



**U 2605 B · U 2606 B
U 2607 B · U 2608 B**

TELEFUNKEN ELECTRONIC

T.65.09

ZERO VOLTAGE SWITCH

Safety Switch-off in Irons – Triacs and Relays

Technology: Bipolar

Features:

- **Triac or relay selection**
- **Debounce circuit for:**
 - Motion detector input
 - Control input/false (side) position indication
- **Output signal for:**
 - acoustic identification
 - optical identification
- **Safety switch-off after:**
 - 31 s in position 1
 - 31 s in position 2
 - 8 min in position 1
 - 8 min in position 2
 - 8 min in position 4
 - 2.5 s in position 3
 - 2.5 s in position 4
- **False position warning:**
 - Position 1
 - Position 2
 - Position 3
 - Position 4
- **Reactivation of output stage after safety switch-off:**
 - Timer Reset
 - Additional push button
- **Timer Reset pulse created when:**
 - Position 1 goes to position 2 or vice versa
 - Position 1 goes to position 3 or vice versa
 - Position 1 goes to position 4 or vice versa
 - Position 2 goes to position 3 or vice versa
 - Position 2 goes to position 4 or vice versa
 - Position 3 goes to position 4 or vice versa
- **Two level control**

U 26.. B			
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Positioning

Motion detector input (Pin 2)	Input control (Pin 8)	Position	Time duration			
			U 2605 B	U 2606 B	U 2607 B	U 2608 B
Ground	Ground	1	31 s	31 s	31 s	8 min
Open	-V _s	2	*	8 min	8 min	31 s
Ground	-V _s	3	*	2.5 s	2.5 s	2.5 s
Open	Ground	4	8 min	2.5 s	2.5 s	2.5 s

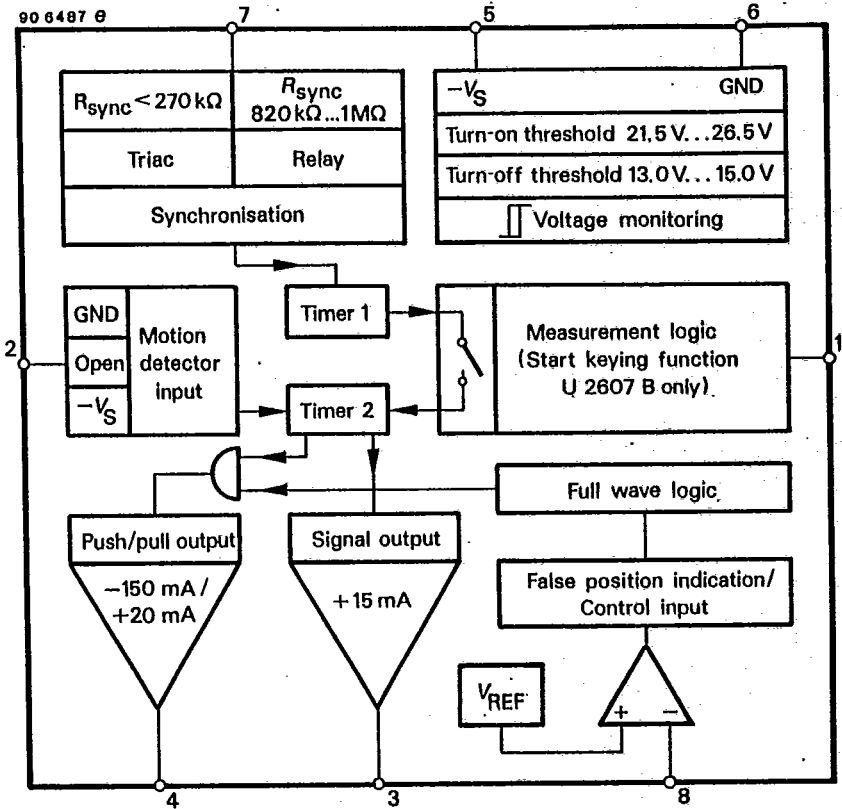


Fig. 1 Block diagram

Pin connections

- Pin 1 Test pin: U 2605 B, U 2606 B, U 2608 B
Additional input for push button: U 2607 B
- Pin 2 Motion detector input
- Pin 3 Output signal
- Pin 4 Push pull output
- Pin 5 Supply $-V_S$
- Pin 6 Supply $+V_S$
- Pin 7 Sync., Relay's/Triac selection
- Pin 8 Input control: U 2605 B
False position indication: U 2606 B, U 2607 B, U 2608 B



**U 2605 B · U 2606 B
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Absolute maximum ratings

Reference point Pin 6 (+V_S - Ground),
unless otherwise specified

Supply current	Pin 5	-I _S	20	mA
$t \leq 10 \mu\text{s}$	Pin 5	-I _S	100	mA
Sync. current	Pin 7	$\pm I_7$	5	mA
$t \leq 10 \mu\text{s}$	Pin 7	$\pm I_7$	20	mA
Push-pull output	Pin 4	+I ₄	30	mA
$t \leq 1 \text{ ms}$	Pin 4	-I ₄	200	mA
Output signal	Pin 3	I ₃	20	mA

