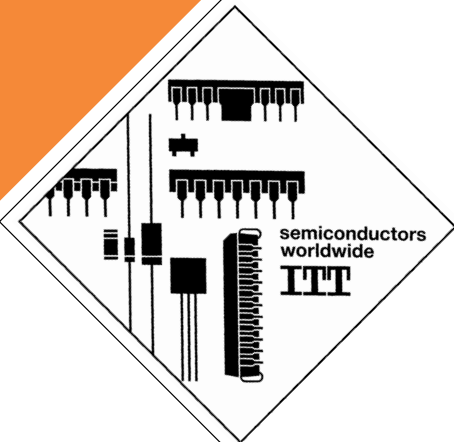


UAF 2115  
Speedometer and  
Mileage Indicator



## Speedometer and Mileage Indicator

The UAF2115 bipolar integrated circuit is designed for use in electronic speedometer and mileage indicators in automobiles.

The UAF2115 consists primarily of the following components:

- Monostable with Schmitt trigger input
- Pulse output
- Meter driver
- Stepping motor buffer
- Voltage regulator
- Current source
- Frequency divider

### 1. Functional Description

The input signal of the UAF2115 derived from a reed contact or a proximity switch (dropout oscillator) placed, for example, at the drive shaft of the gearbox and which supplies one rectangular pulse per shaft rotation.

The monostable flip-flop is triggered by the trailing edge of the input signal. Possible bouncing of the reed contact therefore does not produce faulty indications, since such bouncing coincides with the unstable period of the flip-flop. The shape of the input pulses is irrelevant, provided that the predetermined upper and lower thresholds are reliable attained.

The pulse duration produced by the monostable is determined by the RC network  $R_{8-10}$ ,  $C_{8-13}$ . It can be varied over wide limits and is capable of being adapted to the input frequency.

The rectangular pulses control the current source (meter driver), the frequency divider and the pulse amplifier. The

speed-dependent output current of the meter driver is indicated by a moving-coil meter giving the car's speed. The mean output current from Pin 5 can be adjusted externally by means of a resistance from Pin 4 to ground so as to equalize tolerances of the meter.

The pulse output, Pin 3, is an n-p-n transistor with open collector to control a taximeter. In the event of a short-circuit or overload the internal current limiter comes into action and, after a short time, disconnects the output.

The frequency divider, whose division ratio can be selected by means of Pin 11 to be  $2^5$ ,  $2^6$  or  $2^7$ , supplies pulses for controlling the stepping motor buffer.

Pin 11 connected to pin 10: Division factor of divider is  $2^7$ ,  
Pin 11 connected to ground: Division factor of divider is  $2^6$ ,  
Pin 11 open: Division factor of divider is  $2^5$ .

The stepping motor buffer generates two interlaced pulse trains with a pulse duty factor of 37,5% which drive the two stepping motor windings connected to Pin 12 and Pin 13. The duty cycle of the motor currents is shown in Fig. 4. Some stepping motor coils may act as an inverting transformer. The switching-off coil may induce a negative voltage in the other coil. Be careful that the voltage at pins 2, 3 and 12 do not become more negative than  $-0.5$  V.

Each of the two outputs and the pulse output, Pin 3, are provided with integrated flyback diodes, the cathodes of which being connected to Pin 1. The p-n-p current source (output Pin 7) can be used to feed the sensor which produces the speed dependent input pulses.

In order to protect the integrated circuit against high voltage peaks from the car supply system, an external filtering network for the supply voltage must be provided. The motor supply current does not flow through the resistor of the filter network. Reliable starting of the stepping motor is thus ensured even in the case of low battery voltage.

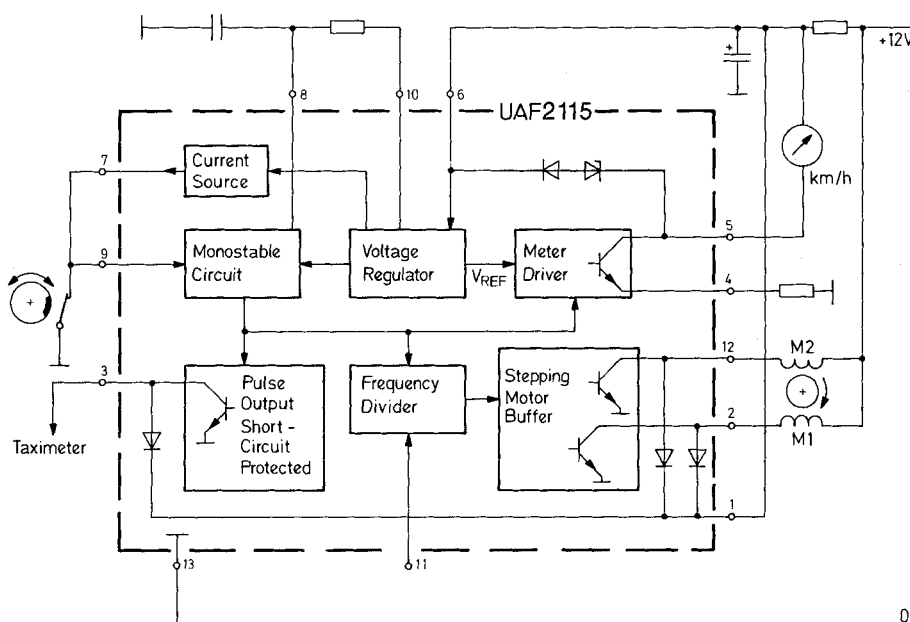


Fig. 1: UAF2115 block diagram and application circuit

2. Outline Dimensions and Pin Connections

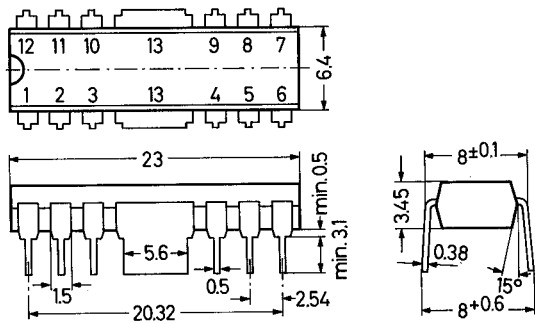


Fig. 2: UAF2115 in 18-pin DIL Plastic Package with 2 cooling fins

Weight approx. 1.5 g, Dimensions in mm

Pin Connections

- 1 Cathodes of Flyback-Diodes
- 2 Stepping Motor Output M 1
- 3 Pulse Output for Taximeter
- 4 Galvanometer Current Setting Output
- 5 Galvanometer Output
- 6 Positive Supply Voltage Input
- 7 Current Source Output for Pickup Circuit
- 8 RC Network for Monostable Pulse Width
- 9 Trigger Input
- 10 Internal Stabilized Voltage Output
- 11 Divider Ratio Select Input
- 12 Stepping Motor Output M 2
- 13 Ground, 0

Pin 6 – Positive Supply Voltage Input

Pin 7 – Current Source Output for Pickup

The p-n-p current source with voltage limitation delivers at this pin the current for supplying the pickup circuit.

Pin 8 – RC Network for Monostable Pulse Width

The constant pulse width determining RC network of the monostable is connected to this pin.

Pin 9 – Trigger Input

The speed proportional pulses of the pickup circuit are fed into this pin.

Pin 10 – Stabilized Voltage Output

This pin delivers the regulated voltage to supply the RC network of the monostable circuit.

Pin 11 – Divider Ratio Select Input

By means of this pin the division ratio of the frequency divider can be selected.

Pin 11 connected to Pin 10: Division ratio is  $2^7$

Pin 11 connected to GND: Division ratio is  $2^6$

Pin 11 open: Division ratio is  $2^5$

Pin 12 – Stepping Motor Output M 2

This pin delivers the current pulses for driving one of the stepping motor coils.

Pin 13 – Ground, 0

3. Pin Descriptions

2115

Pin 1 – Cathodes of Flyback Diodes

The cathodes of the three flyback diodes, two of the motor drivers and one of the pulse output, are brought out at this pin. This pin has to be connected to the positive supply voltage of the UAF2115, Pin 6.

Pin 2 – Stepping Motor Output M 1

This pin delivers the current pulses for driving one of the stepping motor coils.

Pin 3 – Pulse Output for Taximeter

This short-circuits proof pulse output, consisting of an n-p-n transistor with open collector, can be used, for instance, for driving a taximeter.

Pin 4 – Galvanometer Current Setting Output

Tolerances of the meter are adjusted externally by means of a resistor connected from this pin to Ground (Pin 13).

Pin 5 – Galvanometer Output

This pin delivers the constant current pulses for driving the speed indicating galvanometer.

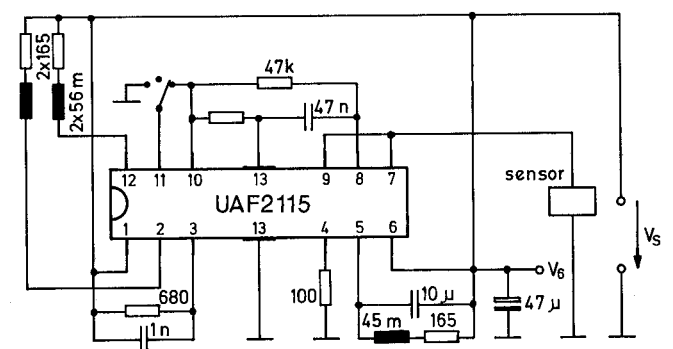


Fig. 3: UAF2115 test circuit

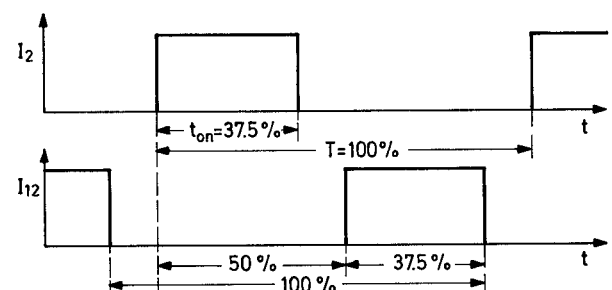


Fig. 4:

Current pulses at stepping motor buffer outputs (pins 2 and 12) with resistive loads

## 4. Electrical Characteristics

All voltages referred to ground (Pin 13), if not otherwise stated.

### 4.1. Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
$V_6$	Supply Voltage	-0.5	18	V
$V_2, V_3, V_{12}$	Breakdown Voltage	40	-	V
$V_9$	Trigger Input Voltage	-0.5	$V_6$	V
$I_9$	Trigger Input Current	-5	5	mA
$I_7$	Current Source Input Current	-	3	mA
$I_{2, 12}$	Motor Output Current	-	300	mA
$I_{3-1}$	Flyback Diode Current	-	50	mA
$I_{2-1}, I_{12-1}$	Flyback Diode Current	-	300	mA
$T_A$	Ambient Operating Temperature Range	-40	+85	°C
$T_S$	Storage Temperature Range	-40	+125	°C

### 4.2. Recommended Operating Conditions

at  $T_A = -40$  to  $+85$  °C

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_6$	Supply Voltage	9	-	16	V
$V_9$	Trigger Input Voltage (any waveform)	-0.5	-	$V_6$	V
$f_9$	Trigger Input Frequency	0	-	10	kHz
$t_9$	Trigger Input Pulse Width	50	-	-	μs
$t_4$	Meter Driver Output Pulse Width	0.05	-	18	ms
$R_{8-10}$	Timing Resistor	10	-	100	kΩ
$C_{8-13}$	Timing Capacitor	depends on frequency			-
$-I_{10}$	Additional Load of Voltage Regulator	-	-	1.5	mA
$R_S$	Filter Resistor	-	33	-	Ω
$C_S$	Filter Capacitor	-	47	-	μF

### 4.3. Characteristics

at recommended operating conditions, if not otherwise stated.

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$I_6$	Quiescent Supply Current	5	–	15	mA	without load $V_9 = V_{11} = V_{8-10} = 0$
$V_{9L}$	Trigger Input Threshold Low Voltage	3	–	4	V	trailing edge of input signal
$V_{9H}$	Trigger Input Threshold High Voltage	4	–	5	V	leading edge of input signal
TC ( $V_9$ )	Temperature Coefficient of $V_{9L}$ and $V_{9H}$	–	–	5	mV/K	
$\Delta V_9$	Trigger Input Hysteresis	0.8	–	1.3	V	$\Delta V_9 = V_{9H} - V_{9L}$
$I_9$	Input Current	–	–	10	$\mu$ A	$V_9 = 0$ to $V_6$
$I_7$	Current Source Current	–1	–	–2.5	mA	$V_7 = V_8 = V_9 = V_{11} = 0$
$V_7$	Current Source Voltage	7.2	–	8.2	V	$V_8 = V_9 = V_{11} = 0$ $I_7 = 0$
$t_4$	Meter Driver Output Pulse Width	2.16416	2.23109	2.29802	ms	Test Circuit Fig. 3
$t_{3\text{ off}}$	Turn-Off Time of Pulse Output	2	–	–	$\mu$ s	$R_{3-6} = 56\ \Omega$ $C_{3-6} = 0$
$t_3$	Overload Sensing Pulse Width of Pulse Output	2	–	15	$\mu$ s	
$V_{3-1}$	Flyback Diode Voltage	1.3	–	2.6	V	$I_3 = 50\text{ mA}$ , $V_{1-3} > 0$
$I_3$	Leakage Current Pulse Output	–	–	20	$\mu$ A	$V_3 = V_6$
$I_3$	Cutoff Current Pulse Output	25	–	120	mA	
$I_3$	Short Circuit Current Pulse Output	–	–	120	mA	Short Circuit Protected, $R_{3-6} = 0$
$V_3$	Saturation Voltage Pulse Output	–	–	1.4	V	at $I_3 = 25\text{ mA}$
$I_5$	Galvanometer Peak Current	–	–	40	mA	
$V_{6-5}$	Galvanometer Current Source Operating Range	6	–	–	V	$V_6 \geq 10\text{ V}$
$\frac{\Delta I_5}{I_5} = f(V_6)$	Galvanometer Current as a Function of Supply Voltage	–	–	+0.5	%	$V_6 = 13.5\text{ V}$ to $16\text{ V}$
Lin. = $f(f_9)$	Galvanometer Current as a Function of Input Frequency	–	–	$\pm 0.5$	%	$f_9 = 50\text{ Hz}$ to $640\text{ Hz}$ , $t_4/T = 0.9$ at $T = 1/640\text{ Hz}$
Lin. = $f(R_{8-10})$	Galvanometer Current as a Function of $R_{8-10}$	–	–	$\pm 1$	%	$C_{8-13} = 68\text{ nF}$ , $R_{8-10} = 10\text{ k}\Omega$ to $100\text{ k}\Omega$
TC ( $I_5$ )	Temperature Coefficient of Galvanometer Current	–	–	+0.02 –0.03	%/K	external components at $T_A = 25\text{ }^\circ\text{C}$
$V_{4-13}$	Voltage Current Source Resistor	2.2	–	2.5	V	
$I_5$	Leakage Current of Galvanometer Current Source	–	–	20	$\mu$ A	
$V_{5-6}$	Protection Diode Voltage	6	–	10	V	$I_{5-6} = 20\text{ mA}$

Characteristics, continued

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$f_3/f_2$	Division Ratio	-	2 <sup>5</sup>	-	-	Pin 11 open
$f_3/f_2$	Division Ratio	-	2 <sup>6</sup>	-	-	$V_{11}=0$
$f_3/f_2$	Division Ratio	-	2 <sup>7</sup>	-	-	$V_{11}=V_{10}$
$I_2, I_{12}$	Motor Output Current	250	-	-	mA	continuous operation
$\nu$	Duty Cycle of Motor Output Current	-	37.5	-	%	see Fig. 4
$I_2, I_{12}$	Motor Buffer Leakage Current	-	-	100	$\mu$ A	
$V_2, V_{12}$	Motor Buffer Saturation Voltage	-	-	1.4	V	$I_2, I_{12}=200$ mA
$V_{2-1}, V_{12-1}$	Flyback Diode Voltage	-	-	2.4	V	$I_{2-1}, I_{12-1}=150$ mA
$V_{10}$	Internal Stabilized Voltage	6	7	8	V	
TC ( $V_{10}$ )	Temperature Coefficient of $V_{10}$	-	-	5	mV/K	
$r_{10}$	Diff. Output Impedance of Stabilized Voltage Source	-	-	20	$\Omega$	$-I_{10}=2$ to 4 mA
$ \Delta V_4 $	Reactive Effect of Output 3 on Output 4	-	0.2	0.5	%	$\Delta V_4=V_4$ (at $I_3=0$ mA) - $V_4$ (at $I_3=25$ mA)



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