

# **Single-ended Triode Amplifiers using zero-bias Transmitting tube**

**A regulator tube drive method**

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# Who am I?

- Born in 1940 in Nagoya city.
- Majored Economics in school .
- Spent most of my life working for a Danish company in the foundry machine field.
- Retired in 2001
- Resumed audio activity in early 1990es.



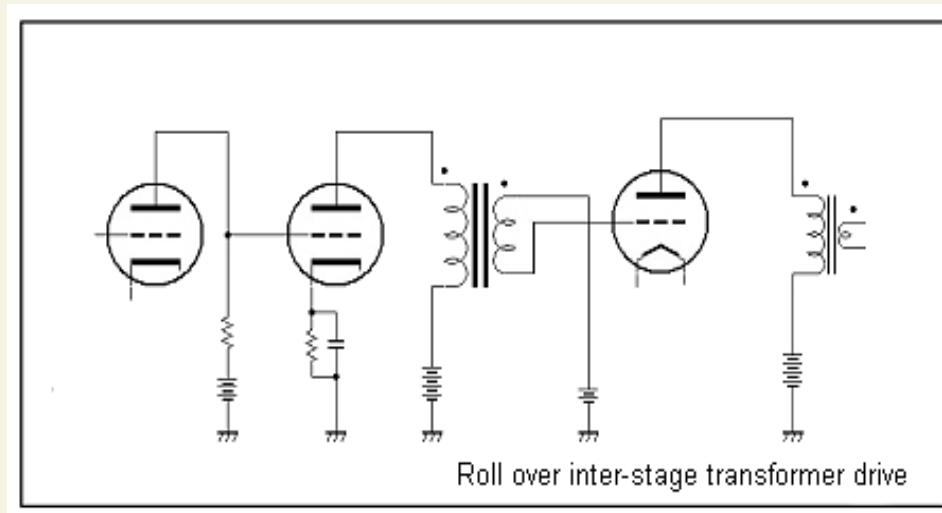
## Why I resumed Audio activity in early 1990es

- Have got amateur radio station license JA2AEY 50 years ago
- I built receivers and transmitters (AM) by myself using 42,807,6146,829B and 4D32
- Soon advanced to SSB era, built SSB generators and linear amps with such as 811A,813 and 4-1000A
- Still active on Ham radio, however all of my present gears are commercially made ones, but in all semiconductors
- Impossible to build quality Ham gears surpassing commercially made radios technically and financially
- My last one was with Eimac 8877 some 30 years ago
- Have come across a new joy to designing and building better amps sufficing my satisfaction and can enjoy hands-on assembling which has been lost in the Ham radio arena
- Early 90es,K.Sisido`s idea inspired me to involve transmitting tube amps: “Inversed inter-stage transformer drive” using zero bias

# Triode Zero bias amplifiers

- 845, 211, DA100 and RS237 are regarded nice sounding but difficult to acquire
- In early 1990es, K. Shishido introduced a method “Inversed inter-stage transformer drive” for zero bias transmitting tubes available in good quality / price in the market
- 800,808,811A,8025A,826,838,805,810 and 100<sup>TH</sup> for plus bias amplifiers were discussed and contributed to MJ in ten years
- Direct Dynamic Coupling method was later introduced by S.Soya ,advantages are 1)simplified circuitry 2)versatality, while its weakness of lower output
- In 2000, transformer-less (inversed inter-stage ) method was contrived by H. Michimori (presenter) and applied it to 811A amp
- In a few years, the said solution has been verified by a difficult to drive tube 100<sup>TH</sup> inclusive 838 and 8025A successfully, then I named it “Regulator tube drive”

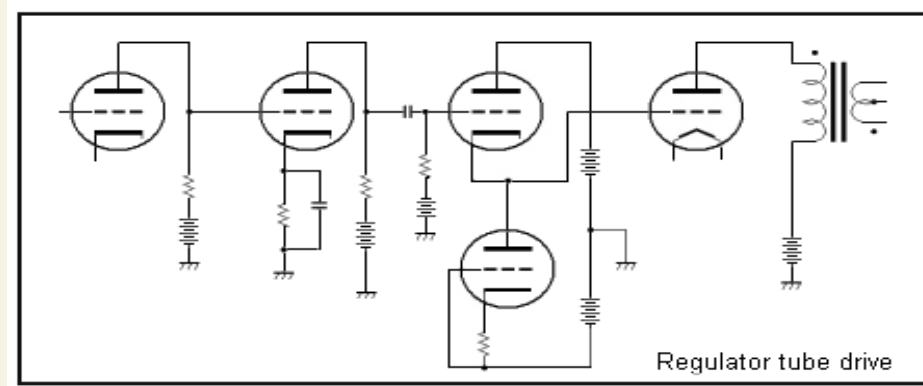
# Inversed Inter-stage transformer drive



- Wide window of Setting grid bias
- Cancels DC magnetization by flows of primary plate current of drive tube and of secondary grid current of output tube in the opposite direction
- Good frequency response and efficient drive using small size of inter-stage transformer
- Inter-stage transformer should be properly matched between drive and power tubes, otherwise prone to down output

# The regulator tube drive

(Cathode Follower & constant current source )



