

1. DESCRIPTION

The XD2002 is high-voltage, high-current Darlington arrays each containing seven open collector Darlington pairs with common emitters. Each channel is rated at 500 mA and can withstand peak currents of 600 mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout.

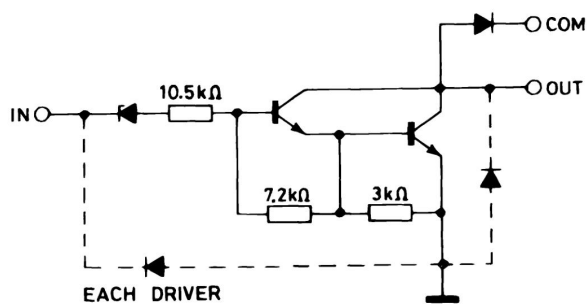
These versatile devices are useful for driving a wide range of loads including solenoids, relay DC motors, LED display filament lamps, thermal printheads and high-power buffers.

The XD2002 is supplied in a 16-pin DIP package with a copper leadframe to reduce thermal resistance. They are available also in small outline package (DIP-16) as XD2002.

2. FEATURES

- Seven Darlington pairs per package
- Output current 500 mA per driver (600 mA peak)
- Output voltage 50 V
- Integrated suppression diodes for inductive loads
- Outputs can be paralleled for higher current
- TTL/CMOS/PMOS/DTL compatible inputs
- Input pins placed opposite to output pins to simplify layout

3. DIAGRAM



XD2002 (each driver)

Figure 1. Schematic diagram

4. PIN CONNECTIONS

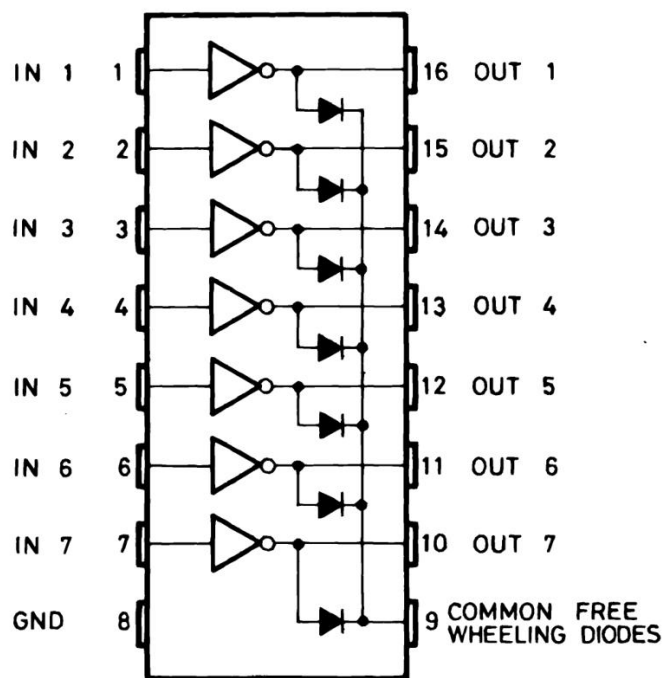


Figure 2. Pin connections (top view)

5. MAXIMUM RATINGS

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_O	Output voltage	50	V
V_I	Input voltage (for XD2002)	30	V
I_C	Continuous collector current	500	mA
I_B	Continuous base current	25	mA
I_F	Clamping diode continuous current	350	mA
V_R	Clamping diode reverse voltage	50	V
T_A	Operating ambient temperature range	- 40 to 85	°C
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Junction temperature	150	°C
ESD	Electrostatic discharge rating - HBM	2	kV

Table 2. Thermal data

Symbol	Parameter	DIP-16	Unit
R_{thJA}	Thermal resistance junction-ambient, Max.	70	°C/W
R_{thJC}	Thermal resistance junction-case (top), Max.		°C/W
R_{thJB}	Thermal resistance junction-board, Max.		°C/W

Note: Maximum power dissipation is a function of $T_{J(max)}$, R_{thJA} and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A) / R_{thJA}$. Operating at the absolute maximum T_J of +150°C can affect reliability.

