



**RF360**  
**Europe GmbH**

## **Data sheet**

### **SAW RF uplink filter**

Small cell & femtocell  
LTE band 12

Series/type: B9616  
Ordering code: B39711B9616P810

Date: July 08, 2019

Version: 2.2

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RF360 Europe GmbH  
A Qualcomm – TDK Joint Venture

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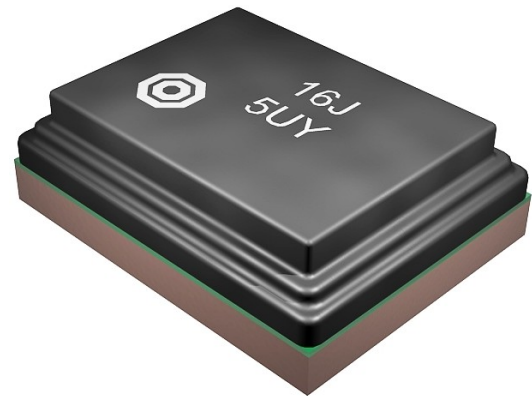
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## 1 Application

- Low-loss SAW RF filter for smallcells.
- Usable pass band 17 MHz.
- No matching network required for operation at 50Ω.

## 2 Features

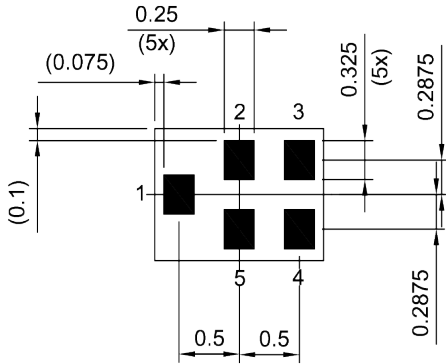
- Industrial grade qualified family
- Package size 1.4±0.1 mm × 1.1±0.1 mm
- Package height 0.45 mm (max.)
- Approximate weight 3 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)



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

3 Package

BOTTOM VIEW

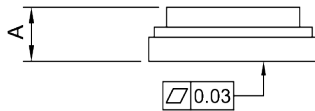


Pad and pitch tolerance ±0.05

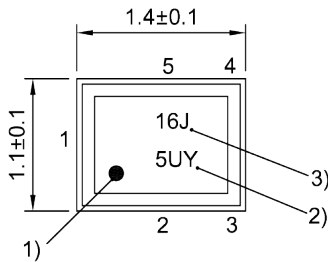
4 Pin configuration

- 1 Input
- 4 Output
- 2, 3, 5 Ground

SIDE VIEW

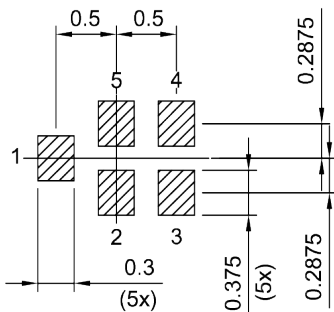


TOP VIEW



- 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 Sec. Package information (p. 19).

