Closing the gap between requirements management and system design using the COSIDE® Jama integration

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Infineon

Table of contents

1 Motivation 3

2 Requirements import 6

3 Tracing strategy 12

4 Parameters extraction 16

5 Outlook 18

Table of contents

1 Motivation 3

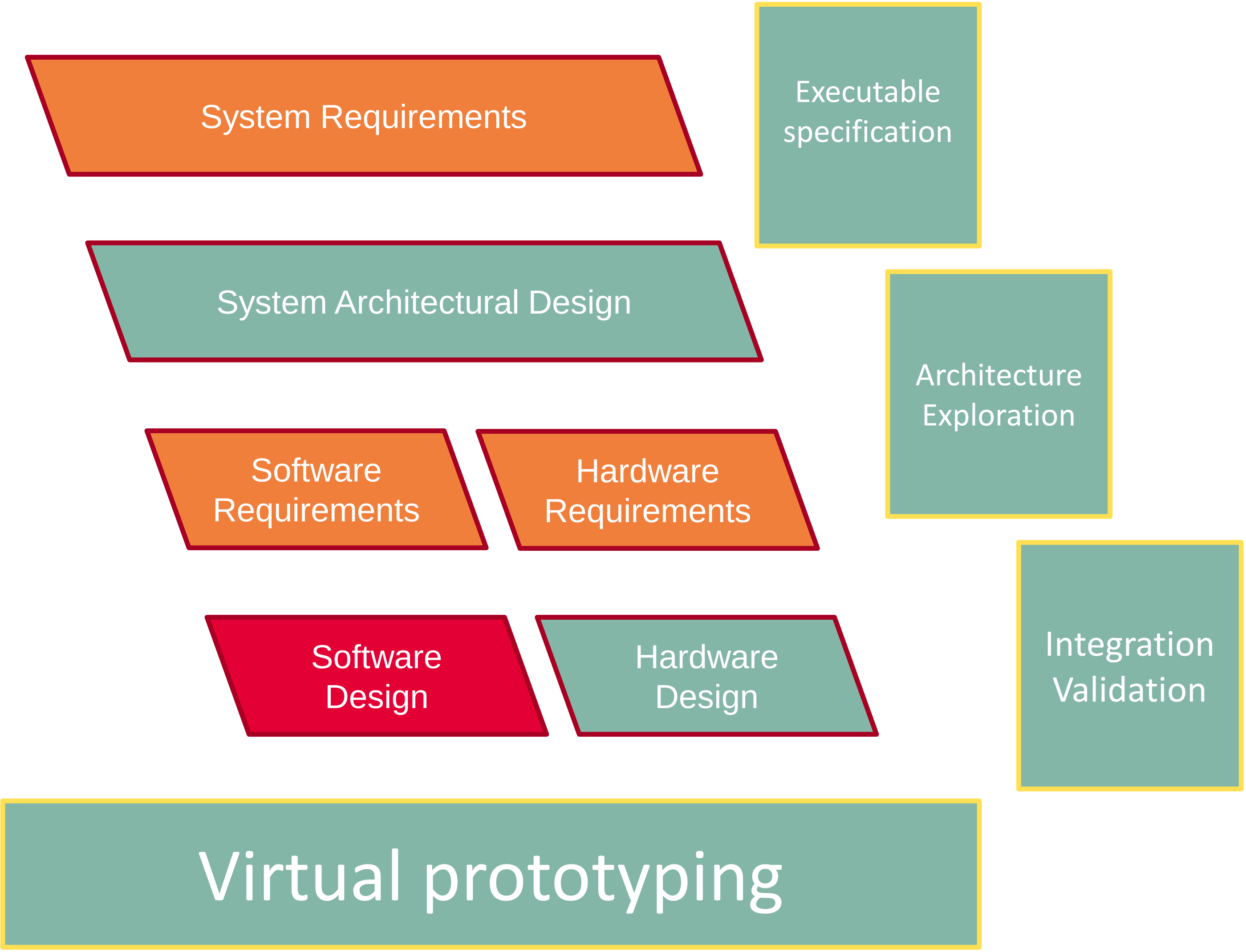
2 Requirements import 6

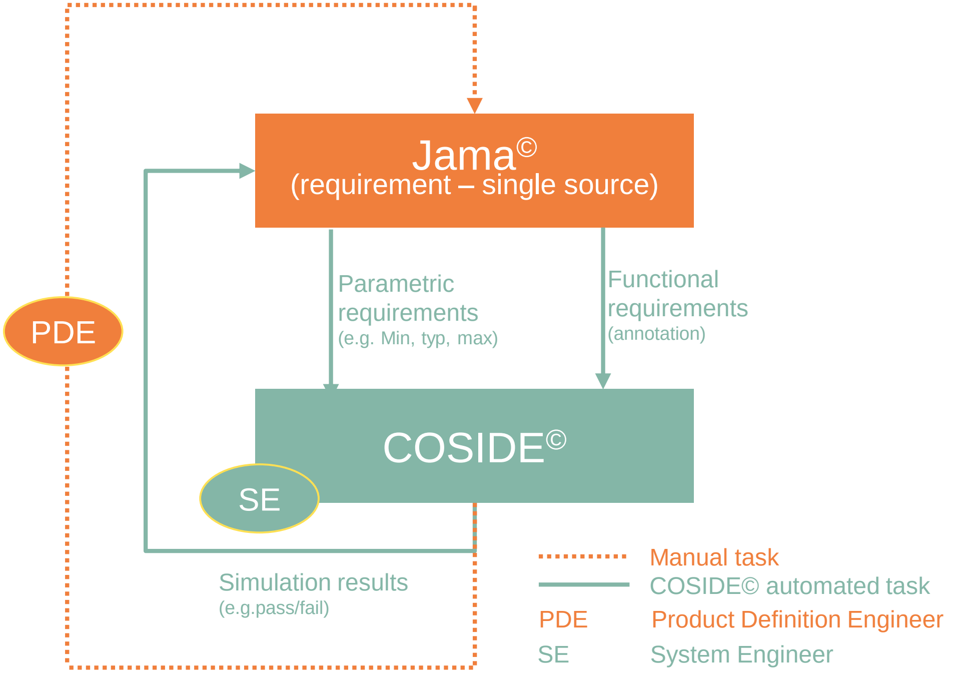
3 Tracing strategy 12

4 Parameters extraction 16

5 Outlook 18

Tracing requirements to system model





Motivation

- Safety critical systems development involves requirements traceability
- Fulfil safety guidelines ISO26262, DOC178C, Automotive SPICE/ISO
- Systematic approach:
