



RF360
Europe GmbH

SAW components

SAW Rx filter

Automotive telematics
LTE band 2

Series/type:	B4366
Ordering code:	B39202B4366P810
Date:	January 11, 2017
Version:	2.0

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Data sheet

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1 Application

- Low-loss RF filter for LTE Band 2 systems (Rx)
- No external matching components required
- Usable pass band 60MHz
- Low amplitude ripple

2 Features

- Package size 1.4±0.1 mm × 1.1±0.1 mm
- Package height 0.45 mm (max.)
- Approximate weight 3 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Filter surface passivated
- Electrostatic Sensitive Device (ESD)
- AEC-Q200 qualified component family
(Grade 1: -40 °C to +125 °C)

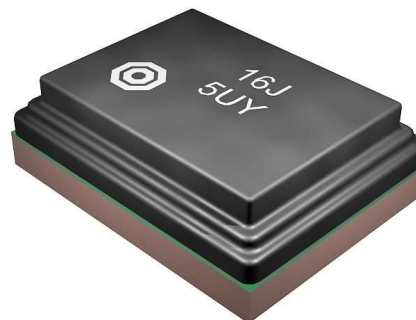
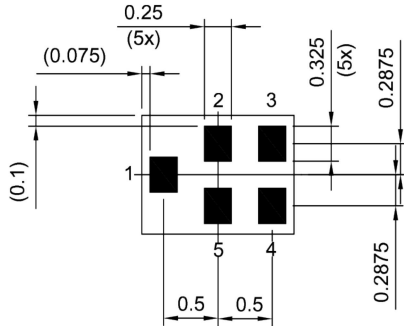


Figure 1: Picture of component with example of product marking.

Data sheet

3 Package

BOTTOM VIEW

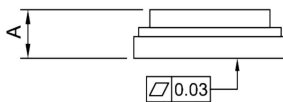


Pad and pitch tolerance ±0.05

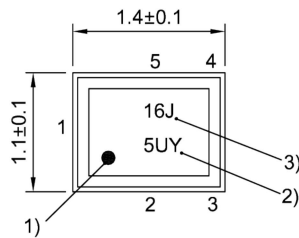
4 Pin configuration

- 1 Input
- 4 Output
- 2, 3, 5 Ground

SIDE VIEW

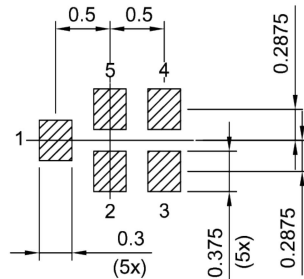


TOP VIEW



- 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 = 0.45 mm (max.). See Sec. Package information (p. 18).

