WELCOME !

STUDIO R.T.S. RAMPIN ING. MARCO

presents

AmpDiVa

Amplificatori Digitali Valvolari

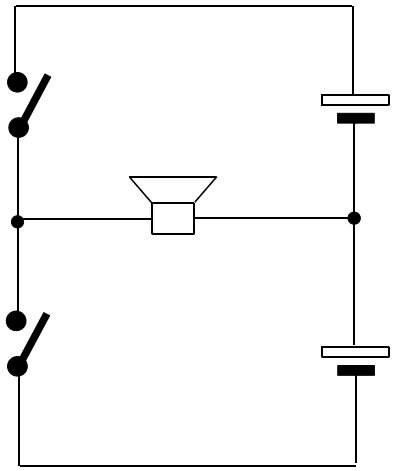
@

the European Maker Faire
in Roma
October 16th to 18th, 2015

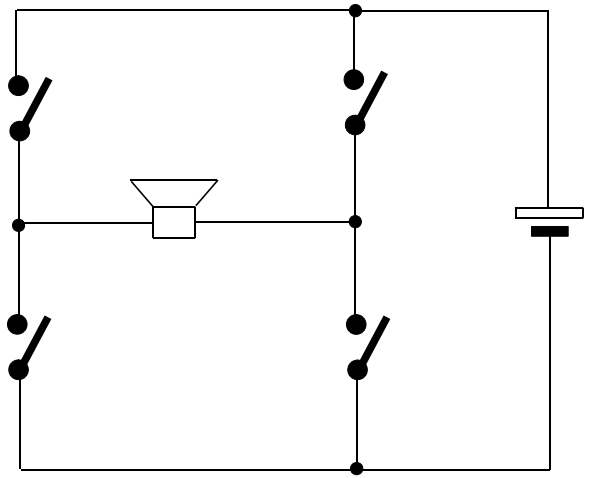
www.ampdiva.com

CLASS D AMPLIFIER

Basic Diagrams



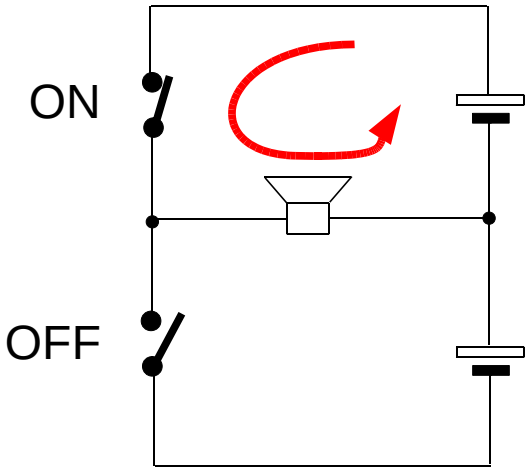
Half Bridge

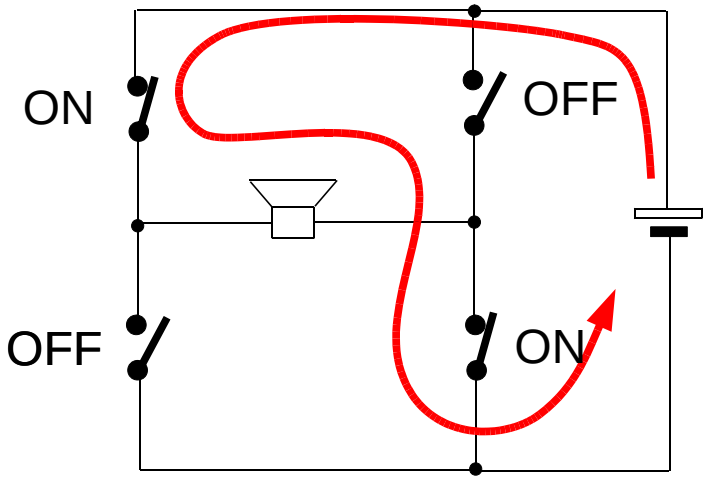


