Quality and Reliability Data

TELEFUNKEN Semiconductors

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1. Quality and Reliability Targets

The following report shows the results of the qualification and monitoring activities carried out in 1995.

The quality targets for 1995 are summarized hereafter.

1.1 Electrical Average Outgoing Quality (AOQ)

Product Group	ICs	Opto Components	Transistors	Diodes
Target (ppm)	20	30	10	5
Test	Quality control test programs			

1.2 Early Failure Rate (EFR)

Product Group	ICs	Opto Components	Transistors	Diodes
Target (ppm)	30	30	30	20

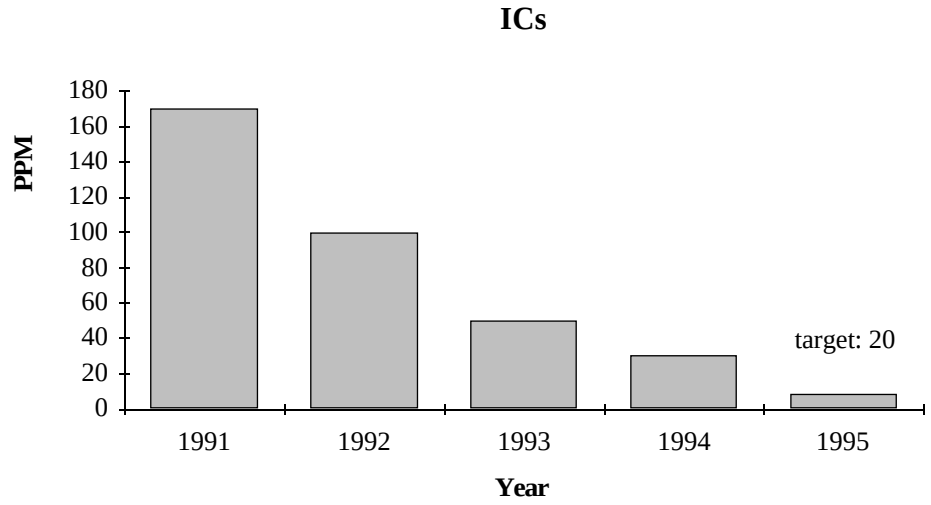
1.3 Latent Failure Rate (LFR)

Product Group	ICs	Opto Components	Transistors	Diodes
Target* (FIT)	5	10	5	5
Test	2000 h life test	1000 h life test	1000 h life test	1000 h life test

