Preliminary Information

Application Brief

APPLICATIONS:

Steppers and Encoders

Home Appliances 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

more. . . . . .

DSP56F80x in Power Line Modem Applications

A power line modem is a device that transceives data through a power line, or mains. Today this device is increasingly used for communication between several appliances and is an integral component of the smart kitchen. These home applications require a duplex-mode power line modem, which both transmits and receives data and a data rate of approximately 10 kbit/s.

Figure 1 shows a sample block diagram of a power line modem. An incoming signal is coupled to the receiving component of the modem, which decodes the data and delivers it to the application through an interface. The application returns data to the modem, where it's coded. The transmitter then generates an amplified signal, which is coupled into the power line.

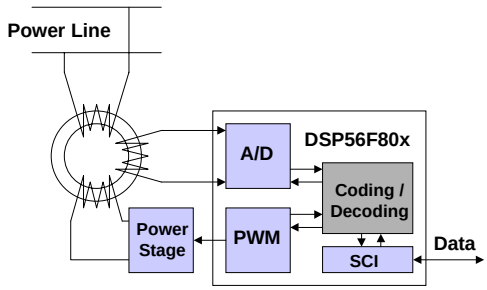

Figure 1. Schematic Block Diagram of a PowerLine Modem

In the past, a power line modem required both a micro controller for general control and a specialized ASIC for coding/decoding and sending/receiving functions. For example, the *Powernet EIB* performs power line communications in the European Installation Bus, where an MC68HC05 and an ASIC from ES2 are used, reaching a data rate of 1200 bit/s.

Today, however, both the micro controller and ASIC in a power line modem are often replaced by a Digital Signal Processor, (DSP).

Among factors to consider in power line communications are:

- Easy signal coupling into and out of the power line
- Efficient transmission through the power line and on-going separation between the communication signal and the power line frequency
- Resistance to noise and interference
- EMI and EMC

Unfortunately, the regulations for power line communication in America, Europe and Asia differ greatly; there is no common standard currently defined among these regions.

In Europe, for example, several frequency bands and frequencies ranging from 3 kHz to 148.5 kHz have been defined for power line communications. The frequency range of 95 kHz to 148.5 kHz is open for home interconnectivity applications with the modulation frequency band, 125kHz - 140kHz, defined as CMSA, (Carrier Sense Multiple Access).

The modulation band selected for power line communications must meet the required data rate while maximizing resistance to noise and interference with the signal.

In any power line, there are several sources of noise and interference, each with individual characteristics:

- Multiples of the main frequency, i. e., 50 Hz, 100 Hz, 150 Hz
- High voltage transients from flashes or switches
- High frequency noise of PFCs, motors, inverters

Every modulation band has advantages and disadvantages; commonly used schemes for modulation include Binary Phase Shift Keying, (BSK), Frequency Shift Keying, (FSK), and several Spread Sprectrum Techniques.

In all applications, a modulation scheme should support networking and independent addressing of the end devices. The physical interface should provide for coupling the signal from the transmitter to the powerline and from the power line to the receiver.

A coupling transformer with high pass characteristic is a reliable solution, providing necessary galvanic isolation of the power line from the main voltage. In a one phase operation, the transformer should be connected in parallel between one phase and neutral for 220V and between two of the three phases for a three phase operation. A serial connection of the coupling transformer is not recommended, as it results in a high current through the transformer, which causes a magnetic saturation of the transformer core. A basic schematic often used for a coupler is displayed in Figure 2.

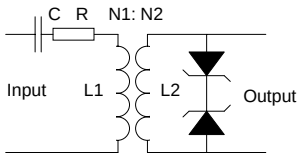

Figure 2. Basic Schematic of a Data Coupler for a Power Line Modem

Dimensions of R, C and the ratio of the transformer depend on the concrete data rate, power and frequency of the signal. For use in frequencies ranging from 95kHz to 148.5kHz, the coupled signal voltage can reach up to 116 dBµV, equaling 631 mV.

Motorola's DSP56F80x offers a superior solution in a power line modem. The DSP56F80x's small form factor, internal clock generator and micro controller functions make this device ideal in a stand-alone operation in small application such as lamps, shutters and switches. The 12-bit ADC has sufficient resolution to detect information signals, and a 15-bit PWM generates clear transmissions. The on-chip flash memory and calculating power code and decode data, which is transmitted to the application by the integrated SCI. Only a small power stage is required to deliver the signal to the coupling performer.

As shown in Figure 3, a power line modem may be added to an existing application using a DSP56F80x. The combination and interaction between the algorithms used for the power line modem and motor drive mean an influence of the motor power stage to the power line communication can be avoided.

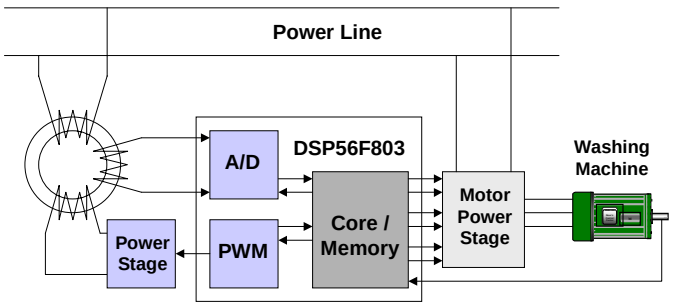

Figure 3. Power Line Modem as an Add-on in a Washing Machine

A special reference design can demonstrate the benefits of including the DSP56F80x in a power line modem. After successfully proving the functionality via the reference design, the software for power line communication may be integrated into the Embedded SDK.

DSP56F80X CUSTOMER SUPPORT:

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1-800-441-2447

Other Inquiries:
Contact you Motorola sales representative or authorized distributor

Disclaimer:
This sheet may not include all the details necessary to completely develop this design. It is provided as a reference only and is intended to demonstrate the variety of applications for the device.

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