

# Dual 1-of-4 Decoder/Demultiplexer

## 74AC139, 74ACT139

### General Description

The AC139/ACT139 is a high-speed, dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each accepting two inputs and providing four mutually-exclusive active-LOW outputs. Each decoder has an active-LOW Enable input which can be used as a data input for a 4-output demultiplexer. Each half of the AC/ACT139 can be used as a function generator providing all four minterms of two variables.

### Features

- I<sub>CC</sub> Reduced by 50%
- Multifunctional Capability
- Two Completely Independent 1-of-4 Decoders
- Active LOW Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- ACT139 has TTL-Compatible Inputs
- These are Pb-Free Devices

### PIN DESCRIPTIONS

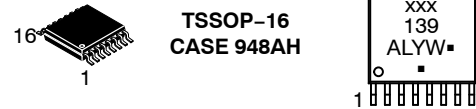
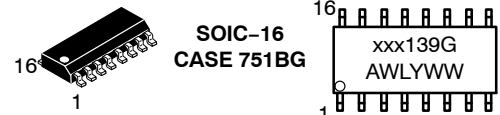
PIN	FUNCTION
A <sub>0</sub> , A <sub>1</sub>	Address Inputs
$\bar{E}$	Enable Inputs
$\bar{O}_0$ - $\bar{O}_3$	Outputs

### TRUTH TABLE

Inputs			Outputs			
$\bar{E}$	A <sub>0</sub>	A <sub>1</sub>	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

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

### MARKING DIAGRAMS



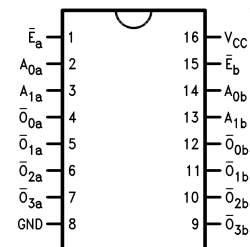
xxx = AC or ACT  
A = Assembly Location  
WL or L = Wafer Lot  
Y = Year  
WW or W = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

### CONNECTION DIAGRAM



# 74AC139, 74ACT139

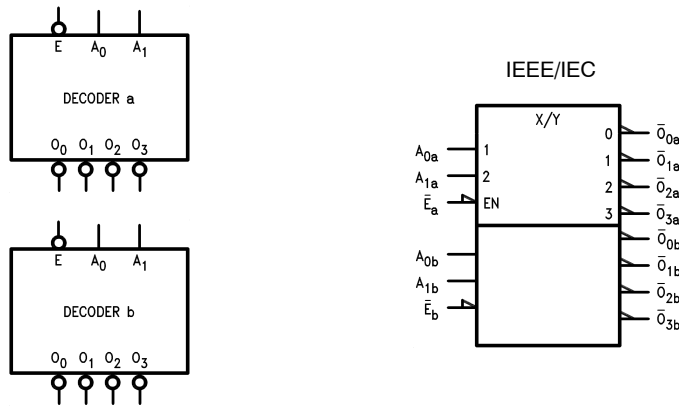
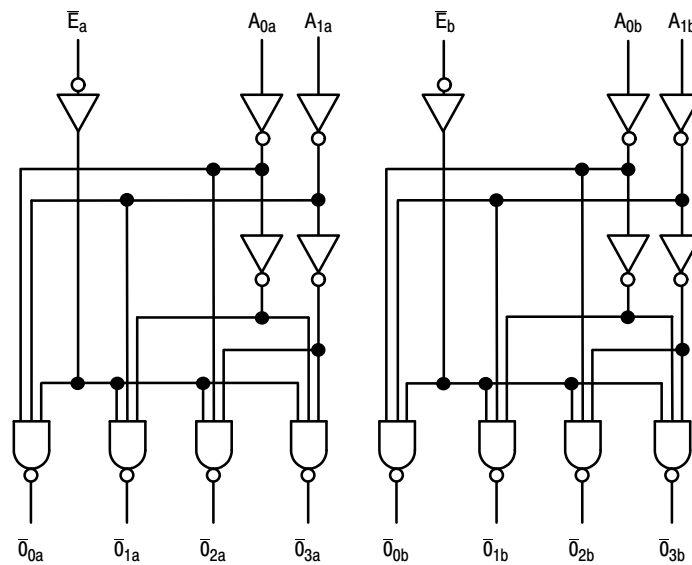


Figure 1. Logic Symbols



NOTE: This diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 2. Logic Diagram

## Functional Description

The AC139/ACT139 is a high-speed dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each of which accepts two binary weighted inputs ( $A_0$ – $A_1$ ) and provides four mutually exclusive active-LOW outputs ( $\bar{O}_0$ – $\bar{O}_3$ ). Each decoder has an active-LOW enable ( $\bar{E}$ ). When  $\bar{E}$  is HIGH all outputs are forced HIGH. The enable can be used as the data input for a 4-output demultiplexer application. Each half of the AC139/ACT139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure 3, and thereby reducing the number of packages required in a logic network.

