NIC

NETWORKS INTERNATIONAL CORPORATION

RF + MICROWAVE FILTERS AND ASSEMBLIES

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REGISTERED
ISO 9001
QSR-624

About NIC

NIC is a leading manufacturer of custom RF & Microwave Filters and Assemblies. Our mission is to develop strategic partnerships with our customers to transfer value and innovation through engineering, design, production and continuous support.

For 20 years, A Trusted Partner for Military, Commercial & Space Solutions…

- Lumped Component Filters
- Ceramic Filters
- Crystal Filters
- Switched Filter Banks
- Phase Shifters
- Mutliplexers & Diplexers
- VCTCXOs & TCXOs

Quality, High Performance Designs to meet your requirements

- Cost effective, Practical, Repeatable Solutions
- 100+ years of RF experience
- Quick Prototyping
- Advanced In-House Testing

NIC is certified as a Small Disadvantaged Business and ISO 9001:2000 Certified.

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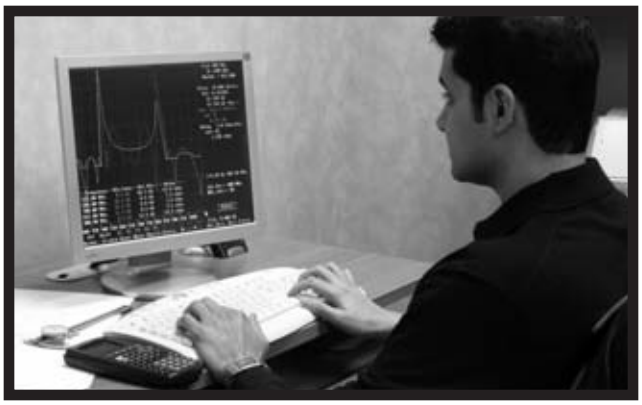
Quick Reference



NETWORKS INTERNATIONAL CORPORATION

Corporate Overview

About Us

Overview

Networks International Corporation (NIC) is a global manufacturer of custom RF & Microwave components. For 20 years, NIC has partnered with its customers to transfer value through superior engineering design, quality, manufacturing and customer support. NIC headquarters is located in Overland Park, KS with additional sales and manufacturing operations in Washington DC and India. NIC is certified as a Small Disadvantaged Business and ISO 9001:2000 certified.

What We Offer

NIC designs and manufactures a best-of-class mix of RF & Microwave Filters and Assemblies. We utilize an integrated team approach of engineering, manufacturing and quality to ensure we meet our customer's requirements.
Our products include:

L.C. Filters
Crystal Filters
Ceramic Filters
Multiplexers & Diplexers
RF + Microwave Assemblies
Crystal Oscillators

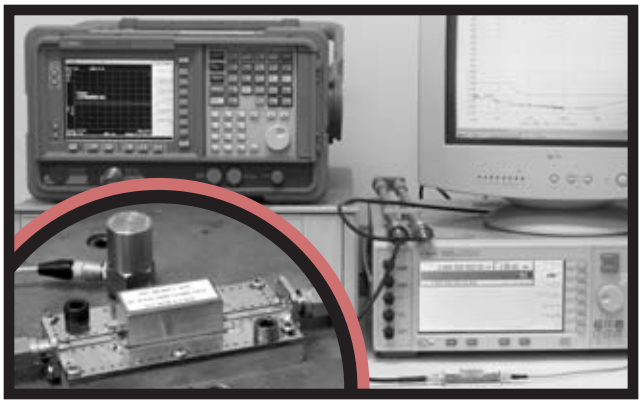
Markets & Applications

NIC serves the Military, Commercial and Space markets providing custom solutions for advanced communication systems. NIC's customer base ranges from Fortune 100 to small entrepreneurial businesses. This diversity reflects NIC's ability to scale our solution to each customer's unique requirements.
The company's heritage and success was built in the military market where precision, high reliability and repeatability, and service are mission critical. Our success within the military industry provided a foundation to offer competitive solutions to both Commercial and Space markets. Typical applications for our products include:

Radar Systems (Ground & Airborne)
Communication/Navigation
Missile Guidance Systems
GPS & Satellite Systems
Point to Point Radio Systems
Point to Multi-Point Radio Systems

Engineering

NIC's engineering and R&D staff has more than 100 years experience in RF design. This experience has translated into a vast design library containing thousands of innovative solutions. Using in-house and standard industry software, our objective is to work in concert with the customer to develop specifications that are high performance, practical, and repeatable. By providing constant feedback and simulated data such as s-parameter, NIC provides the critical information for engineers to analyze proposed product performance.



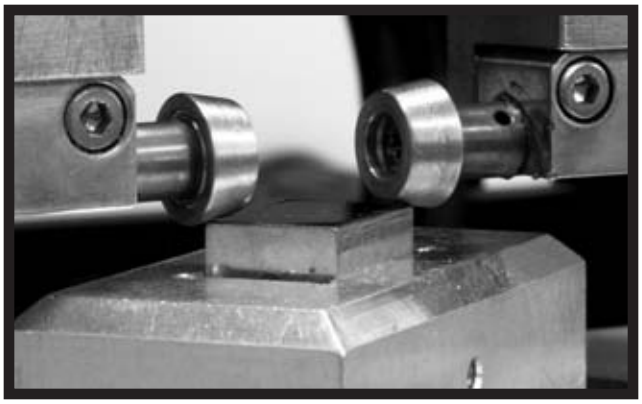
Our integrated approach allows our engineering team to help achieve high quality, repeatable product from design through production. This comprehensive approach allows NIC to provide quick-turn prototypes and the precise matching - from a few components to an entire production run - that can be so crucial to today's sophisticated systems.

NIC's engineering and manufacturing facilities are equipped with the most advanced Network Analyzers on the market. Frequency range covered is up to 25 GHz, which provides resources and technology for R&D on new product development.

Quality

NIC is synonymous with reliability and high quality by virtue that our products are deployed in some of the most sophisticated and innovative military and commercial applications. NIC has implemented a formal Quality Management System based upon ISO-9001:2000 standards. This structure serves as a blue print for processes and continuous improvement initiatives and statement of commitment for the organization.

Management and personnel are specially trained and certified at all levels of operations to ensure that productivity, performance and quality are maintained at the highest standards. Additionally, management is committed to continuous improvement across all functional areas of NIC. Examples include Lean Manufacturing to decrease cycle time and improve decision making/ accountability throughout the organization. Statistical Process Control (SPC) is also used by quality engineers to monitor process variables and gain insight into production trends for each unique part.



Throughout our 20 year history, we have been awarded preferred supplier status by many customers for outstanding product quality and customer service. This success is a testament to our entire organization's commitment to provide our customers cost competitive, high quality product.

100% Environmental Stress Screening (ESS)

Visual - Precap	Mil-STD-883, Method 2017 or IPC-610A
Thermal Shock	MIL-STD-202, Method 107 or MIL-STD-883, Method 1011
Hermeticity	MIL-STD-202, Method 112D MIL-STD-883, Method 1002
Final Electrical	MIL-F-18327E or ATP
Final Visual	MIL-F-18327E or ATP

In-House Environmental Test Capabilities

Vibration	
- Random	MIL-STD-202, Method 214
- High Frequency Sinusoidal	MIL-STD-202, Method 204
Shock	MIL-STD-202, Method 213
Hermeticity (Fine Leak)	MIL-STD-202, Method 112C
Barometric Pressure	MIL-STD-202, Method 105
Acceleration	MIL-STD-202, Method 212A
Humidity	MIL-STD-202, Method 103
Moisture Resistance	MIL-STD-202, Method 106
Life	MIL-STD-202, Method 108
Salt Spray	MIL-STD-202, Method 101
Additional Environmental Tests:	Phase Noise under Vibration Temperature Altitude Pressure Cycling

Manufacturing & Testing

NIC has established global manufacturing centers of excellence to provide cost-effective products with the highest levels of quality. Our integrated team approach - engineering, manufacturing and quality - ensures that NIC transfers value to our customer from design through volume production.

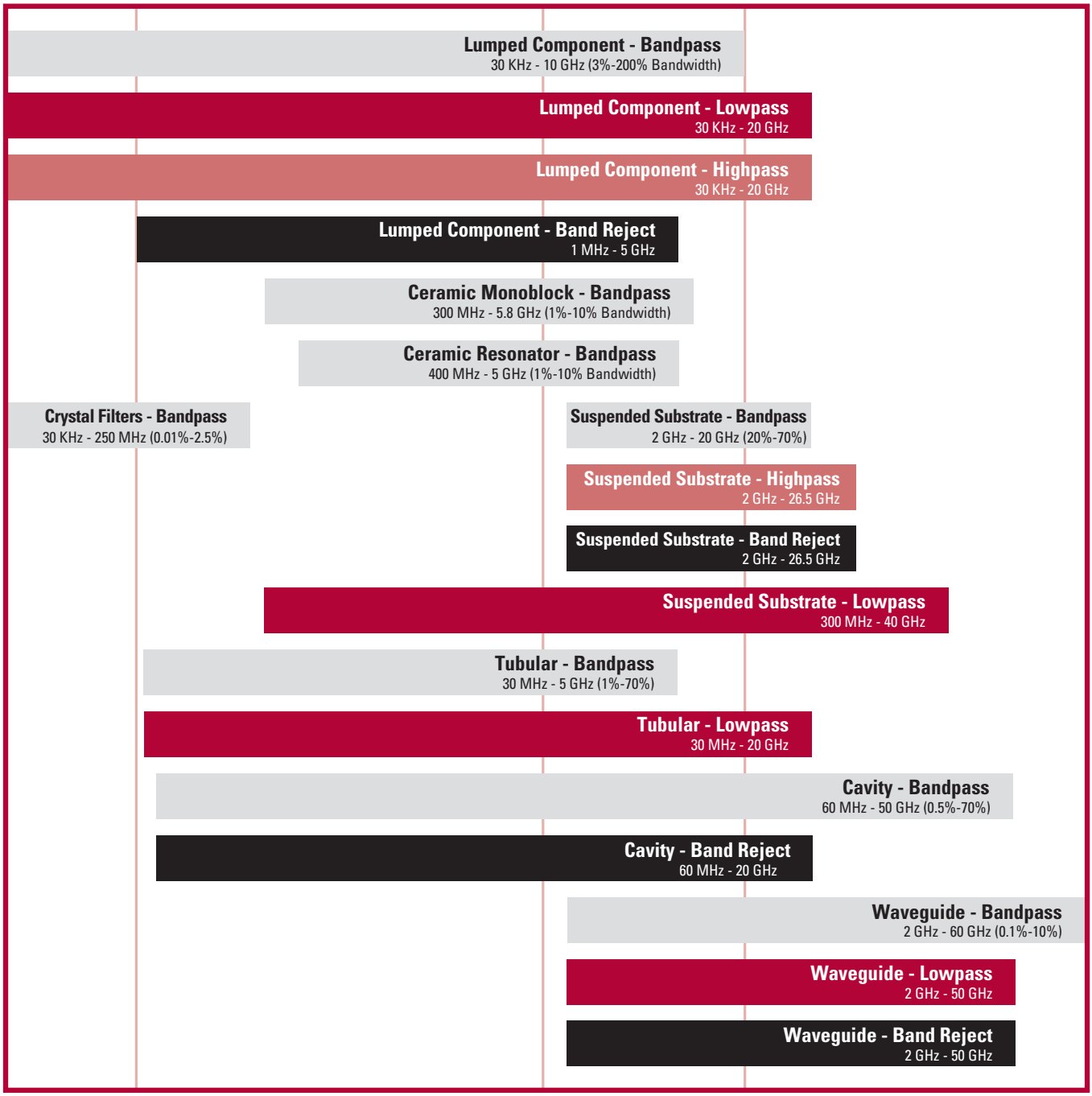
NIC is ISO 9001:2000 certified and its facilities occupy over 20,000 square feet. We operate highly automated and dynamic assemblies lines which allow NIC to monitor a wide variety of products in production at the same time. From special vision systems to automated tuning stations, solder reflow and crystal tuning to precise tooling in our own machine shop, NIC can produce efficient and high quality products for our customers.

