



RF360
Europe GmbH

SAW components

SAW duplexer

Automotive telematics
LTE band 12

Series/type: B4423
Ordering code: B39741B4423P810

Date: January 05, 2017
Version: 2.0

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Data sheet

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Data sheet

1 Application

- Low-loss SAW duplexer for LTE Band 12 systems
- Low insertion attenuation
- Low amplitude ripple
- Usable pass band 17 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)

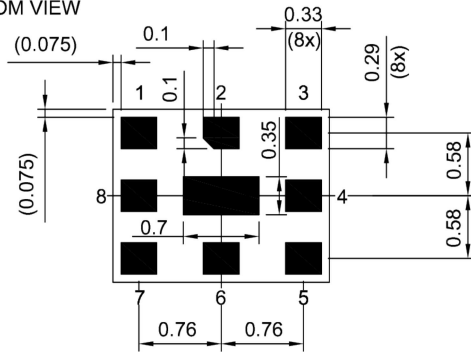


Figure 1: Picture of component with example of product marking.

Data sheet

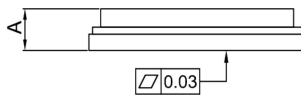
3 Package

BOTTOM VIEW

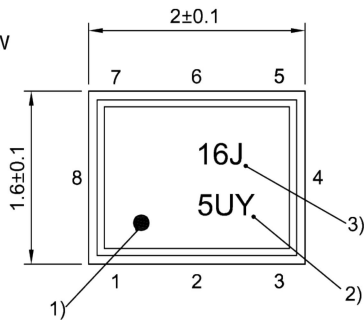


Pad and pitch tolerance ±0.05

SIDE VIEW

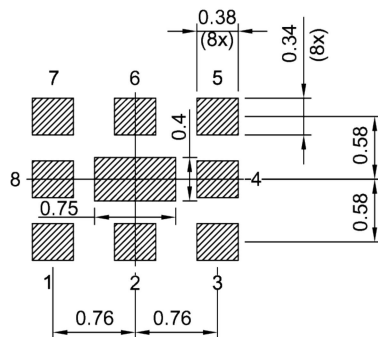


TOP VIEW



- 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

4 Pin configuration

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

Figure 2: Drawing of package with package height A = 0.45 mm (max.). See Sec. Package information (p. 20).

