

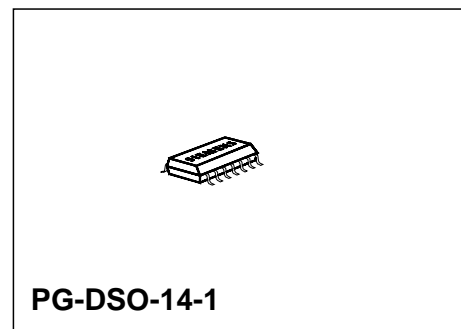
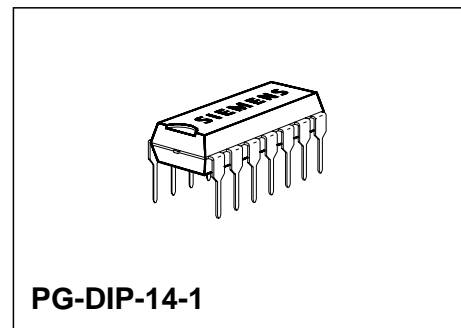
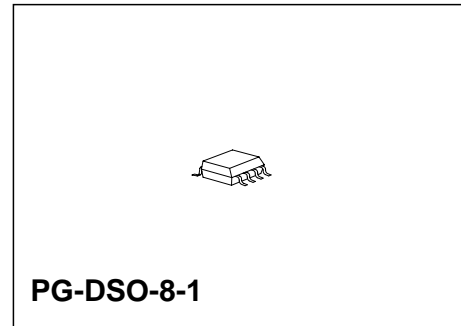
## Proximity Switch

