
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



1. 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-m Ω Shunt**

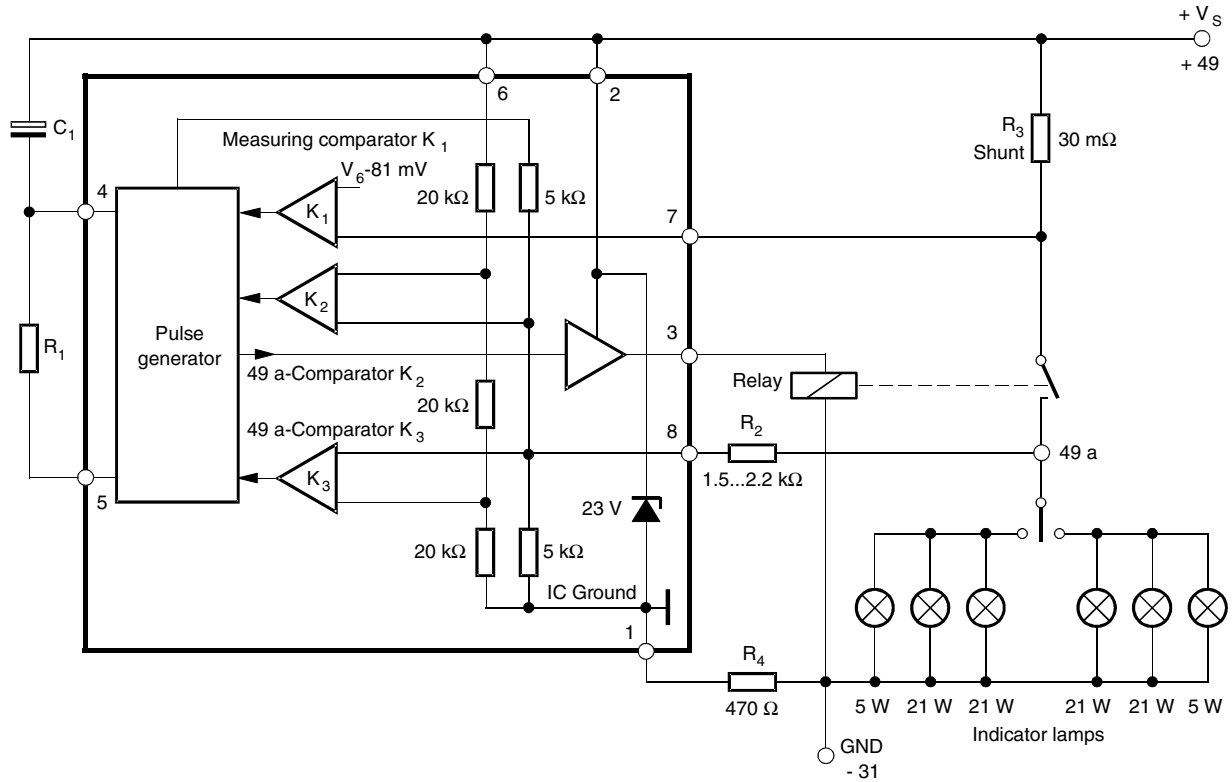
U643B

Rev. 4727B-AUTO-09/05



2. Block Diagram

Figure 2-1. Car Flasher Application Circuit, Resistor R_1 and R_2 : 0.25W; R_4 for Protection Against Continuous Reversed Polarity: 0.5W



3. Pin Configuration

Figure 3-1. Pinning

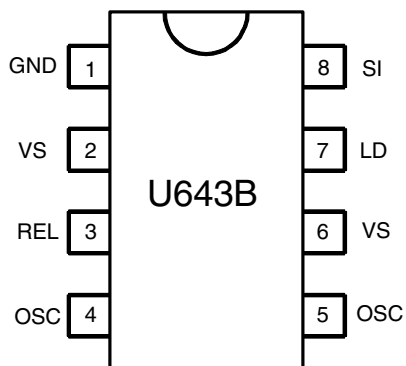


Table 3-1. Pin Description

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)

4. Functional Description

4.1 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.

4.2 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.

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 60Ω .

4.4 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 2-1 on page 2](#)):

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

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_3 and an internal comparator K1 with its reference voltage of typically 81 mV ($V_S = 12V$). The outage of one lamp is detected according to the following calculation:

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

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

The detection threshold should be set in the middle of the current range:

$I_{outage} \approx 2.7A$

Thus, the shunt resistor is calculated as:

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

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

Comparator K1's reference voltage is matched to the characteristics of filament lamps (see Control Signal Threshold in ["Electrical Characteristics" on page 6](#)).

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

4.7 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 49a 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 1W is required.

5. 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 6	V_S	16.5	V
Surge Forward Current			
$t_p = 0.1$ ms Pins 2 and 6	I_{FSM}	1.5	A
$t_p = 300$ ms Pins 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
Power Dissipation			
$T_{amb} = 95^\circ\text{C}$ 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	$^\circ\text{C}$

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 on page 2](#)), V_S (+49, pin 2 and 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 and 6	V_S (+49)		9 to 15		V
Supply current	Pins 2 and 6 Dark phase	I_S		4.5	8	mA
	Bright phase	I_S		7.0	11	mA
Relay output: Saturation voltage	Pin 3 $I_O = 150$ mA, $V_S = 9$ V with resistance = 60Ω	V_O			1.0	V
Reverse current		I_O			0.1	mA
Start delay	First bright phase	t_{on}			10	ms
Frequency tolerance		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 outage	f_2	$2.15 f_1$		$2.3 f_1$	Hz
Control signal threshold	$V_S = 15$ V, pin 7	V_{R3}	85	91	97	mV
	$V_S = 9$ V, pin 7	V_{R3}	66	71	76	mV
	$V_S = 12$ V, pin 7	V_{R3}	76	81	87	mV
Leakage resistance	49a to GND	R_P		4	5	k Ω
Lamp load		P_L	1			W

