

DeltaQualifikationsMatrix

Allgemeines

Kurze Produkt- und Technologiezyklen elektronischer Bauelemente sowie neue Umweltauflagen (Bleiverbot, Flammschwermetalle, ...) führen häufig zu prozess- und werkstofftechnischen Änderungen an Bauelementen, Leiterplatten, Verbindungstechnik und Schaltung, welche evaluiert werden müssen. Eine geeignete Methodik zur Handhabung von Änderungen an elektronischen Bauelementen beschreibt die ZVEI "Guideline for Customer Notifications of Product and /or Process Changes (PCN) of Electronic Components specified for Automotive Applications". Ein wesentlicher Teil dieser Guideline sind die hier vorliegenden Matrizen, welche sich als Empfehlungen für die Evaluierung von typischen Änderungen an elektronischen Bauelementen verstehen. Dies sollte Teil des offenen und risikobewussten Dialoges zwischen Lieferant und Kunden sein. Diese DeltaQualifikationsMatrizen wurden durch den Industriearbeitskreis "PCN DeltaQualifikationsMatrix" und den Bauteilexperten des ZVEI Arbeitskreises "PCN-Methodik" erarbeitet. Der Inhalt wurde basierend auf dem aktuellen Stand der Technik erstellt und erhebt keinen Anspruch auf Vollständigkeit. Im Einzelfall ist ggf. ein abweichendes Vorgehen abzustimmen, da kundenspezifische Vereinbarungen zur Qualifikation zu berücksichtigen sind.

Anwendung der DeltaQualifikationsMatrix (auszufüllen durch den Bauelementhersteller)

- Diese Tabelle ist **nur** bei Änderungen anzuwenden. Neuqualifikationen und Sonderqualifikation (z.B. Verguß von Modulen) sowie Information Notes bleiben von diesen Matrizen unberührt.
- Ist eine Änderung in dieser Tabelle nicht aufgeführt, so ist der Qualifikationsumfang zwischen Kunde und Lieferant abzustimmen.
- Die Matrix der Aktiven Bauelemente ist so aufgebaut, dass zwischen integrierten Halbleitern (AEC-Q100 Rev.H) und diskreten Halbleitern (AEC-Q101 Rev. D1) auszuwählen ist (Zelle D4). Für Passive Bauelemente gilt die AEC-Q200. Für LED's gilt die IEC 60810.
- Alle** Änderungen in der PCN sind in der Spalte B durch ein Kreuz (x) zu markieren und werden dadurch farblich hervorgehoben. Sofern dies geschehen ist, werden im Feld "Tests, which should be considered for the appropriate process change" (Zelle 83 für Aktive Bauelemente, Zelle 466 für Passive Bauelemente oder in Zelle 77 für LED's) alle in Betracht zu ziehenden Zuverlässigkeitstests angezeigt.
- In "Tests, which should be considered for the appropriate process change after selection of condition table" (Zelle 85 für Aktive Bauelemente, Zelle 468 für Passive Bauelemente oder Zelle 79 für LED's) wird die Anpassung der in Betracht zu ziehenden Tests in Folge der Relevanz bezüglich der Änderung berücksichtigt. Dazu ist die Tabelle "Conditions" entsprechend der Auswahl (A/B/C) mit einem (x) zu bewerten.
- In "Suppliers performed tests" (Zelle 87 für Aktive Bauelemente, Zelle 470 für Passive Bauelemente oder Zelle 81 für LED's) dokumentiert der Bauelementhersteller die durchgeführten bzw. geplanten Tests.
- Falls von der Testempfehlung abgewichen wird, so sollten diese Abweichungen vom Bauelementhersteller angezeigt und kommentiert werden. Hierzu ist der Bereich "Reason for exception of tests" (Zelle 89 für Aktive Bauelemente, Zelle 472 für Passive Bauelemente oder Zelle 83 für LED's) zu verwenden. Werden die in Betracht zu ziehenden Tests durch generische Daten (G) belegt, ist dies ebenfalls hier anzuzeigen und zu begründen.

