



FM2044

Dual Output Flasher

Specification

May. 2008



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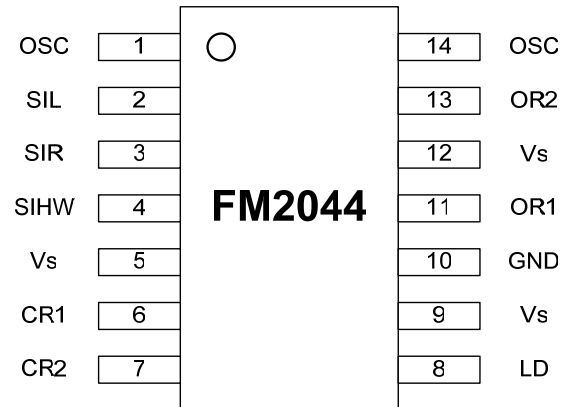
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Description

The integrated circuit FM2044 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 FM2044 can be directly connected to the battery.

Pin Assignment



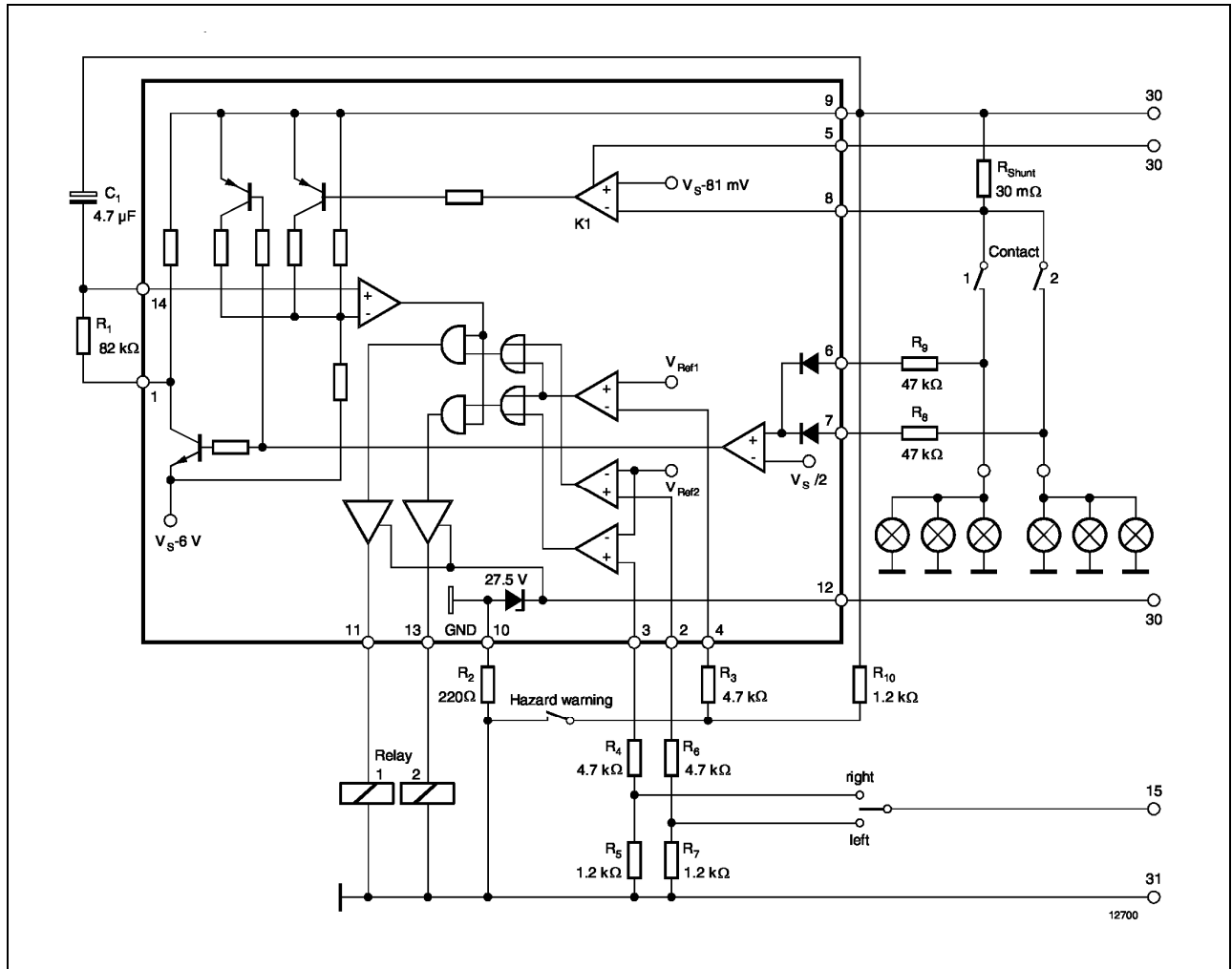
Features

- 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: $\geq 1\text{ W}$
- Very Low Susceptibility to EMI
- Protection According to ISO/TR7637/1 Level 4
- Extremely Low Current Consumption < $10\ \mu\text{A}$ (with Switches Open)
- Reverse Polarity Protection
- Three Control Inputs: Left, Right and Hazard Warning

Pin Function

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

Figure 1. Block Diagram



Function Description

Oscillator (Pin 1 and 14)

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

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

Where $C_1 \leq 47 \mu\text{F}$

$$R_1 = 6.8\text{K}\Omega \sim 180\text{K}\Omega$$

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 $I < 10 \mu\text{A}$. The IC is kept in stand-by mode until there is a voltage drop of $V \approx 6.9 \text{ V}$ 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, K_1 , with its reference voltage of typically 81 mV ($V_S = 12 \text{ V}$). The outage of one lamp out of two lamps is detected according to the following calculation:

Nominal current of 1 lamp:

$$21 \text{ W} / (V_S = 12 \text{ V}): I_{\text{lamp}} = 1.75 \text{ A}$$

Nominal current of 2 lamps:

$$2 \times 21 \text{ W} / (V_S = 12 \text{ V}): I_{\text{lamp}} = 3.5 \text{ A}$$

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

Thus the shunt resistor is calculated as:

$$R_{\text{Shunt}} = V_T (K_1) / I_{\text{outage}}$$