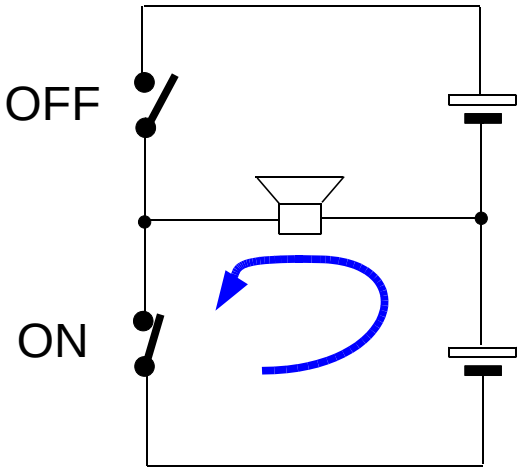
Full Bridge

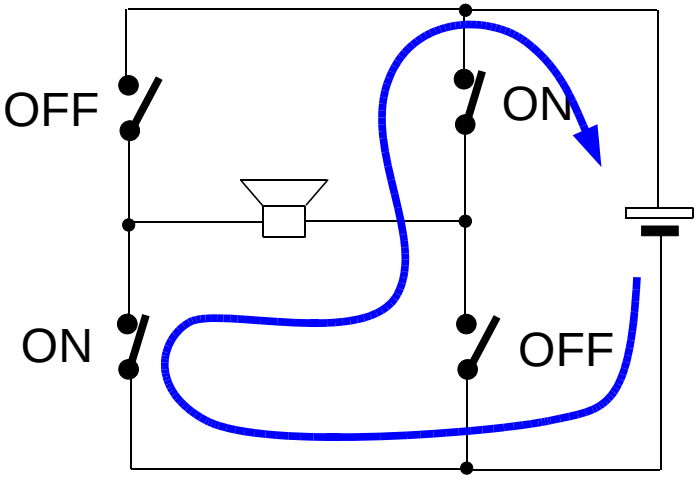
CLASS D AMPLIFIER

Current Path

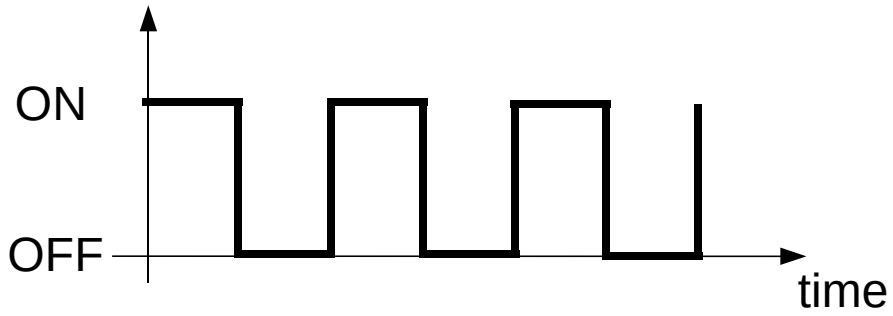


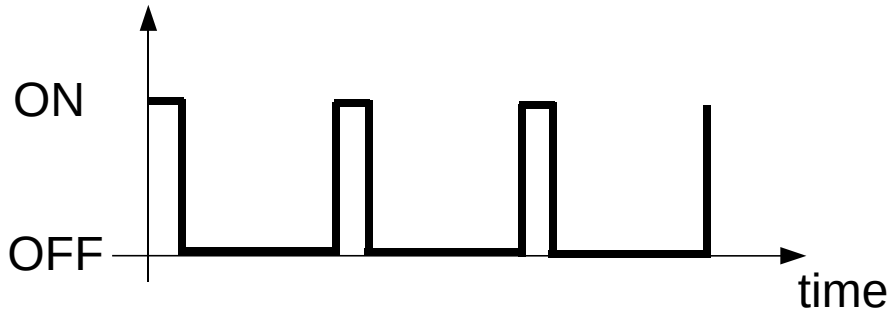


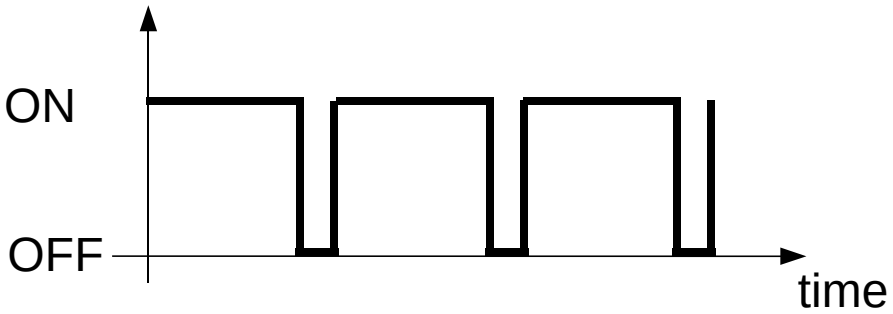




A switch can be only ON or OFF







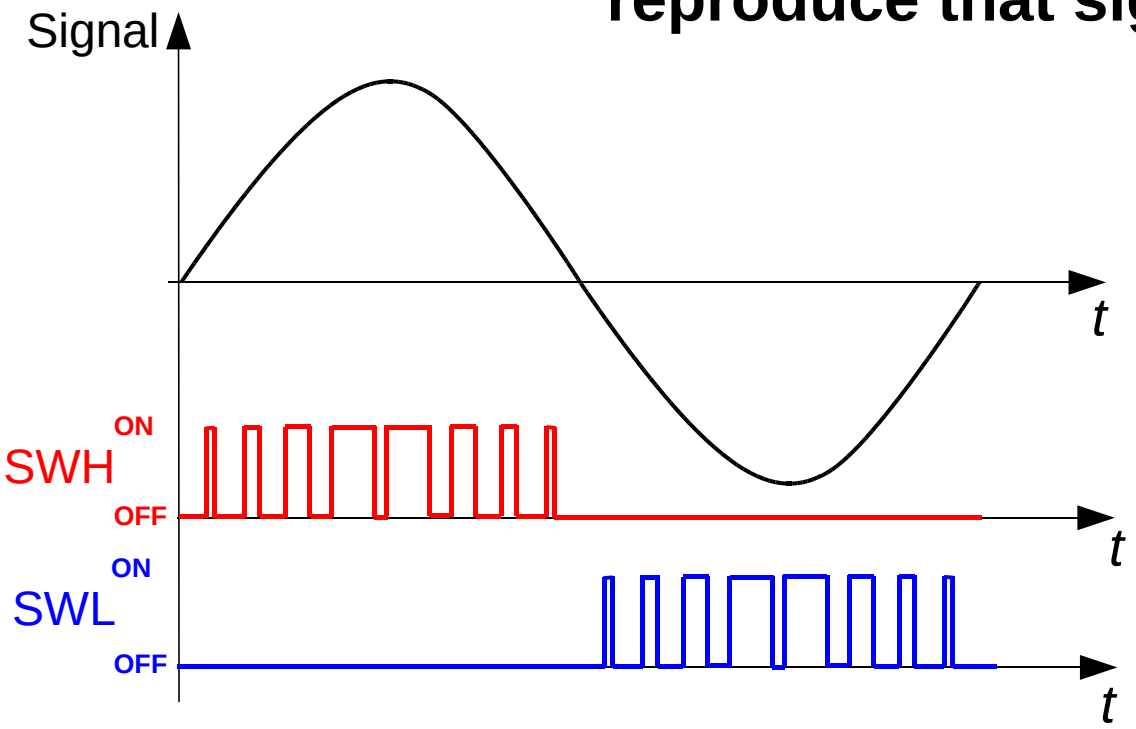
For a switch toggled by a square wave
the energy transferred depends by the “DUTY CYCLE”

