

TC74VHCT540F/FW/FS TC74VHCT541F/FW/FS

OCTAL BUS BUFFER
 TC74VHCT540F/FW/FS INVERTED, 3-STATE OUTPUTS
 TC74VHCT541F/FW/FS NON-INVERTED, 3-STATE OUTPUTS

The TC74VHCT540, 541 are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate CMOS technology. They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The TC74VHCT540 is an inverting type and, The TC74VHCT541 is a non-inverting type.

When either $\bar{G}1$ or $\bar{G}2$ are high, the terminal outputs are in the high-impedance state.

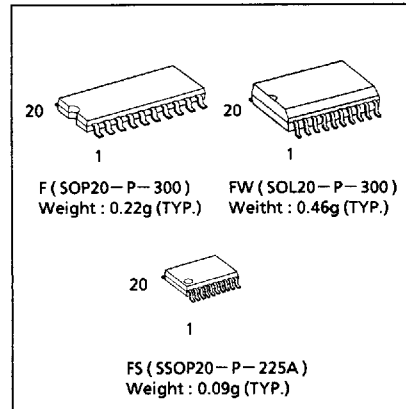
The input voltage are compatible with TTL output voltage.

These devices may be used as a level converter for interfacing 3.3V to 5V system.

Input protection and output circuit ensure that 0 to 7V can be applied to the input and output pins without regard to the supply voltage. This structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

FEATURES:

- High Speed..... $t_{pd} = 5.4ns$ (typ.) at $V_{CC} = 5V$
- Low Power Dissipation..... $I_{CC} = 4\mu A$ (Max.) at $T_a = 25^\circ C$
- Compatible with TTL outputs $V_{IL} = 0.8V$ (Max.)
 $V_{IH} = 2.0V$ (Min.)
- Power Down Protection is provided on all inputs and outputs
- Balanced Propagation Delays..... $t_{pLH} = t_{pHL}$
- Low Noise $V_{OLP} = 1.6V$ (Max.)
- Pin and Function Compatible with 74ALS540/541



APPLICATION NOTE

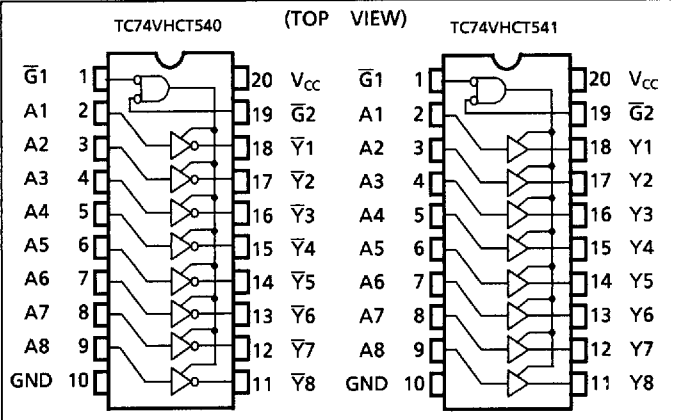
These devices can drive components with CMOS input level by adding a external pull up resistor to output terminal.

TRUTH TABLE

INPUTS			OUTPUTS	
$\bar{G}1$	$\bar{G}2$	A_n	Y_n	\bar{Y}_n
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

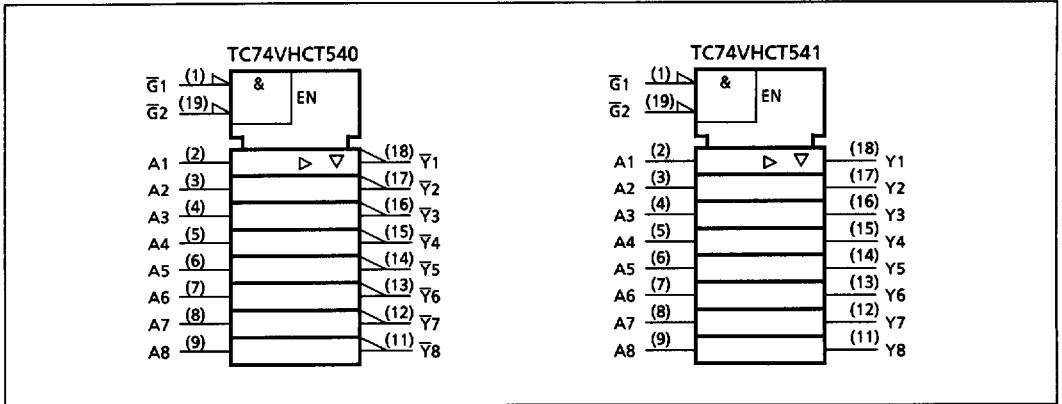
X : Don't Care
 Z : High Impedance
 Y_n : TC74VHCT541
 \bar{Y}_n : TC74VHCT540

