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## Features

- Temperature and Supply Voltage Compensated Flashing Frequency
- Frequency Doubling Indicates Lamp Outage
- Relay Driver Output with High Current Carrying Capacity and Low Saturation Voltage
- Minimum Lamp Load for Flasher Operation:  $\geq 1$  W
- Very Low Susceptibility to EMI
- Protection According to ISO/TR 7637/1 Level 4



## 1. Description

The bipolar integrated circuit U6043B is used in relay-controlled automotive flashers where a high level EMC is required.

Lamp outage is indicated by frequency doubling during hazard warning as well as direction mode.



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**Flasher IC with  
18-m $\Omega$  Shunt**

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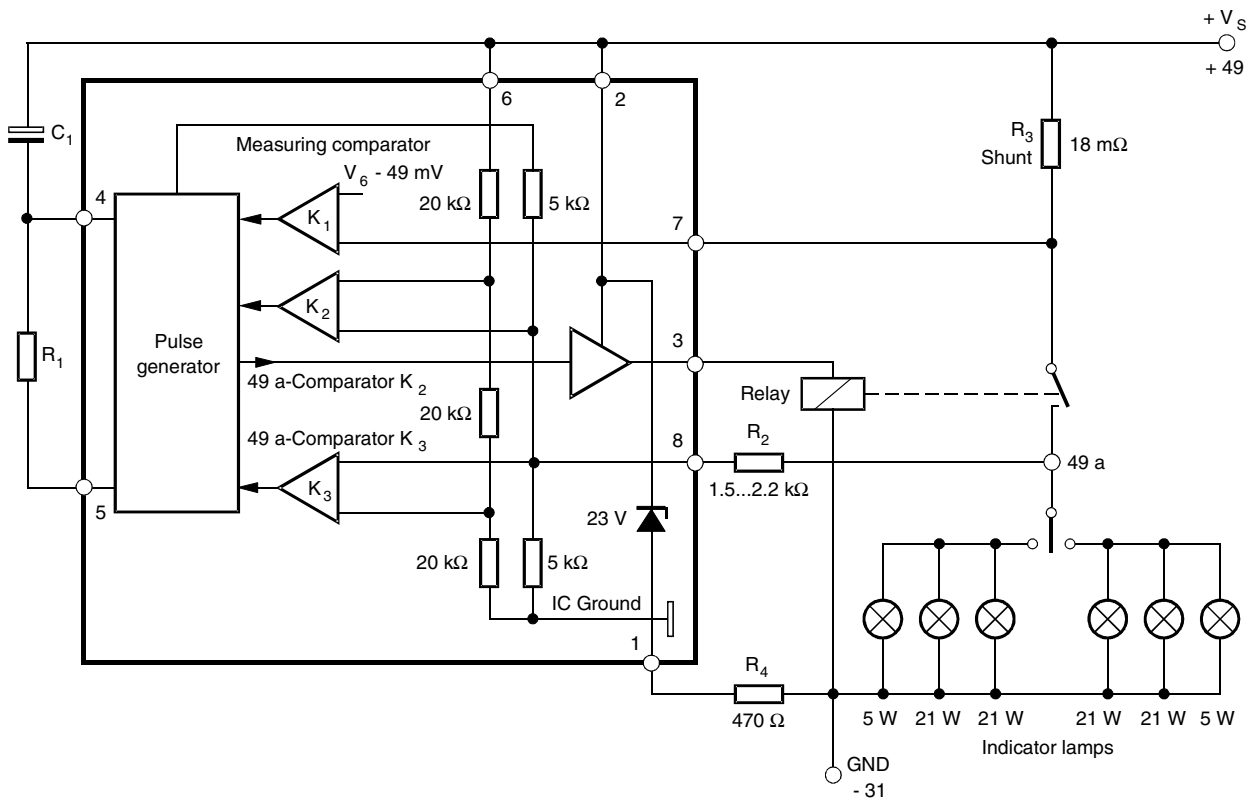
**U6043B**