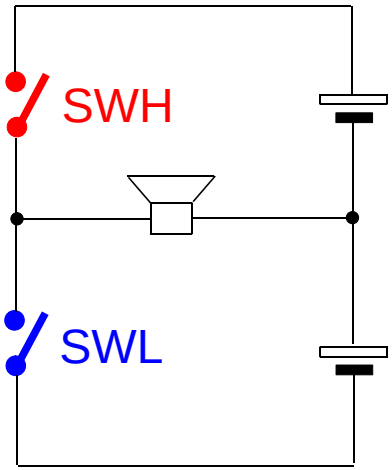
narrow DC ==> little energy

wide DC ==> much energy

PWM - Pulse Width Modulation

If the square wave used to toggle the switches has a frequency much higher than the signal bandwidth, we can use PWM to reproduce that signal.

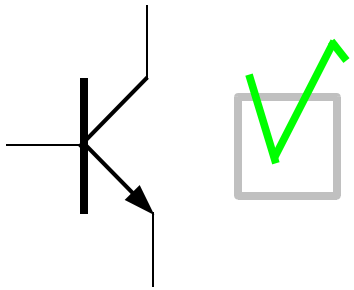




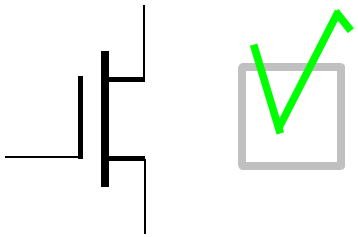
The original signal is reconstructed into the load thanks to its low pass integrating filtering action.
The load follows only the mean energy of each square wave pulse, not being able to follow so fast pulses.

A Suitable Electronic Switch...

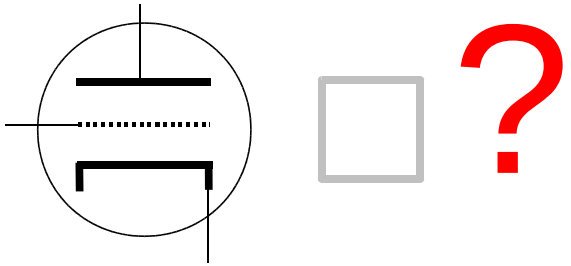
...can be done with a ...



