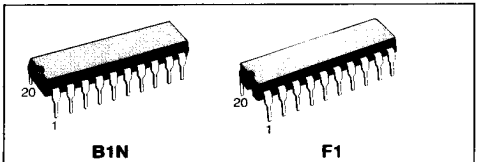
SGS-THOMSON MICROELECTRONICS

M54HC240/241/244
M74HC240/241/244

HC240 OCTAL BUS BUFFER WITH INVERTED 3-STATE OUTPUTS
HC241/244 OCTAL BUS BUFFER WITH NON INVERTED 3-STATE OUTPUTS

PRELIMINARY DATA

- HIGH SPEED
  t_{PD} = 12 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 54/74LS240/244



B1N
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

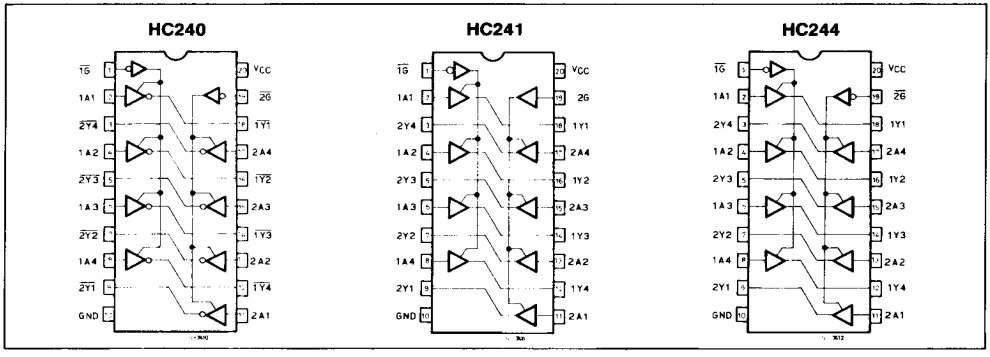
The M54/74HC240, M54/74HC241 and M54HC244 are high speed CMOS OCTAL BUS BUFFER's fabricated in silicon gate C²MOS technology. They have the same high speed performance of LSTTL combined with true CMOS low power consumption. The designer has a choice of selected combinations of inverting and non-inverting outputs, symmetrical $\overline{G}$ (active-low output control) inputs, and complementary G and $\overline{G}$ inputs. Each control input governs four BUS BUFFERs.
These devices are designed to be used with 3-state memory address drivers, etc. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

TRUTH TABLE

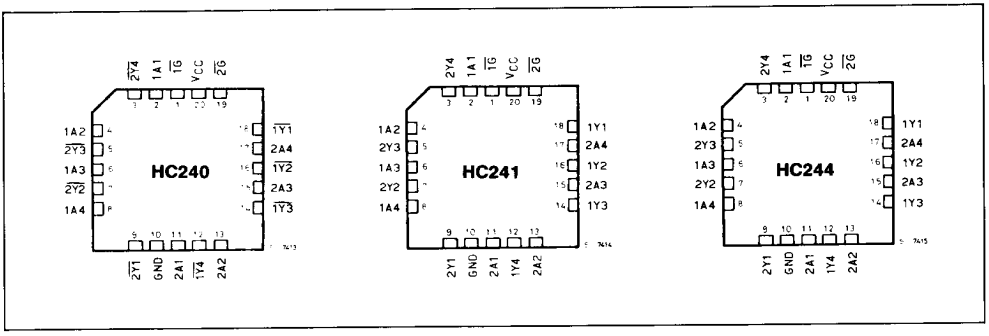
INPUTS			OUTPUTS	
$\overline{G}$	G$^{\Delta}$	An	Yn	$\overline{Yn}^{\Delta\Delta}$
L	H	L	L	H
L	H	H	H	H
H	L	X	Z	Z

X: DON'T CARE Z: HIGH IMPEDANCE
Δ : APPLIED only for M54/74HC241
$\Delta\Delta$: APPLIED only for M54/74HC240

PIN CONNECTION (top view)



CHIP CARRIER



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

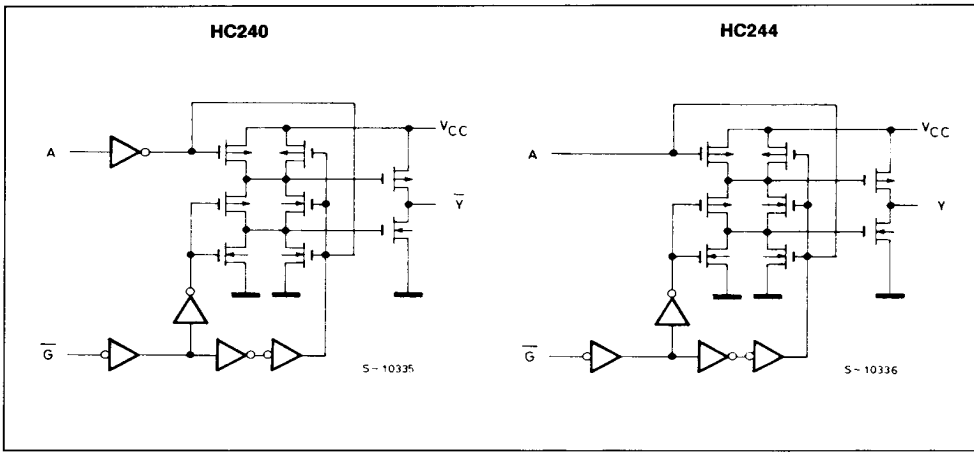
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 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	

