18 11 1C

17 1 2C

16 3C

15 4C

14 5C

13 6C

12 7C

11 8C

10 COM

DW OR N PACKAGE

(TOP VIEW)

1B [

2B 🛛 2

3B 🛛 3

4B 🚺 4

5B 🛛 5

6B 🛿 6

9

7B 🛛 7

8B 8

GND

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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-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.

TA	PACKAG	∋e†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	PDIP (N)	Tube of 20	ULN2803AN	ULN2803AN
–40°C to 85°C	SOIC (DW)	Tube of 40	ULN2803ADW	ULN2803A
	50IC (DVV)	Reel of 2000	ULN2803ADWR	ULIN2003A

ORDERING INFORMATION

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



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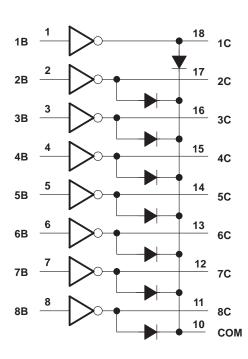
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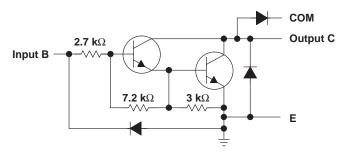
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logic diagram



schematic (each Darlington pair)





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

Collector-emitter voltage	
Continuous collector current	
Output clamp diode current	500 mA
Total substrate-terminal current	–2.5 A
Package thermal impedance, θ_{JA} (see Notes 2 and 3): DW package	73.14°C/W
N package	62.66°C/W
Operating virtual junction temperature, T _J	150°C
Storage temperature range, T _{stg}	\dots –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 $T_J(max)$, θ_{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 CO	NDITIONS	MIN	TYP	MAX	UNIT
ICEX	Collector cutoff current	V _{CE} = 50 V, See Figure 1	l _l = 0,			50	μΑ
II(off)	Off-state input current	$V_{CE} = 50 V,$ $T_{A} = 70^{\circ}C,$	I _C = 500 μA, See Figure 2	50	65		μΑ
I _{I(on)}	Input current	V _I = 3.85 V,	See Figure 3		0.93	1.35	mA
			I _C = 200 mA			2.4	
V _{I(on)}	On-state input voltage	V _{CE} = 2 V, See Figure 4	I _C = 250 mA			2.7	V
. ,			I _C = 300 mA			3	
		I _I = 250 μA, See Figure 5	I _C = 100 mA,		0.9	1.1	
V _{CE(sat)}	Collector-emitter saturation voltage	I _I = 350 μA, See Figure 5	I _C = 200 mA,		1	1.3	V
		I _I = 500 μA, See Figure 5	I _C = 350 mA,		1.3	1.6	
I _R	Clamp diode reverse current	V _R = 50 V,	See Figure 6			50	μΑ
VF	Clamp diode forward voltage	I _F = 350 mA,	See Figure 7		1.7	2	V
Ci	Input capacitance	$V_{I} = 0 V,$	f = 1 MHz		15	25	pF

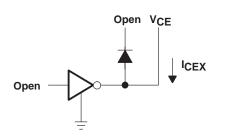
switching characteristics at 25°C free-air temperature

	PARAMETER	TEST CO	NDITIONS	MIN	TYP	MAX	UNIT
^t PLH	Propagation delay time, low- to high-level output	V _S = 50 V,	R _L = 163 Ω,		130		
^t PHL	Propagation delay time, high- to low-level output	C _L = 15 pF,	See Figure 8		20		ns
VOH	High-level output voltage after switching	V _S = 50 V, See Figure 9	$I_{O} \approx 300 \text{ mA},$	V _S - 20			mV



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PARAMETER MEASUREMENT INFORMATION





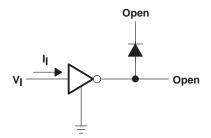


Figure 3. I_{I(on)} Test Circuit

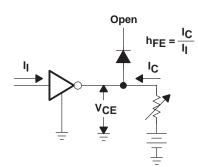


Figure 5. h_{FE}, V_{CE(sat)} Test Circuit

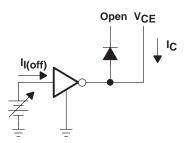


Figure 2. Il(off) Test Circuit

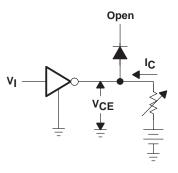


Figure 4. VI(on) Test Circuit

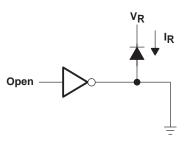


Figure 6. I_R Test Circuit



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PARAMETER MEASUREMENT INFORMATION

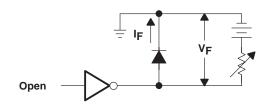
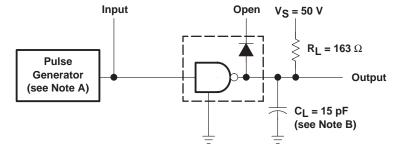
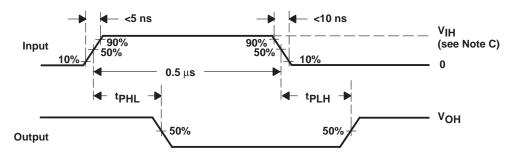


Figure 7. V_F Test Circuit



Test Circuit



Voltage Waveforms

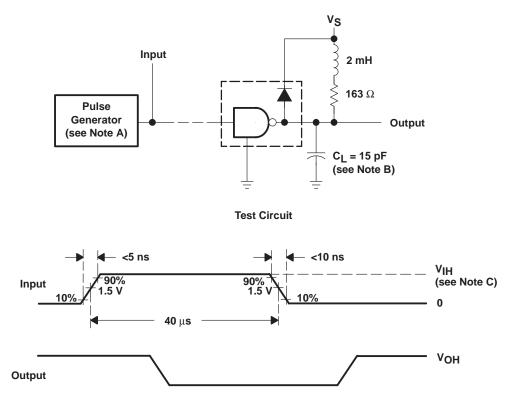
- NOTES: A. The pulse generator has the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$. B. CL includes probe and jig capacitance.