- Output power vs. Input power is extremely high efficient (> 40%) in A2 class operation
- Compliance to higher grid current of power tube (e.g.19.5~ 40.0mA 100TH)
- Wide window of bias voltage setting of power tube (-20 V to + 40V)
- Higher gm tube(5998A) makes CF output impedance lower ( $1/gm=64\text{ohm}$  for 5998A)
- Lower impedance and 100 % negative feedback of CF circuit lead to be strong in stability and various transient response (e.g. signal & bias voltages are not influenced when power tube grid draws higher current,)
- Applicable and versatile to almost all transmitting tubes inclusive negative bias ones

# 811A SE amp

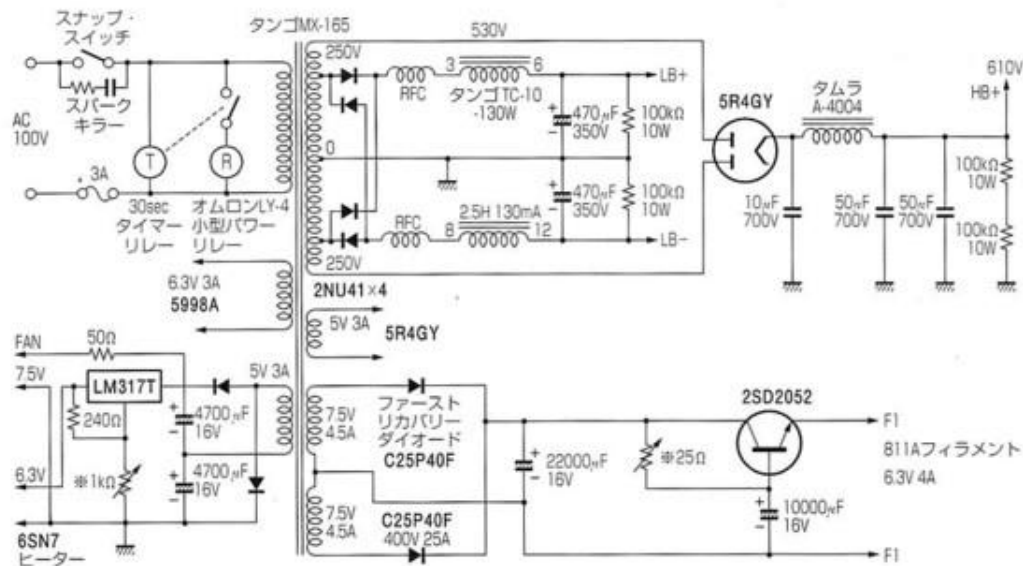
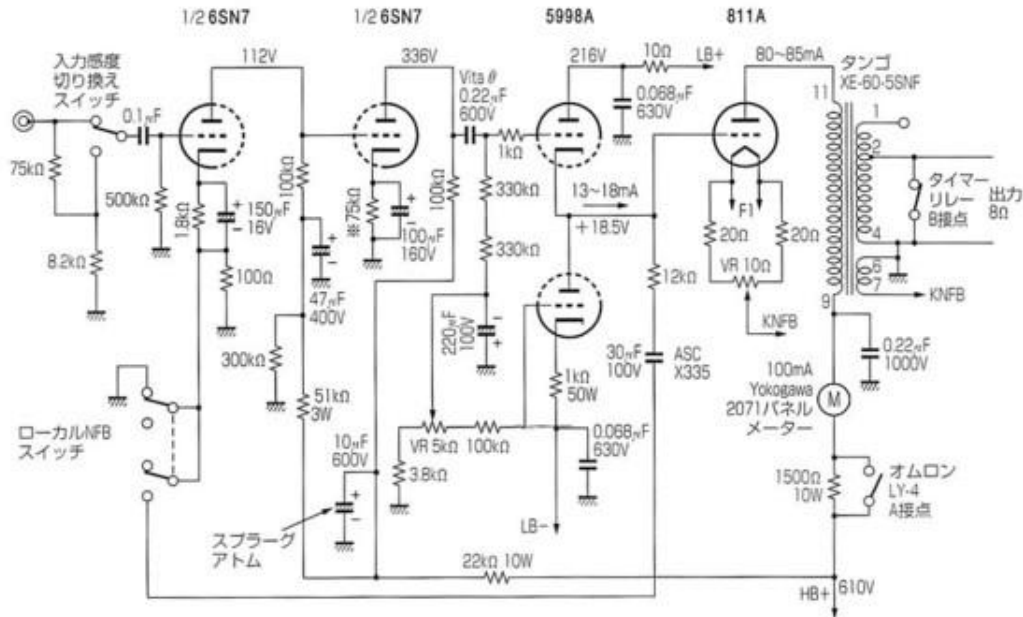
- 811A is a compact size zero-bias transmitting tube and easy to designing & assembling for Audio amplifier
- Plate dissipation 65W(ICAS), filament 6.3V(4A), amplification factor 160, and generic UX socket
- 600V,80mA (no signal) at plate, +18.5V grid bias and 85mA at maximum signal of 47V rms for 22W output in A2 operation
- Transformers (power & output) are of Ex-TANGO XE-60-5SNF & MX165
- XE-60-5SNF possessing 5K ohm load impedance and 36 ohm KNFB coil
- KNFB coil connected to 811A cathode to increase load impedance to ca. 5.9K ohm resulting dumping factor to be improved to 2.0 from 0.2

A 811A(22W) SE amp with regulator tube drive (CF+CCS)



