



RF360
Europe GmbH

Data sheet

SAW RF filter

GNSS

GNSS L1 (B1/E1/L1/G1)

Part number:	B7560
Ordering code:	B39162B7560P810

Date:	May 25, 2023
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Version:	2.0
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1 Application

- Low-loss RF filter for GNSS L1
- Usable pass band 47MHz
- Low group delay ripple

2 Features

- Package size 1.1 ± 0.05 mm $\times$ 0.9 ± 0.05 mm
- Package height 0.45 mm (max.)
- Approximate weight 1 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

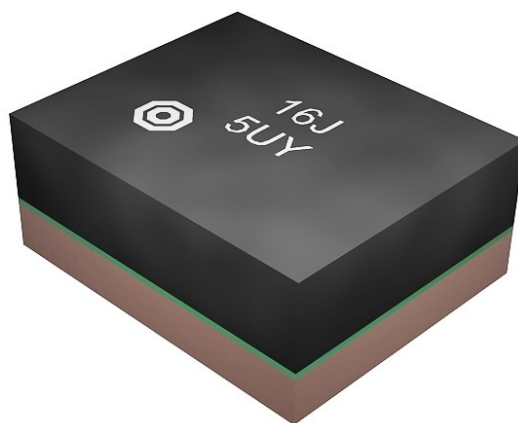
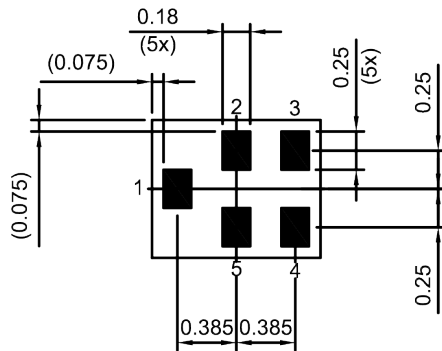


Figure 1: Picture of component with example of product marking.

3 Package

BOTTOM VIEW



Pad and pitch tolerance ± 0.05

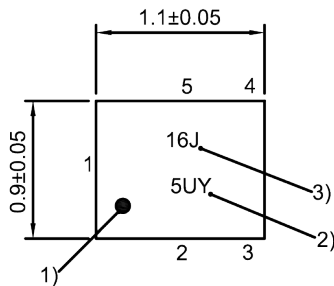
4 Pin configuration

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

SIDE VIEW

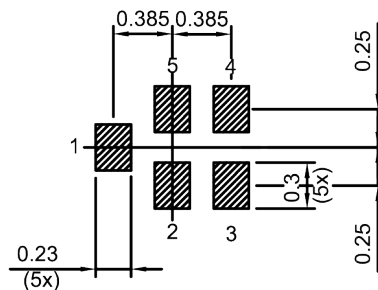


TOP VIEW



- 1) Marking for pad number 1
- 2) Encoded lot number
- 3) Please refer to caption below

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. 18).

