

Digital Signal Processing

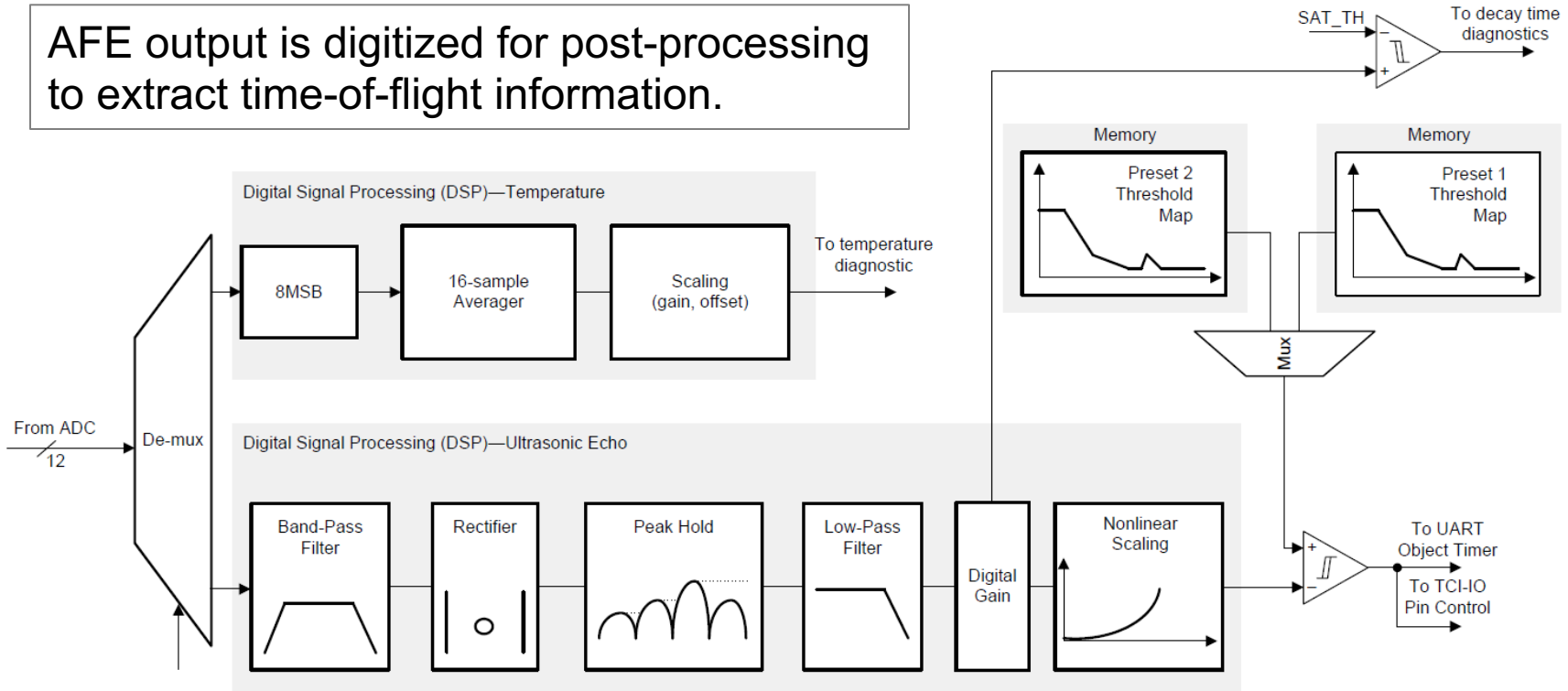
TI Precision Labs - Ultrasonic Position Sensing

