Qualcomm

RF360
Europe GmbH

SAW components

SAW duplexer

Automotive telematics
WCDMA band 5

Series/type:	B4422
Ordering code:	B39881B4422P810
Date:	December 16, 2016
Version:	2.0

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EPCOS AG is a TDK Group Company.

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1 Application

- Low-loss SAW duplexer for W-CDMA Band 5 systems
- Low insertion attenuation
- Low amplitude ripple
- Usable pass band 25 MHz

2 Features

- Package size 2.0±0.1 mm × 1.6±0.1 mm
- Package height 0.45 mm (max.)
- Approximate weight 6 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Filter surface passivated
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)
- AEC-Q200 qualified component family (Grade 3: −40 °C to +85 °C)

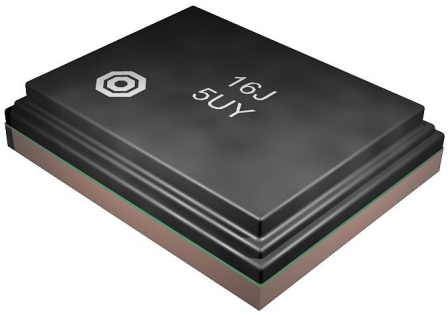
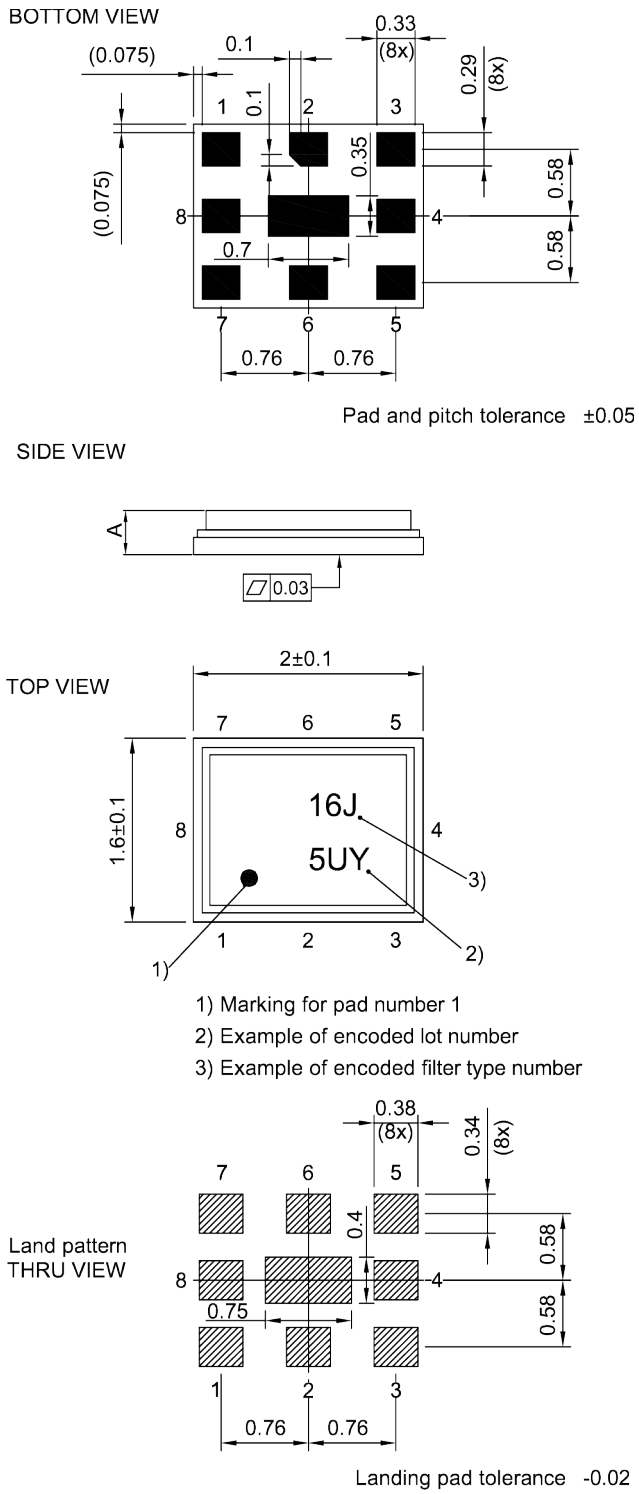


Figure 1: Picture of component with example of product marking.

3 Package



1) Marking for pad number 1
2) Example of encoded lot number
3) Example of encoded filter type number

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 24).

