

## 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:  $\geq 1\text{ W}$
- Very Low Susceptibility to EMI
- Protection According to ISO/TR 7637/1 Level 4

## Description

The bipolar integrated circuit U643B is used in relay-controlled automotive flashers where a high-level EMC is required.

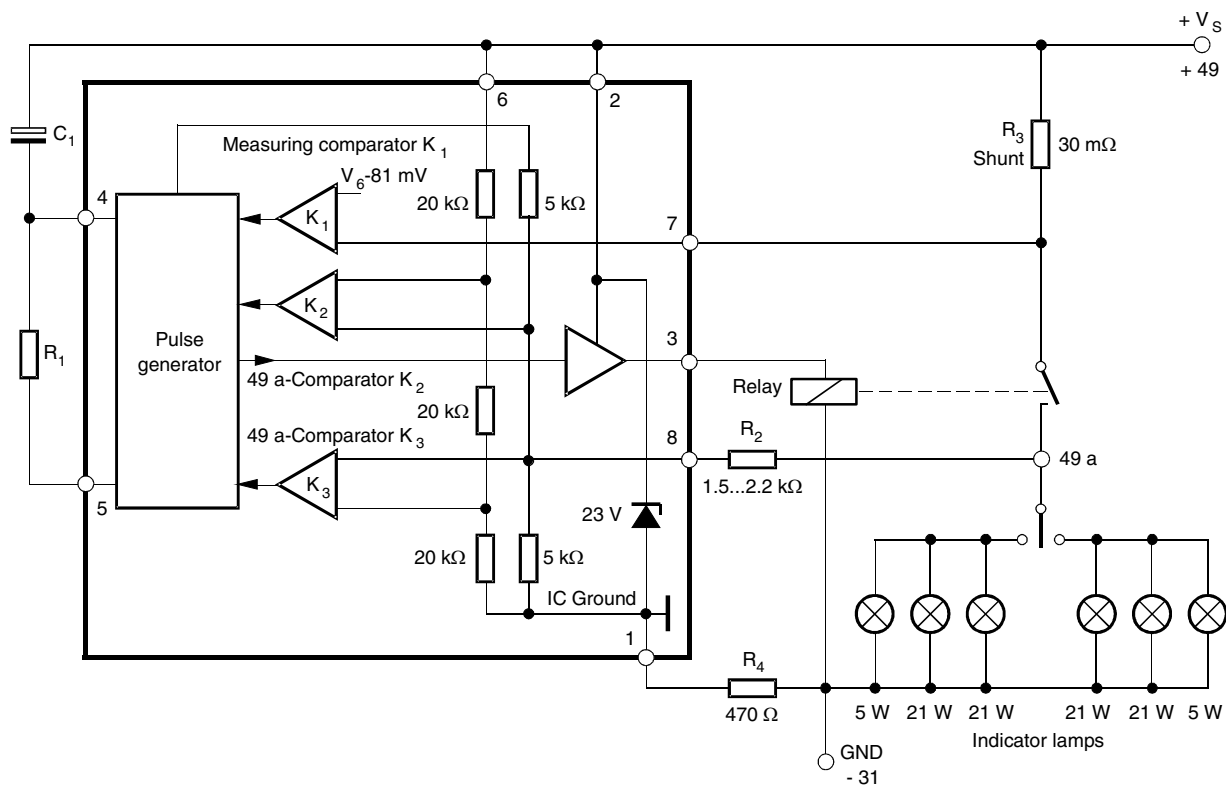
Lamp outage is indicated by frequency doubling during hazard warning as well as direction mode.



