pSemi®
A Murata Company

June 2022

Quarterly Reliability Report

Document Number DOC-110797, Revision 1

Table of Contents

pSemi Reliability System

The Quarterly Reliability Report is a compilation of reliability stress test results that crosses the entire product & technology family of pSemi products. Data is collected on a regular basis through the efforts of product and process qualifications, standard product monitoring and lot acceptance testing. To date, a total of **127,875 devices** have been tested in HTOL with a total of **8.50 billion equivalent device hours**. The overall failure rate for the pSemi family of products is **0.11 FIT.** (Using Eaa = 0.7eV, Tj=55°C at 60% UCL)

pSemi reliability testing standards conform to industry standard qualification procedures as detailed in the JEDEC guidelines. In addition, where clear guidelines have not been established yet, pSemi has developed stringent reliability requirements to ensure consistent high reliability performance.

pSemi makes use of accelerated life testing results, along with thermal acceleration factors in the prediction of failure rates. High Temperature Operating Life (HTOL) stress testing is performed at accelerated voltage and temperature conditions which are based Jedec-JESD22-A108 standards. Resulting data collected from HTOL tests is de-rated to a typical use operating junction temperature (Tj) of 55°C. Early Life Failure Rate (ELFR) is derived after 48-hr performance.

pSemi conducts an ongoing product reliability monitoring program to evaluate sample products from high volume, major product families on a quarterly basis. The reliability monitoring process is a continuously improving system within pSemi as we strive for superior product knowledge and performance.

pSemi performs the majority of Reliability testing using an ISO17025 certified test laboratories located in San Jose, CA. Regular auditing of the laboratory is performed to ensure compliance to ISO standards.

Failure Rate Calculation

Acceleration Factor (AF)

For a given failure mechanism, acceleration factor (AF), is the ratio of the time it takes for a certain fraction of the population to fail, following application of one stress or use condition, to the corresponding time at a more severe stress or use condition.

The industry uses the thermal acceleration model formula based on Arrhenius equation noted below:

$$AF\left(T_{use}, T_{stress}\right) := e^{\frac{E_{aa}}{k_B} \cdot \left(\frac{1}{T_{use}} - \frac{1}{T_{stress}}\right)}$$

where:

$E_{aa} := 0.7\ eV$,is the Apparent Activation Energy

$e = 2.718$, is the base of natural logarithm

$k_B := 8.62 \cdot 10^{-5}\ \frac{eV}{K}$, is the Boltzmann constant

T_{use} & T_{stress}, are the use and stress test temperatures, respectively, in Kelvin

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Sample Calculation

Find the Acceleration Factor (AF) with the following conditions.

(a) $T_{use} := 55\ °C$ and $T_{stress} := 125\ °C$

$$AF\left(T_{use}, T_{stress}\right) = 77.5$$

(b) $T_{use} := 55\ °C$ and $T_{stress} := 150\ °C$

$$AF\left(T_{use}, T_{stress}\right) = 258.7$$

Failure Rate Calculation (continued)

Failure in Time Calculation

Mean time to failure (M.T.T.F.) is defined as the average time it takes for a failure to occur. Failure in Time (F.I.T.) is the number of units predicted to fail in a billion ($1e^9$) device hours at a specified temperature. After the life test is completed and accelerated device hour data is calculated, the failure rate is estimated using the Chi-Square approximation (χ^2) as follows:

$$FIT = \left(\frac{\chi^{2(2r+2)}}{2 * EDH}\right) * 1e^9$$

where:

χ^2 = *chi square function*

r = number of failures

EDH = equivalent device hours (units tested x test hours x AF)

Sample Calculation

Given: Units Tested (Sample Size) = 231 devices
Test temperature = 150°C
Test duration = 500 hours
Failures = 0

EDH = (231 x 500 x 259.2) = 2.99E+7 equivalent device hours

χ^2 @ 60% confidence level and 0 failures = 1.83

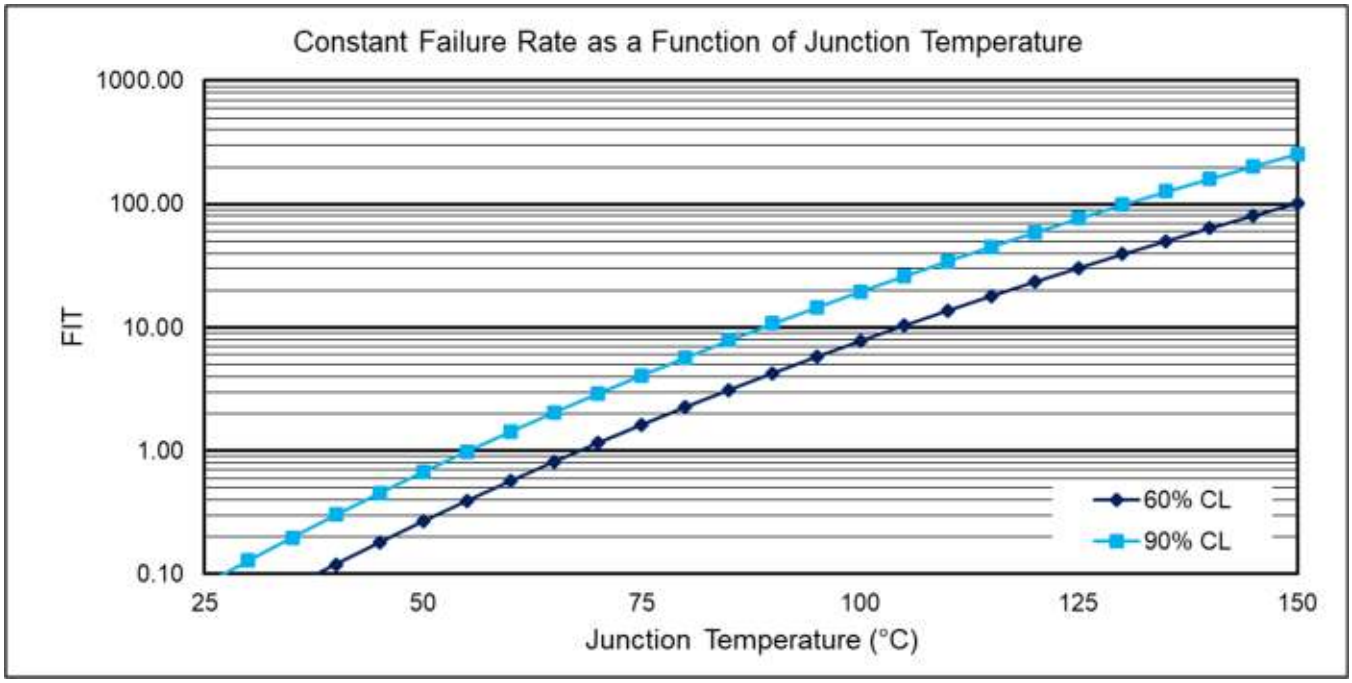
FIT (60% confidence level) = [1.83 / (2 x 2.99E+7)] x 1.0E+9 = <u>30.6 FIT</u>

Technology Classification

UltraCMOS® 2 Process Technology

Generation	:	500 nm CMOS Silicon Epi Process (U500E)
Units Tested	:	35,289
Product Family	:	DC-DC, DSA, MXR, PLL, PSR, Switch

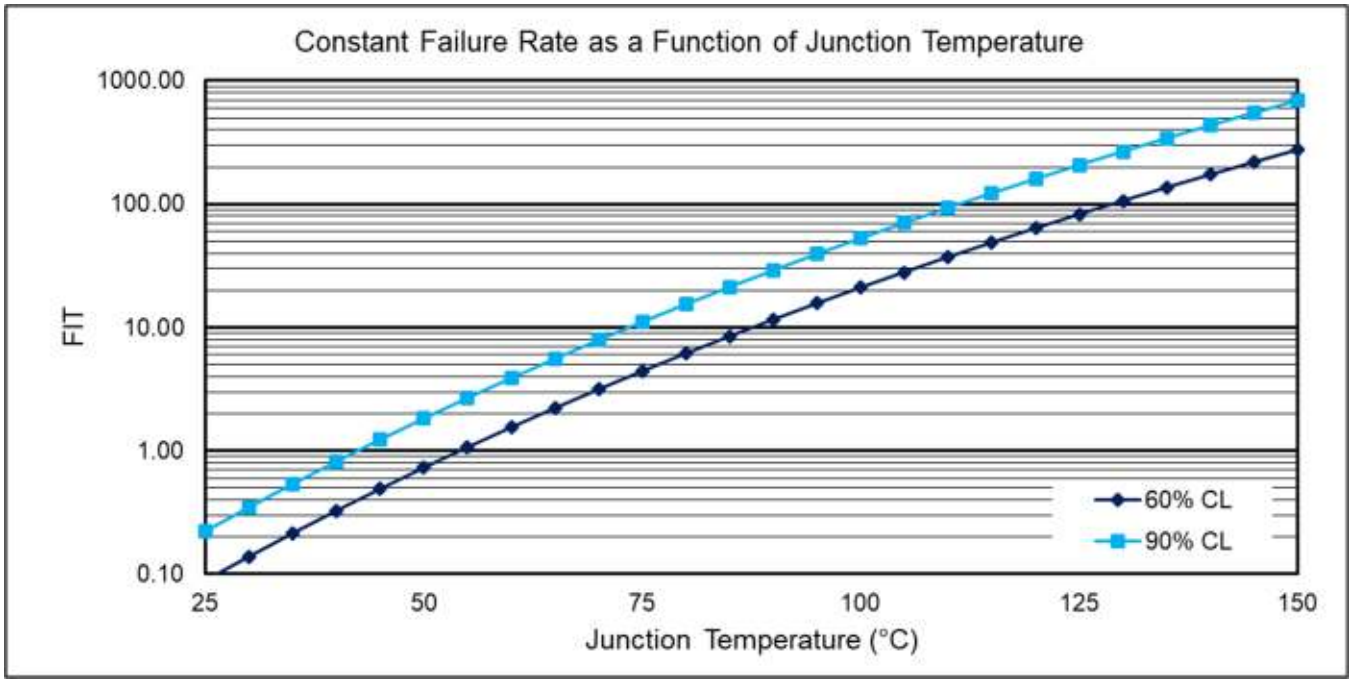
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.82E+08	3.3	3.07E+08
Constant (Random)	2.33E+09	0.4	2.54E+09



UltraCMOS® 3.5 Process Technology

Generation	:	350 nm CMOS Silicon Epi Process (U350E)
Units Tested	:	9,174
Product Family	:	DSA, DTC, Switch

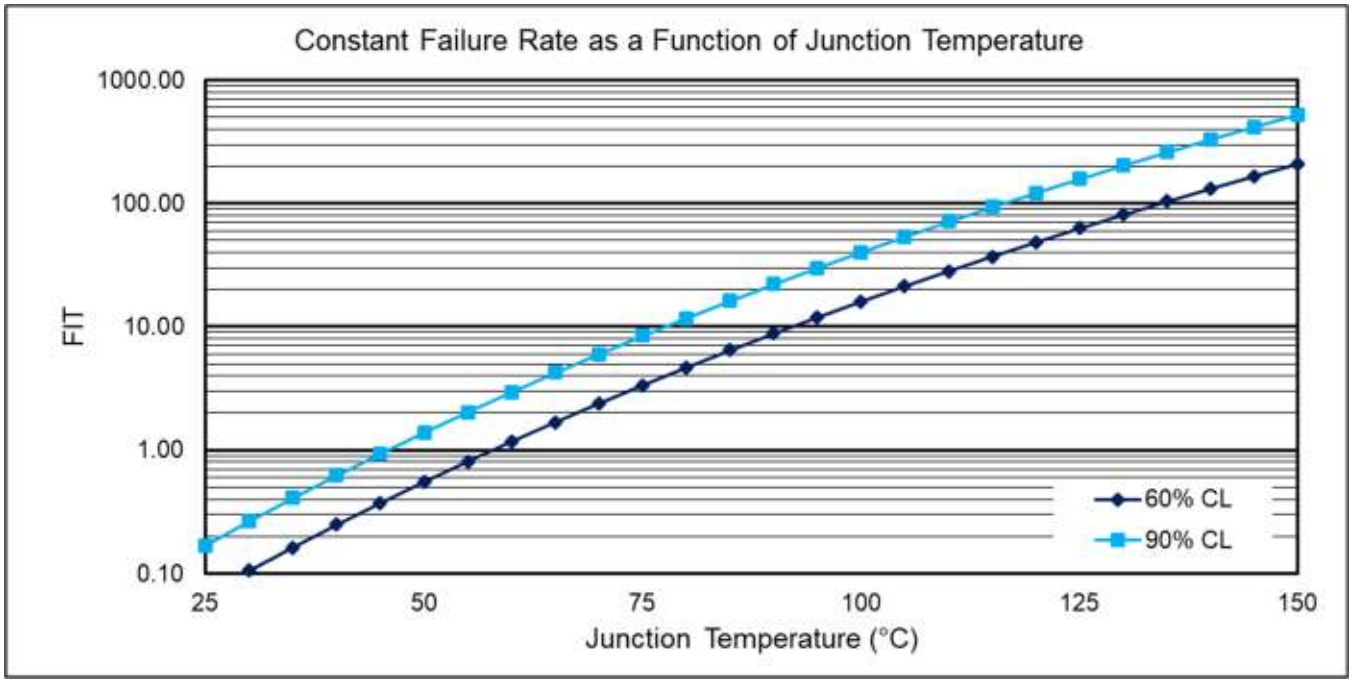
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.11E+08	8.2	1.21E+08
Constant (Random)	8.61E+08	1.1	9.39E+08



UltraCMOS® 5 Process Technology

Generation	:	350 nm CMOS Bonded Silicon Process (U350B)
Units Tested	:	8,806
Product Family	:	DSA, DTC, LMTR, MPAC, PLL, PSH, Switch

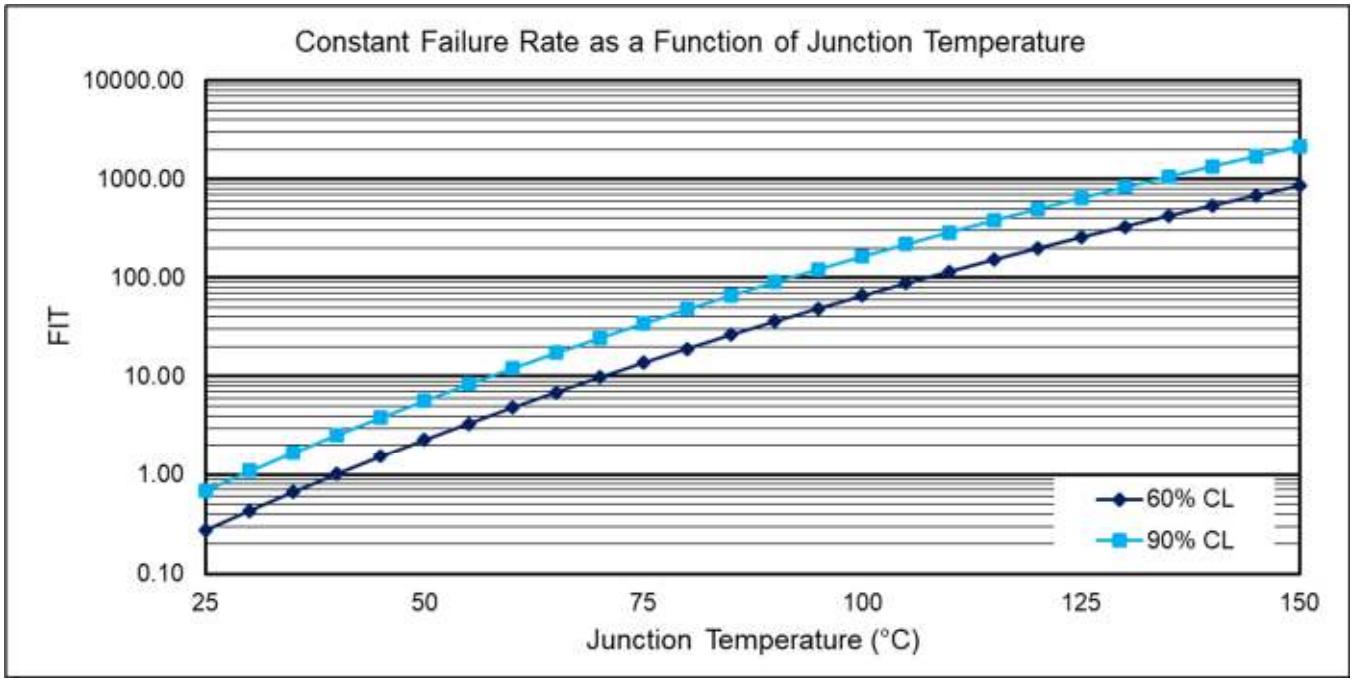
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.07E+08	8.5	1.17E+08
Constant (Random)	1.13E+09	0.8	1.23E+09



