

Results from simulations of amplifier based on NAP 160 ('mjona' and 'bigun') to study behaviour of driver base-stopper phase networks
 Basic circuit with 8R2 + 100nF Zobel, 8R pure resistive speaker load, phase lead compensation network included across fdbk resistor. Vbe adjusted to give 30mA through the output resistors; fdbk cap reduced to 2uF for faster settling of dc-conditions.

1) Without phase correction networks:

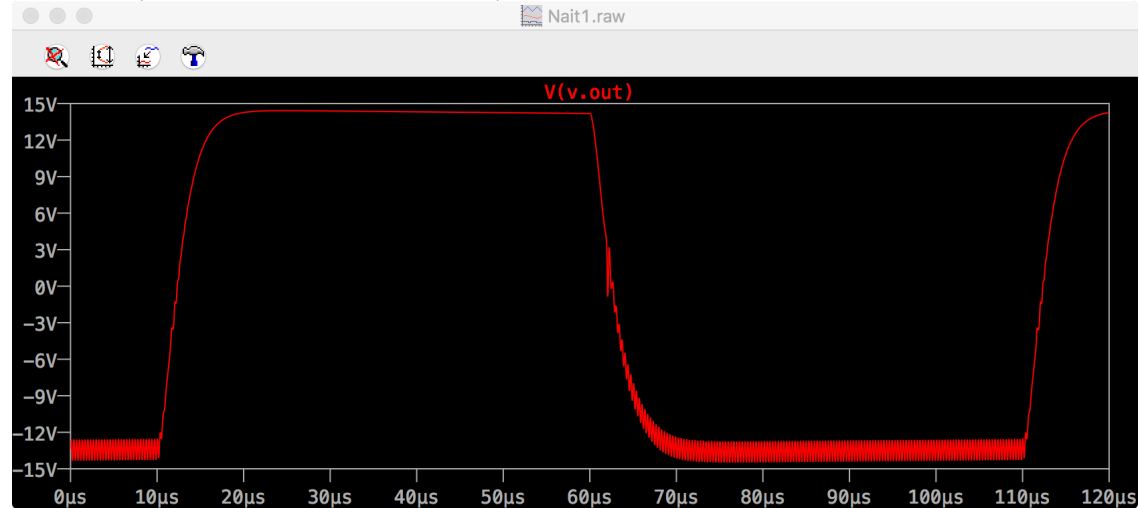
Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No

Capacitor across 8R speaker load: No

Phase correction network across lower driver base-stopper: No

Phase correction network across upper driver base-stopper: No

Observe: instability on -Ve side of waveform due to the Sziklai output.



2) Adding in phase correction networks

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No

Capacitor across 8R speaker load: No

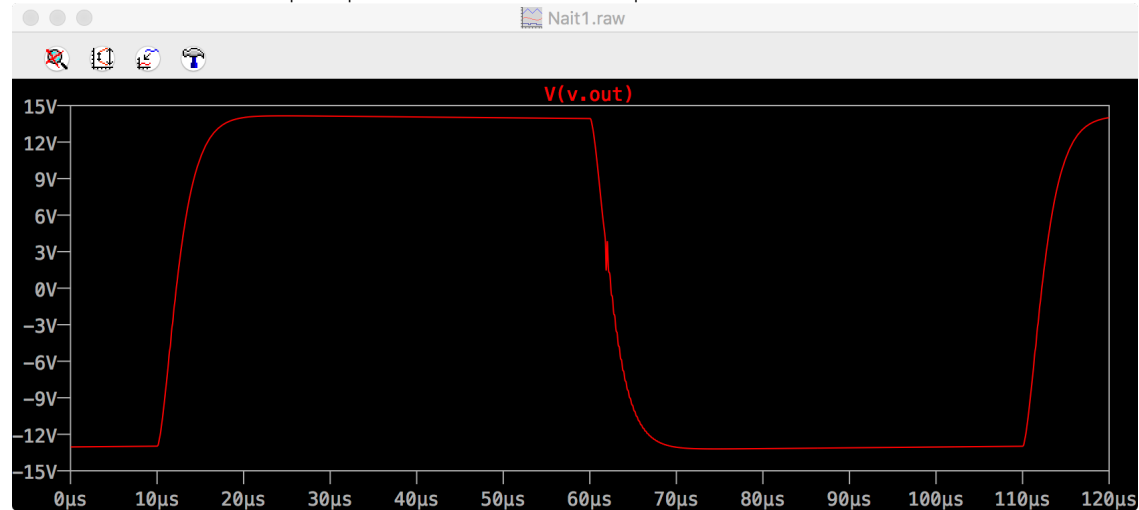
Phase correction network across lower driver base-stopper: Yes

Phase correction network across upper driver base-stopper: Yes/No (makes no difference)

Observe: instability on -Ve side gone but switching spike at cross-over when -Ve side turns 'on'.

