

# SN54LS399, SN74LS399 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

SDLS174 – OCTOBER 1976 – REVISED MARCH 1988

- **Single-Rail Outputs on 'LS399**
- **Selects One of Two 4-Bit Data Sources and Stores Data Synchronously with System Clock**
- **Applications:**
  - Dual Source for Operands and Constants in Arithmetic Processor; Can Release Processor Register Files for Acquiring New Data
  - Implement Separate Registers Capable of Parallel Exchange of Contents Yet Retain External Load Capability
  - Universal Type Register for Implementing Various Shift Patterns: Even Has Compound Left-Right Capabilities

## description

This monolithic quadruple two-input multiplexer with storage provides essentially the equivalent functional capabilities of two separate MSI functions (SN54LS157/SN74LS157 and SN54LS175/SN74LS175) in a single 16-pin package.

When the word-select input is low, word 1 (A1, B1, C1, D1) is applied to the flip-flops. A high input to word select will cause the selection of word 2 (A2, B2, C2, D2). The selected word is clocked to the output terminals on the positive-going edge of the clock pulse.

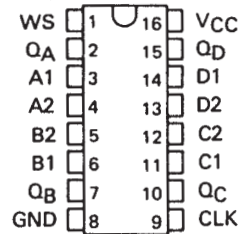
Typical power dissipation is 37 milliwatts. The SN54LS399 is characterized for operation over the full military range of -55°C to 125°C. The SN74LS399 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

INPUTS		OUTPUTS			
WORD SELECT	CLOCK	Q <sub>A</sub>	Q <sub>B</sub>	Q <sub>C</sub>	Q <sub>D</sub>
L	↑	a1	b1	c1	d1
H	↑	a2	b2	c2	d2
X	L	Q <sub>A0</sub>	Q <sub>B0</sub>	Q <sub>C0</sub>	Q <sub>D0</sub>

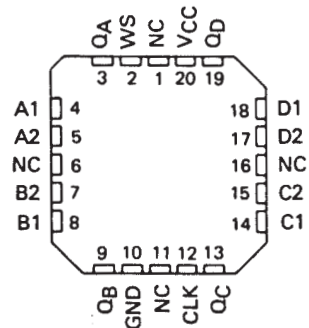
SN54LS399 . . . J OR W PACKAGE  
SN74LS399 . . . D OR N PACKAGE

(TOP VIEW)



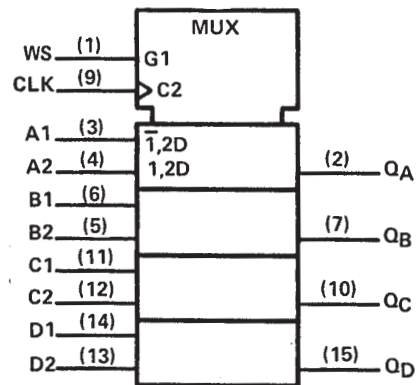
SN54LS399 . . . FK PACKAGE

(TOP VIEW)



NC – No internal connection

## logic symbol†



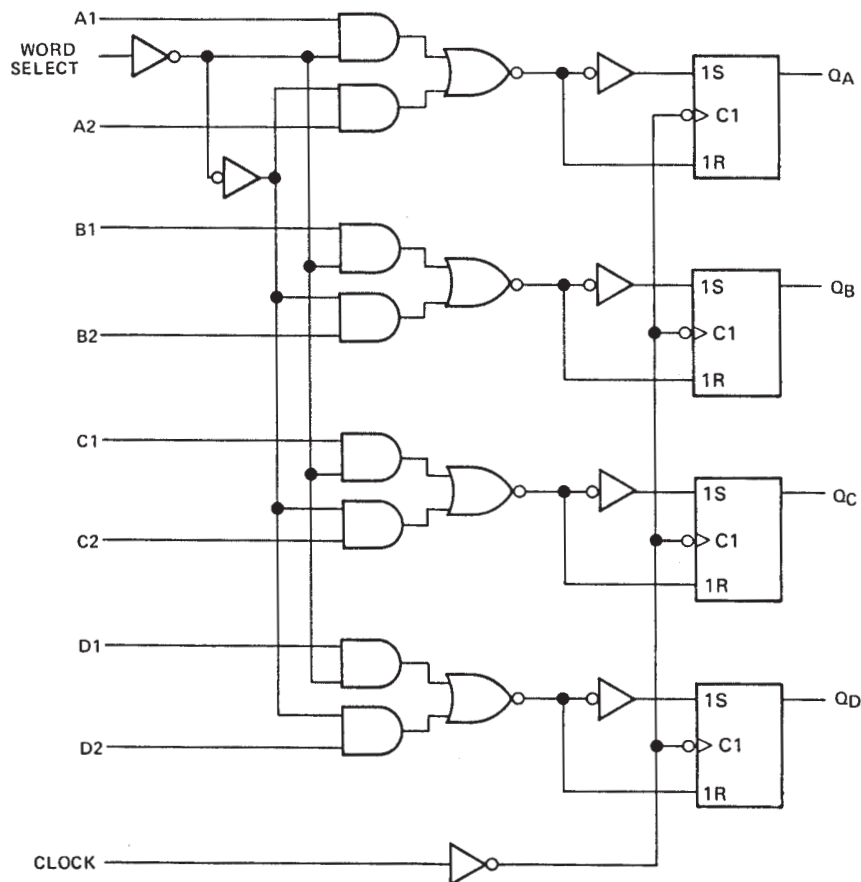
†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

