



# 74LCX244

## Low Voltage Buffer/Line Driver with 5V Tolerant Inputs and Outputs

### Features

- 5V tolerant inputs and outputs
- 2.3V to 3.6V  $V_{CC}$  specifications provided
- 6.5ns  $t_{PD}$  max. ( $V_{CC} = 3.3V$ ), 10 $\mu$ A  $I_{CC}$  max.
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal<sup>(1)</sup>
- $\pm 24$ mA output drive ( $V_{CC} = 3.0V$ )
- Implements proprietary noise/EMI reduction circuitry
- Latch-up performance exceeds 500mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V
- Leadless DQFN package

### Note:

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

### General Description

The LCX244 contains eight non-inverting buffers with 3-STATE outputs. The device may be employed as a memory address driver, clock driver and bus-oriented transmitter/receiver. The LCX244 is designed for low voltage (2.5V or 3.3V)  $V_{CC}$  applications with capability of interfacing to a 5V signal environment.

The LCX244 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.


### Ordering Information

Order Number	Package Number	Package Description
74LCX244WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LCX244SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LCX244BQX <sup>(2)</sup>	MLP20B	20-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 4.5mm
74LCX244MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
74LCX244MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

### Note:

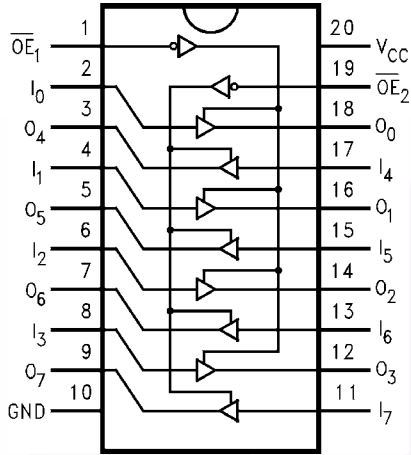
2. DQFN package available in Tape and Reel only.

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

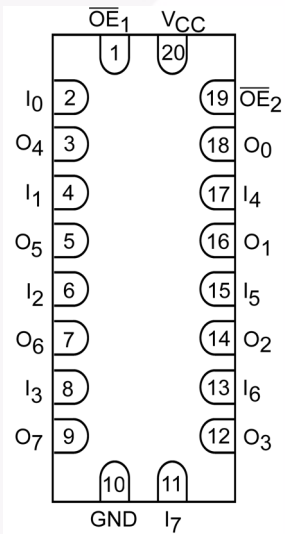
 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram

Pin Assignments for SOIC, SOP, SSOP, and TSSOP



Pad Assignments for DQFN

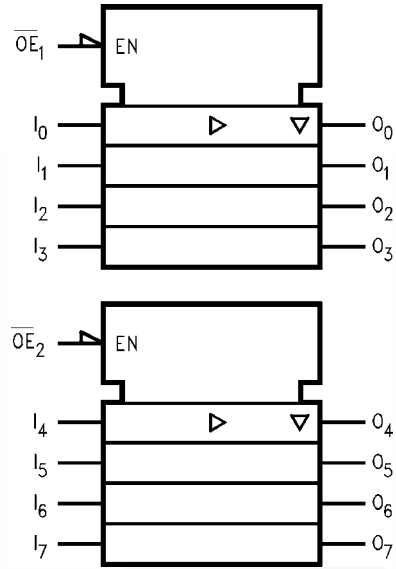


(Top Through View)

### Pin Description

Pin Names	Description
$\overline{OE}_1, \overline{OE}_2$	3-STATE Output Enable Inputs
$I_0-I_7$	Inputs
$\overline{O}_0-\overline{O}_7$	Outputs

### Logic Diagram



### Truth Tables

Inputs		Outputs
$\overline{OE}_1$	$I_n$	(Pins 12, 14, 16, 18)
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	$I_n$	(Pins 3, 5, 7, 9)
L	L	L
L	H	H
H	X	Z

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Z = High Impedance

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	0.5V to +7.0V
$V_I$	DC Input Voltage	0.5V to +7.0V
$V_O$	DC Output Voltage Output in 3-STATE	0.5V to +7.0V
	Output in HIGH or LOW State	0.5V to $V_{CC} + 0.5V$
$I_{IK}$	DC Input Diode Current, $I_{I\#}$ # GND	50mA
$I_{OK}$	DC Output Diode Current $I_{O\#}$ # GND	50mA
	$I_{O\#}$ # $V_{CC}$	+50mA
$I_O$	DC Output Source/Sink Current	-50mA
$I_{CC}$	DC Supply Current per Supply Pin	-100mA
$I_{GND}$	DC Ground Current per Ground Pin	-100mA
$T_{STG}$	Storage Temperature	65°C to +150°C

