FAIRCHILD SEMICONDUCTOR™

October 2000
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74LCXZ2245

Low Voltage Bidirectional Transceiver with 5V Tolerant Inputs and Outputs and 26Ω Series Resistors in B Outputs

General Description

The LCXZ2245 contains eight non-inverting bidirectional buffers with 3-STATE outputs and is intended for bus oriented applications. The device is designed for low voltage (2.7V and 3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment. The T/$\overline{R}$ input determines the direction of data flow through the device. The $\overline{OE}$ input disables both the A and B ports by placing them in a high impedance state. The 26Ω series resistor in the B Port output helps reduce output overshoot and undershoot.

The LCXZ2245 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

When V_{CC} is between 0 and 1.5V, the LCXZ2245 is on the high impedance state during power up or power down. This places the outputs in the high impedance (Z) state preventing intermittent low impedance loading or glitching in bus oriented applications.

Features

- 5V tolerant inputs and outputs
- 2.7V–3.6V V_{CC} specifications provided
- 7.0 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)
- ±12 mA output drive on the B Port (V_{CC} = 3.0V)
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- Equivalent 26Ω series resistor on all B Port outputs
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

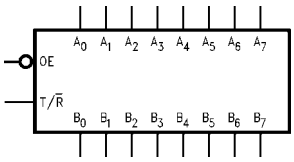
Note 1: To ensure the high-impedance state during power up or down, $\overline{OE}$ should be tied to V_{CC} through a pull-up resistor: the minimum value or the resistor is determined by the current-sourcing capability of the driver.

Ordering Code:

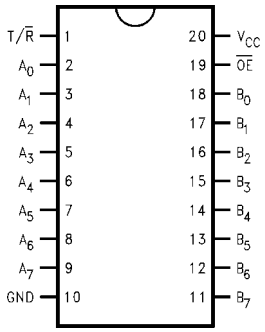
Order Number	Package Number	Package Description
74LCXZ2245WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LCXZ2245SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LCXZ2245MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
74LCXZ2245MTC	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.

Logic Symbol



Connection Diagram



Pin Descriptions

Pin Names	Description
$\overline{OE}$	Output Enable Input
T/$\overline{R}$	Transmit/Receive Input
A_0–A_7	Side A Inputs or 3-STATE Outputs
B_0–B_7	Side B Inputs or 3-STATE Outputs

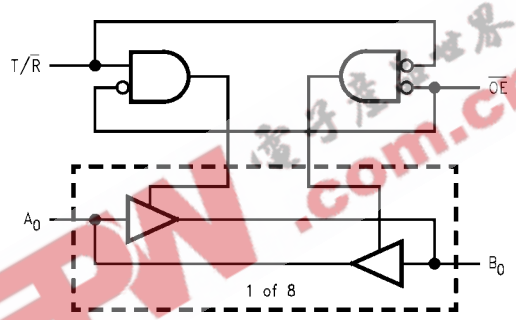
Truth Table

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 $A_0 – A_7$, $B_0 – B_7$ (Note 2)

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

Note 2: Unused bus terminals during HIGH Z State must be held HIGH or LOW.

Logic Diagram



Absolute Maximum Ratings(Note 3)

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 4)	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		°C

Recommended Operating Conditions (Note 5)

Symbol	Parameter		Min	Max	Units
V_{CC}	Supply Voltage	Operating	2.7	3.6	V
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage	HIGH or LOW State	0	V_{CC}	V
		3-STATE	0	5.5	
I_{OH}/I_{OL}	Output Current in I_{OH}/I_{OL} - A Outputs	V_{CC} = 3.0V − 3.6V		±24	mA
		V_{CC} = 2.7V − 3.0V		±12	
	Output Current in I_{OH}/I_{OL} - B Outputs	V_{CC} = 3.0V − 3.6V		±12	mA
		V_{CC} = 2.7V − 3.0V		±8	
T_A	Free-Air Operating Temperature		−40	85	°C
$\Delta t/\Delta V$	Input Edge Rate, V_{IN} = 0.8V − 2.0V, V_{CC} = 3.0V		0	10	ns/V

Note 3: 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 4: I_O Absolute Maximum Rating must be observed.

