

74LCX821

Low Voltage 10-Bit D-Type Flip-Flop with 5V Tolerant Inputs and Outputs

General Description

The LCX821 consists of ten D-type Flip-Flops with 3-STATE outputs for bus organized system applications. The device is designed for low voltage (2.5V or 3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment.

The LCX821 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
- 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)
- ± 24 mA output drive ($V_{OL} = 3.0V$)
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- ESD performance

Human Body Model > 2000V

Machine Model > 200V

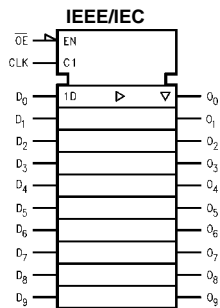
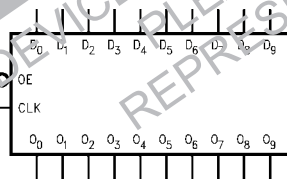
Note 1: To ensure the high-impedance state during power up or down, \overline{OE} should be pulled to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current sourcing capability of the driver.

Ordering Code:

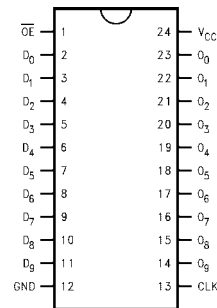
Order Number	Package Number	Package Description
74LCX821WMM	MS-024B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
74LCX821MSA	MS-024	24-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
74LCX821MTC	MTC024	24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in leaded package. Specify by appending the suffix "X" to the ordering code.

Logic Symbols



Connection Diagram



Pin Descriptions

Pin Names	Description
D ₀ –D ₉	Data Inputs
CLK	Clock Input
\overline{OE}	Output Enable Input
O ₀ –O ₉	3-STATE Latch Outputs

Function Table

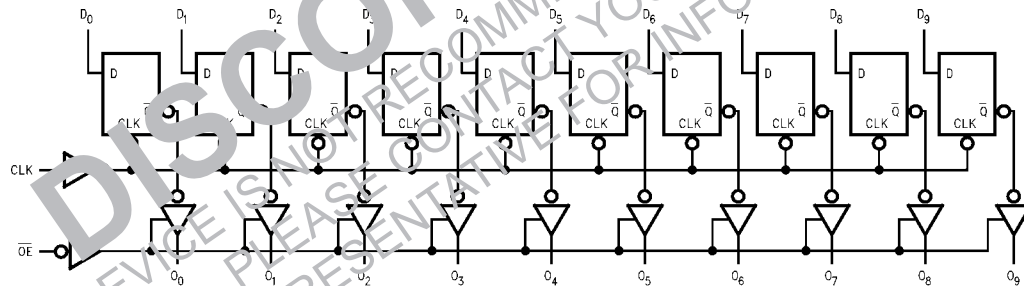
Inputs			Internal	Outputs	Function
\overline{OE}	CLK	D	Q	O _n	
H	H	L	NC	Z	Hold
H	H	H	NC	Z	Hold
H	↗	L	L	Z	Load
H	↗	H	H	Z	Load
L	↗	L	L	L	Data Available
L	↗	H	H	H	Data Available
L	H	L	NC	NC	No Change in Data
L	H	H	NC	NC	No Change in Data

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 Z = High Impedance
 ↗ = LOW-to-HIGH Transition
 NC = No Change

Functional Description

The LCX821 consists of ten edge-triggered flip-flops with individual D-type inputs with 3-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The ten flip-flops will store the state of the individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CLK) transition. With the Output Enable (\overline{OE}) LOW, the contents of the ten flip-flops are available at the outputs. When \overline{OE} is HIGH, the outputs go to the high impedance state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

