



# SAW Components

## SAW RF filter

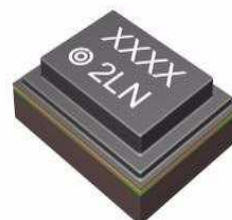
Automotive telematics

|                       |                        |
|-----------------------|------------------------|
| <b>Series/type:</b>   | <b>B4313</b>           |
| <b>Ordering code:</b> | <b>B39162B4313P810</b> |
| <b>Date:</b>          | <b>April 10, 2012</b>  |
| <b>Version:</b>       | <b>2.0</b>             |

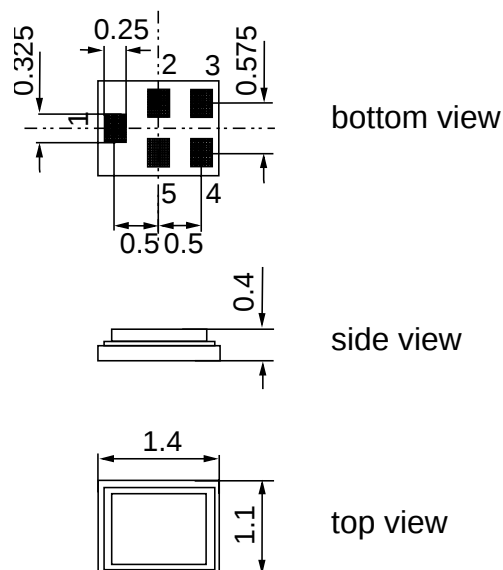
**Data sheet**

**Application**

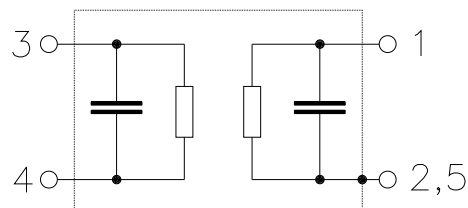
- Low-loss RF filter for automotive telematics applications
- Low insertion attenuation
- Low amplitude ripple
- Unbalanced to balanced operation


**Features**

- Package size 1.4 x 1.1 x 0.4 mm<sup>3</sup>
- Package code QCS5P
- RoHS compatible
- Approximate weight 0.003 g
- Package for **Surface Mount Technology (SMT)**
- Ni, gold-plated terminals
- AEC-Q200 qualified component family (operable temperature range -40°C to +85°C)
- **Electrostatic Sensitive Device (ESD)**


**Pin configuration**

- 1 Input
- 3,4 Output, balanced
- 2,5 to be grounded



**Data sheet**

**Characteristics**

Temperature range for specification:  $T = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$   
 Terminating source impedance:  $Z_S = 50\ \Omega$   
 Terminating load impedance:  $Z_L = 100\ \Omega$  (balanced)

