SAW components

SAW duplexer
LTE band 28a

Series/type:	B8538
Ordering code:	B39771B8538P810
Date:	June 24, 2016
Version:	2.2

Data sheet

Table of contents

1 Application

- Low-loss SAW duplexer for mobile telephone LTE Band 28 systems
- Low insertion attenuation
- Usable pass band 30 MHz
- Duplexer for lower part of Band 28 (Block A)
- Companion type is B8539/B8541 for upper Band 28 (Block B)

2 Features

- Package size 1.8±0.1 mm × 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)

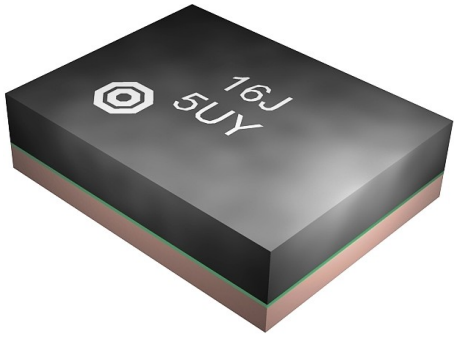

Figure 1: Picture of component with example of product marking.

3 Package

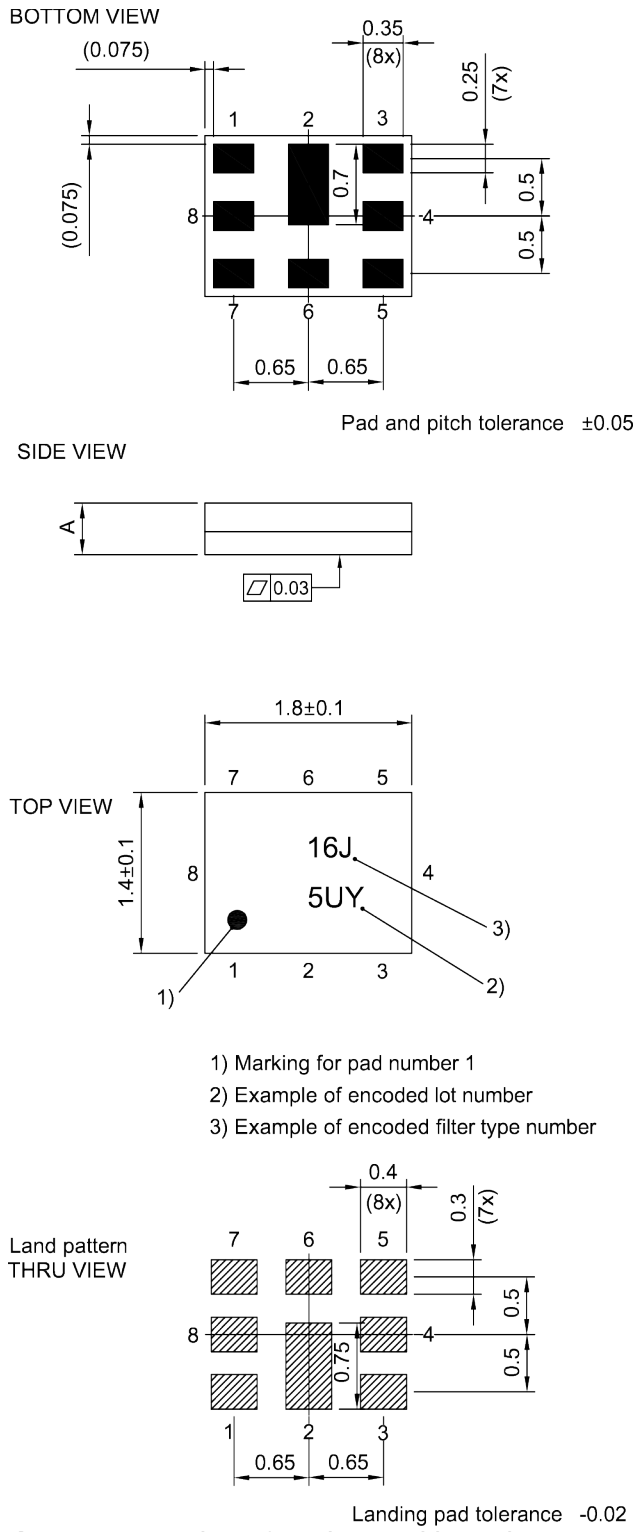

Figure 2: Drawing of package with package height A = 0.475 mm (max.). See Sec. Package information (p. 22).

