AND9167/D

DO-254 Certification Support for Commercial Aircraft Manufacturers

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APPLICATION NOTE

Introduction

In 2005, worldwide aviation safety agencies including the Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) began enforcing a new design assurance standard for hardware. The RTCA/DO-254 standard was created to ensure the highest level of safety for electronic airborne systems. Initially intended to apply to all levels of electronic design, the FAA reduced the scope based on industry feedback for cost of implementation. There are five Design Assurance Levels (DLAs) contained in this standard: A – Catastrophic Failure, B – Hazardous/Severe Failure, C – Major Failure, D – Minor Failure and E – No Effect. FAA Advisory Circular AC20−152, released in June, 2005 stated: "This advisor circular (AC) applies to the manufacturers and installers of products or appliances incorporating complex custom micro-coded components with hardware design assurance levels of A, B, and C. These complex custom micro-coded components include application specific integrated circuits (ASIC), programmable logic devices (PLD), filed programmable gate arrays (FPGA), or similar electronic components used in the design of aircraft systems and equipment. Any airborne system that incorporates ASIC's, PLD's or FPGA's must follow the guidelines contained in DO-254.

Complex Airborne Hardware

The DO-254 standard applies to complex airborne hardware. According to the specification, a hardware item is considered "complex" if a comprehensive combination of deterministic tests and analyses cannot ensure correct functional performance under all foreseeable operating conditions. For complex devices, a rigorous, structured design and verification process takes the place of exhaustive testing. Demonstrating that the development and verification of complex hardware complies with this process is the objective of DO-254.[1]

ON Semiconductor & DO-254 Support

ON Semiconductor's digital ASIC design flow and the methodology it employs, fully supports the stringent requirements of commercial aircraft manufacturers that need to obtain DO-254 certification. A DO-254 compliant solution is an essential aspect of any system-on-a-chip designed for use in flight critical avionics applications. ON Semiconductor has chosen Mentor's ReqTracer™ tool to facilitate the mapping, traceability, implementation and configuration management required by DO-254. ReqTracer links, manages and tracks hardware requirements from multiple sources throughout the design process, provides easy documentation and reports at any stage, and manages the impact of requirement changes. The result: better control and predictability of design schedules and improved overall product quality.[2]

ASIC Design Flow

Figure 1 depicts a typical ASIC development flow. Customer reviews occur throughout the cycle as illustrated, confirming that all requirements are met and documented in accordance with the DO-254 standard. The flow begins with a detailed specification review where ON Semiconductor and the customer agree on the goals of the ASIC development. These specification requirements are entered into the ReqTracer tool and will be evaluated throughout the development process. Once the requirements have been finalized, ON Semiconductor will create a conceptual design.

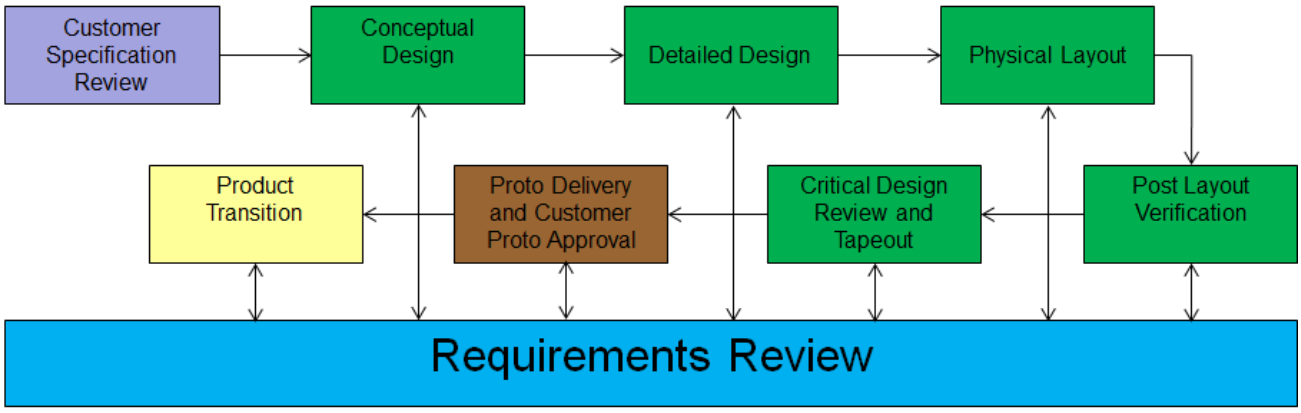

Figure 1. ON Semiconductor's Digital ASIC Flow

Conceptual Design

Utilizing a customer provided RTL or gate level netlist, verifications are performed to confirm that the design can be implemented per the specification. These verifications include but are not limited to synthesis/optimization, netlist translation/optimization, design for test (DFT) insertion, package development or verification, initial power analysis and initial simulation results. During the conceptual design phase, derived requirements, those additional requirements that are inferred from the ASIC specification, will be added to the requirements specifications. The scope of the project is approved and the detailed design phase begins.

Detailed Design

The customer will provide ON Semiconductor a revised RTL or gate level netlist that incorporates any of the changes identified during conceptual design. In the design phase, RTL checking or netlist translation/optimization, Intellectual Property (IP) and DFT insertion, static timing analysis and pre-layout simulations are performed and compared to the specification requirements. Customer approval completes the design phase of the program.

Physical Layout, Post Layout Verification and Critical Design Review

Upon approval of the design, physical layout and post layout verification are performed and completes the ASIC development cycle. Here the post layout netlist and package/pin definition are completed. Final design verification and sign-off documentation is prepared and sent to the customer for approval. A critical design review will be held to confirm that all design aspects have been met.

Prototypes and Product Transition

After receiving final design approval, ON Semiconductor will tape out the design, create fab reticles, fabricate wafers, assemble and test package units and ship prototypes. Customers will evaluate the prototypes at the system level against design objectives. Prototype approval completes the development phase and ON Semiconductor will then transition the ASIC to production.

DO-254 Documentation

Throughout the design process, a significant amount of documentation is generated and supplied to the customer. This includes a design plan, requirements specification, test plan, verification plan, verification report, trace tree, and trace reports. The documentation can be verified and traced to the origin of the collected data and adheres to the stringent requirements for DO-254 certification.

Configuration Management

ON Semiconductor's configuration management process ensures that all elements used to create the ASIC (ie: design library version number) are documented and accessible during the life of the program.

Summary

ON Semiconductor has demonstrated their ability to meet DO-254 requirements on past ASIC designs. With the processes and tools we have in place, we can provide our customers with an ASIC solution that supports DO-254 certification. Contact your local sales office to learn more about how ON Semiconductor can help meet your design objectives.

REFERENCES

[1] Dr. Paul Marriott, Anthony D. Stone. "Understanding DO-254 Compliance for the Verification of Airborne Digital Hardware". White Paper, October, 2009. Synopsys.

[2] "ReqTracer: Managing Requirements in your Design Flow". Data Sheet. Mentor Graphics.

ReqTracer is a trademark of Mentor Graphics.

PUBLICATION ORDERING INFORMATION

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