



RF360 Europe GmbH
A Qualcomm – TDK Joint Venture

SAW components

SAW duplexer
LTE band 13

Series/type:	B1228
Ordering code:	B39781B1228P810
Date:	October 06, 2017
Version:	2.0

RF360 products mentioned within this document are offered by RF360 Europe GmbH and other subsidiaries of RF360 Holdings Singapore Pte. Ltd. (collectively, the “RF360 Subsidiaries”).

RF360 Holdings Singapore Pte. Ltd. is a joint venture of Qualcomm Global Trading Pte. Ltd. and EPCOS AG.

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

© 2017 RF360 Europe GmbH and/or its affiliated companies. All rights reserved.

These materials, including the information contained herein, may be used only for informational purposes by the customer. The RF360 Subsidiaries assume no responsibility for errors or omissions in these materials or the information contained herein. The RF360 Subsidiaries reserve the right to make changes to the product(s) or information contained herein without notice. The materials and information are provided on an AS IS basis, and the RF360 Subsidiaries assume no liability and make no warranty or representation, either expressed or implied, with respect to the materials, or any output or results based on the use, application, or evaluation of such materials, including, without limitation, with respect to the non-infringement of trademarks, patents, copyrights or any other intellectual property rights or other rights of third parties.

No use of this documentation or any information contained herein grants any license, whether express, implied, by estoppel or otherwise, to any intellectual property rights, including, without limitation, to any patents owned by QUALCOMM Incorporated or any of its subsidiaries.

Not to be used, copied, reproduced, or modified in whole or in part, nor its contents revealed in any manner to others without the express written permission of RF360 Europe GmbH.

Qualcomm and Qualcomm RF360 are trademarks of Qualcomm Incorporated, registered in the United States and other countries. RF360 is a trademark of Qualcomm Incorporated. Other product and brand names may be trademarks or registered trademarks of their respective owners.

This technical data may be subject to U.S. and international export, re-export, or transfer ("export") laws. Diversion contrary to U.S. and international law is strictly prohibited.

SAW components	B1228
SAW duplexer	751 / 782 MHz

Data sheet

Table of contents

1 Application	4
2 Features	4
3 Package	5
4 Pin configuration	5
5 Matching circuit	6
6 Characteristics	7
7 Maximum ratings	10
8 Transmission coefficients	11
9 Reflection coefficients	14
10 Packing material	15
11 Marking	19
12 Soldering profile	20
13 Annotations	21
14 Cautions and warnings	22
Important notes	23

Data sheet

1 Application

- Low-loss SAW duplexer for mobile telephone LTE Band 13 systems, also suitable for CDMA applications
- NS07 rejection, public safety frequency band
- High isolation
- Single-ended duplexer
- Near zero temperature drift

2 Features

- Package size 1.8 ± 0.1 mm \times 1.4 ± 0.1 mm
- Package height 0.475 mm (max.)
- Approximate weight 4 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 3 (MSL3)

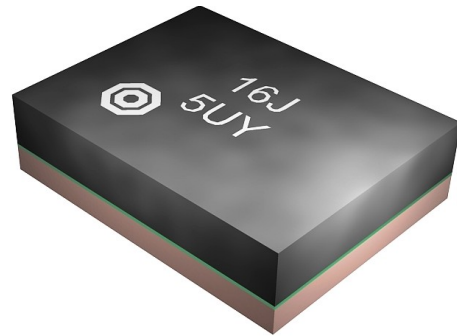


Figure 1: Picture of component with example of product marking.

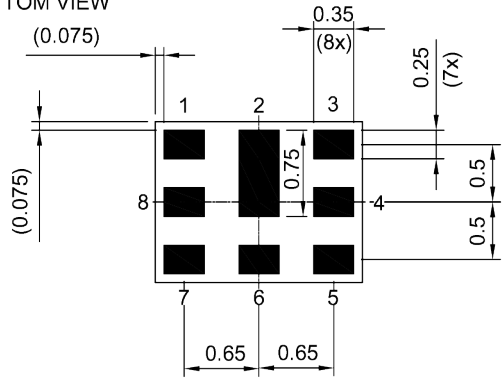
SAW components **B1228**

SAW duplexer **751 / 782 MHz**

Data sheet

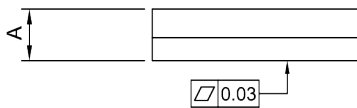
3 Package

BOTTOM VIEW

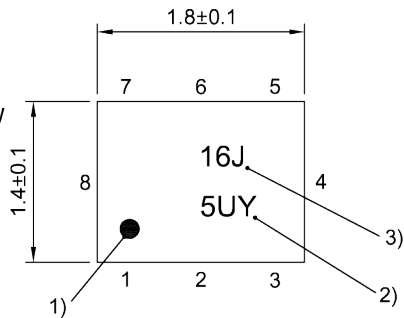


Pad and pitch tolerance ±0.05

SIDE VIEW

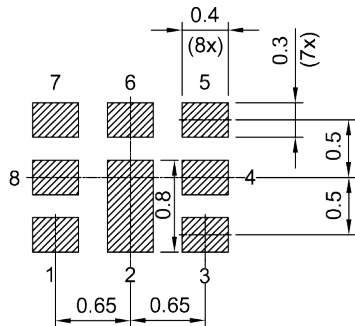


TOP VIEW



- 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 = 0.475 mm (max.). See Sec. Package information (p. 22).

