

# SN54LS348, SN74LS348 (TIM9908) 8-LINE TO 3-LINE PRIORITY ENCODERS WITH 3-STATE OUTPUTS

SDLS161 – OCTOBER 1976 – REVISED MARCH 1988

- 3-State Outputs Drive Bus Lines Directly
- Encodes 8 Data Lines to 3-Line Binary (Octal)
- Applications Include:  
N-Bit Encoding  
Code Converters and Generators
- Typical Data Delay . . . 15 ns
- Typical Power Dissipation . . . 60 mW

## description

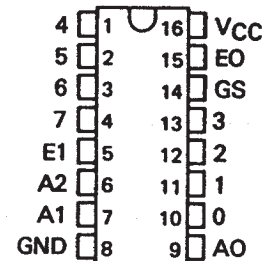
These TTL encoders feature priority decoding of the inputs to ensure that only the highest-order data line is encoded. The 'LS348 circuits encode eight data lines to three-line (4-2-1) binary (octal). Cascading circuitry (enable input E1 and enable output EO) has been provided to allow octal expansion. Outputs A0, A1, and A2 are implemented in three-state logic for easy expansion up to 64 lines without the need for external circuitry. See Typical Application Data.

FUNCTION TABLE

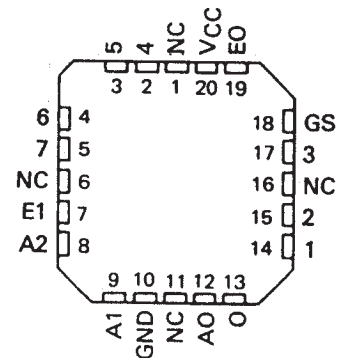
EI	INPUTS								OUTPUTS				
	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
H	X	X	X	X	X	X	X	X	Z	Z	Z	H	H
L	H	H	H	H	H	H	H	H	Z	Z	Z	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	L	H	H	L	L	H	L	H
L	X	X	X	X	L	H	H	H	L	H	L	L	H
L	X	X	X	L	H	H	H	H	H	L	L	L	H
L	X	X	L	H	H	H	H	H	H	L	H	L	H
L	X	L	H	H	H	H	H	H	H	H	L	L	H
L	L	H	H	H	H	H	H	H	H	H	H	L	H

H = high logic level, L = low logic level, X = irrelevant  
Z = high-impedance state

SN54LS348 . . . J OR W PACKAGE  
SN74LS348 . . . D OR N PACKAGE  
(TOP VIEW)

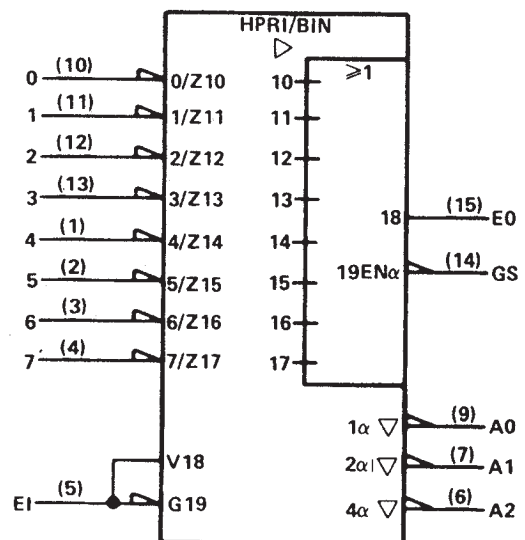


SN54LS348 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

## logic symbol†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, N, and W packages.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