5 Matching circuit

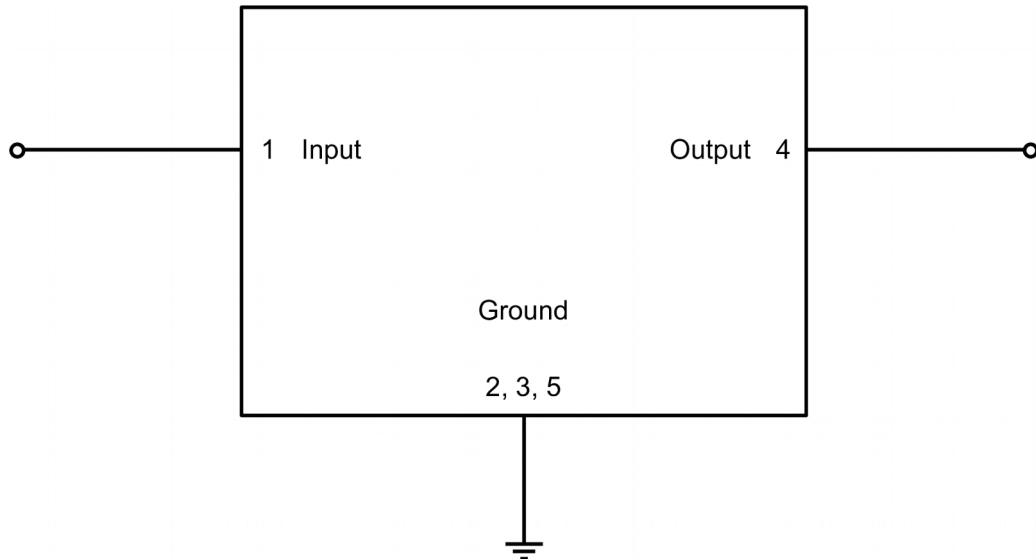


Figure 3: Schematic of matching circuit. No external matching components required.



## 6 Characteristics

Temperature range for specification	$T_{SPEC}$	= -10 °C ... +85 °C
Input terminating impedance	$Z_{IN}$	= 50 $\Omega$
Output terminating impedance	$Z_{OUT}$	= 50 $\Omega$

Characteristics			min. for $T_{SPEC}$	typ. @ +25 °C	max. for $T_{SPEC}$	
<b>Center frequency</b>		$f_C$	—	707.5	—	MHz
<b>Maximum insertion attenuation</b>	699... 716	MHz	$\alpha_{max}$	2.2	2.8	dB
<b>Amplitude ripple (p-p)</b>	699... 716	MHz	$\Delta\alpha$	0.9	1.5	dB
<b>Maximum VSWR</b>			VSWR <sub>max</sub>			
@ input port	699... 716	MHz		1.6	2.0	
@ output port	699... 716	MHz		1.6	2.0	
<b>Maximum error vector magnitude</b>	701.4... 713.6	MHz	EVM <sub>max</sub> <sup>1)</sup>	2.6	4.0	%
<b>Minimum attenuation</b>			$\alpha_{min}$			
	693.25	MHz		5	25	dB
	722.5... 729	MHz		10 <sup>2)</sup>	14	dB
	729... 746	MHz		25	31	dB
	746... 756	MHz		35	47	dB
	756... 768	MHz		45	55	dB
	777... 787	MHz		45	54	dB
	788... 798	MHz		40	57	dB
	869... 894	MHz		45	60	dB
	1398... 1432	MHz		45	62	dB
	1574... 1606	MHz		45	59	dB
	1710... 1755	MHz		45	58	dB
	1850... 1915	MHz		45	58	dB
	1930... 1995	MHz		45	59	dB
	2110... 2170	MHz		40	56	dB
	2400... 2500	MHz		40	57	dB
	5130... 5265	MHz		20	30	dB
	5265... 6000	MHz		15	23	dB

<sup>1)</sup> Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

<sup>2)</sup> Valid for typical temperature T=+25°C.

Temperature range for specification	$T_{SPEC}$	= -40 °C ... +95 °C
Input terminating impedance	$Z_{IN}$	= 50 $\Omega$
Output terminating impedance	$Z_{OUT}$	= 50 $\Omega$

Characteristics			min. for $T_{SPEC}$	typ. @ +25 °C	max. for $T_{SPEC}$		
<b>Center frequency</b>		$f_C$	—	707.5	—	MHz	
<b>Maximum insertion attenuation</b>	699... 716	MHz	$\alpha_{max}$	—	2.2	3.5	dB
<b>Amplitude ripple (p-p)</b>	699... 716	MHz	$\Delta\alpha$	—	0.9	2.2	dB
<b>Maximum VSWR</b>			VSWR <sub>max</sub>				
@ input port	699... 716	MHz		—	1.6	2.1	
@ output port	699... 716	MHz		—	1.6	2.1	
<b>Maximum error vector magnitude</b>	701.4... 713.6	MHz	EVM <sub>max</sub> <sup>1)</sup>	—	2.6	6.0	%
<b>Minimum attenuation</b>			$\alpha_{min}$				
	693.25	MHz		2	25	—	dB
	722.5... 729	MHz		10 <sup>2)</sup>	14	—	dB
	729... 746	MHz		25	31	—	dB
	746... 756	MHz		35	47	—	dB
	756... 768	MHz		45	55	—	dB
	777... 787	MHz		45	54	—	dB
	788... 798	MHz		40	57	—	dB
	869... 894	MHz		45	60	—	dB
	1398... 1432	MHz		45	62	—	dB
	1574... 1606	MHz		45	59	—	dB
	1710... 1755	MHz		45	58	—	dB
	1850... 1915	MHz		45	58	—	dB
	1930... 1995	MHz		45	59	—	dB
	2110... 2170	MHz		40	56	—	dB
	2400... 2500	MHz		40	57	—	dB
	5130... 5265	MHz		20	30	—	dB
	5265... 6000	MHz		15	23	—	dB