4 Pin configuration

■ 1	RX
■ 3	TX
■ 6	ANT
■ 2, 4, 5, 7, 8, 9	Ground

5 Matching circuit

■ L_{p6} = 10 nH

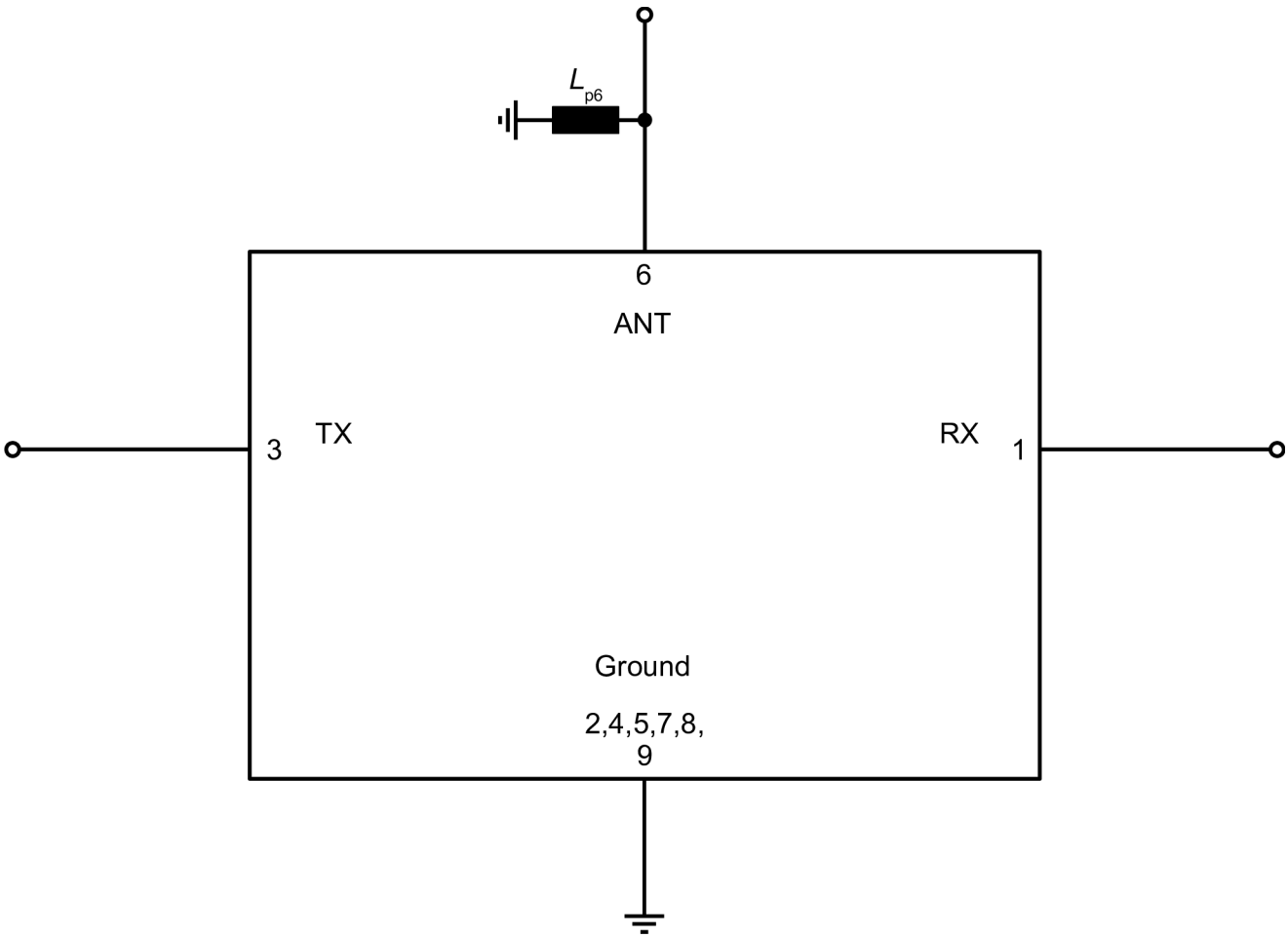


Figure 3: Schematic of matching circuit.

6 Characteristics

6.1 TX – ANT

Temperature range for specification T_{SPEC} = −40 °C ... +85 °C
TX terminating impedance Z_{TX} = 50 Ω
ANT terminating impedance Z_{ANT} = 50 Ω with par. 10 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	—	836.5	—	MHz
Maximum insertion attenuation								
	824 ... 849	MHz		α_{max}	—	1.8	2.3	dB
@$f_{carrier}$	826.4 ... 846.6	MHz		$\alpha_{WCDMA,max}$ [2)]	—	1.6	2.0	dB
Amplitude ripple (p-p)								
	824 ... 849	MHz		$\Delta\alpha$	—	0.7	1.2	dB
@$f_{carrier}$	826.4 ... 846.6	MHz		$\Delta\alpha_{WCDMA}$ [2)]	—	0.4	0.9	dB
Maximum VSWR				$VSWR_{max}$				
@ TX port	824 ... 849	MHz			—	1.7	2.0	
@ ANT port	824 ... 849	MHz			—	1.5	2.0	
Maximum error vector magnitude				EVM_{max} [3)]				
	826.4 ... 846.6	MHz			—	1.6	3.0	%
Minimum attenuation								
	50 ... 420	MHz		α_{min}	37	44	—	dB
	420 ... 494	MHz		α_{min}	35	40	—	dB
	494 ... 701	MHz		α_{min}	32	37	—	dB
	701 ... 728	MHz		α_{min}	32	37	—	dB
	728 ... 764	MHz		α_{min}	32	38	—	dB
	764 ... 804	MHz		α_{min}	30	40	—	dB
	860 ... 864	MHz		α_{min}	3	20	—	dB
	864 ... 869	MHz		α_{min}	14	43	—	dB
	869 ... 894	MHz		α_{min}	44	53	—	dB
@$f_{carrier}$	871.4 ... 891.6	MHz		$\alpha_{WCDMA,min}$ [2)]	45	53	—	dB
	1559 ... 1708	MHz		α_{min}	39	47	—	dB
	1844.9 ... 1879.9	MHz		α_{min}	42	46	—	dB
	1884.5 ... 1919.6	MHz		α_{min}	42	45	—	dB
	1930 ... 1990	MHz		α_{min}	40	44	—	dB
	2110 ... 2170	MHz		α_{min}	38	42	—	dB
	2400 ... 2547	MHz		α_{min}	33	36	—	dB
	3286 ... 3406	MHz		α_{min}	30	33	—	dB
	4110 ... 4255	MHz		α_{min}	20	27	—	dB

Characteristics TX – ANT				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
4900 ... 5950	MHz	α_{min}		14	19	—	dB

1) See Sec. Matching circuit (p. 5).
2) Attenuation of WCDMA signal ("power transfer function"). Please refer to definition of Power Transfer Function (PTF) of WCDMA signal (p. 23).
3) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