Data sheet

5 Matching circuit

■ $L_{p6} = 12 \text{ nH}$

■ $L_{s3} = 4.3 \text{ nH}$

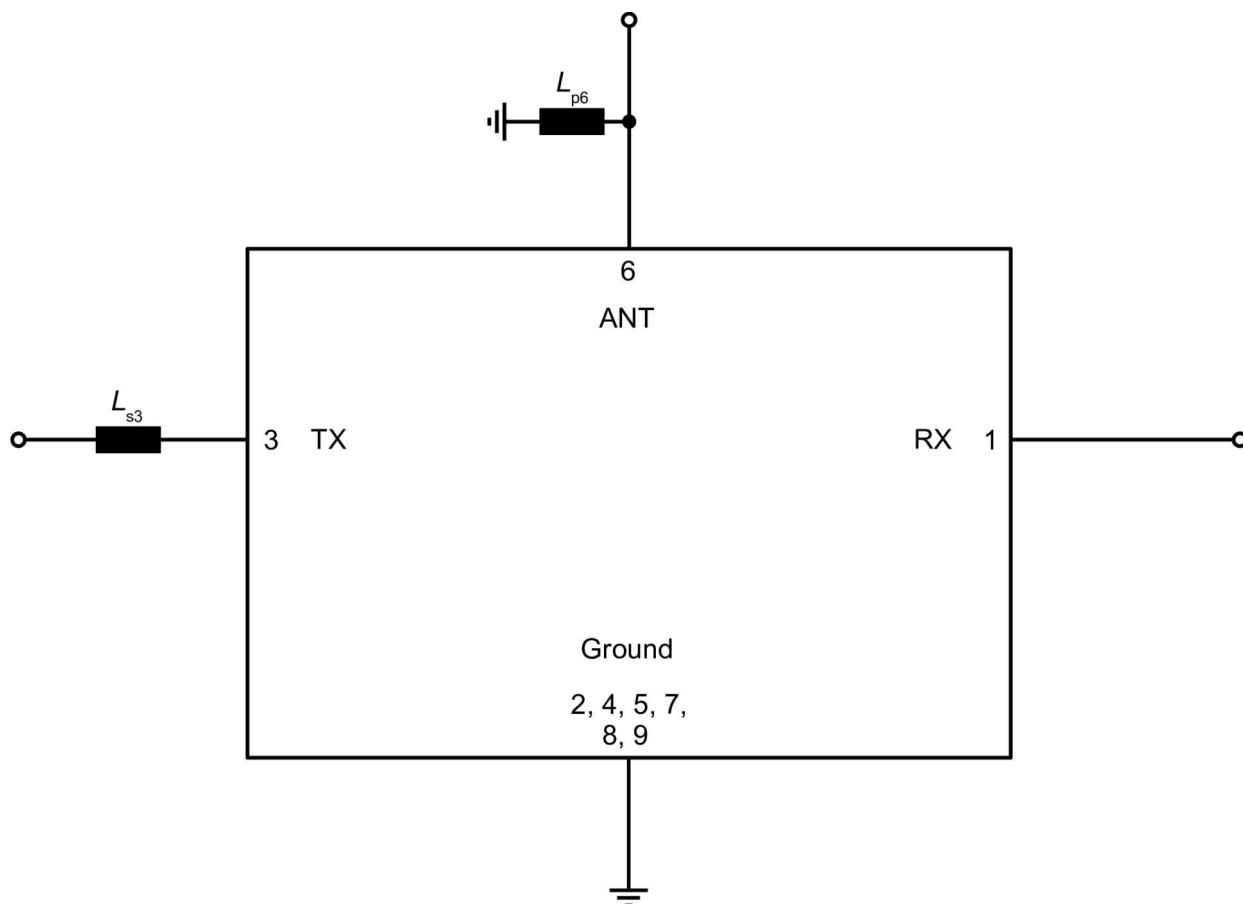


Figure 3: Schematic of matching circuit.

Data sheet

6 Characteristics

6.1 TX – ANT

Temperature range for specification

$$T_{\text{SPEC}} = -20\text{ °C} \dots +85\text{ °C}$$

TX terminating impedance

$$Z_{\text{TX}} = 50\ \Omega \text{ with ser. } 4.3\ \text{nH}^{1)}$$

ANT terminating impedance

$$Z_{\text{ANT}} = 50\ \Omega \text{ with par. } 12\ \text{nH}^{1)}$$

RX terminating impedance

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

Characteristics TX – ANT				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency			f_c	—	707.5	—	MHz
	699.24 ... 715.76	MHz					
Maximum insertion attenuation			α_{max}	—	1.9	2.8	dB
	699.24 ... 715.76	MHz					
Amplitude ripple (p-p)			$\Delta\alpha$	—	0.7	1.7	dB
	699.24 ... 715.76	MHz					
Maximum VSWR			VSWR _{max}				
@ TX port	699 ... 716	MHz		—	1.4	2.0	
@ ANT port	699 ... 716	MHz		—	1.4	2.0	
Minimum attenuation							
	50 ... 650	MHz	α_{min}	33	36	—	dB
	650 ... 686	MHz	α_{min}	34	38	—	dB
	722 ... 728	MHz	$\alpha_{\text{INT,min}}^{2)}$	8	21	—	dB
	729 ... 746	MHz	α_{min}	45	60	—	dB
	746 ... 768	MHz	α_{min}	35	40	—	dB
	768 ... 805	MHz	α_{min}	35	39	—	dB
	824 ... 849	MHz	α_{min}	35	37	—	dB
	869 ... 894	MHz	α_{min}	35	37	—	dB
	1398 ... 1432	MHz	α_{min}	40	44	—	dB
	1559 ... 1607	MHz	α_{min}	42	48	—	dB
	1710 ... 1755	MHz	α_{min}	45	52	—	dB
	1805 ... 1880	MHz	α_{min}	47	54	—	dB
	1930 ... 1990	MHz	α_{min}	48	53	—	dB
	2097 ... 2155	MHz	α_{min}	45	51	—	dB
	2155 ... 2170	MHz	α_{min}	45	51	—	dB
	2400 ... 2484	MHz	α_{min}	44	48	—	dB
	2816 ... 2864	MHz	α_{min}	42	46	—	dB
	4900 ... 5300	MHz	α_{min}	28	33	—	dB
	5300 ... 5950	MHz	α_{min}	20	31	—	dB

¹⁾ See Sec. Matching circuit (p. 5).

²⁾ Please refer to definition of α_{INT} in section Integrated rejection (p. 19).

Data sheet

6.2 ANT – RX

Temperature range for specification

$$T_{\text{SPEC}} = -20\text{ °C} \dots +85\text{ °C}$$

TX terminating impedance

$$Z_{\text{TX}} = 50\ \Omega \text{ with ser. } 4.3\ \text{nH}^{1)}$$

ANT terminating impedance

$$Z_{\text{ANT}} = 50\ \Omega \text{ with par. } 12\ \text{nH}^{1)}$$

RX terminating impedance

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

Characteristics ANT – RX			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}		
Center frequency	729.24 ... 745.76	MHz	—	737.5	—	MHz	
							f_c
Maximum insertion attenuation	729.24 ... 745.76	MHz	—	2.0	2.8	dB	
							α_{max}
Amplitude ripple (p-p)	729.24 ... 745.76	MHz	—	0.6	1.5	dB	
							$\Delta\alpha$
Maximum VSWR	729 ... 746	MHz	—	1.6	2.0		
							VSWR_{max}
							@ ANT port
	729 ... 746	MHz	—	1.5	2.0		
	@ RX port						
Minimum attenuation	50 ... 699	MHz	40	57	—	dB	
	699 ... 716	MHz	45	58	—	dB	
	716 ... 722	MHz	12	22	—	dB	
	777 ... 798	MHz	35	45	—	dB	
	798 ... 805	MHz	35	53	—	dB	
	1710 ... 1755	MHz	50	62	—	dB	
	1850 ... 1910	MHz	50	60	—	dB	
	2202 ... 2238	MHz	48	57	—	dB	
	2400 ... 2500	MHz	48	55	—	dB	
4900 ... 6000	MHz	25	43	—	dB		

¹⁾ See Sec. Matching circuit (p. 5).