### Note:

3.  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions (4)

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Units
$V_{CC}$	Supply Voltage Operating	2.0	3.6	V
	Data Retention	1.5	3.6	
$V_I$	Input Voltage	0	5.5	V
$V_O$	Output Voltage 3-STATE	0	5.5	V
	HIGH or LOW State	0	$V_{CC}$	
$I_{OH} / I_{OL}$	Output Current $V_{CC} !$ 3.0V 3.6V		-24	mA
	$V_{CC} !$ 2.7V 3.0V		-12	
	$V_{CC} !$ 2.3V 2.7V		-8	
$T_A$	Free-Air Operating Temperature	40	85	°C
$\$t/\$V$	Input Edge Rate, $V_I !$ 0.8V 2.0V, $V_{CC} !$ 3.0V	0	10	ns/V

### Note:

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

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	2.3–2.7		1.7		V
		2.7–3.6		2.0		
V <sub>IL</sub>	LOW Level Input Voltage	2.3–2.7			0.7	V
		2.7–3.6			0.8	
V <sub>OH</sub>	HIGH Level Output Voltage	2.3–3.6	I <sub>OH</sub> = -100μA	V <sub>CC</sub> - 0.2		V
		2.3	I <sub>OH</sub> = -8mA	1.8		
		2.7	I <sub>OH</sub> = -12mA	2.2		
		3.0	I <sub>OH</sub> = -18mA	2.4		
			I <sub>OH</sub> = -24mA	2.2		
V <sub>OL</sub>	LOW Level Output Voltage	2.3–3.6	I <sub>OL</sub> = 100μA		0.2	V
		2.3	I <sub>OL</sub> = 8mA		0.6	
		2.7	I <sub>OL</sub> = 12mA		0.4	
		3.0	I <sub>OL</sub> = 16mA		0.4	
			I <sub>OL</sub> = 24mA		0.55	
I <sub>I</sub>	Input Leakage Current	2.3–3.6	0 ≤ V <sub>I</sub> ≤ 5.5V		±5.0	μA
I <sub>OZ</sub>	3-STATE Output Leakage	2.3–3.6	0 ≤ V <sub>O</sub> ≤ 5.5V, V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		±5.0	μA
I <sub>OFF</sub>	Power-Off Leakage Current	0	V <sub>I</sub> or V <sub>O</sub> = 5.5V		10	μA
I <sub>CC</sub>	Quiescent Supply Current	2.3–3.6	V <sub>I</sub> = V <sub>CC</sub> or GND		10	μA
			3.6V ≤ V <sub>I</sub> , V <sub>O</sub> ≤ 5.5V <sup>(5)</sup>		±10	
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	2.3–3.6	V <sub>IH</sub> = V <sub>CC</sub> - 0.6V		500	μA

## Note:

5. Outputs disabled or 3-STATE only.

## AC Electrical Characteristics

Symbol	Parameter	T <sub>A</sub> = -40°C to +85°C, R <sub>L</sub> = 500Ω						Units
		V <sub>CC</sub> = 3.3V ± 0.3V, C <sub>L</sub> = 50pF		V <sub>CC</sub> = 2.7V, C <sub>L</sub> = 50pF		V <sub>CC</sub> = 2.5V ± 0.2V, C <sub>L</sub> = 30pF		
		Min.	Max.	Min.	Max.	Min.	Max.	
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay, Data to Output	1.5	6.5	1.5	7.5	1.5	7.8	ns
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time	1.5	8.0	1.5	9.0	1.5	10.0	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time	1.5	7.0	1.5	8.0	1.5	8.4	ns
t <sub>OSHL</sub> , t <sub>OSLH</sub>	Output to Output Skew <sup>(6)</sup>		1.0					ns

## 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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

**Dynamic Switching Characteristics**

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C	Unit
				Typical	
V <sub>OLP</sub>	Quiet Output Dynamic Peak V <sub>OL</sub>	3.3	C <sub>L</sub> = 50pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V	0.8	V
		2.5	C <sub>L</sub> = 30pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V	0.6	
V <sub>OLV</sub>	Quiet Output Dynamic Valley V <sub>OL</sub>	3.3	C <sub>L</sub> = 50pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V	-0.8	V
		2.5	C <sub>L</sub> = 30pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V	-0.6	