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	V
		Data Retention	1.5	3.6	
V_I	Input Voltage	0	5.5	V	
V_O	Output Voltage	LOW State	0	V_{CC}	V
		3-STATE	0	5.5	
I_{OH}/I_{OL}	Output Current	$V_{CC} = 3.0V - 3.6V$		± 12	mA
		$V_{CC} = 2.7V - 3.0V$		± 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, $V_{IN} = 0.8V - 2.0V$, $V_{IN} = 3.0V$	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 = 50 pF		C _L = 50 pF		C _L = 30 pF		
		Min	Max	Min	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency	150						MHz
t _{PHL}	Propagation Delay	1.5	7.0	1.5	7.0	1.5	8.4	ns
t _{PLH}	CLK to O _n	1.5	7.0	1.5	7.5	1.5	8.4	
t _{PZL}	Output Enable Time	1.5	7.5	1.5	7.5	1.5	9.8	ns
t _{PZH}		1.5	7.5	1.5	8.0	1.5	9.8	
t _{PLZ}	Output Disable Time	1.5	6.5	1.5	7.0	1.5	7.8	ns
t _{PHZ}		1.5	6.5	1.5	7.0	1.5	7.8	
t _{OSSL}	Output to Output Skew (Note 6)		1.0					ns
t _S	Setup Time, D _n to CLK	2.5		2.5		4.0		ns
t _H	Hold Time, D _n to CLK	5		1.5		2.0		ns
t _W	CLK Pulse Width			3.3		4.0		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 _{OSSL}) or LOW-to-HIGH (t _{OSLH}).								
Dynamic Switching Characteristics								
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C		Units		
				Typical				
V _{OLP}	Output Dynamic Peak V _{OL}	C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	0.8		V		
V _{OLV}	Output Dynamic Valley V _{OL}	C _L = 30 pF, V _{IH} = 2.5V, V _{IL} = 0V	2.5	0.6		V		
		C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	-0.8				
		C _L = 30 pF, V _{IH} = 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 _O	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	20	pF				

AC LOADING and WAVEFORMS Generic for LCX Family

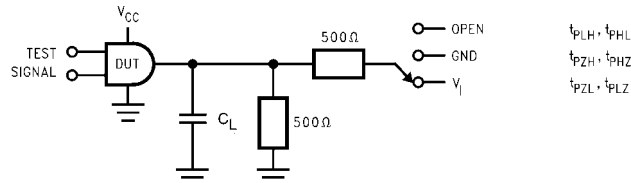
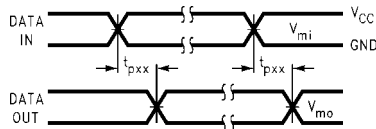
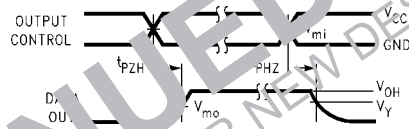


FIGURE 1. AC Test Circuit (C_L includes probe and jig capacitance)

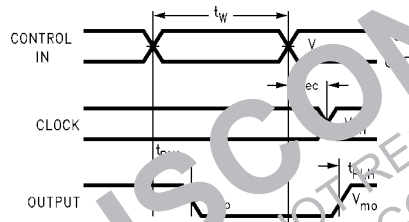
Test	Switch
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V at $V_{CC} = 3.3 \pm 0.3V$ $V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2V$
t_{PZH}, t_{PHZ}	GND



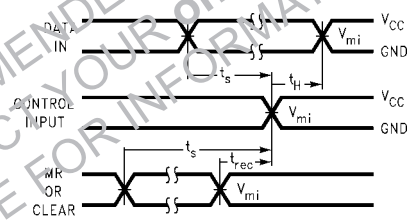
Waveform for Inverting and Non-Inverting Functions



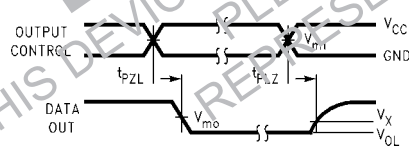
3-STATE Output High Enable and Disable Times for Logic



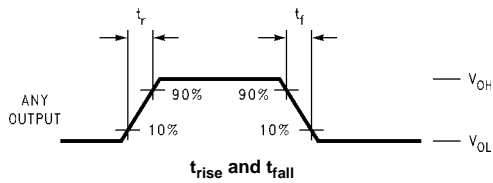
Propagation Delay, Pulse Width and t_{rec} Waveforms



