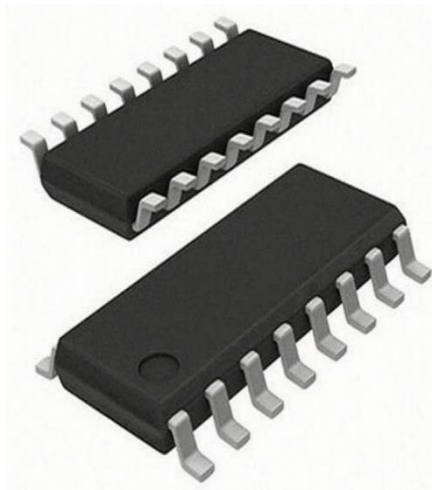


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IC for Inductive Proximity Switches



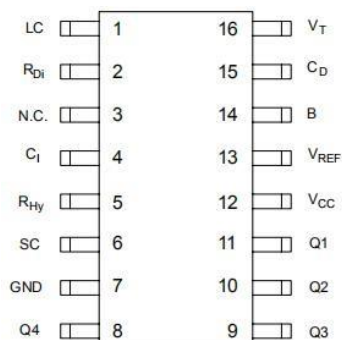
PRODUCTS FEATURES

- Wide supply voltage: 4.0~40V
- Low current consumption : < 0.7mA
- Integrated output stage current: >70mA
- High noise immunity
- High switching frequencies up to 5 kHz
- Suitable for two-wire AC proximity switches
- Temperature response of the IC compensates that of the coil
- Short-circuit and overload protection of output stages and external components
- Temperature range -40~+125°C

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IC for Inductive Proximity Switches