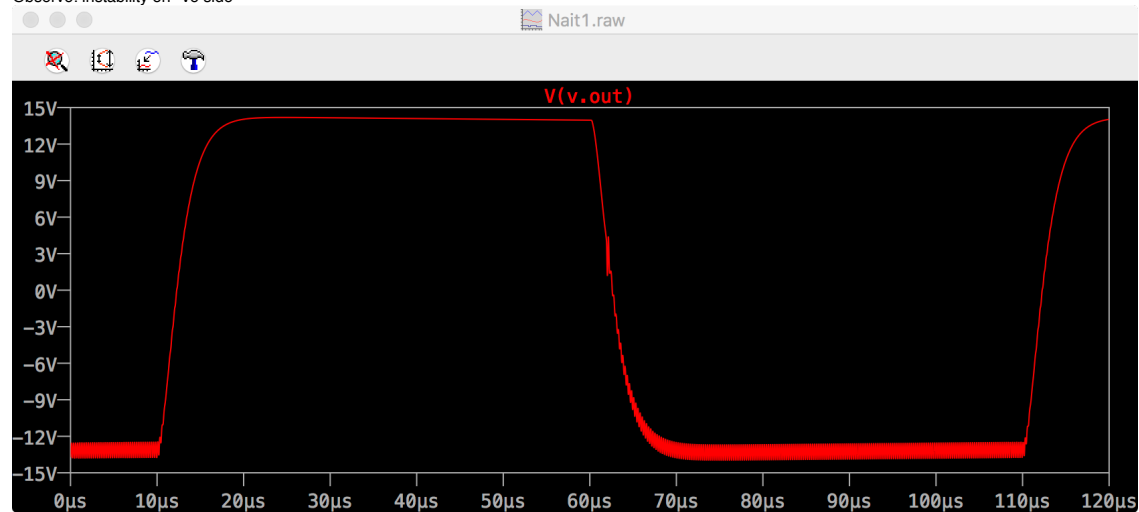
Note: the switching spike can be greatly reduced if the lower phase correction network resistor reduced by factor 10 or 100

Note: same result if a base-collector cap of 100pF added to lower-side driver instead of phase correction network



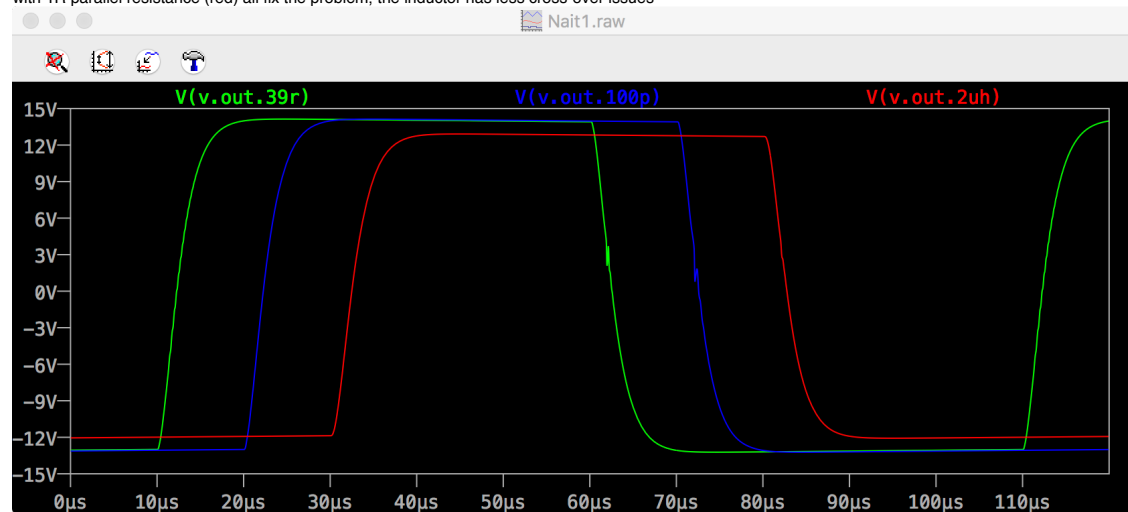
3) Adding 2nF parasitic load (bad speaker cables)

