SAW Components

SAW Triplexer

Short range devices

Series/type: **B3532**
Ordering code: **B39431B3532A410**

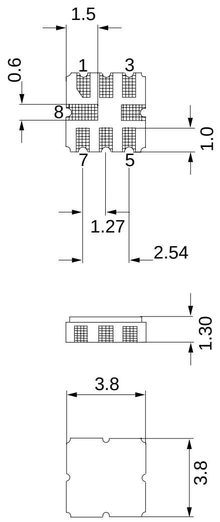
Date: December 20, 2012
Version: 2.2

Application

- Triplexer for remote control receivers
- Channel 1 with pass band at 433.92 MHz
- Channel 2 with pass band at 434.64 MHz
- Channel 3 with pass band at 433.20 MHz

Features

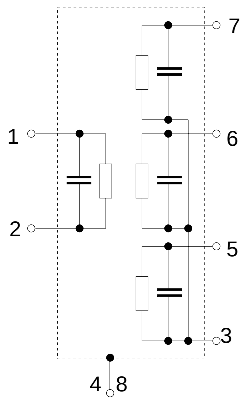
- Package size 3.8 x 3.8 x 1.3 mm^3
- Package code QCC8G
- RoHS compatible
- Approximate weight 0.06g
- Package for **S**urface **M**ount **T**echnology (**SMT**)
- Ni, gold-plated terminals
- Lead free soldering compatible with J - STD20C
- Passivation layer Elpas
- AEC-Q200 qualified component family
- **E**lectrostatic **S**ensitive **D**evice (**ESD**)



Pin configuration[1)]

- 1 Input
- 2 Input ground
- 7 Output [Channel 2]
- 6 Output [Channel 1]
- 5 Output [Channel 3]
- 3 Output ground
- 4,8 Case - grounded

1) The recommended pin configuration usually offers best suppression of electrical crosstalk. The filter characteristics refer to this configuration.



Characteristics Channel 1

Temperature range for specification: T = –40 ˚C to +85 ˚C
Terminating source impedance: Z_S = 50 Ω and matching network
Terminating load impedance: Z_L = 50 Ω and matching network

		min.	typ. @ 25 ˚C	max.	
Center frequency	f_C	—	433.92	—	MHz
Minimum insertion attenuation	α_{min}				
incl. loss in matching elements (Q_L = 42)		—	2.9	3.6	dB
excl. loss in matching elements		—	2.4	3.1	dB
Pass band (relative to α_{min})					
433.82 ... 434.02 MHz		—	0.8	1.5	dB
433.79 ... 434.05 MHz		—	1.0	3.0	dB
Relative attenuation (relative to α_{min})	α_{rel}				
10.00 ... 310.00 MHz		52	58	—	dB
310.00 ... 428.00 MHz		44	50	—	dB
428.00 ... 432.30 MHz		26	32	—	dB
432.30 ... 433.26 MHz		16	22	—	dB
434.55 ... 435.80 MHz		10	16	—	dB
435.80 ... 443.00 MHz		24	30	—	dB
443.00 ... 600.00 MHz		40	46	—	dB
600.00 ... 1050.00 MHz		44	50	—	dB
1050.00 ... 1650.00 MHz		50	56	—	dB
1650.00 ... 2500.00 MHz		35	41	—	dB
Impedance for pass band matching[1)]					
Input: $Z_{IN} = R_{IN} \parallel C_{IN}$		—	350 || 3.6	—	Ω || pF
Output: $Z_{OUT} = R_{OUT} \parallel C_{OUT}$		—	480 || 1.7	—	Ω || pF

[1)] Impedance for passband matching bases on an ideal, perfect matching of the SAW filter to source- and to load impedance (here 50 Ohm). 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 passband. For more details we refer to EPCOS application note #4.

