



SAW Components

SAW Duplexer

W-CDMA Band 4 / CDMA 1x AWS Band

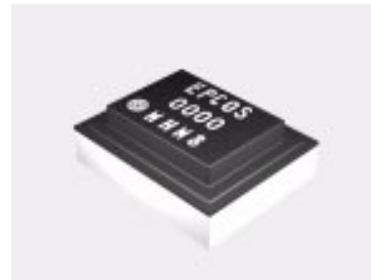
Series/type:	B7959
Ordering code:	B39212B7959P810
Date:	February 11, 2011
Version:	2.2

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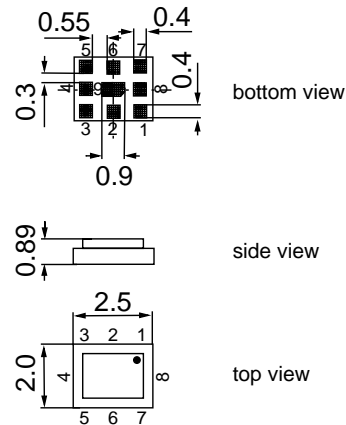
Application

- Low-loss SAW duplexer for mobile telephone W-CDMA Band 4 (UMTS) / CDMA 1x AWS systems
- Low insertion attenuation
- Low amplitude ripple
- Usable passband 45 MHz
- Single-ended to balanced transformation in Antenna-Rx path
- Impedance transformation 50 Ω to 100 Ω in Antenna-Rx path
- High isolation between Tx and Rx



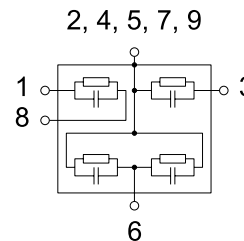
Features

- Package size 2.5 * 2.0 * 0.89 mm³
- RoHS compatible
- Approximate weight 0.017 g
- Package for **Surface Mount Technology (SMT)**
- Ni, Au-plated terminals
- Balanced Rx port, unbalanced Tx port
- **Electrostatic Sensitive Device (ESD)**
- Fully matched by integrated matching network
- **Moisture Sensitive Level 3**



Pin configuration

- 3 Tx input, unbalanced
- 1, 8 Rx output, balanced
- 6 Antenna
- 2, 4, 5, 7, 9 To be grounded



Please read *cautions and warnings and important notes* at the end of this document.



Data sheet



Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °C
 TX terminating impedance: Z_{Tx} = 50 Ω
 ANT terminating impedance: Z_{Ant} = 50 Ω
 RX terminating impedance: Z_{Rx} = 100 Ω (balanced) || 8.2nH

Characteristics Tx-Antenna		min.	typ. @ 25 °C	max.	
Center frequency	f _c	-	1732.5	-	MHz
Maximum insertion attenuation	α _{W-CDMA} ¹⁾				
@f _{Carrier} 1712.4 ... 1752.6MHz		-	1.6	1.8	dB
Amplitude ripple (p-p)	Δα _{W-CDMA} ¹⁾				
@f _{Carrier} 1712.4 ... 1752.6MHz		-	0.3	0.5	dB
Error Vector Magnitude	EVM ²⁾				
@f _{Carrier} 1712.4 ... 1752.6MHz		-	0.5	2.0	%
Input VSWR (Tx port)					
1710.0 ... 1755.0MHz		-	1.7	2.0	
Output VSWR (Ant Port)					
1710.0 ... 1755.0MHz		-	1.6	2.0	
Attenuation	α				
10.0 ... 1565.4MHz		30	37	-	dB
728.0 ... 764.0MHz		39	43	-	dB
851.0 ... 894.0MHz		37	41	-	dB
1565.4 ... 1573.3MHz		40	48	-	dB
1573.3 ... 1577.5MHz		45	51	-	dB
1577.5 ... 1585.5MHz		40	50	-	dB
1597.5 ... 1605.9MHz		45	50	-	dB
1805.0 ... 1880.0MHz		20	43	-	dB
1930.0 ... 1990.0MHz		38	42	-	dB
@f _{Carrier} 2112.4 ... 2152.6MHz	α _{W-CDMA} ¹⁾	43	47	-	dB
2400.0 ... 2500.0MHz		32	35	-	dB
3410.0 ... 3520.0MHz		20	32	-	dB
5120.0 ... 5350.0MHz		20	23	-	dB
5725.0 ... 5850.0MHz		20	25	-	dB

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.