Setup Time, Hold Time and Recovery Time for Logic



3-STATE Output Low Enable and Disable Times for Logic

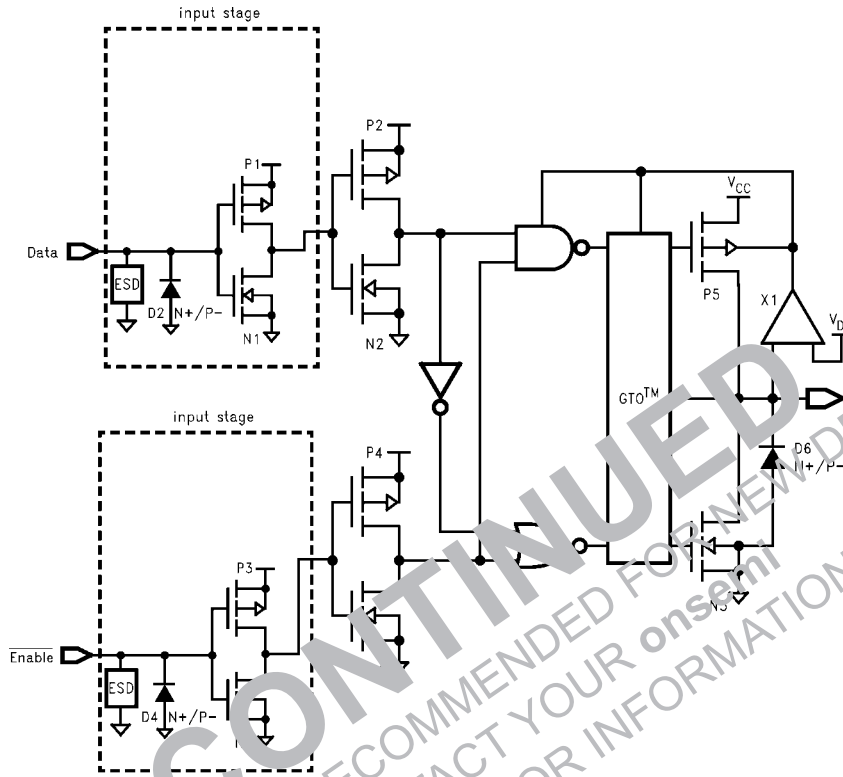


t_{rise} and t_{fall}

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

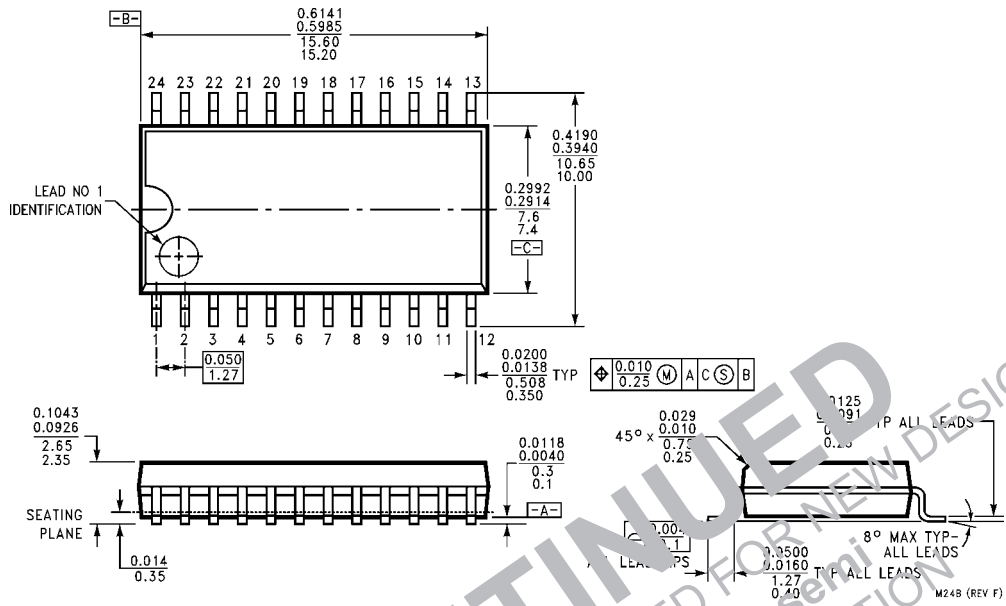
Symbol	V_{CC}		
	$3.3V \pm 0.3V$	2.7V	$2.5V \pm 0.2V$
V_{mi}	1.5V	1.5V	$V_{CC}/2$
V_{mo}	1.5V	1.5V	$V_{CC}/2$
V_x	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$
V_y	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$

