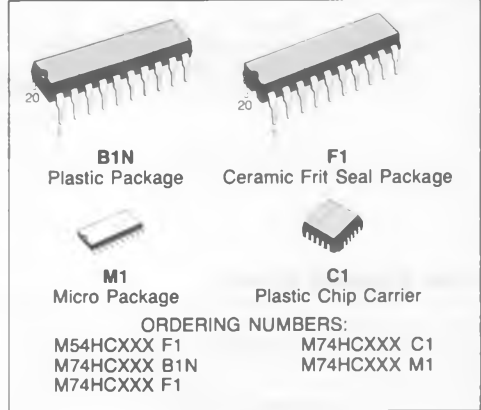


**OCTAL BUS TRANSCEIVER (3-STATE) HC245 NON INVERTING,  
 HC640 INVERTING, HC643 INVERTING/NON INVERTING**

PRELIMINARY DATA

- HIGH SPEED  
 $t_{PD} = 11 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY  
 15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} \text{ (OPR)} = 2\text{V to } 6\text{V}$
- PIN AND FUNCTION COMPATIBLE  
 WITH 54/74LS245/640/643

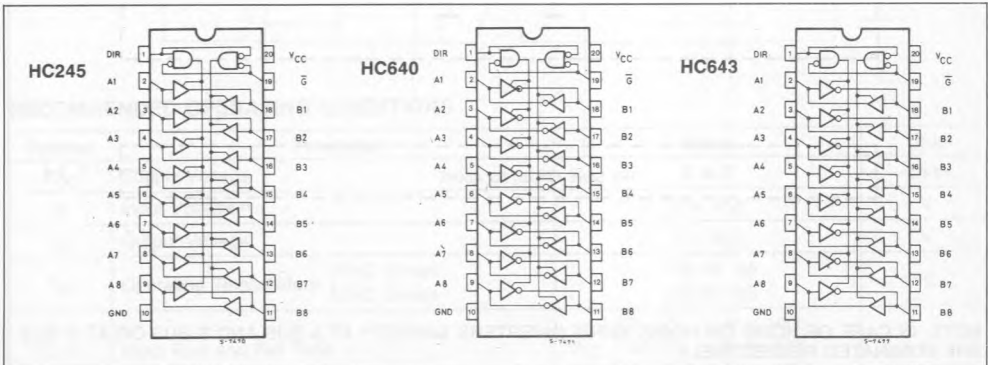

**DESCRIPTION**

The M54/74HC245, M54HC640 and M54HC643 utilise silicon gate C<sup>2</sup>MOS technology to achieve operating speed equivalent to LSTTL devices. Along with the low power dissipation and high noise immunity of standard C<sup>2</sup>MOS integrated circuit, it possesses the driving capability of 15 LSTTL loads. These IC's are intended for two-way asynchronous communication between data buses, and the direction of data transmission is determined by DIR input. The enable input ( $\bar{G}$ ) can be used to disable the device so that the buses are effectively isolated.

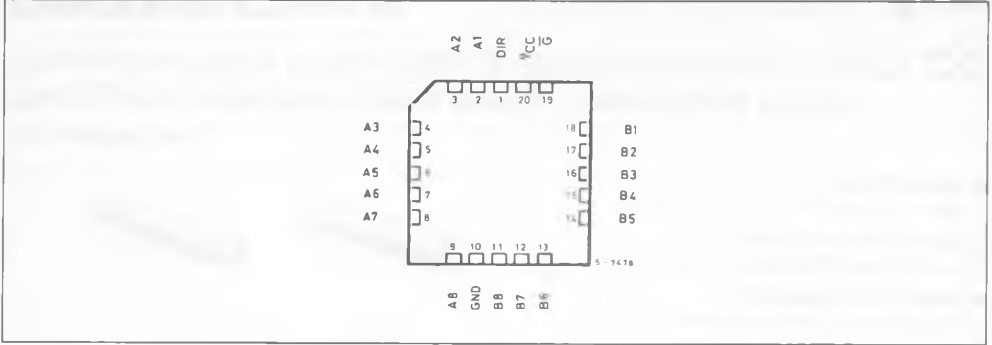
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