Input currents

Input control	Pin 8	$\pm I_8$	5	mA
Motion detector input	Pin 2	$\pm I_2$	5	mA
Test input	Pin 1	-I ₁	200	μA
Start keying function	Pin 1	+I ₁	1.8	mA

Input voltages

Input control	Pin 8	V ₈	0...-V _S	V
Motion detector input	Pin 2	V ₂	0...-V _S	V
Test input	Pin 1	V ₁	+1.3...-6	V
Storage temperature range		T _{stg}	-40...+125	°C
Junction temperature		T _J	125	°C
Ambient temperature		T _{amb}	100	°C

Maximum thermal resistance

Junction ambient

DIP 8

SO 8 on P.C. board

on ceramic without silicone grease

on ceramic with silicone grease

R _{thJA}	120	K/W
R _{thJA}	220	K/W
R _{thJA}	140	K/W
R _{thJA}	80	K/W

Electrical characteristics

Min. Typ. Max.

V_S = -24 V, T_{amb} = 25 °C, reference point Pin 6,
unless otherwise specified

Supply

Supply voltage limitation

-I_S = 4 mA

-I_S = 30 mA

Pin 5	-V _S	24.0	28.0	V
Pin 5	-V _S	24.0	29.0	V

Current requirement

-V_S = 14 V

-V_S = 24 V

Pin 5	-I _S		2.3	mA
Pin 5	-I _S		3.3	mA

Voltage monitoring

Turn-on threshold

Turn-off threshold

Pin 5	-V _{TON}	21.5		V
Pin 5	-V _{TOFF}	13.0	15.5	V



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Synchronisation

Voltage limitation

$I_7 = \pm 5 \text{ mA}$

Current sync.

– Relay

– Triac

	Min.	Typ.	Max.	
$\pm V_{\text{sync.}}$	7.3	8.0	8.7	V
$I_{\text{sync.}}$	0.05		2.0	mA
$I_{\text{sync.}}$	0.15		0.3	mA
$I_{\text{sync.}}$	0.50		2.0	mA

Input control threshold

Pin 8

$-V_8$

3.20

3.70

4.20

V

Motion detection input

Pin 2

Window range : $V_S = -24 \text{ V}$

Ground

open

Supply voltage

Window range : $V_S = -15.5 \text{ V}$

Ground

open

Supply voltage

$-V_2$	0		5.50	V
$-V_2$	9.5		14.50	V
$-V_2$	17.5		V_S	V
$-V_2$	0		2.00	V
$-V_2$	5		9.00	V
$-V_2$	10.5		V_S	V

Test Input $V_1 = -6 \text{ V}$

Pin 1

Output current: Timer 2

non-latched

Timer 2

latched

$\pm I_1$	18		180	μA
$\pm I_1$	0		10	μA

Start-Keying-Function

Input current

Pin 1

$+I_1$

0.8

1.5

mA

Push-pull output

Pin 4

Operating current

Current limitation

Output signal

Operating current

Current limitation

Output pulse width

Pin 4

$V = 220 \text{ V} \sim: R_{\text{sync.}} = 270 \text{ k}\Omega$

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

$R_{\text{sync.}} = 130 \text{ k}\Omega$

I_4			20	mA
$-I_4$	150			mA
$-I_4$		180		mA
I_3			15	mA
I_3		30		mA
t_p	150			μs
t_p	130			μs
t_p	80			μs

Explanation of symbols in diagrams:

$R_{\text{sync.}}$ = Resistance for synchronisation

I_U, I_{HD} = Latching current, dynamic hold current (triac)

I_{gt} = Ignition pulse (triac) min.

R_G = Series resistance – Gate

P_V = Power dissipation to drive the load

R_V = Series resistance, dropper resistance – Supply voltage

I_{tot} = Total current consumption = $I_S + I_{\text{Relay(max)}} + I_P$

I_S = Max. current consumption of the IC

I_P = Current consumption of the external (periphery) components

Description
Supply (Pin 5)

The integrated circuit, which also contains voltage limiting is connected according to current requirement. In case of low current requirement, i.e., triac application, connection according to Fig. 2 is recommended. Series resistance (dropper resistor) R , can be calculated approx. as follows:

$$R \leq 0.85 \frac{V_{\text{mains}} - V_S}{2 \cdot I_{\text{tot}}}$$

Supply voltage is smoothed with capacitor, C_v , connected between Pin 5 and ground (Pin 6). For high current requirement, i.e., relay application, bridge configuration, connected according to Fig. 3 is recommended. Series resistance, R , is calculated as given below:

$$R \leq 0.9 \frac{V_{\text{mains}} - V_S}{I_{\text{tot}}} \text{ whereas}$$

V_{mains} = Mains supply voltage, min.
 V_S = Supply voltage, max.
 I_{tot} = Total current consumption, via R

