ULN2803A DARLINGTON TRANSISTOR (NPN)

1 Introduction

ULN2803A is an 8-channel Darlington structure circuit, with an output current of 500mA, a peak current of 600mA and an output voltage of 50V. It adopts a common emitter structure, and each channel can be output independently. This circuit is often used to drive various loads, such as DC engine, LED display lamp, high-power cache, 5V TTL, CMOS and other general logic circuits.

2 Available Package

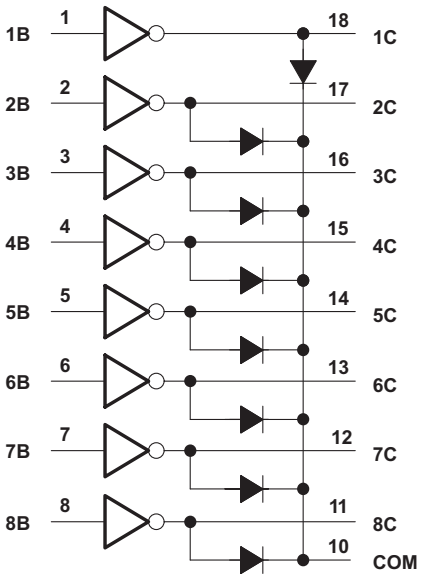
PART NUMBER	PACKAGE
ULN2803A	SOP-18

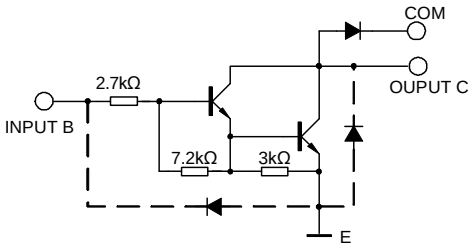
3 Features

- 500mA Rated Collector Current (Each Single Output)
- High-Voltage Outputs: 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic

4 Applications

- Relay Drivers
- Hammer Drivers
- Lamp Drivers
- Line Drivers
- Logic Buffers
- Stepper Motors
- IP Camera
- HVAC Valve and LED Dot Matrix





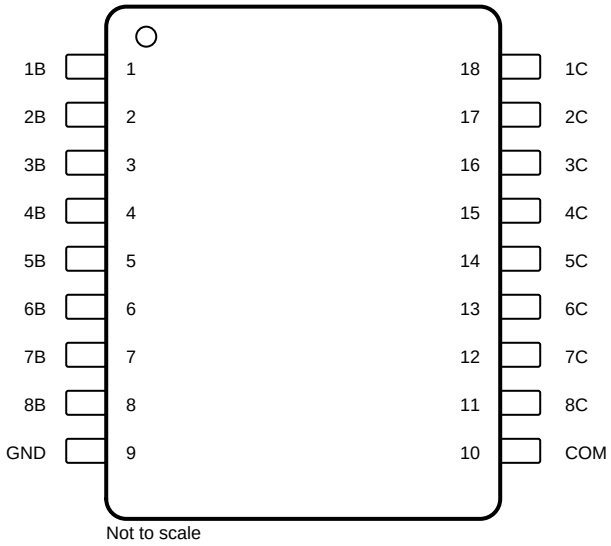
Note: The input and output parasitic diodes cannot be used as clamp diodes.

Figure 2-1. ULN2803A Logic Diagram

5 Pin Configuration and Marking Information

5.1 Pin Configuration and Function

Figure 5-1. SOP-18 Package Top View

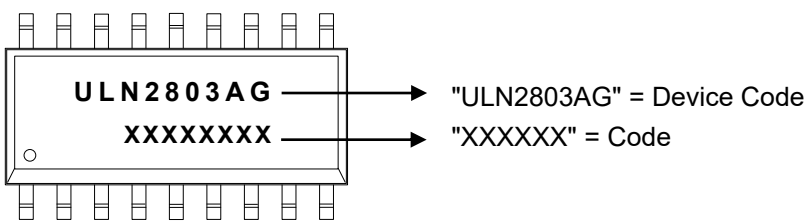


Not to scale

Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
1B	1	I	Channel 1 through 8 Darlington base input
2B	2		
3B	3		
4B	4		
5B	5		
6B	6		
7B	7		
8B	8		
1C	18	O	Channel 1 through 8 Darlington collector output
2C	17		
3C	16		
4C	15		
5C	14		
6C	13		
7C	12		
8C	11		
GND	9	—	Common emitter shared by all channels (typically tied to ground)
COM	10	I/O	Common cathode node for flyback diodes (required for inductive loads)

