HYBRID CIRCUIT FOR PROXIMITY DETECTORS
AMS8176 PNP Open Collector

GENERAL DESCRIPTION

The AMS8176 is a hybrid circuit (2.9mm × 20mm) dedicated to tubular inductive proximity detectors, especially for 4mm to 6.5mm diameter hollow stud constructions.

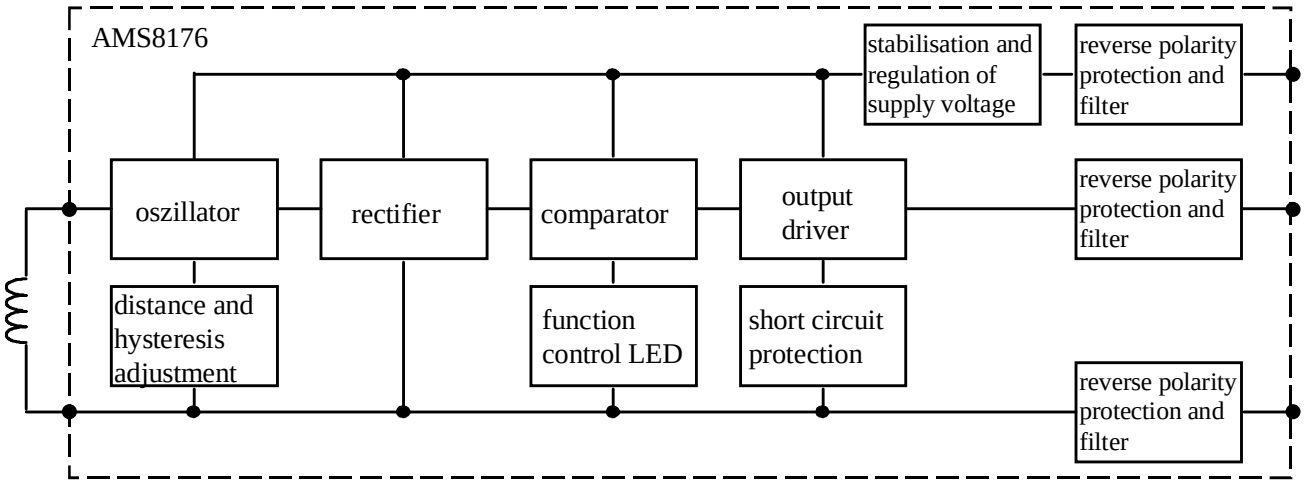
The module consists of a proximity detector IC with a PNP output buffer for NC and NO applications. A part of the multiple protection functions and the status indicator (LED) are realised with discrete elements. All these components are assembled by using hybrid thickfilm technology (ASIC-on-Hybrid) combined with surface mounted devices.

By adding a coil with a potcore and a distance resistor the AMS8176 works as a complete proximity switch.

FEATURES

- **Normally Open, AMS8176-1 or Normally Closed, AMS8176-2 option capability**
- **Switching distance adjustable by discrete resistor trimming**
- **Wide voltage supply range 7 to 35V**
- **Output current up to 100mA; PNP open collector**
- **LED for function control (LED = ON when detection occurs)**
- **Protection against short-circuit and overload (scanning)**
- **Protection against open ground**
- **Protection against reverse polarity**
- **Protection of output transistor against transients by a zener diode (350mW)**
- **Protection against supply voltage overloads by a zener diode (350mW)**
- **Protection against repetitive fast electrical transients on supply voltage leads by RC-filtering**
- **Power-on delay and level**

BLOCK DIAGRAM



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FUNCTIONAL DESCRIPTION

The proximity detector AMS8176 is specially designed for mounting of ∅ 4mm tubes or M6. The proximity detector consists of an oscillator, rectifier, comparator as well as a suitability for industry protecting wiring with PNP open collector output. The detection distance is given by the resistor R_d. This trimmable resistor has to be defined and to be mounted on the hybrid as chip-resistor by the customer.

