SAW Components

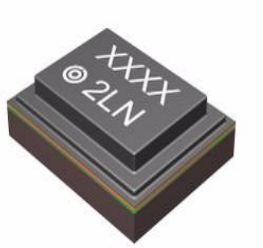
SAW Rx filter

Automotive telematics

Series/type:	**B4304**
Ordering code:	**B39941B4304F210**
Date:	January 30, 2013
Version:	2.2

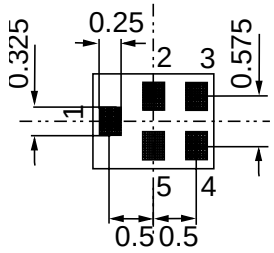
Application

- 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 Ω to 150 Ω
- Suitable for GPRS class 1 to 12

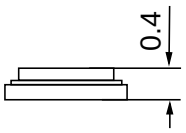


Features

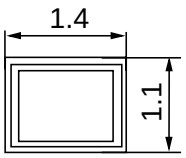
- Package size 1.4 x1.1 x 0.4 mm³
- Package code QCS5M
- RoHS compatible
- Approximate weight 0.003 g
- Package for **S**urface **M**ount **T**echnology (**SMT**)
- Ni, gold-plated terminals
- AEC-Q200 qualified component family (operable temperature range –40˚C to +85˚C)
- **E**lectrostatic **S**ensitive **D**evice (**ESD**)



bottom view



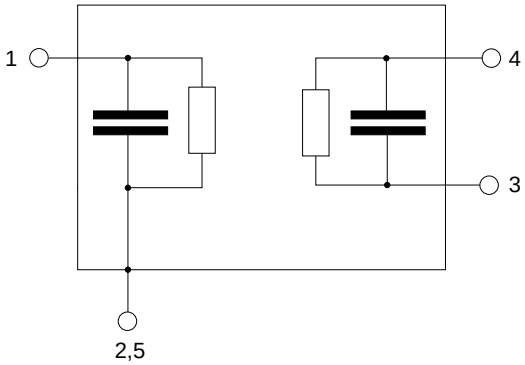
side view



top view

Pin configuration

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



Data sheet SMD

Characteristics

Temperature range for specification: T = -20 ˚C to +75 ˚C
Terminating source impedance: Z_S = 50 Ω (unbalanced)
Terminating load impedance: Z_L = 150 Ω || 100 nH (balanced)

						min.	typ. @ 25 ˚C	max.	
Center frequency					f_C	—	942.5	—	MHz
Maximum insertion attenuation									
	925.0	...	960.0	MHz	α_{GSM}	—	1.5	2.7	dB
@$f_{Carrier\ Bd\ 8\ RX}$	927.4	...	957.6	MHz	α_{WCDMA} [1]	—	1.5	2.0	dB
Amplitude ripple (p-p)									
	925.0	...	960.0	MHz	$\Delta\alpha$	—	0.9	2.1	dB
Error Vector Magnitude [2]									
@$f_{Carrier\ Bd\ 8\ RX}$	927.4	...	957.6	MHz	EVM	—	3.0	4.5	%
VSWR									
Input	925.0	...	960.0	MHz		—	1.9	2.2	
Output	925.0	...	960.0	MHz		—	1.9	2.2	
CMRR ($\lvert S_{21}-S_{31}\rvert$ / $\lvert S_{21}+S_{31}\rvert$)									
	925.0	...	960.0	MHz		20 [3]	25	—	dB
Attenuation					α				
	DC	...	480.0	MHz		45	53	—	dB
	480.0	...	835.0	MHz		33	46	—	dB
	835.0	...	880.0	MHz		30	34	—	dB
@$f_{Carrier\ Bd\ 8\ TX}$	882.4	...	912.6	MHz	α_{WCDMA} [1]	30	34	—	dB
	880.0	...	915.0	MHz	α_{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 ±10° together with an amplitude imbalance of ±1.0 dB

Annotation for characteristics section

Attenuation of WCDMA signal ("Powertransferfunction", α_{WCDMA}) is determined by

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

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

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

Maximum ratings

Operable temperature range	T	–40/+85	˚C	
Storage temperature range	T_{stg}	–40/+85	˚C	
DC voltage	V_{DC}	0	V	
ESD voltage	V_{ESD}	100[1)]	V	machine model, 10 pulses
Input power	P_{IN}	13	dBm	

1) 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 3rd 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.