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5 Matching circuit

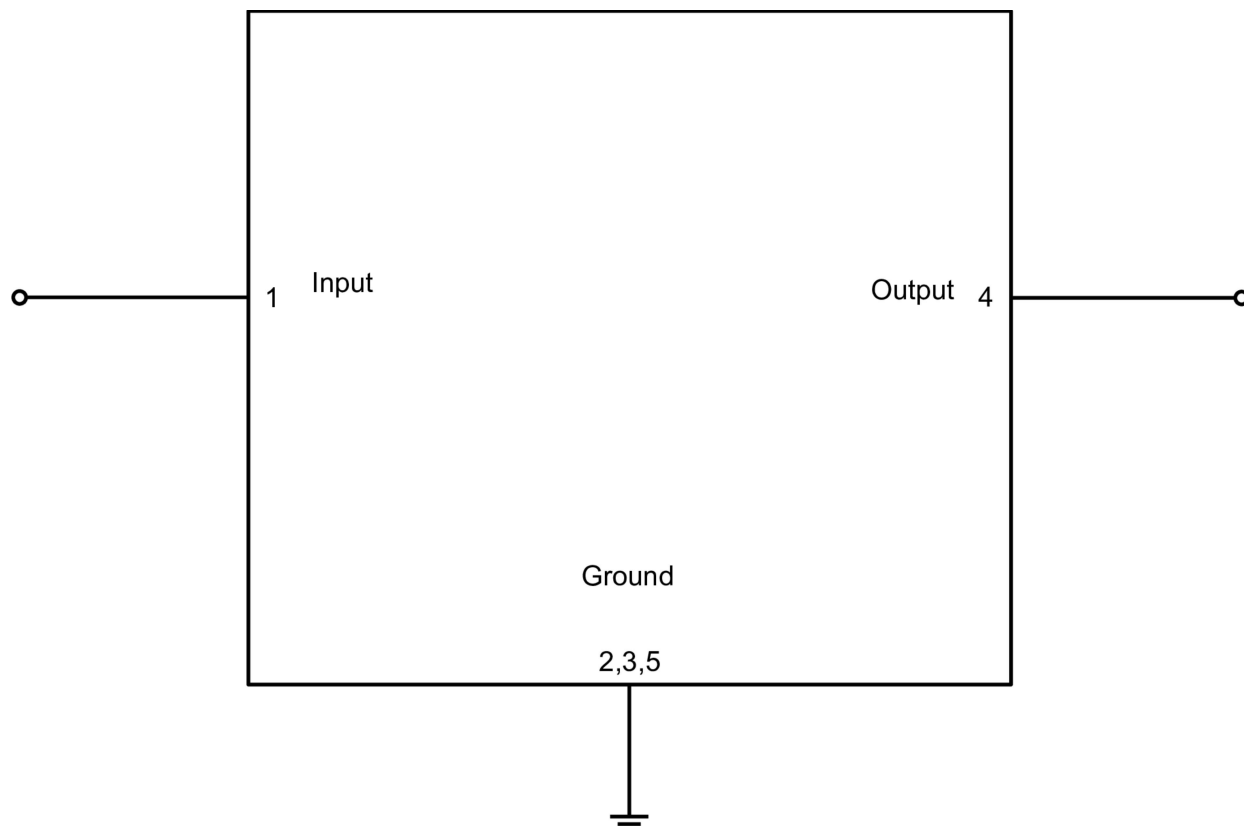


Figure 3: Schematic of matching circuit. No external matching components required.

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6 Characteristics

Temperature range for specification	T_{SPEC}	= -30 °C ... +85 °C
Input terminating impedance	Z_{IN}	= 50 Ω
Output terminating impedance	Z_{OUT}	= 50 Ω

Characteristics				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}		
Center frequency			f_C	—	1960	—	MHz	
Maximum insertion attenuation								
		1930 ... 1990	MHz	α_{max}	—	2.1	4.5	dB
	@ $f_{carrier}$	1932.4 ... 1987.6	MHz	$\alpha_{WCDMA,max}^{1)}$	—	2.0	3.5	dB
Amplitude ripple (p-p)				$\Delta\alpha$				
		1930 ... 1990	MHz		—	0.7	3.1	dB
Maximum VSWR				VSWR _{max}				
@ input port		1930 ... 1990	MHz		—	1.8	2.5	
@ output port		1930 ... 1990	MHz		—	1.9	2.5	
Maximum error vector magnitude				EVM _{max} ²⁾				
		1932.4 ... 1987.6	MHz		—	1.0	5.0	%
Minimum attenuation								
		10 ... 1850	MHz	α_{min}	41	48	—	dB
		699 ... 716	MHz	α_{min}	44	53	—	dB
		824 ... 849	MHz	α_{min}	45	53	—	dB
		1850 ... 1910	MHz	α_{min}	32	46	—	dB
	@ $f_{carrier}$	1852.4 ... 1907.6	MHz	$\alpha_{WCDMA,min}^{1)}$	41	46	—	dB
		2050 ... 2075	MHz	α_{min}	39	45	—	dB
		2075 ... 6000	MHz	α_{min}	24	30	—	dB
		2400 ... 2500	MHz	α_{min}	40	48	—	dB
		4900 ... 5950	MHz	α_{min}	24	30	—	dB

¹⁾ Attenuation of WCDMA signal ("power transfer function"). Please refer to definition of Power Transfer Function (PTF) of WCDMA signal (p. 17).