  - Document stakeholder needs processing
  - Minimize project risk
  - Manage requirements change
- Bridging the gap to the system/concept engineering
- Guarantee consistency

Table of contents

1	Motivation	3
2	Requirements import	6
3	Tracing strategy	12
4	Parameters extraction	16
5	Outlook	18

What can be traced from Jama© to COSIDE©

Parametric requirements i.e electrical characteristics:

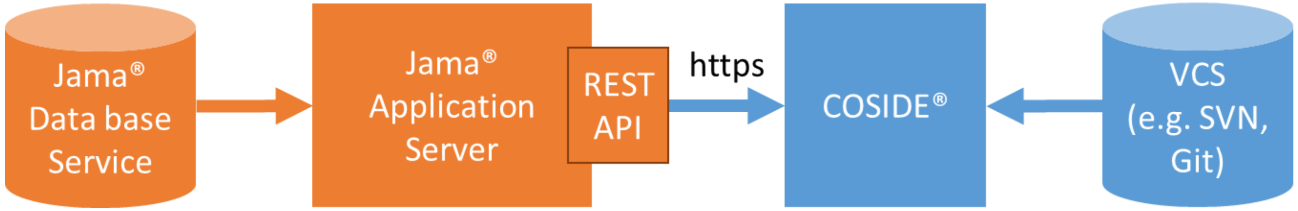
- System operating conditions
  - supply
  - temperature
  - ...
- System limits
  - Input/Output levels
  - Performances

Functional requirements:

- System behavior descriptions
- Algorithms
- States and transitions
- Protections
- Interfaces and protocols
- ...

