National Semiconductor

August 1996

74LVT16244
3.3V ABT 16-Bit Buffer/Line Driver with TRI-STATE® Outputs

General Description

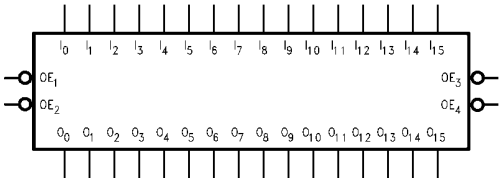
The LVT16244 contains sixteen non-inverting buffers with TRI-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus oriented transmitter/receiver. The device is nibble controlled. Individual TRI-STATE control inputs can be shorted together for 8-bit or 16-bit operation.

These bus buffers and line drivers are designed for low-voltage (3.3V) V_{CC} applications, but with the capability to provide a TTL interface to a 5V environment. The LVT16244 is fabricated with an advanced BiCMOS technology to achieve high speed operation similar to 5V ABT while maintaining a low power dissipation.

Features

- Input and output interface capability to systems at 5V V_{CC}
- Bus-Hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power Up/Down high impedance provides glitch-free bus loading
- Outputs source/sink −32 mA/+64 mA
- Available in SSOP and TSSOP
- Functionally compatible with the 74 series 16244
- Latch-up performance exceeds 500 mA

Logic Symbol



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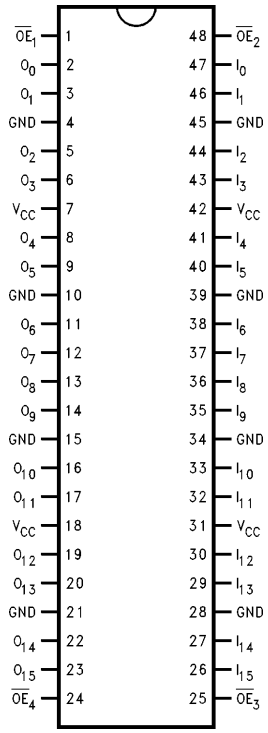
Pin Names	Description
$\overline{OE}_n$	Output Enable Inputs (Active Low)
I_0–I_{15}	Inputs
O_0–O_{15}	Outputs

	SSOP	TSSOP
Order Number	74LVT16244MEA 74LVT16244MEAX	74LVT16244MTD 74LVT16244MTDX
See NS Package Number	MS48A	MTD48

Connection Diagram

Pin Assignment for SSOP and TSSOP



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TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Functional Description

The LVT16244 contains sixteen non-inverting buffers with TRI-STATE 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.

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

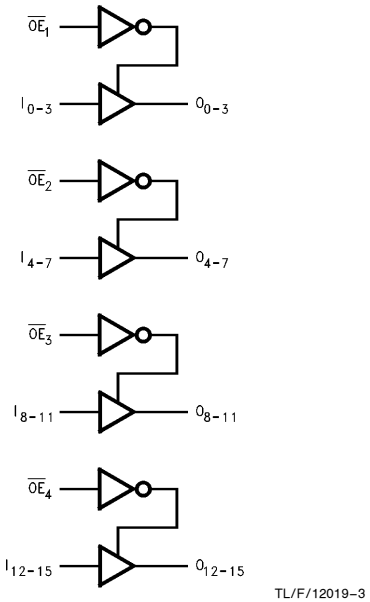
Inputs		Outputs
$\overline{OE}_3$	I_8–I_{11}	O_8–O_{11}
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_4$	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

Logic Diagram



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Absolute Maximum Ratings (Note 1)

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	Output Voltage	−0.5 to +7.0	Output in TRI-STATE	V
		−0.5 to +7.0	Output in High or Low State (Note 2)	V
I_{IK}	DC Input Diode Current	−50	V_I < GND	mA
I_{OK}	DC Output Diode Current	−50	V_O < GND	mA
I_O	DC Output Current	64	V_O > V_{CC} Output at HIGH State	mA
		128	V_O > V_{CC} Output at LOW State	
I_{CC}	DC Supply Current per Supply Pin	±64		mA
I_{GND}	DC Ground Current per Ground Pin	±128		mA
T_{STG}	Storage Temperature	−65 to +150		°C

Note 1: 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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Recommended Operating Conditions

Symbol	Symbol		Min	Max	Units
V_{CC}	Supply Voltage	Operating	2.7	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
		TRI-STATE	0	5.5	
I_{OH}	High-Level Output Current			−32	mA
I_{OL}	Low-Level Output Current			64	mA
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

