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Proximity Switch

**TCA 305
TCA 355**

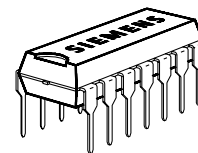
Bipolar IC

Features

- Lower open-loop current consumption; $I_s < 1 \text{ mA}$
- Lower output saturation voltage
- The temperature dependence of the switching distance is lower and compensation of the resonant circuit TC (temperature coefficient) is easier
- The sensitivity is higher, so that larger switching distances are possible and coils of a lower quality can be used
- The switching hysteresis remains constant as regards temperature, supply voltage and switching distance
- The TCA 305 even functions without external integrating capacitor. With an external capacitor (or with RC combination) good noise immunity can be achieved
- The outputs are temporarily short-circuit proof (approx. 10 s to 1 min depending on package)
- The outputs are disabled when $V_s < \text{approx. } 4.5 \text{ V}$ and are enabled when the oscillator stabilizes (from $V_{S \text{ min}} = 5 \text{ V}$)
- Higher switching frequencies can be obtained
- Pb-free lead plating; RoHS compliant



PG-DSO-8-1



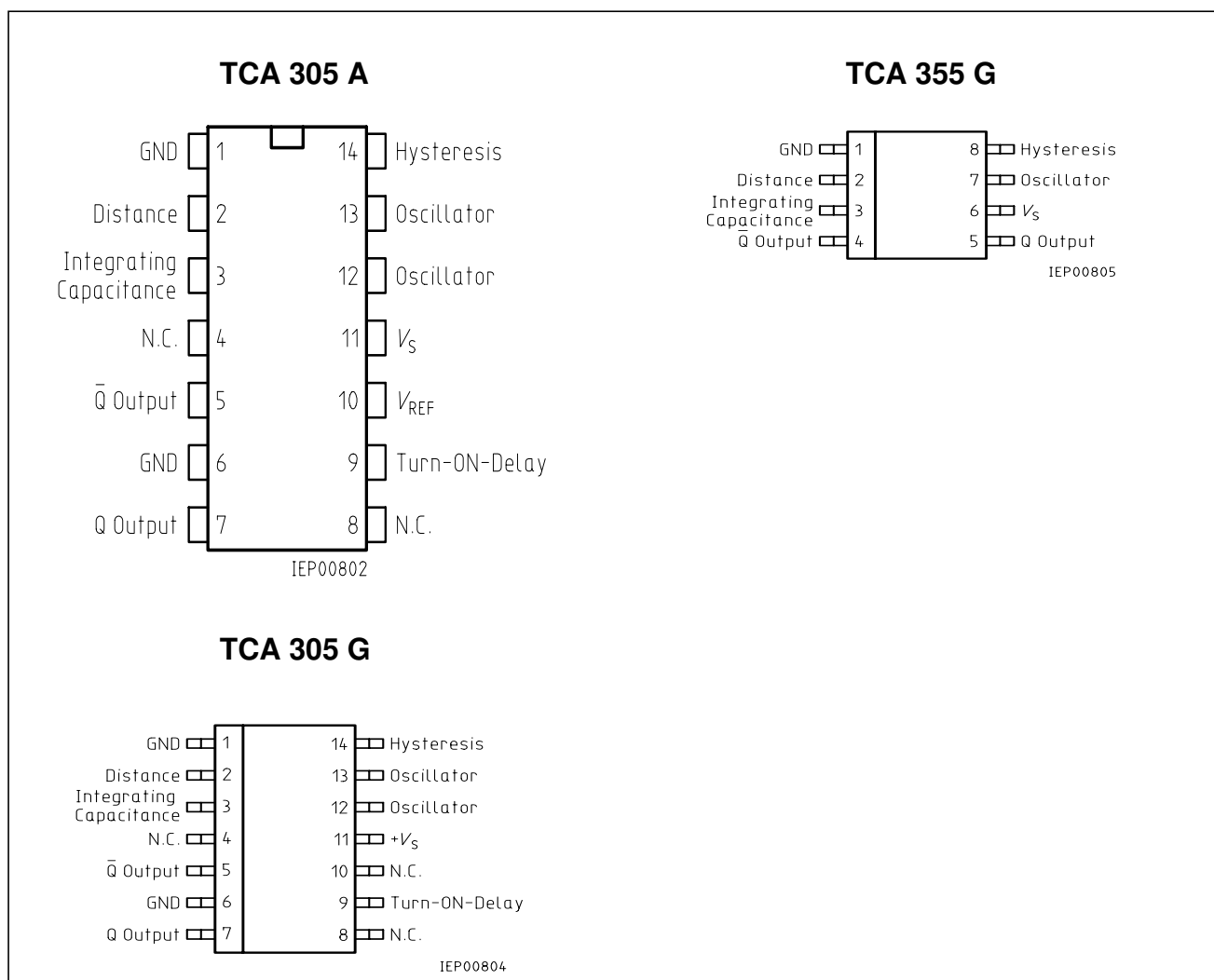
PG-DIP-14-1



PG-DSO-14-1

| Type | Ordering Code | Package |
|-------------|---------------|-------------------|
| ■ TCA 305 A | Q67000-A2291 | PG-DIP-14-1 |
| TCA 305 G | Q67000-A2305 | PG-DSO-14-1 (SMD) |
| TCA 355 G | Q67000-A2444 | PG-DSO-8-1 (SMD) |

■ Not for new design



Pin Configurations (top view)

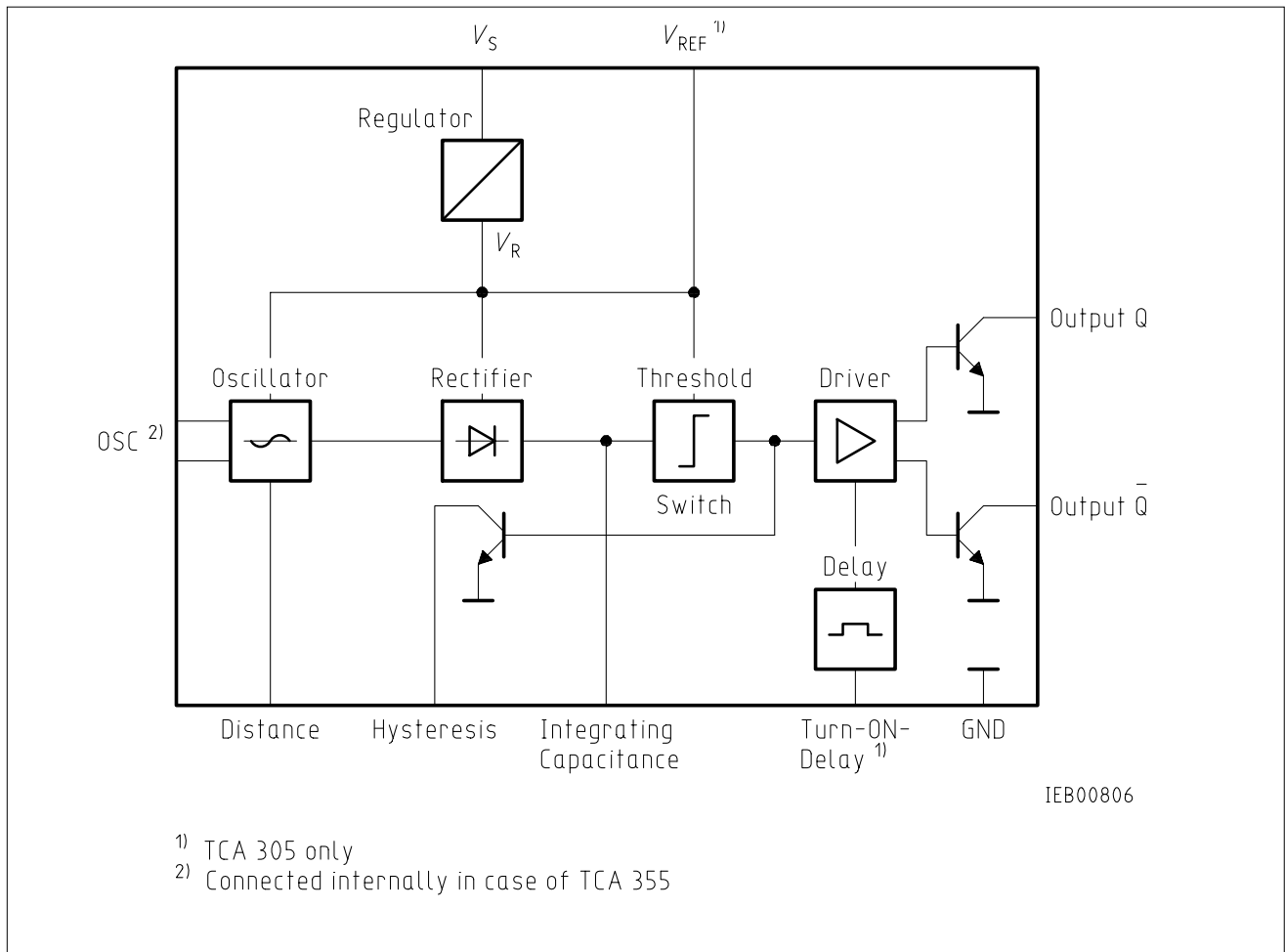
The devices TCA 305 and TCA 355 contain all the functions necessary to design inductive proximity switches. By approaching a standard metal plate to the coil, the resonant circuit is damped and the outputs are switched.