NIC has developed proprietary software to link analyzers to computer-driven automated test stations that require minimal operator intervention during final testing. This allows NIC to reduce cycle time and analyze and provide customers real time measured data.

NIC offers a wide variety of environmental testing capabilities in-house, which allows us to guarantee that quality and reliability meets the requirements of our customer's application. NIC conducts 100% ESS screening on all product manufactured. Testing is automated to increase efficiency and ensure high performance in all conditions. Examples of environmental testing equipment include moisture resistance, temperature/ altitude chambers, thermal shock chambers, automated vibration system, and phase noise testing. The table provided lists NIC's screening capabilities. Please contact NIC with your specific requirements.

Filter References

Filter Topology Frequency Ranges



Filter Design Considerations

TYPE	PASSBAND	PASSBAND DELAY	REJECTION	VSWR	CF STEP RESPONSE SIDELOBES	APPLICATION
Bessel	Gaussian, bell shape similar to Gaussian magnitude	Very good, best of all transfer functions	Gaussian bell poor, slightly better than a Gaussian magnitude	Shape Good at CF only	Monotonic in principle, very good, similar to Gaussian	Same as Gaussian
Butterworth (0.1dB ripple)	Maximally flat only at CV, Significant curvature elsewhere	More delay variation than Chebychev for same rejection	Moderate, not as good as Chebychev	Good at CF not as broad as Chebychev	Poor (15dBc typical)	Inferior to Chebychev in most applications
Chebychev	Equiripple in principle, minor curvature	Signifigant variation around 3dB points	Steep, not as steep as elliptic	Very good over passband almost to 3dB points	Poor (15dBc typical)	Steep selectivity while requiring flat passband response & good VSWR
Elliptic and other non-monotonic stopband designs	Equiripple in principle, some curvature due to Q	Signifigant variation, although less than Chebychev for same rejection	Steepest	Very good over passband almost to 3dB points	Poor (15dBc typical)	Steeper rejection
Gaussian	Gaussian, bell shape	Very good	Gaussian bell shape, poor	Best at Center Frequency	Monotonic in principle, very good (40dBc typical)	Where rejection is not critical
Gaussian to 6dB	Gaussian, bell shape to 6 dB, follows Chebychev reponse outside this region	Good, flat to 6dB level	Gaussian bell shape to 6dB level then follows Chebychev	Best at Center Frequency	Slight ringing, better than Chebychev (30dBc typical)	Steeper rejection than Gaussian to 12dB
Gaussian to 12dB	Gaussian, bell shape to 12dB	Very good, flat to 12dB level	Gaussian bell shape to 12dB level slightly better than full Gaussian	Best at Center Frequency	Slight ringing for higher orders (30dBc typical)	Where steeper rejection is needed than Gaussian

Transfer Function

A filter's transfer function determines both its frequency and time domain characteristics. Depending on the application, certain trade-offs between frequency domain and time domain performance will be required. In general, filters with good time domain response will have poorer roll off characteristics in the frequency domain and vice versa. The table provided is a guideline to select the transfer function that best meets your requirements. Please feel free to contact NIC to review your requirements.

The Q Factor: Filter vs Component

Filter Q (Qf) is a measure of relative bandwidth and equals the center frequency divided by the 3 dB bandwidth of the filter. Thus narrow filters may be referred to as high "Q" filters and wideband filters may be referred to as low "Q". High "Q" filters have higher insertion loss and sharper rejection rolloff than low "Q" filters implemented using the same structure. This is a parameter of the filter itself and not the structure that is used to implement it. Component Q is proportional to the size of a resonator. For a lumped element filter this will be the outside diameter of an inductor. For a cavity filter this will be the volume of the resonator cavity.

Filter Temperature Drift

Filters have a tendency to drift with variations in temperature. To reduce frequency drift, NIC's filter designs utilize temperature-compensating materials that maintain frequency drift as low as 2 ppm degrees C. In general, exposure to cold temperature results in an increase in frequency response and decrease in insertion loss response. Exposure to hot temperature results in a decrease in frequency response and increase in insertion loss response.

Miniature LC Filters

NIC

NIC's miniature LC Filters product line is designed for applications needing superior performance in small packages in both environmentally benign or rugged conditions. Designs are available in lowpass, bandpass, highpass and band-reject responses with various configurations: surface mount, connectorized or RF Pin. NIC utilizes advanced software (industry standard and proprietary) for design simulation and use of high "Q" components to achieve optimal performance.

NETWORKS INTERNATIONAL CORPORATION

Miniature LC Filters - Bandpass

DC - 6000 MHz

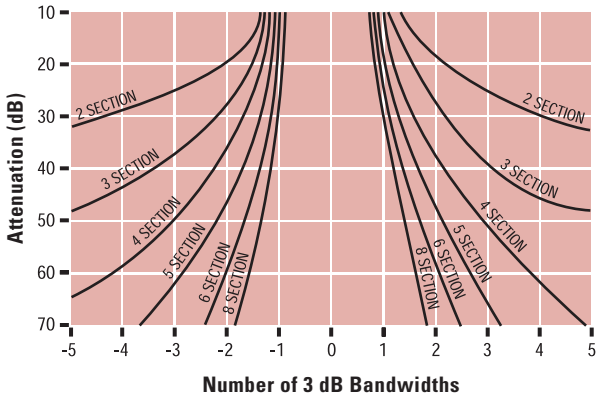
- 3 dB BW 0.5% to 100%
- Low Profile, Compact Design
- Surface Mount (Hermetic + Non Hermetic), RF Pin, Connectorized Options
- Custom Designs Available

Electrical Performance

Frequency (MHz)	3 dB%	# of Sections	Impedance (Ohms)	Insertion Loss	Typical VSWR	Max Power (Watts)	Operating Temperature
DC - 6000	0.5% - 100%	2-10	50 or 75	See Chart	1.5 : 1	40	-50° C ~ +100° C

Contact factory for specific requirements not listed. For screening capabilities, refer to chart on page 3.

Bandpass Attenuation



The following formula is used:

$$\frac{\text{Reject Frequency} - \text{Center Frequency}}{\text{3 dB Bandwidth}}$$

Example:

CF = 21.4MHz, 3dB BW = 2
Number of sections = 6

Find the attenuation at 17.4 and 25.4MHz by substituting in the formula 3dB bandwidth from center frequency = 17.4–21.4/2 = -2BW's, 25.4-21.4/2 = +2BW's.

From the curve, we find the attenuation in dB for a 6-section response –2BW's from center freq. yields 60dB, and = +2BW's from center freq. yields 58dB.

Insertion Loss – Bandpass

The following formula is used:

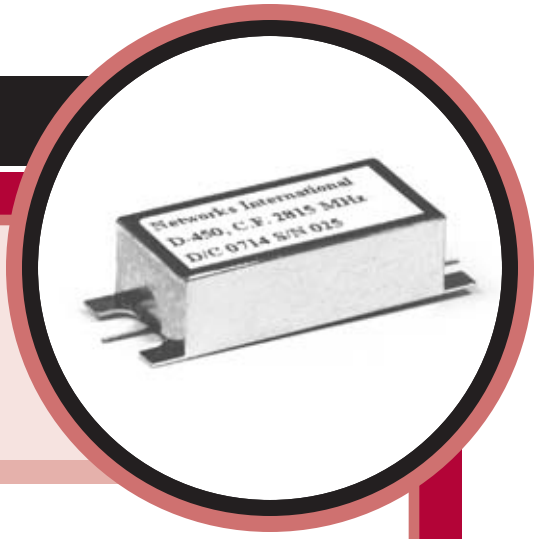
$$IL = \frac{\text{(Loss factor) (No. of sections +.5)}}{\text{\% 3dB BW}} + 0.3$$

Loss Factor	6.8	7.8	6.8	5.7	4.9	4.4	4.0	3.7	3.5	3.25	3.0
Frequency (MHz)	10-159	160-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-6000

Typical response of Insertion loss and attenuation. For optimum response contact factory.

Miniature LC Filters - Lowpass

DC - 6000 MHz



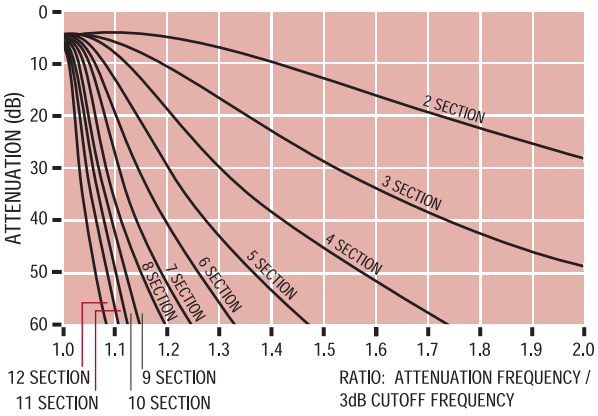
- **Low Profile, Compact Design**
- **Surface Mount (Hermetic + Non Hermetic), RF Pin, Connectorized Options**
- **Custom Designs Available**

Electrical Performance

Frequency (MHz)	# of Sections	Impedance (Ohms)	Insertion Loss	Typical VSWR	Max Power (Watts)	Operating Temperature
DC - 6000	2-10	50 or 75	See Chart	1.5 : 1	40	-50° C ~ +100° C

Contact factory for specific requirements not listed. For screening capabilities, refer to chart on page 3.

Lowpass Attenuation



The following formula is used:

$$\frac{\text{Reject Frequency}}{\text{3 dB Cut-off Frequency}}$$

Example:
Rejection frequency = 70 MHz
3dB cutoff = 50 MHz
Number of sections = 5

By substituting in the formula the multiples of the 3dB cutoff = 70/50 = 1.4

From the curve, a 5 section filter response 1.4 multiples away yields 54 dB.

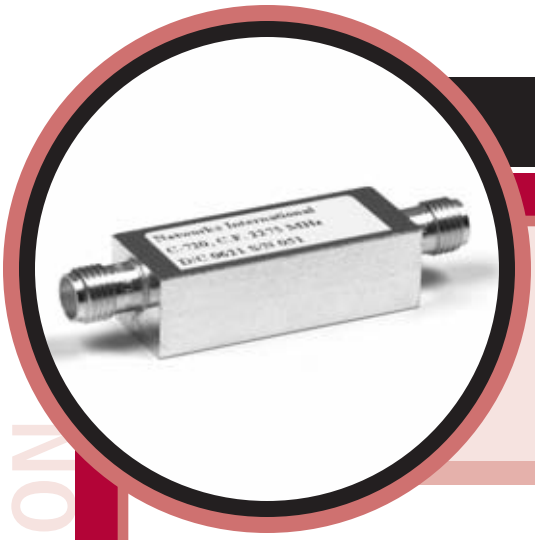
Insertion Loss – Lowpass

The following formula is used:

IL = (Loss factor)*(No. of sections +.5) + 0.25

Loss Factor	0.10	0.12	0.12	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.09
Frequency (MHz)	10-159	160-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-6000

Typical response of Insertion loss and attenuation. For optimum response contact factory.