CIRCUIT SCHEMATIC (1/8 PACKAGE)



DC ELECTRICAL CHARACTERISTICS

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.	
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_I	I_O	1.9	2.0	—	1.9	—	1.9	—	V
		4.5	V_{IH} or V_{IL}	−20 μA	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	
I_I	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND		—	—	±0.1	—	±1.0	—	±1.0	μA
I_{OZ}	3-state 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 $I_O = 0$		—	—	4	—	40	—	80	μA

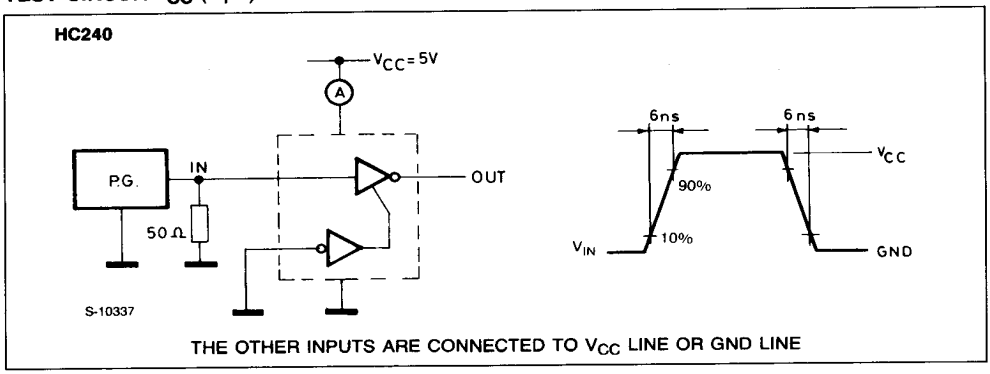
AC ELECTRICAL CHARACTERISTICS ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

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		—	25	60	—	75		90	ns
		4.5		—	7	12	—	15		18	
		6.0		—	6	10	—	13		15	
t_{PLH} t_{PHL}	Propagation Delay Time	2.0		—	52	110	—	140		165	ns
		4.5		—	13	22	—	28		33	
		6.0		—	11	19	—	24		28	
t_{PLH} t_{PHL}	Propagation Delay Time**	2.0		—	48	100	—	125		150	ns
		4.5		—	12	20	—	25		30	
		6.0		—	10	17	—	21		26	
t_{PZL} t_{PHL}	Output Enable Time	2.0	$R_L = 1k\Omega$	—	40	100	—	125		150	ns
		4.5		—	10	20	—	25		30	
		6.0		—	9	17	—	21		26	
t_{PZL} t_{PZH}	Output Enable Time *	2.0	$R_L = 1k\Omega$	—	52	100	—	125	—	150	ns
		4.5		—	13	20	—	25	—	30	
		6.0		—	11	17	—	21	—	26	
t_{PZL} t_{PZH}	Output Disable Time	2.0	$R_L = 1k\Omega$	—	44	150	—	190		225	ns
		4.5		—	21	30	—	38		45	
		6.0		—	18	26	—	33		38	
C_{IN}	Input Capacitance			—	5	10	—	10		10	pF
C_{OUT}	Output Capacitane			—	10	—	—	—			pF
C_{PD} (1)	Power Dissipation Capacitance			—	40	—	—	—			pF

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. (Refer to Test Circuit)
Average operating current can be obtained by the following equation $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per Gate)

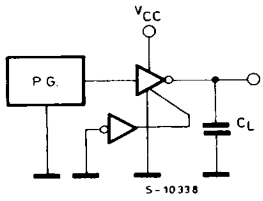
* for M54/74HC241 only
** for M54/74HC240 only

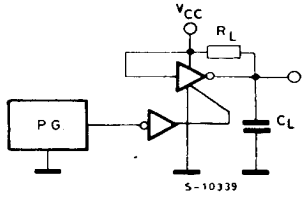
TEST CIRCUIT I_{CC} (Opr.)

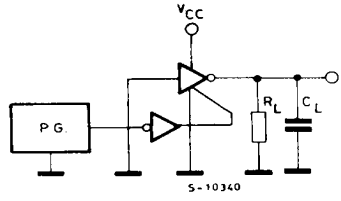


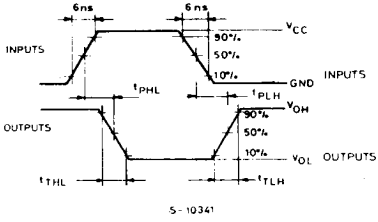
SWITCHING CHARACTERISTICS TEST CIRCUIT

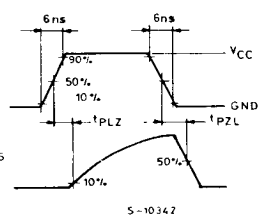
HC240

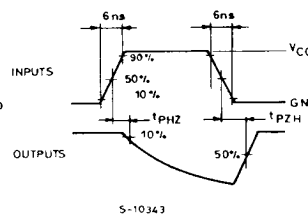












HC241/HC244