FAIRCHILD SEMICONDUCTOR™

January 1993
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74ABT377
Octal D-Type Flip-Flop with Clock Enable

General Description

The ABT377 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously when the Clock Enable ($\overline{CE}$) is LOW.

The register is fully edge-triggered. The state of each D input, one setup time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's Q output. The $\overline{CE}$ input must be stable only one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

Features

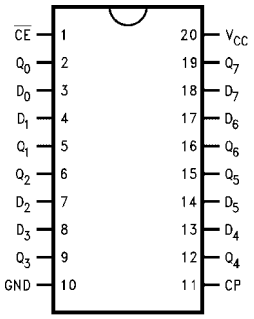
- Clock enable for address and data synchronization applications
- Eight edge-triggered D-type flip-flops
- Buffered common clock
- See ABT273 for master reset version
- See ABT373 for transparent latch version
- See ABT374 for 3-STATE version
- Output sink capability of 64 mA, source capability of 32 mA
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability
- Disable time less than enable time to avoid bus contention

Ordering Code:

Order Number	Package Number	Package Description
74ABT377CSC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Body
74ABT377CSJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ABT377CMSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
74ABT377CMTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Pin Descriptions

Pin Names	Descriptions
D_0–D_7	Data Inputs
$\overline{CE}$	Clock Enable (Active LOW)
CP	Clock Pulse Input
Q_0–Q_7	Data Outputs

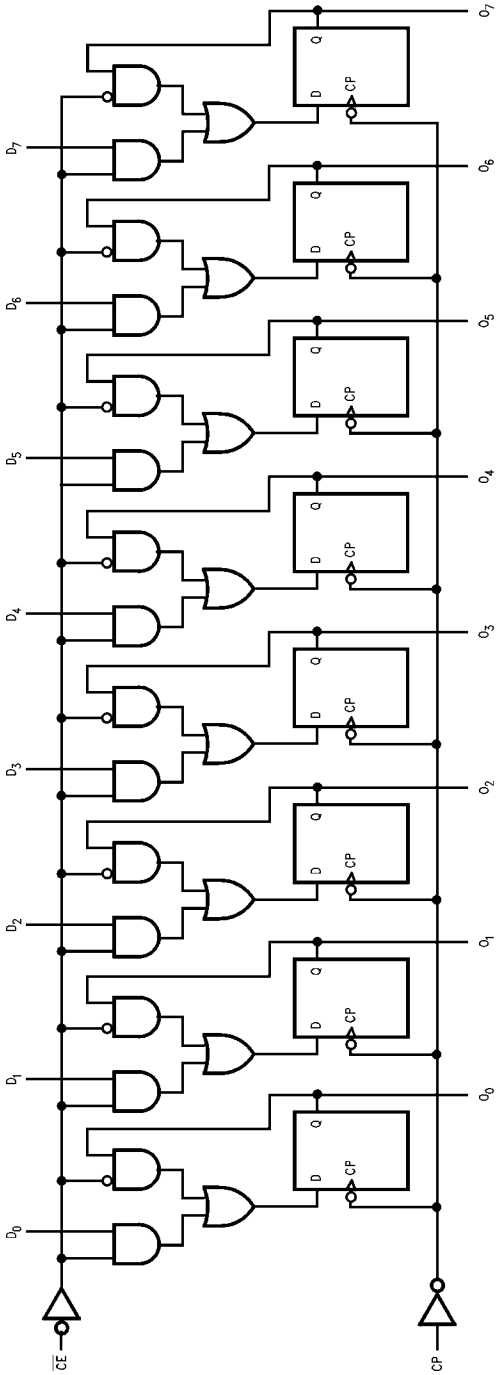
Truth Table

Operating Mode	Inputs			Output
	CP	$\overline{CE}$	D_n	Q_n
Load "1"	⌐	l	h	H
Load "0"	⌐	l	l	L
Hold	⌐	h	X	No Change
(Do Nothing)	X	H	X	No Change

H = HIGH Voltage Level L = LOW Voltage Level
X = Immaterial ⌐ = LOW-to-HIGH Clock Transition
h = HIGH Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
l = LOW Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition

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Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +150°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Any Output	
in the Disabled or	
Power-OFF State	−0.5V to +4.75V
in the HIGH State	−0.5V to V_{CC}
Current Applied to Output	
in LOW State (Max)	Twice the rated I_{OL} (mA)
DC Latchup Source Current	−500 mA
(Across Comm Operating Range)	
Over Voltage Latchup	V_{CC} + 4.5V