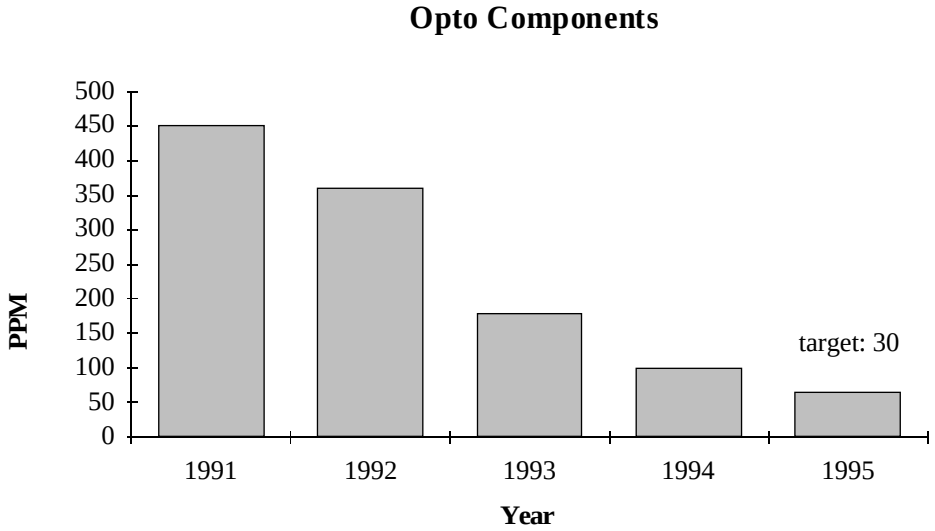
* T_j = 55°C; E_A = 0.7 eV; CL = 60%

2. Average Outgoing Quality

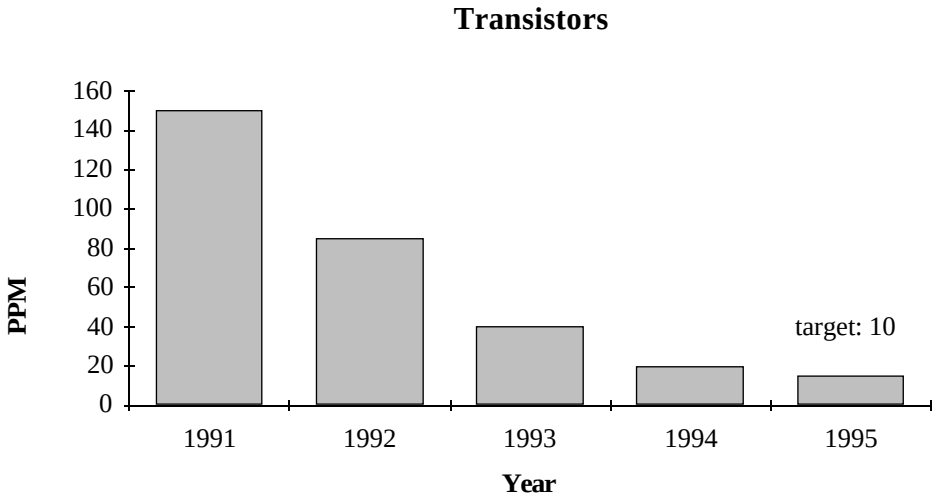
2.1 Electrical AOQ – ICs



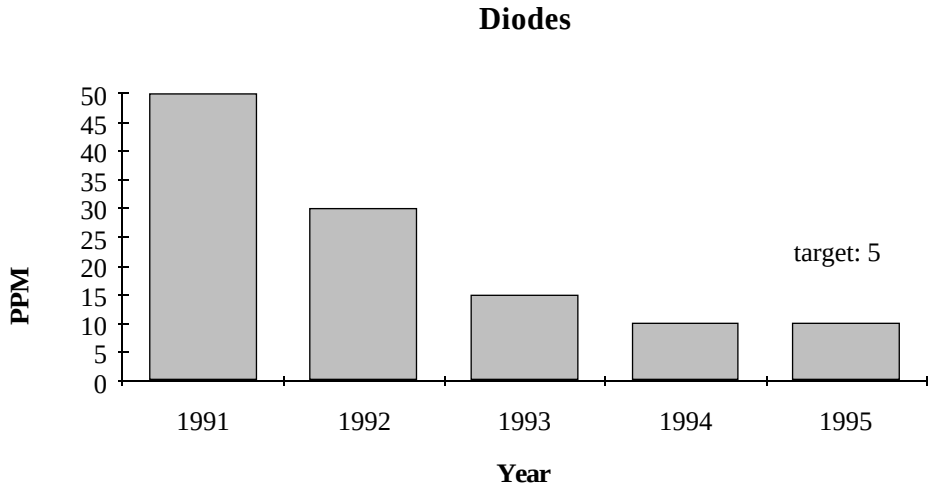
2.2 Electrical AOQ – Opto Components



2.3 Electrical AOQ – Transistors



2.4 Electrical AOQ – Diodes



(Figures for 1995 are only until June)

3. Reliability Data

3.1 Global Reliability

3.1.1 ICs

Test	Sample Size	Result
EFR	93535 - 5	53 ppm
LFR (T_j = 55°C; 60%)	4655 - 0	4 FIT
Temperature cycling	9861 - 1	0.010%
Humidity 85°C/ 85% RH	2470 - 1	0.040%

3.1.2 Opto Components

Test	Sample Size	Result
EFR	10250 - 6	585 ppm
LFR (T_j = 55°C; 60%)	750 - 0	62 FIT
Temperature cycling	9650 - 5	0.05%
Humidity 85°C/ 85% RH	1450 - 0	< 0.07%

(figures from 1994)

3.1.3 Transistors

Test	Sample Size	Result
EFR	1775 - 0	< 564 ppm
LFR (T_j = 55°C; 60%)	743 - 0	5 FIT
Temperature cycling	1064 - 0	< 0.093%
Humidity 85°C/ 85% RH	698 - 0	< 0.143%

3.1.4 Diodes

Test	Sample Size	Result
EFR	5375 - 2	372 ppm
LFR (T_j = 55°C; 60%)	1950 - 2	2 FIT
Temperature cycling	4125 - 3	0.072%
Humidity 85°C/ 85% RH	1400 - 1	0.071%

