RF360
Europe GmbH

SAW components

SAW duplexer
Small cell & femtocell
LTE band 28a

Series/type:	B8035
Ordering code:	B39771B8035P810
Date:	May 09, 2018
Version:	2.1

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

RF360 Europe GmbH
A Qualcomm – TDK Joint Venture

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Table of contents

1 Application

- Low-loss SAW duplexer for 3G/LTE small cell & femtocell systems (Band 28a)
- Usable pass band: 30 MHz
- High power durability in downlink
- Rx = uplink = 703-733 MHz
- Tx = downlink = 758-788 MHz

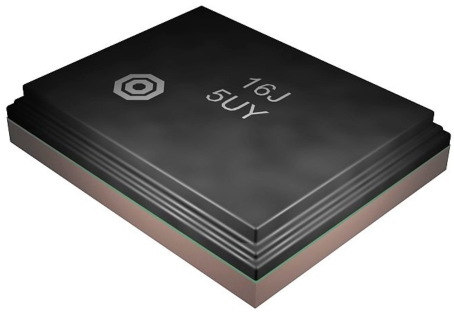

Figure 1: Picture of component with example of product marking.

2 Features

- Industrial grade qualified family
- Package size 2.5±0.1 mm × 2.0±0.1 mm
- Package height 0.5 mm (max.)
- Approximate weight 0.01 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)

3 Package

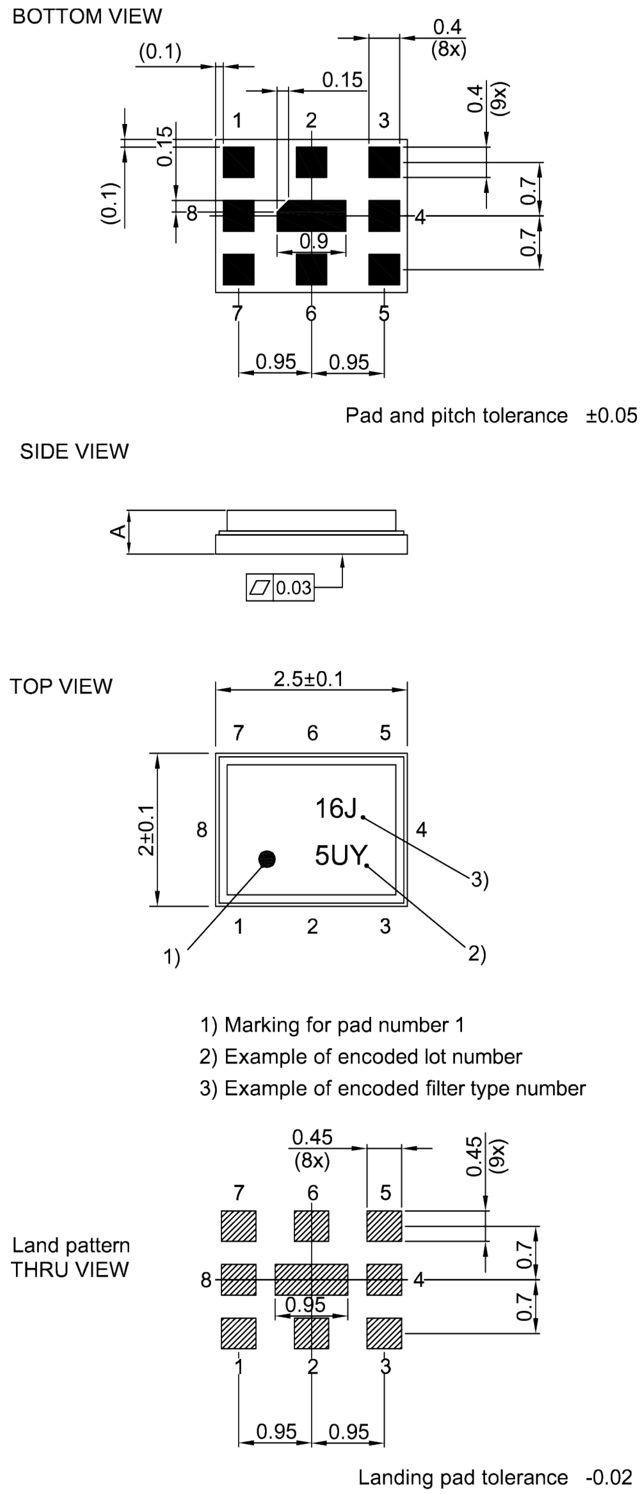

Figure 2: Drawing of package with package height A = 0.5 mm (max.). See Sec. Package information (p. 29).

