Qualcomm

RF360
Europe GmbH

# Data sheet

## SAW filter

Small cell & femtocell
Beidou B1; GPS; GLONASS

| | |
|---|---|
| Series/type: | B9621 |
| Ordering code: | B39162B9621P810 |
| Date: | June 17, 2019 |
| Version: | 2.3 |

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RF360 Europe GmbH

A Qualcomm – TDK Joint Venture

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## Table of contents

## 1 Application

- Low-loss RF GPS + Beidou B1 + GLONASS filter for industrial electronics
- Simultaneous usage of GPS, Beidou B1 and GLONASS Bands
- Usable pass band: 2.0 MHz for GPS, 4.092 MHz for Beidou B1 and 8.34 MHz for GLONASS
- Very low insertion attenuation
- No matching network required for operation at 50 Ω

## 2 Features

- Industrial grade qualified family
- Package size $1.4_{\pm 0.1}$ mm × $1.1_{\pm 0.1}$ 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)

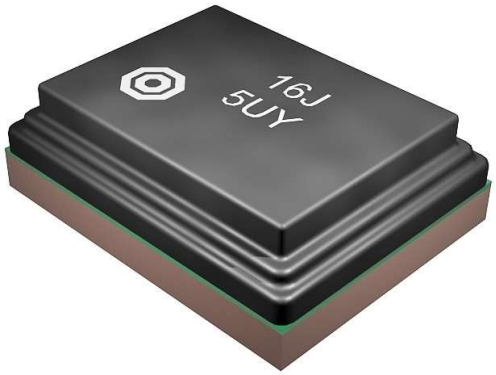


**Figure 1:** Picture of component with example of product marking.

## 3 Package

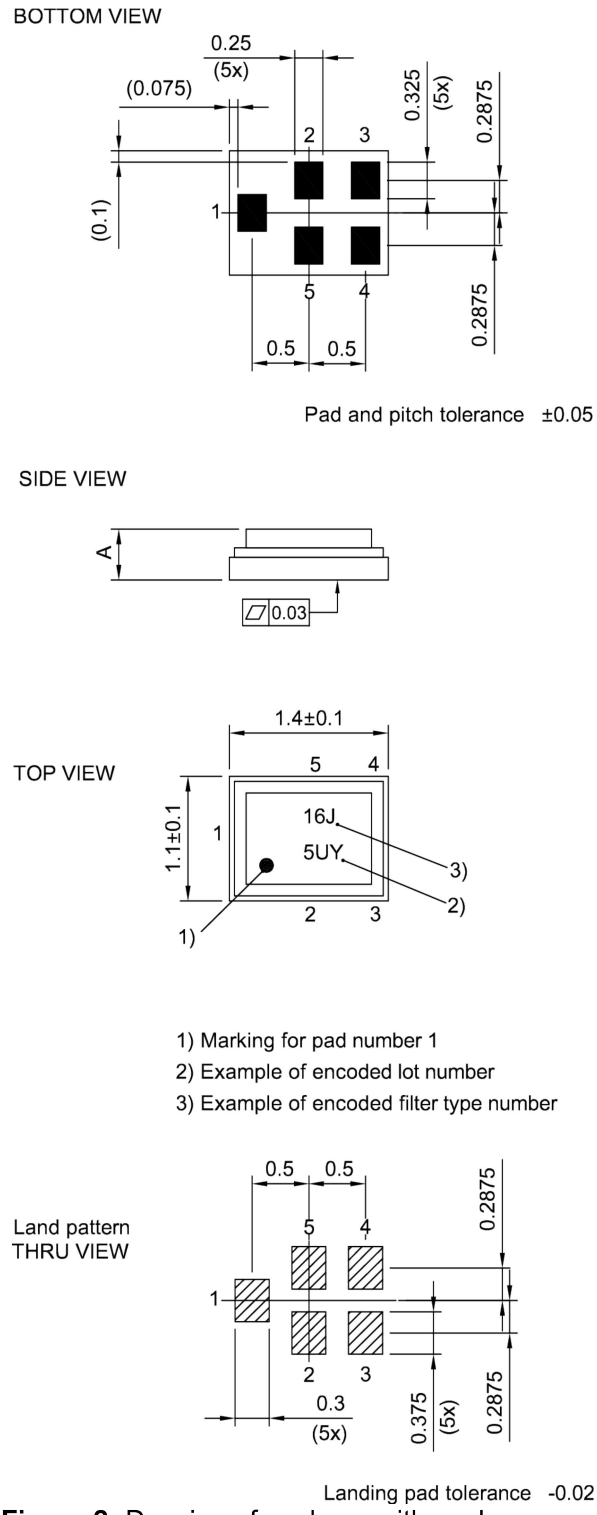


**Figure 2:** Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 19).

## 4 Pin configuration

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

## 5 Matching circuit

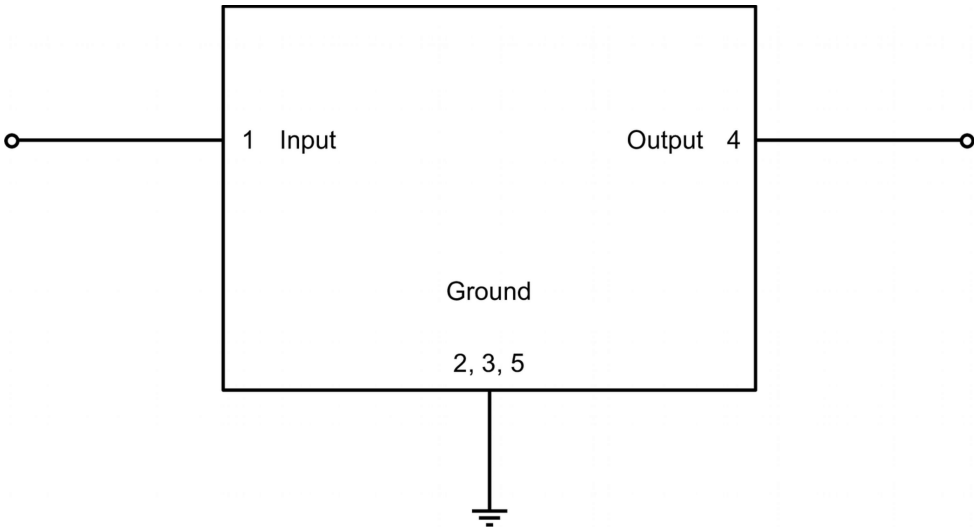


**Figure 3:** Schematic of matching circuit. No external matching components required.

## 6 Characteristics

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