UltraCMOS® 6 Process Technology

Generation	:	250 nm CMOS Silicon Epi Process (U250E2)
Units Tested	:	2,271
Product Family	:	Switch

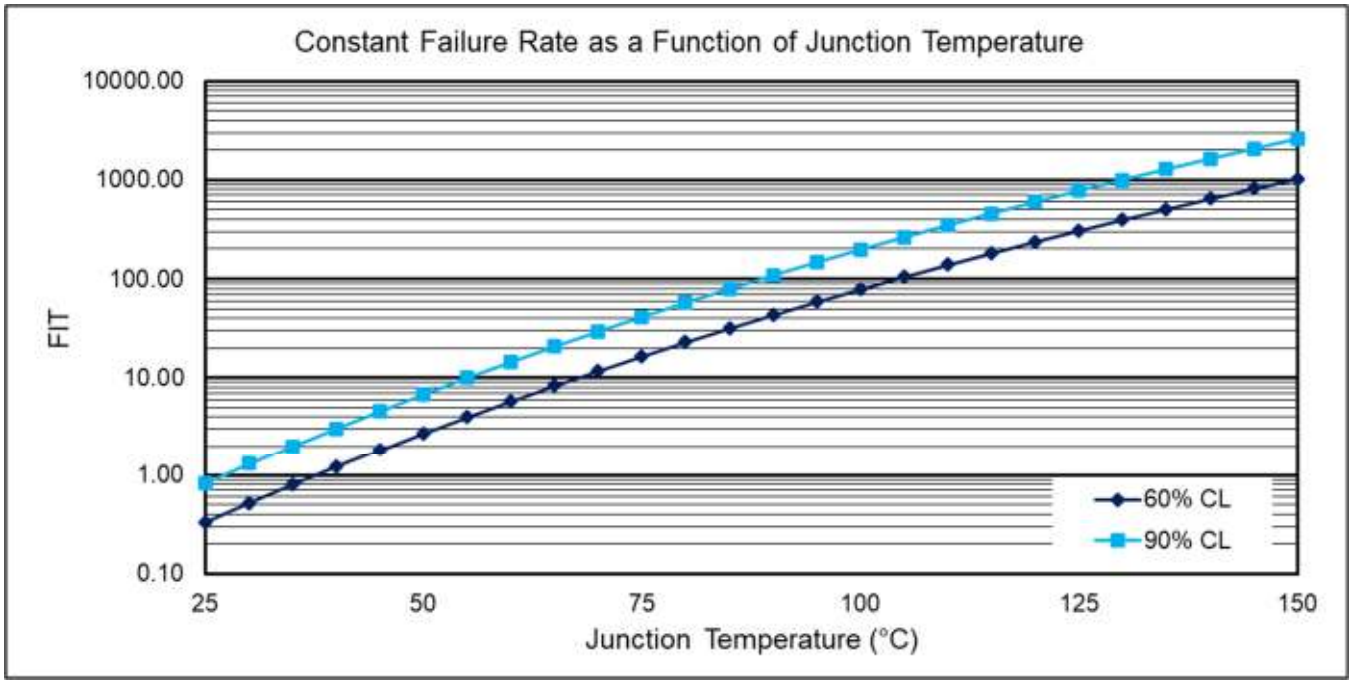
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.71E+07	33.8	2.96E+07
Constant (Random)	2.76E+08	3.3	3.01E+08



UltraCMOS® 6.5 Process Technology

Generation	:	250 nm CMOS Silicon Epi Process (U250E4)
Units Tested	:	1,829
Product Family	:	Driver, DSA, Switch

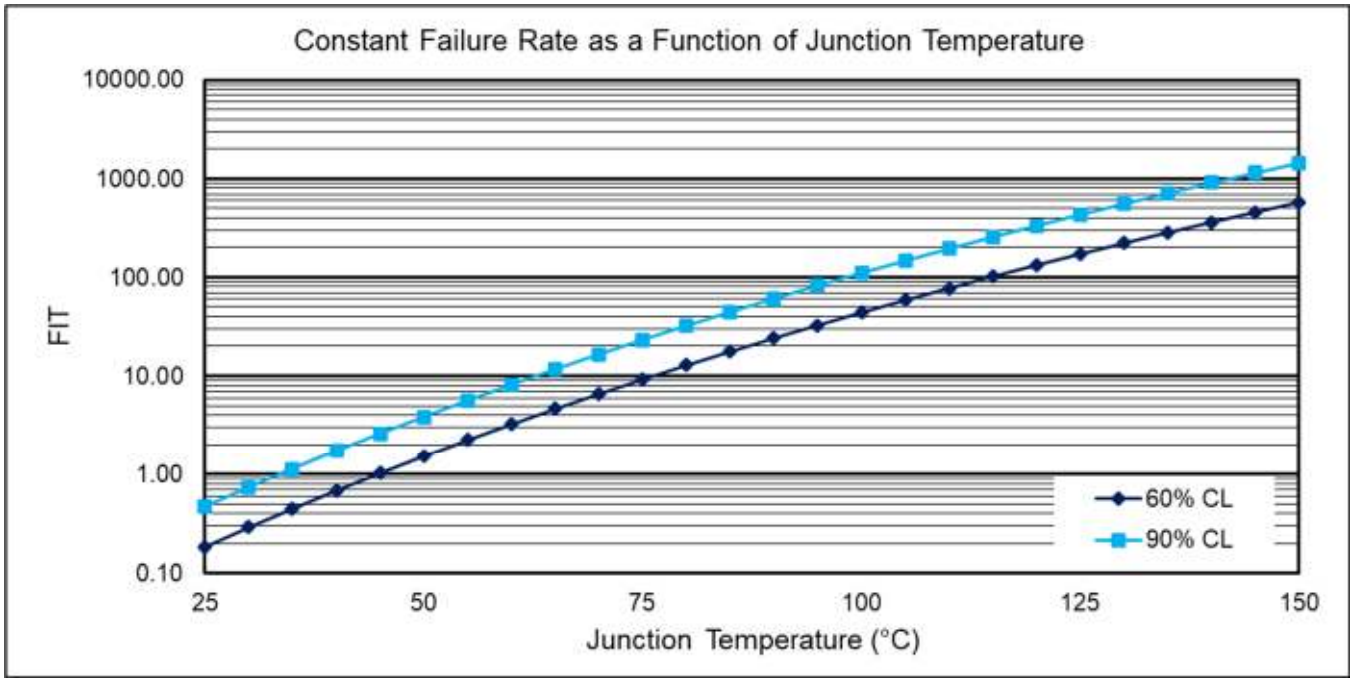
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.83E+07	50.0	2.00E+07
Constant (Random)	2.29E+08	4.0	2.50E+08



UltraCMOS® 8 Process Technology

Generation	:	250 nm CMOS Bonded Silicon Process (U250B)
Units Tested	:	3,205
Product Family	:	Driver, DSA, DTC, LMTR, MPAC, MXR, PSR, Switch

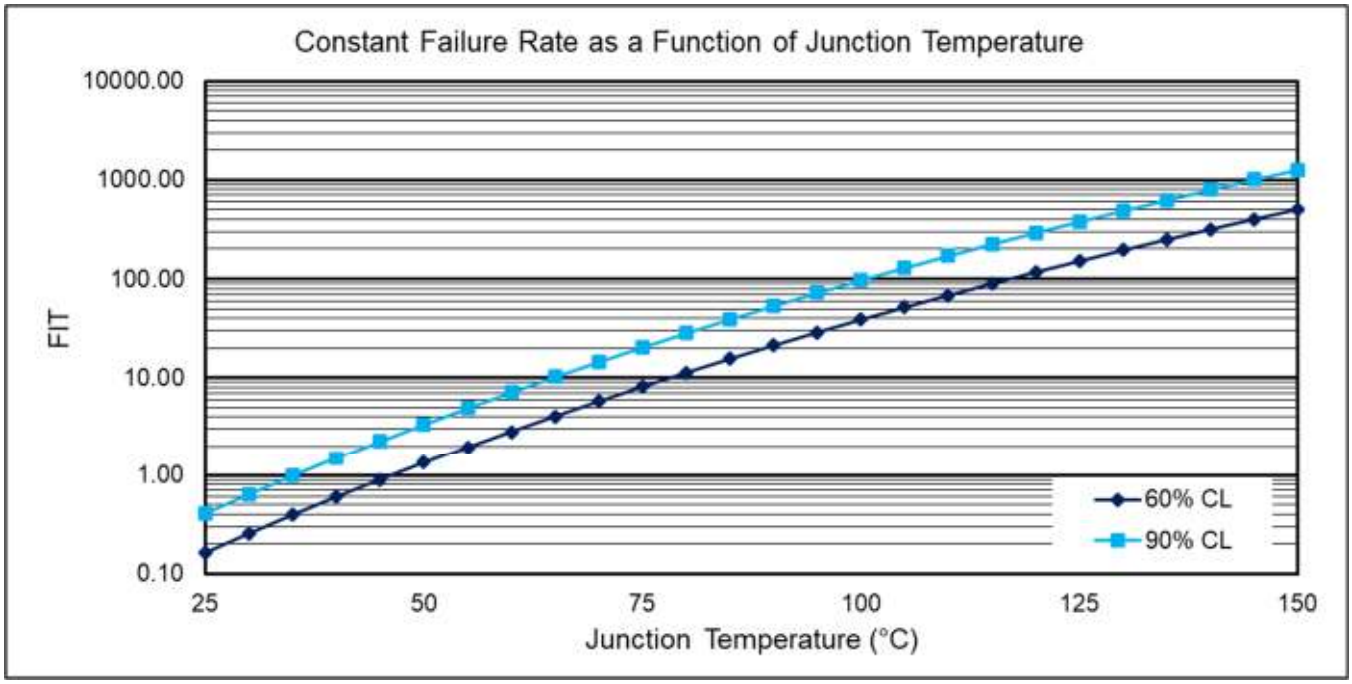
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	3.79E+07	24.2	4.13E+07
Constant (Random)	4.11E+08	2.2	4.48E+08



UltraCMOS® 10 Process Technology

Generation : 130nm CMOS Silicon-On-Insulator in 200mm wafer(U130S1)
Units Tested : 3869
Product Family : Switch

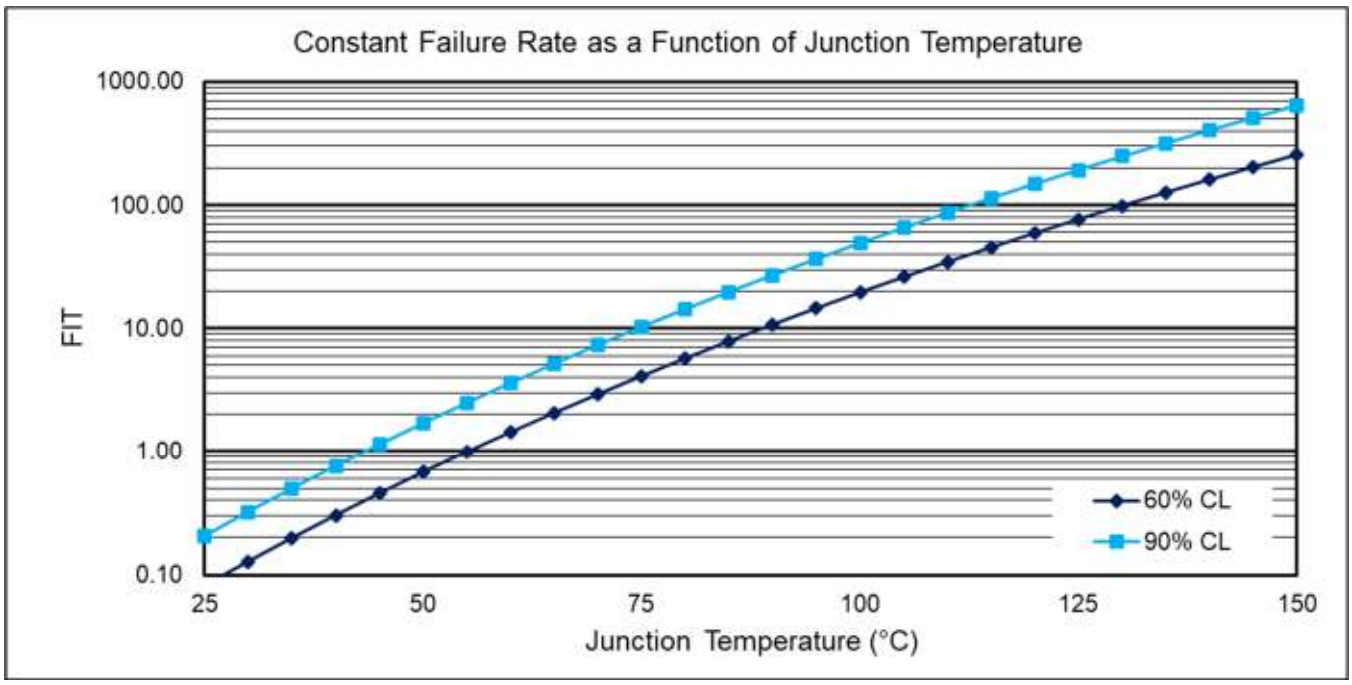
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	4.14E+07	22.1	4.52E+07
Constant (Random)	4.68E+08	2.0	5.10E+08



UltraCMOS® 11 Process Technology

Generation	:	130nm CMOS Silicon-On-Insulator in 300mm wafer (U130S2)
Units Tested	:	12,888
Product Family	:	Amplifier, DC-DC, Switch

