



RF360  
Europe GmbH

## SAW Components

### SAW RF Filter

Automotive Telematics

Series/type:	B4349
Ordering code:	B39262B4349P810
Date:	December 21, 2015
Version:	2.1

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Data sheet

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## 1 Application

- Low-loss SAW filter for LTE Band 41 systems.
- Low insertion attenuation.
- Usable pass band 194MHz.

## 2 Features

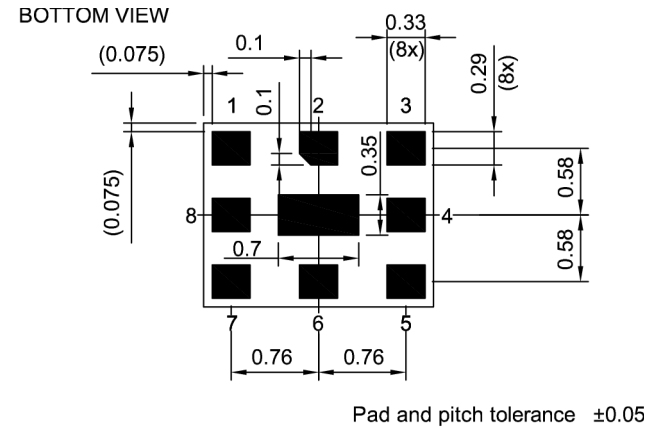
- Package size 2.0±0.1 mm × 1.6±0.1 mm.
- Package height 0.45 mm (max.).
- Package code QCD9L.
- Approximate weight 0.005 g.
- RoHS compatible.
- Package for Surface Mount Technology (SMT).
- Ni/Au-plated terminals.
- Filter surface passivated.
- AEC-Q200 qualified component family (operable temperature range -40 °C to +85 °C).
- Electrostatic Sensitive Device (ESD).



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

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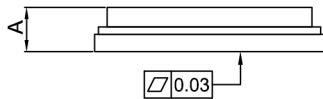
3 Package



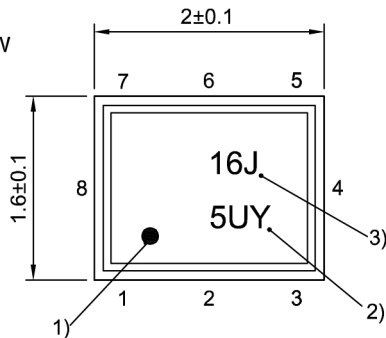
4 Pin configuration

- 3 Output
- 8 Input
- 1, 2, 4, 5, 6, 7, 9 Ground

SIDE VIEW

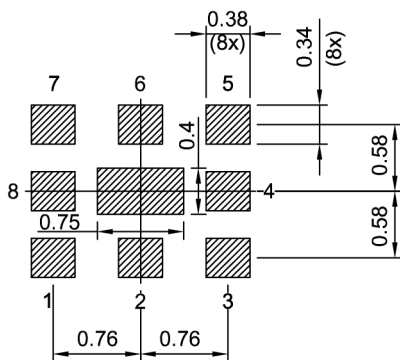


TOP VIEW



- 1) Marking for pad number 1
- 2) Example of encoded lot number
- 3) Example of encoded filter type number