Rev. 4726B-AUTO-11/05



## 2. Block Diagram

Figure 2-1. Car Flasher Application Circuit



## 3. Pin Configuration

Figure 3-1. Pinning

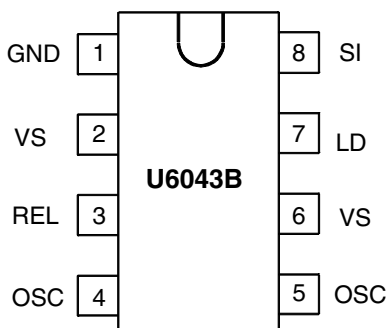


Table 3-1. Pin Description

Pin	Symbol	Function
1	GND	IC ground
2	VS	Supply voltage
3	REL	Relay driver
4	OSC	Oscillator
5	OSC	Oscillator
6	VS	Supply voltage, Sense
7	LD	Lamp outage detection
8	SI	Start input (49a)

## 4. Functional Description

### 4.1 Pin 1, GND

The U6043B is protected against damage in case of battery reversal via resistor  $R_4$  to ground (-31). An integrated protection circuit together with external resistances  $R_2$  and  $R_4$  limits the current pulses in the IC.

### 4.2 Pin 2, Supply Voltage, $V_S$ power

The arrangement of the supply connections to Pin 2 (and 6) must be so as to ensure that on the connection printed circuit board (PCB), the resistance of  $V_S$  to Pin 6 is lower than that to Pin 2.

### 4.3 Pin 3, Relay Control Output (Driver)

The relay control output is a high-side driver with a low saturation voltage. It is capable of driving a typical automotive relay with a minimum coil resistance of  $60 \Omega$ .

#### 4.4 Pin 4 and 5, Oscillator

The flashing frequency,  $f_1$ , is determined by the  $R_1C_1$  components as given by the following formula below (see [Figure 2-1](#)):

$$f_1 \approx \frac{1}{R_1 \times C_1 \times 1,5} \text{ Hz}$$

where  $C_1 \leq 47 \mu\text{F}$ ,  $R_1 = 6.8 \text{ k}\Omega$  to  $510 \text{ k}\Omega$

In case of a lamp outage (see Pin 7) the oscillator frequency is switched to the lamp outage frequency  $f_2$  with  $f_2 \approx 2.2 \times f_1$ .

Duty cycle in normal flashing mode: 50%

Duty cycle in lamp outage mode: 40% (bright phase)

#### 4.5 Pin 6, Supply Voltage, Sense

For accurate monitoring via the shunt resistor, a minimized layer resistance from point  $V_S$ /shunt to Pin 6 is recommended.

#### 4.6 Pin 7, Lamp Outage Detection

The lamp current is monitored via an external shunt resistor  $R_{sh}$  and an internal comparator K1 with its reference voltage of typically 49 mV ( $V_S = 12 \text{ V}$ ). The outage of one lamp is detected according to the following calculation:

Nominal current of 1 lamp:  $21 \text{ W}/(V_S = 12 \text{ V})$ :  $I_{lamp} = 1.75 \text{ A}$

Nominal current of 2 lamps:  $2 \times 21 \text{ W}/(V_S = 12 \text{ V})$ :  $I_{lamp} = 3.5 \text{ A}$

We recommend setting the detection threshold in the middle of the current range:

$$I_{outage} \approx 2.7 \text{ A}$$

Thus, the shunt resistor is calculated as:

$$R_{sh} = V_T (K1)/I_{outage}$$

$$R_{sh} = 49 \text{ mV}/2.7 \text{ A} = 18 \text{ m}\Omega$$

Comparator K1's reference voltage is matched to the characteristics of filament lamps (see "Control Signal Threshold" in the data part).

The combination of shunt resistor and resistance of wire harness prevents Pin 7 from a too high voltage in case of shorted lamps.

