DATASHEET

Saber Electrical System Designer

Design and verify electrical systems, quickly and reliably

Overview

The complexity of the electrical system in today's cars and commercial vehicles has increased tremendously over the last few decades. The expansion of infotainment and the addition of numerous safety systems has multiplied the number of wires and so is the case with aerospace and industrial applications. The move to hybrid and electric motors introduced high voltage to a low voltage environment. To add to this, the ongoing development of vehicle platforms is shared and designed by teams across the world. These factors result in huge and complex designs that need to be designed efficiently and verified quickly and reliably. Design teams working on these platforms are under constant pressure to reduce the cost of the design and improve the design process. These challenges are universal for the development of all electrical systems.

SaberES Designer™ enables design teams to address these challenges by providing an integrated process for electrical system design from concept to manufacturing. SaberES Designer minimizes data entry, manages complex, system-wide design variants, enables concurrent engineering, maintains data integrity, and allows efficient exchange with 3D CAD systems.

SaberES Designer is the Only Completely Unified Tool for Electric System Design and Verification

- Intuitive tool for developing functional and physical electrical system designs
- Integrated data flow for electrical system design from concept to manufacturing
- Single database ensures correct by construction and eliminates data translation errors
- Built-in and extensible design verification

Top-Down “connected” Design Flow

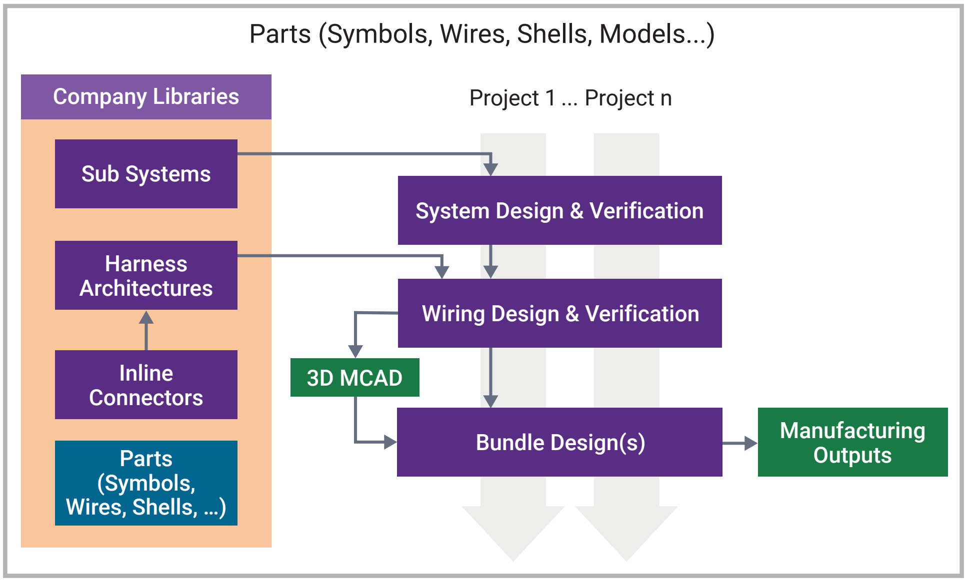


Figure 1: SaberES Designer design flow

To handle the increasing complexity of the designs, SaberES Designer uses a design flow that allows the user to compile the complex design step by step. The SaberES Designer design flow ensures one-time entry for all items in the design. Each part added into the flow gets selected from company databases and libraries. The flow is modular and structured in a way that can be adjusted to fit the company’s needs. The typical process starts with a logical design that represents a subsystem or function.

The symbols are selected from the company library and the other parts needed are selected from the company database. When starting a new platform design, the desired subsystems or functions are selected and combined into a full logical design of the entire system where all functions and options are defined.

This logical design is used to start the physical design, where the physical attributes are selected from the company database. Signals turn into wires, where the physical attributes will be selected form the database. Decisions have to be made on how to connect a logical node, such as can a multi-crimp be used, or will splices or splice connectors be used. Some wires, like CAN-busses, will be assigned to a twist or multi-core cable. This is done by selecting a cable from the database and assigning the wires to the available slots.

