



RF360  
Europe GmbH

## SAW Components

### SAW Rx filter

Automotive telematics

Series/type:	B4304
Ordering code:	B39941B4304F210
Date:	December 19, 2013
Version:	2.3

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# SAW Components

## SAW Rx filter

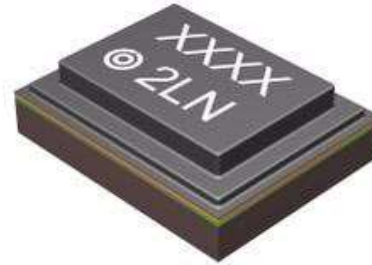
Automotive telematics

<b>Series/type:</b>	<b>B4304</b>
<b>Ordering code:</b>	<b>B39941B4304F210</b>
<b>Date:</b>	<b>December 19, 2013</b>
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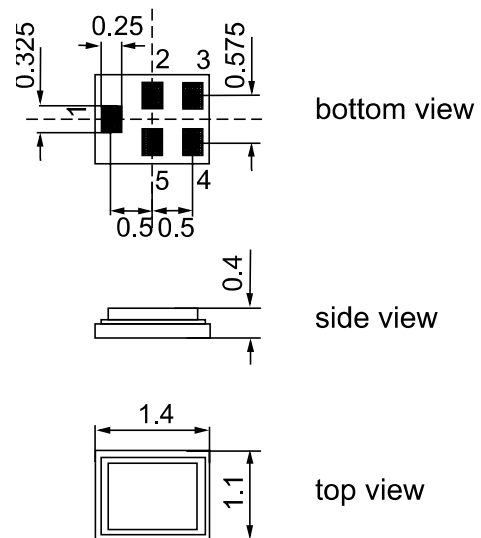
Data sheet


**Application**

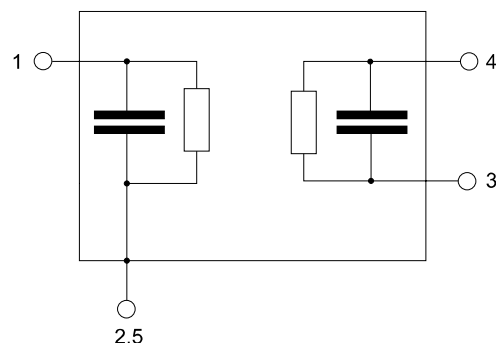
- Low-loss RF filter for WCDMA Band VIII and GSM 900 systems, receive path (RX)
- Very low insertion loss
- Useable passband: 35 MHz
- Unbalanced to balanced operation
- Impedance transformation from 50  $\Omega$  to 150  $\Omega$
- Suitable for GPRS class 1 to 12


**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  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ )
- **Electrostatic Sensitive Device (ESD)**


**Pin configuration**

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



**Data sheet**

**Characteristics**

Temperature range for specification:  $T = -20\text{ °C to }+75\text{ °C}$   
 Terminating source impedance:  $Z_S = 50\ \Omega$  (unbalanced)  
 Terminating load impedance:  $Z_L = 150\ \Omega \parallel 100\text{ nH}$  (balanced)

		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	$f_C$	—	942.5	—	MHz
<b>Maximum insertion attenuation</b>					
	925.0 ... 960.0 MHz	$\alpha_{\text{GSM}}$	1.5	2.7	dB
@ $f_{\text{Carrier Bd 8 RX}}$	927.4 ... 957.6 MHz	$\alpha_{\text{WCDMA}}^{1)}$	1.5	2.0	dB
<b>Amplitude ripple (p-p)</b>					
	925.0 ... 960.0 MHz	$\Delta\alpha$	0.9	2.1	dB
<b>Error Vector Magnitude<sup>2)</sup></b>					
@ $f_{\text{Carrier Bd 8 RX}}$	927.4 ... 957.6 MHz	EVM	3.0	4.5	%
<b>VSWR</b>					
Input	925.0 ... 960.0 MHz		1.9	2.2	
Output	925.0 ... 960.0 MHz		1.9	2.2	
<b>CMRR (<math> S_{21}-S_{31}  /  S_{21}+S_{31} </math>)</b>					
	925.0 ... 960.0 MHz		20 <sup>3)</sup>	25	dB
<b>Attenuation</b>					
	DC ... 480.0 MHz	$\alpha$	45	53	dB
	480.0 ... 835.0 MHz		33	46	dB
	835.0 ... 880.0 MHz		30	34	dB
@ $f_{\text{Carrier Bd 8 TX}}$	882.4 ... 912.6 MHz	$\alpha_{\text{WCDMA}}^{1)}$	30	34	dB
	880.0 ... 915.0 MHz	$\alpha_{\text{GSM}}$	30	33	dB
	915.0 ... 922.0 MHz		1.0	2.5	dB
	980.0 ... 982.0 MHz		20	30	dB
	982.0 ... 1000.0 MHz		23	30	dB
	1850.0 ... 1920.0 MHz		40	47	dB
	2775.0 ... 2880.0 MHz		36	41	dB
	3700.0 ... 3840.0 MHz		38	50	dB
	1000.0 ... 1500.0 MHz		23	32	dB
	1500.0 ... 6000.0 MHz		23	34	dB