6. ELECTRICAL CHARACTERISTICS

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

Table 3. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{CEX}	Output leakage current	$V_{CE} = 50\text{ V}$			50	μA
		$T_A = 85\text{ }^{\circ}\text{C}, V_{CE} = 50\text{ V}$			100	
		$T_A = 85\text{ }^{\circ}\text{C}$ for ULN2002, $V_{CE} = 50\text{ V}$, $V_I = 6\text{ V}$			500	
		$T_A = 85\text{ }^{\circ}\text{C}$ for ULN2002, $V_{CE} = 50\text{ V}$, $V_I = 1\text{ V}$			500	
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$I_C = 100\text{ mA}, I_B = 250\text{ }\mu\text{A}$		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	for ULN2002, $V_I = 17\text{ V}$		0.82	1.25	mA
		for ULN2003, $V_I = 3.85\text{ V}$		0.93	1.35	
		for ULN2004, $V_I = 5\text{ V}$ $V_I = 12\text{ V}$		0.35	0.5	
				1	1.45	
$I_{I(OFF)}$	Input current	$T_A = 85\text{ }^{\circ}\text{C}, I_C = 500\text{ }\mu\text{A}$	50	65		μA
$V_{I(ON)}$	Input voltage	$V_{CE} = 2\text{ V}$, for ULN2002 $I_C = 300\text{ mA}$			13	V
h_{FE}	DC Forward current gain	for ULN2001, $V_{CE} = 2\text{ V}, I_C = 350\text{ mA}$	1000			
C_i	Input capacitance			15	25	pF
t_{PLH}	Turn-on delay time	0.5 V_I to 0.5 V_O		0.25	1	μs
t_{PHL}	Turn-off delay time	0.5 V_I to 0.5 V_O		0.25	1	μs
I_R	Clamp diode leakage current	$V_R = 50\text{ V}$			50	μA
		$T_A = 85\text{ }^{\circ}\text{C}, V_R = 50\text{ V}$			100	
V_F	Clamp diode forward voltage	$I_F = 350\text{ mA}$		1.7	2	V

7. TEST CIRCUITS

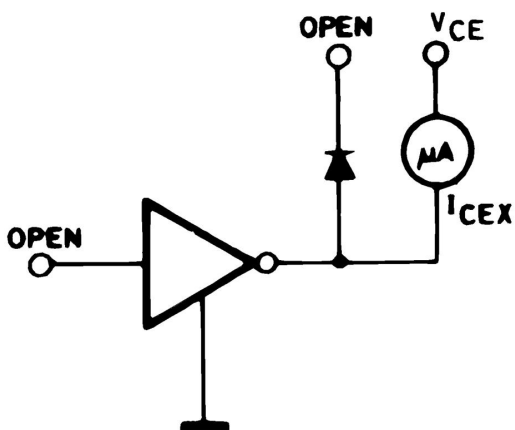


Figure 3. Output leakage current

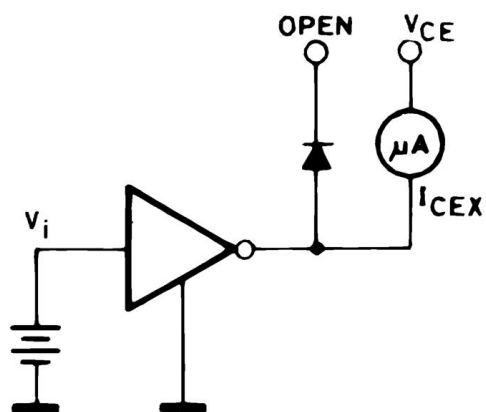


Figure 4. Output leakage current

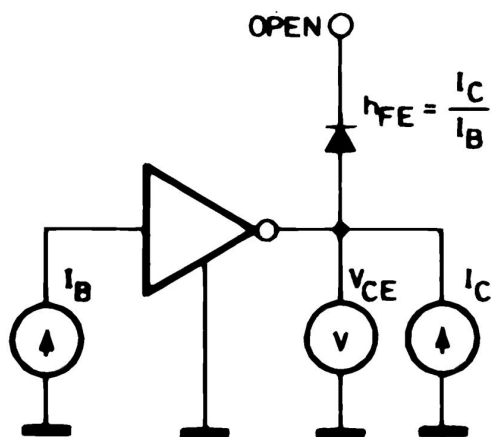


Figure 5. Collector-emitter saturation voltage

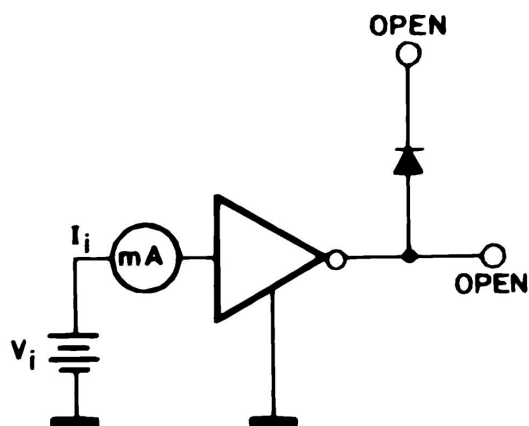


Figure 6. Input current (ON)