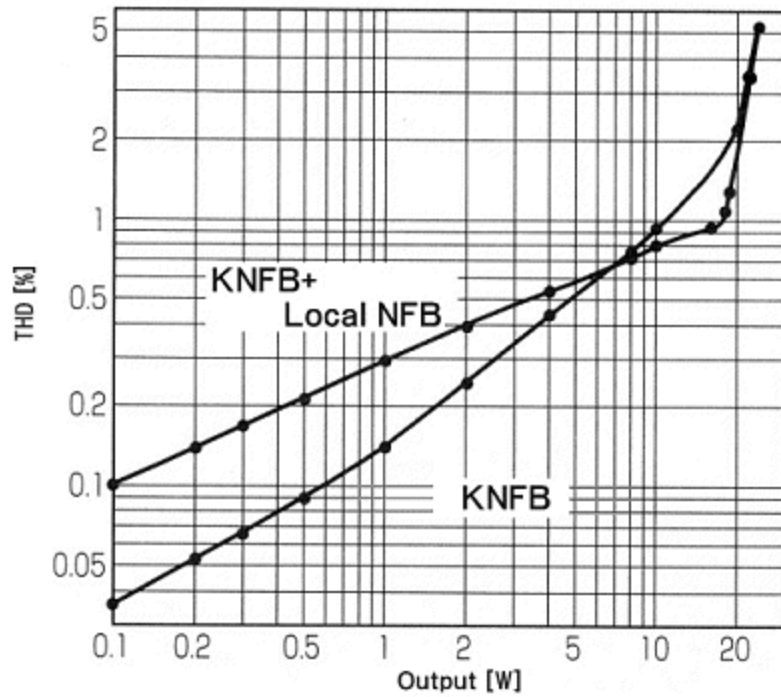


# A811A 22W SE amp

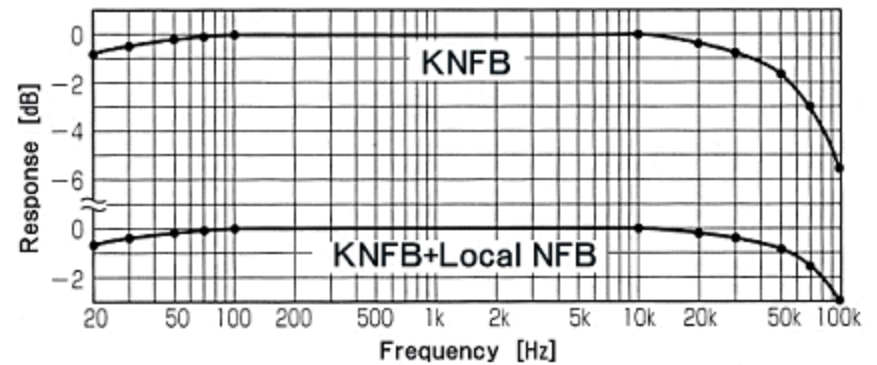


# 811A SE amp

Total Harmonic Distortion



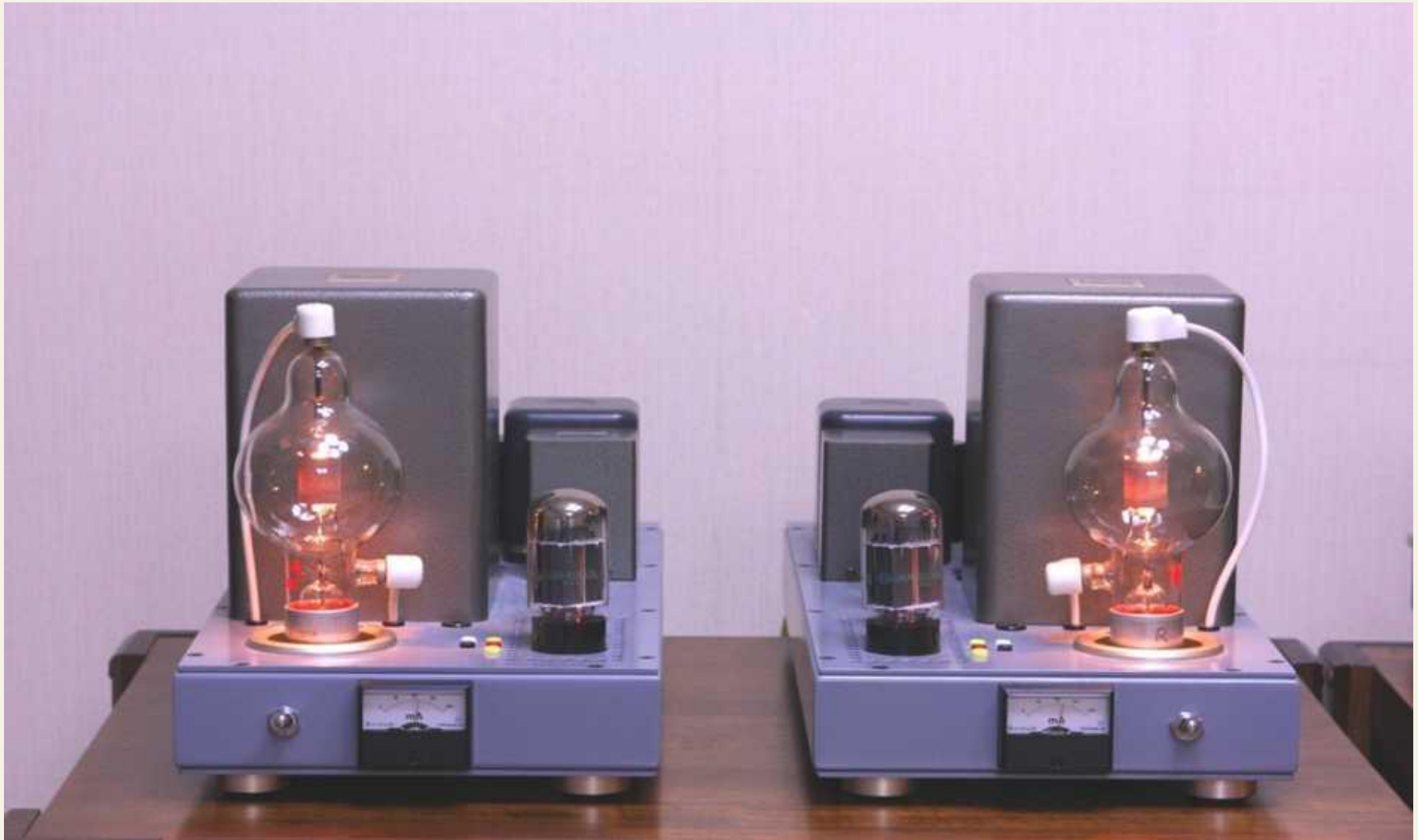
Frequency response (0dB=1.0W)



