Precision Timing Solutions

Smart Mirrors

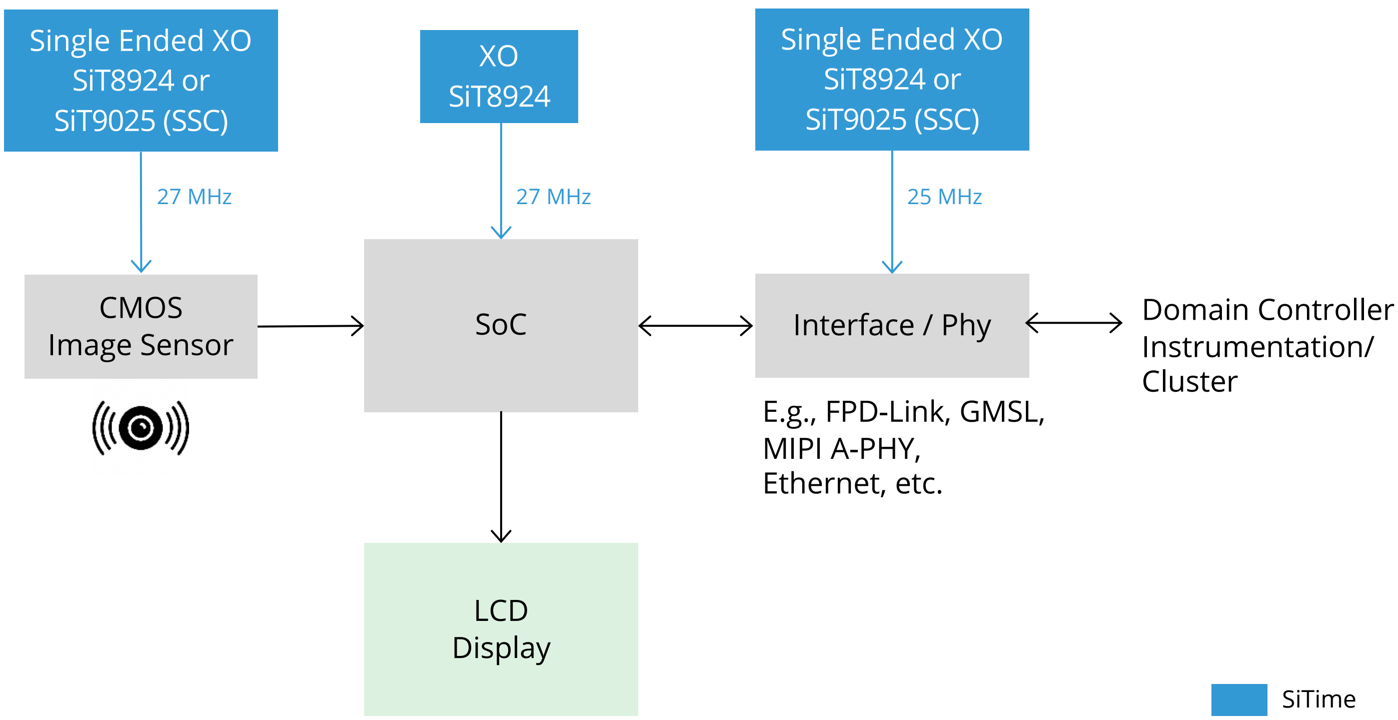
Precision Timing in Smart Mirrors

Side and rear-view mirrors are an integral part of any vehicle. Smart mirrors, a high-tech alternative, are appearing in the market. These camera-based systems offer many advantages: extended field of view, blind spot reduction, less glare at night, and better aerodynamic properties. Smart mirrors can also present information to the driver such as speed limits or blind spot occupancy warning.

Key Considerations

- Reliability and functional safety
- High temperature
- Low jitter
- Small footprint

Smart mirrors replace traditional mirrors by displaying images from a camera onto an LCD display. The architecture of windshield-mounted rear-view "mirrors" can be different from side-view "mirrors“. In the former, the LCD is an integral part of the system, while the latter display the image on LCDs located elsewhere, on the instrumentation dashboard, or even in the doors.



