

CUSTOMIZABLE ANALYSIS REPORT (CAR TOOL)

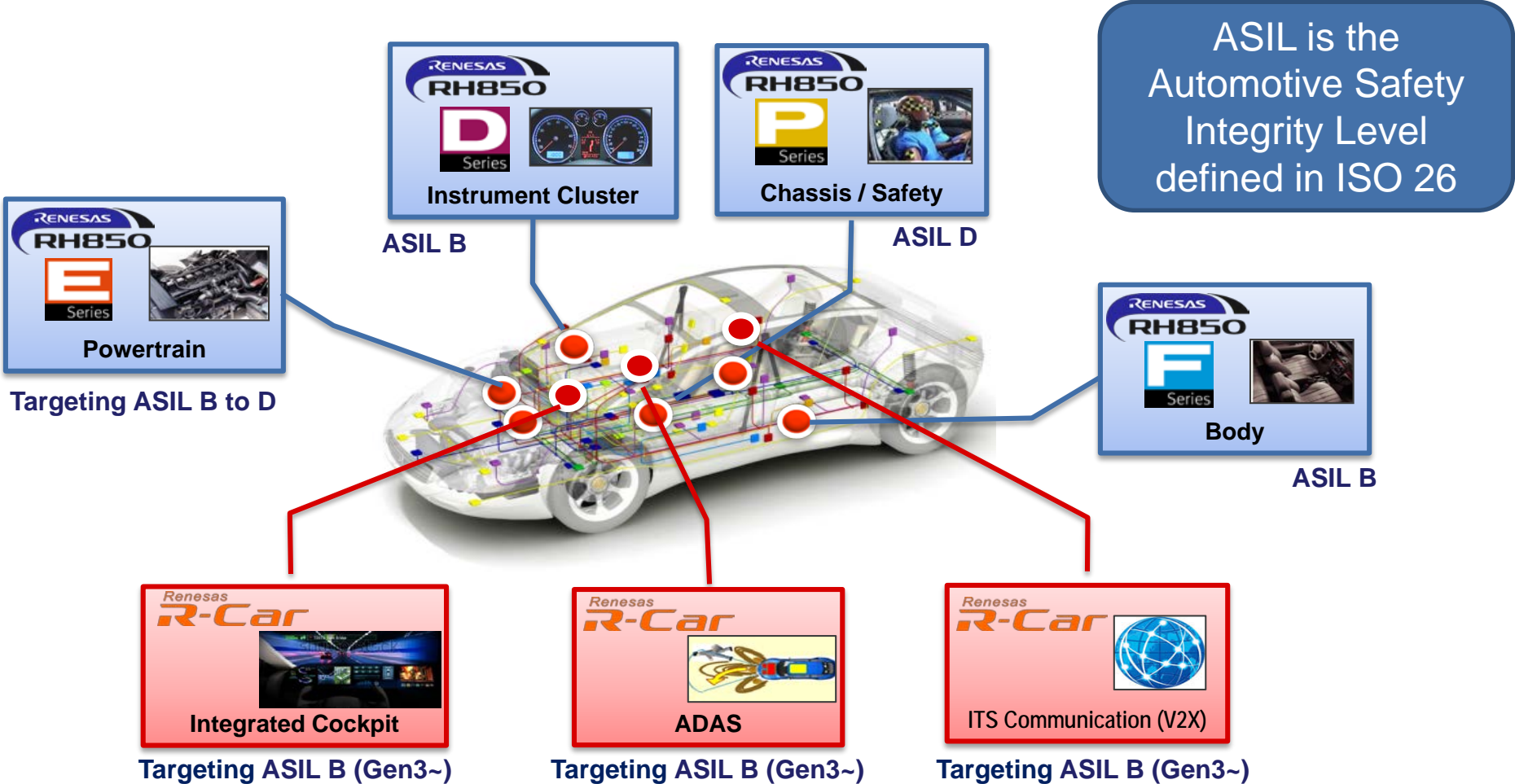
THE RENESAS FMEDA TOOL

RENESAS ELECTRONICS CORPORATION



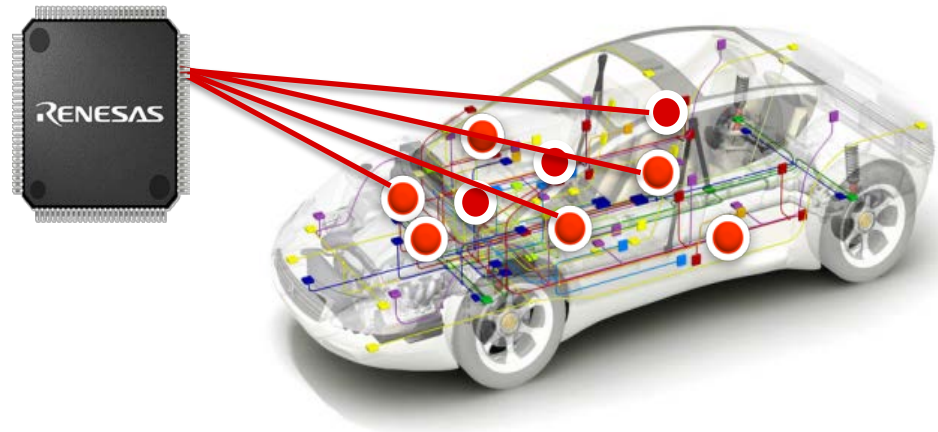
BIG IDEAS
FOR EVERY SPACE

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

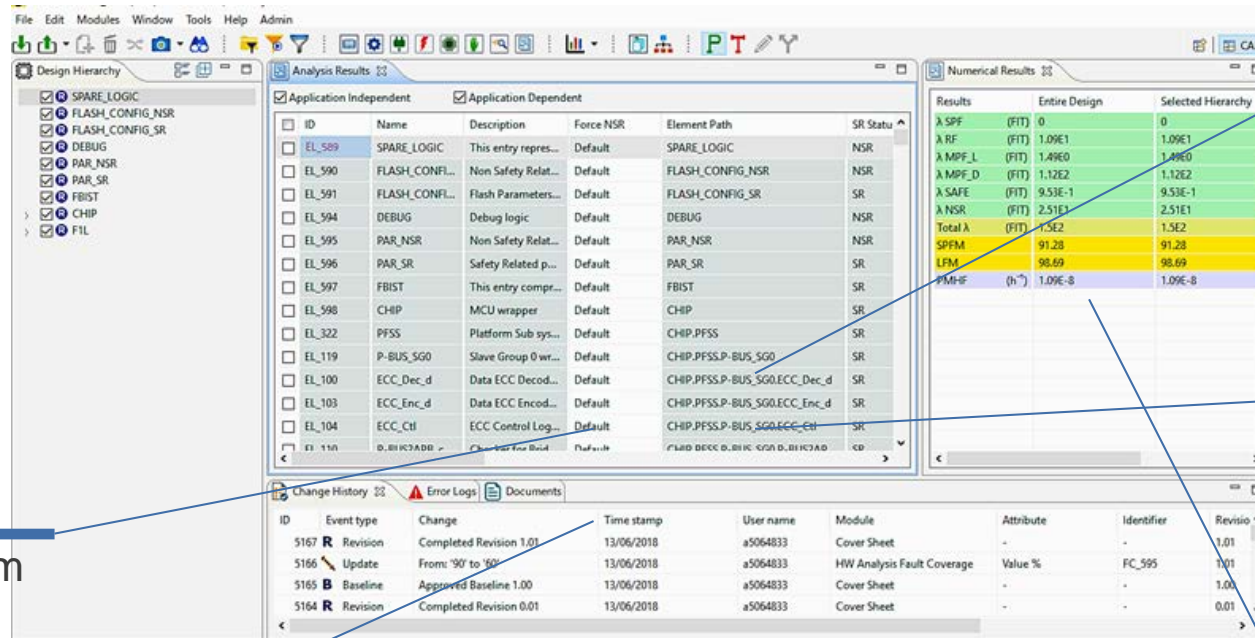
RENESAS IN-HOUSE FMEDA (CAR) TOOL

CUSTOMIZABLE ANALYSIS REPORT

Automatic calculation saves time

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

Automatically record a modification history



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 (%)
SM_11	Ext_measures	Yes	Enable
SM_12	VMON	No	Enable
SM_13	Subset_of_SMs	Yes	Enable
SM_14	P-Bus_Guard	No	Enable
SM_15	INT_UC	Yes	Enable
SM_16	VMON_sust	Yes	Enable
SM_17	Guard	Yes	Enable
SM_18	ECC_sust	No	Enable
SM_19	EDC	Yes	Enable
SM_20	ECM_sust	No	Enable
SM_21	IO_rdc	No	Enable
SM_22	SW_ECC	No	Enable
SM_23	Timer_UC	Yes	Enable
SM_24	Address_Feedback	Yes	Enable
SM_25	DMON_sust	Yes	Enable
SM_27	Write_Verify	Yes	Enable
SM_28	Mode_Checker	No	Enable
SM_29	ICUM_UC	Yes	Enable
SMt_30	Routing_Checker	No	Enable
SM_30	Additional_safety_me...	No	Enable



