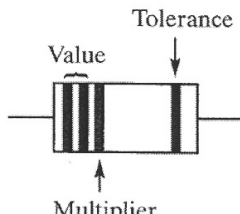


## Electronics

## ELEC1

### Data Sheet

### Unit 1 Introductory Electronics

<b>Resistors</b>	Preferred values for resistors (E24) series: 1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3, 3.6, 3.9, 4.3, 4.7, 5.1, 5.6, 6.2, 6.8, 7.5, 8.2, 9.1 ohms etc.																							
<b>Resistor Printed Code (BS 1852)</b>	This code consists of letters and numbers: R means $\times 1$ K means $\times 1000$ (i.e. $10^3$ ) M means $\times 1\,000\,000$ (i.e. $10^6$ ) Position of the letter gives the decimal point Tolerances are given by the letter at the end of the code, F = $\pm 1\%$ , G = $\pm 2\%$ , J = $\pm 5\%$ , K = $\pm 10\%$ , M = $\pm 20\%$ .																							
<b>Resistor Colour Code</b>	<table><tr><th>Number</th><th>Colour</th></tr><tr><td>0</td><td>Black</td></tr><tr><td>1</td><td>Brown</td></tr><tr><td>2</td><td>Red</td></tr><tr><td>3</td><td>Orange</td></tr><tr><td>4</td><td>Yellow</td></tr><tr><td>5</td><td>Green</td></tr><tr><td>6</td><td>Blue</td></tr><tr><td>7</td><td>Violet</td></tr><tr><td>8</td><td>Grey</td></tr><tr><td>9</td><td>White</td></tr></table>	Number	Colour	0	Black	1	Brown	2	Red	3	Orange	4	Yellow	5	Green	6	Blue	7	Violet	8	Grey	9	White	
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9	White																							
	Tolerance, gold = $\pm 5\%$ , silver = $\pm 10\%$ , no band = $\pm 20\%$																							
<b>Silicon diode</b>	$V_F = 0.7\text{ V}$																							
<b>Silicon transistor</b>	$V_{be} \approx 0.7\text{ V}$ in the on state, $V_{ce} \approx 0.2\text{ V}$ when saturated																							
<b>Resistance</b>	$R_T = R_1 + R_2 + R_3 + \dots$	series																						
	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$	parallel																						
<b>Capacitance</b>	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$	series																						
	$C_T = C_1 + C_2 + C_3 + \dots$	parallel																						
<b>Time constant</b>	$T = CR$ , $T_{\frac{1}{2}} = 0.69 CR$																							
<b>ac theory</b>	$I_{\text{rms}} = \frac{I_0}{\sqrt{2}}$																							
	$V_{\text{rms}} = \frac{V_0}{\sqrt{2}}$																							
	$X_C = \frac{1}{2\pi fC}$	reactance																						
	$X_L = 2\pi fL$	reactance																						
	$f = \frac{1}{T}$	frequency, period																						
	$f_0 = \frac{1}{2\pi\sqrt{LC}}$	resonant frequency																						

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**Operational amplifier**

$$G_V = \frac{V_{\text{out}}}{V_{\text{in}}}$$

voltage gain

$$G_V = -\frac{R_f}{R_1}$$

inverting

$$G_V = 1 + \frac{R_f}{R_1}$$

non-inverting

$$V_{\text{out}} = -R_f \left( \frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3} \right)$$

summing

$$V_{\text{out}} = (V_+ - V_-) \frac{R_f}{R_1}$$

difference

**555 Astable and Monstable**

$$T = 1.1RC$$

monostable

$$t_H = 0.7 (R_A + R_B)C$$

$$t_L = 0.7 R_B C$$

astable

$$f = \frac{1.44}{(R_A + 2R_B)C}$$

astable frequency

$$\text{Electromagnetic waves } c = 3 \times 10^8 \text{ ms}^{-1}$$

speed in vacuo

**Assembler language microcontroller instructions**

Mnemonic	Operands	Description	Operation	Flags	Clock cycles
NOP	none	No operation	none	none	1
CALL	K	Call subroutine	stack <= PC PC <= K	none	2
RET	none	Return from subroutine	PC <= stack	none	2
INC	R	Increments the contents of R	(R) <= (R) + 1	Z	1
DEC	R	Decrements the contents of R	(R) <= (R) - 1	Z	1
ADDW	K	Add K to W	W <= W + K	Z, C	1
ANDW	K	AND K with W	W <= W • K	Z, C	1
SUBW	K	Subtract K from W	W <= W - K	Z, C	1
ORW	K	OR K and W	W <= W + K	Z, C	1
XORW	K	XOR K and W	W <= W ⊕ K	Z, C	1
JMP	K	Jump to K (GOTO)	PC <= K	none	2
JPZ	K	Jump to K on zero	PC <= K if Z=1	Z=1	2
JPC	K	Jump to K on carry	PC <= K if C=1	C=1	2
MOVWR	R	Move W to the contents of R	(R) <= W	Z	1
MOVW	K	Move K to W	W <= K	Z	1
MOVRW	R	Move the contents of R to W	W <= (R)	Z	1