OCR
RECOGNISING ACHIEVEMENT

Wednesday 25 January 2012 – Morning

GCSE DESIGN AND TECHNOLOGY
Electronics and Control Systems

A514/01 Technical Aspects of Designing and Making: Electronics

A528620112

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- A calculator may be used

Duration: 1 hour 15 minutes

A514010

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions **in Section A and Section B**.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Show all your working out for calculations.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Marks will be awarded for the use of correct conventions.
- Your Quality of Written Communication will be assessed in questions marked with an asterisk (*****).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **16** pages. Any blank pages are indicated.

A calculator may be used for this paper

DC (AC/SW) 45697/2

Section A

Answer **all** questions.

1 The switches shown in Fig. 1 can all be found in house alarm circuits.

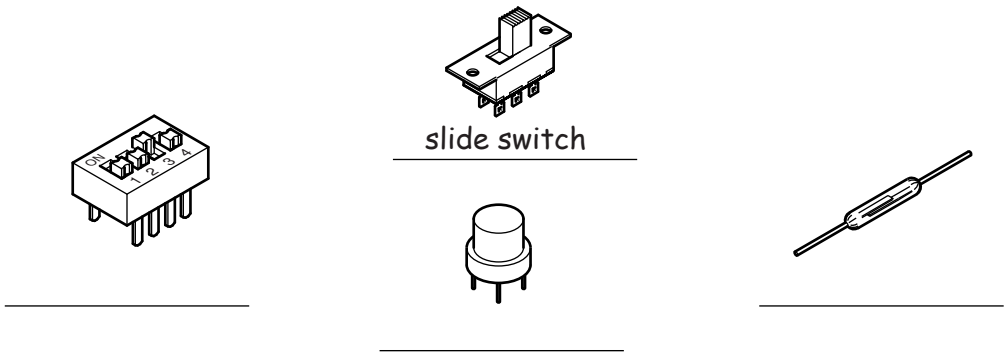


Fig. 1

(a) (i) Use the list of switch types below to complete the labels on Fig. 1.
One has been done for you.

slide switch **reed switch** **DIL switch** **press switch** **[3]**

(ii) One of the switches in Fig. 1 needs an extra component to operate it.
Name the extra component.

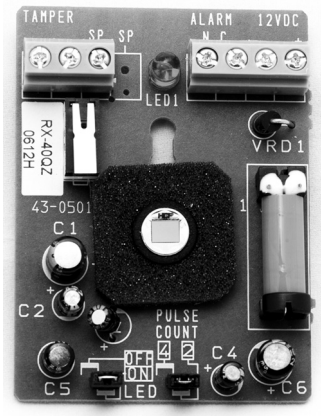
..... **[1]**

(iii) The slide switch can be described as DPDT.
Use sketches and / or notes to show what is meant by DPDT.

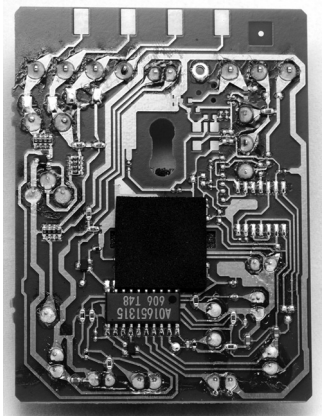
[2]

(b) The passive infra red (PIR) sensor shown in Fig. 2 is designed to be used in a house alarm system.

PIR sensor



front of circuit board



back of circuit board

Fig. 2

(i) Through hole components are used on the front of the circuit board and surface mount components are used on the back of the board.

Give **one** benefit and **one** problem with using surface mount components.

Benefit .....

..... **[1]**

Problem .....

..... **[1]**

(ii) The output of the sensor is switched using a relay shown in Fig. 3.

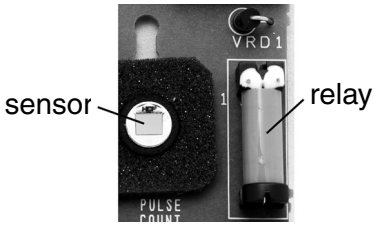


Fig. 3

Give **one** possible reason for using a relay in the PIR sensor circuit.

..... **[1]**

(c) Fig. 4 shows a view of the terminal block used for connections.