²⁾ Error Vector Magnitude (EVM) based on definition in 3GPP TS 25.141.

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7 Maximum ratings

Operable temperature	$T_{OP} = -40\text{ °C} \dots +125\text{ °C}$	
Storage temperature	$T_{STG}^{1)} = -40\text{ °C} \dots +125\text{ °C}$	
DC voltage	$ V_{DC} ^{2)} = 0\text{ V}$	
Input power @ input port: 1930 ... 1990 MHz	$P_{IN} = 15\text{ dBm}$	Continuous wave for 2000 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 coefficient

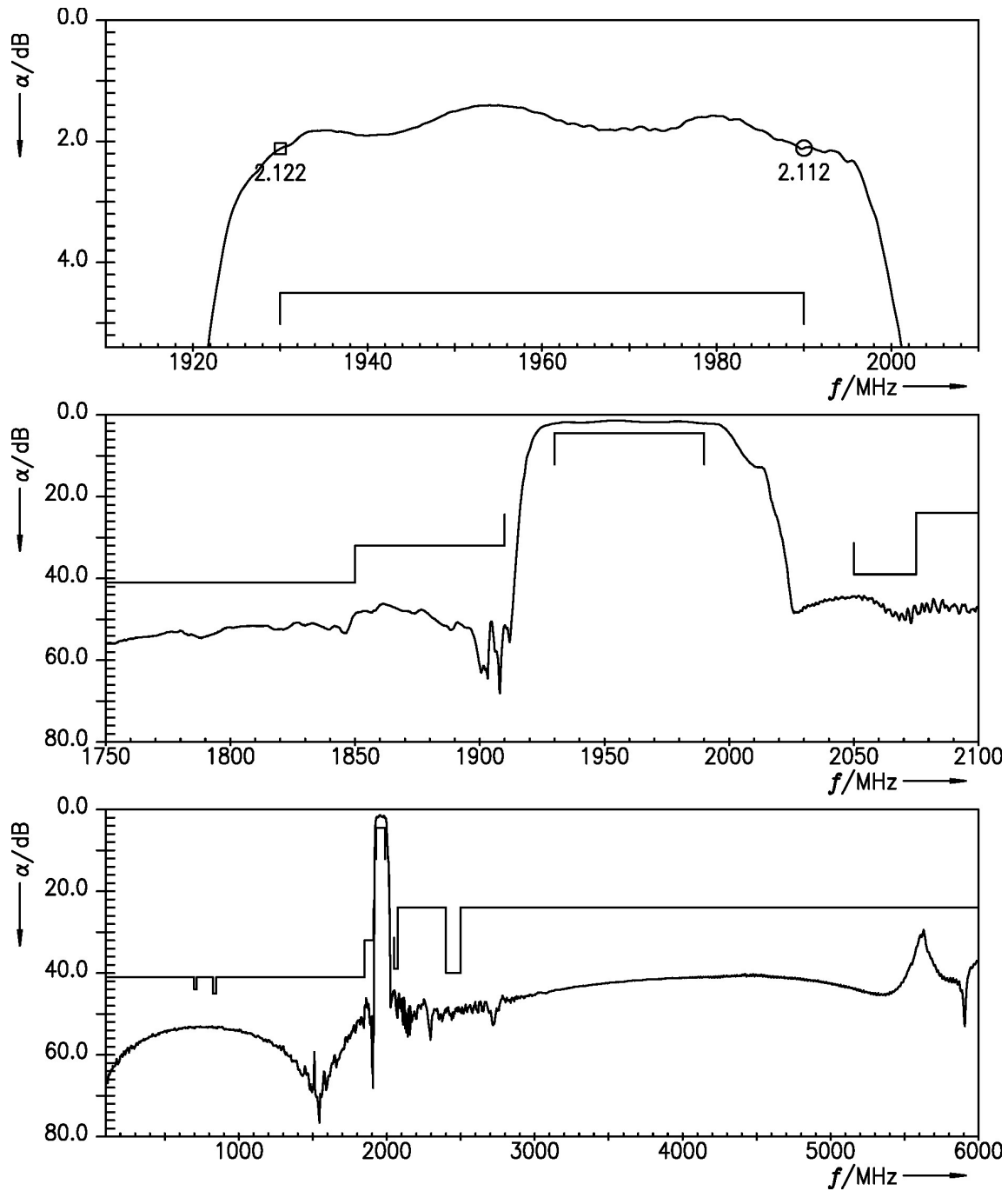


Figure 4: Attenuation.

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9 Reflection coefficients

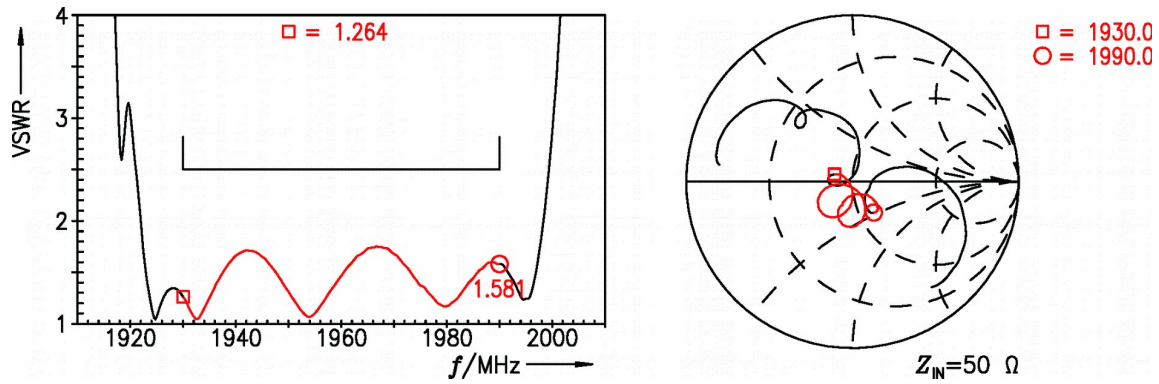


Figure 5: Reflection coefficient at IN port.

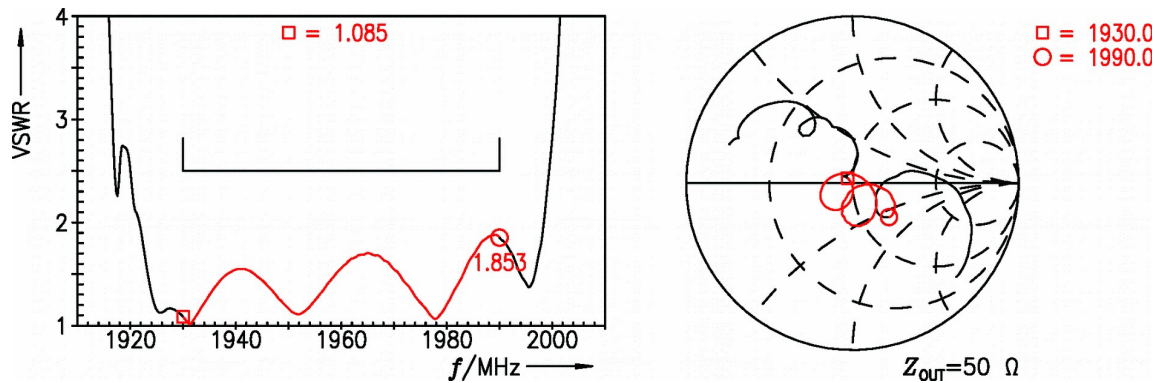


Figure 6: Reflection coefficient at OUT port.

