

Proximity Switch

TCA 305
TCA 355

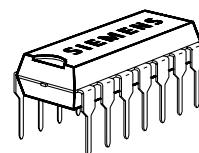
Bipolar IC

Features

- Lower open-loop current consumption; $I_S < 1$ 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 $V_S <$ approx. 4.5 V and are enabled when the oscillator stabilizes (from $V_{S\ min} = 5$ V)
- Higher switching frequencies can be obtained
- Miniature package



P-DSO-8-1



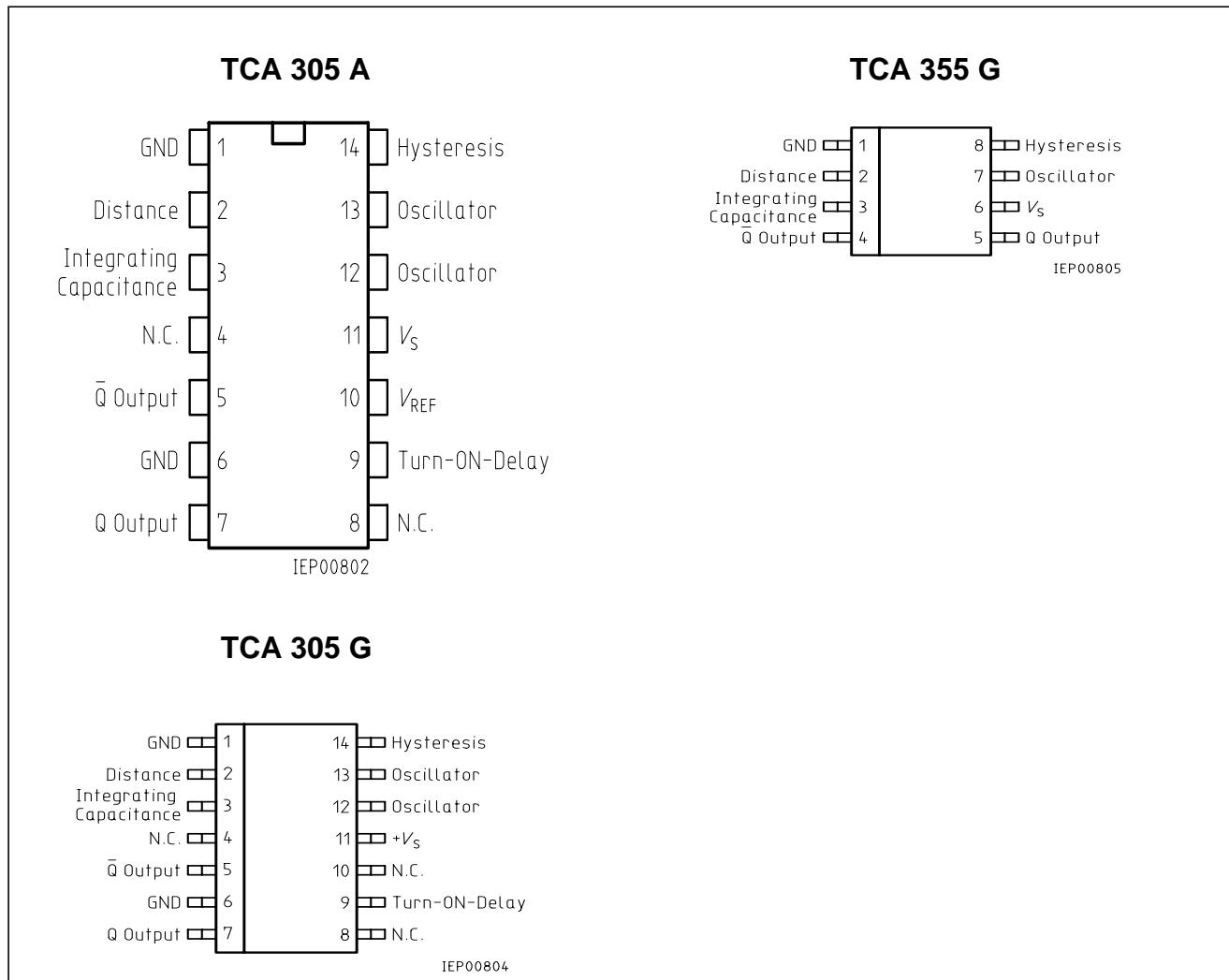
P-DIP-14-1



P-DSO-14-1

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

■ Not for new design



Pin Configurations (top view)