TCA 305  
TCA 355

Bipolar IC

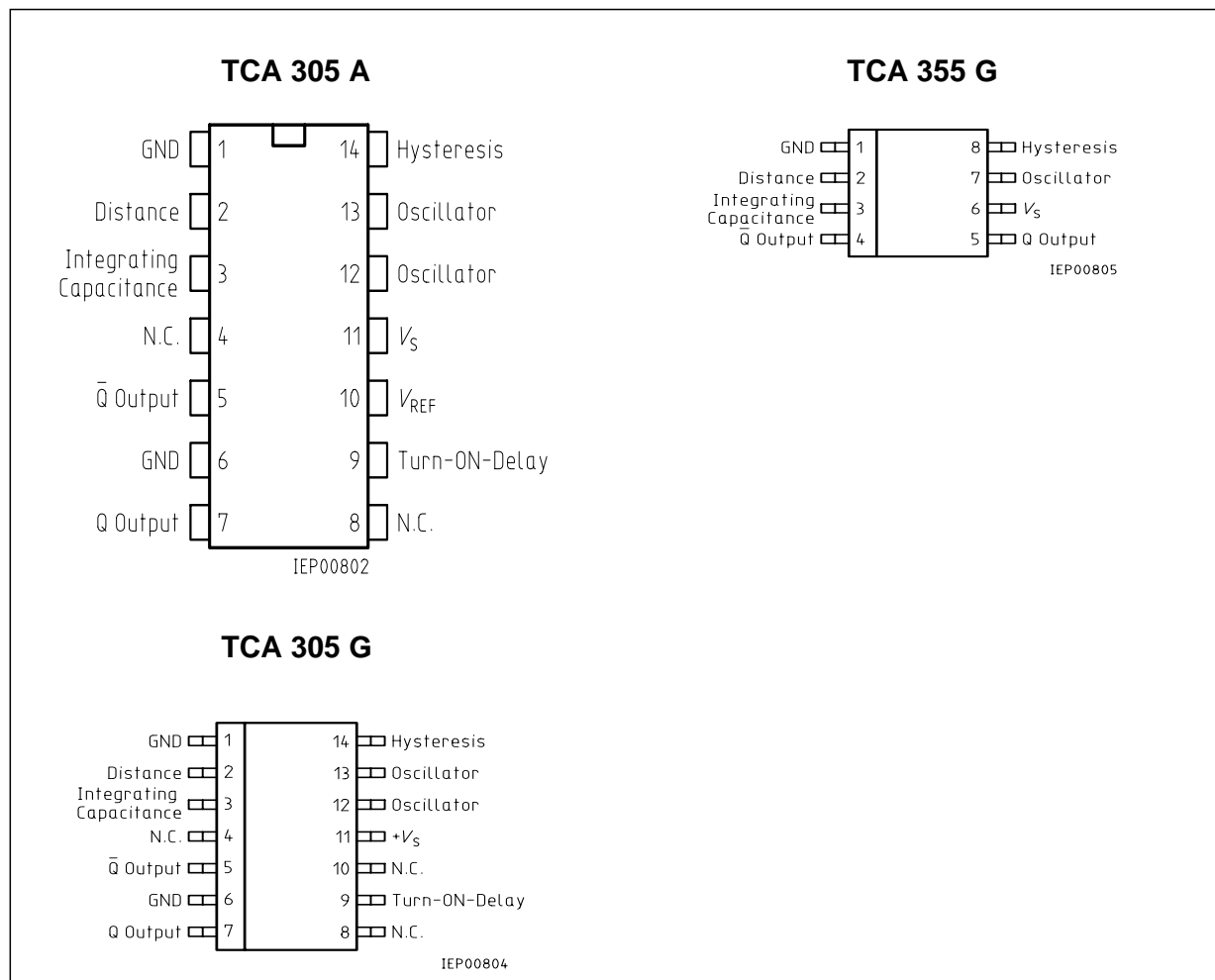
### Features

- 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



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)

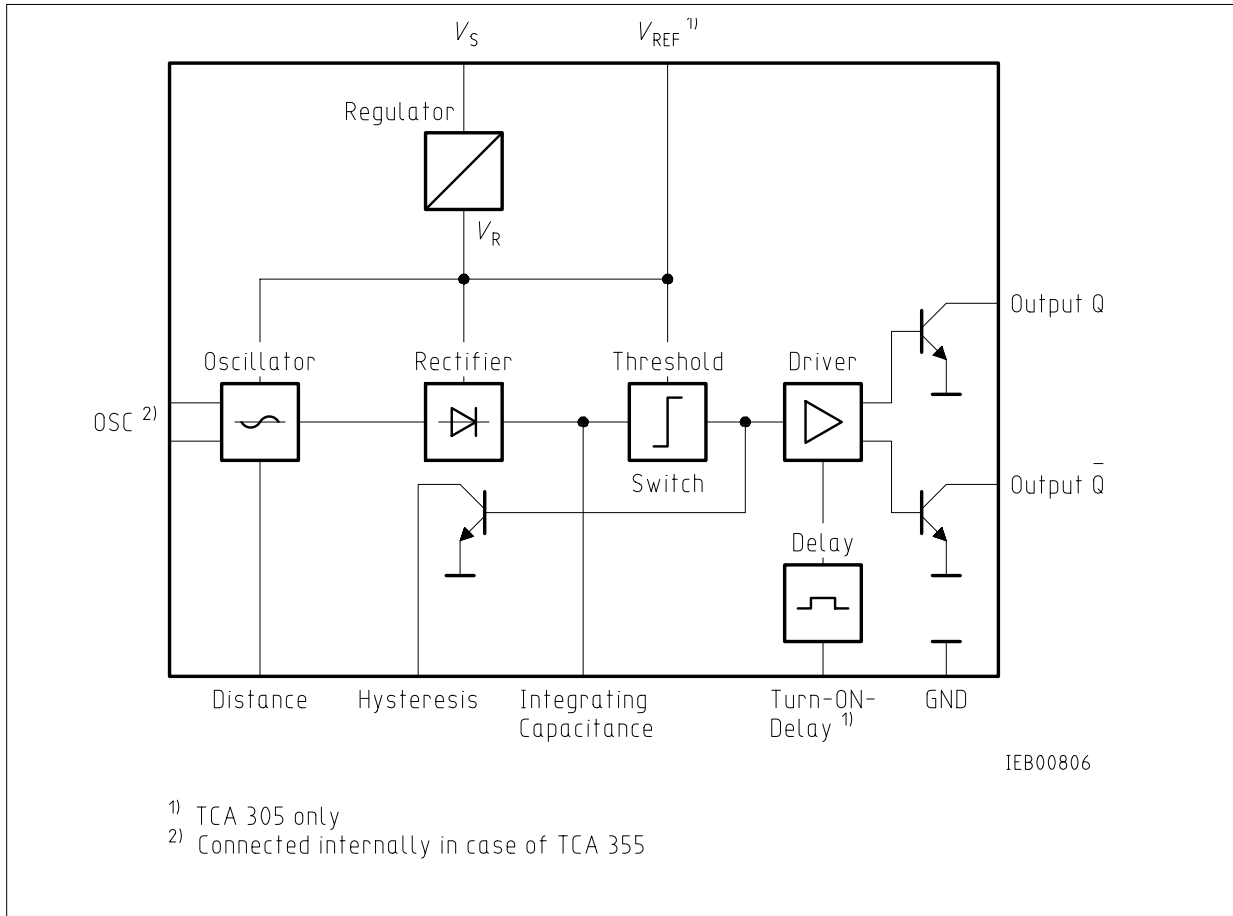
The devices TCA 305 and TCA 355 contain all the functions necessary to design inductive proximity switches. By approaching a standard metal plate to the coil, the resonant circuit is damped and the outputs are switched.

