



RF360
Europe GmbH

SAW components

SAW Tx filter

Automotive telematics
TD-LTE band 40

Series/type:	B4351
Ordering code:	B39242B4351P810
Date:	February 22, 2017
Version:	2.0

DCN: 80-PA243-181 Rev. A

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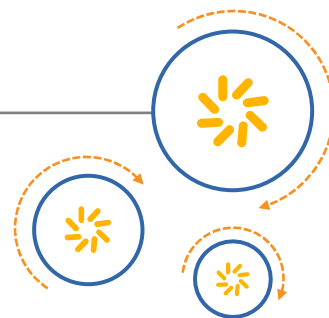
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SAW components**B4351****SAW Tx filter****2350 MHz**

Data sheet

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1 Application

- Band 40 Post PA Tx filter
- Low-loss RF filter for automotive telematics systems
- Usable pass band 100 MHz
- Low insertion attenuation

2 Features

- Package size $2.0 \pm 0.1 \text{ mm} \times 1.6 \pm 0.1 \text{ mm}$
- Package height 0.45 mm (max.)
- Approximate weight 6 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Filter surface passivated
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)
- AEC-Q200 qualified component family (Grade 3: $-40 \text{ }^{\circ}\text{C}$ to $+85 \text{ }^{\circ}\text{C}$)



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

SAW components

B4351

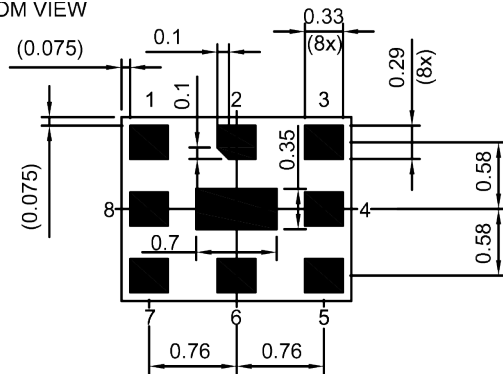
SAW Tx filter

2350 MHz

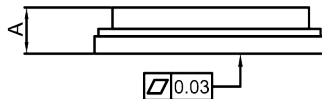
Data sheet

3 Package

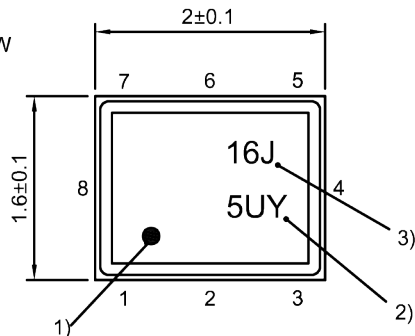
BOTTOM VIEW

Pad and pitch tolerance ± 0.05

SIDE VIEW



TOP VIEW



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

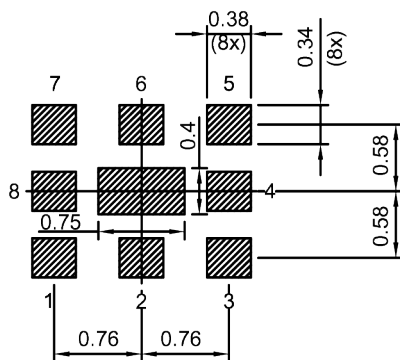
Land pattern
THRU VIEWLanding pad tolerance -0.02

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 18).