# A 100TH SE amp

- Unique appearance as well as reddish glow during operation
- Plate dissipation 100W, filament 5V (6.3A), amplification factor 38, and generic UX socket
- 600V/120mA at plate, +39V of grid bias and grid exciting voltage of 82V rms for 30W output in A2 class operation (THD: 3.6%)
- Grid current varies from 21mA(at idle) to 48mA(at maximum output) for which parallel connection of 5998A for CF is mandatory (for highest drive power)
- Current of 6C19P for constant current source load is set 46mA
- Output transformer is Ex-TANGO 10887, 50W, 3.5K ohm load impedance with 36 ohm of KNFB coil resulting approx. 4.2K ohm
- KNFB -5.2dB and local NFB -5.5dB in total -10.7dB of NFB resulting dumping factor of 2.85 (ON-OFF method at 1KHZ)
- 30 second muting circuit built in

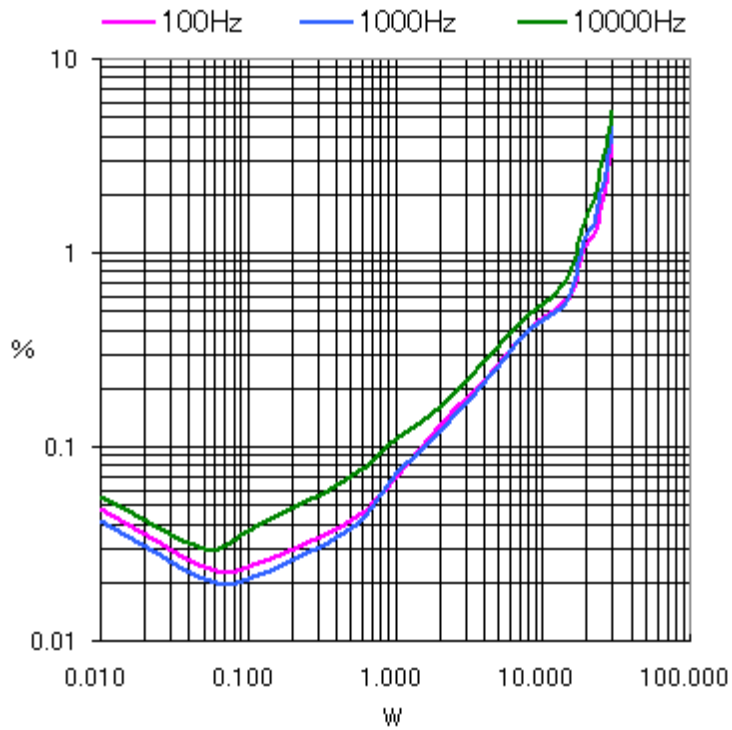
# A 100TH SE amp (30W) with regulator tube drive (CF+CCS)



