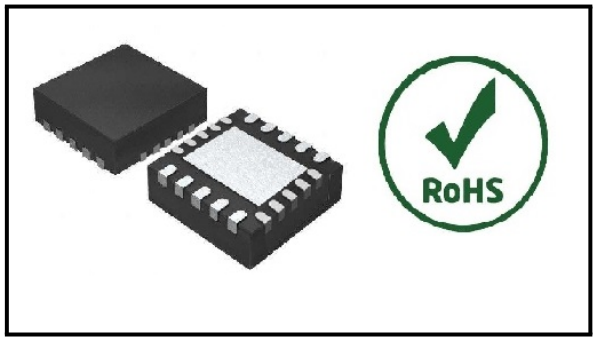
ULN2803QN series High-voltage High-current Darlington Transistor Arrays

Features

- 500-mA-Rated Collector Current(single output)
- High-Voltage Outputs: 50V
- Inputs Compatible With Various Types of Logic
- Output Clamp Diodes
- Relay-Driver Applications

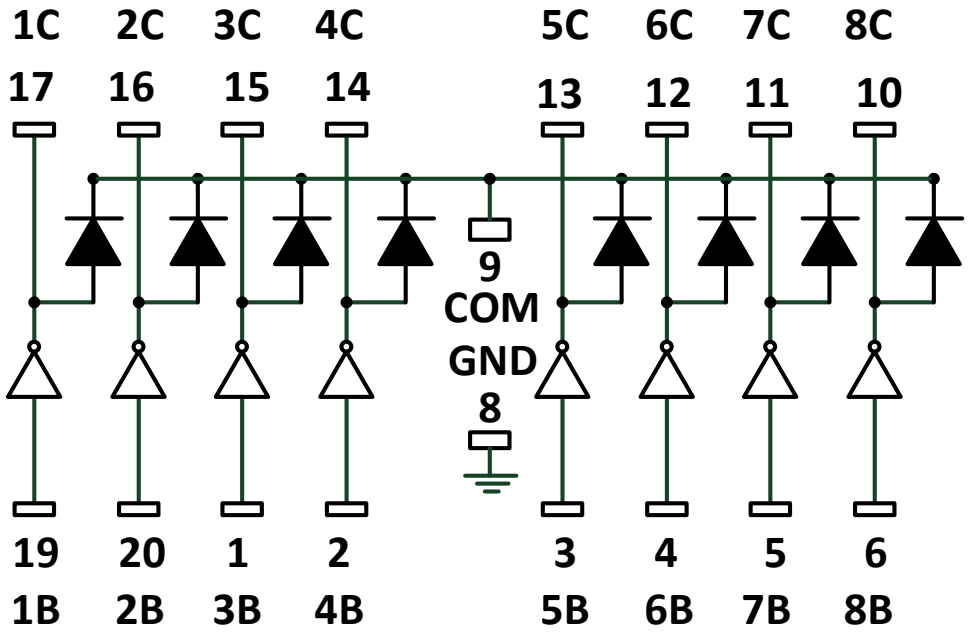
Package



General Description

The ULN2803QN is high-voltage high-current Darlington transistor arrays each containing seven open collector common emitter pairs. Each pair is rated at 500mA. Suppression diodes are included for inductive load driving, the inputs and outputs are pinned in opposition to simplify board layout.These devices are capable of driving a wide range of loads including solenoids, relays, DC motors, LED displays, filament lamps, thermal print-heads and high-power buffers.

