Notes on Practical Electronics

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Generator

series: Total Voltage = $Vt = \sum V$ parallel: $Vt = V$

Total Current = $It = I$ parallel: $It = \sum I$

Various

I=current; V=voltage; R=resistance; P=power

$I = V / R = (P / R)^{1/2} = P / V$

$V = R * I = (P * R)^{1/2} = P / I$

$R = V / I = P / I^2 = V^2 / P$

$P = V * I = I^2 * R = V^2 / R$

Resistors

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 series                                        parallel
     ┌──┬─────┐     (v)= voltameter            ┌────┬────┐     Rt= 1 / ∑(1/R)
V1  (v) █ R1  │     (a)= amperometer          (a)  (a)   ┴ V   I1= V / R1
     └──┤     ┴ V   Tot. resistance Rt= ∑R     │I1  │I2 ─┬─    I2= V / R2
     ┌──┤    ─┬─    I=  V / Rt                 █ R1 █ R2 │     I=  V / Rt
V2  (v) █ R2  │     V1= R1 * I                 │    │    │
     └──┴─(a)─┘     V2= R2 * I                 └────┴─(a)┘
           I                                            I
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Capacitors

series: $Ct = 1 / \sum(1/C)$ parallel: $Ct = \sum C$

Sinusoidal voltage and current

efficacious value= 0,707 * peak value = 1,11 * average value

average value = 0,637 * peak value = 0,9 * efficacious value

peak value = 1,414 * efficacious value = 1,57 * average value

§1 Colour codes for resistors (Ω), capacitors (pF), inductors (μH)

Colour	A	B	C	D %	E %	F
black		0	*1	(±20)		200
brown	1	1	*10	(±1)	±1	100
red	2	2	*100	(±2)	±2	50
orange	3	3	*1000			15
yellow	4	4	*10^4			25
green	5	5	*10^5	(±5)	±0,5	
blue	6	6	*10^6			10
violet	7	7				
grey	8	8				
white	9	9		(±10)		
gold			/10	±5	±5	
silver			/100	±10		

ABCD

A
B
C
D

Band D indicates the tolerance; values in parentheses are used for capacitors. If there are only three bands then tolerance is ±20%.
Band C is the multiplicand.

In metallic layer resistors there are five bands; the first three indicate value; the fourth indicates the multiplicand; the fifth indicates the tolerance (see column E).

In thermal variation resistors there are six bands; the first five are as above, the sixth (see column F) indicates the variation in Ω ppm (parts per million) for each variation of 1 °C (Celsius degree).

In polyester capacitors generally there are four bands; a fifth bands could be used to indicate work tension (red=250, yellow=400, blue=630 volt).

Example: in a resistor the band A is brown, band B is red, band C is orange and band D is silver: resistance value is 12000 Ω with a tolerance of 10%.

§2 Alphanumeric codes

Capacitors

XXX — indicate the value in pF. But if it was made in Japan, Korea, Hong Kong or Taiwan the first two digits indicate the value and the third the multiplicand (10^X).

.XX — value is 0,XX μF.

CC VV M T — CC indicate the container
VV indicate the value in pF or, if there is a point, in 0,VV μF
M indicates the multiplicand (10^M)
T indicates the tolerance (J=5%, K=10%, M=20%).

Resistors

XXM — XX indicate value in Ω.
M is the multiplicand (10^M).

XX indicate a value in Ω.

§3 Commercial values: resistors and capacitors

Values

1	10	100	1000	10000	100000
1.2	12	120	1200	12000	120000
1.5	15	150	1500	15000	150000
1.8	18	180	1800	18000	180000
2.2	22	220	2200	22000	220000
2.7	27	270	2700	27000	270000
3.3	33	330	3300	33000	330000
3.9	39	390	3900	39000	390000
4.7	47	470	4700	47000	470000
5.6	56	560	5600	56000	560000
6.8	68	680	6800	68000	680000
8.2	82	820	8200	82000	820000

Work tensions

1	10	100
1.6	16	160
2.5	25	250
3.5	35	350
4	40	400
4.5	45	450
5	50	500
6.3	63	630

§4 Loudspeakers: let us recognize positive and negative terminal

Connect terminals with a battery of 4.5 Volt. If polarity is correct the cone moves up, otherwise it moves down.

§5 Transistors: let us recognize terminals using a resistance tester

Pay attention: tester must be suited to this kind of measuring; otherwise we run the risk of damaging our transistor.
The base is that terminal which (without changing polarity of test lead) conducts with others. If polarity of test lead is positive then the transistor is a NPN otherwise it is a PNP.
If the transistor has a fin then the terminal connected to the fin is the collector.
Connect the base and a terminal (that we call "A") with a test lead (positive for a NPN or negative for PNP); connect the other terminal (that we call "B") with the other test lead. If value of the resistance shown by tester is less than value shown doing the same measuring but exchanging the two terminals then the terminal B is the collector.