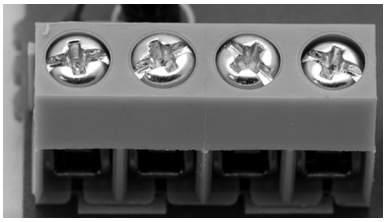


Fig. 4

(i) Give **two** reasons why a terminal block is the most suitable method of connecting wires to the sensor.

1 .....

.....

2 .....

..... **[2]**

(ii) State the reason for the terminal block using the type of screw head shown in Fig. 4.

.....

..... **[1]**

[Total: 12]

2 **(a)** Fig. 5 shows a standard 5 mm LED.

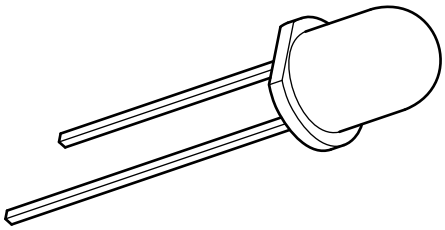


Fig. 5

Give **two** methods of identifying the cathode or negative leg of the LED.

1 .....

2 ..... **[2]**

(b) A tricolour LED consists of a red and green LED in a single package.
If red and green are on together the two colours mix to produce yellow.
A circuit for the tricolour LED is shown in Fig. 6.

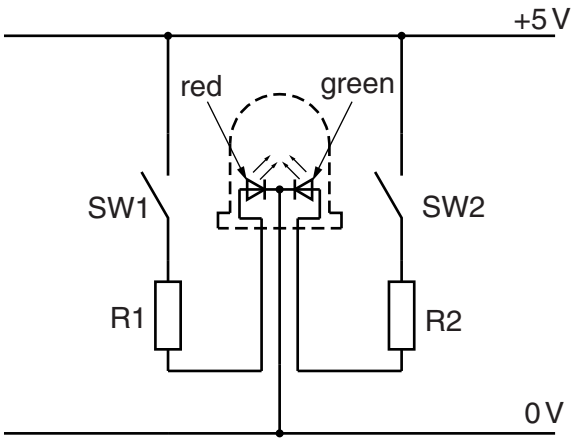


Fig. 6

Complete the table below to show switch positions for each colour.

SW1	SW2	light shown
off	off	none
		red
		yellow
		green

[3]

(c) Resistors R1 and R2 in Fig. 6 are series resistors.
Describe the result of using too high a value for R1 and R2.

.....

..... **[1]**

(d)* Light Emitting Diodes are found in car, cycle and household lighting systems.
Discuss the benefits of using LEDs when compared to other lighting methods.

.... **[6]**

[Total: 12]

3 **(a)** Fig. 7 shows an 8 pin DIL socket.

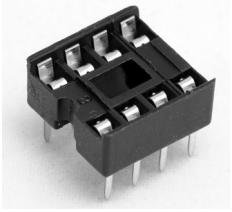


Fig. 7

(i) Give **one** reason for using an 8 pin DIL socket in a prototype circuit.

.....

..... **[1]**

(ii) Describe the procedure for fitting the 8 pin DIL socket ready for soldering.

.....

.....

.....

..... **[2]**

(iii) When removing an IC from a socket a removal tool can be used as shown in Fig. 8.

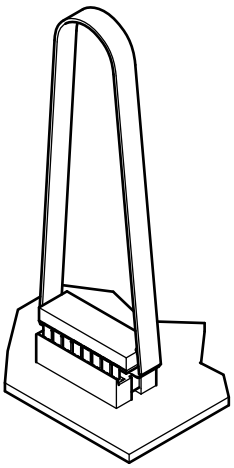


Fig. 8

Explain why a removal tool is better than using a screwdriver to lever the IC or just pulling the IC from the socket by hand.

.....

.....

.....

..... **[2]**

(b) Special precautions should be taken when fitting and removing a CMOS IC.

(i) Give **one** reason for the precautions being taken.

.....

..... **[1]**

(ii) Give **two** precautions that can be taken when handling CMOS ICs.

1 .....

.....

2 .....

..... **[2]**

(c) The soldered connections for a DIL socket are shown in Fig. 9.

