SAW components

SAW Rx filter
Automotive telematics
TD-LTE band 40

Series/type: B4352
Ordering code: B39242B4352P810
Date: April 14, 2016
Version: 2.0
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Please read **Cautions and warnings** and **Important notes** at the end of this document.
SAW components

SAW Rx filter

Data sheet

1 Application
- Low-loss RF filter for TD-LTE Band 40 system, receive path (Rx)
- Suitable for diversity applications
- Usable pass band 100 MHz

2 Features
- Package size 1.4±0.1 mm × 1.1±0.1 mm
- Package height 0.45 mm (max.)
- Package code QCS5P
- Approximate weight 3 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Filter surface passivated
- AEC-Q200 qualified component family (operable temperature range −40 °C to +85 °C)
- Electrostatic Sensitive Device (ESD)

Figure 1: Picture of component with example of product marking.

Please read Cautions and warnings and Important notes at the end of this document.

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### 3 Package

**BOTTOM VIEW**

- Input
- Output
- Ground

**SIDE VIEW**

- Input
- Output
- Ground

**TOP VIEW**

- Example of encoded lot number
- Example of encoded filter type number

**Thru View**

- Land pattern

**Figure 2:** Drawing of package with package height $A = 0.45$ mm (max.). See Sec. Package information (p. 16).
5 Matching circuit

- $L_{p1} = 4.7 \text{ nH}$
- $L_{p4} = 6.2 \text{ nH}$

**Figure 3:** Schematic of matching circuit.
6 Characteristics

Temperature range for specification
\( T_{\text{SPEC}} = -40 \, ^\circ\text{C} \ldots +85 \, ^\circ\text{C} \)

Input terminating impedance
\( Z_N = 50 \, \Omega \) with par. 4.7 nH\(^1\)

Output terminating impedance
\( Z_{\text{OUT}} = 50 \, \Omega \) with par. 6.2 nH\(^1\)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>min. for ( T_{\text{SPEC}} )</th>
<th>typ. @+25 (^\circ\text{C})</th>
<th>max. for ( T_{\text{SPEC}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center frequency ( f_c )</td>
<td>---</td>
<td>2350 ( \ldots ) MHz</td>
<td>--- 2350 ( \ldots ) MHz</td>
</tr>
<tr>
<td>Maximum insertion attenuation ( \alpha_{\text{max}} )</td>
<td>---</td>
<td>2.8 4.0 dB</td>
<td>--- 2.8 4.0 dB</td>
</tr>
</tbody>
</table>

Amplitude ripple (p-p) \( \Delta \alpha \)
\( 2300 \ldots 2400 \) MHz

<table>
<thead>
<tr>
<th>Maximum VSWR ( VSWR_{\text{max}} )</th>
<th>@ input port</th>
<th>2300 \ldots 2400 MHz</th>
<th>--- 1.8 2.3 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>@ output port</td>
<td>2300 \ldots 2400 MHz</td>
<td>--- 1.9 2.3 dB</td>
</tr>
<tr>
<td>Minimum attenuation ( \alpha_{\text{min}} )</td>
<td>50 \ldots 1559 MHz</td>
<td>40 54 dB</td>
<td>--- 40 54 dB</td>
</tr>
<tr>
<td></td>
<td>1559 \ldots 1606 MHz</td>
<td>40 57 dB</td>
<td>--- 40 57 dB</td>
</tr>
<tr>
<td></td>
<td>1606 \ldots 2125 MHz</td>
<td>36 40 dB</td>
<td>--- 36 40 dB</td>
</tr>
<tr>
<td></td>
<td>2125 \ldots 2215 MHz</td>
<td>30 38 dB</td>
<td>--- 30 38 dB</td>
</tr>
<tr>
<td></td>
<td>2215 \ldots 2240 MHz</td>
<td>30 36 dB</td>
<td>--- 30 36 dB</td>
</tr>
<tr>
<td></td>
<td>2430 \ldots 2440 MHz</td>
<td>12 35 dB</td>
<td>--- 12 35 dB</td>
</tr>
<tr>
<td></td>
<td>2440 \ldots 2450 MHz</td>
<td>31 36 dB</td>
<td>--- 31 36 dB</td>
</tr>
<tr>
<td></td>
<td>2450 \ldots 2500 MHz</td>
<td>32 41 dB</td>
<td>--- 32 41 dB</td>
</tr>
<tr>
<td></td>
<td>2500 \ldots 2690 MHz</td>
<td>33 37 dB</td>
<td>--- 33 37 dB</td>
</tr>
<tr>
<td></td>
<td>4600 \ldots 4800 MHz</td>
<td>26 35 dB</td>
<td>--- 26 35 dB</td>
</tr>
<tr>
<td></td>
<td>4900 \ldots 5950 MHz</td>
<td>24 33 dB</td>
<td>--- 24 33 dB</td>
</tr>
</tbody>
</table>

