SAW Components

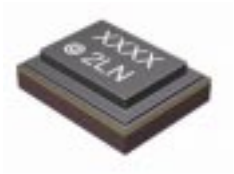
SAW Rx filter

Automotive Telematics

Series/type:	**B4323**
Ordering code:	**B39941B4323P810**
Date:	August 13, 2013
Version:	2.1

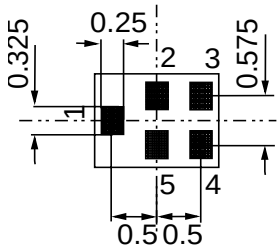
Application

- Low-loss RF filter for WCDMA Band VIII and GSM 900 systems, receive path (RX)
- Very high TX suppression - suitable for diversity applications
- Usable passband: 35 MHz
- Unbalanced to balanced operation
- Impedance transformation from 50 Ω to 100 Ω
- Suitable for GPRS class 1 to 12

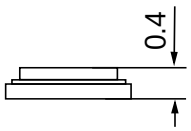


Features

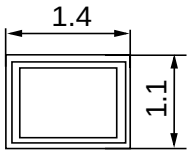
- Package size 1.4 x1.1 x 0.4 mm³
- Package code QCS5P
- RoHS compatible
- Approximate weight 0.003 g
- Package for **S**urface **M**ount **T**echnology (**SMT**)
- Ni, gold-plated terminals
- AEC-Q200 qualified component family (operable temperature range -40˚C to +85˚C)
- **E**lectrostatic **S**ensitive **D**evice (**ESD**)



bottom view



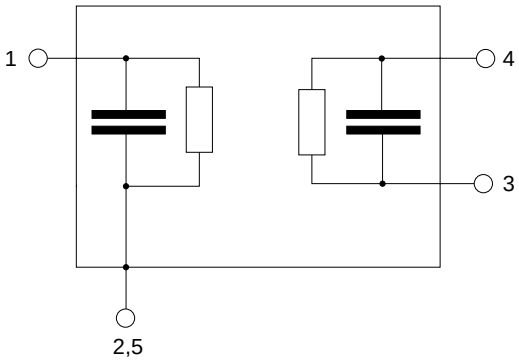
side view



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 +85 ˚C
Terminating source impedance: Z_S = 50 Ω
Terminating load impedance: Z_L = 100 Ω

						min.	typ. @ 25 ˚C	max.	
Center frequency					f_C	—	942.5	—	MHz
Maximum insertion attenuation									
@$f_{Carrier\ Bd\ 8\ RX}$	927.4	...	957.6	MHz	α_{WCDMA} 1)	—	2.1	2.8	dB
@$f_{Carrier\ Bd\ 8\ RX}$	925.7	...	959.3	MHz	α_{LTE} 2)	—	2.3	3.6	dB
	925.0	...	960.0	MHz	α_{GSM}	—	2.5	4.0	dB
Amplitude ripple (p-p)									
	925.0	...	960.0	MHz	$\Delta\alpha$	—	1.5	2.8	dB
Error Vector Magnitude 3)									
@$f_{Carrier\ Bd\ 8\ RX}$	927.4	...	957.6	MHz	EVM	—	3.2	6.2	%
Input VSWR									
	925.0	...	960.0	MHz		—	1.8	2.3	
Output VSWR									
	925.0	...	960.0	MHz		—	1.9	2.4	
CMRR ($\lvert S_{21}-S_{31}\rvert$ / $\lvert S_{21}+S_{31}\rvert$)									
	925.0	...	960.0	MHz		18	23 4)	—	dB
Attenuation					α				
	50.0	...	880.0	MHz		42	55	—	dB
@$f_{Carrier\ Bd\ 8\ TX}$	882.4	...	912.6	MHz	α_{WCDMA} 2)	42	47	—	dB
@$f_{Carrier\ Bd\ 8\ TX}$	880.7	...	914.3	MHz	α_{LTE} 3)	39	44	—	dB
	880.0	...	915.0	MHz	α_{GSM}	35	44	—	dB
	980.0	...	1045.0	MHz		21	25	—	dB
	1045.0	...	1700.0	MHz		35	50	—	dB
	1700.0	...	2600.0	MHz		45	62	—	dB
	2600.0	...	2682.0	MHz		50	60	—	dB
	2682.0	...	4345.0	MHz		44	56	—	dB
	4345.0	...	4470.0	MHz		45	58	—	dB
	4470.0	...	6000.0	MHz		48	55	—	dB