5.2 Marking Information



6 Specification

6.1 Absolute Maximum Ratings(1)

at 25°C free-air temperature (unless otherwise specified)

CHARACTERISTIC		SYMBOL	VALUE	UNIT
Output voltage(2)		V_{OUT}	50	V
Input voltage(2)		V_{IN}	30	V
Collector current (continuous)		I_C	500	mA
Base current (continuous)		I_B	25	mA
Maximum power dissipation	SOP-18	$P_{D\ MAX}$	Internally Limited(3)	W
Maximum junction temperature		$T_{J\ MAX}$	150	°C
Storage Temperature		T_{stg}	-55 ~ 150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.
(2) All voltages are with respect to network ground terminal.
(3) Refer to *Thermal Information* for details.

6.2 Recommended Operating Conditions

PARAMETER	SYMBOL	MIN.	NOM.	MAX.	UNIT
Operating junction temperature	T_J	-40	-	125	°C
Operating ambient temperature	T_A	-40	-	85	°C

6.3 Thermal Information(4)

THERMAL METRIC	SYMBOL	ULN2803A SOP-18 Package	UNIT
Junction-to-ambient thermal resistance	$R_{\Theta JA}$	70.4	°C/W
Reference maximum power dissipation for continuous operation	$P_{D\ Ref}$	1.42	W

(4) Test in T_A = 25°C, see *Notes* for more details.

6 Specification

6.4 Electrical Characteristics

at T_A = 25°C free-air temperature (unless otherwise specified)

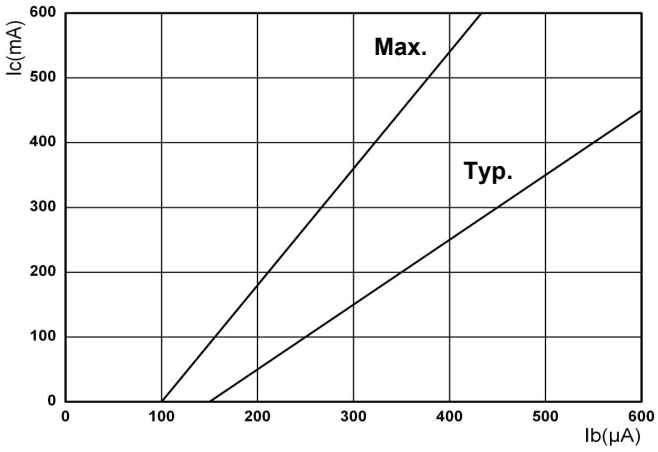
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	FIGURES(5)	MIN.	TYP.(6)	MAX.	UNIT
Collector cutoff current	I_{CEX}	V_{CE} = 50V	1a	-	-	50.0	μA
Collector-emitter saturation voltage	$V_{CE\ (SAT)}$	I_C = 100mA, I_B = 250μA	2	-	0.9	1.1	V
		I_C = 200mA, I_B = 350μA		-	1.1	1.3	
		I_C = 350mA, I_B = 500μA		-	1.3	1.6	
Input current (ON)	$I_{IN\ (ON)}$	V_{IN} = 3.85V	3	-	0.93	1.35	mA
Input voltage (ON)	$V_{IN\ (ON)}$	V_{CE} = 2.0V, I_C = 200mA	5	-	-	2.4	V
		V_{CE} = 2.0V, I_C = 250mA		-	-	2.7	
		V_{CE} = 2.0V, I_C = 300mA		-	-	3.0	
Clamp reverse current	I_R	V_R = 50V	6	-4.0	-	50	μA
Clamp forward voltage	V_F	I_F = 350mA	7	-	1.7	2.0	V
Output leakage current	I_{CEX-1V}	V_{CE} = 50V, V_{IN} = 1.0V	1b	-5.0	-	80	μA

(5) Test figures. See *Parameter Measurement Information* for details.

