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74AC139, 74ACT139

Dual 1-of-4 Decoder / Demultiplexer

ON Semiconductor®

www.onsemi.com

General Description

The AC/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

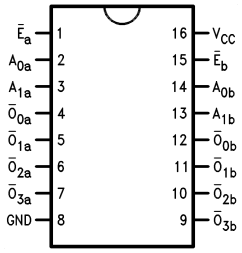
- I_{CC} Reduced by 50%
- Multifunction Capability
- Two Completely Independent 1−of−4 Decoders
- Active LOW Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- ACT139 has TTL−compatible Inputs

ORDERING CODE:

Order Number	Case Number	Package Description
74AC139SC	751BG	16−Lead Small Outline Integrated Circuit (SOIC), JEDEC MS−012, 0.150″ Narrow Body
74AC139SJ	565BF	16−Lead Small Outline Package (SOIC), EIAJ Type II, 5.3 mm Wide
74AC139MTC	948AH	16−Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO−153, 4.4 mm Wide
74AC139PC	648	16−Lead Plastic Dual−In−Line Package (PDIP), JEDEC MS−001, 0.300″ Wide
74ACT139SC	751BG	16−Lead Small Outline Integrated Circuit (SOIC), JEDEC MS−012, 0.150″ Narrow Body
74ACT139SJ	565BF	16−Lead Small Outline Package (SOIC), EIAJ Type II, 5.3 mm Wide
74ACT139MTC	948AH	16−Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO−153, 4.4 mm Wide
74ACT139PC	648	16−Lead Plastic Dual−In−Line Package (PDIP), JEDEC MS−001, 0.300″ Wide

NOTE: Device also available in Tape and Reel. Specify by appending suffix letter “X” to the ordering code.

CONNECTION DIAGRAM

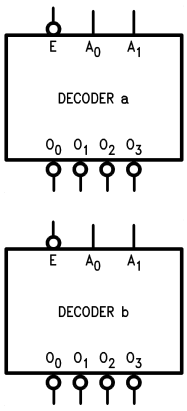


PIN DESCRIPTIONS

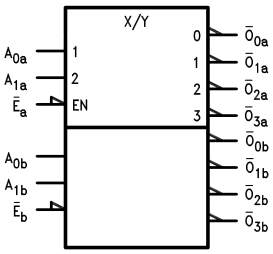
Pin Names	Description
A_0, A_1	Address Inputs
$\overline{E}$	Enable Inputs
$\overline{O}_0$–$\overline{O}_3$	Outputs

© Semiconductor Components Industries, LLC, 1988

Logic Symbol/s



IEEE/IEC



TRUTH TABLE/S

Inputs			Outputs			
$\overline{E}$	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
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

Functional Description

The AC/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 (O_0–O_3). Each decoder has an active−LOW enable (E). When 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 AC/ACT139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure 1, and thereby reducing the number of packages required in a logic network.

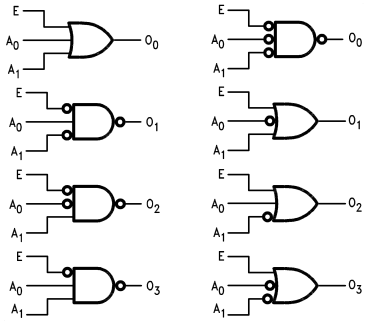
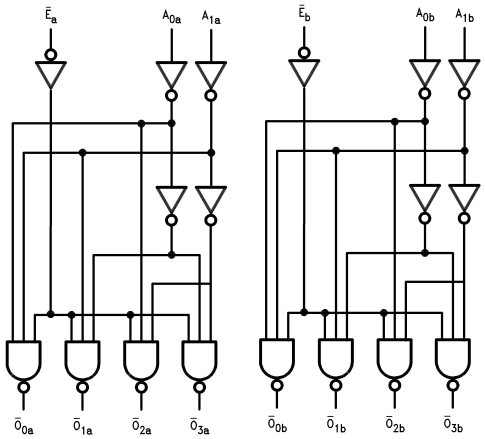


Figure 1. Gate Functions (Each Half)