Note 5: Unused inputs or I/O pins must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = −40°C to +85°C		Units
				Min	Max	
V_{IH}	HIGH Level Input Voltage		2.7 - 3.6	2.0		V
V_{IL}	LOW Level Input Voltage		2.7 - 3.6		0.8	V
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	2.7 - 3.6	V_{CC} − 0.2		V
	B Outputs	I_{OH} = −4 mA	2.7	2.2		
		I_{OH} = −6 mA	3.0	2.4		
		I_{OH} = −8 mA	2.7	2.0		
		I_{OH} = −12 mA	3.0	2.0		
	HIGH Level Output Voltage	I_{OH} = −100 µA	2.7 - 3.6	V_{CC} − 0.2		
	A Outputs	I_{OH} = −12 mA	2.7	2.2		
		I_{OH} = −18 mA	3.0	2.4		
		I_{OH} = −24 mA	3.0	2.2		

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40°C$ to $+85°C$		Units
				Min	Max	
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.7 - 3.6		0.2	V
	B Outputs	I_{OL} = 4 mA	2.7		0.4	
		I_{OL} = 6 mA	3.0		0.55	
		I_{OL} = 8 mA	2.7		0.6	
		I_{OL} = 12 mA	3.0		0.8	
	LOW Level Output Voltage	I_{OL} = 100 µA	2.7 - 3.6		0.2	
	A Outputs	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	$0 \le V_I \le 5.5V$	2.7 - 3.6		±5.0	µA
I_{OZ}	3-STATE I/O Leakage	$0 \le V_O \le 5.5V$ $V_I = V_{IH}$ or V_{IL}	2.7 - 3.6		±5.0	µA
I_{OFF}	Power-Off Leakage Current	V_I or V_O = 5.5V	0		10	µA
$I_{PU/PD}$	Power Up/Down 3-STATE Output Current	V_O = 0.5V to V_{CC} $V_I = V_{CC}$ or GND	0 - 1.5		±5.0	µA
I_{CC}	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.7 - 3.6		225	µA
		3.6V ≤ V_I, V_O ≤ 5.5V (Note 6)	2.7 - 3.6		±225	
ΔI_{CC}	Increase in I_{CC} per Input	$V_{IH} = V_{CC}$ −0.6V	2.7 - 3.6		500	µA

Note 6: Outputs disabled or 3-STATE only.

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $R_L = 500\Omega$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		$C_L = 50$ pF		$C_L = 50$ pF		
		Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay A to B	1.5	8.0	1.5	9.0	ns
t_{PHL} t_{PLH}	Propagation Delay B to A	1.5	7.0	1.5	8.0	
t_{PZL} t_{PZH}	Output Enable Time A to B	1.5	9.5	1.5	10.5	ns
t_{PZL} t_{PZH}	Output Enable Time B to A	1.5	8.5	1.5	9.5	ns
t_{PLZ} t_{PHZ}	Output Disable Time A to B	1.5	7.5	1.5	8.5	ns
t_{PLZ} t_{PHZ}	Output Disable Time B to A	1.5	7.5	1.5	8.5	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 7)		1.0			ns

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} B to A	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V
	Quiet Output Dynamic Peak V_{OL} A to B	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.5	
V_{OLV}	Quiet Output Dynamic Valley V_{OL} B to A	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	2.5	−0.8	V
	Quiet Output Dynamic Valley V_{OL} A to B	$C_L = 50$ pF, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	−0.5	

Capacitance

Symbol	Parameter	Conditions	Typical	Units
C_{IN}	Input Capacitance	V_{CC} = Open, $V_I = 0V$ or V_{CC}	7	pF
$C_{I/O}$	Input/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

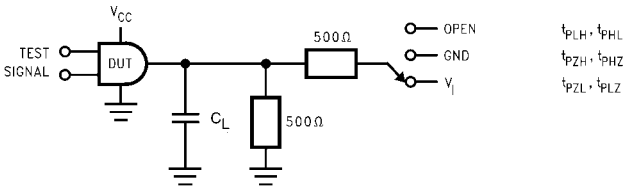
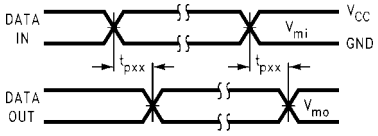
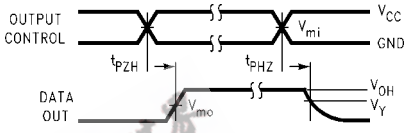