4 Pin configuration

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

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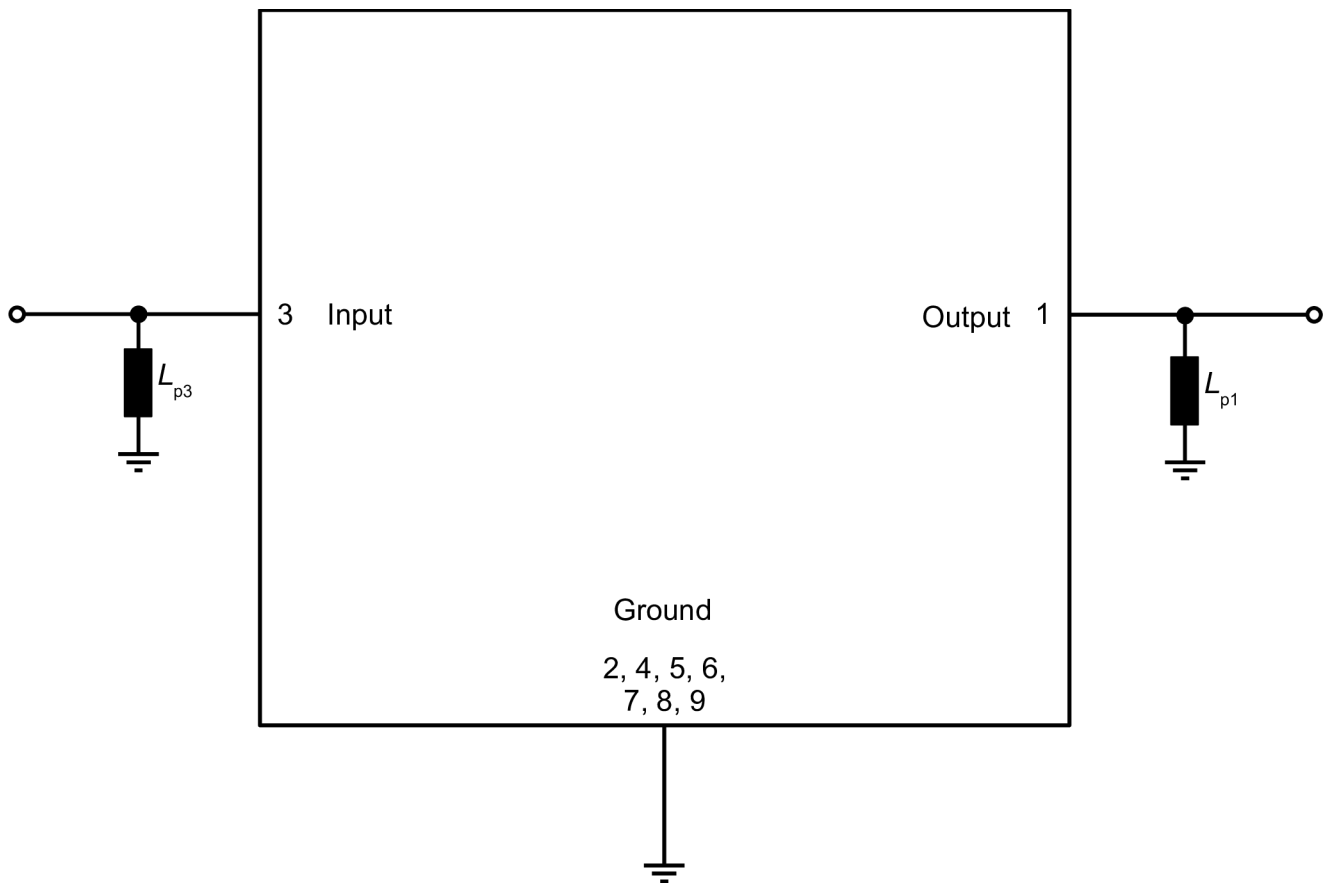
2350 MHz