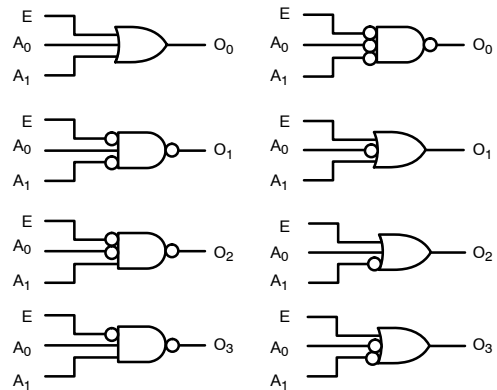


Figure 3. Gate Functions (Each Half)

## 74AC139, 74ACT139

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$I_{IK}$	DC Input Diode Current $V_I = -0.5\text{ V}$ $V_I = V_{CC} + 0.5\text{ V}$	-20 +20	mA
$V_I$	DC Input Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_{OK}$	DC Output Diode Current $V_O = -0.5\text{ V}$ $V_O = V_{CC} + 0.5\text{ V}$	-20 +20	mA
$V_O$	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC Output Source or Sink Current	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current per Output Pin	$\pm 50$	mA
$T_{STG}$	Storage Temperature	-65 to +150	$^{\circ}\text{C}$
$T_J$	Junction Temperature PDIP	140	$^{\circ}\text{C}$

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.

### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	Supply Voltage AC ACT	2.0 4.5	6.0 5.5	V
$V_I$	Input Voltage	0	$V_{CC}$	V
$V_O$	Output Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature	-40	85	$^{\circ}\text{C}$
$\Delta V/\Delta t$	Minimum Input Edge Rate, AC Devices: $V_{IN}$ from 30% to 70% $V_{CC}$ , $V_{CC}$ @ 3.3 V, 4.5 V, 5.5 V	125		mV/ns
$\Delta V/\Delta t$	Minimum Input Edge Rate, ACT Devices: $V_{IN}$ from 0.8 V to 2.0 V, $V_{CC}$ @ 4.5 V, 5.5 V	125		mV/ns

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.

## 74AC139, 74ACT139

### DC ELECTRICAL CHARACTERISTICS FOR AC

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units	
				Typ.	Guaranteed Limits				
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	3.0	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	1.5	2.1	2.1		V	
		4.5		2.25	3.15	3.15			
		5.5		2.75	3.85	3.85			
V <sub>IL</sub>	Maximum LOW Level Input Voltage	3.0	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	1.5	0.9	0.9		V	
		4.5		2.25	1.35	1.35			
		5.5		2.75	1.65	1.65			
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	3.0	I <sub>OUT</sub> = -50 μA	2.99	2.9	2.9		V	
		4.5		4.49	4.4	4.4			
		5.5		5.49	5.4	5.4			
		3.0	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -12 mA		2.56	2.46			
		4.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24 mA		3.86	3.76		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24 mA <sup>(1)</sup>		4.86	4.76		
V <sub>OL</sub>	Maximum LOW Level Output Voltage	3.0	I <sub>OUT</sub> = 50 μA	0.002	0.1	0.1		V	
		4.5		0.001	0.1	0.1			
		5.5		0.001	0.1	0.1			
		3.0	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 12 mA		0.36	0.44			
		4.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24 mA		0.36	0.44		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24 mA <sup>(1)</sup>		0.36	0.44		
I <sub>IN</sub> (Note 2)	Maximum Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> , GND		±0.1	±1.0		μA	
I <sub>OLD</sub>	Minimum Dynamic Output Current (Note 3)	5.5	V <sub>OLD</sub> = 1.65 V Max.			75		mA	
I <sub>OHD</sub>		5.5	V <sub>OHD</sub> = 3.85 V Min.			-75		mA	
I <sub>CC</sub> (Note 2)	Maximum Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND		4.0	40.0		μA	

1. All outputs loaded; thresholds on input associated with output under test.
2. I<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.
3. Maximum test duration 2.0 ms, one output loaded at a time.