BJT

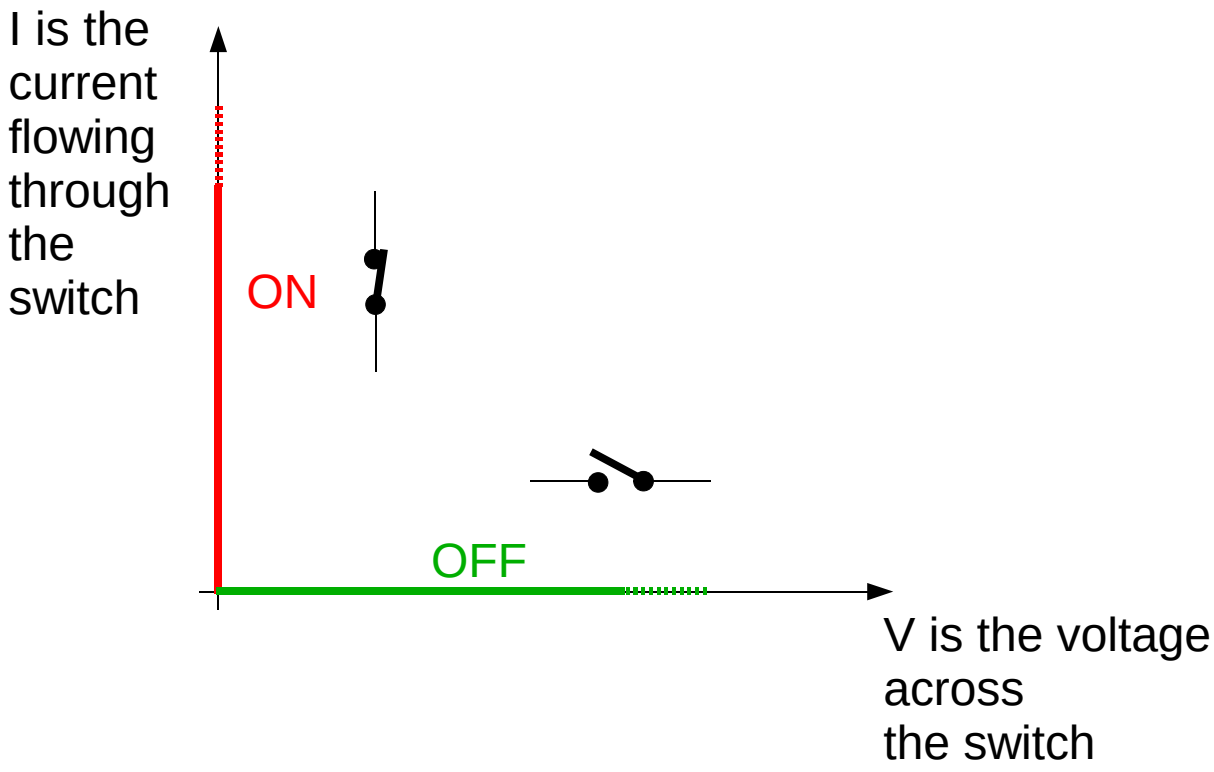


MOSFET



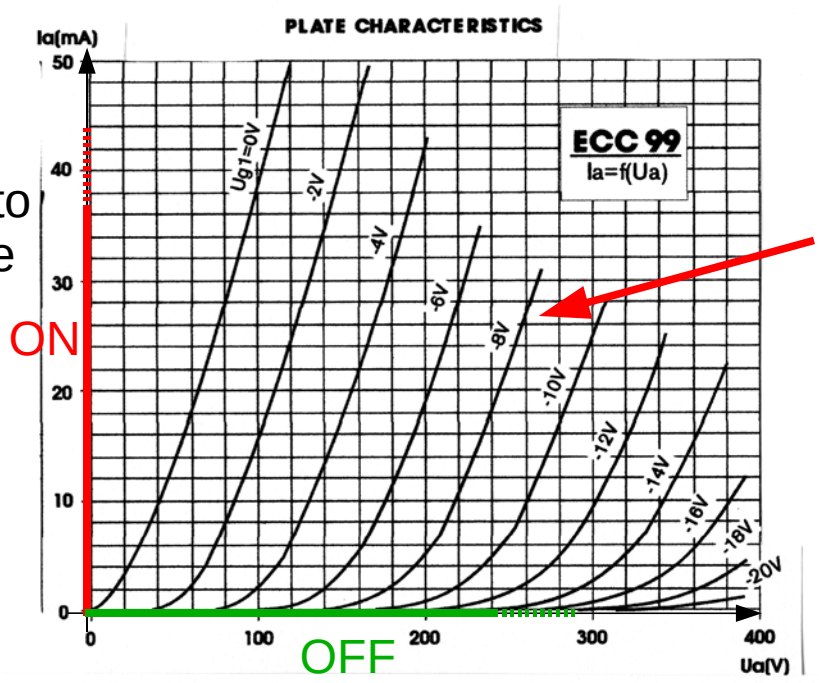
TRIODE

I vs. V characteristic of a very very very good Switch...



… in comparison with the I-V of a common triode

current flowing from anode to cathode



voltage across grid - cathode, that is the *control knob* of our triode switch

voltage across anode - cathode

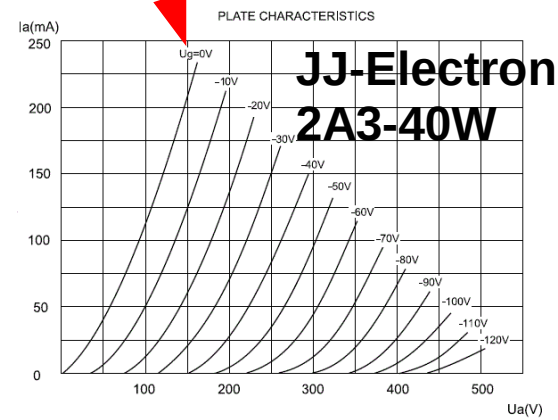
- **good OFF** state if Vgrid < -20V
- **not so good ON** state for Vgrid = 0V (max allowed Vgrid on the data sheets of every common triode)

- how can we have a better ON state ?

- let's investigate...