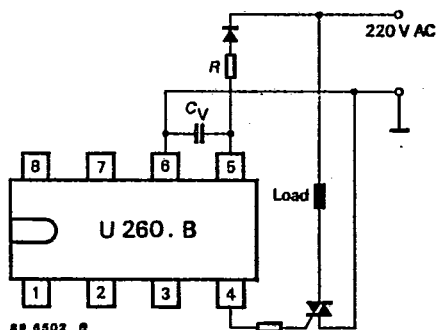


Fig. 2 Low current requirement
(Half wave rectification)

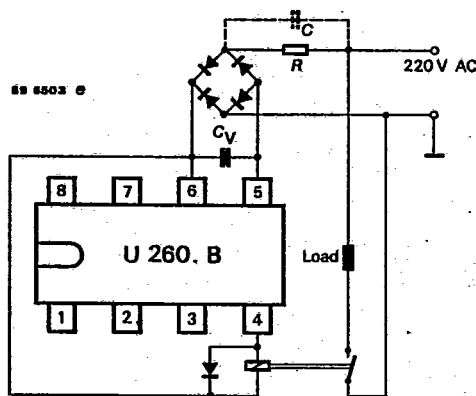


Fig. 3 High current requirement
(Bridge circuit)

Voltage monitoring (Internal)

As the voltage is building up across C_v , the circuit has its Power-On-Reset. Power-On-Reset is withdrawn, once the supply voltage reaches a value of ca. 21.5 V... 26.5 V.

A general Reset is maintained, when the working voltage is lower than 13V... 15.0V, which is identical with Power-On-Reset.

During the Reset, timer, motion- and position detector, signal output and 150 mA-pull stage are locked (switched-off), whereas of 20 mA push-stage remains active.

This is necessary to minimize the power dissipation of the integrated circuit.

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Synchronisation (Pin 7)

Sync. consists of half a wave detector which clocks timer 1 in 20 ms cycles and determines the relay/triac selection.

It is valid for mains supply, 220 V~:

$$1 \text{ M}\Omega \geq R_{\text{sync.}} \geq 820 \text{ k}\Omega - \text{Relay}$$

$$270 \text{ k}\Omega \geq R_{\text{sync.}} \geq 130 \text{ k}\Omega - \text{Triac, for loads above 500 W}$$

The value of $R_{\text{sync.}}$ depends upon the switching load, latching current and dynamic hold current of the triac. For dimensioning, please refer to Figs. 20...24.

Push-pull output stages, Pin 4, Fig. 4

Push-pull output stage is necessary for the relay current greater than 15 mA. It takes over the relay power loss during the relay's off-mode, otherwise it would effect the supply voltage limitation which is released across the external resistor. In this way, one can influence the junction temperature.

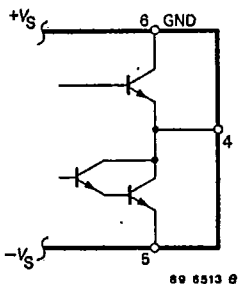


Fig. 4 Push-pull output stage

Pull-out stage is active:

- after the Power-On-Reset is in vertical position
- during and till 8 min. after the last movement in vertical position
- during and up to 30 sec. after the last movement in horizontal position
- during and up to 2.5 sec. after the last movement in side position (lateral stage)

A 20 mA push stage (output) operates complementary to pull-stage.

Mode of operation

- static mode during relay's operation
- dynamic (or pulse) mode during zero voltage crossing of triac operation

Motion (detector) input Pin 2

It is connected with control input (Pin 8) logically in case of U 2606 B, U 2607 B and U 2608 B. It processes the information from the external position switch and controls the timing circuit. To comply with safety switch-off condition, both inputs are suppressed against mains spikes. An internal spike filter suppresses signals smaller than 20...40 ms duration i.e., every type of distortion signals are suppressed. Apart from this both inputs are gated by zero voltage switch.

This circuit concept prevents unsuitable firing pulses being applied – whether due to mains, switching or other reasons – to restart the timer.

Input control Pin 8

Please refer to motion detector input and type designation description, U 2605 B.



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Output signal Pin 3, Fig. 5

To realise optical or acoustic state application, this output signal can be used. After processing, the signal can be used for different output states, i.e., false iron position with mains plug or the safety switch off. For further details please refer to type designation.

