



## Circuit Description

The application circuit shows the operation of the U243B as a car-direction indicator signal generator. The flashing frequency is determined by the components  $R_t$  and  $C_t$ , and the frequency can be calculated from

$$f_1 \approx \frac{1}{R_t \times C_t \times 1.5} \quad (\text{Hz})$$

where  $f_1$  is the frequency in normal flashing operation (basic frequency). The control frequency  $f_2$  is typically 2.2 times the value of  $f_1$  and is the frequency in the case of lamp failure. The bright periods for  $f_1$  and  $f_2$  are internally set in the IC and are 50% for  $f_1$  and 40% for  $f_2$ .

The resistors  $R_1$  and  $R_2$  are needed to protect the circuit against possible damage. An integrated Z-diode in addition to these external resistors limits the impulse current in the integrated circuit to  $\leq 1.5$  A. Connecting the circuit with the wrong polarity leads to current limitation by  $R_1$ ,  $R_2$  and the resistance of the coil of the relay. A current of about 150 mA would then flow over  $R_1$ , so that for unlimited protection against continuous reversal of the polarity of the supply, a 2-W resistor would be necessary. A short circuit between the indicator lamp (49a) and ground (31) can give rise to a voltage drop of about 4 V across the measuring resistance,  $R_3$ . The circuit is not damaged by such a short circuit.

The use of this application circuit ensures damage and interference protection accordance to VDE 0839. The recognition point for lamp failure can be calculated from the control signal threshold, typically 81 mV with  $V_S = 12$  V.

With 81 mV and a measuring resistance of  $R_3 = 30$  m $\Omega$ , it corresponds to a lamp current of 2.7 A, i.e., the frequency change-over with a lamp load of 21 W + 11.4 W. The variation of the control-signal threshold with the supply voltage takes into account the PTC characteristic of the filament lamps. A resistance  $R_p \geq 5$  k $\Omega$  between the lamp indicator (49a) and ground (31) ensures that in case the direction indicator switch is open, the flashing generator is in stand-by mode.

With a control lamp of max. 4 W between 49 and 49a the IC still starts with the bright phase.

The arrangement of the supply connections to Pins 2 and 6 must be such as to ensure that, on the connection PCB, the resistance of  $V_S$  to Pin 6 is lower than that to Pin 2.

Defined operation is ensured with a lamp load of  $P_L \approx 10$  W or more. Defined operation with lamp loads  $\geq 2$  W require an additional external resistance as described in "Applications". With considerably reduced external circuitry, the integrated circuit U243B can be used as an instable multivibrator in the frequency range  $f = 0.05$  to 10 Hz.

## Absolute Maximum Ratings

Reference point Pin 1

Parameters		Symbol	Value	Unit
Supply voltage	Pins 2 and 6	$V_S$	16.5	V
Surge forward current				
$t_p = 0.1$ ms	Pins 2 and 6	$I_{FSM}$	1.5	A
$t_p = 2$ ms	Pins 2 and 6	$I_{FSM}$	1.0	A
$t_p = 2$ ms	Pin 8	$I_{FSM}$	50	mA
Output current	Pin 3	$I_o$	0.3	A
<b>Power dissipation</b>				
$T_{amb} = 95^\circ\text{C}$	DIP8	$P_{tot}$	420	mW
	SO8	$P_{tot}$	340	mW
$T_{amb} = 60^\circ\text{C}$	DIP8	$P_{tot}$	690	mW
	SO8	$P_{tot}$	560	mW
Junction temperature		$T_j$	150	$^\circ\text{C}$
Ambient temperature range		$T_{amb}$	-40 to +95	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55 to +125	$^\circ\text{C}$

## Electrical Characteristics

Typical values under normal operation in application circuit figure 1,  $V_S (+49, \text{Pins } 2 \text{ and } 6) = 12 \text{ V}$   
Reference point ground ( $-31$ ),  $T_{\text{amb}} = 25^\circ\text{C}$ , unless otherwise specified

