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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## Features

- Temperature and Voltage Compensated Frequency
- Warning Indication of Lamp Failure by Means of Frequency Doubling
- Minimum Lamp Load for Flasher Operation  $\geq 10\text{W}$
- Relay Output with High Current Carrying Capacity and Low Saturation Voltage
- Low Susceptibility to EMI

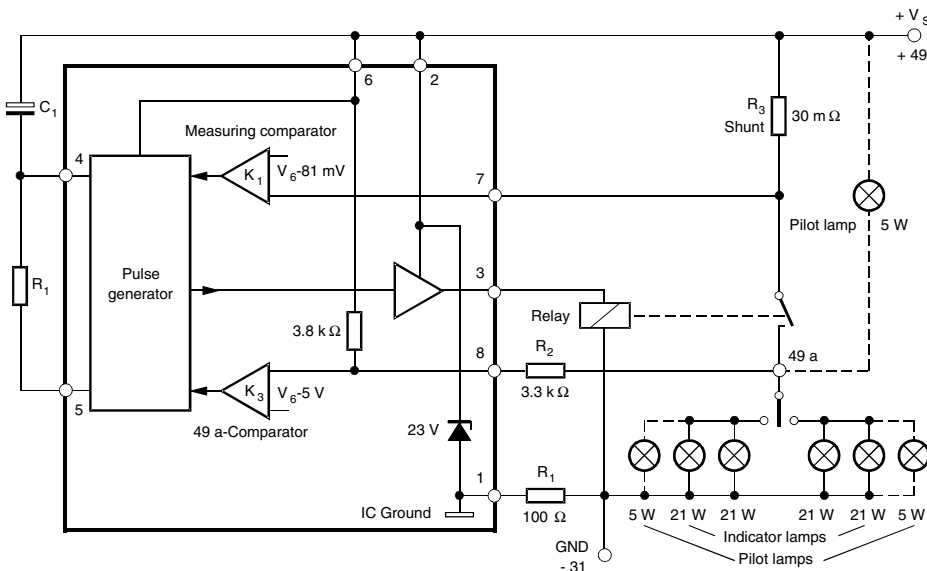


Flasher, 30 m $\Omega$   
Shunt, Pilot  
Lamp to GND or  
 $V_{\text{Batt}}$

## 1. Description

The integrated circuit U2043B is used in relay-controlled automotive flashers where a high EMC level is required. A lamp outage is indicated by frequency doubling during hazard mode as well as direction mode. The pilot lamp can be connected either to  $V_{\text{Batt}}$  or GND.

Figure 1-1. Block Diagram



## 2. Pin Configuration

Figure 2-1. Pinning DIP8/SO8

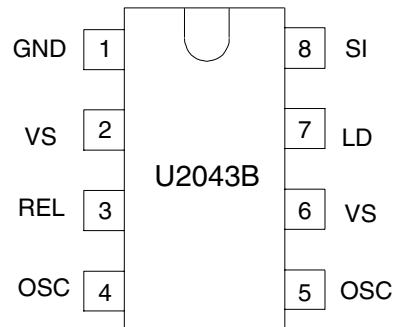


Table 2-1. Pin Description

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)

### 3. Functional Description

#### 3.1 GND (Pin 1)

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

#### 3.2 Supply Voltage, $V_S$ Power (Pin 2)

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.

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

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

#### 3.4 Oscillator (Pin 4 and 5)

Flashing frequency,  $f_1$ , is determined by the  $R_1C_1$  components as follows (see [Figure 1-1 on page 1](#)):

$$f_1 = \frac{1}{R_1 \times C_1 \times 1.5} \text{ Hz}$$

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

In the 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)

#### 3.5 Supply Voltage, Sense (Pin 6)

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

### 3.6 Lamp Outage Detection (Pin 7)

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

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

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

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

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

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 section "Control Signal Threshold").

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

### 3.7 Start Input (Pin 8)

Start condition for flashing:

The voltage at pin 8 has to be less than  $V_S - 5V$  (flasher switch closed).

