

RF360 Europe GmbH

A Qualcomm – TDK Joint Venture

## SAW components

### SAW duplexer

LTE band 66

Series/type:	B8695
Ordering code:	B39222B8695L210
Date:	October 20, 2016
Version:	2.0

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## SAW components

### SAW duplexer LTE band 66

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Data sheet

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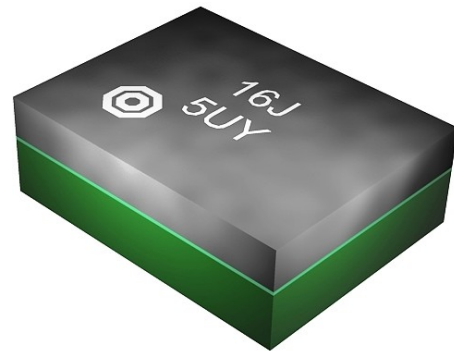
Data sheet

## 1 Application

- Low -loss SAW duplexer for mobile telephone LTE Band 66 system
- Low insertion attenuation
- Low amplitude ripple
- Usable TX pass band: 70 MHz
- Usable RX pass band: 90 MHz

## 2 Features

- Package size 1.8±0.1 mm × 1.4±0.1 mm
- Package height 0.6 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)

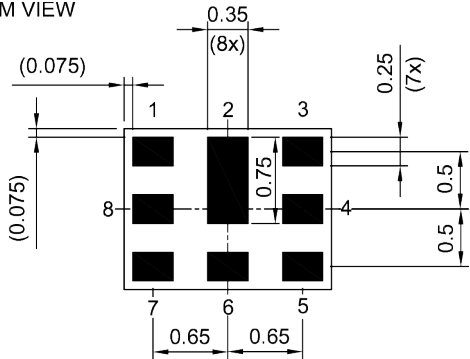


**Figure 1:** Picture of component with example of product marking.

Data sheet

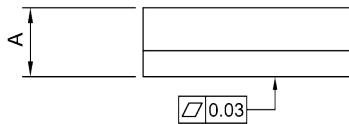
**3 Package**

BOTTOM VIEW

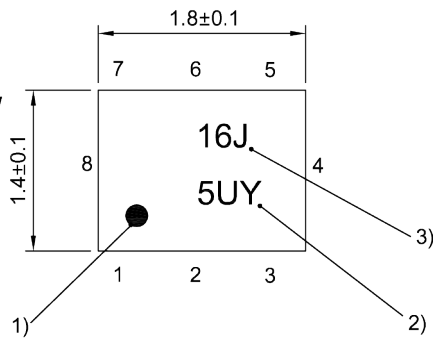


Pad and pitch tolerance ±0.05

SIDE VIEW

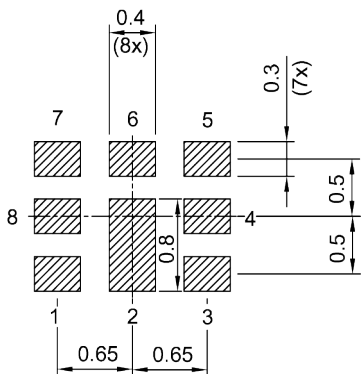


TOP VIEW



- 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 = 0.6 mm (max.). See Sec. Package information (p. 24).

**4 Pin configuration**

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

Data sheet

5 Matching circuit

■  $L_{p1} = 4.2 \text{ nH}$

■  $L_{s3} = 1.0 \text{ nH}$

■  $L_{p6} = 2.7 \text{ nH}$

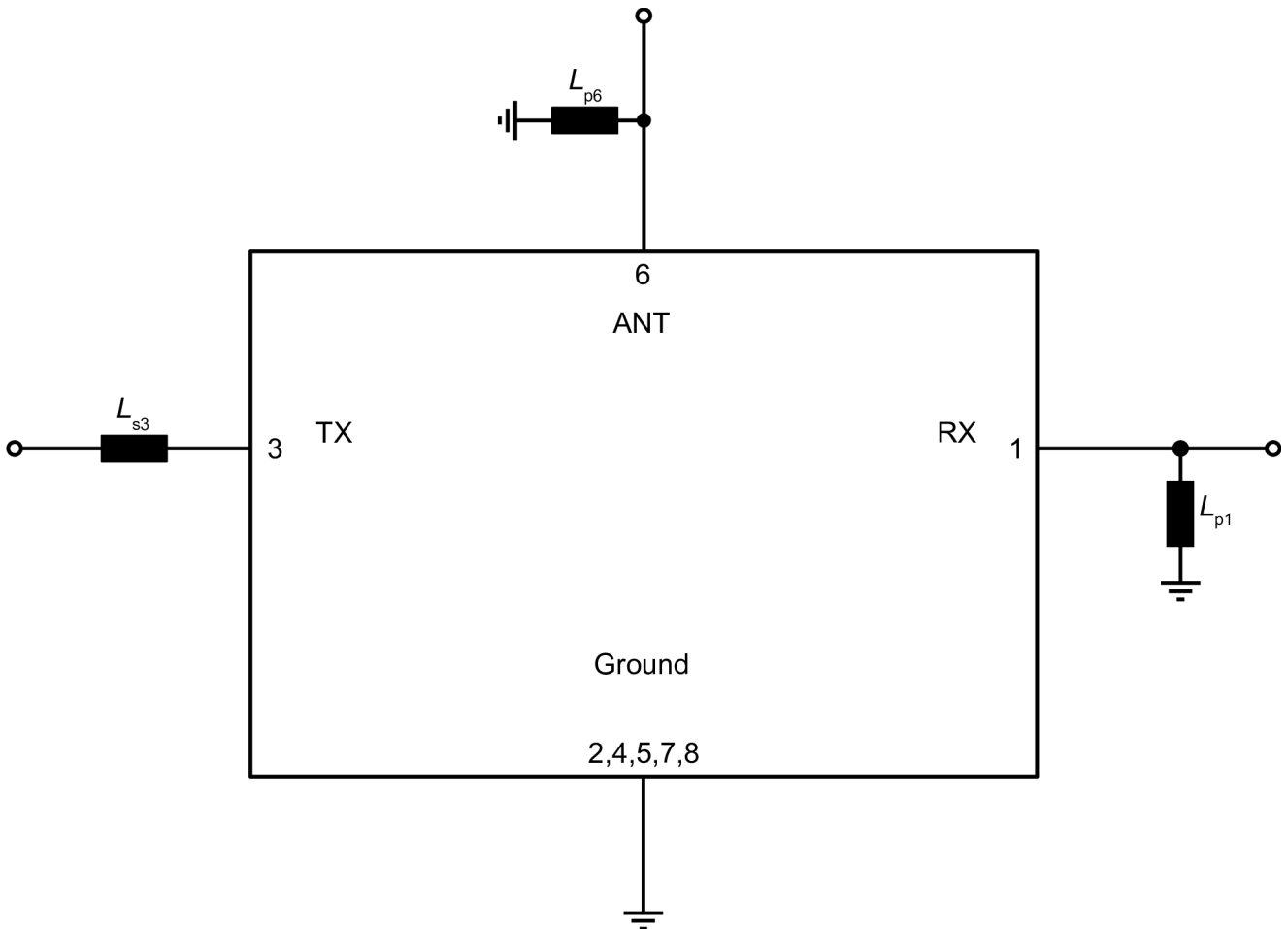


Figure 3: Schematic of matching circuit.

