



**RF360
Europe GmbH**

SAW components

SAW duplexer

Small cell & femtocell
LTE band 1

Series/type: B8092

Ordering code: B39212B8092P810

Date: April 11, 2018

Version: 2.4

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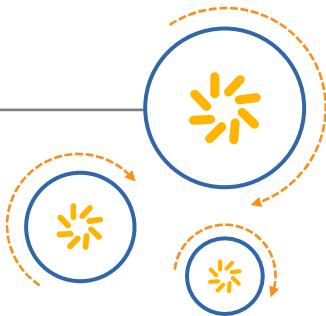
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A Qualcomm – TDK Joint Venture



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Data sheet

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1 Application

- Low-loss SAW duplexer for 3G/LTE small cell & femtocell systems (Band 1)
- Usable pass band 60 MHz
- DECT Europe rejection
- Rx = uplink = 1920 – 1980 MHz
- Tx = downlink = 2110 – 2170 MHz



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

2 Features

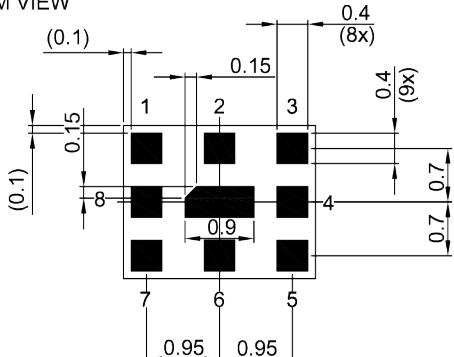
- Industrial grade qualified family
- Package size 2.5 ± 0.1 mm \times 2.0 ± 0.1 mm
- Package height 0.5 mm (max.)
- Approximate weight 0.01 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a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

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3 Package

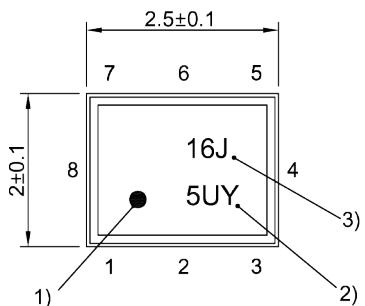
BOTTOM VIEW

Pad and pitch tolerance ± 0.05

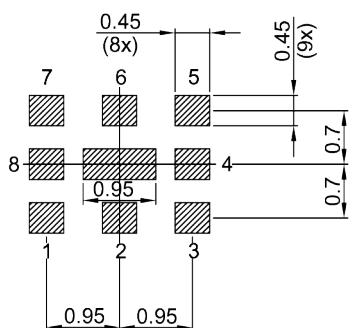
SIDE VIEW



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

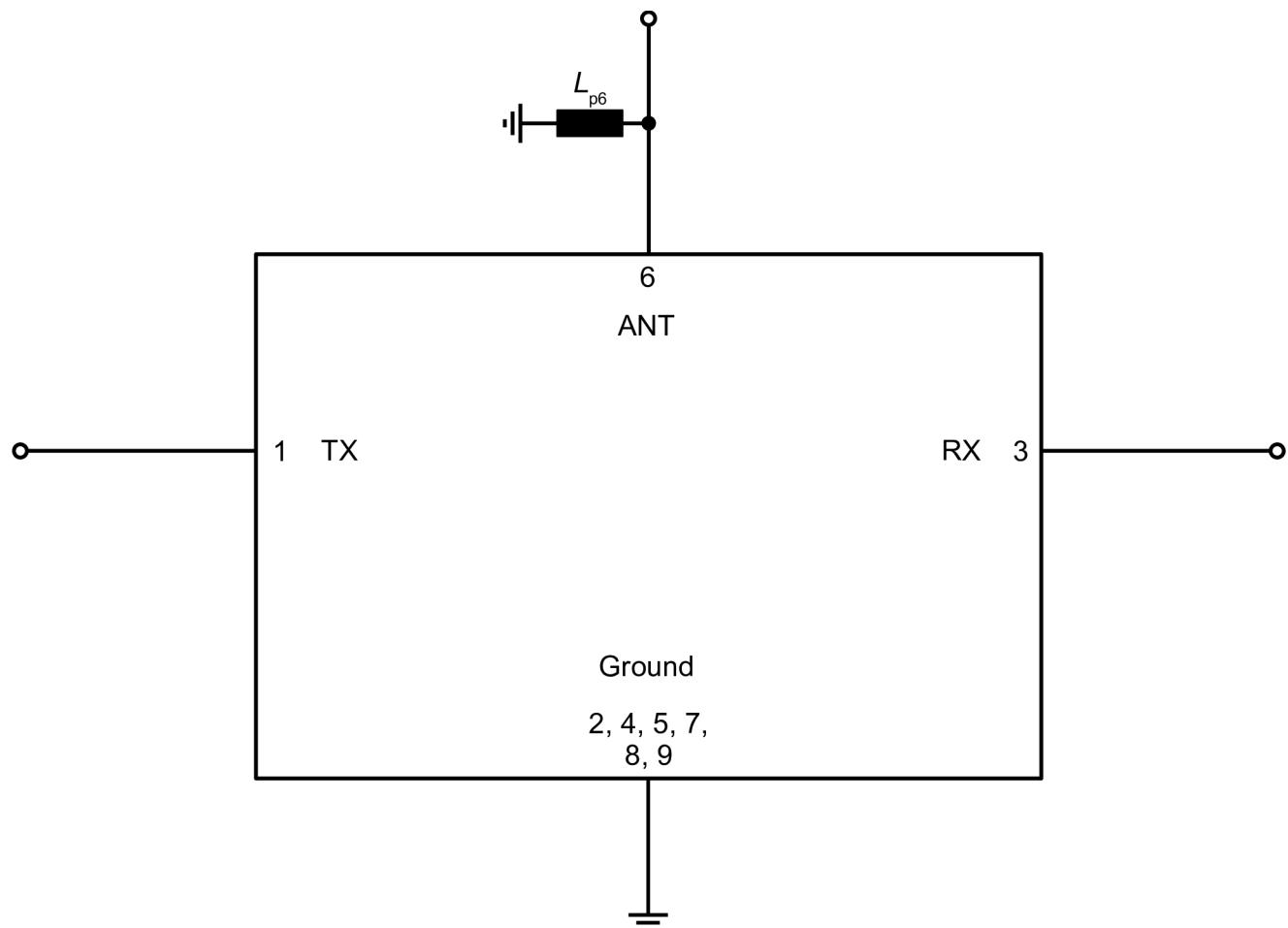
Landing pad tolerance -0.02

Figure 2: Drawing of package with package height A = 0.5 mm (max.). See Sec. Package information (p. 27).

4 Pin configuration

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

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5 Matching circuit■ $L_{p6} = 2.2 \text{ nH}$ **Figure 3:** Schematic of matching circuit.

