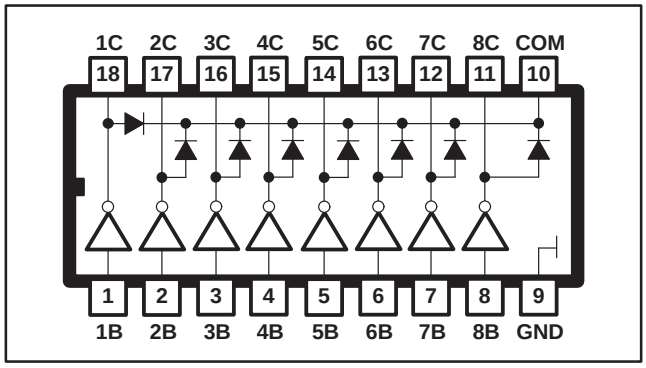
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

- **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**

N DUAL-IN-LINE PACKAGE
(TOP VIEW)



description

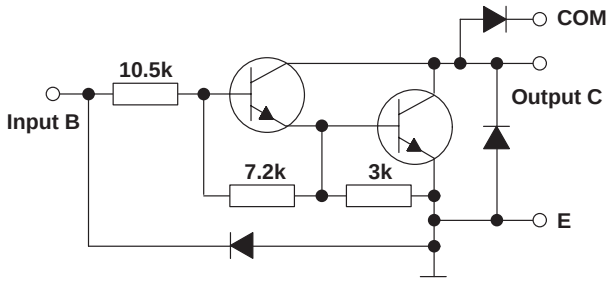
The ULN2804A is a monolithic high-voltage, high-current Darlington transistor array, comprising eight npn Darlington pairs. All units feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. Outputs and inputs can each be paralleled for higher current capability.

Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers.

The ULN2804A has an approximate 10.5-kΩ series input resistor to allow its operation directly from CMOS or PMOS, utilizing supply voltages of 6 to 15 volts.

The ULN2804A is characterized for operation from –20°C to 85°C.

schematic (each Darlington pair)



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
Continuous dissipation (total package) at (or below) 25°C free air temperature (see Note 2) . . . . . 1150 mW
Operating free-air temperature range . . . . . –20°C to 85°C
Storage temperature range . . . . . –65°C to 150°C
Lead temperature 1/16 inch from case for 10 seconds . . . . . 260°C

NOTES: 1. All voltages values, unless otherwise noted, are with respect to the emitter/substrate terminal E.
2. For operation above 25°C free-air temperature, refer to the Dissipation Derating Curves in the Thermal Information section.

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

PARAMETER		TEST FIGURE	TEST CONDITIONS		ULN2804A			UNIT
					MIN	TYP	MAX	
I_{CEX}	Collector cutoff current	1	V_{CE} = 50 V,	I_I = 0			50	µA
		2	T_A = 70°C, V_I = 1 V, V_{CE} = 50 V				500	
$I_{I(off)}$	Off-state input current	3	V_{CE} = 50 V, I_C = 500 µA, T_A = 70°C		50	65		µA
$I_{I(ON)}$	Input current	4	V_I = 3.85 V					mA
			V_I = 5 V			0.35	0.5	
			V_I = 12 V			1.0	1.45	
$V_{I(on)}$	On-state input voltage	6	V_{CE} = 2 V,	I_C = 125 mA			5	V
			V_{CE} = 2 V,	I_C = 200 mA			6	
			V_{CE} = 2 V,	I_C = 250 mA				
			V_{CE} = 2 V,	I_C = 275 mA			7	
			V_{CE} = 2 V,	I_C = 300 mA				
			V_{CE} = 2 V,	I_C = 350 mA			8	
$V_{CE(sat)}$	Collector-emitter saturation voltage	5	I_I = 250 µA,	I_C = 100 mA		0.9	1.1	V
			I_I = 350 µA,	I_C = 200 mA		1.0	1.3	
			I_I = 500 µA,	I_C = 350 mA		1.3	1.6	
I_R	Clamp-diode reverse current	7	V_R = 50 V				50	µA
V_F	Clamp-diode forward voltage	8	I_F = 350 mA			1.7	2	V
C_i	Input capacitance		V_I = 0 V,	f = 1 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	See Figure 9		0.25	1	µs
t_{PHL}	Propagation delay time, high- to low-level output			0.25	1	µs
V_{OH}	High-level output voltage after switching	V_S = 50 V, I_O = 300 mA, See Figure 10	V_S – 20			mV