Data sheet

## 6 Characteristics

### 6.1 TX – ANT

Temperature range for specification	$T_{SPEC}$	= -30 °C ... +90 °C
TX terminating impedance	$Z_{TX}$	= 50 $\Omega$ with ser. 1.0 nH <sup>1)</sup>
ANT terminating impedance	$Z_{ANT}$	= 50 $\Omega$ with par. 2.7 nH <sup>1)</sup>
RX terminating impedance	$Z_{RX}$	= 50 $\Omega$ with par. 4.2 nH <sup>1)</sup>

Characteristics TX – ANT				min. for $T_{SPEC}$	typ. @ +25 °C	max. for $T_{SPEC}$	
<b>Center frequency</b>			$f_C$	—	1745	—	MHz
<b>Maximum insertion attenuation</b>			$\alpha_{max}$				
	1710... 1780	MHz		—	1.6	2.3	dB
<b>Amplitude ripple (p-p)</b>			$\Delta\alpha$				
	1710... 1780	MHz		—	0.7	1.3	dB
<b>Maximum VSWR</b>			VSWR <sub>max</sub>				
@ TX port	1710... 1780	MHz		—	1.6	2.0	
@ ANT port	1710... 1780	MHz		—	1.5	2.0	
<b>Maximum error vector magnitude</b>			EVM <sub>max</sub> <sup>2)</sup>				
	1712.4... 1777.6	MHz		—	1.4	2.0	%
<b>Minimum attenuation</b>			$\alpha_{min}$				
	10... 728	MHz		30	45	—	dB
	699... 716	MHz		30	45	—	dB
	704... 716	MHz		30	45	—	dB
	777... 787	MHz		30	43	—	dB
	824... 849	MHz		30	42	—	dB
	851... 894	MHz		38	41	—	dB
	1226... 1250	MHz		33	36	—	dB
	1559... 1563	MHz		36	40	—	dB
	1565.42... 1573.374	MHz		36	40	—	dB
	1573.374... 1577.466	MHz		37	41	—	dB
	1577.466... 1585.42	MHz		37	41	—	dB
	1597.5515... 1605.886	MHz		35	41	—	dB
	1805... 1880	MHz		2.5	6	—	dB
	2110... 2200	MHz		36	49	—	dB
	2350... 2360	MHz		21	29	—	dB
	2400... 2500	MHz		21	27	—	dB
	2440... 2494	MHz		21	28	—	dB
	2500... 2570	MHz		19	25	—	dB
	3410... 3520	MHz		10	13	—	dB
	4900... 5950	MHz		8	13	—	dB
	4905... 5267	MHz		8	13	—	dB
	6830... 7030	MHz		15	25	—	dB



## Data sheet

- <sup>1)</sup> See Sec. Matching circuit (p. 5).
- <sup>2)</sup> Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.

Data sheet

**6.2 ANT – RX**

Temperature range for specification	$T_{SPEC}$	= -30 °C ... +90 °C
TX terminating impedance	$Z_{TX}$	= 50 $\Omega$ with ser. 1.0 nH <sup>1)</sup>
ANT terminating impedance	$Z_{ANT}$	= 50 $\Omega$ with par. 2.7 nH <sup>1)</sup>
RX terminating impedance	$Z_{RX}$	= 50 $\Omega$ with par. 4.2 nH <sup>1)</sup>

Characteristics ANT – RX			min. for $T_{SPEC}$	typ. @ +25 °C	max. for $T_{SPEC}$	
<b>Center frequency</b>		$f_C$	—	2155	—	MHz
<b>Maximum insertion attenuation</b>	2110... 2200	MHz	—	2.2	2.9	dB
<b>Amplitude ripple (p-p)</b>	2110... 2200	MHz	—	0.8	1.6	dB
<b>Maximum VSWR</b>						
@ ANT port	2110... 2200	MHz	—	1.4	2.0	
@ RX port	2110... 2200	MHz	—	1.7	2.1	
<b>Minimum attenuation</b>						
	10... 1649	MHz	40	54	—	dB
	400	MHz	50	86	—	dB
	699... 716	MHz	45	70	—	dB
	777... 787	MHz	40	68	—	dB
	824... 849	MHz	40	66	—	dB
	1310... 1355	MHz	40	55	—	dB
	1649... 1672	MHz	30	36	—	dB
	1672... 1710	MHz	40	51	—	dB
	1710... 1780	MHz	45	52	—	dB
	1755... 2025	MHz	15	36	—	dB
	1910... 1955	MHz	30	46	—	dB
	2255... 6000	MHz	23	30	—	dB
	2305... 2315	MHz	40	52	—	dB
	2400... 2500	MHz	39	42	—	dB
	2500... 3820	MHz	35	38	—	dB
	3820... 3910	MHz	35	38	—	dB
	4220... 4310	MHz	34	37	—	dB
	4310... 8000	MHz	15	21	—	dB
	4900... 5950	MHz	25	33	—	dB
	5510... 5685	MHz	31	38	—	dB
	5530... 5665	MHz	32	38	—	dB
	6330... 6465	MHz	17	25	—	dB
<b>IMD product levels</b>						
IMD2 <sup>2)</sup>						
Blocker 1	410	MHz	—	-122	-106	dBm

<b>SAW components</b>	<b>B8695</b>
<b>SAW duplexer</b>	<b>1745 / 2155 MHz</b>

Data sheet

<b>Characteristics ANT – RX</b>	<b>min.</b> for $T_{SPEC}$	<b>typ.</b> @ +25 °C	<b>max.</b> for $T_{SPEC}$	
Blocker 3 IMD3 <sup>2)</sup>	—	-114	-101	dBm
Blocker 2	—	-122	-107	dBm
Blocker 4	—	-136	-109	dBm

<sup>1)</sup> See Sec. Matching circuit (p. 5).

<sup>2)</sup> IMD product level limits for power levels  $P_{TX} = 21\text{dBm dBm}$  (antenna port output power) and  $P_{blocker} = -15\text{dBm dBm}$  (antenna port input power).