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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. 2.2 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	—	2140	—	MHz	
Maximum insertion attenuation	α_{max}	—	2.0	2.5	dB	
Amplitude ripple (p-p)	$\Delta\alpha$	—	0.8	1.6	dB	
Maximum VSWR	VSWR_{max}	—	—	—	—	
@ TX port	2110... 2170	MHz	—	1.7	2.0	
@ ANT port	2110... 2170	MHz	—	1.5	2.0	
Maximum error vector magnitude	$\text{EVM}_{\text{max}}^{2)}$	—	0.5	1.5	%	
Minimum attenuation	α_{min}	—	—	—	—	
	10... 1574	MHz	30	34	—	dB
	843... 894	MHz	30	40	—	dB
	1574... 1606	MHz	30	34	—	dB
	1606... 1880	MHz	30	34	—	dB
	1805... 1880	MHz	30	40	—	dB
	1920... 1980	MHz	37	43	—	dB
	2250... 2400	MHz	30	48	—	dB
	2400... 2500	MHz	30	48	—	dB
	2500... 2700	MHz	30	37	—	dB
	2620... 2690	MHz	30	42	—	dB
	2700... 3000	MHz	30	37	—	dB
	3000... 3800	MHz	28	32	—	dB
	3800... 4220	MHz	15	20	—	dB
	4220... 4340	MHz	10	15	—	dB
	4340... 5000	MHz	7	18	—	dB
	5000... 6000	MHz	3	7	—	dB

¹⁾ See Sec. Matching circuit (p. 6).²⁾ Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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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. 2.2 nH¹⁾

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	—	2140	—	MHz
Maximum insertion attenuation		α_{max}	—	2.0	3.0	dB
2110... 2170	MHz		—			
Amplitude ripple (p-p)		$\Delta\alpha$	—	0.8	1.9	dB
2110... 2170	MHz		—			
Maximum VSWR		VSWR_{max}	—			
@ TX port	2110... 2170	MHz	—	1.7	2.2	
@ ANT port	2110... 2170	MHz	—	1.5	2.2	
Minimum attenuation		α_{min}	—			
10... 1574	MHz	30	34	—	—	dB
843... 894	MHz	30	40	—	—	dB
1574... 1606	MHz	30	34	—	—	dB
1606... 1880	MHz	30	34	—	—	dB
1805... 1880	MHz	30	40	—	—	dB
1920... 1980	MHz	37	43	—	—	dB
2250... 2400	MHz	30	48	—	—	dB
2400... 2500	MHz	30	48	—	—	dB
2500... 2700	MHz	30	37	—	—	dB
2620... 2690	MHz	30	42	—	—	dB
2700... 3000	MHz	30	37	—	—	dB
3000... 3800	MHz	28	32	—	—	dB
3800... 4220	MHz	15	20	—	—	dB
4220... 4340	MHz	10	15	—	—	dB
4340... 5000	MHz	7	18	—	—	dB
5000... 6000	MHz	3	7	—	—	dB

¹⁾ See Sec. Matching circuit (p. 6).

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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. 2.2 nH¹⁾

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	—	1950	—	MHz
Maximum insertion attenuation		α_{max}	—	2.3	3.7	dB
Amplitude ripple (p-p)	1920 ... 1980	MHz	$\Delta\alpha$	0.9	2.2	dB
Maximum VSWR	1920 ... 1980	MHz	VSWR_{max}	—	—	
@ ANT port	1920 ... 1980	MHz	—	1.9	2.2	
@ RX port	1920 ... 1980	MHz	—	2.0	2.3	
Maximum error vector magnitude		$\text{EVM}_{\text{max}}^{2)}$	—	1.5	3.0	%
Minimum attenuation		α_{min}	—	—	—	
	10 ... 1785	MHz	30	36	—	dB
	1785 ... 1880	MHz	20	31	—	dB
	1880 ... 1900	MHz	5	15	—	dB
	2000 ... 2110	MHz	2.5	12	—	dB
	2110 ... 2170	MHz	43	48	—	dB
	2255 ... 2400	MHz	30	33	—	dB
	2400 ... 2500	MHz	25	30	—	dB
	2500 ... 3840	MHz	15	20	—	dB
	3840 ... 3960	MHz	20	24	—	dB
	3960 ... 5000	MHz	20	25	—	dB
	5000 ... 5760	MHz	15	30	—	dB
	5760 ... 5940	MHz	15	30	—	dB

¹⁾ See Sec. Matching circuit (p. 6).²⁾ Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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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. 2.2 nH¹⁾

RX terminating impedance

 Z_{RX} = 50 Ω

Characteristics ANT – RX			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Maximum insertion attenuation		α_{max}	—	2.3	5.2	dB
	1920... 1980	MHz				
Amplitude ripple (p-p)		$\Delta\alpha$	—	0.9	3.7	dB
	1920... 1980	MHz				
Maximum VSWR		VSWR_{max}				
@ ANT port	1920... 1980	MHz	—	1.9	2.3	
@ RX port	1920... 1980	MHz	—	2.0	2.3	
Maximum error vector magnitude		$\text{EVM}_{\text{max}}^{2)}$	—	1.5	6.0	%
	1922.5... 1977.5	MHz				
Minimum attenuation		α_{min}				
	10... 1785	MHz	30	36	—	dB
	1785... 1880	MHz	20	31	—	dB
	1880... 1900	MHz	3	15	—	dB
	2000... 2110	MHz	2	12	—	dB
	2110... 2170	MHz	43	48	—	dB
	2255... 2400	MHz	30	33	—	dB
	2400... 2500	MHz	25	30	—	dB
	2500... 3840	MHz	15	20	—	dB
	3840... 3960	MHz	20	24	—	dB
	3960... 5000	MHz	20	25	—	dB
	5000... 5760	MHz	15	30	—	dB
	5760... 5940	MHz	15	30	—	dB

¹⁾ See Sec. Matching circuit (p. 6).²⁾ Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

6.3 TX – RX

Temperature range for specification

$$T_{\text{SPEC}} = -10 \text{ }^{\circ}\text{C} \dots +85 \text{ }^{\circ}\text{C}$$

TX terminating impedance

$$Z_{\text{tx}} = 50 \Omega$$

ANT terminating impedance

$Z_{\text{ANT}} = 50 \Omega$ with par. $2.2 \text{ nH}^1)$

RX terminating impedance

$$Z_{\text{BY}} = 50 \Omega$$

Characteristics TX – RX	min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}
Average isolation	$\alpha_{\text{INT,avg}}^{2)}$		
	1920 ... 1960 MHz	45	48
	1960 ... 1980 MHz	42	48
	2110 ... 2155 MHz	50	52
Minimum isolation	α_{min}		
	1920 ... 1980 MHz	42	48
	2110 ... 2170 MHz	47	52

1) See Sec. Matching circuit (p. 6).

2) Integrated attenuation α_{int} : Averaged power $|\mathbf{S}_{ii}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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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. 2.2 nH¹⁾

RX terminating impedance

 Z_{RX} = 50 Ω

Characteristics TX – RX		min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Average isolation	$\alpha_{\text{INT,avg}}^{2)}$				
1920... 1960	MHz	45	48	—	dB
1960... 1980	MHz	42	48	—	dB
2110... 2155	MHz	50	52	—	dB
2155... 2170	MHz	48	52	—	dB
Minimum isolation	α_{min}				
1920... 1980	MHz	42	48	—	dB
2110... 2170	MHz	47	52	—	dB

¹⁾ See Sec. Matching circuit (p. 6).²⁾ Integrated attenuation α_{INT} : Integrated power $|\mathbf{S}_{ij}|^2$ over the center 4.5 MHz of LTE 5 MHz (25 RB) channels.