| Characteristics | | | min. for $T_{SPEC}$ | typ. @ +25 °C | max. for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Center frequency** | $f_C$ | | — | 1582.47 | — | MHz |
| **Maximum insertion attenuation** | $\alpha_{max}$ | | | | | |
| | 1559.052... 1563.144 | MHz | — | 1.4 | 1.9 | dB |
| | 1574.42... 1576.42 | MHz | — | 1.0 | 1.4 | dB |
| | 1597.55... 1605.89 | MHz | — | 1.4 | 1.9 | dB |
| **Group delay ripple** | $\Delta\tau_{var}$ [1] | | | | | |
| | 1597.55... 1605.89 | MHz | — | 4.0 | 16 | ns |
| **Maximum VSWR** | $VSWR_{max}$ | | | | | |
| @ input port | 1559.052... 1563.144 | MHz | — | 1.8 | 2.2 | |
| | 1574.42... 1576.42 | MHz | — | 1.2 | 1.8 | |
| | 1597.55... 1605.89 | MHz | — | 1.6 | 2.0 | |
| @ output port | 1559.052... 1563.144 | MHz | — | 1.8 | 2.2 | |
| | 1574.42... 1576.42 | MHz | — | 1.2 | 1.8 | |
| | 1597.55... 1605.89 | MHz | — | 1.5 | 2.0 | |
| **Maximum error vector magnitude** | $EVM_{max}$ [2] | | | | | |
| | 1561.452... 1603.49 | MHz | — | 1.0 | 2.0 | % |
| **Minimum attenuation** | $\alpha_{min}$ | | | | | |
| | 10... 960 | MHz | 45 | 49 | — | dB |
| | 960... 1463 | MHz | 36 | 45 | — | dB |
| | 1710... 1785 | MHz | 33 | 42 | — | dB |
| | 1785... 1990 | MHz | 32 | 41 | — | dB |
| | 1990... 2280 | MHz | 34 | 39 | — | dB |
| | 2280... 2400 | MHz | 38 | 51 | — | dB |
| | 2400... 2500 | MHz | 40 | 54 | — | dB |
| | 2500... 2700 | MHz | 40 | 54 | — | dB |
| | 2700... 3000 | MHz | 40 | 58 | — | dB |
| | 3000... 6000 | MHz | 25 | 39 | — | dB |

