

TC74VHCT245F/FW/FS

OCTAL BUS TRANSCEIVER

The TC74VHCT245 is an advanced high speed CMOS OCTAL BUS TRANSCEIVER fabricated with silicon gate C²MOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

It is intended for two-way asynchronous communication between data busses. The direction of data transmission is determined by the level of the DIR input.

The enable input (\bar{G}) can be used to disable the device so that the busses are effectively isolated.

The input voltage are compatible with TTL output voltage.

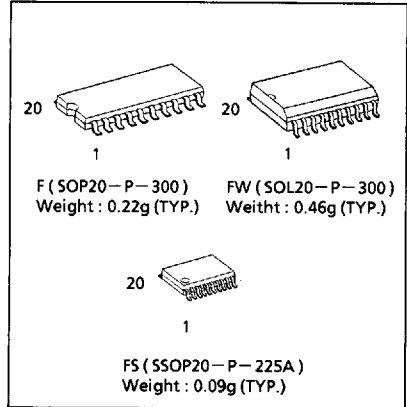
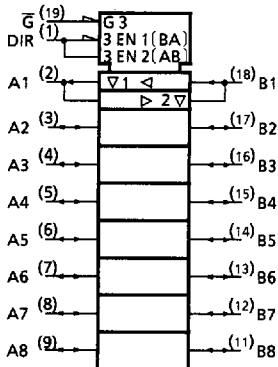
This device may be used as a level converter for interfacing 3.3V to 5V system.

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. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

FEATURES:

- High Speed..... $t_{pd} = 4.9\text{ns}(\text{typ.})$ at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs ... $V_{IL} = 0.8\text{V}(\text{Max.})$
 $V_{IH} = 2.0\text{V}(\text{Min.})$
- Power Down Protection is provided on all inputs and outputs
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Low Noise $V_{OLP} = 1.6\text{V}(\text{Max.})$
- Pin and Function Compatible with 74ALS245

IEC LOGIC SYMBOL



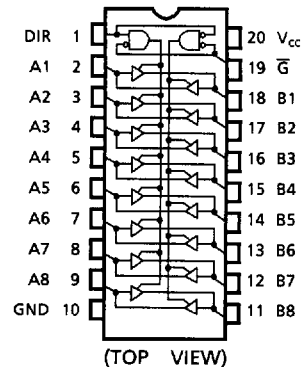
APPLICATION NOTES

This device can drive the components with CMOS input level by adding a external pull up resistor to output terminal.

Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

PIN ASSIGNMENT



TRUTH TABLE

INPUTS		FUNCTION		OUTPUT
\overline{G}	DIR	A BUS	B BUS	
L	L	OUTPUT	INPUT	A = B
L	H	INPUT	OUTPUT	B = A
H	X	High Impedance		Z

X : Don't Care

Z : High Impedance

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	-0.5~7.0	V
DC Input Voltage (DIR, \overline{G})	V_{IN}	-0.5~7.0	V
DC I/O Voltage	$V_{I/O}$	-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 (DIR, \overline{G})	V_{IN}	0~5.5	V
Output Voltage	$V_{I/O}$	0~5.5	V
Operating Temperature	T_{opr}	-40~85	°C
Input Rise and Fall Time	dt/dV	0~20	ns/V

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		
	I _{CC} T	PER INPUT : V _{IN} = 3.4V OTHER INPUT : V _{CC} or GND	5.5	-	-	1.35	-	1.50	mA	
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	V _{CC} (V)	C _L (pF)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time	t _{pLH} t _{pHL}		5.0 ± 0.5	15 50	-	4.9	7.7	1.0	8.5	ns
					-	5.4	8.7	1.0	9.5	
3-State Output Enable Time	t _{pZL} t _{pZH}	R _L = 1kΩ	5.0 ± 0.5	15 50	-	9.4	13.8	1.0	15.0	
					-	9.9	14.8	1.0	16.0	
3-State Output Disable Time	t _{pLZ} t _{pHZ}	R _L = 1kΩ	5.0 ± 0.5	50	-	10.1	15.4	1.0	16.5	
Output to Output Skew	t _{osLH} t _{osHL}	(Note 1)	5.0 ± 0.5	50	-	-	1.0	-	1.0	
Input Capacitance	C _{IN}	DIR, \bar{G}			-	4	10	-	10	
Bus Input Capacitance	C _{I/O}	An, Bn			-	13	-	-	-	
Power Dissipation Capacitance	C _{PD}	(Note 2)			-	16	-	-	-	

