BROADCOM®

Reliability Data Sheet

ACPL-214, ACPL-217, ACPL-224, ACPL-227, ACPL-244, ACPL-247

Half Pitch, Phototransistor Optocoupler

Description

The reliability data shown includes Broadcom® reliability test data from the reliability qualification done 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 reflects actual test data for devices on a per-channel basis. Before stress, all devices are preconditioned at MSL 1 using a solder reflow process (260°C peak temperature). This data is taken from testing on Broadcom devices using internal Agilent Technologies process, material specifications, design standards, and statistical process controls. **It is 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 LEDs always ON as Broadcom testing does. Thus, your application total power and duty cycle must be carefully considered when comparing Table 2 to predictions using MIL-HDBK-217.

Definition of Failure

Inability to switch, that is, "functional failure", is the definition of failure in this data sheet. Specifically, failure occurs when the device fails to switch ON with twice the minimum recommended drive current (but not exceeding the maximum 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 0.43eV activation energy is used as in the hybrid section of MIL-HDBK-217.

Application Information

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

Table 1: Demonstrated Operating Life Test Performance

Stress Test Condition	Total Devices Tested	Total Device Hours	Number of Failed Units	Demonstrated MTTF (hour) at Ta = +115°C	Demonstrated FITs at Ta = +115°C
Ta = 115°C, Iin = 20 mA Ic = 30 mA	232	472,000	0	> 472,000	< 2119

Table 2: Reliability Projection for Device Listed in Title

Ambient Temperature (°C)	Junction Temperature (°C)	Typical (60% Confidence)		90% Confidence	
		MTTF (Hr/fail)	FITs (Fail/10^9h)	MTTF (Hr/fail)	FITs(Fail/10^9h)
115	130	515,120	1941	204,987	4878
110	125	601,679	1662	239,432	4177
100	115	830,795	1204	330,607	3025
90	105	1,166,909	857	464,360	2154
80	95	1,669,546	599	664,379	1505
70	85	2,436,973	410	969,769	1031
60	75	3,635,320	275	1,446,639	691
50	65	5,552,802	180	2,209,682	453
40	55	8,703,610	115	3,463,515	289
30	45	14,033,390	71	5,584,447	179
25	40	18,024,588	55	7,172,705	139

Table 3: Mechanical Tests (Testing Done on a Constructional Basis)

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temperature Cycling	1010 Cond. B	–55°C to 125°C, Transfer < 5 minutes, Dwell = 15 minutes, 1000 cycles	442	0
Solderability (Pb-free condition)	2003	Steam aging (8 hours) + Solder dip (1x, 260°C)	142	0
Solderability (SnPb condition)	2003	Steam aging (8 hours) + Solder dip (1x, 245°C)	142	0
High Temperature Storage Test	1008	Ta = 150°C, Unbiased, Time = 1000 hours	142	0
Low Temperature Storage Test	—	Ta = –55°C, Unbiased, Time = 1000 hours	142	0
Preconditioning	J-STD-020	As per reference standard (to conform to MSL 1)	1060	0

Table 4: Environmental Testing (Testing Done on a Constructional Basis)

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temperature Humidity Bias	N/A	Ta = 85°C, RH = 85%, Vce = 64V, Time = 1000 hours	187	0
Unbiased Autoclave	N/A	Ta = 121°C, RH = 100%, Unbiased, Time = 96 hours	202	0