

QUALITY ASSURANCE PROVISIONS (QAP)

The following Quality Assurance Provisions (QAPs) are an integral part of the TTM – Santa Clara Division Purchase Agreements. These provisions supplement the existing Terms and Conditions of the Purchasing Agreement. Each External Provider listed on the Santa Clara Division's *Qualified Supplier List (QSL)*, shall access this document via the TTM website at: www.ttmtech.com/supplier/default.pdf. External Providers are required to review this document and establish and maintain (as applicable) documented procedures for ensuring control and compliance to the specified provisions listed for their External Provider Classification. An External Provider who is unable to access the TTM website to review the QAPs must contact the TTM-SC Purchasing Department for a copy of this document. External Providers requesting exceptions to specific provisions must submit a written request to the TTM-SC Purchasing Manager.

External Provider Classification	Applicable Quality Assurance Provisions
Raw Material Providers: (Those providing direct materials used in the manufacture of PWBs (i.e.: laminate / prepreg / copper foil / soldermask / legend ink))	Q1, Q2, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q12, Q13, Q15, Q16, Q18, Q19, Q21, Q22, Q23, Q24, Q25
Chemical Providers: (Those providing chemistry used either directly or indirectly in the Manufacturing process)	Q1, Q2, Q4, Q6, Q8, Q10, Q13, Q19, Q21, Q23, Q24, Q25
External Service Providers: (Those providing Manufacturing processes performed offsite (i.e.: Immersion Silver, Immersion Tin, Hole fill, OSP, Plasma))	Q1, Q2, Q4, Q5, Q7-Q14, Q17, Q19, Q21, Q22, Q24, Q25
Calibration Service Providers: (Those providing both onsite and offsite calibration services)	Q1, Q2, Q3, Q4, Q5, Q10, Q24
Testing Service Providers: (Those providing testing of coupons)	Q1, Q2, Q4, Q7, Q10, Q11, Q13, Q14, Q17, Q24
External Manufacturing Support Providers: (Those providing tools for the processing of PWBs i.e.: drill bits, router bits, dryfilm resist, packaging materials)	Q1, Q2, Q4, Q5, Q7, Q8, Q10, Q12, Q13, Q16, Q19, Q24, Q25
General Services: (Janitorial, Auditors, etc.)	Q1, Q4, Q10, Q24

Q1 General Quality Practices

A. **Prohibited Practices: Changes to Drawings, Specifications, Processes, Materials and Procedures:**

The External Provider's Quality system shall provide for procedures assuring the latest applicable drawings and specifications are utilized. The Provider shall remove from use all obsolete drawings and specifications with the receipt of new and/or amended documentation.

Processes, materials and procedures, previously approved, and utilized by the Provider to become a qualified source, including changes by their external providers or manufacturing location, shall not be changed without written approval from TTM-SC.

Material Review authority is not permitted on this purchase order. Providers may submit a written request for deviation.

However, formal authorization from the Buyer is required, prior to shipping the material.

- Re-submittal of Nonconforming Material:** Material rejected by TTM-SC, which has been returned to conformance and subsequently resubmitted to TTM-SC for evaluation, shall be clearly identified as such on the shipping documents. Reference must be made to the TTM-SC Purchase Order # and objective evidence of root cause and corrective action must be made available.
- Unauthorized Repair:** Authority is not granted on this purchase order for the repair of nonconforming material.
- Unauthorized Production Submittal:** The External Provider shall not submit material from a production lot without initial acceptance of a "First Article" inspection, when specified by the purchase order.
- Notification of Facility Change:** The External Provider shall not utilize or relocate any production, processing and/or

QUALITY ASSURANCE PROVISIONS (QAP)

manufacturing facility during the performance of this Purchasing Agreement from those which have been previously qualified, without promptly notifying TTM-SC, and affording the opportunity for examination of such facilities to applicable quality requirements.

5. **Notice of Subcontracted Services:** External Providers are not allowed to subcontract a process originally agreed upon to be provided by said Provider.

