February 1985

OBJECTIVE
SPECIFICATIONS

Octal D-Type Transparent Latches with 3-State Outputs

Features

- **8 latches in a single package**
- **Full parallel access for loading**
- **Function, pin-out, speed and drive compatibility with 54/74ALS logic family**
- **Low power consumption characteristic of CMOS**
- **3-State outputs with high drive current (I_{OL} = 24 mA @ V_{OL} = 0.5V) for direct bus interface**
- **Inputs and outputs interface directly with TTL, NMOS and CMOS devices**
- **Wide operating voltage range: 4.5V to 5.5V**
- **Characterized for operation over industrial and military temperature ranges:**
  74AHCT: −40°C to +85°C
  54AHCT: −55°C to +125°C

Description

The '533 consists of 8 high-speed D-type latches coupled to 3-state output buffers with high drive current capability. It can be used in implementing buffer registers, I/O ports, bidirectional bus drivers and working registers.

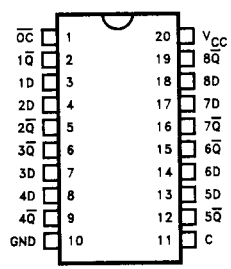
The latches are transparent: when the enable (C) is high, the $\overline{Q}$ outputs follow the complements of the data (D) inputs. When the enable is low, the outputs latch at the levels that were set up at the D inputs.

The output buffers are controlled by a common signal ($\overline{OC}$) which places the outputs at a high-impedance state when it is taken high. The $\overline{OC}$ signal does not affect the internal operations of the latches. Old data can be retained or new data can be entered while outputs are off.

Fabricated using Zytrex's proprietary ICE-MOS process, these devices provide speeds and drive capability equivalent to their ALSTTL counterparts and yet maintain CMOS power levels. The input and output voltage levels allow direct interface with TTL, NMOS and CMOS devices without any external components.

All inputs and outputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Pin Configuration



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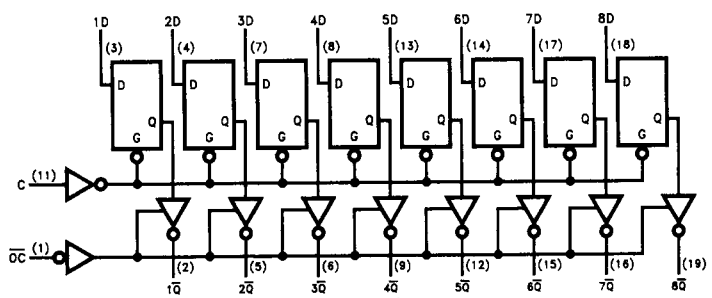
Function Table

(Each Latch)

Inputs			Output
$\overline{OC}$	Enable C	D	$\overline{Q}$
L	H	H	L
L	H	L	H
L	L	X	$\overline{Q}_0$
H	X	X	Z

Logic Diagram



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4

Absolute Maximum Ratings*

Supply Voltage Range, V_{CC} ..... −0.5V to 7V
DC Input Diode Current, I_{IK}
(V_I < −0.5V or V_I > V_{CC} + 0.5V) ..... ±20 mA
DC Output Diode Current, I_{OK}
(V_O < −0.5V or V_O > V_{CC} + 0.5V) ..... ±20 mA
Continuous Output Current Per Pin, I_O
(−0.5V < V_O < V_{CC} + 0.5V) ..... ±70 mA
Continuous Current Through
V_{CC} or GND pins ..... ±250 mA
Storage Temperature Range, T_{STG} .. −65°C to +150°C
Power Dissipation Per Package, P_D† ..... 500 mW

*Absolute Maximum Ratings are those values beyond which permanent damage to the device may occur. These are stress ratings only and functional operation of the device at or beyond them is not implied. Long exposure to these conditions may affect device reliability.