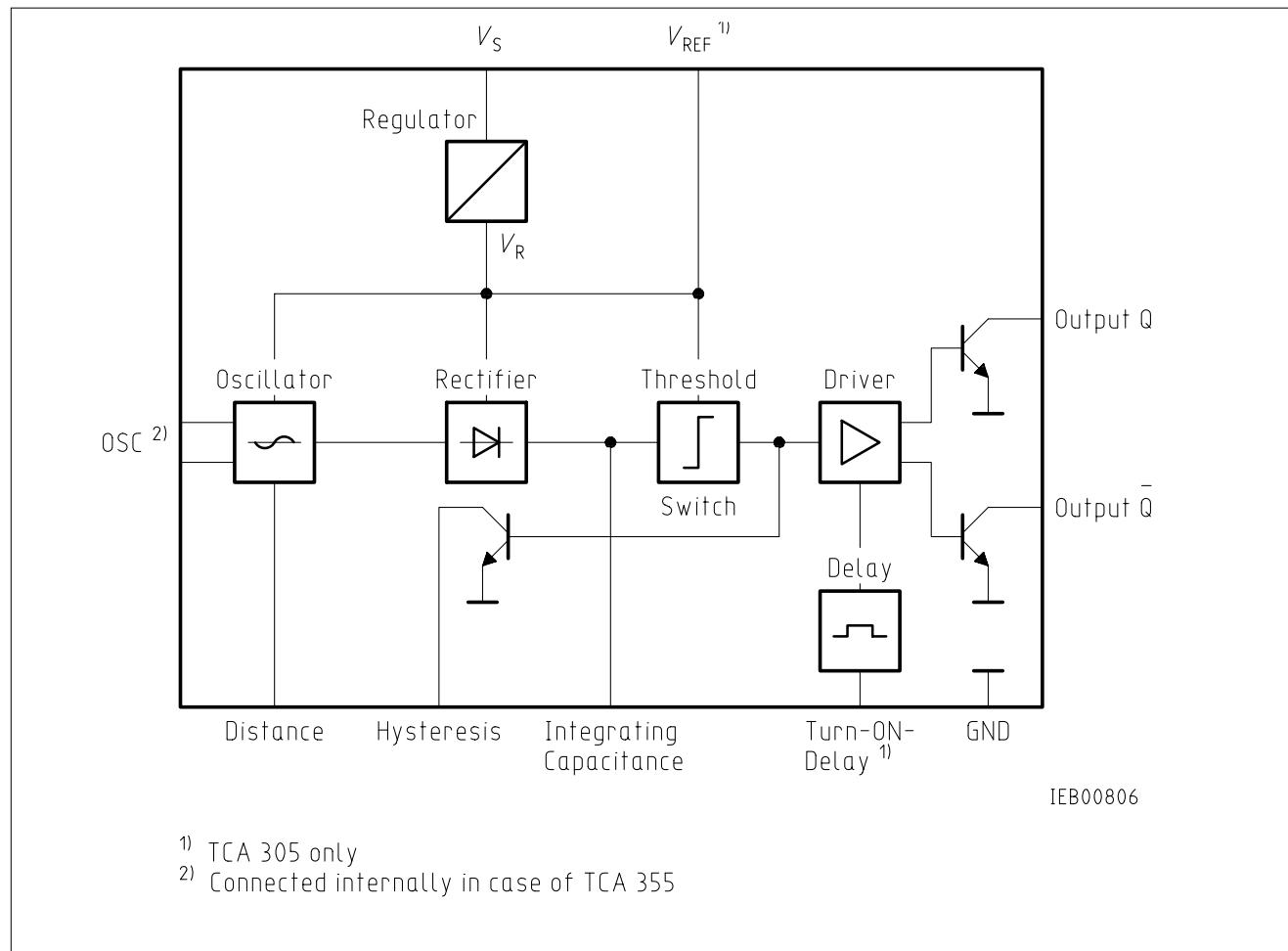
The devices TCA 305 and TCA 355 contain all the functions necessary to design inductive proximity switches. By approaching a standard metal plate to the coil, the resonant circuit is damped and the outputs are switched.