§6 Batteries Ni-Cd and Ni-MH

Ni-Cd: before recharge you have to discharge them connecting positive with negative using a wire resistor of 4-5 Ω. A good recharge is obtained with a current about 1/10 of hour mA given by battery.
Ihp=mA hour mA given by battery; Ir=mA of recharge; Ic=mA absorbed by instrument
recharge time (hours) = Ihp * 1.4 / Ir
discharge time (hours) = Ihp / Ic

Ni-MH: the same rules sound good for Ni-MH batteries, but it is not necessary discharge them before recharge.

§7 Lead batteries

We can recharge them even they are not run-down. Recharge current must not be higher than 1/10 of maximum Ah capacity of battery. If we read a voltage less than 1.3 volt * number of elements, the battery is not good because an element is damaged. When the battery is charged each element gives a tension of 2.1 volt.

§8 Resistor in series for instrument

Va=voltage supplied; Vc=work tension of instrument; Ic=current absorbed by instrument:
R (resistance to connect in series in Ω)= (Va - Vc) / Ic
W (power of resistor in Watt)= Ic^2 * R

Example: for a led (light-emitting diode) we have:

Va	R in Ω (W=1/4)
3	82
4.5	220
6	330
9	470
12	680

§9 Transformer

Power is ≅(Section of ferrite nucleus in cm^2 / 1.2)^2

§10 Section of copper wire and maximum intensity of current

Sec. mm	I ampere	Sec. mm	I ampere	Sec. mm	I ampere	Sec. mm	I ampere
0.10	0.02	0.60	0.71	2.2	9.48	4	31.5
0.15	0.04	0.70	0.96	2.4	11.3		
0.20	0.08	0.80	1.25	2.6	13.2		
0.25	0.12	0.90	1.56	2.8	14.7		
0.30	0.17	1	1.96	3	17.5		
0.35	0.24	1.2	2.85	3.2	20		
0.40	0.31	1.5	4.40	3.4	22.7		
0.45	0.39	1.7	5.65	3.6	25.4		
0.50	0.49	2	7.80	3.8	28.2		

§11 Stabilizer circuit with zener diodes

If we connect in series two zener with a break tension of Vz1 and Vz2 we will have a zener with a break tension of Vz1 + Vz2 and a power of - if they have the same power - (Vz1 + Vz2) * W / Vz2 where Vz2 is the highest tension.
For little corrections of tension it is possible to insert one or more silicon diodes in series (for example 1N4003-1N4007). Tension drop is 0.7 volt per each diode inserted.

§12 Power supply with rectifier diodes

Levelling capacitor: capacity must be chosen according to the intensity to supply

I ampere	capacity µF
0.1	500
0.5	1000
1	2200
3	4700
5	10000

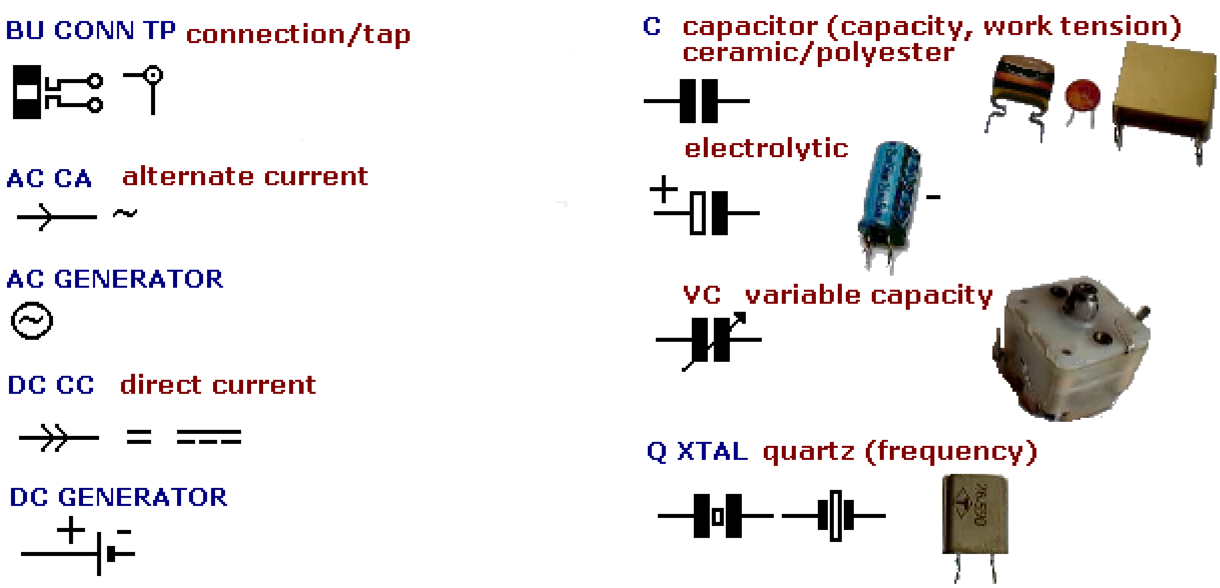
work tension must be 2-3 times the secondary tension of transformer.