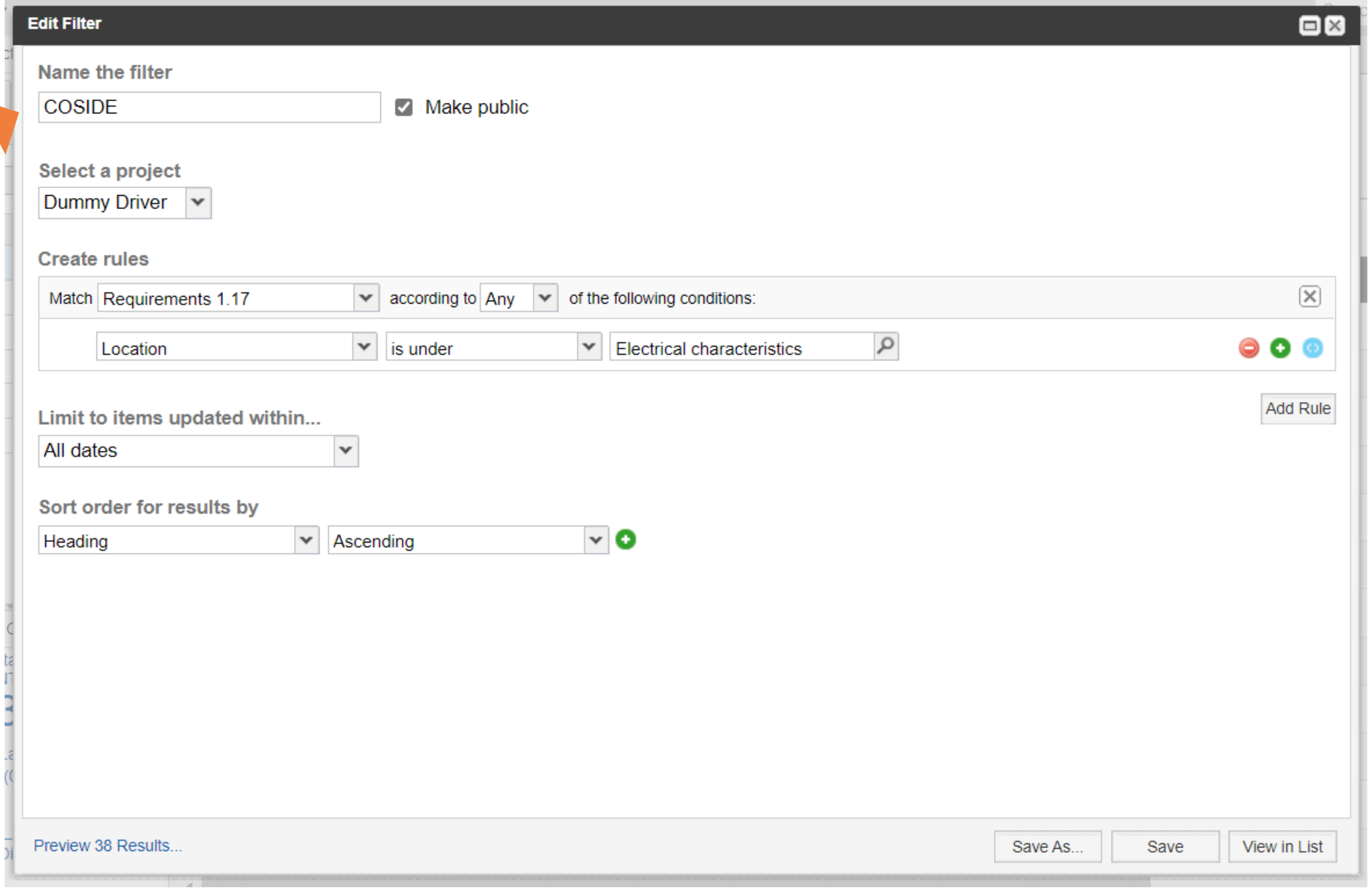
How it works

- Using REST API to query the Jama database
- Importing filtered requirements to COSIDE
- Annotating requirements to system level model



Requirements import

First step is the creation of a dedicated Jama© filter



Edit Filter

Name the filter: COSIDE

☑ Make public

Select a project: Dummy Driver

Create rules

Match Requirements 1.17 according to Any of the following conditions:

