

MM54HC245A/MM74HC245A Octal TRI-STATE® Transceiver

General Description

This TRI-STATE bidirectional buffer utilizes advanced silicon-gate CMOS technology, and is intended for two-way asynchronous communication between data buses. It has high drive current outputs which enable high speed operation even when driving large bus capacitances. This circuit possesses the low power consumption and high noise immunity usually associated with CMOS circuitry, yet has speeds comparable to low power Schottky TTL circuits.

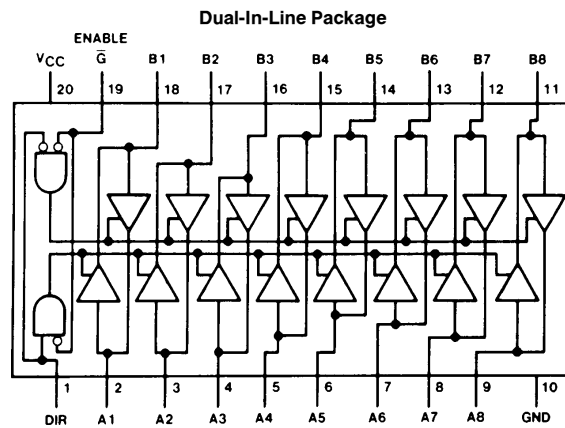
This device has an active low enable input $\overline{G}$ and a direction control input, DIR. When DIR is high, data flows from the A inputs to the B outputs. When DIR is low, data flows from the B inputs to the A outputs. The MM54HC245A/MM74HC245A transfers true data from one bus to the other.

This device can drive up to 15 LS-TTL Loads, and does not have Schmitt trigger inputs. All inputs are protected from damage due to static discharge by diodes to V_{CC} and ground.

Features

- Typical propagation delay: 13 ns
- Wide power supply range: 2–6V
- Low quiescent current: 80 μ A maximum (74 HC)
- TRI-STATE outputs for connection to bus oriented systems
- High output drive: 6 mA (minimum)
- Same as the '645

Connection Diagram



TL/F/5165-1

Order Number MM54HC245A or MM74HC245A

Truth Table

Control Inputs		Operation
$\overline{G}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

H = high level, L = low level, X = irrelevant

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Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage DIR and $\overline{G}$ pins (V_{IN})	−1.5 to $V_{CC} + 1.5V$
DC Input/Output Voltage (V_{IN} , V_{OUT})	−0.5 to $V_{CC} + 0.5V$
Clamp Diode Current (I_{CD})	±20 mA
DC Output Current, per pin (I_{OUT})	±35 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±70 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D)	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. (T_L) (Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN} , V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HC	−40	+85	°C
MM54HC	−55	+125	°C
Input Rise/Fall Times (t_r , t_f)			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C		74HC	54HC	Units
						T _A = −40 to 85°C	T _A = −55 to 125°C	
				Typ	Guaranteed Limits			
V _{IH}	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V _{IL}	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V _{OH}	Minimum High Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 6.0 mA I _{OUT} ≤ 7.8 mA	4.5V	4.2	3.98	3.84	3.7	V
			6.0V	5.7	5.48	5.34	5.2	V
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 6.0 mA I _{OUT} ≤ 7.8 mA	4.5V	0.2	0.26	0.33	0.4	V
			6.0V	0.2	0.26	0.33	0.4	V
I _{IN}	Input Leakage Current ($\overline{G}$ and DIR)	V _{IN} = V _{CC} to GND	6.0V		± 0.1	± 1.0	± 1.0	μA
I _{OZ}	Maximum TRI-STATE Output Leakage Current	V _{OUT} = V _{CC} or GND Enable $\overline{G}$ = V _{IH}	6.0V		± 0.5	± 5.0	± 10	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	6.0V		8.0	80	160	μA

Note 1: Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic “N” package: −12 mW/°C from 65°C to 85°C; ceramic “J” package: −12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of 5V ±10% the worst case output voltages (V_{OH} , and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

** V_{IL} limits are currently tested at 20% of V_{CC} . The above V_{IL} specification (30% of V_{CC}) will be implemented no later than Q1, CY'89. O = V_{IL} .

AC Electrical Characteristics $V_{CC}=5V$, $T_A=25^{\circ}C$, $t_r=t_f=6\text{ ns}$

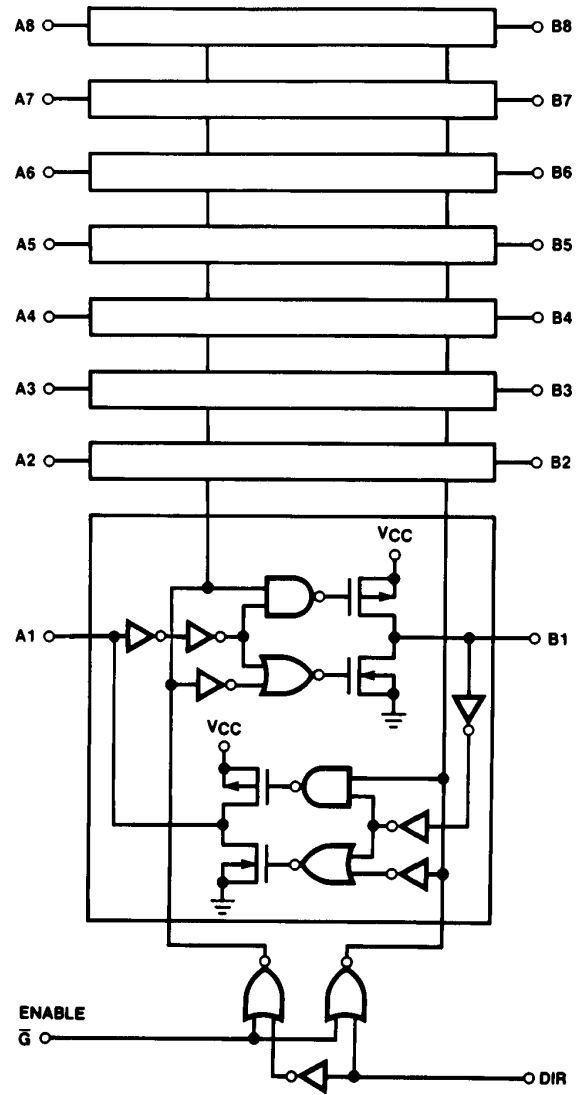
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL} , t_{PLH}	Maximum Propagation Delay	$C_L = 45\text{ pF}$	12	17	ns
t_{PZH} , t_{PZL}	Maximum Output Enable Time	$R_L = 1\text{ k}\Omega$ $C_L = 45\text{ pF}$	24	35	ns
t_{PHZ} , t_{PLZ}	Maximum Output Disable Time	$R_L = 1\text{ k}\Omega$ $C_L = 5\text{ pF}$	18	25	ns