4 Pin configuration

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

5 Matching circuit

- L_{p6} = 8.4 nH
- L_{s3} = 7.7 nH

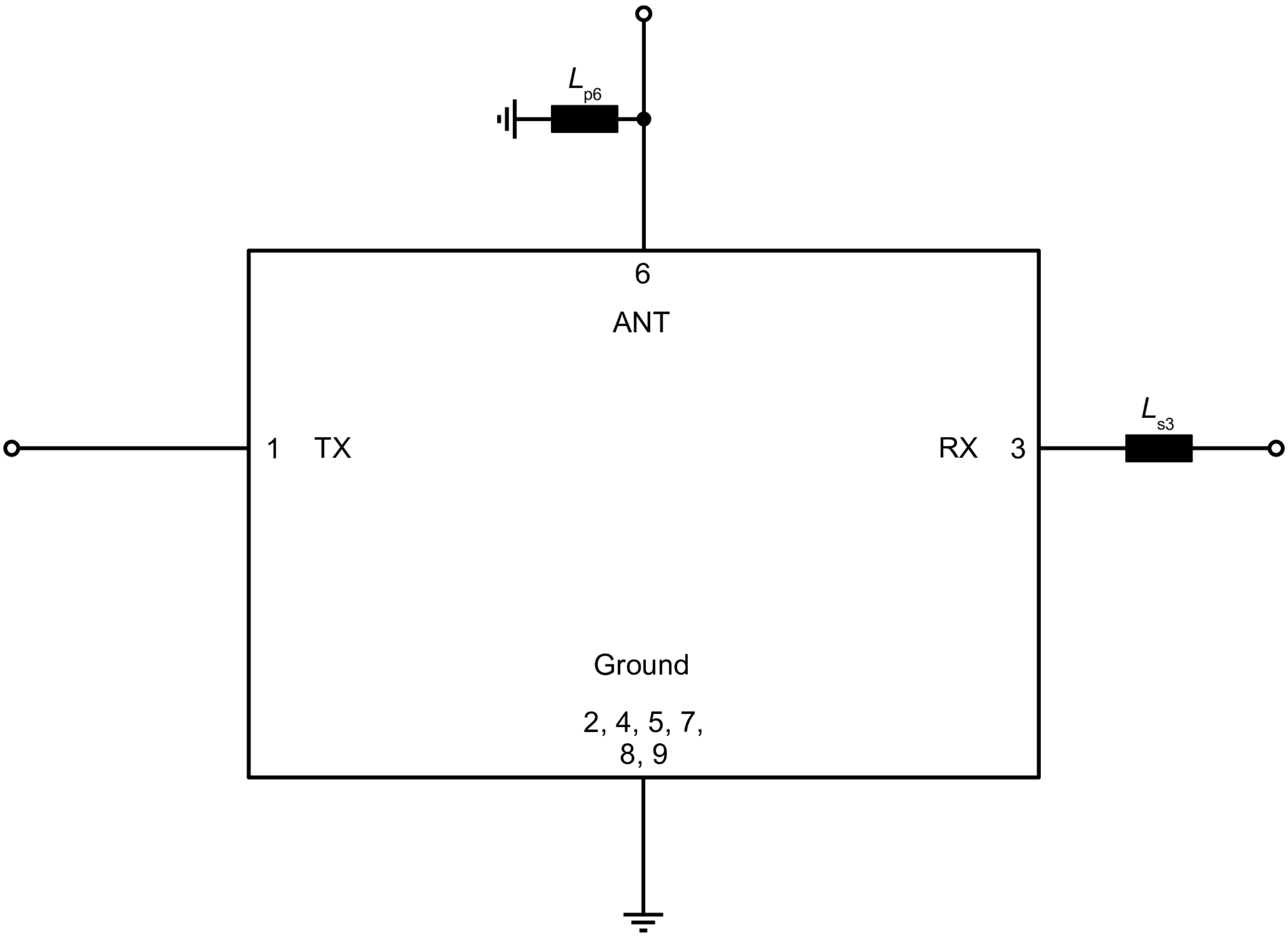

Figure 3: Schematic of matching circuit.

6 Characteristics

6.1 TX – ANT

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics TX – ANT				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	773	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	758 ... 763	MHz		—	1.6	2.5	dB
	763 ... 783	MHz		—	1.5	2.1	dB
	783 ... 788	MHz		—	1.7	2.5	dB
Maximum insertion attenuation			α_{max}				
	758 ... 788	MHz		—	2.0	3.2	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	758 ... 788	MHz		—	1.0	2.1	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	758 ... 788	MHz		—	1.8	2.2	
@ ANT port	758 ... 788	MHz		—	1.9	2.2	
Maximum error vector magnitude			EVM_{max} [3)]				
	760.4 ... 785.6	MHz		—	2.0	4.0	%
Average attenuation			$\alpha_{INT,avg}$ [2)]				
	703 ... 733	MHz		46	50	—	dB
Minimum attenuation			α_{min}				
	50 ... 699	MHz		30	38	—	dB
	703 ... 733	MHz		45	48	—	dB
	733 ... 748	MHz		23	27	—	dB
	803 ... 814	MHz		30	48	—	dB
	880 ... 915	MHz		36	42	—	dB
	925 ... 960	MHz		36	42	—	dB
	1710 ... 1785	MHz		34	36	—	dB
	1805 ... 1880	MHz		33	36	—	dB
	1920 ... 1980	MHz		33	36	—	dB
	2110 ... 2170	MHz		27	34	—	dB
	2400 ... 2500	MHz		27	35	—	dB
	2500 ... 2570	MHz		24	35	—	dB
	2620 ... 2690	MHz		24	31	—	dB
	3000 ... 5150	MHz		10	12	—	dB

	5150 ... 5850	MHz	8	10	—	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] Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics TX – ANT				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Center frequency			f_C	—	773	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	758 ... 763	MHz		—	1.6	2.6	dB
	763 ... 783	MHz		—	1.5	2.1	dB
	783 ... 788	MHz		—	1.7	2.6	dB
Maximum insertion attenuation			α_{max}				
	758 ... 788	MHz		—	2.0	3.4	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	758 ... 788	MHz		—	1.0	2.3	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	758 ... 788	MHz		—	1.8	2.2	
@ ANT port	758 ... 788	MHz		—	1.9	2.2	
Maximum error vector magnitude			EVM_{max} [3)]				
	760.4 ... 785.6	MHz		—	2.0	5.0	%
Average attenuation			$\alpha_{INT,avg}$ [2)]				
	703 ... 733	MHz		46	50	—	dB
Minimum attenuation			α_{min}				
	50 ... 699	MHz		30	38	—	dB
	703 ... 733	MHz		45	48	—	dB
	733 ... 748	MHz		23	27	—	dB
	803 ... 814	MHz		30	48	—	dB
	880 ... 915	MHz		36	42	—	dB
	925 ... 960	MHz		36	42	—	dB
	1710 ... 1785	MHz		34	36	—	dB
	1805 ... 1880	MHz		33	36	—	dB
	1920 ... 1980	MHz		33	36	—	dB
	2110 ... 2170	MHz		27	34	—	dB
	2400 ... 2500	MHz		27	35	—	dB
	2500 ... 2570	MHz		24	35	—	dB
	2620 ... 2690	MHz		24	31	—	dB
	3000 ... 5150	MHz		10	12	—	dB
	5150 ... 5850	MHz		8	10	—	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) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics ANT – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Center frequency			f_C	—	718	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	703 ... 708	MHz		—	1.6	2.8	dB
	708 ... 728	MHz		—	1.8	2.4	dB
	728 ... 733	MHz		—	2.0	2.8	dB
Maximum insertion attenuation			α_{max}				
	703 ... 733	MHz		—	2.2	3.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	703 ... 733	MHz		—	1.2	2.3	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	703 ... 733	MHz		—	1.6	2.2	
@ RX port	703 ... 733	MHz		—	1.5	2.3	
Maximum error vector magnitude			EVM_{max} [3)]				
	705.4 ... 730.6	MHz		—	2.9	6.0	%
Average attenuation			$\alpha_{INT,avg}$ [2)]				
	758 ... 788	MHz		51	55	—	dB
Minimum attenuation			α_{min}				
	50 ... 694	MHz		28	32	—	dB
	694 ... 695	MHz		22	35	—	dB
	758 ... 788	MHz		46	50	—	dB
	788 ... 803	MHz		30	58	—	dB
	791 ... 821	MHz		30	58	—	dB
	869 ... 894	MHz		30	62	—	dB
	925 ... 960	MHz		30	62	—	dB
	1805 ... 1880	MHz		30	64	—	dB
	1930 ... 1995	MHz		30	64	—	dB
	2110 ... 2170	MHz		30	62	—	dB
	2400 ... 2484	MHz		35	63	—	dB
	2620 ... 2690	MHz		30	63	—	dB
	5150 ... 5850	MHz		35	53	—	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) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics ANT – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Center frequency			f_C	—	718	—	MHz
Average insertion attenuation			$\alpha_{INT,avg}$ [2)]				
	703 ... 708	MHz		—	1.6	3.6	dB
	708 ... 728	MHz		—	1.8	2.4	dB
	728 ... 733	MHz		—	2.0	3.6	dB
Maximum insertion attenuation			α_{max}				
	703 ... 733	MHz		—	2.2	4.5	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	703 ... 733	MHz		—	1.2	3.2	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	703 ... 733	MHz		—	1.6	4.0	
@ RX port	703 ... 733	MHz		—	1.5	4.0	
Maximum error vector magnitude			EVM_{max} [3)]				
	705.4 ... 730.6	MHz		—	2.9	8.0	%
Average attenuation			$\alpha_{INT,avg}$ [2)]				
	758 ... 788	MHz		51	55	—	dB
Minimum attenuation			α_{min}				
	50 ... 694	MHz		28	32	—	dB
	694 ... 695	MHz		22	35	—	dB
	758 ... 788	MHz		46	50	—	dB
	788 ... 803	MHz		30	58	—	dB
	791 ... 821	MHz		30	58	—	dB
	869 ... 894	MHz		30	62	—	dB
	925 ... 960	MHz		30	62	—	dB
	1805 ... 1880	MHz		30	64	—	dB
	1930 ... 1995	MHz		30	64	—	dB
	2110 ... 2170	MHz		30	62	—	dB
	2400 ... 2484	MHz		35	63	—	dB
	2620 ... 2690	MHz		30	63	—	dB
	5150 ... 5850	MHz		35	53	—	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) Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −10 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics TX – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Average isolation			$\alpha_{INT,avg}$ [2)]				
	703 ... 733	MHz		49	51	—	dB
	758 ... 788	MHz		51	53	—	dB
Minimum isolation			α_{min}				
	703 ... 733	MHz		48	51	—	dB
	758 ... 788	MHz		49	51	—	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.