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

Comparator K_1 's reference voltage is matched to the characteristics of filament lamps.

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 (KI 30). It is internally clamped by a 27-V Z-diode.

Electronics characteristics

Absolute Maximum Characteristics

Unless otherwise specified, $T_A = 25^\circ\text{C}$

| Parameter | Symbol | Value | Unit |
|---------------------------|-----------|------------|------------------|
| Supply voltage | V_S | +24 | V |
| Junction temperature | T_j | +150 | $^\circ\text{C}$ |
| Ambient temperature Range | T_{amb} | -40 ~ +100 | $^\circ\text{C}$ |
| Storage temperature Range | T_{stg} | -55 ~ +150 | $^\circ\text{C}$ |

DC Characteristics

Typical values under normal operation in application circuit Figure 1, $V_S (+30) = 12\text{V}$. Reference point ground (-31), $T_A = 25^\circ\text{C}$, Unless otherwise specified

| Parameter | Test Condition | Symbol | Min | Typ | Max | Unit |
|------------------------------------|---|-----------|------|------|------|---------------|
| Supply voltage range | Pin 5, 9, 12 | V_S | 8 | 9~15 | 18 | V |
| Supply current, switches open | Pin 2,3 is tied to GND | I_S | | | 10 | μA |
| Saturation voltage | $R_2 = 82\Omega$, $V_S = 12\text{V}$ | V_O | | | 1.2 | V |
| Relay coil resistance | | R_L | 60 | | | Ω |
| Control signal threshold | $V_S = 12\text{V}$ | V_{cst} | 72.0 | 76.9 | 82.5 | mV |
| Clamping voltage | $T_{amb} = -40^\circ\text{C} \sim +100^\circ\text{C}$ | V_k | 25 | 27.5 | 30 | V |
| Relay output overvoltage detection | $T_{amb} = -40^\circ\text{C} \sim +100^\circ\text{C}$ | R_v | 18 | 20 | 23 | V |

AC Characteristics

Typical values under normal operation in application circuit Figure 1, $V_S (+30) = 12\text{V}$. Reference point ground (-31), $T_A = 25^\circ\text{C}$, Unless otherwise specified