Logic Diagram/s



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC})	−0.5 V to +7.0 V
DC Input Diode Current (I_{IK}) V_I = −0.5 V V_I = V_{CC} + 0.5 V	 −20 mA +20 mA
DC Input Voltage (V_I)	−0.5 V to V_{CC} + 0.5 V
DC Output Diode Current (I_{OK}) V_O = −0.5 V V_O = V_{CC} + 0.5 V	 −20 mA +20 mA
DC Output Voltage (V_O)	−0.5 V to V_{CC} + 0.5 V
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Junction Temperature (T_J) PDIP	140°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

Supply Voltage (V_{CC}) AC ACT	 2.0 V to 6.0 V 4.5 V to 5.5 V
Input Voltage (V_I)	0 V to V_{CC}
Output Voltage (V_O)	0 V to V_{CC}
Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate ($\Delta V/\Delta t$) AC Devices V_{IN} from 30% to 70% of V_{CC} V_{CC} @ 3.3 V, 4.5 V, 5.5 V	125 mV/ns
Minimum Input Edge Rate ($\Delta V/\Delta t$) 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.

DC ELECTRICAL CHARACTERISTICS FOR AC

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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

DC ELECTRICAL CHARACTERISTICS FOR ACT

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

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.

AC ELECTRICAL CHARACTERISTICS FOR AC

Symbol	Parameter	V_{CC} (V) (Note 6)	T_A = +25°C, C_L = 50 pF			T_A = –40°C to +85°C, C_L = 50 pF		Units
			Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay A_n to $\overline{O}_n$	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_{PHL}	Propagation Delay A_n to $\overline{O}_n$	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_{PLH}	Propagation Delay $\overline{E}_n$ to $\overline{O}_n$	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_{PHL}	Propagation Delay $\overline{E}_n$ to $\overline{O}_n$	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_{CC} (V) (Note 7)	T_A = +25°C, C_L = 50 pF			T_A = –40°C to +85°C, C_L = 50 pF		Units
			Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay A_n to $\overline{O}_n$	5.0	1.5	6.0	8.5	1.5	9.5	ns
t_{PHL}	Propagation Delay A_n to $\overline{O}_n$	5.0	1.5	6.0	9.5	1.5	10.5	ns
t_{PLH}	Propagation Delay $\overline{E}_n$ to $\overline{O}_n$	5.0	2.5	7.0	10.0	2.0	11.0	ns
t_{PHL}	Propagation Delay $\overline{E}_n$ to $\overline{O}_n$	5.0	2.0	7.0	9.5	1.5	10.5	ns

