Freescale 5 year Shelf Life

Updated March 2014

freescale™

Shelf Life Policy – General Announcement 15464

On January 18, 2013, Freescale issued a GPCN General Announcement # 15464 in regards to shelf life policy to all customers with the following language:

> "Currently, Freescale standard policy is to ship semiconductor products with an assembly date code of 2 years or less. This notice is to announce Freescale's new standard policy to ship semiconductor products with assembly date codes of 5 years or less. The Freescale warranty remains the same."

NOTE: Freescale's Terms and Conditions of Sale, including the warranty, were revised in 2014 for reasons unrelated to the Shelf Life Policy. The warranty period still does not begin to run until the date of shipment.

Key Messages

Why is Freescale doing this?

- Every year semiconductor devices are sent to recycling centers after being stored in a warehouse for two years, yet there's no reliability or quality rationale for this two year limit. Extending the shelf life to 5 years from assembly date will enable an **increased assurance of supply** for our customers with no degradation to product quality.

- Another consideration in moving to a longer storage life is to increase **manufacturing flexibility** to build devices during low utilization cycles, allowing Freescale to even out its manufacturing loading.

- Freescale is not making this change because we have excess aged inventory. Over 95% of shipments over the past 6 months are aged less than 6 months and a very small percentage of inventory is aged 2-5 years. We do not anticipate large volume shipments aged 2-5 years.

There is **no change to Freescale warranty**

- Customers will see the upside of having greater supply available for sale, without seeing any downside in quality.

Benefits of Freescale's Shelf Life Extension

- In some exceptional cases, customers may be short of supply, and previous policy prevented us from utilizing product beyond two year shelf life unless a written customer exception or deviation was generated. Increasing shelf life limitation to five years will increase assurance of supply and supply chain flexibility in these cases by allowing product to ship immediately, if available, resulting in immediate shipment without delay or intervention.

- Extending shelf life to 5 years enables longer availability of mature products over the lifecycle of product, minimizing customer redesigns.

- No negative impact to quality

Adherence to JEDEC packing, handling, and moisture management specifications

- The JEDEC industry standard J-STD-020 defines a set of Moisture Sensitivity Level (MSL) ratings used to identify package sensitivity to moisture. The JEDEC industry standard J-STD-033 for moisture management provides a uniform method to ensure devices are protected during handling, packing, shipment, storage, and use.
- Specific handling, dry packing, and exposure limits are established for each MSL rating to ensure no manufacturing issues are experienced at the board assembly process.
- Freescale adheres to these industry standards for packaging of all our devices.
- The concept behind moisture control is to dry bake units prior to packaging, and then vacuum seal units in a Moisture Barrier Bag (MBB) along with desiccant and a Humidity Indicator Card (HIC). This combination of techniques ensures proper storage.
- The best indication of shelf life is not the manufacturer's date code, but rather the Dry Bag Seal Date. This represents the most recent inspection for moisture exposure and repackaging with fresh desiccant. Using this date, and adhering to the industry standard practices for moisture management, will result in successful assembly manufacturing.

No Degradation to Product Quality

- Proper storage with good dry package integrity is our top priority. Moisture Sensitivity Level bags are not compromised during storage and therefore quality and reliability of the product is not affected. (Moisture sensitivity data attached as Backup)

- Solderability testing using Surface Mount Process Simulation (to simulate customer board assembly) was performed on naturally aged product in multiple package types and lead finishes with no failures: (Data attached as Backup)
  - SnPb plating on leadframe
  - SnPbAg sphere on ball grid array
  - Pb-free (matte Sn) plating on leadframe
  - Pb-free (SnAgCu) sphere on ball grid array

Freescale Warranty and CofC unchanged

- Warranty – no change to Freescale Warranty
  - Freescale warranty begins at the time of shipment to the customer and is unchanged.

- Certificate of Compliance (CofC) – no change
  - All Freescale product ships with a Certificate of Compliance statement on the packing slip

    “It is hereby certified that all articles in the quantities as called for in the above purchase order are in conformance with the requirements, specifications and drawings listed on that order, which have been accepted by Freescale in writing. Records substantiating the above statement are available in our files for inspection by authorized personnel.”