PIN ASSIGNMENT



TC74VHCT540F/FW/FS
TC74VHCT541F/FW/FS

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	-0.5~7.0	V
DC Input Voltage	V_{IN}	-0.5~7.0	V
DC Output Voltage	V_{OUT}	-0.5~7.0	V
Input Diode Current	I_{IK}	-20	mA
Output Diode Current	I_{OK}	-20	mA
DC Output Current	I_{OUT}	±25	mA
DC V_{CC} /Ground Current	I_{CC}	±75	mA
Power Dissipation	P_D	180	mW
Storage Temperature	T_{stg}	-65~150	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	4.5~5.5	V
Input Voltage	V_{IN}	0~5.5	V
Output Voltage	V_{OUT}	0~5.5	V
Operating Temperature	T_{opr}	-40~85	°C
Input Rise and Fall Time	dt/dV	0~20	ns/V

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DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITON		V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High - Level Input Voltage	V _{IH}			4.5~5.5	2.0	—	—	2.0	—	V
Low - Level Input Voltage	V _{IL}			4.5~5.5	—	—	0.8	—	0.8	V
High - Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50μA	4.5	3.15	3.65	—	3.15	—	V
			I _{OH} = -8mA	4.5	2.50	—	—	2.40	—	
Low - Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50μA	4.5	—	0.0	0.10	—	0.10	V
			I _{OL} = 8mA	4.5	—	—	0.36	—	0.44	
3 - State Output Off - State Current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.25	—	±2.50	μA
Input Leakage Current	I _{IN}	V _{IN} = 5.5V or GND		0~5.5	—	—	±0.1	—	±1.0	
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	4.0	—	40.0	mA
	I _{CC(T)}	PER INPUT : V _{IN} = 3.4V OTHER INPUT : V _{CC} or GND		5.5	—	—	1.35	—	1.50	
Output Leakage Current	I _{OPD}	V _{OUT} = 5.5V		0	—	—	+0.5	—	+5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3ns)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = -40~85°C		UNIT	
		V _{CC} (V)	C _L (pF)	MIN.	TYP.	MAX.	MIN.	MAX.		
Propagation Delay Time (TC74VHCT540)	t _{pLH} t _{pHL}	5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	ns	
			50	—	5.9	8.4	1.0	9.5		
Propagation Delay Time (TC74VHCT541)	t _{pLH} t _{pHL}	5.0 ± 0.5	15	—	5.0	6.9	1.0	8.0		
			50	—	5.5	7.9	1.0	9.0		
3-State Output Enable Time	t _{pZL} t _{pZH}	R _L = 1kΩ	5.0 ± 0.5	15	—	8.3	11.3	1.0		13.0
			50	—	8.8	12.3	1.0	14.0		
3-State Output Disable Time	t _{pLZ} t _{pHZ}	R _L = 1kΩ	5.0 ± 0.5	50	—	9.4	11.9	1.0		13.5
Output to Output Skew	t _{osLH} t _{osHL}	(Note 1)	5.0 ± 0.5	50	—	—	1.0	—		1.0
Input Capacitance	C _{IN}			—	4	10	—	10		pF
Output Capacitance	C _{OUT}			—	9	—	—	—		
Power Dissipation Capacitance	C _{PD}	(Note 2)		—	19	—	—	—		

Note (1) Parameter guaranteed by design. t_{osLH} = |t_{pLH m} - t_{pLH n}|, t_{osHL} = |t_{pHL m} - t_{pHL n}|