Data sheet

**6.3 TX – RX**

Temperature range for specification	$T_{SPEC}$	= -30 °C ... +90 °C
TX terminating impedance	$Z_{TX}$	= 50 $\Omega$ with ser. 1.0 nH <sup>1)</sup>
ANT terminating impedance	$Z_{ANT}$	= 50 $\Omega$ with par. 2.7 nH <sup>1)</sup>
RX terminating impedance	$Z_{RX}$	= 50 $\Omega$ with par. 4.2 nH <sup>1)</sup>

<b>Characteristics TX – RX</b>				<b>min.</b> for $T_{SPEC}$	<b>typ.</b> @ +25 °C	<b>max.</b> for $T_{SPEC}$	
<b>Minimum isolation</b>			$\alpha_{min}$				
	1574... 1577	MHz		40	58	—	dB
	1710... 1780	MHz		50	53	—	dB
	2110... 2200	MHz		38	48	—	dB
	3410... 3570	MHz		20	50	—	dB
	5120... 5350	MHz		20	40	—	dB

<sup>1)</sup> See Sec. Matching circuit (p. 5).

<b>SAW components</b>	<b>B8695</b>
<b>SAW duplexer</b>	<b>1745 / 2155 MHz</b>

Data sheet

## 7 Maximum ratings

Storage temperature	$T_{STG}^{1)} = -40\text{ °C} \dots +85\text{ °C}$	
DC voltage	$ V_{DC}  = 5.0\text{ V (max.)}^{2)}$	
ESD voltage		
	$V_{ESD}^{3)} = 50\text{ V (max.)}$	Machine model.
	$V_{ESD}^{4)} = 325\text{ V (max.)}$	Human body model.
	$V_{ESD}^{5)} = 600\text{ V (max.)}$	Charged device model.
Input power	$P_{IN}$	
@ TX port: 1710 ... 1780 MHz	29 dBm	Continuous wave for 5000 h @ 50 °C.
@ TX port: other frequency ranges	10 dBm	Continuous wave for 5000 h @ 50 °C.

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

<sup>2)</sup> 168h Damp Heat Steady State acc. IEC 60068-2-67 Cy.

<sup>3)</sup> According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses.

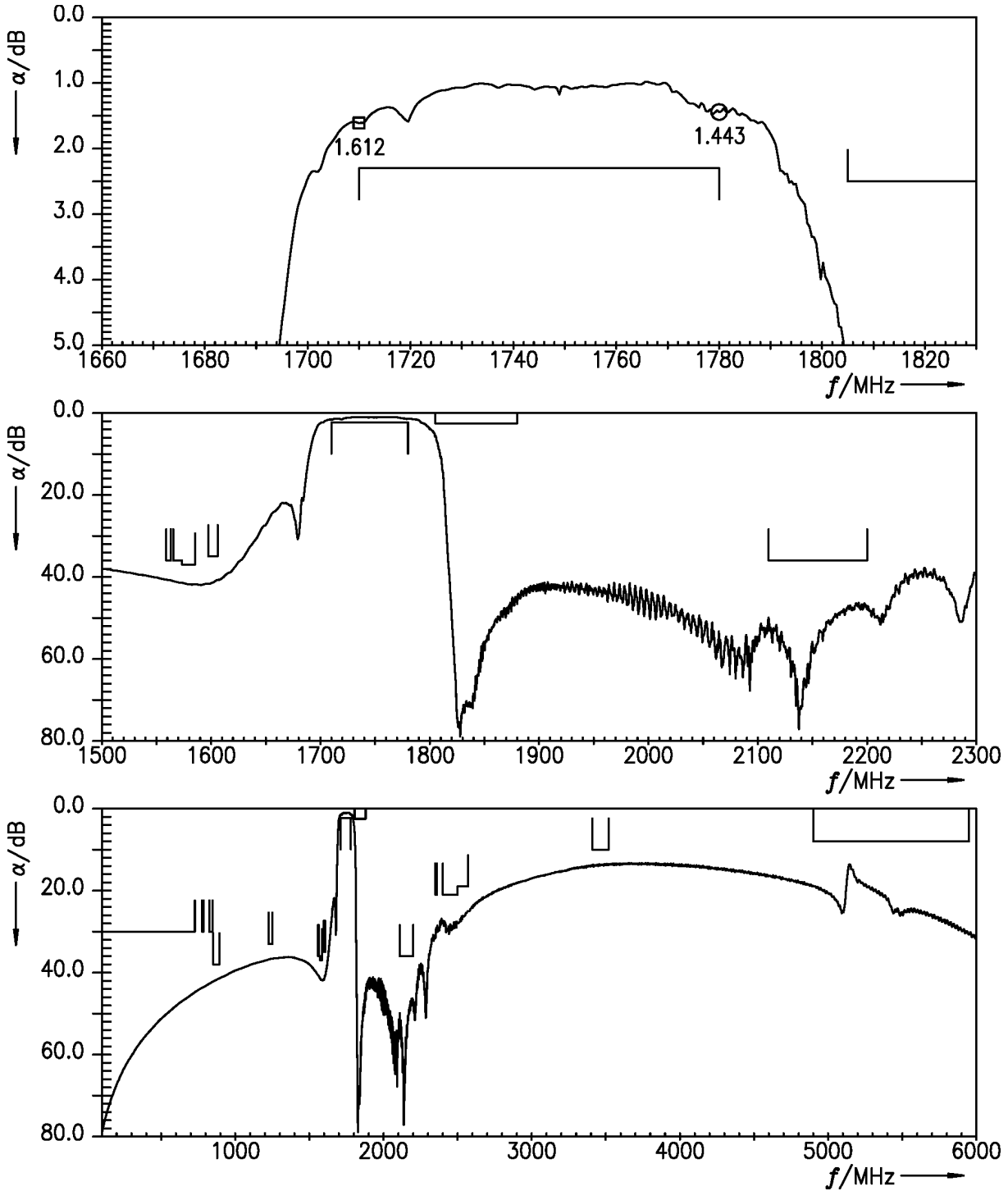
<sup>4)</sup> According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.