Characteristics Channel 2

Temperature range for specification: T = –40 °C to +85 °C
Terminating source impedance: Z_S = 50 Ω and matching network
Terminating load impedance: Z_L = 50 Ω and matching network

		min.	typ. @ 25 °C	max.	
Center frequency	f_C	—	434.64	—	MHz
Minimum insertion attenuation	α_{min}				
incl. loss in matching elements (Q_L = 42)		—	2.9	3.6	dB
excl. loss in matching elements		—	2.4	3.1	dB
Pass band (relative to α_{min})					
434.58 ... 434.70 MHz		—	0.5	1.5	dB
434.55 ... 434.73 MHz		—	1.0	3.0	dB
Relative attenuation (relative to α_{min})	α_{rel}				
10.00 ... 250.00 MHz		52	58	—	dB
250.00 ... 330.00 MHz		46	52	—	dB
330.00 ... 429.00 MHz		40	46	—	dB
429.00 ... 433.26 MHz		24	30	—	dB
433.26 ... 434.05 MHz		10	16	—	dB
435.30 ... 436.00 MHz		12	18	—	dB
436.00 ... 443.00 MHz		24	30	—	dB
443.00 ... 450.00 MHz		40	46	—	dB
450.00 ... 750.00 MHz		42	48	—	dB
750.00 ... 1050.00 MHz		46	52	—	dB
1050.00 ... 1750.00 MHz		50	56	—	dB
1750.00 ... 2500.00 MHz		35	41	—	dB
Impedance for pass band matching[1)]					
Input: $Z_{IN} = R_{IN} \parallel C_{IN}$		—	350 || 3.6	—	Ω || pF
Output: $Z_{OUT} = R_{OUT} \parallel C_{OUT}$		—	480 || 1.7	—	Ω || pF

1) Impedance for passband matching bases on an ideal, perfect matching of the SAW filter to source- and to load impedance (here 50 Ohm). 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 passband. For more details we refer to EPCOS application note #4.

Characteristics Channel 3

Temperature range for specification: T = –40 ˚C to +85 ˚C
Terminating source impedance: Z_S = 50 Ω and matching network
Terminating load impedance: Z_L = 50 Ω and matching network

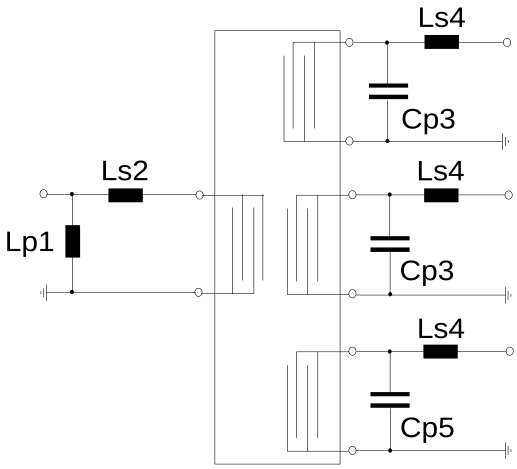
		min.	typ. @ 25 ˚C	max.	
Center frequency	f_C	—	433.20	—	MHz
Minimum insertion attenuation	α_{min}				
incl. loss in matching elements (Q_L = 42)		—	2.8	3.5	dB
excl. loss in matching elements		—	2.4	3.1	dB
Pass band (relative to α_{min})					
433.14 ... 433.26 MHz		—	0.8	1.5	dB
433.11 ... 433.29 MHz		—	1.0	3.0	dB
Relative attenuation (relative to α_{min})	α_{rel}				
10.00 ... 340.00 MHz		52	58	—	dB
340.00 ... 370.00 MHz		46	52	—	dB
370.00 ... 400.00 MHz		40	46	—	dB
400.00 ... 428.00 MHz		35	41	—	dB
428.00 ... 431.50 MHz		26	32	—	dB
431.50 ... 432.40 MHz		16	22	—	dB
433.80 ... 434.50 MHz		14	20	—	dB
434.50 ... 438.00 MHz		24	30	—	dB
438.00 ... 443.00 MHz		20	26	—	dB
443.00 ... 600.00 MHz		34	40	—	dB
600.00 ... 750.00 MHz		40	46	—	dB
750.00 ... 1050.00 MHz		46	52	—	dB
1050.00 ... 1750.00 MHz		52	58	—	dB
1750.00 ... 2500.00 MHz		35	41	—	dB
Impedance for pass band matching[1]					
Input: $Z_{IN} = R_{IN} \| C_{IN}$		—	350 || 3.6	—	Ω || pF
Output: $Z_{OUT} = R_{OUT} \| C_{OUT}$		—	480 || 1.7	—	Ω || pF

[1] Impedance for passband matching bases on an ideal, perfect matching of the SAW filter to source- and to load impedance (here 50 Ohm). 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 passband. For more details we refer to EPCOS application note #4.