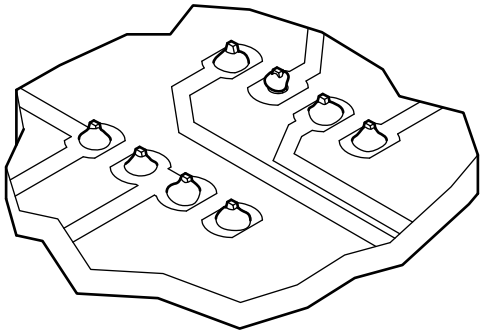
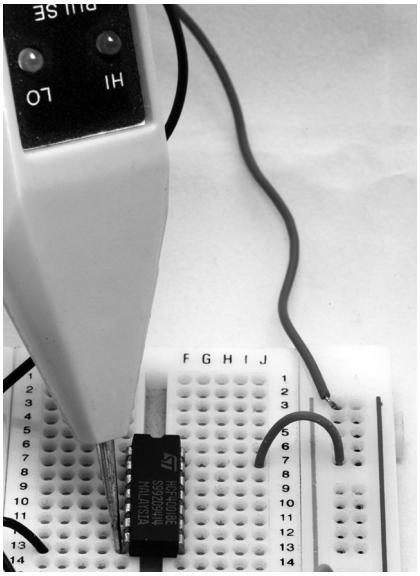


Fig. 9

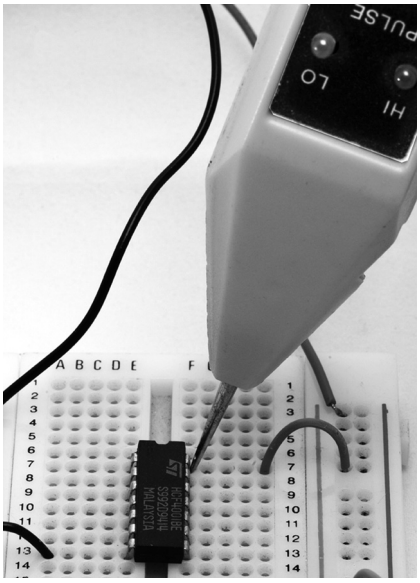
Use sketches and notes to show how the connections can be tested for dry joints.

[2]

(d) Fig. 10 shows a 4001B NOR gate IC fitted in a breadboard.
The power connections are being tested with a logic probe.
Describe the result if the IC is correctly fitted and power is connected.



Test 1



Test 2

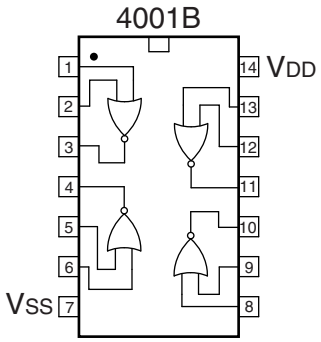


Fig. 10

Test 1 .....

Test 2 ..... **[2]**

[Total: 12]

Section B

Answer **all** questions.

4 An electronic toy for a child uses a small module to produce four different animal sounds. A sound is made when the input for that sound is connected to the positive supply. The module and the type of switch to be used are shown in Fig. 11.

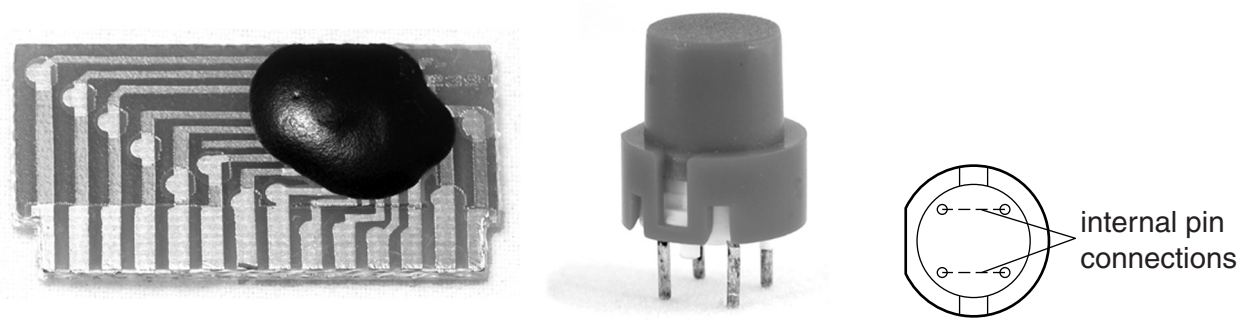


Fig. 11

(a) The switch has two pairs of internally connected pins.
Explain why this may make designing the PCB layout easier.

