50V QUAD DARLINGTON SWITCHES

- FOUR NPN DARLINGTONS
- OUTPUT CURRENT TO 1.5A EACH DARLINGTON
- MINIMUM BREAKDOWN 50V
- SUSTAINING VOLTAGE AT LEAST 35V.
- INTEGRAL SUPPRESSION DIODES (ULN2064B, ULN2066B, ULN2068B AND ULN2070B)
- ISOLATED DARLINGTON PINOUT (ULN2074B, ULN2076B)
- VERSIONS COMPATIBLE WITH ALL POPULAR LOGIC FAMILIES
- 16-pin POWERDIP PACKAGE

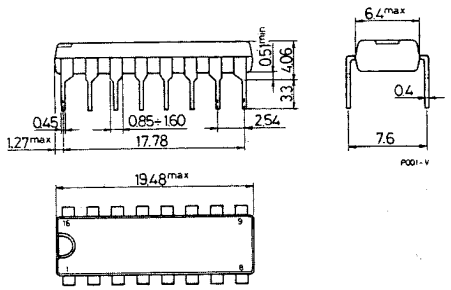
Designed to interface logic to a wide variety of high current, high voltage loads, these devices each contain four darlington switches delivering up to 1.5A with a specified minimum breakdown of 50V and a sustaining voltage of 35V measured at 100 mA. The ULN2064B, ULN2066B, ULN2068B and ULN2070B contain integral suppression diodes for inductive loads have common emitters. The ULN2074B and ULN2076B feature isolated darlington pinouts and are intended for applications such as emitter follower configurations. Inputs of the ULN2064B, ULN2068B and ULN2074B are compatible with popular 5V logic families and the ULN2066B and ULN2076B are compatible with 6-15V CMOS and PMOS. Types ULN2068B and ULN2070B include a predriver stage to reduce loading on the control logic. All of these arrays are supplied in a 16-pin powerdip package with the four center pins used to conduct heat to the printed circuit copper.

ABSOLUTE MAXIMUM RATINGS

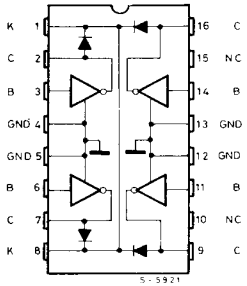
V_{CEX}	Output voltage	50	V
$V_{CE(sus)}$	Output sustaining voltage	35	V
I_o	Output current	1.75	A
V_i	Input voltage for ULN2066B/70B/74B/76B	30	V
	for ULN2064B/68B	15	V
I_i	Input current	25	mA
V_s	Supply voltage for ULN2068B	10	V
	for ULN2070B	20	V
P_{tot}	Power dissipation: at $T_{pins} = 90°C$	4.3	W
	at $T_{amb} = 70°C$	1	W
T_{amb}	Operating ambient temperature range	-20 to 85	°C
T_{stg}	Storage temperature	-55 to 150	°C

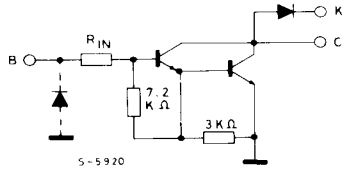
MECHANICAL DATA

Dimensions in mm



CONNECTION AND SCHEMATIC DIAGRAMS





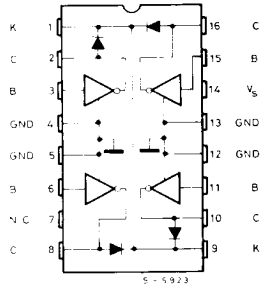
ULN2064B : R_{IN} = 350Ω
ULN2066B : R_{IN} = 3 kΩ

