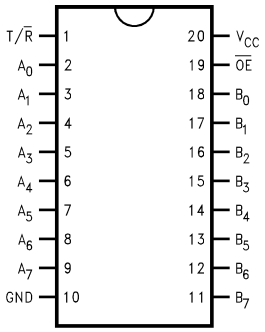
## Connection Diagram

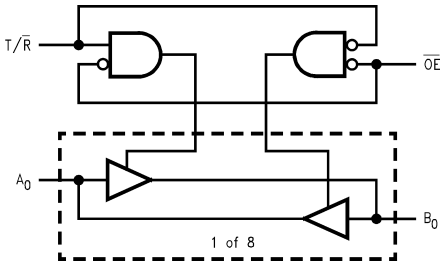



## Truth Table

| Inputs | | Outputs |
|---|---|---|
| $\overline{OE}$ | T/$\overline{R}$ | |
| L | L | Bus $B_0$–$B_7$ Data to Bus $A_0$–$A_7$ |
| L | H | Bus $A_0$–$A_7$ Data to Bus $B_0$–$B_7$ |
| H | X | HIGH Z State on $A_0$–$A_7$, $B_0$–$B_7$ |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

## Logic Diagram



## Absolute Maximum Ratings (Note 1)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5V to +4.6V |
| DC Input Voltage ($V_I$) | −0.5V to +4.6V |
| DC Output Voltage ($V_O$) | |
| Outputs 3-STATE | −0.5V to +4.6V |
| Outputs Active (Note 2) | −0.5V to $V_{CC}$ + 0.5V |
| DC Input Diode Current ($I_{IK}$) $V_I$ < 0V | −50 mA |
| DC Output Diode Current ($I_{OK}$) | |
| $V_O$ < 0V | −50 mA |
| $V_O$ > $V_{CC}$ | +50 mA |
| DC Output Source/Sink Current ($I_{OH}/I_{OL}$) | ±50 mA |
| DC $V_{CC}$ or Ground Current | ±100 mA |
| Storage Temperature ($T_{STG}$) | −65°C to +150°C |

## Recommended Operating Conditions (Note 3)

| | |
|---|---|
| Power Supply | |
| Operating | 1.2V to 3.6V |
| Input Voltage | −0.3V to 3.6V |
| Output Voltage ($V_O$) | |
| Output in Active States | 0V to $V_{CC}$ |
| Output in 3-STATE | 0V to 3.6V |
| Output Current in $I_{OH}/I_{OL}$ | |
| $V_{CC}$ = 3.0V to 3.6V | ±24 mA |
| $V_{CC}$ = 2.3V to 2.7V | ±18 mA |
| $V_{CC}$ = 1.65V to 2.3V | ±6 mA |
| $V_{CC}$ = 1.4V to 1.65V | ±2 mA |
| $V_{CC}$ = 1.2V | ±100 μA |
| Free Air Operating Temperature ($T_A$) | −40°C to +85°C |
| Minimum Input Edge Rate ($\Delta t/\Delta V$) | |
| $V_{IN}$ = 0.8V to 2.0V, $V_{CC}$ = 3.0V | 10 ns/V |

