Qualcomm

RF360
Europe GmbH

Data sheet

SAW triplexer
Automotive telematics
LTE bands 1, 3, & 11/21

Series/type:	B4389
Ordering code:	B39212B4389P810
Date:	June 07, 2019
Version:	2.0

DCN: 80-PA243-380 Rev. A

RF360 Europe GmbH, Anzinger Str. 13, München, Germany

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A Qualcomm – TDK Joint Venture

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Table of contents

1 Application

- Low-loss 3in1 RF filter for LTE Band 1, Band 3 and Band 21/11 systems, receive path (Rx)
- Usable pass bands:
- Band 1: 60 MHz
- Band 3: 75 MHz
- Band 21/11: 35 MHz
- Unbalanced to unbalanced operation for all filters
- Impedance transformation from 50Ω to 50Ω for all filters

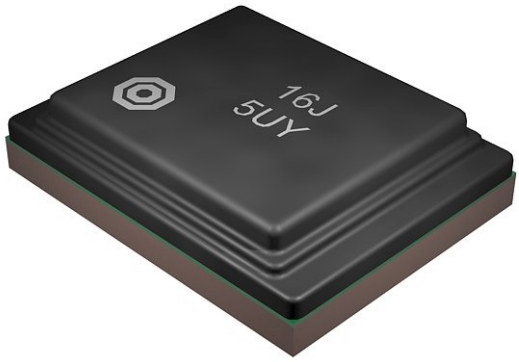

Figure 1: Picture of component with example of product marking.

2 Features

- Package size $1.8_{\pm 0.1}$ mm × $1.4_{\pm 0.1}$ mm
- Package height 0.45 mm (max.)
- Approximate weight 4 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 °C to +85 °C)

3 Package

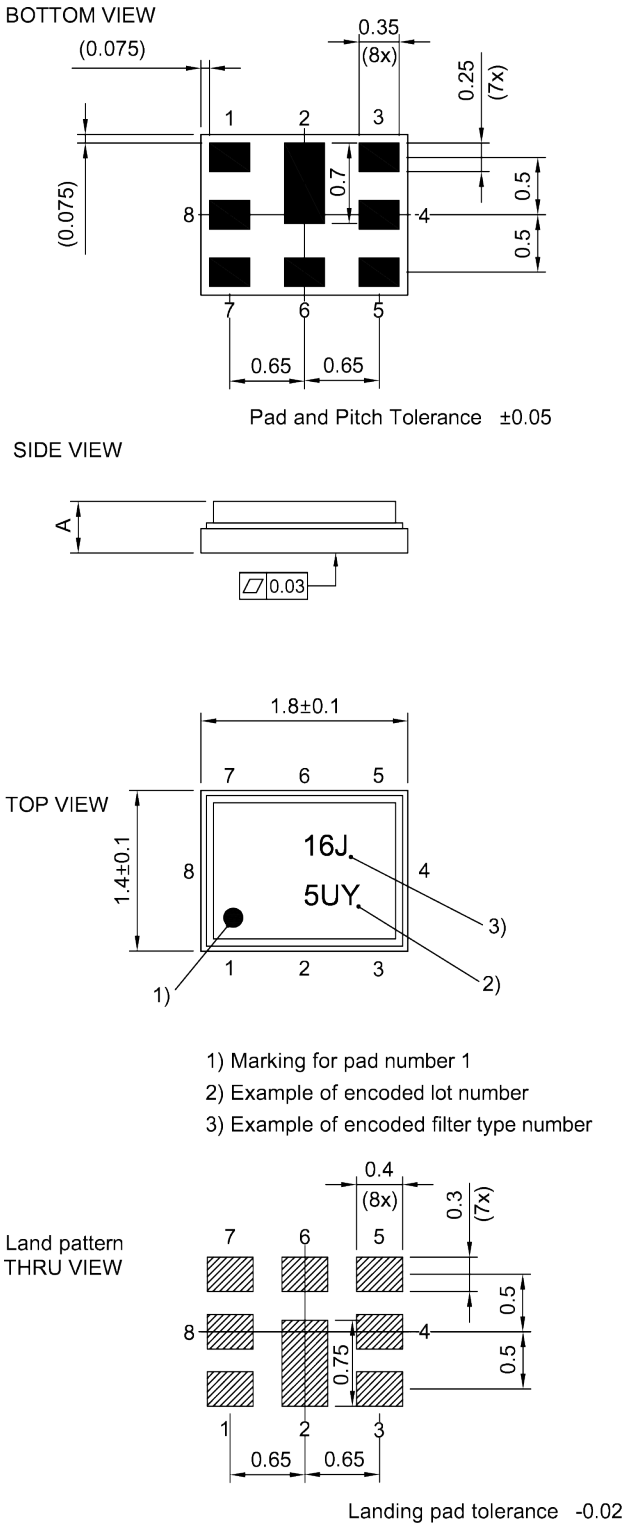

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 23).

4 Pin configuration

- 1 Output (B3)
- 3 Output (B1)
- 5 Output (B11 & B21)
- 7 Input (B1, B3, B11, & B21)
- 2, 4, 6, 8 Ground

