

# Low Voltage 1-of-8 Decoder/Demultiplexer

## 74LVX138

### General Description

The LVX138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three LVX138 devices or a 1-of-32 decoder using four LVX138 devices and one inverter.

### Features

- Input Voltage Level Translation from 5 V to 3 V
- Ideal for Low Power/Low Noise 3.3 V Applications
- Guaranteed Simultaneous Switching Noise Level and Dynamic Threshold Performance
- These Devices are Pb-Free and are RoHS Compliant

### Logic Symbols

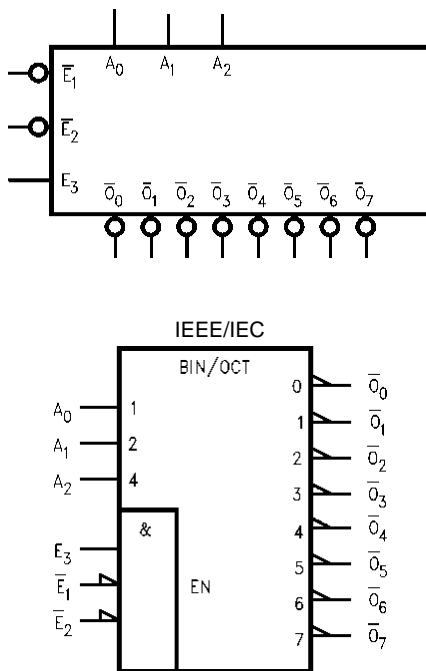
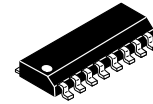
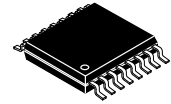


Figure 1. Logic Symbols

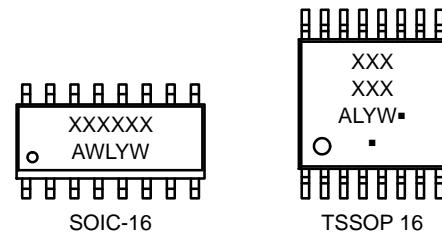


SOIC-16, 150 mils  
CASE 751BG



TSSOP 16  
CASE 948AH

### MARKING DIAGRAMS



XXXXXX = Specific Device Code

A = Assembly Location

WL, L = Wafer Lot

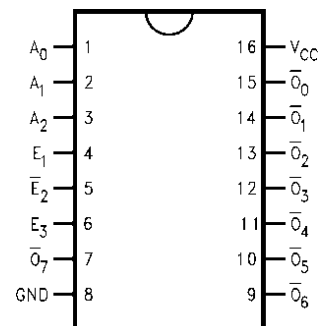
Y = Year

WW, W = Work Week

G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### CONNECTION DIAGRAM



### PIN DESCRIPTIONS

Pins	Function
A <sub>0</sub> -A <sub>2</sub>	Address Inputs
E <sub>1</sub> -E <sub>2</sub>	Enable Inputs
E <sub>3</sub>	Enable Input
O <sub>0</sub> -O <sub>7</sub>	Outputs

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

## 74LVX138

### Functional Description

The LVX138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs ( $A_0$ ,  $A_1$ ,  $A_2$ ) and, when enabled, provides eight mutually exclusive active-LOW outputs ( $\bar{O}_0$ – $\bar{O}_7$ ). The LVX138 features three Enable inputs, two active-LOW ( $\bar{E}_1$ ,  $\bar{E}_2$ ) and one active-HIGH ( $E_3$ ).

All outputs will be HIGH unless  $\bar{E}_1$  and  $\bar{E}_2$  are LOW and  $E_3$  is HIGH.

The LVX138 can be used as an 8-output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