Note (2) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

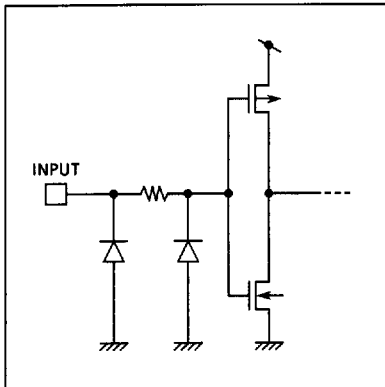
Average operating current can be obtained by the equation:

$$I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$$

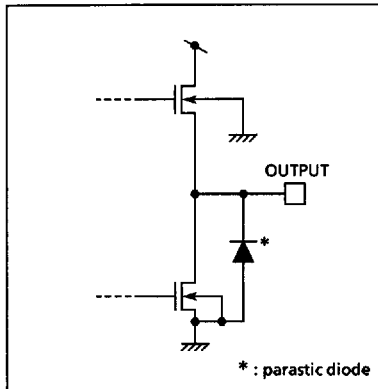
NOISE CHARACTERISTICS (Input $t_r = t_f = 3ns$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			UNIT
			V _{CC} (V)	TYP.	LIMIT	
Quiet Output Maximum Dynamic V _{OL}	V _{OLP}	C _L = 50pF	5.0	1.2	1.6	V
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	C _L = 50pF	5.0	-1.2	-1.6	V
Minimum High Level Dynamic Input Voltage	V _{IHD}	C _L = 50pF	5.0	-	2.0	V
Maximum Low Level Dynamic Input Voltage	V _{ILD}	C _L = 50pF	5.0	-	0.8	V