**Capacitance**

Symbol	Parameter	Conditions	Typical	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = Open, V <sub>I</sub> = 0V or V <sub>CC</sub>	7.0	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>	8.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10MHz	25.0	pF

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Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	0.5V to +7.0V
$V_I$	DC Input Voltage	0.5V to +7.0V
$V_O$	DC Output Voltage Output in 3-STATE	0.5V to +7.0V
	Output in HIGH or LOW State	0.5V to $V_{CC} + 0.5V$
$I_{IK}$	DC Input Diode Current, $I_{I\#}$ # GND	50mA
$I_{OK}$	DC Output Diode Current $I_{O\#}$ # GND	50mA
	$I_{O\#}$ # $V_{CC}$	+50mA
$I_O$	DC Output Source/Sink Current	-50mA
$I_{CC}$	DC Supply Current per Supply Pin	-100mA
$I_{GND}$	DC Ground Current per Ground Pin	-100mA
$T_{STG}$	Storage Temperature	65°C to +150°C

### Note:

3.  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions (4)

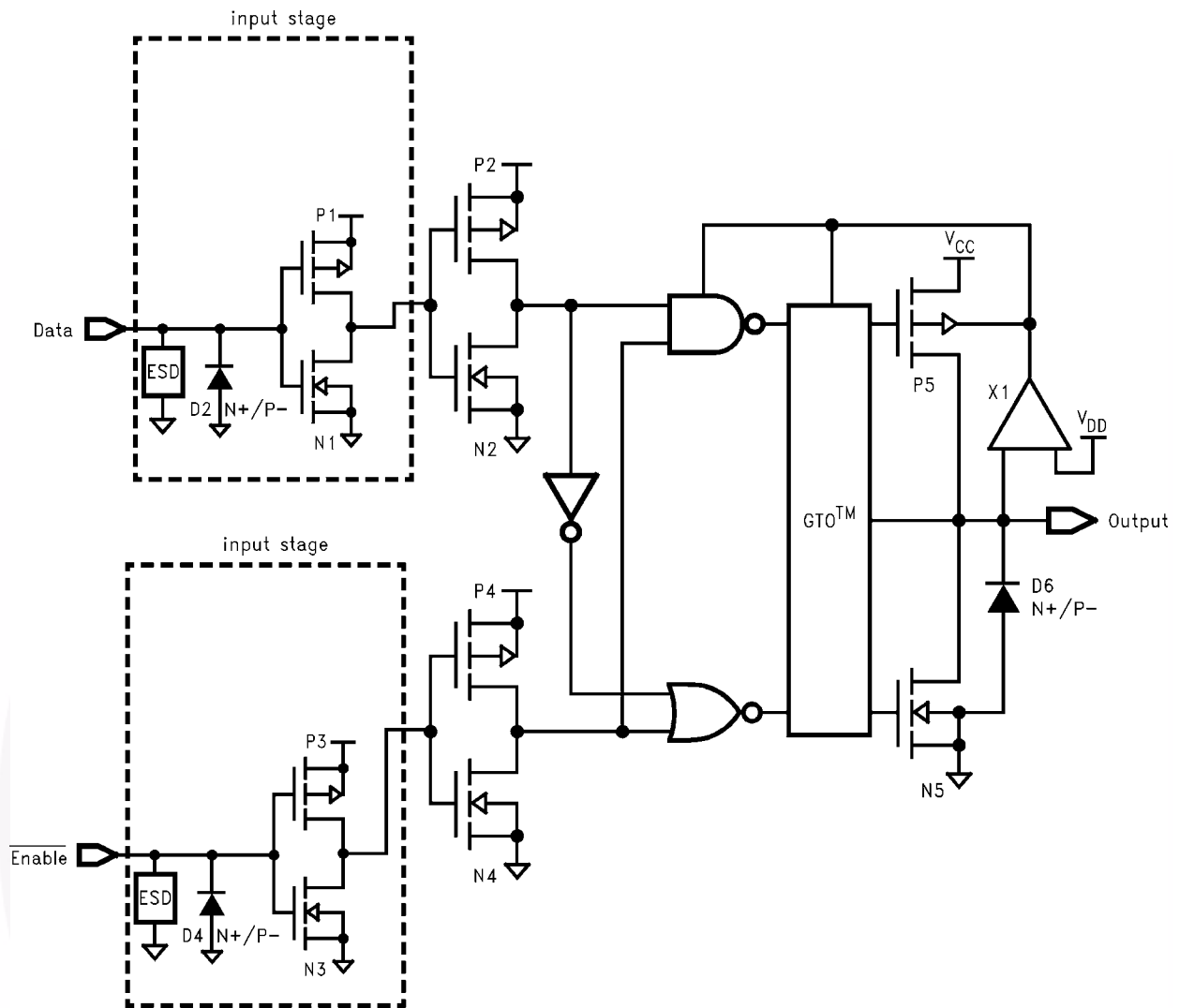
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$V_I$	Input Voltage	0	5.5	V
$V_O$	Output Voltage 3-STATE	0	5.5	V
	HIGH or LOW State	0	$V_{CC}$	
$I_{OH} / I_{OL}$	Output Current $V_{CC} ! 3.0V 3.6V$		-24	mA
	$V_{CC} ! 2.7V 3.0V$		-12	
	$V_{CC} ! 2.3V 2.7V$		-8	
$T_A$	Free-Air Operating Temperature	40	85	°C
$\$t/\$V$	Input Edge Rate, $V_I ! 0.8V 2.0V, V_{CC} ! 3.0V$	0	10	ns/V