4 Pin configuration

- 1 RX
- 3 TX
- 6 ANT
- 2, 4, 5, 7, 8 Ground

Data sheet

5 Matching circuit

- $L_{p6} = 15 \text{ nH}$

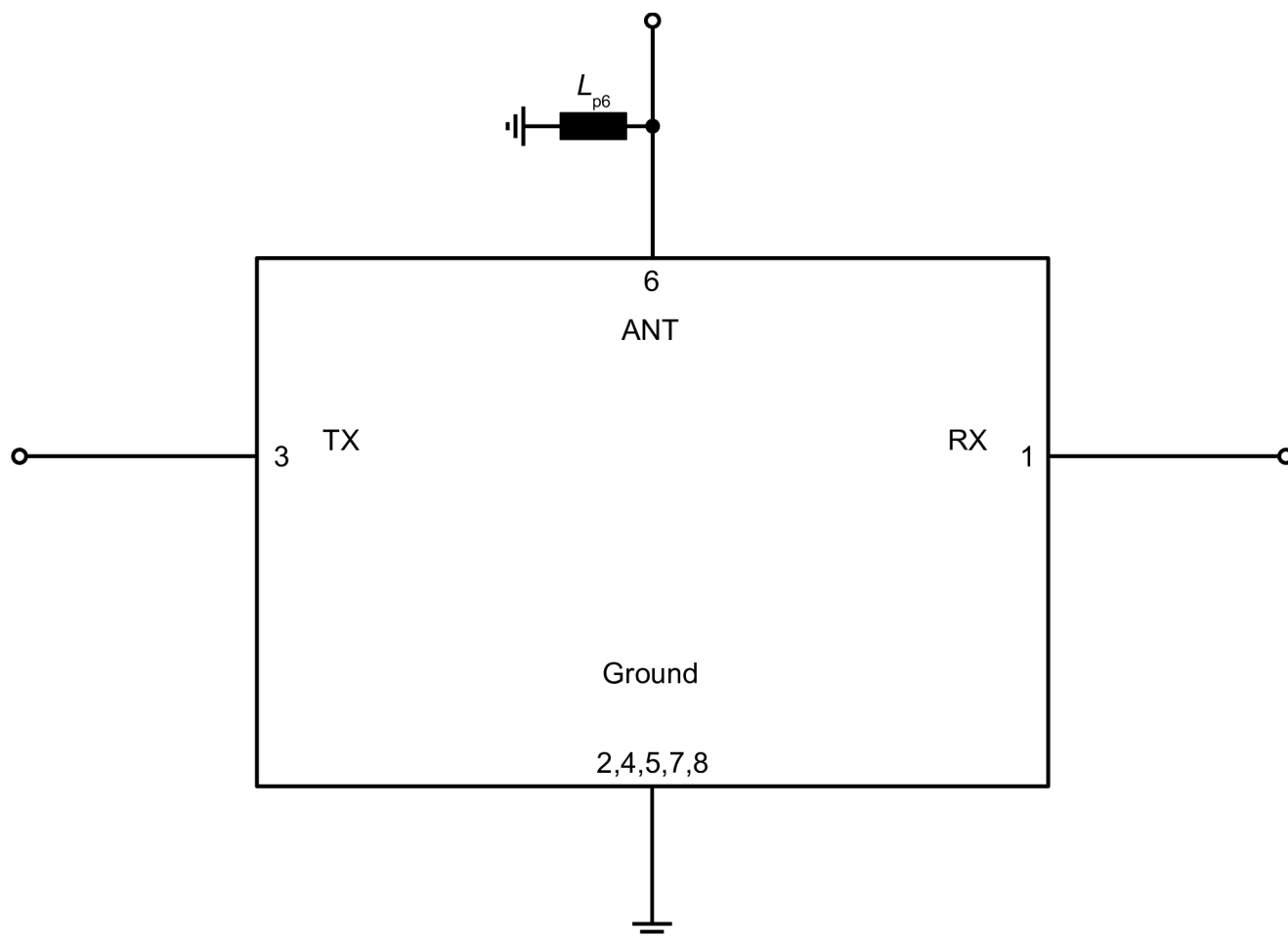


Figure 3: Schematic of matching circuit.

External shunt inductor for ESD protection is recommended at any ports towards antenna.

SAW components

B1228

SAW duplexer

751 / 782 MHz

Data sheet

6 Characteristics

6.1 TX – ANT

Temperature range for specification	T_{SPEC}	= -30 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 15 nH ¹⁾
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – ANT				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	782	—	MHz
Maximum insertion attenuation							
	777... 787	MHz	$\alpha_{INT,max}^{2)}$	—	1.5	2.0	dB
	777.5... 786.5	MHz	α_{max}	—	2.4	3.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	777.5... 786.5	MHz		—	1.3	2.6	dB
Maximum VSWR			VSWR _{max}				
@ TX port	777.5... 786.5	MHz		—	1.2	2.0	
@ ANT port	777.5... 786.5	MHz		—	1.3	2.0	
Minimum attenuation			α_{min}				
	10... 716	MHz		40	45	—	dB
	716... 728	MHz		40	50	—	dB
	728... 746	MHz		45	53	—	dB
	746.34... 755.66	MHz		50	59	—	dB
	758... 768	MHz		35	45	—	dB
	793... 805	MHz		8	16	—	dB
	869... 894	MHz		45	50	—	dB
	1226... 1250	MHz		45	65	—	dB
	1554... 1565	MHz		45	52	—	dB
	1565... 1607	MHz		45	51	—	dB
	1710... 2170	MHz		40	46	—	dB
	2331... 2361	MHz		35	45	—	dB
	2400... 2484	MHz		35	44	—	dB
	3108... 3148	MHz		35	42	—	dB
	4900... 5950	MHz		13	18	—	dB
Minimum attenuation (relative to α_{max})			$\alpha_{rel,min}$				
NS07	768... 775	MHz		22 ³⁾	25 ³⁾	—	dB

¹⁾ See Sec. Matching circuit (p. 6).

²⁾ Integrated attenuation α_{INT} : Averaged power $|S_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

³⁾ Relative to insertion loss in 777.5 – 786.5MHz.

SAW components

B1228

SAW duplexer

751 / 782 MHz

Data sheet

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= -30 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 15 nH ¹⁾
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics ANT – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	751	—	MHz
Maximum insertion attenuation			α_{max}	—	1.2	1.7	dB
	746.34... 755.66	MHz					
Amplitude ripple (p-p)			$\Delta\alpha$	—	0.3	1.0	dB
	746.34... 755.66	MHz					
Maximum VSWR			$VSWR_{max}$				
@ ANT port	746.34... 755.66	MHz		—	1.4	2.0	
@ RX port	746.34... 755.66	MHz		—	1.4	2.0	
Minimum attenuation			α_{min}				
	10... 686	MHz		40	45	—	dB
	686... 728	MHz		30	41	—	dB
	771... 772	MHz		30	60	—	dB
	777.5... 786.5	MHz		50	55	—	dB
	1523... 1543	MHz		42	48	—	dB
	1710... 1755	MHz		38	44	—	dB
	1850... 1910	MHz		38	44	—	dB
	2238... 2268	MHz		40	48	—	dB
	2400... 2500	MHz		40	45	—	dB
	4900... 5950	MHz		15	23	—	dB

¹⁾ See Sec. Matching circuit (p. 6).

