

SAW duplexer Small cell & femtocell LTE band 28a

Series/type:	B8035
Ordering code:	B39771B8035P810
Date:	June 10, 2016
Version:	2.0

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718.0 / 773.0 MHz

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#### 1 Application

- Low-loss SAW duplexer for 3G/LTE smallcells systems (Band 28a)
- Usable pass band: 30 MHz
- High power durability in downlink
- Rx = uplink = 703-733 MHz
- Tx = downlink = 758-788 MHz

#### 2 Features

- Package size 2.5±0.1 mm × 2.0±0.1 mm
- Package height 0.5 mm (max.)
- Approximate weight 9 mg
- RoHS compatible
- Package for Surface Mount Technology (SMT)
- Ni/Au-plated terminals
- Electrostatic Sensitive Device (ESD)
- Moisture Sensitivity Level 2a (MSL2a)



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



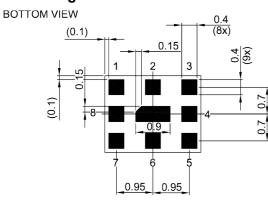
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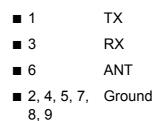
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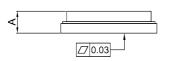
#### 3 Package

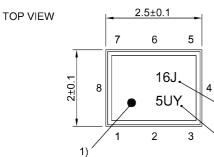


#### 4 Pin configuration



#### SIDE VIEW



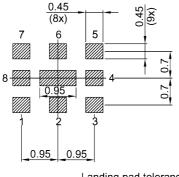


- 1) Marking for pad number 1
- 2) Example of encoded lot number
- 3) Example of encoded filter type number

2)

Pad and pitch tolerance ±0.05

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. 21).



1

0

RX

3

### SAW components B8035 SAW duplexer 718.0 / 773.0 MHz Data sheet Matching circuit 5 ■ *L*<sub>p6</sub> = 8.4 nH ■ *L*<sub>s3</sub> = 7.7 nH L чŀ 6 ANT

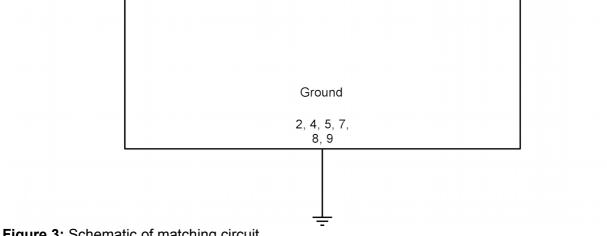


Figure 3: Schematic of matching circuit.

1 TX

0

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#### 6 Characteristics

#### 6.1 TX – ANT

Temperature range for specification	$T_{_{\rm SPEC}}$	= −10 °C +85 °C
TX terminating impedance	Z <sub>TX</sub>	= 50 Ω
ANT terminating impedance	Z <sub>ANT</sub>	= 50 $\Omega$ with par. 8.4 nH <sup>1)</sup>
RX terminating impedance	Z <sub>RX</sub>	= 50 $\Omega$ with ser. 7.7 nH <sup>1)</sup>

Characteristics TX – ANT <sup>2)</sup>				min. for $T_{_{\rm SPEC}}$	<b>typ.</b> @+25 °C	max. for T <sub>SPEC</sub>	
Center frequency			f <sub>c</sub>	—	773		MHz
Maximum insertion attenuation			$\alpha_{_{max}}$				
	758 788	MHz		_	2.2	3.2	dB
Amplitude ripple (p-p)			Δα				
	758 788	MHz		_	1.0	2.1	dB
Maximum VSWR			VSWR <sub>max</sub>				
@ TX port	758 788	MHz		_	1.8	2.2	
@ ANT port	758 788	MHz		_	1.9	2.2	
Maximum error vector magnitude			EVM <sub>max</sub> <sup>3)</sup>				
	760.4 785.6	MHz		_	2.0	4.0	%
Minimum attenuation			$\alpha_{_{min}}$				
	50 699	MHz		30	38	—	dB
	703 733	MHz		37	48	—	dB
	733 748	MHz		23	26	_	dB
	803 814	MHz		30	48	—	dB
	880 915	MHz		36	42	—	dB
	925 960	MHz		36	42	—	dB
	1710 1785	MHz		34	36	—	dB
	1805 1880	MHz		33	36	—	dB
	1920 1980	MHz		33	36	—	dB
	2110 2170	MHz		27	34	—	dB
	2400 2500	MHz		27	35	—	dB
	2500 2570	MHz		24	35	—	dB
	2620 2690	MHz		24	31	—	dB
	3000 5150	MHz		10	12	—	dB
	5150 5850	MHz		8	10	—	dB

<sup>1)</sup> See Sec. Matching circuit (p. 5).