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 document details for 'CAR tool demo' (Revision 1.01, Product DEMO, Variant die0). Below this are two tables for revision control:

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

Buttons for 'Export Change History', 'Rollback to previous revision', and 'Change History Preview' are visible. A 'Change History' window is overlaid on the right, showing a detailed log of changes:

ID	Event type	Change	Time stamp
5167	Revision	Completed Revision 1.01	13/06/2018
5166	Update	From: '90' to '60'	13/06/2018
5165	Baseline	Approved Baseline 1.00	13/06/2018
5164	Revision	Completed Revision 0.01	13/06/2018
5163	Add	Added and filled in attributes.	13/06/2018
5162	Add	Added and filled in attributes.	13/06/2018
5161	Add	Added and filled in attributes.	13/06/2018
5160	Add	Added and filled in attributes.	13/06/2018
5159	Add	Added and filled in attributes.	13/06/2018
5158	Add	Added and filled in attributes.	13/06/2018
5157	Add	Added and filled in attributes.	13/06/2018
5156	Add	Added and filled in attributes.	13/06/2018
5155	Add	Added and filled in attributes.	13/06/2018
5154	Add	Added and filled in attributes.	13/06/2018

A blue callout box in the bottom right corner contains the text: '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.

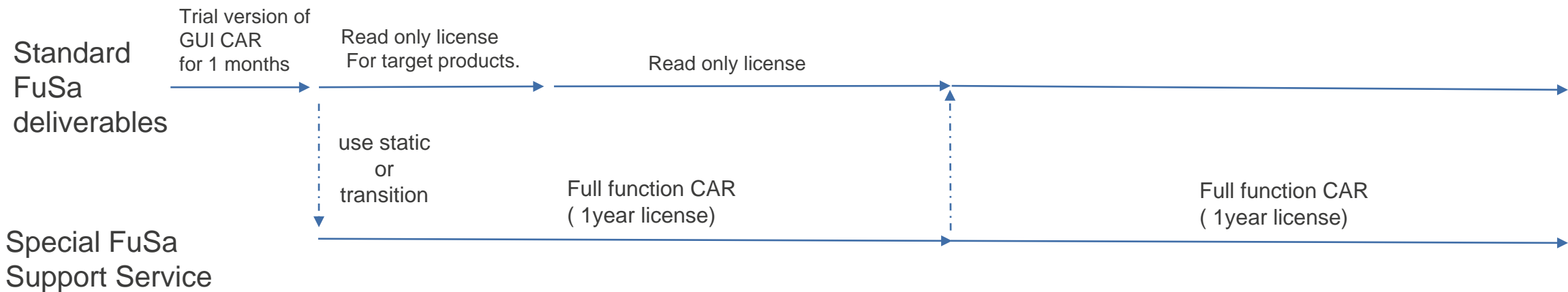
The screenshot displays the CAR tool interface with several key components:

- 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 table includes entries for SPARE_LOGIC, FLASH_CONFIG_NSR, FLASH_CONFIG_SR, DEBUG, PAR_NSR, PAR_SR, and FBIST.
- Change History Table:** A table with columns for ID, File Name, File version, Release, Used, and Referenced in. It lists three documents: ABC-AB-17-0562_RH850_F1KM_SRS_rev.1.0, ABC-AB-17-0563_RH850_F1KM_HSSR...1.0, and ABC-AB-17-0564_RH850F1KM_SAN_r...1.0.
- PDF Document Viewer:** A window titled 'ABC-AB-17-0564_RH850F1KM_SAN_rev.1.0_sample.pdf' displaying a '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