Data sheet

6.3 TX – RX

Temperature range for specification

$$T_{\text{SPEC}} = -20\text{ °C} \dots +85\text{ °C}$$

TX terminating impedance

$$Z_{\text{TX}} = 50\ \Omega \text{ with ser. } 4.3\ \text{nH}^{1)}$$

ANT terminating impedance

$$Z_{\text{ANT}} = 50\ \Omega \text{ with par. } 12\ \text{nH}^{1)}$$

RX terminating impedance

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

Characteristics TX – RX			min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Minimum isolation		α_{min}				
	699.24 ... 715.76	MHz	50	61	—	dB
	715.76 ... 729.24	MHz	25	36	—	dB
	729.24 ... 745.76	MHz	50	63	—	dB
	1398 ... 1432	MHz	30	62	—	dB
	2097 ... 2148	MHz	30	60	—	dB
	2796 ... 2864	MHz	30	59	—	dB

¹⁾ See Sec. Matching circuit (p. 5).

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7 Maximum ratings

Operable temperature	$T_{OP} = -40\text{ °C} \dots +85\text{ °C}$	
Storage temperature	$T_{STG}^{1)} = -40\text{ °C} \dots +85\text{ °C}$	
DC voltage	$ V_{DC} ^{2)} = 0\text{ V}$	
Input power @ TX port: 699 ... 716 MHz	$P_{IN} = 28\text{ dBm}$	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.