### Note:

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

**Schematic Diagram** (Generic for LCX Family)

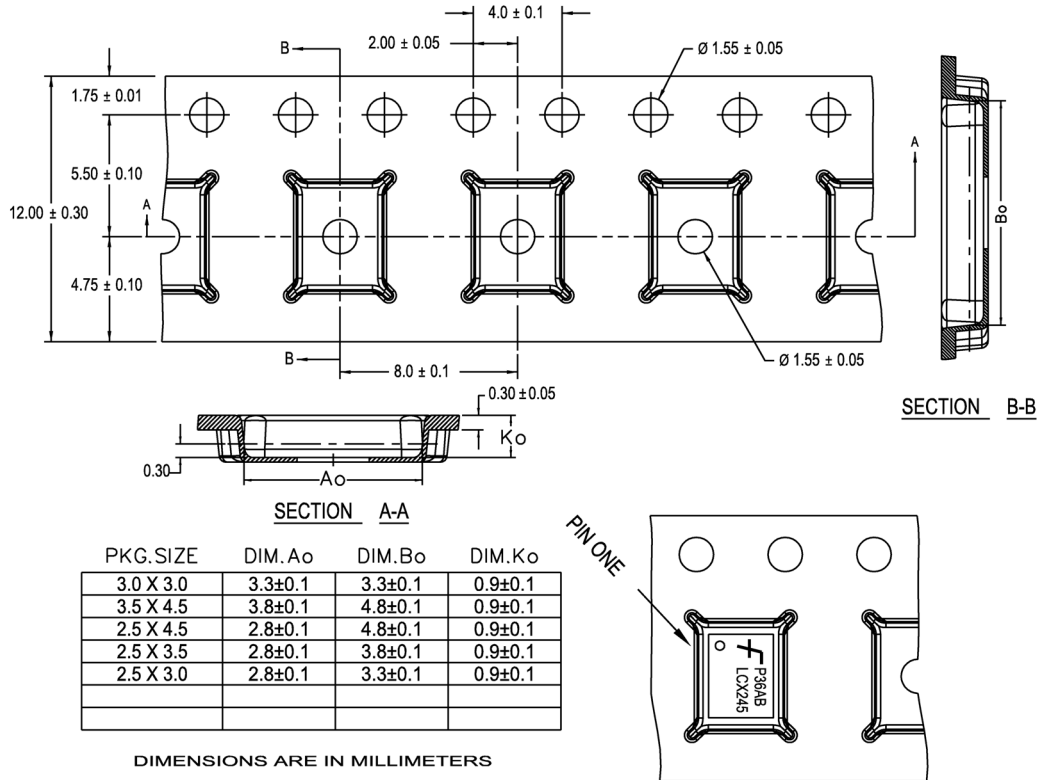


## Tape and Reel Specification

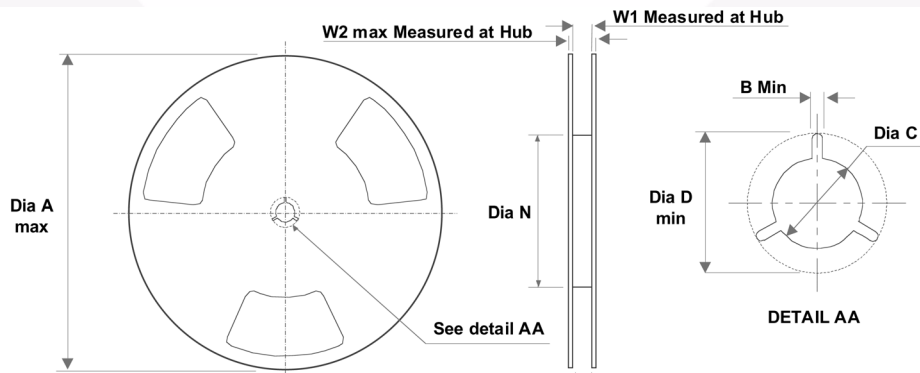
### Tape Format for DQFN

Package Designator	Tape Section	Number of Cavities	Cavity Status	Cover Tape Status
BQX	Leader (Start End)	125 (typ.)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ.)	Empty	Sealed

