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: ≥ 1W**
- **Very Low Susceptibility to EMI**
- **Protection According to ISO/TR 7637/1 Level 4**

Pb Lead Free

Flasher IC with 30-mΩ Shunt

U643B

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.

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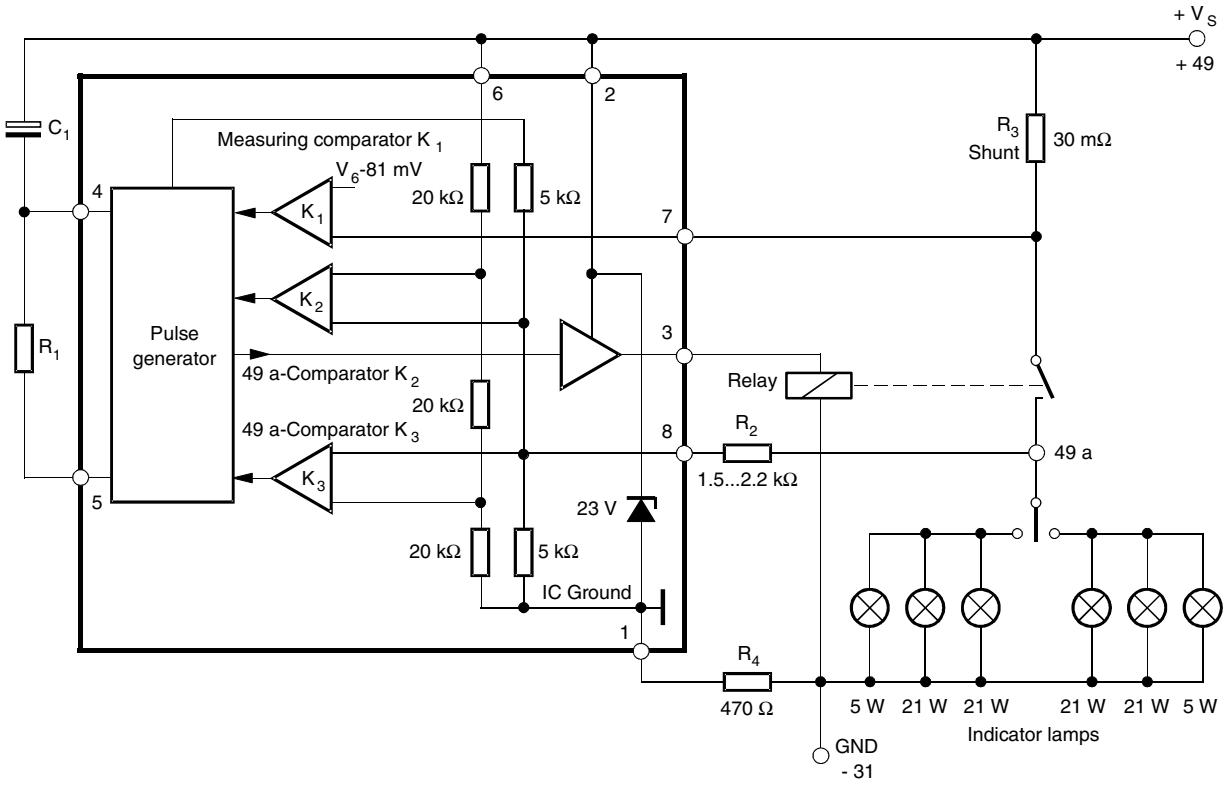
2. Block Diagram

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

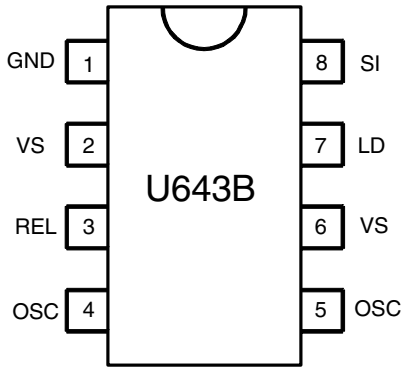


Table 3-1. Pin Description

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 $C_1 \leq 47$ µF, $R_1 = 6.8$ kΩ to 510 kΩ

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 × 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 mV/2.7A = 30 mΩ

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 kΩ, 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 t_P = 300 ms t_P = 300 ms	Pins 2 and 6 Pins 2 and 6 Pin 8	I_{FSM} I_{FSM} I_{FSM}	1.5 1.0 50	A A mA
Output current	Pin 3	I_O	0.3	A
Power Dissipation				
T_{amb} = 95°C T_{amb} = 60°C 	DIP 8 SO8 DIP 8 SO8	P_{tot} P_{tot} P_{tot} P_{tot}	420 340 690 560	mW mW mW 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

6. Thermal Resistance

Parameters		Symbol	Value	Unit
Junction ambient	DIP8 SO8	R_{thJA} R_{thJA}	110 160	K/W 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°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 Bright phase	 I_S I_S		 4.5 7.0	 8 11	 mA mA
Relay output: Saturation voltage Reverse current	Pin 3 I_O = 150 mA, V_S = 9V with resistance = 60Ω	 V_O I_O			 1.0 0.1	 V mA
Start delay	First bright phase	t_{on}			10	ms
Frequency tolerance		δf_1	–5		+5	%
Bright period	Basic frequency f_1 Control frequency f_2	Δf_1 Δf_2	47 37		53 45	% %
Frequency increase	Lamp outage	f_2	2.15 f_1		2.3 f_1	Hz
Control signal threshold	V_S = 15V, pin 7 V_S = 9V, pin 7 V_S = 12V, pin 7	V_{R3} V_{R3} V_{R3}	85 66 76	91 71 81	97 76 87	mV mV mV
Leakage resistance	49a to GND	R_P		4	5	kΩ
Lamp load		P_L	1			W