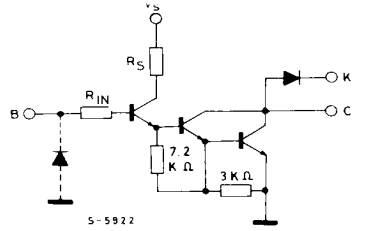
ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.	Fig.
I_{CEX}	Output leakage current	for **ULN2064B-ULN2066B** V_{CE} = 50V V_{CE} = 50V T_{amb} = 70°C			 100 500	 µA µA	1
$V_{CE(sus)}$	Collector-emitter sustaining voltage	for **ULN2064B-ULN2066B** I_C = 100mA V_i = 0.4V	 35			 V	2
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 500mA I_B = 625µA I_C = 750mA I_B = 935µA I_C = 1A I_B = 1.25mA I_C = 1.25A I_B = 2mA			1.1 1.2 1.3 1.4	V V V V	3
$I_{i(on)}$	Input current	for **ULN2064B** V_i = 2.4V for **ULN2064B** V_i = 3.75V for **ULN2066B** V_i = 5V for **ULN2066B** V_i = 12V	1.4 3.3 0.6 1.7		4.3 9.6 1.8 5.2	mA mA mA mA	4
$V_{i(on)}$	Input voltage	for **ULN2064B** V_{CE} = 2V I_C = 1A V_{CE} = 2V I_C = 1.5A for **ULN2066B** V_{CE} = 2V I_C = 1A V_{CE} = 2V I_C = 1.5A			 2 2.5 6.5 10	 V V V V	5
t_{PLH}	Turn-on delay time	0.5V_i to 0.5V_o			1	µs	
t_{PHL}	Turn-off delay time	0.5V_i to 0.5V_o			1.5	µs	
I_R	Clamp diode leakage current	for **ULN2064B-ULN2066B** V_R = 80V V_R = 80V T_{amb} = 70°C			 50 100	 µA µA	6
V_F	Clamp diode forward voltage	I_F = 1A I_F = 1.5A			1.75 2	V V	7

NOTE: 1 — Input voltage is with reference to the substrate (no connection to any other pins) for the ULN2074B and ULN2076B reference is ground for all other types
2 — Input current may be limited by maximum allowable input voltage

CONNECTION AND SCHEMATIC DIAGRAMS



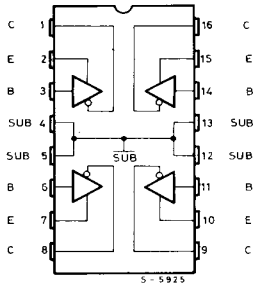


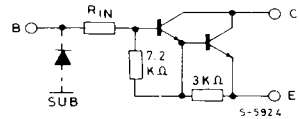
ULN2068B : R_{IN} = 2.5 kΩ R_s = 900Ω
ULN2070B : R_{IN} = 11.6 kΩ R_s = 3.4 KHΩ

ELECTRICAL CHARACTERISTICS (V_s = 5V for ULN2068B, V_s = 12V for ULN2070B, T_{amb} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.	Fig.
I_{CEX}	Output leakage current	for **ULN2068B–ULN2070B** V_{CE} = 50V V_{CE} = 50V T_{amb} = 70°C			 100 500	 µA µA	1
$V_{CE(sus)}$	Collector-emitter sustaining voltage	for **ULN2068B–ULN2070B** I_C = 100mA V_i = 0.4V	 35		 	 V	2
$V_{CE(sat)}$	Collector-emitter saturation voltage	for **ULN2068B** I_C = 500 mA V_i = 2.75V I_C = 750mA V_i = 2.75V I_C = 1A V_i = 2.75V I_C = 1.25A V_i = 2.75V for **ULN2070B** I_C = 500mA V_i = 5V I_C = 750mA V_i = 5V I_C = 1A V_i = 5V I_C = 1.25A V_i = 5V			 1.1 1.2 1.3 1.4 1.1 1.2 1.3 1.4	 V V V V V V V V	2
$I_{i(on)}$	Input current	for **ULN2068B** V_i = 2.75V for **ULN2068B** V_i = 3.75V for **ULN2070B** V_i = 5V for **ULN2070B** V_i = 12V			550 1000 400 1250	µA µA µA µA	4
$V_{i(on)}$	Input voltage	V_{CE} = 2V I_C = 1.5A for **ULN2068B** for **ULN2070B**			 2.75 5	 V V	5
I_s	Supply current	for **ULN2068B** I_C = 500mA V_i = 2.75V for **ULN2070B** I_C = 500mA V_i = 5V			 6 4.5	 mA mA	8
t_{PLH}	Turn-on delay time	0.5V_i to 0.5V_o			1	µs	
t_{PHL}	Turn-off delay time	0.5V_i to 0.5V_o I_C = 1.25A			1.5	µs	
I_R	Clamp diode leakage current	for **ULN2068B–ULN2070B** V_R = 50V V_R = 50V T_{amb} = 70°C			 50 100	 µA µA	6
V_F	Clamp diode forward voltage	I_F = 1A I_F = 1.5A			1.75 2	V V	7

