

Proximity Detectors

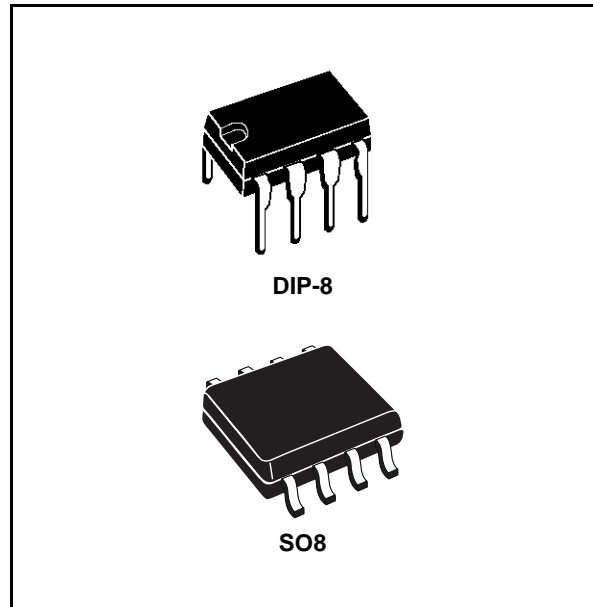
Features

- 10mA Output Current
- Oscillator Frequency 10MHz
- Supply Voltage +4 to +35V

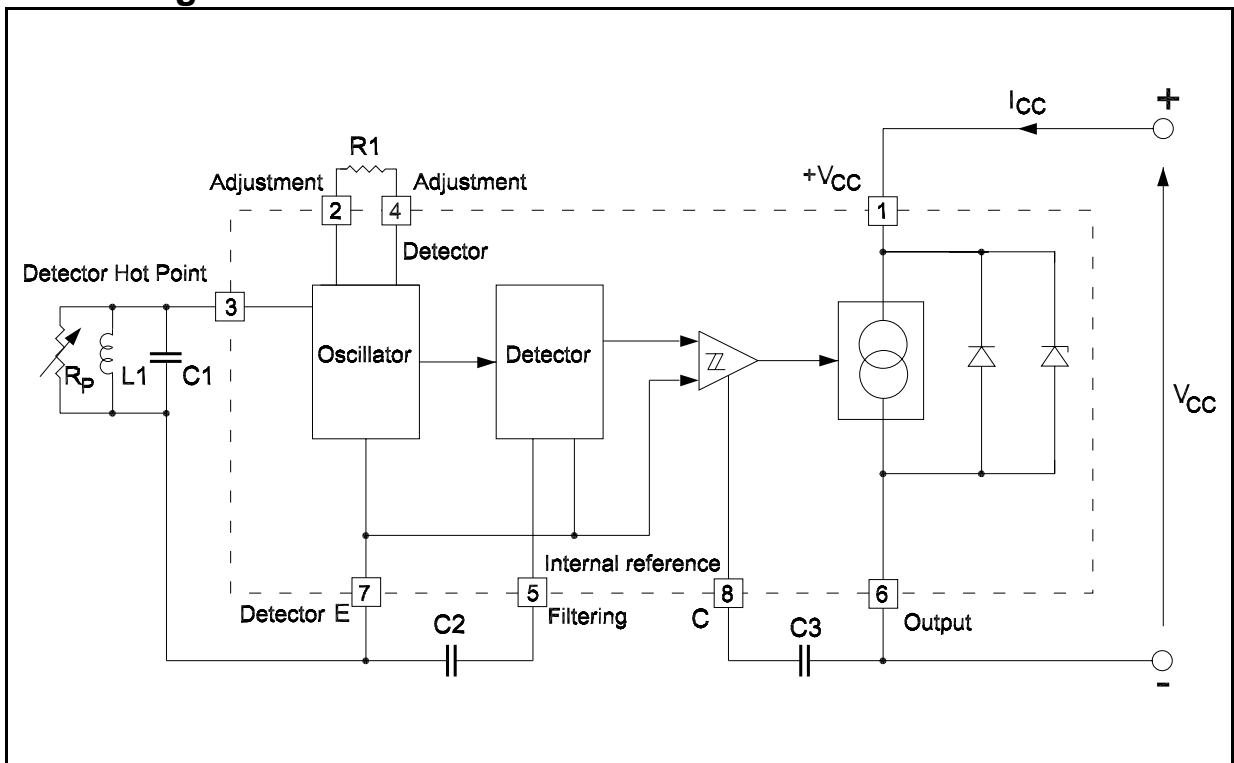
Description

These monolithic integrated circuits are designed for metallic body detection by sensing variations in high frequency Eddy current losses. Using an externally-tuned circuit, they act as oscillators. The output signal level is altered by an approaching metallic object.