Presented by Akeem Whitehead

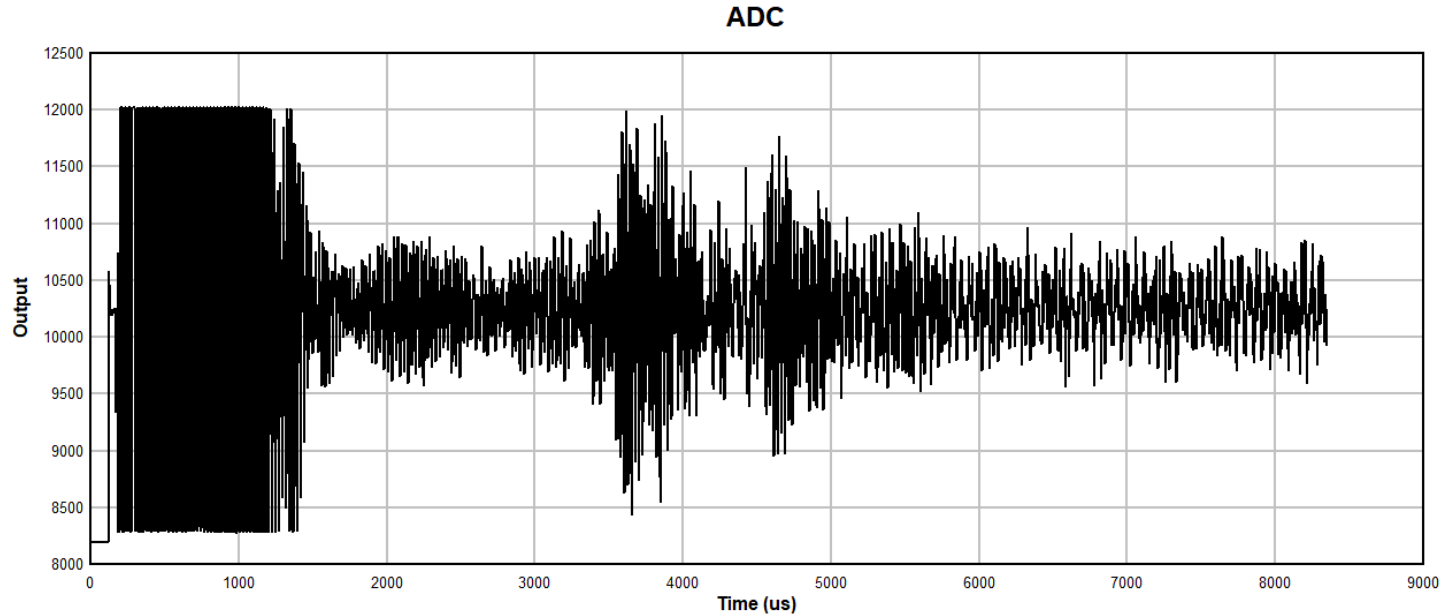
Prepared by Akeem Whitehead

Digital Signal Processing

AFE output is digitized for post-processing to extract time-of-flight information.