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8 Transmission coefficients

8.1 TX – ANT

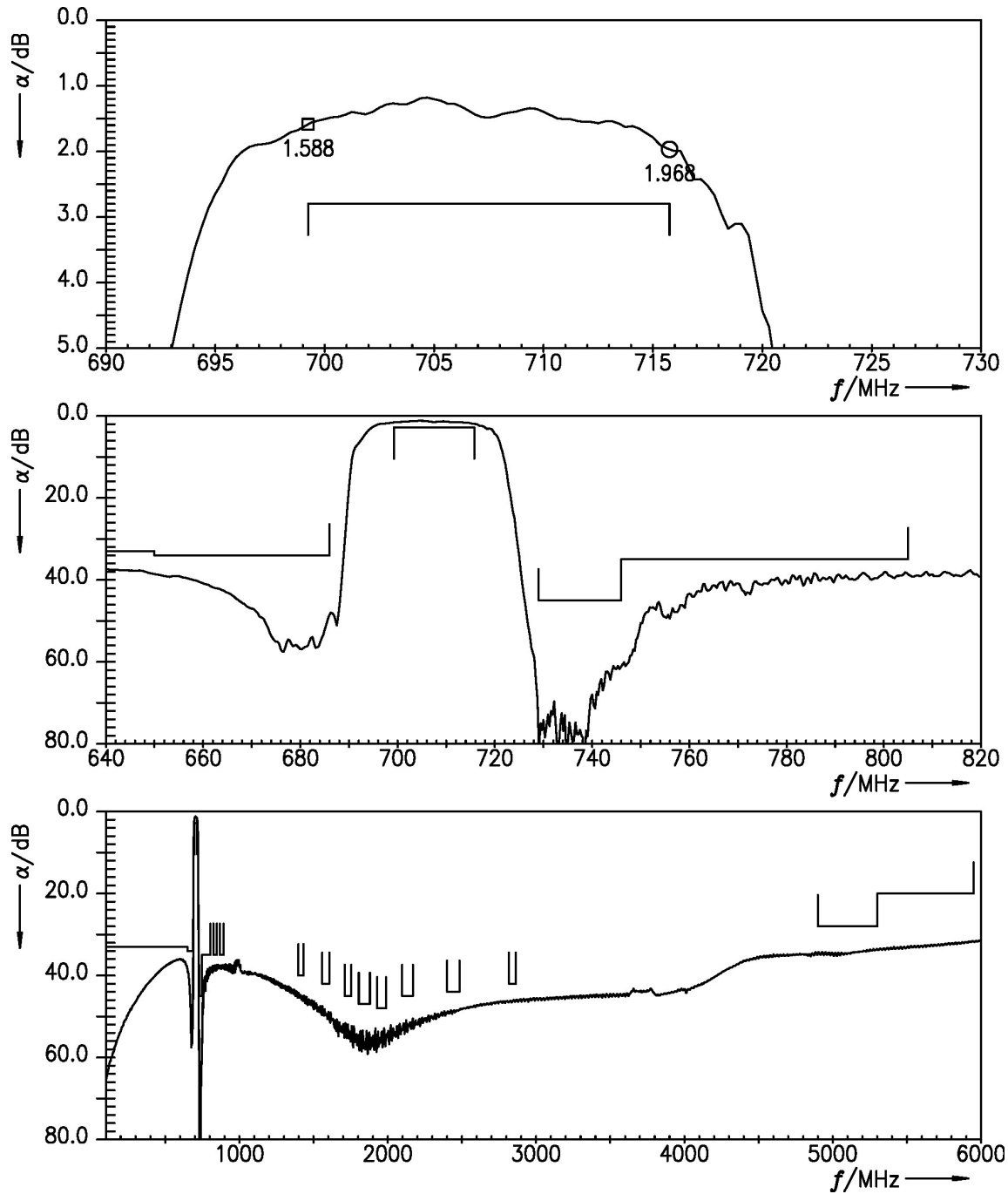


Figure 4: Attenuation TX – ANT.

Data sheet

8.2 ANT – RX

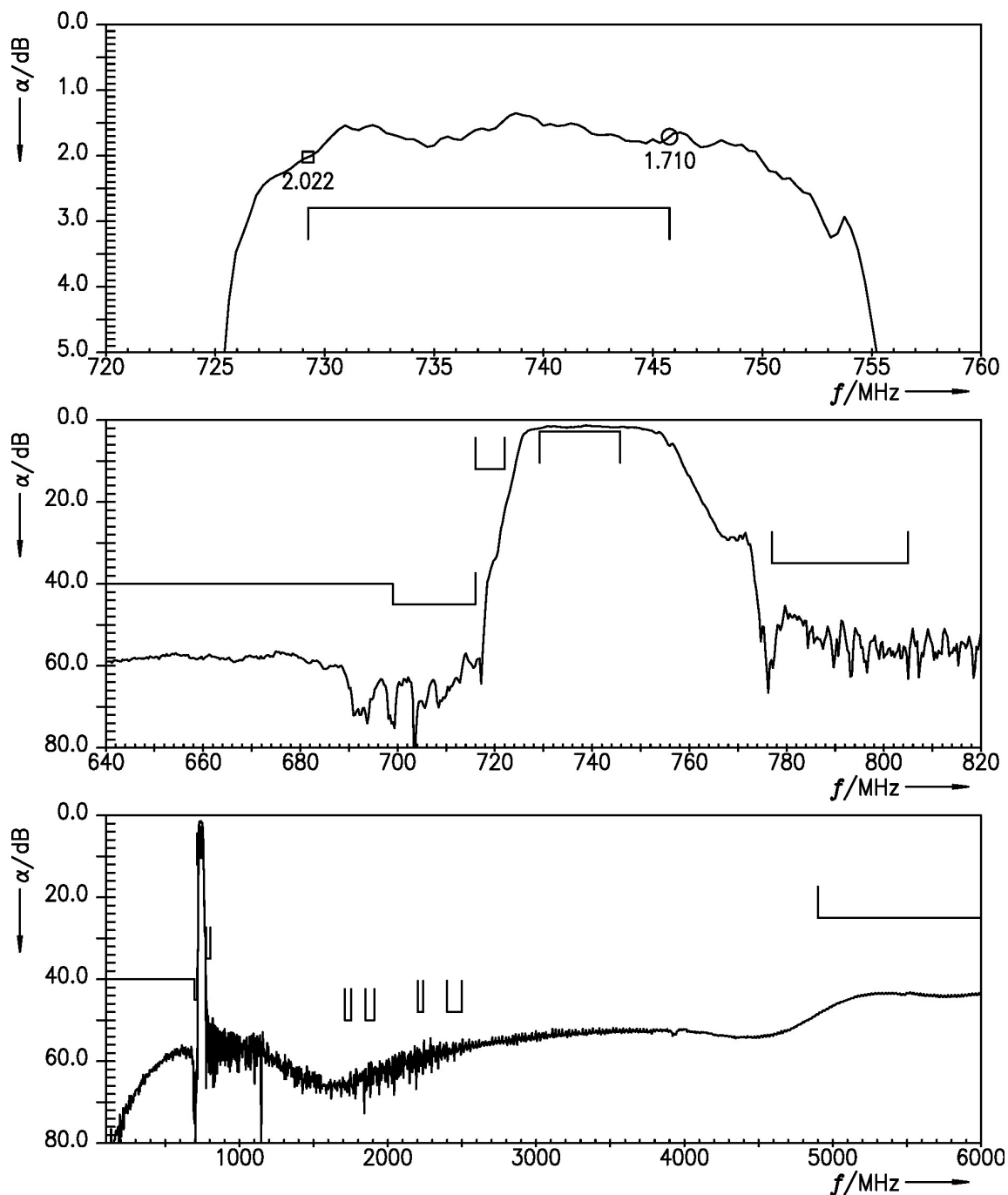


Figure 5: Attenuation ANT – RX.