Miniature LC Filters - Highpass

DC - 6000 MHz

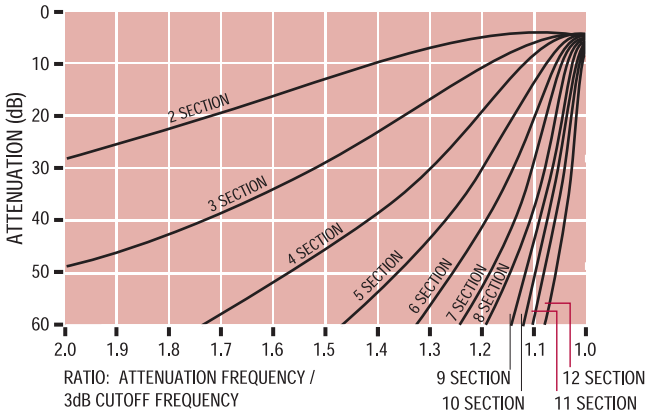
- **Low Profile, Compact Design**
- **Surface Mount (Hermetic + Non Hermetic), RF Pin, Connectorized Options**
- **Custom Designs Available**

Electrical Performance

Frequency (MHz)	# of Sections	Impedance (Ohms)	Insertion Loss	Typical VSWR	Max Power (Watts)	Operating Temperature
DC - 6000	2-10	50 or 75	See Chart	1.5 : 1	40	-50° C ~ +100° C

Contact factory for specific requirements not listed. For screening capabilities, refer to chart on page 3.

Highpass Attenuation



The following formula is used:

$$\frac{\text{3 dB Cut-off Frequency}}{\text{Reject Frequency}}$$

Example:
3dB cutoff = 70 MHz
Rejection frequency = 50 MHz
Number of sections = 5

By substituting in the formula the multiples of the 3dB cutoff = 70/50 = 1.4

From the curve, a 5 section filter response 1.4 multiples away yields 54 dB.

Insertion Loss – Highpass

The following formula is used:

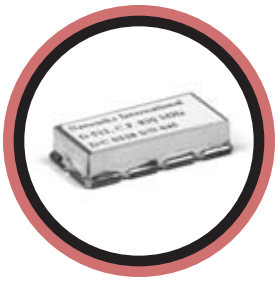
IL = (Loss factor)*(No. of sections +.5) + 0.25

Loss Factor	0.10	0.12	0.12	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.09
Frequency (MHz)	10-159	160-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-6000

Typical response of Insertion loss and attenuation. For optimum response contact factory.

NIC offers a variety of package outlines for LC Filters that can be customized. The list below represents the common package outlines used for LC Filters. Contact the factory with specific requirements.

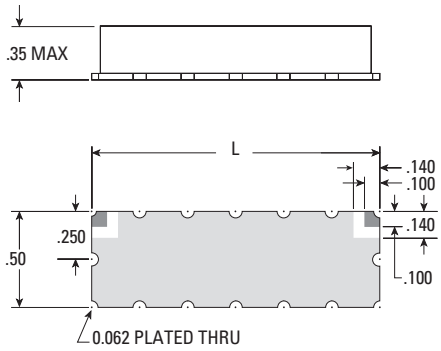
Surface Mount
Non-Hermetic



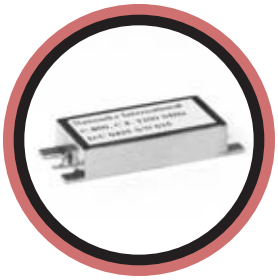
Frequency Ranges (MHz)

"L" - Length (Inches)	10-299	300-1000	1000-6000
0.50	2 to 3	3 to 4	3 to 4
0.75	3 to 4	4 to 5	4 to 5
1.00	4 to 5	4 to 6	5 to 6
1.25	5 to 6	5 to 7	6 to 7
1.50	6 to 8	6 to 8	7 to 9
	Number of Sections		

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements



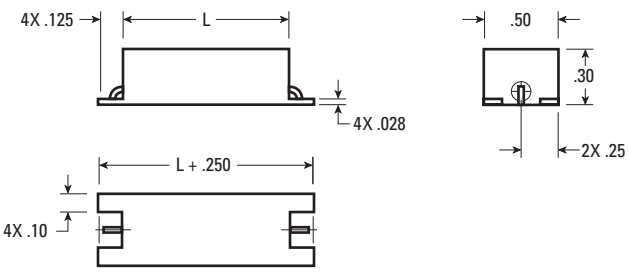
Surface Mount
Hermetic



Frequency Ranges (MHz)

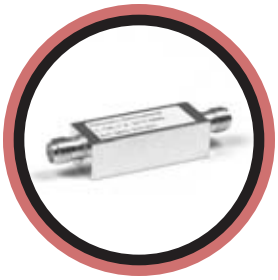
"L" - Length (Inches)	10-299	300-1000	1000-6000
0.50	2 to 3	3 to 4	3 to 4
0.75	3 to 4	4 to 5	4 to 5
1.00	4 to 5	4 to 6	5 to 6
1.25	5 to 6	5 to 7	6 to 7
1.50	6 to 8	6 to 8	7 to 9
	Number of Sections		

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

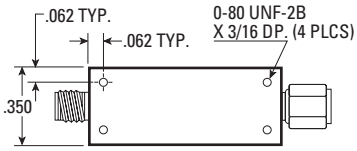


Package Outlines

LC Filters [continued]



Connectorized
Hermetic

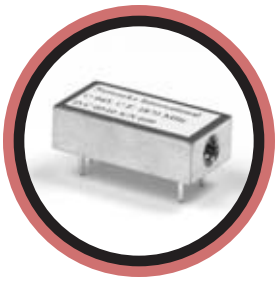


Frequency Ranges (MHz)

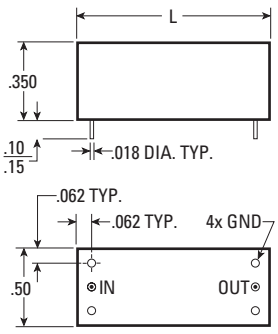
"L" - Length (Inches)	10-299	300-1000	1000-6000
0.50	2 to 3	3 to 4	3 to 4
0.75	3 to 4	4 to 5	4 to 5
1.00	4 to 5	4 to 6	5 to 6
1.25	5 to 6	5 to 7	6 to 7
1.50	6 to 8	6 to 8	7 to 9
	Number of Sections		

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

*Std Connector: SMA; Other connector options available such as SMB,SMC,SSMA,GPO, GPPO.



RF Pin
Hermetic



Frequency Ranges (MHz)

"L" - Length (Inches)	10-299	300-1000	1000-6000
0.50	2 to 3	3 to 4	3 to 4
0.75	3 to 4	4 to 5	4 to 5
1.00	4 to 5	4 to 6	5 to 6
1.25	5 to 6	5 to 7	6 to 7
1.50	6 to 8	6 to 8	7 to 9
	Number of Sections		

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

Specialized LC + Crystal Filters

NIC manufactures specialized LC and Crystal filters with a variety of unique customizations to meet the complex requirements of the advanced systems used in today's Military, Space and Commercial markets. Years of engineering, design experience and production techniques have given NIC the ability to develop unique high performance solutions that off the shelf designs cannot satisfy.

Delay, Phase & Amplitude Equalization
Unique Transfer functions
- Elliptical or Pole Placed designs
- Gaussian
- Bessel

Delay, Amplitude or Phase Matching
Notch & High Power Filters
Space Qualified Products

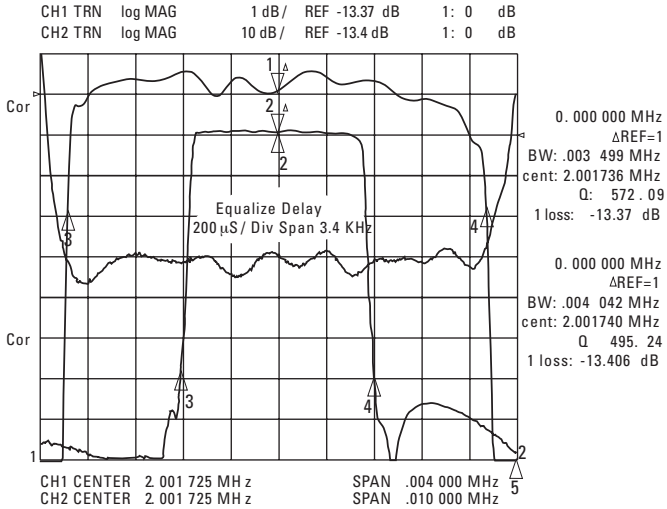
NETWORKS INTERNATIONAL CORPORATION

Delay, Phase + Amplitude Equalization

Specialized LC + Crystal Filters

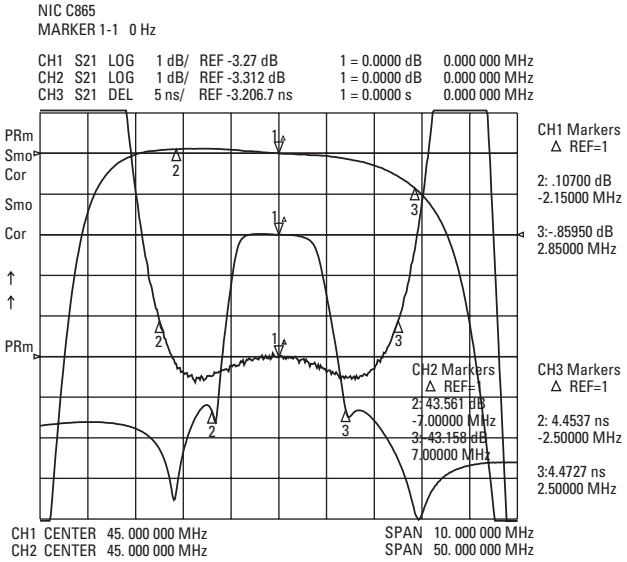
- **LC Designs - DC to 6000 MHz**
- **Crystal Bandpass Designs - DC to 250 MHz**
- **Compact Size and High Selectivity**
- **Very Low GDV in Passband**

Crystal Filter: Delay Equalized: 10:1



Equalized LC and Crystal Filters provide solutions to help maintain high selectivity while achieving flat group delay or linear phase. By combining traditional filter topologies and special equalizing sections, NIC provides unique solutions for today's demanding applications.

LC Filter: Delay Equalized

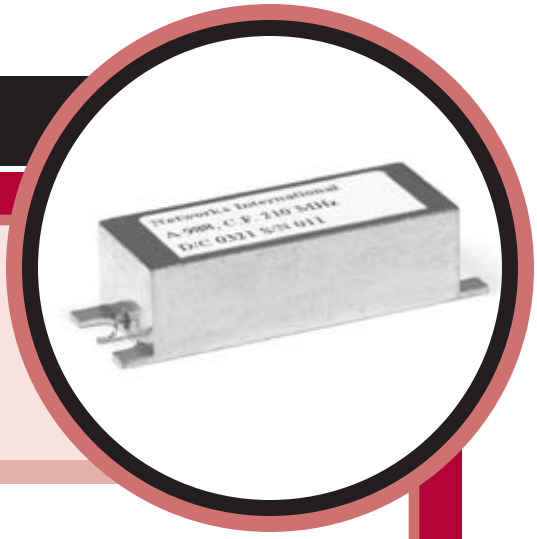


Contact factory with your specific requirements. For screening capabilities, refer to page 3.

For common package outlines, refer to LC & Crystal sections.

Unique Transfer Functions

Specialized LC + Crystal Filters



- **All Tranform Types and Transfer Functions**
- **LC Designs - DC to 6000 MHz**
- **Crystal Bandpass Designs - DC to 250 MHz**
- **Very Low Phase Noise**

NIC designs and manufactures all filter transfer functions for both LC and Crystal filters. We leverage our 100+ years of RF design experience to develop high performance solutions that off the shelf designs cannot satisfy.