1) Attenuation of WCDMA signal ("Powertransferfunction"). Please refer to annotation on page (4).

2) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.

3) A CMRR of 19.6 dB corresponds to a phase imbalance of  $\pm 10^\circ$  together with an amplitude imbalance of  $\pm 1.0$  dB


**Annotation for characteristics section**

Attenuation of WCDMA signal ("Powertransferfunction",  $\alpha_{\text{WCDMA}}$ ) is determined by

$$\int_{-\infty}^{\infty} |S_{\text{ds21}}(f)H_{\text{RRC}}(f - f_{\text{Carrier}})|^2 df$$

$f_{\text{Carrier}}$  according to 3GPP TS 25.101 (e.g. for band VIII RX passband,  $f_{\text{Carrier}}$  ranges from 927.4 MHz (lowest RX channel) to 957.6 MHz (highest RX channel)).  $H_{\text{RRC}}(f)$  is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 with the following normalization:

$$\int_{-\infty}^{\infty} |H_{\text{RRC}}(f)|^2 df = 1$$

**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>	100 <sup>1)</sup>	V	machine model, 10 pulses
Input power	P <sub>IN</sub>	13	dBm	
Input power at				
GSM850, GSM900	P <sub>IN</sub>	15	dBm	effective power in the on-state, duty cycle 4:8
GSM1800, GSM1900	P <sub>IN</sub>	15	dBm	
Tx bands				

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

Data sheet


**ESD protection of SAW filters**

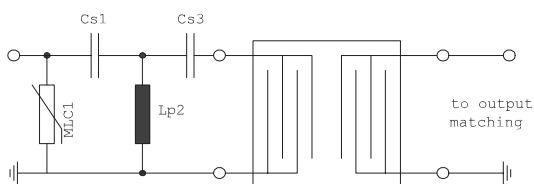
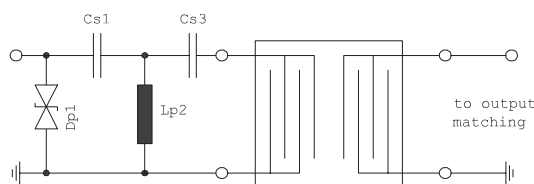
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

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

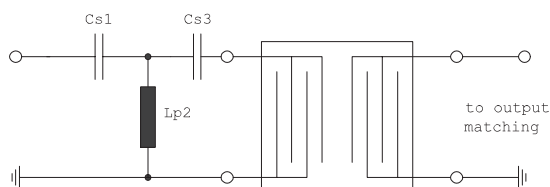
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

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:

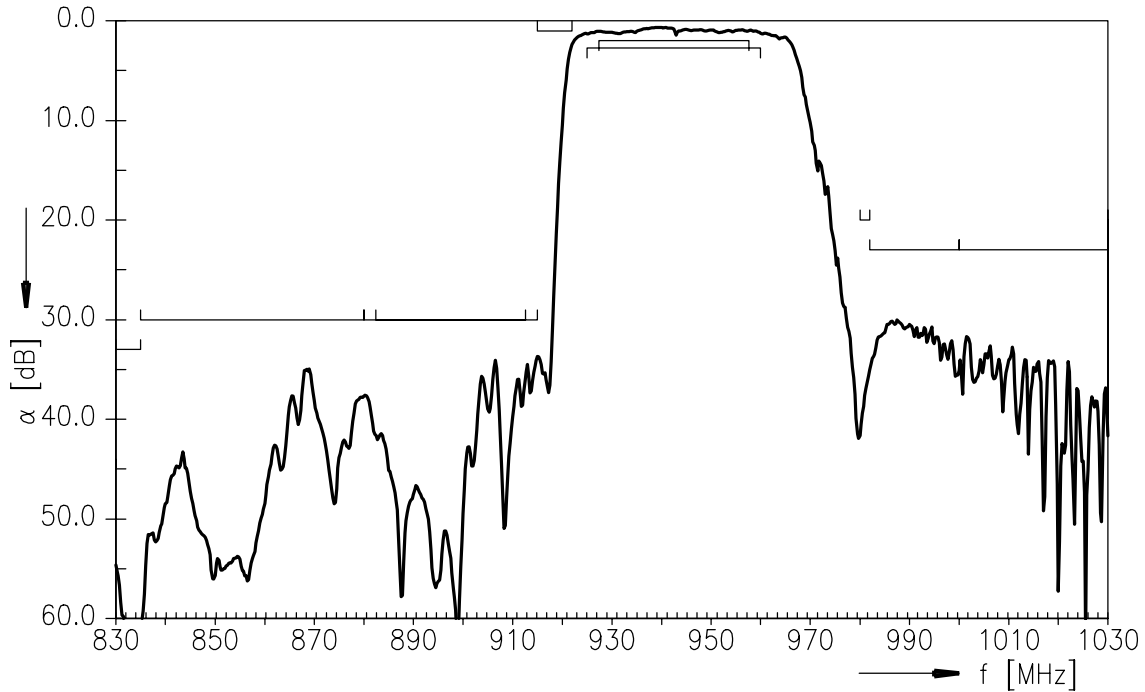
**“ESD protection for SAW filters”.**

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

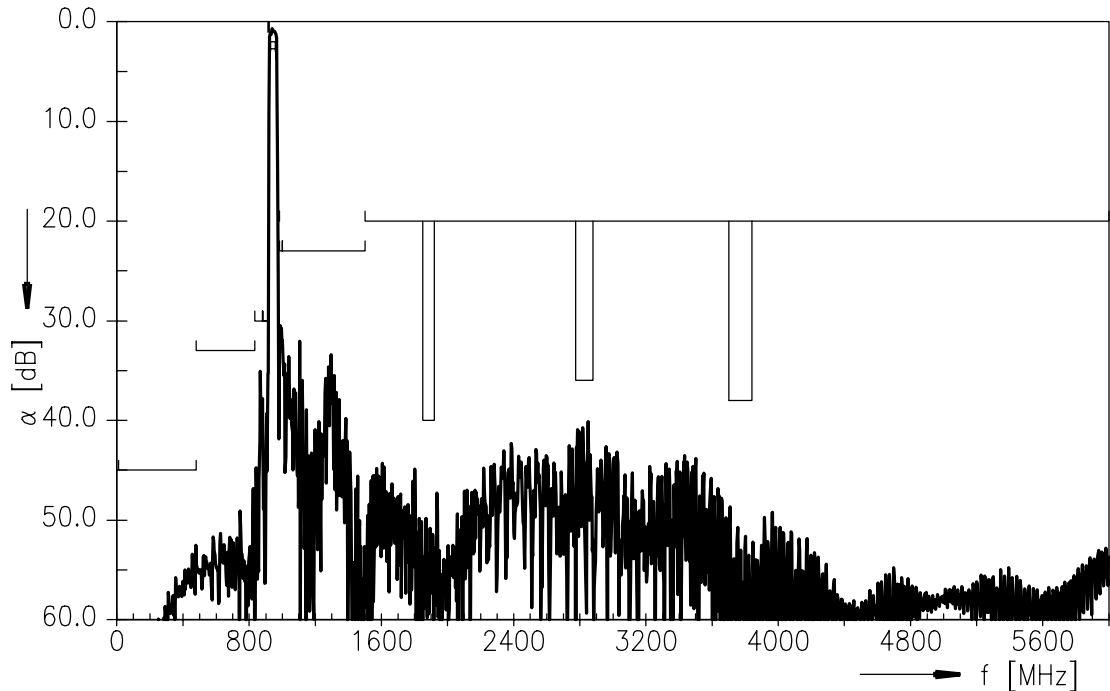
Data sheet



**Transfer function**



**Transfer function (wideband)**



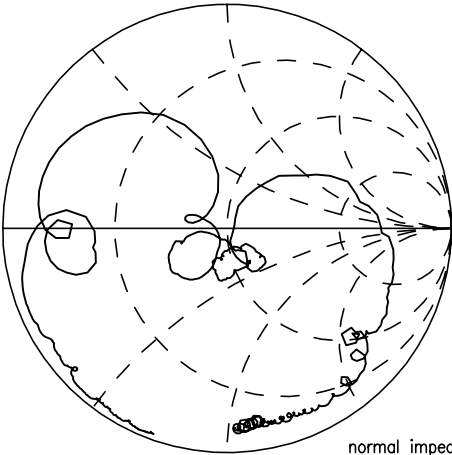


Data sheet

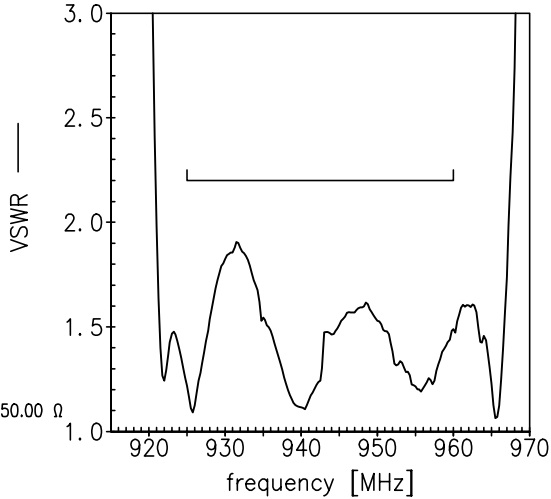


Smith chart

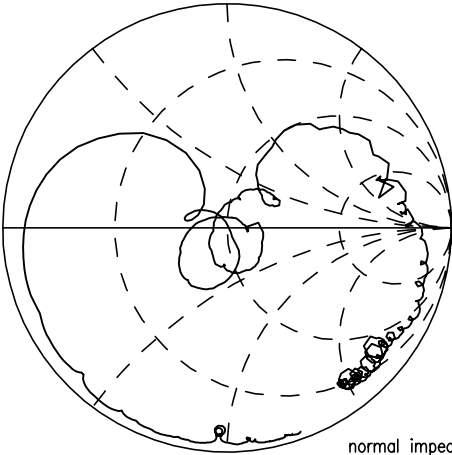
**S<sub>11</sub> function**



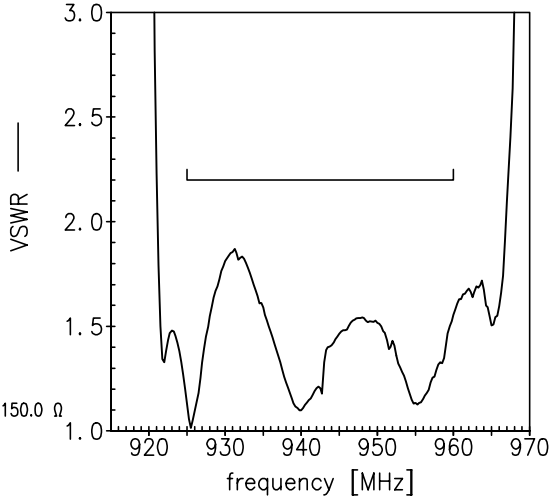
normal impedance: 50.00 Ω



**S<sub>22</sub> function**



normal impedance: 150.0 Ω



<b>SAW Components</b>	<b>B4304</b>
<b>SAW Rx filter</b>	<b>942.50 MHz</b>

Data sheet



## References

<b>Type</b>	B4304
<b>Ordering code</b>	B39941B4304F210
<b>Marking and package</b>	C61157-A8-A8
<b>Packaging</b>	F61074-V8212-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B4304_NB.s3p, B4304_WB.s3p See file header for port/pin assignment table.
<b>Soldering profile</b>	S_6001
<b>RoHS compatible</b>	RoHS-compatible means that products are compatible with the requirements according to Art. 4 (substance restrictions) of Directive 2011/65/EU of the European Parliament and of the Council of June 8 <sup>th</sup> , 2011, on the restriction of the use of certain hazardous substances in electrical and electronic equipment ("Directive") with due regard to the application of exemptions as per Annex III of the Directive in certain cases.
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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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