<sup>5)</sup> According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

Data sheet

**8 Transmission coefficients**

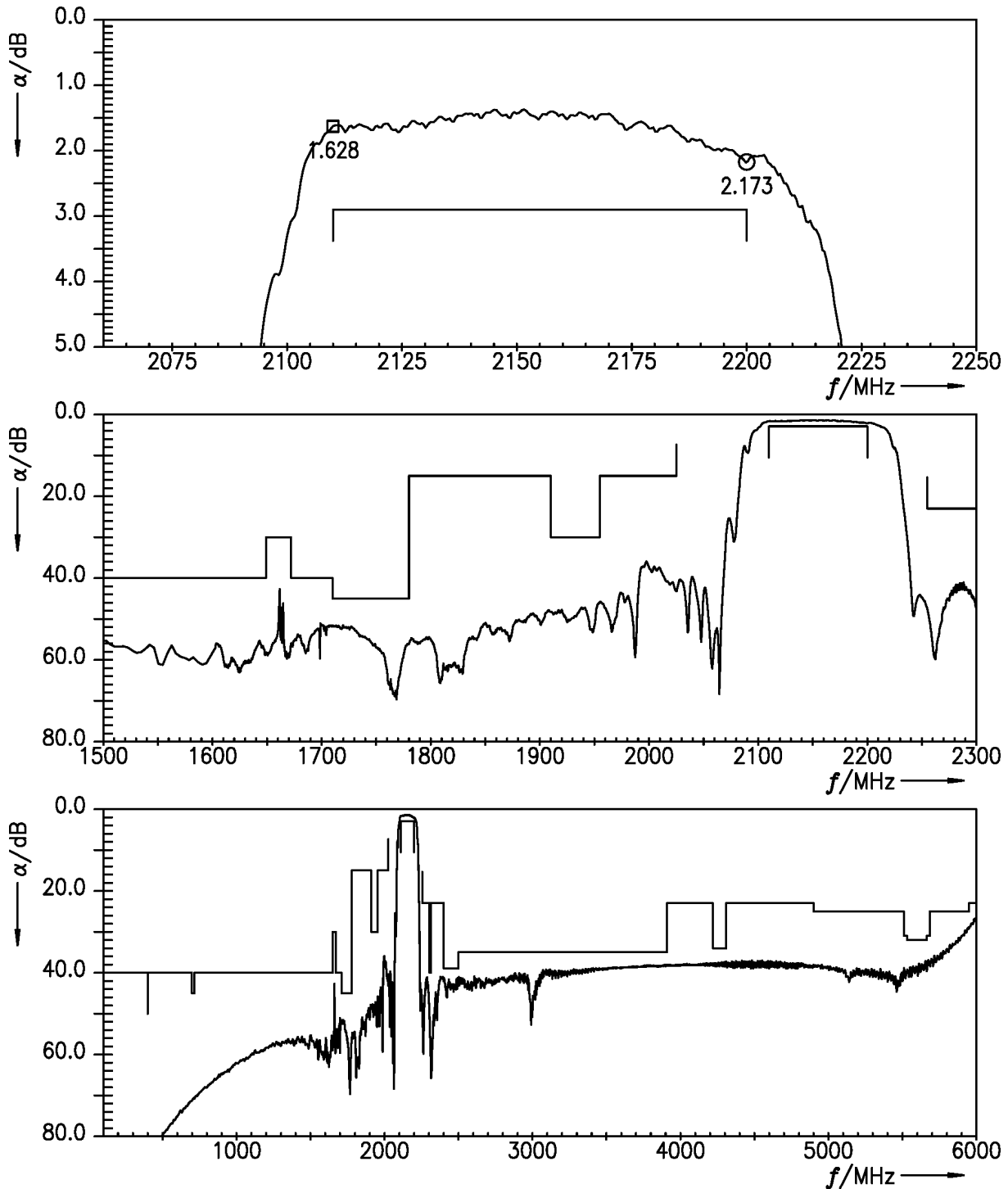
**8.1 TX – ANT**



**Figure 4:** Attenuation TX – ANT.

Data sheet

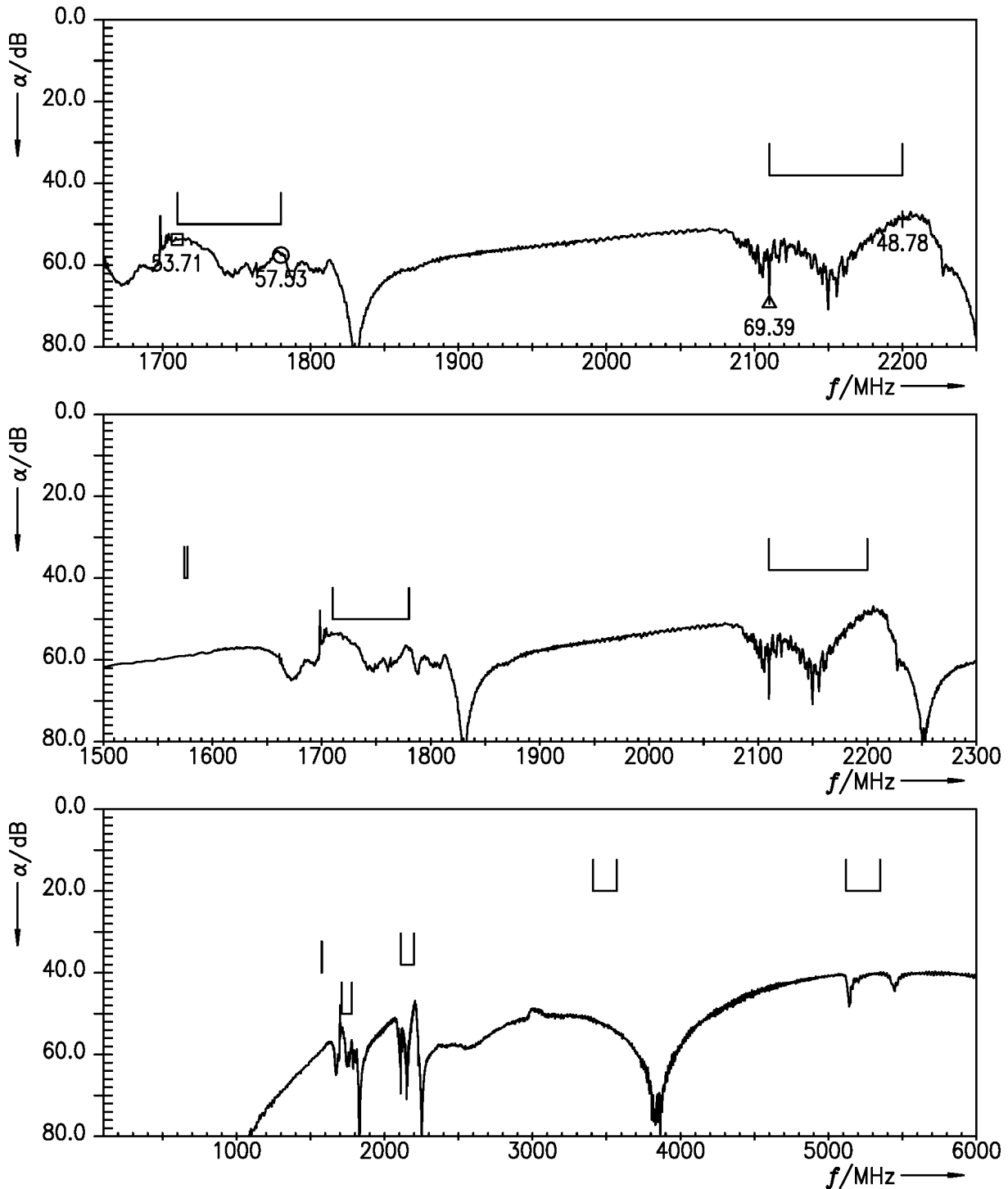
**8.2 ANT – RX**



**Figure 5:** Attenuation ANT – RX.

Data sheet