Land pattern THRU VIEW

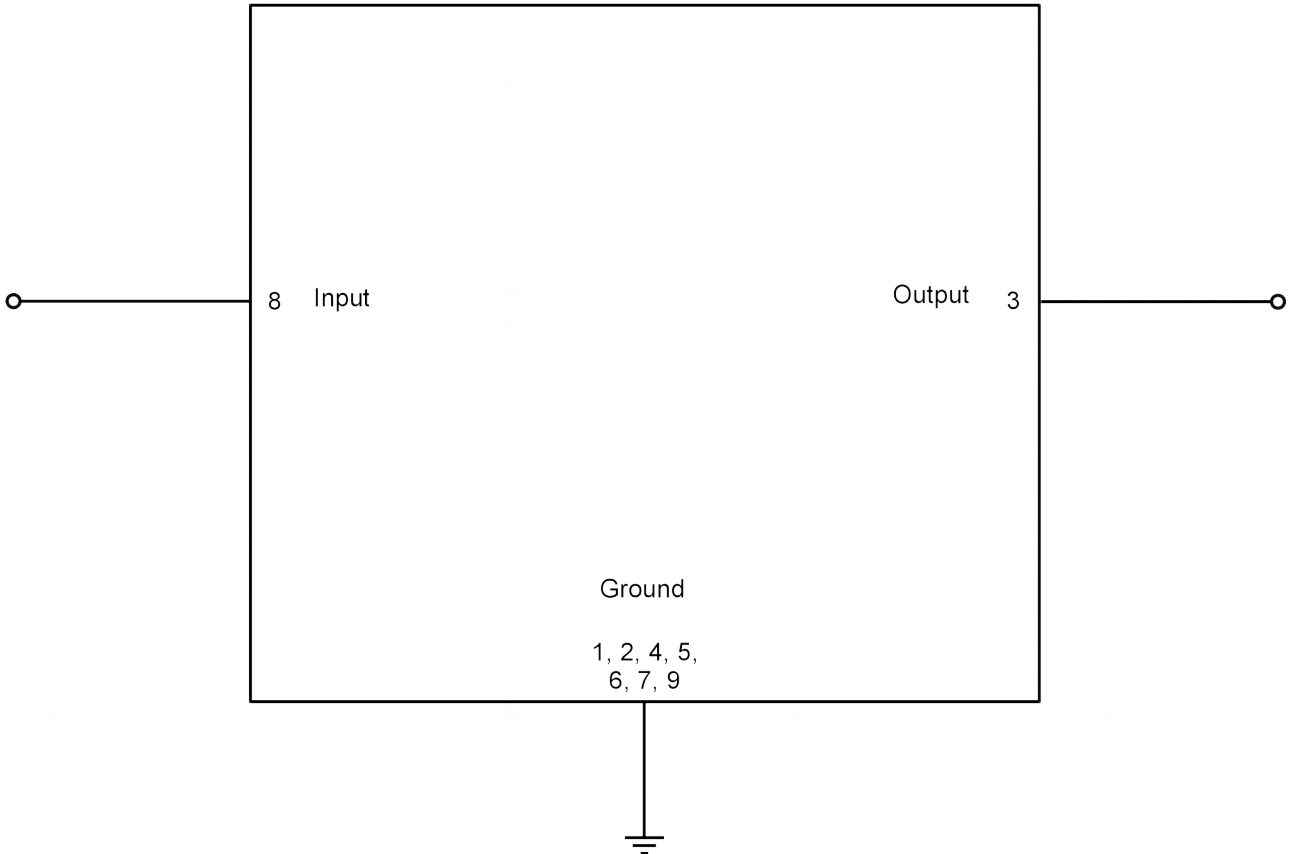


Landing pad tolerance -0.02

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Simplified drawings (p. 15).

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**5 Matching circuit**



**Figure 3:** Schematic of matching circuit. No external matching components required.

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## 6 Characteristics

Temperature range for specification	$T$	= -30 °C to +85 °C
Input terminating impedance	$Z_{IN}$	= 50 $\Omega$
Output terminating impedance	$Z_{OUT}$	= 50 $\Omega$

Characteristics		min.	typ. @+25 °C	max.	
<b>Center frequency</b>	$f_c$	—	2593	—	MHz
<b>Maximum insertion attenuation</b>	$\alpha_{max}$	—	3.5	6.0	dB
2496... 2690 MHz					
<b>Amplitude ripple (p-p)</b>	$\Delta\alpha$	—	1.7	4.3	dB
2496... 2690 MHz					
<b>Maximum VSWR</b>	$VSWR_{max}$				
@ input port		—	1.7	2.2	
@ output port		—	1.6	2.2	
<b>Minimum attenuation</b>	$\alpha_{min}$				
10... 1360 MHz		30	34	—	dB
1361... 1564 MHz		25	28	—	dB
1565... 1615 MHz		24	27	—	dB
1920... 1980 MHz		20	22	—	dB
2400... 2451.5 MHz		25	30	—	dB
2452.5... 2466.5 MHz		27	32	—	dB
2467.5... 2471.5 MHz		14	38	—	dB
2472.5... 2476.5 MHz		5	38	—	dB
4992... 5380 MHz		23	30	—	dB
5381... 7000 MHz		23	33	—	dB
7001... 7487 MHz		13	19	—	dB
7488... 7990 MHz		7	14	—	dB