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5 Matching circuit

$$\blacksquare L_{p1} = 2.0 \text{ nH}$$

$$\blacksquare L_{p3} = 2.4 \text{ nH}$$

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

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6 Characteristics

Temperature range for specification

 T_{SPEC} = -40 °C ... +85 °C

Input terminating impedance

 Z_{IN} = 50 Ω with par. 2.4 nH¹⁾

Output terminating impedance

 Z_{OUT} = 50 Ω with par. 2.0 nH¹⁾

Characteristics				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_{C}	—	2350	—	MHz
Maximum insertion attenuation			α_{max}	—	2.3	3.0	dB
	2300 ... 2400	MHz		—	2.3	3.0	dB
Amplitude ripple (p-p)			$\Delta\alpha$	—	0.7	1.6	dB
	2300 ... 2400	MHz		—	0.7	1.6	dB
Maximum VSWR			VSWR_{max}	—	1.4	2.2	
@ input port	2300 ... 2400	MHz		—	1.4	2.2	
@ output port	2300 ... 2400	MHz		—	1.4	2.2	
Minimum attenuation							
	50 ... 880	MHz	α_{min}	40	56	—	dB
	880 ... 960	MHz	α_{min}	40	54	—	dB
	960 ... 1559	MHz	α_{min}	35	38	—	dB
	1559 ... 1680	MHz	α_{min}	32	36	—	dB
	1805 ... 1880	MHz	α_{min}	31	34	—	dB
	1880 ... 1920	MHz	α_{min}	30	34	—	dB
	2010 ... 2025	MHz	α_{min}	32	37	—	dB
	2110 ... 2170	MHz	α_{min}	30	35	—	dB
Ch 5	2423 ... 2441	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	3.5	7	—	dB
Ch 6	2428 ... 2446	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	4.5	11	—	dB
Ch 7	2433 ... 2451	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	7	18	—	dB
Ch 8	2438 ... 2456	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	10	30	—	dB
Ch 9	2443 ... 2461	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	16	45	—	dB
Ch 10 – 13	2448 ... 2481	MHz	$\alpha_{\text{WLAN,min}}^{2)}$	25	50	—	dB
	2481 ... 2500	MHz	α_{min}	46	51	—	dB
	4600 ... 4800	MHz	α_{min}	35	43	—	dB
	4900 ... 6000	MHz	α_{min}	20	42	—	dB

¹⁾ See Sec. Matching circuit (p. 6).

²⁾ Average over each WLAN channel with band width of 18 MHz.

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7 Maximum ratings

Operable temperature	$T_{OP} = -40\text{ °C} \dots +85\text{ °C}$	
Storage temperature	$T_{STG}^{1)} = -40\text{ °C} \dots +85\text{ °C}$	
DC voltage	$ V_{DC} ^{2)} = 0\text{ V}$	
Input power	P_{IN}	
@ input port: 2300 ... 2400 MHz	29 dBm	Continuous wave for 5000 h @ 55 °C.
@ input port	10 dBm	Continuous wave for 5000 h @ 55 °C.

1) Not valid for packaging material. Storage temperature for packaging material is -25 °C to +40 °C.

2) In case of applied DC voltage blocking capacitors are mandatory.

