Precision Timing Solutions

Ultrasonic Lens Cleaning

Precision Timing in Ultrasonic Lens Cleaning

Ultrasonic lens cleaning (ULC) uses precisely controlled vibrations to vibrate the lens at its resonant frequency, causing contaminants to be ejected away from the lens surface. Different vibration modes are adapted to remove water, mud, ice, and more.

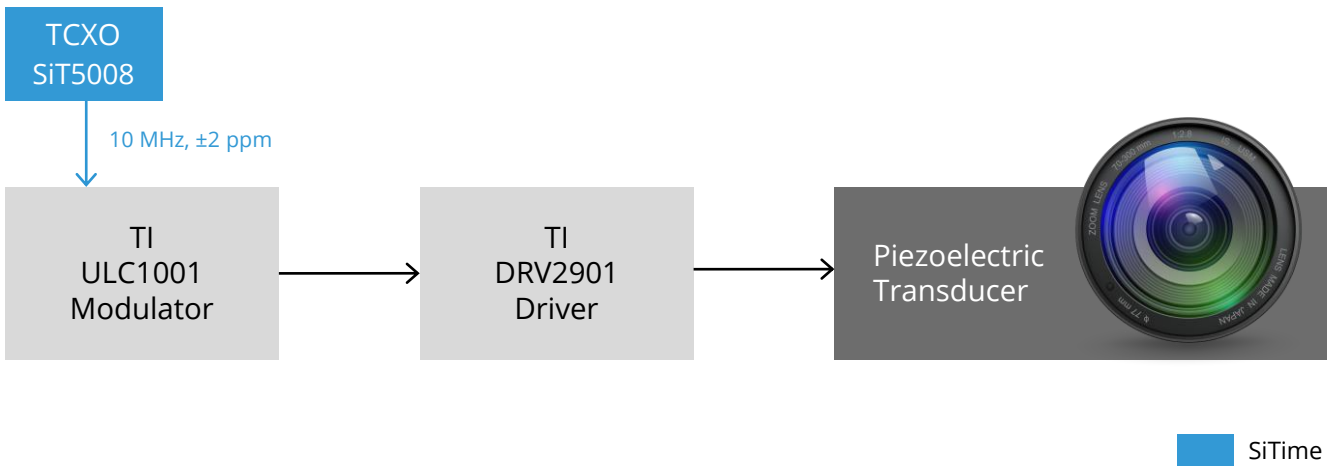
Ultrasonic lens cleaning is particularly useful for automotive, industrial, robotics, surveillance and defense applications.

Key Considerations

- Frequency stability
- Small form factor
- Resilience to vibration
- Low power

Texas Instruments offers two devices for ultrasonic lens cleaning system consists of two devices: the ULC1001 PWM modulator and the DRV2901 driver. The DRV2901 drives a piezoelectric transducer which sets the lens in motion.

Block Diagram



The TI ultrasonic lens cleaning system requires a single 10 MHz oscillator as a clock source with a recommended ±5 ppm stability over temperature. The MEMS-based SiT5008 TCXO meets this requirement in a very small footprint (2.5 x 2.0 mm). If ultra low power and a smaller form footprint (1.6 x 1.2 mm) is desired, the ±25 ppm SiT1623 oscillator can be used.

Due to their construction, silicon MEMS oscillators are 30 times more resilient to shock and vibration than quartz-based devices — an important factor in a vibrating environment such as ultrasonic lens cleaning.

MEMS resonators are hermetically sealed and therefore insensitive to contaminants, which can be present in industrial and defense environments.

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Featured products – please refer to SiTime.com or contact us for more options.

Type	Product	Frequency	Key Features	Key Values
TCXO	SiT5008	10 to 60 MHz	• ±2 and ±10ppm stability options • -40 to +85°C • 2520 package • 4.2 mA typ. current consumption	• High reliability • EMI reduction features • Small footprint • Low power
XO	SiT1603 SiT1623 (AEC-Q100)	10 standard frequencies: 8, 10, 12, 16, 24, 25, 27, 32, 48, 50 MHz	• Up to -40°C to +125°C • AEC-Q100 (SiT1623) • ±25, ±30, ±50 ppm stability • 1612, 2016, 2520, 3225 packages • 2.3 mA typ. current consumption	

SiTime Advantages:

SiTime devices offer the following advantages over traditional quartz-based oscillators:

- Uncompensated oscillators (XO) have up to two-times better frequency stability over the entire operating temperature range.
- Temperature-compensated oscillators (TCXO) stability is as low as ±0.1 ppm over -40°C to +85°C (SiT5356). For ultrasonic lens cleaning, SiTime recommends the SiT5008 (±2 ppm over -40°C to +85°C)
- Thirty-times better shock and vibration resilience.
- The lower the frequency, the larger a crystal resonator must be. Smaller silicon MEMS oscillators do not suffer from this limitation. Smaller footprints such as 2.5 x 2.0 mm and lower are easily achieved.