1) Attenuation of WCDMA signal (“Powertransferfunction”). Please refer to annotation on page (4).
2) Attenuation of LTE signal (“Powertransferfunction”). Please refer to annotation on page (4).
3) Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.
4) A CMRR of 22.8 dB corresponds to a phase balance of 5° togeher an amplitude balance of 1.0 dB

Annotation for characteristics section

Attenuation of WCDMA and LTE signal ("Powertransferfunction", α_{WCDMA}, α_{LTE}) are determined by

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

$H_{RRC}(f)$ is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 with the following normalization:

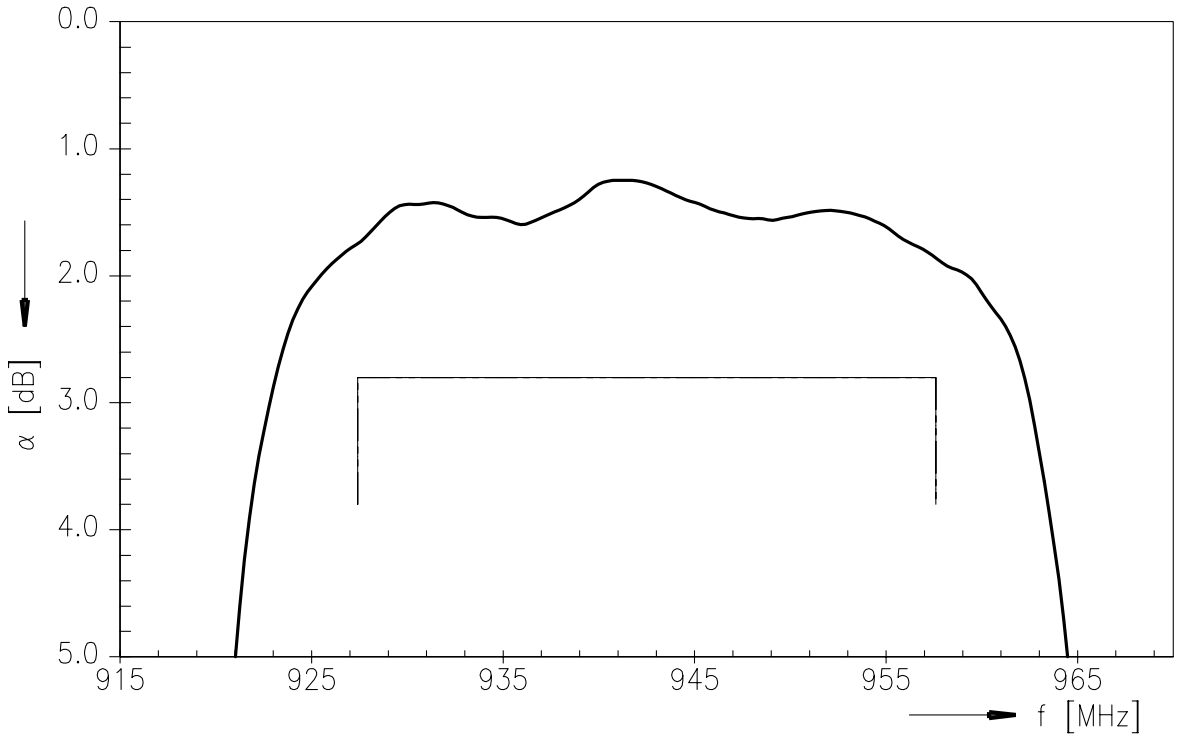
$$\int_{\infty}^{\infty} \left| H_{RRC}(f) \right|^2 df = 1$$

$f_{Carrier}$ of WCDMA signal according to 3GPP TS 25.101 (e.g. for band VIII RX passband, $f_{Carrier}$ ranges from 927.4 MHz (f_C of lowest Rx channel) to 957.6 MHz (f_C of highest Rx channel)). $f_{Carrier}$ of LTE signal according to 3GPP TS 36.101 with a channel band width of 1.08 MHz (equals 6 Resource Blocks) and a guard band of 0.16 MHz (e.g. for band VIII RX passband, $f_{Carrier}$ ranges from 925.7 MHz (f_C of lowest Rx channel) to 959.3 MHz (f_C of highest Rx channel)).