<sup>2)</sup> T is the ambient temperature of the PCB at component position. Specified min./max values are valid for an input power of up to 17 dBm.

<sup>3)</sup> Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141.



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#### 6.2 ANT – RX

Temperature range for specification	T <sub>SPEC</sub>	= −10 °C +85 °C
TX terminating impedance	Z <sub>TX</sub>	= 50 Ω
ANT terminating impedance	Z	= 50 $\Omega$ with par. 8.4 nH <sup>1)</sup>
RX terminating impedance	Z <sub>RX</sub>	= 50 $\Omega$ with ser. 7.7 nH <sup>1)</sup>

Characteristics ANT – RX				$\begin{array}{c} {\rm min.} \\ {\rm for} \ {\rm T}_{\rm _{SPEC}} \end{array}$	<b>typ.</b> @+25 °C	max. for $T_{\rm SPEC}$	
Center frequency			f <sub>c</sub>	—	718	—	MHz
Maximum insertion attenuation			$\alpha_{max}$				
	703 733	MHz		—	2.2	3.5	dB
Amplitude ripple (p-p)			Δα				
	703 733	MHz		_	1.2	2.3	dB
Maximum VSWR			VSWR <sub>max</sub>				
@ ANT port	703 733	MHz		—	1.6	2.2	
@ RX port	703 733	MHz		_	1.5	2.3	
Maximum error vector magnitude			EVM <sub>max</sub> <sup>2)</sup>				
	705.4 730.6	MHz		—	2.9	6.0	%
Minimum attenuation			α <sub>min</sub>				
	50 694	MHz		28	31	_	dB
	694 695	MHz		22	33	_	dB
	758 788	MHz		46	50	_	dB
	788 803	MHz		30	58	_	dB
	791 821	MHz		30	58	_	dB
	869 894	MHz		30	62	—	dB
	925 960	MHz		30	62	—	dB
	1805 1880	MHz		30	64	—	dB
	1930 1995	MHz		30	64	—	dB
	2110 2170	MHz		30	62	—	dB
	2400 2484	MHz		35	63	—	dB
	2620 2690	MHz		30	63	—	dB
	5150 5850	MHz		35	53	—	dB

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1)

See Sec. Matching circuit (p. 5). Error Vector Magnitude (EVM) based on definition given in 3GPP TS 25.141. 2)



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#### 6.3 TX – RX

Temperature range for specification	T <sub>SPEC</sub>	= −10 °C +85 °C
TX terminating impedance	Z <sub>TX</sub>	= 50 Ω
ANT terminating impedance	Z	= 50 $\Omega$ with par. 8.4 nH <sup>1)</sup>
RX terminating impedance	Z <sub>RX</sub>	= 50 $\Omega$ with ser. 7.7 nH <sup>1)</sup>

Characteristics TX – RX				min. for $T_{\rm SPEC}$	<b>typ.</b> @+25 °C	max. for T <sub>SPEC</sub>	
Minimum isolation			$\alpha_{_{min}}$				
	703 733	MHz		48	51	_	dB
	758 788	MHz		49	51	_	dB

<sup>1)</sup> See Sec. Matching circuit (p. 5).