6.2 ANT – RX

Temperature range for specification T_{SPEC} = −40 °C ... +85 °C
TX terminating impedance Z_{TX} = 50 Ω
ANT terminating impedance Z_{ANT} = 50 Ω with par. 10 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	—	881.5	—	MHz
Maximum insertion attenuation								
	869 ... 894	MHz		α_{max}	—	2.0	2.5	dB
@$f_{carrier}$	871.4 ... 891.6	MHz		$\alpha_{WCDMA,max}$ [2)]	—	1.9	2.2	dB
Amplitude ripple (p-p)								
	869 ... 894	MHz		$\Delta\alpha$	—	0.7	1.3	dB
@$f_{carrier}$	871.4 ... 891.6	MHz		$\Delta\alpha_{WCDMA}$ [2)]	—	0.5	0.9	dB
Maximum VSWR				$VSWR_{max}$				
@ ANT port	869 ... 894	MHz			—	1.6	2.0	
@ RX port	869 ... 894	MHz			—	1.6	2.0	
Maximum error vector magnitude				EVM_{max} [3)]				
	871.4 ... 891.6	MHz			—	1.6	3.0	%
Minimum attenuation								
	50 ... 477	MHz		α_{min}	50	65	—	dB
	477 ... 779	MHz		α_{min}	50	63	—	dB
	779 ... 824	MHz		α_{min}	50	64	—	dB
	824 ... 849	MHz		α_{min}	45	54	—	dB
@$f_{carrier}$	826.4 ... 846.6	MHz		$\alpha_{WCDMA,min}$ [2)]	50	55	—	dB
	849 ... 854	MHz		α_{min}	30	37	—	dB
	909 ... 920	MHz		α_{min}	10	18	—	dB
	920 ... 979	MHz		α_{min}	25	32	—	dB
	979 ... 1710	MHz		α_{min}	45	56	—	dB
	1710 ... 1785	MHz		α_{min}	50	65	—	dB
	1785 ... 1788	MHz		α_{min}	45	65	—	dB
	1850 ... 1920	MHz		α_{min}	45	63	—	dB
	1920 ... 1980	MHz		α_{min}	45	63	—	dB
	1980 ... 2400	MHz		α_{min}	40	60	—	dB
	2400 ... 2500	MHz		α_{min}	40	60	—	dB
	2517 ... 2592	MHz		α_{min}	40	59	—	dB
	2607 ... 2682	MHz		α_{min}	40	59	—	dB
	3476 ... 3576	MHz		α_{min}	40	58	—	dB
	4345 ... 4470	MHz		α_{min}	40	60	—	dB

Characteristics ANT – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
4900 ... 5950	MHz	α_{min}		35	45	—	dB

1) See Sec. Matching circuit (p. 5).
2) Attenuation of WCDMA signal ("power transfer function"). Please refer to definition of Power Transfer Function (PTF) of WCDMA signal (p. 23).
3) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −40 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 10 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}				
	824... 849	MHz		50	57	—	dB
	849... 869	MHz		18	30	—	dB
	869... 894	MHz		48	56	—	dB

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

7 Maximum ratings

Operable temperature	T_{OP} = −40 °C ... +85 °C	
Storage temperature	T_{STG} [1] = −40 °C ... +85 °C	
DC voltage	$\lvert V_{DC} \rvert$ [2] = 0 V	
Input power	P_{IN}	
@ TX port: 824 ... 849 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) 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.

