Qualcomm

RF360
Europe GmbH

Data sheet

BAW filter
WLAN 2G

Series/type:	B9645
Ordering code:	B39242B9645P810
Date:	May 13, 2019
Version:	2.2

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RF360 Europe GmbH

A Qualcomm – TDK Joint Venture

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Table of contents

1 Application

- Low-loss BAW RF single filter for Bluetooth/WLAN systems
- Low insertion attenuation

2 Features

- Industrial grade qualified family
- Package size $1.1_{\pm 0.1}$ mm × $0.9_{\pm 0.1}$ mm
- Package height 0.45 mm (max.)
- Approximate weight 5 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)

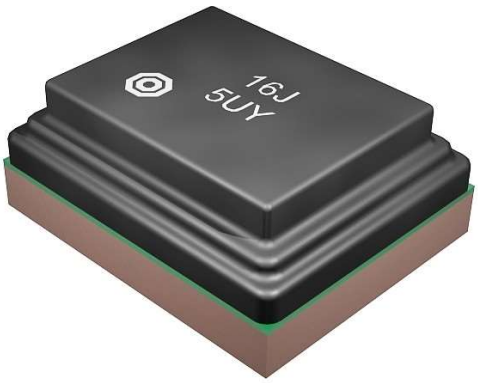

Figure 1: Picture of component with example of product marking.

3 Package

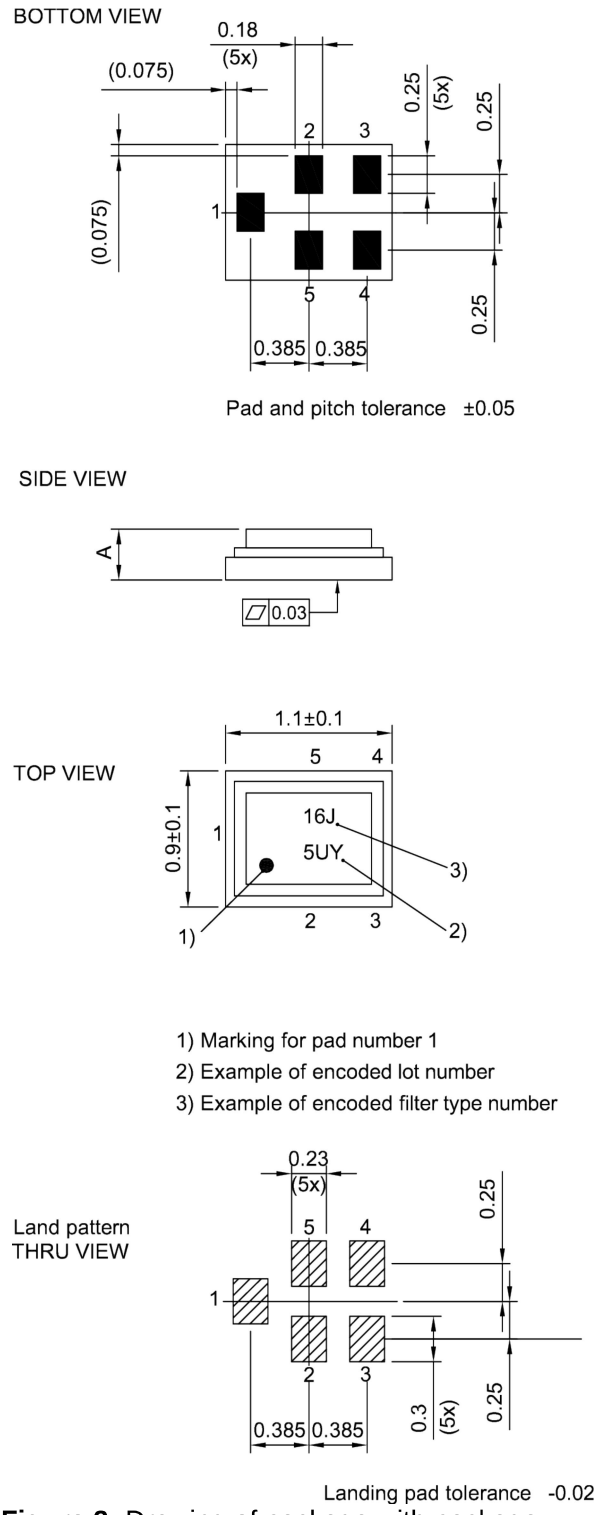

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 21).

