



Customer Notifications of Product and/ or Process Changes (PCN) of Electronic Components specified for Automotive Applications

Guideline (Rev. 5.1.)

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1 Purpose/ Scope

This guideline describes the specific elements of the change management process in the automotive market for Product and/or Process changes. The need for Product/Process change notifications (PCN) is defined, content and form of customer notifications is recommended.

General rules and requirements are proposed for:

1. the classification of Product/Process changes
2. the corresponding customer change notification
3. the recommended qualification activities for suppliers and customers (based on international standards, e.g. AEC-Q, AQG 324)

This guideline is aimed at suppliers who produce, assemble or test electronic components, particularly semiconductor devices, passive components, opto-electronic components, OE-MCM, MEMS, MCM, and Power Modules which are specified between customer and supplier for automotive applications or designed for automotive applications.

The supply chain in this guideline is simplified as Tier2 – Tier1 – OEM relationship. In case of a more complex supply chain, all participants are requested to apply the regulations and processes described in this guideline by appropriate measures and/or contracts.

The PTN is not scope of this guideline.

2 Preamble

Customer notifications resulting from Product/Process changes as described in this guideline require a close supplier/customer co-operation for which the following statements apply:

1. The supplier is entitled to perform changes to the manufacturing process and/or the product itself. For changes which require customer notification or approval as defined below the customer is informed well in advance to the intended date of implementation in order to account for the qualification and release effort on the customer side and possible OEM approval requirements.
2. The customer actively supports the change request by giving timely feedback. This feedback shall include but is not limited to (a) acknowledgement of receipt (1. feedback), (b) interim feedback (2. feedback) stating the customer's release requirements or giving a timeline by when these requirements will be available, and/or (c) change acceptance (final feedback).
3. Continuing lack of response by the customer in spite of feedback requests by the supplier will trigger appropriate escalation actions by the supplier to get customer feedback. In absence of feedback from the customer, a decision is taken by the supplier how to proceed. The customer will be informed accordingly. In cooperative and faithful supplier/customer relationship escalation will not be necessary.
4. For exceptional cases (like disaster recoveries) mutually agreed appropriate measures deviating from the outlined standard customer notification process may apply.

3 Terminology/ Definitions

Automotive Application: embedded electronic system which uses one or more of the electrical/electronic components/modules in a motor vehicle like Electronic Control Unit (ECU), Transmission Control Unit, Display, Headlamp units, etc.

Board: Printed Circuit Board which is used to test electronic components or to evaluate a potential impact on processability/manufacturability at customer.

Component: part manufactured by supplier or in case of modules part delivered to supplier. See also Product.

Customer: Organization that receives the product (e.g. Tier 1).

ZVEI-DeQuMa: Delta Qualification Matrix is a tool to describe the requested change, the evaluation level, and the test which should be considered for qualification.

Evaluation Level: (as indicated in the ZVEI-DeQuMa)

- i. "C: Component Level": The evaluation of a change at component has to be done by the component manufacturer at the component only. Generic data from other relevant evaluations can be used.
- ii. "B: Board Level": The intended change described in the PCN may influence handling/processability/manufacturability of the component at the customer. In addition for power modules the influence occurs not compulsory in interaction with a PCB as one possible technology solution – among many more possible ones – for the next integration level. Therefore, additional evaluation by the customer may be necessary.
- iii. "A: Application Level": The intended change described in the PCN may influence the properties of the application (e.g. ECU). 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. It has to be considered whether the application / assembly requirements are already sufficiently safeguarded by other qualifications (application-specific risk assessment).
- iv. "": Not relevant for qualification matrix

Fit: External dimensions and associated tolerances of the product (without packing).

FMEA: Failure Mode and Effects Analysis is a methodology to identify risks in product and processes and prevent potential failure modes. Hereby the probability of occurrence of a potential failure as well as the effect of this failure in terms of its severity and the ability of detection is assessed.

Form: visual appearance including shape, colour, marking, and surface finish of the product (without packing).

Function: electrical, mechanical, thermal and performance characteristics of the product (without packing).

ID number: is a unique identification number for each indicated change defined in the ZVEI PCN Delta Qualification Matrices. The same ID number is used in the PCN Form sheet to identify the change.

Information Note: A document sent to customers for information only, describing the change(s), the reason for the change(s), its timeline, and projected impact and containing all information as described in 5.1 (Figure 5). The Information Note can also be used for those types of datasheet modifications as specified in Tables 1 – 7 and/or for any other non-mandatory customer information.

Manufacturability: see Processability/Manufacturability

MEMS (Micro Electro Mechanical System): In this document components as defined in AEC-Q103, e. g. pressure sensor.

MCM (Multichip Module): Multiple active and/or passive sub-components interconnected to create a single complex circuit within a single MCM package that is intended for reflow solder attachment to a printed circuit board. Sub-components may be molded and/or unmolded (die) combined into a single hermetic or non-hermetic package.