Parameters	Test Conditions / Pin	Symbol	Min	Typ	Max	Unit
Supply voltage range	Pins 2 and 6	$V_S (+49)$		9 ... 15		V
Supply current, dark phase or stand-by	Pins 2 and 6	$I_S$		4.5	8	mA
Supply current, bright phase	Pins 2 and 6	$I_S$		7.0	11	mA
Z-diode limitation						
$I_{S2,6} = 70 \text{ mA}$	Pins 2 and 6	$V_S$		23		V
Relay output, saturation voltage						
$I_0 = 150 \text{ mA}, V_S = 9 \text{ V}$	Pin 3	$V_O$			1.0	V
Relay output, reverse current	Pin 3	$I_O$			0.1	mA
Relay coil resistance		$R_L$	60			$\Omega$
Start delay (first bright phase)		$t_{\text{on}}$			10	ms
Frequency-determining resistor		$R_t$	6.8		510	k $\Omega$
Frequency-determining capacitor		$C_t$			47	$\mu\text{F}$
Frequency tolerance (normal flashing, basic frequency $f_1$ not including the tolerance of the external components $R_t$ and $C_t$ )		$\Delta f_1$	-5		+5	%
Bright period (basic frequency $f_1$ )		$\Delta f_1$	47		53	%
Bright period (control frequency $f_2$ )		$\Delta f_2$	37		45	%
Frequency increase (lamp failure)		$f_2$	$2.15 f_1$		$2.3 f_1$	
Control-signal threshold						
$V_S = 15 \text{ V}$	Pin 7	$V_{R3}$	85	91	97	mV
$V_S = 9 \text{ V}$	Pin 7	$V_{R3}$	66	71	76	mV
$V_S = 12 \text{ V}$	Pin 7	$V_{R3}$	76	81	87	mV
Transfer resistance						
49a to common for stand-by		$R_P$		2	5	k $\Omega$
Lamp load		$P_L$	10			W

## Applications

- Flashing generator, operation with smaller loads ( $\geq 2 \text{ W}$ )

By adding a resistor to the application circuit (figure 1), defined operation with lamp loads  $\geq 2 \text{ W}$  is possible. The voltage drop across the resistor  $R_4$  is generated by the current flowing over the relay and should be about 15 mV. With a relay current of 150 mA (relay resistance 73  $\Omega$ ), this requires a resistance of  $R_4 = 100 \text{ m}\Omega$ . The change of

the operating point by 15 mV results in a corresponding change of the control signal threshold by 15 mV. For a lamp current of 2.7 A, a measuring resistance of

$$R_3 = \frac{81 \text{ mV} - 15 \text{ mV}}{2.7 \text{ A}} = 25 \text{ m}\Omega \quad \text{results.}$$

• Istable multivibrator

The figure shows the minimum of circuitry necessary for the operation as an instable multivibrator. The circuit is suitable for frequencies between 0.05 Hz and approximately 10 kHz. The frequency can be calculated by using the relationship for  $f_1$  given in circuit description. A starting resistor of 3.8 kΩ is integrated into the circuit between pins 8 and 6. This means that, for a load on pin 3 of, for

example, 500 Ω (open circuits) and zero current, a voltage of about 1.4 V remains on the load (for 70 Ω the corresponding voltage is about 220 mV). A load of  $R_L \leq 3.3 \text{ k}\Omega$  on pin 3 ensures correct operation of the instable multivibrator. The relationship between the on- and off-periods can be changed in this circuit by inserting a resistor-diode combination parallel to  $R_1$  (see dashed lines in the figure), e.g., to reduce the “bright”-time.

