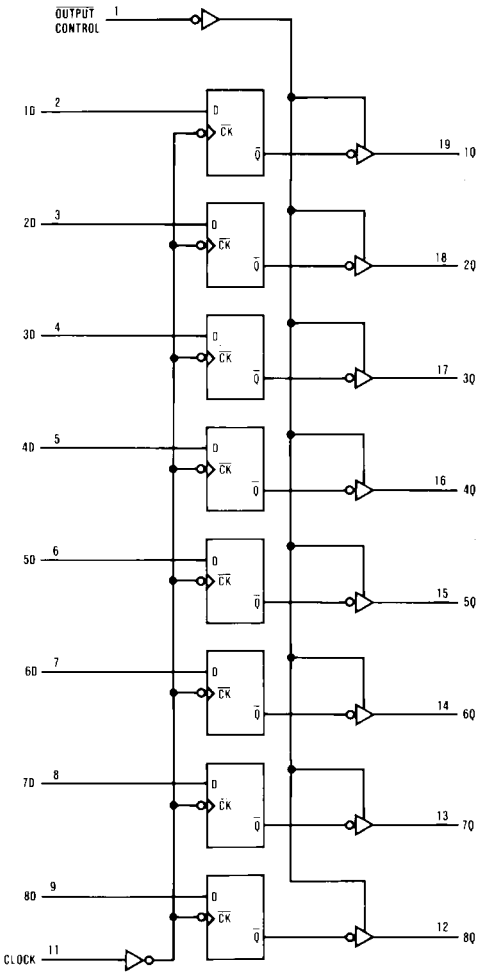
## Function Table

| $\overline{\text{Output}}$ Control | Clock | D | Output Q |
|---|---|---|---|
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | L | X | $Q_0$ |
| H | X | X | Z |

L = LOW State
H = HIGH State
X = Don't Care
↑ = Positive Edge Transition
Z = High Impedance State
$Q_0$ = Previous Condition of Q

## Logic Diagram



## Absolute Maximum Ratings(Note 1)

| | |
|---|---|
| Supply Voltage | 7V |
| Input Voltage | 7V |
| Voltage Applied to Disabled Output | 5.5V |
| Operating Free Air Temperature Range | 0°C to +70°C |
| Storage Temperature Range | −65°C to +150°C |
| Typical $\theta_{JA}$ | |
| N Package | 56.0°C/W |
| M Package | 75.0°C/W |

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

| Symbol | Parameter | | Min | Nom | Max | Units |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | 4.5 | 5 | 5.5 | V |
| $V_{IH}$ | HIGH Level Input Voltage | | 2 | | | V |
| $V_{IL}$ | LOW Level Input Voltage | | | | 0.8 | V |
| $I_{OH}$ | HIGH Level Output Current | | | | −2.6 | mA |
| $I_{OL}$ | LOW Level Output Current | | | | 24 | mA |
| $f_{CLOCK}$ | Clock Frequency | | 0 | | 35 | MHz |
| $t_W$ | Width of Clock Pulse | HIGH | 14 | | | ns |
| | | LOW | 14 | | | ns |
| $t_{SU}$ | Data Setup Time | (Note 2) | 15 ↑ | | | ns |
| $t_H$ | Data Hold Time | (Note 2) | 0 ↑ | | | ns |
| $T_A$ | Free Air Operating Temperature | | 0 | | 70 | °C |

**Note 2:** The (↑) arrow indicates the positive edge of the Clock is used for reference.

## Electrical Characteristics

over recommended operating free air temperature range. All typical values are measured at $V_{CC}$ = 5V, $T_A$ = 25°C.