† Power Dissipation temperature derating:
Plastic Package (N): −12 mW/°C from 65°C to 85°C
Ceramic Package (J): −12 mW/°C from 100°C to 125°C

Recommended Operating Conditions

Supply Voltage, V_{CC} ..... 4.5V to 5.5V
DC Input & Output Voltages*, V_{IN}, V_{OUT} ..... 0V to V_{CC}
Operating Temperature
Range ZX74AHCT: −40°C to +85°C
ZX54AHCT: −55°C to +125°C
Input Rise & Fall Times, t_r, t_f ..... Max 500 ns

*Unused inputs must always be tied to an appropriate logic voltage level (either V_{CC} or GND)

DC Electrical Characteristics (V_{CC} = 5V ±10% Unless Otherwise Specified)

Symbol	Parameter	Test Conditions	T_A = 25°C	74AHCT T_A = −40°C to +85°C	54AHCT T_A = −55°C to +125°C	Unit
			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_O = −20 μA I_O = −6 mA	V_{CC} 4.2	V_{CC} − 0.1 3.98	V_{CC} − 0.1 3.84	V_{CC} − 0.1 3.7	V
V_{OL}	Maximum Low-Level Output Voltage	V_{IN} = V_{IH} or V_{IL} I_O = 20 μA I_O = 12 mA I_O = 24 mA	0	0.1 0.26 0.39	0.1 0.33 0.5	0.1 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 Leakage Current	Output Enable = V_{IH} V_{OUT} = V_{CC} or GND		±0.5	±5.0	±10.0	μA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND I_{OUT} = 0 μA		8.0	80.0	160.0	μA

AC Electrical Characteristics (Input t_r, $t_f \leq 2$ ns), AHCT533

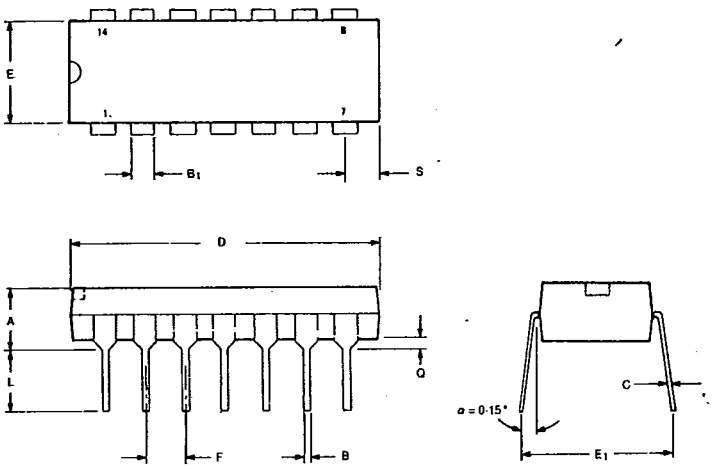
Symbol	Parameter	Conditions†		$T_A = 25°C$ $V_{CC} = 5.0V$	74AHCT $T_A = -40°C$ to $+85°C$ $V_{CC} = 5.0V \pm 10\%$	54AHCT $T_A = -55°C$ to $+125°C$ $V_{CC} = 5.0V \pm 10\%$	Unit
				Typ	Guaranteed Limits		
t_{PLH}	Maximum Propagation Delay, D to $\overline{Q}$	$C_L = 50$ pF		10	16	19	ns
		$C_L = 150$ pF		16	25	30	
t_{PHL}		$C_L = 50$ pF		10	16	19	
		$C_L = 150$ pF		16	25	30	
t_{PLH}	Maximum Propagation Delay, C to any $\overline{Q}$	$C_L = 50$ pF		13	21	25	ns
		$C_L = 150$ pF		19	30	36	
t_{PHL}		$C_L = 50$ pF		13	21	25	
		$C_L = 150$ pF		19	30	36	
t_{PZH}	Maximum Output Enable Time, $\overline{OC}$ to any $\overline{Q}$	$R_L = 1$ kΩ	$C_L = 50$ pF	11	18	22	ns
			$C_L = 150$ pF	17	27	33	
t_{PZL}			$C_L = 50$ pF	11	18	22	
			$C_L = 150$ pF	17	27	33	
t_{PHZ}	Maximum Output Disable Time, $\overline{OC}$ to any $\overline{Q}$	$R_L = 1$ kΩ, $C_L = 50$ pF		10	16	19	ns
t_{PLZ}				10	16	19	
t_w	Minimum Pulse Width, C High			9	15	15	ns
t_{su}	Minimum Setup Time, D before C ↓			9	15	15	ns
t_h	Minimum Hold Time, D after C ↓			3	5	7	ns
C_{IN}	Maximum Input Capacitance			5			pF
C_{OUT}	Maximum Output Capacitance	Output Disabled		10			pF
C_{PD}	Power Dissipation Capacitance* (per stage)	$\overline{OC} = V_{CC}$		5			pF
		$\overline{OC} = GND$		30			

*C_{PD} determines the no-load dynamic power dissipation: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.
†For AC switching test circuits and timing waveforms see section 2.