**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.

**Note 2:** $I_O$ Absolute Maximum Rating must be observed.

**Note 3:** Floating or unused control inputs must be held HIGH or LOW.

## DC Electrical Characteristics

| Symbol | Parameter | Conditions | $V_{CC}$ (V) | Min | Max | Units |
|---|---|---|---|---|---|---|
| $V_{IH}$ | HIGH Level Input Voltage | | 2.7 - 3.6 | 2.0 | | |
| | | | 2.3 - 2.7 | 1.6 | | |
| | | | 1.65 - 2.3 | 0.65 x $V_{CC}$ | | V |
| | | | 1.4 - 1.6 | 0.65 x $V_{CC}$ | | |
| | | | 1.2 | 0.65 x $V_{CC}$ | | |
| $V_{IL}$ | LOW Level Input Voltage | | 2.7 - 3.6 | | 0.8 | |
| | | | 2.3 - 2.7 | | 0.7 | |
| | | | 1.65 - 2.3 | | 0.35 x $V_{CC}$ | V |
| | | | 1.4 - 1.6 | | 0.35 x $V_{CC}$ | |
| | | | 1.2 | | 0.05 x $V_{CC}$ | |
| $V_{OH}$ | HIGH Level Output Voltage | $I_{OH}$ = −100 μA | 2.7 - 3.6 | $V_{CC}$ - 0.2 | | |
| | | $I_{OH}$ = −12 mA | 2.7 | 2.2 | | |
| | | $I_{OH}$ = −18 mA | 3.0 | 2.4 | | |
| | | $I_{OH}$ = −24 mA | 3.0 | 2.2 | | |
| | | $I_{OH}$ = −100 μA | 2.3 - 2.7 | $V_{CC}$ - 0.2 | | |
| | | $I_{OH}$ = −6 mA | 2.3 | 2.0 | | |
| | | $I_{OH}$ = −12 mA | 2.3 | 1.8 | | V |
| | | $I_{OH}$ = −18 mA | 2.3 | 1.7 | | |
| | | $I_{OH}$ = −100 μA | 1.65 - 2.3 | $V_{CC}$ - 0.2 | | |
| | | $I_{OH}$ = −6 mA | 1.65 | 1.25 | | |
| | | $I_{OH}$ = −100 μA | 1.4 - 1.6 | $V_{CC}$ - 0.2 | | |
| | | $I_{OH}$ = −2 mA | 1.4 | 1.05 | | |
| | | $I_{OH}$ = −100 μA | 1.2 | $V_{CC}$ - 0.2 | | |

## DC Electrical Characteristics (Continued)

| Symbol | Parameter | Conditions | $V_{CC}$ (V) | Min | Max | Units |
|---|---|---|---|---|---|---|
| $V_{OL}$ | LOW Level Output Voltage | $I_{OL}$ = 100 μA | 2.7 - 3.6 | | 0.2 | V |
| | | $I_{OL}$ = 12 mA | 2.7 | | 0.4 | |
| | | $I_{OL}$ = 18 mA | 3.0 | | 0.4 | |
| | | $I_{OL}$ = 24 mA | 3.0 | | 0.55 | |
| | | $I_{OL}$ = 100 μA | 2.3 - 2.7 | | 0.2 | |
| | | $I_{OL}$ = 12 mA | 2.3 | | 0.4 | |
| | | $I_{OL}$ = 18 mA | 2.3 | | 0.6 | |
| | | $I_{OL}$ = 100 μA | 1.65 - 2.3 | | 0.2 | |
| | | $I_{OL}$ = 6 mA | 1.65 | | 0.3 | |
| | | $I_{OL}$ = 100 μA | 1.4 - 1.6 | | 0.2 | |
| | | $I_{OL}$ = 2 mA | 1.4 | | 0.35 | |
| | | $I_{OL}$ = 100 μA | 1.2 | | 0.05 | |
| $I_I$ | Input Leakage Current | $V_{IN}$ = $V_{CC}$ or GND | 1.2 - 3.6 | | ±5.0 | μA |
| $I_{I(HOLD)}$ | Bushold Input Minimum Drive Hold Current | $V_{IN}$ = 0.8V | 3.0 | 75.0 | | μA |
| | | $V_{IN}$ = 2.0V | 3.0 | −75.0 | | |
| | | $V_{IN}$ = 0.7V | 2.3 | 45.0 | | |
| | | $V_{IN}$ = 1.6V | 2.3 | −45.0 | | |
| | | $V_{IN}$ = 0.57V | 1.65 | 25.0 | | |
| | | $V_{IN}$ = 1.07V | 1.65 | −25.0 | | |
| $I_{I(OD)}$ | Bushold Input Over-Drive Current to Change State | (Note 4) | 3.6 | 450 | | μA |
| | | (Note 5) | 3.6 | −450 | | |
| | | (Note 4) | 2.7 | 300 | | |
| | | (Note 5) | 2.7 | −300 | | |
| | | (Note 4) | 1.95 | 200 | | |
| | | (Note 5) | 1.95 | −200 | | |
| $I_{OZ}$ | 3-STATE Output Leakage | $V_O$ = $V_{CC}$ or GND<br>$V_I$ = $V_{IH}$ or $V_{IL}$ | 1.2 - 3.6 | | ±10.0 | μA |
| $I_{CC}$ | Quiescent Supply Current | $V_I$ = $V_{CC}$ or GND | 1.2 - 3.6 | | 20.0 | μA |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input | $V_{IH}$ = $V_{CC}$ − 0.6V | 2.7 - 3.6 | | 750 | μA |