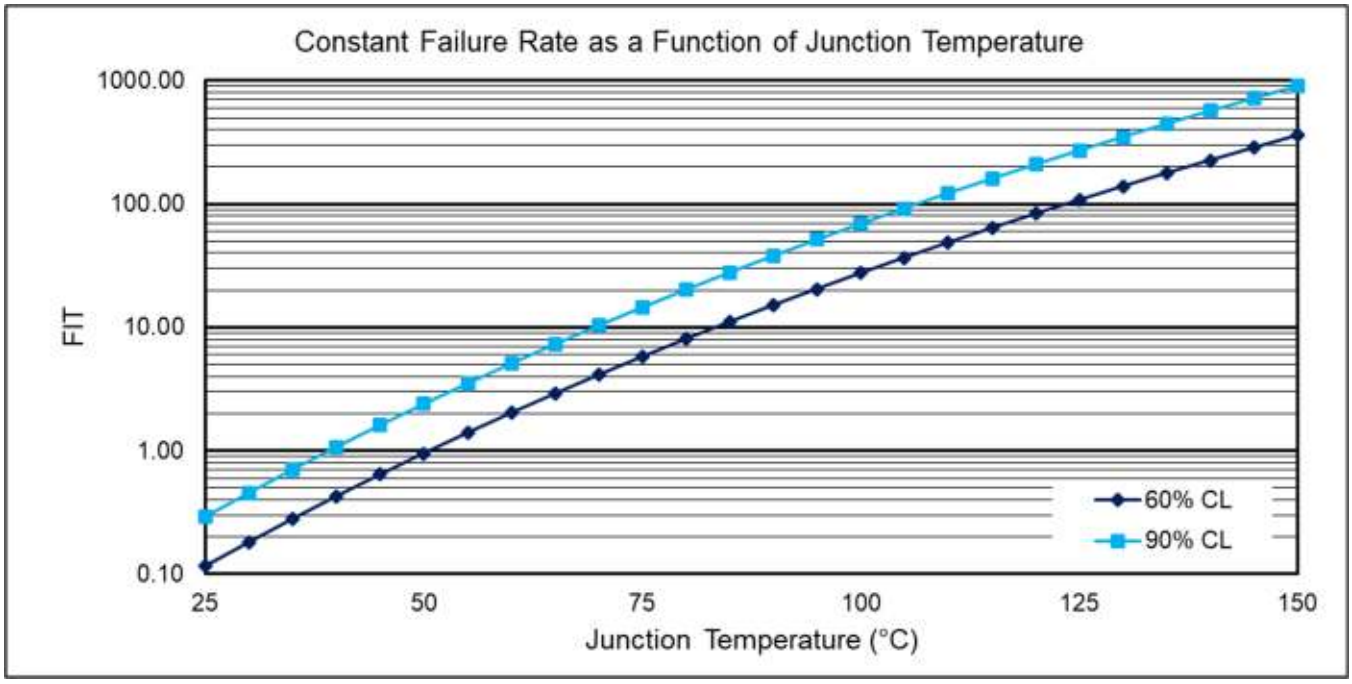
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	7.77E+07	11.8	8.48E+07
Constant (Random)	9.33E+08	1.0	1.02E+09



UltraCMOS® 12 Process Technology

Generation	:	65nm CMOS Silicon-On-Insulator in 300mm wafer (U130S3)
Units Tested	:	15,696
Product Family	:	Amplifier, DSA, PAC, Switch

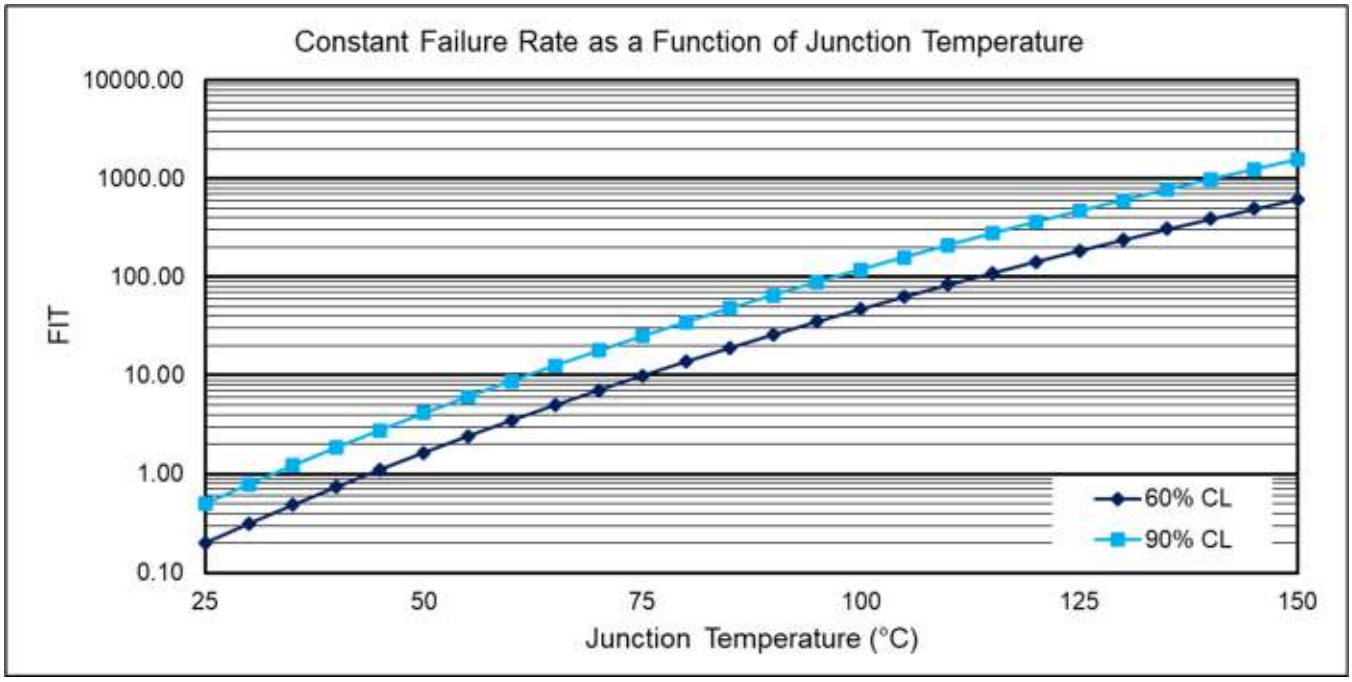
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	8.10E+07	11.3	8.84E+07
Constant (Random)	6.59E+08	1.4	7.19E+08



UltraCMOS® 12A Process Technology

Generation	:	65nm CMOS Silicon-On-Insulator in 300mm wafer (U130S4)
Units Tested	:	6,771
Product Family	:	Amplifier,PAC

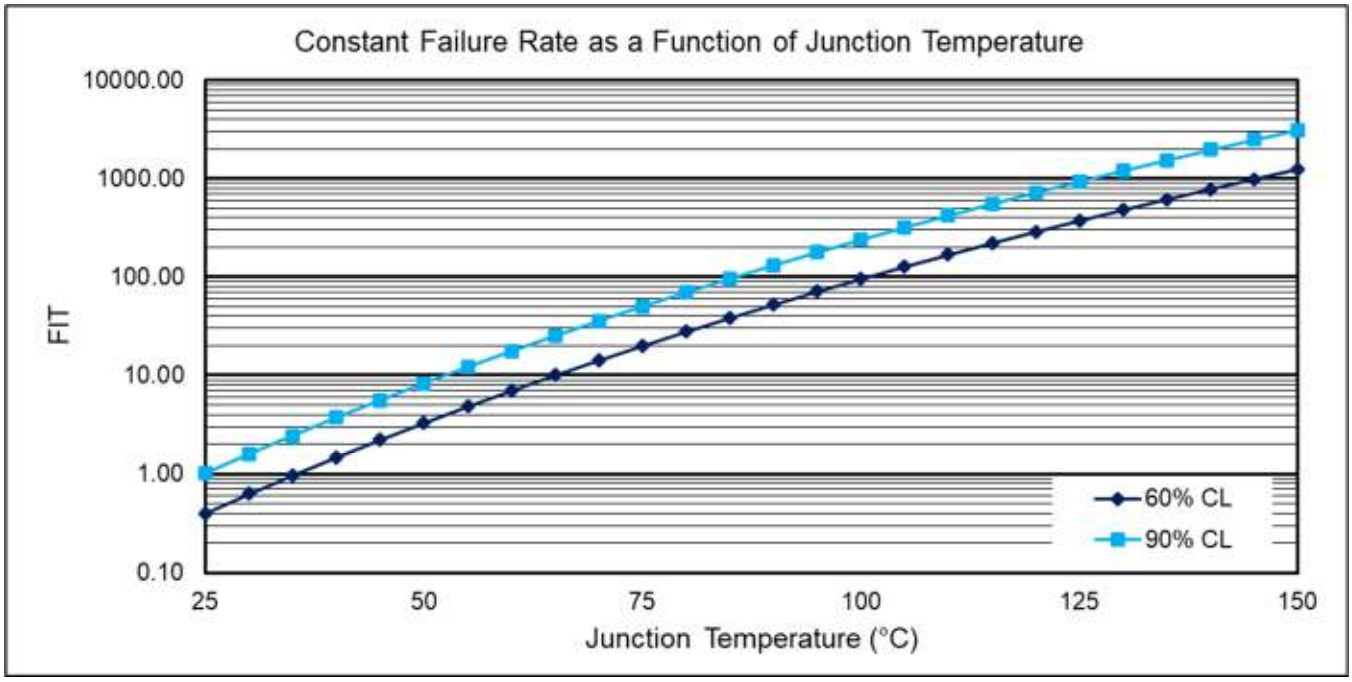
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.60E+07	35.3	2.84E+07
Constant (Random)	3.81E+08	2.4	4.16E+08



UltraCMOS® 13 Process Technology

Generation	:	65nm CMOS Silicon-On-Insulator in 300mm wafer (U130S4)
Units Tested	:	5,416
Product Family	:	Amplifier, Switch

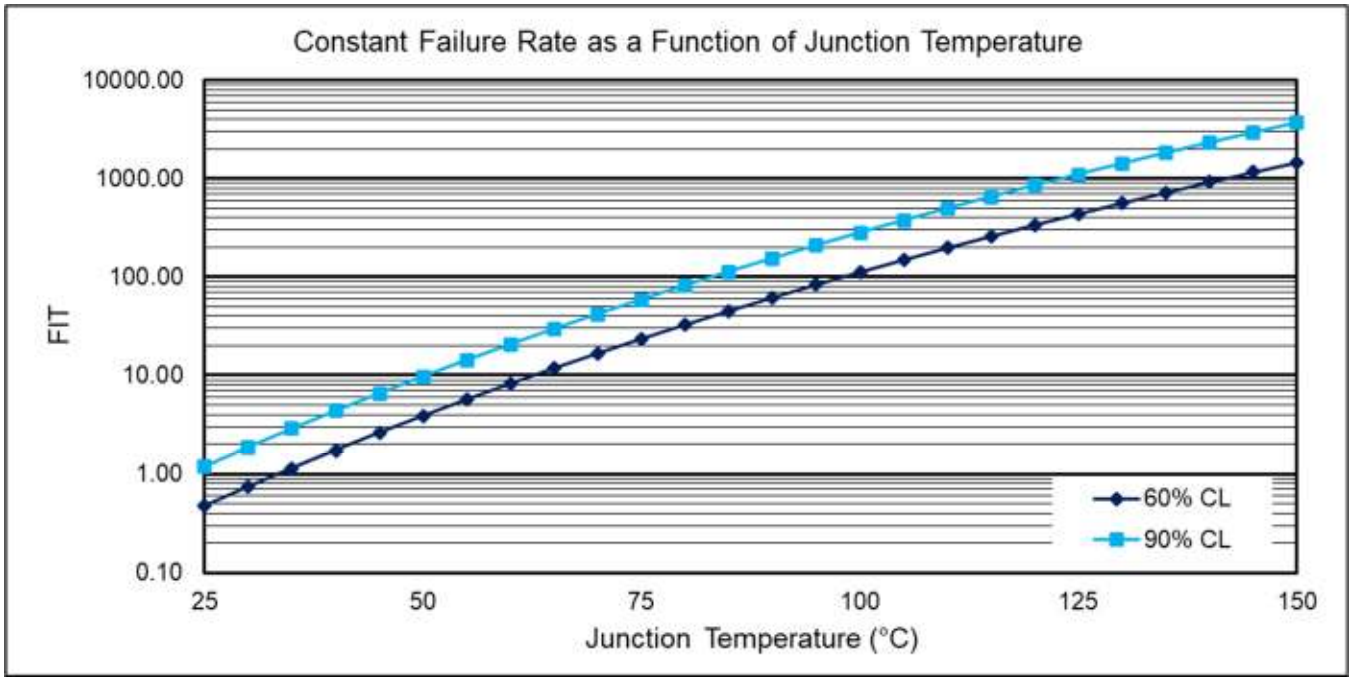
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.02E+07	45.5	2.20E+07
Constant (Random)	1.90E+08	4.8	2.07E+08



UltraCMOS® 13S Process Technology

Generation	:	65nm CMOS Silicon-On-Insulator in 300mm wafer (U130S4)
Units Tested	:	12,500
Product Family	:	Switch

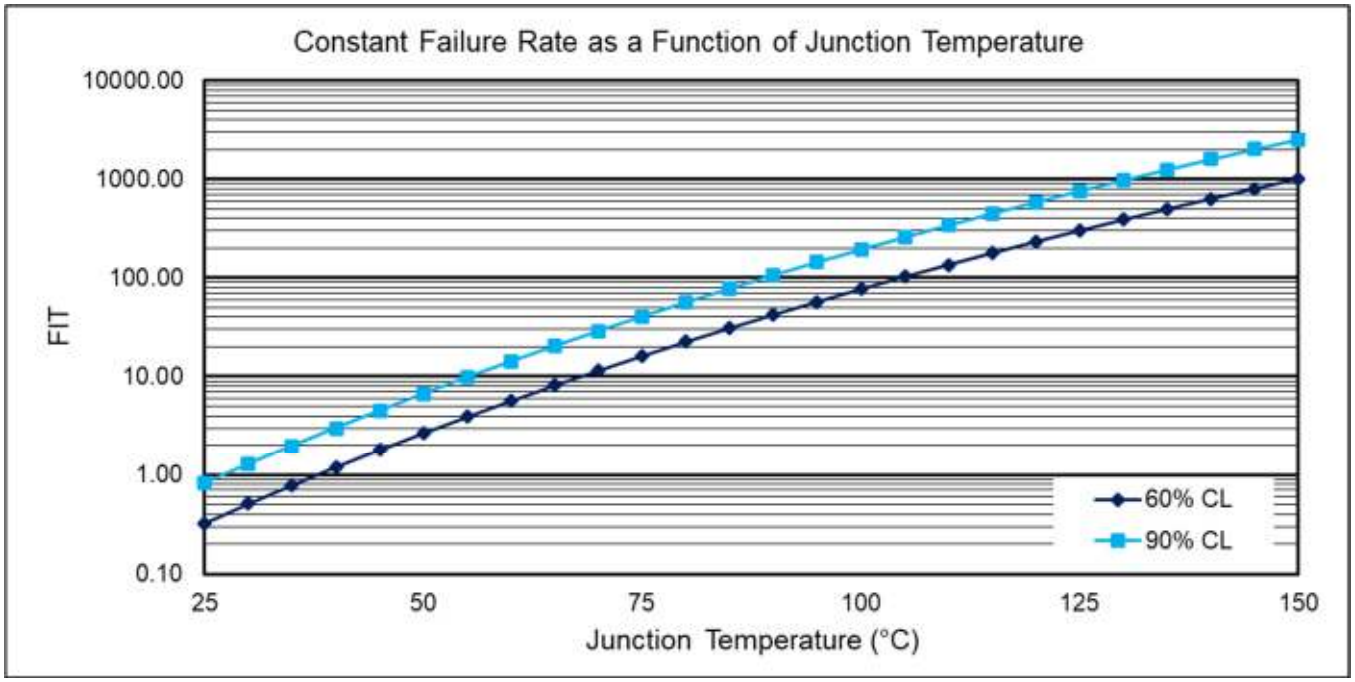
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	4.46E+07	20.5	4.87E+07
Constant (Random)	1.62E+08	5.7	1.76E+08



UltraCMOS® 13SA Process Technology

Generation	:	65nm CMOS Silicon-On-Insulator in 300mm wafer (U130S4)
Units Tested	:	7,050
Product Family	:	Switch