Connection Diagram



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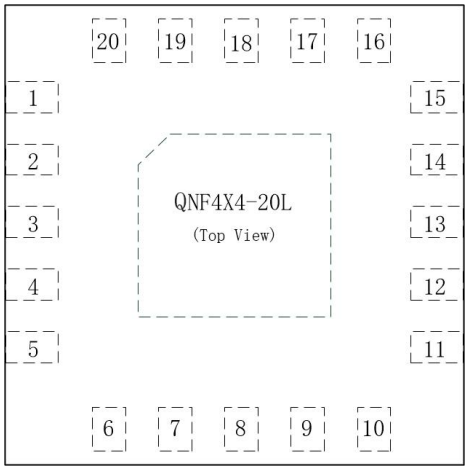
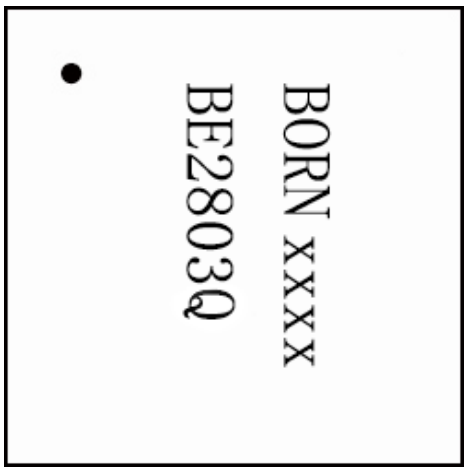
Pin Description



QFN4X4-20L



Top Marking

Pin Number	Name	Function	Pin Number	Name	Function
1	3B	Input pair3	11	7C	Output pair7
2	4B	Input pair4	12	6C	Output pair6
3	5B	Input pair5	13	5C	Output pair5
4	6B	Input pair6	14	4C	Output pair4
5	7B	Input pair7	15	3C	Output pair3
6	8B	Input pair8	16	2C	Output pair2
7	NC	NC	17	1C	Output pair1
8	E	CE(ground)	18	NC	NC
9	COM	CC Diodes	19	1B	Input pair1
10	8C	Output pair8	20	2B	Input pair2

NOTE: CE(ground)= Common Emitter (ground); CC Diodes = Common Clamp Diodes

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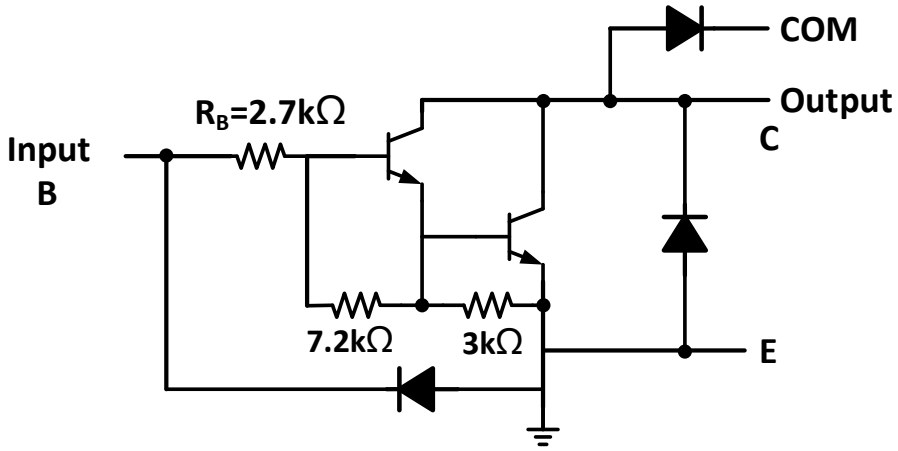
Functional Block Diagram



Note: All resistor values shown are nominal.

The collentor-emitter diode is a parasitic structure and should not be used to conduct current.If the collector(s) go below ground an external Schoottky diode should be added to clamp negative undershoots.

Absolute Maximum Ratings (At 25°C free-air temperature unless otherwise noted)(1)

Symbol	Parameter	Min	Max	Units
V_{CC}	Collector to emitter voltage	-0.5	50	V
V_{COM}	voltage of Pin COM		50	V
V_I	Input voltage	-0.5	30	V
I_{CP}	Peak collector current (See typical characteristics)		500	mA/ch
I_{OK}	Output clamp current		500	mA
I_{TE}	Total emitter-terminal current		-2.5	A
T_J	Operating virtual junction temperature		150	°C
T_{STG}	Storage temperature range	-65	150	°C
P_D	Power consumption		1.3	W

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values are with respect to the emitter/substrate terminal E, unless otherwise noted.

(3) Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allow able ambient temperature is PD = (T_J(max)–T_A)/θ_{JA}. Operating at the absolute maximum T_J of 150°C can affect reliability.

