

## Features

- Phase Controlled Thyristor Ignition
- Triggering with Time Delay
- Repetition Time Delay
- Supply Current  $\leq 2$  mA
- Mains Supply via Resistor

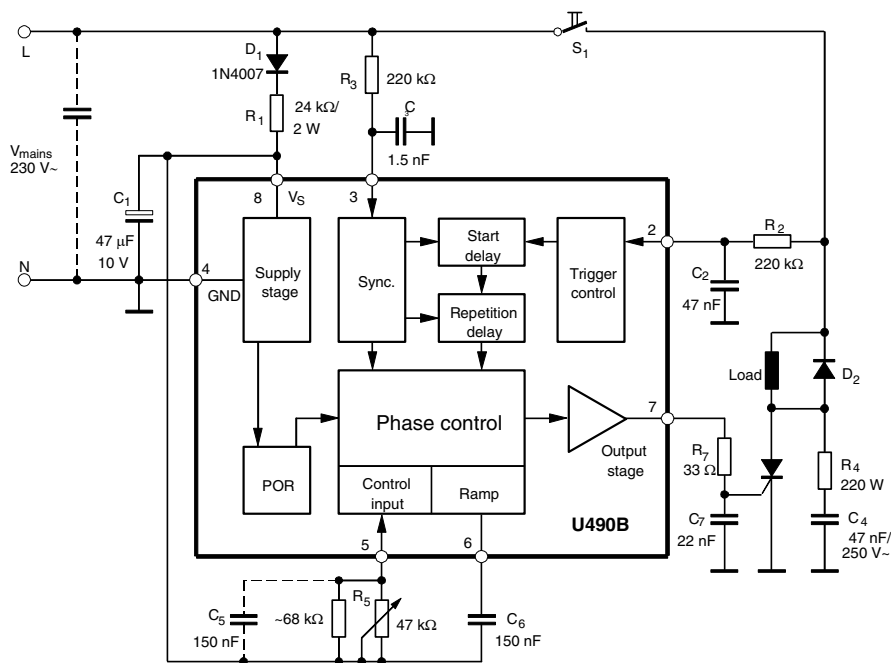
## Applications

- Electric Stapler Devices

## Description

The monolithic integrated bipolar circuit, U490B, is a one-shot power control circuit, designed to control the thyristor which is mainly used in electric stapler devices. The IC is preferred to realize a one-shot phase control, where any phase angle, thus any intensity of the load voltage is adjustable. After successful triggering and the following delay time, an ignition pulse at the output is released. Further triggering is only possible after the delay time elapses.

Figure 1. Block Diagram

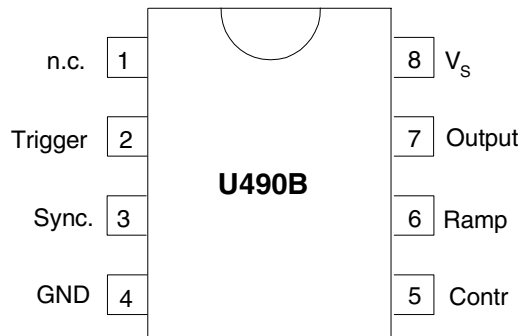


## One-shot Phase Control IC

### U490B

## Pin Configuration

**Figure 2.** Pinning DIP8/SO8



## Pin Description

| Pin | Symbol         | Function        |
|-----|----------------|-----------------|
| 1   | n.c.           | Not connected   |
| 2   | Trigger        | Triggering      |
| 3   | Sync.          | Synchronization |
| 4   | GND            | Ground          |
| 5   | Contr          | Control input   |
| 6   | Ramp           | Ramp            |
| 7   | Output         | Output          |
| 8   | V <sub>S</sub> | Supply voltage  |

### Supply, Pin 8

The internal voltage limiter enables a simple supply from the mains via series resistor  $R_1$ . The supply voltage between pin 8 ( $V_S$ ) and ground (pin 4) builds up via  $R_1$  and is smoothed by the capacitor  $C_1$ .