Industry History

- It is not uncommon in the electronics industry to specify a maximum time interval from device manufacture to shipment and receipt by the customer.
- The origins of date code age restrictions are not well documented, but it is probable that limitations of the packing materials for moisture sensitive components and post storage solderability of SnPb or Sn finishes contributed to the concerns of customers that led to the shelf life restrictions.
- Prior to 1995, the U. S. Military specified electrical retest of devices if a 3 year date code window was exceeded. In 1995, the military specification that mandated electrical retest after 3 years was revised and that requirement was removed entirely. The military now prohibits date code restrictions on component orders.
- A comprehensive evaluation of Long Term Storage devices was started in 2004 by engineers in Dallas and Freising, utilizing both current devices and devices stored for >2 years in a warehouse environment. That study, which included ATE re-verification of electrical performance, concluded that no reliability or quality issues would result from storage of devices well beyond a 5 year period.

Additional Information

- Customer questions are better tracked if entered on a Service Request.
  - Using URL below will link directly to the specific PCN15464:
    Link to Enter Service Request

- You may also contact local sales representative for additional information and support

BACKUP

Industry References

“Managing Date Code Restrictions on Orders for Electronic Components”
http://www.eciaonline.org/standards/documents/WhitePaperDateCodeNEDAMASTER.pdf

Aged Product Testing

Summary of Data Collected

Solderability and Aging Analysis

- Surface Mount Process Simulation

Moisture Sensitivity

- Moisture Soak and Reflow with inspection before and after

Multiple package types and lead finishes

- SnPb plating on leadframe
- SnPbAg sphere on ball grid array
- Pb-free (matte Sn) plating on leadframe
- Pb-free (SnAgCu) sphere on ball grid array

Naturally Aged Devices

- Naturally Aged Material
  - Material sourced from various inventory stocks (5-13 years)
  - Material still in original shipment packaging in most cases

Leadframe – Plated Devices

Surface Mount Process Simulation

- All devices processed through a standard bake-out prior to testing to ensure devices were dry
- Testing performed at temperatures appropriate for plating material and at reduced temperatures to assess margin
- Initial testing of SnPb plated devices completed in 2008
- Additional testing of Pb-free plated devices performed in 2009 and 2013

Moisture Sensitivity Testing

- Naturally aged devices were not processed through a standard bake-out prior to testing to verify storage robustness
- Preconditioning soak conditions and reflow temperatures based on MSL rating of the device
- Testing performed in 2013

Solderability Test Results – SnPb Plated Leadframes

							Surface Mount Process Simulation	
Package	Storage	Lead Frame Material	Plating	Assembly Date	Date Tested	Age at Test (years)	215C	203C
64 QFP	Dry Pack Trays	Al 42	SnPb	Feb-03	Mar-08	5.1	0/20	0/15
144 LQFP	Dry Pack Trays	Cu	SnPb	Nov-00	May-08	7.5	0/20	0/15
				Dec-00	May-08	7.4	0/20	
				Feb-01	May-08	7.2	0/20	
28 PLCC	No Dry Pack Reels	Cu	SnPb	Jun-01	Jun-08	7.0	0/20	0/20
				Jul-01	Jun-08	6.9	0/20	
				Aug-01	Jun-08	6.8	0/20	

Surface Mount Process Simulation

- JEDEC specification: JESD22 B102 Rev E
- Solder Paste: Kester EP256
- Flux: ROL0 - Low activation
- Testing performed at 215C Peak Package Temperature, standard for SnPb plating
- Additional testing performed at 203C for evaluation of margin
- No failures on product naturally aged over 7 years with and without dry pack