3.2 Early Failure Rate

3.2.1 EFR – ICs

Technology	I^2L	Standard	UNI
EFR (ppm)	58	160	110

3.2.2 EFR – Opto Components

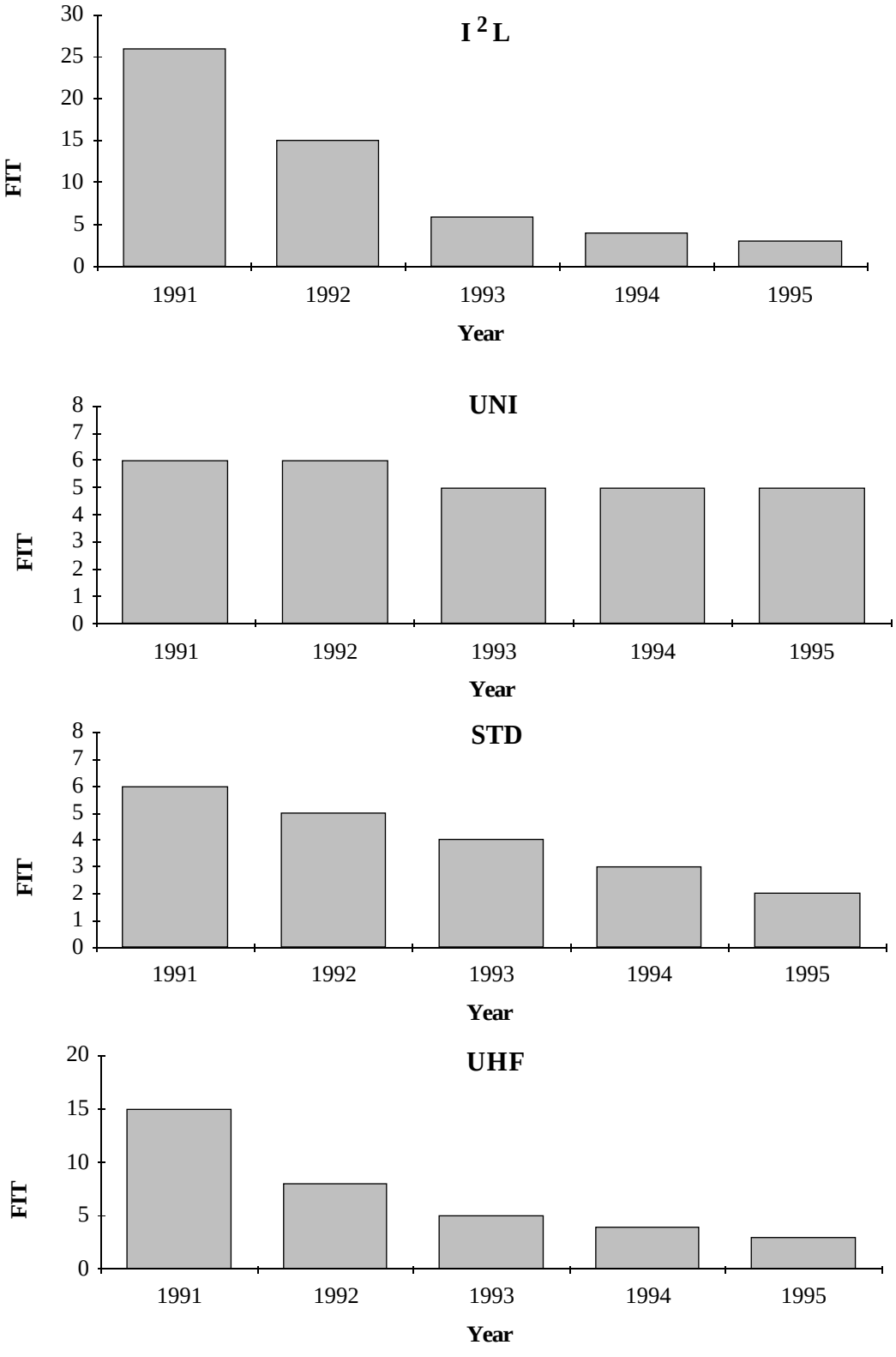
Product group	IR-Emitters	LEDs	Couplers	Modules
EFR (ppm)	889	412	< 435	< 476

3.2.3 EFR – Discretes

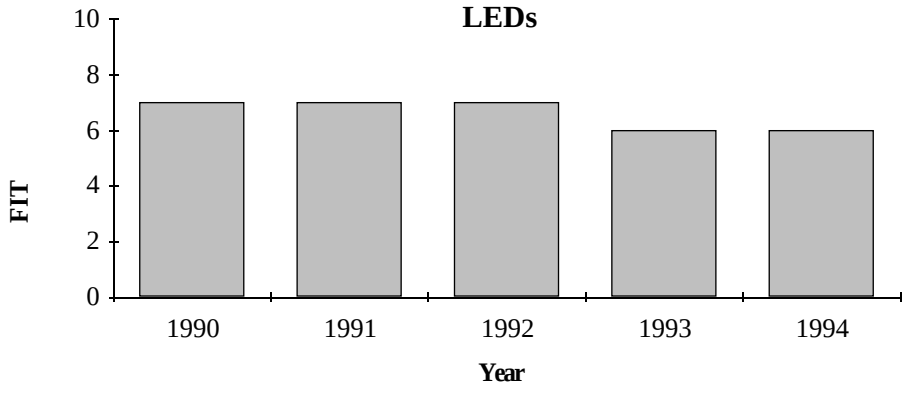
Technology	Diodes	Transistors
EFR (ppm)	372	< 564

