

# CUSTOMIZABLE ANALYSIS REPORT (CAR TOOL)

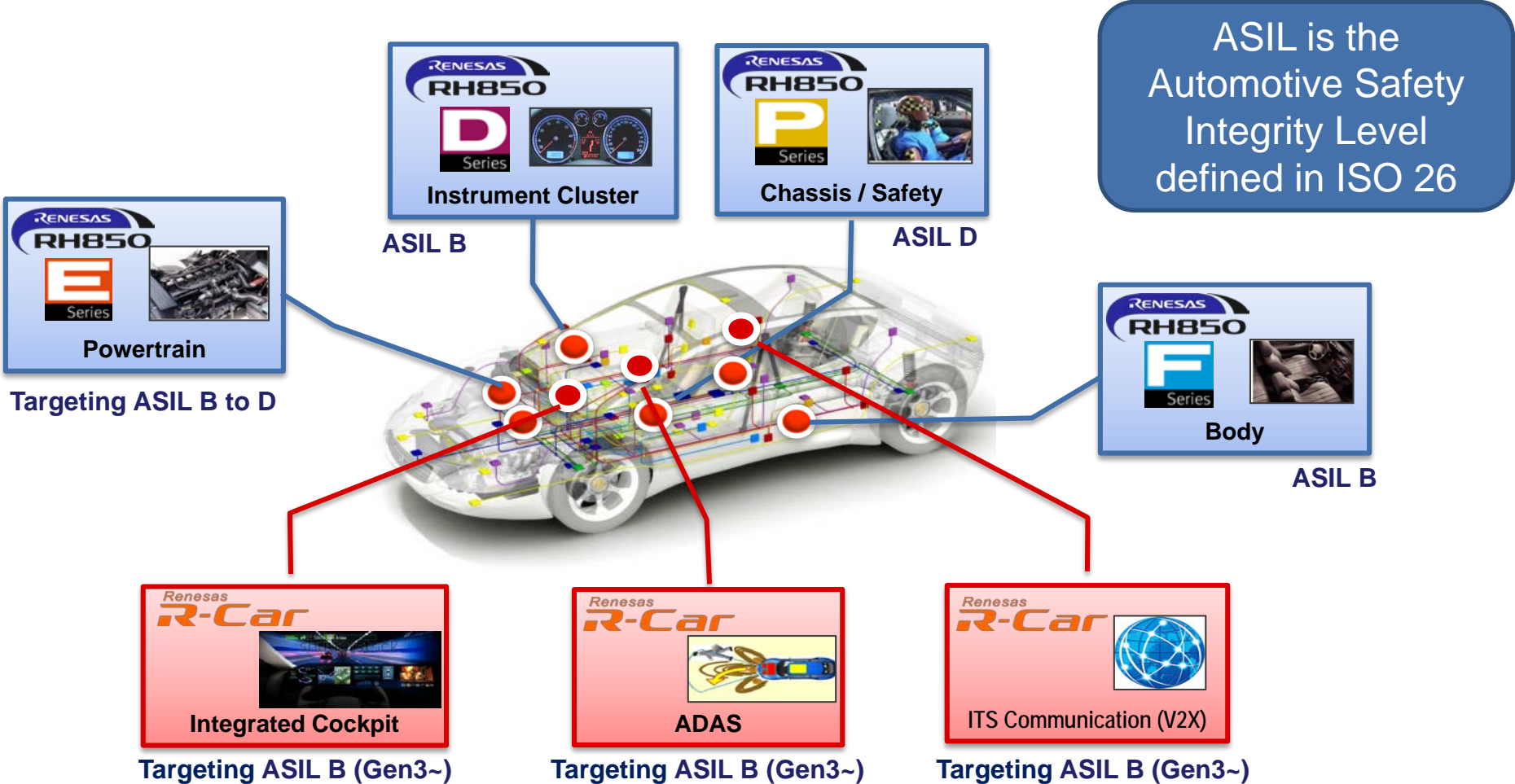
THE RENESAS FMEDA TOOL

RENESAS ELECTRONICS CORPORATION



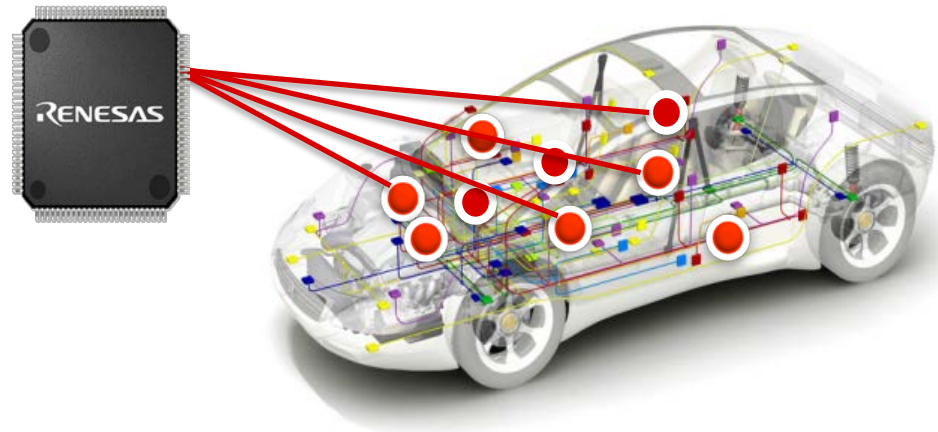
BIG IDEAS  
FOR EVERY SPACE

# 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

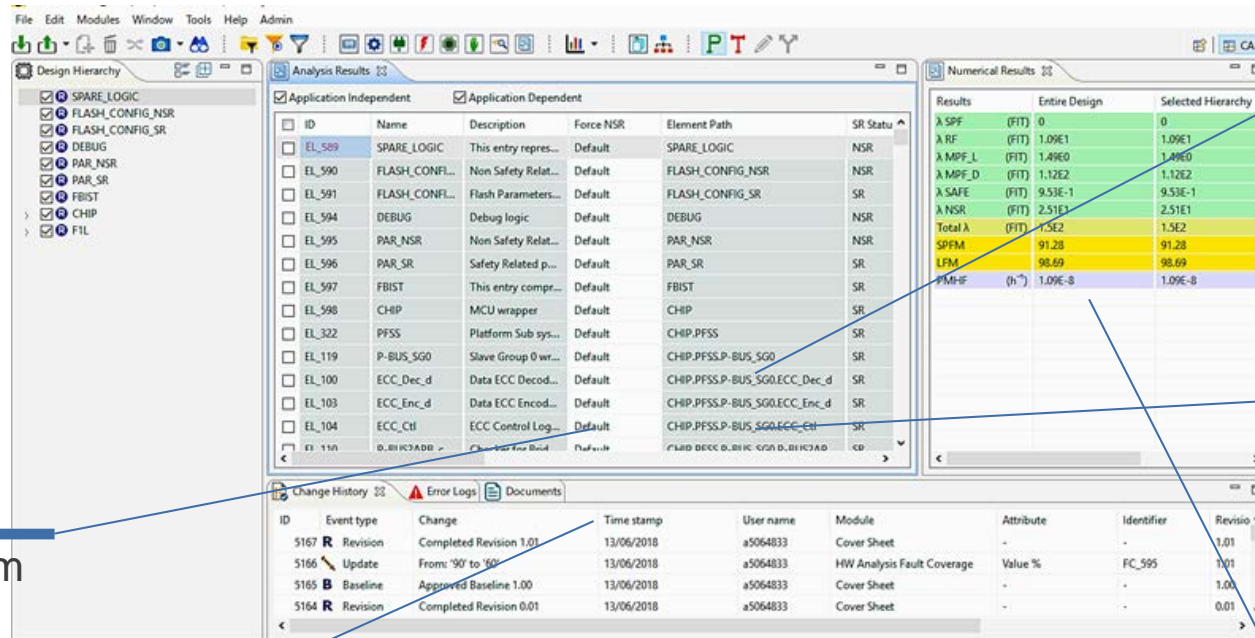
# RENESAS IN-HOUSE FMEDA (CAR) TOOL

## 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
$\lambda$ SPF (FIT)	0	0
$\lambda$ RF (FIT)	5.01E-1	4.87E-1
$\lambda$ MPF_L (FIT)	4.64E-1	3.87E-1
$\lambda$ MPF_D (FIT)	8.47E1	8.26E1
$\lambda$ SAFE (FIT)	4.53E0	3.04E0
$\lambda$ NSR (FIT)	9.83E0	3.23E-1
Total $\lambda$ (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	$\lambda$ SPF	$\lambda$ RF	$\lambda$ MPF_L	$\lambda$ MPF_D	$\lambda$ SAFE	$\lambda$ NSR	Total $\lambda$
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: 'Complete revision' and 'Create Baseline'. A 'Change History' window is open, 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