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8 Transmission coefficient

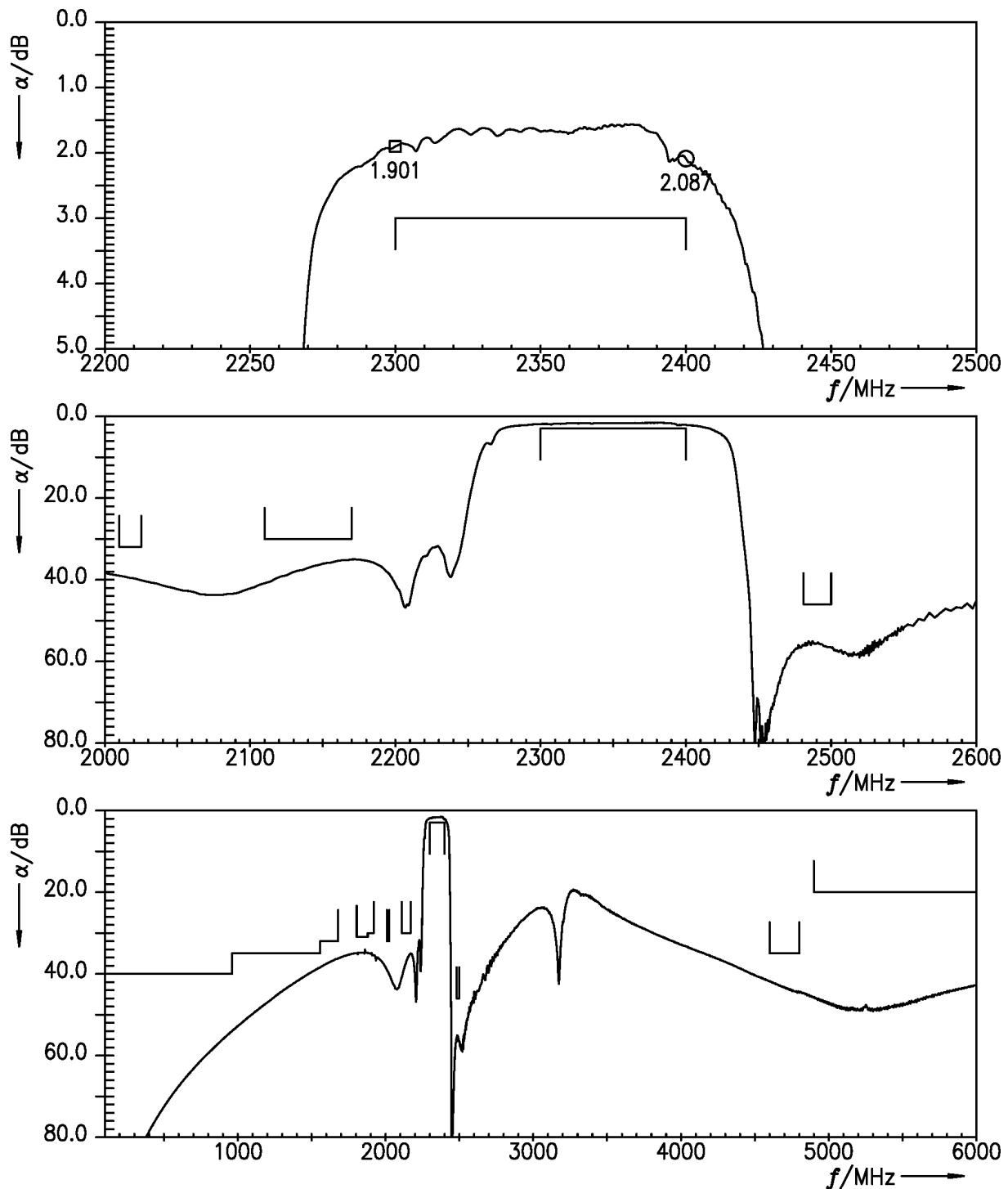


Figure 4: Attenuation.

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9 Reflection coefficients

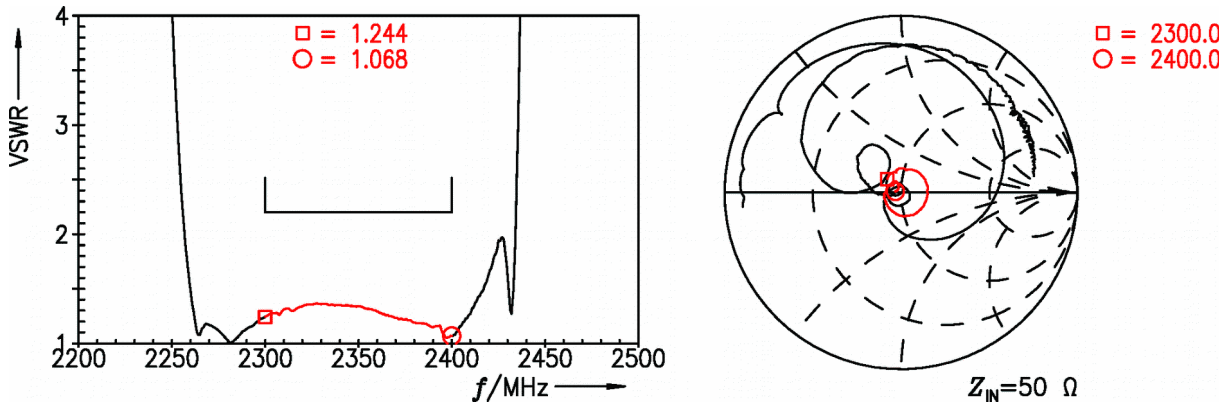


Figure 5: Reflection coefficient at IN port.