<sup>1)</sup> Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

<sup>2)</sup> Valid for typical temperature T=+25°C.

## 7 Maximum ratings

Operable temperature	$T_{OP} = -40\text{ °C} \dots +95\text{ °C}$	
Storage temperature	$T_{STG}^{1)} = -40\text{ °C} \dots +95\text{ °C}$	
DC voltage	$ V_{DC} ^{2)} = 0\text{ V}$	
ESD voltage		
	$V_{ESD}^{3)} = 100\text{ V}$	Machine model.
	$V_{ESD}^{4)} = 300\text{ V}$	Human body model.
Input power	$P_{IN}$	
@ input port: 699 ... 716 MHz	10 dBm <sup>5)</sup>	Continuous wave for 100000 h @ 55 °C. Source and load impedance 50Ω.
@ input port: 699 ... 716 MHz	22 dBm <sup>5)</sup>	Continuous wave for 24 h @ 85 °C. Source and load impedance 50Ω.

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

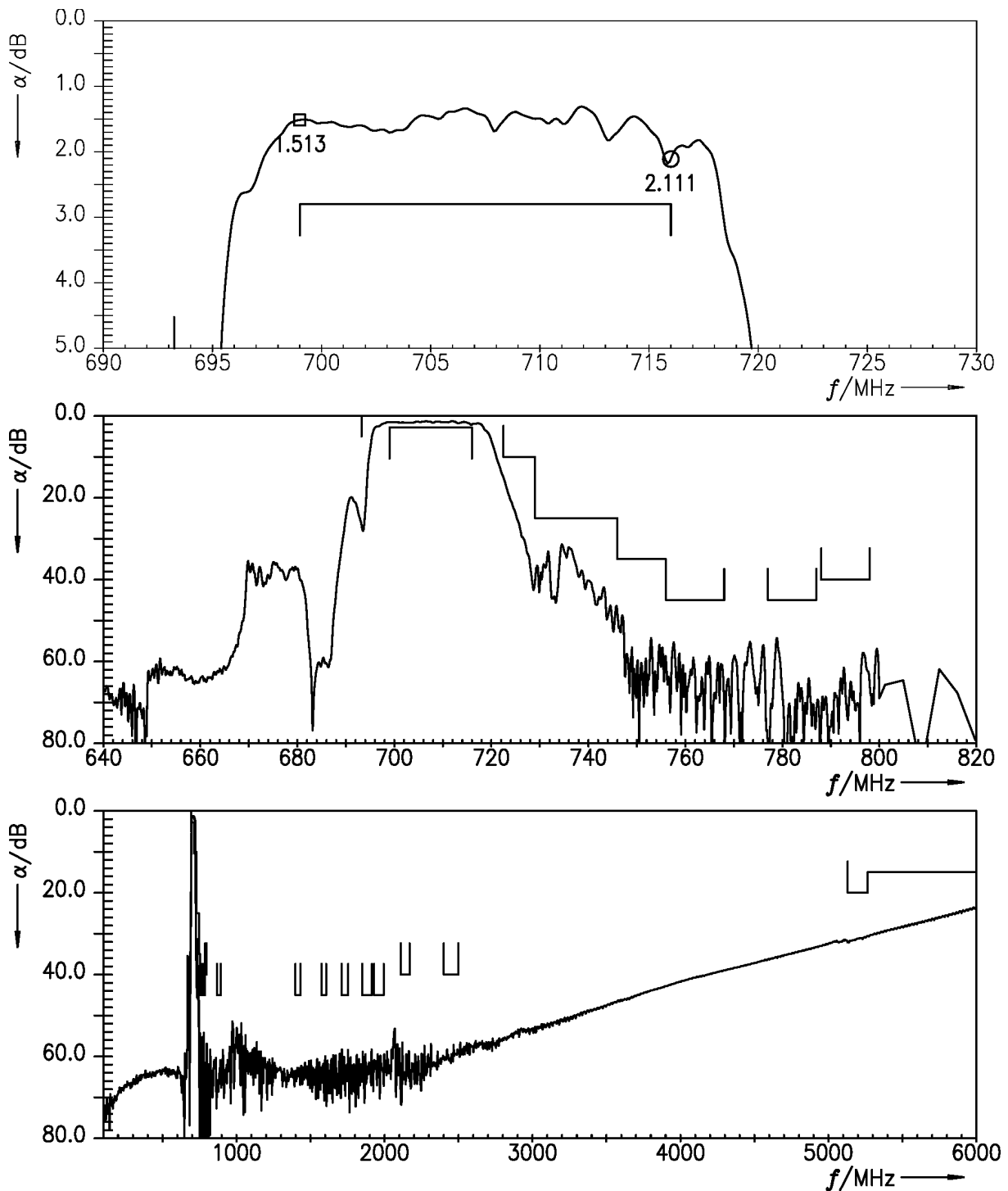
<sup>2)</sup> In case of applied DC voltage blocking capacitors are mandatory.

