FAIRCHILD SEMICONDUCTOR™

February 1984
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MM74HCT373 • MM74HCT374
3-STATE Octal D-Type Latch • 3-STATE Octal D-Type Flip-Flop

General Description

The MM74HCT373 octal D-type latches and MM74HCT374 Octal D-type flip flops advanced silicon-gate CMOS technology, which provides the inherent benefits of low power consumption and wide power supply range, but are LS-TTL input and output characteristic & pin-out compatible. The 3-STATE outputs are capable of driving 15 LS-TTL loads. All inputs are protected from damage due to static discharge by internal diodes to V_{CC} and ground.

When the MM74HCT373 LATCH ENABLE input is HIGH, the Q outputs will follow the D inputs. When the LATCH ENABLE goes LOW, data at the D inputs will be retained at the outputs until LATCH ENABLE returns HIGH again. When a high logic level is applied to the OUTPUT CONTROL input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The MM74HCT374 are positive edge triggered flip-flops. Data at the D inputs, meeting the setup and hold time requirements, are transferred to the Q outputs on positive going transitions of the CLOCK (CK) input. When a high logic level is applied to the OUTPUT CONTROL (OC) input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

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 characteristic compatible
- Typical propagation delay: 20 ns
- Low input current: 1 µA maximum
- Low quiescent current: 80 µA maximum
- Compatible with bus-oriented systems
- Output drive capability: 15 LS-TTL loads

Ordering Code:

Order Number	Package Number	Package Descriptions
MM74HCT373WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HCT373SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT373MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT373N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74HCT373WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HCT373SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT373MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT373N	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.

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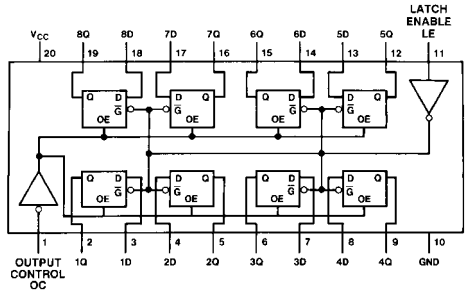
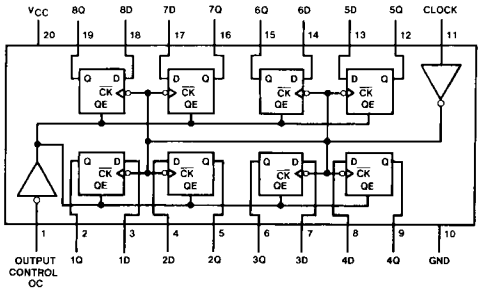
Connection Diagrams

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View
MM74HCT373



Top View
MM74HCT374

Truth Tables

MM74HCT373

Output Control	LE	Data	373 Output
L	H	H	H
L	H	L	L
L	L	X	Q_0
H	X	X	Z

H = HIGH Level
L = LOW Level
Q_0 = Level of output before steady-state input conditions were established.
Z = High Impedance

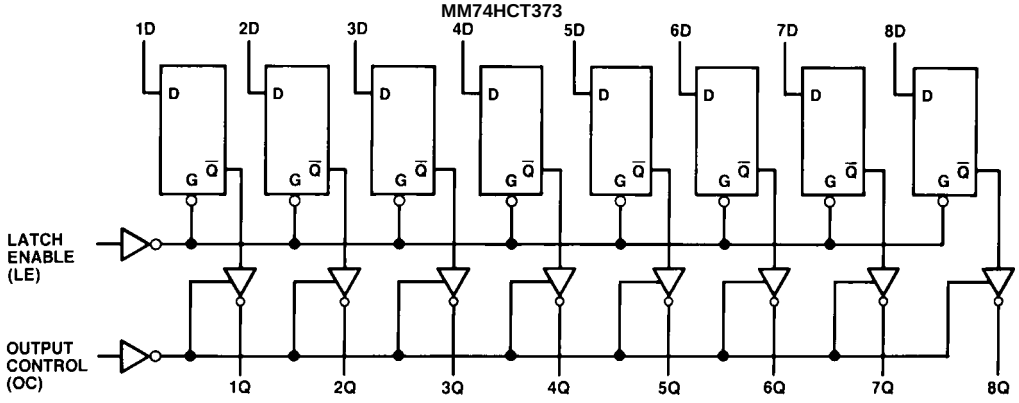
MM74HCT374

Output Control	Clock	Data	Output (374)
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