Die Einstufung des Untersuchungslevel erfolgt in folgende Kategorien

- *C: Component level***: Die Evaluierung der Änderung am Bauelement ist durch Untersuchungen **ausschließlich** am Bauelement beim Bauelementhersteller durchführbar. Zur Evaluierung der Änderung dürfen Ergebnisse aus bereits durchgeführten Untersuchungen herangezogen werden, wenn diese zu einem ähnlichen Bauelement bereits vorliegen (**Generische Daten**).
- *B: Board level***: Die beschriebene Änderung hat möglicherweise Einfluss auf die Verarbeitbarkeit des Bauelementes im Steuergerät. Die Evaluierung der Änderung wird wie unter C beim Bauelementhersteller durchgeführt. Zusätzlich ist durch den Kunden/Steuergeräthehersteller die Verarbeitbarkeit zu prüfen, die z.B. abhängig von der Änderung, Zuverlässigkeitsuntersuchungen auf applikationsrelevanten Testboards erfordert.
- *A: Application level***: Die beschriebene Änderung hat möglicherweise Einfluss auf die Applikation/ das Steuergerät. Die Evaluierung der Änderung wird wie unter C oder B durchgeführt. Zusätzlich ist vom Kunden/Steuergeräthehersteller der Einfluss der Änderung im Steuergerät durch geeignete Untersuchungen zu bewerten. Dieses Vorgehen ist mit dem OEM abzustimmen. Hierbei ist zu berücksichtigen, ob die Steuergeräte- / Baugruppenanforderungen durch andere Qualifikationen bereits hinreichend abgesichert sind (**applikationsspezifische Risikobetrachtung**).
- ** : Not relevant for qualification matrix***: Änderung(en), die nicht in A, B oder C eingestuft werden können und somit nicht relevant für die DeQUMA sind.

Information Notes

Änderungen die nur eine Information Note benötigen (bei der Bewertung Risk on Supply Chain als "I" gekennzeichnet), dürfen nicht in der DeQuMa angekreuzt werden, da Sie ansonsten den erforderlichen Evaluierungslevel verfälschen. Für als "I" bewertete Änderungen ist das Information Note Formblatt zu verwenden.

Wichtige Hinweise

- Zur formgerechten Anwendung der DeltaQualifikationsMatrizen steht auf der Homepage des ZVEI AK ein Tutorial bereit (ZVEI-Tutorial).
- ID Nummer: ist eine eindeutige Identifikationsnummer für jede angegebene Änderung, die in den ZVEI PCN DeltaQualifikationsMatrizen identifiziert ist. Die gleiche ID Nummer wird zur Identifizierung der Änderung im PCN Form Sheet verwendet.
- Die mittels Matrix identifizierten Tests sind in **Betracht zu ziehen**, d.h. es ist zu prüfen, ob der jeweilige Test für die spezifische Änderung in dieser Form notwendig ist. Abweichungen oder generische Daten sind im Detail zu begründen.
- Die Spalte "Further applicable conditions", Bemerkungen und Fußnoten sind unbedingt zu beachten, da sie wichtige Hinweise und Einschränkungen enthalten.
- Zur Nutzung aller Funktionen muss in Excel die Anwendung von Makros freigegeben sein.

Form provided by ZVEI - Revision 3.1 - December 2016

DeltaQualificationMatrix

General

Short product and technology cycles as well as new environmental regulations („Pb-free“, flame retardants, ...) frequently result in process and material changes of components, printed circuit boards, assembly techniques and circuit layout which have to be evaluated. The ZVEI "Guideline for Customer Notifications of Product and /or Process Changes (PCN) of Electronic Components specified for Automotive Applications" describes an appropriate methodology for dealing with changed electronic components. The qualification matrices in this guideline are recommendations for how to assess typical changes of electronic components. These recommendations promote an open risk-based discussion between supplier and customer regarding qualifications.

The DeltaQualificationMatrices were developed by the Industry Task Force Team "PCN DeltaQualificationMatrix" together with component experts from the ZVEI Working Group "PCN-Methodology". Actual content represents state-of-the-art technology and does not claim to be comprehensive. Deviation from proposed guideline should be mutually agreed as customer specific requirements have to be considered.

DeltaQualificationMatrix Application (completion by component manufacturer)

- This table has to be used for changes **only**. The matrices are not applicable for new product, special qualifications (for instance for encapsulation of module) or Information Notes.
- If a change is not listed in this table, the qualification plan has to be defined and agreed between customer and supplier.
- The matrix for Active Components requires the user to choose between integrated circuits (AEC-Q100 Rev. H) and discrete semiconductors (AEC-Q101 Rev.D1) (cell D4). For Passive Components AEC-Q200 is used. For LED'S the IEC 60810 is used.
- All** changes as listed in the PCN have to be marked by a cross (x) in column B and will appear colored. The relevant reliability tests are then shown in "Tests, which should be considered for the appropriate process change" (row 83 for Active Components, row 466 for Passive Components, respectively in row 77 for LED's).
- In "Tests, which should be considered for the appropriate process change after selection of condition table" (see row 85 for Active Components, row 468 for Passive Components, or row 79 for LED's) is for modification of the found relevant tests under consideration of the weight of change. Related table "Conditions" has to be assessed per proposed letters with an (x).
- In "Suppliers performed tests" (here row 87 for Active Components, row 470 for Passive Components, or row 81 for LED's) the component manufacturer documents the planned and performed tests.
- In case of deviations from tests, which should be considered this should be notified and commented by the component manufacturer in the area "Reason for exception of tests" (see row 89 for Active Components, row 472 for Passive Components, or row 83 for LED's). Test results in form of generic data (G) are allowed when notified and justified.

