



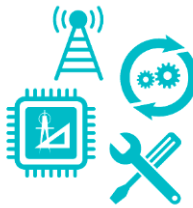
SEMICONDUCTOR  
SOLUTIONS

# S3 Group

ASIC design and supply

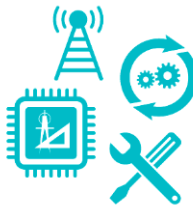


# Agenda



- > **About S3 Group**
- > **About Semiconductor Solutions**
  - > **Semiconductor Solutions IP Portfolio**
  - > **Custom Mixed-Signal and RF ASICs**
- > **S3 Group design strengths**
- > **Tailored ASICs**
  - > **RF Communications**
  - > **Industrial Process Control**
  - > **Process Control ASIC design - A Customer example**
- > **Advantages of using an ASIC**

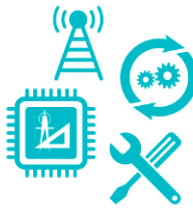
# About S3 Group



Global, Market leading provider of Custom Mixed-Signal ASICs and IP to OEMs, System vendors and semiconductor companies worldwide, lowering the risk in IC development and accelerating time to revenue of our customers

- 
- **Founded in 1986**
  - **Independent, VC funded since 2006**
  - **280+ Employees**
  - **1000s of IC solutions delivered**
  - **Complementary offering Product Portfolio & Services**
  - **ISO9001**
  - **ISO13485**
  - **5 R&D Centers**
  - **Global Sales Support**
  - **Business Units:**
    - **Semiconductor Solutions**
    - **Connected Health**

# About Semiconductor Solutions



## “Trusted Mixed-Signal ASIC Solutions”

### Custom ASICs

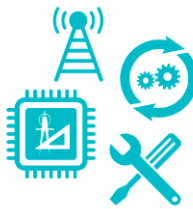
- Complete Turnkey solutions, delivering spec to packaged-tested parts
- 100’s of Millions devices shipped with ICs designed by S3 Group to-date
- OEM focus

### Enabled by Proven IP

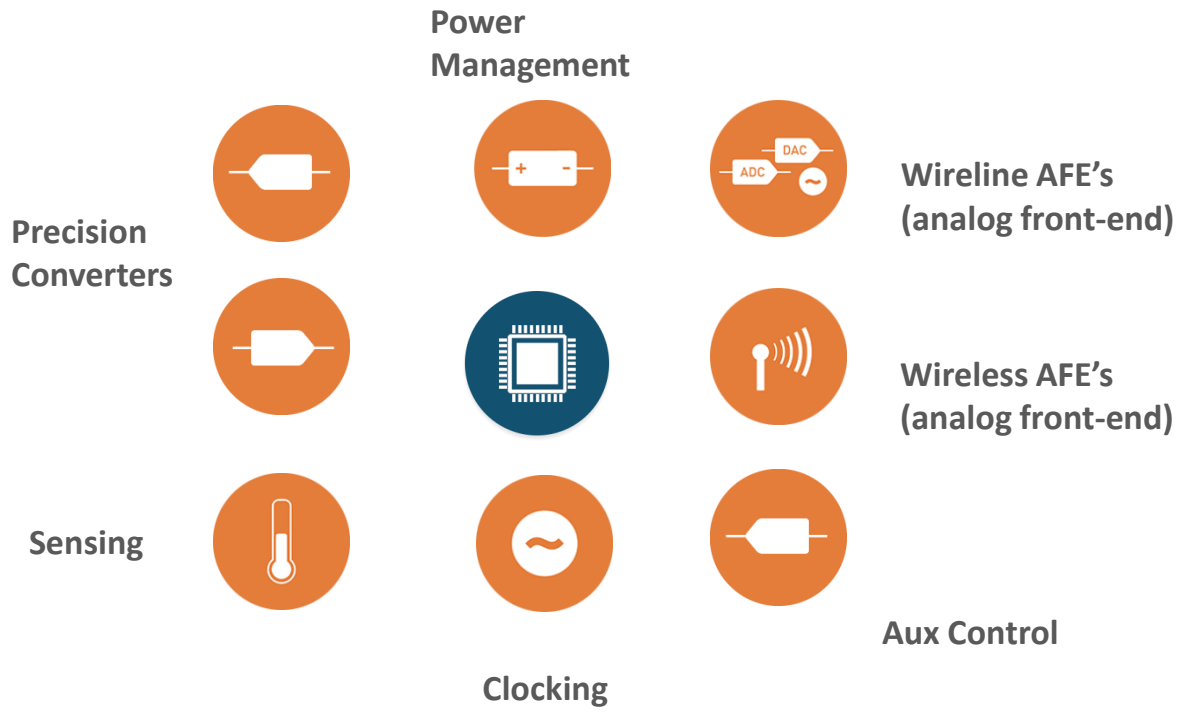
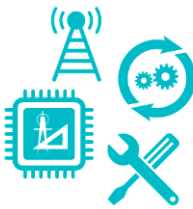
- #1 ranked Mixed-Signal (MS) IP provider
- Strong RF design experience
- 280 Employees, 30 years in business
- > 300 MS IP’s

