SpeedREACH™ DPS8003 — G.lite ADSL Analog Front End for CPE

OVERVIEW

Asymmetric digital subscriber line (ADSL) technology provides a viable solution to meet the emerging need for high-bandwidth communications to the home while utilizing existing twisted-pair copper infrastructure. To simplify the design and reduce deployment costs, LSI Logic has developed DPS8003, an analog front-end (AFE) that is designed to perform all of the analog functions of the receive (RX) and transmit (TX) paths for ADSL for G.lite, excluding POTS reject filtering and high-voltage line drivers/receivers. The DPS8003 requires no external circuitry beyond a pair of precision resistors and bypass/coupling capacitors. Note that (a) for full compliance with the ITU G.992.2 transmit PSD masks, additional off-chip filtering in the TX path is needed; (b) in frequency division multiplexing (FDM) systems, additional off-chip bandsplit filtering may be required for system optimization.

The linearity and noise performance of the analog signal paths enable the chip to successfully transmit and receive data at 1.5 Mbits/s on the longest lines — above 18 kfeet of AWG24 wire. The chip can be utilized in systems employing either echo cancellation (EC) or FDM, and is also fully compatible with the splitterless G.lite standard.
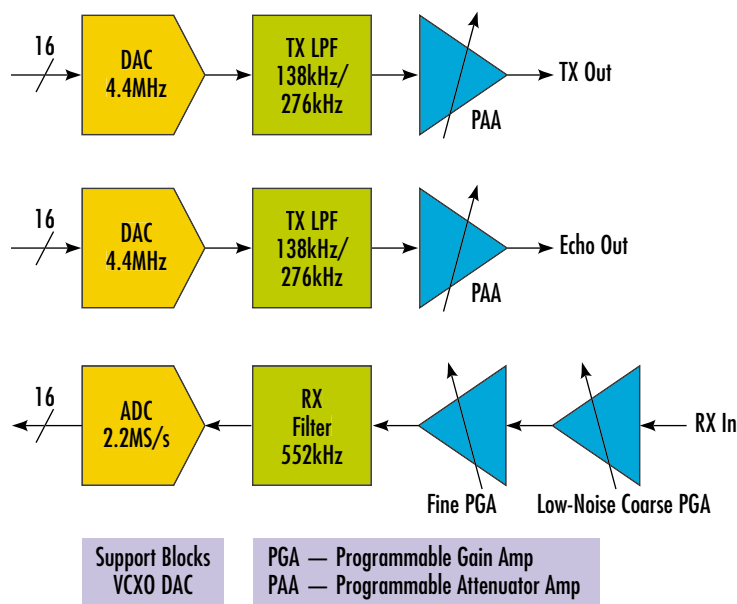

Figure 1. Block diagram of the SpeedREACH DPS8003 AFE.

FEATURES

- ADSL AFE for CPE with full receive (RX) and transmit (TX) analog signal path for G.lite (excluding POTS reject filter and high-voltage line drivers/receivers)

- Fully monolithic: 2 precision resistors, 2 non-critical resistors, and decoupling capacitors required

- Support for both echo-cancelled and FDM-based systems; full analog path support in hardware

- Compatible with ITU G.992.2 (G.lite) standard

- 14-bit linear ADCs and dual 14-bit linear DACs

- 4th-order lowpass filters for RX/TX paths, with ±5% cutoff frequency accuracy

- RX channel: support for both 138 kHz and 276 kHz (for ADSL over ISDN)

- TX channel: support for 552 kHz (G.lite)

- RX path PGAs: 44 dB in 0.25 dB steps

- TX path PAAs: 24 dB in 1 dB steps

- Entire RX channel linearity: 80 dB MTPR

- Entire TX channel linearity: 80 dB MTPR

- 12-bit DAC to support external VCXO

- RX input-referred noise at peak gain: 160 dBm/Hz at 300 kHz

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SpeedREACH™ DPS8003

The RX portion of the chip comprises a low-noise front end programmable gain amplifier (PGA), an anti-aliasing filter, and a 16-bit analog-to-digital converter (ADC). The TX portion consists of two independent signal paths, one for the primary TX signal and one to support echo. One key feature is excellent matching between the echo path and the primary TX path, minimizing difficulties in echo cancellation arising from mismatch between the two. Each path consists of a 16-bit digital-to-analog converter (DAC), a transmit lowpass filter, and a programmable attenuation amplifier (PAA). To simplify the overall system design, DAC droop compensation is handled internally, removing this burden from the back-end signal processing.

Apart from the primary signal paths, the chip also contains support circuitry for other functions required in an ADSL modem. To assist in timing recovery, a 12-bit DAC is present to drive an off-chip voltage controlled crystal oscillator.

The chip's digital input/output interfaces are designed to be as simple as possible, emphasizing ease of design-in and evaluation. The primary digital ADC/DAC interfaces are on separate 16-bit wide busses: 16 for the ADC, and 16 for the primary TX path DAC. When the echo path is used, the chip accepts digital data at a 2X rate and alternate digital words are passed in a ping-pong fashion to the main TX path and the echo path.

A 4-wire serial port provides a simple DSP interface. The serial port is used to modify internal register values, which in turn control attenuation/gain settings, filter bandwidths and the power down of individual blocks. The chip is powered off a +5 V supply, while all digital I/Os run off a +3.3 V supply. The DPS8003 is available in a 128-pin MQFP plastic package. The operating temperature range is between 0° C and +70° C.

DIFFERENCES FROM SPEEDREACH DPS8001

This device is similar to the DPS8001. The differences are as follows:

- The temperature range is from 0 to +70°C.

- The RX path performance (PGA, filter, ADC) is only guaranteed for a G.lite configuration—i.e., for downstream band up to 552 kHz, and ADC running at 2.208 MS/s

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