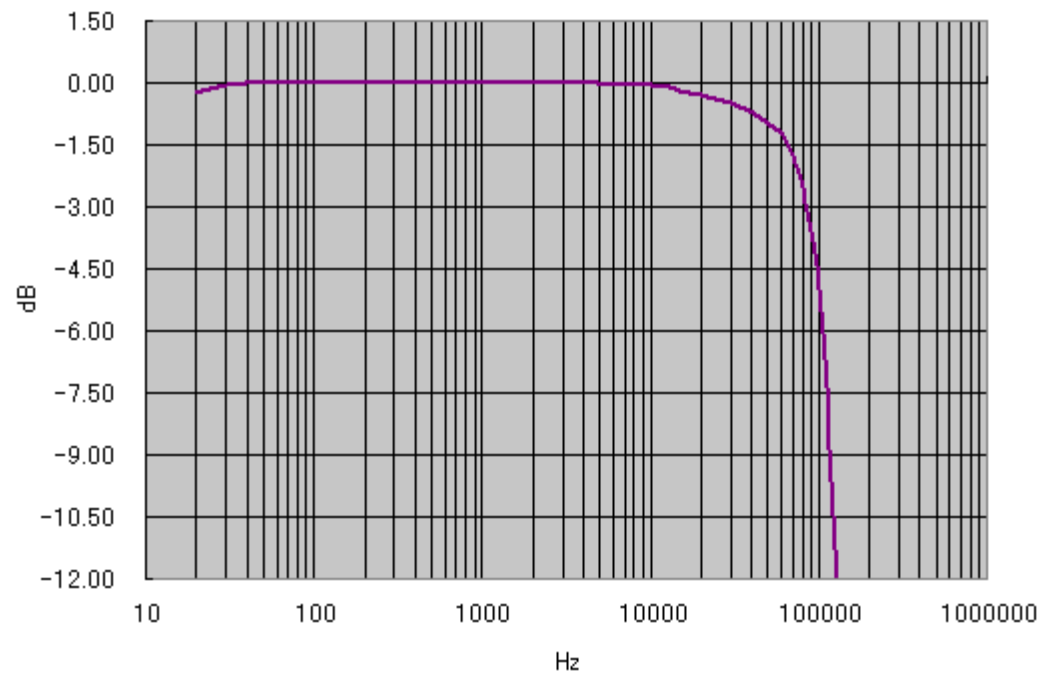


# 100TH 30W SE amp

## Total Harmonic Distortion



## Frequency response (0dB=1W)



# 838 SE amp

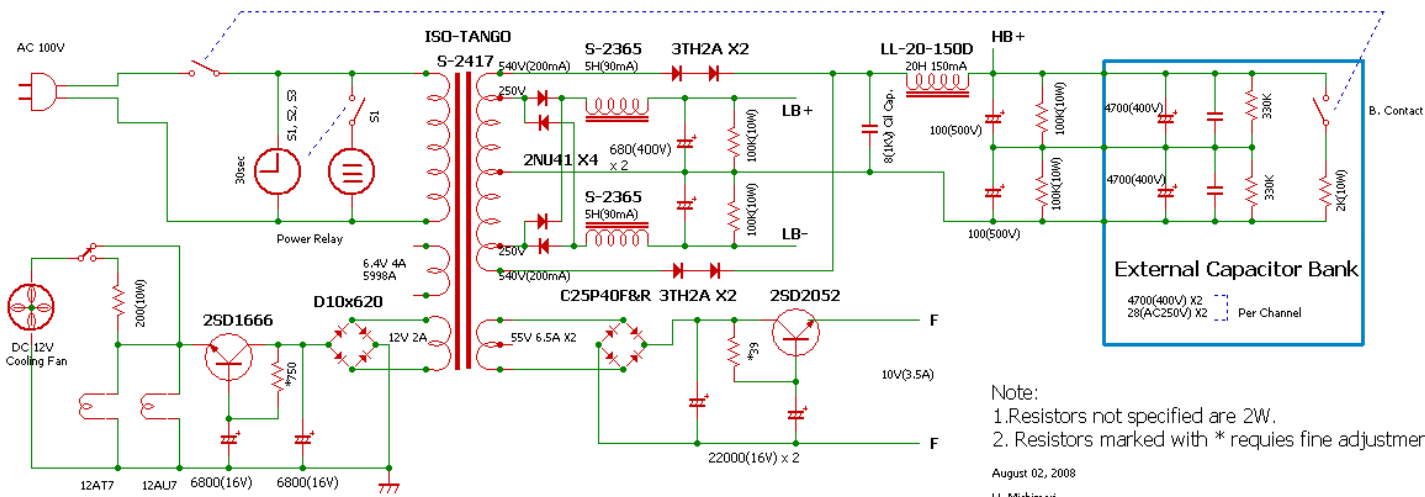
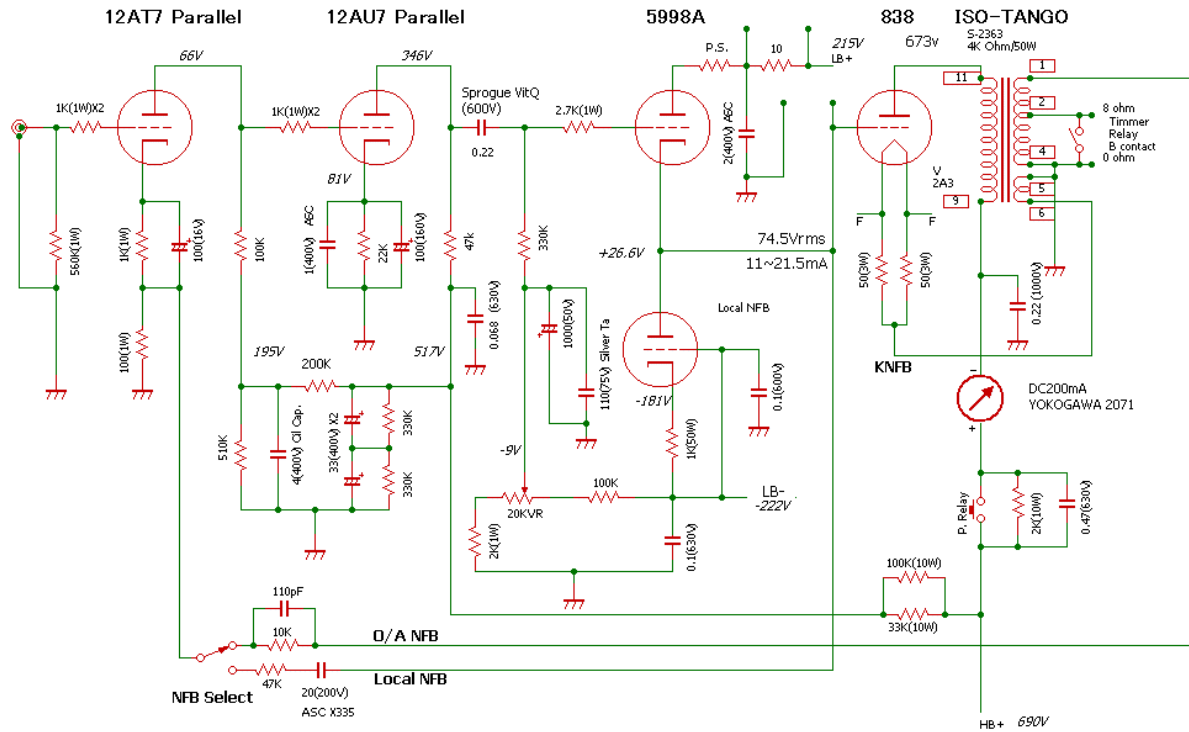
- GE-838: plate dissipation 100W, filament 10V (3.5A), amplification factor 50 and appearance is the same as 211 or 845
- 673V/110mA(no signal) at plate, +26.6V grid bias to increase to 120mA by maximum exciting signal of 74.5V rms, 35W output (THD:3%) in A2 class operation
- Grid current varies 11mA~21.5mA
- A (5998A) unit used for CF plate current is 52mA (nosignal) ~ 63mA (at maximum output), and another unit used for CCS current is 41mA
- Custom-designed output transformer: #S-2363 ex- ISO-Tango, 50W, possessing 4K ohm load impedance and 36 ohm KNFB coil resulting 4.8K ohm load impedance
- NFB: can select global (6.5dB) or local (4.5dB), dumping factor is 4.0 for global and 1.6 for local
- Power transformer S-2417 and Output transformer S-2363 were so designed that can be applied to 100TH SE amp as well