[1] Measured with an aperture of 2 MHz.
[2] Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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

| Characteristics | | | min. for $T_{SPEC}$ | typ. @ +25 °C | max. for $T_{SPEC}$ | |
|---|---|---|---|---|---|---|
| **Maximum insertion attenuation** | | $\alpha_{max}$ | | | | |
| | 1559.052... 1563.144 MHz | | — | 1.4 | 2.4 | dB |
| | 1574.42... 1576.42 MHz | | — | 1.0 | 1.4 | dB |
| | 1597.55... 1605.89 MHz | | — | 1.4 | 1.9 | dB |
| **Group delay ripple** | | $\Delta\tau_{var}$ [1] | | | | |
| | 1597.55... 1605.89 MHz | | — | 4.0 | 20 | ns |
| **Maximum VSWR** | | $VSWR_{max}$ | | | | |
| @ input port | 1559.052... 1563.144 MHz | | — | 1.8 | 2.3 | |
| | 1574.42... 1576.42 MHz | | — | 1.2 | 1.8 | |
| | 1597.55... 1605.89 MHz | | — | 1.6 | 2.0 | |
| @ output port | 1559.052... 1563.144 MHz | | — | 1.8 | 2.3 | |
| | 1574.42... 1576.42 MHz | | — | 1.2 | 1.8 | |
| | 1597.55... 1605.89 MHz | | — | 1.5 | 2.0 | |
| **Maximum error vector magnitude** | | $EVM_{max}$ [2] | | | | |
| | 1561.452... 1603.49 MHz | | — | 1.0 | 3.0 | % |
| **Minimum attenuation** | | $\alpha_{min}$ | | | | |
| | 10... 960 MHz | | 45 | 49 | — | dB |
| | 960... 1463 MHz | | 36 | 45 | — | dB |
| | 1710... 1785 MHz | | 33 | 42 | — | dB |
| | 1785... 1990 MHz | | 32 | 41 | — | dB |
| | 1990... 2280 MHz | | 34 | 39 | — | dB |
| | 2280... 2400 MHz | | 38 | 51 | — | dB |
| | 2400... 2500 MHz | | 40 | 54 | — | dB |
| | 2500... 2700 MHz | | 40 | 54 | — | dB |
| | 2700... 3000 MHz | | 40 | 58 | — | dB |
| | 3000... 6000 MHz | | 25 | 39 | — | dB |

[1] Measured with an aperture of 2 MHz.
[2] Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

## 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] = 50 V (max.) | Machine model. |
| | $V_{ESD}$ [4] = 225 V (max.) | Human body model. |
| Input power | $P_{IN}$ | |
| @ input port: 777 ... 915 MHz | 28 dBm[5] | GSM signal duty cycle 1:8 for 10000 h @ 55 °C. |
| @ input port: 1710 ... 2200 MHz | 28 dBm[5] | GSM signal duty cycle 1:8 for 10000 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.
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 simulation and wear out models.

