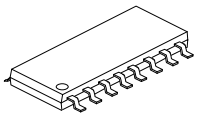
HIGH VOLTAGE HIGH CURRENT DARLINGTON TRANSISTOR ARRAY



SOP-16

■ DESCRIPTION

The UTC **ULN2003R** is high-voltage, high-current darlington transistor arrays. Each consists of seven NPN darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single darlington pair is 500mA. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display (LED) drivers.

The UTC **ULN2003R** has a 2.7kΩ series base resistor for each darlington pair for operation directly with TTL or 5V CMOS devices.

■ FEATURES

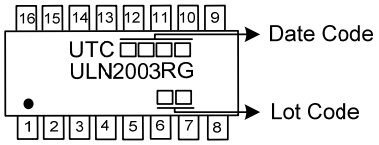
* Output Current (Single Output): 500mA max
* High Sustaining Voltage Output: 50V min
* Inputs Compatible with Various Types of Logic
* Output Clamp Diodes
* Relay-Driver Applications

■ ORDERING INFORMATION

Ordering Number	Package	Packing
ULN2003RG-S16-R	SOP-16	Tape Reel

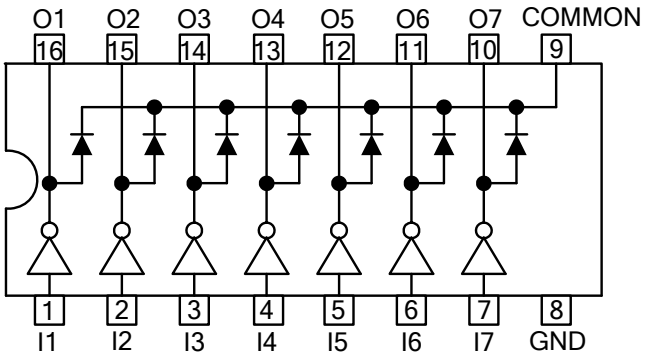
ULN2003RG-S16-R (1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) S16: SOP-16 (3) G: Halogen Free and Lead Free

■ MARKING



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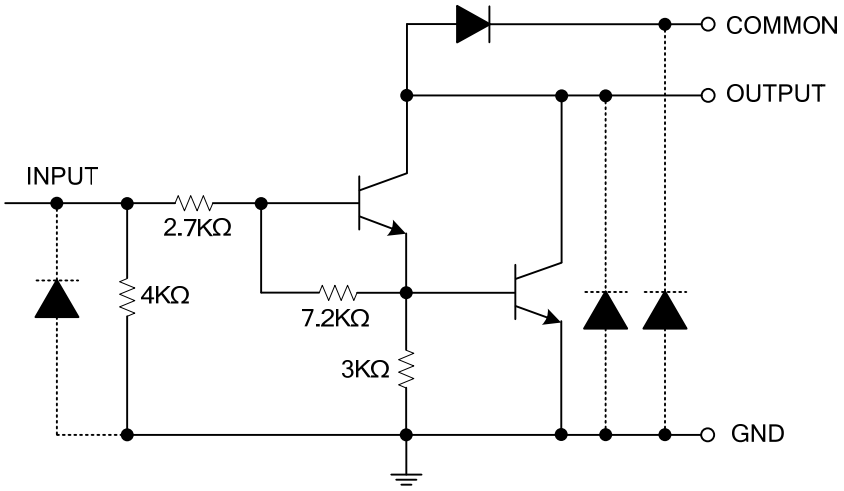
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	I1	1 Channel Input Pin
2	I2	2 Channel Input Pin
3	I3	3 Channel Input Pin
4	I4	4 Channel Input Pin
5	I5	5 Channel Input Pin
6	I6	6 Channel Input Pin
7	I7	7 Channel Input Pin
8	GND	Ground
9	COMMON	Clamp Diode
10	O7	7 Channel Output Pin
11	O6	6 Channel Output Pin
12	O5	5 Channel Output Pin
13	O4	4 Channel Output Pin
14	O3	3 Channel Output Pin
15	O2	2 Channel Output Pin
16	O1	1 Channel Output Pin

