

### Features

- Eight Darlington transistors with common emitters
- Output current to 500 mA
- Output voltage to 50 V
- Integral suppression diodes
- Versions for all popular logic families
- Output can be paralleled
- Inputs pinned opposite outputs to simplify board layout

### Description

The ULN2801A, ULN2802A, ULN2803A and ULN2804A each contain eight Darlington transistors with common emitters and integral suppression diodes for inductive loads. Each Darlington features a peak load current rating of 600 mA (500 mA continuous) and can withstand at least 50 V in the OFF state. Outputs may be paralleled for higher current capability.

Four versions are available to simplify interfacing to standard logic families: the ULN2801A is designed for general purpose applications with a current limit resistor; the ULN2802A has a 10.5 k $\Omega$  input resistor and Zener for 14-25 V PMOS; the ULN2803A has a 2.7 k $\Omega$  input resistor for 5 V TTL and CMOS; the ULN2804A has a 10.5 k $\Omega$  input resistor for 6-15 V CMOS.

All types are supplied in an 18-lead plastic DIP with a copper lead form and feature the convenient input-opposite-output pinout to simplify board layout.

**Table 1. Device summary**

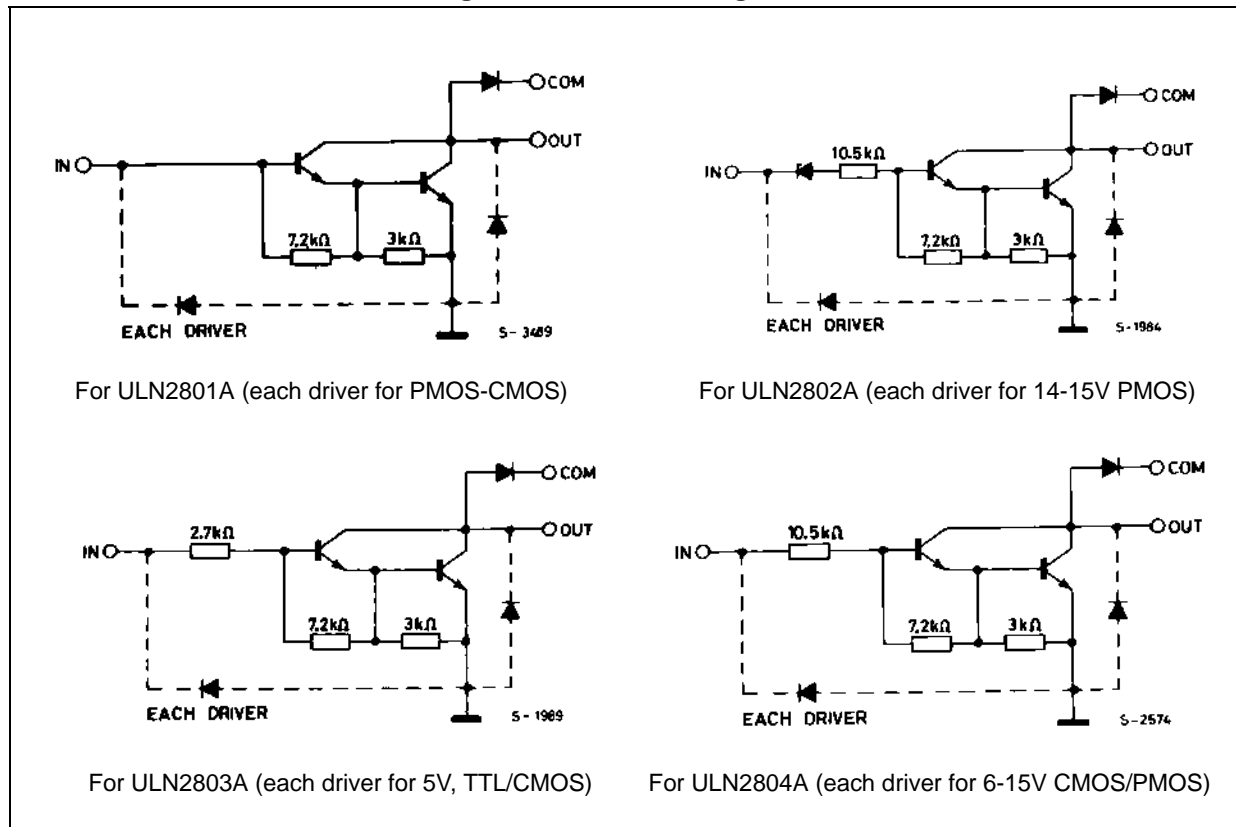
Order codes	Package
ULN2801A	DIP-18
ULN2802A	
ULN2803A	
ULN2804A	