## 8 Transmission coefficient

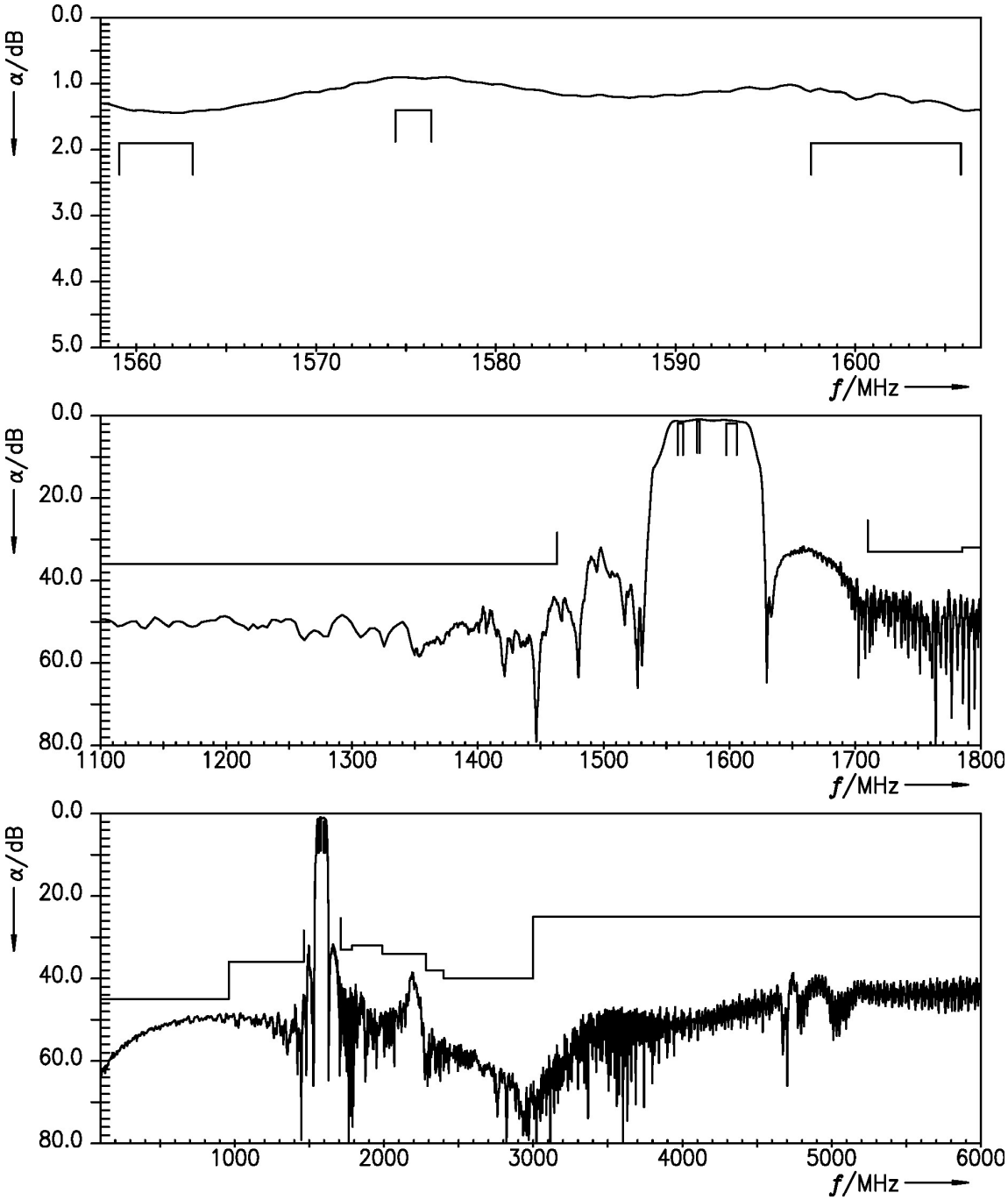


**Figure 4:** Attenuation.

## 9 Reflection coefficients

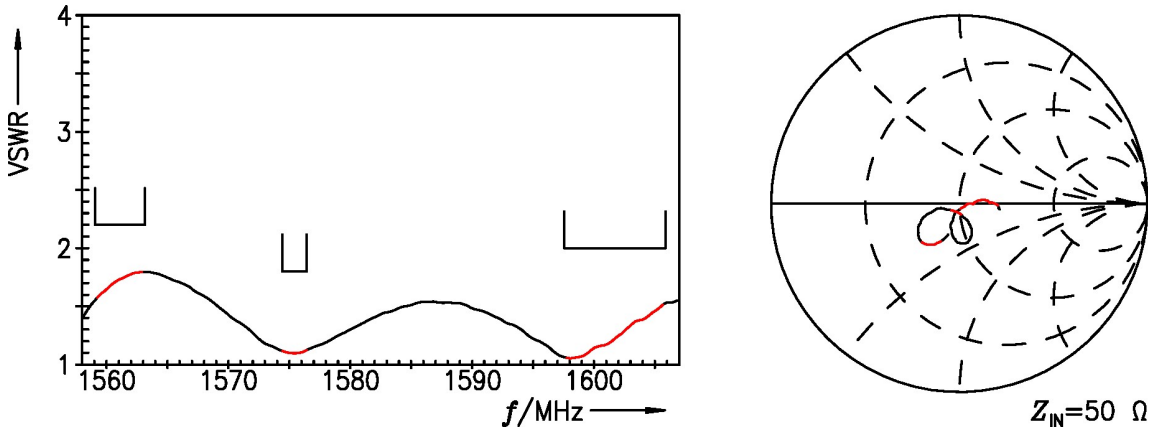


**Figure 5:** Reflection coefficient at input port.

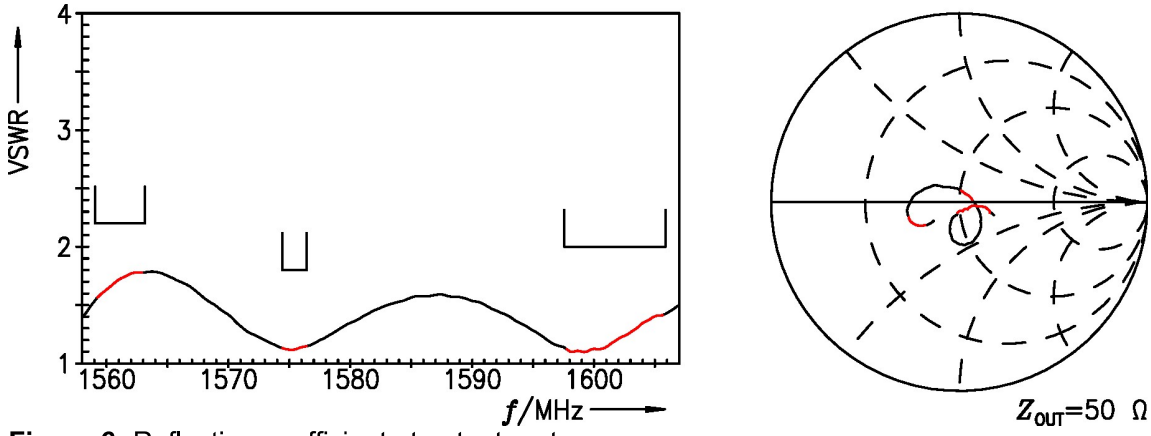


