

## Reliability Data Sheet

### Description

The reliability data shown includes Avago Technologies reliability test data from the past two 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 minutes dwell, 5 minutes transfer). These data are taken from testing on Avago Technologies devices using internal Avago Technologies 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**

<b>Stress Test Condition</b>	<b>Total Devices Tested</b>	<b>Total Device Hours</b>	<b>Number of Failed Units</b>	<b>Demonstrated MTTF (hr) @ T<sub>A</sub> = +85°C</b>	<b>Demonstrated FITs @ T<sub>A</sub> = +85°C</b>
T <sub>A</sub> = +85°C V <sub>CC</sub> = 5.5 V I <sub>in</sub> = 10 mA I <sub>out</sub> = 25 mA	400	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 Temperature (°C)	Junction Temperature (°C)	Typical (60% Confidence)		90% Confidence	
		MTTF (hr/fail)	FITs (fail/10 <sup>9</sup> hr)	MTTF (hr/fail)	FITs (fail/10 <sup>9</sup> hr)
85	100	785,777	1,273	312,692	3,198
70	85	1,375,229	727	547,258	1,827
60	75	2,051,479	487	816,364	1,225
50	65	3,133,550	319	1,246,962	802
40	55	4,911,610	204	1,954,522	512
30	45	7,919,305	126	3,151,402	317
25	40	10,171,613	98	4,047,683	247

**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 mins/cycle, 4 times/axis	139	0
Terminal Strength	2004	2 lb tension 8 oz lead bend stress	150	0
Solderability	2003	Sn60 Pb40 Solder Temp. = 260°C (5 sec, 2X)	397	0
Physical Dimension	2009	Dev. profile @ 10X	220	0

**Table 4. Basic Material Properties**

Material Property	Test Result
Mold Compound Flammability Classification	UL 94V-0
Mold Compound Oxygen Index	32%
Mold Compound Glass Transition Temperature	T <sub>g</sub> = 160°C
Mold Compound Hydrolyzable Chlorine	< 30 ppm

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