4 Pin configuration

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

5 Matching circuit

- L_{g3} = 0.6 nH
- L_{s1} = 1.2 nH
- L_{s4} = 1.5 nH

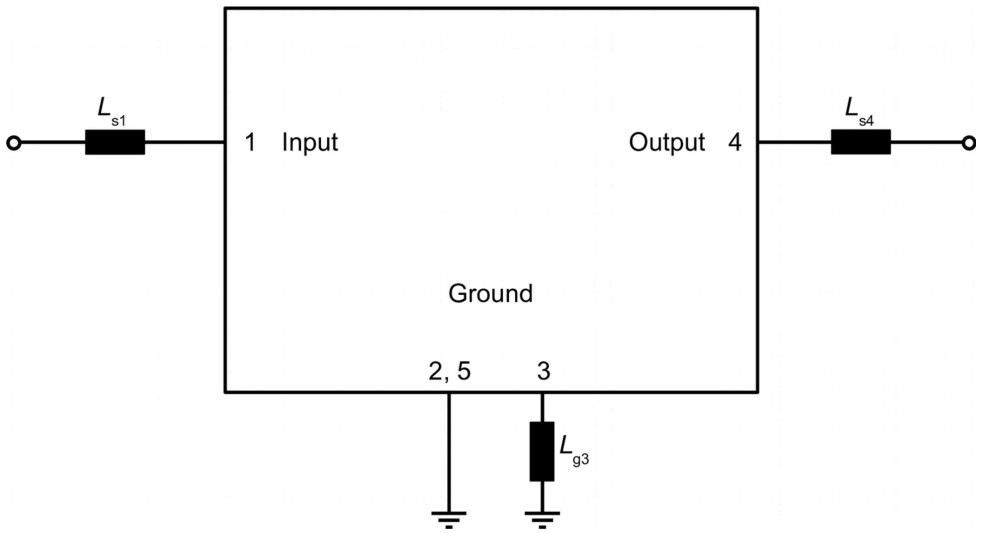

Figure 3: Schematic of matching circuit.

6 Characteristics

Temperature range for specification T_{SPEC} = −10 °C ... +85 °C
Input terminating impedance Z_{IN} = 50 Ω + 1.2 nH[1)]
Output terminating impedance Z_{OUT} = 50 Ω + 1.5 nH[1)]

Characteristics				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion attenuation – WLAN			α_{WLAN} [2)]				
WLAN ch1	2412	MHz		—	1.5	2.2	dB
WLAN ch2	2417	MHz		—	1.2	2.0	dB
WLAN ch3-ch11	2422... 2462	MHz		—	0.9	2.0	dB
WLAN ch12	2467	MHz		—	1.1	2.0	dB
WLAN ch13	2472	MHz		—	1.2	2.0	dB
Insertion attenuation – BT			α_{BT} [3)]				
	2401.5... 2480.5	MHz		—	1.0	2.0	dB
Amplitude ripple (p-p)			Δα				
WLAN ch1	2403.1... 2420.9	MHz		—	1.3	2.4[4)]	dB
WLAN ch2	2408.1... 2425.9	MHz		—	0.9	1.5	dB
WLAN ch3	2413.1... 2430.9	MHz		—	0.6	1.1	dB
WLAN ch4-ch10	2418.1... 2465.9	MHz		—	0.7	1.2	dB
WLAN ch11	2453.1... 2470.9	MHz		—	0.6	1.2	dB
WLAN ch12	2458.1... 2475.9	MHz		—	0.7	1.6	dB
WLAN ch13	2463.1... 2480.9	MHz		—	1.0	2.2[5)]	dB
Maximum VSWR			$VSWR_{max}$				
@ input port	2403.1... 2480.9	MHz		—	1.4	2.3	
@ output port	2403.1... 2480.9	MHz		—	1.4	2.3	
Attenuation			α				
	10... 800	MHz		32	35	—	dB
	800... 1805	MHz		28	32	—	dB
	1805... 2170	MHz		28	32	—	dB
	2170... 2300	MHz		30	36	—	dB
	2300... 2360	MHz		39	48	—	dB
	2360... 2365	MHz		41[6)]	56[6)]	—	dB
	2365... 2370	MHz		35[6)]	51[6)]	—	dB
	2370... 2375	MHz		35[6)]	39[6)]	—	dB
	2375... 2380	MHz		34[6)]	40[6)]	—	dB
	2380... 2385	MHz		21[6)]	39[6)]	—	dB
	2496... 2501	MHz		13[6)]	37[6)]	—	dB
	2500... 2505	MHz		29[6)]	52[6)]	—	dB
	2500... 2505	MHz		35[6), 7)]	52[6)]	—	dB
	2505... 2570	MHz		36	39	—	dB
	2570... 2620	MHz		32	36	—	dB
	2620... 2690	MHz		32	35	—	dB
	2690... 2900	MHz		28	34	—	dB

Characteristics			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	2900... 3400	MHz	28	36	—	dB
	3400... 3600	MHz	35	43	—	dB
	3600... 3800	MHz	30	43	—	dB
	3800... 4100	MHz	14	21	—	dB
	4100... 4800	MHz	26	34	—	dB
	4800... 5150	MHz	20	33	—	dB
	5150... 5850	MHz	20	29	—	dB

1) See Sec. Matching circuit (p. 6).
2) Average over each WLAN channel with band width of 17.8 MHz.
3) Averaged value within each Bluetooth (BT) channel with band width of 79 MHz.
4) Valid for temperature T = +25°C...+85°C. Max=3.8dB for temperature T = -10°C..+85°C.
5) Valid for temperature T = +25°C. Max=5.3dB for temperature T = -10°C..+85 °C.
6) Integrated attenuation: Averaged power $|Sij|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.
7) Valid for temperature T = +25 °C...+85 °C.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
Input terminating impedance	Z_{IN}	= 50 Ω + 1.2 nH[1]
Output terminating impedance	Z_{OUT}	= 50 Ω + 1.5 nH[1]

