

ULN2803A  
DARLINGTON TRANSISTOR ARRAY

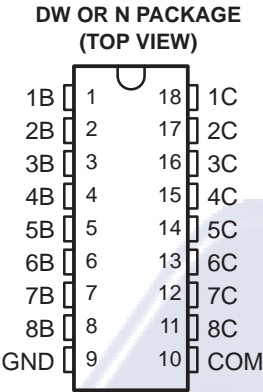
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- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Compatible with ULN2800A Series

description/ordering information

The ULN2803A is a high-voltage, high-current Darlington transistor array. The device consists of eight npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. The Darlington pairs may be connected in parallel for higher current capability.

Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. The ULN2803A has a 2.7-kΩ series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.



ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP (N)	Tube of 20	ULN2803AN	ULN2803AN
	SOIC (DW)	Tube of 40	ULN2803ADW	ULN2803A
		Reel of 2000	ULN2003ADWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

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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.



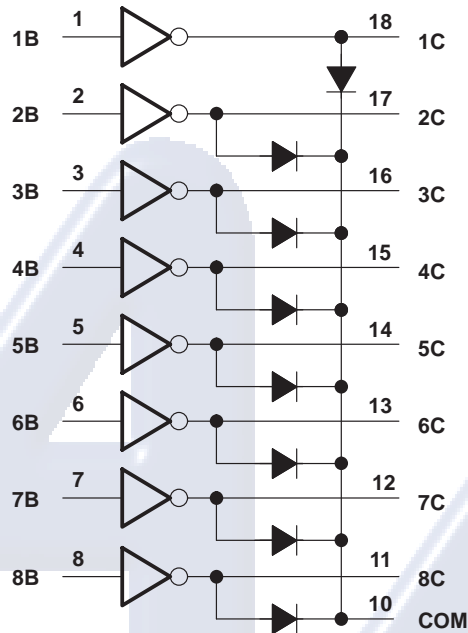
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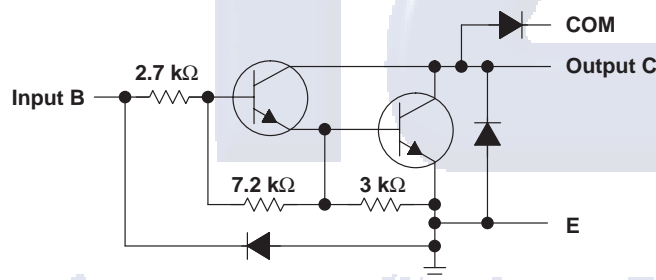
# **ULN2803A** **DARLINGTON TRANSISTOR ARRAY**

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## **logic diagram**



## **schematic (each Darlington pair)**



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# ULN2803A

## DARLINGTON TRANSISTOR ARRAY

SLRS049C – FEBRUARY 1997 – REVISED AUGUST 2004

### absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)†

Collector-emitter voltage	50 V
Input voltage (see Note 1)	30 V
Continuous collector current	500 mA
Output clamp diode current	500 mA
Total substrate-terminal current	–2.5 A
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): DW package	TBD°C/W
N package	TBD°C/W
Operating virtual junction temperature, $T_J$	150°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, unless otherwise noted, are with respect to the emitter/substrate terminal GND.  
 2. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

### electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{CEX}$	Collector cutoff current	$V_{CE} = 50\text{ V}$ , See Figure 1 $I_I = 0$ ,			50	$\mu\text{A}$
$I_{I(off)}$	Off-state input current	$V_{CE} = 50\text{ V}$ , $T_A = 70^\circ\text{C}$ , $I_C = 500\text{ }\mu\text{A}$ , See Figure 2	50	65		$\mu\text{A}$
$I_{I(on)}$	Input current	$V_I = 3.85\text{ V}$ , See Figure 3		0.93	1.35	mA
$V_{I(on)}$	On-state input voltage	$V_{CE} = 2\text{ V}$ , See Figure 4 $I_C = 200\text{ mA}$			2.4	V
		$I_C = 250\text{ mA}$			2.7	
		$I_C = 300\text{ mA}$			3	
$V_{CE(sat)}$	Collector-emitter saturation voltage	$I_I = 250\text{ }\mu\text{A}$ , See Figure 5 $I_C = 100\text{ mA}$ ,		0.9	1.1	V
		$I_I = 350\text{ }\mu\text{A}$ , See Figure 5 $I_C = 200\text{ mA}$ ,		1	1.3	
		$I_I = 500\text{ }\mu\text{A}$ , See Figure 5 $I_C = 350\text{ mA}$ ,		1.3	1.6	
$I_R$	Clamp diode reverse current	$V_R = 50\text{ V}$ , See Figure 6			50	$\mu\text{A}$
$V_F$	Clamp diode forward voltage	$I_F = 350\text{ mA}$ , See Figure 7		1.7	2	V
$C_i$	Input capacitance	$V_I = 0\text{ V}$ , $f = 1\text{ MHz}$		15	25	pF