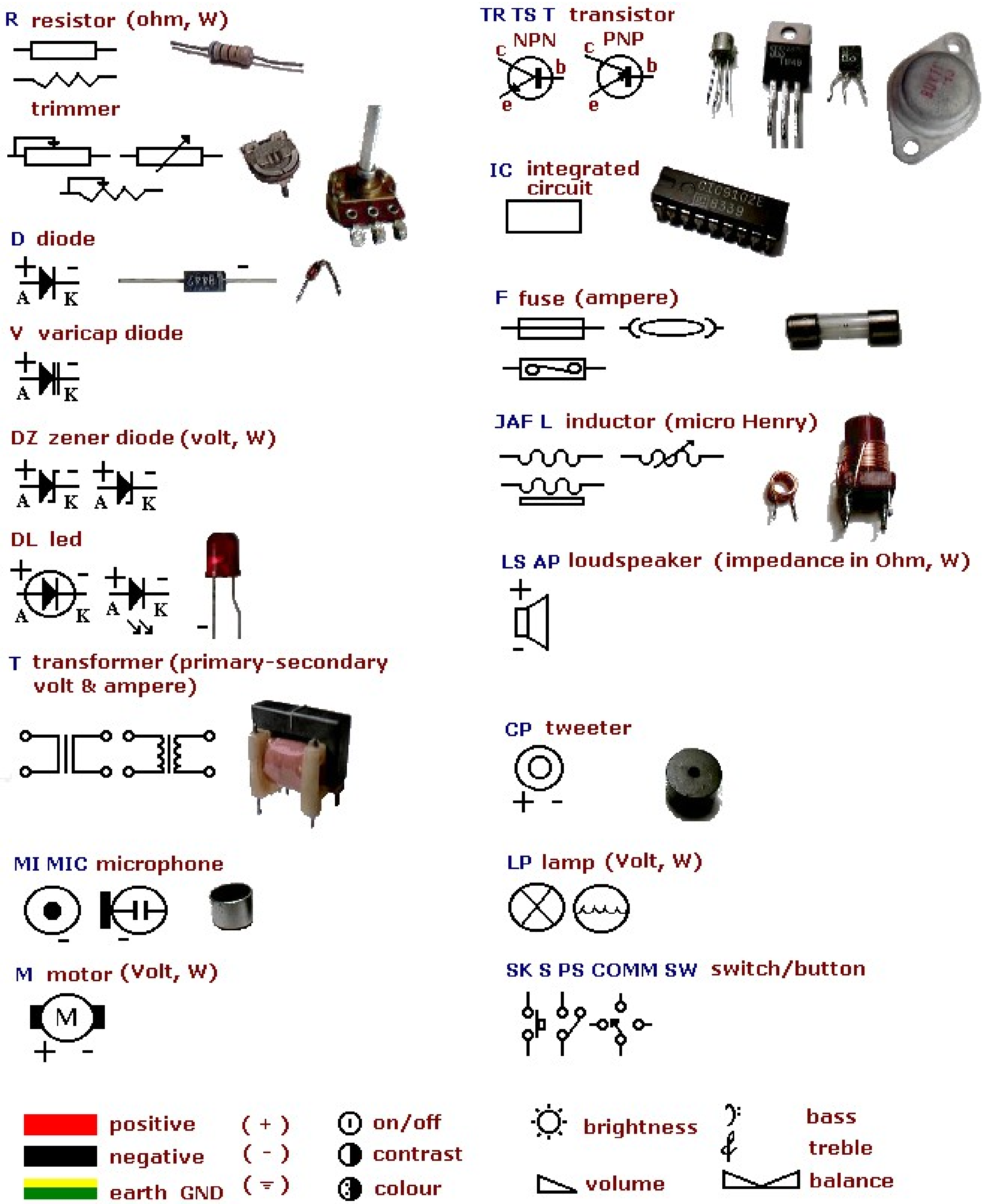
Rectifier diodes: work tension must be 4-7 times the secondary tension of transformer, current intensity must be 2-3 times the current to supply.
The tension on the exit of rectifier diodes is ≅(secondary tension * 1,414) - 1

§13 Microphone terminals

Earth is always connected with the container, while if we measure the resistance between LF output terminal and earth terminal we obtain a value less than that we obtain measuring the resistance between positive terminal and earth.

SYMBOLS




R resistor (ohm, W)
trimmer
D diode
A K
V varicap diode
DZ zener diode (volt, W)
DL led
T transformer (primary-secondary volt & ampere)
MI MIC microphone
M motor (Volt, W)
M
TR TS T transistor
NPN
PNP
c b e
IC integrated circuit
F fuse (ampere)
JAF L inductor (micro Henry)
LS AP loudspeaker (impedance in Ohm, W)
CP tweeter
LP lamp (Volt, W)
SK S PS COMM SW switch/button
positive (+)
negative (-)
earth GND
on/off
contrast
colour
brightness
volume
bass
treble
balance