5 Matching circuit

- L_{p7} = 2.7 nH
- L_{s1} = 3.3 nH
- L_{s3} = 3.6 nH
- L_{s5} = 3.6 nH

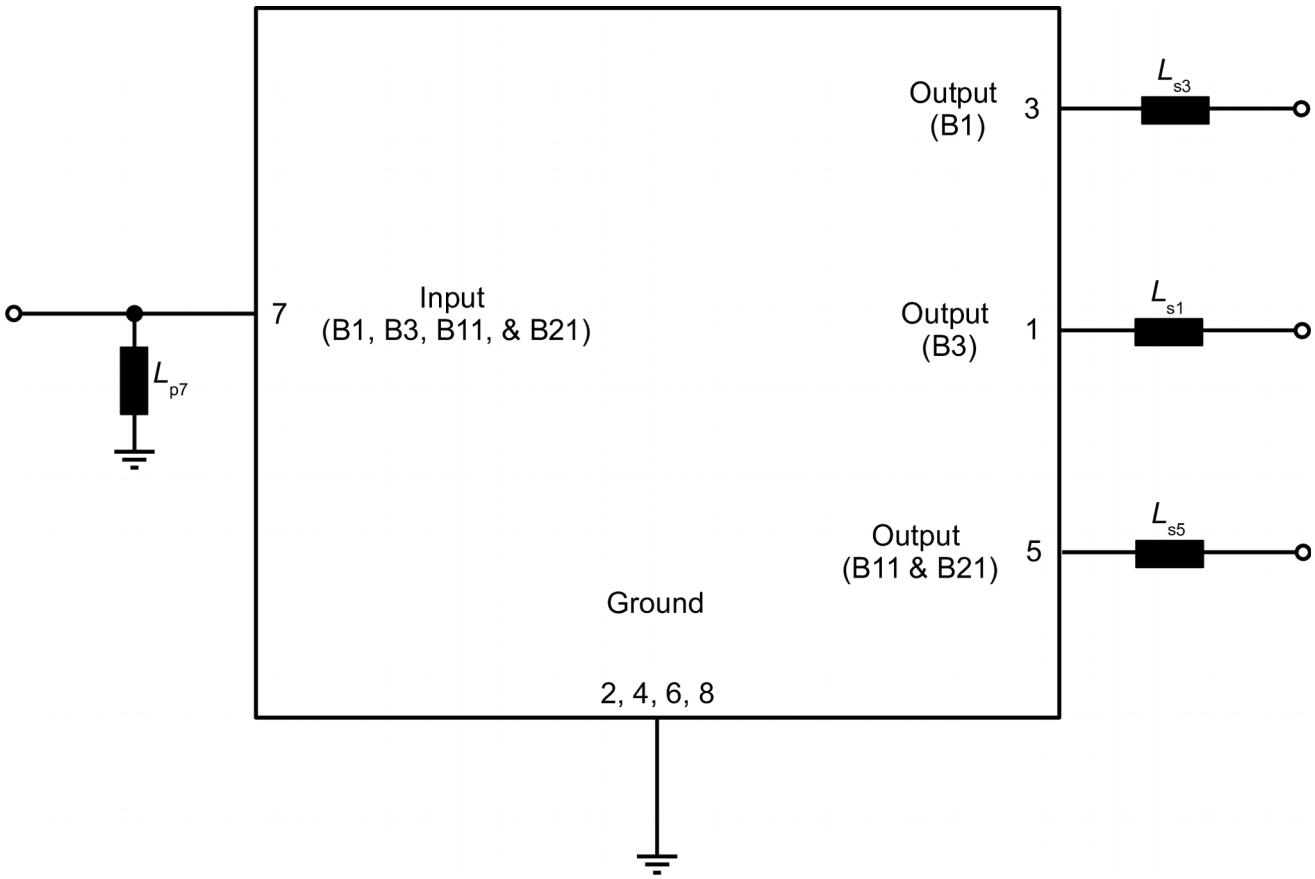

Figure 3: Schematic of matching circuit.

6 Characteristics LTE B1

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
Input terminating impedance Z_{IN} = 50 Ω // 2.7 nH[1)]
B1 output terminating impedance $Z_{B1\ OUT}$ = 50 Ω + 3.6 nH[1)]

Characteristics LTE B1				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	2140	—	MHz
Maximum insertion attenuation			α_{max}				
	2110... 2170	MHz		—	2.4	3.0	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	2110... 2170	MHz		—	0.4	1.1	dB
Maximum VSWR			$VSWR_{max}$				
@ input port	2110... 2170	MHz		—	1.8	2.2	
@ B1 output port	2110... 2170	MHz		—	1.6	2.2	
Minimum attenuation			α_{min}				
	10... 1710	MHz		40	47	—	dB
	188... 192	MHz		50	84	—	dB
	398... 402	MHz		50	71	—	dB
	699... 716	MHz		50	62	—	dB
	777... 787	MHz		50	62	—	dB
	814... 849	MHz		50	59	—	dB
	880... 915	MHz		50	57	—	dB
	1427.9... 1462.9	MHz		45	54	—	dB
	1710... 1785	MHz		45	57	—	dB
	1785... 1920	MHz		45	50	—	dB
	1920... 1980	MHz		40	45	—	dB
	2015... 2075	MHz		25	28	—	dB
	2185... 2690	MHz		1	4	—	dB
	2255... 2400	MHz		25	43	—	dB
	2400... 2500	MHz		36	47	—	dB
	4900... 5950	MHz		45	51	—	dB

[1)] See Sec. Matching circuit (p. 6).

7 Characteristics LTE B3

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
Input terminating impedance Z_{IN} = 50 Ω // 2.7 nH[1)]
B3 output terminating impedance $Z_{B3\ OUT}$ = 50 Ω + 3.3 nH[1)]

Characteristics LTE B3				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	1842.5	—	MHz
Maximum insertion attenuation			α_{max}				
	1805... 1880	MHz		—	2.7	3.6	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	1805... 1880	MHz		—	1.2	2.1	dB
Maximum VSWR			$VSWR_{max}$				
@ input port	1805... 1880	MHz		—	1.7	2.2	
@ B3 output port	1805... 1880	MHz		—	1.8	2.2	
Minimum attenuation			α_{min}				
	10... 1710	MHz		38	41	—	dB
	93... 97	MHz		50	87	—	dB
	824... 849	MHz		50	51	—	dB
	832... 862	MHz		45	51	—	dB
	880... 915	MHz		45	49	—	dB
	1427.9... 1462.9	MHz		40	47	—	dB
	1710.24... 1784.76	MHz		30	35	—	dB
	1785... 1790	MHz		4	33	—	dB
	1920... 5950	MHz		33	39	—	dB
	1920.34... 1979.66	MHz		38	41	—	dB
	2400... 2500	MHz		35	43	—	dB
	2500... 2570	MHz		35	43	—	dB
	4900... 5950	MHz		35	40	—	dB
	5415... 5640	MHz		35	40	—	dB

[1)] See Sec. Matching circuit (p. 6).

