Qualcomm

RF360
Europe GmbH

Data sheet

SAW duplexer

LTE / 5G band 28a

Part number:	B1299
Ordering code:	B39781B1299L210
Date:	September 22, 2021
Version:	2.0

DCN: 80-PA243-584 Rev. A

RF360 Europe GmbH
Anzinger Straße 13
81671 Munich, Germany

Table of contents

1 Application

- Low-loss SAW duplexer for mobile telephone for 4G and 5G Band 28a
- LTE band 28a uplink: 718 MHz (pass band 30 MHz)
- LTE band 28a downlink: 773 MHz (pass band 30 MHz)
- Qualcomm® micro-Acoustic Power Management (MAPM)
- Low insertion attenuation
- Low amplitude ripple
- Usable pass band 30 MHz
- Duplexer for lower part of Band 28

2 Features

- Package size $1.6_{\pm 0.05}$ mm × $1.2_{\pm 0.05}$ 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)

3 Package

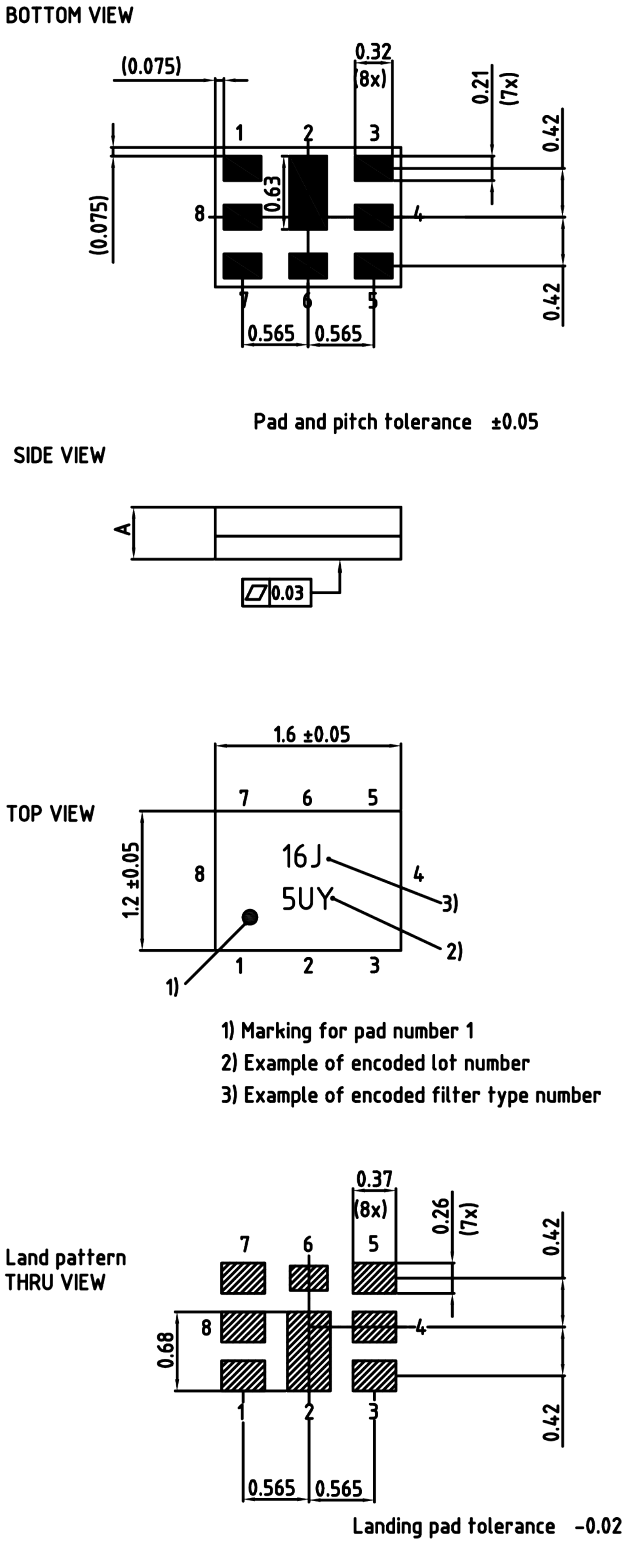

Figure 1: Drawing of package with package height A = 0.6 mm (max.). See Sec. Package information (p. 25).

4 Pin configuration

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

5 Matching circuit

- C_{p3b} = 2.4 pF
- L_{p6} = 8.0 nH
- L_{s1} = 3.6 nH
- L_{s3a} = 10.3 nH

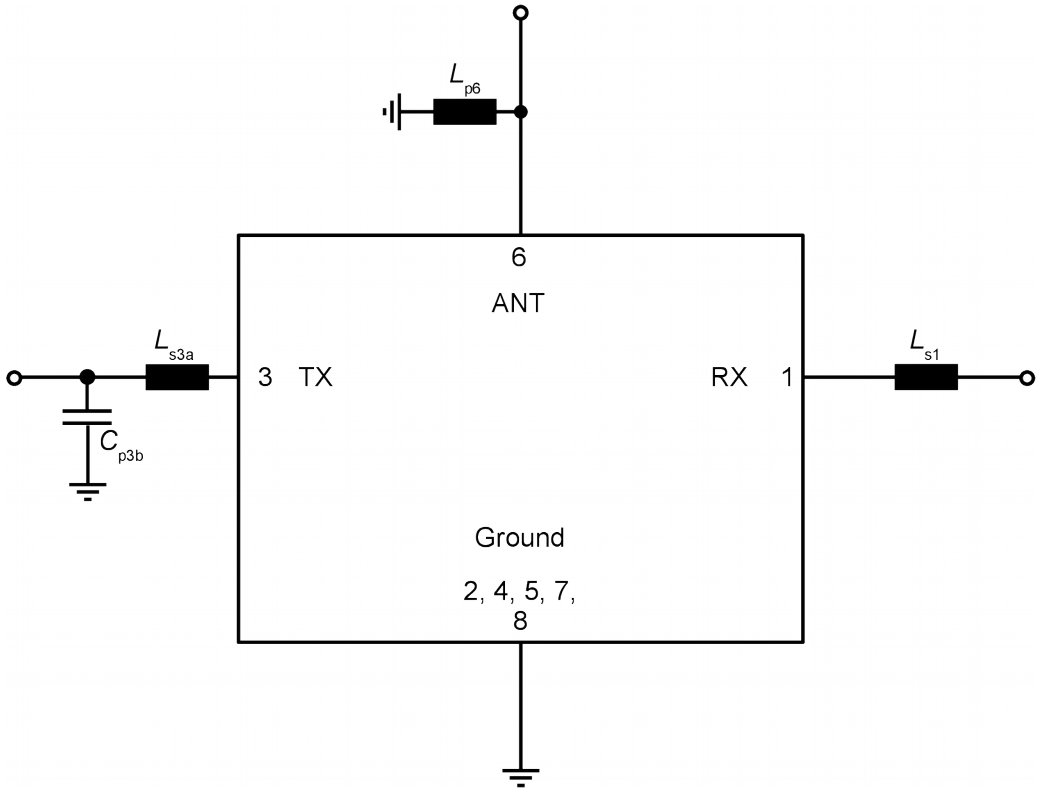

Figure 2: Schematic of matching circuit.