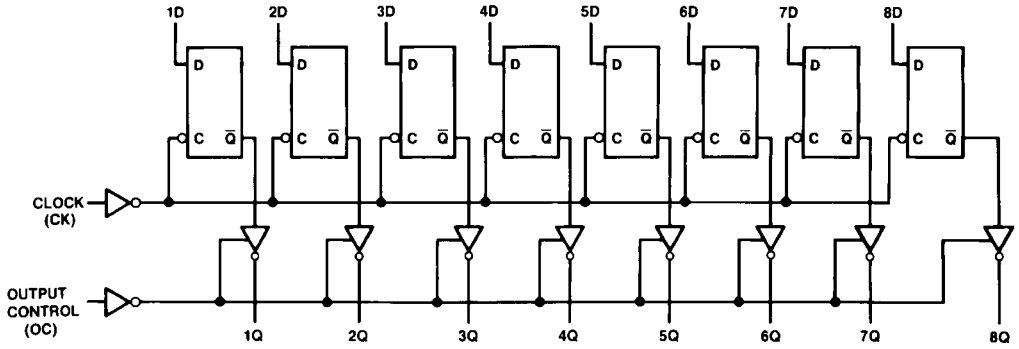
H = HIGH Level
L = LOW Level
X = Don't Care
↑ = Transition from LOW-to-HIGH
Z = High Impedance State
Q_0 = The level of the output before steady state input conditions were established.

Logic Diagrams

MM74HCT373



MM74HCT374



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	5.7	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, V_{IH} or V_{IL}		±0.1	±1.0	±1.0	μA
I_{OZ}	Maximum 3-STATE Output Leakage Current	V_{OUT} = V_{CC} or GND Enable = V_{IH} or VIL		±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)		1.0	1.3	1.5	mA

Note 4: Measured per pin. All others tied to V_{CC}or ground.

AC Electrical Characteristics

MM74HCT373: $V_{CC} = 5.0V$, $t_r = t_f = 6$ ns $T_A = 25°C$ (unless otherwise specified)

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay Data to Output	$C_L = 45$ pF	18	25	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay Latch Enable to Output	$C_L = 45$ pF	21	30	ns
t_{PZH}, t_{PZL}	Maximum Enable Propagation Delay Control to Output	$C_L = 45$ pF $R_L = 1$ kΩ	20	28	ns
t_{PHZ}, t_{PLZ}	Maximum Disable Propagation Delay Control to Output	$C_L = 5$ pF $R_L = 1$ kΩ	18	25	ns
t_W	Minimum Clock Pulse Width			16	ns
t_S	Minimum Setup Time Data to Clock			5	ns
t_H	Minimum Hold Time Clock to Data			10	ns

AC Electrical Characteristics

MM74HCT373: $V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6$ 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 Propagation	$C_L = 50$ pF	22	30	37	45	ns
	Delay Data to Output	$C_L = 150$ pF	30	40	50	60	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay	$C_L = 50$ pF	25	35	44	53	ns
	Latch Enable to Output	$C_L = 150$ pF	32	45	56	68	ns
t_{PZH}, t_{PZL}	Maximum Enable Propagation	$C_L = 50$ pF	21	30	37	45	ns
	Delay Control to Output	$C_L = 150$ pF	30	40	50	60	ns
		$R_L = 1$ kΩ					
t_{PHZ}, t_{PLZ}	Maximum Disable Propagation	$C_L = 50$ pF	21	30	37	45	ns
	Delay Control to Output	$R_L = 1$ kΩ					
t_{THL}, t_{TLH}	Maximum Output Rise	$C_L = 50$ pF	8	12	15	18	ns
	and Fall Time						
t_W	Minimum Clock Pulse Width			16	20	24	ns
t_S	Minimum Setup Time Data to Clock			5	6	8	ns
t_H	Minimum Hold Time Clock to Data			10	13	20	ns
C_{IN}	Maximum Input Capacitance			10	10	10	pF
C_{OUT}	Maximum Output Capacitance			20	20	20	pF
C_{PD}	Power Dissipation Capacitance	OC = V_{CC}		5			pF
	(Note 5)	OC = GND		52			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