CONNECTION AND SCHEMATIC DIAGRAMS





ULN2074B : R_{IN} = 350Ω
ULN2076B : R_{IN} = 3 kΩ

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.	Fig.
I_{CEX}	Output leakage current	for **ULN2074B-ULN2076B** V_{CE} = 50V V_{CE} = 50V T_{amb} = 70°C			 100 500	 μA μA	1
$V_{CE(sus)}$	Collector-emitter sustaining voltage	for **ULN2074B-ULN2076B** I_C = 100mA V_i = 0.4V	 35			 V	2
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 500mA I_B = 625μA I_C = 750mA I_B = 935μA I_C = 1A I_B = 1.25mA I_C = 1.25A I_B = 2mA			1.1 1.2 1.3 1.4	V V V V	3
$I_{i(on)}$	Input current	for **ULN2074B** V_i = 2.4V for **ULN2074B** V_i = 3.75V for **ULN2076B** V_i = 5V for **ULN2076B** V_i = 12V	1.4 3.3 0.6 1.7		4.3 9.6 1.8 5.2	mA mA mA mA	4
$V_{i(on)}$	Input voltage	for **ULN2074B** V_{CE} = 2V I_C = 1A V_{CE} = 2V I_C = 1.5A for **ULN2076B** V_{CE} = 2V I_C = 1A V_{CE} = 2V I_C = 1.5A			 2 2.5 6.5 10	 V V V V	5
t_{PLH}	Turn-on delay time	0.5V_i to 0.5V_o			1	μs	
t_{PHL}	Turn-off delay time	0.5V_i to 0.5V_o			1.5	μs	

TEST CIRCUITS

Fig. 1

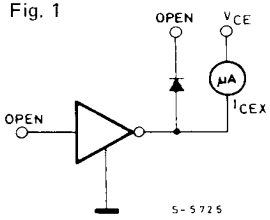


Fig. 2

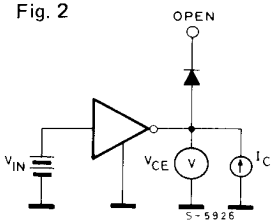


Fig. 3

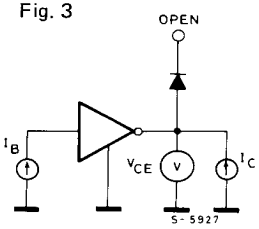


Fig. 4

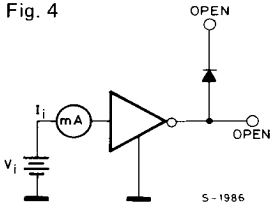


Fig. 5

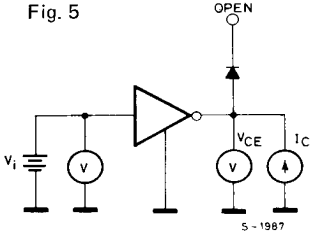


Fig. 6

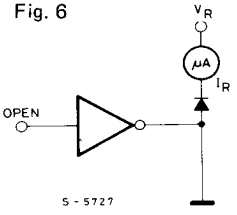


Fig. 7

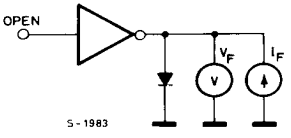


Fig. 8

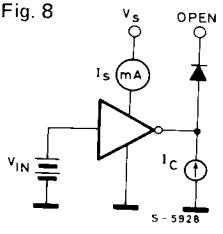


Fig. 9 - Input current as a function of input voltage

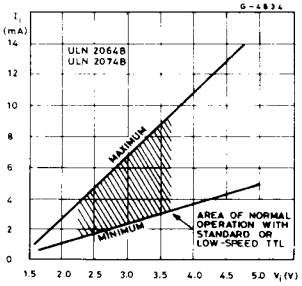


Fig. 10 - Input current as a function of input voltage

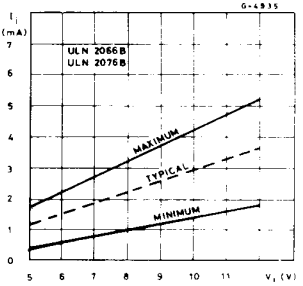
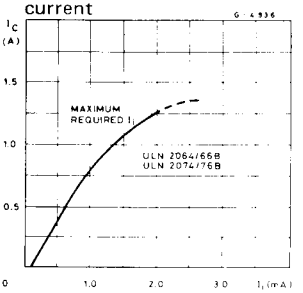