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

6 Characteristics

6.1 TX – ANT

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω with ext. circuitry.[1)]
ANT terminating impedance	Z_{ANT}	= 50 Ω // 8.0 nH[1)]
RX terminating impedance	Z_{RX}	= 50 Ω + 3.6 nH[1)]

Characteristics TX – ANT				**min.** for T_{SPEC}	**typ.** @ +25 °C	**max.** for T_{SPEC}	
Center frequency			f_C	—	718	—	MHz
Maximum insertion attenuation							
	703 ... 733	MHz	$\alpha_{INT,max}$ [2)]	—	1.1	2.2[3)]	dB
	703 ... 733	MHz	$\alpha_{INT,max}$ [2)]	—	1.1	2.5	dB
	703.24 ... 732.76	MHz	α_{max}	—	1.5	2.5[3)]	dB
	703.24 ... 732.76	MHz	α_{max}	—	1.5	2.8	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	703.24 ... 732.76	MHz		—	0.7	2.2	dB
Maximum VSWR			$VSWR_{max}$				
@ TX port	703 ... 733	MHz		—	1.6	2.0	
@ ANT port	703 ... 733	MHz		—	1.6	2.0	
Minimum attenuation			α_{min}				
	10 ... 670	MHz		28	31	—	dB
	670 ... 694	MHz		28	32	—	dB
	692 ... 698	MHz		4	24	—	dB
	758.24 ... 787.76	MHz		42	47	—	dB
	791 ... 821	MHz		22	25	—	dB
	815 ... 849	MHz		26	30	—	dB
	832 ... 862	MHz		28	32	—	dB
	860 ... 894	MHz		30	34	—	dB
	880 ... 915	MHz		25	29	—	dB
	925 ... 960	MHz		28	32	—	dB
	1166 ... 1187	MHz		37	44	—	dB
	1226 ... 1250	MHz		37	42	—	dB
	1406 ... 1466	MHz		35	38	—	dB
	1427.9 ... 1462.9	MHz		35	38	—	dB
	1452 ... 1496	MHz		35	38	—	dB
	1475.9 ... 1510.9	MHz		35	38	—	dB
	1559 ... 1563	MHz		35	38	—	dB
	1565.42 ... 1573.37	MHz		35	38	—	dB
	1573.37 ... 1577.47	MHz		35	38	—	dB
	1577.47 ... 1585.42	MHz		35	38	—	dB
	1597.55 ... 1605.89	MHz		35	37	—	dB
	1710 ... 1785	MHz		30	37	—	dB

Characteristics TX – ANT			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
	1805 ... 1880	MHz	30	37	—	dB
	1930 ... 1995	MHz	30	37	—	dB
	2010 ... 2025	MHz	30	38	—	dB
	2109 ... 2199	MHz	35	38	—	dB
	2300 ... 2400	MHz	30	38	—	dB
	2400 ... 2484	MHz	35	38	—	dB
	2496 ... 2690	MHz	35	39	—	dB
	2812 ... 2932	MHz	30	39	—	dB
	3300 ... 3800	MHz	35	40	—	dB
	3300 ... 4200	MHz	35	40	—	dB
	4400 ... 5000	MHz	35	39	—	dB
	4900 ... 5950	MHz	25	39	—	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) Valid for typical temperature T = +25 °C.

6.2 ANT – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω with ext. circuitry.[1]
ANT terminating impedance	Z_{ANT}	= 50 Ω // 8.0 nH[1]
RX terminating impedance	Z_{RX}	= 50 Ω + 3.6 nH[1]

Characteristics ANT – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_C	—	773	—	MHz
Maximum insertion attenuation							
	758 ... 788	MHz	$\alpha_{INT,max}$ [2]	—	1.6	2.2[3]	dB
	758 ... 788	MHz	$\alpha_{INT,max}$ [2]	—	1.6	2.5	dB
	758.24 ... 787.76	MHz	α_{max}	—	1.9	2.5[3]	dB
	758.24 ... 787.76	MHz	α_{max}	—	1.9	2.8	dB
Amplitude ripple (p-p)			$\Delta\alpha$				
	758.24 ... 787.76	MHz		—	0.7	1.8	dB
Maximum VSWR			$VSWR_{max}$				
@ ANT port	758 ... 788	MHz		—	1.7	2.1	
@ RX port	758 ... 788	MHz		—	1.9	2.2	
Minimum attenuation			α_{min}				
	10 ... 699	MHz		40	52	—	dB
	45 ... 65	MHz		50	93	—	dB
	703.24 ... 732.76	MHz		50	62	—	dB
	733.24 ... 747.76	MHz		30	48	—	dB
	814 ... 2400	MHz		40	48	—	dB
	2400 ... 2483	MHz		30	64	—	dB
	2496 ... 2690	MHz		30	63	—	dB
	3300 ... 3800	MHz		46	52	—	dB
	3300 ... 4200	MHz		42	47	—	dB
	4400 ... 5000	MHz		32	37	—	dB
	4900 ... 5950	MHz		27	32	—	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) Valid for typical temperature T = +25 °C.

6.3 TX – RX

Temperature range for specification	T_{SPEC}	= −30 °C ... +85 °C
TX terminating impedance	Z_{TX}	= 50 Ω with ext. circuitry.[1]
ANT terminating impedance	Z_{ANT}	= 50 Ω // 8.0 nH[1]
RX terminating impedance	Z_{RX}	= 50 Ω + 3.6 nH[1]

Characteristics TX – RX				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum isolation			$\alpha_{INT,min}$[2]				
	703.24 ... 732.76	MHz		55[3]	60	—	dB
	703.24 ... 732.76	MHz		55	60	—	dB
	758.24 ... 787.76	MHz		53[3]	58	—	dB
	758.24 ... 787.76	MHz		53	58	—	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] Valid for typical temperature T = +25 °C.

7 Maximum ratings

Storage temperature	T_{STG}[1)] = −40 °C ... +85 °C	
DC voltage	$\|V_{DC}\|$ = 5.0 V (max.)[2)]	
ESD voltage		
	V_{ESD}[3)] = 100 V (max.)	Machine model.
	V_{ESD}[4)] = 150 V (max.)	Human body model.
	V_{ESD}[5)] = 700 V (max.)	Charged device model.
Input power	P_{IN}	
@ TX port: 703 ... 733 MHz	29.5 dBm	■ 5 MHz LTE uplink signal (1 RB) for 5000 h @ 50 °C. ■ 5 MHz 5G-NR (DFT-s-OFDM) (1 RB) for 5000 h @ 50 °C.
@ TX port: 703 ... 733 MHz	28.5 dBm	5 MHz 5G-NR (CP-OFDM) (1 RB) for 5000 h @ 50 °C.

1) Not valid for packaging material. Storage temperature for packaging material is −25 °C to +40 °C.
2) 168h Damp Heat Steady State acc. IEC 60068-2-67 Cy.
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) According to JESD22-C101C (CDM – Field Induced Charged Device Model), 3 negative & 3 positive pulses.