Note (1) Parameter guaranteed by design. t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|

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

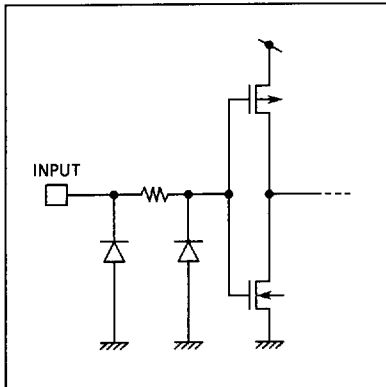
Average operating current can be obtained by the equation:

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

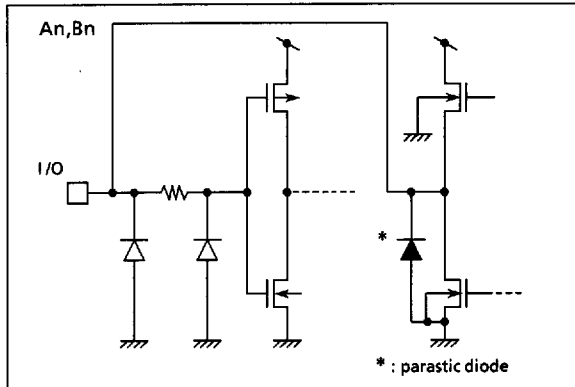
NOISE CHARACTERISTICS (Input $t_r = t_f = 3ns$)