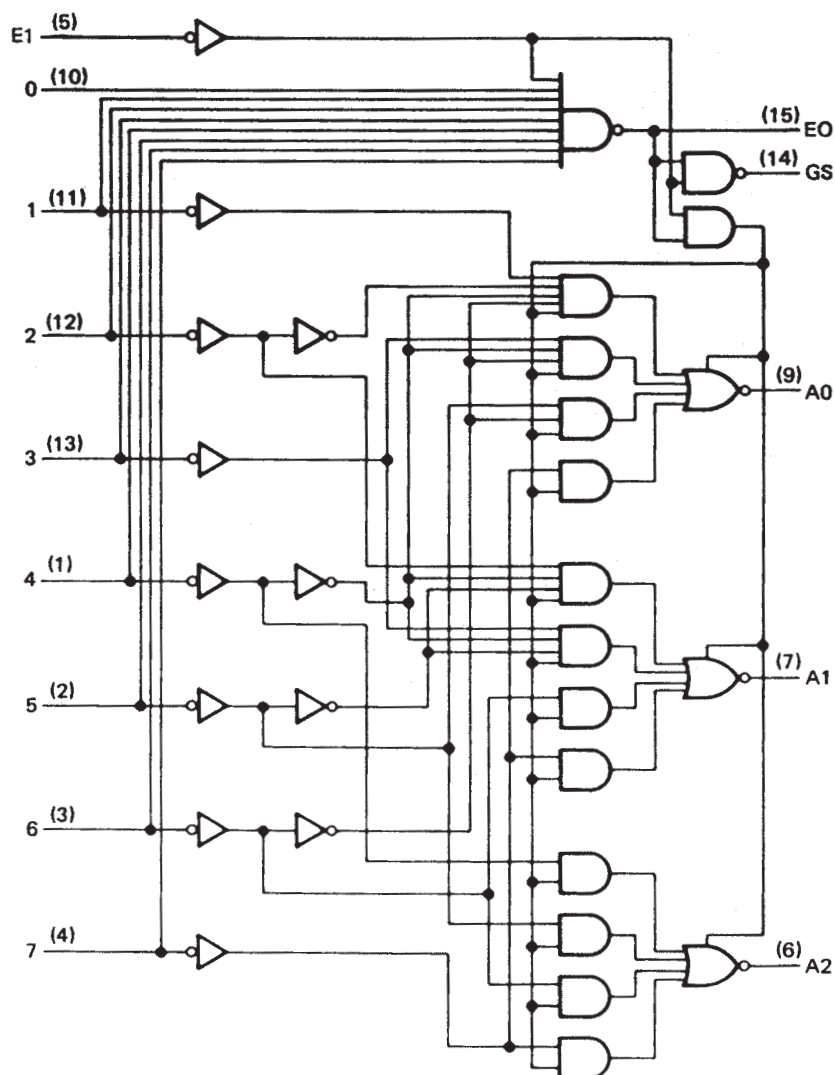
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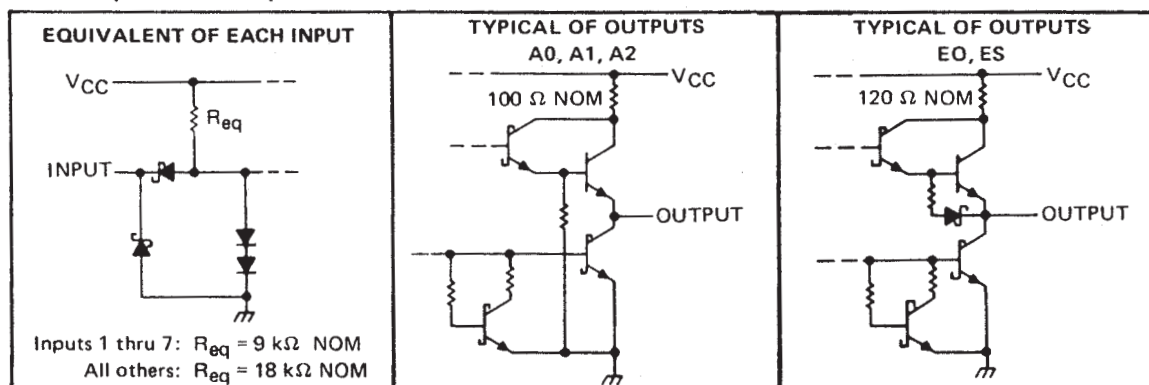
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## logic diagram (positive logic)



Pin numbers shown are for D, J, N, and W packages.

