CHO-TR411
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TEST REPORT

Shock and Vibration Testing for THERMATTACH â T411 Double-Sided Adhesive Tape for Plastic Components

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1. Set Up

Four aluminum shock and vibration plates are used to expose dummy Plastic Quad FlatPack (PQFP) components, THERMATTACH T411 tape, and their heat sinks to the specified shock and vibration stresses. Each plate has several PQFP components of various sizes permanently attached with epoxy adhesive onto the aluminum plate. Wakefield thin fin and pin fin heat sinks were used. The heat sinks were matched to the PQFPs by size.

The PQFPs were cleaned with MEK prior to use (to remove residual adhesive from prior tests). The heat sinks were used as received. First, the tape was applied to the heat sink base. Next, the heat sink and tape assembly was applied to the PQFP with ten seconds of hand pressure.

2. Heat Sinks

P/N	Type	Type	Length	Width	Height	Mass	Fins
652-5AB	Small *	Extruded	15mm	13mm	4mm	1.2 g	5
658-60AB	Medium	Pin fin	28mm	28mm	15mm	8.4 g	8 x 7
659-65AB	Large	Extruded	37mm	37mm	16.5mm	21.5	9

*cut to length in Chomeric's model shop

3. PQFPs

Body Size	Dimensions
Small PQFP	12mm x 12mm
Medium PQFP	18.5mm x 18.5mm
Intermediate PQFP	27mm x 27mm
Large PQFP	38mm x 38mm

4. Torque Measurement

Due to the nature of the shock and vibration fixtures, a die shear test was not feasible. A pull test was considered, but the geometry and lay out of the shock and vibration fixture made this not possible. A torque test was chosen as a measure of the adhesion of the heat sink to the PQFP. This is the same torque test done in the THERMATTACH T410 Shock and Vibration Report.

A small torque wrench was used to remove the heat sink from the PQFP. The screw driver blade of the torque wrench was put into the fins of the heat sink, and the heat sink was twisted off the PQFP. The plane of the torque wrench was parallel to the top surface of the PQFP and the bottom surface of the heat sink base. For the larger pin fin heat sink and the largest extruded heat sink, the fins needed to be braced with thin aluminum bars to prevent distortion of the fins by the applied torque. The aluminum fins deformed before the tape bond was broken.

The torque wrench was limited to 25 in-lbs.

5. Time Zero Data

Three of each size heat sinks where removed from the PQFP before exposure to shock and vibration. The amount of torque was recorded. Visual estimates were made concerning the amount of contact between the heat sink and tape, as well as the state of the tape after removal by torque. The data follows.

Heat Sink	Torque (inch-lbs.)	Type of Failure
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh

6. Shock and Vibration Stress

Vibration Stress:

Random vibration (10 to 1,000 Hertz frequency) performed on 2 axes, with 2 G_{rms} to 12 G_{rms} amplitude; increasing by 2 G_{rms} increments; 10 minutes per step at 150 °F.
10 to 1,000 Hertz frequency

Shock stress:

Will be at a peak of 60 Gs at a duration of 2 milliseconds. The test will be applied in 6 directions with 3 blows per direction.

The testing was done at Bell Technologies in Burlington, Massachusetts. The contact engineer at Bell Technologies is Norman Round.
Bell Technologies (formerly Associated Testing Laboratories)
53 Second Avenue
Burlington, MA 01803
781-272-9050 phone
781-272-8184 fax

7. Post Shock Data

Small Heat sink on a Small PQFP

Heat Sink	Torque (inch-lbs.)	Type of Failure
Small	5	Adhesive to mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	2	Adhesive to mesh
Small	3	Adhesive to mesh
Small	5	Adhesive to mesh
Small	3	Adhesive to mesh
Small	2	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	2	Adhesive to mesh
Small	3	Adhesive to mesh
Small	5	Adhesive to mesh
Small	2	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	3	Adhesive to mesh
Small	2	Adhesive to mesh
Small	2	Adhesive to mesh
Small	2	Adhesive to mesh
Small	1	Adhesive to mesh
Small	3	Adhesive to mesh
Small	2	Adhesive to mesh
Small	2	Adhesive to mesh
Small	2	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	4	Torn mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	6	Adhesive to mesh
Small	4	Adhesive to mesh
Small	4	Adhesive to mesh

Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	4	Adhesive to mesh
Small	4	Adhesive to mesh
Small	6	Adhesive to mesh
Small	4	Adhesive to mesh
Small	4	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	5	Adhesive to mesh
Small	4	Adhesive to mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	5	Adhesive to mesh
Small	4	Adhesive to mesh

8. Small Heat Sink on Medium PQFP

Heat Sink	Torque (inch-lbs.)	Type of Failure
Small	5	Adhesive to mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	4	Adhesive to mesh
Small	3	Adhesive to mesh
Small	3	Adhesive to mesh
Small	2	Adhesive to mesh
Small	3	Adhesive to mesh
Small	5	Adhesive to mesh

9. Medium Heat Sink on Medium PQFP

Heat Sink	Torque (inch-lbs.)	Type of Failure
Pin fin	15	Adhesive to mesh
Pin fin	12	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	11	Adhesive to mesh
Pin fin	12	Adhesive to mesh

Pin fin	9	Adhesive to mesh
Pin fin	16	Adhesive to mesh
Pin fin	9	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	20	Adhesive to mesh
Pin fin	12	Adhesive to mesh
Pin fin	14	Adhesive to mesh
Pin fin	15	Adhesive to mesh
Pin fin	20	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	13	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	15	Adhesive to mesh
Pin fin	12	Adhesive to mesh
Pin fin	15	Adhesive to mesh
Pin fin	5	Adhesive to mesh
Pin fin	13	Adhesive to mesh
Pin fin	20	Adhesive to mesh
Pin fin	15	Adhesive to mesh
Pin fin	14	Adhesive to mesh
Pin fin	10	Adhesive to mesh
Pin fin	5	Adhesive to mesh
Pin fin	7	Adhesive to mesh

NOTE: Several heat sinks could not be removed from the PQFP using a torque wrench. The bond between the heat sink and the PQFP was stronger than the pin fins on the heat sink. The pin fins snapped off from the heat sink base, leaving no place for the torque wrench to gain purchase. Data points were lost where this happened. It is recommended that un-cross cut extrusions with bulky fins be used in future testing.

10. Large Heat Sink on Large PQFP

Heat Sink	Torque (inch-lbs.)	Type of Failure
Large	15	Adhesive to mesh
Large	20	Adhesive to mesh
Large	10	Adhesive to mesh
Large	13	Adhesive to mesh
Large	10	Adhesive to mesh
Large	10	Adhesive to mesh
Large	15	Adhesive to mesh
Large	12	Adhesive to mesh
Large	15	Adhesive to mesh
Large	5	Adhesive to mesh
Large	13	Adhesive to mesh
Large	20	Adhesive to mesh
Large	15	Adhesive to mesh
Large	14	Adhesive to mesh
Large	10	Adhesive to mesh
Large	25	Mesh tear
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	20	Adhesive to mesh
Large	25	Adhesive to mesh
Large	10	Adhesive to mesh
Large	10	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh
Large	20	Adhesive to mesh
Large	25	Adhesive to mesh
Large	10	Adhesive to mesh
Large	25	Adhesive to mesh
Large	25	Adhesive to mesh

11. Conclusion

The post shock and vibration data shows no significant effect from the shock and vibration stresses. The torque values after shock and vibration do not change significantly from the initial values.

No heat sinks were lost during the test. It is important to note that all heat sinks remained attached to the PQFPs during the test.

Based on this data, THERMATTACH T411 adhesive tape is suitable for applications where this type of shock and vibration would be experienced.

Heat sink Size	Before Shock and Vibration	After Shock and Vibration
Small	3.3 in-lbs.	3.6 in-lbs.
Large	25.0 in-lbs.	18.9 in-lbs.

NOTE: The information concerning the medium heat sink data is not reported. The data was incomplete due to the loss of some data points. Several of the pin fin heat sinks where not able to be removed from the PQFP. The thin pin fins broke from the heat sinks before the bond between the heat sink and PQFP. Once the fins were lost, not enough surface remained on the heat sink to use for leverage against the T411 tape bond.