1. PIN configuration

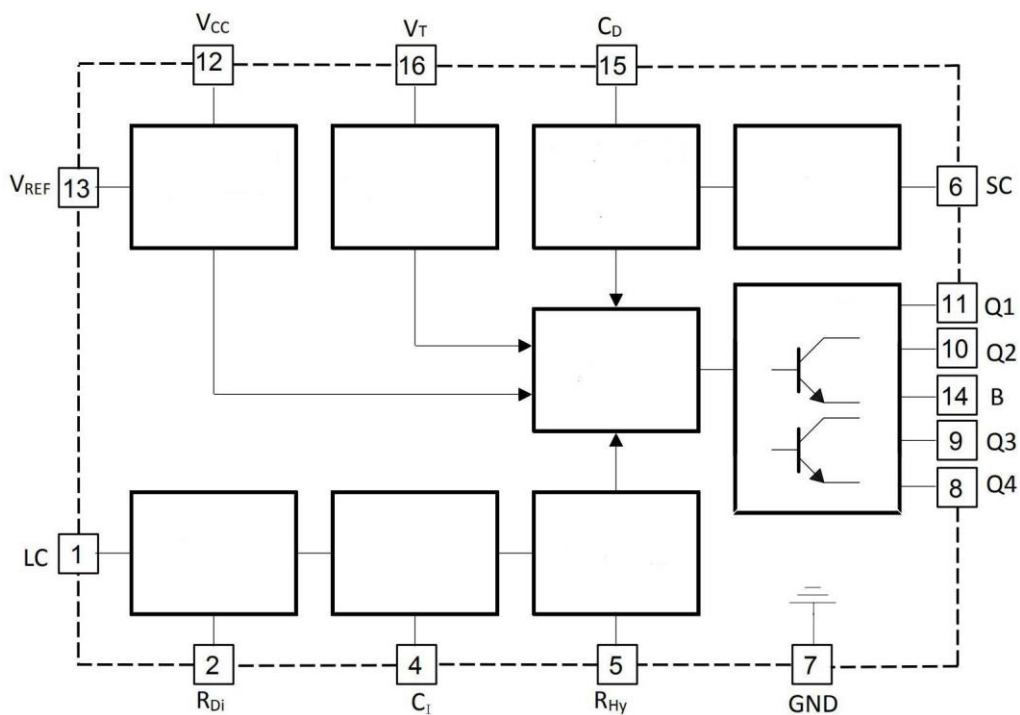


Pin	Symbol	Function	Description
1	LC	Oscillator	An external inductor and capacitor are connected between LC and GND to form a resonant circuit.
2	RD _i	Distance	RD _i external resistor that sets the current and detection distance in the oscillator.
3	NC	Not connected	
4	C _i	Integrating capacitance	An external 1nF capacitor is usually connected between C _i and GND to reduce interference.
5	R _{Hy}	Hysteresis	An external resistor between R _{Hy} and GND is used to set the detected window hysteresis.
6	SC	Short-circuit detector	Short-circuit sampling of the output stage of the circuit (can be for VCC or GND).
7	GND	Ground	
8	Q4	Output	Emitter of second output transistor (open circuit)
9	Q3	Output	Collector of second output transistor (open circuit)
10	Q2	Output	Emitter of first output transistor (open circuit)
11	Q1	Output	Collector of first output transistor (open circuit)
12	V _{CC}	Supply voltage	
13	V _{REF}	Internal reference voltage	Internal stable reference voltage, approximately 3.0V. When V _{REF} and V _{CC} are connected together, the operating voltage range of the circuit can be reduced to 3.1~4.5V.
14	B	Base Output Transistors	Used to limit the base voltage of the internal output stage transistors.
15	C _D	Turn-on delay Short-circuit delay	An external capacitor between C _D and GND is used to set the action delay time.
16	V _T	Two-wire regulator	In two-wire applications, V _T and V _{CC} are connected together.

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2. Functional block diagram



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3. Technical parameters

3.1 Recommended working conditions

Parameter	Symbol	Min	Max	Unit	Test Conditions
Voltage	V _{CC}	4	40	V	Normal work
Voltage	V _{CC}	3.1	4.5	V	V _{CC} =V _{REF} , Low voltage work
Range of working temperature	T _A	-40	125	°C	

3.2 Limit parameter

Parameter	Symbol	Min	Max	Unit	Test Conditions
Voltage	V _{CC}	-0.3	50	V	
Output pin voltage	V _{Q1} ; V _{Q3}	-1	45	V	V _{Q2} ; V _{Q4} ≤ V _{CC}
Output tube voltage (B-pin open)	V _{Q2} ; V _{Q4}	-1	V _{CC}	V	V _{Q1} ; V _{Q2} ; V _{Q4} < V _{Q3}
Output tube voltage (B-pin connection)	V _{Q2} ; V _{Q4}	-1	V _B	V	V _{Q1} ; V _{Q2} ; V _{Q4} < V _{Q3}
Output tube output current	I _{Q1} ; I _{Q3}	0	70	mA	No short circuit protection
Output tube output current	-I _{Q2} ; -I _{Q4}	0	70	mA	No short circuit protection
V _T pin voltage	V _T	-0.3	14	V	
V _{REF} pin current	-I _{VREF}	0	100	μA	
SC pin voltage	V _{SC}	0	V _{CC}	V	
R _{Di} pin pull current	-I _{RDi}	0	2	mA	
R _{Hys} pin sink current	I _{RHy}	0	2	mA	
B pin voltage	V _B	-0.3	V _{CC}	V	
Junction temperature	T _J	-40	150	°C	
Storage temperature	T _S	-55	160	°C	

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3.3 Recommended working conditions

