FAIRCHILD SEMICONDUCTOR™

February 1984
Revised February 1999

MM74HCT540 • MM74HCT541
Inverting Octal 3-STATE Buffer • Octal 3-STATE Buffer

General Description

The MM74HCT540 and MM74HCT541 3-STATE buffers utilize advanced silicon-gate CMOS technology and are general purpose high speed inverting and non-inverting buffers. They possess high drive current outputs which enable high speed operation even when driving large bus capacitances. These circuits achieve speeds comparable to low power Schottky devices, while retaining the low power consumption of CMOS. Both devices are TTL input compatible and have a fanout of 15 LS-TTL equivalent inputs.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

The MM74HCT540 is an inverting buffer and the MM74HCT541 is a non-inverting buffer. The 3-STATE control gate operates as a two-input NOR 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 MM74HCT540 and MM74HCT541 offers a pinout having inputs and outputs on opposite sides of the package. All inputs are protected from damage due to static discharge by diodes to V_{CC} and ground.

Features

- TTL input compatible
- Typical propagation delay: 12 ns
- 3-STATE outputs for connection to system buses
- Low quiescent current: 80 μA
- Output current: 6 mA (min.)

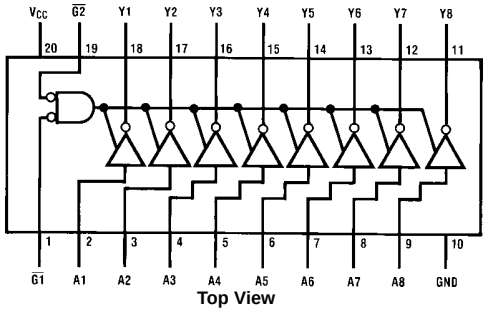
Ordering Code:

Order Number	Package Number	Package Description
MM74HCT540WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HCT540SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT540MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT540N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74HCT541WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HCT541SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT541MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT541N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

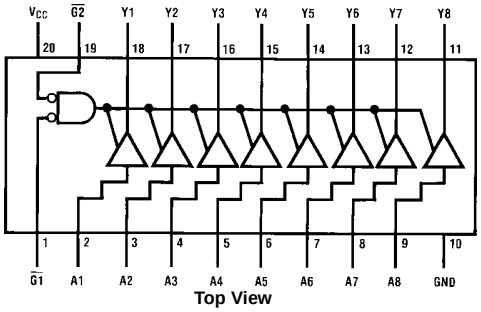
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagrams

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View
MM74HCT540



Top View
MM74HCT541

Absolute Maximum Ratings(Note 1)

(Note 2)

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage (V_{IN})	−1.5 to V_{CC} +1.5V
DC Output Voltage (V_{OUT})	−0.5 to V_{CC} +0.5V
Clamp Diode Current (I_{IK}, I_{OK})	±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 Temperature (T_L)	
(Soldering 10 seconds)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	4.5	5.5	V
DC Input or Output Voltage			
(V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temperature Range (T_A)	−40	+85	°C
Input Rise or Fall Times			
(t_r, t_f)		500	ns

Note 1: Absolute 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.

DC Electrical Characteristics

V_{CC} = 5V ± 10% (unless otherwise specified)

Symbol	Parameter	Conditions	T_A = 25°C	T_A = −40 to 85°C	T_A = −55 to 125°C	Units
			Typ	Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage			2.0	2.0	2.0	V
V_{IL}	Maximum LOW Level Input Voltage			0.8	0.8	0.8	V
V_{OH}	Minimum HIGH Level Output Voltage	V_{IN} = V_{IH} or V_{IL}					
		$\|I_{OUT}\|$ = 20 μA	V_{CC}	V_{CC} − 0.1	V_{CC} − 0.1	V_{CC} − 0.1	V
		$\|I_{OUT}\|$ = 6.0 mA, V_{CC} = 4.5V	4.2	3.98	3.84	3.7	V
		$\|I_{OUT}\|$ = 7.2 mA, V_{CC} = 5.5V	5.2	4.98	4.84	4.7	V
V_{OL}	Maximum LOW Level Voltage	V_{IN} = V_{IH} or V_{IL}					
		$\|I_{OUT}\|$ = 20 μA	0	0.1	0.1	0.1	V
		$\|I_{OUT}\|$ = 6.0 mA, V_{CC} = 4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\|$ = 7.2 mA, V_{CC} = 5.5V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	V_{IN} = V_{CC} or GND		±0.1	±1.0	±1.0	μA
I_{OZ}	Maximum 3-STATE Output Leakage Current	V_{OUT} = V_{CC} or GND $\overline{G}$ = V_{IH}		±0.5	±5.0	±10	μA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND I_{OUT} = 0 μA		8.0	80	160	μA
		V_{IN} = 2.4V or 0.5V (Note 4)	0.6	1.0	1.3	1.5	mA

