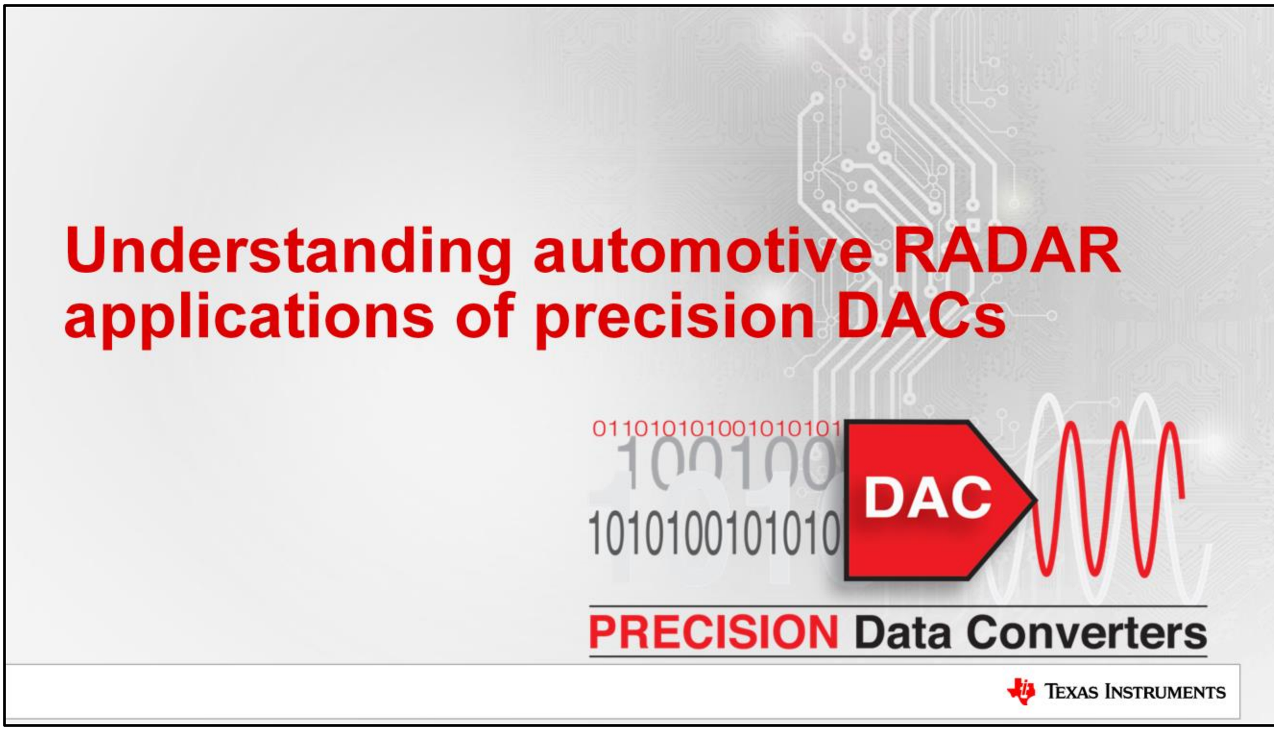


Hello, and welcome to our brief look at how precision DACs enable automotive RADAR applications. In this video, we will talk about a challenge faced in implementation of automotive RADAR, and then how a precision DAC can address this challenge.

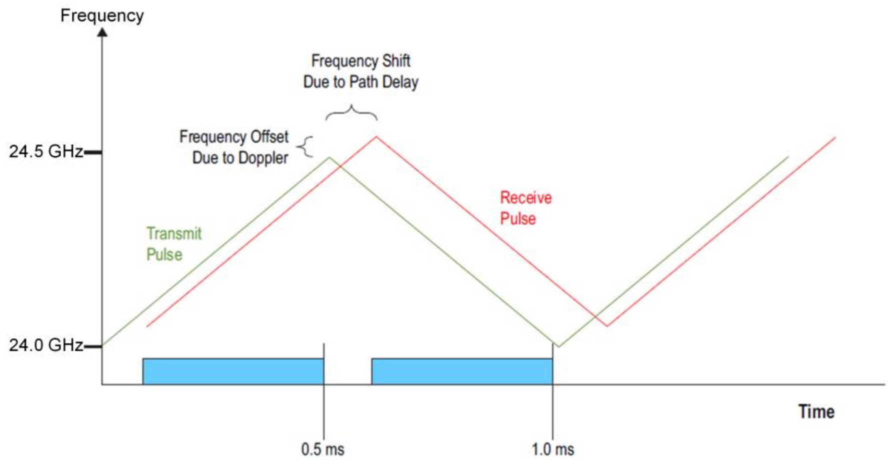
Automotive RADAR

- Collision warning
- Blind spot detection
- Object detection
- Cross traffic detection