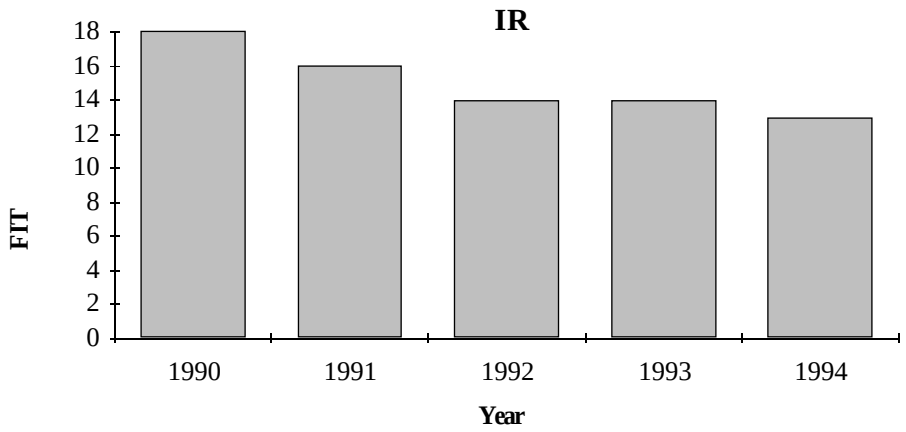
3.3 Latent Failure Rate

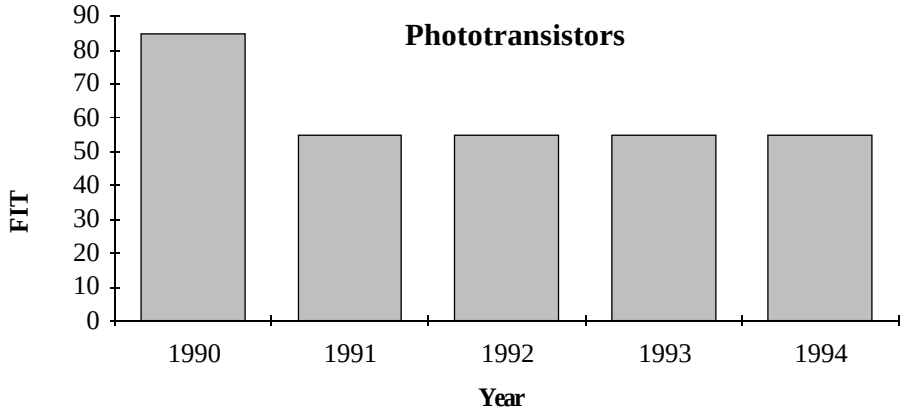
3.3.1 LFR – ICs

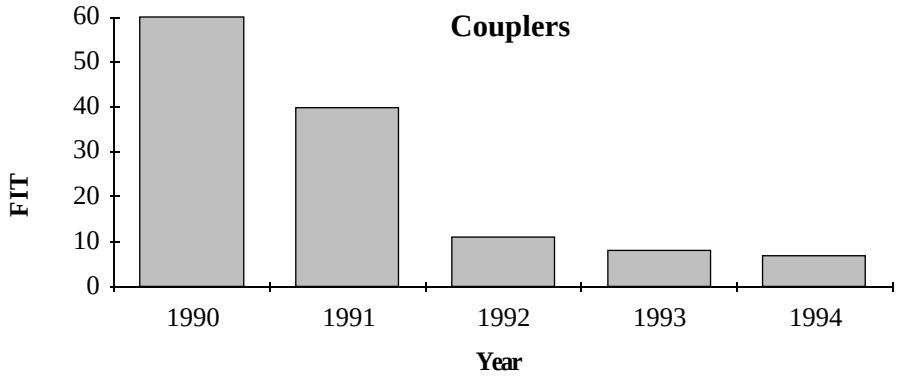


3.3.2 LFR – Opto Components

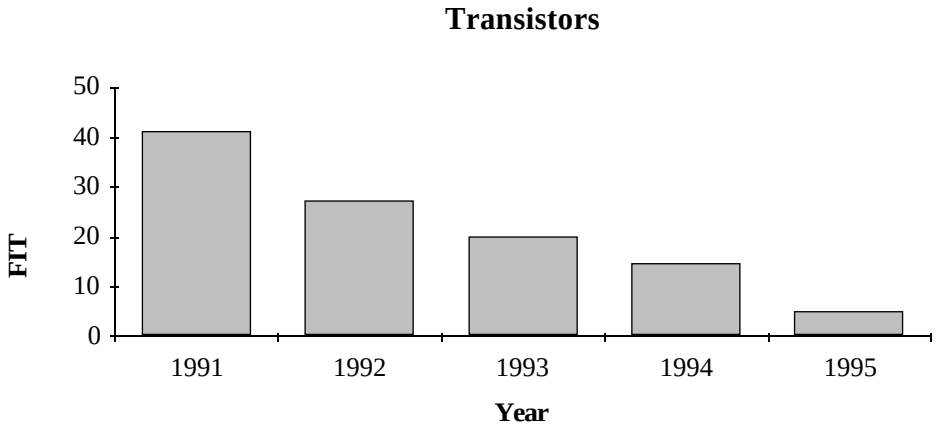




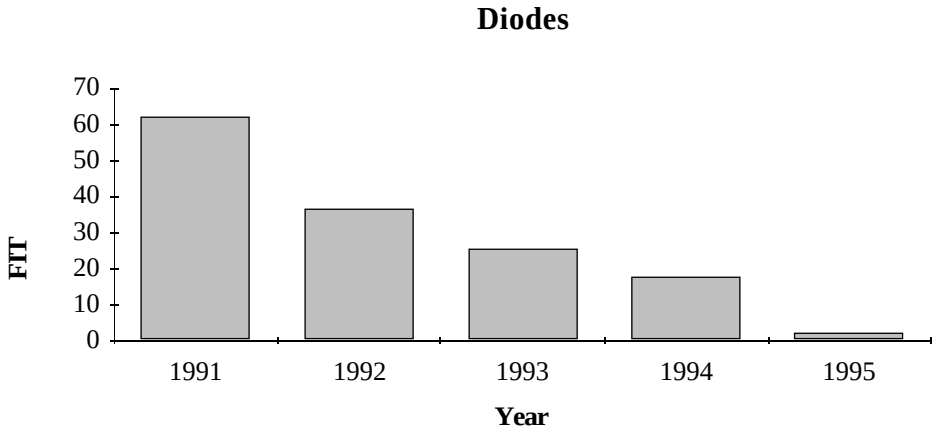




3.3.3 LFR – Transistors



3.3.4 LFR – Diodes



3.4 Reliability Data for Packages

3.4.1 IC Packages

	Test	Solderability		Thermal Shock		Temperature Cycling	
	Test Conditions	Wetting		15 × -55°C/ 150°C		100 × -55°C/ 150°C	
Package Line	Package	Sample Size	Rejects	Sample Size	Rejects	Sample Size	Rejects
DIP300 MIL	DIP16	80	0	200	0	200	0
	DIP18	80	0	200	0	200	0
DIP600 MIL	DIP28	132	0	300	0	340	0
SDIP400 MIL	SDIP28	100	0	250	0	250	0
SO150 MIL	SO8	80	0	199	0	200	0
SO300 MIL	SO20	60	0	150	0	150	0
	SO28	80	0	200	0	200	0
PLCC	PLCC44	100	0	250	0	250	0

	Test	PC - Test		HAST		Humidity	
	Test Conditions	96 h 121°C/ 1 bar		168 h 130°C/ 85% RH		1000 h 85°C/ 85% RH	
Package Line	Package	Sample Size	Rejects	Sample Size	Rejects	Sample Size	Rejects
DIP300 MIL	DIP8					50	0
	DIP16	200	0	200	0		
	DIP18	200	0	200	0	50	0
DIP600 MIL	DIP28	340	0	340	0		
SDIP400 MIL	SDIP28	250	0	250	0	40	0
SO150 MIL	SO8	200	0	198	0		
SO300 MIL	SO20	150	0	150	0		
	SO24					87	0
	SO28	199	0	200	0	50	0
PLCC	PLCC44	250	0	250	0	150	0

