

CUSTOMIZABLE ANALYSIS REPORT (CAR TOOL)

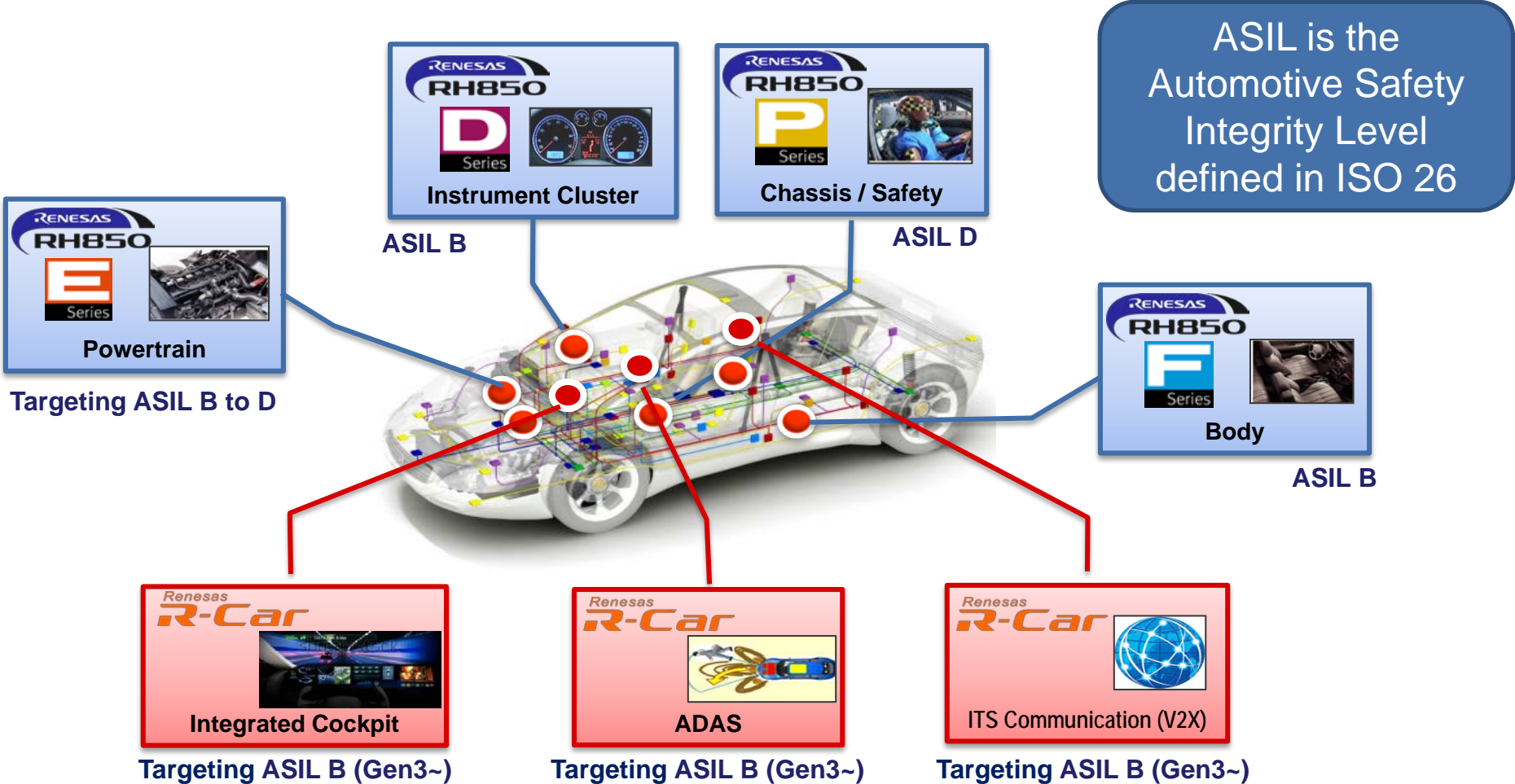
THE RENESAS FMEDA TOOL

RENESAS ELECTRONICS CORPORATION



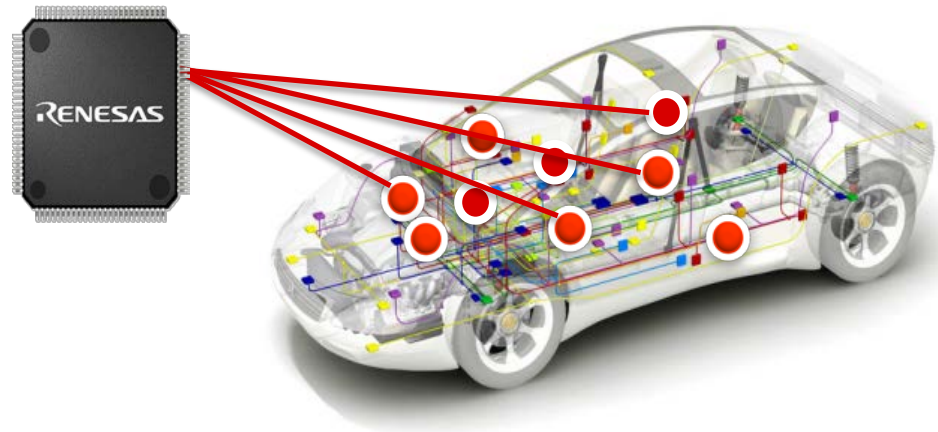
BIG IDEAS
FOR EVERY SPACE

SAFETY IS A MANDATORY REQUEST FOR SEMICONDUCTORS



CHALLENGES IN APPLYING SEMICONDUCTOR TO SYSTEM

- In order to adapt a semiconductor to the customer's system, there are challenges during development. Below are some examples of challenges to realize development that is in compliance with ISO 26262.



Most products are developed as SEooC*, so the safety concept must be modified from assumptions to customer's "real" system.

Circuits are becoming more complex & larger. Calculating the metrics values for all elements is very laborious work.

As users make modifications during revisions of their safety analysis and architecture, a record of changes is required. Managing the revision history is very difficult.

*SEooC: Safety Element Out-of-context

RENESAS IN-HOUSE FMEDA (CAR) TOOL

CUSTOMIZABLE ANALYSIS REPORT

Automatic calculation saves time

Able to select/add Safety mechanisms depending on customer's system

Automatically record a modification history

