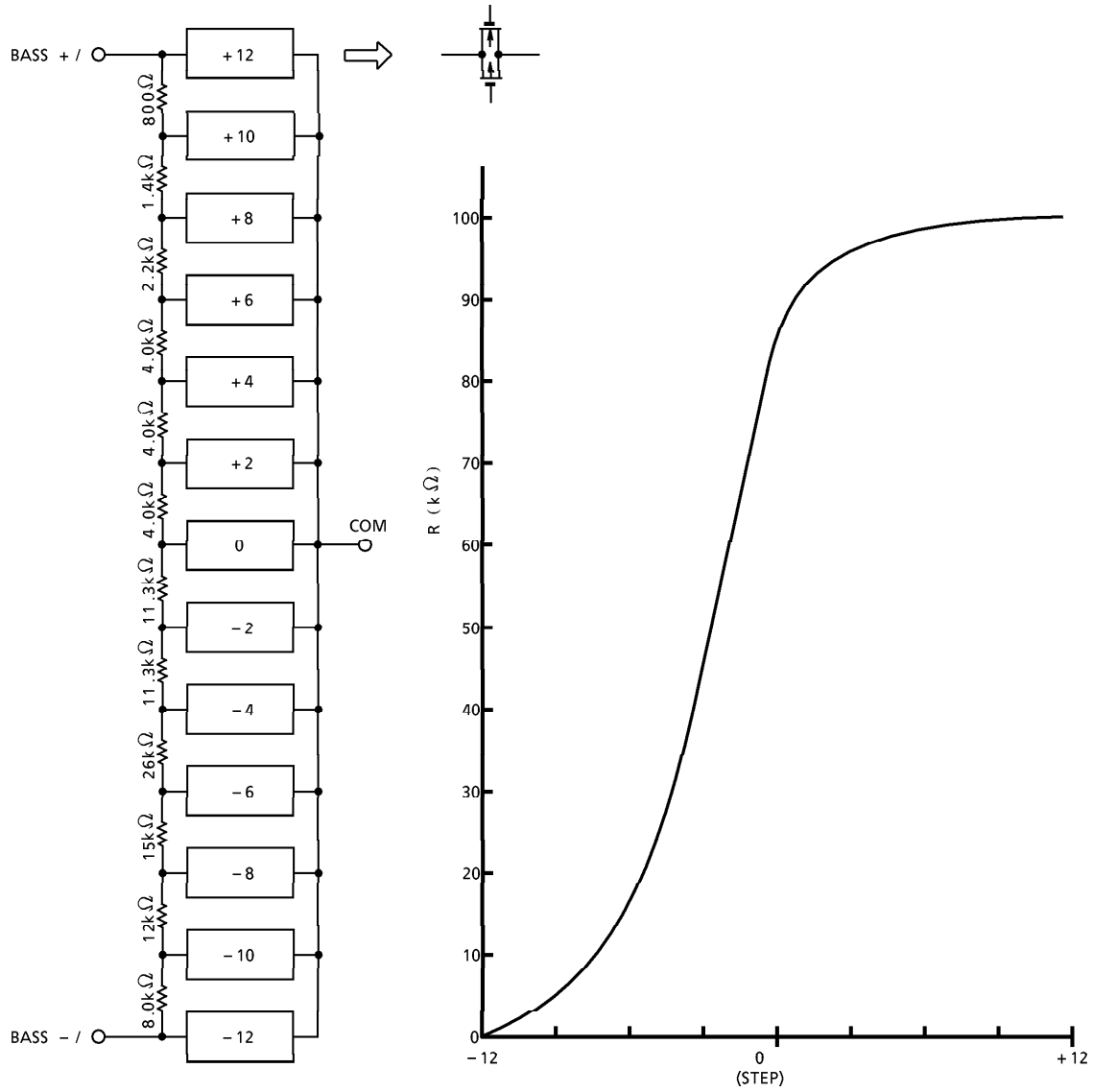
- Use of single power supply



4. Variable resistance

The tone control volume consists of diffused resistors and analog switches. Two sets of BASS/TREBLE VOLUME, in total four volumes, are built-in.