C. $V_{IH} = 3 V$

Figure 8. Propagation Delay Times



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PARAMETER MEASUREMENT INFORMATION

Voltage Waveforms

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

Figure 9. Latch-Up Test



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
ULN2803ADW	ACTIVE	SOIC	DW	18	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
ULN2803ADWG4	ACTIVE	SOIC	DW	18	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
ULN2803ADWR	ACTIVE	SOIC	DW	18	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
ULN2803ADWRG4	ACTIVE	SOIC	DW	18	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
ULN2803AN	ACTIVE	PDIP	Ν	18	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
ULN2803ANE4	ACTIVE	PDIP	Ν	18	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽¹⁾ 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.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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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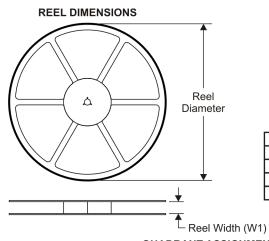
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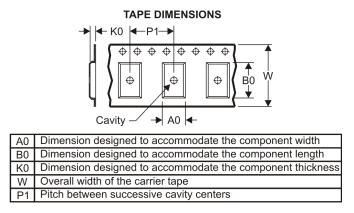
PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal	
-----------------------------	--

Device		Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ULN2803ADWR	SOIC	DW	18	2000	330.0	24.4	10.9	12.0	2.7	12.0	24.0	Q1

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PACKAGE MATERIALS INFORMATION

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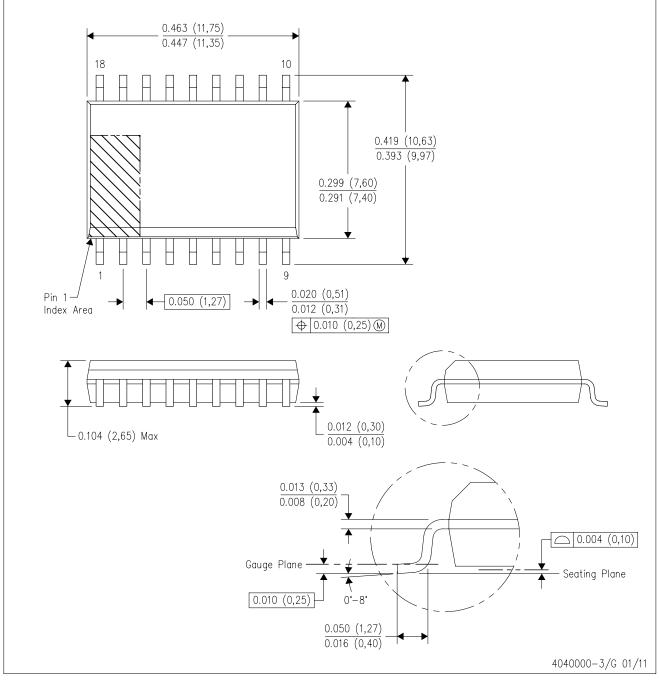


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ULN2803ADWR	SOIC	DW	18	2000	370.0	355.0	55.0

DW (R-PDSO-G18)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

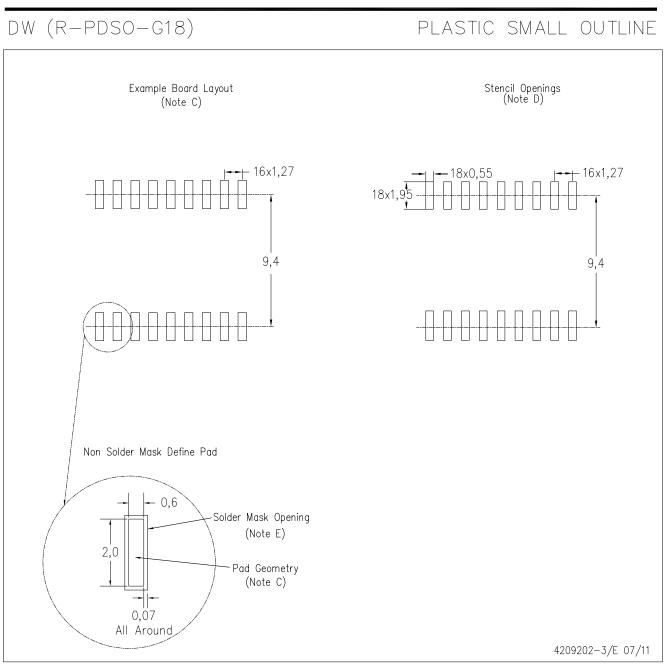
B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).

D. Falls within JEDEC MS-013 variation AB.



LAND PATTERN DATA



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Refer to IPC7351 for alternate board design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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