### 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:

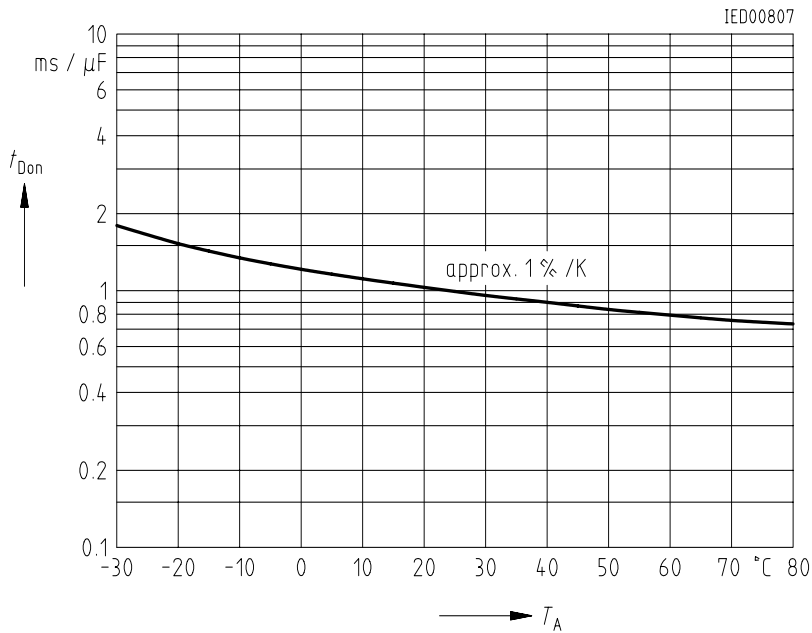
### Logic Functions

Oscillator	Outputs	
	Q	
not damped	H	L
damped	L	H



**Block Diagram**

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



## 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	$\Omega$
Capacitances	$C_I, C_D$	5	$\mu F$
Junction temperature	$T_j$	150	$^{\circ}C$
Storage temperature range	$T_{stg}$	- 55 to 125	$^{\circ}C$
Thermal resistance system - air	$R_{th SA}$	85 (135) <sup>2)</sup>	K/W
TCA 305 A TCA 305 G	$R_{th SA}$	140 (200) <sup>2)</sup>	K/W