The screenshot displays the Renesas FMEDA (CAR) tool interface. It features a 'Design Hierarchy' on the left, an 'Analysis Results' table in the center, a 'Numerical Results' table on the right, and a 'Change History' table at the bottom. The 'Analysis Results' table lists various safety mechanisms with their respective Force NSR, Element Path, and SR Status. The 'Numerical Results' table shows failure rates for different mechanisms. The 'Change History' table tracks revisions, including updates to fault coverage and completion of revisions.

ID	Name	Description	Force NSR	Element Path	SR Status
EL_589	SPARE_LOGIC	This entry repres...	Default	SPARE_LOGIC	NSR
EL_590	FLASH_CONFL...	Non Safety Relat...	Default	FLASH_CONFIG_NS...	NSR
EL_591	FLASH_CONFL...	Flash Parameters...	Default	FLASH_CONFIG_SR	SR
EL_594	DEBUG	Debug logic	Default	DEBUG	NSR
EL_595	PAR_NS...	Non Safety Relat...	Default	PAR_NS...	NSR
EL_596	PAR_SR	Safety Related p...	Default	PAR_SR	SR
EL_597	FBIST	This entry compr...	Default	FBIST	SR
EL_598	CHIP	MCU wrapper	Default	CHIP	SR
EL_322	PFSS	Platform Sub sys...	Default	CHIP.PFSS	SR
EL_119	P-BUS_SG...	Slave Group 0 wr...	Default	CHIP.PFSS.P-BUS_SG...	SR
EL_100	ECC_Dec_d	Data ECC Decod...	Default	CHIP.PFSS.P-BUS_SG...	SR
EL_103	ECC_Enc_d	Data ECC Encod...	Default	CHIP.PFSS.P-BUS_SG...	SR
EL_104	ECC_Ctl	ECC Control Log...	Default	CHIP.PFSS.P-BUS_SG...	SR

