

Collaborative Engineering for Microelectronic Circuit Miniaturization in Satellite Applications

CASE STUDY

High-tech controls and instrumentation designated for space flight demand the most stringent quality standards, plus the crucial requirement of reduced circuit card size to reduce weight.

An OEM building and launching geostationary communications satellites needed to design and build a series of new control and telemetry modules for their new satellite system. The new modules needed to fit in a compact physical space while achieving very demanding performance requirements. This required a new, more miniature electronic package technology versus earlier generations of satellites.

THE SOLUTION

NEOTech was chosen to be the design and manufacturing partner of control and telemetry electronic modules due to our experience building mission critical and high reliability micro-electronic circuits using chip-on-board (CoB) technology.

CONTROL BOARDS

Control boards, whose function is to control the transponders (the receive and transmit modules, i.e. the guts of the satellite), were designed based on customer schematics and



requirements. Each satellite has several transponders (up to 96+) and the operation of each one is managed by a control board.

The NEOTech design of the control boards starts with a customer supplied schematic and a desired form factor. NEOTech designed the control board as Chip-on-Board (CoB) technology assembly. This technology combines standard surface mount technology with microelectronic assembly. In this CoB technology the standard packaged semiconductor parts are replaced with the same device in die (bare silicon chip) form. The die or chip is connected to the traces on the PCB using wire bonding technology; i.e. connecting the small I/O pads on the chip to the PCB using small 0.001" gold wires. This effectively eliminates one level of interconnect (soldering of the package leads) and thus have the added benefit of increasing the reliability of the assembly. The main benefit is the reduction in surface area required by the CoB technology assembly. The gain in packaging density allows our customer to decrease the size of the electronics and save weight, an important factor in any payload launched into space. The control boards are built by NEOTech using Chip-on-Board technology.

TELEMETRY MODULES

Telemetry modules are part of the control systems for the satellite. There are a number of these modules in a satellite. These modules check the status and functionality of various subsystems and can measure vital status information about the satellite and its payload. Examples of this are system voltages, currents, temperature etc.

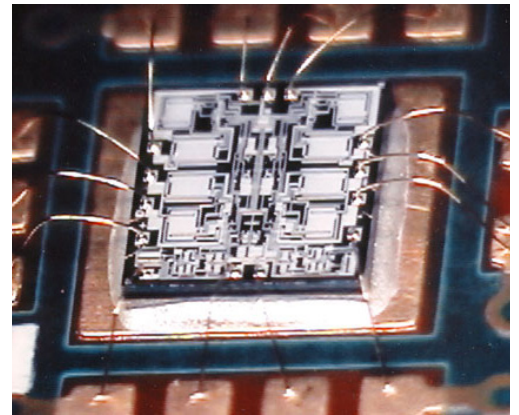
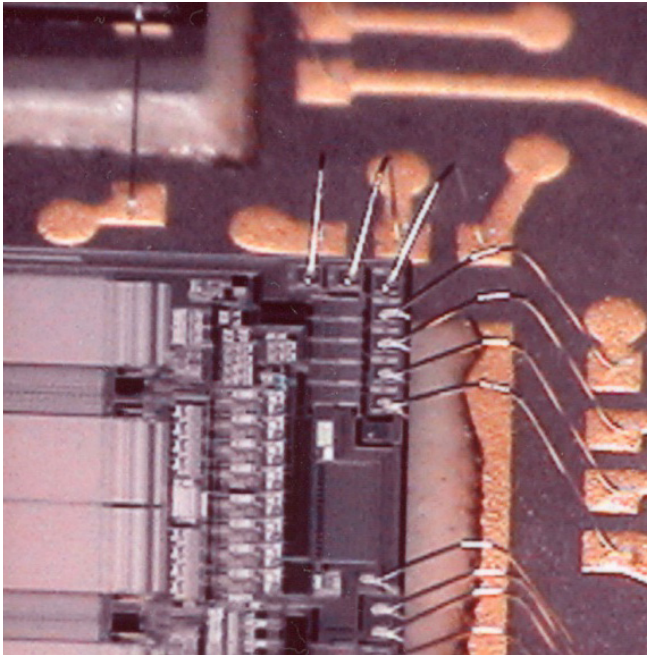
NEOTech designed and developed several standard telemetry modules based on our customer's schematic diagrams. The design activity included the mechanical design of the housing and the layout and analysis of the PCBA's. As in the control board design, the technology chosen was Chip-on-Board technology. Again this technology provided us with higher packaging density and lower mass. This reduced both the system size and mass, vital for achieving the OEM's requirements.