Data sheet

8.3 TX – RX

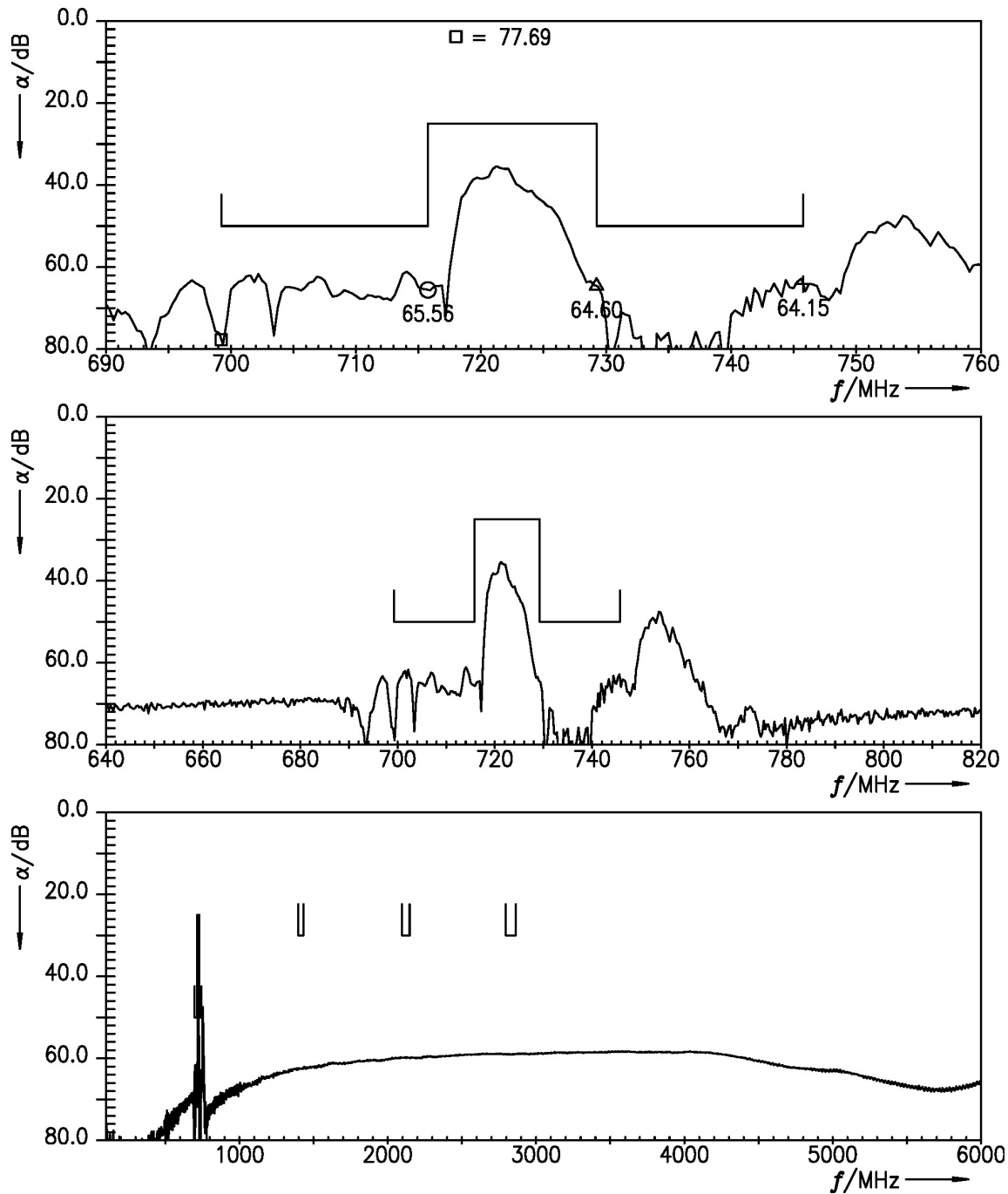


Figure 6: Isolation TX – RX.

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9 Reflection coefficients

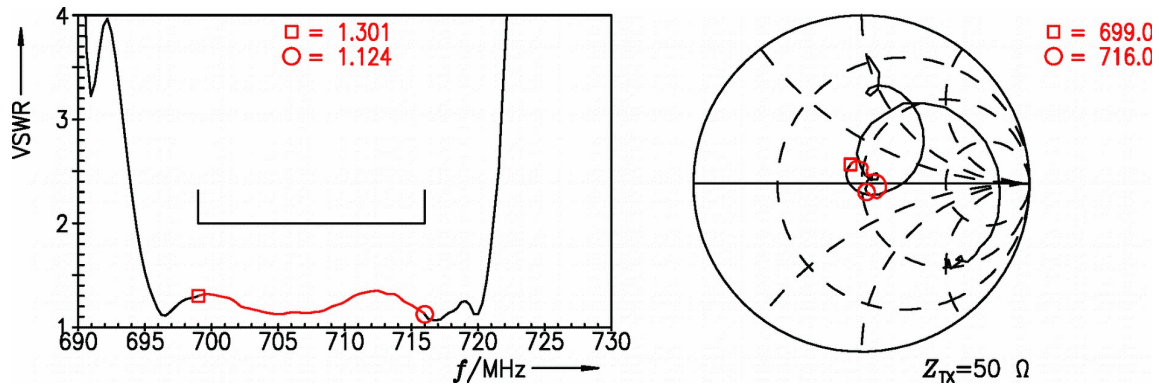


Figure 7: Reflection coefficient at TX port.

