



# SAW Components

## SAW Rx filter

Automotive telematics

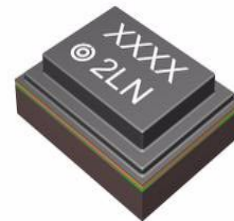
<b>Series/type:</b>	<b>B4302</b>
<b>Ordering code:</b>	<b>B39212B4302F210</b>
Date:	February 01, 2012
Version:	2.3

Data sheet



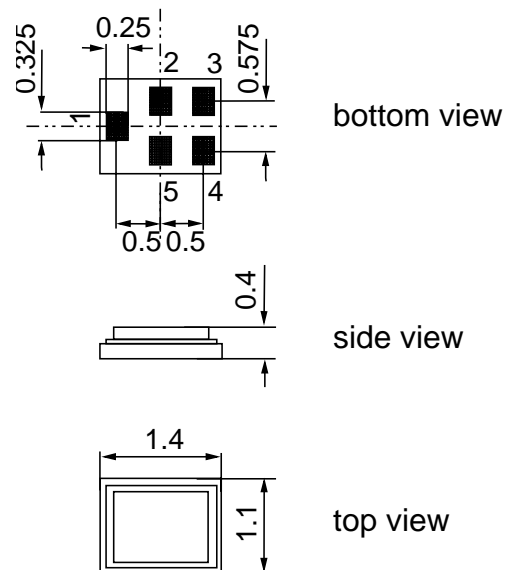
Application

- Low-loss RF filter for mobile telephone WCDMA systems, receive path (RX)
- Impedance transformation from 50 Ω to 150 Ω
- Unbalanced to balanced operation
- Very low insertion attenuation
- Very high Tx-suppression
- Passband with very low error vector magnitude (EVM)
- Low amplitude ripple
- Very low ripple over any 3.84MHz as well as 5.0MHz within the passband
- Usable passband 60 MHz



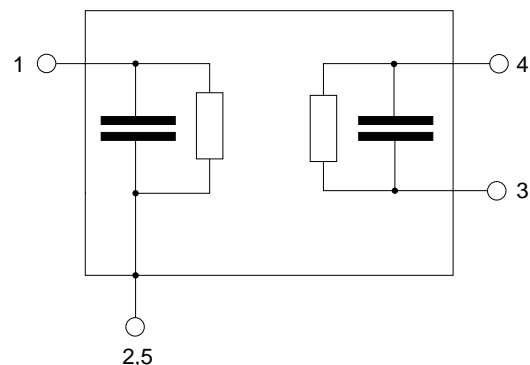
Features

- Package size 1.4 x 1.1 x 0.4 mm<sup>3</sup>
- Package code QCS5M
- 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:  $T = -10\text{ °C to }+85\text{ °C}$   
 Terminating source impedance:  $Z_S = 50\ \Omega$   
 Terminating load impedance:  $Z_L = 150\ \Omega \parallel 18\text{ nH (balanced)}$

		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	$f_C$	—	2140.0	—	MHz
<b>Maximum insertion attenuation</b>	$\alpha_{\max}$	—	1.9	2.5	dB
2110.0 ... 2170.0 MHz					
<b>Amplitude ripple (p-p)</b>	$\Delta\alpha$	—	0.7	1.4	dB
2110.0 ... 2170.0 MHz					
<b>VSWR</b>					
Input	2110.0 ... 2170.0 MHz	—	2.0	2.4	
Output	2110.0 ... 2170.0 MHz	—	2.0	2.4	
<b>CMRR (<math> S_{21}-S_{31}  /  S_{21}+S_{31} </math>)</b>					
2110.0 ... 2170.0 MHz		17 <sup>1)</sup>	22	—	
<b>Attenuation</b>	$\alpha$				
10.0 ... 1920.0 MHz		35	41	—	dB
1920.0 ... 1980.0 MHz		44	49	—	
1980.0 ... 2025.0 MHz		30	34	—	
2025.0 ... 2050.0 MHz		18	32	—	
2230.0 ... 2300.0 MHz		18	25	—	dB
2300.0 ... 2360.0 MHz		22	28	—	
2360.0 ... 4220.0 MHz		28	33	—	
4220.0 ... 4340.0 MHz		35	54	—	
4340.0 ... 6000.0 MHz		30	46	—	

1) A CMRR of 19.6 dB corresponds to a phase imbalance of +/-10° together with an amplitude imbalance of +/- 1.0 dB.