FIGURE 1. AC Test Circuit (C_L includes probe and jig capacitance)

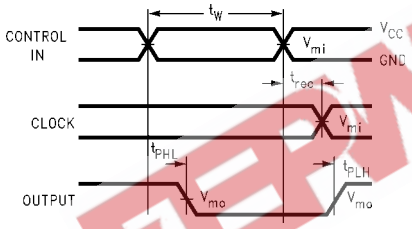
V_I	C_L
6V for V_{CC} = 3.3V, 2.7V	50 pF



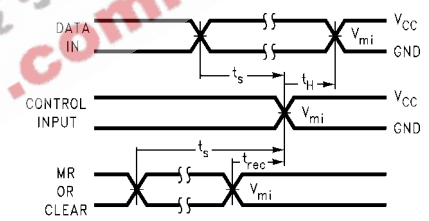
Waveform for Inverting and Non-Inverting Functions



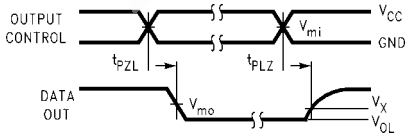
3-STATE Output High Enable and Disable Times for Logic



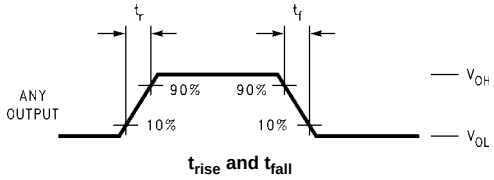
Propagation Delay, Pulse Width and t_{rec} Waveforms