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
TX terminating impedance	Z_{TX}	= 50 Ω
ANT terminating impedance	Z_{ANT}	= 50 Ω with par. 8.4 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω with ser. 7.7 nH[1)]

Characteristics TX – RX				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Average isolation			$\alpha_{INT,avg}$ [2)]				
	703 ... 733	MHz		49	51	—	dB
	758 ... 788	MHz		51	53	—	dB
Minimum isolation			α_{min}				
	703 ... 733	MHz		48	51	—	dB
	758 ... 788	MHz		49	51	—	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.

7 Maximum ratings

Operable temperature	T_{OP} = −40 °C ... +95 °C	
Storage temperature	T_{STG}[1)] = −40 °C ... +95 °C	
DC voltage	$\|V_{DC}\|$[2)] = 0 V (max.)	
ESD voltage		
	V_{ESD}[3)] = 100 V (max.)	Machine model.
	V_{ESD}[4)] = 225 V (max.)	Human body model.
Input power	P_{IN}	
@ TX port: 758 ... 788 MHz	30 dBm[5), 6)]	5 MHz LTE downlink signal (25 RB) for 100000 h @ 55 °C. P_{IN} average – 41 dBm peak. Source and load impedance 50Ω.
@ RX port: 703 ... 733 MHz	27 dBm[5)]	5 MHz LTE uplink signal (25 RB) for 5000 h @ 55 °C. P_{IN} average – 38 dBm peak. Source and load impedance 50Ω.
Operating lifetime with output power at antenna 758 ... 788 MHz	P_{OUT}[7)] = 24 dBm	Continuous wave for 100000 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 test and wear out models.
6) T_{SPEC} is the ambient temperature of the PCB at component position. Specified min./max values from section 6 "characteristics" for maximum input power 30dBm are valid for temperature up to 56.5°C.
7) According to accelerated high temperature operating life (HTOL) test.