3.4.2 Opto Component Packages

Test	Solderability		Solder Heat		Humidity	
Test Conditions	Wetting		260°C, 5 s #		1000 h 85°C/ 85% RH	
Production Group	Sample Size	Rejects	Sample Size	Rejects	Sample Size	Rejects
IR-Emitter	9270	0	9270	0	900	0
Detector	15630	0	15630	0	1300	3
LED	24376	0	24376	0	696	0
Coupler	3600	0	3600	0	697	0
Modules	7740	0	7740	0	150	0

* Temperature cycling: depends on product group
# Coupler: 260°C, 10s

3.4.3 Discrete Packages

	Test	Solderability		Temperature Cycling		Humidity	
	Test Conditions	Wetting		100 × -55°C/ 150°C		1000 h 85°C/ 85% RH	
Package Line	Package	Sample Size	Rejects	Sample Size	Rejects	Sample Size	Rejects
Hermetic sealed	DO35/ 41	140	0	1249	2	350	0
	SOD80/ Q	180	0	1024	1	450	0
	SOD57/ 64	120	0	1280	0	300	0
Plastic	DO214 AC	40	0	256	0	200	0
	SOT143	100	0	64	0	48	0
	TO251	40	0	191	0	100	0
	TO220	60	0	178	0	250	0

4. Reliability Test Description

- **Early Failure Rate (EFR)**

This is an estimate of the total number of devices which fail before reaching the period of constant (random) failures. This normally covers the first 1000 hours of life of the system and is estimated by operating devices for short periods (i.e. 48 hours) at maximum junction temperature. It is expressed in ppm (**p**arts **p**er **m**illion).

