

MADE-TO-ORDER CRYSTAL FILTERS

TECHNICAL TERMS



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 Fax: +44(0)1460 230001
 Email: sales@euroquartz.co.uk
 Web: www.euroquartz.co.uk

NOMINAL FREQUENCY

The Nominal Frequency of a filter is the centre frequency (F_0) or carrier frequency (F_c) in SSB filters.

PASS BANDWIDTH

Stated in kHz, the Pass Bandwidth refers to the frequency bands where attenuation is equal to or lower than the specified attenuation (in dB)

STOP BANDWIDTH

In kHz, the Stop Bandwidth is where attenuations are equal to or larger than the specified figures (dB)

INSERTION LOSS

Insertion Loss is the loss (dB) defined by the logarithmic ratio of power transmitted to load before and after insertion of the filter.

RIPPLE

Ripple is the difference (dB) between maximum and minimum attenuation in the passband.

GUARANTEED ATTENUATION

Attenuation guaranteed (dB) at the specified frequency range.

SPURIOUS

Spurious refers to the attenuation (dB) caused by extraordinary response in the stopband.

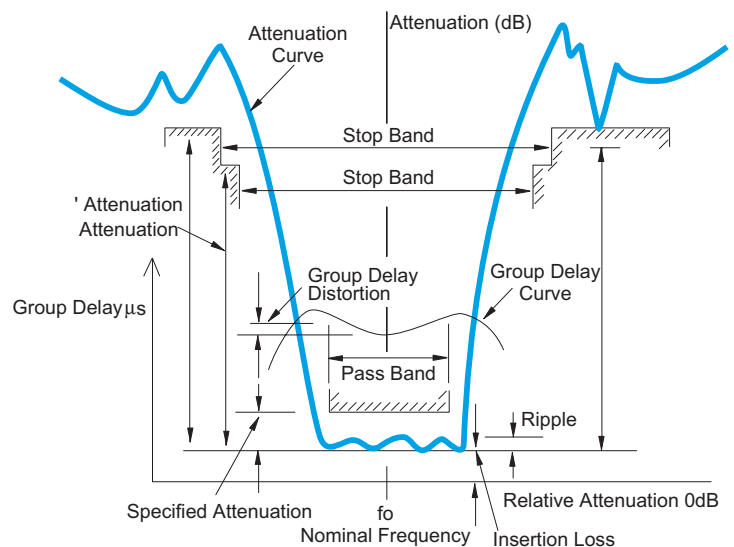
GROUP DELAY DISTORTION

The difference between maximum and minimum group delay with the passband is referred to as Group Delay Distortion.

TERMINATING IMPEDANCE

Refers to either of the impedances presented to the filter by the source or by the load and describes the resistive portion (R_t) and the parallel capacitive portion (C_t) including stray capacitance.

Crystal Filter Parameters



Information Required for Ordering Custom Filters

Type of Filter		
Holder Type		
Nominal Frequency	MHz	
Number of Poles		
Passband Characteristics	dB	\pm kHz
Stopband Characteristics	dB	\pm kHz
Ripple	dB max.	
Insertion Loss	dB max.	
Guaranteed Attenuation	dB	\pm kHz (f_0)
Terminating Impedance	Ohms//	pF
Test Fixture (Test Circuit)		
Operating Temp. Range	$^{\circ}$ C, t_0	$^{\circ}$ C

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FILTER DESIGN CONSIDERATIONS



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BAND PASS FILTERS

NARROW BAND PASS CRYSTAL FILTERS

1.0MHz to 100.0MHz

Operating Temperatures: 0°C to 50°C,
 -10° to 60°C,
 -20°C to 70°C,
 -40°C to 90°C,

Narrow band pass crystal filters are designed to pass a narrow frequency band and reject all other frequencies. The maximum band width using fundamental mode crystals is 0.3% of the centre frequency and is 0.03% when using third overtones.

INTERMEDIATE BAND PASS CRYSTAL FILTERS

1.0MHz to 100.0MHz

The maximum bandwidth of this range of crystal filters is 2.0% of the centre frequency.

