Features

- **Temperature and Supply Voltage Compensated Flashing Frequency**
- **Frequency Doubling Indicates Lamp Outage**
- **Two Relay Driver Outputs with High Current-carrying Capacity and Low Saturation Voltage**
- **Minimum Lamp Load for Flasher Operation: ≥ 1 W**
- **Very Low Susceptibility to EMI**
- **Protection According to ISO/TR7637/1 Level 4**
- **Extremly Low Current Consumption < 10 µA (with Switches Open)**
- **Reverse Polarity Protection**
- **Three Control Inputs: Left, Right and Hazard Warning**

Dual Output Flasher

U2044B

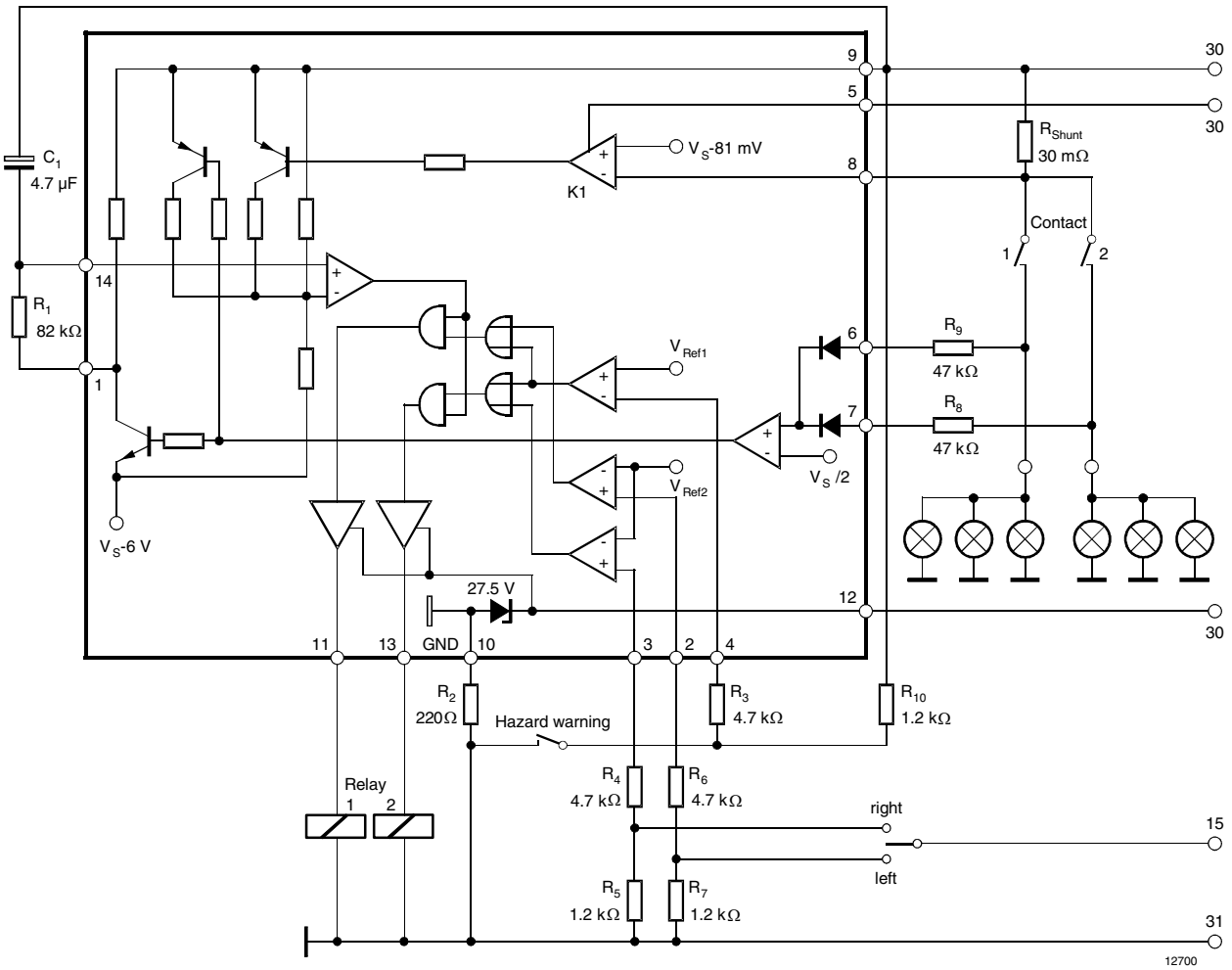
Description

The integrated circuit U2044B is used in relay-controlled automotive flashers. With two output stages, each side of the vehicle is controlled separately. A left and a right direction indicator input with only a small control current makes switch contacts for small loads possible.

The separate hazard warning input simplifies the construction of the hazard switch. Lamp outage is indicated by frequency doubling during direction mode. Thanks to extreme low current consumption the U2044B can be directly connected to the battery.

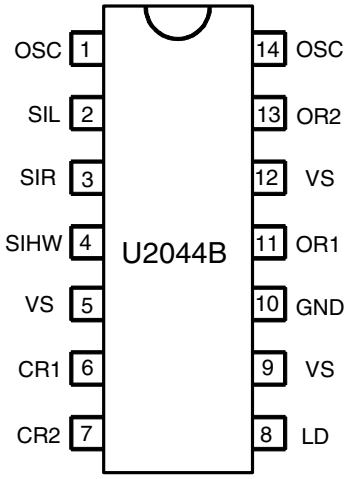
Rev. 4721A–AUTO–05/03

Figure 1. Block Diagram



Pin Configuration

Figure 2. Pinning DIP14/SO14



Pin Description

Pin	Symbol	Function
1	OSC	Oscillator
2	SIL	Start input left
3	SIR	Start input right
4	SIHW	Start input hazard warning
5	VS	V_S
6	CR1	Control input relay 1
7	CR2	Control input relay 2
8	LD	Lamp failure detection
9	VS	V_S
10	GND	IC ground
11	OR1	Output relay 1
12	VS	V_S