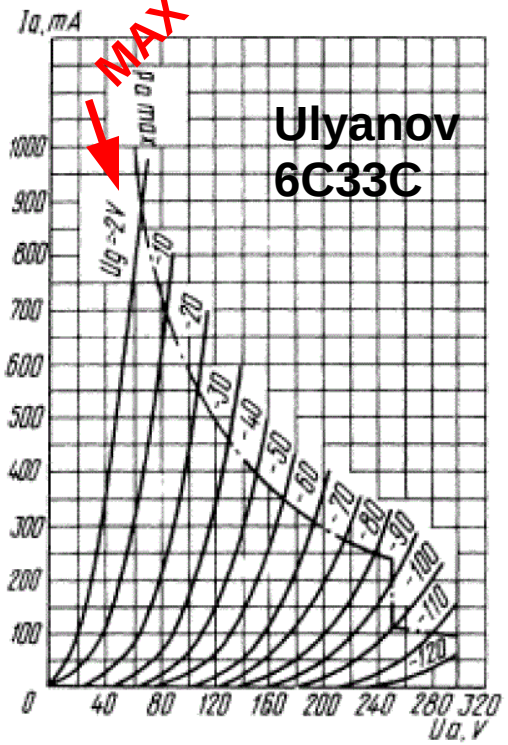
...have a look at tube data sheets

MAX 0V



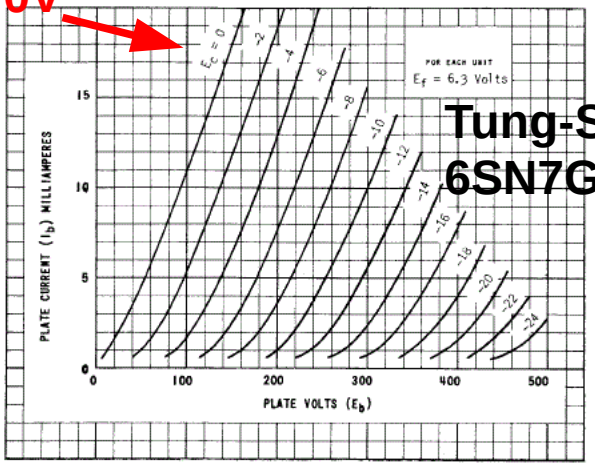
JJ-Electronics
2A3-40W

MAX -2V



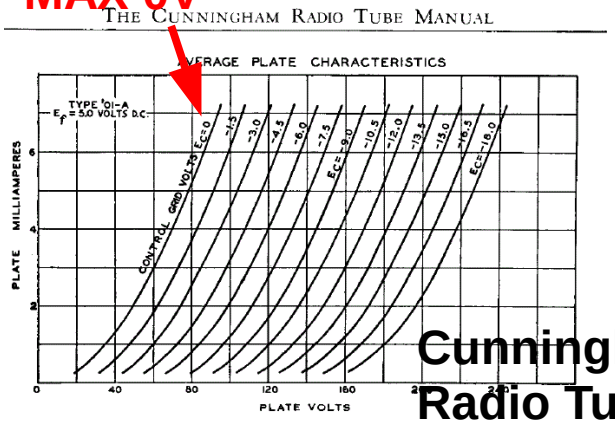
Ulyanov
6C33C

MAX 0V



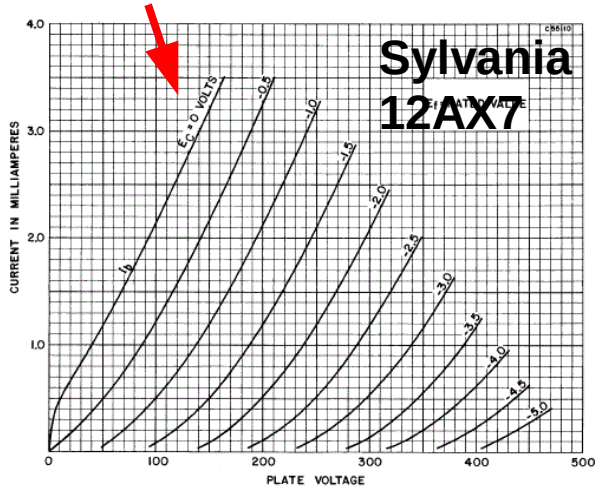
Tung-Sol
6SN7GT

MAX 0V



Cunningham
Radio Tubes
CX01A

MAX 0V



Sylvania
12AX7

...it seems that Vgrid stops always at 0V and must not be positive ...

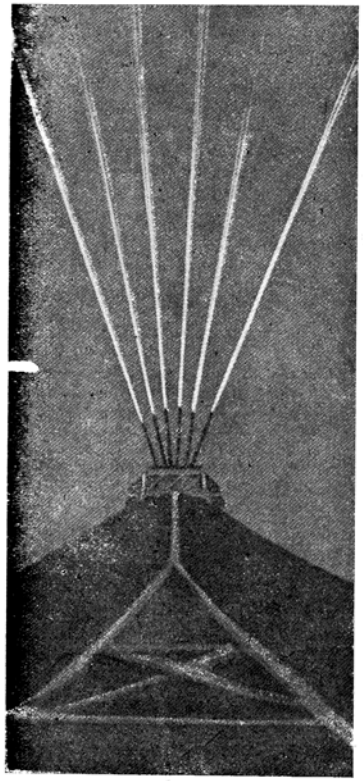
The Forgotten Positive Grid

...has been described in early handbooks...

PROF. ANG. ULIVO

RADIOTELEFONIA

per i Dilettanti



Spiegazioni semplici ed elementari sulla radiotelefonia - Tecnica, costruzione e montaggio degli apparecchi riceventi e trasmettenti

G. LAVAGNOLO
Editore – Torino
1926

...1926...

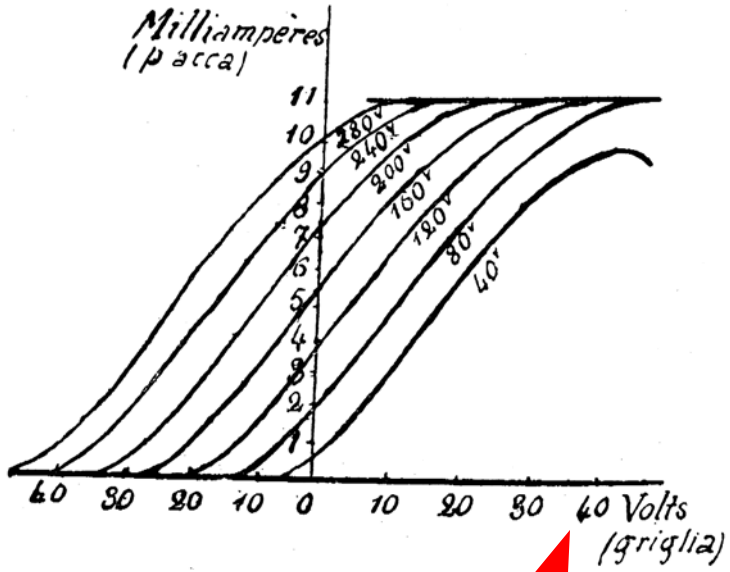


Fig. 84. — Caratteristica di una valvola sotto diverse tensioni di placca

...positive grid polarization...

The Forgotten Positive Grid

...or in few modern textbooks...

SANTE MALATESTA

ORDINARIO NELL'ACCADEMIA NAVALE DI LIVORNO
DOCENTE NELL'UNIVERSITA DI PISA

ELEMENTI DI

ELETTRONICA
E
RADIOTECNICA

VOLUME PRIMO

FONDAMENTI

INDUSTRIA TIPOGRAFICA — COLOMBO CURSI FU GIUSEPPE — PISA

...1967...
that is during the Apollo space age...