Setup Time, Hold Time and Recovery Time for Logic



3-STATE Output Low Enable and Disable Times for Logic

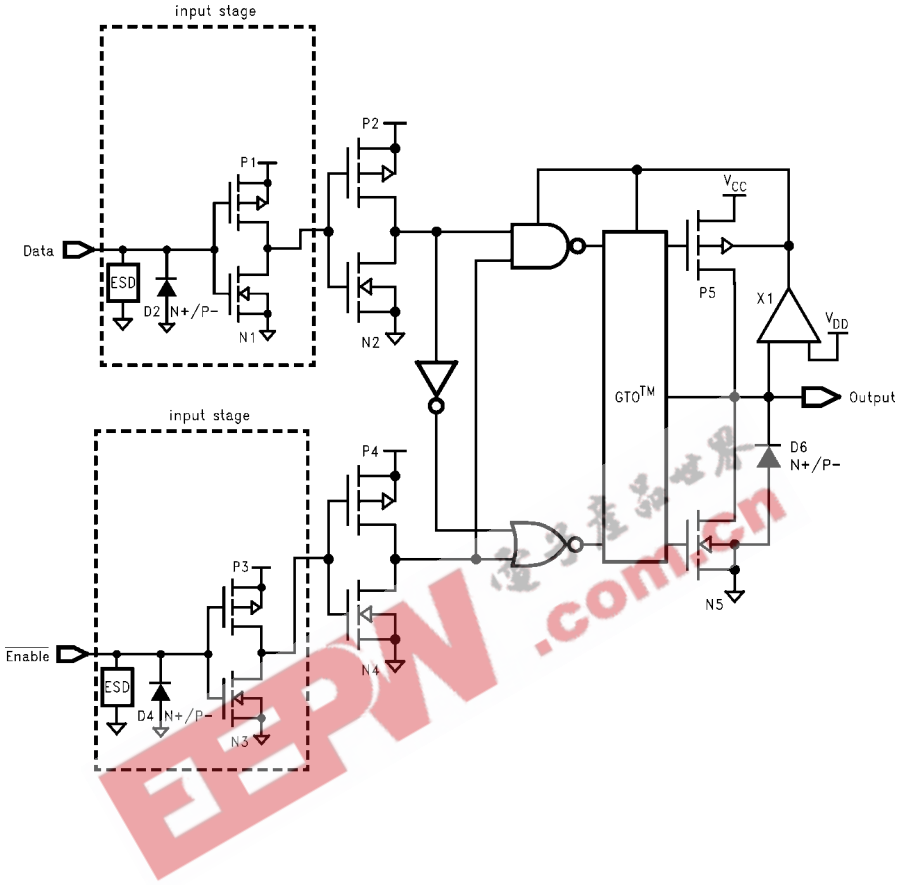


t_{rise} and t_{fall}

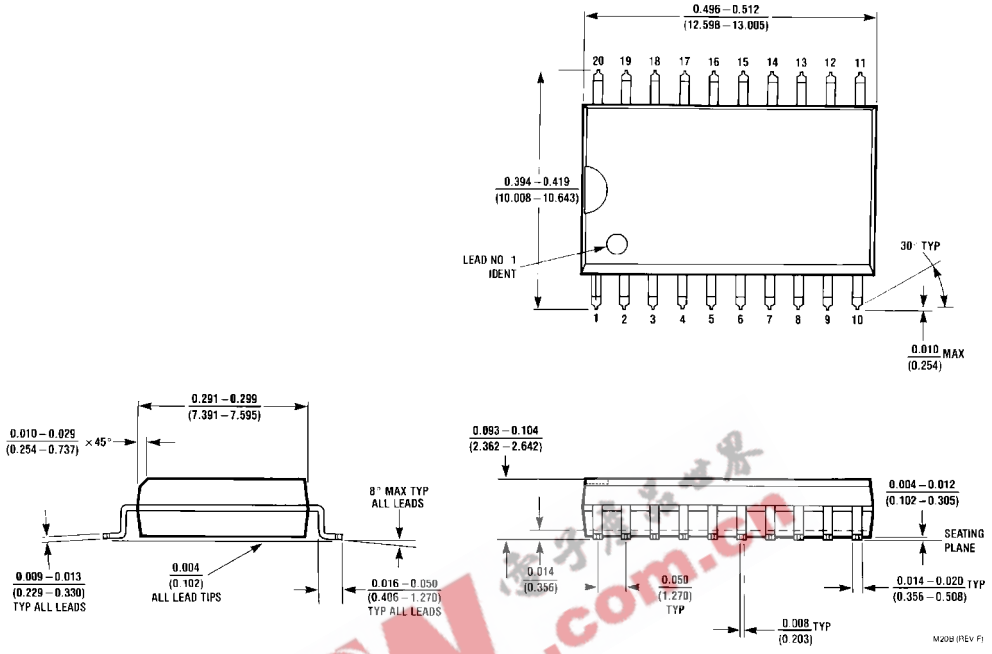
FIGURE 2. Waveforms
(Input Characteristics; f =1MHz, t_R = t_F = 3ns)

Symbol	V_{CC}	
	3.3V ± 0.3V	2.7V
V_{mi}	1.5V	1.5V
V_{mo}	1.5V	1.5V
V_x	V_{OL} + 0.3V	V_{OL} + 0.3V
V_y	V_{OH} − 0.3V	V_{OH} − 0.3V

