



# RELIABILITY REPORT

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## Overview

Intel® Corporation Programmable Solutions Group (formerly Altera Corporation) is the pioneer of programmable logic solutions, enabling system and semiconductor companies to rapidly and cost effectively innovate, differentiate, and win in their markets. Intel offers FPGAs, SoC with embedded processor systems, CPLDs, PowerSOCs in combination with software tools, intellectual property, embedded processors, and customer support to provide high-value programmable solutions.

This report shows reliability results on each product family from Intel's FPGA product catalog. All results successfully meet Intel quality and reliability standards. Intel ensures standard compliance through continuous monitoring.

## Intel® Quality System

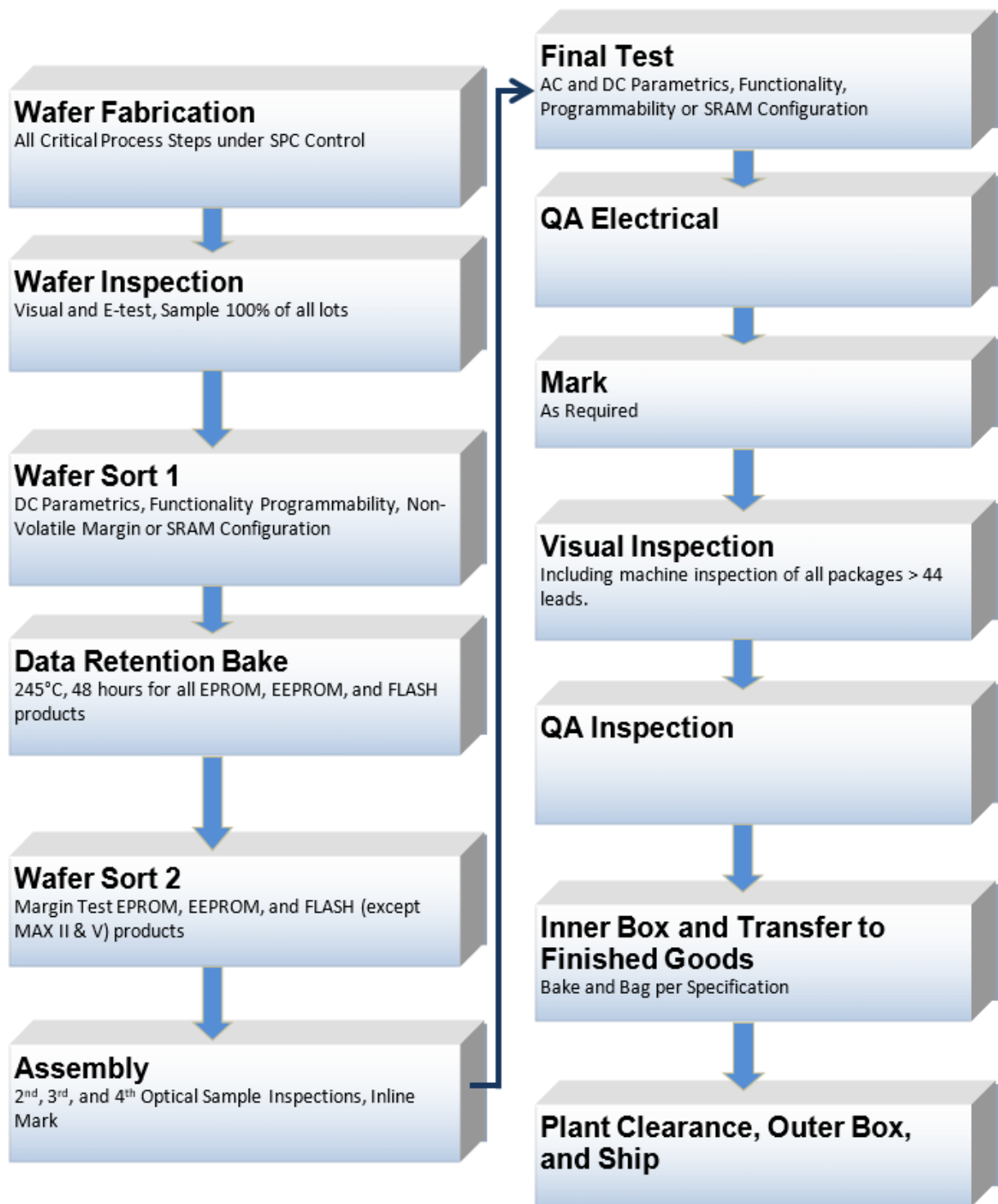
Intel FPGA development is a closed-loop quality and reliability system that conforms to the requirements of ISO 9001:2008, MIL-I-45208 and JEDEC® standards. Intel and all of its major suppliers are ISO 9000 certified. Intel internal specifications govern the reliability qualifications, which define procedures, pass/fail requirements, and corrective actions. Intel's FPGA develop process is ISO9001 certified since October 1994.

Intel FPGA's can provide the automotive supply chain with the highest levels of quality and reliability because all of Intel's foundry, assembly, and test partners are certified and registered to the ISO/TS 16949 automotive industry quality standard.

Intel conducts automotive product qualification which complies with requirements listed in the AEC-Q100 document.

Intel performs comprehensive testing and manufacturing controls on all its FPGA products. Figure 1 shows a typical FPGA product manufacturing flow.

**Figure 1: Typical FPGA Product Flow Chart**



## Reliability Methodology

Reliability qualifications and monitoring are performed specifically for each product family. All members of a product family utilize the same circuit architecture, fabrication process, and share the same package types. See the list and description of the Product Families in Table I.

**Table I: Product Family Description**

PRODUCT FAMILY	TECHNOLOGY	WAFER PROCESS
Arria® 10	FPGA	0.020um
Stratix® V, Arria V, Cyclone® V	FPGA	0.028um
Stratix IV, Arria II GX, HardCopy® III, HardCopy IV	FPGA	0.040um
Stratix III, Cyclone III, Cyclone IV	FPGA	0.065/0.060um
Stratix II, Stratix II GX, Cyclone II, Arria GX, HardCopy II	FPGA	0.090um
Stratix, Stratix GX, Cyclone, HardCopy	FPGA	0.13um
APEX™ 20KC, APEX II, Mercury™	FPGA	0.15um
APEX 20KE, Mercury, Excalibur™	FPGA	0.18um
FLEX® 10KE, FLEX 10KS, ACEX, APEX 20K	FPGA	0.22um
FLEX 10KA, FLEX 6000A	FPGA	0.3/0.35um
FLEX 8000, FLEX 10K, FLEX 6000	FPGA	0.42um
MAX® 10	FPGA/FLASH	55nm
MAX II, MAX V	CPLD/FLASH	0.18um
MAX 7000B	CPLD/EEPROM	0.22um
MAX 7000A, MAX 3000A	CPLD/EEPROM	0.3/0.35um
MAX 7000, MAX 9000	CPLD/EEPROM	0.5um
EPC1	EPROM	0.5um
EPCQ16, EPCQ32, EPCQ64, EPCQ128, EPCQ256, EPCQ512, EPCS128, EPCQ-L256, EPCQ-L512, EPCQ-L1024	FLASH	0.065um
EPCS4, EPCS16, EPCS64	FLASH	0.11um
EPCS1	FLASH	0.15um
EPC4, EPC8, EPC16	FLASH*	0.35/0.13um
EPC2	FLASH	0.40um
The exact list of power device products can be found in following website: <a href="https://www.altera.com/products/power/">https://www.altera.com/products/power/</a>	Power SoC**	0.25um, 0.18u/0.25um

\* Package contains 2 dice with different processes 0.35um and 0.13um.

\*\* Package contains one or more dice with different processes 0.18 and 0.25um.

A product family contains several products, all based upon the same logic elements, embedded storage elements, and programmable interconnect technology. For reliability purposes, such as data reporting and failure rate prediction, a product family will be reported as much as possible on a fabrication process technology.

Product families are qualified based upon the requirements specified in Table II. Product family qualification include products with a range of densities, package types, and package lead counts.

If a new product is added to the product family with a significant increase (more than 50%) in logic elements, Intel performs a product qualification.

Intel performs Reliability monitors on a regular basis to assure that Intel's normal production testing and process control methodologies produce reliable products. The reliability monitor program is also based upon a product family methodology.

Intel has a product reliability goal for long term failure rate. The long term failure rate is listed as <200 FIT at 55°C use condition. Inherent in this requirement are two key components

- Product needs to meet lifetime goal of 100,000h of useful life.
- The wear-out mechanisms are outside of the useful life of the product.

Different products and package types are procured from normal production on a Last in First out (LIFO) schedule to monitor product reliability. Results in this report cover data gathered at least in the last 36 months. For life-test, the report covers a much larger period to assess FIT numbers more accurately.

Reliability monitor sampling is defined in Table III. For HTOL Lifetest, reliability monitor schedules depend on the maturity of the product:

- A) Minimum of 1 lot per quarter for new product in production for less than 5 years
- B) Minimum of 1 lot per year for mature products in production for more than 5 years.

For packaging stress tests, reliability monitoring addresses each type of package, independently of product family.

All new results shown in this reliability report compared to previous version appear upfront in each table of results and are highlighted in a different color and font.

**Table II: Reliability Qualification Requirements**

TYPE OF TEST MIL-STD-883 or JEDEC Std.	METHOD /CONDITION	SAMPLE SIZE	PIN COUNTS	# of Lots	Full Qualification
					Accept Criteria # Rej./Lot
Life Test JESD22-A108	1000 hours @ 1.1 - 1.2 x Vcc, T <sub>j</sub> :110°C min - 140°C max 2000 hours for reference	77 45 25	≤100 pins 101-240 pins >240 pins	3	1 1 0 < 200 FIT@55°C
High Temperature Retention Bake JESD22-A103	1000 hours min. @ 150°C, 168 hours min @ 245°C for wafer level may be substituted.	45 25	≤100 pins 45 >100 pins 25	3	1 0
Temperature Cycling JESD22-A104	Preconditioning + 700 cycles. -55°C to +125°C (condition B)	45 25	≤100 pins 45 >100 pins 25	3	1 0
Biased Humidity/Temp JESD-A101 Or H.A.S.T JESD-A110	Preconditioning + 85°C, 85% R.H.; 1000 hours @ Vcc nom; Or 130°C, 85% RH, 48 or 96 hours, @ Vcc nom.	45 25	≤100 pins 45 >100 pins 25	3	1 0
Autoclave JESD22-A102 Or Unbiased H.A.S.T JESD-A118	121°C, 15 PSIG; 96 hours, 168 hours for reference Or 130°C, 85% RH, 96 hours	45 25	≤100 pins 45 >100 pins 25	3	1 0
ESD HBM JESD22-A114 Mil Std 3015.7	100 pf, & 1500 Ω. Record Distribution of all Failing Pins	3		1	≥ 1000V
ESD Charged Device Model JESD22-C101	Field Induced Charge Device	3		1	≥ 500 V for GIO; ≥ 200 V for high- speed pins < 10 Gbps; Characterize for high- speed pins ≥10 Gbps
Latch-up JESD 78	(I <sub>cc</sub> nom. + 100mA) or I <sub>cc</sub> nom. + 50% on I/O, V <sub>cc</sub> + 50% on Power Supplies	6		1	0
Program/Erase Cycling	Program/Erase 100 cycles (EEPROM or FLASH)	25		1	0
PCB Interconnect Reliability IPC 9701 JESD22-A104	0°C to +100°C, Single Chamber	25		1 Daisy Chain	>2000 Cycles to 0.1% Predicted Failure



**Table III: Reliability Monitor Program**

TYPE OF TEST MIL-STD-883 or JEDEC Std.	METHOD/CONDITION	SAMPLE SIZE
Life Test  JESD22-A108	1000 hours @ 1.1 - 1.2 x Vcc nom. T <sub>j</sub> : 110°C min, 140°C max 2000 hours for reference	≤100 pins 77pcs >100 -240 pins 45pcs >240 pins 22pcs
High Temperature Retention Bake Non-Volatile Products JESD22-A103	1000 hours min. @ 150°C	≤100 pins 45pcs >100 pins 22pcs
Temperature Cycling  JESD22-A104	Preconditioning + 700 cycles. -55°C to +125°C Industrial, 0°C to +125°C Commercial,	≤100 pins 45pcs >100 pins 22pcs
Biased Humidity/Temp. JESD-A101 Or H.A.S.T. JESD-A110	Preconditioning + 85°C, 85% R.H. 1000 hours min. @ Vcc nominal; Or 130°C, 85% RH, 96 hours, @ Vcc nominal	≤100 pins 45pcs >100 pins 22pcs
Autoclave JESD22-A102 Or Unbiased H.A.S.T. JESD-A118	121°C, 15 PSIG; 96 hours min. 168 hours for reference Or 130°C, 85% RH, 96 hours	≤100 pins 45pcs >100 pins 22pcs
Program/Erase	Program/Erase 100 cycles (EEPROM or FLASH only)	22pcs

## **Lifetest: Methodology and Failure Rate Prediction**

### **Lifetest Methodology**

Intel performs a high temperature / high voltage lifetest on its products to accelerate failure mechanisms. These mechanisms include wear-out degradation.

Lifetest is conducted at a Junction Temperature of at least 125°C and at a Vcc power supply increased by 10-20%. In some cases, where increasing junction temperature to 125°C is not possible because of risk of thermal runaway, a minimum junction temperature of 110°C is used. The lifetest boards have special high temperature sockets that maintain lead integrity.

FLEX, APEX, Mercury, Stratix, Stratix GX, Cyclone, Stratix II, Stratix II GX, Cyclone II and Power devices use static life test mode. 65/60 nm, 55nm, 40nm, 28 nm and 20nm products use dynamic life with a real clocked configuration. MAX 3000, MAX 7000, MAX 9000 devices (EEPROM devices), MAX II, MAX V and MAX 10 (FLASH devices) are first subjected to Program Erase Cycles before starting Lifetest (Number of cycles are defined based on data-sheet).

Each device is tested using production test equipment to data sheet specifications before being stressed. All readouts are also done on the same production test equipment to data sheet parameters. A device is considered a failure if it does not pass data sheet specifications.

For non-volatile configuration elements, except those on MAX II and MAX V devices, there is a test mode that allows the configuration elements to be margin tested to determine the amount of charge on the floating gate. At each read-out, the margin of every configuration element is tested and the lowest margin is recorded.

## Failure Rate Prediction

Intel uses exponential distribution of failures in time, and predicts constant failure rate at operating conditions. Extrapolation uses thermal and voltage acceleration factors based on JEDEC formulas (JEP122). The formulas are presented below, and the acceleration factors are listed in Table IV.

Junction temperatures, not ambient temperatures, must be used in calculating thermal acceleration factors. A designer can determine device power dissipation using the Early Power Estimator (EPE) available on [www.altera.com](http://www.altera.com), or using the PowerPlay power analyzer in the Quartus® Prime design tool. Junction temperatures are calculated from ambient temperature or case temperature measurements using the thermal resistance values found in the Altera Device Package Information Data Sheet. Thermal resistance values are specific to each product and package combination. For convenience, formulas to calculate junction temperatures are included with the acceleration formulas below.

At Intel, each expected failure mechanism is assessed separately as this provides a more accurate projection of device failure rate. For each mechanism, we calculate the acceleration using the appropriate model employing the appropriate constants (see table IV). Theoretically, we determine the exponential distribution of time to failure for each mechanism and then we add up the individual failure rates to obtain the device overall failure rate. So, we determine the cumulative distribution function for each mechanism,  $F_i(t)$  and then we can multiply them together  $\prod F_i(t)$  for  $i=1 \dots n$ . Since we assume the distribution of time to failure for each mechanism is exponential, we can simply add the individual failure rates  $\sum \lambda_i$ , which represents the geometric mean. Other semiconductor suppliers simply take an average activation energy (usually  $E_a=0.7$ ) and apply an Arrhenius model to the HTOL results disregarding the individual failure mechanisms.

Note also that temperatures must be converted to Degrees Kelvin when using the Temperature Acceleration formula below. Degrees Kelvin = Degrees Centigrade + 273.

$$\text{Temperature Acceleration Factor} = \exp\left[\frac{E_a}{k(T_{\text{operation}})} - \frac{E_a}{k(T_{\text{stress}})}\right]$$

$$k = \text{Boltzmann's constant} = 8.62 \times 10^{-5} \text{ eV}/^\circ\text{K}$$

$$E_a = \text{Activation energy in eV (see Table III)}$$

$$T = \text{Junction Temperature in Degrees Kelvin}$$

$$kT(\text{eV}) = 0.0258 \times (\text{temperature in Centigrade} + 273)/298$$

$$\text{Gate Oxide Voltage Acceleration Factor} = \exp\left[\left(\frac{\gamma}{(t_{\text{ox}}/10 \text{ nm})}\right)(V_{\text{stress}} - V_{\text{operation}})\right]$$

$$\gamma = \text{Voltage exponent factor (see Table IV)}$$

$$\text{Interlayer Dielectric Acceleration Factor} = \exp[\gamma(V_{\text{stress}} - V_{\text{operation}})]$$

$$\text{Junction Temperature} = (\text{Ambient Temperature}) + (\text{Power dissipation}) * (\theta_{ja})$$

$$= (\text{Case Temperature}) + (\text{Power dissipation}) * (\theta_{jc})$$

$\theta_{ja}$  and  $\theta_{jc}$  are found in the Altera Device Package Information Data Sheet.

Table IV: Common Failure Mechanisms and Acceleration Factors <sup>i</sup>

Mechanism	Activation Energy “Ea” [eV]	Voltage Exponent Factor
Gate Oxide Breakdown ( $\geq 90$ nm)*	0.7	$\gamma = 3.2$
Interlayer defect**	0.7	$\gamma = 2.0$
Via Voiding (0. 15 $\mu\text{m}$ & 0. 13 $\mu\text{m}$ )	0.8	0.0
Via Voiding ( $\leq 90$ nm)	1.0	0.0
Silicon Junction Defect	0.8	0.0
Masking (Poly, Diffusion, etc.) Defect	0.5	0.0
Metallization Defect	0.5	0.0
Al Electromigration	0.7 (Al-Si), 0.85 (Al-Cu)	Current density dependence ( $1/J^2$ )
Cu Electromigration (0. 13 $\mu\text{m}$ , FSG dielectric)	0.8	Current density dependence ( $1/J^2$ )
Cu Electromigration ( $\leq 90$ nm low-k dielectric)	0.9	Current density dependence ( $1/J$ )
Contamination (Surface & Bulk)	1.0	0.0
Data Retention		
Charge Loss (EPROM)	0.6	0.0
Charge Detrapping (FLASH & EEPROM, $\leq 168$ hrs)	1.1	0.0
SILC (FLASH & EEPROM, $> 168$ hrs)	0	2.3

\* $\leq 65$  nm process uses different values with power-law model.

\*\*  $\leq 28\text{nm}$  process uses different values.

Failure rates are calculated on a product family basis (as in the tables of data on the following pages). Device hours accumulated at the stress conditions are converted to normal use conditions using the acceleration factors described above. Equivalent hours are calculated at a typical use condition of  $V_{cc}$  nominal in a  $55^\circ\text{C}$  still-air ambient or  $70^\circ\text{C}$  junction.

Failure rates are expressed in terms of FIT or Failures In Time, where one FIT is equivalent to one failure in one billion or  $10^9$  device-hours. Intel calculates the FIT rate using the JESD85 (Methods for Calculating Failure Rates in Units of FITs) standard.

The failure rate is calculated using a Chi-squared distribution to predict a 60% confidence level from the small number of failures and limited sample size of the population tested. The Chi-squared value is calculated from the inverse Chi-squared distribution using the desired probability level and the degrees of freedom. <sup>ii</sup> The degrees of freedom are calculated as:  $\nu = 2n+2$ , where  $n = \#$  of failures observed. The failure rate is then calculated from the Chi-squared value:

$$\text{Failure Rate} = \frac{X^2}{(2 * A.F. * \text{Device hours})} \frac{\text{failures}}{\text{hour}}$$

$$\text{Device hours} = \Sigma (\text{Hours in lifetest}) \times (\text{Number of devices})$$

$$\text{Acceleration Factor} = (\text{Thermal Acceleration}) \times (\text{Voltage Acceleration})$$

The FIT rate is  $10^9 * \text{Failure Rate}$  and the Mean Time to Failure is simply the inverse of the failure rate for an exponential distribution.

## Lifetest Results

Lifetest results are summarized in table V. More details are presented on following pages.

**Table V: Lifetest Summary**

(For details of new stress results, click on product family name highlighted in blue).