Gaussian

Gaussian to 6 dB

Gaussian to 12 dB

Bessel

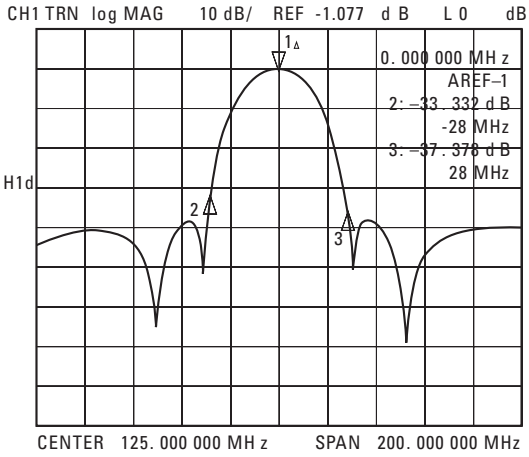
Sin X/X

ERP .05

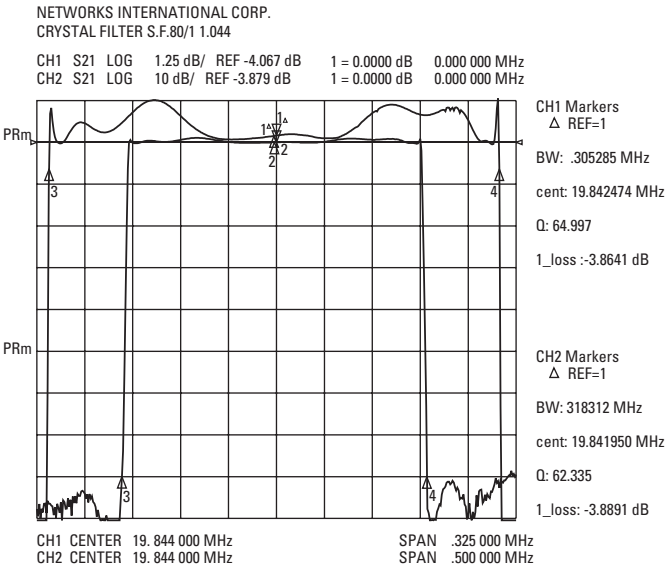
ERP .5

Elliptical or Pole Placed

Gaussian LC Filter

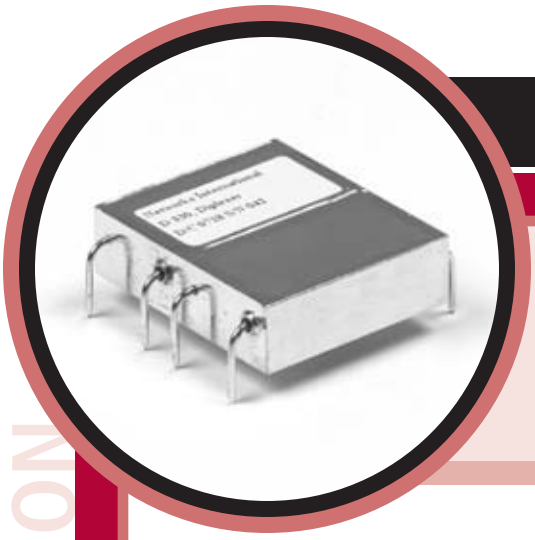


Eliptical Function Crystal Filter
Shape Factor 80/1, 1.044:1



Contact factory with your specific requirements. For screening capabilities, refer to page 3.

For common package outlines, refer to LC & Crystal sections.

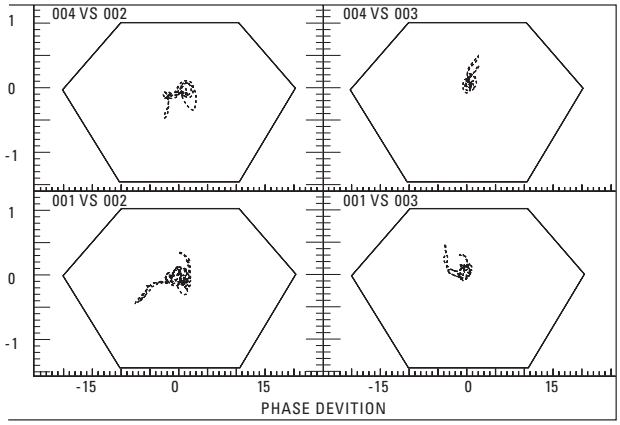


Delay, Amplitude or Phase Matching

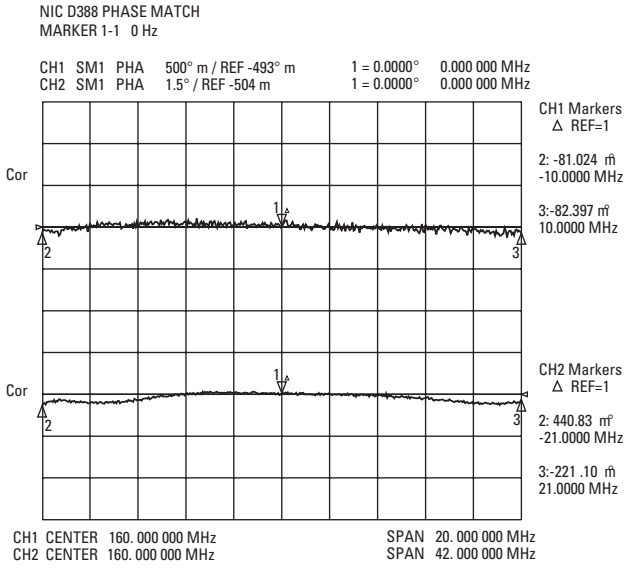
Specialized LC + Crystal Filters

- LC Designs - DC to 6000 MHz
- Crystal Bandpass Designs - DC to 250 MHz
- Delay Matching < ± 1 nS
- Amplitude Matching < ± 0.2 dB
- Phase Matching < ± 0.5˚

Quad Set: Phase vs. Amplitude



Phase Matched Pair < 0.5˚ over Filter Passband



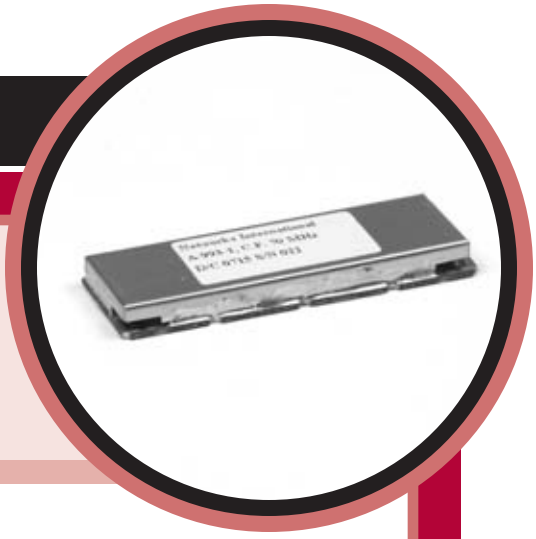
Matching filter performance characteristics play an important role in many of today's demanding applications. NIC's proven "design to match" filter characteristics provides performance capabilities that are unsurpassed. Matching one-to-all, pairs, tri-sets or up to seven filters to perform in all types of environmental conditions is a unique capability that NIC has perfected through years of experience.

Contact factory with your specific requirements. For screening capabilities, refer to page 3.

For common package outlines, refer to LC & Crystal sections.

Band Reject Filters

Specialized LC + Crystal Filters

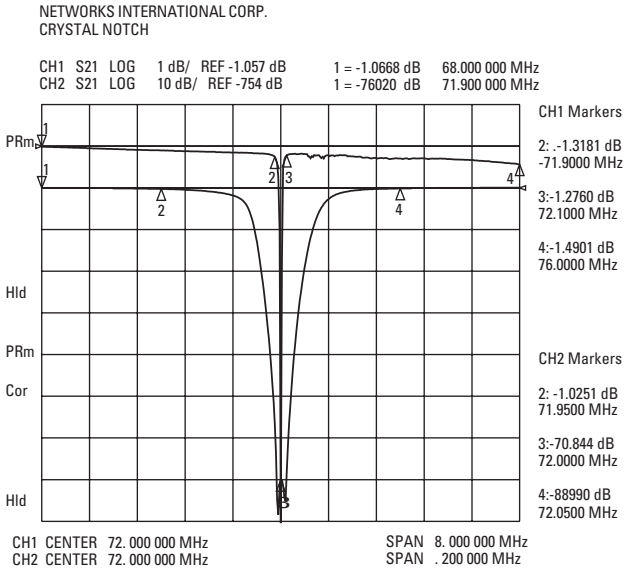


- LC Designs - DC to 6000 MHz
- Crystal Bandpass Designs - DC to 250 MHz
- Low Passband Loss, High Notch Rejection

Band Reject Filters

NIC manufactures both Crystal and LC Notch or Band Reject filters for Military, Space and Commercial applications. These filters are designed to meet very narrow or wide passband or stopband requirements.

Crystal Band Reject Filter



High Power Filters

NIC manufactures products with the ability to handle higher levels of RF energy while maintaining their specified electrical requirements. The main advantage of NIC's higher power Crystal and LC filters is their compact profile, low-loss, excellent VSWR and minimum heat build-up.

LC Designs - DC to 6000 MHz

Up to 50 W Operating, 250 W without damage

Crystal Bandpass Designs - DC to 250 MHz

Up to +30 dBm Operating (1 Watt)

Contact factory with your specific requirements. For screening capabilities, refer to page 3.
For common package outlines, refer to LC & Crystal sections.

Space Qualified Products

Specialized LC + Crystal Filters

- **Product reliability - Up to 30 year operating life**
- **Complete in-house environmental testing**
- **Commercial & Military applications**

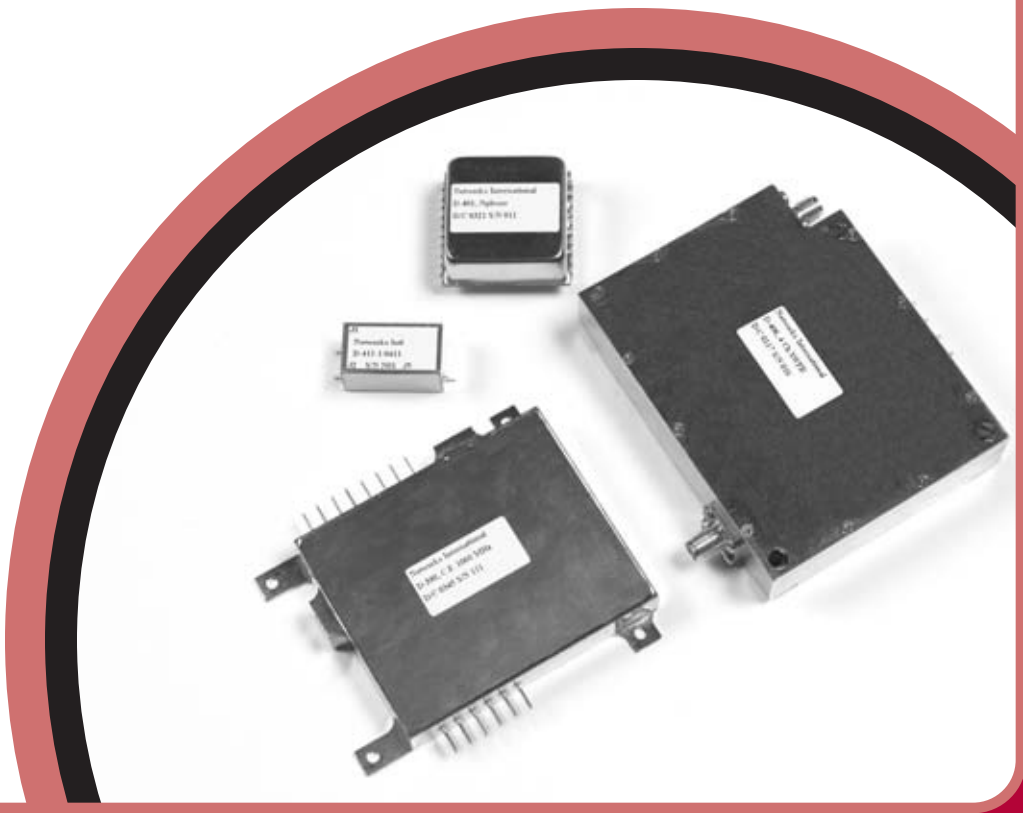
NIC space level products are built with the highest level of quality control. NIC is a proven provider of high quality, cost-effective space products. With over 10 years of experience with military and commercial space applications, NIC's product reliability has operating life up to 30 years.