Fig. 11 - Collector current as a function of input current



TYPICAL APPLICATIONS

Fig. 12 - Common-anode LED drivers

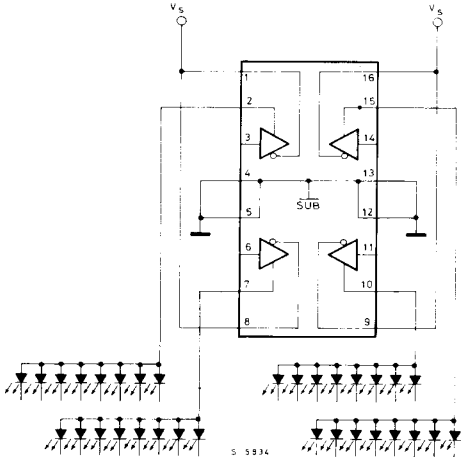
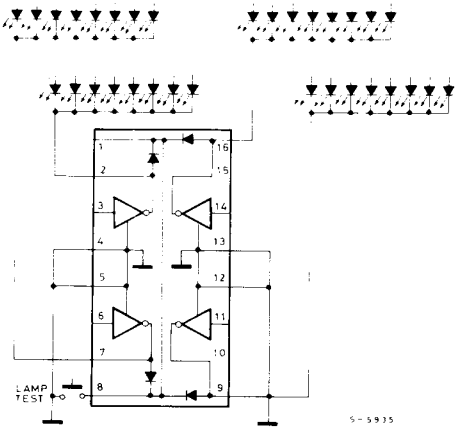


Fig. 13 - Common-cathode LED drivers



MOUNTING INSTRUCTIONS

The $R_{th\ j\text{-}amb}$ can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board (Fig. 14) or to an external heatsink (Fig. 15).
The diagram of figure 16 shows the maximum dissipable power P_{tot} and the $R_{th\ j\text{-}amb}$ as a function of the side "ℓ" of two equal square copper areas having a thickness of 35μ (1.4 mils).
During soldering the pins temperature must not exceed 260°C and the soldering time must not be longer than 12 seconds.
The external heatsink or printed circuit copper area must be connected to electrical ground.

Fig. 14 - Example of P.C. board copper area which is used as heatsink.

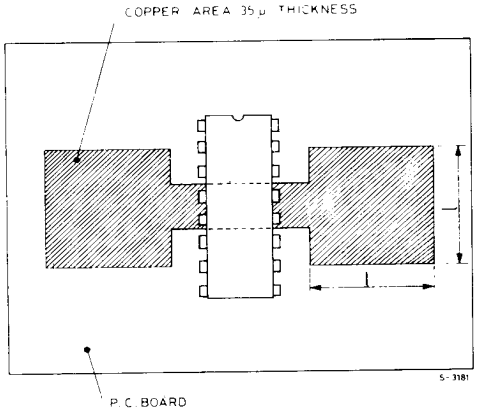


Fig. 15 - External heatsink mouting example

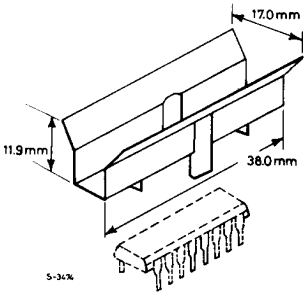


Fig. 16 - Maximum dissipable power and junction to ambient thermal resistance vs. side "ℓ"

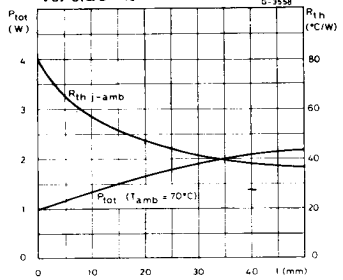


Fig. 17 - Maximum allowable power dissipation vs. ambient temperature