BASS Volume



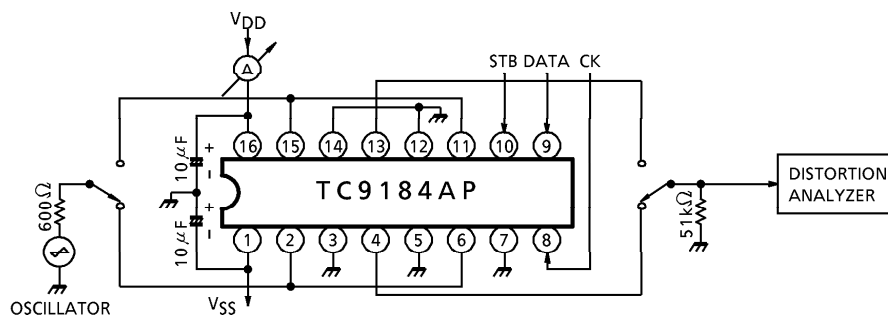
MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage (1)	V _{DD} -V _{SS}	-0.3~36	V
Power Supply Voltage (2)	V _{DD} -GND	-0.3~20	V
GND Block Input Voltage	V _{IN} (1)	-0.3~V _{DD} +0.3	V
V _{SS} Block Input Voltage	V _{IN} (2)	V _{SS} -0.3~V _{DD} +0.3	V
Power Dissipation	P _D	300	mW
Operating Temperature	T _{opr}	-40~85	°C
Storage Temperature	T _{stg}	-65~150	°C

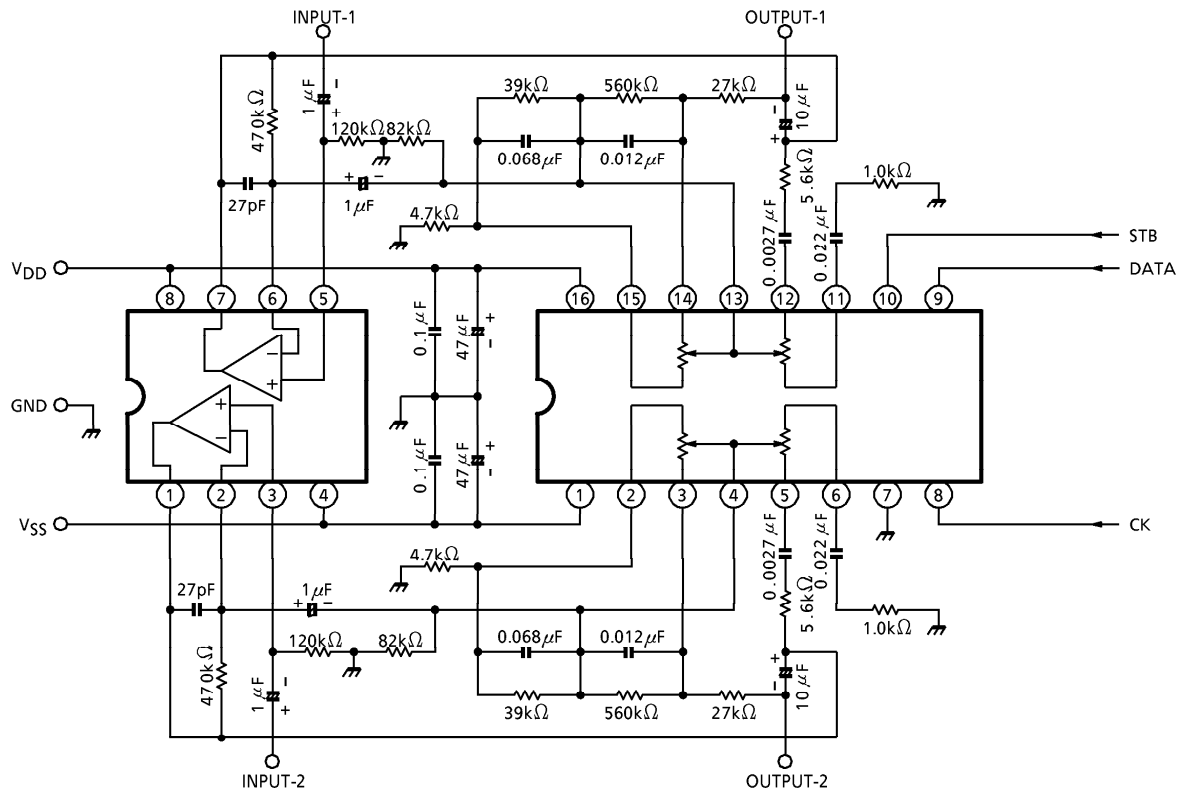
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{DD} = 15V, V_{SS} = -15V, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage (1)	V _{DD} - V _{SS}	—	—	12	~	34	V
Operating Supply Voltage (2)	V _{DD} - GND	—	—	6.0	~	18	V
Operating Supply Current	I _{DD}	1	No input, No load	—	0.5	1.0	mA
Input Voltage	"H" Level	V _{IH}	CK, DATA, STB V _{DD} = 6.0~18V	4.0	—	V _{DD}	V
	"L" Level	V _{IL}		GND	—	1.0	
Input Current	"H" Level	I _{IH}	CK, DATA STB	-1.0	—	1.0	μA
	"L" Level	I _{IL}		V _{IH} = V _{DD} V _{IL} = 0V	-1.0	—	
Volume Resistance	R	—	—	70	100	130	kΩ
Relative Resistance Error	ΔR	—	—	-5.0	—	5.0	%
Max. Input Amplitude	V _{IN}	—	—	—	—	10	V _{rms}
Max. Clock Frequency	f _{CK}	—	—	—	—	500	kHz
Min. Clock Pitch	T _{CK}	—	—	2.0	—	—	μs
Total Harmonic Distortion	THD	1	STEP = 12dB, f _{IN} = 1kHz V _{IN} = 1.0V _{p-p}	—	0.005	0.01	%

