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## *Evaluation Kit*

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### **APPLICABLE PARTS**

- AIC1601

### **DESCRIPTION**

The AIC1601 Eval board can be used for evaluation of the Apex AIC1601 in an inductive proximity switch application. It features a low side open collector output which is integrated in the IC, and a high side output realized by means of external components. Both outputs are protected against over voltage and over current. In case of over current, power dissipation is limited by entering a hiccup mode until normal load condition has returned. Freewheel diodes are placed on both outputs, allowing to switch inductive loads such as relays.

### **FEATURES**

- Sensitivity adjustable by potentiometer (R5)
- Jumper JP1 to select normally OFF or normally ON operation (preset to NO)
- Power LED (green)
- Detect LED (red)
- Freewheel diode for external relay (D4 for low side, D5 for high side switch)
- Optional low supply voltage operation by closing jumper JP2 and solder joint SJ1 (the latter only in case of high side switch operation)

### **GETTING STARTED**

After connecting a DC supply voltage of 5.5V to 24V to the supply terminals VCC (positive) and Gnd the green Power LED is turned on. With no target near the sensor coil the red Detection LED should be off, indicating that the LC oscillator is working. This can be validated by connecting an oscilloscope probe to test point TP2. The ringing amplitude should be in the order of 2Vpp. If the Detection LED is on and no oscillation is observed on TP2 the resistance of potentiometer R5 for sensitivity adjustment can be reduced by turning the trimming screw counter-clockwise until the oscillation starts and the Detection LED turns off.

Once the Detection LED is off a metal target can be placed in the desired detection distance an potentiometer R5 is set to switch the LED at this distance. Turn the trimming screw clockwise until the LED turns on or counter-clockwise until it turns off. As a rule of thumb a detection distance of 50% to 75% of the coil diameter is appropriate for a stable design.

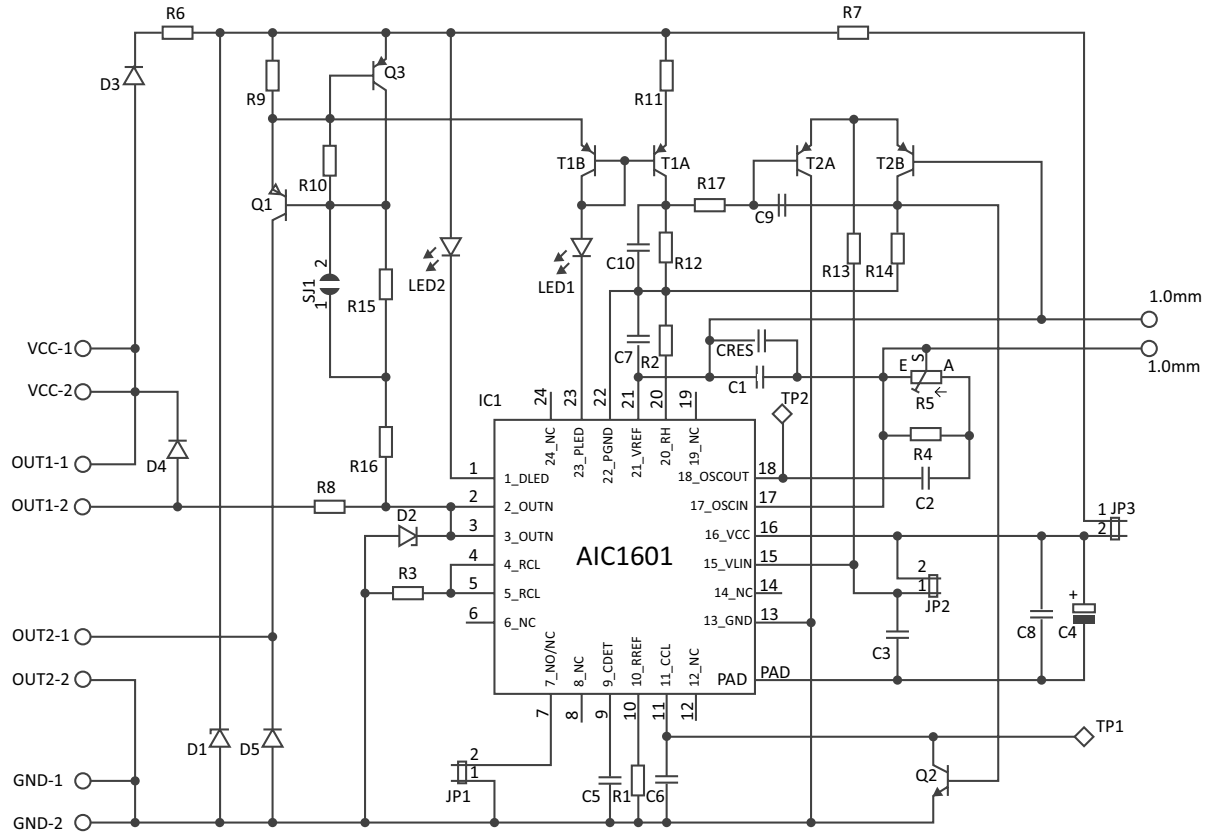
Jumper JP3 (normally closed) can be used to measure the IC's supply current, excluding the external load current. Before applying the supply voltage to VCC of the board, an amp-meter should be connected to the two terminals of the opened jumper.

