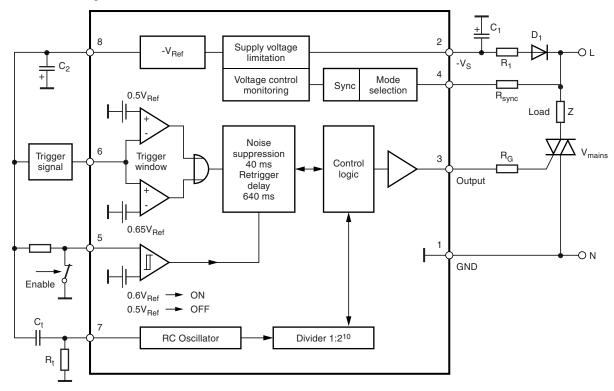


Figure 1-1. Block Diagram with External Circuit



# 2. Pin Configuration

Figure 2-1. Pinning DIP8/SO8

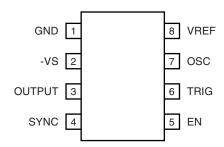


Table 2-1.Pin Description

Pin	Symbol	Function	
1	GND	Reference point	
2	-VS	Supply voltage	
3	OUTPUT	Driver output	
4	SYNC	Synchronization and mode selection	
5	EN	Enable	
6	TRIG	Input trigger signal	
7	OSC	RC oscillator	
8	VREF	Reference voltage	





## 3. General Description

The monostable integrated power-control circuit U2100B can be used according to the mode selection in relay or triac applications. In addition, it can be used in triac applications for two-wire systems as power switch (the load in series to the switch), where the supply voltage for the control unit is gained from the remaining phase angle ( $\alpha_{\min}$  operation).

Figure 3-1. Two-wire Circuit

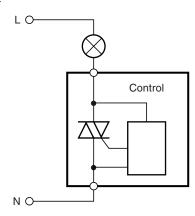
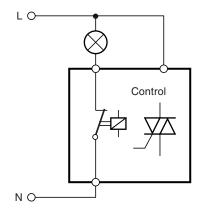


Figure 3-2. Three-wire Circuit



For three-wire switch systems, two operational modes are possible:

- Zero voltage switch operation for triac control
- Static operation for relay control

### 3.1 Mode Selection Pin 4 and Supply Voltage Pin 2

The operational modes can be selected by the external voltage at the synchronous input pin 4 (clamping). The mode selection determines the current requirement of the relay's or triac's driver stage and hence the selection of the supply voltage.

### 3.2 Zero Voltage Switch Operation (Figure 3-3 on page 6)

Selection condition:

V<sub>4</sub> = internal synchronous limitation, without external clamping

$$R_1 \approx 0.85 \frac{V_M - V_S}{2 I_{tot}}$$

$$I_{tot} = I_S + I_p + I_X$$

where:

S = Supply current of the IC without load

I<sub>P</sub> = Average trigger current I<sub>G</sub>

I<sub>X</sub> = External circuit current requirement

 $V_M = Mains voltage$ 

Required firing pulse width tp

$$t_{p} = \frac{2}{\omega} arcsin \left( \frac{I_{L} \times V_{M}}{P \times \sqrt{2}} \right)$$

where:

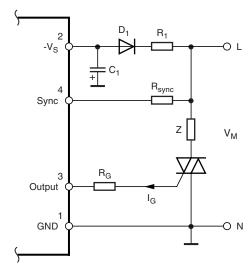
I<sub>L</sub> = Triac latching current P = Power at load Z

$$R_{sync}[k\Omega] \approx \frac{V_{M}[V] \times \sqrt{2} sin (\omega \times t_{p}[s]) - 0.7}{1.8 \times 10^{-2}} - 176$$





Figure 3-3. Zero Voltage Switch Operation



# 3.3 DC Operation

Selection condition (Figure 3-4):