The series resistor  $R_1$  can be calculated as follows:

$$R_{1\max} \approx 0.85 \times \frac{V_{\text{mains}} - V_{S\max}}{2 \times I_{\text{tot}}} \quad \text{where}$$

$V_{\text{mains}}$  Mains supply voltage

$V_{S\max}$  Maximum supply voltage

$I_{\text{tot}}$   $I_{S\max} + I_X$

$I_{S\max}$  Maximum current consumption of the IC

$I_X$  Current consumption of the external components

## Phase Control, Pins 3, 5 and 6

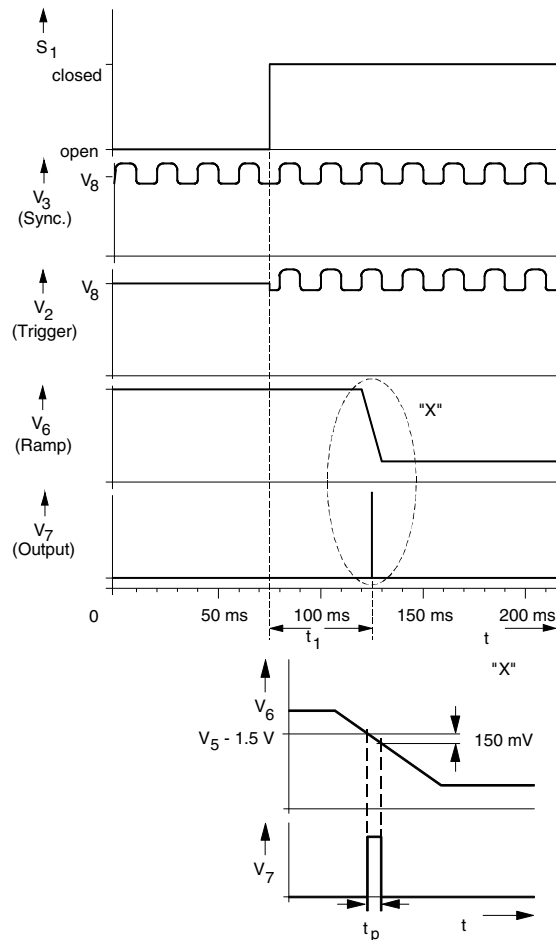
The circuit is synchronized with mains supply through pin 3. As long as the switch  $S_1$  is open, the circuit is in wait state, i.e., the capacitor  $C_6$  (150 nF) is discharged and is kept in this state (High level). When the switch  $S_1$  is closed, there is a current flow in pin 2 which is evaluated by the circuit. If this current flows after the delay time elapses, the phase control is released. The capacitor  $C_6$  is then charged with  $I_6 + 100 \mu\text{A}$  towards ground. At the same time, a current of  $\approx 100 \mu\text{A}$  flows into pin 5, which results in a voltage drop across resistor  $R_5$ . The control voltage  $V_5$  is then 1.5 V lower internally.

The output stage is released when the ramp voltage  $V_6$  is equal to  $(V_5 - 1.5 \text{ V})$ . When the voltage difference is  $\approx 150 \text{ mV}$ , it is again turned-off.

The result is an output pulse, whose phase shift to the zero crossing of the mains voltage is determined by the resistor  $R_5$  at the control input pin 5 (see Figure 3). The capacitor  $C_6$  is charged to a value of  $\approx 1.5 \text{ V}$ . This value is kept until the switch  $S_1$  opens again and the repetition delay time has elapsed.

The circuit is released when four periods of the line voltage have expired after build-up of the operating voltage, before the switch  $S_1$  is closed.

**Figure 3.** Signal Characteristics



## 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.

Reference point pin 4 (GND), unless otherwise specified

| Parameters                  | Symbol    | Value         | Unit |
|-----------------------------|-----------|---------------|------|
| Supply current, pin 8       | $I_S$     | 30            | mA   |
| $t \leq 10 \mu s$           | $i_s$     | 150           | mA   |
| Output stage                |           |               |      |
| Input voltage, pin 7        | $V_I$     | -0.5 to $V_S$ | V    |
| Input current, pins 2 and 3 | $\pm I_I$ | 5             | mA   |
| $t \leq 1 ms$               | $\pm I_I$ | 30            | mA   |
| Input voltage, pins 5 and 6 | $V_I$     | 0 to $V_g$    | V    |
| Junction temperature        | $T_j$     | +125          | °C   |
| Ambient temperature         | $T_{amb}$ | -10 to +100   | °C   |
| Storage temperature range   | $T_{stg}$ | -40 to +125   | °C   |

## Thermal Resistance

| Parameters       | Symbol     | Value | Unit |
|------------------|------------|-------|------|
| Junction ambient | $R_{thJA}$ | 110   | K/W  |
| DIP8             | $R_{thJA}$ | 220   | K/W  |
| SO8 on p.c.      | $R_{thJA}$ | 140   | K/W  |
| SO8 on ceramic   | $R_{thJA}$ |       |      |

