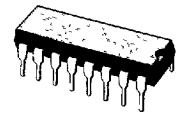
80 V - 1.5 A QUAD DARLINGTON SWITCHES

- OUTPUT CURRENT TO 1.5 A EACH DARLINGTON
- MINIMUM BREAKDOWN 80 V
- SUSTAINING VOLTAGE AT LEAST 50 V
- INTEGRAL SUPPRESSION DIODES (ULN2065B, ULN2067B, ULN2069B and ULN2071B)
- ISOLATED DARLINGTON PINOUT (ULN2075B and ULN2077B)
- VERSIONS COMPATIBLE WITH ALL POPULAR LOGIC FAMILIES

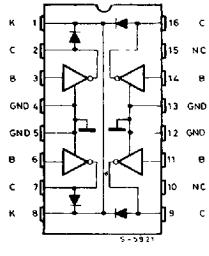
DESCRIPTION

Designed to interface logic to a wide variety of high current, high voltage loads, these devices each contain four NPN darlington switches delivering up to 1.5 A with a specified minimum breakdown of 80 V and a sustaining voltage of 50 V. The ULN2065B, ULN2067B, ULN2069B and ULN2071B contain integral suppression diodes for inductive loads and have common emitters ; the ULN2075B and ULN2077B feature isolated darlington pinouts and are intended for applications such as emitter follower configurations. Inputs of the ULN2065B, ULN2069B and ULN2075B are compatible with popular 5 V logic families and the ULN2067B, ULN2071B and ULN2077B are compatible with 6-15 VCMOS and PMOS. The ULN2069B and ULN2071B include a predriver stage to provide extragain, reducing the load on control logic.

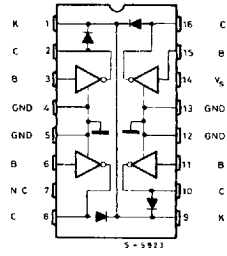


POWERDIP
12 + 2 + 2

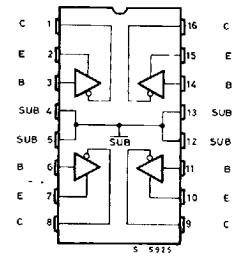
PIN CONNECTIONS AND ORDER CODES



ULN2065B
ULN2067B



ULN2069B
ULN2071B

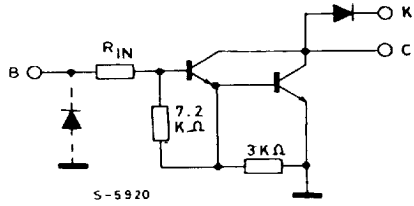


ULN2075B
ULN2077B

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEX}	Output Voltage	80	V
$V_{CE(sus)}$	Output Sustaining Voltage	50	V
I_O	Output Current	1.75	A
V_i	Input Voltage for **ULN2075B – 2077B**	60	V
	for **ULN2067B – 2071B**	30	V
	for **ULN2065B – 2069B**	15	V
I_I	Input Current	25	mA
V_s	Supply Voltage for **ULN2069B**	10	V
	for **ULN2071B**	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

SCHEMATIC DIAGRAM



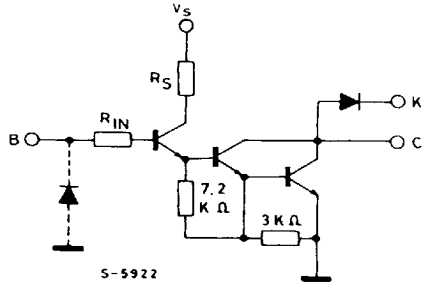
ULN2065B : R_{IN} = 350 Ω
ULN2067B : R_{IN} = 3 kΩ