8 Characteristics LTE B11 & B21

Temperature range for specification T_{SPEC} = −30 °C ... +85 °C
Input terminating impedance Z_{IN} = 50 Ω // 2.7 nH[1)]
B11 B21 output terminating impedance $Z_{B11\ B21\ OUT}$ = 50 Ω + 3.6 nH[1)]

Characteristics LTE B11 & B21			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency	f_C		—	1493.4	—	MHz
Maximum insertion attenuation	α_{max}					
	1476.15 ... 1495.65	MHz	—	2.0	3.0	dB
	1476.15 ... 1510.65	MHz	—	2.0	3.0	dB
	1496.15 ... 1510.65	MHz	—	1.4	1.8	dB
Amplitude ripple (p-p)	Δα					
	1476.15 ... 1495.65	MHz	—	0.8	1.8	dB
	1476.15 ... 1510.65	MHz	—	0.8	1.8	dB
	1496.15 ... 1510.65	MHz	—	0.2	0.6	dB
Maximum VSWR	$VSWR_{max}$					
@ input port	1476.15 ... 1495.65	MHz	—	1.6	2.1	
	1496.15 ... 1510.65	MHz	—	1.5	2.1	
@ B11 B21 output port	1476.15 ... 1495.65	MHz	—	1.6	2.1	
	1496.15 ... 1510.65	MHz	—	1.2	2.0	
Minimum attenuation	α_{min}					
	10 ... 1427.9	MHz	35	43	—	dB
	1427.9 ... 1447.9	MHz	35	43	—	dB
	1447.9 ... 1462.9	MHz	28	32	—	dB
	1452 ... 1460	MHz	29	38	—	dB
	1581 ... 2400	MHz	30	35	—	dB
	1596 ... 1920	MHz	32	35	—	dB
	1710 ... 1785	MHz	40	44	—	dB
	1920 ... 1980	MHz	40	48	—	dB
	2400 ... 2500	MHz	40	46	—	dB
	4427.7 ... 4487.8	MHz	35	42	—	dB
	4900 ... 5950	MHz	35	43	—	dB

[1)] See Sec. Matching circuit (p. 6).

9 Maximum ratings

Operable temperature	T_{OP} = −40 °C ... +85 °C	
Storage temperature	T_{STG} [1] = −40 °C ... +85 °C	
DC voltage	$\lvert V_{DC} \rvert$ [2] = 0 V (max.)	
Input power	P_{IN}	
@ input port: 1427.9 ... 1447.9 MHz	15 dBm	Continuous wave for 2000 h @ 55 °C.
@ input port: 1447.9 ... 1462.9 MHz	15 dBm	Continuous wave for 2000 h @ 55 °C.
@ input port: 1710 ... 1785 MHz	15 dBm	Continuous wave for 2000 h @ 55 °C.
@ input port: 1920 ... 1980 MHz	15 dBm	Continuous wave for 2001 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.

10 Transmission coefficient LTE B1

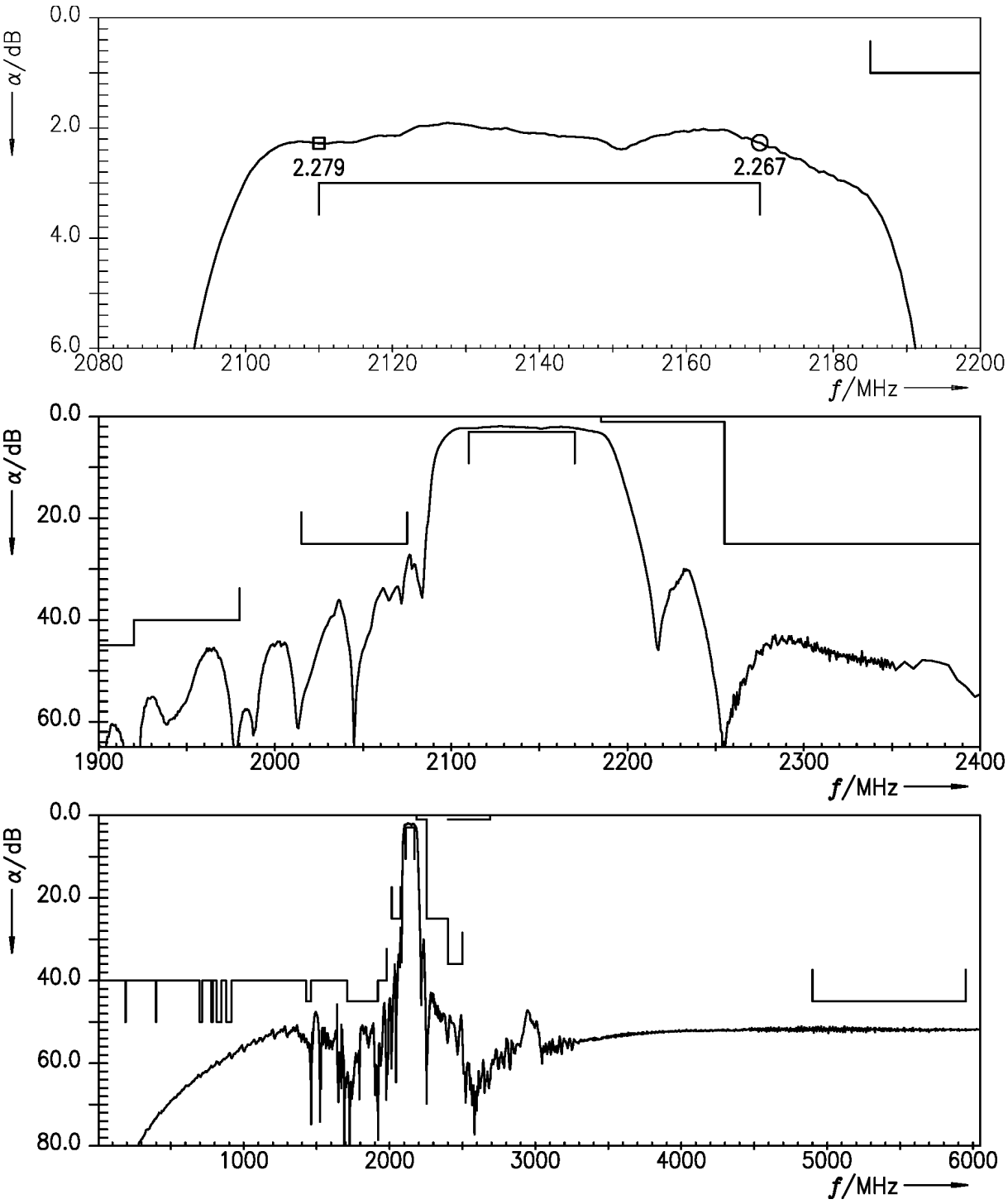

Figure 4: Attenuation LTE B1.