**8.3 TX – RX**

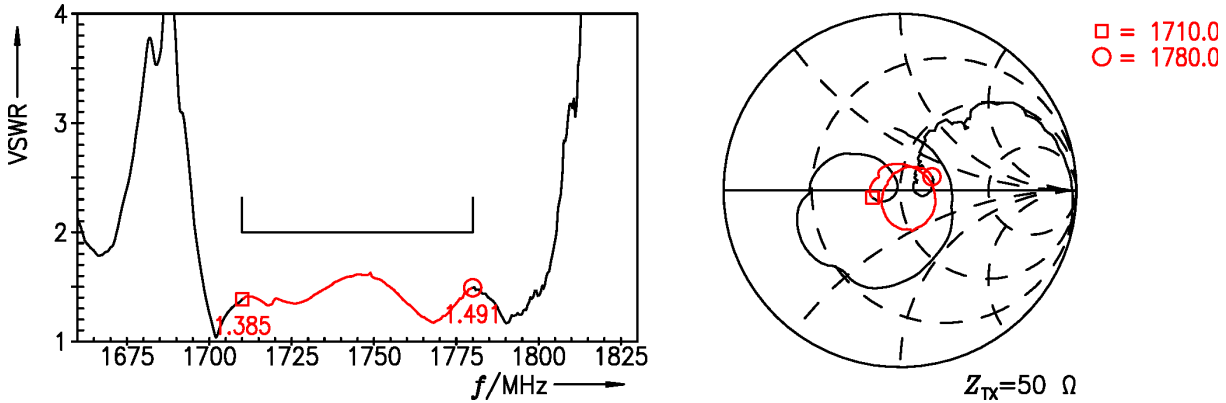


**Figure 6:** Isolation TX – RX.

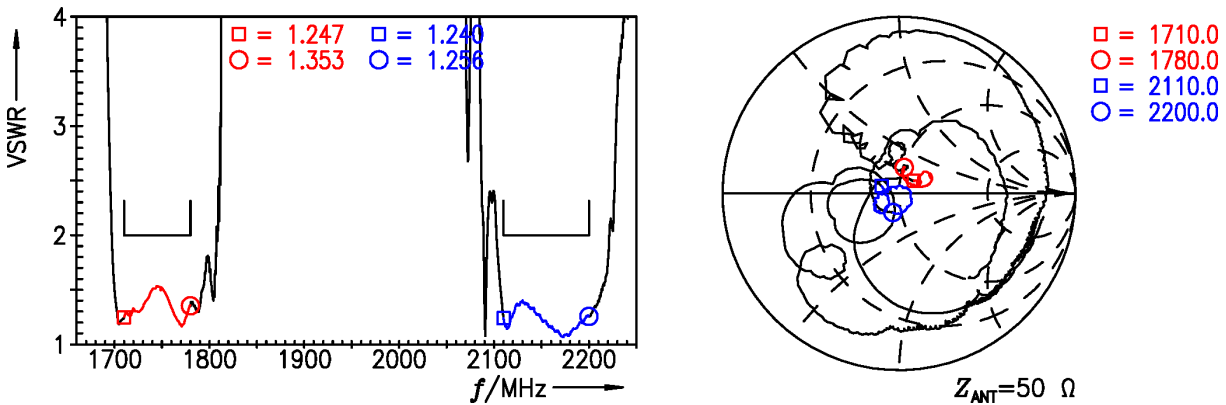


Data sheet

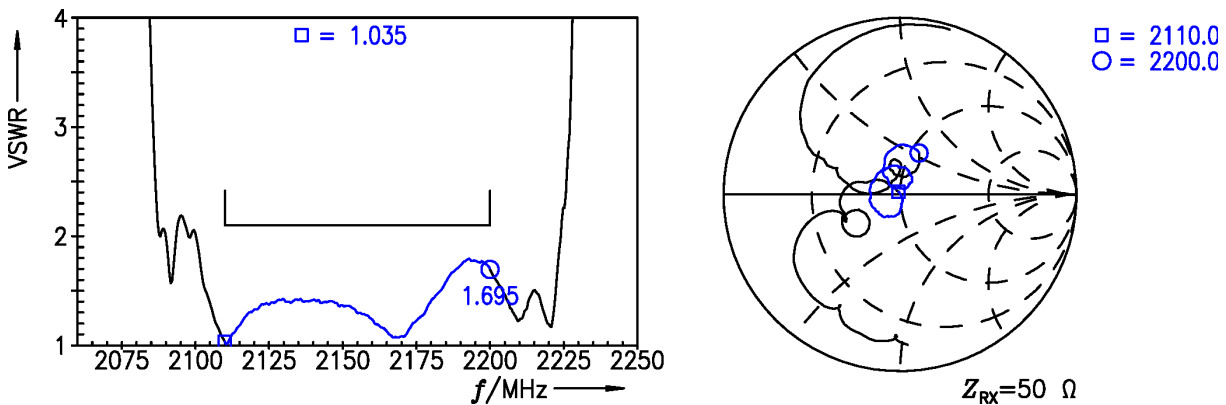
**9 Reflection coefficients**



**Figure 7:** Reflection coefficient at TX port.



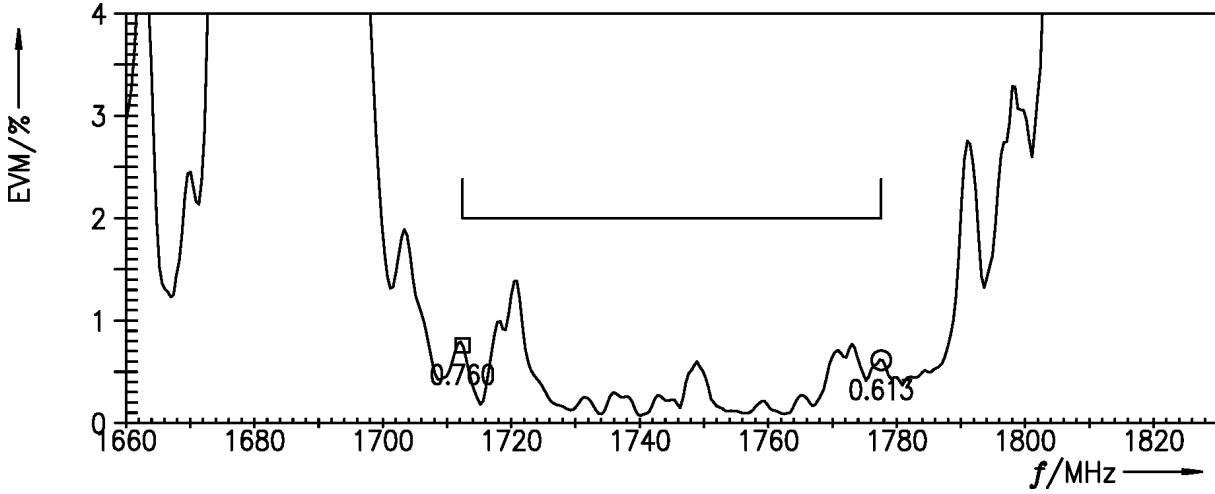
**Figure 8:** Reflection coefficient at ANT port.