<sup>3)</sup> According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.

<sup>4)</sup> According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.

<sup>5)</sup> Expected lifetime according to accelerated power durability simulation and wear out models.

**8 Transmission coefficient**



**Figure 4:** Attenuation.

9 Reflection coefficients

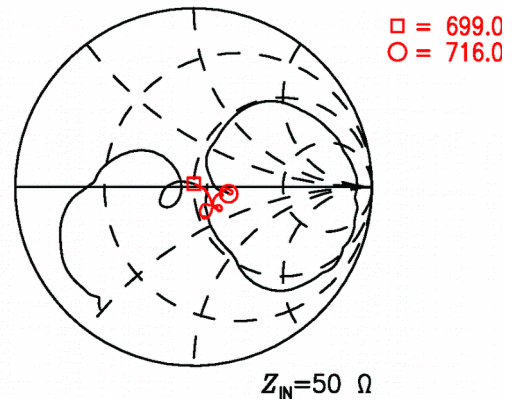
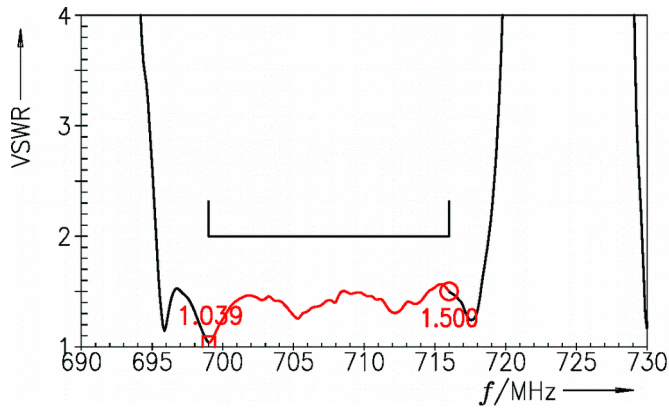


Figure 5: Reflection coefficient at input port.

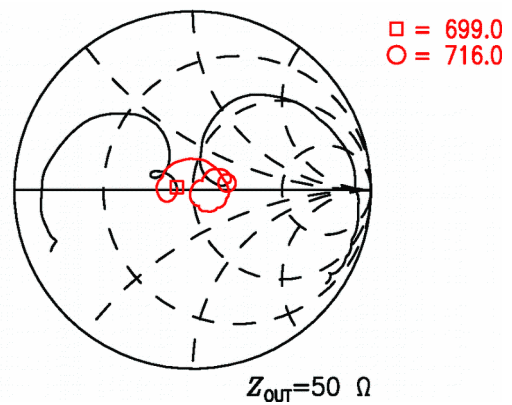
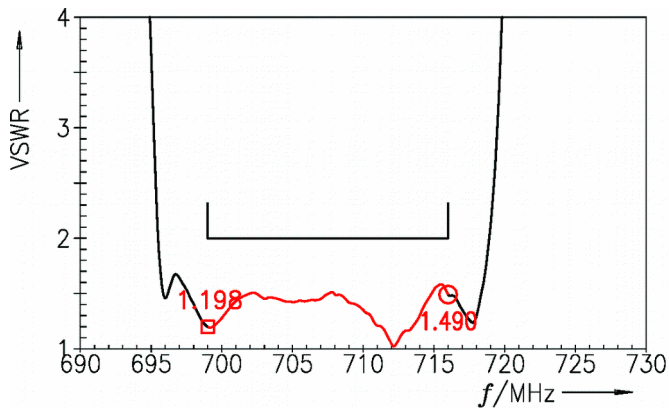