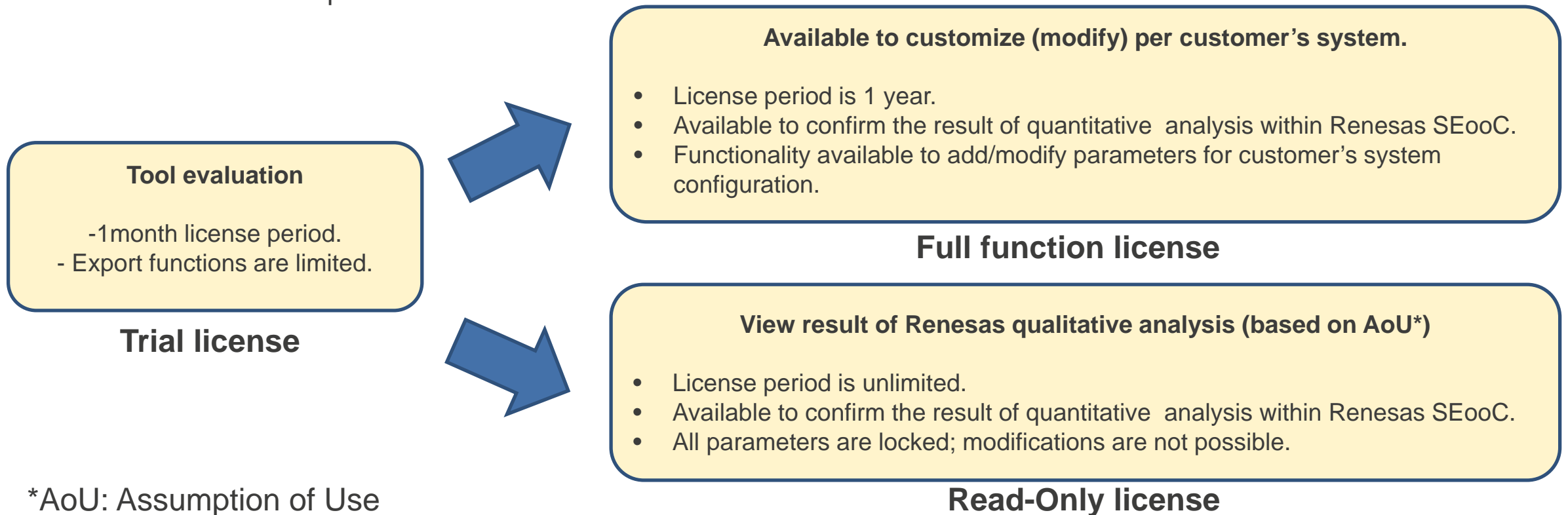
- Two types of licenses are prepared: Full function or “Read-only” license. Customer can choose which license type to use. A Full function license is dynamic and allows for extensive customization.



“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

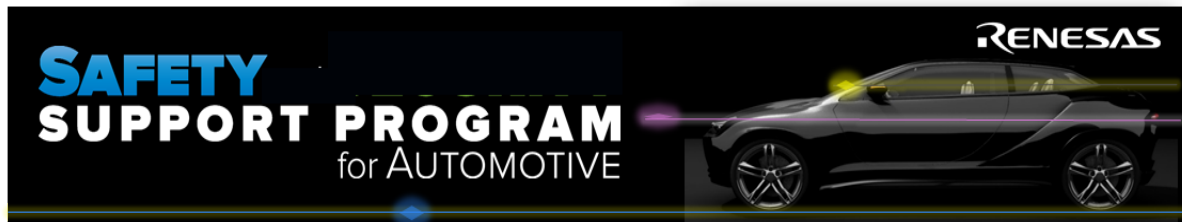
- The difference between full function license and Read-only license is described below. A Read-only license can only confirm the result of Renesas quantitative analysis; for analysis of system configuration, modification using other tools is required.



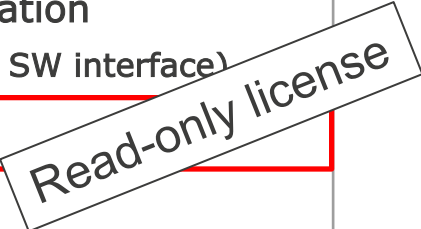
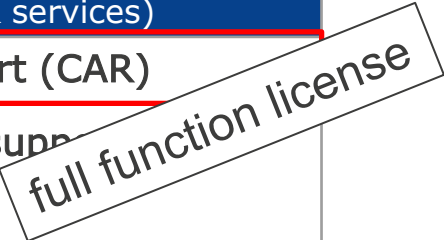
*AoU: Assumption of Use

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.

