		<b>APPLICATION FOR EXTENSION OF ESCC TECHNOLOGY FLOW APPROVAL</b>			Page 1 Appl. No. <b>287D</b>
Component Title: <b>Thin Film Technology for Chip, Wraparound, Single and Network Resistors, Fixed</b>		Executive Member: <b>CNES</b>		Date: <b>23/01/2015</b>	
Technology Flow submitted for Extension of Qualification Approval:					1
<b>SUMMARY DESCRIPTION</b> P : Single resistor 0402, 0603, 0805, 1206, 2010 chip PRA : 2 to 8 resistors of similar value, based on 0603 (PRA 100), 0805 (PRA135) or 1206 (PRA182) units CNW : 2 to 8 resistors with at least two different values with the same form factor as PRA Substrate : Alumina Resistive layer : Nickel Chromium Protection : Silicium nitride Termination : Nickel Barrier Processes : Thin Film deposition Finish : SnPbAg or Au		<b>TEST STRUCTURES</b> P0402, P0603, P0805, P1206 and P2010 with min., critical resistance and max. values, PRA100, PRA135, PRA182 with min., critical resistance and max. values.		<b>COMPONENTS PROPOSED FOR QUALIFICATION</b> By form factor : ESCC4001023 var. 15 and 13, 14(*) ESCC4001023 var. 01, 05 (*) and 09 ESCC4001023 var. 02, 06 (*) and 10 ESCC4001023 var. 03, 07 (*) and 11 ESCC4001023 var. 04, 08 (*) and 12 ESCC4001025 var. 01 to 07, 22 to 28 ESCC4001025 var. 08 to 14, 29 to 35 ESCC4001025 var. 15 to 21, 36 to 42 (*) Note that gold finish variants are not intended for de-golding and tinning	
Component Manufacturer <b>VISHAY SA</b> <b>Division Résistances de Très Haute Précision</b>		2	Location of Manufacturing Plant(s) <b>Nice (France)</b>		3
Date of original qualification approval: Date: <b>15/02/2009</b> Certificate Ref No. <b>287</b>			4		
ESCC Specifications used for Maintenance testing: Generic: 4001 Issue: Detail(s): 4001/023 Issue: 4001/025 Issue:		5	Deviations to LVT testing and Detail Specification used: No <input type="checkbox"/> Yes <input checked="" type="checkbox"/> (supply details in Box 15) Deviation from current Specifications: No <input checked="" type="checkbox"/> Yes <input type="checkbox"/> (Supply details)		6
Qualification Extension Report reference and date: <b>QML Quality Synthesis reports :</b> <b>QML 2013 Synthesis, including PHR0402 Qualification report,</b> <b>QML 2014 Synthesis, 20/12/2014</b>			7		
Summary of procurement or equivalent test results during current validity period in support of this application (those to ESCC listed first) <b>Note that 2013 data are available from the 2013 QML Synthesis Report, below is a 2014 summary</b>					8
Customer	Component	LVT	Date code	Quantity Delivered	
RUAG, TTI, ALTER T, ASTRIUM, TAS ...	PHR1206 PHR0603 P0402	LVT1 LVT3 LVT3	1414 1413 1436	88 000	
TTI, TAS, TESAT	PRA / CNW	-		48 500	
ALTER, Vishay DALE, ECOMEL, FARNELL	PFRR	-		24 400	
PID changes since start of qualification None <input type="checkbox"/> Minor* <input checked="" type="checkbox"/> Major* <input type="checkbox"/> *Provide details in box: <b>19</b>		9	Current PID Verified by: <b>CNES</b> Name of Executive Representative Ref No: <b>PID-TFD P PRA CNW</b> Issue: <b>7</b> Date: <b>02/02/2015</b> Rev. <b>0</b> Date: <b>22/01/2015</b>		
Current Manufacturing facilities surveyed by: <b>ESA and CNES</b> on <b>22/01/2015</b> (Name of Executive Representative) (Date)			11		
Satisfactory: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explain					
Report Reference: <b>CNES – DCT/AQ/CQ/2015-01664</b>					