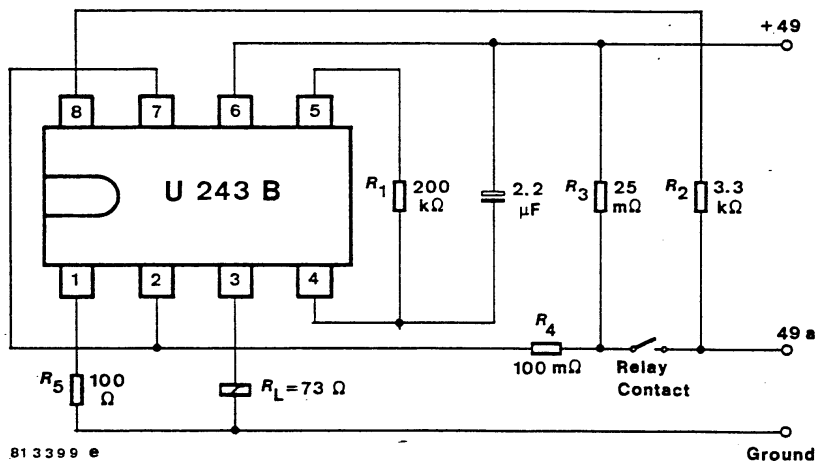


Figure 2. Flashing generator with small loads

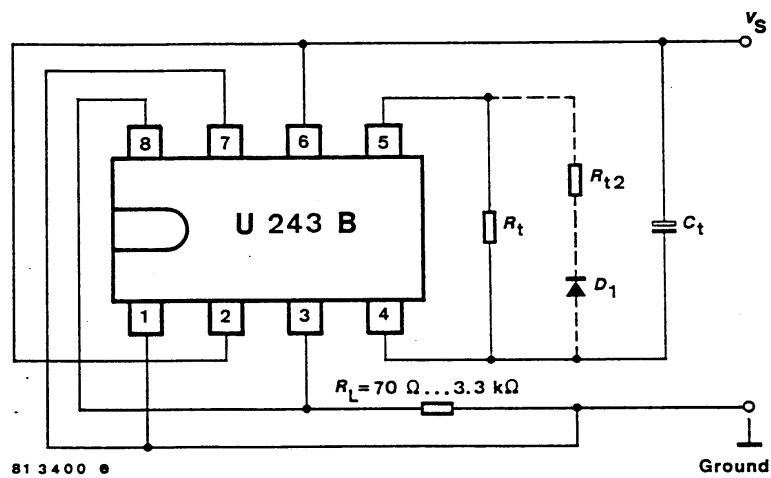


Figure 3. Instable multivibrator for general-purpose applications

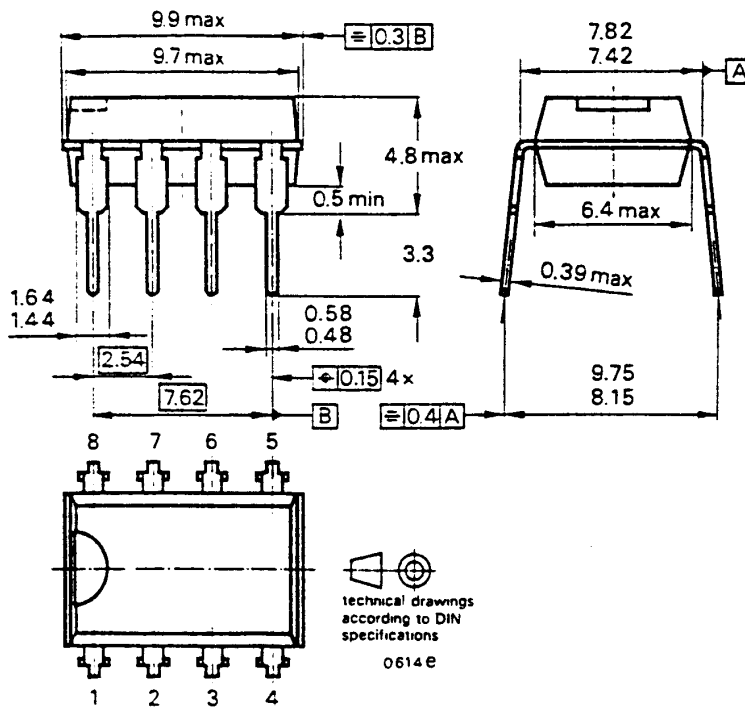
## Pin Description

Pin	Function
1	IC ground
2	Supply voltage $V_S$
3	Relay driver
4	$C_t$ oscillator

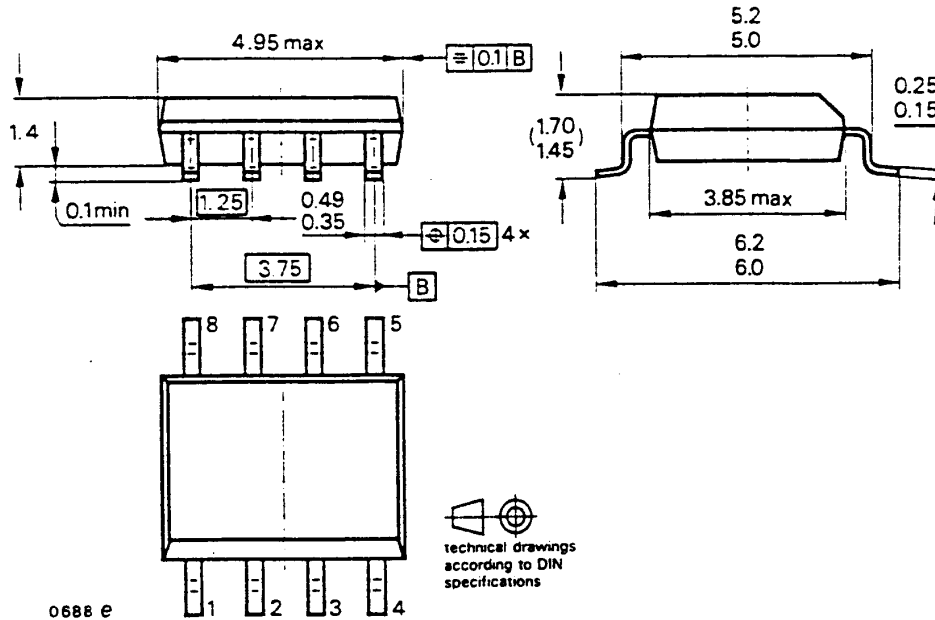
Pin	Function
5	$R_t$ oscillator
6	Supply voltage $V_S$
7	Lamp-failure detection
8	Start input (49a)

**Dimensions in mm**

Package: DIP8



Package: SO8 (SOT96A)



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2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

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