The output signal is determined by supply current changes. Independent of supply voltage, this current is high or low, according to the presence or absence of a closely located metallic object.



Block Diagram

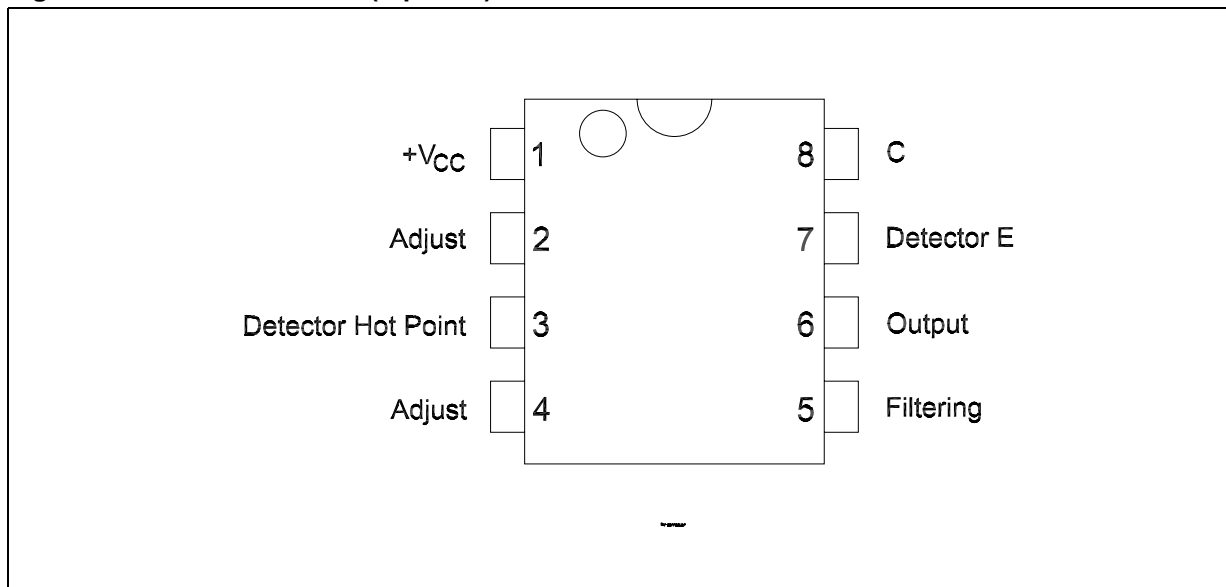


Contents

| | | |
|----------|--------------------------------------|-----------|
| 1 | Connections | 3 |
| 2 | Electrical ratings | 4 |
| | 2.1 Electrical characteristics | 4 |
| 3 | Operating Mode | 5 |
| 4 | Typical Applications | 6 |
| 5 | Package Mechanical Data | 8 |
| 6 | Order codes | 10 |
| 7 | Revision history | 11 |

1 Connections

Figure 1. Pin Connections (top view)



2 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|-----------------------------|------------|------|
| V_{CC} | Supply Voltage | 35 | V |
| T_J | Operating Temperature Range | +150 | °C |
| T_{STG} | Storage Temperature Range | -55 to 150 | °C |

2.1 Electrical characteristics

$-40 < T_A < +100^\circ\text{C}$, $P_{TOT} < 150\text{mW}$, unless otherwise specified.

