



# Intelligent Power Module and Gate Drive Interface Optocouplers

## Reliability Data Sheet

Agilent  
HCPL-4506

### 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. 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

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) @ $T_A = +125^\circ\text{C}$	Demonstrated FITs @ $T_A = +125^\circ\text{C}$
$T_A = +125^\circ\text{C}$ $V_{CC} = 30.0\text{ V}$ $I_{in} = 16\text{ mA}$ $I_{out} = 11\text{ mA}$	800	800,000	0	> 800,000	< 1,250

### 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.



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**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)
125	140	873,086	1,145	347,435	2,878
120	135	1,012,201	988	402,795	2,483
110	125	1,375,709	727	547,449	1,827
100	115	1,899,570	526	755,913	1,323
90	105	2,668,076	375	1,061,732	942
80	95	3,817,331	262	1,519,066	658
70	85	5,572,011	179	2,217,322	451
60	75	8,311,969	120	3,307,658	302
50	65	12,696,193	79	5,052,313	198
40	55	19,900,351	50	7,919,130	126
30	45	32,086,616	31	12,768,523	78
25	40	41,212,282	24	16,399,983	61

**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 20 cycles	800	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. Environmental Testing**

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Salt Atmosphere	1009 Cond. A	T <sub>A</sub> = 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	T <sub>g</sub> = 160°C
Mold Compound Hydrolyzable Chlorine	< 30 ppm

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Data subject to change.

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