Parameter	Test conditions	Symbol	Min.	Typ.	Max.	Unit
Power section						
Static supply current	Three-wire system	ICC		0.55	0.70	mA
Static supply current	Two-wire system	ICC		0.62	0.80	mA
Three –wire system						
Minimum starting voltage	Output start action	V _{TON1}		3.64	4	V
Shutdown voltage	Output to no action	V _{TOFF1}	3.0	3.6		V
Hysteresis	V _{TON1} -V _{TOFF1}	ΔV _{Hy1}		0.04		V
Oscillator section (LC, R_{Di})						
Oscillating frequency		f _{OSC}			3	MHz
Oscillation amplitude		A _{OSC}		0.8		V _{PP}
Modulator and threshold switch section (C_I, R_{Hy})						
C _I Pin threshold		V _{CI}		2		V
C _I Pin hysteresis		V _{HyCI}		0.8		V
C _I pin sink current		I _{CI}		7		μA
C _I pin pull current		-I _{CI}		6		μA
On-off level frequency	C _I < 50 pF, L=70μH	f _s		5		kHz
Reference voltage (V_{REF})						
Reference voltage	I _{VREF} =0~100μA	V _{REF}	2.65	3.0	3.10	
Two-wire regulator (V_T)						
Minimum starting voltage		V _{TON2}	6.7	8.0	9.3	V
Shutdown voltage		V _{TOFF2}	5.0	6.0	7.0	V
Hysteresis	V _{TON2} -V _{TOFF2}	ΔV _{Hy2}	1.6	2.0	2.4	V
Switch delay and short circuit protection delay (C_D)						
Turn-on delay		t _{DON}	0.49	0.65	0.82	ms/nF
Shutdown delay		t _{VA}	17.0	25	34.0	μs/nF
Short circuit protection delay		t _{SC}	1.70	2.5	3.40	μs/nF

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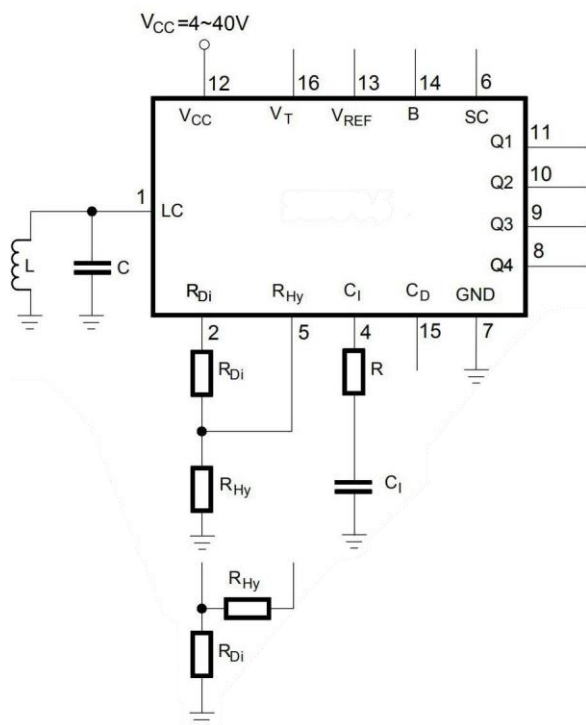
Parameter	Test conditions	Symbol	Min.	Typ.	Max.	Unit
Output stage (Q1, Q2, Q3, Q4)						
Output voltage difference	$I_Q=5\text{mA}, V_{Q1}-V_{Q2}, V_{Q3}-V_{Q4}$	V_{QR}		0.10	0.14	V
Output voltage difference	$I_Q=70\text{mA}, V_{Q1}-V_{Q2}, V_{Q3}-V_{Q4}$	V_{QR}		0.5	0.99	V
Output current during short circuit protection		I_{QSC}		300	500	mA
Short circuit detection (SC)						
Trigger voltage when short-circuiting the power supply VCC		V_{SCS}	0.255	0.3	0.345	V
Trigger current when short circuit to power supply VCC		I_{SCS}			30	μA
Trigger voltage when shorted to ground GND		V_{SCO}	0.255	0.3	0.345	V
Trigger current when shorted to ground GND		$-I_{SCO}$			6	μA

