

Truth Table

(Each Flip-Flop)

Inputs			Outputs
Clear	Clock	D	Q
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q0

H = HIGH Level (steady-state)

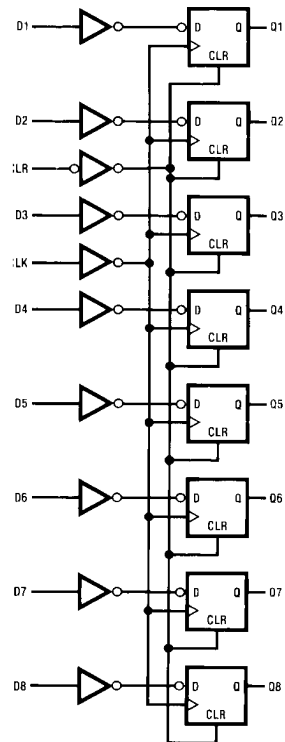
L = LOW Level (steady-state)

X = Don't Care

↑ = Transition from LOW-to-HIGH level

Q0 = The level of Q before the indicated steady-state input conditions were established.

Logic Diagram



Absolute Maximum Ratings(Note 1)

(Note 2)

Supply Voltage (V_{CC})	-0.5V to +7.0V
DC Input Voltage (V_{IN})	-1.5V to $V_{CC} + 1.5V$
DC Output Voltage (V_{OUT})	-0.5V to $V_{CC} + 0.5V$
Clamp Diode Current (I_{IK}, I_{OK})	± 20 mA
DC Output Current, per Pin (I_{OUT})	± 25 mA
DC V_{CC} or GND Current, per Pin (I_{CC})	± 50 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** $V_{CC} = 5V \pm 10\%$ unless otherwise specified

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

Symbol	Parameter	Conditions	T _A = 25°C		T _A = -40°C to 85°C	T _A = -55°C 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} = 4.0 mA, V _{CC} = 4.5V	4.2	3.98	3.84	3.7	V
		I _{OUT} = 4.8 mA, V _{CC} = 5.5V	5.2	4.98	4.84	4.7	V
V _{OL}	Minimum LOW Level Voltage	V _{IN} = V _{IH} or V _{IL}					
		I _{OUT} = 20 μA	0	0.1	0.1	0.1	V
		I _{OUT} = 4.0 mA, V _{CC} = 4.5V	0.2	0.26	0.33	0.4	V
		I _{OUT} = 4.8 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 _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA		8	80	160	μA
		V _{IN} = 2.4V or 0.5V (Note 4)		0.6	0.8	0.9	mA

Note 4: Measured per pin, all other inputs held at V_{CC} or GND.

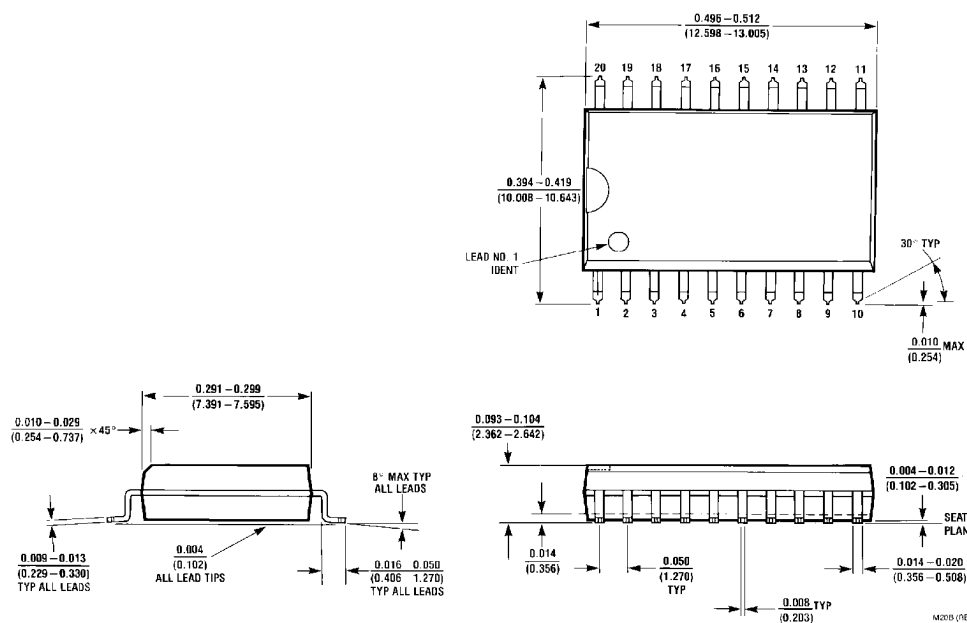
AC Electrical Characteristics
 $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15\text{ pF}$, $t_r = t_f = 6\text{ ns}$