Maximum ratings

Operable temperature range	T	–45/+125	˚C	
Storage temperature range	T_{stg}	–45/+125	˚C	
DC voltage	V_{DC}	6	V	
Source power	P_S	10	dBm	source impedance 50 Ω

Matching network to 50 Ω (element values depend on pcb layout and equivalent circuit)



L_{p1} = 16 nH

L_{s2} = 20 nH

Channel 1,2

C_{p3} = 0.3 pF

L_{s4} = 47 nH

Channel 3

C_{p5} = 0.2 pF

L_{s4} = 47 nH

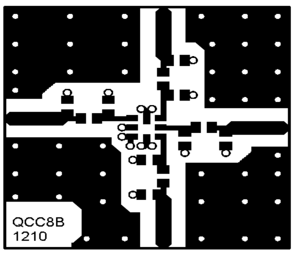
Minimising the crosstalk

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 0.5nH degrades the ultimate rejection (crosstalk) by 20dB.

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



Optimised PCB layout for SAW filters in QCC8G package, pinning 1 - 5,6,7 (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.

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 two figures show recommended “ESD matching” topologies.

Depending on the input impedance of the SAW filter and the source impedance, the needed component values have to be determined from case to case.

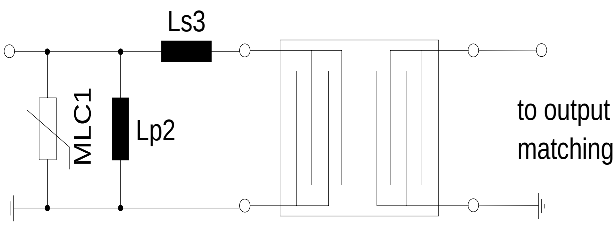


Fig. 1 MLC varistor plus ESD matching

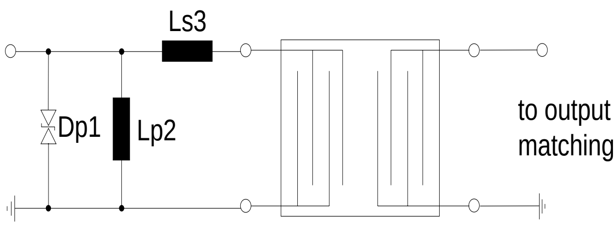


Fig. 2 Suppressor diode plus ESD matching

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

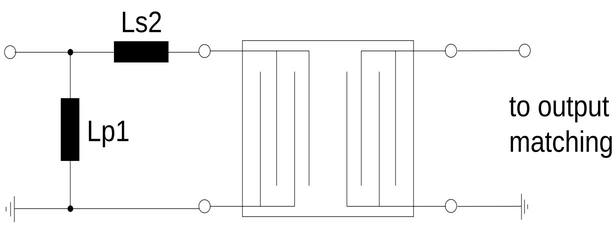


Fig. 3 shunt L – series L matching

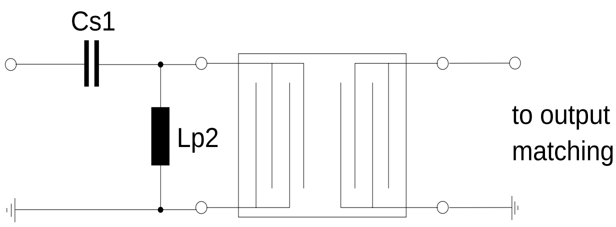
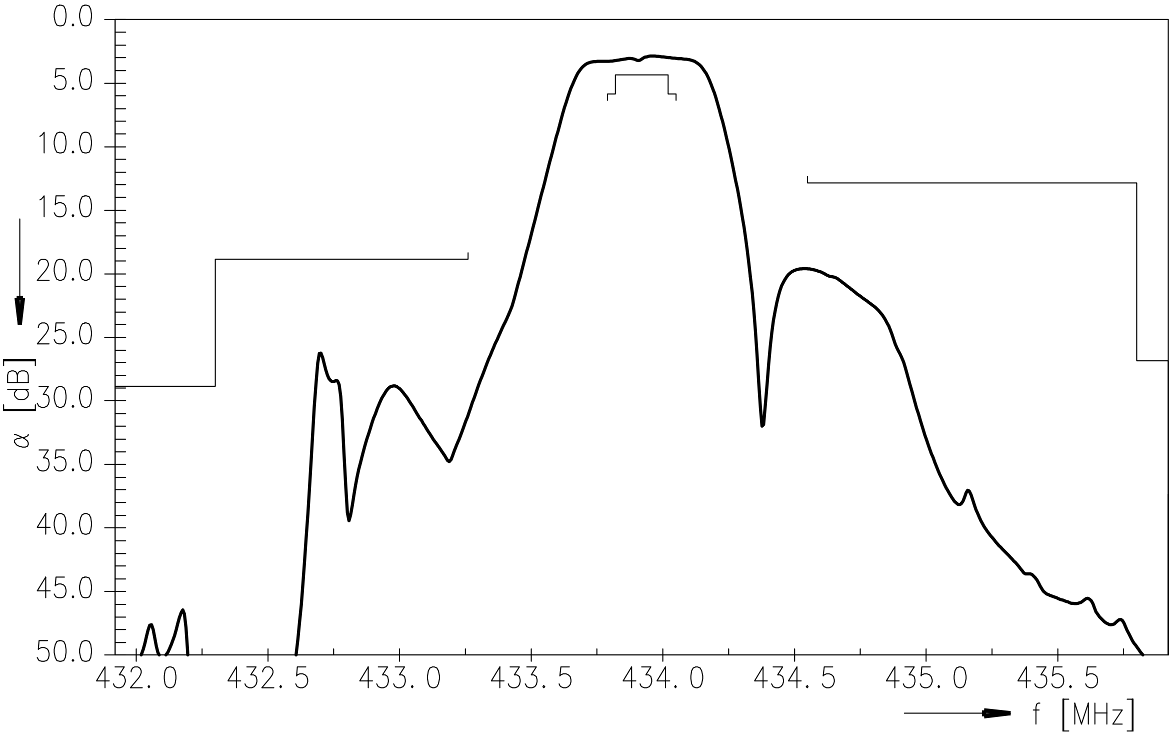


Fig. 4 series C – shunt L matching

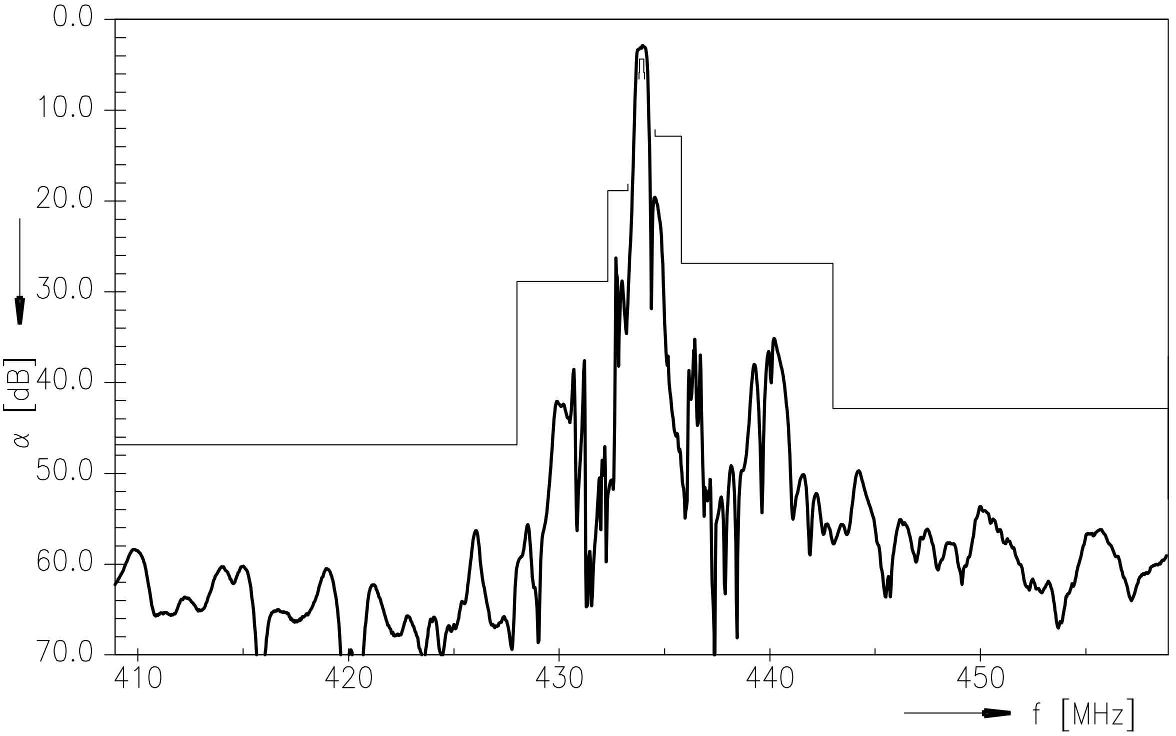
Effectiveness of the applied ESD protection has to be checked according to relevant industry standards or customer specific requirements.