Note 4: Measured per input. All other inputs at V_{CC} or GND.

AC Electrical Characteristics

MM74HCT540: $V_{CC} = 5.0V$, $t_r = t_f = 6$ ns, $T_A = 25°C$, (unless otherwise specified)

Symbol	Parameter	Conditions	Typ	Guaranteed Limits	Units
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	$C_L = 45$ pF	12	18	ns
t_{PZL}, t_{PZH}	Maximum Output Enable Time	$C_L = 45$ pF $R_L = 1$ kΩ	14	28	ns
t_{PLZ}, t_{PHZ}	Maximum Output Disable Time	$C_L = 5$ pF $R_L = 1$ kΩ	13	25	ns

AC Electrical Characteristics

MM74HCT540: $V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6$ ns (unless otherwise specified)

Symbol	Parameter	Conditions		$T_A = 25°C$	$T_A = -40$ to $85°C$	$T_A = -55$ to $125°C$	Units
				Typ	Guaranteed Limits		
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	$C_L = 50$ pF		12	20	25	30	ns
		$C_L = 150$ pF		22	30	38	45	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	$R_L = 1$ kΩ	$C_L = 50$ pF	15	30	38	45	ns
			$C_L = 150$ pF	20	40	50	60	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	$R_L = 1$ kΩ $C_L = 50$ pF		15	30	38	45	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	$C_L = 50$ pF		6	12	15	18	ns
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF
C_{OUT}	Maximum Output Capacitance			15	20	20	20	pF
C_{PD}	Power Dissipation	(per output)	$\overline{G} = V_{CC}$	12				pF
	Capacitance (Note 5)		$\overline{G} = GND$	50				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, $I_S = C_{PD} V_{CC} f + I_{CC}$.

AC Electrical Characteristics

MM74HCT541: $V_{CC} = 5.0V$, $t_r = t_f = 6$ ns, $T_A = 25°C$, (unless otherwise specified)

Symbol	Parameter	Conditions	Typ	Guaranteed Limits	Units
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	$C_L = 45$ pF	13	20	ns
t_{PZL}, t_{PZH}	Maximum Output Enable Time	$C_L = 45$ pF $R_L = 1$ kΩ	17	28	ns
t_{PLZ}, t_{PHZ}	Maximum Output Disable Time	$C_L = 5$ pF $R_L = 1$ kΩ	15	25	ns

