

# ***Engineering out Obsolescence***

Alun D. Jones

MicroSS Components

[www.microSS.com](http://www.microSS.com)

# Overall Strategy

## Engineering solutions in obsolescence

- In-house semiconductor ASIC **DESIGN**
- Selected hi-rel foundry partners for fabrication
- **Banking** silicon die and wafers to hedge against future obsolescence
- **Manufacture**
  - In-house ceramic and metal can **ASSEMBLY**
  - COB (Chip on Board)
  - Ex-house plastic assembly
- **Electrical test** (In-house)
  - Up to full Mil/Aero and Space level testing
- **Environmental test** (In-house)
  - Up to full Mil/Aero and Space level screening
- **Delivery**
  - Delivered as an on-going part to meet customers schedule

# 3 F / 5 R Obsolescence Strategy

- Requirements, the 3**F**'s

- **F**orm

- Identical or Conforming Packaging
    - Matching the Footprint
    - Require to use the same board assembly techniques

- **F**it

- Specification
    - “Fit for purpose”
    - Same decoupling ?

- **F**unction

- What goes on inside the Chip
    - Living with the application
    - Same pin-out & power supplies

- Solutions, the 5**R**'s

- **R**e-Package

- Calling off from die stocks

- **R**eplace, similar product

- COTS, spec. change, up-screening

- **R**e-Invent,

- using MCM / Hybrid techniques

- **R**efit

- PLD/FPGA mimiking device function

- **R**e-Design,

- using ASIC solutions

# *DESIGN*

- In-house custom design for Analog, Mixed-Signal and Digital Technologies
- Based upon industry standard Cadence toolset:
  - Verilog XL with M/S integration
  - Spectre or cdsSpice for analog simulation
  - Analog Artist for schematics and layout
  - DIVA extraction for DRC/LVS etc.,
- Expertise in Bipolar, CMOS, BiCMOS and SOS.
- Right first time philosophy, excellent track record.
  - Re-engineering of standard and custom product.
  - 6 point QA-driven Design Review system involving customer throughout project design-cycle.
  - Full “box-file” documentation to ISO9001 & AS9100

# ***FOUNDRIES***

- Selected foundries to produce silicon for high reliability applications and designs.
  - Acting as a “central collection” buffer for small volume designs.
  - Known long-term track records / history.
  - Well established personal contacts.
  - Installed technology design databases.
  - Matching toolsets.

# *Die and Wafer Banking*



- Die and Wafers are “banked” as tested product, awaiting call-off and build – in accordance with IEC 62258 : Part 3.
- Positive pressure cabinet storage using dry Nitrogen with controlled temperature and humidity.
- Current storage includes product that is in excess of 30 years old.
  - *We still hold original DTL die product.*
- Freshly built product has TODAY’s date-code on it, even though the silicon may have been fabricated many years ago.
- Can stave off unnecessary or un-budgeted board / module redesign, giving the project a new “lease of life”.
- Member of the “Good-Die” and ENCAST European Union funded projects and IEC-PT 62258

# ***ASSEMBLY***

- In-house ceramic packaging
  - Extensive range of hermetic packages
  - MCM or multi-chip capability
  - Novel design packaging technology available
  - Numerous options of attach and bonding available
- In-house metal canning
- In-house “chip-on-board”
- Ex-house plastic packaging
  - Using selected packaging partners
  - Available for high volumes and as high reliability COTS/PEMS

# ***ELECTRICAL TEST***

- Full range of semiconductor ATE
  - High frequency (ECL) capability
  - High pin count, high complexity
  - Memory and custom logic
  - Complex analog & mixed signal
- In-house dedicated ATE software writing and hardware jig building teams.
- Vast library of existing ATE software & hardware solutions.
- Testing at temperature extremes :
  - From  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  and above

# ***ENVIRONMENTAL TEST***



- Extensive range of static and dynamic burn-in facilities
- Complete range of standard reliability test equipment
  - RCT, HAST, HTOL, PIND, ESD, etc.,
- Dedicated Reliability and Environmental engineering team.
- Screening to full MIL883 / BS / Space levels.

# *QUALITY*

- AS9100 based, full QML approvals.
- Dedicated Quality team, driving design and manufacturing reviews.
- Customer focussed.
- Full DFA capability.
- Product control, calibration and monitoring throughout all design and manufacturing stages.

# *Our Offering ...*

Micross Components offers a complete “turn-key” obsolescence solution package, replacing an unavailable part with a matching part using current technology.

**We deliver the final tested product.**

By close collaboration with our customer, we have a long track record of 100% first-time right in engineering a solution to meet his needs; his success is our success.

Engineering solutions in obsolescence

## ***Our Boast ...***

We have designed, assembled and tested over 120 “engineered solution” parts for our customers, from full custom ASIC’s to MCM solutions.

We have achieved 100% success.

We achieved it 1<sup>st</sup> time round.

Thanks to our customers!