Recommended Operating Conditions

Free Air Ambient Temperature	−40°C to +85°C
Supply Voltage	+4.5V to +5.5V
Minimum Input Edge Rate (ΔV/Δt)	
Data Input	50 mV/ns
Enable Input	20 mV/ns

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs

DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage	2.0			V		Recognized HIGH Signal
V_{IL}	Input LOW Voltage			0.8	V		Recognized LOW Signal
V_{CD}	Input Clamp Diode Voltage			−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	2.5 2.0			V	Min	I_{OH} = −3 mA I_{OH} = −32 mA
V_{OL}	Output LOW Voltage			0.55	V	Min	I_{OL} = 64 mA
I_{IH}	Input HIGH Current			1 1	μA	Max	V_{IN} = 2.7V (Note 3) V_{IN} = V_{CC}
I_{BVI}	Input HIGH Current Breakdown Test			7	μA	Max	V_{IN} = 7.0V
I_{IL}	Input LOW Current			−1 −1	μA	Max	V_{IN} = 0.5V (Note 3) V_{IN} = 0.0V
V_{ID}	Input Leakage Test	4.75			V	0.0	I_{ID} = 1.9 μA All Other Pins Grounded
I_{OS}	Output Short-Circuit Current	−100		−275	mA	Max	V_{OUT} = 0.0V
I_{CEX}	Output HIGH Leakage Current			50	μA	Max	V_{OUT} = V_{CC}
I_{CCH}	Power Supply Current			50	μA	Max	All Outputs HIGH
I_{CCL}	Power Supply Current			30	mA	Max	All Outputs LOW
I_{CCT}	Maximum I_{CC}/Input Outputs Enabled			1.5	mA	Max	V_I = V_{CC} − 2.1V Data Input V_I = V_{CC} − 2.1V All Others at V_{CC} or GND
I_{CCD}	Dynamic I_{CC} No Load			0.3	mA/ MHz	Max	Outputs Open (Note 4) One bit Toggling, 50% Duty Cycle

Note 3: Guaranteed but not tested.

Note 4: For 8 bits toggling, I_{CCD} < 0.5 mA/MHz.

AC Electrical Characteristics

(SOIC Package)

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			$T_A = -40°C$ to $+85°C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	150	200		150		MHz
t_{PLH}	Propagation Delay	2.2		6.0	2.2	6.0	ns
t_{PHL}	CP to O_n	2.8		6.8	2.8	6.8	

AC Operating Requirements

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF		$T_A = -40°C$ to $+85°C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units
		Min	Max	Min	Max	
$t_S(H)$	Setup Time, HIGH	2.0		2.0		ns
$t_S(L)$	or LOW D_n to CP	2.0		2.0		
$t_H(H)$	Hold Time, HIGH	1.8		1.8		ns
$t_H(L)$	or LOW D_n to CP	1.8		1.8		
$t_S(H)$	Setup Time, HIGH	3.0		3.0		ns
$t_S(L)$	or LOW $\overline{CE}$ to CP	3.0		3.0		
$t_H(H)$	Hold Time, HIGH	1.0		1.0		ns
$t_H(L)$	or LOW $\overline{CE}$ to CP	1.0		1.0		
$t_W(H)$	Pulse Width, CP,	3.3		3.3		ns
$t_W(L)$	HIGH or LOW	3.3		3.3		

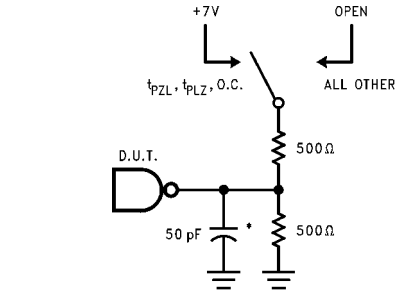
Capacitance

(SOIC Package) (Note 5)

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	5	pF	$V_{CC} = 0V$, $T_A = 25°C$
C_{OUT} (Note 5)	Output Capacitance	9	pF	$V_{CC} = 5.0V$

Note 5: C_{OUT} is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

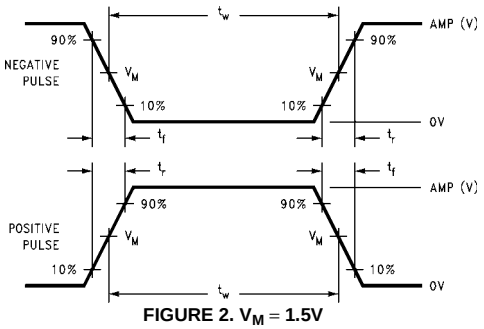


FIGURE 2. V_M = 1.5V

Input Pulse Requirements

Amplitude	Rep. Rate	t_W	t_r	t_f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