8 Transmission coefficients

8.1 TX – ANT

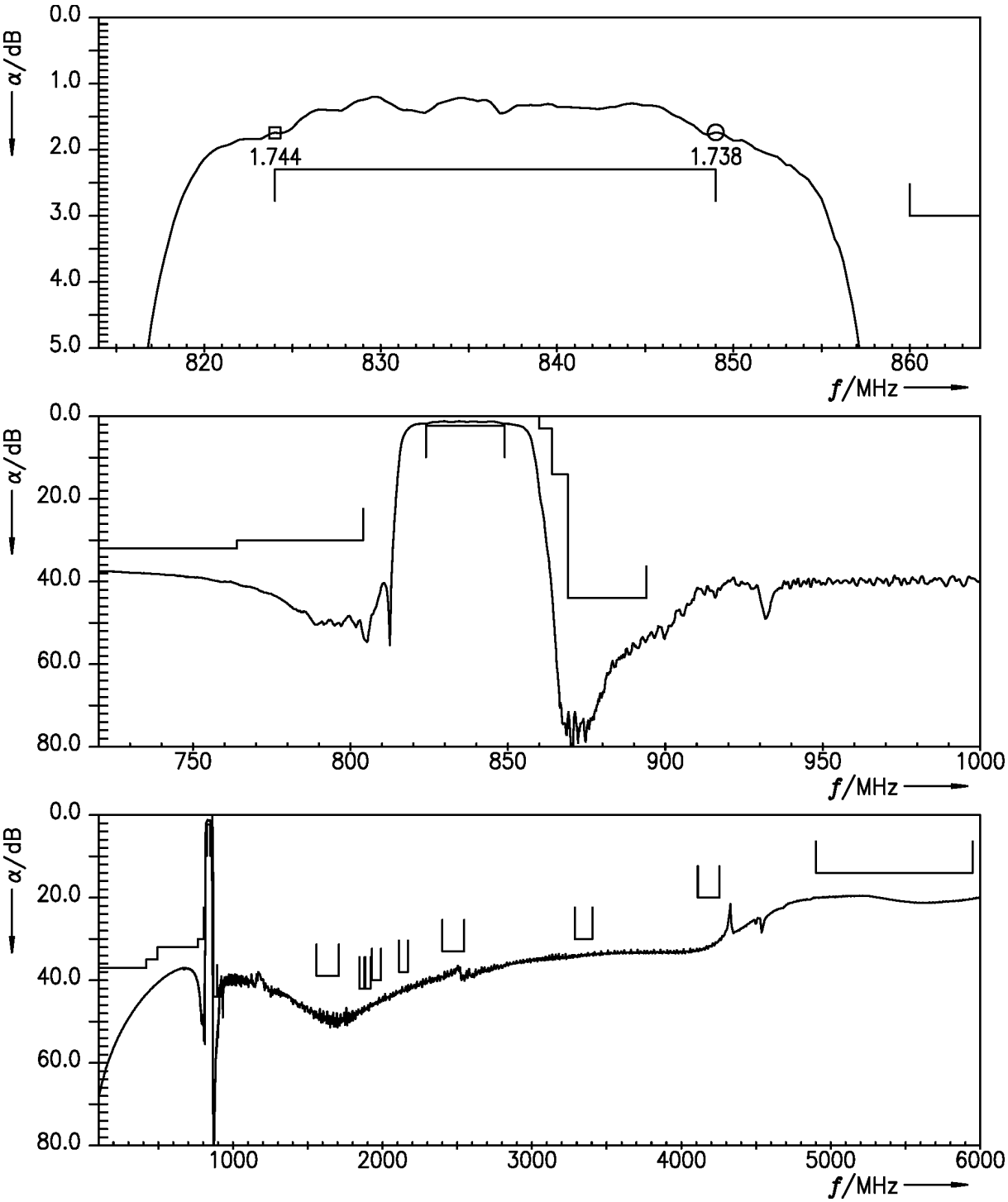


Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

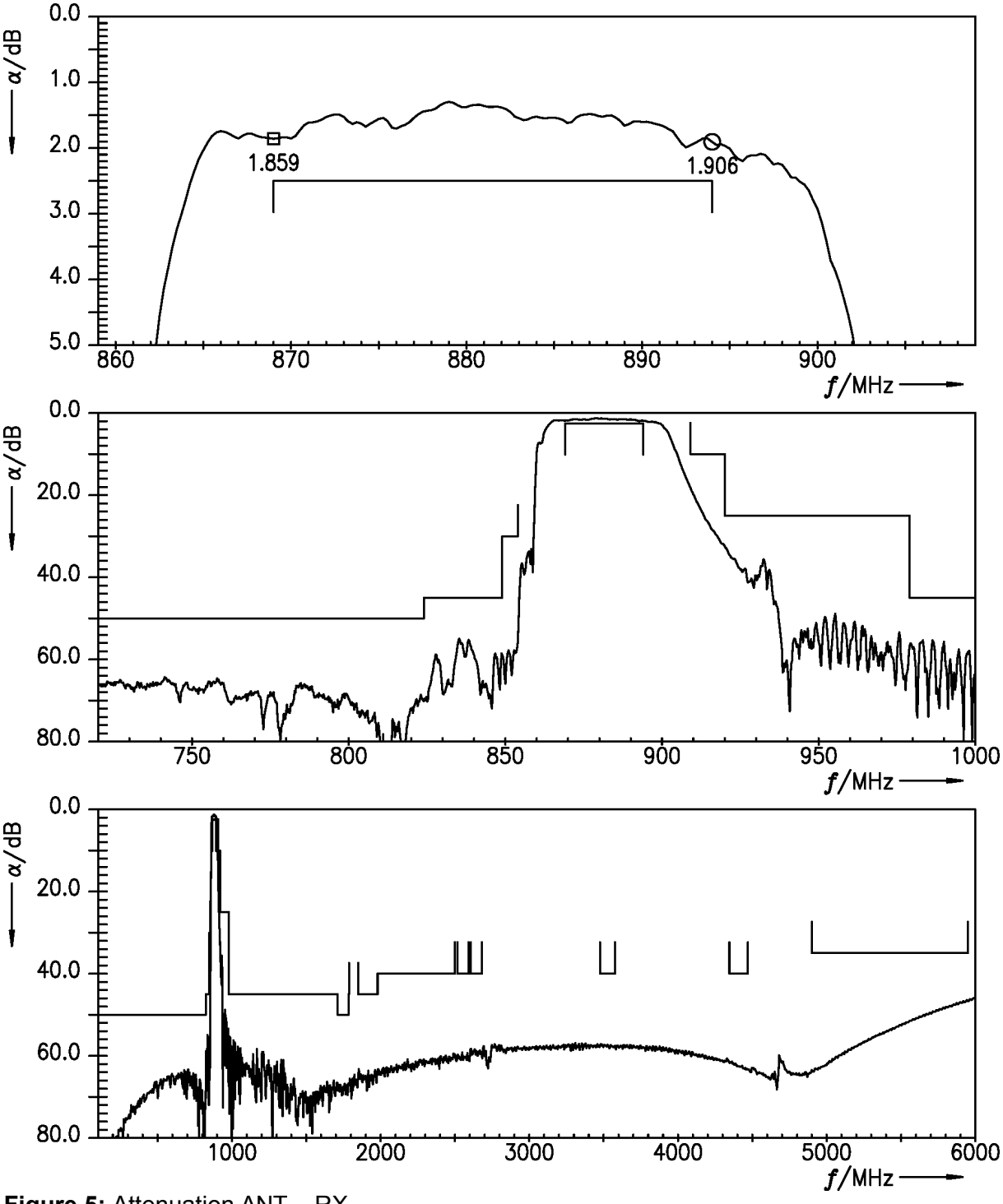


Figure 5: Attenuation ANT – RX.