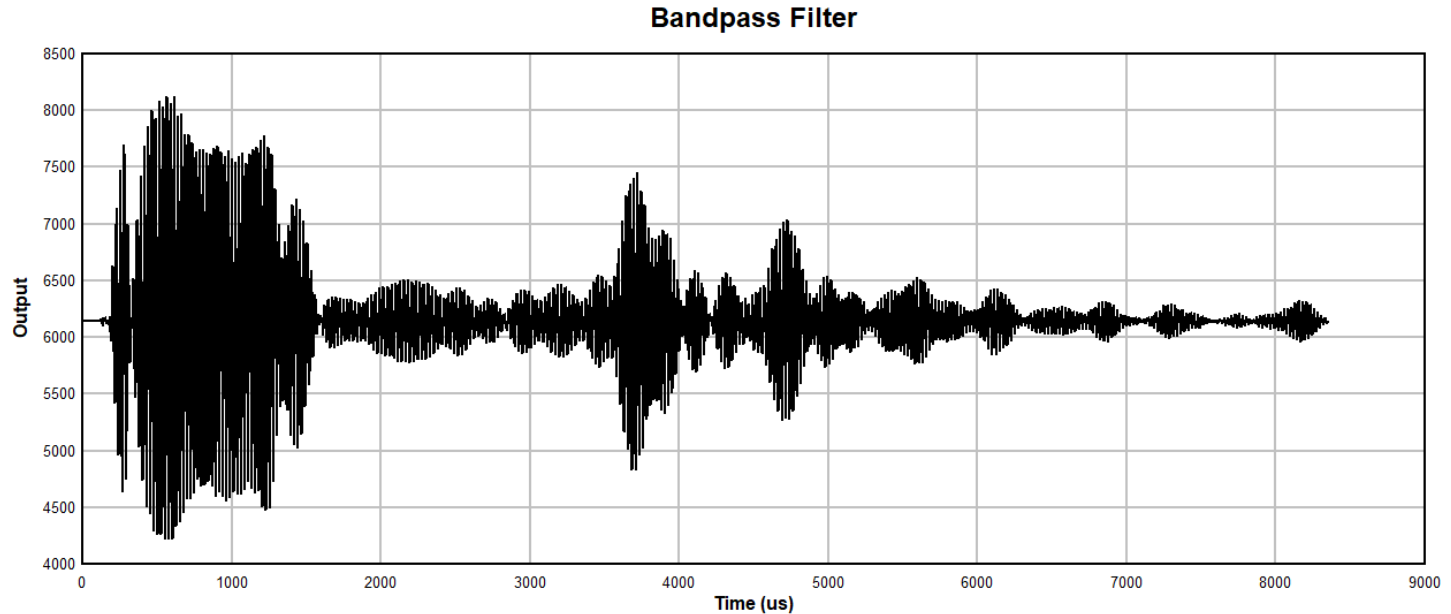


DSP ADC



Analog AFE output is digitized by a 12-bit 1-MSPS ADC.