## schematic of inputs and outputs



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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS348	–55°C to 125°C
SN74LS348	0°C to 70°C
Storage temperature range	–65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

## recommended operating conditions

		SN54LS348			SN74LS348			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$		4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$	A0, A1, A2	–1			–2.6			mA
	EO, GS	–400			–400			μA
Low-level output current, $I_{OL}$	A0, A1, A2	12			24			mA
	EO, GS	4			8			mA
Operating free-air temperature, $T_A$		–55	125		0	70		°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		SN54LS348		SN74LS348		UNIT	
				MIN	TYP‡	MAX	MIN		TYP‡
$V_{IH}$	High-level input voltage			2		2		V	
$V_{IL}$	Low-level input voltage			0.7		0.8		V	
$V_{IK}$	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$		-1.5		-1.5		V	
$V_{OH}$	High-level output voltage	A0, A1, A2	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$	$I_{OH} = -1 \text{ mA}$	2.4	3.1		V	
				$I_{OH} = -2.6 \text{ mA}$			2.4		3.1
		EO, GS	$V_{IL} = V_{ILmax}$	$I_{OH} = -400 \mu\text{A}$	2.5	3.4			2.7
$V_{OL}$	Low-level Output voltage	A0, A1, A2	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$	$I_{OL} = 12 \text{ mA}$	0.25	0.4	0.25	0.4	V
				$I_{OL} = 24 \text{ mA}$			0.35	0.5	
		EO, GS	$V_{IL} = V_{ILmax}$	$I_{OL} = 4 \text{ mA}$	0.25	0.4	0.25	0.4	
				$I_{OL} = 8 \text{ mA}$			0.35	0.5	
$I_{OZ}$	Off-State (high-impedance state) output current	A0, A1, A2	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}$	$V_O = 2.7 \text{ V}$	20		20	$\mu\text{A}$	
				$V_O = 0.4 \text{ V}$	-20		-20		
$I_I$	Input current at maximum input voltage	Inputs 1 thru 7	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$	0.2		0.2		mA	
		All other inputs		0.1		0.1			
$I_{IH}$	High-level input current	Inputs 1 thru 7	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	40		40		$\mu\text{A}$	
		All other inputs		20		20			
$I_{IL}$	Low-level input current	Inputs 1 thru 7	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	-0.8		-0.8		mA	
		All other inputs		-0.4		-0.4			
$I_{OS}$	Short-circuit output current§	Outputs A0, A1, A2	$V_{CC} = \text{MAX}$	-30	-130	-30	-130	mA	
		Outputs EO, GS		-20	-100	-20	-100		
$I_{CC}$	Supply current	$V_{CC} = \text{MAX},$ See Note 2	Condition 1	13	25	13	25	mA	
			Condition 2	12	23	12	23		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time.

NOTE 2:  $I_{CC}$  (condition 1) is measured with inputs 7 and EI grounded, other inputs and outputs open.  $I_{CC}$  (condition 2) is measured with all inputs and outputs open.



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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	1 thru 7	A0, A1, or A2	In-phase output	CL = 45 pF, RL = 667 Ω, See Note 3		11	17	ns
tPHL						20	30	
tPLH	1 thru 7	A0, A1, or A2	Out-of-phase output			23	35	ns
tPHL						23	35	
tPZH	EI	A0, A1, or A2				25	39	ns
tPZL						24	41	
tPLH	0 thru 7	EO	Out-of-phase output	CL = 15 pF RL = 2 kΩ, See Note 3		11	18	ns
tPHL						26	40	
tPLH	0 thru 7	GS	In-phase output			38	55	ns
tPHL						9	21	
tPLH	EI	GS	In-phase output			11	17	ns
tPHL						14	36	
tPLH	EI	EO	In-phase output			17	26	ns
tPHL						25	40	
tPHZ	EI	A0, A1, or A2		CL = 5 pF RL = 667 Ω		18	27	ns
tPLZ						23	35	

† tPLH = propagation delay time, low-to-high-level output  
tPHL = propagation delay time, high-to-low-level output  
tpZH = output enable time to high level  
tpZL = output enable time to low level  
tpHZ = output disable time from high level  
tpLZ = output disable time from low level  
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

