

Professional Power Amp Design

With all the power amp classifications, there may be terms you are unfamiliar with, so this document contains a brief description of Carvin's professional power amplifier designs and terminology. First, power amps have two basic components, a) the **POWER SUPPLY** which supplies the voltages and current to the amp, and b) the **AMPLIFIER** itself with inputs, outputs and level controls. It is the final output stage of the amplifier that determines its Class. However, before explaining the different amp classes, one needs to understand the differences between power supplies, since that is what powers the amp. The type of power supply has nothing to do with an amplifier's class; that is determined by the design of the amp itself.

POWER SUPPLY

1) The first power supplies, starting in the 1930s, used **IRON CORE** transformers to raise or lower AC voltages, which were rectified (converted) into DC voltages for the amplifier. These iron core transformers were quite heavy, primarily due to the weight of the core.



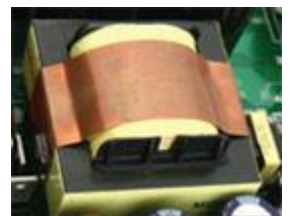
Typical Iron Core Transformer



Typical Toroid Transformer

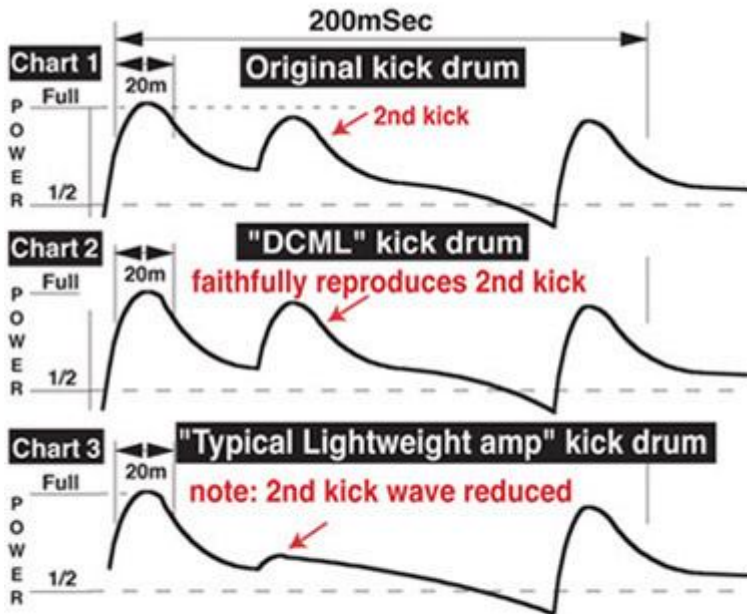
2) Next came **TOROIDS** in the 1990s, which used iron cores also, but were more efficient because the primary (incoming) and secondary (output) wire were layered next to each other on an iron ring. This more efficient design resulting in saving weight versus iron core transformers.

3) The latest technology is the **SWITCHING POWER SUPPLY**. This too was available in the 90s, however, it was limited to smaller power applications. Today the advantage of a switching supply is its light weight - nearly 90% reduction and better regulation for the amplifier. High frequencies of 100,000 Hz or greater no longer required the heavy iron core along with the many turns of copper wire, which added resistance, causing heat. However, while switching supply technology is a great breakthrough to produce lightweight amps, many of these amps do not deliver their rated RMS power because of their design. Typical complaints can be there is not enough bottom-end. Even toroid power supplies (non-switching) had this problem too. Here's why:



Switch Mode Transformer

KICK DRUM TEST



Test condition: All amps were pushed into into "slight clipping" for their maximum usable power at their minimum rated impedance

The kick drum test will demonstrate in Chart #3 that the typical lightweight amp will deliver its full power for the 1st kick of 20mSec. However, when the 2nd kick comes there is sag in the voltage / current, and the amp cannot reproduce the full kick. The reason is these switching supplies are not built to "linear power" specifications and their voltages / current sags. Generally these lightweight amps cost less to build because of smaller capacitors, fewer output devices and smaller heat sinks. For the most part these typical lightweight amps satisfy the light users, but not the pros who have used these amps and hear the lacking bottom-end at high power levels.

