REQUIREMENTS FOR SUPPLIERS PROVIDING PRODUCT TO TTM SYRACUSE.

1.0 PURPOSE

The purpose of this document is to define the requirements of TTM Technologies Syracuse, TTM Salem, Syracuse Microelectronics (collectively TTM Technologies, hereafter TTM) in support of providing product to these entities against written purchase orders.

As a supplier, you are essential to TTM's success and significantly contribute to product conformity, including product safety and environmental requirements. This requirement is not meant to discourage suppliers from making product or process improvements. It is intended to ensure that when changes are made, they are done so in a manner that will ensure product integrity is maintained. All exceptions and/or deviations to any requirements defined herein shall have prior approval from TTM Procurement.

Terms and Conditions. All purchase orders must be accepted in writing by Seller. If for any reason Seller should fail to accept in writing, any conduct by Seller that recognizes the existence of a contract pertaining to the matter of the purchase order shall constitute acceptance by the Seller of the purchase order and its terms and conditions above.
Reference TTM website for Terms and Conditions:
https://www.ttm.com/en/suppliers/ttm-requirements-for-suppliers
Document TTMTCP100

2.0 SCOPE

This procedure applies to all material purchased by TTM when this document is specified on the Purchase Order, and also flows down applicable requirements to sub-tier suppliers.

Definitions

Commercial Off The Shelf (COTS) Part: Any item for which the requirements are defined and controlled solely by the manufacturer/ supplier, and which TTM is purchasing to the manufacturer part number/ supplier specifications.

COTS Source Controlled Document (SCD): A SCD specifying a COTS part number for which the requirements are defined and controlled solely by the manufacturer PN and which TTM is purchasing to the SCD/COTS part number.

TTM Custom Source Controlled Document (SCD): Any drawing or document or which the requirements are defined and controlled solely by TTM and purchased to the specifications and/or source outlined within the drawing or document. TTM specified changes, alterations or up-screening to a COTS item may be considered a TTM Custom SCD item for the purposes of this document. Note: Ref Section 5.2.7 for FAI requirements.

Packaging Material: Any material defined either as COTS or through a SCD which is purchased with a sole function of packaging TTM finished goods for shipment. Typical packaging material may include, but is not limited to, cardboard boxes, Pelican hard cases, custom foam inserts, ESD bags (compliant to Section 7.6 of this document), bubble wrap, and plastic shipping trays, etc..

3.0 ORDER OF PRECEDENCE

When the requirements of documents conflict, the document of higher precedence shall govern. The order of precedence is as follows:

1) Purchase Order
2) TTM Quality Provision # 81000
3) Procurement Document
4) TTM Drawing (i.e.: Master Drawing, TTM Custom SCD, etc.)

4.0 SUPPLIER TO TTM DELIVERABLES

4.1 Certificate of Conformance: A C of C shall be included with each product/material shipment. The C of C must include the statement that the product meets all the requirements of the associated Part Number listed on the purchase order.

4.2 Both the Distributor's Certificate of Conformance and OEM Certificate of Conformance must be provided with each shipment. The Distributor is required to immediately notify TTM Procurement if their Authorization is changed, expired, or revoked.

4.3 FAI data in accordance with Section 5.2.7.

4.4 When stated on the SCD as deliverable, MLI data with cross-referenced copy of drawing traceable to Key measured features in accordance with section 5.2.8. MLI data must be retained on file at supplier location available to TTM upon request.

4.5 When applicable, a copy of the approved deviation shall be included with each shipment of affected product/material.

4.6 When applicable, Certification of Analysis in accordance with 5.2.11 Table 1. For COTS-SCD components, the standard manufacturer C of A is acceptable and not required to align with the COTS-SCD requirements.

4.7 When applicable, a C of C from the plating supplier in accordance with 5.2.13.

4.8 When applicable, a Certificate of Metal Analysis in accordance with 5.2.12.

4.9 When applicable, expiration date of the material shall be clearly marked on the container and in accordance with Table 1.