Screening Inspection	Visual Pre-cap (MIL-STD-883, Method 2017) Temperature Cycling (MIL-STD-202, Method 107 Test Condition B) Sinusoidal Vibration (MIL-STD-202F, Method 204D) Random Vibration (MIL-STD-202F, Method 214) Temperature Run (MIL-C-3098) PIND Test (MIL-STD-883, Method 2020, Test Condition B) Aging (MIL-C-3098) Seal Test (MIL-STD-202, Method 112, Test Condition C) Phase Noise Under Vibration Temperature Altitude Radiographic Inspection
Visual + Mechanical Inspection	ATP/ MIL-F-18327E/ MIL-STD-883
Reliability Analysis	Calculation carried out per MIL-HDBK-217F
Component Selection	Crystals: ESA/SCCG level C# or MIL-C-3098 with group B testing Discrete semiconductors: JANTXV per MIL-PRF-19500 Microcircuits: MIL-STD-883 class B or ESA/SCCG level C3 Passive Parts: ER type with failure level "S" or better Connectors: ESA/SCC level C3 or as per NASA/GSFC requirements

Contact factory with your specific requirements. For screening capabilities, refer to page 3.
For common package outlines, refer to LC & Crystal sections.

RF + Microwave Assemblies

NIC manufactures custom integrated product assemblies that allow customers to achieve the high performance and reliability required for complex filter applications. These filter assemblies range from diplexers and multiplexers to switched filter banks and phase shifters. The assemblies consist of diverse components such as amplifiers, switches, filters, MMIC devices, power dividers and Bias T's. Using LNAs, Low I.L. filters and precisely selecting other components, NIC can offer assemblies with very low Noise Figure (NF). NIC's assemblies are designed to perform in both benign and rugged environments for applications such as Electronic Warfare, GPS systems, Point to Point communications and Radar systems.



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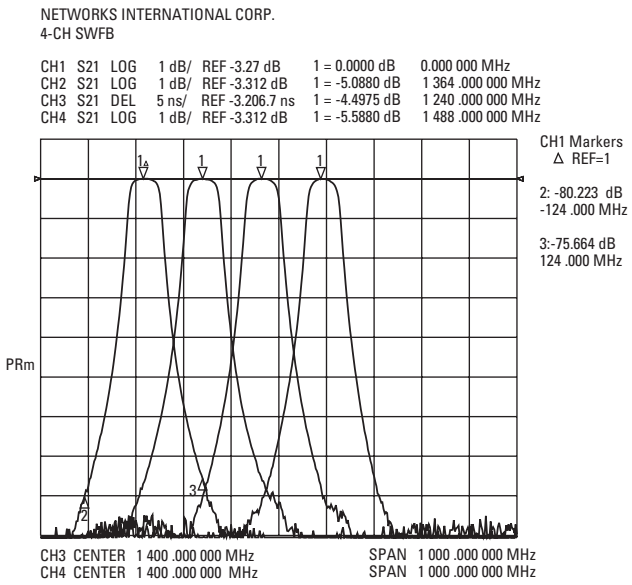
Switched Filter Banks

500 MHz - 6000 MHz

- **User Customizable Channels 2 to 8**
- **High Isolation – Up to 70 dB between channels**
- **Switching speed < 50 nS**
- **Military, Space, Commercial Applications**

Four Channel Switched Filter Bank

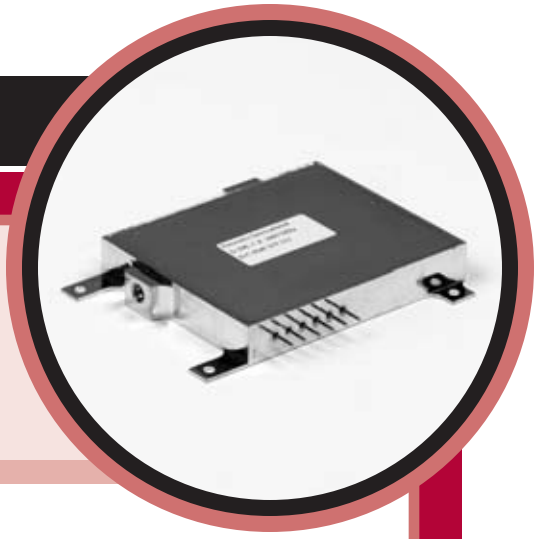


NIC manufactures custom Switched Filter Banks designed for high reliability environments. Covering a frequency range of 500 MHz to 6000 MHz, the channels are completely customizable by the user (2-8 channels). These assemblies are TTL controlled and feature a variety of filter and switch technologies and electrical characteristics such as: low insertion loss; high adjacent channel isolation (up to 70 dB), fast switching speeds and amplitude matching. Standard SMA RF connectors are used but a variety of mounting and connector options are available. Contact the factory with your specific requirements.

For NIC's screening and testing capabilities, refer to page 3.

Phase Shifters

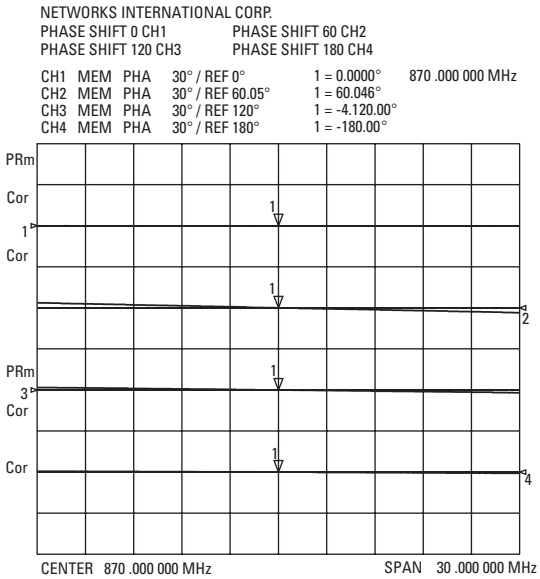
1 MHz - 6000 MHz



- **Customizable Phase Shifts: Fixed or Variable**
- **±1˚ performance over temperature**
- **Integral TTL Drivers**
- **Switching Speed < 1nS**
- **Military, Space, Commercial Applications**

NIC manufactures custom Phase Shifters designed for high reliability environments. The assemblies consist of diverse components such as amplifiers, switches, filters, and MMIC devices. Each component is carefully designed and adapted to meet all custom specifications. NIC designs phase shifters to enable the end-user to shift phase states from 0˚C to 360˚C at any user-defined delta with various phase transitions and stability over temperature. A variety of mounting and connector options are available. Contact the factory with your specific requirements.

Fixed: ± 60˚, ± 120˚, ± 180˚



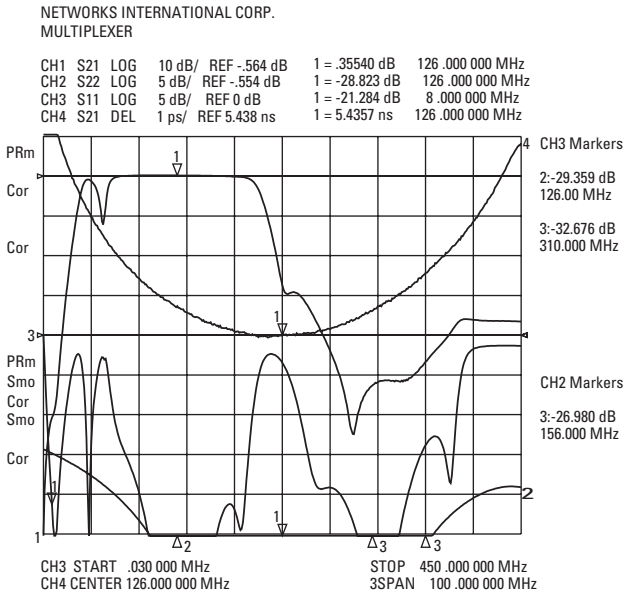
For NIC's screening and testing capabilities, refer to page 3.

Multiplexers + Diplexers

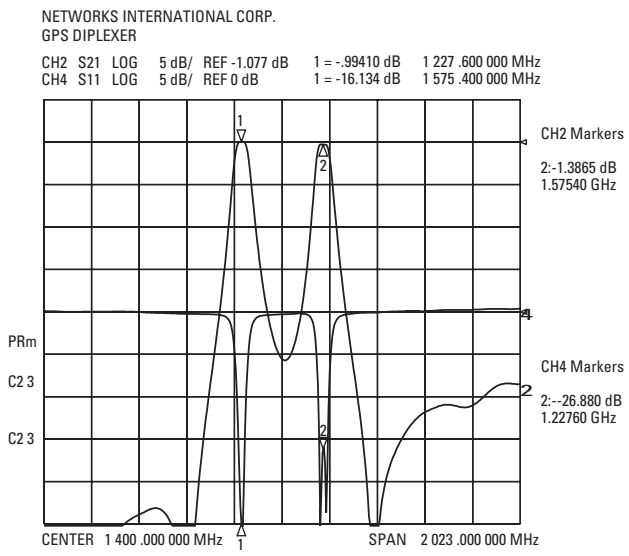
DC - 6000 MHz

- **Crystal, LC & Ceramic Designs**
- **Compact Size and High Selectivity**
- **Broadband and Narrowband**
- **Military, Space, Commercial Applications**

Broadband Point to Multipoint Multiplexer



Dual Bandpass GPS Filter

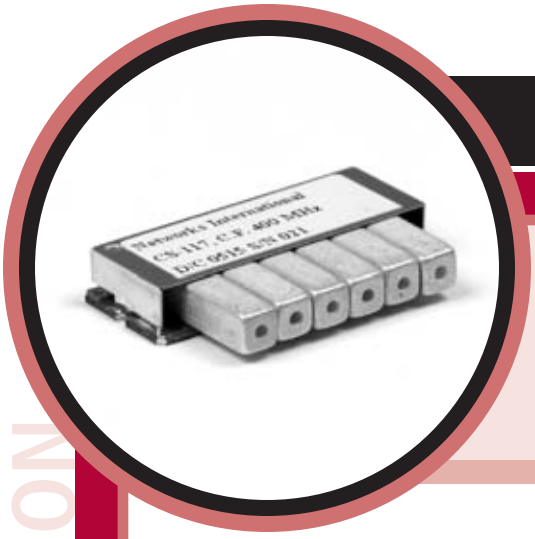


NIC designs and manufactures Multiplexers and Diplexers for broadband and narrowband applications. Filters within any of the bandpass series or combinations of different series may be used to form the basic networks of diplexers and multiplexers. NIC offers custom designs with phase linearity, group delay and in matched sets. Contact the factory with your specific requirements.

For NIC's screening and testing capabilities, refer to page 3.

Ceramic Filters

NIC's ceramic resonator filter product line is designed for applications needing superior performance in small packages in both environmentally benign and rugged conditions. Custom designs are available in bandpass and band-reject responses with various configurations: surface mount – hermetic and non-hermetic, and connectorized options. Capable of performing in both commercial and military environments, NIC's ceramic filters provide a cost-effective solution where High "Q" requirements are needed.