**Figure 9:** Reflection coefficient at RX port.

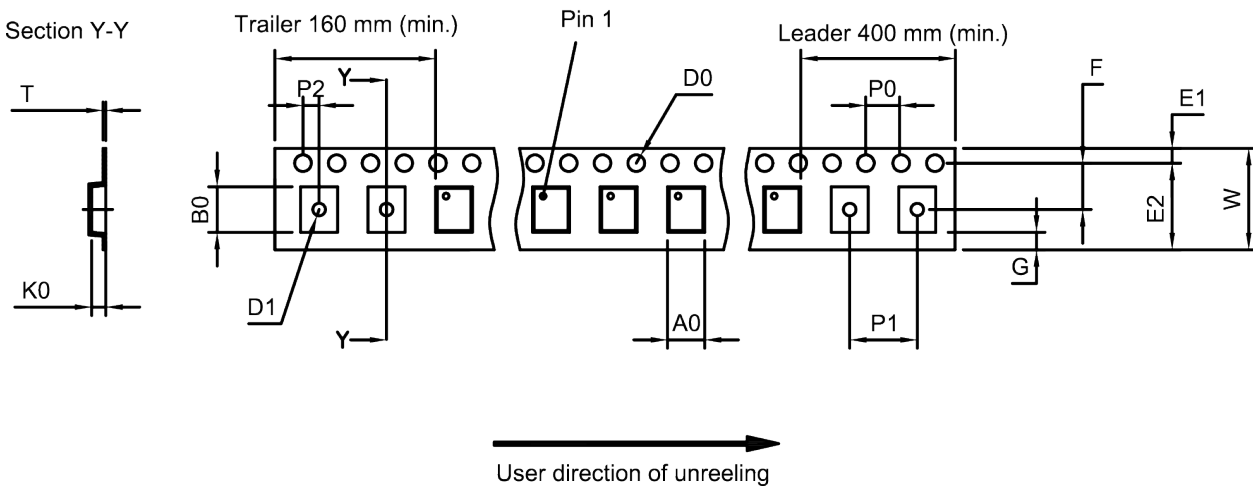
Data sheet

**10 EVM**



**Figure 10:** Error vector magnitude.

Data sheet

**11 Packing material**
**11.1 Tape**

**Figure 11:** Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A <sub>0</sub>	1.65±0.05 mm
B <sub>0</sub>	2.05±0.05 mm
D <sub>0</sub>	1.5+0.1/-0 mm
D <sub>1</sub>	1.0 mm (min.)
E <sub>1</sub>	1.75±0.1 mm

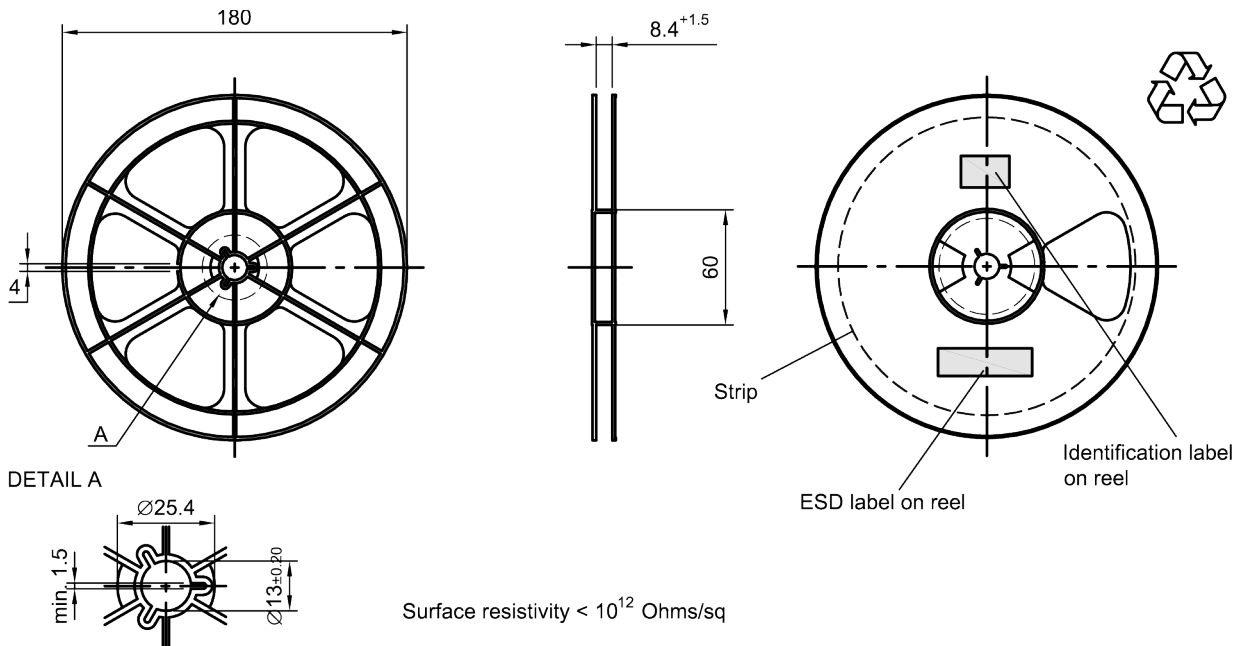
E <sub>2</sub>	6.25 mm (min.)
F	3.5±0.05 mm
G	0.75 mm (min.)
K <sub>0</sub>	0.7±0.05 mm
P <sub>0</sub>	4.0±0.1 mm

P <sub>1</sub>	4.0±0.1 mm
P <sub>2</sub>	2.0±0.05 mm
T	0.25±0.03 mm
W	8.0+0.3/-0.1 mm