8.3 TX – RX

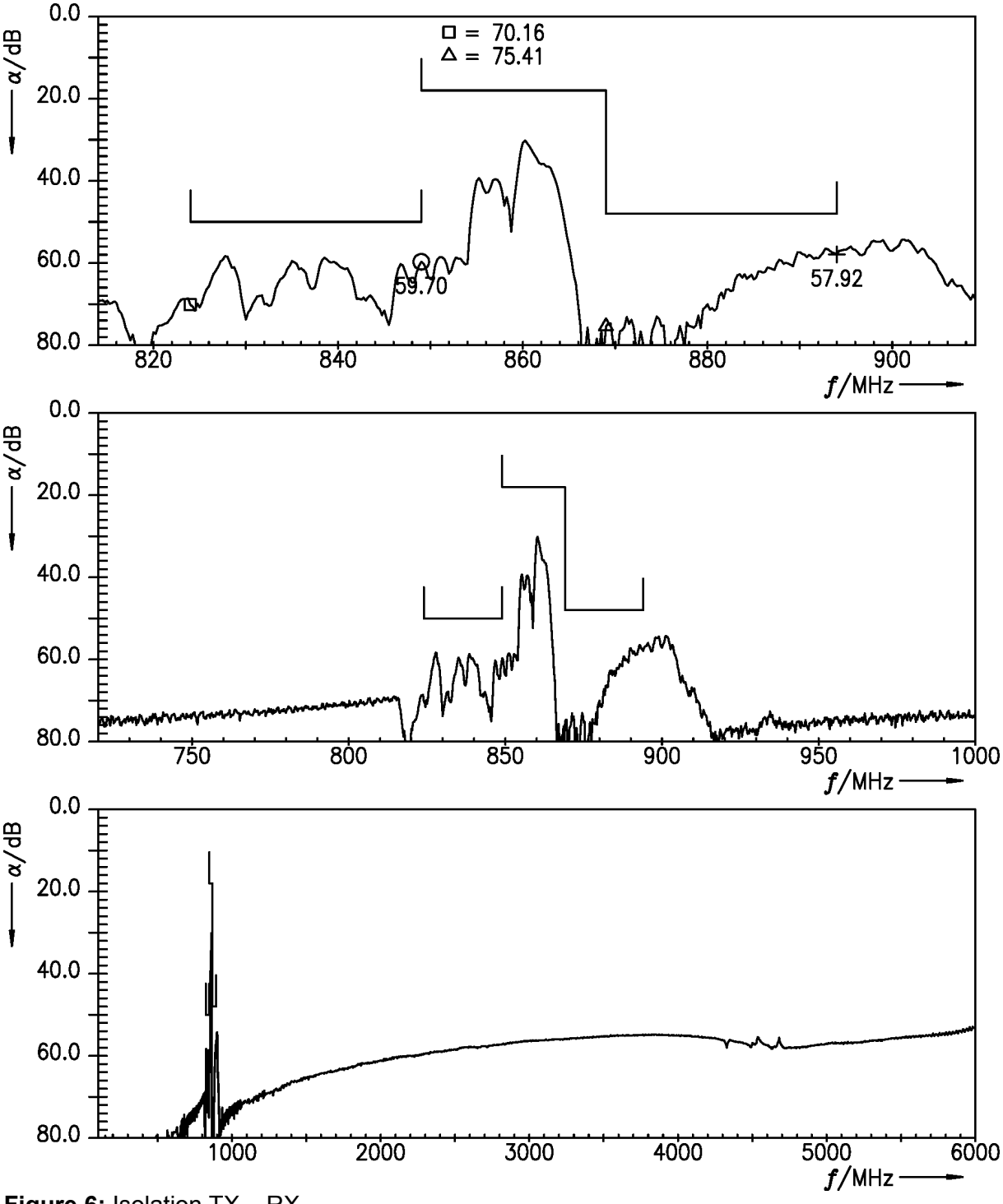


Figure 6: Isolation TX – RX.

9 Reflection coefficients

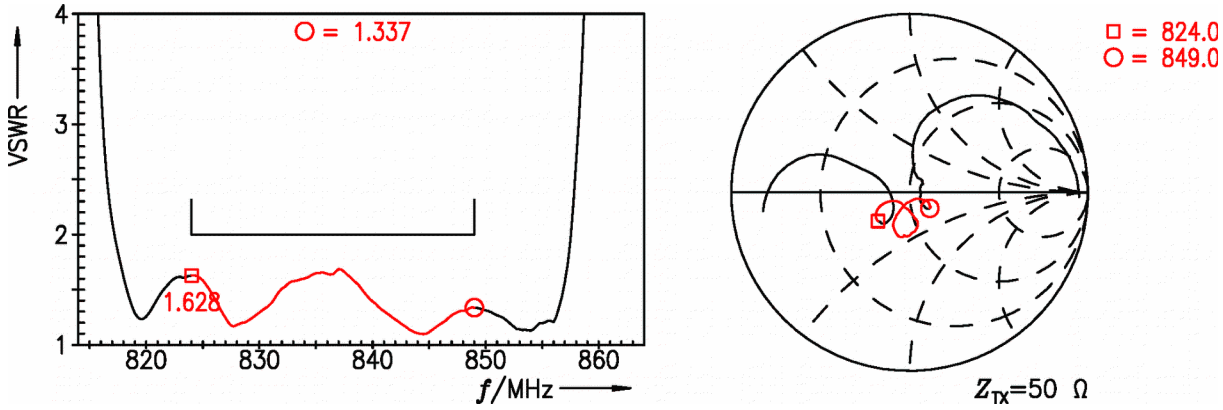


Figure 7: Reflection coefficient at TX port.

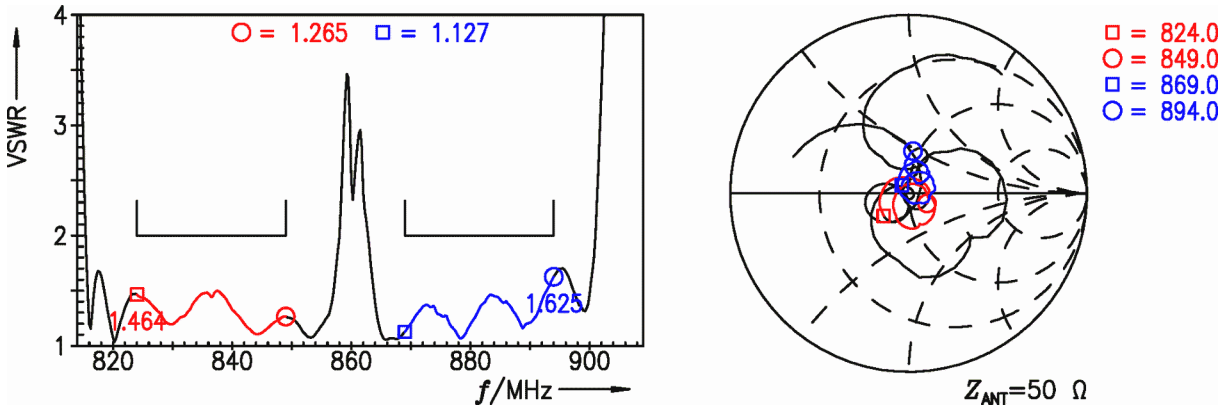


Figure 8: Reflection coefficient at ANT port.

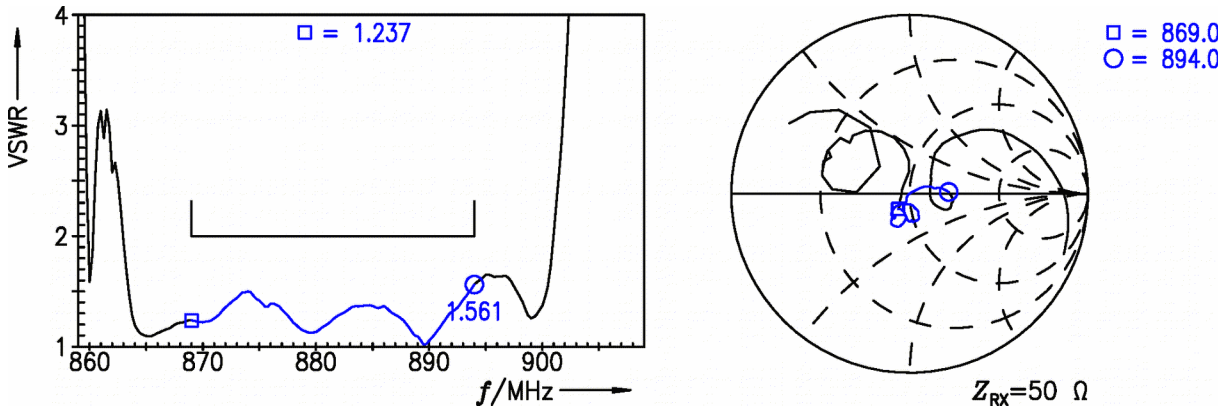


Figure 9: Reflection coefficient at RX port.

