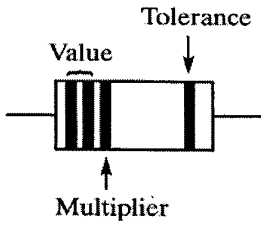


# Electronics

# ELEC2

## Unit 2 Further Electronics Data Sheet

<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 and multiples of ten	
<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>	Number	Colour
	0	Black
	1	Brown
	2	Red
	3	Orange
	4	Yellow
	5	Green
	6	Blue
	7	Violet
	8	Grey
	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>	$R_T = R_1 + R_2 + R_3$	series
	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	parallel
<b>Capacitance</b>	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$	series
	$C_T = C_1 + C_2 + C_3$	parallel
<b>Time constant</b>	$T = CR, T_{\frac{1}{2}} = 0.69 CR$	
<b>A.C. theory</b>	$I_{rms} = \frac{I_0}{\sqrt{2}}$	
	$V_{rms} = \frac{V_0}{\sqrt{2}}$	
	$X_C = \frac{1}{2\pi fC}$	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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<b>Operational amplifier</b>	$G_V = \frac{V_{out}}{V_{in}}$	voltage gain
	$G_V = -\frac{R_f}{R_1}$	inverting
	$G_V = 1 + \frac{R_f}{R_1}$	non-inverting
	$V_{out} = -R_f \left( \frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3} \right)$	summing
	$V_{out} = (V_+ - V_-) \frac{R_f}{R_1}$	difference
<b>555 Astable and Monstable</b>	$T = 1.1RC$	monostable
	$t_H = 0.7 (R_A + R_B)C$	astable
	$t_L = 0.7 R_B C$	
	$f = \frac{1.44}{(R_A + 2R_B)C}$	astable frequency
<b>Electromagnetic waves</b>	$c = 3 \times 10^8 \text{ m s}^{-1}$	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 $\leftarrow$ PC PC $\leftarrow$ K	none	2
RET	none	Return from subroutine	PC $\leftarrow$ stack	none	2
INC	R	Increments the contents of R	(R) $\leftarrow$ (R) + 1	Z	1
DEC	R	Decrements the contents of R	(R) $\leftarrow$ (R) - 1	Z	1
ADDW	K	Add K to W	W $\leftarrow$ W + K	Z, C	1
ANDW	K	AND K with W	W $\leftarrow$ W • K	Z, C	1
SUBW	K	Subtract K from W	W $\leftarrow$ W - K	Z, C	1
ORW	K	OR K and W	W $\leftarrow$ W + K	Z, C	1
XORW	K	XOR K and W	W $\leftarrow$ W $\oplus$ K	Z, C	1
JMP	K	Jump to K (GOTO)	PC $\leftarrow$ K	none	2
JPZ	K	Jump to K on zero	PC $\leftarrow$ K if Z=0	Z=0	2
JPC	K	Jump to K on carry	PC $\leftarrow$ K if C=0	C=1	2
MOVWR	R	Move W to the contents of R	(R) $\leftarrow$ W	Z	1
MOVW	K	Move K to W	W $\leftarrow$ K	Z	1
MOVRW	R	Move the contents of R to W	W $\leftarrow$ (R)	Z	1