## Electrical Characteristics

$V_S = 7 V$ ,  $T_{amb} = 25^\circ C$ , reference point pin 4 (GND), unless otherwise specified

| Parameters                | Test Conditions/ Pins       | Symbol     | Min. | Typ. | Max. | Unit    |
|---------------------------|-----------------------------|------------|------|------|------|---------|
| Supply voltage limitation | $I_S = 3 mA$ Pin 8          | $V_S$      | 7.2  | 8.2  | 9.2  | V       |
|                           | $I_S = 30 mA$               | $V_S$      | 7.4  | 8.4  | 9.4  | V       |
| Current consumption       | $V_S = 7 V$ Pin 8           | $I_S$      |      |      | 2    | mA      |
| <b>Voltage Monitoring</b> |                             |            |      |      |      |         |
| Switch-on threshold       | Pin 8                       | $V_{Son}$  |      | 5    |      | V       |
| Switch-off threshold      |                             | $V_{Soff}$ |      | 3    |      | V       |
| <b>Synchronization</b>    |                             |            |      |      |      |         |
| Voltage limitation        | $I_3 = +1 mA$ Pin 3 – 8     | $V_{lim}$  |      | 1.5  |      | V       |
|                           | $I_3 = -1 mA$               | $-V_{lim}$ |      | 0.75 |      | V       |
| Switch-on threshold       | Pin 3                       | $I_{Ton}$  |      | 120  |      | $\mu A$ |
| Switch-off threshold      |                             | $I_{Toff}$ |      | 35   |      | $\mu A$ |
| <b>Trigger Input</b>      |                             |            |      |      |      |         |
| Voltage limitation        | $I_2 = +1 mA$ Pin 2 – 8     | $V_{lim}$  |      | 1.5  |      | V       |
|                           | $I_2 = -1 mA$               | $-V_{lim}$ |      | 0.75 |      | V       |
| Switch-on threshold       | Pin 2                       | $I_{Ton}$  |      | 120  |      | $\mu A$ |
| Switch-off threshold      |                             | $I_{Toff}$ |      | 35   |      | $\mu A$ |
| Start delay time          | $f_{mains} = 50 Hz$ Pin 2–7 | $t_1$      | 40   |      | 60   | ms      |
| Repetition delay time     |                             | $t_2$      | 60   |      | 80   | ms      |

## Electrical Characteristics (Continued)

$V_S = 7\text{ V}$ ,  $T_{\text{amb}} = 25^\circ\text{C}$ , reference point pin 4 (GND), unless otherwise specified

| Parameters                                                | Test Conditions/ Pins                                               | Symbol                | Min. | Typ. | Max.  | Unit          |
|-----------------------------------------------------------|---------------------------------------------------------------------|-----------------------|------|------|-------|---------------|
| <b>Phase Control</b>                                      |                                                                     |                       |      |      |       |               |
| Control input:                                            | Pin 5                                                               |                       |      |      |       |               |
| Input voltage range                                       |                                                                     | $V_I$                 | 2    |      | $V_S$ | V             |
| Input current                                             | $2\text{ V} \leq V_5 \leq V_8$                                      | $I_I$                 | 50   | 90   | 130   | $\mu\text{A}$ |
| <b>Ramp</b>                                               |                                                                     |                       |      |      |       |               |
| Charge current                                            | $2\text{ V} \leq V_6 \leq V_8 - 0.5\text{ V}$                       | $I_{\text{ch}}$       | 50   | 90   | 130   | $\mu\text{A}$ |
| Discharge current                                         | $V_5 = 4\text{ V}$                                                  | $-I_{\text{dis}}$     | 2    |      |       | mA            |
| <b>Phase Shift</b>                                        |                                                                     | $t_{\text{dmax}}$     |      | 7    |       | ms            |
|                                                           | $C_6 = 150\text{ nF}$ , $V_5 = 2\text{ V}$<br>$V_5 = V_8$ , Pin 7–5 | $t_{\text{dmin}}$     |      | 600  |       | $\mu\text{s}$ |
| <b>Output Stage, <math>V_7 + 0\text{ V}</math>, Pin 7</b> |                                                                     |                       |      |      |       |               |
| Output reverse current                                    | Status OFF                                                          | $\pm I_{\text{O(r)}}$ |      |      | 10    | $\mu\text{A}$ |
| Output current                                            | Status ON                                                           | $-I_{\text{O}}$       | 100  |      |       | mA            |
| Pulse width                                               | $C_6 = 150\text{ nF}$<br>(see Figure 3 on page 3)                   | $t_p$                 | 100  | 200  | 300   | $\mu\text{s}$ |