**Flasher IC with  
30-mΩ Shunt**

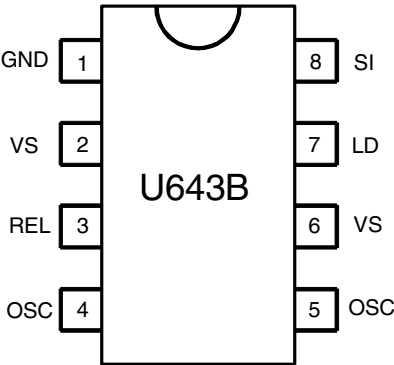
**U643B**

**Figure 1.** Car Flasher Application Circuit, Resistor R<sub>1</sub> and R<sub>2</sub>: 1/4 Watt  
R<sub>4</sub> for Protection Against Continuous Reversed Polarity: 0.5 Watt



Pin Configuration

Figure 2. Pinning



Pin Description

| Pin | Symbol | Function               |
|-----|--------|------------------------|
| 1   | GND    | IC ground              |
| 2   | VS     | Supply voltage $V_S$   |
| 3   | REL    | Relay driver           |
| 4   | OSC    | $C_1$ Oscillator       |
| 5   | OSC    | $R_1$ Oscillator       |
| 6   | VS     | Supply voltage $V_S$   |
| 7   | LD     | Lamp failure detection |
| 8   | SI     | Start input (49a)      |

## Functional Description

### Pin 1, GND

The U643B 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.

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

The arrangement of the supply connections to Pin 2 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.

### 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  $\Omega$ .

### Pin 4 and 5, Oscillator

The flashing frequency,  $f_1$ , is determined by the  $R_1C_1$  components as given by the formula below (see Figure 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)

### 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.

### Pin 7, Lamp Outage Detection

The lamp current is monitored via an external shunt resistor  $R_3$  and an internal comparator K1 with its reference voltage of typ. 81 mV ( $V_S = 12 \text{ V}$ ). The outage of one lamp is detected according to the following calculation:

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

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

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

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

Thus, the shunt resistor is calculated as:

$R_3 = V_T (K1)/I_{\text{outage}}$

$R_3 = 81 \text{ mV}/2.7 \text{ A} = 30 \text{ m}\Omega$

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 the case of shorted lamps.

## Pin 8, Start Input

Start condition for flashing: the voltage at Pin 8 has to be below 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 still remains 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.

## 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> |             |           |             |                  |
| $t_P = 0.1 \text{ ms}$       | Pin 2 and 6 | $I_{FSM}$ | 1.5         | A                |
| $t_P = 300 \text{ ms}$       | Pin 2 and 6 | $I_{FSM}$ | 1.0         | A                |
| $t_P = 300 \text{ ms}$       | Pin 8       | $I_{FSM}$ | 50          | mA               |
| Output current               | Pin 3       | $I_O$     | 0.3         | A                |
| <b>Power Dissipation</b>     |             |           |             |                  |
| $T_{amb} = 95^\circ\text{C}$ | DIP 8       | $P_{tot}$ | 420         | mW               |
|                              | SO8         | $P_{tot}$ | 340         | mW               |
| $T_{amb} = 60^\circ\text{C}$ | DIP 8       | $P_{tot}$ | 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 | $^\circ\text{C}$ |

## Thermal Resistance

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

## Electrical Characteristics

Typical values under normal operation in application circuit (see Figure 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   | $V_S$ (+49)  |            | 9 to 15 |           | V          |
| Supply current                      | Pin 2 and 6   | $I_S$        |            | 4.5     | 8         | mA         |
|                                     | Dark phase  |              |            | 7.0     | 11        | mA         |
| Relay output:<br>Saturation voltage | Pin 3<br>$I_O = 150\text{ mA}$ , $V_S = 9\text{ V}$<br>with resistance = $60\ \Omega$ | $V_O$        |            |         | 1.0       | V          |
| Reverse current                     |   | $I_O$        |            |         | 0.1       | mA         |
| Start delay                         | First bright phase  | $t_{on}$     |            |         | 10        | ms         |
| Frequency tolerance                 |   | $\delta f_1$ | -5         |         | +5        | %          |
| Bright period                       | Basic frequency $f_1$   | $\Delta f_1$ | 47         |         | 53        | %          |
|                                     | Control frequency $f_2$   | $\Delta f_2$ | 37         |         | 45        | %          |
| Frequency increase                  | Lamp outage   | $f_2$        | $2.15 f_1$ |         | $2.3 f_1$ | Hz         |
| 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         |
| Leakage resistance                  | 49a to GND  | $R_P$        |            | 4       | 5         | k $\Omega$ |
| Lamp load                           |   | $P_L$        | 1          |         |           | W          |

