Quality and Reliability Report

First Quarter 2022

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Quality and Reliability Report Overview

Silicon Labs is pleased to share this Quality and Reliability Report with our customers. It provides the latest quality performance data along with failure rate estimates and reliability monitor data. Module data has been added starting 2022. These data are collected on a continual basis as qualification, production and reliability monitors are completed. The report is published and updated quarterly to provide customers visibility to the most recent information. The Quality Trend charts on page 5 are shown on a rolling five-year basis. All other reports include data from the previous four quarters on a rolling, one-year basis.

The report provides data covering:

- Estimates of shipped product quality
- Long-term operating life estimates
- Mean time to failure estimates
- Data retention life estimates
- Reliability monitor results

Silicon Labs is registered to ISO 9001:2015, ISO 14001:2015 and maintained certification to ISO/TS 16949:2009 from January 2008 to October 2014. Due to a change in the ISO/TS 16949 certification eligibility requirements in 2013, fabless semiconductor companies are no longer eligible for certification. Silicon Labs now conforms to IATF 16949 and continues to internally audit to IATF 16949 as well as being audited externally with IATF 16949 certified auditors. Silicon Labs uses IATF 16949 certified suppliers for automotive products.

Silicon Labs is committed to quality excellence. That commitment is demonstrated by extensive product and process qualification. Each product undergoes extensive qualification testing prior to production release. Silicon Labs qualifies integrated circuit products using JEDEC JESD47, *Stress-Test-Driven Qualification of Integrated Circuits* or AEC-Q100, *Stress Test Qualification for Integrated Circuits*, as appropriate.

Once a product is qualified, on-going product quality and reliability is verified through monitoring programs. Monitors are scheduled to periodically sample wafer fab technologies and package technologies. The results are published in this report. Any failures are used to drive corrective action and process and product improvement.
We hope you find this report useful. Please let us know if you have any specific questions or suggestions.

Reliability qualification reports are available on www.silabs.com.

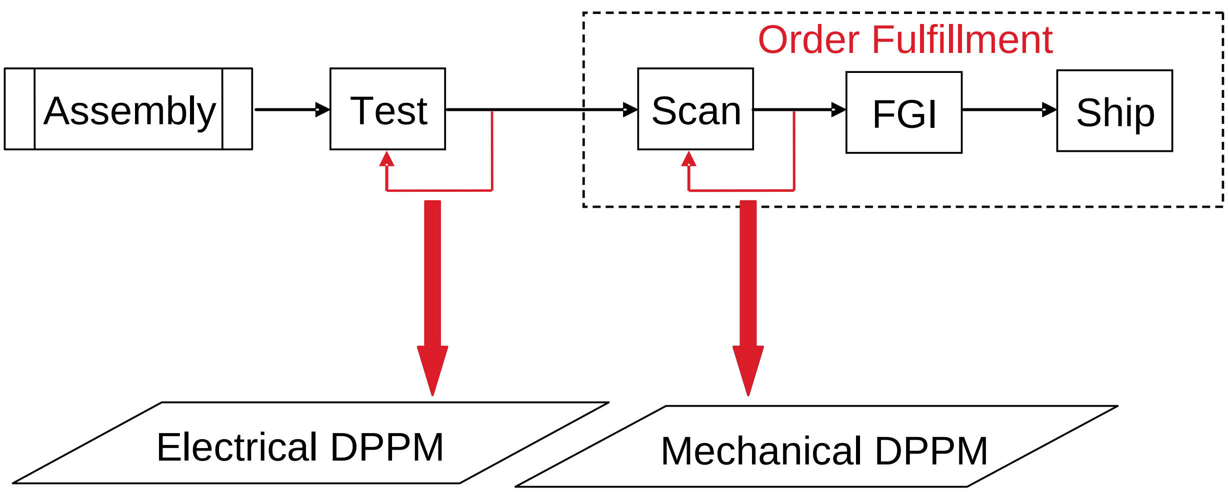
Average Outgoing Quality (AOQ)

Overview

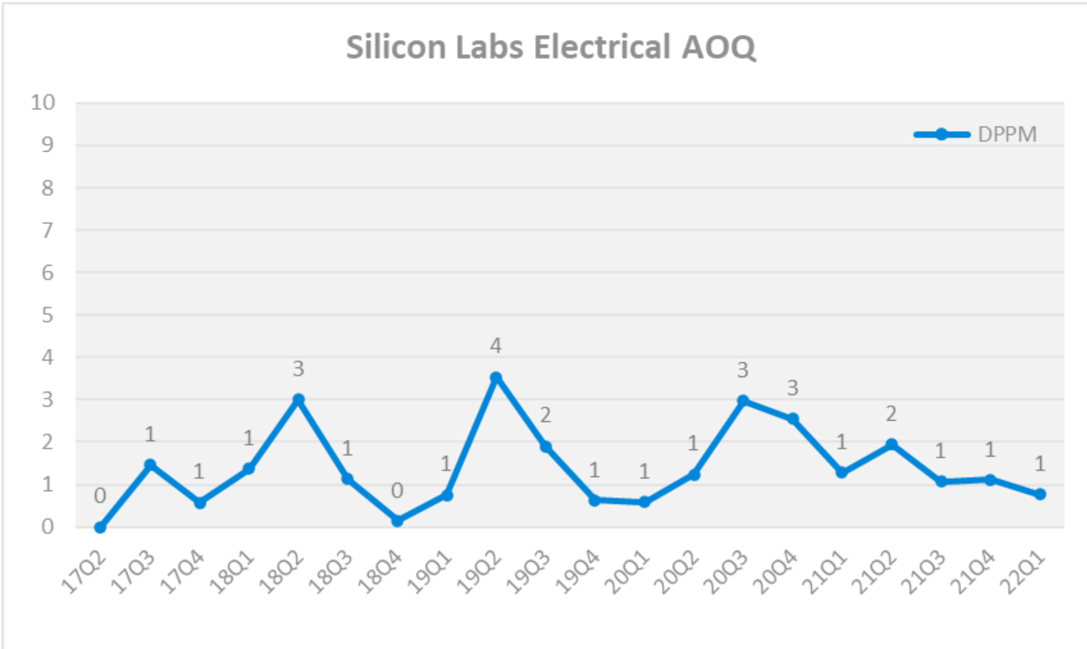
Two elements of product quality are reported – electrical quality and mechanical/visual quality. We measure electrical quality by taking a sample (monitor) of production parts and retesting the sample to the datasheet limits (see Figure 1). The sample electrical test may be performed at an alternate test temperature to verify part performance across the datasheet temperature range. This sample method identifies defects introduced at the test process step or that have escaped the test process. Any failures drive corrective actions and product/process improvements.

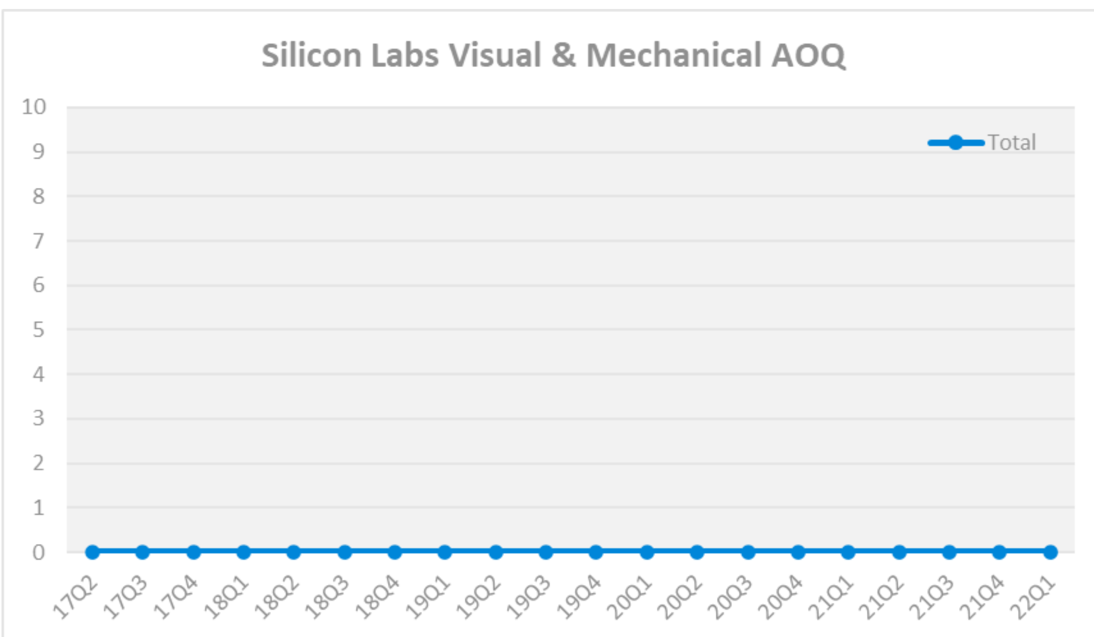
Visual/Mechanical quality is estimated by sample inspection of the completed product prior to final pack. Inspection items cover a broad range of characteristics and include mark, count, label, cover tape workmanship, moisture barrier bag integrity, lead location, part placement, and many other general workmanship items required for customer satisfaction and product protection during shipment. Any failures drive corrective actions and process improvements.

Figure 1 – Quality Monitor Flow



Electrical and Visual / Mechanical Outgoing Quality Graphs





Part Numbers by Fab Technology

Part Number	Technology	Part Number	Technology
BGM11SX	90 nm, embedded flash	**CF34X**	0.35 um, embedded flash
BGM12X	90 nm, embedded flash	**CF35X**	0.35 um, embedded flash
BGM13S22FX	90 nm, embedded flash	**CF36X**	0.35 um, embedded flash
BGM13S3X	90 nm, embedded flash	**CF37X**	0.35 um, embedded flash
BGM220SX	40 nm, embedded flash	**CF38X**	0.18 um, embedded flash
BGX13S22GX	90 nm, embedded flash	**CF39X**	0.18 um, embedded flash
BGX220S2	40 nm, embedded flash	**CF4XX**	0.25 um, embedded flash
BM11X	90 nm, embedded flash	**CF5XX**	0.25 um, embedded flash
BM22S	40 nm, embedded flash	**CF7XX**	0.18 um, embedded flash
C8051F0XX	0.35 um, embedded flash	**CF8XX**	0.18 um, embedded flash
C8051F1XX	0.35 um, embedded flash	**CF9XX**	0.18 um, embedded flash
C8051F2XX	0.35 um, embedded flash	**CP2101**	0.35 um, embedded flash
C8051F30X	0.35 um, embedded flash	**CP2102**	0.35 um, embedded flash
C8051F31X	0.35 um, embedded flash	**CP2102N**	0.18 um, embedded flash
C8051F32X	0.35 um, embedded flash	**CP2103**	0.35 um, embedded flash
C8051F33X	0.35 um, embedded flash	**CP2104**	0.18 um, OTP
C8051F34X	0.35 um, embedded flash	**CP2105**	0.18 um, OTP
C8051F35X	0.35 um, embedded flash	**CP2107**	0.18 um, OTP
C8051F36X	0.35 um, embedded flash	**CP2108**	0.18 um, embedded flash
C8051F37X	0.18 um, embedded flash	**CP2109**	0.18 um, OTP
C8051F37X	0.35 um, EEPROM	**CP211X**	0.18 um, OTP
C8051F38X	0.18 um, embedded flash	**CP2120**	0.35 um, embedded flash
C8051F39X	0.18 um, embedded flash	**CP213X**	0.18 um, OTP
C8051F4XX	0.25 um, embedded flash	**CP22XX**	0.35 um, embedded flash
C8051F5XX	0.25 um, embedded flash	**CP240X**	0.18 um
C8051F7XX	0.18 um, embedded flash	**CP250X**	0.35 um, embedded flash
C8051F8XX	0.18 um, embedded flash	**CP254X**	0.18 um, OTP
C8051F9XX	0.18 um, embedded flash	**CP26XX**	0.18 um, embedded flash
C8051TXXX	0.18 um, OTP	**CP4000**	0.13 um
CF0XX	0.35 um, embedded flash	**CPTXXXX**	0.18 um, embedded flash
CF1XX	0.35 um, embedded flash	**CT3XX**	0.18 um, OTP
CF2XX	0.35 um, embedded flash	**CT6XX**	0.18 um, OTP
CF30X	0.35 um, embedded flash	**EFM32G2X**	0.18 um, embedded flash
CF31X	0.35 um, embedded flash	**EFM32G3X**	0.18 um, embedded flash
CF32X	0.35 um, embedded flash	**EFM32G8X**	0.18 um, embedded flash
CF33X	0.35 um, embedded flash	**EFM32GG1X**	90 nm, embedded flash

Part Number	Technology
EFM32GG2X	0.18 um, embedded flash
EFM32GG3X	0.18 um, embedded flash
EFM32GG8X	0.18 um, embedded flash
EFM32GG9X	0.18 um, embedded flash
EFM32HG	0.18 um, embedded flash
EFM32JG	90 nm, embedded flash
EFM32LG	0.18 um, embedded flash
EFM32PG1	90 nm, embedded flash
EFM32PG2	40 nm, embedded flash
EFM32TG108X	0.18 um, embedded flash
EFM32TG110X	0.18 um, embedded flash
EFM32TG11BX	90 nm, embedded flash
EFM32TG2X	0.18 um, embedded flash
EFM32TG8X	0.18 um, embedded flash
EFM32WG	0.18 um, embedded flash
EFM32ZG	0.18 um, embedded flash
EFM8BB1X	0.18 um, embedded flash
EFM8BB2X	0.18 um, embedded flash
EFM8BB3X	0.18 um, embedded flash
EFM8BB5X	90 nm, embedded flash
EFM8LX	0.18 um, embedded flash
EFM8SX	0.18 um, embedded flash
EFM8UX	0.18 um, embedded flash
EFPX	0.18 um
EFR32BG1X	90 nm, embedded flash
EFR32BG2X	40 nm, embedded flash
EFR32FG1X	90 nm, embedded flash
EFR32FG2X	40 nm, embedded flash
EFR32MG12PX	90 nm, embedded flash
EFR32MG13P6X	90 nm, embedded flash
EFR32MG13P7X	90 nm, embedded flash
EFR32MG13P8X	90 nm, embedded flash
EFR32MG13P8X	90 nm, flash
EFR32MG14PX	90 nm, embedded flash
EFR32MG1B1X	90 nm, embedded flash
EFR32MG1B2X	90 nm, embedded flash
EFR32MG1B6X	90 nm, embedded flash
EFR32MG1B6X	90 nm, flash

Part Number	Technology
EFR32MG1B7X	90 nm, embedded flash
EFR32MG1B7X	90 nm, flash
EFR32MG1P1X	90 nm, embedded flash
EFR32MG1P2X	90 nm, embedded flash
EFR32MG1P6X	90 nm, embedded flash
EFR32MG1P6X	90 nm, flash
EFR32MG1P7X	90 nm, embedded flash
EFR32MG1P7X	90 nm, flash
EFR32MG1V1X	90 nm, embedded flash
EFR32MG2X	40 nm, embedded flash
EFR32R	90 nm, embedded flash
EFR32ZG1X	90 nm, embedded flash
EFR32ZG23X	40 nm, embedded flash
EM25X	0.18 um, embedded flash
EM26X	0.18 um, embedded flash
EM31X	0.11 um
EM31X	0.18 um, embedded flash
EM34X	0.18 um, embedded flash
EM35X	0.18 um, embedded flash
EZR32X	0.11 um
EZR32X	0.18 um, embedded flash
IA10XX	Diode
IA12XX	0.6 um - 0.8 um BiCMOS
IA14XX	0.6 um - 0.8 um BiCMOS
MGM13SX	90 nm, embedded flash
S3CX	0.18 um, embedded flash
S3UX	0.18 um, embedded flash
SD35X	0.13 um, embedded flash
Si100X	0.18 um, embedded flash
Si100X	0.18 um, RF
Si101X	0.18 um, embedded flash
Si101X	0.18 um, RF
Si102X	0.18 um, embedded flash
Si102X	0.18 um, RF
Si103X	0.18 um, embedded flash
Si103X	0.18 um, RF
Si106X	0.11 um
Si106X	0.18 um, embedded flash

Part Number	Technology
Si108X	0.11 um
Si108X	0.18 um, embedded flash
Si1102	0.6 um - 0.8 um BiCMOS
Si1102	Diode
Si1120	0.6 um - 0.8 um BiCMOS
Si1120	Diode
Si1132	0.18 um, OTP
Si1133	0.18 um
Si114X	0.18 um, OTP
Si115X	0.18 um
Si117X	0.18 um
Si118X	0.18 um
Si210X	0.13 um
Si2111	0.11 um
Si2113	0.11 um
Si2115	0.11 um
Si220X	0.315 um - 0.35 um
Si221X	0.25 um
Si401X	0.13 um
Si402X	0.6 um - 0.8 um BiCMOS
Si403X	0.18 um, RF
Si405X	0.11 um
Si406X	0.11 um
Si41XX	0.315 um - 0.35 um
Si4310	0.13 um
Si4311	0.13 um
Si4312	0.13 um
Si4313	0.18 um, RF
Si432X	0.6 um - 0.8 um BiCMOS
Si433X	0.18 um, RF
Si435X	0.11 um
Si436X	0.11 um
Si442X	0.6 um - 0.8 um BiCMOS
Si4430	0.18 um, RF
Si4431	0.18 um, RF
Si4432	0.18 um, RF
Si4438	0.11 um
Si445X	0.11 um

Part Number	Technology
Si446X	0.11 um
Si46XX	55 nm
Si47XX-B1X	0.13 um
Si47XX-B2X	0.13 um
Si47XX-B3X	0.13 um
Si47XX-C3X	0.13 um
Si47XX-C4X	0.13 um
Si47XX-D	0.11 um
Si49XX	0.6 um - 0.8 um BiCMOS
Si50122	0.13 um
Si50122	0.18 um
Si7005	0.18 um, RF
Si7006	0.18 um, embedded flash
Si7007	0.18 um, embedded flash
Si7008	0.18 um, embedded flash
Si701X	0.18 um, embedded flash
Si702X	0.18 um, embedded flash
Si703X	0.18 um, OTP
Si7055-A21	0.18 um, embedded flash
Si705X-A10	0.18 um, OTP
Si705X-A20	0.18 um, embedded flash
SI7060X	0.18 um
Si72X	0.18 um
SiM3XXXX	0.18 um, embedded flash
TS1001	High Voltage
TS1002	High Voltage
TS1003	0.18 um
TS1004	High Voltage
TS1005	0.18 um
TS11XX	0.6 um - 1.0 um
TS12XX	High Voltage
TS3001	0.18 um
TS3002	0.18 um
TS3003	High Voltage
TS3004	High Voltage
TS3005	High Voltage
TS3006	High Voltage
TS3300	High Voltage

Part Number	Technology
TS331X	0.18 um
TS4XXX	High Voltage
TS6XXX	0.6 um - 1.0 um
TS7XXX	0.18 um
TS9XXX	0.18 um
TSAXXXX	0.18 um
TSM12XX	0.18 um
TSM60XX	0.6 um - 1.0 um
TSM91XX	0.18 um
TSM92XX	0.18 um
TSM93XX	0.18 um

Part Number	Technology
TSM96XX	0.6 um - 1.0 um
TSM97XX	0.18 um
TSM98XX	0.18 um
TSM99XX	0.6 um - 1.0 um
WF200	40 nm
WFM200	40 nm
ZGM1	90 nm, embedded flash
ZGM2	40 nm, embedded flash
ZM51X	0.13 um, embedded flash
ZW0X	0.18 um, embedded flash

Failure Rate Estimation by Fab Technology

Failure in Time (FIT)

A long-term, steady-state failure rate is often required by circuit and system engineers for allocations of the failure rates at the component level during system design. FIT, which stands for failure-in-time, is a widely-used term to describe failure rates of electronic components, and as used here, represents the number of failures in a billion hours of operation. FIT rates are reported in the following section as curves and in tables for specific temperatures and assumptions.

Mean Time to Failure (MTTF)

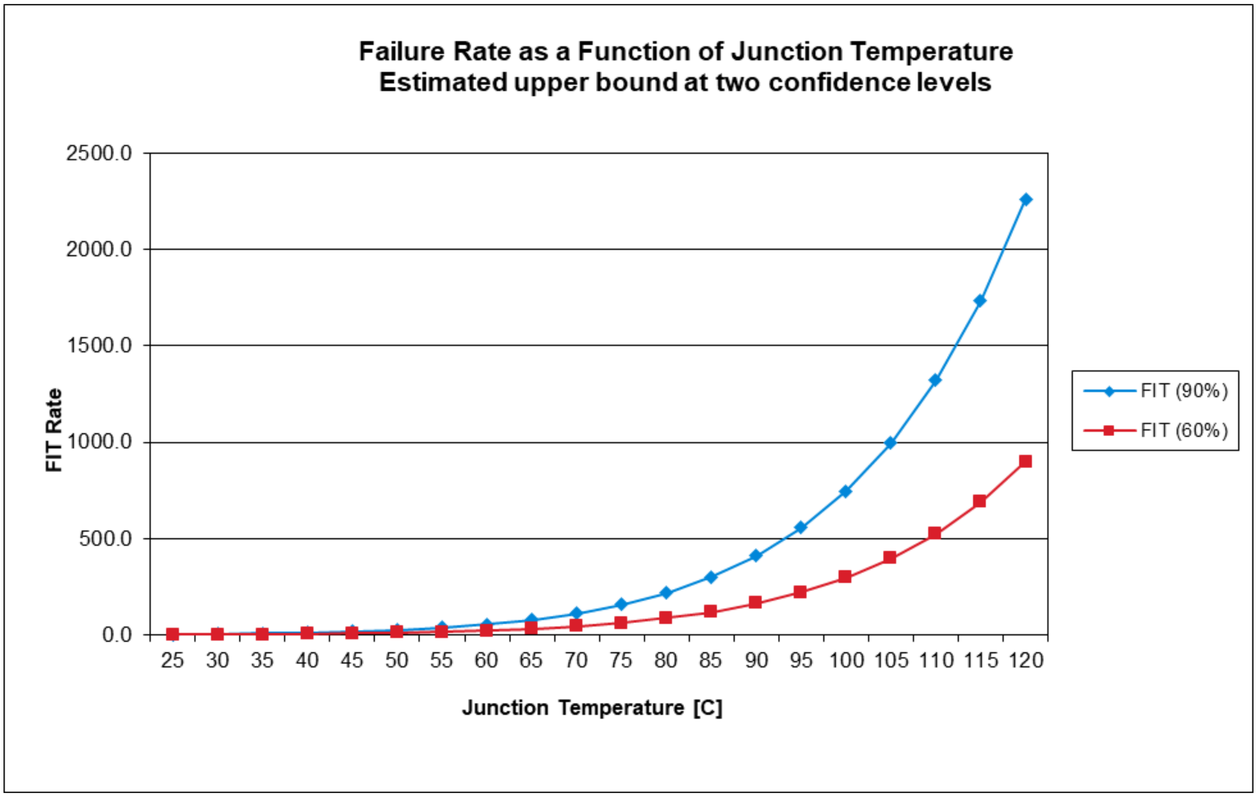
Another way to express failure rates is by mean time to failure (MTTF). MTTF is the inverse of the FIT rate and is useful for repair and maintenance planning. This relationship can be seen by examining the units of each measure: MTTF is given in time/failure; FIT is given in failure/time. MTTF is reported in the tables following the FIT rate curves for each specific fab technology.