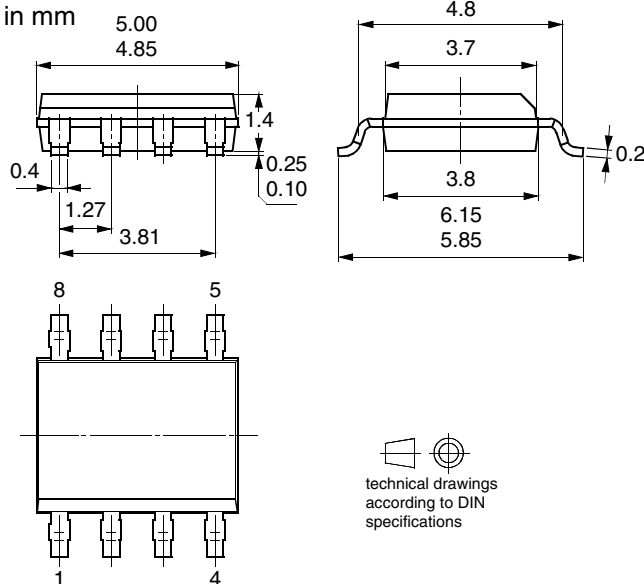
## Ordering Information

| Extended Type Number | Package | Remarks          |
|----------------------|---------|------------------|
| U490B-x              | DIP8    | Tube             |
| U490B-xFP            | SO8     | Tube             |
| U490B-xFPG3          | SO8     | Taped and reeled |

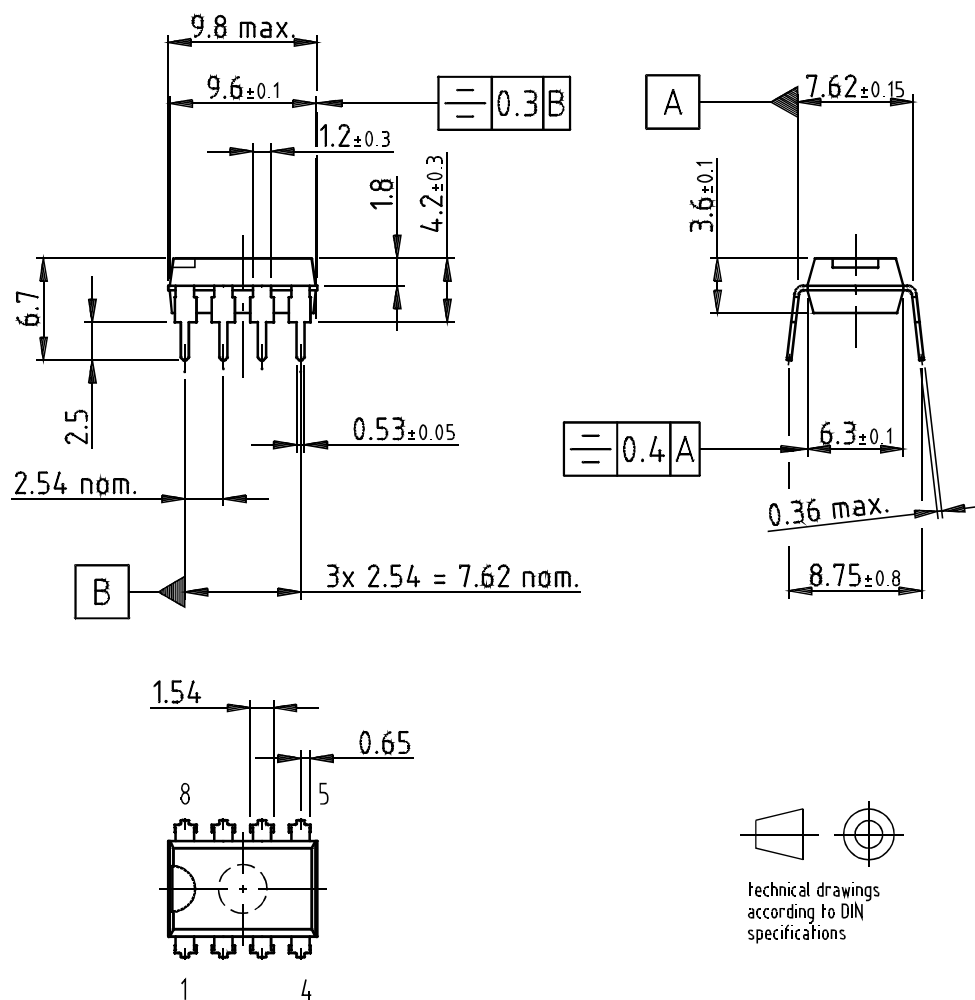
## Package Information

### Package SO8

Dimensions in mm



Package: DIP 8  
Dimensions in mm



Drawing-No.: 6.543-5040.01-4  
Issue: 1; 16.01.02



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