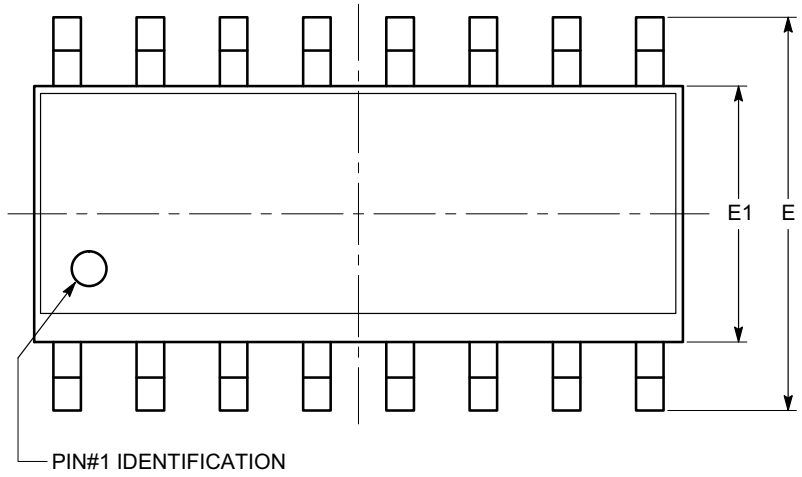
7. Voltage Range 5.0 is 5.0 V ± 0.5 V

CAPACITANCE

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	40.0	pF	V_{CC} = 5.0V

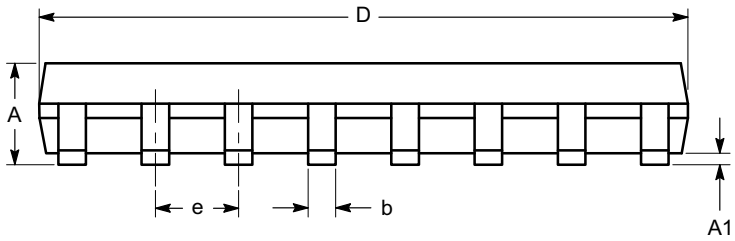
PACKAGE DIMENSIONS

SOIC−16, 150 mils
CASE 751BG−01
ISSUE O

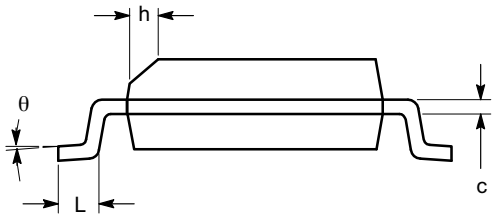


TOP VIEW

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
θ	0°		8°



SIDE VIEW

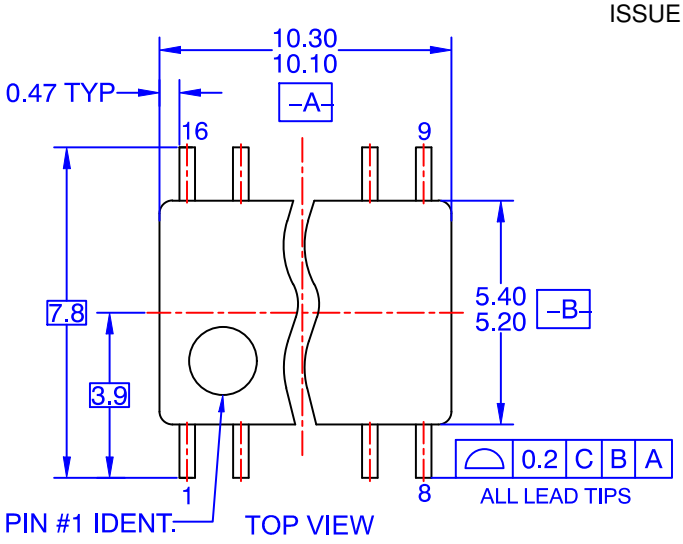