8 Transmission coefficients

8.1 TX – ANT

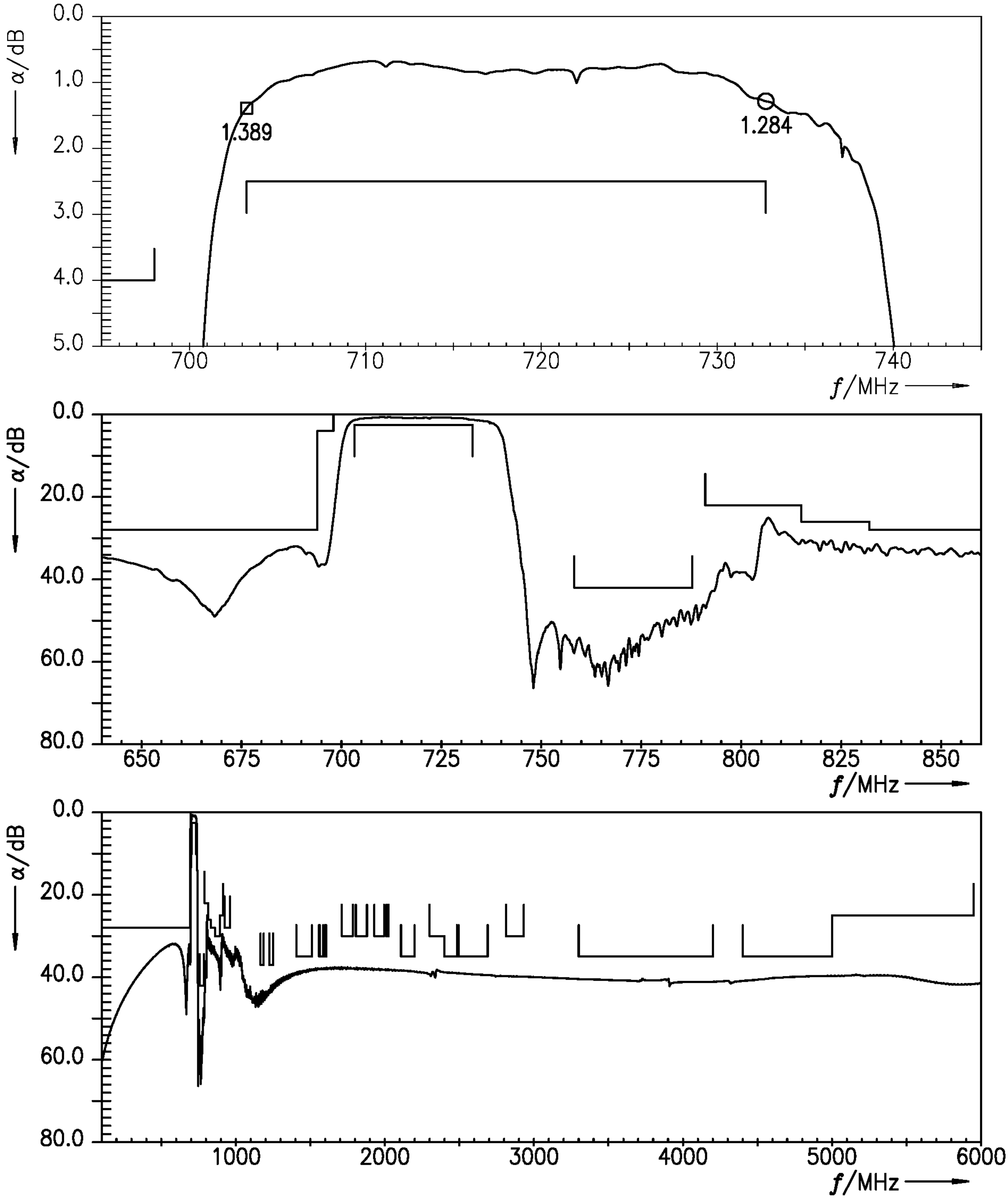

Figure 3: Attenuation TX – ANT.

8.2 ANT – RX

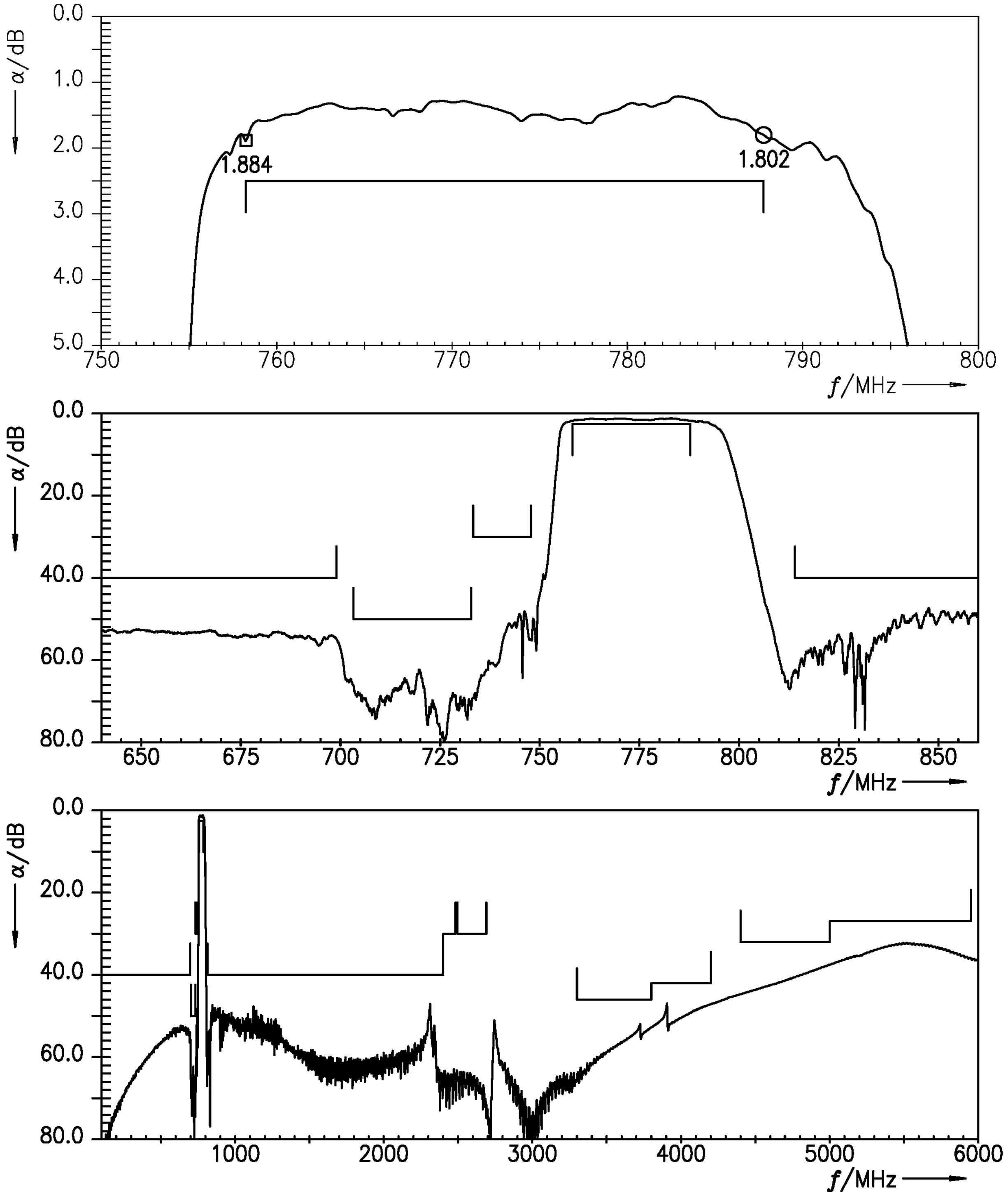

Figure 4: Attenuation ANT – RX.