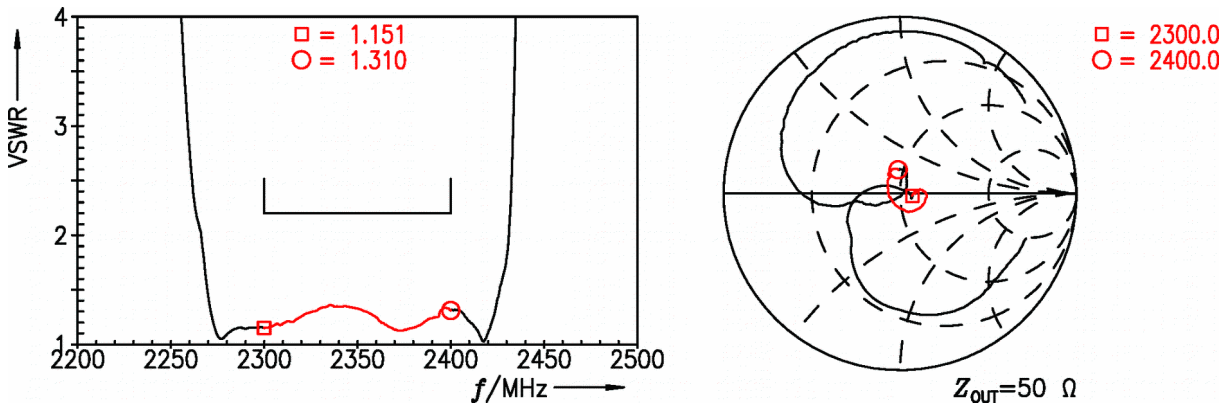


Figure 6: Reflection coefficient at OUT port.

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10 Packing material

10.1 Tape

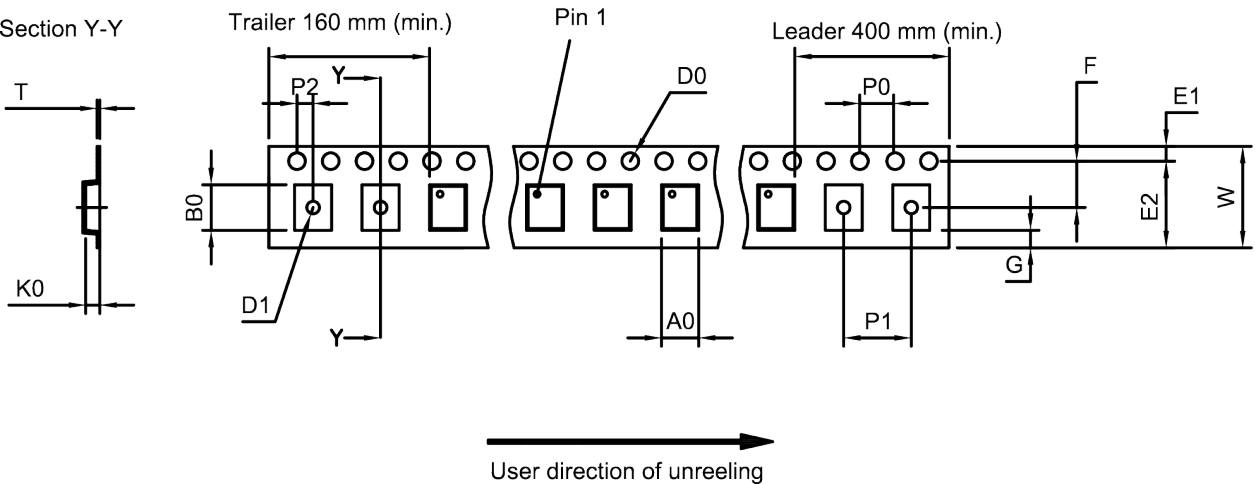


Figure 7: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A ₀	1.8±0.05 mm	E ₂	6.25 mm (min.)	P ₁	4.0±0.1 mm
B ₀	2.25±0.05 mm	F	3.5±0.05 mm	P ₂	2.0±0.05 mm
D ₀	1.5+0.1/-0 mm	G	0.75 mm (min.)	T	0.25±0.03 mm
D ₁	1.0 mm (min.)	K ₀	0.6±0.05 mm	W	8.0+0.3/-0.1 mm
E ₁	1.75±0.1 mm	P ₀	4.0±0.1 mm		

Table 1: Tape dimensions.