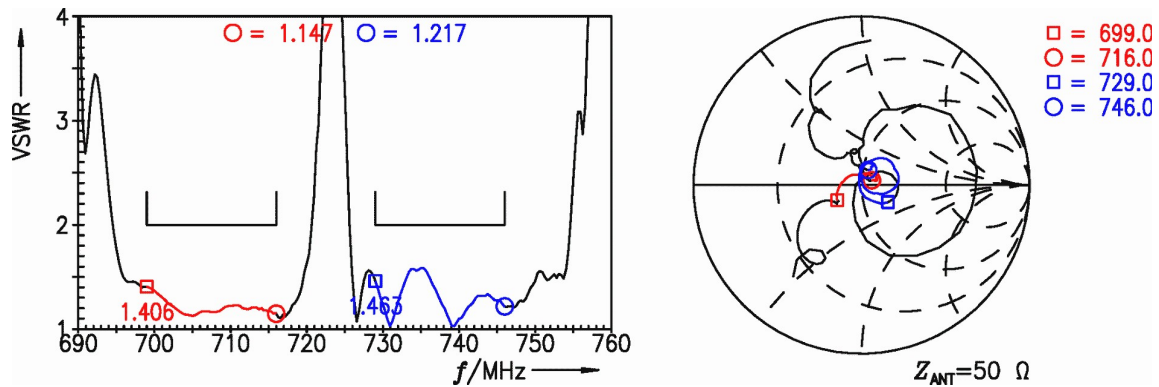


Figure 8: Reflection coefficient at ANT port.

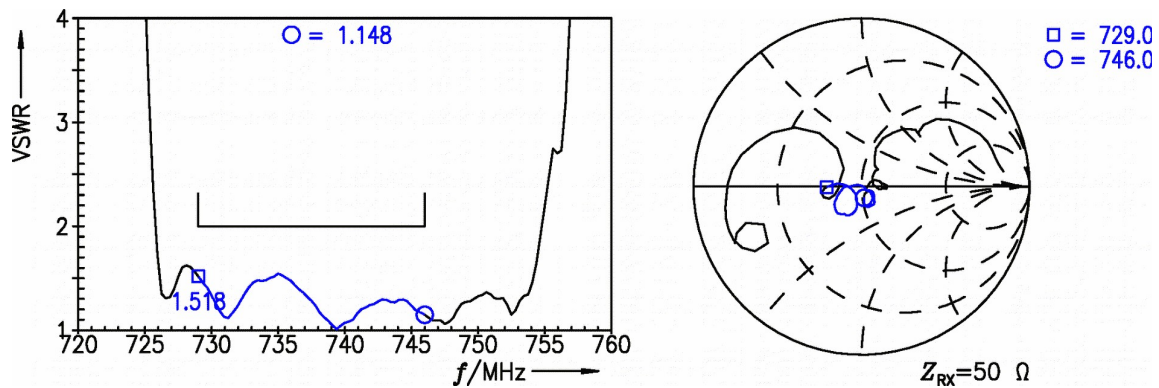
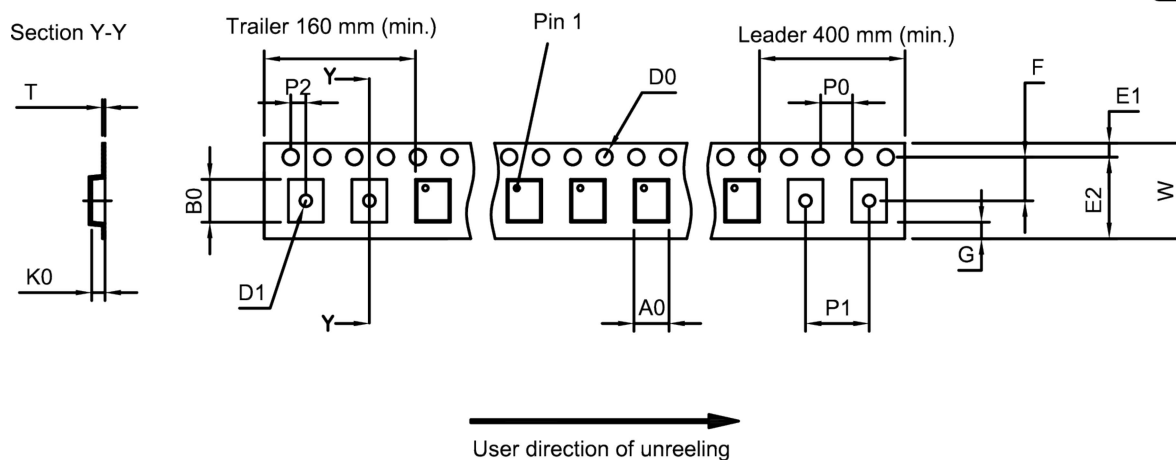


Figure 9: Reflection coefficient at RX port.

