

Agency for Science, Technology and Research (A*STAR) Technical Capabilities

Process Capabilities	Specialty 200 mm Processes and Materials	- PVD AlN thickness: 0.1 – 2 μm - PVD ScAlN thickness: 0.1 – 2 μm - Sc concentration in PVD ScAlN: 30/36% - PVD PZT thickness: 1 – 2 μm - Piezoelectric constant measurement: DBLI - Max lithography (stepper) field size: 52 x 52 mm - Metals: Al, Mo, Pt, Au - Dielectrics: SiO₂ (thermal, TEOS, USG), Si₃N₄, Al₂O₃ (ALD) - Silicon: Epi-poly - Release: VHF, XeF₂ - Bonding: Fusion, Eutectic
	Front-Side Cavity Platform	- Device layer stack: Metal–Piezo–Metal - Piezoelectric material: AlN or ScAlN (up to 4 layers) - Cavity: Over a pre-defined sacrificial layer or starting cavity SOI - Compatibility with CMOS integration: Yes - Thickness trimming: Available, e.g. for frequency tuning - Applications: Mainly RF and timing; Extendable to Piezoelectric Micromachined Ultrasonic Transducers (PMUT) with minor modifications
Integration Platforms	Back-Side Cavity Platform	- Device layer stack: Metal–Piezo–Metal–Si - Piezoelectric material: AlN, ScAlN (up to 4 layers) or PZT (single layer) - Si device layer thickness: Flexible - Diameter of back side cavity: 100 μm – 2 mm - Max cantilever length: 1 mm - Applications: sensors, actuators, PMUT, timing
	PMUT	- Frequency: 0.1 – 12 MHz - Piezoelectric material: AlN, ScAlN, PZT - Transmit sensitivity (per membrane, air-coupled): 10 Pa/V (typical) - Receive sensitivity (per membrane, air-coupled): 4 mV/Pa (typical)
Demonstrated Devices	MHz Resonators	- Frequency: 10 – 500 MHz - Piezoelectric material: AlN, ScAlN - Resonator quality factor: 10,000 (typical for <100 MHz resonator)
	GHz Resonators and Filters	- Frequency: 1 – 25 GHz - Piezoelectric material: ScAlN - Resonator effective coupling coefficient: 15 – 20% - Filter fractional bandwidth: 11% at 21 GHz (typical) - Filter insertion loss: 3.2 dB at 21 GHz (typical)