### Tape Dimension inches (millimeters)



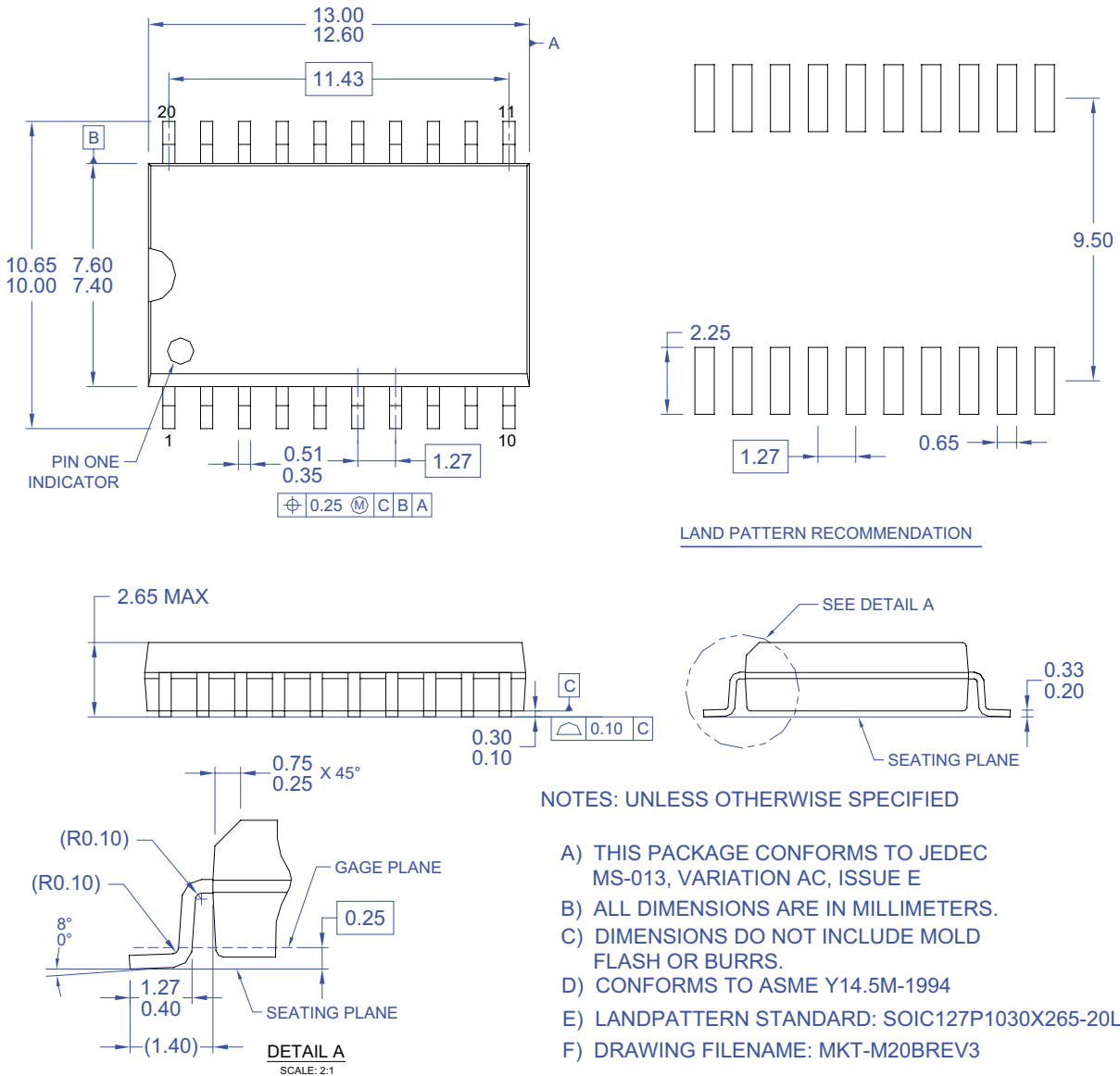
### Reel Dimensions inches (millimeters)