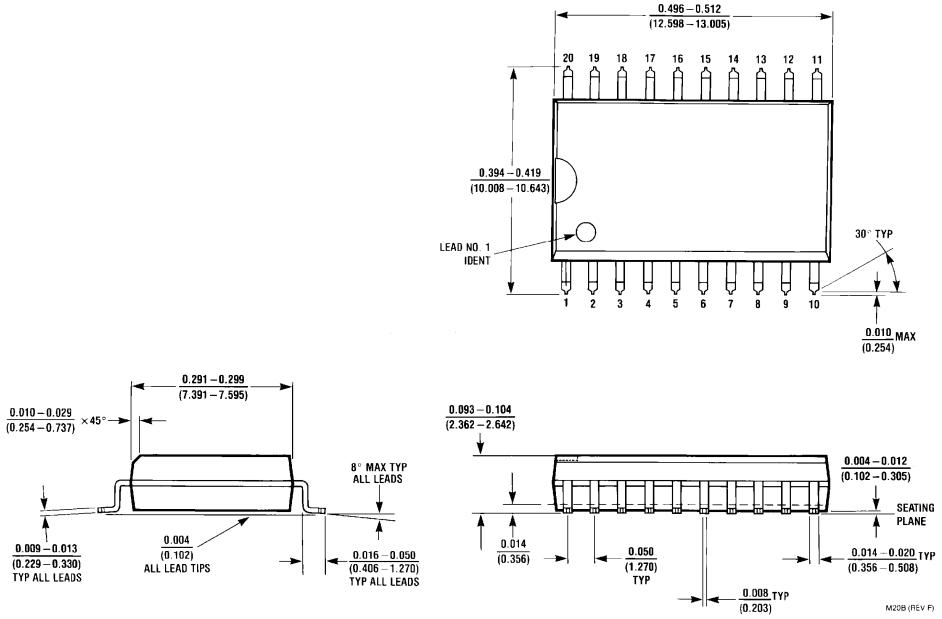
| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{IK}$ | Input Clamp Voltage | $V_{CC}$ = 4.5V, $I_I$ = −18 mA | | | | −1.2 | V |
| $V_{OH}$ | HIGH Level Output Voltage | $V_{CC}$ = 4.5V, $V_{IL}$ = $V_{IL}$ Max | $I_{OH}$ = Max | 2.4 | 3.2 | | V |
| | | $V_{CC}$ = 4.5V to 5.5V | $I_{OH}$ = −400 µA | $V_{CC}$ − 2 | | | V |
| $V_{OL}$ | LOW Level Output Voltage | $V_{CC}$ = 4.5V, $V_{IH}$ = 2V | $I_{OL}$ = 12 mA | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 24 mA | | 0.35 | 0.5 | V |
| $I_I$ | Input Current at Max Input Voltage | $V_{CC}$ = 5.5V, $V_{IH}$ = 7V | | | | 0.1 | mA |
| $I_{IH}$ | HIGH Level Input Current | $V_{CC}$ = 5.5V, $V_{IH}$ = 2.7V | | | | 20 | µA |
| $I_{IL}$ | LOW Level Input Current | $V_{CC}$ = 5.5V, $V_{IL}$ = 0.4V | | | | −0.2 | mA |
| $I_O$ | Output Drive Current | $V_{CC}$ = 5.5V, $V_O$ = 2.25V | | −30 | | −112 | mA |
| $I_{OZH}$ | OFF-State Output Current HIGH Level Voltage Applied | $V_{CC}$ = 5.5V, $V_{IH}$ = 2V, $V_O$ = 2.7V | | | | 20 | µA |
| $I_{OZL}$ | OFF-State Output Current d LOW Level Voltage Applied | $V_{CC}$ = 5.5V, $V_{IH}$ = 2V, $V_O$ = 0.4V | | | | −20 | µA |
| $I_{CC}$ | Supply Current | $V_{CC}$ = 5.5V, Outputs Open | Outputs HIGH | | 11 | 18 | mA |
| | | | Outputs LOW | | 17 | 27 | mA |
| | | | Outputs Disabled | | 17 | 28 | mA |