Location is under Electrical characteristics

Limit to items updated within...: All dates

Sort order for results by: Heading Ascending

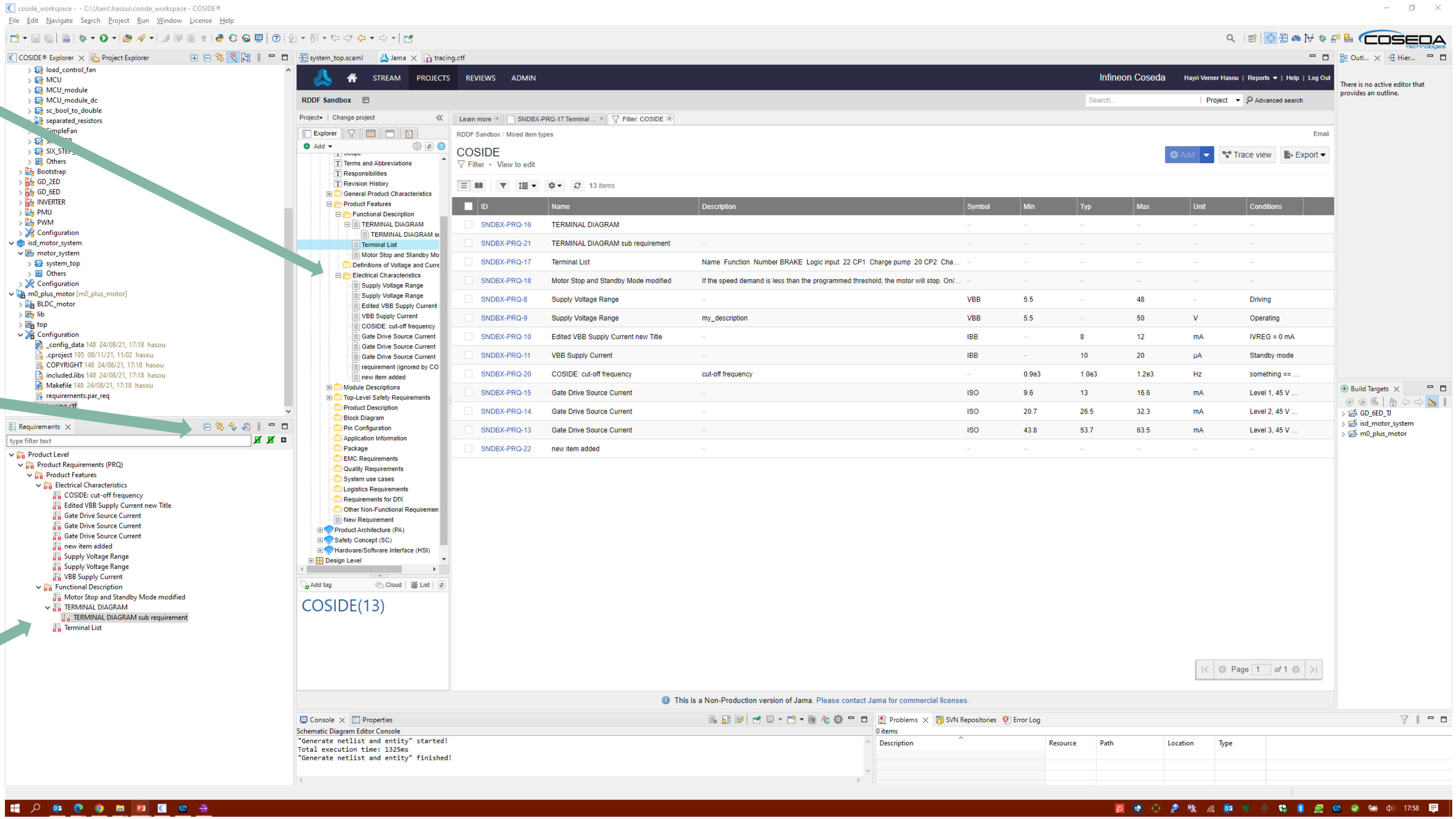
Specific filter name shall be used

Requirements visualization and editing

It is possible to use the embedded browser to edit in Jama

Filter requirements to view by name and by annotation type: create the task list

Requirements view will show the same structure of Jama, but only relevant items are listed



