# SAW Components

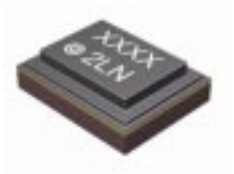
## SAW Tx Filter

Automotive Telematics

| | |
|---|---|
| **Series/type:** | **B4320** |
| **Ordering code:** | **B39851B4320P810** |
| Date: | August 13, 2013 |
| Version: | 2.0 |

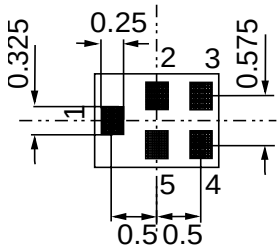
## Application

- Low-loss RF filter for LTE systems (Tx)
- No matching network required for operation at 50 Ω
- Unbalanced to unbalanced operation
- Usable passband 30 MHz

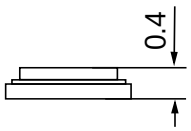



## Features

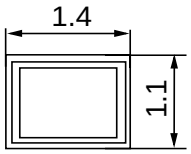
- Package size 1.4 x1.1 x 0.4 mm³
- Package code QCS5M
- RoHS compatible
- Approximate weight 0.003 g
- Package for **S**urface **M**ount **T**echnology (**SMT**)
- Ni, gold-plated terminals
- AEC-Q200 qualified component family (operable temperature range -40˚C to +85˚C)
- **E**lectrostatic **S**ensitive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




bottom view



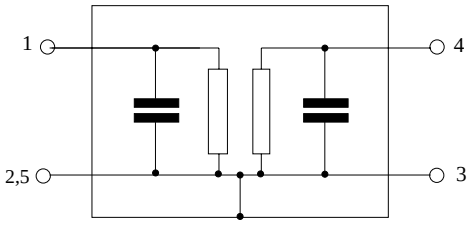

side view




top view

## Pin configuration

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



Data sheet SMD

## Characteristics

Temperature range for specification: T = –40 ˚C to +85 ˚C
Terminating source impedance: $Z_S$ = 50 Ω
Terminating load impedance: $Z_L$ = 50 Ω

| | | min. | typ. @ 25 ˚C | max. | |
|---|---|---|---|---|---|
| **Center frequency** | $f_C$ | — | 847.00 | — | MHz |
| **Maximum insertion attenuation** | $\alpha_{max}$ | | | | |
| 832.0 ... 862.0 MHz | | — | 1.6 | 2.5 | dB |
| 832.0 ... 862.0 MHz | | — | 1.6 | 2.4[1)] | dB |
| 832.0 ... 862.0 MHz | | — | 1.6 | 2.2[2)] | dB |
| **Amplitude ripple** (p-p) | Δα | | | | |
| 832.0 ... 862.0 MHz | | — | 0.8 | 1.8 | dB |
| 832.0 ... 862.0 MHz | | — | 0.8 | 1.7[3)] | dB |
| 832.0 ... 862.0 MHz | | — | 0.8 | 1.5[4)] | dB |
| **Input VSWR** | | | | | |
| 832.0 ... 862.0 MHz | | — | 2.0 | 2.4 | |
| **Output VSWR** | | | | | |
| 832.0 ... 862.0 MHz | | — | 1.9 | 2.3 | |
| **Absolute attenuation** | α | | | | |
| 50.00 ... 791.00 MHz | | 30.0 | 36.0 | — | dB |
| 791.00 ... 821.00 MHz | | 31.0 | 36.0 | — | dB |
| 925.00 ... 960.00 MHz | | 20.0 | 31.0 | — | dB |
| 1565.42 ... 1606.00 MHz | | 32.0 | 44.0 | — | dB |
| 1664.00 ... 1724.00 MHz | | 25.0 | 43.0 | — | dB |
| 1805.00 ... 1880.00 MHz | | 25.0 | 42.0 | — | dB |
| 2110.00 ... 2170.00 MHz | | 25.0 | 42.0 | — | dB |
| 2400.00 ... 2496.00 MHz | | 31.0 | 42.0 | — | dB |
| 2496.00 ... 2586.00 MHz | | 25.0 | 34.0 | — | dB |
| 2586.00 ... 2620.00 MHz | | 30.0 | 40.0 | — | dB |
| 2620.00 ... 2690.00 MHz | | 25.0 | 42.0 | — | dB |
| 3328.00 ... 3448.00 MHz | | 20.0 | 45.0 | — | dB |

1) 2.4 dB for reduced temperature range –30 ˚C to +85 ˚C.

2) 2.2 dB for reduced temperature range –10 ˚C to +60 ˚C.