4 Pin configuration

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

5 Matching circuit

■ L_{p6} = 6.0 nH ■ L_{s3} = 4.0 nH

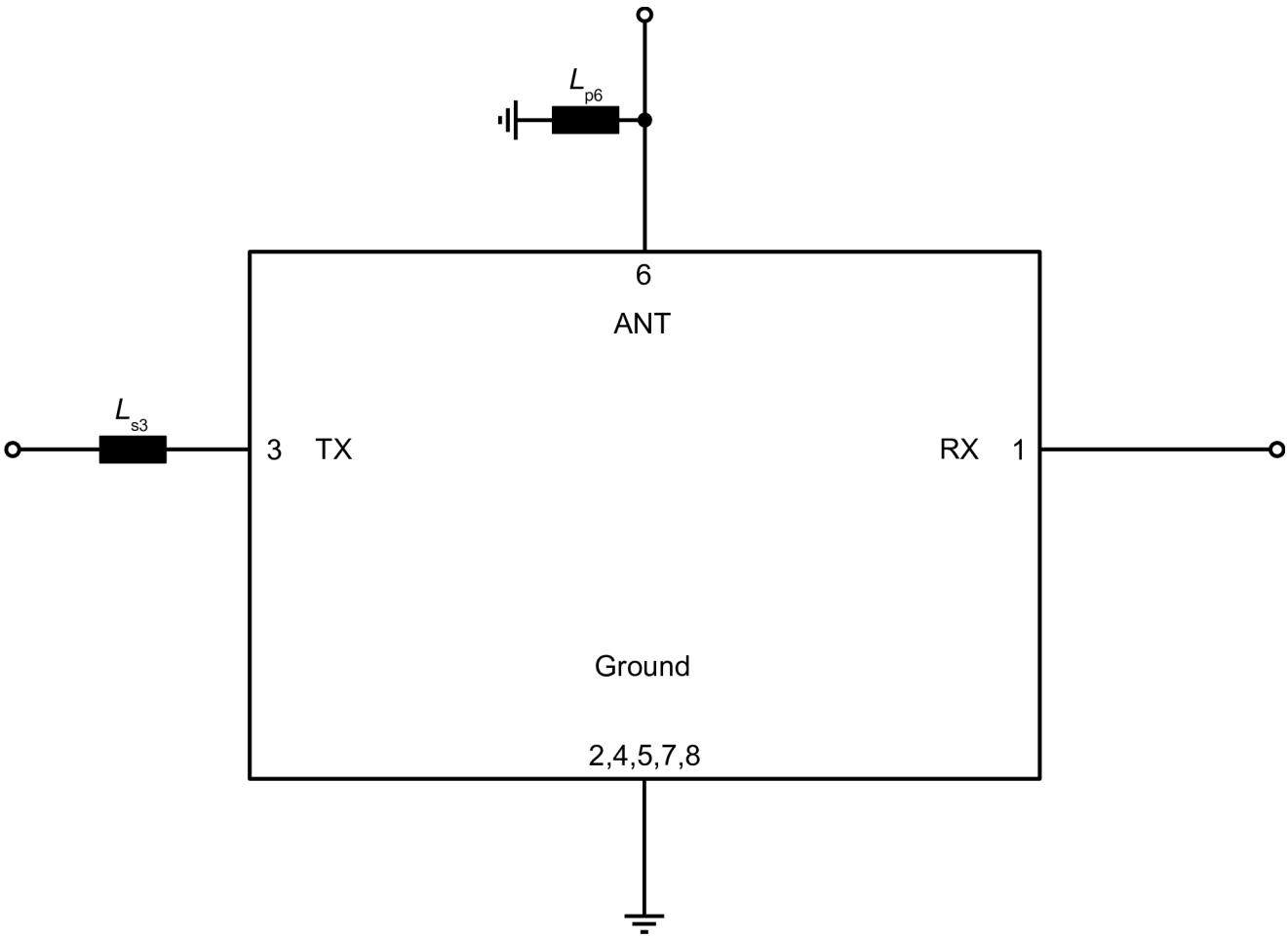

Figure 3: Schematic of matching circuit.

6 Characteristics

6.1 TX – ANT

Temperature range for specification T_{SPEC} = −20 °C ... +90 °C
TX terminating impedance Z_{TX} = 50 Ω with ser. 4.0 nH[1)]
ANT terminating impedance Z_{ANT} = 50 Ω with par. 6.0 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	—	718	—	MHz
Maximum insertion attenuation			α_{max}				
	703.24... 732.76	MHz		—	1.8	3.0	dB
Amplitude ripple (p-p)			Δα				
	703.24... 732.76	MHz		—	1.0	2.1	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	703... 733	MHz		—	1.7	2.0	
@ ANT port	703... 733	MHz		—	1.5	2.0	
Minimum attenuation			α_{min}				
	10... 670	MHz		30	38	—	dB
	670... 694	MHz		30	38	—	dB
	694... 695	MHz		30	38	—	dB
	695... 698	MHz		7[2)]	26	—	dB
	695... 698	MHz		5	26	—	dB
	758.24... 787.76	MHz		43	49	—	dB
	788... 803	MHz		30	39	—	dB
	859... 894	MHz		30	35	—	dB
	1225... 1250	MHz		35	45	—	dB
	1406... 1466	MHz		35	40	—	dB
	1559... 1563	MHz		35	38	—	dB
	1565.42... 1573.374	MHz		35	38	—	dB
	1573.374... 1577.466	MHz		35	38	—	dB
	1577.466... 1585.42	MHz		35	38	—	dB
	1597.55... 1605.89	MHz		34	38	—	dB
	1805... 1880	MHz		30	36	—	dB
	1930... 1995	MHz		30	35	—	dB
	2010... 2025	MHz		30	35	—	dB
	2109... 2199	MHz		30	34	—	dB
	2400... 2484	MHz		28	34	—	dB
	2570... 2620	MHz		28	33	—	dB
	2812... 2932	MHz		15	32	—	dB
	4900... 5950	MHz		15	22	—	dB

1) See Sec. Matching circuit (p. 5).

2) Valid for temperature T_{SPEC} = +15 °C...+70 °C.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −20 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω with ser. 4.0 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 6.0 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	—	773	—	MHz
Maximum insertion attenuation			α_{max}				
	758.24... 787.76	MHz		—	2.3	3.0	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	758.24... 787.76	MHz		—	0.9	1.5	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	758... 788	MHz		—	1.5	2.0[2)]	
	758... 788	MHz		—	1.5	2.2[3)]	
@ RX port	758... 788	MHz		—	1.8	2.1	
Minimum attenuation			α_{min}				
	1.0... 699	MHz		40	62	—	dB
	45... 65	MHz		50	70	—	dB
	703.24... 732.76	MHz		50	65	—	dB
	733.24... 747.76	MHz		30	42	—	dB
	814... 3000	MHz		40	44	—	dB
	3000... 6000	MHz		26	37	—	dB

1) See Sec. Matching circuit (p. 5).
2) Valid for temperature T_{SPEC} = 0 °C...+90 °C.
3) Valid for temperature T_{SPEC} = −20 °C...0 °C.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −20 °C ... +90 °C
TX terminating impedance	Z_{TX}	= 50 Ω with ser. 4.0 nH[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 6.0 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}					
	703.24... 732.76	MHz	60	63	—	dB
	758.24... 787.76	MHz	54[2)]	57	—	dB
	758.24... 787.76	MHz	53[3)]	57	—	dB

1) See Sec. Matching circuit (p. 5).
2) Valid for temperature T_{SPEC} = +20 °C...+90 °C.
3) Valid for temperature T_{SPEC} = −20 °C...+20 °C.

7 Maximum ratings

Storage temperature	T_{STG} [2] = −40 °C ... +85 °C[1]	
DC voltage	V_{DC} = 5.0 V (max.)	
ESD voltage	V_{ESD}	
	100 V (max.)[3]	
	300 V (max.)[4]	
	600 V (max.)[5]	
Input power	P_{IN}	
@ TX port: 703 ... 733 MHz	29 dBm	Continuous wave for 5000 h @ 50 °C.
@ TX port: other frequency ranges	10 dBm	Continuous wave for 5000 h @ 50 °C.

