Preliminary Information

Application Brief

APPLICATIONS:

- *Steppers and Encoders*
- *Home Appliance Controls Integrated with Voice Control*
- *Smart Appliances*
- *Home Security*
- *Digital Telephone Answering Machine*
- *Engine Management*
- *Power Line Modem*
- *Servo Drives*
- *Automotive Control*
- *Electric Lawn Equipment*
- *Noise Cancellation*
- *Internet Appliances*
- *IP Phone*
- *Modems*
- *Magnetic Card Readers*
- *Security*
- *Digital Speakers*
- *Voice Recognition Systems*
- *"Hands-free" Kits*
- *Digital Cameras*
- *Telecom Test Equipment*
- *Fuel Management Systems*
- *and more. . . . . .*

Class D Amplifier Using DSP5680x

From the perspective of wasted power, the best amplifier operates in pure switching mode—class D. Normally, the amplifier has efficiency higher than 90 percent, meaning over 90 percent of the power is delivered into the load. In fact, a Class D amplifier works as a power D/A converter and can be used to realize high output power, 300W or more. The Class D amplifier is based on an analog technique of pulse width modulation (PWM).

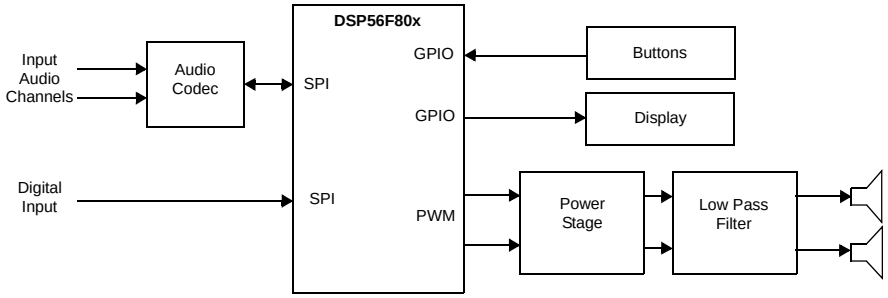

Figure 1. Class D Amplifier Block Scheme

As shown in the block scheme in Figure 1, an audio codec is connected to the SPI of the DSP5680x, providing A/D conversion of the input signal. The audio codec may be bypassed and the SPI used directly as a digital input. Control components such as display and buttons are connected to GPIO pins. The most important component is the power stage connected to the PWM output of the DSP and includes power transistors, switchers of the output. The low pass filter is passive and cuts frequencies exceeding the maximum frequency of the input signal. Distortion and noise of the output signal is leveled by cutting these high frequencies, presented in the output signal because of the PWM modulation.

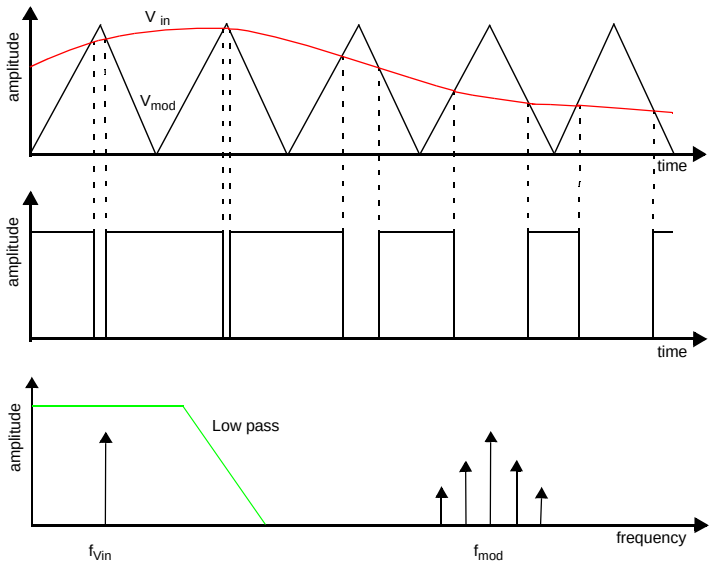

Figure 2. PWM Modulation Principle

The principle of PWM modulation, illustrated in Figure 2, is quite simple. The input signal V_{in} is modulated with a modulation signal V_{mod}. There is a modulated signal in the middle and the spectrum of the modulated signal is at the bottom in the figure. The original signal f_{in} is selected with a low pass filter, cutting the higher frequencies around the modulation frequency f_{mod}. The required frequency of PWM is 25 or more times faster than the bandwidth of the signal being reproduced. A PWM modulation frequency of 1MHz or higher should be used for 44,100Hz sampling frequency of the audio codec.

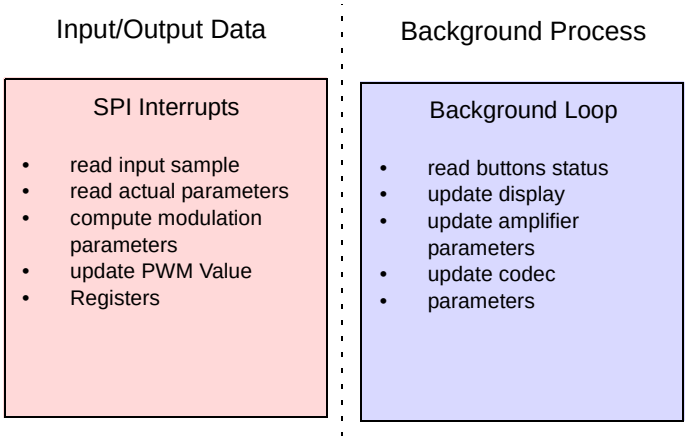

Figure 3. D-Class Amplifier Software Model

Figure 3 is a software mode for an application designed to be interrupt-driven. The most important feature is the interrupt generated by the audio codec connected to the SPI. Inside the interrupt routine, the data sample must be read and processed. PWM Value Registers (PWMVAL), shown in Figure 2 are updated from the input sample using the following formula:

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PWM Value = (Input Data Sample) x (PWM Modulus)
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PWM Value = A new value of the PWM Value register (PWM VAL)

Input Data Sample = Current sample of input signal read from audio codec

PWM Modulus = A value read from the PWM Counter Modulo Register (PMCM)

The result of the formula must be shifted to be displayed in the 16-bit PWM Value Register (PMVAL).

The PWM module is configured to work in center-aligned mode. The module will work in both independent and complementary modes. For details, see the DSP586801/803/805/807 User's Manual or visit:
http://www.motorola.com/semiconductors/dsp