The Freescale® MPXV4115V pressure sensor is the ideal part for automotive vacuum sensing needs such as those found in the brake booster application.

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Advanced braking systems are becoming increasingly common in today’s automobiles. Higher level systems and technology now being used in “brake assist systems” (BAS) in several European cars, have made it possible for more efficient and intelligent braking systems. A key functional application block found in these braking systems that has advanced with this technology surge, is the vacuum brake booster function. Here are a few driving factors behind the need and use of the brake booster, which helps ensure a safer braking system.

**Independent Systems:** In current gasoline engine cars, the engine’s intake manifold generates the vacuum for the brake booster. This system works fine with one exception. The amount of vacuum in the brake booster is unknown by the braking system. Thus the amount of amplification is also unknown. If heavy braking is needed, there is no possibility for the brake system to interact with the intake manifold if additional amplification is required.

The manufacturer’s interest for having the vacuum generated by an auxiliary vacuum pump is that the brake system can manage the amount of vacuum as required, on demand. This in turns gives it the ability to perform amplification on its own, giving it complete independent from the engine’s operating condition.

The auxiliary pump is also able to provide higher amounts of vacuum whenever necessary. In situations calling for heavy braking, the pressure will naturally decrease in the brake booster, also causing a decrease in the amplification during braking. With an
external pump it is possible to maintain, or even increase the amplification during a heavy braking phase.

**Smart Safety:** Wheel blocking due to high-braking force is controlled by the Anti-Lock Brake System (ABS). However, it has been observed that in many cases, drivers do not break hard enough in an emergency situation. The auxiliary pump makes it possible for the brake system to increase the brake force to the maximum in these instances. Variation in vacuum measured in the brake booster can be compared and analyzed to determine normal braking conditions from emergency situations.

**Extra Boost:** The type of engine used in the car also plays a significant role in the performance of the braking system. Both diesel and gasoline direct injection (GDI) engines, found predominately in Europe, are unable to generate enough vacuum for sufficient braking power. In addition, most GDI engines are running in a "lean burn mode" at low speeds, with the throttle valve always slightly open. This considerably limits the amount of vacuum that can be generated by the displacement of the piston. In both cases a vacuum pump is the preferred solution to reach the necessary braking power in these vehicles.

**Bridge to the Future:** The brake booster is an intermediate step for improving the braking systems of today and the fully electric braking systems of tomorrow. However, the electric braking system does not come without its share of technical challenges and issue that must be overcome. The need for a 42V-power supply is the most publicized of the technical hurdles associated with these systems. But perhaps more critical is the issue of public perception. Gaining the trust and confidence of the consumer and car manufacturer that a fully electric braking system is as reliable as the hydraulic vacuum assisted system is a must. Some predict that several years of testing must take place before gaining full public acceptance. Until then, the brake booster is a means by which the current hydraulic braking systems can be made safer and more intelligent.

*Note: Copies of the brake booster application note, featuring the MPXV4115V, can be ordered using the AN4007 order numbers. In addition, a more in-depth technical article on the brake booster system written by Marc Osajda can be found at the Automotive Engineering International Magazine’s web site- [http://www.sae.org/automag/techbriefs_04-00/01.htm](http://www.sae.org/automag/techbriefs_04-00/01.htm).*