DC Electrical Characteristics

Symbol	Parameter		V_{CC} (V)	$T_A = -40°C$ to $+85°C$			Units	Conditions
				Min	Typ (Note 3)	Max		
V_{IK}	Input Clamp Diode Voltage		2.7			−1.2	V	$I_I = -18$ mA
V_{IH}	Input HIGH Voltage		2.7–3.6	2.0			V	$V_O \leq 0.1V$ or $V_O \geq V_{CC} - 0.1V$
V_{IL}	Input LOW Voltage		2.7–3.6			0.8	V	
V_{OH}	Output HIGH Voltage		2.7–3.6	$V_{CC} - 0.2$			V	$I_{OH} = -100\ \mu A$
			2.7	2.2			V	$I_{OH} = -8$ mA
			3.0	2.0			V	$I_{OH} = -32$ mA
V_{OL}	Output LOW Voltage		2.7			0.2	V	$I_{OL} = 100\ \mu A$
			2.7			0.5	V	$I_{OL} = 24$ mA
			3.0			0.4	V	$I_{OL} = 16$ mA
			3.0			0.5	V	$I_{OL} = 32$ mA
			3.0			0.55	V	$I_{OL} = 64$ mA
$I_{I(HOLD)}$	Bus-Hold Input Minimum Drive		3.0	75			μA	$V_I = 0.8V$
				−75			μA	$V_I = 2.0V$
$I_{I(OD)}$	Bus-Hold Input Over-Drive Current to Change State		3.0	500			μA	(Note 4)
				−500			μA	(Note 5)
I_I	Input Current		3.6			10	μA	$V_I = 5.5V$
		Control Pins	3.6			±1	μA	$V_I = 0V$ or V_{CC}
		Data Pins	3.6			−5	μA	$V_I = 0V$
						1	μA	$V_I = V_{CC}$
I_{OFF}	Power Off Leakage Current		0			±100	μA	$0V \leq V_I$ or $V_O \leq 5.5V$
$I_{PU/PD}$ (Note 6)	Power Up/Down TRI-STATE Current		0–1.2V			±100	μA	$V_O = 0.5V$ to V_{CC}, $V_I =$ GND or V_{CC}
I_{OZL}	TRI-STATE Output Leakage Current		3.6			−5	μA	$V_O = 0.5V$
I_{OZH}	TRI-STATE Output Leakage Current		3.6			5	μA	$V_O = 3.0V$
$I_{OZH}{}^+$	TRI-STATE Output Leakage Current		3.6			10	μA	$V_{CC} < V_O \leq 5.5V$
I_{CCH}	Power Supply Current		3.6			0.115	mA	Outputs High
I_{CCL}	Power Supply Current		3.6			9.5	mA	Outputs Low
I_{CCZ}	Power Supply Current		3.6			0.115	mA	Outputs Disabled
$I_{CCZ}{}^+$	Power Supply Current		3.6			0.115	mA	$V_{CC} \leq V_O \leq 5.5V$, Outputs Disabled
ΔI_{CC}	Increase in Power Supply Current (Note 7)		3.6			0.2	mA	One Input at $V_{CC} - 0.6V$, Other Inputs at V_{CC} or GND

Note 3: All typical values are at $V_{CC} = 3.3V$, $T_A = 25°C$.

Note 4: An external driver must source at least the specified current to switch from LOW to HIGH.

Note 5: An external driver must sink at least the specified current to switch from HIGH to LOW.

Note 6: This parameter is valid for any V_{CC} between 0V and 1.2V at 25°C only.

Note 7: This is the increase in supply current for each input that is at the specified voltage level rather than V_{CC} or GND.

Dynamic Switching Characteristics (Note 8)

Symbol	Parameter	V_{CC} (V)	$T_A = 25°C$			Units	Conditions $C_L = 50$ pF, $R_L = 500\Omega$
			Min	Typ	Max		
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3		0.8		V	(Note 9)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3		−0.8		V	(Note 9)

Note 8: Characterized in SOIC package. Guaranteed parameter, but not tested.

Note 9: Max number of outputs defined as (n). n−1 data inputs are driven 0V to 3V. Output under test held LOW.

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $C_L = 50$ pF, $R_L = 500\Omega$					Units
		$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$		
		Min	Typ (Note 3)	Max	Min	Max	
t_{PLH}	Propagation Delay Data to Output	1.0		4.1	1.0	5.0	ns
t_{PHL}		1.0		4.1	1.0	5.2	
t_{PZH}	Output Enable Time	1.0		5.2	1.0	6.3	ns
t_{PZL}		1.0		5.2	1.0	6.7	
t_{PHZ}	Output Disable Time	1.8		5.7	1.8	6.3	ns
t_{PLZ}		1.8		5.1	1.8	5.6	
t_{OSHL}	Output to Output Skew (Note 10)			1.0			ns
t_{OSLH}							