PRODUCT FAMILY	TECHNOLOGY NODE	DEVICE HOURS @ STRESS CONDITIONS	NUMBER OF FAILS	FIT (60%C.L.)
<i>Arria 10</i>	<i>0.020 μm</i>	<i>685,500</i>	<i>0</i>	<i>52.1 (1)</i>
Stratix V	0.028 μm	813,326	0	38.5 (1)
<i>Arria V, Cyclone V</i>	<i>0.028 μm</i>	<i>2,173,058</i>	<i>0</i>	<i>13.5 (1)</i>
<i>Stratix IV, Arria II GX, HardCopy III, HardCopy IV</i>	<i>0.040 μm</i>	<i>1,377,311</i>	<i>2</i>	<i>37.5 (1)</i>
<i>MAX 10</i>	<i>0.055 μm</i>	<i>958,000</i>	<i>0</i>	<i>31.4 (1)</i>
<i>Stratix III, Cyclone III, Cyclone IV</i>	<i>0.065/0.060 μm</i>	<i>2,282,828</i>	<i>0</i>	<i>9.5(1)</i>
<i>Stratix II, Stratix II GX, Cyclone II, Arria GX, HardCopy II</i>	<i>0.090 μm</i>	<i>1,278,728</i>	<i>0</i>	<i>16.8 (1)</i>
Stratix, Stratix GX, Cyclone, HardCopy	0.13 μm	1,629,590	0	4.9 (1)
APEX 20KC, APEX II, Mercury	0.15 μm	150,000	0	3.3 (1)
APEX 20KE, Mercury, Excalibur	0.18 μm	285,575	0	48.4 (2)
FLEX 10KE, FLEX 10KS, ACEX, APEX 20K	0.22 μm	605,000	0	4.6 (2)
<i>FLEX 10KA, FLEX 6000A</i>	<i>0.3/0.35 μm</i>	<i>400,000</i>	<i>0</i>	<i>40.2 (2)</i>
FLEX 8000, FLEX 10K, FLEX 6000	0.42 μm	395,660	0	19.5 (2)
<i>MAX II, MAX V</i>	<i>0.18 μm</i>	<i>2,564,000</i>	<i>0</i>	<i>9.2 (1)</i>
MAX 7000B	0.22 μm	150,000	0	31.2 (1)
MAX 7000A, MAX 3000A	0.3/0.35 μm	1,496,000	0	6.2 (1)
MAX 7000S, MAX 9000	0.5 μm	543,235	0	22.1 (1)
EPC1	0.5 μm	847,000	0	22.9 (2)
EPC2 and EPC4, EPC8, EPC16	0.4 μm and (0.35/0.13 μm)	1,031,000	0	4.3 (2)
EPCS1	0.15 μm	350,000	0	1 (2)
EPCS4, EPCS16, EPCS64	0.11 μm	263,000	0	1 (2)
EPCS128, EPCQ16, EPCQ32, EPCQ64. EPCQ128, EPCQ256, EPCQ512	0.065 μm	343,000	0	4 (2)
EPCQ-L256, EPCQ-L512, EPCQ-L1024	0.065 μm	231,000	0	7.9 (2)
<i>PowerSoC</i>	<i>0.25 μm /0.18 μm</i>	<i>26,187,836</i>	<i>0</i>	<i>1.3 (1)</i>

(1) FITs calculated at 70°C junction operating temperature

(2) FITs calculated at 55°C ambient operating temperature

## FLEX 0.42 $\mu$ Products

FLEX 8000, FLEX 10K and FLEX 6000 products are fabricated on a 0.42 $\mu$  feature size on the same process technology. Lifetests are conducted at 6.0V, which is a 20% overvoltage.

## FLEX 0.42 $\mu$ Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Pkg. Fail. EQUIV. HRS.	Date Code
13070017	EPF10K70	240RQFP	125	45	1000	0	45000	5.35E+06	1319
9020001	EPF10K10	208 PQFP	125	44	1015	0	44660	6.13E+06	0901
10030001	EPF10K50	240 RQFP	125	25	1000	0	25000	2.99E+06	1008
10040004	EPF10K70	240 RQFP	125	24	1000	0	24000	2.86E+06	1013
10110029	EPF10K70	240 RQFP	125	45	1000	0	45000	5.35E+06	1048
11040014	EPF10K70	240 RQFP	125	45	1000	0	45000	5.35E+06	1107
11030014	EPF6016	208 PQFP	125	45	1000	0	45000	5.45E+06	1101
9070001	EPF8282A	84 PLCC	125	77	1000	0	77000	8.69E+06	0919
12090021	EPF6016	208 PQFP	125	45	1000	0	45000	4.88E+06	1225
Total:				395			395660	4.71E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs</b>	<b>FITs</b>	
Package Failure(Ea=1.0,C=0)				0	1.83		4.71E+07	19.5	
<b>Note: Typical application Ta=55°C.</b>									

## FLEX 0.3/0.35 $\mu$ Products

FLEX 10KA and FLEX 6000A products are fabricated on a 0.3/0.35 $\mu$  process technology. Devices are available in TQFP, PQFP, RQFP, FBGA and BGA packages. The process technology operates with a 3.3V supply voltage and has I/Os that are 2.5V and 5.0V tolerant. Lifetests are conducted at 4.0V, which is a 20% overvoltage.

## FLEX 0.3/0.35 $\mu$ Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVE HOURS	Interlayer EQUIV. HRS.	Date Code
<b>16060056</b>	<b>EPF6016A</b>	<b>144 TQFP</b>	<b>125</b>	<b>45</b>	<b>1000</b>	<b>0</b>	<b>45000</b>	<b>2.73E+06</b>	<b>1613</b>
14040011	EPF10K50A	356 SBGA	125	25	1000	0	25000	1.48E+06	1407
13030014	EPF10K50A	356 SBGA	125	25	1000	0	25000	1.52E+06	1243
10080023	EPF10K30A	144 TQFP	125	45	1000	0	45000	1.75E+06	1019
9050005	EPF10K50V	356 BGA	125	25	1000	0	25000	1.52E+06	0913
12030020	EPF10K50A	356 BGA	125	25	1000	0	25000	1.47E+06	1201
10020042	EPF10K100A	240 RQFP	125	25	1000	0	25000	1.44E+06	1001
10040033	EPF10K100A	240 RQFP	125	45	2000	0	90000	5.30E+06	1016
11070013	EPF10K100A	484 FBGA	125	25	1000	0	25000	9.99E+05	0937
9080008	EPF6016A	144 TQFP	125	45	1000	0	45000	3.11E+06	0932
12030020	EPF10K50A	356 BGA	125	25	1000	0	25000	1.47E+06	1201
			Total:	355		Total:	400000	2.28E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Interlayer Defect				0	1.83		2.28E+07	40.2	
<b>Note: Typical application Ta=55°C.</b>									

## FLEX, ACEX, and APEX 0.22 $\mu$ Products

FLEX 10KE, FLEX 10KS, ACEX, and APEX 20K products are fabricated on a 0.22 $\mu$  process technology. Devices are available in TQFP, PQFP, RQFP, FBGA and BGA packages. The process technology operates with a 2.5V supply. Lifetests are conducted at 3.0V, which is a 20% overvoltage.

## FLEX, ACEX, and APEX 0.22 $\mu$ Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Interlayer EQUIV. HRS.	Date Code
14100041	EP20K100E	356 BGA	125	25	1000	0	25000	1.24E+07	1343
14040048	EPF10K100E	208 PQFP	125	45	1000	0	45000	8.75E+06	1231
13040043	EPF10K100E	208 PQFP	125	45	1000	0	45000	9.52E+06	1307
10050025	EP1K50	256 FBGA	125	25	1000	0	25000	1.01E+07	1013
10090006	EP1K50	256 FBGA	125	45	2000	0	90000	3.65E+07	1031
11100016	EP20K100	208 PQFP	125	45	1000	0	45000	1.31E+07	1119
9100008	EP20K100	356 BGA	125	25	1000	0	25000	1.24E+07	0931
12050013	EP20K100	356 BGA	125	25	1000	0	25000	1.20E+07	1213
9040003	EPF10K100E	208 PQFP	125	45	1000	0	45000	9.08E+06	0913
10020025	EPF10K100E	356 BGA	125	25	1000	0	25000	1.02E+07	1001
11110023	EPF10K100E	356 BGA	125	25	1000	0	25000	1.02E+07	1131
12030028	EPF10K100E	208 PQFP	125	45	1000	0	45000	9.01E+06	1143
10050019	EPF10K50S	256 FBGA	125	45	2000	0	90000	3.65E+07	1018
10120008	EPF10K200S	672 FBGA	125	25	2000	0	50000	1.01E+07	1050
Total:				490			605000	2.00E+08	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Silicon Defect (Ea=0.9)				0	1.83		2.00E+08	4.6	
<b>Note: Typical application Ta=55°C.</b>									



## APEX, Excalibur, and Mercury 0.18 $\mu$ Products

APEX 20KE, Excalibur, and Mercury products are fabricated on a 0.18 $\mu$  process technology. Devices are available in TQFP, PQFP, RQFP, FBGA, BGA & PGA packages. The process technology operates with a 1.8V supply. Lifetests are conducted at 2.3V, which is over 25% overvoltage.

### APEX, Excalibur, and Mercury 0.18 $\mu$ Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Interlayer EQUIV. HRS.	Date Code
10020023	EP20K100E	208 PQFP	125	46	1000	0	46000	3.31E+06	1001
12020014	EP20K100E	240 PQFP	125	45	1000	0	45000	2.04E+06	1125
9030002	EP20K160E	240 PQFP	125	45	1000	0	45000	2.20E+06	0907
11080018	EP20K160E	356 BGA	125	25	1000	0	25000	1.94E+06	1101
10040002	EP20K200E	208 PQFP	125	45	1000	0	45000	2.08E+06	1007
9090020	EP20K300E	672 FBGA	125	25	1000	0	25000	2.90E+06	0925
11040003	EP20K300E	672 FBGA	125	28	1000	0	28000	3.25E+06	1115
9060011	EP20K400E	672 FBGA	125	25	1063	0	26575	1.19E+06	0919
Total:				284			285575	1.89E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs</b>	<b>FITs</b>	
Interlayer Defect				0	1.83		1.89E+07	48.4	
<b>Note: Typical application Ta=55°C.</b>									

## APEX and Mercury 0.15 $\mu$ Products

APEX 20KC, APEX II and Mercury products are fabricated on a 0.15 $\mu$  process technology. Devices are available in FBGA, QFP, BGA, and Flip Chip FBGA packages. The APEX 20KC product family operates with a 1.8V supply and the lifestest is conducted at 2.3V, which is a 25% overvoltage. The APEX II product family operates at 1.5V and the lifestest is conducted at 1.8V, which is a 20% overvoltage.

## APEX and Mercury 0.15 $\mu$ Lifestest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Date Code
14070004	EP20K400C	672 FBGA	125	25	1000	0	25000	4.42E+07	1419
13050018	EP20K400C	672 FBGA	125	25	1000	0	25000	5.13E+07	1313
9020002	EP20K400C	672 FBGA	125	25	1000	0	25000	5.13E+07	0901
10090008	EP20K400C	672 FBGA	125	25	1000	0	25000	5.13E+07	1031
11050015	EP20K400C	672 FBGA	125	25	1000	0	25000	5.13E+07	1121
12070008	EP20K400C	672 FBGA	125	25	1000	0	25000	3.23E+07	1201
			Total:	150			150000	2.82E+08	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Dielectric Breakdown				0	1.83		2.82E+08	3.3	
<b>Note: Typical application Tj=70°C.</b>									

## Stratix, Stratix GX, Cyclone and HardCopy 0.13 $\mu$ Products

Stratix, Stratix GX, Cyclone and HardCopy products are fabricated on a 0.13 $\mu$  process technology. Devices are available in FBGA, QFP, BGA, and Flip Chip FBGA packages. The Stratix, Stratix GX, Cyclone and HardCopy product families operate with a 1.5V supply. The lifestest is conducted at 1.8V, which is a 20% overvoltage. A lifestest temperature of 100°C is used on some devices to keep junction temperature below absolute maximum ratings.

## Stratix, Stratix GX, Cyclone and HardCopy 0.13 $\mu$ Lifestest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Via voiding Fail. EQUIV. HRS.	Date Code
15040038	EP1S80	1508 FBGA	125	25	1000	0	25000	3.46E+06	1513
15080073	EP1C6	144 TQFP	125	30	1000	0	30000	2.65E+06	1531
14100023	EP1S40	1020 FBGA	125	25	1000	0	25000	3.62E+06	1413
14120014	EP1C4	324 FBGA	125	30	1000	0	30000	2.92E+06	1443
14120017	EP1C6	144 TQFP	125	30	1000	0	30000	3.12E+06	1443
13070004	EP1C4	324 FBGA	125	30	1000	0	30000	2.92E+06	1319
13030016	EP1S40	1020 FBGA	125	25	1000	0	25000	3.62E+06	1307
13040063	EP1S30	780 FBGA	125	25	1000	0	25000	3.62E+06	1317
11060013	EP1C3	144 TQFP	125	77	1000	0	77000	8.15E+06	0937
12040013	EP1C4	324 FBGA	125	78	1000	0	78000	7.60E+06	1204
9050010	EP1C6	144 TQFP	125	24	1000	0	24000	2.50E+06	0918
9060034	EP1C6	144 TQFP	125	77	1000	0	77000	8.01E+06	0925
10030015	EP1C6	144 TQFP	125	77	1000	0	77000	7.54E+06	1012
10030016	EP1C6	144 TQFP	125	77	1000	0	77000	7.54E+06	1012
10040015	EP1C6	144 TQFP	125	74	1000	0	74000	7.05E+06	1007
12110047	EP1C6	144 TQFP	125	77	1000	0	77000	6.26E+06	1219
9060004	EP1C12	324 FBGA	125	75	1000	0	75000	7.50E+06	0919
8030020	EP1S25	672 FBGA	125	25	1000	0	25000	3.21E+06	0807
8100015	EP1S25	672 FBGA	100	25	1001	0	25025	6.70E+05	0841
9100030	EP1S25	672 FBGA	100	25	1000	0	25000	6.69E+05	0942
10100017	EP1C12	324 FBGA	125	77	1000	0	77000	1.07E+07	1037
11110022	EP1C20	324 FBGA	125	77	1000	0	77000	1.04E+07	1119
9030008	EP1S40	1020 FBGA	125	29	1058	0	30682	4.44E+06	0911
9030007	EP1S40	1508 FBGA	125	29	2027	0	58783	8.14E+06	0913
12010023	EP1S40	1508 FBGA	125	25	1000	0	25000	3.46E+06	1149
10030002	EP1S60	1020 FBGA	125	25	1000	0	25000	4.14E+06	1001
10070028	EP1S80	1020 FBGA	125	25	1000	0	25000	4.60E+06	1028
			Total:	1572			1629590	1.86E+08	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Via voiding Failure(Ea=0.8)				0	1.83		1.86E+08	4.9	
<b>Note: Typical application Tj=70°C.</b>									

## Stratix II, Stratix II GX, Cyclone II, Arria GX and HardCopy II – 90 nm Products

Stratix II, Stratix II GX, Cyclone II, Arria GX and HardCopy II products are fabricated on a 90 nm process technology. Stratix II and GX devices are available in Flip Chip FBGA packages. Cyclone II devices are available in QFP, FBGA and UBGA packages. The Stratix II, Stratix II GX, Cyclone II, Arria GX and HardCopy II product families operate with a 1.2V supply and the lifestest is conducted at 1.44V, which is a 20% overvoltage. Lifestest is run at junction temperature of 125°C to keep it below absolute maximum ratings.

## Stratix II, Stratix II GX, Cyclone II, Arria GX and HardCopy II – 90 nm Lifestest Results

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Interlayer EQUIV. HRS.	Date Code
<b>16060012</b>	<b>EP2S30</b>	<b>484 FBGA</b>	<b>125</b>	<b>25</b>	<b>1000</b>	<b>0</b>	<b>25000</b>	<b>1.06E+06</b>	<b>1619</b>
16050034	EP2C70	672 FBGA	125	30	1000	0	30000	1.28E+06	1613
15060034	EP2C70	672 FBGA	125	30	1000	0	30000	1.28E+06	1519
15010015	EP2C5	256 FBGA	125	30	1000	0	30000	1.28E+06	1437
14030025	EP2S30	672 FBGA	125	25	1000	0	25000	1.06E+06	1407
13080023	EP2C5	256 FBGA	125	30	1000	0	30000	1.28E+06	1331
13010061	EP2C70	672 FBGA	125	30	1000	0	30000	1.28E+06	1243
13040041	EP2S90	1508 FBGA	125	25	1000	0	25000	1.06E+06	1313
13060020	EP2S90	1020 FBGA	125	25	1000	0	25000	1.06E+06	1319
10020010	EP2C8	256 FBGA	125	77	1000	0	77000	3.28E+06	1001
11030026	EP2C20	256 FBGA	125	77	1000	0	77000	3.28E+06	1049
12110006	EP2C20	256 FBGA	125	77	2000	0	154000	6.56E+06	1243
9040021	EP2C35	672 FBGA	125	77	1006	0	77462	3.30E+06	0913
9100029	EP2C70	672 FBGA	125	25	1037	0	25925	1.10E+06	0942
10090028	EP2C70	672 FBGA	125	76	1049	0	79724	3.40E+06	1025
12030025	EP2C70	672 FBGA	125	77	2000	0	154000	6.56E+06	1207
12090011	EP2C70	672 FBGA	125	77	1000	0	77000	3.28E+06	1219
10100001	EP2S30	672 FBGA	125	24	1046	0	25104	1.07E+06	1039
9020005	EP2S90	1020 FBGA	125	25	2000	0	50000	2.13E+06	0901
9100003	EP2S90	1020 FBGA	125	25	1086	0	27150	1.16E+06	0937
10040020	EP2S90	1020 FBGA	125	28	1014	0	28392	1.21E+06	1013
11060011	EP2S90	1020 FBGA	125	25	1000	0	25000	1.06E+06	1125
12040010	EP2S90	1508 FBGA	125	25	1000	0	25000	1.06E+06	1207
120900020	EP2S90	1508 FBGA	125	25	1000	0	25000	1.06E+06	1213
9010010	EP2S130	1020 FBGA	125	25	1001	0	25025	1.07E+06	0901
9040029	EP2S130	1508 FBGA	125	24	1004	0	24096	1.03E+06	0913
11120011	EP2S130	1508 FBGA	125	25	1000	0	25000	1.06E+06	1119
9090024	EP2SGX90	1152 FBGA	125	25	1074	0	26850	1.14E+06	0931
			<b>Total:</b>	<b>1089</b>			<b>1278728</b>	<b>5.45E+07</b>	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Interlayer Breakdown (Ea=0.7)				<b>0</b>	<b>1.83</b>		<b>5.45E+07</b>	<b>16.8</b>	
<b>Note: Typical application Tj=70°C.</b>									

## Stratix III, Cyclone III and Cyclone IV – 65/60 nm Products

Stratix III, Cyclone III and Cyclone IV products are fabricated on a 65/60 nm process technology. Stratix III devices are available in Flip Chip FBGA packages. Cyclone III and Cyclone IV devices are available in QFP, QFN, FBGA and UBGA packages. The Stratix III product families operate with a 1.1V supply. Lifetest is conducted at 1.32V, which is a 20% overvoltage. The Cyclone III and Cyclone IV product families operate with a 1.2V supply. Lifetest is conducted at 1.44V, which is a 20% overvoltage.

### Stratix III, Cyclone III and Cyclone IV – 65/60 nm Lifetest

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Interlayer EQUIV. HRS.	Date Code
<b>16060019</b>	<b>EP3SL200</b>	<b>1152 FBGA</b>	<b>125</b>	<b>25</b>	<b>1000</b>	<b>0</b>	<b>25000</b>	<b>1.06E+06</b>	<b>1619</b>
<b>16090017</b>	<b>EP3SL150</b>	<b>1152 FBGA</b>	<b>125</b>	<b>25</b>	<b>1000</b>	<b>0</b>	<b>25000</b>	<b>1.06E+06</b>	<b>1637</b>
15110021	EP3C25*	144 EQFP	125	30	1000	0	30000	1.28E+06	1543
16030041	EP3C120*	780 FBGA	125	30	1000	0	30000	1.28E+06	1601
16060007	EP3C120*	780 FBGA	125	30	1000	0	30000	1.28E+06	1619
15060002	EP3SL150	1152 FBGA	125	25	1000	0	25000	1.02E+06	1513
15040034	EP3SL200	1152 FBGA	125	25	1000	0	25000	1.02E+06	1513
15080072	EP3C120*	780 FBGA	125	30	1000	0	30000	1.23E+06	1519
14070005	EP3SL150	1152 FBGA	125	30	1000	0	30000	1.23E+06	1419
14050015	EP3C120*	780 FBGA	125	30	1000	0	30000	1.28E+06	1413
14030031	EP3C120*	780 FBGA	125	30	1000	0	30000	1.28E+06	1407
14020057	EP3SL200	1152 FBGA	125	25	1000	0	25000	1.02E+06	1325
13040011	EP3C120*	780 FBGA	125	30	1000	0	30000	1.28E+06	1307
13010060	EP3SL200	1152 FBGA	125	25	1000	0	25000	1.02E+06	1237
10010012	EP3C5*	144 EQFP	125	30	1033	0	30990	1.32E+06	1001
10040029	EP3C5*	144 EQFP	125	78	1066	0	83148	3.54E+06	1016
10050001	EP3C16*	144 EQFP	125	80	1010	0	80800	3.44E+06	1018
9090042	EP3C25*	144 EQFP	125	77	1019	0	78463	3.34E+06	0931
10020005	EP3C25*	144 EQFP	125	79	1004	0	79316	3.38E+06	1005
9050016	EP3C25*	256 FBGA	125	77	1000	0	77000	3.28E+06	0913
9010016	EP3C120*	780 FBGA	125	25	1061	0	26525	1.13E+06	0903
9090022	EP3C120*	780 FBGA	125	43	1001	0	43043	1.83E+06	0937
9090023	EP3C120*	780 FBGA	125	44	1001	0	44044	1.88E+06	0937
10030008	EP3C120*	780 FBGA	125	36	2000	0	72000	3.07E+06	1009
10030013	EP3C120*	780 FBGA	125	41	2012	0	82492	3.51E+06	1010
10100014	EP3C120*	780 FBGA	125	43	2014	0	86602	3.69E+06	1040
11040013	EP3C120*	780 FBGA	125	30	1002	0	30060	1.28E+06	1117
12060015	EP3C120*	780 FBGA	125	77	1070	0	82390	3.51E+06	1222
9070009	EP3CLS200*	780 FBGA	125	35	3004	0	105140	4.48E+06	0916
9070010	EP3CLS200*	780 FBGA	125	35	3004	0	105140	4.48E+06	0925
11070014	EP3SL50	780 FBGA	125	25	1000	0	25000	1.02E+06	1112
9040010	EP3SL110	1152 FBGA	125	25	1000	0	25000	1.02E+06	0912
10100010	EP3SL150	1152 FBGA	125	25	1000	0	25000	1.02E+06	1041
11100002	EP3SL150	1152 FBGA	125	25	1000	0	25000	1.02E+06	1119
12070022	EP3SL150	1152 FBGA	125	25	1000	0	25000	1.02E+06	1152
9040015	EP3SL200	1152 FBGA	125	25	1001	0	25025	1.02E+06	0907
10080012	EP3SL200	1152 FBGA	125	25	1066	0	26650	1.09E+06	1019
11080004	EP3SL200	1152 FBGA	125	25	1000	0	25000	1.02E+06	1049
12010021	EP3SL200	1152 FBGA	125	25	1000	0	25000	1.02E+06	1146
10020043	EP4CGX15*	148 QFN	125	48	2000	0	96000	4.09E+06	1007
10080028	EP4CGX15*	148 QFN	125	77	1000	0	77000	3.28E+06	1025
11030010	EP4CGX15*	148 QFN	125	78	1000	0	78000	3.32E+06	1101
11100015	EP4CGX15*	148 QFN	125	77	2000	0	154000	6.56E+06	1131
12080036	EP4CGX15*	148 QFN	125	77	2000	0	154000	6.56E+06	1131
* 60 nm Feature Size			Total:	1802			2282628	9.66E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Interlayer Breakdown (Ea=0.7)				0	1.83		9.66E+07	9.5	
<b>Note: Typical application Tj=70°C.</b>									

## MAX 10 – 55nm Products

MAX 10 FPGA products are built on TSMC 55-nm embedded flash process technology. MAX 10 units are available in copper wire bonded FBGA, UBGA and MBGA, EQFP, and Wafer Level CSP packages. The MAX 10 product family can operate from a dual power supply (1.2V and 2.5V) or a single power supply (3.3V or 3.0V). Life-test is conducted at 1.44V for dual power supply parts only, which is 20% overvoltage.