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



Data sheet



Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °C
 TX terminating impedance: Z_{TX} = 50 Ω
 ANT terminating impedance: Z_{Ant} = 50 Ω
 RX terminating impedance: Z_{Rx} = 100 Ω (balanced) || 8.2nH

Characteristics Antenna-Rx		min.	typ. @ 25 °C	max.	
Center frequency	f _c	-	2132.5	-	MHz
Maximum insertion attenuation @f _{Carrier} 2112.4 ... 2152.6MHz	α _{W-CDMA} ¹⁾	-	2.0	2.3	dB
Amplitude ripple (p-p) @f _{Carrier} 2112.4 ... 2152.6MHz	Δα _{W-CDMA} ¹⁾	-	0.2	0.5	dB
Input VSWR (Ant port) 2110.0 ... 2155.0MHz		-	1.3	2.0	
Output VSWR (Rx port) 2110.0 ... 2155.0MHz		-	1.4	2.0	
CMRR (S ₃₂ -S ₄₂ / S ₃₂ +S ₄₂) 2110.0 ... 2155.0MHz		22 ²⁾	25	-	dB
IMD product level limits³⁾					
at f_{TX}=1732.5 MHz, f_{RX}= 2132.5 MHz					
Blocker 1	400.0MHz		-130		dBm
Blocker 2	1332.5MHz		-107		dBm
Blocker 3	3865.0MHz		-117		dBm
Blocker 4	5597.5MHz		-130		dBm

1) Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.
 2) A combination of 10 ° phase balance and 1 dB amplitude balance corresponds to 19.6 dB CMRR
 3) IMD product level limits for power levels P_{TX}=21.5 dBm (antenna port output power) and P_{Blocker}=-15dBm (antenna port input power)



Data sheet



Characteristics for W-CDMA Band 4

Temperature range for specification: T = -15 °C to +80 °C
 TX terminating impedance: Z_{Tx} = 50 Ω
 ANT terminating impedance: Z_{Ant} = 50 Ω
 RX terminating impedance: Z_{Rx} = 100 Ω (balanced) || 8.2nH

Characteristics Antenna-Rx				min.	typ. @ 25 °C	max.	
Attenuation							
			α				
	1.0 ... 1710.0	MHz		35	53	-	dB
@f _{Carrier}	1712.4 ... 1752.6	MHz	α _{W-CDMA} ¹⁾	45	58	-	dB
	1755.0 ... 2025.0	MHz		30	38	-	dB
	2240.0 ... 2400.0	MHz		15	40	-	dB
	2400.0 ... 2484.0	MHz		30	44	-	dB
	2484.0 ... 6000.0	MHz		35	46	-	dB

¹⁾ Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.

Characteristics Tx-Rx				min.	typ. @ 25 °C	max.	
Differential Mode Isolation							
			α				
	1574.0 ... 1577.0	MHz		40	60	-	dB
	1712.4 ... 1752.6	MHz	α _{W-CDMA} ¹⁾	55	60	-	dB
	2112.4 ... 2152.6	MHz	α _{W-CDMA} ¹⁾	50	54	-	dB
	3410.0 ... 3520.0	MHz		20	60	-	dB
	5120.0 ... 5275.0	MHz		20	60	-	dB
Common Mode Isolation							
			α				
	1712.4 ... 1752.6	MHz	α _{W-CDMA} ¹⁾	50	53	-	dB

¹⁾ Attenuation of W-CDMA signal (Power Transfer Function). Please, refer to page 9 of this document.



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Characteristics for CDMA 1x AWS Band

Temperature range for specification: T = -30 °C to +85 °C
 TX terminating impedance: Z_{Tx} = 50 Ω
 ANT terminating impedance: Z_{Ant} = 50 Ω
 RX terminating impedance: Z_{Rx} = 100 Ω (balanced) || 8.2nH