Evaluation Levels are categorized as follows

- *C: Component level***: The evaluation of a change at component level by the component manufacturer is sufficient. Generic data from other relevant evaluations can be used.
- *B: Board level***: The intended change described in the PCN may influence processability / manufacturability of the component at board level. Therefore additional evaluation by customer may be necessary, for example reliability tests on application relevant testboards, depending on change.
- *A: Application level***: The intended change described in the PCN may influence the properties of the application (e.g. Electronic Control Unit). In addition to the evaluation under C or B the influence of the change in the application is evaluated by suitable investigations by the customer. The scope of the evaluation has to be aligned with the OEM. It has to be considered whether the application / assembly requirements are already sufficiently safeguarded by other qualifications (**application specific risk assessment**).
- ** : Not relevant for qualification matrix***: Changes which fulfill neither A,B nor C definitions

Information Notes

Changes indicated as "I" shall not be marked in the DeQuMa. For those changes the InformationNote sheet shall be used. As the DeQuMa is desired for PCN only, a marking of "I"-changes would automatically influence evaluation level and test effort.

Important Notes

- To use the matrices in the right form the ZVEI working group provides a Tutorial on its homepage (ZVEI-Tutorial)
- ID number: is a unique identification number for each indicated change defined in the ZVEI PCN DeltaQualificationMatrices. The same ID number is used in the PCN Form sheet to identify the change.
- Tests identified by the matrix have to be **considered** and checked if they are necessary to assess the specific change. Test modifications or generic data have to be justified in detail.
- "Further applicable conditions", comments and notes need attention, as they provide important hints and limitations.
- In order to use all functions in EXCEL, macros have to be allowed.

History of DeQuMa

Version	Remarks
2.0	Revised by ZVEI PCN Methodology Workgroup in March 2015
2.1	Released March 2015
2.1.1	Active Components - delete write protection in comments
2.2	Solved problems with some ActiveX configurations
2.2.2	Solved Problems in Active Components
2.2.3	Solved Problems ActiveX, Active Components SEM-DE-02 (Design changes in routing) error fixed
2.2.4	Minor fixes
3.0	General Revision by ZVEI PCN Methodology Workgroup in June 2016 Changes are indicated by underlining in the read only version named Changes_DeQuMa_rev3_vs_rev2.xlsx
3.0.4	Expert Release
3.0.5	Fixing of macro bugs
3.1	Final Release (orthographic and punctuation corrections)

Worked on: (Name, Function)	Max Mustermann
Date:	
PCN number:	
Signature:	

Form provided by Q202 - Revision 3.1 - December 2019

Component	ID	Type of change	Impact on Risk	Further applicable conditions	Device evaluation additional to AEC-Q200 Revision D																	Remarks																				
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P																						
NETWORKS & RESISTORS	ANY																																									
	PAS-RES-MX-01		Any change with impact on special customer characteristics contractual agreements	P	P																																					
	PAS-RES-MX-02		Any change with impact on processability/manufacturability of customer, which is not covered in the main below	P	P																																					
NETWORKS & RESISTORS	DESIGN																																									
	PAS-RES-DS-01		Change of electrical/parametric/electrical specification (mfg. / use, type, related test / or AGDCC specification)	P	P																																					
	PAS-RES-DS-02		Correction of data sheet	I	P																																					
NETWORKS & RESISTORS	MATERIAL																																									
	PAS-RES-MM-01		Change of material composition - 50/50 mix of material element	P	P																																					
	PAS-RES-MM-02		Change of material composition - 100% Wire material of Terminal element	P	P																																					
NETWORKS & RESISTORS	PACKAGING																																									
	PAS-RES-PK-01		Change of material composition - Package Mat	P	P																																					
	PAS-RES-MM-04		Change of material composition - Resistor Material	P	P																																					
NETWORKS & RESISTORS	PROCESSING																																									
	PAS-RES-PR-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-PR-06		Change of supplier of material	C	P																																					
NETWORKS & RESISTORS	DESIGN																																									
	PAS-RES-DE-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-DE-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	PROCESSING																																									
	PAS-RES-PR-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-PR-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	PACKAGING																																									
	PAS-RES-PK-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-PK-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	DESIGN																																									
	PAS-RES-DE-01		Change of material composition - Substrate material	P	P																																					
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	PAS-RES-MM-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	PACKAGING																																									
	PAS-RES-PK-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-PK-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	DESIGN																																									
	PAS-RES-DS-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-DS-02		Change of material composition - Substrate material	P	P																																					
NETWORKS & RESISTORS	MATERIAL																																									
	PAS-RES-MM-01		Change of material composition - Substrate material	P	P																																					
	PAS-RES-MM-02		Change of material composition - Substrate material	P	P																																					