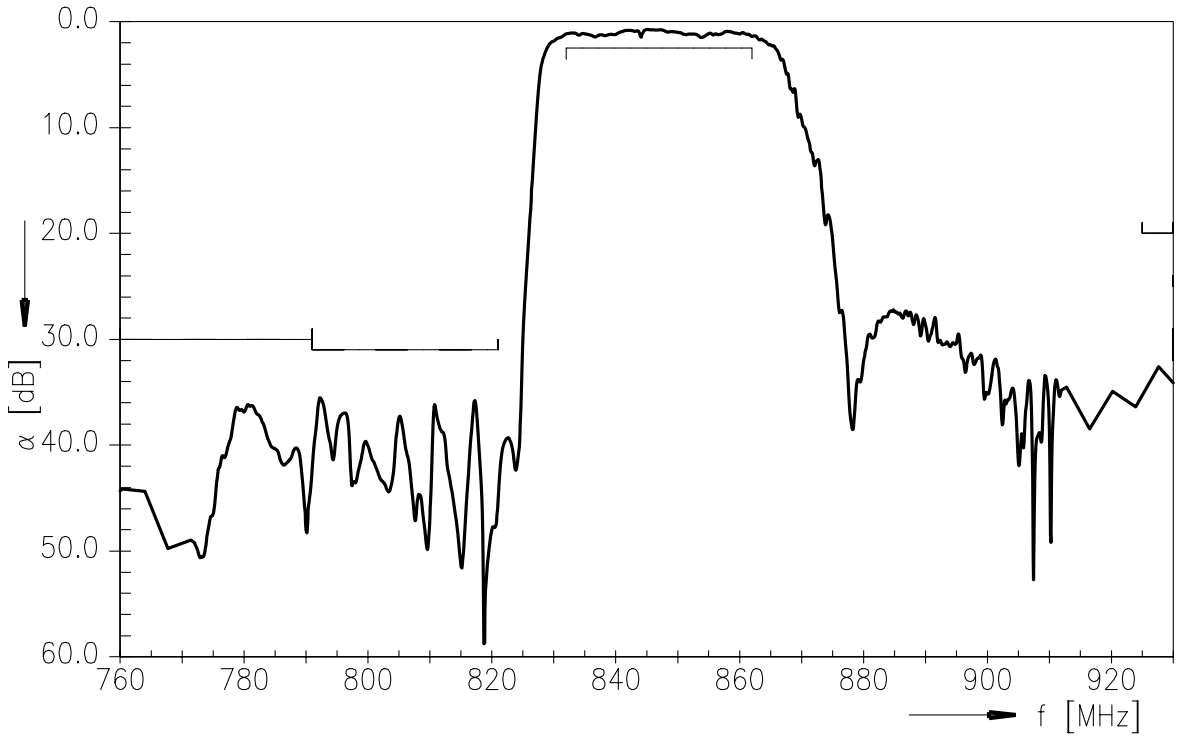
3) 1.7 dB for reduced temperature range –30 ˚C to +85 ˚C.

4) 1.5 dB for reduced temperature range –10 ˚C to +60 ˚C.