Failure Rate Calculation Method

Long-term failure rates are estimated by applying the Arrhenius equation to data collected from long term operating life tests. A confidence factor is applied based upon the sample size and number of failures to estimate the maximum failure rate at a specific confidence level. The calculation details are provided in the table below each of the following FIT rate curves.

FIT Rate Curves and Data

Process – 40 nm



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Reliability FIT Calculations for temperature acceleration

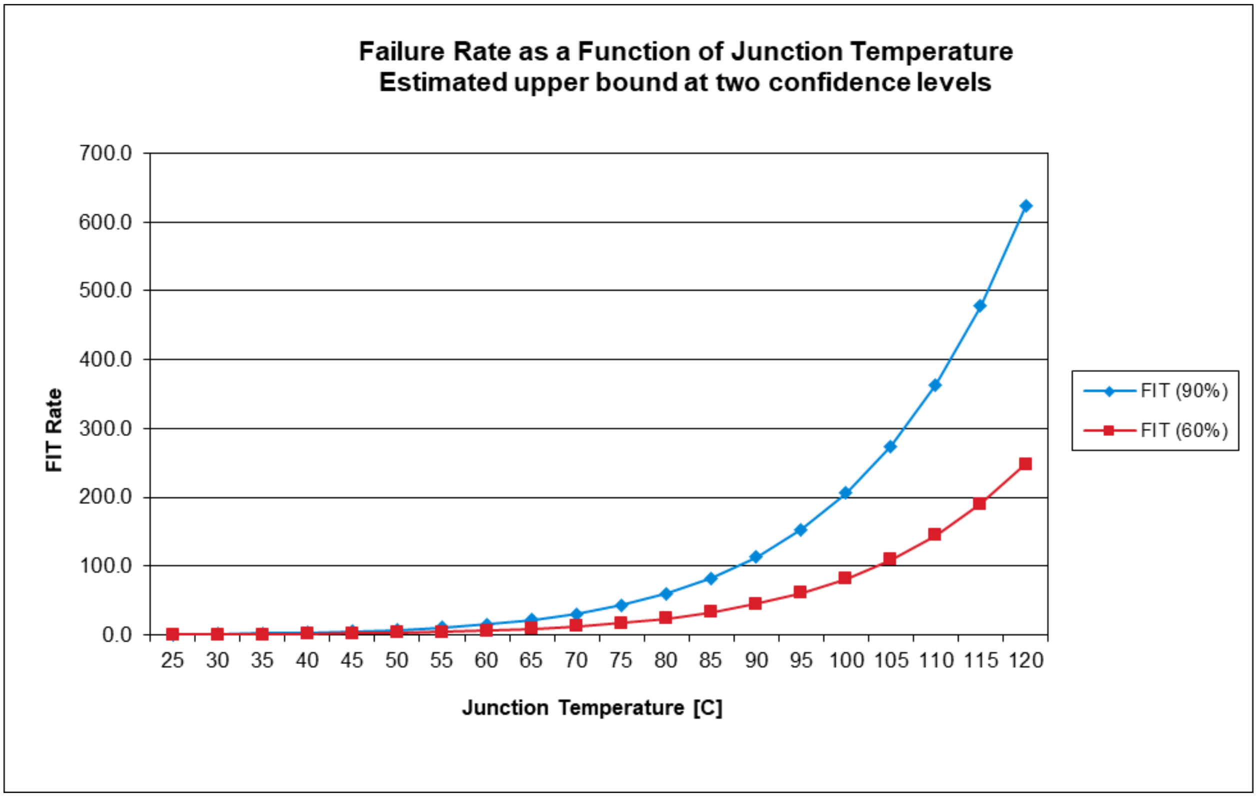
Single Point Calculation for 40 nm

Variables:	90%	60%	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	374	374	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	373884	373884	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	25.7	10.2	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	3.9E+07	9.8E+07	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	4437.0	11150.0	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 40 nm

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	3.1	1.2	36546	91839
30	1257.7	4.9	1.9	23314	58586
35	814.1	7.6	3.0	15091	37922
40	534.4	11.5	4.6	9905	24890
45	355.4	17.3	6.9	6588	16554
50	239.4	25.7	10.2	4437	11150
55	163.2	37.7	15.0	3025	7601
60	112.5	54.7	21.8	2086	5241
65	78.5	78.5	31.2	1454	3654
70	55.3	111.4	44.3	1025	2575
75	39.3	156.5	62.3	729	1832
80	28.3	217.9	86.7	524	1317
85	20.5	300.4	119.5	380	955
90	15.0	410.5	163.4	278	699
95	11.1	556.3	221.4	205	516
100	8.2	747.8	297.6	153	384
105	6.2	997.4	396.9	114	288
110	4.7	1320.2	525.4	86	217
115	3.5	1735.0	690.4	66	165
120	2.7	2264.3	901.0	50	127

Process – 40 nm w/ embedded flash



Reliability FIT Calculations for temperature acceleration

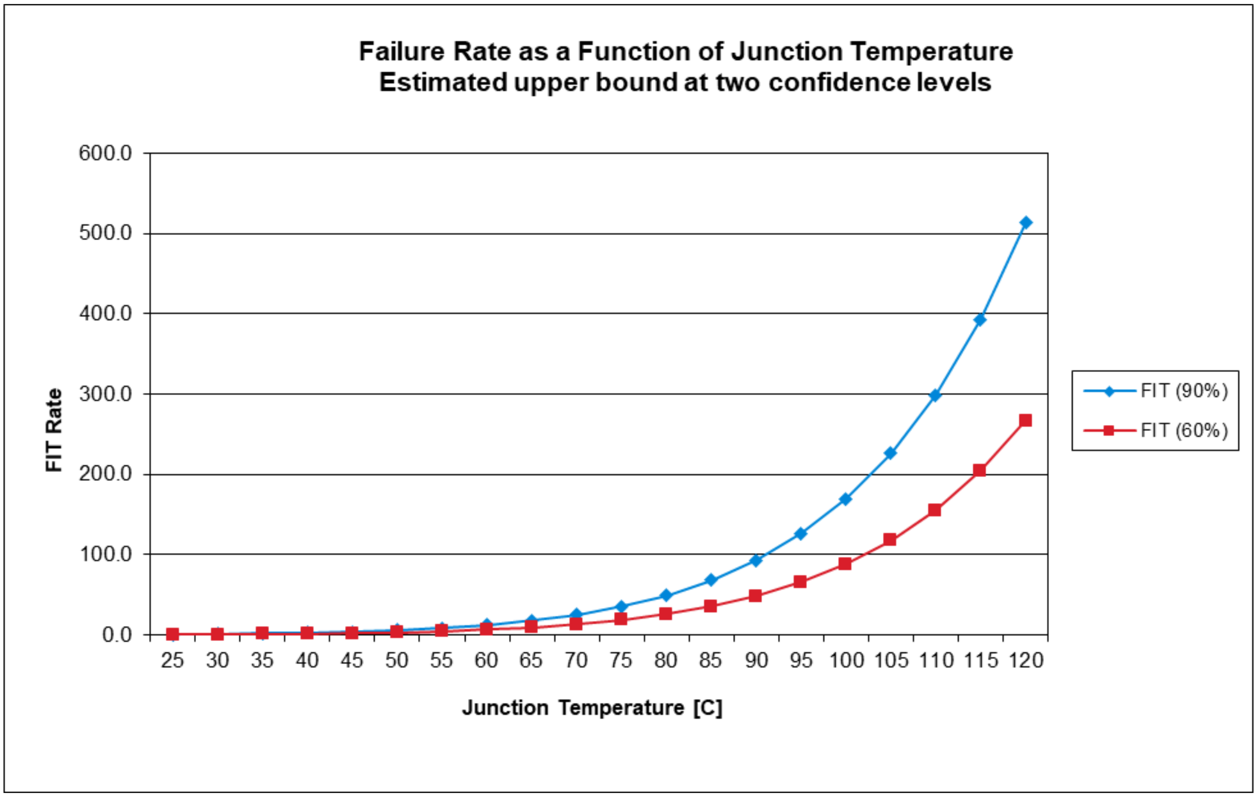
Single Point Calculation for 40 nm w/ embedded flash

Variables:	90%	60%	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	1358	1358	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	1358042	1358042	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	7.1	2.8	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.4E+08	3.5E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	16116.4	40499.6	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 40 nm w/ embedded flash

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.9	0.3	132746	333583
30	1257.7	1.3	0.5	84681	212799
35	814.1	2.1	0.8	54814	137744
40	534.4	3.2	1.3	35977	90408
45	355.4	4.8	1.9	23928	60129
50	239.4	7.1	2.8	16116	40500
55	163.2	10.4	4.1	10987	27609
60	112.5	15.1	6.0	7576	19038
65	78.5	21.6	8.6	5282	13274
70	55.3	30.7	12.2	3722	9352
75	39.3	43.1	17.2	2649	6656
80	28.3	60.0	23.9	1903	4783
85	20.5	82.7	32.9	1380	3469
90	15.0	113.0	45.0	1010	2538
95	11.1	153.2	61.0	745	1873
100	8.2	205.9	81.9	554	1393
105	6.2	274.6	109.3	416	1045
110	4.7	363.5	144.6	314	789
115	3.5	477.7	190.1	239	601
120	2.7	623.4	248.1	183	460

Process – 90 nm w/ embedded flash



Reliability FIT Calculations for temperature acceleration

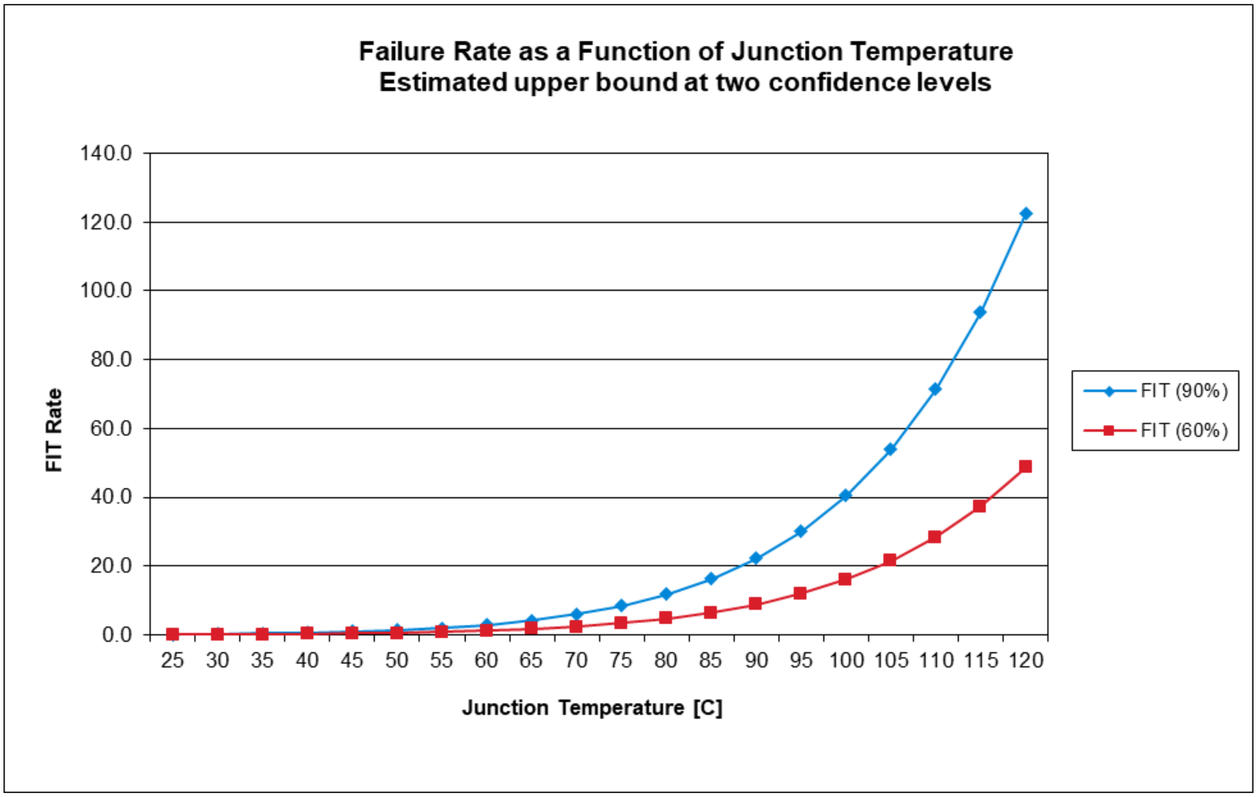
Single Point Calculation for 90 nm w/ embedded flash

Variables:	90%	60%	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	2787	2787	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	1	1	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	4.0	4.0	degrees of freedom [2(F+1)]
DH	2786632	2786632	Total device hours D*H
X2	7.8	4.0	Chi-Square Distribution Value
FIT	5.8	3.0	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.7E+08	3.3E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	19576.4	37653.2	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 90 nm w/ embedded flash

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.7	0.4	161245	310138
30	1257.7	1.1	0.6	102861	197843
35	814.1	1.7	0.9	66581	128063
40	534.4	2.6	1.4	43701	84054
45	355.4	3.9	2.0	29065	55903
50	239.4	5.8	3.0	19576	37653
55	163.2	8.6	4.4	13345	25668
60	112.5	12.4	6.4	9203	17700
65	78.5	17.8	9.3	6416	12341
70	55.3	25.3	13.1	4521	8695
75	39.3	35.5	18.4	3217	6188
80	28.3	49.4	25.7	2312	4447
85	20.5	68.1	35.4	1677	3225
90	15.0	93.0	48.4	1227	2360
95	11.1	126.1	65.6	905	1741
100	8.2	169.5	88.1	674	1295
105	6.2	226.1	117.5	505	971
110	4.7	299.2	155.6	382	734
115	3.5	393.2	204.4	290	558
120	2.7	513.2	266.8	222	428

Process - 0.11 micron

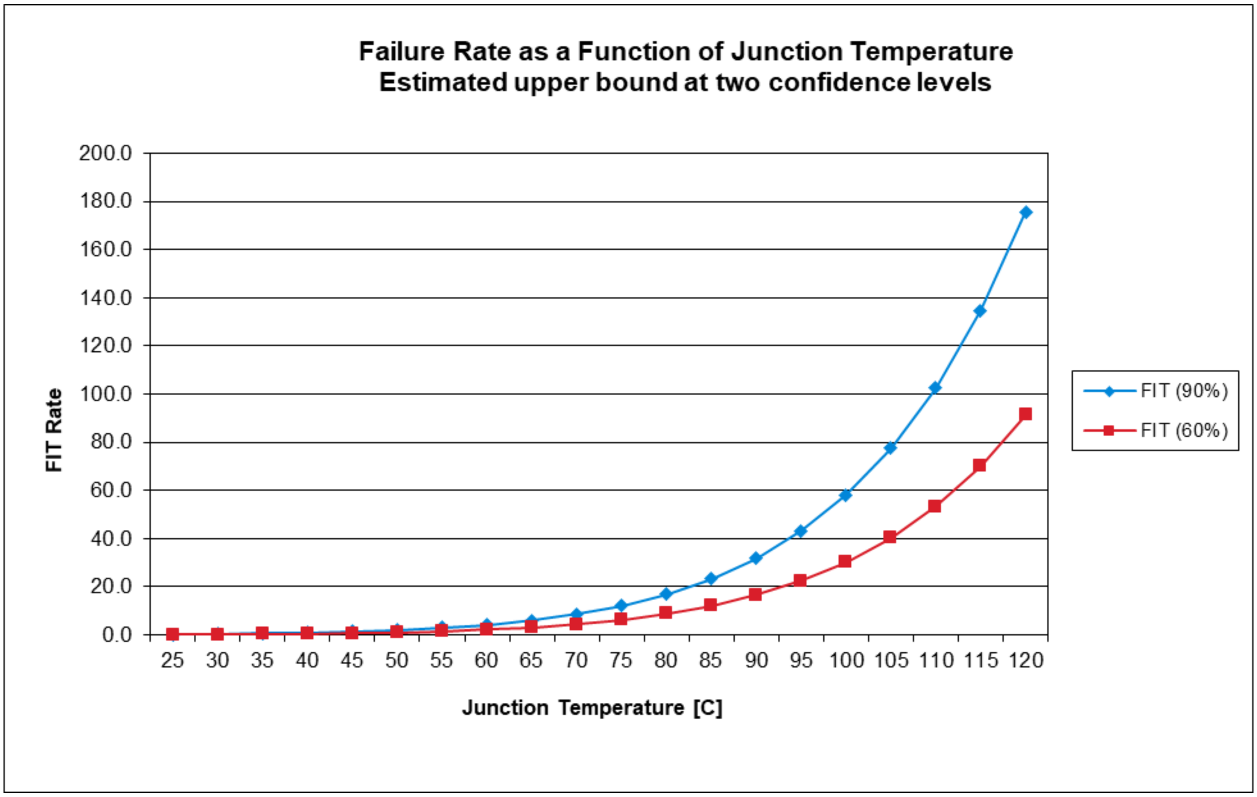


Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.11 micron			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	6916	6916	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	6915545	6915545	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	1.4	0.6	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	7.2E+08	1.8E+09	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	82069.4	206235.6	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.11 micron					
Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.2	0.1	675981	1698701
30	1257.7	0.3	0.1	431222	1083635
35	814.1	0.4	0.2	279128	701431
40	534.4	0.6	0.2	183205	460383
45	355.4	0.9	0.4	121848	306197
50	239.4	1.4	0.6	82069	206236
55	163.2	2.0	0.8	55947	140591
60	112.5	3.0	1.2	38580	96949
65	78.5	4.2	1.7	26898	67594
70	55.3	6.0	2.4	18952	47625
75	39.3	8.5	3.4	13488	33894
80	28.3	11.8	4.7	9692	24356
85	20.5	16.2	6.5	7029	17664
90	15.0	22.2	8.8	5143	12925
95	11.1	30.1	12.0	3795	9537
100	8.2	40.4	16.1	2824	7095
105	6.2	53.9	21.5	2117	5320
110	4.7	71.4	28.4	1599	4019
115	3.5	93.8	37.3	1217	3058
120	2.7	122.4	48.7	933	2343

Process - 0.13 micron



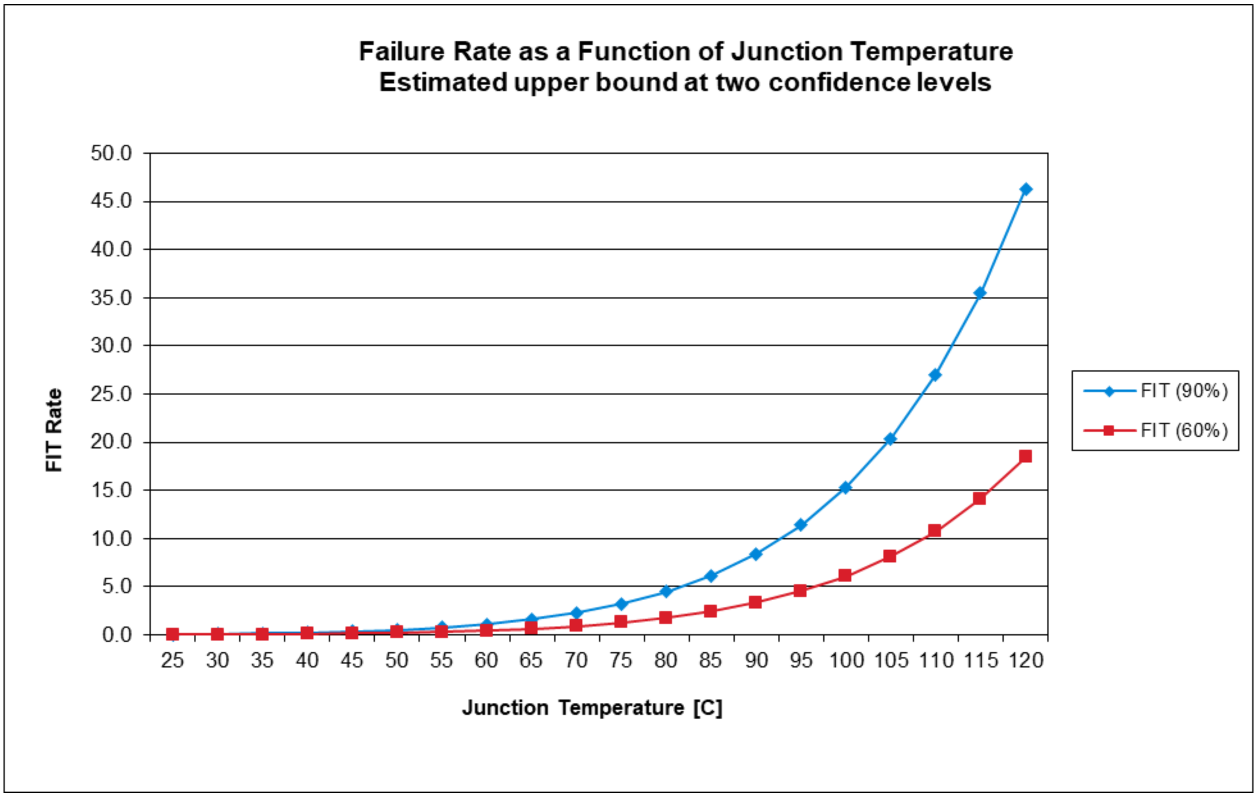
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.13 micron			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	8137	8137	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	1	1	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	4.0	4.0	degrees of freedom [2(F+1)]
DH	8136978	8136978	Total device hours D*H
X2	7.8	4.0	Chi-Square Distribution Value
FIT	2.0	1.0	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	5.0E+08	9.6E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	57163.0	109947.5	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.13 micron

