PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data

1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	AMS/20/12524
1.3 Title of PCN	VIPER31: Final Test Limits Change
1.4 Product Category	See Products List (Power Conversion)
1.5 Issue date	2020-12-21

2. PCN Team

2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
2.2 Change responsibility	
2.2.1 Product Manager	Domenico ARRIGO
2.1.2 Marketing Manager	Fulvio PULICELLI
2.1.3 Quality Manager	Alessandro PLATINI

3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
General Product & Design	Modification of datasheet :parameters/electrical specification (min./max./typ. values) and/or AC/DC specification	FE/Catania, Italy (Controller die) FE/AMK, Singapore (Mosfet die) BE/Assy & FT: UTAC (Thai)

4. Description of change

	Old	New
4.1 Description	Limits are +/- 25%---- DATASHEET Rev. 2	Limits increased +/- 37.5% ---- DATASHEET Rev. 3
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No IMPACT	

5. Reason / motivation for change

5.1 Motivation	The change of Final Test Limits improves the yield improvement at Final test.
5.2 Customer Benefit	YIELD IMPROVEMENT

6. Marking of parts / traceability of change

6.1 Description	DATASHEET Rev 3.

7. Timing / schedule

7.1 Date of qualification results	2020-10-31
7.2 Intended start of delivery	2021-03-17
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation

8.1 Description	12524 PCN_VIPer31_TSS_limits_change_application_report_.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2020-12-21

9. Attachments (additional documentations)
12524 Public product.pdf 12524 PCN_VIPer31_TSS_limits_change_application_report_.pdf

10. Affected parts		
10. 1 Current		10.2 New (if applicable)
10.1.1 Customer Part No	10.1.2 Supplier Part No	10.1.2 Supplier Part No
	VIPER318HDTR	
	VIPER318LDTR	
	VIPER319XDTR	

VIPer31

evaluation on datasheet limits change

CP: VIPer318HDTR, VIPER318LDTR, VIPER319XDTR

I&PC Appl. Lab

Oct-2020

Purpose of evaluation

Parameter	VIPer31			
	old range		new range	
	Min	Max	Min	Max
t_{SS} [ms]	6	10	5	11
t_{OVP_DEB} [us]	188	312	156	344
t_{UVP_DEB} [ms]	22.5	37.5	18.75	41.25
$t_{UVP\_RESTART}$ [ms]	22.5	37.5	18.75	41.25
$t_{RESTART}$ [s]	0.75	1.25	0.625	1.375
$t_{OVP\_RESTART}$ [s]	0.375	0.625	0.312	0.688

In order to improve the yield, the range of the above listed parameters needs to be enlarged in VIPer31 (from «old range» to «new range»).
Purpose of this evaluation is to find out if this change may cause issues on the VIPer31 and/or on the system, both in terms of output voltage regulation/stability and of reliability (thermal dissipation)

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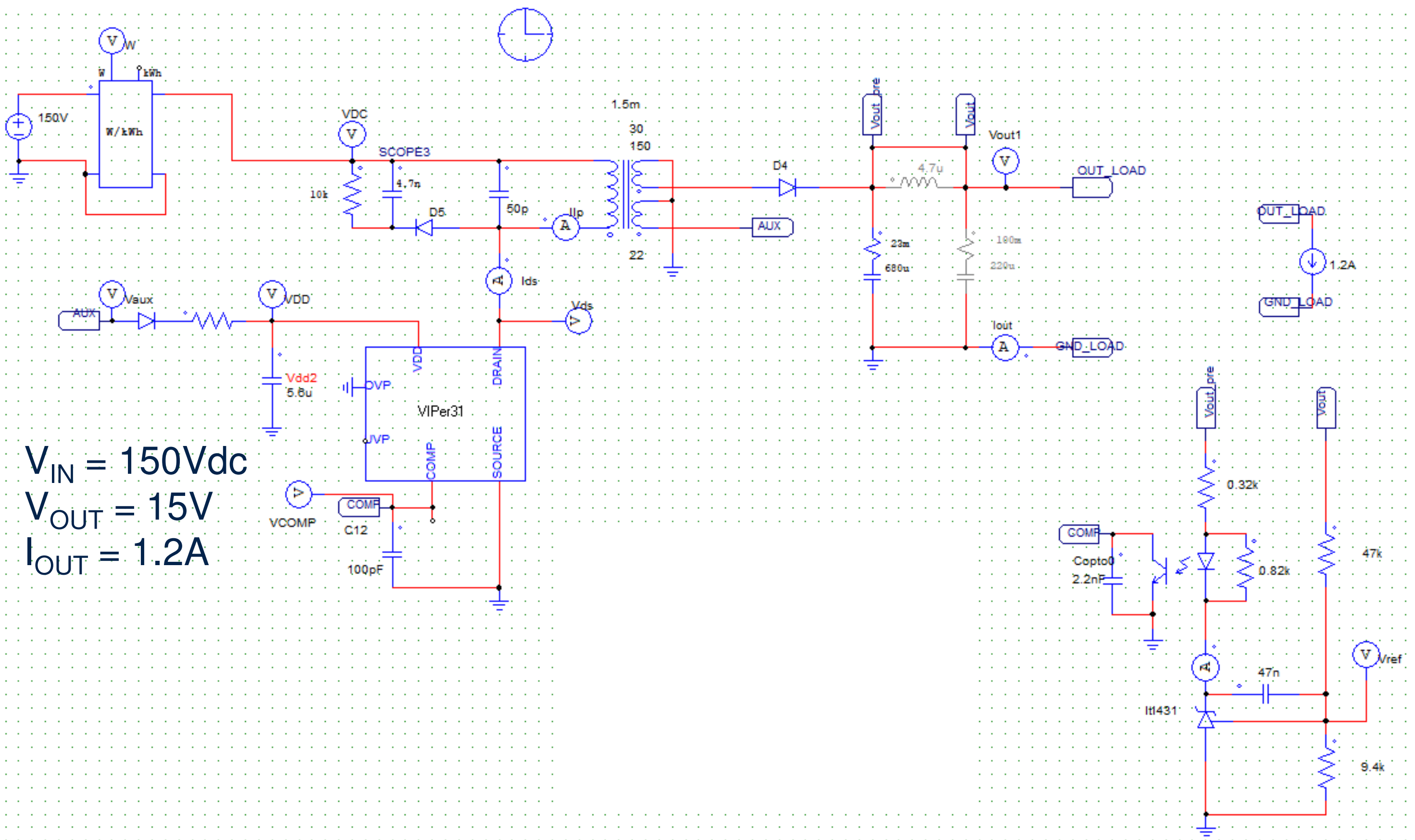
Evaluation of t_{SS}