BAND PASS FILTERS

LINEAR PHASE CRYSTAL FILTERS

1.0MHz to 180.0MHz

To avoid distortion and ringing due to group delay it is necessary to have a flat time-delay characteristic. The group delay of a highly selective filter varies considerably within the pass band. This introduces distortion into digital and low noise transmission signals. These problems can be overcome by specifying a Linear Phase Crystal Filter.

SPECIALIST CRYSTAL FILTERS

COMB FILTER BANKS

1.0MHz to 100.0MHz

A comb filter bank is made up of a number of crystal filter elements which are used to divide a particular frequency spectrum into discrete elements.

BAND-REJECT FILTERS

1.0MHz to 100.0MHz

A band reject filter is a narrow band device which will reject a single frequency from a spectrum of frequencies

BAND PASS CRYSTAL FILTERS

Design considerations

To obtain an optimum design many factors require consideration. All specification variations are interdependent and computer simulation is the only satisfactory means of realizing a design. Euroquartz Filters' possess this facility and can design a filter to your requirement if the general specification is known.

Specifying the Passband

It is necessary to specify the filter centre frequency in MHz and the band width in kHz. The bandwidth is normally specified at some level of attenuation say -0.5dB or -3dB etc. Variation within the Passband is specified in dB and is termed Ripple. This is defined as the maximum variation of output within the Passband at the specified bandwidth. Insertion loss is the relative loss in dB at the normal bandwidth, and is a function of the complexity of a filter.

Specifying the Stopband

It is necessary to specify the attenuation at a defined level of bandwidth (e.g ± 20 kHz at -40dB) along with the maximum attenuation. It is also necessary to know input and output impedances. These are normally specified in terms of resistance and capacitance. e.g $1500\Omega//2.0\text{pF}$

Phase response

A filters' phase response is the phase difference between the output sine voltage and the input sine voltage.

Group delay

Group delay is determined from the slope of the filter phase characteristic and is an indication of the time delay that occurs when a modulated signal passes through the filter.

Packaging

The filter assembly is available packaged in a wide range of different styles which can be chosen to suit customer's requirements. Our design engineers will be pleased to advise on the most suitable package for any particular application.

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SPECIMEN FILTER DESIGN - 1



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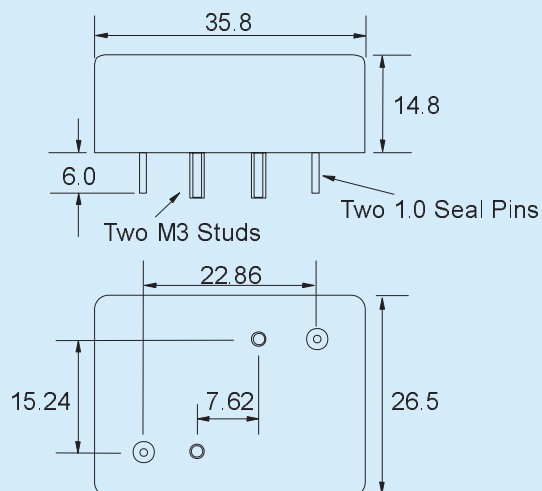
Crystal Filter 19.9750MHz

This filter was designed and manufactured for a data transmission application where excellent Group Delay parameters were an essential part of the specification.

General Specification

Centre Frequency:	19.9750MHz
Insertion Loss:	2dB max.
Ripple:	0.5dB max.
0.5dB	±8.5kHz
1.0dB	±12kHz
Differential Delay:	5µs max.
12dB	±25kHz
25dB	±34kHz
30dB	±41.5kHz
45dB	±50kHz
45dB	±58.5kHz
70dB	±70kHz
Ultimate Attenuation:	55dB
Temperature Range:	0° to +55°C
Terminations:	50Ω
Spurious:	40dB min.

