CMOS Phase Locked Loop

Reliability Data

HPLL-8001

Description

The following cumulative test results have been obtained from testing performed for Hewlett-Packard Communication Semiconductor Solutions Division in accordance with the latest revision of MIL-STD-883. Data was gathered from the product qualification, reliability monitor, and engineering evaluation.

For the purpose of this reliability data sheet, a failure is any part which fails to meet the electrical and/or mechanical specification listed in the Designer's Catalog.

1. Life Test

A. Demonstrated Performance (0.8 micron n-well)

Test Name	Test Conditions	Units Tested	Total Device Hrs.	Total Failed
High Temperature Operating Life	$T_J = 150°C$ $V_{CC} = 5.5$ V, 3000 h	308	924,000	1
High Temperature Operating Life	$T_J = 150°C$ $V_{CC} = 5.5$ V, 2000 h	77	154,000	0

B. Failure Rate Prediction

The failure rate will depend on the junction temperature of the device. The estimated life at different temperatures is calculated, using the Arrhenius plot with activation energy of 0.7 eV and 60% confidence level, and is listed in the following table.

The Long Term Failure Rate does not include 48 hrs. (Early Failure Rejects) at 150°C test temperature.

The Early Failure Rate is calculated for 55°C junction temperature and 60% confidence level when Ea = 0.7 eV.

Junction Temp. $T_J(°C)$	Point[1]		60% Confidence Level[2]	
	MTTF* (hours)	MTTF FIT[3]	MTTF (hours)	MTTF FIT[3]
150	1,078,000	928	539,000	1,855
100	14,082,969	71	7,041,484	142
85	35,017,208	29	17,508,604	57
55	277,938,362	4	138,969,181	7

*MTTF data calculated from high temperature Operating Life tests.

Infant mortality rate is expressed in terms of ppm (parts per million). The current EFR is 30 ppm/khrs (per 10k gates) for the 0.8 micron n-well technology (about 4000 samples tested, 1 reject).

MTTF / HOURS (0.7 eV)

MTTF / FIT (0.7 eV)
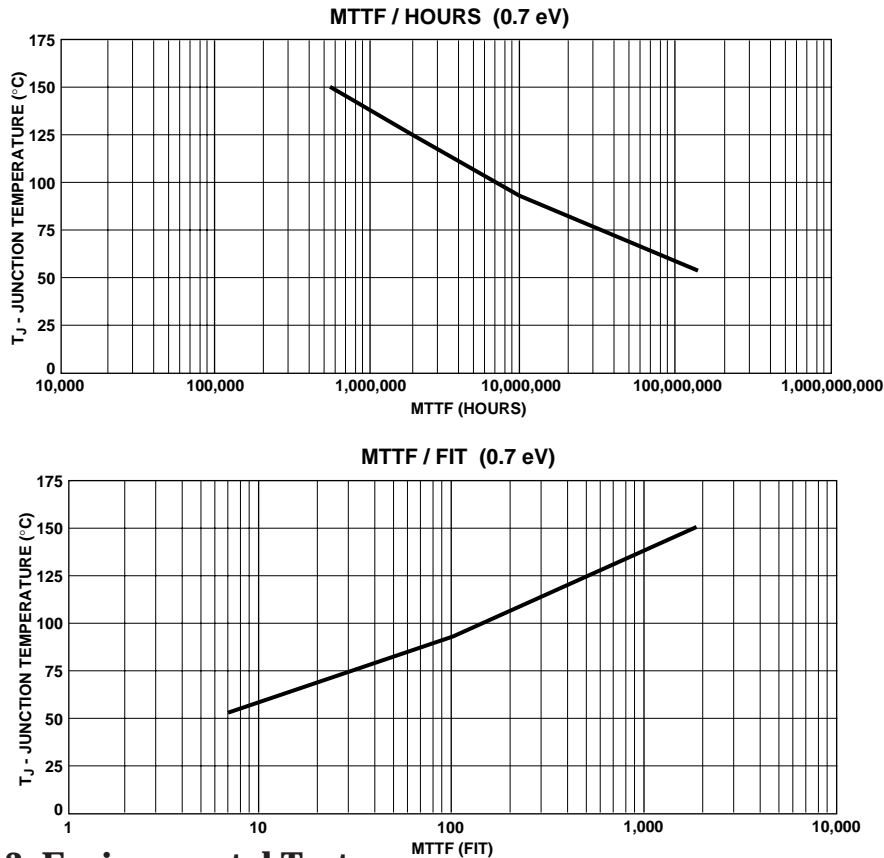
Notes:
1. The point MTTF is simply the total device hours divided by the number of failures.
2. This MTTF and failure rate represent the performance level for which there is a 60% probability of the device doing better than the stated value. The confidence level is based on the statistics of failure distribution. The assumed distribution is exponential. This particular distribution is commonly used in describing useful life failures.
3. FIT is defined as Failure in Time, or specifically, failures per billion hours. The relationship between MTTF and FIT is as follows: FIT = 10^9/(MTTF).

2. Environmental Tests

Test Name	MIL-STD-883 Method	Test Conditions	Units Tested	Units Failed
Temperature Cycle	M1010	-65˚C to +150˚C; 1000 cycles	45	0
Humidity Bias	CECC 90 000	85˚C, 85% RH; 5.5 V 1000 hrs. 3000 hrs.	45	0
HAST	CECC 90 000	130°C, 85% RH 96 hrs. 240 hrs.	45	0
Lead Integrity	M2004	—	15	0
Solderability	M2003	Solder temp. 245˚C; Dwell time 5 seconds; 8 hours steam age	15	0
Resistance to Solvents	M2015	3 solvents	16	0
Internal Inspection	M2010	––	5	0
Physical Dimension and Visual Inspection	M2016	Outline Drawing	125	0

3. Electrostatic Discharge Sensitivity

Test Condition: MIL-STD-883 M3015   Human Body Model
Classification: Class 1

4. Latch-up Test

Test Condition: JEDEC 17
Test Result: U ≥ 10 V   pass
I ≥ ± 250 mA   pass