### TRUTH TABLE

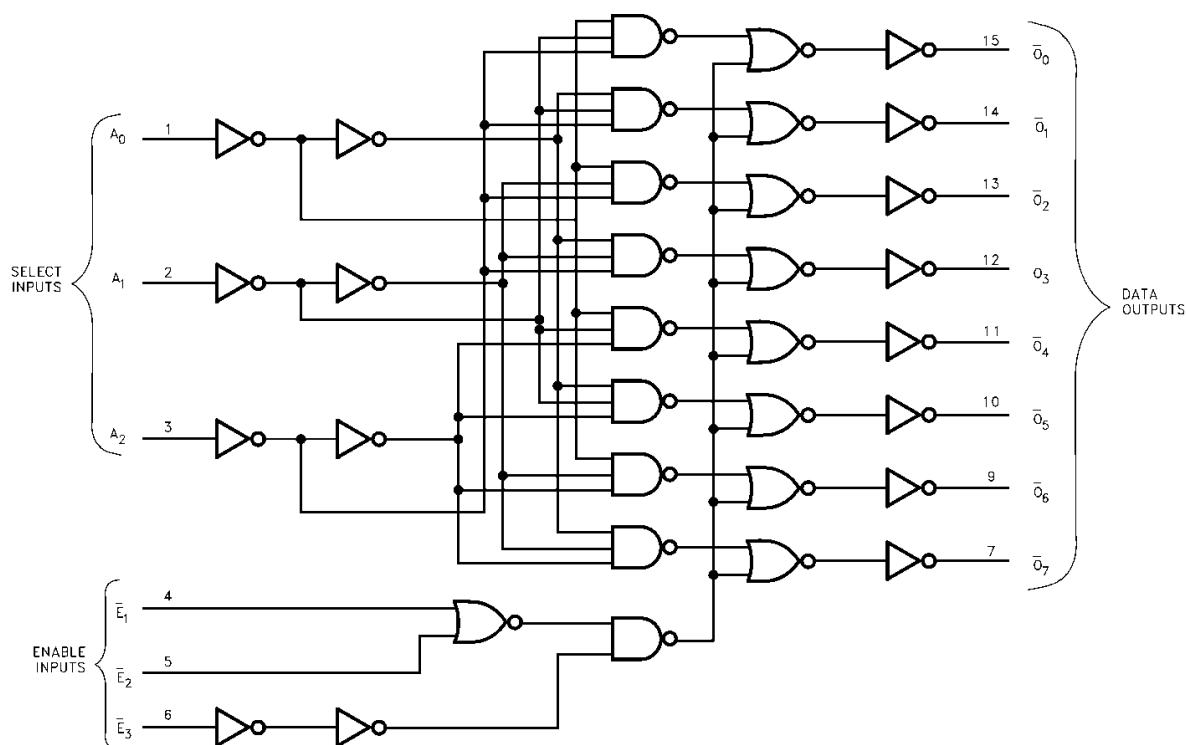
Inputs						Outputs							
$\bar{E}_1$	$\bar{E}_2$	$E_3$	$A_0$	$A_1$	$A_2$	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$	$\bar{O}_4$	$\bar{O}_5$	$\bar{O}_6$	$\bar{O}_7$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

### 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.

Figure 2. Logic Diagram

**MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	−0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage	−0.5 to +6.5	V
V <sub>OUT</sub>	DC Output Voltage	−0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IN</sub>	DC Input Current, per Pin	±20	mA
I <sub>OUT</sub>	DC Output Current, per Pin	±25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	±75	mA
I <sub>IK</sub>	Input Clamp Current	−20	mA
I <sub>OK</sub>	Output Clamp Current	±20	mA
T <sub>STG</sub>	Storage Temperature Range	−65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 1)	SOIC-16 TSSOP 16 126 159	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 25 °C	SOIC-16 TSSOP 16 995 787	mW
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34 UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage (Note 2)	Human Body Model Charged Device Model 2000 N/A	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	3.6	V
V <sub>in</sub>	DC Input Voltage (Note 3)	0	5.5	V
V <sub>out</sub>	DC Output Voltage (Note 3)	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature	−40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	0	100	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

3. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25 °C			T <sub>A</sub> = -40 to 85 °C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage		2.0 3.0 3.6	1.5 2.0 2.4	– – –	– – –	1.5 2.0 2.4	– – –	V
V <sub>IL</sub>	LOW Level Input Voltage		2.0 3.0 3.6	– – –	– – –	0.5 0.8 0.8	– – –	0.5 0.8 0.8	V
V <sub>OH</sub>	HIGH Level Output Voltage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -50 µA I <sub>OH</sub> = -50 µA I <sub>OH</sub> = -4 mA	2.0 3.0 3.0	1.9 2.9 2.58	2.0 3.0 –	– – –	1.9 2.9 2.48	– – –	V
V <sub>OL</sub>	LOW Level Output Voltage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OL</sub> = 50 µA I <sub>OL</sub> = 50 µA I <sub>OL</sub> = 4 mA	2.0 3.0 3.0	– – –	0.0 0.0 –	0.1 0.1 0.36	– – –	0.1 0.1 0.44	V
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	3.6	–	–	±0.1	–	±1.0	µA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6	–	–	4.0	–	40.0	µA

