

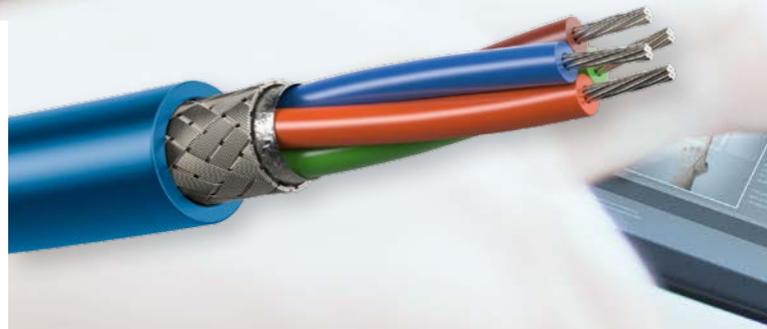
New LEONI Dacar[®] generation

Star quad data cables
for transfer rates of up to 3 Gbit/s

The number of applications in cars that require high data rates has risen tremendously in recent years. Roughly speaking, they can be categorised into 'infotainment' and, in the widest sense, 'assist systems'. The most familiar examples are camera systems, USB connections, smart phone connectivity and environment recognition.

Data rates of 3 Gbit/s in cars

The desire of many car owners for applications that are familiar from their home environment is driving the need in the automotive industry for transmission of ever greater rates of data. While it is meanwhile almost normal in domestic living rooms to be enjoying movies in full HD resolution at a data rate of approx 3 Gbit/s, this technology is only gradually moving into cars. To enable reliable data transfer in cars, the individual components must fulfil increasingly greater demands in terms of transmission properties and must simultaneously be matched better to one another. This requires intensive collaboration between the individual manufacturers because the interaction of all components is ultimately what determines the robustness of the overall system.



APIX2 – the new chip generation

The collaboration between LEONI and Inova Semiconductors is a prime example of such a trend. The Munich-based chip manufacturer has been well known for years with its APIX system (Automotive PIXel link) for differential data transmission by means of CML (Current Mode Logic) – often designated as LVDS SerDes (Low voltage differential signalling serializer/deserialiser) – in cars. The new APIX2 chip generation is suited, for example, to transmission of HD content with 24 Bit colour depth and a refresh rate of 100 Hz. With resolution of 1,600 x 600 pixels, which is typical for screens in cars, the data volume to be transmitted thus amounts to 2.3 GBit/s. An