**Note 4:** An external driver must source at least the specified current to switch from LOW-to-HIGH.

**Note 5:** An external driver must sink at least the specified current to switch from HIGH-to-LOW.

## AC Electrical Characteristics (Note 6)

| Symbol | Parameter | Conditions | $V_{CC}$ (V) | $T_A = -40°C$ to $+85°C$ | | Units | Figure Number |
|---|---|---|---|---|---|---|---|
| | | | | Min | Max | | |
| $t_{PHL}$, $t_{PLH}$ | Propagation Delay $A_n$ to $B_n$ or $B_n$ to $A_n$ | $C_L = 30$ pF, $R_L = 500\Omega$ | $3.3 \pm 0.3$ | 0.6 | 3.5 | ns | Figures 1, 2 |
| | | | $2.5 \pm 0.2$ | 0.8 | 4.2 | | |
| | | | $1.8 \pm 0.15$ | 1.5 | 8.4 | | |
| | | $C_L = 15$ pF, $R_L = 2k\Omega$ | $1.5 \pm 0.1$ | 1.0 | 16.8 | | Figures 5, 6 |
| | | | 1.2 | | 42.0 | | |
| $t_{PZL}$, $t_{PZH}$ | Output Enable Time | $C_L = 30$ pF, $R_L = 500\Omega$ | $3.3 \pm 0.3$ | 0.6 | 4.5 | ns | Figures 1, 3, 4 |
| | | | $2.5 \pm 0.2$ | 0.8 | 5.6 | | |
| | | | $1.8 \pm 0.15$ | 1.5 | 9.8 | | |
| | | $C_L = 15$ pF, $R_L = 2k\Omega$ | $1.5 \pm 0.1$ | 1.0 | 19.6 | | Figures 5, 7, 8 |
| | | | 1.2 | | 49.0 | | |
| $t_{PLZ}$, $t_{PHZ}$ | Output Disable Time | $C_L = 30$ pF, $R_L = 500\Omega$ | $3.3 \pm 0.3$ | 0.6 | 3.6 | ns | Figures 1, 3, 4 |
| | | | $2.5 \pm 0.2$ | 0.8 | 4.0 | | |
| | | | $1.8 \pm 0.15$ | 1.5 | 7.2 | | |
| | | $C_L = 15$ pF, $R_L = 2k\Omega$ | $1.5 \pm 0.1$ | 1.0 | 14.4 | | Figures 5, 7, 8 |
| | | | 1.2 | | 36.0 | | |
| $t_{OSHL}$ $t_{OSLH}$ | Output to Output Skew (Note 7) | $C_L = 30$ pF, $R_L = 500\Omega$ | $3.3 \pm 0.3$ | | 0.5 | ns | |
| | | | $2.5 \pm 0.2$ | | 0.5 | | |
| | | | $1.8 \pm 0.15$ | | 0.75 | | |
| | | $C_L = 15$ pF, $R_L = 2k\Omega$ | $1.5 \pm 0.1$ | | 1.5 | | |
| | | | 1.2 | | 1.5 | | |

