

74LCX373

Low Voltage Octal Transparent Latch with 5V Tolerant Inputs and Outputs

General Description

The LCX373 consists of eight latches with 3-STATE outputs for bus organized system applications. The device is designed for low voltage (3.3V or 2.5V) V_{CC} applications with capability of interfacing to a 5V signal environment.

The LCX373 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

Features

- 5V tolerant inputs and outputs
- 2.3V–3.6V V_{CC} specifications provided
- 8.0 ns t_{PD} max ($V_{CC} = 3.3V$), 10 μA I_{CC} max
- Power-down high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- ± 24 mA output drive ($V_{CC} = 3.0V$)
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- ESD performance:
 - Human Body Model > 2000V
 - Machine Model > 200V

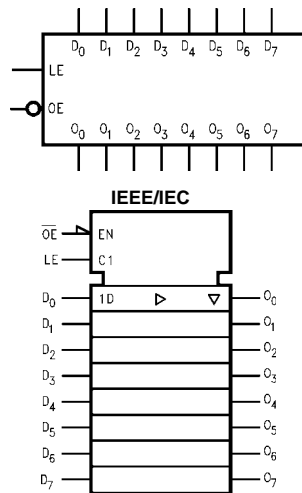
Note 1: To ensure the high-impedance state during power up or down, \overline{OE} should be tied to V_{CC} through a pull-up resistor: the minimum value or the resistor is determined by the current-sourcing capability of the driver.

Ordering Code:

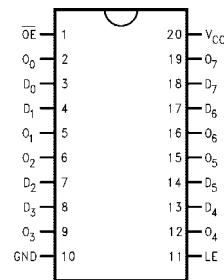
Order Number	Package Number	Package Description
74LCX373WMM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LCX373SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LCX373MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
74LCX373MTC	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 suffix letter "X" to the ordering code.

Logic Symbols



Connection Diagram



Pin Descriptions

Pin Names	Description
D_0 – D_7	Data Inputs
LE	Latch Enable Input
\overline{OE}	Output Enable Input
O_0 – O_7	3-STATE Latch Outputs

Truth Table

Inputs			Outputs
LE	\overline{OE}	D_n	O_n
X	H	X	Z
H	L	L	L
H	L	H	H
L	L	X	O_0

H = HIGH Voltage Level

L = LOW Voltage Level

Z = High Impedance

X = Immaterial

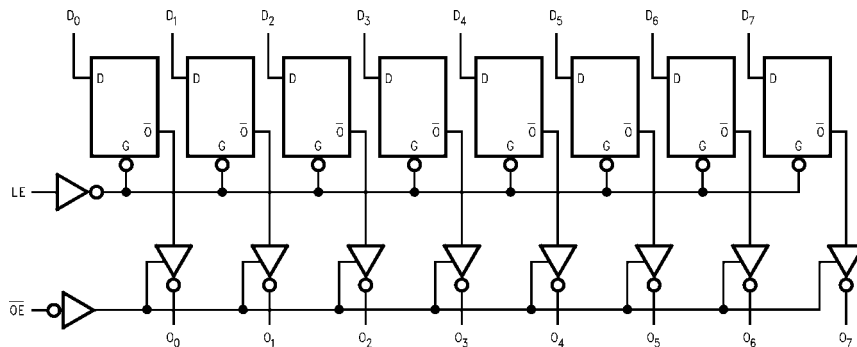
O_0 = Previous O_0 before HIGH-to-LOW transition of Latch Enable

Functional Description

The LCX373 contains eight D-type latches with 3-STATE standard outputs. When the Latch Enable (LE) input is HIGH, data on the D_n inputs enters the latches. In this condition the latches are transparent, i.e. a latch output will change state each time its D input changes. When LE is LOW, the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW tran-

sition of LE. The 3-STATE standard outputs are controlled by the Output Enable (\overline{OE}) input. When \overline{OE} is LOW, the standard outputs are in the 2-state mode. When \overline{OE} is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the latches.