- **Latent Failure Rate (LFR**)

This is the failure rate during the period of constant (random) failures. It is expressed in FITs (**F**ailures **I**n **T**ime) at a particular junction temperature (T_j = 55°C) and confidence level (60%).

- **Humidity Test**

This test is applied to plastic packages to determine their ability to withstand storage under high humidity conditions.

- **HAST** (**H**ighly **A**ccelerated **S**tress **T**est)

This is an accelerated stress test at high humidity and temperature. It is designed to accelerate humidity-related failure modes but without condensation on the package.

- **PC** (**P**ressure **C**ooker Test)

This is a very highly accelerated humidity test designed to penetrate moisture into a plastic package so as to look for any contaminants which may cause corrosion of the silicon chip. Under these conditions, the device is in a saturated condition under high temperature.

- **Temperature Cycling**

During this test, devices are cycled between maximum storage temperatures to assess the effects of thermal expansion upon the active chips and their connections.

- **Resistance to Solder Heat**

This test is carried out in order to check the ability of the device to withstand the thermal stresses applied during soldering.

- **Solderability**

A solderability test is used to check that the device leads can be soldered after a simulated period of storage (equivalent to two years under normal storage conditions).

5. Technology List

Product	Technology	Product	Technology
T2229B-A	STD	TDA4481-D	UNI
T2229B-AA	STD	TDA4483-D	UNI
T321MV-A	MOS	TDA4484-A	UNI
TBA120S-A	STD	TDA4555-AA	UNI
TBA120T-A	STD	TDA4556-B	UNI
TBA120T-AA	STD	TDA4557-A	UNI
TBA120U-A	STD	TDA4565-A	STD
TBA120U-AA	STD	TDA4565-AA	STD
TDA1072A-A	STD	TDA4950-B	LFP
TDA1220B-A	STD	TDA4951-B	LFP
TDA1940-A	STD	TDA8140-A	LFP
TDA3505G-A	STD	TDA8145-B	LFP
TDA3560-B	STD	TEA1007-A	STD
TDA4173-A	LFP	TEA1024-B	UNI
TDA4210-A	STD	TEA1124-B	UNI
TDA4427A-A	STD	TEA2029CV-A	UNI
TDA4439-BA	STD	TEA8170-A	LFP
TDA4439-CA	STD	TEA8170-AA	LFP
TDA4440-A	STD	TEA8172-A	LFP
TDA4442-A	STD	TEA8172-AA	LFP
TDA4443-AA	STD	U106BS-A	STD
TDA4445A-A	STD	U111B-A	STD
TDA4445A-B	STD	U145M-A	MOS
TDA4445A-BA	STD	U15901M-A	MOS
TDA4452-A	UNI	U15902M-A	MOS
TDA4453-G	STD	U15913M-A	MOS
TDA4453-GA	STD	U15914M-A	MOS
TDA4454-B	UNI	U16913M-A	MOS
TDA4455-A	UNI	U16918M-A	MOS
TDA4462-A	UNI	U16920M-A	MOS
TDA4470-A	UNI	U16921M-A	MOS
TDA4474-A	UNI	U176M-A	MOS
TDA4474-B	UNI	U184M-A	MOS
TDA4480-D	UNI	U185M-A	MOS

Product	Technology
U186M-A	MOS
U187M-A	MOS
U188M-A	MOS
U189M-A	MOS
U2008B-A	STD
U2010B-A	STD
U2042B-A	STD
U2043B-A	STD
U2043B-AA	STD
U2044B-A	STD
U2069B-A	STD
U2070B-A	STD
U208B-B	STD
U2097B-A	STD
U209B3-B	STD
U2100B-C	I^2L
U2100B-CA	I^2L
U2101B-A	I^2L
U2102B-A	I^2L
U210B1-A	STD
U211B2-B	STD
U211B3-B	STD
U2137B-B	I^2L
U2137B-BA	I^2L
U2141B-A	I^2L
U2141B-B	I^2L
U2141B-C	I^2L
U2148B-A	UNI
U215B-AA	STD
U217B-B	STD
U2203B-A	UHF
U2203B-B	UHF
U221B-A	STD
U2222B-A	STD