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7 Maximum ratings

Operable temperature	$T_{OP} = -40 \text{ }^{\circ}\text{C} \dots +95 \text{ }^{\circ}\text{C}$	
Storage temperature	$T_{STG}^{1)} = -40 \text{ }^{\circ}\text{C} \dots +95 \text{ }^{\circ}\text{C}$	
DC voltage	$ V_{DC} ^{2)} = 0 \text{ V}$	
ESD voltage		
	$V_{ESD}^{3)} = 50 \text{ V}$	Machine model.
	$V_{ESD}^{4)} = 100 \text{ V}$	Human body model.
Input power	P_{IN}	
@ TX port: 2110 ... 2170 MHz	28 dBm ^{5), 6)}	5 MHz LTE downlink signal (25 RB) for 100000 h @ 55 °C. P_{IN} average – 39 dBm peak. Source and load impedance 50Ω.
@ TX port: other frequency ranges	10 dBm	Source and load impedance 50Ω.
Operating lifetime with output power at antenna 2110 ... 2170 MHz	$P_{OUT}^{7)} = 24 \text{ dBm}$	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.

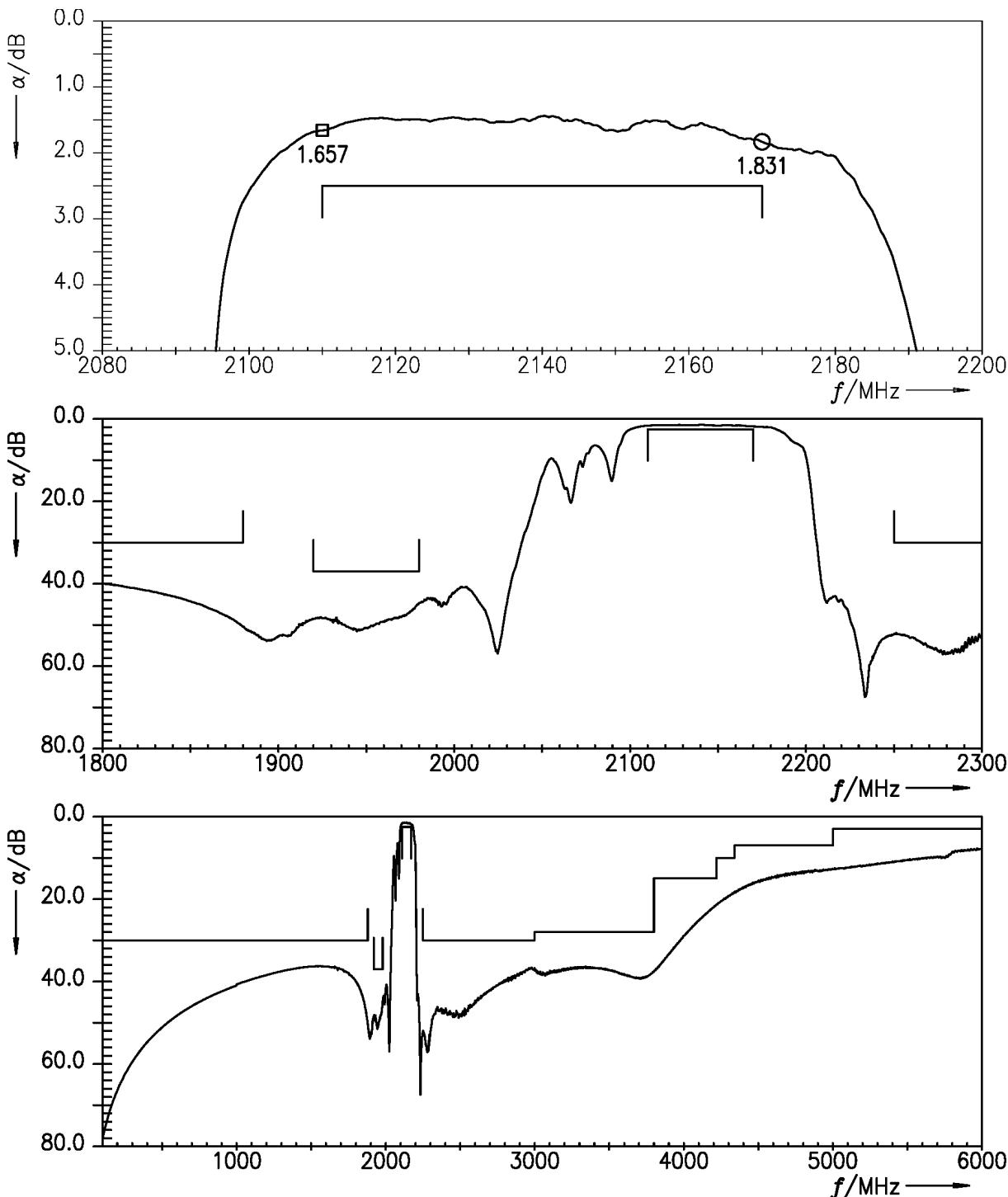
⁴⁾ According to JESD22-A114F (HBM – Human Body Model), 1 negative & 1 positive pulse.

⁵⁾ Expected lifetime according to accelerated power durability tests, 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 28dBm are valid for temperature up to 57°C.

⁷⁾ According to accelerated high temperature operating life (HTOL) test.

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8 Transmission coefficients**8.1 TX – ANT****Figure 4:** Attenuation TX – ANT.