4

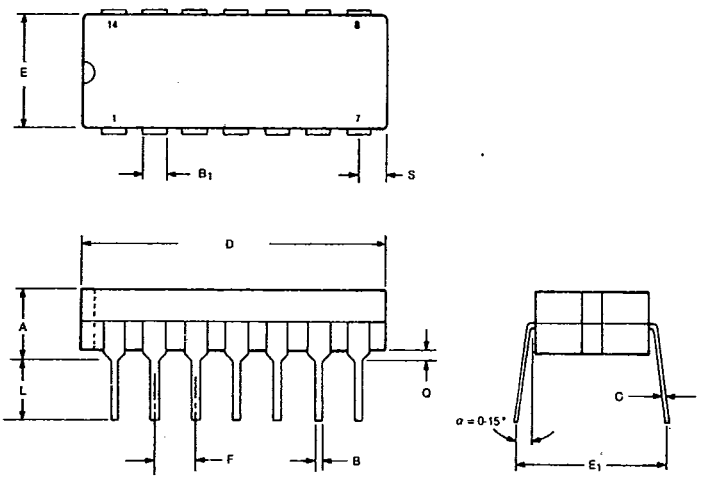
14-Pin Packages

Plastic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.150	0.200
B	0.38	0.58	0.015	0.023
B_1	1.40	1.78	0.055	0.070
C	0.20	0.38	0.008	0.015
D	18.16	19.56	0.715	0.770
E	6.10	7.49	0.240	0.295
E_1	7.62	10.03	0.300	0.395
F	2.54		0.100	
L	3.18	4.19	0.125	0.165
Q	0.51	1.02	0.020	0.040
S	1.91	2.29	0.075	0.090

Ceramic Package

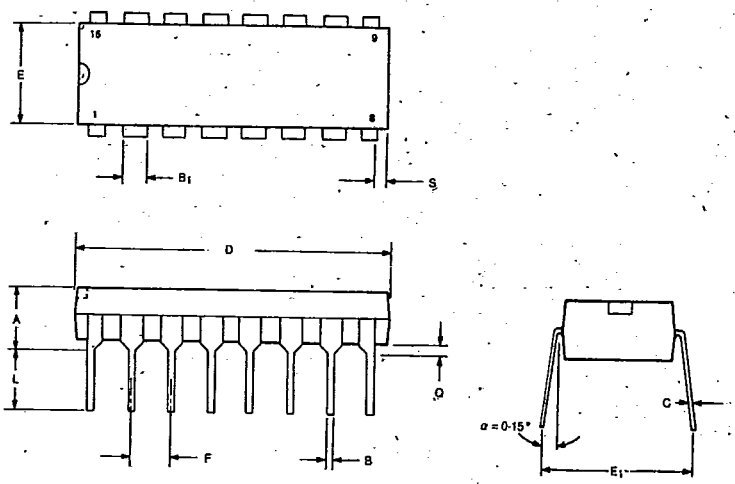


DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	—	5.08	—	0.200
B	0.38	0.58	0.015	0.023
B_1	1.40	1.78	0.055	0.070
C	0.20	0.38	0.008	0.015
D	19.05	19.94	0.750	0.785
E	6.10	7.49	0.240	0.295
E_1	7.62	10.03	0.300	0.395
F	2.54		0.100	
L	3.18	4.19	0.125	0.165
Q	0.51	1.02	0.020	0.040
S	1.91	2.29	0.075	0.090