Tape Size	A	B	C	D	N	W1	W2
12mm	13.0 (330.0)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.488 (12.4)	0.724 (18.4)



## Physical Dimensions



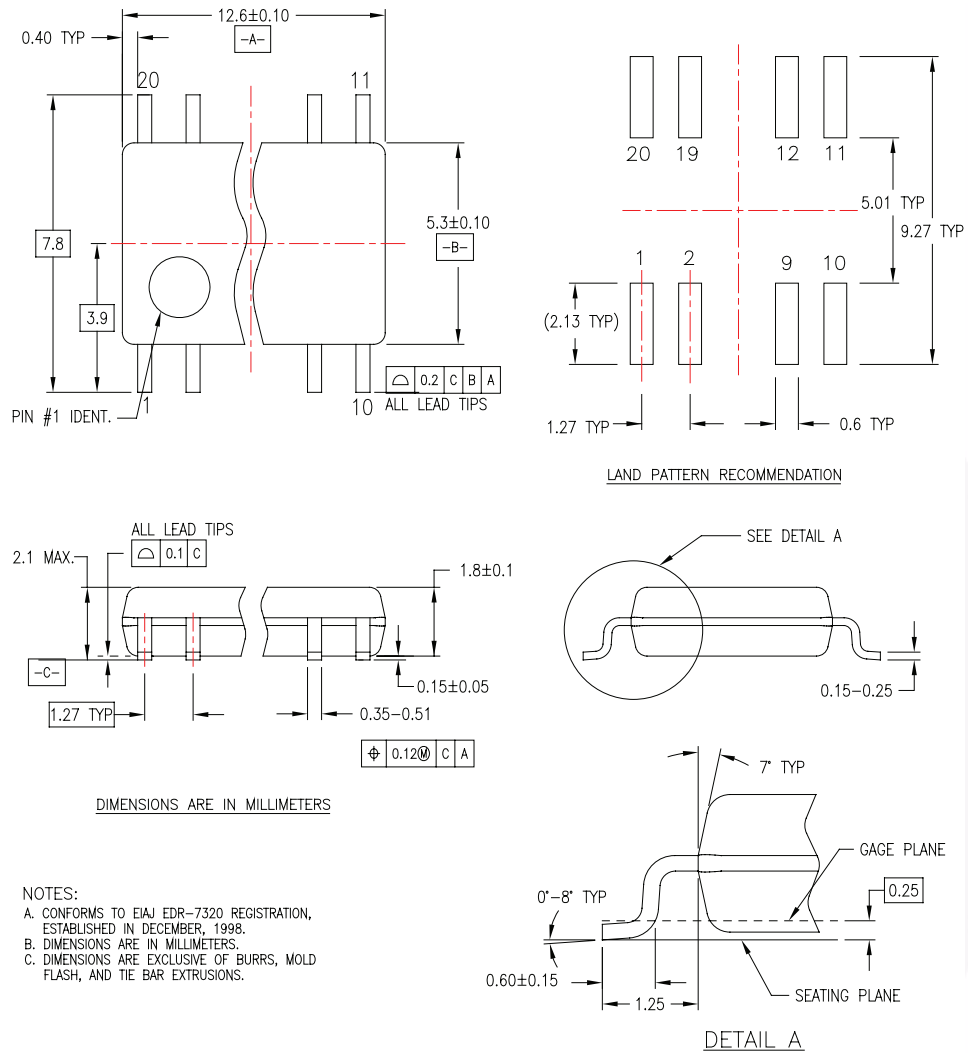
**Figure 3. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide**

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**Physical Dimensions (Continued)**