Results	Entire Design	Selected Hierarchy
λ SP (FIT)	0	0
λ RF (FIT)	1.09E1	1.09E1
λ MPF_L (FIT)	1.49E0	1.49E0
λ MPF_D (FIT)	1.12E2	1.12E2
λ SAFE (FIT)	9.53E-1	9.53E-1
λ NSR (FIT)	2.51E1	2.51E1
Total λ (FIT)	1.5E2	1.5E2
SPFM	91.28	91.28
LPM	98.69	98.69
PMM-F (h ⁻¹)	1.09E-8	1.09E-8

ID	Event type	Change	Time stamp	User name	Module	Attribute	Identifier	Revision
5167	R Revision	Completed Revision 1.01	13/06/2018	a5064833	Cover Sheet	-	-	1.01
5166	Update	From: '90' to '90'	13/06/2018	a5064833	HW Analysis Fault Coverage	Value %	FC_595	101
5165	B Baseline	Approved Baseline 1.00	13/06/2018	a5064833	Cover Sheet	-	-	1.00
5164	R Revision	Completed Revision 0.01	13/06/2018	a5064833	Cover Sheet	-	-	0.01

Reliable data base for Safety mechanisms

Applicable Safety mechanisms, Diagnosis coverage

Flexible parameter changes are possible

Failure rate, Failure type, Failure rate distributions, FTTI, etc.

Able to add data

Failure mode, System safety mechanisms

Easy to control by GUI

Notifies input error/explanation

Parameters can be Automatically calculated

H/W Architectural metrics, Safety goal violation rate

AUTOMATIC CALCULATION SAVES TIME

- GUI CAR tool automatically re-calculates the metric values (SPFM, LFM e.g.) upon user input data modifications (such as diagnostic coverage, Safety-relevance, etc.); the user can easily confirm achievement of their implementation!

The screenshot displays two windows from the GUI CAR tool. The 'Analysis Results' window on the left shows a table of components with columns for ID, Name, Description, Force NSR, Element Path, and SR/NSR. The 'Numerical Results' window on the right shows a table of metrics for the entire design and selected hierarchy.

Results	Entire Design	Selected Hierarchy
λ SPF (FIT)	0	0
λ RF (FIT)	5.01E-1	4.87E-1
λ MPF_L (FIT)	4.64E-1	3.87E-1
λ MPF_D (FIT)	8.47E1	8.26E1
λ SAFE (FIT)	4.53E0	3.04E0
λ NSR (FIT)	9.83E0	3.23E-1
Total λ (FIT)	1E2	8.69E1
SPFM	99.44	99.44
LFM	99.48	99.55
PMHF (h^{-1})	5.02E-10	4.88E-10



Easy to confirm the product's compatibility!!

ABLE TO SELECT/ADD SAFETY MECHANISMS DEPENDING ON CUSTOMER'S SYSTEM

- Very easy to add/modify parameters, and metric values are automatically re-calculated.

ID	Element Name	Effective SM	Value (%)
FC_328	PFSS	Additional_safety_mecha...	99

ID	Name	λ SPF	λ RF	λ MPF_L	λ MPF_D	λ SAFE	λ NSR	Total λ
EL_598	CHIP	0	3.42E-3	0	3.08E-2	0	0	3.42E-2
EL_322	PFSS	0	3.15E-1	0	0	0	0	3.15E-1

Add a safety mechanism

Assign a safety mechanism and DC value to target element

Confirmation of re-calculated metric value

Only 3 steps to modify the safety mechanism.