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#### 7 **Maximum ratings**

Operable temperature	$T_{\rm OP} = -40 ^{\circ}{\rm C} \dots +85 ^{\circ}{\rm C}$	
Storage temperature	T <sub>stg</sub> = −40 °C +85 °C	
DC voltage	$V_{\rm DC} = 0 V$	
ESD voltage	$V_{\rm ESD}^{1)} = 100  \rm V$	Machine model.
Input power	P <sub>IN</sub>	source and load impedance 50 $\Omega$
@ TX port: 758 788 MHz	P <sub>IN</sub> 30 dBm <sup>2)</sup>	Pin 30 dBm average – 41dBm peak LTE 5 MHz downlink for 100000 h @ 55 °C.
@ elsewhere	P <sub>IN</sub> 10 dBm	
@ RX port: 703 733 MHz	P <sub>IN</sub> 27 dBm <sup>2)</sup>	LTE 5 MHz uplink for 5000 h @ 55 °C.
Operating lifetime with Output power at antenna		source and load impedance 50 $\Omega$
@ TX port: 758 788 MHz	P <sub>out</sub> t.b.d. dBm <sup>3)</sup>	Continuous wave for 100000 h @ 55 °C.

1) According to JESD22-A115B (MM – Machine Model), 10 negative & 10 positive pulses. Time to failure (TTF) according to accelerated power durability test, and wear out models.

2)

3) According to accelerated High Temperating Operating Life (HTOL) test.



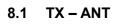
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#### 8 Transmission coefficients



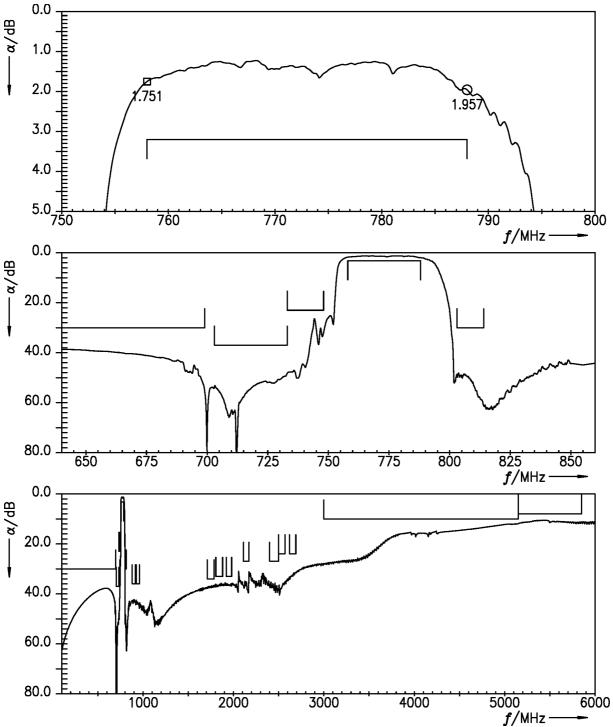


Figure 4: Attenuation TX – ANT.