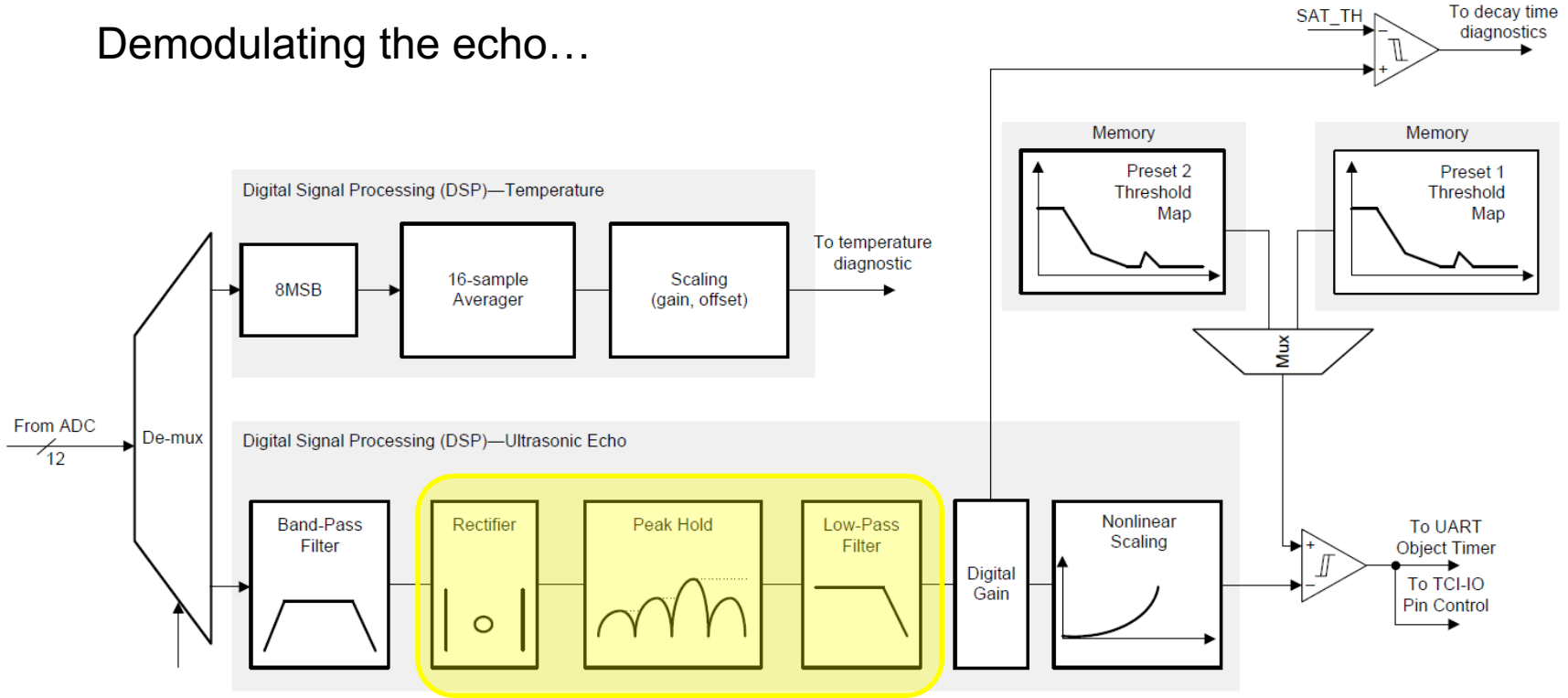
DSP Band-Pass Filter



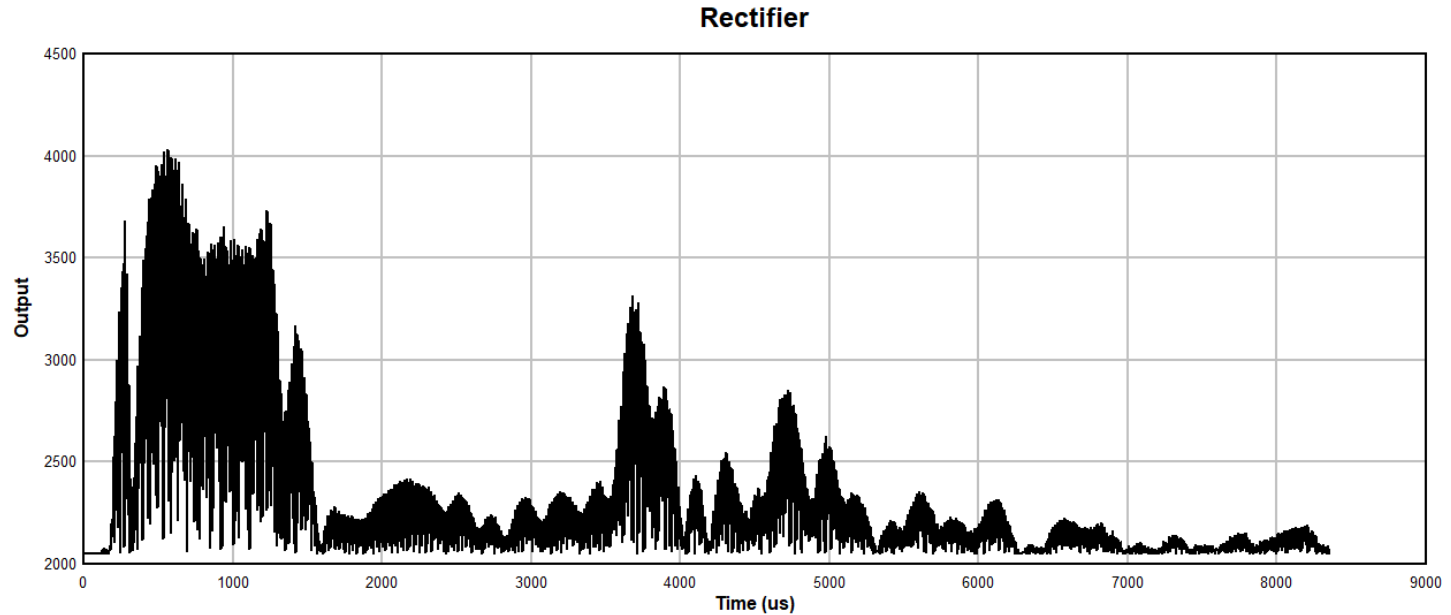
Filters out-of-band noise from LNA output and external noise to only pass ultrasonic transducer frequency energy of interest.

Digital Signal Processing

Demodulating the echo...

