



# SAW Filters for Automotive Electronics

## **Series/Type: B3511**

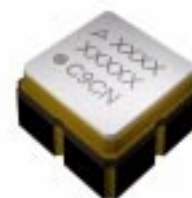
The following products presented in this data sheet are being withdrawn.

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B39192B3511U810		2013-05-10	2013-08-31	2013-11-30

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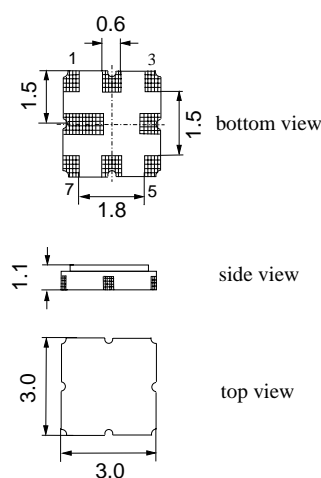
### Application

- Low-loss 2-in1-RF filter for mobile telephone PCS systems, transmit path
- Device with two integrated Tx-filter
- Usable passband of Tx-filter 1 30 MHz
- Usable passband of Tx-filter 2 30 MHz
- Extended temperature range for automotive application
- No matching network required for operation at 50 Ω



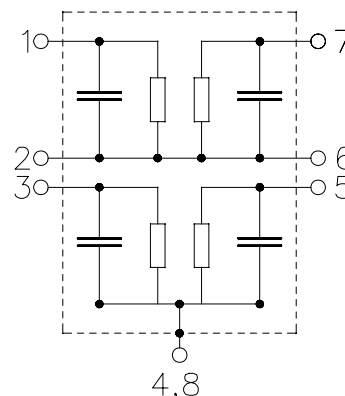
### Features

- Package size 3.0 x 3.0 x 1.1 mm<sup>3</sup>
- Package code QCC8D
- RoHS compatible
- Approximate weight 0.037 g
- Package for **Surface Mount Technology (SMT)**
- Ni, gold-plated terminals
- Lead free soldering compatible with J - STD20C
- Passivation layer Elpas
- AEC-Q200 qualified component family
- **Electrostatic Sensitive Device (ESD)**



### Pin configuration<sup>1)</sup>

- 1 Input Tx-filter 1
- 7 Output Tx-filter 1
- 2,6 To be grounded
- 3 Input Tx-filter 2
- 5 Output Tx-filter 2
- 4,8 Case/Ground, to be grounded



1) The recommended pin configuration usually offers best suppression of electrical crosstalk. The filter characteristics refer to this configuration.

**Data sheet**

**Characteristics of Tx-filter 1**

Temperature range for specification:  $T = -40\text{ °C to }+85\text{ °C}$   
 Terminating source impedance:  $Z_S = 50\ \Omega$   
 Terminating load impedance:  $Z_L = 50\ \Omega$

		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	$f_C$	—	1865.0	—	MHz
<b>Maximum insertion attenuation</b>	$\alpha_{\max}$				
1850.0 ... 1880.0 MHz		—	1.8	3.0	dB
<b>Amplitude ripple (p-p)</b>	$\Delta\alpha$				
1850.0 ... 1880.0 MHz		—	0.7	1.7	dB
<b>Input return loss</b>					
1850.0 ... 1880.0 MHz		9.0	10.0	—	dB
<b>Output return loss</b>					
1850.0 ... 1880.0 MHz		9.0	10.0	—	dB
<b>Attenuation</b>	$\alpha$				
10.0 ... 1770.0 MHz		24	26	—	dB
1770.0 ... 1800.0 MHz		26	30	—	dB
1930.0 ... 1960.0 MHz		36	41	—	dB
2113.0 ... 2174.0 MHz		32	34	—	dB
2200.0 ... 3000.0 MHz		20	26	—	dB

**Data sheet**

**Characteristics of Tx-filter 2**

Temperature range for specification:  $T = -40\text{ °C to }+85\text{ °C}$   
 Terminating source impedance:  $Z_S = 50\ \Omega$   
 Terminating load impedance:  $Z_L = 50\ \Omega$

		min.	typ. @ 25 °C	max.	
<b>Center frequency</b>	$f_C$	—	1895.0	—	MHz
<b>Maximum insertion attenuation</b>	$\alpha_{\max}$				
1880.0 ... 1910.0 MHz		—	1.8	3.0	dB
<b>Amplitude ripple (p-p)</b>	$\Delta\alpha$				
1880.0 ... 1910.0 MHz		—	0.7	1.7	dB
<b>Input return loss</b>					
1880.0 ... 1910.0 MHz		9.0	10.0	—	dB
<b>Output return loss</b>					
1880.0 ... 1910.0 MHz		9.0	10.0	—	dB
<b>Attenuation</b>	$\alpha$				
10.0 ... 1800.0 MHz		24	26	—	dB
1800.0 ... 1830.0 MHz		26	29	—	dB
1960.0 ... 1990.0 MHz		36	41	—	dB
2113.0 ... 2174.0 MHz		32	34	—	dB
2200.0 ... 3000.0 MHz		20	26	—	dB

**Maximum ratings**

Operable temperature range	T	−45/+125	°C	
Storage temperature range	T <sub>stg</sub>	−45/+125	°C	
DC voltage	V <sub>DC</sub>	6	V	
Input power max. 1850.0 ... 1910.0 MHz	P <sub>IN</sub>	10	dBm	source and load impedance 50 Ω continuous wave

### ESD protection of SAW filters

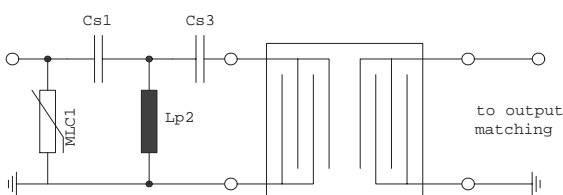
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

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

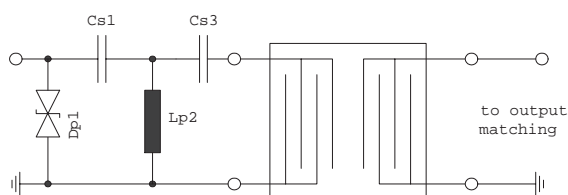
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

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.

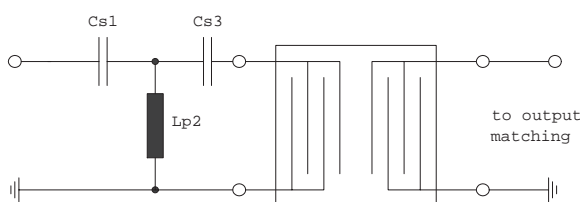


**Fig. 1 MLC varistor plus ESD matching**



**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>	B3511
<b>Ordering code</b>	B39192B3511U810
<b>Marking and package</b>	C61157-A7-A72
<b>Packaging</b>	F61074-V8168-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B3511_NB.s2p, B3511_WB.s2p 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.
<b>Moldability</b>	Before using in overmolding environment, please contact your EPCOS sales office.
<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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