■ BLOCK DIAGRAM



UTC ULN2003R Drive Circuit

■ ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector-Emitter Voltage	V_{CE}	-0.5~50	V
Clamp Diode Reverse Voltage	V_{COM}	50	V
Input Voltage	V_I	-0.5~30	V
Peak Collector Current	I_{CP}	500	mA
Output Clamp Current	I_{OK}	500	mA
Total Emitter-Terminal Current	I_{ET}	-2.5	A
Power Dissipation (Note 1, 2)	P_D	0.54 / 0.065 (Note 3)	W
Junction Temperature (Note 2)	T_J	150	°C
Storage Temperature	T_{STG}	-60~+150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. The maximum allowable power dissipation at any allowable ambient temperature is $P_D= (T_J-T_A)/\theta_{JA}$.
3. On glass epoxy PCB (30x30x1.6mm Cu 50%).

■ RECOMMENDED OPERATING CONDITIONS (T_A=25°C, unless otherwise specified)

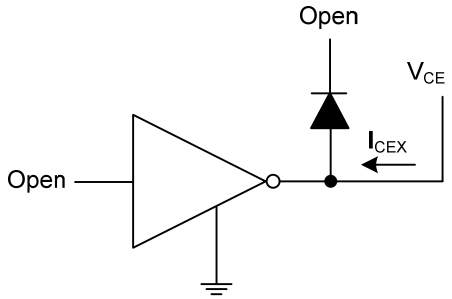
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output Sustaining Voltage	V_{CE}			0		50	V
Output Current	I_{OUT}	T_{PW}=25ms,	Duty=10%	0		233	mA/ch
		T_A=85°C, T_J=120°C	Duty=50%	0		70	mA/ch
Input Voltage	V_{IN}			0		24	V
Input Voltage (Output On)	$V_{IN\ (ON)}$	I_{OUT}=400mA		2.8		24	V
Input Voltage (Output Off)	$V_{IN\ (OFF)}$			0		0.7	V
Clamp Diode Reverse Voltage	V_R					50	V
Clamp Diode Forward Current	I_F					350	mA
Operating Temperature Range	T_A			-40		+85	°C
Power Dissipation	P_D	T_A=85°C				0.325	W

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

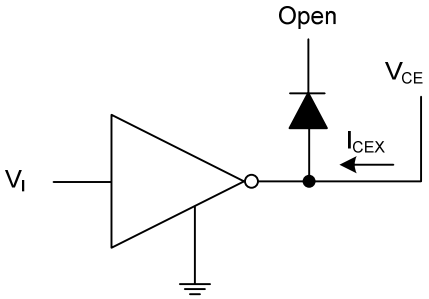
PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input Voltage (Output On)	$V_{I(ON)}$	4	V_{CE}=2V	I_C=200mA		1.9	2.4	V
				I_C=250mA		2.0	2.7	V
				I_C=300mA		2.1	3	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	5	V_{IN}=2.4V, I_C=30mA			0.78		V
			V_{IN}=2.4V, I_C=60mA			0.82		V
			V_{IN}=2.4V, I_C=120mA			0.9		V
			V_{IN}=2.4V, I_C=240mA			1.1		V
			V_{IN}=2.4V, I_C=350mA			1.25		V
Clamp Diode Forward Voltage	V_F	8	I_F=350mA			1.6	2.0	V
Output Leakage Current	I_{CEX}	1	V_{CE}=50V, I_I=0				50	μA
		2	V_{CE}=50V, T_A=85°C, V_I=0V				100	μA
Input Current	I_I	4	V_{IN}=12V	I_C=60mA		7		mA
			V_{IN}=6V			3.2		mA
			V_{IN}=4.5V			2.3		mA
			V_{IN}=2.4V			0.95		mA
Clamp Diode Reverse Current	I_R	7	V_R=50V				100	μA
Input Capacitance	C_{IN}					15		pF
Propagation Delay Time, Low- to High	t_{PLH}	9	V_L=12V, R_L=45Ω			0.15	1	μs
Propagation Delay Time, High - to Low	t_{PHL}	9	V_L=12V, R_L=45Ω			0.15	1	μs