Solder joint SJ1 should be shorted (closed) in case the high side output OUT2 is used and the supply voltage VCC is 8V or lower. SJ1 reduces the base drive resistor for Q1 from 6.1k $\Omega$  to 2.2k $\Omega$ .

For further information please refer to AIC1601's data sheet and Application Note AN67.

EVAL BOARD SCHEMATIC

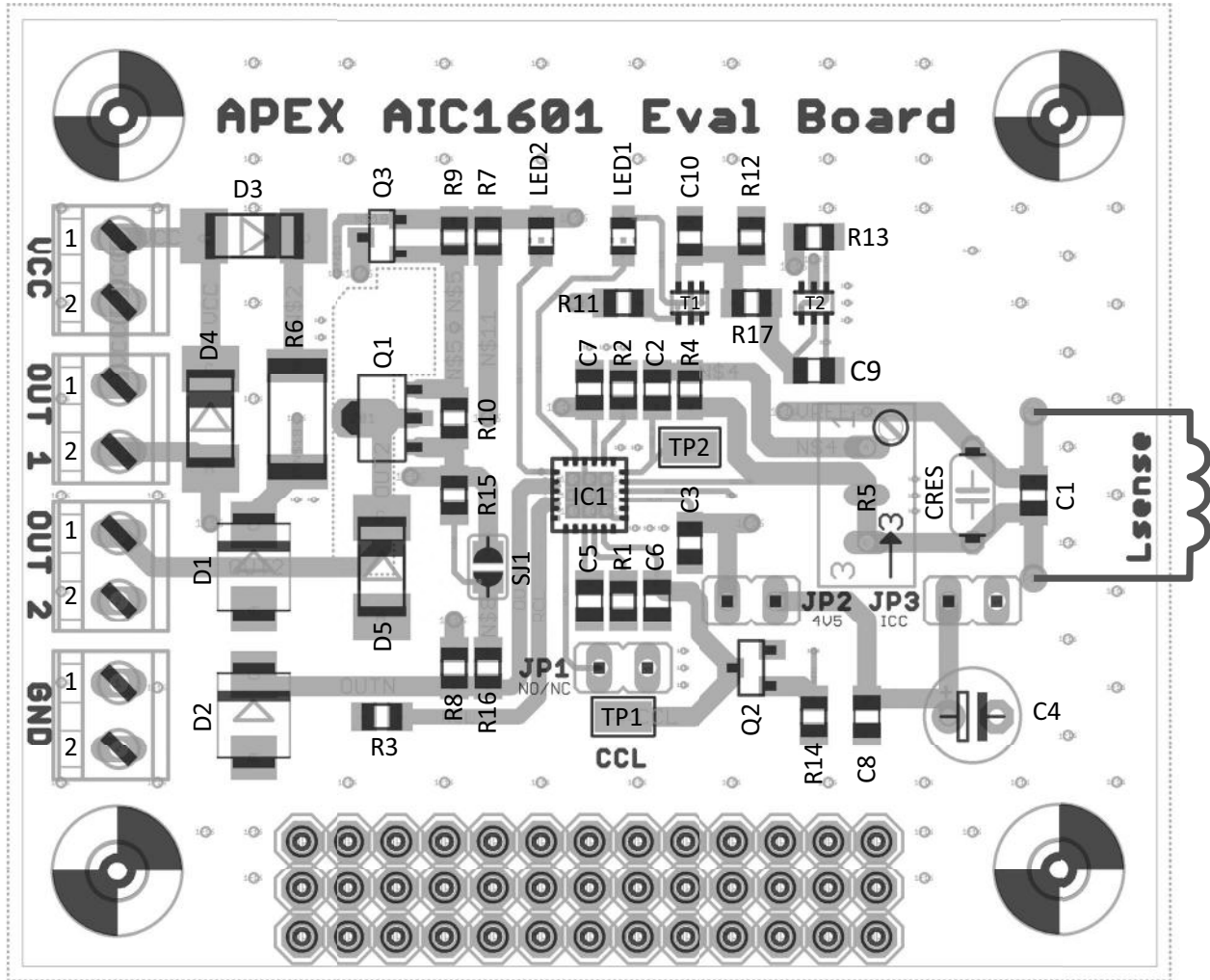
Figure 1: Schematic of AIC1601 Evaluation Board