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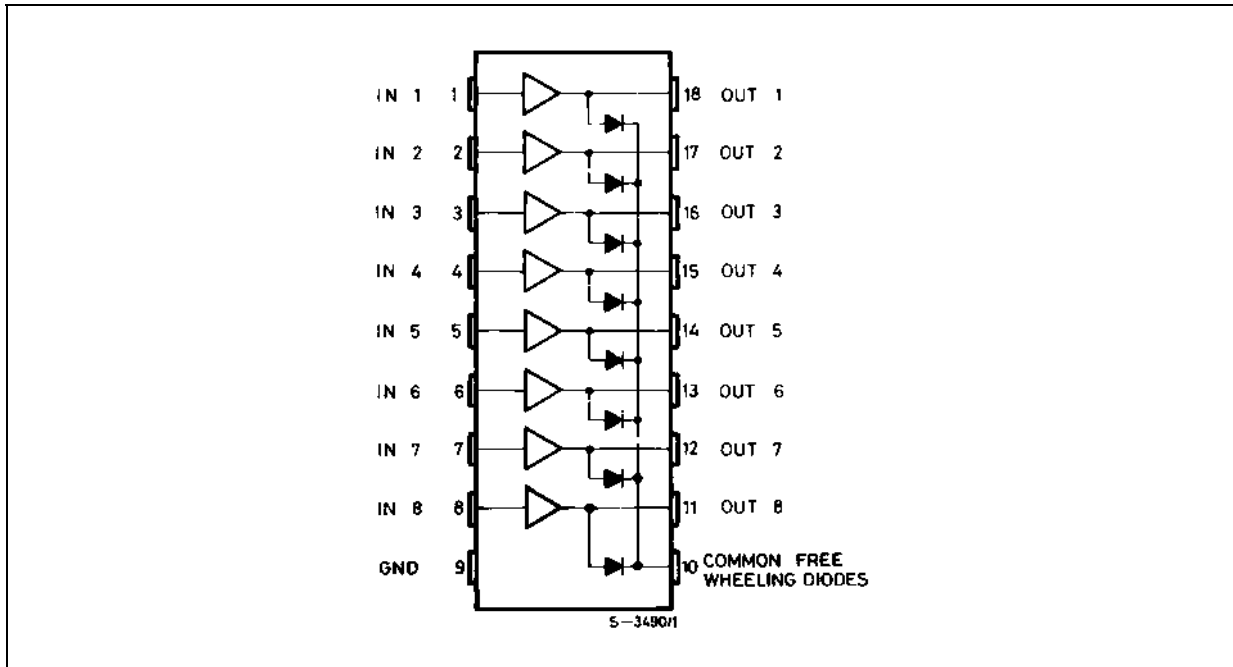
# 1 Diagram

Figure 1. Schematic diagrams



## 2 Pin configuration

Figure 2. Pin connections (top view)



### 3 Maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_O$	Output voltage	50	V
$V_I$	Input voltage (for ULN2802A - ULN2803A - ULN2804A)	30	V
$I_C$	Continuous collector current	500	mA
$I_B$	Continuous base current	25	mA
$P_{TOT}$	Power Dissipation (one Darlington pair)	1	W
	Power Dissipation (total package)	2.25	
$T_A$	Operating ambient temperature range	- 20 to 85	°C
$T_{STG}$	Storage temperature range	- 55 to 150	°C
$T_J$	Junction temperature	-20 to 150	°C

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJA}$	Thermal resistance junction-ambient	55	°C/W

## 4 Electrical characteristics

$T_A = 25\text{ °C}$  unless otherwise specified.