INPUT EQUIVALENT CIRCUIT



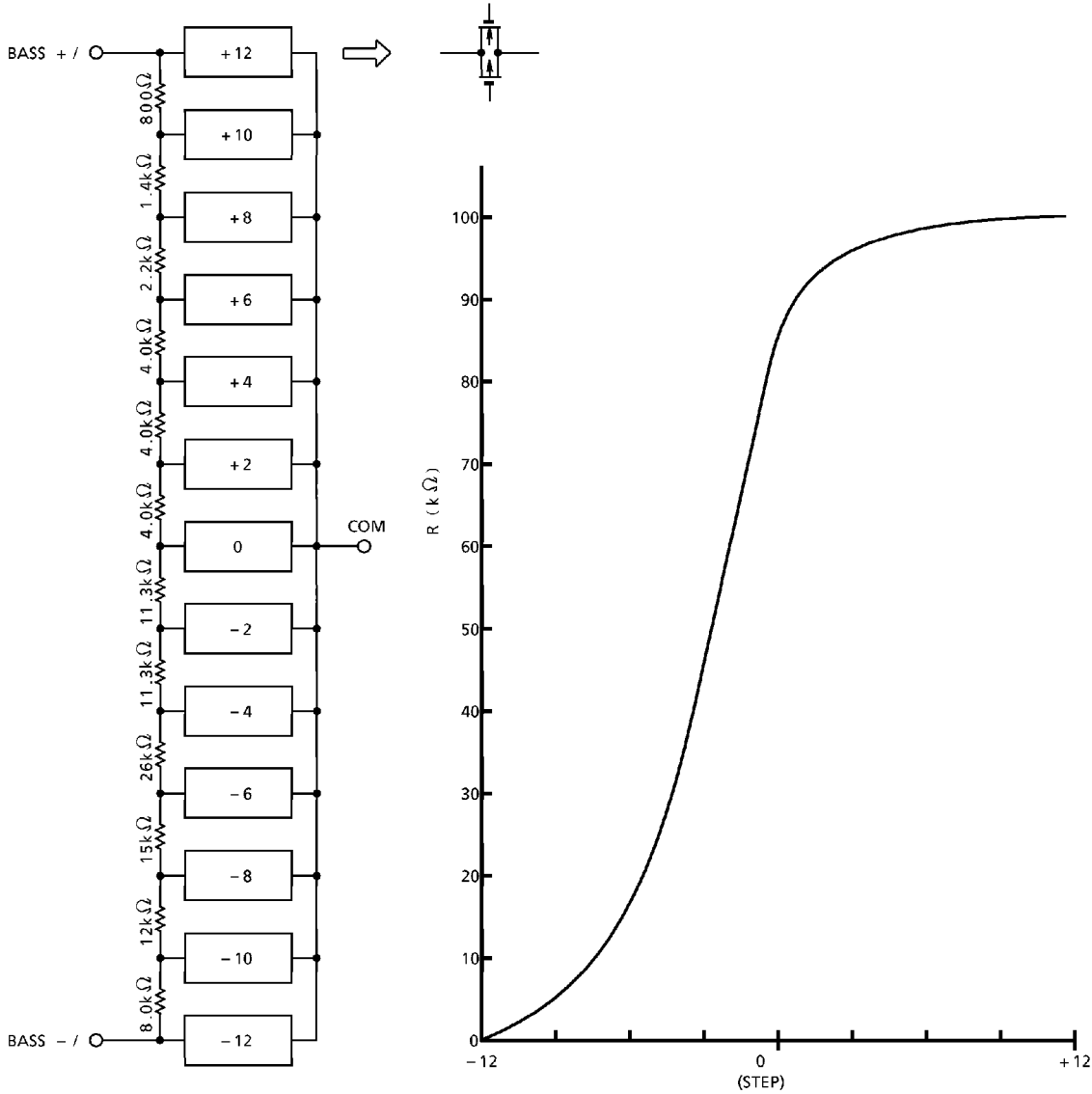
OUTPUT EQUIVALENT CIRCUIT



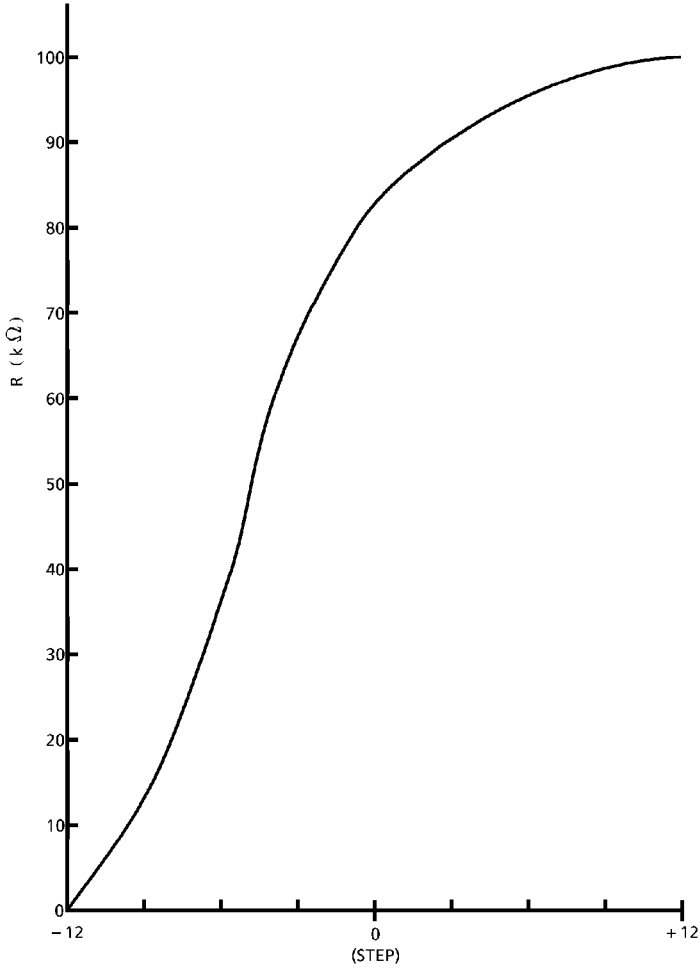
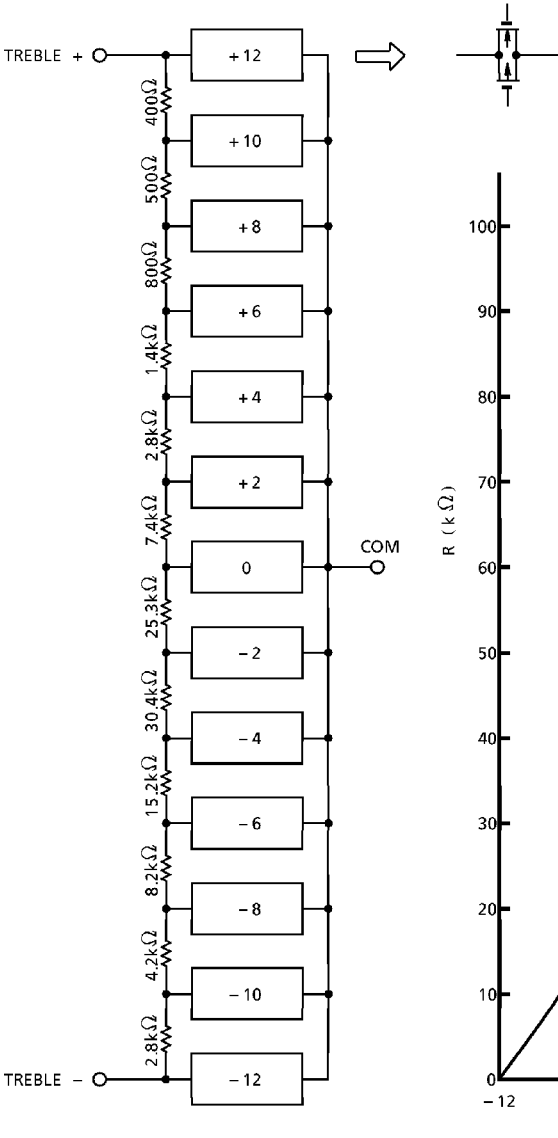
4. Variable resistance