1) See Sec. Matching circuit (p. 5).
### Maximum ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operable temperature</td>
<td>( T_{\text{OP}} = -40 , ^\circ\text{C} \ldots +85 , ^\circ\text{C} )</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( T_{\text{STG}} = -40 , ^\circ\text{C} \ldots +85 , ^\circ\text{C} )</td>
</tr>
<tr>
<td>DC voltage</td>
<td>( V_{\text{DC}} = 0 , \text{V} )</td>
</tr>
<tr>
<td>Input power @ input port: 2300 ... 2400 MHz</td>
<td>( P_{\text{IN}} = 16 , \text{dBm} ) Continuous wave for 2000 h @ 55 , ^\circ\text{C}.</td>
</tr>
</tbody>
</table>
8 Transmission coefficient

Figure 4: Attenuation.
9 Reflection coefficients

Figure 5: Reflection coefficient at IN port.

Figure 6: Reflection coefficient at OUT port.

Please read Cautions and warnings and Important notes at the end of this document.
10 Packing material

10.1 Tape

Section Y-Y

Figure 7: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

Table 1: Tape dimensions.

<table>
<thead>
<tr>
<th>A</th>
<th>1.27±0.05 mm</th>
<th>E2</th>
<th>6.25 mm (min.)</th>
<th>P1</th>
<th>4.0±0.1 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>1.57±0.05 mm</td>
<td>F</td>
<td>3.5±0.05 mm</td>
<td>P2</td>
<td>2.0±0.05 mm</td>
</tr>
<tr>
<td>D0</td>
<td>1.5±0.1 mm</td>
<td>G</td>
<td>0.75 mm (min.)</td>
<td>T</td>
<td>0.25±0.03 mm</td>
</tr>
<tr>
<td>D1</td>
<td>0.5±0.1 mm</td>
<td>K0</td>
<td>0.62±0.05 mm</td>
<td>W</td>
<td>8.0±0.3–0.1 mm</td>
</tr>
<tr>
<td>E1</td>
<td>1.75±0.1 mm</td>
<td>P0</td>
<td>4.0±0.1 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.2 Reel with diameter of 180 mm

Figure 8: Drawing of reel (first-angle projection) with diameter of 180 mm.
Figure 9: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

Figure 10: Drawing of folding box for reel with diameter of 180 mm.

11 Marking
Products are marked with product type number and lot number encoded according to Table 2:
- Type number:
SAW components

B4352

SAW Rx filter

Data sheet

The 4 digit type number of the ordering code, e.g., B3xxxxB1234xxxx, is encoded by a special BASE32 code into a 3 digit marking.

Example of decoding type number marking on device in decimal code.

\[
16J \Rightarrow 1234
\]

\[
1 \times 32^2 + 6 \times 32^1 + 18 (=J) \times 32^0 = 1234
\]

The BASE32 code for product type B4352 is 480.

Lot number:

The last 5 digits of the lot number, e.g., 12345, are encoded based on a special BASE47 code into a 3 digit marking.