OEM: Car maker

OE-MCM (Optoelectronic Multichip Module): OE-MCM consists of multiple active and/or passive sub-components including at least one optical subcomponent interconnected to create a single complex circuit within a single MCM package that is intended for direct attachment to a printed circuit board (e.g. by soldering or gluing). Individual subcomponents may be packaged (e.g. molded) and/or unpackaged (e.g. bare die) and are combined into a single package, which is considered to be indivisible. The primary purpose of an OE-MCM is the detection and/or emission of light but some OE-MCM may use the optoelectronic functions only internally (e.g. optocoupler and light barriers). (acc. AEC-Q102-003)

PCN (Product/Process Change Notification): A document sent to customers describing change(s), the reasons for the change(s), its timeline, projected impact and containing all information as described in 5.1 (Figure 5).

Power Module: See definition in AQG 324.

Processability/ Manufacturability: The properties of a product to be processed according to the specified processes at customer.

Product: Electrical/electronic component delivered by supplier to customer including packing and associated information (e.g. labelling, barcode, shipment documents).

PTN (Product Termination Notification): The PTN process is not scope of this document.

Reliability: the capability of a product to perform specified properties over time

Supplier: see scope

Supply chain (simplified): Tier2 – Tier1 – OEM

In case of a more complex supply chain, all participants are requested to apply the regulations and processes described in this document by appropriate measures and/or contracts.

Tier: "Tier" describes the level/rank of suppliers in the supply chain, e.g.

Tier1: Automotive application manufacturer and direct supplier to OEM

Tier2: (Electronic) component supplier to Tier1

Note: Minor/Major Changes: these terms are not used in this document. Classification of different types of notification (PCN, Information Note and no information) is shown in Tables 1 – 7.

4 Approach to classify Product/ Process changes

4.1 Change Notification

The supplier shall have a documented method and an associated metric for assessing the potential impact of the intended change. One such method is the Failure Mode and Effects Analysis (FMEA).

The following aspects have to be taken into account:

- contractual agreements
- technical interface of handling/processability/manufacturability of customer
- form, fit, function, quality performance, reliability

In case, a potential impact is concluded, a PCN is required (exceptions see ZVEI-DeQuMa, e.g. ID "xxx-DS-02" - Correction of data sheet or issue of errata). Otherwise, an assessment of the type of change according to the relevant section in the ZVEI-DeQuMa is necessary to decide whether or which kind of Customer Notification is required (see Figure 1).

General change assessment flow

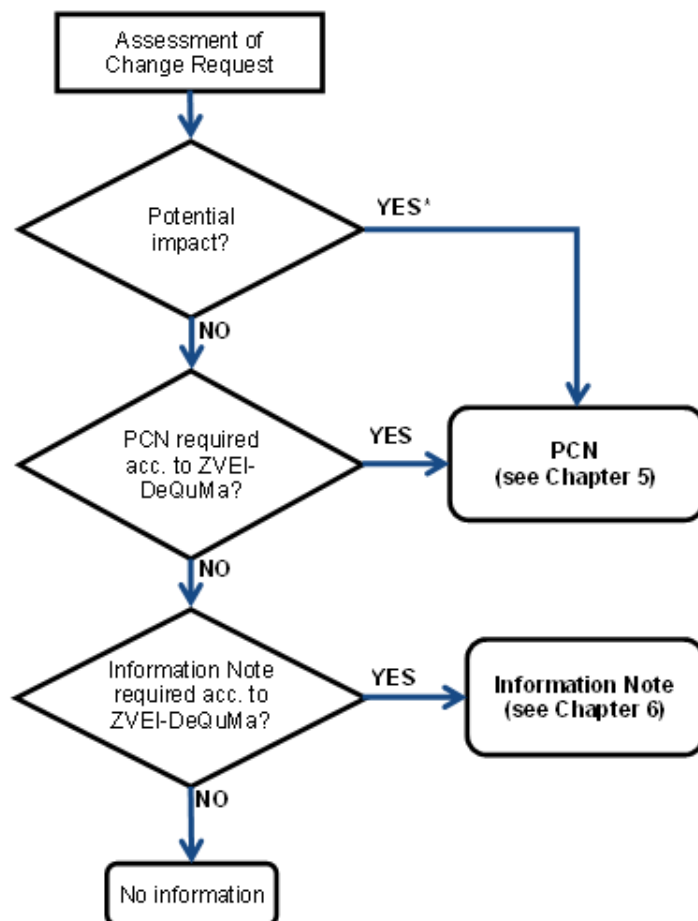


Figure 1

* Exceptions see ZVEI-DeQuMa, e.g. ID "xxx-DS-02" - Correction of data sheet or issue of errata

The change assessment matrix in the relevant section of the ZVEI-DeQuMa contain examples only and should not be considered as representing all possible changes. These matrices are aimed at giving guidance in the decision process concerning the need and kind of Customer Notification.