## MAX 10 – 55nm Lifetest

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Via voiding Fail. EQUIV. HRS.	Interlayer EQUIV. HRS.
16120038	10M50	484 FBGA	125	80	1000	0	80000	1.26E+09	8.57E+06	3.41E+06
16120044	10M50	484 FBGA	125	80	1000	0	80000	1.26E+09	8.57E+06	3.41E+06
16120045	10M50	484 FBGA	125	80	1000	0	80000	1.26E+09	8.57E+06	3.41E+06
16120046	10M50	484 FBGA	125	120	1000	0	120000	1.89E+09	1.29E+07	5.11E+06
16030023	10M50	484 FBGA	125	30	1500	0	45000	7.10E+08	4.82E+06	1.92E+06
14080013	10M08	484 FBGA	125	28	1000	0	28000	4.42E+08	3.00E+06	1.19E+06
14090001	10M08	484 FBGA	125	23	1000	0	23000	3.63E+08	2.46E+06	9.80E+05
14090014	10M08	484 FBGA	125	28	1000	0	28000	4.42E+08	3.00E+06	1.19E+06
14090022	10M08	484 FBGA	125	78	1000	0	78000	1.23E+09	8.35E+06	3.32E+06
15030018	10M08	484 FBGA	125	78	1000	0	78000	1.23E+09	8.35E+06	3.32E+06
15010001	10M50	484 FBGA	125	32	1000	0	32000	5.05E+08	3.43E+06	1.36E+06
15010021	10M50	484 FBGA	125	24	1000	0	24000	3.78E+08	2.57E+06	1.02E+06
15020011	10M50	484 FBGA	125	24	1000	0	24000	3.78E+08	2.57E+06	1.02E+06
15060046	10M50	484 FBGA	125	79	2000	0	158000	2.49E+09	1.69E+07	6.73E+06
15060062	10M50	484 FBGA	125	80	1000	0	80000	1.26E+09	8.57E+06	3.41E+06
Total:				864			958000	1.51E+10	1.03E+08	4.08E+07
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>		
Gate Oxide dielectric breakdown (Ea=0.59)				0	1.83		1.51E+10	0.1		
Via voiding Failure(Ea=1.0)				0	1.83		1.03E+08	8.9		
Interlayer Breakdown (Ea=0.7)				0	1.83		4.08E+07	22.5		
<b>Combined Failure Rate</b>								<b>31.4</b>		

Note: Typical application Tj=70°C.

## Stratix IV, Arria II GX & GZ and HardCopy III & IV – 40 nm Products

Stratix IV, Arria II GX and HardCopy III & IV products are fabricated on a 40 nm process technology. Stratix IV and Arria II GX devices are available in Flip Chip FBGA packages. The Stratix IV, Arria II GX and HardCopy III & IV product families operate with a 0.9 V supply. Stratix IV lifetest is conducted at 1.1 x Vcc while Arria II and HardCopy III & IV lifetest is conducted at 1.2 x Vcc.

## Stratix IV, Arria II GX and HardCopy III & IV – 40 nm Life-test Results

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Via voiding Fail. EQUIV. HRS.	Interlayer EQUIV. HRS.	Date Code
<b>16080031</b>	<b>EP4SGX230</b>	<b>1517 FBGA</b>	<b>125</b>	<b>30</b>	<b>2000</b>	<b>0</b>	<b>25000</b>	<b>2.98E+06</b>	<b>2.68E+06</b>	<b>8.05E+05</b>	<b>1517</b>
15080071	EP4SGX230	1517 FBGA	125	25	1000	0	25000	2.98E+06	2.68E+06	8.05E+05	1531
14100027	EP4SGX230	1517 FBGA	125	25	1000	0	25000	2.98E+06	2.68E+06	8.05E+05	1437
14100026	EP4SGX230	1517 FBGA	125	25	1000	0	25000	2.98E+06	2.68E+06	8.05E+05	1437
15030037	EP4SGX230	1517 FBGA	125	25	1000	0	25000	2.98E+06	2.68E+06	8.05E+05	1413
14050023	EP2AGX260	780 FBGA	125	30	1000	0	30000	2.23E+07	3.21E+06	1.18E+06	1421
13120041	EP4SGX230	1517 FBGA	125	30	2000	0	60000	7.15E+06	6.43E+06	1.93E+06	1349
13120013	EP4SGX230	1517 FBGA	125	30	2000	0	60000	7.15E+06	6.43E+06	1.93E+06	1349
13120007	EP4SGX230	1517 FBGA	125	30	2000	0	60000	7.15E+06	6.43E+06	1.93E+06	1349
13040001	EP4SGX230	1517 FBGA	125	25	1000	0	25000	2.98E+06	2.68E+06	8.05E+05	1301
13040007	EP2AGX260	780 FBGA	125	25	1000	0	25000	1.86E+07	2.68E+06	9.83E+05	1301
9090041	EP4SGX230	1517 FBGA	125	27	2000	0	54000	6.43E+06	5.78E+06	1.74E+06	0938
9100001	EP4SGX230	1517 FBGA	125	30	1000	0	30000	3.57E+06	3.21E+06	9.66E+05	0939
9100005	EP4SGX230	1517 FBGA	125	30	2000	0	60000	7.15E+06	6.43E+06	1.93E+06	0940
10080001	EP4SGX230	1517 FBGA	125	11	1069	0	11759	1.40E+06	1.26E+06	3.79E+05	0950
11120033	EP4SGX230	1517 FBGA	125	25	1021	0	25525	3.04E+06	2.73E+06	8.22E+05	1137
12080033	EP4SGX230	1517 FBGA	125	25	1005	0	25125	2.99E+06	2.69E+06	8.09E+05	1208
9120003	EP4SGX290	1517 FBGA	125	27	2000	0	54000	6.43E+06	5.78E+06	1.74E+06	0946
10010020	EP4SGX530	1517 FBGA	125	29	2000	1	a 58000	6.91E+06	6.21E+06	1.87E+06	0952
10030004	EP4SGX530	1517 FBGA	125	46	2000	0	92000	1.10E+07	9.85E+06	2.96E+06	1008
10030036	EP4SGX530	1517 FBGA	125	36	2000	1	b 72000	8.58E+06	7.71E+06	2.32E+06	1012
10100018	EP4SGX530	1517 HBGA	125	31	1019	0	31589	3.76E+06	3.38E+06	1.02E+06	1026
10110013	EP4SGX530	1517 HBGA	125	28	2021	0	56588	6.74E+06	6.06E+06	1.82E+06	1026
12050041	EP4SGX530	1517 HBGA	125	24	1000	0	24000	2.86E+06	2.57E+06	7.73E+05	1205
10080027	EP2AGX65	358 UBGA	125	61	1000	0	61000	4.53E+07	6.53E+06	2.40E+06	1034
10090017	EP2AGX65	358 UBGA	125	60	1000	0	60000	4.46E+07	6.43E+06	2.36E+06	1037
10090018	EP2AGX65	358 UBGA	125	51	1000	0	51000	3.79E+07	5.46E+06	2.01E+06	1037
10090019	EP2AGX65	358 UBGA	125	65	168	0	10920	8.11E+06	1.17E+06	4.29E+05	1037
10100012	EP2AGX95	780 FBGA	125	12	1015	0	12180	9.05E+06	1.30E+06	4.79E+05	1040
10110012	EP2AGX125	780 FBGA	125	25	1048	0	26200	1.95E+07	2.81E+06	1.03E+06	1040
9120004	EP2AGX125	780 FBGA	125	27	1000	0	27000	2.01E+07	2.89E+06	1.06E+06	0940
12120014	EP2AGX125	780 FBGA	125	25	1026	0	25650	1.91E+07	2.75E+06	1.01E+06	1237
10020045	EP2AGX260	780 FBGA	125	22	2000	0	44000	3.27E+07	4.71E+06	1.73E+06	1008
12050040	EP2AGX260	780 FBGA	125	25	1015	0	25375	1.88E+07	2.72E+06	9.98E+05	1205
11120001	EP2AGX260	780 FBGA	125	25	1016	0	25400	1.89E+07	2.72E+06	9.99E+05	1131
10060022	HC335	1152 FBGA	125	29	1000	0	29000	2.15E+07	3.11E+06	1.14E+06	1020
<b>Total:</b>				<b>1096</b>			<b>1377311</b>	<b>4.46E+08</b>	<b>1.48E+08</b>	<b>4.76E+07</b>	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>			
Via voiding Failure(Ea=1.0)				1	4.04		1.48E+08	13.7			
Dielectric Breakdown*(1)				1	4.04		4.46E+08	4.5			
Interlayer Breakdown (Ea=0.7)				0	1.83		4.76E+07	19.3			
<b>Combined Failure Rate</b>								<b>37.5</b>			
a- IPATPG reject at 2000 hours due to a faulty scan chain caused by a random defect. Suspect Via 1 failure.											
b- CRAM min/max reject that is intermittent oxide failure at 500 hrs. Damaged during FA.											
<b>Note: Typical application Tj=70°C.</b>											

## Arria V and Cyclone V – 28nm Low Power Products

Arria V and Cyclone V products are fabricated on a TSMC 28 nm LP process technology.

Arria V devices are available in Flip Chip FBGA packages. Cyclone V devices are available in Wire-bonded FBGA packages.

- Arria V product families operate with a 0.85V, 1.10V or 1.15V core supply voltage and lifetest is conducted at 1.15 x Vcc.
- Cyclone V product families operate with a 1.10V supply and lifetest is conducted at 1.2 x Vcc.

## Arria V and Cyclone V – 28nm Low Power Life-test results

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Via voiding Fail. EQUIV. HRS.	Interlayer EQUIV. HRS.	Date Code
<b>16090004</b>	<b>5CGXC7</b>	<b>896 FBGA</b>	<b>125</b>	<b>30</b>	<b>2000</b>	<b>0</b>	<b>60000</b>	<b>4.66E+08</b>	<b>6.43E+06</b>	<b>2.44E+06</b>	<b>1543</b>
15060024	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3.14E+06	1519
15120010	5AGTD7	1152 FBGA	125	24	1000	0	24000	1.86E+08	2.57E+06	9.78E+05	1549
16010015	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3.14E+06	1607
16010017	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3.14E+06	1607
16030010	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3.14E+06	1613
15050001	5CGXC9	1152 FBGA	125	20	1000	0	50000	3.14E+09	5.36E+06	2037005.2	1443
15060041	5AGTD7	1152 FBGA	125	25	1032	0	25800	2.00E+08	2.76E+06	1051094.7	1524
15060063	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3136988.1	1519
15060064	5CGXC5	301 MBGA	125	77	1000	0	77000	4.83E+09	8.25E+06	3136988.1	1519
14090018	5AGTD7	1152 FBGA	125	24	2108	0	50592	3.93E+08	5.42E+06	2.06E+06	1410
14050005	5CGXC4	301 MBGA	125	30	2000	0	60000	3.76E+09	6.43E+06	2.44E+06	1418
14110024	5AGTD7	1152 FBGA	125	25	1000	0	25000	1.94E+08	2.68E+06	1.02E+06	1447
15030019	5CGXC7	896 FBGA	125	30	2000	0	60000	3.76E+09	6.43E+06	2.44E+06	1437
15030020	5CSTD6	896 FBGA	125	25	2000	0	50000	3.14E+09	5.36E+06	2.04E+06	1501
14040009	5CGXC5	301 MBGA	125	30	1000	0	30000	1.88E+09	3.21E+06	1.22E+06	1415
14080015	5AGTD7	1152 FBGA	125	30	2000	0	60000	4.66E+08	6.43E+06	2.44E+06	1418
14050034	5CGXC9	1152 FBGA	125	16	1000	0	16000	1.00E+09	1.71E+06	6.52E+05	1418
14050005	5CGXC4	301 MBGA	125	30	2000	0	60000	3.76E+09	6.43E+06	2.44E+06	1418
13100001	5AGTD7	1152 FBGA	125	25	2005	0	50125	3.89E+08	5.37E+06	2.04E+06	1339
13100007	5AGTD7	1152 FBGA	125	25	2048	0	51200	3.97E+08	5.48E+06	2.09E+06	1340
13030049	5CSTD6	896 FBGA	125	33	1025	0	33825	2.12E+09	3.62E+06	1.38E+06	1313
13030050	5CSTD6	896 FBGA	125	33	1000	0	33000	2.07E+09	3.53E+06	1.34E+06	1313
13050009	5CSTD6	896 FBGA	125	33	1000	0	33000	2.07E+09	3.53E+06	1.34E+06	1313
13030031	5CGXC7	896 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	1.63E+06	1312
13090027	5CGXC9	1152 FBGA	125	29	1500	0	43500	2.73E+09	4.66E+06	1.77E+06	1336
13090029	5AGTD7	1152 FBGA	125	24	1237	0	29688	2.30E+08	3.18E+06	1.21E+06	1320
12010024	5AGXB3	1152 FBGA	125	27	2048	0	55296	4.29E+08	5.92E+06	2.25E+06	1150
12020032	5AGXB3	1152 FBGA	125	24	2003	0	48072	3.73E+08	5.15E+06	1.96E+06	1201
12070007	5AGXB3	1152 FBGA	125	24	1000	0	24000	1.86E+08	2.57E+06	9.78E+05	1222
12070018	5AGXD7	1152 FBGA	125	24	1000	0	24000	1.86E+08	2.57E+06	9.78E+05	1226
12070019	5AGTD7	1152 FBGA	125	24	2040	0	48960	3.80E+08	5.24E+06	1.99E+06	1229
12080042	5AGTD3	1152 FBGA	125	24	1000	0	24000	1.86E+08	2.57E+06	9.78E+05	1228
12080041	5AGTD3	1152 FBGA	125	24	2049	0	49176	3.82E+08	5.27E+06	2.00E+06	1235
12100021	5AGTD3	1152 FBGA	125	24	2032	0	48768	3.79E+08	5.22E+06	1.99E+06	1240
12100022	5AGTD3	1152 FBGA	125	24	2044	0	49056	3.81E+08	5.25E+06	2.00E+06	1240
12040021	5CGXC7	896 FBGA	125	32	1000	0	32000	2.01E+09	3.43E+06	1.84E+06	1212
12040031	5CGXC7	896 FBGA	125	22	1000	0	22000	1.38E+09	2.36E+06	1.27E+06	1214
12060017	5CGXC7	896 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1206
12060035	5CGXC7	896 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1225
12100003	5CGXC9	1152 FBGA	125	32	1000	0	32000	2.01E+09	3.43E+06	1.84E+06	1225
12100007	5CGXC9	1152 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1225
12100030	5CGXC9	1152 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1225
12100032	5CGXC9	1152 FBGA	125	32	1000	0	32000	2.01E+09	3.43E+06	1.84E+06	1205
12110015	5CGXC7	896 FBGA	125	48	1000	0	48000	3.01E+09	5.14E+06	2.77E+06	1206
12110040	5CGXC9	1152 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1225
12110042	5CGXC7	896 FBGA	125	48	1000	0	48000	3.01E+09	5.14E+06	2.77E+06	1206
13030031	5CGXC7	896 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	2.31E+06	1312
			<b>Total:</b>	1716			2173058	9.52E+10	2.33E+08	9.62E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>			
Via voiding Failure(Ea=1.0)				0	1.83		2.33E+08	3.9			
Dielectric Breakdown(Ea=0.53)				0	1.83		9.52E+10	0.0			
Interlayer Breakdown (Ea=0.56)				0	1.83		9.62E+07	9.5			
<b>Combined Failure Rate</b>								<b>13.5</b>			
<b>Note: Typical application Tj=70°C.</b>											



## Stratix V – 28nm High Performance Products

Stratix V products are fabricated on a TSMC 28 nm HP process technology. Stratix V devices are available in Flip Chip FBGA packages. Stratix V product families operate with a 0.85 V or 0.9V (depending on speed grade) supply voltage and lifestest is conducted at 1.1 and 1.2 x Vcc.

## Stratix V – 28nm High Performance Lifestest

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Via voiding Fail. EQUIV. HRS.	Interlayer EQUIV. HRS.	Date Code
15060029	5SGXA7	1517 FBGA	125	25	1000	0	25000	2.04E+07	2.68E+06	7.14E+05	1524
15070020	5SGXA7	1517 FBGA	125	18	1034	0	18612	1.52E+07	1.99E+06	5.32E+05	1528
14080019	5SGXA7	1517 FBGA	125	25	1000	0	25000	2.04E+07	2.68E+06	7.14E+05	1435
15030027	5SGSD8	1517 FBGA	125	15	1000	0	25000	2.04E+07	2.68E+06	7.14E+05	1510
15040021	5SGXAB	1517 FBGA	125	14	1000	0	14000	1.14E+07	1.50E+06	4.00E+05	1515
14050030	5SGXA7	1152 FBGA	125	77	1000	0	77000	6.29E+07	8.25E+06	2.20E+06	1421
14020019	5SGXA7	1517 FBGA	125	77	1023	0	78771	6.43E+07	8.44E+06	2.25E+06	1406
13100009	5SGXA7	1517 FBGA	125	77	1080	0	83160	6.79E+07	8.91E+06	2.38E+06	1336
13020081	5SX9E	1517 FBGA	125	25	2186	0	54650	4.46E+07	5.85E+06	1.56E+06	1250
11080015	5SGXA7	1517 FBGA	125	25	1000	0	25000	2.04E+07	2.68E+06	7.14E+05	1127
11100001	5SGXA7	1517 FBGA	125	31	1000	0	31000	2.53E+07	3.32E+06	8.86E+05	1135
11110005	5SGXA7	1517 FBGA	125	28	1000	0	28000	2.29E+07	3.00E+06	8.00E+05	1136
11110008	5SGXA7	1517 FBGA	125	29	1000	0	29000	1.82E+09	3.11E+06	1.67E+06	1136
12010001	5SGXA7	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	1.44E+06	1201
12030034	5SGXB6	1760 FBGA	125	20	1000	0	20000	1.25E+09	2.14E+06	1.15E+06	1203
12030049	5SGXB6	1760 FBGA	125	27	1000	0	27000	1.69E+09	2.89E+06	1.56E+06	1209
12040028	5SGXB6	1760 FBGA	125	9	1000	0	9000	5.64E+08	9.64E+05	5.19E+05	1209
12050034	5SGXA7	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	1.44E+06	1217
12050036	5SGXA7	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	1.44E+06	1217
12110014	5SGXA9	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	1.44E+06	1218
12100033	5SGXD5	1517 FBGA	125	27	1079	0	29133	1.83E+09	3.12E+06	1.68E+06	1223
12100035	5SGXA7	1517 FBGA	125	27	1000	0	27000	1.69E+09	2.89E+06	1.56E+06	1233
13010064	5SGXA9	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	1.44E+06	1250
13020013	5SGXA7	1517 FBGA	125	28	1000	0	28000	1.76E+09	3.00E+06	1.61E+06	1240
13020041	5SGXA7	1517 FBGA	125	34	1000	0	34000	2.13E+09	3.64E+06	1.96E+06	1240
<b>Total:</b>				763			813326	2.10E+10	8.71E+07	3.28E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>			
Via voiding Failure(Ea=1.0)				0	1.83		8.71E+07	10.5			
Dielectric Breakdown(Ea=0.53)				0	1.83		2.10E+10	0.0			
Interlayer Breakdown (Ea=0.56)				0	1.83		3.28E+07	28.0			
<b>Combined Failure Rate</b>								<b>38.5</b>			
<b>Note: Typical application Tj=70°C.</b>											

## Arria 10 – 20nm

Arria 10 products are fabricated on a TSMC 20 nm process technology. Arria 10 devices are available in Flip Chip FBGA packages. Arria 10 product family operate with a typical 0.9V supply voltage and life-test is conducted at 1.2x Vcc.