V_{IN} = 150Vdc
V_{OUT} = 15V
I_{OUT} = 1.2A

t_{ss}			
old range		**new range**	
min	max	min	max
6ms	10ms	5ms	11ms

Output power has been set to 18W, which is roughly the maximum manageable by VIPer31 in wide range.
In the following slides, the converter startup with different t_{SS} values is simulated, in order to check if increasing the tolerance of this parameter from the old range to new range can affect the output voltage ramp-up or the system stability

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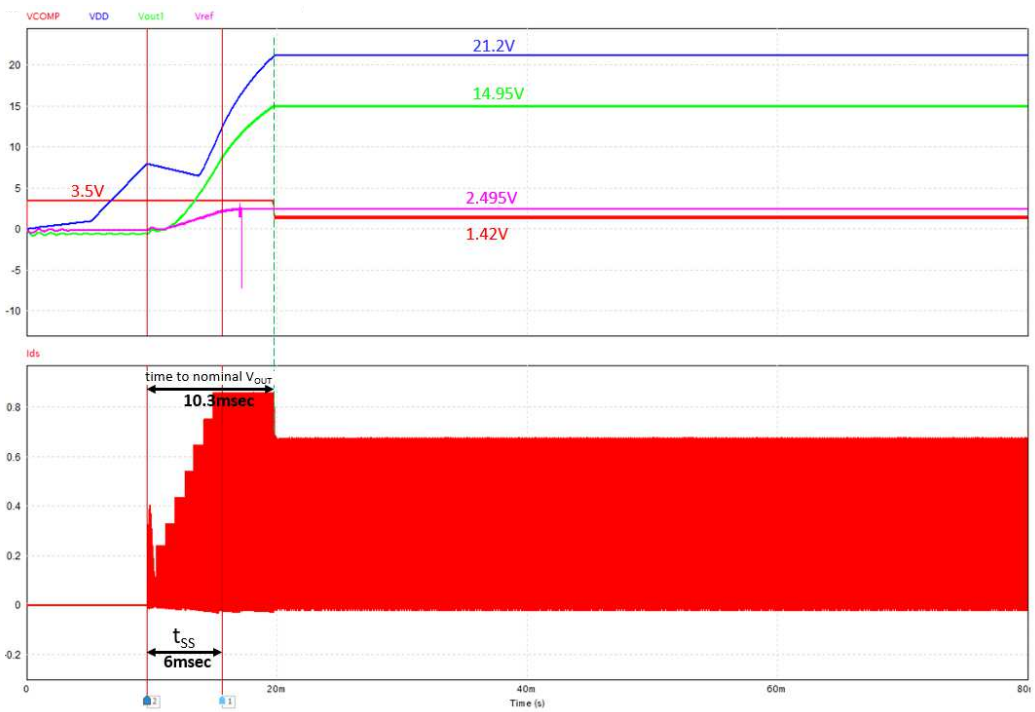
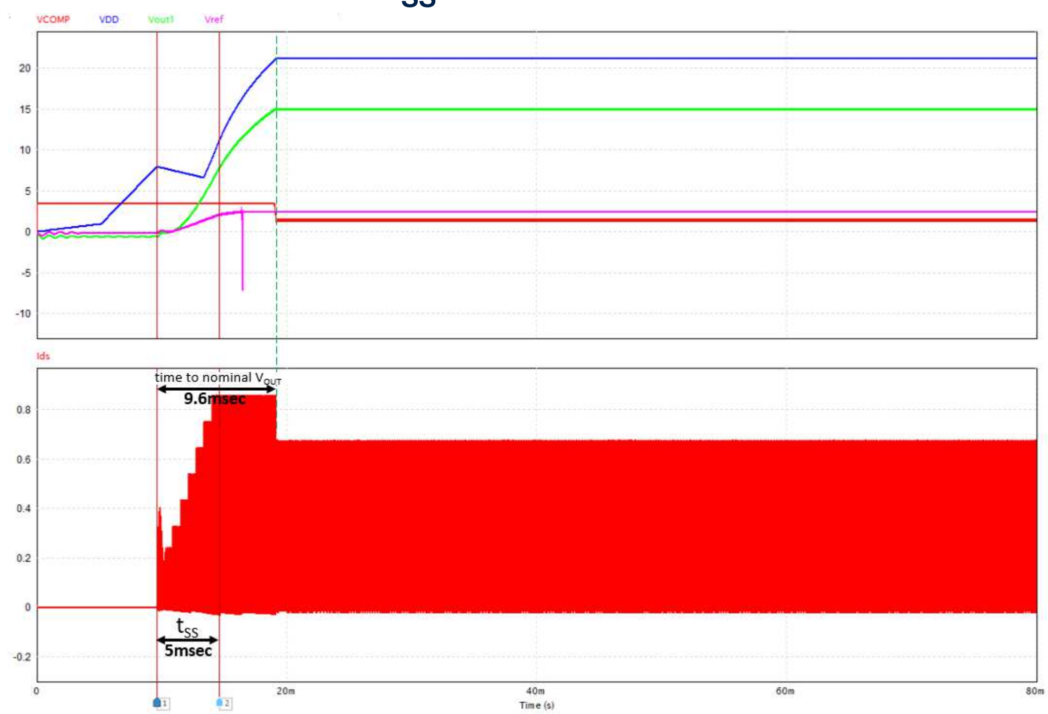
Evaluation of t_{SS}

t_{SS} = 6msec



t_{SS} = 5msec



Result: if t_{SSmin} of «new range» is assumed in place of t_{SSmin} of «old range», the change we can expect in startup behavior is negligible