## 74AC139, 74ACT139

### DC ELECTRICAL CHARACTERISTICS FOR ACT

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units
				Typ.	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	4.5	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	1.5	2.0	2.0		V
		5.5		1.5	2.0	2.0		
V <sub>IL</sub>	Maximum LOW Level Input Voltage	4.5	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	1.5	0.8	0.8		V
		5.5		1.5	0.8	0.8		
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	4.5	I <sub>OUT</sub> = -50 μA	4.49	4.4	4.4		V
		5.5		5.49	5.4	5.4		
		4.5	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24 mA		3.86	3.76		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24 mA <sup>(4)</sup>		4.86	4.76	
V <sub>OL</sub>	Maximum LOW Level Output Voltage	4.5	I <sub>OUT</sub> = 50 μA	0.001	0.1	0.1		V
		5.5		0.001	0.1	0.1		
		4.5	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24 mA		0.36	0.44		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24 mA <sup>(4)</sup>		0.36	0.44	
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> , GND		±0.1	±1.0		μA
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V	0.6		1.5		mA
I <sub>OLD</sub>	Minimum Dynamic Output Current (Note 5)	5.5	V <sub>OLD</sub> = 1.65 V Max.			75		mA
I <sub>OHD</sub>		5.5	V <sub>OHD</sub> = 3.85 V Min.			-75		mA
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND		4.0	40.0		μA

4. All outputs loaded; thresholds on input associated with output under test.

5. Maximum test duration 2.0 ms, one output loaded at a time.

## 74AC139, 74ACT139

### AC ELECTRICAL CHARACTERISTICS FOR AC

Symbol	Parameter	V <sub>CC</sub> (V) (Note 6)	T <sub>A</sub> = +25°C, C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50 pF		Units
			Min.	Typ.	Max.	Min.	Max.	
t <sub>PLH</sub>	Propagation Delay, A <sub>n</sub> to $\bar{O}_n$	3.3	4.0	8.0	11.5	3.5	13.0	ns
		5.0	3.0	6.5	8.5	2.5	9.5	
t <sub>PHL</sub>	Propagation Delay, A <sub>n</sub> to $\bar{O}_n$	3.3	3.0	7.0	10.0	2.5	11.0	ns
		5.0	2.5	5.5	7.5	2.0	8.5	
t <sub>PLH</sub>	Propagation Delay, $\bar{E}_n$ to $\bar{O}_n$	3.3	4.5	9.5	12.0	3.5	13.0	ns
		5.0	3.5	7.0	8.5	3.0	10.0	
t <sub>PHL</sub>	Propagation Delay, $\bar{E}_n$ to $\bar{O}_n$	3.3	4.0	8.0	10.0	3.0	11.0	ns
		5.0	2.5	6.0	7.5	2.5	8.5	

6. Voltage range 3.3 is 3.3 V ± 0.3 V.  
Voltage range 5.0 is 5.0 V ± 0.5 V.

### AC ELECTRICAL CHARACTERISTICS FOR ACT

Symbol	Parameter	V <sub>CC</sub> (V) (Note 7)	T <sub>A</sub> = +25°C, C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50 pF		Units
			Min.	Typ.	Max.	Min.	Max.	
t <sub>PLH</sub>	Propagation Delay, A <sub>n</sub> to $\bar{O}_n$	5.0	1.5	6.0	8.5	1.5	9.5	ns
t <sub>PHL</sub>	Propagation Delay, A <sub>n</sub> to $\bar{O}_n$	5.0	1.5	6.0	9.5	1.5	10.5	ns
t <sub>PLH</sub>	Propagation Delay, $\bar{E}_n$ to $\bar{O}_n$	5.0	2.5	7.0	10.0	2.0	11.0	ns
t <sub>PHL</sub>	Propagation Delay, $\bar{E}_n$ to $\bar{O}_n$	5.0	2.5	7.0	9.5	1.5	10.5	ns