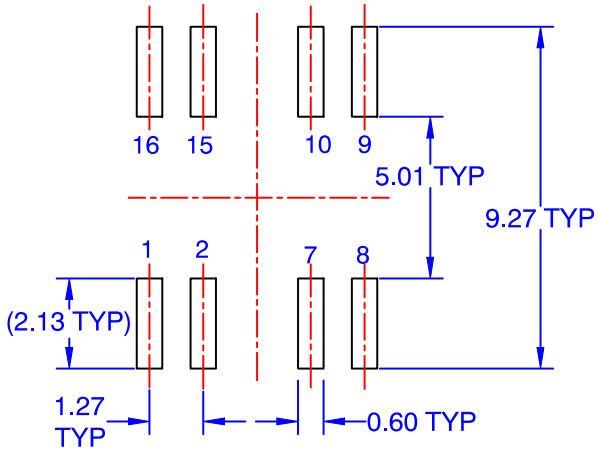
END VIEW

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

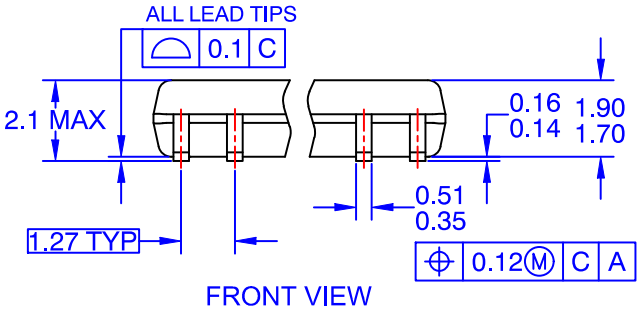
PACKAGE DIMENSIONS

SOP16
CASE 565BF
ISSUE O

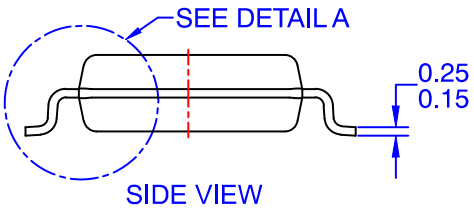




LAND PATTERN RECOMMENDATION



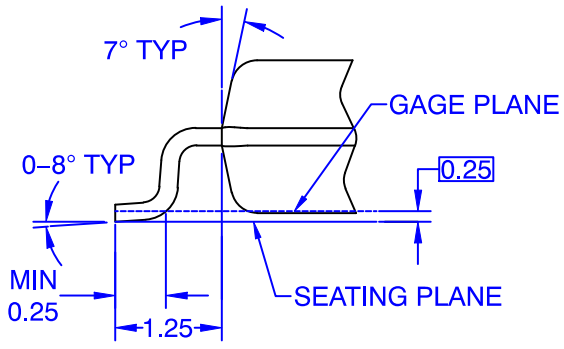
FRONT VIEW



SIDE VIEW

NOTES:

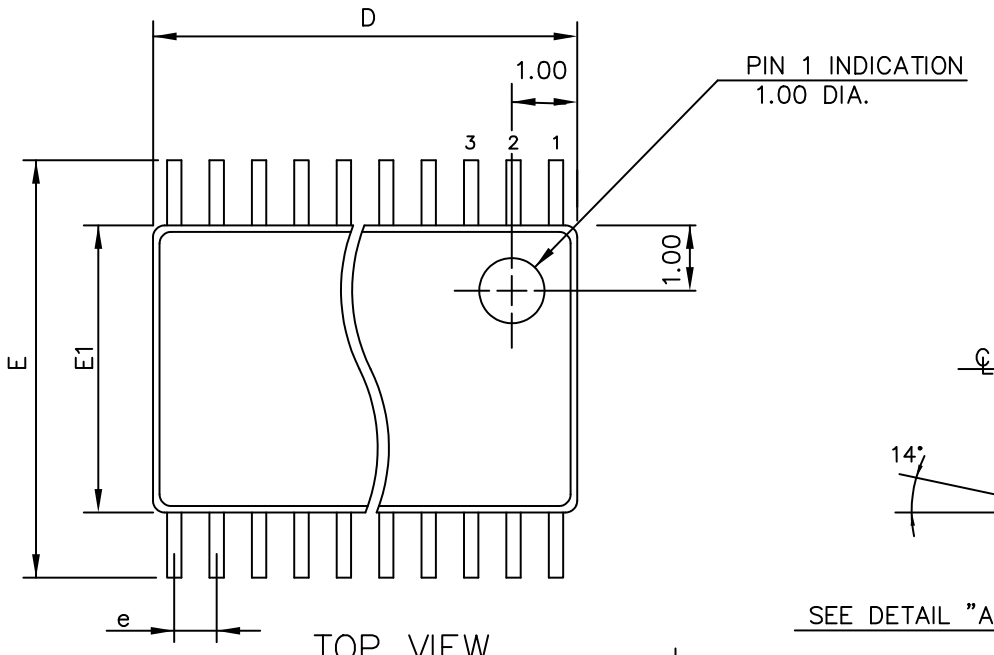
A. CONFORMS TO EIAJ EDR–7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

