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SEMICONDUCTOR ™

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74LCX16244

Low Voltage 16-Bit Buffer/Line Driver with 5V Tolerant Inputs and Outputs

General Description

The LCX16244 contains sixteen non-inverting buffers with 3-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus oriented transmitter/receiver. The device is nibble controlled. Each nibble has separate 3-STATE control inputs which can be shorted together for full 16-bit operation.

The LCX16244 is designed for low voltage (2.5V or 3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment.

The LCX16244 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
- 4.5 ns t_{PD} max (V_{CC} = 3.0V), 20 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
74LCX16244MEA	MS48A	48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
74LCX16244MTD	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

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

Connection Diagram
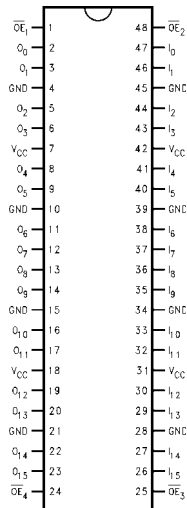
Logic Symbol
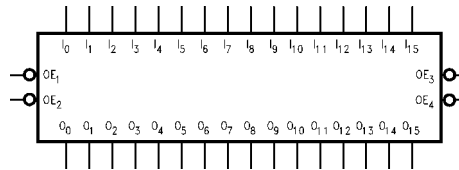
Pin Descriptions

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active LOW)
I_0–I_{15}	Inputs
O_0–O_{15}	Outputs

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Truth Tables

Inputs		Outputs
$\overline{OE}_1$	I_0–I_3	O_0–O_3
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_3$	I_8–I_{11}	O_8–O_{11}
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	I_4–I_7	O_4–O_7
L	L	L
L	H	H
H	X	Z

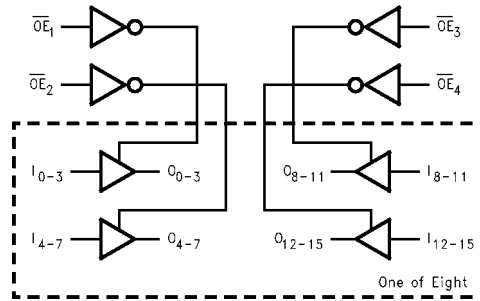| Inputs		Outputs
$\overline{OE}_4$	I_{12}–I_{15}	O_{12}–O_{15}
L	L	L
L	H	H
H	X	Z

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

Functional Description

The LCX16244 contains sixteen non-inverting buffers with 3-STATE standard outputs. The device is nibble (4 bits) controlled with each nibble functioning identically, but independent of the other. The control pins can be shorted together to obtain full 16-bit operation. The 3-STATE outputs are controlled by an Output Enable ($\overline{OE}_n$) input for each nibble. When $\overline{OE}_n$ is LOW, the outputs are in 2-state mode. When $\overline{OE}_n$ is HIGH, the outputs are in the high impedance mode, but this does not interfere with entering new data into the inputs.

Logic Diagram

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	Output in 3-STATE	V
		−0.5 to V_{CC} + 0.5	Output in HIGH or LOW State (Note 3)	
I_{IK}	DC Input Diode Current	−50	V_I < GND	mA
I_{OK}	DC Output Diode Current	−50	V_O < GND	mA
		+50	V_O > V_{CC}	
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 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	HIGH or LOW State	0	V_{CC}	V
		3-STATE	0	5.5	
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
$\Delta t/\Delta V$	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°C to +85°C Min	T_A = −40°C to +85°C Max	Units
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 μA	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 μA	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	$0 \leq V_O \leq 5.5V$	2.3 – 3.6		±5.0	μA
		$V_I = V_{IH}$ or V_{IL}				
I_{OFF}	Power-Off Leakage Current	V_I or V_O = 5.5V	0		10	μA

