

# **Design and Technology**

General Certificate of Secondary Education **1953/01**

Electronic Products

## **Mark Scheme for June 2010**

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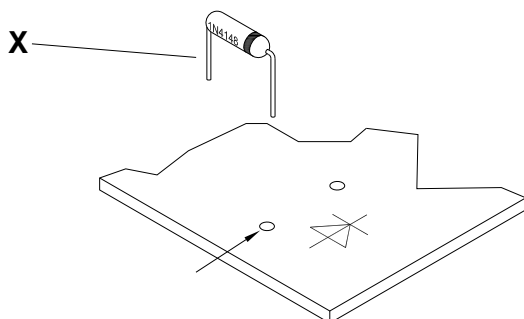
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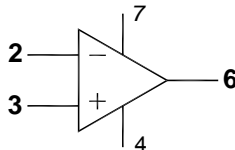
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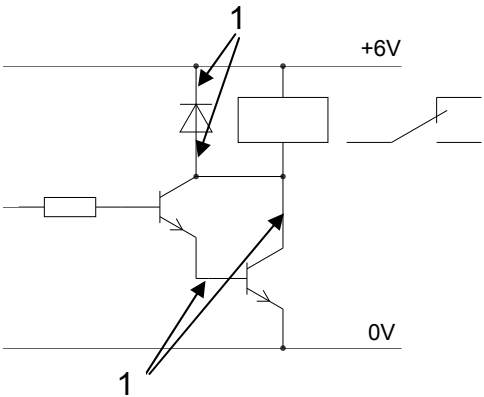
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Question	Expected Answer	Mark	Rationale												
1	<p>(a)(i) d c a b e , 1 mark for each correct, 4 x 1</p> <table><tr><th>Feature on component</th><th>component</th></tr><tr><td>flat to show negative end</td><td>d</td></tr><tr><td>colour coded</td><td>c</td></tr><tr><td>coloured band at one end</td><td>a</td></tr><tr><td>notch or dot at pin 1 end</td><td>b</td></tr><tr><td>negative leg is shorter</td><td>e</td></tr></table>	Feature on component	component	flat to show negative end	d	colour coded	c	coloured band at one end	a	notch or dot at pin 1 end	b	negative leg is shorter	e	[4]	
Feature on component	component														
flat to show negative end	d														
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	<p>(a)(ii) 1000μF value of the capacitor, 1 mark 16V working voltage of the capacitor.</p>	[1] [1]	Allow any reference to the highest safe voltage that can be applied.												
	<p>(b)(i) Correct hole indicated, 1 mark.</p> 	[1]													
	<p>(b)(ii) The component will block a signal that is intended to pass through the diode.</p>	[1]	Allow clear reference to the blocking / one way effect or damage to other component(s). Allow 'circuit would not work'.												

Question		Expected Answer	Mark	Rationale
1	(c)	<p>Benefits could include the following:</p> <ul style="list-style-type: none"><li>• No heat on IC;</li><li>• IC can be easily replaced;</li><li>• Upgraded IC can easily be fitted;</li><li>• IC can always be fitted correct way around without any desoldering;</li><li>• IC can be used again.</li></ul> <p>1 mark each for two valid points</p>	[2]	
		Total	[10]	

Question	Expected Answer	Mark	Rationale
2 (a)(i)	If thermistor is cooled the resistance reading will increase.	[1]	Allow any reference to increase, e.g. larger, go up, gets bigger.
(a)(ii)	Purpose of VR1 is to set sensitivity / output voltage from thermistors. VR1 sets switching temperature. R3 is current limiting resistor for the transistor.	[1] [1]	Allow 'potential divider'. Allow reference to protection <b>of transistor</b> .
(b)	1 mark for inverting input (2) correct; 1 mark for non- inverting input (3) correct; 1 mark for output (6) correct. 	[3]	
(c)	Fault 1: Desoldering described, allow 'solder sucker', braid, or other practical method  Fault 2: Reheat with soldering iron, ensuring that both pad and leg are hot, add more solder if necessary.	[1] [1]	Responses must refer to correction of the faults.
(d)(i)	Flux in solder is <b>to protect</b> component and pad from oxidation, active fluxes also clean, allow either for 1 mark.	[1]	Allow reference to 'helps solder to stick'
(d)(ii)	Lead no longer allowed in solder for manufacturing, 1 mark	[1]	Allow 'led' as a mis-spelling
Total		[10]	

Question	Expected Answer	Mark	Rationale															
3	(a)(i) NOR gate, 1 mark.	[1]																
	(a)(ii) Truth table correctly completed 1 mark. <div><table><tr><td>A</td><td>B</td><td>Q</td></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></div>	A	B	Q	0	0	1	0	1	0	1	0	0	1	1	0	[1]	Or correct truth table for gate given in 3 (a)(i)
A	B	Q																
0	0	1																
0	1	0																
1	0	0																
1	1	0																
	(a)(iii) Pull down resistors: required to ensure that logic inputs are always at a logic level and not floating.	[1]	Allow mark for understanding shown.															
	(b) A round hole would allow the switch to rotate during use, 1 mark	[1]	Allow reference to not staying in place.															
	(c)(i) Substitution into formula $0.360 = 6 \times I$ , 1 mark $I = 0.360 / 6 = 0.06\text{A}$ or $60\text{mA}$ , 1 mark. Correct answer with correct units regardless of working, 2 marks	[2]	1 mark for $360 \div 6$ The final answer must have units to match the substitution for both marks.															
	(c)(ii) Benefits of relay use could include: <ul style="list-style-type: none"><li>• Different voltage possible on the output (siren)</li><li>• Siren cannot interfere with logic operation</li><li>• Higher current can be operated</li><li>• Safe method of switching high voltage.</li></ul> 2 x 1 marks for valid benefits.	[2]																