B. Communication & Documentation: Changes proposed by External Providers, both material and process, which may affect form, fit, function, reliability, serviceability, performance, regulatory compliance and safety **must be submitted in writing 60 days in advance of such change**, for TTM-SC approval. This includes, but is not limited to, discontinuance of supply of any materials to this division, changes of sources of material and/or parts, changes in manufacturing processes, test procedures, manufacturing locations, relocation or replacement of equipment and any similar changes that are anticipated by Sub-Tier Providers. Items affected by such changes may not be delivered to TTM-SC until the External Provider has received written approval for the changes from TTM-SC. At a minimum, the change notice must include the External Provider's affected part number or software revision (if applicable), date of implementation, reason for the change, specific details of the change and, if available, supporting data that demonstrates the change will not negatively affect TTM-SC process compatibility. In addition, TTM-SC reserves the right to request samples for evaluation prior to approval. External Providers must notify TTM-SC of nonconforming processes, products or services and obtain approval for their disposition.

1. **Pricing:** TTM-SC requires 30 days written notice prior to any price increases.

2. **Purchase Orders:** TTM-SC requires purchase order numbers to appear on all packing slips & invoices.

C. On-Site Survey / Inspection: TTM-SC reserves the right to conduct on-site survey / inspection(s), for the evaluation of processing capabilities, adequate quality systems, and assurance of continuous compliance to the requirements of the Purchasing Agreement. This survey / inspection may include representatives from TTM-SC Customer base and encompass visiting the External Provider's sub-tier Supplier(s).

D. Conformance to Contractual Requirements: On-site survey(s) / inspection(s), conducted by TTM-SC or a Customer Representative, as well as First Article and Receiving Inspections, shall not relieve the External Provider of the responsibility for furnishing items in compliance to the contractual requirements of the Purchase Order. The External Provider is responsible and shall control sub-tier External Provider procurement to the extent necessary for ensuring specified quality requirements are satisfied. Documented evidence shall be maintained as validation of this control.

E. Retention of Documentation: The External Provider is required to maintain records of acceptance activities for services performed and/or products and services delivered to TTM-SC. These records may include, as appropriate, test/inspection criteria, revision level of documents/equipment/software used, operating procedures (planning, routing or Traveler sheets), dates of test/inspection, and the results. The records required shall be retained indefinitely (based on the lifetime of the Customer product) from the close of the contract. These records are subject to TTM-SC review, and must be available at the External Provider's facility, upon request. TTM-SC must be informed of disposition of any applicable records before disposal.

F. Corrective Action: TTM-SC may request corrective action for quality related issues surfacing from received material, deliverable documentation discrepancies and/or problems associated with material detected further in the process which can be attributed to the External Provider's manufacturing practices. Upon written request from TTM-SC, the External Provider shall provide documented corrective action plan(s) to prevent future deviations from requirements within 15 days from receipt of a Supplier Corrective Action Request (SCAR) from TTM-SC. At a minimum, the External Provider's response must include: analysis of root cause, action taken to prevent a recurrence, the date of effectiveness, and signature of an authorized company representative. Failure to respond within the allotted time, or evidence of inadequate corrective action, may result in the removal of the External Provider from the TTM-SC **Qualified Supplier List (QSL)**.

G. Continuity or Disaster Preparedness Plan: The External Provider shall establish a continuity or disaster preparedness plan in the event of a major natural disaster, pandemic, or any unexpected occurrence forcing emergency shutdown of the manufacturing of goods, delivery of materials or provision of services, to minimize the impact on TTM-SC. A copy of the plan

QUALITY ASSURANCE PROVISIONS (QAP)

must be made available to TTM-SC upon request.

Q2 Quality System / Program Requirements: External Provider shall establish and maintain a documented Quality System Program in compliance with an International Standard, such as ISO9000. Demonstrated adherence to a Quality System must be evident for the assurance of conformance to specified requirements. If an External Provider is certified to an ISO9000 or AS9100 standard and fails to maintain that certification, the Provider must communicate this change in status to TTM-SC Purchasing Management. In the event a Provider is not compliant with a known International Standard, at a minimum, the Provider must have a documented system and be able to demonstrate effective control of materials, processes, services and chemistries that are supplied to TTM-SC.

Q3 Calibration System Requirements: External Calibration Providers shall establish and maintain a documented calibration program in compliance to the requirements of ANSI NCSL **Z540-3**. The Provider shall submit with each individual calibration, a Certificate of Calibration, stating that the tool/equipment was inspected and calibrated / verified as complying to calibrated standards and traceable to NIST.