(4) Maximum pow er dissipation is a function of T_J(max), θ_{JC}, and T_A. The maximum allow able pow er dissipation at any allow able ambient temperature is PD = (T_J(max)–T_A)/θ_{JC}. Operating at the absolute maximum T_J of 150°C can affect reliability.

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Typical Characteristics

Symbol	Parameter	Min	Max	Units
V_{CE}	Collector to emitter voltage	-	50	V
T_A	Operating Ambient Temperature	-40	+105	°C

Electrical Characteristics (T_A=+25°C, unless otherwise specified)

Parameter		Test Figure	Test Conditions		BE2803Q			Unit
					MIN	TYP	MAX	
$V_{I(on)}$	On-state input voltage	Figure 6	V_{CE} = 2 V	I_C = 200 mA	–	–	2.4	V
				I_C = 250 mA	–	–	2.7	
				I_C = 300 mA	–	–	3	
$V_{CE(sat)}$	Collector-emitter saturation voltage	Figure 5	I_I = 250 μA	I_C = 100 mA	–	0.9	1.1	V
			I_I = 350 μA	I_C = 200 mA	–	1	1.3	
			I_I = 500 μA	I_C = 350 mA	–	1.2	1.6	
I_{CEX}	Collector cutoff current	Figure 1	V_{CE} = 50 V,	I_I = 0	–	–	50	μA
		Figure 2	V_{CE} = 50 V; T_A = +105°C	I_I = 0	–	–	100	
V_F	Clamp forw ard voltage	Figure 8	I_F = 350 mA		–	1.7	2	V
$I_{I(off)}$	Off-state input current	Figure 3	V_{CE}= 50 V,I_C = 500 μA		50	65	–	μA
I_I	Input current	Figure 4	V_I = 3.85 V		–	0.93	1.35	mA
			V_I = 5 V		–	–	–	
			V_I = 12 V		–	–	–	
I_R	Clamp reverse current	Figure 7	V_R = 50 V	T_A = 25°C	–	–	50	μA
				T_A = 70°C	–	–	100	
C_i	Input capacitance		V_I = 0, f = 1 MHz		–	15	25	pF

Switching Characteristics (T_A = +25°C, unless otherwise specified)

Parameter		Test Conditions	BE2803Q			Unit
			MIN	TYP	MAX	
t_{PLH}	Propagation delay time, low - to high-level output	Figure 9	–	0.25	1	μs
t_{PHL}	Propagation delay time, high- to low -level output	Figure 9	–	0.25	1	μs
V_{OH}	High-level output voltage after switching	V_S = 50 V, I_O = 300 mA Figure 9	V_S–20	–	–	mV

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Parameter Measurement Information