1) Extended upper limit :168h@125 C .to IEC 60068-2-2Bb.
2) Not valid for packaging material. Storage temperature for packaging material -25 to +40 °C.
3) According to JESD22-A115B (machine model), 10 negative and 10 positive pulses.
4) Acc to JESD22-A114F (human body model), 10 negative and 10 positive pulses.
5) According to JESD22-A101C (Charger device model), 3 negative and 3 positive pulses.

8 Transmission coefficients

8.1 TX – ANT

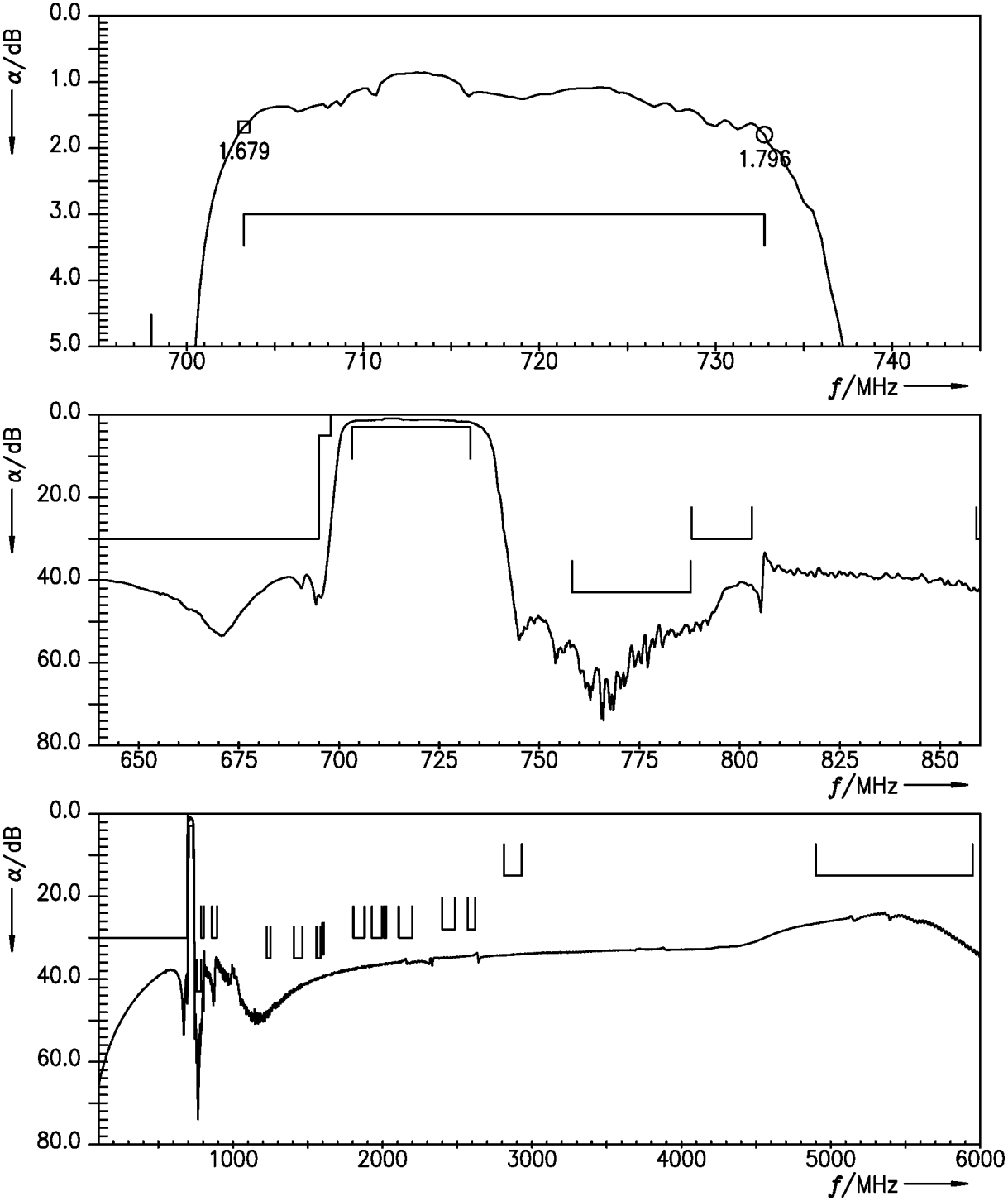

Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

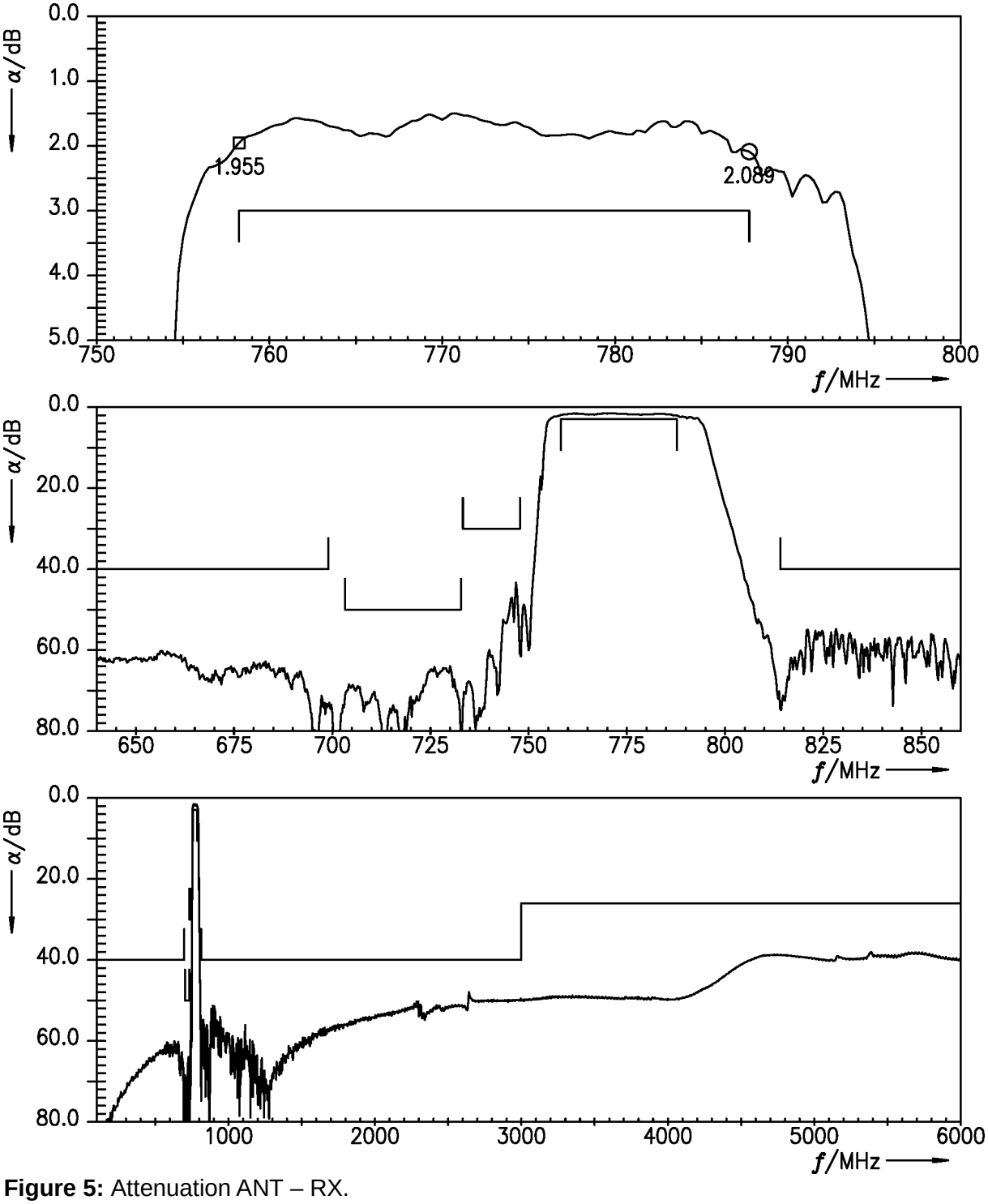

Figure 5: Attenuation ANT – RX.

8.3 TX – RX

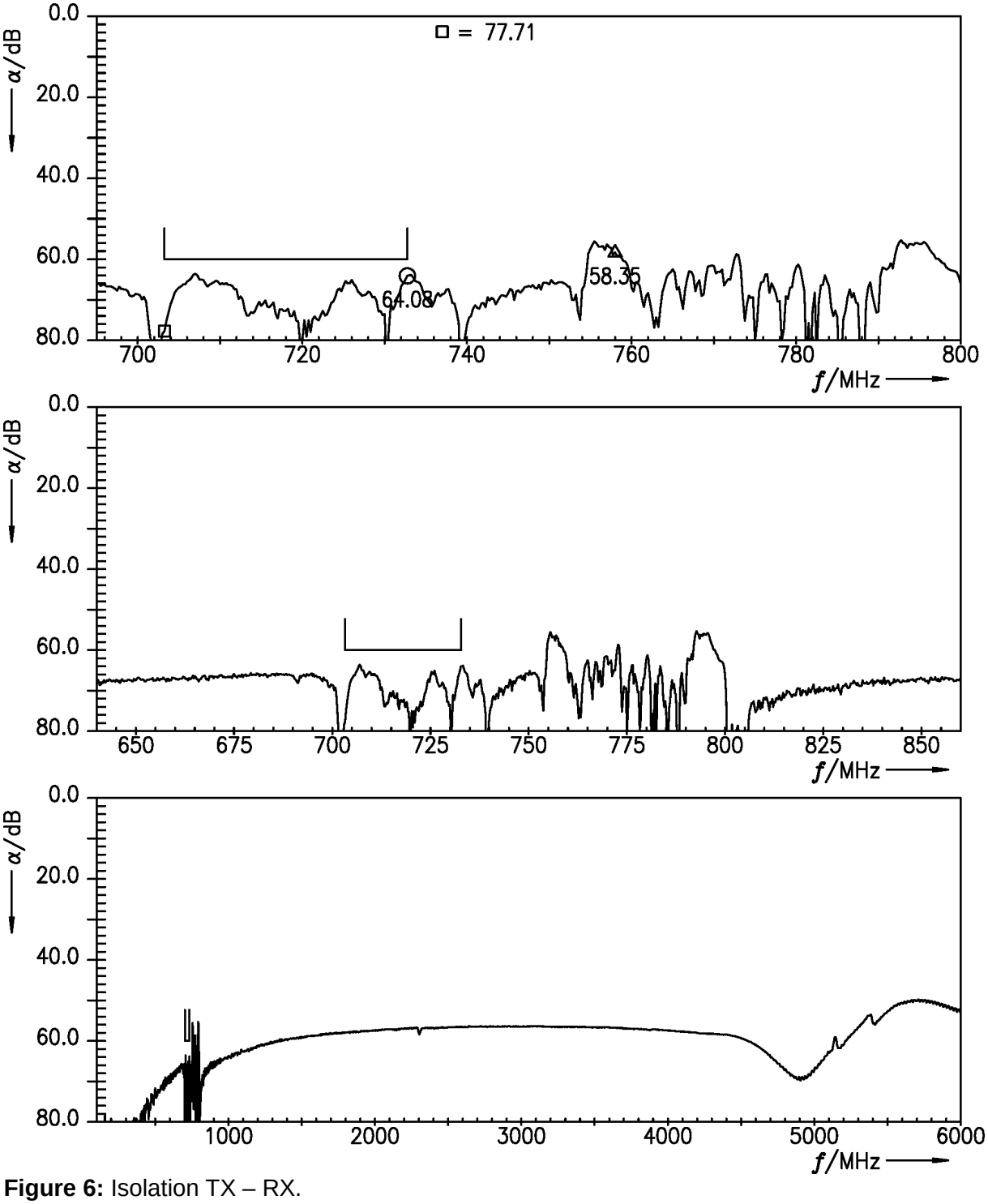

Figure 6: Isolation TX – RX.

