# A Tipping Point for ADAS Is on the Short-Term Horizon

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## Background

Either humans are not cutting it as responsible drivers on the roads anymore or there are more potential hazards on them today where the need for advanced driver assistance systems (ADAS) are necessary to help us cope! Being a child of the 1960s, I can still remember being driven in cars that did not even have seat belts in them! Then, when I started to learn how to drive a car in the mid-1970s, the standard equipment usually consisted of a steering wheel, vehicle operational controls, turn signal indicators, rear view mirrors, a dashboard and a parking break. As for understanding what was going on around you once driving in a vehicle was concerned – it was your eyes and ears that gave you the knowledge of what was happening. Furthermore, it was your own accumulated driving experiences that enabled one to anticipate what might happen under the myriad of different situations that could occur under variable traffic conditions.

Of course, one could argue that was a much “simpler” time, where there were fewer vehicles, and correspondingly, fewer drivers on the back roads and highways. Fast forward to 2016, where there are over 1.2 billion vehicles on the world’s roads and you can start to understand why it might be necessary to have systems in the car that can assist the driver to understanding what is going on around them. By way of example, consider that 1.2 million people die due to traffic related accidents on the roads each year across the globe [Source: WHO and the World Bank]. What is potentially even more frightening is that this figure is expected to rise by 65% in 2020. That said, what are the major causes of these accidents? But before I get to that, I think that it is important to have a little more background on this topic. For example, did you know that the first vehicular fatality occurred in London in 1896? Since that time, over 25 million people worldwide have died in vehicle-related accidents [Source: WHO]. Perhaps the greatest irony here is that it is the vehicle drivers themselves that are the major cause of accidents! So, the six major causes of accidents, in order of greatest risk factor, are:

1. Distracted drivers. These include; rubbernecking, looking at scenery, passengers or children, adjusting audio systems and reading maps, books or other documents.

2. Driver fatigue. Drowsy drivers account for over 100,000 accidents in the USA on an annual basis [Source: U.S. National Traffic Safety Administration, aka, NHTSA].
3. Drunk driving.
4. Speeding. This is a multi-tiered threat because not only does it reduce the amount of time necessary to avoid a crash, it also increases the risk of crashing and makes the crash more severe if it does occur.
5. Aggressive driving. This includes behaviors such as; aggressive tailgating, flashing lights at other drives because they irritated you, aggressive or rude gestures, verbal abuse, physical assaults, disregarding traffic signals and changing lanes in a frequent and unsafe manner.
6. Weather.

So, if ADAS are necessary for drivers to avoid causing, or reduce the potential for accidents, what are these systems and what does their growth potential look like?

**ADAS Market and Growth**

It might surprise you to learn that the ADAS market is expected to reach $60B globally by 2020 [Source: Allied Market Research]. This represents a CACR of 22.8% during the 2014 – 2020 time period. Not something to easily dismiss!

So what does ADAS do? Well, for a start, they facilitate safe driving and warn the driver if the system detects risks from surrounding objects – whatever they might be. These systems are one of the major trends in automobiles for the second half of this decade. They typically provide dynamic features such as adaptive cruise control, blind spot detection, lane departure warning, drowsiness monitoring, night vision and even more. As a result, it is the increasing focus of consumers on safety, demands for comfort while driving and the continued increase of government safety regulations that are fueling the growth of ADAs in automobiles. Nevertheless, this growth does not come without challenges for the industry, which include pricing pressure, inflation, complexity and difficulty in testing these systems.

It should come as no surprise that the European automotive industry is one most innovative automotive market, and as such, it has seen major market penetration and adoption of ADAS from its customers. Nevertheless, both the American and Japanese auto makers are not far behind them. Some of the ADAS key players include Valeo, Bosch, Continental AG, Audi, Ford Motors, General Motors and Denso Corp.

Of course, the “unspoken” ultimate goal with these systems is to have a fully autonomous vehicle that does not necessarily need a driver to operate it!