5 Matching circuit

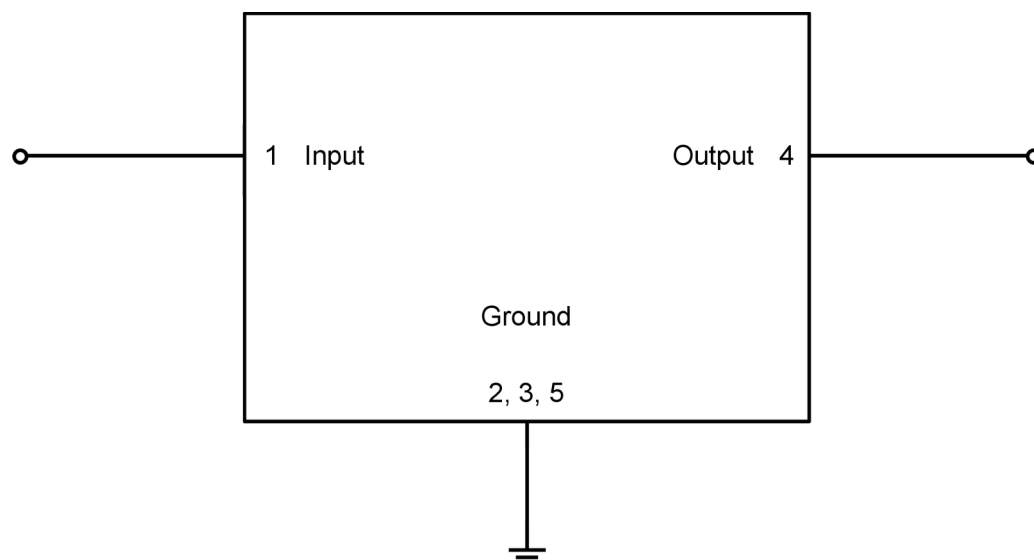


Figure 3: Schematic of matching circuit. No external matching components required.

6 Characteristics

Temperature range for specification

$$T_{\text{SPEC}} = -40\text{ °C} \dots +85\text{ °C}$$

Input terminating impedance

$$Z_{\text{IN}} = 50\ \Omega$$

Output terminating impedance

$$Z_{\text{OUT}} = 50\ \Omega$$

Characteristics			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency		f_c	—	1582.5	—	MHz
Maximum insertion attenuation		α_{max}				
	1559.05... 1563.14 MHz		—	1.7	2.3	dB
	1573.37... 1577.47 MHz		—	1.7	2.0	dB
	1597.55... 1605.89 MHz		—	1.7	2.4	dB
Amplitude ripple (p-p)		$\Delta\alpha$				
	1559... 1606 MHz		—	0.3	1.0	dB
Group delay ripple		$\Delta\tau_{\text{var}}^{1)}$				
	1559.05... 1563.14 MHz		—	1.4	5	ns
	1573.37... 1577.47 MHz		—	1.4	5	ns
	1597.55... 1605.89 MHz		—	1.6	5	ns
Maximum VSWR		VSWR_{max}				
@ input port	1559... 1606 MHz		—	1.3	2.0	
@ output port	1559... 1606 MHz		—	1.2	2.0	
Minimum attenuation		α_{min}				
	880... 920 MHz		32	40	—	dB
	1710... 1785 MHz		23	31	—	dB
	1850... 1910 MHz		32	37	—	dB
	1920... 1980 MHz		32	38	—	dB
	2400... 2500 MHz		30	40	—	dB

¹⁾ Aperture 2 MHz.

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}$	
ESD voltage		
	$V_{ESD}^{3)} = 100\text{ V}$	Machine model.
	$V_{ESD}^{4)} = 250\text{ V}$	Human body model.
Input power @ input port: 1559 ... 1606 MHz	$P_{IN} = 10\text{ dBm}^{5)}$	Continuous wave for 20000 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 simulation, and wear out models.