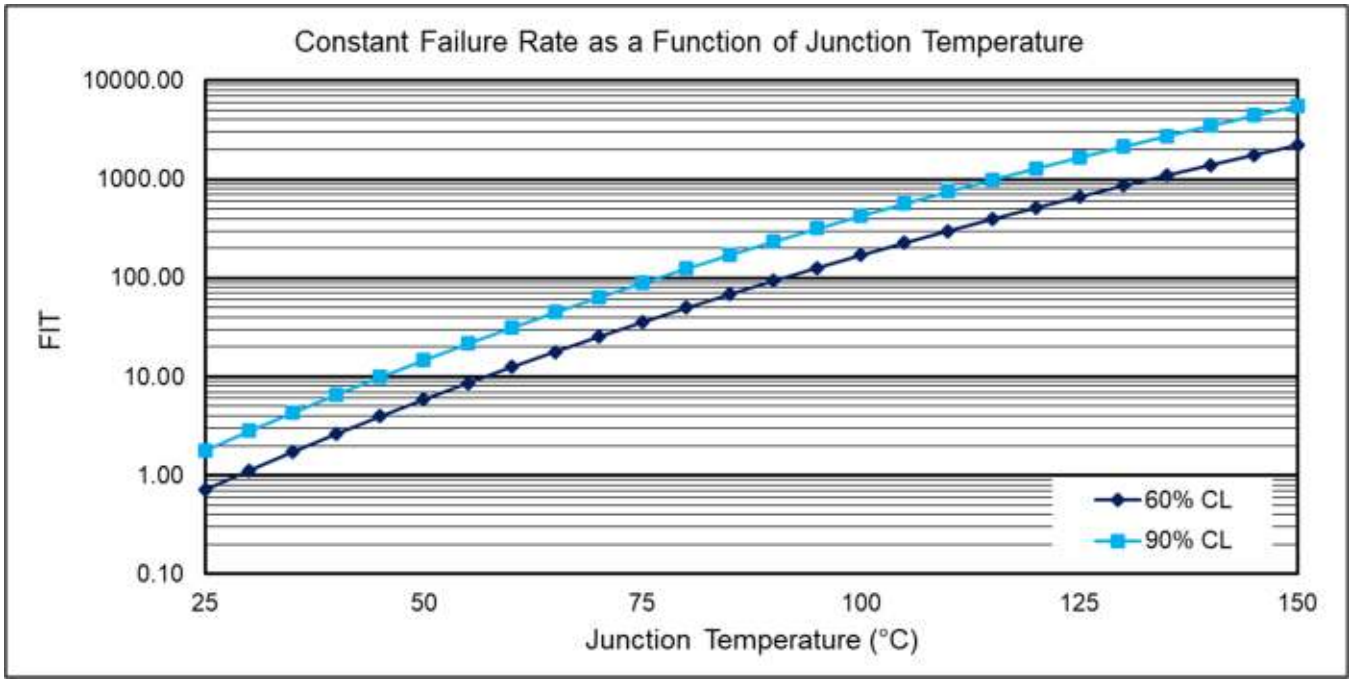
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.45E+07	37.4	2.67E+07
Constant (Random)	2.34E+08	3.9	2.56E+08



BCD GEN II Process Technology

Generation	:	180nm BCD Gen 2 Process
Units Tested	:	1,370
Product Family	:	DC-DC

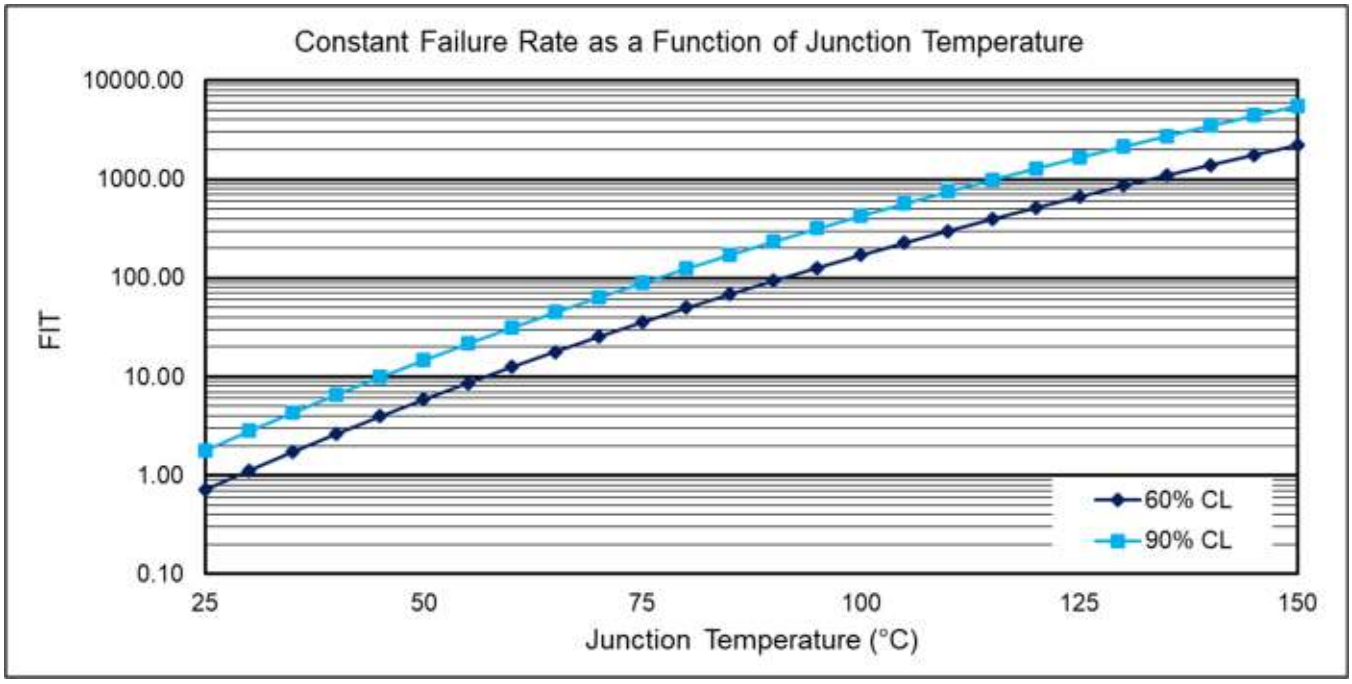
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	5.10E+06	179.7	5.56E+06
Constant (Random)	1.06E+08	8.6	1.16E+08



BCD GEN III Process Technology

Generation : 180nm BCD Gen 3 Process
Units Tested : 340
Product Family : DC-DC

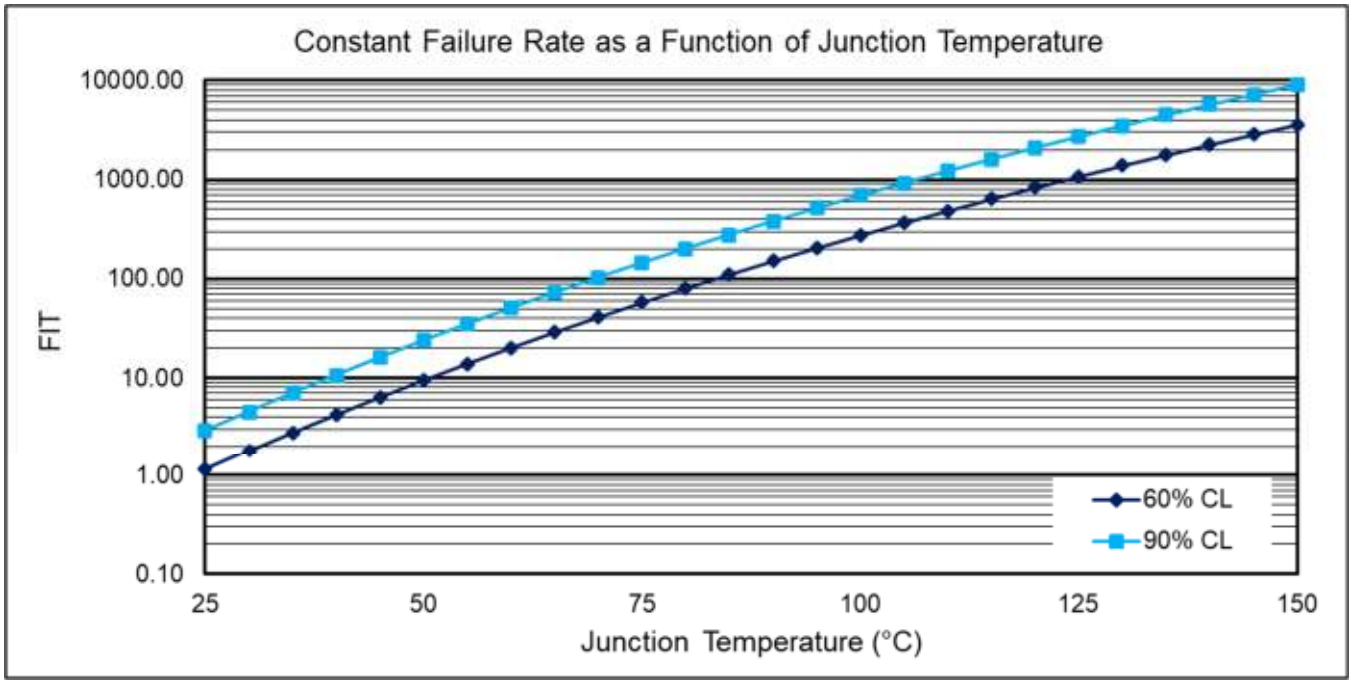
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.27E+06	724.1	1.38E+06
Constant (Random)	2.64E+07	34.8	2.88E+07



BCDLite Process Technology

Generation : 130nm BCDLite Process
Units Tested : 786
Product Family : DC-DC

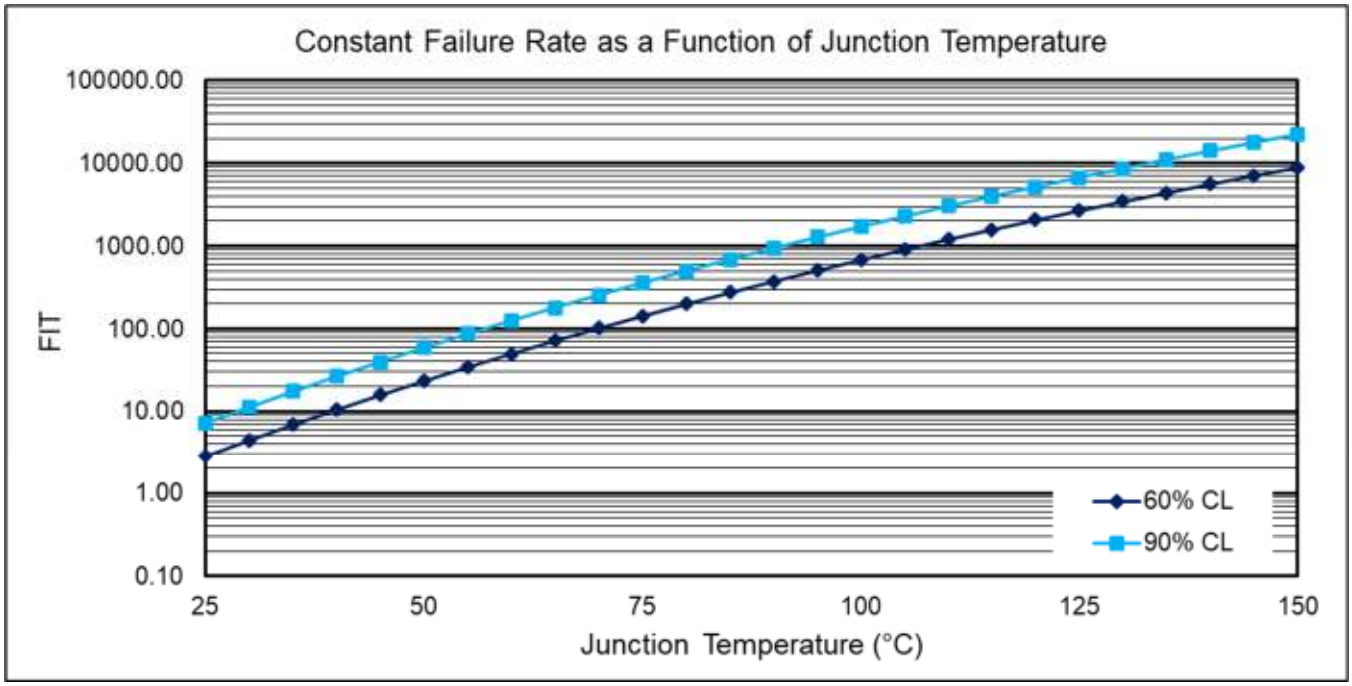
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	4.82E+06	190.0	5.26E+06
Constant (Random)	6.59E+07	13.9	7.19E+07



55LPx Process Technology

Generation	:	55nm 300mm wafer (C055C1E6)
Units Tested	:	343
Product Family	:	ASIC

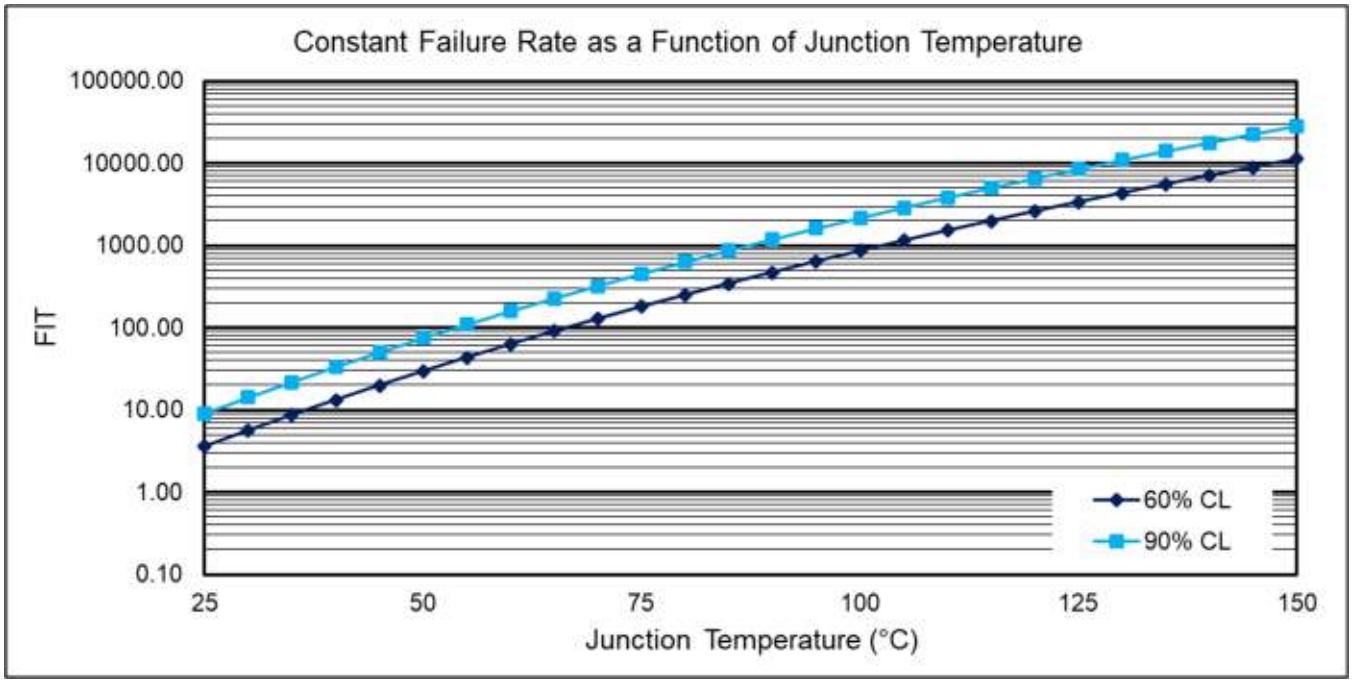
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	4.82E+06	190.0	5.26E+06
Constant (Random)	6.59E+07	13.9	7.19E+07