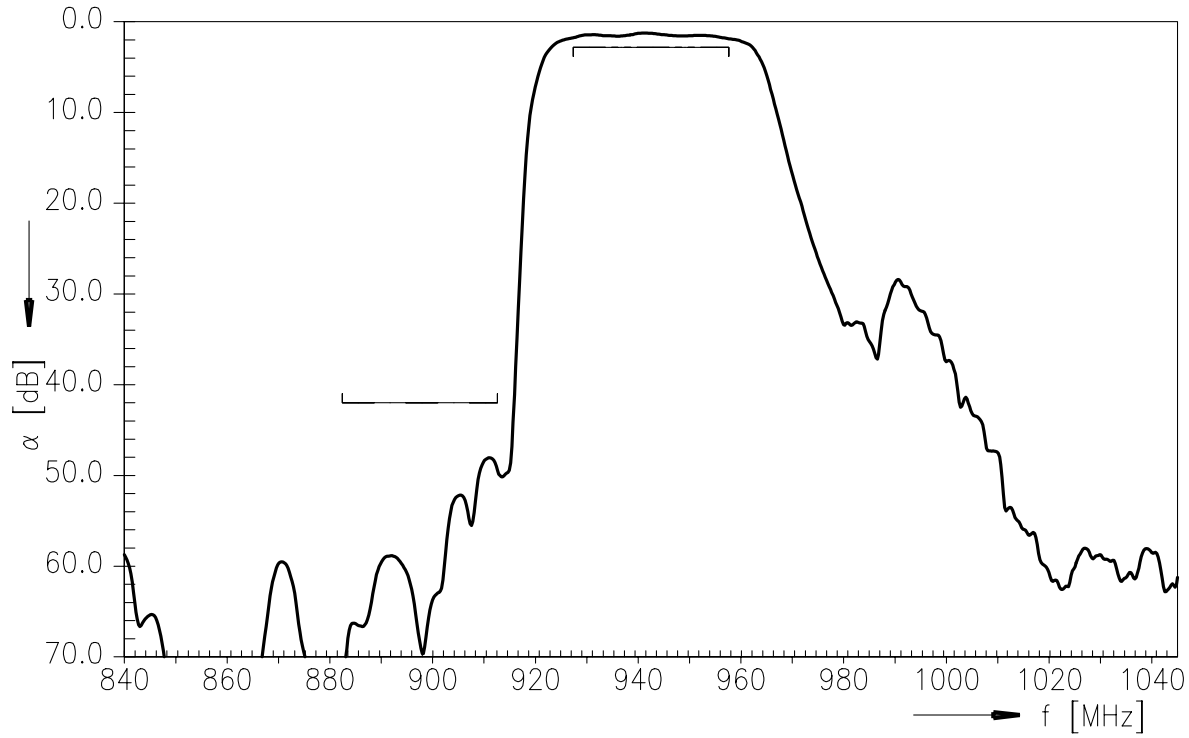
Maximum ratings

Operable temperature range	T	–40/+85	˚C	
Storage temperature range	T_{stg}	–40/+85	˚C	
DC voltage	V_{DC}	0	V	
Input power at	P_{IN}	17	dBm	10000h @ 55˚C