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10.2 Reel with diameter of 180 mm

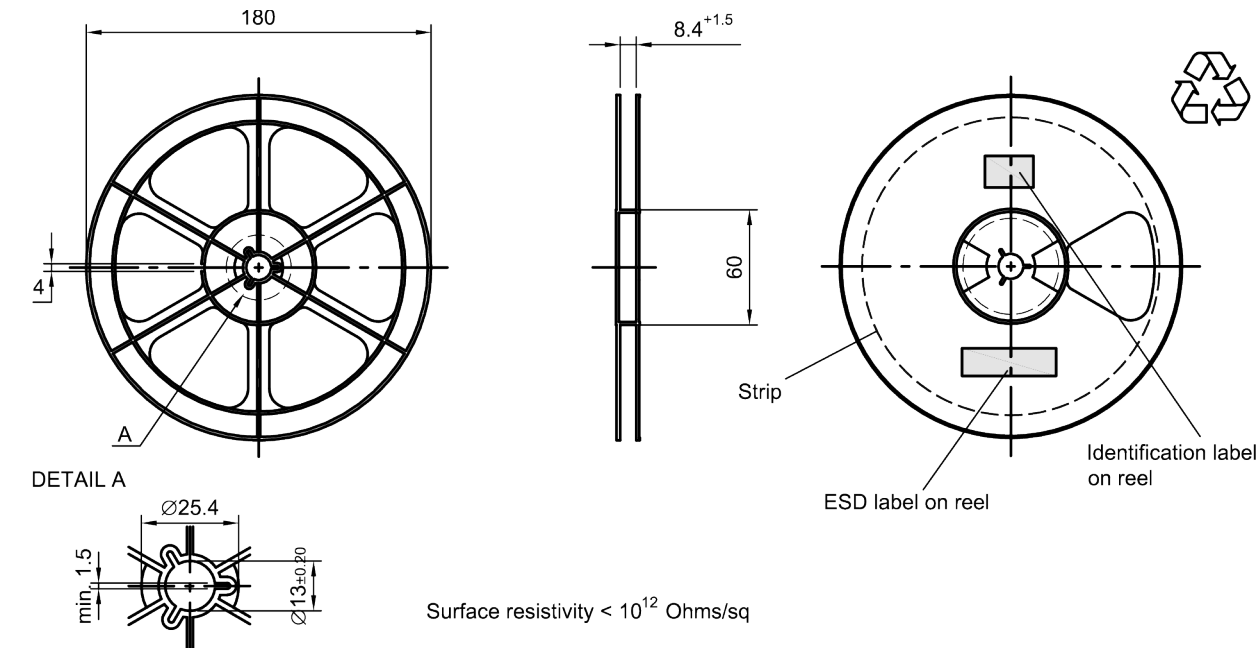


Figure 8: Drawing of reel (first-angle projection) with diameter of 180 mm.