7. Voltage range 5.0 is 5.0 V ± 0.5 V.

### CAPACITANCE

Symbol	Parameter	Conditions	Typ.	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = OPEN	4.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 5.0 V	40.0	pF

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
74AC139MTCX	TSSOP-16 (Pb-Free)	2500 Units / Tape & Reel
74AC139SCX	SOIC-16 (Pb-Free)	2500 Units / Tape & Reel
74ACT139MTCX	TSSOP-16 (Pb-Free)	2500 Units / Tape & Reel
74ACT139SCX	SOIC-16 (Pb-Free)	2500 Units / 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.

# MECHANICAL CASE OUTLINE

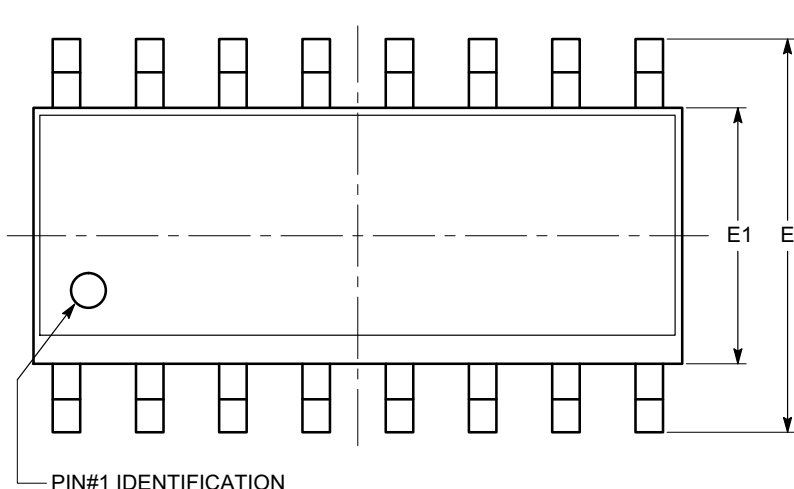
## PACKAGE DIMENSIONS

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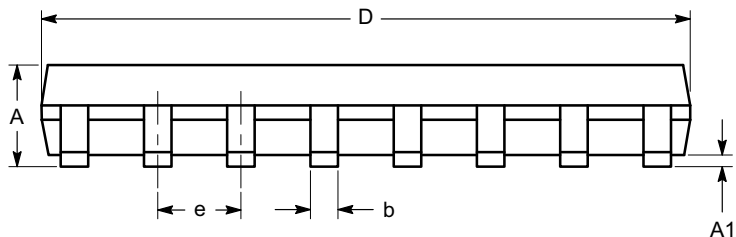
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CASE 751BG-01  
ISSUE O