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.2	0.1	470835	905605
30	1257.7	0.4	0.2	300355	577703
35	814.1	0.6	0.3	194418	373944
40	534.4	0.9	0.5	127606	245437
45	355.4	1.3	0.7	84870	163238
50	239.4	2.0	1.0	57163	109947
55	163.2	2.9	1.5	38968	74951
60	112.5	4.2	2.2	26872	51685
65	78.5	6.1	3.2	18735	36035
70	55.3	8.6	4.5	13200	25390
75	39.3	12.2	6.3	9395	18070
80	28.3	16.9	8.8	6751	12985
85	20.5	23.3	12.1	4896	9417
90	15.0	31.9	16.6	3582	6890
95	11.1	43.2	22.5	2643	5084
100	8.2	58.0	30.2	1967	3783
105	6.2	77.4	40.2	1475	2836
110	4.7	102.5	53.3	1114	2143
115	3.5	134.7	70.0	848	1630
120	2.7	175.8	91.4	650	1249

Process - 0.18 micron



SILICON LABS

Reliability FIT Calculations for temperature acceleration

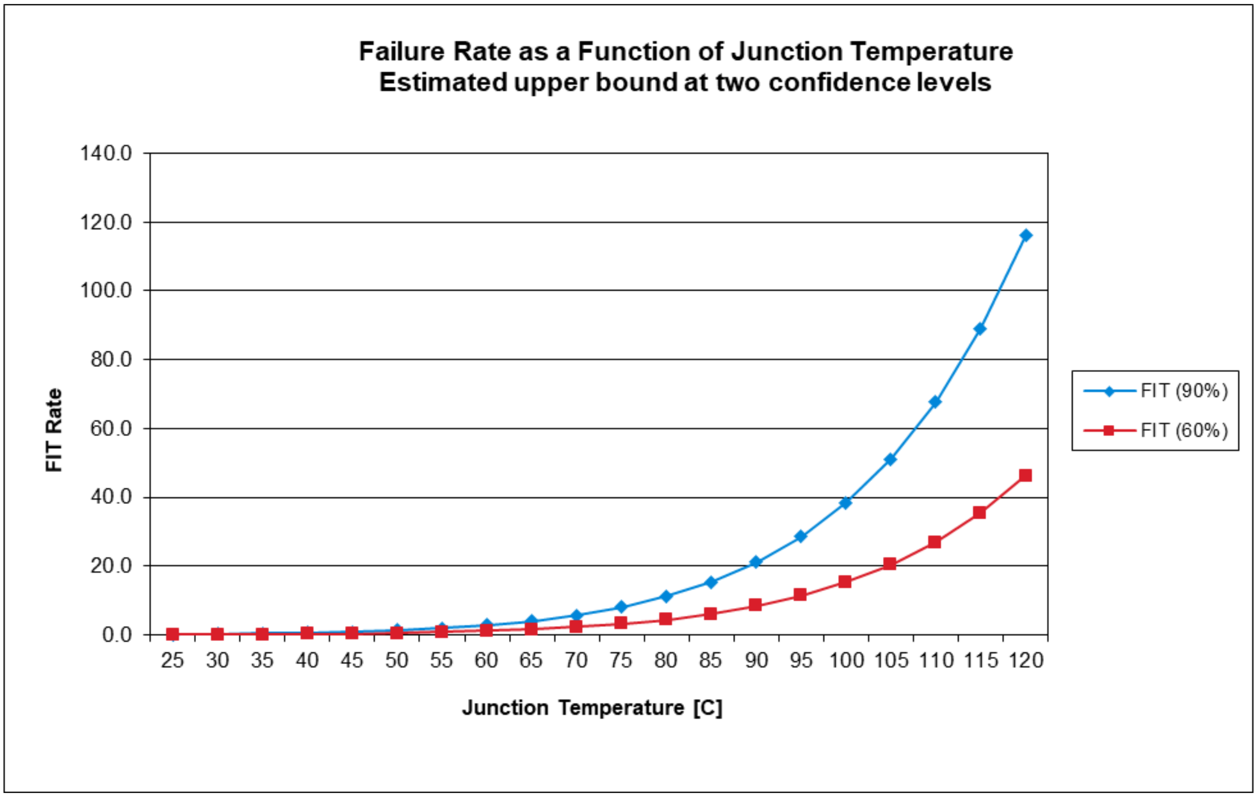
Single Point Calculation for 0.18 micron

Variables:	90%	60%	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	18274	18274	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	18273509	18273509	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	0.5	0.2	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.9E+09	4.8E+09	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	216858.7	544953.2	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.18 micron

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.1	0.0	1786200	4488617
30	1257.7	0.1	0.0	1139453	2863378
35	814.1	0.2	0.1	737561	1853449
40	534.4	0.2	0.1	484097	1216507
45	355.4	0.4	0.1	321969	809089
50	239.4	0.5	0.2	216859	544953
55	163.2	0.8	0.3	147833	371495
60	112.5	1.1	0.4	101943	256177
65	78.5	1.6	0.6	71075	178609
70	55.3	2.3	0.9	50078	125843
75	39.3	3.2	1.3	35640	89562
80	28.3	4.5	1.8	25610	64358
85	20.5	6.1	2.4	18574	46675
90	15.0	8.4	3.3	13590	34152
95	11.1	11.4	4.5	10029	25201
100	8.2	15.3	6.1	7461	18749
105	6.2	20.4	8.1	5594	14058
110	4.7	27.0	10.7	4226	10620
115	3.5	35.5	14.1	3216	8081
120	2.7	46.3	18.4	2464	6192

Process - 0.18 micron w/ embedded flash



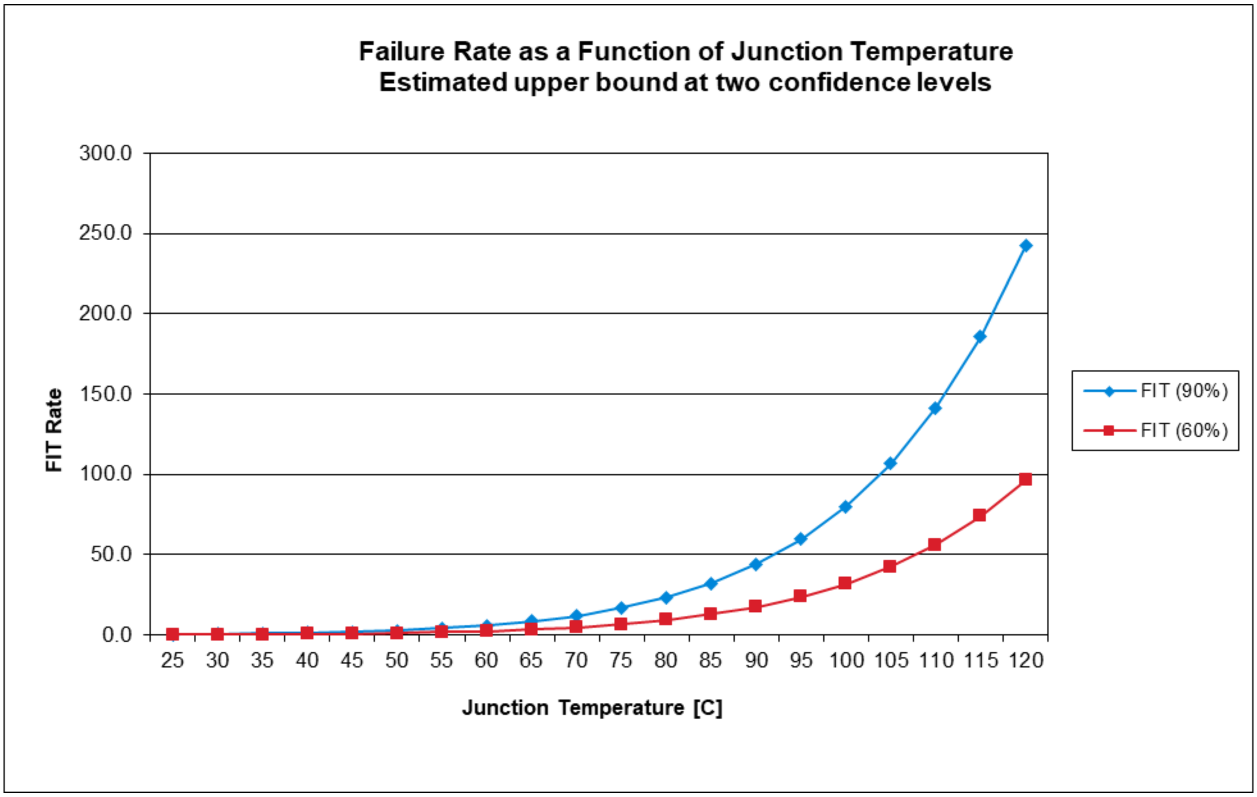
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.18 micron w/ embedded flash			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	7286	7286	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	7286057	7286057	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	1.3	0.5	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	7.6E+08	1.9E+09	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	86466.4	217285.1	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.18 micron w/ embedded flash

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.2	0.1	712198	1789712
30	1257.7	0.3	0.1	454325	1141693
35	814.1	0.4	0.2	294082	739012
40	534.4	0.6	0.2	193020	485049
45	355.4	0.9	0.4	128376	322602
50	239.4	1.3	0.5	86466	217285
55	163.2	1.9	0.8	58944	148123
60	112.5	2.8	1.1	40647	102144
65	78.5	4.0	1.6	28339	71215
70	55.3	5.7	2.3	19967	50176
75	39.3	8.0	3.2	14211	35710
80	28.3	11.2	4.4	10211	25661
85	20.5	15.4	6.1	7406	18610
90	15.0	21.1	8.4	5419	13617
95	11.1	28.5	11.4	3999	10048
100	8.2	38.4	15.3	2975	7476
105	6.2	51.2	20.4	2231	5605
110	4.7	67.7	27.0	1685	4234
115	3.5	89.0	35.4	1282	3222
120	2.7	116.2	46.2	982	2469

Process - 0.18 micron w/ OTP



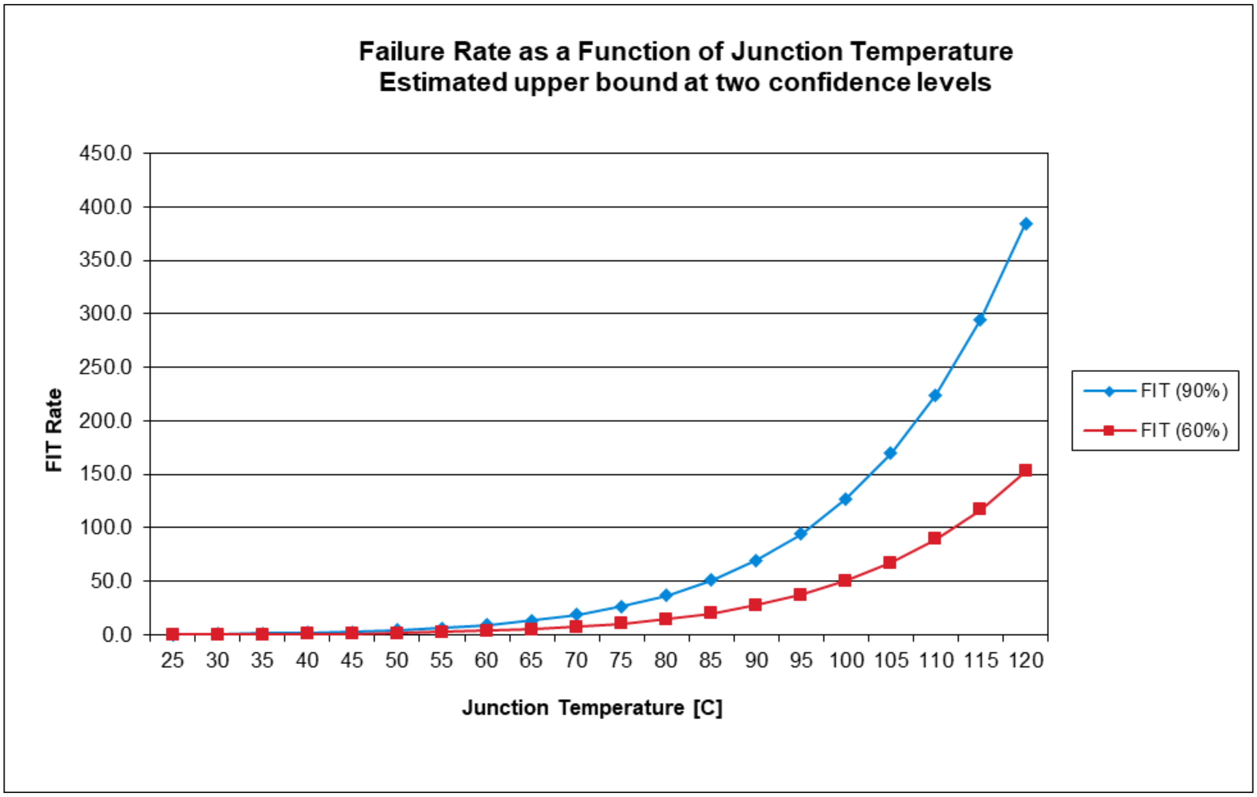
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.18 micron w/ OTP			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	3492	3492	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	3491552	3491552	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	2.8	1.1	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	3.6E+08	9.1E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	41435.6	104125.2	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.18 micron w/ OTP

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.3	0.1	341293	857648
30	1257.7	0.5	0.2	217717	547111
35	814.1	0.8	0.3	140927	354142
40	534.4	1.2	0.5	92497	232440
45	355.4	1.9	0.7	61519	154594
50	239.4	2.8	1.1	41436	104125
55	163.2	4.0	1.6	28247	70982
60	112.5	5.9	2.3	19478	48948
65	78.5	8.4	3.3	13581	34127
70	55.3	11.9	4.7	9568	24045
75	39.3	16.8	6.7	6810	17113
80	28.3	23.3	9.3	4893	12297
85	20.5	32.2	12.8	3549	8918
90	15.0	44.0	17.5	2597	6525
95	11.1	59.6	23.7	1916	4815
100	8.2	80.1	31.9	1426	3582
105	6.2	106.8	42.5	1069	2686
110	4.7	141.4	56.3	807	2029
115	3.5	185.8	73.9	614	1544
120	2.7	242.5	96.5	471	1183

Process - 0.18 micron w/ RF



Reliability FIT Calculations for temperature acceleration

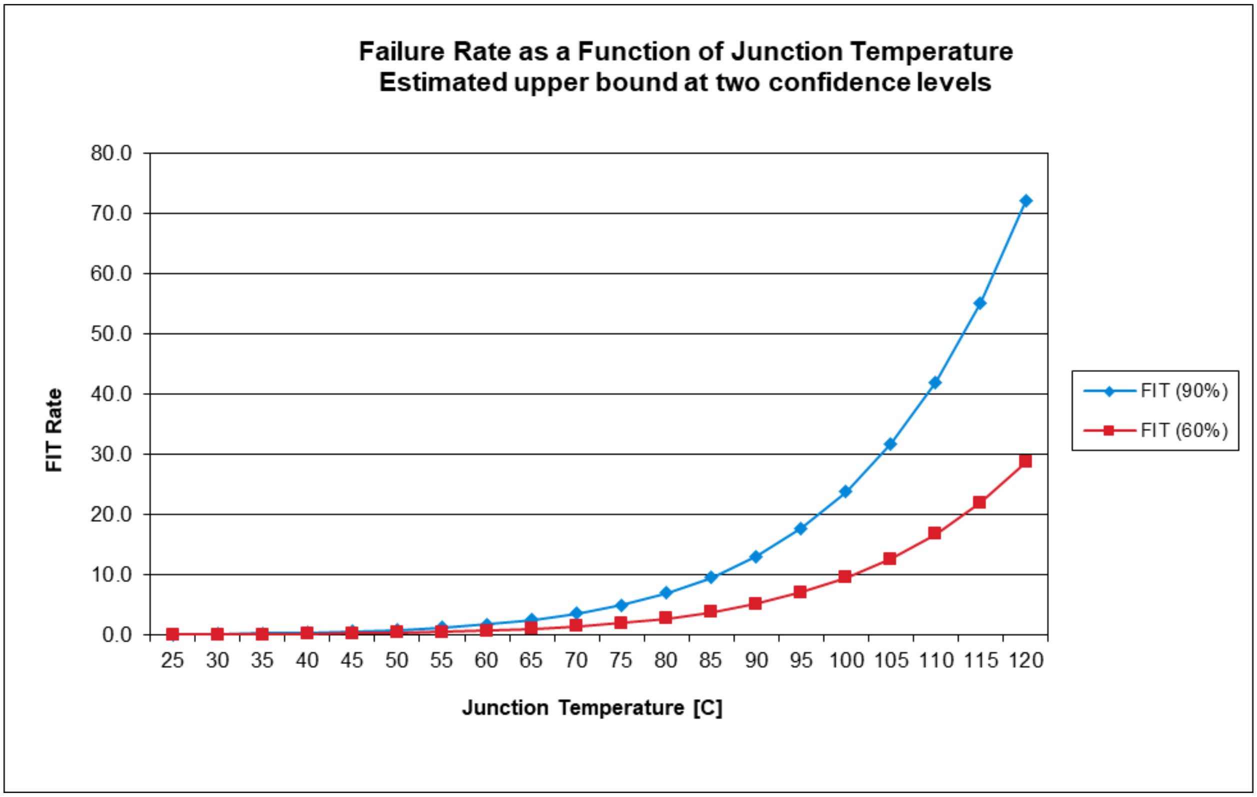
Single Point Calculation for 0.18 micron w/ RF

Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	2201	2201	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	2200683	2200683	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	4.4	1.7	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	2.3E+08	5.7E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	26116.3	65628.8	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.18 micron w/ RF

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.5	0.2	215113	540565
30	1257.7	0.8	0.3	137225	344837
35	814.1	1.3	0.5	88825	223211
40	534.4	2.0	0.8	58300	146504
45	355.4	2.9	1.2	38775	97439
50	239.4	4.4	1.7	26116	65629
55	163.2	6.4	2.6	17804	44739
60	112.5	9.3	3.7	12277	30851
65	78.5	13.3	5.3	8560	21510
70	55.3	18.9	7.5	6031	15155
75	39.3	26.6	10.6	4292	10786
80	28.3	37.0	14.7	3084	7751
85	20.5	51.0	20.3	2237	5621
90	15.0	69.7	27.8	1637	4113
95	11.1	94.5	37.6	1208	3035
100	8.2	127.0	50.6	899	2258
105	6.2	169.4	67.4	674	1693
110	4.7	224.3	89.3	509	1279
115	3.5	294.8	117.3	387	973
120	2.7	384.7	153.1	297	746

Process - 0.25 micron



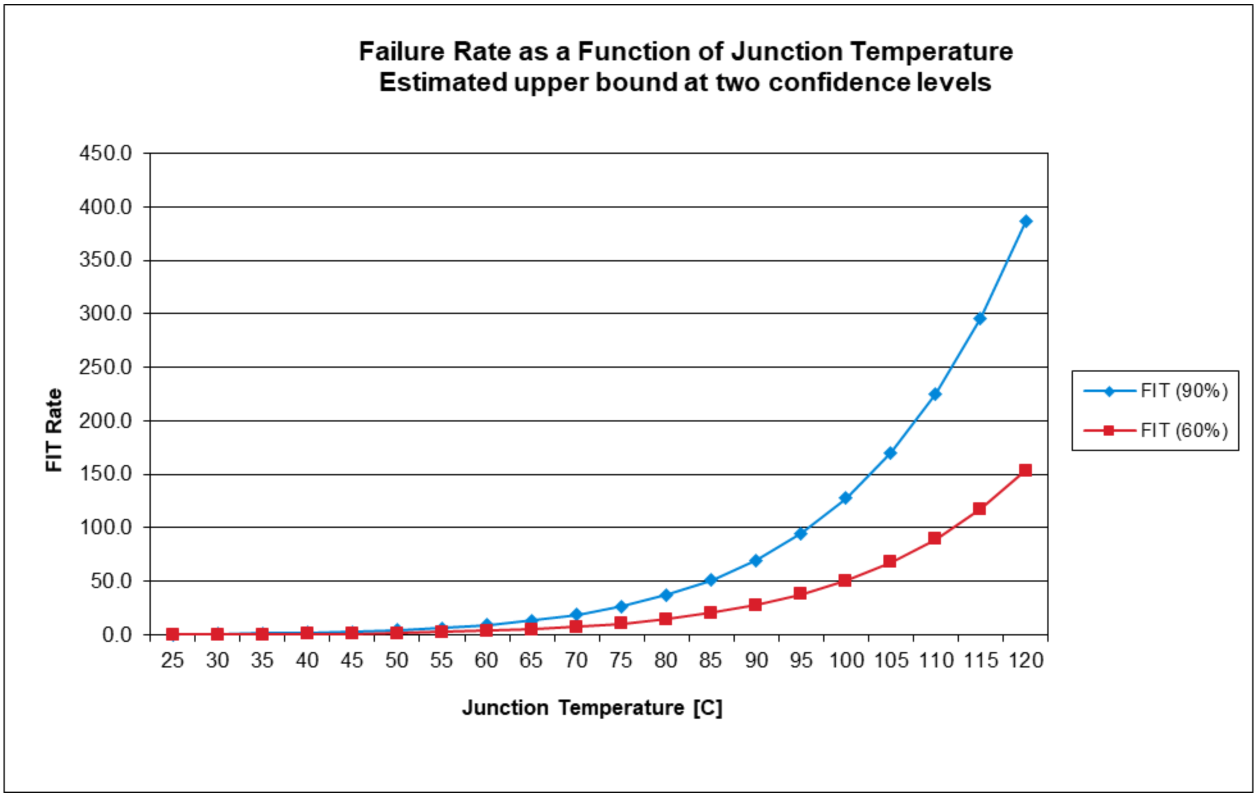
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.25 micron			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	11748	11748	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	11747895	11747895	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	0.8	0.3	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.2E+09	3.1E+09	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	139416.8	350346.2	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.25 micron