MM74HCT374: $V_{CC} = 5.0V$, $t_r = t_f = 6$ ns $T_A = 25°C$ (unless otherwise specified)

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Clock Frequency		50	30	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay to Output	$C_L = 45$ pF	20	32	ns
t_{PZH}, t_{PZL}	Maximum Enable Propagation Delay Control to Output	$C_L = 45$ pF $R_L = 1$ kΩ	19	28	ns
t_{PHZ}, t_{PLZ}	Maximum Disable Propagation Delay Control to Output	$C_L = 5$ pF $R_L = 1$ kΩ	17	25	ns
t_W	Minimum Clock Pulse Width			20	ns
t_S	Minimum Setup Time Data to Clock			5	ns
t_H	Minimum Hold Time Clock to Data			16	ns

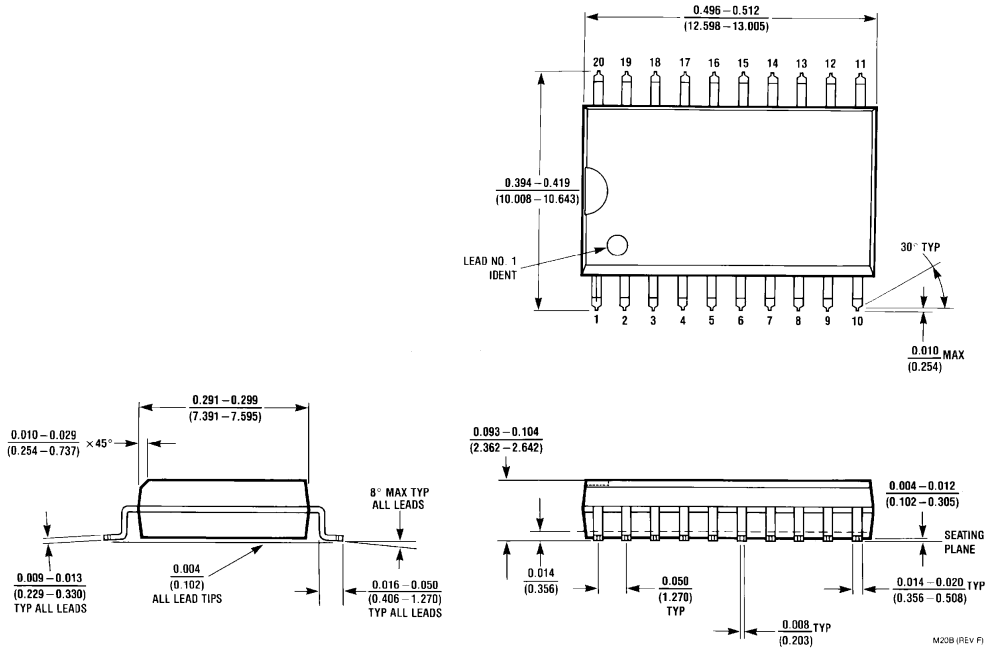
AC Electrical Characteristics

MM74HCT374: $V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6$ ns (unless otherwise specified)