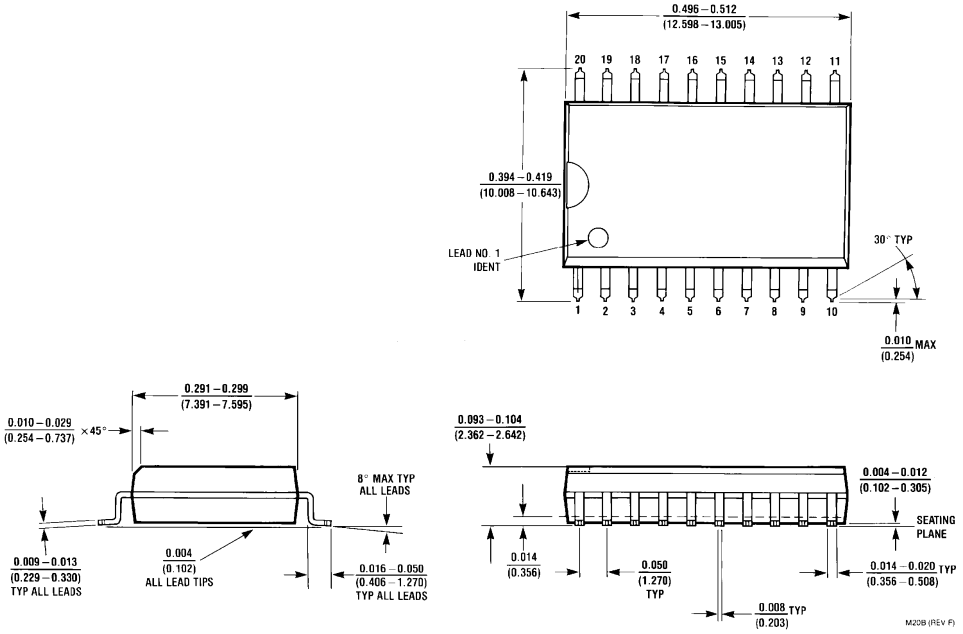
AC Electrical Characteristics

MM74HCT541: $V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6$ ns (unless otherwise specified)

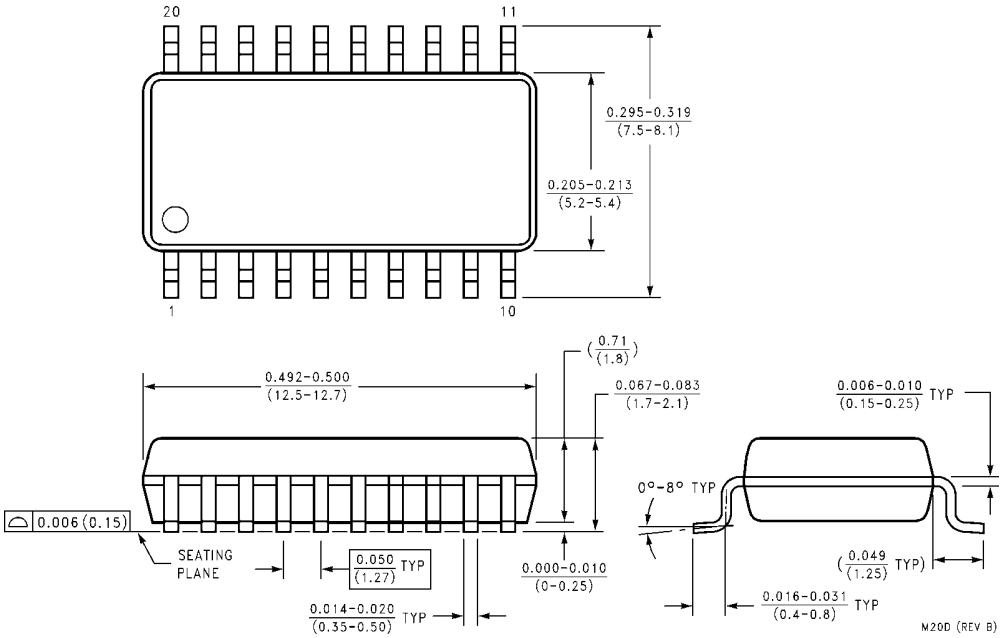
Symbol	Parameter	Conditions		$T_A = 25°C$	$T_A = -40$ to $85°C$	$T_A = -55$ to $125°C$		Units
				Typ	Guaranteed Limits			
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	$C_L = 50$ pF		14	23	29	34	ns
		$C_L = 150$ pF		17	33	42	49	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	$R_L = 1$ kΩ	$C_L = 50$ pF	17	30	38	45	ns
			$C_L = 150$ pF	22	40	50	60	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	$R_L = 1$ kΩ $C_L = 50$ pF		17	30	38	45	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	$C_L = 5$ 0 pF		6	12	15	18	ns
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF
C_{OUT}	Maximum Output Capacitance			15	20	20	20	pF
C_{PD}	Power Dissipation Capacitance (Note 6)	(per output)	$\overline{G} = V_{CC}$	12				pF
			$\overline{G} = GND$	45				pF

Note 6: 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, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted