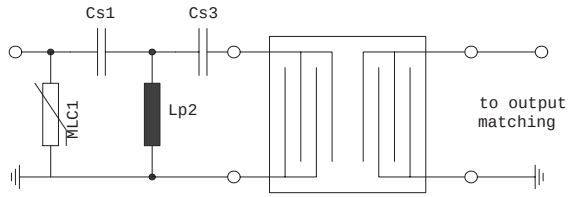


Fig. 1 MLC varistor plus ESD matching

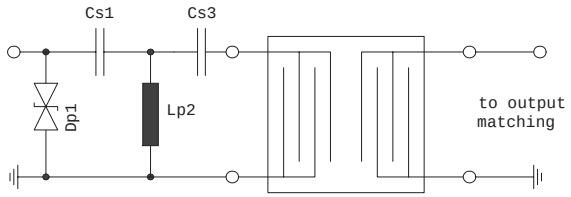


Fig. 2 Suppressor diode plus ESD matching

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

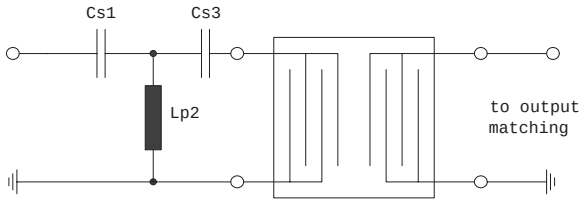


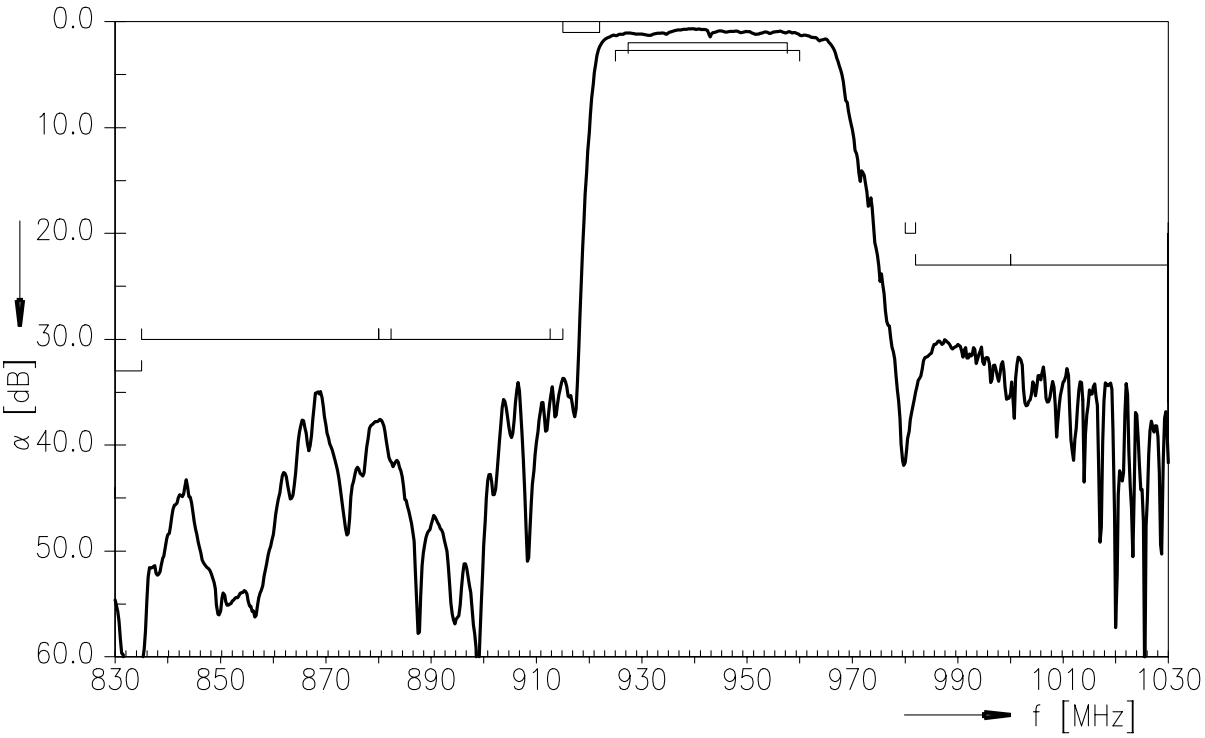
Fig. 3 3rd order high-pass structure for basic ESD protection

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.

