

## Flasher, 30-mW Shunt, Pilot Lamp to GND or V<sub>Batt</sub>

## 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  $V_{Batt}$  or GND.

## Features

- D Temperature and voltage compensated frequency
- D Warning indication of lamp failure by means of frequency doubling
- D Minimum lamp load for flasher operation w 10 W
- D Relay output with high current carrying capacity and low saturation voltage
- D Low susceptibility to EMI

## Ordering Information

Extended Type Number	Package	Remarks
U2043B	DIP8	
U2043B-FP	SO8	

## Block Diagram

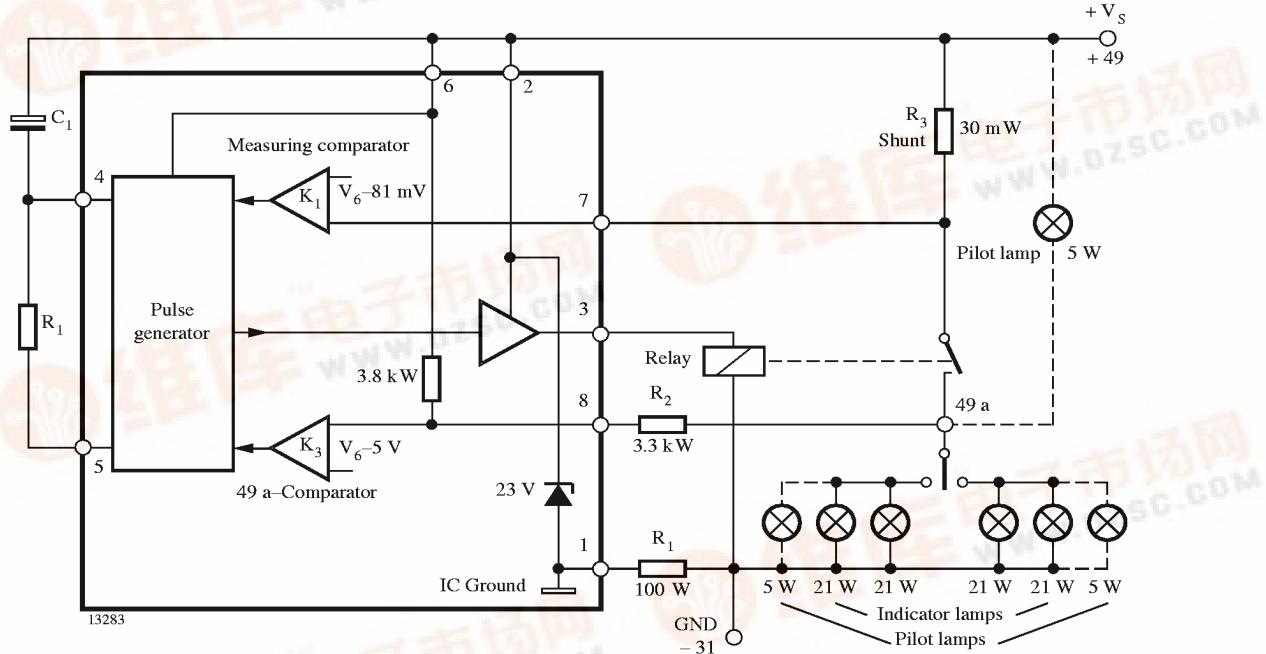
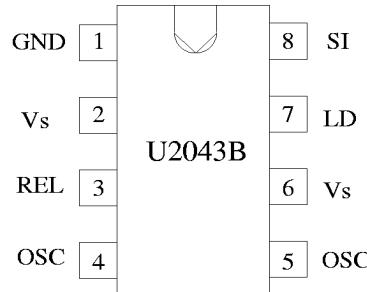


Figure 1.

## Pin Description

Pin	Symbol	Function
1	GND	IC ground
2	V <sub>S</sub>	Supply voltage V <sub>S</sub>
3	REL	Relay driver
4	OSC	C <sub>1</sub> oscillator
5	OSC	R <sub>1</sub> oscillator
6	V <sub>S</sub>	Supply voltage V <sub>S</sub>
7	LD	Lamp failure detection
8	SI	Start input (49a)



12749

Figure 2. Pinning

## Functional Description

### Pin 1, GND

The integrated circuit is protected against damage via resistor R<sub>4</sub> to ground (-31) in the case of battery reversal. An integrated protection circuit together with external resistances R<sub>2</sub> and R<sub>4</sub> limits the current pulses in the IC.

### Pin 2, Supply voltage, V<sub>S</sub> - 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<sub>S</sub> 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 and capable to drive a typical automotive relay with a minimum coil resistance of 60 W.

### Pin 4 and 5 Oscillator

Flashing frequency, f<sub>1</sub>, is determined by the R<sub>1</sub>C<sub>1</sub> components as follows (see figure 1):

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

where  $C_1 = 47 \text{ nF}$   
 $R_1 = 6.8 \text{ kW to } 510 \text{ kW}$

In the case of a lamp outage (see Pin 7) the oscillator frequency is switched to the lamp outage frequency f<sub>2</sub> with f<sub>2</sub> [ 2.2 f<sub>1</sub>.

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 mini-

mized layer resistance from point V<sub>S</sub> / shunt to Pin 6 is recommended.