9 Reflection coefficients

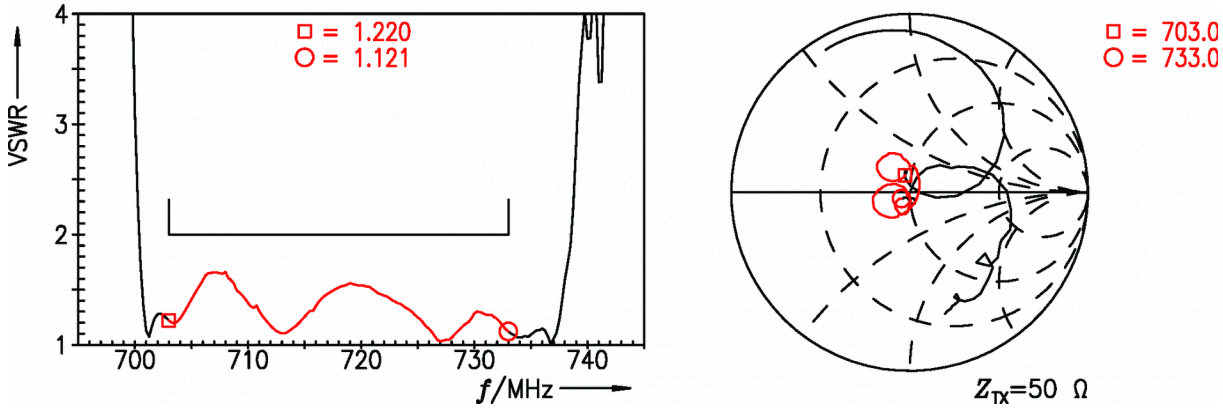

Figure 7: Reflection coefficient at TX port.

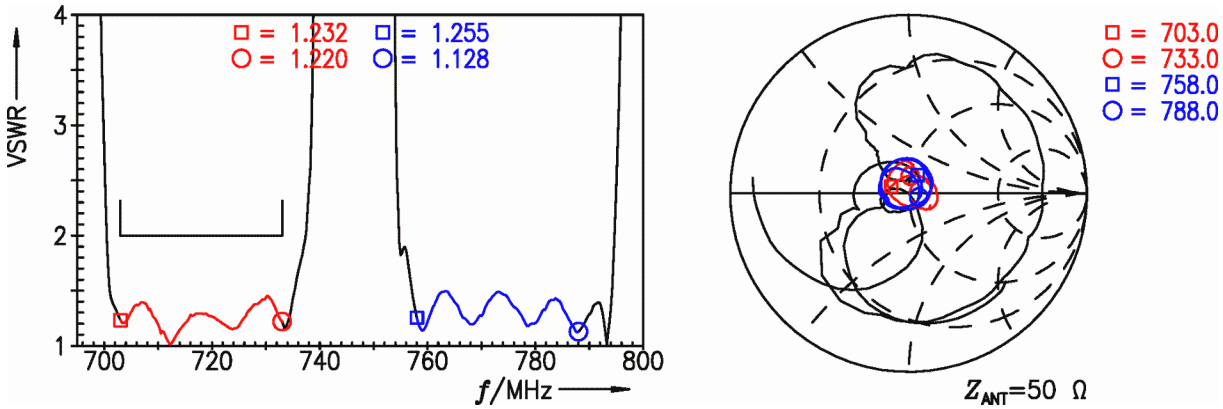

Figure 8: Reflection coefficient at ANT port.

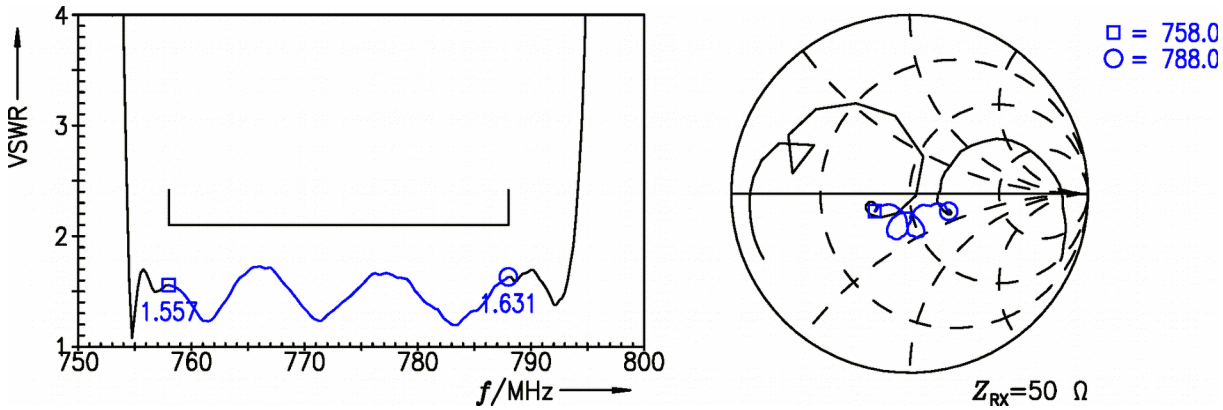

Figure 9: Reflection coefficient at RX port.

10 Packing material

10.1 Tape

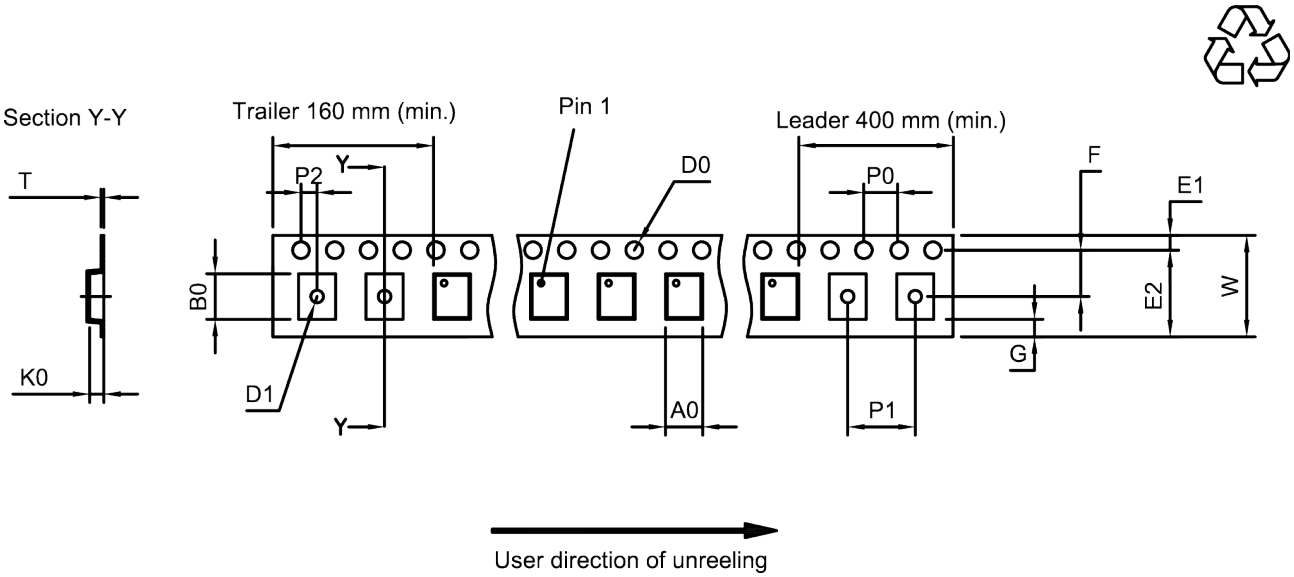

Figure 10: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	1.62±0.05 mm
B_0	2.04±0.05 mm
D_0	1.5±0.05 mm
D_1	0.8±0.05 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±0.02 mm
W	8.0±0.1 mm

Table 1: Tape dimensions.