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8.2 ANT - RX

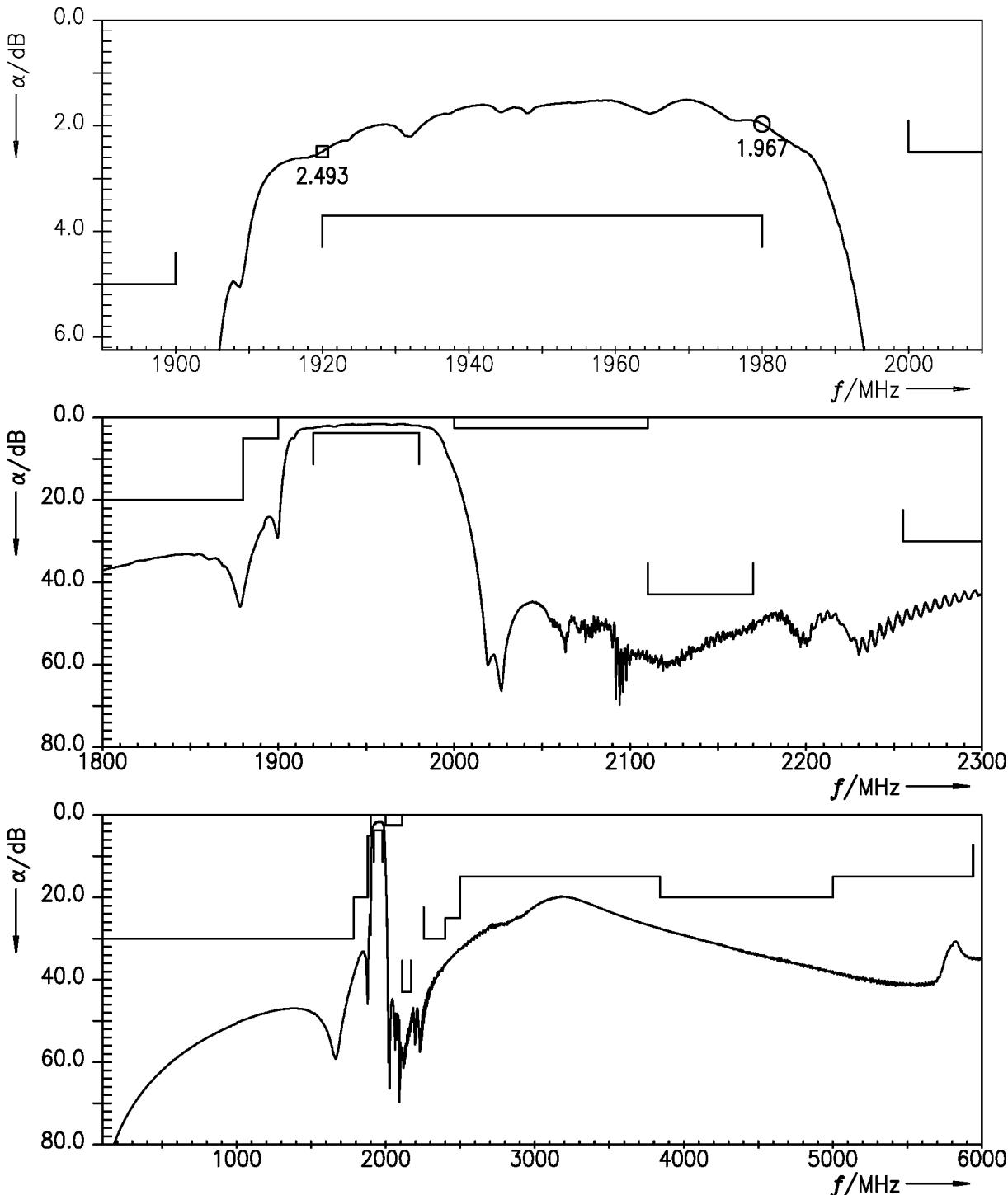


Figure 5: Attenuation ANT - RX.

Data sheet

8.3 TX – RX

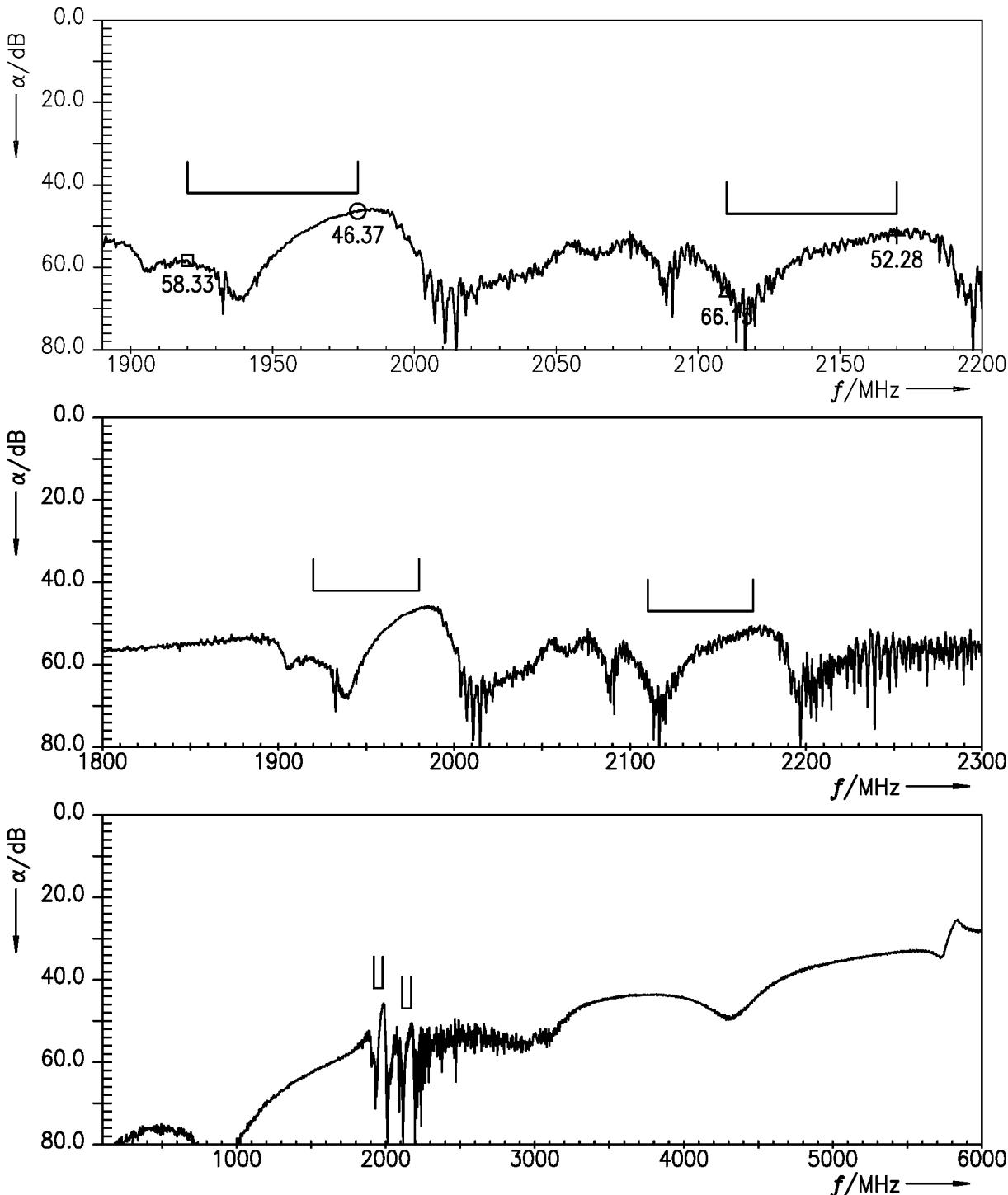


Figure 6: Isolation TX – RX.