“Delivering lower cost, higher performance, product differentiation”

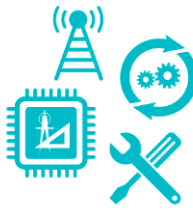
# Global Locations



# IP Portfolio includes..

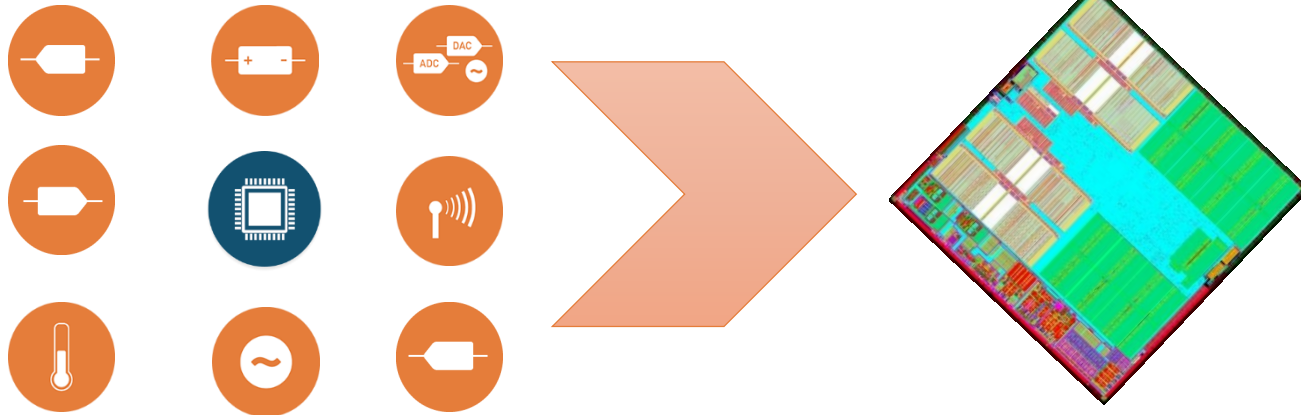
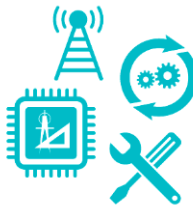


# S3 Group Integration Expertise



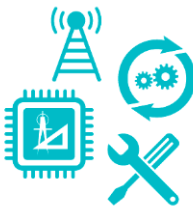
*We are **Expert** at  
Integrating Performance  
Mixed-Signal & RF  
with any **Processor**  
on silicon*

# We provide **Custom Mixed-Signal ASICs** - from design to supply of end product





# Summary of Mixed-Signal IP Portfolio



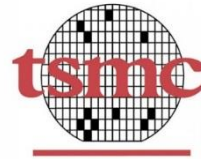
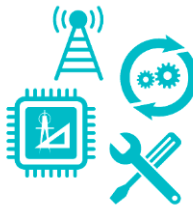
300+ high-performance MS IPs!