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 “data sheets” and then “Applications” under category “Further information”.

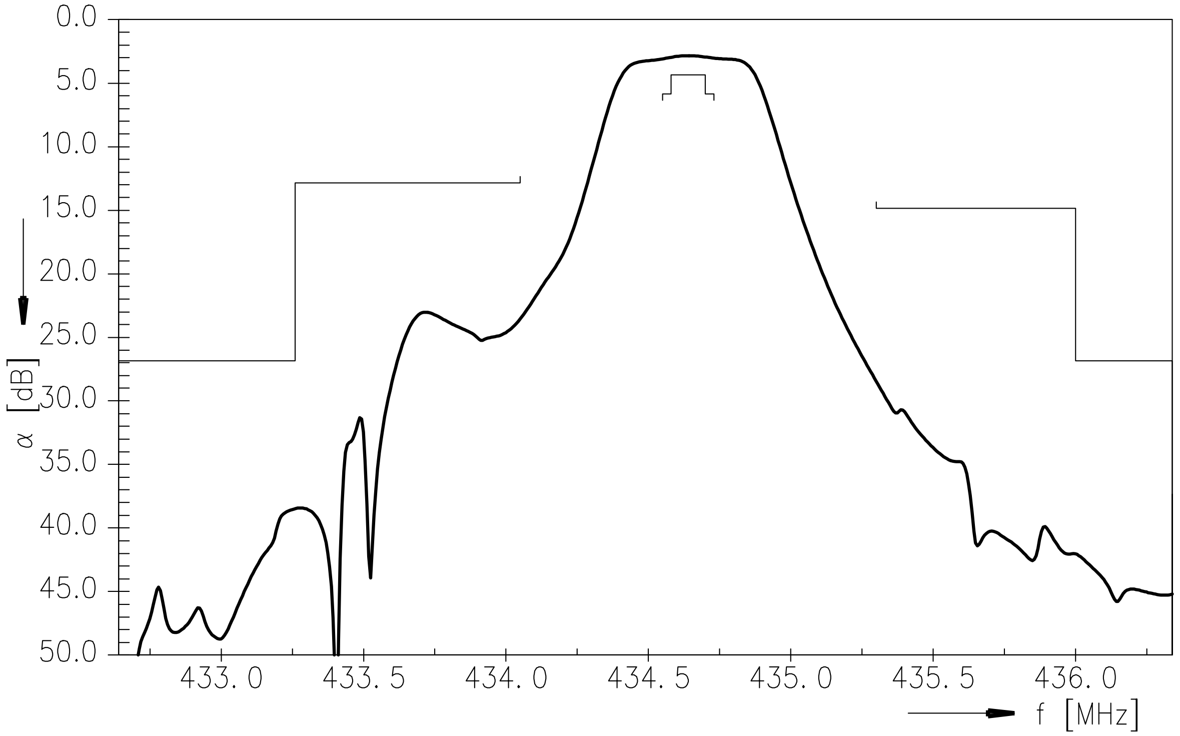
Transfer function Channel 1



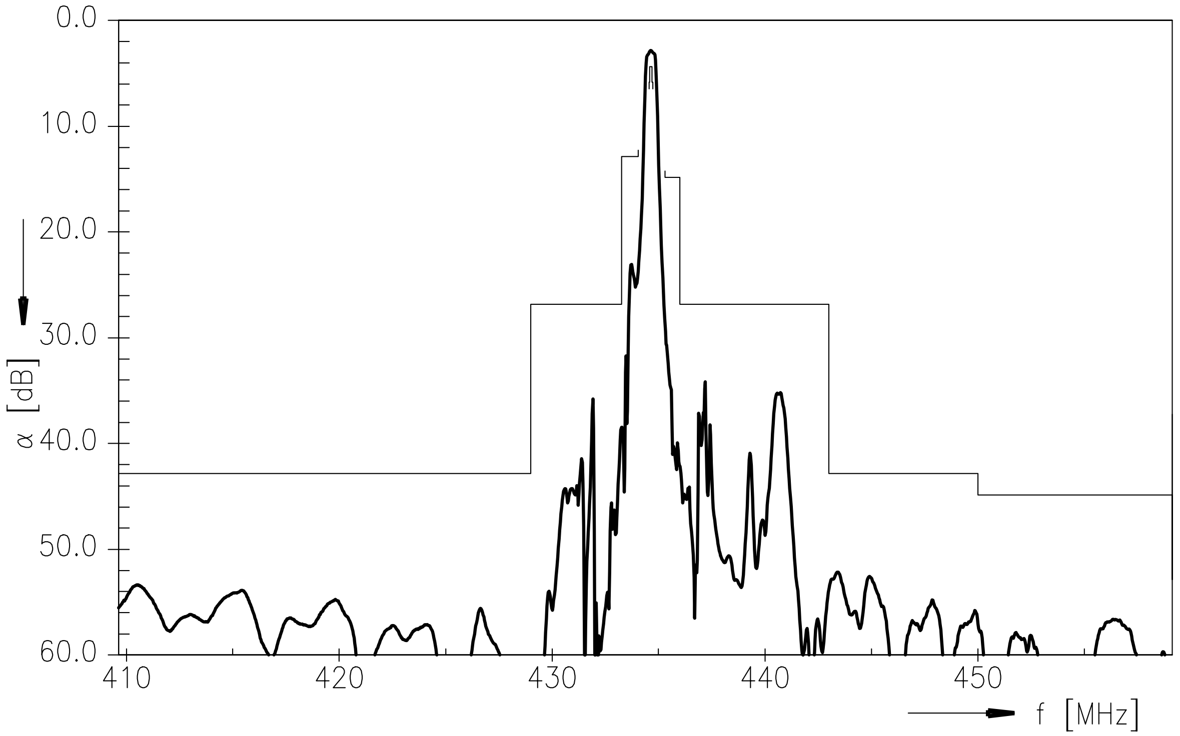
Transfer function Channel 1 (wideband)