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9 Reflection coefficients

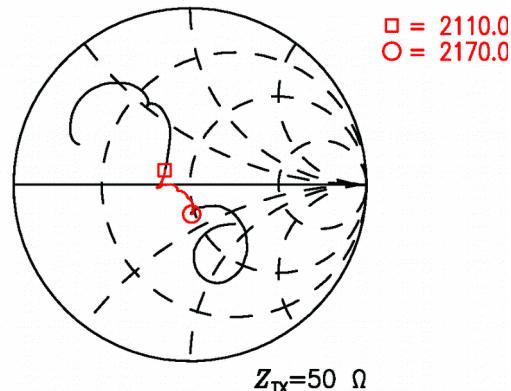
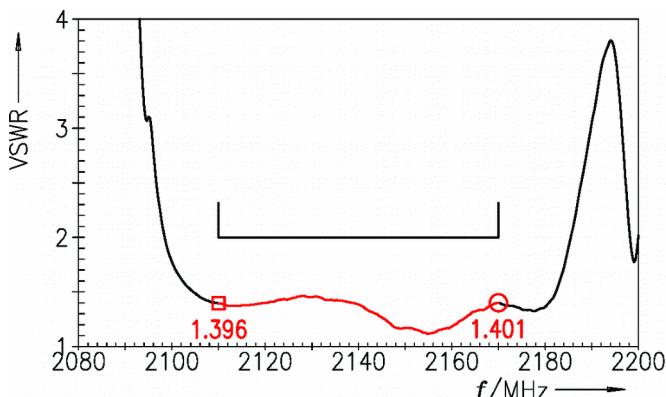


Figure 7: Reflection coefficient at TX port.

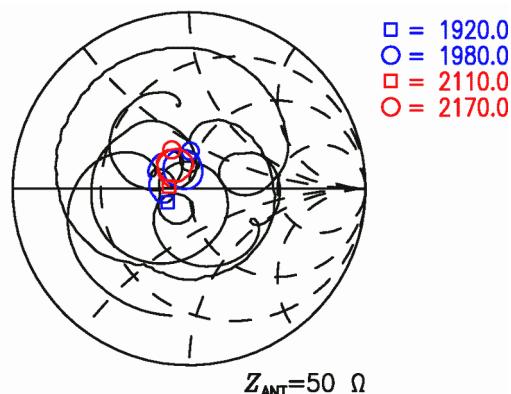
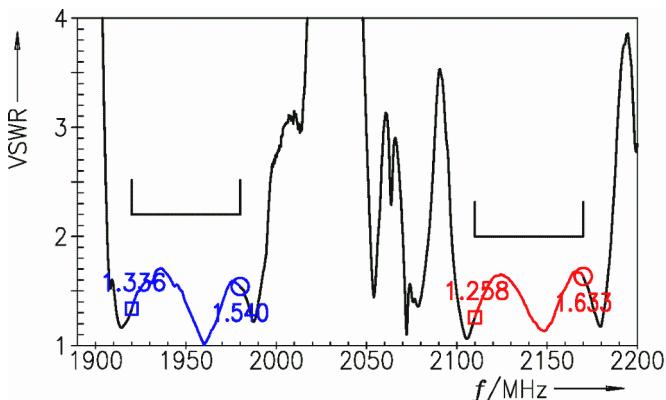


Figure 8: Reflection coefficient at ANT port.

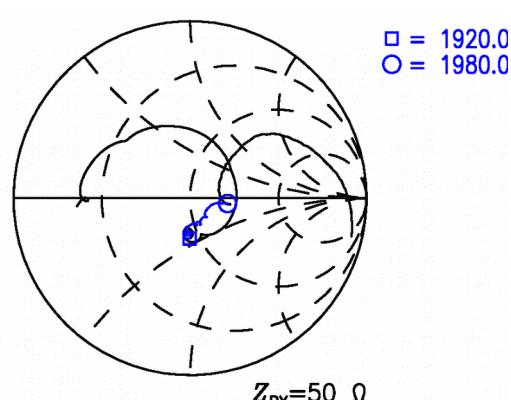
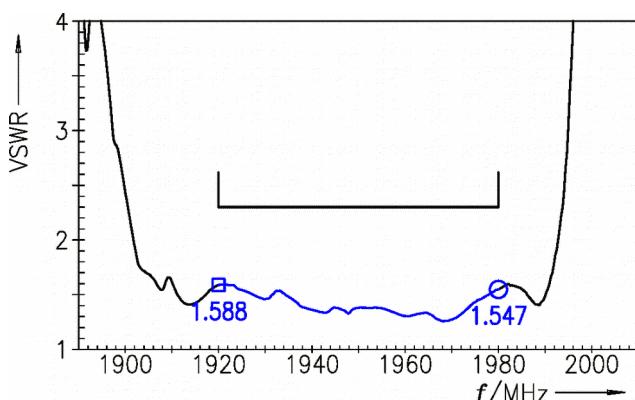
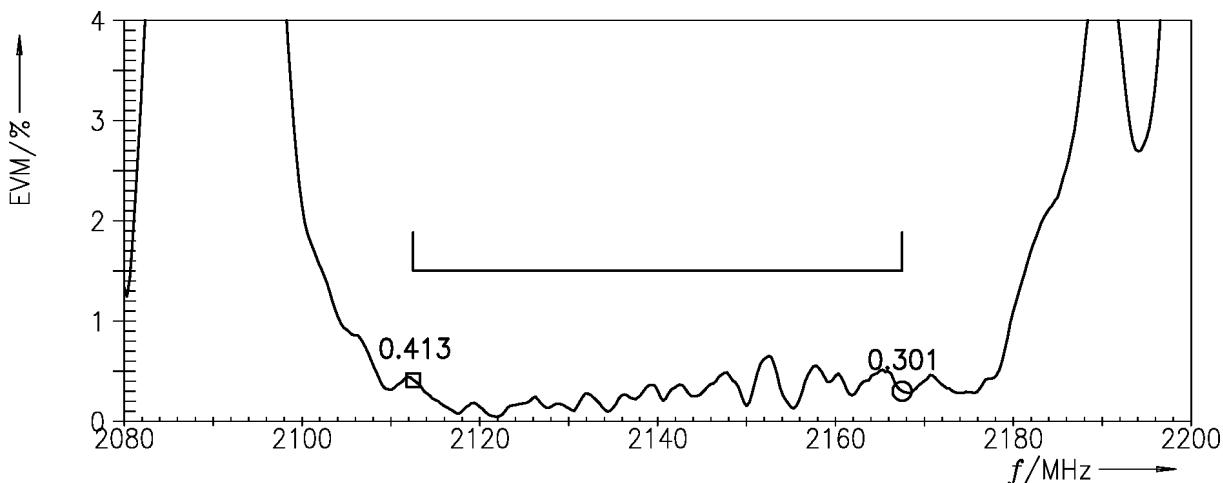
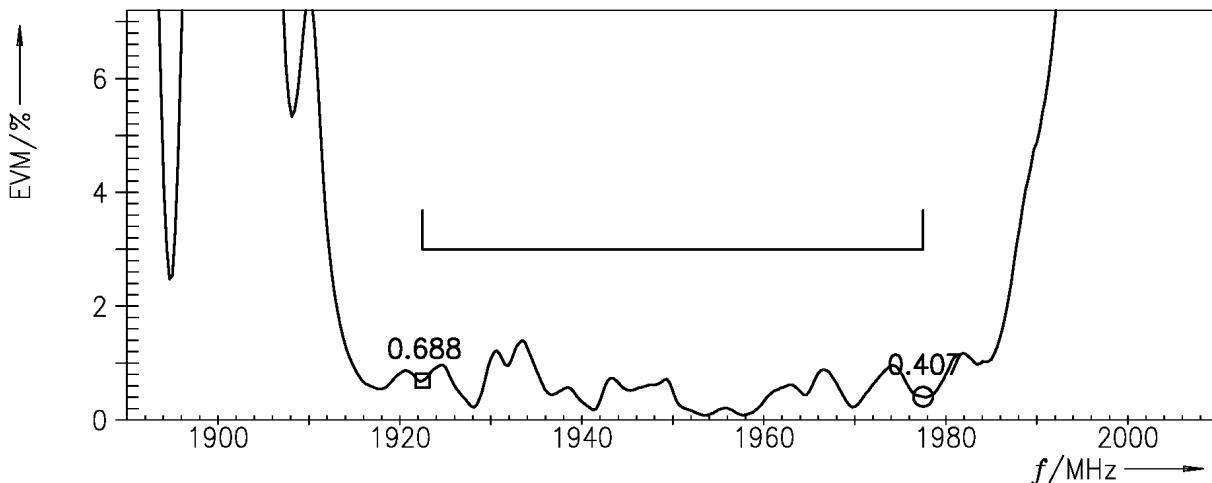