8 Transmission coefficients

8.1 TX – ANT

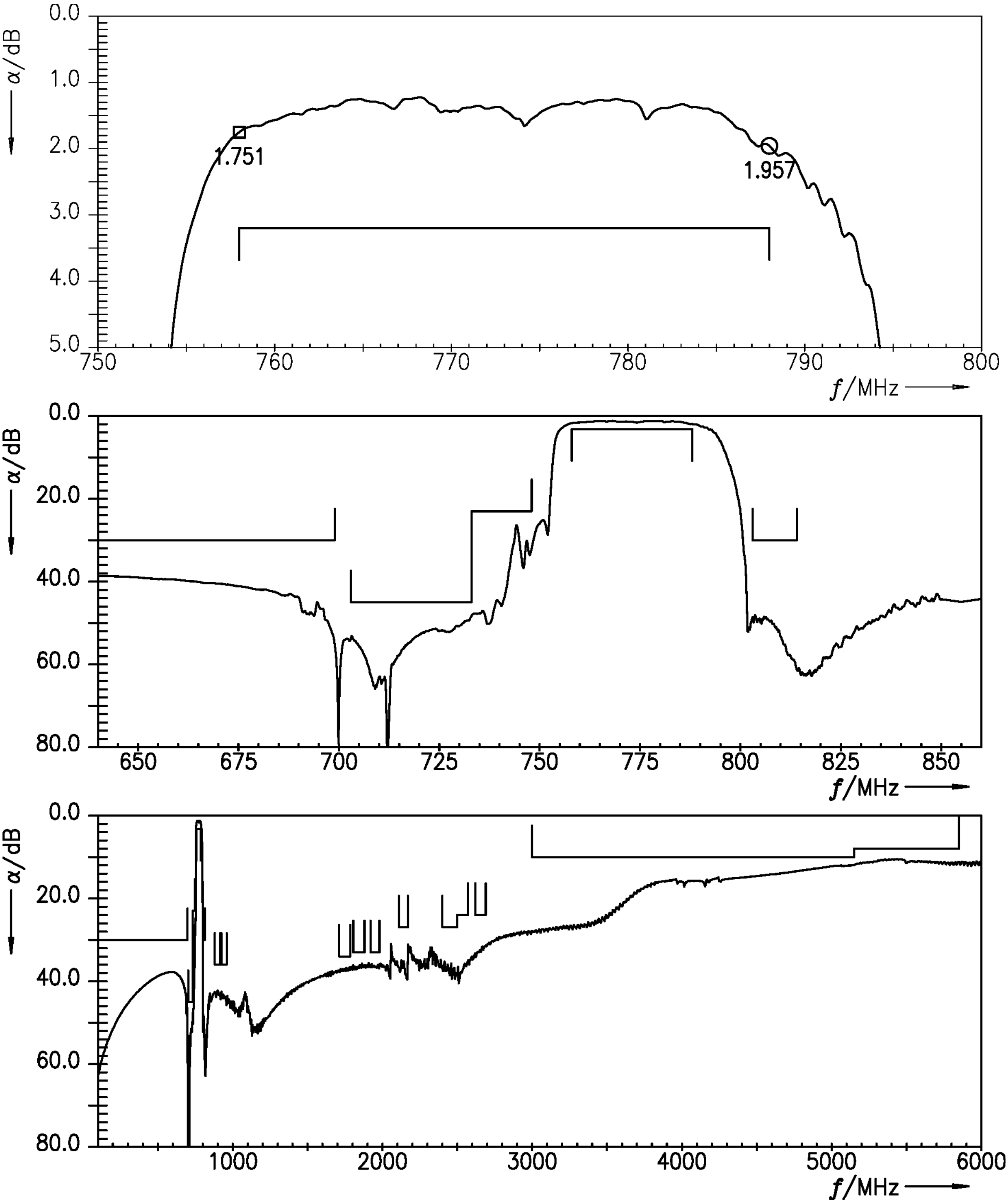

Figure 4: Attenuation TX – ANT.

8.2 ANT – RX

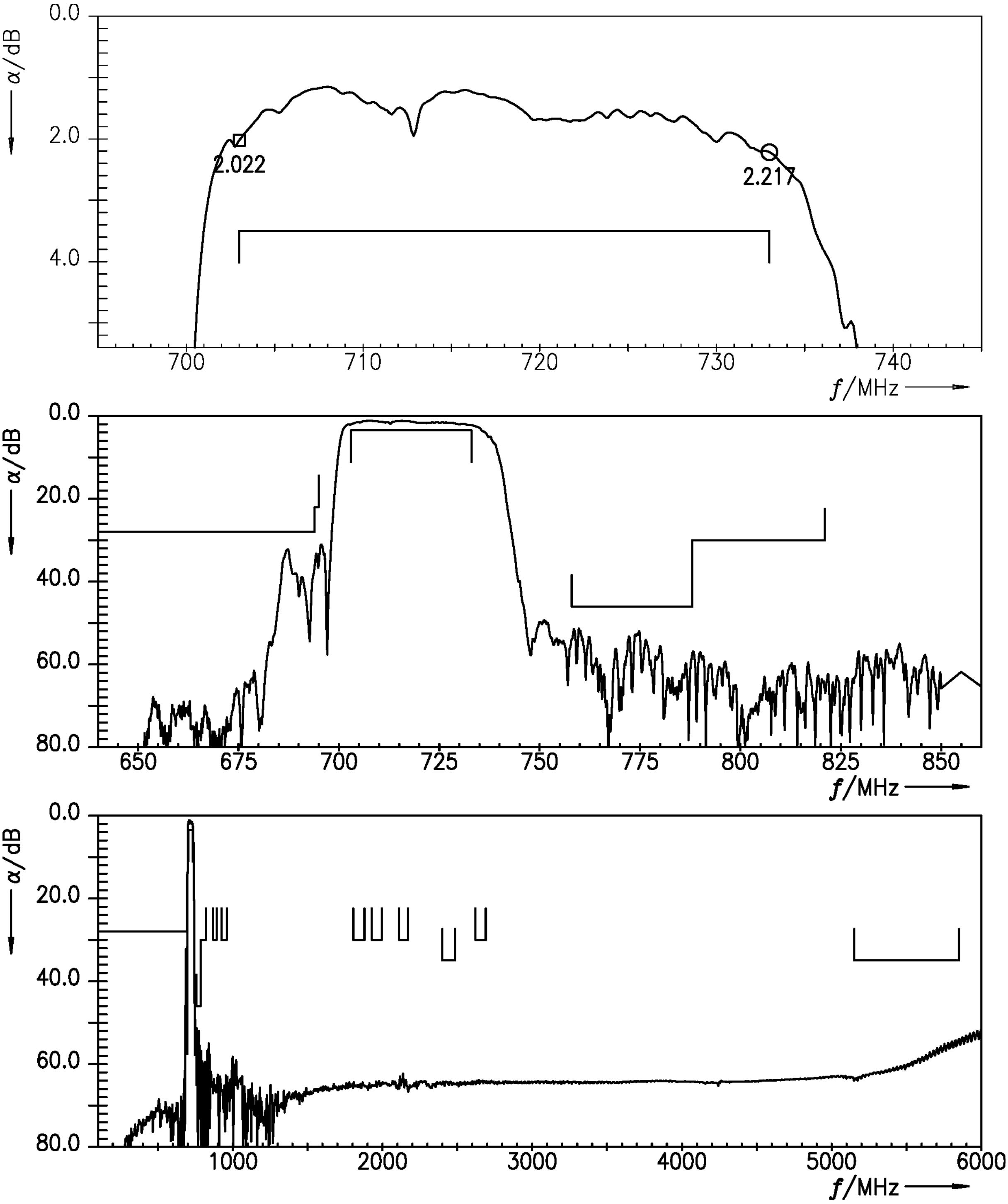

Figure 5: Attenuation ANT – RX.