If you look at Chart #2, you'll see the Carvin DCML power amps maintain their reserve voltage/current to faithfully reproduce Chart #1 delivering the full 2nd

beat of the original kick drum signal. This demonstrates the DCML high damping factor for instantaneous voltage/current. The Carvin SwitchMode Technology™ power supplies are not only designed for 100% "on-demand" voltage / current of a linear power supply but they also feature autoswitching from 120V 60 Hz to 240V 50 Hz.

AMPLIFIER CLASS

1) CLASS A/B is a conventional linear amplifier. It could be tubes, FETS (field effect transistor), or bi-polar transistors it's all the same CLASS A/B. In more technical terms, a CLASS B amp does not draw current until there is a signal. The problem with CLASS B is that distortion can be introduced during the time when the output voltage crosses zero. CLASS A draws current continuously even if there is no signal - a huge power supply is required and it runs hot. The combination of CLASS A/B eliminates the distortion of CLASS B by the help of the CLASS A idle current.

DCM MODELS: [DCM1540L](#), [DCM2000L](#)

2) CLASS A/B TRACKING is identical to the CLASS A/B amplifier in the original DCM series but how the high voltage is applied to the amplifier is different. This design introduces a third section that interfaces the power supply to the amplifier. The voltage from the power supply is adjusting to what is needed to produce the output wattage demanded by the input of the amplifier. This section keeps the high voltage very low on the amplifier until it sees a need to raise it up. The voltage tracks the input signal and the rail voltage is adjusted as necessary, which is why it's called CLASS A/B TRACKING. The primary advantage is to use less power, thus removing heat from the chassis.

BASS AMPS: [B2000](#)

DCM MODELS: [DCM3000L](#), [DCM3800L](#)

3) CLASS D is a totally different amplifier, which is called a "switching amplifier". Carvin CLASS D amplifiers incorporate both a "switching power supply" and a "switching amplifier", which saves a considerable amount of weight and power. The CLASS D output features a high frequency switching signal, which is a 500,000Hz square wave. This is modulated with an input audio signal and then rolled off to produce a linear high power audio output. The advantage of CLASS D is its 94% efficiency eliminating heat and substantially reducing the AC line power requirement.

BASS AMPS: [BX500](#), [BX1500](#)

DCM MODELS: DCM1000L, [DCM2000L](#) (Feb 2010 model), DCM2004

MIXERS: [XP800L](#), [XP1000L](#), [RX1200L](#), C1648P

CLASS SUMMARY:

While Class A/B has been the standard for years, Class D has the advantage of being more efficient. Both classes sound great and the RMS equivalent is the same for either Class. However, the THD (distortion) output of a Class D amp will change according to its output impedance. Example: 8 ohms: .08%, 4 ohms .1%, and 2 ohms .25%. Typically, you would not hear any difference between 2 or 4 ohms especially for subwoofers so the operation efficiency of Class D can become more important than the THD difference.



*High current components & FR4
fire retardant circuit card*

CONCLUSION:

Carvin's Class A/B and Class D power amps and mixers are engineered to the highest standards to provide years of quality performance. Continuous full power is assured from high-grade 6063-T5-aluminum heat sinks and high-current components. Heavy-duty connectors provide a positive connection to your cables, ensuring every watt gets to your speakers. Carvin's "SMT" Surface Mount Technology utilizes surface mounted components to prevent parts from shaking or vibrating loose, and precision 1% tolerances guarantee your settings will be accurate every time. Fire retardant FR-4 military spec circuit cards feature double-sided copper to guard against noise and radio frequencies (RF) interference. Carvin's power amps and mixers are made in the USA, and will provide excellent sound and performance for years.