SIX SIGMA EDGE

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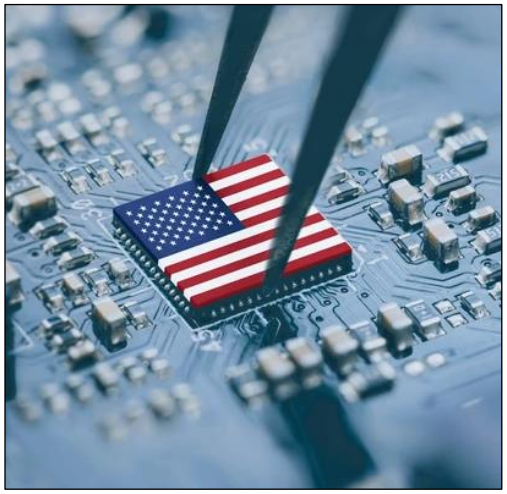
DID YOU KNOW?

Intermetallic compounds are the most extensively studied and characterized microstructures among solder/substrate interfacial reactions.

Find out more about intermetallic compounds on Sn-Pb and SAC solders on page 2.



SIX SIGMA MICROELECTRONICS: A DMEA TRUSTED SUPPLIER

For over 8 years, Six Sigma Microelectronics has been accredited as a Trusted Supplier through the Department of Defense (DoD) Defense Microelectronics Activity (DMEA) Trusted Foundry Program.

As a U.S.-based manufacturer specializing in high-reliability integrated circuit solutions, this accreditation demonstrates compliance with the DoD's highest standards for security, traceability, and process discipline. These benchmarks are vital to ensuring the integrity of microelectronics used in aerospace, defense, and other mission-critical applications.

About the DMEA Trusted Foundry Program

The Trusted Foundry Program designates U.S.-based suppliers qualified to securely manufacture and manage sensitive microelectronics. The program safeguards national security by ensuring that mission-critical devices are produced, assembled, and tested exclusively by vetted and trusted domestic partners.

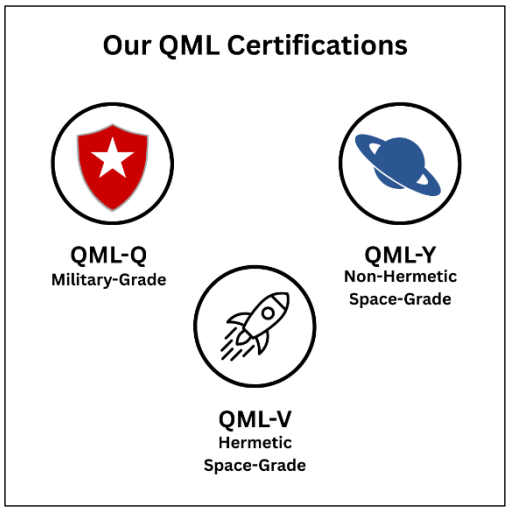
Six Sigma maintains its Trusted status by meeting ongoing compliance requirements, including:

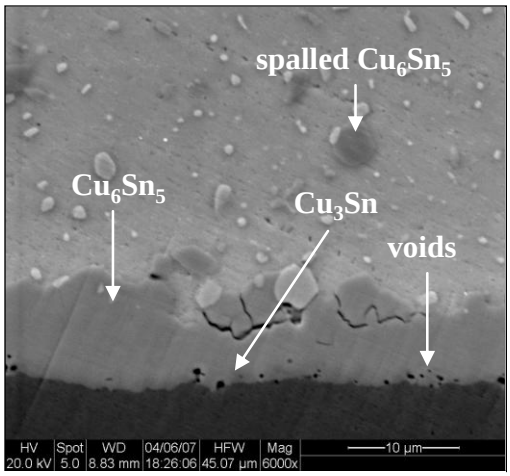
- **Controlled manufacturing environments**
  Production facilities are secured and regulated to support both classified and unclassified government and commercial programs.
- **Comprehensive traceability**
  All materials and assemblies are meticulously logged and fully traceable from initial receipt through final delivery, with comprehensive documentation ensuring compliance and maintaining product integrity.
- **Program isolation and IP protection**
  Customer programs are segregated to protect intellectual property and ensure against unauthorized attempts at reverse engineering, exposure of functionality, or evaluation of their possible vulnerabilities.

Why This Matters

Mission-critical customers may send unclassified devices to Six Sigma and request a "Trusted Flow", ensuring full compliance with DMEA Trusted requirements throughout the processing of these devices.

This approach extends DMEA Trusted standards to all handling and processing, providing the same level of security and traceability even for unclassified devices. Customers can rely on Six Sigma to maintain strict confidentiality for their sensitive projects.





Interfacial reactions between SAC 305 and Cu after reflow, followed by aging at 150°C for 30 days.

QML CERTIFICATION

The Defense Logistics Agency (DLA) Qualified Manufacturers List (QML) identifies suppliers approved to provide high-reliability products for military and aerospace applications. Six Sigma holds certifications in three product classes: **QML-Q** (Military Grade), **QML-V** (Hermetic Space Grade), and **QML-Y** (Non-hermetic Space Grade), reflecting the highest levels of quality, performance, and reliability.

Achieving QML certification requires rigorous qualification and ongoing compliance with applicable **MIL-PRF specifications**. Certified manufacturers must maintain strict process controls, keep detailed production records, and undergo periodic DLA audits to verify compliance.

In addition to QML accreditation, Six Sigma holds **DLA Laboratory Suitability** status, allowing in-house environmental and mechanical testing of integrated circuits. Six Sigma's lab suitability certifications include: Seal (Hermeticity), Solderability, External Visual, Bond Strength, Resistance to Solvents, Physical Dimensions Test (PDT), X-Ray Fluorescence (XRF), and Column Pull.

For defense and aerospace contractors, these certifications provide assurance that products meet stringent technical and security requirements for mission-critical programs. Working with a QML-certified supplier supports risk mitigation, strengthens traceability, and ensures long-term product availability and support.

These accreditations are more than credentials. They validate Six Sigma's proven ability to deliver secure, reliable, and fully traceable microelectronics to the most demanding sectors of the industry.

INTERMETALLIC COMPOUNDS (IMCs) IN SOLDERS

Intermetallic compounds (IMCs) form when two or more metals, in contact with each other, react under appropriate time and temperature conditions. The formation of these IMCs typically indicates good bonding between these metals. The IMCs that form between metallic materials can be predicted by referring to the appropriate binary or ternary phase diagrams. There are two types of IMCs: stoichiometric (line compounds) and non-stoichiometric. Line compounds are vertical lines in the phase diagram that have fixed compositions and definite stoichiometries, while non-stoichiometric compounds (also called intermediate phases) have a broader composition range.

For Sn-Pb solders that come into contact with a Cu substrate, the IMCs that typically form under normal reflow conditions are scallop-like Cu_6Sn_5. Over time, Cu_3Sn also forms between Cu_6Sn_5 and Cu. When Sn-Pb is in contact with a Ni substrate, then Ni_3Sn_4 forms. For SAC alloys, needle-like Ag_3Sn also forms in the bulk solder. IMCs have gained a "bad reputation" in that many believe that they cause a brittle solder joint, which can later lead to failures; however, not all IMCs are bad as long as the peak temperature and dwell time during reflow are controlled. If not controlled, these IMCs can grow excessively – voids may even form in the Cu_3Sn layer due to imbalanced diffusion between Cu and Sn.

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