Characteristics				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Insertion attenuation – WLAN			α_{WLAN}[2]				
WLAN ch1	2412	MHz		—	1.5	2.5	dB
WLAN ch2	2417	MHz		—	1.2	2.0	dB
WLAN ch3-ch11	2422... 2462	MHz		—	0.9	2.0	dB
WLAN ch12	2467	MHz		—	1.1	2.0	dB
WLAN ch13	2472	MHz		—	1.2	2.2	dB
Insertion attenuation – BT			α_{BT}[3]				
	2401.5... 2480.5	MHz		—	1.0	2.0	dB
Amplitude ripple (p-p)			Δα				
WLAN ch1	2403.1... 2420.9	MHz		—	1.3	2.4[4]	dB
WLAN ch2	2408.1... 2425.9	MHz		—	0.9	1.5	dB
WLAN ch3	2413.1... 2430.9	MHz		—	0.6	1.1	dB
WLAN ch4-ch10	2418.1... 2465.9	MHz		—	0.7	1.2	dB
WLAN ch11	2453.1... 2470.9	MHz		—	0.6	1.2	dB
WLAN ch12	2458.1... 2475.9	MHz		—	0.7	1.6	dB
WLAN ch13	2463.1... 2480.9	MHz		—	1.0	2.2[5]	dB
Maximum VSWR			$VSWR_{max}$				
@ input port	2403.1... 2480.9	MHz		—	1.4	2.5	
@ output port	2403.1... 2480.9	MHz		—	1.4	2.5	
Attenuation			α				
	10... 800	MHz		32	35	—	dB
	800... 1805	MHz		28	32	—	dB
	1805... 2170	MHz		28	32	—	dB
	2170... 2300	MHz		30	36	—	dB
	2300... 2360	MHz		39	48	—	dB
	2360... 2365	MHz		41[6]	56[6]	—	dB
	2365... 2370	MHz		35[6]	51[6]	—	dB
	2370... 2375	MHz		35[6]	39[6]	—	dB
	2375... 2380	MHz		34[6]	40[6]	—	dB
	2380... 2385	MHz		19[6]	39[6]	—	dB
	2496... 2501	MHz		10[6]	37[6]	—	dB
	2500... 2505	MHz		24[6]	52[6]	—	dB
	2500... 2505	MHz		35[6, 7]	52[6]	—	dB
	2505... 2570	MHz		36	39	—	dB
	2570... 2620	MHz		32	36	—	dB
	2620... 2690	MHz		32	35	—	dB
	2690... 2900	MHz		28	34	—	dB
	2900... 3400	MHz		28	36	—	dB

Characteristics			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	3400... 3600	MHz	35	43	—	dB
	3600... 3800	MHz	30	43	—	dB
	3800... 4100	MHz	14	21	—	dB
	4100... 4800	MHz	26	34	—	dB
	4800... 5150	MHz	20	33	—	dB
	5150... 5850	MHz	20	29	—	dB

1) See Sec. Matching circuit (p. 6).
2) Average over each WLAN channel with band width of 17.8 MHz.
3) Averaged value within each Bluetooth (BT) channel with band width of 79 MHz.
4) Valid for temperature T = +25°C...+95°C. Max=6.1dB for temperature T = -40°C..+95°C.
5) Valid for temperature T = +25°C. Max=6.3dB for temperature T = -40°C..+95°C.
6) Integrated attenuation: Averaged power $|Sij|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.
7) Valid for temperature T = +25 °C...+95 °C.

7 Maximum ratings

Operable temperature	T_{OP} = −40 °C ... +95 °C	
Storage temperature	T_{STG} [1] = −40 °C ... +95 °C	
DC voltage	$\|V_{DC}\|$ [2] = 0 V (max.)	
ESD voltage		
	V_{ESD} [3] = 150 V (max.)	Machine model.
	V_{ESD} [4] = 250 V (max.)	Human body model.
Input power	P_{IN}	
@ input port: 2403.1 ... 2480.9 MHz	27 dBm [5), 6)]	20 MHz WLAN signal for 100000 h @ 55 °C. Source and load impedance 50Ω.
@ input port: other frequency ranges	10 dBm	20 MHz WLAN signal for 100000 h @ 55 °C. Source and load impedance 50Ω.

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.
3) According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.
4) According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.
5) Expected lifetime according to accelerated power durability test, and wear out models.
6) Tspec is the ambient temperature of the PCB at component position. Specified min./max values from section 6 “characteristics” for maximum input power 27dBm are valid for temperature up to 61°C.

