Ultra bias boosting using an enhanced Wilson current mirror biasing

The TRIAD circuit comprises a novel dc bias circuit, which comprises an enhanced complementary fully symmetrical Wilson current mirror as a Ultra bias boosting circuit for biasing the Driver and output transistors. These current sources are configured to make the charging rate faster than the discharging rate for each respective half of the complementary Diamond Buffer output stage. The current source of the enhanced Wilson current mirror dictates the quiescent current of the driver and output transistors. Our dc bias circuit comprises an adjustable JFET Constant Current source supplying a precise amount of DC current to both Wilson current mirror circuits at the same time and in precisely equal amounts.

Thus, we have a Ultra stable bias boosting circuit capable of charging and discharging the Driver and output transistors with a charging rate faster than a discharging rate

In a conventionally biased class AB amplifier, the average bias supply current increases as power increases. This increased average current results in an increased voltage drop in the resistive part of the bias circuit. This in turn reduces the average voltage drop across the forward-biased PN junction of the power-amplifying transistor, pushing the amplifier into class B and even class C operations. Therefore, the output will be saturated as the input further increases.

Linearity and power-added efficiency are two contradictory requirements in a power amplifier. A tradeoff between the linearity and power-added efficiency are the classic design dilemmas for the power amplifier. It is usually done by achieving the highest power-added efficiency for a given linearity requirement, However to obtain this in actual practice requires a good control of the quiescent current for the power amplifier. In the TRIAD, an impedance-controllable biasing scheme could be used to provide independent control of quiescent current of the power amplifier. Therefore, it could achieve high power-added efficiency while maintaining its linearity by properly controlling the quiescent current. However, such a scheme is not simple and compact enough.

Therefore, Our Design is to provide a power amplifier circuit with a novel biasing scheme, which is simple but capable of providing both self-bias boosting capacities while maintaining good controlling of quiescent current of the power transistors.

The enhanced Wilson current mirror comprises a first pair of mirror transistors of PNP polarity to supply Bias current for the positive half of the output stage. The second pair of Mirror Transistors is of the NPN polarity and supply Bias current to the Negative Half of the output stage. When the Jfet bias generator Bias Resistor R10is adjusted for proper operation this current, source bias current simultaneously presented to each positive and negative Wilson current mirror. The current then selected such that the charging rate is faster than the discharging rate for the output stage.

ULTRA bias boosting capacity is achieved. By properly controlling current the output current, the charging and discharging rates can provide desirable bias boosting for achieving optimized output power, gain, power-added efficiency when Icq is fixed, as well as the linearity improvements.