An 838 SE amp (35W) with regulator tube drive (CF+CCS)





# GE 838 SINGLE ENDED AMPLIFIER

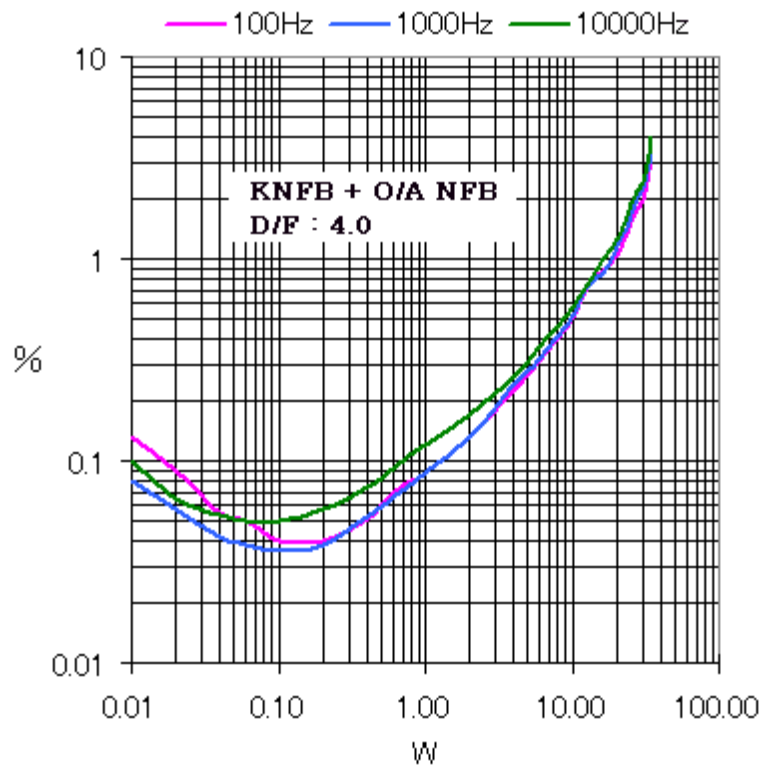


Note:  
 1. Resistors not specified are 2W.  
 2. Resistors marked with \* requires fine adjustment.