## Arria 10 – 20nm Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	Stress Tj (C)	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Dielectric EQUIV. HRS.	Via voiding Fail. EQUIV. HRS.	Interlayer EQUIV. HRS.
<b>16090020</b>	<b>10AX115</b>	<b>1932 FBGA</b>	<b>125</b>	<b>25</b>	<b>1500</b>	<b>0</b>	<b>37500</b>	<b>2.35E+09</b>	<b>4.02E+06</b>	<b>1.07E+06</b>
16120032	10AX115	1932 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	1.14E+06
17050043	10AX115	1932 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	7.14E+05
14100022	10AX115	1517 FBGA	125	23	1000	0	23000	1.44E+09	2.46E+06	6.57E+05
14110027	10AX115	1517 FBGA	125	25	1000	0	25000	1.57E+09	2.68E+06	7.14E+05
14110026	10AX115	1517 FBGA	125	23	1000	0	23000	1.44E+09	2.46E+06	6.57E+05
15030032	10AX115	1517 FBGA	125	47	1000	0	47000	2.95E+09	5.03E+06	1.34E+06
15030031	10AX115	1517 FBGA	125	47	1000	0	47000	2.95E+09	5.03E+06	1.34E+06
15070025	10AX115	1517 FBGA	125	40	1000	0	40000	2.51E+09	4.28E+06	1.14E+06
15070024	10AX115	1517 FBGA	125	38	1000	0	38000	2.38E+09	4.07E+06	1.09E+06
15070023	10AX115	1517 FBGA	125	47	1000	0	47000	2.95E+09	5.03E+06	1.34E+06
15070051	10AX115	1517 FBGA	125	46	1000	0	46000	2.88E+09	4.93E+06	1.31E+06
15080003	10AX115	1517 FBGA	125	8	1000	0	8000	5.02E+08	8.57E+05	2.29E+05
15110035	10AX115	1517 FBGA	125	55	1000	0	55000	3.45E+09	5.89E+06	1.57E+06
15120024	10AX115	1932 FBGA	125	62	1000	0	62000	3.89E+09	6.64E+06	1.77E+06
15110036	10AX115	1517 FBGA	125	62	1000	0	62000	3.89E+09	6.64E+06	3.57E+06
15050014	10AS066	1152 FBGA	125	23	1000	0	23000	1.44E+09	2.46E+06	1.33E+06
15050015	10AS066	1152 FBGA	125	19	1000	0	19000	1.19E+09	2.04E+06	1.10E+06
15050016	10AS066	1152 FBGA	125	18	1000	0	18000	1.13E+09	1.93E+06	1.04E+06
			Total:	673			685500	4.30E+10	7.34E+07	2.31E+07
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>		
Via voiding Failure				0	1.83		7.34E+07	12.5		
Dielectric Breakdown				0	1.83		4.30E+10	0.0		
Interlayer Breakdown				0	1.83		2.31E+07	39.6		
<b>Combined Failure Rate</b>								<b>52.1</b>		
<b>Note: Typical application Tj=70°C.</b>										

## MAX 7000S and MAX 9000 – Third Generation

These MAX 7000 and MAX 9000 products are fabricated on a 0.5 $\mu$  CMOS EEPROM process. Devices are available in PLCC, TQFP, PQFP, RQFP, and PGA packages. Lifetests are conducted at 6.0V, which is a 20% overvoltage.

### Third Generation MAX 7000S & MAX 9000 Lifetest Results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	Life Test HOURS	# Fail	DEVICE HOURS	Data Retention Equiv Hrs.	Date Code
13060021	EPM7064S	44 TQFP	125	77	1000	0	77000	6.85E+06	1319
9040002	EPM7032S	44 PLCC	125	77	1055	0	81235	4.34E+06	0907
11040002	EPM7064S	44 PLCC	125	77	1000	0	77000	5.46E+06	1101
9100028	EPM7064S	44 TQFP	125	77	1000	0	77000	6.60E+06	0937
10040017	EPM7064S	44 TQFP	125	77	1000	0	77000	5.89E+06	1007
10060027	EPM7064S	44 TQFP	125	77	1000	0	77000	7.11E+06	1019
12110039	EPM7064S	44 TQFP	125	77	1000	0	77000	5.20E+06	1237
Total:				539			543235	4.14E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Data retention failure				0	1.83		4.14E+07	22.1	
<b>Note: Typical application Tj=70°C.</b>									

## MAX 7000A and MAX 3000A – Fourth Generation

The MAX 7000A and MAX 3000A products are fabricated on a 0.3/0.35 $\mu$  CMOS EEPROM process. Devices are available in PLCC, TQFP, PQFP, BGA, and FBGA packages. Lifetest are conducted at 4.0V, which is a 20% overvoltage.

### Fourth Generation MAX 7000A and MAX 3000A Lifetest Results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# Fail	DEVICE HOURS	Data Retention Equiv Hrs.	Date Code
16040014	EPM7032AE	44 TQFP	125	77	1000	0	77000	4.60E+06	1607
14120010	EPM7064AE	100 TQFP	125	77	1000	0	77000	4.27E+06	1343
15040017	EPM7256AE	256 FBGA	125	25	1000	0	25000	2.81E+06	1413
14030023	EPM7512AE	208 PQFP	125	45	1000	0	45000	1.37E+07	1401
14070047	EPM7064S	44 TQFP	125	73	1000	0	73000	5.91E+06	1419
13020083	EPM7512AE	208 PQFP	125	45	1000	0	45000	6.03E+06	1301
13060021	EPM7064S	44 TQFP	125	77	1000	0	77000	5.07E+06	1319
11100003	EPM7064AE	44 TQFP	125	77	1000	0	77000	4.07E+06	1125
9010009	EPM7064AE	100 TQFP	125	232	2000	0	464000	1.52E+07	0851
12080009	EPM7064AE	100 TQFP	125	77	1000	0	77000	4.27E+06	1230
9010008	EPM7256AE	144 TQFP	125	274	1000	0	274000	3.19E+07	0851
12040011	EPM7512AE	208 PQFP	125	45	1000	0	45000	6.54E+06	1207
10100013	EPM7512AE	208 PQFP	125	45	1000	0	45000	1.37E+07	1037
11070008	EPM7512AE	208 PQFP	125	45	1000	0	45000	1.37E+07	0919
9050031	EPM7512AE	256 FBGA	125	25	1000	0	25000	8.73E+06	0922
10030018	EPM7512AE	256 FBGA	125	25	1000	0	25000	6.98E+06	1001
Total:				1264			1496000	1.47E+08	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Data retention failure				0	1.83		1.47E+08	6.2	
<b>Note: Typical application Tj=70°C.</b>									

## MAX 7000B – Fifth Generation

These MAX 7000B products are fabricated on a 0.22 $\mu$  CMOS EEPROM process. Devices are available in PLCC, TQFP, UBGA, PQFP & FBGA packages. Lifetests are conducted at 3.0V, which is a 20% overvoltage.

### Fifth Generation MAX 7000B Lifetest Results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# Fail	DEVICE HOURS	Data Retention Equiv Hrs.	Date Code
14100037	EPM7256B	256 FBGA	125	25	1000	0	25000	3.90E+06	1413
8070001	EPM7256B	256 FBGA	125	25	1000	0	25000	3.90E+06	0819
9080001	EPM7256B	256 FBGA	125	25	1000	0	25000	3.90E+06	0919
12060013	EPM7256B	256 FBGA	125	25	1000	0	25000	9.49E+05	1207
10080013	EPM7512B	256 FBGA	125	25	1000	0	25000	8.36E+06	1025
11100018	EPM7512B	256 FBGA	125	25	1000	0	25000	8.36E+06	1137
				150		Total:	150000	2.94E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Data retention failure				0	1.83		2.94E+07	31.2	
<b>Note: Typical application Tj=70°C.</b>									

## MAX II, MAX V – 0.18 µm FLASH Products

These MAX II & V products are fabricated on an 8", 0.18µm CMOS flash memory process technology. Devices are available in TQFP and FBGA packages. The operating supply voltage is 3.3V for the MAX II device and lifetests are conducted at 3.96V. The operating supply voltage is 1.8V for the MAX II G, MAX II Z and MAX V devices and lifetest is conducted at 2.16V. Both are 20% overvoltage.

### MAX II & V Lifetest Results

REL LOT #	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Data Retention EQUIV.HRS.	Date Code
<b>16100010</b>	<b>EPM570Z</b>	<b>144 TQFP</b>	<b>125</b>	<b>30</b>	<b>1000</b>	<b>0</b>	30000	1.63E+06	<b>1631</b>
16030019	EPM1270	144 TQFP	125	30	2000	0	60000	1.93E+06	1507
15060001	EPM2210	256 FBGA	125	30	1000	0	30000	1.63E+06	1507
15100035	EPM240Z	144 TQFP	125	30	1000	0	30000	1.45E+06	1531
15110007	EPM570	256 FBGA	125	30	1000	0	30000	1.63E+06	1532
14120016	EPM240	100 MBGA	125	30	2000	0	60000	1.41E+06	1343
14080016	EPM2210	256 FBGA	125	30	1000	0	30000	1.41E+06	1419
15030006	EPM1270	256 FBGA	125	30	2000	0	60000	1.64E+06	1501
15030007	EPM1270	144 TQFP	125	30	2000	0	60000	1.60E+06	1501
14020051	EPM1270G	256 FBGA	125	30	1000	0	30000	1.41E+06	1419
14070012	EPM570Z	144 FBGA	125	30	1000	0	30000	1.30E+06	1425
14080001	EPM570	256 FBGA	125	30	1000	0	30000	1.41E+06	1401
13020067	EPM1270	256 FBGA	125	30	1000	0	30000	1.34E+06	1243
13060022	EPM2210	256 FBGA	125	30	1000	0	30000	1.41E+06	1319
13070024	EPM570	256 FBGA	125	30	1000	0	30000	1.41E+06	1319
9100012	EPM570	144 TQFP	125	77	1000	0	77000	5.55E+06	0937
9090007	EPM570	256 FBGA	125	75	1000	0	75000	3.36E+06	0931
9050008	EPM1270	144 TQFP	125	77	1000	0	77000	3.34E+06	0913
10030003	EPM1270	144 TQFP	125	77	1000	0	77000	3.34E+06	1001
10070001	EPM1270	144 TQFP	125	75	1000	0	75000	3.26E+06	1019
12080031	EPM1270	256 FBGA	125	77	1000	0	77000	3.45E+06	1219
12070013	EPM1270	256 FBGA	125	25	1000	0	25000	2.20E+06	1225
12070014	EPM1270	256 FBGA	125	25	1000	0	25000	2.14E+06	1225
12070015	EPM1270	256 FBGA	125	25	1000	0	25000	2.20E+06	1225
9020008	EPM2210	256 FBGA	125	76	1000	0	76000	3.82E+06	0901
12030035	EPM2210	256 FBGA	125	100	2000	0	200000	4.79E+06	1201
10080014	EPM2210G	256 FBGA	125	25	1000	0	25000	1.05E+06	1032
9100011	EPM240Z	100 MBGA	125	77	1000	0	77000	2.85E+06	0925
10040030	EPM240Z	100 MBGA	125	77	1000	0	77000	2.85E+06	1017
11030013	EPM240Z	100 MBGA	125	77	2000	0	154000	3.62E+06	1101
11090026	5M570Z	144 TQFP	125	78	2000	0	156000	6.40E+06	1136
11120013	5M570Z	144 TQFP	125	80	2000	0	160000	6.57E+06	1131
11050006	5M1270Z	144 TQFP	125	75	2000	0	150000	4.00E+06	1118
11120012	5M1270Z	144 TQFP	125	80	2000	0	160000	4.27E+06	1143
11030028	5M1270Z	256 FBGA	125	73	2000	0	146000	4.22E+06	1107
11080001	5M2210Z	256 FBGA	125	80	1000	0	80000	3.35E+06	1130
			Total:	1881			2564000	9.93E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Data retention failure				0	1.83		9.93E+07	9.2	
<b>Note: Typical application Tj=70°C.</b>									

## Configuration Devices – EPROM

These Configuration EPROMs are fabricated on a 0.5µm CMOS EPROM process. These devices are erasable with UV light when supplied in windowed hermetic packages for prototyping. Lifetests are conducted at least 6.0V, which is a minimum of 20% overvoltage.

### Third Generation Classic and Configuration Devices Lifetest Results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Data Retention Equiv. Hrs.	Date Code
15110006	EPC1441S	20 PLCC	125	77	1000	0	77000	3.63E+06	1537
16030038	EPC1S	20 PLCC	125	77	1000	0	77000	3.70E+06	1537
14050027	EPC1441	20PLCC	125	77	1000	0	77000	3.41E+06	1413
13010054	EPC1S	20 PLCC	125	77	1000	0	77000	3.70E+06	1249
13060024	EPC1S	20 PLCC	125	77	1000	0	77000	3.70E+06	1319
9040001	EPC1	20 PLCC	125	77	1000	0	77000	3.70E+06	0907
11090028	EPC1	20 PLCC	125	77	1000	0	77000	3.70E+06	1127
12080001	EPC1S	20 PLCC	125	77	1000	0	77000	3.70E+06	1230
9010014	EPC1441	20 PLCC	125	77	1000	0	77000	3.48E+06	0901
10020046	EPC1441	20 PLCC	125	77	1000	0	77000	3.63E+06	1001
12030019	EPC1441	20 PLCC	125	77	1000	0	77000	3.63E+06	1207
<b>Total:</b>				847			847000	4.00E+07	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Data retention failure				0	1.83		4.00E+07	22.9	
<b>Note: Typical application Ta=55°C.</b>									

## Configuration Devices – Flash Memory

The EPC2 configuration device is fabricated on a 0.4 $\mu$  CMOS Flash process. EPC4, EPC8 and EPC16 are stacked-die configuration devices in which the controller die is fabricated on a 0.35 $\mu$  double layer metal CMOS logic process and the memory die is fabricated on 0.13 $\mu$  triple layer metal CMOS Flash process. These devices are electrically erasable. For EPC2, life-tests are conducted at 6.0V. For EPC4, EPC8 and EPC16, life-tests are conducted at 4.0V. This represents 20% overvoltage.

## Flash Memory Devices Lifetest Results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	Data Retention Equiv. Hrs.	Date Code
15010016	EPC16	88 UBGA	125	77	1000	0	77000	1.31E+07	1443
14030022	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1407
14050027	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1407
13020080	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1301
13070005	EPC16	88 UBGA	125	30	1000	0	30000	5.18E+06	1319
9070002	EPC2	20 PLCC	125	76	1000	0	76000	1.30E+07	0919
10050020	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1013
10110001	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1037
11080010	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1113
12020028	EPC2	20 PLCC	125	77	1000	0	77000	1.84E+07	1204
10010008	EPC16	88 UBGA	125	77	1000	0	77000	1.29E+07	0949
10080009	EPC16	88 UBGA	125	78	1000	0	78000	1.33E+07	1019
12030016	EPC16	88 UBGA	125	77	1000	0	77000	1.30E+07	1209
12100009	EPC16	88 UBGA	125	77	1000	0	77000	1.29E+07	1231
<b>Total:</b>				1031			1031000	2.12E+08	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs</b>	<b>FITs</b>	
Data retention failure				0	1.83		2.12E+08	4.3	
<b>Note: Typical application Ta=55°C.</b>									



## PowerSoC devices Family

Products from this family are 5V, 6V and 12V DC-DC Buck (step-down) and Bus converters.

These products are fabricated on a 0.25um CMOS process technology. Few products are fabricated on a 0.18um technology assembled within the same package with another power device fabricated on a 0.25um technology.

Devices are available in QFN and DFN packages.

Life-tests are conducted at 125C

## PowerSoC devices Family - Lifetest results

REL LOT#	DEVICE	PACKAGE TYPE	TA	# UNITS	L.T. HOURS	# FAIL	DEVICE HOURS	EQUIVALENT HOURS	DATE CODE
17030012	EP53A7HQI	16QFN	125	80	168	0	13440	3.54E+05	1647
17030013	EP5357LUI	16QFN	125	80	168	0	13440	3.54E+05	1647
17030014	EN5339QI	24QFN	125	80	168	0	13440	3.54E+05	1647
17030015	EN6347QI	38QFN	125	80	168	0	13440	3.54E+05	1647
17030016	EN5337QI	38QFN	125	80	168	0	13440	3.54E+05	1647
17030017	EQC1240QI	24QFN	125	80	168	0	13440	3.54E+05	1647
17050046	EP53F8QI	16QFN	125	80	168	0	13440	3.54E+05	1710
17050047	EN6337QI	38QFN	125	80	168	0	13440	3.54E+05	1712
17050048	EP5357LUI	16QFN	125	80	168	0	13440	3.54E+05	1641
17050050	EP53A7LQI	16QFN	125	80	168	0	13440	3.54E+05	1705
17050051	EP53A8LQI	16QFN	125	80	168	0	13440	3.54E+05	1647
17060039	EN5311QI	16QFN	125	79	168	0	13272	3.50E+05	1716
17060040	EN6347QA	38QFN	125	80	168	0	13440	3.54E+05	1709
17060041	EP53A8LQI	16QFN	125	80	168	0	13440	3.54E+05	1640
17060042	EN63A0QI	76QFN	125	80	168	0	13440	3.54E+05	1712
17060043	EN6337QA	38QFN	125	80	168	0	13440	3.54E+05	1711
17060044	EP5358LUI	16QFN	125	80	168	0	13440	3.54E+05	1713
1708070	EN5395QI	58QFN	125	80	168	0	13440	3.54E+05	1641
1708071	EP5357LUI	16QFN	125	79	168	0	13272	3.50E+05	1627
1708072	EN6347QI	38QFN	125	80	168	0	13440	3.54E+05	1630
1708073	EN6347QA	38QFN	125	80	168	0	13440	3.54E+05	1642
1708074	EP53F8QI	67QFN	125	80	168	0	13440	3.54E+05	1629
1708075	EN5311QI	20QFN	125	80	168	0	13440	3.54E+05	1631
<b>Total:</b>				1838			308784	8.14E+06	
<b>Failure Mechanism</b>				<b># Fail</b>	<b>Chi Sq.</b>		<b>Equiv. Hrs.</b>	<b>FITs</b>	
Metal Inteconnect				0	1.83		8.14E+06	1.3	
<b>FITs include historical equivalent hours:</b>				6.90E+08	extrapolated from		26,187,826	device hours	
<b>Note: Typical application Ta=70°C.</b>									

## High Temperature Storage

Reference: JESD22-A103 (JEDEC Standard)

All lots are subjected to 150°C Bake after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow.