■ TEST CIRCUIT

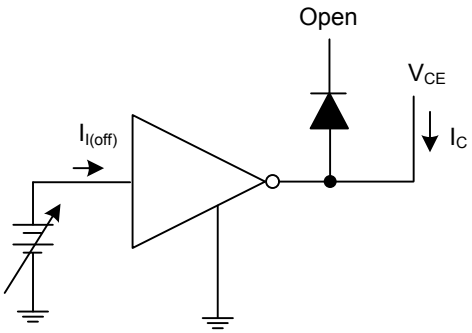
1. I_{CEX}



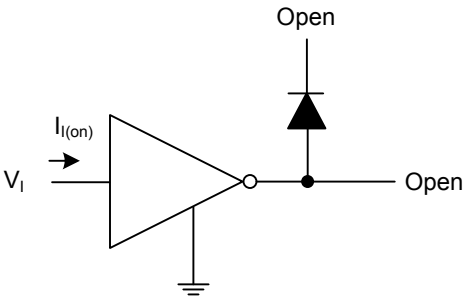
2. I_{CEX}



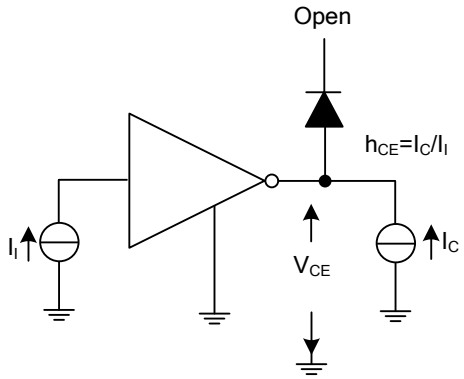
3. $I_{I(off)}$



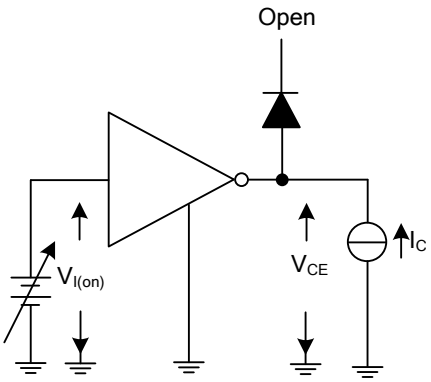
4. I_I



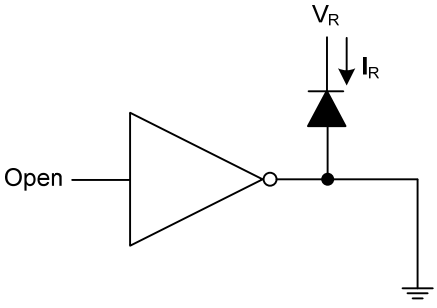
5. h_{FE},$V_{CE(sat)}$