The current revision of the ZVEI-DeQuMa is covering semiconductor devices (Table 1), passive components (Table 2), optoelectronic components (Table 3), OE-MCM (Table 4), MCM (Table 5), MEMS (Table 6) and Power Modules (Table 7).

Remark: The ZVEI-DeQuMa is not covering all existing component types, even within above enumeration and therefore additional components types may be added without updating this guideline. In case a component affected by a PCN is not covered by ZVEI-DeQuMa, a solution using the methodology of the ZVEI-DeQuMa and mentioned changes and qualification tests can be developed in alignment with the customer.

Note: Tables 1 - 7 are referenced in VDA Volume 2 "Production process and product approval (PPA)" and VDA 210-200 "Changes to Electrical / Electronic Components in Mass Production HW DQM – Hardware Deltaqualification Matrix".

Table 1: Change Assessment Matrix for semiconductor components without LED components

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|---|-------------------|-----|
| | No | Yes |
| Type of change | | |
| ANY | | |
| Any change with impact on agreed upon technical contractual agreements | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | P | P |
| DATA SHEET | | |
| Change of data sheet parameters/electrical specification (min./max./typ. values) and/or AC/DC specification | P | P |
| Correction of data sheet or issue of errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Design changes in active elements. ¹⁾ | P | P |
| Design changes in routing. ²⁾ | P | P |
| Die shrink ³⁾ | P | P |
| Firmware modification | I | P |
| PROCESS - WAFER PRODUCTION | | |
| New / change of wafer substrate material | P | P |
| New wafer diameter | P | P |
| New final wafer thickness | P | P |
| Change of electrically active doping/implantation element | P | P |
| Change of gate material / dielectrics | P | P |
| New / change of backside operation (grinding / metallization) | P | P |
| New / change of metallization / vias / contacts | P | P |
| New / change of passivation or die coating (without bare die) | P | P |
| Change in process technology not covered by any other type of change | -- | P |
| Process integrity: tuning within process specification | -- | P |
| Change of wafer supplier. | -- | P |
| Change of specified wafer process sequence (deletion and/or additional process step) | -- | P |
| Move all or parts of production to a different wafer fab site. | P | P |
| Lithography | -- | P |
| Oxide / Interlayer Dielectric (excl. gate oxide) | -- | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "Active Component")

Table 2: Change Assessment Matrix for passive components

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | | Potential impact? | |
|---|--|-------------------|-----|
| Type of change | | No | Yes |
| ANY | | | |
| Any change with impact on agreed upon technical contractual agreements | | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | | P | P |
| DATA SHEET | | | |
| Change of datasheet parameters/electrical specification (min./max./typ. values) and / or AC/DC specification | | P | P |
| Correction of data sheet or issue of errata | | I | I |
| Specification of additional parameters | | I | P |
| MATERIAL | | | |
| Change of material composition - ... | | P | P |
| Change of supplier of material | | - | P |
| DESIGN | | | |
| Changes of termination, surface finish, shape, color, appearance or dimension structure | | I | P |
| Changes of inner construction - ... | | - | P |
| PROCESS | | | |
| Changes in process technology or manufacturing methods - ... | | - | P |
| Process integrity: tuning within specification | | - | P |
| PACKING / SHIPPING - NEW MATERIAL, CRITICAL DIMENSIONS | | | |
| Packing / shipping specification change (loosening of tolerances) | | P | P |
| Dry pack requirements change | | I | P |
| Change of carrier (tray, reel) | | P | P |
| PACKING / SHIPPING - VISUAL INSPECTION | | | |
| Change of labelling | | I | P |
| Change of product marking | | I | P |
| Change of packing/shipping specification | | P | P |
| LOGISTICS / CAPACITY / TESTING - EQUIPMENT | | | |
| Production from a new equipment/tool 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 |
| Production from a new equipment/tool which uses the same basic technology (replacement equipment or extension of existing equipment pool) | | - | P |
| Change in final test equipment type that uses a different technology | | P | P |
| LOGISTICS / CAPACITY / TESTING - PROCESS FLOW | | | |
| Manufacturing site transfer or movement of a part of production process to a different location/site | | P | P |
| Elimination or addition of a manufacturing process step | | - | P |
| Elimination of final electrical measurement / test flow block | | I | P |
| LOGISTICS / CAPACITY / TESTING - Q-GATE | | | |
| Change of test coverage used by the supplier to ensure data sheet compliance (e.g., elimination/addition of electrical measurement/test flow block, relaxation/enhancement of monitoring procedure or sampling) | | - | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "Passive Component")