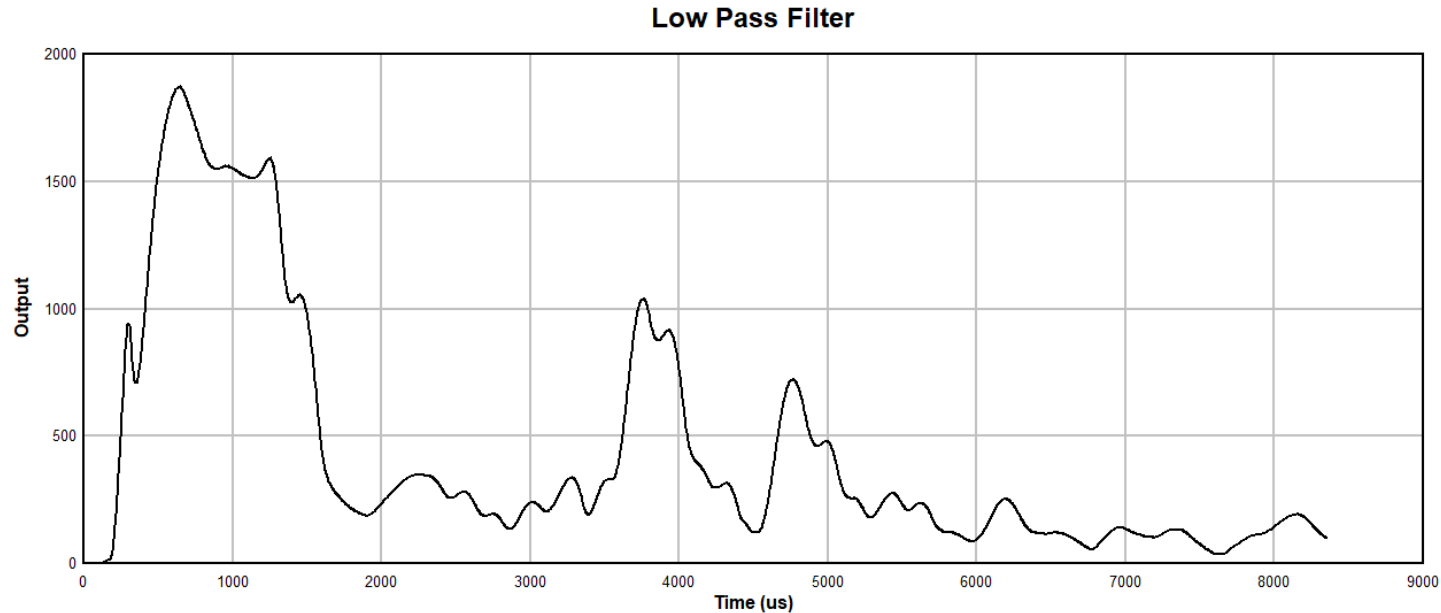


DSP Rectifier



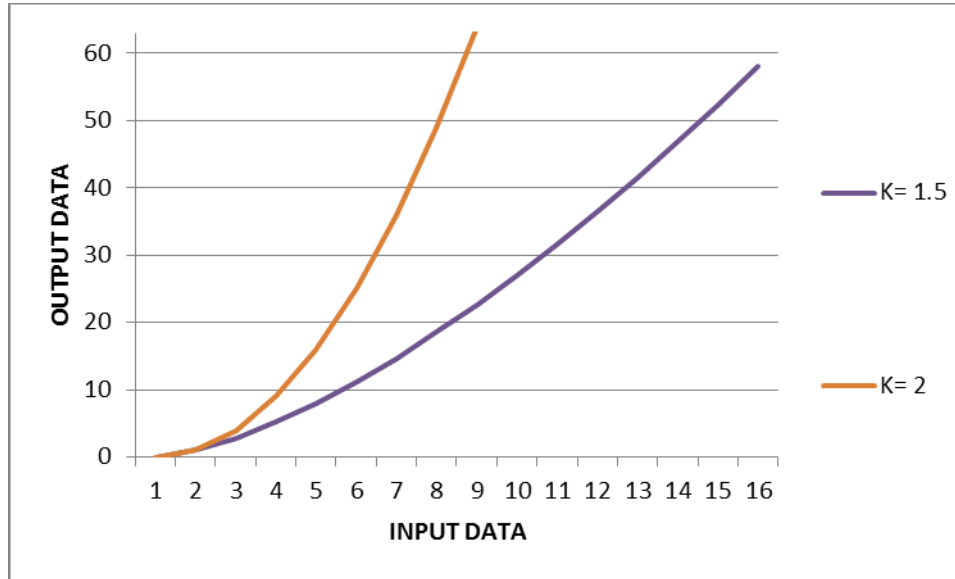
Outputs the absolute value of the input signal since the input signal can be positive and negative in amplitude.