Figure 6: Reflection coefficient at output port.

10 EVM

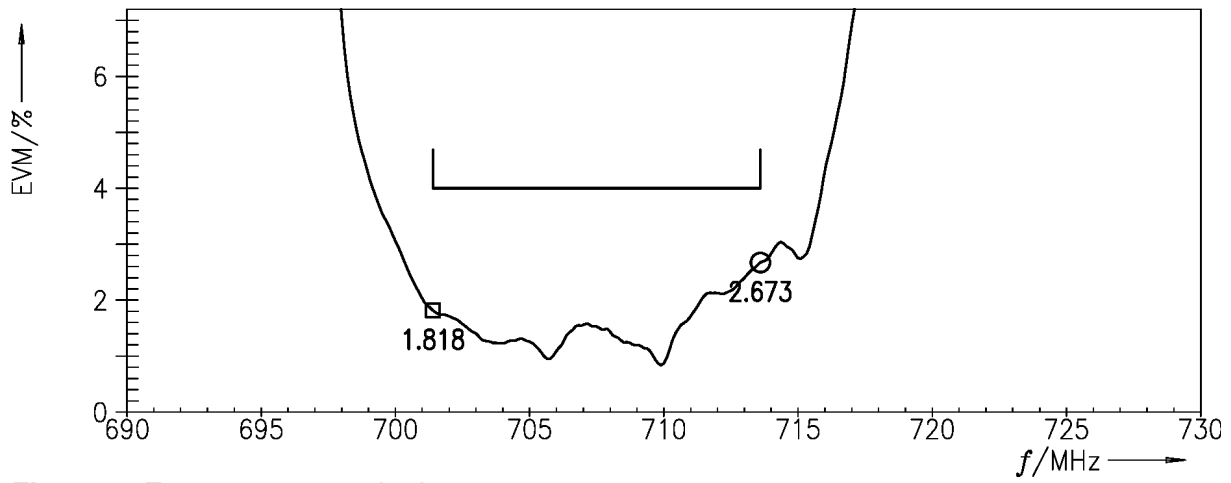
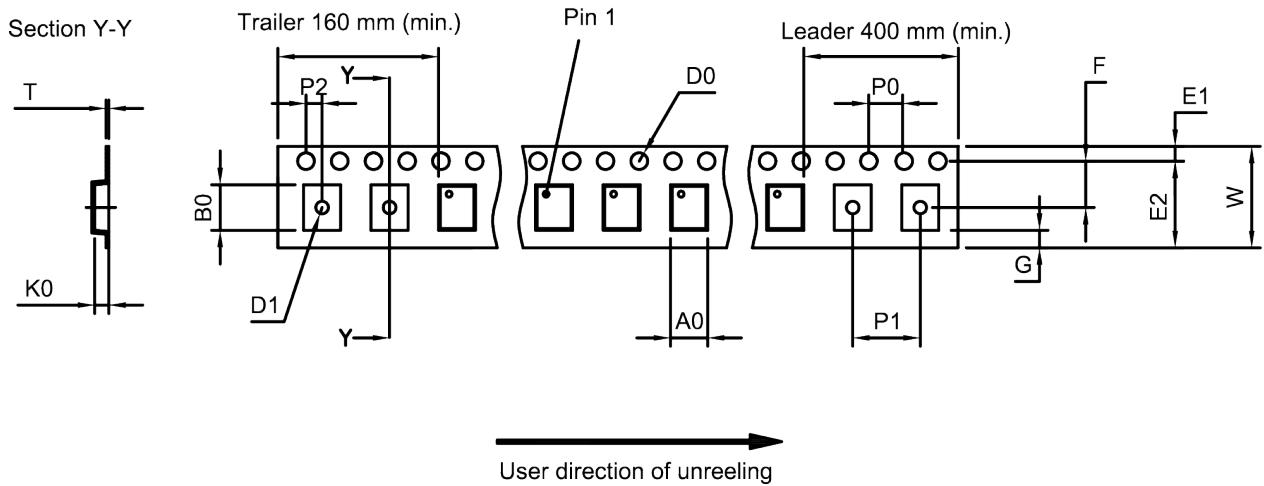