Schematic Diagram Generic for LCX Family

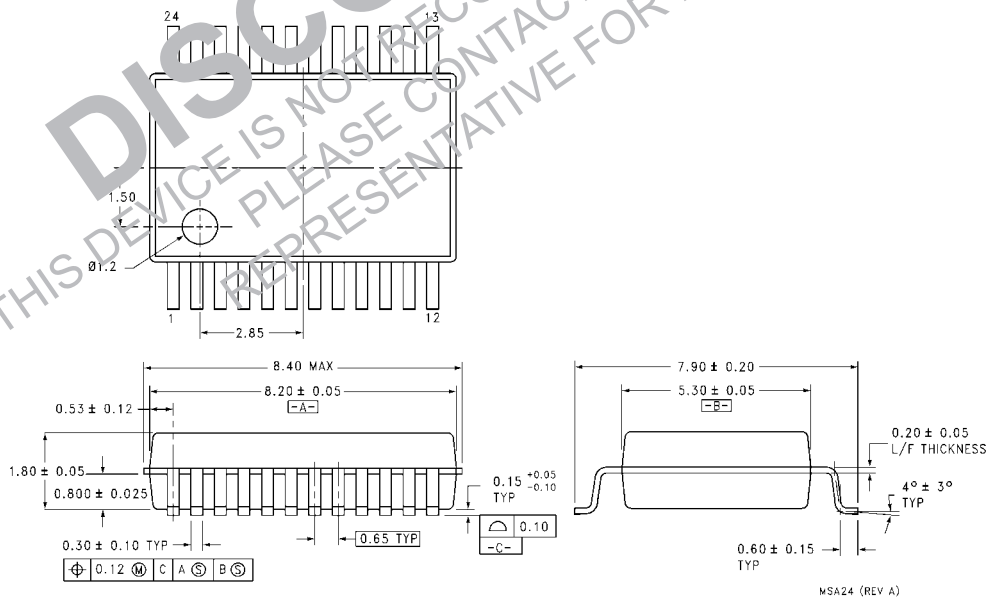


DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

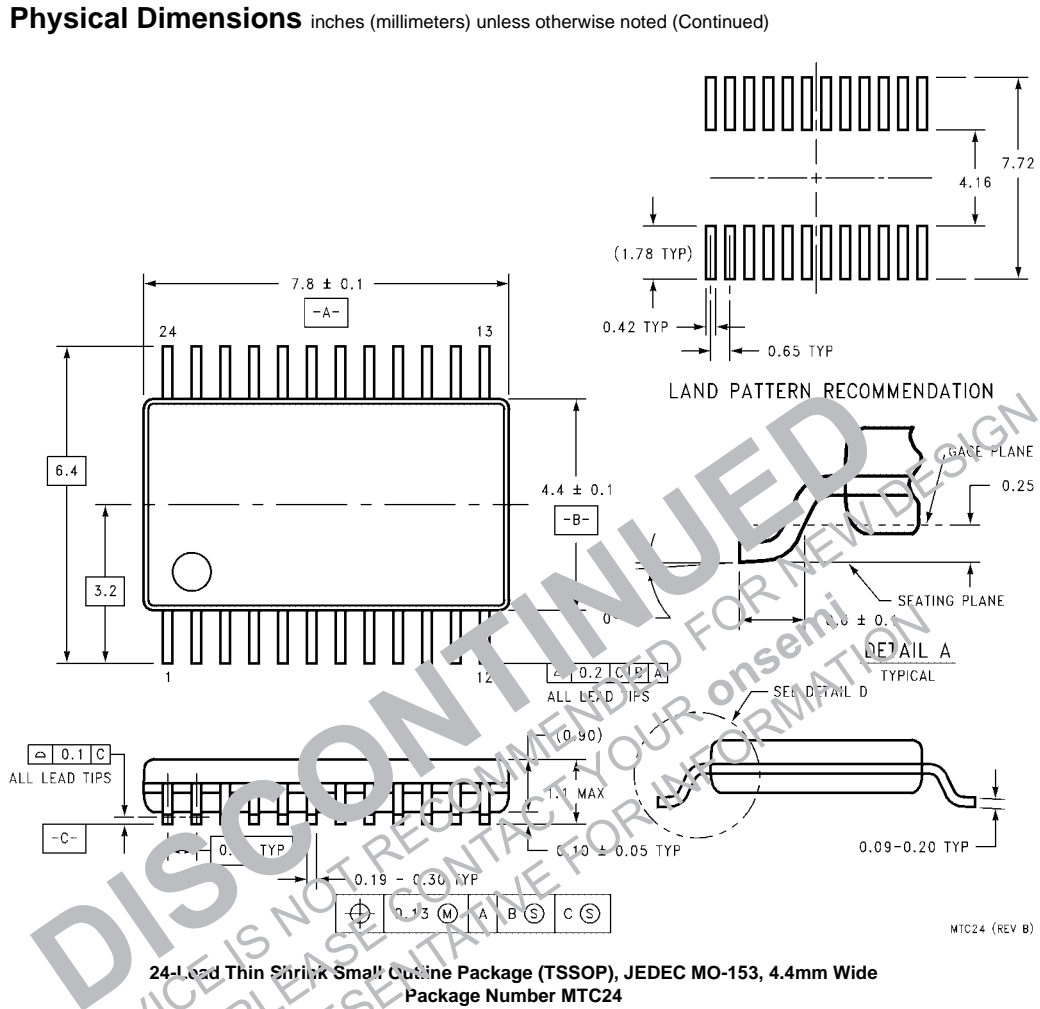
Physical Dimensions inches (millimeters) unless otherwise noted



**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
Package Number M248**



**24-Lead Shrink Small Outline Package (SSOP), EIAJ TYPE II, 5.3mm Wide
Package Number MSA24**



Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.


LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
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.

www.fairchildsemi.com

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative