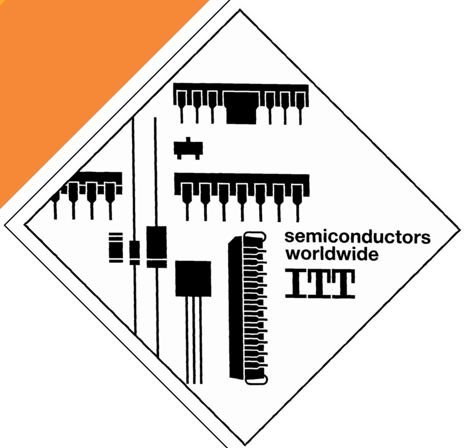

UAF 2115
Speedometer and Mileage Indicator

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ITT Semiconductors

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 if beeing 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 widings 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 beeing 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.

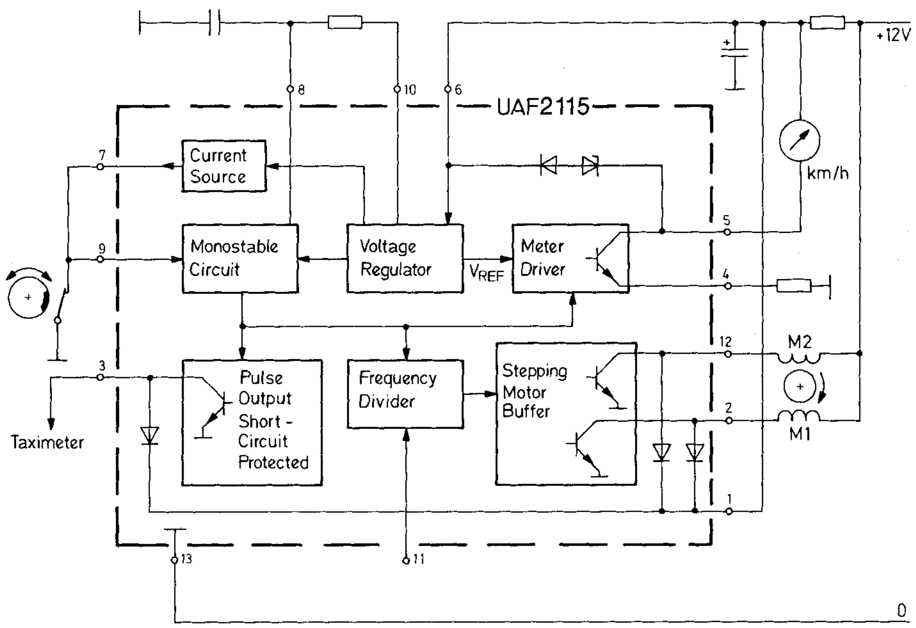

Fig. 1: UAF2115 block diagram and application circuit

2. Outline Dimensions and Pin Connections

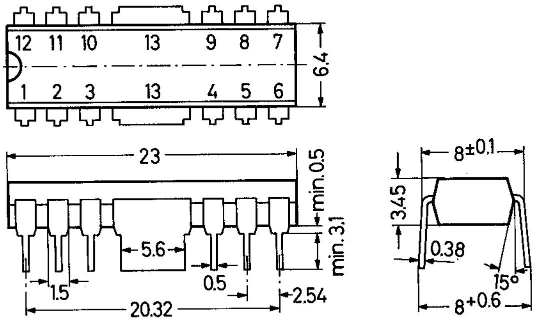

Fig. 2:
UAF 2115 in 18-pin DIL Plastic Package with 2 cooling fins

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

2115

3. Pin Descriptions

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 UAF 2115 , 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.