Product	Technology
U2225B-BA	STD
U2226B-A	STD
U2227B-B	STD
U225B-A	STD
U2300B-B	UHF
U2309B-A	UHF
U2320B-A	UHF
U2320B-B	UHF
U2321B-A	UHF
U2321B-AA	UHF
U2321B-B	UHF
U2323B-A	UHF
U232B-A	STD
U2330B-B	UHF
U2350B-A	STD
U2352B-A	I^2L
U237B-A	STD
U2390B-F	I^2L
U2391B-A	I^2L
U2400B-B	I^2L
U2400B-BA	I^2L
U2402B-A	I^2L
U2402B-B	I^2L
U2402B-C	I^2L
U2403B-A	UNI
U2405B-A	I^2L
U243B-A	STD
U243B-AA	STD
U2477B-A	I^2L
U2479B-A	I^2L
U247B-A	STD
U2481B-A	I^2L
U2501B-A	STD
U2505B-A	STD

Product	Technology
U2507B-A	STD
U2510B-CA	UNI
U2510B-CB	UNI
U2528B-A	STD
U2532B-A	UNI
U2535B-A	UNI
U2537B-D	UNI
U2537B-DA	UNI
U2537B-F	UNI
U2537B-H	UNI
U2537B-HA	UNI
U2537B-L	UNI
U2538B-A	UNI
U2550B1-A	I^2L
U2550B1-AA	I^2L
U2552B-A	I^2L
U2554B-A	I^2L
U2554B-B	I^2L
U2554B-BA	I^2L
U2555B-B	I^2L
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U2559B-A	STD
U2560B-B	I^2L
U2560B-C	I^2L
U2561B-B	UNI
U2565B-A	UNI
U2581B-C	I^2L
U2581B-CA	I^2L
U2602BR-A	UNI
U2604B-A	UNI
U2605B-B	I^2L
U2605B-BA	I^2L
U2609B-A	I^2L
U2609B-AA	I^2L

Product	Technology
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U2642B-A	I^2L
U267B-A	STD
U269B-B	STD
U2705B-A	STD
U2740B-A	UHF
U2753B-A	UHF
U2759B-A	UNI
U2760B-A	UHF
U2775B-B	UNI
U2777B-C	UNI
U2781B-A	UHF
U2782B-A	UHF
U2783B-A	UHF
U2784B-A	UHF
U2790B-BA	UHF
U2791B-A	UHF
U2793B-A	UHF
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U2795B-C	UHF
U2796B-BA	UHF
U2796B-C	UHF
U2797B-A	UHF
U2829B-B	UNI
U2830B-B	UNI
U2831B-A	UNI
U2840B-A	UNI
U2860B-A	UNI
U2860B-B	UNI
U2891B-A	UHF
U2900B-A	UNI
U3082M-A	MOS
U3084M-A	MOS
U3090M-A	MOS

Product	Technology
U3211BM-B	BICMOS
U327MD-A	MOS
U338M-A	MOS
U353M-A	MOS
U4000B-A	I^2L
U4001B-A	I^2L
U4030B-A	UNI
U4049B-A	UHF
U4050B-B	UNI
U4050B-BA	UNI
U4055B-B	STD
U4056B-C	STD
U4058B-B	UNI
U4062B-B	UHF
U4062B-C	UHF
U4064B-A	UHF
U4065B-A	UHF
U4071B-A	I^2L
U4072B-A	I^2L
U4072B-AA	I^2L
U4074B-C	I^2L
U4074B-CA	I^2L
U4076B-A	I^2L
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U4078B-A	I^2L
U4078B-AA	I^2L
U4078B1-A	I^2L
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U4082B-A	UNI
U4083B-A	STD
U4084B-A	UNI
U4085B-C	I^2L

Product	Technology
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U4090B-A	UNI
U420B2-A	STD
U4221B-A	UNI
U4221B-B	UNI
U4222B-B	UNI
U4222B-C	UNI
U4223B-A	UNI
U4223B-B	UNI
U4225B-A	UNI
U4230B-A	UHF
U4240B-B	UNI
U4260B-A	UNI
U4261B-A	UNI
U4270B-B	STD
U4270B-BA	STD
U4270B-C	STD
U4275B-A	UNI
U427B-C	STD
U4290B-B	UNI
U4291B-A	UNI
U429B-A	STD
U4311B-C	UNI
U4313B-A	UNI
U4314B-A	UNI
U4391B-A	STD
U4392B-A	STD
U4393B-A	STD
U4439B-BA	STD
U4439B-CA	STD
U4490B-D	UNI
U450B-A	I^2L
U452B-A	I^2L
U4605B-A	STD