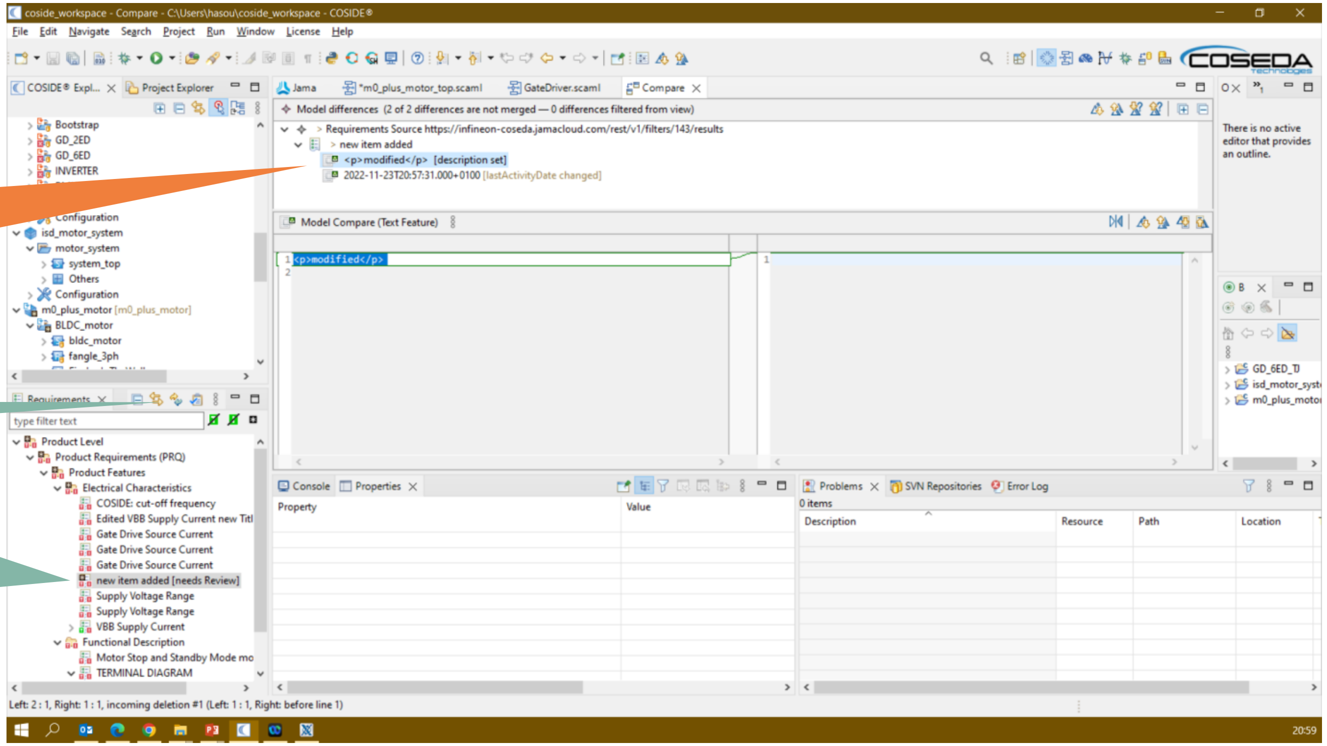
ID	Name	Description	Symbol	Min	Typ	Max	Unit	Conditions
SNDBX-PRQ-16	TERMINAL DIAGRAM		–	–	–	–	–	–
SNDBX-PRQ-21	TERMINAL DIAGRAM sub requirement	–	–	–	–	–	–	–
SNDBX-PRQ-17	Terminal List	Name Function Number BRAKE Logic input 22 CP1 Charge pump 20 CP2 Cha...	–	–	–	–	–	–
SNDBX-PRQ-18	Motor Stop and Standby Mode modified	If the speed demand is less than the programmed threshold, the motor will stop. On/...	–	–	–	–	–	–
SNDBX-PRQ-8	Supply Voltage Range	–	VBB	5.5	–	48	–	Driving
SNDBX-PRQ-9	Supply Voltage Range	my_description	VBB	5.5	–	50	V	Operating
SNDBX-PRQ-10	Edited VBB Supply Current new Title	–	IBB	–	8	12	mA	IVREG = 0 mA
SNDBX-PRQ-11	VBB Supply Current	–	IBB	–	10	20	µA	Standby mode
SNDBX-PRQ-20	COSIDE: cut-off frequency	cut-off frequency	–	0.9e3	1.0e3	1.2e3	Hz	something == ...
SNDBX-PRQ-15	Gate Drive Source Current	–	ISO	9.6	13	16.6	mA	Level 1, 45 V ...
SNDBX-PRQ-14	Gate Drive Source Current	–	ISO	20.7	26.5	32.3	mA	Level 2, 45 V ...
SNDBX-PRQ-13	Gate Drive Source Current	–	ISO	43.8	53.7	63.5	mA	Level 3, 45 V ...
SNDBX-PRQ-22	new item added	–	–	–	–	–	–	–

This is a Non-Production version of Jama. Please contact Jama for commercial licenses.

```
Schematic Diagram Editor Console
"Generate netlist and entity" started!
Total execution time: 1325ms
"Generate netlist and entity" finished!
```

Synchronization flow

- › During the system model development the PDE may release new baselines for the requirements
  - – Capturing of new stakeholder inputs
  - – Results of feasibility and simulations
- › If a requirement is modified, the change must be analized and managed
  - – Change the implementation
  - – Update the test
- › A compare window shows all modifications


coside_workspace - Compare - C:\Users\hasou\coside_workspace - COSIDE®

Model differences (2 of 2 differences are not merged — 0 differences filtered from view)

Requirements Source https://infineon-coseda.jamacloud.com/rest/v1/filters/143/results
new item added
<p>modified</p> [description set]
2022-11-23T20:57:31.000+0100 [lastActivityDate changed]