8. Ordering Information

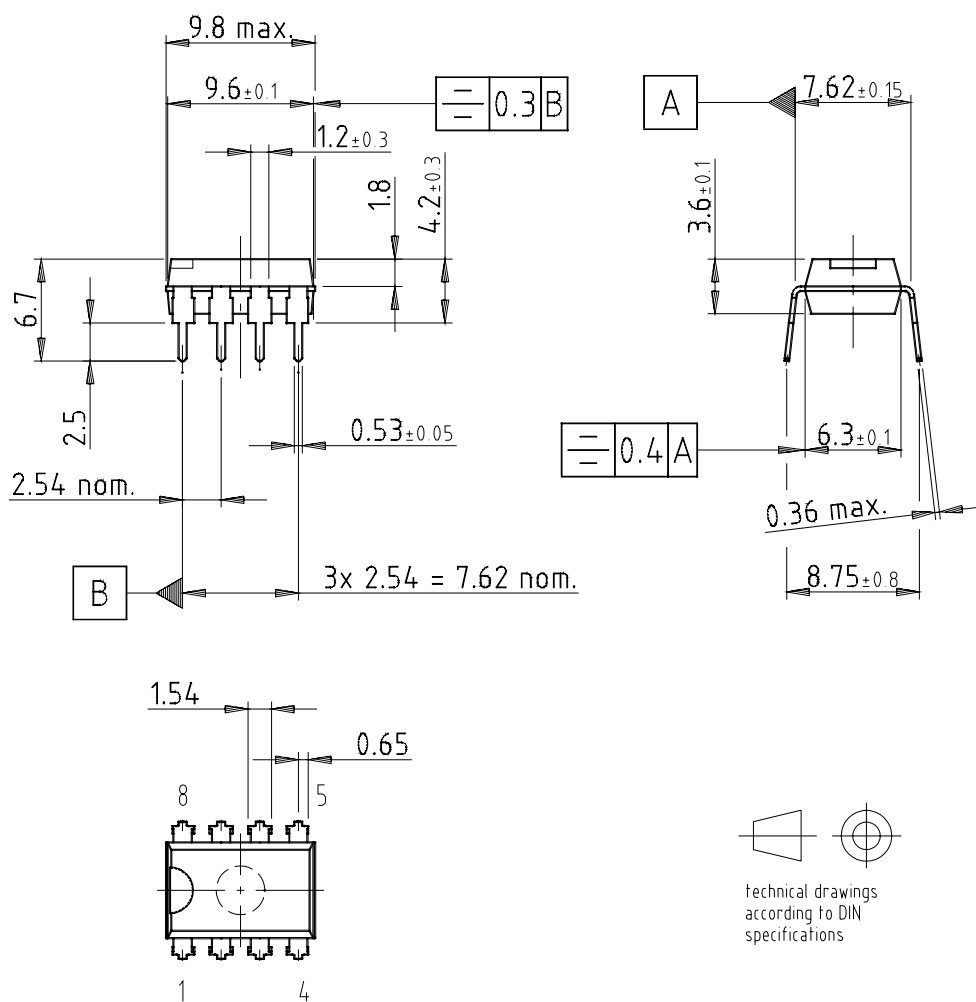
Extended Type Number	Package	Remarks
U643B-MY	DIP8	Pb-free
U643B-MFPY	SO8	Tubed, Pb-free
U643B-MFPG3Y	SO8	Taped and reeled, Pb-free

9. Package Information

9.1 DIP8

Package: DIP 8

Dimensions in mm



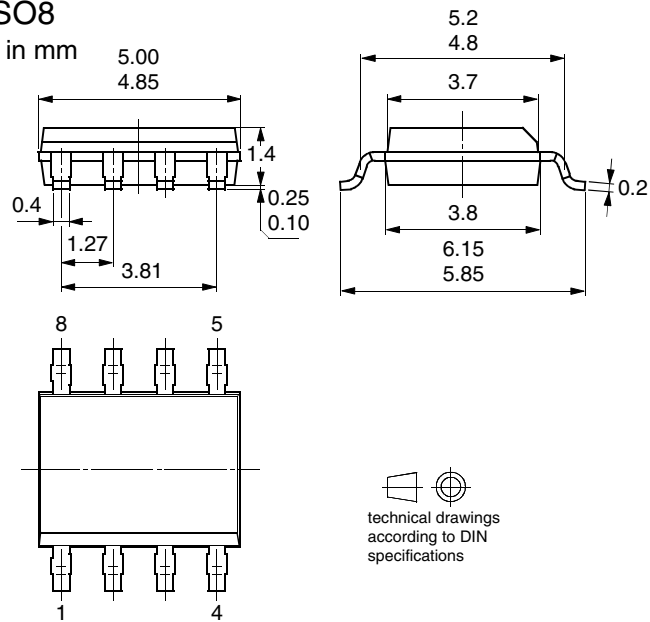
Drawing-No.: 6.543-5040.01-4

Issue: 1; 16.01.02

9.2 SO8

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
4727B-AUTO-09/05	<ul style="list-style-type: none"> • Put datasheet in a new template • Updated text to new style guide • First page: Pb-free logo added • Page 6: Ordering Information changed



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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