## Operating Range

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

## Characteristics

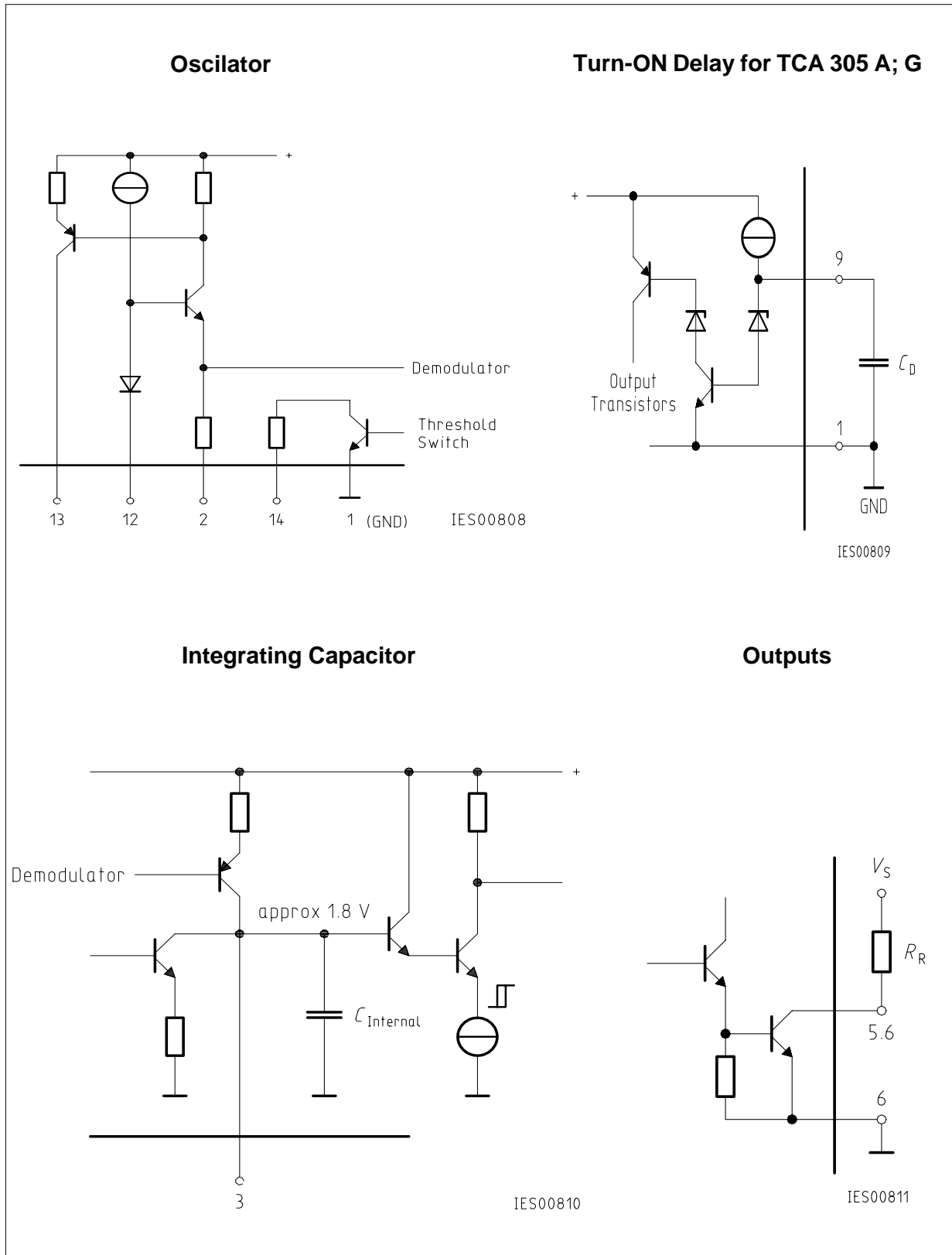
$V_S = 12 V, T_A = - 25 \text{ to } 85 \text{ }^{\circ}C$