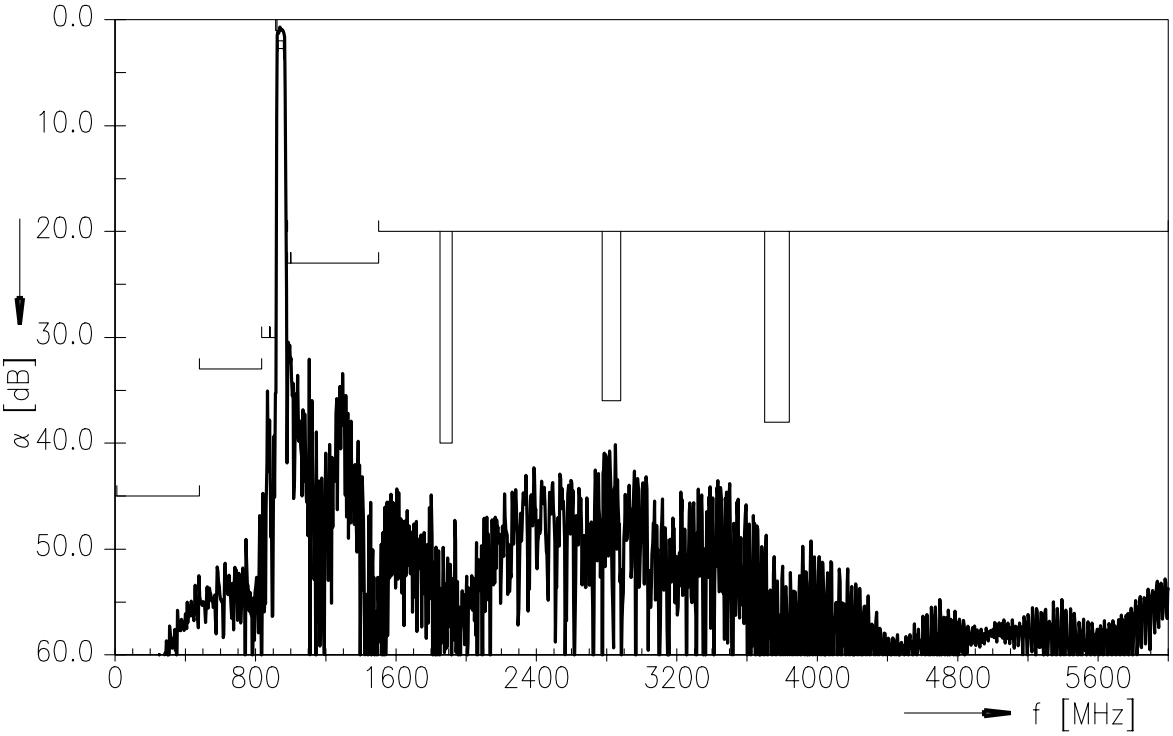
Effectiveness of the applied ESD protection has to be checked according to relevant industry standards or customer specific requirements

For further information, please refer to EPCOS Application report:
“**ESD protection for SAW filters**”.
This report can be found under www.epcos.com/rke.Click on “Applications Notes”.