Outline and Dimensions



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SPECIMEN FILTER DESIGN - 2



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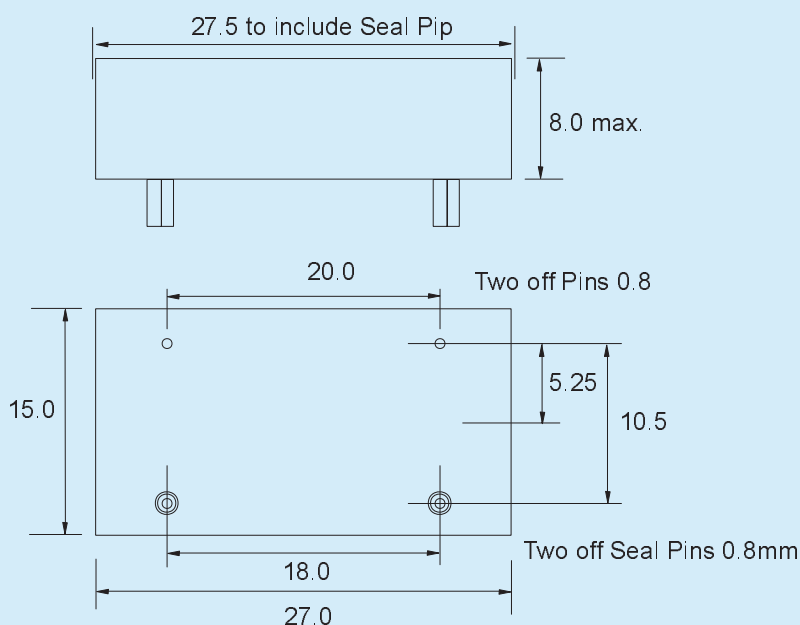
Crystal Filter 19.850MHz

This miniature discrete filter has been produced in a very small package.

General Specification

Centre Frequency:	19.850MHz
Insertion Loss:	2dB max.
Ripple:	0.5dB max.
0.5dB	± 7.7 kHz
1.0db	± 12 kHz
25dB	± 22.3 kHz
45dB	± 30 kHz max.
Ultimate Attenuation:	45dB
Group Delay	
± 7.7 kHz	13 μ s p-p max.
Impedance:	50 Ω
Temperature Range:	0° to +70°C
Shock:	30g 11ms half sine

Outline and Dimensions



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SPECIMEN FILTER DESIGN - 3



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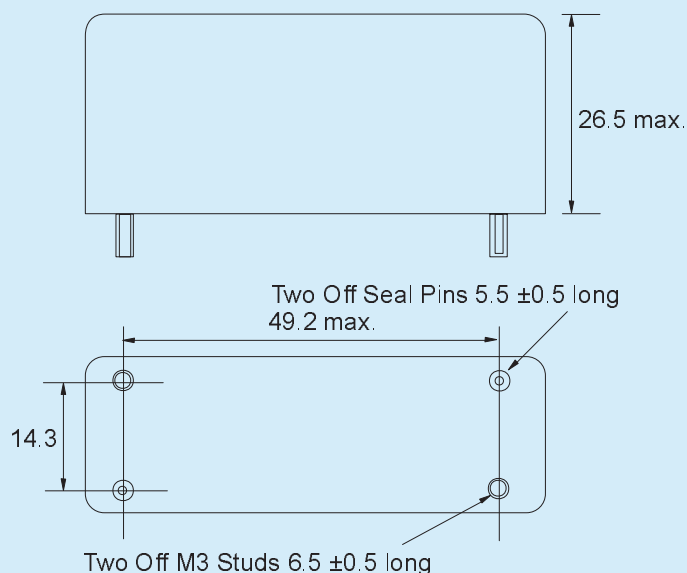
8 Pole Wide Band Crystal Filter

This wide band filter has been designed for satellite data monitoring.

General Specification

Centre Frequency:	21.40MHz
Insertion Loss:	6dB max.
Ripple:	2dB max.
Bandwidth 6dB:	±60kHz
Bandwidth 60dB:	±160kHz
Termination:	1.6kΩ//2.2pF
Ultimate Attenuation:	70dB

Outline and Dimensions



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174.0MHz Crystal Filter

A high frequency filter in a small, low-profile package.

General Specification

Centre Frequency:	174.00MHz
Insertion Loss:	6dB max.
Ripple:	1dB max.
Bandwidth 3dB:	±40kHz nominal
173.9375MHz	30dB min.
173.875MHz	45dB min.

Outline and Dimensions