Table 3: Change Assessment Matrix for optoelectronic components

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|--|--------------------------|-----|
| | No | Yes |
| Type of change | | |
| LIGHT EMITTING DIODE (LED) | | |
| ANY | | |
| Any change with impact on agreed upon technical contractual agreements | P | P |
| Any change with impact on technical interface or processability/manufacturability of customer, which is not covered in the matrix below | P | P |
| DATA SHEET | | |
| Change of datasheet parameters/electrical specification (min./max./typ. values) and/or Pulse/DC specification | P | P |
| Correction of data sheet or issue of errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Design changes in epitaxy. | P | P |
| Design changes in routing/layout. | P | P |
| Die shrink | P | P |
| LED package (except leadframe) | P | P |
| Design of leadframe | P | P |
| PROCESS - WAFER PRODUCTION | | |
| New / change of wafer substrate or carrier material | P | P |
| Wafer diameter | P | P |
| New final wafer thickness | P | P |
| Change of electrically active doping/implantation element | P | P |
| Change of stacking | P | P |
| New / change of metallization (specifically chip frontside) | P | P |
| New / change of metallization (specifically chip backside) | P | P |
| Change in process technique (e.g. significant process changes like lithography, etch, oxide deposition, die back surface preparation/backgrind, ...) | -- | P |
| Process Integrity: Tuning within specification | -- | P |
| Change of material supplier with no impact on agreed specifications | -- | P |
| Change of specified wafer process sequence (deletion and/or additional process step) | -- | P |
| Change in die coating or passivation | P | P |
| New wafer production location or transfer of wafer production to a different not previously released location/site/subcontractor | P | P |
| BARE DIE DELIVERIES | | |
| New / change of front side metallization | P | P |
| New / change of backside metallization | P | P |
| Change of wafer setup or number of dies on wafer. | I | P |
| New final wafer thickness | P | P |
| Change in die coating or passivation | P | P |
| PROCESS - ASSEMBLY | | |
| Change of leadframe/submount base material | P | P |
| Change of leadframe/carrier finishing material (internal) | P | P |
| Change of lead and heat slug plating material/plating thickness (external) | P | P |
| Bump Material / Metall System (internal) | P | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "Optoelectronic Components")

Table 4: Change Assessment Matrix for OE-MCM (Optoelectronic Multichip Modules)

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|--|-------------------|-----|
| | No | Yes |
| Type of change | | |
| ANY | | |
| Any change with impact on agreed upon technical contractual agreements | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | P | P |
| DATA SHEET | | |
| Change of datasheet parameters/electrical specification (min./max./typ. Values) and/or AC/DC specification | P | P |
| Correction of data sheet / errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Firmware modification | I | P |
| Change that adds or subtracts sub-components from the module BOM | P | P |
| Substrate change affecting module schematic (Changes to the internal dimensions and / or schematics) | P | P |
| PROCESS - ASSEMBLY - MATERIALS | | |
| Replacement of any sub-component by a Non-AEC qualified sub-component | P | P |
| Replacement of any sub-component by an AEC qualified sub-component | P | P |
| Replacement of any sub-component by an AEC qualified sub-component Critical characteristics of the OE-MCM (e.g. form, fit, function, yield and/or reliability) are not affected by the sub-component. | I | P |
| Change within an AEC sub-component that has been requalified Critical characteristics of sub-component are affected | P | P |
| Change within a sub-component that has been requalified - Critical characteristics of sub-component are not affected | I | P |
| Change to the processes used in module assembly (e.g., pick & place, die attach, bonding, reflow, encapsulation, singulation, die overcoat, underfill, die preparation, die clean etc.) | - | P |
| Process integrity: tuning within specification | - | P |
| Change to materials used in module assembly (e.g., adhesive, underfill, encapsulate, solder, epoxy, bump material, die attach material, bond wire, die overcoat, substrate, leadframe base material etc.) | P | P |
| Change of direct material supplier | - | P |
| Change of assembly site (Move all or parts of production to a different assembly site) | P | P |
| Change of product marking | I | P |
| Change or replacement of mechanical or optical components (e.g. lenses, pig-tail adapters etc.) | - | P |
| PACKING/SHIPPING | | |
| Packing/shipping specification change | I | P |
| Dry pack requirements change | I | P |
| Change of carrier (tray, reel) | P | P |
| Change of labelling | I | P |
| EQUIPMENT | | |
| Production from a new equipment/tool which uses a different basic technology or which due to its unique form or function can be expected to influence the integrity of the final product. | P | P |
| Production from a new equipment/tool which uses the same basic technology (replacement equipment or extension of existing equipment pool) without change of process. | - | P |
| Change of testing platform (Change in final test equipment type leading to a different test concept) | P | P |
| TEST FLOW | | |
| Change of testing location (Move of all or part of the final test to a different test site) | P | P |
| Q-GATE | | |
| Change of the test coverage/testing process flow used by the supplier to ensure data sheet compliance (e.g. elimination/ addition of electrical measurement/test flow block; relaxation/enhancement of monitoring procedure or sampling) | - | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "OE-MCM")