10 EVMs

10.1 TX – ANT

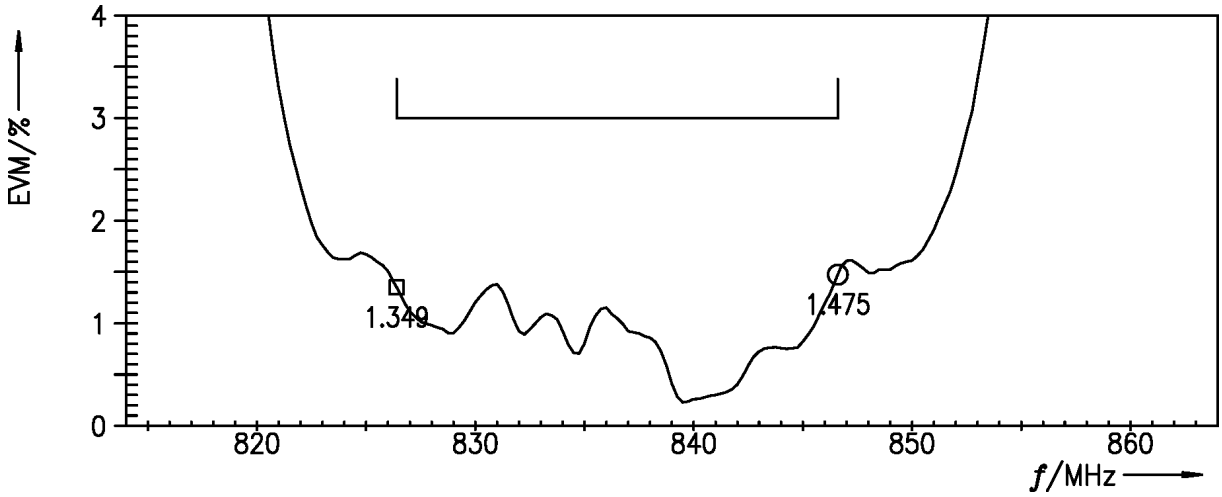


Figure 10: Error vector magnitude TX – ANT.

10.2 ANT – RX

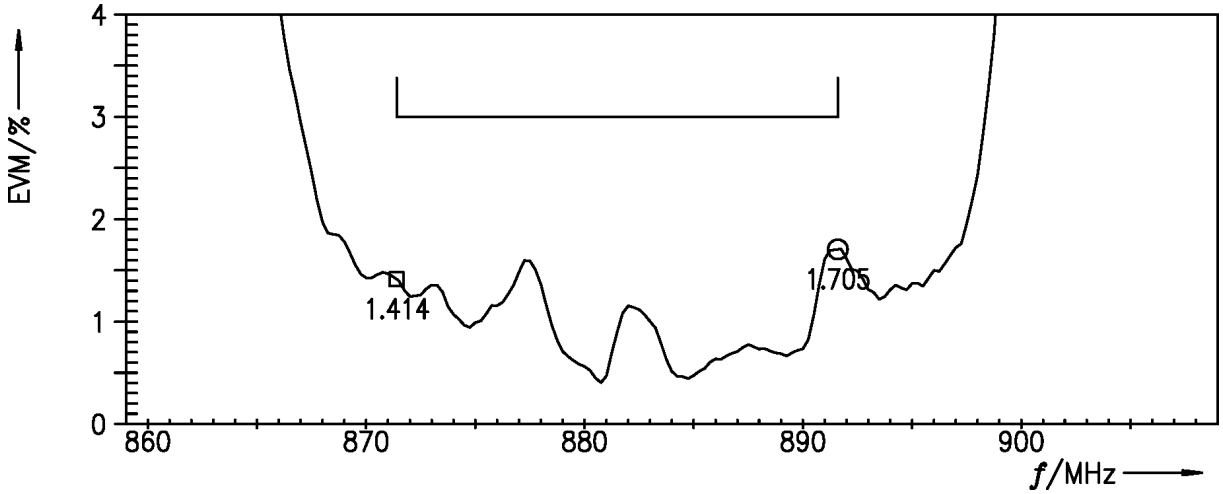


Figure 11: Error vector magnitude ANT – RX.