8.3 TX – RX

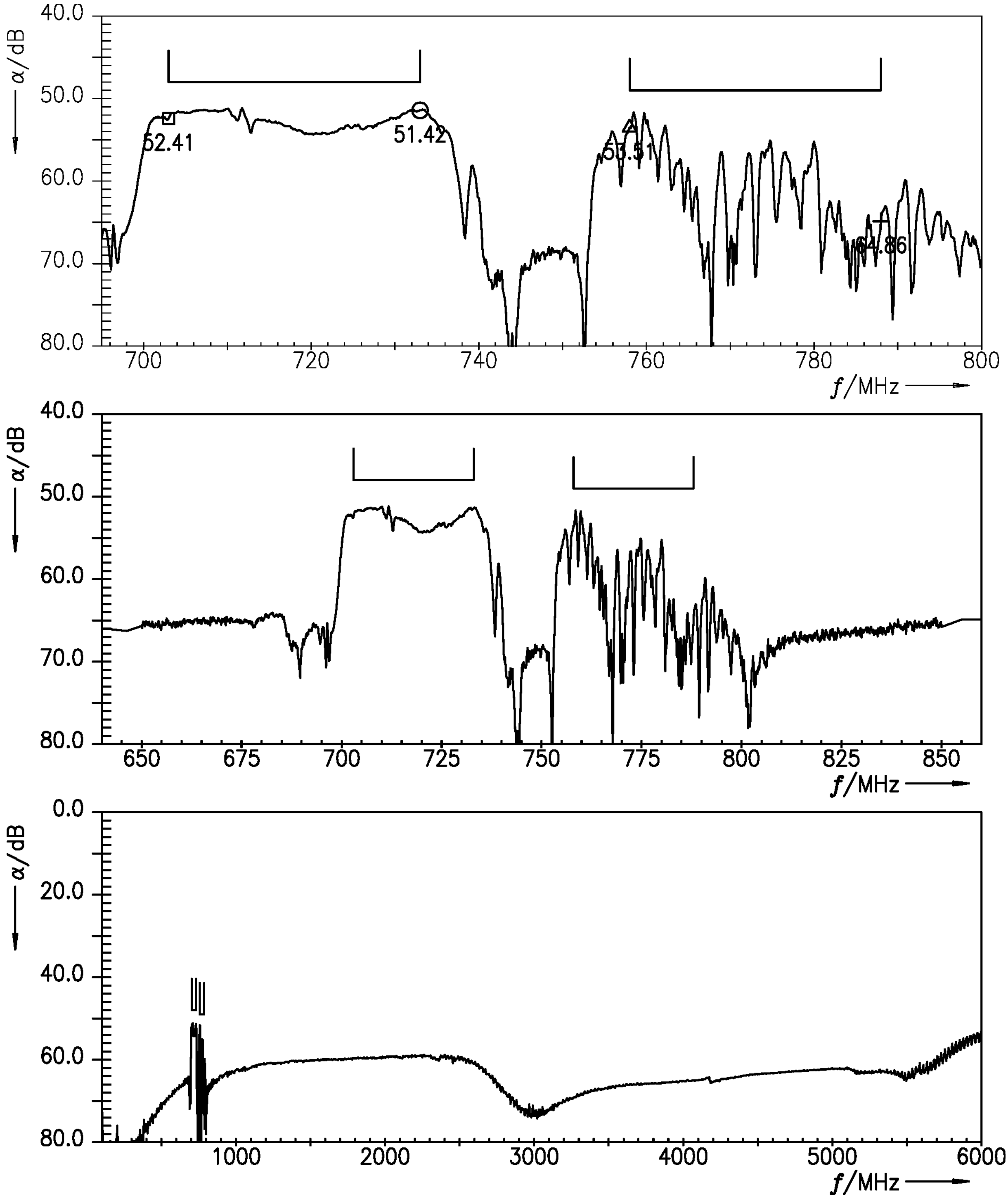

Figure 6: Isolation TX – RX.

9 Reflection coefficients

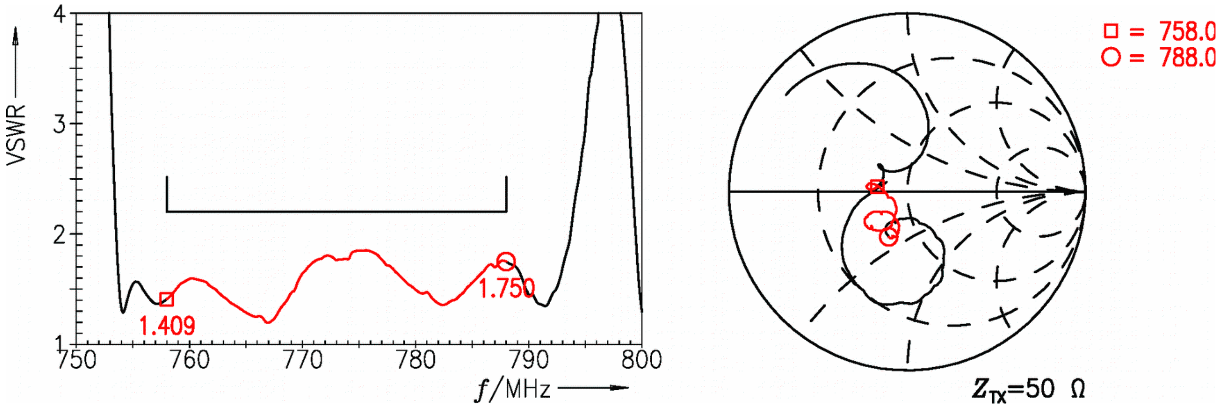

Figure 7: Reflection coefficient at TX port.

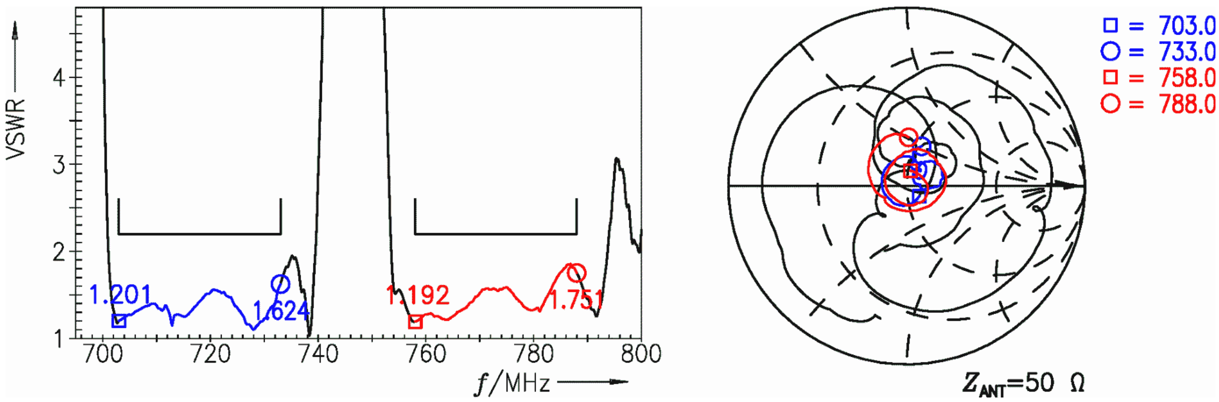

Figure 8: Reflection coefficient at ANT port.