11 Reflection coefficients LTE B1

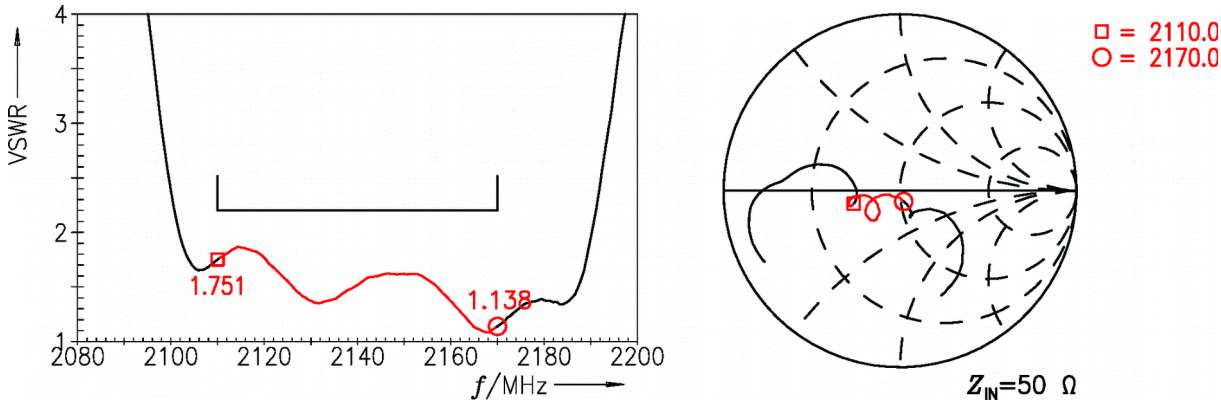

Figure 5: Reflection coefficient at input port.

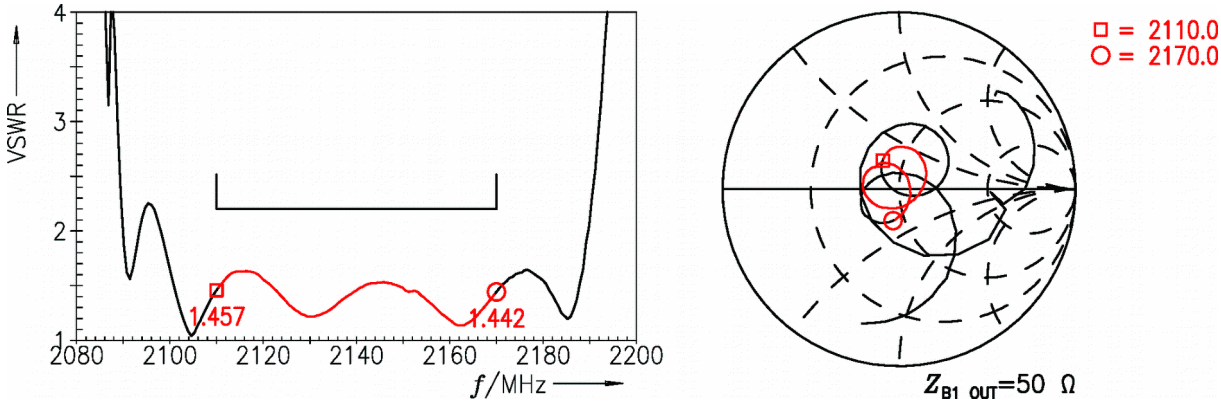

Figure 6: Reflection coefficient at B1 OUT port.

12 Transmission coefficient LTE B3

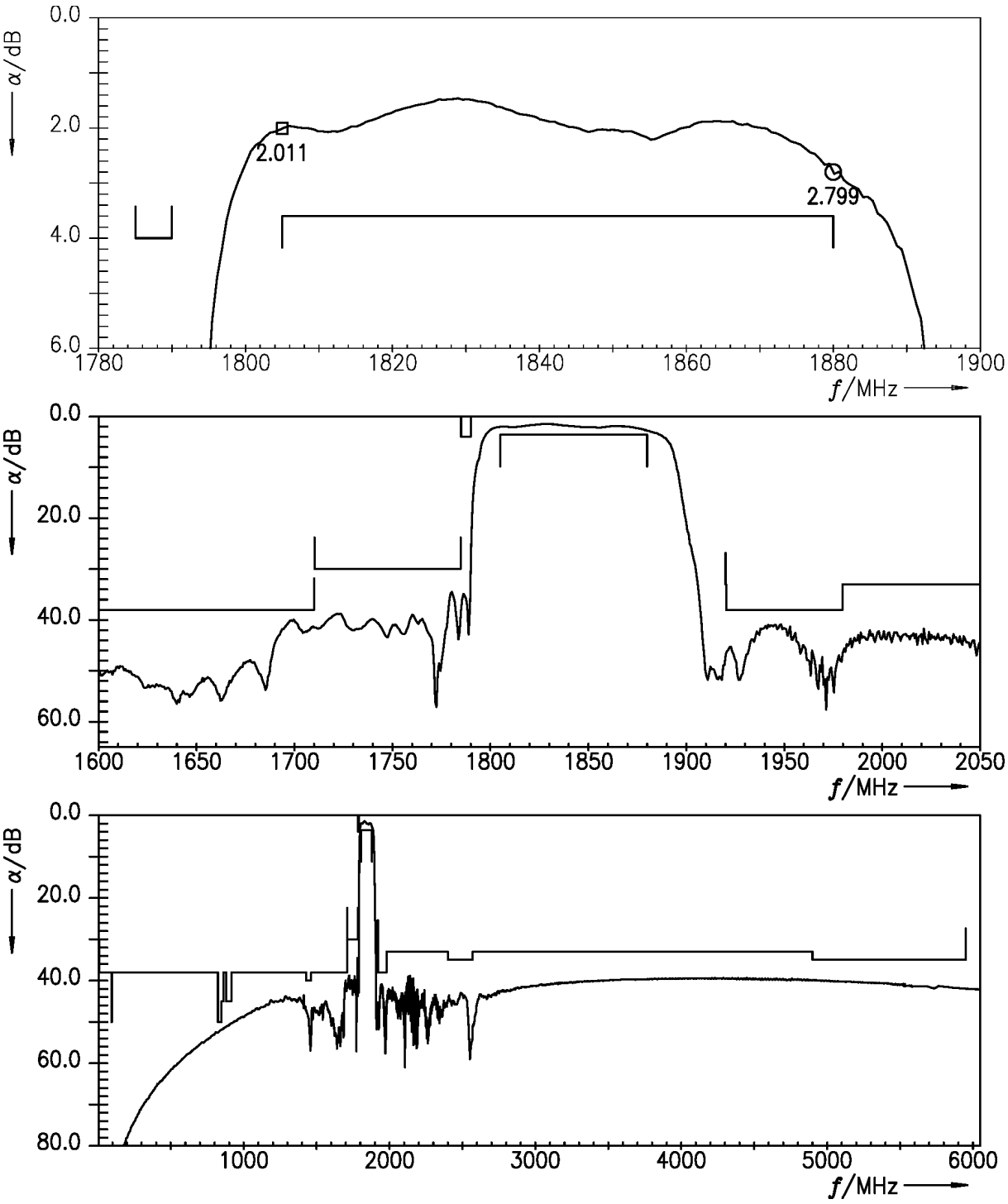

Figure 7: Attenuation LTE B3.