DSP Peak-Hold & Low Pass Filter



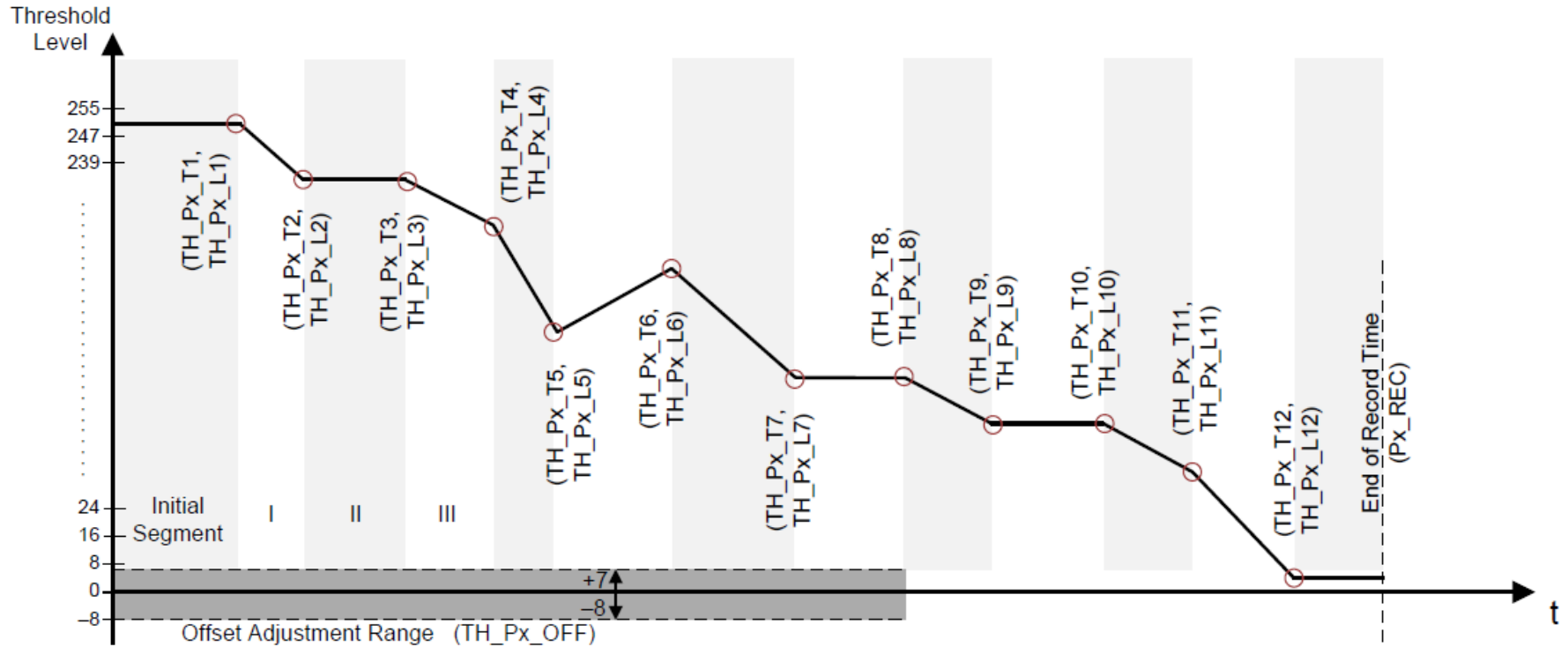
Holds the peak value of the rectified signal for a specific amount of time required for the low-pass filter to detect the peak amplitude of the signal and removes any noise artifacts.

