RF360
Europe GmbH

SAW components

SAW filter
Short range devices

Series/type:	B3760
Ordering code:	B39431B3760Z810
Date:	April 27, 2017
Version:	2.4

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A Qualcomm – TDK Joint Venture

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Table of contents

1 Application

- Low-loss RF filter for remote control receivers
- Balanced and unbalanced operation possible

2 Features

- Package size 3.8±0.15 mm × 3.8±0.15 mm
- Package height 1.5+0.1/−0.15 mm
- Package code QCC8B
- Approximate weight 0.07 g
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Lead free soldering compatible with J-STD20C
- Filter surface passivated
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 1 (MSL1)
- AEC-Q200 qualified component family
  (Grade 1: −40 °C to +125 °C)

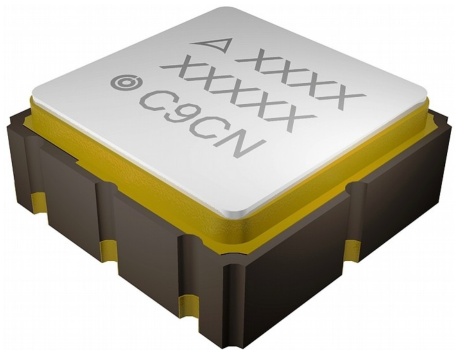

Figure 1: Picture of component with example of product marking.

3 Package

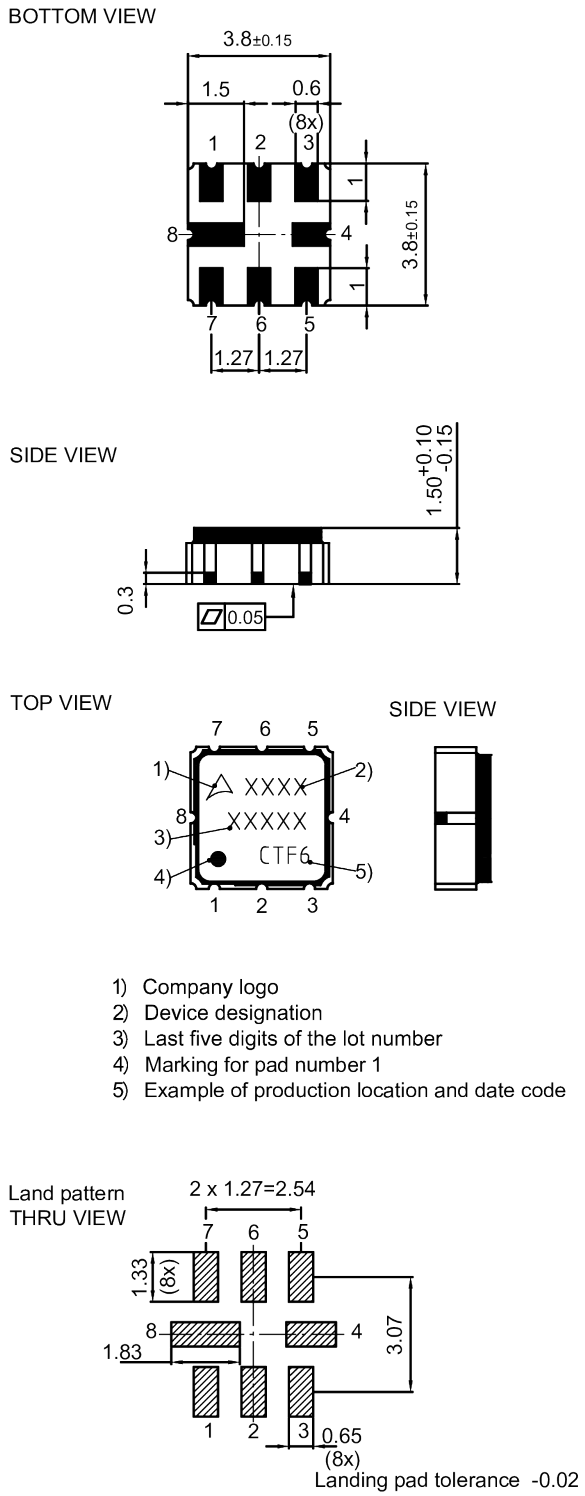

Figure 2: Drawing of package. See Sec. Package information (p. 16).