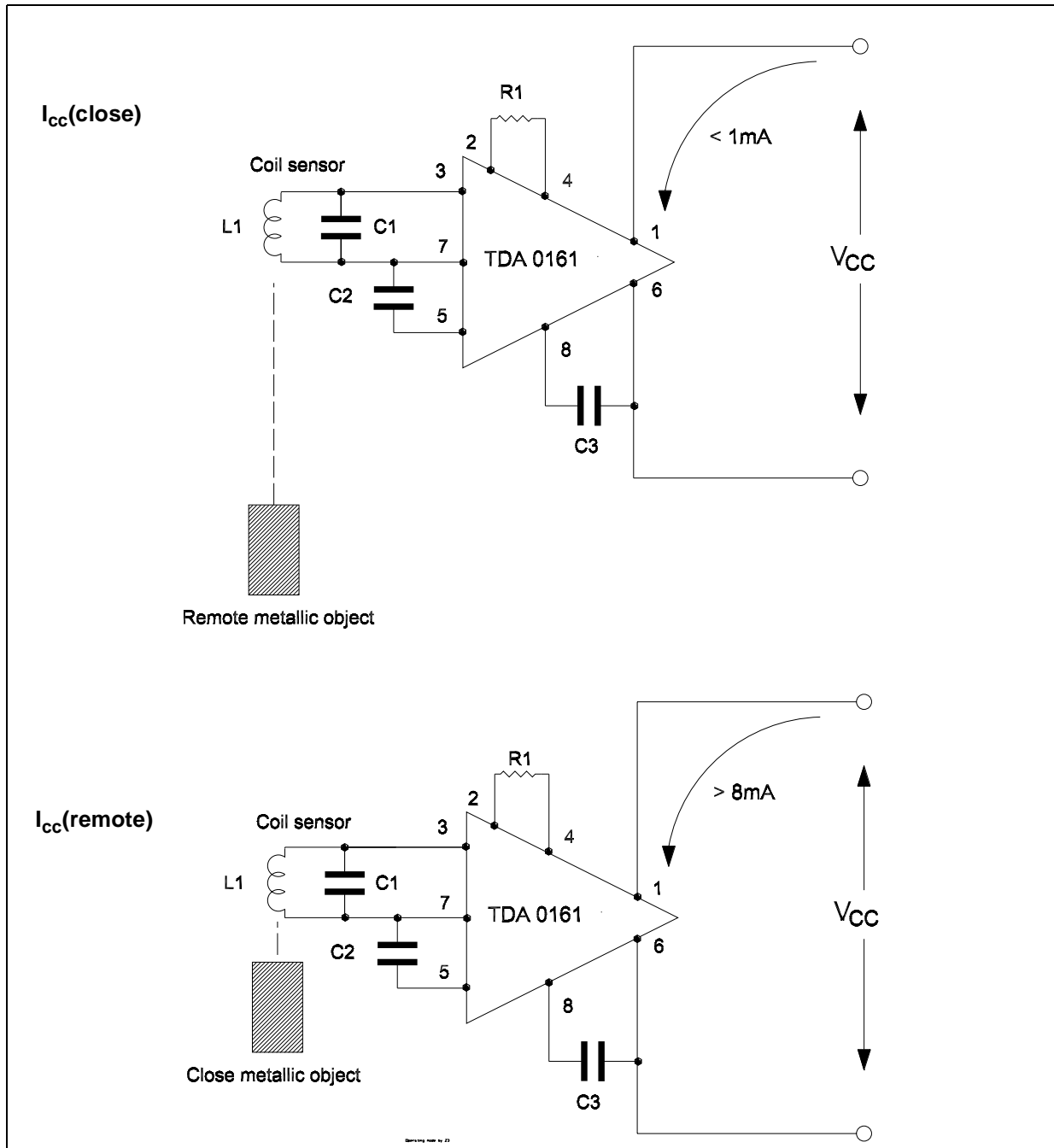
Table 2. Electrical Characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|--|--|----------|-------------------------|----------|---------------|
| V_{CC} | Supply Voltage | | 4 | | 35 | V |
| | Reverse Voltage Limitation | $I_{CC} = -100\text{mA}$ | | -1 | | V |
| I_{CC} | Supply Current close target | $T_A = +25^\circ\text{C}$ $+4\text{V} < V_{CC} < +35\text{V}$ | 8 | 10 | 12 | mA |
| I_{CC} | Supply Current remote target | $+4\text{V} < V_{CC} < +35\text{V}$ | | | 1 | mA |
| | Supply Current transition time | $C3 = 0$ | | 1 | | μs |
| | | $C3 \neq 0$ | | $100 \times C3$ (nF) | | μs |
| f_{OSC} | Oscillator Tuning Frequency | | | | 10 | MHz |
| f_O | Output Frequency | $C3 = 0$ | 0 | | 10 | kHz |
| ΔI_{CC} | Output Current Ripple | $C3 = 0$, $C2$ (pF) $> 150/f_{OSC}$ (MHz) | | | 20 | μA |
| R_n | Negative Resistance on Terminals A and E | $4\text{k}\Omega < R1 < 50\text{k}\Omega$, $f_{OSC} < 3\text{MHz}$ | $0.9 R1$ | $R1$ | $1.1 R1$ | |
| HYST | Hysteresis at Detection Point | $C2$ (pF) $> 150/f_{OSC}$ (MHz) | 0.5 | | 5 | % |