8 Transmission coefficient

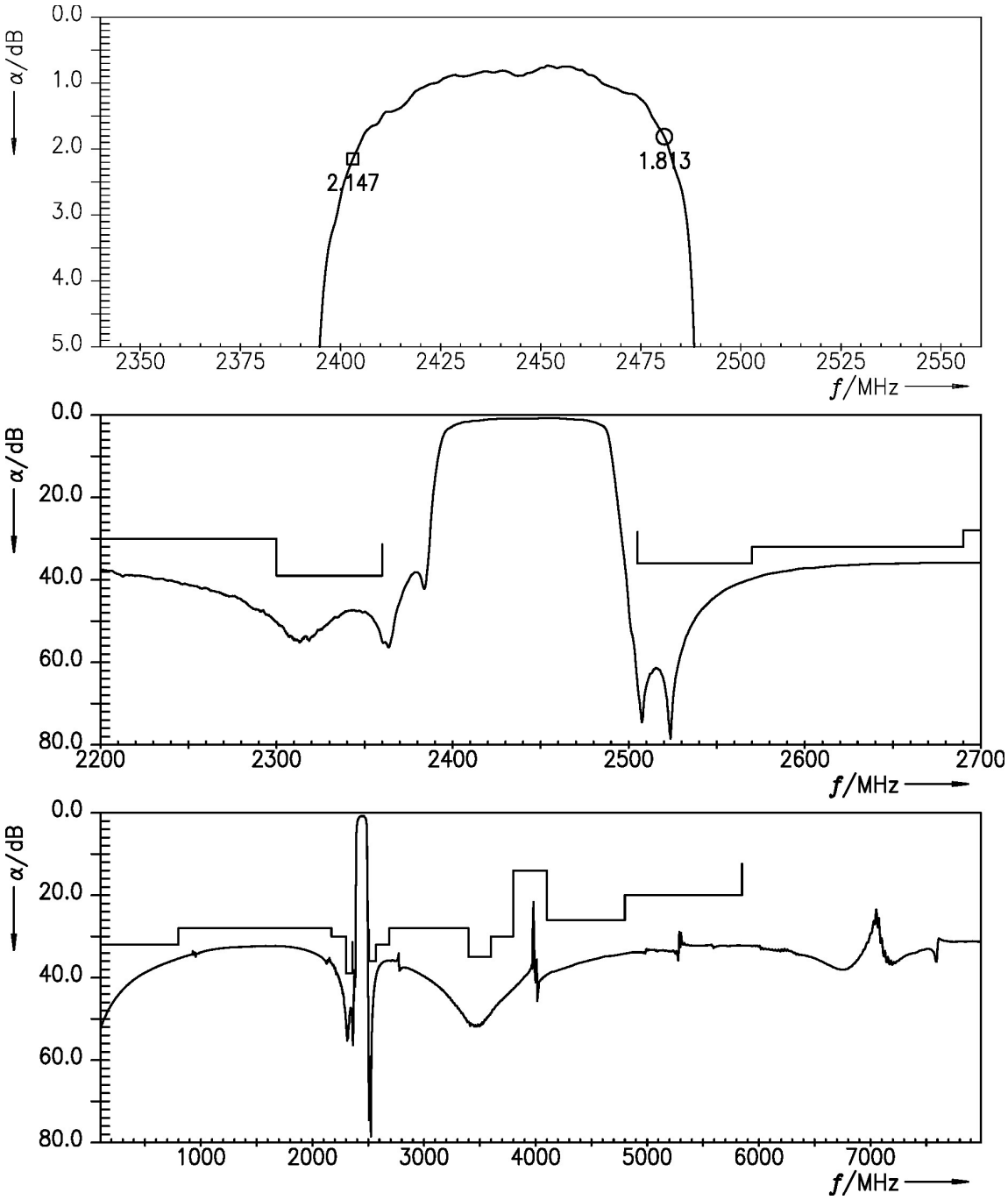

Figure 4: Attenuation.

9 Reflection coefficients

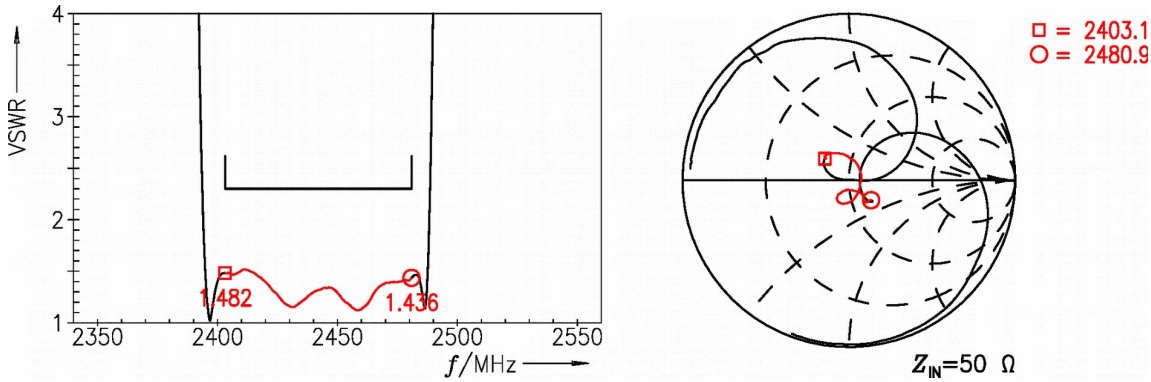

Figure 5: Reflection coefficient at input port.

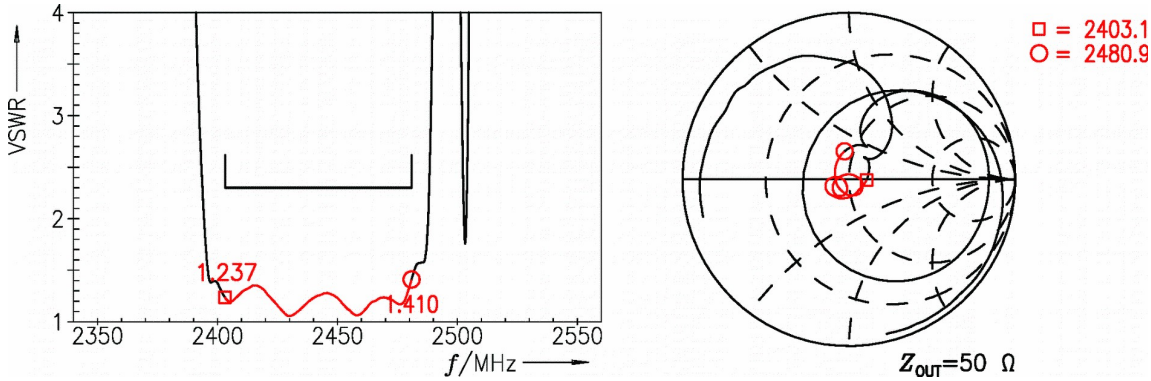

Figure 6: Reflection coefficient at output port.

