BROADCOM®

Reliability Data Sheet

ACPL-K309T

Automotive Photovoltaic Driver

Description

The reliability data shown includes Broadcom reliability test data from the reliability qualification done on this product family. All of these products use a 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) and 20 temperature cycles (–55°C to +125°C, 15-minute dwell, 1-minute transfer). This data is taken from testing on Broadcom devices using internal Broadcom processes, material specifications, design standards, and statistical process controls. *This data 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 IC 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 two times the minimum recommended drive current (but not exceeding the maximum rating) or when the device 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 uses the Arrhenius acceleration relationship, where a 0.43-eV activation energy is used as in the hybrid section of MIL-HDBK-217.

Application Information

The data of Table 1 and Table 2 was obtained on devices with a high-temperature operating life duration. 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 1: Demonstrated Operating Life Test Performance

Stress Test Condition	Total Devices Tested	Total Device Hours	Number of Failed Units	Demonstrated MTTF(hr) @ Ta = +125°C	Demonstrated FITs @ Ta = +125°C
Ta = 125°C Biasing based on data sheet	231	231,000	0	> 231,000	< 4,329

Table 2: Reliability Projection

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)
125	140	252,103	3,967	100,322	9,968
120	135	292,273	3,421	116,307	8,598
110	125	397,236	2,517	158,076	6,326
100	115	548,500	1,823	218,270	4,581
90	105	770,406	1,298	306,576	3,262
80	95	1,102,253	907	438,631	2,280
70	85	1,608,917	622	640,252	1,562
60	75	2,400,079	417	955,088	1,047
50	65	3,666,023	273	1,458,857	685
40	55	5,746,222	174	2,286,652	437
30	45	9,265,004	108	3,686,916	271
25	40	11,900,038	84	4,735,501	211

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

Test Name	Reference Standard	Test Conditions	Units Tested	Units Failed
Temperature Cycling	JESD-A104	–65°C to 150°C Transfer = 1 minute Dwell = 15 minutes 500 cycles	231	0
Physical Dimensions	JESD-B100	Conformance to data sheet package drawings	30	0
Solderability (RoHS Condition)	JESD-B102	8 hours steam aging (93°C), followed by solder dip (260°C, 5 seconds)	15	0
Preconditioning	J-STD-020 JA113	As per reference standard (to conform to MSL 1)	1,059	0

Table 4: Environmental Testing

Test Name	Reference Standard	Test Conditions	Units Tested	Units Failed
Highly Accelerated Stress Test (Biased)	JESD-A110	Ta = 130°C, RH = 85% Vcc = 5.5V Vin = –5V Vout = 5.5V Time = 96 hours	231	0
High Temperature Bake	JESD-A103	Ta = 175°C Unbiased Time = 500 hours	135	0
Unbiased HAST	JESD-A118	Ta = 130°C, RH = 85% Unbiased Time = 96 hours	231	0