TEST CIRCUIT

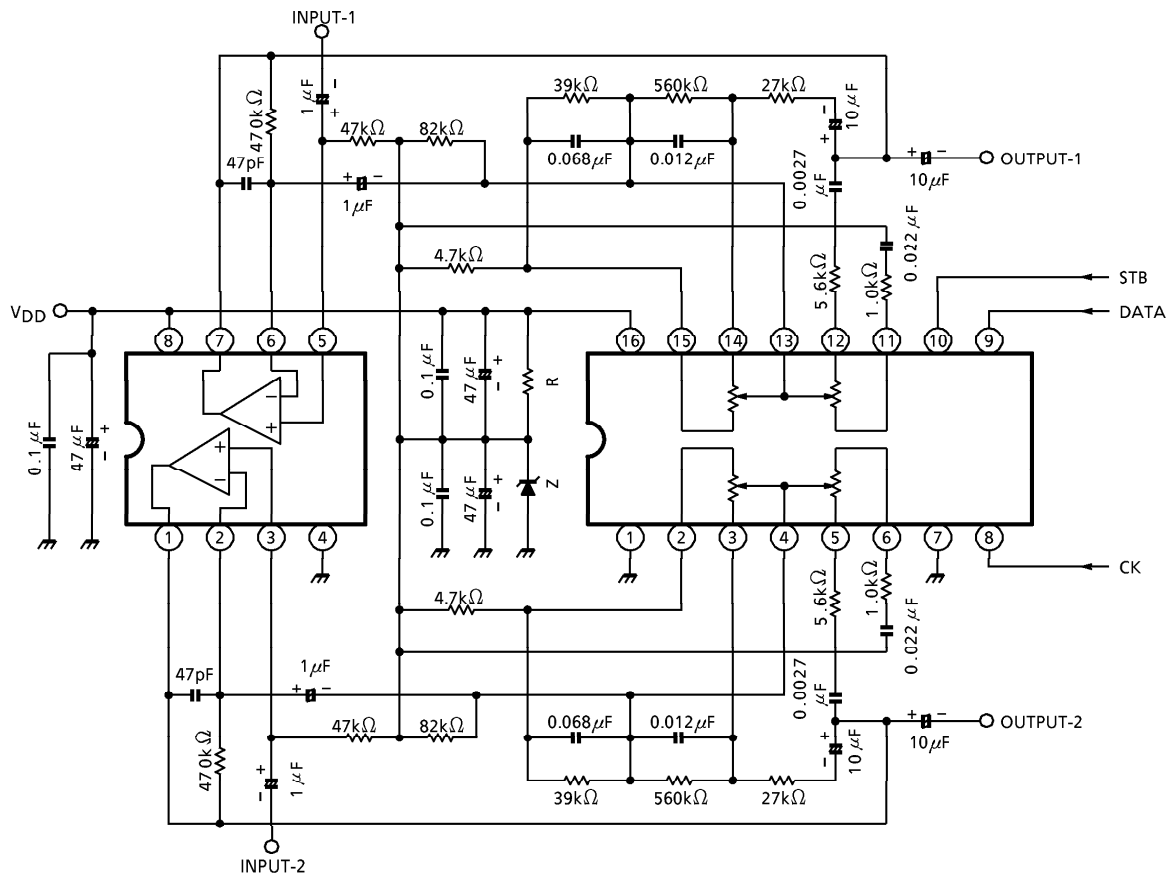


APPLICATION CIRCUIT (Dual power supply)



OP AMP : TA75558P, TA75559P or equivalent

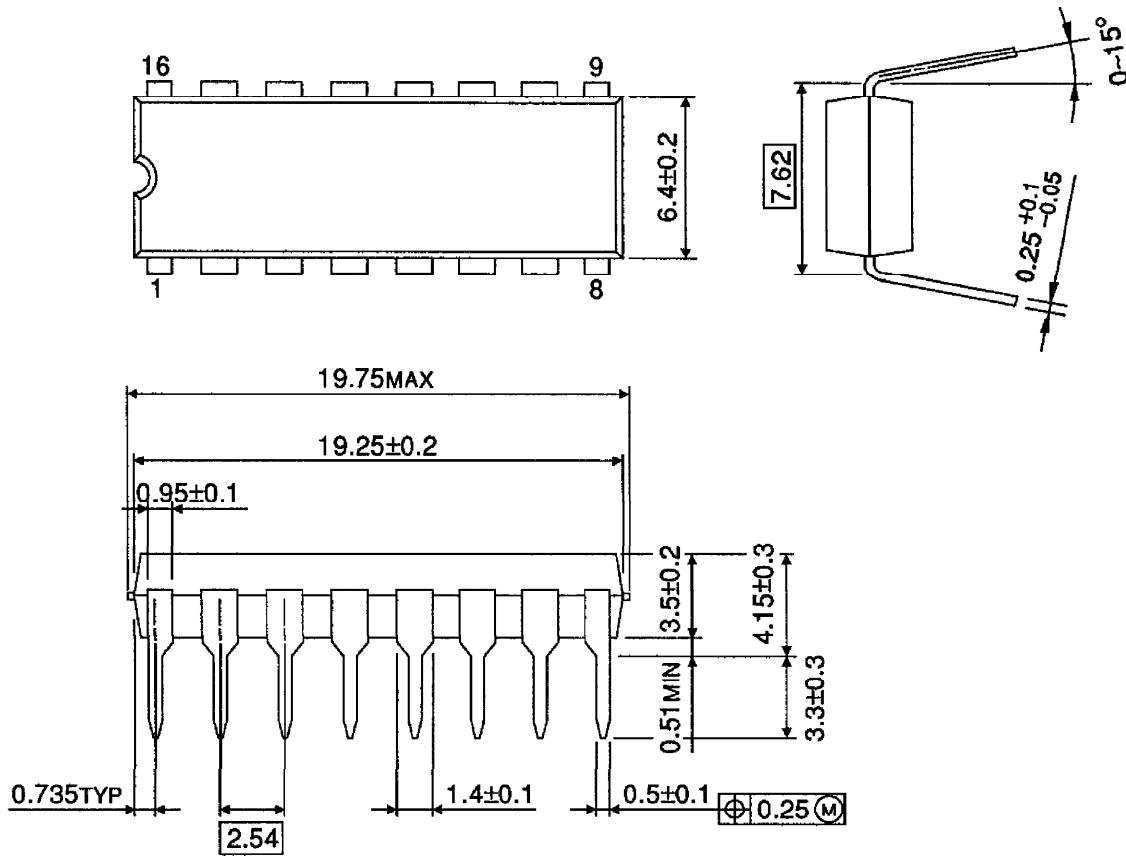
APPLICATION CIRCUIT (Single power supply)



OP AMP : TA75558P, TA75559P or equivalent
 V_Z (Zener voltage) = $1/2 V_{DD}$

OUTLINE DRAWING
DIP16-P-300-2.54A

Unit : mm



Weight : 1.00g (Typ.)