## High Temperature Storage Results

REL LOT #	DEVICE	PACKAGE TYPE	BAKE TEMP.	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16060003	10M08	153 MBGA	150	77	2000	0	55nm FLASH	1423
16060004	10M08	153 MBGA	150	77	1500	0	55nm FLASH	1423
16060005	10M08	153 MBGA	150	77	1500	0	55nm FLASH	1423
16060006	10M08	153 MBGA	150	77	1500	0	55nm FLASH	1423
16060012	EP2S30	484 FBGA	150	25	2000	0	90nm SRAM	1619
16060053	EP3C25	144 EQFP	150	30	2000	0	60nm SRAM	1619
16070003	5AGTD3	1152 FBGA	150	45	2000	0	28nm SRAM	1625
16070005	10M50	144 EQFP	150	50	2000	0	55nm FLASH	1425
16070006	10M50	144 EQFP	150	50	2000	0	55nm FLASH	1425
16070007	10M50	144 EQFP	150	50	2000	0	55nm FLASH	1425
16080005	10M02	324 UBGA	150	45	2000	0	55nm FLASH	1626
16080006	10M02	324 UBGA	150	45	2000	0	55nm FLASH	1626
16080031	EP4SGX230	1517 FBGA	150	30	2000	0	40nm SRAM	1637
16090004	5CGXC7	896 FBGA	150	30	2000	0	28nm SRAM	1543
16090015	10M50	672 FBGA	150	45	1500	0	55nm FLASH	1637
16090016	10M50	672 FBGA	150	45	2000	0	55nm FLASH	1637
16090017	EP3SL150	1152 FBGA	150	25	2000	0	65nm SRAM	1637
16090028	EPM2210	256 FBGA	150	77	2000	0	0.18um FLASH	1640
16090029	EPM2210	256 FBGA	150	77	2000	0	0.18um FLASH	1640
16090033	EPM2210G	256 FBGA	150	30	2000	0	0.18um FLASH	1631
16090034	5SGXMA4	1152 FBGA	150	25	1000	0	28nm SRAM	1619
16100001	10M50	484 FBGA	150	32	2000	0	55nm FLASH	1613
16100010	EPM570Z	144 TQFP	150	30	2000	0	0.18um FLASH	1631
16100026	10M50	672 FBGA	150	30	2000	0	55nm FLASH	1642
16100027	10M50	672 FBGA	150	30	2000	0	55nm FLASH	1642
16100028	10M50	672 FBGA	150	77	2000	0	55nm FLASH	1642
16100029	10M50	672 FBGA	150	77	2000	0	55nm FLASH	1642
16100030	10M50	672 FBGA	150	77	2000	0	55nm FLASH	1642
16100041	5CGXC9	484 UBGA	150	35	2000	0	28nm SRAM	1645
16110015	5CGXC9	896 FBGA	150	40	2000	0	28nm SRAM	1640
16110016	5CGXC9	896 FBGA	150	40	2000	0	28nm SRAM	1640
16110018	5CGXC9	484 UBGA	150	25	2000	0	28nm SRAM	1644
16120047	5CGXC9	484 UBGA	150	80	2000	0	28nm SRAM	1652
16120048	EPM570	256 FBGA	150	35	2000	0	0.18um FLASH	1645
17010021	EP2C8	208 PQFP	150	77	2000	0	90nm SRAM	1701
17010022	EP2C8	208 PQFP	150	30	2000	0	90nm SRAM	1701
17020007	EP2C8	144 TQFP	150	45	2000	0	90nm SRAM	1701
17020008	EP2C8	144 TQFP	150	45	2000	0	90nm SRAM	1701
17020028	EP4CGX	484 FBGA	150	25	2000	0	60nm SRAM	1649
17030030	EPM2210	256 FBGA	150	30	2000	0	0.18um FLASH	1707
17080053	EN5322QI	24 QFN	150	77	1000	0	Power devices	1706
17080056	EN5329QI	24 QFN	150	77	1000	0	Power devices	1704
15060002	EP3SL150	1152 FBGA	150	25	2000	0	65nm SRAM	1513
15060003	EP1C4	400 FBGA	150	28	2000	0	0.13um SRAM	1425
15060029	5SGXA7	1517 FBGA	150	25	1000	0	28nm SRAM	1524
15060034	EP2C70	672 FBGA	150	30	2000	0	90nm SRAM	1519
15060043	5CSTD6	672 UBGA	150	22	2000	0	28nm SRAM	1513

REL LOT #	DEVICE	PACKAGE TYPE	BAKE TEMP.	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
15060050	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
15060052	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
15060053	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
15060055	EPM1270	256 FBGA	150	30	2000	0	0.18um FLASH	1519
15060056	EPM1270	256 FBGA	150	30	2000	0	0.18um FLASH	1519
15060057	EPM1270	256 FBGA	150	30	2000	0	0.18um FLASH	1519
15060060	EP2S130	1508 FBGA	150	25	2000	0	90nm SRAM	1519
15070002	10M50	144 EQFP	159	80	2000	0	55nm FLASH	1425
15070041	10M08	153 MBGA	150	30	2000	0	55nm FLASH	1423
15070042	10M08	153 MBGA	150	30	2000	0	55nm FLASH	1423
15070043	10M08	153 MBGA	150	30	2000	0	55nm FLASH	1423
15070047	EPM1270	256 FBGA	150	45	2000	0	0.18um FLASH	1531
!5070048	EPM1270	256 FBGA	150	45	2000	0	0.18um FLASH	1531
15070049	EPM1270	256 FBGA	150	45	2000	0	0.18um FLASH	1531
15080024	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15080025	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15080026	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15080071	EP4SGX230	1517 FBGA	150	25	2000	0	40nm SRAM	1531
15080072	EP3C120	780 FBGA	150	27	2000	0	65nm SRAM	1519
15080073	EP1C6	144 TQFP	150	30	2000	0	65nm SRAM	1531
15080074	EP2C8	208 PQFP	150	30	2000	0	90nm SRAM	1519
15090005	10M16	144 EQFP	150	80	2000	0	55nm FLASH	1425
15090006	10M16	144 EQFP	150	80	2000	0	55nm FLASH	1425
15090007	10M16	484 FBGA	150	80	2000	0	55nm FLASH	1425
15100018	EP3C25	256 FBGA	150	45	2000	0	65nm SRAM	1542
15100025	5CGXA7	1517 FBGA	150	25	1000	0	28nm SRAM	1542
15100035	EPM240Z	144 TQFP	150	30	2000	0	0.18um FLASH	1531
15100039	10M16	144 EQFP	150	80	2000	0	55nm FLASH	1425
15110001	5CGXC9	896 FBGA	150	45	2000	0	28nm SRAM	1544
15110003	5CGXC9	896 FBGA	150	45	2000	0	28nm SRAM	1544
15110004	5CGXC9	896 FBGA	150	45	2000	0	28nm SRAM	1544
15110027	10M50	672 FBGA	150	45	2000	0	55nm FLASH	1545
15110035	10AX115	1517 FBGA	150	77	1000	0	20nm SRAM	1548
15110036	10AX115	1517 FBGA	150	77	1000	0	20nm SRAM	1548
15110037	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
15120019	10M50	672 FBGA	150	45	2000	0	55nm FLASH	1545
15120026	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
15120027	10M50	672 FBGA	150	80	2000	0	55nm FLASH	1439
16010020	5CGXC9	1152 FBGA	150	45	2000	0	28nm SRAM	1602
16010021	5CGXC9	1152 FBGA	150	45	2000	0	28nm SRAM	1602
16010022	5CGXC9	1152 FBGA	150	45	2000	0	28nm SRAM	1602
16040006	10M50	672 FBGA	150	45	1000	0	55nm FLASH	1614
16040007	10M50	672 FBGA	150	45	1000	0	55nm FLASH	1614
16040008	10M50	672 FBGA	150	45	1000	0	55nm FLASH	1614
16040018	10M50	256 FBGA	150	45	2000	0	55nm FLASH	1439
16040019	10M50	256 FBGA	150	45	2000	0	55nm FLASH	1439
16040029	10M50	256 FBGA	150	45	2000	0	55nm FLASH	1614
15010001	10M50	484 FBGA	150	80	2000	0	55nm FLASH	1423
15010003	10M08	153 MBGA	150	30	2000	0	55nm FLASH	1423
15010004	10M08	153 MBGA	150	30	2000	0	55nm FLASH	1423
15010014	5CSTD6	672 UBGA	150	30	2000	0	28nm SRAM	1401
15010022	5CGXC9	1152 FBGA	150	30	2000	0	28nm SRAM	1443
15010025	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15010027	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15010028	5CSTD6	672 UBGA	150	30	2000	0	28nm SRAM	1401
15030005	EP2C35	672 FBGA	150	30	2000	0	0.09μ SRAM	1437
15030006	EPM1270	256 FBGA	150	30	2000	0	0.18μ FLASH	1501

REL LOT #	DEVICE	PACKAGE TYPE	BAKE TEMP.	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
15030007	EPM1270	144 TQFP	150	30	2000	0	0.18μ FLASH	1501
15030020	5CSTD6	896 FBGA	150	25	2000	0	28nm SRAM	1501
15030033	EP4CGX150	896 FBGA	150	30	2000	0	60nm SRAM	1507
15030037	EP4CGX230	1517 FBGA	150	25	2000	0	60nm SRAM	1513
15040006	10M50	144 EQFP	150	80	2000	0	55nm FLASH	1425
15040017	EPM7256A	256 FBGA	150	25	2000	0	0.35μ EEPROM	1413
15040034	EP3SL200	1152 FBGA	150	25	2000	0	65nm SRAM	1513
15040038	EP1S80	1508 FBGA	150	25	2000	0	0.13μ SRAM	1508
15060002	EP3SL150	1152 FBGA	150	25	2000	0	65nm SRAM	1513
15060003	EP1C4	400 FBGA	150	28	2000	0	0.13μ SRAM	1425
15060024	5CGXC5	301 MBGA	150	77	2000	0	28nm SRAM	1519
15060029	5SGXMA	1517 FBGA	150	25	1000	0	28nm SRAM	1524
15060034	EP2C70	672 FBGA	150	30	2000	0	0.09μ SRAM	1519
15060043	5CSEMA	672 UBGA	150	22	1000	0	28nm SRAM	1513
15060055	EPM1270	256 FBGA	150	30	2000	0	0.18μ FLASH	1519
15060056	EPM1270	256 FBGA	150	30	2000	0	0.18μ FLASH	1519
15060057	EPM1270	256 FBGA	150	30	2000	0	0.18μ FLASH	1519
15060060	EP2S130	1508 FBGA	150	25	2000	0	0.09μ SRAM	1519
15060063	5CGXC5	301 MBGA	150	77	2000	0	28nm SRAM	1519
15060064	5CGXC5	301 MBGA	150	77	2000	0	28nm SRAM	1519
15070002	10M50	144 EQFP	150	80	2000	0	55nm FLASH	1425
15070047	EPM1270	256 FBGA	150	45	2000	0	0.18μ FLASH	1531
15070048	EPM1270	256 FBGA	150	45	2000	0	0.18μ FLASH	1531
15070049	EPM1270	256 FBGA	150	45	2000	0	0.18μ FLASH	1531
15080024	10M50	256 FBGA	150	80	2000	0	55nm FLASH	1439
15080071	EP4SGX230	1517 FBGA	150	25	2000	0	40nm SRAM	1531
15080072	EP3C120	780 FBGA	150	27	2000	0	60nm SRAM	1519
15080073	EP1C6	144 TQFP	150	30	2000	0	0.13μ SRAM	1531
15080074	EP2C8	208 PQFP	150	30	2000	0	0.09μ SRAM	1519
15090007	10M50	484 FBGA	150	80	1000	0	55nm FLASH	1425
15100025	5SGXMA	1517 FBGA	150	25	1000	0	28nm SRAM	1542
15100039	10M16	144 EQFP	150	80	1000	0	55nm FLASH	1425
14110024	5AGTD7	1152 FBGA	150	25	1025	0	28nm SRAM	1447
15020012	EP5SGXBB	1517 FBGA	150	25	1050	0	28nm SRAM	1502
14100037	EPM7256B	256 FBGA	150	25	2000	0	0.22μ EEPROM	1437
15010016	EPC16	88 UBGA	150	45	2000	0	0.35μ FLASH	1443
14100023	EP1S40Z	1020 FBGA	150	25	2000	0	0.13μ SRAM	1413
14100026	EP4SGX230	1517 FBGA	150	25	2000	0	40nm SRAM	1437
14100027	EP4SGX230	1517 FBGA	150	25	2000	0	40nm SRAM	1437
15010015	EP2C5	256 FBGA	150	30	2000	0	0.09μ SRAM	1437
14070004	EP20K400	672 FBGA	150	25	2000	0	0.15μ SRAM	1419
14070005	EP3SL150	1152 FBGA	150	25	2000	0	65nm SRAM	1419
14070012	EPM570Z	144 FPBGA	150	30	2000	0	0.18μ FLASH	1425
14070047	EPM7064S	44 TQFP	150	45	2000	0	0.5μ EEPROM	1419
14070049	EP3C120	484 PFBGA	150	30	2000	0	60nm SRAM	1207
14080001	EPM570	256 FBGA	150	30	2000	0	0.18μ FLASH	1419
14080002	EPM2210	324 FBGA	150	30	2000	0	0.18μ FLASH	1337
14080004	5CGXC9	896 PFBGA	150	30	2000	0	28nm SRAM	1428
14080014	EP2AGX125	780 FBGA	150	25	2000	0	40nm SRAM	1433
14100005	EP2S130	1508 FBGA	150	30	1000	0	0.09μ SRAM	1437
14100021	EPM570Z	144 TQFP	150	30	1000	0	0.18μ FLASH	1437

## Reflow Simulation and Moisture Preconditioning

Intel moisture soaks devices according to their J-STD020D moisture classification and then passes them through simulated 100% convection reflow soldering 3 times. Devices are examined for package cracks and are electrically tested after preconditioning and reflow soldering. The devices are then subjected to Reliability tests to assess package reliability.

## Accelerated Moisture Resistance

Four different stresses are commonly used to assess moisture resistance of integrated circuits:

- Temperature Humidity Bias (THB) at 85°C/85%RH,
- Autoclave at 121°C/100% RH
- Biased HAST at 130°C/85%RH
- Unbiased HAST at 130°C/85%RH

All four stresses can detect metallization corrosion and moisture induced charge loss in nonvolatile devices. In addition, THB and biased HAST can detect galvanic corrosion since they are biased. Per JESD47 recommendation, BGA packages will no longer be subjected to Autoclave testing. Unbiased HAST will be used instead.

## Autoclave

The Autoclave stress subjects semiconductor devices to a 121°C saturated DI water steam environment.

## Unbiased HAST

Reference: JESD22-A118 (JEDEC Standard)

All lots are subjected to Unbiased HAST test after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow.

## Autoclave & Unbiased HAST Results

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16060012	EP2S30	484 FBGA	PRECON 3- 130C/85% RH	25	96	0	90nm SRAM	1619
16060013	5CGXC9	484 UBGA	PRECON 3- 130C/85% RH	20	192	0	28nm SRAM	1620
16060014	5CGXC7	484 UBGA	PRECON 3- 130C/85% RH	20	192	0	28nm SRAM	1620
16060019	EP3SL200	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	65nm SRAM	1619
16060053	EP3C25	144 EQFP	PRECON 3- 130C/85% RH	45	192	0	60nm SRAM	1626
16060056	EPF6016	144 TQFP	PRECON 3- 130C/85% RH	25	96	0	0.3um SRAM	1613
16060057	EPF10K30	144 TQFP	PRECON 3- 130C/85% RH	25	96	0	0.22um SRAM	1613
16070001	5CSEBA2	672 UBGA	PRECON 3- 130C/85% RH	28	192	0	28nm SRAM	1625
16070005	10M50	144 EQFP	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1425
16070006	10M50	144 EQFP	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1425
16070007	10M50	144 EQFP	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1425
16080005	10M02	324 UBGA	PRECON 3- 130C/85% RH	45	192	0	55nm FLASH	1626
16080006	10M02	324 UBGA	PRECON 3- 130C/85% RH	45	192	0	55nm FLASH	1626
16080022	5CGXFC4C6	484 UBGA	PRECON 3- 130C/85% RH	20	192	0	28nm SRAM	1635
16080031	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16080032	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16080033	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16080034	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16080035	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16080036	EP4CGX230	1517 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1637
16090010	10M02	324 UBGA	PRECON 3- 130C/85% RH	20	192	0	55nm FLASH	1625
16090011	10M08	169 UBGA	PRECON 3- 130C/85% RH	20	192	0	55nm FLASH	1631
16090012	10M02	169 UBGA	PRECON 3- 130C/85% RH	20	192	0	55nm FLASH	1625
16090028	EPM2210	256 FBGA	PRECON 3- 130C/85% RH	77	192	0	0.18um FLASH	1640
16090029	EPM2210	256 FBGA	PRECON 3- 130C/85% RH	77	192	0	0.18um FLASH	1640

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16090033	EPM2210	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18um FLASH	1631
16090034	5SGXMA4	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	28nm SRAM	1619
16100001	10M50	484 FBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1613
16100010	5M240Z	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18um FLASH	1631
16100011	10M16	324 UBGA	PRECON 3- 130C/85% RH	25	192	0	55nm FLASH	1640
16100012	10M16	324 UBGA	PRECON 3- 130C/85% RH	25	192	0	55nm FLASH	1640
16100013	10M16	169 UBGA	PRECON 3- 130C/85% RH	25	192	0	55nm FLASH	1640
16100014	10M16	169 UBGA	PRECON 3- 130C/85% RH	25	192	0	55nm FLASH	1640
16100024	10M50	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1642
16100025	10M50	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1642
16100028	10M50	672 FBGA	PRECON 3- 130C/85% RH	15	192	0	55nm FLASH	1642
16100041	5CEFA9	484 UBGA	PRECON 3- 130C/85% RH	35	192	0	28nm SRAM	1645
16110003	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	25	192	0	28nm SRAM	1642
16120001	EP3C40	484 FBGA	PRECON 3- 130C/85% RH	25	192	0	60nm SRAM	1649
16120005	EP3C40	484 FBGA	PRECON 3- 130C/85% RH	25	192	0	60nm SRAM	1649
16120013	EP3C40	484 FBGA	PRECON 3- 130C/85% RH	25	192	0	60nm SRAM	1619
17010007	EP2C35	484 FBGA	PRECON 3- 130C/85% RH	25	192	0	90nm SRAM	1637
17010022	EP2C8	208 PQFP	PRECON 3- 130C/85% RH	30	192	0	90nm SRAM	1701
17020007	EP2C8	144 TQFP	PRECON 3- 130C/85% RH	45	192	0	90nm SRAM	1701
17020008	EP2C8	144 TQFP	PRECON 3- 130C/85% RH	45	192	0	90nm SRAM	1701
17020028	EP4CGX75	484 FBGA	PRECON 3- 130C/85% RH	25	192	0	60nm SRAM	1649
17030024	10M08	324 UBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1707
17030025	10M08	169 UBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1631
17030035	10M50	484 FBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1631
17040019	10M50	144 EQFP	PRECON 3- 130C/85% RH	110	192	0	55nm FLASH	1425
17080053	EN5322QI	24 QFN	PRECON 3- 130C/85% RH	45	96	0	Power devices	1706
17080054	EV1320QI	16 QFN	PRECON 3- 130C/85% RH	45	96	0	Power devices	1705
15060050	10M50	672 FBGA	PRECON 3- 130C/85% RH	48	192	0	55nm FLASH	1439
15060052	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15060053	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	96	0	55nm FLASH	1439
15070002	10M50	144 EQFP	PRECON 3- 130C/85% RH	40	192	0	55nm FLASH	1425
15100010	10M50	144 EQFP	PRECON 3- 130C/85% RH	44	192	0	55nm FLASH	1425
15100011	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15100012	10M08	484 FBGA	PRECON 3- 130C/85% RH	51	192	0	55nm FLASH	1436
15110001	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	45	192	0	28nm SRAM	1544
15110003	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	45	192	0	28nm SRAM	1544
15110004	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	45	192	0	28nm SRAM	1544
15110007	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	96	0	0.18um FLAHL	1531
15110008	5SGXA7	1517 FBGA	PRECON 3- 130C/85% RH	23	96	0	28nm SRAM	1545
15110009	EP2AGX260	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1537
15110019	10M50	672 FBGA	PRECON 3- 130C/85% RH	35	192	0	55nm FLASH	1439
15110021	EP3C25	144 EQFP	PRECON 3- 130C/85% RH	30	192	0	65nm SRAM	1543
15110027	10M50	672 FBGA	PRECON 3- 130C/85% RH	45	192	0	55nm FLASH	1545
15110037	10M50	672 FBGA	PRECON 3- 130C/85% RH	60	192	0	55nm FLASH	1439
15110039	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18um FLASH	1548
15110040	5CGXC7	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1543
15110041	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1543
15120010	5AGTD7	1152 FBGA	PRECON 3- 130C/85% RH	24	96	0	28nm SRAM	1549
15120019	10M50	672 FBGA	PRECON 3- 130C/85% RH	45	192	0	55nm FLASH	1545
15120020	EPM240Z	100 TQFP	PRECON 3- 130C/85% RH	25	192	0	0.18um FLAHL	1543
15120021	EPM1270G	144 TQFP	PRECON 3- 130C/85% RH	25	192	0	0.18um FLAHL	1543
15120026	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15120027	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
16010003	EP3C16	256 FBGA	PRECON 3- 130C/85% RH	25	96	0	65nm FLAHL	1551
16010013	10M50	256 FBGA	PRECON 3- 130C/85% RH	63	192	0	55nm FLASH	1439
16020059	10M08	VBGA 36	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1549
16030003	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1610
16030005	EP3C25	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	65nm SRAM	1601

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16030011	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1607
16030016	EP3C25	256 FBGA	PRECON 3- 130C/85% RH	45	192	0	65nm SRAM	1611
16030019	EPM1270	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18um FLAH	1607
16030023	10M50	484 FBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1537
16030038	EPC1S	20 PLCC	PRECON 3- 130C/85% RH	45	96	0	0.5um EPROM	1537
16040001	EP2AGX260	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1437
16040016	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	30	192	0	65nm SRAM	1615
16040017	5CSTD6	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1607
15010001	10M50	484 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1423
15010003	10M08	153 MBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1423
15010004	10M08	153 MBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1423
15010005	10M08	153 MBGA	PRECON 3- 130C/85% RH	30	192	0	55nm FLASH	1423
15010014	5CSTD6	672 UBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1401
15010020	EP2S130	1508 FBGA	PRECON 3- 130C/85% RH	30	96	0	0.09μ SRAM	1443
15010022	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1443
15010024	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15010025	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15010027	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15010030	5CSTD6	672 UBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1401
15020011	10M50	484 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15030008	EPM570Z	64 EQFP	PRECON 3- 130C/85% RH	77	192	0	0.18μ FLASH	1511
15030014	10M50	672 FBGA	PRECON 3- 130C/85% RH	25	192	0	55nm FLASH	1439
15050008	EPM240	100 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1513
15050010	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1513
15050013	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1513
15060002	EP3SL150	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	65nm SRAM	1513
15060004	EPF10K100E	208 PQFP	PRECON 3- 130C/85% RH	25	96	0	0.22μ SRAM	1349
15060029	5SGXMA	1517 FBGA	PRECON 3- 130C/85% RH	25	96	0	28nm SRAM	1519
15060030	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1524
15060031	EP3C25	240 PQFP	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1519
15060032	EP2C20	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1519
15060034	EP2C70	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1519
15060041	5AGTD7	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	28nm SRAM	1524
15060043	5CSTD6	672 UBGA	PRECON 3- 130C/85% RH	22	192	0	28nm SRAM	1513
15060054	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15060057	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1519
15060058	EPM1270	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1519
15060059	EPM1270	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1519
15060060	EP2S130	1508 FBGA	PRECON 3- 130C/85% RH	25	96	0	0.09μ SRAM	1519
15070001	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1513
15070003	10M50	672 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15070037	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1525
15070038	EP3C25	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1519
15070047	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	45	192	0	0.18μ FLASH	1531
15070048	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	45	192	0	0.18μ FLASH	1531
15070049	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	45	192	0	0.18μ FLASH	1531
15080024	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15080025	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15080026	10M50	256 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1439
15080067	EPM240	100 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1531
15080068	EP2C5	208 PQFP	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1525
15080069	EP2C35	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1525
15080070	EP2C20	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1535
15080071	EP4SGX230	1517 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1531
15080072	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1519
15080073	EP1C6	144 TQFP	PRECON 3- 130C/85% RH	30	96	0	0.13μ SRAM	1531
15080074	EP2C8	208 PQFP	PRECON 3- 130C/85% RH	30	96	0	0.09μ SRAM	1519
15090005	10M16	144 EQFP	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1425