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.1	0.0	1148334	2885697
30	1257.7	0.2	0.1	732545	1840843
35	814.1	0.2	0.1	474172	1191568
40	534.4	0.4	0.1	311222	782083
45	355.4	0.6	0.2	206991	520157
50	239.4	0.8	0.3	139417	350346
55	163.2	1.2	0.5	95040	238831
60	112.5	1.7	0.7	65538	164694
65	78.5	2.5	1.0	45694	114826
70	55.3	3.5	1.4	32195	80903
75	39.3	5.0	2.0	22913	57579
80	28.3	6.9	2.8	16465	41375
85	20.5	9.6	3.8	11941	30007
90	15.0	13.1	5.2	8737	21956
95	11.1	17.7	7.0	6447	16202
100	8.2	23.8	9.5	4797	12053
105	6.2	31.7	12.6	3596	9038
110	4.7	42.0	16.7	2717	6828
115	3.5	55.2	22.0	2067	5195
120	2.7	72.1	28.7	1584	3981

Process - 0.25 micron w/ embedded flash



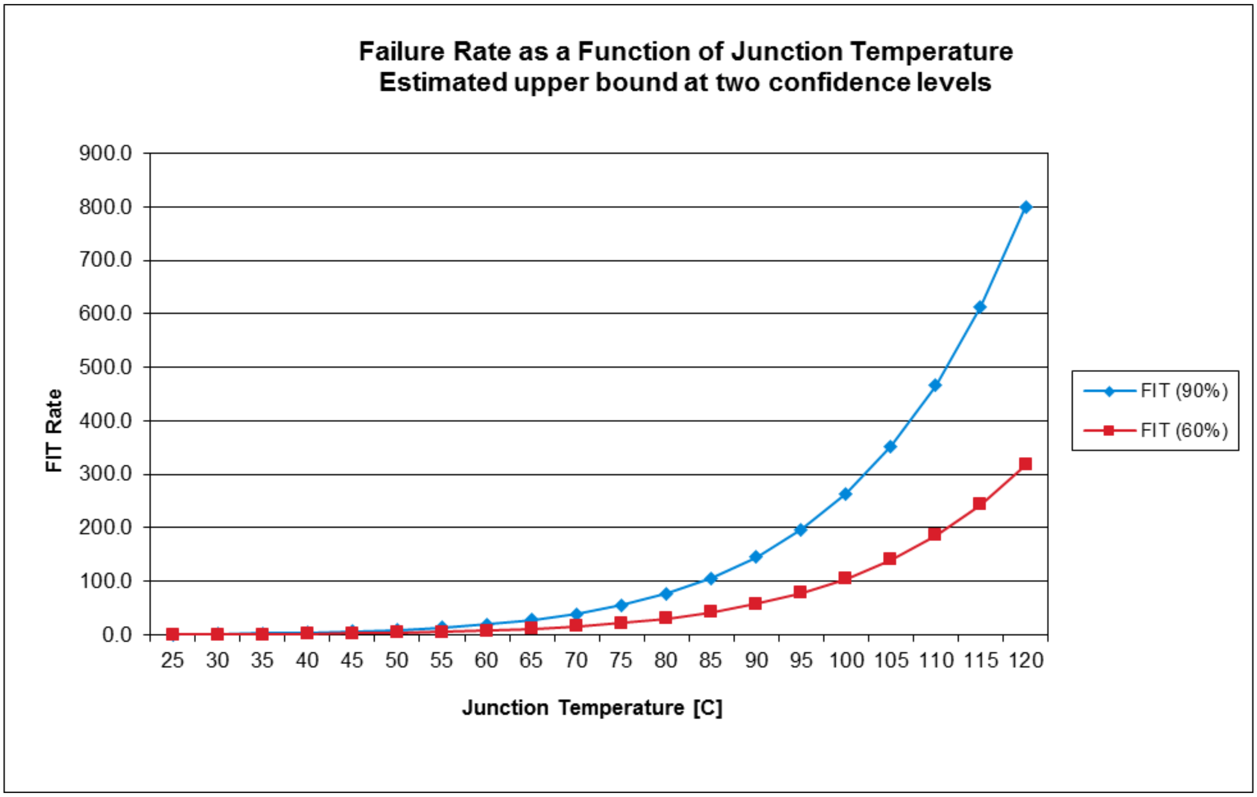
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.25 micron w/ embedded flash			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	2193	2193	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	2192540	2192540	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	4.4	1.7	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	2.3E+08	5.7E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	26019.7	65386.0	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.25 micron w/ embedded flash

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.5	0.2	214317	538565
30	1257.7	0.8	0.3	136717	343561
35	814.1	1.3	0.5	88496	222385
40	534.4	2.0	0.8	58084	145962
45	355.4	3.0	1.2	38631	97078
50	239.4	4.4	1.7	26020	65386
55	163.2	6.4	2.6	17738	44574
60	112.5	9.3	3.7	12232	30737
65	78.5	13.4	5.3	8528	21430
70	55.3	19.0	7.6	6009	15099
75	39.3	26.7	10.6	4276	10746
80	28.3	37.1	14.8	3073	7722
85	20.5	51.2	20.4	2229	5600
90	15.0	70.0	27.9	1631	4098
95	11.1	94.9	37.8	1203	3024
100	8.2	127.5	50.7	895	2250
105	6.2	170.1	67.7	671	1687
110	4.7	225.1	89.6	507	1274
115	3.5	295.9	117.7	386	970
120	2.7	386.1	153.7	296	743

Process – 0.315 - 0.35 micron

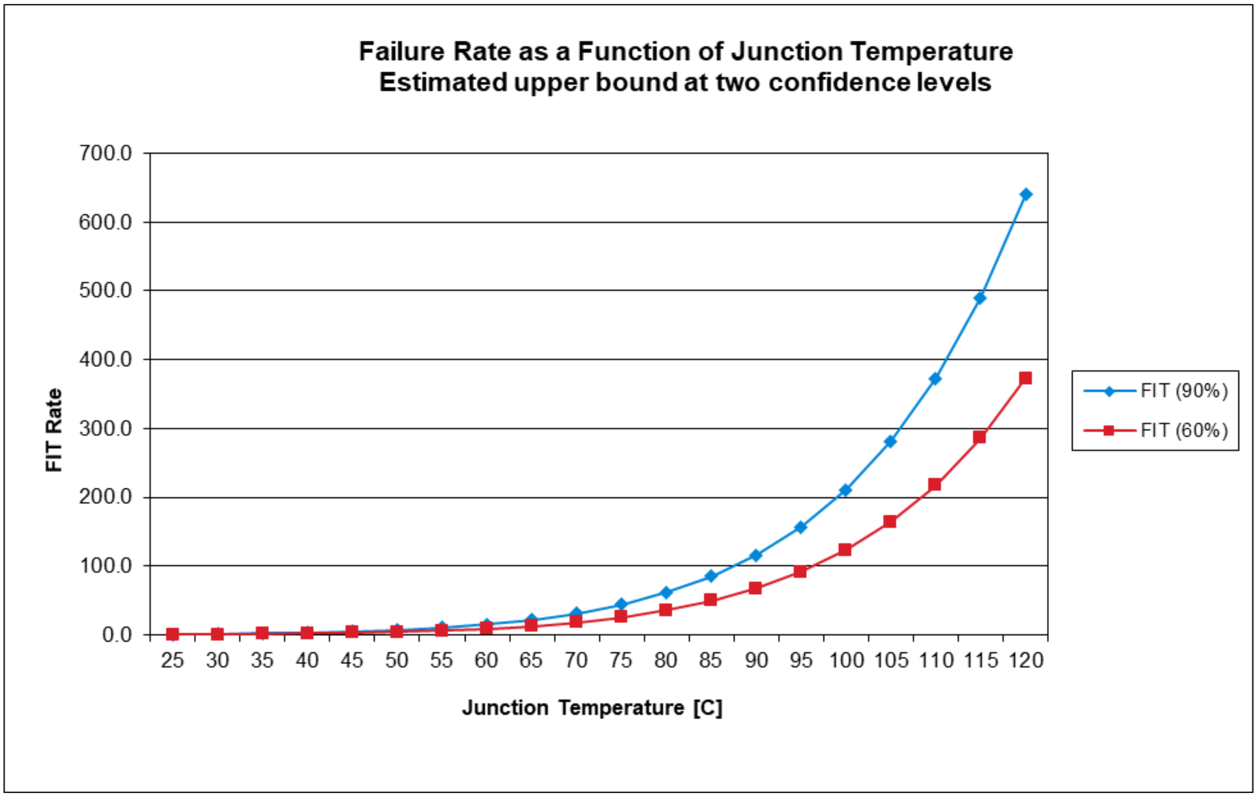


Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.315 um - 0.35 um			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	1058	1058	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	1058304	1058304	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	9.1	3.6	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.1E+08	2.8E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	12559.3	31560.8	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.315 um - 0.35 um					
				MTTF	MTTF
Tja	Af	FIT (90%)	FIT (60%)	90% (yrs)	60% (yrs)
25	1971.6	1.1	0.4	103447	259957
30	1257.7	1.7	0.7	65991	165832
35	814.1	2.7	1.1	42716	107342
40	534.4	4.1	1.6	28036	70454
45	355.4	6.1	2.4	18647	46858
50	239.4	9.1	3.6	12559	31561
55	163.2	13.3	5.3	8562	21515
60	112.5	19.3	7.7	5904	14836
65	78.5	27.7	11.0	4116	10344
70	55.3	39.4	15.7	2900	7288
75	39.3	55.3	22.0	2064	5187
80	28.3	77.0	30.6	1483	3727
85	20.5	106.1	42.2	1076	2703
90	15.0	145.0	57.7	787	1978
95	11.1	196.5	78.2	581	1460
100	8.2	264.2	105.1	432	1086
105	6.2	352.4	140.2	324	814
110	4.7	466.4	185.6	245	615
115	3.5	612.9	243.9	186	468
120	2.7	799.9	318.3	143	359

Process - 0.35 micron



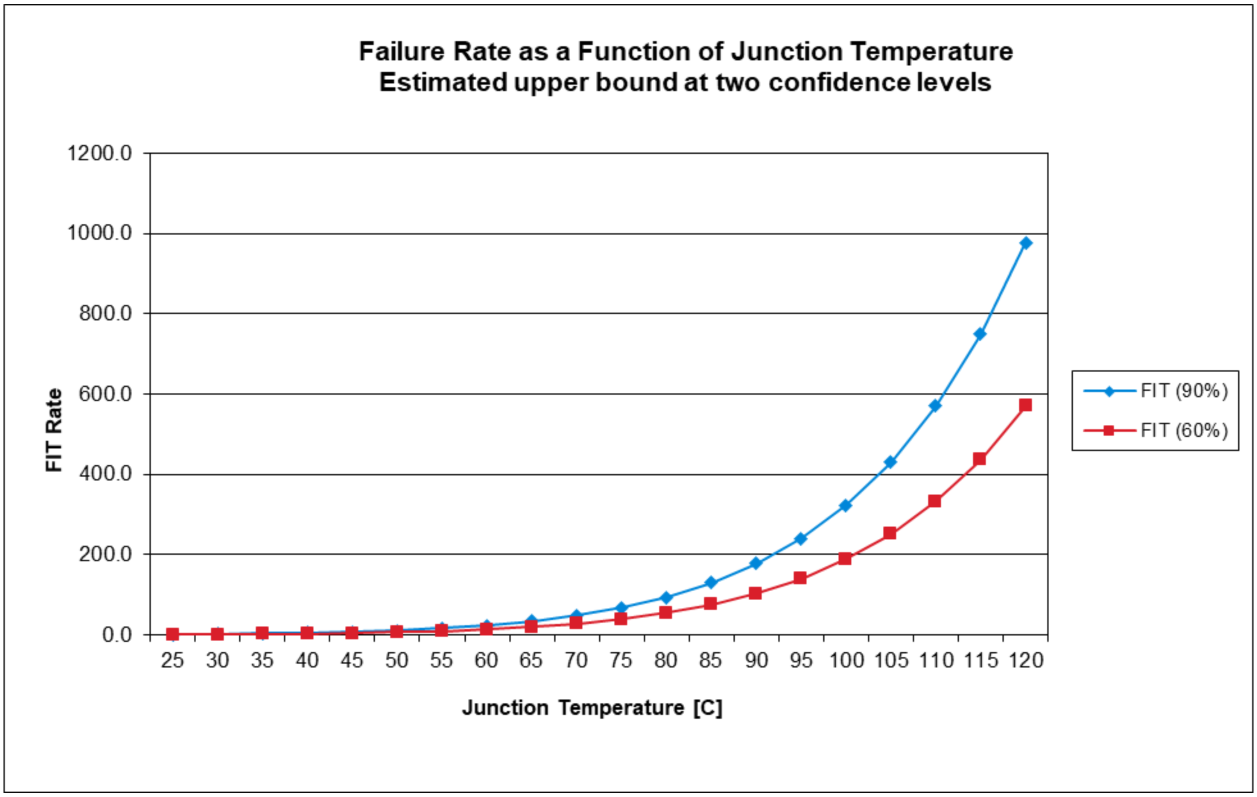
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.35 micron			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	3059	3059	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	2	2	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	6.0	6.0	degrees of freedom [2(F+1)]
DH	3058808	3058808	Total device hours D*H
X2	10.6	6.2	Chi-Square Distribution Value
FIT	7.3	4.2	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	1.4E+08	2.4E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	15704.4	26915.9	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.35 micron

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.9	0.5	129353	221698
30	1257.7	1.4	0.8	82517	141426
35	814.1	2.1	1.2	53413	91544
40	534.4	3.3	1.9	35057	60085
45	355.4	4.9	2.9	23316	39962
50	239.4	7.3	4.2	15704	26916
55	163.2	10.7	6.2	10706	18349
60	112.5	15.5	9.0	7382	12653
65	78.5	22.2	12.9	5147	8822
70	55.3	31.5	18.4	3627	6216
75	39.3	44.2	25.8	2581	4424
80	28.3	61.6	35.9	1855	3179
85	20.5	84.9	49.5	1345	2305
90	15.0	116.0	67.7	984	1687
95	11.1	157.2	91.7	726	1245
100	8.2	211.3	123.3	540	926
105	6.2	281.8	164.4	405	694
110	4.7	373.0	217.6	306	525
115	3.5	490.2	286.0	233	399
120	2.7	639.7	373.3	178	306

Process - 0.35 micron w/ embedded flash



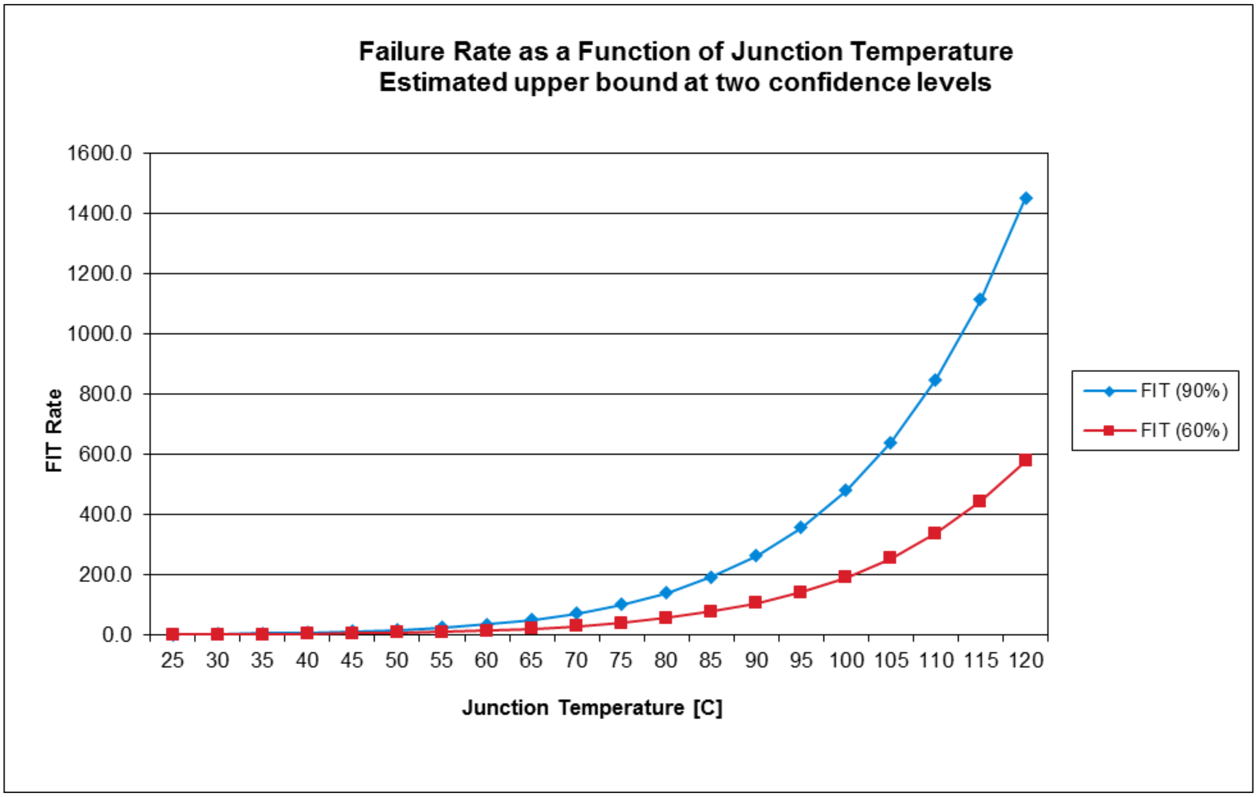
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.35 micron w/ embedded flash			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	2001	2001	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	2	2	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	6.0	6.0	degrees of freedom [2(F+1)]
DH	2000504	2000504	Total device hours D*H
X2	10.6	6.2	Chi-Square Distribution Value
FIT	11.1	6.5	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	9.0E+07	1.5E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	10270.9	17603.4	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.35 micron w/ embedded flash

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	1.3	0.8	84598	144994
30	1257.7	2.1	1.2	53967	92494
35	814.1	3.3	1.9	34933	59871
40	534.4	5.0	2.9	22928	39296
45	355.4	7.5	4.4	15249	26136
50	239.4	11.1	6.5	10271	17603
55	163.2	16.3	9.5	7002	12000
60	112.5	23.6	13.8	4828	8275
65	78.5	33.9	19.8	3366	5770
70	55.3	48.1	28.1	2372	4065
75	39.3	67.6	39.5	1688	2893
80	28.3	94.1	54.9	1213	2079
85	20.5	129.8	75.7	880	1508
90	15.0	177.4	103.5	644	1103
95	11.1	240.3	140.2	475	814
100	8.2	323.1	188.5	353	606
105	6.2	430.9	251.4	265	454
110	4.7	570.3	332.8	200	343
115	3.5	749.5	437.3	152	261
120	2.7	978.2	570.7	117	200