Schematic Diagram Generic for LCX Family

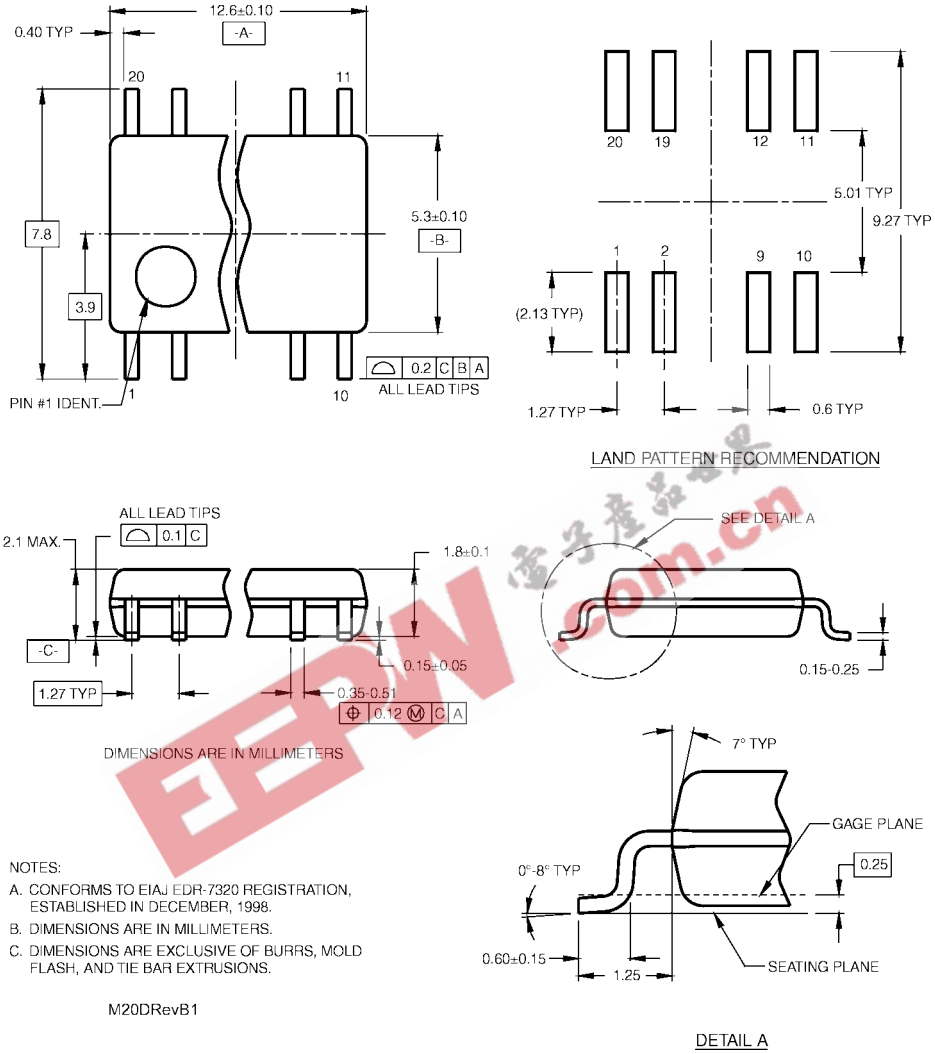


Physical Dimensions inches (millimeters) unless otherwise noted



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

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



NOTES:

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

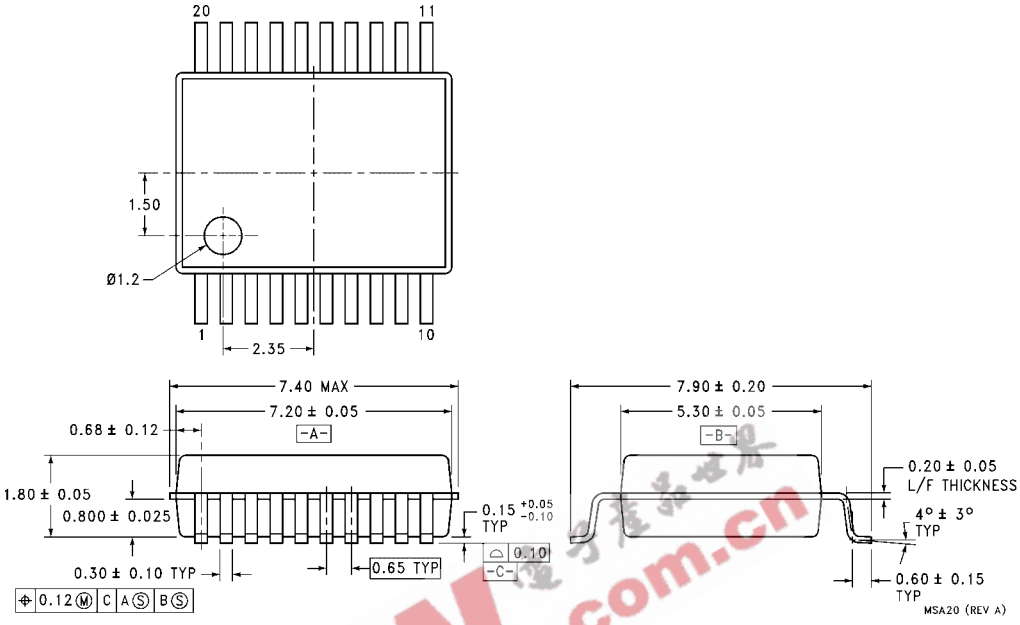
B. DIMENSIONS ARE IN MILLIMETERS.