Ceramic Filters

400 MHz - 6000 MHz

- **Bandpass & Bandreject**
- **Low Profile, Compact Design**
- **Surface Mount (Hermetic + Non Hermetic), Connectorized Options**
- **Custom Designs Available**

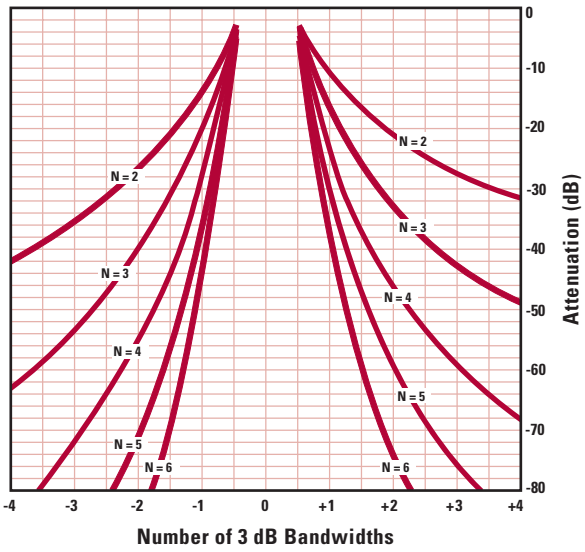
Electrical Performance

Frequency (MHz)	3 dB%	# of Sections	Impedance (Ohms)	Typical VSWR	Max Power (Watts)	Operating Temperature
400 - 6000	0.5% - 25%	2-10	50 or 75	1.5 : 1	10	-50° C ~ +100° C

Contact factory for specific requirements not listed. For screening capabilities, refer to chart on page 3.

Filter Attenuation

The attenuation data shows typical performance for ceramic resonator filters.



The following formula is used:

$$\frac{\text{Reject Frequency} - \text{Center Frequency}}{\text{3 dB Bandwidth}}$$

Example:

Center Frequency = 1500 MHz
3 dB BW = 30 MHz
Rejection Frequency = 1575 MHz
Required Attenuation > 60 dB

(1575 – 1500)/30 = +2.5

From the graph, 5 sections would provide greater than 60 dB attenuation @ 1575 MHz

Typical response of attenuation. For optimum response contact factory.

Package Outlines

Ceramic Filters

NIC offers a variety of package outlines for Ceramic Filters that can be customized. The list below represents the common package outlines used. Contact the factory with your requirements.

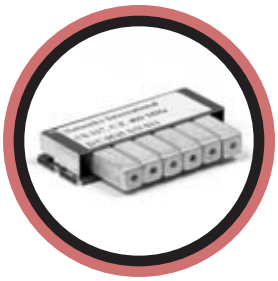
Length	# of Resonators x Size of Resonator + .100"
Width	Determined by Frequency & Dielectric Constant
Height	Size of Resonator + .03"

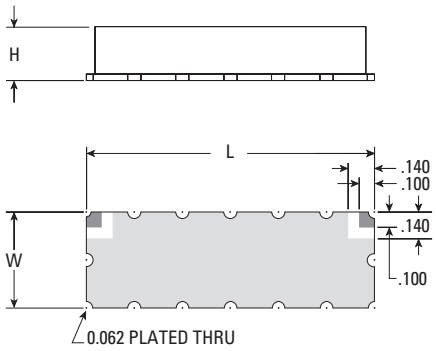
Standard Resonator Size

12 mm	0.492"
6 mm	0.256"
4 mm	0.177"

*Note: Approximate Dimensions Only, Final Outline determined by Customer Requirements

Surface Mount
Non-Hermetic





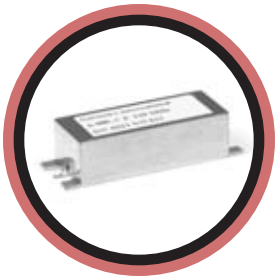
Length	# of Resonators x Size of Resonator + .250"
Width	Determined by Frequency & Dielectric Constant
Height	Size of Resonator + .05"

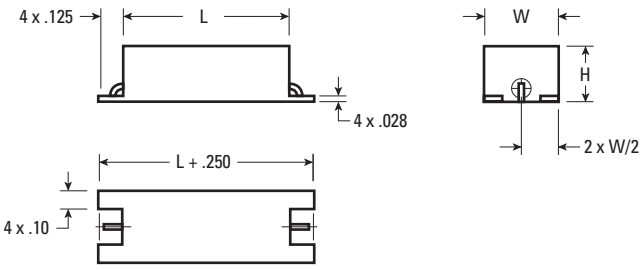
Standard Resonator Size

12 mm	0.492"
6 mm	0.256"
4 mm	0.177"

*Note: Approximate Dimensions Only, Final Outline determined by Customer Requirements

Surface Mount
Hermetic





Crystal Oscillators

NIC's Crystal Oscillator product line is designed for a variety of applications that need high performance in both environmentally benign and rugged conditions. NIC manufactures TCXOs & VCTCXOs which typically employ a thermistor network to generate a correction voltage which reduces the frequency variation over temperature. The correction voltage is usually applied to a varactor diode in the crystal circuit such that the crystal frequency may be varied by a small amount. TCXOs & VCTCXOs are preferred in low power applications and when a warm-up period is not acceptable. The only warm-up time is the time required for the components to reach thermal equilibrium and the total current consumption can be very low - often determined by the output signal power requirements.

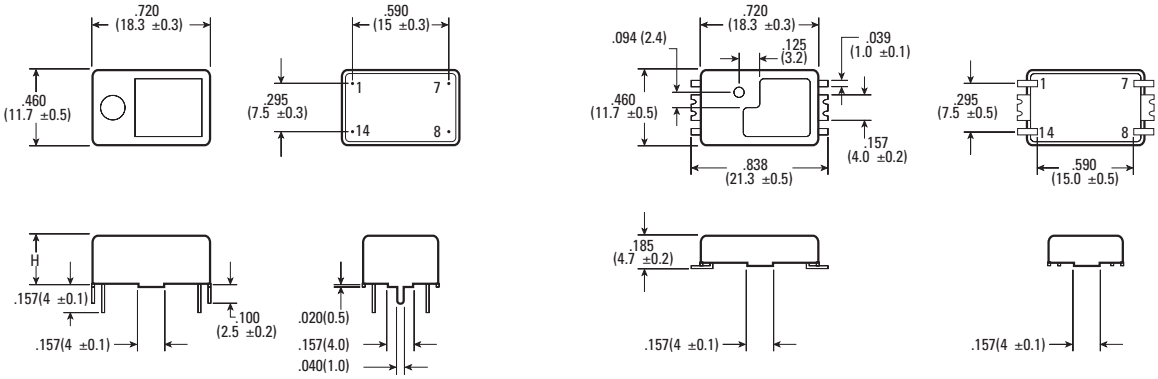
VCTCXOs

10 MHz - 40 MHz

- High Stability
- Phase Noise Measurements Available
- Military, Space, Commercial Applications
- Custom Designs Available

Condition		XO-183	XO-184
Frequency Range	MHz	10 - 20	10 - 20
Frequency Stability			
vs. Temperature	PPM	± 2.5 Max.	± 2.5 Max.
vs. Supply	PPM	± 0.3 Max.	± 0.3 Max.
vs. Aging / Year	PPM	± 0.8 Max.	± 0.8 Max.
Operating Temperature	°C	-30°C ~ 75°C	-30°C ~ 75°C
Supply Voltage	Vdc	+3V ± 5%	+3V ± 5%
		+5V ± 5%	+5V ± 5%
Current Consumption	mA	1.5 Max. +3V	1.5 Max. +3V
		2.0 Max. +5V	2.0 Max. +5V
Output			
Load		10ohm//10PF	10 ohm//10PF
Voltage		0.8Vp-p min.	0.8Vp-p min.
		0.7Vp-p min.	0.7Vp-p min.
		Clipped sine	Clipped sine
		DC CUT	DC CUT
Preset frequency	PPM	±0.5 / +25°C ± 2/C	±2.0 / +25°C ±2/C
Frequency Adjustment	PPM	± 3min, Trimmerless	± 3min, Trimmerless
Voltage Control (VCTCXO only)	PPM	±5 ~10 +2.5V ±2	±8 ~14 +2.5V ±2

Mechanical Dimensions (mm)



Height: 0.185 (4.7±0.2)

Height: 0.314 (8.0±0.5)

Pin No.	Connections
1	No Connection
7	GRD & Case
8	OUTPUT
14	Vcc

Inches (mm)

Note: The trimmer hole location may vary.

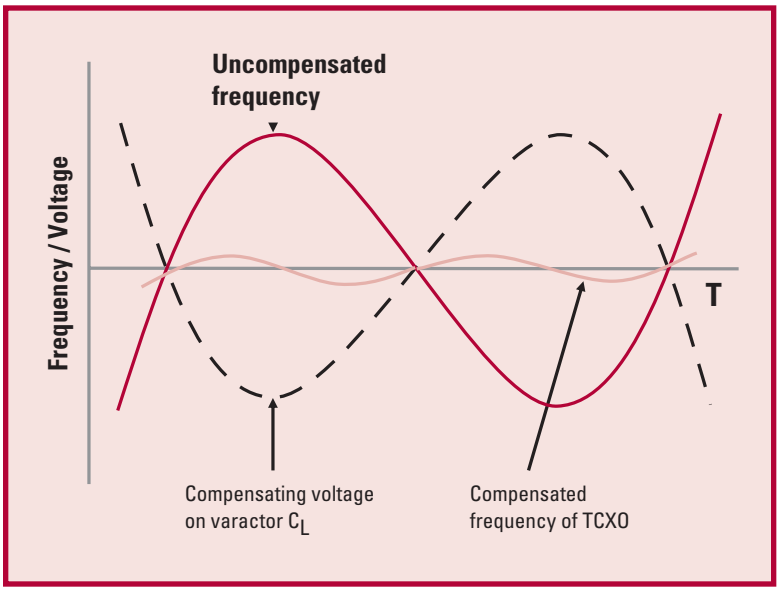
TCXOs

10 MHz - 100 MHz

- **High Stability**
- **Phase Noise Measurements Available**
- **Military, Space, Commercial Applications**
- **Custom Designs Available**

Condition		XO-125	XO-126	XO-163	XO-164
Frequency Range	MHz	8-40	8-40	8-40	8-40
Operating Temperature	°C	0°C ~ 50°C	0°C ~ 50°C	-30°C ~ 75°C	-30°C ~ 75°C
Storage	°C	-20°C ~ 70°C	-20°C ~ 70°C	-20°C ~ 70°C	-20°C ~ 70°C
Supply Voltage	Vdc	+5Vdc ± 5%	+5Vdc ± 5%	+5Vdc ± 5%	+5Vdc ± 5%
Current Consumption	mA	3 Max.	20 Max.	3 Max.	20 Max.
Output					
Load		20K ohm//5PF	2TTL Min.	20K ohm//5PF	CMOS
Voltage		1Vp-p Min. sine	Vol=.4v Max.	1Vp-p Min. sine	
		Clipped DC-Cut	Vol=2.4 Min.	Clipped DC-Cut	
Waveform		Sine	Square	Sine	Square
Frequency Adjustment	PPM	± 5 Min.	± 5 Min.	± 5 Min.	± 5 Min.

Crystal Oscillator Frequency vs. Temperature



Crystal Filters

NIC

NIC's success was built on our Crystal Filter capabilities. We manufacture our own filter crystals for the finest in precision and reliable performance. Given the unique design requirements for crystal filters we use well established design and manufacturing techniques which are supported by the most advanced computerized design and test software and equipment available.

NIC's crystal product line consists of a variety of standard frequencies and custom designs. Center Frequency range covers DC to 250 MHz with bandwidths that range from 0.01% to 2.5%. Typical topologies include bandpass and bandreject or notch available in several configurations: Surface Mount, Thru-Hole, Pin and Connectorized.

