



**SAW filters for  
automotive  
applications**



**VECTRON**  
INTERNATIONAL

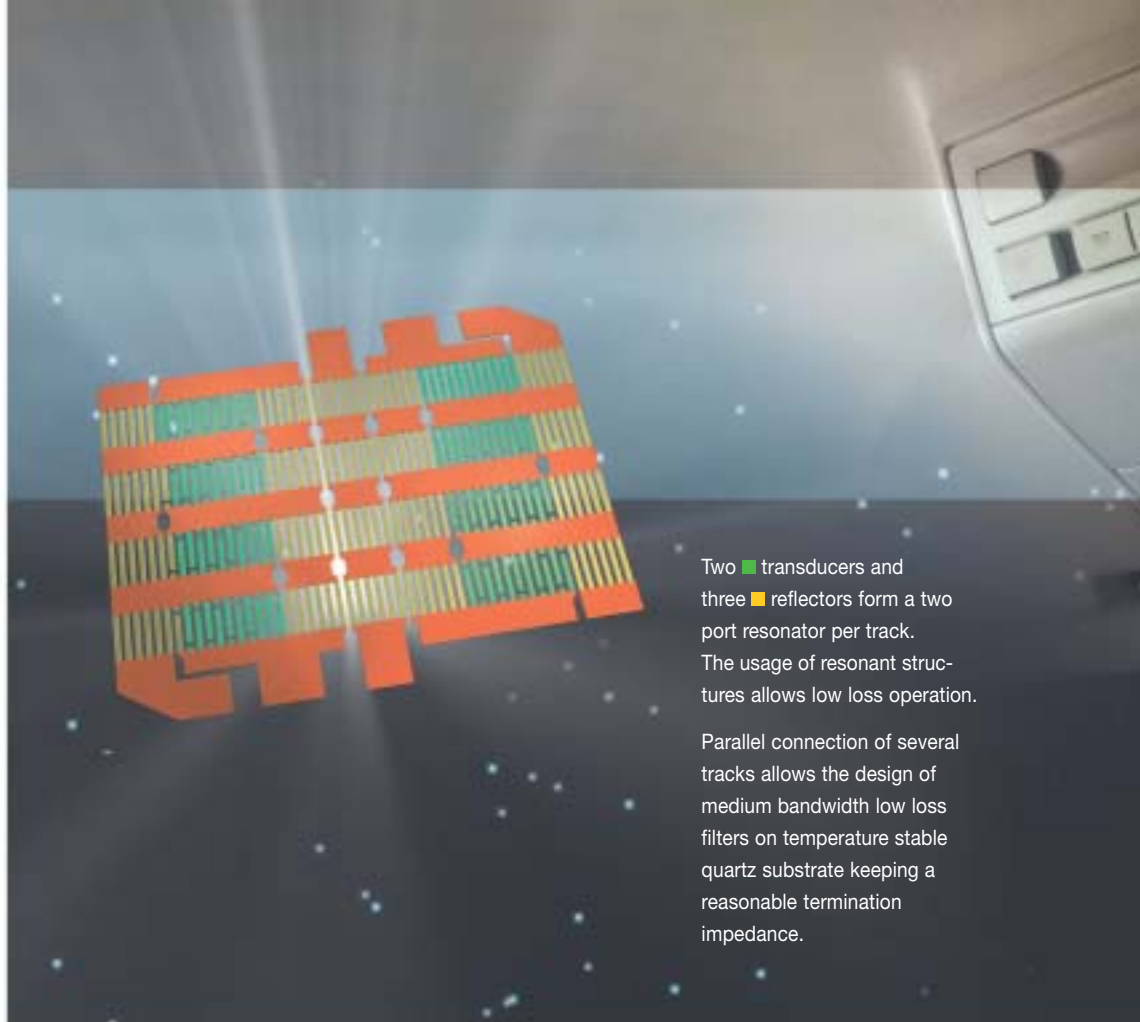
A **DOVER** COMPANY





## Requirements for SAW filters for automotive applications:

- Low insertion loss
- Wide operating temperature range
- High reliability
- Low cost



Two ■ transducers and three ■ reflectors form a two port resonator per track. The usage of resonant structures allows low loss operation.

