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 Avago Technologies in accordance with the latest revision of MIL-STD-883.

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

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:

 $T_J(^{\circ}C) = T_A(^{\circ}C) + \theta_{JA} P_{AVG}$

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 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 |

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.
[2] A failure is any LED which does not an it light at the discloyed in the statistic failures.

[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° \pm 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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