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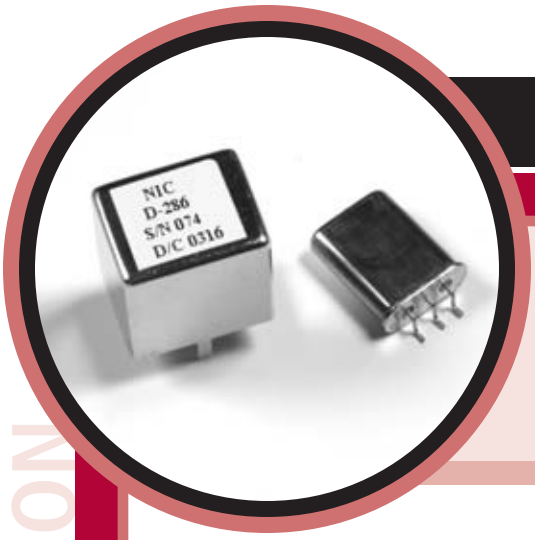


Monolithic Filters

10.7 MHz - 21.4 MHz - 45.0 MHz - 70.0 MHz

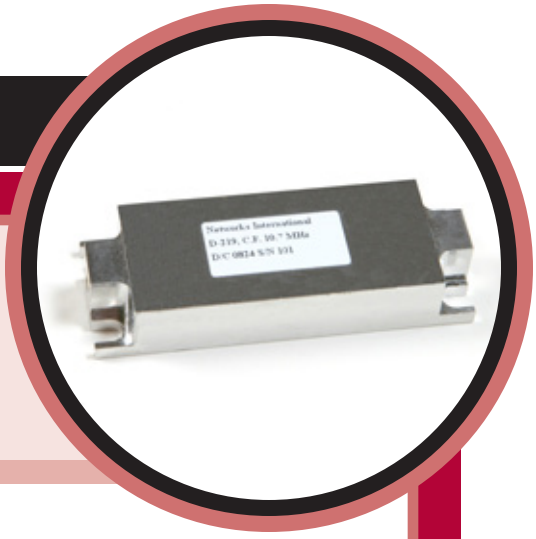
- **Ultra Small: SMT/ Low Profile**
- **Wide Operating Temperature Range: -55˚C to +105˚C**
- **Military, Space, Commercial Applications**
- **Custom Designs Available**

NIC Part No.	Poles	Pass Band dB	Pass Band KHz	Stop Band dB	Stop Band KHz	Max RIP.	Max I.L.	Ult. Attn. dB	Ult. Attn. Fo±KHz	Impedance Ohm // PF	Package L x W x H
10.7 MHz Fundamental (25 KHz Channel Spacing)											
10N15 A	2	3	±7.50	18	±25.0	0.5	1.5	35	±300 - ±1000	3.0K // 2.0	HC49/3
10N15 B	4	3	±7.50	40	±25.0	1.0	2.5	50	±300 - ±1000	3.0K // 2.0	HC49/3x2
10N15 C	6	3	±7.50	65	±25.0	2.0	3.0	65	±25 - ±300	3.3K // 1.5	P201
10N15 D	8	6	±7.50	90	±25.0	2.0	3.5	90	±25 - ±300	3.3K // 1.5	P202
21.4 MHz Fundamental (50 KHz Channel Spacing)											
21N30 A	2	3	±15.0	15	±45.0	0.5	1.5	35	±350 - ±1000	3.0K // 0.5	HC45/3
21N30 B	4	3	±15.0	40	±50.0	1.0	2.5	65	±350 - ±1000	3.0K // -0. 5	HC45/3x2
21N30 C	6	3	±15.0	65	±50.0	2.0	2.5	65	±50 - ±300	2.2K // 0.5	P203
21N30 D	8	6	±15.0	80	±50.0	2.0	3.0	80	±50 - ±300	2.2K // 0.5	P204
45.0 MHz Fundamental											
45N30AF	2	3	±15.0	15	±50.0	1.0	2.0	35	±500 - ±1000	80 // 1.5	HC45/3
45N30BF	4	3	±15.0	40	±60.0	1.0	3.0	70	±500 - ±1000	800 // 1.0	HC45/3x2
45.0 MHz 3rd Overtone											
45N7A	2	3	±3.75	10	±12.5	1.0	2.5	35	±910	2.5K // -0. 5	HC45/3
45N7B	4	3	±3.75	30	±12.5	1.0	4.0	75	±910	2.5K // 0.5	HC45/3x2
45N15 A	2	3	±7.50	18	±28.0	1.0	2.0	35	±500 - ±1000	4.0K // -1. 0	HC45/3
45N15 B	4	3	±7.50	40	±30.0	1.0	3.0	70	±500 - ±1000	4.0K // -1. 0	HC45/3x2
70.0 MHz											
70N15 A	2	3	±7.5	15	±30.0	1.0	2.0	35	±500 - ±1000	2.0K // -1. 0	HC45/3
70N15 B	4	3	±7.5	25	±25.0	1.0	3.0	70	±500 - ±1000	2.0K // -1. 0	HC45/3x2
70N20 A	2	3	±10.0	15	±40.0	1.0	2.0	35	±500 - ±1000	2.5K // -1. 0	HC45/3
70N20 B	4	3	±10.0	35	±40.0	1.0	3.0	70	±500 - ±1000	2.5K // -1. 0	HC45/3x2
Monolithic Filters (50 Ohms) **21.4 MHz**											
P21N7A	2	3	±3.75	20	±18.0	0.5	1.5	35	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N7B	4	3	±3.75	40	±14.0	1.0	2.5	65	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N15A	2	3	±7.5	18	±25.0	0.5	1.5	35	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N15B	4	3	±7.5	40	±25.0	1.0	2.5	65	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N15C	6	3	±7.5	65	±25.0	2.0	2.5	65	±25 ~ ±300	50 / 50	1.00 x 0.5 x .40 - .750
P21N30A	2	3	±15	15	±45.0	0.5	1.5	35	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N30B	4	3	±15	40	±50.0	1.0	2.5	65	±350 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P21N30C	6	3	±15	65	±50.0	2.0	2.5	65	±50 ~ ±300	50 / 50	1.00 x 0.5 x .40 - .750
45.0 MHz											
P45N15B	4	3	±7.5	30	±30.0	1.0	3.0	70	±500 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P45N30A	2	3	±15.0	15	±50.0	1.0	2.0	35	±500 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750
P45N30B	4	3	±15.0	40	±60.0	1.0	3.0	70	±500 ~ ±1000	50 / 50	1.00 x 0.5 x .40 - .750

Contact factory with your specific requirements. For NIC's screening capabilities, refer to page 3.

Crystal Bandpass

1 MHz - 20 MHz



- 3 dB BW 0.01% - 2.5%
- Phase & Amplitude Matching
- Very Sharp Shape Factor: Up to 1.03:1
- Custom Designs Available

NIC Part No.	C.F. MHz	Poles	Type/Make	B.W. KHz	I.L. dB	Stop Band dB	Stop Band KHz	Source/Load	Package L x W x H
A-521	1.000	4	CHV	0.400	6.0	60	3.400	50 / 50	3.00 x 0.55 x 1.20
D-104 *	1.400	6	ELP	0.300	10.0	60	0.600	1K / 1K	3.00 x 1.40 x 1.40
D-106 *	1.400	8	ELP	3.000	10.0	60	6.000	1K / 1K	3.00 x 1.40 x 1.40
A-259	1.400	14	ELP	3.240	5.0	60	4.300	1K / 1K	3.00 x 1.65 x 1.20
D-168 *	1.600	4	CHV	0.200	3.0	60	1.600	1K / 1K	2.75 x 1.10 x 1.25
D-102	2.000	12+10	ELP+EQ	3.200	12.0	60	4.500	50 / 50	8.50 x 1.25 x 1.70
A-389	2.000	8	ELP	4.000	6.0	60	6.000	1K / 1K	2.50 x 1.60 x 1.85
A-276	2.000	10	LSB	20.000	8.0	-	-	1K / 1K	2.50 x 1.60 x 1.05
A-278	2.000	8	ELP	32.000	10.0	60	48.000	1K / 1K	2.50 x 1.60 x 1.05
A-141	2.200	6	CHV	0.300	8.0	60	1.000	200 / 200	2.38 x 1.00 x .400 - 1.00
A-140	2.200	8	ELP	3.000	8.0	45	4.400	200 / 200	2.38 x 1.00 x .400 - 1.00
D-175-1 *	2.250	6	CHV	0.500	7.0	40	1.000	50 / 50	2.38 x 1.00 x .400 - 1.00
D-122 *	3.000	6	ELP	1.000	8.0	60	2.500	50 / 50	2.50 x 1.30 x 0.75
D-123 *	3.000	10	ELP	3.000	8.0	60	6.000	50 / 50	2.50 x 1.30 x 0.75
D-124 *	3.000	10	ELP	10.000	8.0	60	20.000	50 / 50	2.50 x 1.30 x 0.75
D-125 *	3.000	10	ELP	50.000	8.0	60	100.000	50 / 50	2.50 x 1.30 x 0.75
A-153	3.000	10	ELP	100.000	11.0	80	180.000	200 / 200	2.50 x 1.30 x 0.75
A-554	5.000	4	GAU6	0.300	6.0	40	1.600	50 / 50	1.783 x .787 x .590
A-555	5.000	4	GAU6	3.000	6.0	40	16.000	50 / 50	1.783 x .787 x .590
A-613	5.000	1	BUT	4.000	4.0	-	-	50 / 50	1.50 x 1.00 x 0.50
A-556	5.000	4	GAU6	6.000	6.0	40	32.000	50 / 50	1.783 x .787 x .590
A-557	5.000	4	GAU6	15.000	15.0	40	64.000	50 / 50	1.783 x .787 x .590
A-559	5.000	2	CHV	30.000	5.0	40	240.000	1.5K / 1.5K	1.75 x .600 x .440
A-522	9.600	4	CHV	0.400	6.0	40	4.800	500 / 1K	3.00 x 0.55 x 1.20
A-391	9.755	8	ELP	110.000	6.0	50	150.000	50 / 50	2.40 x 1.60 x 0.75
A-200	12.700	4	GAU	8.000	5.0	60	56.000	200 / 200	2.40 x 1.00 x 0.70
A-111	12.700	6	GAU	15.000	6.0	60	80.000	200 / 200	1.90 x 1.00 x 0.60
A-214-P1	14.500	4	CHV	10.000	5.0	40	40.000	50 / 50	1.50 x 0.50 x 0.625
D-244*	14.960	10	ELP	150.000	12.0	70	220.000	50 / 50	2.75 x 1.25 x 0.85
D-126-1*	15.000	10	ELP	25.000	8.0	60	50.000	50 / 50	2.50 x 1.00 x 0.740
D-127-1*	15.000	10	ELP	75.000	8.0	60	150.000	50 / 50	2.50 x 1.00 x 0.740
A-257	20.000	2	BUT	5.000	4.0	30	60.000	50 / 50	0.75 x 0.65 x 0.45
A-149	20.000	6	GAU	32.000	8.0	60	220.000	50 / 50	2.40 x 1.00 x 0.60
A-196-08	20.000	8	ELP	100.000	5.0	60	200.000	50 / 50	1.80 x 0.90 x 0.60
D-175	20.000	4	BES	100.000	14.0	40	440.000	50 / 50	2.40 x 1.00 x 0.75

Contact factory with your specific requirements. For NIC's screening capabilities, refer to page 3. *Phase Matched Pairs

Crystal Bandpass

10.7 MHz + 21.4 MHz

- 3 dB BW 0.01% - 2.5%
- Phase & Amplitude Matching
- Very Sharp Shape Factor: Up to 1.03:1
- Custom Designs Available