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 2)				
Symbol	Parameter	Value	Conditions	Units
V_{CC}	Supply Voltage	-0.5 to +7.0		V
V_I	DC Input Voltage	-0.5 to +7.0		V
V_O	DC Output Voltage	-0.5 to +7.0 -0.5 to $V_{CC} + 0.5$	Output in 3-STATE Output in HIGH or LOW State (Note 3)	V
I_{IK}	DC Input Diode Current	-50	$V_I < GND$	mA
I_{OK}	DC Output Diode Current	-50 +50	$V_O < GND$ $V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	± 50		mA
I_{CC}	DC Supply Current per Supply Pin	± 100		mA
I_{GND}	DC Ground Current per Ground Pin	± 100		mA
T_{STG}	Storage Temperature	-65 to +150		$^{\circ}C$

Recommended Operating Conditions (Note 4)				
Symbol	Parameter	Min	Max	Units
V_{CC}	Supply Voltage			
		Operating	2.0	3.6
		Data Retention	1.5	3.6
V_I	Input Voltage	0	5.5	V
V_O	Output Voltage			
		HIGH or LOW State	0	V_{CC}
		3-STATE	0	5.5
I_{OH}/I_{OL}	Output Current			
		$V_{CC} = 3.0V - 3.6V$		± 24
		$V_{CC} = 2.7V - 3.0V$		± 12
		$V_{CC} = 2.3V - 2.7V$		± 8
T_A	Free-Air Operating Temperature	-40	85	$^{\circ}C$
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8V - 2.0V$, $V_{CC} = 3.0V$	0	10	ns/V

Note 2: 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 3: I_O Absolute Maximum Rating must be observed.

Note 4: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40^{\circ}C$ to $+85^{\circ}C$		Units
				Min	Max	
V_{IH}	HIGH Level Input Voltage		2.3 - 2.7	1.7		V
			2.7 - 3.6	2.0		
V_{IL}	LOW Level Input Voltage		2.3 - 2.7		0.7	V
			2.7 - 3.6		0.8	
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	2.3 - 3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -8 mA$	2.3	1.8		
		$I_{OH} = -12 mA$	2.7	2.2		
		$I_{OH} = -18 mA$	3.0	2.4		
		$I_{OH} = -24 mA$	3.0	2.2		
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100 \mu A$	2.3 - 3.6		0.2	V
		$I_{OL} = 8 mA$	2.3		0.6	
		$I_{OL} = 12 mA$	2.7		0.4	
		$I_{OL} = 16 mA$	3.0		0.4	
		$I_{OL} = 24 mA$	3.0		0.55	
I_I	Input Leakage Current	$0 \leq V_I \leq 5.5V$	2.3 - 3.6		± 5.0	μA
I_{OZ}	3-STATE Output Leakage	$0 \leq V_O \leq 5.5V$ $V_I = V_{IH}$ or V_{IL}	2.3 - 3.6		± 5.0	μA
I_{OFF}	Power-Off Leakage Current	V_I or $V_O = 5.5V$	0		10	μA

