National Semiconductor

August 1996

74LVT245
3.3V ABT Octal Bidirectional Transceiver with TRI-STATE® Inputs/Outputs

General Description

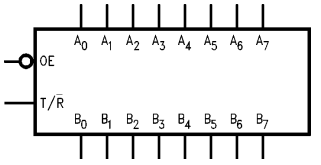
The LVT245 contains eight non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus-oriented applications. Current sinking capability is 64 mA at both the A and B ports. The Transmit/Receive (T/R) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B ports to A ports. The Output Enable input, when HIGH, disables both A and B ports by placing them in a HIGH Z condition.

These transceivers are designed for low-voltage (3.3V) V_{CC} applications, but with the capability to provide a TTL interface to a 5V environment. The LVT245 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 SOIC JEDEC, SOIC EIAJ, TSSOP and SSOPII
- Functionally compatible with the 74 series 245
- Latch-up performance exceeds 500 mA

Logic Symbols



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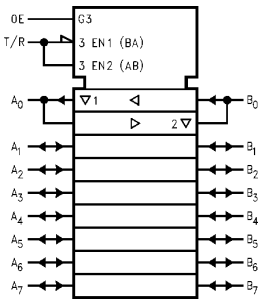
IEEE/IEC



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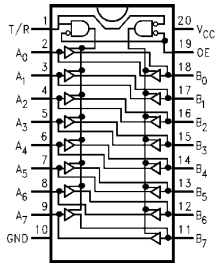
Connection Diagram

Pin Assignment for SOIC, TSSOP and SSOPII



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Truth Table

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

Inputs		Outputs
$\overline{OE}$	T/$\overline{R}$	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	HIGH-Z State

H = HIGH Voltage Level L = LOW Voltage Level X = Immaterial

	SOIC JEDEC	SOIC EIAJ	TSSOP JEDEC	SSOPII
Order Number	74LVT245WM 74LVT245WMX	74LVT245SJ 74LVT245SJX	74LVT245MTC 74LVT245MTCX	74LVT245MSA 74LVT245MSAX
See NS Package Number	M20B	M20D	MTC20	MSA20

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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	DC 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
ESD	Human Body Model	1000		V

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	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	3.6	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	
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_{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

DC Electrical Characteristics (Continued)

Symbol	Parameter		V_{CC} (V)	$T_A = -40°C$ to $+85°C$			Units	Conditions
				Min	Typ (Note 3)	Max		
$I_{I(HOLD)}$	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	Control Pins	3.6			10	μA	$V_I = 5.5V$
						±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	$0V \le V_I$ or $V_O \le 5.5V$
$I_{PU/PD}$ (Note 6)	Power Up/Down TRI-STATE Output 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			20	μA	$V_{CC} < V_O \le 5.5V$
I_{CCH}	Power Supply Current		3.6			0.19	mA	Outputs High
I_{CCL}	Power Supply Current		3.6			17.5	mA	Outputs Low
I_{CCZ}	Power Supply Current		3.6			0.19	mA	Outputs Disabled
$I_{CCZ}{}^+$	Power Supply Current		3.6			0.19	mA	$V_{CC} \le V_O \le 5.5V$, 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 for Test Methodology (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 for Test Methodology

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} t_{PHL}	Propagation Delay Data to Output	1.0 1.0		4.0 4.0	1.0 1.0	5.2 5.5	ns
t_{PZH} t_{PZL}	Output Enable Time	1.1 1.5		5.9 6.5	1.1 1.5	7.1 7.9	ns
t_{PHZ} t_{PLZ}	Output Disable Time	2.2 2.0		5.9 5.5	2.2 2.0	6.5 5.6	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 10)			1.0			ns

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.

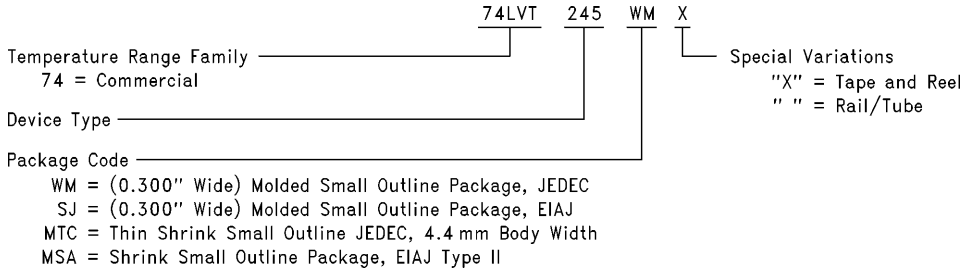
Capacitance (Note 11)

Symbol	Parameter	Min	Typ	Max	Units	Conditions
C_{IN}	Input Capacitance		5		pF	$V_{CC} = 0V$, $V_I = 0V$ or V_{CC}
C_{IO}	Output Capacitance		12		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.