45RFSOI Process Technology

Generation	:	55nm 300mm wafer (C045S1E8)
Units Tested	:	272
Product Family	:	mmWave FEM

	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.01E+06	905.1	1.10E+06
Constant (Random)	2.11E+07	43.4	2.30E+07

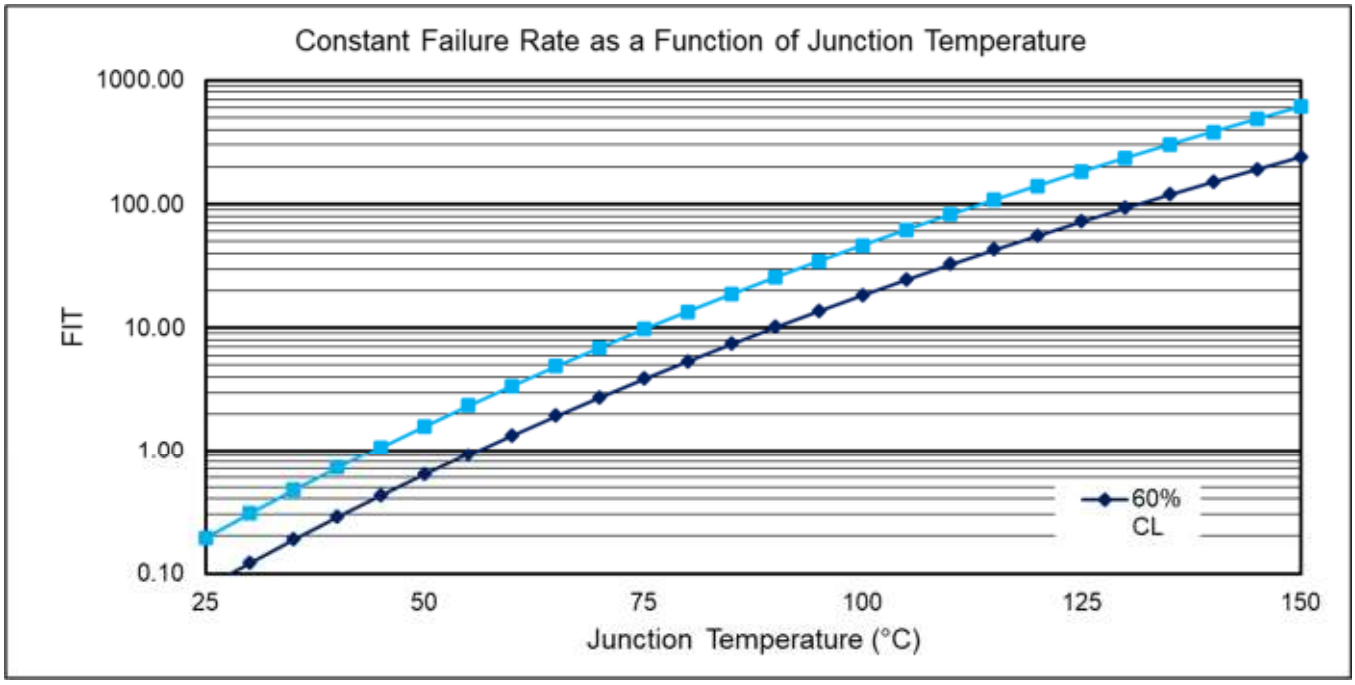


Product Family Classification

Amplifiers (LNA & PA)

Description	:	UltraCMOS Low-Noise Amplifiers (LNA) and Power Amplifiers (PA)
Products in Family	:	See Appendix A (page 47)
Process Technology	:	UltraCMOS® 11, UltraCMOS® 12, UltraCMOS® 12A, UltraCMOS® 13
Units Tested	:	23,100

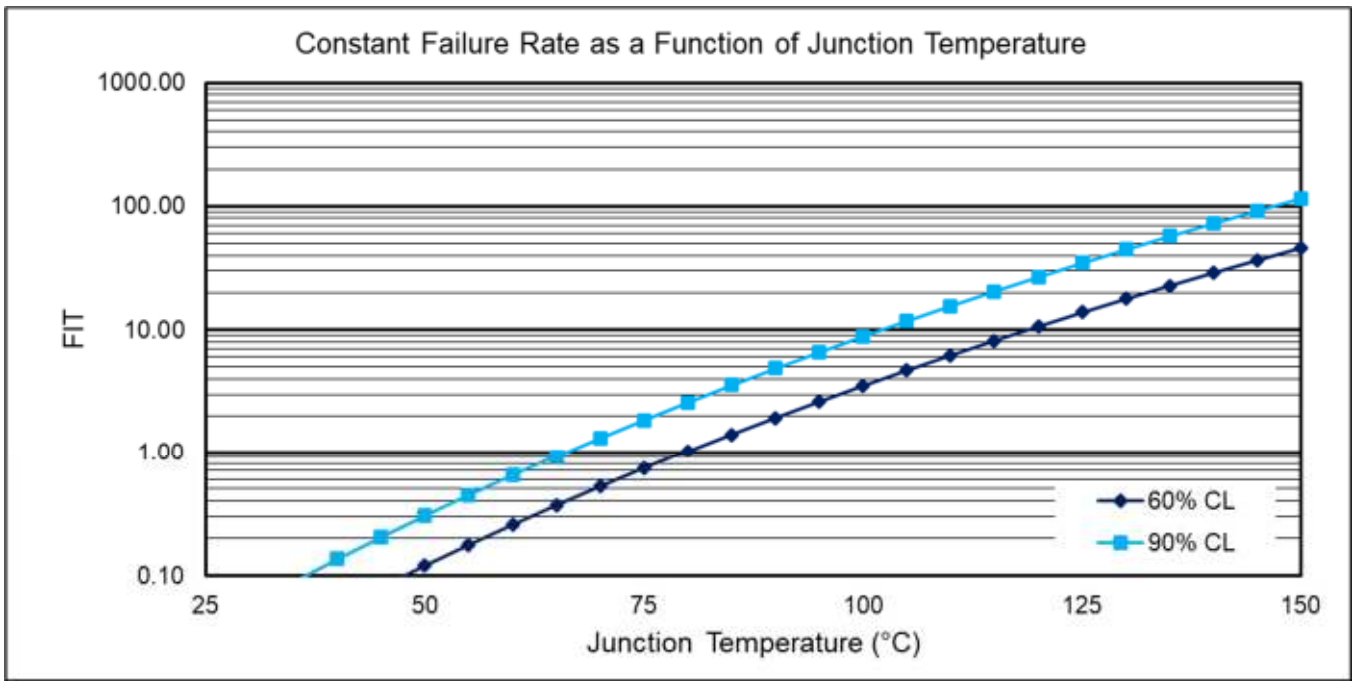
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	9.19E+07	10.0	1.00E+08
Constant (Random)	9.78E+08	0.9	1.07E+09



Switches (ASW, HPSW, ATS & BSW)

Description	:	Multi-pole & multi-throw high power handling antenna switch products for Mobile Wireless RF, broadband infrastructure, and Test Equipment /ATE applications.
Products in Family	:	See Appendix B (page 49)
Process Technology	:	UltraCMOS® 2, UltraCMOS® 3.5, UltraCMOS® 5, UltraCMOS® 6, UltraCMOS® 6.5, UltraCMOS® 8, UltraCMOS® 10, UltraCMOS® 11, UltraCMOS® 12, UltraCMOS® 13, UltraCMOS® 13S
Units Tested	:	68,353

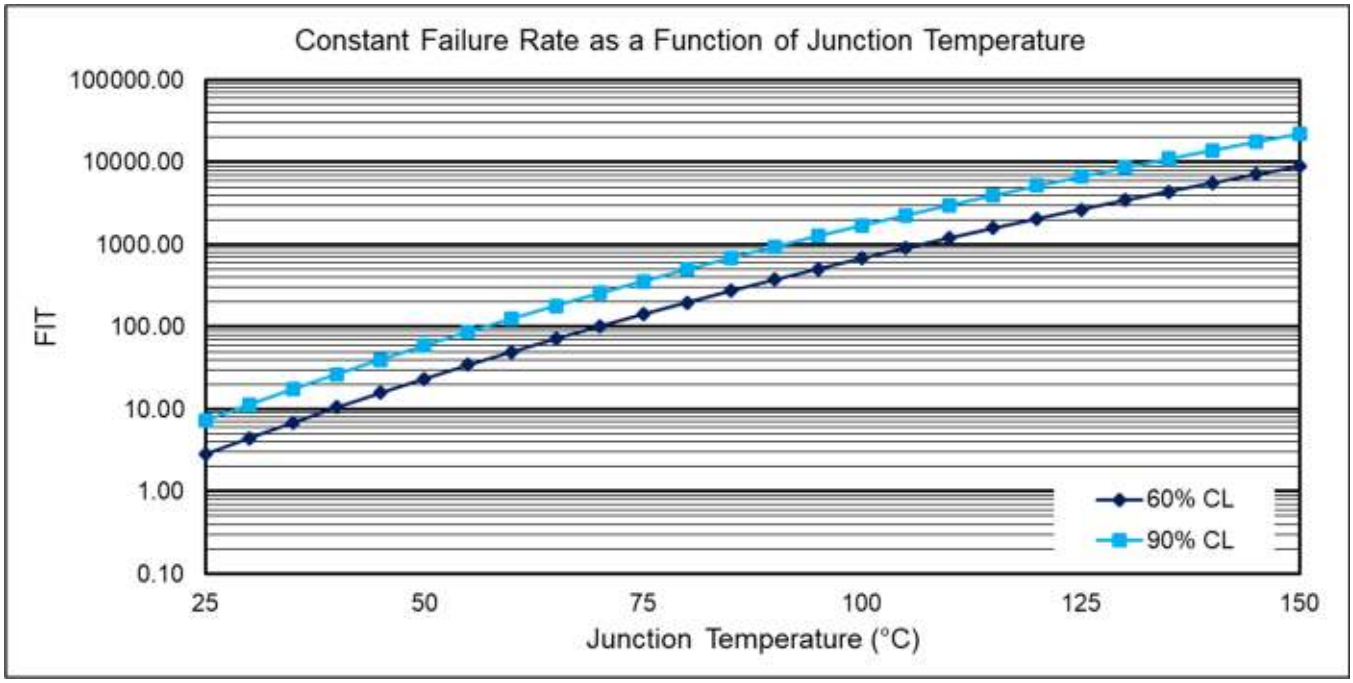
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	6.09E+08	1.5	6.64E+08
Constant (Random)	5.29E+09	0.2	5.77E+09



ASIC

Description	:	These ICs have high precision ADCs for sensing MEMS capacitance and high accuracy temperature sensors to support high conversion rates and low latency.
Products in Family	:	WP71900, WP71901
Process Technology	:	55LPx
Units Tested	:	343

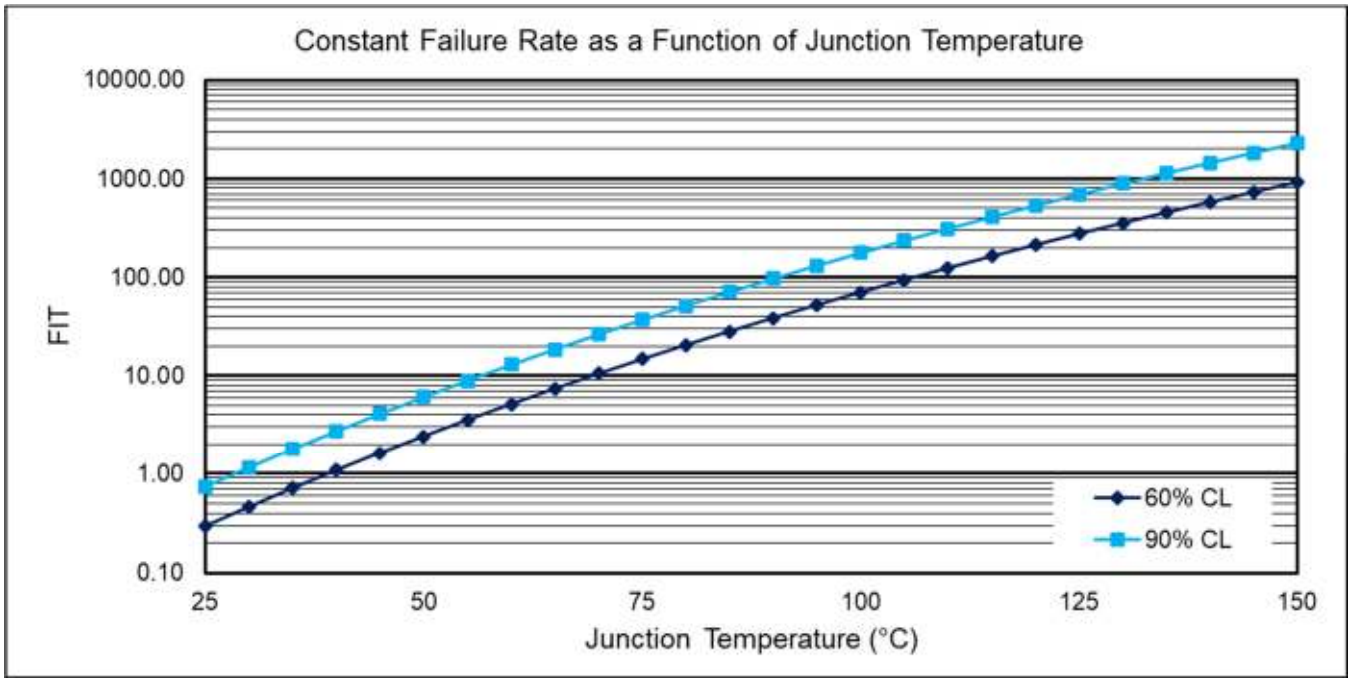
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.28E+06	717.7	1.39E+06
Constant (Random)	2.66E+07	34.5	2.90E+07



DC-DC

Description	:	These devices are ultra-high efficiency DC/DC converter solution with integrated programmable current sinks that drive strings of LEDs.
Products in Family	:	PE22100, PE23100, PE23102, PE23108, PE23261, PE23363, PE24101, PE24102, PE25200, PE25204, PE27100, PE99151, PE99153, PE99153-11, PE99155, PE99155-11
Process Technology	:	BCD GEN II, BCD GEN III, BCDLite, UltraCMOS® 2, UltraCMOS® 11
Units Tested	:	3,782