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4. Application circuit

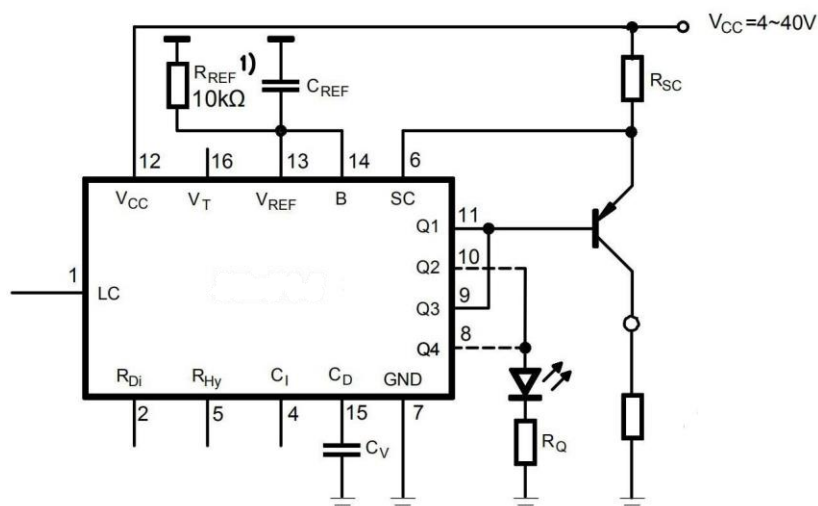
4.1 The input circuit uses four pins of LC, R_{Di} , R_{Hy} , and C_i .



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4.2 The output circuit uses eight pins of VREF, B, SC, Q1, Q2, Q3, Q4, and CD.



Remark: External PNP structure output with short circuit protection and LED indication. Generally, the short circuit protection is calculated by using the following equation:

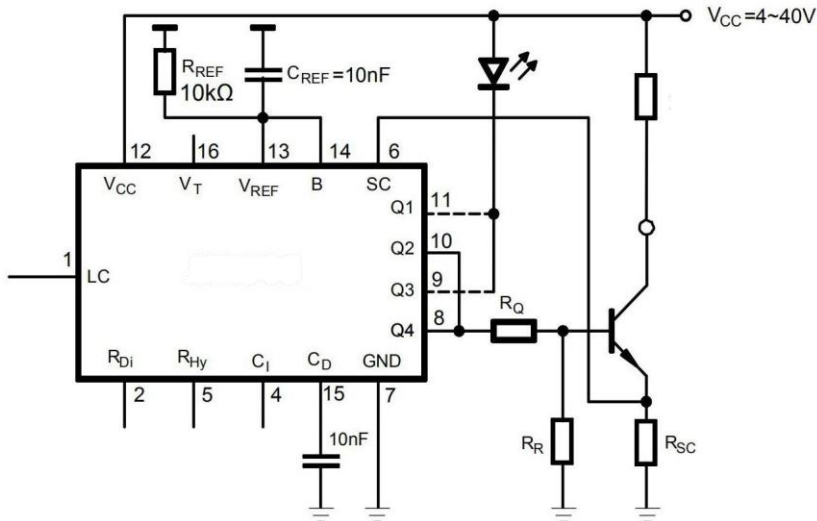
$$R_{sc} = - \frac{0.3 V}{\text{max. load current}}$$

During the current sampling period, the current in the chip is limited to a maximum of 250mA.