Parallel connection of several tracks allows the design of medium bandwidth low loss filters on temperature stable quartz substrate keeping a reasonable termination impedance.

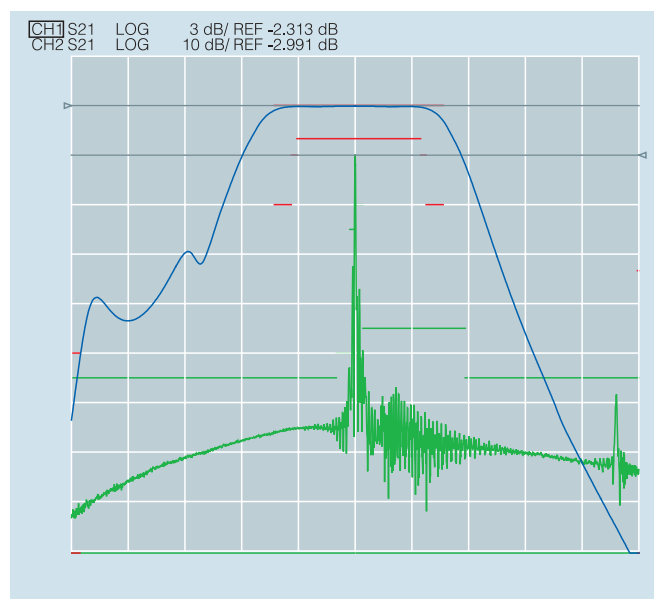
### SAW filters for automotive applications

The strong influence of insertion loss on system performance requires application of resonant design principles like LCRF (Longitudinal Couples Resonator Filter), IEF (Impedance Element Filter) and balanced bridge filter. VI-Telefilter is using its experience in application and combination of these design principles for the development of low loss filters for automotive applications.

To support the booming market of automotive applications VI-Telefilter has been certified according to TS16949 in 2004.

### Design capabilities

For automotive applications the LCRF design principle is used frequently. An LCRF design can be described as combination of two port resonators. The drawing above shows a parallel connection of 4 two port resonators. This allows very low loss reducing resistive losses and avoiding waveguide effects. For filters on quartz the parallel connection is very important to get a reasonable termination impedance for stable production having a short matching path to 50 Ohm source or load. The quartz which is often used due to its high temperature stability has got a low electromechanical coupling coefficient requiring parallel connection.





### VI-Telefilter products for automotive applications

There are product lines using quartz and LiTaO3 as substrate materials on the market.

Solutions on quartz can offer close-in rejection but are limited in bandwidth to some hundred kHz.

Solutions on LiTaO3 can offer a wider bandwidth, 50 Ohm termination impedance and extremely low insertion loss, can however not guarantee close-in rejection. The lack of close-in rejection is caused by the higher temperature coefficient of the material.

VI-Telefilter supports both product lines and the frequencies that are requested in different regions of the world.



### Solutions for automotive applications

- using quartz and LiTaO3 for low loss filters with close-in rejection or a wide bandwidth
- Highly-automated and flexible production lines for low cost solutions