4. — **Triodo con griglia positiva.**

Ci siamo limitati finora a considerare il comportamento del triodo con griglia negativa di fronte all'emettitore, perchè è in tali condizioni

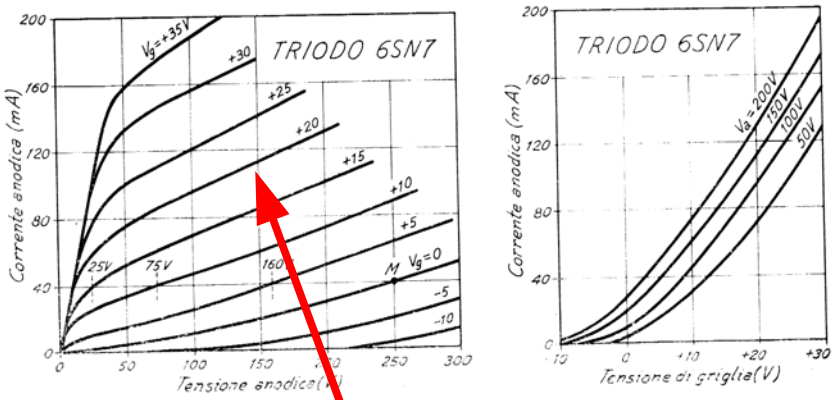


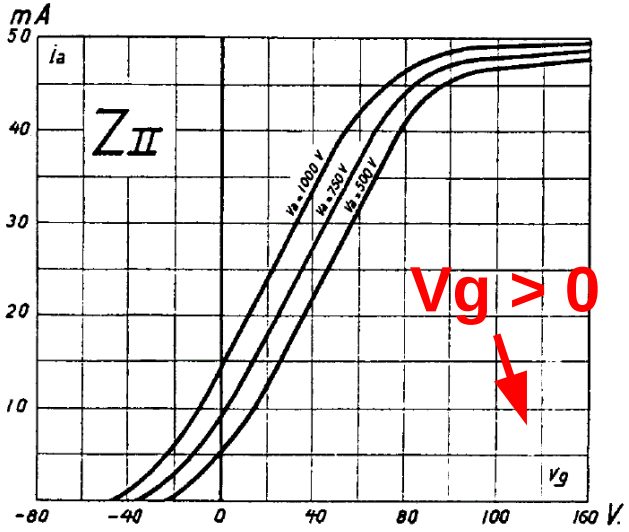
Fig. 17 — Estensione delle caratteristiche anodiche e mutue della figura 12 a valori positivi della tensione di griglia.

che il triodo è normalmente adoperato. Ma in alcune applicazioni la griglia è condotta a divenire positiva e perciò è bene conoscere il comportamento del triodo anche in tali condizioni; tale conoscenza è, poi,

...positive grid polarization...

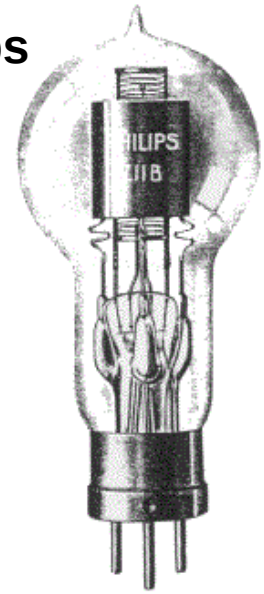
The Forgotten Positive Grid

...we find it in 1920s datasheets ...

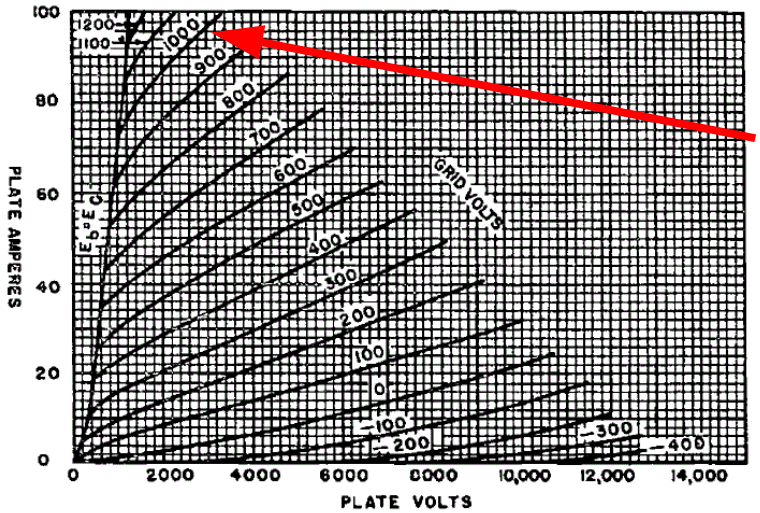


Vg > 0

Philips
Z II B



...or in very special specs of 1950s ...