<b>SAW Components</b>	<b>B4349</b>
<b>SAW RF Filter</b>	<b>2593 MHz</b>

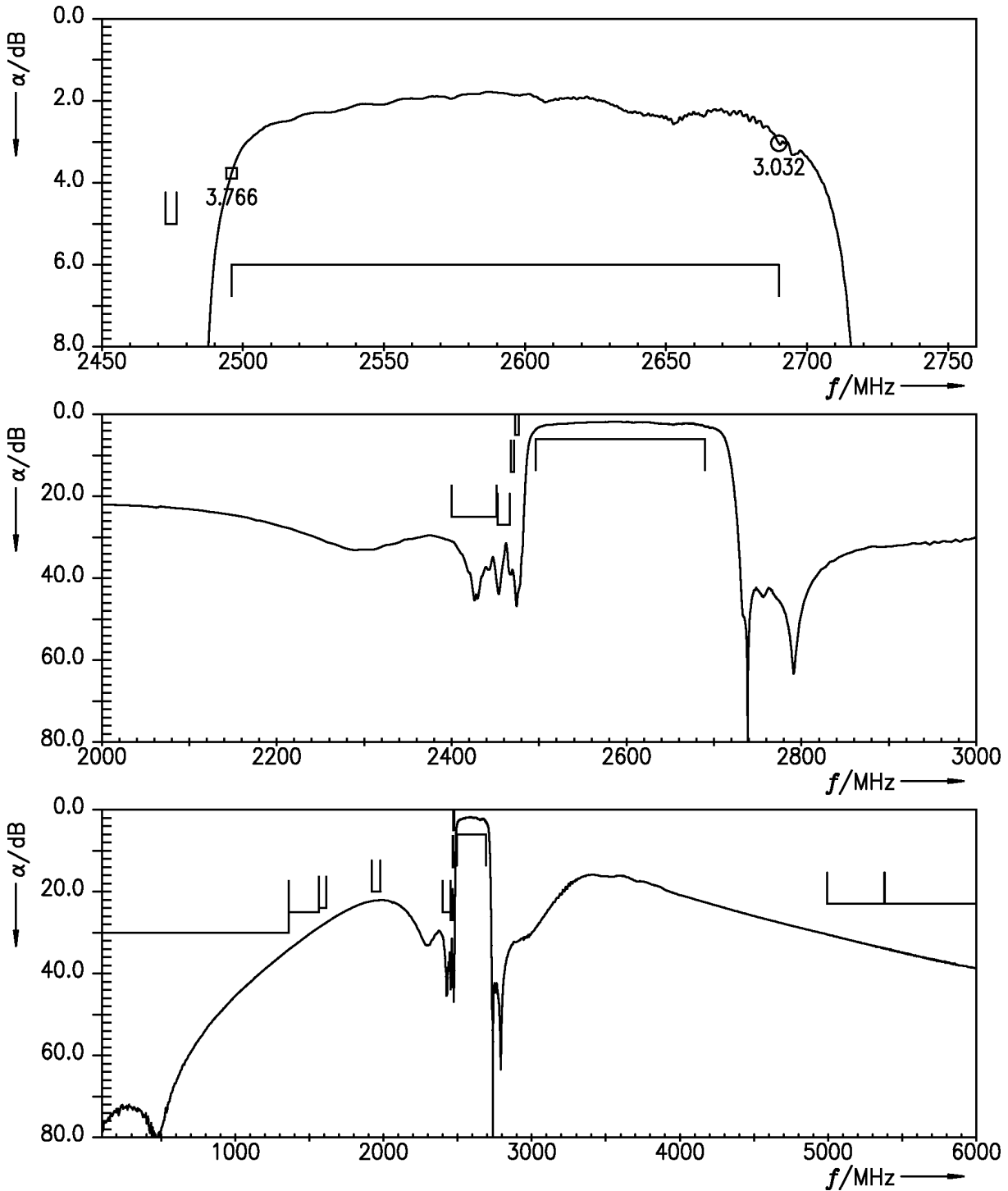
Data sheet

**7 Maximum ratings**

Operable temperature	$T_{OP} = -40\text{ °C to }+85\text{ °C}$	
Storage temperature	$T_{STG} = -40\text{ °C to }+85\text{ °C}$	
DC voltage	$V_{DC} = 0\text{ V (max.)}$	
Input power @ input port: 2496 ... 2690 MHz	$P_{IN} = 21\text{ dBm}$	Continuous wave for 10000 h @ 55 °C.