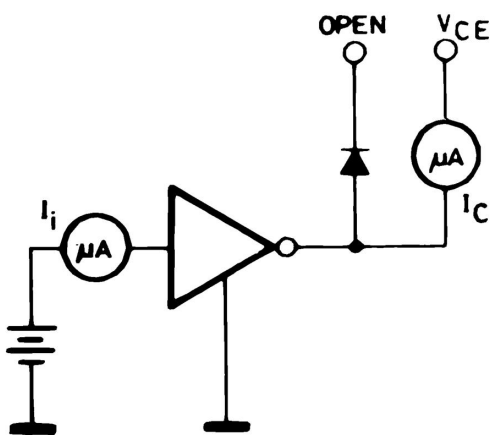


Figure 7. Input current (OFF)

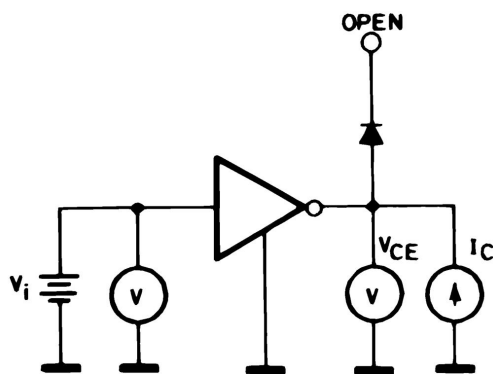


Figure 8. Input voltage

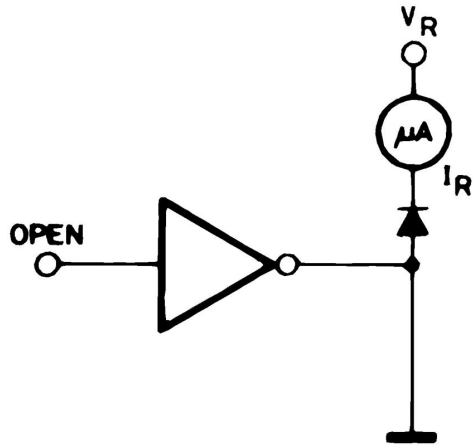


Figure 9. Clamp diode leakage current

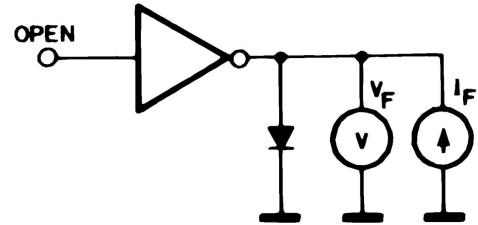


Figure 10. Clamp diode forward voltage

8. TYPICAL PERFORMANCE CHARACTERISTICS

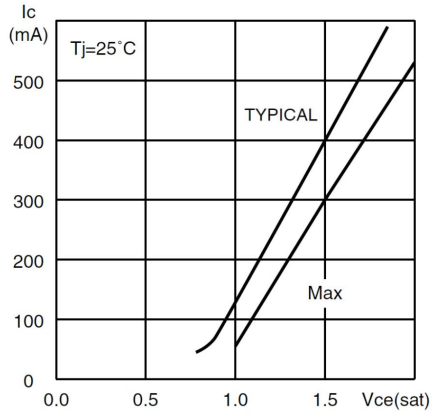


Figure 11. Collector current vs. saturation voltage ($T_j = 25^\circ\text{C}$)