Question	Expected Answer	Mark	Rationale
(c)(iii)	<p>Darlington pair connections correct 1 mark Diode and relay connections correct 1 mark.</p> 	[2]	Ignore any connections to relay output which do not affect switching of relay.
Total		[10]	

Question	Expected Answer	Mark	Rationale
4 (a)	<p>Benefits of using CAD could include:</p> <ul style="list-style-type: none"> <li>• Accuracy of the drawing;</li> <li>• Ease of changing / updating / copying of the drawing;</li> <li>• Ease of storage for file;</li> <li>• Data can be transferred quickly;</li> <li>• Data can be sent straight to a CNC machine, no need to print.</li> </ul> <p>1 mark each for 2 valid benefits, 2 x 1</p>	[2]	Allow reference to speed <b>of editing</b> .
(b)	<p>The tolerance is to allow for inaccuracy in either the PCB holes or those produced using the template, mountings / screws will still fit.</p>	[1]	Allow 'drill bit too big' or screw larger than stated diameter.

Question	Expected Answer	Mark	Rationale
4 (c)(i)	The 25mm test line on the template can be measured with a ruler.	[1]	Allow mark for other method that would work in practice e.g. try component for fit, comparison with other template etc.
(c)(ii)	<ul style="list-style-type: none"> <li>The acrylic template cannot get stretched, expand / contract due to humidity.</li> <li>Will last longer than the paper template;</li> <li>The acrylic template will guide the drill without the need for centre punching / marking.</li> </ul> 1 mark for reason, 1 mark for justification / clarity of explanation.	[2]	Allow reference to accuracy of laser cutting with reference to guiding the drill.
(c)(iii)	Methods of accurately securing could include: <ul style="list-style-type: none"> <li>Drilling one hole and then using this for an alignment screw / bolt;</li> <li>Adding materials to the sides of template and creating a folded portion that will grip sides;</li> <li>Using tape or sticky pads to hold template;</li> <li>Small clamp to hold parts together.</li> </ul> 1 mark for workable method of securing, 1 mark for clear description of method of alignment.	[2]	Must include method of alignment for 2 marks. Allow visual alignment
(d)	Marking should include; <ul style="list-style-type: none"> <li>A recycling symbol or other indication that the item can be recycled,</li> <li>Type of material should be marked e.g. PP, HIP, ABS, or number</li> </ul> 1 mark for each of two pieces of information.	[2]	Allow the 'not to be thrown into waste bin' symbol.
	<b>Total</b>	<b>[10]</b>	

Question	Expected Answer	Mark	Rationale
5 (a)	Any two factors from: <ul style="list-style-type: none"> <li>• Shape/size of detector fits the hand;</li> <li>• Can be used by right and left handed;</li> <li>• Good positioning of controls for either finger or thumb use;</li> <li>• Symbols rather than words used against LEDs;</li> <li>• LED torch included for working in dark areas;</li> <li>• Clear indication of which way 'wood' control turns to increase sensitivity.</li> </ul> 2 x 1 marks for suitable factors.	[2]	Allow reference to smooth edges
(b)(i)	Self tapping screw used as it will cut its own thread into softer plastics material of casing and is unlikely to be used frequently.	[1]	Reduced production time/cost – must be qualified. Allow reference to security of fixing / ease of removal.
(b)(ii)	Symbols applied after moulding because moulding process uses single colour of raw plastics.	[1]	Allow mark for understanding shown e.g. symbols not deformed/melted.
(c)(i)	Wires are held in place with glue as a form of strain relief. Reduced cost compared to other methods.	[1]	'Quicker' or 'cheaper' must be qualified.
(c)(ii)	Reasons given could include; <ul style="list-style-type: none"> <li>• The enamelling is on the copper wire as an insulator;</li> <li>• It does not take up as much space as extruded plastic insulation;</li> <li>• Will not be subjected to any abrasion so enamelling is sufficient.</li> </ul> 1 mark for understanding of the reason shown.	[1]	
(d)(i)	Workable method 1 mark. Quality of notes / sketches 1 mark. Methods could include use of a spacer to hold LED in position whilst soldering.	[2]	Allow cutting the legs to length.

Question		Expected Answer	Mark	Rationale
	(d)(ii)	<ul style="list-style-type: none"> <li>• Bending the radial capacitor requires enough leg to be left above the board to allow a bend to be made.</li> <li>• Bending legs also causes a strain on them.</li> <li>• The shorter style of radial capacitor will not require bending.</li> <li>• Axial capacitors are designed to be fitted flat to the board.</li> </ul> 1 mark for good reason for using suggested alternative methods 1 mark for recognising problems with method shown. 2 x 1 marks.	[2]	
		<b>Total</b>	<b>[10]</b>	

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