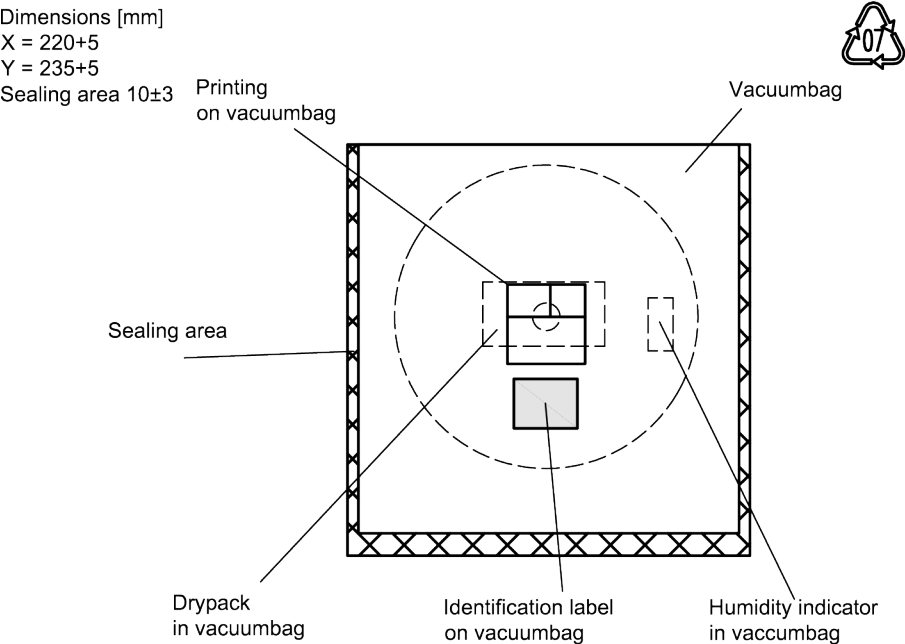


Figure 9: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

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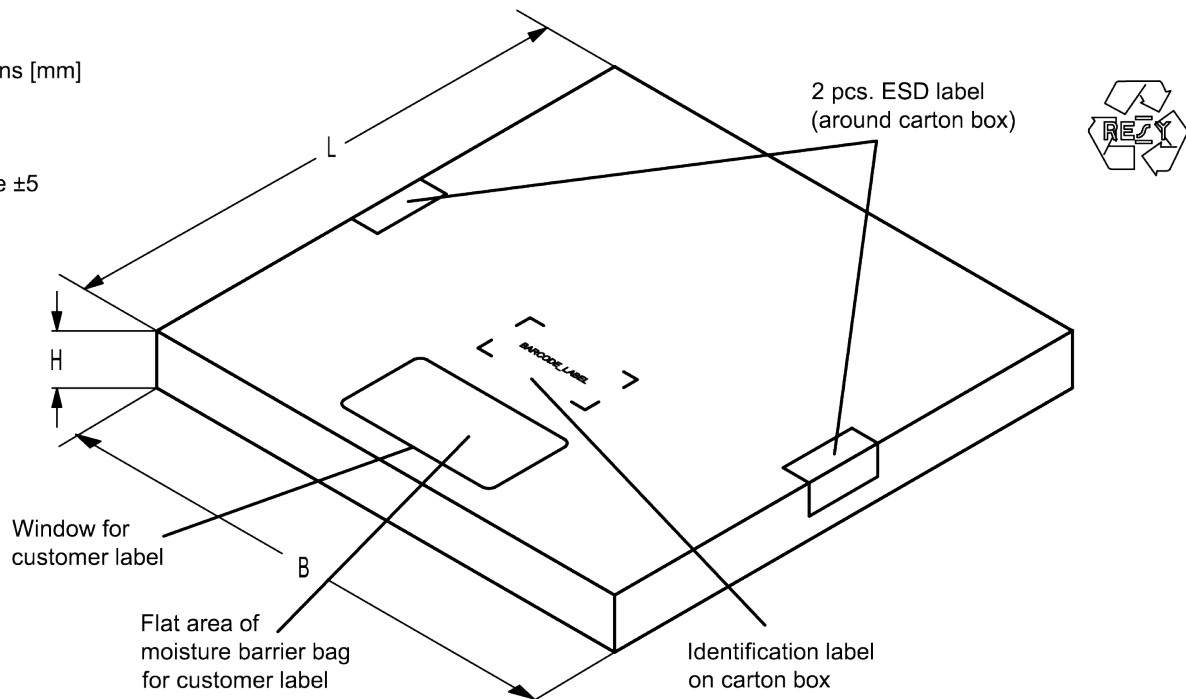
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Dimensions [mm]

L = 188

B = 188

H = 30

Tolerance ± 5 **Figure 10:** Drawing of folding box for reel with diameter of 180 mm.

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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.
16J	=>	1234
$1 \times 32^2 + 6 \times 32^1 + 18 (=J) \times 32^0$	=	1234

The BASE32 code for product type B4351 is 47Z.