Texas Instruments

In the continually-progressing world of automotive safety, RADAR technology is often used to detect all kinds of conditions while driving. RADAR can be used for (CLICK) checking for an impending collision, (CLICK) monitoring cars that might be in a blind spot, (CLICK) detecting objects that can’t be seen over the hood or behind the trunk, (CLICK) or watching cross traffic to avoid an accident while reversing out of a parking space, to name a few. So, how does RADAR accomplish these tasks?

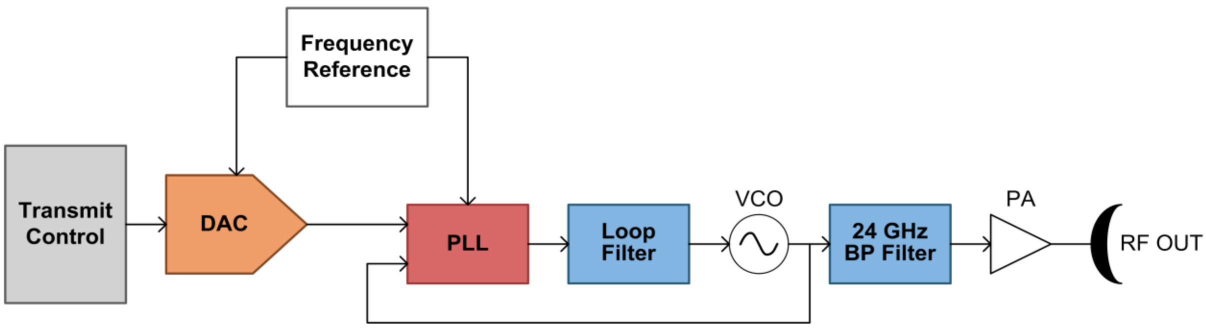
Generating the signal



TEXAS INSTRUMENTS

Speed and distance of an object relative to the point of measurement can be determined by generating a frequency ramp over time. This means that the radio signal generated will increase and decrease linearly over time, in about 1 millisecond as depicted here. By measuring the offset of the returned frequency, the speed of the detected object can be determined via the Doppler effect. Similarly, the time shift of the returned frequency determines the distance of the object. This method requires a very precise linear ramp of the radio frequency. Let’s look at how it is generated.

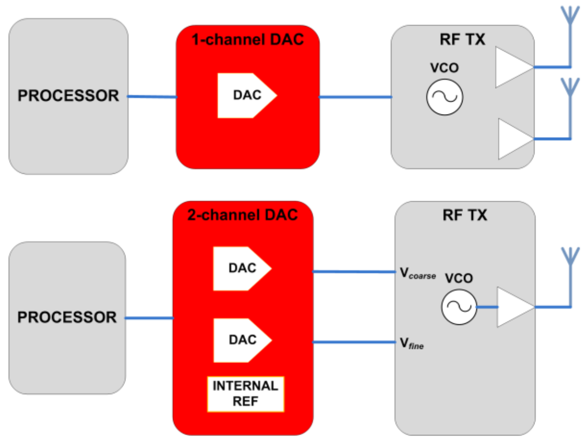
Frequency ramp solution



A precision DAC is needed to finely tune the oscillation circuit that generates the RADAR signal. The DAC reference input is coupled to the reference frequency of the PLL and voltage controlled oscillator. Therefore, as the DAC changes its code from 0 to full scale, each code transition makes a small change to the output frequency of the VCO, generating the required frequency ramp. The VCO output is then applied to a 77 GHz band pass filter, and then amplified out through the transmitter.