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Failure Analysis, DPA, NCCS available: Yes ☒ No ☐ (Supply data) **8D reports 114006, 114012, 114018, 114020, 114032, 114037**

Ref. No's and purposes: **Post or pre-assembly peeling of top metallization: 114006 (PRAHR dc1246), 114018 (P1206 dc 1234), 114032 (PFRR1206 dc 1421), 114037 (PFRR0603 dc 1304)**

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The undersigned hereby certifies on behalf of the ESCC Executive - that the above information is correct; - that the appropriate documentation has been evaluated; - that full compliance to all ESCC requirements is evidence (except as stated in box 15;) - that the reports and data are available at the ESCC Executive and therefore applies on behalf of CNES as the responsible Executive Member for ESCC qualification status to be extended to the component(s) listed herein.

Date: **03/02/2015**

**JP. BUSSENOT**

(Signature of the Executive Coordinator)

Continuation of Boxes above:

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**Box 6: Periodic Testing is defined in paragraph 6 of the Technology Flow PID (See page 3)**



## APPLICATION FOR EXTENSION OF ESCC QUALIFICATION APPROVAL

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Non compliance to ESCC requirements:

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No.:	Specification	Paragraph	Non compliance
1	4001	Chart F4	Chart F4 testing replaced with the implementation of periodic testing as described in box 16

Additional tasks required to achieve full compliance for ESCC qualification or rationale for acceptability of noncompliance:

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None

PRELEVEMENT PHR	PRA/CNW HR (14 mini)	ESSAIS	SPECIFICATION
3 mois / 10p		Pliage	ESCC 4001 Para 8.11.2.2
3 mois / 10p	6 mois / 5p	VRT (pièces montées pour CMS)	ESCC 4001 Para 8.8
3 mois / 20p		Séquence Climatique	ESCC 4001 Para 8.10
Note 1	12 mois / 10p	Endurance 2000h	ESCC 4001 Para 8.13
3 mois / 10p	6 mois / 5p	Soudure : 1) Soudabilité 2) Résistance chaleur de soudage	ESCC 4001 Para 8.14 & 8.12
3 mois / 10p	6 mois / 10p	CT (+ Tracking sur PRA/CNW)	ESCC 4001 Para 8.3.3

**Note 1 : See PID, includes PFRR ESCC 26000 testing for Ohmic value > 99.9 ohm and yearly 2 000 hours for values < 100 ohms**

Executive Manager Disposition

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Application Approval: Yes ☐ No ☐

Action / Remarks:

Date:

\_\_\_\_\_  
Signature, ESA Representative



# APPLICATION FOR EXTENSION OF ESCC QUALIFICATION APPROVAL

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## ANNEX 1: LIST OF TESTS DONE TO SUPPORT EXTENSION OF QUALIFICATION

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Tests conducted in compliance with:

- ESCC 4001 generic specification; Chart F4 (for ESCC/QPL parts);
- or PID-TFD **P PRA CNW Issue 7** (for ESCC/QML parts)

Tests vehicle identification/description:

PHR0402 (x3) dc 1338 (Chart F4), 1438 PHR0603 dc 1302, 1308, 1347, (x2) 1413 (LVT3) 1438	PHR2010 dc 1319, 1343, 1416, 1439
PHR0805 dc 1344, 1350, 1406 PHR1206 dc 1308, 1331, 1345, 1414 (LVT1)	PRAHR dc 1321, 1342, 1347, 1413 CNWHR dc 1312, 1320, 1337, 1410