13 Reflection coefficients LTE B3

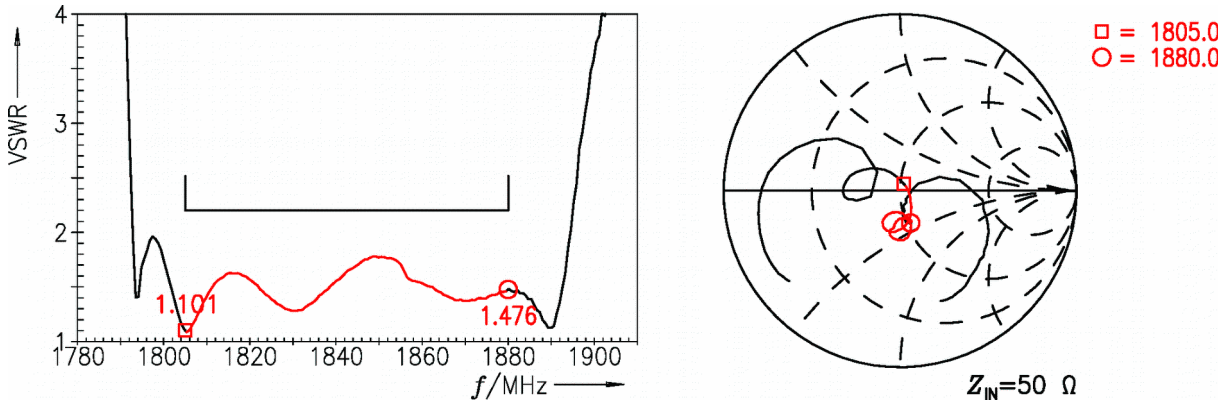

Figure 8: Reflection coefficient at input port.

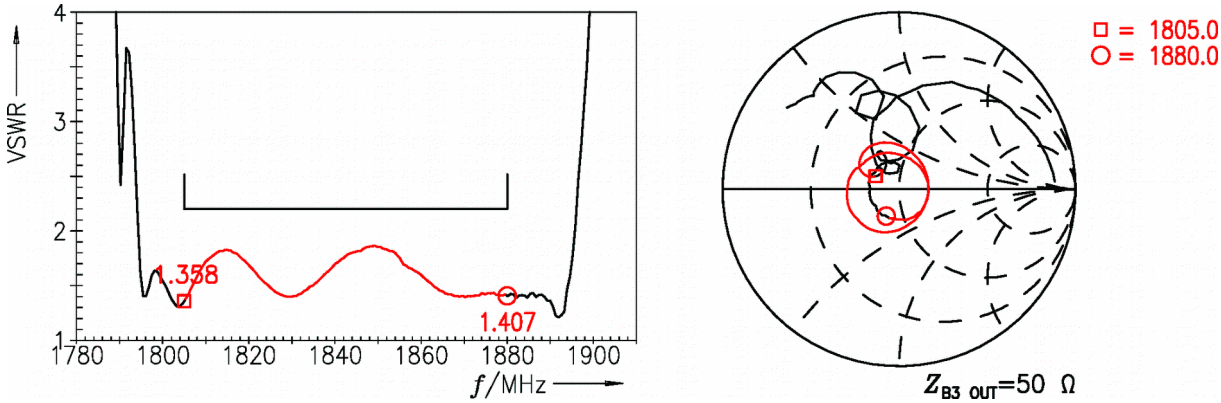

Figure 9: Reflection coefficient at B3 OUT port.