TYPICAL APPLICATION DATA

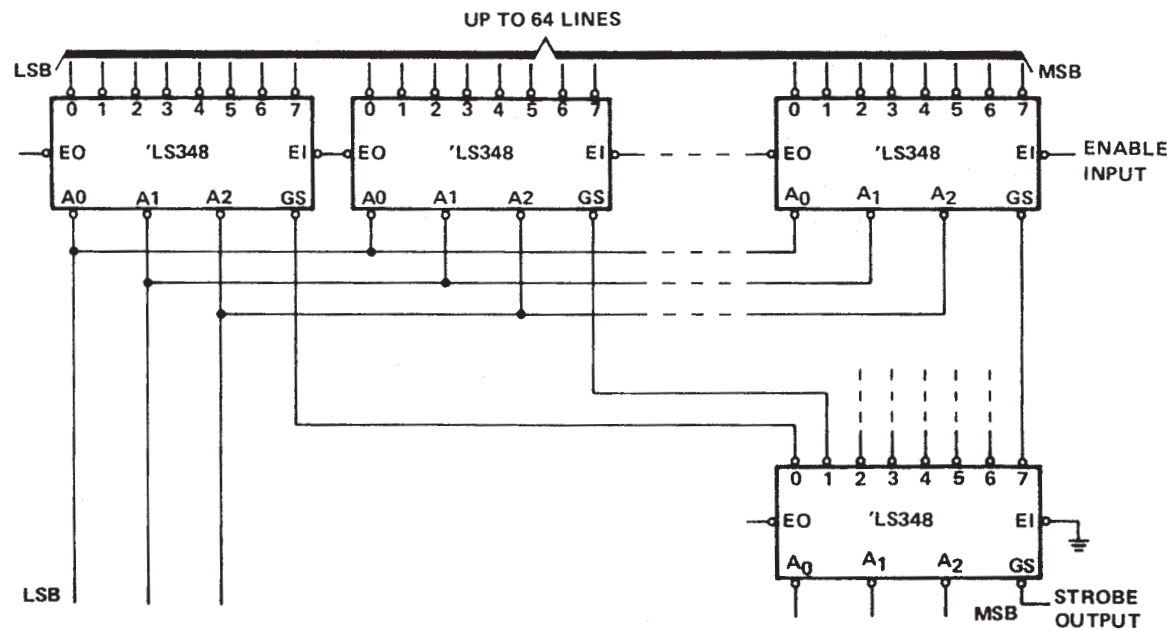


FIGURE 1—PRIORITY ENCODER WITH UP TO 64 INPUTS.



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## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN74LS348D</a>	Active	Production	SOIC (D)   16	40   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS348
<a href="#">SN74LS348N</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS348N

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LS348D	D	SOIC	16	40	507	8	3940	4.32
SN74LS348N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS348N	N	PDIP	16	25	506	13.97	11230	4.32

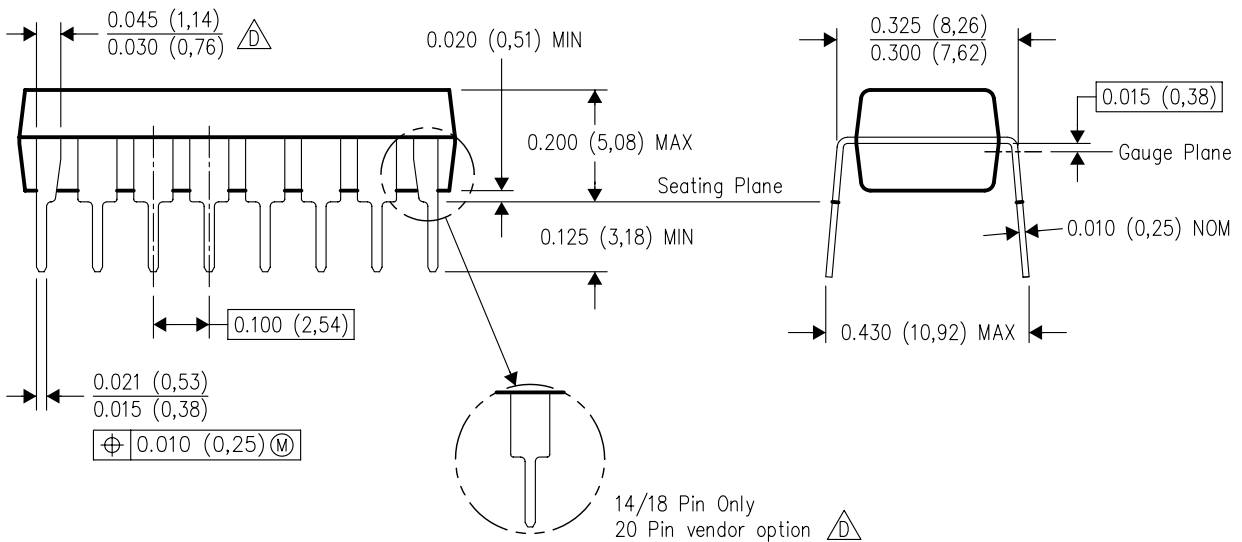
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