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
15090006	10M16	144 EQFP	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1425
15090007	10M50	484 FBGA	PRECON 3- 130C/85% RH	50	192	0	55nm FLASH	1435
15090027	EP3C10	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1531
15090051	EP2AGX260	1152 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1537
15090052	EP2AGX260	1152 FBGA	PRECON 3- 130C/85% RH	45	192	0	40nm SRAM	1537
15100001	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1524
15100007	5CGXC7	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1540
15100008	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1537
15100009	EP3C25	240 PQFP	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1531
15100017	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1542
15100018	EP3C25	256 FBGA	PRECON 3- 130C/85% RH	45	192	0	60nm SRAM	1542
15100025	5SGXMA	1517 FBGA	PRECON 3- 130C/85% RH	22	96	0	28nm SRAM	1517
15100035	EPM240Z	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1531
15100042	EP2AGX260	780 FBGA	PRECON 3- 130C/85% RH	25	192	0	40nm SRAM	1531
15110028	5SGXEA7	1517 FBGA	PRECON 3- 130C/85% RH	24	96	0	28nm SRAM	1547
14110009	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1446
14110010	EP2C20	240 PQFP	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
14110012	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1446
14110020	EP2C5	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1443
14110021	EP2C35	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
14110024	5AGTD7	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	28nm SRAM	1447
14110032	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1443
14110033	EP3C40	324 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1443
14110034	EPM240	100 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1443
14120005	EPM240	100 MBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1443
14120006	EPM240	100 MBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1443
14120007	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1443
15010009	EP20K160	356 SBGA	PRECON 3- 130C/85% RH	25	96	0	0.15μ SRAM	1449
15010015	EP2C5	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
15010016	EPC16	88 UBGA	PRECON 3- 130C/85% RH	45	96	0	0.35μ FLASH	1443
15010032	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	20	192	0	0.18μ FLASH	1501
15010033	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	20	192	0	0.18μ FLASH	1501
15020008	EP3C10	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1501
15020009	EP3C25	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1449
15020010	EP2C70	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1449
15020012	5SX9E	1517 SHBGA	PRECON 3- 130C/85% RH	25	96	0	28nm SRAM	1517
15020020	EP2C20	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1501
15020021	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1501
15020022	EP2C5	208 PQFP	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1501
15020024	EPM240	100 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1501
15020026	5CSTD6	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1501
15030001	5CGXC9	1152 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1501
15030002	EP4CGX150	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1501
15030005	EP2C35	672 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
15030007	EPM1270	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1501
15030020	5CSTD6	896 FBGA	PRECON 3- 130C/85% RH	25	192	0	28nm SRAM	1510
15030033	EP4CGX150	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1507
15030035	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1507
15030036	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1507
15030037	EP4SGX230	1517 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1507
15040015	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1507
15040016	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1507
15040020	EP3C25	240 PQFP	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1501
15040034	EP3SL200	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	65nm SRAM	1513
15040038	EP1S80	1508 FBGA	PRECON 3- 130C/85% RH	25	96	0	0.13μ FLASH	1513
15050003	EP2C8	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1513
15050009	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1513
14010008	5CGXC7	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1343



REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
14070002	EP2C20	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1425
14070004	EP20K400	672 FBGA	PRECON 3- 130C/85% RH	25	96	0	0.15μ SRAM	1419
14070005	EP3SL150	1152 FBGA	PRECON 3- 130C/85% RH	25	96	0	65nm SRAM	1419
14070012	EPM570Z	144 PFBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1425
14070047	EPM7064S	44 TQFP	PRECON 3- 130C/85% RH	45	96	0	0.5μ EEPROM	1419
14070049	EP3C120	484 PFBGA	PRECON 3- 130C/85% RH	30	96	0	60nm SRAM	1407
14080001	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1419
14080002	EPM2210	324 FBGA	PRECON 3- 130C/85% RH	30	96	0	0.18μ FLASH	1419
14080004	5CGXC9	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1428
14080005	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	15	192	0	60nm SRAM	1425
14080006	EP3C40	780 FBGA	PRECON 3- 130C/85% RH	15	192	0	60nm SRAM	1425
14080007	EP2C35	672 FBGA	PRECON 3- 130C/85% RH	15	192	0	0.09μ SRAM	1431
14080011	EP2C35	672 FBGA	PRECON 3- 130C/85% RH	15	192	0	0.09μ SRAM	1431
14080014	EP2AGX125	780 FBGA	PRECON 3- 130C/85% RH	25	192	0	40nm SRAM	1433
14090003	EP2C20	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1431
14090004	EP2C5	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1431
14090005	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090006	EP3C16	240 PQFP	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1431
14090007	EPM240	100 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090015	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090016	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090017	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090020	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14090021	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1431
14100001	EP3C120	780 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1437
14100003	EP2C5	208 PQFP	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
14100004	EP4CGX150	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	60nm SRAM	1439
14100005	EP2S130	1508 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.09μ SRAM	1437
14100006	5CGXC7	896 FBGA	PRECON 3- 130C/85% RH	30	192	0	28nm SRAM	1437
14100014	EPM1270	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1437
14100015	EPM570	256 FBGA	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1437
14100021	EPM570Z	144 TQFP	PRECON 3- 130C/85% RH	30	192	0	0.18μ FLASH	1437
14100023	EP1S40	1020 FBGA	PRECON 3- 130C/85% RH	25	96	0	0.13μ FLASH	1413
14100026	EP4SGX230	1517 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1437
14100027	EP4SGX230	1517 FBGA	PRECON 3- 130C/85% RH	25	96	0	40nm SRAM	1437

## Temperature Humidity Bias

Reference: JESD22-A101 (JEDEC Standard)

All lots are subjected to Biased Humidity test after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow. Stress can last up to 2000 Hrs.

## Temperature Humidity Bias Results

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16060014	5CGXC7	484 UBGA	PRECON 3-85/85THB	20	2000	0	28nm SRAM	1620
16060018	10M50	144 EQFP	PRECON 3-85/85THB	28	1000	0	55nm FLASH	1619
16060019	EP3SL200	1152 FBGA	PRECON 3-85/85THB	25	1000	0	65nm SRAM	1619
16070005	10M50	144 EQFP	PRECON 3-85/85THB	60	2000	0	55nm FLASH	1619
16070006	10M50	144 EQFP	PRECON 3-85/85THB	50	2000	0	55nm FLASH	1619
16070007	10M50	144 EQFP	PRECON 3-85/85THB	50	2000	0	55nm FLASH	1619
16080022	5CGXC4	484 UBGA	PRECON 3-85/85THB	20	2000	0	28nm SRAM	1635
16080032	EP4SGX230	1517 FBGA	PRECON 3-85/85THB	45	1000	0	40nm SRAM	1635
16100041	5CGXC9	484 UBGA	PRECON 3-85/85THB	35	2000	0	28nm SRAM	1645
16120047	5CGXC9	484 UBGA	PRECON 3-85/85THB	80	2000	0	28nm SRAM	1652
17020009	EP2AGX260	1152 FBGA	PRECON 3-85/85THB	30	1000	0	40nm SRAM	1701
17020014	EP3C120	780 FBGA	PRECON 3-85/85THB	30	2000	0	60nm SRAM	1701
15060050	10M50	672 FBGA	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1439
15060052	10M50	672 FBGA	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1439
15060053	10M50	672 FBGA	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1439
15060054	10M50	672 FBGA	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1439
15070002	10M50	144 EQFP	PRECON 3-85/85THB	90	1000	0	55nm FLASH	1425
15070003	10M50	672 FBGA	PRECON 3-85/85THB	75	2000	0	55nm FLASH	1439
15070027	10AX115	1517 FBGA	PRECON 3-85/85THB	50	1000	0	20nm SRAM	1529
15070038	EP3C25	256 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1519
15080024	10M50	256 FBGA	PRECON 3-85/85THB	28	2000	0	55nm FLASH	1439
15080025	10M50	256 FBGA	PRECON 3-85/85THB	28	2000	0	55nm FLASH	1439
15080026	10M50	256 FBGA	PRECON 3-85/85THB	28	2000	0	55nm FLASH	1439
15090005	10M16	144 EQFP	PRECON 3-85/85THB	50	2000	0	55nm FLASH	1425
15090006	10M16	144 EQFP	PRECON 3-85/85THB	50	2000	0	55nm FLASH	1425
15090007	10M50	484 FBGA	PRECON 3-85/85THB	32	2000	0	55nm FLASH	1435
15090052	EP2AGX260	1152 FBGA	PRECON 3-85/85THB	45	1000	0	40nm SRAM	1537
15100010	10M50	144 EQFP	PRECON 3-85/85THB	66	1000	0	55nm FLASH	1425
15100011	10M50	256 FBGA	PRECON 3-85/85THB	80	2000	0	55nm FLASH	1439
15100018	EP3C25	256 FBGA	PRECON 3-85/85THB	45	2000	0	65nm SRAM	1542
15100033	EP3C10	256 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1543
15100046	10AX115	1517 FBGA	PRECON 3-85/85THB	29	1000	0	20nm SRAM	1543
15110001	5CGXC9	896 FBGA	PRECON 3-85/85THB	45	2000	0	28nm SRAM	1544
15110003	5CGXC9	896 FBGA	PRECON 3-85/85THB	45	2000	0	28nm SRAM	1544
15110004	5CGXC9	896 FBGA	PRECON 3-85/85THB	45	2000	0	28nm SRAM	1544
15110009	EP2AGX260	1152 FBGA	PRECON 3-85/85THB	25	1000	0	40nm SRAM	1537
15110021	EP3C25	144 EQFP	PRECON 3-85/85THB	30	2000	0	40nm SRAM	1543
15110025	10M50	144 EQFP	PRECON 3-85/85THB	10	1000	0	55nm FLASH	1425
15110038	10M50	144 EQFP	PRECON 3-85/85THB	20	2000	0	55nm FLASH	1425
15110040	5CGXC7	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1543
15110042	EP2AGX260	1152 FBGA	PRECON 3-85/85THB	30	1000	0	40nm SRAM	1537
16010002	EP3C10	256 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1543
16010003	EP3C16	256 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1551
16010012	EP3C40	780 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1601
16010020	5CGXC9	1152 FBGA	PRECON 3-85/85THB	45	2000	0	28nm SRAM	1602
16010022	5CGXC9	1152 FBGA	PRECON 3-85/85THB	45	2000	0	28nm SRAM	1602
16030011	5CGXC9	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1607
16030015	EP3C25	256 FBGA	PRECON 3-85/85THB	45	2000	0	65nm SRAM	1611
16030016	EP3C25	256 FBGA	PRECON 3-85/85THB	45	2000	0	65nm SRAM	1614

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16030042	10AX115	1932 FBGA	PRECON 3-85/85THB	29	1000	0	20nm SRAM	1614
16040001	EP2AGX260	1152 FBGA	PRECON 3-85/85THB	25	1000	0	40nm SRAM	1614
16040017	5CSTD6	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1607
15010001	10M50	484 FBGA	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1435
15010022	5CGXC9	1152 FBGA	PRECON 3-85/85THB	30	2000	0	28nm SRAM	1443
15010024	10M50	256 FBGA	PRECON 3-85/85THB	28	2000	0	55nm FLASH	1439
15010025	10M50	256 FBGA	PRECON 3-85/85THB	28	1000	0	55nm FLASH	1439
15020011	10M50	484 FBGA	PRECON 3-85/85THB	32	2000	0	55nm FLASH	1435
15020026	5CSTD6	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1501
15010027	10M50	256 FBGA	PRECON 3-85/85THB	28	1000	0	55nm FLASH	1439
15030005	EP2C35	672 FBGA	PRECON 3-85/85THB	30	2000	0	0.09μ SRAM	1437
15030020	5CSTD6	896 FBGA	PRECON 3-85/85THB	25	1000	0	28nm SRAM	1501
15030033	EP4CGX150	896 FBGA	PRECON 3-85/85THB	30	2000	0	40 nm SRAM	1507
15030035	EP3C120	780 FBGA	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1507
15030036	EP3C120	780 FBGA	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1507
15030037	EP4SGX230	1517 FBGA	PRECON 3-85/85THB	25	1000	0	40 nm SRAM	1507
15040008	10M50	144 EQFP	PRECON 3-85/85THB	30	2000	0	55nm FLASH	1425
15040018	5CGXC5	301 MBGA	PRECON 3-85/85THB	40	1000	0	28nm SRAM	1513
15040020	EP3C25	240 PQFP	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1501
15040034	EP3SL200	1508 FBGA	PRECON 3-85/85THB	25	1000	0	65nm SRAM	1513
15060002	EP3SL150	1152 FBGA	PRECON 3-85/85THB	25	1000	0	65nm SRAM	1513
15060030	5CGXC9	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1524
15060034	EP2C70	672 FBGA	PRECON 3-85/85THB	30	2000	0	0.09μ SRAM	1519
15060060	EP2S130	1508 FBGA	PRECON 3-85/85THB	25	1000	0	0.09μ SRAM	1508
15080069	EP2C35	672 FBGA	PRECON 3-85/85THB	30	1000	0	0.09μ SRAM	1525
15080071	EP4SGX230	1517 FBGA	PRECON 3-85/85THB	25	1000	0	40 nm SRAM	1531
15080072	EP3C120	780 FBGA	PRECON 3-85/85THB	30	2000	0	60nm SRAM	1519
15080074	EP2C8	208 PQFP	PRECON 3-85/85THB	30	1000	0	0.09μ SRAM	1519
15090027	EP3C10	256 FBGA	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1531
15100001	5CGXC9	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1524
15100007	5CGXC7	896 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1540
15100009	EP3C25	240 PQFP	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1531
14100001	EP3C120	780 FBGA	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1437
14100004	EP4CGX150	896 FBGA	PRECON 3-85/85THB	30	1000	0	60nm SRAM	1439
14100023	EP1S40Z	1020 FBGA	PRECON 3-85/85THB	25	1000	0	0.13μ SRAM	1413
14100026	EP4SGX230	1517 FBGA	PRECON 3-85/85THB	25	1000	0	40 nm SRAM	1437
14100027	EP4SGX230	1517 FBGA	PRECON 3-85/85THB	25	1000	0	40 nm SRAM	1437
14110021	EP2C35	672 FBGA	PRECON 3-85/85THB	30	1000	0	0.09μ SRAM	1437
14110024	5AGTD7	1152 FBGA	PRECON 3-85/85THB	25	1000	0	28nm SRAM	1447
15010009	EP20K160	356 SBGA	PRECON 3-85/85THB	25	1000	0	0.15μ SRAM	1449
15020008	EP3C10	256 FBGA	PRECON 3-85/85THB	30	1500	0	60nm SRAM	1501
15020009	EP3C25	256 FBGA	PRECON 3-85/85THB	30	1500	0	60nm SRAM	1449
15030001	5CGXC9	1152 FBGA	PRECON 3-85/85THB	30	1000	0	28nm SRAM	1510
14070004	EP20K400	672 FBGA	PRECON 3-85/85THB	25	1000	0	0.15μ SRAM	1419
14070005	EP3SL150	1152 FBGA	PRECON 3-85/85THB	30	1000	0	65nm SRAM	1419
14080004	5CGXC9	896 FBGA	PRECON 3-85/85THB	30	2000	0	28nm SRAM	1428

# Highly Accelerated Stress Testing

Reference: JESD22-A110 (JEDEC Standard)

All lots are subjected to HAST test after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow

## HAST Results

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16060016	10M25	484 FBGA	PRECON 3-HAST	25	192	0	55nm FLASH	1607
16060017	10M08	256 FBGA	PRECON 3-HAST	28	192	0	55nm FLASH	1619
16060038	EP20K100	240 PQFP	PRECON 3-HAST	63	96	0	0.22um SRAM	1625
16060039	EP20K100	240 PQFP	PRECON 3-HAST	14	96	0	0.22um SRAM	1625
16060056	EPF6016A	144 TQFP	PRECON 3-HAST	25	96	0	0.3um SRAM	1613
16060057	EPF10K30	144 TQFP	PRECON 3-HAST	25	96	0	0.22um SRAM	1613
16060058	EP2C8	256 FBGA	PRECON 3-HAST	22	192	0	90nm SRAM	1629
16080001	EPM1270	256 FBGA	PRECON 3-HAST	28	192	0	0.18um FLASH	1607
16080004	EPM570	100TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1607
16090028	EPM2210	256 FBGA	PRECON 3-HAST	77	192	0	0.18um FLASH	1640
16090028	EPM2210	256 FBGA	PRECON 3-HAST	77	192	0	0.18um FLASH	1640
16090028	EPM2210G	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1631
16100010	EPM570Z	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1631
16100026	10M50	672 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1642
17030035	10M50	484 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1631
17050022	10M50	484 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1701
17050030	10M50	484 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1701
15060001	EPM2210	256 FBGA	PRECON 3-HAST	30	96	0	0.18um FLASH	1507
15060004	EPF10K100	208 PQFP	PRECON 3-HAST	25	96	0	0.22um SRAM	1349
15060032	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	90nm SRAM	1519
15060055	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1519
15060056	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1519
15060057	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1519
15060058	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1519
15060059	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1519
15070047	EPM1270	256 FBGA	PRECON 3-HAST	45	192	0	0.18um FLASH	1531
15070048	EPM1270	256 FBGA	PRECON 3-HAST	45	192	0	0.18um FLASH	1531
15070049	EPM1270	256 FBGA	PRECON 3-HAST	45	192	0	0.18um FLASH	1531
15080067	EPM240	100 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1531
15080068	EP2C5	208 PQFP	PRECON 3-HAST	30	192	0	90nm SRAM	1535
15080070	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	90nm SRAM	1535
15080073	EP1C6	144 TQFP	PRECON 3-HAST	30	96	0	0.13um SRAM	1531
15090035	10M50	256 FBGA	PRECON 3-HAST	28	192	0	55nm FLASH	1439
15100008	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1537
15100017	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1542
15100034	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	90nm SRAM	1543
15100035	EPM240Z	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1531
15100027	10M50	672 FBGA	PRECON 3-HAST	45	192	0	55nm FLASH	1545
15100029	10M50	672 FBGA	PRECON 3-HAST	15	192	0	55nm FLASH	1439
15110039	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1548
15120020	EPM240Z	100 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1543
15120021	EPM1270G	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1543
15120026	10M50	672 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1439
16010001	EPM570	256 MBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1525
16010018	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1601
16010019	EPM1270	256 FBGA	PRECON 3-HAST	30	96	0	0.18um FLASH	1601
16020024	10M08	81 VBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1538
16030006	EP2C5	208 PQFP	PRECON 3-HAST	30	192	0	90nm SRAM	1601
16030007	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1611
16030019	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1607

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
16030023	10M50	484 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1535
16030038	EPC1S	20 PLCC	PRECON 3-HAST	45	96	0	0.5um EPROM	1537
16040014	EPM7032AE	44 TQFP	PRECON 3-HAST	45	96	0	0.3um EEPROM	1607
16040015	EPM570Z	100 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1607
16040018	10M50	256 FBGA	PRECON 3-HAST	45	192	0	55nm FLASH	1439
16040019	10M50	256 FBGA	PRECON 3-HAST	77	192	0	55nm FLASH	1439
16040024	10M50	484 FBGA	PRECON 3-HAST	30	192	0	55nm FLASH	1607
16040025	10M50	256 FBGA	PRECON 3-HAST	45	192	0	55nm FLASH	1614
16050002	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1613
16050006	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18um FLASH	1613
16050008	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1607
16050010	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18um FLASH	1613
16050032	EPM2210	256 FBGA	PRECON 3-HAST	30	96	0	0.18um FLASH	1613
16050033	10M08	484 FBGA	PRECON 3-HAST	30	96	0	55nm FLASH	1620
16060016	10M25	484 FBGA	PRECON 3-HAST	25	192	0	55nm FLASH	1607
16060017	10M08	256 FBGA	PRECON 3-HAST	28	192	0	55nm FLASH	1619
16060056	EPF6016	144 TQFP	PRECON 3-HAST	25	96	0	0.35μ SRAM	1613
15050010	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1513
15060001	EPM2210	256 FBGA	PRECON 3-HAST	30	96	0	0.18μ FLASH	1507
15060004	EPF10K100	208 PQFP	PRECON 3-HAST	25	96	0	0.22μ SRAM	1349
15060032	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1519
15060055	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1519
15060056	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1519
15060057	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1519
15060058	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1519
15060059	EPM1270	144 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1519
15070047	EPM1270	256 FBGA	PRECON 3-HAST	45	192	0	0.18μ FLASH	1531
15080068	EP2C5	208 PQFP	PRECON 3-HAST	30	192	0	0.09μ SRAM	1525
15080070	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1535
15080073	EP1C6	144 TQFP	PRECON 3-HAST	30	96	0	0.13μ SRAM	1531
15100035	EPM240Z	144 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1531
14110010	EP2C20	240 PQFP	PRECON 3-HAST	30	192	0	0.09μ SRAM	1437
14110020	EP2C5	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1443
14110032	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1443
14120007	EPM570	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1443
15010015	EP2C5	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1437
15010016	EPC16	88 UBGA	PRECON 3-HAST	45	96	0	0.35μ FLASH	1443
15010033	EPM1270	256 FBGA	PRECON 3-HAST	40	192	0	0.18μ FLASH	1501
15020020	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1501
15020021	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1501
15010022	EP2C5	208 PQFP	PRECON 3-HAST	30	192	0	0.09μ SRAM	1501
15020024	EPM240	100 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1501
15040016	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1507
15040017	EPM7256AE	256 FBGA	PRECON 3-HAST	25	96	0	0.35μ FLASH	1513
15050009	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1513
14060029	EP2C8	208 PQFP	PRECON 3-HAST	30	192	0	0.09μ SRAM	1419
14070002	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1425
14070012	EPM570Z	144 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1425
14070047	EPM7064	44 TQFP	PRECON 3-HAST	45	96	0	0.5μ EEPROM	1419
14080001	EPM570	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1419
14090003	EP2C20	256 FBGA	PRECON 3-HAST	30	192	0	0.09μ SRAM	1431
14090005	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1431
14090006	EP3C16	240 PQFP	PRECON 3-HAST	30	192	0	60nm SRAM	1431
14090007	EPM240	100 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1431
14090008	EPM240	100 TQFP	PRECON 3-HAST	30	96	0	0.18μ FLASH	1431
14090015	EPM1270	256 FBGA	PRECON 3-HAST	30	96	0	0.18μ FLASH	1431
14090016	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1431
14090017	EPM570	256 FBGA	PRECON 3-HAST	30	96	0	0.18μ FLASH	1431
14090020	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1431

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	STRESS HOURS	# FAIL	TECHNOLOGY	DATE CODE
14090021	EPM570	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1431
14100003	EP2C5	208 PQFP	PRECON 3-HAST	30	192	0	0.09μ SRAM	1437
14100014	EPM1270	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1437
14100015	EPM570	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1437
14100017	EPM570	256 FBGA	PRECON 3-HAST	30	192	0	0.18μ FLASH	1437
14100021	EPM570Z	144 TQFP	PRECON 3-HAST	30	192	0	0.18μ FLASH	1437
14100037	EPM7256	256 FBGA	PRECON 3-HAST	25	96	0	0.22μ FLASH	1437

# Temperature Cycling

Reference: JESD22-A104C (JEDEC Standard)

All lots are subjected to T/C B after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow. Stress can be pushed up to 2000 cycles.