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:

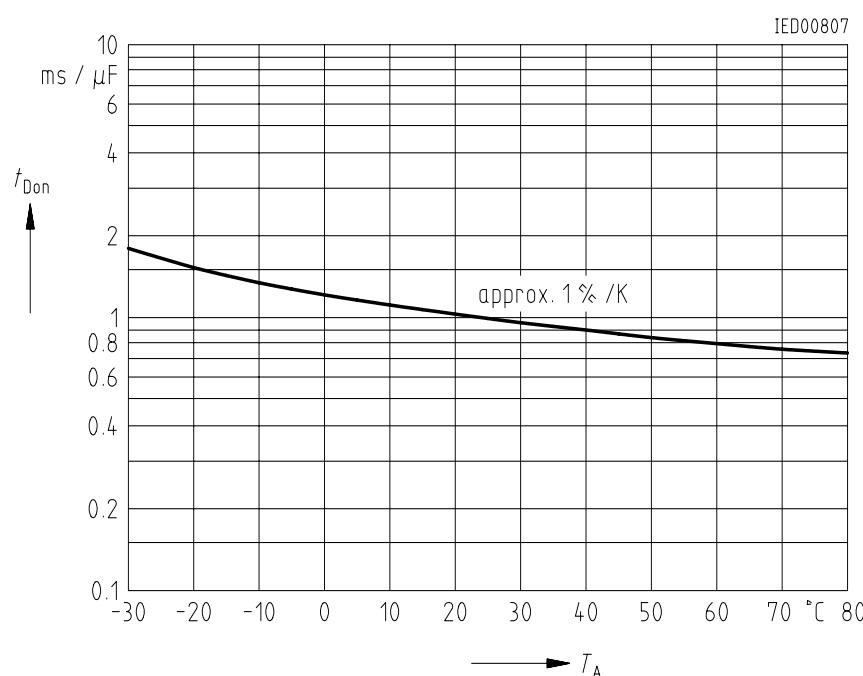
Logic Functions

Oscillator	Outputs
	Q
not damped	H
damped	L



Block Diagram

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



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_{D_i}, R_{Hy}	0	Ω
Capacitances	C_I, C_D	5	μF
Junction temperature	T_j	150	$^{\circ}\text{C}$
Storage temperature range	T_{stg}	– 55 to 125	$^{\circ}\text{C}$
Thermal resistance system - air	$R_{th\ SA}$	85 (135) ²⁾	K/W
TCA 305 A		140 (200) ²⁾	K/W
TCA 305 G			

Operating Range

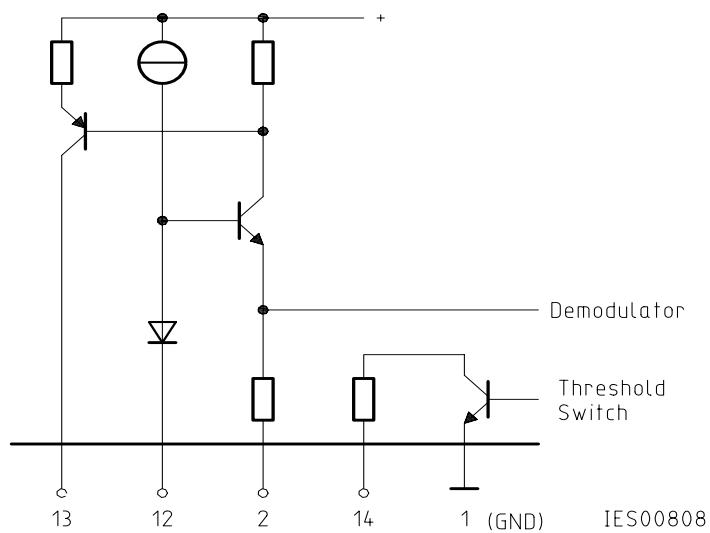
Supply voltage	V_s	5 to 30 ³⁾	V
Oscillator frequency	f_{osc}	0.015 to 1.5	MHz
Ambient temperature	T_A	– 25 to 85	$^{\circ}\text{C}$