Process - 0.6 - 1.0um



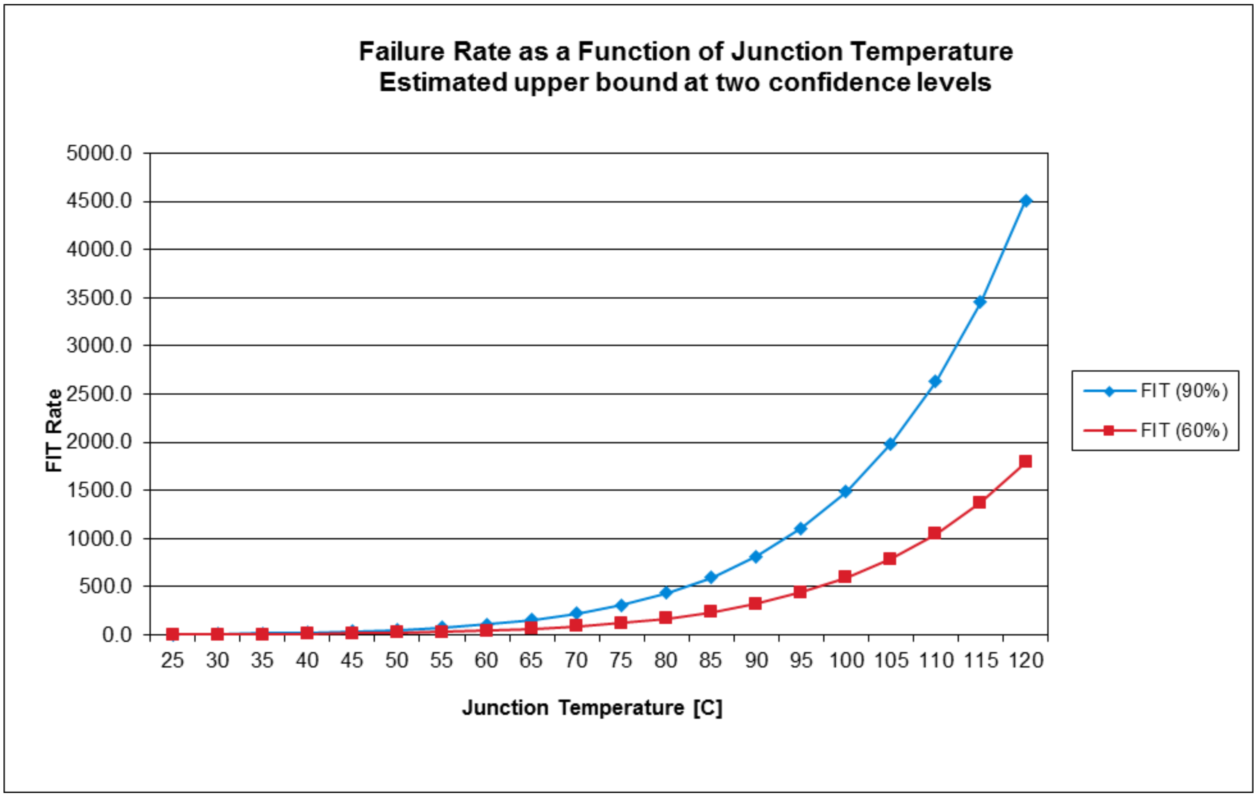
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for 0.6 - 1.0um			
Variables:	90%	60%	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	582	582	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	582487	582487	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	16.5	6.6	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	6.1E+07	1.5E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	6912.6	17370.9	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for 0.6 - 1.0um

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	2.0	0.8	56937	143079
30	1257.7	3.1	1.3	36321	91273
35	814.1	4.9	1.9	23511	59081
40	534.4	7.4	2.9	15431	38777
45	355.4	11.1	4.4	10263	25791
50	239.4	16.5	6.6	6913	17371
55	163.2	24.2	9.6	4712	11842
60	112.5	35.1	14.0	3250	8166
65	78.5	50.4	20.1	2266	5693
70	55.3	71.5	28.5	1596	4011
75	39.3	100.5	40.0	1136	2855
80	28.3	139.8	55.6	816	2051
85	20.5	192.8	76.7	592	1488
90	15.0	263.5	104.9	433	1089
95	11.1	357.1	142.1	320	803
100	8.2	480.0	191.0	238	598
105	6.2	640.2	254.8	178	448
110	4.7	847.4	337.2	135	339
115	3.5	1113.6	443.2	103	258
120	2.7	1453.4	578.4	79	197

Process – Diode



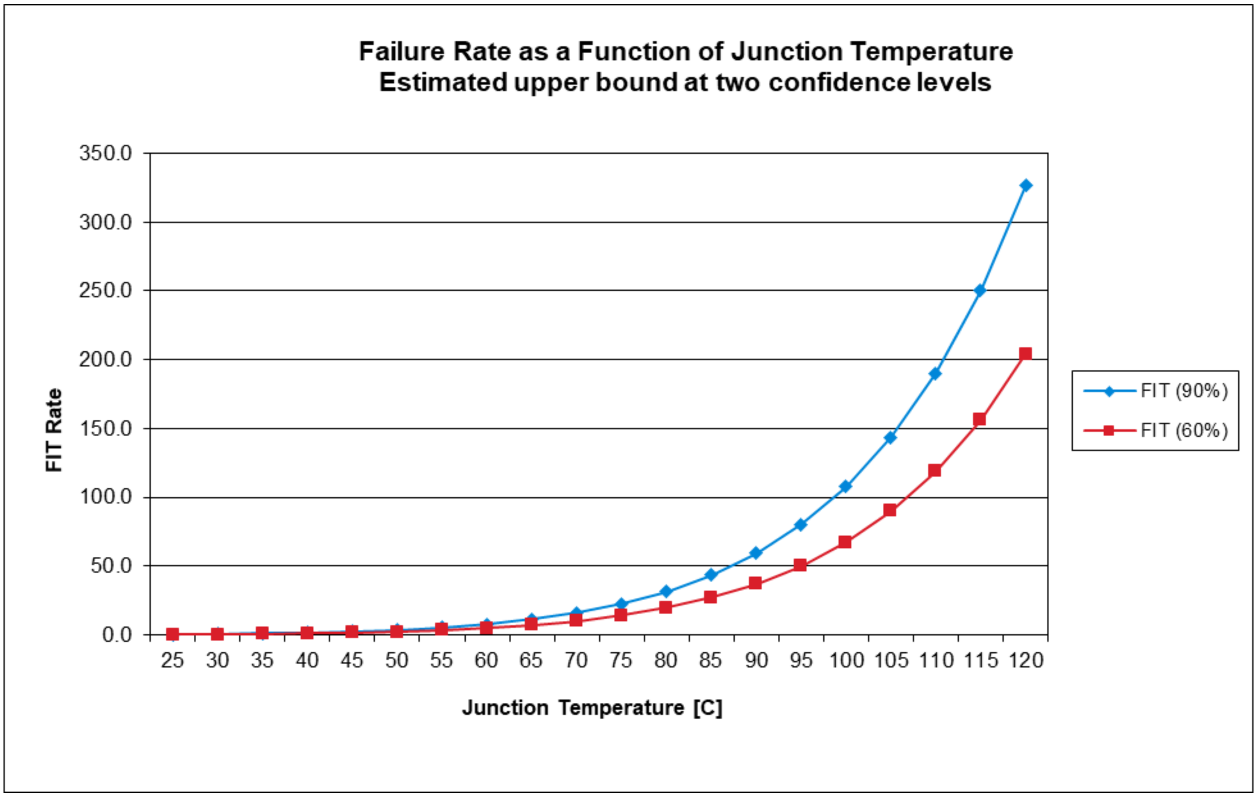
Reliability FIT Calculations for temperature acceleration

Single Point Calculation for Diode			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	188	188	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	0	0	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	2.0	2.0	degrees of freedom [2(F+1)]
DH	187703	187703	Total device hours D*H
X2	4.6	1.8	Chi-Square Distribution Value
FIT	51.2	20.4	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	2.0E+07	4.9E+07	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	2227.5	5597.7	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

FIT Estimation Curves for Diode

Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	6.2	2.5	18348	46107
30	1257.7	9.8	3.9	11704	29412
35	814.1	15.1	6.0	7576	19038
40	534.4	23.0	9.1	4973	12496
45	355.4	34.5	13.7	3307	8311
50	239.4	51.2	20.4	2228	5598
55	163.2	75.2	29.9	1519	3816
60	112.5	109.0	43.4	1047	2631
65	78.5	156.4	62.2	730	1835
70	55.3	221.9	88.3	514	1293
75	39.3	311.8	124.1	366	920
80	28.3	433.9	172.7	263	661
85	20.5	598.3	238.1	191	479
90	15.0	817.7	325.4	140	351
95	11.1	1108.2	441.0	103	259
100	8.2	1489.6	592.8	77	193
105	6.2	1986.6	790.6	57	144
110	4.7	2629.7	1046.5	43	109
115	3.5	3455.9	1375.2	33	83
120	2.7	4510.2	1794.8	25	64

Process - High Voltage



Reliability FIT Calculations for temperature acceleration

Single Point Calculation for High Voltage			
Variables:	**90%**	**60%**	Confidence Level
Tja [C]	50	50	Junction Temperature at operating condition
Tsa [C]	125	125	Ambient Temperature at stress
Tjs [C]	140	140	Junction Temperature at stress (assume 15C rise)
Ea	0.7	0.7	Energy Activation
D	7523	7523	Equivalent Devices stressed (Assuming 1000hrs per device)
H	1000	1000	Number of hours on stress
F	3	3	Number of failures
P	0.1	0.4	Confidence Level [.1 = 90%; .4 = 60%]
Constants:			
k	8.61E-05	8.61E-05	Boltzman's constant [eV/K]
Calculated Values:			
Af	239.4	239.4	Acceleration Factor: [exp(Ea/k*(1/(Tja + 273.15) - (1/(Tjs + 273.15))]
v	8.0	8.0	degrees of freedom [2(F+1)]
DH	7523339	7523339	Total device hours D*H
X2	13.4	8.4	Chi-Square Distribution Value
FIT	3.7	2.3	Failures in time [failures / 1xE9 hours] =[X2/(2*AF*D*H)*1E9]
MTTF	2.7E+08	4.3E+08	Mean Time To Failure [hours] (Note: MTTF is 1/FIT)
MTTF	30771.9	49237.7	Mean Time To Failure [years] (Note: MTTF is 1/FIT)

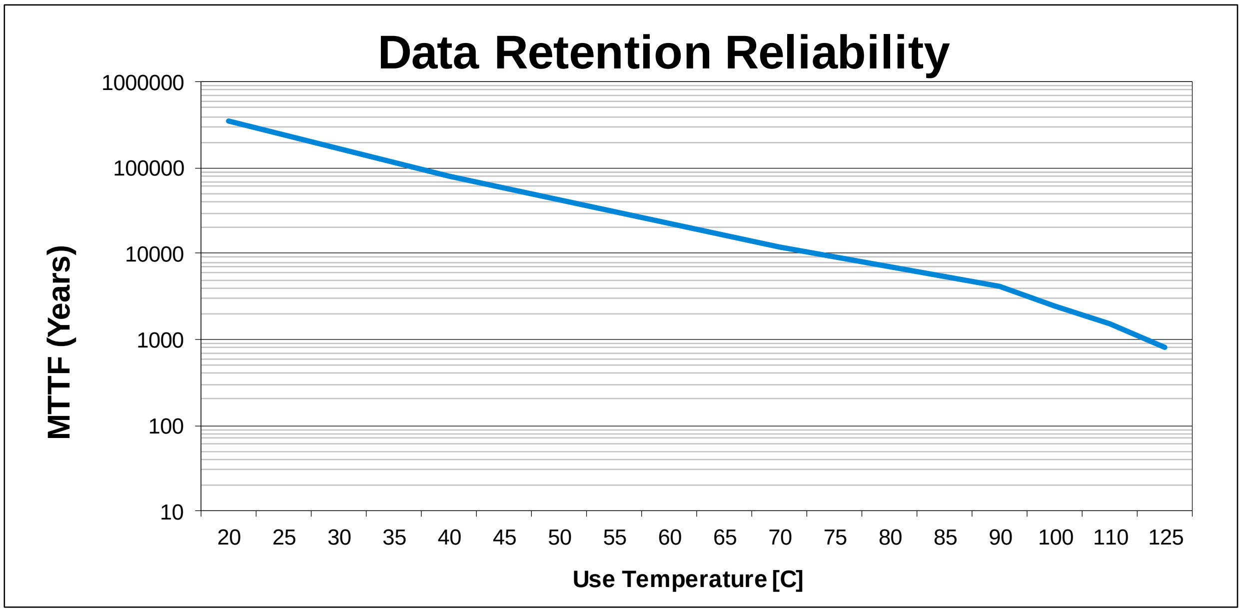
FIT Estimation Curves for High Voltage

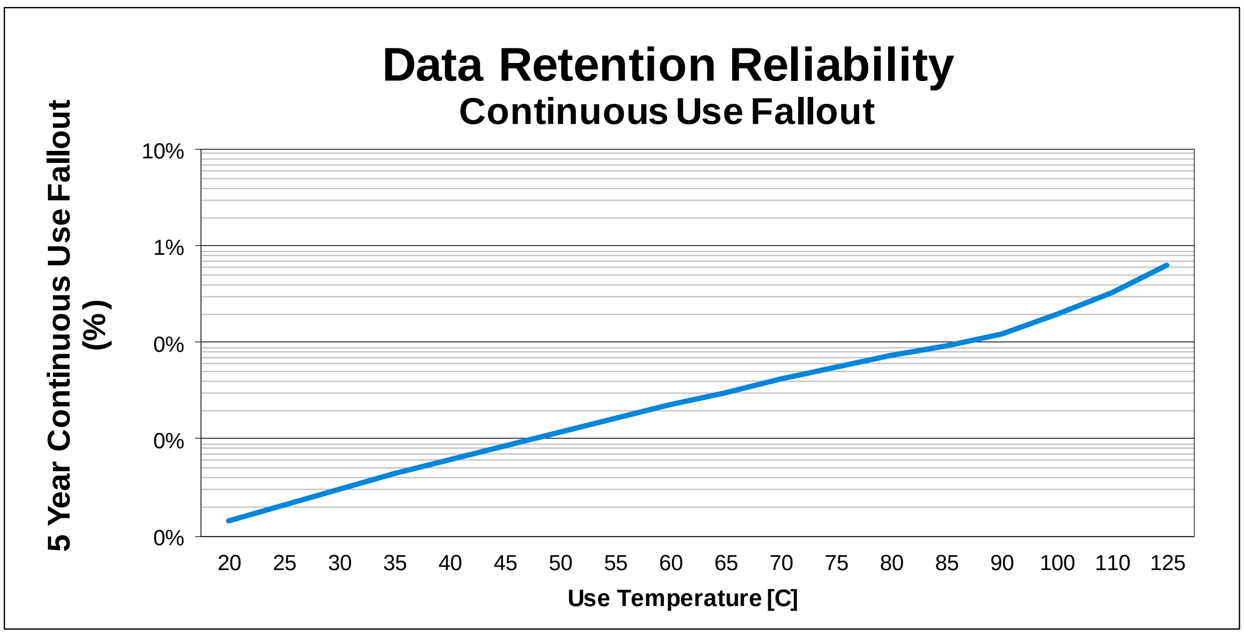
Tja	Af	FIT (90%)	FIT (60%)	MTTF 90% (yrs)	MTTF 60% (yrs)
25	1971.6	0.5	0.3	253459	405556
30	1257.7	0.7	0.4	161686	258712
35	814.1	1.1	0.7	104659	167463
40	534.4	1.7	1.0	68692	109914
45	355.4	2.5	1.6	45687	73103
50	239.4	3.7	2.3	30772	49238
55	163.2	5.4	3.4	20977	33565
60	112.5	7.9	4.9	14466	23146
65	78.5	11.3	7.1	10085	16138
70	55.3	16.1	10.0	7106	11370
75	39.3	22.6	14.1	5057	8092
80	28.3	31.4	19.6	3634	5815
85	20.5	43.3	27.1	2636	4217
90	15.0	59.2	37.0	1928	3086
95	11.1	80.2	50.1	1423	2277
100	8.2	107.8	67.4	1059	1694
105	6.2	143.8	89.9	794	1270
110	4.7	190.4	119.0	600	960
115	3.5	250.2	156.3	456	730
120	2.7	326.5	204.0	350	559

Flash Reliability Summary by Fab Technology

40 nm Flash Reliability Summary

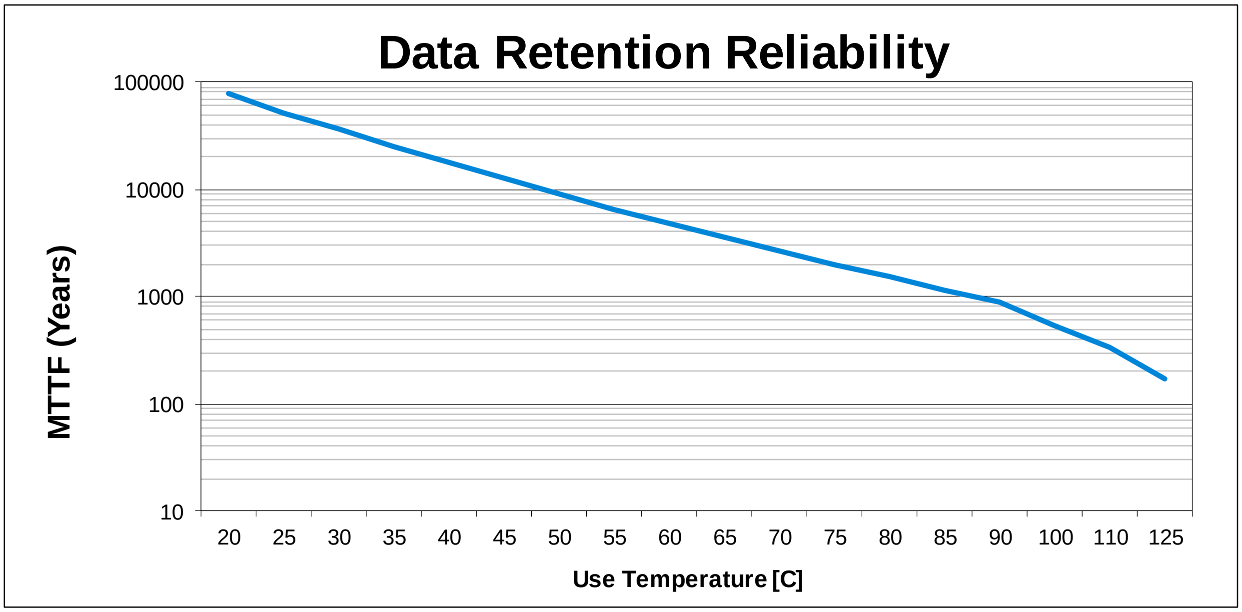
Effective Dev-Hrs at 150°C	Chargeable Failures	**Typical Case:** Predicted FIT @Ta=50˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=50°C 60% UCL	**Worst Case:** Predicted FIT @Ta=85˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=85°C 60% UCL
2,334,588	**0**	**2.7**	**0.024%**	**21.4**	**0.187%**

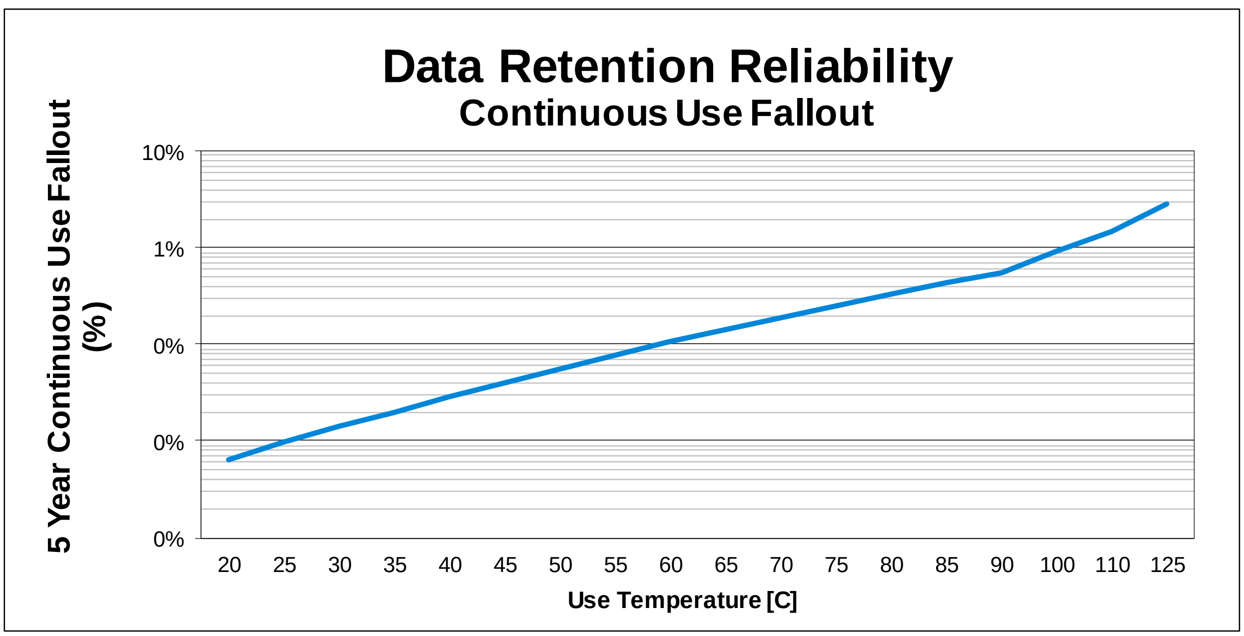




40 nm OTP Reliability Summary

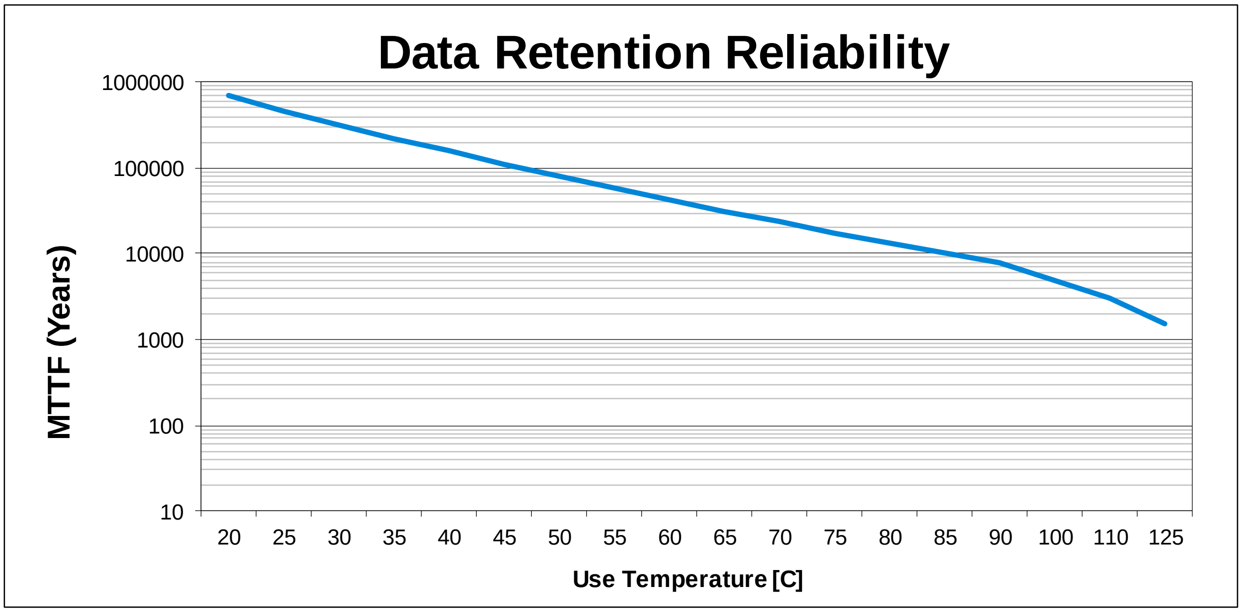
Effective Dev-Hrs at 150°C	Chargeable Failures	**Typical Case:** Predicted FIT @Ta=50˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=50°C 60% UCL	**Worst Case:** Predicted FIT @Ta=85˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=85°C 60% UCL
506,000	**0**	**12.7**	**0.111%**	**98.7**	**0.861%**