11 Packing material

11.1 Tape

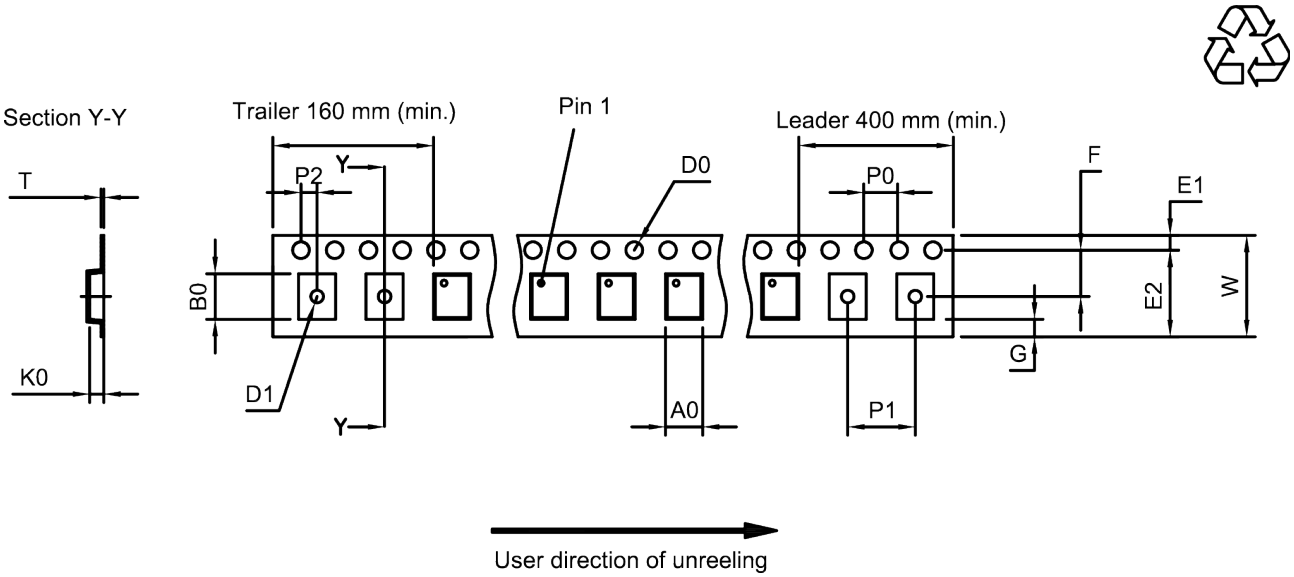


Figure 12: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	1.8±0.05 mm
B_0	2.25±0.05 mm
D_0	1.5+0.1/−0 mm
D_1	1.0 mm (min.)
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	0.6±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