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DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V_CC (V)	T_A = −40°C to +85°C Min	T_A = −40°C to +85°C Max	Units
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	2.3 – 3.6		20	μA
		3.6V ≤ V_I, V_O ≤ 5.5V (Note 5)	2.3 – 3.6		±20	
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	V_{CC} = 3.3V ± 0.3V C_L = 50 pF Min	V_{CC} = 3.3V ± 0.3V C_L = 50 pF Max	V_{CC} = 2.7V C_L = 50 pF Min	V_{CC} = 2.7V C_L = 50 pF Max	V_{CC} = 2.5V ± 0.2V C_L = 30 pF Min	V_{CC} = 2.5V ± 0.2V C_L = 30 pF Max	Units
t_{PHL}	Propagation Delay	1.5	4.5	1.5	5.2	1.5	5.4	ns
t_{PLH}	Data to Output	1.5	4.5	1.5	5.2	1.5	5.4	
t_{PZL}	Output Enable Time	1.5	5.5	1.5	6.3	1.5	7.2	ns
t_{PZH}		1.5	5.5	1.5	6.3	1.5	7.2	
t_{PLZ}	Output Disable Time	1.5	5.4	1.5	5.7	1.5	6.5	ns
t_{PHZ}		1.5	5.4	1.5	5.7	1.5	6.5	
t_{OSHL}	Output to Output Skew (Note 6)		1.0					ns
t_{OSLH}			1.0					

(T_A = −40°C to +85°C, R_L = 500 Ω)

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_{OSHL}) or LOW-to-HIGH (t_{OSLH}). Parameter guaranteed by design.

Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_CC (V)	T_A = 25°C Typical	Units
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 = 30 pF, V_{IH} = 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 = 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_{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	20	pF

AC LOADING and WAVEFORMS Generic for LCX Family
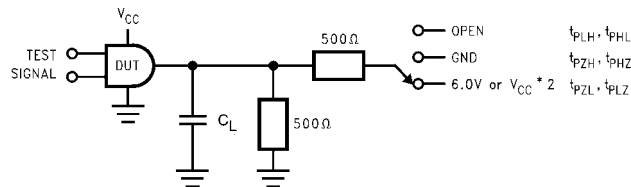
FIGURE 1. AC Test Circuit (C_L includes probe and jig capacitance)
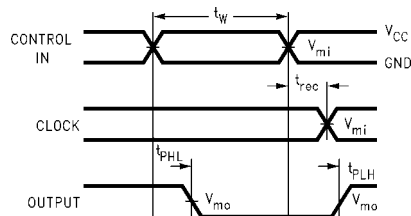
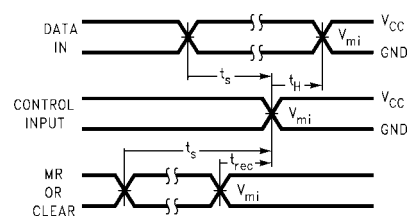| Test	Switch
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V at $V_{CC} = 3.3 \pm 0.3V$ V_{CC} x 2 at $V_{CC} = 2.5 \pm 0.2V$
t_{PZH}, t_{PHZ}	GND
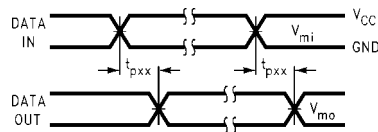
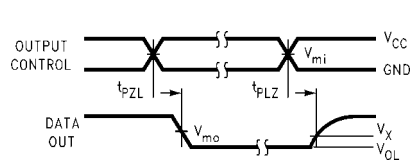**Waveform for Inverting and Non-Inverting Functions**
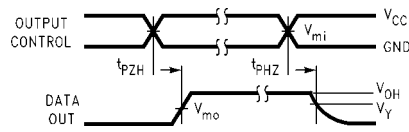
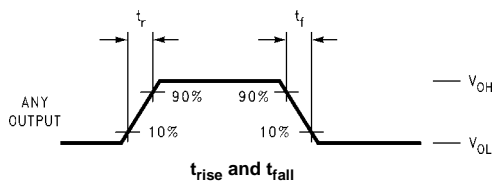**3-STATE Output High Enable and Disable Times for Logic**