## *Some examples (1) ...*

- Unavailable old op-amp, Fairchild uA702, required to unusual specification for radar application, alternative manufacturers or devices unsatisfactory (oscillation, excessive noise etc.,).
- Design was “print-to-build”, no engineering expertise available from customer to re-design system, or even understand how the original design worked.
- Micross Components’ ASIC design team undertook a detailed design appraisal, and manufactured an electrically identical product for customer to sample. Packaged in metal TO cans, the initial part was to satisfy 4 circuit locations, final samples worked in all 37 circuit locations.
- Current status : *On-going manufacture by Micross Components . Available as standard product.*

## *Some examples (2) ...*

- Complete chip-set required for fresh “build-to-print” of a modern missile system, comprising 5 bipolar analog and 2 complex CMOS digital ASIC’s (50K & 22K gate designs), all to military specifications.
- Sketchy design information available, although application knowledge was available from the customer.
- Micross Components were commissioned to re-design all 7 ASIC’s using current technologies, and wafer bank to hedge against future obsolescence. All designs worked 1<sup>st</sup> time in customers application. One device was re-spun to improve final yield against changed customer specification (original part had lower gain, and didn’t meet original spec., so application circuit had changed to accommodate this lower gain).
- Current status : *Micross Components are delivering all 7 ASIC’s as a set, in accordance with the customer’s call-off rate. Die and Wafer Banked, and Customer is satisfied that further obsolescence has been addressed.*

## *Some examples (3) ...*

- Manufacturer of space vehicles & satellites required significant weight-savings to increase payload. Existing “control function” logic was understood, additional functions were required.
- Micross Components, in close collaboration with the customer, designed a total of 4 digital ASIC’s in SOS technology, each chip having separate and independent function, replacing many PCB’s in the process.
- Current status : *Micross Components delivered all 4 ASIC’s, working 1<sup>st</sup> time, ahead of schedule. Current product is “flying” without mishap, and additional quantities are being delivered on an ad-hoc call-off basis.*

## *Some examples (4) ...*

- Military OEM used old bipolar MMI PAL's, could not get replacement parts (almost complete family of PAL's used in 20+ patterns).
- Microcross Components converted all PAL designs to modern PLD technology, finally using only 3 GAL types.
- One device required an MCM design to include delay IC's as original PAL's were ~50nS, and faster PLD's (~10nS) uncovered timing race problem in customers design.
- Current status : *Microcross Components delivered all patterned parts, including low cost MCM device. Project now concluded, but all designs/patterns & silicon remain available for future build.*

## *Some examples (5) ...*

- Military OEM used special high gain differential IF amplifier IC obsoleted 10 years ago. No other commercially available part would suffice. Customer initial requirement was for 400 parts for re-build & repair scenario.
- Micross Components reverse engineered existing silicon and designed new part. Delivered prototypes to customer within 12 weeks, design working 1<sup>st</sup> time.
- Current status : *Micross Components has delivered all 400 parts plus contingency. Customer claims that design “has not gone away”, now due to the ability to source new product.*

## *Some examples (6) ...*

- Military Naval OEM used a high voltage bipolar logic family that had not been available for over 10 years. He used a limited range of this HNIL family, and required a limited quantity for repair & replacement.
- Micross Components designed and built 8 separate low-cost ceramic substrate MCM solutions in 14- and 16-pin DIL packages. Thick-film hybrid technology was used for the passive components, and a mixture of CMOS and Bipolar die were used to recreate the unique functions. Costs were kept to a minimum by this method as quantities were low. All 8 parts worked 1<sup>st</sup> time in the customers application.
- Current status : *Required quantities were small, although their overall importance was exaggerated by the project's high profile. Micross Components has delivered all required parts plus a contingency.*

## *Some examples (7) ...*

- Commercial manufacturer of nautical commercial equipment could no longer purchase a custom ASIC of his design, having exhausted his LTB purchased stock.
- Microcross Components re-engineered the original ASIC, with customer requested improvements, and worked 1<sup>st</sup> time to the customers requirements. Design was altered and re-iterated after the initial delivery to accommodate additional features and a change in external components, as Microcross's low-cost re-design option gave the customer further opportunities to reduce component costs elsewhere.
- Being of commercial/automotive grade, the ASIC is plastic packaged externally, and fully tested in-house. Microcross delivered price was significantly cheaper than the original product.
- Current status : *Microcross Components is delivering the ASIC in quantities of over 1000 units per month, and has been for the past 5 years. Ongoing analysis continues with zero return-defects.*

## *Some examples (8) ...*

- Industrial manufacturer of machine gear equipment used a Siemens device for use in a proximity sensor, the original part became obsolete, with no alternative supplier
- Micross Components' Design team re-engineered the original part using a low cost ASIC in accordance with the original data sheet. Again the new part worked 1<sup>st</sup> time to the customers requirements and data sheet.
- Being of industrial grade, the ASIC is plastic packaged externally, and fully tested in-house. Micross's delivered price was again cheaper than the original product.
- *Current status : Micross Components is delivering the ASIC in quantities of over 300 units per month, and has been for the past 4 years with no customer returns.*

## *Some examples (9) ...*

- A Plessey Semiconductors designed VOGAD for military radio set, truly obsolete, was required for further build and repair scenario by an foreign company.
- Micross Components re-engineered the original part using a low cost ASIC in accordance with the original Plessey data sheet. Yet again the new part worked 1<sup>st</sup> time to the customers requirements and data sheet. The remaining range of Plessey VOGAD chips were also designed for possible future use.
- The ASIC was packaged in a ceramic 8-pin DIL, and fully tested in-house. Once again Micross's delivered unit price was again cheaper than the original product.
- Current status : *Micross Components delivered over 7,000 of these parts to the manufacturer. The order is now complete with excess die now being held in Die bank.*

## *Some examples (10) ...*

- A large military OEM desired a large flash memory array for in-flight data. The device footprint, mass, weight and power budget of the complete assembly were already allocated, but no current commercial or military device would fit. Requirements included specific technology for prolonged airborne usage.
- Microcross Components designed and funded a novel double-sided flash module (one device on the top, one on the underside) in a 13-layer custom ceramic package that matched the current 48-pin TSOP JEDEC footprint. Special tooling and software were developed alongside the package and electrical design to ensure manufacturability.
- The flash memory module was manufactured as a standard Microcross product, MS16TS2048, and supplied against a full military specification part.
- Current status : *To date, Microcross Components has delivered over 16,000 of these parts to different OEMs and projects, with ongoing volume production.*