Detail Specification reference: **4001/023 & /025**

Chart F4	Test	Tick when done	Conditions	Date Code	Tested Qty	N° of Rejects	Comments if not performed. Comments on Rejection
Environmental /Mechanical Subgroup	Mounting	<input checked="" type="checkbox"/>	IEC 60115-1 clause 4.31	1344 1345 1342 1347 1337 1406 1350 1343 1319 1413 1410	5 5 5 5 5 5 5 5 5 5 5	0	
	Rapid Change Of Temperature	<input checked="" type="checkbox"/>	IEC 60068-2-14	1344 1345 1342 1347 1337 1406 1350 1343 1319 1413 1410	5 5 5 5 5 5 5 5 5 5 5	0	
	Vibration	<input type="checkbox"/>	IEC 60068-2-6				NA
	Climatic test Sequence	<input checked="" type="checkbox"/>	ESCC 4001, Para 8.10	1344 1345 1406 1350 1343 1319	10 10 10 10 10 10	0	
	Seal Test	<input type="checkbox"/>	IEC 60068-2-17				NA
	Mounting	<input checked="" type="checkbox"/>	IEC 60115-1 clause 4.31	1347 1344 1345 1406 1350 1343 1319 1416	5 5 5 5 5 5 5 5	0	
	Robustness of Terminations	<input checked="" type="checkbox"/>	IEC 60068-2-21	1347 1344 1345 1406 1350 1343 1319 1416	5 5 5 5 5 5 5 5	0	
	Climatic test Sequence	<input type="checkbox"/>	ESCC 4001, Para 8.10				NA vs PID
	Seal Test	<input type="checkbox"/>	IEC 60068-2-17				NA
	Resistance to Soldering Heat	<input checked="" type="checkbox"/>	IEC 60068-2-20	1347 1344 1342 1347 1337 1406 1350 1319 1416 1413 1410	5 5 3 3 3 5 5 5 5 5 5	0	
	Mounting	<input type="checkbox"/>	IEC 60115-1 clause 4.31				
	Climatic test Sequence	<input type="checkbox"/>	ESCC 4001, Para 8.10				NA vs PID
	Seal Test	<input type="checkbox"/>	IEC 60068-2-17				NA
	Mounting	<input type="checkbox"/>	IEC 60115-1 clause 4.31				

	Insulation Resistance	<input type="checkbox"/>	ESCC 4001, Para 8.3.1.2				NA vs PID
	Voltage Proof	<input type="checkbox"/>	ESCC 4001, Para 8.3.1.3				NA vs PID
Endurance Subgroup	Mounting	<input checked="" type="checkbox"/>	IEC 60115-1 clause 4.31	1342 1347 1337	5 5 5	0	PRA / CNW
	Operating Life	<input checked="" type="checkbox"/>	ESCC 4001, Para 8.13	1342 1347 1337 1413 1410	5 5 5 5 5	0	PRA / CNW
	Seal Test	<input type="checkbox"/>	IEC 60068-2-17				NA
Assembly Capability Subgroup	Solderability	<input checked="" type="checkbox"/>	IEC 60068-2-20	1347 1344 1342 1347 1337 1406 1350 1343 1319 1413 1410	5 5 5 5 5 5 5 5 5 5 5	0	
	Permanence of marking	<input checked="" type="checkbox"/>	ESCC 24800	1342 1347 1337 1413 1410	2 2 2 2 2	0	PRA / CNW
Failure Rate Endurance Subgroup	Operating Life	<input checked="" type="checkbox"/>	ESCC 4001, Para 8.13	Various	120 400 400	0	2 000H 4 000H 8 000H
	Seal Test	<input type="checkbox"/>	IEC 60068-2-17				NA
Additional Tests	High & Low Temp (Temperature Coefficient)	<input checked="" type="checkbox"/>	ESCC 4001	1347 1344 1345 1342 1347 1337 1406 1350 1343 1319 1416 1413 1410	5 4 8 5 5 5 5 5 4 3 3 5 5	0	
		<input type="checkbox"/>					
		<input type="checkbox"/>					

**APPLICATION FOR EXTENSION OF ESCC QUALIFICATION APPROVAL**Component Title: **Thin Film Technology for Chip, Wraparound, Single and Network Resistors, Fixed**Executive Member: **CNES**Date: **23/01/2015**