Table 5: Change Assessment Matrix for MCM (Multichip Module components)

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|--|--------------------------|-----|
| | No | Yes |
| Type of change | | |
| ANY | | |
| Any change with impact on agreed upon technical contractual agreements | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | P | P |
| DATA SHEET | | |
| Change of datasheet parameters/electrical specification (min./max./typ. values) and/or AC/DC specification | P | P |
| Correction of data sheet / errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Firmware modification | I | P |
| Change that adds or subtracts sub-components from the module BOM | P | P |
| Substrate change affecting module schematic (Changes to the internal dimensions and / or schematics) | P | P |
| PROCESS - ASSEMBLY - MATERIALS | | |
| Replacement of any sub-component by a Non-AEC qualified sub-component | P | P |
| Replacement of any sub-component by an AEC qualified sub-component | P | P |
| Replacement of any sub-component by an AEC qualified sub-component Critical characteristics of sub-component are not affected | I | P |
| Change within a sub-component that has been requalified - Critical characteristics of sub-component are affected | P | P |
| Change within a sub-component that has been requalified - Critical characteristics of sub-component are not affected | I | P |
| Change to the processes used in module assembly (e.g., pick & place, die attach, bonding, reflow, encapsulation, singulation, die overcoat, underfill, die preparation, die clean) | - | P |
| Process integrity: tuning within specification | - | P |
| Change to materials used in module assembly (e.g., adhesive, underfill, encapsulate, solder, epoxy, bump material, die attach material, bond wire, die overcoat, substrate, leadframe base material) | P | P |
| Change of direct material supplier | - | P |
| Change to assembly location (Move all or parts of production to a different assembly site) | P | P |
| Change of product marking | I | P |
| PACKING/SHIPPING | | |
| Packing/shipping specification change | P | P |
| Dry pack requirements change | P | P |
| Change of carrier (tray, reel) | I | P |
| Change of labelling | I | P |
| EQUIPMENT | | |
| Production from a new equipment/tool which uses a different basic technology or which due to its unique form or function can be expected to influence the integrity of the final product | P | P |
| Production from a new equipment/tool which uses the same basic technology (replacement equipment or extension of existing equipment pool) without change of process. | - | P |
| Change to testing platform (Change in final test equipment type leading to a different test concept) | P | P |
| TEST FLOW | | |
| Change to testing location (Move of all or part of the final test to a different test site) | P | P |
| Q-GATE | | |
| Change of the test coverage/testing process flow used by the supplier to ensure data sheet compliance (e.g. elimination/ addition of electrical measurement/test flow block; relaxation/enhancement of monitoring procedure or sampling) | - | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "MCM")

Table 6: Change Assessment Matrix for MEMS

| Assessment of impact regarding following aspects - contractual agreements - technical interface of handling/processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|---|-------------------|-----|
| | No | Yes |
| Type of change | | |
| ANY | | |
| Any change with impact on agreed upon technical contractual agreements | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | P | P |
| DATA SHEET | | |
| Change of datasheet parameters/electrical specification (min./max./typ. values) and/or AC/DC specification | P | P |
| Correction of data sheet or issue of errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Design changes in active elements. ¹⁾ | P | P |
| Design changes in routing. ²⁾ | P | P |
| MEMS (pressure Sensing Element) Design Change | P | P |
| PROCESS - WAFER PRODUCTION | | |
| New / change of wafer substrate material | P | P |
| New wafer diameter | P | P |
| New final wafer thickness (including pressure sensor membrane) | P | P |
| Change of electrically active doping/implantation element | P | P |
| Change of gate material / dielectrics | P | P |
| New / change of backside operation (grinding / metallization) | P | P |
| New / change of metallization / vias / contacts | P | P |
| New / change of passivation or die coating (without bare die) | P | P |
| Change in process technology not covered by any other type of change | -- | P |
| Process integrity: tuning within specification | -- | P |
| Change of wafer supplier. | -- | P |
| Change of specified wafer process sequence (deletion and/or additional process step) | -- | P |
| Move all or parts of production to a different wafer fab site. | P | P |
| Lithography | -- | P |
| Oxide / Interlayer Dielectric | -- | P |
| MEMS (pressure Sensing Element) specific process | -- | P |
| BARE DIE | | |
| New final wafer thickness | P | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "MEMS")