8 Transmission coefficient

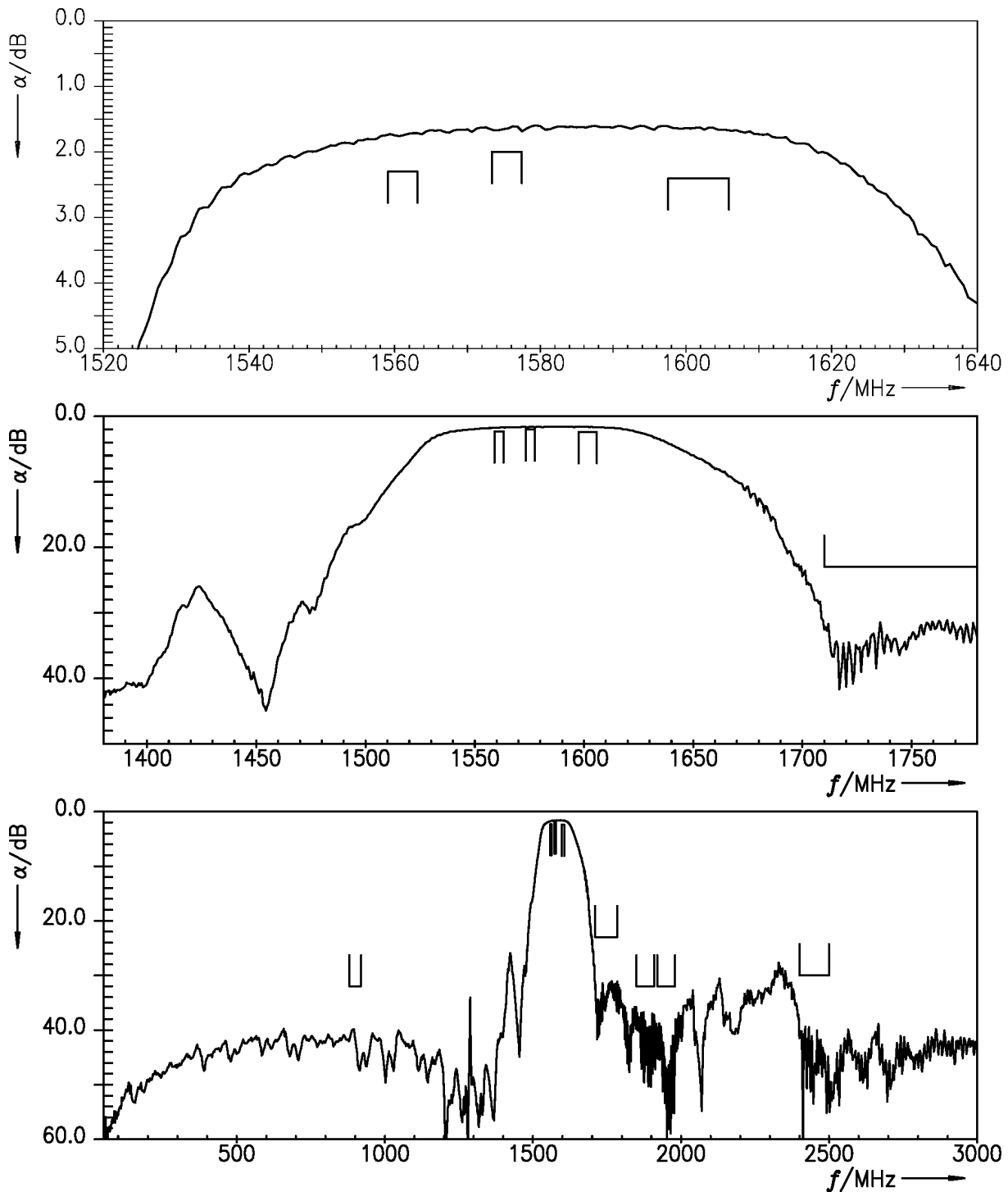


Figure 4: Attenuation.

9 Reflection coefficients

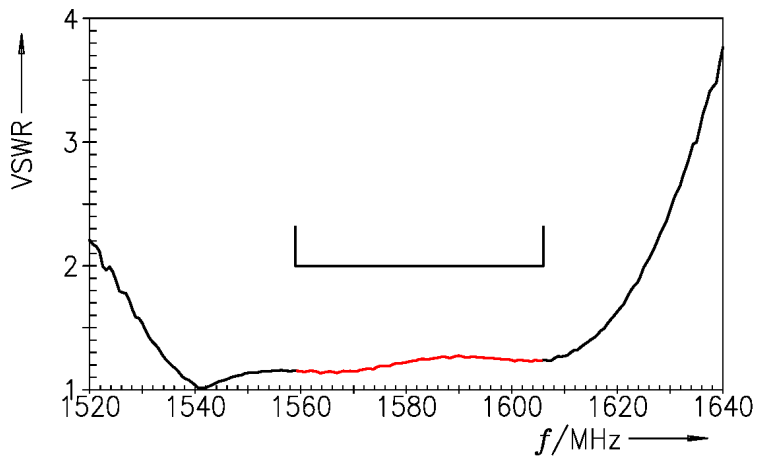


Figure 5: Reflection coefficient at input port.