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## ANNEX 2 : CONFIDENTIAL DATA

## PID changes details

None ☐Minor ☒Major ☐**Correction of PHR Qualified Range, Updating of Periodic Testing Table in paragraph 6.3 of the PID, introduction of procedures for handling of Failure Rate testing and Periodic testing, up-dating of organization, validation of EPOLAC modification.**

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## Noncompliance to ESCC requirements:

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No.:	Specification	Paragraph	Non compliance

Additional tasks required to achieve full compliance for ESCC qualification or rationale for acceptability of noncompliance:

21

## Additional Comments

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## APPLICATION FOR EXTENSION OF ESCC QUALIFICATION APPROVAL

Component title: **Thin Film Technology for Chip, Wraparound, Single and Network Resistors. Fixed**

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**NOTES ON THE COMPLETION OF THE APPLICATION FORM FOR ESCC QUALIFICATION EXTENSION APPROVAL**

## ENTRIES

Form heading shall indicate: - the title of the component as given in its detail specification or the name of the series, family; - the Executive Member; - the entering date; - the certificate number and its sequential suffix.

<b>Box 1</b>	<p>shall provide details given in the table; in particular there shall be listed: - the variants or range of variants; - the range of components (the ESCC code is recommended to indicate the values or values range, the tolerance, the voltage, etc); the designation given in the detail specification as 'base on'; - under Test Vehicle enter either an ESCC code or the specific characteristic capable of identifying the component tested (e.g., voltage of coil for a relay); - under component similar enter a cross if relevant.</p>	
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**Box 2: 3 and 4** As per QPL entry; otherwise, an explanation of the changes must be supplied.

**Box 5** Will show the ESCC Generic and Detail specifications, including issue number and revision letter, current at the time the tests reported were performed. If the specifications are different from those current on the date of the application, see Box 6.

<b>Box 6</b>	Will show the deviations from the Generic and Detail Specifications listed in Box 5, in particular deviations from testing. In case of deviations this must be listed in Box 15. In case the referenced specification in Box 5 have currently a different issue and/or revision indicate also whether the test data deviates or not from such current documents.
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**Box 7** Must reference the report(s) supplied in support of the application.

<b>Box 8</b>	Should provide the details of procurement to the full ESCC System, documentation of all of which should already have been delivered to the ESCC Executive under the terms of the relevant Generic Specification. An appropriate table has been drawn in this box.
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**Box 9** If the PID evolved after the Original Qualification or after the last Extension of Qualification, adequate details of such evolution shall be provided together with the reasons for the changes. Major changes shall be clearly marked.

**Box 10** Identify the current PID issue status, date and actual date of verification. The date of verification of the current PID should be arranged as close as possible to the required date of extension.

<b>Box 11</b>	This box can be completed only after a physical visit to the plant to confirm that no unexplained changes occurred and that the practices, procedures, material, etc. used in manufacturing the components are as described in the PID. This survey shall be carried out in accordance with the requirements of ESCC Basic Specification No. 20200 and its findings shall be recorded.
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<b>Box 12</b>	Provide details of, or reference to, any Destructive Physical Analysis (DPA) and Failure Analysis reports as well as any Nonconformance(s) (NCCS) occurred during the qualification validity period, stating if established corrective action have produced satisfactory results.
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**Box 13** Enter only the name of the Executive Member (i.e., CNES, DLR, ESTEC, etc.) and the signature of the responsible Executive Coordinator

**Box 14** To be used when there is a need to expand any of the boxes from 1 through 12. Identify box affected and reference the Box 14 in the relevant Box. Box 14 can be broken into 14a, 14b, etc. if several boxes have to be expanded.

**Box 15** Fill in Table as requested.

**Box 16** Any additional action deemed necessary by the Executive Member to bring the submitted data to a standard likely to be accepted by the ESCC Executive should be listed herein or the reason(s) to accept the noncompliance.