AUTOMATICALLY RECORD A MODIFICATION HISTORY

- GUI CAR Tool automates revision control and change history generation, so users can easily manage and track what has been changed.

The screenshot displays the GUI CAR Tool interface. On the left is the Design Hierarchy tree with items like SPARE_LOGIC, FLASH_CONFIG_NS, and DEBUG. The main area shows the CoverSheet form with fields for Document Title (CAR tool demo), Document Number (DocNumxxx_V1.01_RV), Product (DEMO), and Variant (die0). Below the form are two tables for revision control. The 'Complete revision' table lists authors and dates. The 'Create Baseline' table lists approvers and dates. A 'Change History' window is open, showing a detailed log of changes with columns for ID, Event type, Change, Time stamp, User name, Module, Attribute, and Identifier.

Authors	Date	Revision	Comment
a5064833	13/06/2018 0...	1.01	
a5064833	13/06/2018 0...	0.01	

Approvers	Date	Revision	Comment
a5064833	13/06/2018 0...	1.00	add aaa

ID	Event type	Change	Time stamp	User name	Module	Attribute	Identifier
5167	Revision	Completed Revision 1.01	13/06/2018	a5064833	Cover Sheet	-	-
5166	Update	From: '90' to '60'	13/06/2018	a5064833	HW Analysis Fault Coverage	Value %	FC_595
5165	Baseline	Approved Baseline 1.00	13/06/2018	a5064833	Cover Sheet	-	-
5164	Revision	Completed Revision 0.01	13/06/2018	a5064833	Cover Sheet	-	-

Automatically record what was changed

CAR TOOL IS NOT JUST A CALCULATION TOOL

- Reference documents (e.g. functional safety work products) can be embedded in the GUI CAR tool and they can be accessed during safety analysis.

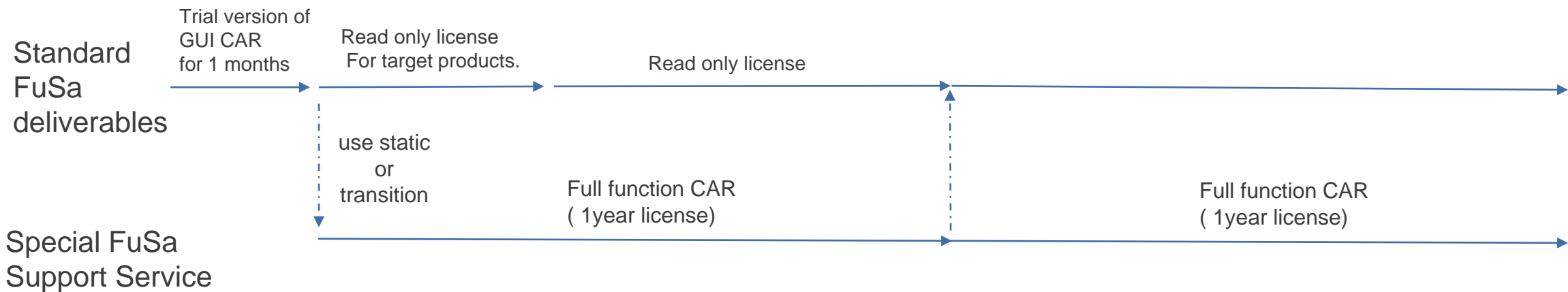
The screenshot displays the CAR tool interface with several key components:

- Design Hierarchy:** A tree view on the left showing components like SPARE_LOGIC, FLASH_CONFIG_NSR, DEBUG, PAR_NSR, PAR_SR, FBIST, CHIP, and F1L.
- HW Description Table:** A table listing hardware elements with columns for ID, Name, Element Path, Description, Size, Size Unit, Nature, Application In..., and FIT Cha. The first row is highlighted: ID EL_589, Name SPARE_LOGIC, Element Path SPARE_LOGIC, Description This entry represents ...
- Change History Table:** A table with columns for ID, File Name, File version, Release, Used, and Referenced in. It lists three documents, with the first one highlighted: ID 1, File Name ABC-AB-17-0562_RH850_F1KM_SRS_rev.1.0, Release 13/06/2018, Used No.
- Documents Panel:** A panel at the bottom showing a list of documents, with the first one highlighted: ID 1, File Name ABC-AB-17-0562_RH850_F1KM_SRS_r..., File version 1.0, Release 13/06/2018, Used No.
- PDF Viewer:** A window on the right displaying a PDF document titled "Safety Application Note" for the "RH850/F1KM Group SAN". The document includes an introduction and a list of sub-sections: Recommended Usage, Failure Control, and Software Test Description.

A blue callout box with the text "Easy to access reference documents for implementation." is overlaid on the bottom right of the PDF viewer.

LICENSE PERIOD

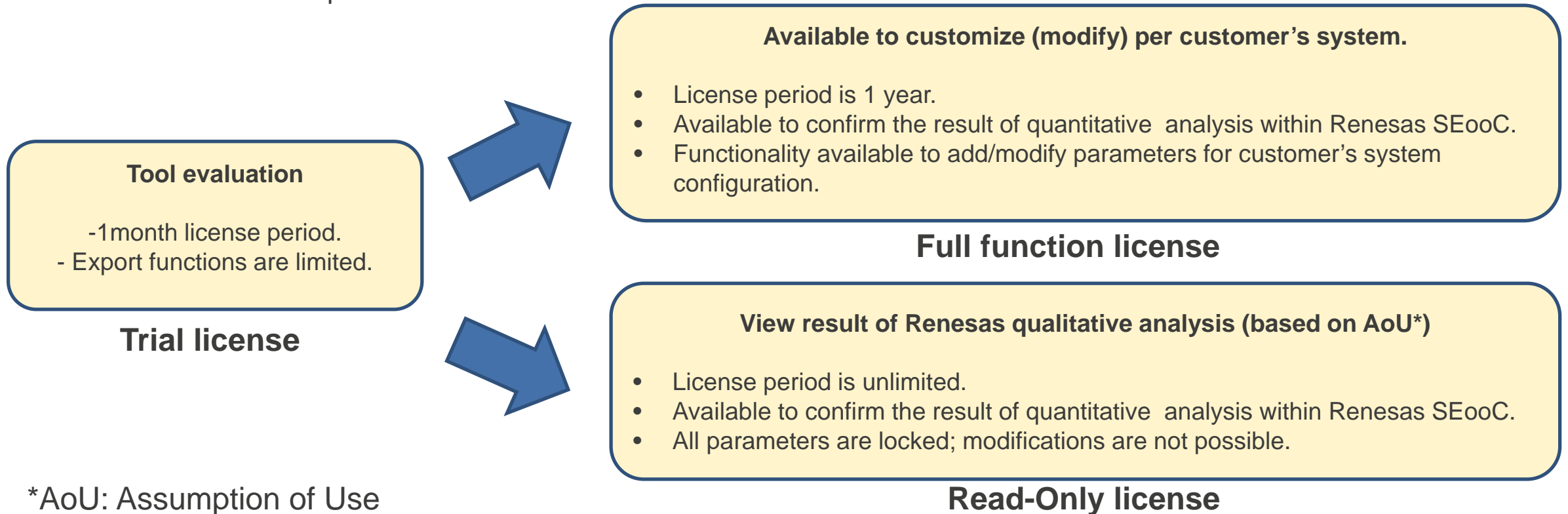
- Two types of licenses are prepared: Full function or “Read-only” license. Customer can choose which license type to use. A Full function license is dynamic and allows for extensive customization.



“Read-only” license is provided to ANY customer as a part of HW offer, but the content cannot be modified; Full function license must be purchased or customization.

