

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

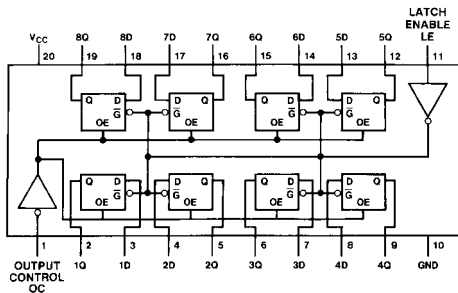
- TTL input characteristic compatible
- Typical propagation delay: 20 ns
- Low input current: 1 μ A maximum
- Low quiescent current: 80 μ A maximum
- Compatible with bus-oriented systems
- Output drive capability: 15 LS-TTL loads

Ordering Code:

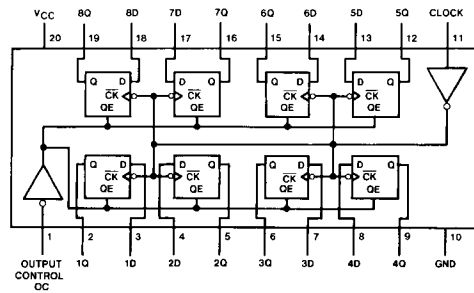
| Order Number | Package Number | Package Descriptions |
|---------------|----------------|---|
| MM74HCT373WWM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| MM74HCT373SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HCT373MTC | 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 |
| MM74HCT374WWM | M20B | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| MM74HCT374SJ | M20D | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HCT374MTC | MTC20 | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT374N | 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.

Connection Diagrams



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 |

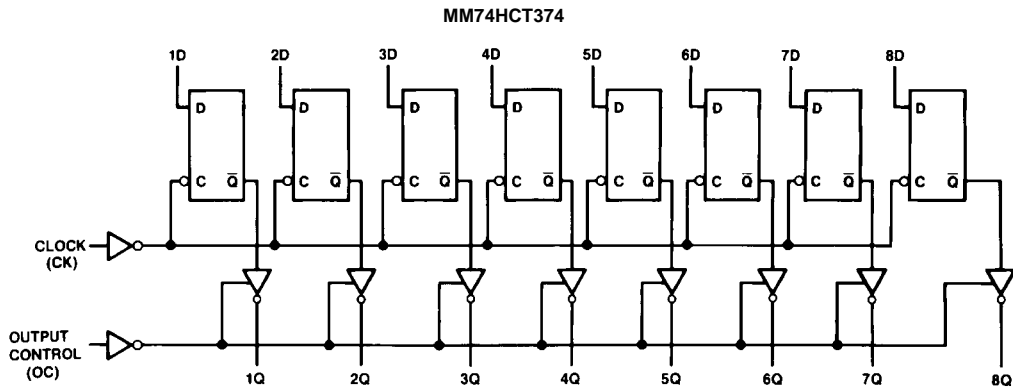
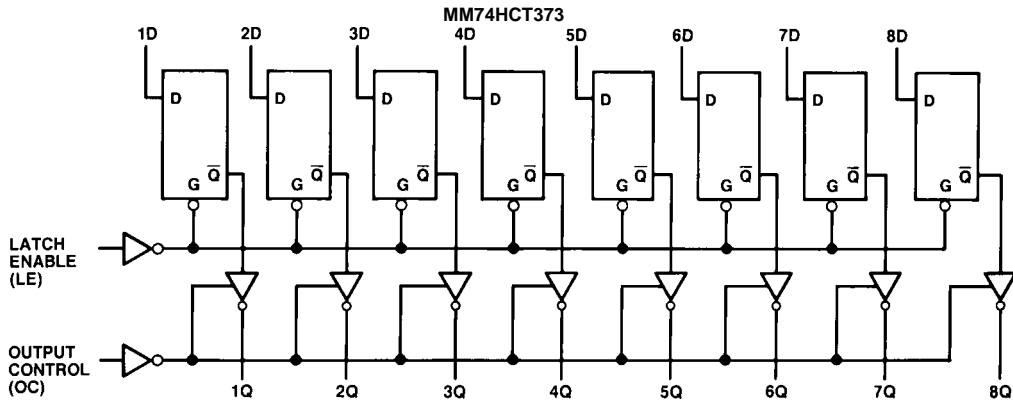
H = HIGH Level
 L = LOW Level
 Q₀ = Level of output before steady-state input conditions were established.
 Z = High Impedance

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
 Q₀ = The level of the output before steady state input conditions were established.