**IC Content of ADAS**

At the heart of most ADAS systems is some kind of microprocessor to process all the input from the various sensors within the vehicle and to then process it so that it can be easily presented to the driver in a way that it can be easily seen and understood. Moreover, these systems are usually powered directly from the vehicles main battery that is a nominal 9V to 18V, but could be as high as 42V due to voltage transients within the system, and as low as 3.5V during a cold-crank condition. Thus, it is clear that any DC/DC converter to be used must be able to handle a broad input voltage range of 3.5V to 42V.

Many ADAS systems will need a 5V and 3.3V rail to power its various analog and digital IC content; however, it will be the processor I/O and Core voltages that will be in the sub-2V realm. Furthermore, there are space and thermal considerations that must also be taken into account. While it is commonplace to use a high voltage DC/DC converter for a 5V and 3.3V rail, utilizing this kind of converter for sub-2V rails is not always practical due to the solutions size of using multiple single output converters and the potential thermal constraints. A more a suitable solution would be to use a single DC/DC converter with multiple outputs.

It was because of these constraints that Linear Technology developed its 4 output monolithic synchronous buck converter, the LT8602. Its 3V to 42V input voltage range make it ideal for automotive applications, including ADAS, which must regulate through cold-crank and stop-start scenarios with minimum input voltages as low as 3V and load dump transients in excess of 40V. As can be seen in Figure 1, its quad channel design combines two high voltage 2.5A and 1.5A channels with two lower voltage 1.8A channels to deliver four independent outputs delivering voltages as low as 0.8V, enabling it to drive the lowest voltage microprocessor cores currently available. Its synchronous rectification topology delivers up to 94% efficiency while Burst Mode® operation keeps quiescent current under 30µA (all channels on) in no-load standby conditions making it ideal for always-on systems.

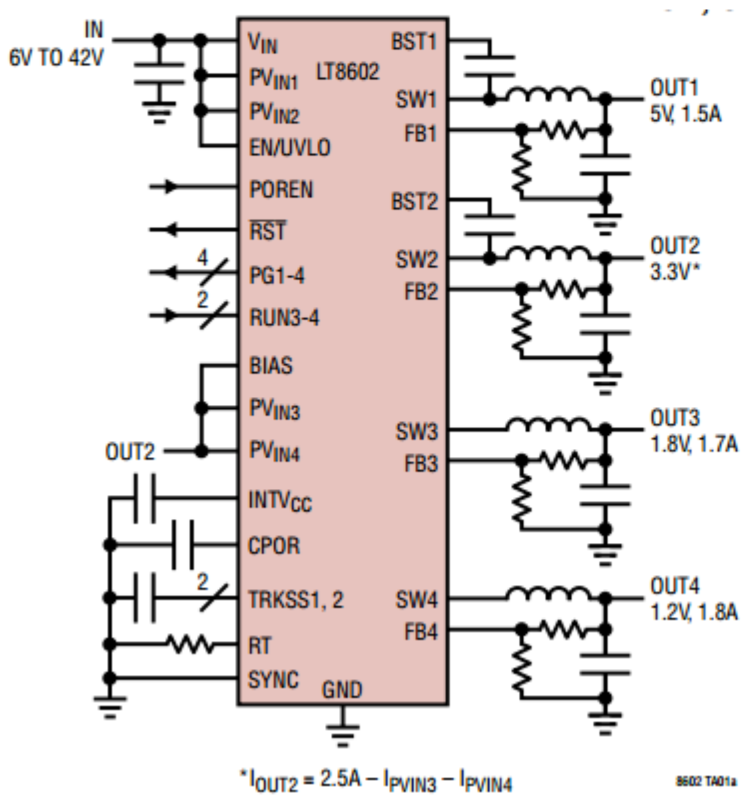


**Figure 1. LT8602 Schematic Delivering 5V, 3.3V, 1.8V & 1.2V Outputs**

For noise sensitive applications, the LT8602, with a small external filter, can utilize its pulse-skipping mode to minimize switching noise and can meet the CISPR25, Class 5 EMI requirements as shown in Figure 2.