8

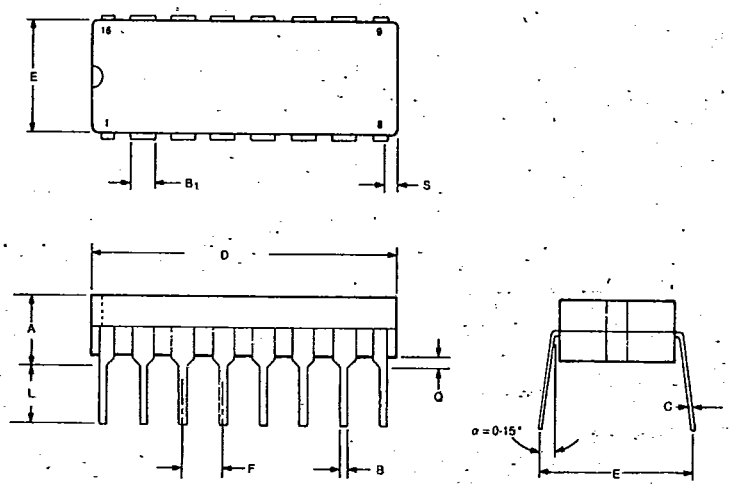
16-Pin Packages

Plastic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	4.32	0.150	0.170
B	0.38	0.58	0.015	0.023
B_1	1.40	1.78	0.055	0.070
C	0.20	0.38	0.008	0.015
D	19.05	19.94	0.750	0.785
E	6.10	7.49	0.240	0.295
E_1	7.62	8.89	0.300	0.350
F	2.54		0.100	
L	3.18	4.19	0.125	0.165
Q	0.51	1.02	0.020	0.040
S	1.91	2.29	0.075	0.090

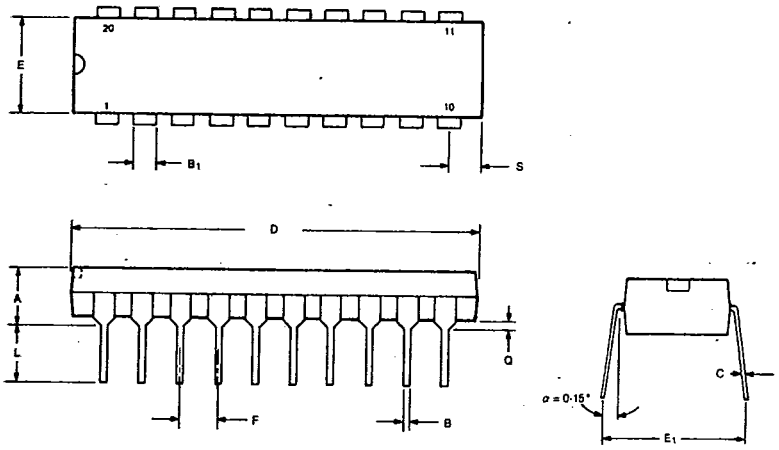
Ceramic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	—	5.08	—	0.200
B	0.38	0.58	0.015	0.023
B_1	1.40	1.78	0.055	0.070
C	0.20	0.38	0.008	0.015
D	19.05	19.94	0.750	0.785
E	6.10	7.49	0.240	0.295
E_1	7.62	10.03	0.300	0.395
F	2.54		0.100	
L	3.18	4.19	0.125	0.165
Q	0.51	1.02	0.020	0.040
S	1.51	1.14	0.020	0.045

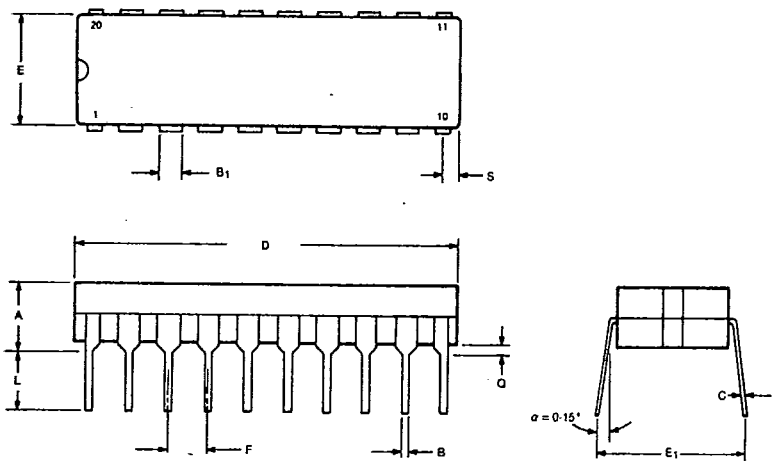
20-Pin Packages

Plastic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.06	5.08	0.160	0.200
B	0.38	0.53	0.015	0.021
B_1	1.14	1.52	0.045	0.060
C	0.20	0.38	0.008	0.015
D	25.65	27.18	1.010	1.070
E	6.10	6.60	0.240	0.260
E_1	7.77	8.89	0.306	0.350
F	2.54		0.100	
L	3.30	4.01	0.130	0.158
Q	0.38	0.89	0.015	0.035
S	1.85	1.93	0.073	0.076