Logic Diagrams



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** $V_{CC} = 5V \pm 10\%$ (unless otherwise specified)

| Symbol | Parameter | Conditions | $T_A = 25^\circ\text{C}$ | | $T_A = -40$ 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} | V_{CC} | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | V |
| | | $ I_{OUT} = 20 \mu\text{A}$ | 4.2 | 3.98 | 3.84 | 3.7 | V |
| | | $ I_{OUT} = 6.0 \text{ mA}, V_{CC} = 4.5V$ $ I_{OUT} = 7.2 \text{ 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} | 0 | 0.1 | 0.1 | 0.1 | V |
| | | $ I_{OUT} = 20 \mu\text{A}$ | 0.2 | 0.26 | 0.33 | 0.4 | V |
| | | $ I_{OUT} = 6.0 \text{ mA}, V_{CC} = 4.5V$ $ I_{OUT} = 7.2 \text{ 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 V_{IL} | | ± 0.5 | ± 5.0 | ± 10 | μA |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu\text{A}$ | | 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: $V_{CC} = 5.0V$, $t_r = t_f = 6 \text{ ns}$, $T_A = 25^\circ\text{C}$ (unless otherwise specified) | | | | | |
| Symbol | Parameter | Conditions | Typ | Guaranteed Limit | Units |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay Data to Output | $C_L = 45 \text{ pF}$ | 18 | 25 | ns |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay Latch Enable to Output | $C_L = 45 \text{ pF}$ | 21 | 30 | ns |
| t_{PZH} , t_{PZL} | Maximum Enable Propagation Delay Control to Output | $C_L = 45 \text{ pF}$ $R_L = 1 \text{ k}\Omega$ | 20 | 28 | ns |
| t_{PHZ} , t_{PLZ} | Maximum Disable Propagation Delay Control to Output | $C_L = 5 \text{ pF}$ $R_L = 1 \text{ k}\Omega$ | 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: $V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6 \text{ ns}$ (unless otherwise specified) | | | | | | | |
| Symbol | Parameter | Conditions | $T_A = 25^\circ\text{C}$ | | | Units | |
| | | | Typ | Guaranteed Limits | | | |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay Data to Output | $C_L = 50 \text{ pF}$ | 22 | 30 | 37 | 45 | ns |
| | | $C_L = 150 \text{ pF}$ | 30 | 40 | 50 | 60 | ns |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay Latch Enable to Output | $C_L = 50 \text{ pF}$ | 25 | 35 | 44 | 53 | ns |
| | | $C_L = 150 \text{ pF}$ | 32 | 45 | 56 | 68 | ns |
| t_{PZH} , t_{PZL} | Maximum Enable Propagation Delay Control to Output | $C_L = 50 \text{ pF}$ | 21 | 30 | 37 | 45 | ns |
| | | $C_L = 150 \text{ pF}$ $R_L = 1 \text{ k}\Omega$ | 30 | 40 | 50 | 60 | ns |
| t_{PHZ} , t_{PLZ} | Maximum Disable Propagation Delay Control to Output | $C_L = 50 \text{ pF}$ $R_L = 1 \text{ k}\Omega$ | 21 | 30 | 37 | 45 | ns |
| t_{THL} , t_{TLH} | Maximum Output Rise and Fall Time | $C_L = 50 \text{ pF}$ | 8 | 12 | 15 | 18 | ns |
| 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 (Note 5) | $OC = V_{CC}$ | | 5 | | | pF |
| | | $OC = GND$ | | 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: $V_{CC} = 5.0V$, $t_r = t_f = 6\text{ ns}$, $T_A = 25^\circ\text{C}$ (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 | $C_L = 45\text{ pF}$ | 20 | 32 | ns |
| t_{PZH} , t_{PZL} | Maximum Enable Propagation Delay Control to Output | $C_L = 45\text{ pF}$ $R_L = 1\text{ k}\Omega$ | 19 | 28 | ns |
| t_{PHZ} , t_{PLZ} | Maximum Disable Propagation Delay Control to Output | $C_L = 5\text{ pF}$ $R_L = 1\text{ k}\Omega$ | 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 |