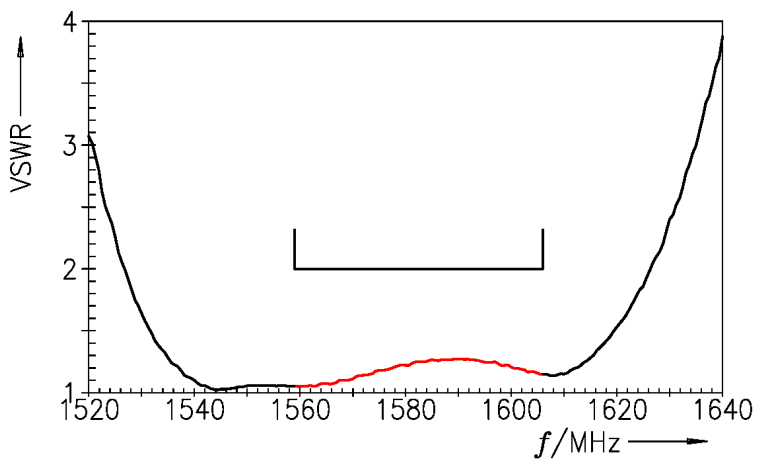
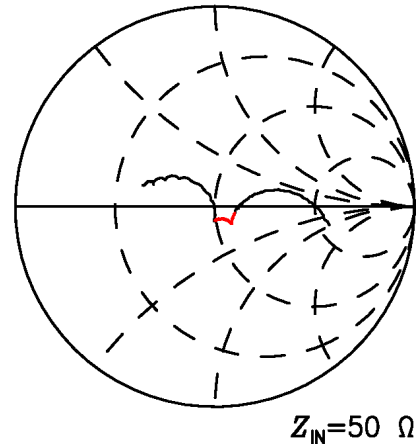
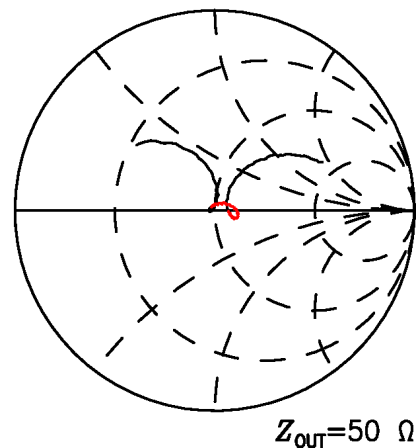


Figure 6: Reflection coefficient at output port.



10 Group delay

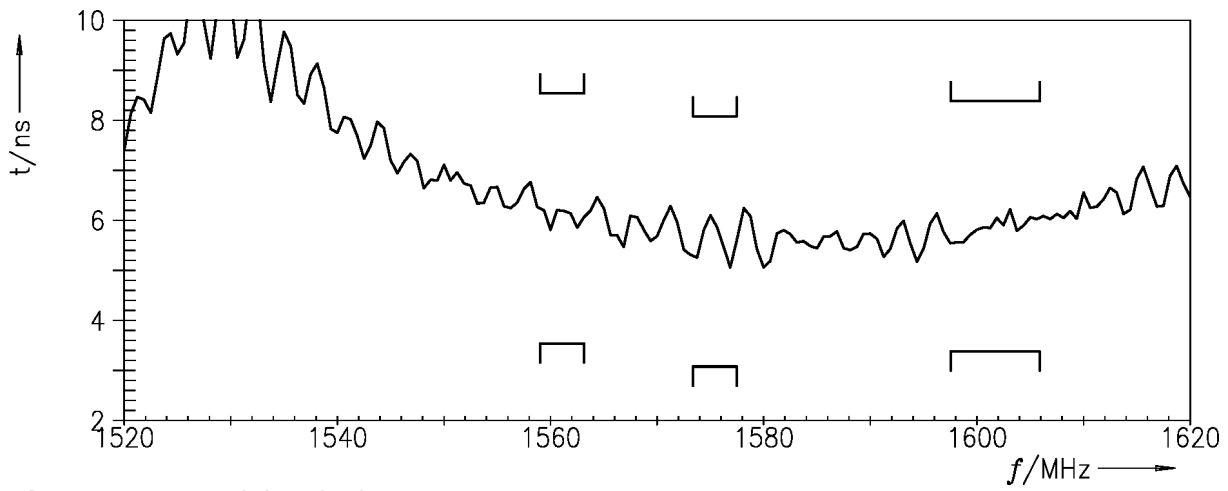


Figure 7: Group delay ripple.