Model Compare (Text Feature)

```
<p>modified</p>
```

Requirements

- Product Level
  - Product Requirements (PRQ)
    - Product Features
      - Electrical Characteristics
        - COSIDE: cut-off frequency
        - Edited VBB Supply Current new Titl
        - Gate Drive Source Current
        - Gate Drive Source Current
        - Gate Drive Source Current
        - new item added [needs Review]
        - Supply Voltage Range
        - Supply Voltage Range
        - VBB Supply Current
      - Functional Description
        - Motor Stop and Standby Mode mo
        - TERMINAL DIAGRAM

Left: 2 : 1, Right: 1 : 1, incoming deletion #1 (Left: 1 : 1, Right: before line 1)

Change in requirement: differences with previous local version

Synchronize with Jama (receive updates)

Updated item is highlighted

Table of contents

1 Motivation 3

2 Requirements import 6

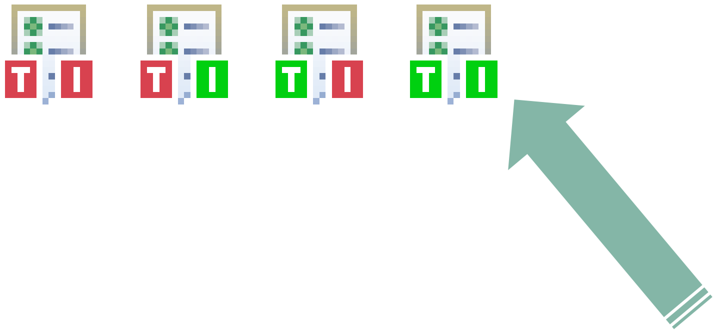
3 Tracing strategy 12

4 Parameters extraction 16

5 Outlook 18

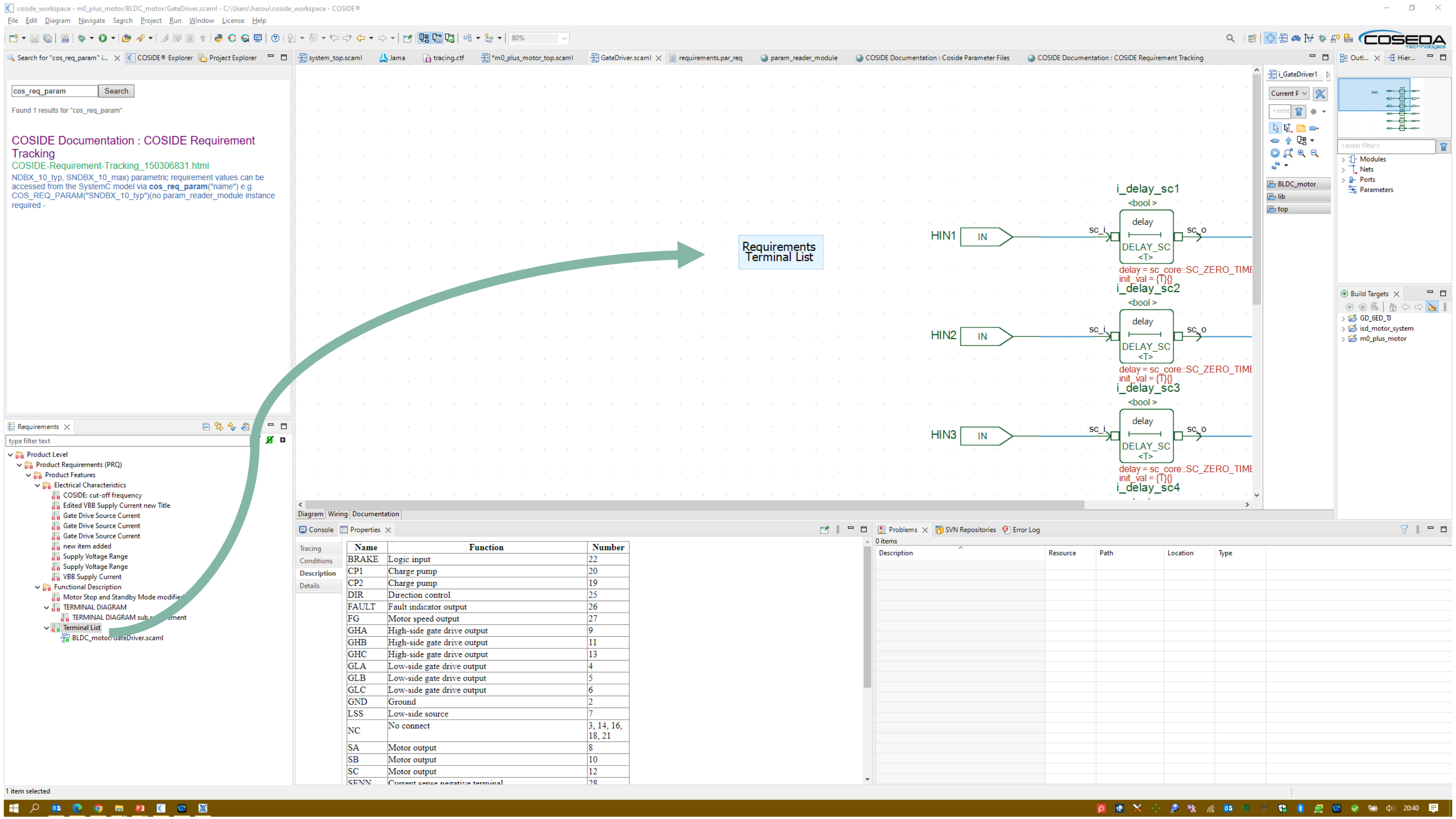
Requirements tracing

- All relevant requirements shall be implemented and tested.
- To implement a requirement, System Engineer must create a relationship with an hardware element like a schematic.
- To test a requirement, it must be annotated to a verification setup.
- Relations are created by dragging requirements on COSIDE objects.
- Traffic light indicators will represent the actual state of each requirement



Implemented and Tested

Functional requirement annotation: implementation



Search for "cos_req_param" i...

cos_req_param Search

