



# M54HCT245/640/643

# M74HCT245/640/643

## OCTAL BUS TRANSCEIVER (3-STATE)

### HCT245 NON INVERTING, HCT640 INVERTING, HCT643 INVERTING/NON INVERTING

S G S - T H O M S O N

- LOW POWER DISSIPATION  
 $I_{CC} = 4\mu A$  (MAX.) at  $T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS  
 $V_{IH} = 2V$  (MIN)  $V_{IL} = 0.8V$  (MAX)
- OUTPUT DRIVE CAPABILITY  
15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| |I_{OL}| = 6mA$  (MIN.)
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- PIN AND FUNCTION COMPATIBLE  
WITH 54/74LS245/640/643

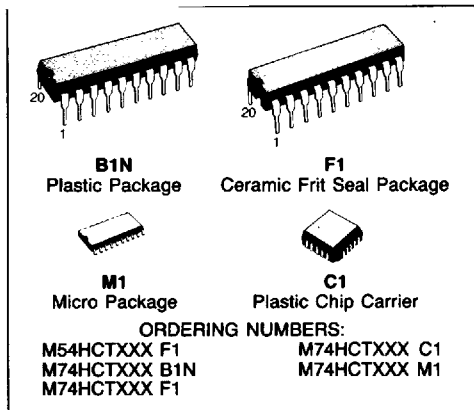
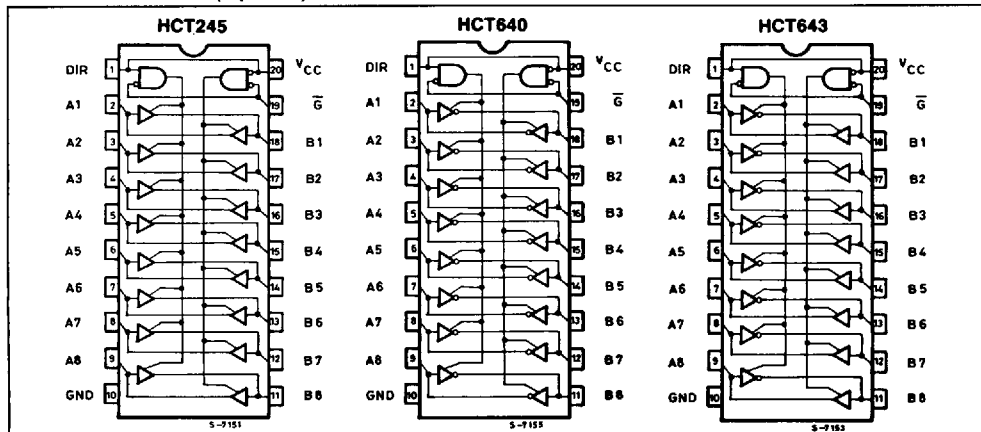
#### DESCRIPTION

The HCT245, HCT640, and HCT643 utilize silicon gate C<sup>2</sup>MOS technology to achieve operating speeds equivalent to LSTTL parts.

Along with the low power dissipation and high noise immunity of standard C<sup>2</sup>MOS integrated circuit, it possesses the capability to drive of 15 LSTTL loads. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

These IC's are intended for two-way asynchronous communication between data buses, and the direction of data transmission is determined by the DIR input.

#### PIN CONNECTIONS (top view)



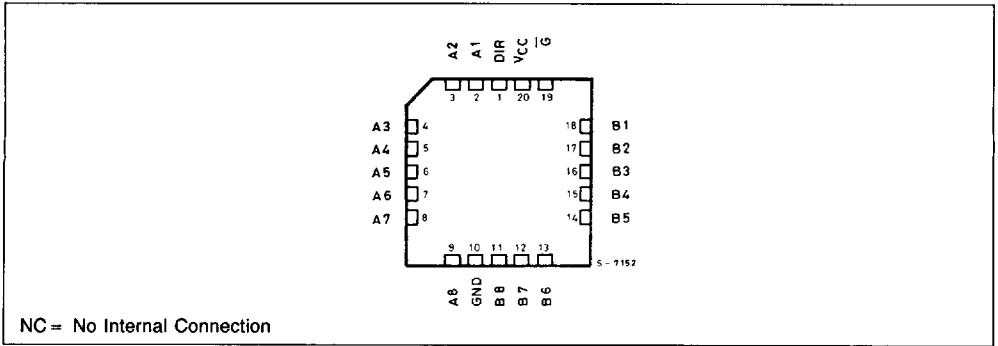
The enable input ( $\bar{G}$ ) can be used to disable the device so that the buses are effectively isolated. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