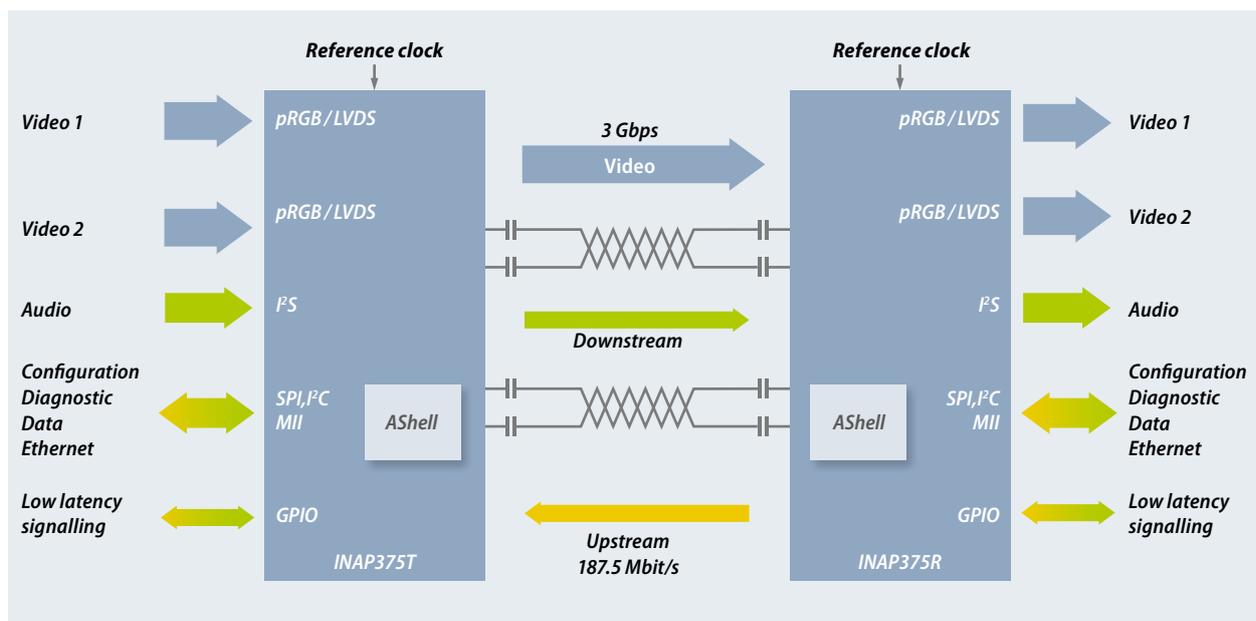


Figure 1: Depiction of an APIX2 link (source: Inova Semiconductors)



alternative to transmitting a high-resolution video signal involves transferring two separate streams of lower resolution (e.g. 1,280 x 720 pixels) – see Fig. 1. The special feature of the APIX2 technology is that, alongside video, it also enables transmission of up to 8 audio channels, data communication like I²C (Inter-Integrated Circuit) or SPI (Serial Peripheral Interface) and even 100 Mbit Ethernet via LEONI Dacar 636 in real time.

New generation of LVDS cables

Transmission of such data volumes requires cables whose mechanical stability and high frequency properties are equally outstanding. The LEONI Dacar 535 and LEONI Dacar 535-2 standard star-quad cables that have been deployed up to now are specified for maximum operating frequencies of 1 GHz and their suitability for higher demands with signals at data rates of up to 3 GBit/s is therefore limited. Such data rates require the cables used to provide robust transmission up to maximum operating frequencies of 3 GHz; three times the bandwidth available up to now. On this basis, LEONI conducted extensive studies in the past year to optimise the LEONI Dacar 535 family, which ensure the required cable properties.

The outcome of this development work is a new generation of our LVDS cables, which come in two types:

- LEONI Dacar 636 for static fitting in cars
- LEONI Dacar 636-2 for such dynamic applications as mirrors and tailgates

Purely in terms of their look these cables hardly differ from their predecessors; only their blue jacket colour serves to distinguish between the generations. Our LEOMER (9Y-131-NFD-1) compound, developed in-house, is used as the insulation material. Due to dimensions that are identical to the LEONI Dacar 535 family, the existing interface can

also still be used for LEONI Dacar 636 and LEONI Dacar 636-2, which significantly reduces the expense of implementing the change in cars. The performance enhancement up to 3 GHz is achieved to a crucial extent by significant process optimisation. Among other aspects, this includes narrowing production tolerances as well as enhancing precision in the individual production stages. There was also a significant improvement in the high frequency properties pursuant to the typical ageing tests versus the previous results.

The cable attenuation illustrates this:

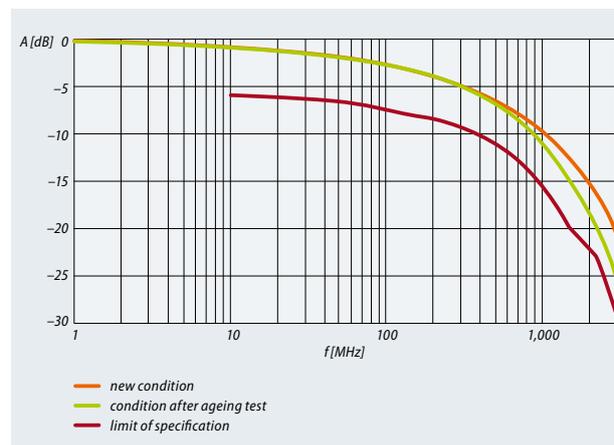


Figure 2: Typical attenuation curves of the new LEONI Dacar 636 and 636-2 cable generation

With these optimised HF properties, our new generation of star-quad cables, LEONI Dacar 636 and LEONI Dacar 636-2, is well equipped for transmitting signals at data rates of up to 3 GHz.