|                                              |                 | min. | typ.<br>@ 25 °C | max. |     |
|----------------------------------------------|-----------------|------|-----------------|------|-----|
| <b>Center frequency</b>                      | $f_C$           | —    | 1588.655        | —    | MHz |
| <b>Maximum insertion attenuation</b>         | $\alpha_{\max}$ |      |                 |      |     |
| 1573.42 ... 1577.42 MHz                      |                 | —    | 1.4             | 1.9  | dB  |
| 1597.55 ... 1605.89 MHz                      |                 | —    | 1.6             | 2.0  | dB  |
| 1571.42 ... 1605.89 MHz                      |                 | —    | 1.6             | 2.0  | dB  |
| <b>Amplitude ripple (p-p)</b>                | $\Delta\alpha$  |      |                 |      |     |
| 1573.42 ... 1577.42 MHz                      |                 | —    | 0.4             | 0.9  | dB  |
| 1597.55 ... 1605.89 MHz                      |                 | —    | 0.5             | 1.1  | dB  |
| 1571.42 ... 1605.89 MHz                      |                 | —    | 0.6             | 1.2  | dB  |
| <b>VSWR</b>                                  |                 |      |                 |      |     |
| 1573.42 ... 1577.42 MHz                      |                 | —    | 1.7             | 2.1  |     |
| 1597.55 ... 1605.89 MHz                      |                 | —    | 1.7             | 2.1  |     |
| 1571.42 ... 1605.89 MHz                      |                 | —    | 1.8             | 2.2  |     |
| <b>Group delay ripple<sup>1)</sup> (p-p)</b> |                 |      |                 |      |     |
| 1573.42 ... 1577.42 MHz                      |                 | —    | 4               | 9    | ns  |
| 1597.55 ... 1605.89 MHz                      |                 | —    | 10              | 13   | ns  |
| 1571.42 ... 1605.89 MHz                      |                 | —    | 10              | 13   | ns  |
| <b>Attenuation</b>                           | $\alpha$        |      |                 |      |     |
| 500.0 ... 1350.0 MHz                         |                 | 45   | 50              | —    | dB  |
| 1350.0 ... 1450.0 MHz                        |                 | 38   | 44              | —    | dB  |
| 1450.0 ... 1525.0 MHz                        |                 | 30   | 35              | —    | dB  |
| 1650.0 ... 1700.0 MHz                        |                 | 30   | 35              | —    | dB  |
| 1700.0 ... 2150.0 MHz                        |                 | 37   | 40              | —    | dB  |
| 2150.0 ... 2300.0 MHz                        |                 | 30   | 35              | —    | dB  |
| 2300.0 ... 2700.0 MHz                        |                 | 40   | 46              | —    | dB  |

<sup>1)</sup> Averaged over 500 kHz

**Maximum ratings**

|                            |                  |                  |     |                           |
|----------------------------|------------------|------------------|-----|---------------------------|
| Operable temperature range | T                | −40/+85          | °C  |                           |
| Storage temperature range  | T <sub>stg</sub> | −40/+85          | °C  |                           |
| DC voltage                 | V <sub>DC</sub>  | 0                | V   |                           |
| ESD voltage                | V <sub>ESD</sub> | 50 <sup>1)</sup> | V   | machine model, 10 pulses  |
| Input Power at             |                  |                  |     |                           |
| GSM850, GSM900             | P <sub>IN</sub>  | 15               | dBm | peak power of GSM signal, |
| GSM1800, GSM1900           | P <sub>IN</sub>  | 15               | dBm | duty cycle 4:8            |
| Tx bands                   |                  |                  |     |                           |

<sup>1)</sup> acc. to JESD22-A115A (machine model), 10 negative & 10 positive pulses.

### ESD protection of SAW filters

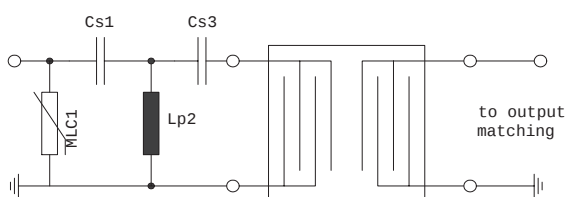
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

In general, “ESD matching” has to be ensured at that filter port, where electrostatic discharge is expected.

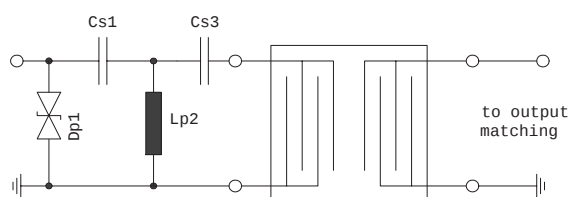
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

Below three figures show recommended “ESD matching” topologies.

For wideband filters the high-pass ESD matching structure needs to be at least of 3<sup>rd</sup> order to ensure a proper matching for any impedance value of antenna and SAW filter input. The required component values have to be determined from case to case.