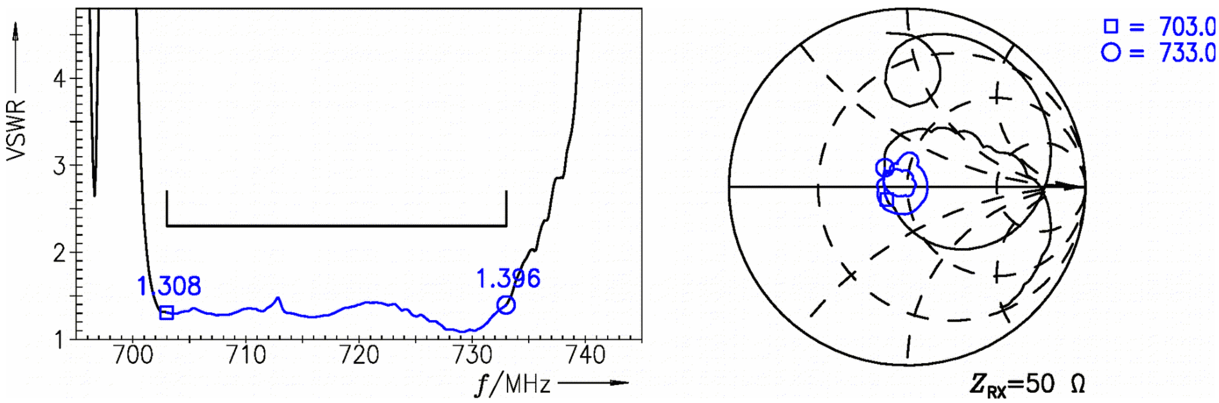

Figure 9: Reflection coefficient at RX port.

10 EVMs

10.1 TX – ANT

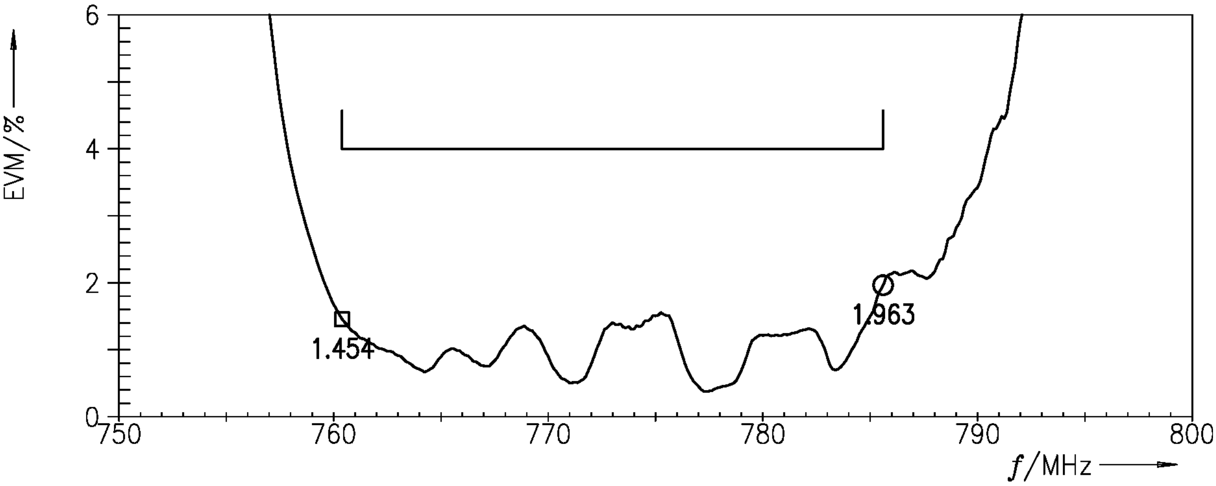

Figure 10: Error vector magnitude TX – ANT.

10.2 ANT – RX

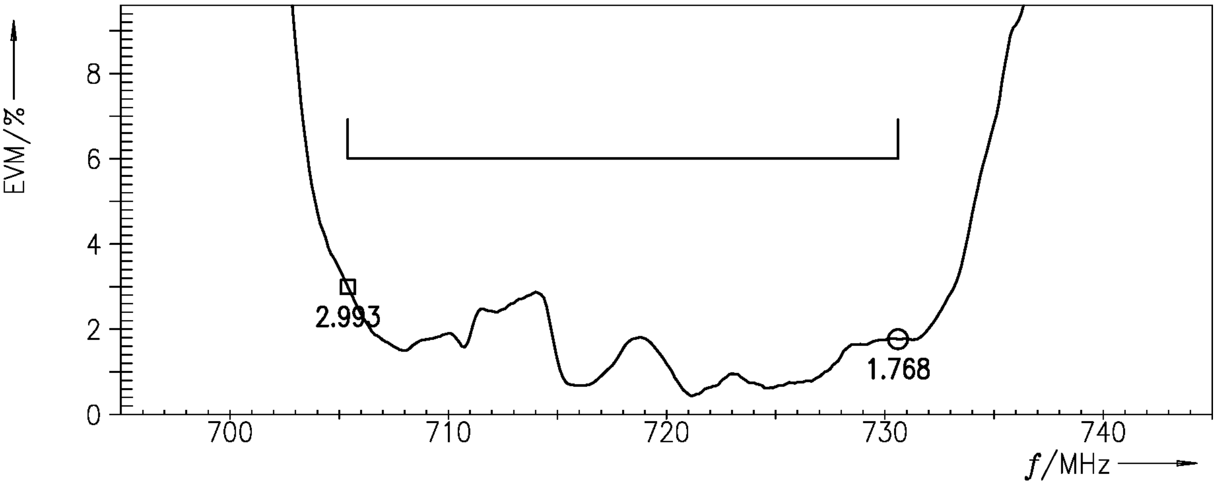

Figure 11: Error vector magnitude ANT – RX.