Symbol	Parameter	Conditions	Typ	Guaranteed Limits	Units
f_{MAX}	Maximum Operating Frequency		68	30	MHz
t_{PHL} , t_{PLH}	Maximum Propagation Delay from Clock to Q		18	30	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay from Clear to Q		21	30	ns
t_{REM}	Minimum Removal Time, Clear to Clock		-1	5	ns
t_S	Minimum Set-Up Time D to Clock		6	20	ns
t_H	Minimum Hold Time Clock to D		-3	5	ns
t_W	Minimum Pulse Width Clock or Clear		10	16	ns

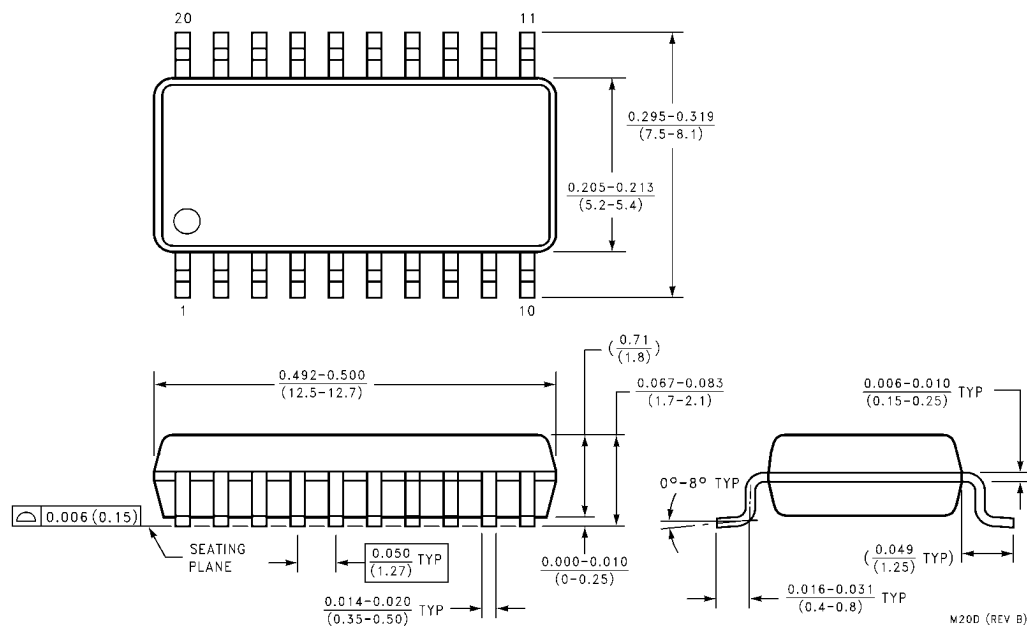
AC Electrical Characteristics
 $V_{CC} = 5.0V \pm 10\%$, $C_L = 50\text{ pF}$, $t_r = t_f = 6\text{ ns}$ unless otherwise specified

Symbol	Parameter	Conditions	T _A = 25°C		T _A = −40°C to 85°C	T _A = −55°C to 125°C	Units
			Typ	Guaranteed Limits			
f _{MAX}	Maximum Operating Frequency		68	27	21	18	MHz
t _{PHL} , t _{PLH}	Maximum Propagation Delay from Clock to Q		22	37	46	56	ns
t _{PHL} , t _{PLH}	Maximum Propagation Delay from Clear to Q		25	35	44	52	ns
t _{REM}	Minimum Removal Time Clear to Clock		−1	5	6	7	ns
t _S	Minimum Set-Up Time D to Clock		6	20	25	30	ns
t _H	Minimum Hold Time Clock to D		−3	5	5	5	ns
t _W	Minimum Pulse Width Clock or Clear		10	16	25	30	ns
t _r , t _f	Maximum Input Rise and Fall Time, Clock			500	500	500	ns
t _{THL} , t _{TLH}	Maximum Output Rise and Fall Time		11	15	19	22	ns
C _{PD}	Power Dissipation Capacitance (Note 5)	(Per Flip-Flop)	50				pF
C _{IN}	Maximum Input Capacitance		6	10	10	10	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, $I_S = C_{PD} V_{CC}^2 f + I_{CC}$.

