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## AN-102

## Amplifier with Feedback from Output Transformer

CineMag manufactures a number of output transformers with tertiary windings which are intended to provide feedback to the drive amplifier, most of which are specifically designed for tube circuits. However, the same principles can be applied to solid state circuits with good results. The CMOQ transformer series will provide good performance in such applications. Consider using the "L" 50% Ni 50% Steel version instead of the High Nickel core version to reduce cost.

For a transformer to perform well providing feedback it must have very good coupling between the tertiary winding and the primary. The tertiary winding must provide a signal which closely mirrors what the primary winding is doing. The CMOQ series are quadfilars. They can provide good results because care is taken in their manufacture to assure these necessary characteristics.

The following circuit is not optimized in any way. It is merely provided to show a topology and to provide data to demonstrate what this technique can do. The LF353 f.e.t. amplifier is not the very best choice, but it has a decent offset voltage. The Harris HA-5002\* buffer amplifier provides very good power bandwidth and has good current drive capability. There will be a small d.c. offset (the LF353 is trimmed to 10 mV maximum offset), but the transformer is not affected by it. In practice, keep the two op-amps on the same die so that d.c. offsets will track each other with temperature change. Note: Many output transformers can be fabricated to tolerate some d.c. current. If your design will cause a significant amount of d.c. current to be passed through the transformer, please inform us about this in your application so that yours can be manufactured to tolerate it.

The HA-5002 has very good current drive capability. Consider providing some high frequency roll-off in the feedback circuit by placing a small capacitor between AR1 pin 7 and U1A pin 2. U1A will have to be taking some gain, otherwise U1B will just short out this compensation. This will help avoid square wave overshoot on the leading edge -which is minor even without it.

\*Note: The EL-2002 shown in the first generation of AN-102 Rev A has been discontinued. Intersil/Harris, which absorbed Elantec, recommends the HA-5002 now. Note the new pinout and current limiting resistors.