9 Transmission coefficients (LTE)

9.1 TX – ANT

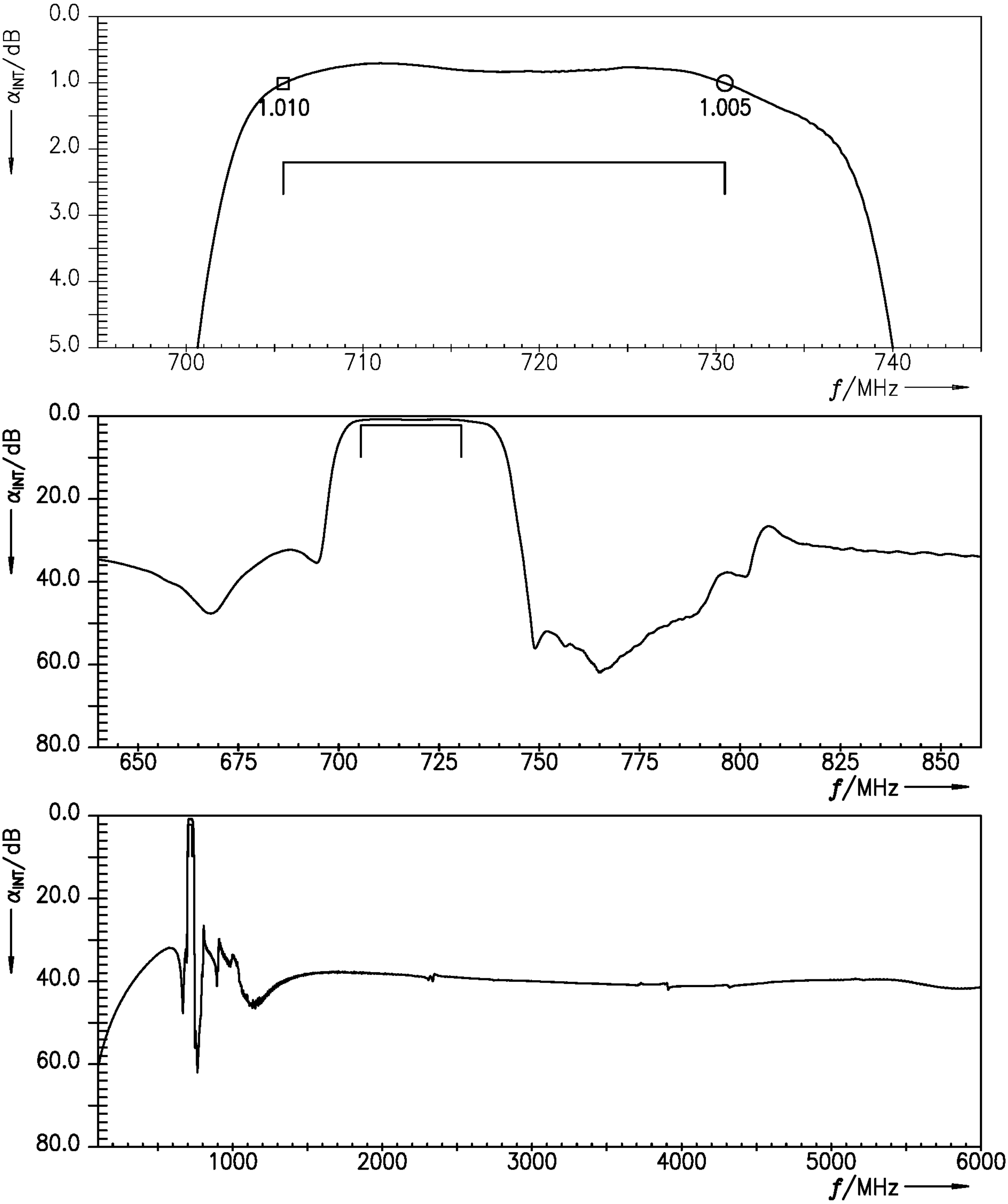

Figure 5: Attenuation (LTE) (integration window = 5 MHz) TX – ANT.

9.2 ANT – RX

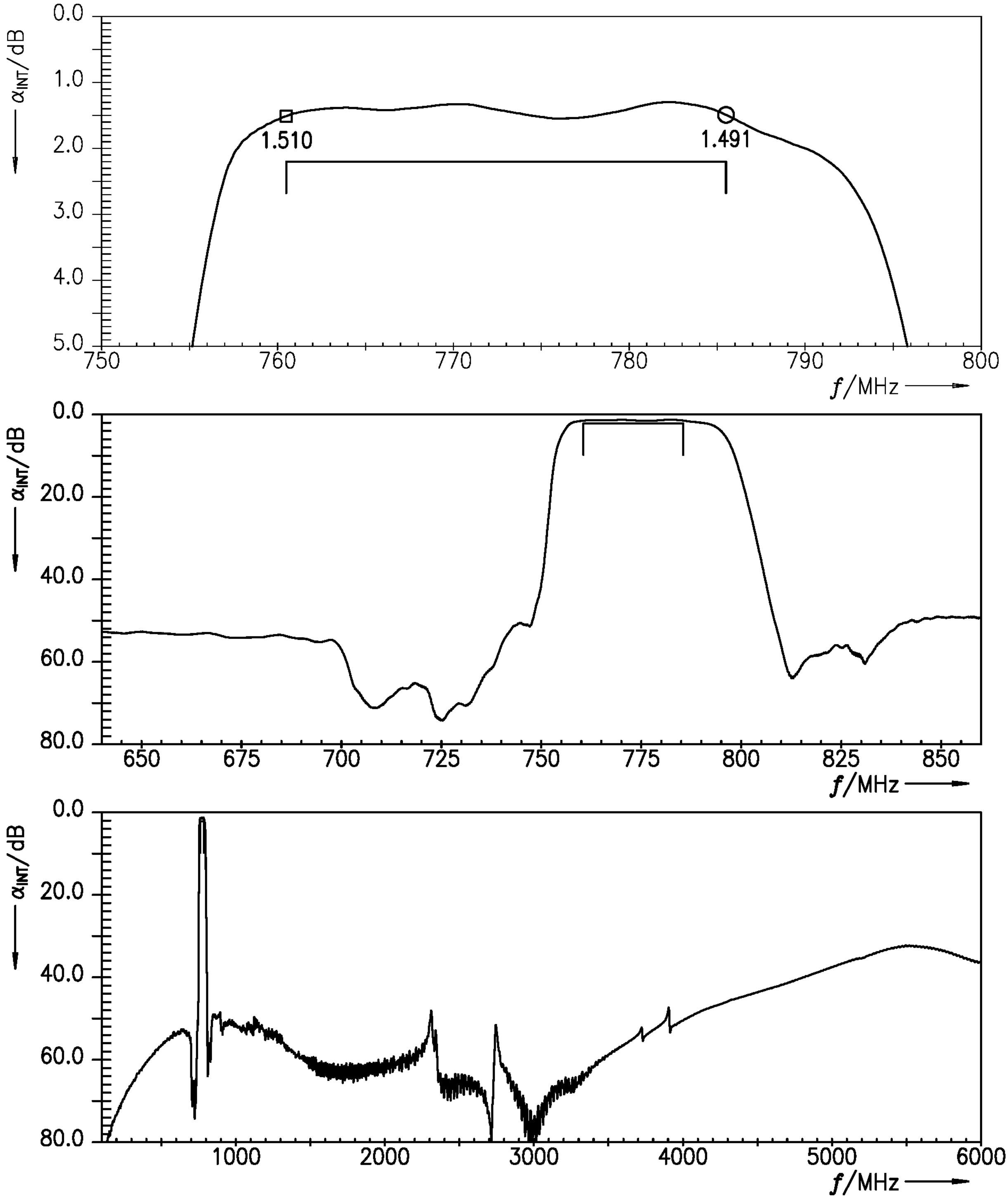

Figure 6: Attenuation (LTE) (integration window = 5 MHz) ANT – RX.

