

## DS8881 Vacuum Fluorescent Display Driver

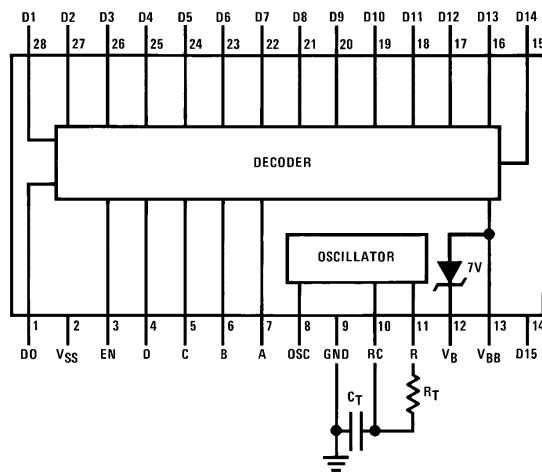
### General Description

The DS8881 vacuum fluorescent display driver will drive 16-digit grids of a vacuum fluorescent display. The decode inputs select one of the sixteen outputs to be pulled high. The device contains an oscillator for supplying clock signals to the MOS circuit, the filament bias zener and 50 kΩ pull-down resistors for each grid. Outputs will source up to 7 mA. The DS8881 is designed for 9V operation. If the enable input is pulled low, all outputs are disabled.

### Features

- Oscillator frequency accuracy and stability allows maximum system speed
- Interdigit blanking with the enable input provides ghost-free display operation
- 50 kΩ pull-down resistors for each grid
- 7V filament bias zener

### Connection Diagram



TL/F/5846-1

Top View

Order Number DS8881N  
See NS Package Number N28B

### Truth Table

All outputs now shown high are off (low)

Inputs					Digit Outputs															
EN	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
H	L	L	L	L	H															
H	L	L	L	H		H														
H	L	L	H	L			H													
H	L	L	H	H				H												
H	L	H	L	L					H											
H	L	H	L	H						H										
H	L	H	H	L							H									
H	L	H	H	H								H								
H	H	L	L	L									H							
H	H	L	L	H										H						
H	H	L	H	H											H					
H	H	H	L	L												H				
H	H	H	L	H													H			
H	H	H	H	L														H		
H	H	H	H	H															H	
H	H	H	H	H																H
L	X	X	X	X		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{SS}-V_{BB}$ )	38V
Input Current	10 mA
Output Current	-20 mA
Storage Temperature	-65°C to +150°C
Maximum Power Dissipation* at 25°C	
Molded Package	2168 mW
Lead Temperature (Soldering, 4 sec.)	260°C

\*Derate molded package 17.35 mW/°C above 25°C.

## Operating Conditions

	Min	Max	Units
Supply Voltage			
$V_{SS}$	5.0	9.5	V
$V_{BB}$	Gnd	-26	V
Temperature ( $T_A$ )	0	+70	°C