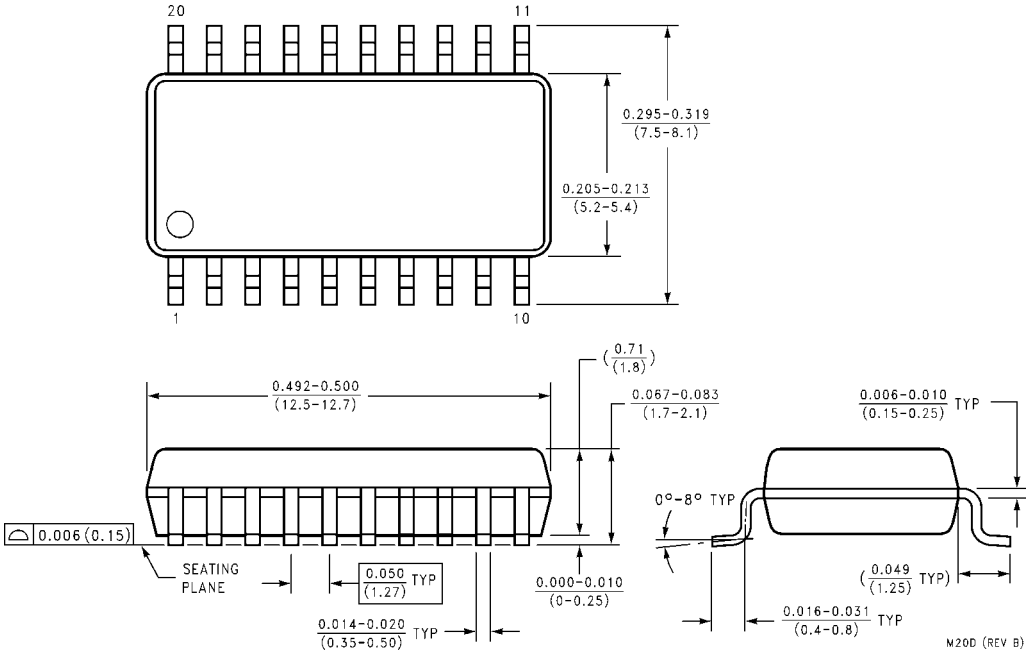
Symbol	Parameter	Conditions	$T_A = 25°C$	$T_A = -40$ to $85°C$	$T_A = -55$ to $125°C$	Units
			Typ	Guaranteed Limits		
f_{MAX}	Maximum Clock Frequency			30	24	20	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay	$C_L = 50$ pF	22	36	45	48	ns
	to Output	$C_L = 150$ pF	30	46	57	69	ns
t_{PZH}, t_{PZL}	Maximum Enable Propagation	$C_L = 50$ pF	21	30	37	45	ns
	Delay Control to Output	$C_L = 150$ pF	30	40	50	60	ns
		$R_L = 1$ kΩ					
t_{PHZ}, t_{PLZ}	Maximum Disable Propagation	$C_L = 50$ pF	21	30	37	45	ns
	Delay Control to Output	$R_L = 1$ kΩ					
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	$C_L = 50$ pF	8	12	15	18	ns
t_W	Minimum Clock Pulse Width			16	20	24	ns
t_S	Minimum Setup Time Data to Clock			20	25	30	ns
t_H	Minimum Hold Time Clock to Data			5	5	5	ns
C_{IN}	Maximum Input Capacitance			10	10	10	pF
C_{OUT}	Maximum Output Capacitance			20	20	20	pF
C_{PD}	Power Dissipation Capacitance	OC = V_{CC}		5			pF
	(Note 6)	OC = GND		58			pF

Note 6: C_{PD} determines the no load 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