13	OR2	Output relay 2
14	OSC	Oscillator

Functional Description

Oscillator (Pin 1 and 14)

Flashing frequency, f_1, is determined by the R_1C_1 components as follows (see Figure 1):

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

where $C_1 \leq 47\ \mu F$
$R_1 = 6.8\ k\Omega$ to $180\ k\Omega$

In the case of a lamp outage, 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)

Start Input Right and Left (Pin 2 and 3)

Flashing is disabled as long as the input comparator is tied to GND (pull-down resistor R_7 or R_5). The high-side flasher switch left or right changes the comparator status and enables the output stage at pin 11 or Pin 13. R_6 and R_4 are protection resistors for the input stage.

With an open flasher switch the current consumption is only I < 10 µA. The IC is kept in stand-by mode until there is a voltage drop of V ≈ 6.9 V at the pull-down resistor.

Direction mode can only be activated when the ignition switch is in the ON-position as shown in Figure 1.

Start Input Hazard Warning (Pin 4)

In contrast to the direction switches, the hazard input is a low-side type. The pull-up resistor R_{10} provides the off-state. R_3 is a protection resistor for the input stage. Hazard warning can be activated independent of the ignition switch position.

Supply Voltage Sense (Pin 5)

This pin supplies the lamp outage comparator at pin 8 and is externally connected to the battery (KI 30).

Control Input Relay 1 and 2 (Pin 6 and 7)

The feedback detects the bright phase and the dark phase and enables the oscillator.

