Class A Amplifiers

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There is rarely a subject which causes more confusion. It is quite widely thought amongst the non-technical, that "Class A" means literally "the best class" of amplifier. In reality, "Class A" simply refers to the mode of operation of the output stage of the power amp (it is also sometimes used to describe preamps etc, but this is very misleading, as 99% of preamps have gain stages which work in Class A; they just don't mention the fact). The fact that an amplifier has an output stage working in Class A, doesn't mean it's technically better, or necessarily sonically superior, to the more common Class AB.

Most power amplifiers use an output stage where one device (transistor or valve) handles half of the signal waveform (say, the positive half), and another device, the other (negative) half; this is called "push-pull" operation. It's generally very efficient, because minimal current flows when there's no signal (music) present. This means only a compact power supply is necessary, only a minimum of heatsinking for the output transistors is necessary, and the manufacturer saves money all round. The user gets a small, efficient, amplifier, that runs cool and doesn't cost a fortune to purchase.

The efficiency of such an output stage *does* depend, though, on how minimal the current flow is when there is no signal. The extreme case of both transistors switching right off in the absence of a signal (or during the "zero crossing" point of an audio waveform) is descibed as *Class B* operation - the most efficient. This method of operation, however, isn't particularly suited to audio amplifiers, as the transition in the *crossover* region is rarely perfect. There is usually some discontinuity, and this leads to severe *crossover distortion*, a familiar term.

Class A operation describes the situation where neither transistor *ever* switches off - they both pass a constant high current, on which the audio signal is superimposed. This is the exact opposite of Class B, and it is very inefficient. Because such a high constant current is flowing, the output transistors get very hot, so need a huge heatsink arrangement, and the power supply needed to sustain this current needs to be oversized and expensive. However, as there is no longer any crossover region between the two devices, there is no longer any crossover distortion, and you can get a better sound (sometimes). A few other, more obscure, distortion mechanisms are also eliminated at the same time, leading to the generally good name that Class A amplifiers have acquired.

The majority of amplifiers (95%) have *Class AB* output stages, a sort of mixture of the two. The operation is mostly Class B, except at the crossover region, where a modest standing current (*quiescent current*) is allowed to flow, thereby almost eliminating crossover distortion, whilst retaining the efficiency benefits of pure Class B. These amplifiers effectively run in Class A up to a certain power level (normally a Watt or two), sliding seamlessly into Class B at higher levels, up to their maximum output.

Audiophiles will argue the toss about which class of operation, A or AB, is preferable, but the fact is, competant, good sounding, amplifiers of either type can be designed with skill, although it has to be said, it's probably *easier* to make a Class A amp sound good - although the consumer pays the price. I will probably be shot down in flames for that last statement!

Incidentally, the classification system was invented many decades ago, back at the start of the "wireless" age, before audiophiles were invented (!), and was mainly used to describe the mode of operation of audio amplifiers and radio transmitters. Classes C and D are irrelevant to audio; they describe modes where the output stage devices conduct current for *less* than half of the signal input, and so are very non linear - but are used in transmitter output stages with considerable efficiency gains, where the output tuned circuit (or "tank" circuit, as radio engineers call it) "reconstructs" the missing parts of the signal.