.....

.....

.....

..... **[2]**

(b) A partly completed PCB layout and circuit diagram are shown in Fig. 12.

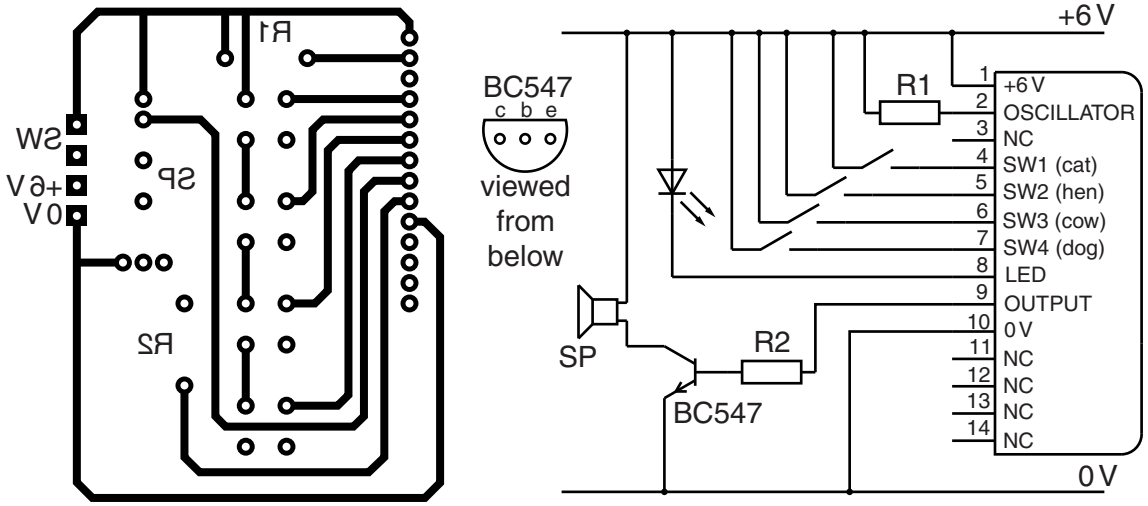


Fig. 12

(i) Add the output connections to the PCB layout. **[3]**

(ii) State the meaning of **NC** on pins 3, 11, 12, 13, 14 of the module.

..... **[1]**

(c)* Modular components like those shown in Fig. 13 are often used in electronic circuits.

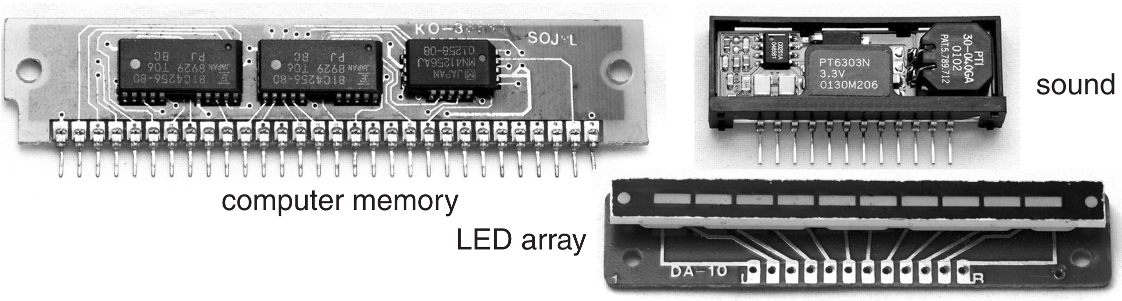


Fig. 13

Discuss the benefits and problems that this type of component can bring to a product.

[6]

[Total: 12]

5 Logic gates used to control a central heating system are shown in Fig. 14.

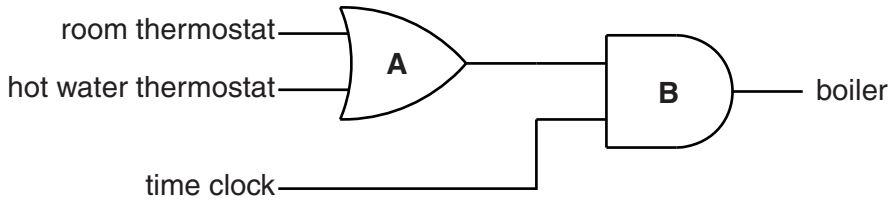


Fig. 14

(a) With the time clock switched on, the boiler is started either by the room thermostat, the hot water thermostat or both thermostats switching on.