Max change with an "X" in the column

Selection of component

additional to AEC-Q200

Change ID	Change Description	Category	Sub-Category	Impact	Priority	Phase	Requirement	Material	Process	Equipment	Documentation	Testing	Validation	Approval	Other
PAS-QU-PR-02	Dry pack requirements change	P	P	Change of dry pack requirements	g.g. change of MSL h.g. change in dry pack assurance (PIC, MBS)	B									
PAS-QU-PR-03	Change of carrier tray (nest)	P	P	Change of carrier	g.g. change by material h.g. change by geometry	B									
PACKING / SHIPPING - VISUAL INSPECTION															
PAS-QU-PIV-01	Change of labelling	I	P	Change of labelling, also on nest	g.g. a. without information (that's shared) h.g. change of customer specific information	B									
PAS-QU-PIV-02	Change of product marking	I	P	Marking on device	g.g. change of content of marking h.g. change of method of marking i.g. change of assurance of marking	B									
PAS-QU-PIV-03	Change of packaging/shipping specification	P	P	Change in packing specification which does not affect a change of the packing	g.g. change of documentation in packing specification	-									
LOGISTICS / CAPACITY / TESTING - EQUIPMENT															
PAS-QU-ED-01	Production from a new equipment which uses a different technology or which due to its unique form or function can be expected to influence the integrity of the final product	P	P	Change in process technique which is not already covered by other rules. Changes affecting the product or process by the rules require also a PCH	g.g. new equipment supplier with different process control	C									Test effort depends on final risk assessment. Performance test according to affected process change.
PAS-QU-ED-02	Production from a new equipment which uses the same basic technology (replacement equipment or extension of existing equipment)	I	P	PCH required for dedicated equipment for sensitive component production	g.g. additional equipment to increase production capacity h.g. replacement of same equipment	C									Test effort depends on final risk assessment. Performance test according to affected process change.
PAS-QU-ED-03	Change in final test equipment type that uses a different technology	P	P	Change of final test equipment which use different technology PCH required for dedicated equipment for sensitive parameters	g.g. change of water platform	C									Gage R&R / Gage combination
LOGISTICS / CAPACITY / TESTING - PROCESSES / PLAN															
PAS-QU-PP-01	Manufacturing site transfer or replacement of a part of production process to a different location	P	P	Change of manufacturing site. Note: transportation risks (one applicable is not affected)	Assessment or transfer of manufacturing site or process only to a different location	B									
PAS-QU-PP-02	Extension or addition of a manufacturing process step	I	P	Change of manufacturing process technique	g.g. adding / changing process h.g. change of order processing	C									Characterization depends on impact of production line
LOGISTICS / CAPACITY / TESTING - G-GATE															
QUA-GE-01	Change of test component used by the supplier to reduce data sheet compliance (e.g. microprocessor) or physical requirements (e.g. flow block, microprocessor) or electrical requirements (e.g. test flow block, reduction from PCH to test flow block) or change in test process	I	P	Change of test coverage	g.g. change from 100% to sample inspection h.g. test flow block, reduction from PCH to test flow block i.g. change in test process	C									Check: RPTs, test coverage / capability only for change in test process
MECHANICAL / ELECTRICAL / CHEMICAL															
PAS-ALL-ME-01	Any change with impact on processability/manufacturability of customer, which is not covered in the contract	P	P	No relevant for technical evaluation		-									
PAS-ALL-ME-02	Any change with impact on processability/manufacturability of customer, which is not covered in the contract	P	P	Technical interface means component terminals. The processability on board level		B									
DATASHEET															