**Box 17** All Executive Manager recommendations on the application itself, special conditions or restrictions, modifications of the QPL or QML entry, letters to the manufacturer, etc. shall be entered clearly in Box 19, signed by the representative for ESA, and dated.


**Box 18** Fill in Table as requested.

**Box 19** Confidential Details of PID changes including those of a confidential nature, shall be provided.

**Box 20** State noncompliance with reference to specification(s) and paragraph(s). To simplify reference in Box 16 each nonconformance shall be sequentially numbered. If relevant state 'None'.

**Box 21** Any additional action deemed necessary by the Executive Member to bring the submitted data to a standard likely to be accepted by the ESCC Executive should be listed herein or the reason(s) to accept the noncompliance.

**Box 22** Additional Comments.

Types covered by similarity:		Remarks: Components under ESCC QML qualification. Refer to Technology Flow description in REF006. <del>This certificate replaces certificate 265C.</del>		
Procurement Specifications	Manufacturer	Nature of Approval	Supervising Authority	Initial Qualification Date
Generic ESCC 4001  Detail ESCC 4001/023 ESCC 4001/025	VISHAY S.A. Division Sfernice Nice France	Qualification	CNES	Feb 2009
Characteristics and qualified variants: Refer to tables on the next page.  4001/023      PHR      High Stability and Precision Chip  4001/023      PFRR      High Stability and Precision Chip with Established Reliability Level R  4001/025      PRA/CNWHR      High Stability and Precision Surface Mount Array  Operating Temperature Range, (°C): -55 to +155 Lead material is E with either Type 2 or Type 4 finish. The terminal material and finish of some of these variants makes them unsuitable for solder assembly methods . They shall be assembled using glue or wire bond techniques. See Detail specifications.				
		RESISTORS,  FILM, FIXED, CHIP AND ARRAY, THIN FILM,  BASED ON TYPES PHR; PFRR; PRAHR/CNWHR		Page  Certificate  287 € D  10-09 002A



Characteristics: Type PHR, Variants 01 to 08, 13 and 14 are qualified:

Detail Specification	Style	Critical R (kΩ)	Rated Dissipation (W)	Limiting Element Voltage (V)	Type Variant
4001/023	0402	18	0.050	30	13; 14
	0603	12.25	0.100	35	01; 05
	0805	45	0.125	75	02; 06
	1206	40	0.250	100	03; 07
	2010	45	0.500	150	04; 08

Variant	Style	Resistance Range (Note 1)		Tolerance (±%) (Note 2)	Temperature Coefficient (10 <sup>-6</sup> /°C) (Note 2)	Weight (g)
		Min (Ω)	Max (MΩ)			
01, 05	0603	10	0.200 (0.160 for TC « C »)	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.003
02, 06	0805	10	0.250	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.004
03, 07	1206	10	1.000	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.01
04, 08	2010	10	3.000	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.03
13, 14	0402	10	0.100 (0.067 for TC « C »)	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.002

## NOTES

1.

Variant	Style	Critical Resistance (KΩ)
01 – 05	0603	12.25
02 – 06	0805	45
03 – 07	1206	40
04 – 08	2010	45
13 – 14	0402	18

2.

Resistance (Ω)	Available Tolerances (±%)	Series
10 ≤ R < 50	0,1	Any value in the resistance range
50 ≤ R < 100	0,05 and 0,1	
100 ≤ R < 250	0,02; 0,05 and 0,1	
R ≥ 250	0,01; 0,02; 0,05 and 0,1	

Resistance (Ω)	Temperature Coefficient (ppm/°C)	Series
10 ≤ R < 20	E: 25 (-55 °C; +155 °C)	Any value in the resistance range
20 ≤ R < 50	Y: 10 (-55 °C; +155 °C)	
20 ≤ R < 50	Z: 5 (+22 °C; +70 °C)	
R ≥ 50	C: 5 (-55 °C; +155 °C)	