**Table 1:** Tape dimensions.

Data sheet

**11.2 Reel with diameter of 180 mm**



**Figure 12:** Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

Printing on vacuumbag

Vacuumbag

Sealing area

Drypack in vacuumbag

Identification label on vacuumbag

Humidity indicator in vacuumbag

**Figure 13:** Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

Data sheet

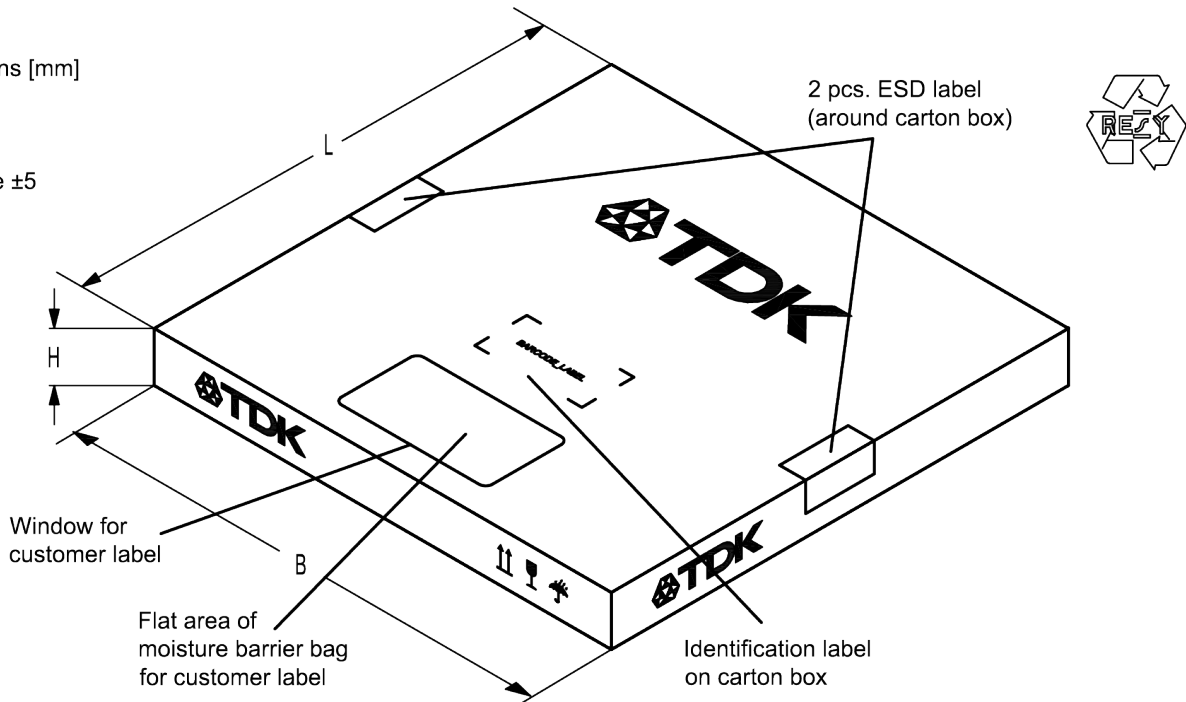
Dimensions [mm]

L = 188

B = 188

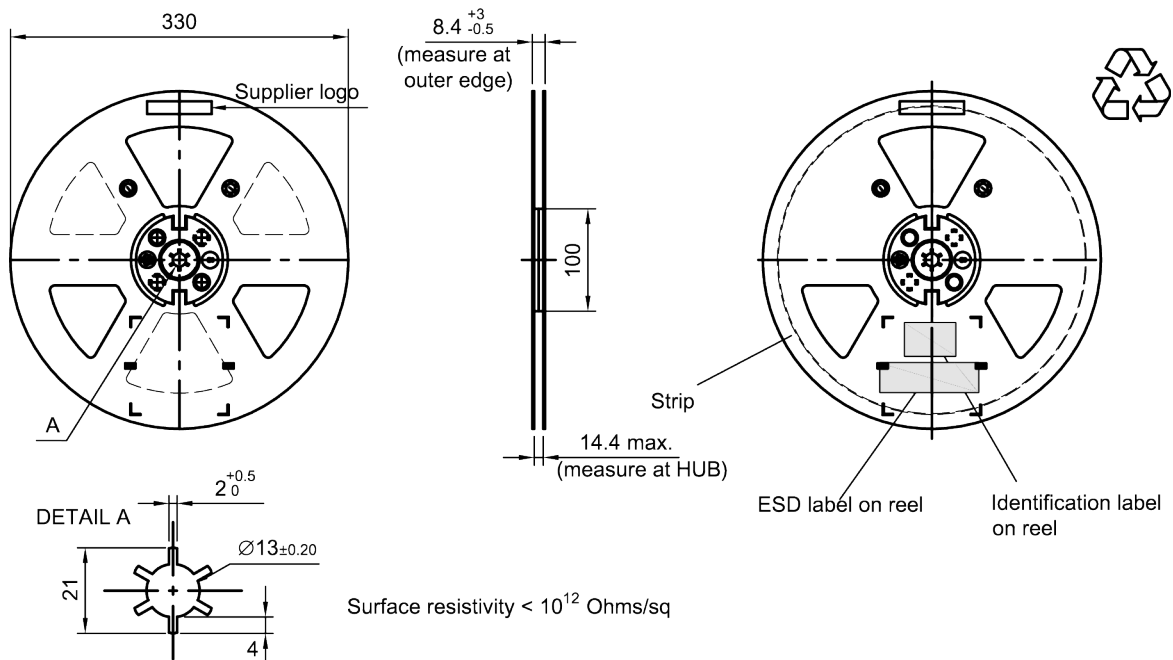
H = 30

Tolerance  $\pm 5$



**Figure 14:** Drawing of folding box for reel with diameter of 180 mm.

**11.3 Reel with diameter of 330 mm**



**Figure 15:** Drawing of reel (first-angle projection) with diameter of 330 mm.

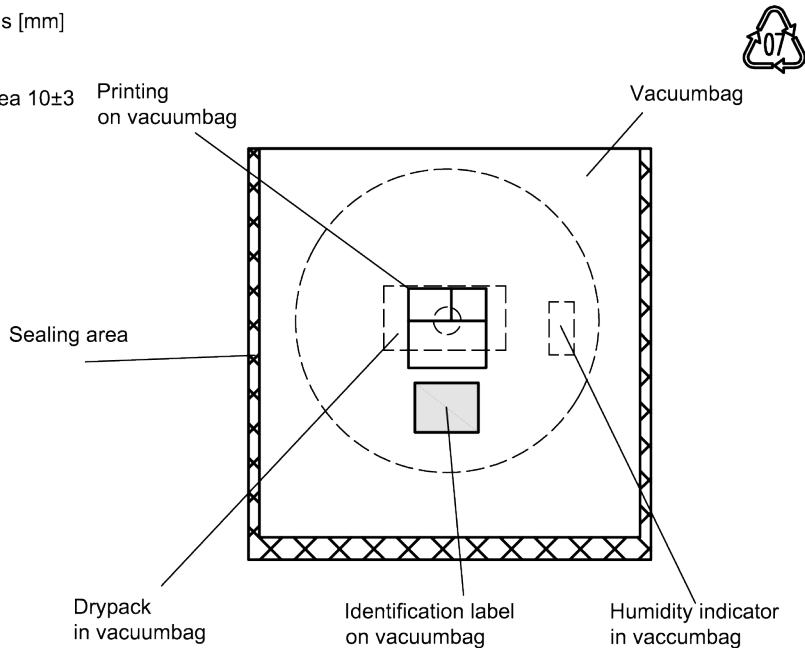
Data sheet

Dimensions [mm]