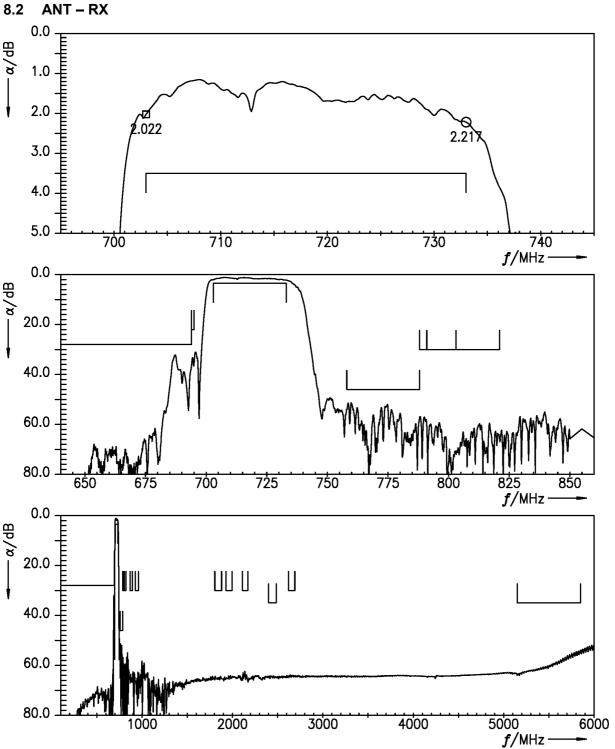


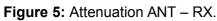
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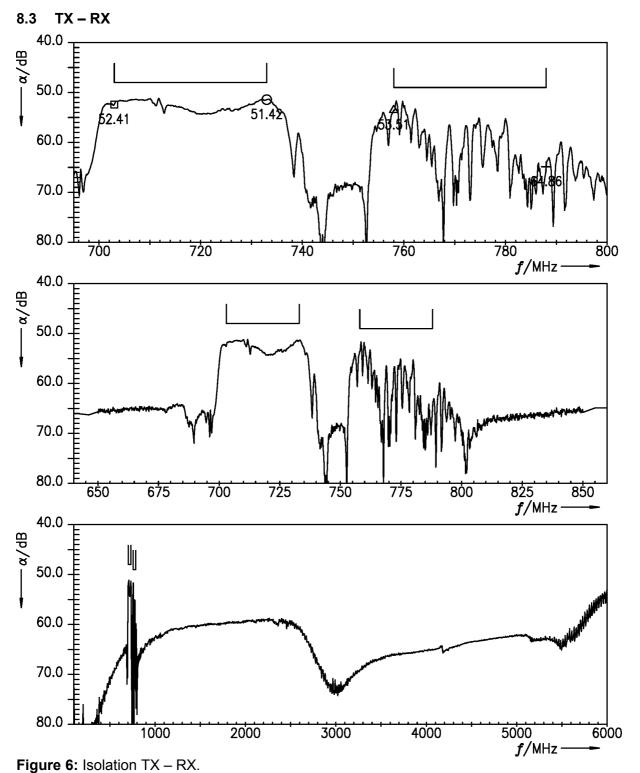
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□ = 758.0 O = 788.0

*Z*<sub>TX</sub>=50 Ω

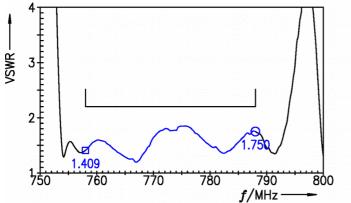
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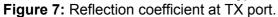
#### SAW components

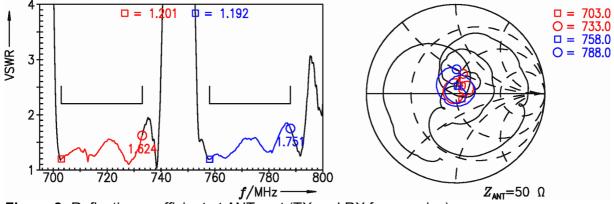
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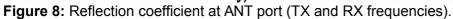
Data sheet

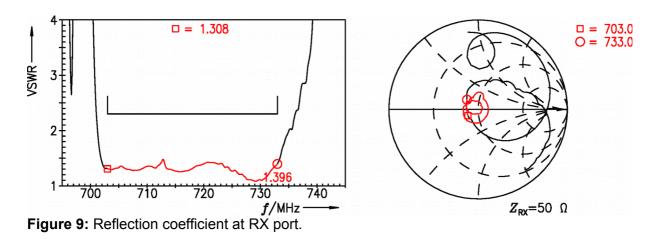
### 9 Reflection coefficients













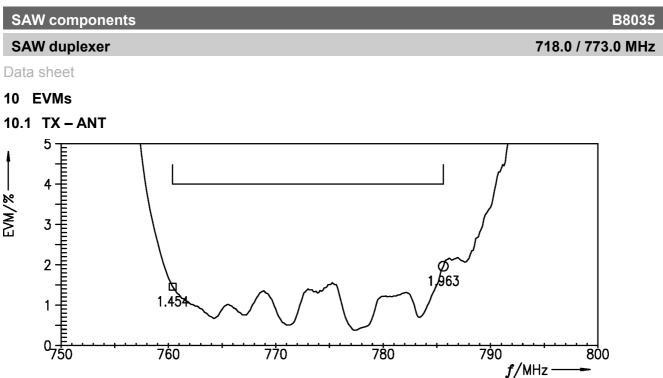


Figure 10: Error vector magnitude TX – ANT.