### switching characteristics at 25°C free-air temperature

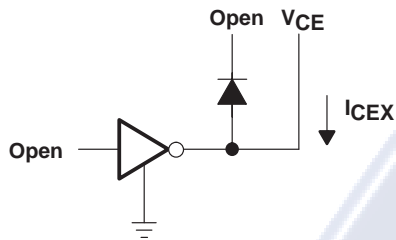
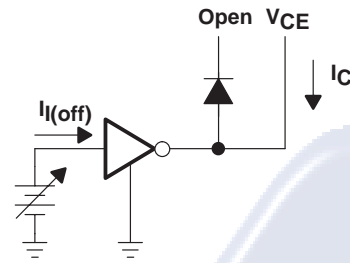
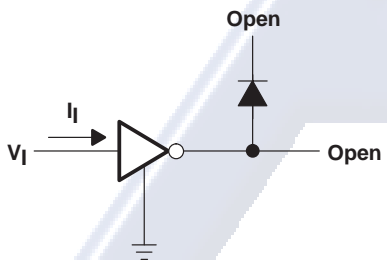
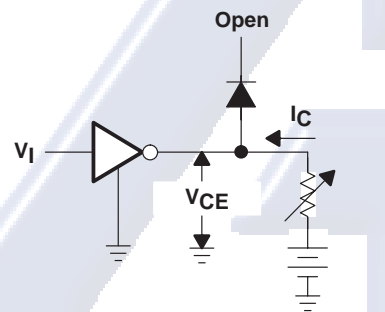
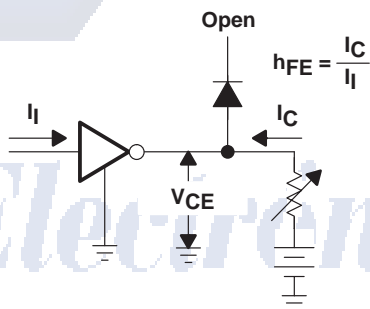
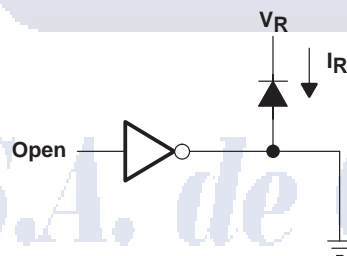
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation delay time, low- to high-level output	$V_S = 50\text{ V}$ , $R_L = 163\text{ }\Omega$ , $C_L = 15\text{ pF}$ , See Figure 8		130		ns
$t_{PHL}$	Propagation delay time, high- to low-level output			20		
$V_{OH}$	High-level output voltage after switching	$V_S = 50\text{ V}$ , See Figure 9 $I_O \approx 300\text{ mA}$ ,	$V_S - 20$			mV



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## PARAMETER MEASUREMENT INFORMATION

Figure 1.  $I_{CEX}$  Test CircuitFigure 2.  $I_{I(off)}$  Test CircuitFigure 3.  $I_{I(on)}$  Test CircuitFigure 4.  $V_{I(on)}$  Test CircuitFigure 5.  $h_{FE}$ ,  $V_{CE(sat)}$  Test CircuitFigure 6.  $I_R$  Test Circuit

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## PARAMETER MEASUREMENT INFORMATION