Lamp Outage Detection (Pin 8)

The lamp current is monitored via an external shunt resistor, R_{Shunt} and an internal comparator, K1, with its reference voltage of typically 81 mV (V_S = 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_S = 12 V): I_{lamp} = 1.75 A
Nominal current of 2 lamps: 2 × 21 W / (V_S = 12 V): I_{lamp} = 3.5 A

We recommend setting the detection threshhold in the middle of the current range: $I_{outage} \approx 2.7$ A

Thus the shunt resistor is calculated as:

$R_{Shunt} = V_T\ (K1)/I_{outage}$
R_{Shunt} = 81 mV/2.7 A = 30 mΩ

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 8 from a too high voltage in the case of shorted lamps.

Supply Voltage (Pin 9)

This pin supplies the oscillator, the comparators and the logic parts of the IC.

GND (Pin 10)

The integrated circuit is protected against transients according to ISO-TR 7637-3 level 3 via resistor R_2 to ground (-31). An integrated protection circuit together with external resistors R_2, R_3, R_4, R_6, R_8 and R_9 limits the current pulses in the IC. The IC is also protected against reversed battery.

Control Output Relay 1 and 2 (Pin 11 and 13)

The relay control outputs are high-side drivers with a low saturation voltage and capable of driving a typical automotive relay with a coil resistance of 60 Ω.

Supply Voltage Power (Pin 12)

This pin supplies the relay drivers connected directly to the battery (Kl 30). It is internally clamped by a 27-V Z-diode.

Absolute Maximum Ratings

Reference point pin 1

Parameters	Symbol	Value	Unit
Supply voltage, 1 min, pins 5, 9 and 12	V_S	24	V
Junction temperature	T_j	150	°C
Ambient temperature range	T_{amb}	-40 to +100	°C
Storage temperature range	T_{stg}	-55 to +150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient, DIP14	R_{thJA}	90	K/W
Junction ambient, SO14	R_{thJA}	120	K/W

Electrical Characteristics

Typical values under normal operation in application circuit Figure 1, V_S (+30) = 12 V.
Reference point ground (-31), T_{amb} = 25°C, unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pins 5, 9, 12	V_S	8		18	V
Supply current, switches open	Pins 5, 9, 12	I_S			10	µA
Output current for relay driver	Pins 11, 13	I_O			300	mA
Saturation voltage	R_L = 82 Ω V_S = 8 V V_S = 12 V	V_O			1.0 1.2	V V
Relay output reverse current	Pin 11, 13	I_O			0.1	mA
Relay coil resistance		R_L	60			Ω
Start delay	First bright phase	t_{on}			10	ms

Electrical Characteristics (Continued)

Typical values under normal operation in application circuit Figure 1, V_S (+30) = 12 V.
Reference point ground (-31), T_{amb} = 25°C, unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Control signal threshold	V_S = 9 V V_S = 13.5 V V_S = 16 V	V_S V_S V_S		70.6 85.0 93.0		mV mV mV
Tolerance of control signal threshold	V_S = 9 V to 16 V, pin 8, T_{amb} = -140°C to 100°C		-6		+6	%
Temperature coefficient of control signal threshold	V_S = 13.5 V, pin 8	T_K		10		µV/K
Clamping voltage	T_{amb} = -40°C to 100°C	V_{12}	25.0	27.5	30.0	V
Relay output overvoltage detection (relay disabled)	T_{amb} = -40°C to 100°C	V_{12}	18	20	22	V

Tolerances

Typical values under normal operation in application circuit Figure 1, V_S (+30) = 12 V.
Reference point ground (-31), T_{amb} = 25°C, unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Frequency determining resistor		R_1	6.8		510	kΩ
Frequency determining capacitor		C_1			47	µF
Frequency tolerance	Normal flashing, basic frequency f_1 not including the tolerance of the external components R_1 and C_1	Δf_1	-5		+5	%
Bright period	Basic frequency f_1	Δf_1	47		53	%
	Control frequency f_2	Δf_2	37		45	%
Frequency increase	Lamp failure	f_2	2.15 × f_1		2.3 × f_1	Hz
Lamp load		P_L	1			W