4.10 When specified on the TTM Custom SCD or Procurement Document, data and records for product produced shall be included in shipment.

5.0 QUALITY REQUIREMENTS:

The fundamental requirement is to ensure that workmanship and material is controlled to TTM requirements and/or accepted industry standards. The following specifies SUPPLIER actions required to show that they have the proper documentation, system, and operator training in place to consistently provide product with verifiable raw material and workmanship quality.

5.1 Recurring Quality Requirements:

5.1.1 Unless otherwise specified on TTM Custom SCD, data and records for each product produced for TTM will be retained by the SUPPLIER for a period not less than seven (7) years. This information will be available to TTM upon request.

5.2 Other Quality Requirements:

5.2.1 Supplier shall conform to and maintain a Quality system which is in conformance with ISO 9001, AS9100, or is subject to TTM approval. The supplier shall report to TTM a lapse in certification for any reason.

5.2.2 The Supplier's calibration system shall conform to either ISO 10012, ISO 17025 or ANSI Z540-3 or is subject to TTM approval.

5.2.3 TTM Visits:

All facilities Quality Control, Inspection Systems, Operator Training Program, Manufacturing Process and documentation used to manufacture material shall be open to inspection, review, verification and analysis by TTM, TTM Customer, or Regulatory Agency at all reasonable times. TTM will give reasonable notice, and obtain SUPPLIER concurrence prior to any visit or inspection.

5.2.4 Material Review Board (MRB) Authority:

The SUPPLIER is not granted MRB authority for Repair or Use As Is (UAI) dispositions. Requests for these dispositions are to be made through TTM Procurement. Rework is defined as restoring the item to drawing specification.

5.2.5 **Non-Conforming Material:**

5.2.5.1 Non-conforming material rejected by TTM and determined to be SUPPLIER responsibility requires the SUPPLIER to respond to TTM's request for root cause and corrective action. Supplier shall also state whether items were reworked or replaced and if reworked what rework was performed. Supplier's statements must be executed and returned with the shipments.

5.2.5.2 Should the SUPPLIER become aware of non-conforming materials incorporated into the delivered product, the SUPPLIER shall immediately notify the TTM Procurement of non-conformance.

5.2.5.3 Request for Deviation to specification

a. In the event that TTM agrees to use non-conforming material, the SUPPLIER will not ship product without receiving an approved deviation from TTM Procurement for the affected product.
b. A copy of the approved deviation shall be included with each shipment of affected product. Either the deviation number shall be noted on the Supplier C of C, OR the deviation itself shall be included with the Supplier C of C.

5.2.6 Responsibility for Inspection**:**

Unless otherwise specified in the Purchase Order, the SUPPLIER is responsible for the performance of all inspection requirements as specified. The SUPPLIER may utilize their own facility or any suitable Laboratory or third party unless disapproved by TTM. TTM reserves the right to perform any of the tests where such tests are deemed necessary to ensure material(s) and services conform to prescribed requirements.

5.2.7 First Article Inspection **(FAI):**

When specified on the Purchase Order or TTM Custom SCD, the supplier will provide full or partial FAI's. If an AS9102 FAI is specified, the FAI must conform to the requirements of AS9102 Rev B.
First article inspection data is not required for standard COTS items, MIL Spec, COTS SCD items or packaging material as defined in section 2.0.

5.2.8 Manufacturing Lot Inspection (MLI):

5.2.8.1 The supplier is responsible to use appropriate process controls, test, and/or inspection methods in order to ensure that all delivered product is compliant to drawing and PO requirements.

5.2.8.2 Critical MLI items are identified by a D[#] or K[#] symbol on the drawing. When so identified, the supplier shall measure and retain records of these characteristics consistent with drawing requirements and the suppliers' own measurement, test or inspection per record retention guidelines.