**NOTICE FOR APPLICATION**

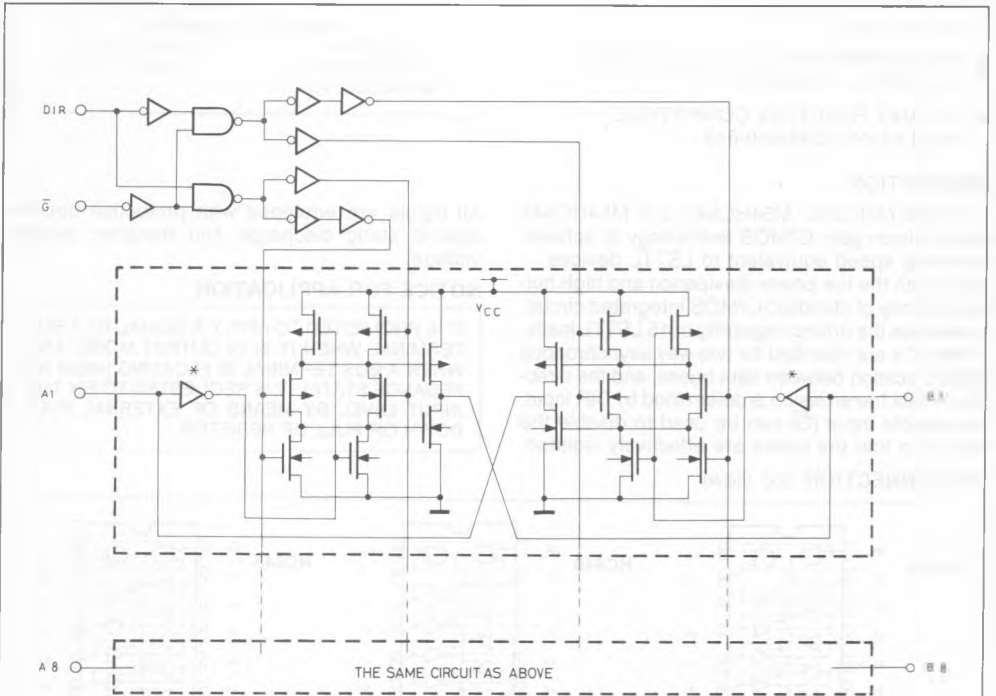
IT IS PROHIBITED TO APPLY A SIGNAL TO A BUS TERMINAL WHEN IT IS IN OUTPUT MODE. AND WHEN A BUS TERMINAL IS FLOATING (HIGH IMPEDANCE STATE), IT IS REQUESTED TO FIX THE INPUT LEVEL BY MEANS OF EXTERNAL PULL DOWN OR PULL UP RESISTOR.

**PIN CONNECTION (top view)**


CHIP CARRIER



LOGIC DIAGRAM (HC640)



NOTE: IN CASE OF HC245 OR HC643, INPUT INVERTERS MARKED\* AT A BUS AND B BUS OR AT B BUS ARE ELIMINATED RESPECTIVELY

## TRUTH TABLE

INPUT		FUNCTION		OUTPUT		
$\overline{G}$	DIR	A BUS	B BUS	HC245	HC640	HC643
L	L	OUTPUT	INPUT	A = B	A = $\overline{B}$	A = B
L	H	INPUT	OUTPUT	B = A	B = $\overline{A}$	B = $\overline{A}$
H	X	Z	Z	Z	Z	Z