Table 7: Change Assessment Matrix for Power Modules

| Assessment of potential impact on Supply Chain regarding following aspects - contractual agreements - technical interface of processability/manufacturability of customer - form, fit, function, quality performance, reliability | Potential impact? | |
|---|--------------------------|-----|
| | No | Yes |
| Type of change | | |
| ANY | | |
| Any change with impact on agreed technical contractual agreements | P | P |
| Any change with impact on processability/manufacturability at customer, which is not covered in the matrix below. | P | P |
| DATA SHEET | | |
| Change of datasheet parameters/electrical specification (min./max./typ. values) and/or AC/DC specification | P | P |
| Correction of data sheet or issue of errata | I | I |
| Specification of additional parameters | I | P |
| DESIGN | | |
| Layout change - change of pad design or pad size on substrate | - | P |
| Layout change - change in trace routing or trace width and spacing | - | P |
| Placement - change in position of individual sub-components | - | P |
| Placement - alternative population/mounting variant | P | P |
| Component - (ex)change of active electrical component | P | P |
| Component - (ex)change of passive electrical component (with possible impact on application) | P | P |
| Component - (ex)change of passive electrical component (with no impact on application) | P | P |
| Electrical contacting elements - change in position, geometry or number of contacting elements | P | P |
| Mounting elements - change in position or geometry of mounting element with connection to PCU | P | P |
| Chip top side contacting technology or layout/routing of topside contacts | P | P |
| Design change of housing, carrier or frame elements | I | P |
| Change of base plate geometry | P | P |
| Change of substrate geometry | - | P |
| BARE DIE (Bare die supplier needs to perform delta qualification acc. to BE active , following tests need to be performed by module manufacturer) | | |
| New final wafer thickness | P | P |
| Change of top metallization or bond pad stack | P | P |
| New / change of backside metallization | P | P |
| Change of wafer setup or number of possible good dies on wafer. | - | P |
| Change of optical appearance of wafer edge region (like imide coverage or edge exclusion) | - | P |
| Die scribe or separation at chip manufacturer or its subcontractor | - | P |
| Die Preparation / Clean | - | P |
| New / change of passivation or die coating | - | P |
| Move all or parts of production to a different wafer fab site. | P | P |

The entire change assessment matrix can be found in ZVEI-DeQuMa (sheet "Power Modules")

4.2 Change Evaluation

Each change has to be evaluated. For changes which are listed in Tables 1 – 7, the PCN Delta Qualification Matrix (ZVEI-DeQuMa) has been developed by ZVEI (see Figure 2 and corresponding Excel File “ZVEI-DeQuMa”). This is a helpful guideline to determine which tests should be considered and which information is needed for approval of a proposed change.

For listed changes in Tables 1 – 7, the Delta Qualification Matrix contains proposals for evaluation based on accepted standards (AEC-Q) and latest knowledge. The described changes are classified for the best suitable evaluation level to verify feasible interactions between e.g. package, processability/manufacturability, and reliability.

Following classifications are used:

- A – application level (includes component and / or board level)
- B – board level (includes component level)
- C – component level

The evaluation levels are based on best knowledge of component/technology experts. They are recommendations for qualification effort and represent the most anticipated occurrence. Deviations from recommended evaluation level are shown under further applicable conditions.

The Delta Qualification Matrix considers aspects as line evaluation, specification of material and remarks to the change.

Worksheet "Passive Components" of the corresponding Excel File "Delta Qualification Matrix (ZVEI-DeQuMa)"

[illegible][illegible][illegible]

| | |
|----|--------------|
| 10 | Not required |
| 11 | Not required |

4) Use a "V" value for the performance of the student's ability, recorded by the appropriate practitioner.
 4 "V" is recorded on the *Form 400*

CONDITIONS

- A** Teacher's name only
- C** Cooperator only
- E** Teacher's full (last) name only, always required
- F** Equalizer/Teacher only
- F** Disruptive only
- M** Refused only
- R** Resistant only
- L** DRP teacher only
- W** With teacher's initials only
- W** Cooperator with initials only
- Refrs. G** Refr. grade with initials, last name and initials of the student

Re

1

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Figure 2

The recommended Communication Flow between supplier (Tier2) and customer (Tier1) is described in chapter 5 (PCN) and chapter 6 (Information Notes) of this document (referenced in VDA Volume 2 "Production process and product approval (PPA)").

Note: The communication between and within all parties is crucial for the total through-put time of the PCN process within the supply chain (Tier2-Tier-1OEM).

5 Customer Notification Process for PCN

In general, the PCN process can be understood as shown in Figure 3. Total through put time for complete PCN process should not exceed the projected through put time as described in Table 8. All parties are asked to support short through put times.