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10 EVM

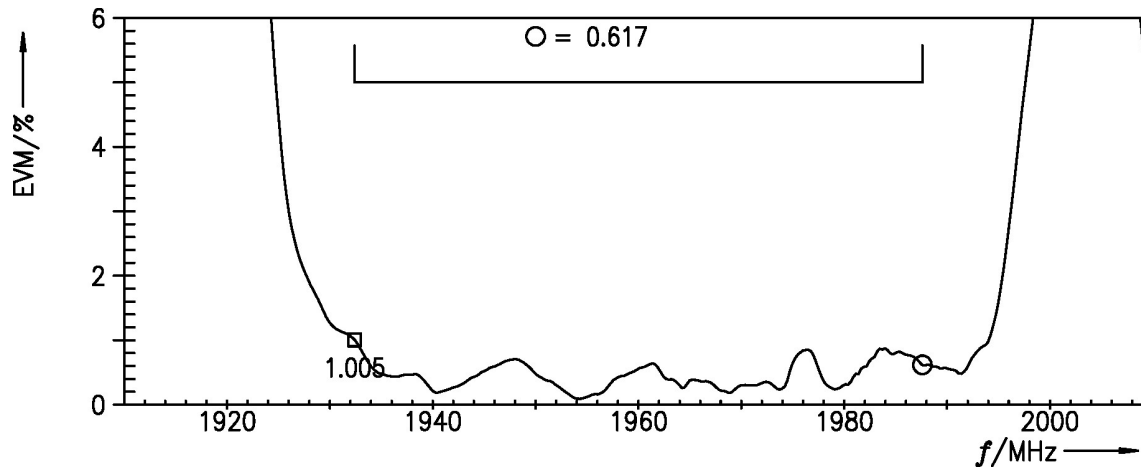
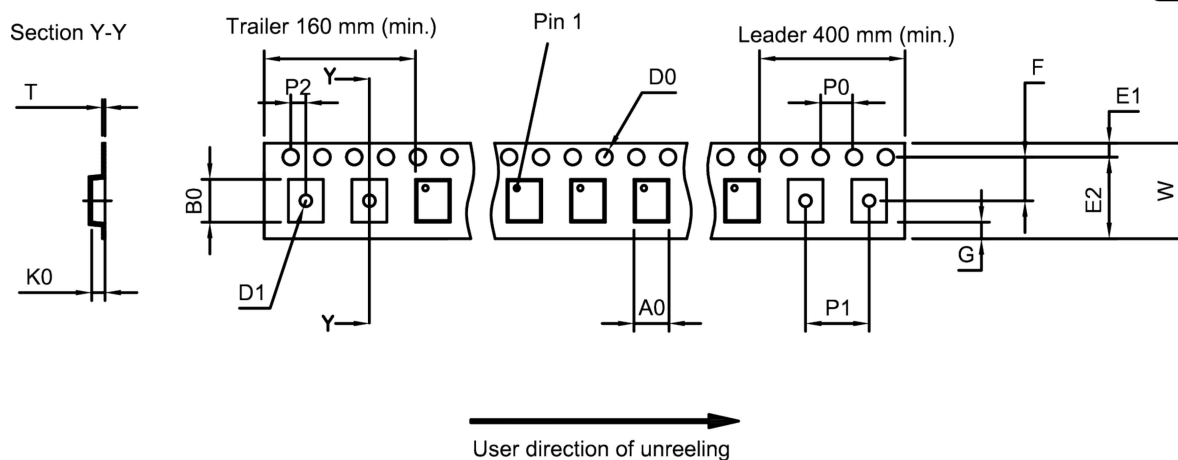


Figure 7: Error vector magnitude.