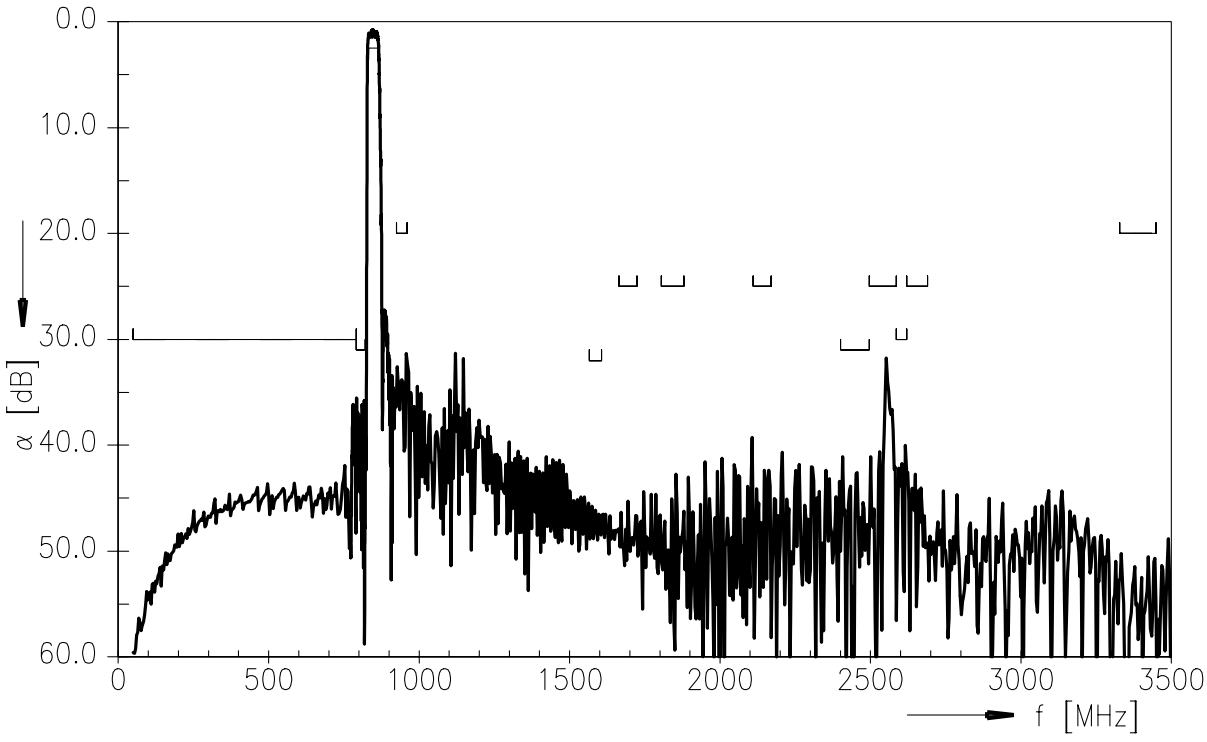
## Maximum ratings

| | | | | |
|---|---|---|---|---|
| Operable temperature range | $T$ | –40/+85 | ˚C | |
| Storage temperature range | $T_{stg}$ | –40/+85 | ˚C | |
| DC voltage | $V_{DC}$ | 0 | V | |
| Input power at | | | | |
| 832.0 ... 862.0 MHz | $P_{IN}$ | 13 | dBm | continous wave, 55˚C , 50000h |