11 Packing material

11.1 Tape

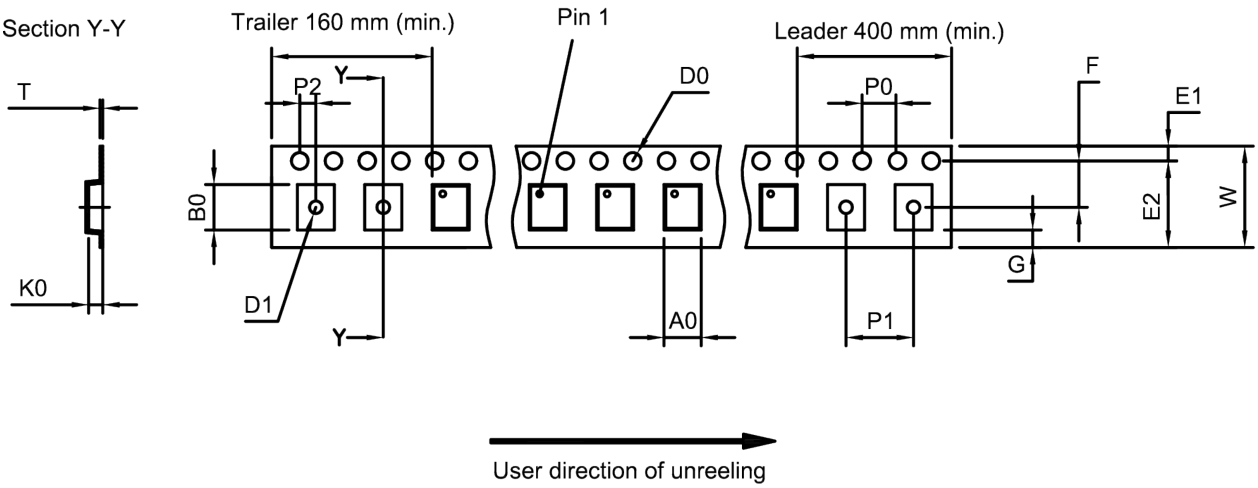

Figure 12: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	$2.25_{\pm 0.05}$ mm	E_2	6.25 mm (min.)	P_1	$4.0_{\pm 0.1}$ mm
B_0	$2.75_{\pm 0.05}$ mm	F	$3.5_{\pm 0.05}$ mm	P_2	$2.0_{\pm 0.05}$ mm
D_0	$1.5_{+0.1/-0}$ mm	G	0.75 mm (min.)	T	$0.25_{\pm 0.03}$ mm
D_1	1.0 mm (min.)	K_0	$0.6_{\pm 0.05}$ mm	W	$8.0_{+0.3/-0.1}$ mm
E_1	$1.75_{\pm 0.1}$ mm	P_0	$4.0_{\pm 0.1}$ mm		

Table 1: Tape dimensions.