SAW components

B1228

SAW duplexer

751 / 782 MHz

Data sheet

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= -30 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 15 nH ¹⁾
RX terminating impedance	Z_{RX}	= 50 Ω

Characteristics TX – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum isolation							
		α_{min}					
	746.34... 755.66	MHz		55	59	—	dB
	777.5... 786.5	MHz		55	58	—	dB
	1552... 1574	MHz		30	54	—	dB
	2328... 2361	MHz		30	50	—	dB
	3104... 3148	MHz		30	47	—	dB

¹⁾ See Sec. Matching circuit (p. 6).

SAW components

B1228

SAW duplexer

751 / 782 MHz

Data sheet

7 Maximum ratings

Storage temperature	$T_{\text{STG}}^{1)} = -40\text{ °C} \dots +85\text{ °C}$	
DC voltage	$ V_{\text{DC}} ^{3)} = 0\text{ V (max.)}^{2)}$	
Input power	P_{IN}	
@ TX port: 777.5 ... 786.5 MHz	29 dBm	10 MHz LTE uplink signal (50 RB) for 5000 h @ 50 °C.
@ TX port: 782 MHz	33 dBm	Continuous wave for 20 ms @ 50 °C.
@ TX port: other frequency ranges	10 dBm	10 MHz LTE uplink signal (50 RB) for 5000 h @ 50 °C.

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

²⁾ DC resistance at RX output might be less than 100Mohm at elevated temperatures. Hence, we recommend usage of blocking capacitors.

³⁾ In case of applied DC voltage blocking capacitors are mandatory.

Data sheet

8 Transmission coefficients

8.1 TX – ANT

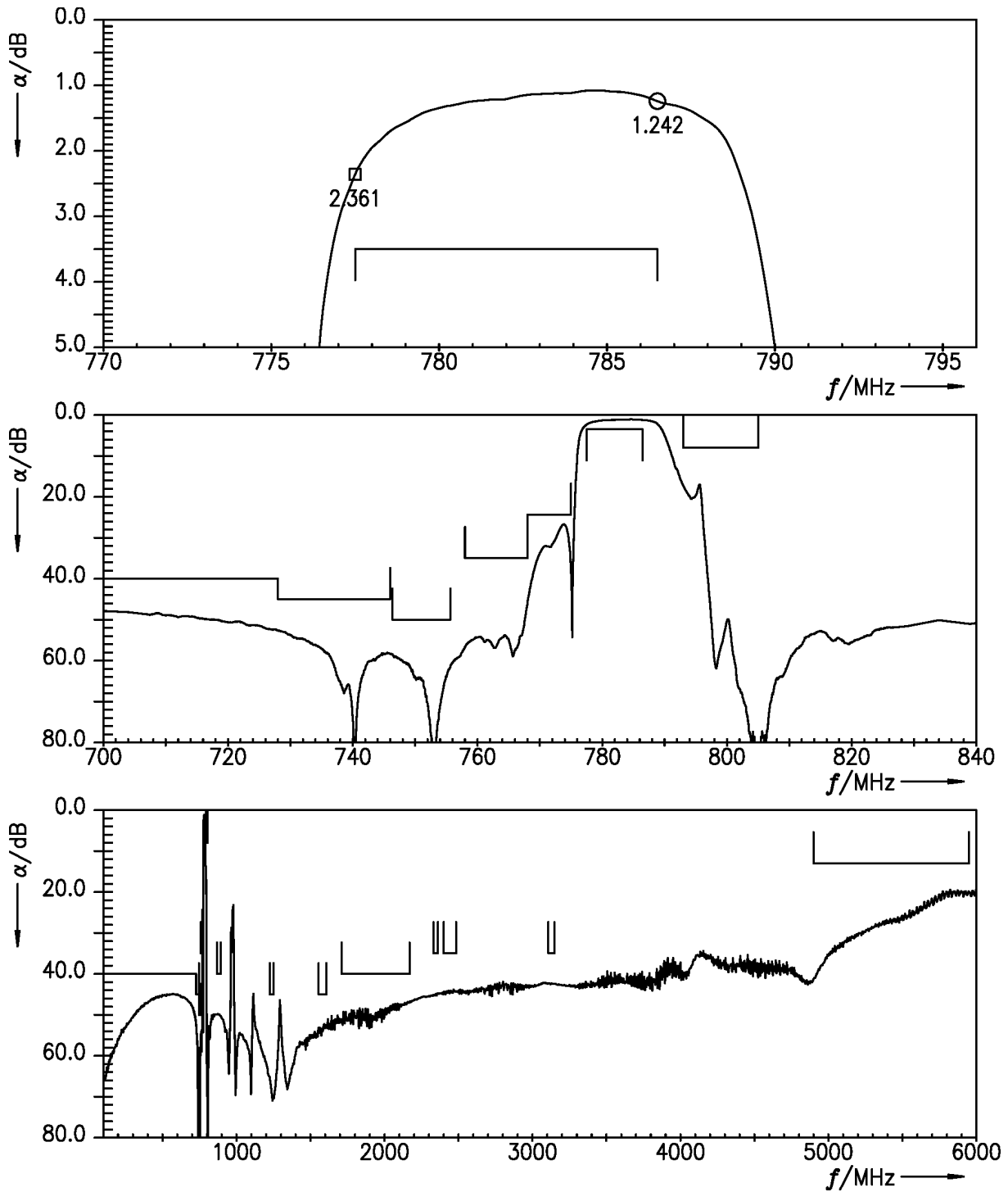


Figure 4: Attenuation TX – ANT.