JP1 - NO/NC switch  
 JP2 - if closed enables low supply voltage operation  
 JP3 - supply current monitor

EVAL BOARD LAYOUT

Figure 2: Layout of AIC1601 Evaluation Board



Jumper and solder joint function and preset:

JP1	NO/NC normally open/normally closed	open = NO
JP2	to be closed for low supply operation*	open = 5.5V – 24V operation
JP3	open for IC current measurement	closed
SJ1	adjustment of Q1 base drive current	open = 8V – 24V operation

Test points

TP1	voltage on over current timing capacitor
TP2	output voltage of the internal oscillator driving the LC resonant circuit

\* Note: all Operations below 5.5 V are outside of the specification of the IC. Accordingly, correct operation of the IC is not guaranteed. Operation of the board at supply voltages between 4.5V and 5.5V is possible by closing jumper JP2. In that case the internal voltage regulator is bypassed and the external supply voltage is directly fed into its output Vlin. Please note that the Eval-Board contains a reverse protection diode which reduces the voltage applied from external by approximately 0.7V.

## PARTS LIST

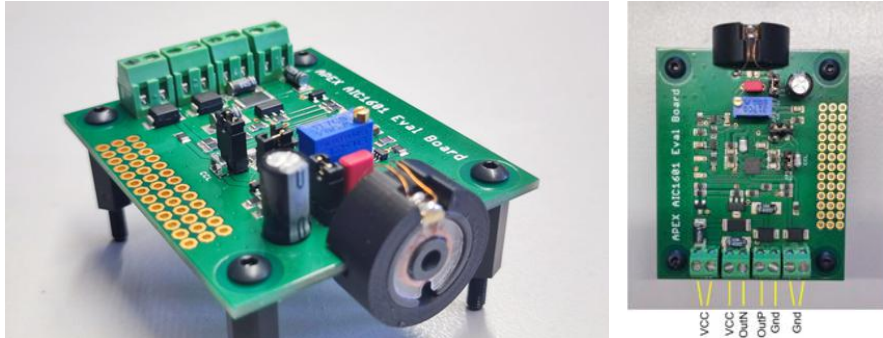
Reference	Manufacturer Part #	Description	QTY
<b><u>Capacitors</u></b>			
C1	User choice optional	fine tuning	
C2	C0805C104K1RAC7800	CAP CER 0.1UF 100V X7R 0805	1
C3, C7, C8, C10	C0805C224K1RAC7800	CAP CER 0.22UF 100V X7R 0805	4
C5	C0805C120J1GAC7800	CAP CER 12PF 100V COG/NPO 0805	1
C6	C0805C223J1RAC7800	CAP CER 0.022UF 100V X7R 0805	1
C9	C0805C222K1RAC7800	CAP CER 2200PF 100V X7R 0805	1
CRES	FKP0F011000B00KSSD	CAP FILM 1000PF 10% 250VDC RAD	1
C4	ESL106M100AE3AA	CAP ALUM 10UF 20% 100V RADIAL	1
<b><u>Diodes</u></b>			
D1, D2	P6SMB27A	TVS DIODE 23.1VWM 37.5VC DO214AA	2