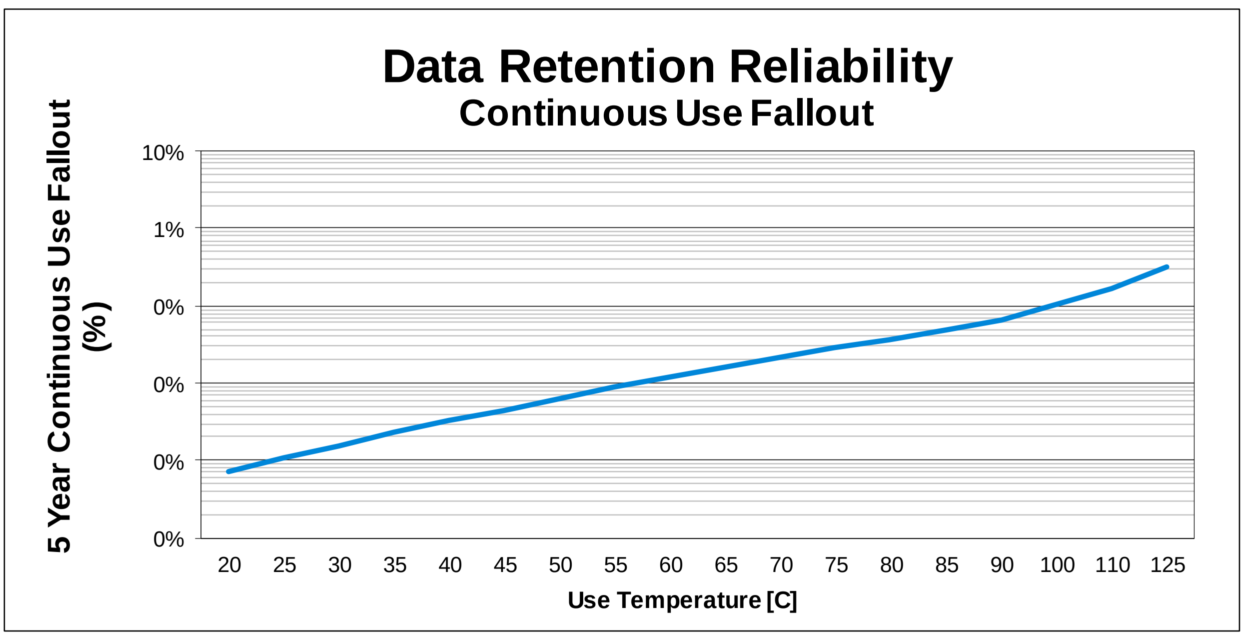




90 nm Flash Reliability Summary

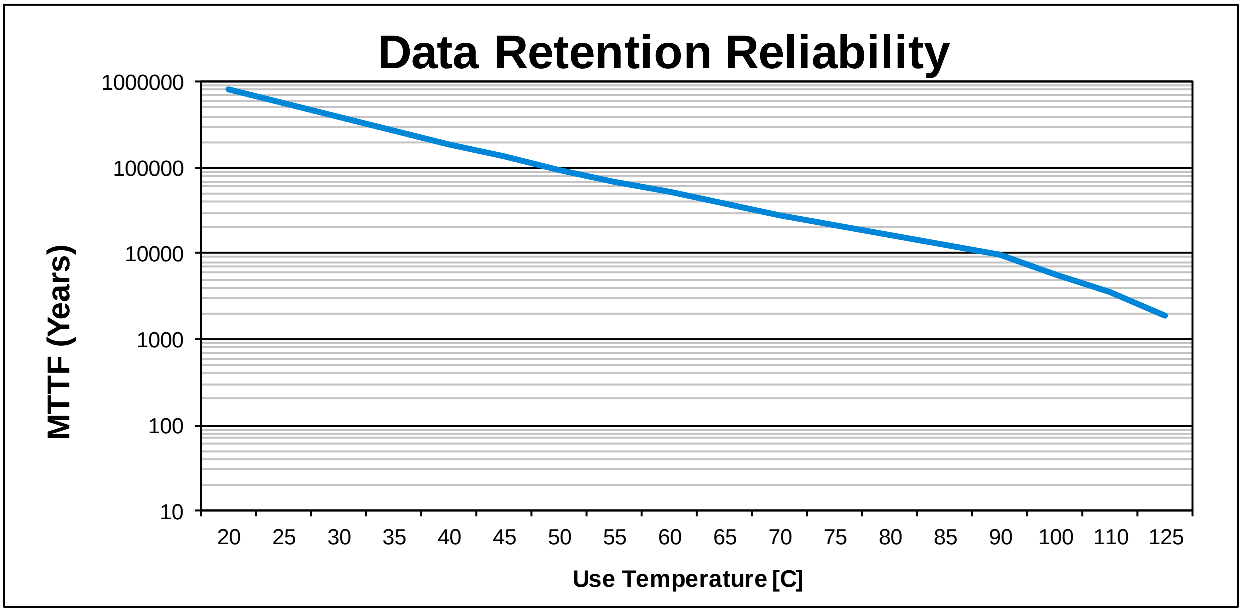
Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
4,472,664	0	1.4	0.013%	11.2	0.098%

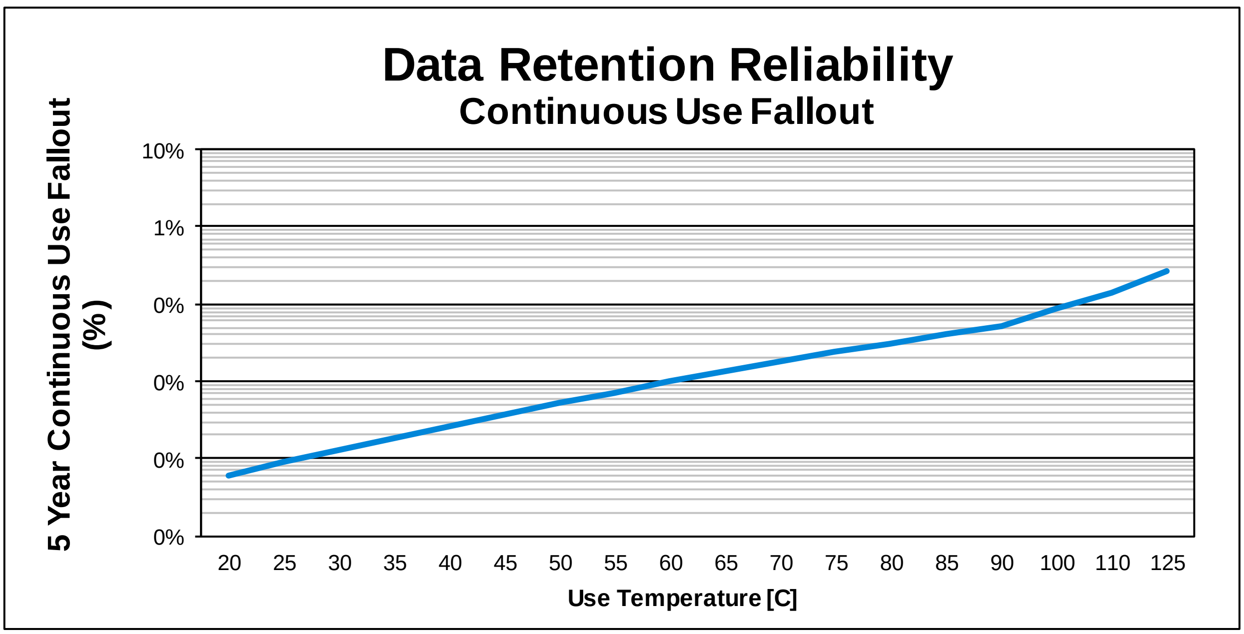




0.11um OTP Reliability Summary

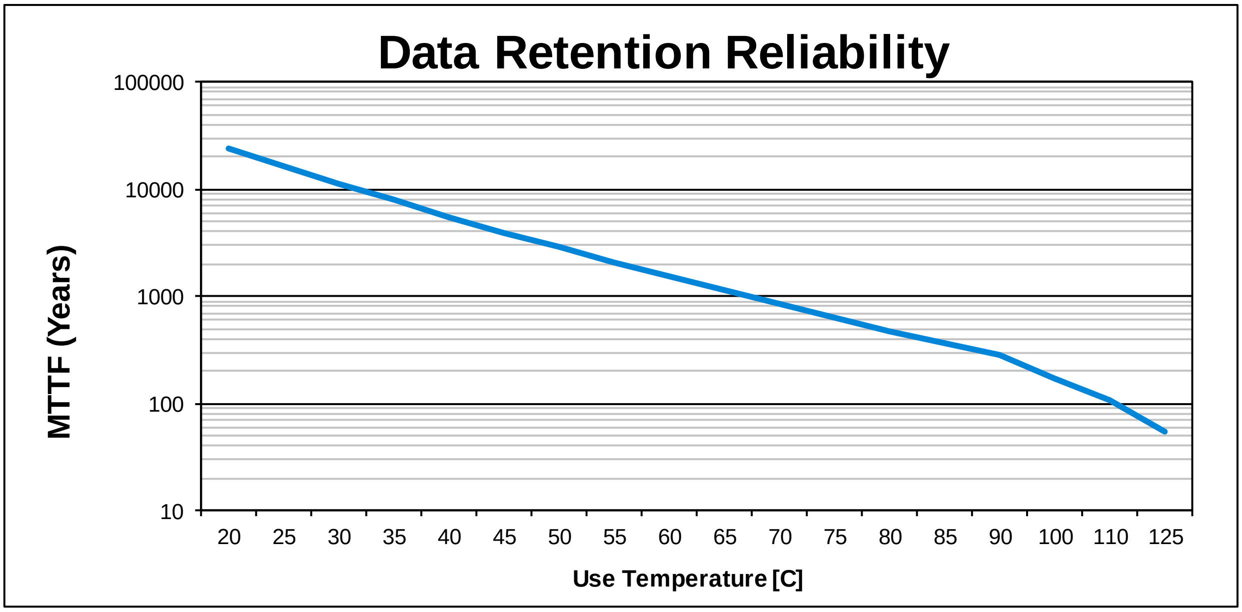
Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
5,417,196	0	1.2	0.010%	9.2	0.081%

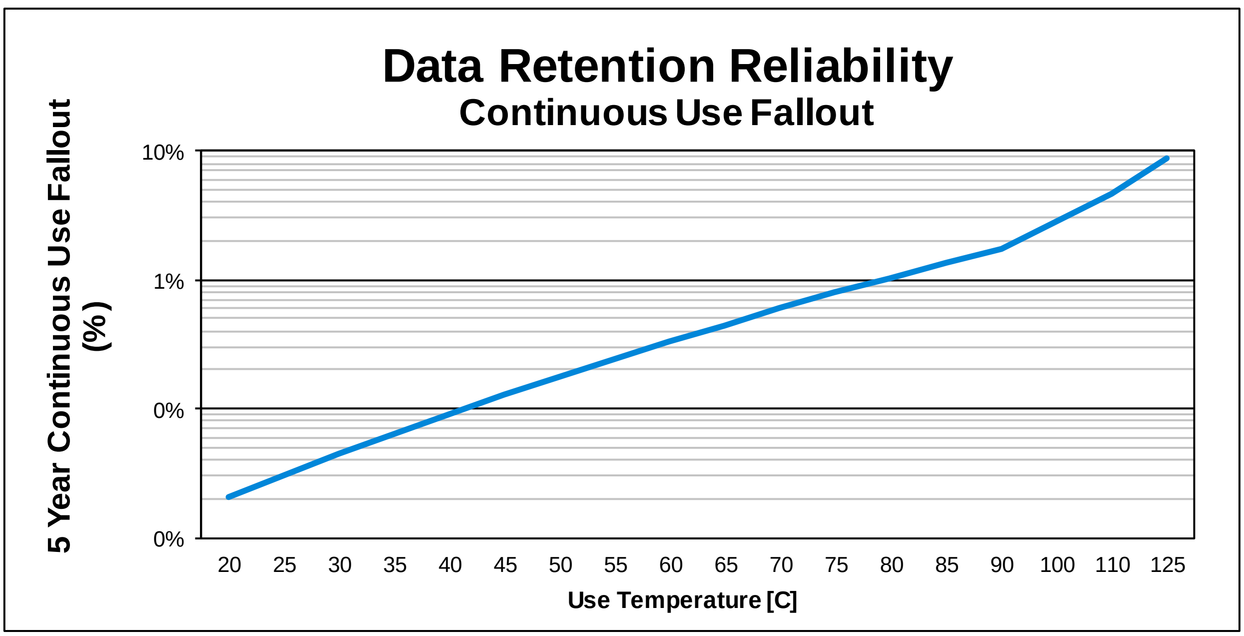




0.13um Flash Reliability Summary

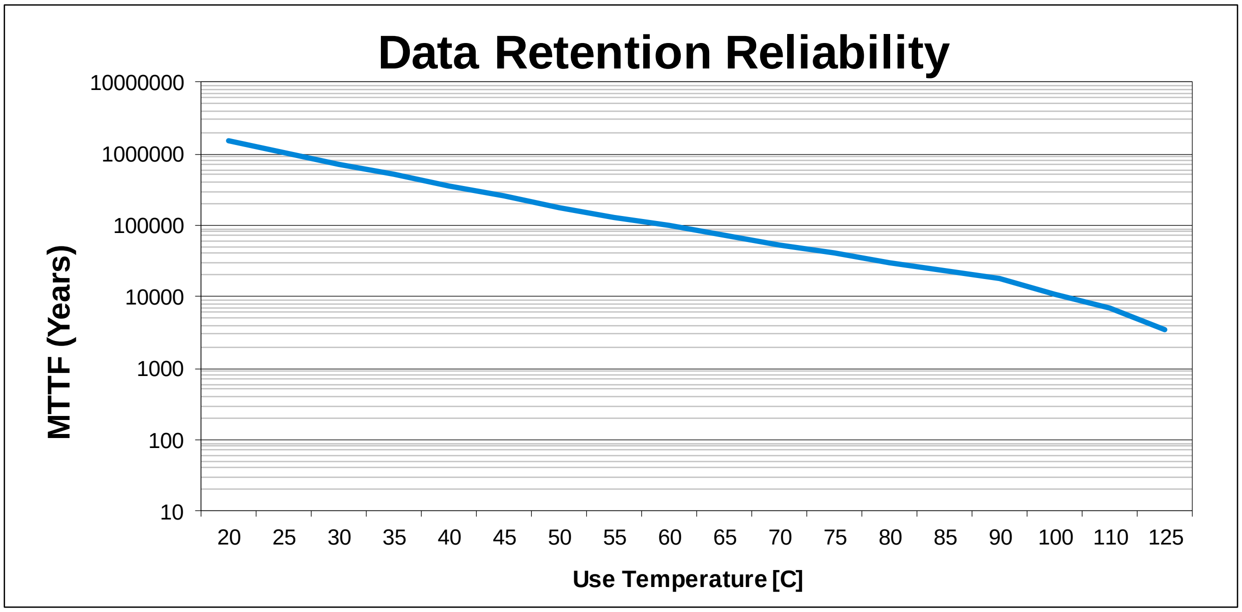
Effective Dev-Hrs at 150°C	Chargeable Failures	**Typical Case:** Predicted FIT @Ta=50˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=50°C 60% UCL	**Worst Case:** Predicted FIT @Ta=85˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=85°C 60% UCL
160,000	**0**	**40.1**	**0.351%**	**312.1**	**2.697%**

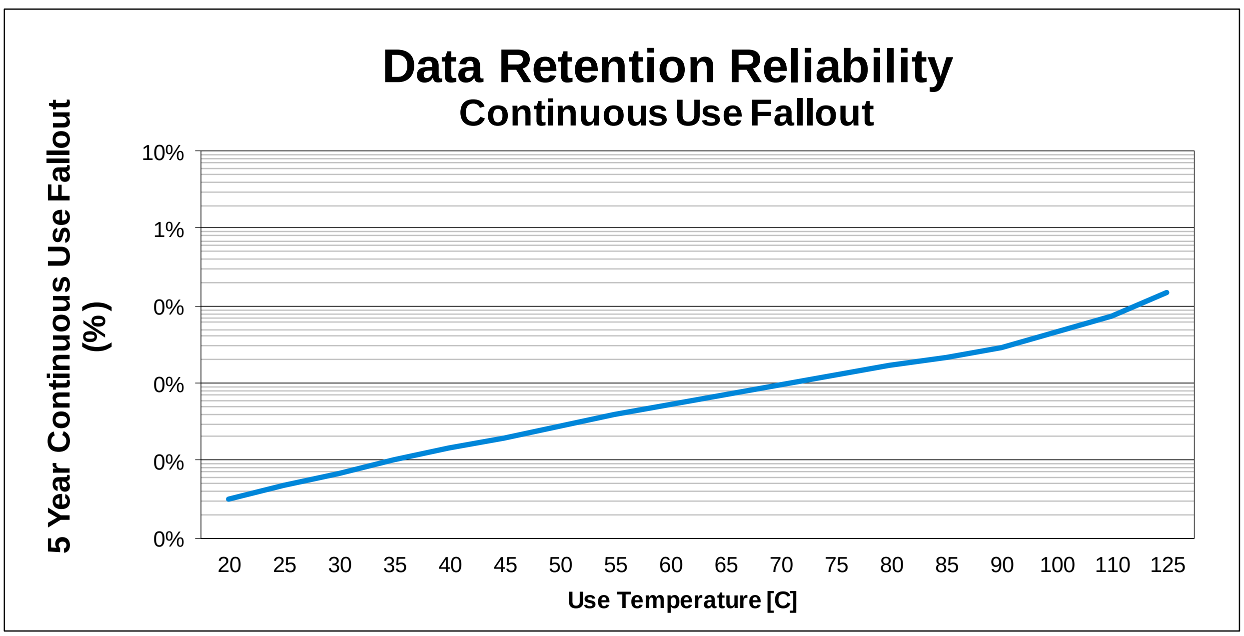




0.13um OTP Reliability Summary

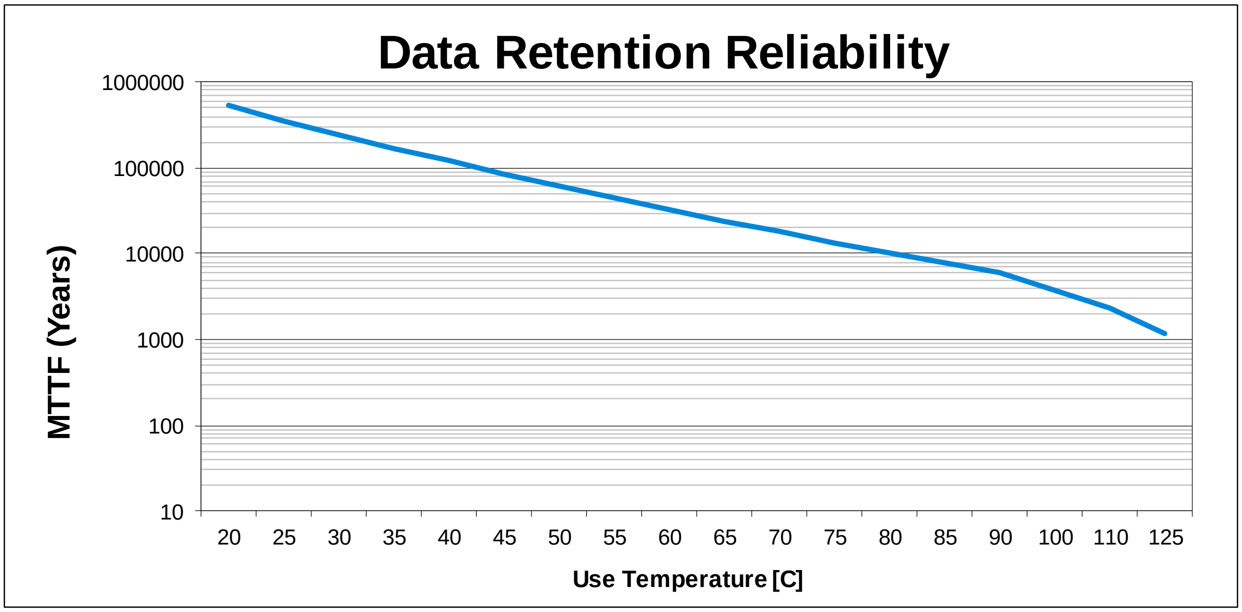
Effective Dev-Hrs at 150°C	Chargeable Failures	**Typical Case:** Predicted FIT @Ta=50˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=50°C 60% UCL	**Worst Case:** Predicted FIT @Ta=85˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=85°C 60% UCL
10,153,138	**0**	**0.6**	**0.006%**	**4.9**	**0.043%**