SAW components **B1228**
SAW duplexer **751 / 782 MHz**

Data sheet

8.2 ANT – RX

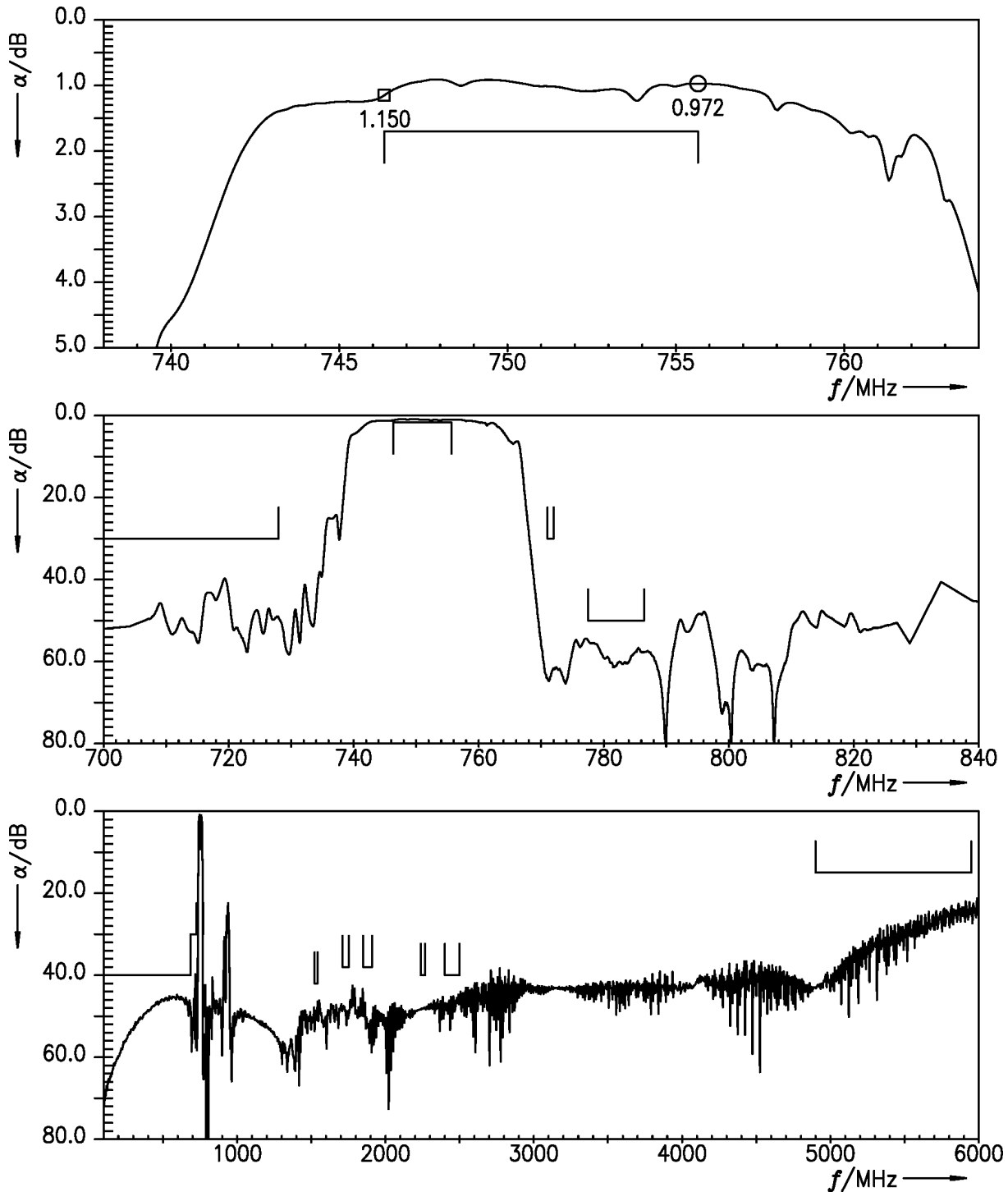


Figure 5: Attenuation ANT – RX.

Data sheet

8.3 TX – RX

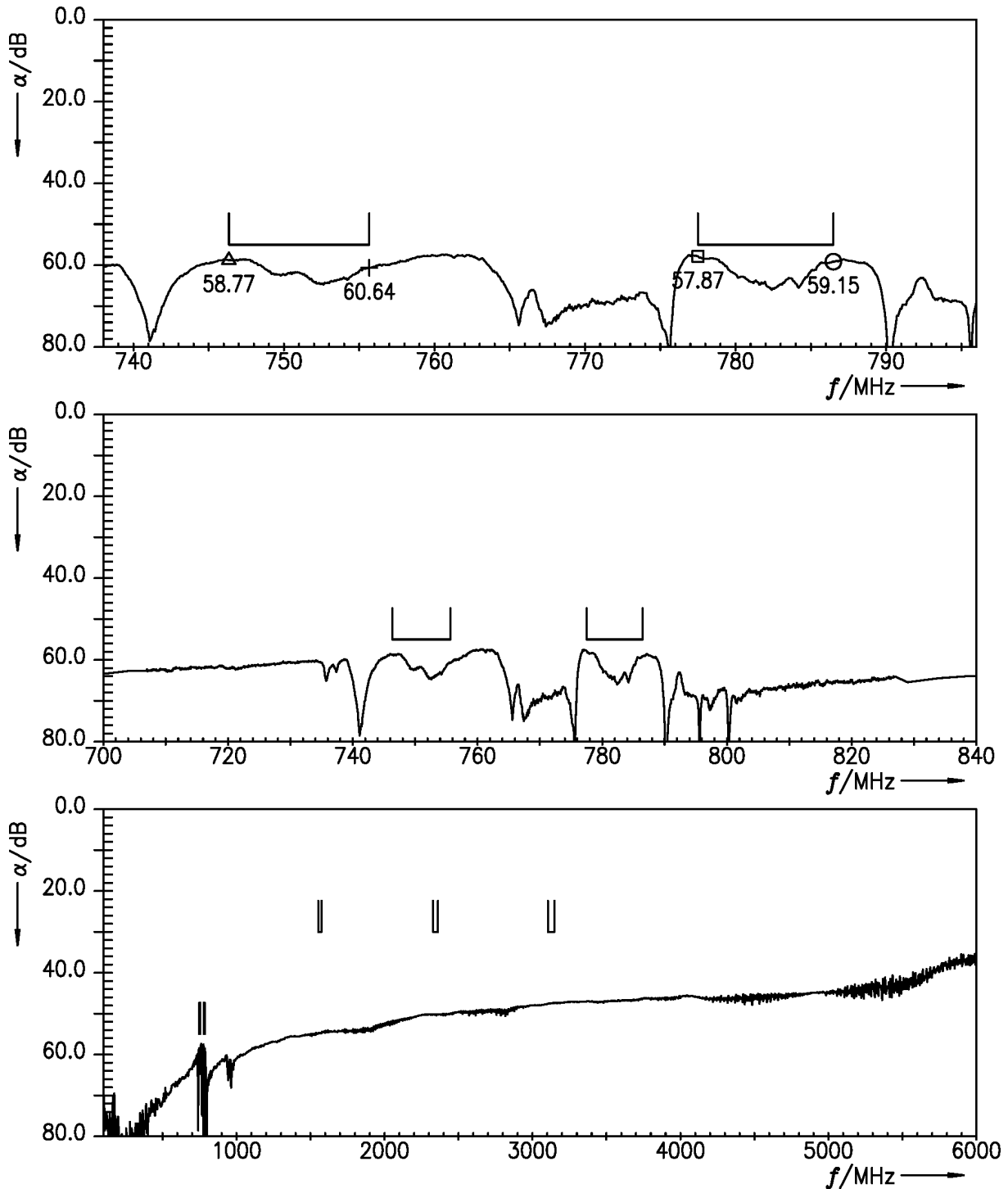


Figure 6: Isolation TX – RX.

