



# SAW Components

## SAW RF filter

Digital radio

<b>Series/type:</b>	<b>B1646</b>
<b>Ordering code:</b>	<b>B39232B1646U410</b>
<b>Date:</b>	<b>May 29, 2013</b>
<b>Version:</b>	<b>2.1</b>

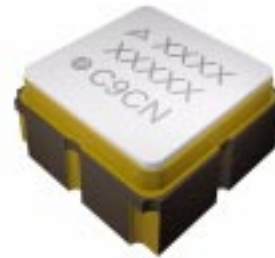
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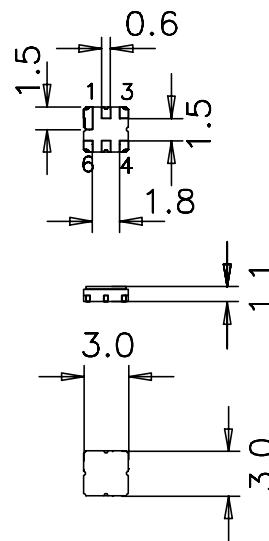
Data sheet


**Application**

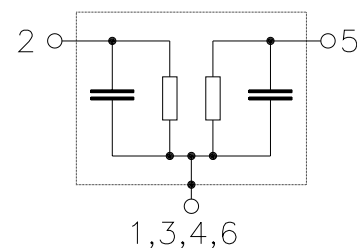
- Low-loss RF filter for digital radio
- Very low insertion attenuation
- Low amplitude ripple
- Usable passband 12.5 MHz
- no matching network required


**Features**

- Package size 3.0 x3.0 x 1.1 mm<sup>3</sup>
- Package code DCC6C
- RoHS compatible
- Approximate weight 0.037 g
- Package for **Surface Mount Technology (SMT)**
- Ni, gold-plated terminals
- AEC-Q200 qualified component family
- **Electrostatic Sensitive Device (ESD)**


**Pin configuration**

- 5 Input
- 2 Output
- 1,3,4,6 To be grounded



Data sheet


**Characteristics**

Temperature range for specification:	T = -20 °C to +85 °C
Terminating source impedance:	Z <sub>S</sub> = 50 Ω
Terminating load impedance:	Z <sub>L</sub> = 50 Ω

		min.	typ. @ 25 °C	max.	
<b>Nominal frequency</b>	f <sub>N</sub>	—	2326.25	—	MHz
<b>Maximum insertion attenuation</b>	α <sub>max</sub>	—	2.5	3.5	dB
2320.0 ... 2332.5 MHz					
<b>Amplitude ripple (p-p)</b>	Δα	—	0.6	1.5	dB
2320.0 ... 2332.5 MHz					
<b>Input return loss</b>		10.0	16.0	—	dB
<b>Output return loss</b>		10.0	15.0	—	dB
<b>Attenuation</b>	α				
50.0 ... 2175.0 MHz		27	34	—	dB
2227.0 MHz		19	26	—	dB
2400.0 MHz		12	18	—	dB
2500.0 MHz		23	29	—	dB
2700.0 ... 3000.0 MHz		27	34	—	dB
<b>Group delay ripple (p-p)</b>		—	5	15	ns
2320.0 ... 2332.5 MHz					