10 Packing material

10.1 Tape

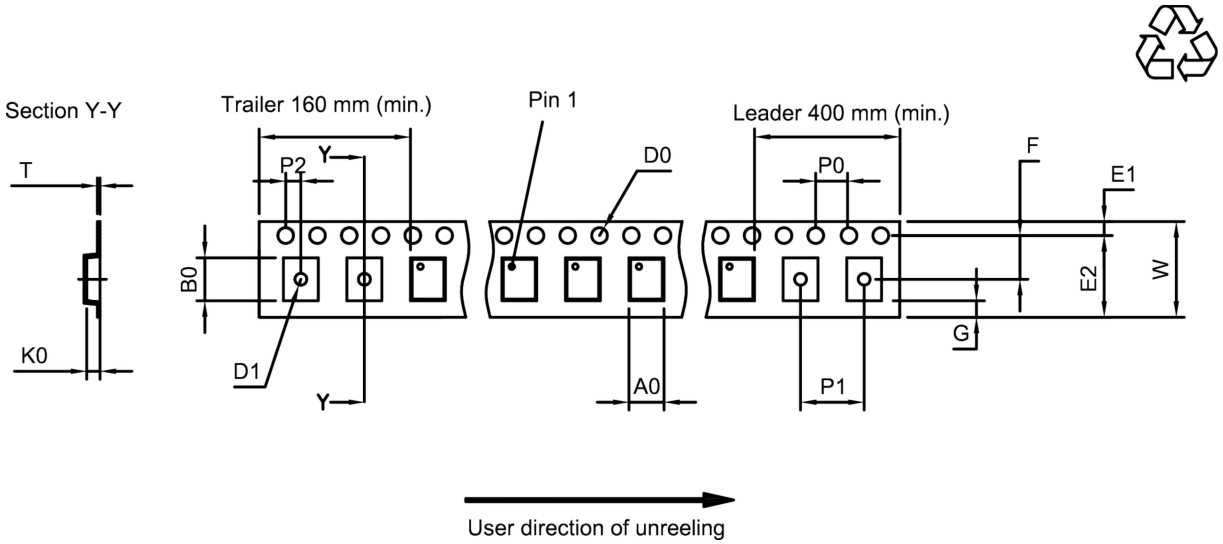

Figure 7: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	$1.02_{\pm 0.05}$ mm
B_0	$1.22_{\pm 0.05}$ mm
D_0	$1.55_{\pm 0.05}$ mm
D_1	$0.55_{\pm 0.1}$ mm
E_1	$1.75_{\pm 0.1}$ mm

E_2	6.25 mm (min.)
F	$3.5_{\pm 0.05}$ mm
G	–
K_0	$0.6_{\pm 0.05}$ mm
P_0	$4.0_{\pm 0.1}$ mm

P_1	$2.0_{\pm 0.1}$ mm
P_2	$2.0_{\pm 0.05}$ mm
T	$0.25_{\pm 0.03}$ mm
W	$8.0_{+0.3/-0.1}$ mm

Table 1: Tape dimensions.

10.2 Reel with diameter of 180 mm

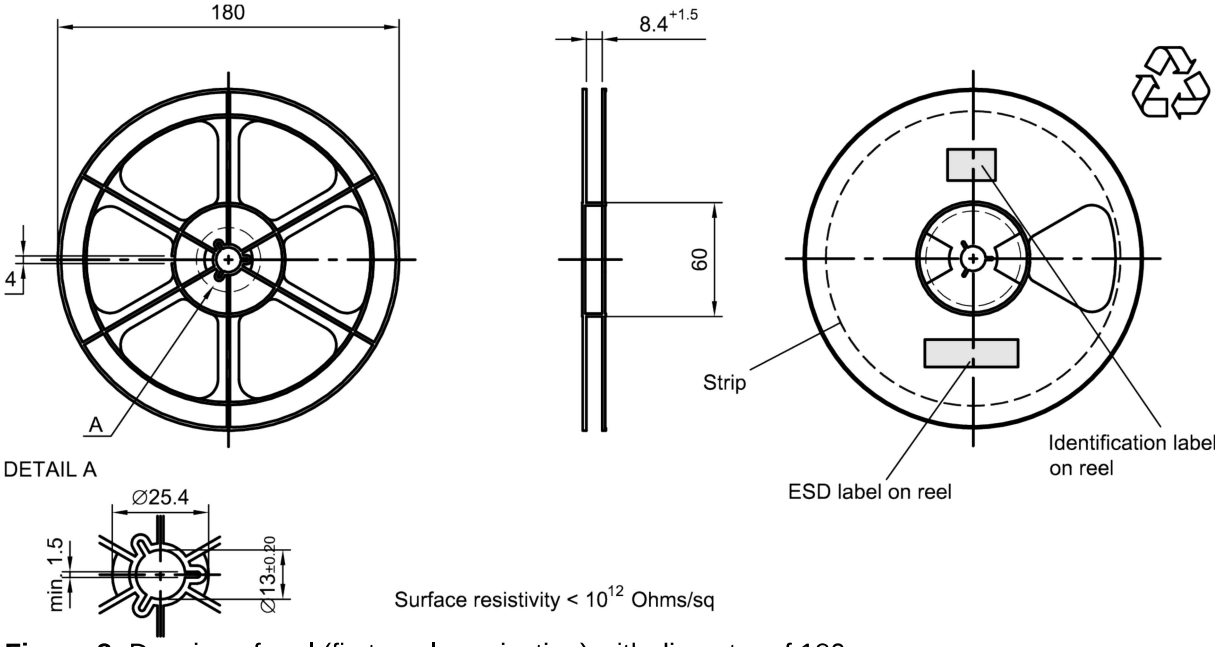

Figure 8: Drawing of reel (first-angle projection) with diameter of 180 mm.