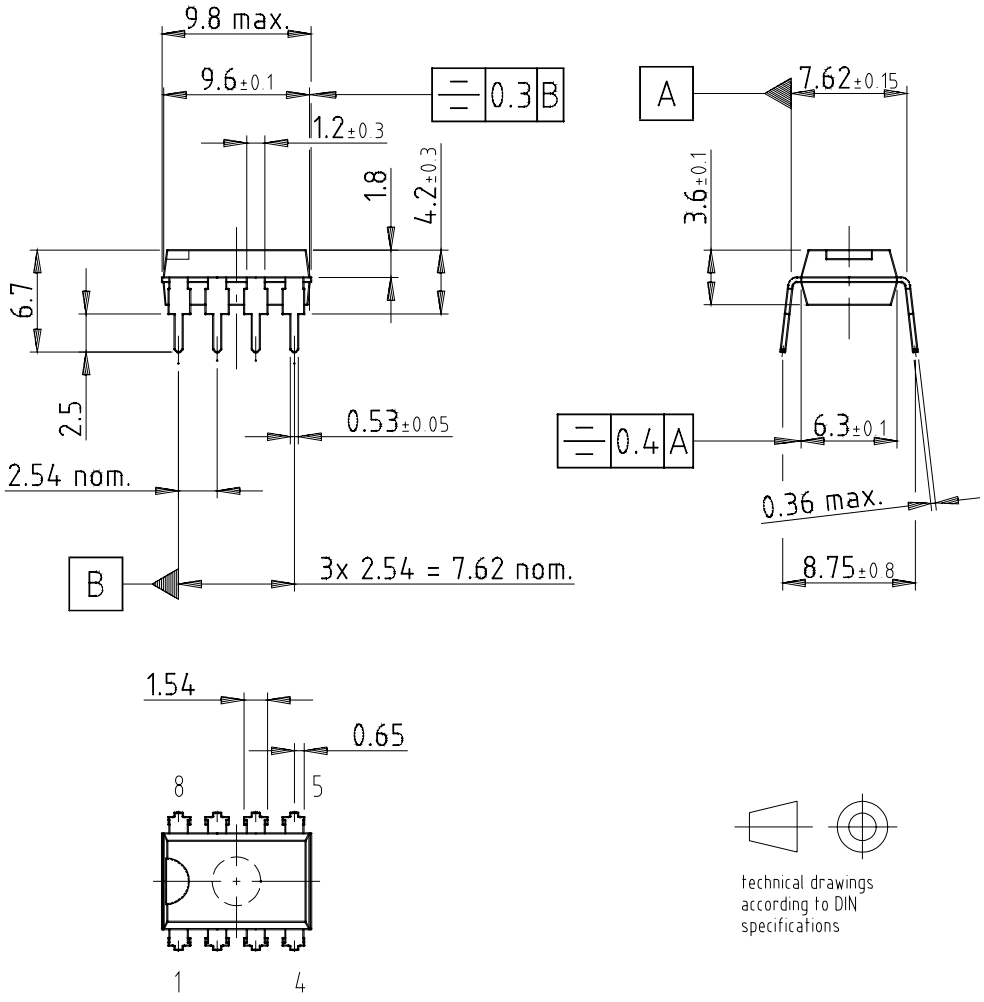
8. Ordering Information

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

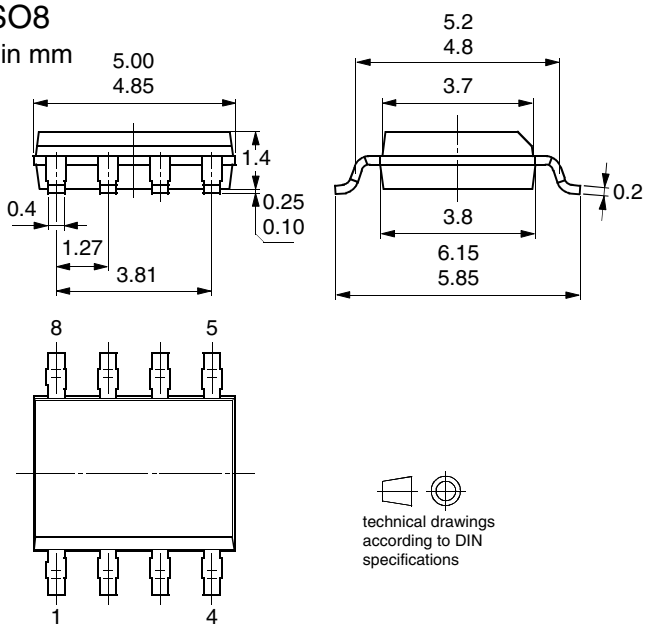
Package: DIP 8
Dimensions in mm



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	• Put datasheet in a new template • Updated text to new style guide • First page: Pb-free logo added • Page 6: Ordering Information changed

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