Custom Packaging Overview

Aeroflex Plainview, Inc. dba Cobham Semiconductor Solutions
March 2015

Commercial in Confidence
Cobham Semiconductor Solutions

Experts in HiRel Power Regulation, Distribution and Battery Management

High reliability, high performance, RadHard
- ICs
- Multi-Chip Modules
- Subsystems

For High Value/Mission Critical Applications:

- Space, Avionics & Defense 75%
- Commercial Wireless Communications 13%
- Medical and Other 12%
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- Commercial Wireless Communications 13%
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World Class Manufacturing Facility

Plainview, L.I., N.Y.
100,000 Sq Ft. including
~25,000 Sq ft – Clean Room
~ 25,000 Sq ft – Eng/QA Lab
~ 6,000 Sq ft – RF Eng Lab
Vertically Integrated Solutions

1. Radiation Performance LEO, MEO, HEO, GEO & Deep Space in a Single Device
2. Increases our competitiveness & GM in value added modules, slices and boxes
3. Entrée into new low voltage designs

**Custom Application Solutions**
- Space Hybrids
- Chip-on-Board
- Discrete Modules

**Space Board-Level Solutions**
- RHDs, PDMs, VRGs, RDCs

**Space Boxes**
- Cell Balancing (BEUs)
- Battery Health Monitoring

**Footprint Compatible with Existing MUX Series Multi-Chip-Modules Packages. Provides 16, 32, 48, 64 channels for Low Voltage Applications on Demand.**

**VRG8691/92**
- High Current-Low Voltage LDO

**RHD Series**
- Vertical Integration into Plainview Space Products Portfolio Increases Competitiveness & Profitability

**RHD 1Mrad(Si) Series**
- Op-Amps
- Comparators
- Multiplexers
- Digital-to-Analog Converters
- Precision Current Source
- Resolver to Digital

**Price**
Cobham Semiconductor Solutions is a leading supplier of a standard and custom multi-chip modules for space and military applications.
Digital MCMs

- Leading Supplier of Microelectronic Modules to All Major US Aerospace Concerns
- Leading Supplier of Data Communication Modules for Space, Airborne, Telecom, & Commercial Aviation Markets
- Leading Supplier of RISC Multi Chip Modules for Defense Applications
ACT-5271SC-F10-M21C

HTCC Hermetically Sealed MCM

- 2 MB SC: (Sync Burst Cache RAM), 4ea
- CPU Cycle FIFO: 2 FPGA
- Control CPLD
- Configuration Serial PROM: FPGA
- PLL CLK Driver
- Cache TAG RAM
- MIPS uP: RM5271
Hermetically Sealed Die Cavity + SMT

2 RadHard Mixed-Signal ASICs tooled by Cobham

JY04B ASIC from Cobham – FPGA Net List Conversion
Packaged devices within a hybrid

CT2216, HTCC Package in a Hermetically Sealed Kovar Package

ARX1633, Glass Frit bonded package with an 80C51 uP in a Hermetically Sealed Kovar Package

IC Packaged in HTCC

Programmable Device
Ring Frame Hybrids

• Ring Frame Packages:
  – Cost Effective
  – Lightweight
  – Leadless Packages
  – Low Resistance Paths
  – 25 Amps DC, 150 Amps, 10 ms
  – Space Qualified
  – Integral Substrate
  – Low Package Tooling Cost

• Features a hermetically sealed ring frame hybrid with SMT attached components on a common ceramic substrate.

Die are hermetically sealed under this metal housing which is solder sealed to a ring frame on the ceramic.
Flip Chip Process Development

- Equipment
- ASIC vs. Power PC
- Assembly – Fixturing (ASIC)
- Post Reflow x-ray
- Sonoscan
- Cross Section – Underfill
- Solder Bump

Datacon 2200 apm+

SEC Omni Bonder Model 860

Samsung CP45 FV
Original High Temperature Co-Fired Ceramic (HTCC) Package Design of Class “K” Module

THE OLD WAY OF DOING THINGS!
THE NEW WAY OF DOING THINGS!

Board installed in housing. Sealed, plug & play module shipped to our customer.

- Bare die
- SMT Chip Caps & Resistors
- Discrete Leaded Components & Connectors

MODULE IN FULL SCALE PRODUCTION, >2,500 UNITS SHIPPED TO DATE
Chip On Board Successes

- Analog Control Board for a Satellite Payload
- Double Sided SMT
- Single Sided COB
- High Density Nanonics SMT Connectors
- PWB is \( \approx 6'' \) sq. & Replaced 3 Separate PWBs

- MMIC Control Circuit –
- \( \sim 2'' \) L \( \times 0.5'' \) W, note odd shape
- >10,000 UNITS SHIPPED TO DATE
Chip On Board Power Supply

Missile Application

Image of a circuit board with labels:
- Chip & Wire
- Planar Magnetics
- Wedge Locks
- MIL-Connectors

3 Output Device
Plastic Strategy

- Hybrid Killers
  - Die Scale Packaging
  - Non-Hermetic Reliability w/Plastic
  - Tooling Costs
  - Cost of Packages
  - FPGAs
  - ASICs

- Advantages of a COB BGA Assembly
  - Counters Fear of Counterfeit Parts
  - Overcomes Lack of Lot Control
  - Full Traceability to Wafer Diffusion Lot
  - Visual Inspection of each Die
  - Flexibility to Achieve Obsolescence Avoidance
  - Eliminates possibility of Defective PEMs being “pop corned”
  - Consolidation of Supplier Base
Chip on Board BGA Assembly

- High I/O Count
- Ideal for Mixed Signal Applications
- Hermetic Seal over Die Island
- Suitable to 2 GHz
- Polyimide PWB for High Reliability Applications
- Low Mass allows device to be automatically picked & placed
- Ability to overcome Obsolescence
- MIL-PRF-38534 Qualification
Power Conversion Capability

Front End Push-Pull Driver for a Commercial Space Power Converter

H-Bridge Front End Driver for a MILSTAR Power Converter

Solid State Power Controller for F-22

Front End H-Bridge for a 15kW Low Output Voltage Converter

Synchronous Rectifier for a 15kW Low Output Voltage Converter
Space Grade DC-DC Converter

Conventional Chip & Wire Hybrid Style DC/DC Converters
5101 Motor Driver, 500 VDC, 50A DC Rating

• Features
  – PACKAGE SIZE 3.0" x 2.1" x 0.39"
  – 4 QUADRANT CONTROL
  – 6 STEP TRAPEZOIDAL DRIVE CAPABILITY
  – ISOLATED UPPER & LOWER GATE DRIVERS
  – MIL-PRF-38534 Screening, -55°C TO +125°C
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