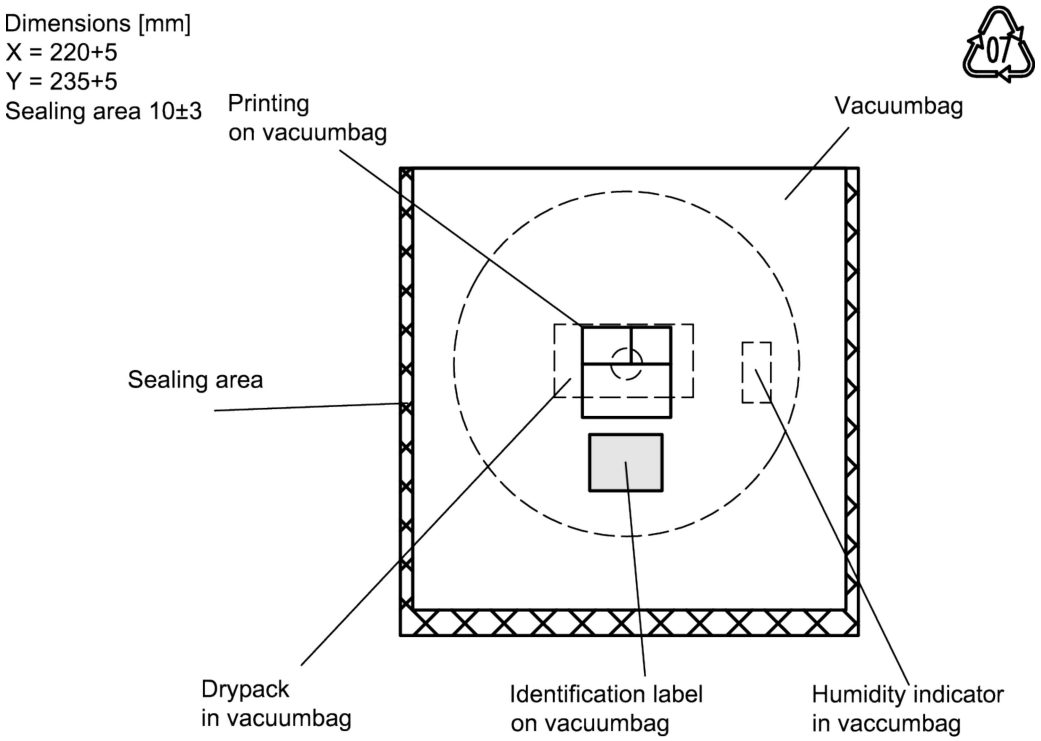

Figure 9: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

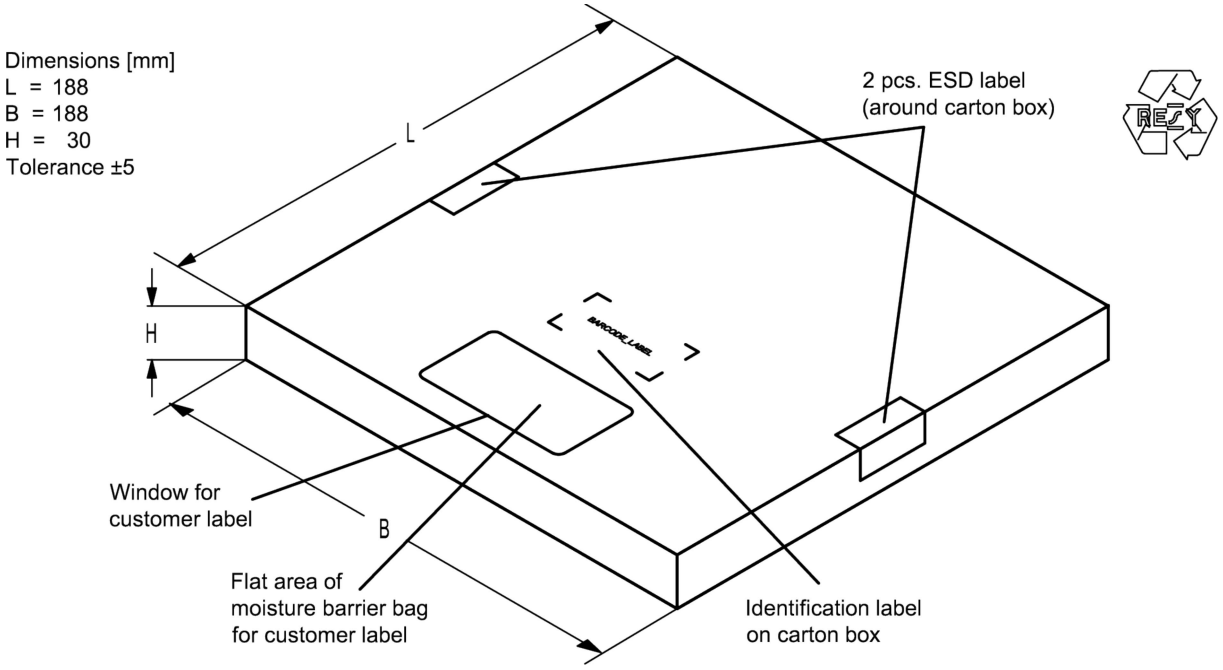

Figure 10: Drawing of folding box for reel with diameter of 180 mm.