28nm	●	●	●		●	
40nm	●	●	●	●		
65nm	●	●	●	●		
90nm	●	●	●	●	●	●
130nm	●	●		●		
180nm	●	●	●	●	●	●
	ADC	DAC	AFE	PLL	PMU	RF
Up to	16 bit	16 bit	12 bit	1.2 GHz	95% $\eta$	
Up to	424 MS/s	1 GS/s	424 MS/s	<1 ps (jitter)		

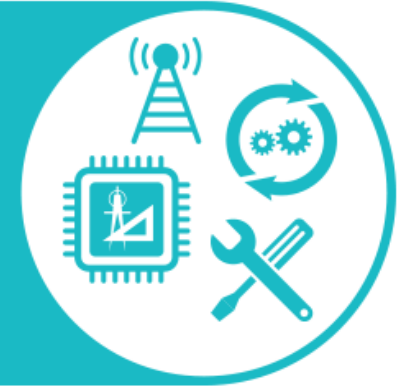
● Available

Please visit our website: [http://www.s3group.com/semiconductor\\_solutions/products/](http://www.s3group.com/semiconductor_solutions/products/)

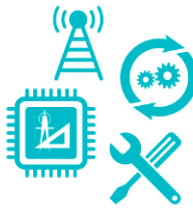
# Our Key Partners



# S3 Group ASIC design strengths



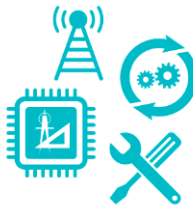
# S3 Group ASIC design strengths



- **Sense it**
  - Data gathering via connectivity to local and remote temperature, pressure, flow and other sensors
  - Integrated Wired and Wireless connectivity
  - Wireless connectivity via network technologies including ISM, SIGFOX, NB-IoT, 802.11x
- **Process it**
  - Integrated high resolution Data Converters to accurately process (and digitise) data gathered
  - Integrated processor (including ARM core and other cores) and peripherals used to manage all aspects of the data gathering and communication functions
- **Communicate it**
  - Integrated communication functions
  - Wired communication via UART, SPI, I2C, CAN Bus, Foundation Fieldbus, HART
  - Wireless communication via network technologies including ISM, SIGFOX, NB-IoT, 802.11x

# Tailored ASICs





# Sample Completed ASIC Projects

- Smart Valve (flow control) ASIC
  - Power Management Unit (PMU)
  - MEMS Interface ASIC
  - Bluetooth Headset Controller
  - Satellite/Modem Handset RF ASIC
  - Cellular Basestation Mixed Signal IC
  - Wireless HDMI
- ...and more..

# Satellite ASIC developments



- > We have developed numerous L-band satellite Transceivers for numerous customers since 2008
  - > Publically we are allowed to reveal that Iridium is one such customer
  - > Our solution is found in both their satellite phone and M2M terminal equipment
  - > We continue to provide solutions for their NEXT program
  
- > We are engaged with numerous other Satellite Operators to provide similar integrated Transceiver solutions



## Press Release

S3 Group announces world's first fully integrated, single conversion radio to be used in devices, transceivers and modems operating off the Iridium network

BGAN Module



# Smart Valve Monitoring & Control - ASIC example





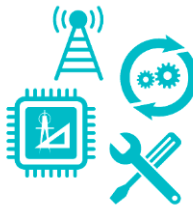


# A customer example - background

- > Our customer is an OEM that provides valves (flow process control) solutions to the Oil & Gas Industry
- > No ASIC experience
- > However they heard that through customised silicon integration they could:
  - > Increase their top-line by adding more value to their existing product line
  - > Increase their bottom line by reducing their eBOM
  - > Extend their portfolio into new application areas
- > With enhanced connectivity they could introduce new service centric revenue streams



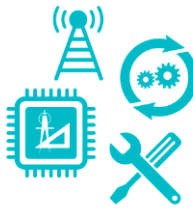
# The Customer's Requirements



## Technical Requirements

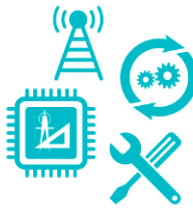
- > Allow for portfolio tiering
- > Multiple Sensor Interfaces - Pressure, Temp, Diagnostics
- > Integrated Smart Control Loop
- > Valve Positioning
- > Communications (FF, HART)
- > Integrated ARM processor core
- > Designed to be intrinsically safe
- > Low Power (<20mW)