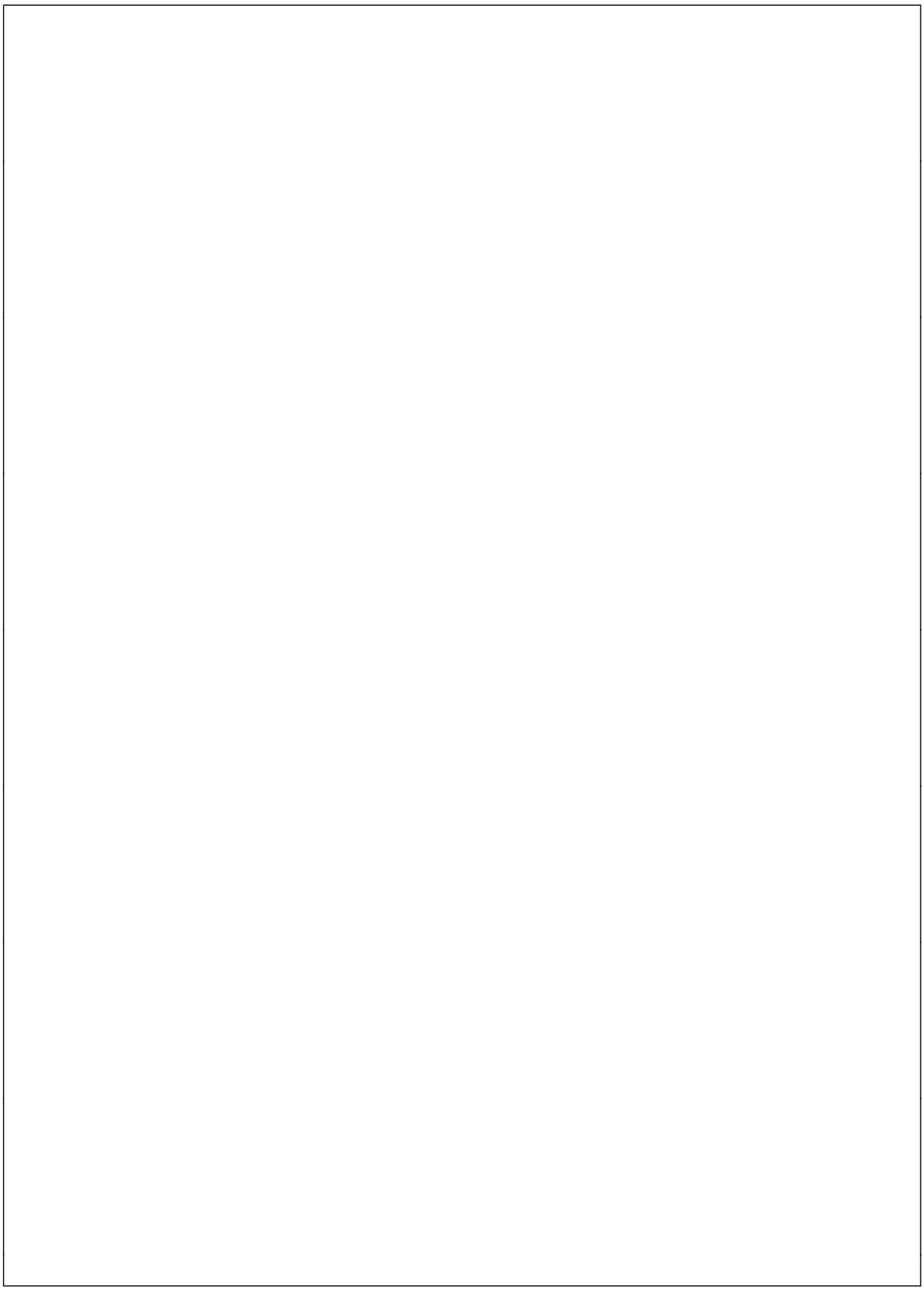
Note 3: All typical values are at $V_{CC} = 3.3V$, $T_A = 25°C$.

Note 10: 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.

Capacitance (Note 11)

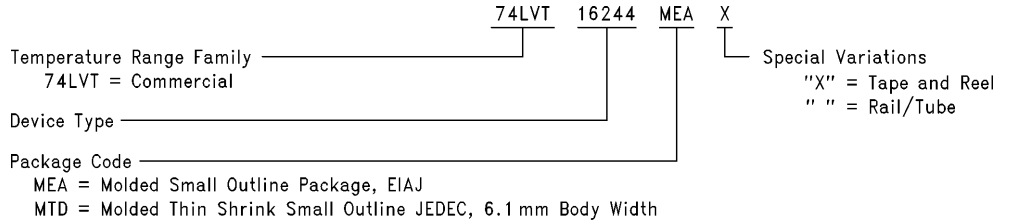
Symbol	Parameter	Min	Typ	Max	Units	Conditions
C_{IN}	Input Capacitance		4		pF	$V_{CC} = 0V$, $V_I = 0V$ or V_{CC}
C_{OUT}	Output Capacitance		11		pF	$V_{CC} = 3.0V$, $V_O = 0V$ or V_{CC}

Note 11: Capacitance is measured at frequency f = 1 MHz, per MIL-STD-883B, Method 3012.