The Certificate shall state that the Provider has on file all data validating compliance to the specified requirements. Data substantiating compliance must be accessible for examination by TTM-SC and associated Customers. The Provider is also required to alert TTM-SC of any inspection equipment found out of specification in the "as received" condition (before calibration).

The Certificate of Calibration must include, as a minimum, the following:

1. Title: "Certificate of Calibration"
2. Identification of the calibration service
3. Certificate identification (unique identification of the C of C)
4. Customer (TTM Technologies Inc., Santa Clara, CA)
5. Identification of the calibration procedure used
6. Description and/or Part name
7. Status of the instrument upon receipt from Customer, to be indicated on the C of C indicating:
 - a) Tool in Tolerance
 - b) Tool out of Tolerance
8. Identification and calibration status of the equipment and standards used in performing the calibration
9. Calibration completion date
10. Calibration interval and next calibration due date
11. Calibration results with units of measurement, where appropriate
12. Calibration results before and after adjustment or repair, if available
13. Calibration actions taken (i.e.: adjusted, repaired, new value assigned, limited, de-rated, modified, etc.), as applicable
14. Limitations of use, if applicable
15. Person authorizing the calibration certificate (report)
16. Statement of measuring traceability
17. Factors and conditions under which the calibration(s) were performed that have an influence on the measurement results
18. Uncertainty of measurement, where appropriate, and/or a statement of conformance

Q4 Order of Precedence: In case conflicts occur between the requirements of the purchase order, drawing, a referenced specification or this document, the Purchase Order will take precedence. Formal changes to the purchase order require written approval from the TTM-SC Buyer. Original purchase order requirements not modified by the change must be met in full, unless otherwise specified.

Q5 Purchase Order Flow Down: The External Provider is responsible for ensuring that TTM-SC and applicable TTM Customer Requirements (i.e. drawings, referenced specifications, artwork, requirements, etc.) are flowed-down to all sub-tier External Providers.

Q6 Raw Material Certification: Chemical and Physical analysis of raw materials furnished under this purchase order is required. Certification substantiating the raw material adherence to the specifications and requirements imposed by the purchase order shall be stated. The certificate of conformance must indicate the key characteristic analysis, specification or drawing requirements, actual measured results and acceptance. Documented reports shall include as a minimum, the following information:

1. External Provider Name

QUALITY ASSURANCE PROVISIONS (QAP)

2. Purchase Order Number (*excluding chemicals*)
3. Part Name and Description
4. Lot Number / Batch Number
5. Manufacturing Specification (IPC/MILSpec, if applicable) (*excluding chemicals*)
6. Manufactured Date (if applicable)
7. Material Expiration Date (if applicable)
8. Quantity – (By Date Code, if applicable) (*excluding chemicals*)
9. Unit of Measure (*excluding chemicals*)
10. Date and Signature of Authorized Company Representative
11. Statement certifying compliance of material, including traceability to applicable specs.
12. When special processes are required by drawing or specifications, specific Certificate of Compliance to applicable military and/or Customer specifications are required, including revision.

The certificate of conformance shall be enclosed with any other required shipping documents.