RESISTORS,  
FILM, FIXED, CHIP AND ARRAY, THIN FILM,  
BASED ON TYPES PHR; PFRR; PRAHR/CNWHR

Certificate

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002B

Characteristics: Type PFRR, Variants 09 to 12 and 15 are qualified

Detail Specification	Style	Critical R (k $\Omega$ )	Rated Dissipation (W)	Limiting Element Voltage (V)	Type Variant
4001/023	0402	32	0.050	40	15
	0603	25	0.100	50	09
	0805	80	0.125	100	10
	1206	90	0.250	150	11
	2010	80	0.500	200	12

Style	Resistance Range ( $\Omega$ )	Tolerance ( $\pm\%$ )	Temperature Coefficient TC( $\pm 10^{-6}/^{\circ}\text{C}$ )
0402; 0603; 0805; 1206; 2010	From 100 to $\leq 100\text{K}$	0.05; 0.1	10; 25
0603; 0805; 1206; 2010	From 100 to $\leq 261\text{K}$	0.05; 0.1	10; 25
0805; 1206; 2010	From 261K to $\leq 301\text{K}$	0.05; 0.1	10; 25
1206; 2010	From 301K to $\leq 1\text{M}$	0.05; 0.1	10; 25
2010	From 1M to 3M01	0.05; 0.1	10; 25

The Established Reliability Level R is evaluated according to the ESCC Basic Specification 26000.



RESISTORS,  
FILM, FIXED, CHIP AND ARRAY, THIN FILM,  
BASED ON TYPES PHR; PFRR; PRAHR/CNWHR

Certificate

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002C

Characteristics: Type PRAHR/CNWHR,, Variants 01 to 42 are qualified

Detail Specification	Style	Critical R (K $\Omega$ )	Rated Dissipation (W/resistor)	Limiting Element Voltage (V/resistor)	Type Variant	
					Same Ohmic Values	Different Ohmic Values
4001/025	PRA100	12.25	0.100	35	01 to 07	22 to 28
	PRA135	56.25	0.100	75	08 to 14	29 to 35
	PRA182	100	0.100	100	15 to 21	36 to 42

Style	Resistance Range ( $\Omega$ )	Tolerance ( $\pm\%$ )		Temperature Coefficient TC( $\pm 10^{-6}$ / $^{\circ}\text{C}$ )	
		Absolute	Relative	Absolute	Relative
PRA100; PRA135; PRA182	From 100 to 200K	0.1; 0.5; 1	0.05; 0.1	10	3; 5
PRA135; PRA182	From 200K to 250K	0.1; 0.5; 1	0.05; 0.1	10	3; 5
PRA182	From 250K to 1M	0.1; 0.5; 1	0.05; 0.1	10	3; 5

Number of Resistors per Array: 2 to 8



RESISTORS,  
FILM, FIXED, CHIP AND ARRAY, THIN FILM,  
BASED ON TYPES PHR; PFRR; PRAHR/CNWHR

Certificate

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#### 4.4 VISHAY S.A. FRANCE

##### 4.4.1 Contact Information

Address	ESCC Chief Inspector
Vishay S.A. Division SFERNICE 199, Boulevard de la Madeleine CS71159 F-06003 Nice Cedex 01 France	Mr. L. Cresson Tel: +33 4 93 37 27 88 FAX: +33 4 93 37 28 77 EMAIL: <a href="mailto:laurent.cresson@vishay.com">laurent.cresson@vishay.com</a>

##### 4.4.2 Qualification

Current Qualification Certificate No.	In QML since:	Type Designation
287C D	Feb. 2009	Thin Film Technology for Chip, Wraparound, Single and Network Resistors, Fixed, Based on Types P for Single Chip, PRA and CNW for Resistor Networks

##### 4.4.3 Applicable Documents

ESCC Generic Specification No. 4001

ESCC Detail Specification Nos. 4001/023, 4001/025

Vishay S.A. Process Identification Document PID PID-TFD P PRA CNW

##### 4.4.4 List of Qualified Components

NOTE: the Established Reliability Level R is evaluated according to ESCC specification 26000.