Hysteresis and *TK* is determined in thickfilm-resistors (R_h and R_k), by laser trimming of producer of hysteresis > 10% and *TK* typical 0.2%/°C.

The bipolar coil has to be mounted on the capacitor C_{osc} and after applying the positive supply voltage to the hybrid the AMS8176 is able to work as a proximity detector.

The AMS8176 has an integrated short circuit protection whose scanning duty cycle is pre-adjusted.

ABSOLUTE MAXIMUM RATINGS

DC supply voltage	$V+$	35V
Output voltage	V_{out}	35V
Output transistor dissipation	P_{tr}	330mW
Junction temperature of the output transistor	T_j	150°C
Storage temperature	T_{st}	– 45 to 100°C
Operating temperature range	T_S	– 40 to 85°C

PERFORMANCES

Oscillator frequency (see oscillator recommendations)	typ. 833kHz
Operating (switching) distance (see mounting recommendations) depending on magnetic environment and used materials	1.0mm
Differential travel (% of operating distance, hysteresis in switching distance), depending on magnetic environment	typ. 10%
Maximum operating frequency (according to EN 50010), with recommended potcore and coil in brass tube	typ. 2.5kHz
Switching distance temperature drift, depending on magnetic environment	typ. 0.2%/°C

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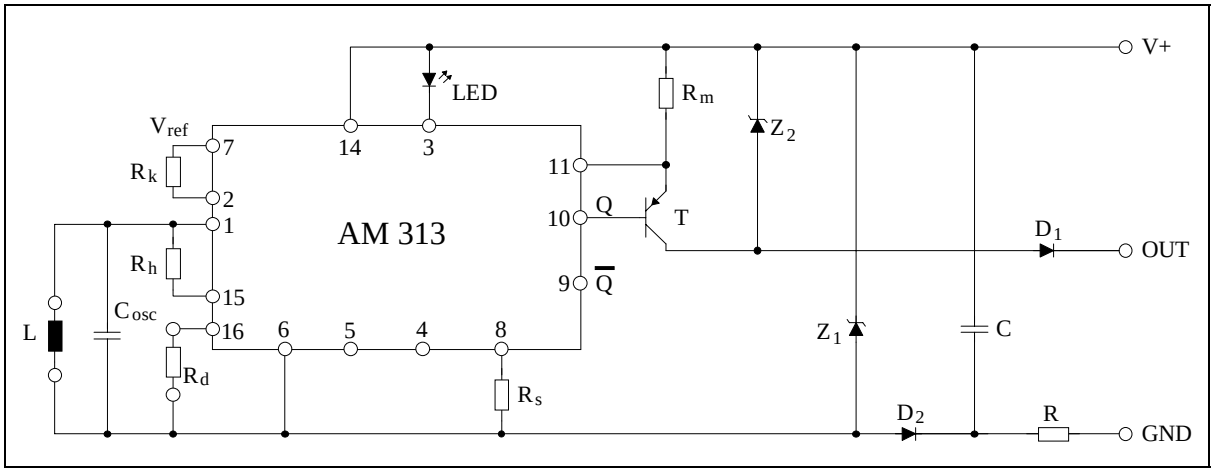
ELECTRICAL SPECIFICATIONS

V+ = 7 to 35V, *T* = 25°C, unless otherwise indicated
with R_d = 5kΩ, R_h = 50kΩ, R_k = 30Ω
encapsulated (see mounting recommendations)

Parameter	Symbol	Conditions	min	typ.	max.	Unit
Supply current		T_S = –25 to 75°C				
NO Detector	*I*+	Output stage "OFF" (25V)	1.0	1.6	2.5	mA
		Output stage "OFF" (35V)			3.0	mA[1)]
		Output stage "ON“	3.5	7.0	10.0	mA
NC Detector	*I*+	Output stage "OFF"	3.5	7.0	10.0	mA
		Output stage "ON"	1.0	2.0	3.5	mA
Current limit for	*Iout*	T_S = –25°C		180		mA
short circuit		T_S = 25°C	120	150	250	mA
protection		T_S = 75°C	100	120		mA
Output voltage drop	*Vdrop*	I_{out} = 10mA			0.9	V
		I_{out} = 100mA			1.9	V
		T_S = –25 to 75°C				
Power on delay	*Tabt*			350		µs
Scanning duty cycle	*Ton*	Output overload or		5.5		µs
	Toff	short circuit		380		µs