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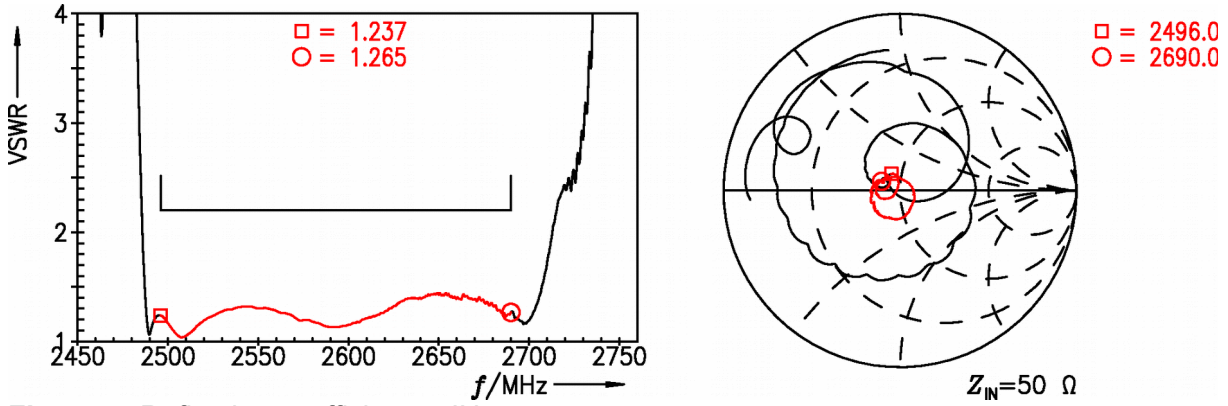
**8 Transmission coefficient**



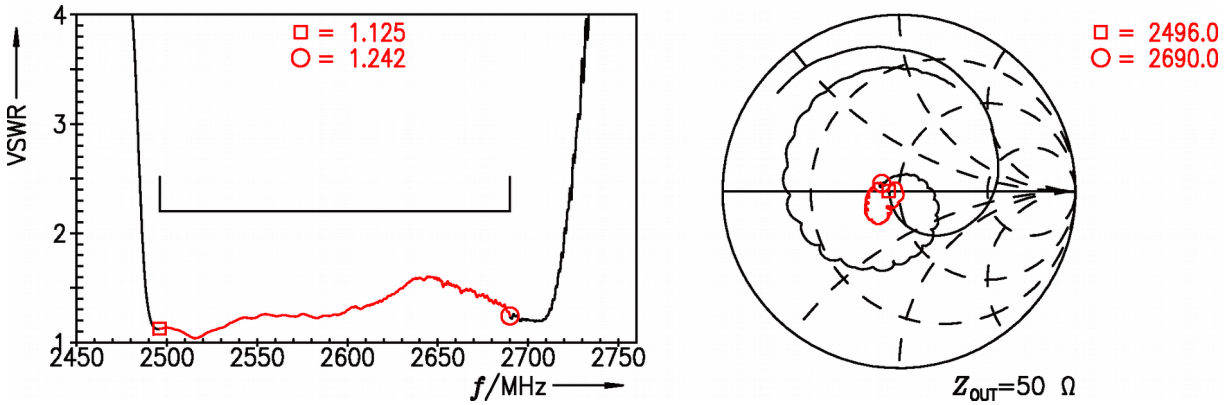
**Figure 4:** Attenuation.