4 Pin configuration

- 2 Input (recommend or ground)
- 5 Output (recommend or ground)
- 1 Ground (recommend or input)
- 3, 4, 7, 8 Ground
- 6 Ground (recommend or output)

5 Matching circuit

- L_{s2} = 33 nH
- L_{s5} = 33 nH

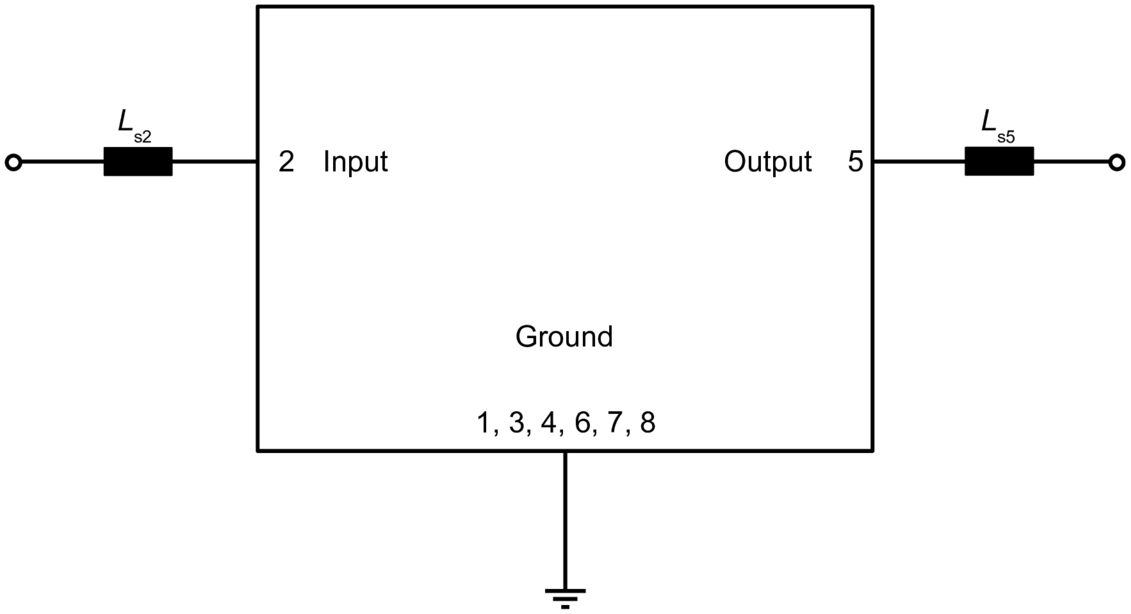

Figure 3: Schematic of matching circuit.

Minimising the crosstalk

For a good ultimate rejection a low crosstalk is necessary. Low crosstalk can be realised with a good RF layout. The major crosstalk mechanism is caused by the “ground-loop” problem.
Grounding loops are created if input-and output transducer GND are connected on the top-side of the PCB and fed to the system grounding plane by a common via hole. To avoid the common ground path, the ground pin of the input- and output transducer are fed to the system ground plane (bottom PCB plane) by their own via hole. The transducers’ grounding pins should be isolated from the upper grounding plane.
A common GND inductivity of 0.5 nH degrades the ultimate rejection (crosstalk) by 20 dB.
The optimised PCB layout, including matching network for transformation to 50 Ohm, is shown here. In this PCB layout the grounding loops are minimised to realise good ultimate rejection.

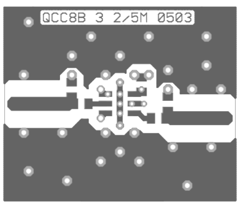

Figure 4: Optimised PCB layout for SAW filters in QCC8B package, pinning 2,5 (top side, scale 1:1).

The bottom side is a copper plane (system ground area). The input and output grounding pins are isolated and connected to the common ground by separated via holes.
For good contact of the upper grounding area with the lower side it is necessary to place enough via holes.