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

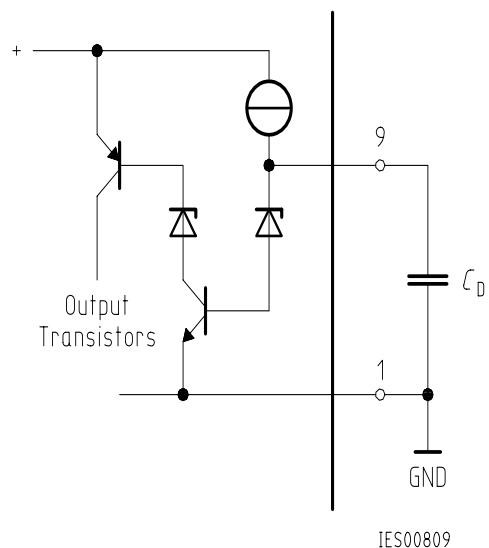
Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Open-loop current consumption	I_s		0.6	0.9 (1.0) ²⁾	mA	outputs open
Reference voltage ¹⁾	V_{REF}		3.2		V	$I_{REF} < 10\text{ }\mu\text{A}$
L-output voltage per output	V_{Q_L}		0.04	0.15	V	$I_{Q_L} = 5\text{ mA}$
	V_{Q_L}		0.10	0.35	V	$I_{Q_L} = 25\text{ mA}$
	V_{Q_L}		0.22	0.75	V	$I_{Q_L} = 50\text{ mA}$
H-output current per output	I_{Q_H}			10	μA	$V_{Q_H} = 30\text{ V}$
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	$T_A = 25\text{ }^{\circ}\text{C}$
Switching frequency w/o C_I	f_s			5	kHz	

¹⁾ TCA 305 only²⁾ Values in parenthesis apply to TCA 355 only³⁾ 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 Ω ²⁾.