## Temperature Cycling Results

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF CYCLES	# FAIL	TECHNOLOGY	DATE CODE
16060002	10AX115	1932 FBGA	PRECON 3-TEMP CYC B	76	2000	0	20nm SRAM	1623
16060012	EP2S30	484 FBGA	PRECON 3-TEMP CYC B	25	1000	0	90nm SRAM	1619
16060014	5CGXC7	484 UBGA	PRECON 3-TEMP CYC B	20	2000	0	28nm SRAM	1620
16060019	EP3SL200	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1619
16060056	EPF6016A	144 TQFP	PRECON 3-TEMP CYC B	25	1000	0	0.35μ SRAM	1613
16060057	EPF10K30	144 TQFP	PRECON 3-TEMP CYC B	25	1000	0	0.22μ SRAM	1613
16080022	5CGXC4	484 UBGA	PRECON 3-TEMP CYC B	20	2000	0	28nm SRAM	1635
16080027	5CGXC9	484 UBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1501
16090017	EP3SL150	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1637
16090034	5SGXMA4	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	28nm SRAM	1631
16100001	10M50	484 FBGA	PRECON 3-TEMP CYC B	30	1000	0	55nm FLASH	1613
16100007	5CGXC9	484 UBGA	PRECON 3-TEMP CYC B	30	1000	0	28nm SRAM	1504
16110003	5CGXC9	1152 FBGA	PRECON 3-TEMP CYC B	77	2000	0	28nm SRAM	1642
16110004	5CGXC9	1152 FBGA	PRECON 3-TEMP CYC B	77	2000	0	28nm SRAM	1642
16120026	EPM240	64 EQFP	PRECON 3-TEMP CYC B	20	2000	0	0.18μ FLASH	1643
17010008	EP3C40	484 FBGA	PRECON 3-TEMP CYC B	25	2000	0	60nm SRAM	1642
17020009	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	30	1000	0	40nm SRAM	1701
17020014	EP3C120	780 FBGA	PRECON 3-TEMP CYC B	30	2000	0	60nm SRAM	1701
17030032	EPM2210	256 FBGA	PRECON 3-TEMP CYC B	77	2000	0	0.18μ FLASH	1707
17050023	5SGXA7	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	28nm SRAM	1613
17050024	5SGXA7	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	28nm SRAM	1613
17080053	EN5322QI	24 QFN	PRECON 3-TEMP CYC B	45	1000	0	Power devices	1706
17080055	EP53A8LQA	16 QFN	PRECON 3-TEMP CYC B	45	1000	0	Power devices	1623
15060050	10M50	672 FBGA	PRECON 3-TEMP CYC B	45	2000	0	55nm FLASH	1439
15060052	10M50	672 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1439
15060053	10M50	672 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1439
15070002	10M50	144 EQFP	PRECON 3-TEMP CYC B	40	2000	0	55nm FLASH	1425
15070028	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	49	2000	0	20nm SRAM	1529
15090008	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090009	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	10	2000	0	20nm SRAM	1535
15090010	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090011	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090012	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090013	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090014	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	21	2000	0	20nm SRAM	1535
15090056	EP4SGX110	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15100002	EP4SGX110	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15100010	10M50	144 EQFP	PRECON 3-TEMP CYC B	44	1000	0	55nm FLASH	1425
15100011	10M50	256 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1439
15110001	5CGXC9	896 FBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1544
15110003	5CGXC9	896 FBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1544
15110004	5CGXC9	896 FBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1544
15110015	5AGTD3	1152 FBGA	PRECON 3-TEMP CYC B	50	2000	0	28nm SRAM	1545
16020007	10AX115	1932 FBGA	PRECON 3-TEMP CYC B	54	2000	0	20nm SRAM	1606
16020008	10AX115	1932 FBGA	PRECON 3-TEMP CYC B	46	2000	0	20nm SRAM	1602
16020024	10M08	VBGA 81	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1538
16020059	10M08	VBGA 36	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1549

REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF CYCLES	# FAIL	TECHNOLOGY	DATE CODE
16020060	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	97	2000	0	20nm SRAM	1602
16030001	10AX115	1517 FBGA	PRECON 3-TEMP CYC B	46	2000	0	20nm SRAM	1608
16030015	EP3C25	256 FBGA	PRECON 3-TEMP CYC B	55	2000	0	65nm SRAM	1611
16040006	10M50	672 FBGA	PRECON 3-TEMP CYC B	83	2000	0	55nm FLASH	1614
16040007	10M50	672 FBGA	PRECON 3-TEMP CYC B	77	2000	0	55nm FLASH	1614
16040016	EP3C120	780 FBGA	PRECON 3-TEMP CYC B	28	1000	0	65nm SRAM	1615
16040025	10M50	484 FBGA	PRECON 3-TEMP CYC B	28	1000	0	55nm FLASH	1607
15010001	10M50	484 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1435
15010003	10M08	MBGA 153	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1425
15010004	10M08	MBGA 153	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1425
15010005	10M08	MBGA 153	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1425
15010006	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1437
15010007	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1437
15010009	EP20K160E	356 SBGA	PRECON 3-TEMP CYC B	25	1000	0	0.18μ SRAM	1449
15010012	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1501
15010013	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1501
15010014	5CSTD6	672 UBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1401
15010020	EP2S130	1508 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.09μ SRAM	1443
15010022	5CGXC9	1152 FBGA	PRECON 3-TEMP CYC B	30	1000	0	28nm SRAM	1443
15020005	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1501
15020006	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	30	2000	0	28nm SRAM	1501
15030020	5CSTD6	896 FBGA	PRECON 3-TEMP CYC B	25	2000	0	28nm SRAM	1501
15040006	10M50	144 EQFP	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1425
15040008	10M50	144 EQFP	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1425
15040018	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	1000	0	28nm SRAM	1513
15040038	EP1S80	1508 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.13μ SRAM	1513
15060002	EP3SL150	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1513
15060003	EP1C4	400 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.13μ SRAM	1425
15060004	EP1K100	208 PQFP	PRECON 3-TEMP CYC B	25	1000	0	0.22μ SRAM	1349
15060024	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15060034	EP2C70	672 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1519
15060054	10M50	672 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1439
15060055	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060056	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060057	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060060	EP2S130	1508 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.09μ SRAM	1519
15060063	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15060064	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15070041	10M08	153 MBGA	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1423
15070047	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	45	2000	0	0.18μ FLASH	1531
15070048	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	45	2000	0	0.18μ FLASH	1531
15080071	EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40nm SRAM	1531
15080072	EP3C120	780 FBGA	PRECON 3-TEMP CYC B	30	1000	0	60nm SRAM	1519
15080073	EP1C6	144 TQFP	PRECON 3-TEMP CYC B	30	1000	0	0.13μ SRAM	1531
15080074	EP2C8	208 PQFP	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1519
15090005	10M16	144 EQFP	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1425
15090051	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090052	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090053	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090056	EP4SGX110	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15100017	484 FBGA	484 FBGA	PRECON 3-TEMP CYC B	50	1000	0	55nm FLASH	1436
14100005	EP2S130	1508 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437
14100023	EP1S40Z	1020 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.13μ SRAM	1413
14100026	EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1437
14100027	EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1437
14100037	EPM7256B	256 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.35μ EEPROM	1437
15010011	EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15010015	EP2C5	256 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437



REL LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF CYCLES	# FAIL	TECHNOLOGY	DATE CODE
15010016	EPC16	88 UBGA	PRECON 3-TEMP CYC B	45	1000	0	0.35 FLASH	1443
15010017	EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15020012	5SX9E	1517 SHBGA	PRECON 3-TEMP CYC B	25	700	0	28nm SRAM	1502
15020015	EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15030005	EP2C35	672 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437
15030006	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1501
15030007	EPM1270	144 TQFP	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1501
15030033	EP4CGX150	896 FBGA	PRECON 3-TEMP CYC B	30	1000	0	60nm SRAM	1507
15030037	EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1507
15040017	EPM7256A	256 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.35μ EEPROM	1513
15040034	EP3SL200	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1513
14070004	EP20K400	672 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.15μ SRAM	1419
14070005	EP3SL150	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1419
14070012	EPM570Z	144 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1425
14070047	EPM7064S	44 TQFP	PRECON 3-TEMP CYC B	45	1000	0	0.5μ EEPROM	1419
14070049	EP3C120	484 FBGA	PRECON 3-TEMP CYC B	30	1000	0	60nm SRAM	1407
14080001	EPM570	256 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1419
14080002	EPM2210	324 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1337
14080004	5CGXC9	896 FBGA	PRECON 3-TEMP CYC B	30	1000	0	28nm SRAM	1428
14080012	EP2C35	672 FBGA	PRECON 3-TEMP CYC B	15	1000	0	0.09μ SRAM	1431
14080014	EP2AGX125	780 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40nm SRAM	1433
14100021	EPM570Z	144 TQFP	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1437
14020019	5SGXA7	1517 FBGA	PRECON 3-TEMP CYC B	25	1123	0	28 nm SRAM	1406
14020041	EP20K600	652 TBGA	PRECON 3-TEMP CYC B	30	1500	0	0.22μ SRAM	1408
14030011	5AGTD7	1932 FBGA	PRECON 3-TEMP CYC B	24	2000	0	28 nm SRAM	1411
15040008	10M50	144 EQFP	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1425
15040018	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	1000	0	28nm SRAM	1513
15040038	EP1S80	1508 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.13μ SRAM	1513
15060002	EP3SL150	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1513
15060003	EP1C4	400 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.13μ SRAM	1425
15060004	EP1K100	208 PQFP	PRECON 3-TEMP CYC B	25	1000	0	0.22μ SRAM	1349
15060024	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15060034	EP2C70	672 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1519
15060054	10M50	672 FBGA	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1439
15060055	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060056	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060057	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	2000	0	0.18μ FLASH	1519
15060060	EP2S130	1508 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.09μ SRAM	1519
15060063	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15060064	5CGXC5	301 MBGA	PRECON 3-TEMP CYC B	45	2000	0	28nm SRAM	1519
15070041	10M08	153 MBGA	PRECON 3-TEMP CYC B	30	2000	0	55nm FLASH	1423
15070047	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	45	2000	0	0.18μ FLASH	1531
15070048	EPM1270	256 FBGA	PRECON 3-TEMP CYC B	45	2000	0	0.18μ FLASH	1531
15080071	EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40nm SRAM	1531
15080072	EP3C120	780 FBGA	PRECON 3-TEMP CYC B	30	1000	0	60nm SRAM	1519
15080073	EP1C6	144 TQFP	PRECON 3-TEMP CYC B	30	1000	0	0.13μ SRAM	1531
15080074	EP2C8	208 PQFP	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1519
15090005	10M16	144 EQFP	PRECON 3-TEMP CYC B	50	2000	0	55nm FLASH	1425
15090051	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090052	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090053	EP2AGX260	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15090056	EP4SGX110	1152 FBGA	PRECON 3-TEMP CYC B	45	2000	0	40nm SRAM	1537
15100017	484 FBGA	484 FBGA	PRECON 3-TEMP CYC B	50	1000	0	55nm FLASH	1436
14100005	EP2S130	1508 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437
14100023	EP1S40Z	1020 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.13μ SRAM	1413

REL #	LOT #	DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF CYCLES	# FAIL	TECHNOLOGY	DATE CODE
14100026		EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1437
14100027		EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1437
14100037		EPM7256B	256 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.35μ EEPROM	1437
15010011		EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15010015		EP2C5	256 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437
15010016		EPC16	88 UBGA	PRECON 3-TEMP CYC B	45	1000	0	0.35 FLASH	1443
15010017		EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15020012		5SX9E	1517 SHBGA	PRECON 3-TEMP CYC B	25	700	0	28nm SRAM	1502
15020015		EP2AGX65	358 UBGA	PRECON 3-TEMP CYC B	30	2000	0	40nm SRAM	1447
15030005		EP2C35	672 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.09μ SRAM	1437
15030006		EPM1270	256 FBGA	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1501
15030007		EPM1270	144 TQFP	PRECON 3-TEMP CYC B	30	1000	0	0.18μ FLASH	1501
15030033		EP4CGX150	896 FBGA	PRECON 3-TEMP CYC B	30	1000	0	60nm SRAM	1507
15030037		EP4SGX230	1517 FBGA	PRECON 3-TEMP CYC B	25	1000	0	40 nm SRAM	1507
15040017		EPM7256A	256 FBGA	PRECON 3-TEMP CYC B	25	1000	0	0.35μ EEPROM	1513
15040034		EP3SL200	1152 FBGA	PRECON 3-TEMP CYC B	25	1000	0	65nm SRAM	1513

## PowerSoC Device Package Stress

All packages are QFN, DFN types in different sizes.

### High Temperature Storage

DEVICE	PACKAGE TYPE	BAKE TEMP.	# UNITS	# OF HOURS	# FAIL
EN5310DC, EN5330DC	DFN 8.1x12.5x2.1mm	150	480	1000	0
EN5360DC	DFN 8.1x17x2.1mm	150	160	1000	0
EP5348UI	QFN 1.75x2x0.9 mm	150	155	1000	0
EP5358LUI EP5358HUI EP5368QI EP5388QI EP53A8LQI EP53A8HQI EP53F8QI	QFN 1.75x2x0.9 mm	150	399	1000	0
EP5352QI EP5362QI EP5382QI EN5311QI EN5312QI	QFN 4x5x1.1mm	150	320	1000	0
EN5322QI EN5339QI	QFN 4x6x1.1mm	150	240	1000	0
EN5335QI EN5336QI	QFN 7.5x10x1.85mm	150	231	1000	0
EN5365QI EN5366QI	QFN 10x12x1.85mm	150	381	1000	0
EN5364QI EN5394QI EN5395QI EN5396QI	QFN 8x11x1.85mm 10x12x1.85mm	150	80	1000	0
EN5337QI	QFN 4x7x1.85mm	150	80	1000	0
EN6360QI, EN63A0QI	QFN 8x11x3mm 10x11x3mm	150	160	1000	0
EN2340QI, EN2360QI, EN2390QI, EN23F0QI	QFN 8x11x3mm 10x11x3mm 12x13x3mm	150	320	1000	0
EV1320QI	QFN 3x3x0.55mm	150	480	1000	0
EV1340QI	QFN 5.5x10x3mm	150	160	1000	0
EV1380QI	QFN 8x11x3mm	150	160	1000	0
EC2360QI	QFN 5.5x5.5x0.9mm	150	80	1000	0
EQC1240QI	QFN 4x4x0.75mm	150	240	1000	0

## Unbiased HAST / Autoclave

All lots are subjected to Unbiased HAST or Autoclave test after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow.

DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF HOURS	# FAIL
EN5310DC, EN5330DC	DFN 8.1x12.5x2.1mm	PRECON 3- 130C/85% RH	475	96	0
EN5360DC	DFN 8.1x17x2.1mm	PRECON 3- 130C/85% RH	160	96	0
EP5348UI	QFN 1.75x2x0.9 mm	PRECON 3- 121°C/100% RH	240	96	0
EP5358LUI EP5358HUI EP5368QI EP5388QI EP53A8LQI EP53A8HQI EP53F8QI	QFN 1.75x2x0.9 mm	PRECON 3- 121°C/100% RH	240	96	0
		PRECON 3- 130C/85% RH	160	96	0
EP5352QI EP5362QI EP5382QI EN5311QI EN5312QI	QFN 4x5x1.1mm	PRECON 3- 130C/85% RH	551	96	0
EN5322QI EN5339QI	QFN 4x6x1.1mm	PRECON 3- 121°C/100% RH	320	96	0
EN5335QI EN5336QI	QFN 7.5x10x1.85mm	PRECON 3- 121°C/100% RH	240	96	0
EN5365QI EN5366QI	QFN 10x12x1.85mm	PRECON 3- 121°C/100% RH	240	96	0
		PRECON 3- 130C/85% RH	158	96	0
EN5364QI EN5394QI EN5395QI EN5396QI	QFN 8x11x1.85mm 10x12x1.85mm	PRECON 3- 121°C/100% RH	240	96	0
EN5337QI	QFN 4x7x1.85mm	PRECON 3- 121°C/100% RH	80	96	0
EN5367QI	QFN 5.5x10x3mm	PRECON 3- 121°C/100% RH	80	96	0
EN6360QI, EN63A0QI	QFN 8x11x3mm 10x11x3mm	PRECON 3- 121°C/100% RH	160	96	0
EN2340QI, EN2360QI, EN2390QI, EN23F0QI	QFN 8x11x3mm 10x11x3mm 12x13x3mm	PRECON 3- 121°C/100% RH	400	96	0
EV1320QI	QFN 3x3x0.55mm	PRECON 3- 121°C/100% RH	480	96	0
EV1340QI	QFN 5.5x10x3mm	PRECON 3- 121°C/100% RH	160	96	0
EV1380QI	QFN 8x11x3mm	PRECON 3- 121°C/100% RH	80	96	0
EC2360QI	QFN 5.5x5.5x0.9mm	PRECON 3- 121°C/100% RH	160	96	0
EQC1240QI	QFN 4x4x0.75mm	PRECON 3- 121°C/100% RH	320	96	0

## Temperature Humidity Test

All lots are subjected to Biased Humidity test after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow.

DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF HOURS	# FAIL
EN5310DC, EN5330DC	DFN 8.1x12.5x2.1mm	PRECON 3-85/85THB	463	1000	0
EN5360DC	DFN 8.1x17x2.1mm	PRECON 3-85/85THB	159	1000	0
EP5348UI	QFN 1.75x2x0.9 mm	PRECON 3-85/85THB	80	1000	0
EP5358LUI EP5358HUI EP5368QI EP5388QI EP53A8LQI EP53A8HQI EP53F8QI	QFN 1.75x2x0.9 mm	PRECON 3-85/85THB	79	1000	0
EP5352QI EP5362QI EP5382QI EN5311QI EN5312QI	QFN 4x5x1.1mm	PRECON 3-85/85THB	239	1000	0
EN5322QI EN5339QI	QFN 4x6x1.1mm	PRECON 3-85/85THB	159	1000	0
EN5335QI EN5336QI	QFN 7.5x10x1.85mm	PRECON 3-85/85THB	80	1000	0
EN5365QI EN5366QI	QFN 10x12x1.85mm	PRECON 3-85/85THB	240	1000	0
EN5364QI EN5394QI EN5395QI EN5396QI	QFN 8x11x1.85mm 10x12x1.85mm	PRECON 3-85/85THB	160	1000	0
EN5337QI	QFN 4x7x1.85mm	PRECON 3-85/85THB	80	1000	0
EN5367QI	QFN 5.5x10x3mm	PRECON 3-85/85THB	80	1000	0
EN6337QI, EN6347QI	QFN 4x7x1.85mm	PRECON 3-85/85THB	80	1000	0
EN6360QI, EN63A0QI	QFN 8x11x3mm 10x11x3mm	PRECON 3-85/85THB	160	1000	0
EN2340QI, EN2360QI, EN2390QI, EN23F0QI	QFN 8x11x3mm 10x11x3mm 12x13x3mm	PRECON 3-85/85THB	78	1000	0
EV1320QI	QFN 3x3x0.55mm	PRECON 3-85/85THB	78	1000	0
EV1340QI	QFN 5.5x10x3mm	PRECON 3-85/85THB	80	1000	0
EV1380QI	QFN 8x11x3mm	PRECON 3-85/85THB	80	1000	0
EC2360QI	QFN 5.5x5.5x0.9mm	PRECON 3-85/85THB	80	1000	0
EQC1240QI	QFN 4x4x0.75mm	PRECON 3-85/85THB	80	1000	0

## Temperature Cycling: (Conditions C: -65°C to +150°C 500 cycles)

All lots are subjected to T/C after being preconditioned to JEDEC standard moisture sensitivity level (MSL) and subjected to a 3X reflow.