**Data sheet**

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Terminating source impedance:	Z <sub>S</sub> = 50 Ω
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		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	f <sub>C</sub>	—	2140.0	—	MHz
<b>Maximum insertion attenuation</b>	α <sub>max</sub>	—	1.9	3.5	dB
2110.0 ... 2170.0 MHz					
<b>Amplitude ripple (p-p)</b>	Δα	—	0.7	2.4	dB
2110.0 ... 2170.0 MHz					
<b>VSWR</b>					
Input	2110.0 ... 2170.0 MHz	—	2.0	2.6	
Output	2110.0 ... 2170.0 MHz	—	2.0	2.6	
<b>CMRR ( S<sub>21</sub>-S<sub>31</sub>  /  S<sub>21</sub>+S<sub>31</sub> )</b>					
2110.0 ... 2170.0 MHz		17 <sup>1)</sup>	22	—	
<b>Attenuation</b>	α				
10.0 ... 1920.0 MHz		35	41	—	dB
1920.0 ... 1980.0 MHz		44	49	—	
1980.0 ... 2025.0 MHz		30	34	—	
2025.0 ... 2050.0 MHz		18	32	—	
2230.0 ... 2300.0 MHz		18	25	—	dB
2300.0 ... 2360.0 MHz		22	28	—	
2360.0 ... 4220.0 MHz		28	33	—	
4220.0 ... 4340.0 MHz		35	54	—	
4340.0 ... 6000.0 MHz		30	46	—	

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B4302

SAW Rx filter

2140.0 MHz

Data sheet



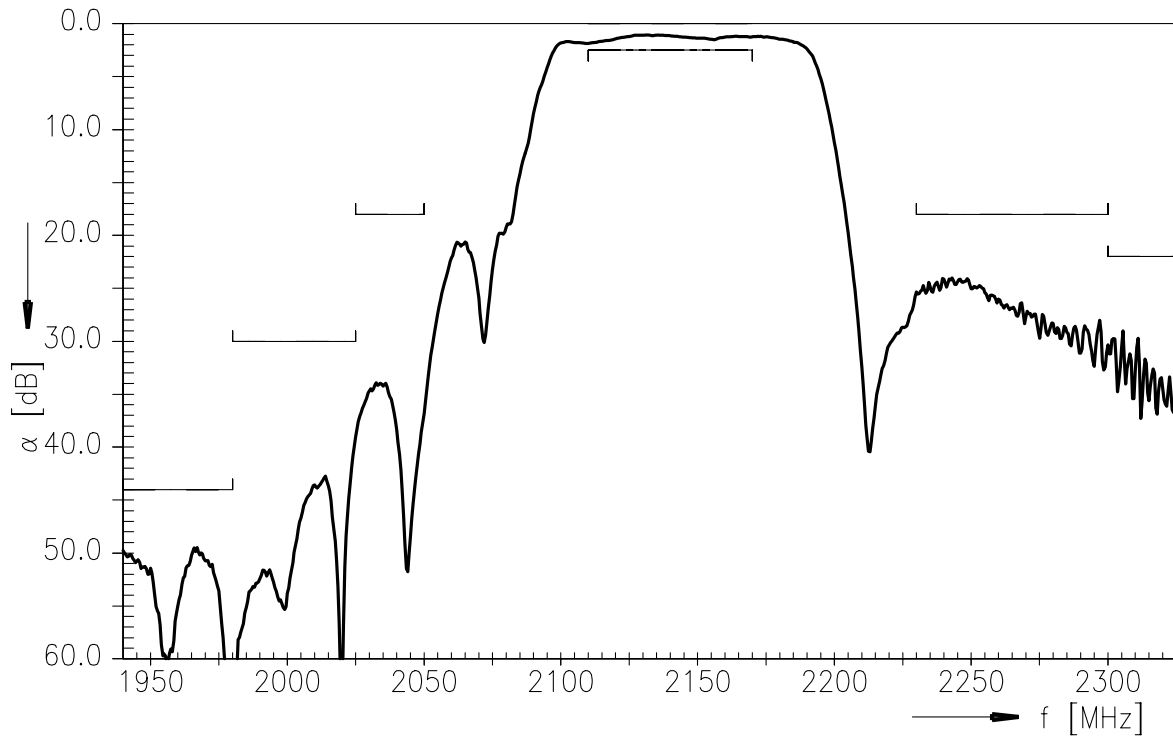
Operable temperature range	T	-40/+85	°C	machine model, 10 pulses
Storage temperature range	T <sub>stg</sub>	-40/+85	°C	
DC voltage	V <sub>DC</sub>	0	V	
ESD voltage	V <sub>ESD</sub>	50 <sup>1)</sup>	V	
Source Power	P <sub>s</sub>	10	dBm	