10.2 Reel with diameter of 180 mm

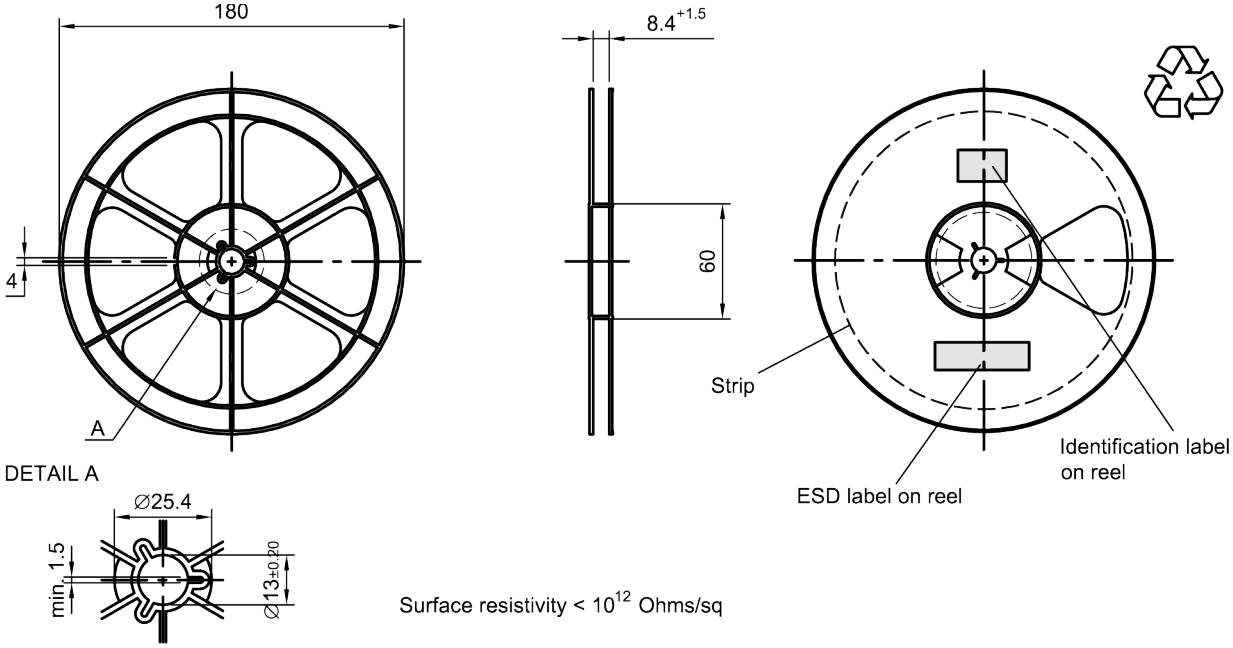

Figure 11: Drawing of reel (first-angle projection) with diameter of 180 mm.