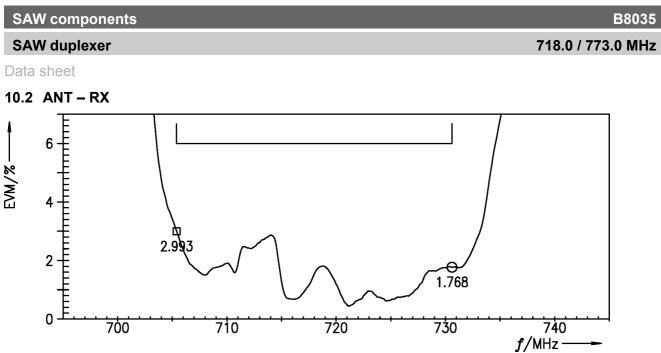


Figure 11: Error vector magnitude ANT – RX.



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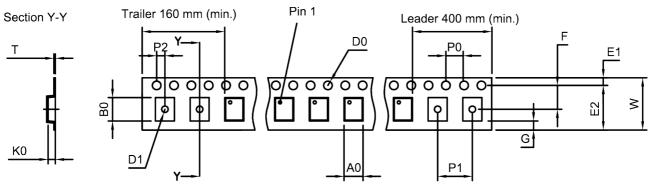
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#### 11 Packing material

#### 11.1 Tape



User direction of unreeling

Figure 12: Drawing of tape (first-angle projection) with tape dimensions according to Table 1.

A <sub>0</sub>	2.25±0.05 mm
B₀	2.75±0.05 mm
D <sub>0</sub>	1.5+0.1/-0 mm
D <sub>1</sub>	1.0 mm (min.)
E1	1.75±0.1 mm

E2	6.25 mm (min.)
F	3.5±0.05 mm
G	0.75 mm (min.)
K <sub>0</sub>	0.6±0.05 mm
P <sub>0</sub>	4.0 <sub>±0.1</sub> mm

<b>P</b> <sub>1</sub>	4.0±0.1 mm
P <sub>2</sub>	2.0±0.05 mm
Т	0.25±0.03 mm
W	8.0+0.3/-0.1 mm

 Table 1: Tape dimensions.

#### 11.2 Reel with diameter of 180 mm

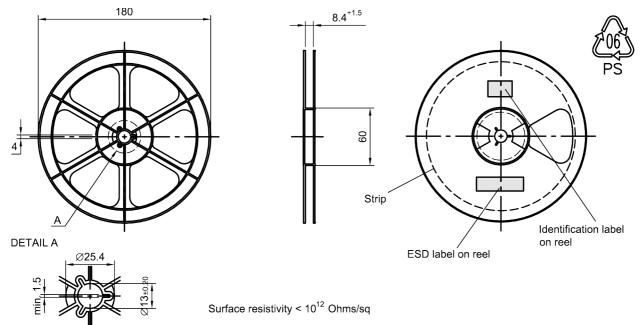
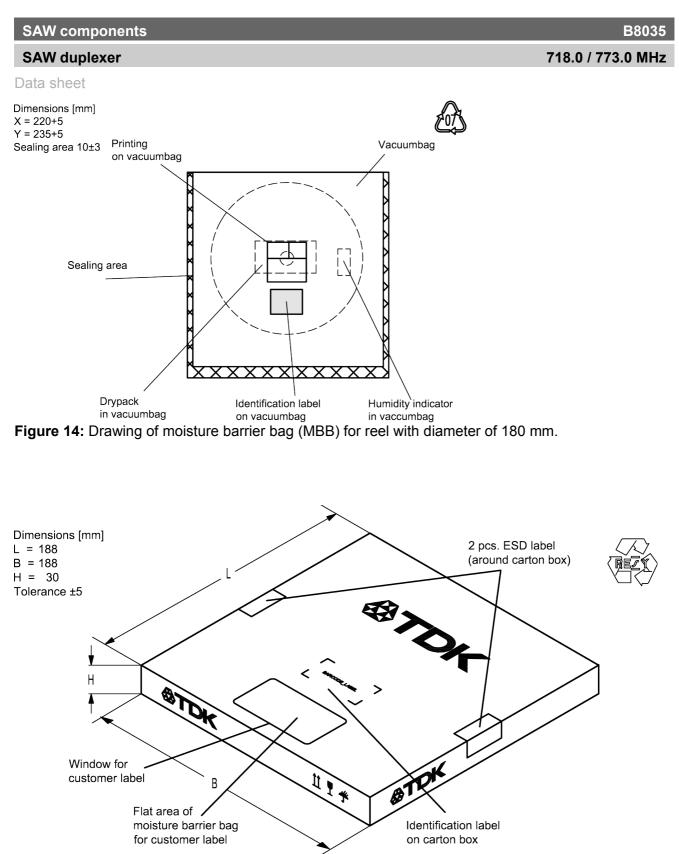
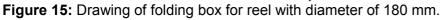


Figure 13: Drawing of reel (first-angle projection) with diameter of 180 mm.