9.3 TX – RX

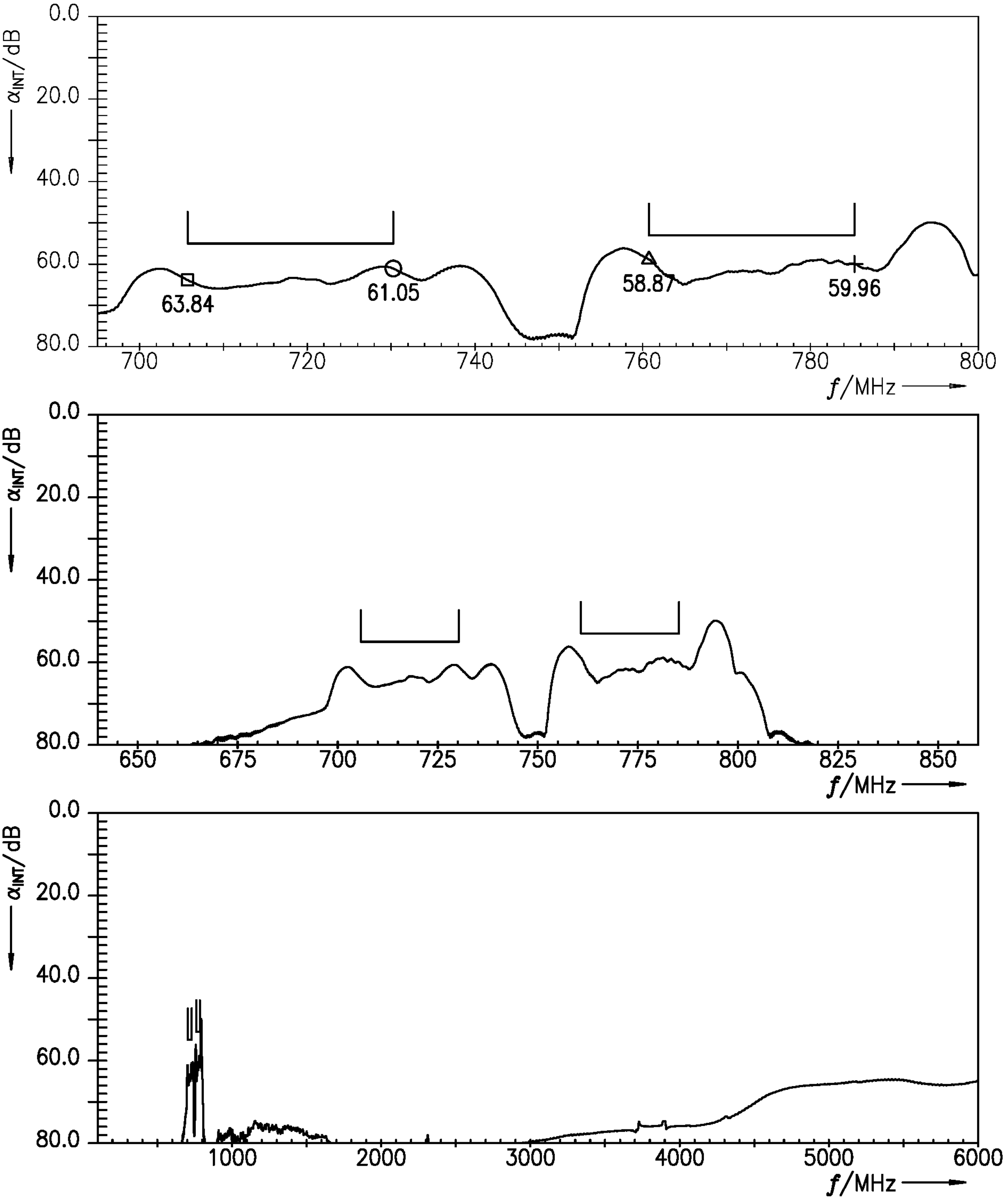

Figure 7: Isolation (LTE) (integration window = 5 MHz) TX – RX.

10 Reflection coefficients

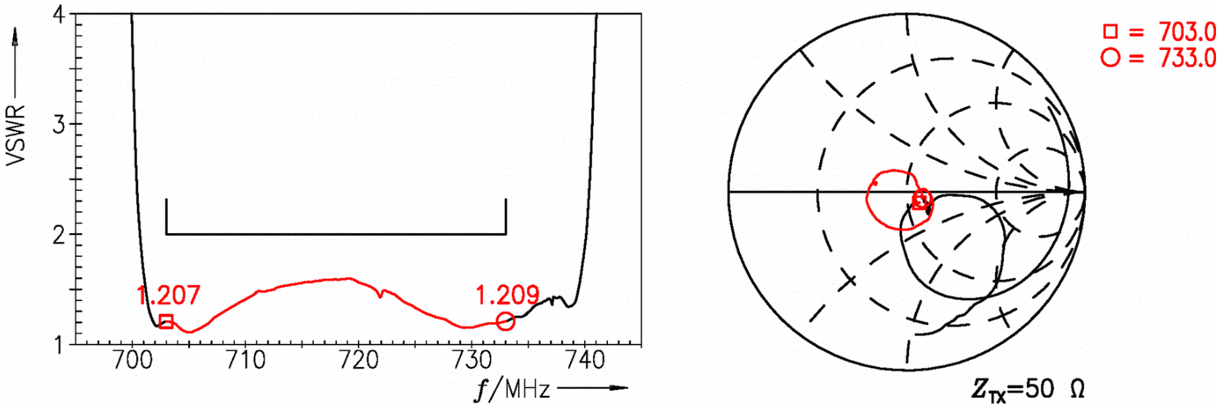

Figure 8: Reflection coefficient at TX port.

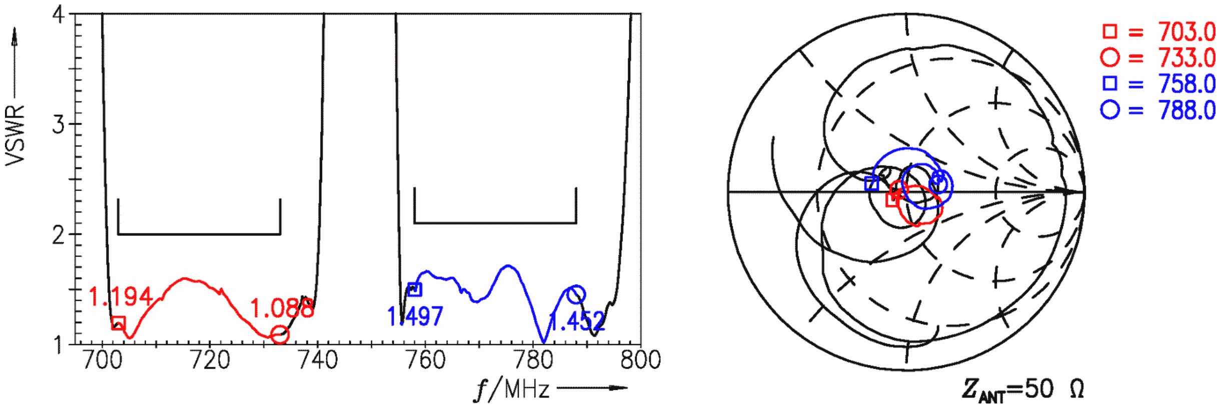

Figure 9: Reflection coefficient at ANT port (TX and RX frequencies).

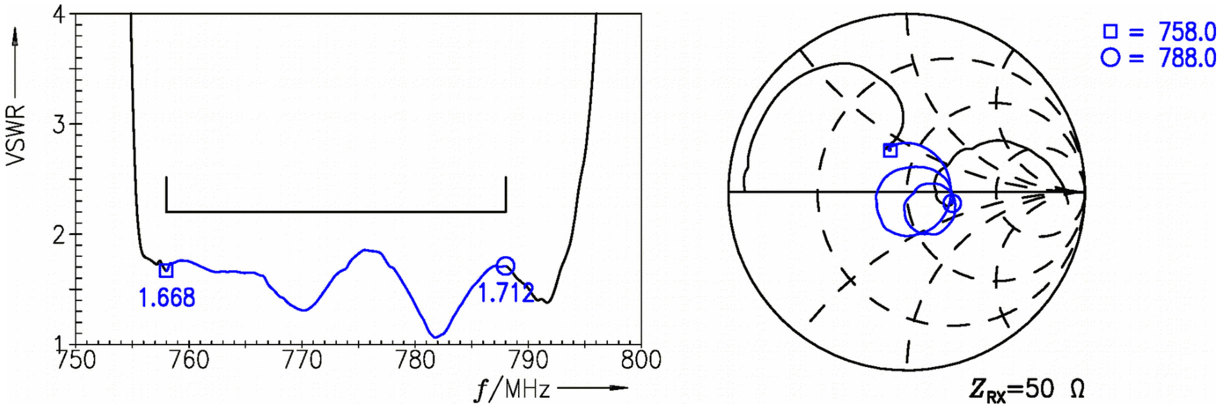

Figure 10: Reflection coefficient at RX port.