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**9 Reflection coefficients**



**Figure 5:** Reflection coefficient at IN port.



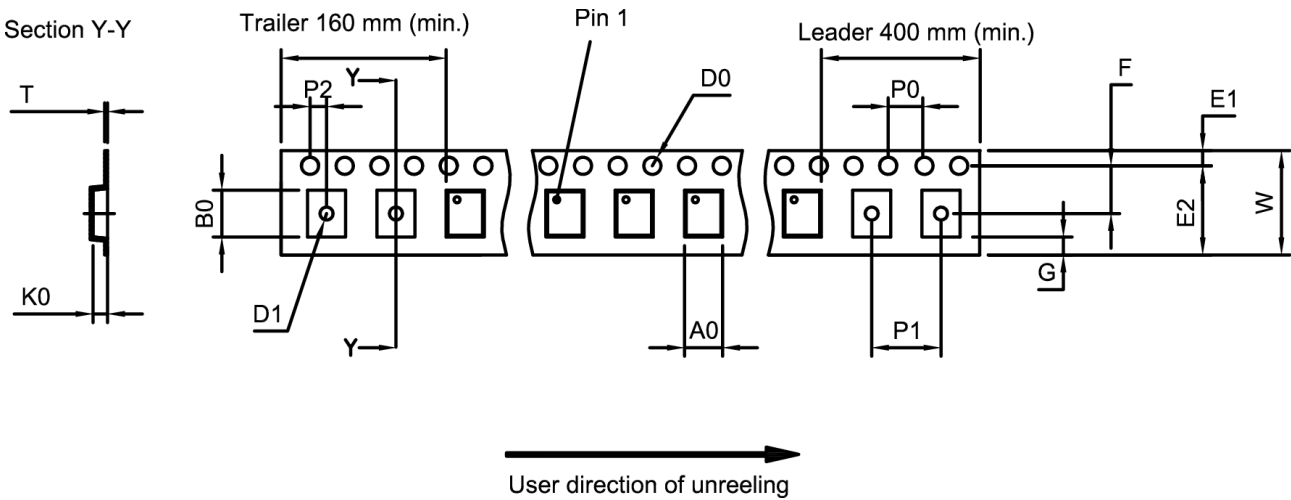
**Figure 6:** Reflection coefficient at OUT port.

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**10 Packing material**

**10.1 Tape**

Section Y-Y



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

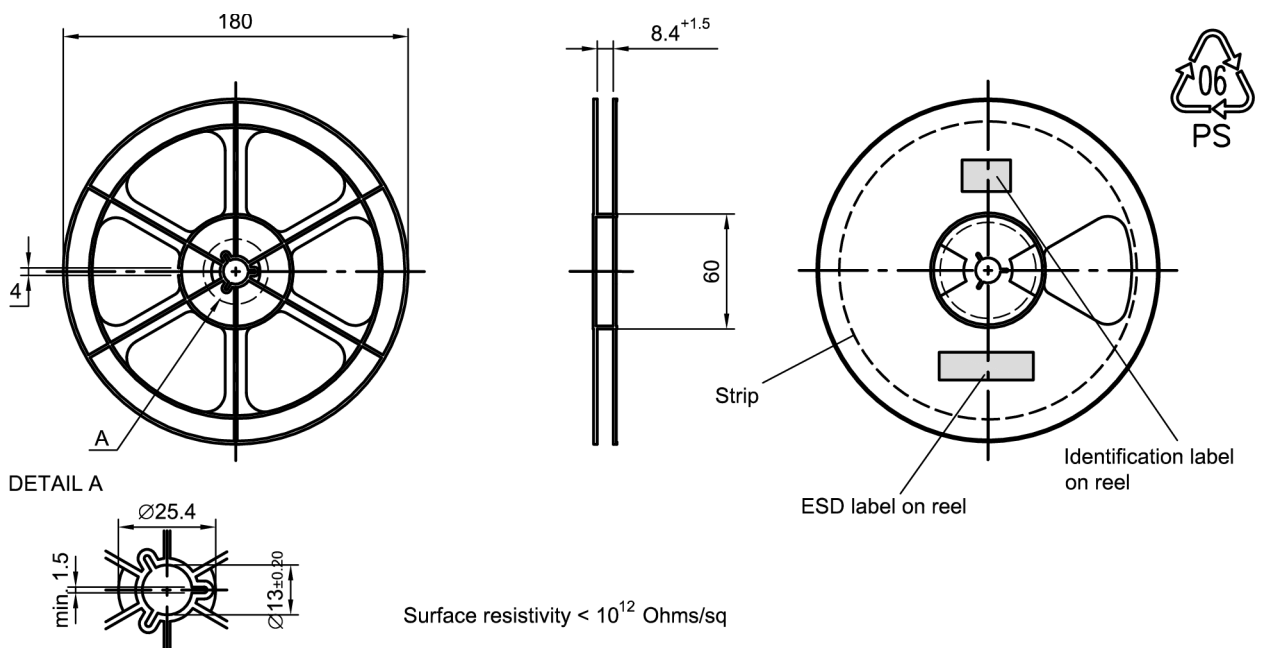
A <sub>0</sub>	1.8±0.05 mm
B <sub>0</sub>	2.25±0.05 mm
D <sub>0</sub>	1.5+0.1/-0 mm
D <sub>1</sub>	1.0 mm (min.)
E <sub>1</sub>	1.75±0.1 mm

