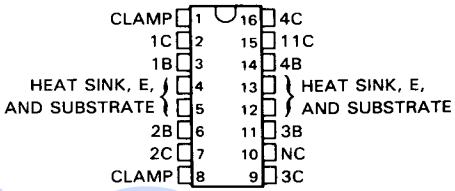
D2528, DECEMBER 1979—REVISED SEPTEMBER 1986

- **Output Collector Current . . . 1.5 A Max**
- **2-W Dissipation Rating**
- **High Output-Voltage Capability**
- **Outputs Diode-Clamped for Inductive Loads**
- **Common-Emitter Circuit for Current Sink**
- **ULN2064 and ULN2065 Have TTL Compatible Inputs**
- **ULN2066 and ULN2067 Have CMOS- and PMOS-Compatible Inputs**
- **Designed for Interchangeability With Sprague ULN2064 thru ULN2067, Respectively**

NE PACKAGE
(TOP VIEW)



NC—No internal connection

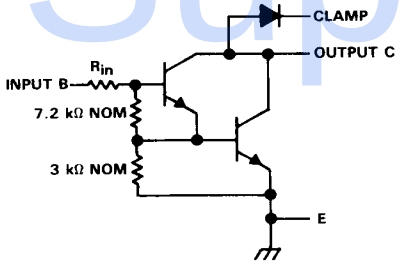
description

The ULN2064, ULN2065, ULN2066, and ULN2067 are monolithic high-voltage, high-current darlington transistor switches. Each comprises four n-p-n darlington pairs. All units feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. Outputs and inputs may each be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. These common-emitter circuits are designed to operate as current sinks to the load.

The ULN2064 and ULN2065 are intended for use with TTL and 5-V MOS logic. The ULN2066 and ULN2067 are intended for use with PMOS and higher-voltage CMOS logic.

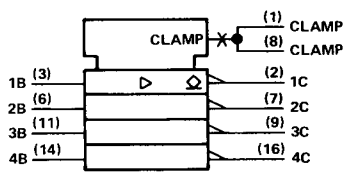
The ULN2064, ULN2065, ULN2066, and ULN2067 are characterized for operation from −20°C to 85°C.

schematic (each darlington pair)



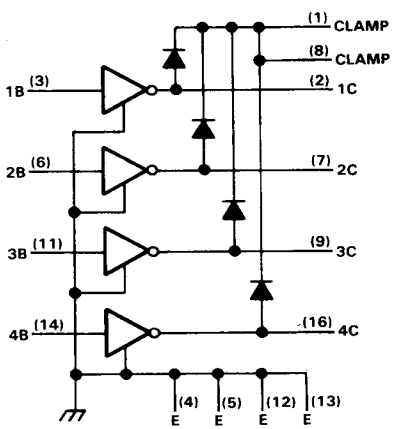
ULN2064, ULN2065: R_{in} = 350 Ω NOM
ULN2066, ULN2067: R_{in} = 3 kΩ NOM

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram



absolute maximum ratings at 25°C free-air temperature for each switch (unless otherwise noted)

	ULN2064	ULN2065	ULN2066	ULN2067	UNIT
Collector-emitter voltage	50	80	50	80	V
Input voltage (see Note 1)	15	15	30	30	V
Peak collector current (see Figures 12, 13, and 14)	1.5	1.5	1.5	1.5	A
Input current	25	25	25	25	mA
Total power dissipation at (or below) 25°C free-air temperature (see Note 2)	2075	2075	2075	2075	mW
Operating free-air temperature range	−20 to 85	−20 to 85	−20 to 85	−20 to 85	°C
Storage temperature range	−55 to 150	−55 to 150	−55 to 150	−55 to 150	°C
Lead temperature 1,6 mm (1/16 inch) from the case for 10 seconds	260	260	260	260	°C

NOTES: 1. All voltage values (unless otherwise noted) are with respect to the emitter/substrate terminal E.
2. For operation above 25°C free-air temperature, derate total power linearly to 1079 mW at 85°C at the rate of 16.6 mW/°C.

electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST FIGURE	TEST CONDITIONS	ULN2064 MIN	ULN2064 MAX	ULN2065 MIN	ULN2065 MAX	ULN2066 MIN	ULN2066 MAX	ULN2067 MIN	ULN2067 MAX	UNIT
$V_{CEX(sus)}$	Collector sustaining voltage	1	V_I = 0.4 V, I_C = 100 mA	35		50		35		50		V
I_{CEX}	Collector output cutoff current	2	V_{CE} = 50 V		100				100			μA
			V_{CE} = 50 V, T_A = 70°C		500				500			
			V_{CE} = 80 V				100				100	
			V_{CE} = 80 V, T_A = 70°C				500				500	
$I_{I(on)}$	On-state input current	3	V_I = 2.4 V	1.4	4.3	1.4	4.3					mA
			V_I = 3.75 V	3.3	9.6	3.3	9.6					
			V_I = 5 V					0.6	1.8	0.6	1.8	
			V_I = 12 V					1.7	5.2	1.7	5.2	
$V_{I(on)}$	On-state input voltage	4	V_{CE} = 2 V, I_C = 1 A		2		2		6.5		6.5	V
			V_{CE} = 2 V, I_C = 1.5 A, See Note 3		2.5		2.5		10		10	
$V_{CE(sat)}$	Collector-emitter saturation voltage	5	I_I = 625 μA, I_C = 500 mA		1.1		1.1		1.1		1.1	V
			I_I = 935 μA, I_C = 750 mA		1.2		1.2		1.2		1.2	
			I_I = 1.25 mA, I_C = 1 A		1.3		1.3		1.3		1.3	
			I_I = 2 mA, I_C = 1.25 A, See Note 3		1.4				1.4			
			I_I = 2.25 mA, I_C = 1.5 A, See Note 3				1.5				1.5	
I_R	Clamp-diode reverse current	6	V_R = 50 V		50				50			μA
			V_R = 50 V, T_A = 70°C		100				100			
			V_R = 80 V				50				50	
			V_R = 80 V, T_A = 70°C				100				100	
V_F	Clamp-diode forward voltage	7	I_F = 1 A		1.75		1.75		1.75		1.75	V
			I_F = 1.5 A, See Note 3		2		2		2		2	

NOTE 3: These parameters must be measured on one output at a time using pulse techniques, t_w = 10 ms, duty cycle ≤ 10%.

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switching characteristics at 25°C free-air temperature, V_{CC} = 5 V

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	See Figure 8			1	μs
t_{PHL}	Propagation delay time, high-to-low-level output				1.5	μs

PARAMETER MEASUREMENT INFORMATION

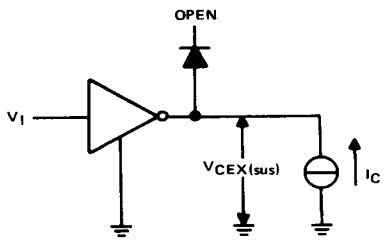


FIGURE 1. $V_{CEX(sus)}$

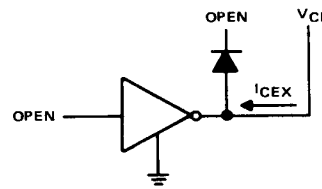


FIGURE 2. I_{CEX}

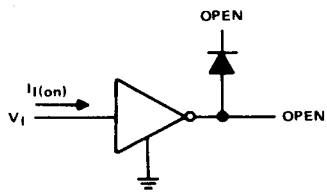


FIGURE 3. $I_{I(on)}$

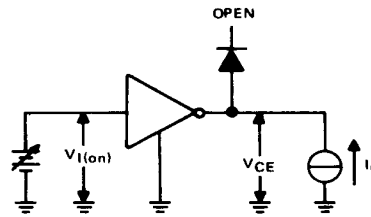


FIGURE 4. $V_{I(on)}$

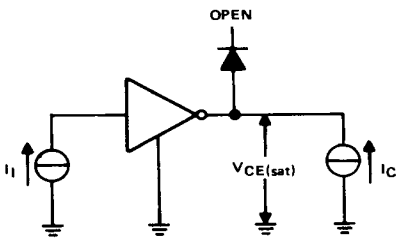


FIGURE 5. $V_{CE(sat)}$

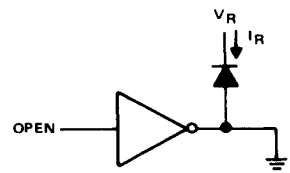


FIGURE 6. I_R

PARAMETER MEASUREMENT INFORMATION

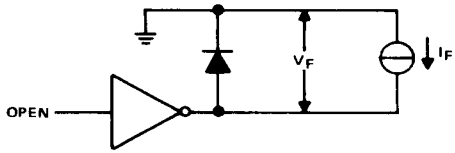
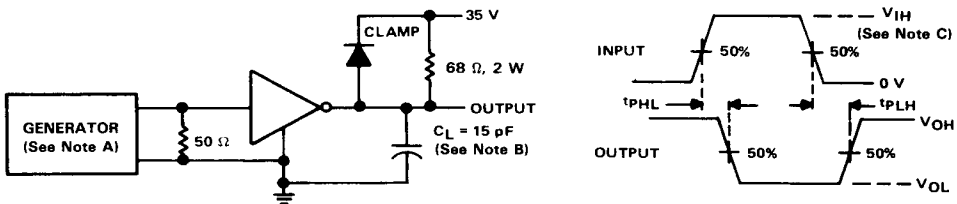


FIGURE 7. V_F



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 50 kHz, duty cycle = 10%, Z_O = 50 Ω.
B. C_L includes all probe and stray capacitance.
C. V_{IH} = 2.5 V for ULN2064 and ULN2065. V_{IH} = 10 V for ULN2065 and ULN2067.

