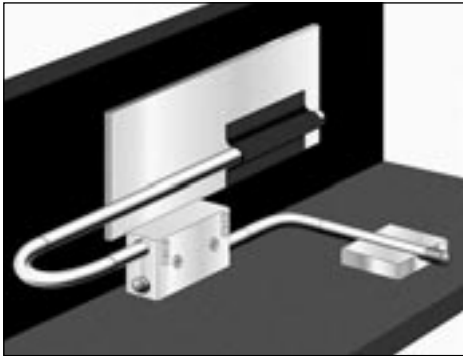


The NBPC Thermal Hinge

A Flexible Thermal Hinge



INTRODUCTION

Enertron's NBPC Thermal Hinge provides designers of notebook PCs and other mobile electronics with an alternative to placing the entire thermal solution inside the system. If an LCD screen is used with the computer, heat can be removed through free convection from the main unit case to the posterior of the LCD screen. Under these circumstances, the thermal hinge acts as a mobile joint.

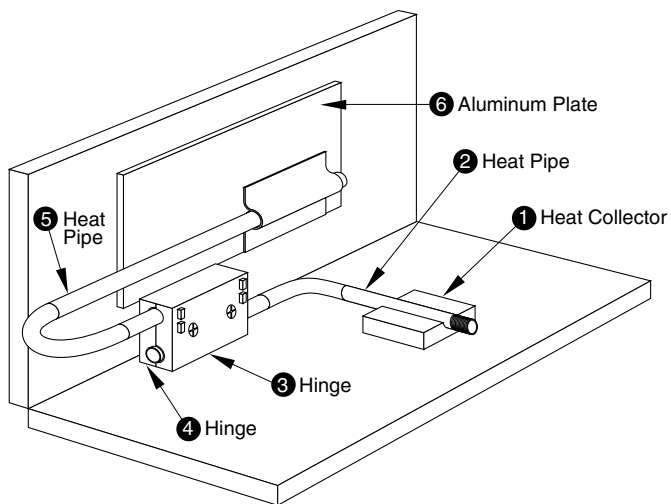


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The thermal hinge allows designers to utilize a flexible, mobile joint for heat transfer in a NBPC. The thermal hinge is assembled with at least one heat pipe. The heat pipe acts as both a heat transfer path and a rotating device, which must then be connected to the LCD back cover. A thermal hinge subsystem consists of the following basic components:

- Heat collector (1) – the thermal interconnection between the heat source (CPU) and the heat pipe.
- Lower heat pipe (2) – a thermal conductor between the heat source and the thermal hinge. If the heat source is very close to the hinge (less than 5 cm away), then the heat pipe can be replaced by a solid aluminum or copper path.
- Hinge (3 & 4) – two pieces designed to transfer heat from the lower heat pipe to the upper heat pipe.
- Upper heat pipe (5) – functions as a rotating device and a thermal conductor between the hinge and the heat spreader plate located on the LCD back cover.
- Heat spreader (6) - an aluminum plate which can spread heat from the upper heat pipe to ambient from the LCD back cover.



Specifications:

Dimensions 25 mm x 16 mm x 7 mm
Material: Copper C110
Rotating torque and thermal contact: Maintained by compression force produced by (2) Belleville springs.
Overall thermal resistance (θ) <0.35 °C/W (from lower heat pipe to upper heat pipe).

Best Applications:

- Mobile Electronics
- Notebook PCs

See page 2 for a NBPC Thermal Hinge thermal performance experiment and results

Enertron... A Powerful Thermal Management Team and a Skilled Production Partner

Enertron is both a powerful thermal management engineering service and a highly-skilled, cost effective production partner. Enertron offers custom thermal solutions at "off-the-shelf" prices and delivery times. Enertron's customers are Fortune 500 companies in the computer, microelectronics, aerospace, and defense industries. Enertron competes on its industrial expertise, timely service, and unerring commitment to excellence for its customers.

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Life Cycling Experiment — Notebook PC Thermal Hinge

Experiment set-up:

Heat source:	TE heat pump 23 mm x 23 mm, Melcor CP1.0-127-05L
Heat collector:	30 mm x 23 mm. In-house design
Lower heat pipe:	f4 mm copper water, groove mesh, 200 mm long
Hinge:	In-house design
Upper heat pipe:	f4 mm copper water, groove mesh, 200 mm long
Heat spreader:	Aluminum plate 1 mm thick, 250 mm x 150 mm
Heat spreader flipping mechanism:	Heat spreader plate is connected to a rotating wheel by a connecting arm. Flipping speed is 5 seconds per open and close cycle. Flipping angle is 120°.

Experiment results:

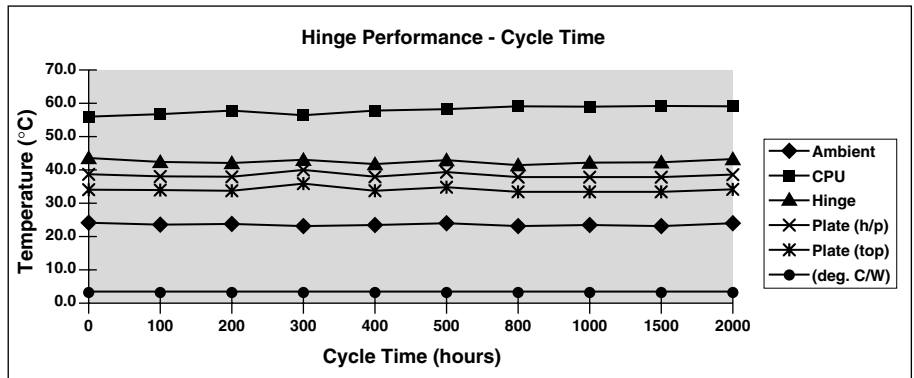
Test set-up: ϕ 4 mm dia. groove HP x 2, Enertron hinge, Aluminum plate 280 mm x 150 mm.

Aluminum plate connected to a rotating wheel by a connecting arm for cycling flipping angle: 120°.

Thermal interface: lub grease

Torque: Full (0.8 mm thick washer)

Power input (watt): 10 (heated by TE cooler)



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