Data sheet


**Characteristics**

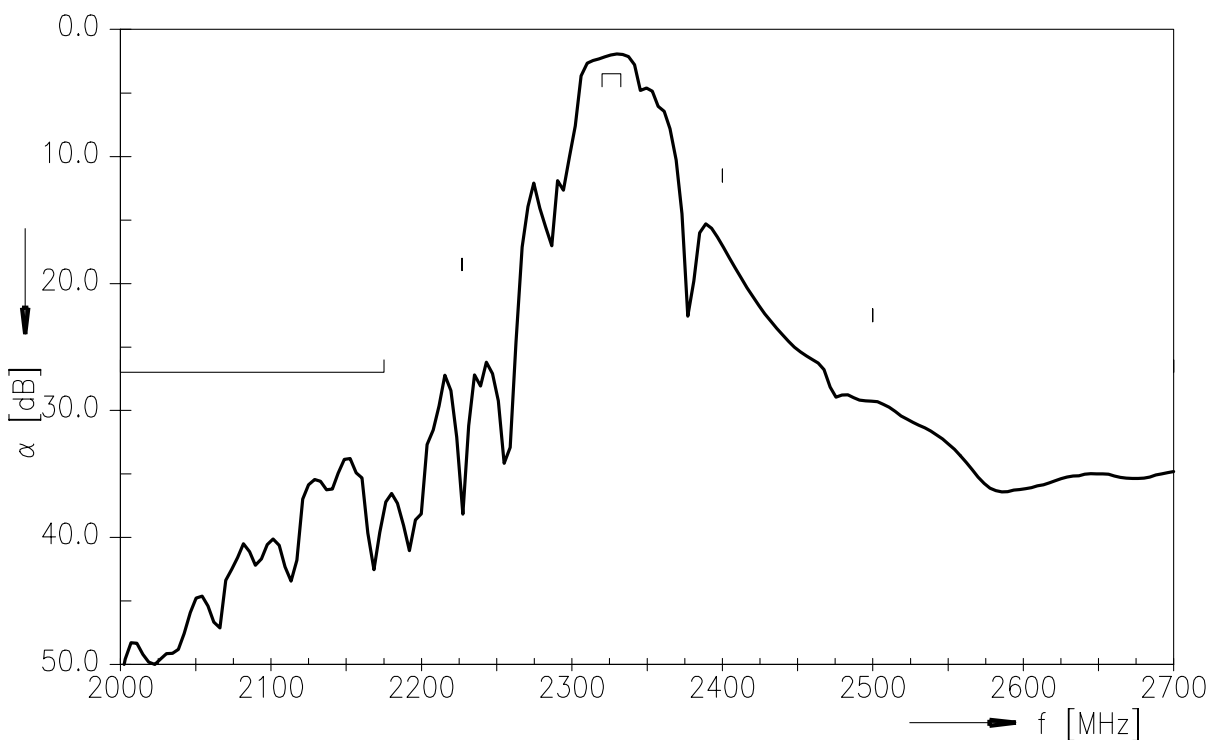
Temperature range for specification:	T = -40 °C to +105 °C
Terminating source impedance:	Z <sub>S</sub> = 50 Ω
Terminating load impedance:	Z <sub>L</sub> = 50 Ω

		min.	typ. @ 25 °C	max.	
<b>Nominal frequency</b>	f <sub>N</sub>	—	2326.25	—	MHz
<b>Maximum insertion attenuation</b>	α <sub>max</sub>	—	2.5	4.5	dB
2320.0 ... 2332.5 MHz					
<b>Amplitude ripple (p-p)</b>	Δα	—	0.6	2.6	dB
2320.0 ... 2332.5 MHz					
<b>Input return loss</b>		8.1	16.0	—	dB
<b>Output return loss</b>		8.1	15.0	—	dB
<b>Attenuation</b>	α				
50.0 ... 2175.0 MHz		27	34	—	dB
2227.0 MHz		19	26	—	dB
2400.0 MHz		12	18	—	dB
2500.0 MHz		23	29	—	dB
2700.0 ... 3000.0 MHz		27	34	—	dB
<b>Group delay ripple (p-p)</b>		—	5	30	ns
2320.0 ... 2332.5 MHz					


**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	
ESD voltage	V <sub>ESD</sub>	50 <sup>1)</sup>	V	machine model, 10 pulses
Input power at				
824.0 ... 849.0 MHz	P <sub>IN</sub>	30	dBm	
1850.0...1910.0 MHz	P <sub>IN</sub>	25	dBm	
2320.0...2332.5 MHz	P <sub>IN</sub>	8	dBm	source impedance 50 Ω