#### NOTICE FOR APPLICATION

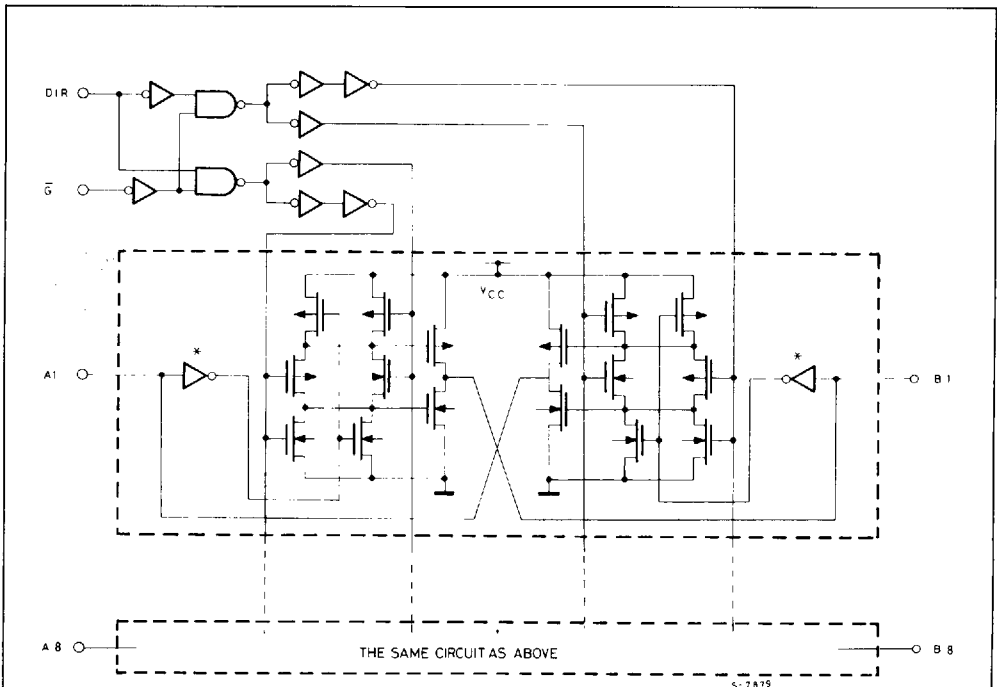
IT IS NOT POSSIBLE TO APPLY A SIGNAL TO A BUS TERMINAL WHEN IT IS IN THE OUTPUT MODE. PULL UP OR PULL DOWN RESISTOR SHOULD BE USED ON HIGH IMPEDANCE (3-STATE) FLOATING BUS TERMINAL.

CHIP CARRIER

SGS-THOMSON



LOGIC DIAGRAM (HCT 640)



NOTE: IN CASE OF HCT245 OR HCT643, INPUT INVERTERS MARKED \* AT A BUS OR AT B BUS ARE ELIMINATED RESPECTIVELY.

## S G S-THOMSON

INPUT		FUNCTION		OUTPUT		
$\bar{G}$	DIR	A BUS	B BUS	HCT245	HCT640	HCT643
L	L	OUTPUT	INPUT	A=B	A=B	A=B
L	H	INPUT	OUTPUT	B=A	B=A	B=A
H	X	Z	Z	Z	Z	Z

X: DON'T CARE

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	$^{\circ}C$

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

(\*) 500 mW:  $\equiv 65^{\circ}C$  derate to 300 mW by 10 mW/ $^{\circ}C$ :  $65^{\circ}C$  to  $85^{\circ}C$

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	4.5 to 5.5	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	$^{\circ}C$
$t_r, t_f$	Input Rise and Fall Time	0 to 500	ns

## DC SPECIFICATIONS

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.		
V <sub>IH</sub>	High Level Input Voltage	4.5 to 6.0		2.0	—	—	2.0	—	2.0	—	V	
V <sub>IL</sub>	Low Level Input Voltage	4.5 to 5.5		—	—	0.8	—	0.8	—	0.8	V	
V <sub>OH</sub>	High Level Output Voltage	4.5	V <sub>IN</sub>	I <sub>OH</sub>	4.4	4.5	—	4.4	—	4.4	—	V
			V <sub>IH</sub> or V <sub>IL</sub>	-20 μA								
V <sub>OL</sub>	Low Level Output Voltage	4.5	V <sub>IN</sub>	I <sub>OL</sub>	—	0	0.1	—	0.1	—	0.1	V
			V <sub>IH</sub> or V <sub>IL</sub>	20 μA								
I <sub>OZ</sub>	3-State Output Off-State Current	5.5	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND	—	—	±0.5	—	±5.0	—	±10.0		
I <sub>IN</sub>	Input Leakage Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND	—	—	±0.1	—	±1	—	±1	μA	
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND	—	—	4	—	40	—	80	μA	
I <sub>CC</sub>			Per input: V <sub>IN</sub> = 0.5V or 2.4V Other input: V <sub>CC</sub> or GND	—	—	2.0	—	2.9	—	3.0	mA	