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

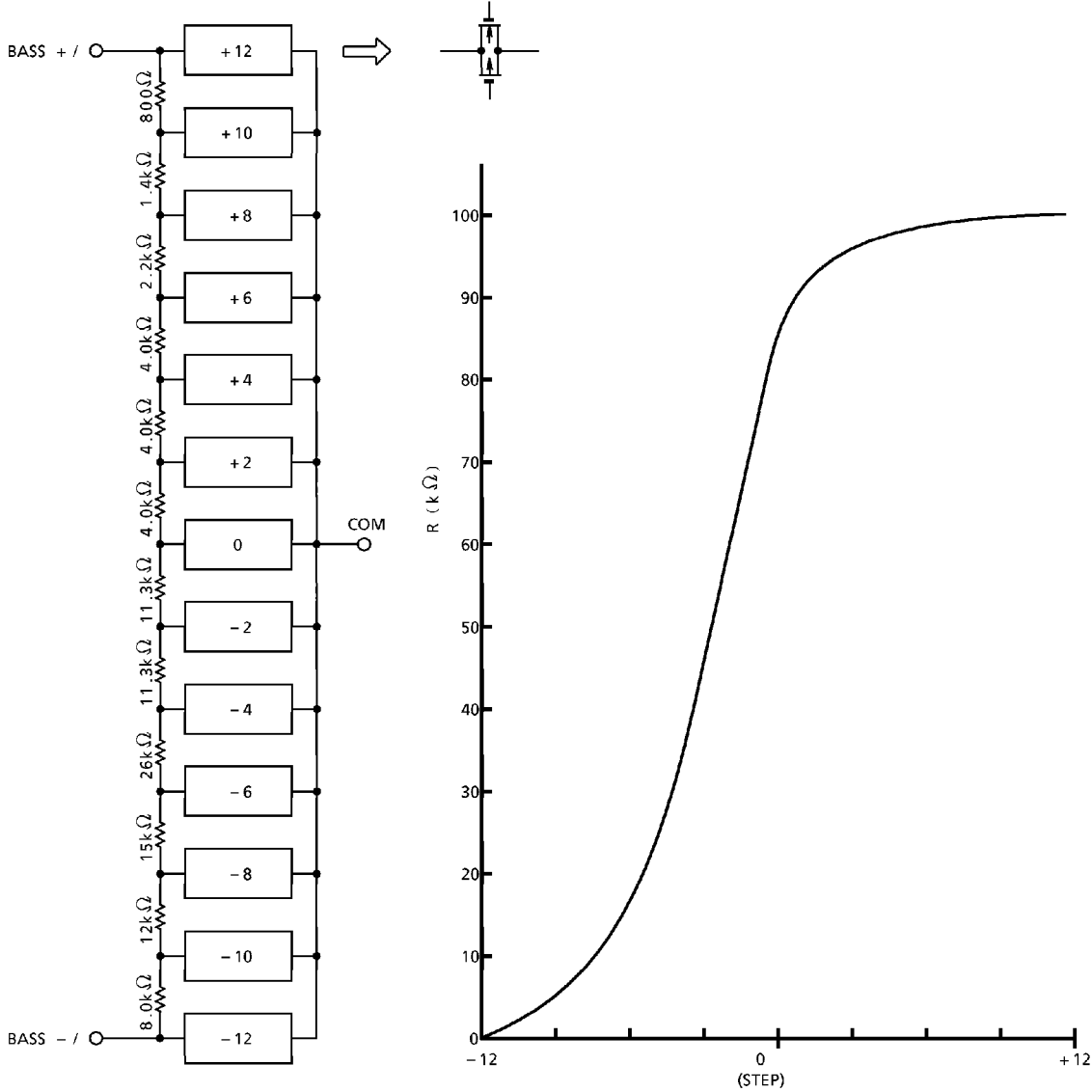


* : parasitic diode

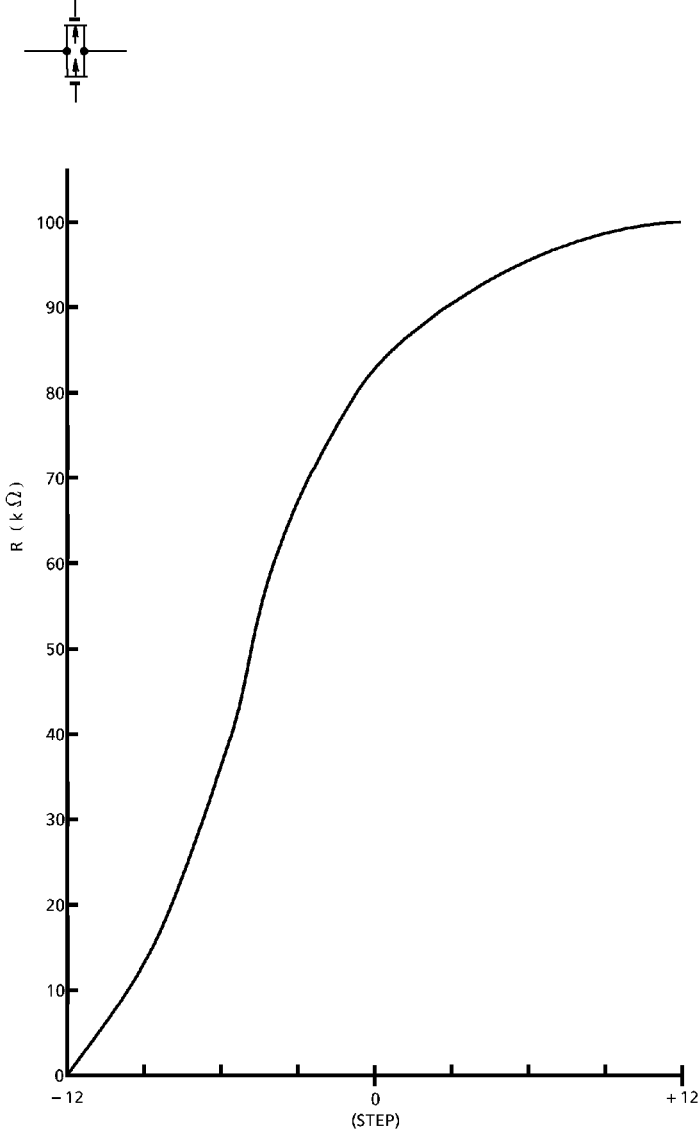
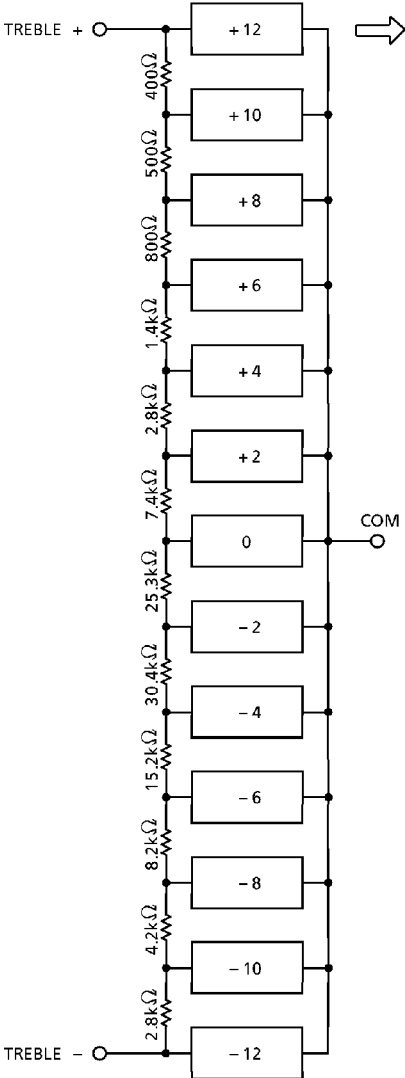
4. Variable resistance