Solderability Test Results – Pb-Free (Sn) Plated Leadframes

							Surface Mount Process Simulation				
Package	Storage	Lead Frame Material	Plating	Assembly Date	Date Tested	Age at Test (years)	Solder Paste	Flux	245C	16 hr bake 150C + 245C	230C
144 LQFP	Dry Pack Trays	Cu	Matte Sn	Nov-03	Dec-09	6.1	Indium Solders SMQ230	ROL1	0/20		0/20
80 LQFP	Dry Pack Trays	Cu	Matte Sn	May-04	Dec-09	5.6			0/20		0/20
64 LQFP	Dry Pack Trays	Cu	Matte Sn	Aug-04	Dec-09	5.3			0/20		0/20
132 CQUAD	JEDEC trays, no drypack	Cu	Matte Sn	Apr-05	Oct-13	8.5	Indium HF8.9 NC (SAC305)	ROL0	0/15	0/15	

Surface Mount Process Simulation

- JEDEC specification: JESD22 B102 Rev E
- Testing performed at 245C Peak Package Temperature, standard for Pb-Free
- Additional testing performed at 230C for evaluation of margin
- No failures on product naturally aged over 6 years with dry pack

Moisture Sensitivity – Pb-Free (Sn) Plated Leadframes

							Moisture Sensitivity Testing Parts pulled out of storage with no bake before soak				
Package	Storage	Lead Frame Material	Plating	Assembly Date	Date Tested	Age at Test (years)	Temp °C	Level	Soak Time Hours	INSPECT Time 0	INSPECT Post Precond
132 CQUAD	JEDEC trays, no drypack	Cu	Matte Sn	Apr-05	Oct-13	8.5	260	3	168	0/15	0/15

Moisture Sensitivity Testing

- IPC/JEDEC J-STD-020D.1
- Parts pulled directly out of storage with no bake prior to analysis
- Flow: Soak, reflow, inspect

Ball Grid Arrays

Surface Mount Process Simulation

- All devices processed through a standard bake-out prior to testing to ensure devices were dry.
- Testing performed at temperatures appropriate for surface mount of package type including Pb-Free and at reduced temperatures to assess margin
- Initial testing completed October 2009 – January 2010
- Additional testing performed in 2013

Moisture Sensitivity Testing

- Devices were not processed through a standard bake-out prior to testing to verify storage robustness
- Preconditioning soak conditions and reflow temperatures based on MSL rating of the device
- Testing performed in 2013

Solderability Test Results – SnPb Ball Grid Array

						Surface Mount Process Simulation	
Package	Storage	Sphere Composition	Assembly Date	Date Tested	Age at Test (years)	215C	203C
119 PBGA	non dry pack trays	SnPbAg	Nov-96	Oct-09	12.9	0/20	0/20
225 MAP	dry pack T&R	SnPbAg	Feb-03	Oct-09	6.7	0/20	0/20
272 PBGA	dry pack trays	SnPbAg	Jul-03	Dec-09	6.4	0/20	0/20

Surface Mount Process Simulation

- JEDEC specification: JESD22 B102 Rev E
- Solder Paste: Kester EP256
- Flux: ROL0 - Low activation
- Testing performed at 215C Peak Package Temperature, standard for SnPb plating
- Additional testing performed at 203C for evaluation of margin
- No failures on product naturally aged over 12 years without dry pack

Solderability Test Results – Pb-Free Ball Grid Array

						Surface Mount Process Simulation					
Package	Storage	Sphere Composition	Assembly Date	Date Tested	Age at Test (years)	Solder Paste	Flux	245C	Bake + 245C	230C	Bake + 230CC
357 PBGA	dry pack trays	SAC405	Dec-02	Jan-10	7.1	Indium Solders SMQ230 (SAC387)	ROL1	0/20	0/20	0/20	0/20
516 PBGA	dry pack trays	SAC387	Nov-03	Jan-10	6.2			0/20	0/20	0/20	0/20
280 MAP 13x13	non dry pack trays	SAC105	Jul-05	Jan-10	4.5			0/20		0/20	
516 PBGA 27x27	dry pack trays	SAC387	Nov-03	Oct-13	9.9	Indium HF8.9 NC (SAC305)	ROL0	0/15			
783 FCPBGA 29x29	dry pack trays	Sn/Ag	Jun-06	Oct-13	7.3			0/15	0/15		
256 MAP 14x14	dry pack trays	SAC405	Dec-06	Oct-13	6.8			0/15			
208 MAP 17x17	dry pack trays	SAC387	Feb-07	Oct-13	6.6			0/15	0/15		
672 TBGA 35x35	dry pack trays	Sn/Ag	May-07	Oct-13	6.4			0/15			
416 TEPBGA 27x27	dry pack trays	SAC387	Oct-07	Oct-13	6.0			0/15			