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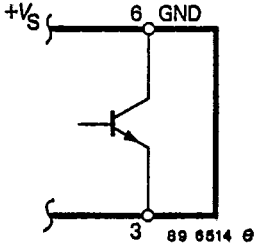


Fig. 5 Output signal

Type designation

U 2605 B

Input control, Pin 8

It has separate input control as compared to other types of the family. The internal switching threshold from -3.7 V ($\pm 0.5\text{ V}$) with reference to ground (Pin 6), allows driving via TTL-, CMOS or operational amplifier application. Push-pull output stage can be driven directly via integrated full wave logic (Fig. 13 + 14), as long as the safety switch off is not effective. Two point control with switching hysteresis as shown in Fig. 14 can be realised in a simple manner:

Input logic

V_B (Pin 8)	150 mA output (Pin 4)	
	when X	when Y
$\geq -3.20\text{ V}$	1	0
$\leq -4.20\text{ V}$	0	0

V_B = Input control voltage against Pin 6

X = Safety switch-off, inactivated

Y = Safety switch-off, activated

1 = 1 ON

0 = OFF

Output signal, Pin 3

For indication, the following operation possibilities are available:

- a) Switch-on position warning follows after mains plug insertion $-V_2 = 0\text{ V}$ - horizontal position. Output signal generates a constant signal of 31 s. It follows with 30.5 s intermission (pause) and 640 ms pulse (t_p - pulse time) duration sequence continuously as shown in Fig. 6. A signal change on motion switch (detector) input of $t \geq 40\text{ ms}$ duration generates a timer-reset which resets the output position.

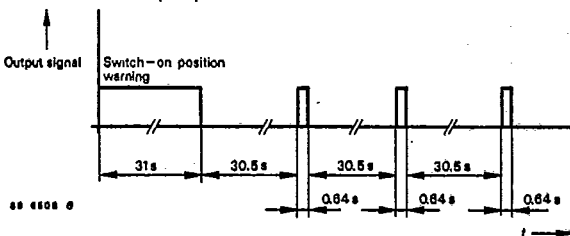


Fig. 6 Output signal: Switch positioning warning Plug-in fail state



b) Switch-off designation follows after time specified by safety switch-off.

Output signal is generated for a duration of 31 s, a rectangular pulse of 640 ms pulse- and interruption (pause) time. Afterwards it goes to the sequence as mentioned under a) (Fig. 7).

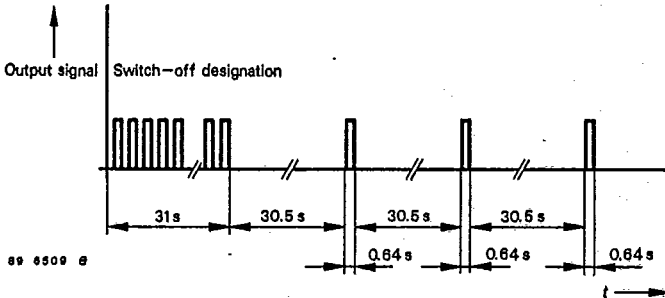


Fig. 7: Switch-off designation

U 2606 B

Side position identification, Pin 8

Electrical characteristics are identical with control input (Pin 8) of U 2605 B. In comparison to U 2605 B, this input does not effect the push-pull output stage, but it influences the motion and position detection. Together with motion switch input one can detect motion and position, i.e., a third position can be known. See table: Positioning and motion switch input.

Output signal, Pin 3

It can be designed mainly for acoustic applications.

- a) Switch-on position follows after mains insertlon in the position of 1, 3 and 4. It creates a signal as in U 2605 B, see also Fig. 6.
- b) Switch-off designation see U 2605 B, Fig. 7:

U 2607 B

It is identical with IC U 2606 B but has an additional safety condition with start-keying-function.

Start-keying function:

The activation of the output stage, after mains plug-in and safety switch-off, can only be done by start-keying function. In this case, start-keying function sets the priority for mains plug-in and safety switch-off.

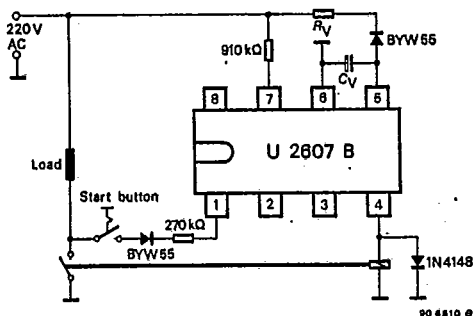
During switch-on mode, timer can also be reset by a motion detector signal. Start-keying function can be realised by raising a positive current of min. 0.8 mA at Pin 1. Fig. 8 shows a recommended application circuit.

Output signal, Pin 3

It is suitable for acoustic designation, as is the case with U 2606 B,

- a) Switch-on position warning follows practically in every position after mains plug-in. Signal sequence is identical with U 2606 B.
 Resetting of the output signal can only be achieved by activating the start-keying function which results in timer-reset.