Product	Technology
U4614B-A	STD
U4646B-A	UNI
U4647B-A	UNI
U4648B-B	UNI
U4649B-A	UNI
U4650B-B	UNI
U4650B-C	UNI
U4744B-A	UHF
U4790B-A	STD
U4791B-A	STD
U4793B-A	STD
U479B-A	STD
U490B-B	I^2L
U4966B-A	UNI
U5710BM-A	BICMOS
U5711BM-A	BICMOS
U5715M-A	MOS
U6024BS-AA	UHF
U6028BS-AA	UHF
U6030B-A	I^2L
U6031B-A	I^2L
U6032B-C	I^2L
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U6037B-C	I^2L
U6040B-A	I^2L
U6043B-B	STD
U6043B-BA	STD
U6044B-D	I^2L
U6046B-C	I^2L
U6047B-A	I^2L
U6047B-C	I^2L
U6048B-A	I^2L
U6049B-C	I^2L
U6050B-A	I^2L

Product	Technology
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U6055B-A	I^2L
U6056B-A	I^2L
U6081B-CA	STD
U6082B-C	STD
U6082B-CA	STD
U6083B-C	STD
U6083B-CA	STD
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U6092B-A	I^2L
U6093B-AA	UNI
U6095B-AA	I^2L
U6095B-B	I^2L
U6095B-BB	I^2L
U6192B-AB	UNI
U6193B-AB	UNI
U6193B-AC	UNI
U6195B-A	I^2L
U6195B-AB	I^2L
U6195B-B	I^2L
U6195B-BB	I^2L
U6202B-C	UHF
U6202B-CA	UHF
U6202B-EA	UHF
U6204B-C	UHF
U6204B-CA	UHF
U6204B-E	UHF
U6204B-EA	UHF
U6206B-E	UHF
U6206B-EA	UHF
U6207B-E	UHF
U6207B-EA	UHF

Product	Technology
U6209B-FA	UHF
U6210B-A	STD
U6210B-AA	STD
U6210B-AB	STD
U6211B-A	STD
U6212B-A	STD
U6213B-A	STD
U6214B-A	UHF
U6215B-A	UHF
U6216B-A	UHF
U6217B-A	UHF
U6223B-A	UHF
U6224B-A	UHF
U6225B-B	UHF
U6226B-A	I^2L
U6226B-AA	I^2L
U6226B-B	I^2L
U6227B-A	I^2L
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U6237B-A	UHF
U62901M-A	MOS
U6316B-A	UHF
U6358B-B	UHF
U6359B-A	UHF
U6359B-B	UHF
U6359B-BA	UHF
U642B-B	STD
U642B-C	STD
U642B-CA	STD
U6430B-B	STD
U6431B-B	STD
U6432B-A	STD

Product	Technology
U6433B-A	STD
U643B-B	STD
U643B-BA	STD
U644B-A	STD
U6670B-A	STD
U6672B-A	STD
U6673B-A	STD
U6675B-A	STD
U6676B-A	STD
U6677B-A	STD
U6678B-A	STD
U6680B-A	STD
U6681B-A	STD
U6681B-B	STD
U6682B-A	STD
U6701B-A	I^2L
U6702B-B	I^2L
U6705B-A	UHF
U670B-A	UNI
U6715B-A	I^2L
U6725B-A	UHF
U672B-A	UNI
U6742B-A	STD
U6755B-A	STD
U6759B-A	STD
U6778B-A	LFP
U6780B-B	STD
U6784B-A	STD
U6785B-A	STD
U6786B-A	STD
U6791B-B	UHF
U6791B-C	UHF
U6792B-D	UHF
U6795B-D	UHF

Product	Technology
U6802B-A	STD
U6803B-A	STD
U6805B-B	STD
U6806B-A	STD
U6810B-A	I^2L
U6811B-B	I^2L
U690B-A	I^2L
U811BS-A	UHF
U813BSE-A	UHF
U821B-A	STD
U82910M-A	MOS
U82911M-A	MOS
U82912M-A	MOS
U82914M-A	MOS
U82916M-A	MOS
U829B-A	STD
U829B-AA	STD
U832BS-AA	UHF
U833BS-A	UHF
U833BSE-A	UHF

Product	Technology
U834BS-A	UHF
U842B-A	I^2L
U8442B-G	UNI
U847BST-A	UHF
U8600B-A	UHF
U860B-B	STD
U862BS-A	UHF
U864BS-A	UHF
U880B-AA	I^2L
U880B-D	I^2L
U880B-DA	I^2L
U891B-A	UHF
U891BS-A	UHF
U891BSE-A	UHF
U893BS-A	UHF
U893BSE-A	UHF
U898BSE-A	UHF
U96920M-A	MOS
U98903M-A	MOS
UAA145-A	STD