6 Characteristics

Temperature range for specification	T_{SPEC}	= −40 °C ... +95 °C
Input terminating impedance	Z_{IN}	= 50 Ω with ser. 33 nH[1)]
Output terminating impedance	Z_{OUT}	= 50 Ω with ser. 33 nH[1)]

Characteristics				min. for T_{SPEC}	typ. @ +25 °C	max. for T_{SPEC}	
Center frequency (center frequency between 3 dB points)			f_C	—	433.92	—	MHz
Minimum insertion attenuation			α_{min}				
Incl. loss in matching components (Q_L=47)				—	1.9	2.6	dB
Excl. loss in matching components				—	1.6	2.3	dB
Pass band (relative to α_{min})			$\alpha_{rel, max}$				
	433.76 ... 434.08	MHz		—	0.5	2.0	dB
	433.74 ... 434.1	MHz		—	0.7	3.0	dB
	433.7 ... 434.14	MHz		—	1.0	6.0	dB
Minimum attenuation (relative to α_{min})			$\alpha_{rel,min}$				
	10 ... 414	MHz		52	56	—	dB
	414 ... 423.5	MHz		48	52	—	dB
	423.5 ... 431.72	MHz		29	34	—	dB
	431.72 ... 432.12	MHz		26	35	—	dB
	432.12 ... 433.1	MHz		17	21	—	dB
	434.7 ... 434.92	MHz		16	24	—	dB
	434.92 ... 442	MHz		18	21	—	dB
	442 ... 500	MHz		40	45	—	dB
	500 ... 700	MHz		50	55	—	dB
	700 ... 805	MHz		45	50	—	dB
	805 ... 1000	MHz		60	65	—	dB
Band width relative to attenuation level of 3.0 dB			B	0.62	0.68	0.74	MHz
Impedance for pass band matching							
@ input port: $Z_{in,IN} = R_{IN} \parallel C_{IN}$			$Z_{in,IN}$ [2)]	—	240 ‖ 2.4	—	Ω ‖ pF
@ output port: $Z_{in,OUT} = R_{OUT} \parallel C_{OUT}$			$Z_{in,OUT}$ [2)]	—	240 ‖ 2.4	—	Ω ‖ pF

1) See Sec. Matching circuit (p. 6).
2) Impedance for pass band matching bases on an ideal, perfect matching of the SAW filter to source and to load impedance (here 50 Ω). After removal of the SAW filter the input impedance of the input and output matching network is calculated. The conjugate complex value of these characteristic impedances are the input and output impedances for flat pass band. For more details we refer to RF360 application note #18.

7 Maximum ratings

Operable temperature	T_{OP} = −45 °C ... +125 °C	
Storage temperature	T_{STG}[1)] = −45 °C ... +125 °C	
DC voltage	$\|V_{DC}\|$ = 6.0 V	
Source power	P_S = 10 dBm	Source impedance 50 Ω.

1) Not valid for packaging material. Storage temperature for packaging material is −25 °C to +40 °C.