DC Electrical Characteristics (Continued)								
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C		Units		
				Min	Max			
I _{CC}	Quiescent Supply Current	V _I = V _{CC} or GND	2.3 – 3.6		10	μA		
		3.6V ≤ V _I , V _O ≤ 5.5V (Note 5)	2.3 – 3.6		±10			
ΔI _{CC}	Increase in I _{CC} per Input	V _{IH} = V _{CC} - 0.6V	2.3 – 3.6		500	μA		
Note 5: Outputs disabled or 3-STATE only.								
AC Electrical Characteristics								
Symbol	Parameter	T _A = -40°C to +85°C, R _L = 500Ω						Units
		V _{CC} = 3.3V ± 0.3V		V _{CC} = 2.7V		V _{CC} = 2.5V ± 0.2V		
		C _L = 50pF		C _L = 50pF		C _L = 30pF		
		Min	Max	Min	Max	Min	Max	
t _{PHL}	Propagation Delay	1.5	8.0	1.5	9.0	1.5	9.6	ns
t _{PLH}	D _n to O _n	1.5	8.0	1.5	9.0	1.5	9.6	
t _{PHL}	Propagation Delay	1.5	8.5	1.5	9.5	1.5	10.5	ns
t _{PLH}	LE to O _n	1.5	8.5	1.5	9.5	1.5	10.5	
t _{PZL}	Output Enable Time	1.5	8.5	1.5	9.5	1.5	10.5	ns
t _{PZH}		1.5	8.5	1.5	9.5	1.5	10.5	
t _{PLZ}	Output Disable Time	1.5	7.5	1.5	8.5	1.5	9.0	ns
t _{PHZ}		1.5	7.5	1.5	8.5	1.5	9.0	
t _S	Setup Time, D _n to LE	2.5		2.5		4.0		ns
t _H	Hold Time, D _n to LE	1.5		1.5		2.0		ns
t _W	LE Pulse Width	3.3		3.3		4.0		ns
t _{OSSL}	Output to Output Skew		1.0					ns
t _{OSLH}	(Note 6)		1.0					
Note 6: 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 _{OSSL}) or LOW-to-HIGH (t _{OSLH}).								
Dynamic Switching Characteristics								
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C		Units		
				Typical				
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	0.8		V		
		C _L = 30pF, V _I = 2.5V, V _{IL} = 0V	2.5	0.6				
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	-0.8		V		
		C _L = 30pF, V _I = 2.5V, V _{IL} = 0V	2.5	-0.6				
Capacitance								
Symbol	Parameter	Conditions	Typical	Units				
C _{IN}	Input Capacitance	V _{CC} = Open, V _I = 0V or V _{CC}	7	pF				
C _{OUT}	Output Capacitance	V _{CC} = 3.3V, V _I = 0V or V _{CC}	8	pF				
C _{PD}	Power Dissipation Capacitance	V _{CC} = 3.3V, V _I = 0V or V _{CC} , f = 10 MHz	25	pF				

AC LOADING and WAVEFORMS Generic for LCX Family

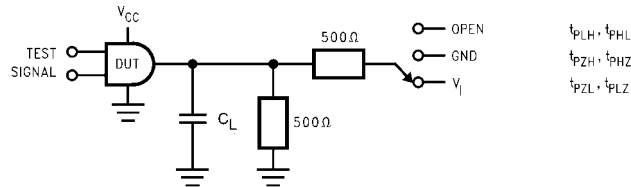
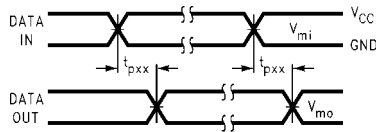
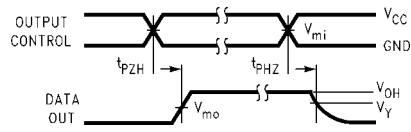


FIGURE 1. AC Test Circuit (C_L includes probe and jig capacitance)

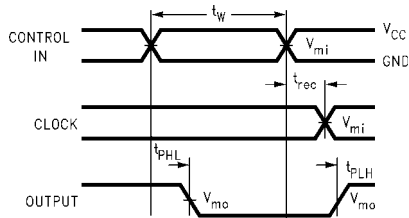
Test	Switch
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V at $V_{CC} = 3.3 \pm 0.3V$ $V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2V$
t_{PZH}, t_{PHZ}	GND



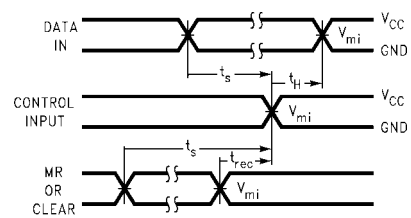
Waveform for Inverting and Non-Inverting Functions



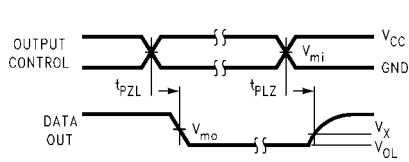
3-STATE Output High Enable and Disable Times for Logic



