Agilent 5082-7300, -7302, and -7340 Hexadecimal and Numeric Displays

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Agilent Technologies in accordance with the latest revision of MIL-STD-883.

Agilent tests parts at the absolute maximum rated conditions recommended for the device. The actual performance you obtain from Agilent parts depends on the electrical and environmental characteristics of your application but will probably be better than the performance outlined in Table 1.

Table 1. Life Tests Demonstrated Performance

					Point Typical Performance	
Test Name	**Stress Test Conditions**	**Total Device Hrs.**	**Units Tested**	**Units Failed [3]**	**MTBF [1]**	**Failure Rate (% /1K Hours)**
High Temperature Operating Life	T_A = +100°C, V_{CC} = 5.5 V Numeric Cycling	514,000	514	0	514,000	0.195

Failure Rate Prediction

The failure rate of semiconductor devices is determined by the junction temperature of the device. The relationship between ambient temperature and actual junction temperature is given by the following:

$$T_J\ (°C) = T_A\ (°C) + \theta_{JA} \quad P_{AVG}$$

where

T_A = ambient temperature in °C

θ_{JA} = thermal resistance of junction-to-ambient in °C/watt

P_{AVG} = average power dissipated in watts

The estimated MTBF and failure rate at temperatures lower than the actual stress temperature can be determined by using an Arrhenius model for temperature acceleration. Results of such calculations are shown in the table on the following page using an activation energy of 0.43 eV (reference MIL-HDBK-217).

Table 2. Reliability Predictions

		Point Typical Performance in Time [1] (60% Confidence)		Performance in Time [2] (90% Confidence)	
Ambient Temperature (°C)	Junction Temperature (°C)	MTBF [1]	Failure Rate (%/1K Hours)	MTBF [2]	Failure Rate (%/1K Hours)
100	140	514,000	0.195	223,000	0.448
90	130	694,000	0.144	301,000	0.332
80	120	951,000	0.105	413,000	0.242
70	110	1,324,000	0.076	575,000	0.174
60	100	1,878,000	0.053	816,000	0.123
50	90	2,714,000	0.037	1,179,000	0.085
40	80	4,007,000	0.025	1,740,000	0.057
30	70	6,050,000	0.017	2,628,000	0.038
20	60	9,365,000	0.011	4,067,000	0.025

Notes:
[1] The point typical MTBF (which represents 60% confidence level) is the total device hours divided by the number of failures. In the case of zero failures, one failure is assumed for this calculation.
[2] The 90% Confidence MTBF represents the minimum level of reliability performance which is expected from 90% of all samples. This confidence interval is based on the statistics of the distribution of failures. The assumed distribution of failures is exponential. This particular distribution is commonly used in describing useful life failures. Refer to MIL-STD-690B for details on this methodology.
[3] A failure is any LED which does not emit light or the display's inability to transmit information.

Example of Failure Rate Calculation

Assume a device operating 8 hours/day, 5 days/week. The utilization factor, given 168 hours/week is:
(8 hours/day) x (5 days/week) / (168 hours/week) = 0.25

The point failure rate per year (8760 hours) at 50°C ambient temperature is:
(0.037% / 1K hours) x (0.25) x (8760 hours/year) = 0.081% per year

Similarly, 90% confidence level failure rate per year at 50°C:
(0.085% / 1K hours) x (0.25) x (8760 hours/year) = 0.186% per year

Table 3. Environmental Tests

Test Name	MIL-STD-883C Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	1010	-40 to +100°C, 15 minute dwell and 5 minute transfer, 500 cycles	926	12(4)
Temperature/ Humidity Op Life	–	T_A = +85°C, RH = 85% V_{CC} = 5.0 Volts	515	16
Solder Heat Resistance	2003	260° ± 5°C, dwell time = 5 seconds, 2 times.	1916	0

Notes:
[4] Failures after 20 temperature cycles are considered Infant Failures. Corrective action is required and has been implemented for all infant failures.

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Data subject to change.

Obsoletes 5964-9632E
5968-9715E (1/00)

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