Data sheet

9 Reflection coefficients

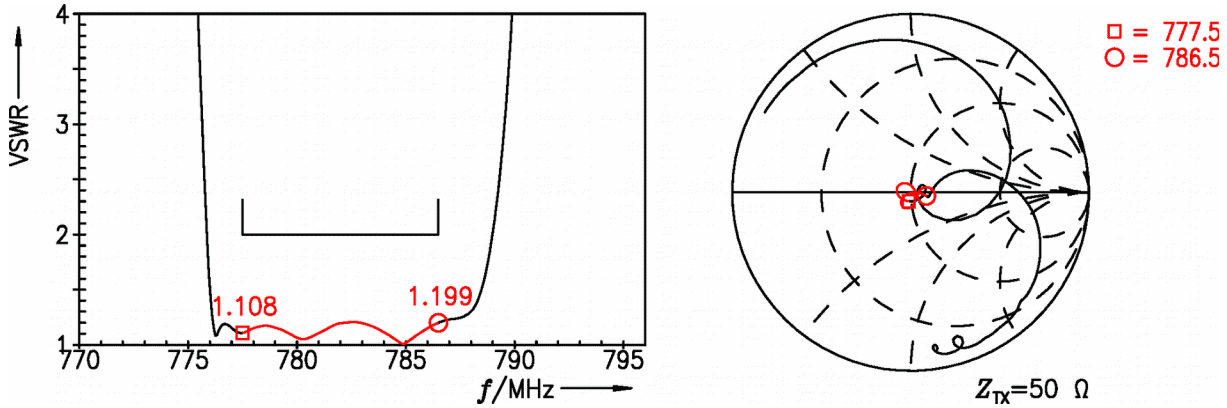


Figure 7: Reflection coefficient at TX port.

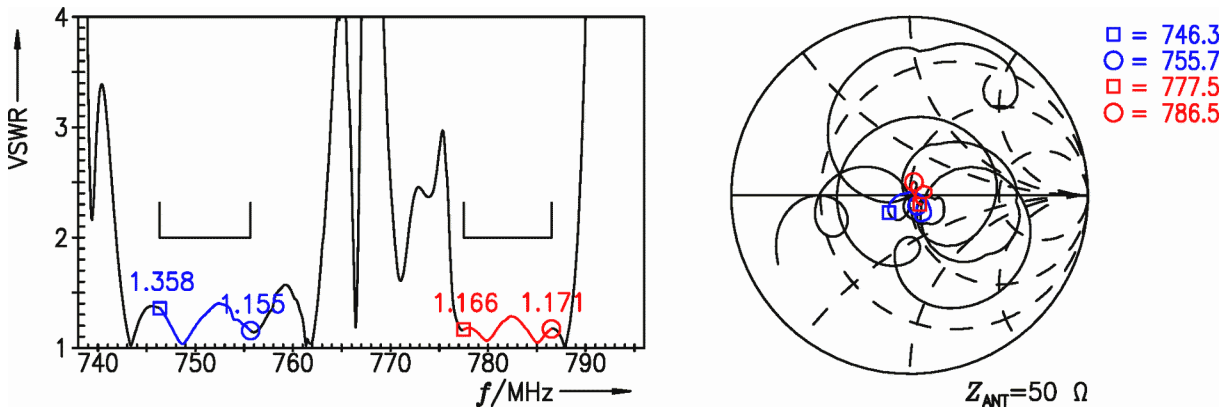


Figure 8: Reflection coefficient at ANT port.

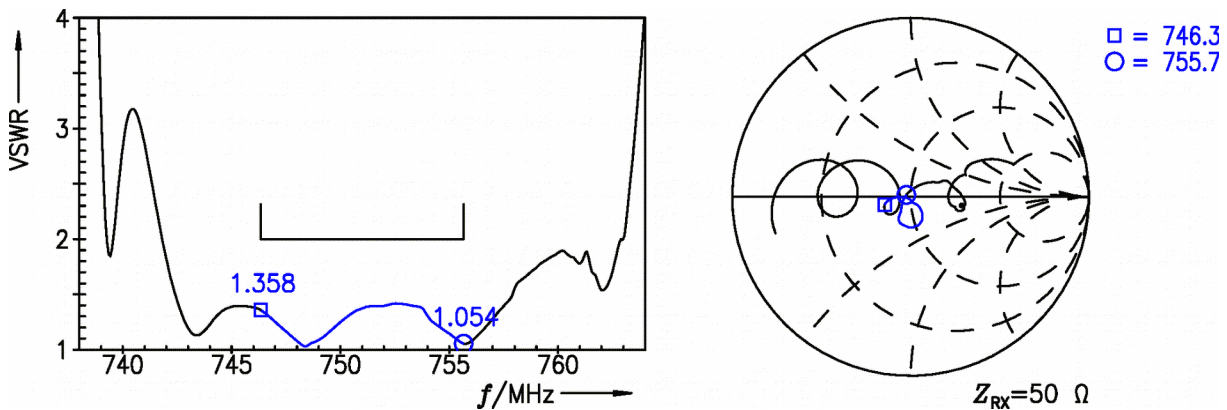


Figure 9: Reflection coefficient at RX port.