Transfer function

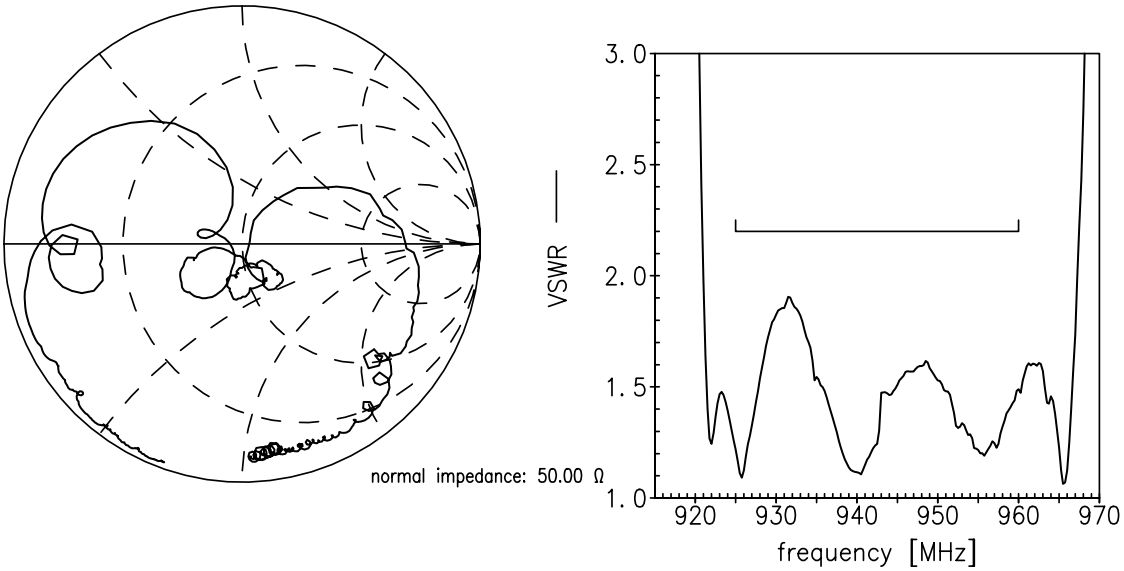


Transfer function (wideband)

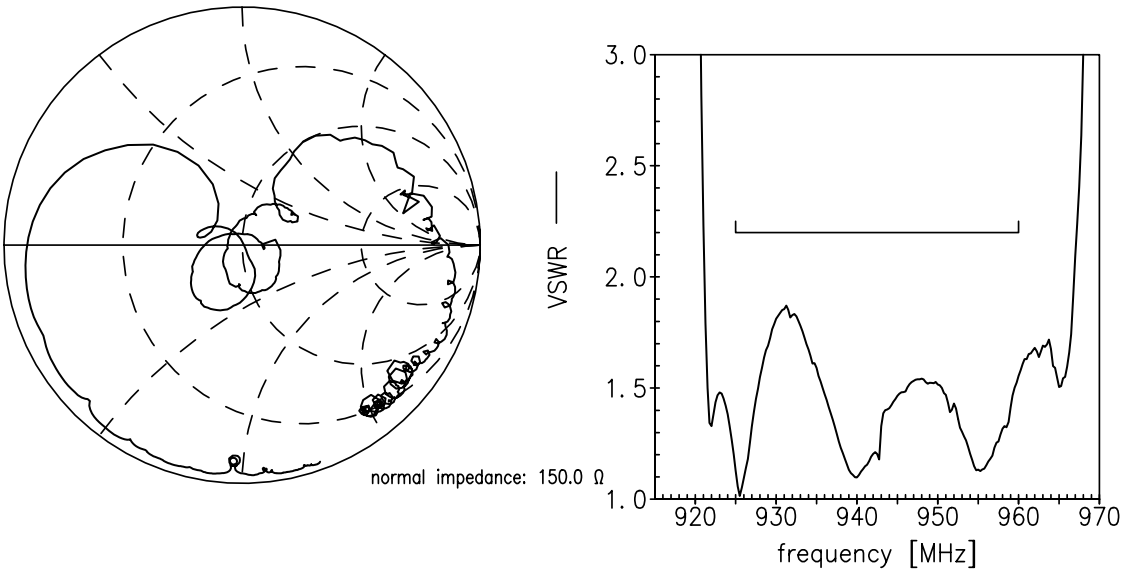


Smith chart

S_{11} function



S_{22} function



References

Type	B4304
Ordering code	B39941B4304F210
Marking and package	C61157-A8-A8
Packaging	F61074-V8212-Z000
Date codes	L_1126
S-parameters	B4304_NB.s3p, B4304_WB.s3p see file header for port/pin assignment table
Soldering profile	S_6001
RoHS compatible	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 8th, 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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