**Figure 6:** Reflection coefficient at output port.

## 10 EVM

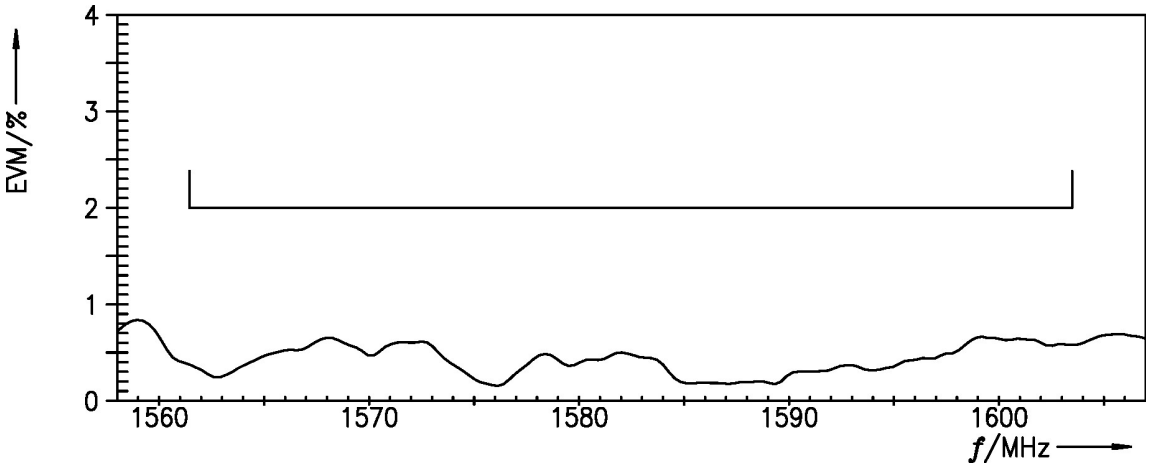


**Figure 7:** Error vector magnitude.

## 11 Packing material

### 11.1 Tape

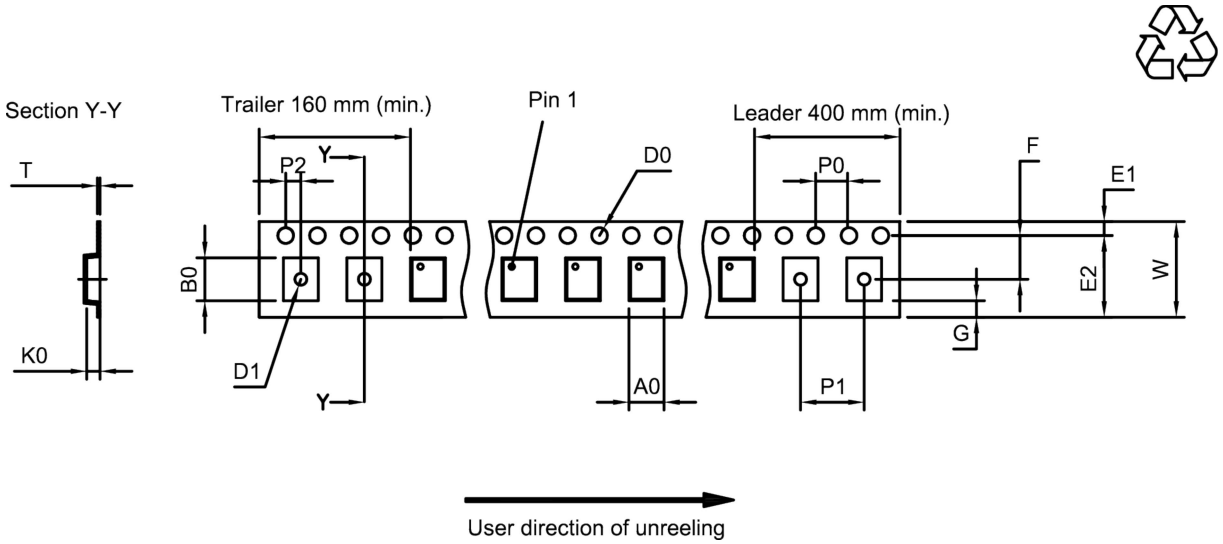


**Figure 8:** Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

| | |
|---|---|
| $A_0$ | 1.27±0.05 mm |
| $B_0$ | 1.57±0.05 mm |
| $D_0$ | 1.5+0.1/–0 mm |
| $D_1$ | 0.5±0.1 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.) |
| $K_0$ | 0.62±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.

