CHO-TR410
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TEST REPORT

Shock and Vibration Testing for THERMATTACH â T410 Double-Sided Adhesive Tape for Plastic Components

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1. Set Up

Four aluminum shock and vibration plates are used to expose the dummy Plastic Quad Flat Pack (PQFP) components and their heat sinks to the specified shock and vibration stresses. Each plate has several PQFP components of various sizes permanently attached onto the aluminum. THERMATTACH T410 tape was used to hold Wakefield heat sinks onto the PQFPs. The heat sinks were matched to the PQFPs by size.

The PQFPs were cleaned using MEK from previous laboratory work. The heat sinks were used as received. First, the tape was applied to the heat sink base first. Next, the heat sink and tape assembly was applied to the PQFP with ten seconds of hand pressure.

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

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

2. 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 determined this was not possible. A torque test was chosen as an indication of the adhesion of the heat sink to the PQFP.

A small torque wrench was used to remove the heat sink from the PQFP. A screw driver blade was inserted into the fins of the heat sink, and the heat sink was twisted off. 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. In cases where the applied torque reached 25 in-lbs., the length of time the torque was maintained before the bond broke was recorded. The scale of the torque wrench was not precise, so values to the nearest 5 in-lbs. were recorded.

3. 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.)	Contact Area (% coverage)	Tape Location	Type of Failure
Small	5 or less	25	Heat sink	Adhesive
Small	5 or less	20	PQFP	Adhesive
Small	5 or less	20	PQFP	Cohesive
Pin fin	20	15	PQFP	Cohesive, ripped
Pin fin	15-20	15	PQFP	Cohesive, ripped
Pin fin	25	15	PQFP	Adhesive
Large	1 second	20	PQFP	Adhesive
Large	4 seconds	20	PQFP	Adhesive
Large	10 seconds	20	PQFP	Adhesive

4. 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

5. Post Shock Data

Small Heat sink on a Small PQFP

Heat Sink	Torque (inch-lbs.)	Tape Location	Type of Failure
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	<5	Heat sink	Cohesive
Small	5	Both	Cohesive, ripped
Small	<5	Both	Cohesive, ripped
Small	<5	PQFP	Adhesive
Small	<5	PQFP	Adhesive
Small	<5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	10	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	5	Both	Cohesive, ripped
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	Heat sink	Adhesive
Small	5	PQFP	Adhesive
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	5	Heat sink	Adhesive
Small	<5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	<5	Heat sink	Adhesive
Small	10	Heat sink	Adhesive
Small	5	PQFP	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	Heat sink	Adhesive

Small	<5	Heat sink	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	Heat sink	Adhesive
Small	5	PQFP	Adhesive
Small	<5	Heat sink	Adhesive
Small	<5	PQFP	Adhesive
Small	<5	PQFP	Adhesive
Small	<5	PQFP	Adhesive
Small	<5	PQFP	Adhesive
Small	<5	PQFP	Adhesive

Small Heat sink on Medium PQFP

Heat Sink	**Torque (inch-lbs.)**	**Tape Location**	**Type of Failure**
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive
Small	5	PQFP	Adhesive

Medium Heat Sink on Medium PQFP

Heat Sink	**Torque (inch-lbs.)**	**Tape Location**	**Type of Failure**
Pin fin	15	both	cohesive
Pin fin	20	both	cohesive
Pin fin	10	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	20	both	cohesive
Pin fin	20	both	cohesive
Pin fin	20	both	cohesive
Pin fin	10	both	cohesive
Pin fin	15	both	cohesive

Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	20	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	15	both	cohesive
Pin fin	20	both	cohesive
Pin fin	15	both	cohesive
Pin fin	20	both	cohesive
Pin fin	20	both	cohesive
Pin fin	20	both	cohesive
Pin fin	>25	both	cohesive
Pin fin	>25	both	cohesive
Pin fin	25	both	cohesive
Pin fin	25	both	cohesive
Pin fin	25	both	cohesive
Pin fin	25	both	cohesive
Pin fin	>25	Heat sink	adhesive
Pin fin	20	both	cohesive
Pin fin	>25	Heat sink	adhesive
Pin fin	25	both	cohesive
Pin fin	>25	Heat sink	adhesive
Pin fin	25	both	cohesive
Pin fin	25	both	cohesive
Pin fin	20	both	cohesive

Large Heat Sink on Large PQFP

Heat Sink	**Torque (inch-lbs.)**	**Tape Location**	**Type of Failure**
Large	10 seconds	PQFP	Adhesive
Large	30 seconds	PQFP	Adhesive
Large	6 seconds	Heat sink	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	3 seconds	PQFP	Adhesive
Large	3 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	3 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	25	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive

Large	2 seconds	PQFP	Adhesive
Large	>5	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	>5	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive
Large	25	PQFP	Adhesive
Large	4 seconds	PQFP	Adhesive
Large	>5	PQFP	Adhesive
Large	3 seconds	PQFP	Adhesive
Large	2 seconds	PQFP	Adhesive

6. 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.

One heat sink was lost during the test. A pin fin heat sink fell off at 12 $G_{rms.}$

The torque data did not change after the shock and vibration. Based on this data, THERMATTAH T410 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	≥ 5 in-lbs.	4.6 in-lbs.
Medium	20	19.0 in-lbs.
Large	25 in-lbs.	22 in-lbs.