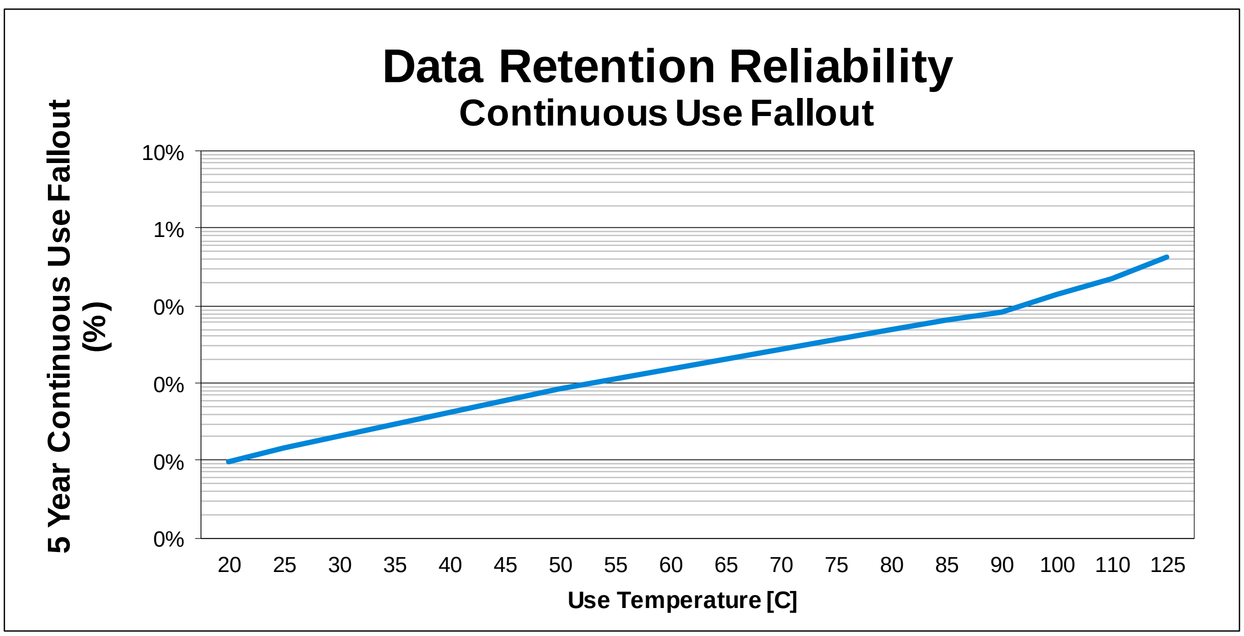




0.18um Flash Reliability Summary

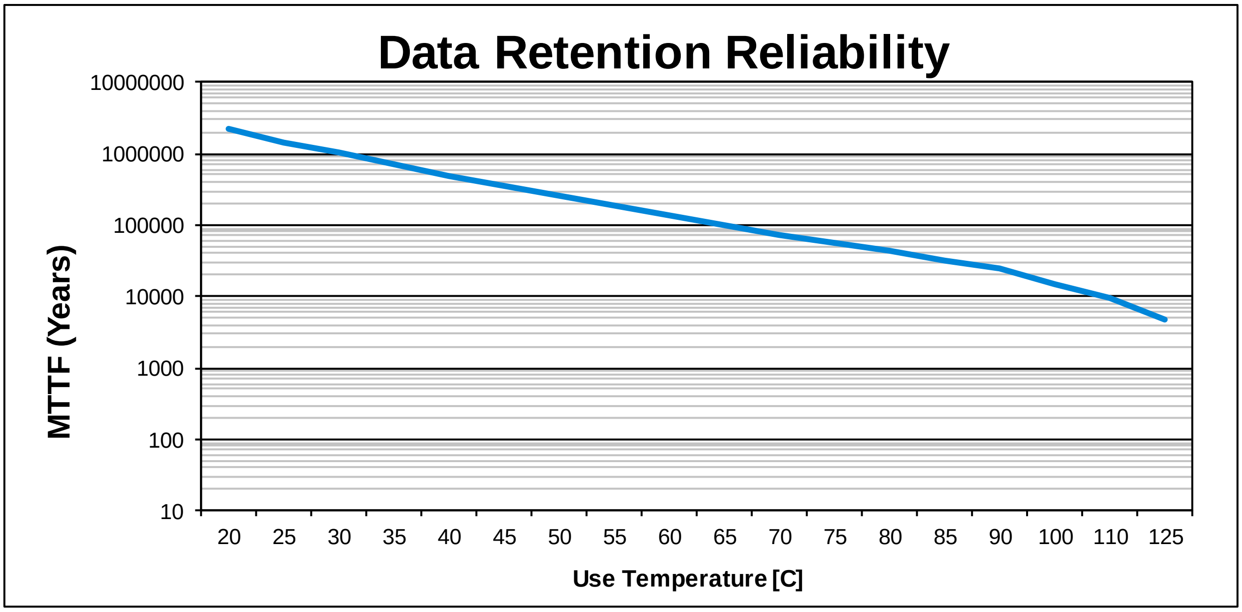
Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
27,558,808	6	1.9	0.016%	14.5	0.127%

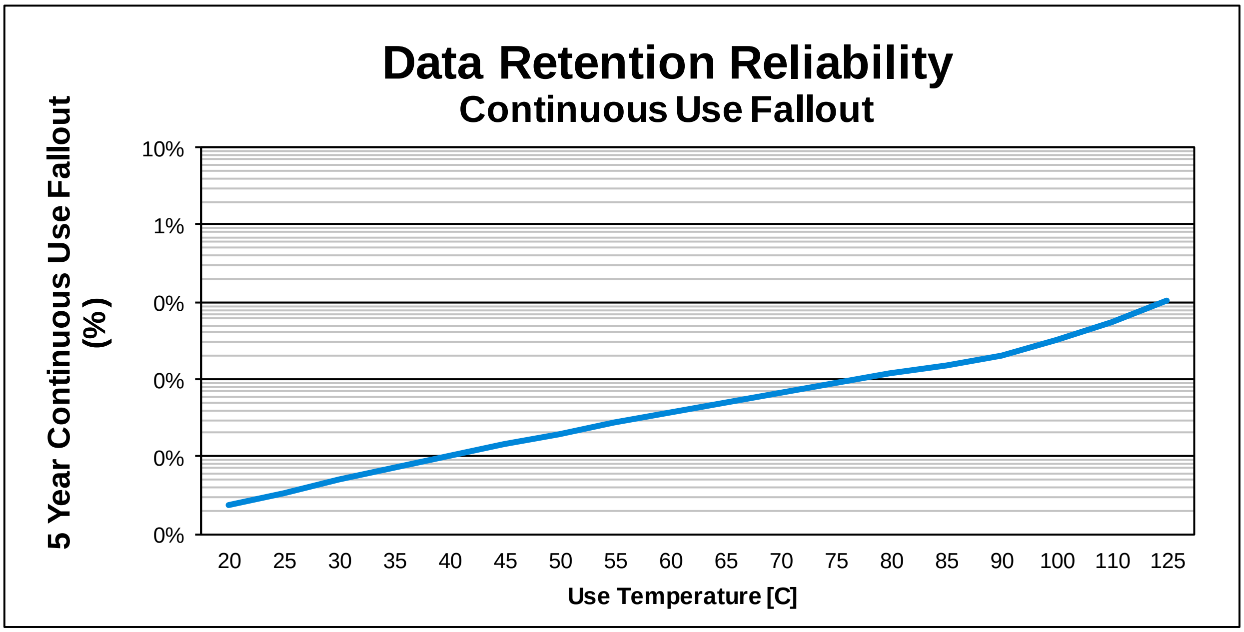




0.18um OTP Reliability Summary

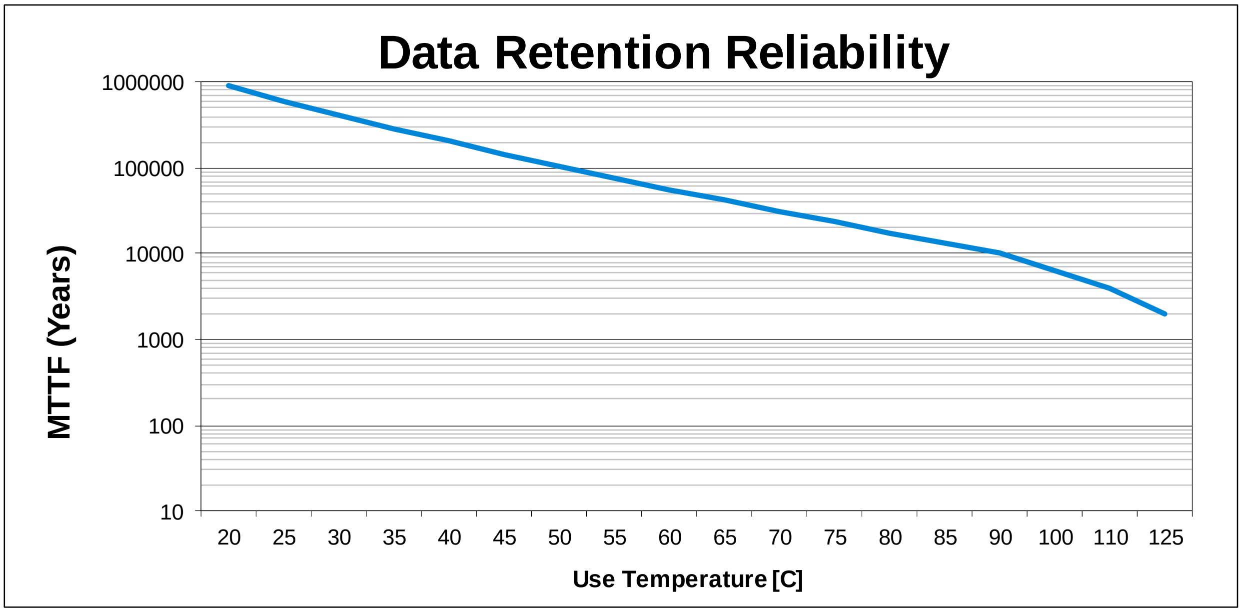
Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
14,125,798	0	0.5	0.004%	3.5	0.031%

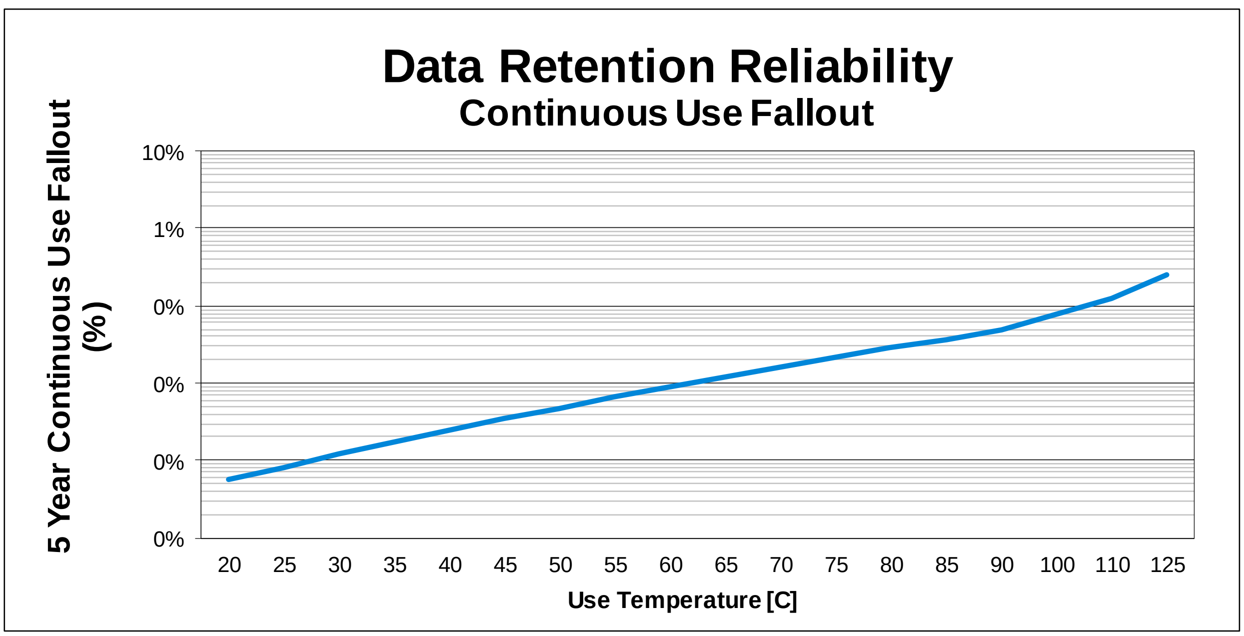




0.25um HDR Flash Reliability Summary

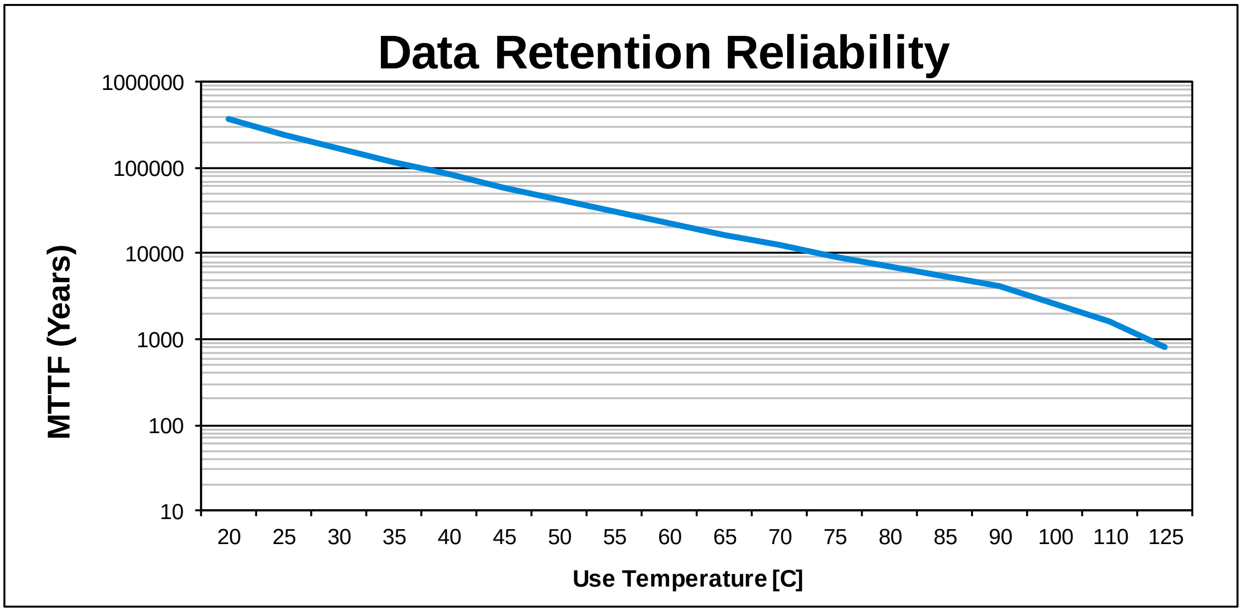
Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
5,911,033	0	1.1	0.010%	8.4	0.074%

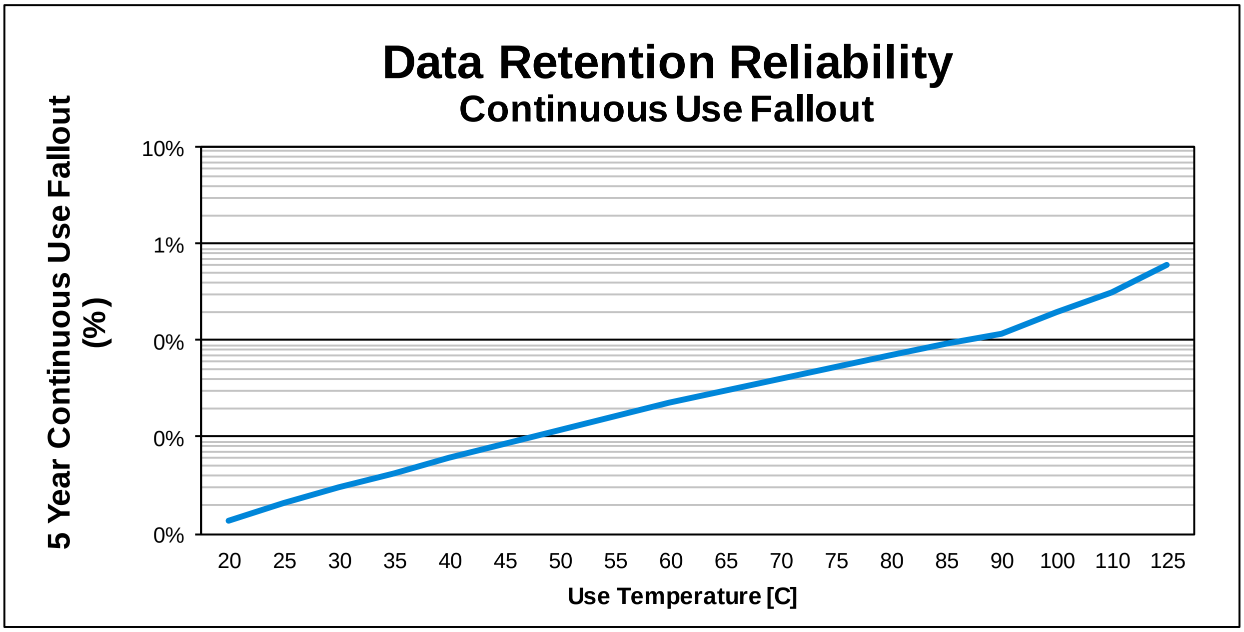




0.35um HE Flash Reliability Summary

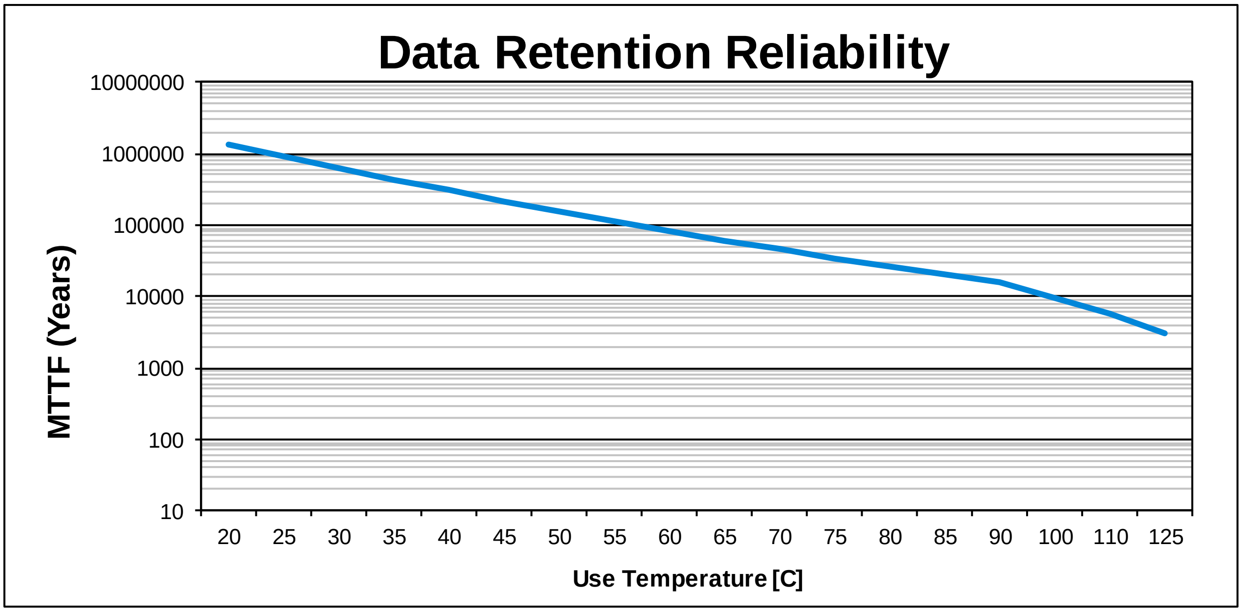
Effective Dev-Hrs at 150°C	Chargeable Failures	**Typical Case:** Predicted FIT @Ta=50˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=50°C 60% UCL	**Worst Case:** Predicted FIT @Ta=85˚C, 60% UCL	**10 Year** Predicted Failure Rate Ta=85°C 60% UCL
2,371,053	**0**	**2.7**	**0.024%**	**21.1**	**0.184%**

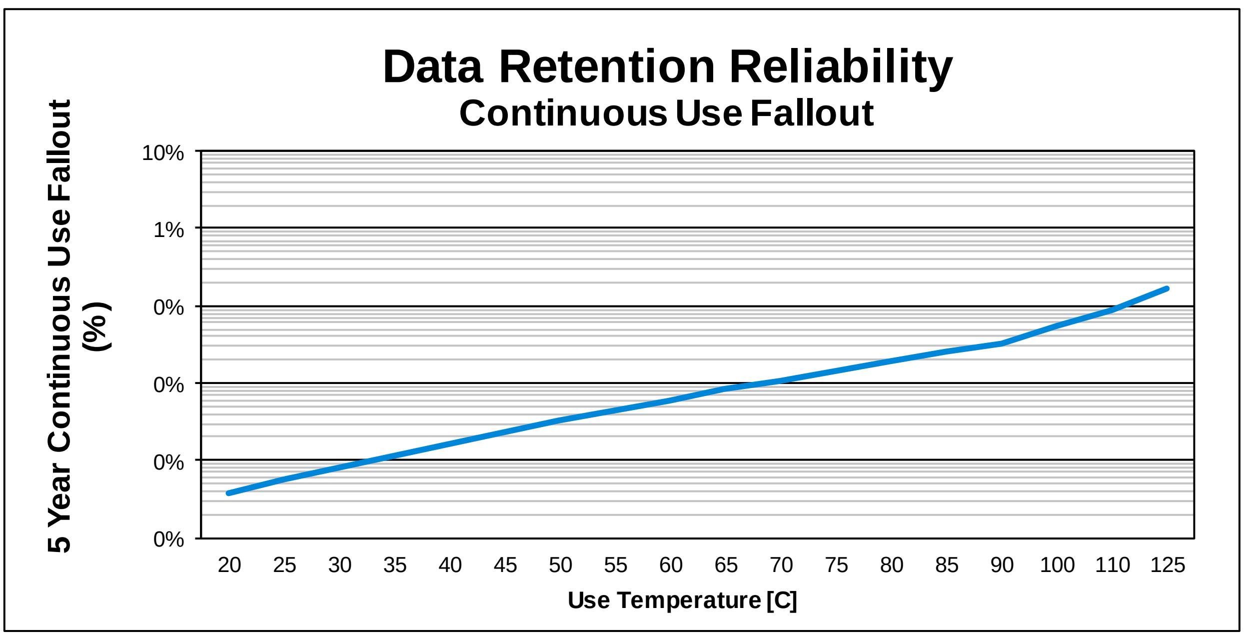




0.35um Non-HE Flash Reliability Summary

Effective Dev-Hrs at 150°C	Chargeable Failures	Typical Case: Predicted FIT @Ta=50˚C, 60% UCL	10 Year Predicted Failure Rate Ta=50°C 60% UCL	Worst Case: Predicted FIT @Ta=85˚C, 60% UCL	10 Year Predicted Failure Rate Ta=85°C 60% UCL
8,750,366	0	0.7	0.006%	5.7	0.050%





Reliability Monitors

Overview

Once a product is qualified, we verify continued product reliability with a reliability monitor program. The monitor program is scheduled to periodically sample wafer fab and package technologies. The results are published in this report. Any failures are used to drive corrective action and product and process improvement.