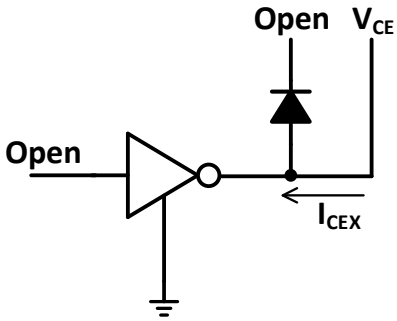

Fig.1 I_{CEX} Test Circuit

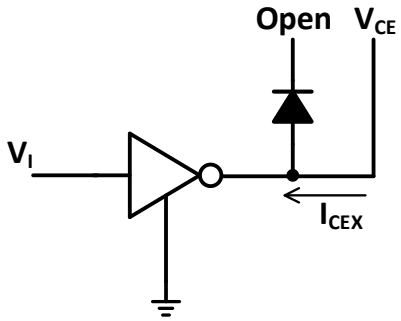

Fig.2 I_{CEX} Test Circuit

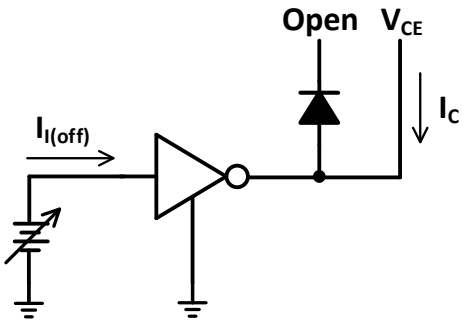

Fig.3 $I_{I(off)}$ Test Circuit

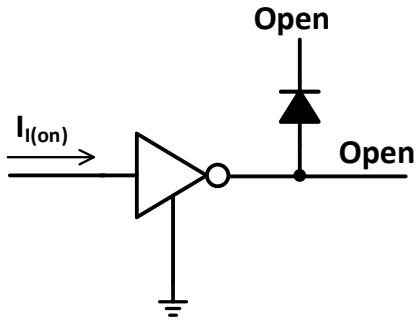

Fig.4 I_I Test Circuit

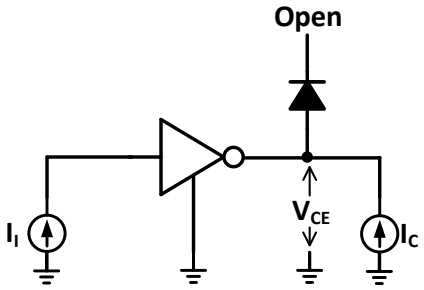

Fig.5 h_{fe}, $V_{CE(sat)}$ Test Circuit

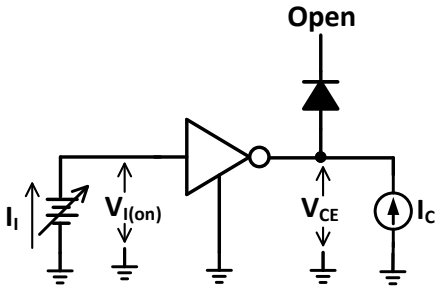

Fig.6 $V_{I(on)}$ Test Circuit

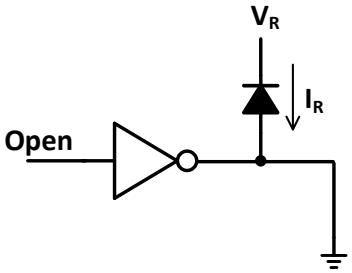

Fig.7 I_R Test Circuit

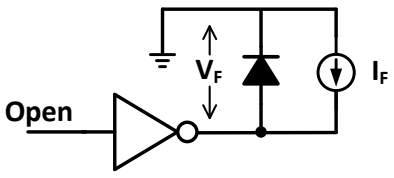

Fig.8 V_F Test Circuit

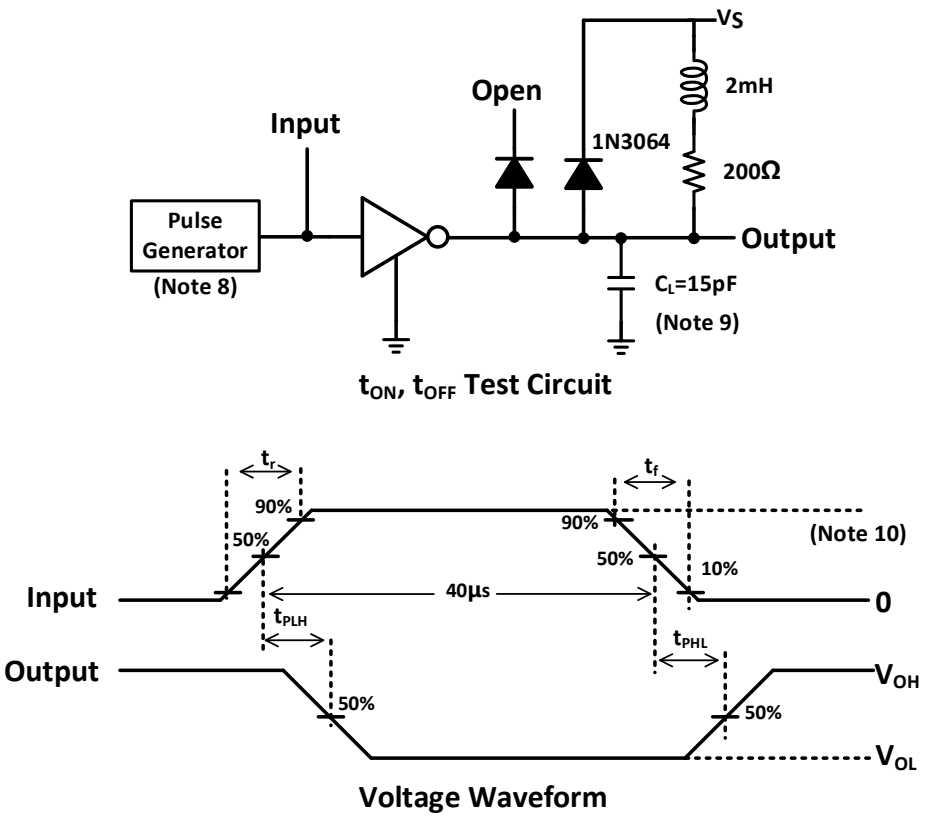

Fig.9 Latch-Up Test Circuit and Voltage Waveform

Notes:

8. The pulse generator has the follow ing characteristics: Pulse Width=12.5Hz, output impedance 50Ω, t_f≤5ns, t_f≤10ns.

9. C_L includes prove and jig capacitance.

10 V_{IH}=3V

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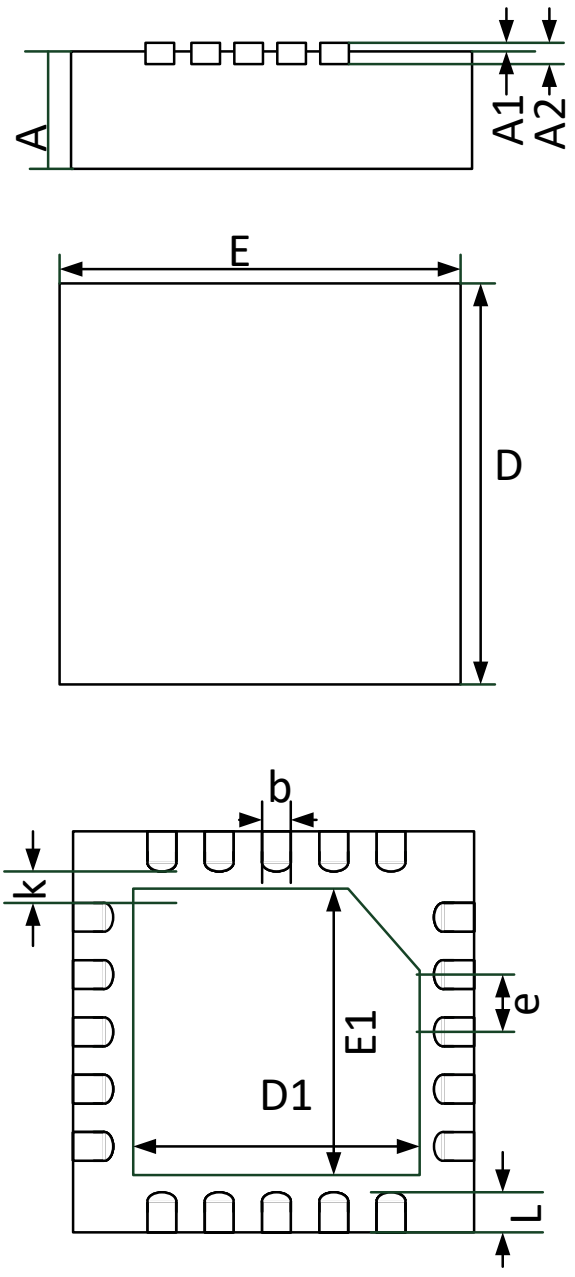
QFN4X4-20L Package Specifications



SYMBOL	MIN	TYP	MAX
A	0.400	0.450	0.500
	0.500	0.550	0.600
	0.700	0.750	0.800
A1	0.00	–	0.050
A2	0.195	0.203	0.211
D	3.900	4.00	4.100
E	3.900	4.000	4.100
D1	2.625	2.650	2.675
E1	2.625	2.650	2.675
k	0.150MIN.		
b	0.200	0.250	0.300
e	0.500TYP.		
L	0.300	0.400	0.500

Note:All dimensions shown are in millimeters (mm) and refer to JEDEC STANDARD MO-220 WHHD-4

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