11 Packing material

11.1 Tape

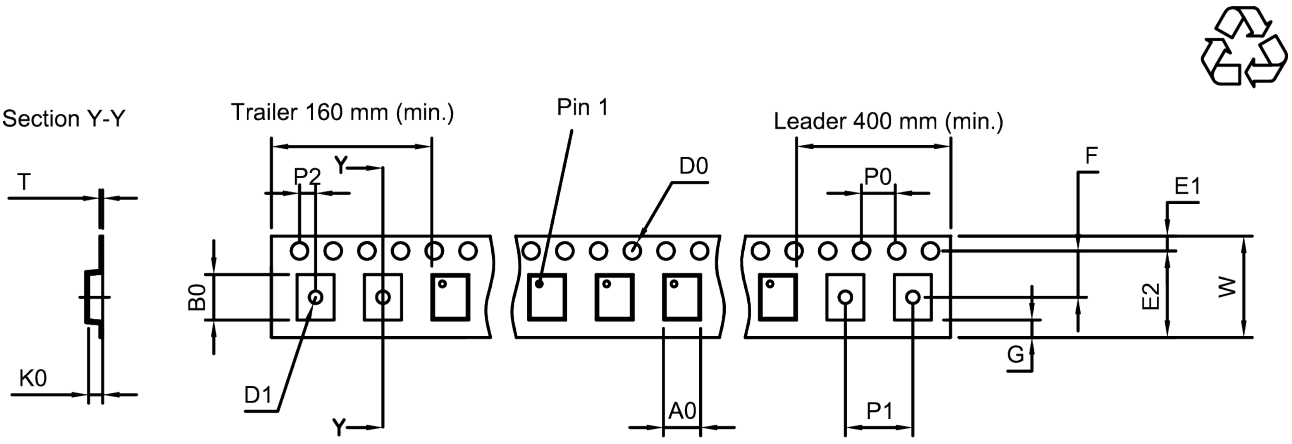

Figure 11: Drawing of tape (first-angle projection) for illustration only and not to scale. The valid tape dimensions are listed in Table 1.

A_0	$1.4_{\pm0.05}$ mm	E_2	6.25 mm (min.)	P_1	$4.0_{\pm0.1}$ mm
B_0	$1.8_{\pm0.05}$ mm	F	$3.5_{\pm0.05}$ mm	P_2	$2.0_{\pm0.05}$ mm
D_0	$1.5_{+0.1/-0}$ mm	G	0.75 mm (min.)	T	$0.25_{\pm0.03}$ mm
D_1	$0.6_{+0.1/-0}$ mm	K_0	$0.7_{\pm0.05}$ mm	W	$8.0_{+0.3/-0.1}$ mm
E_1	$1.75_{\pm0.1}$ mm	P_0	$4.0_{\pm0.1}$ mm		

Table 1: Tape dimensions.

11.2 Reel with diameter of 180 mm

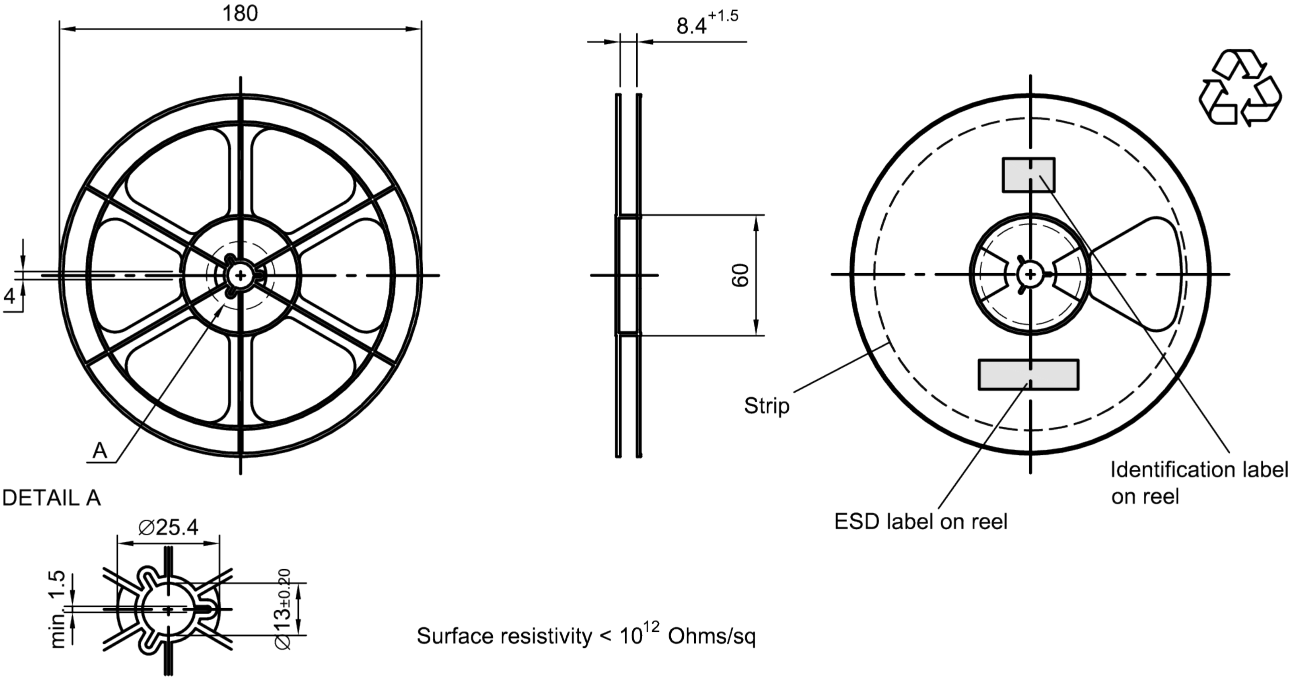

Figure 12: Drawing of reel (first-angle projection) with diameter of 180 mm.