PARAMETER MEASUREMENT INFORMATION

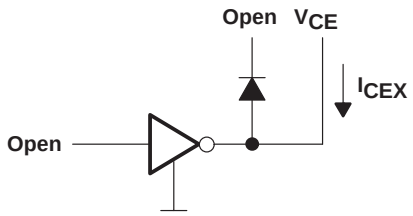


Figure 1. I_{CEX}

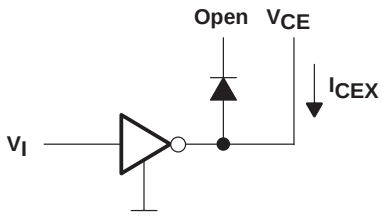


Figure 2. I_{CEX}

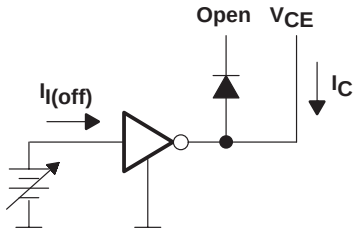


Figure 3. $I_{I(off)}$

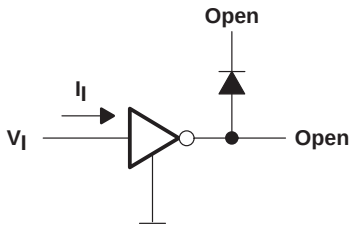


Figure 4. $I_{I(on)}$

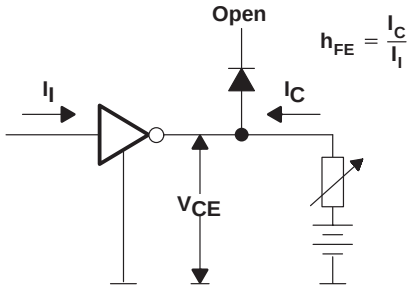


Figure 5. h_{FE}, $V_{CE(sat)}$

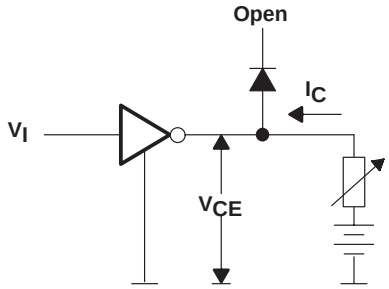


Figure 6. $V_{I(on)}$

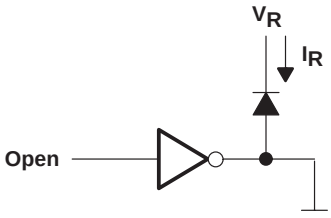


Figure 7. I_R

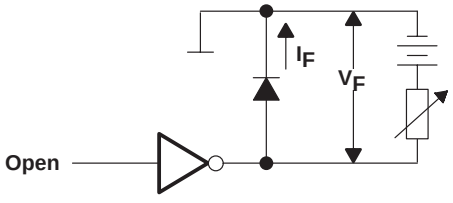
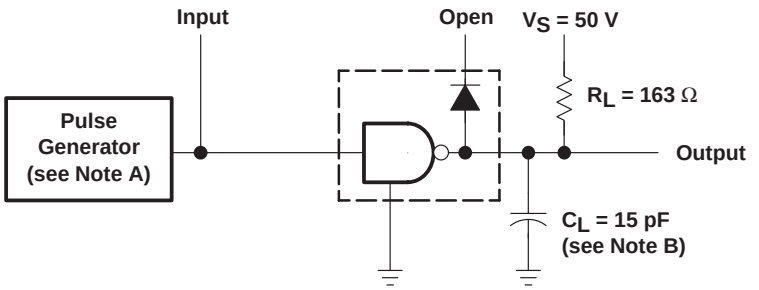
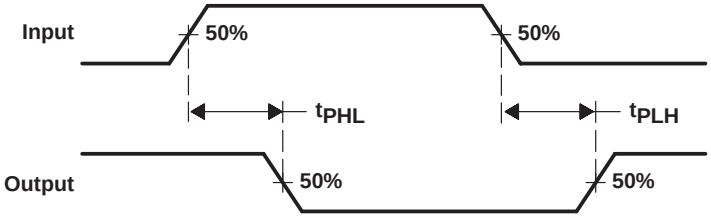


Figure 8. V_F

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUITS

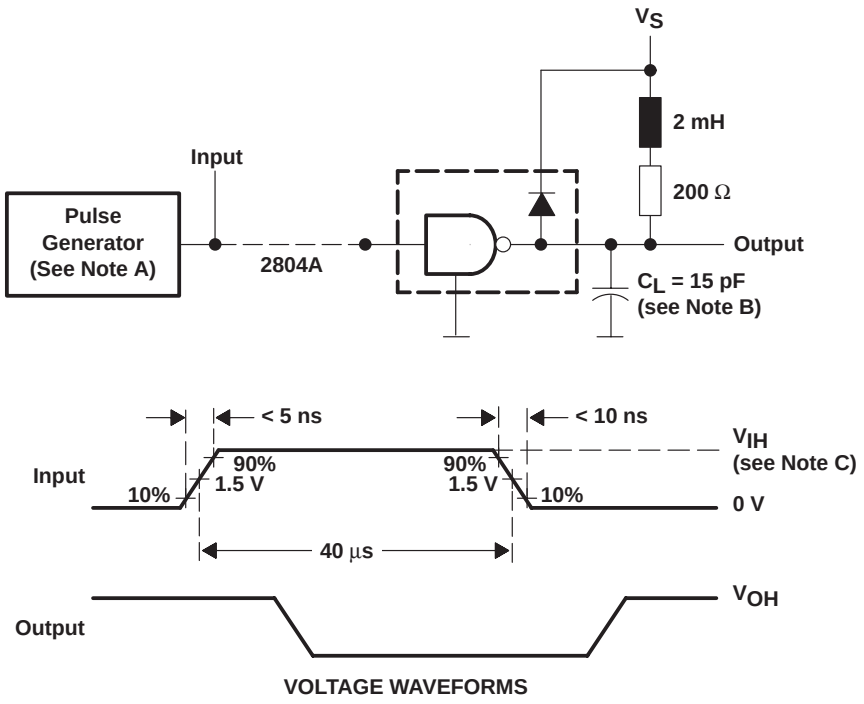


VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 KHz, Z_O = 50 Ω.
B. C_L includes probe and jig capacitance.

Figure 9. Propagation Delay Times

PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 kHz, Z_{out} = 50 Ω.
B. C_L includes probe and jig capacitance.
C. V_{IH} = 8 V

Figure 10. Latch-Up Test

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
ULN2804AN	OBSOLETE	PDIP	N	18		None	Call TI	Call TI

(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 - 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.

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

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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265