12 Markir	ng							
Products a	are marked	with produc	t type num	ber and	lot number	encoded a	ccording to	Table 2:
Type nur	nber <sup>.</sup>		•••				•	
				-1 -		<b>.</b>		
The 4 digit type number of the ordering code, e.g., B3xxxxB1234xxxx, is encoded by a special BASE32 code into a 3 digit marking.								
	•			•	•		in decimal	code
Example of decoding type number marking on device <b>16J</b>							123	
		2 <sup>2</sup> + <b>6</b> x 32 <sup>1</sup>	+ 18 (=J) x	=		123		
The BASE32 code for product type B8035 is 7V3.								
■ Lot num	oer:							
The last	The last 5 digits of the lot number, e.g., <b>12345</b> ,							
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								45
					-		123	545
		7² + <b>27 (=U</b> )	x 47 <sup>1</sup> + <b>31</b>	(=Y) × 4	-		123	-
Adopte				(=Y) × 4	47° =		-	345
Decimal	<b>5</b> x 4 <b>6 BASE32 co</b> Base32		number Base32	( <b>=Y)</b> x 4	47° =		123 code for lot n Decimal	umber Base47
Decimal value	5 x 4 ed BASE32 co Base32 code	ode for type r Decimal value	number Base32 code	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value	ted BASE47 o Base47 code	<b>123</b> code for lot no Decimal value	Base47 code
Decimal	<b>5</b> x 4 <b>6 BASE32 co</b> Base32	ode for type r Decimal value 16	number Base32 code G	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal	ed BASE47 o Base47	<b>123</b> code for lot no Decimal value 24	Base47 code R
Decimal value 0 1	5 x 4 ed BASE32 co Base32 code	ode for type r Decimal value 16 17	number Base32 code	( <b>=Y)</b> × 4	47 <sup>0</sup> = Adopt Decimal value 0 1	ted BASE47 o Base47 code	<b>123</b> code for lot n Decimal value 24 25	Base47 code R S
Decimal value 0	5 x 4 ed BASE32 co Base32 code 0	ode for type r Decimal value 16	number Base32 code G	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0	ted BASE47 of Base47 code 0	<b>123</b> code for lot no Decimal value 24	Base47 code R
Decimal value 0 1	<b>5</b> x 4 <b>6 BASE32 co</b> Base32 code 0 1	ode for type r Decimal value 16 17	number Base32 code G H	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1	Base47 code 0 1	<b>123</b> code for lot n Decimal value 24 25	Base47 code R S
Decimal value 0 1 2	<b>5</b> x 4 <b>6 BASE32 co</b> Base32 code 0 1 2	ode for type r Decimal value 16 17 18	number Base32 code G H J	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2	Base47 Code 0 1 2	123 code for lot m Decimal value 24 25 26	Base47 code R S T
Decimal value 0 1 2 3	<b>5</b> x 4 <b>ad BASE32 co</b> Base32 code 0 1 2 3	ode for type r Decimal value 16 17 18 19	Base32 code G H J K	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3	ted BASE47 of Base47 code 0 1 2 3	123 code for lot m Decimal value 24 25 26 27	Base47 code R S T U
Decimal value 0 1 2 3 4	<b>5</b> x 4 <b>6 BASE32 code</b> 0 1 2 3 4	ode for type r Decimal value 16 17 18 19 20	Base32 code G H J K M	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4	ted BASE47 of Base47 code 0 1 2 3 4	123 code for lot n Decimal value 24 25 26 27 28	Base47 code R S T U V
Decimal value 0 1 2 3 4 5	<b>5</b> x 4 <b>6 BASE32 co</b> Base32 code 0 1 2 3 4 5	ode for type r Decimal value 16 17 18 19 20 21	number Base32 code G H J K K M N	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4 5	ted BASE47 of Base47 code 0 1 2 3 4 5	123 code for lot n Decimal value 24 25 26 27 28 29	Base47 code R S T U V W
Decimal value 0 1 2 3 4 5 6	<b>5</b> x 4 <b>6 BASE32 co</b> Base32 code 0 1 2 3 4 5 6	ode for type r Decimal value 16 17 18 19 20 21 22	Base32 code G H J K M N N P	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4 5 6	ted BASE47 of Base47 code 0 1 2 3 4 5 6	<b>123</b> <b>code for lot n</b> Decimal value 24 25 26 27 28 29 30	Base47 code R S T U V W X
Decimal value 0 1 2 3 4 5 6 7	<b>5</b> x 4 <b>ad BASE32 code</b> 0 1 2 3 4 5 6 7	ode for type r           Decimal           value           16           17           18           19           20           21           22           23	Base32 code G H J K M N P Q	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4 5 6 7	<b>ed BASE47 o</b> Base47 code 0 1 2 3 4 5 6 7	<b>123</b> <b>code for lot n</b> Decimal value 24 25 26 27 28 29 30 31	Base47 code R S T U V W X X Y
Decimal value 0 1 2 3 4 5 6 7 8	<b>5</b> x 4 <b>6 BASE32</b> code 0 1 2 3 4 5 6 7 8	Decimal           value           16           17           18           19           20           21           22           23           24	Base32 code G H J K M N P Q R	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4 5 6 7 8	ted BASE47 code 0 1 2 3 4 5 6 7 8	<b>123</b> <b>code for lot m</b> <b>Decimal</b> value 24 25 26 27 28 29 30 31 32	Base47 code R S T U V W X X Y Z
Decimal value 0 1 2 3 4 5 6 7 8 8 9	<b>5</b> x 4 <b>6 BASE32 co</b> <b>7</b> <b>8</b> <b>9</b>	Decimal           value           16           17           18           19           20           21           22           23           24           25	Base32 code G H J K M N P Q R S	(=Y) × 4	47 <sup>0</sup> = Adopt Decimal value 0 1 2 3 4 5 6 7 8 9	ted BASE47 of Base47 code 0 1 2 3 4 5 6 7 8 9	<b>123</b> <b>code for lot n</b> Decimal value 24 25 26 27 28 29 30 31 32 33	Base47 code R S T U V W X Y Z b