DATE 19 DEC 2008

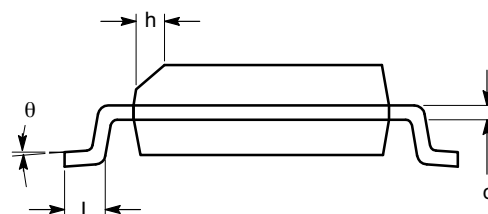


SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
$\theta$	0°		8°

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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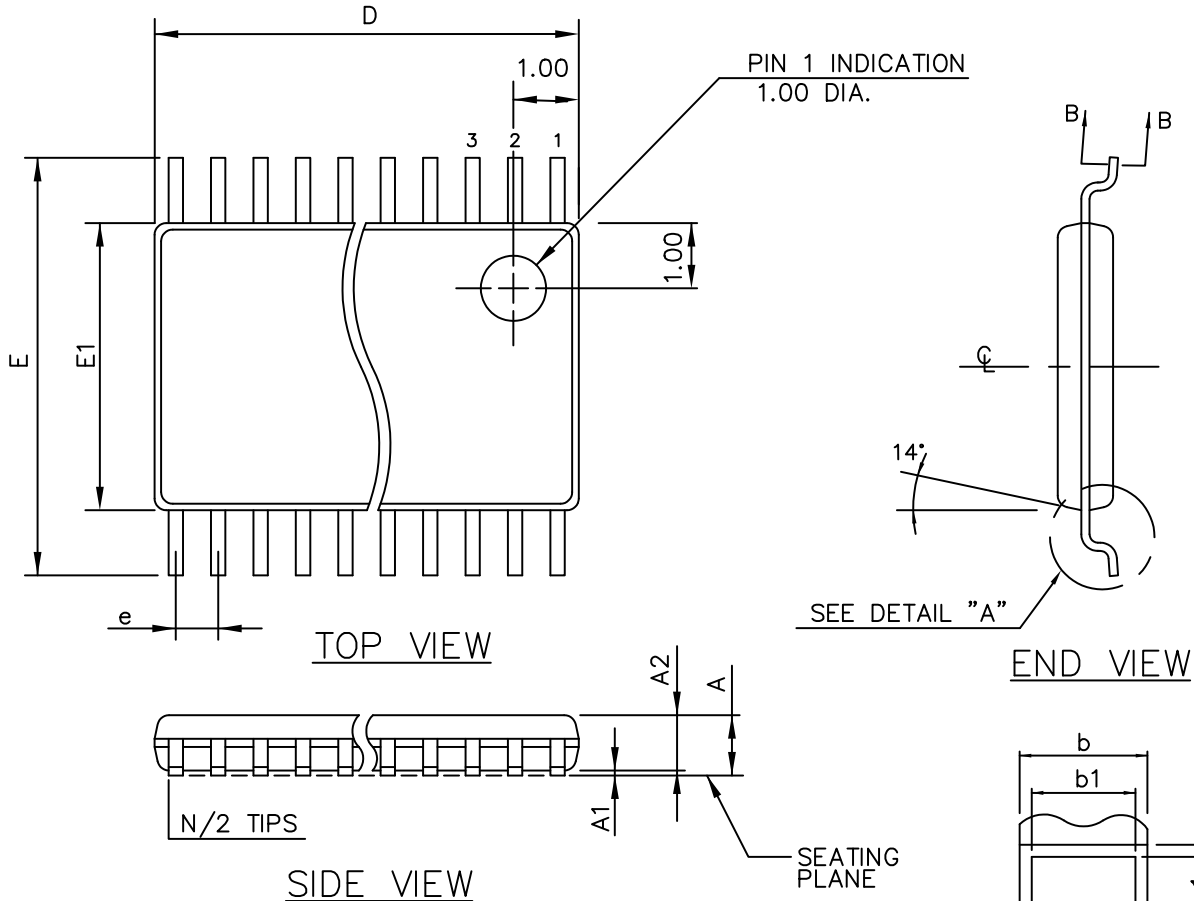
## PACKAGE DIMENSIONS

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ISSUE O

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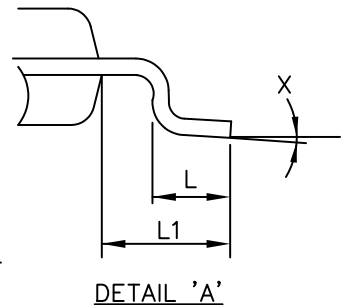


THIS TABLE FOR 0.65mm PITCH

SYMBOL	COMMON DIMENSIONS			NOTE VARIATIONS	D	N
	MIN.	NOM.	MAX.			
A	—	—	1.10	AA/AAT	3.00 BSC	8
A <sub>1</sub>	0.05	—	0.15	AB-1/ABT	5.00 BSC	14
A <sub>2</sub>	0.85	0.90	0.95	AB/ABT	5.00 BSC	16
b	0.19	—	0.30	AD/ADT	7.80 BSC	24
b <sub>1</sub>	0.19	0.22	0.25			
c	0.09	—	0.20			
c <sub>1</sub>	0.09	0.127	0.16			
D	SEE VARIATIONS					
E <sub>1</sub>	4.30	4.40	4.50			
e	0.65 BSC					
E	6.40 BSC					
L	0.50	0.60	0.70			
L <sub>1</sub>	1.00 REF					
N	SEE VARIATIONS					
X	0°	—	8°			

ALL DIMENSIONS IN MILLIMETERS

SECTION "B-B"



MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15mm ON D PER SIDE

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