Ceramic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.06	5.08	0.160	0.200
B	0.38	0.53	0.015	0.021
B_1	1.14	1.52	0.045	0.060
C	0.20	0.38	0.008	0.015
D	25.78	25.93	1.015	1.021
E	6.10	6.60	0.240	0.260
E_1	7.77	7.98	0.306	0.314
F	2.54		0.100	
L	3.73	4.01	0.147	0.158
Q	0.38	0.89	0.015	0.035
S	0.51	1.14	0.020	0.045

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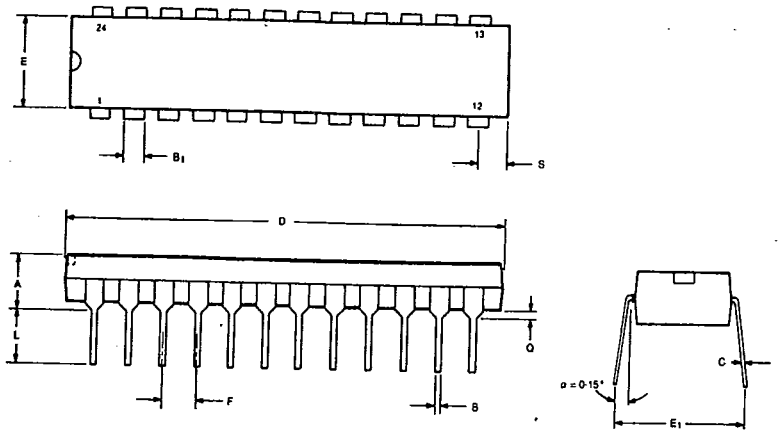
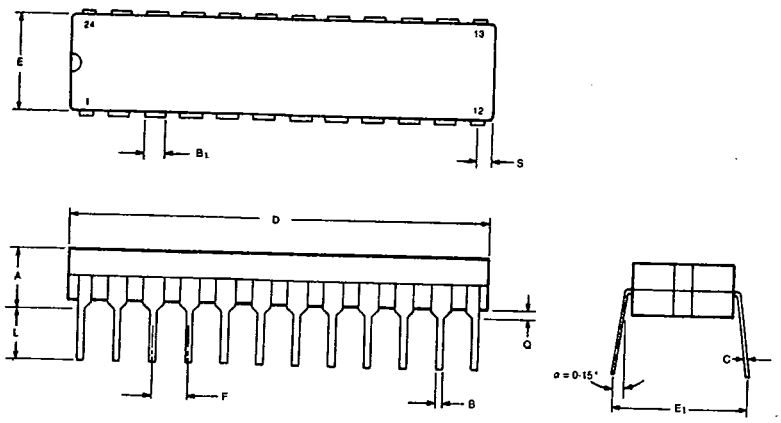
24-Pin Packages

Plastic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.06	5.08	0.160	0.200
B	0.38	0.53	0.015	0.021
B_1	1.14	1.52	0.045	0.060
C	0.20	0.38	0.008	0.015
D	31.24	32.13	1.230	1.265
E	6.10	6.60	0.240	0.260
E_1	7.77	8.89	0.306	0.350
F	2.54		0.100	
L	3.30	4.01	0.130	0.158
Q	0.38	0.89	0.015	0.035
S	0.51	1.14	0.020	0.045

Ceramic Package



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.06	5.08	0.160	0.200
B	0.38	0.53	0.015	0.021
B_1	1.14	1.52	0.045	0.060
C	0.20	0.38	0.008	0.015
D	31.50	32.64	1.240	1.285
E	7.24	7.75	0.285	0.305
E_1	7.77	7.98	0.306	0.314
F	2.54		0.100	
L	3.73	4.01	0.147	0.158
Q	0.508	1.778	0.020	0.070
S	1.85	1.93	0.073	0.076