**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:

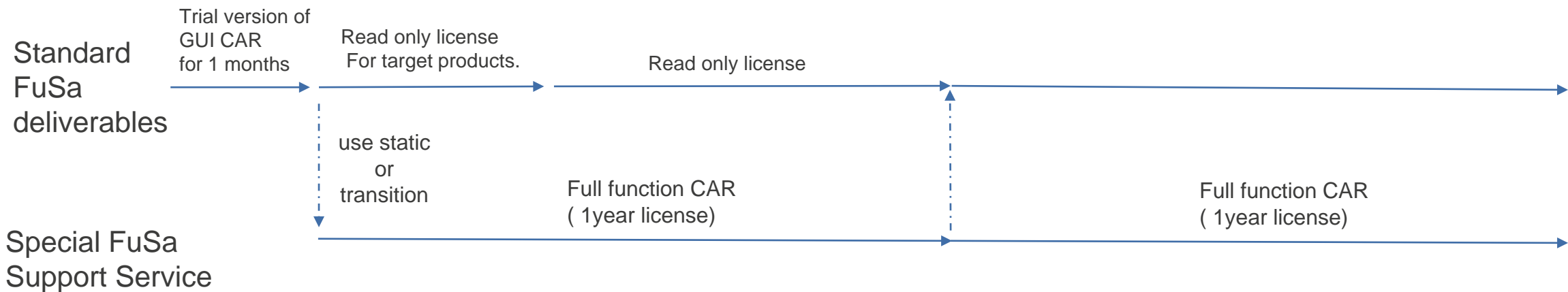
- Design Hierarchy:** A tree view on the left showing components like SPARE\_LOGIC, FLASH\_CONFIG\_NSR, DEBUG, PAR\_NSR, PAR\_SR, FBIST, CHIP, and F1L.
- HW Description Table:** A table listing hardware elements with columns for ID, Name, Element Path, Description, Size, Size Unit, Nature, Application 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 files: 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 displaying a Renesas Safety Application Note for the RH850/F1KM Group SAN, Rev. 1.0, dated Nov. 30, 2017. The document includes sections for Introduction, 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

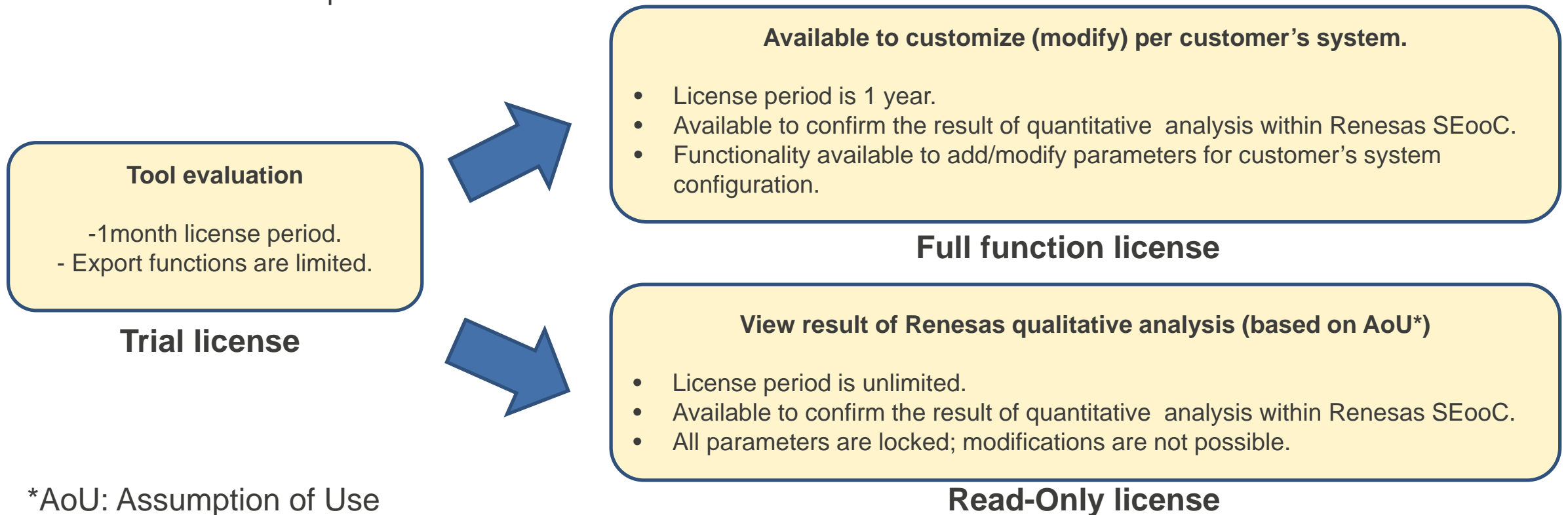
- Two types of licenses are prepared: Full function or “Read-only” license. Customer can choose which license type to use. A Full function license is dynamic and allows for extensive customization.