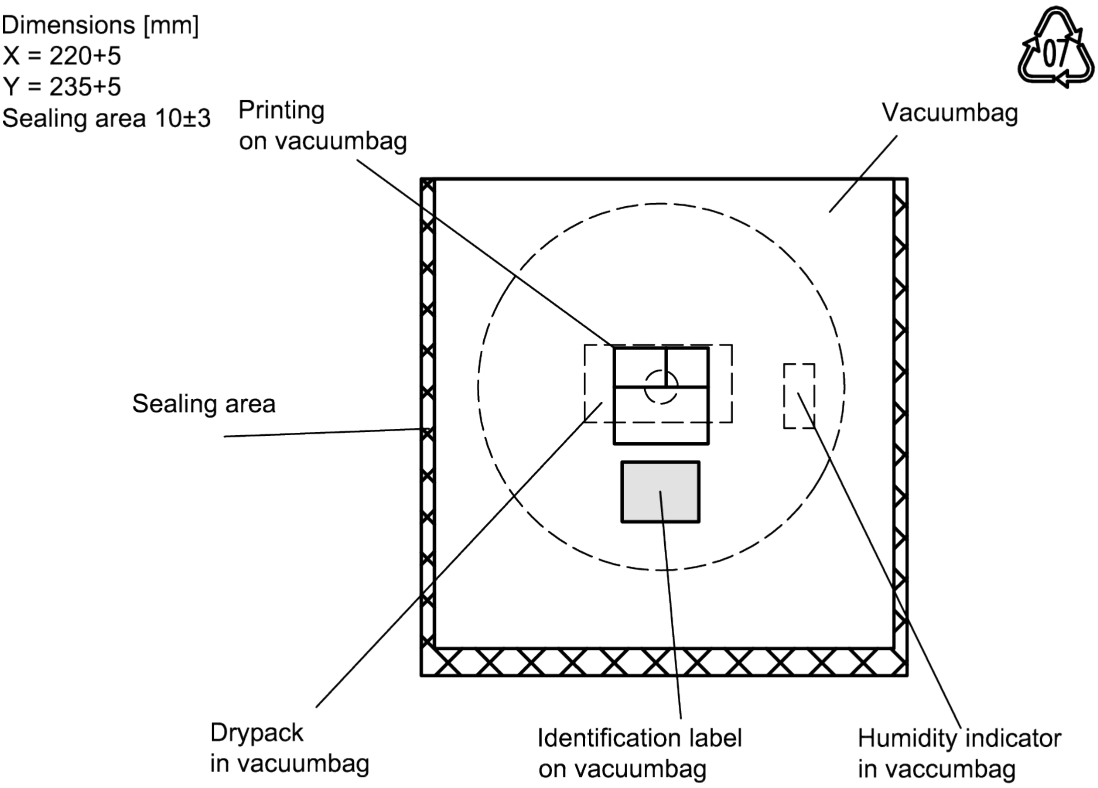

Figure 13: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

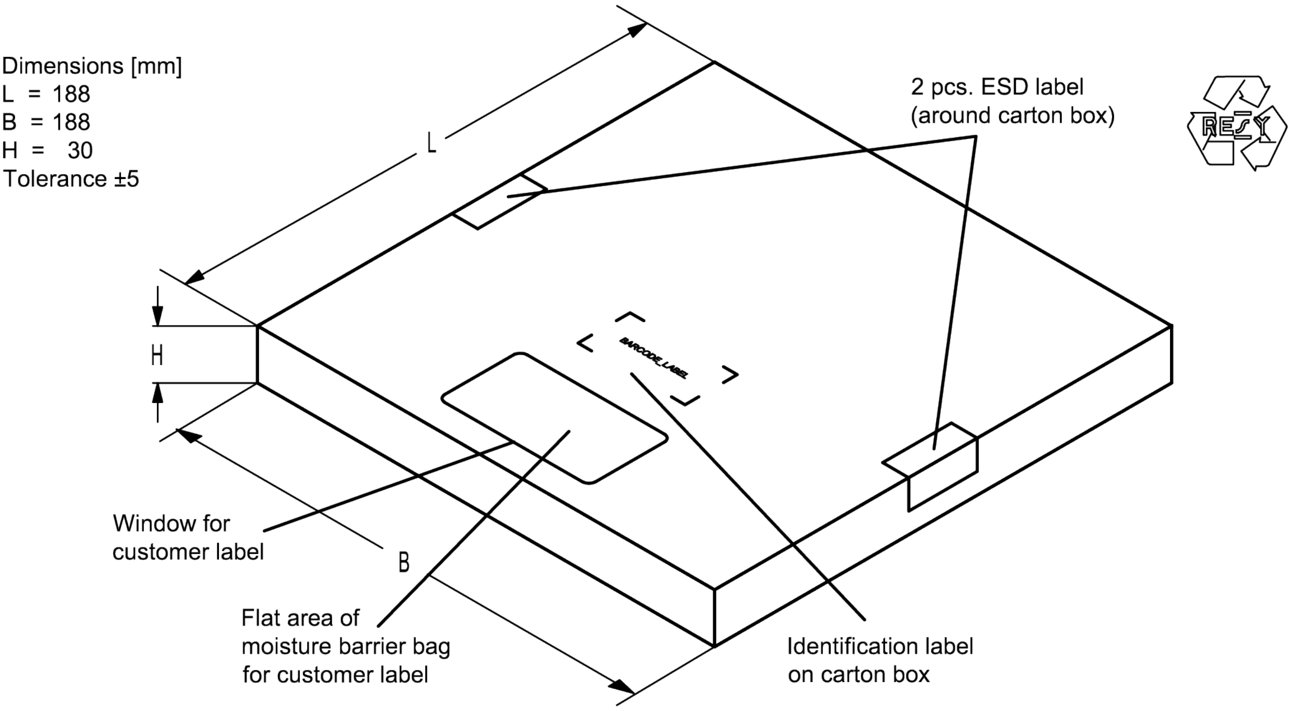

Figure 14: Drawing of folding box for reel with diameter of 180 mm.

11.3 Reel with diameter of 330 mm

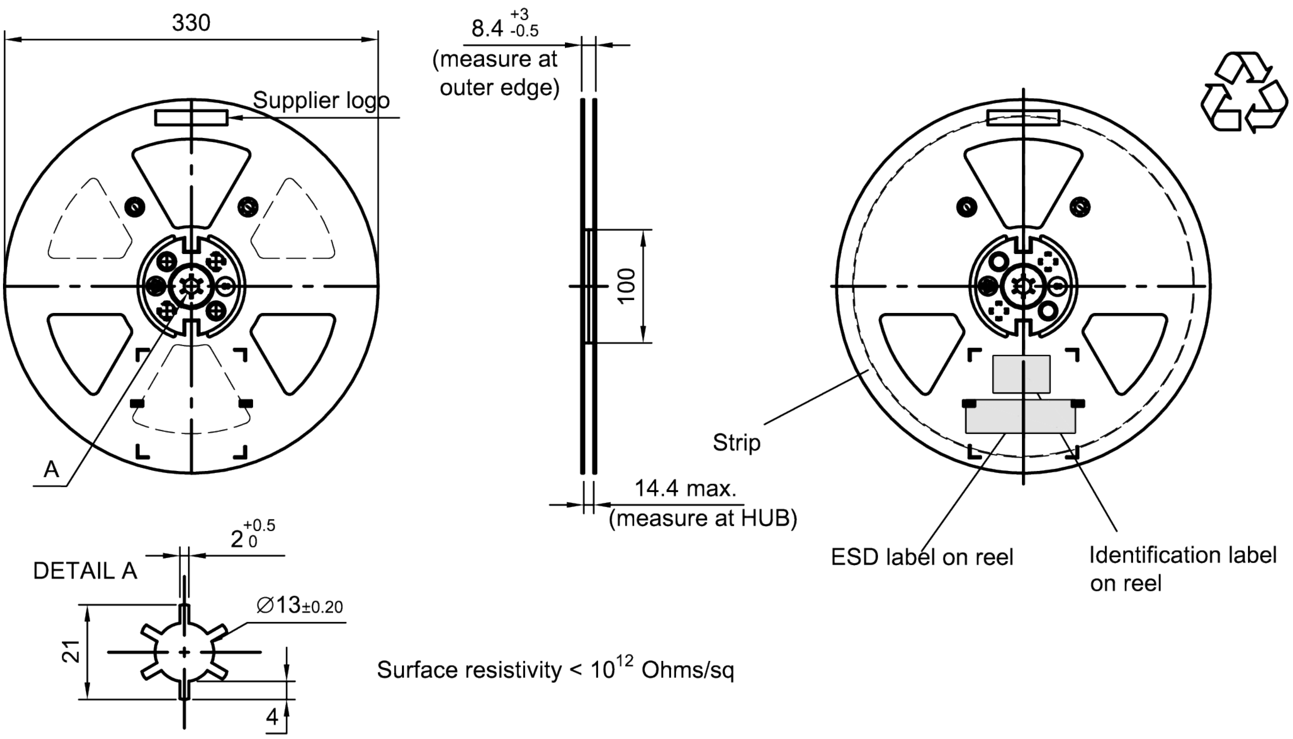

Figure 15: Drawing of reel (first-angle projection) with diameter of 330 mm.