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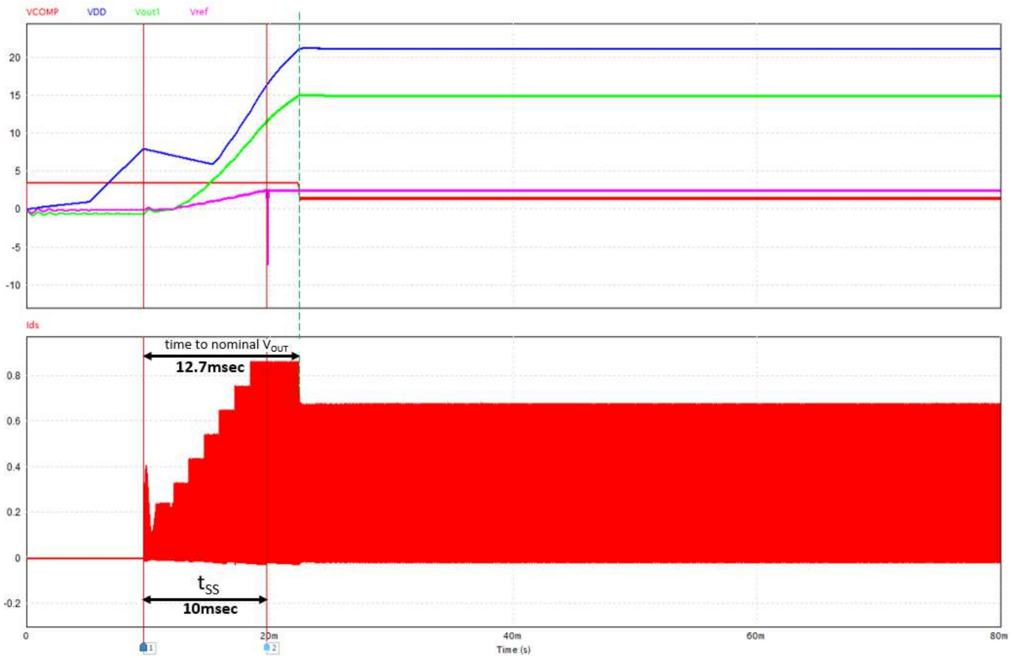
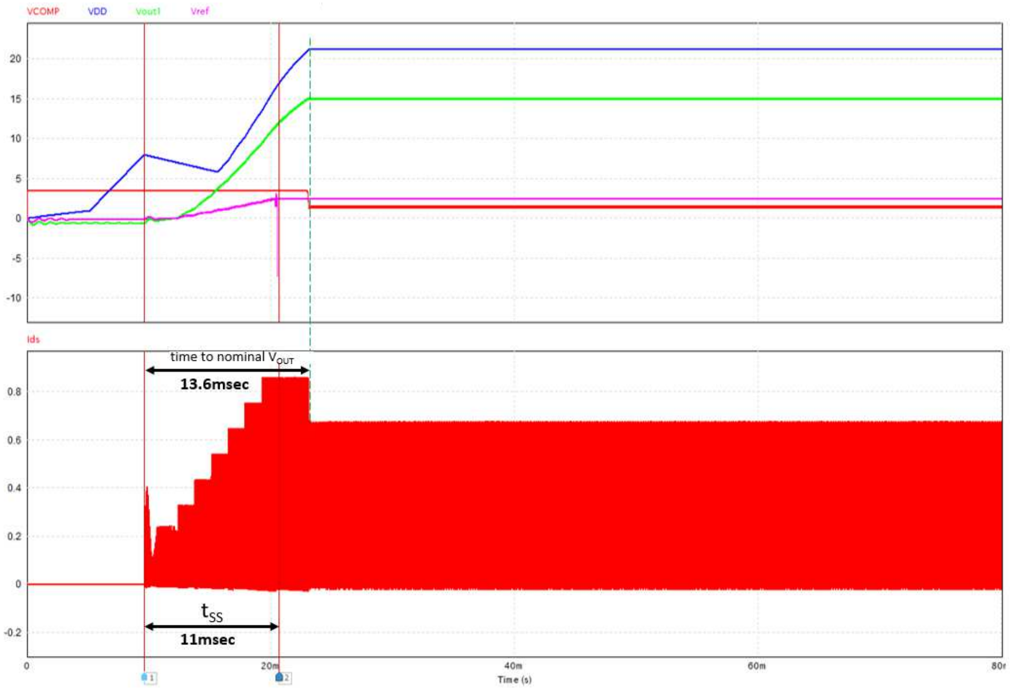
t_{SS} = 10msec