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4.3 The output circuit uses eight pins of VREF, B, SC, Q1, Q2, Q3, Q4, and CD



Remark: External NPN structure output with short circuit protection and LED indication. Generally, the short circuit protection is calculated by using the following equation:

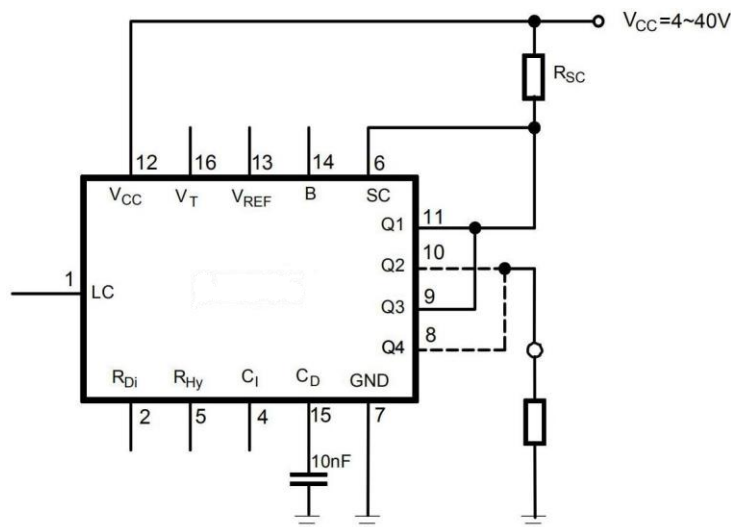
$$R_{Sc} = - \frac{0.3 V}{max. load current}$$

During the current sampling period, the current in the chip is limited to a maximum of 250mA.

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4.4 The output circuit uses six pins of SC, Q1, Q2, Q3, Q4, and CD



Note: Direct internal NPN output structure with short circuit protection and LED indication. Generally, the short circuit protection is calculated by using the following equation:

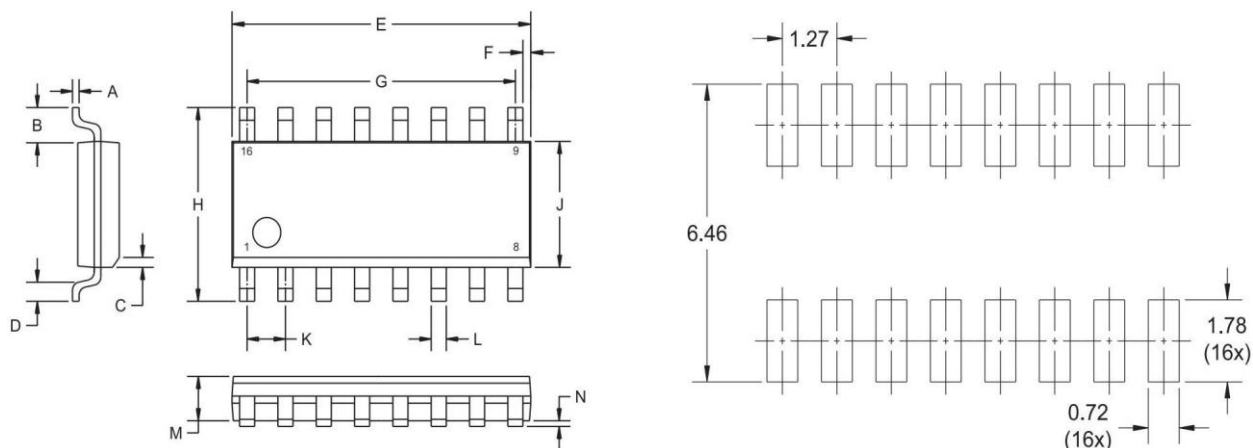
$$R_{Sc} = - \frac{0.3 V}{max. load current}$$

During the current sampling period, the current in the chip is limited to a maximum of 250mA.

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6. Dimension



Name	Min	Typ	Max
A	0.19	0.25	0.22
B	-	-	1.04
C	0.30	0.50	0.40
D	0.45	0.80	0.60
E	9.80	10.00	9.90
F	-	-	0.25
G	-	-	8.89
H	5.80	6.20	6.00
J	3.80	4.00	3.90
K	-	-	1.27
L	0.35	0.51	0.43
M	1.25	1.55	1.45
N	0.10	0.20	0.15

Note:

- 1) All dimensions in mm
- 2) Package is SOP16