Precision DAC for automotive RADAR

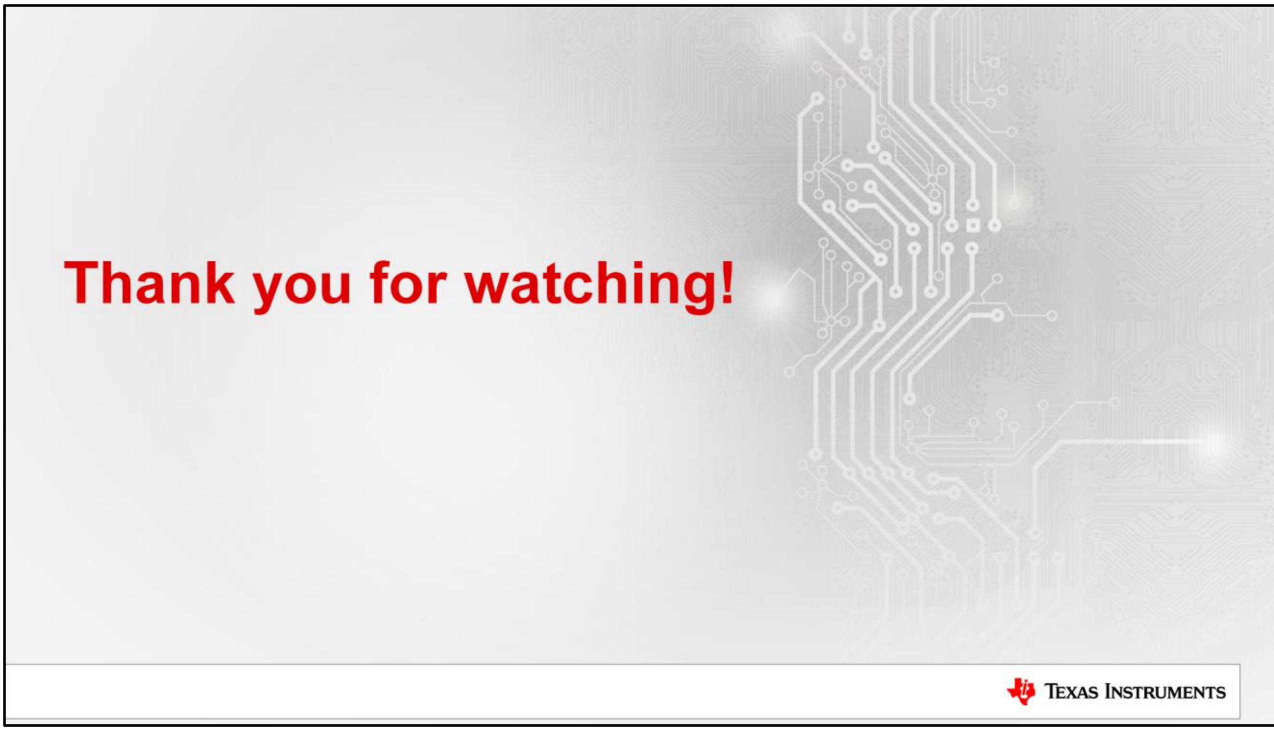
- Key specifications
  - High resolution
  - Low glitch
  - Fast settling time
  - AEC-Q100 grade 1 qualification
- Example devices
  - DAC8551-Q1
  - DAC7551-Q1
  - DAC8562-Q1
  - DAC7562-Q1



Texas Instruments

For this application, a few key specifications need to be met for the DAC to be able to produce the desired results. First, high resolution is required to be able to precisely tune the frequency ramp. Low glitch is critical because large overshoot or undershoot of the DAC output voltage will translate to a wavy, non-monotonic frequency ramp which is undesirable. Fast settling time is also important because the ramp must be completed in a finite amount of time, leaving little wait time for the DAC to settle out. And, of course, Q100 qualification is needed to support easy automotive development for the designer.

Four example devices that meet these specifications are the DAC8551-Q1, DAC7551-Q1, DAC8562-Q1 and DAC7562-Q1, all of which have low-glitch string architectures. Characteristically similar, these four devices provide single and dual channel solutions. The DAC8551-Q1 and DAC7551-Q1 can be used in a single channel solution, where the output of the DAC is used to control the VCO. The DAC8562-Q1 and DAC7562-Q1 build on this solution with one output for coarse adjustment and a second for fine adjustment of the frequency, along with an internal reference.



Thank you for watching this video on enabling automotive RADAR with precision DACs. Please watch our other videos on precision DACs to learn more.