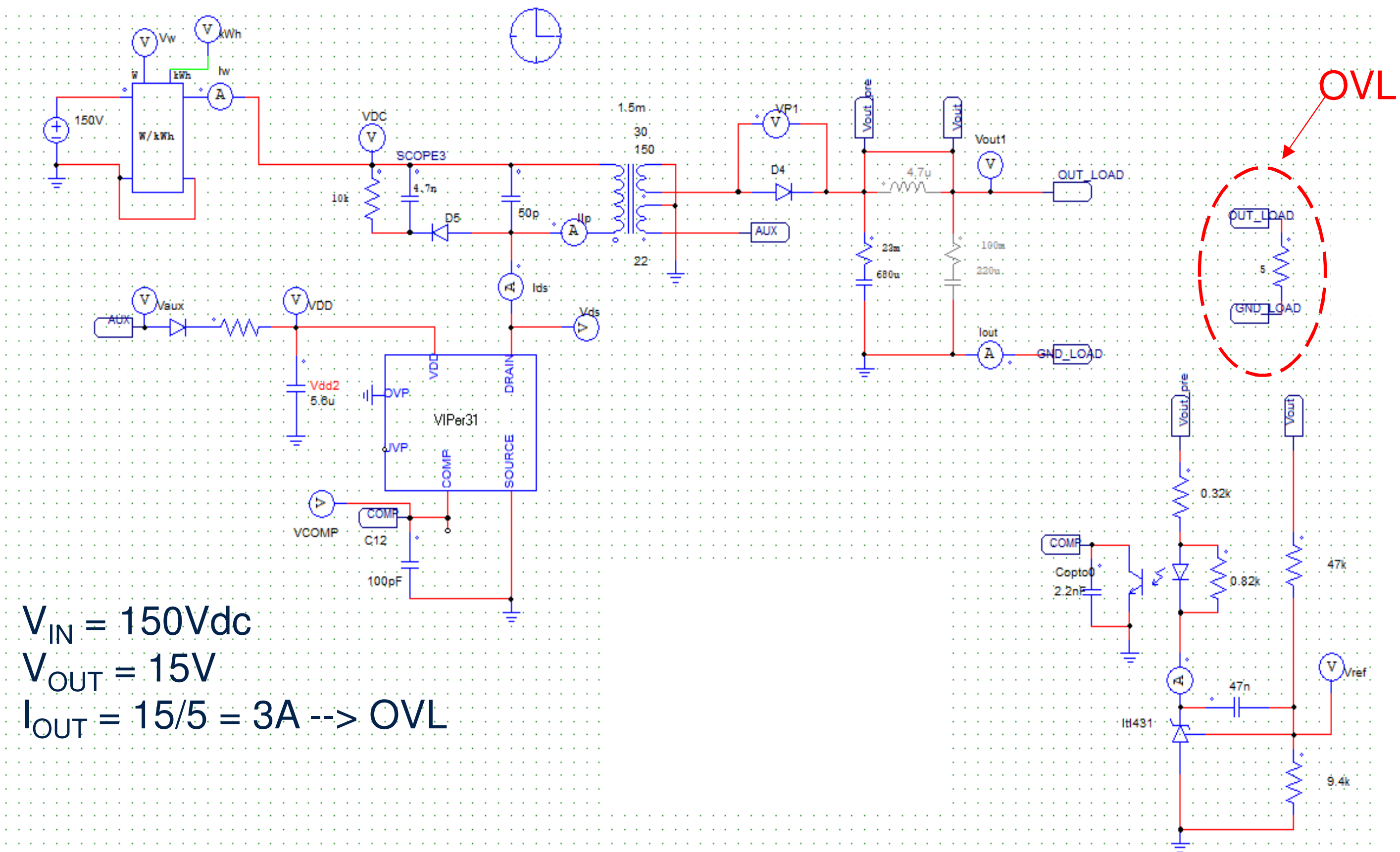


t_{SS} = 11msec



Result: if t_{SSmax} of «new range» is assumed in place of t_{SSmax} of «old range», the change we can expect in startup behavior is negligible

Evaluation of $t_{RESTART}$



V_{IN} = 150Vdc
V_{OUT} = 15V
I_{OUT} = 15/5 = 3A --> OVL

$t_{RESTART}$			
old range		new range	
min	max	min	max
0.75s	1.25s	0.625s	1.375s

Output load has been set to 3A, which is beyond the maximum manageable by VIPer31, thus triggering overload protection.

In the following slides, the power dissipation across VIPer31 with t_{SS_max} , t_{OVL_max} and $t_{RESTART\_min}$ (worst-case combination) is simulated, to estimate the max junction temperature increase which can be expected when «new range» (11ms, 55ms, 625ms) is assumed in place of «old range» (10ms, 55ms, 750ms)

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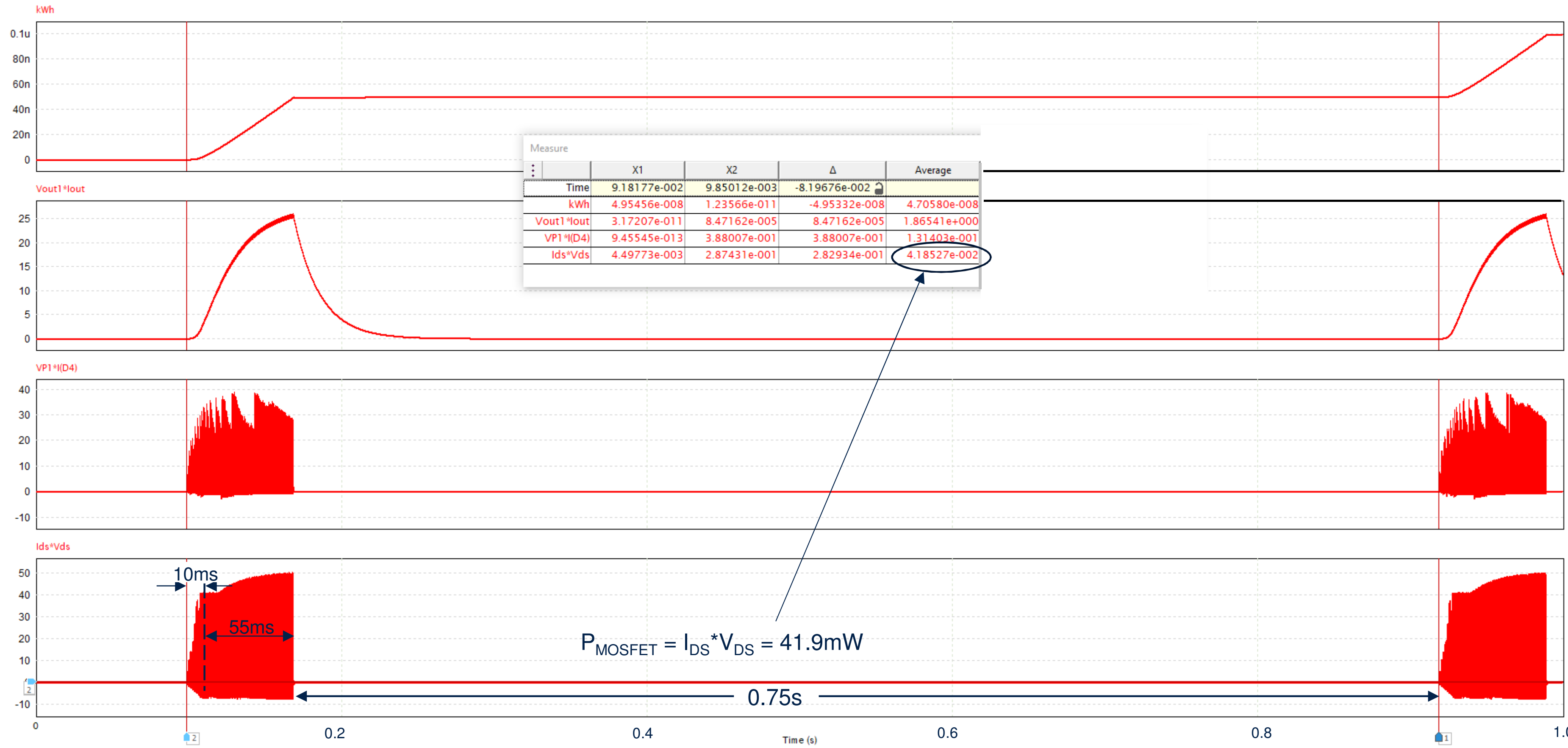
Evaluation of $t_{RESTART}$