**“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

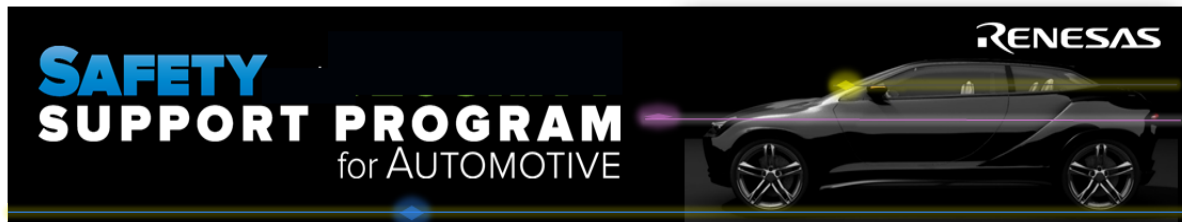
- The difference between full function license and Read-only license is described below. A Read-only license can only confirm the result of Renesas quantitative analysis; for analysis of system configuration, modification using other tools is required.



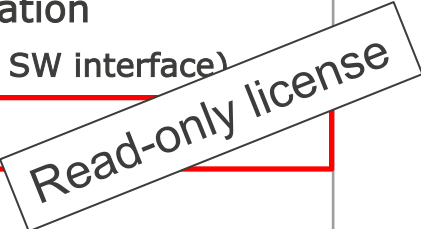
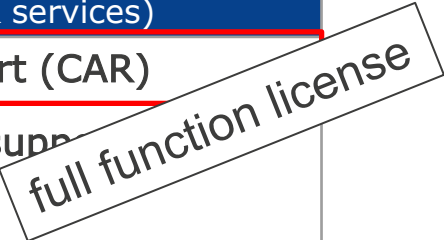
\*AoU: Assumption of Use

# 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.

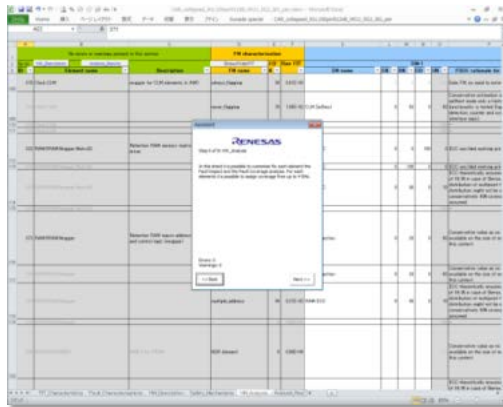


<b>Hardware</b> Safety mechanisms MCU, SoC, A&P 	<b>Software</b> CPU Core self-test Safety Software 	<b>Work products</b> Safety analysis tool, Report, etc. 	<b>Consulting</b> Workshop Development support 
--	---	---	---

Standard FuSa deliverables (Free of charge)	
<ul style="list-style-type: none"> <li>■ DIA template</li> <li>■ Safety requirement specification</li> <li>■ Safety application note (HW SW interface)</li> </ul>	
<ul style="list-style-type: none"> <li>■ Static FMEDA</li> <li>■ Safety case summary</li> <li>■ Functional safety assessment report</li> </ul>	
FuSa Support Options (Optional charged deliverables & services)	
<ul style="list-style-type: none"> <li>■ Customizable Analysis Report (CAR)</li> <li>■ Functional safety technical support</li> <li>■ Safety Workshop</li> <li>■ FuSa SW products</li> </ul>	