**Table 4. Electrical characteristics**

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$I_{CEX}$	Output leakage current	$V_{CE} = 50\text{ V}$				$\mu\text{A}$
		$T_A = 70\text{ °C}$ , $V_{CE} = 50\text{ V}$ (Figure 3)			50	
		$T_A = 70\text{ °C}$ for ULN2802A, $V_{CE} = 50\text{ V}$ , $V_I = 6\text{ V}$ (Figure 4)			100	
		$T_A = 70\text{ °C}$ for ULN2804A, $V_{CE} = 50\text{ V}$ , $V_I = 1\text{ V}$ (Figure 4)			500	
$V_{CE(SAT)}$	Collector-emitter saturation voltage (Figure 5)	$I_C = 100\text{ mA}$ , $I_B = 250\text{ }\mu\text{A}$		0.9	1.1	V
		$I_C = 200\text{ mA}$ , $I_B = 350\text{ }\mu\text{A}$		1.1	1.3	
		$I_C = 350\text{ mA}$ , $I_B = 500\text{ }\mu\text{A}$		1.3	1.6	
$I_{I(ON)}$	Input current (Figure 6)	for ULN2802A, $V_I = 17\text{ V}$		0.82	1.25	mA
		for ULN2803A, $V_I = 3.85\text{ V}$		0.93	1.35	
		for ULN2804A, $V_I = 5\text{ V}$		0.35	0.5	
		$V_I = 12\text{ V}$		1	1.45	
$I_{I(OFF)}$	Input current (Figure 7)	$T_A = 70\text{ °C}$ , $I_C = 500\text{ }\mu\text{A}$	50	65		$\mu\text{A}$
$V_{I(ON)}$	Input voltage (Figure 8)	$V_{CE} = 2\text{ V}$ , for ULN2802A			13	V
		$I_C = 300\text{ mA}$			2.4	
		for ULN2803A			2.7	
		$I_C = 200\text{ mA}$			3	
		$I_C = 250\text{ mA}$			5	
		for ULN2804A			6	
		$I_C = 125\text{ mA}$			7	
		$I_C = 200\text{ mA}$			8	
$I_C = 275\text{ mA}$						
$I_C = 350\text{ mA}$						
$h_{FE}$	DC Forward current gain (Figure 5)	for ULN2801A, $V_{CE} = 2\text{ V}$ , $I_C = 350\text{ mA}$	1000			
$C_I$	Input capacitance			15	25	pF
$t_{PLH}$	Turn-on delay time	$0.5 V_I$ to $0.5V_O$		0.25	1	$\mu\text{s}$
$t_{PHL}$	Turn-off delay time	$0.5 V_I$ to $0.5V_O$		0.25	1	$\mu\text{s}$
$I_R$	Clamp diode leakage current (Figure 9)	$V_R = 50\text{ V}$			50	$\mu\text{A}$
		$T_A = 70\text{ °C}$ , $V_R = 50\text{ V}$			100	
$V_F$	Clamp diode forward voltage (Figure 10)	$I_F = 350\text{ mA}$		1.7	2	V

## 5 Test circuits

Figure 3. Output leakage current

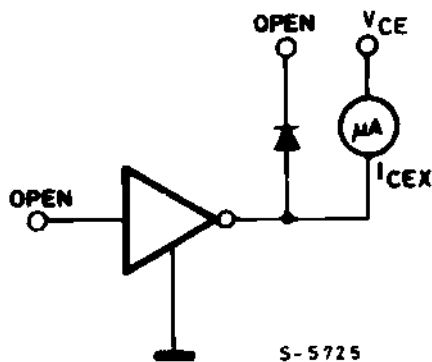


Figure 4. Output leakage current (for ULN2802A only)