 $+V_4 = 6.1V$ ,  $-V_4 = internal limitation where:$ 

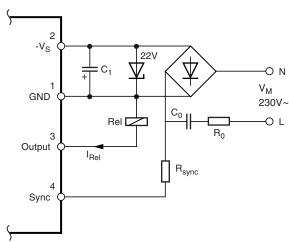
$$R_0 \approx 1/10 X_c$$

$$X_{c} = 0.85 \frac{V_{M} - V_{S}}{I_{tot}}$$

$$I_{tot} = I_S + I_{Rel} + I_X$$

$$C_0 = \frac{1}{\omega \times X_C}$$

Figure 3-4. DC Operation



# 3.4 $\alpha_{\min}$ Operation

Selection condition (Figure 3-5):

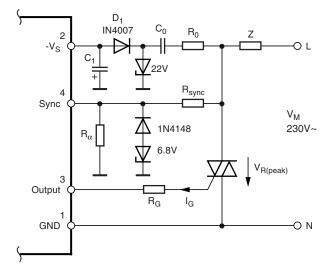
 $-V_4 = 6.5$  to 7.8V,  $+V_4 =$  internal limitation

$$R_{\alpha max} = R_{sync} \frac{3.6 \text{ V}}{V_{R(peak)} - 3.6 \text{ V}}$$

$$R_{\alpha min} \, = \, R_{sync} \, \frac{10 \, V}{V_M \times \sqrt{2} - 10 \, V}$$

 $V_{R(peak)}$  is the peak voltage of the remaining phase angle, which should be high enough to generate the supply voltage,  $V_S$ .

**Figure 3-5.**  $\alpha_{\min}$  Operation (Two-wire Operation)



 $C_1 = 100 \,\mu\text{F}/35\text{V}$ 

 $C_o = 0.33 \, \mu F/250 V \sim$ 

 $R_o = 390\Omega$ 

 $R_{\text{sync}}$  = 220 k $\Omega$ 

 $R_{\alpha}$  = 10 k $\Omega$ 

 $R_G = 390\Omega$ 

 $D_1 = IN 4007$ 





### 3.5 Tracking Time Pin 7

An internal RC oscillator with a following divider stage 1:2<sup>10</sup> allows a very long and reproducible tracking time.

The RC values for the required final time,  $t_{\text{t}}$ , can be calculated as follows:

$$\mathsf{R}_{\mathsf{t}}[\Omega] \, = \, \frac{\mathsf{t}_{\mathsf{t}}[\mathsf{s}] \times \, \mathsf{10}^6}{\mathsf{1.6} \times \, \mathsf{1024} \times \, \mathsf{C}_{\mathsf{t}}[\mu\mathsf{F}]}$$

$$C_t[\mu F] \,=\, \frac{t_t[s] \times \, 10^6}{1.6 \times \, 1024 \times \, R_t[\Omega]} \label{eq:ctotal}$$

$$t_t[s] \,=\, \frac{C_t[\mu F] \times \, R_t[\Omega] \times \, 1.6 \times \, 1024}{10^6}$$

### 3.6 Trigger Inputs Pins 5 and 6

Two AND-connected, identical inputs determine the trigger conditions of the monostable time stages (Figure 3-6, Figure 3-7 on page 9), i.e., both inputs must be in position "ON" so that the output is switched on. The tracking time starts after the trigger conditions have elapsed. The output ON state is given until the tracking time has elapsed.

Input pin 5 is a simple comparator, whereas input pin 6 is designed as a window discriminator.

The noise suppression for  $t_{ON} = 40$  ms prevents peak noise signals at the inputs which could trigger the circuit.

At the same time, the retrigger function is delayed for a duration of 640 ms ( $t_{OFF}$ ) to avoid noise signal that may trigger the relay.