# S3 Group Approach

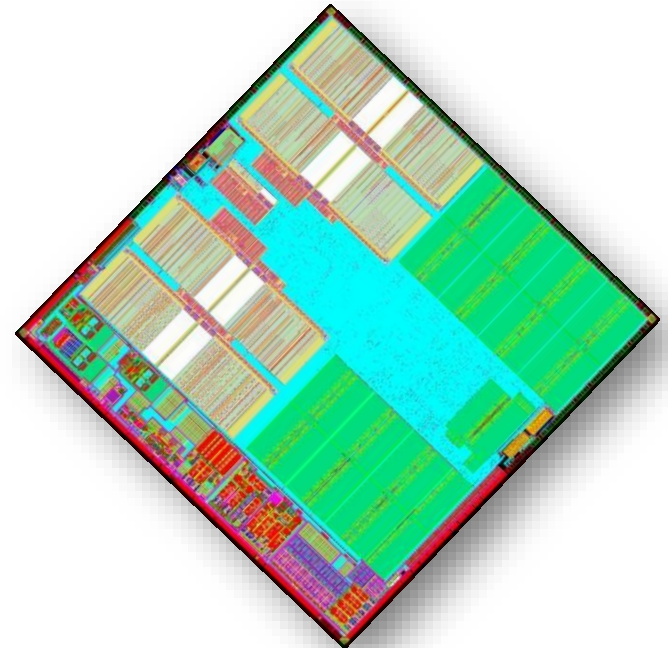


- > Review the Customer's product roadmap
- > What assets are they trying to Sense , Control & Connect
- > What can we do to build a solution that meets their current needs as well as is scalable to allow them to enter parallel application areas?
- > We discussed sensing needs, measurement needs, control & programmability needs, connectivity needs and security needs
- > Applied our Silicon Economics and Systems knowledge to provide an integrated mixed-signal SoC, leveraging from the rich portfolio of IP, all available at mature TSMC foundry nodes

# The ASIC Solution



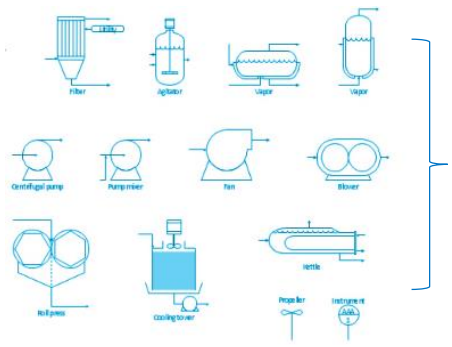
- > Technology: 180nm eLL
- > Dynamic Power: 157  $\mu$ W/MHz
- > Main Blocks
  - > ARM Cortex-M4 core
  - > PIC microcontroller
  - > AFE including
    - > 14bit ultra-low power SAR ADCs
    - > 12bit control DACs,
    - > Power switches
    - > Analog multiplexors & op-amps,
    - > Temperature sense,
    - > Optimised power management blocks
    - > FLASH & SRAM memories
- > Industrial Communication interfaces (Foundation Fieldbus MAU and HART)
- > Multiple Digital interfaces (SPI, UART, I2C, Parallel)



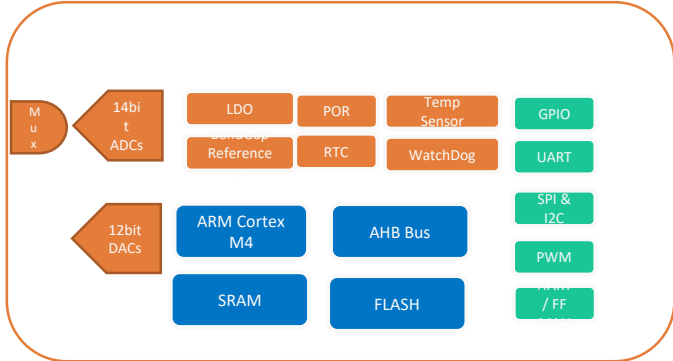
# Custom Mixed-Signal ASIC for Process Control