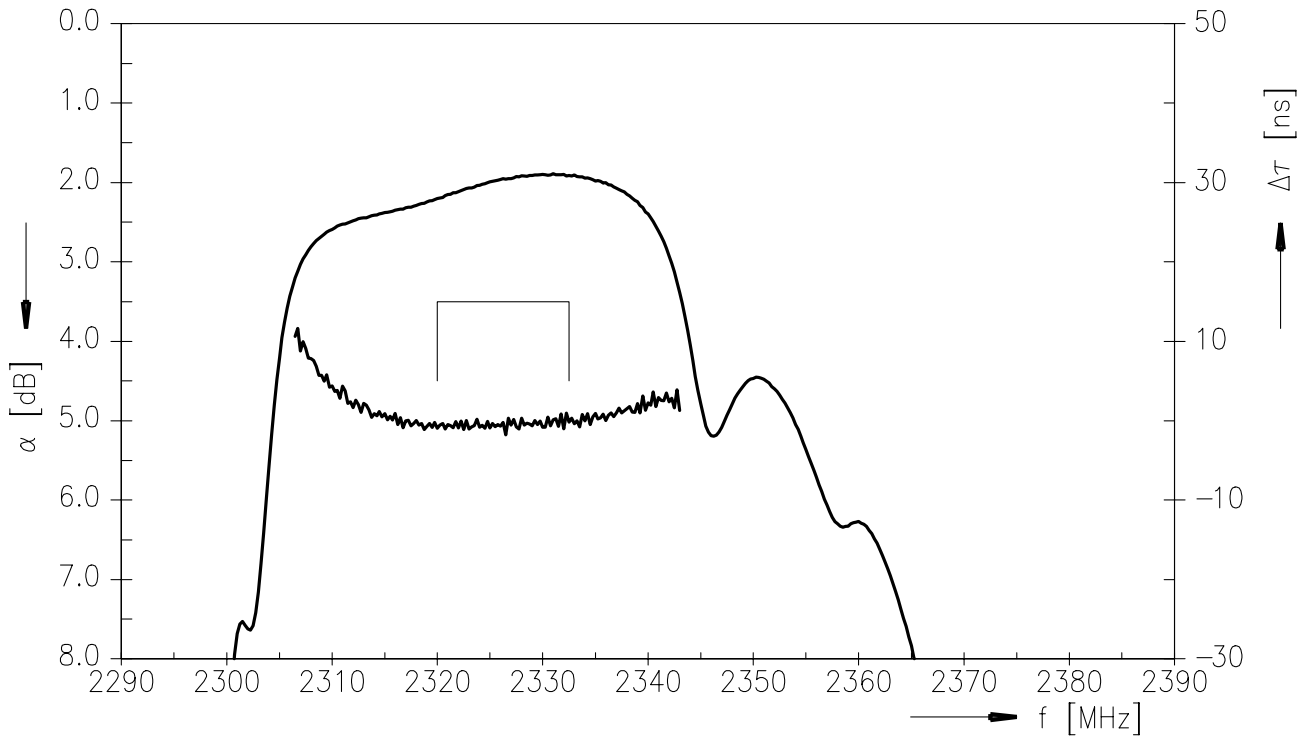
1) according to JESD22-A115B, 50V, Machine Model, 10 negative & 10 positive pulses.