Old range, worst case
t_{SS} = 10ms ; $t_{RESTART}$ = 0.75s



	X1	X2	Δ	Average
Time	9.18177e-002	9.85012e-003	-8.19676e-002	
kWh	4.95456e-008	1.23566e-011	-4.95332e-008	4.70580e-008
Vout1*Iout	3.17207e-011	8.47162e-005	8.47162e-005	1.86541e+000
VP1*I(D4)	9.45545e-013	3.88007e-001	3.88007e-001	1.31403e-001
Ids*Vds	4.49773e-003	2.87431e-001	2.82934e-001	4.18527e-002

$P_{MOSFET} = I_{DS} * V_{DS}$ = 41.9mW

Let us assume Rth = 80⁰C/W → $\Delta Tj = Rth \cdot P_{MOSFET} = 80 \cdot 0.0419 = 3.35^{0}C$

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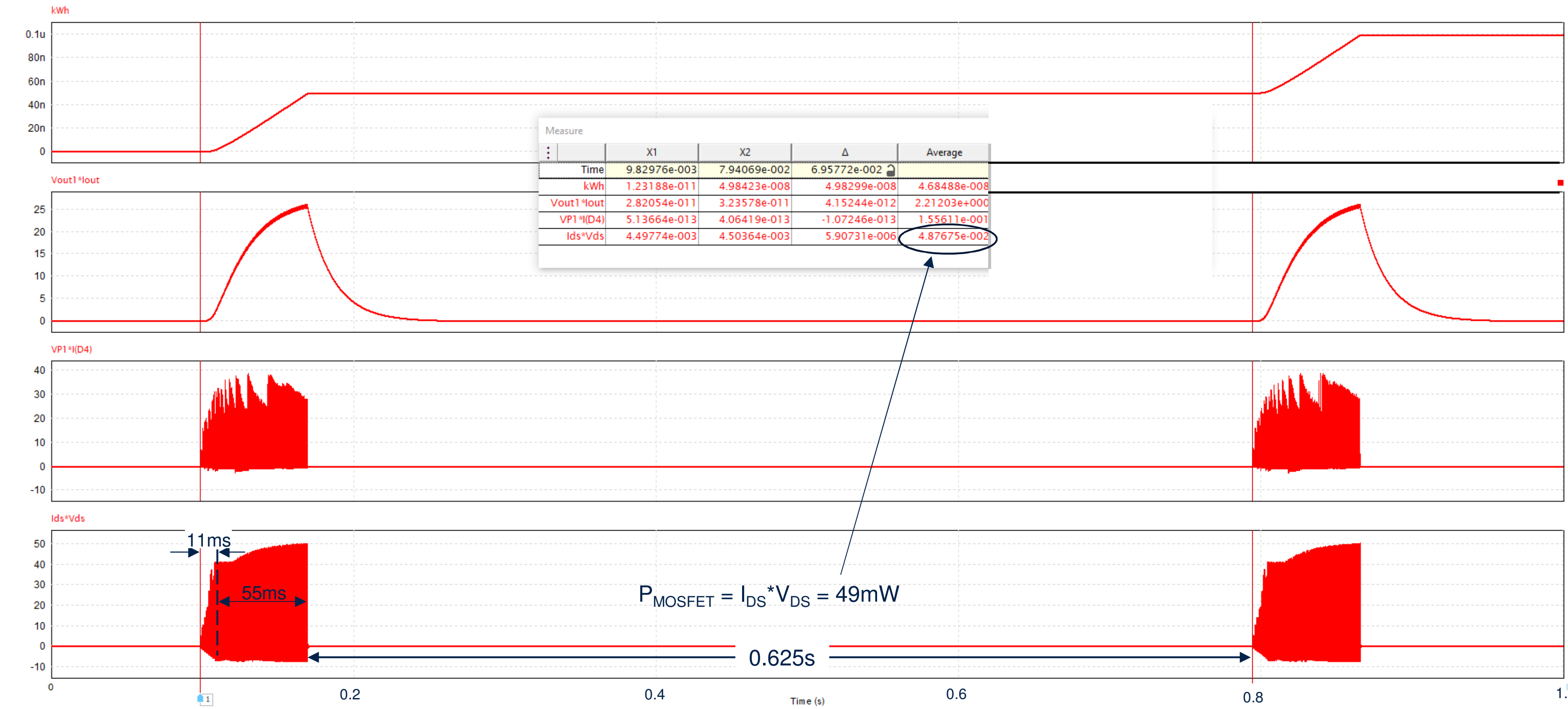
Evaluation of $t_{RESTART}$