AC Waveforms

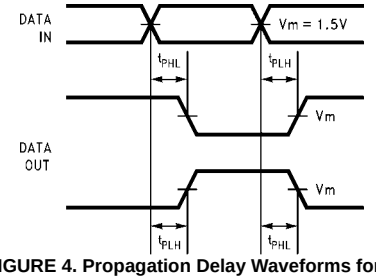


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

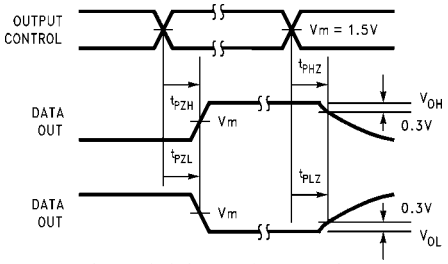


FIGURE 6. 3-STATE Output HIGH and LOW Enable and Disable Times

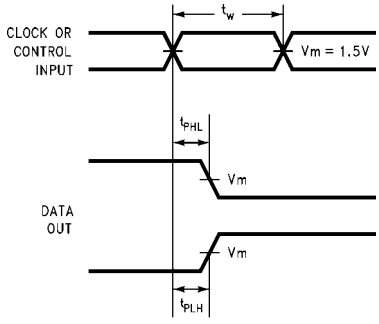


FIGURE 5. Propagation Delay, Pulse Width Waveforms

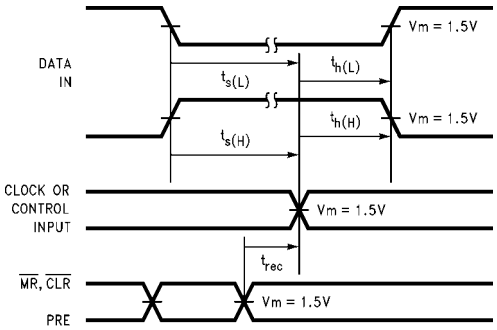
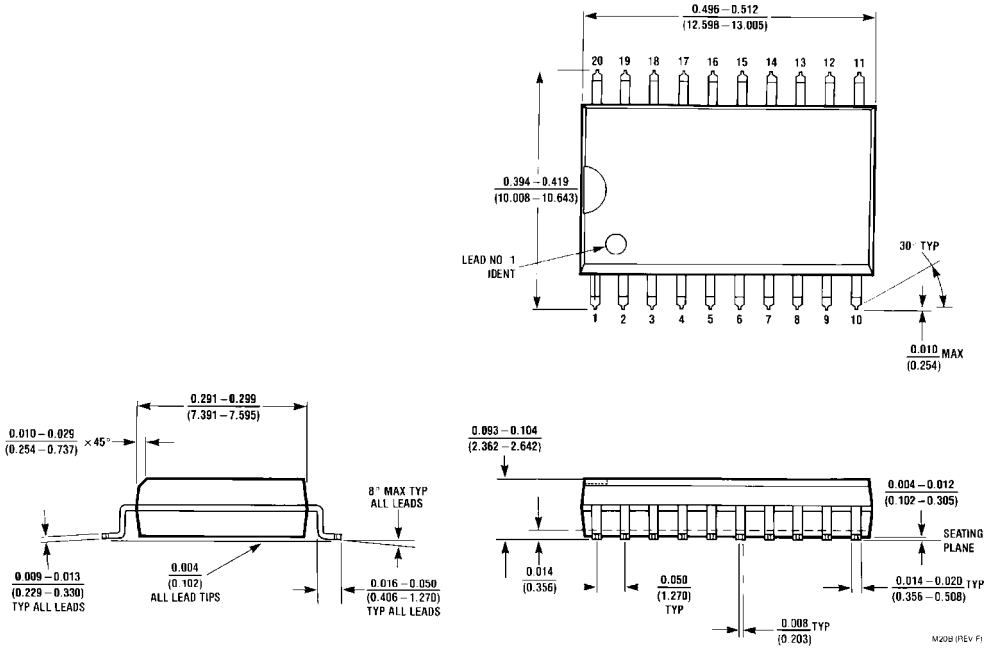