Figure 9: Reflection coefficient at RX port.

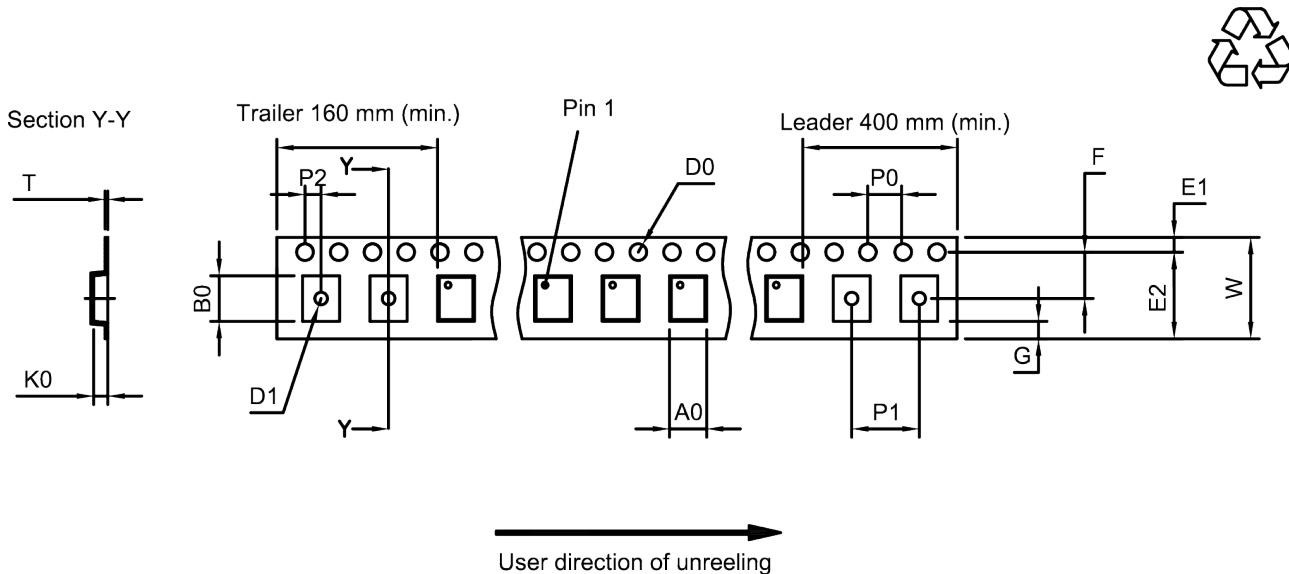
Data sheet

10 EVMs**10.1 TX – ANT****Figure 10:** Error vector magnitude TX – ANT.

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10.2 ANT – RX**Figure 11:** Error vector magnitude ANT – RX.

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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 _{±0.05} mm
B ₀	2.75 _{±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.

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11.2 Reel with diameter of 180 mm