Operation Schematic: see TCA 205

The types TCA 305 and TCA 355 have been developed from the type TCA 205 and are outstanding for the following characteristics:

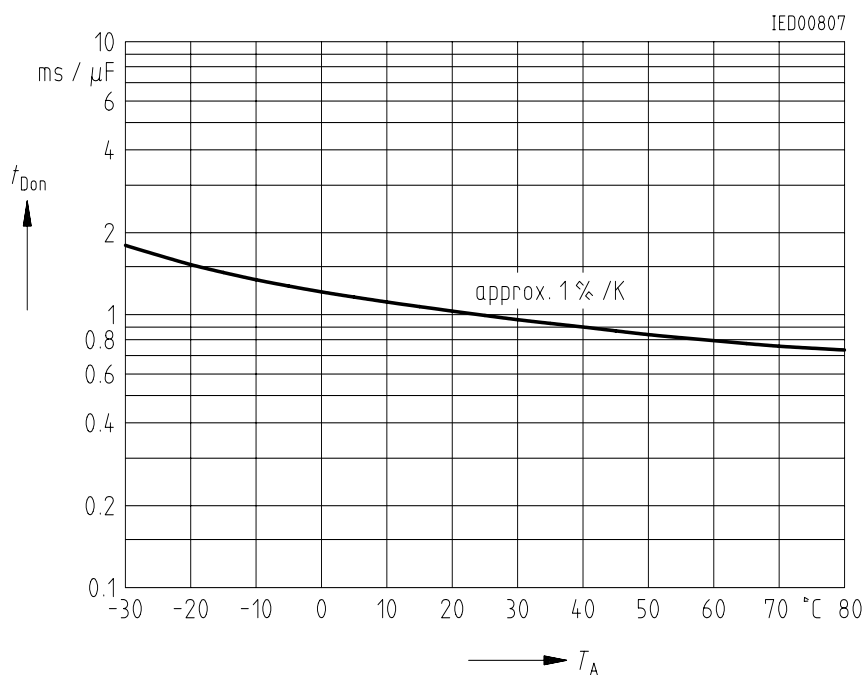
Logic Functions

| Oscillator | Outputs | |
|------------|---------|---|
| | Q | |
| not damped | H | L |
| damped | L | H |