14 Transmission coefficient LTE B11 & B21

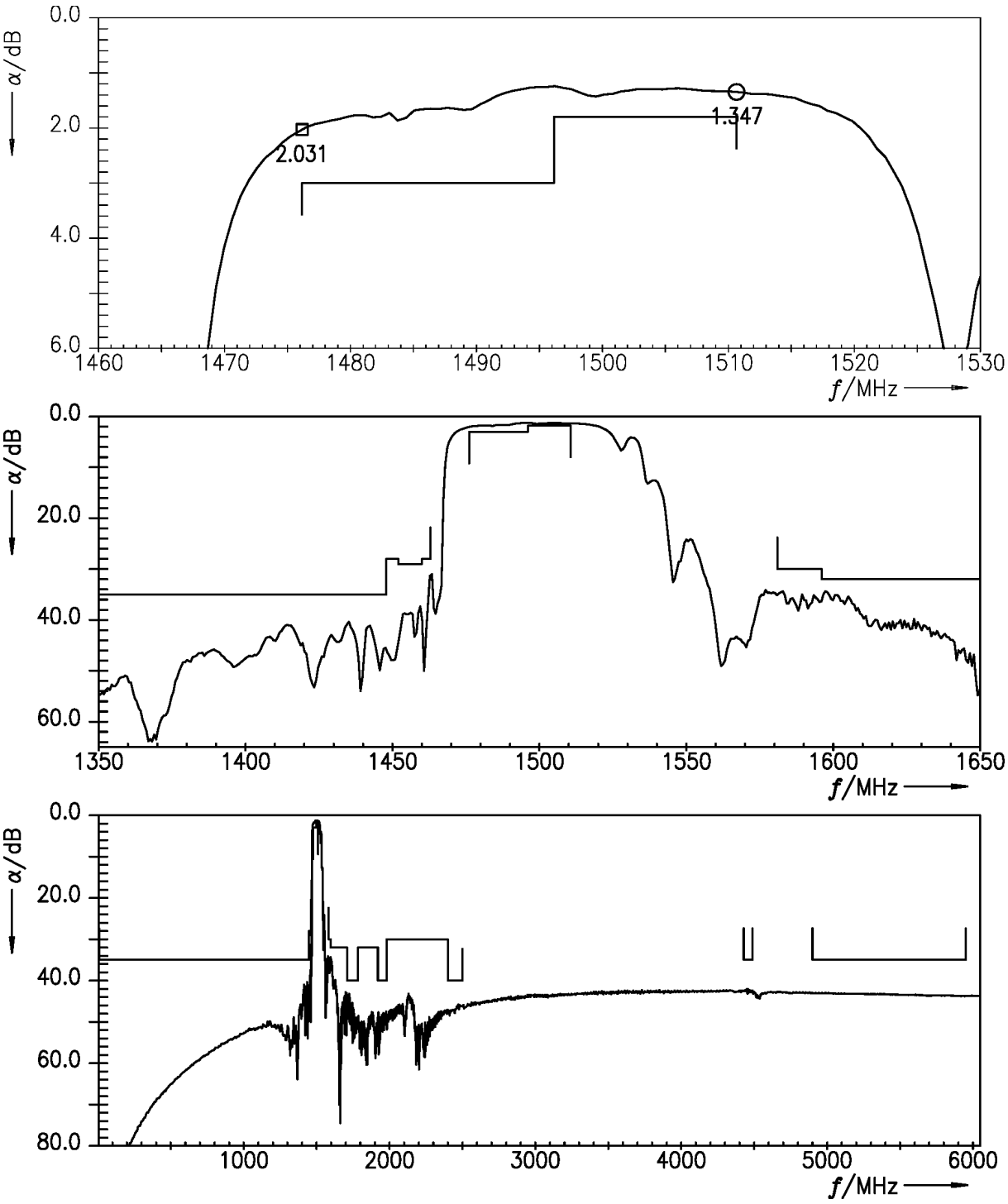

Figure 10: Attenuation LTE B11 & B21.

15 Reflection coefficients LTE B11 & B21

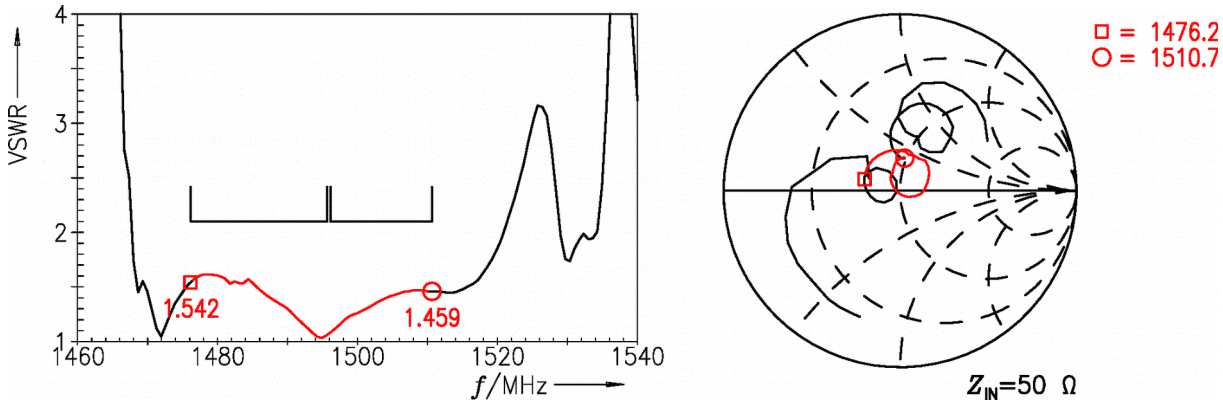

Figure 11: Reflection coefficient at input port.

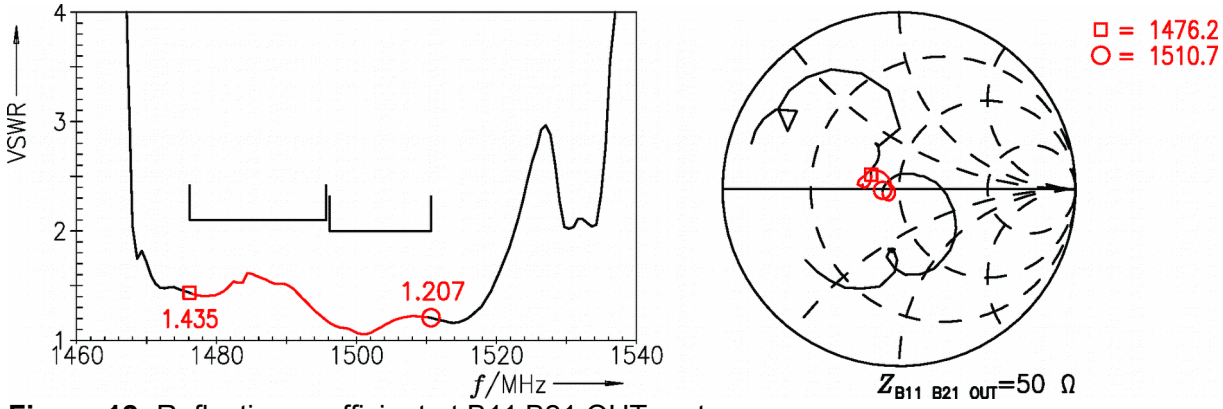

Figure 12: Reflection coefficient at B11 B21 OUT port.

16 Packing material

16.1 Tape

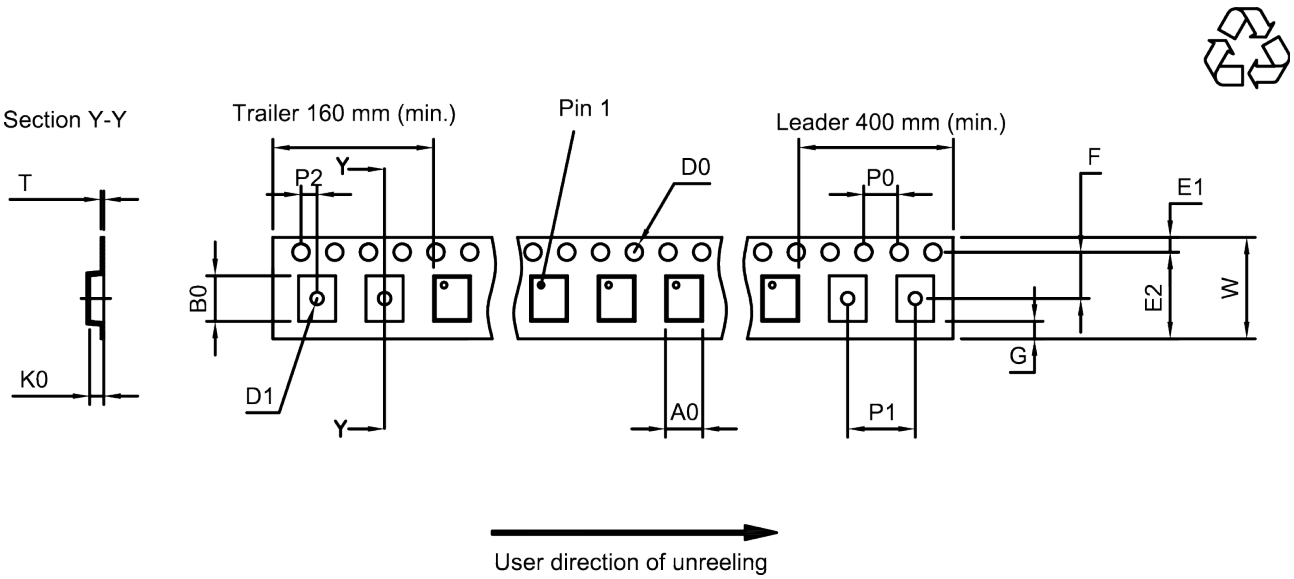

Figure 13: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	1.6±0.05 mm
B_0	2.0±0.05 mm
D_0	1.5+0.1/−0 mm
D_1	0.8+0.1/−0 mm
E_1	1.75±0.1 mm