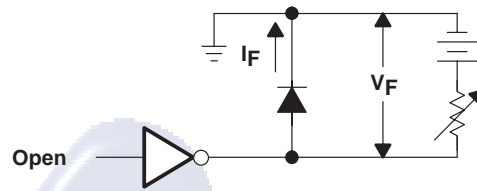
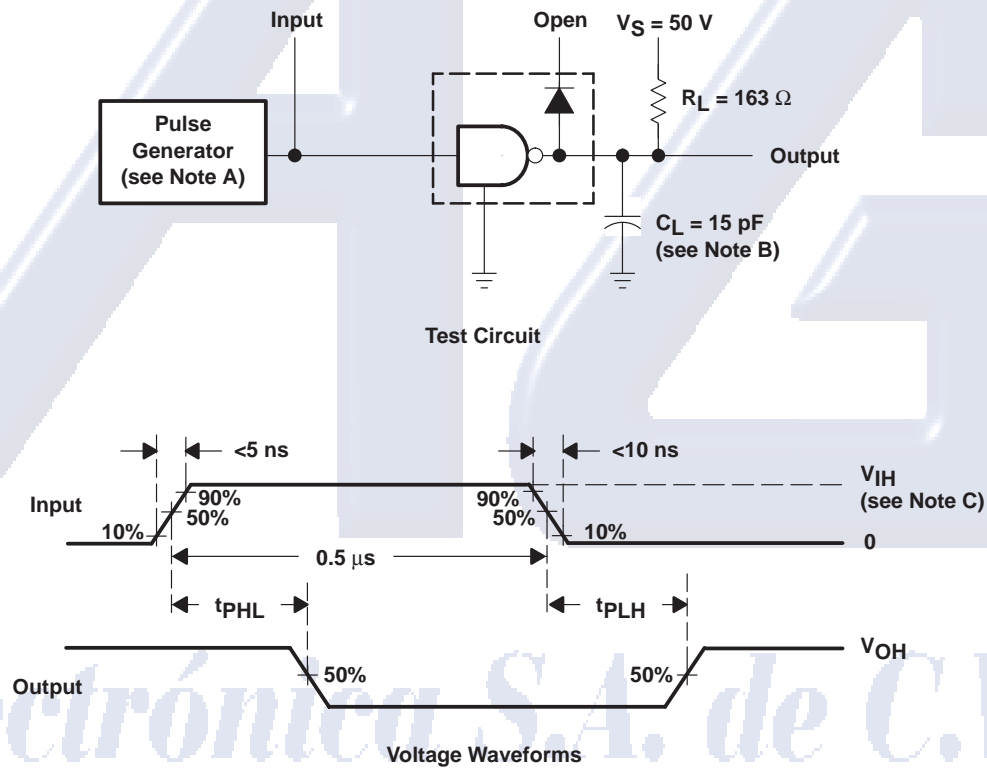


Figure 7.  $V_F$  Test Circuit



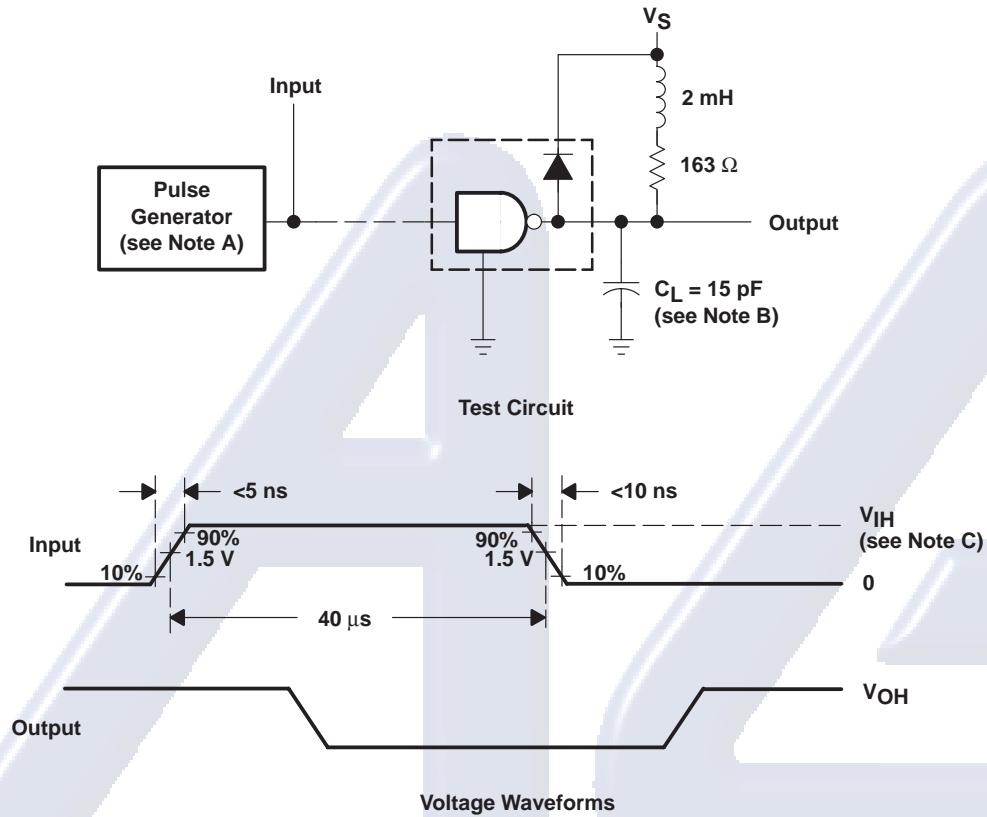
- NOTES: A. The pulse generator has the following characteristics: PRR = 1 MHz,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.  
 C.  $V_{IH} = 3 \text{ V}$