PAS-ALL-DS-01	Change of electrical parameters/electrical specification (Min, Max, Typ, values) and / or AC/DC specification	P	P	Change of application relevant information. Supplier or change. No technical change of the product, only variation in description (naming, drawing, ...)	g.g. tighten of electrical parameter distribution	A									Risk assessment depending on change for each application.
PAS-ALL-DS-02	Correction of data sheet	I	P	g.g. in case of technical change (PI) in case of impact on product (PI)	g.g. data sheet correction because of new information about component behavior	A									
PAS-ALL-DS-03	Specification of additional parameters	I	P	Description of a new test products (cover of parameter). No technical change of the product (PI). Risk assessment depending on change for each application to provide additional parameters (see evaluation)	g.g. adding new tested parameter	A									
MATERIAL															
PAS-ALL-M-01	Change of material composition - Housing	P	P	Change of housing	g.g. change Al alloy for housing	C									g.g. only if a cap holder holds the capacitor body by pressing
PAS-ALL-M-02	Change of material composition - Sealing	P	P	Change of sealing	g.g. change of rubber compound h.g. change of welding wire (material leads, SnAg Ni) i.g. change from PCH to PCH	B									g.g. in case of internal surface of sealing is changed, Evaluation only, if exposure to gas
PAS-ALL-M-03	Change of material composition - External insulation / covering	P	P	Change of external insulation / covering	g.g. change from PCH to PCH h.g. change of colour	B									g.g. Only for glass capacitors
PAS-ALL-M-04	Change of material composition - Lead / Termination	P	P	Change of lead or solder termination	g.g. change of leadframe from iron into copper h.g. change of leadframe from lead to lead free	C									g.g. A, Only if impedance increases (delta change expected). Check if electrical is affected (PAS-ALL-DS-01)
PAS-ALL-M-05	Change of material composition - Internal insulation / Paper	P	P	Change of paper type / internal insulation	g.g. change of paper thickness 50 µm to 40µm	C									g.g. A, Only if impedance increases (delta change expected). Check if electrical is affected (PAS-ALL-DS-01)
PAS-ALL-M-06	Change of material composition - Electrolyte	P	P	Change of electrolyte	g.g. change in formulation	C									g.g. A, Only if impedance increases (delta change expected). Check if electrical is affected (PAS-ALL-DS-01)
PAS-ALL-M-07	Change of material composition - Tape Material	P	P	Change of changing tape material	g.g. change of die or base material	B									
PAS-ALL-M-08	Change of material composition - Base Plate	P	P	Change of base plate material	g.g. change of used plastic material	B									
PAS-ALL-M-09	Change of supplier of material	I	P	Change to a new or additional material supplier at component manufacturer	g.g. for 2nd source purpose	C									Test effort depends on final risk assessment. Performance test according to affected process. Internal specification remains unchanged. Otherwise see change of material.
DESIGN															
PAS-ALL-DE-01	Change of termination, surface finish, shape, color, appearance or dimension structure - Wire Connect	I	P	Change of wire diameter	g.g. change from 0.8 into 0.6 mm wire diameter	B									
PAS-ALL-DE-02	Change of termination, surface finish, shape, color, appearance or dimension structure - Termination	I	P	Change of termination appearance for solder / reflow only	g.g. change from reel to into length in	B									
PAS-ALL-DE-03	Change of termination, surface finish, shape, color, appearance or dimension structure - Appearance	I	P	Change of appearance. Note: Marking on device is defined as process change (PAS-QU-PIV-02)	g.g. change of color/appearance h.g. change of wire and shape	B									
PAS-ALL-DE-04	Change of termination, surface finish, shape, color, appearance or dimension structure - Rubber Seals	I	P	Change of rubber sealing stand-off shape (for solder)	g.g. change of profile / shape	A									
PAS-ALL-DE-05	Change of inner connection - Aluminum Fill	I	P	Change of Al fill with	g.g. change of with	B									
PAS-ALL-DE-06	Change of inner connection - Soldering	I	P	Change of soldering with	g.g. change of with	C									
PAS-ALL-DE-07	Change of inner connection - Chemical Clean	I	P	Change of inner connection	g.g. change of inner connection/density	C									