M20DRFVC

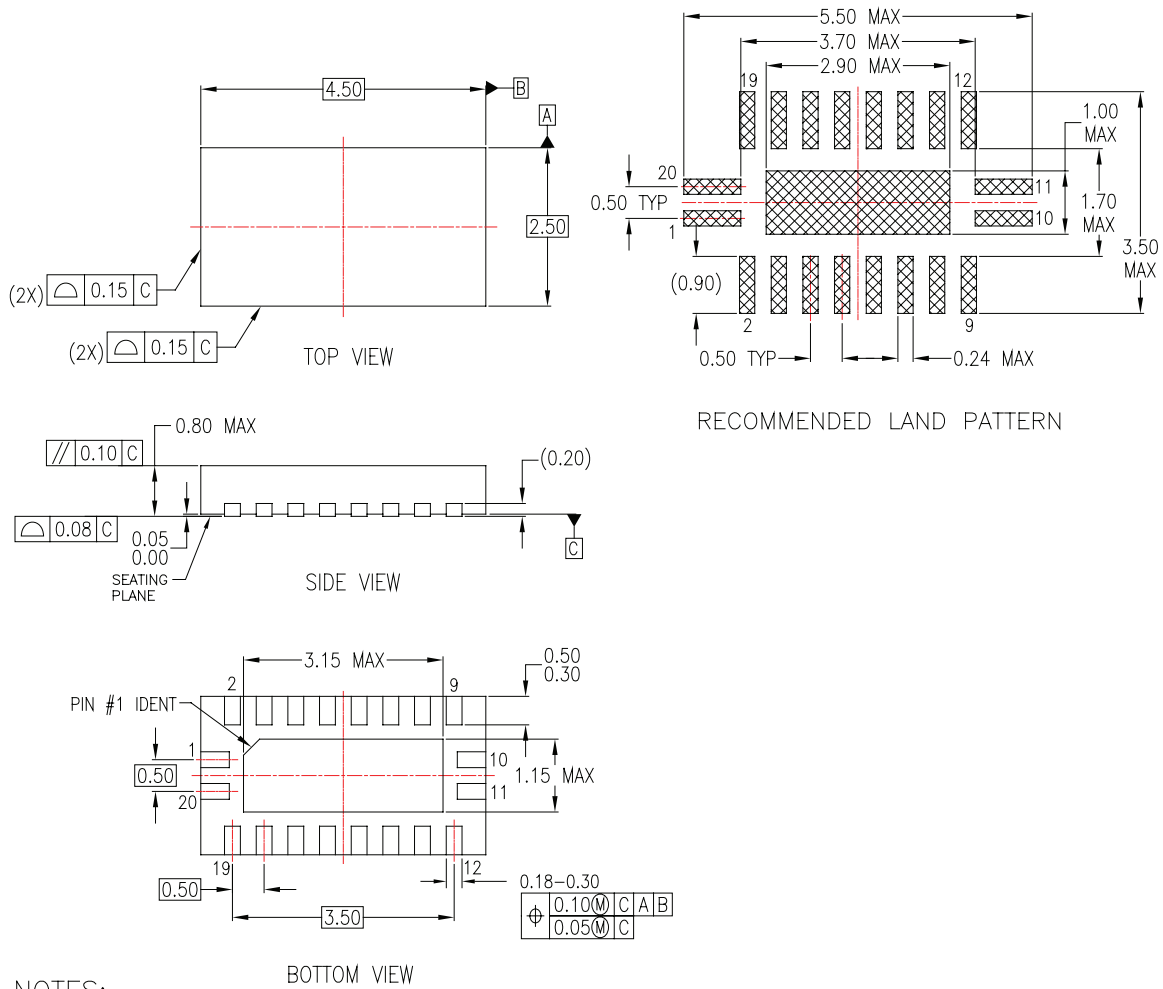
**Figure 4. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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Physical Dimensions (Continued)



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AC
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

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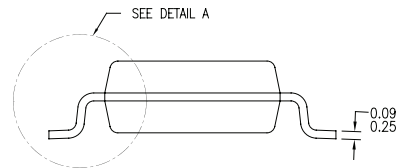
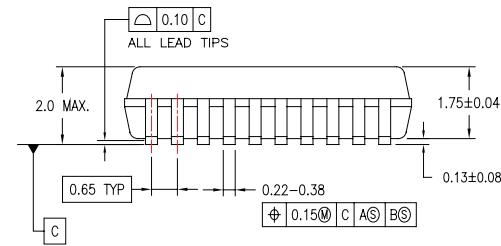
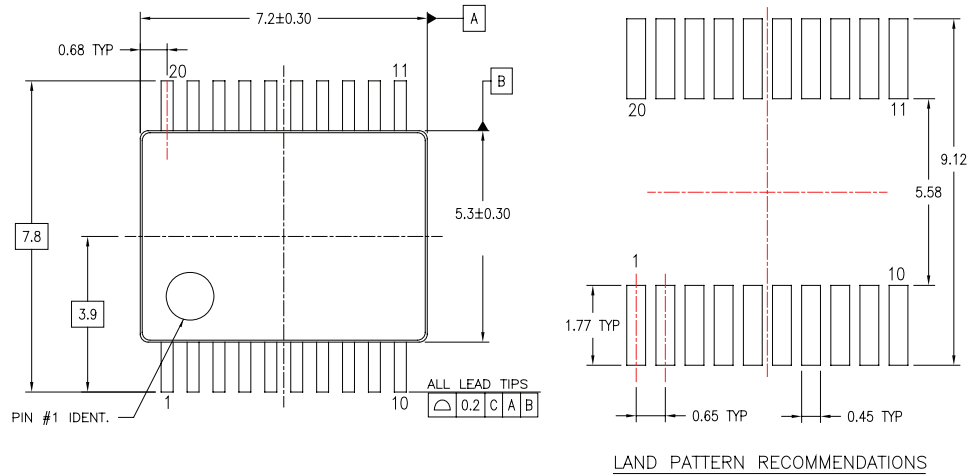
Figure 5. 20-Terminal Depopulated Quad Very-Thin Flip-Chip at Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 4.5mm