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 monstable 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

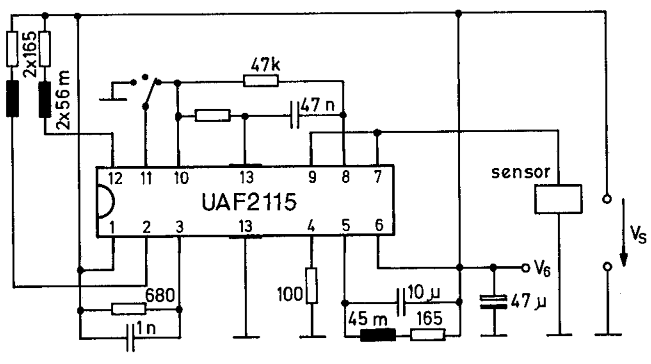

Fig. 3: UAF 2115 test circuit

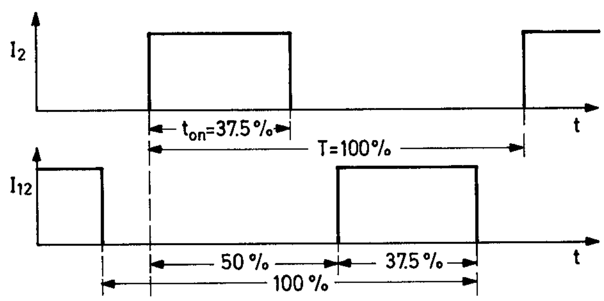

Fig. 4:
Current pulses at stepping motor buffer outputs (pins 2 and 12) with resistive loads

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	
ΔV_9	Trigger Input Hysteresis	0.8	–	1.3	V	$\Delta V_9 = V_{9H} - V_{9L}$
I_9	Input Current	–	–	10	µA	$V_9 = 0$ 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
$t_{3\ off}$	Turn-Off Time of Pulse Output	2	–	–	µs	$R_{3-6} = 56\ \Omega$ $C_{3-6} = 0$
t_3	Overload Sensing Pulse Width of Pulse Output	2	–	15	µs	
V_{3-1}	Flyback Diode Voltage	1.3	–	2.6	V	$I_3 = 50$ mA, $V_{1-3} > 0$
I_3	Leakage Current Pulse Output	–	–	20	µA	$V_3 = V_6$
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 $I_3 = 25$ mA
I_5	Galvanometer Peak Current	–	–	40	mA	
V_{6-5}	Galvanometer Current Source Operating Range	6	–	–	V	$V_6 \geq 10$ V
$\frac{\Delta I_5}{I_5} = f(V_6)$	Galvanometer Current as a Function of Supply Voltage	–	–	+0.5	%	$V_6 = 13.5$ V to 16 V
Lin. = $f(f_9)$	Galvanometer Current as a Function of Input Frequency	–	–	±0.5	%	$f_9 = 50$ Hz to 640 Hz, $t_4/T = 0.9$ at $T = 1/640$ Hz
Lin. = $f(R_{8-10})$	Galvanometer Current as a Function of R_{8-10}	–	–	±1	%	$C_{8-13} = 68$ nF, $R_{8-10} = 10$ KΩ to 100 kΩ
TC (I_5)	Temperature Coefficient of Galvanometer Current	–	–	+0.02 −0.03	%/K	external components at $T_A = 25\ °C$
V_{4-13}	Voltage Current Source Resistor	2.2	–	2.5	V	
I_5	Leakage Current of Galvanometer Current Source	–	–	20	µA	
V_{5-6}	Protection Diode Voltage	6	–	10	V	$I_{5-6} = 20$ mA

Characteristics, continued

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
f_3/f_2	Division Ratio	–	2^5	–	–	Pin 11 open
f_3/f_2	Division Ratio	–	2^6	–	–	$V_{11}=0$
f_3/f_2	Division Ratio	–	2^7	–	–	$V_{11}=V_{10}$
I_2, I_{12}	Motor Output Current	250	–	–	mA	continous operation
ν	Duty Cycle of Motor Output Current	–	37.5	–	%	see Fig. 4
I_2, I_{12}	Motor Buffer Leakage Current	–	–	100	µA	
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	Ω	$-I_{10}=2$ 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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