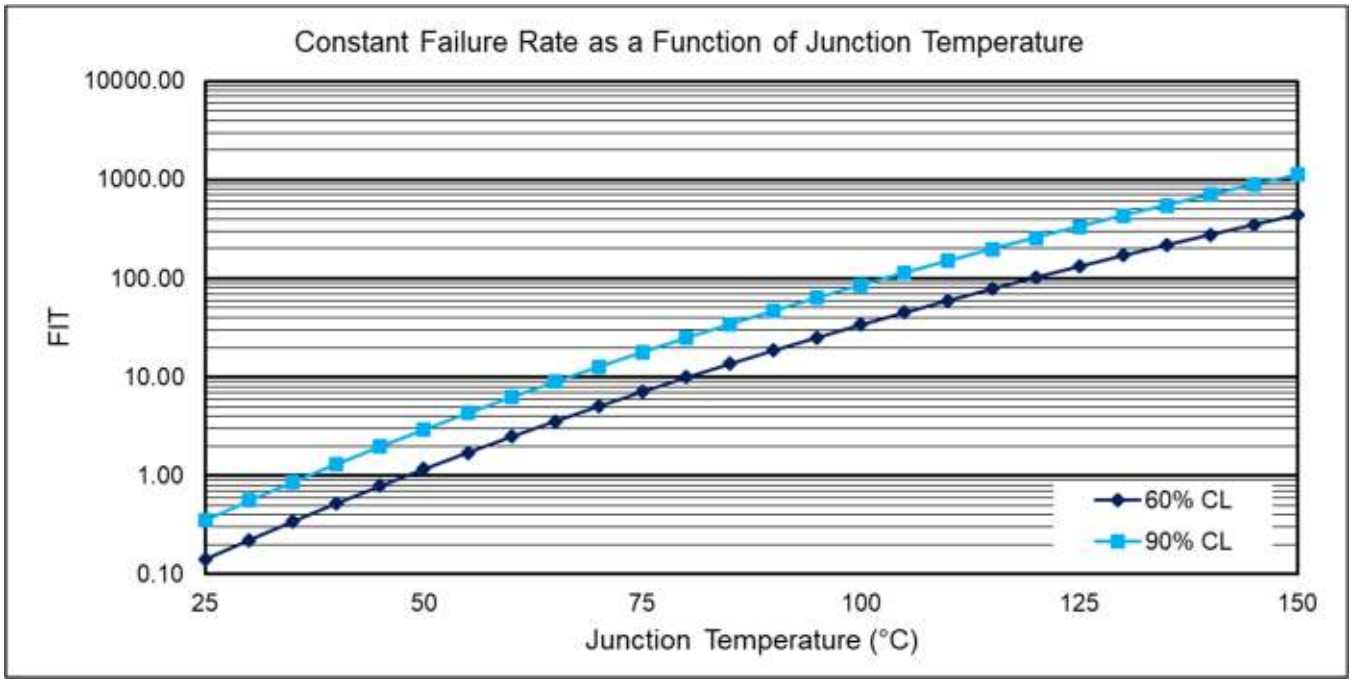
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.64E+07	55.9	1.79E+07
Constant (Random)	2.58E+08	3.6	2.82E+08



Digital Step Attenuators (DSA)

Description	:	50Ω and 75Ω Digital Step Attenuators for wireless infrastructure, microwave, test equipment and high reliability space applications.
Products in Family	:	PE4302, PE4306, PE4308, PE4309, PE4312, PE43204, PE43205, PE43610, PE43614, PE43703, PE43704, PE43713
Process Technology	:	UltraCMOS® 2, UltraCMOS® 3.5, UltraCMOS® 5, UltraCMOS® 6.5, UltraCMOS® 8, UltraCMOS® 12
Units Tested	:	6,325

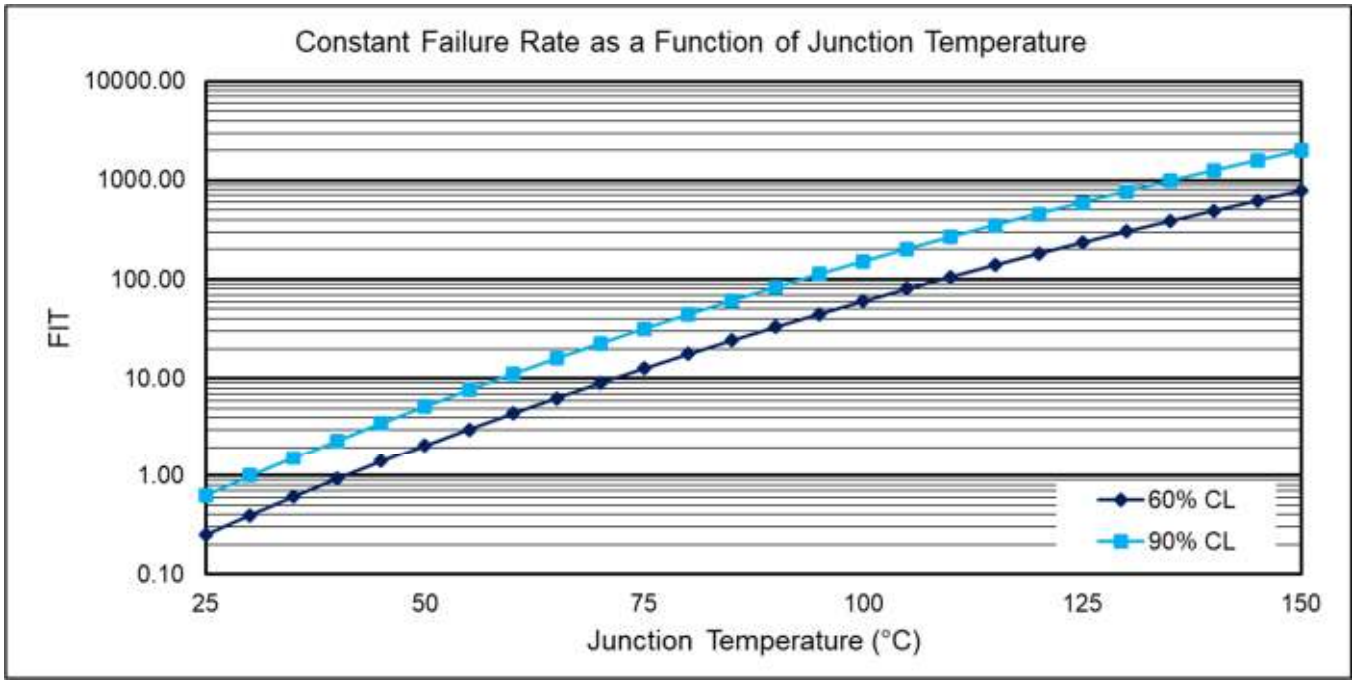
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	5.05E+07	18.1	5.51E+07
Constant (Random)	5.33E+08	1.7	5.82E+08



Digitally Tunable Capacitors (DTC)

Description	:	Supports a wide range of tuning applications, from tuning the center frequency of mobile-TV and antennas, to tunable impedance matching and filters.
Products in Family	:	PE623060, PE623090, PE64102, PE64906, PE62304, PE62305, PE64904, PE613040, PE613050
Process Technology	:	UltraCMOS® 3.5, UltraCMOS® 5, UltraCMOS® 8
Units Tested	:	2,237

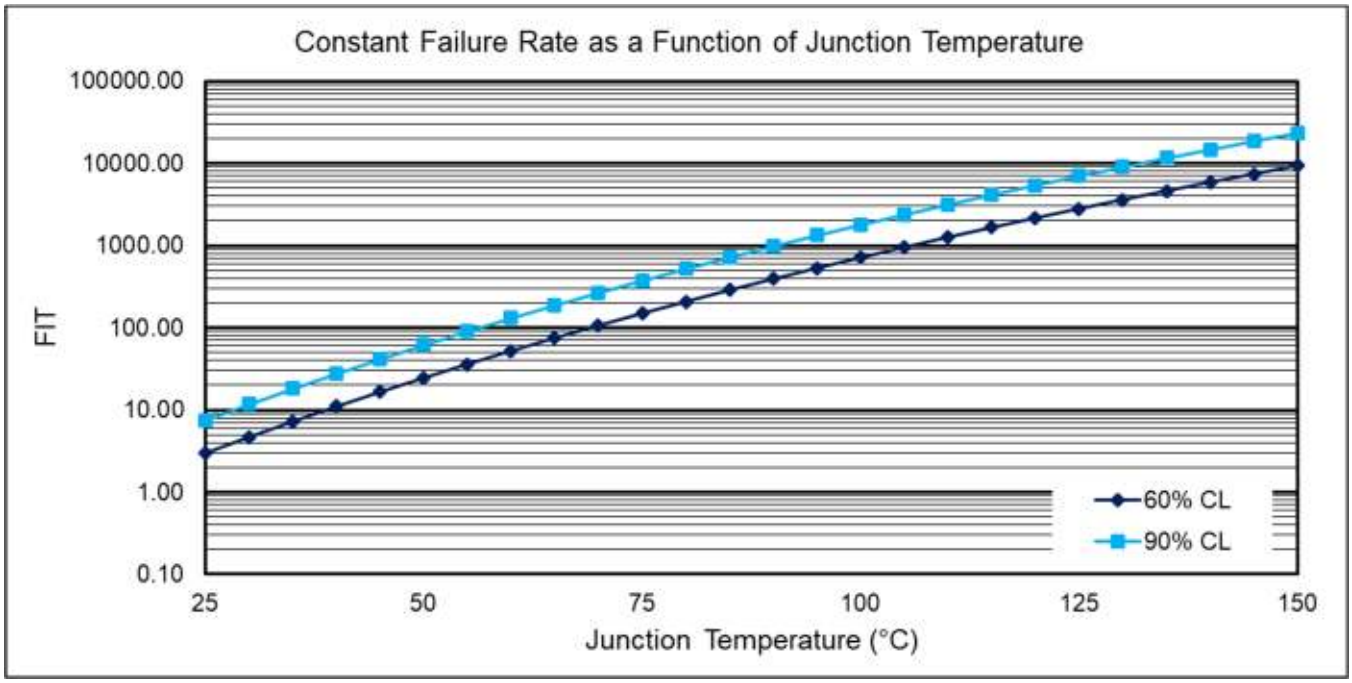
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.87E+07	32.0	3.13E+07
Constant (Random)	3.00E+08	3.1	3.27E+08



GaN Driver Product Family

Description	:	High-speed FET Driver
Products in Family	:	PE29100, PE29101, PE29102
Process Technology	:	UltraCMOS® 6.5, UltraCMOS® 8
Units Tested	:	327

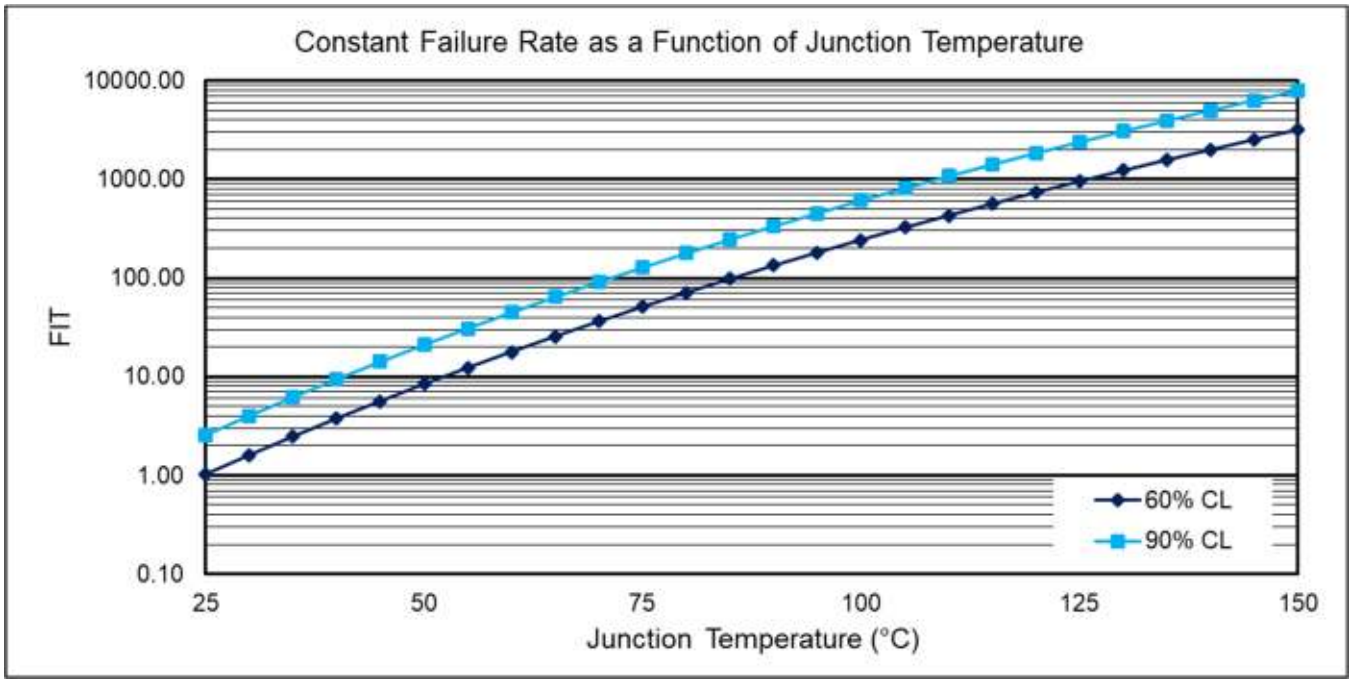
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.22E+06	752.9	1.33E+06
Constant (Random)	2.54E+07	36.1	2.77E+07



Power Limiters (LMTR)

Description	:	UltraCMOS Power Limiters.
Products in Family	:	PE45140, PE45361, PE45450
Process Technology	:	UltraCMOS® 5, UltraCMOS® 8
Units Tested	:	589

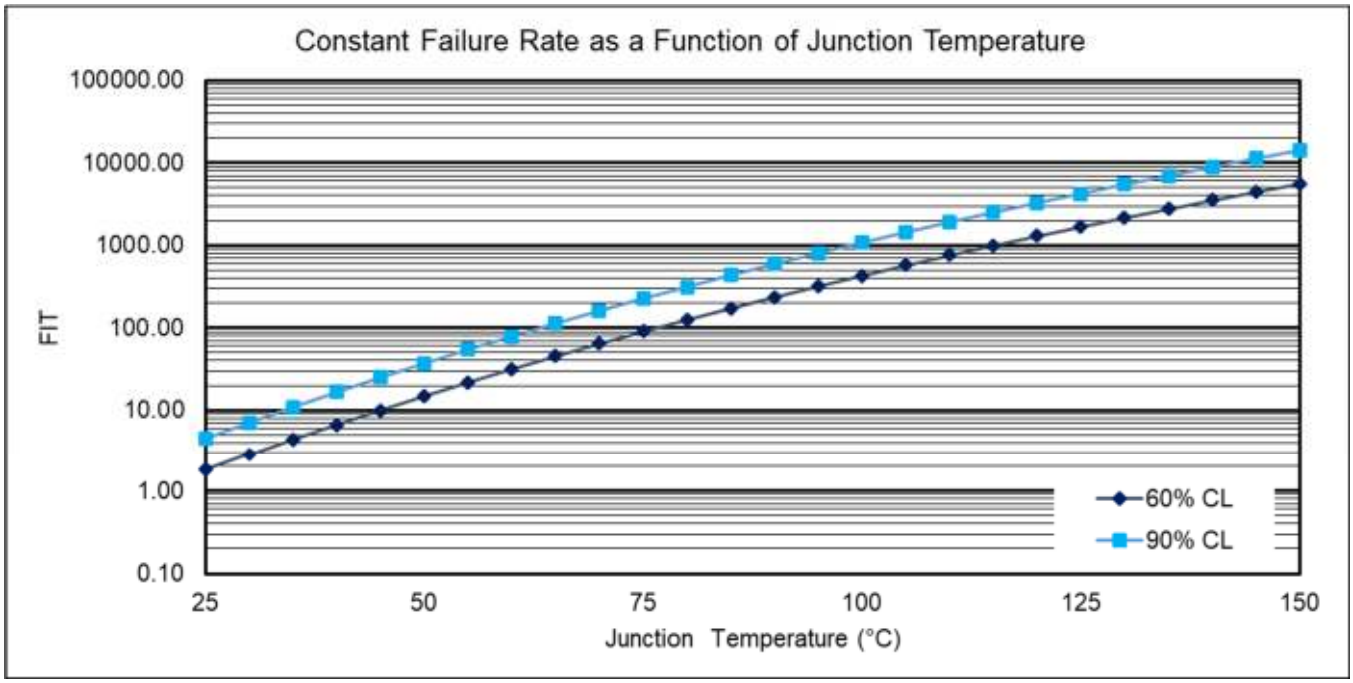
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	7.04E+06	130.2	7.68E+06
Constant (Random)	7.45E+07	12.3	8.13E+07



mmWave

Description	:	mmWave FEM
Products in Family	:	PE188100, PE188200, PE1283x0
Process Technology	:	UltraCMOS® 12A, 45RFSOI
Units Tested	:	553