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 54HC and 74HC			-40 to 85°C 74HC		-55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t <sub>TLH</sub> t <sub>THL</sub>	Output Transition Time	4.5		—	8	12	—	15	—	18	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	4.5		—	19	28	—	35	—	42	ns
t <sub>PZL</sub> t <sub>PZH</sub>	3-State Output Enable Time	4.5	R <sub>L</sub> = 1kΩ	—	27	42	—	53	—	63	ns
t <sub>PLZ</sub> t <sub>PHZ</sub>	3-State Output Disable Time	4.5	R <sub>L</sub> = 1kΩ	—	27	40	—	50	—	60	ns

AC ELECTRICAL CHARACTERISTICS (Continued)

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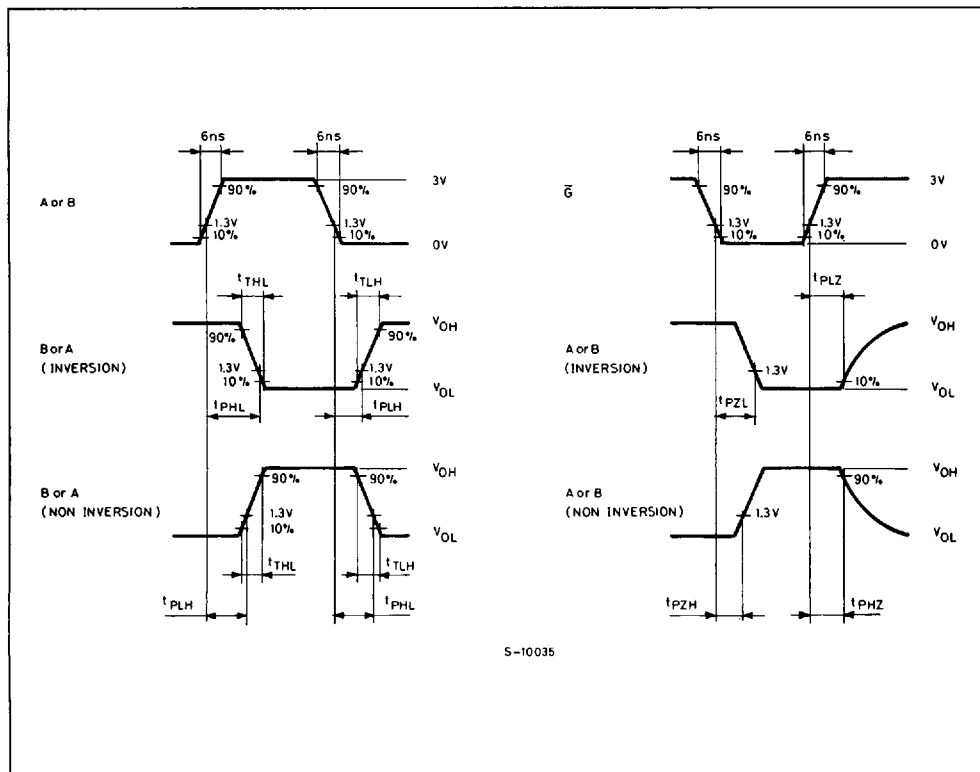
Symbol	Parameter	V <sub>CC</sub>	Test Condition	T <sub>A</sub> = 25°C 54HC and 74HC			-40 to 85°C 74HC		-55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
				C <sub>IN</sub>	Input Capacitance		DIR, G, $\bar{G}$ ,	—	5	10	
C <sub>I/O</sub>	Bus Inp. Capacit.		An, Bn	—	13	—	—	—	—	—	pF
C <sub>PD</sub> (*)	Power Dissipation		M54/74HCT245	—	46	—	—	—	—	—	pF
	Capacitance		M54/74HCT640/643	—	44	—	—	—	—	—	

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

Average operating current can be obtained by the following equation:

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

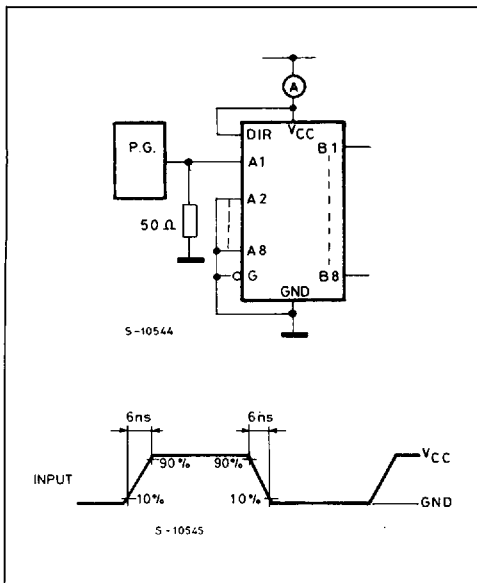
SWITCHING CHARACTERISTICS TEST WAVEFORM



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## TEST CIRCUIT

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

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

In determining the typical value of C<sub>PD</sub>, a relatively high frequency of 1MHz was applied to f<sub>IN</sub>, in order to eliminate any error caused by the quiescent supply current