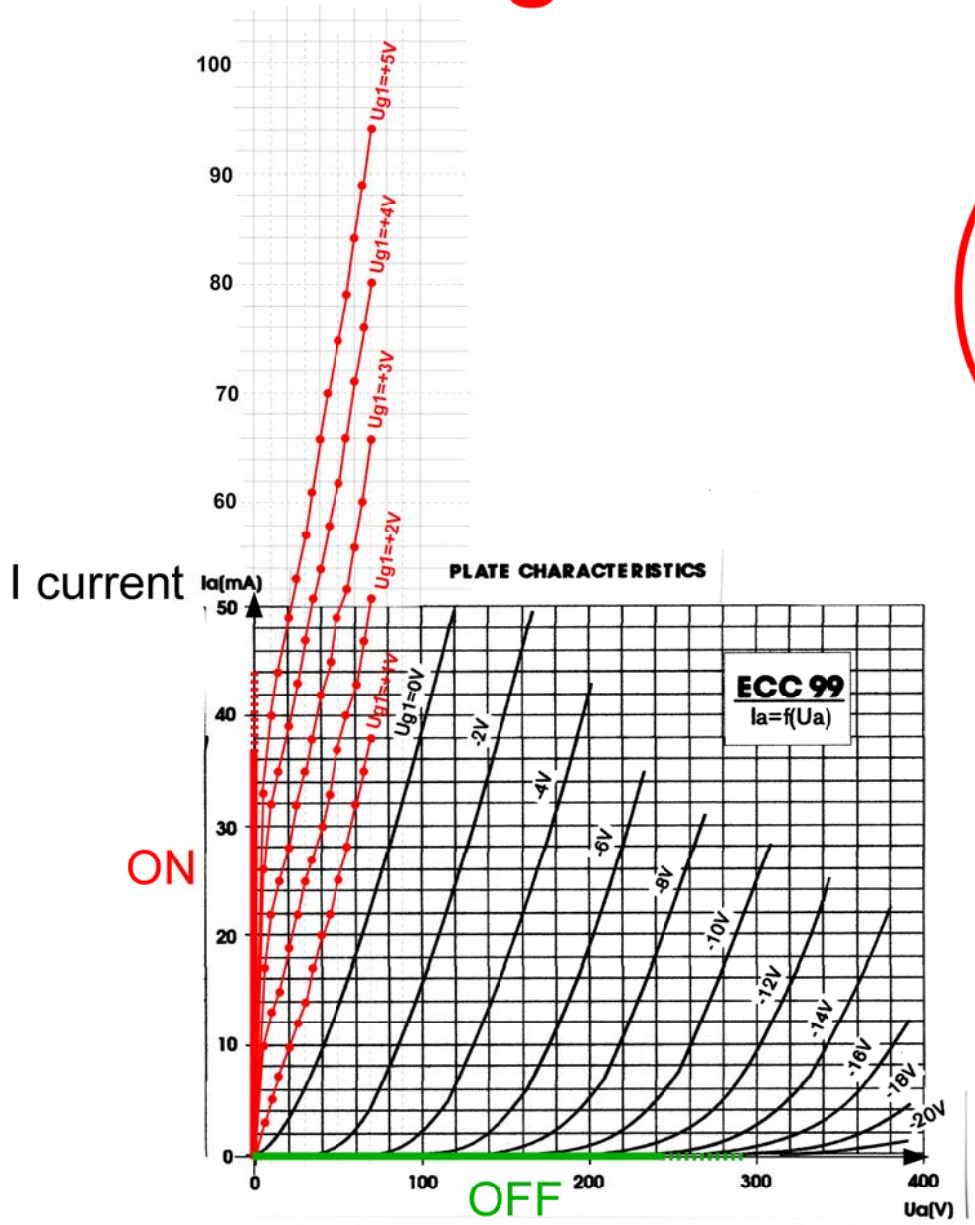
+1000 V !!!

Amperex 6078
a 45KW, 30Kg, short waves tx tube...

...but then the positive grid largely disappeared from tech docs !

The Maker's approach:

1- infringe common views

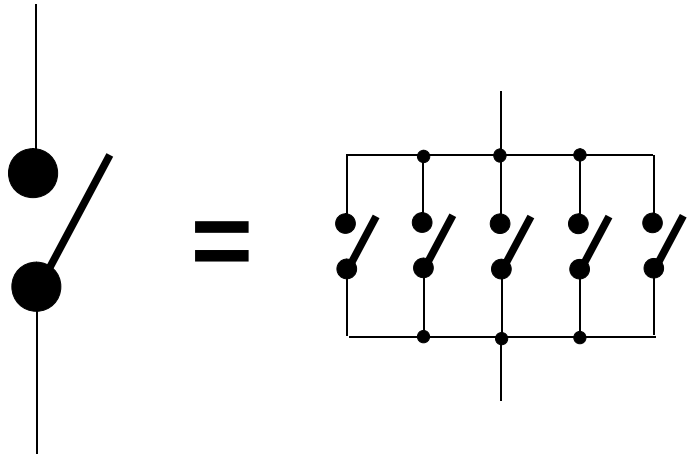


Use Vgrid > 0V to obtain higher current at lower voltage !

IS THIS NOT YET ENOUGH ?

...go further :

2 - multiply, that is **several small can be better than one large !**



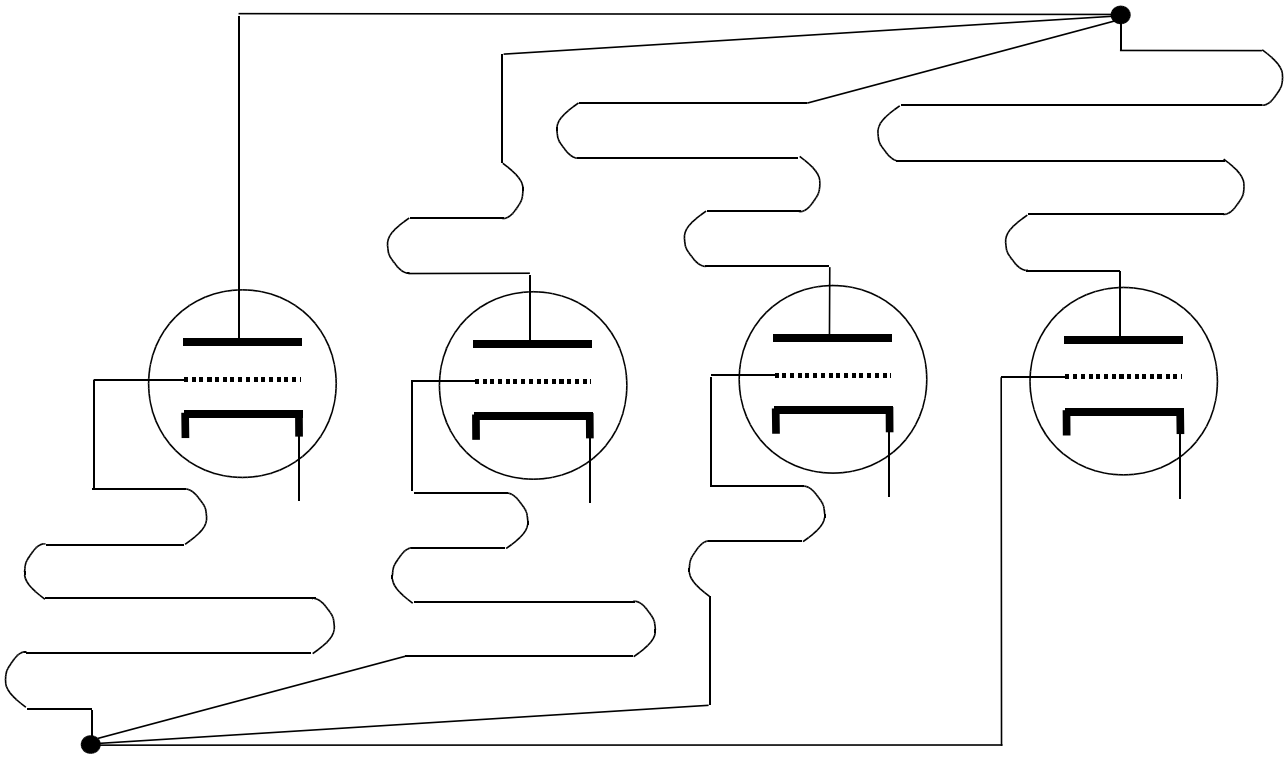
Connect several switches in parallel to obtain a large ON current...