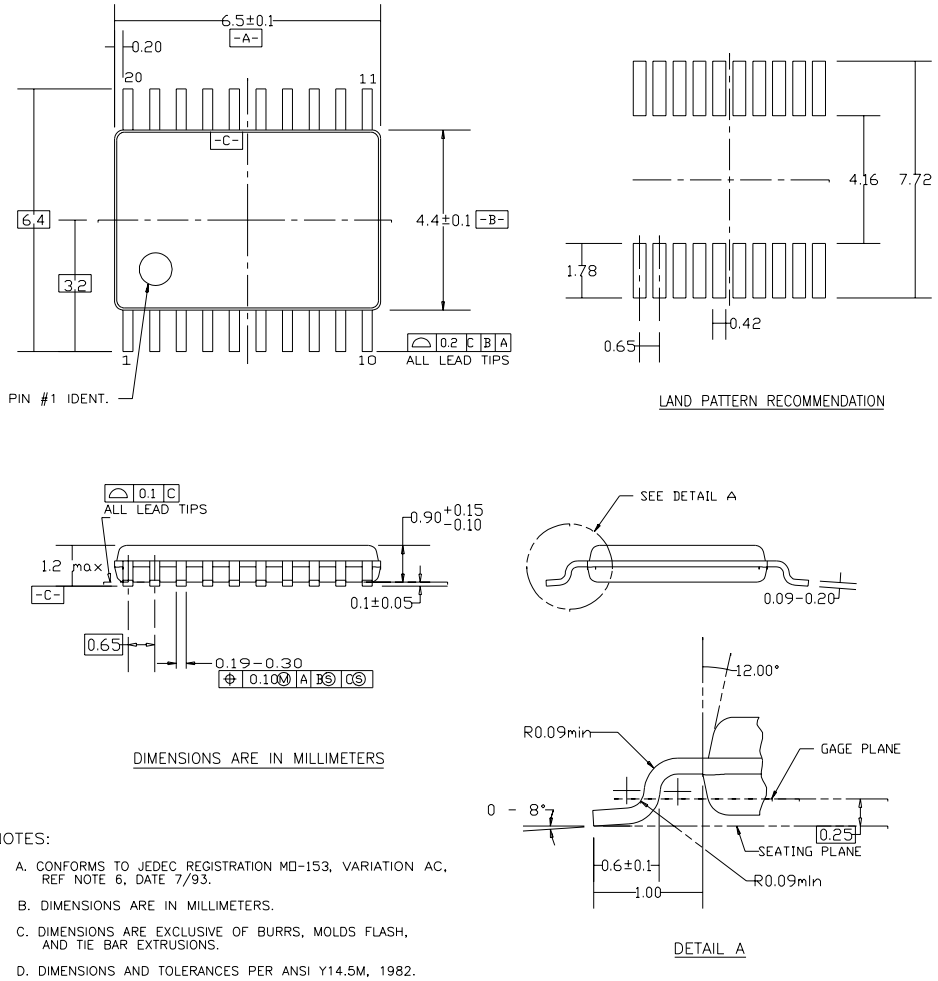


20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B



20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.

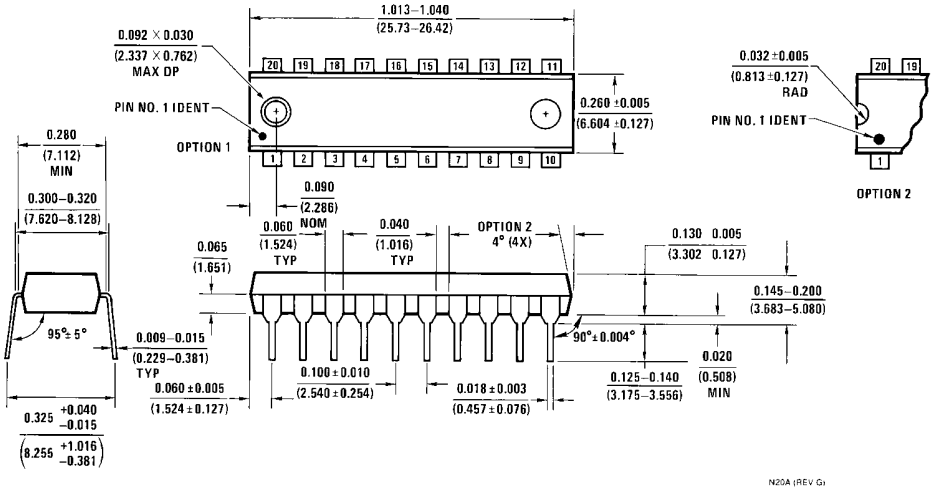
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC20

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N20A