5.2.8.3 When MLI data is stated on the TTM Custom SCD as a deliverable, the provided sample size shall be per the SCD. If sample size is not specified, it shall be per section 5.2.8.4 below.

5.2.8.4 When critical MLI items are identified on the SCD and the supplier uses sampling inspection as a means of product acceptance, the sampling plan shall be justified on the basis of recognized statistical principles and appropriate for use (i.e., matching the sampling plan to the criticality of the product and to the process capability). Unless otherwise specified by the TTM Custom SCD, the minimum sample size shall be ANSI/ASQ Z1.4, special inspection level S-2, single sampling plan for normal inspection, c = 0 (accept on zero nonconformance, reject on one nonconformance).

5.2.9 Shelf Life Material:

Item(s) that are controlled by shelf life shall have:

- 75% of the item's shelf life remaining upon delivery to TTM if the product shelf life is less than 12 months
- 50% of the item's shelf life remaining upon delivery to TTM if the product shelf life is 12 months or more.

5.2.10 Counterfeit Material:

All purchase orders shall comply with the Supplier Counterfeit Parts Requirements.pdf document located at:
https://www.ttm.com/support/supplier_req.aspx Section 1: Terms and Conditions

If required, authorization per section 1. (b.) of Supplier Counterfeit Parts Requirements may only be granted through an official deviation.

5.2.11 Certificates of Conformance (C of C), Certificates of Analysis (C of A) and Other Deliverable Documentation. A certificate of metal analysis and country of origin shall be included with each custom metal shipment (see section 8.4 Conflict Materials). The minimum information required in the C of C is defined in Table 1.

	C of C				
	COTS	COTS SCD	TTM Custom SCD	Epoxies, Ink and Solder[1]	TTM Custom SCD with metal
Supplier AND manufacturer Name	O	R	R	R	R
Supplier's issuing location	O	R	R	R	R
TTM Part Number	O	D	R	D	R
TTM Part Revision	O	D	R	D	R
Manufacturer's Part Number	R	R	O	R	O
Quantity Shipped	R	R	R	R	R
Purchase Order #	R	D	R	R	R
Date of issue/ approval	R	R	R	R	R
Signature and/ or name & title of Authorized agent	R	R	R	R	R
OEM Cof C (If supplied by distributor)	R	R	R	R	N/A
Plating / Special Process C of C	N/A	N/A	R	N/A	R
OEM Lot/ Serial Number	R	R	R	R	R
Country of origin	O	O	O	W	R
Certificate of Analysis	O	O	O	R	R
Statement of RoHS Compliance	W	W	W	W	W
Date of Manufacture	S	S	S	R	O
Expiration Date	S	S	S	R	O

R = Required W = When specified on the drawing N/A = Not applicable
O = Optional S = Items with a limited shelf life
D = Required on Distributor's C of C optional on OEM C of C

[1] Epoxies include MIL-STD 883/5011 certified epoxies in preform or paste form. Solder includes J-STD-006 certified alloys in paste, cream, preform or wire form. Ink includes thick film conductive, resistive and dielectric used in printed electronics.

Table 1

5.2.12 Certificate of Analysis

When required in accordance with Table 1 above, a certificate of analysis shall be included with each shipment.

At a minimum, the following information shall be provided on the certificate:

- Name and address of supplier issuing location
- Material Composition / Characteristic Analysis Report
- Date of issue/approval
- Lot/Serial Number
- Statement of RoHS compliance (when applicable)
- Metal Material Country of Origin (conflict minerals)

5.2.13 Plating / Special Process Certificate of Conformance

When required in accordance with Table 1 (as specified in Section 7.5), a plating or special process certificate of conformance shall be included with each shipment. At a minimum, the following information shall be provided on the certificate:

- TTM Part Number Processed
- TTM Part Revision
- The applicable specifications (including revision letters or numbers to which the part conforms.
- Date of Issue/Approval
- The name of the agency that performed the process, if other than the supplier
- Quantity of parts processed
- If a NADCAP process utilized, a statement acknowledging part(s) were processed with a NADCAP certified process. Include certification expiration date, and the NADCAP certificate number.