Block Diagram

Standard Turn-ON Delay Referred to $T_A = 25^\circ\text{C}$



Absolute Maximum Ratings

| Parameter | Symbol | Limit Values | Unit |
|---|----------------------------|---|-------------|
| Supply voltage | V_S | 35 | V |
| Output voltage | V_Q | 35 | V |
| Output current | I_Q | 50 | mA |
| Distance, hysteresis resistance | R_{Di}, R_{Hy} | 0 | Ω |
| Capacitances | C_i, C_D | 5 | μF |
| Junction temperature | T_j | 150 | $^{\circ}C$ |
| Storage temperature range | T_{stg} | – 55 to 125 | $^{\circ}C$ |
| Thermal resistance system - air TCA 305 A TCA 305 G | $R_{th SA}$ $R_{th SA}$ | 85 (135) ²⁾ 140 (200) ²⁾ | K/W K/W |

Operating Range

| | | | |
|----------------------|-----------|-----------------------|-------------|
| Supply voltage | V_S | 5 to 30 ³⁾ | V |
| Oscillator frequency | f_{osc} | 0.015 to 1.5 | MHz |
| Ambient temperature | T_A | – 25 to 85 | $^{\circ}C$ |

Characteristics

$V_S = 12 V$, $T_A = -25$ to $85^{\circ}C$

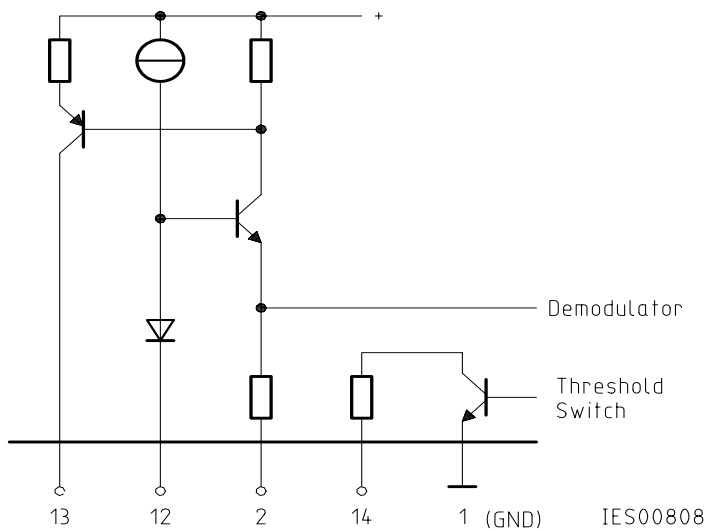
| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---------------------------------|------------|--------------|------|-------------------------|-------------|----------------------|
| | | min. | typ. | max. | | |
| Open-loop current consumption | I_S | | 0.6 | 0.9 (1.0) ²⁾ | mA | outputs open |
| Reference voltage ¹⁾ | V_{REF} | | 3.2 | | V | $I_{REF} < 10 \mu A$ |
| L-output voltage | V_{QL} | | 0.04 | 0.15 | V | $I_{QL} = 5 mA$ |
| per output | V_{QL} | | 0.10 | 0.35 | V | $I_{QL} = 25 mA$ |
| | V_{QL} | | 0.22 | 0.75 | V | $I_{QL} = 50 mA$ |
| H-output current per output | I_{QH} | | | 10 | μA | $V_{QH} = 30 V$ |
| Threshold at 3 | V_{S3} | | 2.1 | | V | |
| Hysteresis at 3 | V_{Hy} | 0.4 | 0.5 | 0.6 | V | |
| Turn-ON delay ¹⁾ | $t_{D ON}$ | – 25 % | 600 | – 25 % | ms/ μF | $T_A = 25^{\circ}C$ |
| Switching frequency w/o C_i | f_s | | | 5 | kHz | |

¹⁾ TCA 305 only

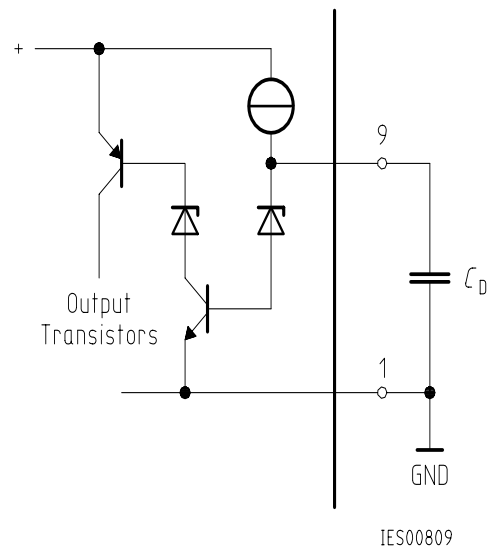
²⁾ Values in parenthesis apply to TCA 355 only