■ 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	=> 12345
$5 \times 47^2 + 27 (=U) \times 47^1 + 31 (=Y) \times 47^0$	= 12345

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.

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12 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3rd 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_{peak}	250 °C +0/-5 °C
wetting temperature T_{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).

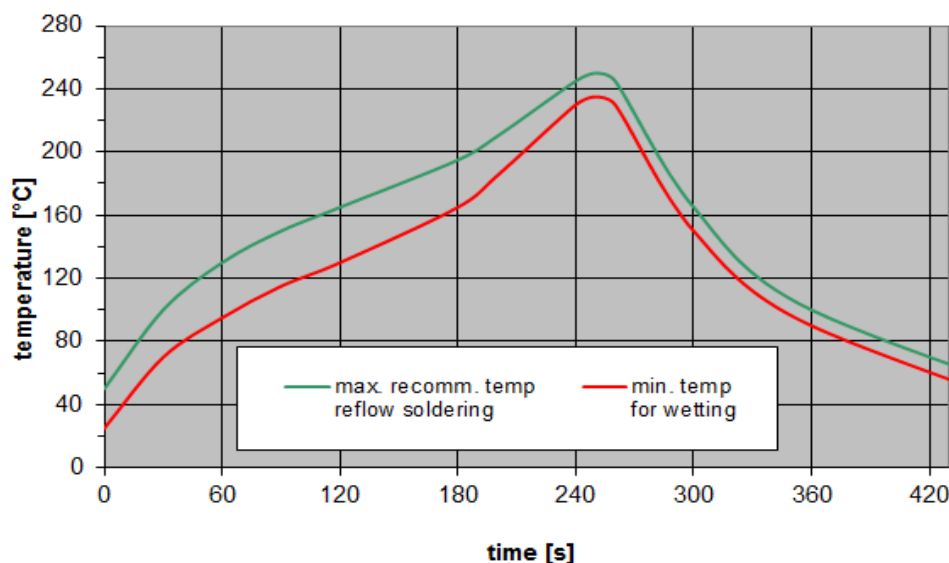


Figure 11: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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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 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.

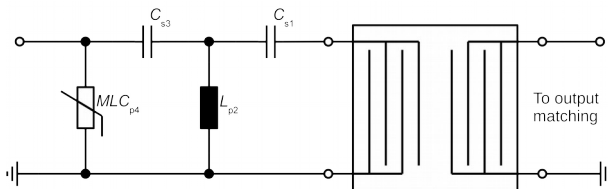


Figure 12: MLC varistor plus ESD matching.

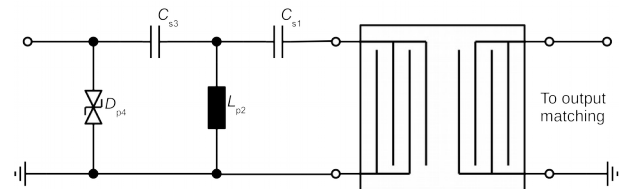


Figure 13: Suppressor diode plus ESD matching.

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

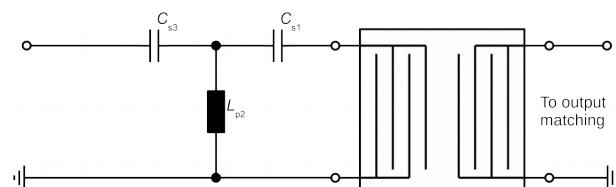


Figure 14: 3rd order high-pass structure for basic ESD protection.

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 RF360 Application report: “**ESD protection for SAW filters**”. This report can be found under www.rf360jv.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 RF360 sales office.

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15 Cautions and warnings

15.1 Display of ordering codes for RF360 products

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15.2 Material information

Due to technical requirements components may contain dangerous substances. For information on the type in question please also contact one of our sales offices.

For information on recycling of tapes and reels please contact one of our sales offices.

15.3 Moldability

Before using in overmolding environment, please contact your local RF360 sales office.

15.4 Package information

Landing area

The printed circuit board (PCB) land pattern (landing area) shown is based on RF360 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 RF360, 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.

Important notes

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