8 Transmission coefficient

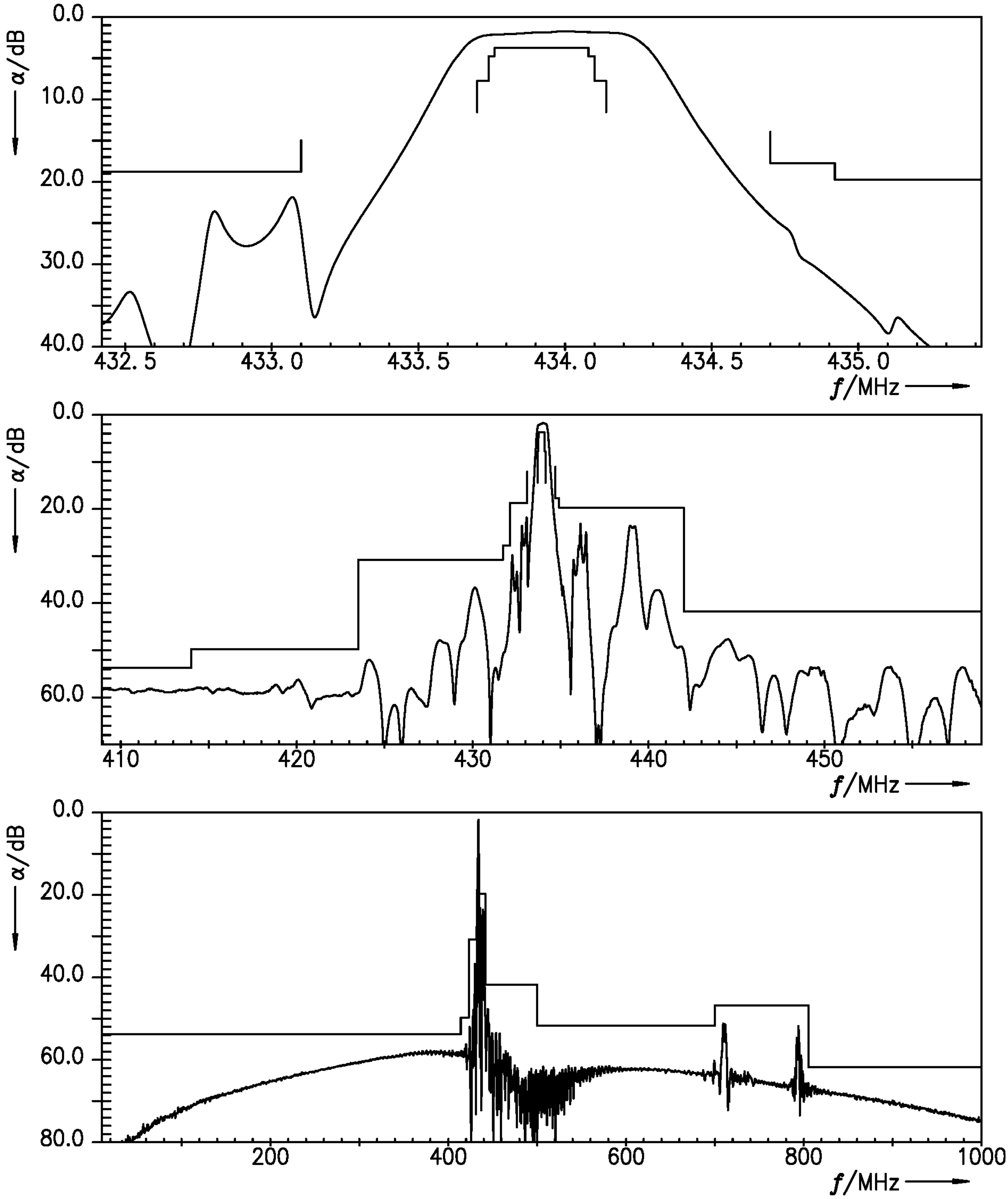

Figure 5: Attenuation.