- b) Switch-off designation, see U 2606 B, Fig. 7

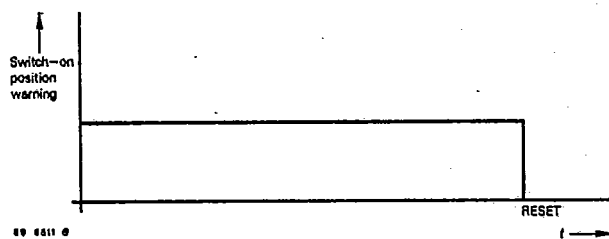

Fig. 8 Start-keying circuit
U 2608 B

It is recommended for optical (LED) designation, see output signal, Pin 3. A further difference is the logic connection (combination) of motion switch input and side position identification as compared to U 2606 B. Additionally, there are inverted input informations so that other possibilities for motion switch are available.

Output signal, Pin 3

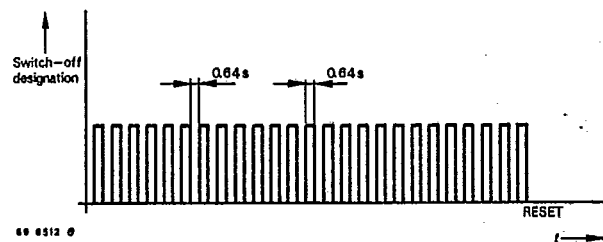
As mentioned above, the output signal is designed for optical application.

- a) Switch-on position warning follows by mains plug-in, in the positions 2, 3 and 4. The integrated circuit generates a continuous output signal till a motion or position change occurs (Fig. 9).


Fig. 9 Switch-on position warning

- b) Switch-off designation follows after time specified safety-switch off.

The integrated circuit generates a rectangular signal at the output, of 640 ms pulse and interrupt until movement or position change occurs (Fig. 10).