- Q7 Foreign Object Elimination:** The External Provider shall establish and maintain an effective Foreign Object Damage (FOD) Prevention Program to reduce FOD. The material supplied to TTM–SC shall be manufactured in an environment that is free of foreign objects. Material supplied shall be free of foreign objects. The External Provider’s program shall utilize effective FOD prevention practices.
The program shall be proportional to the sensitivity of the design of the product(s) to FOD, as well as, to the FOD generating potential of the manufacturing methods. The written procedures or policies developed by the External Provider shall be subject to review, upon request, by TTM–SC, and disapproval when the External Provider’s procedures or policies do not accomplish their objectives.
- Q8 Age Control:** Materials with defined characteristics may, over time, become susceptible to quality degradation through use or storage, shall be clearly identified on the lowest level of unit packaging. The package shall be marked to indicate the critical date the shelf life was initiated and date of expiration. At a minimum, materials shall be marked with the date of manufacture, expiration date, storage temperature and humidity requirements, special handling conditions, in addition to the standard identification requirements. Materials at the date of receipt by TTM–SC shall have a minimum of seventy-five (75) percent of the usable shelf life remaining.
- Q9 Inspection and Test Plan:** The External Provider shall prepare an inspection and test plan for materials processed and delivered against this purchase order. The inspection and test plan shall include the manufacturing/processing sequences, in-process, and final inspection points in relation to procurement, manufacture, and final acceptance, the method of inspection that will be utilized, measuring and test equipment, and system of delivery. All applicable procedures, specifications, and work instructions shall be referenced by number at the appropriate points. TTM Technologies may elect to establish its own inspection points, consistent with the External Provider’s plan.
- Q10 TTM Technologies Right of Access / Inspection:** TTM–SC reserves the right of access to all applicable External Provider facilities, at any level of the supply chain, to allow their Customers and/or regulatory authorities access to review any applicable records pertaining to an order of purchased goods or services. TTM–SC may audit the Provider’s quality system at periodic intervals, upon written advance notification. TTM–SC reserves the right, should the need present itself, to verify processing methods, with the exception of proprietary processes. This includes those processes of the External Provider’s sub-tier Provider. The Provider shall have available all documentation, shop order and/or rout sheet, drawings and specifications, inspection and test results, purchase order, test samples and material for inspection.
- Q11 Special Processing:** The External Provider and sub-tier Providers shall establish and document procedures for the control of all special processes (i.e. plating, heat treat, brazing, welding, bonding, coating, testing, etc.). Special processing utilized in the manufacturing of materials for this purchase order requires prior approval, as well as the methods of verifying compliance. This approval does not relieve the External Provider of responsibility for delivering compliant material to the stated requirements. The External Provider shall notify TTM Technologies in writing of changes to the process or inspection/test methods. A Certificate of Compliance is required for each shipment in which material was produced / tested utilizing a special process. Stated on this document shall be the special process, applicable military, industry and/or customer specification and associated revision.

QUALITY ASSURANCE PROVISIONS (QAP)

Q12 Packaging Requirements, including Bar Coding of Boxes, Bags and Packing Slips:

The External Provider shall establish and maintain a documented system for the control and monitoring of its packaging and shipping practices. Included will be provisions for handling, preservation, storage, packaging, and final shipment. The system must be designed to ensure the quality of deliverable material through prevention of damage, deterioration and degradation. Packaging requirements are as stated on the purchase order. When not specified, the method used will be "best commercial practices". All Laminate, Prepreg, and Flex materials are to have individual boxes/bags identified with readable bar codes. Information required includes; TTM Part #, Qty of pieces, and Lot #. All Laminate, Prepreg, and Flex materials require packing slips with readable bar codes. Information required includes TTM PO #, TTM Part #, and total Qty of pieces for the specific part #. The order of these bar codes is important as the receiving and issuing programs flow in this order. The use of bar codes for other materials/supplies, although not required, is encouraged for boxes and/or packing slips.

Q13 Qualification Lot: Proposed External Providers, as an alternative method for placement onto the **Qualified Supplier List (QSL)**, shall manufacture, inspect, and test a qualification lot of material and/or service(s). The qualification lot shall be produced with the processes, materials, and equipment planned for production orders. The requirements of the qualification lot shall be documented and flowed down to the proposed Provider through the purchasing document. An inspection and test plan shall be prepared by the Quality department for verification of the qualification lot upon receipt. Results of this verification will be forwarded to the Provider through the purchasing department.

Q14 Statistical Process Control / Improvement: The External Provider shall establish and maintain a documented system for the application and implementation of statistical techniques for product acceptance, the qualification, measurement, monitoring, control, and continuous improvement of critical processes, where appropriate. The Provider shall identify key process characteristics and as required, provide objective evidence as to the performance of these indicators. Evidence shall include but is not limited to: identification of key characteristic, method of measuring performance, distribution values, CPK level, etc.

Q15 Dielectric Thickness: The dielectric thickness minimum requirement of 0.0035" is to be measured peak to peak, measured using 50x, referee using 100x.

Q16 Counterfeit Part Prevention: Qualified External Providers shall not deliver counterfeit raw materials, products, components, and/or electrical and/or mechanical parts/assemblies. Providers of electronic components shall ensure that a counterfeit avoidance, detection, mitigation and disposition process is in effect, per standards AS5553 & AS6174. Providers must report immediately to TTM-SC in writing when it is determined they have either acquired or provided suspect materials/parts or counterfeit material/parts. In addition, the Provider shall:

- respond to all acquired or provided suspect materials/parts or counterfeit material/parts inquiries made by TTM-SC regarding the authenticity of products supplied by the Provider.
- disclose the source of parts if the parts should become the subject of a legal or counterfeit issue.