Example of decoding lot number marking on device in decimal code.

\[
5UY \Rightarrow 12345
\]

\[
5 \times 47^2 + 27 (=U) \times 47^1 + 31 (=Y) \times 47^0 = 12345
\]

<table>
<thead>
<tr>
<th>Adopted BASE32 code for type number</th>
<th>Adopted BASE47 code for lot number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal value</td>
<td>Base32 code</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
</tr>
<tr>
<td>12</td>
<td>C</td>
</tr>
<tr>
<td>13</td>
<td>D</td>
</tr>
<tr>
<td>14</td>
<td>E</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
</tr>
<tr>
<td>16</td>
<td>G</td>
</tr>
<tr>
<td>17</td>
<td>H</td>
</tr>
<tr>
<td>18</td>
<td>J</td>
</tr>
<tr>
<td>19</td>
<td>K</td>
</tr>
<tr>
<td>20</td>
<td>L</td>
</tr>
<tr>
<td>21</td>
<td>M</td>
</tr>
<tr>
<td>22</td>
<td>N</td>
</tr>
<tr>
<td>23</td>
<td>P</td>
</tr>
</tbody>
</table>

Table 2: Lists for encoding and decoding of marking.
12 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3rd edit and IPC/JEDEC J-STD-020B.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ramp rate</td>
<td>≤ 3 K/s</td>
</tr>
<tr>
<td>preheat</td>
<td>125 °C to 220 °C; 150 s to 210 s, 0.4 K/s to 1.0 K/s</td>
</tr>
<tr>
<td>$T &gt; 220 ^\circ C$</td>
<td>30 s to 70 s</td>
</tr>
<tr>
<td>$T &gt; 230 ^\circ C$</td>
<td>min. 10 s</td>
</tr>
<tr>
<td>$T &gt; 245 ^\circ C$</td>
<td>max. 20 s</td>
</tr>
<tr>
<td>$T \geq 255 ^\circ C$</td>
<td>–</td>
</tr>
<tr>
<td>peak temperature $T_{peak}$</td>
<td>250 °C +0/-5 °C</td>
</tr>
<tr>
<td>wetting temperature $T_{min}$</td>
<td>230 °C +5/-0 °C for 10 s ± 1 s</td>
</tr>
<tr>
<td>cooling rate</td>
<td>≤ 3 K/s</td>
</tr>
<tr>
<td>soldering temperature $T$</td>
<td>measured at solder pads</td>
</tr>
</tbody>
</table>

Table 3: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

Figure 11: Recommended reflow profile for convection and infrared soldering – lead-free solder.
ESD protection of SAW filters

SAW filters are Electro Static Discharge 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 wide band 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.

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

In all three figures the shunt inductor $L_{p2}$ 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”.

Please read Cautions and warnings and Important notes at the end of this document.
14 Annotations

14.1 Matching coils

See TDK inductor pdf-catalog [http://www.tdk.co.jp/tfe02/coil.htm#aname1](http://www.tdk.co.jp/tfe02/coil.htm#aname1) and Data Library for circuit simulation [http://www.tdk.co.jp/etvcl/index.htm](http://www.tdk.co.jp/etvcl/index.htm).

14.2 RoHS compatibility

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.

14.3 Scattering parameters (S-parameters)

The pin/port assignment is available in the headers of the S-parameter files. Please contact your local EPCOS sales office.
15  Cautions and warnings

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due to different processes employed and do not affect the specifications of the respective products.
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the type in question please also contact one of our sales offices.

15.3  Moldability

Before using in overmolding environment, please contact your local EPCOS sales office.

15.4  Package information

Landing area

The printed circuit board (PCB) land pattern (landing area) shown is based on EPCOS internal
development and empirical data and illustrated for example purposes, only. As customers' SMD
assembly processes may have a plenty of variants and influence factors which are not under control
or knowledge of EPCOS, additional careful process development on customer side is necessary and
strongly recommended in order to achieve best soldering results tailored to the particular customer
needs.

Dimensions

Unless otherwise specified all dimensions are understood using unit millimeter (mm).

Dimensions do not include burrs.

Projection method

Unless otherwise specified first-angle projection is applied.
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