11.2 Reel with diameter of 180 mm

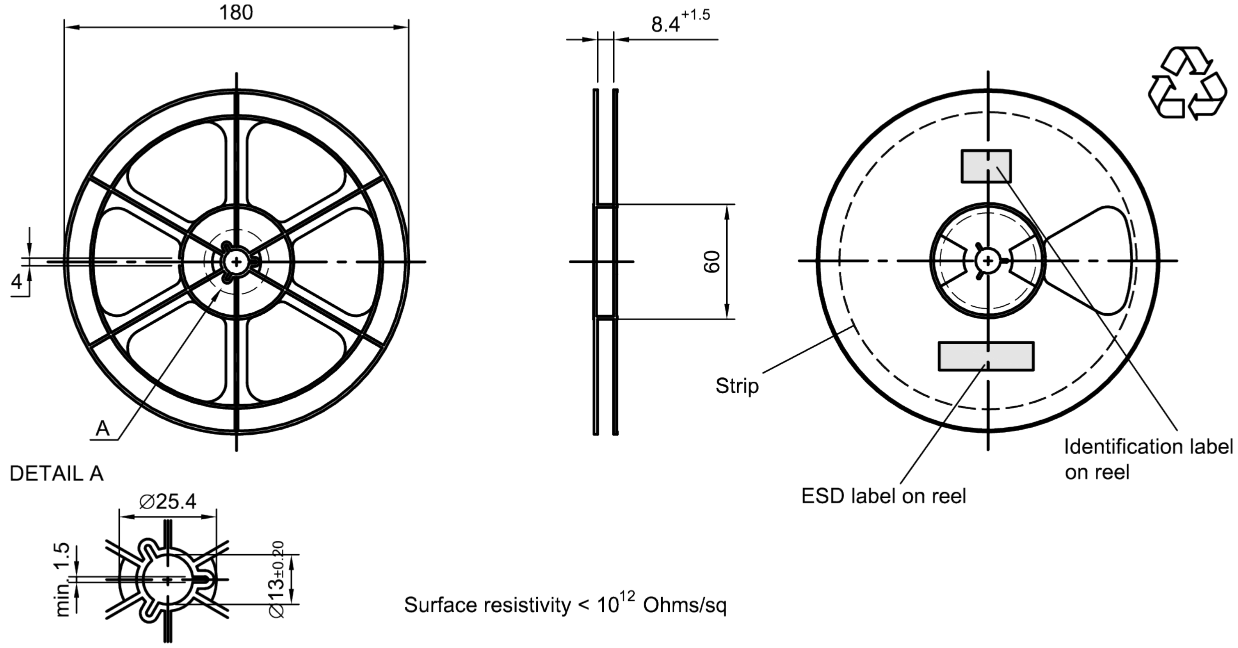

Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

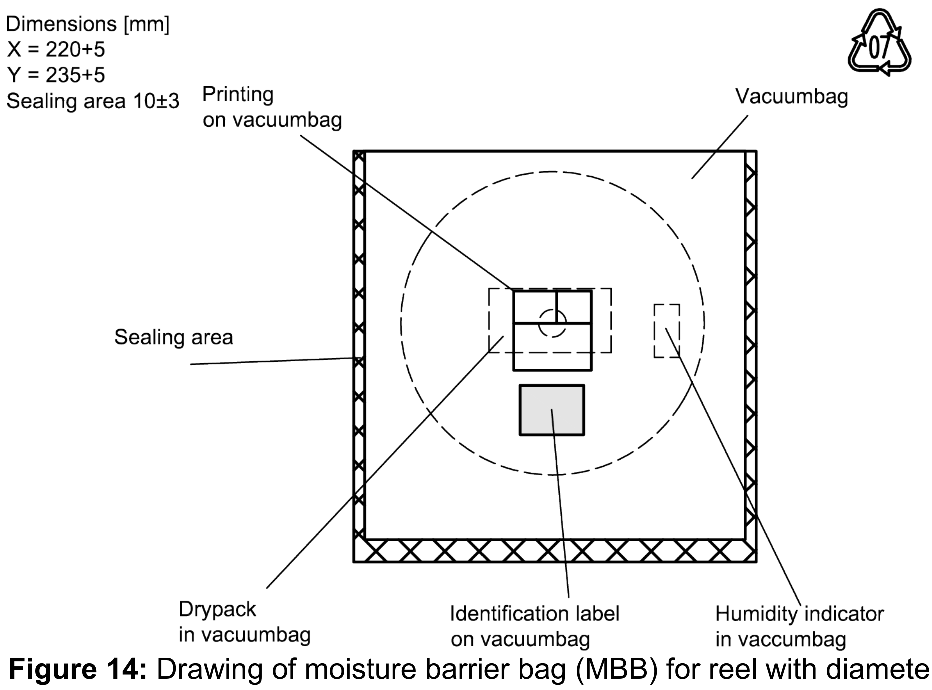

Figure 14: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

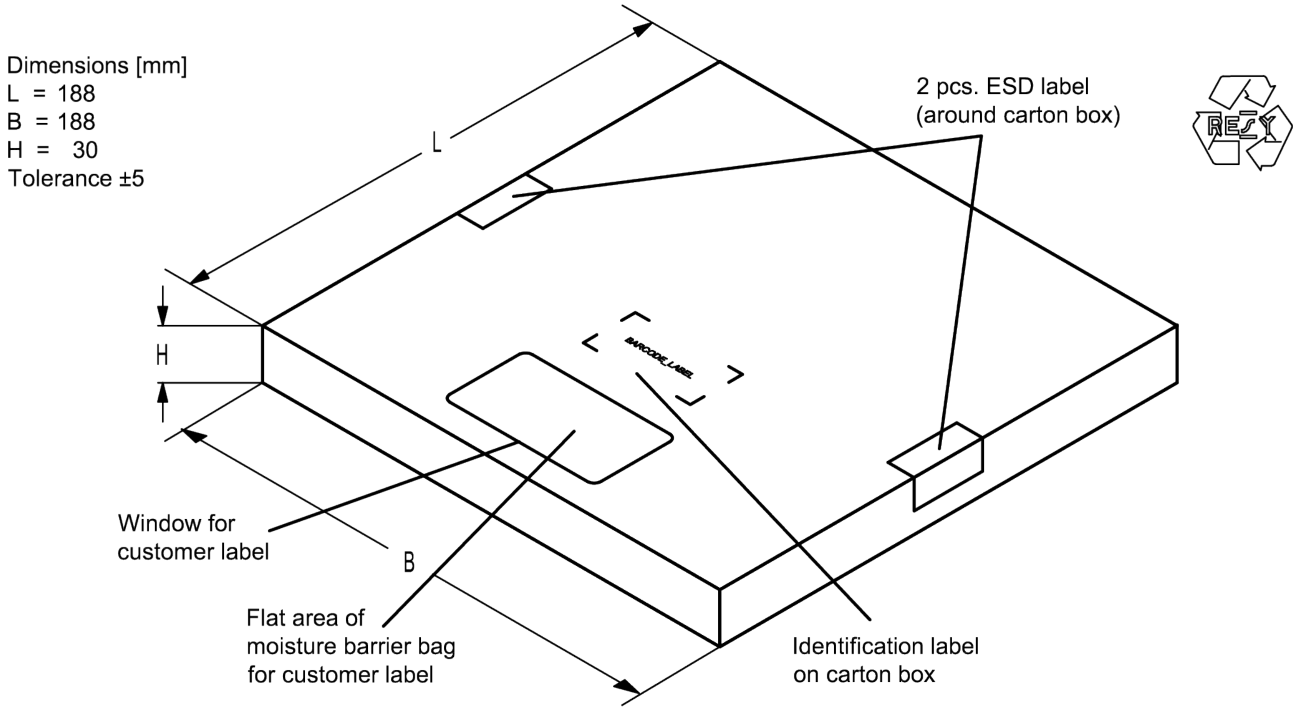

Figure 15: Drawing of folding box for reel with diameter of 180 mm.

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**

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

  The BASE32 code for product type B8035 is 7V3.

- 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**

  $\mathbf{5} \times 47^2 + \mathbf{27\ (=U)} \times 47^1 + \mathbf{31\ (=Y)} \times 47^0$ = **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	≤ 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 ($Sn95.5Ag3.8Cu0.7$).

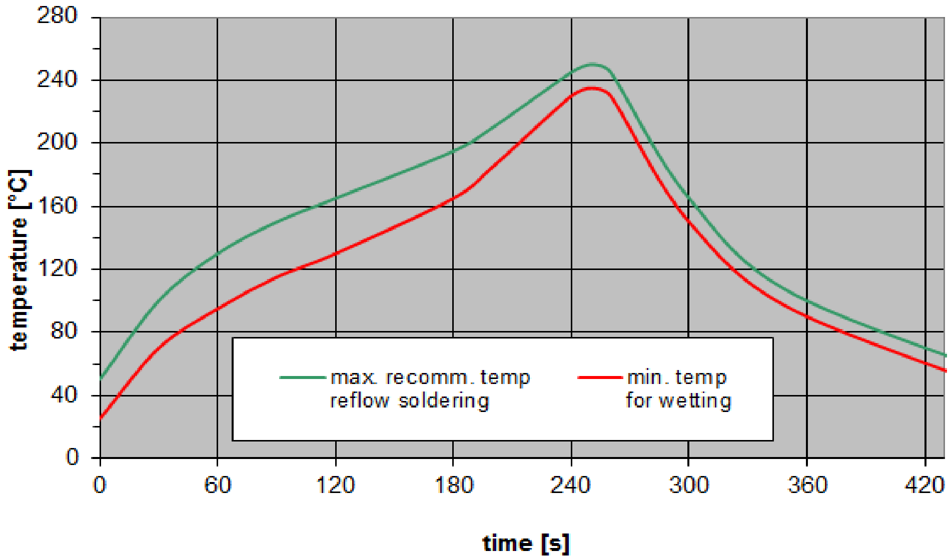

Figure 16: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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 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 RF360 sales office.

14.4 Ordering codes and packing units

Ordering code	Packing unit
B39771B8035P810	5000 pcs

Table 4: Ordering codes 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 www.rf360jv.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 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).

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, 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.

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

Данный компонент на территории Российской Федерации

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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9