Stress Descriptions

Silicon Labs follows JEDEC as the preferred industry standard. The most common reliability tests and conditions are listed in the following table. The specific JEDEC documents are available on the Internet at www.jedec.org.

Reliability Tests, Procedures and Conditions Table

	Stress Name	Stress Procedure	Standard Conditions
DR	Data Retention Bake	AEC-Q100	150°C (pkg form); 250°C (wafer)
ELFR	Early Life Failure Rate	JEDEC JESD22-A108	125°C; Max operating voltage
HAST	Highly-Accelerated Temperature and Humidity Stress Test	JEDEC JESD22-A110	130°C; 85%RH; 22.2 psia; biased
HTB	High Temperature Bake	JEDEC JESD22-A103	150°C
LTOL	Low Temperature Operating Life	JEDEC JESD22-A108	-10°C; Max operating voltage
HTOL	High Temperature Operating Life	JEDEC JESD22-A108	125°C; Max operating voltage
PC	Preconditioning	JEDEC JESD22-A113	According to MSL level prior to package stresses (listed below)
TC	Temperature Cycle	JEDEC JESD22-A104	Condition C: -65 to 150°C
U-HAST	Unbiased HAST	JEDEC JESD22-A118	130°C; 85%RH
THB	Temperature Humidity Bias	JEDEC JESD22-A101	85°C; 85%RH; Max operating voltage
Qualification Guideline	Stress Test Driven Qualification of Integrated Circuits; EIA / JEDEC EIA/JESD47 / AEC-Q100		

Silicon Reliability Test Method and Conditions

Early Life Failure Rate (ELFR)

The purpose of this test is to simulate the user operation over the first portion of the product lifetime, also called early life. Silicon Labs typically uses dynamic conditions, meaning the device is powered up, and the inputs are toggled to exercise a maximum number of transistors and circuit area. Reliability acceleration is accomplished primarily by temperature and secondarily by voltage.

High Temperature Operating Life (HTOL)

The purpose of this test is to simulate the user part operation over the expected life of the product. We typically use dynamic conditions, meaning the device is powered up, and the inputs are toggled to exercise a maximum number of transistors and circuit area. Reliability acceleration is accomplished primarily by temperature and secondarily by voltage.

High Temperature Storage Life (HTSL) / High Temperature Bake (HTB)

The purpose of this test is to determine the effect of storage at elevated temperature. This is performed to assess the stability of semiconductor device materials and interfaces.

Low Temperature Operating Life (LTOL)

The purpose of this test is to simulate the user operation at low temperature. This is a specialized test to address specific fab failure mechanisms, such as hot-carrier injection. Wafer level reliability tests are more effective for this characterization and are the primary qualification method. Silicon Labs typically uses dynamic conditions, meaning the device is powered up, and the inputs are toggled to exercise a maximum number of transistors and circuit area.

Nonvolatile Memory Data Retention (DR)

The purpose of this test is to measure the ability of a nonvolatile memory cell to retain its charge state at elevated temperature in the absence of applied external bias. This test can be done either in wafer form or on packaged units.

Reliability Monitor Report – Silicon Stresses

QLotNum	Stress	Fab Process	Read Date	Sample Size	Read Pt	Fails	ºC
Q048582	HTSL	0.13 um 12 IN	22-Nov-21	30	1000	0	150
Q048586	HTSL	0.13 um 12 IN	22-Nov-21	30	1000	0	150
Q048590	HTSL	0.13 um 12 IN	22-Nov-21	30	1000	0	150
Q047858	HTOL	0.18 um	14-Jul-21	85	1000	0	97
Q047523	HTOL	40 nm	19-Apr-21	82	1000	0	105
Q047627	HTSL	40 nm	11-May-21	28	1000	0	150
Q047628	HTSL	40 nm	11-May-21	28	1000	0	150
Q047629	HTSL	40 nm	11-May-21	28	1000	0	150
Q047689	HTSL	40 nm	20-May-21	28	1000	0	150
Q047690	HTSL	40 nm	20-May-21	28	1000	0	150
Q047691	HTSL	40 nm	20-May-21	28	1000	0	150
Q047816	HTSL	40 nm	18-Jun-21	28	1000	0	150
Q047817	HTSL	40 nm	18-Jun-21	28	1000	0	150
Q047818	HTSL	40 nm	18-Jun-21	28	1000	0	150
Q047943	LTOL	40 nm	09-Aug-21	7	1000	0	-10
Q047874	ELFR	40 nm, embedded flash	26-May-21	2	48	0	125
Q047859	ELFR	40 nm, embedded flash	08-Jun-21	503	48	0	125
Q048537	ELFR	40 nm, embedded flash	07-Dec-21	493	48	0	125
Q048592	ELFR	40 nm, embedded flash	20-Dec-21	501	48	0	115
Q048681	ELFR	40 nm, embedded flash	27-Jan-22	502	48	0	110
Q047499	HTDR	40 nm, embedded flash	21-Apr-21	40	1000	0	150
Q047787	HTDR	40 nm, embedded flash	28-May-21	40	1000	0	150
Q048264	HTDR	40 nm, embedded flash	27-Oct-21	43	1000	0	150
Q048333	HTDR	40 nm, embedded flash	11-Nov-21	44	1000	0	150
Q048510	HTDR	40 nm, embedded flash	07-Dec-21	45	1000	0	150
Q048623	HTDR	40 nm, embedded flash	07-Feb-22	44	1000	0	150
Q047506	HTOL	40 nm, embedded flash	29-Apr-21	79	1000	0	125
Q048111	HTOL	40 nm, embedded flash	20-Jul-21	85	100	0	110
Q047998	HTOL	40 nm, embedded flash	20-Dec-21	78	1000	0	125
Q048608	HTOL	40 nm, embedded flash	21-Dec-21	85	100	0	110
Q048609	HTOL	40 nm, embedded flash	21-Dec-21	85	100	0	110
Q048683	HTOL	40 nm, embedded flash	24-Jan-22	80	100	0	110
Q047429	HTSL	40 nm, embedded flash	07-Apr-21	30	1000	0	150
Q047583	HTSL	40 nm, embedded flash	26-Apr-21	30	1000	0	150
Q047620	HTSL	40 nm, embedded flash	03-May-21	30	1000	0	150
Q047655	HTSL	40 nm, embedded flash	10-May-21	30	1000	0	150

QLotNum	Stress	Fab Process	Read Date	Sample Size	Read Pt	Fails	ºC
Q047673	LTDR	40 nm, embedded flash	11-May-21	39	500	0	25
Q048263	LTDR	40 nm, embedded flash	08-Oct-21	44	500	0	25
Q048334	LTDR	40 nm, embedded flash	23-Oct-21	43	500	0	25
Q048622	LTDR	40 nm, embedded flash	08-Feb-22	43	500	0	25
Q047886	ELFR	90 nm, embedded flash	08-Jun-21	138	48	0	125
Q047942	ELFR	90 nm, embedded flash	14-Jun-21	24	48	0	125
Q048225	ELFR	90 nm, embedded flash	11-Aug-21	156	48	0	125
Q048227	ELFR	90 nm, embedded flash	11-Aug-21	80	48	0	125
Q048226	ELFR	90 nm, embedded flash	17-Aug-21	156	48	0	125
Q048228	ELFR	90 nm, embedded flash	17-Aug-21	80	48	0	125
Q048229	ELFR	90 nm, embedded flash	17-Aug-21	80	48	0	125
Q047803	HTOL	90 nm, embedded flash	14-Jun-21	80	1000	0	125

Package Reliability Test Method and Conditions

Preconditioning (PC)

This test method is performed to simulate the various shipping conditions, the end use environment and customer board mounting process for a given packaging system. Preconditioning is an industry standard flow for non-hermetic (plastic) integrated circuit packages that is representative of a typical industry solder reflow operation. The test parts are subject to bake, moisture soak and three reflow cycles prior to being submitted to package reliability testing.

Temperature Cycling (TC)

This test evaluates potential reliability degradation due to thermal cycling effects. Devices are placed in a chamber using forced air to cycle devices between the specified temperature extremes. This test is conducted to determine the ability of components and solder interconnects to withstand mechanical stresses induced by alternating high and low temperature extremes. Permanent changes in electrical and/or physical characteristics can result from these mechanical stresses.

Temperature Humidity and Bias (THB)

This test evaluates the reliability of non-hermetic packaged integrated circuits in humid environments. It employs severe conditions of temperature, humidity and bias to accelerate the penetration of moisture through the external protective material (encapsulant) or along the interface between the external protective material and the metallic conductors passing through it. This test is less accelerated than autoclave and unbiased HAST and takes longer to complete. It provides more realistic results in line with actual field performance. The dominant failure mechanism is aluminum corrosion accelerated by moisture, bias and contamination.

Highly-Accelerated Temperature and Humidity Stress Test (HAST)

This test evaluates the reliability of non-hermetic packaged integrated circuits in humid environments. It employs severe conditions of temperature, humidity, and bias which accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductors which pass through it. The stress usually activates the same failure mechanisms as the “85/85” Temperature Humidity and Bias (THB) test.

Unbiased Highly-Accelerated Stress Test (U-HAST)

This test is performed to evaluate the reliability of non-hermetic packaged integrated circuits in humid environments. It is an alternate to Autoclave and tests for the same failure mechanisms. It employs severe conditions of temperature, humidity, and pressure to accelerate the penetration of moisture through the external protective material (encapsulant) or along the interface between the external protective material and the metallic conductors passing through it. UHAST is preferred over the autoclave stress method due to the reduction in artifacts induced by the 100%rh environment of autoclave, such as lead corrosion or contamination transfer by liquid water. The dominant failure mechanism is corrosion of internal materials.

Reflow Profile and Moisture Sensitivity Level

Overview

Non-hermetic (plastic) integrated circuit packages are classified by moisture sensitivity level per IPC/JEDEC J-Std-020. It is critical for final product quality that the board assembly process account for package moisture sensitivity, especially the peak reflow temperature and the maximum manufacturing expose time (MET).

Reflow Profile

Non-hermetic integrated circuit SMD (surface mount devices) are qualified in compliance to the applicable reflow profiles provided in IPC/JEDEC J-STD-020. The board assembler should not exceed the limits defined in the reflow profile tables of IPC/JEDEC J-STD-020.

Moisture Sensitivity Level

The Moisture Sensitivity Level (MSL) and peak reflow temperature are indicated on each product packing label.

Reliability Monitor Report – Package Stresses

QLotNum	Stress	Package Type	Read Date	Sample Size	Read Point	Fails
Q048180	Temp Cycle	20-MQFN-3x3	11-Aug-21	28	500	0
Q048290	Temp Cycle	32-QFN-6x6	25-Aug-21	30	500	0
Q048292	Temp Cycle	32-QFN-6x6	25-Aug-21	30	500	0
Q048294	Temp Cycle	32-QFN-6x6	25-Aug-21	30	500	0
Q047667	Temp Cycle	40-QFN-5x5	06-Apr-21	30	500	0
Q047806	Temp Cycle	40-QFN-5x5	17-May-21	28	500	0
Q048158	Temp Cycle	40-QFN-5x5	28-Jul-21	28	500	0
Q048159	Temp Cycle	40-QFN-5x5	28-Jul-21	28	500	0
Q048160	Temp Cycle	40-QFN-5x5	05-Aug-21	27	500	0
Q048278	Temp Cycle	40-QFN-5x5	07-Sep-21	28	500	0
Q048279	Temp Cycle	40-QFN-5x5	07-Sep-21	28	500	0
Q048280	Temp Cycle	40-QFN-5x5	07-Sep-21	27	500	0
Q048581	Temp Cycle	40-QFN-5x5	23-Oct-21	30	500	0
Q048585	Temp Cycle	40-QFN-5x5	23-Oct-21	30	500	0
Q048589	Temp Cycle	40-QFN-5x5	23-Oct-21	30	500	0
Q048161	UHAST	40-QFN-5x5	26-Jul-21	28	96	0
Q048162	UHAST	40-QFN-5x5	26-Jul-21	28	96	0
Q048163	UHAST	40-QFN-5x5	26-Jul-21	28	96	0
Q048282	UHAST	40-QFN-5x5	07-Sep-21	28	96	0
Q048580	UHAST	40-QFN-5x5	15-Oct-21	30	96	0
Q048584	UHAST	40-QFN-5x5	15-Oct-21	30	96	0
Q048588	UHAST	40-QFN-5x5	15-Oct-21	30	96	0
Q048430	Temp Cycle	44-SiP_LGA-6x6	11-Aug-21	30	500	0
Q048432	Temp Cycle	44-SiP_LGA-6x6	11-Aug-21	30	500	0
Q048434	Temp Cycle	44-SiP_LGA-6x6	11-Aug-21	30	500	0
Q047658	HAST	48-QFN-6x6	07-Apr-21	28	96	0
Q047622	Temp Cycle	48-QFN-6x6	01-Apr-21	30	500	0
Q047657	Temp Cycle	48-QFN-6x6	02-Apr-21	30	500	0
Q047699	Temp Cycle	48-QFN-6x6	03-May-21	30	500	0
Q048065	Temp Cycle	48-QFN-6x6	09-Jul-21	26	500	0
Q048064	Temp Cycle	48-QFN-6x6	15-Jul-21	26	500	0
Q048066	Temp Cycle	48-QFN-6x6	27-Jul-21	26	500	0
Q048275	Temp Cycle	48-QFN-6x6	30-Aug-21	28	500	0
Q048276	Temp Cycle	48-QFN-6x6	31-Aug-21	28	500	0
Q048277	Temp Cycle	48-QFN-6x6	31-Aug-21	28	500	0
Q048421	Temp Cycle	48-VFBGA-4x4	16-Sep-21	30	500	0

QLotNum	Stress	Package Type	Read Date	Sample Size	Read Point	Fails
Q047656	UHAST	48-QFN-6x6	07-Apr-21	30	96	0
Q048060	UHAST	48-QFN-6x6	12-Jul-21	27	96	0
Q048062	UHAST	48-QFN-6x6	12-Jul-21	27	96	0
Q048063	UHAST	48-QFN-6x6	12-Jul-21	27	96	0
Q048281	UHAST	48-QFN-6x6	30-Aug-21	28	96	0
Q048495	UHAST	48-VFBGA-4x4	20-Oct-21	30	96	0
Q048470	HAST	56-QFN-7x7	09-Nov-21	30	96	0
Q048471	HAST	56-QFN-7x7	15-Nov-21	30	96	0
Q048671	HAST	56-QFN-7x7	14-Feb-22	30	96	0
Q048251	Temp Cycle	56-SiP_LGA-6.5X6.5	11-Aug-21	30	500	0
Q048253	Temp Cycle	56-SiP_LGA-6.5X6.5	11-Aug-21	30	500	0
Q048255	Temp Cycle	56-SiP_LGA-6.5X6.5	11-Aug-21	30	500	0
Q048474	Temp Cycle	56-QFN-7x7	10-Nov-21	30	500	0
Q048475	Temp Cycle	56-QFN-7x7	12-Nov-21	30	500	0
Q048673	Temp Cycle	56-QFN-7x7	07-Feb-22	30	500	0
Q048472	UHAST	56-QFN-7x7	09-Nov-21	30	96	0
Q048473	UHAST	56-QFN-7x7	09-Nov-21	30	96	0
Q048672	UHAST	56-QFN-7x7	14-Feb-22	30	96	0
Q048436	Temp Cycle	76-LGA-6x6	02-Sep-21	38	500	0
Q048438	Temp Cycle	76-LGA-6x6	02-Sep-21	39	500	0
Q048440	Temp Cycle	76-LGA-6x6	02-Sep-21	39	500	0
Q047610	HAST	84-QFN-7x7	07-Apr-21	27	96	0
Q047611	HAST	84-QFN-7x7	12-Apr-21	27	96	0
Q047615	HAST	84-QFN-7x7	12-Apr-21	27	96	0
Q047693	HAST	84-QFN-7x7	19-Apr-21	27	96	0
Q047692	HAST	84-QFN-7x7	20-Apr-21	27	96	0
Q047694	HAST	84-QFN-7x7	27-Apr-21	27	96	0
Q047813	HAST	84-QFN-7x7	11-May-21	27	96	0
Q047814	HAST	84-QFN-7x7	11-May-21	27	96	0
Q047815	HAST	84-QFN-7x7	17-May-21	27	96	0
Q047624	Temp Cycle	84-QFN-7x7	06-Apr-21	30	500	0
Q047625	Temp Cycle	84-QFN-7x7	06-Apr-21	30	500	0
Q047626	Temp Cycle	84-QFN-7x7	06-Apr-21	30	500	0
Q047683	Temp Cycle	84-QFN-7x7	15-Apr-21	30	500	0
Q047684	Temp Cycle	84-QFN-7x7	15-Apr-21	30	500	0
Q047685	Temp Cycle	84-QFN-7x7	15-Apr-21	30	500	0
Q047822	Temp Cycle	84-QFN-7x7	12-May-21	30	500	0
Q047823	Temp Cycle	84-QFN-7x7	13-May-21	30	500	0

QLotNum	Stress	Package Type	Read Date	Sample Size	Read Point	Fails
Q047824	Temp Cycle	84-QFN-7x7	13-May-21	30	500	0
Q047612	UHAST	84-QFN-7x7	07-Apr-21	28	96	0
Q047613	UHAST	84-QFN-7x7	07-Apr-21	28	96	0
Q047614	UHAST	84-QFN-7x7	07-Apr-21	28	96	0
Q047686	UHAST	84-QFN-7x7	20-Apr-21	28	96	0
Q047687	UHAST	84-QFN-7x7	20-Apr-21	28	96	0
Q047688	UHAST	84-QFN-7x7	20-Apr-21	28	96	0
Q047819	UHAST	84-QFN-7x7	12-May-21	28	96	0
Q047820	UHAST	84-QFN-7x7	12-May-21	28	96	0
Q047821	UHAST	84-QFN-7x7	12-May-21	28	96	0
Q048134	Temp Cycle	112-LFBGA-10x10	07-Jul-21	30	500	0
Q048136	Temp Cycle	112-LFBGA-10x10	07-Jul-21	30	500	0
Q048138	Temp Cycle	112-LFBGA-10x10	07-Jul-21	30	500	0
Q048165	Temp Cycle	120-VFBGA-7x7	06-Jul-21	80	700	0
Q048167	Temp Cycle	120-VFBGA-7x7	06-Jul-21	80	700	0
Q048169	Temp Cycle	120-VFBGA-7x7	06-Jul-21	80	700	0
Q048189	Temp Cycle	120-VFBGA-7x7	07-Jul-21	30	500	0
Q048195	Temp Cycle	120-VFBGA-7x7	07-Jul-21	30	500	0
Q048199	Temp Cycle	120-VFBGA-7x7	07-Jul-21	30	500	0
Q047999	Temp Cycle	126-SiP_LGA-7.9X4.63	07-Jul-21	30	850	0
Q048000	Temp Cycle	126-SiP_LGA-7.9X4.63	07-Jul-21	30	850	0
Q048001	Temp Cycle	126-SiP_LGA-7.9X4.63	07-Jul-21	30	850	0
Q048002	Temp Cycle	173-SiP_LGA-9.1X9.8	07-Jul-21	30	850	1
Q048003	Temp Cycle	173-SiP_LGA-9.1X9.8	07-Jul-21	30	850	0
Q048009	Temp Cycle	173-SiP_LGA-9.1X9.8	25-Jul-21	30	850	0
Q048416	Temp Cycle	173-SiP_LGA-9.1X9.8	29-Sep-21	30	850	0
Q047408	THB	173-SiP_LGA-9.1X9.8	22-Apr-21	27	1000	0
Q047846	THB	173-SiP_LGA-9.1X9.8	24-Jun-21	51	1000	0

Revision History

Rev No	Description	Effective Date
01	Original	22-Apr-2022