## NOISE CHARACTERISTICS (Note 4)

Symbol	Characteristic	C <sub>L</sub> (pF)	V <sub>CC</sub> (V)	T <sub>A</sub> = 25 °C		Unit
				Typ	Limit	
V <sub>OLP</sub>	Quiet Output Maximum Dynamic V <sub>OL</sub>	50	3.3	0.3	0.5	V
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	50	3.3	-0.33	-0.5	V
V <sub>IHD</sub>	Minimum HIGH Level Dynamic Input Voltage	50	3.3	–	2.0	V
V <sub>ILD</sub>	Maximum LOW Level Dynamic Input Voltage	50	3.3	–	0.8	V

4. Input tr = tf = 3 ns

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	C <sub>L</sub> (pF)	V <sub>CC</sub> (V)	T <sub>A</sub> = 25 °C			T <sub>A</sub> = -40 to 85 °C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time A <sub>n</sub> to $\bar{O}_n$	15	2.7	–	7.1	13.8	1.0	16.5	ns
		50		–	9.6	17.3	1.0	20.0	
		15	3.3	–	5.5	8.8	1.0	10.5	
		50	±0.3	–	8.0	12.3	1.0	14.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time $\bar{E}_1$ or $\bar{E}_2$ to $\bar{O}_n$	15	2.7	–	8.8	16.0	1.0	18.5	ns
		50		–	11.3	19.5	1.0	22.0	
		15	3.3	–	6.9	10.4	1.0	11.5	
		50	±0.3	–	9.4	13.9	1.0	15.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time E <sub>3</sub> to $\bar{O}_n$	15	2.7	–	8.7	16.3	1.0	19.5	ns
		50		–	11.2	19.8	1.0	23.0	
		15	3.3	–	6.8	10.6	1.0	12.5	
		50	±0.3	–	9.3	14.1	1.0	16.0	
t <sub>OSSL</sub> , t <sub>OSLH</sub>	Output to Output Skew (Note 5)	50	2.7	–	–	1.5	–	1.5	ns
			3.3	–	–	1.5	–	1.5	

5. Parameter guaranteed by design. t<sub>OSSL</sub> = |t<sub>PLHm</sub> - t<sub>PLHn</sub>|, t<sub>OSLH</sub> = |t<sub>PHLm</sub> - t<sub>PHLn</sub>|

## 74LVX138

### CAPACITANCE

Symbol	Parameter	T <sub>A</sub> = 25 °C			T <sub>A</sub> = -40 to 85 °C		Unit
		Min	Typ	Max	Min	Max	
C <sub>in</sub>	Input Capacitance	–	4	10	–	10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	–	34	–	–	–	pF

6. CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $C_{PD} \times V_{CC} \times I_{IN} + I_{CC}$

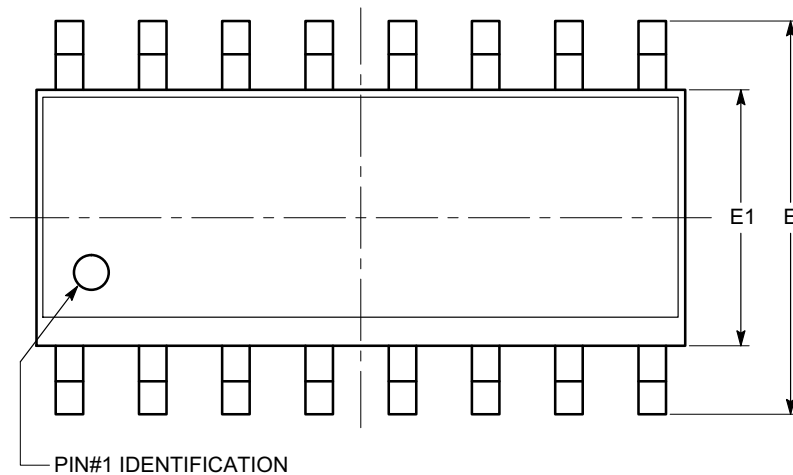
### ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
74LVX138MX	LVX138G	SOIC-16 (Pb-Free)	2500 Tape & Reel
74LVX138MTCX	LVX 138	TSSOP 16 (Pb-Free)	2500 Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

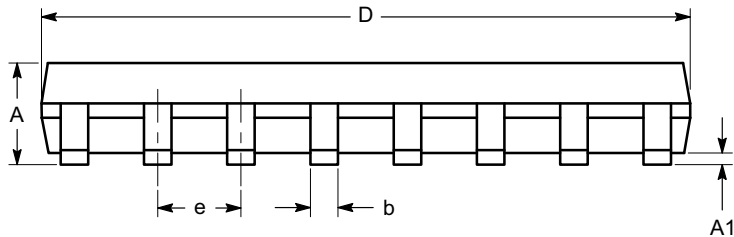
**SOIC-16, 150 mils**  
**CASE 751BG**  
**ISSUE O**