SAW components **B1228**
SAW duplexer **751 / 782 MHz**

Data sheet

10 Packing material

10.1 Tape

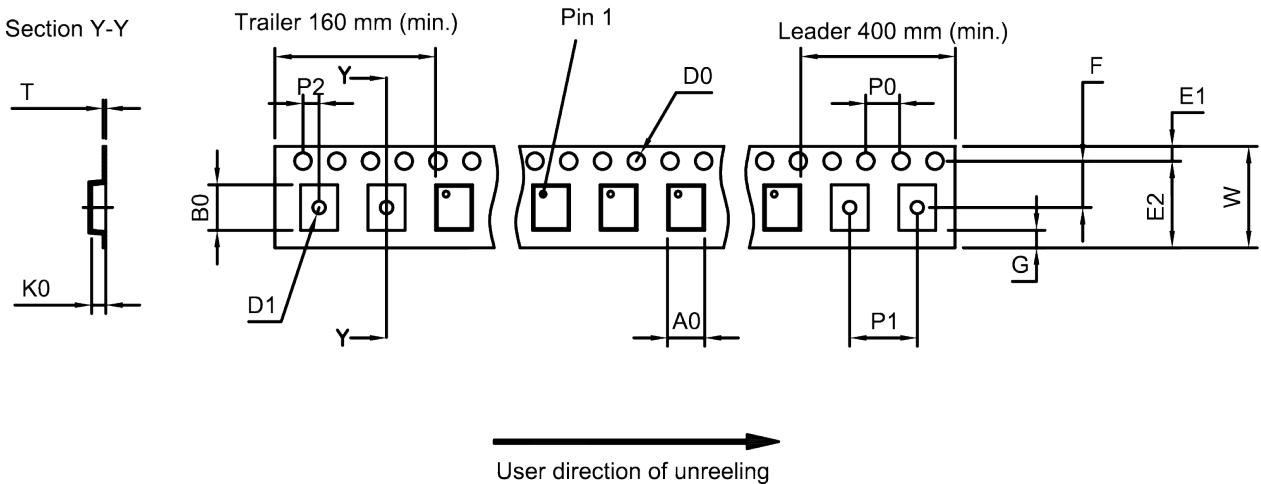


Figure 10: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A ₀	1.62±0.05 mm	E ₂	6.25 mm (min.)	P ₁	4.0±0.1 mm
B ₀	2.04±0.05 mm	F	3.5±0.05 mm	P ₂	2.0±0.05 mm
D ₀	1.5+0.1/-0 mm	G	0.75 mm (min.)	T	0.25±0.05 mm
D ₁	0.8±0.05 mm	K ₀	0.62±0.05 mm	W	8.0±0.1 mm
E ₁	1.75±0.1 mm	P ₀	4.0±0.1 mm		

Table 1: Tape dimensions.