E_2	6.25 mm (min.)
F	3.5±0.05 mm
G	0.75 mm (min.)
K_0	0.64±0.05 mm
P_0	4.0±0.1 mm

P_1	4.0±0.1 mm
P_2	2.0±0.05 mm
T	0.25±0.03 mm
W	8.0+0.3/−0.1 mm

Table 1: Tape dimensions.

16.2 Reel with diameter of 180 mm

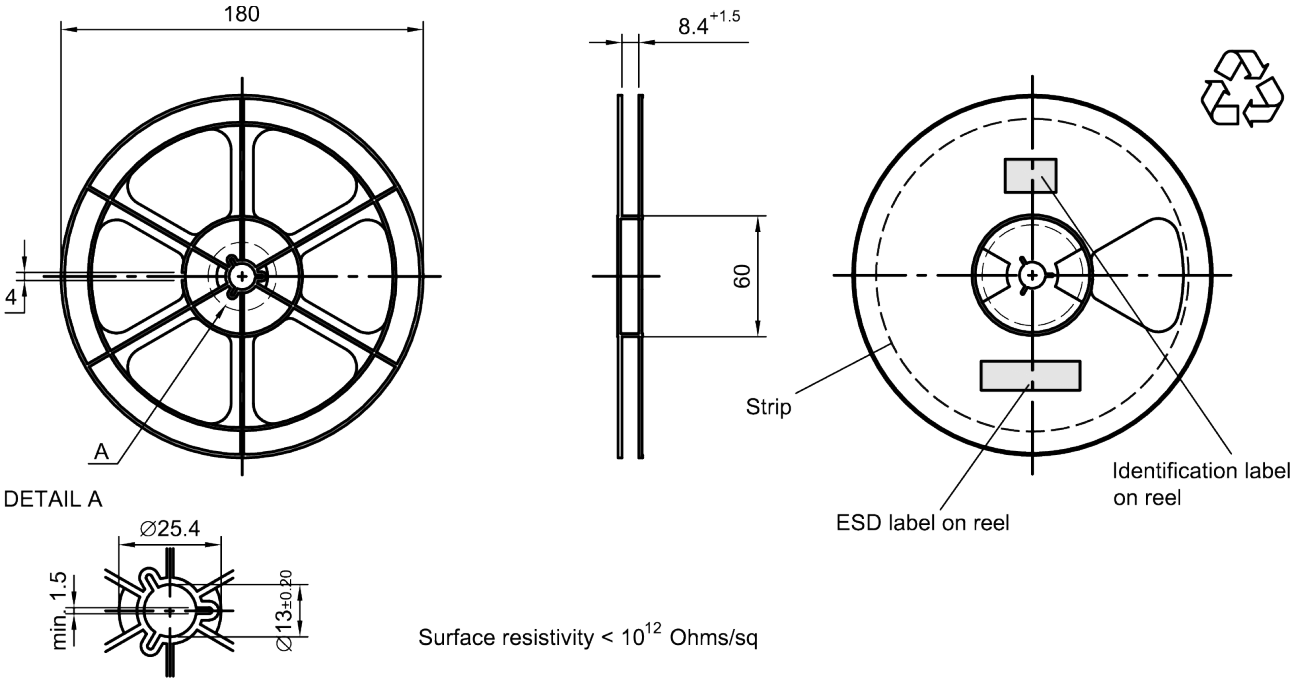

Figure 14: Drawing of reel (first-angle projection) with diameter of 180 mm.

