OCTAL BUS TRANSCEIVER/REGISTER
TC74AC646P NON-INVERTING
TC74AC648P INVERTING

The TC74AC646/648 are advanced high speed CMOS OCTAL BUS TRANSCEIVER/REGISTERs fabricated with silicon gate and double-layer metal wiring C^2MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

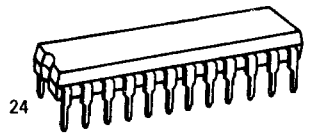
These devices are bus transceivers with 3-state outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the internal registers.

The TC74AC646 is a non-inverting output type while the TC74AC648 is of the inverting output type.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

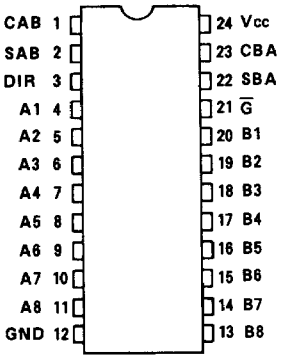
FEATURES:

- High Speed ····· f_{MAX}=150MHz(typ.)at V_{CC}=5V
- Low Power Dissipation ····· I_{CC}=8μA(Max.)at Ta=25℃
- High Noise Immunity ····· $V_{NIH}=V_{NIL}$ 28% V_{CC}(Min.)
- Symmetrical Output Impedance ··· $|I_{OH}|=I_{OL}$=24mA(Min.) Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays ····· $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ··· V_{CC}(opr.)=2V~5.5V
- Pin and Function Compatible with 74F646/648.



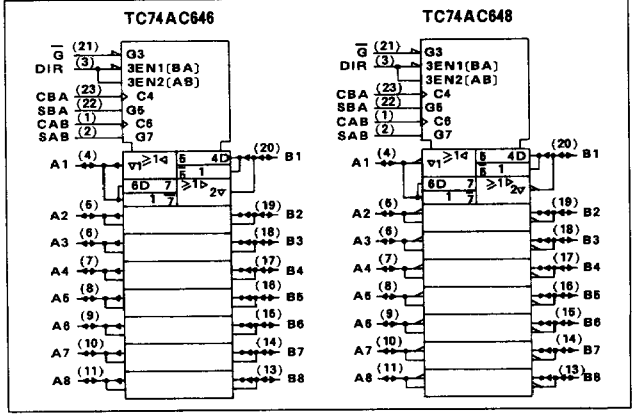
P

PIN ASSIGNMENT



(TOP VIEW)

IEC LOGIC SYMBOL



APPLICATION NOTES

1) Do not apply a signal to any bus terminal when it is in the out put mode. Damage may result.

2) All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors or bus terminator IC's such as the TOSHIBA TC40117BP.

TRUTH TABLE

TC74AC646 (The truth table for TC74AC648 is the same, but with the outputs inverted)

$\overline{G}$	DIR	CAB	CBA	SAB	SBA	A	B	Function
H	X	X	X	X	X	INPUTS Z	INPUTS Z	The output functions of A and B Busses are disabled.
		↓	↓	X	X	X	X	Both A and B Busses are used as inputs to the internal flip-flops. Data on the Bus will be stored on the rising edge of the Clock.
L	H	X	X*	L	X	INPUTS L H	OUTPUTS L H	The data on the A bus are displayed on the B bus.
		↓	X*	L	X	L H	L H	The data on the A Bus are displayed on the B Bus, and are stored into the A storage flip-flops on the rising edge of CAB.
		X	X*	H	X	X	Qn	The data in the A storage flip-flops are displayed on the B Bus.
		↓	X*	H	X	L H	L H	The data on the A Bus are stored into the A storage flip-flops on the rising edge of CAB, and the stored data propagate directly onto the B Bus.
L	L	X*	X	X	L	OUTPUTS L H	INPUTS L H	The data on the B bus are displayed on the A bus.
		X*	↓	X	L	L H	L H	The data on the B Bus are displayed on the A Bus, and are stored into the B storage flip-flops on the rising edge of CBA.
		X*	X	X	H	Qn	X	The data in the B storage flip-flops are displayed on the A Bus.
		X*	↓	X	H	L H	L H	The data on the B Bus are stored into the B storage flip-flops on the rising edge of CBA, and the stored data propagate directly onto the A Bus.