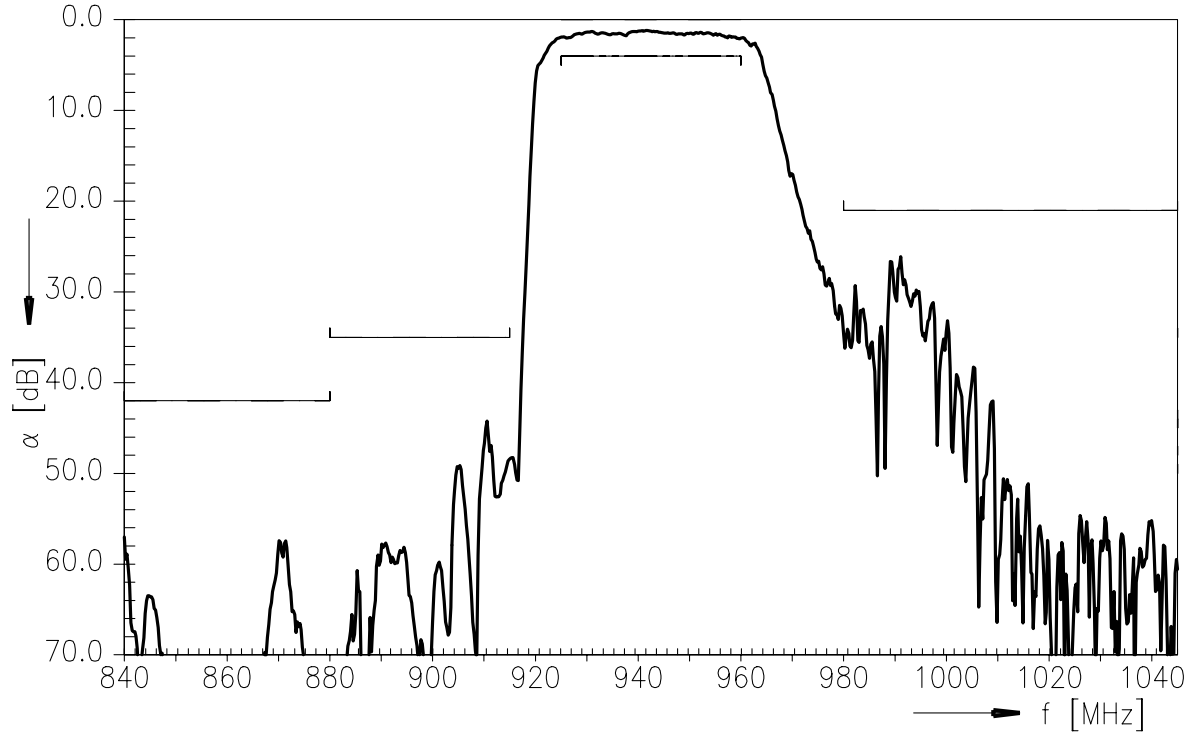
Transfer function for WCDMA signals (Powertransferfunction vs. carrier frequency)



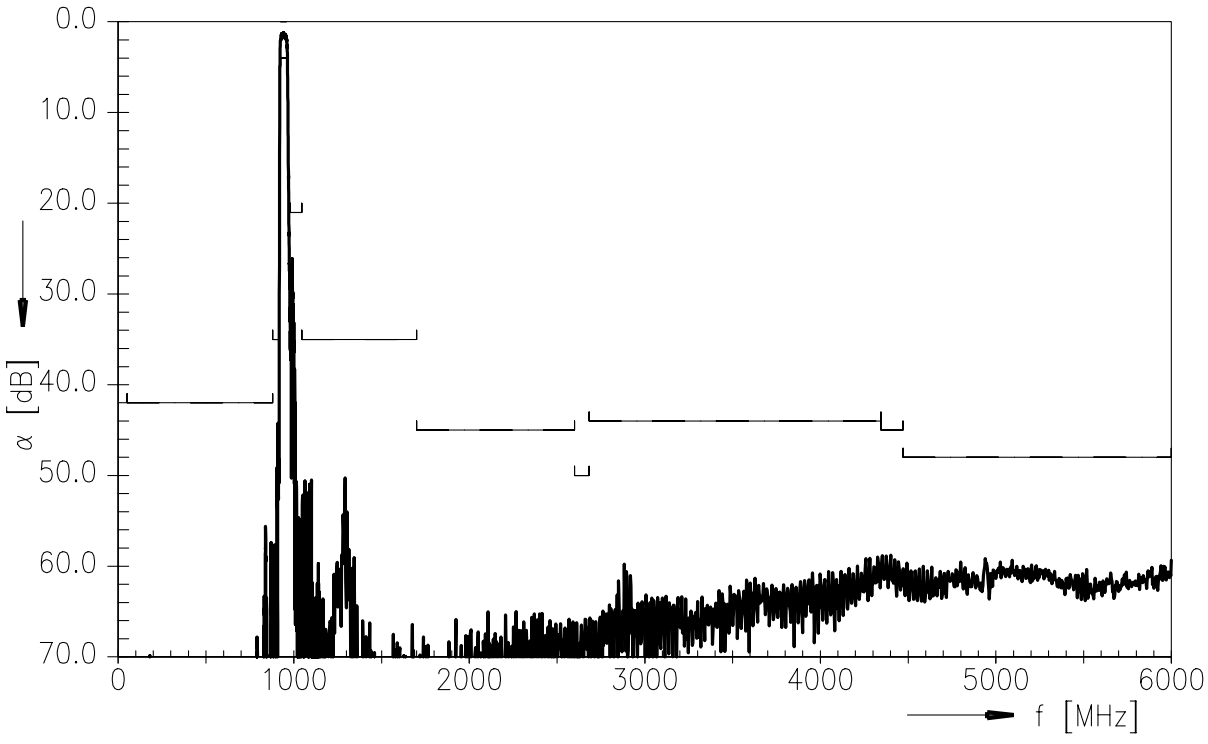
Transfer function for WCDMA signals (Powertransferfunction vs. carrier frequency)