New range, worst case

t_{SS} = 11ms ; $t_{RESTART}$ = 0.625s



	X1	X2	Δ	Average
Time	9.82976e-003	7.94069e-002	6.95772e-002	
kWh	1.23188e-011	4.98423e-008	4.98299e-008	4.68488e-008
Vout1*Iout	2.82054e-011	3.23578e-011	4.15244e-012	2.21203e+000
VP1*I(D4)	5.13664e-013	4.06419e-013	-1.07246e-013	1.55611e-001
Ids*Vds	4.49774e-003	4.50364e-003	5.90731e-006	4.87675e-002

$\Delta T_j = R_{th} \cdot P_{MOSFET} = 80 \cdot 0.0488 = 3.90^0C$

Result: if «new range» is assumed in place of «old range», the max ΔTj increase we can expect is negligible

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Evaluation of t_{OVP_DEB} & $t_{OVP\_RESTART}$

old range			
t_{OVP_DEB}		$t_{OVP\_RESTART}$	
min	max	min	max
188us	312us	0.375s	0.625s

new range			
t_{OVP_DEB}		$t_{OVP\_RESTART}$	
min	max	min	max
156us	344us	0.312s	0.688s

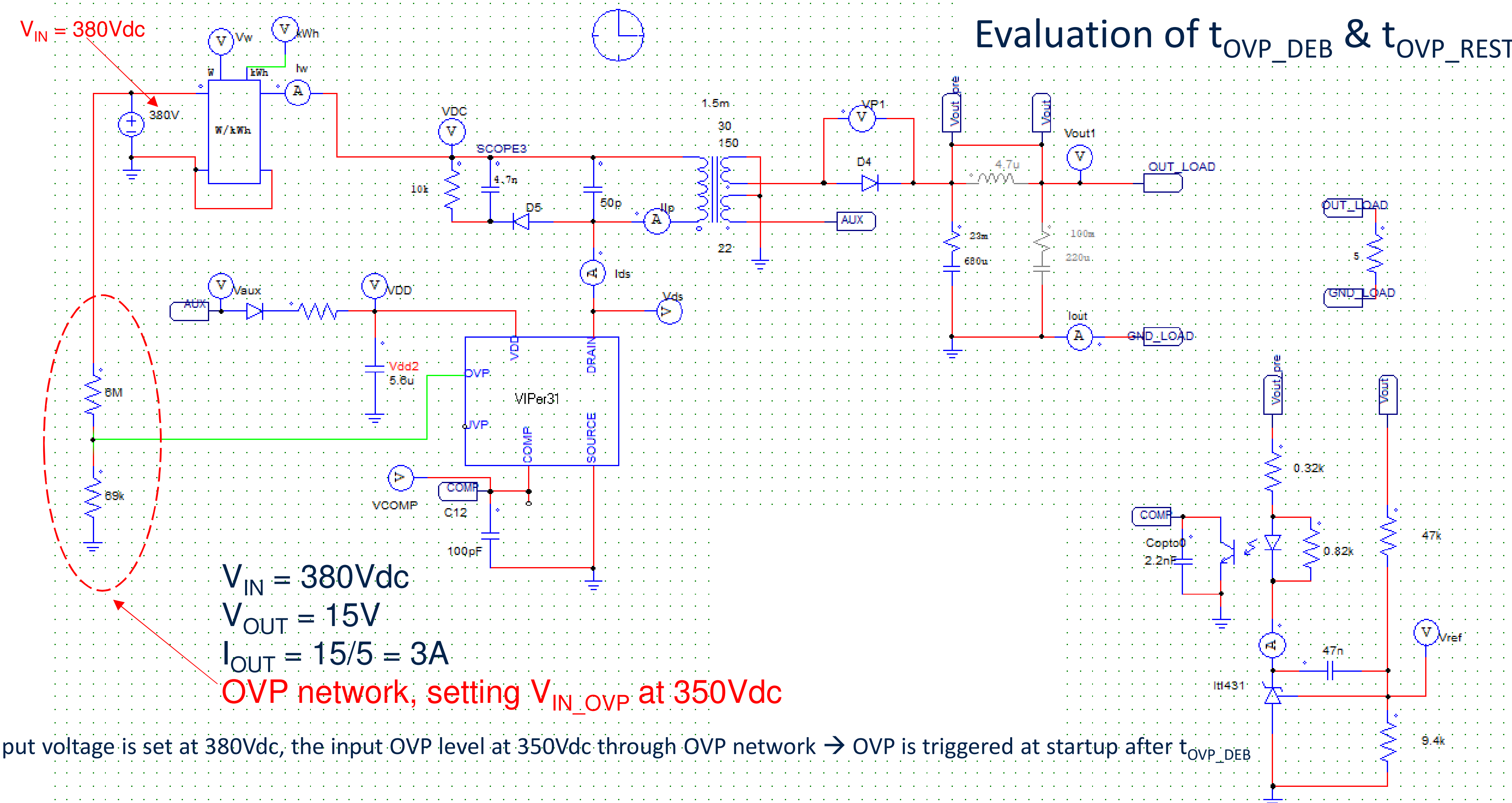
Worst cases

From thermal point of view, worst case is:

t_{OVP_DEB} = max

$t_{OVP\_RESTART}$ = min

Evaluation of t_{OVP_DEB} & $t_{OVP\_RESTART}$



The input voltage is set at 380Vdc, the input OVP level at 350Vdc through OVP network → OVP is triggered at startup after t_{OVP_DEB}