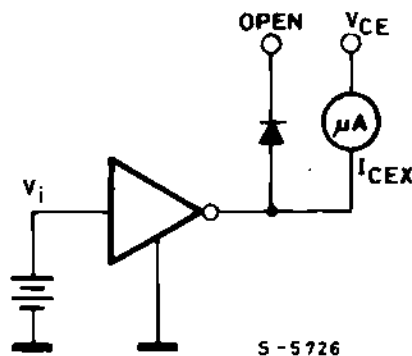


Figure 5. Collector-emitter saturation voltage

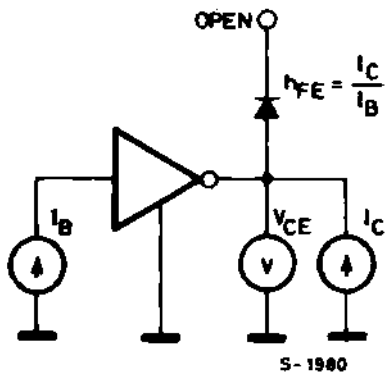


Figure 6. Input current (ON)

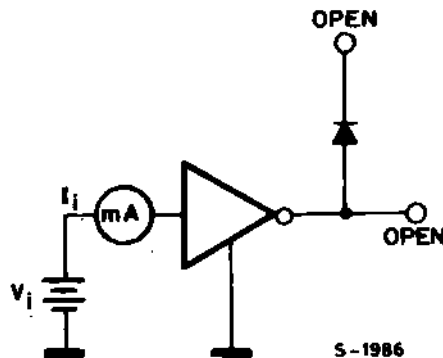


Figure 7. Input current (OFF)

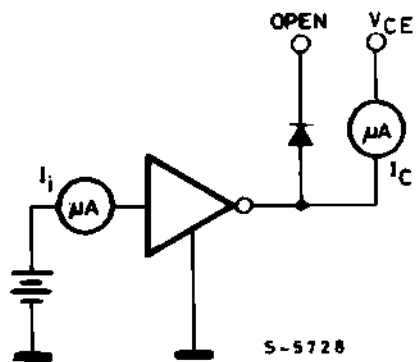
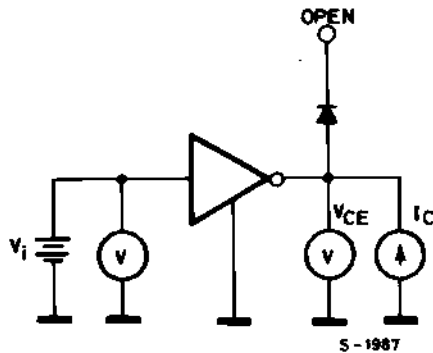
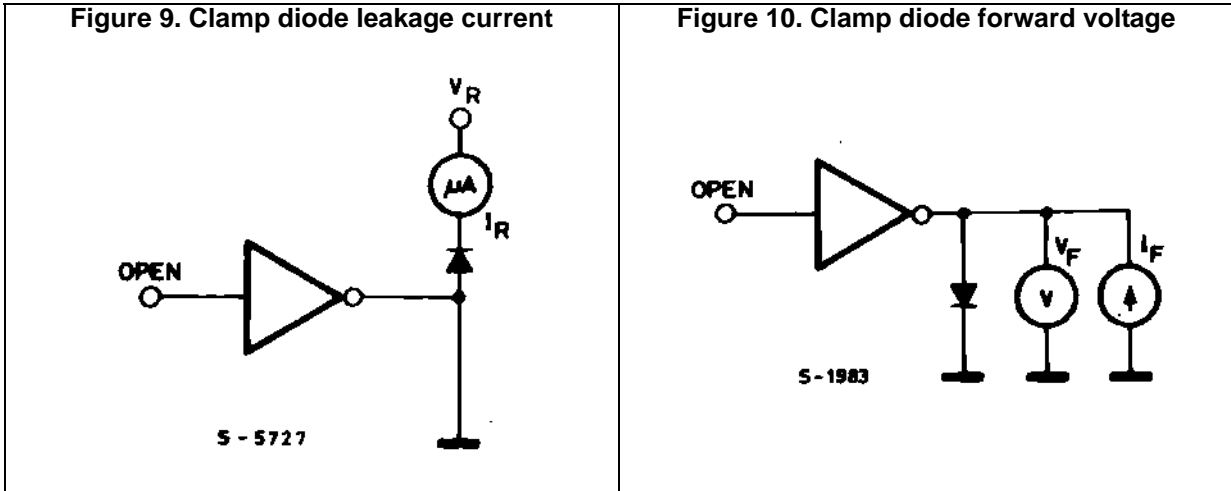