Figure 7: Error vector magnitude.

**11 Packing material**

**11.1 Tape**



**Figure 8:** Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A <sub>0</sub>	1.27±0.05 mm	E <sub>2</sub>	6.25 mm (min.)	P <sub>1</sub>	4.0±0.1 mm
B <sub>0</sub>	1.57±0.05 mm	F	3.5±0.05 mm	P <sub>2</sub>	2.0±0.05 mm
D <sub>0</sub>	1.5+0.1/-0 mm	G	0.75 mm (min.)	T	0.25±0.03 mm
D <sub>1</sub>	0.5±0.1 mm	K <sub>0</sub>	0.62±0.05 mm	W	8.0+0.3/-0.1 mm
E <sub>1</sub>	1.75±0.1 mm	P <sub>0</sub>	4.0±0.1 mm		

**Table 1:** Tape dimensions.

11.2 Reel with diameter of 180 mm

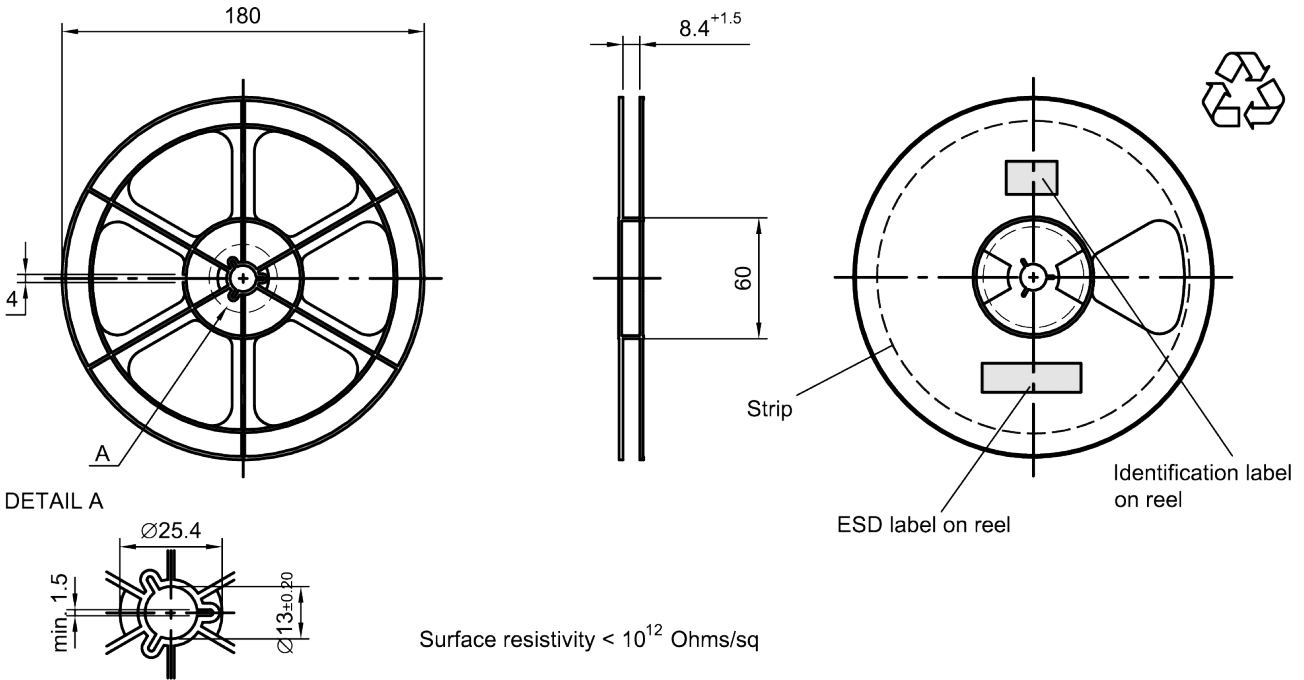


Figure 9: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

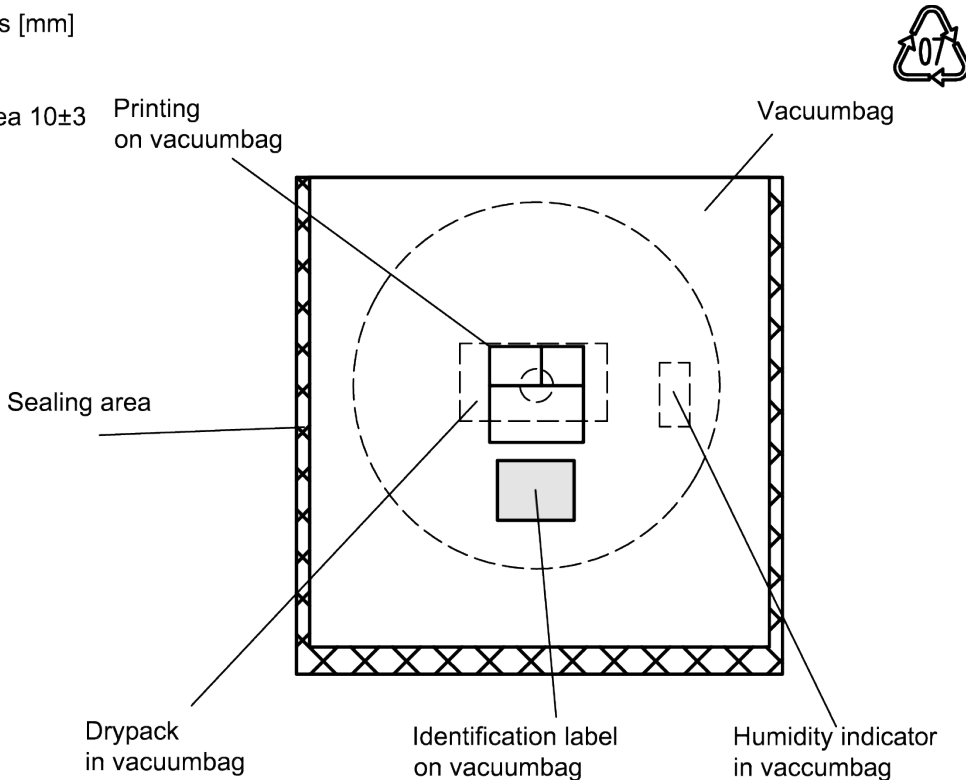
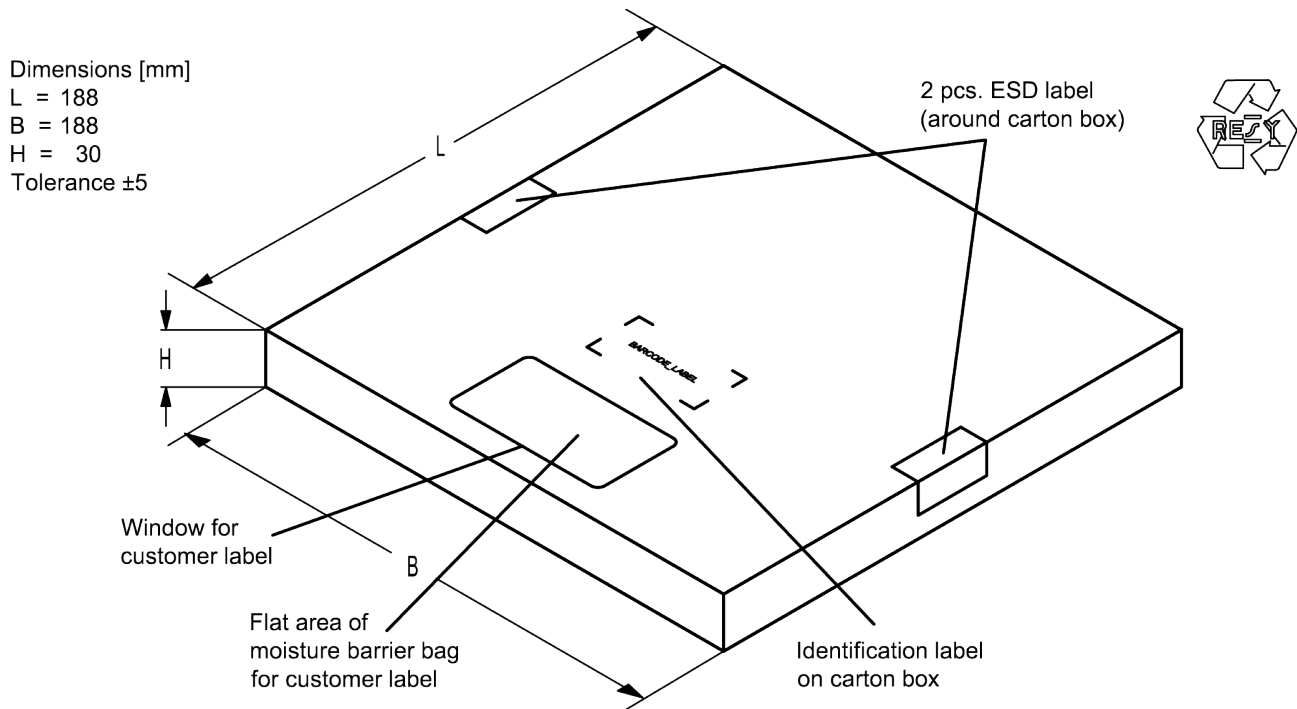