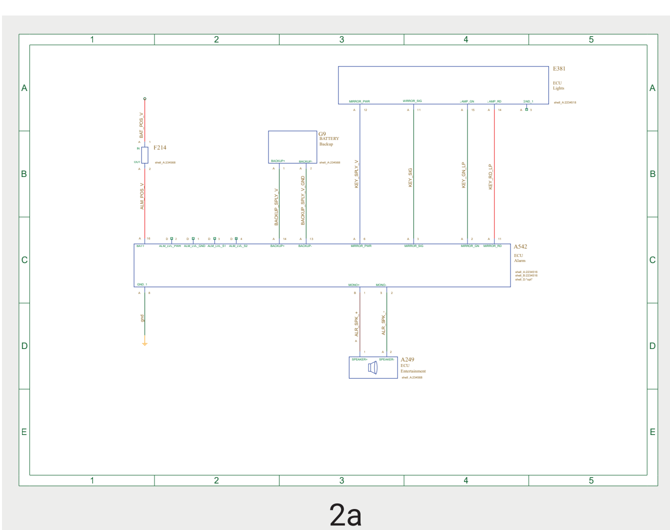


Figure 2a: Functional design

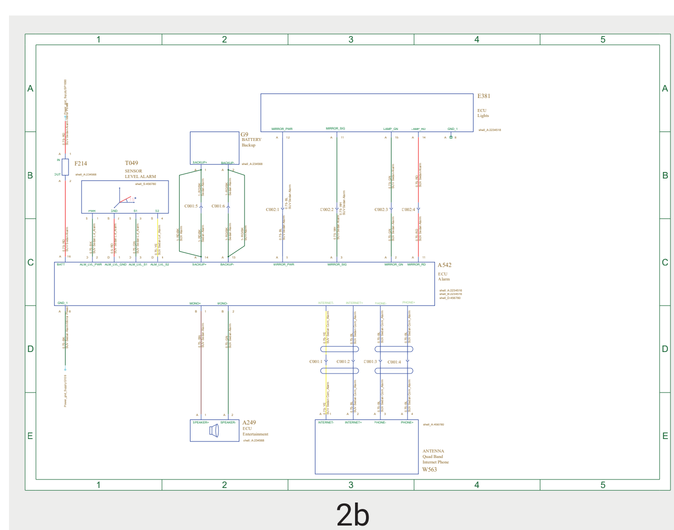


Figure 2b: Physical design

Part of the design process of the physical design is to divide the design up into geographical areas using inline connectors. This process can be done manually or by using a Harness Architecture design to automate that part of the flow.

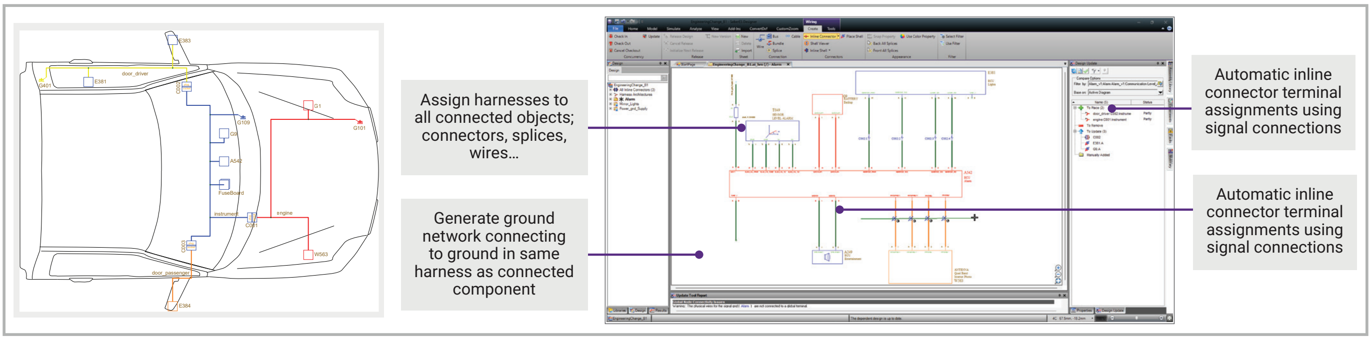


Figure 3: Harness architecture design and design synthesis

Harness Architecture:

- Reduces the manual entry of data, which reduce the chance of introducing errors into the system
- Adds automation to the creation of Wiring Designs, reducing the time engineers spend creating schematics
- Helps take a vehicle's entire electric system and break them into manageable geometric zones
  - Allows the definition of how the geometric zones are connected early in the design process before physical wires are designed
  - Provides a clear visual indication of an entire vehicle's electric system and where harnesses are installed within a vehicle. This provides an excellent set of graphics for design reviews
- Facilitates the standardization of connectors across vehicles using libraries of connectors and libraries of topologies
- Enables design constraints on connectors, such as wire diameters and signals that can/cannot be placed next to each other in connectors
- Ensures the consistency of data between System Designs, Harness Architecture Designs, and Wiring Designs by using a single database with an update tool that automatically updates all designs when data is changed

Variant Handling and Filtering

An important part of designing and maintaining a big and complex design is managing the design variations. While the wiring design will hold all possible options for all possible vehicles, the designer still needs to design a wiring harness for an individual order.