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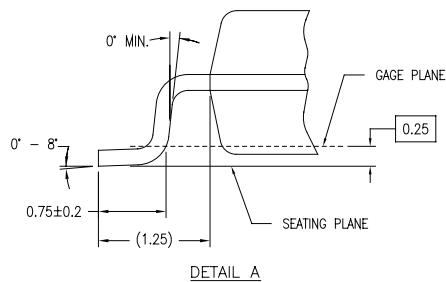
**Physical Dimensions** (Continued)



DIMENSIONS ARE IN MILLIMETERS

NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-150, VARIATION AE, DATE 1/94.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND THE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ASME Y14.5M - 1994.



MSA20RFVB

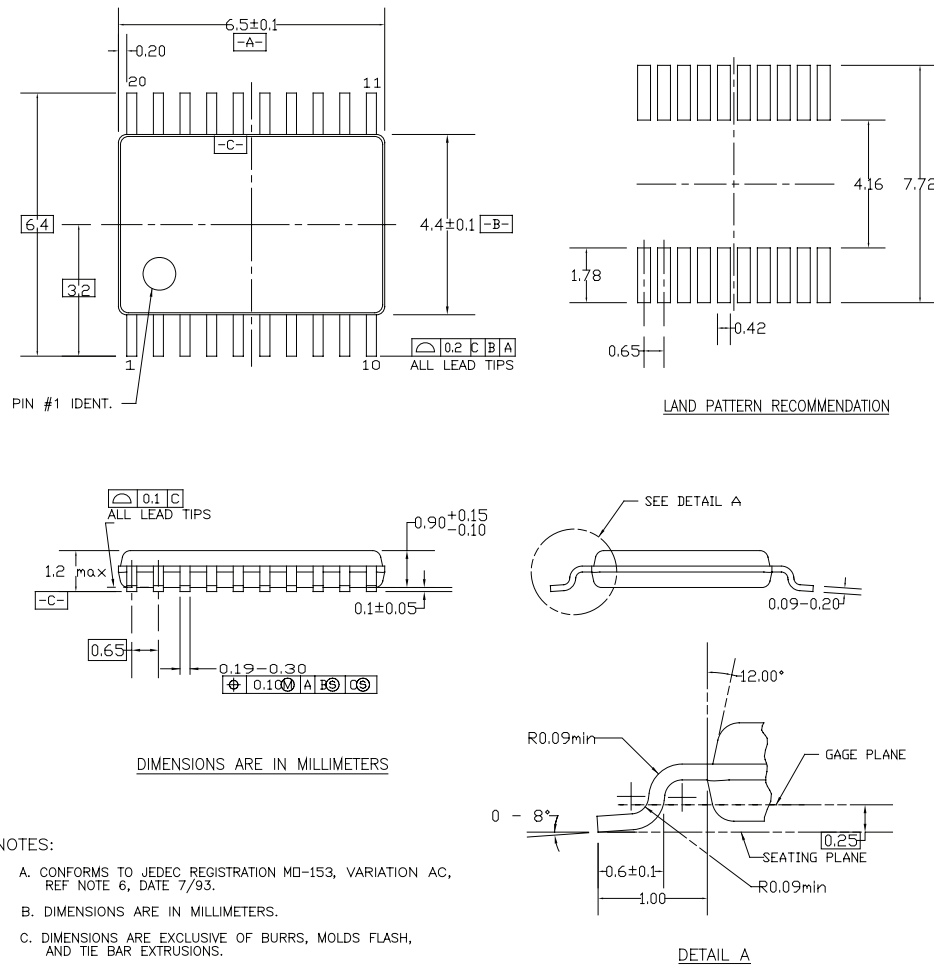
**Figure 6. 20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide**

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**Physical Dimensions** (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

**Figure 7. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**

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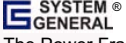
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|  ™ | MicroFET  | SPM®   | oSerDes   |
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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I38