**Note 6:** For $C_L = 50$ pF, add approximately 300 ps to the AC maximum specification.

**Note 7:** Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ($t_{OSHL}$) or LOW-to-HIGH ($t_{OSLH}$).

## Dynamic Switching Characteristics

| Symbol | Parameter | Conditions | $V_{CC}$ (V) | $T_A = 25°C$ Typical | Units |
|---|---|---|---|---|---|
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ | $C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$ | 1.8 | 0.3 | V |
| | | | 2.5 | 0.7 | |
| | | | 3.3 | 1.0 | |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ | $C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$ | 1.8 | –0.3 | V |
| | | | 2.5 | –0.7 | |
| | | | 3.3 | –1.0 | |
| $V_{OHV}$ | Quiet Output Dynamic Valley $V_{OH}$ | $C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$ | 1.8 | 1.3 | V |
| | | | 2.5 | 1.7 | |
| | | | 3.3 | 2.0 | |

## Capacitance

| Symbol | Parameter | Conditions | $T_A = +25°C$ Typical | Units |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_I = 0V$ or $V_{CC}$, $V_{CC} = 1.8V$, 2.5V or 3.3V | 6 | pF |
| $C_{I/O}$ | Input/Output Capacitance | $V_I = 0V$ or $V_{CC}$, $V_{CC} = 1.8V$, 2.5V or 3.3V | 7 | pF |
| $C_{PD}$ | Power Dissipation Capacitance | $V_I = 0V$ or $V_{CC}$, f = 10 MHz, $V_{CC} = 1.8V$, 2.5V or 3.3V | 20 | pF |

## AC Loading and Waveforms ($V_{CC}$ 3.3V ± 0.3V to 1.8V ± 0.5V)

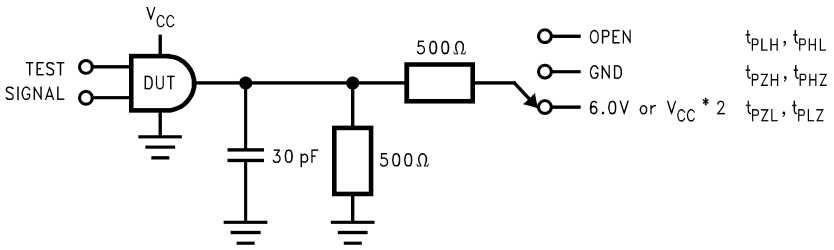



**FIGURE 1. AC Test Circuit**

| TEST | SWITCH |
|---|---|
| $t_{PLH}$, $t_{PHL}$ | Open |
| $t_{PZL}$, $t_{PLZ}$ | 6V at $V_{CC}$ = 3.3 ± 0.3V;<br>$V_{CC}$ x 2 at $V_{CC}$ = 2.5V ± 0.2V; 1.8V ± 0.15V |
| $t_{PZH}$, $t_{PHZ}$ | GND |

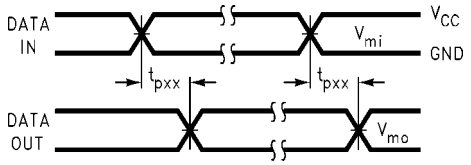



**FIGURE 2. Waveform for Inverting and Non-inverting Functions**

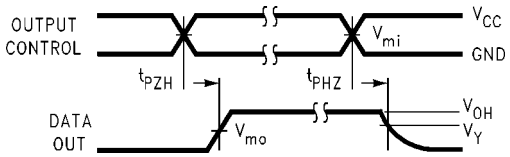



**FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic**

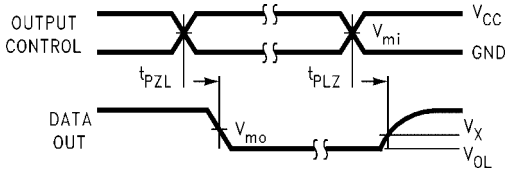



**FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic**

| Symbol | $V_{CC}$ | | |
|---|---|---|---|
| | 3.3V ± 0.3V | 2.5V ± 0.2V | 1.8V ± 0.15V |
| $V_{mi}$ | 1.5V | $V_{CC}$/2 | $V_{CC}$/2 |
| $V_{mo}$ | 1.5V | $V_{CC}$/2 | $V_{CC}$/2 |
| $V_x$ | $V_{OL}$ + 0.3V | $V_{OL}$ + 0.15V | $V_{OL}$ + 0.15V |
| $V_y$ | $V_{OH}$ − 0.3V | $V_{OH}$ − 0.15V | $V_{OH}$ − 0.15V |