Surface Mount Process Simulation

- JEDEC specification: JESD22 B102 Rev E
- Testing performed at 245C Peak Package Temperature, standard for Pb-Free
- Additional testing performed at 230C for evaluation of margin
- No failures on product naturally aged over 9 years with dry pack

Moisture Sensitivity – Pb-Free Ball Grid Array

						Moisture Sensitivity Testing				
Package	Storage	Sphere Composition	Assembly Date	Date Tested	Age at Test (years)	Temp °C	Level	Soak Time Hours	CSAM Time 0	CSAM Post Precond
516 PBGA 27x27	dry pack trays	SAC387	Nov-03	Oct-13	9.9	260	3	168	0/15	0/15
783 FCPBGA 29x29	dry pack trays	Sn/Ag	Jun-06	Oct-13	7.3	260	3	168	0/15	0/15
256 MAP 14x14	dry pack trays	SAC405	Dec-06	Oct-13	6.8	260	3	168	0/15	0/15
208 MAP 17x17	dry pack trays	SAC387	Feb-07	Oct-13	6.6	245	3	168	0/15	0/15
672 TBGA 35x35	dry pack trays	Sn/Ag	May-07	Oct-13	6.4	260	3	168	0/15	0/15
416 TEPBGA 27x27	dry pack trays	SAC387	Oct-07	Oct-13	6.0	260	3	168	0/15	0/15

Moisture Sensitivity Testing

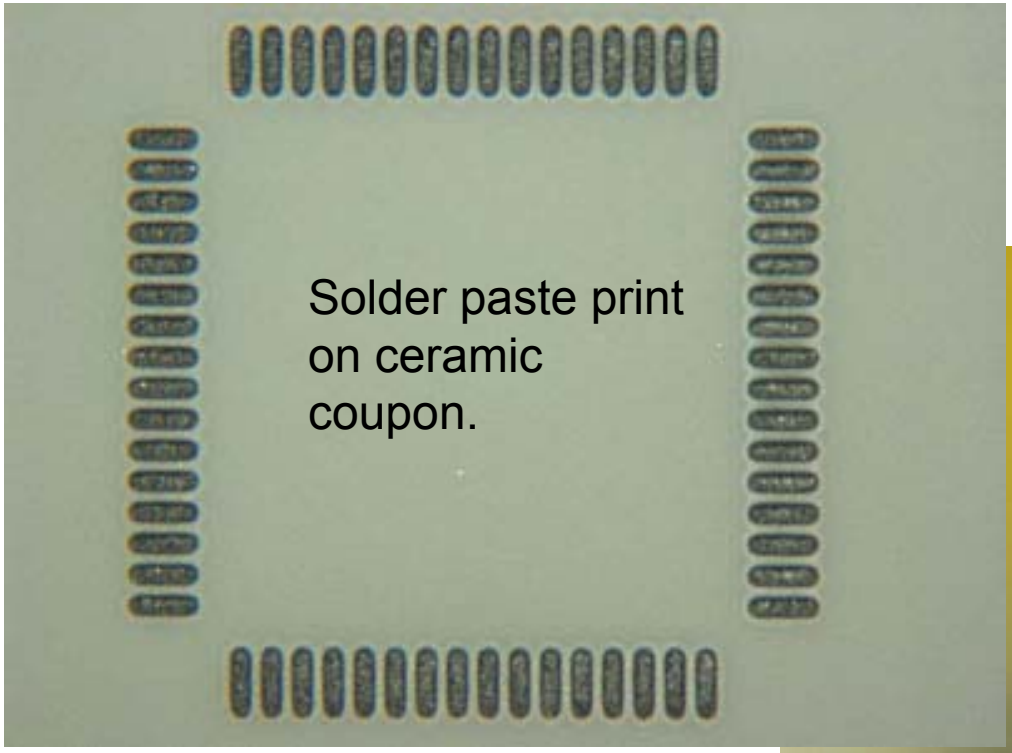
- IPC/JEDEC J-STD-020D.1
- Parts pulled directly out of drypack with no bake prior to analysis
- Flow: CSAM, soak, reflow, CSAM
  - CSAM = Confocal Scanning Acoustic Microscopy