Characteristics: Type PHR, Variants 01 to 08, 13 and 14 are qualified:

Detail Specification	Style	Critical R (kΩ)	Rated Dissipation (W)	Limiting Element Voltage (V)	Type Variant
4001/023	0402	18	0.050	30	13; 14
	0603	12.25	0.100	35	01; 05
	0805	45	0.125	75	02; 06
	1206	40	0.250	100	03; 07
	2010	45	0.500	150	04; 08

Variant	Style	Resistance Range (Note 1)		Tolerance (±%) (Note 2)	Temperature Coefficient (10 <sup>-9</sup> /°C) (Note 2)	Weight (g)
		Min (Ω)	Max (MΩ)			
01, 05	0603	10	0.200 (0.160 for TC « C »)	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.003
02, 06	0805	10	0.250	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.004
03, 07	1206	10	1.000	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.01
04, 08	2010	10	3.000	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.03
13, 14	0402	10	0.100 (0.067 for TC « C »)	0.01; 0.02; 0.05; 0.1	±5; ±10; ±25	0.002

#### NOTES

1.

Variant	Style	Critical Resistance (KΩ)
01 – 05	0603	12.25
02 – 06	0805	45
03 – 07	1206	40
04 – 08	2010	45
13 – 14	0402	18

2.

Resistance (Ω)	Available Tolerances (±%)	Series
10 ≤ R < 50	0,1	Any value in the resistance range
50 ≤ R < 100	0,05 and 0,1	
100 ≤ R < 250	0,02; 0,05 and 0,1	
R ≥ 250	0,01; 0,02; 0,05 and 0,1	

Resistance (Ω)	Temperature Coefficient (ppm/°C)	Series
10 ≤ R < 20	E: 25 (-55 °C; +155 °C)	Any value in the resistance range
20 ≤ R < 50	Y: 10 (-55 °C; +155 °C)	
20 ≤ R < 50	Z: 5 (+22 °C; +70 °C)	
R ≥ 50	C: 5 (-55 °C; +155 °C)	

Characteristics: Type PFRR, Variants 09 to 12 and 15 are qualified

Detail Specification	Style	Critical R (kΩ)	Rated Dissipation (W)	Limiting Element Voltage (V)	Type Variant
4001/023	0402	32	0.050	40	15
	0603	25	0.100	50	09
	0805	80	0.125	100	10
	1206	90	0.250	150	11
	2010	80	0.500	200	12

Style	Resistance Range (Ω)	Tolerance (±%)	Temperature Coefficient TC(±10 <sup>-6</sup> /°C)
0402; 0603; 0805; 1206; 2010	From 100 to ≤ 100K	0.05; 0.1	10; 25
0603; 0805; 1206; 2010	From 100 to ≤ 261K	0.05; 0.1	10; 25
0805; 1206; 2010	From 261K to ≤ 301K	0.05; 0.1	10; 25
1206; 2010	From 301K to ≤ 1M	0.05; 0.1	10; 25
2010	From 1M to 3M01	0.05; 0.1	10; 25

Characteristics: Type PRAHR/CNWHR,, Variants 01 to 42 are qualified

Detail Specification	Style	Critical R (K $\Omega$ )	Rated Dissipation (W/resistor)	Limiting Element Voltage (V/resistor)	Type Variant	
4001/025	PRA100	12.25	0.100	35	Same Ohmic Values 01 to 07	Different Ohmic Values 22 to 28
	PRA135	56.25	0.100	75	08 to 14	29 to 35
	PRA182	100	0.100	100	15 to 21	36 to 42