X: "H" or "L"    Z: HIGH IMPEDANCE

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to 7	V
$V_I$	DC Input Voltage	-0.5 to $V_{CC} + 0.5$	V
$V_O$	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	$\pm 20$	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Source Sink Current Per Output Pin	$\pm 35$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 70$	mA
$P_D$	Power Dissipation	500 (*)	mW
$T_{stg}$	Storage Temperature	-65 to 150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(\*) 500 mW:  $\cong$  65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage	2 to 6	V	
$V_I$	Input Voltage	0 to $V_{CC}$	V	
$V_O$	Output Voltage	0 to $V_{CC}$	V	
$T_A$	Operating Temperature	74HC Series 54HC Series	-40 to 85 -55 to 125	°C
$t_r, t_f$	Input Rise and Fall Time	$V_{CC}$ $\begin{cases} 2 \text{ V} \\ 4.5 \text{ V} \\ 6 \text{ V} \end{cases}$	0 to 1000 0 to 500 0 to 400	ns

## DC SPECIFICATIONS

Symbol	Parameter	V <sub>CC</sub>	Test Condition		T <sub>A</sub> = 25°C			- 40 to 85°C		- 55 to 125°C		Unit
					54HC and 74HC			74HC		54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V <sub>IH</sub>	High Level Input Voltage	2.0			1.5	—	—	1.5	—	1.5	—	V
		4.5			3.15	—	—	3.15	—	3.15	—	
		6.0			4.2	—	—	4.2	—	4.2	—	
V <sub>IL</sub>	Low Level Input Voltage	2.0			—	—	0.5	—	0.5	—	0.5	V
		4.5			—	—	1.35	—	1.35	—	1.35	
		6.0			—	—	1.8	—	1.8	—	1.8	
V <sub>OH</sub>	High Level Output Voltage	2.0	V <sub>I</sub>	I <sub>O</sub>	1.9	2.0	—	1.9	—	1.9	—	V
		4.5	V <sub>IH</sub> or V <sub>IL</sub>	- 20 μA	4.4	4.5	—	4.4	—	4.4	—	
		6.0			5.9	6.0	—	5.9	—	5.9	—	
		4.5	- 6.0 mA - 7.8 mA	4.18	4.31	—	4.13	—	4.10	—		
		6.0		5.68	5.8	—	5.63	—	5.60	—		
		V <sub>OL</sub>	Low Level Output Voltage	2.0	V <sub>IH</sub> or V <sub>IL</sub>	20 μA	—	0.0	0.1	—	0.1	
4.5	—			0.0			0.1	—	0.1	—	0.1	
6.0	6.0 mA 7.8 mA			—	0.17	0.26	—	0.33	—	0.40		
4.5				—	0.18	0.26	—	0.33	—	0.40		
6.0												
I <sub>I</sub>	Input Leakage Current*	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND		—	—	± 0.1	—	± 1.0	—	± 1.0	μA
I <sub>OZ</sub>	3-State Output Off-State Current	6.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = V <sub>CC</sub> or GND		—	—	± 0.5	—	± 5.0	—	± 10	μA
I <sub>CC</sub>	Quiescent Supply Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND I <sub>O</sub> = 0		—	—	4	—	40	—	80	μA

\* Applicable only to DIR, G,  $\bar{G}$  input

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

Symbol	Parameter	V <sub>CC</sub>	Test Condition		T <sub>A</sub> = 25°C			- 40 to 85°C		- 55 to 125°C		Unit
					54HC and 74HC			74HC		54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t <sub>TLH</sub> t <sub>THL</sub>	Output Transitio Time	2.0			—	25	60	—	75	—	90	ns
		4.5			—	7	12	—	15	—	18	
		6.0			—	6	10	—	13	—	15	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time (for HC245)	2.0			—	48	90	—	115	—	135	ns
		4.5			—	12	18	—	23	—	27	
		6.0			—	10	15	—	20	—	23	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time (for HC640/643)	2.0			—	52	110	—	140	—	165	ns
		4.5			—	13	22	—	28	—	33	
		6.0			—	11	19	—	24	—	28	
t <sub>PZL</sub> t <sub>PZH</sub>	3 State Output Enable Time	2.0	R <sub>L</sub> = 1kΩ		—	80	160	—	200	—	240	ns
		4.5			—	20	32	—	40	—	48	
		6.0			—	17	27	—	34	—	41	
t <sub>PLZ</sub> t <sub>PHZ</sub>	3 State Output Disable Time	2.0	R <sub>L</sub> = 1kΩ		—	80	190	—	240	—	285	ns
		4.5			—	25	38	—	48	—	57	
		6.0			—	21	32	—	41	—	48	