11 Packing material

11.1 Tape

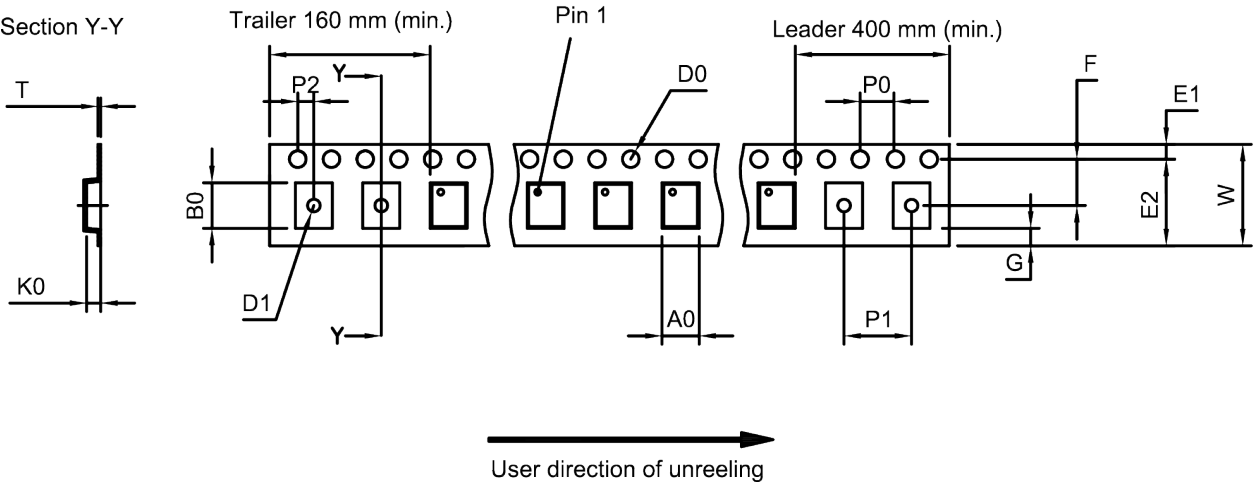


Figure 8: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A ₀	1.02±0.05 mm	E ₂	6.25 mm (min.)	P ₁	2.0±0.1 mm
B ₀	1.22±0.05 mm	F	3.5±0.05 mm	P ₂	2.0±0.05 mm
D ₀	1.55±0.05 mm	G	–	T	0.25±0.03 mm
D ₁	0.55±0.1 mm	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.