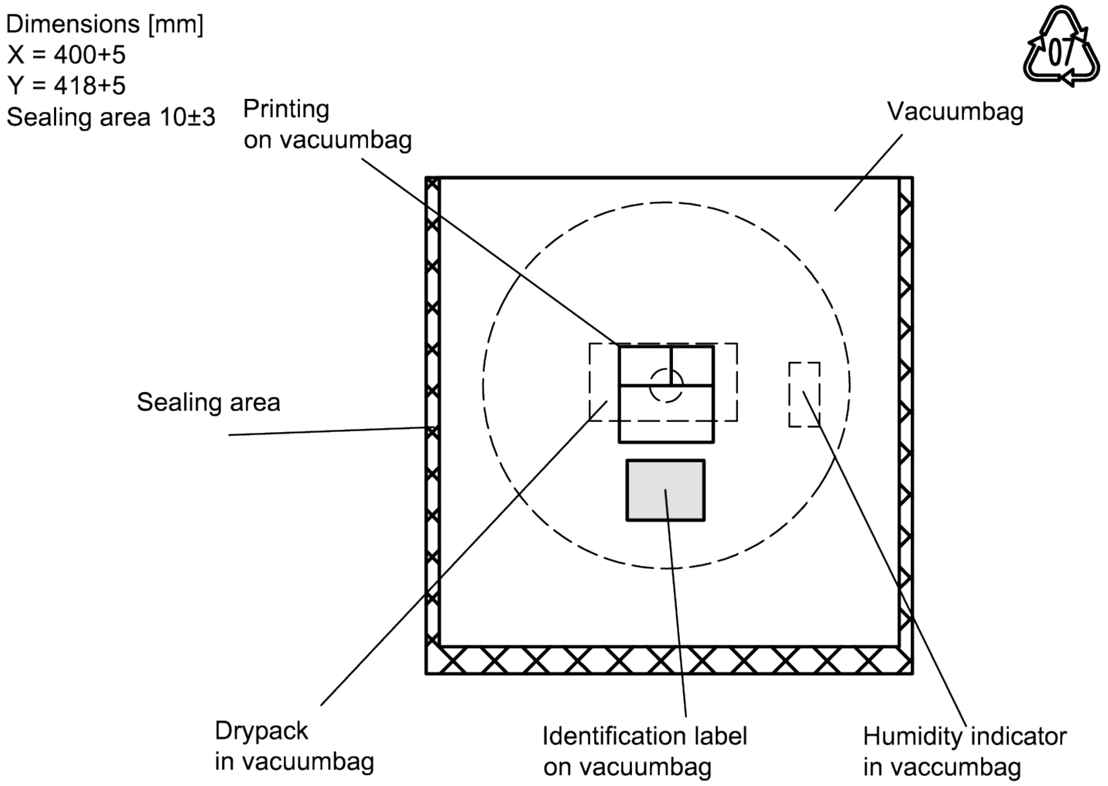

Figure 16: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

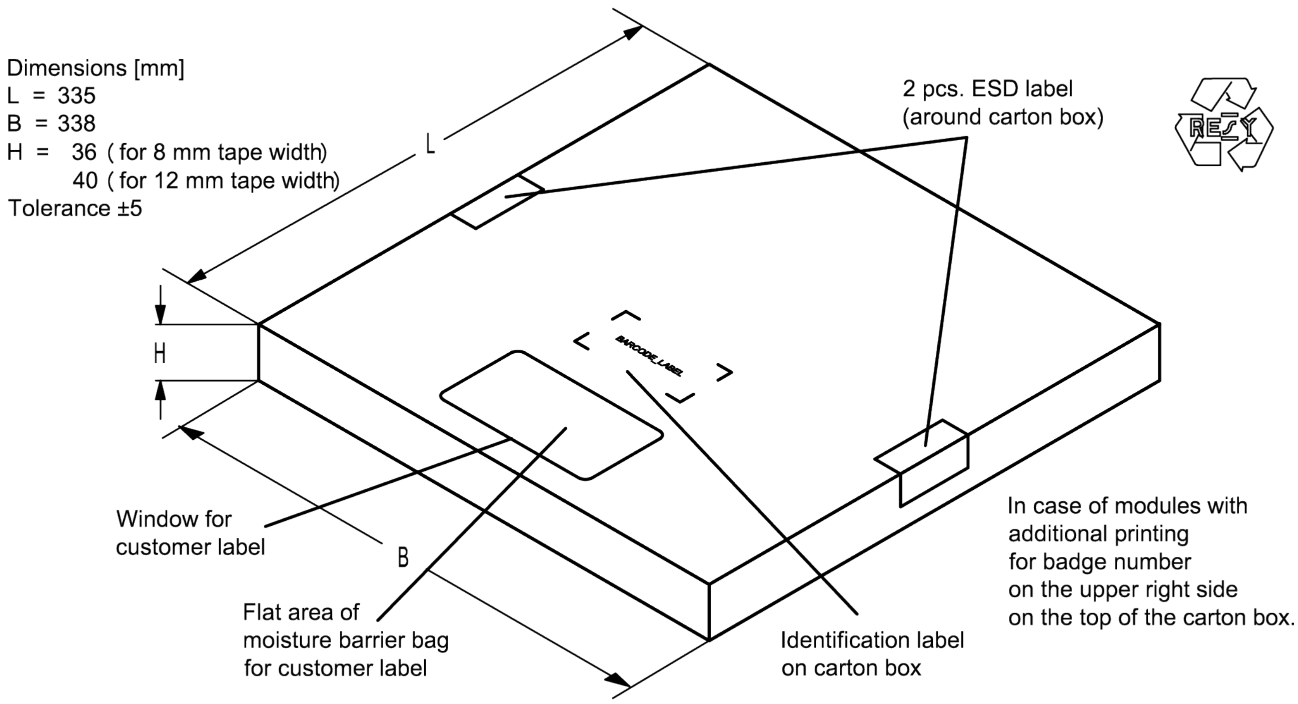

Figure 17: Drawing of folding box for reel with diameter of 330 mm.

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 B1299 is 18K.

- 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).

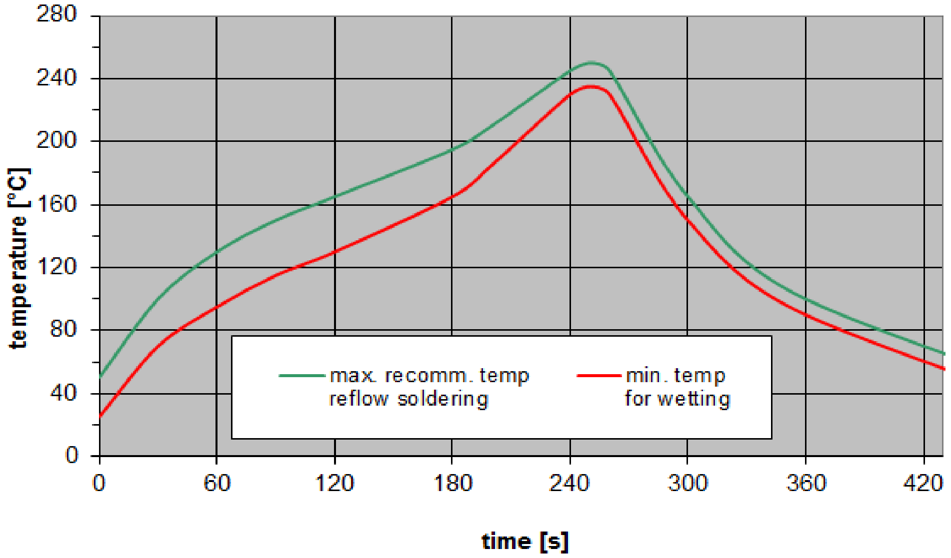

Figure 18: Recommended reflow profile for convection and infrared soldering – lead-free solder.

14 Annotations

14.1 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.

14.2 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.

14.3 Ordering codes / product IDs and packing units

Ordering code / product ID	RF360 label	Packing unit
B39781B1299L210S 5	B39781-B1299-L210-S05	5000 pcs

Table 4: Ordering codes / product IDs 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 https://rffe.qualcomm.com/.

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).

Projection method

Unless otherwise specified first-angle projection is applied.

16 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 (https://rffe.qualcomm.com). 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.