SAW components **B1228**
SAW duplexer **751 / 782 MHz**

Data sheet

10.2 Reel with diameter of 180 mm

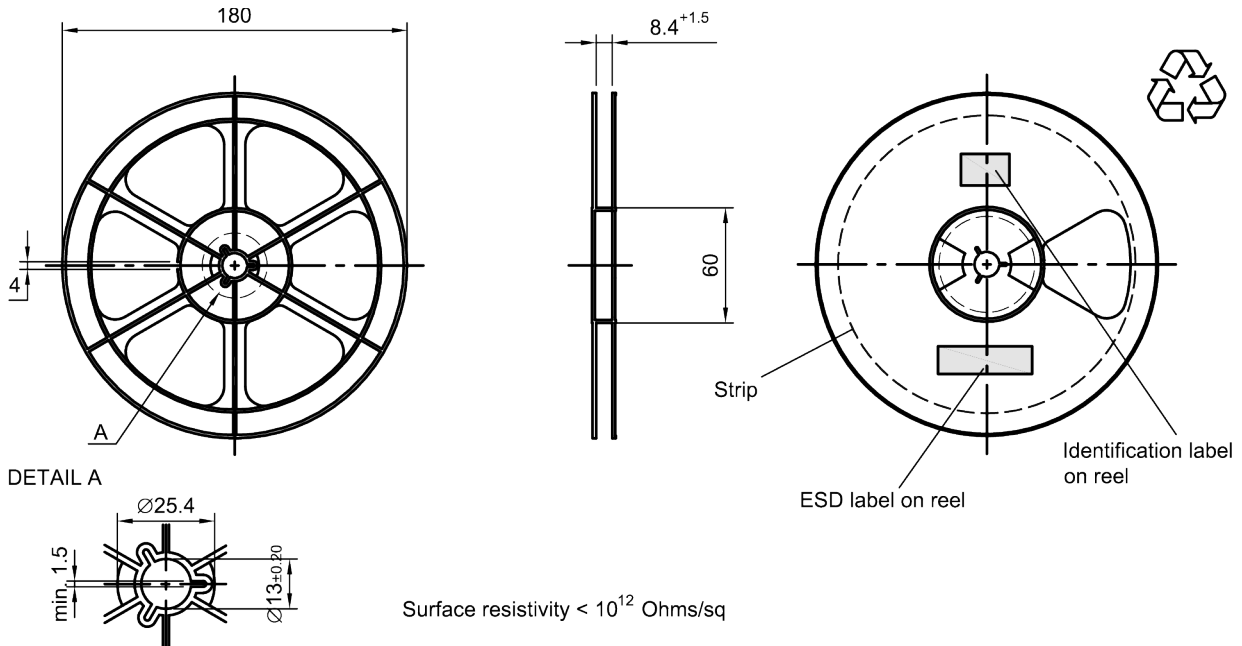


Figure 11: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

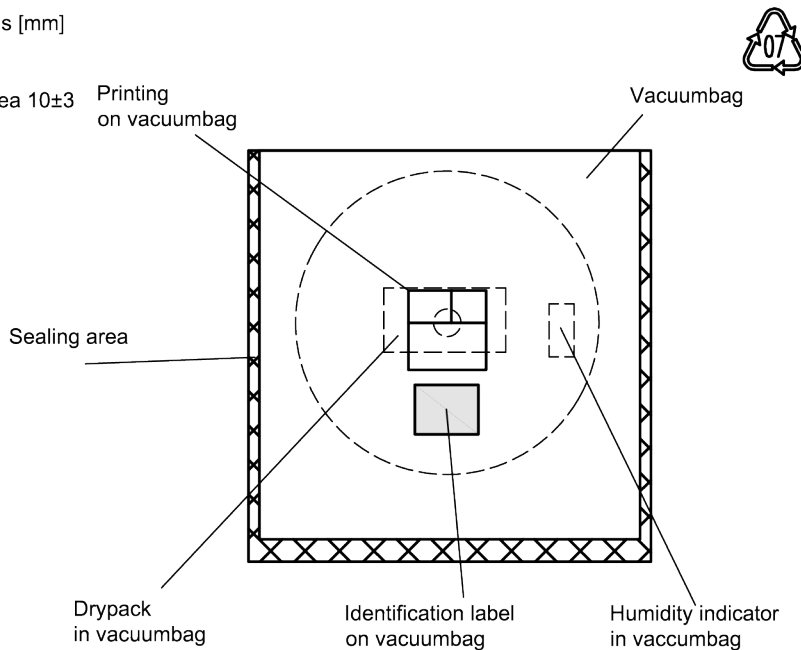


Figure 12: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

SAW components **B1228**
SAW duplexer **751 / 782 MHz**

Data sheet

Dimensions [mm]
 L = 188
 B = 188
 H = 30
 Tolerance ±5

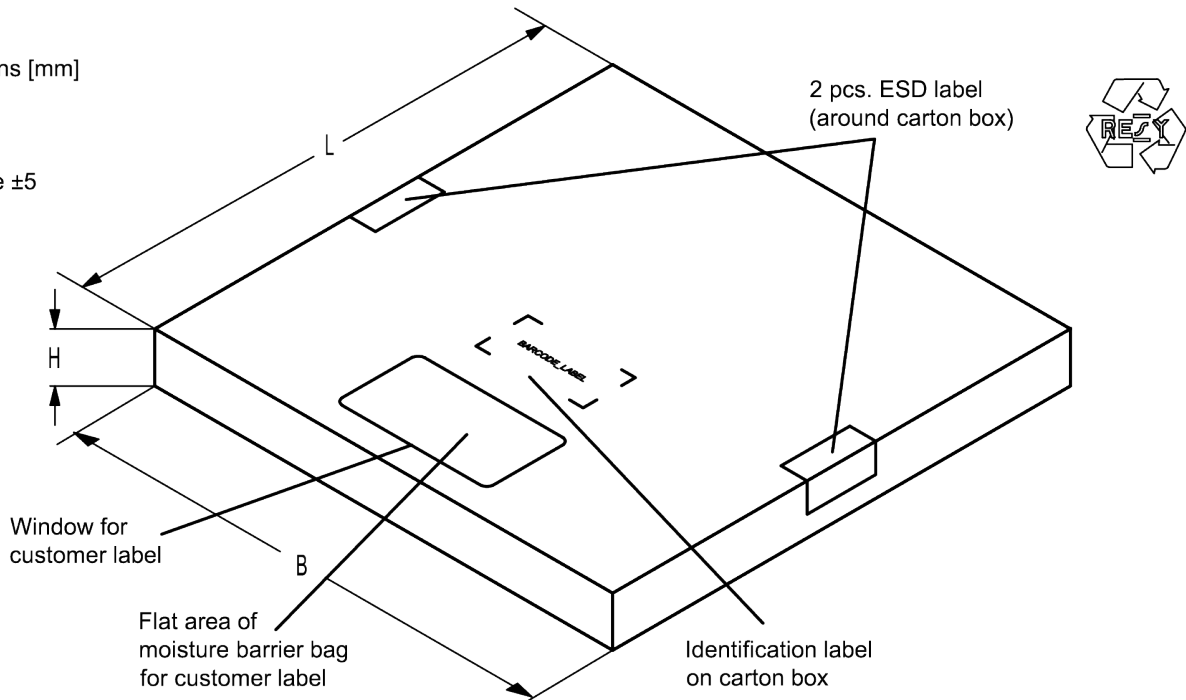


Figure 13: Drawing of folding box for reel with diameter of 180 mm.

10.3 Reel with diameter of 330 mm

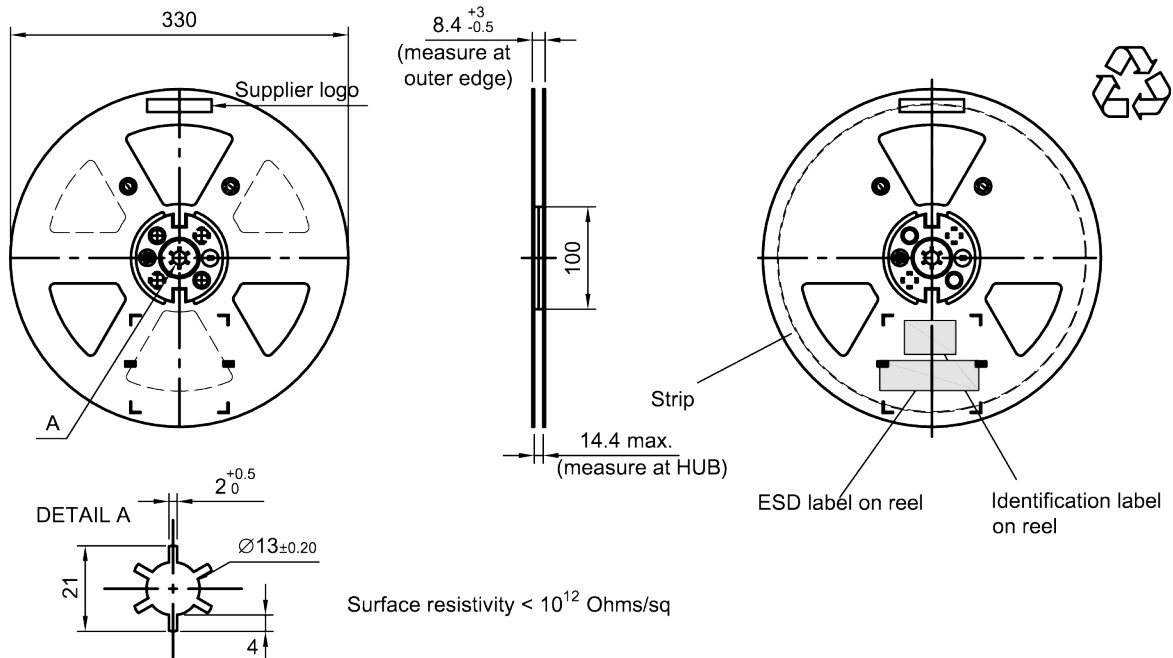


Figure 14: Drawing of reel (first-angle projection) with diameter of 330 mm.