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



TREBLE Volume



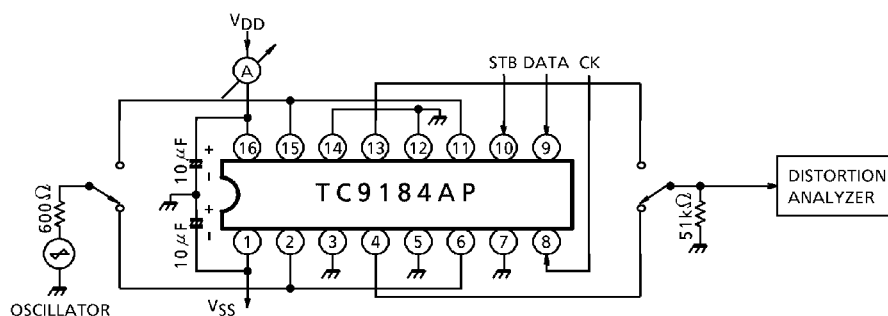
MAXIMUM RATINGS (Ta = 25°C)

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

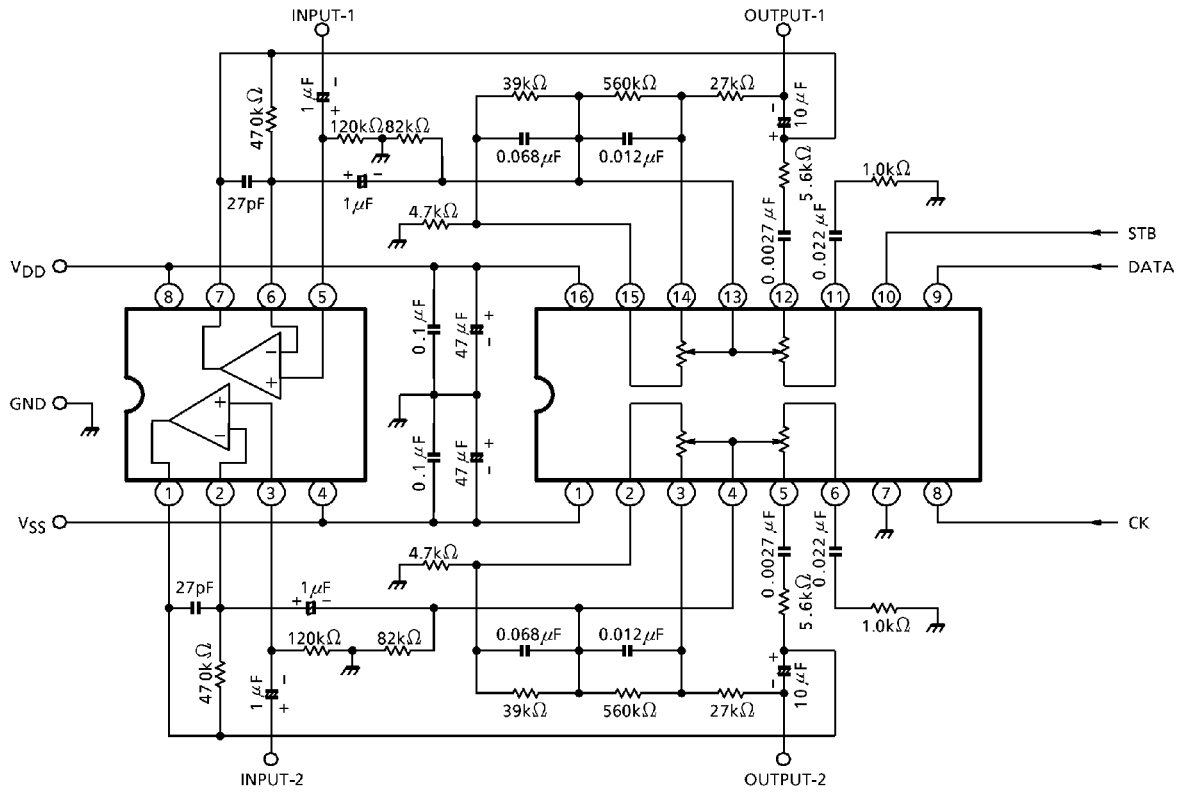
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{DD} = 15V、V_{SS} = -15V、Ta = 25°C)