## Sensors & Actuators

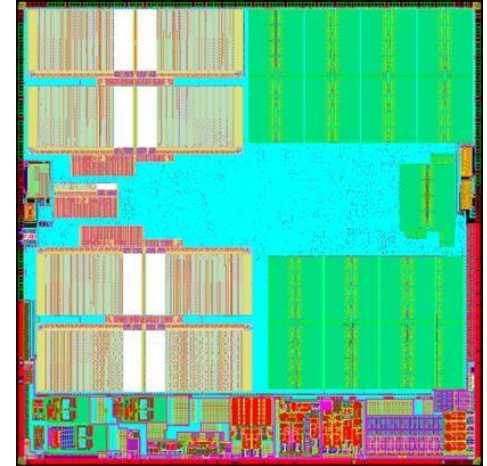


## Data Processing & Communication



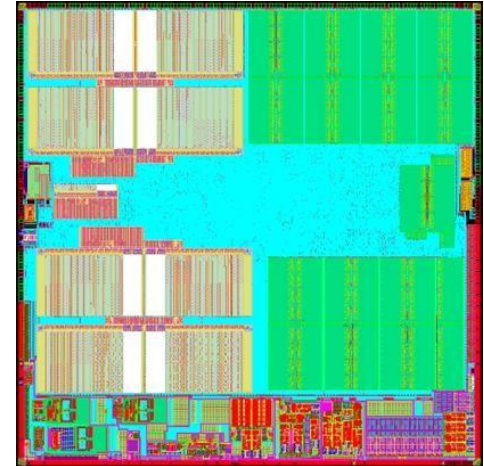
# Custom ASIC Solution - Features

- Key features
  - Can operate from current loop of 4-20mA
  - Temperature range from -52°C to 85°C
  - Supports full control of the valve, upgrades of the firmware
  - Variable core frequency
  - Industrial interfaces (HART and FF-MAU)
  - Variety of digital interfaces allow for connection of different peripherals to add more functionality/connectivity
  - External FLASH and SRAM interfaces allow for extra SW functionality
  - Not used sub-blocks can be independently powered-off

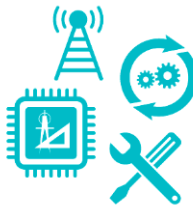


# Custom ASIC Solution - S3 Group project elements

- **ASIC development**
  - System architecture development
  - Design Specification generation
  - Verification Plan generation
  - Test Plan generation
  - Digital RTL design, integration and verification
  - Analog block schematic development, simulation and implementation
  - Top-level physical implementation
  - DfT insertion, test patterns generation, ATE bring-up support
- **Prototyping**
  - FPGA Prototyping Plan generation
  - FPGA Prototyping of the digital core
- **Validation/Qualification**
  - Validation Plan generation
  - Validation board development and manufacturing
  - Validation of real chip across PVT corners
  - Validation Report generation
- **Part delivery (supply chain management)**



# The Customer's Outcome



- > Reduced Power
- > Smaller Form Factor
- > Improved reliability, due to less components
- > Better signal integrity
- > > 80% saving in eBOM
- > Feature differentiation - they defined their solution & now own their solution
- > Roadmap success - can be leveraged across their connectivity portfolio
- > IP security - solution is not readily copied
- > Simpler inventory management - one part for all the end-product tiers

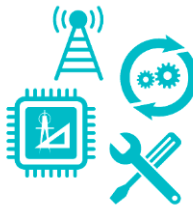




# Advantages of using an ASIC



# Advantages of using an ASIC



- > Significant eBOM (electronic Bill-of-Materials) cost savings
- > Full Custom capability - ASIC is manufactured to Customer's design specifications
- > ASIC may be designed to support a portfolio of products using one programmable device
- > Increased performance and reliability
- > Lower power consumption and dissipation
- > Smaller form factor - since ASIC is manufactured to Customer's design specifications
- > Customer's IP is protected
- > Lower unit cost, particularly when there is moderate shipment volumes
- > Complete ASIC supply chain managed



SEMICONDUCTOR  
SOLUTIONS

Thank you

[www.s3group.com/semiconductor-solutions](http://www.s3group.com/semiconductor-solutions)