Figure 8. Input voltage







## 6 Typical performance characteristics

Figure 11. Collector current as a function of saturation voltage

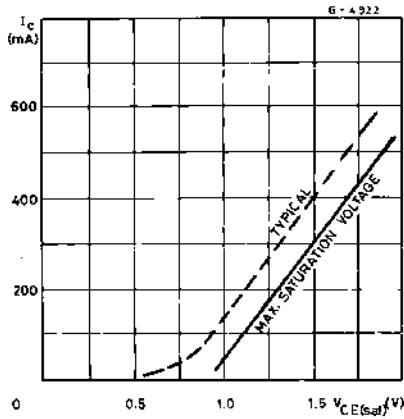


Figure 12. Collector current as a function of input current

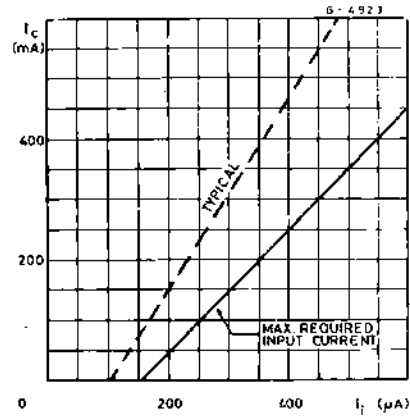


Figure 13. Allowable average power dissipation as a function of  $T_A$

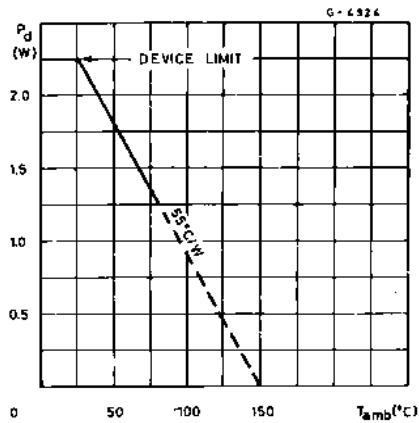


Figure 14. Peak collector current as a function of duty cycle

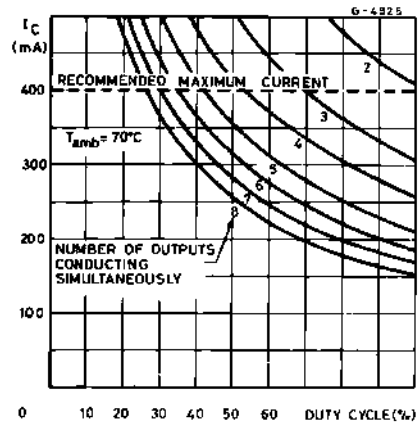


Figure 15. Peak collector current as a function of duty cycle

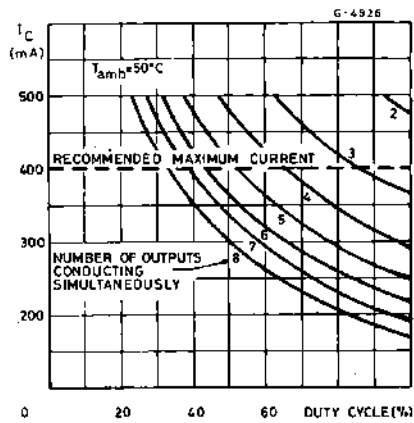


Figure 16. Input current as a function of input voltage (for ULN2802A)

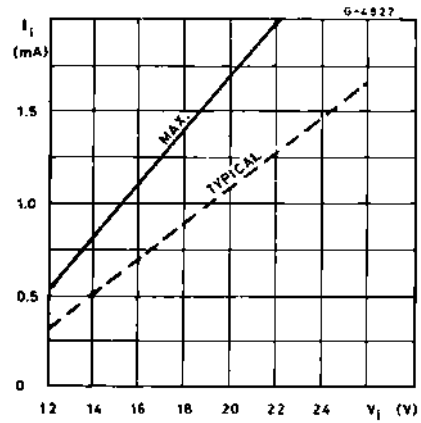


Figure 17. Input current as a function of input voltage (for ULN2804A)

