

## **HEAT PIPES APPLICATIONS IN AUTOMOTIVE ELECTRONICS COOLING**

**<sup>1</sup>Randeep Singh, <sup>2</sup>Masataka Mochizuki, <sup>2</sup>Yuji Saito, <sup>2</sup>Tadao Yamada, <sup>2</sup>Thang Nguyen, <sup>2</sup>Tien Nguyen,**

<sup>1</sup>Fujikura Automotive Europe GmbH, Albin-Köbis Strasse 6, D-51147 Köln  
Tel: +49-2203-290-43-11, Fax: +49-2203-290-43-13, Email: [randeep.singh@jp.fujikura.com](mailto:randeep.singh@jp.fujikura.com)

<sup>2</sup>Fujikura Ltd., 1-5-1, Kiba, Koto-ku, Tokyo 135-8512, Japan  
Phone: +81-3-5606-1220, Fax: +81-3-5606-1538

### **Abstract**

Automotive are equipped with variant of electronic devices for human interaction & interfacing (display panel, touch panel), human comfort & entertainment (lightning, sound system, camera), proper system operation (electronic control unit), system safety (fuse-box, junction box) and so on. With the increase in performance and functionalities of these devices, cooling modules with high thermal performance and lighter weight have to be developed. LEDs (light emitting diodes) in headlamps, displays and internal lightning, and high power semiconductors in entertainment, information and control systems are most potential areas for cooling by heat pipe based passive thermal solution. The present investigation discusses heat pipe cooling modules developed for automotive electronics including headlamp, display panel, head-up display, sound system and camera. Heat output from these devices range from 1 to 50 W with natural convection cooling using air. Heat pipe heat sinks has been proposed and tested for cooling 10 W and 30 W LED light functions in two headlamps respectively. For front panel and head-up-display cooling, heat pipe system with 3-10 W capacity was designed and tested. In addition to this, heat pipe solution for sound system and camera cooling was also evaluated. In summary, heat pipe based cooling modules outlined in this paper will provide energy efficient and thin thermal management solutions for space conservative high density electronics in automotive.