Style	Resistance Range ( $\Omega$ )	Tolerance ( $\pm\%$ )		Temperature Coefficient TC( $\pm 10^{-6}/^{\circ}\text{C}$ )	
		Absolute	Relative	Absolute	Relative
PRA100; PRA135; PRA182	From 100 to 200K	0.1; 0.5; 1	0.05; 0.1	10	3; 5
PRA135; PRA182	From 200K to 250K	0.1; 0.5; 1	0.05; 0.1	10	3; 5
PRA182	From 250K to 1M	0.1; 0.5; 1	0.05; 0.1	10	3; 5

Number of Resistors per Array: 2 to 8

- Note that gold finish variants are not intended for de-golding and tinning.
- The electrical ranges of these ESCC QML Qualified components variants are listed in the ESCC Detail Specifications and in the Qualified Part List (REP005) document available on the ESCIES website, [https:// escies.org](https://escies.org).

#### 4.4.5 Technology Flow Abstract

- Technology Flow  
The thin film technology for chip, fixed, wraparound, single and network resistors are designed on types based on P for single chip, PRA for 2 to 8 resistors of similar value and CNW for 2 to 8 resistors with at least two different values with the same form factor as PRA.

Technology Flow	Scope	Site
Design Centre	Single resistor chips in 0402 0603, 0805, 1206 and 2010 formats 2 to 8 resistors of similar value in formats 0603, 0805 and 1206 2 to 8 resistors with at least 2 different values with the same form factor, 0603, 0805 or 1206	Vishay S.A. Division SFERNICE 199, Boulevard de la Madeleine CS71159 F-06003 Nice Cedex 01 France
Fabrication	Film deposition Photolithography Thermal treatment Passivation Thermal stabilization and control	As above
Assembly	Laser trim Protective layer Termination and Test	As above

Test	Chart F2, F3 and F4 Periodic Testing	As above
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(a) Basic Information

The technology consists of:

- Substrate: High purity alumina (99.5%)
- Resistive Layer: Nickel chromium
- Passivation Layer: Silicon Nitride
- Protection: Epoxy and Silicone
- Termination: Nickel barrier
- Processes: Thin film deposition
- Finish: SnPbAg or Au

Critical resistance by style:

- P 0402 FR:32 k
- P 0603 FR:25 k
- P 0603 HR:12.25 k
- P 0805 FR: 80k
- P 0805 HR: 45 k
- P 1206 FR: 90 k
- P 1206 HR: 40 k
- P 2010 FR: 80k
- P 2010 HR: 45 k
- PRA 100: 12.25 k
- PRA 135: 56.25 k
- PRA 182: 100 k

(a) Component Types

The available formats are defined in the variants table in the Detail Specifications. Variants with established reliability in accordance with Basic specification No. 26000 are designated with an "FR" suffix here for convenience. Variants 09, 10, 11 and 12 have established reliability level 'R' at 60% confidence level.

5. Design

The design manuals covers the design rules and limits:

- HP-BE/001 (Maîtrise de la conception)
- HP-BE/004 (Données technologiques, Règles d'implémentation, Performances)

Critical design characteristics:

- Minimum metal width: 10  $\mu\text{m}$
- Power dissipation lower than 250mW/mm<sup>2</sup>
- Current density lower than 7000 A/mm<sup>2</sup>
- Electrical field lower than 5V/  $\mu\text{m}$

3. Fabrication/Assembly

The manufacturing flows and procedures are described in section 4 of Vishay S.A.PID.

4. Test

Complete test sequence as detailed in ESCC Generic 4001 and the relevant Detail Specifications is conducted by Vishay S.A.

The deletion of the Third Harmonic Control requirement from ESCC Detail Specification No. 4001/023 for thin film wraparound technology is documented in reference report MAT/3HC/07.02 revision 3 dated 2007-06-20.

For variants with established reliability the efficiency of the Overload Test is increased with the implementation of a resistance change rejection criteria of 500 ppm and approved by TRB decisions on 2007-04-04.

5. Radiation Characteristics

The resistors covered in this technology domain is considered insensitive to radiation effects.