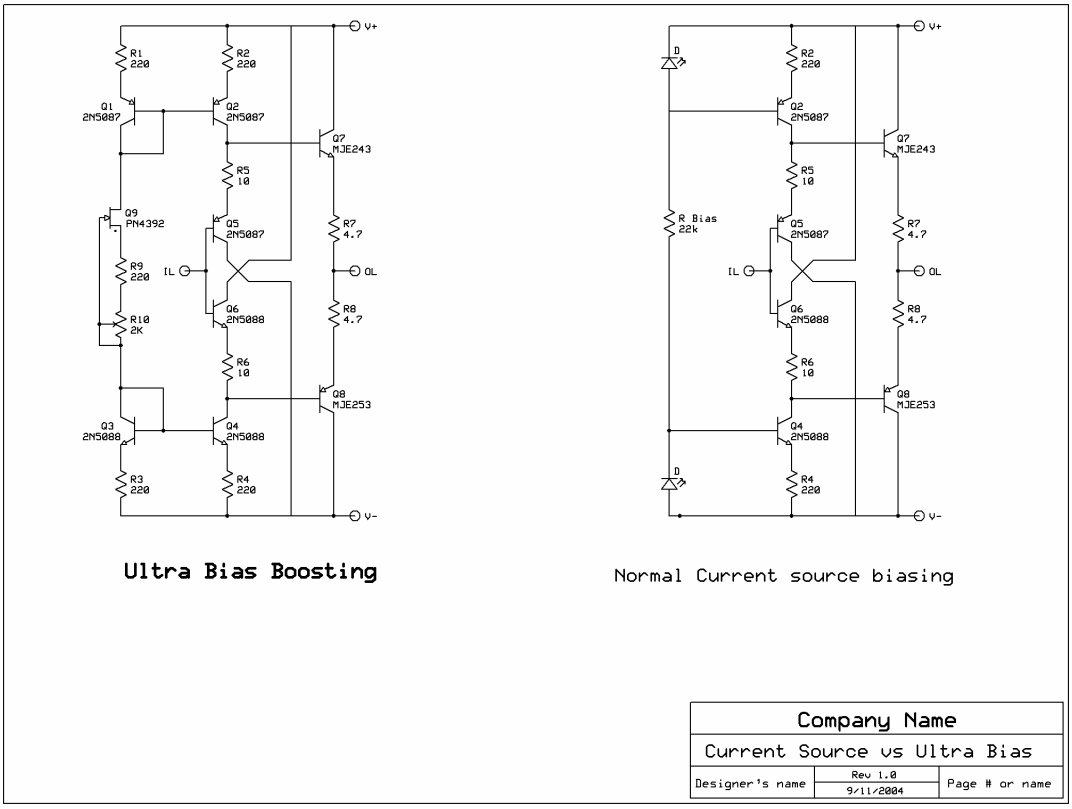
As in an enhanced Wilson current mirror, it is appreciated that the current source bias in the bias circuit controls the drive current. Furthermore, the current source bias also controls the quiescent current of the amplifying transistor. We will preferably, configure the quiescent current in the transistor to be directly proportional to the value of current source bias by properly scaling the emitter areas ratios between the transistor pairs. For example, the ratio of Q5 to Q7 is set as2:1 to 1, while the ratios of Q6 to Q7 also 2:1 and Q1 to Q2 are set as 1 to 1. Thus, the quiescent current of amplifying transistor Q%&Q6 is in good control by the current source bias Q1~Q4..

The availability of current mirrors that may operate as accurate current sources in a low voltage environment has become desirable.

A current mirror circuit typically referred to as the Wilson current mirror employed. This particular embodiment of a Wilson current mirror uses negative feedback to increase the output impedance by active circuitry are employed so that the terminals or nodes of the transistors have corresponding voltages that are identical. If this is accomplished, then the two transistors will exhibit identical current densities. The current then, in the mirroring device or transistor, will be equal to the current of the reference transistor equal to the output current through the current source. Therefore, since the current mirror output portion mirrors the current through the programming position, the currents through the output portion will match the current through the current source and quickly responds to variations of the input signals so that this amplifier has a short response time. This particular Topology provides a number of advantages including significant current accuracy and achieving this accuracy with output voltages that are relatively low, and may be near close to 2 volts in some situations.

The Enhanced Wilson current mirror as an Ultra-bias boosting circuit for biasing the output transistor through a bias resistor. The current source and the bias resistor be configured to make the charging rate faster than the discharging rate. Furthermore, the current source of the enhanced Wilson current mirror dictates the quiescent current of the amplifying transistor. Preferably, the quiescent current may be set as in direct proportion to the current source by scaling the emitter resistor ratios between transistor pairs. This method is most common in Diamond Buffer topology to obtain Class AB as opposed to just Class B operation.

ULTRA BIAS vs. CONVENTIONIAL BIASING



In the Above schematic of a normal current source, Biasing arrangement showed on the Right hand schematic in the above illustration. On the Left is the Ultra Biasing arrangement utilized in the Triad module. While more complex in design and requiring more component parts the enormous benefits derived from the Ultra Biasing Boost applied in symmetric fashion to each half of the Diamond Buffer Circuit results in the ability to slew at very high rates and still retain a symmetrical rising and descending slew rates. This is very desirable to eliminate odd order distortion components known to result in improperly or asymmetrically biased Complementary output stages. The result over the conventional current source is a more smooth yet detailed reproduction textures Musical presented clearly yet never thrown in an uncontrolled manor out at the listener. Control with detail and micro dynamics are the result of using the more complex Ultra Bias method of biasing a complementary output stage.