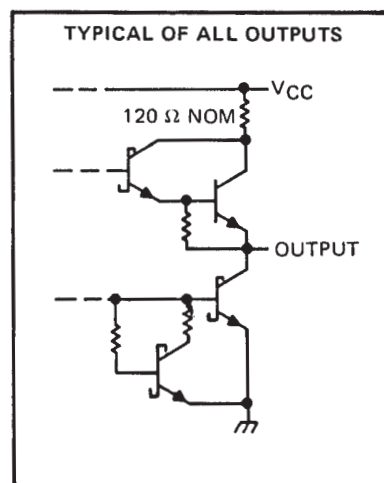
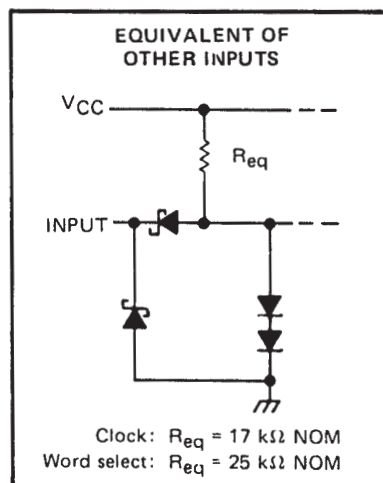
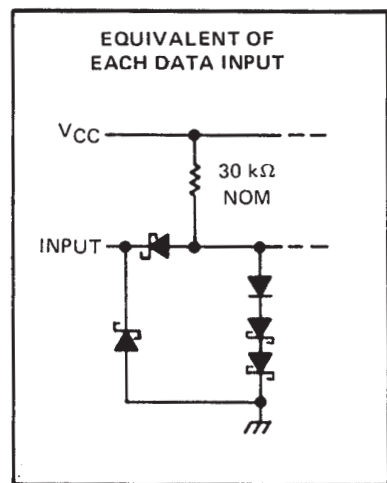
# SN54LS399, SN74LS399 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

SDLS174 – OCTOBER 1976 – REVISED MARCH 1988

## logic diagram (positive logic)



## schematics of inputs and outputs



# SN54LS399, SN74LS399 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

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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: SN54LS399	–55°C to 125°C
SN74LS399	0°C to 70°C
Storage temperature range	–65°C to 150°C

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

## recommended operating conditions

		SN54LS399			SN74LS399			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, $I_{OH}$				–400			–400	$\mu$ A
Low-level output current, $I_{OL}$				4			8	mA
Width of clock pulse, high or low level, $t_W$		20			20			ns
Setup time, $t_{su}$	Data	25			25			ns
	Word select	45			45			
Hold time, $t_h$	Data	0			0			ns
	Word select	0			0			
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†		SN54LS399			SN74LS399			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IH</sub> High-level input voltage			2			2			V
V <sub>IL</sub> Low-level input voltage			0.7			0.8			V
V <sub>IK</sub> Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = −18 mA		−1.5			−1.5			V
V <sub>OH</sub> High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub> I <sub>OH</sub> = −400 μA		2.5	3.4		2.7	3.4		V
V <sub>OL</sub> Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>ILmax</sub>	I <sub>OL</sub> = 4 mA	0.25	0.4		0.25	0.4		V
		I <sub>OL</sub> = 8 mA				0.35	0.5		
I <sub>I</sub> Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V		0.1			0.1			mA
I <sub>IH</sub> High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V		20			20			μA
I <sub>IL</sub> Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V		−0.4			−0.4			mA
I <sub>OS</sub> Short-circuit output current§	V <sub>CC</sub> = MAX		−20	−100		−20	−100		mA
I <sub>CC</sub> Supply current	V <sub>CC</sub> = MAX, See Note 2		7.3	13		7.3	13		mA

† 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, duration of the short-circuit should not exceed one second.

