B&W Bowers & Wilkins

Class-D Amplifiers

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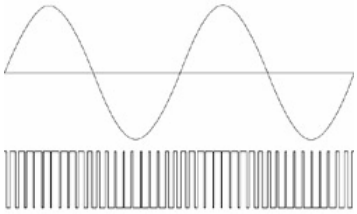

Traditional linear amplifiers are not very efficient, wasting anything up to 50% of their power as heat, which has to be dissipated by a heatsink. Although not a problem for low power applications, the heatsinks required can become bulky and heavy if high powers are required. Class-D amplifiers are much more efficient – typically 90% or more. They are a Pulse Width Modulation (PWM) design, where the output devices are switched rapidly between the fully on and fully off states. The ratio between the on and off times follows the amplitude of the original analogue audio signal, as shown in the illustration. In these two states, little heat is generated in the output devices, hence the high efficiency. The total amplifier size can be reduced because the size of heatsink required is much smaller. High output compact subwoofers are a particularly appropriate application for Class-D amplifiers. In order to overcome the bass extension limitations normally associated with small cabinets, the amplifier has to provide considerable boost at low frequencies. This boost requires a high amplifier power output and the smaller size of a Class-D amplifier takes up less of the limited cabinet volume than traditional designs. It is worth noting that, even when used only over the restricted bandwidth of a subwoofer, B&W's Class-D amplifiers are designed to give audiophile performance over the full audio bandwidth. Looking at the specifications, it might appear at first sight that our Class-D amplifiers with switched mode power supplies are over 600% efficient, because the rated power consumption is much less than the rated power output. This appears to contravene the laws of physics and the answer lies in the nature of the signals that the amplifier processes. Music and movie soundtracks may contain high peak powers, but the power drain is far from constant. If you imagine the amplifier and its power supply as a power reservoir, it is easy to understand how a relatively low level, but constant recharging can support sporadic bursts of high output drain. One must, of course, take care in the design to ensure that the capacity of the power supply is enough to cope with all likely power drain situations and we have built in a particularly generous safety factor in that respect. Part of that safety factor involves good heat sinking and you will notice that our Class-D/SMPS amplifiers still incorporate fins on the heat sink whereas many other similar designs do not. Conventional amplifiers and power supplies continuously waste significant power as heat, irrespective of the signal they are processing and the rated power output is typically only 70% of the rated power consumption.