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

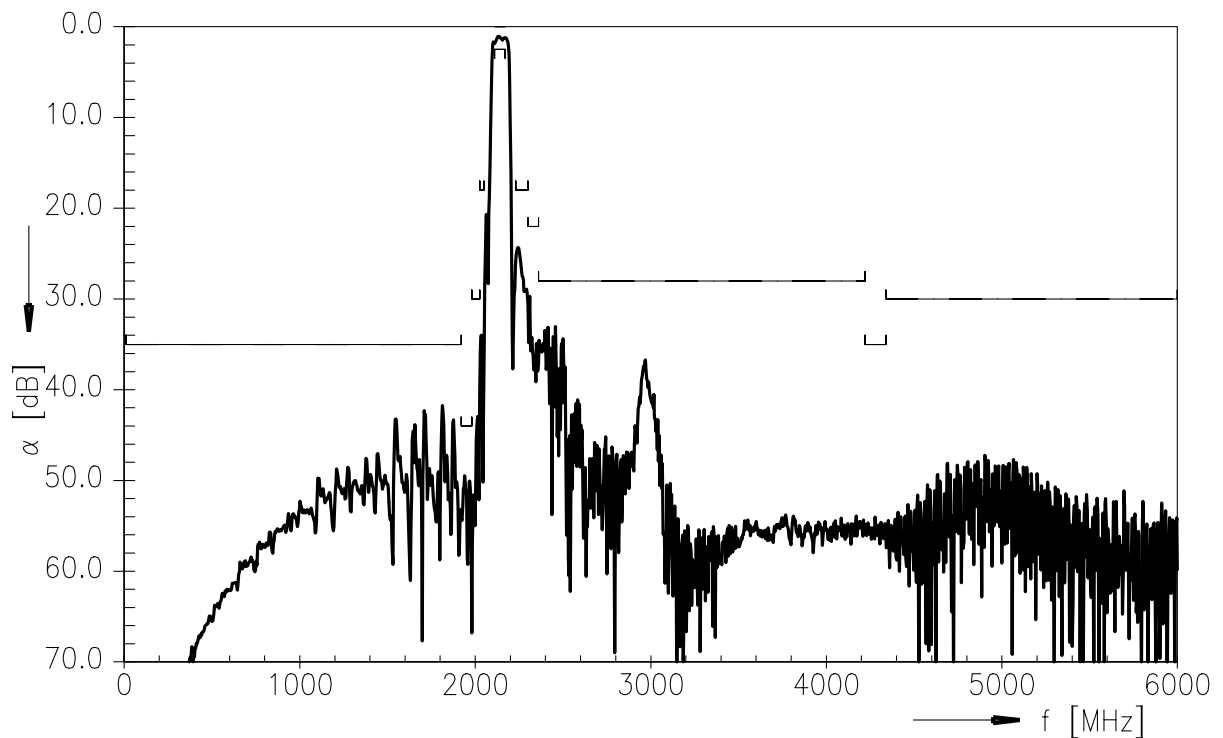
Data sheet



Frequency response (narrowband)



Frequency response (wideband)

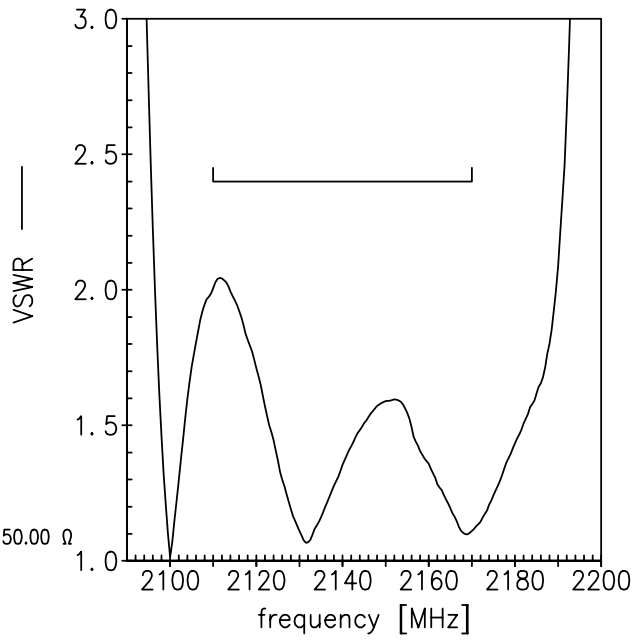
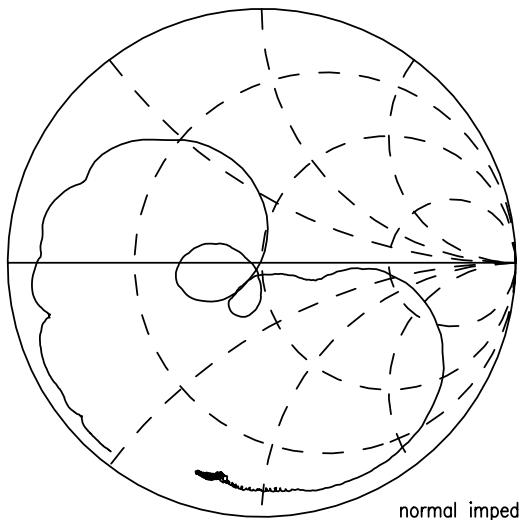