PAS-ALL-DE-08	Change of inner connection - Inner Connection	I	P	Change of inner connection	g.g. change of shape/dimension	C									Terminal Strength (1) not for sold components without visible film.
PAS-ALL-DE-09	Change of inner connection - Changing Tape	I	P	Change of changing tape	g.g. change of dimension	C									
PAS-ALL-DE-10	Change of inner connection - Fill	I	P	Change of fill type	g.g. change of wetting level h.g. change of thickness	C									
PROCESS															
PAS-ALL-PR-01	Changes in process technology or manufacturing methods - Terminal Attach	I	P	Change of terminal attach process	g.g. change of wetting / wetting layout	C									Terminal Strength (1) and Voltage (1) not for sold components without MSL/MBS
PAS-ALL-PR-02	Changes in process technology or manufacturing methods - Winding	I	P	Change of winding process	g.g. change of material composition	B									g.g. only for HFR application
PAS-ALL-PR-03	Changes in process technology or manufacturing methods - Impregnation	I	P	Change of impregnation	g.g. change of fill process into industrial application	C									g.g. Surge voltage test for high voltage components only.
PAS-ALL-PR-04	Changes in process technology or manufacturing methods - Assembly	I	P	Change of assembly process	g.g. change of welding method h.g. change of assembly process assistance	C									g.g. Diodes on process change
PAS-ALL-PR-05	Changes in process technology or manufacturing methods - Aging / Testing	I	P	Change of aging/testing process	g.g. change of aging, voltage or temperature of process	C									g.g. Diodes on process change
PAS-ALL-PR-06	Changes in process technology or manufacturing methods - Tin & Form Lead	I	P	Change of tin & form process (lead)	g.g. change of holding shape or bonding procedure	B									Substability may be influenced
PAS-ALL-PR-07	Changes in process technology or manufacturing methods - Tin & Form SMD	I	P	Change of tin & form process (SMD)	g.g. change of holding shape or bonding procedure	B									Substability may be influenced
PAS-ALL-PR-08	Process tightly, tuning with specification	I	P	Variant within process specification	g.g. process control	C									
PACKING / SHIPPING - NEW MATERIAL, CRITICAL DIMENSIONS															
PAS-ALL-PIV-01	Packing / shipping specification change (dimension of tolerances)	P	P	Change of packing specification	g.g. number of pieces on nest	B									
PAS-ALL-PR-02	Dry pack requirements change	P	P	Change of dry pack requirements	g.g. change of MSL h.g. change in dry pack assurance (PIC, MBS)	B									
PAS-ALL-PR-03	Change of carrier tray (nest)	P	P	Change of carrier	g.g. change by material h.g. change by geometry	B									
PACKING / SHIPPING - VISUAL INSPECTION															
PAS-ALL-PIV-01	Change of labelling	I	P	Change of labelling, also on nest	g.g. a. without information (that's shared) h.g. change of customer specific information	B									
PAS-ALL-PIV-02	Change of product marking	I	P	Marking on device	g.g. change of content of marking h.g. change of method of marking i.g. change of assurance of marking	B									
PAS-ALL-PIV-03	Change of packaging/shipping specification	P	P	Change in packing specification which does not affect a change of the packing	g.g. change of documentation in packing specification	-									
LOGISTICS / CAPACITY / TESTING - EQUIPMENT															
PAS-ALL-ED-01	Production from a new equipment which uses a different technology or which due to its unique form or function can be expected to influence the integrity of the final product	P	P	Change in process technique which is not already covered by other rules. Changes affecting the product or process by the rules require also a PCH	g.g. new equipment supplier with different process control	C									Test effort depends on final risk assessment. Performance test according to affected process change.
PAS-ALL-ED-02	Production from a new equipment which uses the same basic technology (replacement equipment or extension of existing equipment)	I	P	PCH required for dedicated equipment for sensitive component production	g.g. additional equipment to increase production capacity h.g. replacement of same equipment	C									Test effort depends on final risk assessment. Performance test according to affected process change.