Propagation Delay, Pulse Width and t_{rec} Waveforms



Setup Time, Hold Time and Recovery Time for Logic



3-STATE Output Low Enable and Disable Times for Logic

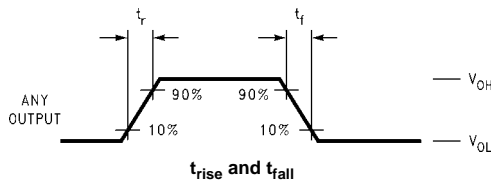
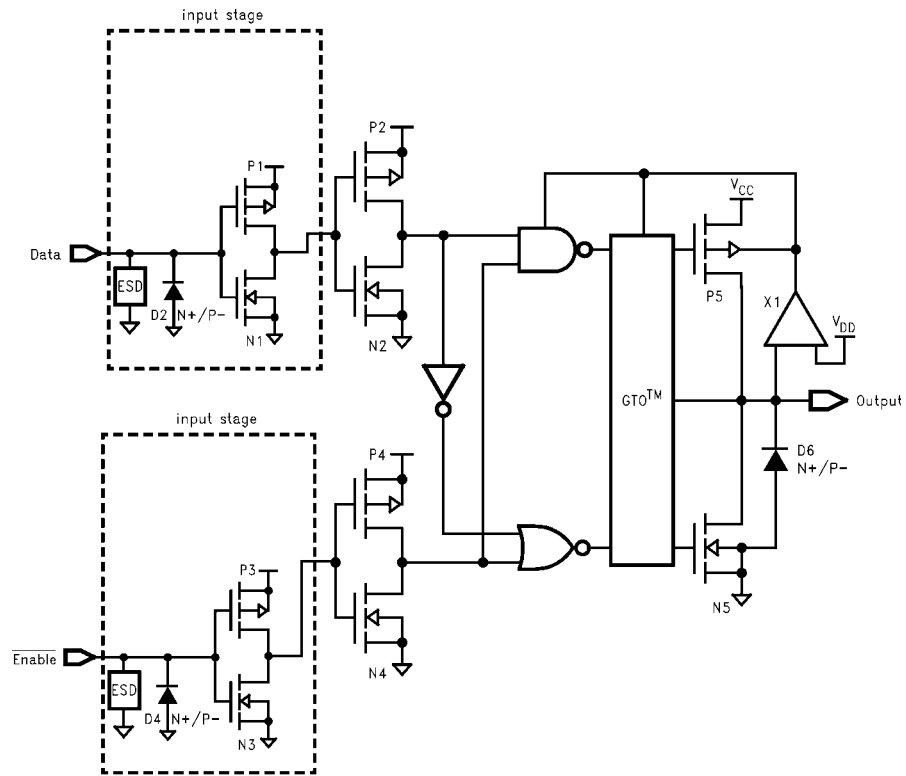


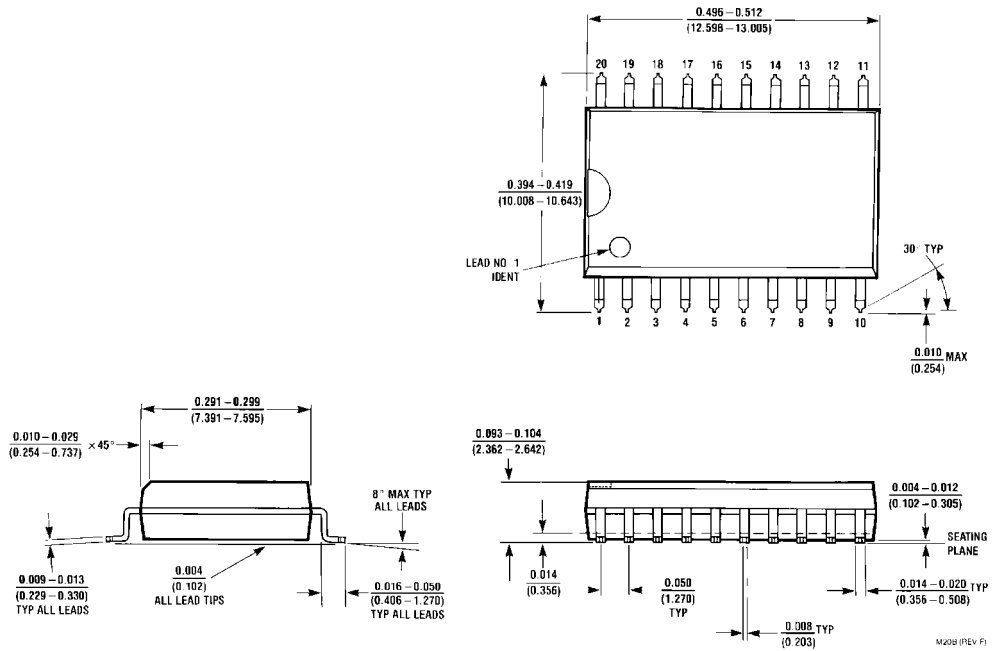
FIGURE 2. Waveforms
(Input Characteristics; $f = 1MHz$, $t_r = t_f = 3ns$)