Propagation Delay. Pulse Width and t_{rec} Waveforms

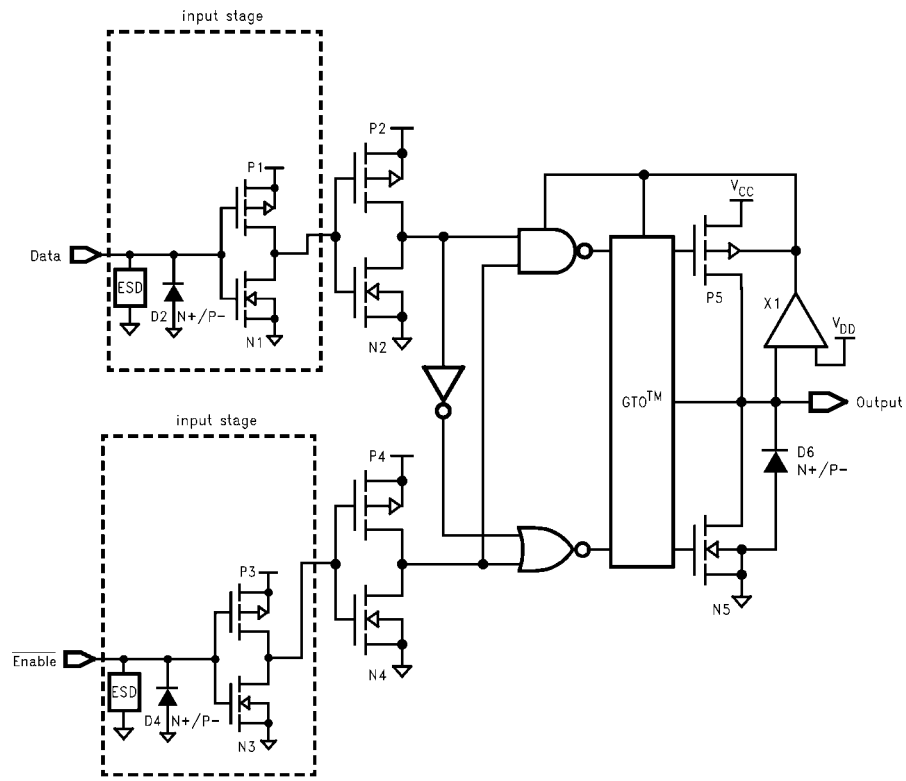**Setup Time, Hold Time and Recovery Time for Logic**