9 Packing material

9.1 Tape

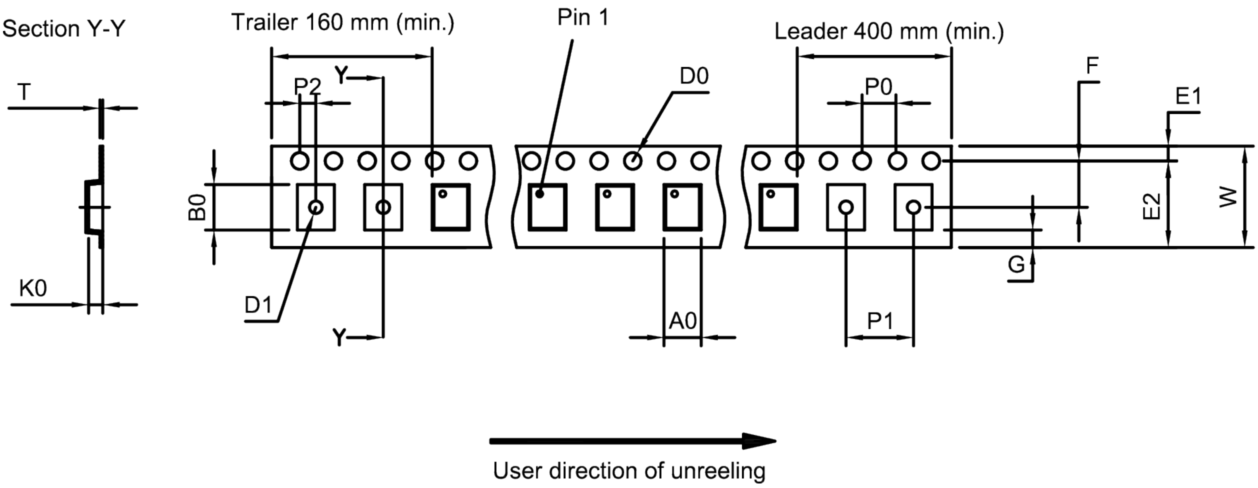

Figure 6: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A_0	$4.1_{\pm0.1}$ mm	E_2	10.25 mm (min.)	P_1	$8.0_{\pm0.1}$ mm
B_0	$4.1_{\pm0.1}$ mm	F	$5.5_{\pm0.05}$ mm	P_2	$2.0_{\pm0.1}$ mm
D_0	$1.5_{+0.1/-0}$ mm	G	0.75 mm (min.)	T	$0.3_{\pm0.05}$ mm
D_1	1.5 mm (min.)	K_0	$1.8_{\pm0.1}$ mm	W	$12.0_{+0.3/-0.1}$ mm
E_1	$1.75_{\pm0.1}$ mm	P_0	$4.0_{\pm0.1}$ mm		

Table 1: Tape dimensions.

9.2 Reel with diameter of 330 mm

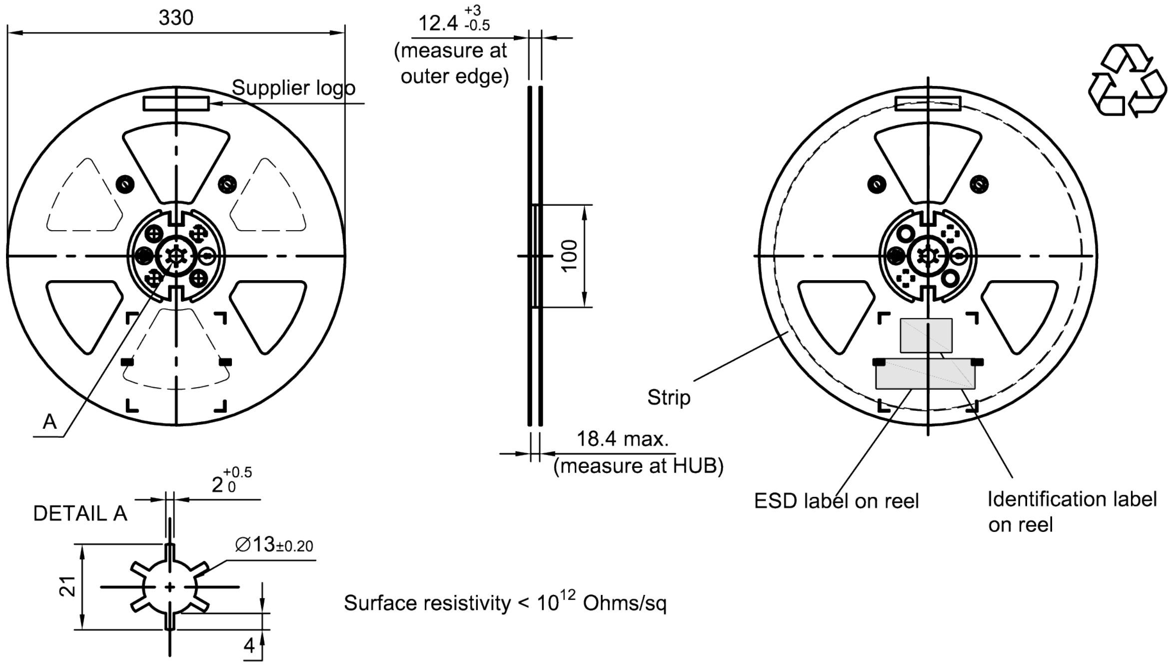

Figure 7: Drawing of reel (first-angle projection) with diameter of 330 mm.