Integrity of Storage

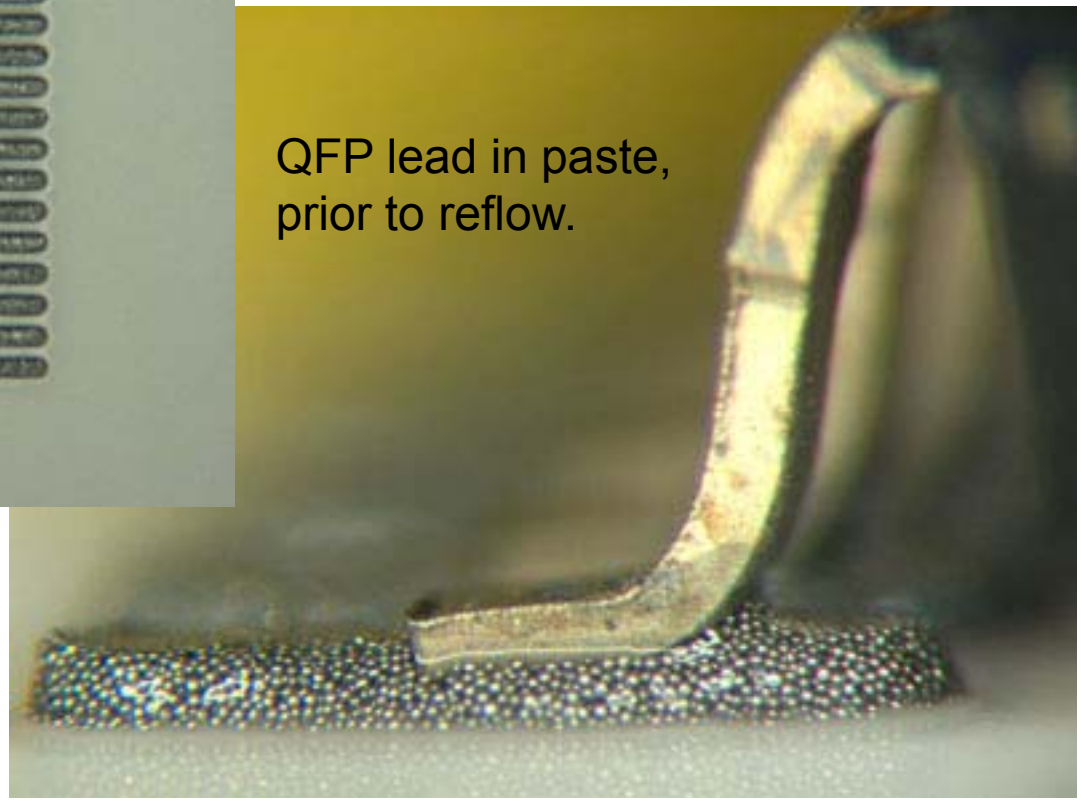
No significant moisture ingress detected when packaging is opened