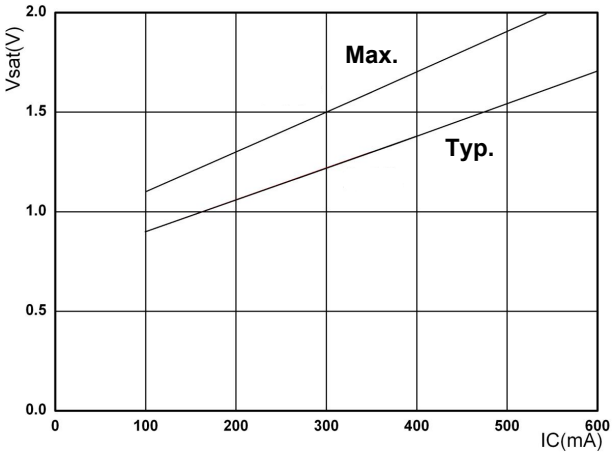
(6) Typical numbers are at 25°C and represent the most likely norm.

6.5 Typical Characteristics

Output Voltage vs. Input Current



Saturation Voltage vs. Output Voltage



7 Parameter Measurement Information

Figure 1a.

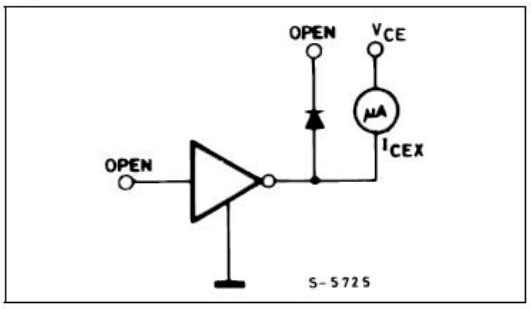


Figure 1b.

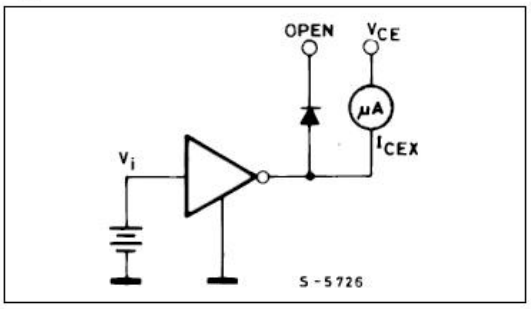


Figure 2.

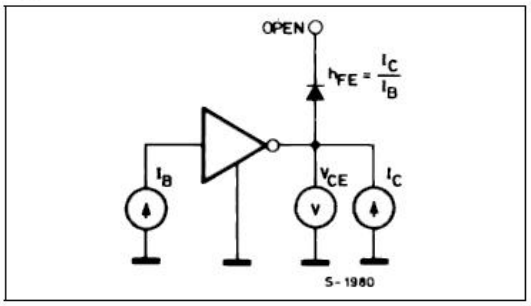


Figure 3.

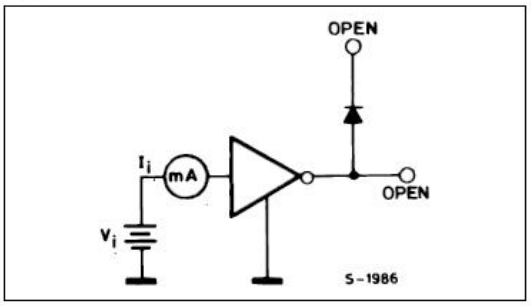


Figure 4.