#### 4.7 Pin 8, Start Input

Start condition for flashing: the voltage at Pin 8 has to be below the K3 threshold (flasher switch closed).

Humidity and dirt may decrease the resistance between 49 a and GND. If this leakage resistance is  $> 5 \text{ k}\Omega$ , the IC is still kept in the off-condition. In this case the voltage at Pin 8 is between the thresholds of comparators K2 and K3.

During the bright phase the voltage at Pin 8 is above the K2 threshold, during the dark phase it is below the K3 threshold. For proper start conditions a minimum lamp wattage of 1 W is required.

## 5. Absolute Maximum Ratings

Reference point Pin 1

Parameters		Symbol	Value	Unit
Supply voltage	Pin 2 and 6	$V_S$	16.5	V
<b>Surge Forward Current</b>				
$t_p = 0.1$ ms	Pin 2 and 6	$I_{FSM}$	1.5	A
$t_p = 300$ ms	Pin 2 and 6	$I_{FSM}$	1.0	A
$t_p = 300$ 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 +150	$^\circ\text{C}$

## 6. Thermal Resistance

Parameters		Symbol	Value	Unit
Junction ambient	DIP8	$R_{thJA}$	110	K/W
	SO8	$R_{thJA}$	160	K/W

## 7. Electrical Characteristics

Typical values under normal operation in application circuit (see [Figure 2-1](#)),  $V_S$  (+49, Pin 2 and 6) = 12 V.

Reference point ground (-31),  $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified.

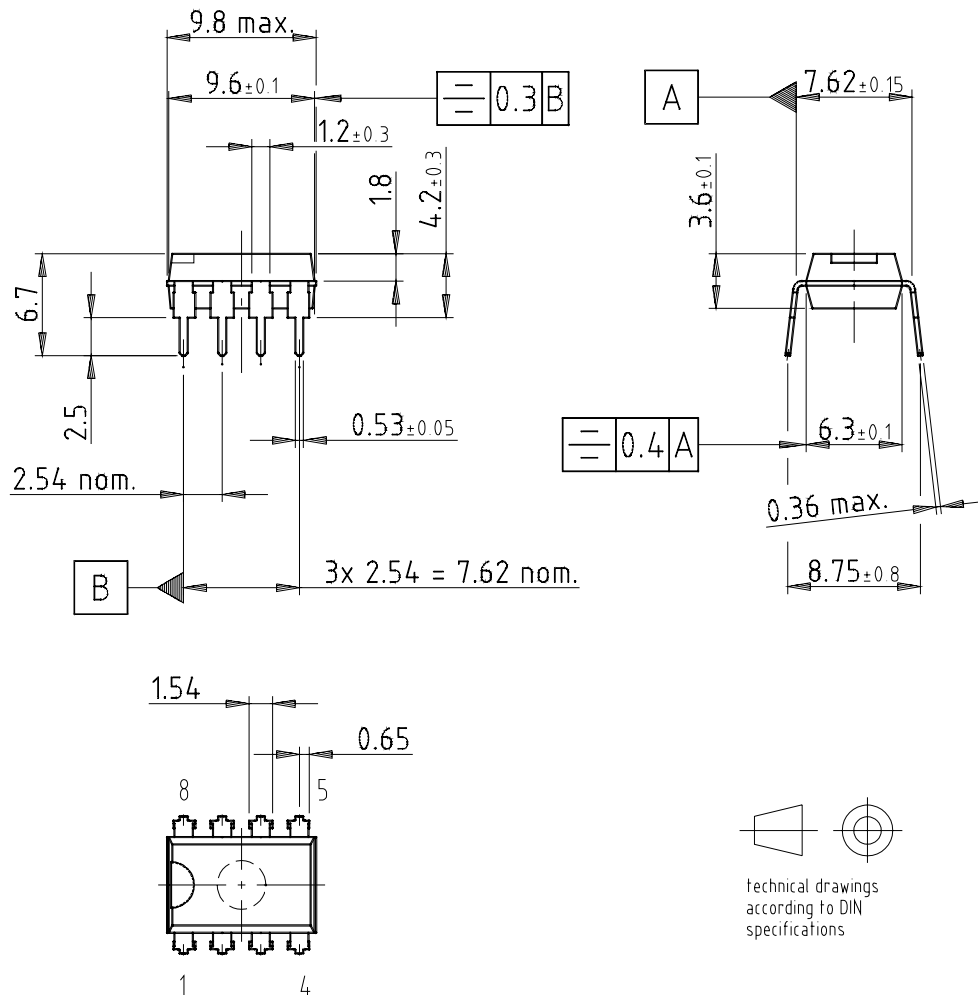
Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 2 and 6	$V_S$	9		15	V
Supply current	Dark phase, Pin 2 and 6 Bright phase, Pin 2 and 6	$I_S$ $I_S$		4.5 7.0	8 11	mA mA
Relay control output: Saturation voltage Reverse current	Pin 3 $I_O = 150$ mA, $V_S = 9$ V	$V_O$ $I_O$			1.0 0.1	V mA
Start delay (Delay time)	First bright phase	$t_{on}$			10	ms
Frequency tolerance	Normal flashing	$\Delta f_1$	-5		+5	%
Bright period	Basic frequency $f_1$ Control frequency $f_2$	$\Delta f_1$ $\Delta f_2$	47 37		53 45	% %
Frequency increase	Lamp outage	$f_2$	$2.15 \times f_1$		$2.3 \times f_1$	Hz
Control signal threshold	$V_S = 15$ V, Pin 7 $V_S = 9$ V, Pin 7 $V_S = 12$ V, Pin 7	$V_{RS}$ $V_{RS}$ $V_{RS}$	50 43 47	53 45 49	57 47 51	mV mV mV
Leakage resistance	49a to GND	$R_P$		4	5	k $\Omega$
Lamp load		$P_L$	1			W

