**SURFACE MOUNT TECHNOLOGY (SMT)**

**BALL GRID ARRAY - BGA**

Ball Grid Array packages were designed to provide a device having high density input/output (I/O) array pattern interconnects, while minimizing device footprint and temperature coefficient (TC) problems. The array design features a low profile with shorter interconnections — resulting in superior electrical performance, speed, heat dissipation and noise reduction.

The placement of the interconnects on the bottom of the package limits visual inspection of the inner terminations, requiring the use of special microscopes or three-dimensional X-ray.

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**NASA WORKMANSHIP STANDARDS**

**SURFACE MOUNT TECHNOLOGY (SMT)**

**BALL GRID ARRAY – BGA (cont.)**

**UNACCEPTABLE NON-REFLOW**

Lack of proper reflow indicates poor process controls, typically insufficient heat during reflow.

**Best Workmanship Practice**

**UNACCEPTABLE NON-WETTING**

Non-wetting is an indicator of poor process controls.

**Best Workmanship Practice**

**UNACCEPTABLE POOR DEFINITION**

Solder joint boundaries exhibiting poor definition, appear fuzzy or which blend in with the background, indicate insufficient reflow.

**Best Workmanship Practice**

**UNACCEPTABLE SOLDER BALLS**

Solder balls that violate the minimum electrical clearance shall be cause for rejection.

**Best Workmanship Practice**

**UNACCEPTABLE SOLDER BRIDGE**

Solder bridging is an indicator of improper process, typically excess paste deposit.

**Best Workmanship Practice**

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**PREFERRED FIDUCIAL ALIGNMENT**

Alignment within the fiducial marks provides a rapid, visual indication of proper device alignment.

**Best Workmanship Practice**

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**ACCEPTABLE PAD OVERHANG**

Pad overhang is less than 25%.

**Best Workmanship Practice**

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**ACCEPTABLE VOIDS**

Terminations that exhibit less than 10% voiding in the ball-to-board interface are acceptable.

**Best Workmanship Practice**

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**UNACCEPTABLE SOLDER BALLS**

Solder balls that bridge more than 25% of the distance between the leads shall be cause for rejection.

**Best Workmanship Practice**

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**UNACCEPTABLE SOLDER BRIDGE**

Solder bridging is an indicator of improper process, typically excess paste deposit.

**Best Workmanship Practice**

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**PREFERRED**

Solder terminations are smooth and rounded, with a clearly defined boundary. Terminations exhibit no voids, and are of the same diameter, volume, darkness and contrast. Registration is straight, with no pad overhang or rotation. No solder balls are present.
SURFACE MOUNT TECHNOLOGY (SMT)
BALL GRID ARRAY – BGA (cont.)

UNACCEPTABLE
SOLDER OPENS
Solder opens are an indicator of improper process, typically insufficient paste deposit.
Best Workmanship Practice

UNACCEPTABLE
POOR FLOW
The fillet shall not exhibit poor or uneven flow at the top of the solder fillet.
Best Workmanship Practice

UNACCEPTABLE
VOIDING
Terminations that exhibit 10% (or more) voiding in the ball-to-board interface shall be grounds for rejection.
Best Workmanship Practice

UNACCEPTABLE
DARK SPOTS
Dark spots in the x-ray view, which cannot be attributed to circuitry (traces) or components underneath the BGA, shall be cause for rejection.
Best Workmanship Practice

UNACCEPTABLE
EXCESSIVE PAD OVERHANG
Pad overhang shall not exceed 25%.
Best Workmanship Practice

UNACCEPTABLE
VOIDING
Terminations exhibiting fractures in the ball-to-board interface are unacceptable.
Best Workmanship Practice

UNACCEPTABLE
MISALIGNMENT
Misalignment is an indicator of improper process controls.
Best Workmanship Practice

UNACCEPTABLE
MISSING BALL
BGAs exhibiting missing solder balls shall be rejected.
Best Workmanship Practice

UNACCEPTABLE
MISSING SOLDER
Missing solder is an indicator of improper process controls.
Best Workmanship Practice

NASA WORKMANSHIP STANDARDS
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHNSON SPACE CENTER
HOUSTON, TEXAS USA 77058

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