FIGURE 8. SWITCHING TIMES

ELECTRICAL CHARACTERISTICS

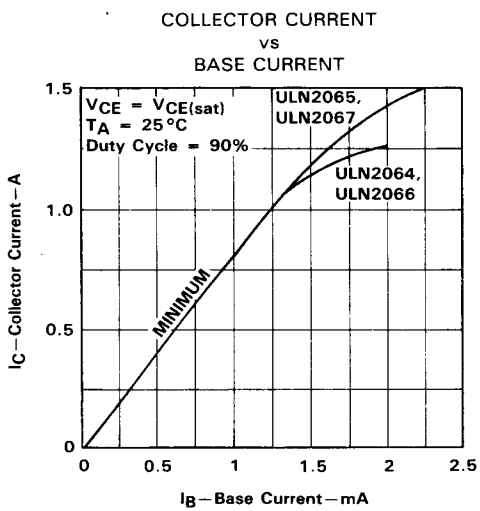


FIGURE 9

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THERMAL INFORMATION

MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

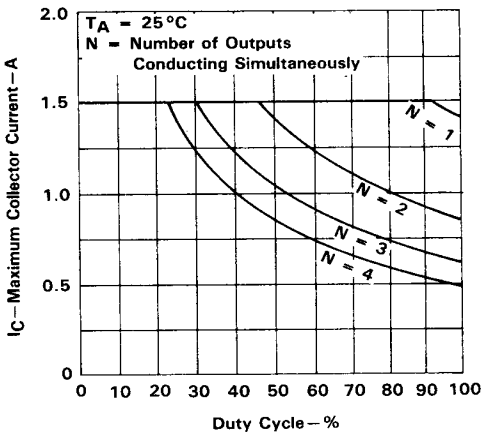

FIGURE 10

MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

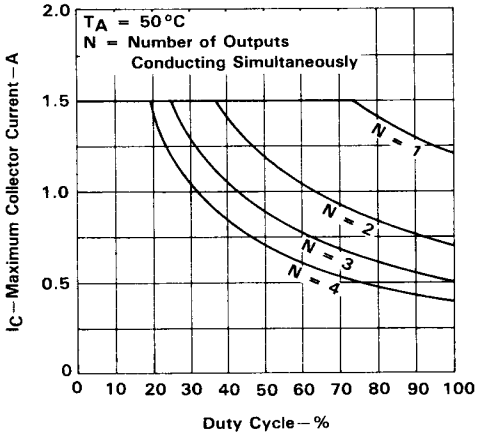

FIGURE 11

MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

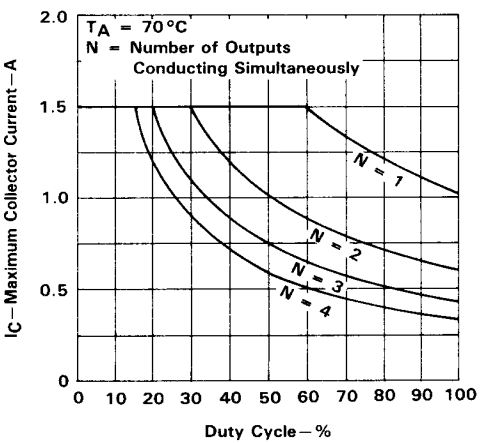

FIGURE 12

APPLICATION INFORMATION

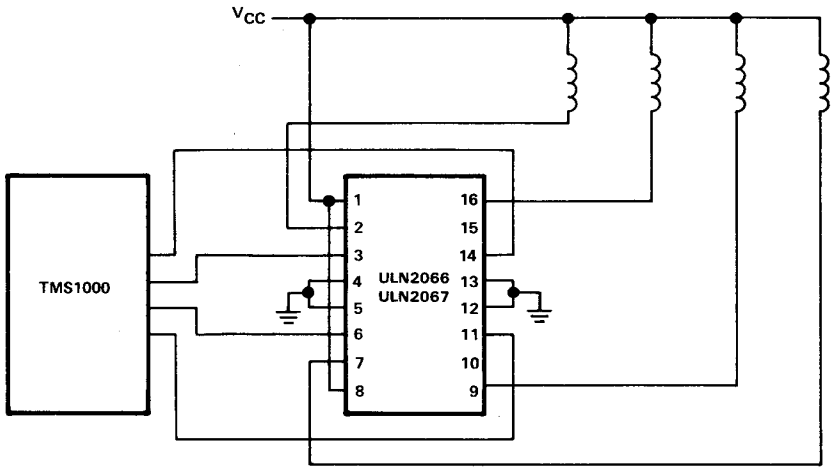

FIGURE 13. RELAY DRIVER INTERFACE

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