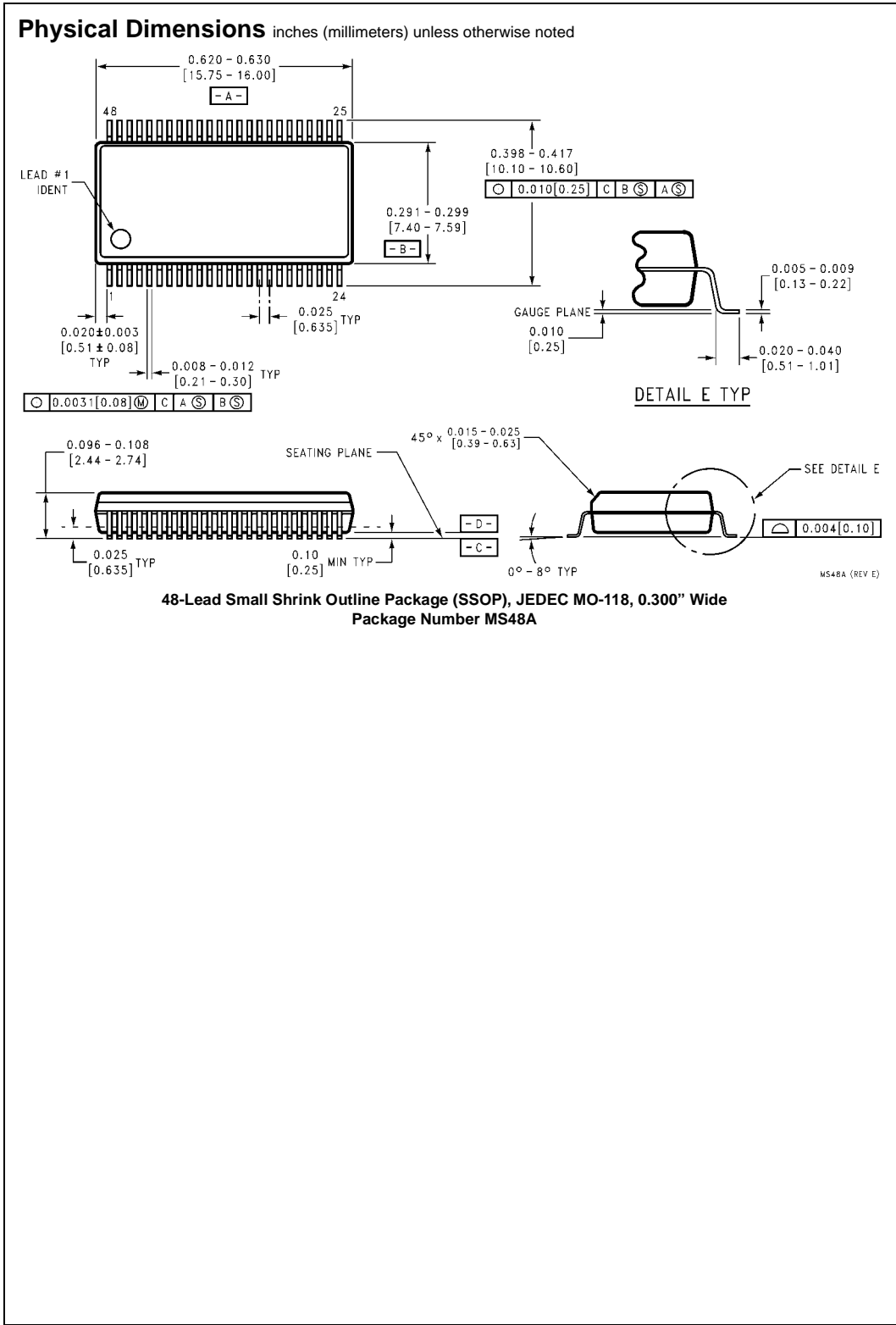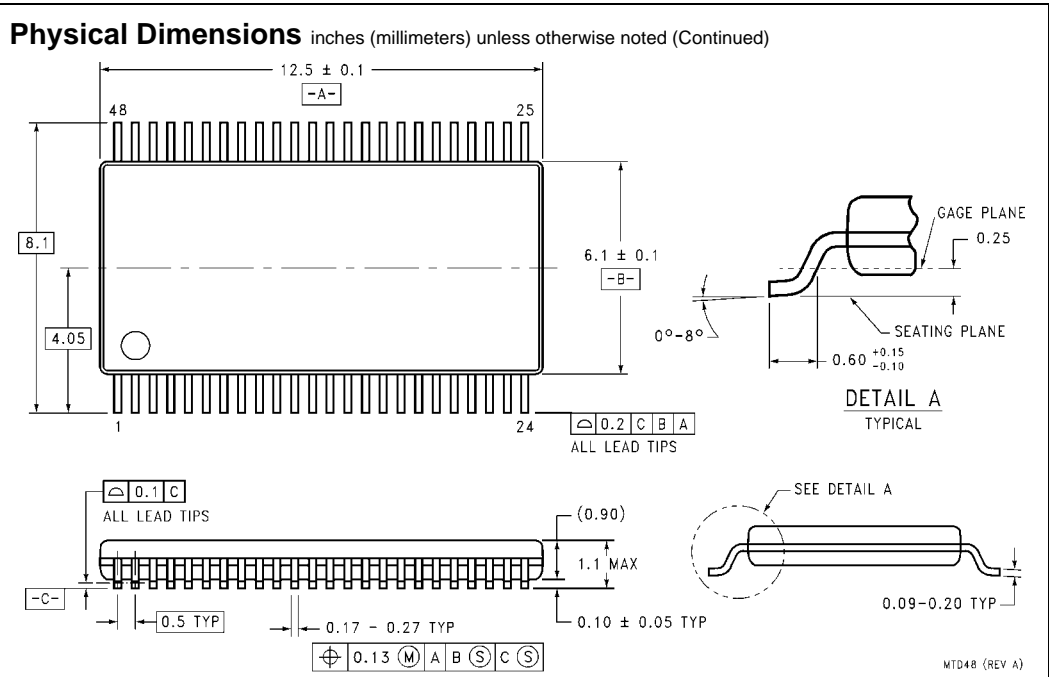**3-STATE Output Low Enable and Disable Times for Logic**

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	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$

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Schematic Diagram Generic for LCX Family

Physical Dimensions inches (millimeters) unless otherwise noted

48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
Package Number MS48A

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

48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD48

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