5.2.14 Government Review:

Government Inspection or release of product item prior to shipment is not required unless otherwise specified on the TTM purchase order. Supplier shall provide a copy of the TTM Purchase order to its government representative upon request.

6.0 SUPPLIER EVALUATION AND STATUS

6.1 The primary requirement is for all features to comply to specifications 100% for all parts and components delivered. If the process is not capable of meeting 100% compliance, it is TTM's expectation that all suppliers pursue measurable continuous improvements. TTM defines its minimum performance expectation as:

- >95% on time delivery to confirmed delivery dates
- >98% product quality

6.2 TTM measures a supplier's performance in terms of delivery, quality, and customer service.

- A supplier's status to receive future purchase orders may be impacted by performance trends
- TTM will periodically provide historical performance feedback to suppliers

6.3 Delivery: factors involved in the delivery score are:

- Early delivery: received more than 10 days early
- Late delivery: received more than 3 days past the PO confirmed due date

6.4 Quality: factors considered in developing a quality score include:

- Yield at incoming inspection
- In-process defects that may be traced back to the part / component manufacturer

6.5 Quality Alerts: Supplier Quality Alerts are issued as a means of notifying suppliers of potential problems. Alerts are issued for an interim period only and will not affect supplier scorecard evaluation.

7.0 DESIGN & MANUFACTURING REQUIREMENTS

7.1 Sourcing of Printed Circuit Boards

7.1.1 Suppliers may modify original TTM data to establish working data to create CAM tools.

7.1.1.1 Any modifications made to the original TTM data in addition to those made per 7.1.1 must be approved by TTM prior to starting the manufacturing process. The following note will be placed on all part drawings:

"Prior to building product, TTM Syracuse requires approval of the production artwork in panelized data format if changes have been made to either feature size, outline or location. This data should be forwarded to TTM Syracuse and the job held until approval is given to proceed. Approval is only required for the initial build, when changes are made to the production artwork that affects resultant board design, or when explicitly required on the purchase order".

7.1.1.2 Supplier must retain TTM original data, as well as working data. Changes to working data to improve manufacturability must be revision controlled and approved by TTM.

7.2 Requirements for change notification:

The SUPPLIER shall not make any changes to the design, materials**,** manufacturing process, test process, or manufacturing location without prior notification and approval from TTM.

TTM reserves the right to request documentation of the testing and/or verification of any changes before approving such changes.

A SUPPLIER that desires to make a change in design, materials, manufacturing processes, test process or manufacturing location shall obtain written approval by TTM Procurement a minimum of sixty (60) working days prior to the planned implementation date of the change. The SUPPLIER shall provide, in writing, a description of the change, planned implementation date of the change, and verification plan used to insure the change will not affect product form, fit, function or reliability. Upon review, TTM may subsequently request copies of data taken during the change verification.

7.3 Process Interruption Notification:

TTM is to be notified in writing at least ten (10) business days prior to any routine scheduled preventative maintenance activities to critical manufacturing processes that may impact production or affect delivery schedule. If critical manufacturing processes experience an unplanned interruption, TTM is to be notified immediately.

7.4 Foreign Object Damage practices:

The SUPPLIER shall establish and maintain an effective Foreign Object Damage (FOD) Prevention Program to reduce FOD using NAS412 or equivalent.

The material supplied to TTM shall be manufactured in an effective FOD Prevention Program to reduce FOD using NAS412 or equivalent. The material supplied to TTM shall be manufactured in an environment that is free of foreign objects. Material supplied to TTM shall be free to foreign objects. The SUPPLIER'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 SUPPLIER shall be subject to review and audit by TTM and disapproval when the SUPPLIER's procedures or policies do not accomplish their objectives.