Figure 8. Propagation Delay Times

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## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 KHz,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.  
 C.  $V_{IH} = 3 \text{ V}$

**Figure 9. Latch-Up Test**

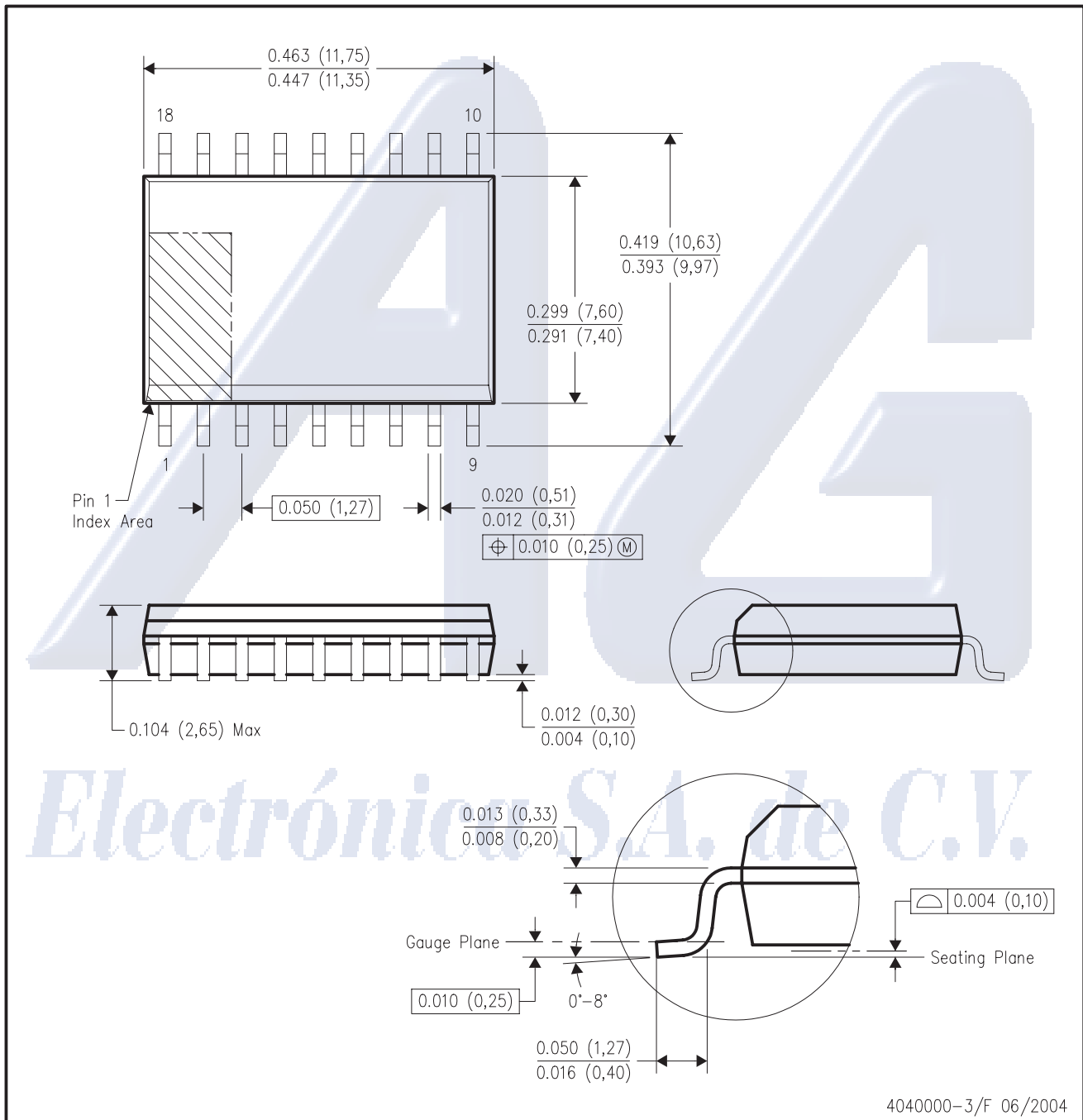
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DW (R-PDSO-G18)