SIMULATION AND VALIDATION FOR ADVANCED RF MICROELECTRONICS

NEOTech engineers utilize state of the art tools (Ansys HFSS, SI Wave and Microwave Office) for 3D electromagnetic field simulation when designing these products to ensure they meet the stringent signal integrity demanded by these high-frequency and high-speed applications. NEOTech Engineers use these tools as a specialized design platform for power integrity, signal integrity, and EMI analysis of IC packages and PCBs. With this we can help model, simulate, and validate high-speed channels and complete power delivery systems typical in miniaturized control and telemetry module electronics.

Successful design of microelectronic space control boards and telemetry modules of geostationary communication satellites require

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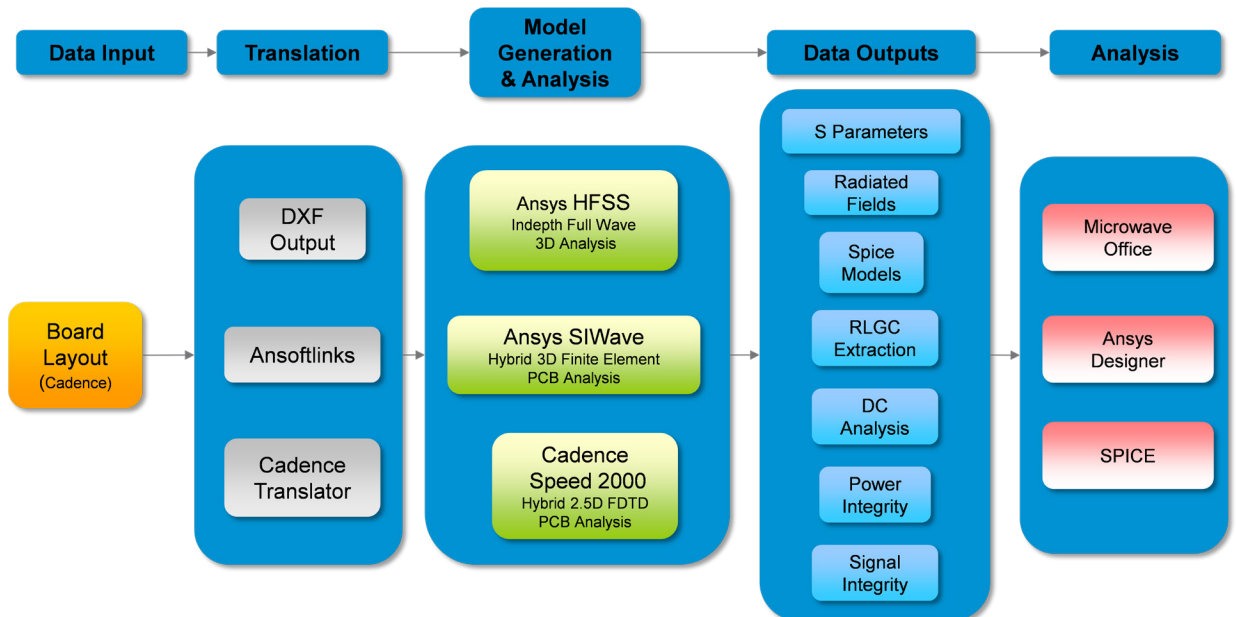
power integrity, signal integrity, and thermal integrity co-analysis. NEOTech engineers handle the complexity of interconnect design from die-to-die across ICs, packages, connectors, and boards by utilizing these powerful toolsets. With advanced RF and signal integrity simulation, we can help our customers understand the performance of high-speed electronic products long before building a prototype in hardware. This approach enables NEOTech to achieve a faster time to market, reduced costs, and improved system performance of their microelectronic products.

CONCLUSION

Through close collaboration with our customer and implementing high density microelectronic packaging technology, NEOTech designed, fabricated, and tested high reliability modules for use in geostationary satellites. The technology and the assembly skills of our employees allowed the customer to achieve lower system mass and high system reliability.



RF Circuit and Signal Integrity (SI) Design Flow



Electronic Manufacturing Services exceeding the quality requirements of our world's most complex products. NEOTech – an industry-leader specializing in high-reliability programs for the Aerospace and Defense, Medical Device, and Industrial Technology markets.

(818) 676-9058

HEADQUARTERS
9340 Owensmouth Ave
Chatsworth, CA 91311

www.neotech.com

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