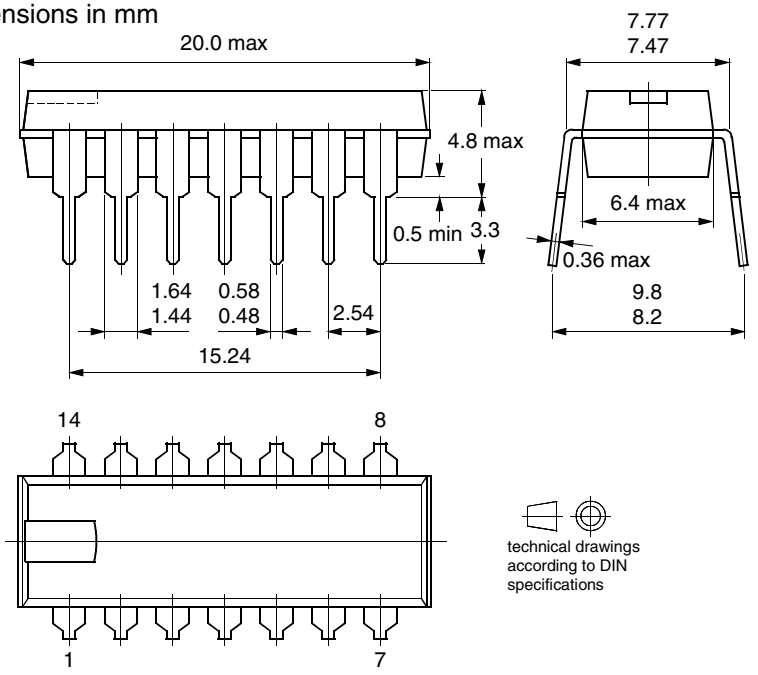
Ordering Information

Extended Type Number	Package	Remarks
U2044B	DIP14	–
U2044B-FP	SO14	–

Package Information

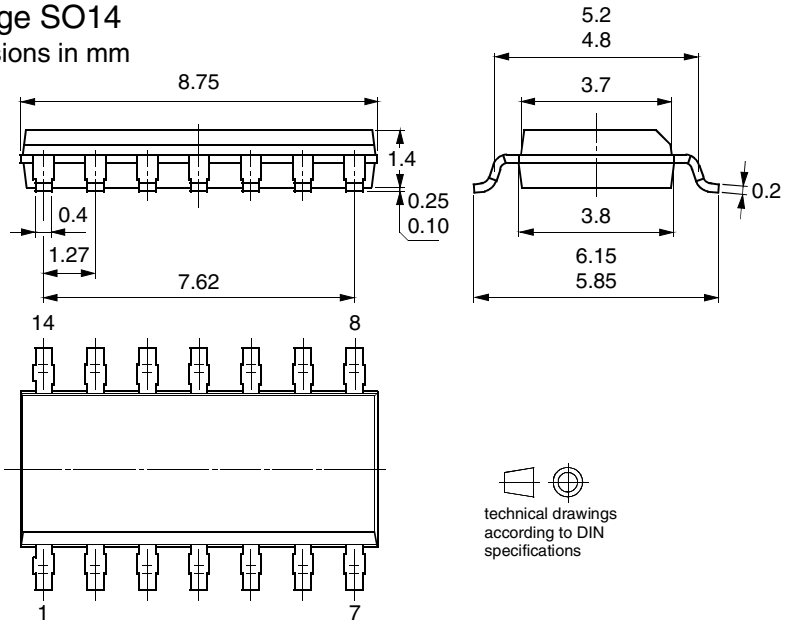
Package DIP14

Dimensions in mm



Package SO14

Dimensions in mm



Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 487-2600

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 Tsimhatsui
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

Web Site
http://www.atmel.com

4721A–AUTO–05/03 xM