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit	Fig.
I_{CEX}	Output Leakage Current	for **ULN2065B – ULN2067B**						
		V_{CE} = 80 V				100	µA	1
		V_{CE} = 80 V	T_{amb} = 70 °C			500	µA	
$V_{CE(sus)}$	Collector-emitter Sustaining Voltage	for **ULN2065B – ULN2067B**						
		I_C = 100 mA	V_I = 0.4 V	50			V	2
$V_{CE(sat)}$	Collector-emitter Saturation Voltage	I_C = 500 mA	I_B = 625 µA			1.1	V	3
		I_C = 750 mA	I_B = 935 µA			1.2	V	
		I_C = 1 A	I_B = 1.25 mA			1.3	V	
		I_C = 1.25 A	I_B = 2 mA			1.4	V	
		for **ULN2065B – ULN2067B**						
		I_C = 1.5 A	I_B = 2.25 mA			1.5	V	
$I_{I(on)}$	Input Current	for **ULN2065B**	V_I = 2.4 V	1.4		4.3	mA	4
		for **ULN2065B**	V_I = 3.75 V	3.3		9.6	mA	
		for **ULN2067B**	V_I = 5 V	0.6		1.8	mA	
		for **ULN2067B**	V_I = 12 V	1.7		5.2	mA	
$V_{I(on)}$	Input Voltage	for **ULN2065B**						5
		V_{CE} = 2 V	I_C = 1 A			2	V	
		V_{CE} = 2 V	I_C = 1.5 A			2.5	V	
		for **ULN2067B**						
		V_{CE} = 2 V	I_C = 1 A			6.5	V	
		V_{CE} = 2 V	I_C = 1.5 A			10	V	
t_{PLH}	Turn-on Delay Time	0.5 V_I to 0.5 V_o				1	µs	
t_{PHL}	Turn-off Delay Time	0.5 V_I to 0.5 V_o				1.5	µs	
I_R	Clamp Diode Leakage Current	for **ULN2065B – ULN2067B**						6
		V_R = 80 V				50	µA	
		V_R = 80 V	T_{amb} = 70 °C			100	µA	
V_F	Clamp Diode Forward Voltage	I_F = 1 A				1.75	V	7
		I_F = 1.5 A				2	V	

Notes : 1 Input voltage is with reference to the substrate (no connection to any other pins) for the ULN2075B and ULN2077B reference is ground for all other types
2 Input current may be limited by maximum allowable input voltage.

SCHEMATIC DIAGRAM

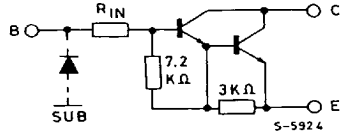


ULN2069B : R_{IN} = 2.5 KΩ, R_S = 900 Ω
ULN2071B : R_{IN} = 11.6 KΩ, R_S = 3.4 KΩ

ELECTRICAL CHARACTERISTICS (V_s = 5 V for ULN2069B, V_s = 12 V for ULN2071B, T_{amb} = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	Fig.
I_{CEX}	Output Leakage Current	for **ULN2069B – ULN2071B** V_{CE} = 80 V V_{CE} = 80 V T_{amb} = 70 °C			 100 500	 µA µA	1
$V_{CE(sus)}$	Collector-emitter Sustaining Voltage	for **ULN2069B – ULN2071B** I_C = 100 mA V_i = 0.4 V	 50			 V	2
$V_{CE(sat)}$	Collector-emitter Saturation Voltage	for **ULN2069B** I_C = 500 mA V_i = 2.75 V I_C = 750 mA V_i = 2.75 V I_C = 1 A V_i = 2.75 V I_C = 1.25 A V_i = 2.75 V I_C = 1.5 A V_i = 2.75 V for **ULN2071B** I_C = 500 mA V_i = 5 V I_C = 750 mA V_i = 5 V I_C = 1 A V_i = 5 V I_C = 1.25 A V_i = 5 V I_C = 1.5 A V_i = 5 V			 1.1 1.2 1.3 1.4 1.5 1.1 1.2 1.3 1.4 1.5	 V V V V V V V V V V	2
$I_{i(on)}$	Input Current	for **ULN2069B** V_i = 2.75 V for **ULN2069B** V_i = 3.75 V for **ULN2071B** V_i = 5 V for **ULN2071B** V_i = 12 V			550 1000 400 1250	µA µA µA µA	4
$V_{i(on)}$	Input Voltage	V_{CE} = 2 V I_C = 1.5 A for **ULN2069B** for **ULN2071B**			 2.75 5	 V	5
I_s	Supply Current	for **ULN2069B** I_C = 500 mA V_i = 2.75 V for **ULN2071B** I_C = 500 mA V_i = 5 V			 6 4.5	 mA mA	8
t_{PLH}	Turn-on Delay Time	0.5 V_i to 0.5 V_o			1	µs	
t_{PHL}	Turn-off Delay Time	0.5 V_i to 0.5 V_o I_C = 1.25 A			1.5	µs	
I_R	Clamp Diode Leakage Current	for **ULN2069B – ULN2071B** V_R = 80 V V_R = 80 V T_{amb} = 70 °C			 50 100	 µA µA	6
V_F	Clamp Diode Forward Voltage	I_F = 1 A I_F = 1.5 A			1.75 2	V V	7