PLASTIC SMALL-OUTLINE PACKAGE



- 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-013 variation AB.



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**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>
ULN2803ADW	ACTIVE	SOIC	DW	18	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
ULN2803ADWR	ACTIVE	SOIC	DW	18	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
ULN2803AN	ACTIVE	PDIP	N	18	20	Pb-Free (RoHS)	CU NIPDAU	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.

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

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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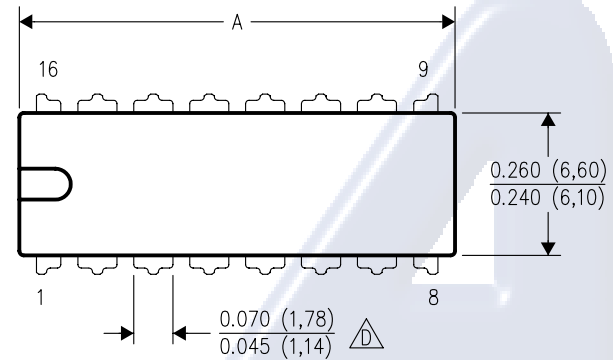


## MECHANICAL DATA

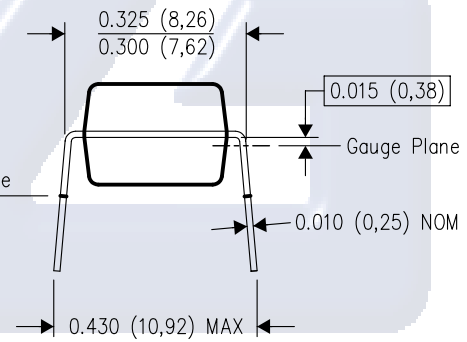
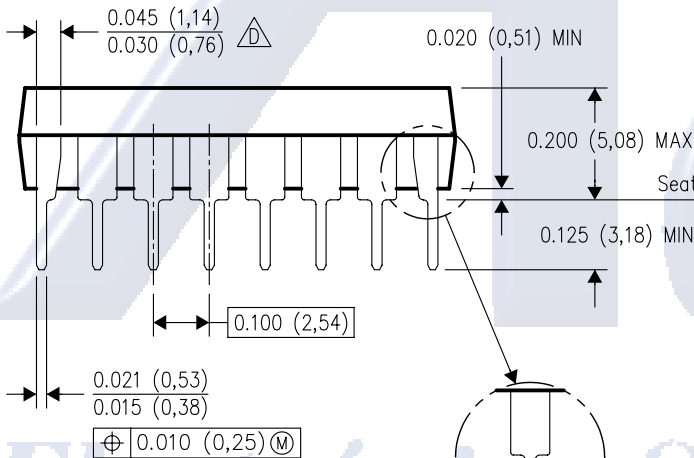
## N (R-PDIP-T\*\*)

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



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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.
  - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

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