Figure 3-6. Trigger Condition, Pin 5

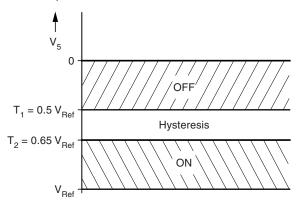
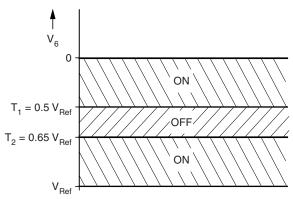


Figure 3-7. Trigger Condition, Pin 6



## 4. Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

		_			
Parameters	Pin Sy		Value	Unit	
Supply	2				
Supply current		-I <sub>S</sub>	10		
Peak current t ≤10 ms		-i <sub>s</sub>	60	mA	
Supply voltage		-V <sub>S</sub>	32	V	
Reference voltage source Output current	8	Io	3	mA	
Synchronization		+1.	5	mA	
Input current	4	±I <sub>Sync.</sub>	20	mA	
t ≤10 ms		i <sub>Sync.</sub>	20	IIIA	
Window Monitoring					
Input voltage	6	-V <sub>1</sub>	V <sub>Ref</sub> to 0	V	
Enable Schmitt Trigger 5					
Input voltage		-V <sub>1</sub>	V <sub>Ref</sub> to 0	V	
Driver Output	3				
Collector voltage		-V <sub>o</sub>	V <sub>S</sub> to 2		
Storage temperature range		T <sub>stg</sub>	−40 to +125 °C		
Junction temperature		T <sub>j</sub>	125 °C		
Ambient temperature range		T <sub>amb</sub>	0 to 100	°C	

## 5. Thermal Resistance

Parameters		Symbol	Value	Unit	
	DIP8	$R_{thJA}$	110	K/W	
Junction ambient	SO8 on PC board	R <sub>thJA</sub>	220	K/W	
	SO8 on ceramic	R <sub>thJA</sub>	140	K/W	





## 6. Electrical Characteristics

 $V_S = -18V$ ,  $T_{amb} = 25$ °C, reference point pin 1, unless otherwise specified.

Parameters	Test Conditions	Pin	Symbol	Min.	Тур.	Max.	Unit
Supply-voltage limitation	$I_S = 800 \mu A$ $I_S = 2 mA$	2	-V <sub>S</sub> -V <sub>S</sub>	21 21.3		23 24	V V
Current consumption	I <sub>3</sub> = 0		-I <sub>S</sub>			750	μA
Supply-voltage Monitoring	ļ	2					
ON-threshold			-V <sub>S</sub>		15		V
OFF-threshold			-V <sub>S</sub>		6.5		V
Reference voltage	I <sub>8</sub> = 0.1 mA I <sub>8</sub> = 1.5 mA	8	-V <sub>Ref</sub>	4.95 4.75		5.45 5.45	V V
Synchronization		4	•	•	<u>'</u>		
Input current			±i <sub>sync</sub>	0.1		1.1	mA
Voltage limitation	$I_4 = \pm 1 \text{ mA}$		±V <sub>sync</sub>	8.8	9.4	10	V
Remaining phase angle $\alpha_{\min}$ threshold	ON Off		±V <sub>T</sub> ±V <sub>T</sub>	3.6 1.8	4 2	4.4 2.2	V V
Zero identification		4		l			
Zero identification	ON OFF		±V <sub>T</sub> ±I <sub>T</sub> ±V <sub>T</sub> ±I <sub>T</sub>		1.5 8.5 4 20		V μA V μA
Operation Selection		4		l			
Zero voltage switch			±V <sub>sync</sub>		V <sub>4</sub> limit		
$\alpha_{\min}$ operation			+V <sub>sync</sub> -V <sub>sync</sub>		V <sub>4</sub> limit 6.5 to 7.8		V V
DC mode			-V <sub>sync</sub> +V <sub>sync</sub>		V <sub>4</sub> limit 6.5 to 7.8		V V
Window Monitoring, Figure 3	3-7 on page 9	6	,		1		
Threshold 1			-V <sub>I</sub> /V <sub>Ref</sub>	0.52	0.49	0.46	
Threshold 2			-V <sub>I</sub> /V <sub>Ref</sub>	0.67	0.65	0.63	
Enable Schmitt Trigger, Figu	ire 3-6 on page 8	5					
Threshold 1	OFF		-V <sub>I</sub> /V <sub>Ref</sub>	0.33	0.3	0.27	
Threshold 2	ON		-V <sub>I</sub> /V <sub>Ref</sub>	0.62	0.6	0.58	
Oscillator	$f = \frac{1}{1.6 \times R_t \times C_t}$	5					
Threshold 1	7 - 1		V <sub>I</sub> /V <sub>Ref</sub>	0.25	0.20	0.15	
Threshold 2	7 - 8		V <sub>I</sub>		100	200	mV
Input current	7		I <sub>1</sub>		100	500	nA
Output Stage		3	•	•	•		
Saturation voltage	I <sub>3</sub> = 100 mA		V <sub>3-2</sub>			2	V
Output current			I <sub>3</sub>	100			mA