## 8. Ordering Information

Extended Type Number	Package	Remarks
U6043B-MY	DIP8	Pb-free
U6043B-MFPY	SO8	Tubed, Pb-free
U6043B-MFPG3Y	SO8	Taped and reeled, Pb-free

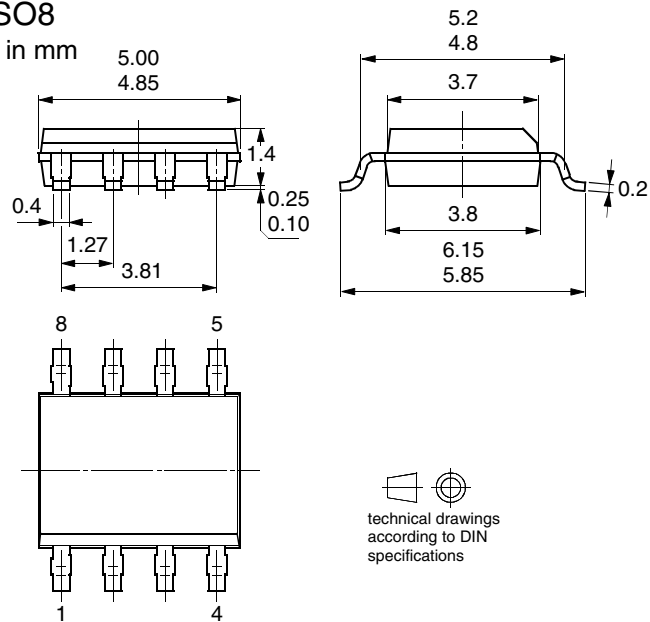
## 9. Package Information

Package: DIP 8  
Dimensions in mm



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

Package SO8  
Dimensions in mm



## 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
4726B-AUTO-11/05	<ul style="list-style-type: none"> <li>• Put datasheet in a new template</li> <li>• First page: Pb-free logo added</li> <li>• Page 6: Ordering Information changed</li> </ul>



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