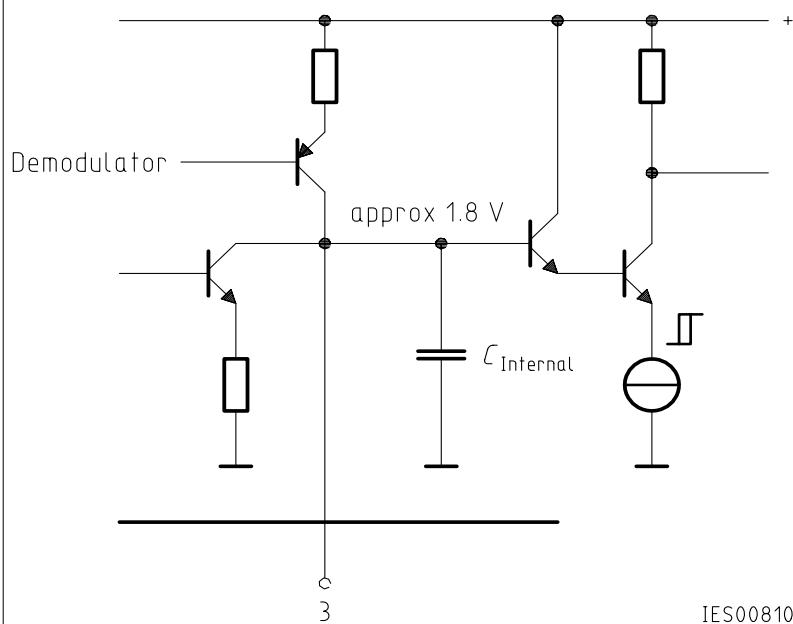
Oscillator



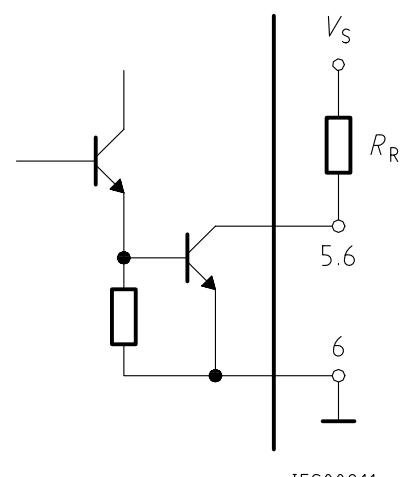
Turn-ON Delay for TCA 305 A; G



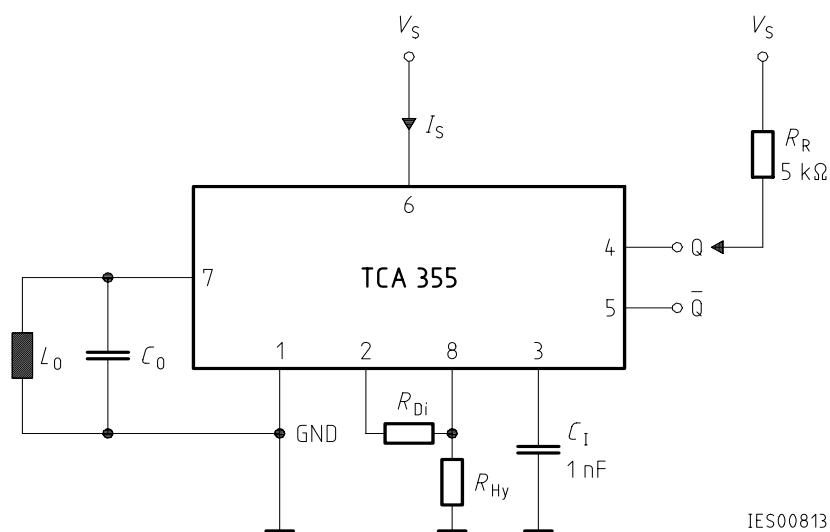
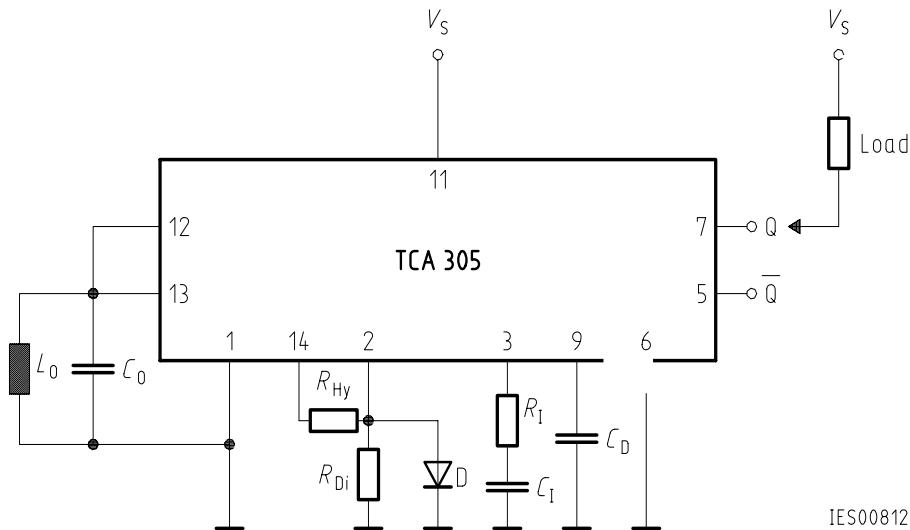
Integrating Capacitor



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	$206 \mu\text{H}$	$268 \mu\text{H}$	$585 \mu\text{H}$
C_0 (STYROFLEX®)	1000 pF	1.2 nF	3.3 nF
f_{osc}	appr. 350 kHz	appr. 280 kHz	appr. 115 kHz
S_n	4 mm	8 mm	15 mm
R_A (Metal)	$8.2 \text{ k}\Omega + 330 \text{ }\Omega$	$33 \text{ k}\Omega$	$22 \text{ k}\Omega + 2.7 \text{ k}\Omega$
C_D	100 nF	100 nF	100 nF