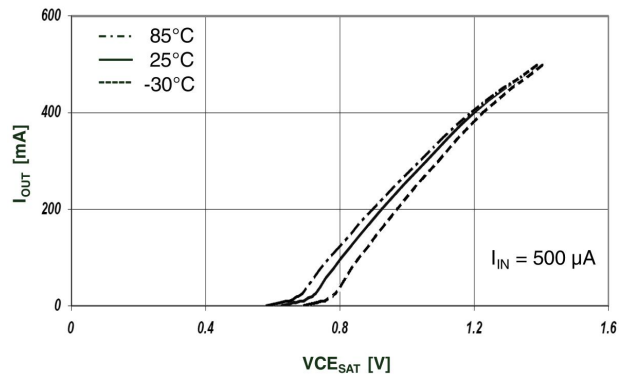


Figure 12. Collector current vs. saturation voltage

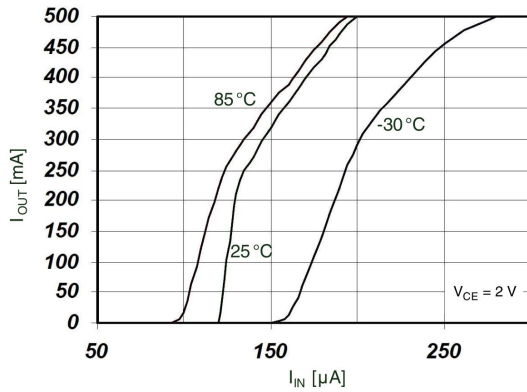


Figure 13. Collector current vs. input current

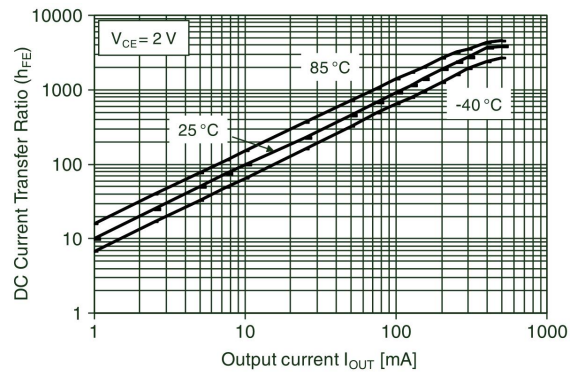


Figure 14. h_{FE} vs. output current

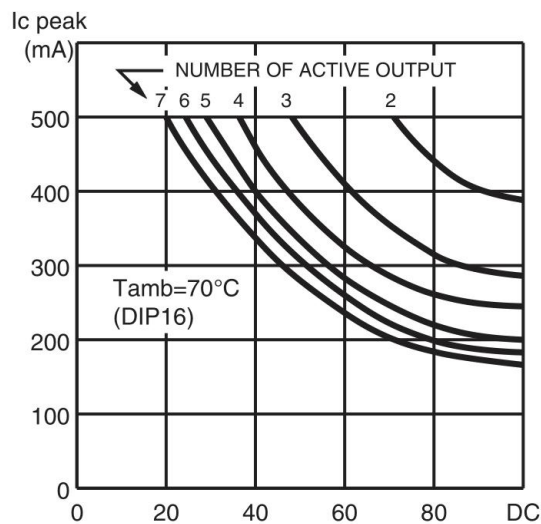


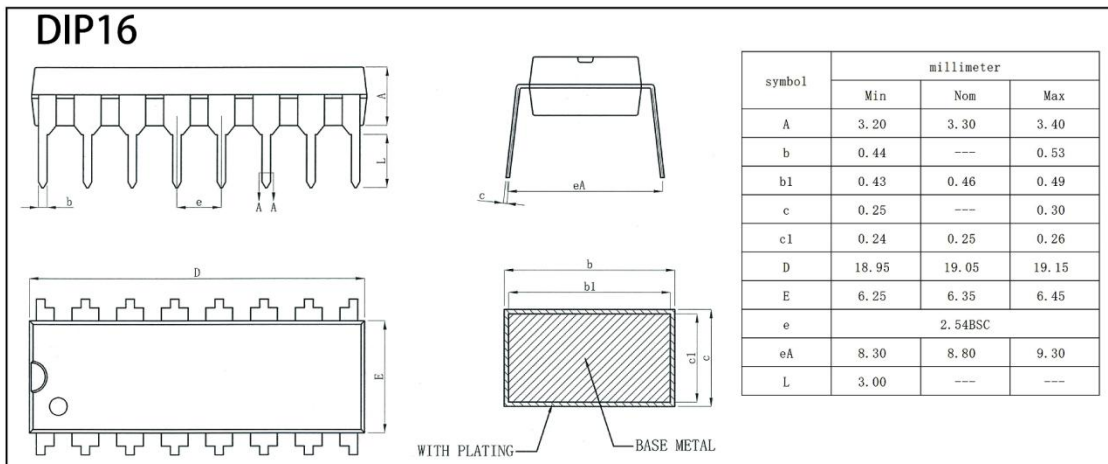
Figure 15. Peak collector current vs. duty cycle (DIP-16)

9. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XD2002	XD2002	DIP16	19.05 * 6.35	- 40 to 85	MSL3	Tube 25	1000

10. DIMENSIONAL DRAWINGS



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