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No
Capacitor across 8R speaker load: Yes, 2nF (2uF has no detrimental impact on stability)
Phase correction network across lower driver base-stopper: Yes
Phase correction network across upper driver base-stopper: Yes
Observe: instability on -Ve side



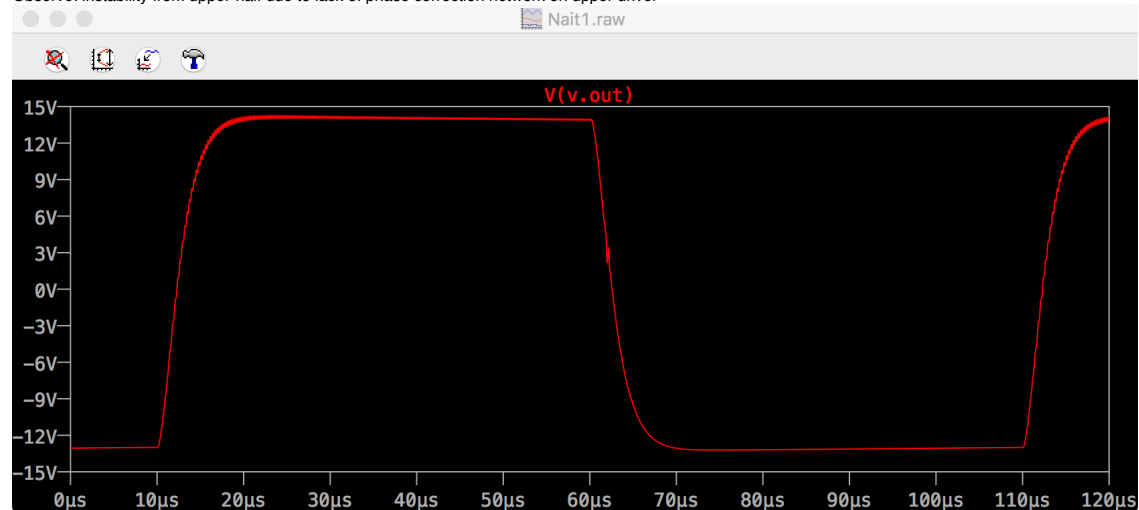
4) Optimizing lower-half phase correction network (cleaning up behaviour with 2nF load)

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No (green, blue), Yes (red)
Capacitor across 8R speaker load: Yes, 2nF (2uF has no detrimental impact on stability)
Phase correction network across lower driver base-stopper: Yes at 390R (blue, red), Yes at 39R (green)
Phase correction network across upper driver base-stopper: Yes
A 100pF base-collector cap on lower side driver: No (green, red), Yes (blue)
Observe: reducing phase correction network series resistor by factor 10 (green) or adding 100pF base-collector cap on lower side driver (blue) or using an output inductor with 1R parallel resistance (red) all fix the problem, the inductor has less cross-over issues



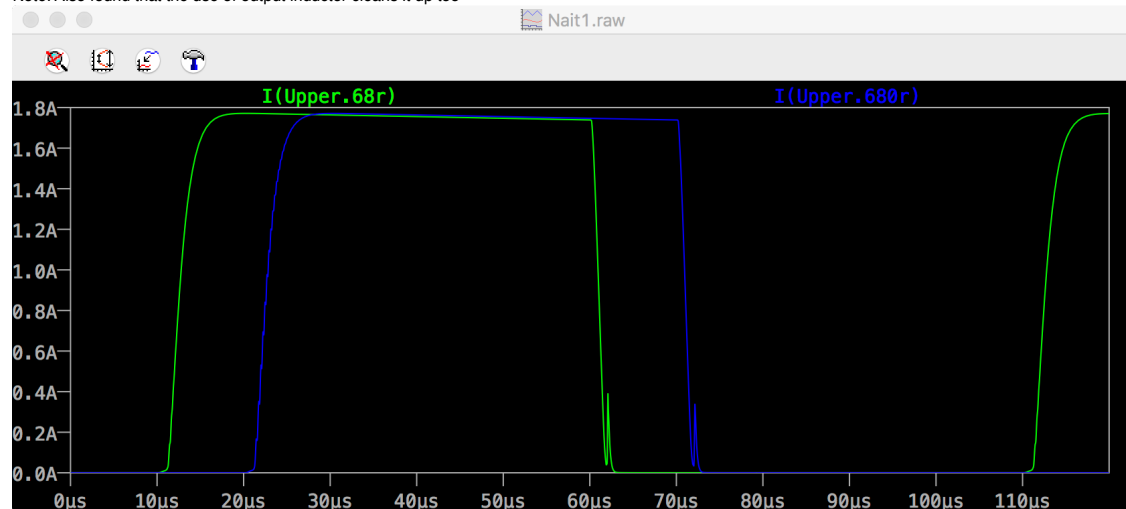
5) Demonstrating benefit of upper-half phase correction network