Notes: X: Don't Care

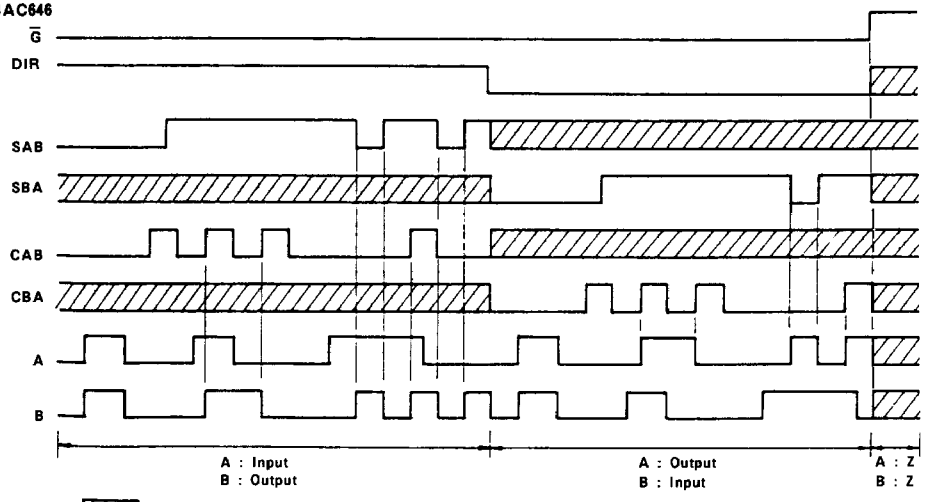
Qn: The data stored into the internal flip-flops by most recent low to high transition of the clock inputs.

Z: High Impedance

• The clocks are not internally gated with either $\overline{G}$ or DIR. Therfore, data on the A and/or B Busses may be clocked into the storage flip-flops at any time.

TIMING CHART

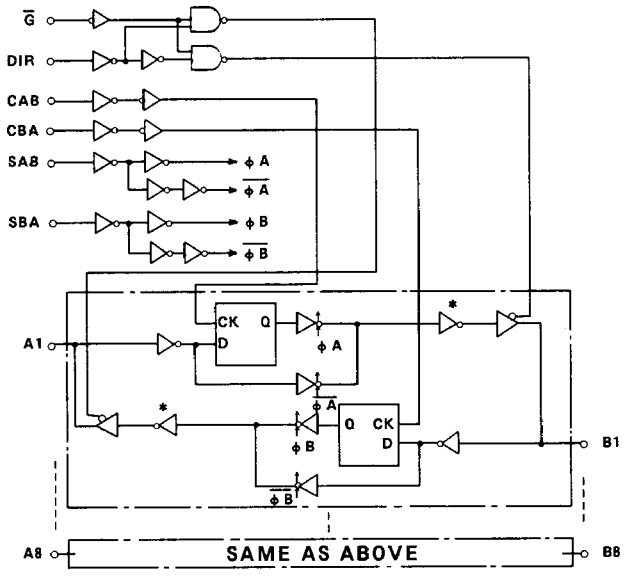
TC74AC646



Note: The timing chart for TC74AC648 is the same, but with the outputs inverted.

SYSTEM DIAGRAM

TC74AC648



Note: In case of TC74AC646 output inverter marked * at A bus and B bus are eliminated.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	−0.5 ~7.0	V
DC Input Voltage	V_{IN}	−0.5 ~V_{CC}+0.5	V
DC Output Voltage	V_{OUT}	−0.5 ~V_{CC}+0.5	V
Input Diode Current	I_{IK}	±20	mA
Output Diode Current	I_{OK}	±50	mA
DC Output Current	I_{OUT}	±50	mA
DC V_{CC}/Ground Current	I_{CC}	±200	mA
Power Dissipation	P_D	500(DIP)*/180(SOP)	mW
Storage Temperature	T_{stg}	−65 ~150	℃
Lead Temperature 10sec	T_L	300	℃

*500mW in the range of Ta= −40℃~ 65℃. From Ta=65℃ to 85℃ a derating factor of −10mW/℃ should be applied up to 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	2.0~5.5	V
Input Voltage	V_{IN}	0 ~ V_{CC}	V
Output Voltage	V_{OUT}	0 ~ V_{CC}	V
Operating Temperature	T_{opr}	−40 ~ 85	℃
Input Rise and Fall Time	dt/dv	0~100(V_{CC}=3.3±0.3V) 0~ 20(V_{CC}= 5 ±0.5V)	ns/v