E <sub>2</sub>	6.25 mm (min.)
F	3.5±0.05 mm
G	0.75 mm (min.)
K <sub>0</sub>	0.6±0.05 mm
P <sub>0</sub>	4.0±0.1 mm

P <sub>1</sub>	4.0±0.1 mm
P <sub>2</sub>	2.0±0.05 mm
T	0.25±0.03 mm
W	8.0+0.3/-0.1 mm

**Table 1:** Tape dimensions.

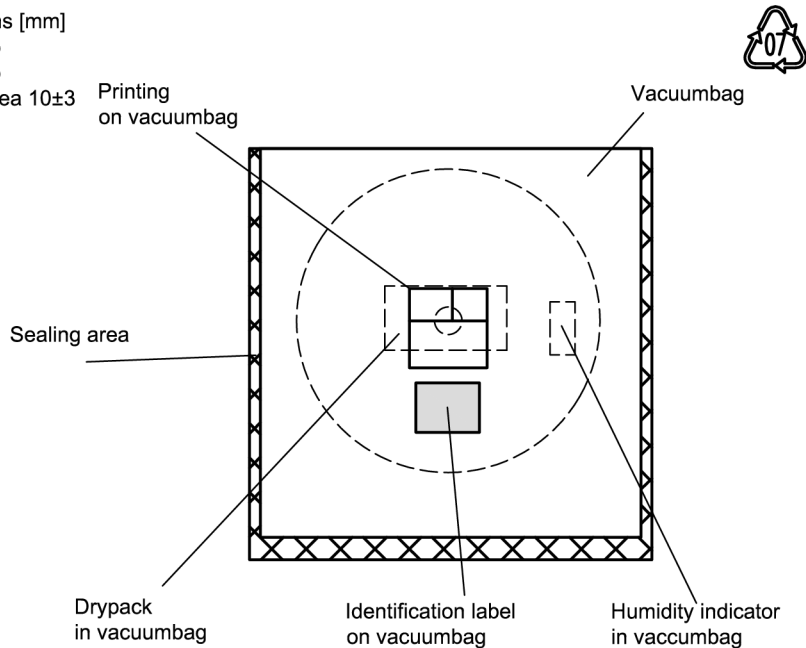
**10.2 Reel with diameter of 180 mm**



**Figure 8:** Drawing of reel (first-angle projection) with diameter of 180 mm.

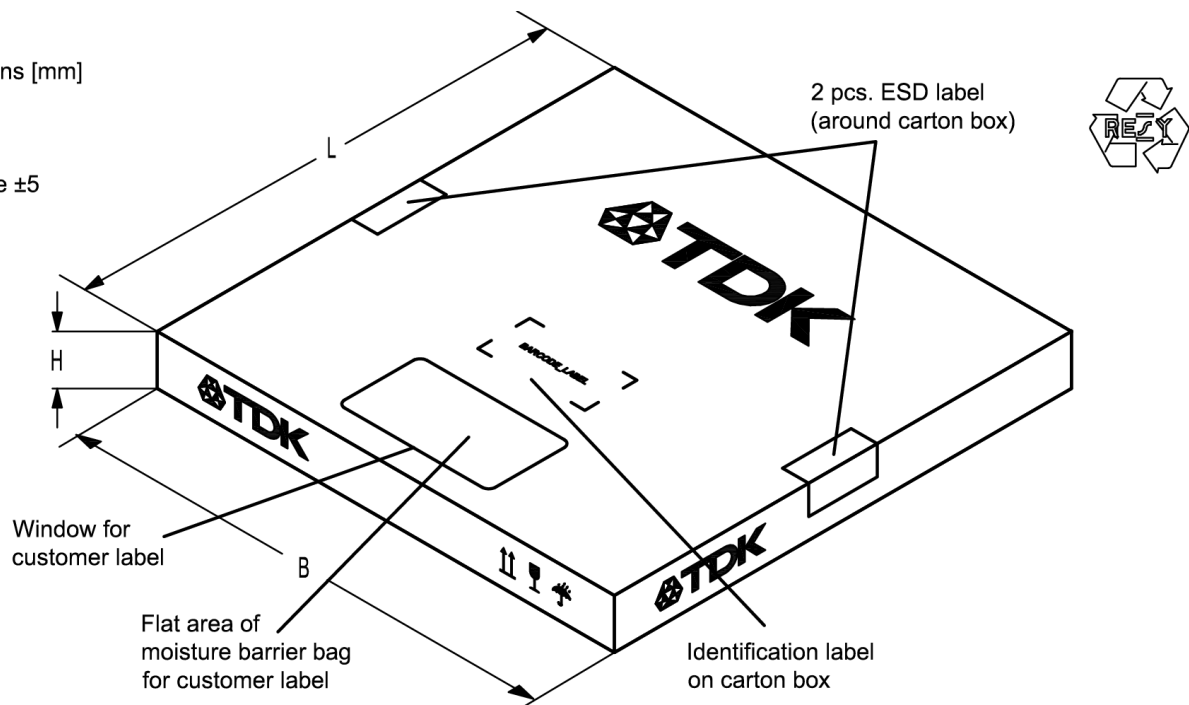
Data sheet

Dimensions [mm]  
 X = 220±5  
 Y = 235±5  
 Sealing area 10±3



**Figure 9:** Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

Dimensions [mm]  
 L = 188  
 B = 188  
 H = 30  
 Tolerance ±5



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

Data sheet

## 11 Marking

Products are marked with product type number and lot number encoded according to Table 2:

### ■ Type number:

The 4 digit type number of the ordering code, e.g., B3xxxxB**1234**xxxx, is encoded by a special BASE32 code into a 3 digit marking.

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