Characteristics Tx-Antenna	min.	typ. @ 25 °C	max.	
Center frequency f _c	-	1732.5	-	MHz
Maximum insertion attenuation α 1710.00 ... 1755.00 MHz	-	1.6	2.0	dB
Amplitude ripple (p-p) Δα 1710.00 ... 1755.00 MHz	-	0.3	0.7	dB
Input VSWR (Tx port) 1710.00 ... 1755.00 MHz	-	1.7	2.0	
Output VSWR (Ant Port) 1710.00 ... 1755.00 MHz	-	1.6	2.0	
Attenuation α				
10.0 ... 1565.4 MHz	30	37	-	dB
728.0 ... 764.0 MHz	39	43	-	dB
851.0 ... 894.0 MHz	37	41	-	dB
1565.4 ... 1573.3 MHz	40	48	-	dB
1573.3 ... 1577.5 MHz	45	51	-	dB
1577.5 ... 1585.5 MHz	40	50	-	dB
1597.5 ... 1605.9 MHz	45	50	-	dB
1805.0 ... 1880.0 MHz	20	43	-	dB
1930.0 ... 1990.0 MHz	38	42	-	dB
2110.0 ... 2155.0 MHz	43	47	-	dB
2400.0 ... 2500.0 MHz	32	35	-	dB
3410.0 ... 3520.0 MHz	20	32	-	dB
5120.0 ... 5350.0 MHz	20	23	-	dB
5725.0 ... 5850.0 MHz	20	25	-	dB



Data sheet



Characteristics for CDMA 1x AWS Band

Temperature range for specification: $T = -30\text{ °C to }+85\text{ °C}$
 TX terminating impedance: $Z_{Tx} = 50\ \Omega$
 ANT terminating impedance: $Z_{Ant} = 50\ \Omega$
 RX terminating impedance: $Z_{Rx} = 100\ \Omega$ (balanced) || 8.2nH

Characteristics Antenna-Rx	min.	typ. @ 25 °C	max.	
Center frequency f_c	-	2132.5	-	MHz
Maximum insertion attenuation α 2110.00 ... 2155.00 MHz	-	2.0	2.4	dB
Amplitude ripple (p-p) $\Delta\alpha$ 2110.00 ... 2155.00 MHz	-	0.3	0.7	dB
Input VSWR (Ant port) 2110.00 ... 2155.00 MHz	-	1.3	2.0	
Output VSWR (Rx port) 2110.00 ... 2155.00 MHz	-	1.4	2.0	
CMRR ($ S_{32}-S_{42} / S_{32}+S_{42} $) 2110.0 ... 2155.0 MHz	22 ¹⁾	25	-	dB
Attenuation α				
1.0 ... 1710.0 MHz	35	53	-	dB
1710.0 ... 1755.0 MHz	45	58	-	dB
1755.0 ... 2025.0 MHz	30	38	-	dB
2240.0 ... 2400.0 MHz	15	40	-	dB
2400.0 ... 2484.0 MHz	30	44	-	dB
2484.0 ... 6000.0 MHz	35	46	-	dB

1) A combination of 10 ° phase balance and 1 dB amplitude balance corresponds to 19.6 dB CMRR



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Characteristics for CDMA 1x AWS Band

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 TX terminating impedance: $Z_{Tx} = 50\ \Omega$
 ANT terminating impedance: $Z_{Ant} = 50\ \Omega$
 RX terminating impedance: $Z_{Rx} = 100\ \Omega$ (balanced) || 8.2nH

Characteristics Tx-Rx				min.	typ. @ 25 °C	max.	
Differential Mode Isolation α							
1574.0	...	1577.0	MHz	40	60	-	dB
1710.0	...	1755.0	MHz	55	59	-	dB
2110.0	...	2155.0	MHz	50	54	-	dB
3410.0	...	3520.0	MHz	20	60	-	dB
5120.0	...	5275.0	MHz	20	60	-	dB
Common Mode Isolation α							
1710.0	...	1755.0	MHz	50	53	-	dB

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Annotation for characteristics section

Attenuation of W-CDMA signal (Power Transfer Function, α_{W-CDMA}) is determined by

$$\int_{-\infty}^{\infty} |S_{ds21}(f)H_{RRC}(f - f_{Carrier})|^2 df$$

with $f_{Carrier}$ according to 3GPP TS 25.101 (e.g. for UMTS pass band, $f_{Carrier}$ ranges from 882.4 MHz (lowest Tx channel) to 912.6 MHz (highest Tx channel)). Here, $H_{RRC}(f)$ is the transfer function of the root-raised cosine transmit pulse shaping filter according to 3GPP TS 25.101 with the following normalization:

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

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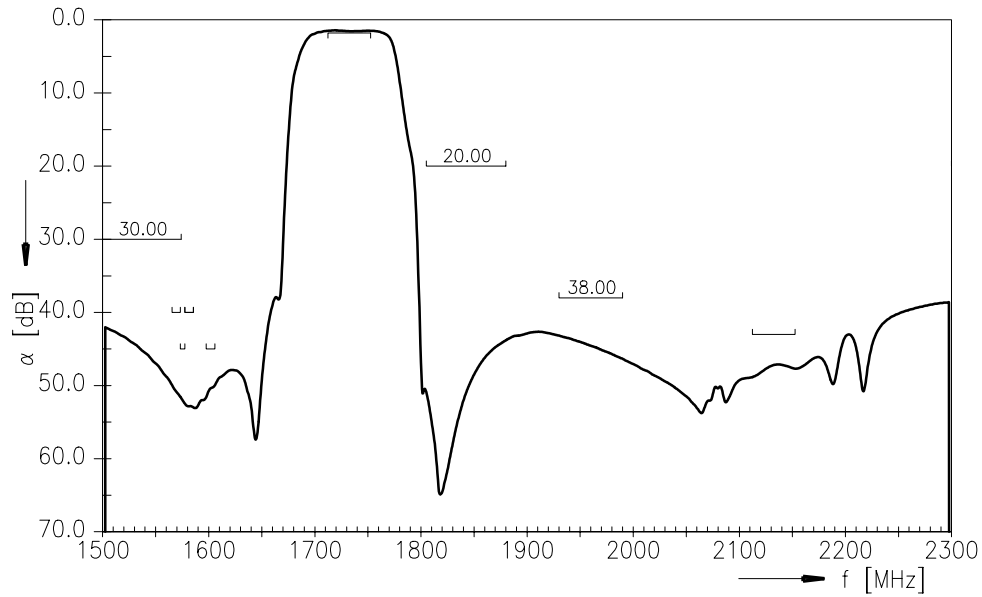
Maximum Ratings

Storage temperature range	T _{stg}	-40/+85	°C	
DC voltage	V _{DC}	5	V	
ESD voltage	V _{ESD}	50 ¹⁾	V	machine model, 10 pulses
Input power at				
1710.0 ... 1755.0 MHz	P _{in}	29	dBm	} continuous wave 50 °C, 5000h
elsewhere	P _{in}	10	dBm	

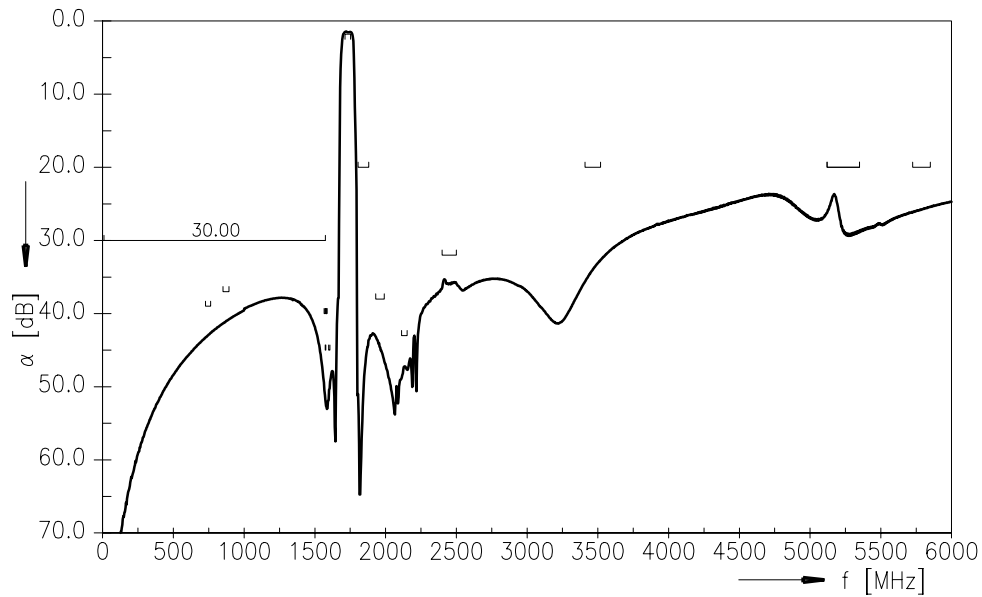
¹⁾ According to JESD22-A115A (machine model), 10 negative and 10 positive pulses.