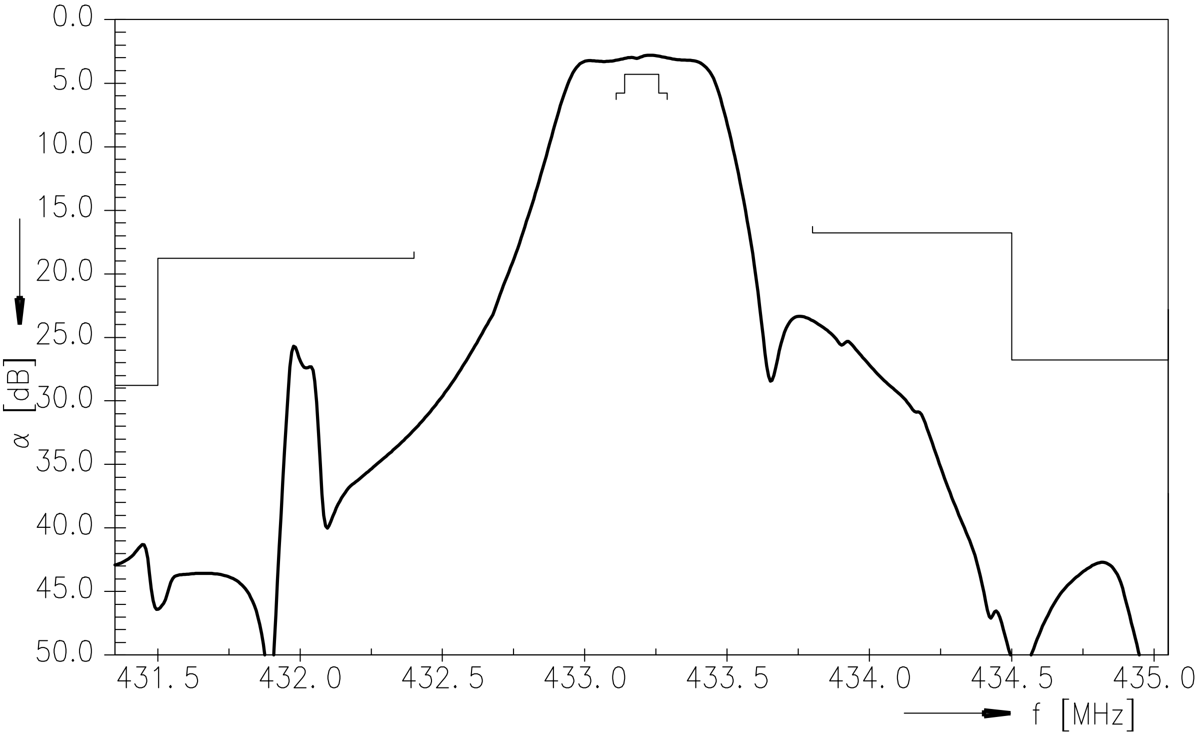
Transfer function Channel 2



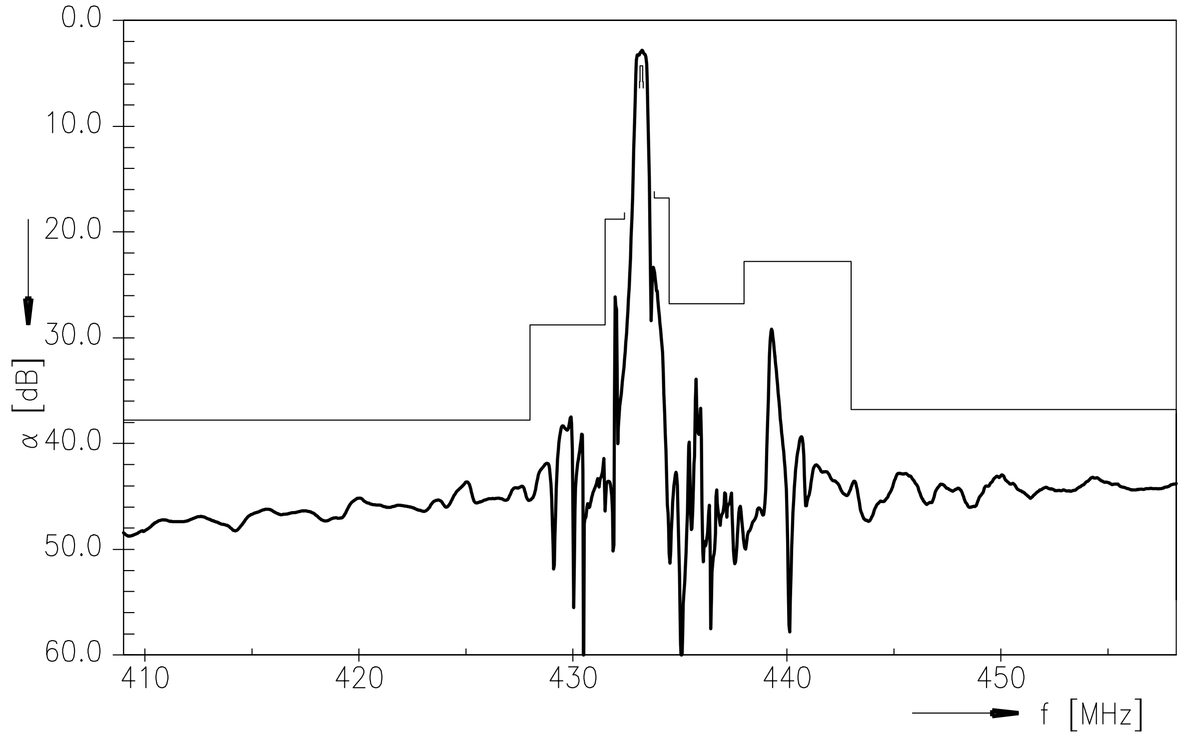
Transfer function Channel 2 (wideband)



Transfer function Channel 3



Transfer function Channel 3 (wideband)



References

Type	B3532
Ordering code	B39431B3532A410
Marking and package	C61157-A7-A176
Packaging	F61074-V8229-Z000
Date codes	L_1126
S-parameters	B3532_NB.s4p, B3532_WB.s4p see file header for port/pin assignment table
Soldering profile	S_6001
RoHS compatible	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.
Matching coils	See 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

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