74LVT245 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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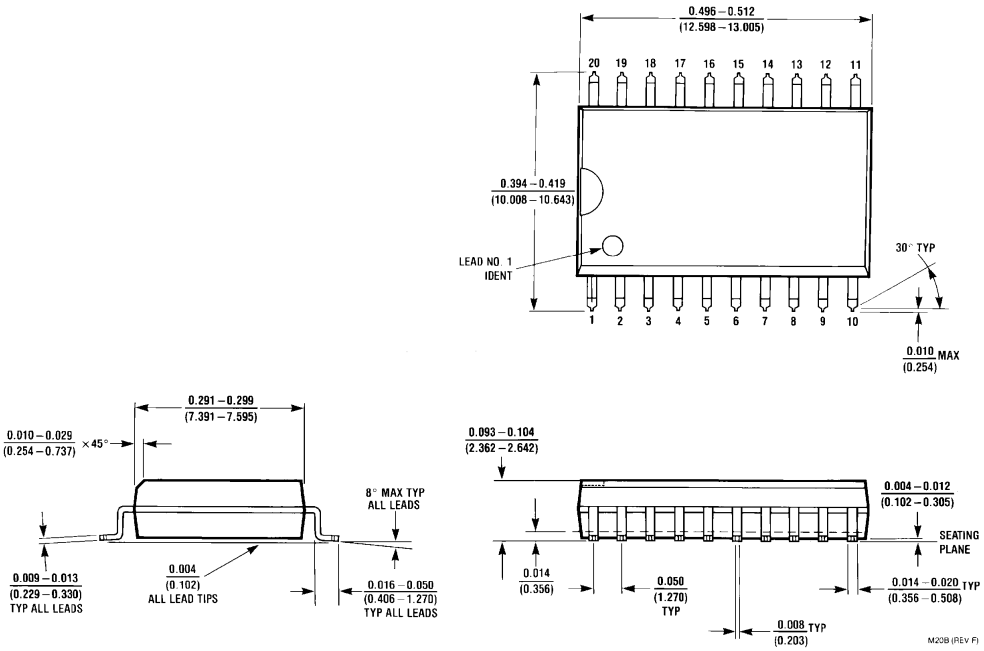
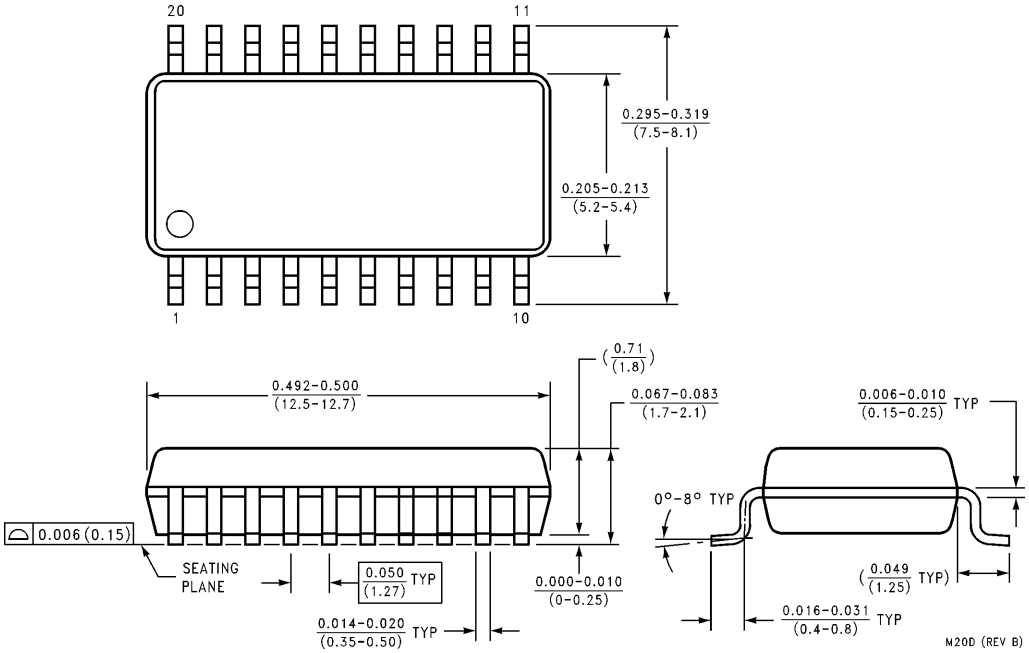
Physical Dimensions inches (millimeters) unless otherwise noted