7.5 Special Process Control:

7.5.1 Requirements for Special Processes

A Special Process is defined as a process where the resulting output cannot be verified by subsequent monitoring or measurement. Use of NADCAP or TTM approved sources of supply does not absolve the Supplier of their responsibility to provide acceptable product and comply with all specification and quality requirements.

All Fabricated Metal and Circuit Board Suppliers utilizing a Special Process shall meet one of the following requirements:

Condition I - Special processes used by supplier or sub-supplier shall be NADCAP (National Aerospace and Defense Contractors Accreditation Program) approved for the process specified by the PO/TTM Custom SCD.**
** List of NADCAP approved suppliers can be found at www.eauditnet.com.

Condition II –The supplier or sub-supplier is TTM approved for the special process specified by the PO/TTM Custom SCD.

Piece parts, components, and/or assemblies that are manufactured in accordance with (or manufactured to meet the requirements of) a Military, Federal, or Commercial Specification, COTS or COTS SCD parts are exempt from this special process requirement. (Examples: JANTX, M39014, MS15795, NAS, RNR, MIL-PRF-39012).

If the Special Process Specification is denoted on the TTM Custom SCD, only as a general special process category (ex: gold plated, painted, heat treated), NADCAP certification is not applicable. The requirements shall be managed by the Supplier in accordance with their Quality Management System

The special process requirements are applicable to all items (including lower level items) that are processed, assembled, manufactured, inspected, or tested at Supplier's facility, or its sub-tier suppliers, which include a Special Process specification imposed by the TTM Custom SCD.

The SUPPLIER retains responsibility for monitoring performance and compliance of sub-suppliers or internal processes. The SUPPLIER is responsible for reporting to TTM a lapse in NADCAP certification for any reason (including sub-supplier loss of certification) when plating, surface finish or conditioning processes are required by TTM SCD. The supplier shall communicate all instances of nonconforming material delivery to TTM Procurement.

Special Processes include:

- Welding / Brazing: Examples include, but are not limited to: Fusion Welding, Spot Welding, Arc Welding, Resistance Welding, Friction Stir Welding, Electron Beam Welding, Brazing, and Diffusion Bonding.

- Non-Destructive Testing (NDT): Penetrant, Magnetic Particle, Radiography, Ultrasonic, and Eddy Current.

- Heat Treating: Examples include, but are not limited to:
  - Annealing, Hardening, Tempering, Precipitation Hardening, Aging, and Case Hardening, thermal treatments specified by drawing callout such as Stress Relieving, Thermal Cycling and Stabilization Treatments.
  - This requirement does not apply to heat treatment processing that is controlled by an Industry/Military material specification. (i.e. Aluminum Forging: 7075-T7352 IAW AMS 4117, 6061-T651 IAW ASTM B209)

- Painting: Examples include, but are not limited to: Paint Application in accordance with MIS- 41252, MIS-47255, WS-9778, or WS-9780.

- Plating, Surface Finishes, and Conditioning:
  Examples include, but are not limited to: Conversion Coating, Passivation, Oxide Coating, Anodic Coating, Vapor Deposited Coating, and Plating: MIL-A8625, ASTM B488, AMS 2404, etc

A C of C from the special process supplier is required with each delivery in accordance with Table 1.

7.5.2 Prohibition of Pure **Tin**

7.5.3.1 The uses of Pure Tin Plated finishes are strictly PROHIBITED. Any Tin Plating or Tin Solder processes shall contain NO LESS than 3 percent LEAD composition, unless specifically called out in the COTS, COTS SCD, TTM Custom SCD, Statement of Work (SOW) or authorized in writing by the TTM Procurement. These restrictions apply for all types and levels of procurements, with the supplier responsible for communicating these restrictions to subcontractors or sub-tier suppliers as required.

7.5.3.2 NOTE: if the COTS, COTS SCD, TTM Custom SCD specifies a Supplier Part Number which contains pure tin, then the prohibition is not applicable.