## Switching Characteristics

over recommended operating free air temperature range

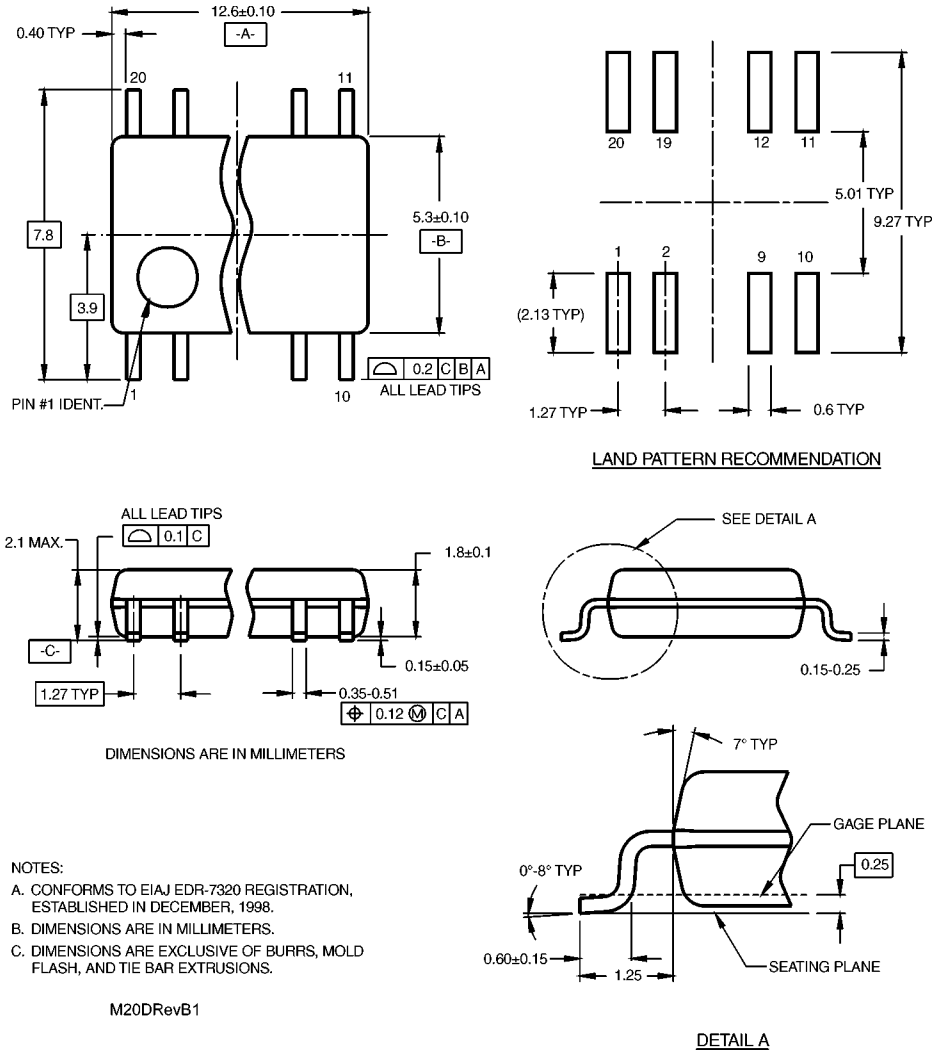
| Symbol | Parameter | Conditions | From | To | Min | Max | Units |
|---|---|---|---|---|---|---|---|
| $f_{MAX}$ | Maximum Clock Frequency | $V_{CC}$ = 4.5V to 5.5V | | | 35 | | MHz |
| $t_{PLH}$ | Propagation Delay Time LOW-to-HIGH Level Output | $R_L$ = 500Ω | Clock | Any Q | 4 | 14 | ns |
| $t_{PHL}$ | Propagation Delay Time HIGH-to-LOW Level Output | $C_L$ = 50 pF | Clock | Any Q | 4 | 14 | ns |
| $t_{PZH}$ | Output Enable Time to HIGH Level Output | | Output Control | Any Q | 4 | 18 | ns |
| $t_{PZL}$ | Output Enable Time to LOW Level Output | | Output Control | Any Q | 4 | 18 | ns |
| $t_{PHZ}$ | Output Disable Time from HIGH Level Output | | Output Control | Any Q | 2 | 10 | ns |
| $t_{PLZ}$ | Output Disable Time from LOW Level Output | | Output Control | Any Q | 2 | 12 | ns |

## Physical Dimensions inches (millimeters) unless otherwise noted




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

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




NOTES:

A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.

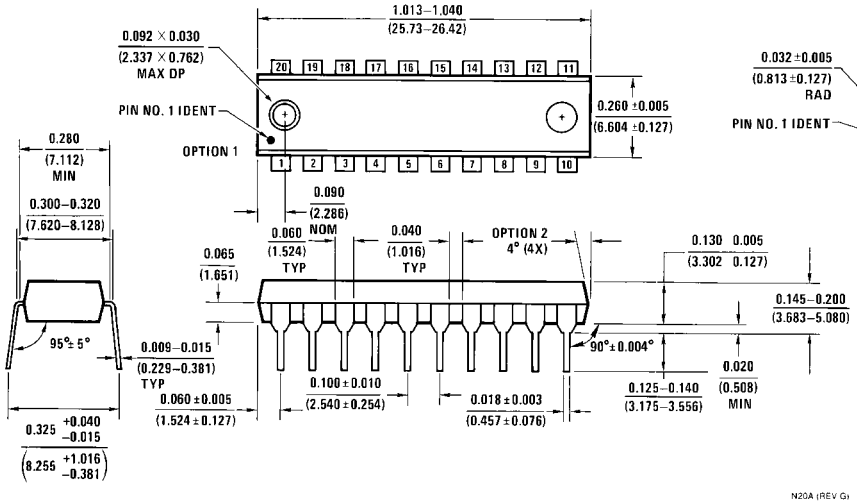
B. DIMENSIONS ARE IN MILLIMETERS.

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

M20DRevB1

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

## 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**