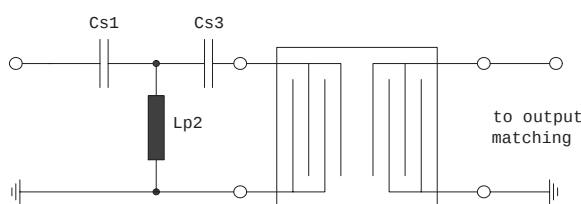


**Fig. 1 MLC varistor plus ESD matching**



**Fig. 2 Suppressor diode plus ESD matching**

In cases where minor ESD occur, following simplified “ESD matching” topologies can be used alternatively.



**Fig. 3 3<sup>rd</sup> order high-pass structure for basic ESD protection**

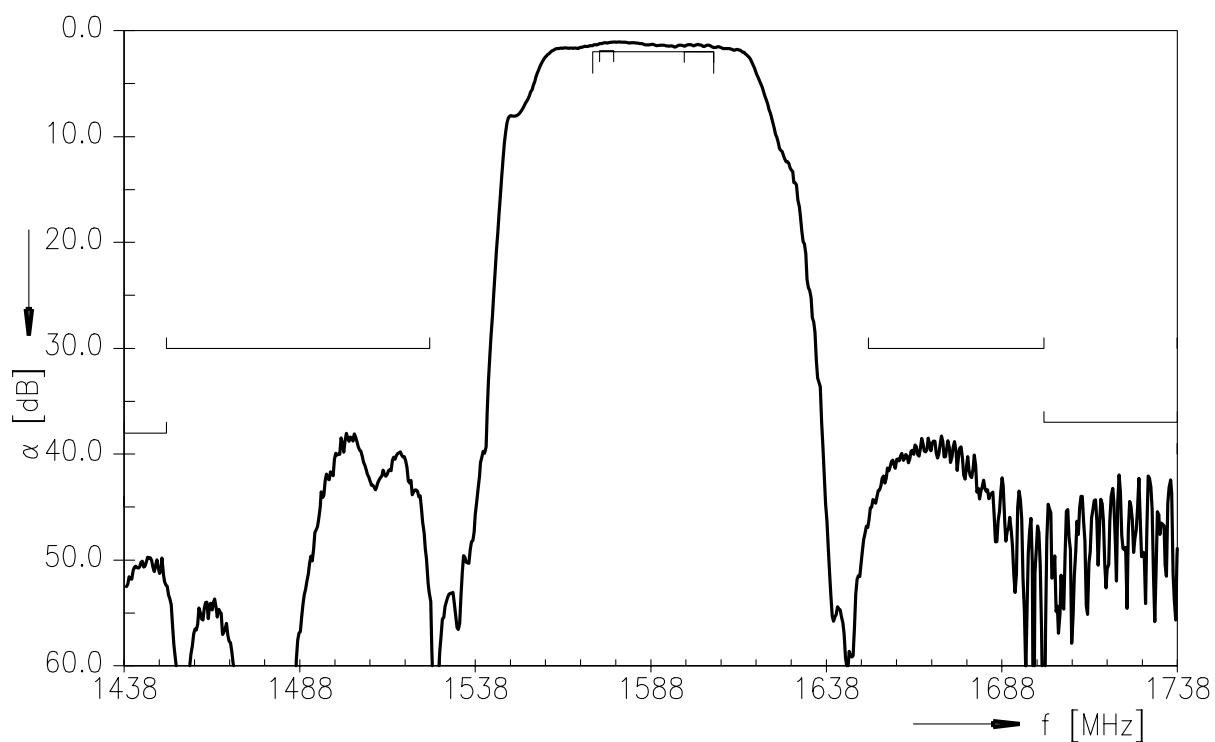
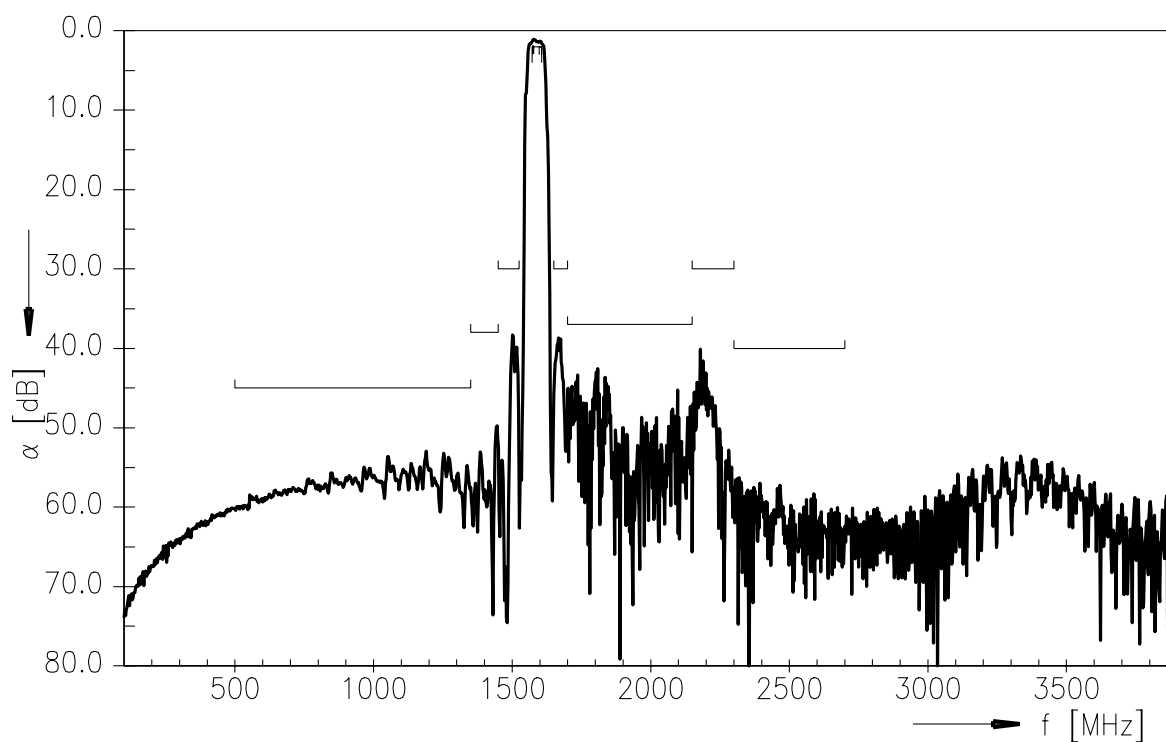
In all three figures the shunt inductor Lp2 could be replaced by a shorted microstrip with proper length and width. If this configuration is possible depends on the operating frequency and available pcb space.

Effectiveness of the applied ESD protection has to be checked according to relevant industry standards or customer specific requirements

For further information, please refer to EPCOS Application report:

**“ESD protection for SAW filters”.**

This report can be found under [www.epcos.com/rke](http://www.epcos.com/rke). Click on “Applications Notes”.

**Frequency response**

**Frequency response (wideband)**


**References**

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Type</b>                | B4313                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Ordering code</b>       | B39162B4313P810                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Marking and package</b> | C61157-A8-A9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Packaging</b>           | F61074-V8212-Z000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Date codes</b>          | L_1126                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>S-parameters</b>        | B4313_NB.s3p, B4313_WB.s3p<br>See file header for port/pin assignment table.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Soldering profile</b>   | S_6001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>RoHS compatible</b>     | defined as compatible with the following documents:<br>"DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. 2005/618/EC from April 18th, 2005, amending Directive 2002/95/EC of the European Parliament and of the Council for the purposes of establishing the maximum concentration values for certain hazardous substances in electrical and electronic equipment." |
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