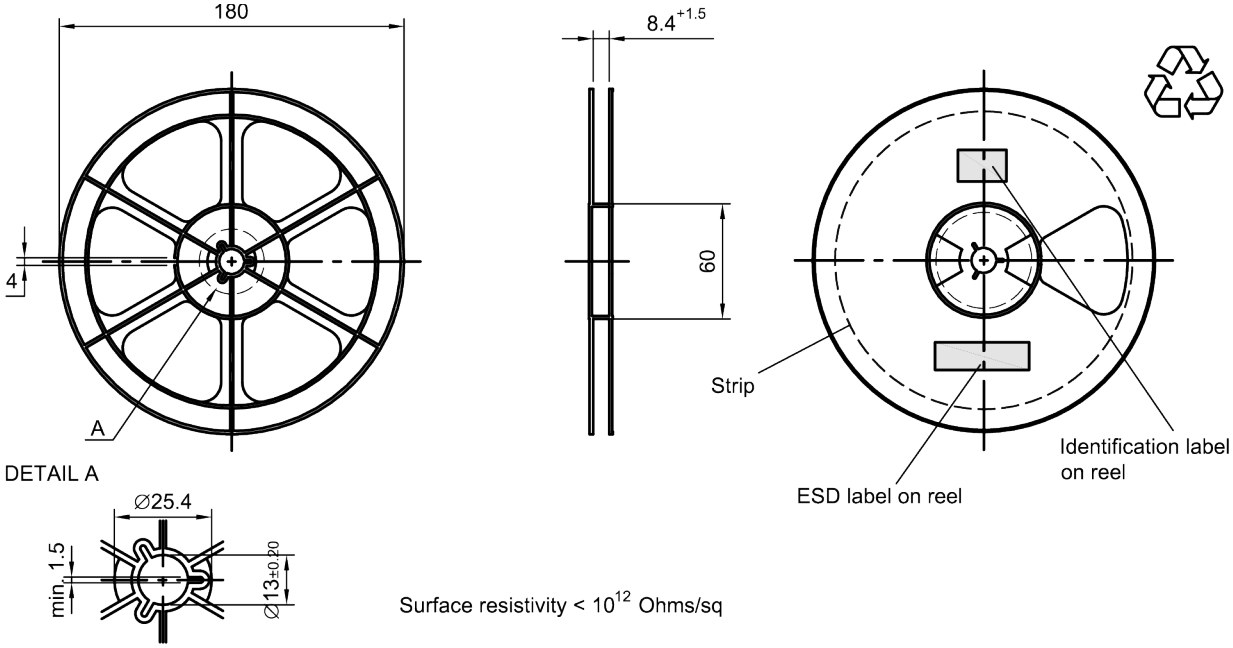


Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

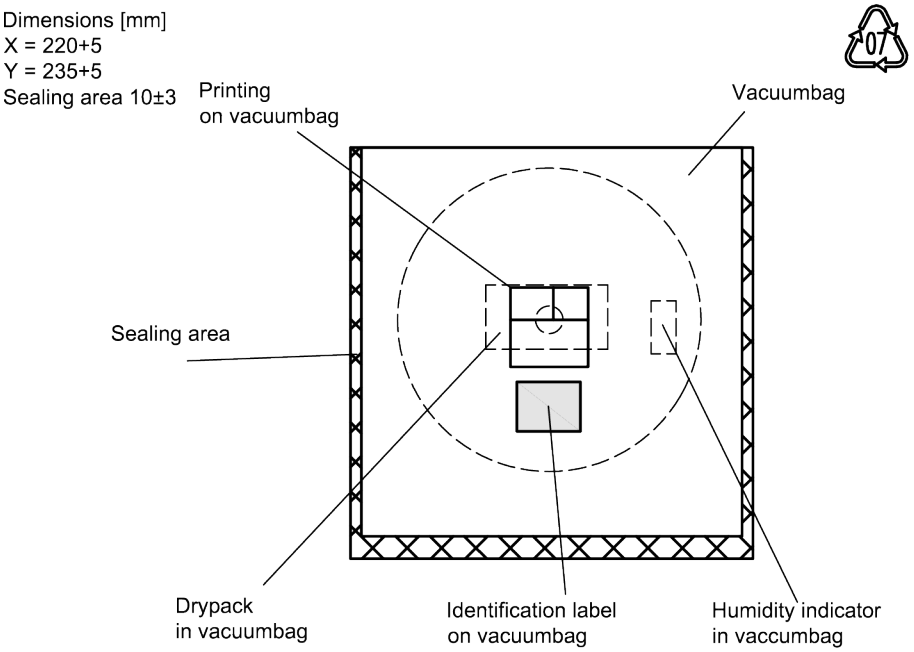


Figure 14: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

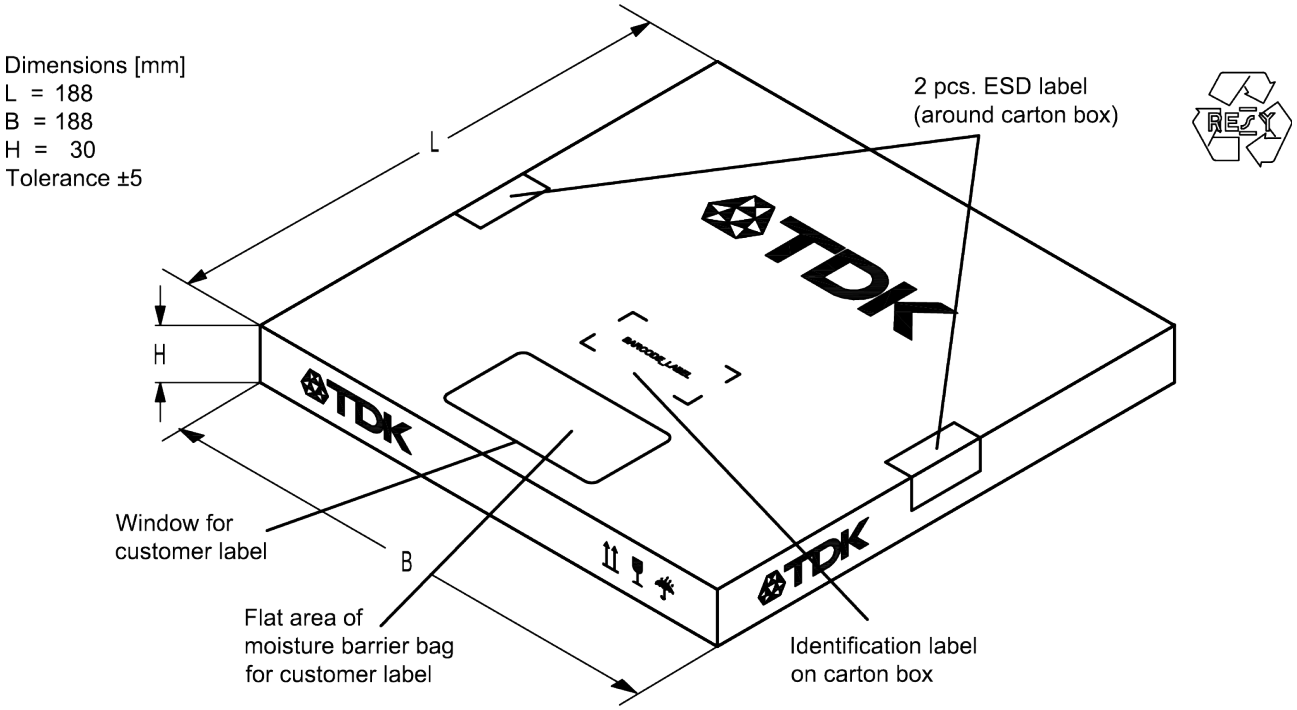


Figure 15: Drawing of folding box for reel with diameter of 180 mm.

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 B4422 is 4A6.

- 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).

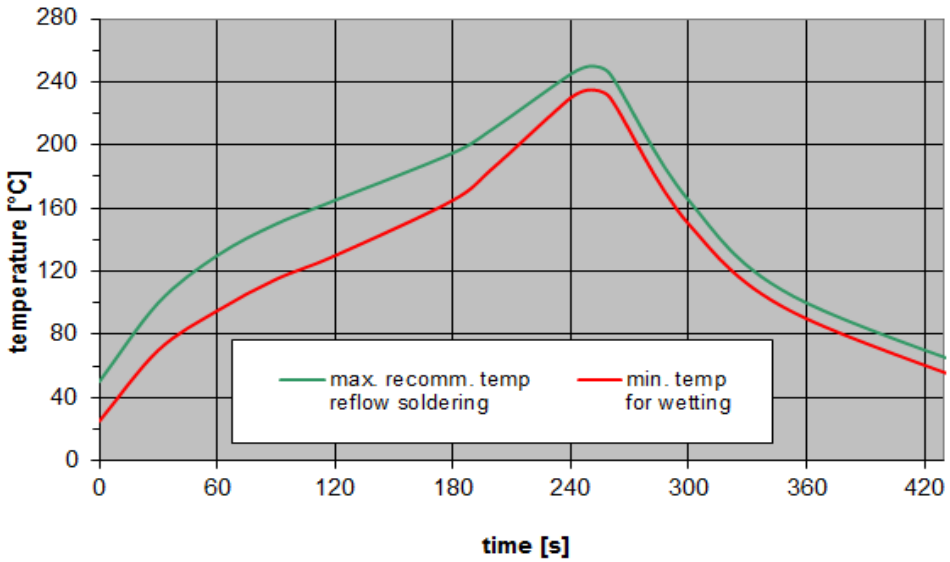


Figure 16: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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 Power Transfer Function (PTF) of WCDMA signal

Attenuation of WCDMA signal, α_{WCDMA}, is defined by

$$\alpha_{\mathrm{WCDMA}}(f_{\mathrm{carrier}}) = 10\log_{10}\left|\frac{1}{\mathrm{PTF}(f_{\mathrm{carrier}})}\right| \mathrm{dB}$$

and

$$\mathrm{PTF}(f_{\mathrm{carrier}}) = \int_{-\infty}^{+\infty} \left|S_{21}(f)\, H_{\mathrm{RRC}}(f - f_{\mathrm{carrier}})\right|^2 \mathrm{d}f$$

with $f_{carrier}$ according to 3GPP TS 25.101 (e.g., for the WCDMA B8 pass band, $f_{carrier}$ ranges from 882.4 MHz to 912.6 MHz which correspond to the lowest and highest TX channels, respectively). $H_{RRC}(f)$ is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 using the normalization

$$\int_{-\infty}^{+\infty} \left|H_{\mathrm{RRC}}(f)\right|^2 \mathrm{d}f = 1 \quad .$$

14.3 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.

14.4 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.

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**.

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).

Dimensions do not include burrs.

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.
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.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

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