NOTE 2: With all outputs open and all inputs except clock low,  $I_{CC}$  is measured after applying a momentary 4.5 V, followed by ground, to the clock input.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	$C_L = 15 \text{ pF}$ , $R_L = 2 \text{ k}\Omega$ ,		18	27	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output	See Note 3		21	32	

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
84154012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
8415401EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
8415401EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
8415401FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
8415401FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SN54LS399J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN54LS399J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SN74LS399D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS399DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS399N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS399N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS399N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS399N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS399NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS399NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LS399NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS399NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54LS399FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS399FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS399J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS399J	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS399W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54LS399W	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

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**OBSELETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK

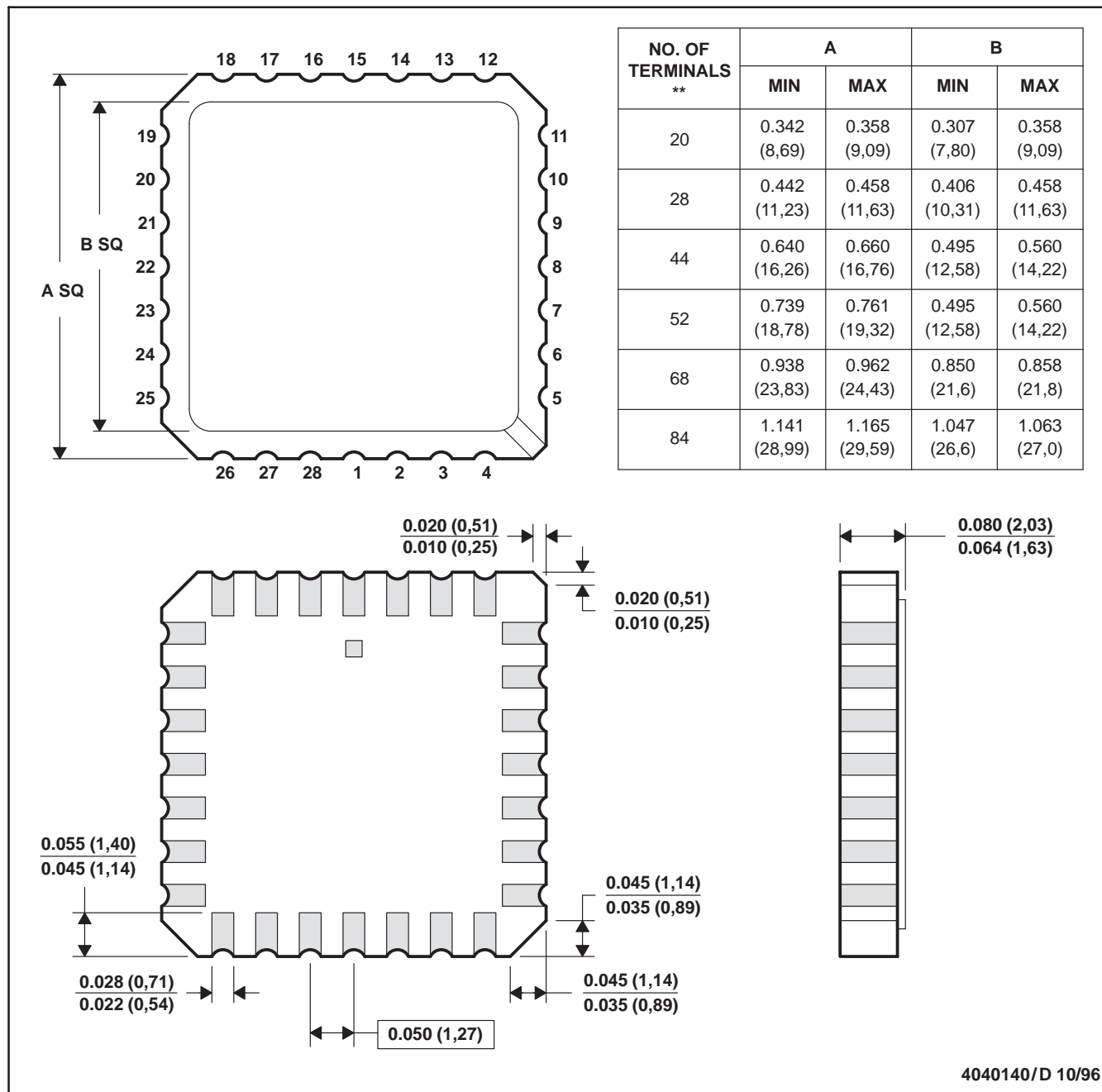


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

## FK (S-CQCC-N\*\*)

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004



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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
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



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 PACKAGE



4040047-4/F 07/2004

## NOTES:

- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MS-012 variation AC.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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