11.2 Reel with diameter of 180 mm

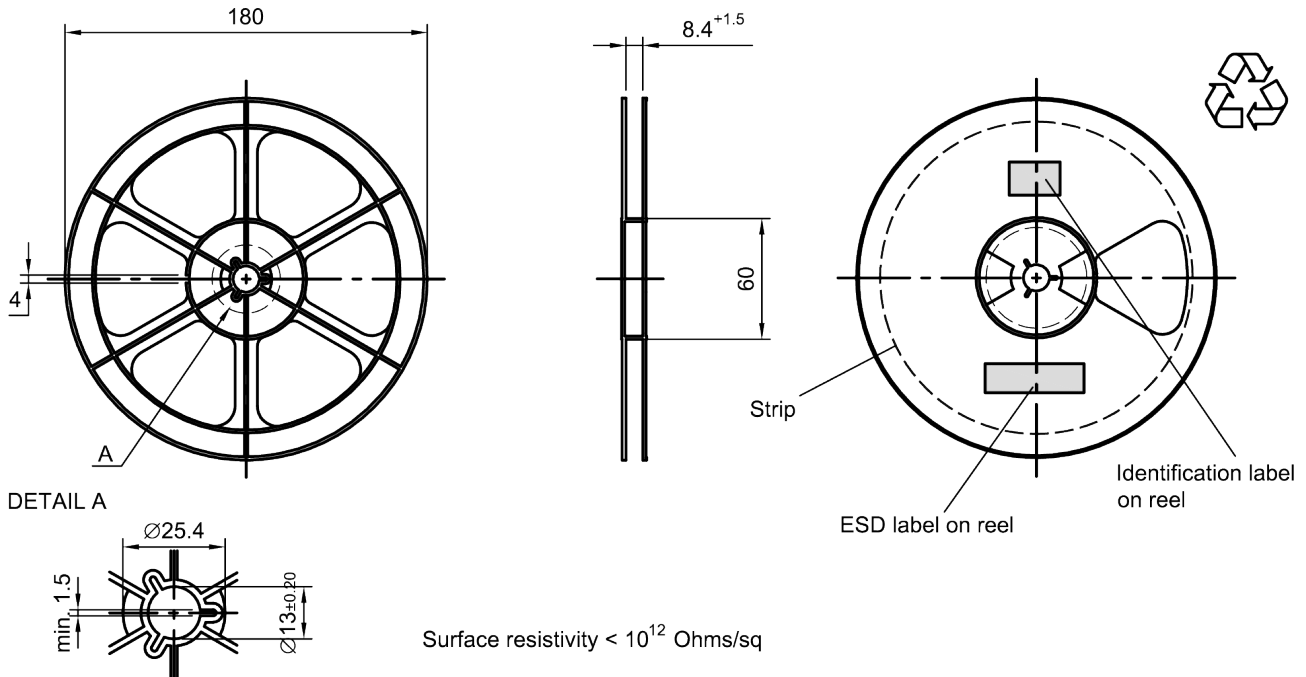


Figure 9: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

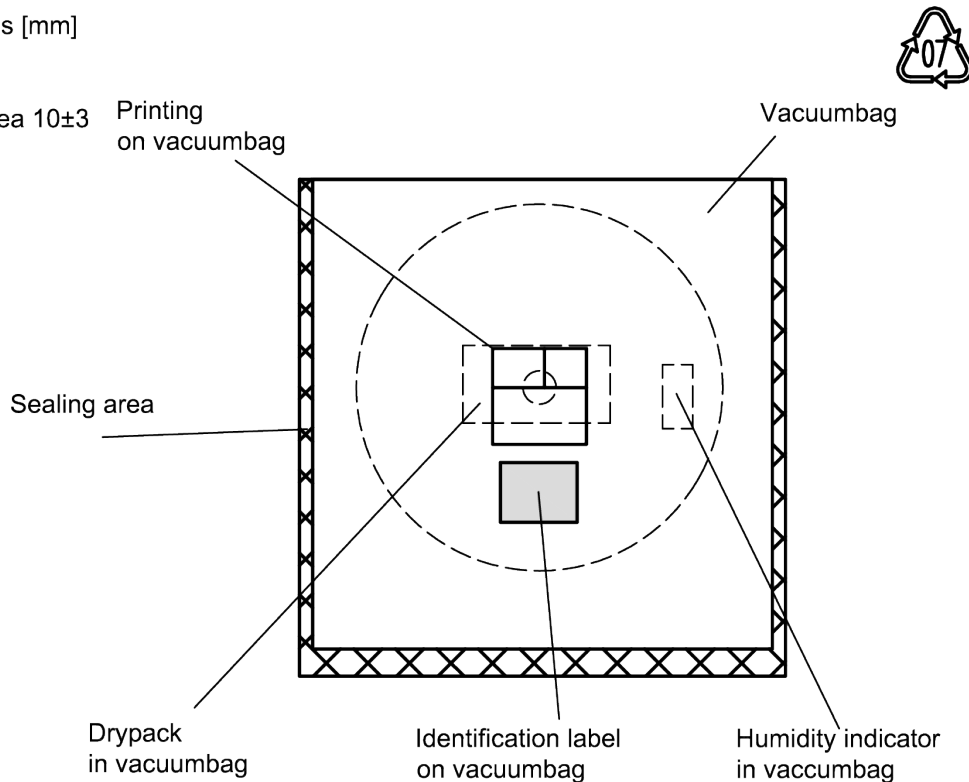


Figure 10: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

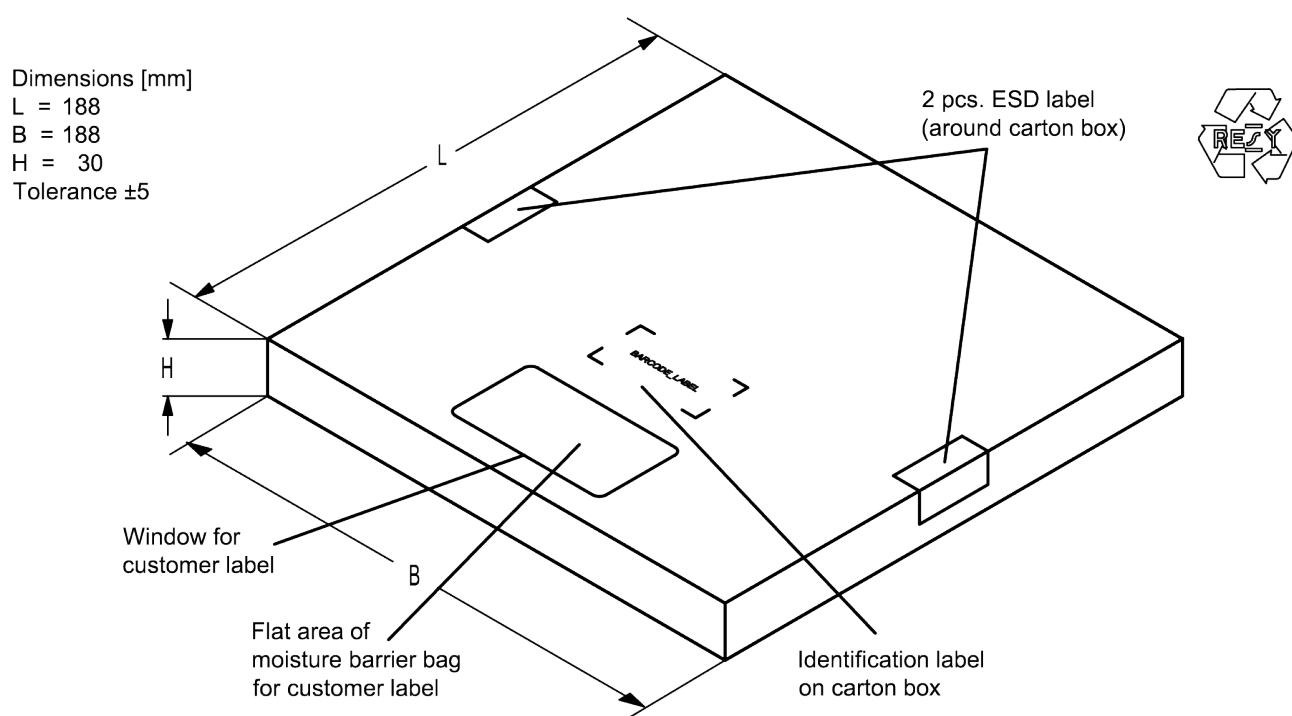


Figure 11: Drawing of folding box for reel with diameter of 180 mm.

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 $\Rightarrow$ **1234**
 $1 \times 32^2 + 6 \times 32^1 + 18 (=J) \times 32^0 =$ **1234**

The BASE32 code for product type B7560 is 7C8.