In following slides, the power dissipation across VIPer31 with $t_{OVP\_DEB\_max}$ and $t_{OVP\_RESTART\_min}$ (worst-case combination) is simulated, to estimate the max junction temperature increase which can be expected when «new range» (344us, 312ms) is assumed in place of «old range» (312us, 375ms)

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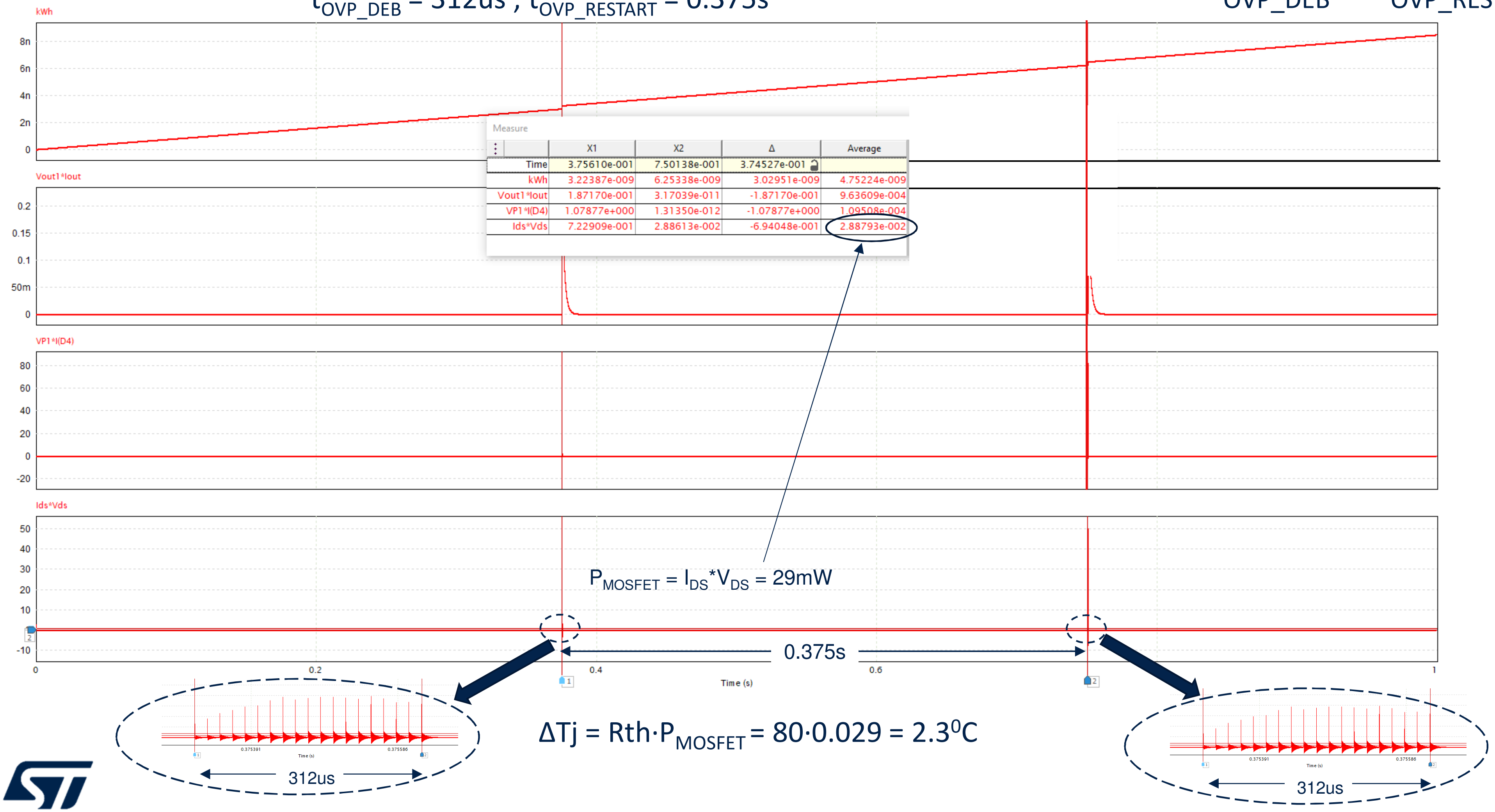
Evaluation of t_{OVP_DEB} & $t_{OVP\_RESTART}$