	FA5-VOR-DE-04	Change of termination, surface finish, shape, color, appearance or dimension structure appearance	I	P	Change of appearance. Note: Marking on device to reflect an appearance change (FA5-VOR-PIV-03)	e.g. change of solder or color on component during construction with other changes	B																																
	FA5-VOR-DE-05	Change of inner construction: Electrode	...	P	Change of electrode layer thickness or geometry	e.g. change of electrode design for multilayer technology only	C																																
	FA5-VOR-DE-06	Change of inner construction: Layer Thickness	...	P	Change of ceramic layer thickness. For multilayer technology only	e.g. change from 1.5µm to 1µm	C																																
	FA5-VOR-DE-07	Change of inner construction: Number of Layers	...	P	Change of number of ceramic or metal layers for multilayer technology only. Always in combination with FA5-VOR-DE-06		C																																
	FA5-VOR-DE-08	Change of inner construction: Grain size	...	P	Change of grain size. Grain size is a result of process and / or material choice	e.g. change of grain size	C																																
	FA5-VOR-DE-09	Change of inner construction: Grain boundary size	...	P	Change of grain boundary size. Grain boundary size is a result of process and / or material choice	e.g. change of grain boundary size	C																																
	PROCESS																																						
	FA5-VOR-PR-01	Change in process technology or manufacturing methods: Lamination	...	P	Change of laminated / press technique Note: FCN required	e.g. pressure or temperature	C																																
	FA5-VOR-PR-02	Change in process technology or manufacturing methods: Firing	...	P	Change of firing / sintering profile	e.g. temperature level or the level / or atmosphere, e.g. from forced to soft lit.	C																																
	FA5-VOR-PR-03	Change in process technology or manufacturing methods: Cling	...	P	Change of clinging	e.g. change from coating to sintering	C																																
	FA5-VOR-PR-04	Change in process technology or manufacturing methods: Termination	...	P	Change for termination preparation like paste or steps of termination base layer	e.g. change in printing technology (final termination)	B																																
	FA5-VOR-PR-05	Change in process technology or manufacturing methods: Electrode apply	...	P	Change of electrode apply. For multilayer technology only	e.g. change of sinter electrode by laser method	C																																
	FA5-VOR-PR-06	Change in process technology or manufacturing methods: Assembly	...	P	Change in assembly process for loaded or unloaded devices	e.g. adding method for test select to element or adding reworkable process	C																																
	FA5-VOR-PR-07	Process regularly being within specification	...	P	Deviation within process specification	e.g. process control	C																																
	PACKING / SHIPPING - NEW MATERIAL, MATERIAL SUBSTITUTION																																						
	FA5-VOR-PIV-01	Packing / shipping specification change (downstream of fabrication)	P	P	Change of packing specification	e.g. number of pieces on reel	B																																
	FA5-VOR-PIV-02	Dry pack requirements change	P	P	Change of dry pack requirements	e.g. change of IEC, change in dry pack insurance (IEC, IES)	B																																
	FA5-VOR-PIV-03	Change of carrier (day, reel)	P	P	Change of carrier	e.g. change by material, e.g. change by diameter	B																																
	PACKING / SHIPPING - VISUAL IDENTIFICATION																																						
	FA5-VOR-PIV-01	Change of labeling, also on reel	I	P	Change of labeling, also on reel	e.g. additional information (part number, etc.) or change of customer specific information	B																																
	FA5-VOR-PIV-02	Change of product marking	I	P	Marking on device	e.g. change of content of marking, e.g. change of method of marking, e.g. change of appearance of marking	B																																
	FA5-VOR-PIV-03	Change of packing/shipping specification	P	P	Change in packing specification which does not determine a change of dimensions or material of the packing	e.g. change of documentation in packing specification	-																																
	LOGISTICS / CAPABILITY / TESTING - EQUIPMENT																																						
	FA5-VOR-ED-01	Production from a new experimental which uses a different technology or which due to its unique form or function can be expected to influence the integrity of the final product	P	P	Change in process technique which is not already covered above. Note: Change affecting the product not covered by the table require also a FCN	e.g. change from wet to dry technology.	C																																
	FA5-VOR-ED-02	Production from a new experimental which uses the same basic technology (Equipment equipment or extension of existing equipment used)	...	P	FCN required for dedicated equipment for sensitive component production	e.g. elimination of manual handling processes	C																																
	FA5-VOR-ED-03	Change in test equipment type that uses a different technology	P	P	Change of test test equipment which use different technology. FCN required for dedicated equipment for sensitive parameters	e.g. change of tester platform	C																																
	LOGISTICS / CAPABILITY / TESTING - PROCESS FLOW																																						
	FA5-VOR-PIF-01	Manufacturing site transfer or movement of a part of production process to a different location	P	P	Change of manufacturing site. Note: Reorganization inside one location is not affected	transfer or transfer of manufacturing site or process steps to a different location	B																																
	FA5-VOR-PIF-02	Elimination or addition of a manufacturing process step	...	P	Change of manufacturing process sequence	e.g. reworking / checking process	C																																
	LOGISTICS / CAPABILITY / TESTING - QUALITY																																						
	FA5-VOR-QU-01	Change of test coverage used by the supplier to ensure data sheet compliance (e.g., identification of electrical measurements for block, reworkability/structures of reworking procedure or sampling)	...	P	Change of test coverage	e.g. change from 100% to sample inspection, e.g. use test blocks, reduction from three to two generation measurements, e.g. change in burn-in in process	C																																