Transfer function for CW signals (narrowband)

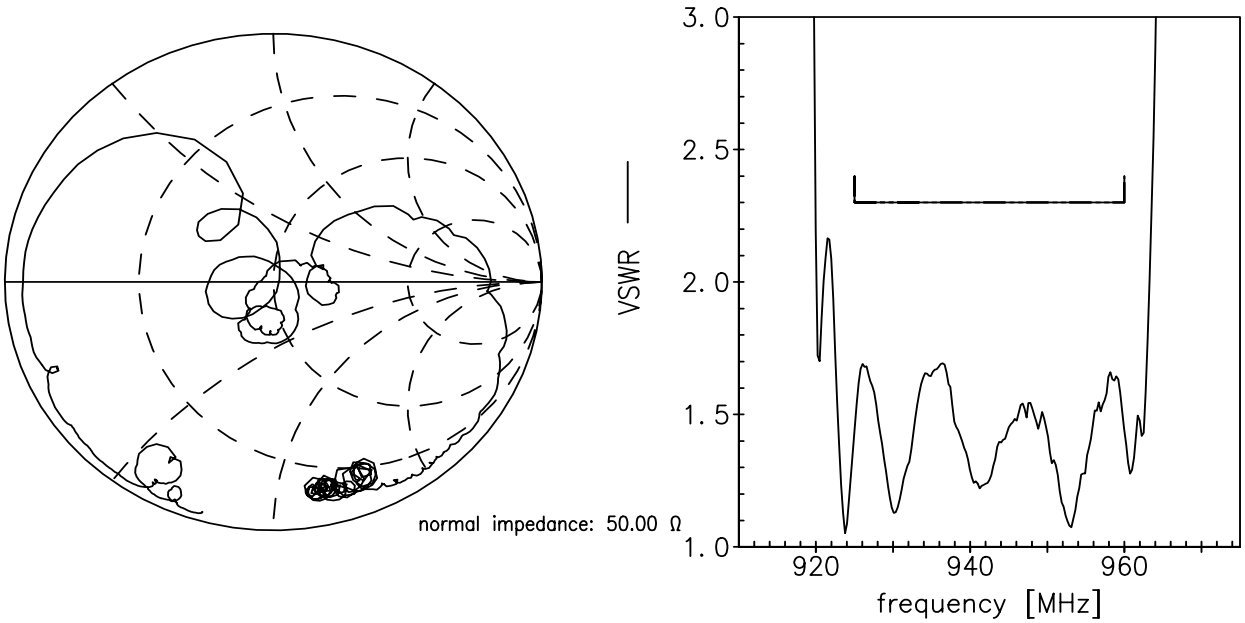


Transfer function for CW signals (wideband)