Symbol	V_{CC}		
	$3.3V \pm 0.3V$	$2.7V$	$2.5V \pm 0.2V$
V_{mi}	1.5V	1.5V	$V_{CC}/2$
V_{mo}	1.5V	1.5V	$V_{CC}/2$
V_x	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$
V_y	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$

Schematic Diagram Generic for LCX Family

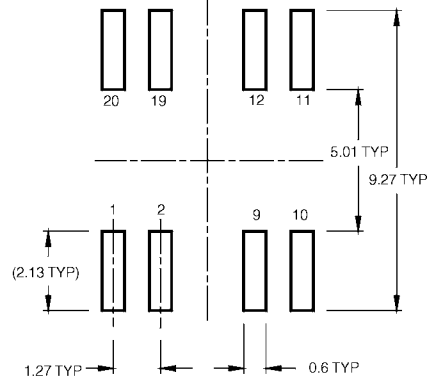
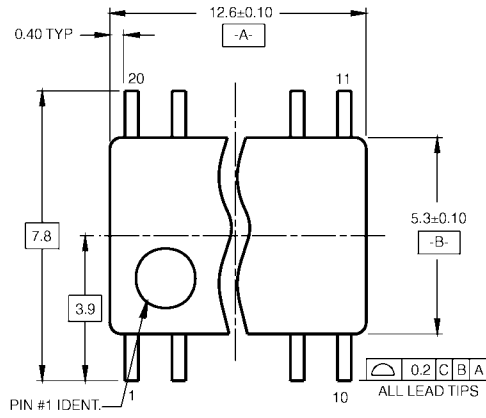


Physical Dimensions inches (millimeters) unless otherwise noted

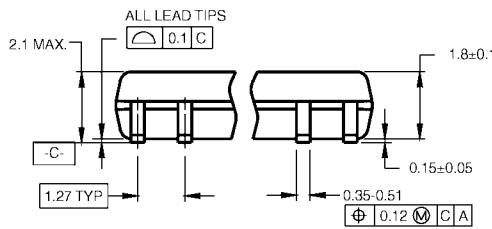


**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B**

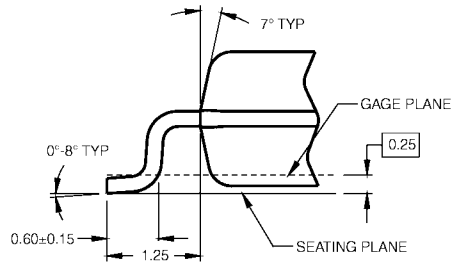
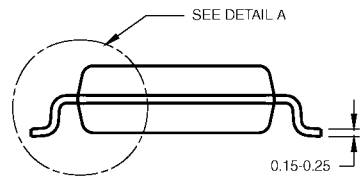
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