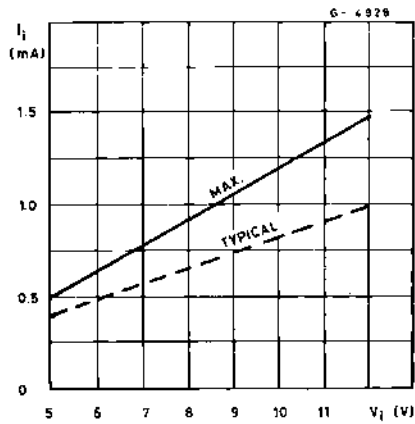
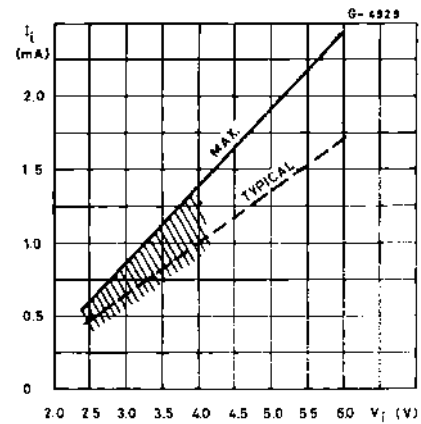


Figure 18. Input current as a function of input voltage (for ULN2803A)



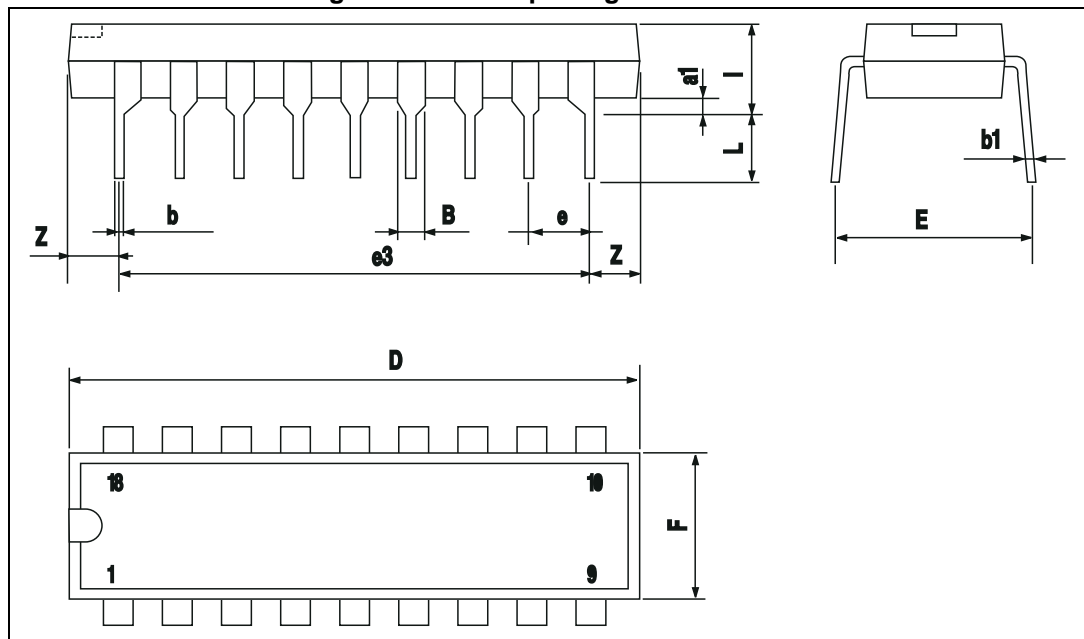
## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Table 5. DIP-18 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
a1	0.254		
B	1.39		1.65
b		0.46	
b1		0.25	
D			23.24
E		8.5	
e		2.54	
e3		20.32	
F			7.1
l			3.93
L		3.3	
Z		1.27	1.59

Figure 19. DIP-18 package dimensions



## 8 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
18-Sep-2003	1	First release
10-Mar-2010	2	Updated package mechanical data
19-Nov-2012	3	Modified input voltage values Table 4 on page 6.
27-Jun-2018	4	Updated: $I_{I(ON)}$ test condition in <a href="#">Table 4: Electrical characteristics</a> .

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