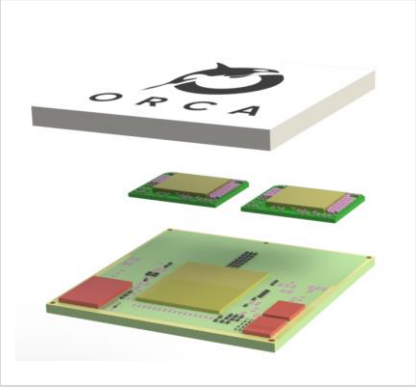
Open Rapid Chipletized Approach (ORCA)

Next Generation RF System-in-Package: Wide Bandwidth, 64GSPS and Versal Adaptive SOC Enabled Processing

Direct-to-digital processing at chip scale

- High speed data conversion with up to 8 channels
- Up to 64GSPS per channel
- DC to 50 GHz frequency range
- On-chip memory
- North American design and manufacturing at a DMEA-accredited facility



The advanced System-in-Package consists of a Texas Instruments high speed data converter, AMD Versal Adaptive SoC, and integrated memory. This technology, combined with Mercury's North American design and manufacturing, bring commercial technology to mission-critical applications creating a trusted and secure solution for modern sensor processing at the edge.

ORCA is the latest innovation to deliver rapid flexible chip scale solutions using Mercury's heritage in developing modular open systems. ORCA represents a family of RF System-in-Package (RFSiP) solutions that leverages a common tile approach to enable modularity at the chip scale level. This RFSiP offers direct digitization and massive processing while maintaining SWaP-C optimization through the reduction of multiple boards and reducing overall system cost. The on-chip memory simplifies system design and integration and contributes to the overall system longevity.

Included in the RFSiP is the latest data converter made by Texas Instruments for wideband performance and high sampling rate. Paired with the TI data converter is the AMD Versal SoC, LPDDR4, and flash. ORCA provides direct digitization up to 64 GSPS per channel and RF frequency range up to 50 GHz wide bandwidth without the need for additional frequency conversion stages. TI's data converter provides additional DSP blocks for phase coherent hopping, equalization, and fractional sampling features.

Highlights

- Two offerings: RFS1240 (4 Tx/Rx channels) and RFS1280 (8 Tx/Rx channels)
- Optimized for size, weight, power and cooling to deliver the best performance per watt for consistent and efficient operation – anywhere
- Development platform available – ask your sales representative for details

TECHNICAL SPECIFICATIONS

ADC/DAC

Texas Instruments AFE34RF90

- Channel count: 4 ch Tx/Rx for each ADC/DAC (up to 8 ch Tx/Rx when doubled per RFSiP)
- Sampling Rate: 32 to 64 GSPS
- Resolution: 12 bits
- RF Input Bandwidth: Up to 50 GHz
- ADC Performance
  - Noise Floor: -154dBFS/Hz
  - IMD3 (-7dBFS each tone, 16.1GHz): -60dBc
- DAC Performance
  - -NSD (-12dBFS, 16.1GHz): -163dBFS/Hz
  - -IMD3 (-7dBFS each tone, 16.1GHz): -60dBc
- DSP blocks
  - Multiband DUC/DDC (phase coherent hopping)
  - PFIR Equalizer
  - FFT spectrum analyzer
  - Fractional resampler

Adaptive SOC

AMD Versal Premium VP1402

- APU: Dual-core Arm Cortex-A72
- RPU: Dual-core Arm Cortex-R5F
- Memory: 256 KB On-Chip Memory w/ ECC
- System logic cells: 2,233,280
- CLB flip-flops: 2,041,856
- LUTs: 1,020,928
- DSP engines: 2,672
- More info: Versal™ Architecture and Product Data Sheet: Overview (DS950) • Viewer • AMD Technical Information Portal)

Memory

4GB LPDDR4

4Gb NOR Flash

External I/O

400Gb Ethernet

PCIe Gen 5

GTYP quads (8x)

GTM quads (32x supporting PAM4 53.125 Gbps)

GTM/GTYP reference clocks

XPIO banks (7x)

MIO banks (3x)

SYSMON + Bank 503 for config

RF differential pairs (32x)

GPIO (30x)

Power

RFSiP designed for a max power of 120 W, actual power consumption dependent on use case

Supply voltages:

- Sub-1V: 0.7, 0.8, 0.88, 0.9, 0.92
- 1.0V-1.5V: 1.0, 1.1, 1.2, 1.35, 1.5
- Above 1.5V: 1.8, 2.5, 3.3
- Note: some voltages support different power rails that cannot be combined due to sequencing

Mechanical

Dimensions: 55mm x 55 mm x 7 mm

Weight: 100 g

BGA ball size: 0.6 mm

BGA ball pitch: 0.92mm

FCBGA footprint

Board Support Packages (BSP)

Vitis enabled platform infrastructure with BSP

Environment

Ruggedized to MIL-STD 883 with operating temperature from -40˚C to 85˚C.

APPLICATIONS

- Aerospace and Defense
    - Phased Array Systems
    - Fire Control Radar, Surveillance Radar, Synthetic Aperture Radar, High Range Resolution Radar
    - Electromagnetic Spectrum Operations (EMSO)
        - Electronic Warfare (EW)
        - Signals Intelligence (SIGINT)
        - Electronic Intelligence (ELINT)
        - Communications Intelligence (COMINT)
        - Electronic Attack (EA)
        - Electronic Support (ES)
    - Intelligence, Surveillance and Reconnaissance (ISR)
    - Military communications
- Test And Measurement
    - High speed, multi-channel testers
    - Wideband spectrum analysis
    - Oscilloscopes
- Commercial Communications: 5G/6G Base Stations
- Radiometry