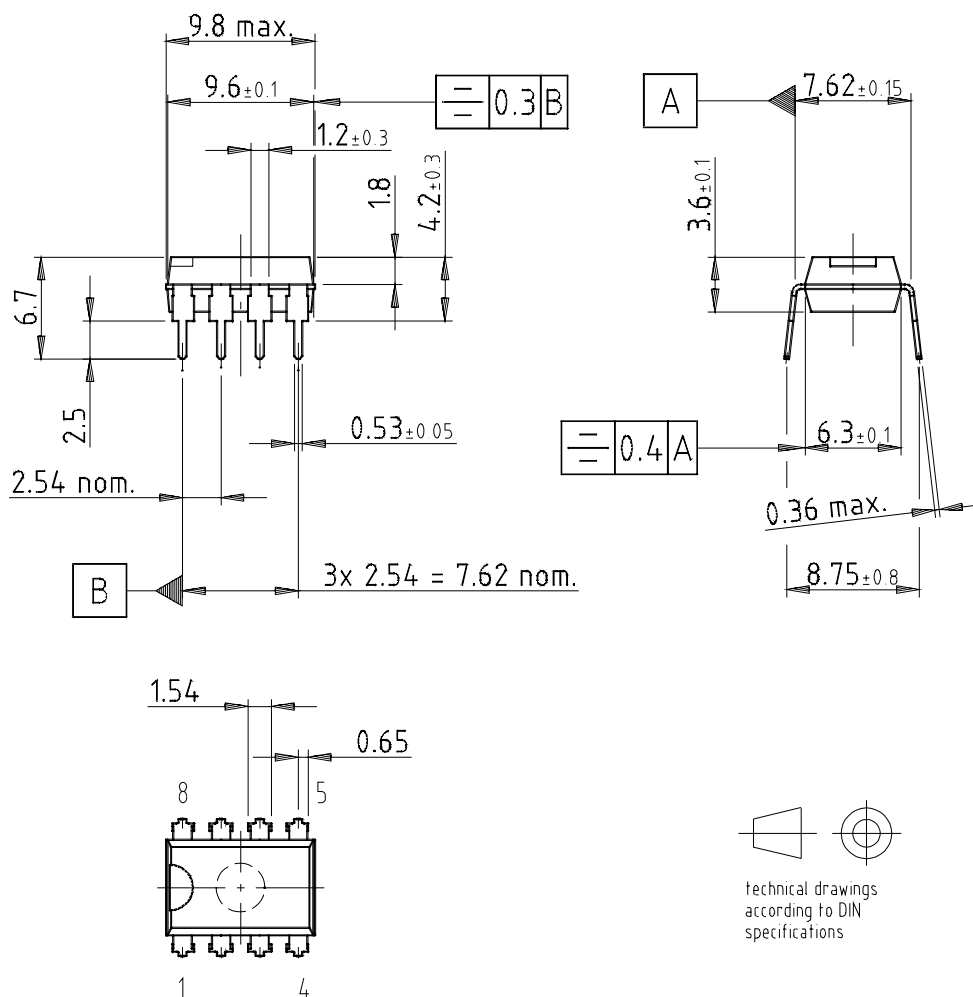
## Ordering Information

| Extended Type Number | Package | Remarks |
|----------------------|---------|---------|
| U643B                | DIP8    | –       |
| U643B-FP             | SO8     | –       |