LICENSE OVERVIEW

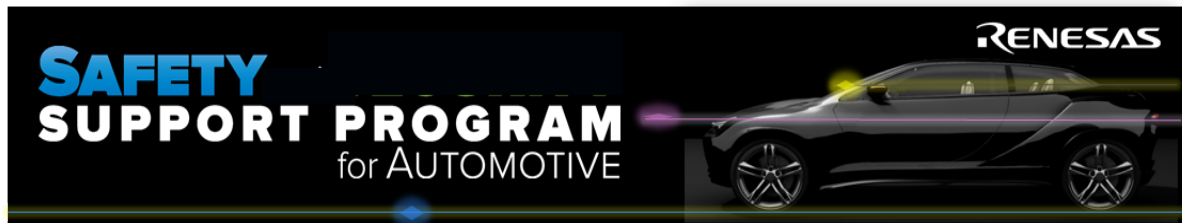
- The difference between full function license and Read-only license is described below. A Read-only license can only confirm the result of Renesas quantitative analysis; for analysis of system configuration, modification using other tools is required.



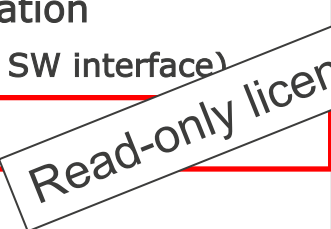

*AoU: Assumption of Use

HOW TO GET GUI CAR TOOL?

- CAR tool is one of the work products in our safety support program.
For details, please contact the local sales team.

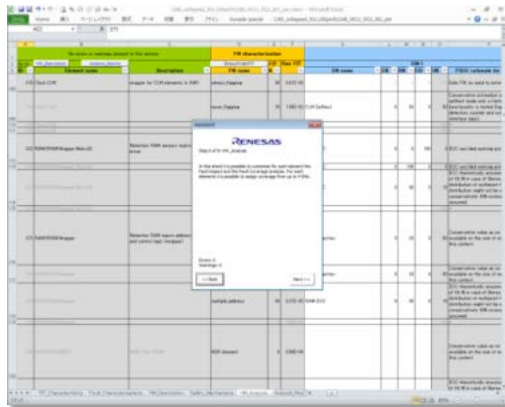


Hardware Safety mechanisms MCU, SoC, A&P 	Software CPU Core self-test Safety Software 	Work products Safety analysis tool, Report, etc. 	Consulting Workshop Development support 
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Standard FuSa deliverables (Free of charge)	
<ul style="list-style-type: none"> ■ DIA template ■ Safety requirement specification ■ Safety application note (HW SW interface) 	
<ul style="list-style-type: none"> ■ Static FMEDA ■ Safety case summary ■ Functional safety assessment report 	
FuSa Support Options (Optional charged deliverables & services)	
<ul style="list-style-type: none"> ■ Customizable Analysis Report (CAR) ■ Functional safety technical support ■ Safety Workshop ■ FuSa SW products 	

