ADVANCED SIP APPLICATION IN LORA SYSTEM CHIP INTEGRATION

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ASR Introduction

- ASR Microelectronics (ASR), founded in April 2015, is headquartered at Zhangjiang Hi-tech Park, Shanghai, and has R&D teams in the U.S. and South Korea. ASR is specialized in mobile intelligent telecommunications (3G/4G/5G), IoT, navigation, and other consumer electronic chips.

- ASR is led by senior experts who have worked in the top telecommunications semiconductor design companies for many years. Many Chinese and international experienced design engineers have also joined ASR to add to the powerful technological strength.

- ASR IoT chips are applicable to multiple fields, such as LoRa, NB-IoT, GNSS, Wi-Fi, and Bluetooth. ASR provides comprehensive System on Chip (SoC) solutions.

Branches:
The U.S. and South Korea
Shanghai, Shenzhen, Beijing, Hefei, and Chengdu in China

Products:
Mobile telecommunications SoC (3G/4G/5G), LoRa, NB-IoT, GNSS, Wi-Fi, Bluetooth, and other consumer electronic chips

R&D Members:
More than 500
ASR Introduction

Over 540 R&D senior engineers around the world
ASR Microelectronics (Shenzhen) Co., Ltd., founded in Dec. 2017, is a wholly owned subsidiary of ASR Microelectronics (Shanghai) Co., Ltd.

ASR (Shenzhen) is led by senior experts who have worked in World TOP Semiconductor Company for many years. Many Chinese and international experienced design engineers have also joined ASR (Shenzhen) to add to the powerful technological strength.

ASR (Shenzhen) is mainly focused on IoT products, including LoRa, GNSS, Wi-Fi and Bluetooth. GNSS SoC is in production since 2017. LoRa SiP chip ASR6501/6502 is in production since Sep. 2018. LoRa SoC chip based on IP license agreement between ASR and Semtech will be done in 2019.
LoRa in IoT
LoRa in IoT
LoRa in IoT
SiP in LoRa

More than Moore: Diversification

Integration with people and environment
Non-digital content
System-in-Package (SiP)

Combining SoC and SiP: Higher Value Systems

More Moore: Miniaturization

Baseline of CMOS: CPU, Memory, Logic

130nm
90nm
65nm
45nm
32nm
22nm
16nm
SiP in LoRa

Varies LoRa Applications
- Smart Buildings
- Smart Metering
- Smart Home
- Smart Care
- Smart Energy
- Smart Retail
- Smart Working
- Smart Society
- Big Data
SiP in LoRa

Varies Requirements For System Chip:

SiP is the best choice for fast Production define and different Applications.
SiP in LoRa

Traditional Industry Chain in Assembly and Test is updated from vertical to cross coordination.
### SiP in LoRa

**How to choose SiP Structures?**

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<td>3D Fan-out WLP</td>
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ASR Confidential
SiP in LoRa

Parallel SiP
- Large Size
- Complex system
- Big data

Stacked SiP
- Small Size
- Simple function
- Small data
Advanced Stacked SiP
ASR6501: QFN-48PIN, 6mm*6mm*0.9mm, released in Sep. 2018 at “Alibaba Hangzhou Computing Conference 2018”.
ASR6502: QFN-60PIN, 7mm*7mm*0.9mm, will release in Nov. 2018.
ASR LoRa Chip

SX1262+Cypress PSoC4100s Plus MCU
ASR LoRa Chip

Key Features:

✓ Small footprint: 6mm x 6mm x 0.9mm.
✓ LoRa Radio and LoRa Modem.
✓ Frequency Range: 150MHz ~ 960MHz.
✓ Maximum Power +21dBm constant RF output.
✓ High sensitivity: down to -140dBm.
✓ Programmable bit rate up to 62.5kbps in LoRa modulation mode.
✓ Programmable bit rate up to 300kbps in (G)FSK modulation mode.
✓ Preamble detection.
✓ Embedded memories (up to 128kbytes of Flash memory and 16Kbytes of SRAM).
✓ 6x~13x configurable GPIOs, 1x~2x I2C, 1x~3x UART, 1x SWD, 1x~2x SPI.
✓ 48-MHz ARM Cortex-M0+ CPU.
✓ 8-Channel DMA engine.
✓ Embedded 12-bit 1Msps SAR ADC.
✓ 32.768kHz External Watch Crystal Oscillator.
✓ 4-33MHz External Crystal Oscillator for MCU (Optional).
✓ 32MHz External Crystal Oscillator for LoRa Radio.
✓ Embedded internal High frequency (48MHz) RC oscillator.
✓ Embedded internal Low frequency (40kHz) RC oscillator.
✓ Embedded internal PLL to generate 48MHz clock.
ASR LoRa Chip

Highly Integrated SoC with Full Features

Minimum LoRa SoC
6mm*6mm*0.9mm

Full LoRa Frequency Band
150MHz-960MHz

Cost-efficient LoRaWAN
Integration of LoRaWAN Stack and AIOS
Certified by Alibaba Link WAN

Connect to Cloud

Link WAN

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ASR LoRa Chip

Low-Power and High-Performance SoC for LPWAN

Advanced SiP Solution
- Sandwich structure in an ultra-thin package of 0.9mm

Ultra-low Active Current
- LoRa + MCU
  - RX current: <10mA
  - TX current: <52mA @ 17dBm

High Sensitivity
- -140dBm @ 8W = 125 kHz
- -148dBm @ 8W = 7.8 kHz

High Transmit Power Wide Tuning Range
- +22dBm output power
  - 31dB continuously-adjustable gain control
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SF=12
TX Power=17dBm

SF=12
TX Power=22dBm
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ASR LoRa Chip

- ASR6501 EVK and SDK
  - Reference module design documents;
  - EVK Demo board environment;
  - Chip Evaluation test support;
  - SDK3.0 released and support LoRaWAN Class A/B/C;
  - Support LoRaWAN, LinkWAN and Customized Private Protocols.
  - AliOS integrated, make it easy to link with Ali Cloud.
ASR LoRa Chip

Design In 85%
Module Design 15%
Production 3%

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Thanks!