10.3 Reel with diameter of 330 mm

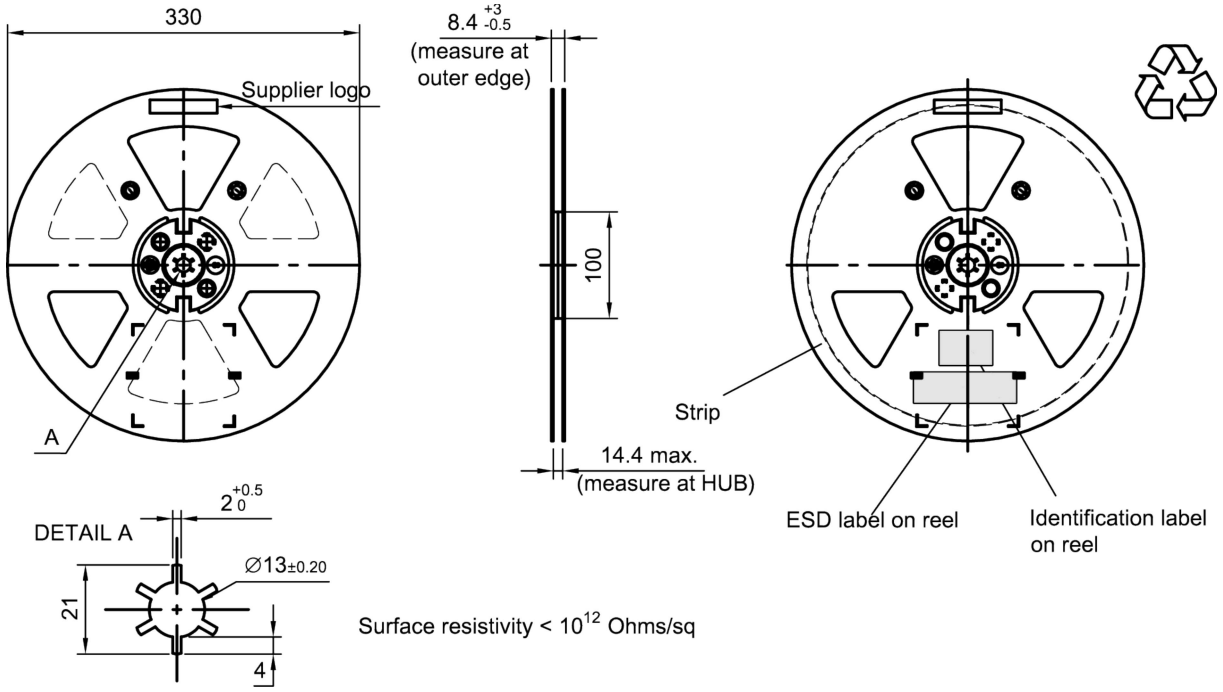

Figure 11: Drawing of reel (first-angle projection) with diameter of 330 mm.