DEVICE	PACKAGE TYPE	RELIABILITY TEST	# UNITS	# OF CYCLES	# FAIL
EN5310DC, EN5330DC	DFN 8.1x12.5x2.1mm	PRECON 3-TEMP CYC C	434	500	0
EN5360DC	DFN 8.1x17x2.1mm	PRECON 3-TEMP CYC C	200	500	0
EP5348UI	QFN 1.75x2x0.9 mm	PRECON 3-TEMP CYC C	240	500	0
EP5358LUI EP5358HUI EP5368QI EP5388QI EP53A8LQI EP53A8HQI EP53F8QI	QFN 1.75x2x0.9 mm	PRECON 3-TEMP CYC C	400	500	0
EP5352QI EP5362QI EP5382QI EN5311QI EN5312QI	QFN 4x5x1.1mm	PRECON 3-TEMP CYC C	1089	500	0
EN5322QI EN5339QI	QFN 4x6x1.1mm	PRECON 3-TEMP CYC C	320	500	0
EN5335QI EN5336QI	QFN 7.5x10x1.85mm	PRECON 3-TEMP CYC C	311	500	0
EN5365QI EN5366QI	QFN 10x12x1.85mm	PRECON 3-TEMP CYC C	391	500	0
EN5364QI EN5394QI EN5395QI EN5396QI	QFN 8x11x1.85mm 10x12x1.85mm	PRECON 3-TEMP CYC C	160	500	0
EN5337QI	QFN 4x7x1.85mm	PRECON 3-TEMP CYC C	80	500	0
EN5367QI	QFN 5.5x10x3mm	PRECON 3-TEMP CYC C	80	500	0
EN6360QI, EN63A0QI	QFN 8x11x3mm 10x11x3mm	PRECON 3-TEMP CYC C	160	500	0
EN2340QI, EN2360QI, EN2390QI, EN23F0QI	QFN 8x11x3mm 10x11x3mm 12x13x3mm	PRECON 3-TEMP CYC C	480	500	0
EV1320QI	QFN 3x3x0.55mm	PRECON 3-TEMP CYC C	480	500	0
EV1340QI	QFN 5.5x10x3mm	PRECON 3-TEMP CYC C	160	500	0
EV1380QI	QFN 8x11x3mm	PRECON 3-TEMP CYC C	80	500	0
EC2360QI	QFN 5.5x5.5x0.9mm	PRECON 3-TEMP CYC C	160	500	0
EQC1240QI	QFN 4x4x0.75mm	PRECON 3-TEMP CYC C	320	500	0

## Solder Joint Reliability

Reference: IPC9701

Solder Joint Reliability is measured by temperature cycling devices on a printed circuit board from 0°C to 100°C. The number of cycle can go to up to 6000 cycles to detect first fail.

### Tin-Lead (Sn-Pb) Solder Ball

PACKAGES	SUBSTRATE PAD SIZE	PITCH	TECHNOLOGY	HEAT SINK	DIE SIZE (mm)	MTTF (Cycles)	CYCLES TO 0.1% FAILS (Extrapolated)
M301	0.30mm	0.5mm	Cu-pillar + Flip Chip 4 Layer BT	None	11x11	0 fails to 5000	0 fails to 5000
U88	0.4 mm	0.8 mm	Wire-bonded Stacked Die + 2L FR4 substrate	None	6.9 * 4.6	4068	3162
E144	NA	0.5mm	lead frame + ground pad	None	5.12 * 5.21	0 fail to 6000	0 fails to 6000
QFN148	NA	0.5mm	lead frame + ground pad	None	5.12 * 5.21	2839	2119
F256	0.45mm	1.0mm	low k die + Wire Bond + 4 Layer BT	None	5.80*6.22	4798	3775
F256	0.45mm	1.0mm	low k die + Wire Bond + 4 Layer BT	None	5.80*6.22	5058	3236
F256	0.45mm	1.0mm	low k die + Wire Bond + 4 Layer BT	None	5.80*6.22	4194	2161
F256	0.45 mm	1.0 mm	Wire Bond + 2 Layer BT	None	8.8 * 7.9	4437	3687
F256 thin outline	0.45 mm	1.0 mm	low k die + Wire Bond + 4 Layer BT	None	7.68 * 6.81	3574	2888
F256	0.45mm	1.0mm	Wire bond + 2Layer BT	None	5.46 x 5.85	4437	3713
B356	0.58 mm	1.27 mm	Wire Bond + 2 Layer BT	None	9 * 9.8	0 fail to 5000	0 fails to 5000
U358	0.4mm	0.8mm	Lid-less Flip-Chip + 4L build up BT	None	10.11*10	2777	2740
U484	0.4mm	0.8mm	low k die + Wire Bond + 4 Layer BT	None	8.4 * 8.03	0 fail to 5000	0 fails to 5000
B652	0.58 mm	1.27 mm	Wire bond + 1 Layer Tape	Cu	17.01 * 15.38	0 fail to 5000	0 fails to 5000
B724	0.55 mm	1.27 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	18.1 * 13.4	0 fail to 2800	0 fails to 2800
F484	0.45 mm	1.0 mm	Wire bond + 2 layer BT	None	11.5 * 11.5	6534	3408
F672	0.45 mm	1.0 mm	Wire Bond + 4 Layer BT	None	11.19*11.12	5601	4448
F672	0.45 mm	1.0 mm	Wire Bond + 4 Layer BT	None	16 * 11.8	0 fail at 5200	0 fails at 5200
F672	0.45 mm	1.0 mm	Wire Bond + 4 Layer BT	None	16 * 11.8	0 fail at 5400	0 fails at 5400
F672	0.45mm	1.0mm	Low K die + Wire Bond + 4 Layer BT	None	8.4 * 8.03	0 fail to 5400	0 fails to 5400
F672	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	AlSiC	19.1 * 16.5	4419	3284
F672	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	AlSiC	19.1 * 16.5	0 fail to 5700	0 fails to 5700
F672	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	AlSiC	16.5 * 13.1	5304	3437
F672	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	AlSiC	16.5 * 13.1	4130	3487

PACKAGES	SUBSTRATE PAD SIZE	PITCH	TECHNOLOGY	HEAT SINK	DIE SIZE (mm)	MTTF (Cycles)	CYCLES TO 0.1% FAILS (Extrapolated)
F672	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	AlSiC	16.5 * 13.1	0 fail to 5100	0 fails to 5100
F672	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	16.5 * 13.1	0 fail to 5400	0 fails to 5400
F780	0.45mm	1.0mm	Wire bond + 4Layer BT	None	10.7 5* 11.62	5087	3413
F780	0.45mm	1.0mm	Wire bond + 2Layer BT	None	10.7 5* 11.62	5318	4380
F780	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	16.3 * 13.5	5890	4614
F780	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	16.3 * 13.5	0 fail to 4500	0 fails to 4500
F896	0.45mm	1.0 mm	Wire bonded + 4 layer BT	None	8.86 * 9.96	0 fail to 4000	0 fails to 4000
F896	0.45mm	1.0 mm	Wire bonded + 4 layer BT	None	11.19*11.12	5148	3080
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	AlSiC	22.6 * 19.9	0 fail to 6000	0 fails to 6000
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	AlSiC	22.6 * 19.9	8897	5670
F896	0.45 mm	1mm	Wire Bond + 2 Layer BT	None	13.16 X 12.39mm	3911	2927
F896	0.45mm	1.0mm	N20 triple row staggered Wire bond + 2Layer BT	None	10.9 X 10.5 (N28 ELK die)	4512	3307
F896	0.45mm	1.0mm	WB+ 2 layer BT + OSP surface finish	None	13.16 X 12.39	0 fail to 3500	0 fails to 3500
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	22.1 * 19.4	5781	5174
F1020	0.55mm	1.0mm	Low k Die + Flip Chip + 8 layer BT build-up	2 pc Cu	15.33 * 14.24	5432	4510
F1020	0.55mm	1.0mm	Low k Die + Flip Chip + 8 layer BT build-up	2 pc Cu	15.33 * 14.24	4333	3705
F1020	0.55mm	1.0mm	Low k Die + Flip Chip + 8 layer BT build-up	2 pc Cu	22.56 * 25.54	5579	4603
F1020	0.55mm	1.0mm	Flip Chip + 8 layer BT build-up	2 pc Cu	22.6X19.9	0 fail to 4000	0 fails to 4000
F1020	0.55 mm	1.0 mm	Lidless Flip Chip + 6 layer build-up BT	None	17.62*15.94	4804	3104
F1020	0.55 mm	1.0 mm	Lidless Flip Chip + 6 layer build-up BT	None	18.03*17.29	4551	3168
F1152	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	16*14	4106	3216
F1152	0.55 mm	1.0 mm	Lidless Flip Chip + 6 layer build-up BT	None	16*14	4421	3474
F1508	0.55mm	1.0mm	Low k Die + Flip Chip + 8 layer BT build-up	SPL	22.17 * 19.24	6506	3651
F1508	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	23.9 * 23.3	4233	2694
F1508	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	23.9 * 23.3	3074	2040
F1508	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	SPL	23.9 * 23.3	4797	3182
F1517	0.55 mm	1.0 mm	Flip Chip + 14 layer build-up BT	2 pc Cu	25.6 * 26.5 (N40 ELK die)	4497	3564
F1517	0.55 mm	1.0 mm	Flip Chip + 14 layer build-up BT	SPL	25.6 * 26.5 (N40 ELK die)	4733	4100



PACKAGES	SUBSTRATE PAD SIZE	PITCH	TECHNOLOGY	HEAT SINK	DIE SIZE (mm)	MTTF (Cycles)	CYCLES TO 0.1% FAILS (Extrapolated)
F1681	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	SPL	18 * 22 (N40 ELK die)	0 fail to 4890	0 fail to 4890
F1681	0.55 mm	1.0 mm	Molded Flip Chip + 8 layer build-up BT	None	18 * 22 (N40 ELK die)	3656	2958
F1760	0.55 mm	1.0 mm	Flip Chip + 12 layer build-up BT	2 pc Cu	20.0 * 20.0 (N40 ELK die)	3541	2572
F1760	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	SPL	25.5 * 26.5 (N28 ELK die)	3703	3296
F1932	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	2 pc Cu	25.6 * 26.5 (N28 ELK die)	3552	2932
F1932	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	1mm FTSP	31x26	4021	3136

### Lead Free Solder Ball

PACKAGES	SUBSTRATE PAD SIZE	PITCH	TECHNOLOGY	HEAT SINK	DIE SIZE (mm)	MTTF (Cycles)	CYCLES TO 0.1% FAILS (Extrapolated)
QFN	N/A	0.5mm	EN6347QA	None	2.90 x 1.78	0 fail to 2570	0 fail to 2570
QFN	N/A	0.5mm	EN6360QI	None	6.02 x 1.92	3811	N/A
M301	0.30mm	0.5mm	Cu-pillar + Flip Chip 4 Layer BT	None	11x11	0 fails to 6000	0 fails to 6000
F1932	0.55 mm	1.0 mm	Flip Chip + 12 layer build-up BT (RoHS6 - Compliant)	FTSP	25 * 26 (N20 ELK die)	0 fail to 6000	0 fail to 6000
M100	0.3 mm	0.5 mm	Wire Bond + 2 Layer BT	None	3.2 * 3.2	0 fail to 6000	0 fail to 6000
M256	0.3 mm	0.5 mm	Wire Bond + 4 Layer BT	None	3.9 * 3.9	0 fail to 6000	0 fail to 6000
U88	0.4 mm	0.8 mm	Wire-bonded Stacked Die + 2L FR4 substrate	None	6.9 * 4.6	0 fail to 6000	0 fail to 6000
T144	N/A	0.5 mm	lead frame	N/A	4.9*6.0	0 fail to 5500	0 fail to 5500
E144	NA	0.5mm	lead frame + ground pad	None	5.12 * 5.21	0 fail to 6000	0 fail to 6000
QFN148	NA	0.5mm	lead frame + ground pad	None	5.12 * 5.21	2938	2511
F256 thin outline	0.45 mm	1.0 mm	Wire Bond + 4 Layer BT	None	7.68 * 6.81	0 fail to 5000	0 fail to 5000
F256	0.45mm	1.0mm	low k die + Wire Bond + 4 Layer BT	None	5.80*6.22	0 fail to 6000	0 fail to 6000
F256	0.45mm	1.0mm	Wire bond + 2Layer BT	None	5.46 x 5.85	0 fail to 6000	0 fail to 6000
Q240	N/A	0.5 mm	lead frame	N/A	8.0*7.9	0 fail to 6000	0 fails to 6000
U358	0.4mm	0.8mm	Lid-less Flip-Chip + 4 Layer build up BT	None	10.11*10	0 fail to 6000	0 fails to 6000
U484	0.4mm	0.8mm	low k die + Wire Bond + 4 Layer BT	None	8.4 * 8.03	0 fail to 3500	0 fail to 3500
F484	0.45mm	1.0 mm	Wire-bonded + 4 layer BT	None	10.8 * 8.8	0 fail to 6000	0 fail to 6000
F672	0.45 mm	1.0 mm	Wire Bond + 4 Layer BT	None	11.19*11.12	0 fail to 6000	0 fail to 6000
F780	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	16.3 * 13.5	0 fail to 5000	0 fail to 5000

PACKAGES	SUBSTRATE PAD SIZE	PITCH	TECHNOLOGY	HEAT SINK	DIE SIZE (mm)	MTTF (Cycles)	CYCLES TO 0.1% FAILS (Extrapolated)
F896	0.45mm	1.0 mm	Wire-bonded + 4 layer BT	None	8.86 * 9.96	0 fail to 4000	0 fail to 4000
F896	0.45mm	1.0 mm	Wire bonded + 4 layer BT	None	11.19*11.12	0 fail to 6000	0 fail to 6000
F896	0.45mm	1.0mm	N20 triple row staggered Wire bond + 2Layer BT	None	10.9 X 10.5 (N28 ELK)	0 fail to 6000	0 fail to 6000
M1019	0.3mm	0.5mm	Lid-less Flip-Chip + 3-2-3 build up substrate	None	10.16*10.52	0 fail to 6000	0 fail to 6000
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	22.6 * 19.9	0 fail to 5887	0 fail to 5887
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	SPL	17.62*15.94	0 fail to 6000	0 fail to 6000
F1020	0.55 mm	1.0 mm	Lidless Flip Chip + 6 layer build-up BT	None	17.62*15.94	0 fail to 6000	0 fail to 6000
F1020	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	SPL	18.03*17.29	0 fail to 6000	0 fail to 6000
F1020	0.55 mm	1.0 mm	Lidless Flip Chip + 6 layer build-up BT	None	18.03*17.29	0 fail to 6000	0 fail to 6000
F1152	0.45mm	1.0mm	Wire bonded + 4 layer BT	None	13.2*13.53	0 fail to 4800	0 fail to 4800
F1508	0.55 mm	1.0 mm	Flip Chip + 6 layer build-up BT	2 pc Cu	23.9 * 23.3	0 fail to 6000	0 fail to 6000
F1681	0.55 mm	1.0 mm	Molded Flip Chip + 8 layer build-up BT	None	18 * 22 (N40 ELK die)	0 fail to 7000	0 fail to 7000
F1760	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	SPL	25 * 26 (N28 ELK die)	0 fail to 7000	0 fail to 7000
F1932	0.55 mm	1.0mm	Flip Chip + 8 layer build-up BT	1 mm FTSP	31*26	0 fail to 7000	0 fail to 7000
F1932	0.55 mm	1.0 mm	Flip Chip + 8 layer build-up BT	SPL	25 * 26 (N28 ELK die)	0 fail to 6000	0 fail to 6000

# Configuration Devices

## Description

### Serial Configuration Devices

The EPCS1 serial configuration device is fabricated on Micron 0.15  $\mu\text{m}$ . CMOS process technology.

The EPCS4, EPCS16 and EPCS64 serial configuration devices are fabricated on Micron 0.11  $\mu\text{m}$  CMOS process technology.

The EPCS128 device is fabricated on Micron 65nm CMOS process technology.

These products operate at a nominal  $V_{cc}$  of 3.3V.

The EPCS1, EPCS4 and EPCS16 devices are available in the 8-pins small outline integrated circuit (SOIC) package.

The EPCS64 and EPCS128 are available in the 16-pins SOIC package.

### Quad-Serial Configuration Devices

The EPCQ16, EPCQ32, EPCQ64, EPCQ128, EPCQ256 and EPCQ512 quad- serial configuration devices are fabricated on Micron 65 nm CMOS process technology.

These products operate at a nominal  $V_{cc}$  of 3.3V.

The EPCQ16 and EPCQ32 are available in the 8-pin small outline integrated circuit (SOIC) package while EPCQ64, EPCQ128 and EPCQ256 are available in 16-pin SOIC package.

### Low Power Quad-Serial Configuration Devices

The EPCQ-L256, EPCQ-L512 and EPCQ-L1024 quad- serial configuration devices are fabricated on Micron Low Power 65 nm CMOS process technology.

These products operate at a nominal  $V_{cc}$  of 1.8V.

The EPCQ-L256, EPCQ-L512 and EPCQ-L1024 are available in FBGA 24 pins package.

## Reliability Results

### 0.15 $\mu\text{m}$ process – Monitoring Results

TEST PROCEDURE	TEST CONDITIONS	LOT1	LOT2	LOT3
High Temperature Operating Life	140°C, 4.2V 504hrs 1008hrs	0/80 0/80	0/77 0/77	0/80 0/80
Low Temperature Operating Life	-40°C, 4.2V 504hrs	0/80	0/77	0/80
High Temperature Bake	200°C, 500hrs 1000hrs	0/77 0/77	0/77 0/77	0/77 0/77
Erase/Write Cycles and Bake	10,000 E/W cycles + Bake 200°C, 48hrs 100,000 E/W cycles + Bake 200°C, 48hrs	0/77 0/77	0/77 0/77	0/77 0/77
Electrostatic Discharge	Human body model: 1.5k $\Omega$ , 100pF	>2000V	>2000V	>2000V
Latch-up	Class II - Level A (at 85°C)	Pass	Pass	Pass

### 0.11 $\mu\text{m}$ process – Monitoring Results

TEST PROCEDURE	TEST CONDITIONS	LOT1	LOT2	LOT3
High Temperature Operating Life	140°C, 4.2V 168 hrs 500 hrs 1000 hrs	0/77 0/77 0/77	0/77 0/77 0/77	0/77 0/77 0/77
Low Temperature Operating Life	-40°C, 4.2V 168 hrs	0/15	0/15	0/15
High Temperature Bake	250°C, 168 hrs 500 hrs	0/77 0/77	0/77 0/77	0/77 0/77
Erase/Write Cycles and Bake	10,000 E/W cycles 100,000 E/W cycles + Bake 250°C, 168 hrs	0/77 0/77 0/77	0/77 0/77 0/77	0/77 0/77 0/77
Electrostatic Discharge	Human body model: 1.5k $\Omega$ , 100pF Machine Model: 0 $\Omega$ , 200pF	>2000V >200 V	>2000V > 200 V	>2000V >200 V
Latch-up	Class II - Level A (at 150°C)	Pass	Pass	Pass

## 65 nm process – Monitoring Results (new results in blue)

TEST PROCEDURE	TEST CONDITIONS	HOURS OR CYCLES (Failures/Devices)	FAILURES/SAMPLING
ELFR	125°C Read	168 Hours	0/4733
NVM cycling	Room Temperature	1000 cycles	0/731
Temperature Cycle	-55°C for 15mn, 125°C for 15mn, air to air	500 cycles 1000 cycles	0/158 0/158
High Temperature Storage	150°C, no bias	504 Hours 1008 Hours	0/80 0/80
HAST	130°C, 85% RH	96 Hours	0/237

## 65 nm Low Power process – Qualification results

### Die-related test conditions

TEST PROCEDURE	TEST CONDITIONS	LOT1	LOT2	LOT 3
High Temperature Operating Life	140°C, 2.2V 168 hrs 500 hrs 1000 hrs	0/77 0/77 0/77	0/77 0/77 0/77	0/77 0/77 0/77
Erase/Write Cycles and High Temperature Data Retention	100,000 E/W cycles + Bake 125°C, 10 hrs + Bake 125°C, 100 hrs	0/40 0/40 0/40	0/40 0/40 0/40	0/40 0/40 0/40
Erase/Write Cycles and Low Temperature Data Retention	100,000 E/W cycles + 500 hrs @ 25°C	0/40 0/40	0/40 0/40	0/40 0/40
Electrostatic Discharge	Human body model: 1.5k $\Omega$ , 100pF Machine Model: 0 $\Omega$ , 200pF Electrostatic discharge (CDM)	>2000V >200 V >750V	>2000V > 200 V >750V	>2000V >200 V >750V
Latch-up	Class II - 125°C (Max Oper.Temp.)	Pass	Pass	Pass

### Package-related test conditions

TEST PROCEDURE	TEST CONDITIONS	LOT1	LOT2	LOT 3
Pre conditioning	Level 3 per J-STD-020D	0/77	0/77	0/77
High Temperature Bake	150°C, 168 hrs 500 hrs 1000 hrs	0/77 0/77 0/77	0/77 0/77 0/77	0/77 0/77 0/77
HAST	130C, 85%RH, Vccmax 48 hrs 96 hrs	0/77 0/77	0/77 0/77	0/77 0/77
Thermal Cycling	-65°C/150°C 100 cyc 500 cyc	0/77 0/77	0/77 0/77	0/77 0/77

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- i* JEDEC publication, JEP122-E, "Failure Mechanisms and Models for Semiconductor Devices" pp29-31, Table 1. <http://www.jedec.org/download/search/jep122a.pdf>
- ii* Microsoft Excel 5.0 statistical functions, Inverse Chi-Squared Distribution, variables are degrees of free dom and Confidence Level.