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#### 12

Table 2: Lists for encoding and decoding of marking.

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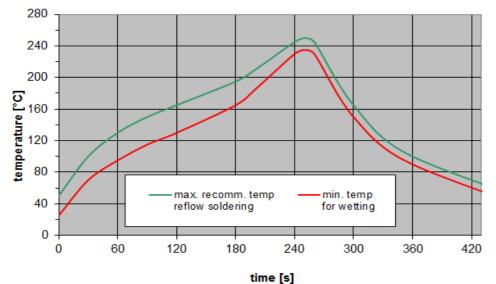
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#### 13 Soldering profile

The recommended soldering process is in accordance with IEC 60068-2-58 – 3<sup>rd</sup> 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
<i>T</i> > 220 °C	30 s to 70 s
<i>T</i> > 230 °C	min. 10 s
<i>T</i> > 245 °C	max. 20 s
<i>T</i> ≥ 255 °C	_
peak temperature T <sub>peak</sub>	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 16:** Recommended reflow profile for convection and infrared soldering – lead-free solder.

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#### 14 Annotations

#### 14.1 Matching coils

See TDK inductor pdf-catalog <u>http://www.tdk.co.jp/tefe02/coil.htm#aname1</u> and Data Library for circuit simulation <u>http://www.tdk.co.jp/etvcl/index.htm</u>.

#### 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 EPCOS sales office.

#### 14.4 Ordering codes and packing units

Ordering code	Packing unit
B39771B8035P810	5000 pcs

 Table 4: Ordering codes and packing units.

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#### **15** Cautions and warnings

#### **15.1** 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 <u>www.epcos.com/orderingcodes</u>.

#### 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.

#### 15.3 Moldability

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

#### **15.4 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.

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#### Important notes

The following applies to all products named in this publication:

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