## 11.2 Reel with diameter of 180 mm

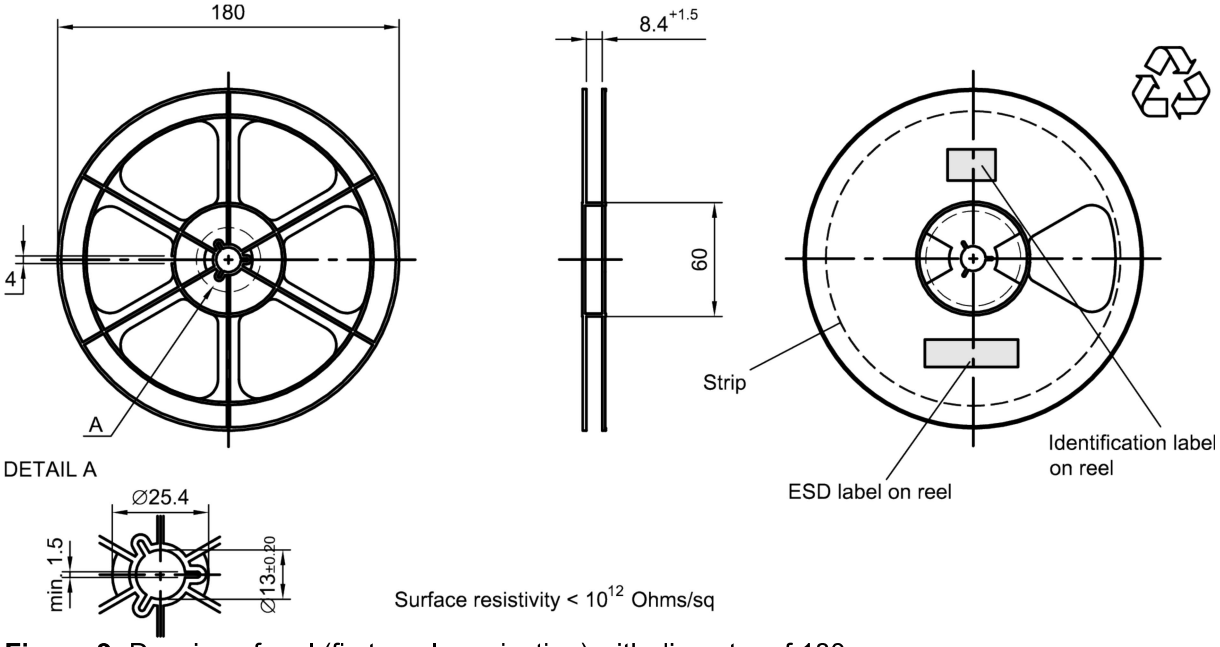


**Figure 9:** Drawing of reel (first-angle projection) with diameter of 180 mm.

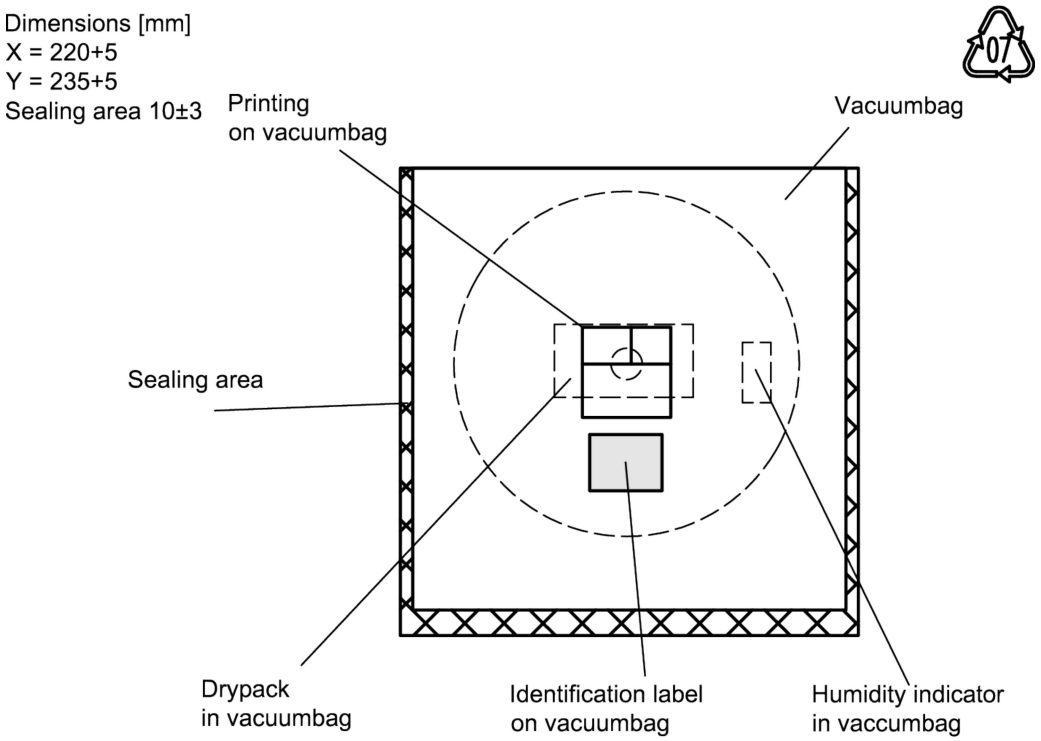


**Figure 10:** Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

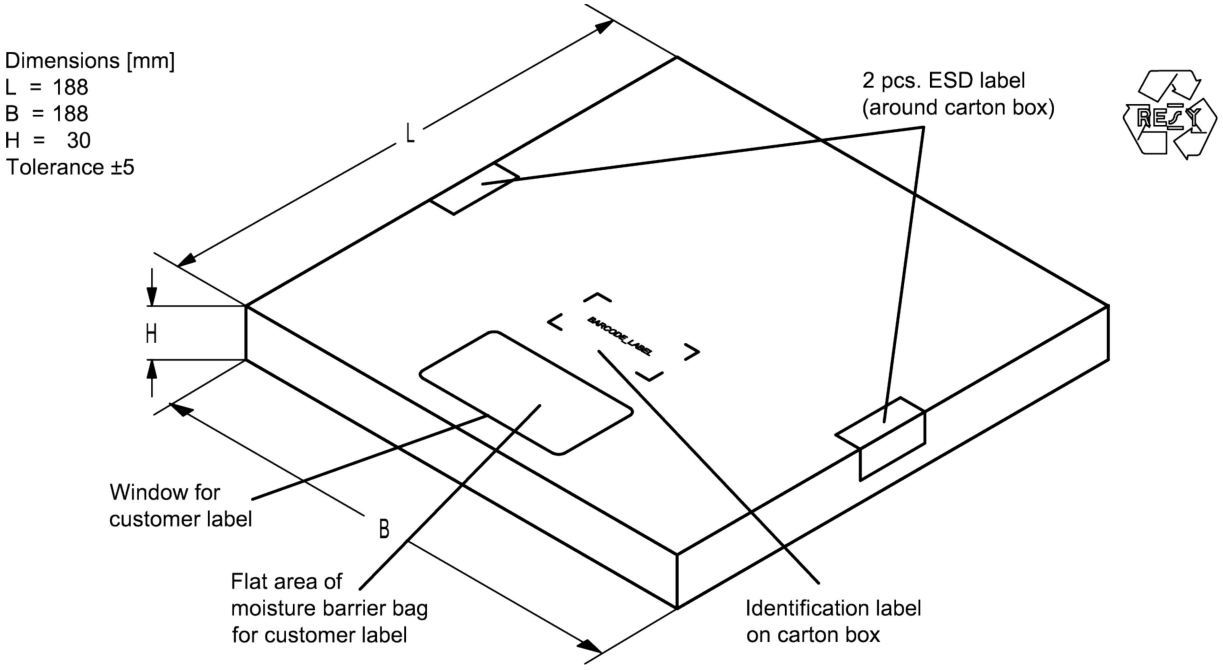


**Figure 11:** Drawing of folding box for reel with diameter of 180 mm.

## 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** x $32^2$ + **6** x $32^1$ + **18 (=J)** x $32^0$ = **1234**
  The BASE32 code for product type B9621 is 9CN.