SCHEMATIC DIAGRAM



ULN2075B : R_{IN} = 350 Ω
ULN2077B : R_{IN} = 3 kΩ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	Fig.
I_{CEX}	Output Leakage Current	for **ULN2075B – ULN2077B**					
		V_{CE} = 80 V			100	µA	1
		V_{CE} = 80 V T_{amb} = 70 °C			500	µA	
$V_{CE(sus)}$	Collector-emitter Sustaining Voltage	for **ULN2075B – ULN2077B** I_C = 100 mA V_i = 0.4 V	50			V	2
$V_{CE(sat)}$	Collector-emitter Saturation Voltage	I_C = 500 mA I_B = 625 µA			1.1	V	3
		I_C = 750 mA I_B = 935 µA			1.2	V	
		I_C = 1 A I_B = 1.25 mA			1.3	V	
		I_C = 1 25 A I_B = 2 mA			1.4	V	
		for **ULN2075B – ULN2077B**					
		I_C = 1.5 A I_B = 2.25 mA			1.5	V	
$I_{i(on)}$	Input Current	for **ULN2075B** V_i = 2.4 V	1.4		4.3	mA	4
		for **ULN2075B** V_i = 3.75 V	3.3		9.6	mA	
		for **ULN2077B** V_i = 5 V	0 6		1.8	mA	
		for **ULN2077B** V_i = 12 V	1.7		5.2	mA	
$V_{i(on)}$	Input Voltage	for **ULN2075B**					5
		V_{CE} = 2 V I_C = 1 A			2	V	
		V_{CE} = 2 V I_C = 1.5 A			2.5	V	
		for **ULN2077B**					
		V_{CE} = 2 V I_C = 1 A			6.5	V	
		V_{CE} = 2 V I_C = 1.5 A			10	V	
t_{PLH}	Turn-on Delay Time	0.5 V_i to 0 5 V_o			1	µs	
t_{PHL}	Turn-off Delay Time	0.5 V_i to 0.5 V_o			1.5	µs	

TEST CIRCUITS

Figure 1.

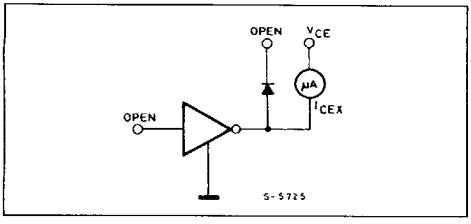


Figure 2.

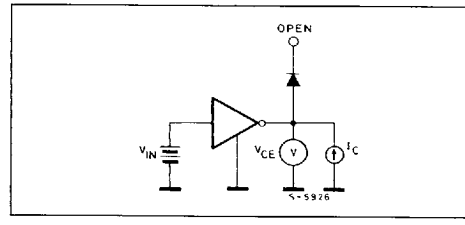


Figure 3.

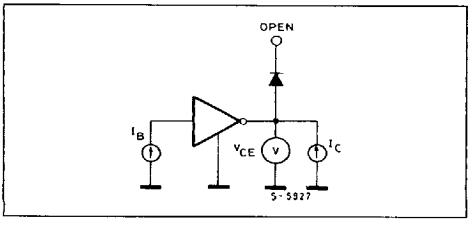


Figure 4.

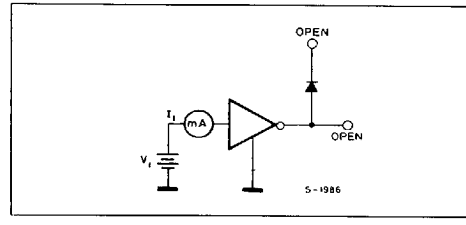


Figure 5.

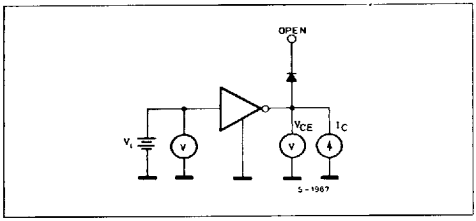


Figure 6.

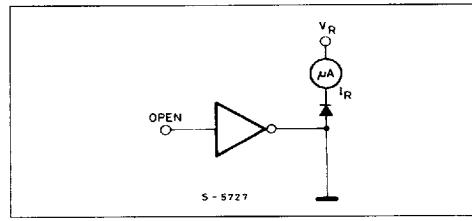


Figure 7.