3 Operating Mode

Between pins 3 and 7, the integrated circuit acts like a negative resistor with a value equal to that of the external resistor R1 (connected between pins 2 and 4). The oscillation stops when the tuned circuit loss resistance (R_p) becomes smaller than R1. As a result, $I_{CC(close)} = 10\text{mA}$ (pins 1 and 6). The oscillation is sustained when R_p is higher than R1, and $I_{CC(remote)} = 1\text{mA}$ (pins 1 and 6). Eddy currents induced by coil L1 in a metallic body determine the value of R_p .

Figure 2. Electrical Scheme



If the circuit is used at frequency higher than 3MHz, it is recommended to connect a capacitor of 100pF between pins 7 and 6

4 Typical Applications

Figure 3. Application Interface Connection Diagram

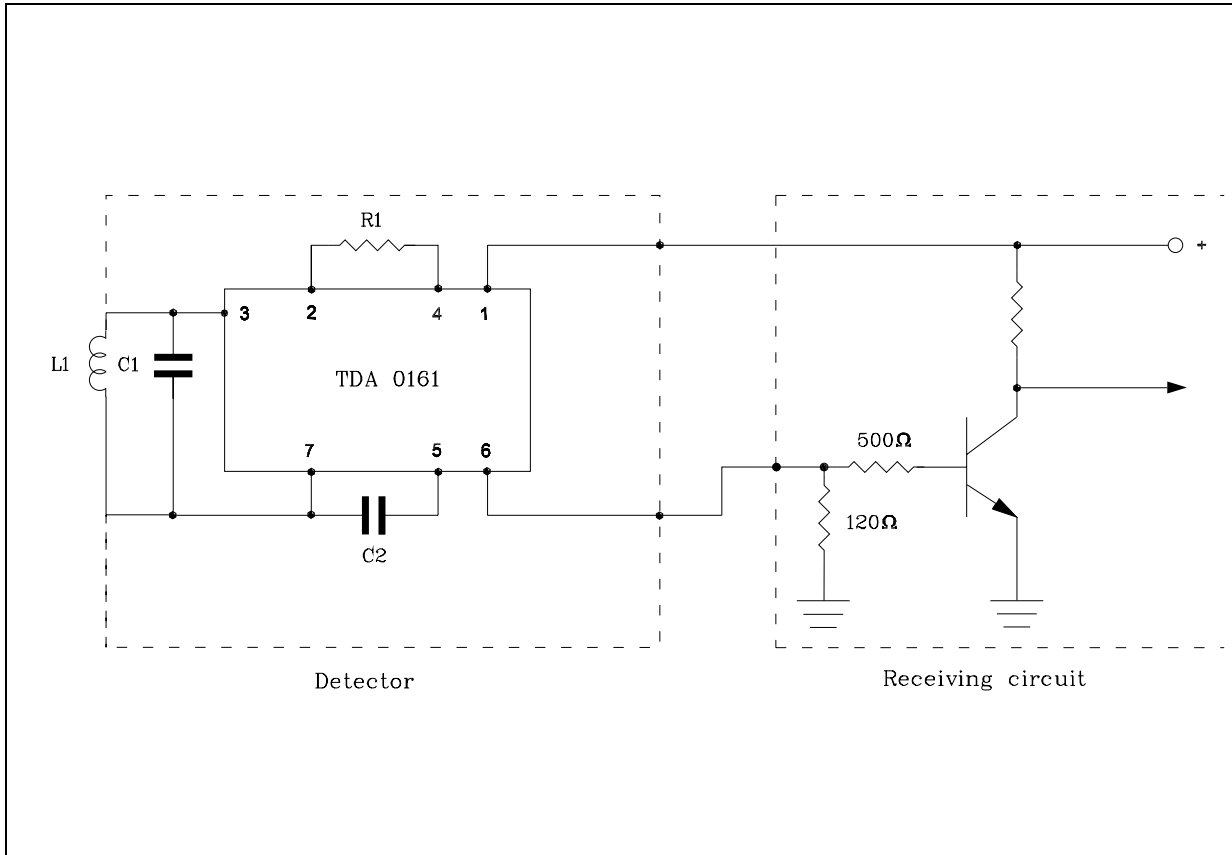


Table 3. Detection Range

| Detection Range (#) | L1 (μH) | C1 (pF) | f _{osc} (kHz) | R1 (kΩ) | C2 (pF) |
|---------------------|----------|---------|------------------------|---------|---------|
| 2mm | 30 (1) | 120 | 2650 | 6.8 | 47 |
| 5mm | 300 (2) | 470 | 425 | 27 | 470 |
| 10mm | 2160 (3) | 4700 | 50 | 27 | 3300 |

Table 4. Coil Characteristics

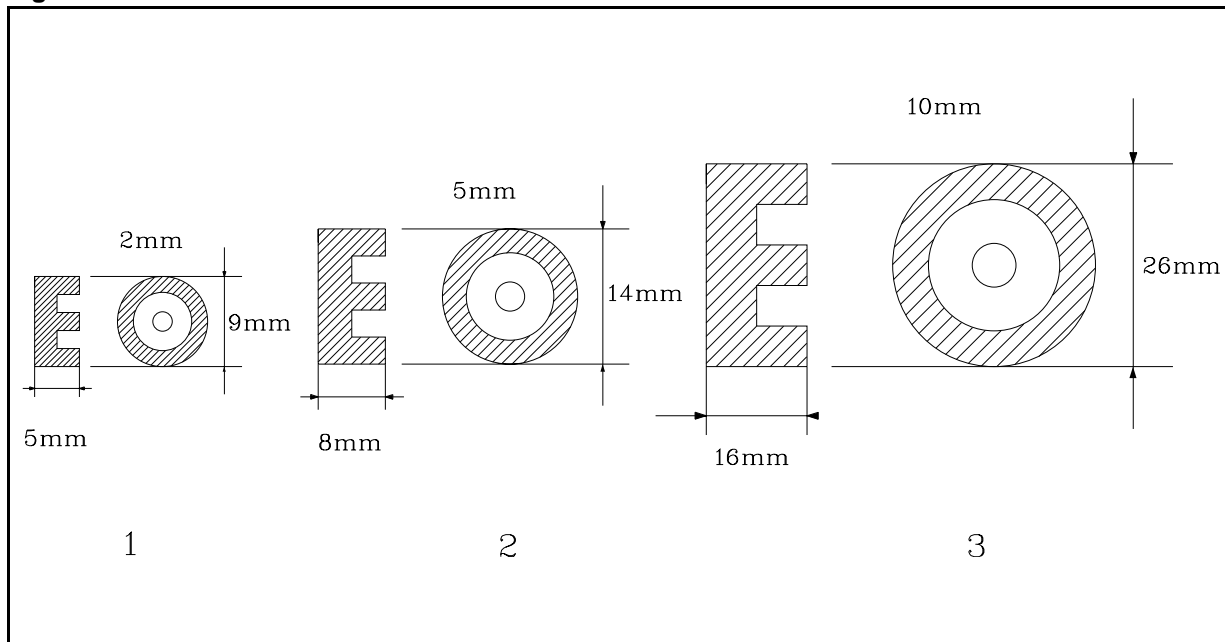
| | Core | Coil Former | Wire (##) | Number of Turns |
|---|--------------------------|-----------------|--|-----------------|
| 1 | Cofelec 432 FP 9 x 5 SE | 1/2 Car 091 - 2 | THOMSON Fils et Câbles Thomrex 14 (14 / 100mm) | 40 |
| 2 | Cofelec 432 FP 14 x 8 SE | 1/2 Car 142 - 2 | | 100 |
| 3 | Cofelec 432 FP 26x 16 SE | 1/2 Car 262 - 2 | | 200 |