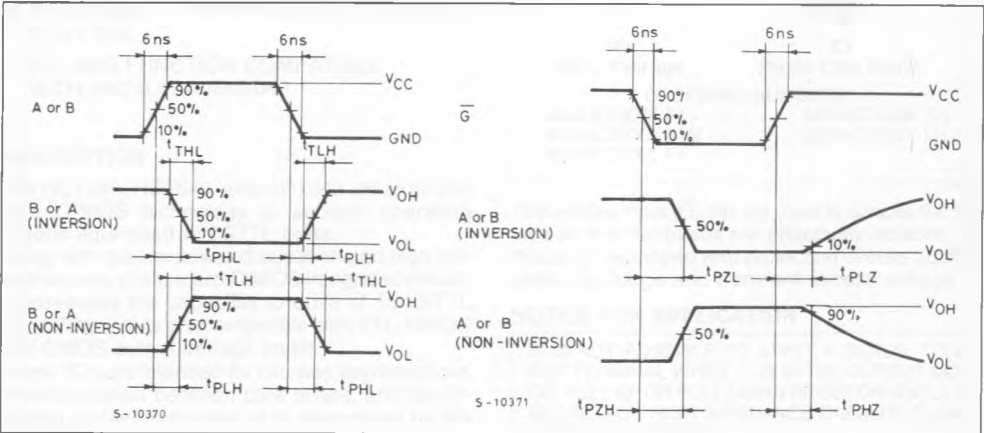
**AC ELECTRICAL CHARACTERISTICS (Continued)**

Symbol	Parameter	V <sub>CC</sub>	Test Condition	T <sub>A</sub> = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C <sub>IN</sub>	Input Capacitance		DIR, G, $\bar{G}$	—	5	10	—	10	—	10	pF
C <sub>I/O</sub>	Bus Input Capacitance		A <sub>n</sub> , B <sub>n</sub>	—	13	—	—	—	—	—	pF
C <sub>PD</sub> (*)	Power Dissipation Capacitance		HC245 HC640/643	—	33 40	—	—	—	—	—	pF

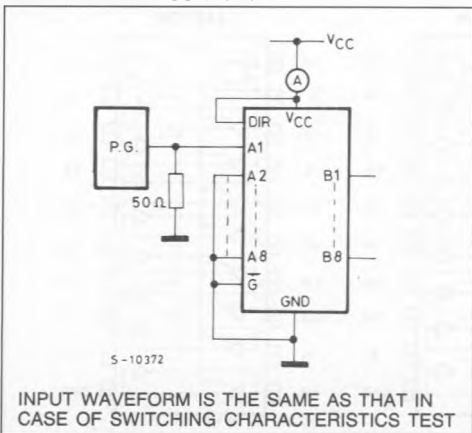
Note (\*) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

Average operating current is: I<sub>CC(opr)</sub> = C<sub>PD</sub> · V<sub>CC</sub> · f<sub>IN</sub> + I<sub>CC/8</sub> (per Circuit).

**SWITCHING CHARACTERISTICS TEST WAVEFORM**



**TEST CIRCUIT I<sub>CC</sub> (Opr.)**



**C<sub>PD</sub> CALCULATION**

C<sub>PD</sub> is to be calculated with the following formula by using the measured value of I<sub>CC</sub> (Opr.) in the test circuit opposite.

$$C_{PD} = \frac{I_{CC} \text{ (Opr.)}}{f_{IN} \cdot V_{CC}}$$