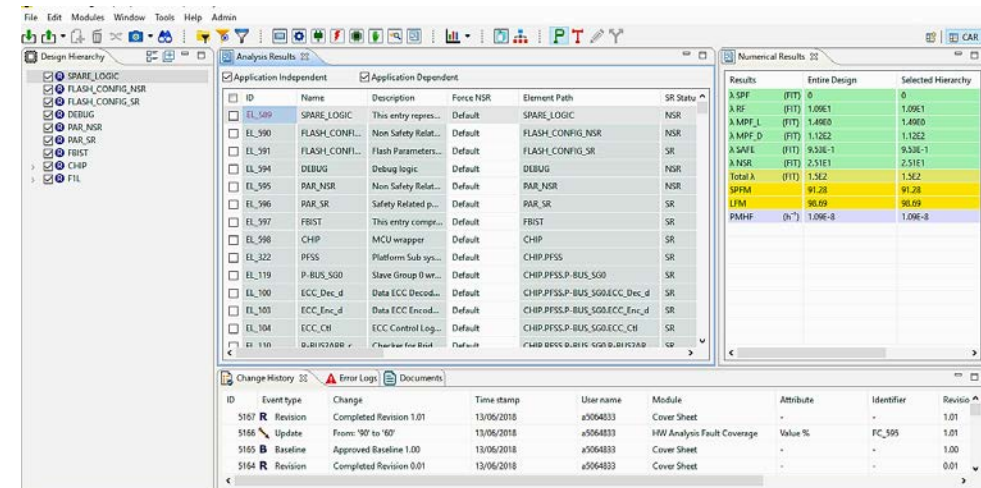
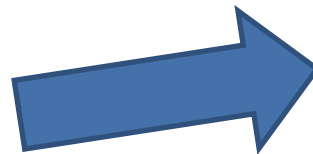
TRANSITION PLAN FROM EXCEL BASE TO GUI BASE

- Renesas will provide GUI base CAR tool from next generation of MCU (RH850) and 3rd generation of SoC (R-Car). Gen1.0 & 1.5 MCU products are basically supported by Excel based CAR tool. For long term, we'll convert these data to GUI base CAR tool.



Excel base CAR tool

Gen 1& Gen 1.5 products of MCU (x1x series)



GUI base CAR tool

2nd generation of MCU(x2x series)

3rd generation of SoC (x3x series)

(TBD)

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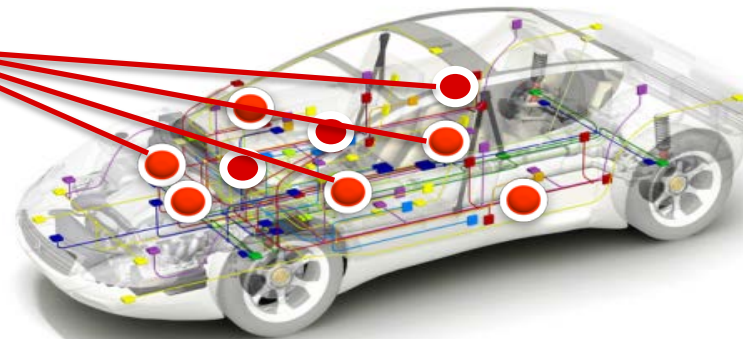
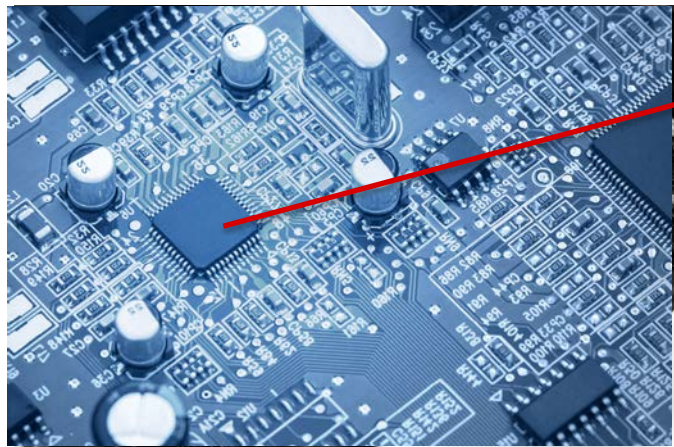
SEOOOC*: CUSTOMIZATION CHALLENGES

In-Context:

- Intended for use in a specific item
- Safety goals are fixed
- Safety requirements are clearly defined
- Safety HW is customized for use case
- “Top-down” approach is mainly used

Out-of-context

- Intended for use in multiple and different items.
- Safety goal information only considered
- Safety requirements are assumed
- Safety HW is implemented based on assumed use
- Combination of “top-down” plus “bottom-up” approaches is used



*For this and all other slides, SEooC (Safety Element Out-of-Context) refers to a component.