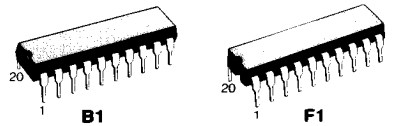
SGS-THOMSON MICROELECTRONICS

M54HC540/541
M74HC540/541

HC540 OCTAL BUS BUFFER INVERTING (3-STATE)
HC541 OCTAL BUS BUFFER (3-STATE)

- HIGH SPEED
  t_{PD} = 11 ns (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION
  I_{CC} = 4 μA (MAX.) at T_A = 25°C
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (MIN.)
- OUTPUT DRIVE CAPABILITY
  15 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 6 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS540/541



B1 Plastic Package

F1 Ceramic Frit Seal Package

M1 Micro Package

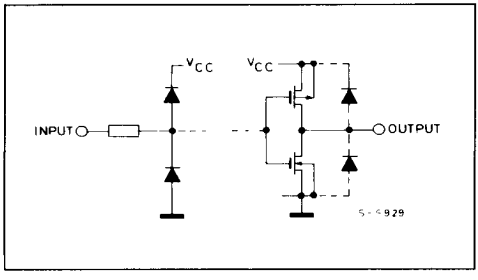
C1 Plastic Chip Carrier

ORDERING NUMBERS:
M54HCXXX F1
M74HCXXX B1N
M74HCXXX F1
M74HCXXX C1
M74HCXXX M1

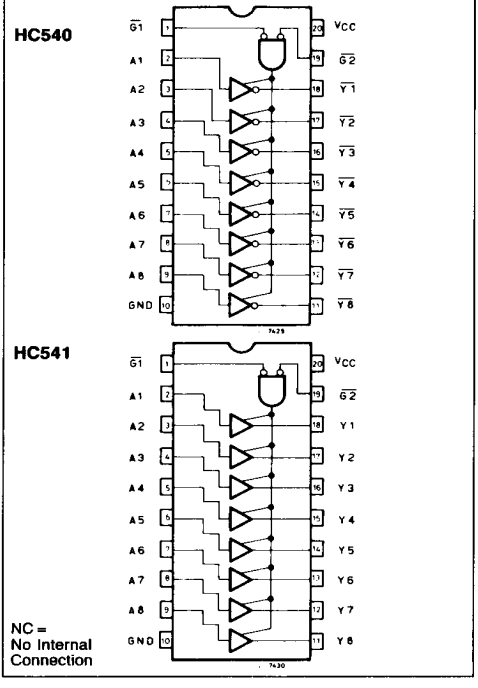
DESCRIPTION

The M54/74HC540/541 are high speed CMOS OCTAL BUS BUFFERS (3-STATE) fabricated in silicon gate C²MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption. The M54/74HC540 is an inverting buffer and the M54/74HC541 is a non-inverting buffer. The 3-STATE control gate operates as a two-input AND such that if either $\overline{G1}$ or $\overline{G2}$ are high, all eight outputs are in the high-impedance state.
In order to enhance PC board layout, the 'HC540 and 'HC541 offers a pinout having inputs and outputs on opposite sides of the package.
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

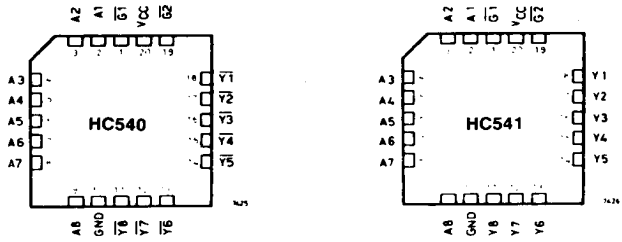
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN CONNECTIONS (top view)