- 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.

## 13 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).

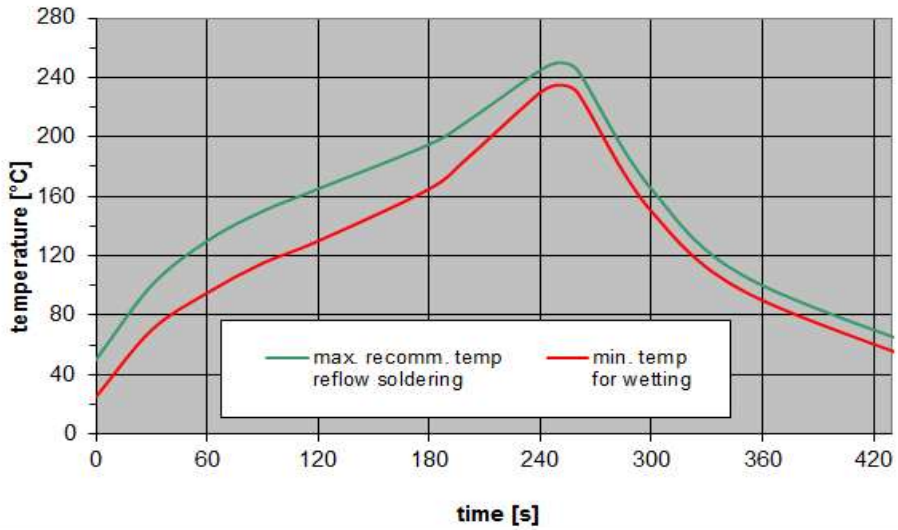


**Figure 12:** Recommended reflow profile for convection and infrared soldering – lead-free solder.

# 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 |
|---|---|
| B39162B9621P810 | 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.

## 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.**
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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