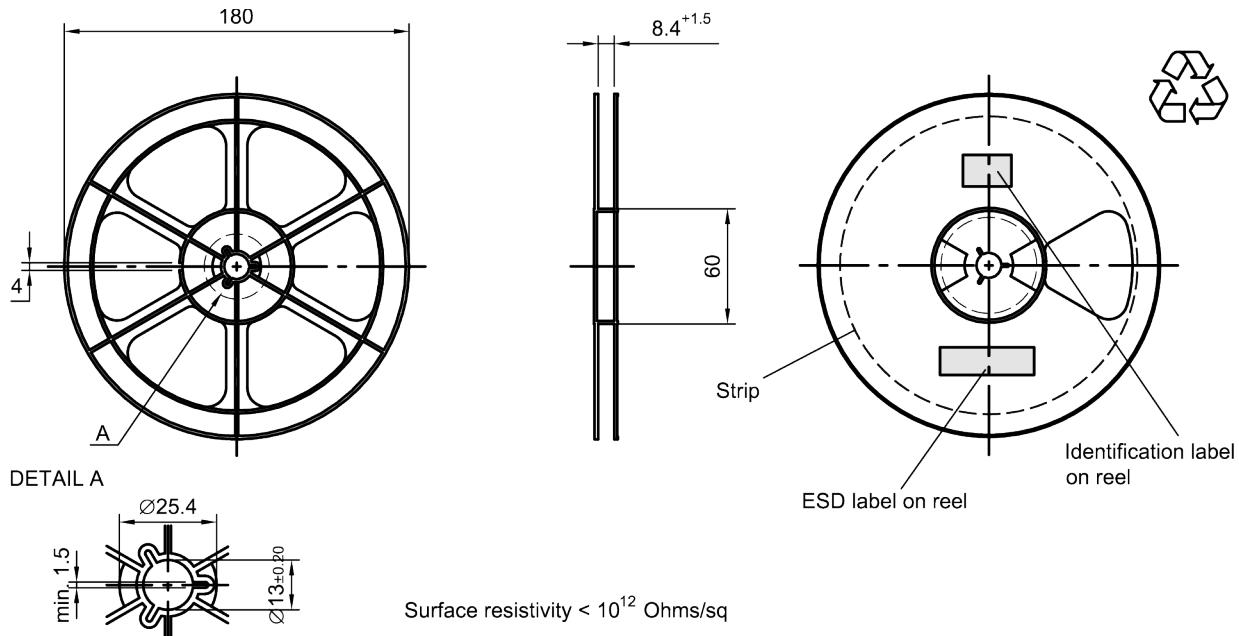


Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

Printing on vacuumbag

Sealing area

Drypack in vacuumbag

Vacuumbag

Identification label on vacuumbag

Humidity indicator in vacuumbag



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

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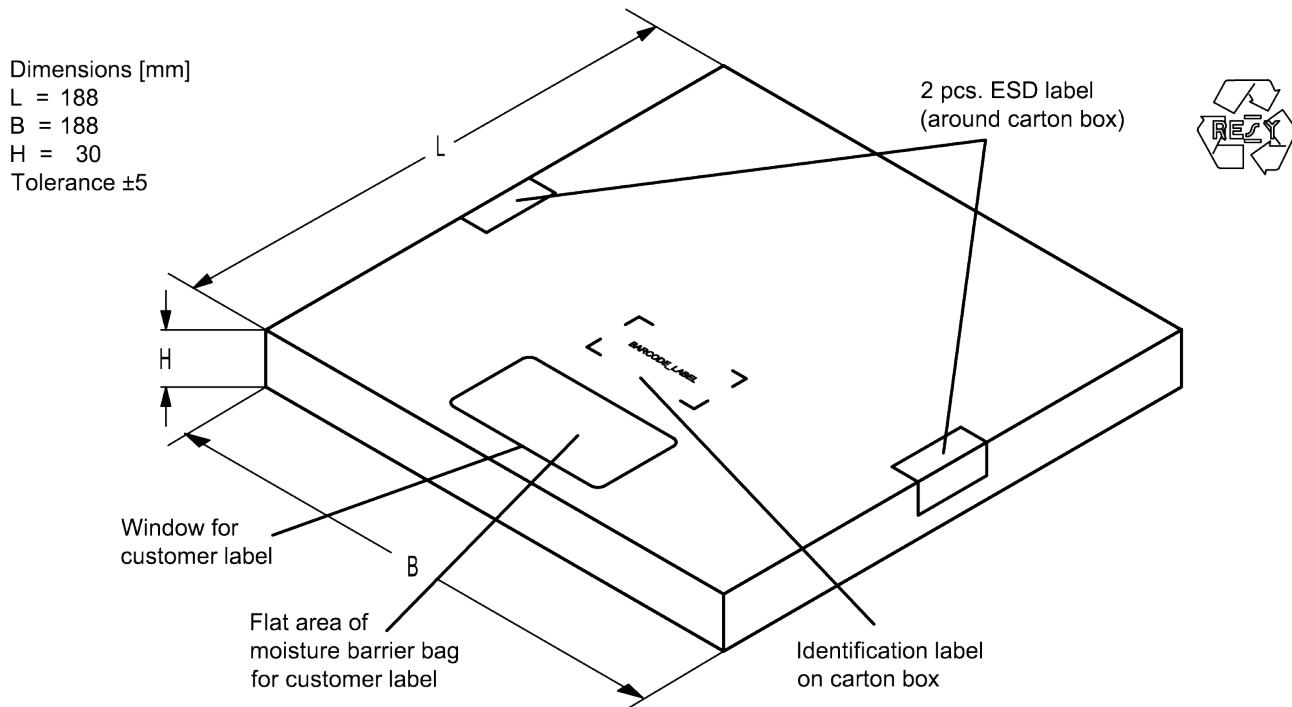


Figure 15: Drawing of folding box for reel with diameter of 180 mm.

11.3 Reel with diameter of 330 mm

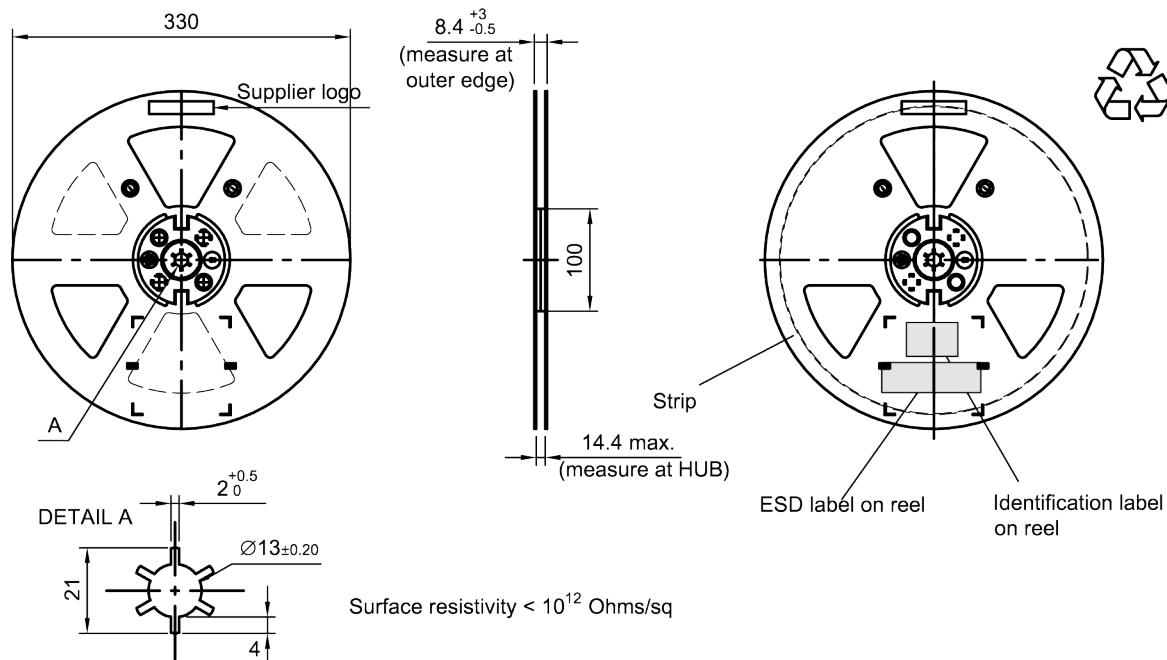


Figure 16: Drawing of reel (first-angle projection) with diameter of 330 mm.

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Dimensions [mm]

X = 400+5

Y = 418+5

Sealing area 10±3 Printing on vacumbag

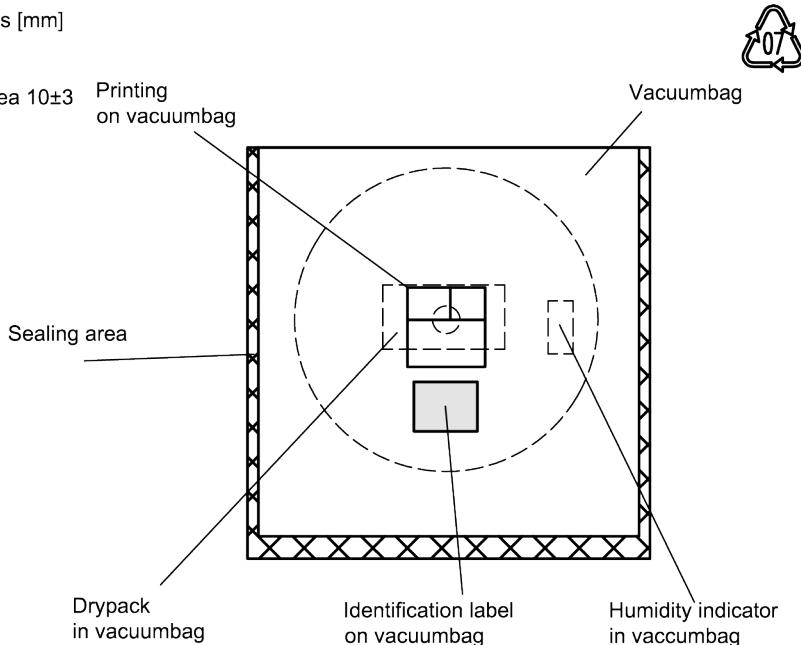


Figure 17: Drawing of moisture barrier bag (MBB) for reel with diameter of 330 mm.