AC Electrical Characteristics $V_{CC}=2.0V$ to $6.0V$, $C_L=50\text{ pF}$, $t_r=t_f=6\text{ ns}$ (unless otherwise specified)

Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C		74HC T _A = −40 to 85°C	54HC T _A = −55 to 125°C	Units
				Typ	Guaranteed Limits			
t _{PHL} , t _{PLH}	Maximum Propagation Delay	C _L = 50 pF	2.0V	31	90	113	135	ns
		C _L = 150 pF	2.0V	41	96	116	128	ns
		C _L = 50 pF	4.5V	13	18	23	27	ns
		C _L = 150 pF	4.5V	17	22	28	33	ns
		C _L = 50 pF	6.0V	11	15	19	23	ns
		C _L = 150 pF	6.0V	14	19	23	28	ns
t _{PZH} , t _{PZL}	Maximum Output Enable Time	R _L = 1 kΩ						
		C _L = 50 pF	2.0V	71	190	240	285	ns
		C _L = 150 pF	2.0V	81	240	300	360	ns
		C _L = 50 pF	4.5V	26	38	48	57	ns
		C _L = 150 pF	4.5V	31	48	60	72	ns
		C _L = 50 pF	6.0V	21	32	41	48	ns
t _{PHZ} , t _{PLZ}	Maximum Output Disable Time	C _L = 150 pF	6.0V	25	41	51	61	ns
		R _L = 1 kΩ	2.0V	39	135	169	203	ns
		C _L = 50 pF	4.5V	20	27	34	41	ns
t _{TLH} , t _{THL}	Output Rise and Fall Time	C _L = 50 pF	6.0V	18	23	29	34	ns
		C _L = 50 pF	2.0V	20	60	75	90	ns
		C _L = 50 pF	4.5V	6	12	15	18	ns
C _{PD}	Power Dissipation Capacitance (Note 5)	C _L = 50 pF	6.0V	5	10	13	15	ns
		C _L = 50 pF	2.0V	20	60	75	90	ns
		C _L = 50 pF	4.5V	6	12	15	18	ns
C _{IN}	Maximum Input Capacitance	C _L = 50 pF		50	5			pF
C _{IN/OUT}	Maximum Input/Output Capacitance, A or B	C _L = 50 pF		50	5			pF

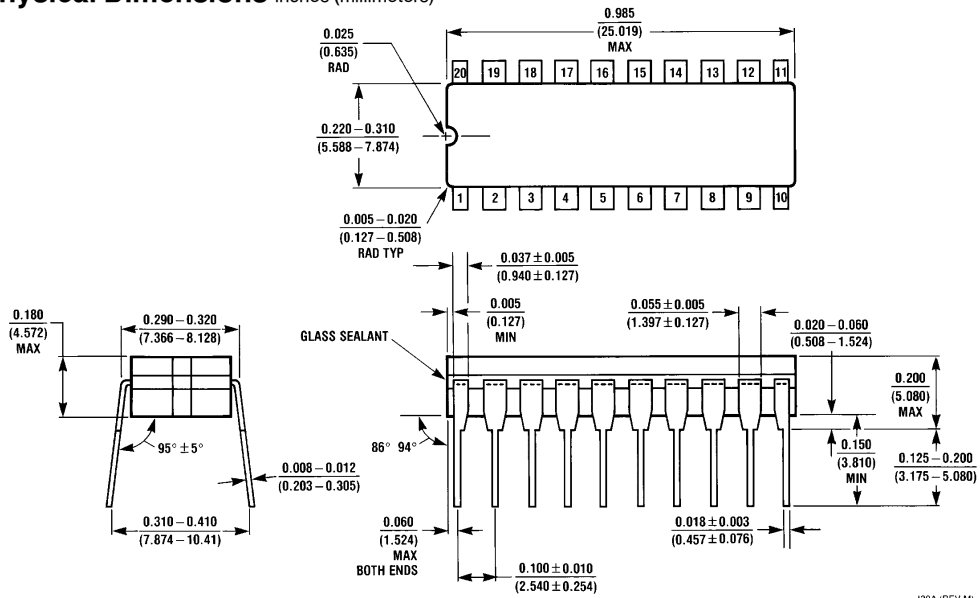
Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Logic Diagram



TL/F/5165-2

Physical Dimensions inches (millimeters)





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