...just toggle all of them in the same time !

Can we do that ?

...and don't forget your experience:

3 - use knowledge



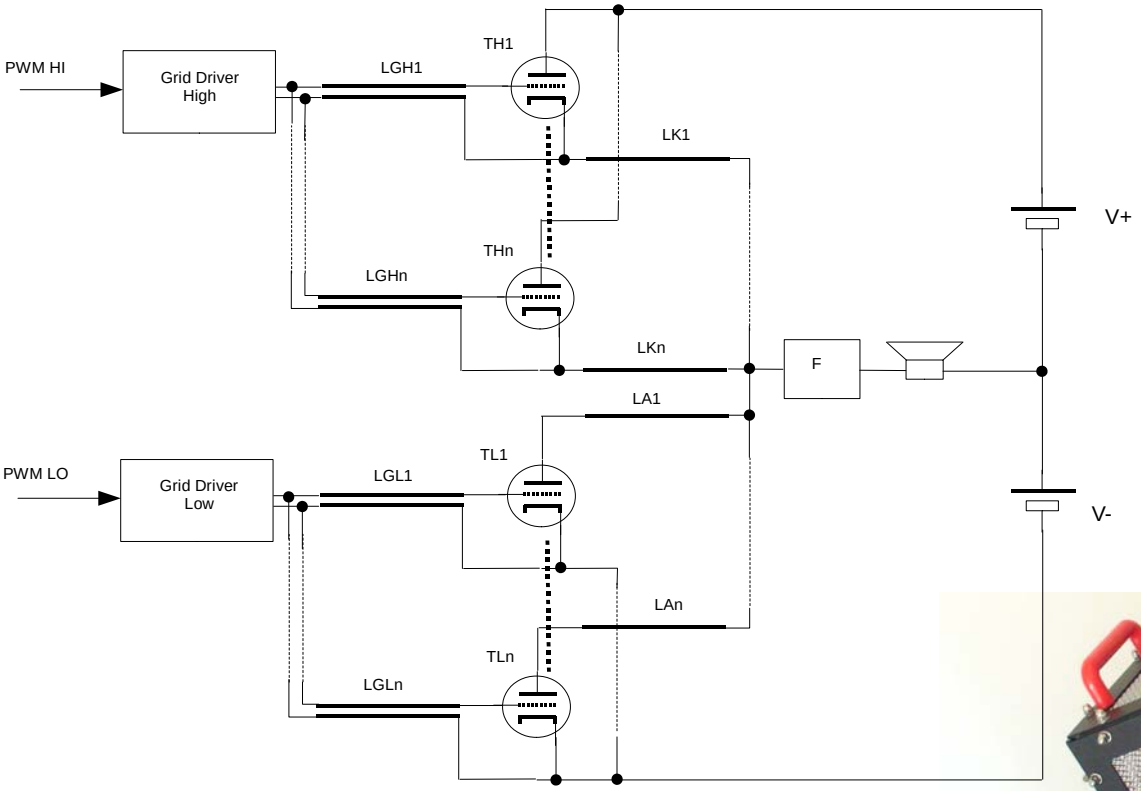
Use Lenght Line Equalization to connect in parallel the triodes

***Signal Integrity...*the magic secret for modern high speed electronic technology.**

the Final Result

AmpDiVa

Amplificatori Digitali Valvolari



www.ampdiva.com

Sorry Sir, but why should I use it ?

- somebody hates digital at all and **loves only analog** sound reproduction but...

- somebody else thinks **digital is the most perfect** way to enjoy music but...

- several of both like it hot: ***tubes sound is warmer*** than everything else !

So, what about a *pure digital sound* coming from *real digital hot tubes* ?

Visit our booth and enjoy our sound technology !
Thank you !

www.ampdiva.com

One more question...

why the positive grid specs did disappear from the data sheets ?
We have not yet found an answer...

If the grid is positive respect to the cathode, they run as a diode in direct conduction and the large flow of current can burn the grid.
So, this could be one reason....
...but we can always limit this current with some external device.

For sure during simple, static I-V measurement
on certain triodes
we have found a strange instability on the anode current flow.

And this was due to a self oscillating behaviour of the tube up to the GHz range !

This may be the real reason...