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



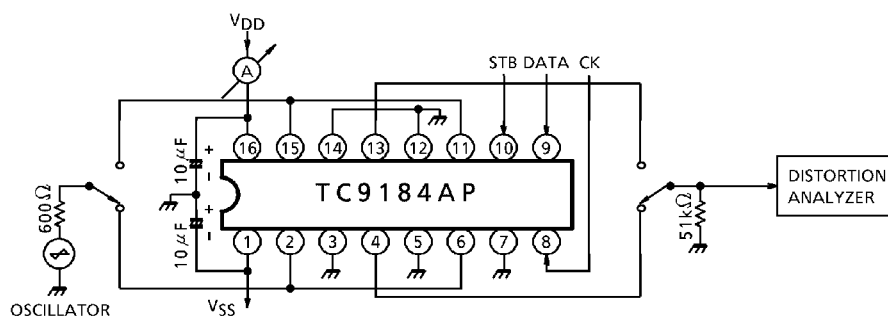
MAXIMUM RATINGS (Ta = 25°C)

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

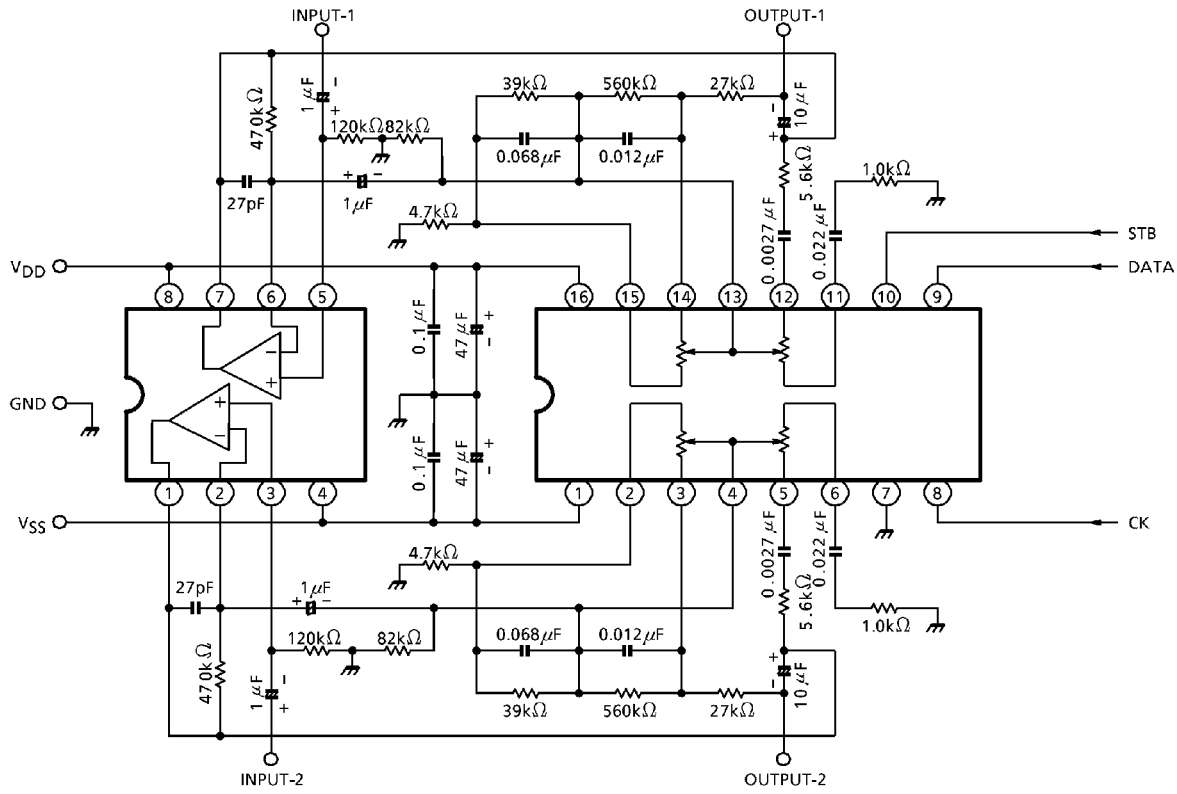
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{DD} = 15V、V_{SS} = -15V、Ta = 25°C)