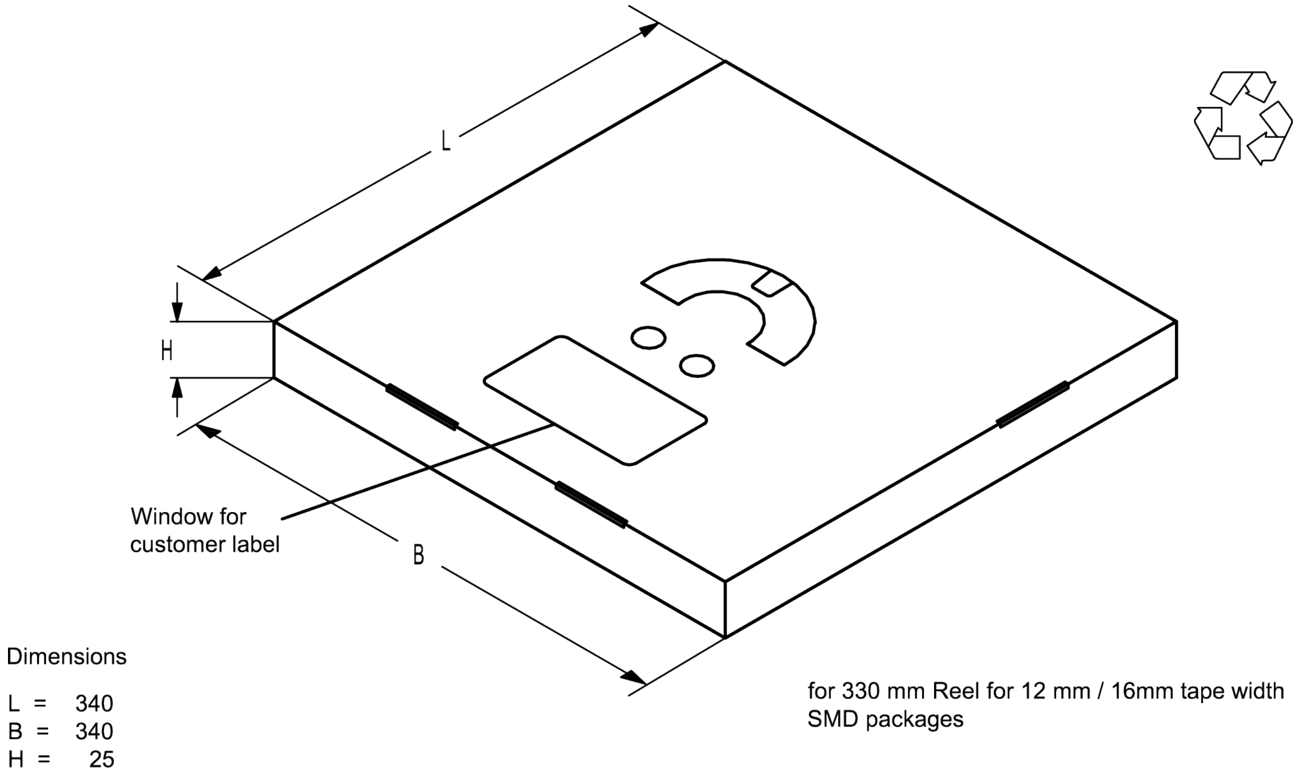

Figure 8: Drawing of folding box for reel with diameter of 330 mm.

10 Marking

Products are marked with device designation, lot number, as well as production location and date code.

- Device designation: The 4-character device designation of the ordering code is used for the marking.

  Example for 4-character device designation: B3xxxxB**1234**xxxx

- Lot number: The last 5 digits of the lot number are used for the marking.

  Example: **12345**

- Production location and date code: The production location is Wuxi (encoded in the first character 'C'). The production date code is encoded in the last three characters according to Table 2.

1^{st} digit (day)						2^{nd} digit (year)				3^{rd} digit (month)			
Day	Code	Day	Code	Day	Code	Year	Code	Year	Code	Month	Code	Month	Code
1	1	11	A	21	M	2010	A	2022	P	Jan	1	Jul	7
2	2	12	B	22	N	2011	B	2023	R	Feb	2	Aug	8
3	3	13	C	23	P	2012	C	2024	S	Mar	3	Sep	9
4	4	14	D	24	R	2013	D	2025	T	Apr	4	Oct	0
5	5	15	E	25	S	2014	E	2026	U	May	5	Nov	N
6	6	16	F	26	T	2015	F	2027	V	Jun	6	Dec	D
7	7	17	H	27	U	2016	H	2028	W				
8	8	18	J	28	V	2017	J	2029	X				
9	9	19	K	29	W	2018	K	2030	Z				
10	0	20	L	30	X	2019	L	2031	A				
				31	Z	2020	M	2032	B				
						2021	N	and so on					

Table 2: Production date code.

Example of how to decode production location and date code:

Code: **C T F 6**

Location: C → Wuxi

Day: T → 26th

Year: F → 2015

Month: 6 → June

11 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).

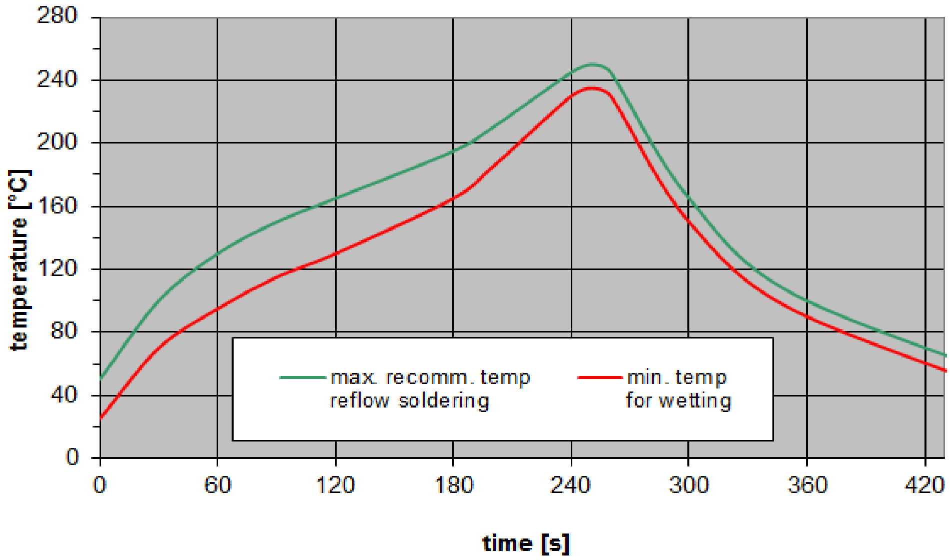

Figure 9: Recommended reflow profile for convection and infrared soldering – lead-free solder.

12 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.

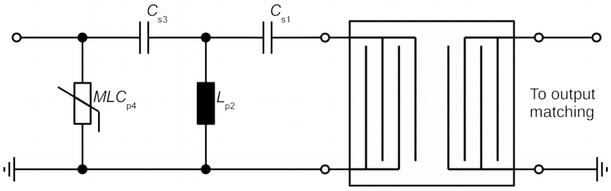

Figure 10: MLC varistor plus ESD matching.

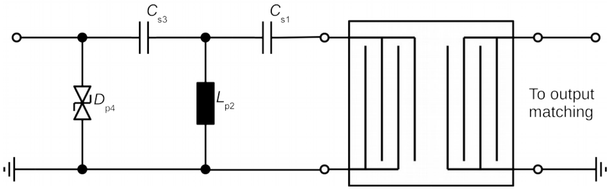

Figure 11: Suppressor diode plus ESD matching.

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

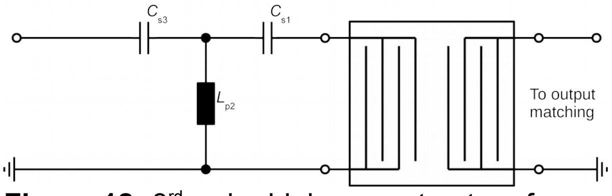

Figure 12: 3rd order high-pass structure for basic ESD protection.

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 RF360 Application report: **“ESD protection for SAW filters”.** This report can be found under www.rf360jv.com/rke. Click on “Applications Notes”.

13 Annotations

13.1 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.

13.2 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.

13.3 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 Cautions and warnings

14.1 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.

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 RF360 sales office.

14.4 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.

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