National Semiconductor

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MM54HCT640/MM74HCT640 Inverting Octal TRI-STATE® Transceiver MM54HCT643/MM74HCT643 True-Inverting Octal TRI-STATE Transceiver

General Description

These TRI-STATE bi-directional transceivers utilize advanced silicon-gate CMOS technology and are intended for two-way asynchronous communication between data buses. They have high drive current outputs which enable high speed operation even when driving large bus capacitances. These circuits possess the low power consumption of CMOS circuitry, yet have speeds comparable to low power Schottky TTL circuits.

All devices are TTL input compatible and can drive up to 15 LS-TTL loads, and all inputs are protected from damage due to static discharge by diodes to V_{CC} and ground.

Both the MM54HCT640/MM74HCT640 and the MM54HCT643/ MM74HCT643 have one active low enable input ($\overline{G}$), and a direction control (DIR). When the DIR input is high, data flows from the A inputs to the B outputs. When DIR is low, data flows from B to A. The MM54HCT640/MM74HCT640 transfers inverted data from one bus to the other. The MM54HCT643/MM74HCT643 transfers inverted data from the A bus to the B bus and non-inverted data from the B bus to the A bus.

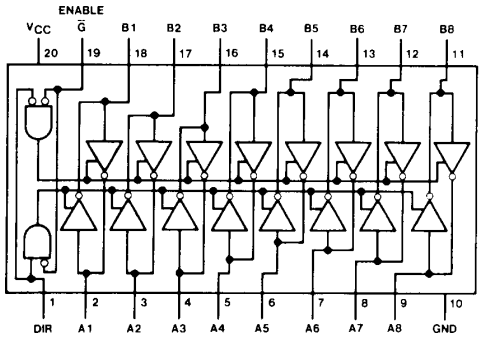
MM54HCT/MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

Features

- TTL input compatible
- Octal TRI-STATE outputs for μP bus applications: 6 mA, typical
- High speed: 16 ns typical propagation delay
- Low power: 80 μA maximum (74HCT)

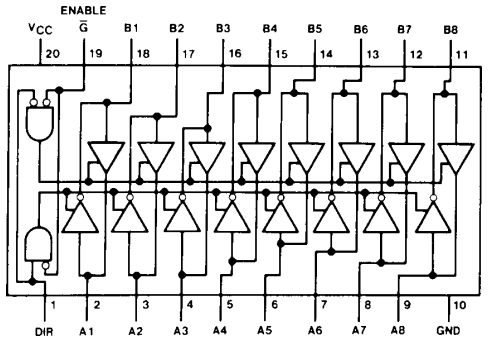
Connection Diagram

Dual-In-Line Packages



TL/F/5370–1

Top View
Order Number MM54HCT640 or MM74HCT640



TL/F/5370–2

Top View
Order Number MM54HCT643 or MM74HCT643

Truth Table

Control Inputs		Operation	
$\overline{G}$	DIR	640	643
L	L	$\overline{B}$ data to A bus	B data to A bus
L	H	$\overline{A}$ data to B bus	$\overline{A}$ data to B bus
H	X	Isolation	Isolation

H = high level, L = low level, X = irrelevant

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Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

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

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 Temp. Range (T_A)			
MM74HCT	−40	+85	°C
MM54HCT	−55	+125	°C
Input Rise or Fall Times (t_r, t_f)		500	ns

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

Symbol	Parameter	Conditions	T_A = 25°C	74HCT T_A = −40 to 85°C	54HCT 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
		$\|I_{OUT}\|$ = 6.0mA, V_{CC} = 4.5V	4.2	3.98	3.84	3.7	V
		$\|I_{OUT}\|$ = 7.2mA, 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
		$\|I_{OUT}\|$ = 6.0mA, V_{CC} = 4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\|$ = 7.2mA, V_{CC} = 5.5V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	V_{IN} = V_{CC} or GND, V_{IH} or V_{IL}		±0.1	±1.0	±1.0	μA
I_{OZ}	Maximum TRI-STATE Output Leakage Current	V_{OUT} = V_{CC} or GND Enable $\overline{G}$ = V_{IH}		±0.5	±5.0	±10	μA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND I_{OUT} = 0μA		8	80	160	μA
		V_{IN} = 2.4V or 0.5V (Note 4)	0.6	1.0	1.3	1.5	mA

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; ceramic "J" package: −12 mW/°C from 100°C to 125°C.