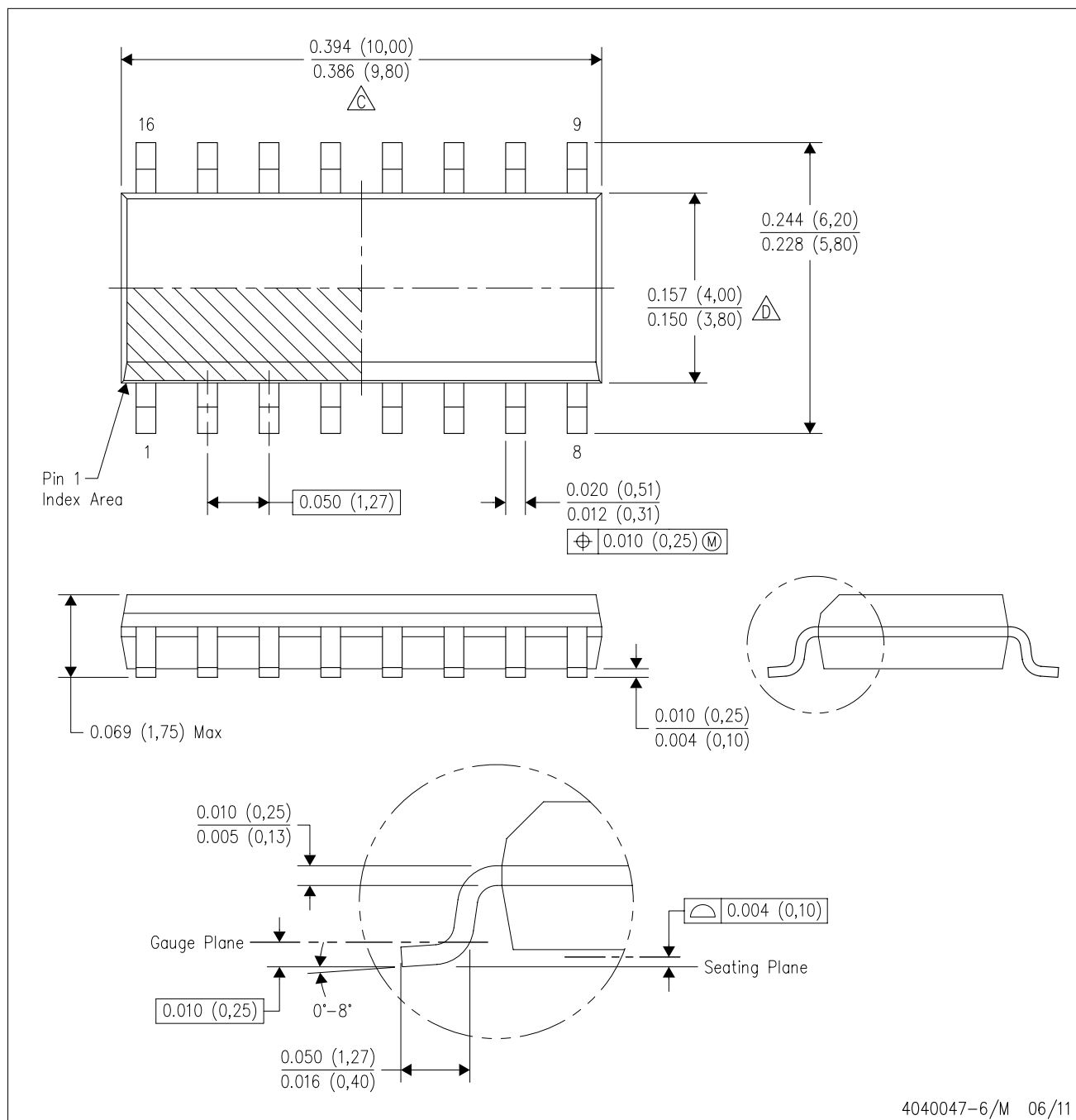
14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AC.



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