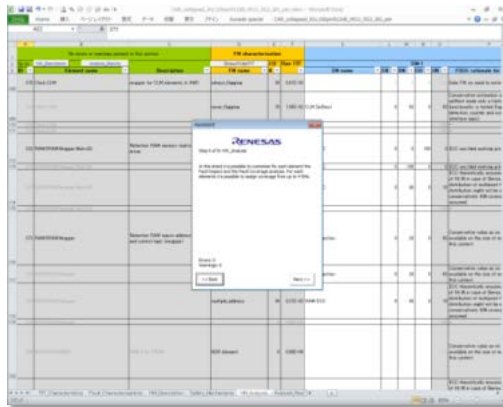


Hardware Safety mechanisms MCU, SoC, A&P 	Software CPU Core self-test Safety Software 	Work products Safety analysis tool, Report, etc. 	Consulting Workshop Development support 
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Standard FuSa deliverables (Free of charge)	
<ul style="list-style-type: 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 	

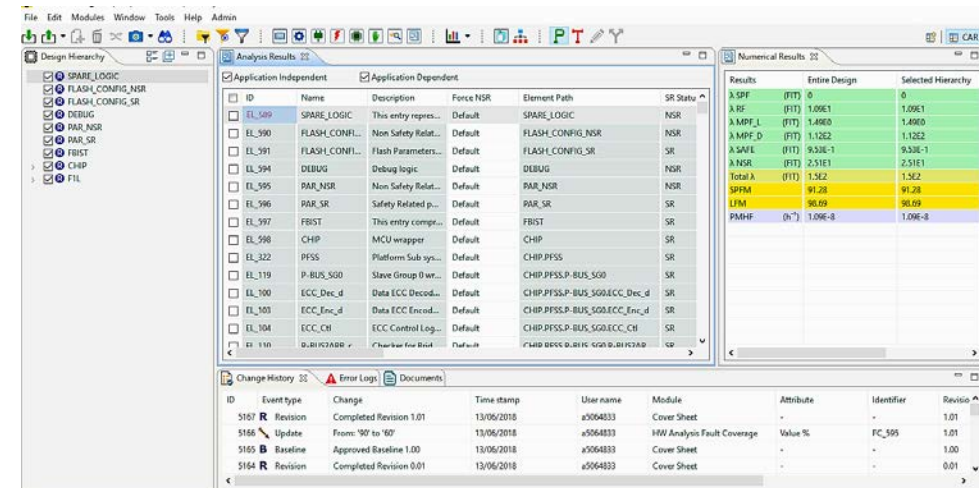
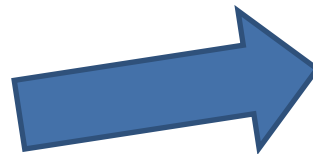
TRANSITION PLAN FROM EXCEL BASE TO GUI BASE

- 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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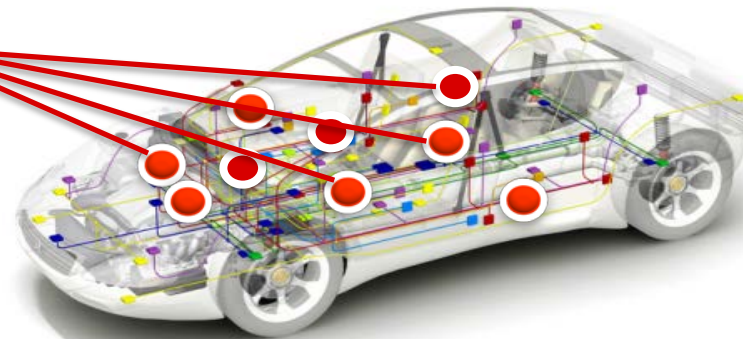
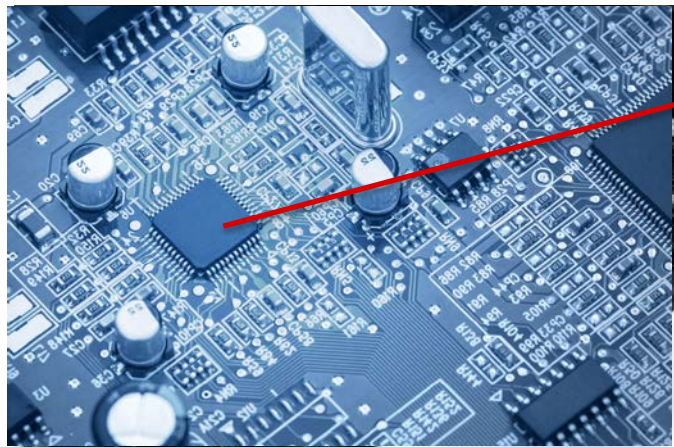
SEOOOC*: CUSTOMIZATION CHALLENGES

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.