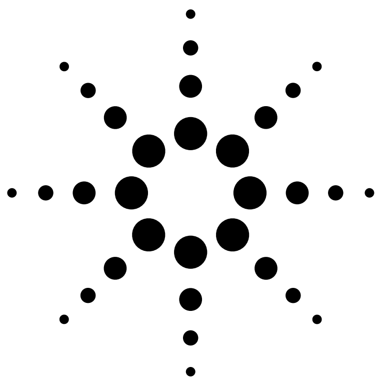

Small Outline High Speed Optocouplers

Reliability Data Sheet

Agilent
HCPL-0500 / 0530
HCPL-0501 / 0531 / 0534
HCPL-0452 / M452
HCPL-0453 / M453

Description

The reliability data shown includes Agilent 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. Note single channel device hours are equal to 1.5X dual channel device hours according to MIL-HDBK-217. Before stress, all devices are preconditioned using a IR reflow process (EIAJ Profile, 3X) and 20 temperature cycles (-55°C to +125°C, 15 minutes dwell, 5 minutes transfer). These data are taken from testing on Agilent Technologies devices using internal Agilent 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 Agilent 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°C	Demonstrated FITs @ T_A = +125°C
T_A = +125°C V_{CC} = 20.0 V I_{in} = 20 mA I_{out} = 10 mA	1360	1,180,000	1	1,180,000	847

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.

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.

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.

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

Ambient Temperature (°C)	Junction Temperature (°C)	Typical (60% Confidence) MTTF (hr/fail)	Typical (60% Confidence) FITs (fail/10^9hr)	90% Confidence MTTF (hr/fail)	90% Confidence FITs (fail/10^9hr))
125	140	584,000	1,712	303,000	3,297
120	135	677,000	1,478	352,000	2,843
110	125	919,000	1,089	478,000	2,091
100	115	1,266,000	790	661,000	1,513
90	105	1,776,000	563	929,000	1077
80	95	2,537,000	394	1,329,000	752
70	85	3,696,000	271	1,941,000	515
60	75	5,504,000	192	2,898,000	345
50	65	8,390,000	119	4,429,000	226
40	55	13,124,000	76	6,947,000	144
30	45	21,114,000	47	11,209,000	89
25	40	27,088,000	37	14,402,000	69

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 500 cycles	240	0
Moisture Storage Plus Solder Heat	N/A	T_A = 85°C, RH = 85% Time = 168 hours Temp. = 260°C (10 sec.)	40	0
Terminal Strength	2004	2 lb tension 8 oz lead bend stress	150	0
Solderability After Steam Aging	2003	Sn60 Pb40 Solder Temp. = 260°C (5 sec, 2X) 8 hours steam aging	10	0
Physical Dimension	2009	Dev. 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 = 125°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 = 96 hours	79	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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Data subject to change.
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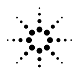

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