Tests, which should be considered for the appropriate process change.

Tests, which should be considered for the appropriate process change after selection of condition table.

Suppliers performed tests (mark with an 'X' for done, or 'G' for generic)

Reason for exception of tests and/or usage of generic data:

=	Not required
!	Information Note required
F	FCN required

A letter or "*" indicates that performance of that stress test should be considered for the appropriate process change.

CONDITIONS		No
A	Termination equipment only	
C	Ceramics only	
B	Complete also (in changed or changed) required	
E	Capacitive trimmers only	
F	Film products only	
N	Nanotubes only	
R	Resistors only	
S	SMD components only	
W	Wirewound products only	
Y	Component not hermetically sealed	
Note 1:	For parts marked with 'R' only. Laser and stamp marked parts shall be exempt.	
⇒ Please mark 'N' with 'X', default is 'YES'		

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating junction temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_A^+ = V_D^+ = V_{IN}^+ = V_{OUT0}^+ = V_{OUT1}^+ = V_{OUT2}^+ = 3.3\text{V}$, unless otherwise specified. All voltages are with respect to GND. (Note 2)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	
LVDS Clock Outputs							
f_{OUT}	Frequency	Differential Termination = 100 Ω , 3.5mA Mode	●		800	MHz	
		Differential Termination = 50 Ω , 7mA Mode	●		1400	MHz	
$ V_{OD} $	Differential Voltage (Output Static)	Differential Termination = 100 Ω , 3.5mA Mode	●	290	370	450	mV _{PK}
		Differential Termination = 50 Ω , 7mA Mode	●	290	370	450	mV _{PK}
$ \Delta V_{OD} $	Delta V_{OD} (Output Static)	Differential Termination = 100 Ω , 3.5mA Mode	●	-30		30	mV
		Differential Termination = 50 Ω , 7mA Mode	●	-30		30	mV
V_{OS}	Offset Voltage (Output Static)	Differential Termination = 100 Ω , 3.5mA Mode	●	1.16	1.23	1.32	V
		Differential Termination = 50 Ω , 7mA Mode	●	1.15	1.23	1.32	V
$ \Delta V_{OS} $	Delta V_{OS} (Output Static)	Differential Termination = 100 Ω , 3.5mA Mode	●	-15		15	mV
		Differential Termination = 50 Ω , 7mA Mode	●	-15		15	mV
t_{RISE}	Rise Time, 20% to 80%	Differential Termination = 100 Ω , 3.5mA Mode			240	ps	
		Differential Termination = 50 Ω , 7mA Mode			120	ps	
t_{FALL}	Fall Time, 80% to 20%	Differential Termination = 100 Ω , 3.5mA Mode			240	ps	
		Differential Termination = 50 Ω , 7mA Mode			120	ps	
$ I_{SA} , I_{SB} $	Short-Circuit Current to Common	Shorted to GND, 3.5mA Mode			16	mA	
		Shorted to GND, 7mA Mode			25	mA	
$ I_{SAB} $	Short-Circuit Current to Complementary	3.5mA Mode			4	mA	
		7mA Mode			8	mA	
DC_{LVDS}	Duty Cycle	$Mx[5:0] = 1$			DC_{IN}	%	
		$Mx[5:0] > 1$ (Even or Odd)	●	45	50	55	%
Output Propagation Delays							
$t_{PD(LVPECL)}$	Propagation Delay From IN to Any LVPECL Output	$Mx[5:0] = 1$	●	290	360	480	ps
		$Mx[5:0] > 1$	●	360	430	550	ps
	Temperature Variation of the Propagation Delay From IN to Any LVPECL Output	$Mx[5:0] = 1$	●	320	0.65		ps/ $^\circ\text{C}$
		$Mx[5:0] > 1$	●	305	0.68		ps/ $^\circ\text{C}$
$t_{pd(LVDS)}$	Propagation Delay From IN to Any LVDS Output, LVCSx = 1 (7mA Mode)	$Mx[5:0] = 1$	●	350	420	545	ps
		$Mx[5:0] > 1$	●	415	480	625	ps
	Temperature Variation of the Propagation Delay From IN to Any LVDS Output, LVCSx = 1 (7mA Mode)	$Mx[5:0] = 1$	●	370	0.8		ps/ $^\circ\text{C}$
		$Mx[5:0] > 1$	●		0.85		ps/ $^\circ\text{C}$
	Propagation Delay From IN to Any LVDS Output, LVCSx = 0 (3.5mA Mode)	$Mx[5:0] = 1$			480		ps
		$Mx[5:0] > 1$			550		ps
Temperature Variation of the Propagation Delay From IN to Any LVDS Output, LVCSx = 0 (3.5mA Mode)	$Mx[5:0] = 1$	●		0.8		ps/ $^\circ\text{C}$	
	$Mx[5:0] > 1$	●		0.85		ps/ $^\circ\text{C}$	
$t_{pd(CMOS)}$	Propagation Delay From IN to Any CMOS Output, Complementary Outputs (CMSINVx = 1)	$Mx[5:0] = 1$			1.25	ns	
		$Mx[5:0] > 1$			1.32	ns	
	Temperature Variation of the Propagation Delay From IN to Any CMOS Output (CMSINVx = 1)	$Mx[5:0] = 1$	●		1.3		ps/ $^\circ\text{C}$
		$Mx[5:0] > 1$	●		1.4	ps/ $^\circ\text{C}$	

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