D3, D4, D5	SM4002	DIODE GEN PURP 100V 1A MELF	3
LED1	XZCDGK54W-1VF	LED GREEN CLEAR 0805 SMD 2mA	1
LED2	XZCM2CRK54WA-1VF	LED RED CLEAR 0805 SMD 2mA	1
<b><u>Resistors</u></b>			
R1	CRCW080588K7FKEA	RES SMD 88.7K OHM 1% 1/8W 0805	1
R10, R16	CRCW08052K20FKEA	RES SMD 2.2K OHM 1% 1/8W 0805	2
R11	CRCW0805270RFKEA	RES SMD 270 OHM 1% 1/8W 0805	1
R12	CRCW08051K00FKEA	RES SMD 1K OHM 1% 1/8W 0805	1
R13, R14	CRCW080510K0FKEA	RES SMD 10K OHM 1% 1/8W 0805	2
R15	CRCW08053K90FKEA	RES SMD 3.9K OHM 1% 1/8W 0805	1
R17	CRCW080533K0FKEA	RES SMD 33K OHM 1% 1/8W 0805	1
R2	CRCW0805100RFKEA	RES SMD 100 OHM 1% 1/8W 0805	1
R3, R9	CRCW08051R60FKEA	RES SMD 1.6 OHM 1% 1/8W 0805	2
R4	CRCW080571K5FKEA	RES SMD 71.5K OHM 1% 1/8W 0805	1
R7, R8	CRCW080510R0FKEA	RES SMD 10 OHM 1% 1/8W 0805	2
R6	CRCW25121R00FN0G	RES SMD 1 OHM 1% 1W 2512	1
R5	3296W-1-503LF	TRIMMER 50K OHM 0.5W PC PIN TOP	1
SJ1	CRCW08050000Z0EA	RES SMD 0 OHM JUMPER 1/8W 0805	1
<b><u>Inductors</u></b>			
Lsense	SCH14F08WE63	Choke core Sch14, mat F08, body We63	1
<b><u>Transistors</u></b>			
Q1	FCX790ATA	TRANS PNP 40V 2A SOT89-3	1
Q2	BC847C-13-F	TRANS NPN 45V 0.1A SOT23-3	1
Q3	BC857A-7-F	TRANS PNP 45V 0.1A SOT23-3	1
T1, T2	BC857BS-13-F	TRANS 2PNP 45V 0.1A SOT363	2
<b><u>Hardware</u></b>			
GND, OUT1, OUT2, VCC	691214110002	TERM BLK 2POS SIDE ENT 3.5MM PCB	4

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IC1	AIC1601	Inductive Proximity Sensor IC QFN24	1
JP1, JP2, JP3	61300211121	CONN HEADER VERT 2POS 2.54MM	3
JP1, JP2, JP3	60900213421	JUMPER W/TEST PNT 1X2PINS 2.54MM	3
TP1, TP2	5019	PC TEST POINT MINIATURE	2
PCB	EVAL103	Eval board PCB for EK89	1

## AIC1601 APPLICATION

Figure 3: Photos of AIC1601 Applications



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