7.5.3.2.2 NOTE: Tin-plated finishes may be used if: (a) the seller has a written tin control plan in accordance with GEIA-STD-0005-2 that has been approved in writing by TTM, and (b) the tin usage conforms with requirements of the plan. Lead-free solder processes may be used if: (a) the seller has a written Lead-Free control plan in accordance with GEIA-STD-0005-1 that has been approved in writing by TTM, and (b) the lead-free solder usage conform to the requirements of the plan.

7.6 Electrostatic Discharge Control practices:

For electrical and electronic parts, assemblies, and equipment, susceptible to damage from Electrostatic Discharge (ESD), the supplier is responsible to establish and implement an ESD Control Program per the latest revision MIL-STD-1686 or equivalent. The supplier shall take the necessary precautions to ensure that static susceptible devices are adequately protected from ESD damage during manufacturing, test, inspection, packaging and shipping per MIL-STD-1686 and ESD S20.20 or as applicable to TTM Procurement documents. Packaging shall be marked with an ESD cautionary note or symbol.

Anti-Static, static dissipative packing material (pink poly formulation) must comply with Contact Corrosivity Testing in accordance with MIL-STD-3010 Method 3005 (formerly Federal Standard 101, Method 3005) or equivalent. This anti-static, static dissipative packing material may not be used in direct contact with Optics and Polycarbonates. Product or packaging furnished shall not contain Pink Polyethylene or be contaminated externally by Pink Polyethylene or Amine.

7.7 Process Restrictions

Mercury Usage
Supplies furnished shall not contain functional Mercury or be contaminated externally by metallic Mercury or Mercury compounds.

Functional Mercury is that Mercury or Mercury compound required for proper operation of the items delivered under contract. Supplier agrees to notify TTM before shipment if Mercury contamination is suspected or if Mercury is knowingly induced in the manufacturing process.

8.0 ENVIRONMENTAL REQUIREMENTS

The environmental requirements for suppliers may be found on Section 3 the TTM Technologies website as follows:

https://www.ttm.com/en/suppliers/ttm-requirements-for-suppliers

8.1 European Union restriction on hazardous substances. RoHS- section 2.1 of the document. (hereafter "the document")
8.2 China RoHS – section 2.2 of the document.
8.3 European Union REACH compliance: - section 2.3 of the document
8.4 Conflict Minerals: - document TTMTCP400
8.5 Documentation Submittal: - section 3 of the document

The latest revisions of the following FAR's will apply to all purchase orders

52.223-3 Hazardous material identification and materials safety data sheet
52.223-5 Pollution prevention and right to know information
52.223-10 Waste reduction program

Conformance to the environmental requirements may be made through the certificate of conformance required for each shipment. If in compliance, the supplier should state on the certificate of conformance that they meet all requirements outlined in the purchase order of this document.

9.0 SUPPLIER SHIPMENT REQUIREMENTS FOR INDIVIDUAL PACKAGING

For the safety of handling packages (i.e.: boxes, cartons, containers, etc.), being received by TTM, the following specifications are established for all incoming packages to TTM:

9.1 Packages should be in good condition, with weight distributed evenly, as feasible, with no sharp edges or exposed staples.

9.2 Supplier is responsible to use commercially acceptable methods and standards to ensure that packaging is adequate to protect the product during transportation, handling, and storage.

9.3 Packages must not exceed 50 pounds gross weight.

9.4 Packages exceeding 50 pounds must be approved by TTM in advance of shipment. These packages must have conspicuous warning signs or labels identifying the package as "Heavy" (or similar) with the actual weight printed on the package. Signs or labels must also denote that the package requires two-person lifting, mechanical device (hand truck, etc.) and/or similar warnings.

9.5 Printed circuit boards are to be individually bagged, and each bag marked with both the board part number and serial number unless otherwise specified on the TTM SCD.