74LVT16244 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



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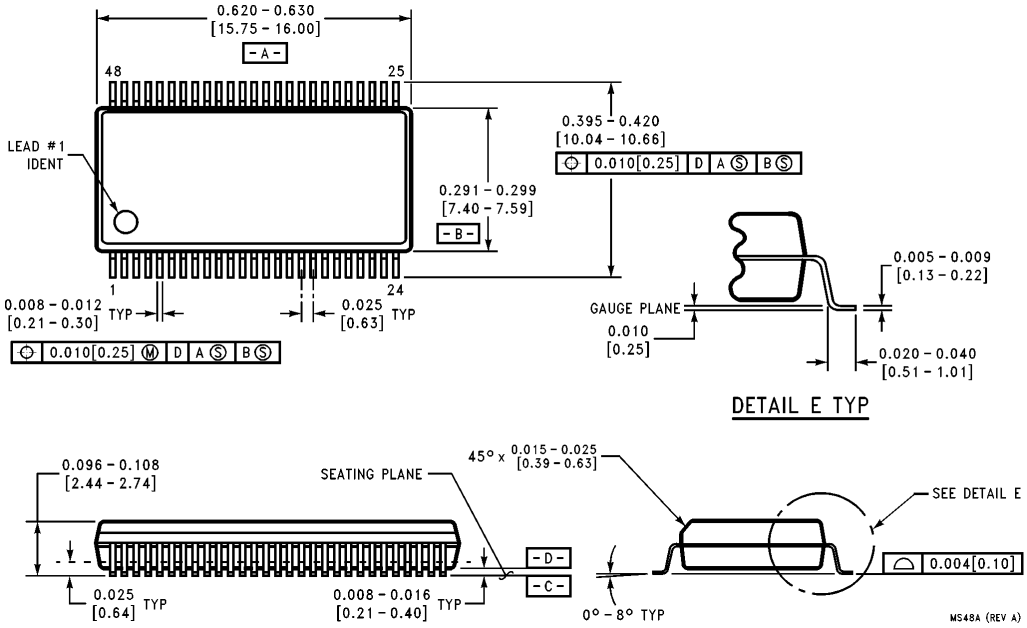
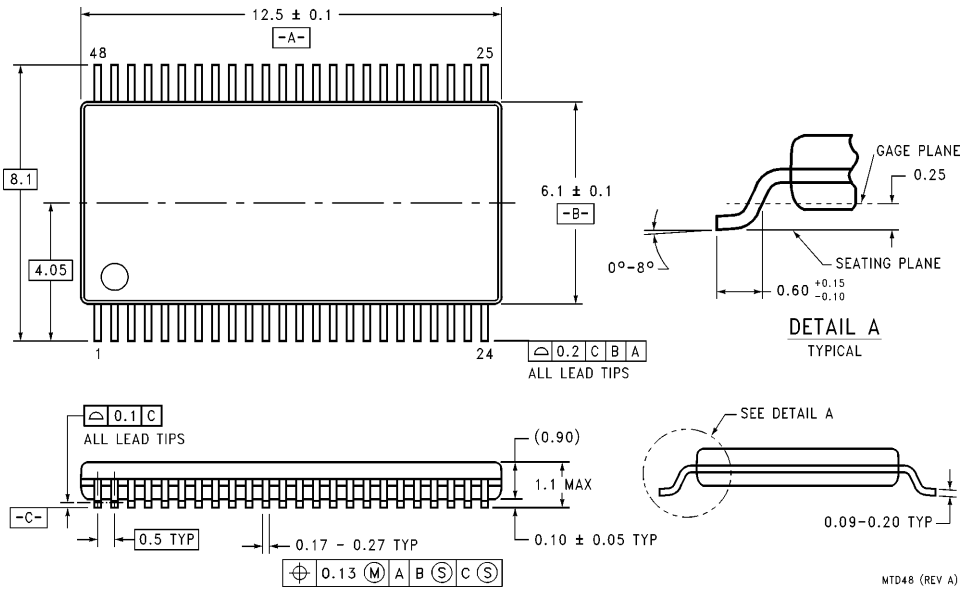
Physical Dimensions inches (millimeters) unless otherwise noted



48-Lead Molded Shrink Small Outline Package, EIAJ
Order Number 74LVT16244MEA or 74LVT16244MEAX
NS Package Number MS48A

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



48-Lead Molded Thin Shrink Small Outline Package, JEDEC, 6.1 mm Body Width
Order Number 74LVT16244MTD or 74LVT16244MTDX
NS Package Number MTD48

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2. A critical component is 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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