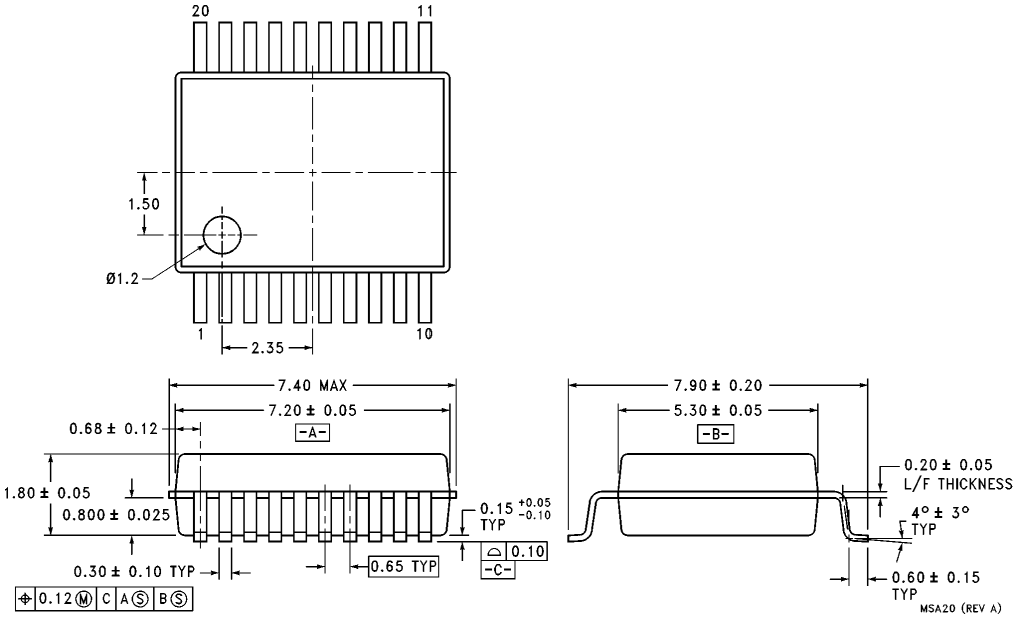
20-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC
Order Number 74LVT245WM or 74LVT245WMX
NS Package Number M20B

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



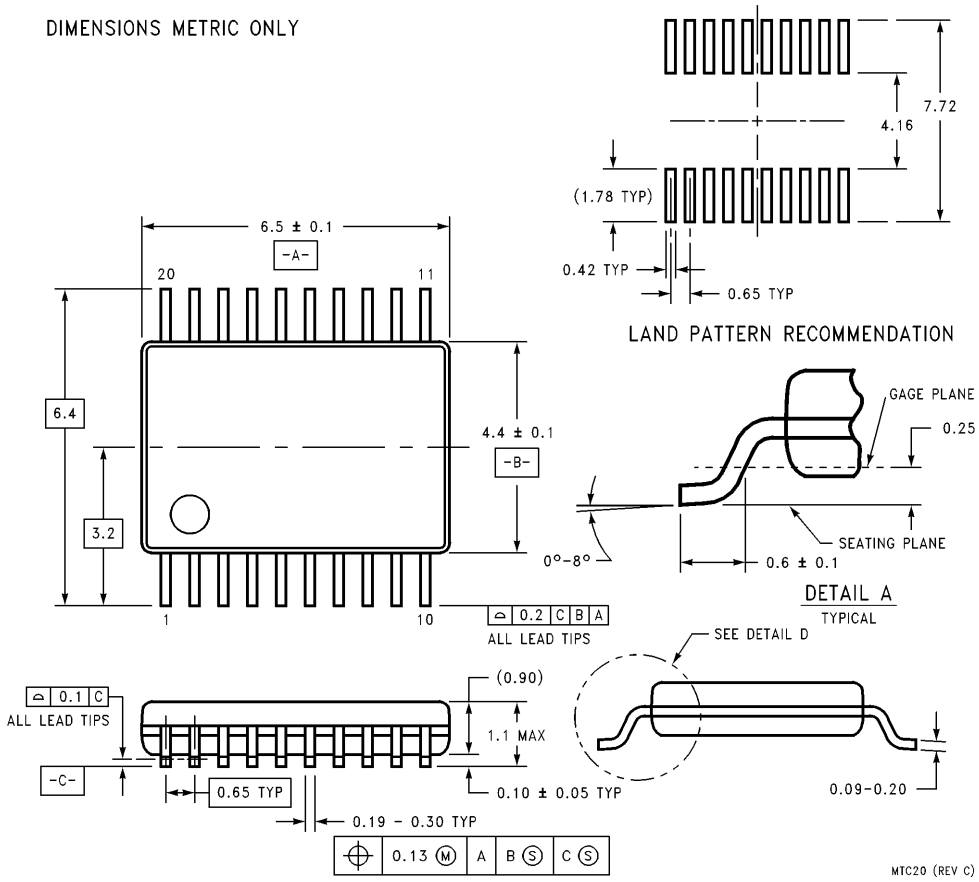
20-Lead (0.300″ Wide) Molded Small Outline Package, EIAJ
Order Number 74LVT245SJ or 74LVT245SJX
NS Package Number M20D

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



20-Lead Molded Shrink Small Outline Package, EIAJ Type II
Order Number 74LVT245MSA or 74LVT245MSAX
NS Package Number MSA20

Physical Dimensions millimeters (Continued)



20-Lead Molded Thin Shrink Small Outline Package, JEDEC
Order Number 74LVT245MTC or 74LCX245MTCX
NS Package Number MTC20

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