Data sheet

10 Packing material
10.1 Tape

Figure 10: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	1.8 ± 0.05 mm	E_2	6.25 mm (min.)	P_1	4.0 ± 0.1 mm
B_0	2.25 ± 0.05 mm	F	3.5 ± 0.05 mm	P_2	2.0 ± 0.05 mm
D_0	$1.5^{+0.1/-0}$ mm	G	0.75 mm (min.)	T	0.25 ± 0.03 mm
D_1	1.0 mm (min.)	K_0	0.6 ± 0.05 mm	W	$8.0^{+0.3/-0.1}$ mm
E_1	1.75 ± 0.1 mm	P_0	4.0 ± 0.1 mm		

Table 1: Tape dimensions.

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10.2 Reel with diameter of 180 mm

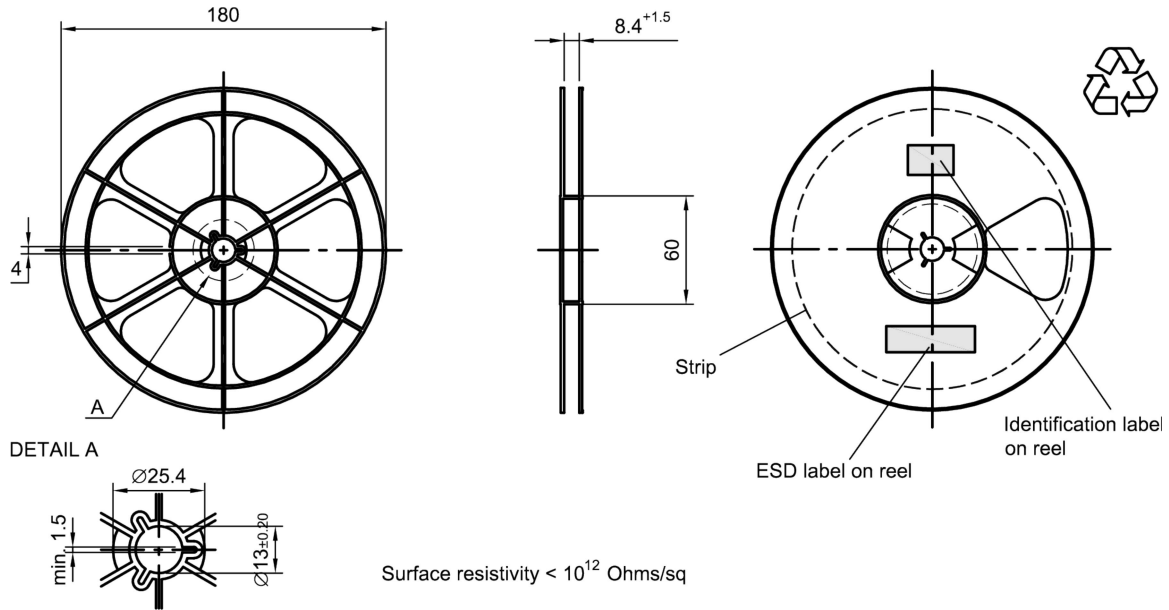


Figure 11: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

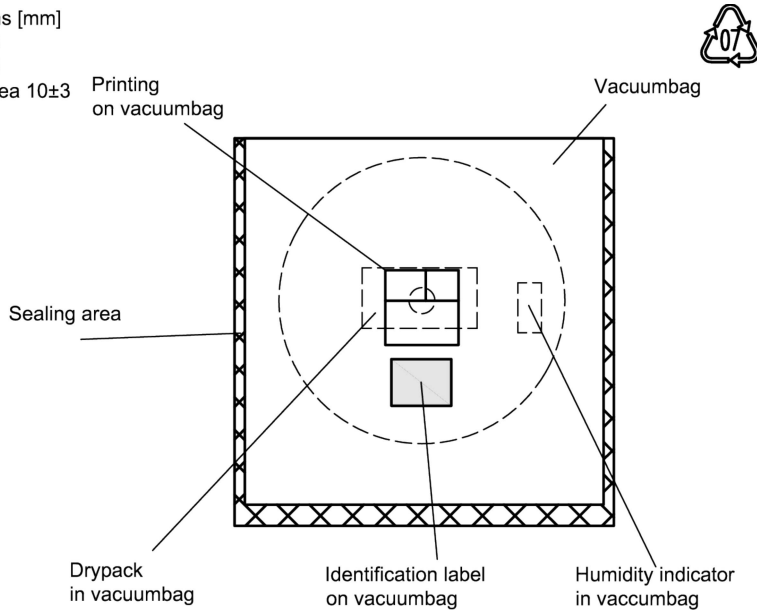


Figure 12: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

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Dimensions [mm]