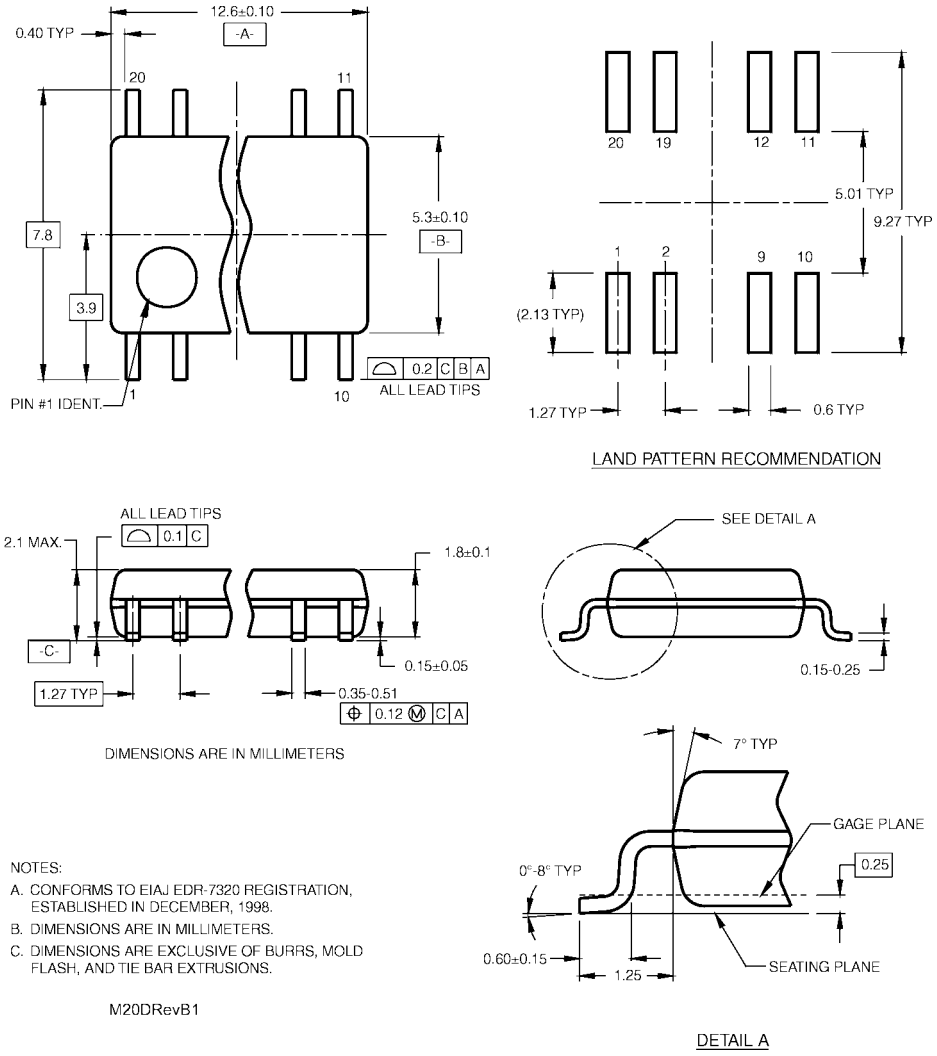
FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

Physical Dimensions inches (millimeters) unless otherwise noted



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

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



NOTES:

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

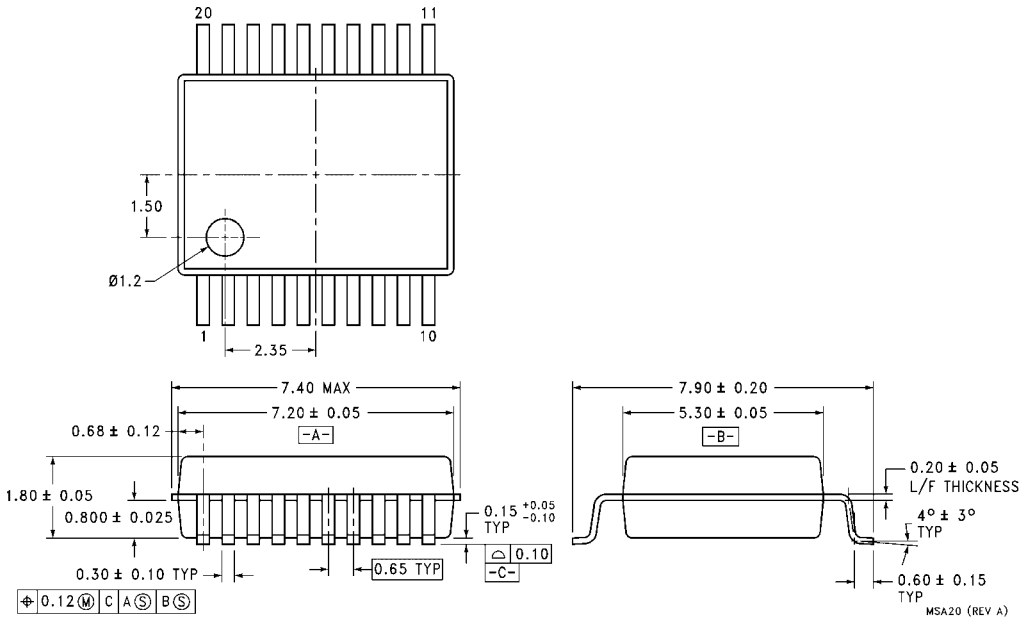
B. DIMENSIONS ARE IN MILLIMETERS.