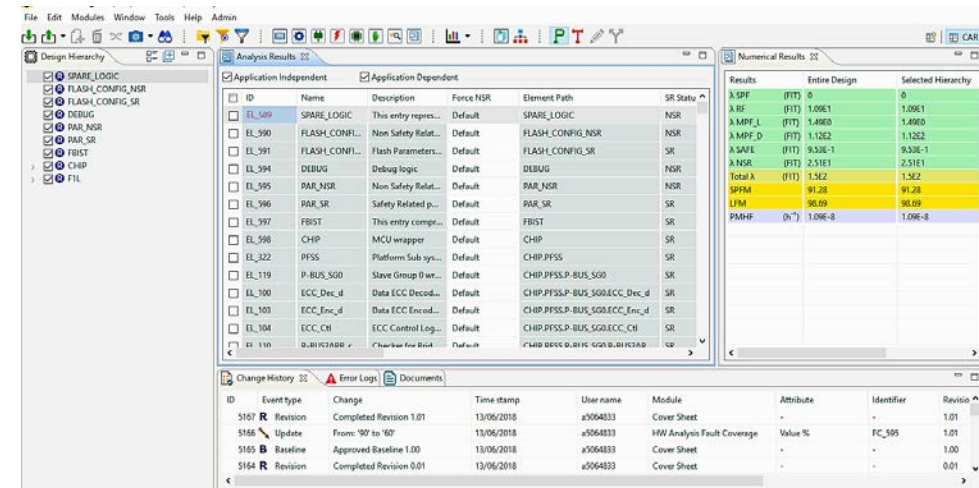
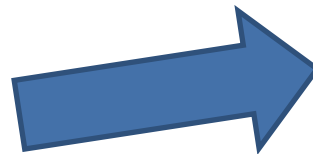
# TRANSITION PLAN FROM EXCEL BASE TO GUI BASE

- Renesas will provide GUI base CAR tool from next generation of MCU (RH850) and 3<sup>rd</sup> 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**

2<sup>nd</sup> generation of MCU(x2x series)

3<sup>rd</sup> generation of SoC (x3x series)

(TBD)

# NOTICE

---

1.Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.

2.Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.

3.Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4.You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.

5.Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.

“Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.

“High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.

Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.

6.You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.

7.Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.

8.Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

9.Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.

10.It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.

11.This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

12.Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.



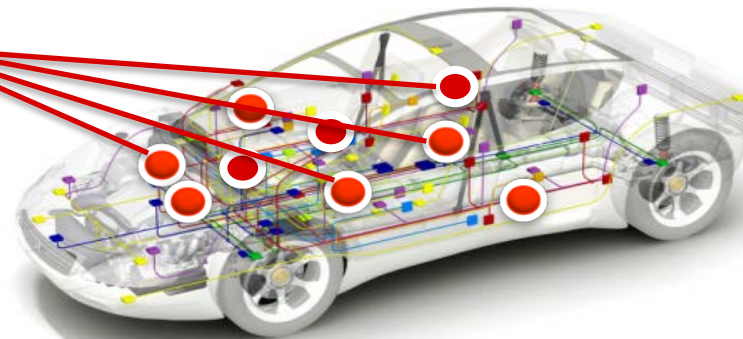
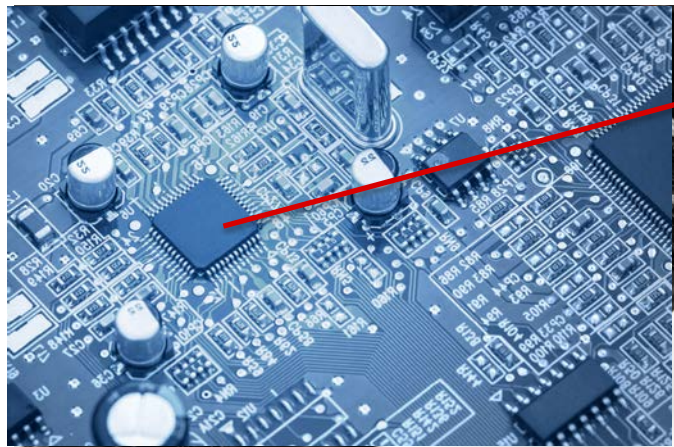
# SEOOOC\*: CUSTOMIZATION CHALLENGES

## 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, SEOOOC (Safety Element Out-of-Context) refers to a component.