

Reliability Data Sheet

Description

The reliability data shown includes Avago Technologies reliability test data from the past three years on this product family. All of these products use the same LEDs, similar IC, and the same packaging materials, processes, stress conditions and testing. The data in Table 1 and Table 2 reflect actual test data for devices on a per channel basis. Before stress, all devices are preconditioned using a solder reflow process (260°C, 5 sec 2X) and 20 temperature cycles (-55°C to +125°C, 15 mins dwell, 5 mins transfer). These data are taken from testing on Avago Technologies devices using internal Avago process, material specifications, design standards, and statistical process controls. **THEY ARE NOT TRANSFERABLE TO OTHER MANUFACTURERS' SIMILAR PART TYPES.**

Operating Life Test

For valid system reliability calculations it is necessary to adjust for the time when the system is not in operation. Note that if you are using MIL-HDBK-217 for predicting component reliability, the results may not be comparable to those given in Table 2 due to different conditions and factors that have been accounted for in MIL-HDBK-217. For example, it is unlikely that your application will exercise all available channels at full rated power with the LED(s) always ON as Avago Technologies testing does. Thus, your application total power and duty cycle must be carefully considered when comparing Table 2 to predictions using MIL-HDBK-217.

Table 1. Demonstrated Operating Life Test Performance

Stress Test Condition	Total Devices Tested	Total Device Hours	Number of Failed Units	Demonstrated MTTF (hr) @ $T_A = +125^\circ\text{C}$	Demonstrated FITs @ $T_A = +125^\circ\text{C}$
$T_A = +125^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$ $I_{in} = 20\text{ mA}$, $I_{out} = 50\text{ mA}$	1000	720,000	0	> 720,000	< 1,389

Definition of Failure

Inability to switch, i.e., "functional failure", is the definition of failure in this data sheet. Specifically, failure occurs when the device fails to switch ON with 2 times the minimum recommended drive current (but not exceeding the max. rating) or fails to switch OFF when there is no input current.

Application Information

The data of Tables 1 and 2 were obtained on devices with high temperature operating life duration up to 1000 hours. An exponential (random) failure distribution is assumed, expressed in units of FIT (failures per billion device hours) are only defined in the random failure portion of the reliability curve.

Failure Rate Projections

The demonstrated point mean time to failure (MTTF) is measured at the absolute maximum stress condition. The failure rate projections in Table 2 use the Arrhenius acceleration relationship, where a 0.43eV activation energy is used as in the hybrid section of MIL-HDBK-217.

Table 2. Reliability Projections (per channel) for Devices Listed in Title

Ambient (°C)	Junction Temperature (°C)	Typical (60% Confidence)		90% Confidence	
		MTTF (hr/fail)	FITs (fail/10 ⁹ hr)	MTTF (hr/fail)	FITsTemperature (fail/10 ⁹ hr)
125	140	787,000	1,271	531,000	1,882
120	135	912,000	1,097	616,000	1,623
110	125	1,237,000	808	838,000	1,194
100	115	1,706,000	586	1,157,000	864
90	105	2,392,000	418	1,627,000	615
80	95	3,417,000	293	2,328,000	429
70	85	4,979,000	201	3,401,000	294
60	75	7,412,000	135	5,076,000	197
50	65	11,302,000	88	7,758,000	129
40	55	17,679,000	57	12,169,000	82
30	45	28,442,000	35	19,635,000	51
25	40	36,489,000	27	25,228,000	40

Table 3. Mechanical Tests (Testing done on a constructional basis)

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temperature Cycle	1010 Cond. B	-55 to 125°C, Transfer = 5 mins; Dwell = 15 mins; 1000 cycles	160	0
Mechanical Shock	2002 Cond. B	2 blows each axis, 1500 G, 0.5 ms pulse	139	0
Mechanical Vibration	2007 Cond. A	20 G, 20 - 2000 Hz, 4 min/cycle, 4 times/axis	139	0
Terminal Strength	2004	2 lb. tension, 8 oz. lead bend stress	150	0
Solderability	2003	Sn60 Pb40 Solder Temperature = 260°C (5 sec, 2X)	397	0
Physical Dimensions	2009	Device profile @ 10X	220	0

Table 4. Environmental Testing

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temp. and Humidity Bias	N/A	T _A = 85°C, RH = 85% See Table 1 for bias condition. Time = 1000 hours	120	0
Un-Biased Pressure Pot	N/A	T _A = 121°C, RH = 100% Time = 168 hours	400	0
Salt Atmosphere	1009 Cond. A	T _A = 35°C Mist	80	0
Resistance to Solvents	2015	3 one-min. immersion. Brush after solvent.	80	0

Table 5. Basic Material Properties

Material Property	Test Result
Mold Compound Flammability Classification	UL 94V-0
Mold Compound Oxygen Index	32%
Mold Compound Glass Transition Temperature	Tg = 160°C
Mold Compound Hydrolizable Chlorine	< 30 ppm

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