#) .Ingot steel target

##).The above results are obtained with single wire coil. When using Litz wire instead of single wire, the parallel resistance of the coil becomes higher and value of R1 may be increased, resulting in better sensitivity

4.1 Typical Application Example

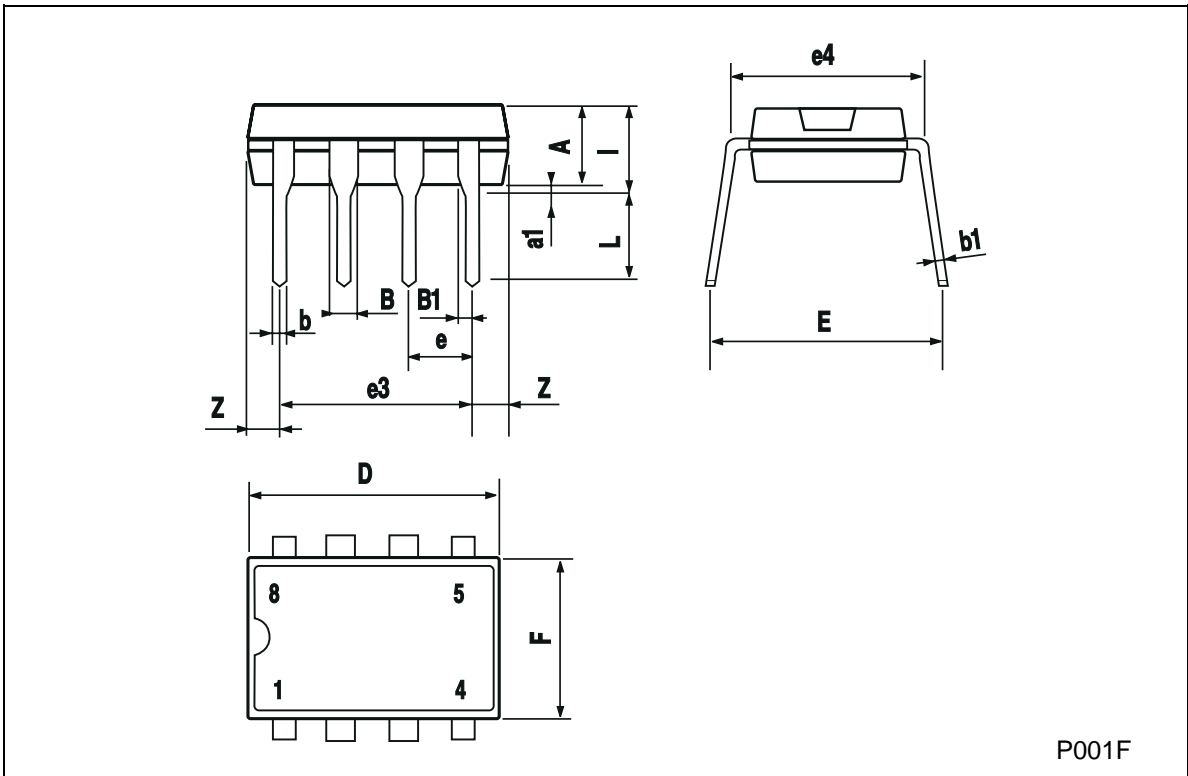
Figure 4. Detection distance



5 Package Mechanical Data

Plastic DIP-8 MECHANICAL DATA

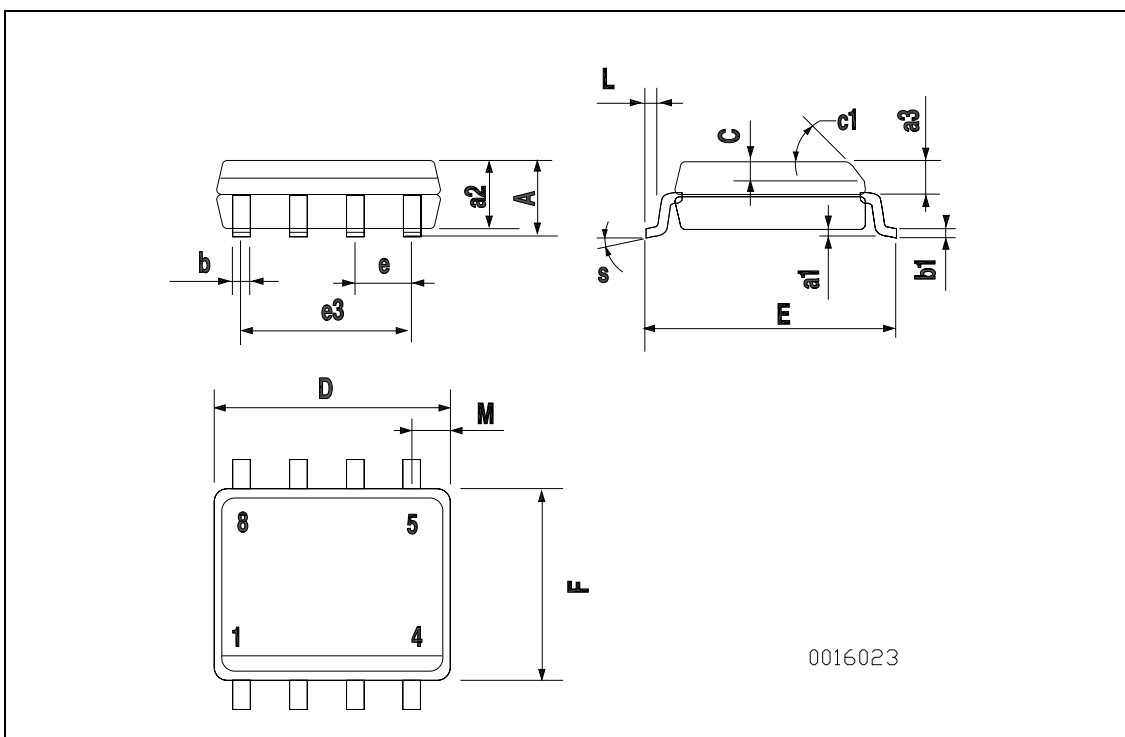
| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | 3.3 | | | 0.130 | |
| a1 | 0.7 | | | 0.028 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| B1 | 0.91 | | 1.04 | 0.036 | | 0.041 |
| b | | 0.5 | | | 0.020 | |
| b1 | 0.38 | | 0.5 | 0.015 | | 0.020 |
| D | | | 9.8 | | | 0.386 |
| E | | 8.8 | | | 0.346 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 7.62 | | | 0.300 | |
| e4 | | 7.62 | | | 0.300 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 4.8 | | | 0.189 |
| L | | 3.3 | | | 0.130 | |
| Z | 0.44 | | 1.6 | 0.017 | | 0.063 |



P001F

SO-8 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-----------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.003 | | 0.009 |
| a2 | | | 1.65 | | | 0.064 |
| a3 | 0.65 | | 0.85 | 0.025 | | 0.033 |
| b | 0.35 | | 0.48 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.019 |
| c1 | 45 (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.188 | | 0.196 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.14 | | 0.157 |
| L | 0.4 | | 1.27 | 0.015 | | 0.050 |
| M | | | 0.6 | | | 0.023 |
| S | 8 (max.) | | | | | |



6 Order codes

| Part number | Temp range | Package | Packing |
|-------------|------------|---------|---------------|
| TDA0161DP | 150°C | DIP-8 | Tube |
| TDA0161FP | 150°C | SO8 | Tube |
| TDA0161FPT | 150°C | SO8 | Tape and Reel |

7 Revision history

| Date | Revision | Changes |
|-------------|----------|------------------|
| 06-Jan-2003 | 1 | Initial release. |
| 12-Oct-2005 | 2 | Final release. |

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