## Electrical Characteristics (Notes 2 and 3)

Symbol	Parameter	Conditions		Min	Typ	Max	Units		
$V_{IH}$	Logical "1" Input Voltage	$V_{SS} = \text{Max}$	Enable	$I_{IN} = 260 \mu\text{A}$			5.1	V	
			A, B, C, D	$I_{IN} = 1400 \mu\text{A}$			1.5	V	
$I_{IH}$	Logical "1" Input Current	$V_{SS} = \text{Max}$	Enable A, B, C, D				260	$\mu\text{A}$	
$V_{IL}$	Logical "0" Input Voltage	$V_{SS} = \text{Max}$	Enable				1.0	V	
			A, B, C, D				0.3	V	
$I_{IL}$	Logical "0" Input Current	$V_{SS} = \text{Max}$	Enable	$V_{IN} = 0\text{V}$			-1.0	$\mu\text{A}$	
			A, B, C, D	$V_{IN} = V_{IL(\text{MAX})}$	25			$\mu\text{A}$	
$V_{OH}$	Logical "1" Output Voltage	Digit Output, $I_{OH} = -7 \text{ mA}$			$V_{SS} - 2.5$			V	
$I_{OH}$	Logical "1" Output Current	$V_{SS} = \text{Max}$ , Osc. Output, $V_{RC} = 0.6\text{V}$ , $V_{OH} = 10\text{V}$					50	$\mu\text{A}$	
$I_{OS}$	Output Short-Circuit Current	$V_{SS} = \text{Min}$ , Pin R, $V_{RC} = 0.6\text{V}$ , $V_R = 0\text{V}$			-150		-450	$\mu\text{A}$	
$R_{OUT}$	Output Pull-Down Resistor	$V_{SS} = \text{Min}$ , Digit Output			30	50	85	$\text{k}\Omega$	
$V_{OL}$	Logical "0" Output Voltage	$V_{SS} = \text{Min}$	Osc	$V_{RC} = 1.6\text{V}$				0.5	V
			Pin R						$I_{OL} = 6 \text{ mA}$
		$V_{SS} = \text{Max}$	Digit Output	$V_{ENABLE} = 1\text{V}$	$I_{OL} = 10 \mu\text{A}$			$V_{BB} + 1.4$	V
$I_{SS}$	Supply Current	$V_{SS} = 9.5\text{V}$ , $I_{OH} = 0$	$V_{ENABLE} = 5.1\text{V}$			9.0	12.5	mA	
			$V_{ENABLE} = 1\text{V}$			5.0	9.0	mA	
$I_{BB}$	Supply Current	$V_{SS} = 9.5\text{V}$ , $I_B = 0$ , $V_{BB} = -26\text{V}$ , $I_{IN} = 300 \mu\text{A}$ (Note 4)	$V_{ENABLE} = 1\text{V}$			-0.8	-1.5	mA	
			$V_{ENABLE} = 5.1\text{V}$			-3.0	-5.0	mA	
$V_B$	Filament Bias Voltage	$I_B = 10 \text{ mA}$			$V_{BB} + 6.4$	$V_{BB} + 6.9$	$V_{BB} + 7.4$	V	

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Unless otherwise specified, min/max limits apply across the 0°C to +70°C range. All typicals are given for  $T_A = 25^\circ\text{C}$ .

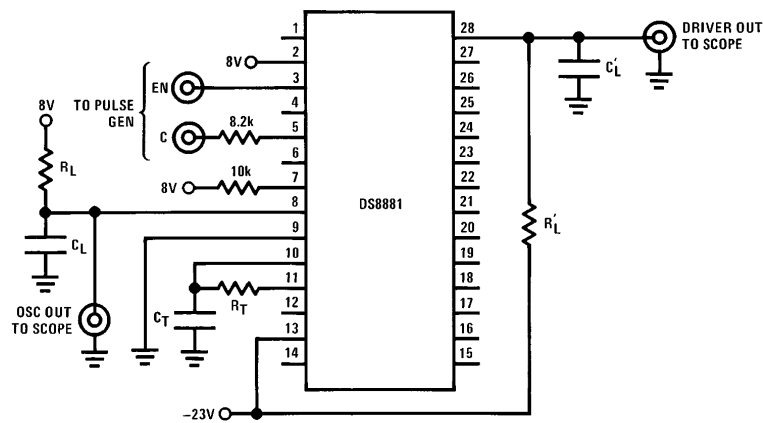
**Note 3:** All currents into device pins shown as positive, out of device pins as negative, and all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

**Note 4:** Approximately 50% of input current on pins 4, 5, 6, 7 is shunted to  $V_{BB}$ . If minimum  $I_{BB}$  is desired, then  $I_{IN}$  should be minimized by using resistors in series with the inputs.

### Switching Characteristics $T_A = 25^\circ\text{C}$ unless otherwise specified

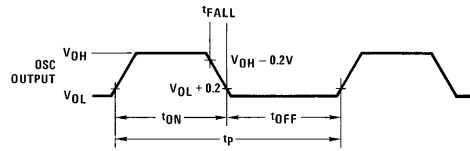
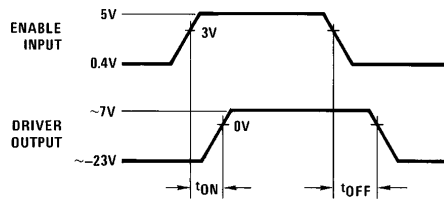
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd0}$	Propagation Delay to a Logical "0" from Enable Input to Digit Output	$R_L = 4.7\text{ k}\Omega, C_L = 50\text{ pF}, V_{BB} = -23\text{V}, V_{SS} = 8\text{V}$			1	$\mu\text{s}$
$t_{pd0}$	Propagation Delay to a Logical "0" A, B, C, D to Digit Output				1	$\mu\text{s}$
$t_{pd1}$	Propagation Delay to a Logical "1" from Enable Input to Digit Output				300	ns
$t_{pd1}$	Propagation Delay to a Logical "1" from A, B, C, D to Digit Output				500	ns
$t_{FALL}$	Oscillator Output Transition Time from 1 to 0	$V_{SS} = 9.5\text{V}, R_L = 6\text{ k}\Omega \text{ to } V_{SS}, C_L = 25\text{ pF}$			50	ns
$f_{OSC}$	Oscillator Frequency	$7\text{V} < V_{SS} < 9.5\text{V}, R_T = 27\text{ k}\Omega \pm 2\%, R_L = 1.3\text{k}, C_T = 100\text{ pF}, \pm 5\%, C_L = 50\text{ pF}$	320	360	400	kHz
dc	Oscillator Duty Cycle		46	56	66	%