Old range, worst case

t_{OVP_DEB} = 312us ; $t_{OVP\_RESTART}$ = 0.375s



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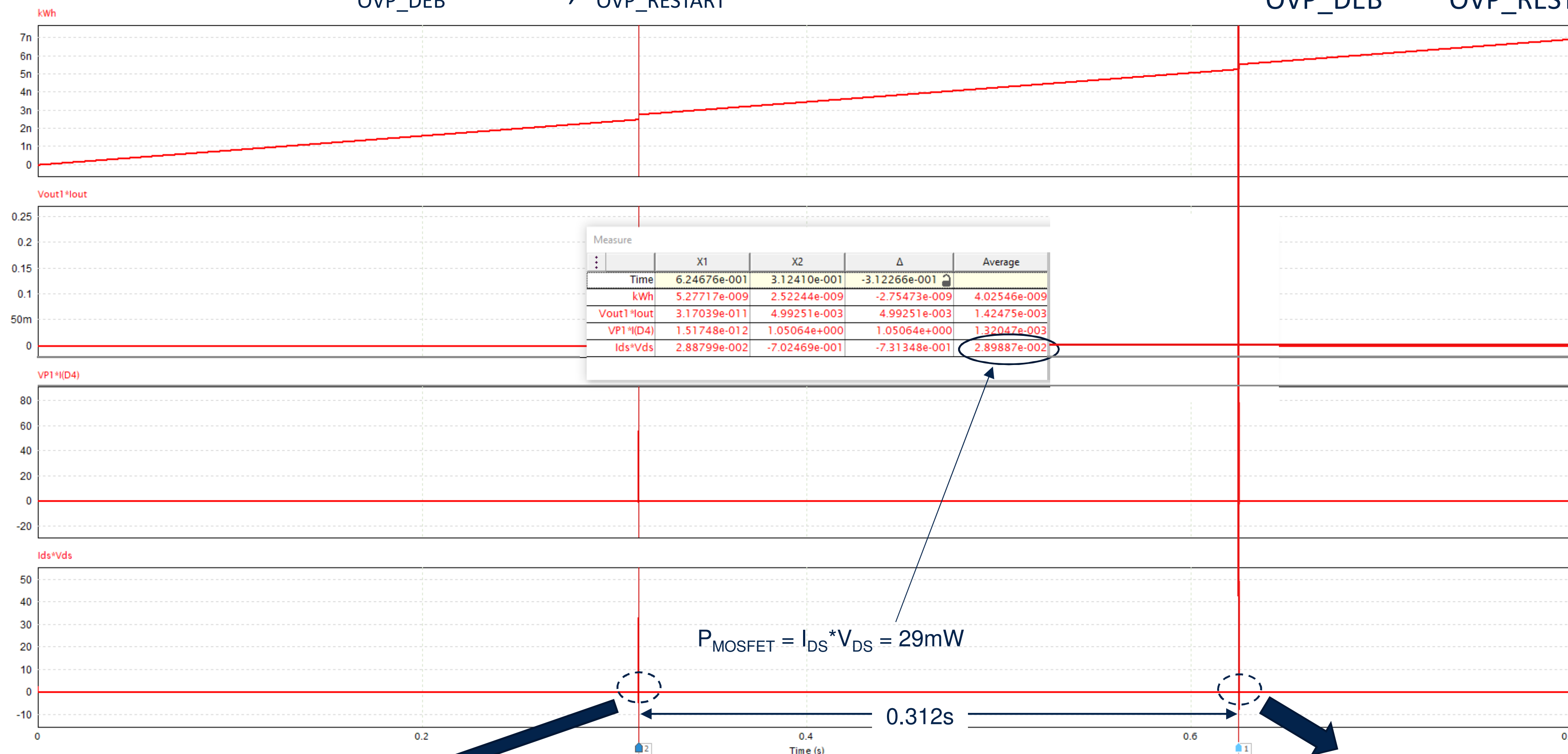
Evaluation of t_{OVP_DEB} & $t_{OVP\_RESTART}$

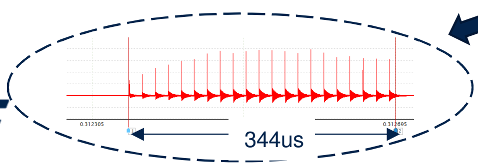
New range, worst case

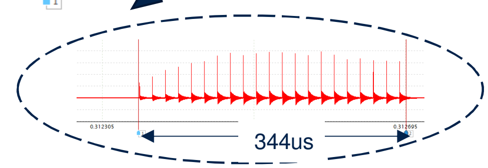
t_{OVP_DEB} = 344us ; $t_{OVP\_RESTART}$ = 0.312s



	X1	X2	Δ	Average
Time	6.24676e-001	3.12410e-001	-3.12266e-001	
kWh	5.27717e-009	2.52244e-009	-2.75473e-009	4.02546e-009
Vout1*Iout	3.17039e-011	4.99251e-003	4.99251e-003	1.42475e-003
VP1*I(D4)	1.51748e-012	1.05064e+000	1.05064e+000	1.32047e-003
Ids*Vds	2.88799e-002	-7.02469e-001	-7.31348e-001	2.89887e-002

$P_{MOSFET} = I_{DS}*V_{DS}$ = 29mW





$\Delta Tj = Rth \cdot P_{MOSFET} = 80 \cdot 0.029 = 2.3^{0}C$

Result: if «new range» is assumed in place of «old range», the max ΔTj increase we can expect is negligible

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Evaluation of t_{UVP_DEB} & $t_{UVP\_RESTART}$

old range			
t_{UVP_DEB}		$t_{UVP\_RESTART}$	
min	max	min	max
22.5ms	37.5ms	22.5ms	37.5ms

new range			
t_{UVP_DEB}		$t_{UVP\_RESTART}$	
min	max	min	max
18.75ms	41.25ms	18.75ms	41.25ms

t_{UVP_DEB} is the time interval the UVP pin voltage must stay below the internal threshold V_{UVP_th} for UVP triggering.
Once UVP is entered, VIPer31 switching is inhibited → no functional/reliability issue can come from limits range enlargement.

t_{UVP_REST} is the time interval the UVP pin voltage must stay above V_{UVP_th} for exiting UVP and resume switching.
During t_{UVP_REST},VIPer31 is not switching → no functional/reliability issue can come from limits range enlargement.

Conclusions

		VIPer31				
Parameter	**Unit of measure**	**Old range**		**New range**		**Application impact of the change**
		Min	Max	Min	Max	Negligible
t_{SS}	ms	6	10	5	11	Negligible
t_{OVP_DEB}	us	188	312	156	344	Negligible
t_{UVP_DEB}	ms	22.5	37.5	18.75	41.25	Negligible
$t_{UVP\_RESTART}$	ms	22.5	37.5	18.75	41.25	Negligible
$t_{RESTART}$	s	0.75	1.25	0.625	1.375	Negligible
$t_{OVP\_RESTART}$	s	0.375	0.625	0.312	0.688	Negligible

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Public Products List

Publict Products are off the shelf products. They are not dedicated to specific customers, they are available through ST Sales team, or Distributors, and visible on ST.com

PCN Title : VIPER31: Final Test Limits Change

PCN Reference : AMS/20/12524

Subject : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change.

VIPER319XDTR	VIPER318LDTR	VIPER318HDTR

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