## AC Loading and Waveforms ($V_{CC}$ 1.5V ± 0.1V to 1.2V)

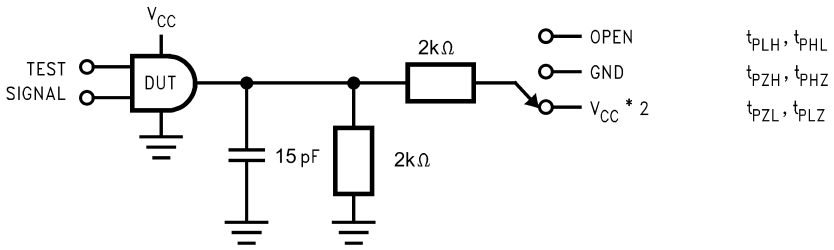



**FIGURE 5. AC Test Circuit**

| TEST | SWITCH |
|---|---|
| $t_{PLH}$, $t_{PHL}$ | Open |
| $t_{PZL}$, $t_{PLZ}$ | $V_{CC}$ x 2 at $V_{CC}$ = 1.5 ± 0.1V |
| $t_{PZH}$, $t_{PHZ}$ | GND |

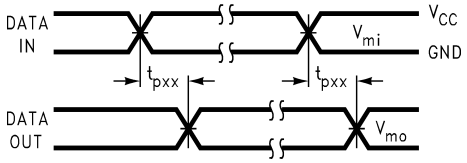



**FIGURE 6. Waveform for Inverting and Non-Inverting Functions**

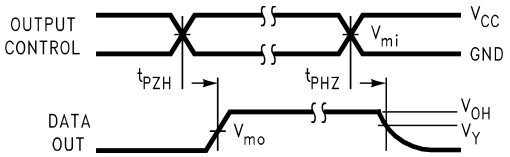



**FIGURE 7. 3-STATE Output High Enable and Disable Times for Low voltage Logic**

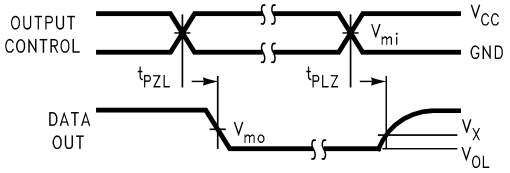
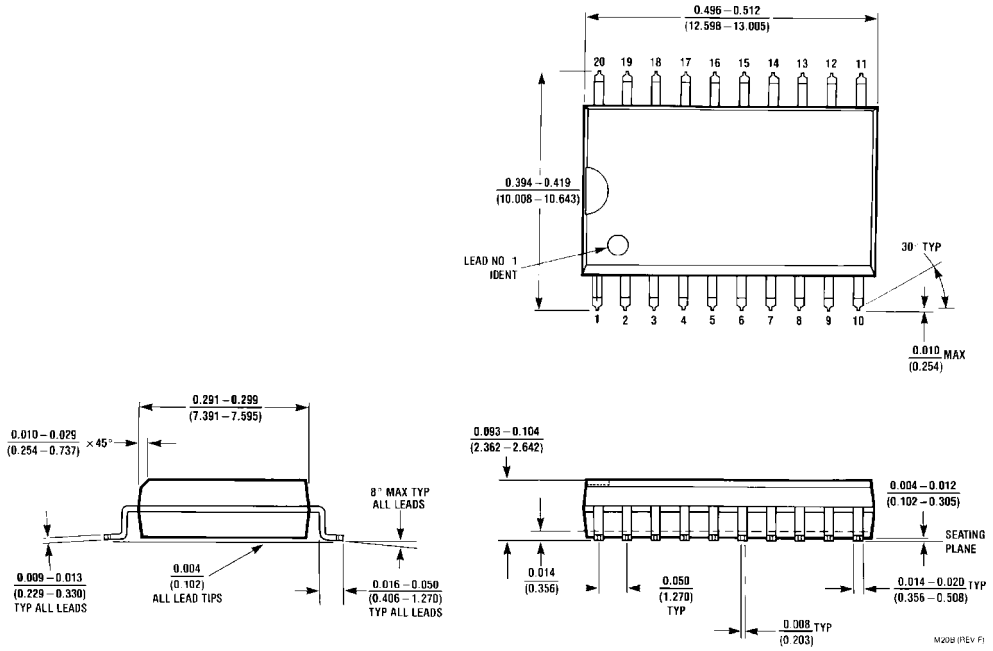