L = 188

B = 188

H = 30

Tolerance ± 5

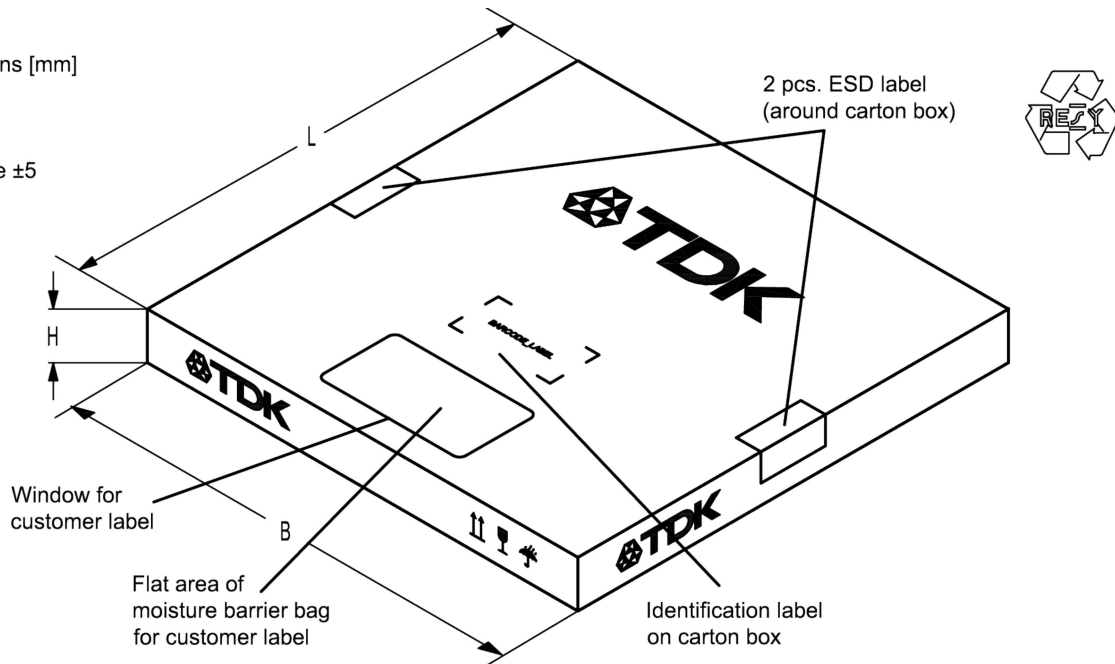


Figure 13: Drawing of folding box for reel with diameter of 180 mm.

Data sheet

11 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.

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

The BASE32 code for product type B4423 is 4A7.

■ 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.

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

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

12 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
$T \geq 255$ °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).

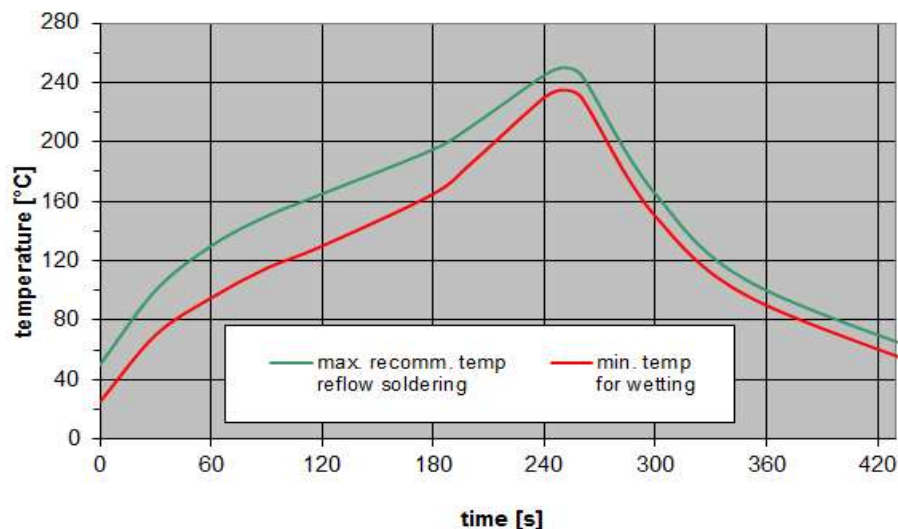


Figure 14: Recommended reflow profile for convection and infrared soldering – lead-free solder.

Data sheet

13 Annotations

13.1 Integrated rejection

Integrated rejection, α_{INT} , is defined by

$$\alpha_{\text{INT}} = 20 \log_{10} \left(\frac{\sum_{n=2}^N \frac{\text{Loss}(F_{n-1}) + \text{Loss}(F_n)}{2} \times (F_n - F_{n-1})}{F_N - F_1} \right)$$

where

$$H(f_n) = 1/|S_{21}|$$

and

N = Number of frequency sampling points, insertion loss pairs in channel.

13.2 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>.

13.3 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.

13.4 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.

Data sheet

14 Cautions and warnings

14.1 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.

14.2 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.

14.3 Moldability

Before using in overmolding environment, please contact your local EPCOS sales office.

14.4 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.**
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