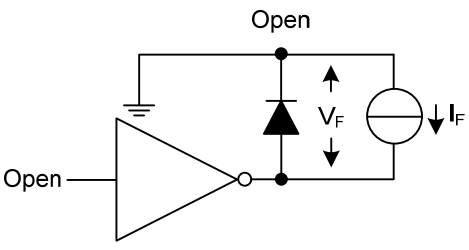
6. $V_{I(on)}$



7. I_R

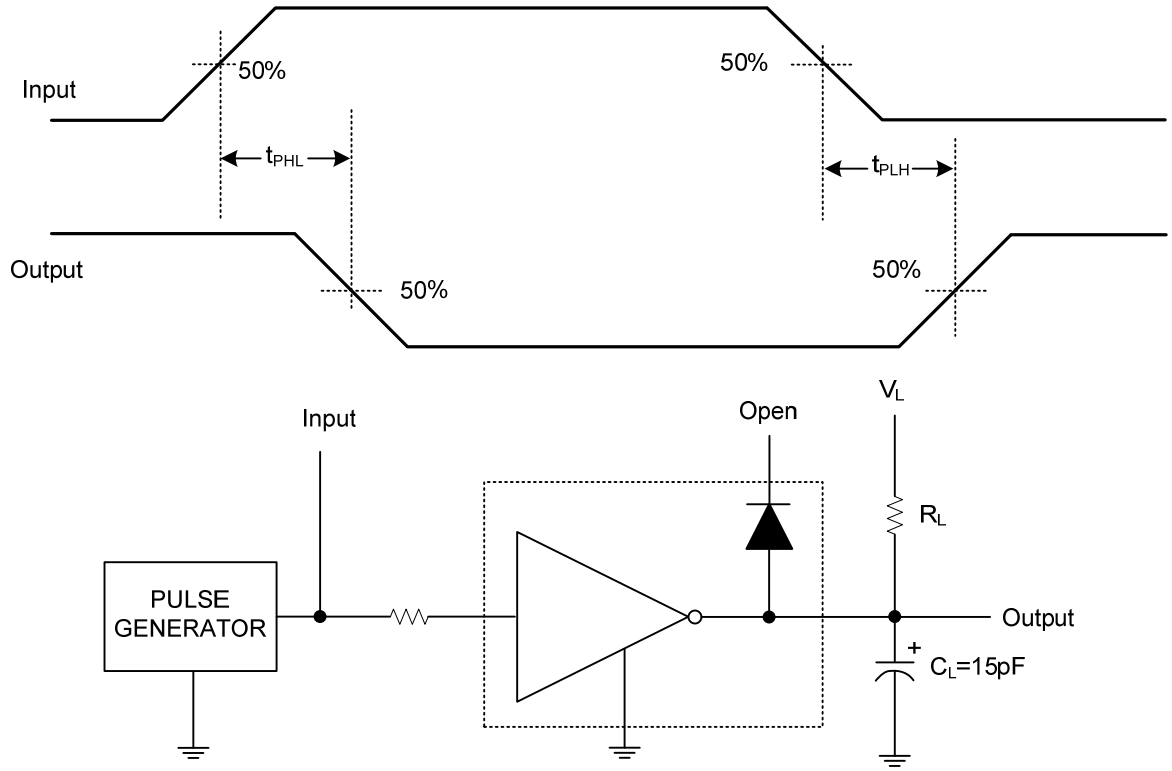


8. V_R

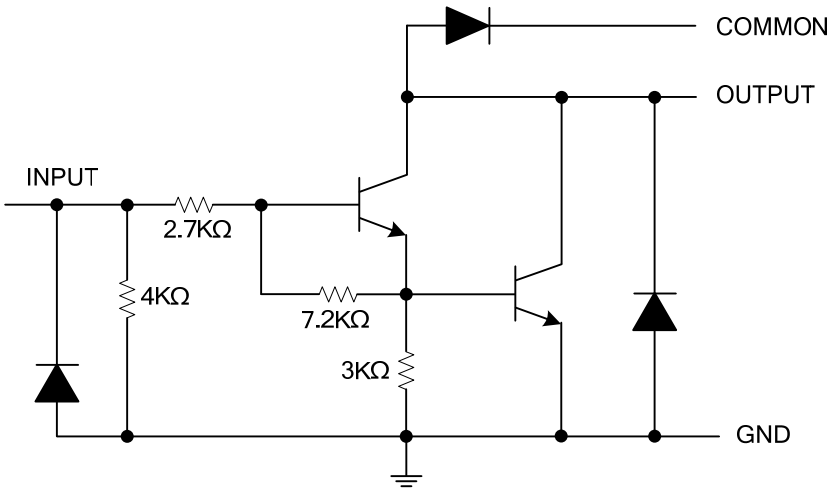


■ TEST CIRCUIT (Cont.)

9. Propagation Delay-Time Waveforms



■ TYPICAL APPLICATION CIRCUIT



UTC ULN2003R Drive Circuit

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