$$\begin{array}{rcl} \mathbf{16J} & \Rightarrow & \mathbf{1234} \\ \mathbf{1 \times 32^2 + 6 \times 32^1 + 18 (=J) \times 32^0} & = & \mathbf{1234} \end{array}$$

The BASE32 code for product type B4349 is 47X.

### ■ 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.

$$\begin{array}{rcl} \mathbf{5UY} & \Rightarrow & \mathbf{12345} \\ \mathbf{5 \times 47^2 + 27 (=U) \times 47^1 + 31 (=Y) \times 47^0} & = & \mathbf{12345} \end{array}$$

Adopted BASE32 code for type number			
Decimal value	Base32 code	Decimal value	Base32 code
0	0	16	G
1	1	17	H
2	2	18	J
3	3	19	K
4	4	20	M
5	5	21	N
6	6	22	P
7	7	23	Q
8	8	24	R
9	9	25	S
10	A	26	T
11	B	27	V
12	C	28	W
13	D	29	X
14	E	30	Y
15	F	31	Z

Adopted BASE47 code for lot number			
Decimal value	Base47 code	Decimal value	Base47 code
0	0	24	R
1	1	25	S
2	2	26	T
3	3	27	U
4	4	28	V
5	5	29	W
6	6	30	X
7	7	31	Y
8	8	32	Z
9	9	33	b
10	A	34	d
11	B	35	f
12	C	36	h
13	D	37	n
14	E	38	r
15	F	39	t
16	G	40	v
17	H	41	\
18	J	42	?
19	K	43	{
20	L	44	}
21	M	45	<
22	N	46	>
23	P		