Fig. 10 Switch-off designation

Applications

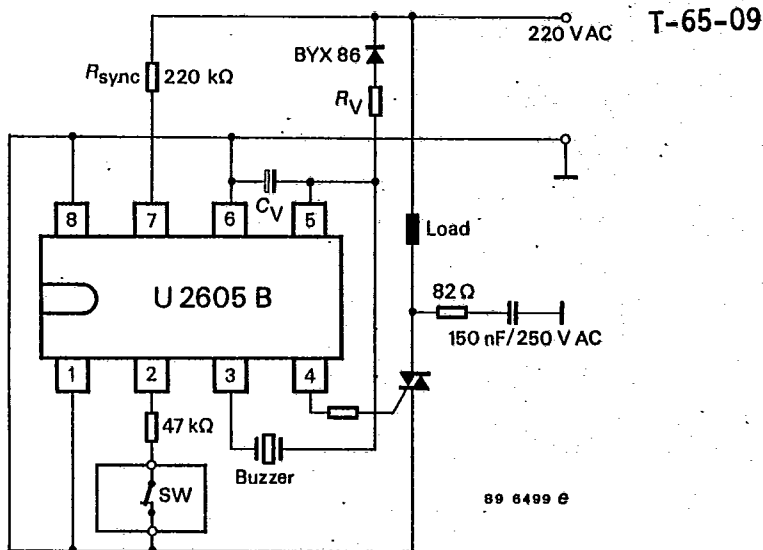


Fig. 11 Standard application with triac - U 2605 B

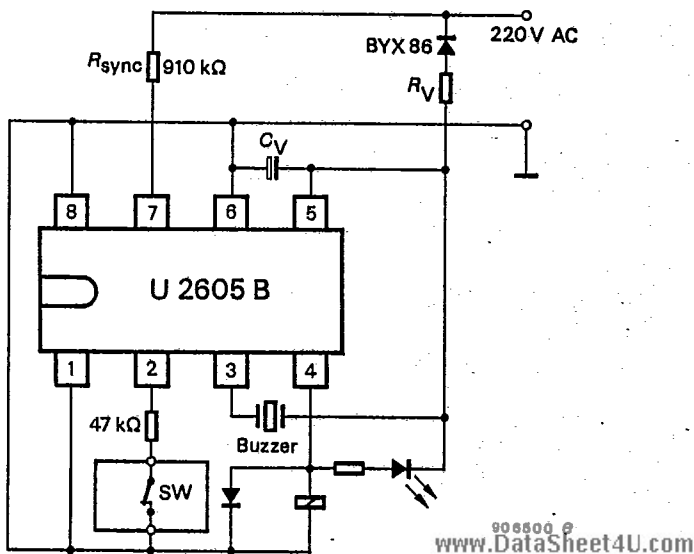


Fig. 12 Standard application with relay - U 2605 B

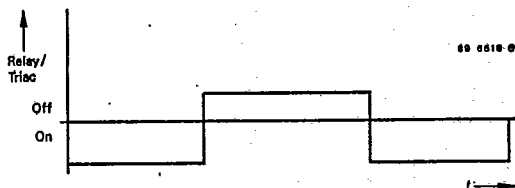
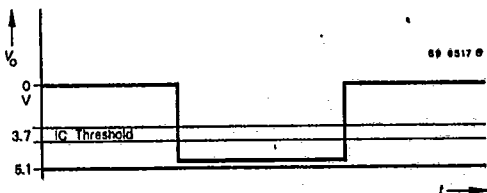
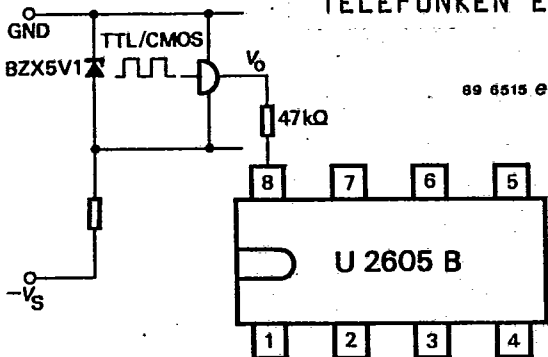