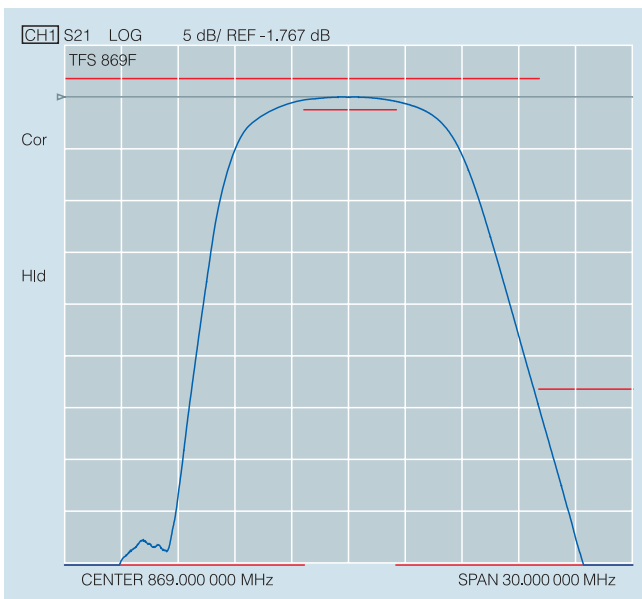
Type	Frequency MHz	Bandwidth MHz	Insertion Loss dB	Package mm
TFS315D	315.00	0.60	1.9	3.8x3.8
TFS433P	433.92	0.44	2.6	5.0x5.0
TFS433V	433.92	0.32	3.8	3.8x3.8
TFS433S	433.92	1.71	2.6	5.0x5.0
TFS868K	868.30	0.50	2.4	3.8x3.8
TFS869F	869.00	2.00	1.8	3.0x3.0
TFS915	915.00	1.00	2.5	3.8x3.8
TFS915A	915.00	26.00	2.5	3.8x3.8

### Automotive applications and VI-Telefilter

All VI-Telefilter plants are TS16949 and ISO14000 certified.

Highly-automated and flexible production lines are utilized for high and medium volume products to follow the market needs for low cost solutions.

All design principles needed to address this market with its special requirements are available. Telefilter invented basic elements (parallel connection on page 2) as early as in 1994.





**Vectron International-  
Telefilter – Germany**

Employees: 170

Turnover: \$28 Mio (2004)

**Products:**

SAW Filters, SAW Resonators and  
Monolithic Crystal Filters (MCF)

Experienced SAW design team,  
supported by a worldwide sales  
organization

75% of product portfolio less  
than 2 years old

Technological expertise on  
materials, front-end and back-end

Fully automated assembly process

**Vectron Frequency Devices –  
Switzerland**

High-end Nikon stepper  
for high resolution (0.35µm)  
and high throughput

**Products:**

High-performance RF-filters,  
High volume low cost RF-filters  
up to 3 GHz



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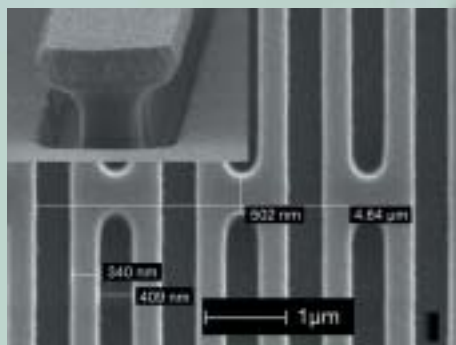
telefilter@vectron.com  
www.vectron.com



**Vectron International-Telefilter  
is always a good address**

Vectron International-Telefilter (VI-Telefilter) is particularly successful in the development of passive electronic components like SAW filters, SAW resonators, and monolithic crystal filters (MCF). Our corporate policy is strictly customer-oriented, and our customers opt for us because we reliably deliver high-quality components always according to the individual customer requirements in terms of performance, costs, and technology modification.

Due to its flexible design capacities and thoroughly cost-optimized production facilities VI-Telefilter has gained a leading role among the suppliers of electronic components for the mass market as well as in the high-performance segment.



**A true partner – with the reliability of an international group**

VI-Telefilter is 100%-owned by Vectron International and is thus a member of the international Dover Corporation. Dover Corporation is NYSE-traded (DOV) and listed at Fortune 500. Dover Corporation has a broad customer base throughout the world, in over 100 countries and sales close to \$5 Billion.

According to the Dover corporate policy each individual group member company operates independently on the very sound financial background of a strong international group. VI is one of the largest suppliers of Frequency Control Products with worldwide annual sales of over \$200 Million and a growth rate that is clearly above average.

As a group member within the VI group VI-Telefilter is located in Teltow/Berlin and operates on a global level.



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