## Package Information

### DIP8

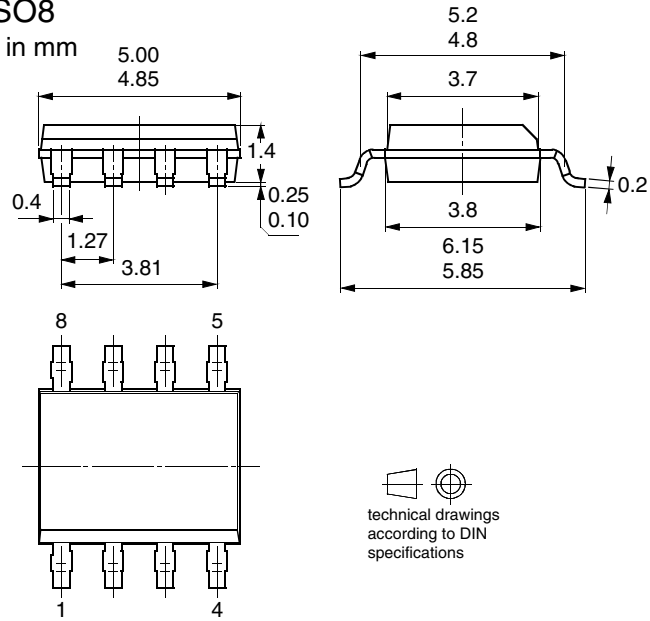
Package: DIP 8  
Dimensions in mm



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

# SO8

## Package SO8 Dimensions in mm







## Atmel Corporation

2325 Orchard Parkway  
San Jose, CA 95131  
Tel: 1(408) 441-0311  
Fax: 1(408) 487-2600

## Regional Headquarters

### Europe

Atmel Sarl  
Route des Arsenaux 41  
Case Postale 80  
CH-1705 Fribourg  
Switzerland  
Tel: (41) 26-426-5555  
Fax: (41) 26-426-5500

### Asia

Room 1219  
Chinachem Golden Plaza  
77 Mody Road Tsimshatsui  
East Kowloon  
Hong Kong  
Tel: (852) 2721-9778  
Fax: (852) 2722-1369

### Japan

9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
Tel: (81) 3-3523-3551  
Fax: (81) 3-3523-7581

## Atmel Operations

### Memory

2325 Orchard Parkway  
San Jose, CA 95131  
Tel: 1(408) 441-0311  
Fax: 1(408) 436-4314

### Microcontrollers

2325 Orchard Parkway  
San Jose, CA 95131  
Tel: 1(408) 441-0311  
Fax: 1(408) 436-4314

La Chantrerie  
BP 70602  
44306 Nantes Cedex 3, France  
Tel: (33) 2-40-18-18-18  
Fax: (33) 2-40-18-19-60

### ASIC/ASSP/Smart Cards

Zone Industrielle  
13106 Rousset Cedex, France  
Tel: (33) 4-42-53-60-00  
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906  
Tel: 1(719) 576-3300  
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park  
Maxwell Building  
East Kilbride G75 0QR, Scotland  
Tel: (44) 1355-803-000  
Fax: (44) 1355-242-743

### RF/Automotive

Theresienstrasse 2  
Postfach 3535  
74025 Heilbronn, Germany  
Tel: (49) 71-31-67-0  
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906  
Tel: 1(719) 576-3300  
Fax: 1(719) 540-1759

### Biometrics/Imaging/Hi-Rel MPU/

### High Speed Converters/RF Datacom

Avenue de Rochepleine  
BP 123  
38521 Saint-Egreve Cedex, France  
Tel: (33) 4-76-58-30-00  
Fax: (33) 4-76-58-34-80

---

### e-mail

[literature@atmel.com](mailto:literature@atmel.com)

### Web Site

<http://www.atmel.com>

**Disclaimer:** Atmel Corporation makes no warranty for the use of its products, other than those expressly contained in the Company's standard warranty which is detailed in Atmel's Terms and Conditions located on the Company's web site. The Company assumes no responsibility for any errors which may appear in this document, reserves the right to change devices or specifications detailed herein at any time without notice, and does not make any commitment to update the information contained herein. No licenses to patents or other intellectual property of Atmel are granted by the Company in connection with the sale of Atmel products, expressly or by implication. Atmel's products are not authorized for use as critical components in life support devices or systems.

© Atmel Corporation 2003. All rights reserved.

Atmel® and combinations thereof are the registered trademarks of Atmel Corporation or its subsidiaries.

Other terms and product names may be the trademarks of others.



Printed on recycled paper.