³⁾ Operation at voltages less than 5 V (between approx. 2.5 and 5 V) is possible, if V_{REF} is connected to V_S . In this case V_{REF} is no longer internally stabilized. Additionally, the pin "turn-on delay" is to be applied as follows: If no turn-on delay is needed, this pin has to be connected to V_S . If, however, a turn-on delay is required, the charge current for D_D has to be adjusted with an external resistor between this pin and V_S (recommended value $390 k\Omega$).

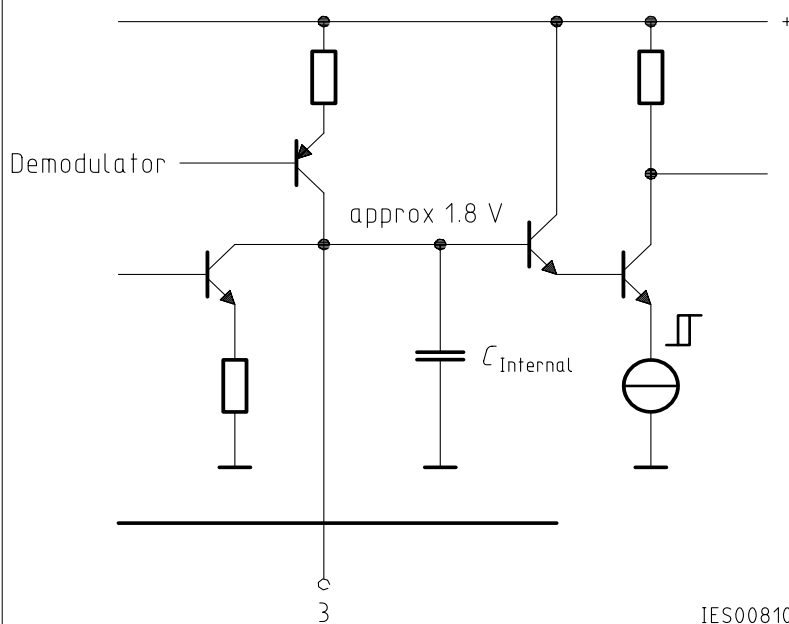
Oscillator



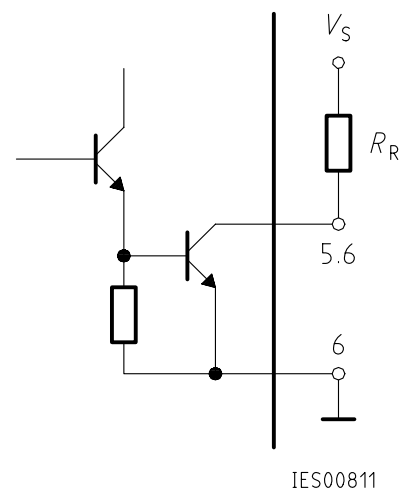
Turn-ON Delay for TCA 305 A; G



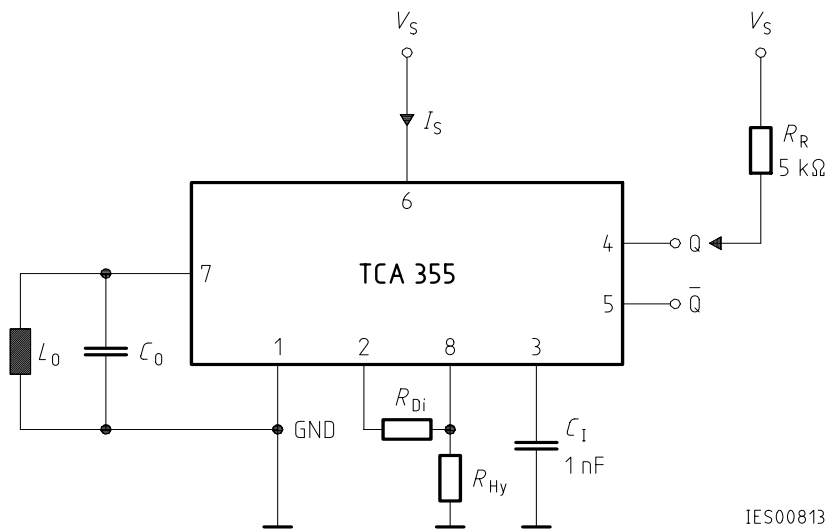
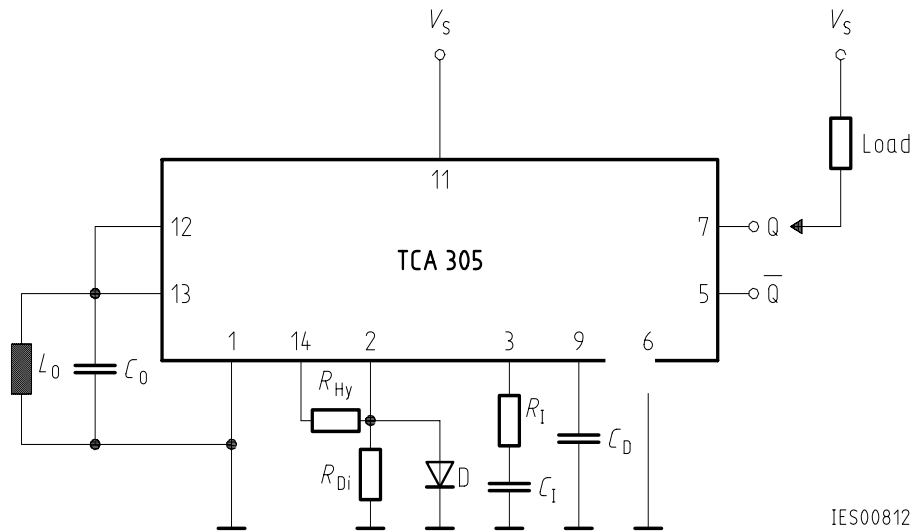
Integrating Capacitor



Outputs



Schematic Circuit Diagram



Application Circuit

| | |
|------------|---|
| L_0, C_0 | Resonant circuit |
| R_{Hy} | Hysteresis adjustment |
| R_{Di} | Distance adjustment |
| D | Temperature compensation of the resonant circuit; possibly with series resistance for the purpose of adjustment. The diode is not absolutely necessary. Whether it is used or not depends on the temperature coefficient of the resonant circuit. |