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No
Capacitor across 8R speaker load: Yes, 2nF (2uF has no detrimental impact on stability)
Phase correction network across lower driver base-stopper: Yes at 39R
Phase correction network across upper driver base-stopper: No
Observe: instability from upper-half due to lack of phase correction network on upper driver



6) Optimizing upper half phase correction network

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No
Capacitor across 8R speaker load: Yes, 2nF (2uF has no detrimental impact on stability)
Phase correction network across lower driver base-stopper: Yes at 39R
Phase correction network across upper driver base-stopper: Yes at 680R (blue), Yes at 68R (green)
A 100pF base-collector cap on lower side driver: No
Observation: Looking at the current through the emitter resistor of upper-half output, reducing the upper driver phase network series resistor value from 680R to 68R substantially reduces the 'wiggles' of instability on the rising edge as the upper Darlington turns 'on'
Note: Also found that the use of output inductor cleans it up too



7) Benefit of reducing lower half driver emitter resistor

Output Inductor with 1R parallel resistor in place of 0R22 output resistor: No

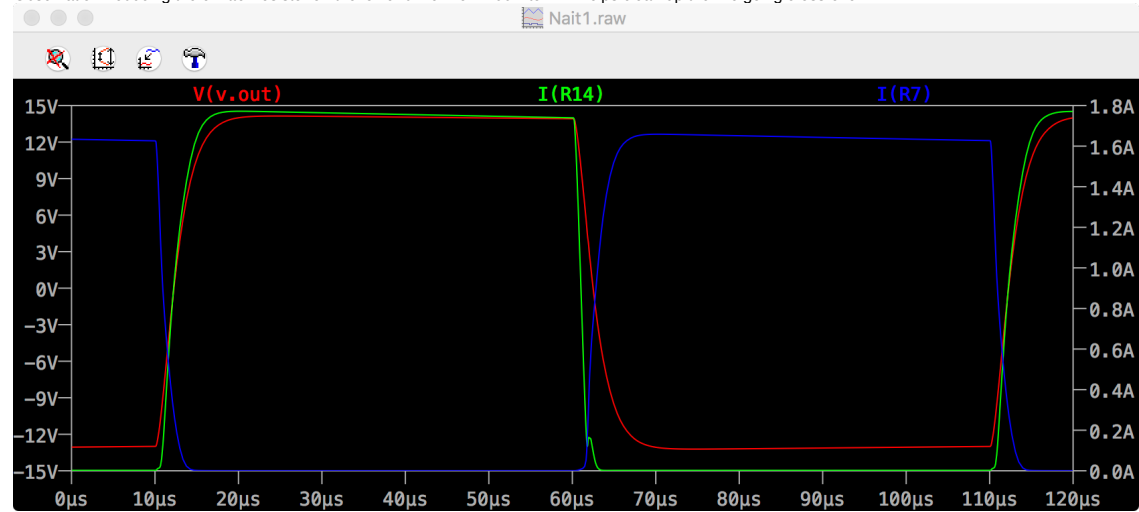
Capacitor across 8R speaker load: Yes, 2nF (2uF has no detrimental impact on stability)

Phase correction network across lower driver base-stopper: Yes at 39R

Phase correction network across upper driver base-stopper: Yes at 68R

A 100pF base-collector cap on lower side driver: No

Observation: reducing the emitter resistor on the lower driver from 100R to 22R helps clean up the -Ve going cross-over



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