Found 1 results for "cos_req_param"

COSIDE Documentation : COSIDE Requirement Tracking

COSIDE-Requirement-Tracking_150306831.html

NDBX_10_typ, SNDBX_10_max) parametric requirement values can be accessed from the SystemC model via **cos_req_param**("name") e.g. COS_REQ_PARAM("SNDBX_10_typ")(no param_reader_module instance required -

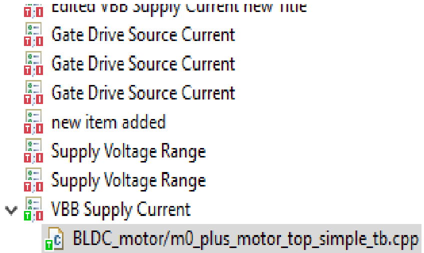
Requirements

- Product Level
  - Product Requirements (PRQ)
    - Product Features
      - Electrical Characteristics
        - COSIDE: cut-off frequency
        - Edited VBB Supply Current new Title
        - Gate Drive Source Current
        - Gate Drive Source Current
        - Gate Drive Source Current
        - new item added
        - Supply Voltage Range
        - Supply Voltage Range
        - VBB Supply Current
      - Functional Description
        - Motor Stop and Standby Mode modified
        - TERMINAL DIAGRAM
          - TERMINAL DIAGRAM sub requirement
        - Terminal List
          - BLDC_motor/GateDriver.scaml

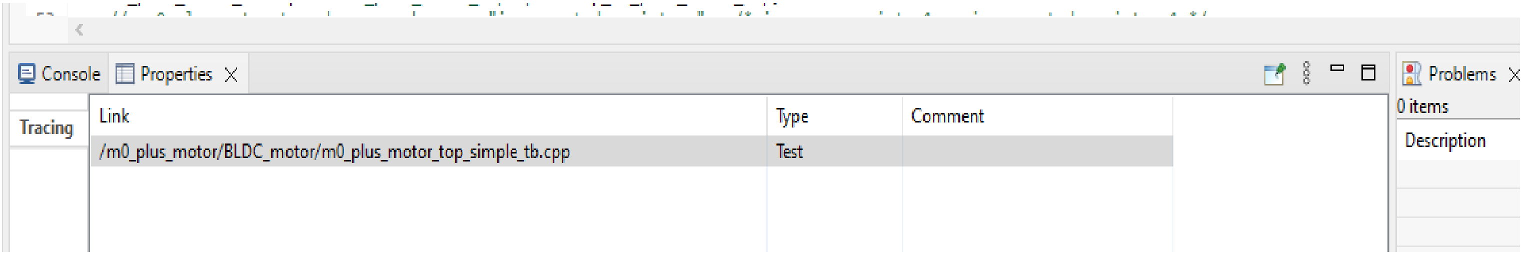
Name	Function	Number
BRAKE	Logic input	22
CP1	Charge pump	20
CP2	Charge pump	19
DIR	Direction control	25
FAULT	Fault indicator output	26
FG	Motor speed output	27
GHA	High-side gate drive output	9
GHB	High-side gate drive output	11
GHC	High-side gate drive output	13
GLA	Low-side gate drive output	4
GLB	Low-side gate drive output	5
GLC	Low-side gate drive output	6
GND	Ground	2
LSS	Low-side source	7
NC	No connect	3, 14, 16, 18, 21
SA	Motor output	8
SB	Motor output	10
SC	Motor output	12
SENN	Current sense negative terminal	28