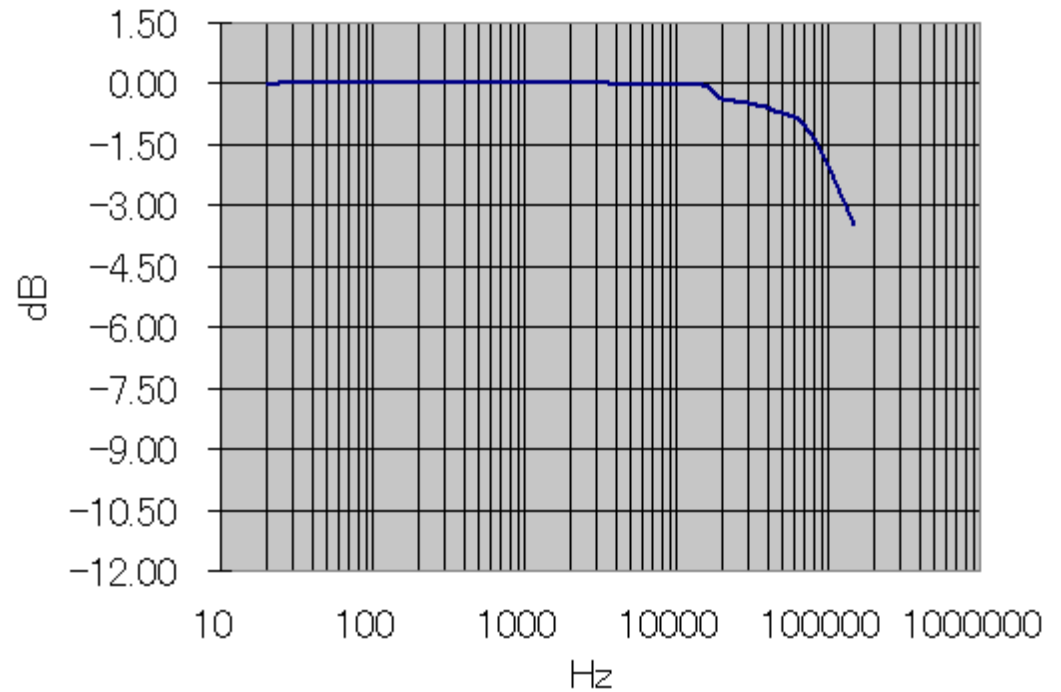
August 02, 2008  
 H. Michimori

# 838 SE amp

### Total Harmonic Distortion



### Frequency response (0dB=1.25W)



## Three 801A's PSE 17W amp

- Designed adopting an idea from “801A's parallel single ended stereo amp” appeared in “Radio Gijyutsu” on September, 1979 written by K. Takesue
- 801A: Plate dissipation 20W, filament 7.5V (1.25A), amplification factor 8 and unique inherent linearity of average plate characteristics
- Three 801As in parallel to lower plate load resistance to 1/3 and to widen selection of output transformers keeping its unique inherent linearity
- 600V/70mA in A class operation with no NFB and conventional minus bias configuration to generate 17W output
- Output transformer: Magnequest FS-007 (6K ohm)

Three 801A PSE 17W amp





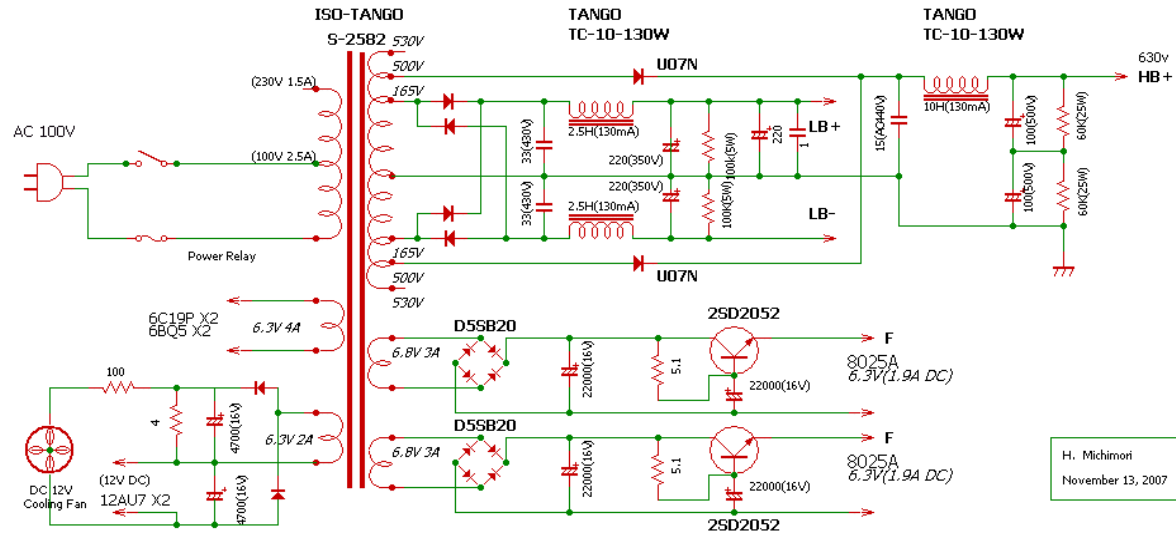
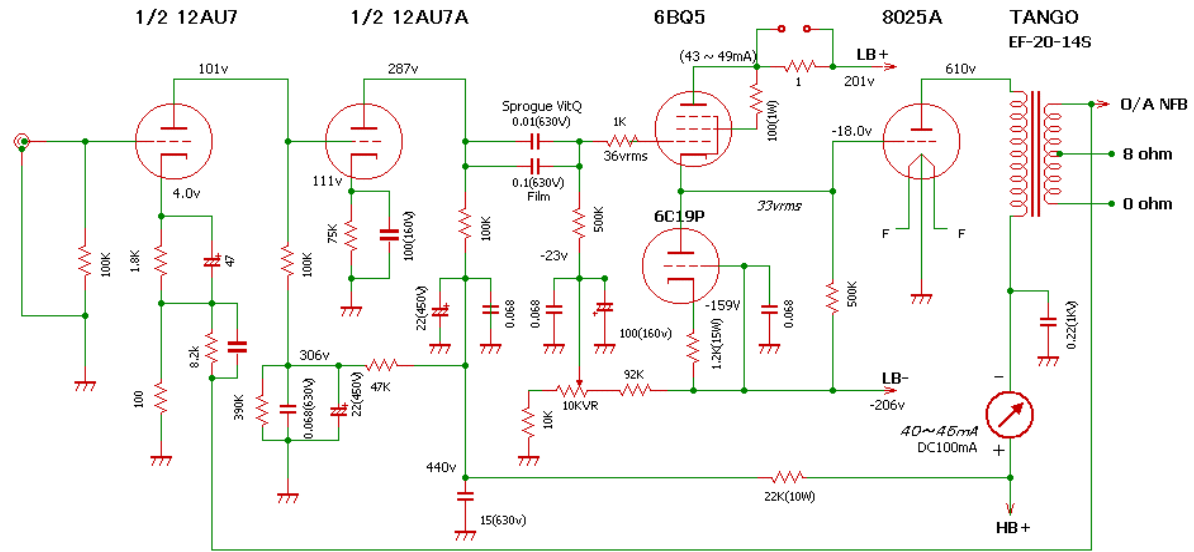
## A 8025A SE amp (12W)