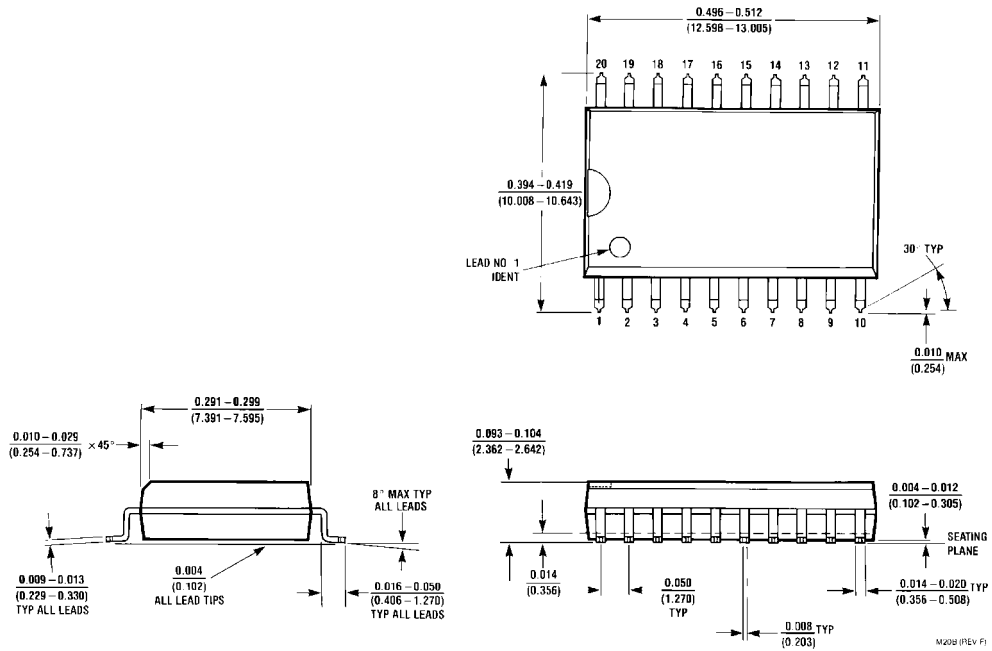
AC Electrical Characteristics

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

| Symbol | Parameter | Conditions | $T_A = 25^\circ\text{C}$ | | $T_A = -40\text{ to }85^\circ\text{C}$ | $T_A = -55\text{ to }125^\circ\text{C}$ | Units |
|-----------------------|---|---|--------------------------|-------------------|--|---|-------|
| | | | Typ | Guaranteed Limits | | | |
| f_{MAX} | Maximum Clock Frequency | | | 30 | 24 | 20 | MHz |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay to Output | $C_L = 50\text{ pF}$ | 22 | 36 | 45 | 48 | ns |
| | | $C_L = 150\text{ pF}$ | 30 | 46 | 57 | 69 | ns |
| t_{PZH} , t_{PZL} | Maximum Enable Propagation Delay Control to Output | $C_L = 50\text{ pF}$ | 21 | 30 | 37 | 45 | ns |
| | | $C_L = 150\text{ pF}$ $R_L = 1\text{ k}\Omega$ | 30 | 40 | 50 | 60 | ns |
| t_{PHZ} , t_{PLZ} | Maximum Disable Propagation Delay Control to Output | $C_L = 50\text{ pF}$ $R_L = 1\text{ k}\Omega$ | 21 | 30 | 37 | 45 | ns |
| t_{THL} , t_{TLH} | Maximum Output Rise and Fall Time | $C_L = 50\text{ pF}$ | 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 (Note 6) | $OC = V_{CC}$ | | 5 | | | pF |
| | | $OC = GND$ | | 58 | | | pF |

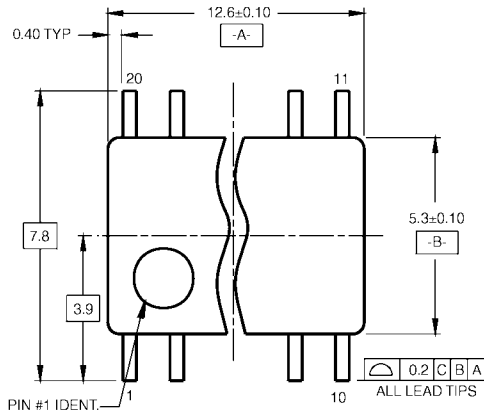
Note 6: C_{PD} determines the no load power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted



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

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



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

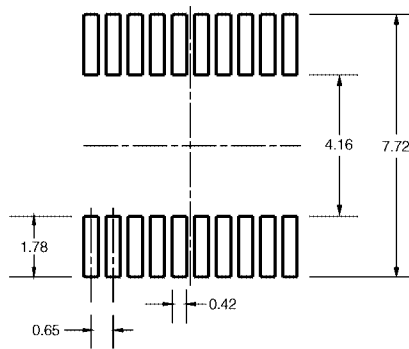
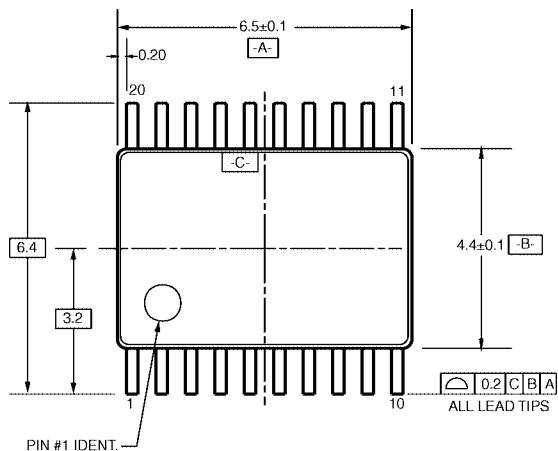
NOTES:

- 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.

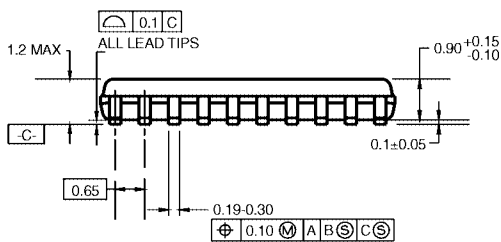
M20DRevB1

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

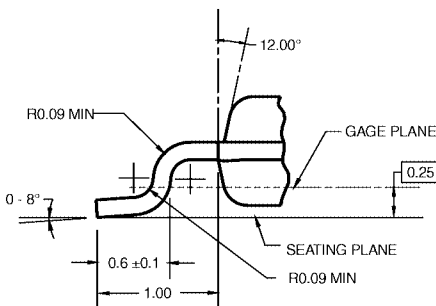
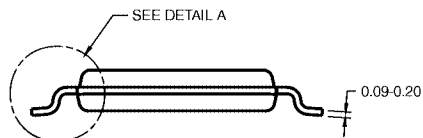
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



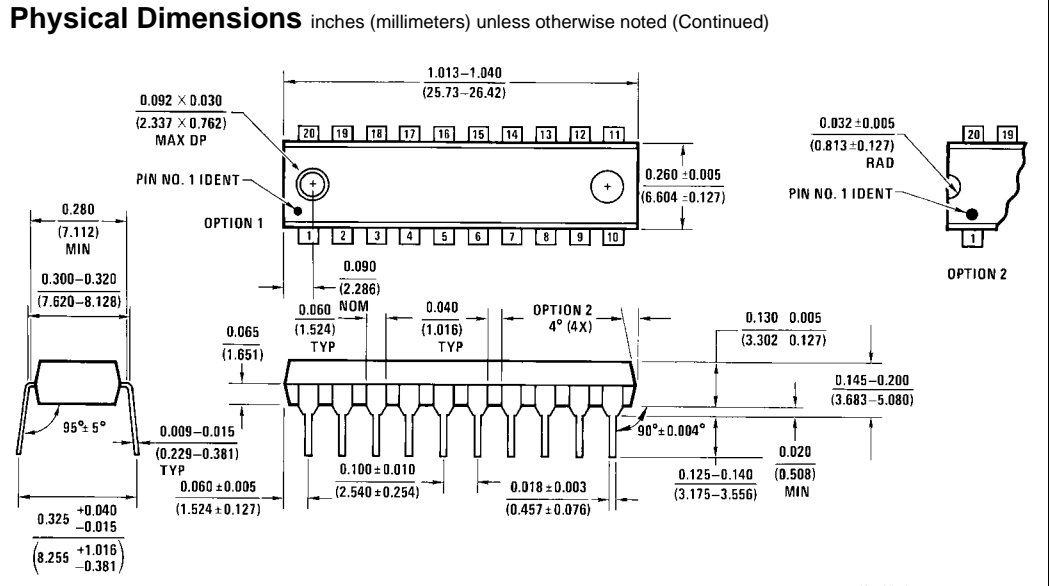
DETAIL A

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, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20RevD1

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



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N20A

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