Q17 ITAR Compliance: If an External Provider is providing a board testing service or outside manufacturing/processing activity, they must be DDTC (Directorate of Defense Trade Controls) registered, and provide evidence upon request. If the External Provider contracts work to a sub-tier Provider, the sub-tier Provider(s) must also be registered with the DDTC and provide evidence of such upon request.

Q18 User/Provider Agreements: A documented (User/Provider) agreement is required between the PWB Manufacturer and the laminate / prepreg Provider, assuring that material is certified to IPC-4101. The agreement shall be submitted to the Customer (if required) for concurrence, prior to submittal of a PWB to the Customer (if required). The Customer's Supplier Management shall maintain agreements. The PWB Manufacturer shall notify the Customer (if required) prior to any change.

Q19 Conflict Minerals Declaration: The External Provider shall annually submit the latest version of a completed and accurate conflict minerals reporting template (CMRT) issued by the Conflict Free Sourcing Initiative (CFSI). The CMRT shall be completed in English and submitted in Excel format.

- Providers to PCB divisions shall utilize source smelters that are validated as Conflict Free Smelters (CFS) by third party organizations such as CFSI, LBMA or RJC.

QUALITY ASSURANCE PROVISIONS (QAP)

b) Providers shall notify TTM at least 90 days prior to any change in source smelters and shall confirm changes in a revised CMRT.

Q20 GIDEP (Government-Industry Data Exchange Program): The External Provider shall notify TTM-SC in writing if a GIDEP alert is received and affects product(s) delivered or in-transit to TTM-SC.

Q21 Employee Awareness: External providers must have evidence that personnel that have contributed to manufacturing and/or processing of their product or service are knowledgeable in their position and documented as having been properly trained. The Provider shall ensure their employees are aware of their contribution to product and service conformity, their contribution to product safety, and the importance of ethical behavior.

Q22 Use of Ozone-depleting Substances: External Providers shall inform TTM-SC of any products manufactured with or containing ozone-depleting substances.

Q23 Prohibited Metals: External Providers are prohibited from supplying TTM - Santa Clara with the following metals: Mercury (in any form), Pure Tin (greater than 97%) except for tin-coated drawn wire products (i.e.: tin coating applied prior to drawing process), Cadmium (except as an alloying material), Zinc (except as an alloying material) in its products. This prohibition includes, but is not limited to, pure Tin (greater than 97%) plating, Cadmium plating, Zinc plating or die cast zinc parts. Product delivered shall not contain these materials. This prohibition is applicable to all surfaces, both internal and external to the product.

Q24 Fraud & Falsification: Where the External Provider's services or materials are performed or used, directly or indirectly, on products produced under contract, that may affect the national security of the United States and the requirements, these contracts are designed to ensure that essential attributes of the work force and their sub-tier Providers are carefully checked or inspected and that records accurately reflect results of the work. The External Provider shall not, in any manner, falsify, conceal or alter any material fact, or provide any false, fraudulent or fictitious statement of representation in connection with the work under any contract within the jurisdiction of the Government. Doing so is not only prohibited, but may be punishable under Federal Law.

Q25 DPAS Ratings: The United States Government, in the interest of keeping current defense programs on schedule and maintaining an administrative means of promptly mobilizing the nation's economic resources in the event of war or national emergency, requires that Contractors/Suppliers use industrial priority ratings to support military procurement under prime contracts which have been assigned priority ratings. The Department of Defense (DoD) has authority, under the Defense Priorities and Allocations System (DPAS) (15 CFR Part 700.11(a)), to place industrial priority ratings on its contracts. The levels of priority rating are:

♦ ***(DX) Highest National Defense Urgency***

♦ *All DX-rated orders have equal priority and take preference over DO and unrated (commercial) orders (based on ship schedule).*

♦ ***(DO) Critical to National Defense***

♦ *All DO-rated orders have equal priority and take preference over unrated (commercial) orders (based on ship schedule).*

In the event these ratings are specified, they will be prominently displayed on Purchase Orders placed by TTM-SC.