X = 400±5

Y = 418±5

Sealing area 10±3



**Figure 16:** Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

Dimensions [mm]

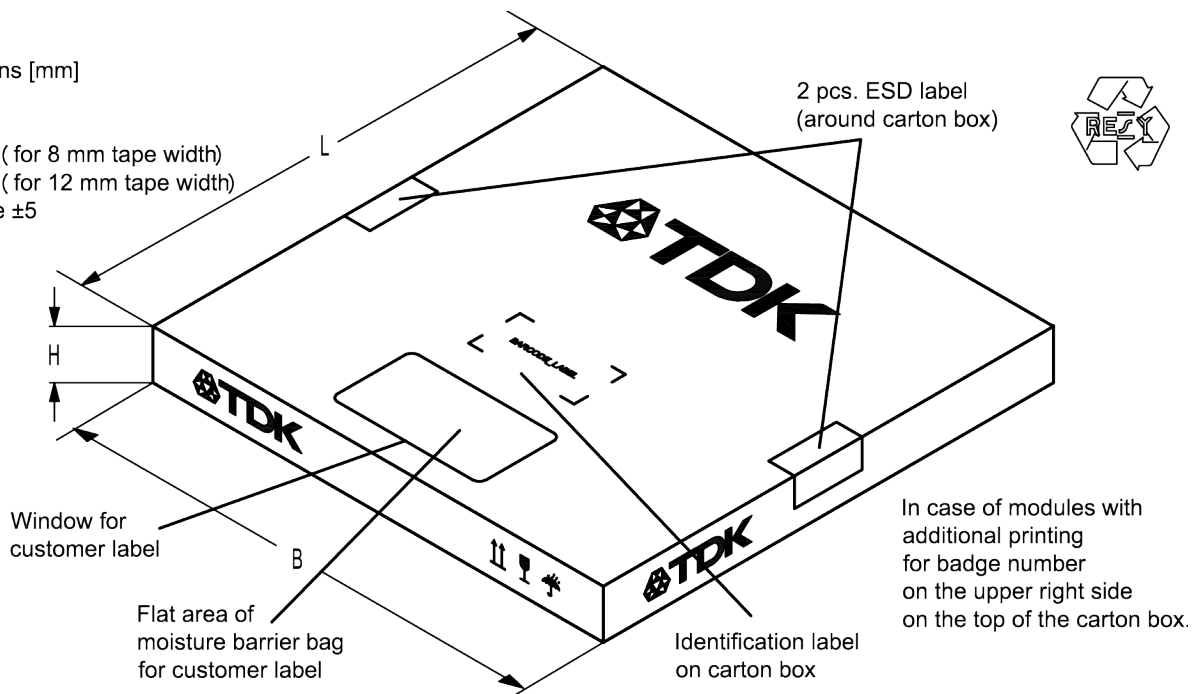
L = 335

B = 338

H = 36 ( for 8 mm tape width)

40 ( for 12 mm tape width)

Tolerance ±5



**Figure 17:** Drawing of folding box for reel with diameter of 330 mm.

Data sheet

## 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.

$$\begin{array}{rcl} \mathbf{16J} & \Rightarrow & \mathbf{1234} \\ \mathbf{1 \times 32^2 + 6 \times 32^1 + 18 (=J) \times 32^0} & = & \mathbf{1234} \end{array}$$

The BASE32 code for product type B8695 is 8FQ.

### ■ 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.

$$\begin{array}{rcl} \mathbf{5UY} & \Rightarrow & \mathbf{12345} \\ \mathbf{5 \times 47^2 + 27 (=U) \times 47^1 + 31 (=Y) \times 47^0} & = & \mathbf{12345} \end{array}$$

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.

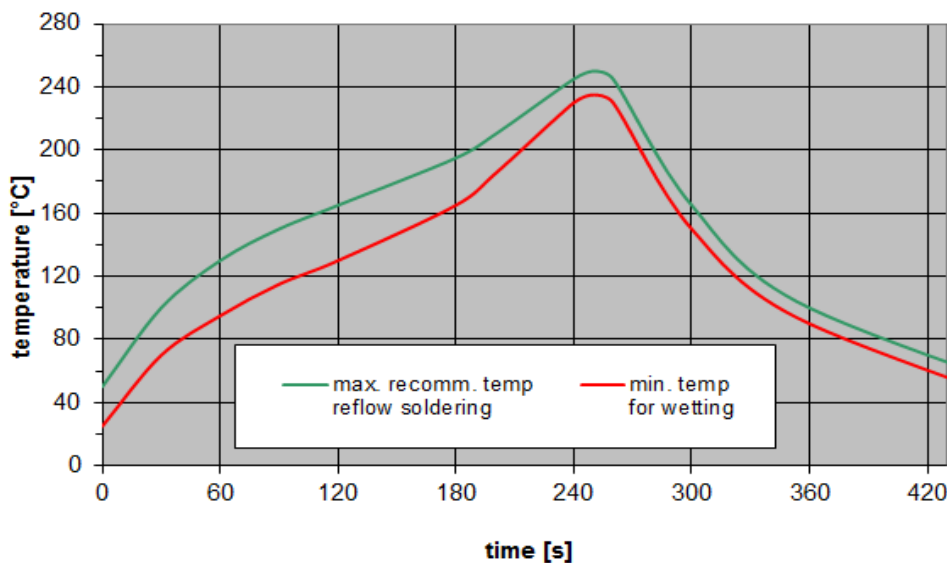
Data sheet

### 13 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3<sup>rd</sup> edit and IPC/JEDEC J-STD-020B.

ramp rate	$\leq 3$ 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 $\pm$ 1 s
cooling rate	$\leq 3$ 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 18:** Recommended reflow profile for convection and infrared soldering – lead-free solder.



<b>SAW components</b>	<b>B8695</b>
<b>SAW duplexer</b>	<b>1745 / 2155 MHz</b>

Data sheet

## 14 Annotations

### 14.1 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>.

### 14.2 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.

### 14.3 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.

### 14.4 Ordering codes and packing units

Ordering code	Packing unit
B39222B8695L210	15000 pcs
B39222B8695L210S 5	5000 pcs

**Table 4:** Ordering codes and packing units.

Data sheet

## 15 Cautions and warnings

### 15.1 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](http://www.epcos.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 EPCOS sales office.

### 15.4 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

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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.**
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