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

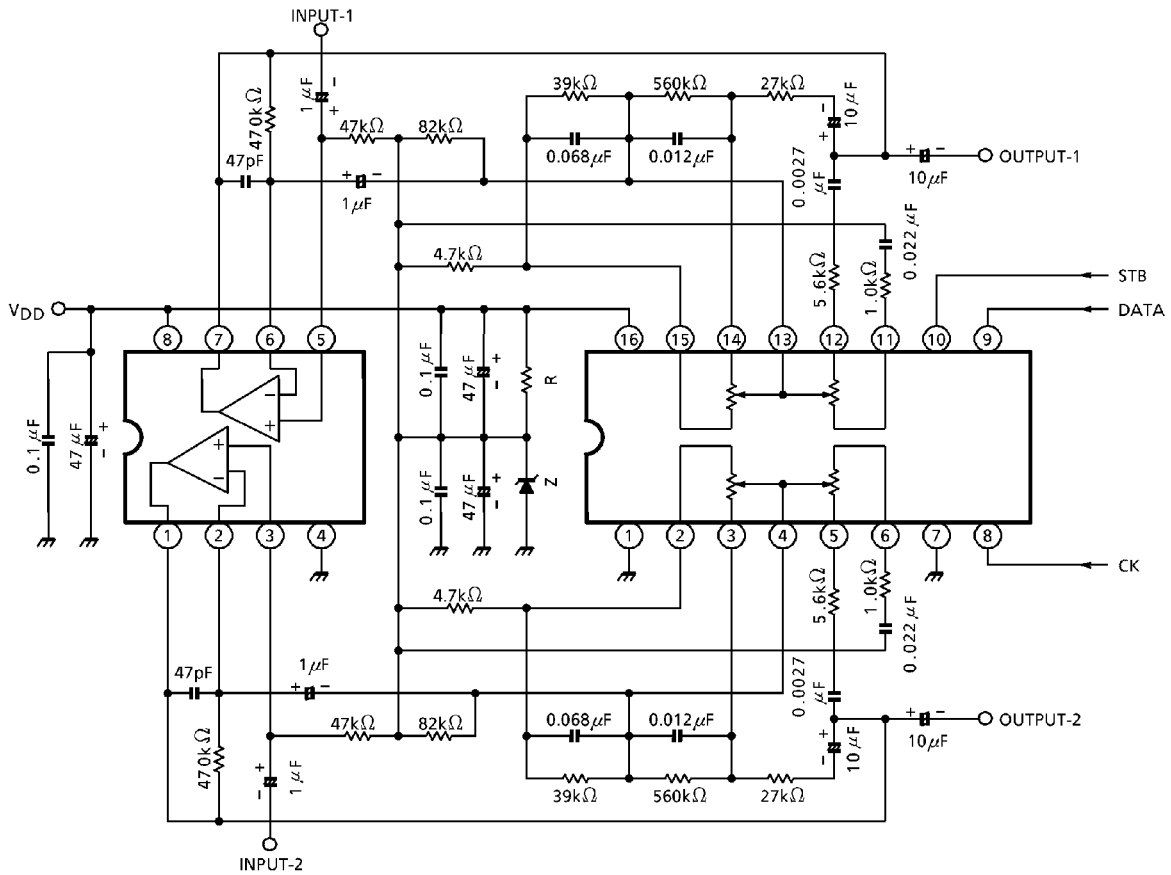


APPLICATION CIRCUIT (Dual power supply)



OP AMP : TA75558P, TA75559P or equivalent

APPLICATION CIRCUIT (Single power supply)



OP AMP : TA75558P, TA7559P or equivalent
V_Z (Zener voltage) = 1/2 V_{DD}