Generic PCN process flow

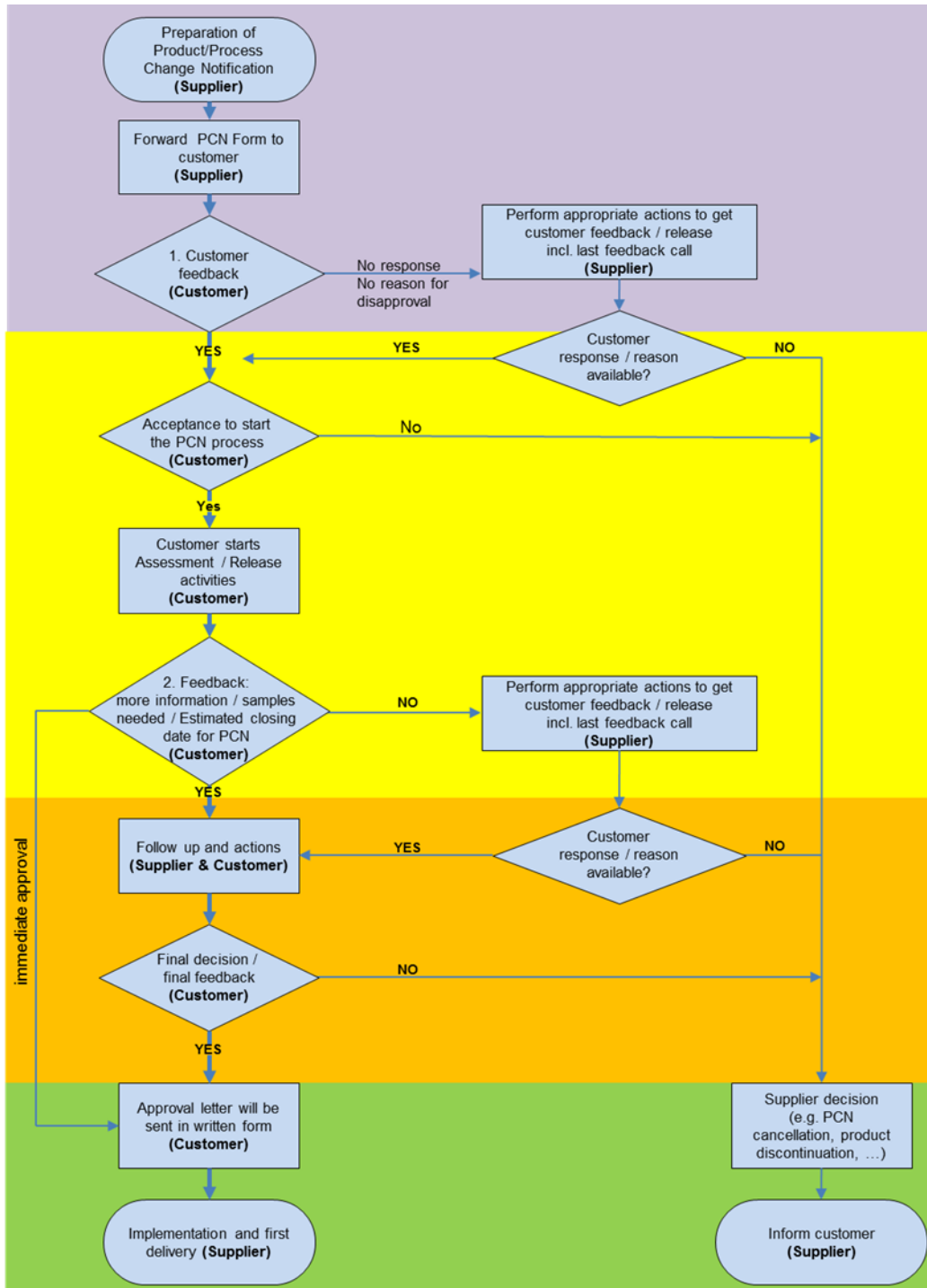


Figure 3

5.1 Preparation of a Product/Process Change Notification

ZVEI recommends using the tools (Excel Files) "PCN Form" (Figure 5) and "Delta Qualification Matrix" (completion of mandatory content, relevant attachments like datasheet and qualification results, ...). Both are available at [Product / Process Change Notification Method in Automotive Electronics](#). Both tools are linked by a unique identification number (ID number) for each indicated change in the ZVEI PCN Delta Qualification Matrices.

New feature in ZVEI DeQuMa:

Selected ID numbers will be automated filled into PCN Form by clicking the respective action button "Create PCN Form ..." in each ZVEI DeQuMa sheets.

Further details are described in the DeQuMa tutorial in section "How to fill the PCN Form" which is available at www.zvei.org/PCN.

New button "Create PCN-Form"

The screenshot shows a form with the following fields and buttons:

| | |
|--|---------------------|
| Worked on: (Name, Function) | Max Mustermann |
| Signature: | |
| Date: | |
| PCN number: | |
| For integrated circuits or discrete semiconductors select below: | AEC-Q101 Revision E |

Below the form, there are four buttons:

- Hide Text
- Values: Hide Rows
- Create PCN-Form Active** (highlighted with a blue border)
- Values: Hide Columns

Figure 4

However, if the "PCN Form" is not used, all mandatory information indicated in the "PCN Form" have to be provided and the Qualification has to correspond to the Delta Qualification Matrix.