Dimensions [mm]

L = 335

B = 338

H = 36 (for 8 mm tape width)
40 (for 12 mm tape width)

Tolerance ±5

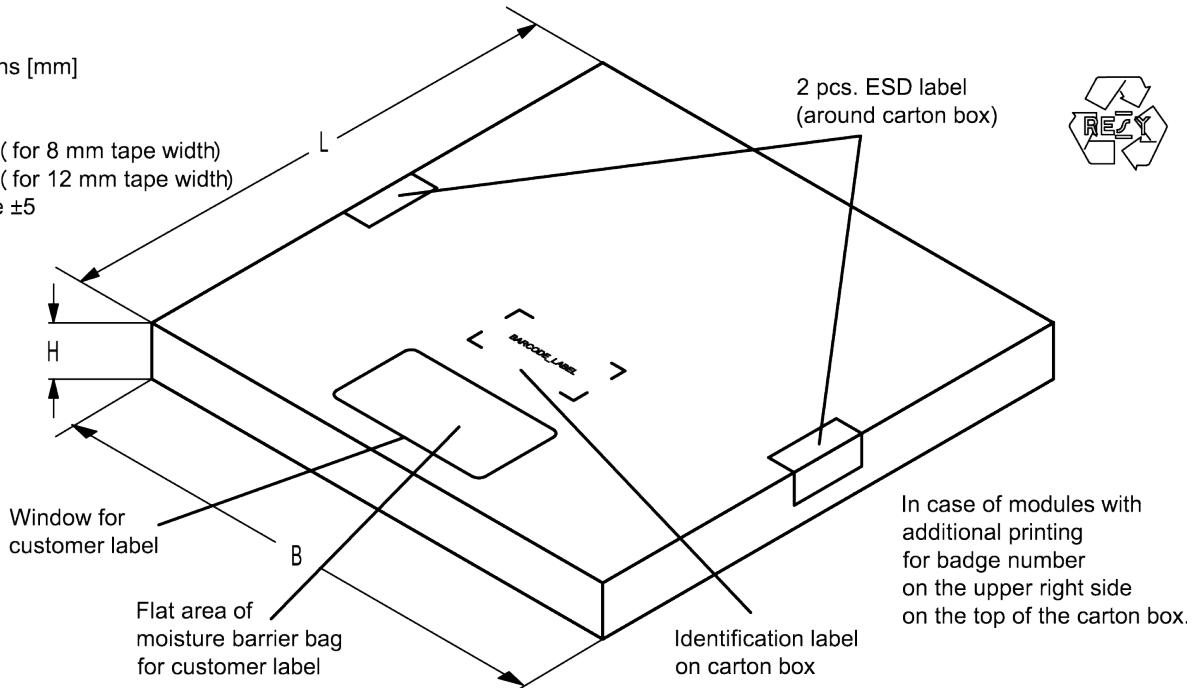


Figure 18: Drawing of folding box for reel with diameter of 330 mm.

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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, is encoded by a special BASE32 code into a 3 digit marking.

e.g., B3xxxxB1234xxxx,

Example of decoding type number marking on device in decimal code.

16J => **1234**
 $1 \times 32^2 + 6 \times 32^1 + 18 \text{ (=J)} \times 32^0$ = **1234**

The BASE32 code for product type B8092 is 7WW.

■ Lot number:

The last 5 digits of the lot number, are encoded based on a special BASE47 code into a 3 digit marking.

e.g., **12345**,

Example of decoding lot number marking on device in decimal code.

5UY => **12345**
 $5 \times 47^2 + 27 \text{ (=U)} \times 47^1 + 31 \text{ (=Y)} \times 47^0$ = **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.

Data sheet

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	$\leq 3 \text{ K/s}$
preheat	125 °C to 220 °C, 150 s to 210 s, 0.4 K/s to 1.0 K/s
$T > 220 \text{ }^{\circ}\text{C}$	30 s to 70 s
$T > 230 \text{ }^{\circ}\text{C}$	min. 10 s
$T > 245 \text{ }^{\circ}\text{C}$	max. 20 s
$T \geq 255 \text{ }^{\circ}\text{C}$	–
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	$\leq 3 \text{ K/s}$
soldering temperature T	measured at solder pads

Table 3: Characteristics of recommended soldering profile for lead-free solder (Sn95.5Ag3.8Cu0.7).

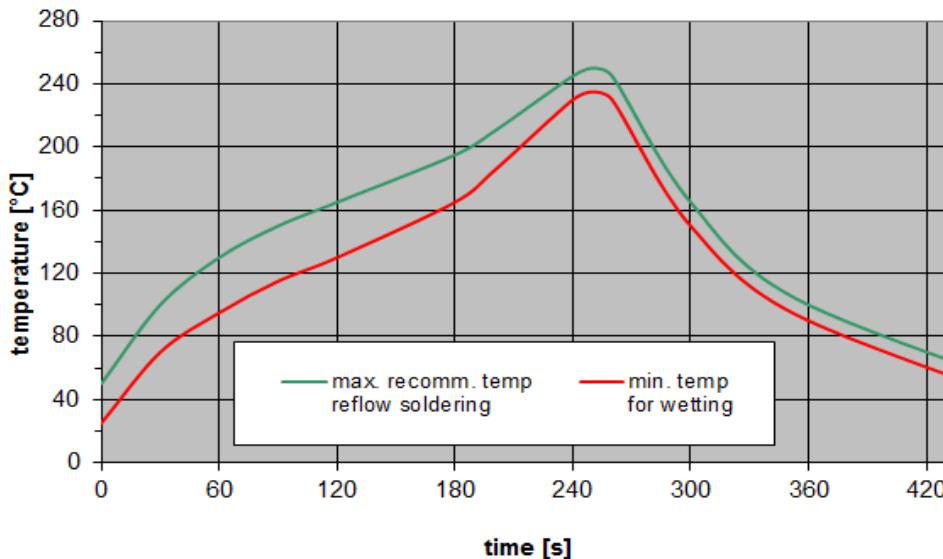


Figure 19: Recommended reflow profile for convection and infrared soldering – lead-free solder.

SAW components	B8092
SAW duplexer	1950 / 2140 MHz

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 RF360 sales office.

14.4 Ordering codes and packing units

Ordering code	Packing unit
B39212B8092P810	5000 pcs

Table 4: Ordering codes and packing units.

SAW components	B8092
SAW duplexer	1950 / 2140 MHz

Data sheet

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:

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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.
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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