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}					
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

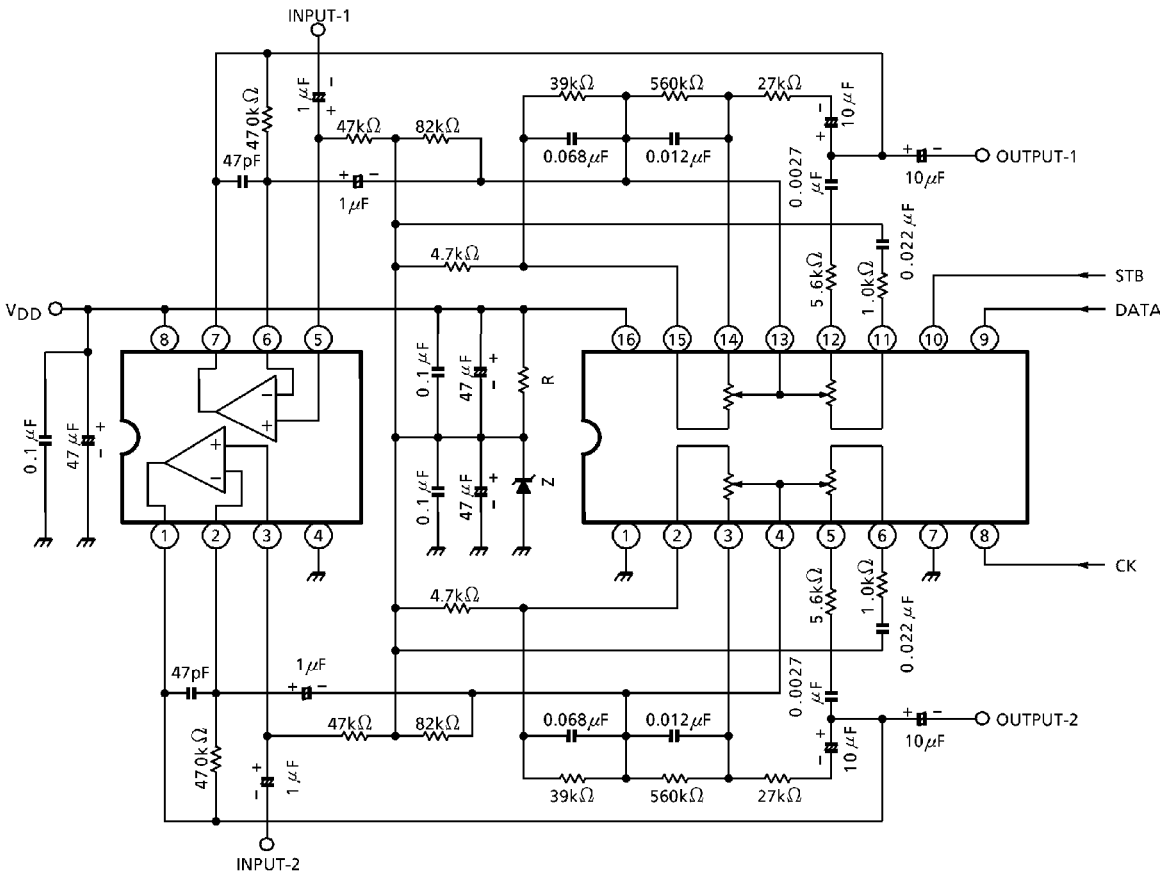


APPLICATION CIRCUIT (Dual power supply)



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}