■ 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 $\Rightarrow$ **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 – 3rd edit and IPC/JEDEC J-STD-020B.

ramp rate	$\leq 3 \text{ K/s}$
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 $\pm 5 \text{ °C}$
wetting temperature T_{min}	230 °C $\pm 5 \text{ °C}$ for $10 \text{ s} \pm 1 \text{ s}$
cooling rate	$\leq 3 \text{ K/s}$
soldering temperature T	measured at solder pads

Table 3: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

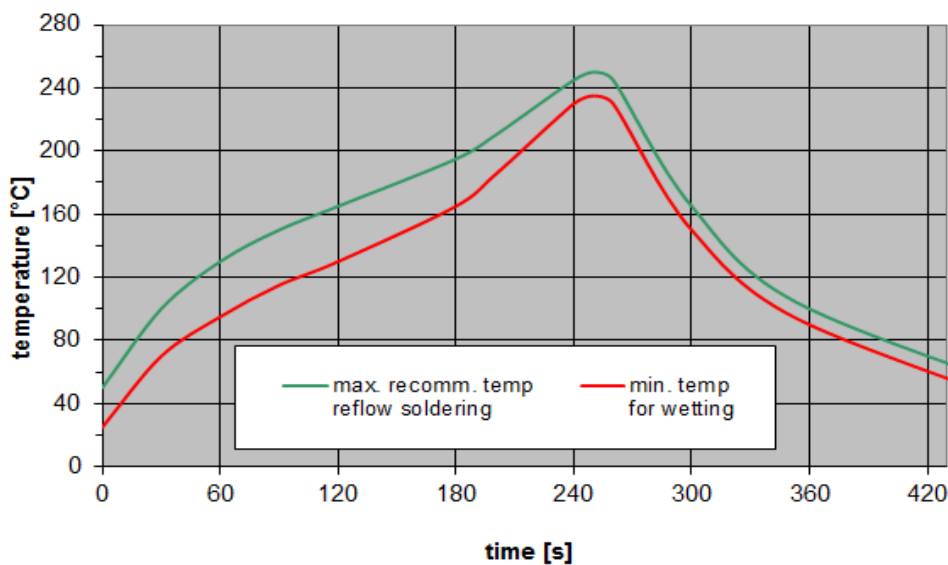


Figure 12: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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, product IDs, labels, and packing units

Ordering code	Product ID	RF360 label	Packing unit
B39162B7560P810	B39162-B7560-P810-W05	B39162B7560P810W 5	5000 pcs

Table 4: Ordering codes / product IDs 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 <https://rfe.qualcomm.com/>.

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).

Projection method

Unless otherwise specified first-angle projection is applied.

16 ESD protection of acoustic devices

Acoustic devices are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies must be applied.

In general, “ESD matching” must be ensured at that electrical port, where electrostatic discharge is expected.

Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore, only the input matching of the acoustic device must be designed to short circuit or to block the ESD pulse.

Below three figures show recommended “ESD matching” topologies.

For wide band acoustic devices 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 input port. The required component values must be determined from case to case.

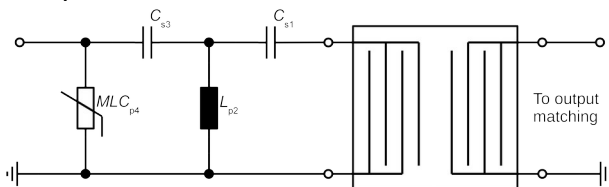


Figure 13: MLC varistor plus ESD matching.

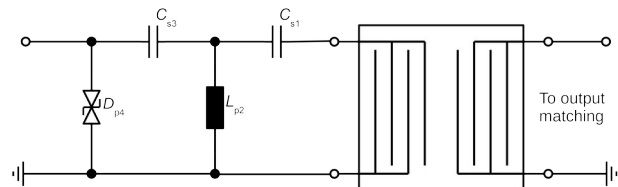


Figure 14: Suppressor diode plus ESD matching.

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

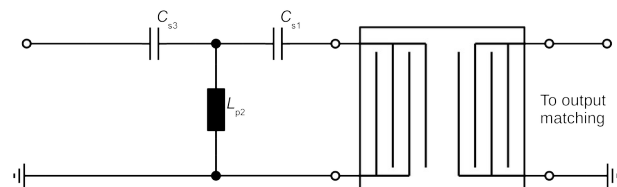


Figure 15: 3rd order high-pass structure for basic ESD protection.

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 <https://rffe.qualcomm.com>.

17 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.
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