Fig. 13 TTL/CMOS control – U 2605 B

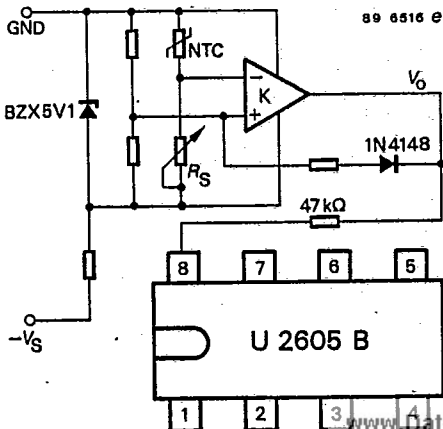


Fig. 14 Two level control – U 2605 B

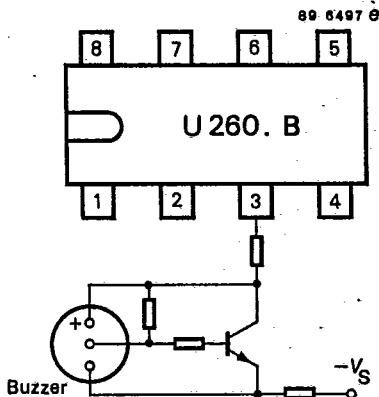


Fig. 15 Buzzer circuit

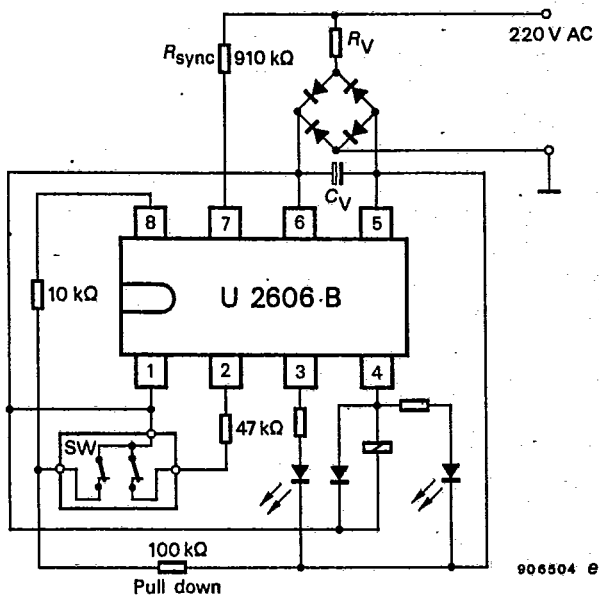


Fig. 16 Standard application with relay – U 2606 B

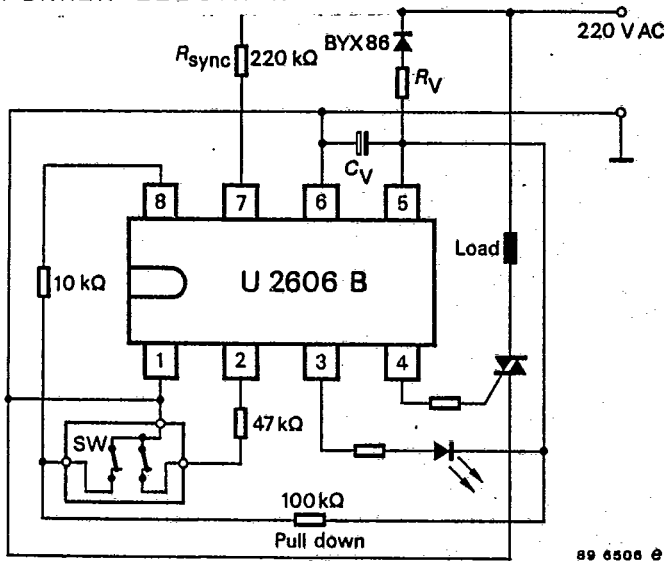


Fig. 17 Standard application with triac - U 2606 B

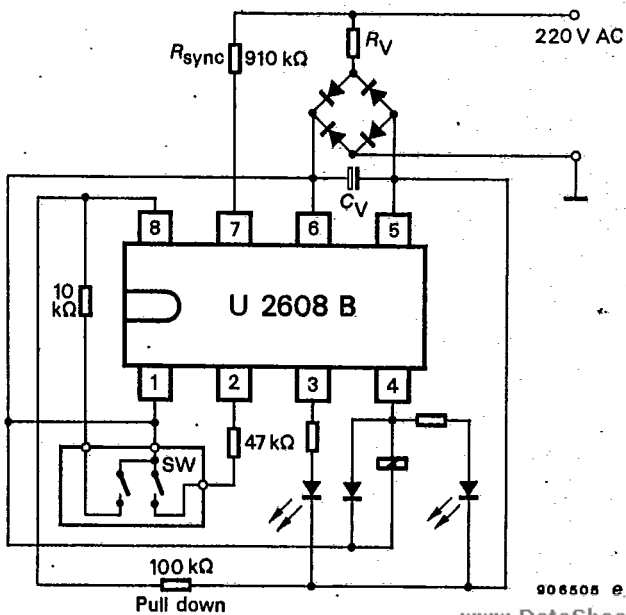
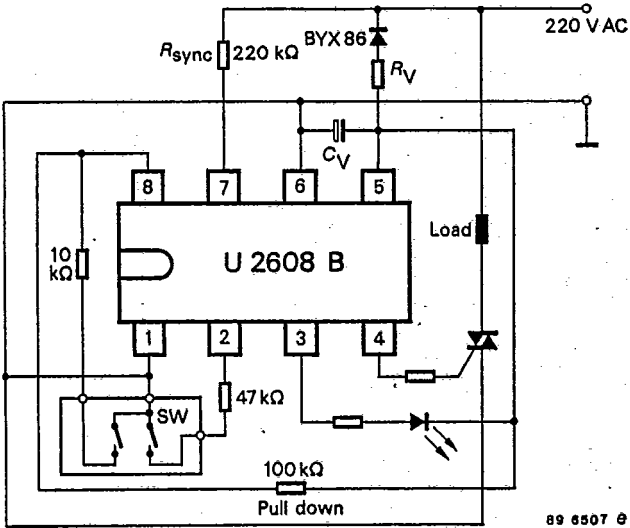
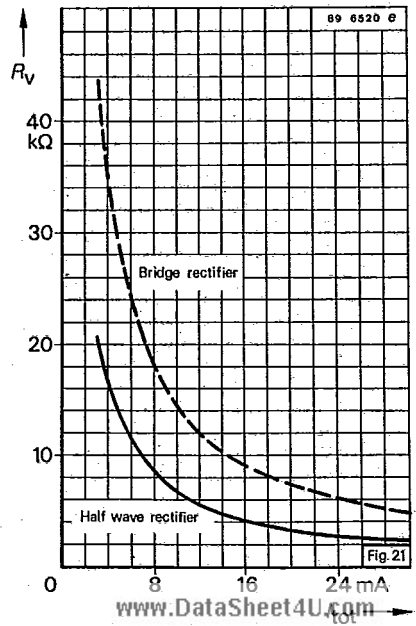
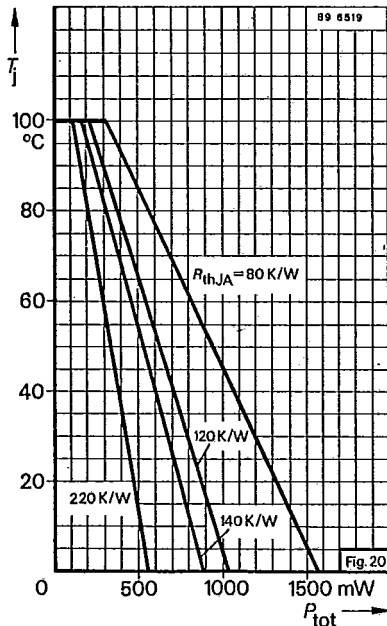


Fig. 18 Standard application with relay - U 2608 B



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Fig. 19 Standard application with triac – U 2608 B



