REV	*REASON FOR REVISION / DESCRIPTION OF CHANGE*	*ORIGINATOR*	*DATE*
05	Update codes in section 7.1	Pete Cannon	08/17/07
04	Section 7.1: removed the comment "BGA/Laminate packages to be LHF compliant by December 31, 2005." In the footnote at the bottom of the table	Pete Cannon	12/18/06
03	Added para. 4.4 JEDEC STD201 and JESD22-A121 (Sn Whisker specifications) Edit para. 5.3 to Pb-Free, RoHS Compliant, and Halide Free	Mark Fisher Pete Cannon	05/16/06
02	Updates include: New minimum Sn requirements	Mark Fisher	10/04/05
01	Updates include: New code matrix and corresponding notes	Mark Fisher	03/23/05
00	Initial Release	Mark Fisher	10/29/04

1.0 TITLE: CORPORATE Pb FREE/HALOGEN FREE PACKAGING SPECIFICATION

2.0 PURPOSE:

The intent of this policy is to define standards for Pb-free / Halogen-free product assembly and marking designation.

3.0 SCOPE:

This policy applies to all Atmel products.

4.0 REFERENCE DOCUMENTS:

4.1 JEDEC standard (JESD97 – Marking, Symbols, and labels for the identification of Pb-Free Assemblies, Components, and Devices)

4.2 RoHS Directive 2002/95/EC

4.3 CPQ-1000 Corporate Quality Manual

4.4 JEDEC STD201 and JESD22-A121 (Sn Whisker specifications)

5.0 DEFINITIONS:

Defined Limits for Pb-Free, RoHS-compliant, and Green (LHF) Assembly Materials (LHF=Lead/Halide Free)

		Element / Compound	Limit
5.1	**Pb Free**	Pb	1000 ppm
5.2	**RoHS Compliant**	Pb	1000 ppm
		Hg	1000 ppm
		Cd	100 ppm
		Cr^{+6}	1000 ppm
		Polybrominated Biphenyl	1000 ppm
		Polybrominated Diphenyl Ether	1000 ppm
		Pentabromo Diphenyl Ether	1000 ppm
		Octabromo Diphenyl Ether	1000 ppm
5.3	**Green**	Pb-Free, RoHS Compliant, and Halide-Free	
		Br (Bromine)	900 ppm
		Cl (Chlorine)	900 ppm
		Sb (Antimony)	900 ppm
		TBTO (Tributyltin Oxide)	Not used
		Phosphorus	Not used

6.0 RESPONSIBILITY:

N/A

7.0 REQUIREMENTS:

7.1 Part Numbering System: The codes in the table noted below are included in the Atmel ordering part number for standard products. This designation denotes the temperature grade and the environmental packaging option.

Environmental Packaging Option / Temperature Grade	Standard Plating Containing Pb	Green (NiPdAu or Alternate Alloy)	Green (Matte Sn or Sn Alloy)
Commercial (0°C to 70°C)	**C**	**G**	**X**
Industrial (-40°C to 85°C)	**I**	**H**	**U**
High Grade (-40°C to 105°C)	**E**	**P**	**Q**
Automotive (-40°C to 85°C)	- N/A -	- N/A -	**T**
Automotive (-40°C to 105°C)	- N/A -	- N/A -	**B**
Automotive (-40°C to 125°C)	**A**	**R**	**Z**
Automotive (-40°C to 150°C)	- N/A -	- N/A -	**D**
Military	**M**	- N/A -	- N/A -
Space	**S**	- N/A -	- N/A -
No Temperature Grade	- N/A -	- N/A -	**W**

7.1.1 Due to previously defined formats already adopted by customers, there are a few NTO products that utilize two-digit codes in lieu of the “B” and “D” codes noted above (T1 = automotive -40°C / 105°C and T2 = automotive -40°C / 150°C). Also, RFA products use the “Y” code to denote “RoHS compliant; but not green; no temperature grade”.

7.1.2 Historically Used Codes: The letters “L”, “J”, “N”, and “K” had historically been used to designate RoHS Compliant, Sn Alloy (not Green) packaging for commercial, industrial, high grade, and automotive temperature grades, respectively.

7.1.3 Atmel will only mark the code character on individual parts; the JESD97 e-codes will be included on the intermediate container label. This strategy is necessary because a majority of Atmel products are mark-space constrained due to small package sizes and it is important to apply a consistent marking methodology on all package families. This strategy is compliant with JESD97.

7.2 Pb Free Categories per JESD97

The following categories are meant to describe the Pb free 2nd level interconnect terminal finish/material of components/ or the solder paste/solder used in board assembly:

e1 – SnAgCu (Shall not be included in category e2)
e2 – Sn alloys with no Bi or Zn excluding SnAgCu
e3 – Sn
e4 – Precious metal (e.g., Ag, Au, NiPd, NiPdAu) (no Sn)
e5 – SnZn, SnZnx (no Bi)
e6 – contains Bi
e7 – low temperature solder (≤ 150°C) containing Indium (no Bi)

e0, e8, and e9 symbols are unassigned at this time.

7.3 Supplier Process Requirements:

Solderability data/tools used must be part of the recorded standard characterization. Delamination control and monitoring must be in place to ensure JEDEC compliancy. All leadframe products are expected to be backward compatible with Pb/Sn solder.

7.3.1 Laminate products

7.3.1.1 Atmel standard solder ball composition is SnAgCu.

7.3.2 Subcontractor solder mask and laminate core material shall be controlled and subject to PCN notification.

7.3.3 Leadframe products - Plating Options

7.3.3.1 Matte Sn (Atmel preferred option for standard products)

7.3.3.1.1 Sn thickness to be 400 micro-inches minimum
7.3.3.1.2 C content must be <. 05%
7.3.3.1.3 Minimum 1 hour anneal bake @ 150°C within 24 hours of plating process.
7.3.3.1.4 NEMI whisker acceleration test data to be collected and reported on a quarterly basis. (NEMI Tin Whisker Users group –July 28, 2004)
7.3.3.1.5 50um max. whisker length for 0.5mm pitch and higher products, 30um for <0.5mm pitch products.
7.3.3.1.6 A Wetting Balance Test J-Std-002 is the preferred quality monitor for solderability testing.

7.3.3.2 Sn/Cu (Optional process, not Atmel preferred)

7.3.3.2.1 Sn^{+4} concentration in bath must be controlled and monitored.

7.3.3.2.2 Other requirements are the same as above for matte Sn except anneal bake (bake is not required).

7.3.3.3 NiPdAu plated leads

7.3.3.3.1 Minimum thickness:
Ni = 20 micro inches
Pd = 0.8 micro inches

7.3.3.3.2 Maximum thickness for Au layer is 0.6 micro inches

7.3.4 Reflow Requirements follow IPC/Jedec J-STD-020C refer to tables 4.2 and 5.2.

7.3.4.1 Atmel goal is not to lose MSL level from Pb to Pb free product.

7.3.4.2 Minimum acceptable MSL level is 3.

7.3.4.3 Delamination criteria per JEDEC shall apply. Atmel goal is to have NO delamination. Other customer requirements may apply and will be uniquely specified.

7.3.5 Process Capability

7.3.5.1 Per CPQ-1000, Cpk indices should be consistent with Atmel Corporate quality goals.