**FIGURE 8. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic**

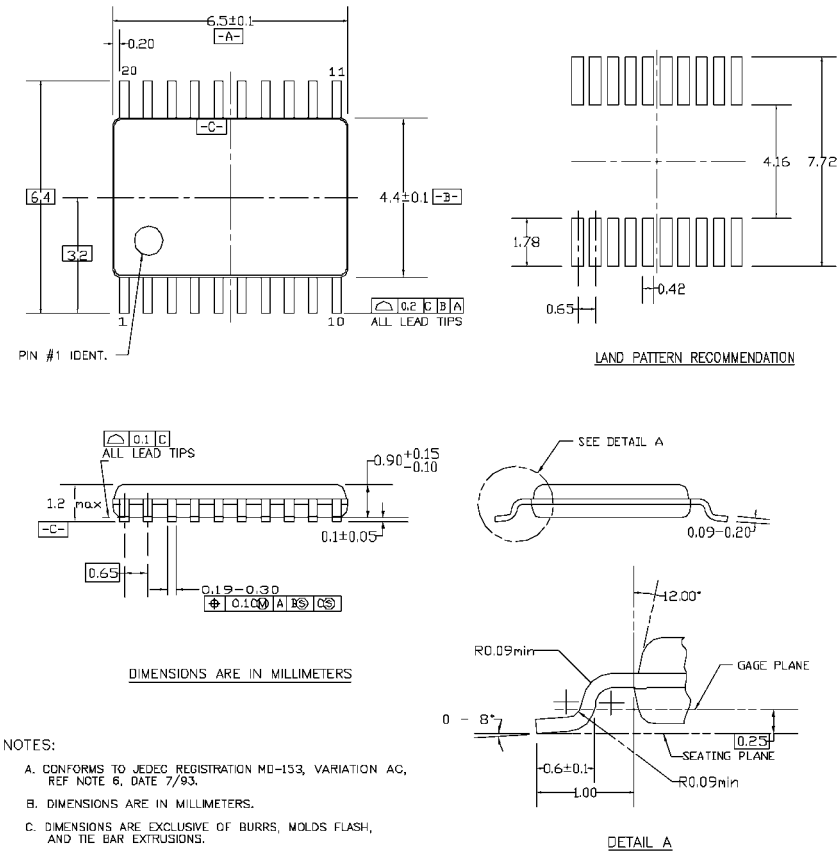
| Symbol | $V_{CC}$ |
|---|---|
| | **1.5V ± 0.1V** |
| $V_{mi}$ | $V_{CC}/2$ |
| $V_{mo}$ | $V_{CC}/2$ |
| $V_X$ | $V_{OL}$ + 0.1V |
| $V_Y$ | $V_{OH}$ – 0.1V |

## Physical Dimensions inches (millimeters) unless otherwise noted




**20-Lead Small Outline Integrated Circuit, JEDEC MS-013, 0.300" Wide Body**
**Package Number M20B**

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




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.

MTC20REVD1

**20-Lead Thin Shrink Small Outline Package, JEDEC MO-153, 4.4mm Wide**
**Package Number MTC20**



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