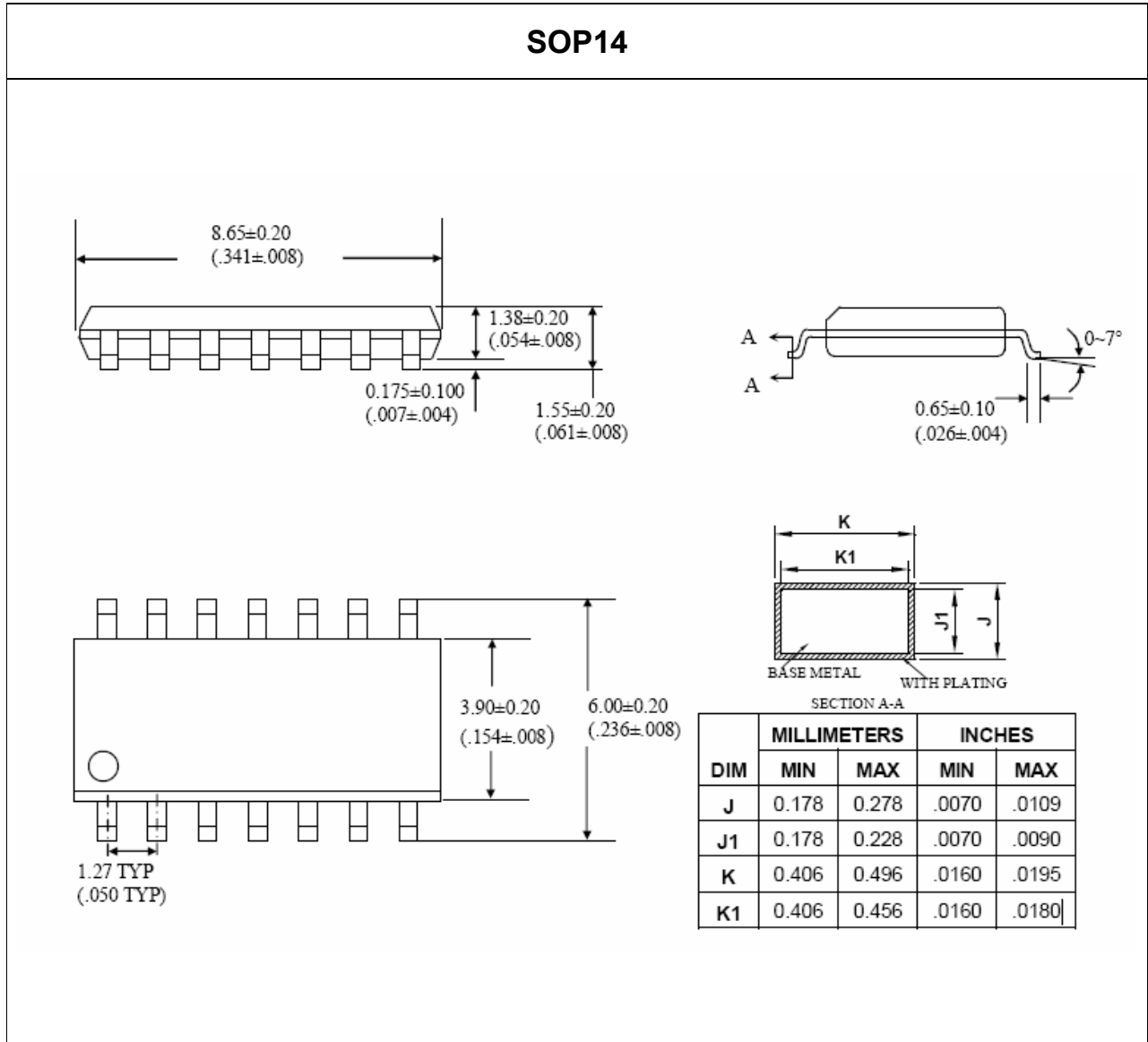
| Parameter | Test Condition | Symbol | Min | Typ | Max | Unit |
|---------------------|---|--------------|-------------------|-----|------------------|------|
| Frequency tolerance | Normal flashing, basic frequency f_1 , not including the tolerance of the external components R_1 and C_1 | Δf_1 | -5 | | +5 | % |
| Bright period | Basic frequency f_1 | Df_1 | 47 | | 53 | % |
| | Control frequency f_2 | Df_2 | 37 | | 45 | % |
| Frequency increase | Lamp failure | f_2 | $2.15 \times f_1$ | | $2.3 \times f_1$ | Hz |



Ordering Information

| Ordering Code | Package | Operation Range |
|---------------|---------|--|
| FM2044-SO | SOP14 | Industrial Temperature (-40°C ~ +100°C) |
| | | |

Package Information





Revision History

| Version | Publication date | Pages | Paragraph or Illustration | Revise Description |
|---------|------------------|-------|---------------------------|-----------------------------------|
| 1.0 | Oct. 2007 | 10 | | Initial Release. |
| 1.1 | May. 2008 | 10 | Sales and service | Updated the address of HK office. |
| | | | | |



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