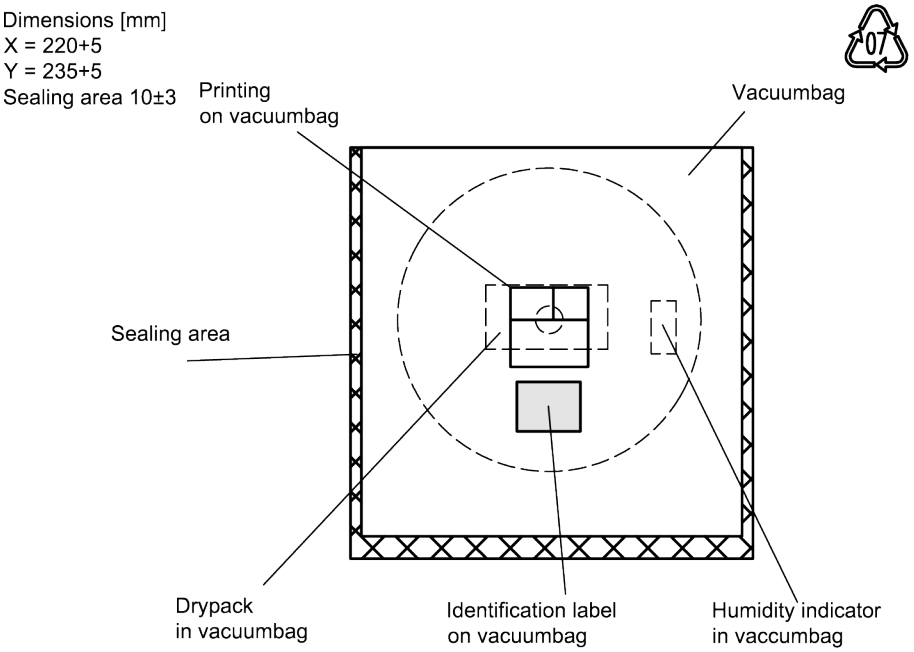

Figure 12: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

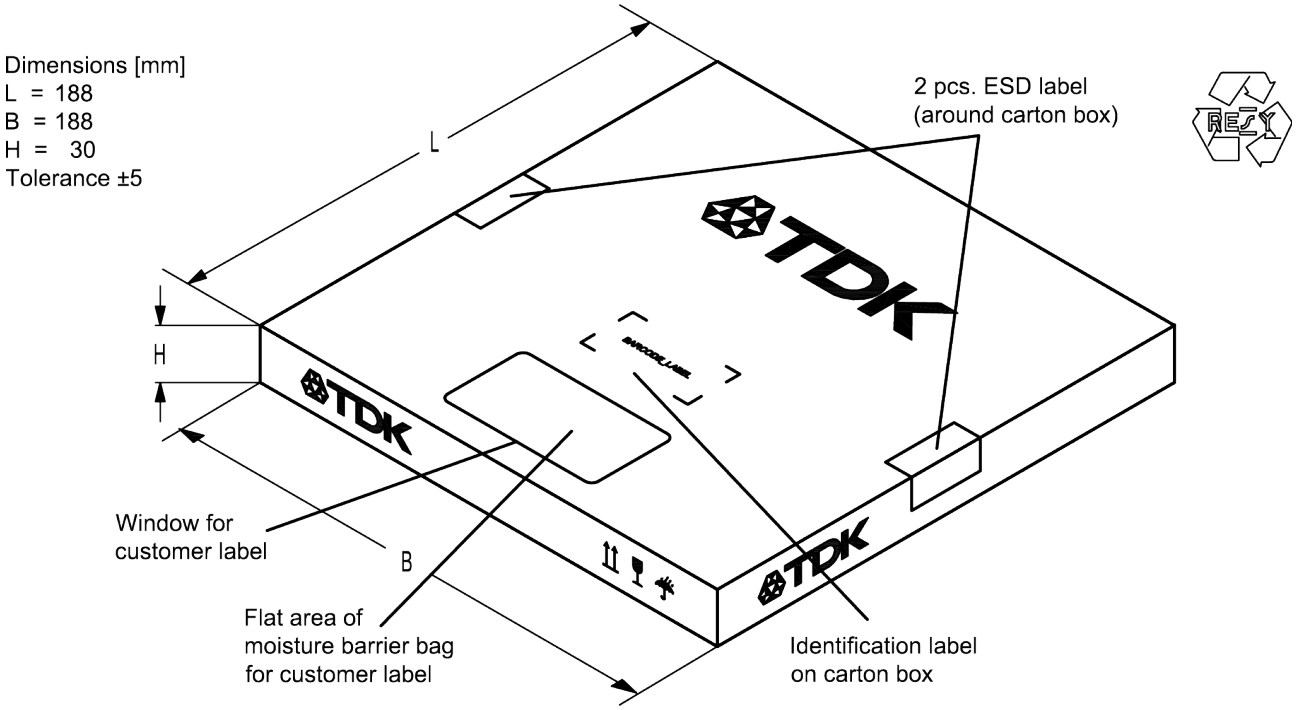

Figure 13: Drawing of folding box for reel with diameter of 180 mm.

10.3 Reel with diameter of 330 mm

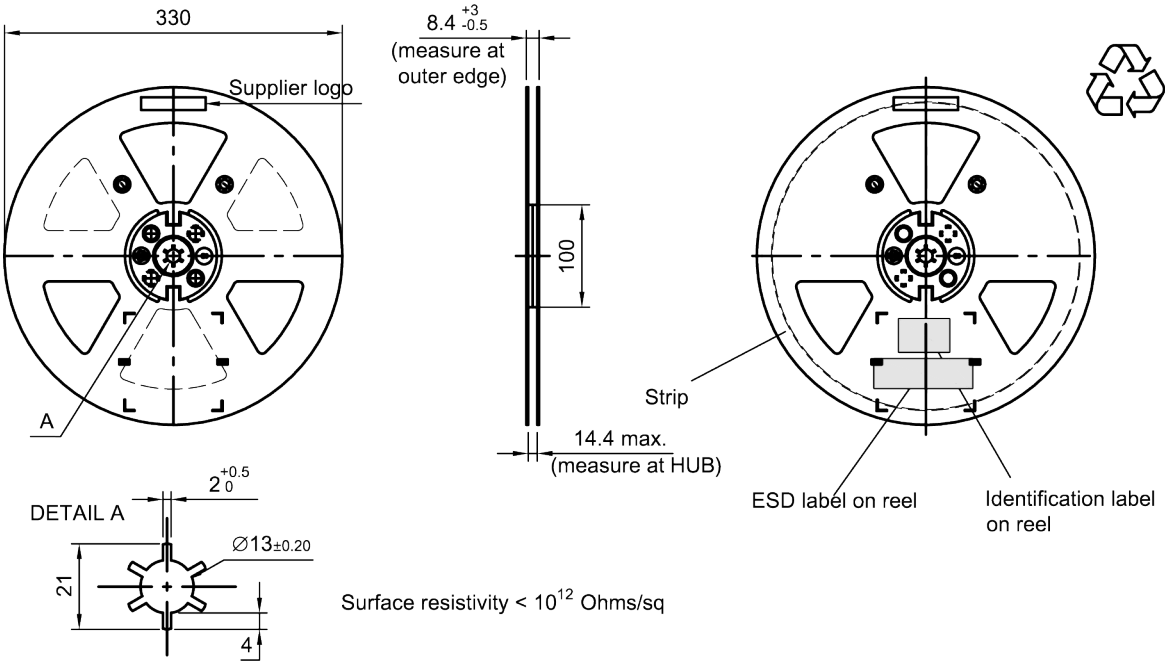

Figure 14: Drawing of reel (first-angle projection) with diameter of 330 mm.