Regardless of architecture differences, smart mirrors rely on several building blocks: an imager, a system-on-chip for processing, and one or more LCD displays. Interfaces are necessary to transmit or receive video data to/from other sources. Switching image sources – for instance from a camera mimicking a rear-view mirror in normal driving, to a close-up backup camera while maneuvering – provides real advantages to the driver but complexifies the architecture to some extent.

SiTime

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Featured products – please refer to the Selector Guide for more options

Type	Product	Frequency	Key Features	Key Values
Single-ended oscillator	SiT8924	1 to 110 MHz	• Up to -55°C to +125°C • ±20 ppm stability • 2016, 2520, 3225 packages	• High reliability • Extended temperature range • EMI reduction features • Small footprint • Low power • Low jitter enables highest speed links
	SiT9025	1 to 150 MHz	• Up to -55°C to +125°C • Spread spectrum • Configurable rise / fall times • 2016, 2520, 3225 packages	
	SiT1625	44 standard frequencies	• -40°C to +125°C • ±25, ±30, ±50 ppm stability • 1612, 2016, 2520, 3225 packages • 500 fs RMS jitter[1] • 2.3 mA typ. current consumption	
Differential oscillator	SiT9396	1 to 220 MHz	• Low jitter: < 150 fs RMS[1] • ±30 ppm or ±50 ppm stability • LVPECL, LVDS, HCSL, Low-power HCSL, FlexSwing™ • -40°C to +125°C • 2016, 2520, 3225 packages	• High reliability • Low jitter • Enables interfaces with demanding jitter requirements, such as PCI-Express and 10 GB Ethernet
	SiT9397	220 to 920 MHz		
Super-TCXO DCXO/ VCXO	SiT5386	1 to 60 MHz	• 1 to 220 MHz • ±0.1, ±0.2, ±0.25 ppm stability • ±1 ppb/°C frequency slope • -40°C to 105°C • Low jitter: 0.31 ps RMS[1] • Optional voltage or digital frequency control	• High accuracy • Excellent frequency stability even with fast temperature gradients • No GNSS signal loss or V2X disconnect, as the MEMS resonator is not subject to "micro-jump" like crystal oscillators
	SiT5387	60 to 220 MHz		

[1] 12 kHz to 20 MHz integration range

Clocks

Several clocks are typically needed in a smart mirror system.

- CMOS imager clock: usually a single-ended clock, for instance 27 MHz
- SoC clock: usually a single-ended clock, in the range 16 – 40 MHz
- Interface / PHY clock: depending on the interface, either single-ended or differential: single-ended 25 MHz for GMSL, single-ended 27 MHz for FPD-Link, single-ended 25 MHz for Ethernet, differential 156.25 MHz for 16 GB Ethernet, etc.

Note that the exact clocks required depend on architecture and components used.

SiTime advantages

SiTime devices offer the following advantages over quartz crystals, which are particularly important for automotive applications:

- 50x better reliability: Apart from reducing the amount of field failures, the better reliability translates into a lower FIT rate. This provides better hardware safety metrics in an FMEDA, the quantitative analysis required as part of a functional safety assessment.
- 10x better resilience to shock, vibration and electromagnetic interference, due to the smaller size (0.4 x 0.4 mm) and lower mass of MEMS resonators compared to crystals. When not causing permanent damage to the crystal, shock and vibration can induce jitter in a crystal oscillator. Jitter can be detrimental to the bit error rate of a high-speed link. The better resilience of SiTime oscillators ensures a low error rate regardless of operating conditions.
- A typical requirement of clocks for data interface is: "the faster the interface, the lower the clock jitter“. The jitter of the clocks must be below a certain limit defined by the chipset manufacturer. SiTime devices offer state-of the art jitter performance.
- Small footprint: Due to the small size of the silicon MEMS resonator, SiTime devices have a very small footprint – down to 1.2 x 1.1 mm. This is of advantage in space-constrained applications.