(i) Complete the truth tables below for the two logic gates.

gate **A**

in 1	in 2	out
0	0	
0	1	
1	0	
1	1	

gate **B**

in 1	in 2	out
0	0	
0	1	
1	0	
1	1	

[2]

(ii) The system can be converted into NOR gates as shown in Fig. 15a.

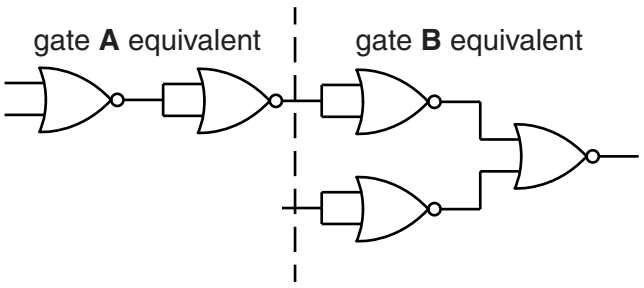


Fig. 15a

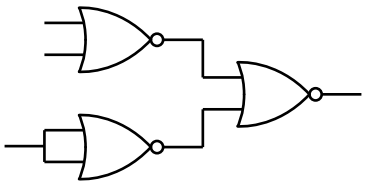


Fig. 15b

Give **one** benefit to the designer of using a single type of logic gate.

..... **[1]**

(iii) Fig. 15b shows the developed system in its simplest form.
Explain why two of the gates can be removed from the circuit.

.....

.....

.....

..... **[2]**

(b) Fig. 16 shows the circuit from Fig. 15b as a PCB layout.
The IC to be used is a 4001B quad NOR gate.

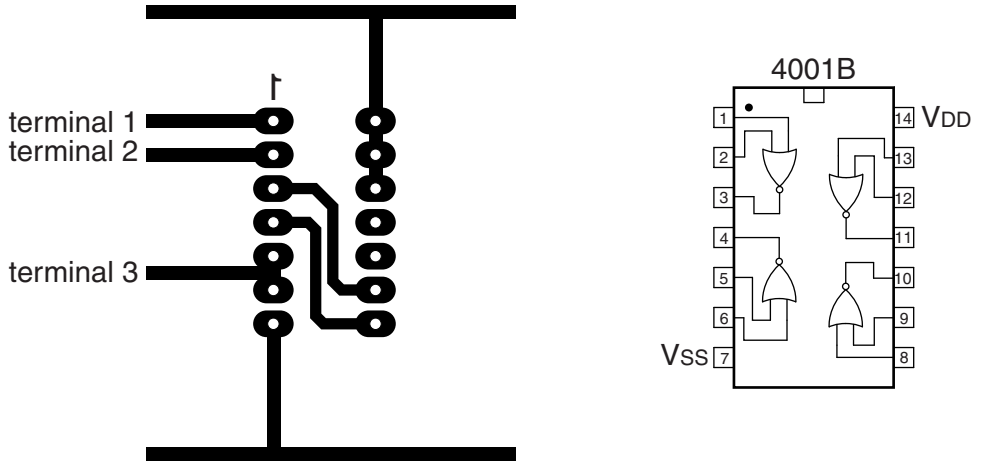


Fig. 16

(i) State the reason for connecting IC pins 12, 13 and 14 on the PCB layout.

.....

..... **[1]**

(ii) A data table will be needed for users of the system to show which input should be connected to each terminal.
Use information from Figs. 14 and 15b to complete the data table below.

terminal	connection
1	*room thermostat*
2	
3	

[2]

(c) The output of the logic system operates a relay with a coil resistance of 150 Ω.
The logic circuit voltage is connected to a +6 V supply.
Use the formula $V = I \times R$ to calculate the current flow in mA.

.....

.....

..... **[2]**

(d) Explain why a designer may choose a logic system to operate the boiler rather than a programmable PIC IC.

.....

.....

.....

..... **[2]**

[Total: 12]

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