

IEE's foil heater - comfort meets simplicity

## SafeHeat - Interior Foil Heater

SafeHeat is based on IEE's more than 20 years' experience with thin foil technology for various sensor applications integrated in the vehicle seat or its interior surfaces. The automotive standard approved technology allows us to create foil heaters using printing technologies. These heaters have a great deal of design freedom to create the complex surface shapes that are common for interior components.

### Simple integration - flat and thin between material layers

IEE's heating foils are thin and flat, and don't feature any elevated structures, which allows them to be easily integrated into various interior components. The thin foil can be integrated directly below the top decor surfaces, resulting in outstanding time-to-temperature ratings. We can provide the foils with integrated temperature sensors, which are required for some ECU applications. This option will reduce integration efforts even further.

### Passenger-centric heating approach – a quick heating experience

SafeHeat's fast time-to-temperature means a quick heating experience for passengers. As the panels can introduce a significant heating power to the passenger compartment, the annoying side effects of traditional heating systems, in particular air draft and ventilation noises, may be reduced. These benefits are behind the growing trend for panel heaters becoming an integral component of future heating, ventilation and air conditioning (HVAC) units.



## Key Advantages

- **Design freedom:** The printed foil heater can be designed for the complex shapes that are common for interior components.
- **Homogeneous heating:** The power density of the heater can be varied to achieve the most homogeneous temperature distribution on the surface, even for varying thermal boundary conditions.
- **Self-regulating:** PTC ink formulation enables cost-effective interior heater applications that don't need an ECU with a closed loop controller.
- **Simple integration:** Our thin and flat foil heaters can be easily integrated into a variety of interior components.
- **No local high temperature:** Due to the fact that SafeHeat heats over a relatively large foil area, local high temperature spots are avoided. This helps prevent material aging, such as the local discoloration of the decor surface that may occur with wire heaters.
- **Failsafe technology:** As printed PTC heater elements increase resistance at higher temperatures, our foil heater technology is considered failsafe in terms of overheating.
- **Experience:** IEE has significant experience in the integration of sensor systems, with our products in serial production at major car manufacturers around the world.

# SafeHeat - Comfort

## PTC heater ink - inherent added value

IEE can optionally apply a unique heater ink, that features the so-called PTC effect, for the heater elements. The bulk resistance of the proprietary ink formulations increase in a non-linear manner with increasing temperature. This effect reduces the heating power of the heater foil at higher temperatures and limits the temperature of the printed heater elements to the ink formulation's specific switch-off temperature.

With IEE's PTC foil heater technology you have two unique features:

- **Less is more - self regulating**

Due to the PTC effect, the ink regulates itself at the given temperature. This allows the implementation of heated surfaces without electronic control units (ECUs) for cost-sensitive applications.

- **Heating made safer - intrinsic safety**

Many applications require a high level of safety. Our printed PTC heater limits its maximum temperature intrinsic to the ink characteristic – this means that even if there is an ECU failure, the system will not overheat.

## Low power demand

IEE's foil heater can be integrated directly below the top decor surface, as the foil itself is completely flat without any topography that could disturb the look and feel (haptics) of the surface. Compared to competitive technologies, this integration method allows reduced power for the same time-to-temperature rating or a faster time-to-temperature for the same power rating.

## Interior heating - improved comfort

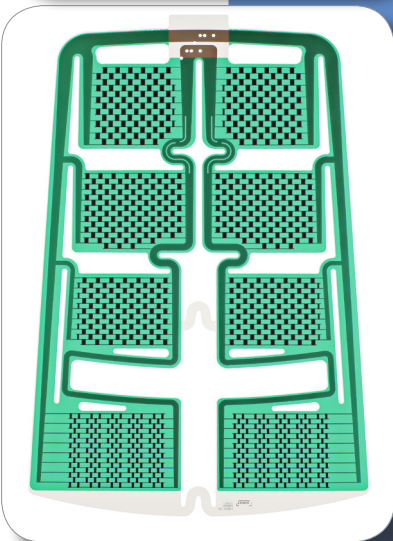
SafeHeat can be used for heating applications for almost all interior components, for example armrests, door panels, dashboards, leg room area, carpets, head liners and roof areas. Therefore, the technology supports novel heating concepts for comfort enhancements and electrical vehicle heating.

## Interior heating - electrical vehicle heating

Electrical vehicles, in particular, benefit in a very special way from heating foils. The heat can be generated close to the passengers, leading to significant reductions in energy losses compared with alternative concepts.

## Wide range of electrical ratings - 48V ready

- With SafeHeat, all extra safe operation voltages are possible, including 12V, 24V and 48V
- The typical power density for interior components varies between 500 and 1000W/m<sup>2</sup>. However, power densities of several kW/m<sup>2</sup> are also possible.



## About Us

IEE is an innovative developer of specialized sensing systems. Our sensing systems are dedicated to the following markets: Automotive, Building Management & Security, Medical, Sports & Healthcare.

IEE was founded in 1989 and is headquartered in Luxembourg. We operate in Europe, the U.S. and Asia, and employ 1,900 people worldwide. More than 10% of our workforce is dedicated to Research and Development.

For more information, please visit [www.iee.lu](http://www.iee.lu).