Naturally aged product 7.5 years

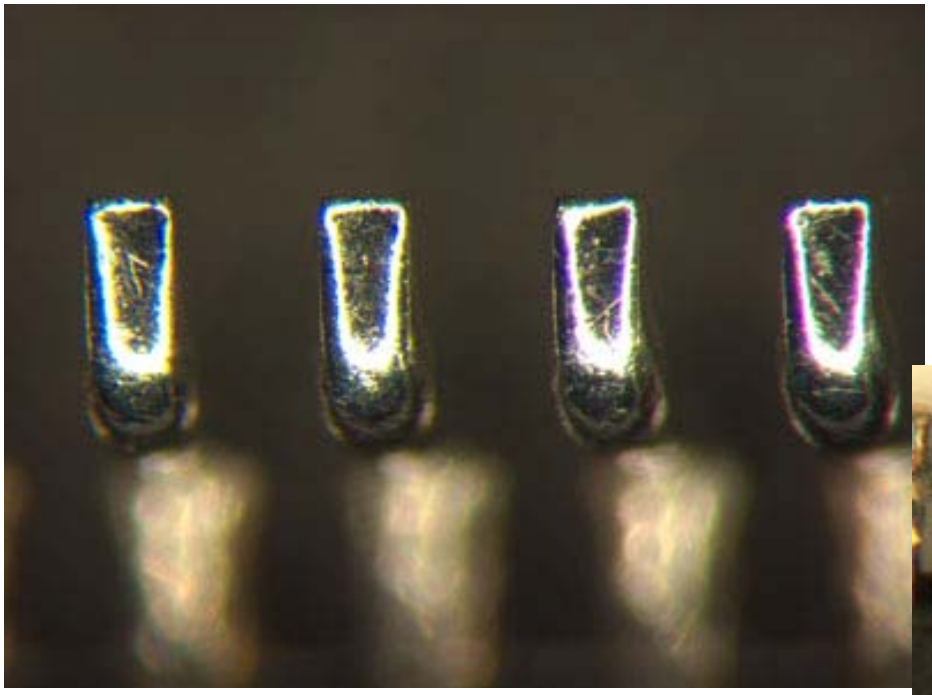
Surface Mount Process Simulation

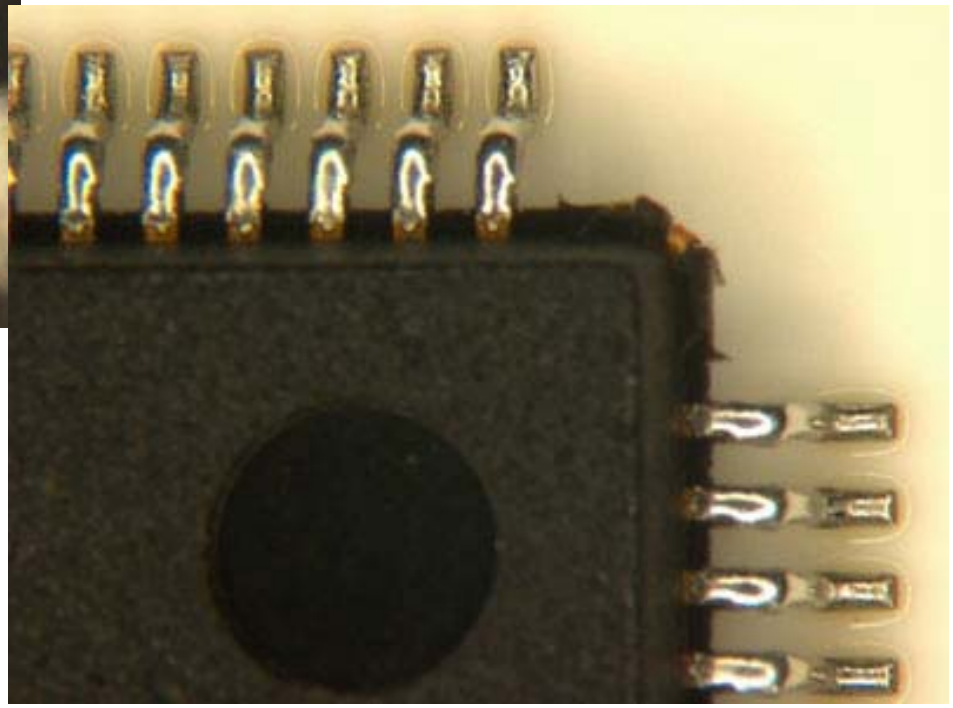


150um Thick Solder Paste Applied to Each Lead



144ld LQFP Post 215C Solderability Test





Applied solder showing good wetting up lead

Conclusion

Industry experience, published studies, and internal Freescale evaluations indicate extended storage of semiconductor devices is feasible. Industry experience indicates good results beyond 10 years with proper storage. Freescale solderability and moisture robustness data passed at over 7 years.

The data in this document is provided for informational purposes only and is not intended to extend or modify the terms of Freescale's warranty.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