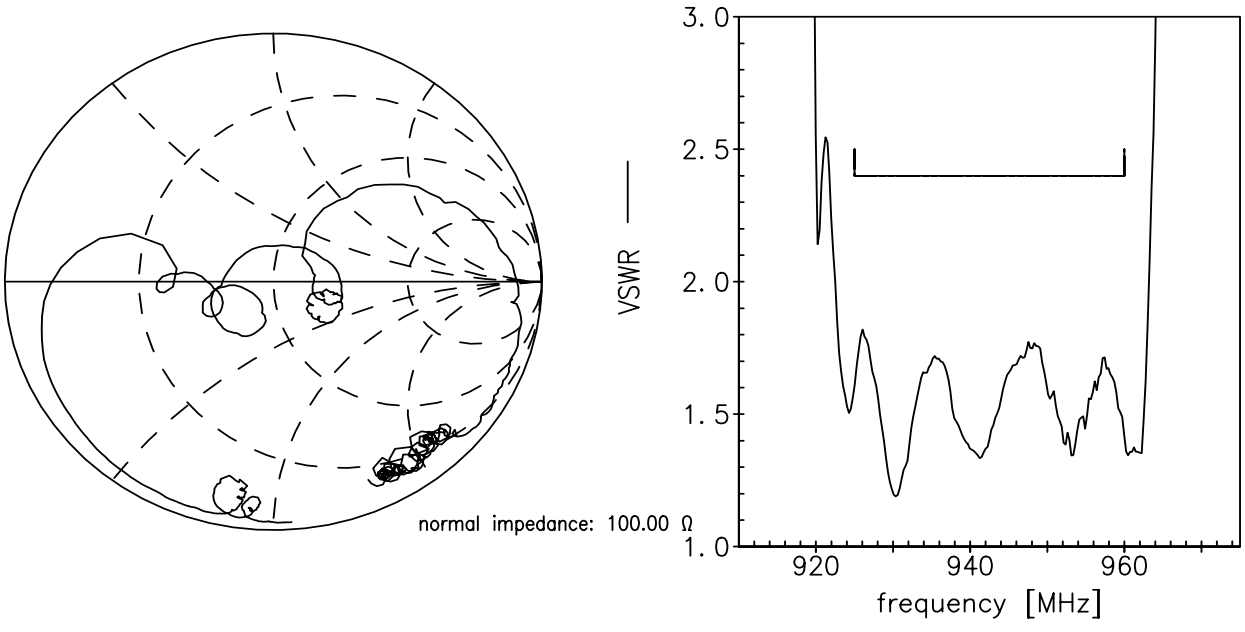


Smith chart

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 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.

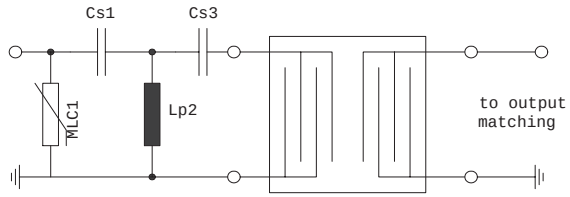


Fig. 1 MLC varistor plus ESD matching

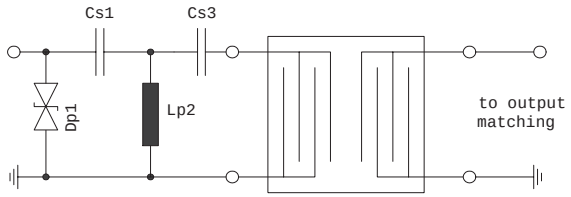


Fig. 2 Suppressor diode plus ESD matching

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

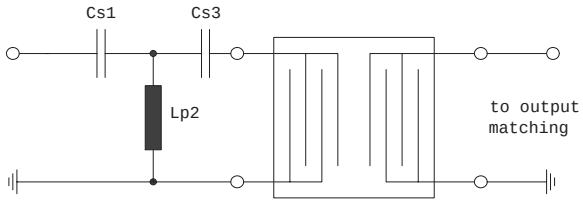


Fig. 3 3rd order high-pass structure for basic ESD protection

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”.

References

Type	B4323
Ordering code	B39941B4323P810
Marking and package	C61157-A8-A9
Packaging	F61074-V8212-Z000
Date codes	L_1126
S-parameters	B4323_NB.s3p, B4323_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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