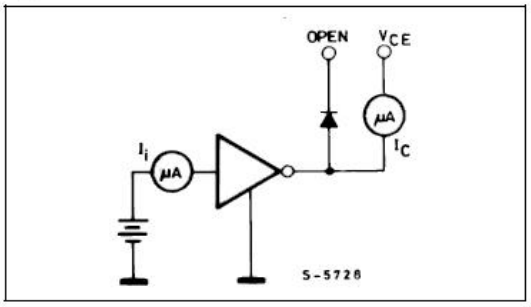


Figure 5.

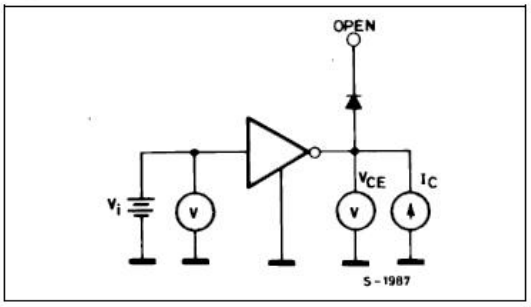


Figure 6.

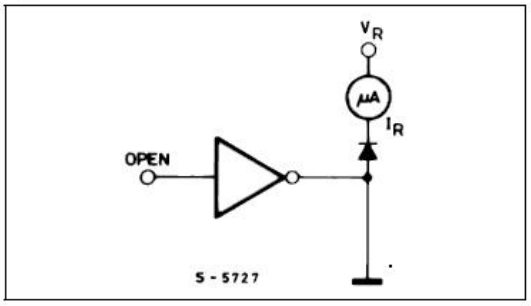
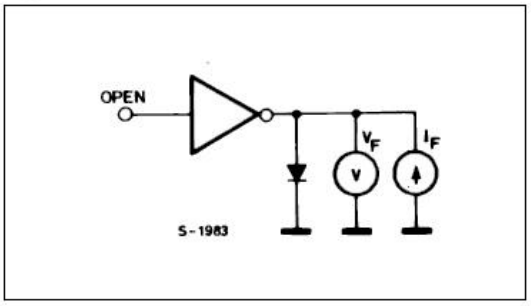
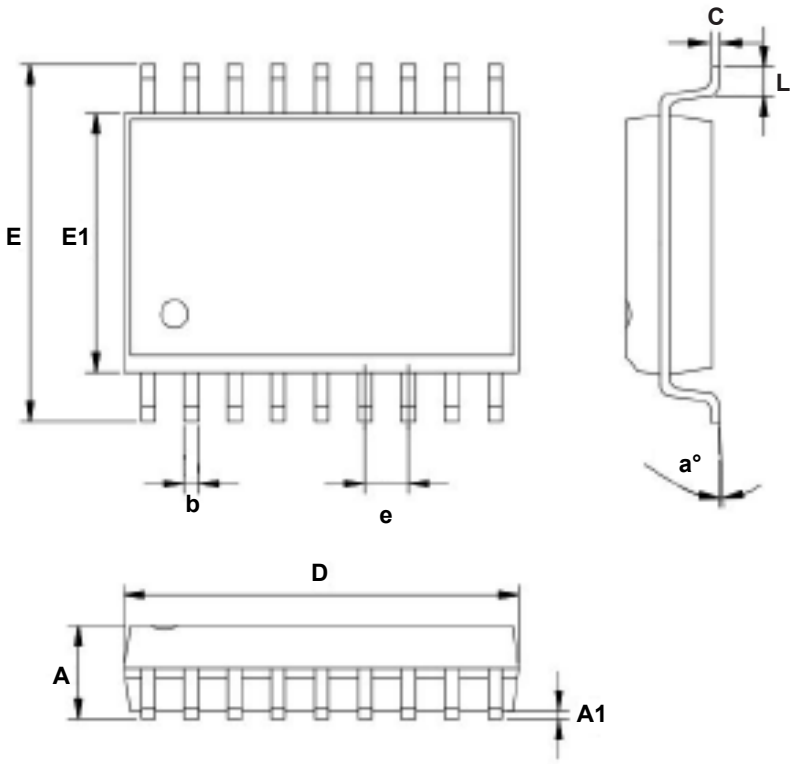


Figure 7.