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

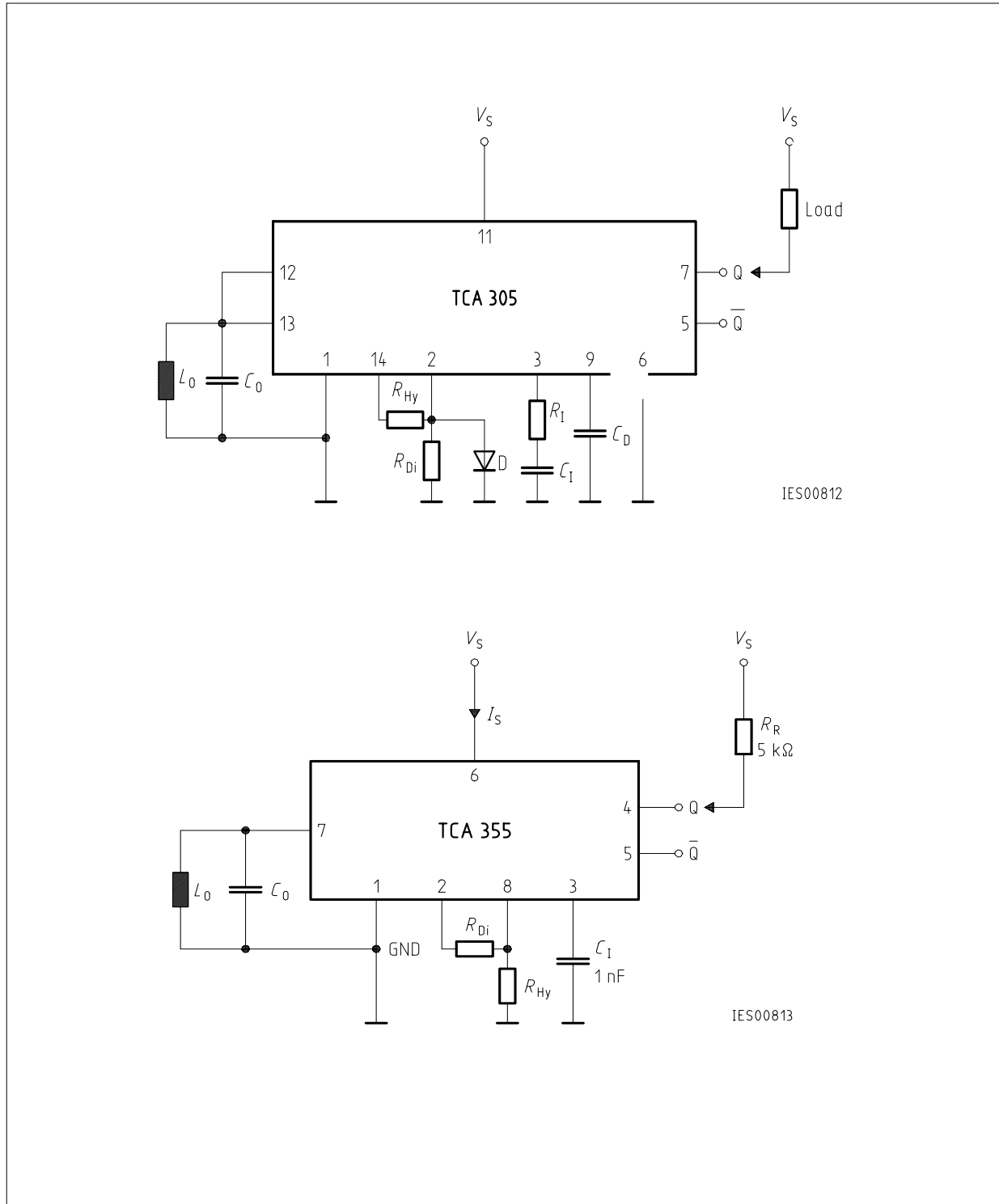
1) TCA 305 only

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 $\Omega$ ).



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., $R_i = 1 M\Omega$ and $C_i = 10$ 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 $\mu$ H	268 $\mu$ H	585 $\mu$ H
$C_0$ (STYROFLEX®)	1000 pF	1.2 nF	3.3 nF
$f_{sc}$	appr. 350 kHz	appr. 280 kHz	appr. 115 kHz
Sn	4 mm	8 mm	15 mm
$R_A$ (Metal)	8.2 k $\Omega$ + 330 $\Omega$	33 k $\Omega$	22 k $\Omega$ + 2.7 k $\Omega$
$C_D$	100 nF	100 nF	100 nF