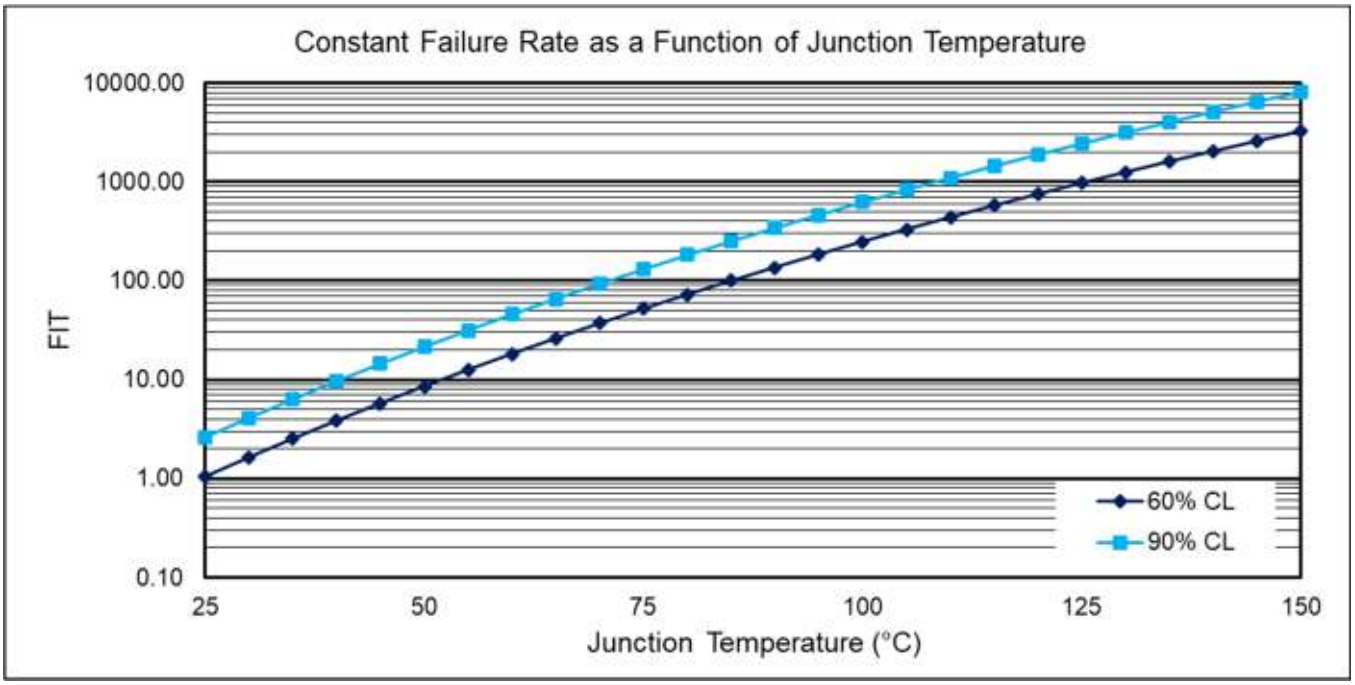
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	2.02E+06	453.4	2.21E+06
Constant (Random)	4.21E+07	21.8	4.60E+07



Monolithic Phase & Amplitude Controller (MPAC)

Description	:	UltraCMOS RF MPACs.
Products in Family	:	PE19601, PE46120, PE46130, PE46140
Process Technology	:	UltraCMOS® 5, UltraCMOS® 8
Units Tested	:	565

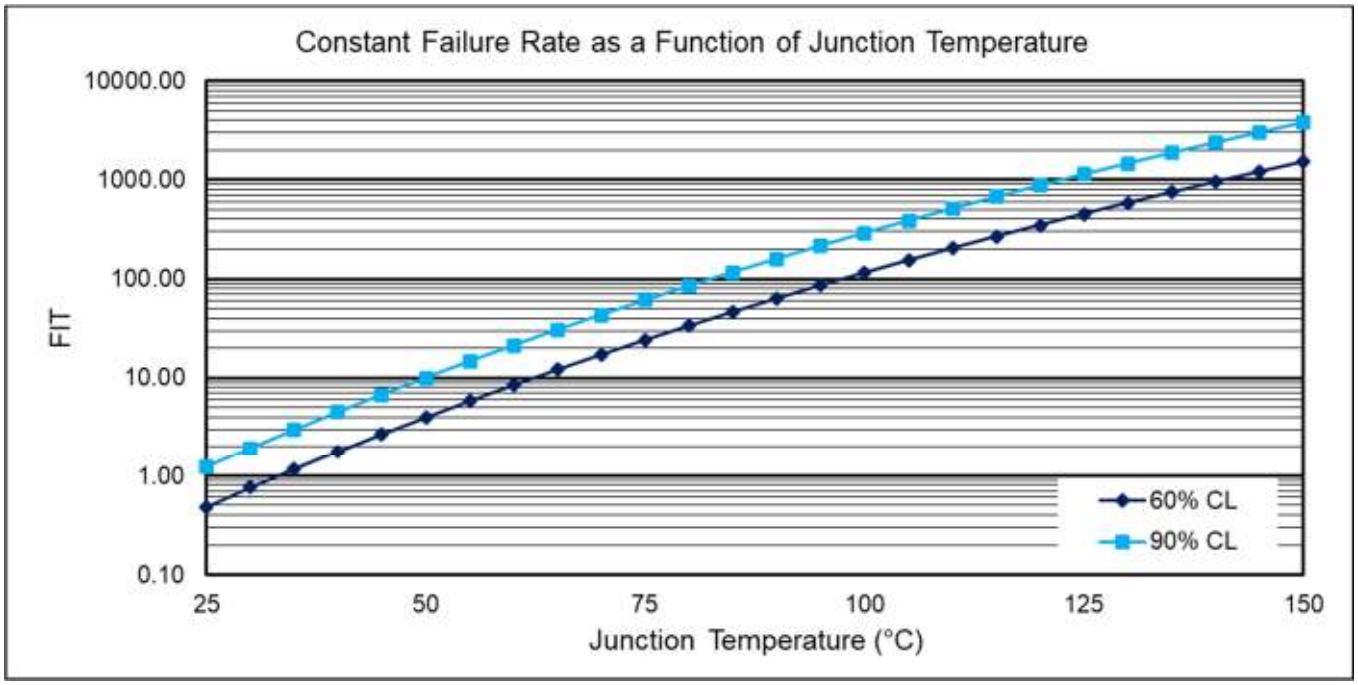
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	7.02E+06	130.6	7.66E+06
Constant (Random)	7.31E+07	12.5	7.98E+07



Mixers (MXR)

Description	:	UltraCMOS MOSFET quad array broadband and tuned mixers.
Products in Family	:	PE4120, PE4122, PE4126, PE4134, PE4140, PE4150, PE4151, PE4152, PE41901
Process Technology	:	UltraCMOS® 2, UltraCMOS® 8
Units Tested	:	1,136

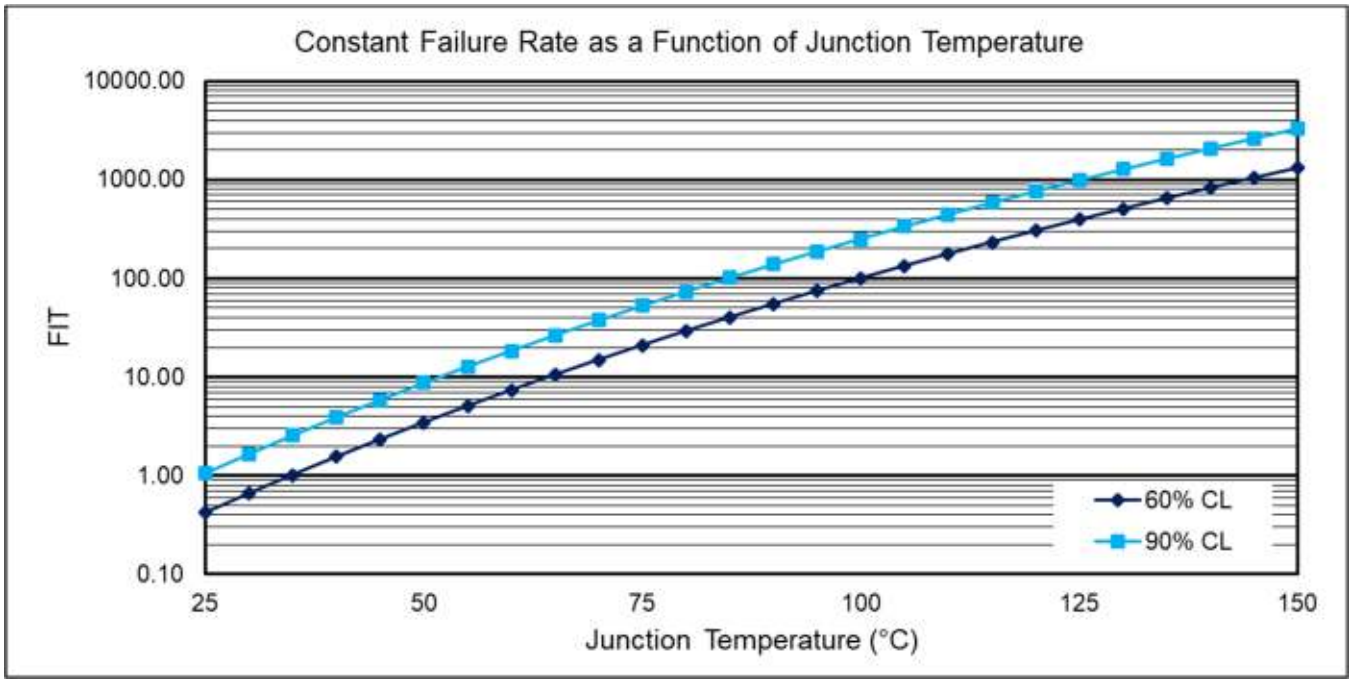
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	9.15E+06	100.1	9.99E+06
Constant (Random)	1.57E+08	5.9	1.71E+08



PA Controller (PAC)

Description	:	PA Controller controls the PA bias current in PAD modules for RF Front Ends
Products in Family	:	PE510021, PE515131, PE515170, PE515190, PE515200, PE519011
Process Technology	:	UltraCMOS® 12
Units Tested	:	7,938

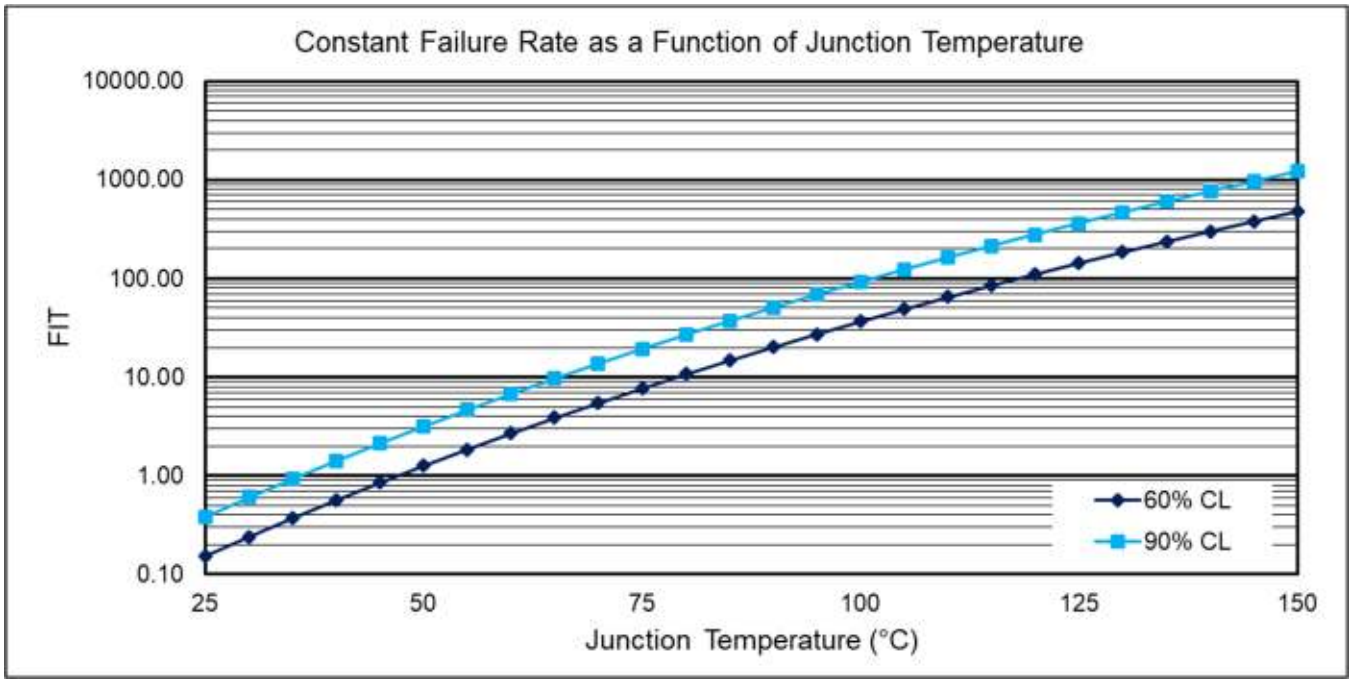
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	3.18E+07	28.8	3.47E+07
Constant (Random)	1.80E+08	5.1	1.97E+08



Phase Locked-Loop Synthesizers (PLL)

Description	:	Integer-N, Fractional-N and Delta Sigma Modulated frequency synthesizers for base station, mobile wireless and high reliability space applications.
Products in Family	:	PE3236, PE33241, PE3335, PE3336, PE33361, PE3341, PE3342, PE83336-21, PE9601, PE9701, PE9702, PE97022, PE9704, PE97042, PE97240, PE9763, PE9763-14, PE97632, PE97640
Process Technology	:	UltraCMOS® 2, UltraCMOS® 5
Units Tested	:	9,270