DATE 19 DEC 2008

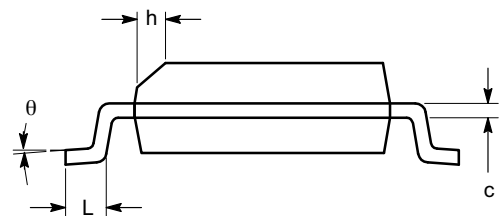


SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
$\theta$	0°		8°

**TOP VIEW**



**SIDE VIEW**



**END VIEW**

**Notes:**

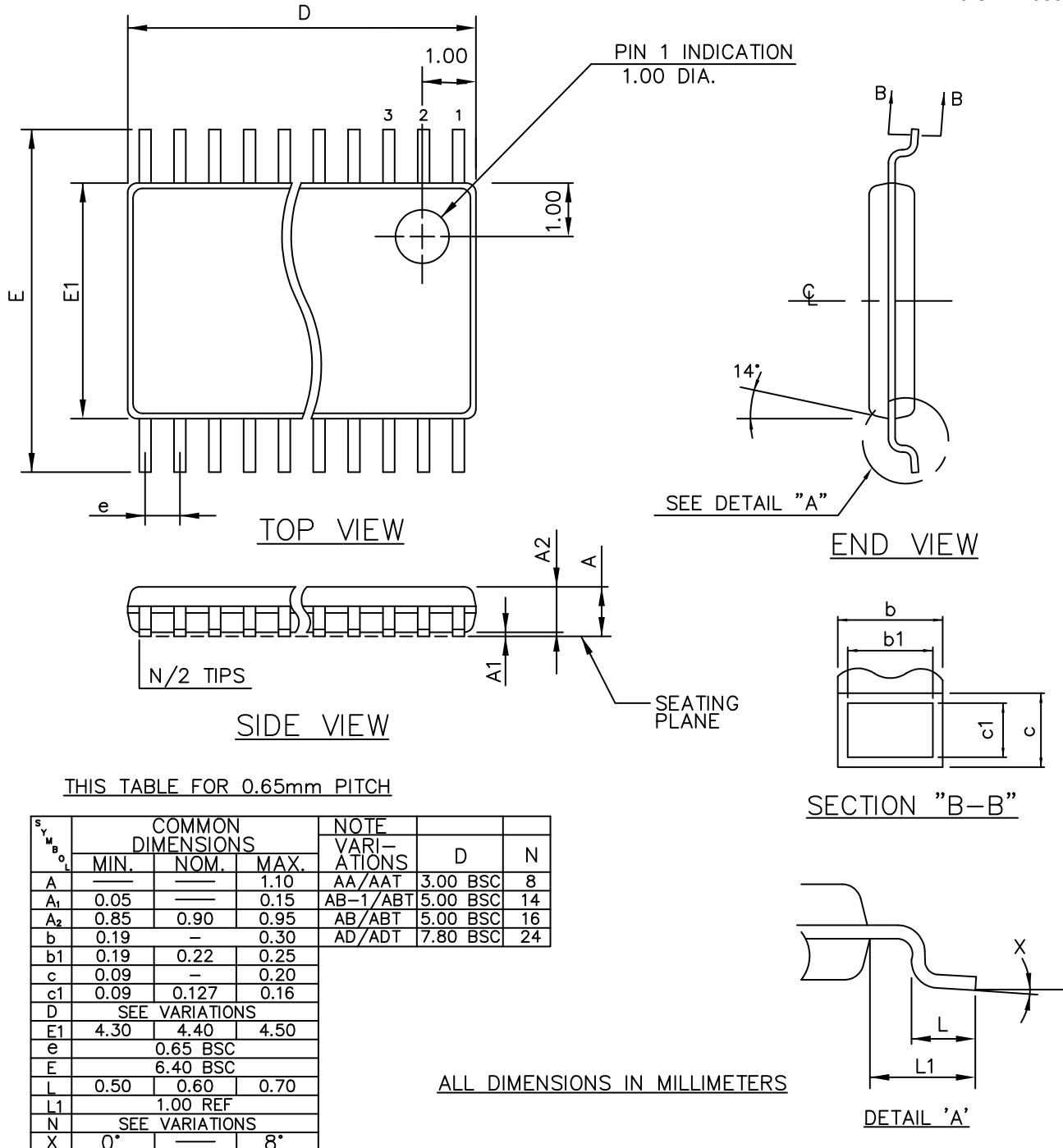
- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-012.

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