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

M20DRevB1

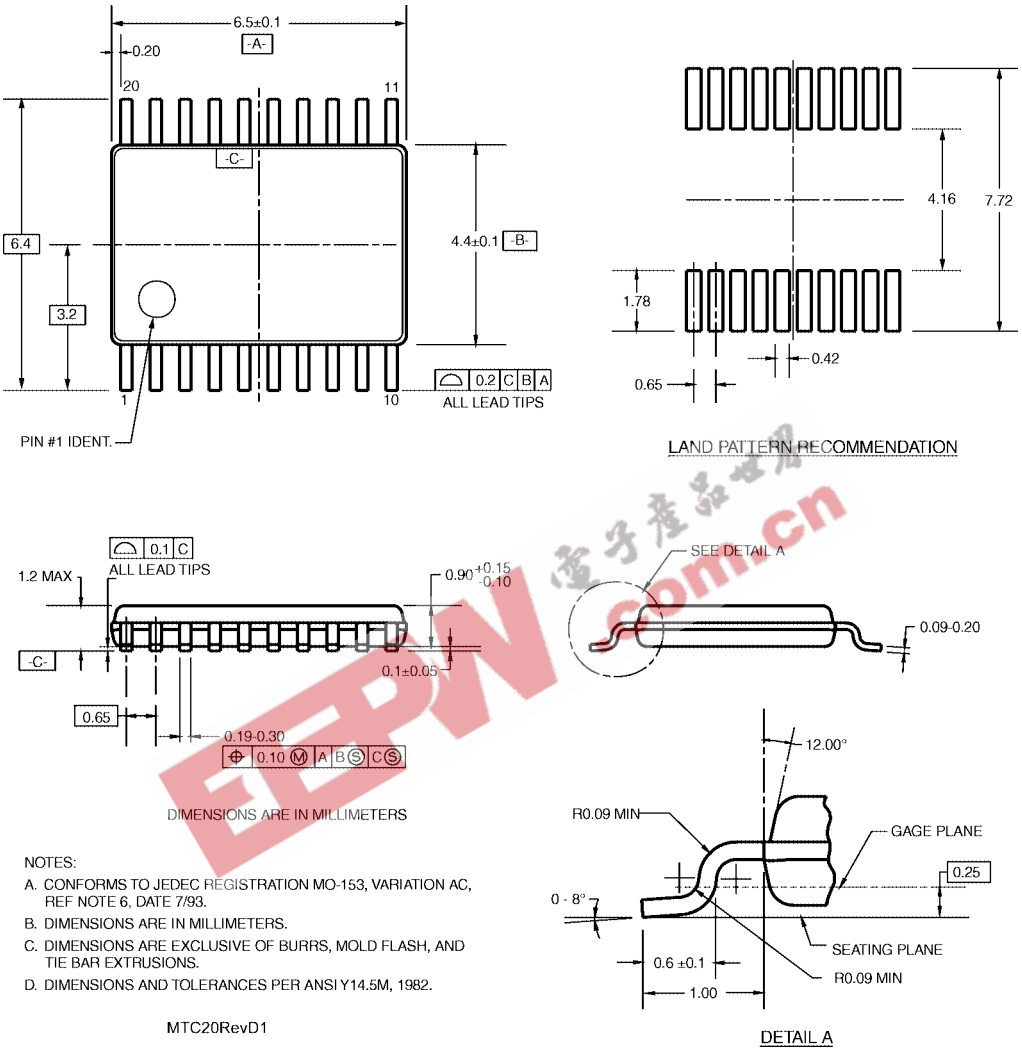
20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D

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)



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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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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