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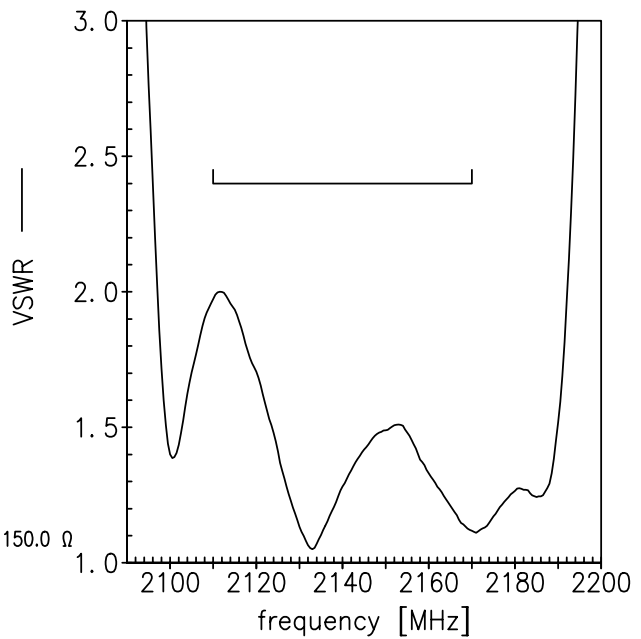
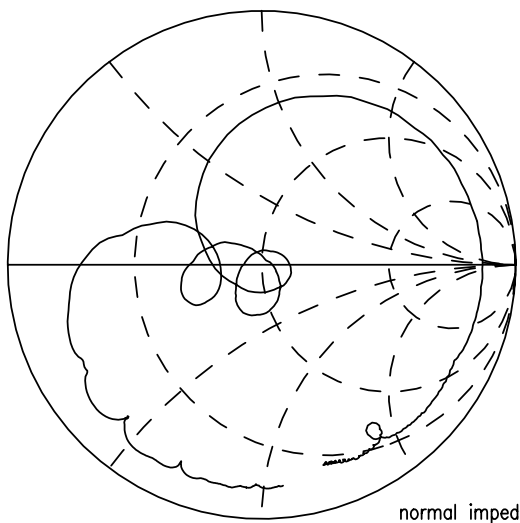


Smith chart

$S_{11}$  function



$S_{22}$  function



**ESD protection of SAW filters**

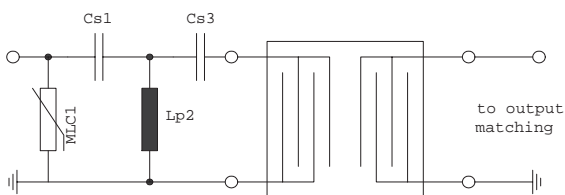
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

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

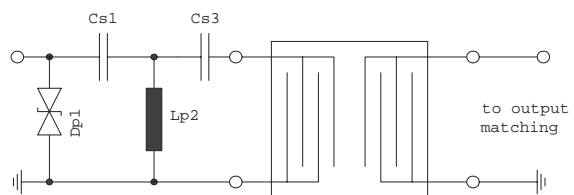
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

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.

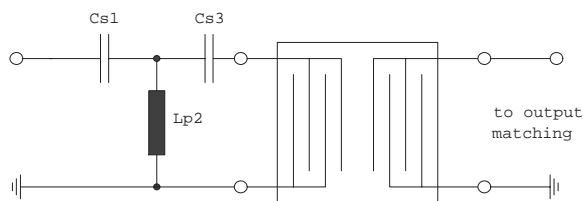


**Fig. 1 MLC varistor plus ESD matching**



**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”.




**References**

<b>Type</b>	B4302
<b>Ordering code</b>	B39212B4302F210
<b>Marking and package</b>	C61157-A8-A8
<b>Packaging</b>	F61074-V8212-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B4302_NB.s3p, B4302_WB.s3p 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: "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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<b>Matching coils</b>	See Inductor pdf-catalog <a href="http://www.tdk.co.jp/tefe02/coil.htm#aname1">http://www.tdk.co.jp/tefe02/coil.htm#aname1</a> and Data Library for circuit simulation <a href="http://www.tdk.co.jp/etvcl/index.htm">http://www.tdk.co.jp/etvcl/index.htm</a>

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