DSP Non-Linear Scaling

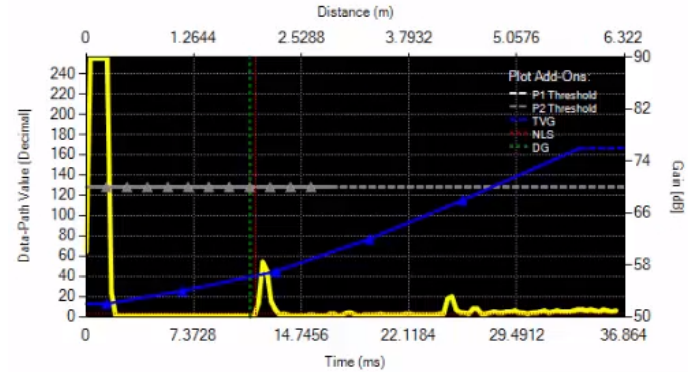
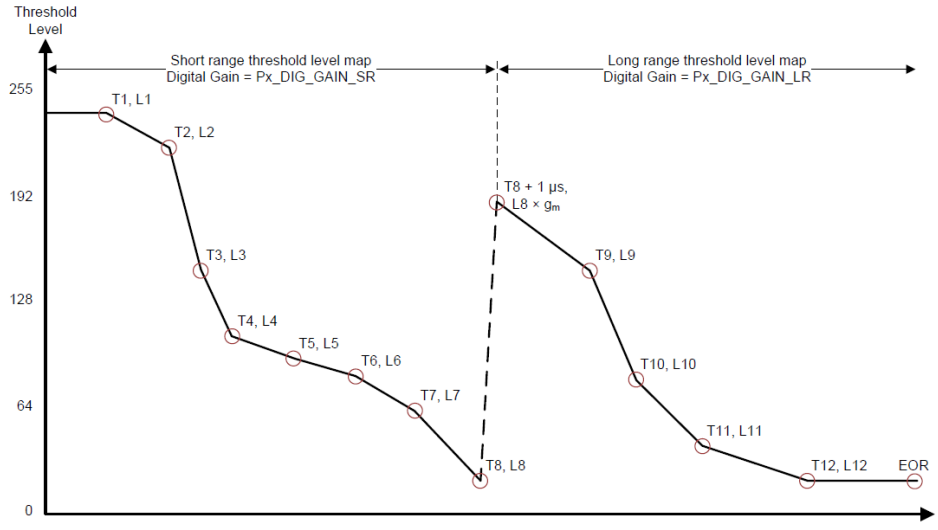


- Provides exponential scaling for the echo signal to achieve a higher SNR.
- Useful for detecting long distance objects where the amplitude of the echo signal is very attenuated and close to the noise floor.

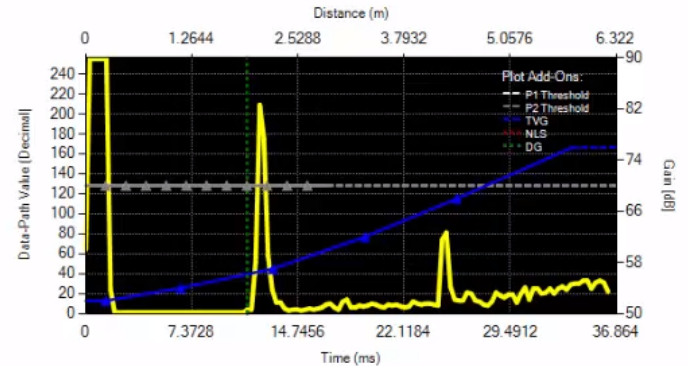
DSP Threshold



DSP Digital Gain Multiplier



Digital Gain disabled



Optimized SNR scaling with Digital Gain

To find more ultrasonic sensing technical resources and search products, visit ti.com/ultrasonic