Frequency Response TX-ANT (PTF)



Frequency Response TX-ANT (wideband)



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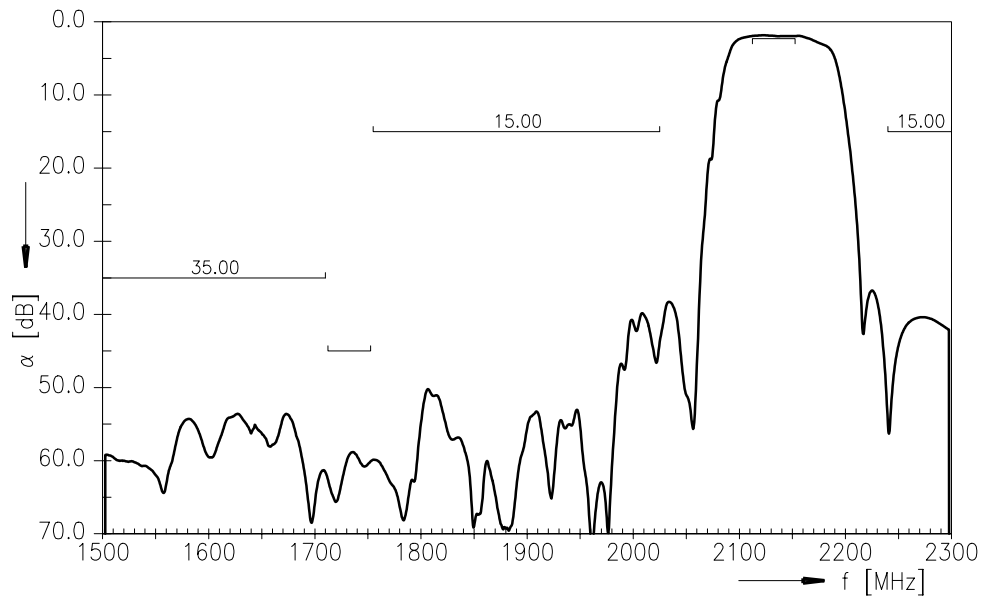
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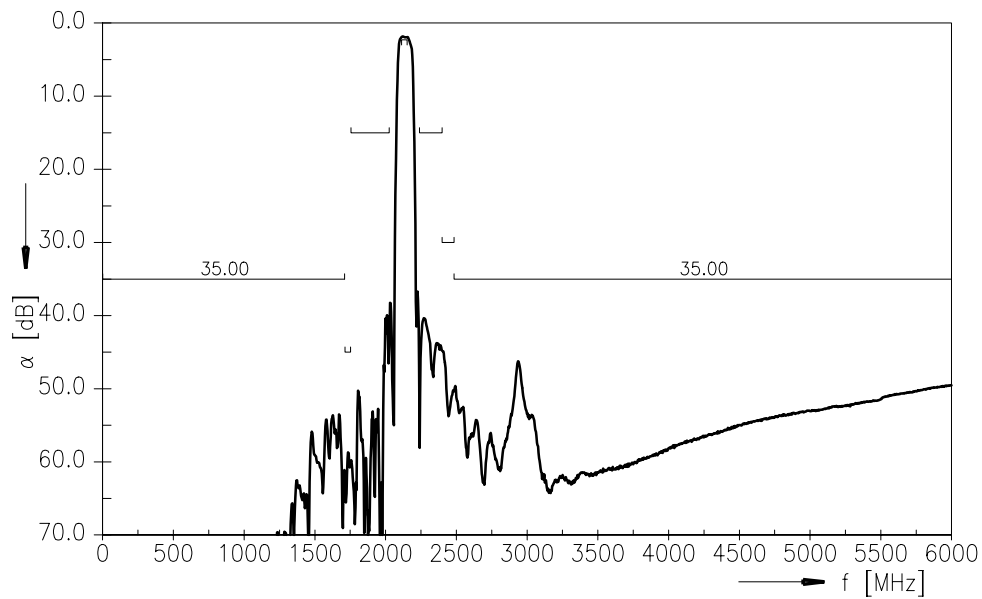
Data sheet



Frequency Response ANT-RX (PTF)