SAW components B1228
SAW duplexer 751 / 782 MHz

Data sheet

Dimensions [mm]
 X = 400+5
 Y = 418+5
 Sealing area 10±3

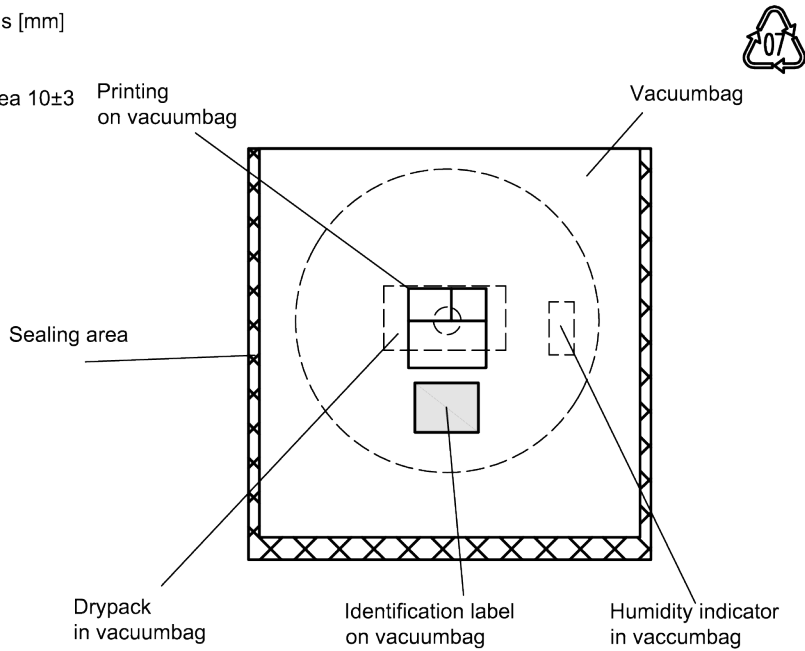


Figure 15: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

Dimensions [mm]
 L = 335
 B = 338
 H = 36 (for 8 mm tape width)
 40 (for 12 mm tape width)
 Tolerance ±5

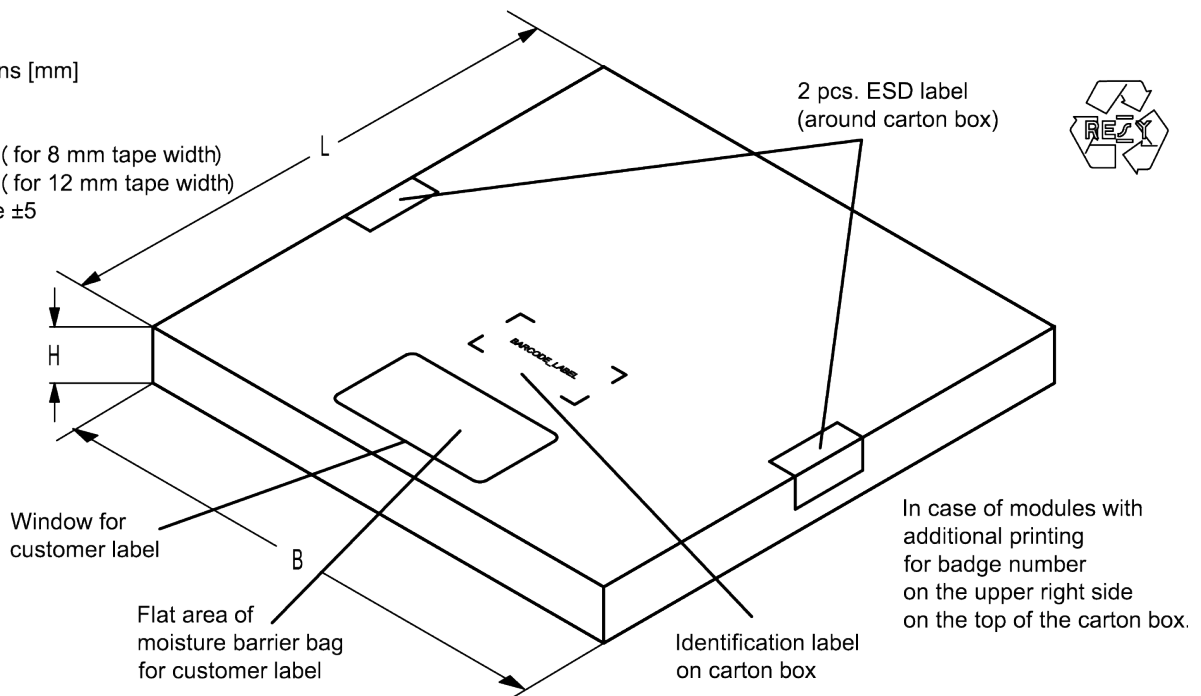


Figure 16: Drawing of folding box for reel with diameter of 330 mm.

SAW components **B1228**
SAW duplexer **751 / 782 MHz**

Data sheet

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

The BASE32 code for product type B1228 is 16C.

■ 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.

Data sheet

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
$T \geq 255$ °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).

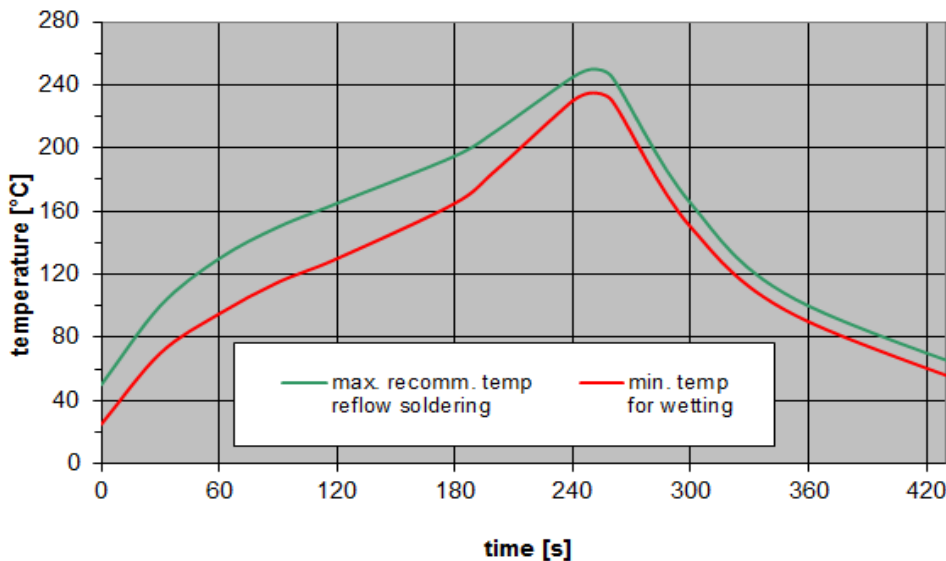


Figure 17: Recommended reflow profile for convection and infrared soldering – lead-free solder.

Data sheet

13 Annotations

13.1 Matching coils

See TDK inductor pdf-catalog <http://www.tdk.co.jp/tefe02/coil.htm#aname1> and Data Library for circuit simulation <http://www.tdk.co.jp/etvcl/index.htm>.

13.2 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.

13.3 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.

13.4 Ordering codes and packing units

Ordering code	Packing unit
B39781B1228P810	15000 pcs

Table 4: Ordering codes and packing units.

Data sheet

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).

Projection method

Unless otherwise specified first-angle projection is applied.

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.

单击下面可查看定价，库存，交付和生命周期等信息

[>>RF360 / Qualcomm](#)