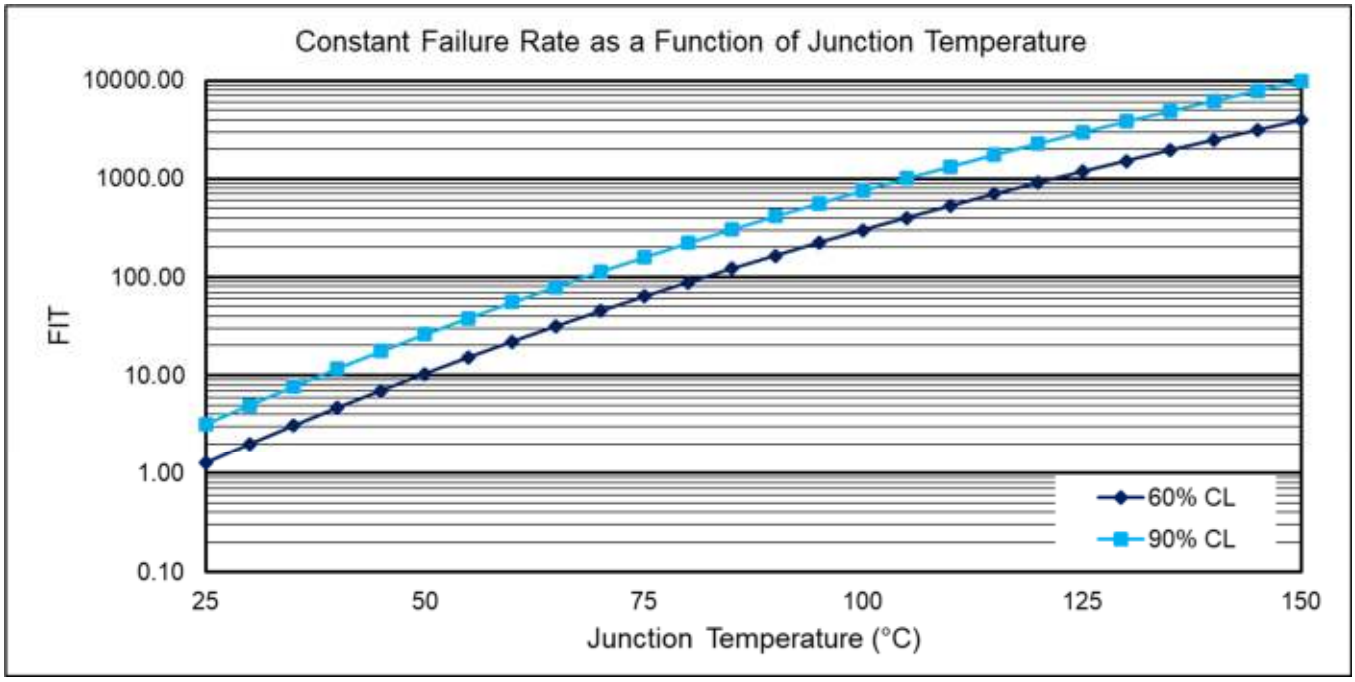
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	4.44E+07	20.6	4.84E+07
Constant (Random)	4.92E+08	1.9	5.37E+08



Phase Shifters (PSH)

Description	:	UltraCMOS RF Phase Shifters.
Products in Family	:	PE44820
Process Technology	:	UltraCMOS® 5
Units Tested	:	432

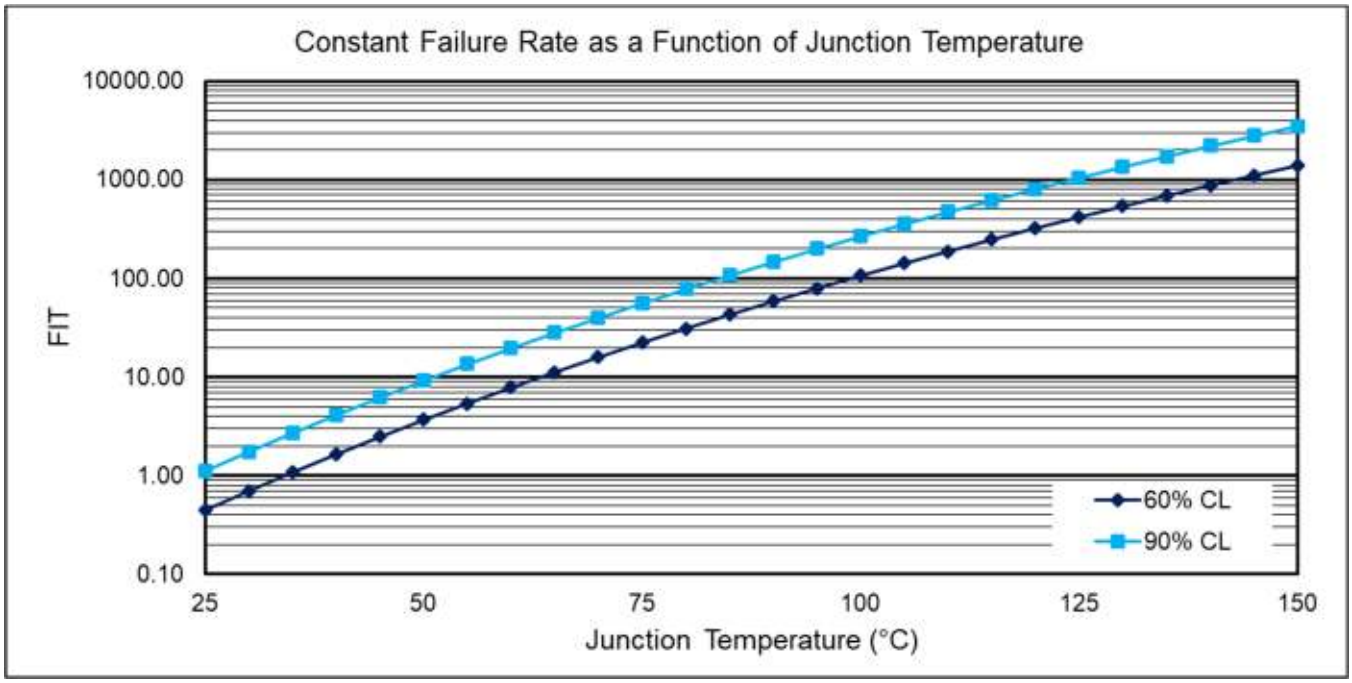
	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	5.37E+06	170.8	5.86E+06
Constant (Random)	6.00E+07	15.3	6.55E+07



Prescalers (PSR)

Description	:	UltraCMOS RF Prescalers.
Products in Family	:	PE3501, PE3503, PE3511, PE3512, PE35400, PE83512, PE9301, PE9303, PE9304, PE9308, PE9309, PE9311, PE9312, PE9313
Process Technology	:	UltraCMOS® 2, UltraCMOS® 8
Units Tested	:	2,697

	Standard Failure Rate Calculations at 55°C and 60% CL		
	EDH (hours)	FITs	MTTF (hours)
Early Life	1.35E+07	68.1	1.47E+07
Constant (Random)	1.69E+08	5.4	1.85E+08



Reliability Data

(Periodic Testing for the last 8 Quarters)

High Temperature Operating Life (HTOL)

Reference Standards : JESD22-A108

Test Conditions : T_A = 125°C (A) or 150°C (B)

: V_{bias} = max operating voltage

Test Duration (typical) : HTOL: 1,000 hrs. at (A) or 500 hrs. at (B)
ELFR: 48 hrs. at (A) or 24 hrs. at (B)

HTOL & ELFR	2020	2020	2020	2021	2021	2021	2021	2022
Process Technology	Q3	Q4	Q1	Q1	Q3	Q4	Q1	Q2
45RF SOI	-	-	-	-	-	-	-	-
55LPx	-	-	0/88	-	-	-	-	-
BCD Gen II	-	-	-	0/80	0/83	-	0/80	-
BCD Gen III	-	0/85	-	-	0/255	-	-	-
BCD Lite	-	-	-	-	-	-	-	-
UltraCMOS® 10	-	-	-	-	-	-	-	-
UltraCMOS® 11	0/25	-	-	-	-	-	-	-
UltraCMOS® 12	-	0/85	0/84	0/180	0/90	-	0/180	0/85
UltraCMOS® 12A	0/422	-	0/2,435	0/896	0/598	-	0/896	0/275
UltraCMOS® 13	0/255	0/90	0/270	0/261	0/270	0/85	0/261	-
UltraCMOS® 13S	0/340	-	-	-	0/360	0/2,815	-	-
UltraCMOS® 13SA	-	-	-	-	0/2,970	0/400	-	0/575
UltraCMOS® 2	0/175	0/90	0/85	-	0/84	-	-	0/85
UltraCMOS® 3.5	0/170	0/85	0/85	-	0/85	-	-	0/85
UltraCMOS® 5	-	-	-	-	0/85	-	-	-
UltraCMOS® 6	-	-	-	-	-	-	-	-

HTOL & ELFR	2020	2020	2020	2021	2021	2021	2021	2022
Product Group	Q3	Q4	Q1	Q1	Q3	Q4	Q1	Q2
ASIC	-	-	0/88	-	-	-	-	-
ASW	-	-	-	-	-	-	-	-
ATS	-	-	-	-	-	-	-	-
BSW	-	-	-	-	-	-	-	-
Coupler Switch	-	-	-	-	-	-	-	-
DC-DC	0/25	0/85	-	0/80	0/338	-	0/80	-
Driver	-	-	-	-	-	-	-	-
DSA	-	-	-	-	-	-	-	-
DTC	-	-	-	-	-	-	-	-
FEM	-	-	-	-	-	-	-	-
HPSW	-	-	-	-	-	-	-	-
LMTR	-	-	-	-	-	-	-	-
LNA	-	-	-	-	-	-	-	-
mmWave FEM	-	-	-	-	-	-	-	-

Temperature Cycle (TC)

Reference Standards : JESD22-A104

Test Conditions : -55°C to +125°C (B)

: -65°C to +150°C (C)

Test Duration (typical) : 1,000 cyc. at (B) or 500 cyc. at (C)

TC	2020	2020	2020	2021	2021	2021	2021	2022
Package Family	Q3	Q4	Q1	Q1	Q3	Q4	Q1	Q2
WLCSP	0/400	0/770	-	0/580	0/1,745	0/1,630	0/580	0/830
Wire Bonded Die	-	-	0/161	-	-	-	-	-
Flip Chip Die	-	-	0/90	-	-	-	-	-
Embedded-Die-in-Substrate	-	-	-	-	-	-	-	-
8L TSSOP	-	-	-	-	-	-	-	-
8L MSOP	-	-	-	-	-	-	-	-
8L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
7L SOIC	-	-	-	-	-	-	-	-
6L SC70	0/105	0/55	0/50	-	0/50	-	-	0/50
6L 3x3 MLP	-	-	-	-	-	-	-	-
6L 3x3 DFN	-	-	-	-	-	-	-	-
6L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
68L CQFJ	-	-	-	-	-	-	-	-
64L CQFP	-	-	-	-	-	-	-	-
64L 9x9 QFN	-	-	-	-	-	-	-	-

Note

n/a - Reliability data not available. Package (family) not yet qualified at the specified period.

dash (-) - Test not performed at the specified period.

* Plastic encapsulated packages had undergone MSL Preconditioning prior to test.

Highly Accelerated Stress Test (HAST)

Reference Standards : JESD22-A110
Test Conditions : 130°C, 85% RH, 2.27 atm. (A)
: 110°C, 85% RH, 1.20 atm. (B)
Test Duration (typical) : 96 hrs. at (A) or 264 hrs. at (B)

HAST	2020	2020	2020	2021	2021	2021	2021	2022
Package Family	Q3	Q4	Q1	Q1	Q3	Q4	Q1	Q2
WLCSP	-	-	-	-	0/660	-	-	-
Wire Bonded Die	-	-	0/161	-	-	-	-	-
Flip Chip Die	0/144	-	0/144	0/338	0/285	-	0/338	-
Embedded-Die-in-Substrate	-	-	-	-	-	-	-	-
8L TSSOP	-	-	-	-	-	-	-	-
8L MSOP	-	-	-	-	-	-	-	-
8L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
7L SOIC	-	-	-	-	-	-	-	-
6L SC70	0/105	0/55	0/50	-	0/54	-	-	-
6L 3x3 MLP	-	-	-	-	-	-	-	-
6L 3x3 DFN	-	-	-	-	-	-	-	-
6L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
68L CQFJ	-	-	-	-	-	-	-	-
64L CQFP	-	-	-	-	-	-	-	-
64L 9x9 QFN	-	-	-	-	-	-	-	-

Note

n/a - Reliability data not available. Package (family) not yet qualified at the specified period.

dash (-) - Test not performed at the specified period. HAST may not apply to hermetic packages.

* Plastic encapsulated packages had undergone MSL Preconditioning prior to test.

High Temperature Storage (HTS)

Reference Standards : JESD22-A103
Test Conditions : Ta = 150°C
Test Duration (typical) : 1,000 hrs.

HTS	2020	2020	2020	2021	2021	2021	2021	2022
Package Family	Q3	Q4	Q1	Q1	Q3	Q4	Q1	Q2
WLCSP	-	-	-	-	0/495	0/170	-	0/255
Wire Bonded Die	-	-	0/165	-	-	-	-	-
Flip Chip Die	-	-	0/90	-	-	-	-	-
Embedded-Die-in-Substrate	-	-	-	-	-	-	-	-
8L TSSOP	-	-	-	-	-	-	-	-
8L MSOP	-	-	-	-	-	-	-	-
8L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
7L SOIC	-	-	-	-	-	-	-	-
6L SC70	0/105	0/55	0/50	-	0/50	-	-	0/50
6L 3x3 MLP	-	-	-	-	-	-	-	-
6L 3x3 DFN	-	-	-	-	-	-	-	-
6L 1.5x1.5 UDFN	-	-	-	-	-	-	-	-
68L CQFJ	-	-	-	-	-	-	-	-
64L CQFP	-	-	-	-	-	-	-	-
64L 9x9 QFN	-	-	-	-	-	-	-	-

Note

n/a - Reliability data not available. Package (family) not yet qualified at the specified period.

dash (-) - Test not performed at the specified period.

Appendix A

(RF Amplifiers Products List)

Amplifiers (LNA &PA)

Description	:	UltraCMOS Low-Noise Amplifiers (LNA) and Power Amplifiers (PA)
Products in Family	:	PE47002X, PE47004x, PE470081, PE47051x, PE47066x, PE470681, PE471110, PE471112, PE471741, PE472110, PE477180, PE477181, PE477181, PE478021, PE478031, PE478051, PE478070, PE478090, PE478091, PE478100, PE478110, PE478130, PE47814X, PE478180, PE478190, PE478211, PE47901X, PE47902X, PE479050, PE479070, PE479081, PE479091, PE479381, PE479641, PE521200, PE521221, PE52321X, PE523231, PE53210
Process Technology	:	UltraCMOS® 11, UltraCMOS® 12, UltraCMOS® 12A, UltraCMOS® 13
Units Tested	:	23,100

Appendix B

(RF Switch Products List)

Switches (ASW, HPSW, ATS & BSW)

Description	:	Multi-pole & multi-throw high power handling antenna switch products for Mobile Wireless RF, broadband infrastructure, and Test Equipment /ATE applications.
Products in Family	:	PE420021, PE42020, PE420540, PE420551, PE420560, PE4210, PE421080, PE421130, PE421141, PE421160, PE421230, PE421240, PE421261, PE421281, PE421292, PE421293, PE421294, PE421321, PE421422, PE42145x, PE421460, PE421510, PE421550, PE421592, PE421603, PE421628, PE421690, PE421711, PE421729, PE421752, PE421812, PE421821, PE421880, PE421941, PE421951, PE421979, PE422020, PE422050, PE4230, PE4231, PE4232, PE423422, PE4235, PE42359, PE423641, PE4237, PE4239, PE42412, PE42420, PE42421, PE42422, PE42424, PE42430, PE4244, PE42441, PE4245, PE42450, PE42452, PE4251, PE42510, PE42520, PE42522, PE42524, PE42525, PE42540, PE42542, PE42543, PE42552, PE42556, PE4256, PE4257, PE4259, PE4261, PE426140, PE42615, PE4263, PE42633, PE426331, PE42641, PE426412, PE426482, PE42650, PE42660, PE42672, PE426810, PE42682, PE426823, PE426850, PE426860, PE426880, PE426882, PE42691, PE426911, PE42695, PE42696, PE426960, PE426970, PE4270, PE42721, PE42723, PE42742, PE42750, PE42823, PE42850, PE429002, PE429011, PE42956x, PE429570, PE4314, PE43701, PE43711, PE61293x, PE613010, PE614910, PE614912, PE61493x, PE636030, PE636040, PE84140, PE84244, PE926C31, PE926C32, PE9354, PE94257, PE95420, PE95421
Process Technology	:	UltraCMOS® 2, UltraCMOS® 3.5, UltraCMOS® 5, UltraCMOS® 6, UltraCMOS® 6.5, UltraCMOS® 8, UltraCMOS®10, UltraCMOS®11, UltraCMOS® 12, UltraCMOS® 13, UltraCMOS® 13S
Units Tested	:	59,180