



## U2043

## LINEAR INTEGRATED CIRCUIT

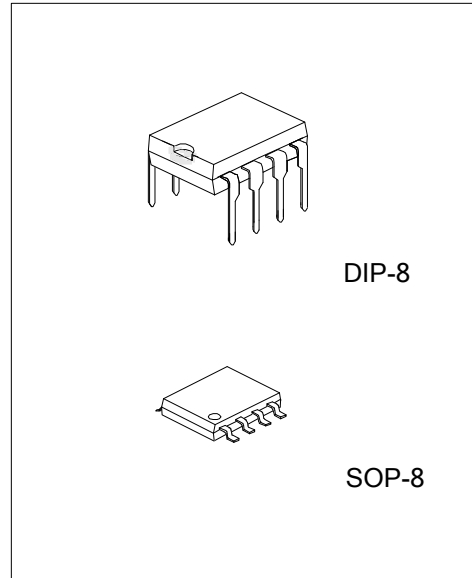
### FLASHER, SHUNT, PILOT LAMP TO GND OR V<sub>BATT</sub>

#### DESCRIPTION

The UTC U2043 is designed to use 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<sub>Batt</sub> or GND.

#### FEATURES

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



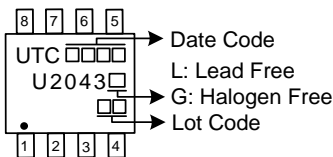
#### ORDERING INFORMATION

Order Number		Package	Packing
Lead Free	Halogen Free		
U2043L-D08-T	U2043G-D08-T	DIP-8	Tube
U2043L-S08-R	U2043G-S08-R	SOP-8	Tape Reel

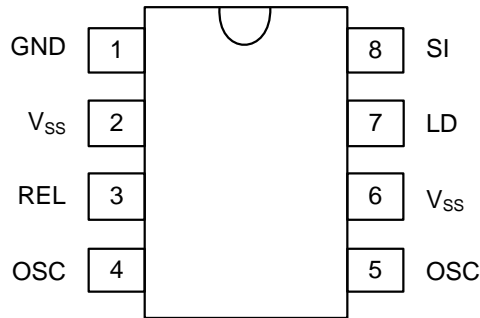
Note: Pin Assignment: G: Gate D: Drain S: Source

<p>U2043G-D08-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) D08: DIP-8, S08: SOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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#### MARKING



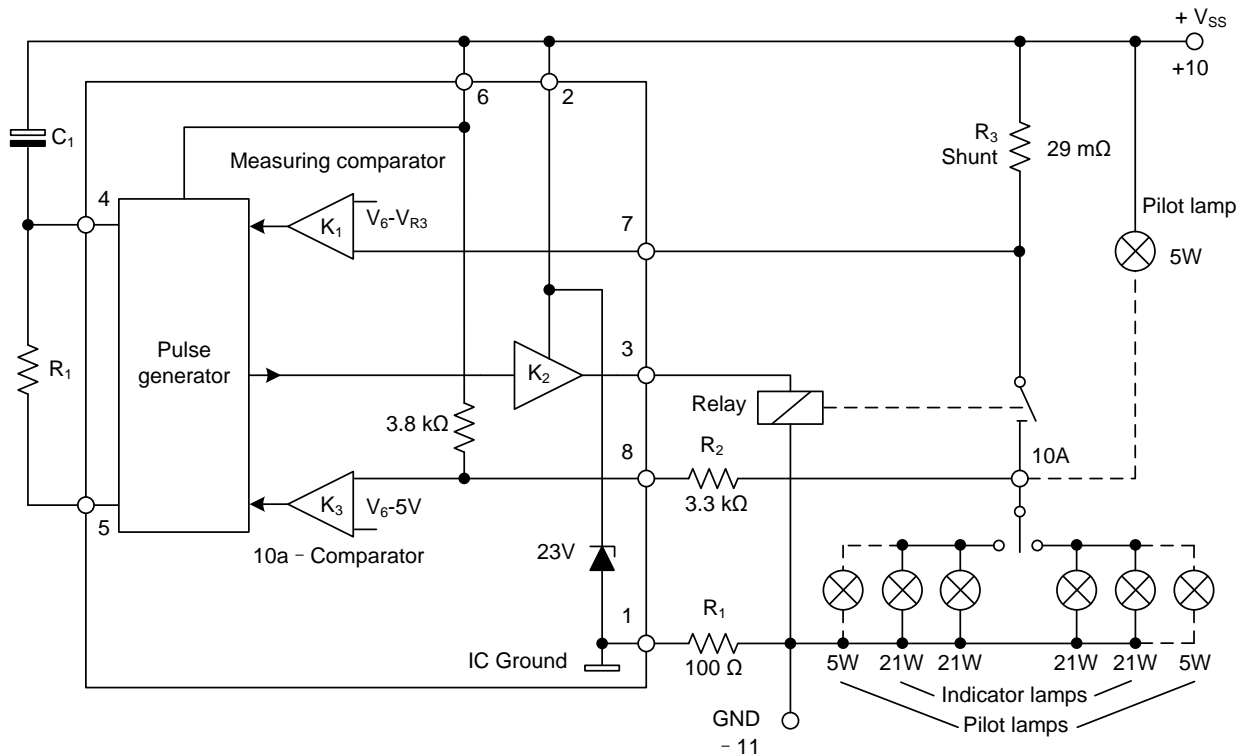
## PIN CONFIGURATION



## PIN DESCRIPTION

PIN NO.	SYMBOL	DESCRIPTION
1	GND	IC ground
2	V <sub>SS</sub>	Supply voltage, V <sub>SS</sub> - Power
3	REL	Relay control output (driver)
4	OSC	Oscillator (C <sub>1</sub> )
5	OSC	Oscillator (R <sub>1</sub> )
6	V <sub>SS</sub>	Supply voltage, Sense
7	LD	Lamp failure detection
8	SI	Start input (10a)