Figure 10: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.





**Figure 11:** Drawing of folding box for reel with diameter of 180 mm.

**12 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 B9616 is 9CG.

■ 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		

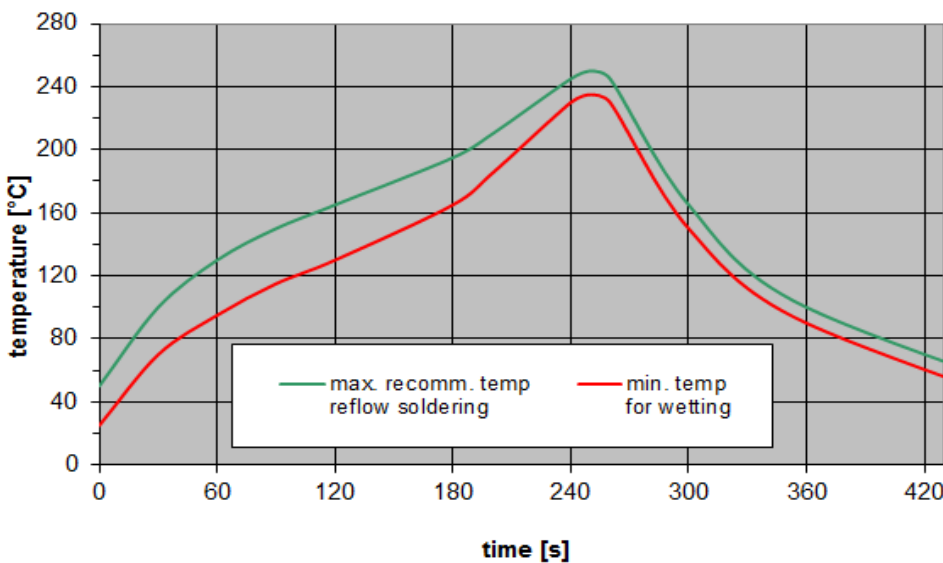
**Table 2:** Lists for encoding and decoding of marking.

**13 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 °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 12:** Recommended reflow profile for convection and infrared soldering – lead-free solder.

## 14 Annotations

### 14.1 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.

### 14.2 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.

### 14.3 Ordering codes and packing units

Ordering code	Packing unit
B39711B9616P810	5000 pcs

**Table 4:** Ordering codes and packing units.

## 15 Cautions and warnings

### 15.1 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](http://www.rf360jv.com/orderingcodes).

### 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.

## 16 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.**
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