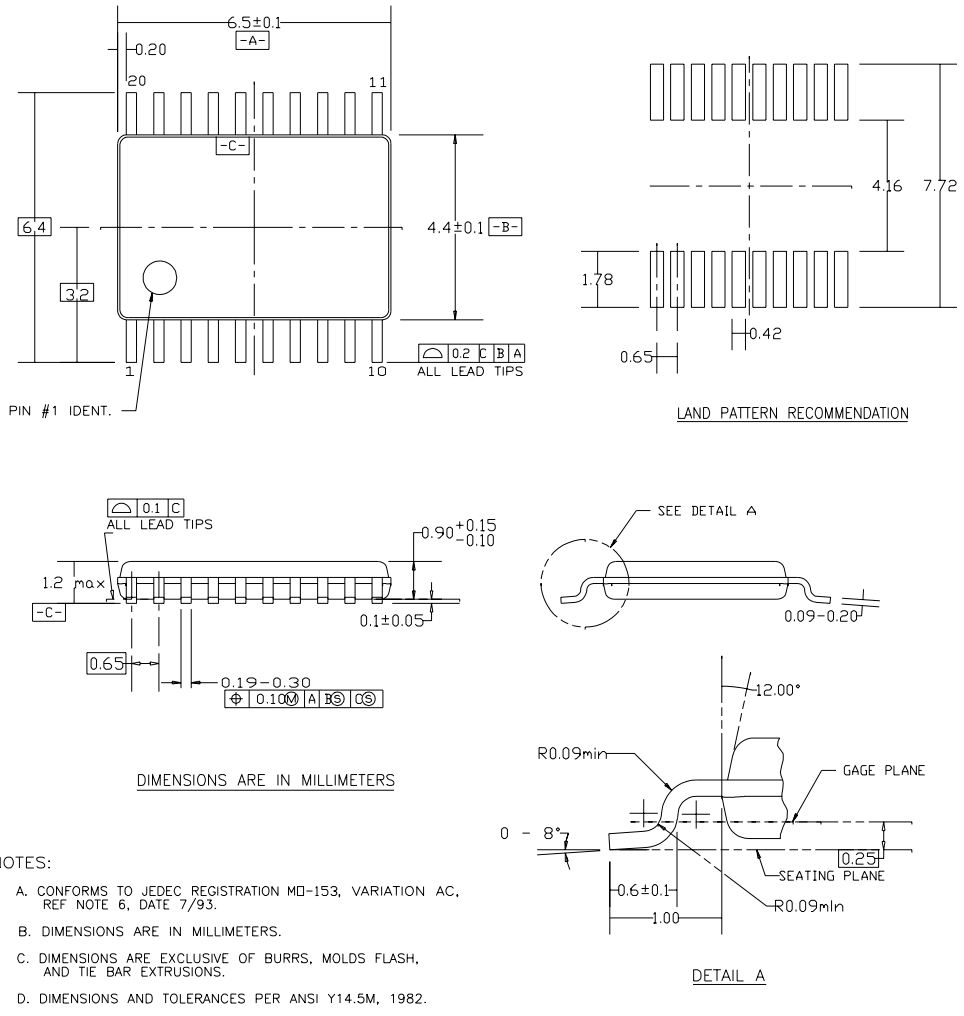


20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B



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.

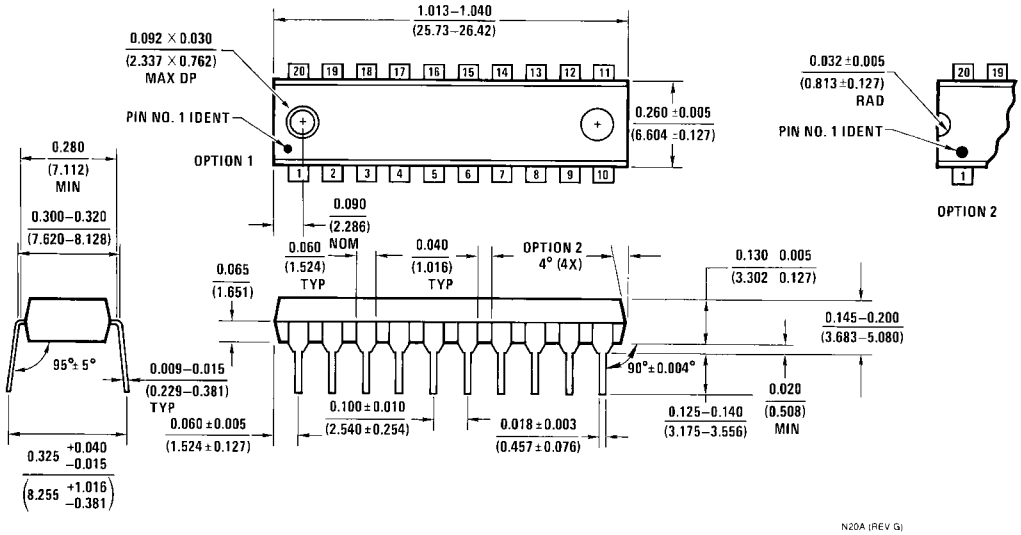
B. DIMENSIONS ARE IN MILLIMETERS.

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

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