A Highly Integrated and Comprehensive SiP Solutions for IoT

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Introduction
IoT Segmentation

Source: Yole, 2016/10
SiP Heterogeneous Integration

- Miniaturization by SiP core technologies
- Heterogeneous integration with different technologies
- Design / Performance Optimization
- Lower cost alternative than SoC
- Fast-turn-tailor-made changes
- Higher quality, production efficiency and re-configurable
SiP Module and System Integration Solution
Wireless Connectivity - BLE

- **Application:** Bluetooth Low Energy (BLE) for wearable products
- **Challenge:** Size reduction; conventional module size and antenna size occupy large area making wearable products less attractive

**Service provided:** Module design, manufacturing, system-level testing & firmware co-qualification

**Technology:**
- Antenna on Package (AoP)
- Conformal Shielding

**Improvement:** 82% module XY size reduction

Before: Single Sided Module with Chip Antenna
Module Size: 15.0 x 15.0 x 2.0 mm

Solution: AoP
Module Size: 6.5 x 6.5 x 1.2 mm (82% XY reduction)
Wireless Connectivity - WLAN

- **Application:** WiFi 802.11 a/b/g/n 2x2 for smartphone & wearable products
- **Challenge:** size reduction, especially on XY dimension

802.11 a/b/g/n 2x2 + BT 4.0
Dual Band (2.4 & 5 GHz)
RF Passive 50 Pcs
Substrate : 2+2+2 , 0.3 mm
MUF, C/S , 01005, 100um SMT clearance

Before: Single Sided Module
Module Size: 10.0 x 6.6 x 1.1 mm

Solution: Double Sided Molding Module
Module Size: 7.75 x 5.4 x 1.3 mm (30 % XY reduction)

- **Service provided:** Module design & manufacturing
- **Technology:**
  - Double side SMT
  - Double side molding & exposed molding
  - Conformal shielding
- **Improvement:** 30% module XY size reduction
Sensor Integrated SiP: Sensor + AFE/MCU

- **Application:** Smart Handheld (Ambient Light / Proximity / Gesture), Body Motion & Physiological Sign Sensing
- **Challenge:** Product mechanical constraint, especially on XY dimension

- **Service provided:** Design, materials, assembly & manufacturing, system-level testing & firmware co-qualification
- **Technologies:**
  - Stacked die & WB
  - High density SMT
  - Embedded die substrate
- **Improvement:** 80% module XY size reduction

Before: Double-sided module
Module Size: PCB-27 x 10 x 3 mm; Sensor-15x10mm

Solution: Embedded die substrate
Module Size: 8 x 8 x 1.2 mm (~80 % XY size reduction)
BLE+MCU+Sensors for Smart Bike

**Features:**

- 1. Security Lock/Unlock: Accelerator, BLE Beacon
- 2. Fitness Monitor: HRM/SpO2 Sensor
- 3. Turn Lighting: Gesture Sensor
- 4. UV, Front/Rear Lighting: UV/ALS Sensor
HyPas Platform Solutions
HyPas Platform

◆ What is HyPas?
  ◆ High Performance Passives and Package Hybrid Solution
  ◆ 3D Inductor and Highly Integrated SiP Module

◆ Features:
  ◆ With or Without Glass
  ◆ High-Q 3D tall pillar inductor
  ◆ Functional passive form by integrated L+C
  ◆ Embedded active/passive ability
  ◆ Compatible with Fan-out process
  ◆ Low profile and compact form factor
  ◆ Compatible to traditional SMT & FC process
  ◆ WB tuning mechanism
  ◆ EMI shielding
3D Solution: HyPAs vs. TGV

**HyPAs with Tall Pillar (TP)**
- No TGV
- Embedded IPD cap bank
- Top 2RDL/ Bottom 2 RDL
- Tall Pillar Diameter < 30um, > 120um Pillar High
- 3D Inductor
- RFIC with 70um Cu pillar
- FC with MUF assembly
- Pre-solder

**IPD with TGV**
- Glass with TGV
- Glass IPD cap
- Top 1RDL/ Bottom 1 RDL
- TGV Diameter 60um/ Depth 250um
- 3D Inductor
- RFIC with 70um Cu pillar
- FC with MUF assembly
- WLCSP assembly with 250um ball

Total: 900um

Total: 400um
Summary
Summary

- ASE offers variety of technology solution for SiP requirements
- HyPas Platform is a High performance Passives/ Packaging solution
- Highly integrated SiP solution is especially suited for IOT End Devices