- RCA8025A: Designed for UHF transmitting triode, plate dissipation 30W(non forced-air cooling), Filament 6.3V(1.92A), Amplification factor 18 and generic UX-socket
- 610V / 40~45mA, -18V grid bias, and generate 12W output (THD :3.6%)
- Up to 2.5W in pure A class operation, but Grid current starts to flowing in 0~5mA above 2.5W output
- Output transformer: ISO-Tango FE-20-14S, the primary impedance: 14K ohm
- Power transformer: ISO-Tango (of custom order nr of S-2582)

A 8025A SE amp (12W) with CF+CCS drive



## 8025A 12W SINGLE ENDED AMPLIFIER with Regulator Tube Drive (CF+CCS)

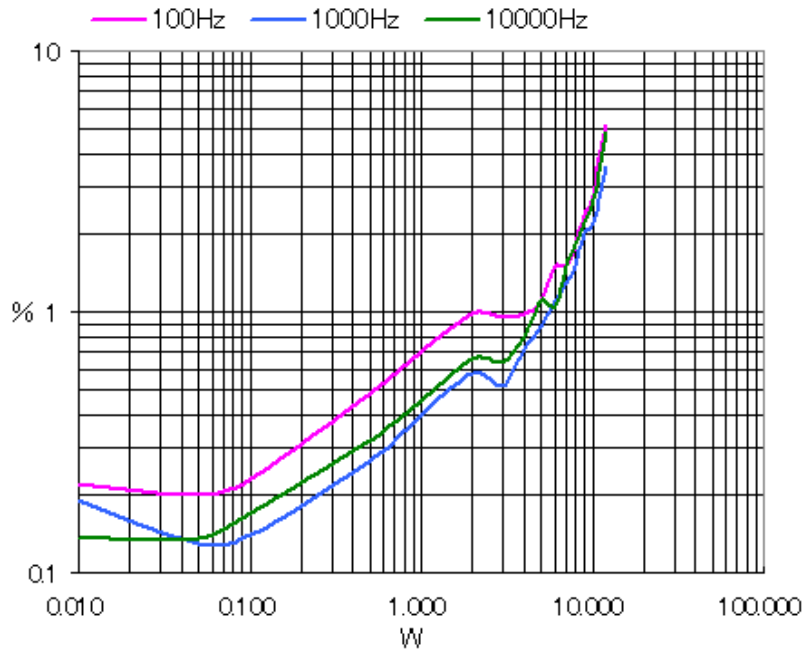


H. Michimori  
November 13, 2007

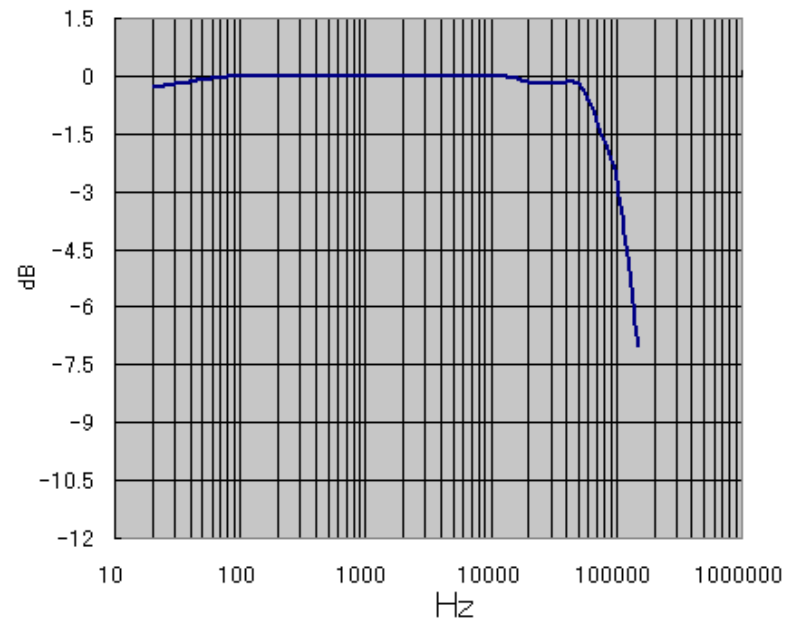


# 8025A SE amp

Frequency response (0dB=1.25W)



Total Harmonic Distortion



# Data Sheet

# Wrap up of my presentation

- For a decade, I have been spending days on direct heating, triode transmitting (plus bias) tubes amps
- For reference purpose, built a 801A x 3 in parallel (negative bias and non NFB) to monitor plus bias amps for comparison
- No tangible differences observed between amps to use grid current flowing and conventional 801A with negative bias
- For my B&W N-802 SP-system, more than 30W power is desirable to drive I feel.....
- Finally, it is my pleasure to be able to participate in ETF 2008, and could have a lot of valuable discussion with group members, Arigato and thank you all.....

# Addendum-Audio room



# Addendum-Capacitor Bank



# Addendum-Ham shack & Service Bench