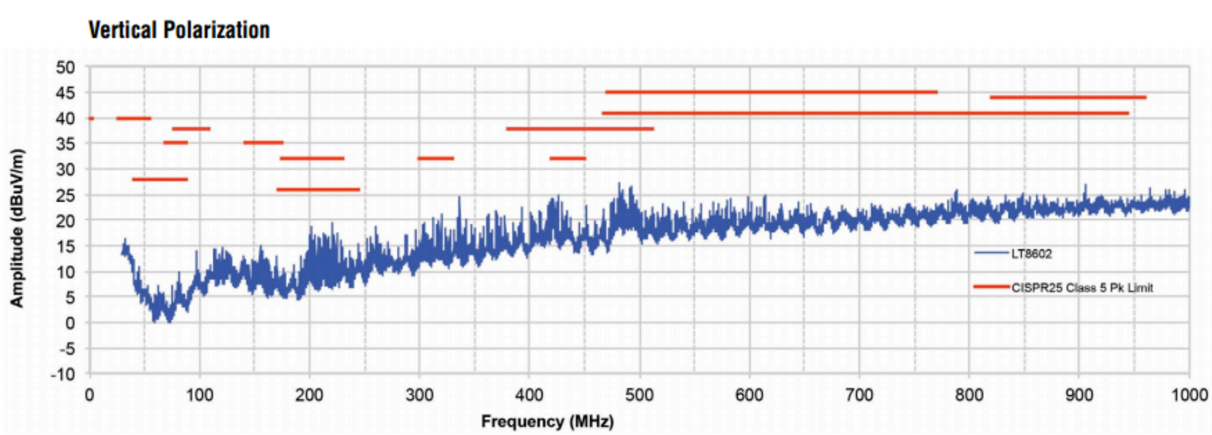


**Figure 2. The LT8602 Exceeds CISPR 25, Class 5 Radiated Emissions**

The LT8602's switching frequency can be programmed from 250kHz to 2MHz and can be synchronized throughout this range. Its 60ns minimum on-time enables $16V_{IN}$ to $2.0V_{OUT}$ stepdown conversions on the high voltage channels with a 2MHz switching frequency. As the high voltage $V_{OUT2}$ channel feeds the two low voltage channels ($V_{OUT3}$ and $V_{OUT4}$), these can deliver outputs as low as 0.8V while also switching at 2MHz, offering a very compact (~25mm x 25mm) quad output solution as shown in Figure 3.

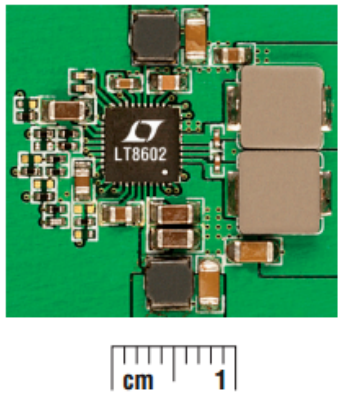


**Figure 3. LT8602 Quad Output Solution Footprint**

In addition the minimizing the solution footprint, the LT8602's 2MHz switching frequency enables designers to avoid critical noise-sensitive frequency bands, such as AM radio.  Each channel of the LT8602 maintains a minimum dropout voltage of only 200mV (@1A) under all conditions, enabling it to excel in scenarios such as automotive cold-crank. Programmable power-on reset and power good indicators for each channel helps to ensure overall system reliability.  The LT8602's 40-lead thermally enhanced 6mm x 6mm QFN package and high switching frequency keeps external inductors and capacitors small, providing a compact, thermally efficient footprint. In addition, unique design techniques and a new high speed process enable high efficiency over a wide input voltage range and the LT8602's current-mode topology enables fast transient response and excellent loop stability.

## Conclusion

The good news for drivers is that ADAS systems will continue to increase within automobiles to enable a safer and more comfortable driving experience while also providing increased awareness of what is going on around them. Meanwhile, the engineers designing these systems are getting more compact and efficient power converters to provide both cost and space-effective solutions.