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

AC Electrical Characteristics MM54HCT640/MM74HCT640

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	16	20	ns
t_{PZL}, t_{PZH}	Maximum Output Enable Time	C_L = 45 pF R_L = 1 kΩ	29	40	ns
t_{PLZ}, t_{PHZ}	Maximum Output Disable Time	C_L = 5 pF R_L = 1 kΩ	20	25	ns

AC Electrical Characteristics MM54HCT640/MM74HCT640

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

Symbol	Parameter	Conditions	T_A = 25°C	74HCT T_A = −40 to 85°C	54HCT T_A = −55 to 125°C	Units
			Typ	Guaranteed Limits		
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	C_L = 50 pF	17	23	29	34	ns
		C_L = 150 pF	24	30	38	45	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	R_L = 1kΩ, C_L = 50 pF	23	30	38	45	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	R_L = 1kΩ, C_L = 50 pF	21	30	38	45	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	C_L = 50 pF	8	12	15	18	ns
C_{IN}	Maximum Input Capacitance		10	15	15	15	pF
C_{OUT}	Maximum Output/ Input Capacitance		20	25	25	25	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	(per output) $\overline{G} = V_{CC}$	7				pF
		(per output) $\overline{G}$ = GND	100				pF

AC Electrical Characteristics MM54HCT643/MM74HCT643

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	16	20	ns
t_{PZL}, t_{PZH}	Maximum Output Enable Time	C_L = 45 pF, R_L = 1 kΩ	29	40	ns
t_{PLZ}, t_{PHZ}	Maximum Output Disable Time	C_L = 5 pF, R_L = 1 kΩ	20	25	ns

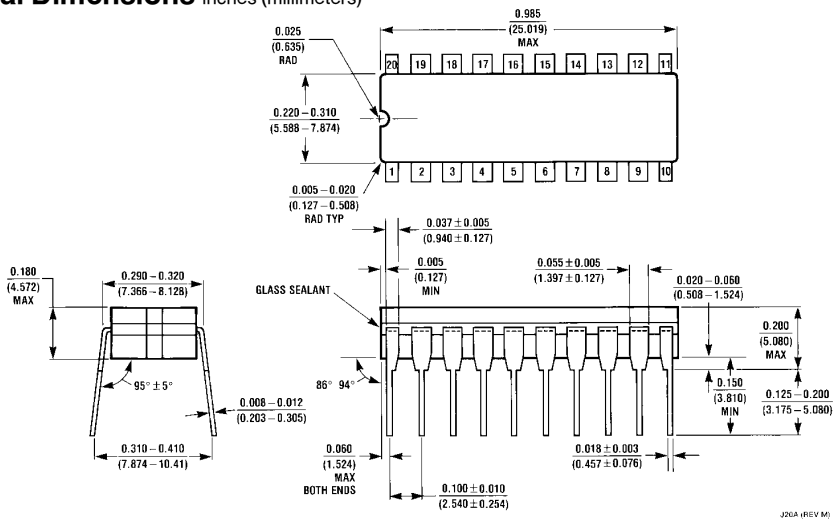
AC Electrical Characteristics MM54HCT643/MM74HCT643

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

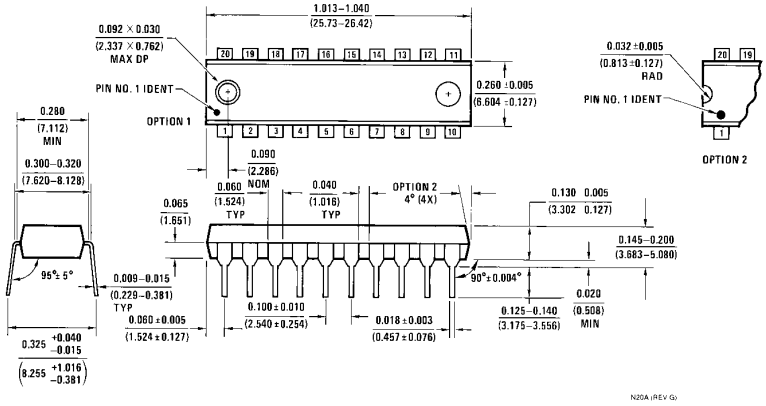
Symbol	Parameter	Conditions	T_A = 25°C	74HCT T_A = −40 to 85°C	54HCT T_A = −55 to 125°C	Units
			Typ	Guaranteed Limits		
t_{PHL}, t_{PLH}	Maximum Output Propagation Delay	C_L = 50 pF	17	23	29	34	ns
		C_L = 150 pF	24	30	38	45	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	R_L = 1 kΩ, C_L = 50 pF	23	30	38	45	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	R_L = 1 kΩ, C_L = 50 pF	21	30	38	45	ns ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	C_L = 50 pF	8	12	15	18	ns
C_{IN}	Maximum Input Capacitance		10	15	15	15	pF
C_{OUT}	Maximum Output/ Input Capacitance		20	25	25	25	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	(per output) $\overline{G} = V_{CC}$	7				pF
		(per output) $\overline{G}$ = GND	100				pF

Note 5: C_{PD} determines the no load power consumption. $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$. The no load dynamic current consumption, $I_S = C_{PD} V_{CC} + I_{CC}$.

Physical Dimensions inches (millimeters)



Cavity Dual-In line Package (J)
Order Number MM54HCT640J, MM54HCT643J, MM74HCT640J, or MM74HCT643J
See NS Package J20A



Moulded Dual-In line Package (N)
Order Number MM74HCT640N or MM74HCT643N
See NS Package N20A

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