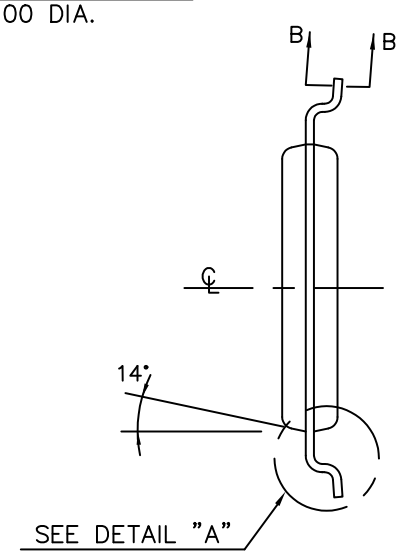


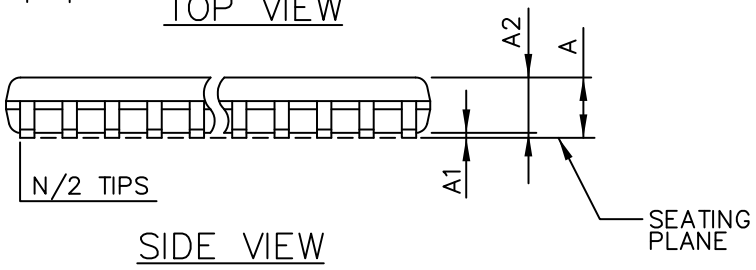
DETAIL A

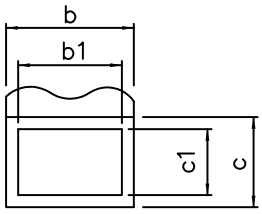
PACKAGE DIMENSIONS

TSSOP−16
CASE 948AH−01
ISSUE O





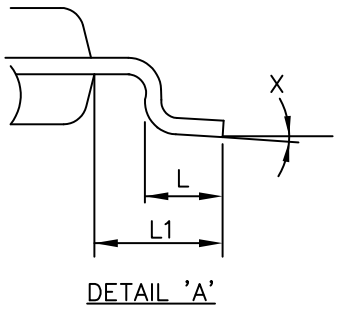




THIS TABLE FOR 0.65mm PITCH

SYMBOL	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	——	——	1.10
A_1	0.05	——	0.15
A_2	0.85	0.90	0.95
b	0.19	–	0.30
b1	0.19	0.22	0.25
c	0.09	–	0.20
c1	0.09	0.127	0.16
D	SEE VARIATIONS		
E1	4.30	4.40	4.50
e	0.65 BSC		
E	6.40 BSC		
L	0.50	0.60	0.70
L1	1.00 REF		
N	SEE VARIATIONS		
X	0°	——	8°

NOTE VARIATIONS	D	N
AA/AAT	3.00 BSC	8
AB−1/ABT	5.00 BSC	14
AB/ABT	5.00 BSC	16
AD/ADT	7.80 BSC	24

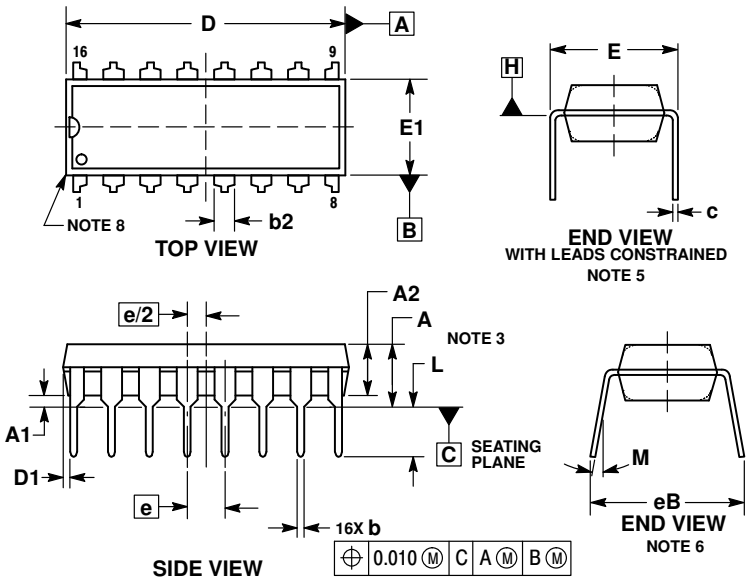


ALL DIMENSIONS IN MILLIMETERS

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

PACKAGE DIMENSIONS

PDIP−16
CASE 648−018
ISSUE V



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS−3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	----	0.210	---	5.33
A1	0.015	----	0.38	---
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.35	0.56
b2	0.060 TYP		1.52 TYP	
C	0.008	0.014	0.20	0.36
D	0.735	0.775	18.67	19.69
D1	0.005	----	0.13	---
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100 BSC		2.54 BSC	
eB	----	0.430	---	10.92
L	0.115	0.150	2.92	3.81
M	----	10°	---	10°

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