**Frequency response** (narrowband)

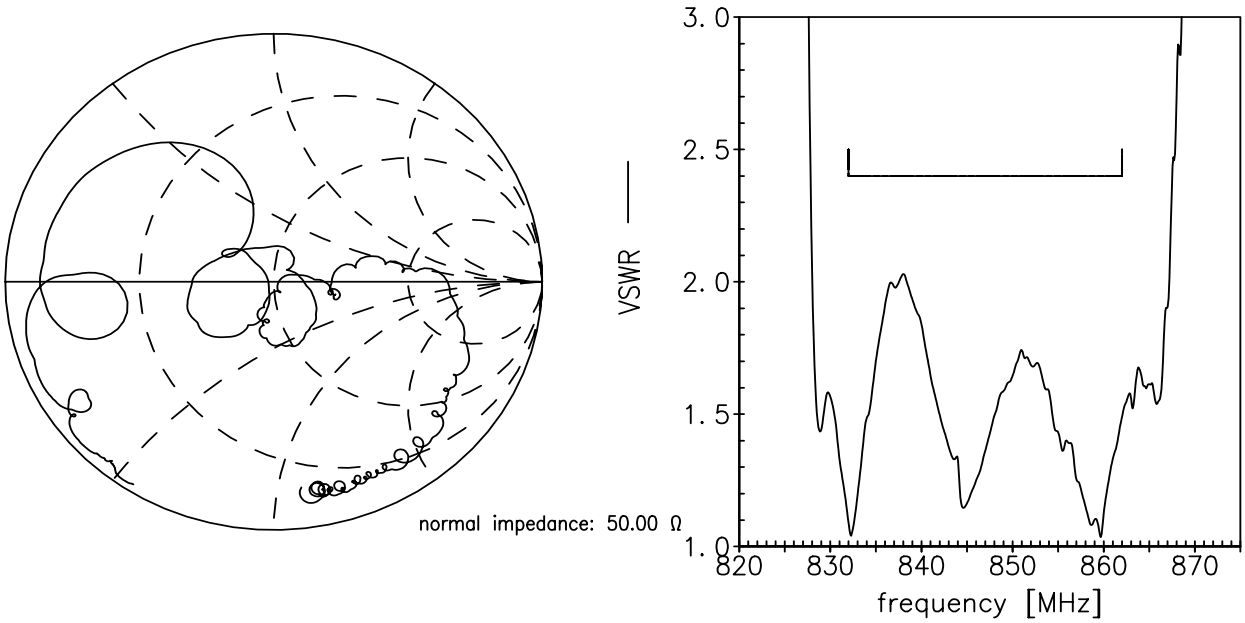



**Frequency response** (wideband)

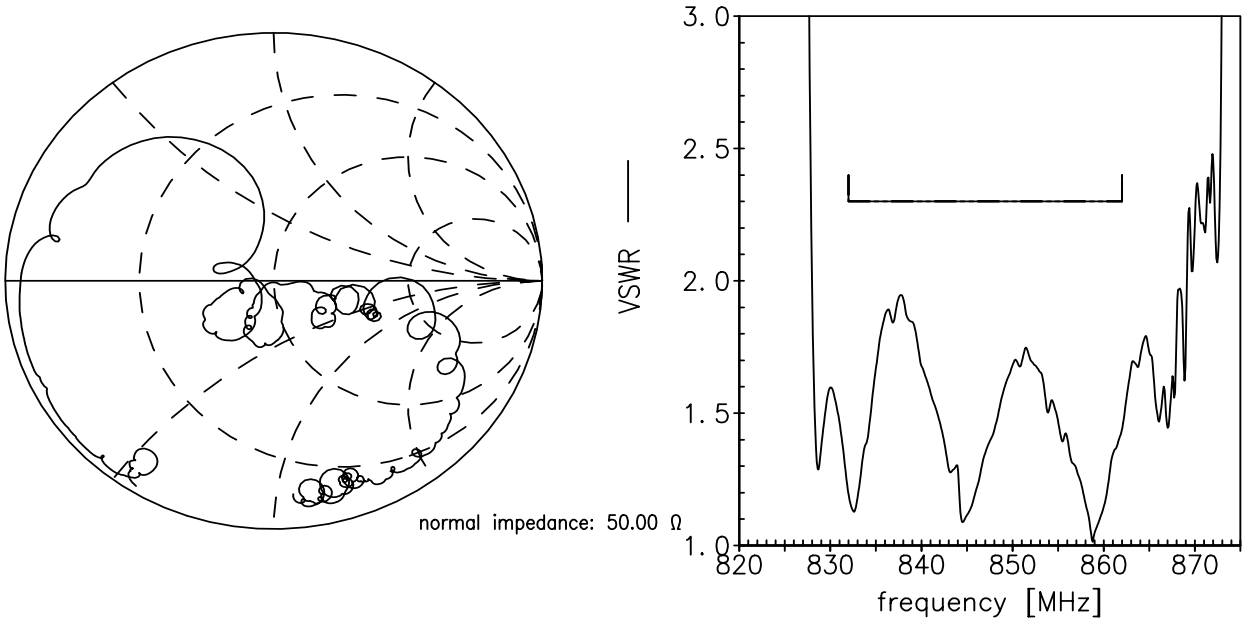


**Smith chart**

**$S_{11}$ 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.

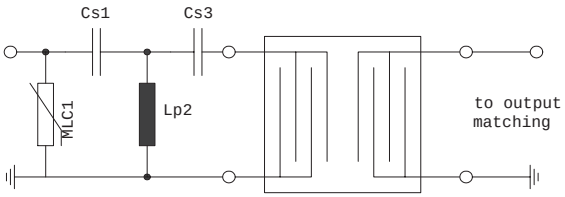



**Fig. 1 MLC varistor plus ESD matching**

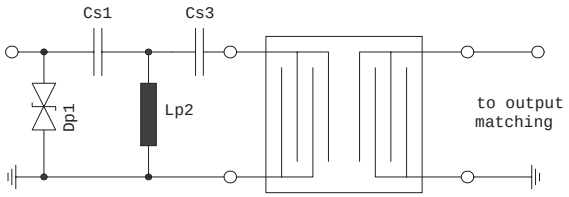



**Fig. 2 Suppressor diode plus ESD matching**

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

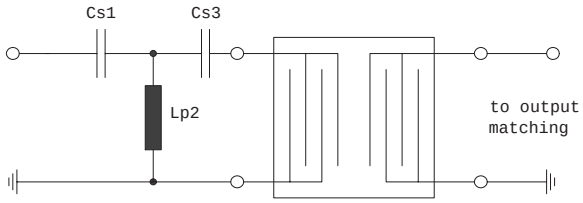



**Fig. 3 3rd order high-pass structure for basic ESD protection**

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** | B4320 |
| **Ordering code** | B39851B4320P810 |
| **Marking and package** | C61157-A8-A8 |
| **Packaging** | F61074-V8212-Z000 |
| **Date codes** | L_1126 |
| **S-parameters** | B4320_NB.s2p, B4320_WB.s2p<br>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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