CHIP CARRIER

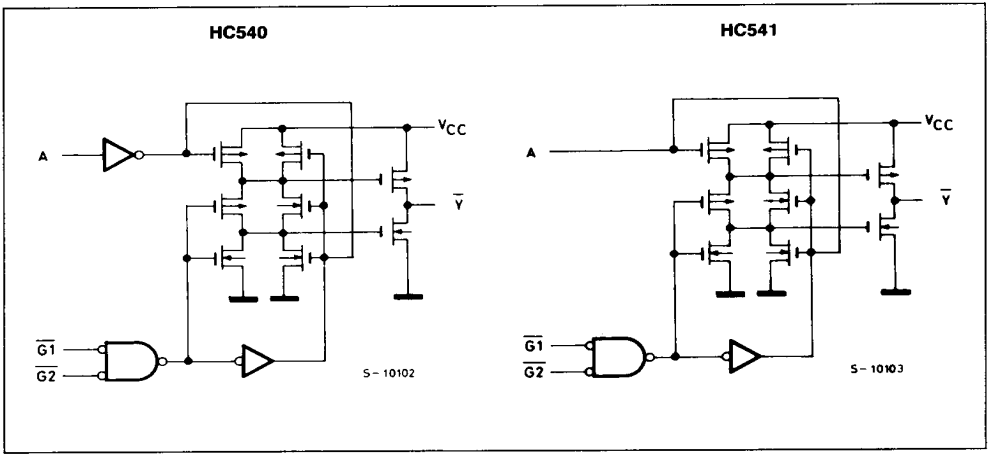


TRUTH TABLE

INPUTS			OUTPUT	
$\overline{G1}$	$\overline{G2}$	An	Yn*	$\overline{Yn}$*
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	L	L
L	L	L	L	H

X: DON'T CARE Z: HIGH IMPEDANCE
*: Yn.....HC541 $\overline{Yn}$.....HC540

CIRCUIT DIAGRAM (Per Circuit)



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	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 35	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 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: ≅ 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} = 2 V	0 to 1000		ns
		V_{CC} = 4.5V	0 to 500		
		V_{CC} = 6 V	0 to 400		

DC SPECIFICATIONS

Symbol	Parameter	V_{CC}	Test Condition		T_A = 25°C 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
			V_I	I_O	Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	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_{IL}	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_{OH}	High Level Output Voltage	2.0	V_{IH} or V_{IL}	−20 μA	1.9	2.0	—	1.9	—	1.9	—	V
		4.5			4.4	4.5	—	4.4	—	4.4	—	
		6.0			5.9	6.0	—	5.9	—	5.9	—	
		4.5		−4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
		6.0		−5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V_{OL}	Low Level Output Voltage	2.0	V_{IH} or V_{IL}	20 μA	—	0.0	0.1	—	0.1	—	0.1	V
		4.5			—	0.0	0.1	—	0.1	—	0.1	
		6.0			—	0.0	0.1	—	0.1	—	0.1	
		4.5		4.0 mA	—	0.17	0.26	—	0.33	—	0.40	
		6.0		5.2 mA	—	0.18	0.26	—	0.33	—	0.40	

DC SPECIFICATIONS (Continued)

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25°C$ 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_I	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND	—	—	±0.1	—	±1.0	—	±1.0	μA
I_{OZ}	3-Stato Output Off-State Current	6.0	$V_I = V_{IH}$ or V_{IL} $V_O = V_{CC}$ or GND	—	—	±0.5	—	±5.0	—	±10	μA
I_{CC}	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND	—	—	4	—	40	—	80	μA

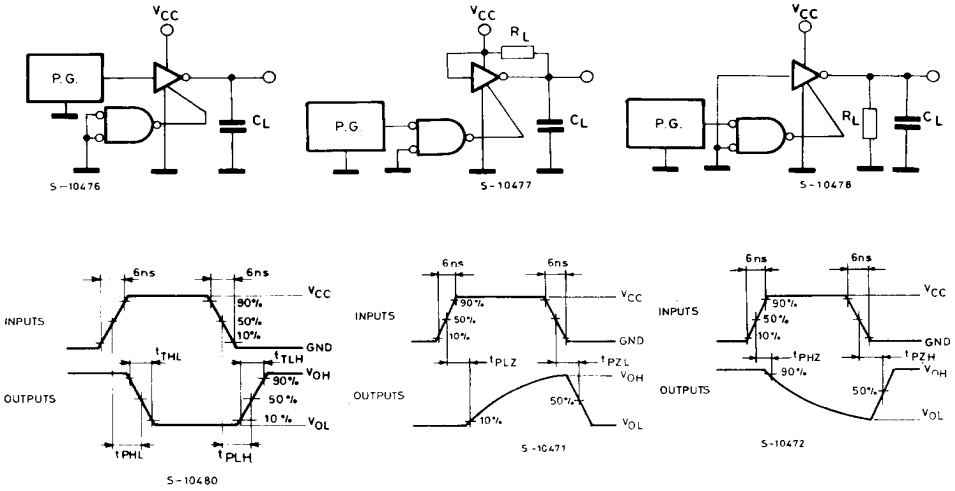
AC ELECTRICAL CHARACTERISTICS ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