In the physical design, all items will be assigned a harness group, which corresponds to a geographical area, and design options. With the use of these attributes, design filters can be created for the wiring harness designs. The filters also can be reused to create exports and simulate the design.

- Generate 150% wiring designs for electrical systems with different variations
- Assign feature options to components and wires in wiring designs
- Use Assembly Library to graphically select feature options and generate variant-dependent buildable harnesses

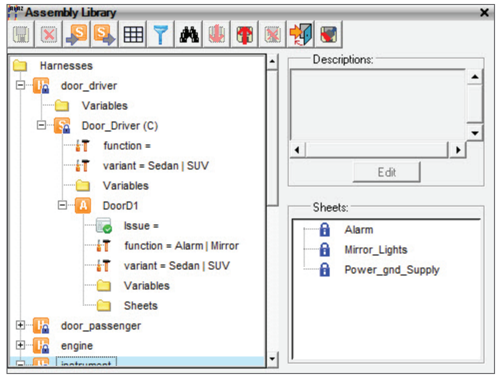


Figure 4: Assembly library

When the buildable harness is defined, the next step is to design the layout of the wiring harness. This can be done manually or by importing from a 3D MCAD tool. From the company library additional parts, such as back shells and protective hosing, are placed.

- Easily export wiring design data to 3D MCAD tools
- Conversely, import placement and routing data from 3D MCAD tools
- Use SaberES Designer Table Manager to quickly generate ASCII files for custom export, like bill of material tables
- Generate wire harnesses from connectivity, wiring design, and variant information
- Set connector symbol position and define desired harness segment routings
- Reuse geometrical information, such as length, from the 3D MCAD tools
- Project 3D information from 3D MCAD tools in 2D drawing
- Select viewing perspective, rotation, and scale of the projection