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11 Packing material
11.1 Tape

Figure 8: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	1.27±0.05 mm	E_2	6.25 mm (min.)	P_1	4.0±0.1 mm
B_0	1.57±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	0.5±0.1 mm	K_0	0.62±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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11.2 Reel with diameter of 180 mm

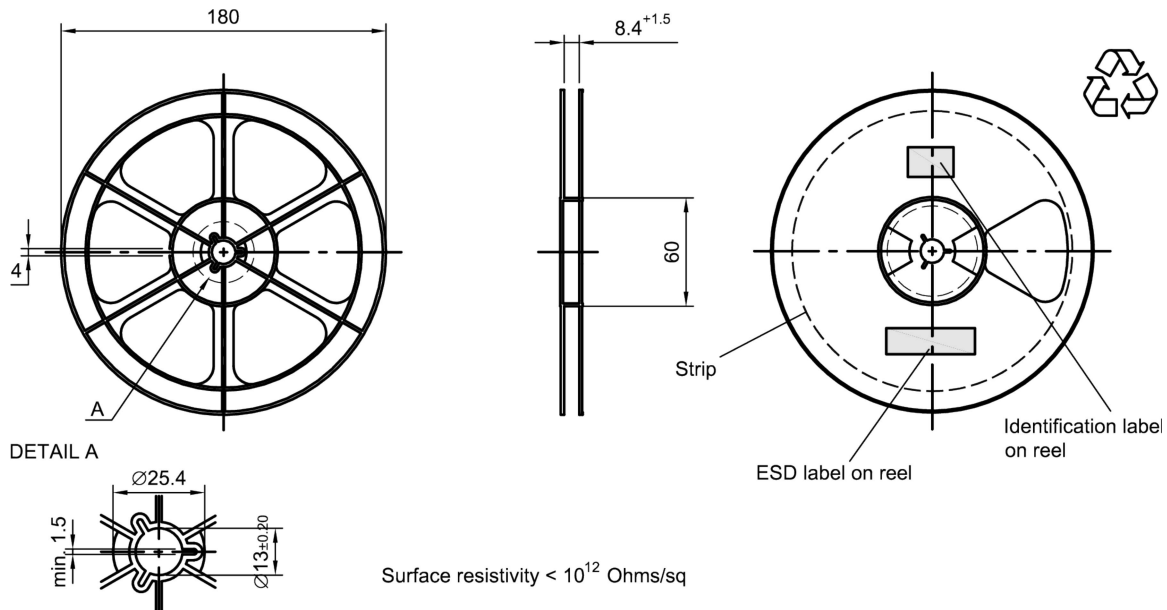


Figure 9: Drawing of reel (first-angle projection) with diameter of 180 mm.

Dimensions [mm]

X = 220+5

Y = 235+5

Sealing area 10±3

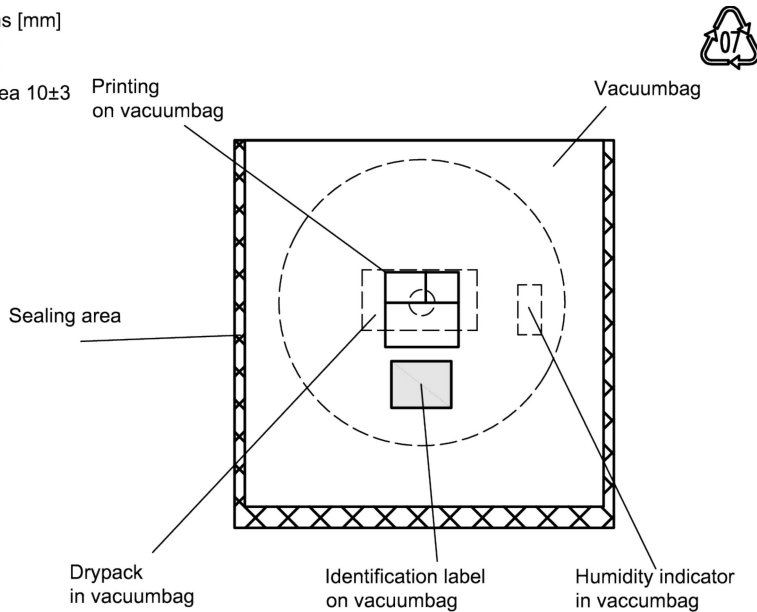


Figure 10: Drawing of moisture barrier bag (MBB) for reel with diameter of 180 mm.