8 Mechanical Information

SOP-18 Package Information



SYMBOL	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	2.65	-	-	0.104
A1	0.10	-	0.30	0.004	-	0.012
b	0.35	-	0.48	0.014	-	0.019
D	11.25	11.45	11.76	0.443	0.451	0.463
E	10.10	10.30	10.64	0.398	0.406	0.419
E1	7.30	7.50	7.70	0.287	0.295	0.303
e	1.27 Bsc.			0.05 Bsc.		
L	0.50	-	1.00	0.020	-	0.039
a°	0°	-	8°	0°	-	8°
C	0.19	-	0.29	0.007	-	0.011

9 Notes and Revision History

9.1 Associated Product Family and Others

To view other products of the same type or IC products of other types, please click the official website of JSCJ -- ***https: www.jscj-elec.com*** for more details.

9.2 Notes

Electrostatic Discharge Caution

This IC may be damaged by ESD. Relevant personnel shall comply with correct installation and use specifications to avoid ESD damage to the IC. If appropriate measures are not taken to prevent ESD damage, the hazards caused by ESD include but are not limited to degradation of integrated circuit performance or complete damage of integrated circuit. For some precision integrated circuits, a very small parameter change may cause the whole device to be inconsistent with its published specifications.

Junction-to-ambient Thermal Resistance $R_{\Theta JA}$

Definition: The junction to ambient thermal resistance $R_{\Theta JA}$ is a metric of the thermal performance of the device's packages. By comparing the metric of different companies on the same product package, the thermal performance of the product can be roughly estimated in a relative sense. $R_{\Theta JA}$ is measured under the conditions specified in the corresponding specifications. If the measurement of $R_{\Theta JA}$ of two products follows different specifications and standards, or although the same specifications and standards are adopted, it is not tested in strict accordance with the specifications, then the RΘJA of two products will lose the meaning of comparison. This product follows the test specified by JEDEC in the EIA/JESD51-x series documents. $R_{\Theta JA}$ is measured in still air with TA = 25°C and installed on a 1 in 2 FR-4 board covered with 2 ounces of copper.

Usage: Junction to ambient thermal resistance $R_{\Theta JA}$ is a parameter defined at the system level rather than on a single device or chip. In the test of $R_{\Theta JA}$ provided in the data sheet, most of the heat generated by the operation of the device is dissipated through the test board rather than the packaging surface of the device. In fact, the design and layout of PCB (such as chip or pad size, internal package geometry, etc.) will significantly affect $R_{\Theta JA}$. At this time, any calculation of the junction temperature or thermal power consumption of the device by applying $R_{\Theta JA}$ in the data sheet will have a very large error, so that it does not match the real performance of the device.

Therefore, $R_{\Theta JA}$ should be used as the relative comparison of product packaging thermal performance between different companies, rather than directly using $R_{\Theta JA}$ in the data sheet in the actual calculation.

Reference Maximum Power Dissipation for Continuous Operation $P_{D\ Ref}$

The reference maximum power dissipation for continuous operation $P_{D\ Ref}$ is not an accurate value obtained from the actual test. It is a theoretical value obtained according to the heat dissipation capacity of packaging combined with practical application. It is used to compare the differences of heat dissipation capacity more intuitively between products of different companies. This value is only for estimation reference and cannot be used as an index of the actual performance of the device for circuit design.

9 Notes and Revision History

9.3 Revision History

August, 2022: updated ULN2803A rev-1.0.

DISCLAIMER

IMPORTANT NOTICE, PLEASE READ CAREFULLY

The information in this data sheet is intended to describe the operation and characteristics of our products. JSCJ has the right to make any modification, enhancement, improvement, correction or other changes to any content in this data sheet, including but not limited to specification parameters, circuit design and application information, without prior notice.

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