**Table 2:** Lists for encoding and decoding of marking.

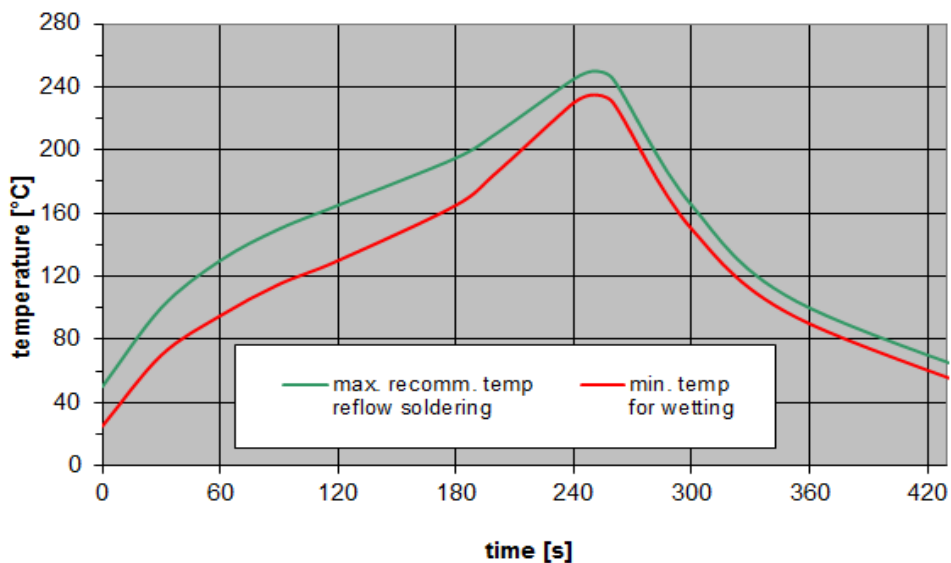
Data sheet

## 12 Soldering profile

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

ramp rate	≤ 3 K/s
preheat	125 °C to 220 °C, 150 s to 210 s, 0.4 K/s to 1.0 K/s
$T > 220\text{ °C}$	30 s to 70 s
$T > 230\text{ °C}$	min. 10 s
$T > 245\text{ °C}$	max. 20 s
$T \geq 255\text{ °C}$	–
peak temperature $T_{\text{peak}}$	250 °C +0/-5 °C
wetting temperature $T_{\text{min}}$	230 °C +5/-0 °C for 10 s ± 1 s
cooling rate	≤ 3 K/s
soldering temperature $T$	measured at solder pads

**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.

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### 13 ESD protection of SAW filters

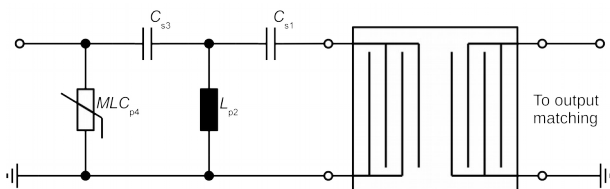
SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

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

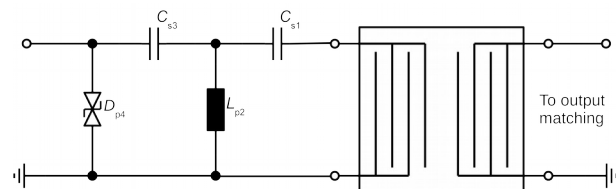
Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore, only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

Below three figures show recommended “ESD matching” topologies.

For wide band 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.

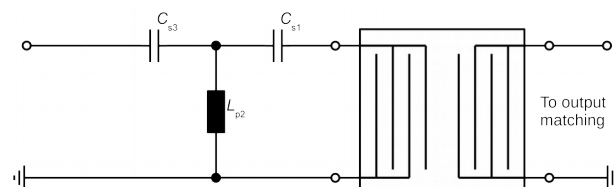


**Figure 12:** MLC varistor plus ESD matching.



**Figure 13:** Suppressor diode plus ESD matching.

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



**Figure 14:** 3<sup>rd</sup> order high-pass structure for basic ESD protection.

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](http://www.epcos.com/rke). Click on “Applications Notes”.



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## 14 Annotations

### 14.1 Matching coils

See TDK inductor pdf-catalog <http://www.tdk.co.jp/tefe02/coil.htm#aname1> and Data Library for circuit simulation <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.

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### 15.2 Moldability

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

### 15.3 Simplified drawings

#### 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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### Contact and Important notes

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