## BLOCK DIAGRAM AND APPLICATION CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS (Reference point Pin 1)

PARAMETERS		SYMBOL	RATINGS	UNIT
Supply Voltage	Pins 2, 6	$V_{SS}$	16.5	V
Surge Forward Current				
$t_p = 0.1\text{ms}$	Pins 2, 6	$I_{FSM}$	1.5	A
$t_p = 2\text{ms}$	Pins 2, 6	$I_{FSM}$	1.0	A
$t_p = 2\text{ms}$	Pin 8	$I_{FSM}$	50	mA
Output Current Pin 3		$I_{OUT}$	0.3	A
Power Dissipation $T_A = 95^\circ\text{C}$	DIP-8	$P_D$	420	mW
	SOP-8		340	mW
Power Dissipation $T_A = 60^\circ\text{C}$	DIP-8	$P_D$	690	mW
	SOP-8		560	mW
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Ambient Temperature		$T_A$	-40 ~ +95	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

## ■ THERMAL DATA

PARAMETERS		SYMBOL	RATINGS	UNIT
Thermal Resistance (Junction to Ambient)	DIP-8	$\theta_{JA}$	110	K/W
	SOP-8		160	K/W

## ■ ELECTRICAL CHARACTERISTICS

( $V_{SS}$  (+10, Pins 2 and 6) = 12V. Reference point ground (-11),  $T_A = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETERS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage Range	$V_{SS}(+10)$			9~15		V
Relay Output	$V_{OUT}$	Saturation voltage, $I_{OUT}=150\text{mA}$ , $V_{SS} = 9\text{V}$			1.0	V
Supply current	$I_{SS}$	Dark phase or stand-by		4.5	8	mA
		Bright phase		7.0	11	mA
Relay Output Reverse Current	$I_{OUT}$				0.1	mA
Relay Coil Resistance	$R_L$		60			$\Omega$
Start Delay	$t_{ON}$	First bright phase			10	ms
Frequency Determining Resistor	$R_1$		6.8		510	k $\Omega$
Frequency Determining Capacitor	$C_1$				47	$\mu\text{F}$
Frequency Tolerance	$\Delta f_1$	Normal flashing, $f_1$ excluding the tolerance of $R_1$ and $C_1$	-5		+5	%
Bright Period	$\Delta f_1$	Basic frequency $f_1$	47		53	%
	$\Delta f_2$	Control frequency $f_2$	37		45	%
Frequency Increase	$f_2$	Lamp outage	2.15xf1		2.3xf1	Hz
Control Signal Threshold	$V_{R3}$	$V_{SS} = 15\text{V}$ Pin 7	75	86	97	mV
	$V_{R3}$	$V_{SS} = 9\text{V}$	56	66	76	mV
	$V_{R3}$	$V_{SS} = 12\text{V}$	66	77	87	mV
Leakage Resistance	$R_{LEAK}$	10a to GND		2	5	k $\Omega$
Lamp Load	$P_L$		10			W

Note: Typical values under normal operation in application circuit.

## ■ FUNCTIONAL DESCRIPTION

### Pin 1, GND, IC ground

In the case of battery reversal, resistor  $R_4$  to ground (-11) will protect the IC against damage. An integrated protection circuit together with external resistances  $R_2$  and  $R_4$  limits the current pulses in the IC.

### Pin 2, Supply voltage, $V_{SS}$ - Power

On the PCB connection, the arrangement of the supply connections to Pin 2 must be so as to ensure that, the resistance of  $V_{SS}$  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  $60\Omega$ .

### Pin 4 and 5 Oscillator ( $C_1$ and $R_1$ )

Flashing frequency,  $f_1$ , is determined by the  $R_1 C_1$  components as follows (see Application Circuit):

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

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, 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)

### Pin 6, Supply voltage, Sense

A minimized layer resistance from point  $V_S$ /shunt to Pin 6 is recommended to accurate monitoring via the shunt resistor.

### Pin 7, Lamp outage detection

The lamp current is monitored via an external shunt resistor  $R_3$  and an internal comparator  $K_1$  with its reference voltage of typ.  $77\text{mV}$  ( $V_{SS} = 12\text{V}$ ). The outage of one lamp out of two lamps is detected according to the following calculation:

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

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

The detection threshold is recommended to be set in the middle of the current range:  $I_{\text{outage}} \approx 2.7\text{A}$ .

Thus the shunt resistor is calculated as:

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

$$R_3 = 77\text{mV} / 2.7\text{A} \approx 29\text{m}\Omega.$$

Comparator  $K_1$ '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 case of shorted lamps.

### Pin 8, Start input

Start condition for flashing: the voltage at Pin 8 has to be less than  $V_{SS} - 5\text{V}$  (flasher switch closed).

Humidity and dirt may decrease the resistance between 10a 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  $V_{SS} - 5\text{V}$ .

During the bright phase the voltage at Pin 8 is above the  $K_2$  threshold, during the dark phase it is below the  $K_3$  threshold. For proper start conditions a minimum lamp wattage of  $10\text{W}$  is required.

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