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

M20DRevB1

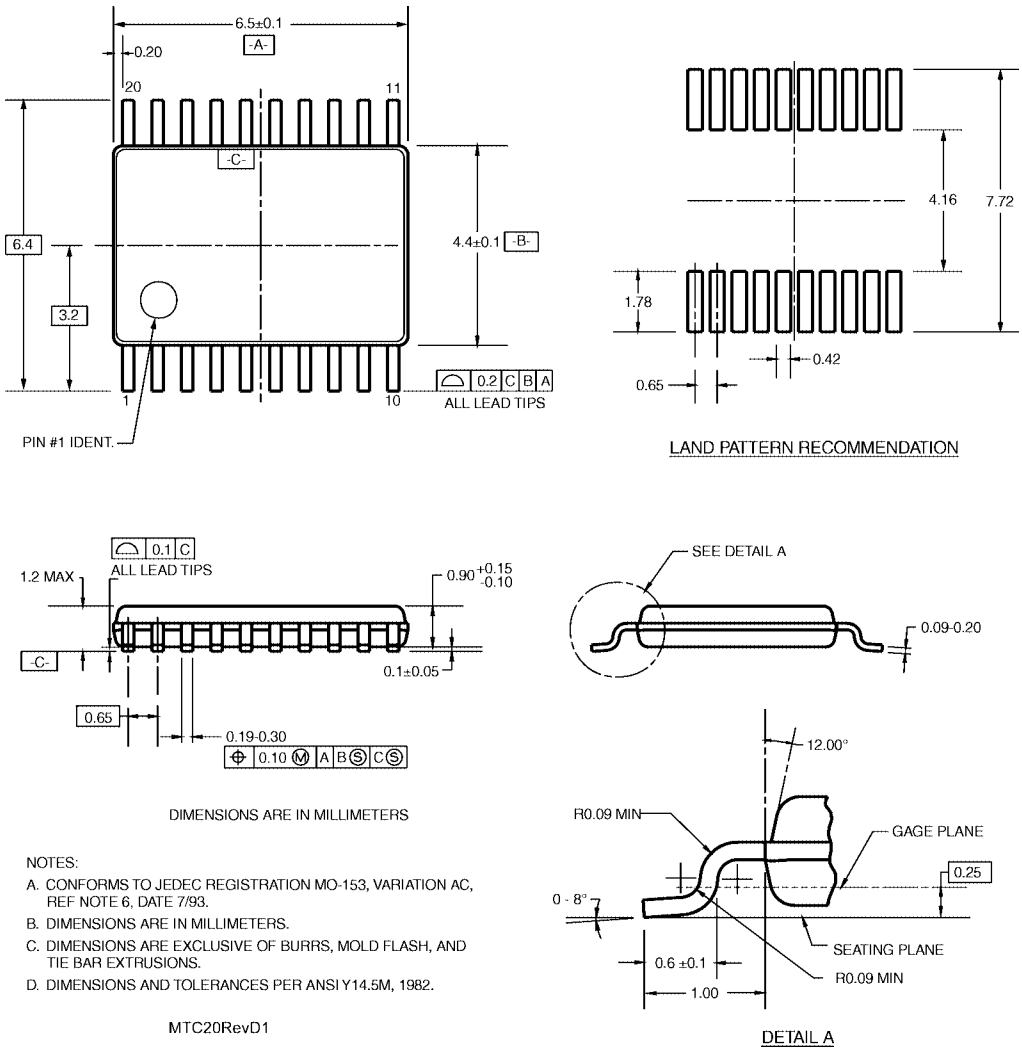
20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D

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



20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
Package Number MSA20

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, 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

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