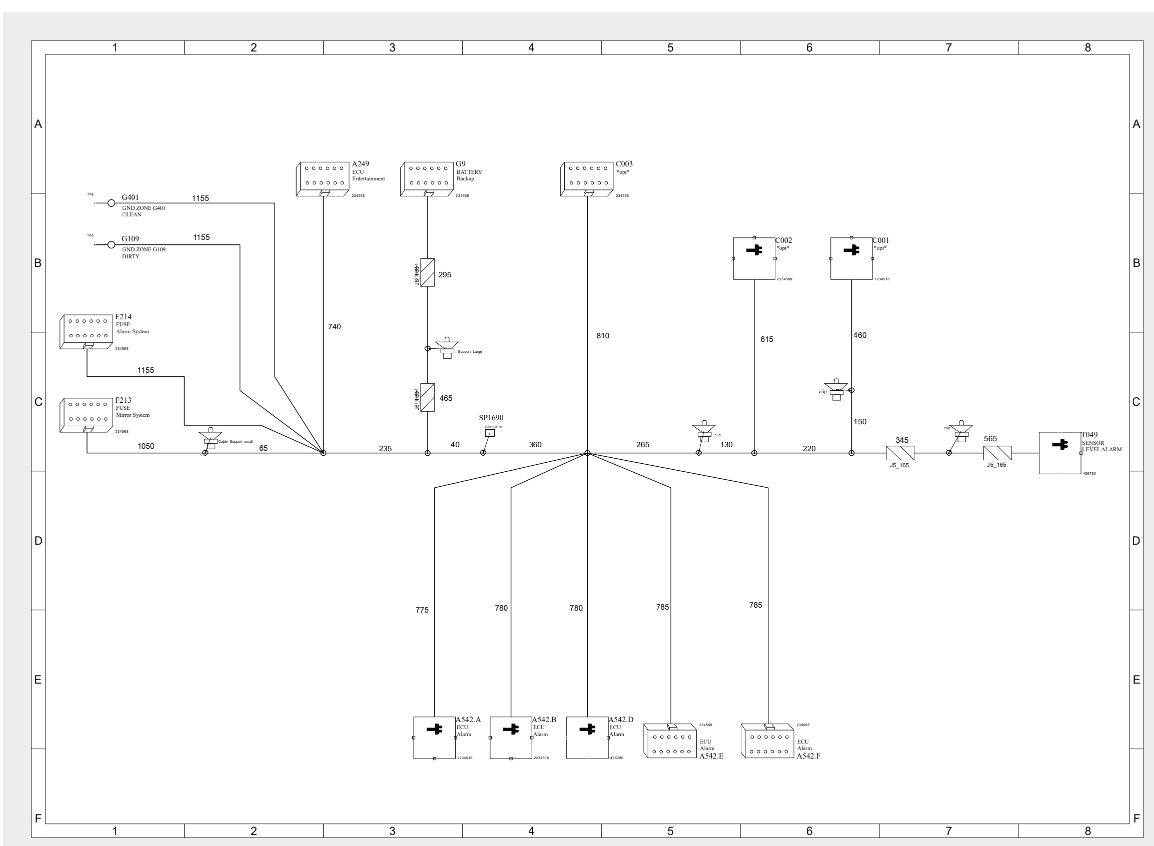


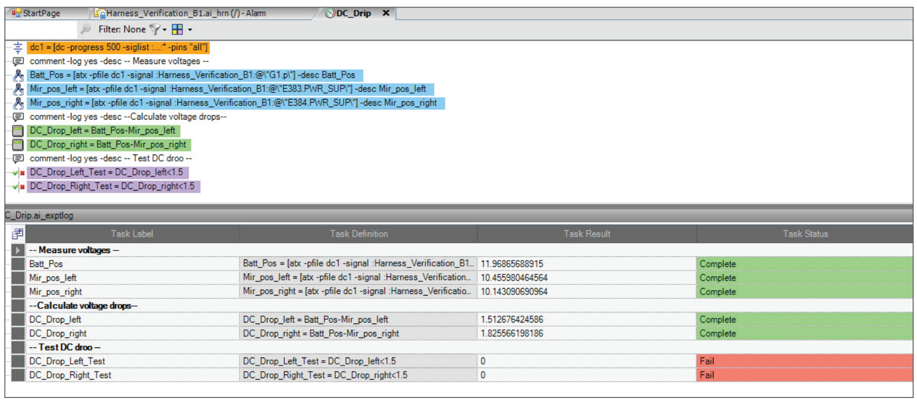
Figure 5: Harness drawing

Verification of Electrical Systems

The increasing complexity of the design and design variations increased the need for an alternative way of verifying the design. The traditional way of building and measuring a physical prototype is costly both in time and money. On top, it is impossible to validate all design variations. Simulation allows for earlier, more detailed, and complete verification of the design.

Voltage Drop and Over-current

- Implement reusable verification simulations using SaberES Designer Experiment Analyzer
- Use built-in DC simulation capabilities to verify voltage drop and overcurrent to determine fuse sizes, cross-sectional areas of all wires, existence of sneak paths, etc
- Back-annotate simulation data and probe critical nodes to quickly identify problem areas



Task Label	Task Definition	Task Result	Task Status
-- Measure voltages --			
Batt_Pos	Batt_Pos = [atx -pfile dc1 -signal :Harness_Verification_B1...	11.96865688915	Complete
Mir_pos_left	Mir_pos_left = [atx -pfile dc1 -signal :Harness_Verification...	10.455980464564	Complete
Mir_pos_right	Mir_pos_right = [atx -pfile dc1 -signal :Harness_Verificatio...	10.143090690964	Complete
--Calculate voltage drops--			
DC_Drop_left	DC_Drop_left = Batt_Pos-Mir_pos_left	1.512676424586	Complete
DC_Drop_right	DC_Drop_right = Batt_Pos-Mir_pos_right	1.825566198186	Complete
-- Test DC droo --			
DC_Drop_Left_Test	DC_Drop_Left_Test = DC_Drop_left<1.5	0	Fail
DC_Drop_Right_Test	DC_Drop_Right_Test = DC_Drop_right<1.5	0	Fail

Figure 6: Simulation experiment

Simulation for Robust Design

- Verify transient behavior of high-speed systems including vehicle networks
- Analyze parameter sensitivity, and worst-case behaviors
- Optimize the design for component variations and shifts in operating conditions
- Quickly select and configure hardware faults directly from the SaberES Designer wiring design
- Verify functional safety of electrical systems through automated fault injection
- Export functional safety simulation results From SaberES Designer Experiment Analyzer to document fault coverage and support functional safety flows

For more information about Synopsys products, support services or training, visit us on the web or at synopsys.com or contact your local sales representative.

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