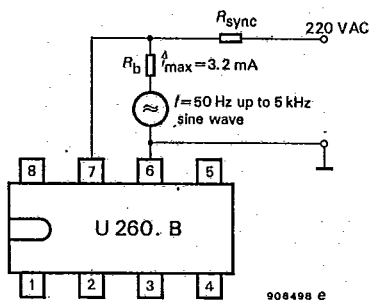
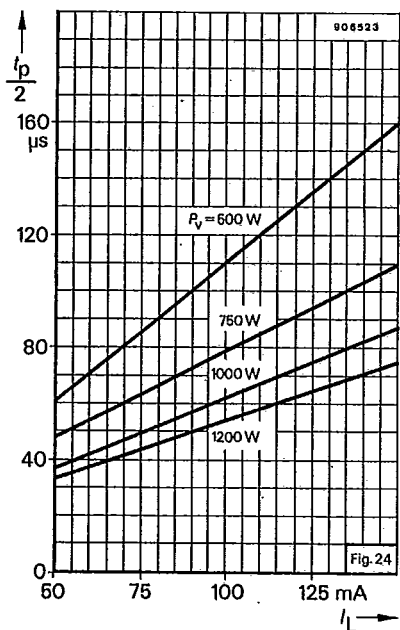
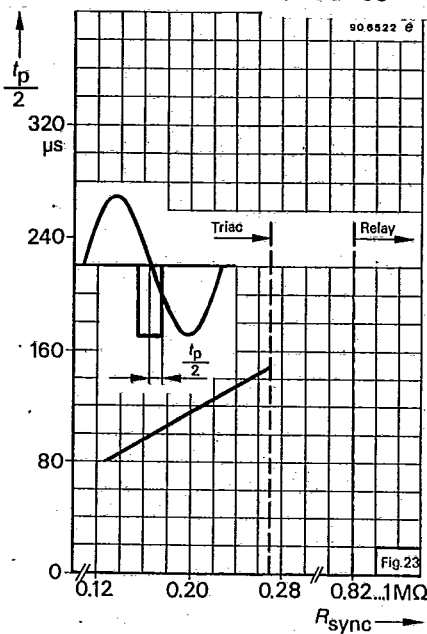
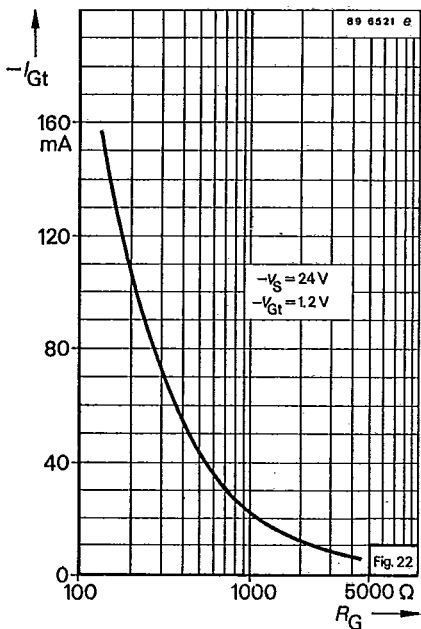


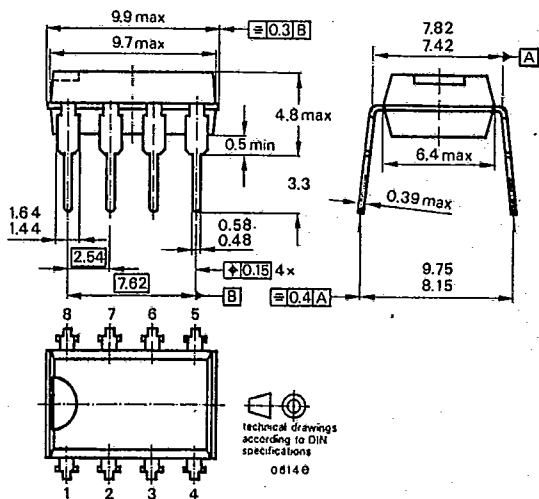
Fig. 25 Test circuit

Quick function test

A suitable test circuit is given in Fig. 25. It has the advantage that the P.C. board can be put into test under a supply voltage (220 V~), via a transformer according to VDE specification. When frequency is modulated with higher frequency so that the switching times are correspondingly shorter.

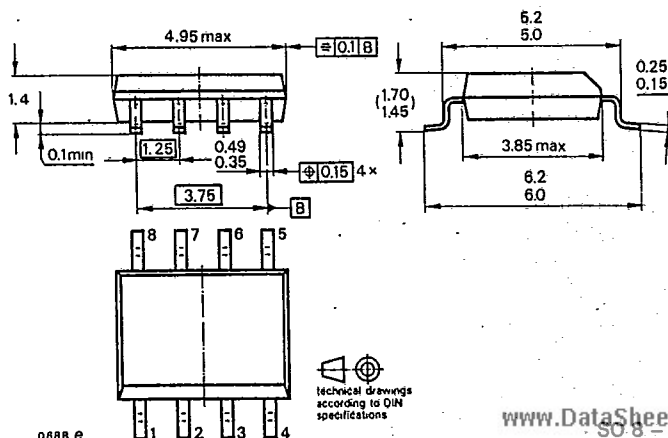
Dimensions in mm

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Case:

DIP 8 - U 2605 B
U 2606 B
U 2607 B
U 2608 B



Case:

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