CADY

Case Study

CADY's AI-powered technology effectively identified two critical errors in a schematic design during its final stage, eliminating the need for a re-spin.

Introduction

In early 2022, an American aerospace manufacturer became an early adopter of our product. This collaboration took place approximately a year prior to the commercial release. The company shared their intricately designed electrical schematic and provided us with a comprehensive feedback document based on the inspection report they received. The feedback proved to be immensely valuable, as it included a detailed performance analysis of the system. It highlighted genuine errors, identified deficiencies, and offered valuable suggestions for enhancements. We invested a significant amount of time studying the report thoroughly, addressing the identified issues, and implementing necessary improvements.

This case study delves into the analysis of two distinct boards conducted by CADY. In both instances, the designer identified specific findings that required attention and categorized them as "Need to fix."

Inspection Report Overview

CADY’s report includes a variety of findings, ranging from wrong input voltages to connection instruction violations. The system's comprehension of datasheet information leads to an average accuracy rate of 80% in its findings. Each finding is presented in a new line containing a drop-down selection where the user can mark the finding as “Need to Fix” or “Skip”. “Need to Fix” is quite straight forward, whereas in the “Skip” option the user has a choice to ignore the alert due to intentional design or due to insignificance. The rest (20%) are false positive alarms (not design errors) that can easily be classified by the user, as the system provides information in the report regarding the information’s origin in the datasheet, that led the system to issue that specific alert.

In over 65% of the inspected projects, at least one of the findings is marked as "Need to fix", meaning that the finding is accurate and significant, and the user fixed it to improve their design based on CADY's report.

Let's dive deeper into the report findings:

1st Board
Pull-up Resistor Value And Best Practice Recommendation

In this board, the system detected the voltage controller, TPS3808G125QDBVRQ1, in both the Netlist and BOM and successfully matched it to the corresponding entry in CADY's database. Through the system's NLP algorithm, which analyzed the component's datasheet, it was inferred that pin 1 (RESET#) should be connected to a pull-up resistor. **The recommended value for this resistor is between 10 kΩ and 1 MΩ**.

Consequently, the system scanned through the netlist and discovered that this particular pin was indeed connected to a pull-up resistor. However, it identified a discrepancy: **the resistor's value was lower than the specified minimum of 10 kΩ**. Consequently, the system issued an alert regarding the mismatch between the connected pull-up resistor's value and the required range stated in the datasheet. Utilizing a pull-up resistor with a value lower than necessary may have several potential consequences:

1. Increased power consumption: A lower resistance value draws more current from the power source when the input is pulled high, resulting in increased power consumption.
2. Slower signal rise time: Pull-up resistors are commonly employed to ensure a smooth transition of a signal from low to high when the signal is not actively driven. A lowervalue pull-up resistor can cause a faster rise time, leading to a quicker signal transition. However, if the signal source has limited current-driving capability, a lower-value pull-up resistor may result in a slower rise time due to increased loading.
3. Reduced noise immunity: Pull-up resistors also contribute to providing noise immunity by establishing a known state for the signal when it is not actively driven. With a lowervalue pull-up resistor, the signal becomes more susceptible to noise since it offers less resistance against external interference. This heightened vulnerability to noise can lead to an increased likelihood of false triggering or incorrect readings.
4. Compatibility issues: If a lower-value pull-up resistor is connected to a device or integrated circuit (IC) that expects a higher-value pull-up resistor, compatibility issues may arise. The circuit may not function as intended, resulting in unpredictable behavior or errors. value pull-up resistor can cause a faster rise time, leading to a quicker signal transition. However, if the signal source has limited current-driving capability, a lowervalue pull-up resistor may result in a slower rise time due to increased loading.

Furthermore, the designer made changes to the schematic based on two additional findings, which were obtained from a different perspective. CADY not only verifies consistency between instructions in the datasheet and the schematic but also offers from a different analysis method that can be configured. One of these recommendations involved confirming the presence of a capacitor connected to Ground on every reset net in the schematic. The user implemented this recommendation.

Adding a capacitor to the reset pin stabilizes voltage levels, prevents false resets by maintaining a stable voltage, and ensures reliable operation, particularly in noisy environments.

Consequently, utilizing the system's capability to classify the function of each pin in every component (such as Power , I/O , enable , and specifically, in this instance, reset), the system analyzed the schematic and identified two separate reset pins that lacked a connection to Ground via a capacitor. Once the user received the report they marked these findings as "need to fix" and promptly added capacitors to both nets.

2nd Board
Operating Ambient Temperature Range Mismatch

CADY's system utilizes the datasheet of each component to detect the operating ambient temperature range. In this case, the system successfully identified the operating temperature range for temperature range of one of this board's voltage regulators, UA78M33CKVURG3, as stated in its datasheet. The identified range for UA78M33CKVURG3 was 0°C to 125°C.

Subsequently, the system cross-referenced the ambient temperature range selected by the user for this specific design (-40°C to 85°C) with each component in the design. The analysis discovered and alerted that UA78M33CKVURG3 is not designed to operate below 0°C.

Using a component in a colder environment than its specified temperature range may lead to malfunction, reduced performance, mechanical stress, condensation issues, increased power consumption, and potential warranty or liability concerns. It is important to select components that are suitable for the intended temperature range to ensure reliable operation.

Consequently, the designer marked the finding as “need to fix”, and replaced the component.

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About CADY

CADY uses AI technology to perform automatic inspection and verification of electrical schematics - enabling clients to improve and expedite the design process, save money & resources, reduce time to market and contribute to the quality, reliability, and safety of the final product. CADY's system realizes requirements and properties of the components in the schematic from their corresponding datasheets and checks them against the schematic wiring connections to detect errors.

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