Symbol	Parameter	V_{CC}	Test Condition	T_A = 25°C 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0 4.5 6.0		— — —	25 7 6	60 12 10	— — —	75 15 13		90 18 15	ns
t_{PLH} t_{PHL}	Propagation Delay Time	2.0 4.5 6.0	HC540	— — —	52 13 11	105 21 18	— — —	130 26 22		160 32 27	ns
t_{PLH} t_{PHL}	Propagation Delay Time	2.0 4.5 6.0	HC541		56 14 12	15 23 20	— — —	145 29 25	— — —	135 35 30	ns
t_{PLZ} t_{PHZ}	3-State Output Enable	2.0 4.5 6.0	$R_L = 1K\Omega$	— — —	72 18 15	145 29 25	— — —	180 36 31	— — —	220 44 38	ns
t_{PLZ} t_{PHZ}	3-State Output Disable Time	2.0 4.5 6.0	$R_L = 1K\Omega$	— — —	88 22 19	160 32 27	— — —	200 40 34	— — —	240 48 41	ns
C_{IN}	Input Capacitance			—	5	10	—	10		10	pF
C_{OUT}	Output Capacitance			—	10	—	—	—	—	—	pF
C_{PD} (1)	Power Dissipation Capacitance		HC540	—	33	—	—	—	—	—	pF
			HC541	—	36	—	—	—	—	—	

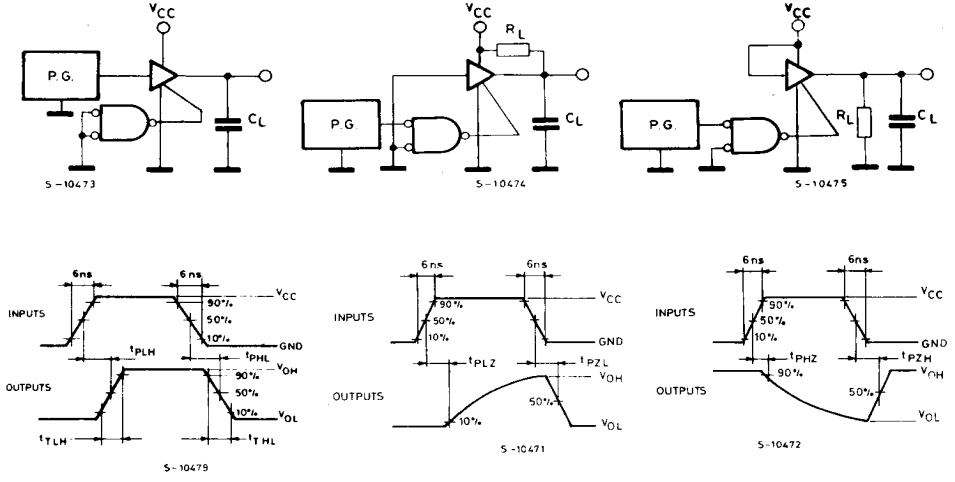
Note (1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the following equation.
$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per Gate).

SWITCHING CHARACTERISTICS TEST CIRCUIT AND WAVEFORM

HC540

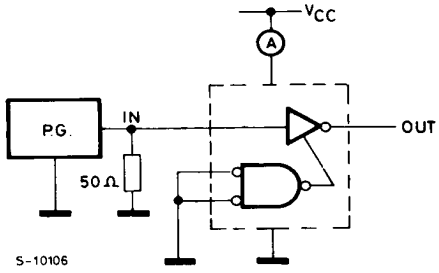


HC541

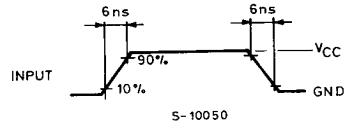


TEST CIRCUIT I_{CC} (Opr.)

HC540



S-10106



S-10050

THE OTHER INPUTS ARE CONNECTED V_{CC} LINE OR GND LINE.

TEST CIRCUIT OF THE HC541 IS THE SAME AS THIS