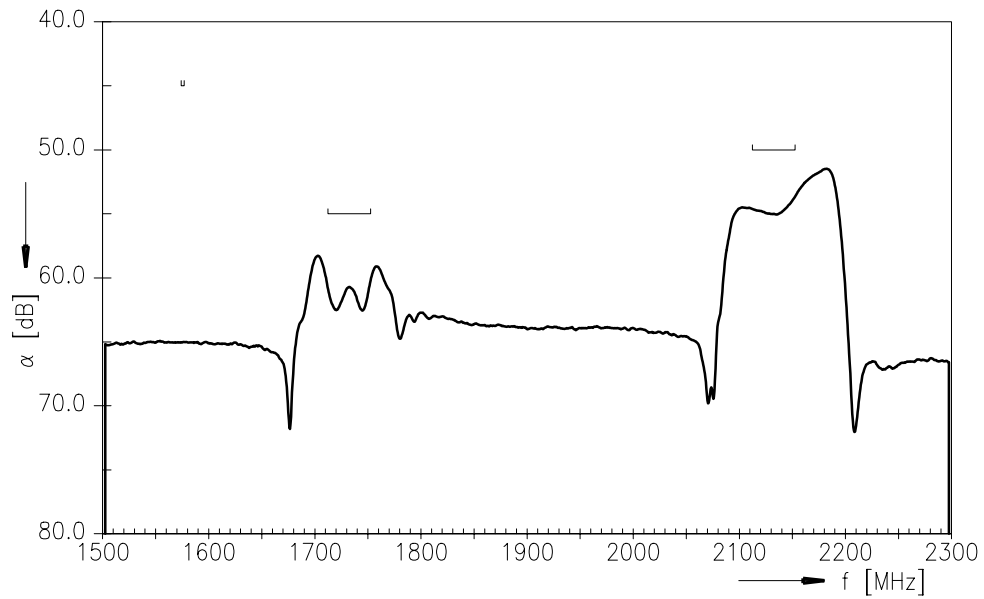
Frequency Response ANT-RX (wideband)



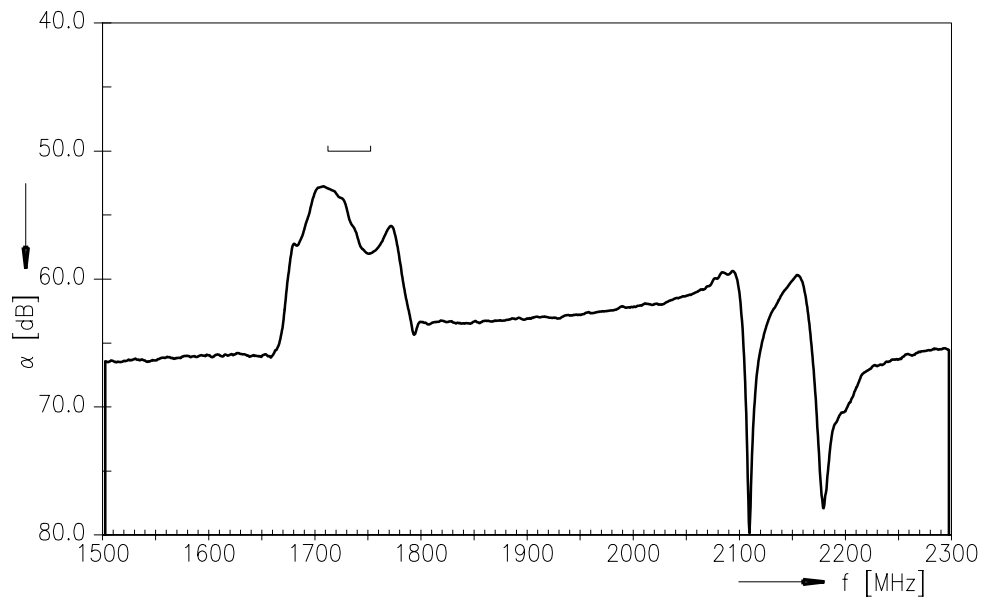
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Frequency Response TX-RX (PTF) Differential Mode



Frequency Response TX-RX (PTF) Common Mode



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References

Type	B7959
Ordering code	B39212B7959P810
Marking and package	C61157-A3-A59
Packaging	F61074-V8153-Z000
Date codes	L_1126
S-parameters	B7959_NB.s4p, B7959_WB.s4p see file header for port/pin assignment table
Soldering profile	S_6001
RoHS compatible	Defined as compatible with the following documents: "DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. 2005/618/EC from April 18th, 2005, amending Directive 2002/95/EC of the European Parliament and of the Council for the purposes of establishing the maximum concentration values for certain hazardous substances in electrical and electronic equipment."
Moldability	Before using in overmolding environment, please contact your EPCOS sales office.
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

For further information please contact your local EPCOS sales office or visit our webpage at www.epcos.com.

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14 February 11, 2011



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