**Transfer function**


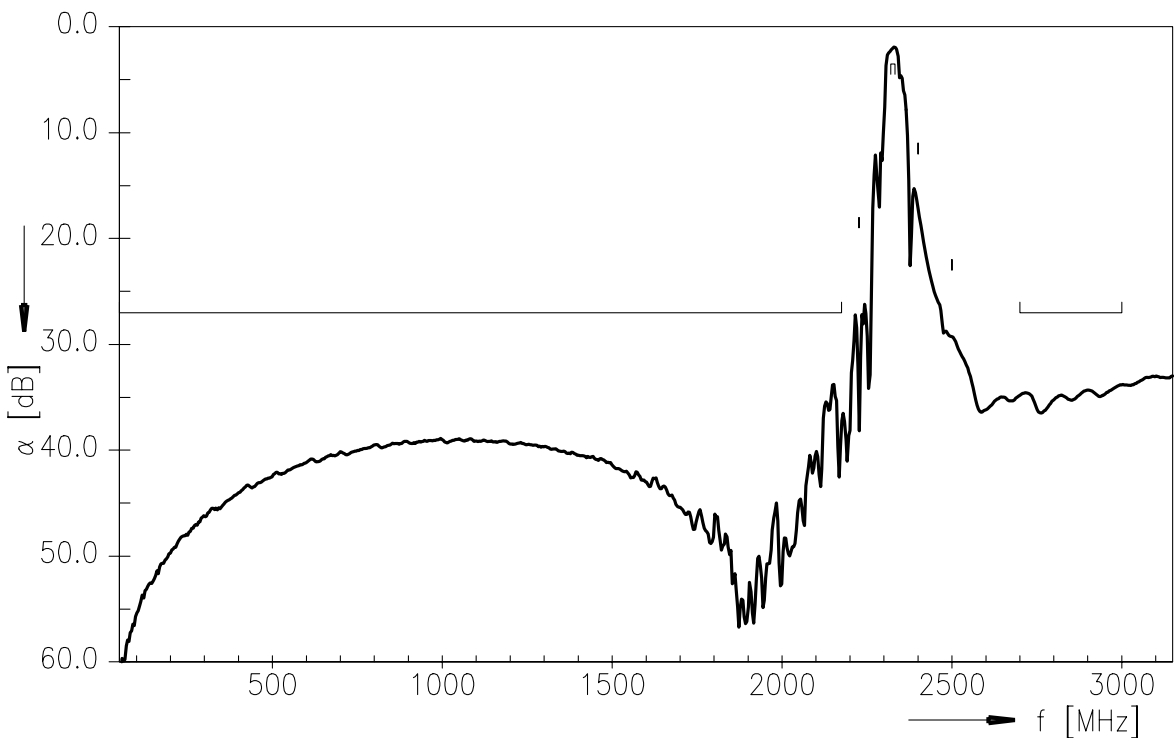
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**Transfer function (passband)**



**Transfer function (wideband)**





### ESD protection of SAW filters

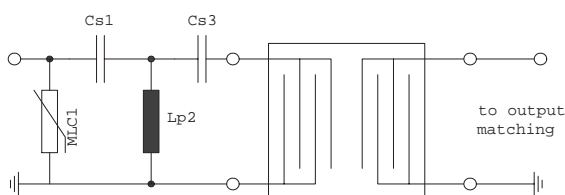
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

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

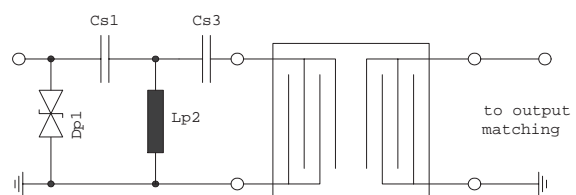
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

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.

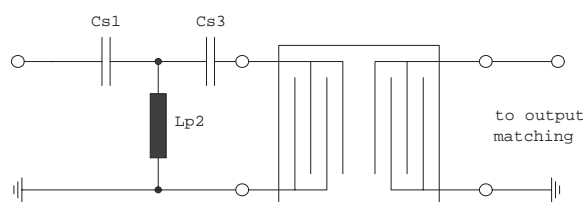


**Fig. 1 MLC varistor plus ESD matching**



**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>	B1646
<b>Ordering code</b>	B39232B1646U410
<b>Marking and package</b>	C61157-A7-A67
<b>Packaging</b>	F61074-V8168-Z000
<b>Date codes</b>	L_1126
<b>S-parameters</b>	B1646_NB.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>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> for a large variety of matching coils.

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**Published by EPCOS AG**  
**Systems, Acoustics, Waves Business Group**  
**P.O. Box 80 17 09, 81617 Munich, GERMANY**

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