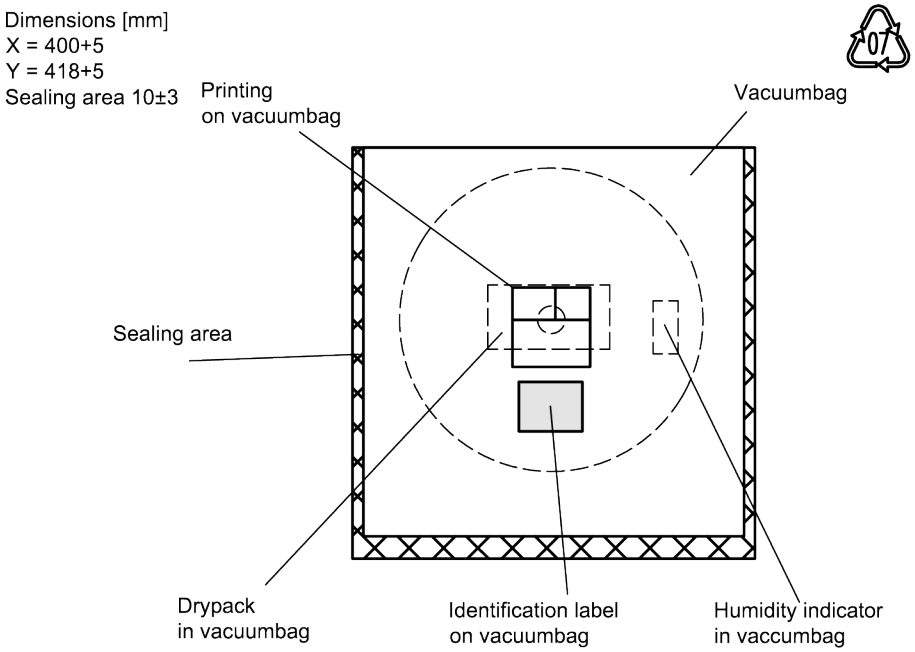

Figure 15: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

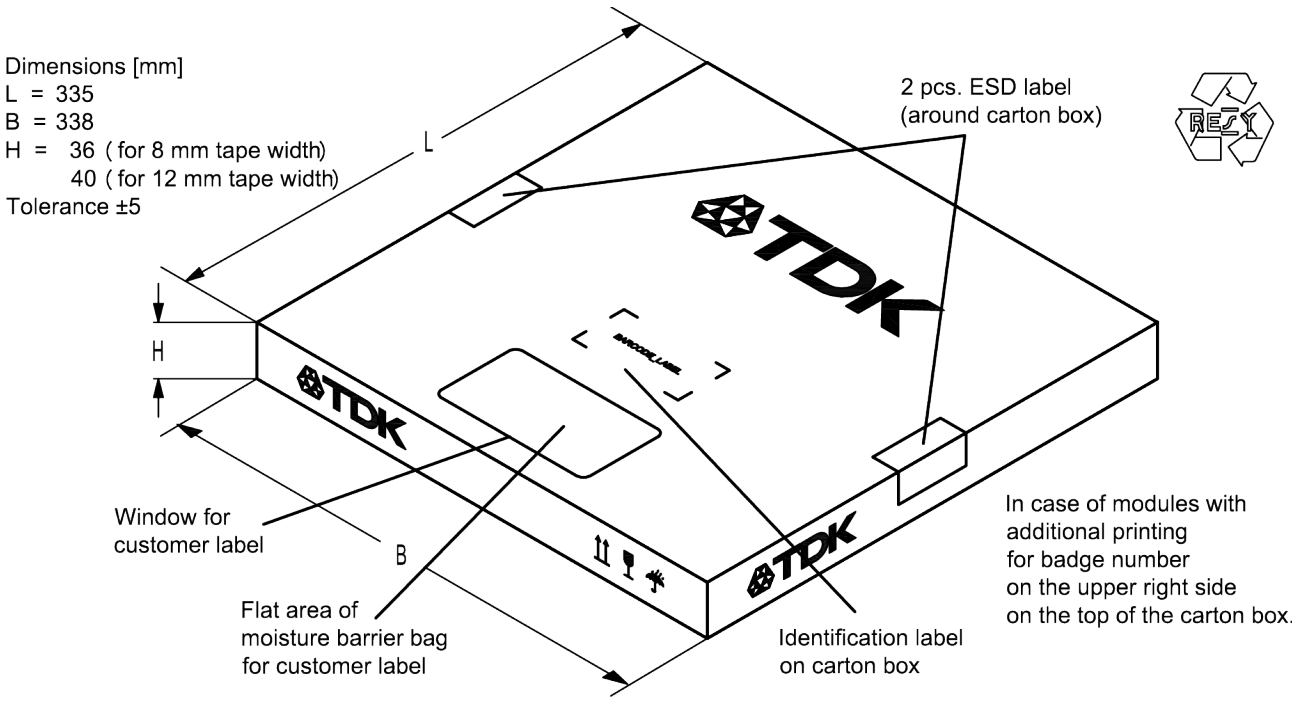

Figure 16: Drawing of folding box for reel with diameter of 330 mm.

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 B8538 is 8AT.

- 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).

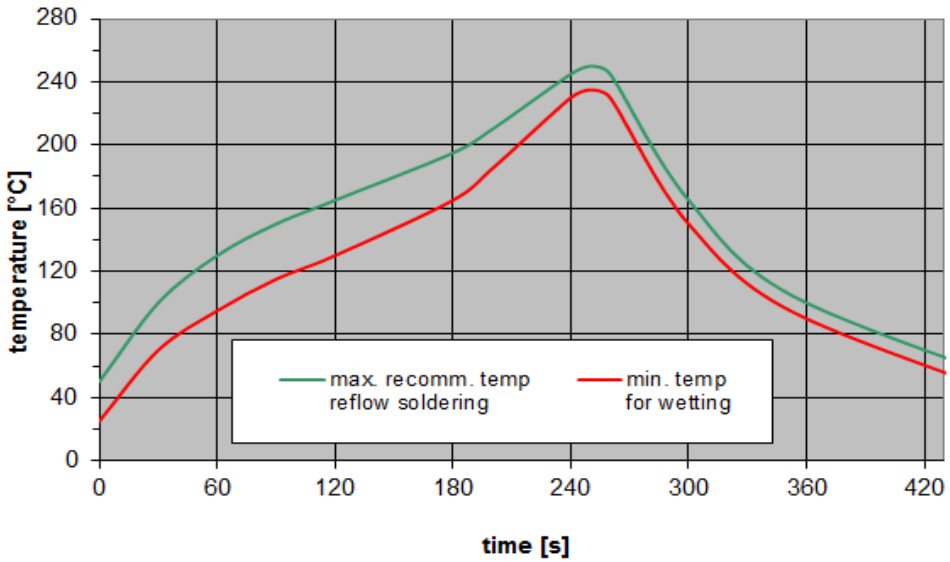

Figure 17: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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 EPCOS sales office.

13.4 Ordering codes and packing units

Ordering code	Packing unit
B39771B8538P810	15000 pcs
B39771B8538P810S 5	5000 pcs

Table 4: Ordering codes and packing units.

14 Cautions and warnings

14.1 Display of ordering codes for EPCOS 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 EPCOS, 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.epcos.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 EPCOS sales office.

14.4 Package information

Landing area

The printed circuit board (PCB) land pattern (landing area) shown is based on EPCOS 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 EPCOS, 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, EPCOS is 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 EPCOS 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.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
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