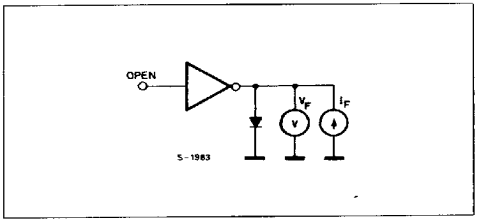


Figure 8.

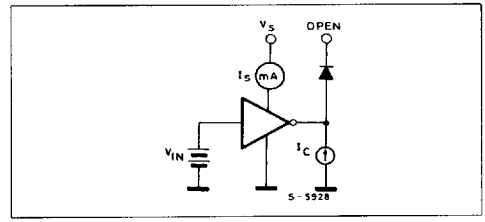


Figure 9 : Input Current as a Function of Input Voltage.

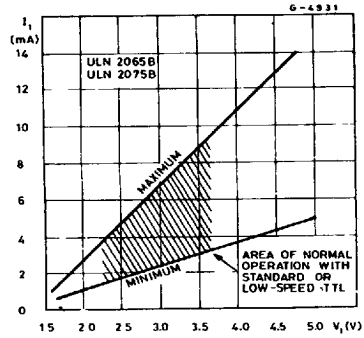


Figure 10 : Input Current as a Function of Input Voltage.

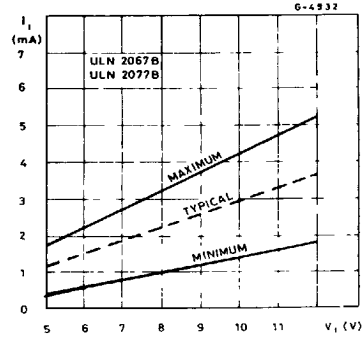
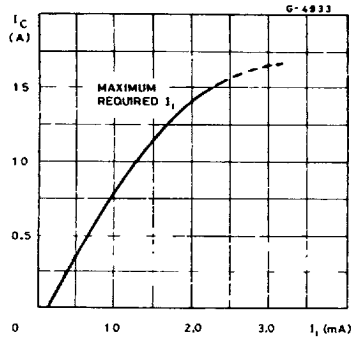


Figure 11 : Collector Current as a Function of Input Current.



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. 12) or to an external heatsink (Fig. 13).

The diagram of figure 14 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 35 µ (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.

Figure 12 : Example of P.C. Board Area which is Used as Heatsink.

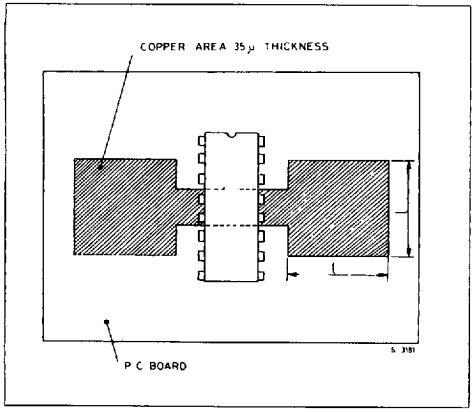


Figure 13 : External Heatsink Mounting Example.

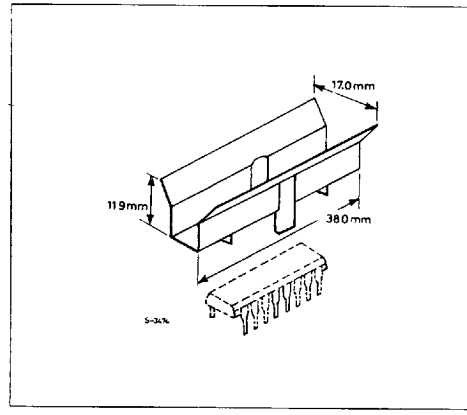


Figure 14 : Maximum Dissipable Power and Junction to Ambient Thermal Resistance vs. Side "l".

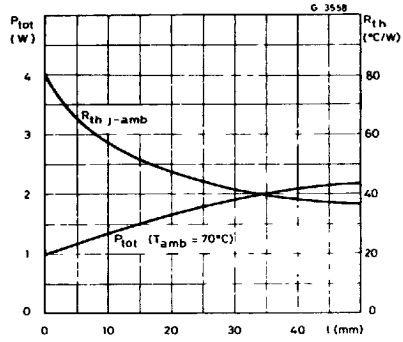


Figure 15 : Maximum Allowable Power Dissipation vs. Ambient Temperature.