1) not tested but guaranteed by design

CIRCUIT DIAGRAM



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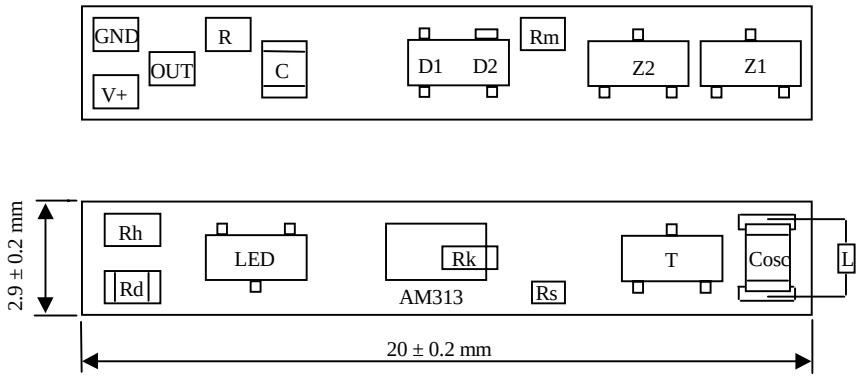
EXTERNAL COMPONENTS

Symbol	Value	Description
R_d	LC depended (≈ 5kΩ)	Operating distance adjust (SMD resistor 0805)
R_h	50kΩ typical	Differential hysteresis adjust
R_k	30Ω typical	Oscillator temperature drift adjust
C_{osc}	1nF NPO	Oscillator capacitor
R_m	1.05Ω typical	Maximum output current limitation resistor
R_s	300Ω typical	Output transistor base current adjust
D_1, D_2	BAS 28	Protection against reverse polarity
Z_1	BZX 84 C 39 V	Protection against supply overloads
Z_2	BZX 84 C 39 V	Protection against transients
R	100Ω typical	Voltage supply filter
C	22nF X7R	Voltage supply filter
T	BCW 68G (0.33W)	Discrete output power transistor
LED	LYS 260	Function control display (yellow)
L	Application depended	External coil (see recommendations)

OUTLINE AND CONNECTIONS

R_k, R, R_m and R_s are thickfilm screen printed resistors.
R_d has to be trimmed and/or assembled according to customer's specifications.
Coil connections are located on each extremity of C_{osc}.
NC (normally closed) is identified with a red dot.



Order No: AMS8176 NO (normally open) 8176-1
AMS8176 NC (normally closed) 8176-2

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MOUNTING RECOMMENDATIONS

If a protective cap is mounted on the coil, it should be as thin as possible, because its thickness forms part of the operating distance.

The stud wall should not extend beyond the potcore.

The exact value of the operating distance with its tolerance is determined by:

- the values of the adjustment resistors (R_d, R_h, R_k)
- the oscillator coil
- the metal of the actuator and the material and shape of the housing

Handle with care to avoid electrostatic discharge.

OSCILLATOR RECOMMENDATIONS

Potcore SIFFERIT (Siemens) ∅ 3.3mm, K1 material

Coil N = 80 Thermofix S (Isolawerke) ∅ Cu 0.063mm

Coil L = 36.5µH embedded in NiCr steel tube

SOLDERING RECOMMENDATIONS

To solder the external connection pads it is necessary to preheat the substrate to 120...150°C and use solder type Sn-Pb-Ag 62-36-2 (2% silver).

POTTING RECOMMENDATIONS

First cover the hybrid circuit with about 0.5mm of silicone coating, let it harden and with the parts inserted in the housing, fill with epoxy resin.

There might be some problems of starting up cold if the quality coefficient of the coil is not sufficient.