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Dimensions [mm]

L = 188

B = 188

H = 30

Tolerance ± 5

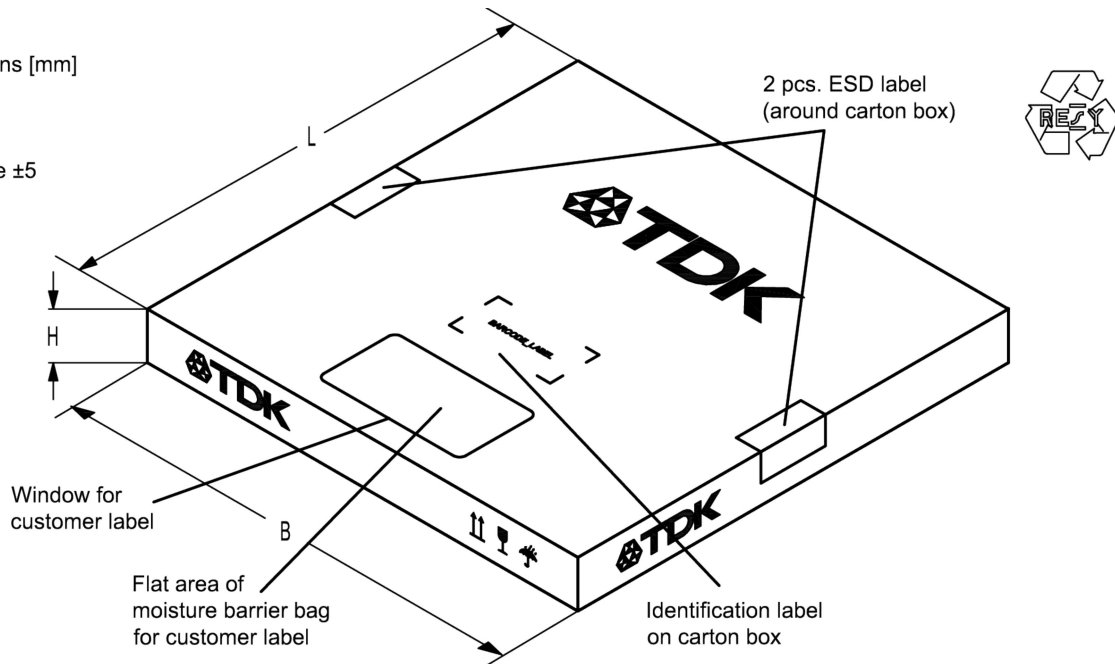


Figure 11: Drawing of folding box for reel with diameter of 180 mm.

Data sheet

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.

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

The BASE32 code for product type B4366 is 48E.

■ 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.

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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
$T \geq 255$ °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).