# 7. Applications

Figure 7-1. Lamp Time Control 18 Seconds to 23 Minutes for Two-wire Systems

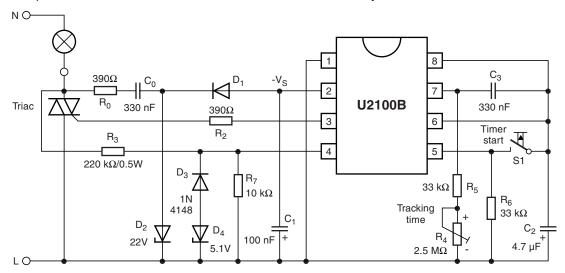
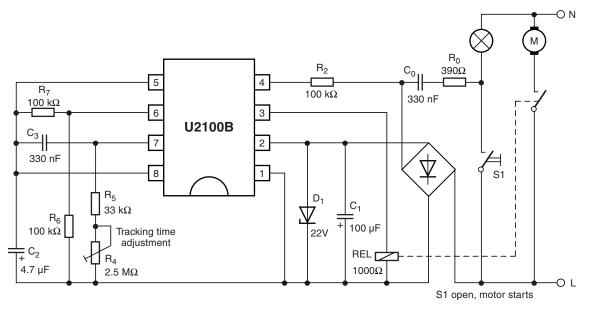


Figure 7-2. Fan Tracking Time Control 18 Seconds to 23 Minutes



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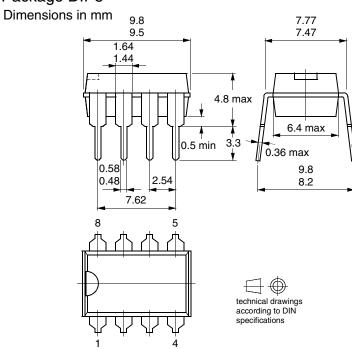


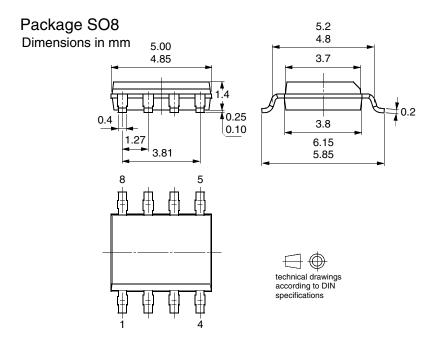
# 8. Ordering Information

Extended Type Number	Package	Remarks
U2100B-xY	DIP8	Tube
U2100B-xFPY	SO8	Tube
U2100B-xFPG3Y	SO8	Taped and reeled

# 9. Package Information

## Package DIP8





# 10. Revision History

Please note that the following page numbers referred to in this section refer to the specific revision mentioned, not to this document.

Revision No.	History
4769C-INDCO-07/05	Put datasheet in a new template
4769C-INDCO-07/05	Section 3.5 "Tracking Time Pin 7" on page 8 changed
4769B-INDCO-12/04	Put datasheet in a new template
4703D-INDCO-12/04	Table "Electrical Characteristics" on page 9 changed





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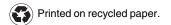
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