Humidity and dirt may decrease the resistance between 49a and GND. If this leakage resistance is  $> 5 \text{ k}\Omega$  the IC is still kept in its off-condition. In this case the voltage at pin 8 is greater than  $V_S - 5V$ .

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 10W is required.



## 4. 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 1

Parameters	Symbol	Value	Unit
Supply voltage, pins 2 and pin 6	$V_S$	16.5	V
Surge forward current			
$t_p = 0.1$ ms	$I_{FSM}$	1.5	A
$t_p = 2$ ms	$I_{FSM}$	1.0	A
$t_p = 2$ ms	$I_{FSM}$	50	mA
Output current, pin 3	$I_O$	0.3	A
Power Dissipation			
$T_{amb} = 95^\circ\text{C}$ , DIP8 SO8	$P_{tot}$	420	mW
	$P_{tot}$	340	mW
$T_{amb} = 60^\circ\text{C}$ , DIP8 SO8	$P_{tot}$	690	mW
	$P_{tot}$	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	$^\circ\text{C}$

## 5. Thermal Resistance

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

## 6. Electrical Characteristics

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

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pins 2, 6	$V_S(+49)$		9 to 15		V
Supply current	Dark phase or stand-by, pins 2, 6	$I_S$		4.5	8	mA
Supply current	Bright phase, pins 2, 6	$I_S$		7.0	11	mA
Relay output	Saturation voltage $I_O = 150$ mA, $V_S = 9$ 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	$t_{on}$			10	ms
Frequency determining resistor		$R_1$	6.8		510	k $\Omega$
Frequency determining capacitor		$C_1$			47	$\mu\text{F}$
Frequency tolerance	Normal flashing, basic frequency $f_1$ not including the tolerance of the external components $R_1$ and $C_1$	$\Delta f_1$	-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	$f_2$	$2.15 \times f_1$		$2.3 \times f_1$	Hz
Control signal threshold	$V_S = 15$ V (pin 7)	$V_{R3}$	85	91	97	mV
	$V_S = 9$ V	$V_{R3}$	66	71	76	mV
	$V_S = 12$ V	$V_{R3}$	76	81	87	mV
Leakage resistance	49a to GND	$R_p$		2	5	k $\Omega$
Lamp load		$P_L$	10			W

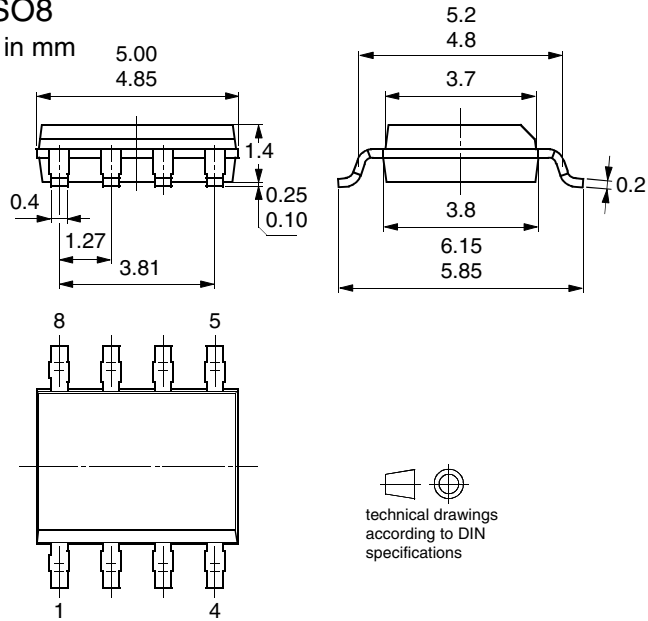
## 7. Ordering Information

Extended Type Number	Package	Remarks
U2043B-MY	DIP8	Tubed, Pb-free
U2043B-MFPY	SO8	Tubed, Pb-free
U2043B-MFPG3Y	SO8	Taped and reeled, Pb-free