### Pin 7, Lamp outage detection

The lamp current is monitored via an external shunt resistor R<sub>3</sub> and an internal comparator K1 with its reference voltage of typ. 81 mV (V<sub>S</sub> = 12 V). The outage of one lamp out of two lamps is detected according to the following calculation:

Nominal current of 1 lamp: 21 W / (V<sub>S</sub> = 12 V):

$$I_{\text{lamp}} = 1.75 \text{ A}$$

Nominal current of 2 lamps: 2 x 21 W / (V<sub>S</sub> = 12 V):

$$I_{\text{lamp}} = 3.5 \text{ A}$$

The detection threshold is recommended to be set in the middle of the current range: I<sub>outage</sub> [ 2.7 A

Thus the shunt resistor is calculated as:

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

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

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 less than V<sub>S</sub> - 5 V (flasher switch closed).

Humidity and dirt may decrease the resistance between 49 a and GND. If this leakage resistance is u 5 kW the IC is still kept in its off-condition. In this case the voltage at Pin 8 is greater than V<sub>S</sub> - 5 V.

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 10 W is required.

## Absolute Maximum Ratings

Reference point Pin 1

Parameters		Symbol	Value	Unit
Supply voltage	Pins 2, 6	$V_S$	16.5	V
Surge forward current				
$t_p = 0.1$ ms	Pins 2, 6	$I_{FSM}$	1.5	A
$t_p = 2$ ms	Pins 2, 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>				
$T_{amb} = 95^\circ C$	DIP8	$P_{tot}$	420	mW
	SO8	$P_{tot}$	340	mW
$T_{amb} = 60^\circ C$	DIP8	$P_{tot}$	690	mW
	SO8	$P_{tot}$	560	mW
Junction temperature		$T_j$	150	°C
Ambient temperature range		$T_{amb}$	-40 to +95	°C
Storage temperature range		$T_{stg}$	-55 to +150	°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 figure 1,  $V_S$  (+49, Pins 2 and 6) = 12 V.  
Reference point ground (-31),  $T_{amb} = 25^\circ C$ , unless otherwise specified

Parameters	Test Conditions / Pins	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			W
Start delay	First bright phase	$t_{on}$			10	ms
Frequency determining resistor		$R_1$	6.8		510	kW
Frequency determining capacitor		$C_1$			47	nF

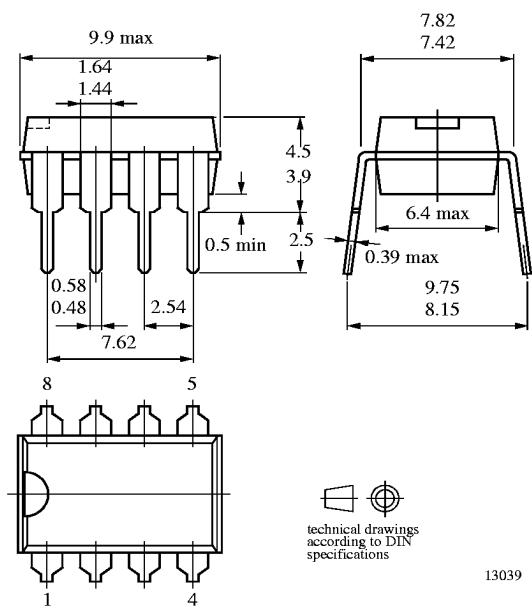
**Electrical Characteristics (continued)**

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Frequency tolerance	Normal flashing, basic frequency $f_1$ not including the tolerance of the external components $R_1$ and $C_1$	$Df_1$	-5		+5	%
Bright period	Basic frequency $f_1$	$Df_1$	47		53	%
Bright period	Control frequency $f_2$	$Df_2$	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
	$V_S = 9 \text{ V}$	$V_{R3}$	66	71	76	mV
	$V_S = 12 \text{ V}$	$V_{R3}$	76	81	87	mV
Leakage resistance	49a to GND	$R_p$		2	5	kW
Lamp load		$P_L$	10			W

## Package Information

### Package DIP8

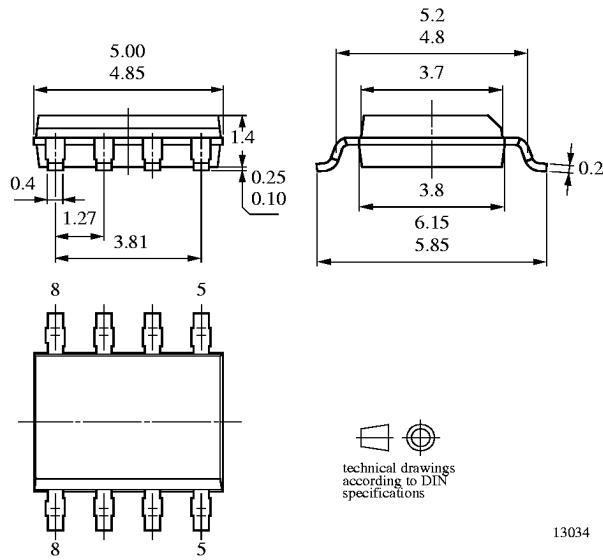
Dimensions in mm



13039

### Package SO8

Dimensions in mm



13034