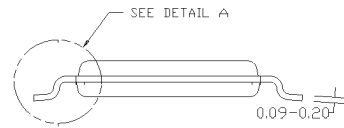
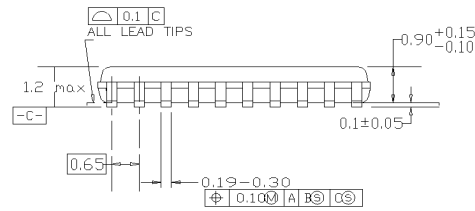
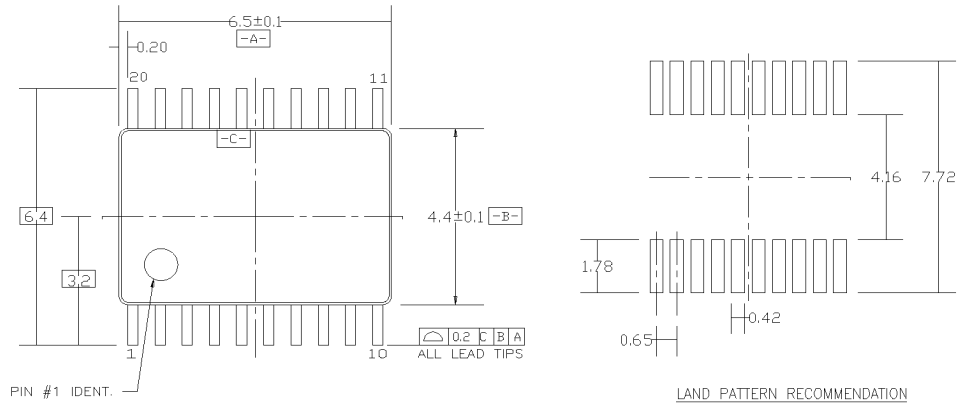
Physical Dimensions inches (millimeters) unless otherwise noted

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

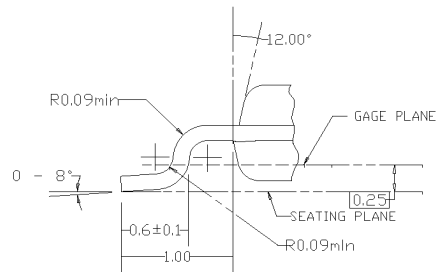
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

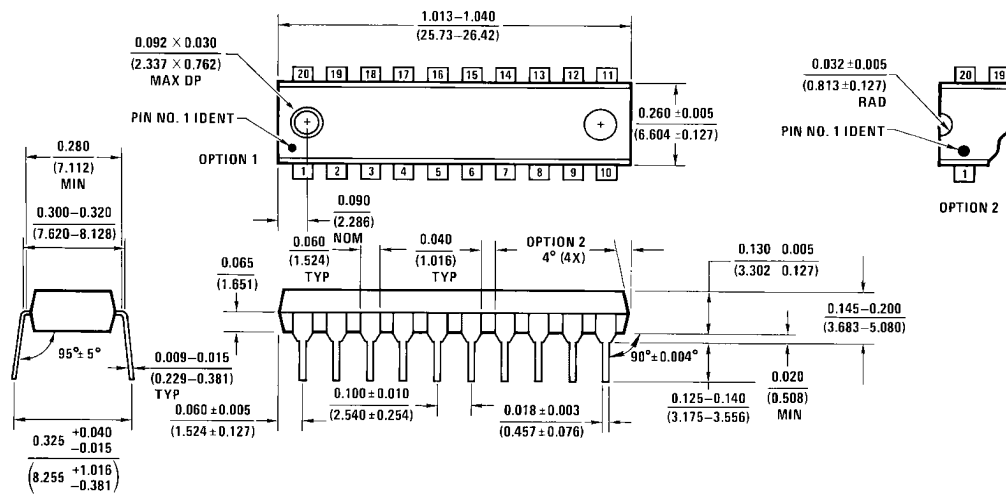
NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- 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

N20A (REV G)

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