The PCN has to be forwarded to the appointed PCN contact at customer.

Note: Complete Information is crucial to avoid a delay in the PCN process.

Standardized Information for Process/Product Change Notification (excerpt)

Standardized Information for Process/Product Change Notification (PCN)

| 1. PCN basic data | | | |
|-------------------------------------|--|--|-----------------------------------|
| 1.1 Company | Your company's name and address | | |
| 1.2 PCN No. | e.g. CM123456 | | |
| 1.3 Title of PCN | e.g. Change of mold compound into green mold for SOT23 | | |
| 1.4 Product Category | Active Components – Integrated Circuits | | |
| 1.5 Issue date | 2015.01.01 | | |
| 1.6 PCN revision history (optional) | 1.7 Issue date of previous revision (optional) | 1.8 Delta to previous revision (optional) | |
| e.g. CM1234566 | 2014.10.10 | e.g. Change of mold compound into green mold for D2PAK | |
| | | | |
| | | | |
| 2. PCN Team | | | |
| 2.1 Contact supplier | | | |
| 2.1.1 Name | | | |
| max. mustermann | | | |
| 2.1.2 Phone | | | |
| +49 123 456789 | | | |
| 2.1.3 Email | | | |
| max.mustermann@newcompany.com | | | |
| 2.2 Team supplier (optional) | | | |
| 2.2.1 Name (optional) | | 2.2.2 Phone (optional) | 2.2.3 Email (optional) |
| Carl Clever | | +49 123 987654 | carl.clever@newcompany.com |
| | | | |
| | | | |
| Set changes | | | |
| 3. Changes | | | |
| No. | 3.0 Ident | 3.1 Category | 3.2 Type of change |
| #1 | SEM-DS-02 | DATA SHEET | Correction of data sheet / errata |
| #2 | SEM-PA-11 | PROCESS - ASSEMBLY | Change of mold compound |

Figure 5

5.2 First and second feedback from customer

Customer should acknowledge receipt of the PCN and provide a first feedback latest within 2 weeks from delivery of the PCN according to the attached customer feedback form displayed in the ZVEI PCN template. In case of no reaction from customer within 3 weeks from delivery of the PCN an escalation will be started by the supplier (see Chapter 5.6).

After customer has finished its assessment according to the PCN Delta Qualification Matrix, a second feedback to the supplier will be given according to the attached customer feedback form displayed in the ZVEI PCN template indicating:

- acknowledge evaluation level
- additional information
- needed samples
- estimated closing date for PCN.

The total through-put time for both feedbacks from customer should not be longer than 6 weeks from delivery of the PCN. If the second feedback is the final feedback the customer is asked to send the approval to the supplier immediately.

Table 8: Projected through-put time

| Evaluation Level | 1 st Feedback | 2 nd Feedback | Evaluation and Documentation ⁽¹⁾ | Finalize and Closure | Projected through-put time |
|------------------|--------------------------|--------------------------|---|----------------------|----------------------------|
| * | 2 weeks | 4 weeks | 2 weeks | 2 weeks | 10 weeks |
| C | 2 weeks | 4 weeks | 4 weeks | 2 weeks | 12 weeks |
| B | 2 weeks | 4 weeks | 12 weeks | 2 weeks | 20 weeks |
| A | 2 weeks | 4 weeks | depends on application | 2 weeks | depends on application |

(1) starts with sample availability at customer (if required)

5.3 Evaluation and Documentation

Based on customer feedback and assessment the identified action points need to be done. To assure the fastest throughput time a good cooperation and communication between supplier and customer is mandatory.

The evaluation by the customer results in an approval or disapproval of the proposed change. In case the projected throughput time (see Table 8) is jeopardized an escalation will be started by supplier or customer (see Chapter 5.6).

5.4 Finalize and Closure

If the proposed change can be agreed, the customer will give approval to the supplier within two weeks. The supplier will implement the change and indicate the first delivery of the changed product in alignment with the customer.

5.5 Disapproval

Disapproval will end in a supplier decision how to proceed with the change (e. g. PCN cancellation, product discontinuation/termination, ...). The customer will be informed accordingly.

5.6 Escalation path

Lack of response by the customer within the projected throughput time will trigger appropriate escalation actions by the supplier. In absence of feedback from the customer, a decision is taken by the supplier how to proceed. The customer will be informed accordingly.

6 Communication Flow for Information Notes

If an Information Note is required (see Figure 1 and Tables 1 – 7), ZVEI recommends using the Information Note template (included as separate sheet in PCN Form). However, if the Information Note template is not used, all mandatory information indicated there should be provided.

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

The Information Note has to be forwarded to the appointed PCN contact at customer (if not otherwise defined) in a timely manner.

Confirmation of receipt is recommended.

7 References

All mentioned documents are available at ZVEI Homepage under www.zvei.org/PCN

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