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V_{CC}	Ta=25℃ MIN.	Ta=25℃ TYP.	Ta=25℃ MAX.	Ta=−40~85℃ MIN.	Ta=−40~85℃ MAX.	UNIT
High-Level Input Voltage	V_{IH}			2.0 3.0 5.5	1.50 2.10 3.85	− − −	− − −	1.50 2.10 3.85	− − −	V
Low-Level Input Voltage	V_{IL}			2.0 3.0 5.5	− − −	− − −	0.50 0.90 1.65	− − −	0.50 0.90 1.65	V
High-Level Output Voltage	V_{OH}	V_{IN}= V_{IH} or V_{IL}	I_{OH}=−50μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	− − −	1.9 2.9 4.4	− − −	V
			I_{OH}=−4mA I_{OH}=−24mA I_{OH}=−75mA*	3.0 4.5 5.5	2.58 3.94 −	− − −	− − −	2.48 3.80 3.85	− − −	
Low-Level Output Voltage	V_{OL}	V_{IN}= V_{IH} or V_{IL}	I_{OL}=50μA	2.0 3.0 4.5	− − −	0.0 0.0 0.0	0.1 0.1 0.1	− − −	0.1 0.1 0.1	V
			I_{OL}=12mA I_{OL}=24mA I_{OL}=75mA*	3.0 4.5 5.5	− − −	− − −	0.36 0.36 −	− − −	0.44 0.44 1.65	
3-State Output Off-State Current	I_{OZ}	V_{IN}=V_{IH} or V_{IL} V_{OUT}=V_{CC} or GND		5.5	−	−	±0.5	−	±5.0	μA
Input Leakage Current	I_{IN}	V_{IN}=V_{CC} or GND		5.5	−	−	±0.1	−	±1.0	
Quiescent Supply Current	I_{CC}	V_{IN}=V_{CC} or GND		5.5	−	−	8.0	−	80.0	

* :This spec indicates the capability of driving 50Ω transmission lines.
One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIRMENTS(Input $t_r=t_f=3ns$)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25℃ TYP.	Ta=25℃ LIMIT	Ta=−40 ~85℃ LIMIT	UNIT
Minimum Pulse Width (CLOCK)	$t_{W(L)}$		3.3±0.3	−	7.0	7.0	ns
	$t_{W(H)}$		5.0±0.5	−	5.0	5.0	
Minimum Set−up Time	t_s		3.3±0.3	−	5.0	5.0	
			5.0±0.5	−	3.0	3.0	
Minimum Hold Time	t_h		3.3±0.3	−	2.0	2.0	
			5.0±0.5	−	2.0	2.0	

AC ELECTRICAL CHARACTERISTICS(C_L=50pF, R_L=500Ω, Input $t_r=t_f$=3ns)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25℃ MIN.	Ta=25℃ TYP.	Ta=25℃ MAX.	Ta=−40 ~85℃ MIN.	Ta=−40 ~85℃ MAX.	UNIT
Propagation Delay Time (BUS−BUS) *	t_{pLH}		3.3±0.3	−	9.2	14.9	1.0	17.0	ns
	t_{pHL}		5.0±0.5	−	6.0	8.7	1.0	10.0	
Propagation Delay Time (CAB,CBA−BUS) *	t_{pLH}		3.3±0.3	−	11.3	19.3	1.0	22.0	
	t_{pHL}		5.0±0.5	−	7.5	11.4	1.0	13.0	
Propagation Delay Time (SAB,SBA−BUS) *	t_{pLH}		3.3±0.3	−	10.4	17.5	1.0	20.0	
	t_{pHL}		5.0±0.5	−	6.9	10.5	1.0	12.0	
Propagation Delay Time (BUS−BUS)**	t_{pLH}		3.3±0.3	−	8.4	14.0	1.0	16.0	
	t_{pHL}		5.0±0.5	−	5.8	8.7	1.0	10.0	
Propagation Delay Time (CAB,CBA−BUS)**	t_{pLH}		3.3±0.3	−	10.8	18.4	1.0	21.0	
	t_{pHL}		5.0±0.5	−	6.9	10.5	1.0	12.0	
Propagation Delay Time (SAB,SBA−BUS)**	t_{pLH}		3.3±0.3	−	10.1	16.7	1.0	19.0	
	t_{pHL}		5.0±0.5	−	6.4	10.1	1.0	11.5	
Output Enable time ($\overline{G}$,DIR−BUS)	t_{pZL}		3.3±0.3	−	10.5	17.5	1.0	20.0	
	t_{pZH}		5.0±0.5	−	6.7	10.5	1.0	12.0	
Output Disable time ($\overline{G}$,DIR−BUS)	t_{pLZ}		3.3±0.3	−	8.5	14.0	1.0	16.0	
	t_{pHZ}		5.0±0.5	−	6.8	9.6	1.0	11.0	
Maximum Clock Frequency	f_{MAX}		3.3±0.3	55	85	−	55	−	MHz
			5.0±0.5	75	130	−	75	−	
Input Capacitance	C_{IN}			−	5	10	−	10	pF
Output Capacitance	C_{OUT}			−	13	−	−	−	
Power Dissipation Capacitance	C_{PD}	Note(AC646)			21				
Power Dissipation Capacitance	C_{PD}	Note(AC648)		−	19	−	−	−	

Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating curent can be obtained by the equation:

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

*:for TC74AC646 only
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