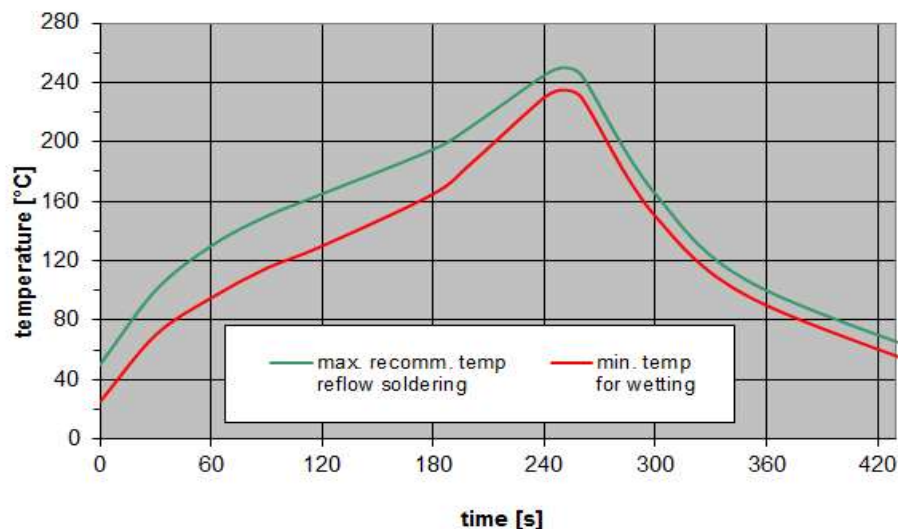


Figure 12: Recommended reflow profile for convection and infrared soldering – lead-free solder.

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14 ESD protection of SAW filters

SAW filters are **E**lectro **S**tatic **D**ischarge sensitive devices. To reduce the probability of damages caused by ESD, special matching topologies have to be applied.

In general, “ESD matching” has to be ensured at that filter port, where electrostatic discharge is expected.

Electrostatic discharges predominantly appear at the antenna input of RF receivers. Therefore, only the input matching of the SAW filter has to be designed to short circuit or to block the ESD pulse.

Below three figures show recommended “ESD matching” topologies.

For wide band filters the high-pass ESD matching structure needs to be at least of 3rd order to ensure a proper matching for any impedance value of antenna and SAW filter input. The required component values have to be determined from case to case.

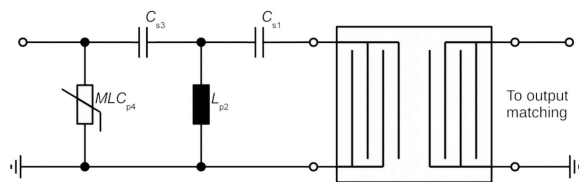


Figure 13: MLC varistor plus ESD matching.

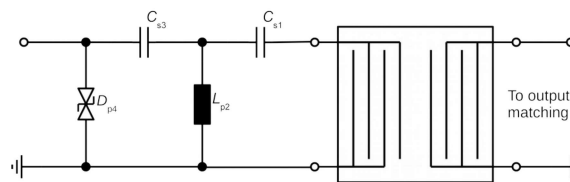


Figure 14: Suppressor diode plus ESD matching.

In cases where minor ESD occur, following simplified “ESD matching” topologies can be used alternatively.

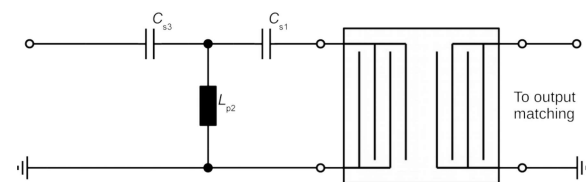


Figure 15: 3rd order high-pass structure for basic ESD protection.

In all three figures the shunt inductor L_{p2} could be replaced by a shorted microstrip with proper length and width. If this configuration is possible depends on the operating frequency and available PCB space.

Effectiveness of the applied ESD protection has to be checked according to relevant industry standards or customer specific requirements.

For further information, please refer to EPCOS Application report: “**ESD protection for SAW filters**”. This report can be found under www.epcos.com/rke. Click on “Applications Notes”.

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15 Annotations

15.1 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>.

15.2 Power Transfer Function (PTF) of WCDMA signal

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

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

and

$$\text{PTF}(f_{\text{carrier}}) = \int_{-\infty}^{+\infty} |S_{21}(f) H_{\text{RRC}}(f - f_{\text{carrier}})|^2 df$$

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). $H_{\text{RRC}}(f)$ is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 using the normalization

$$\int_{-\infty}^{+\infty} |H_{\text{RRC}}(f)|^2 df = 1 \quad .$$

15.3 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.

15.4 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.

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16 Cautions and warnings

16.1 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.

16.2 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.

16.3 Moldability

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

16.4 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

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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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