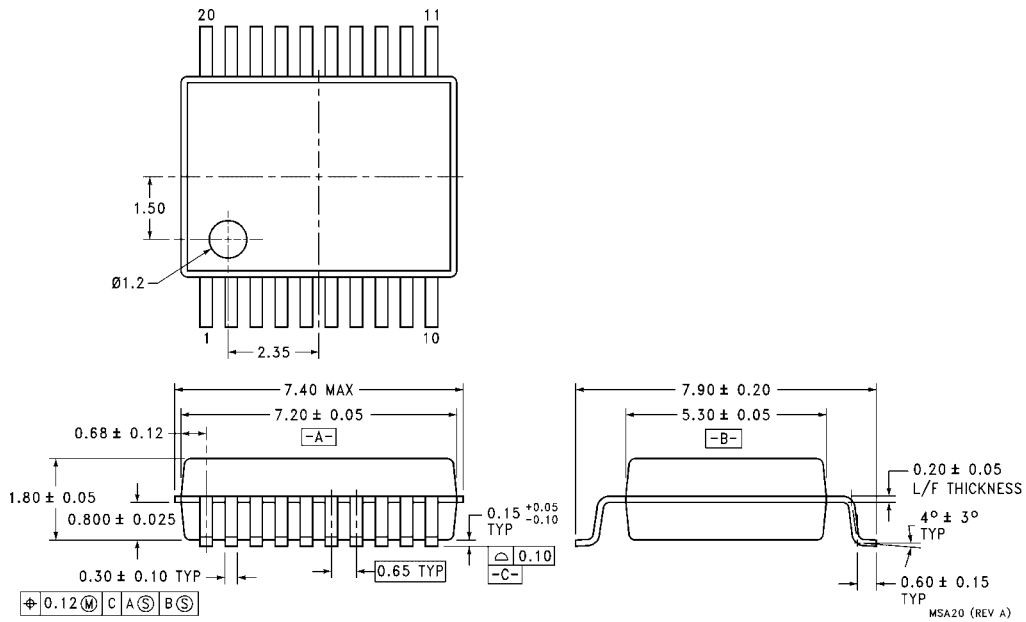
DETAIL A

- 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

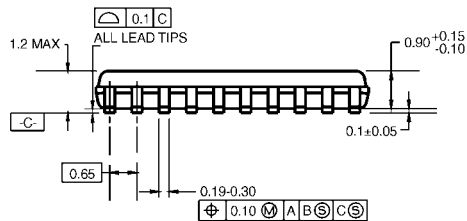
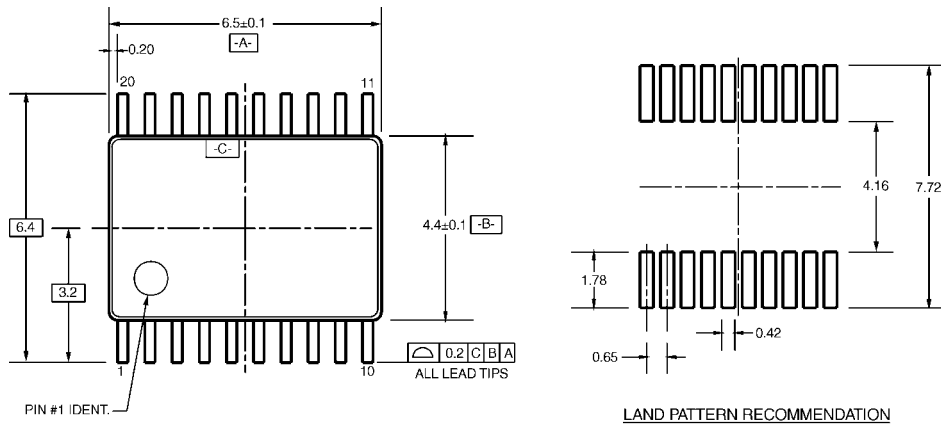
**20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D**

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



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

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

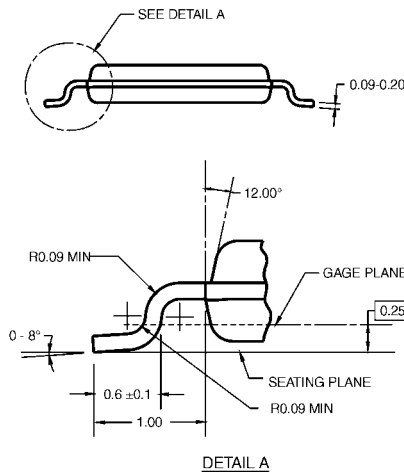


DIMENSIONS ARE IN MILLIMETERS

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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