## 8. Package Information

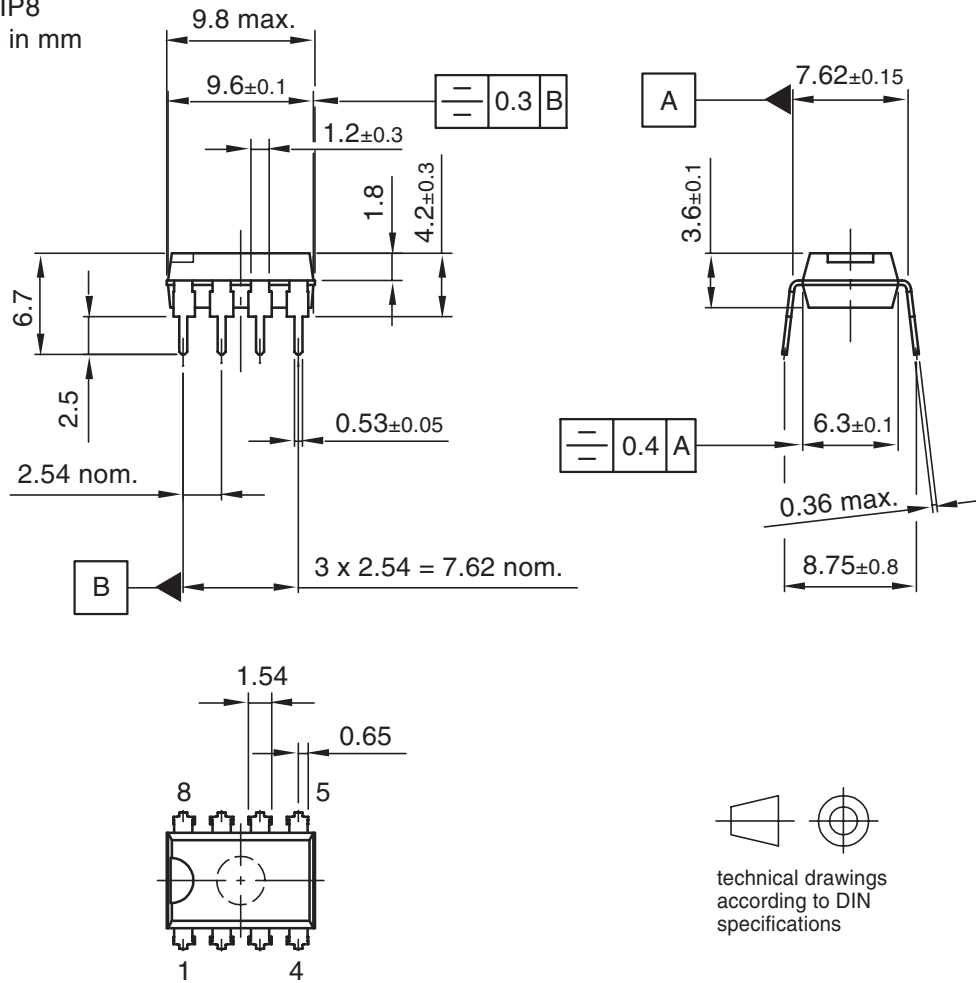
### Package SO8

Dimensions in mm





Package: DIP8  
Dimensions in mm



Drawing-No.: 6.543-5040.01-4

Issue: 1; 16.01.02

## 9. 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
4720B-AUTO-09/05	<ul style="list-style-type: none"><li>• Put datasheet in a new template</li><li>• Pb-free logo on page 1 added</li><li>• New heading rows in Table “Absolute Maximum Rating” on page 5 added</li><li>• Ordering Information on page 7 changed</li></ul>



## Atmel Corporation

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

### Microcontrollers

2325 Orchard Parkway  
San Jose, CA 95131, USA  
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, USA  
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, USA  
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

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