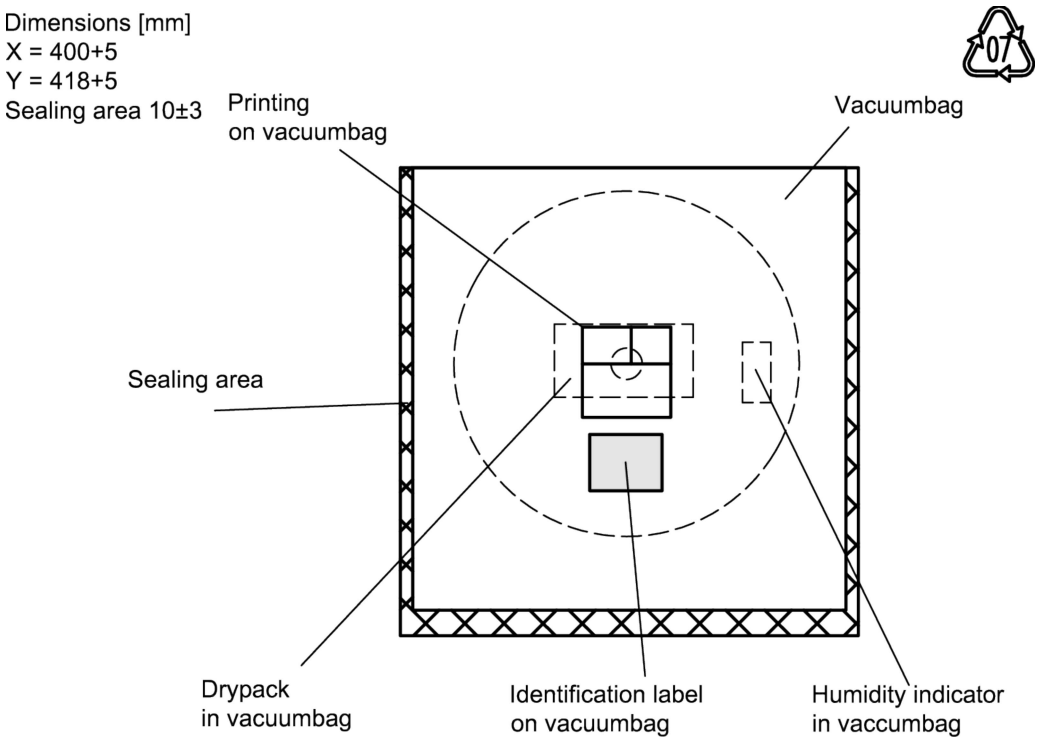

Figure 12: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

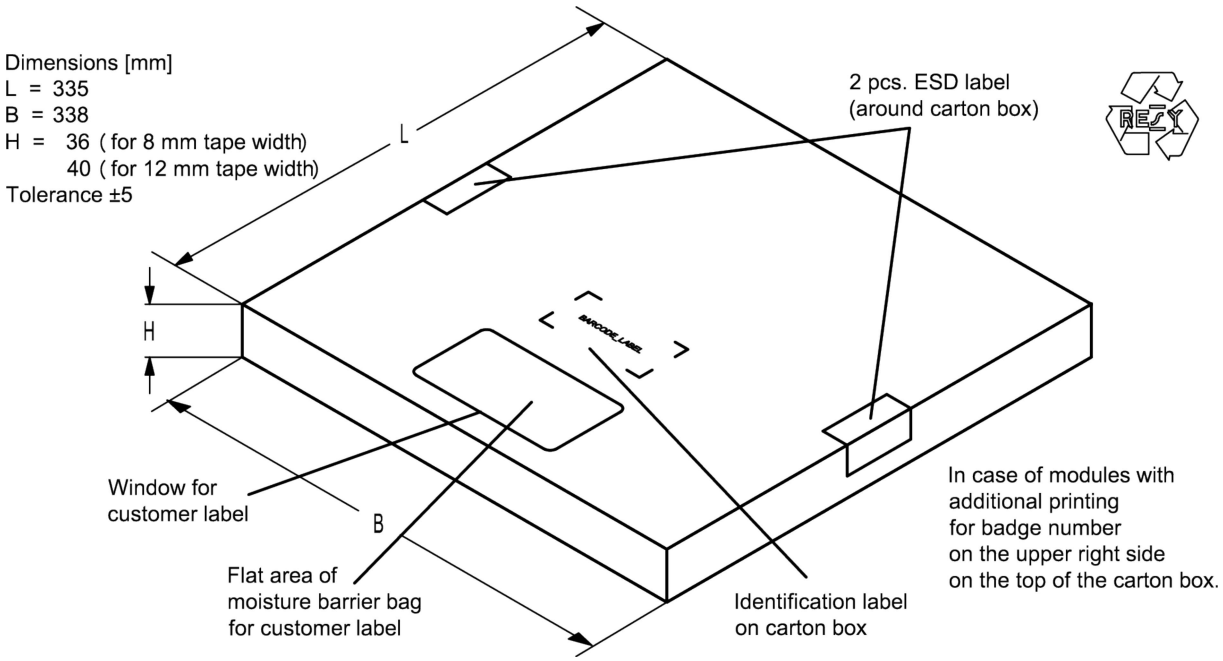

Figure 13: Drawing of folding box for reel with diameter of 330 mm.

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 x 32^2 + **6** x 32^1 + **18 (=J)** x 32^0 = **1234**
  The BASE32 code for product type B9645 is 9DD.

- 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.

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 °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).

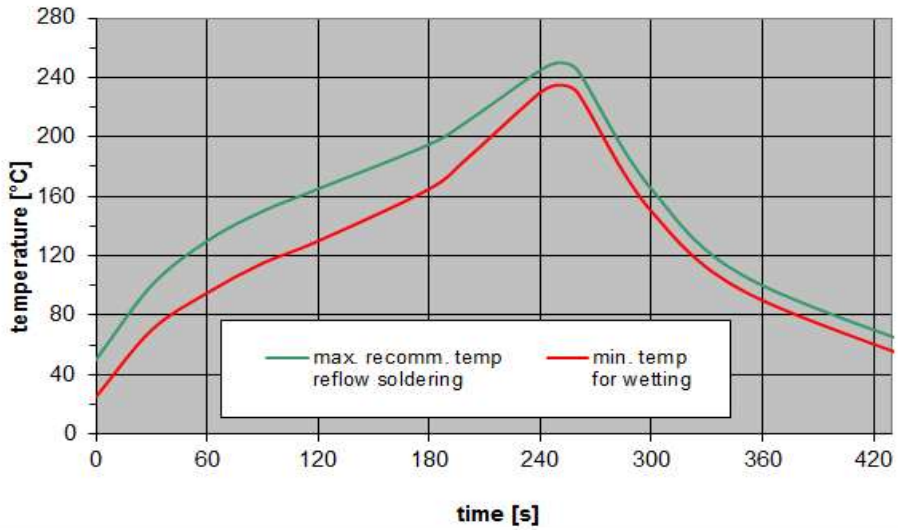

Figure 14: Recommended reflow profile for convection and infrared soldering – lead-free solder.

13 Annotations

13.1 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.

13.2 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.

13.3 Ordering codes and packing units

Ordering code	Packing unit
B39242B9645P810	5000 pcs

Table 4: Ordering codes and packing units.

14 Cautions and warnings

14.1 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.

14.2 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.

14.3 Moldability

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

14.4 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.

15 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.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.
   The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.