Functional requirement annotation: test

- Dropping a requirement on the simple testbench source code automatically detects the **Test** annotation type



- Edited VBB Supply Current new Title
- Gate Drive Source Current
- Gate Drive Source Current
- Gate Drive Source Current
- new item added
- Supply Voltage Range
- Supply Voltage Range
- VBB Supply Current
  - BLDC_motor/m0_plus_motor_top_simple_tb.cpp



Link	Type	Comment
/m0_plus_motor/BLDC_motor/m0_plus_motor_top_simple_tb.cpp	Test	

Table of contents

1	Motivation	3
2	Requirements import	6
3	Tracing strategy	12
4	**Parameters extraction**	**16**
5	Outlook	18

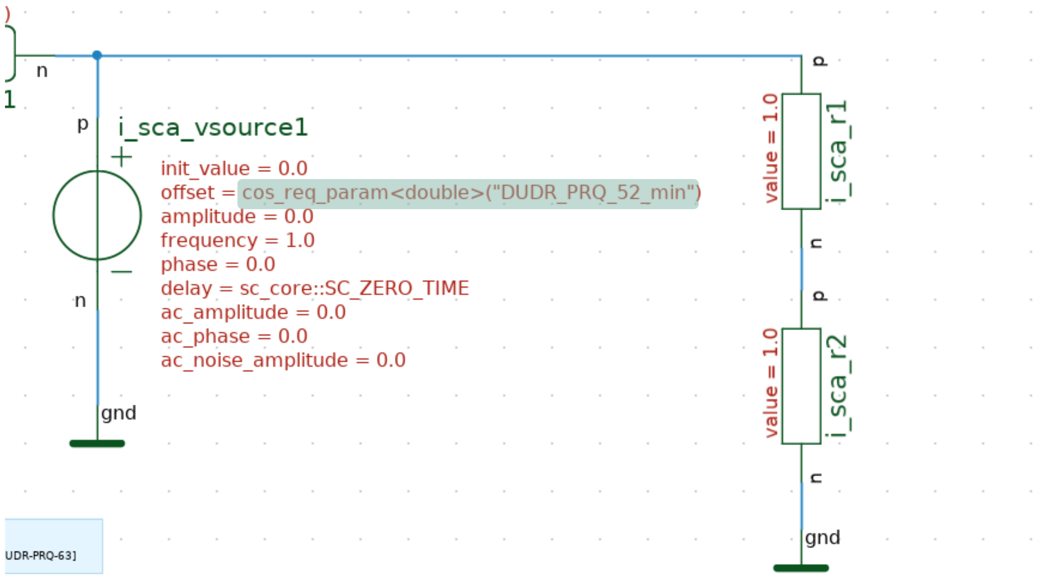
Parametric requirements

- It is common to have nominal values and limits as requirements for electrical characteristics.
  - Example: max supply current in standby mode, in µA
- COSIDE will automatically generate a parameter file with the values defined in JAMA.

```
…
--//--------------------------------------------------
--// VBB Supply Current - [SNDBX-PRQ-11]
--//SNDBX_PRQ_11_min =
SNDBX_PRQ_11_typ = 10
SNDBX_PRQ_11_max = 20
…
```

- These values can be included in the project by using the cos_req_param function

```
…
--//-----------------------------------------------
--// Logic high input voltage - [DUDR-PRQ-52]
DUDR_PRQ_52_min = 700
--//DUDR_PRQ_52_typ =
--//DUDR_PRQ_52_max =
--//-----------------------------------------------
…
```



```
init_value = 0.0
offset = cos_req_param<double>("DUDR_PRQ_52_min")
amplitude = 0.0
frequency = 1.0
phase = 0.0
delay = sc_core::SC_ZERO_TIME
ac_amplitude = 0.0
ac_phase = 0.0
ac_noise_amplitude = 0.0
```

Table of contents

1	Motivation	3
2	Requirements import	6
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4	Parameters extraction	16
5	Outlook	18

Features that should be added

- Highlighting of added / removed requirements
- Automated analysis of parametric requirements
  - parameter sweep
  - Monte-Carlo
  - corner-case
  - Constrained random verification with UVM SystemC
- New items shall be created in Jama
  - Test cases documentation (config)
  - System Architecture references
- Preset of T/I values for a requirement
  - Avoid unnecessary efforts to annotate when verifiability or feasibility analysis has been excluded
- Support of further requirement tools - front-ends
  - Polarion
  - SysML

infineon

Part of your life. Part of tomorrow.