| R_i, C_i | Integration element. At pin 3 (integrating capacitance) we recommend a capacitor of typ. 1 nF. To increase noise immunity this capacitor can be substituted by an RC circuit with, e.g., $R_i = 1 \text{ M}\Omega$ and $C_i = 10 \text{ nF}$. |
| C_D | Delay capacitor |

Dimensioning Examples in Accordance with CENELEC Standard (flush)

| | M 12 | M 18 | M 30 |
|-----------------------|-------------------------------|----------------------|--------------------------------|
| Ferrite pot core | M 33 (7.35 × 3.6) mm | N 22 (14.4 × 7.5) mm | N 22 (25 × 8.9) mm |
| Number of turns | 100 | 80 | 100 |
| Cross section of wire | 0.1 CuL | 20 × 0.05 | 10 × 0.1 |
| L_0 | 206 μH | 268 μH | 585 μH |
| C_0 (STYROFLEX®) | 1000 pF | 1.2 nF | 3.3 nF |
| f_{sc} | appr. 350 kHz | appr. 280 kHz | appr. 115 kHz |
| S_n | 4 mm | 8 mm | 15 mm |
| R_A (Metal) | 8.2 k Ω + 330 Ω | 33 k Ω | 22 k Ω + 2.7 k Ω |
| C_D | 100 nF | 100 nF | 100 nF |