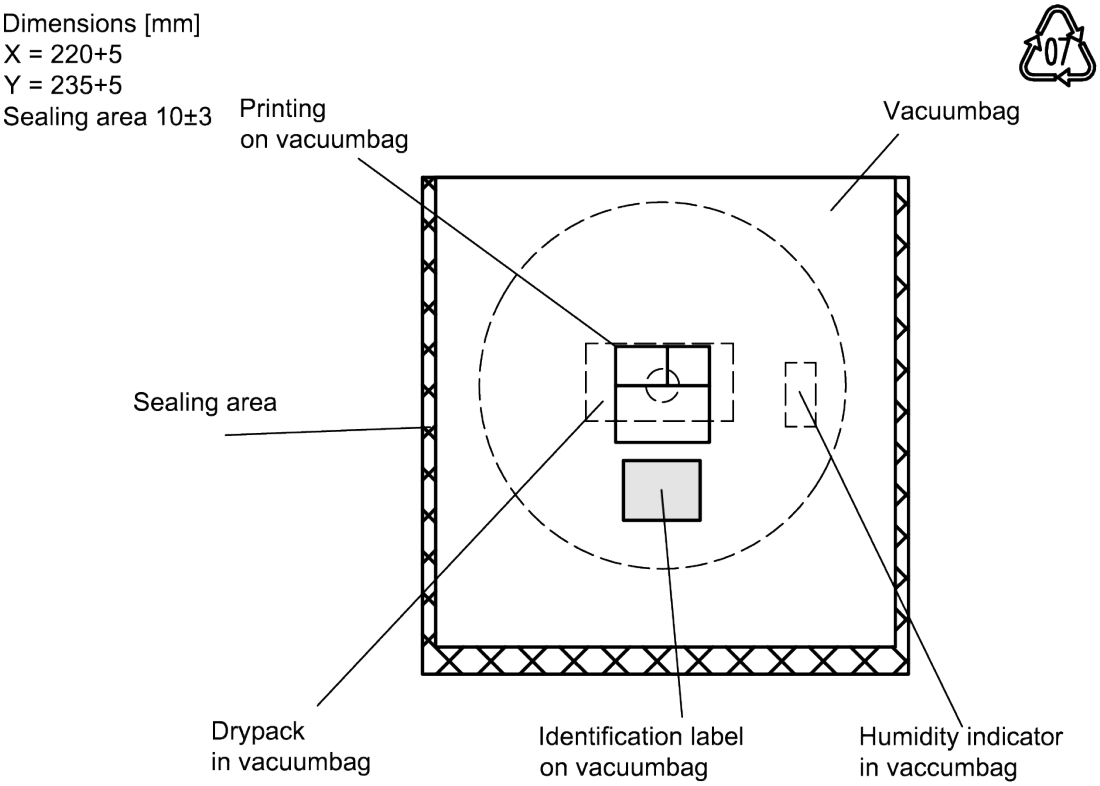

Figure 15: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

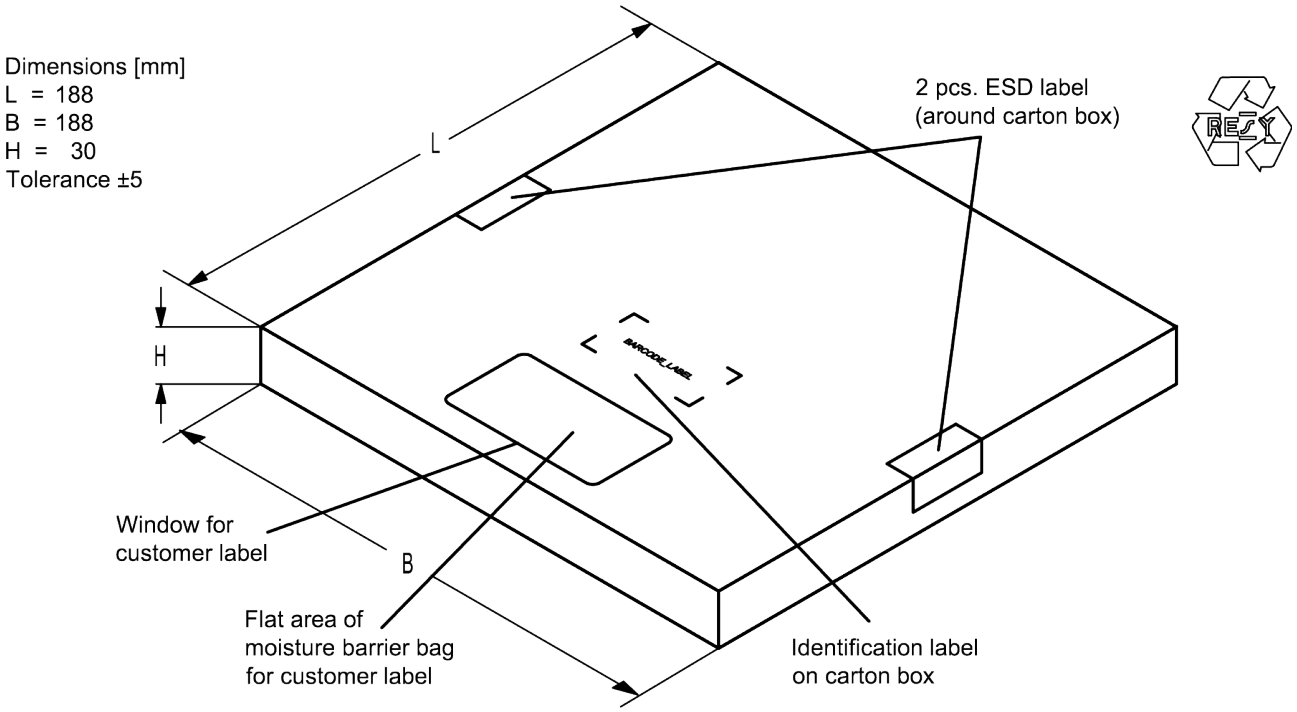

Figure 16: Drawing of folding box for reel with diameter of 180 mm.

17 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 x 32^2 + **6** x 32^1 + **18 (=J)** x 32^0 **=** **1234**
  The BASE32 code for product type B4389 is 495.

- 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 x 47^2 + **27 (=U)** x 47^1 + **31 (=Y)** x 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.

18 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 °C	30 s to 70 s
T > 230 °C	min. 10 s
T > 245 °C	max. 20 s
T ≥ 255 °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).

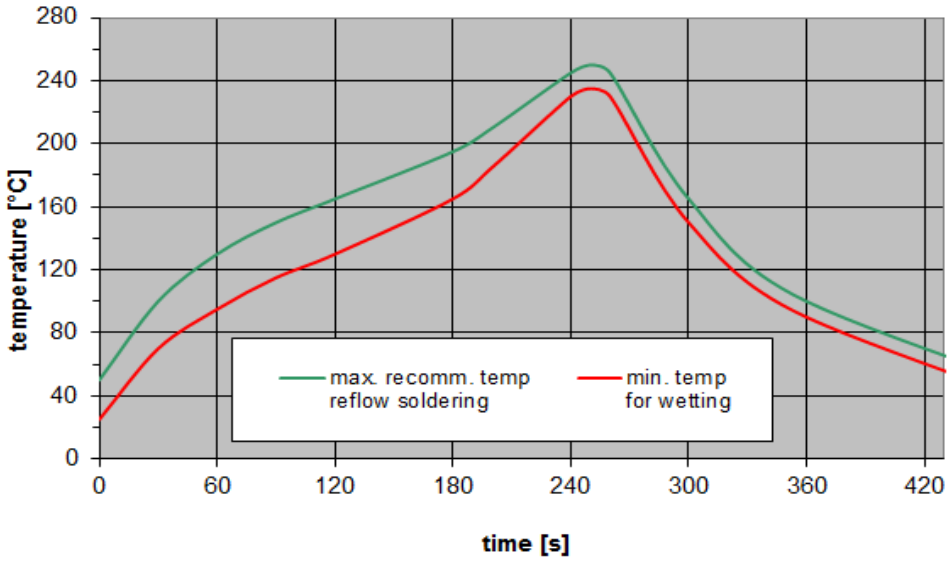

Figure 17: Recommended reflow profile for convection and infrared soldering – lead-free solder.

19 Annotations

19.1 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.

19.2 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.

20 Cautions and warnings

20.1 Display of ordering codes for RF360 products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of RF360, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products. Detailed information can be found on the Internet under www.rf360jv.com/orderingcodes.

20.2 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.

20.3 Moldability

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

20.4 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.

21 Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, RF360 Europe GmbH and its affiliates are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an RF360 product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.rf360jv.com/material). Should you have any more detailed questions, please contact our sales offices.
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