### AC Test Circuit



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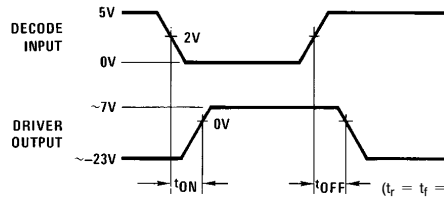
## Switching Time Waveforms



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$$\text{Duty Cycle} = \frac{t_{ON}}{t_p}$$

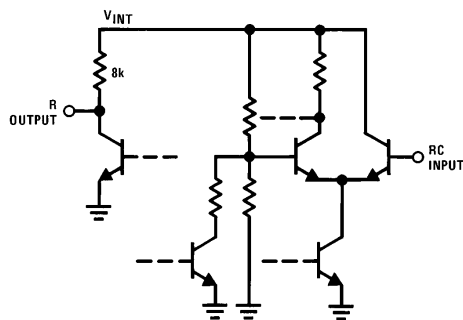
$$\text{Frequency} = \frac{1}{t_p}$$



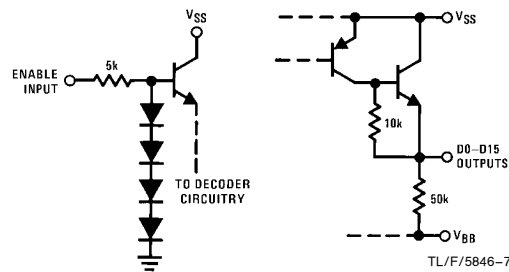
( $t_r = t_f = 10$  ns from 10% to 90% of input)

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## Input-Output Schematics

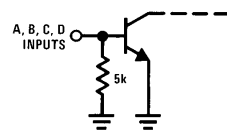


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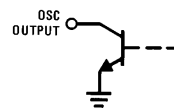


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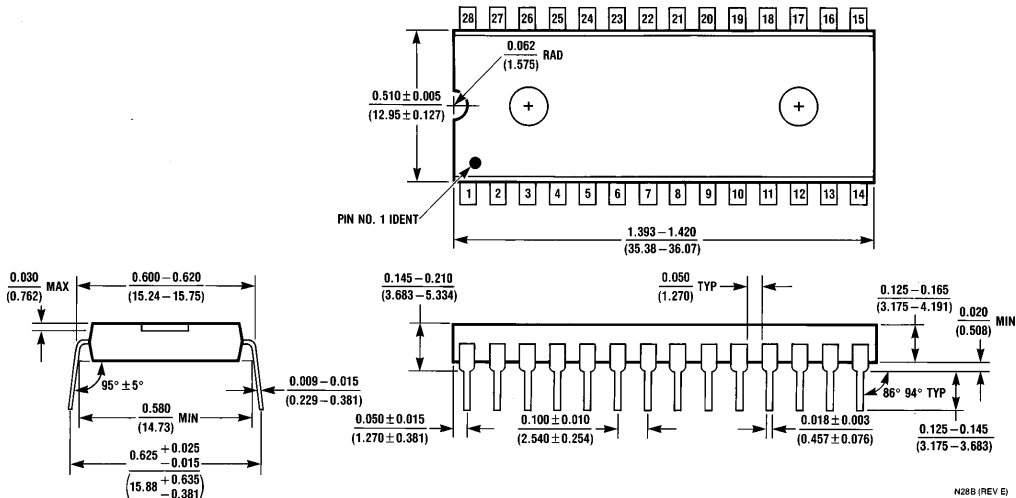


TL/F/5846-9



# DS8881 Vacuum Fluorescent Display Driver

## Physical Dimensions inches (millimeters)



N28B (REV E)

**Molded Dual-In-Line Package (N)**  
**Order Number DS8881N**  
**NS Package Number N28B**

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