NIC Part No.	C.F. MHz	Poles	Type/Make	B.W. KHz	I.L. dB	Stop Band dB	Stop Band KHz	Source/Load	Package L x W x H
A-330	10.700	2	CHV	0.500	3.00	40	5.000	50 / 50	2.38 x 1.00 x .400 - 1.00
D-169-P1*	10.700	6	ELP	1.000	6.00	60	2.500	50 / 50	2.40 x 1.50 x 0.60
A-224	10.700	6	GAU	2.000	6.00	60	12.000	50 / 50	3.00 x 1.00 x 0.50
A-226	10.700	5	CHV	2.850	4.00	–	L.S.B.	200 / 200	2.38 x 1.00 x .400 - 1.00
A-408	10.700	6	CHV	2.850	4.00	–	U.S.B.	200 / 200	2.38 x 1.00 x .400 - 1.00
A-245	10.700	6	CHV	3.200	4.00	60	10.600	200 / 200	1.42 x 1.050 x .754
D-208-P6	10.700	6	ELP	6.000	5.00	60	12.000	125 / 125	2.20 x 1.20 x 0.60
D-165*	10.700	6	ELP	7.000	4.00	60	16.000	680 / 680	2.20 x 1.15 x 0.60
D-208-P8	10.700	6	ELP	10.000	4.00	60	20.000	50 / 50	2.20 x 1.15 x 0.60
A-727	10.700	6	CHV	20.000	6.00	60	100.000	50 / 50	2.38 x 1.00 x .400 - 1.00
D-169-P3*	10.700	8	CHV	25.000	4.00	60	50.000	50 / 50	2.40 x 1.55 x 0.60
A-511	10.700	3	CHV	28.000	3.00	45	120.000	50 / 50	1.75 x .600 x .440
D-208-P10	10.700	8	ELP	30.000	4.00	60	60.000	50 / 50	2.15 x 1.15 x 0.60
A-135	10.700	8	ELP	50.000	8.00	60	100.000	50 / 50	2.00 x 0.80 x 0.60
A-324	10.700	6	ELP	100.000	11.00	60	300.000	50 / 50	1.15 x 1.00 x 0.75
A-571	10.700	4 x 2	ELP	280.000	7.50	66	700.000	50 / 50	1.00 x 0.5 x .40 - .750

NIC Part No.	C.F. MHz	3 dB BW	I.L. dB	Shape Factor dB	Spurious Response dB	Package L x W x H
A-202	21.400	3.2 KHz	5.0	2.5:1	60	1.75 x .600 x .440
A-123	21.400	10 KHz	3.0	2.5:1	60	1.75 x .600 x .440
A-185	21.400	15 KHz	3.0	2.5:1	60	1.75 x .600 x .440
A-124	21.400	20 KHz	3.0	2.5:1	60	1.75 x .600 x .440
A-125	21.400	50 KHz	3.0	2.5:1	60	1.75 x .600 x .440
A-248	21.400	75 KHz	3.0	2.5:1	60	1.75 x .600 x .440
A-126	21.400	100 KHz	8.0	2.5:1	55	1.75 x .600 x .440
A-220	21.400	200 KHz	8.0	2.5:1	55	1.75 x .600 x .440
A-188	21.400	250 KHz	8.0	2.5:1	60	1.75 x .600 x .440
A-127	21.400	300 KHz	8.0	2.5:1	60	1.75 x .600 x .440
A-128	21.400	500 KHz	8.0	4.0:1	60	1.75 x .600 x .440
C-135	21.400	1 MHz	5.0	3.5:1	60	1.75 x .600 x .440
C-136	21.400	2 MHz	3.0	3.0:1	60	1.75 x .600 x .440
C-137	21.400	4 MHz	3.0	3.0:1	60	1.75 x .600 x .440
C-233	21.400	6 MHz	2.0	2.5:1	60	1.75 x .600 x .440
C-138	21.400	8 MHz	1.0	2.5:1	60	1.75 x .600 x .440
C-175	21.400	10 MHz	1.0	2.5:1	60	1.75 x .600 x .440
C-176	21.400	12 MHz	1.0	2.5:1	60	1.75 x .600 x .440

Contact factory with your specific requirements. For NIC's screening capabilities, refer to page 3. *Phase Matched Pairs

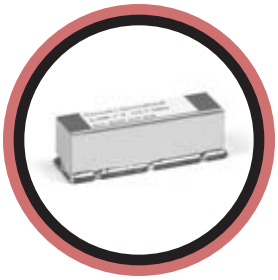
Crystal Bandpass - High Frequency

22 MHz - 250 MHz

- 3 dB BW 0.01% - 2.5%
- Phase & Amplitude Matching
- Very Low 3rd Order I/M
- Custom Designs Available

NIC Part No.	C.F. MHz	Poles	Type/Make	B.W. KHz	I.L. dB	Stop Band dB	Stop Band KHz	Source / Load or Fundamental Overtone	Package L x W x H
A-356	25.000	6	CHV	21.000	3.0	60	56.000	50 / 50	1.00 x 0.5 x .40 - .750
A-700	30.008	6	ELP	4.500	4.0	60	28.000	50 / 50	1.00 x 0.5 x .40 - .750
A-372	35.000	6	CHV	15.000	4.0	60	115.000	50 / 50	1.5 x 0.75 x 0.75
A-196	40.000	8	GAU	100.000	8.0	60	1000.000	50 / 50	2.4 x 1.0 x 0.60
A-997-2	40.000	6	CHV	100.000	8.0	60	350.000	50 / 50	2.4 x 1.0 x 0.60
A-997-3	40.000	6	CHV	300.000	8.0	60	1000.000	50 / 50	2.4 x 1.0 x 0.60
A-678	40.455	6	CHV	20.000	5.0	60	60.000	50 / 50	2.85 x 0.65 x 0.33
A-228	40.455	4	CHV	25.000	5.0	60	240.000	50 / 50	2.38 x 1.00 x .400 - 1.00
A-634*	40.455	4	CHV	30.000	3.0	60	120.000	50 / 50	2.38 x 1.00 x .400 - 1.00
A-460	40.455	4	CHV	32.000	5.0	60	128.000	50 / 50	1.783 x .787 x .590
A-310	40.455	6	GAU	100.000	9.0	60	350.000	50 / 50	2.38 x 1.00 x .400 - 1.00
A-241	40.455	4	ELP	200.000	6.0	60	1000.000	50 / 50	2.38 x 1.00 x .400 - 1.00
A-437	40.455	8	ELP	256.000	8.0	75	ULT	50 / 50	1.75 x .600 x .440
A-443	45.000	4	CHV	14.000	5.0	60	100.000	50 / 50	1.00 x 0.5 x .40 - .750
A-523	45.000	6	CHV	25.000	4.5	65	80.000	50 / 50	2.80 x 0.65 x 0.32
A-765	45.000	2	C HV	45.000	2.0	40	400.000	50 / 50	0.50 x 0.50 x 0.50
A-457	45.000	4	CHV	200.000	5.0	25	400.000	50 / 50	1.75 x .600 x .440
A-475	45.000	4	ELP	280.000	5.0	50	1000.000	50 / 50	1.75 x .600 x .440
D-337*	70.000	4 x 2	CHV	25.000	6.0	60	75.000	OT	1.75 x .600 x .440
A-859	70.000	6	CHV	30.000	8.0	60	90.000	Fund.	1.75 x .6 x .4
A-893	70.000	2	CHV	50.000	3.0	20	150.000	OT	1.00 x 0.5 x .40 - .750
A-802	70.000	6	CHV	50.000	6.0	80	400.000	Fund.	2.2 x .75 x .52
A-890	70.000	4	CHV	100.000	5.0	40	300.000	Fund.	1.75 x .600 x .440
A-771	70.000	6	GAU	100.000	5.0	60	450.000	Fund.	1.00 x 0.5 x .40 - .750
A-494*	70.000	6	CHV	150.000	5.0	60	400.000	Fund.	2.25 x 0.75 x 1.00
A-895	70.000	2	CHV	200.000	3.0	20	630.000	Fund.	1.00 x 0.5 x .40 - .750
A-891	70.000	4	CHV	200.000	5.0	40	600.000	Fund.	1.75 x .600 x .440
A-772	75.000	4	GAU6	26.000	6.0	60	600.000	OT	1.75 x .600 x .440
A-763	80.000	6	ELP	100.000	6.0	60	400.000	OT	1.783 x .787 x .590
A-214P3	92.500	4	CHV	10.000	7.0	40	40.000	OT	1.50 x 0.50 x 0.50
A-453	100.000	4	CHV	6.000	8.0	50	45.000	OT	1.00 x 0.5 x .40 - .750
D-342	125.000	6	CHV	50.000	5.0	80	500.000	Fund.	2.85 x 0.52 x 0.34
A-996	112.500	6	ELP	50.000	4.0	60	150.000	Fund.	1.00 x 0.5 x .40 - .750
A-902	140.400	6	ELP	50.000	4.0	60	120.000	Fund.	1.00 x 0.5 x .40 - .750
A-930	160.000	4	CHV	100.000	5.0	60	600.000	Fund.	1.00 x 0.5 x .40 - .750
A-944	220.000	4	CHV	50.000	5.0	60	350.000	Fund.	1.00 x 0.5 x .40 - .750

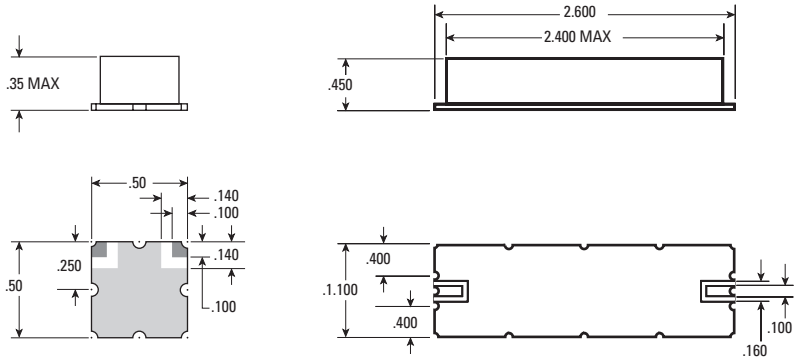
Contact factory with your specific requirements. For NIC's screening capabilities, refer to page 3. *Phase Matched Pairs

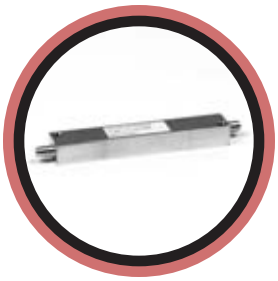


Surface Mount
Non-Hermetic

NIC offers a variety of package outlines for Crystal Filters that can be customized. The list below represents the common package outlines used. Contact the factory with your requirements.

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

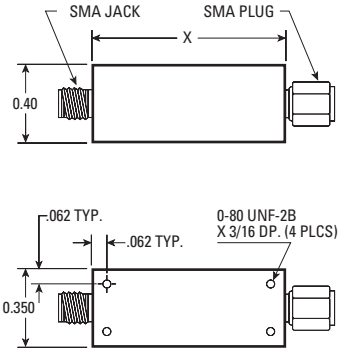




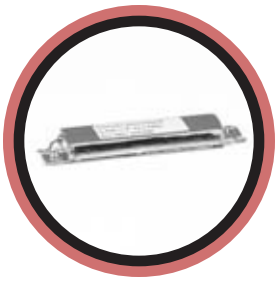
Connectorized
Hermetic

*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

*Std Connector: SMA; Other connector options available such as SMB,SMC,SSMA,GPO, GPPO.

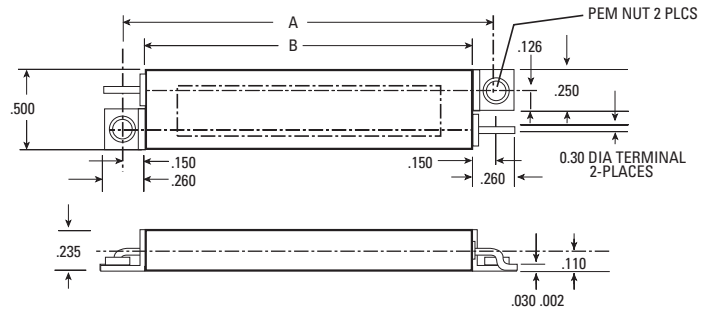


Surface Mount
Hermetic

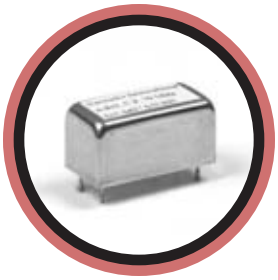


*Note: Approximate Dimensions in Inches.
Final Outline determined by Customer Requirements

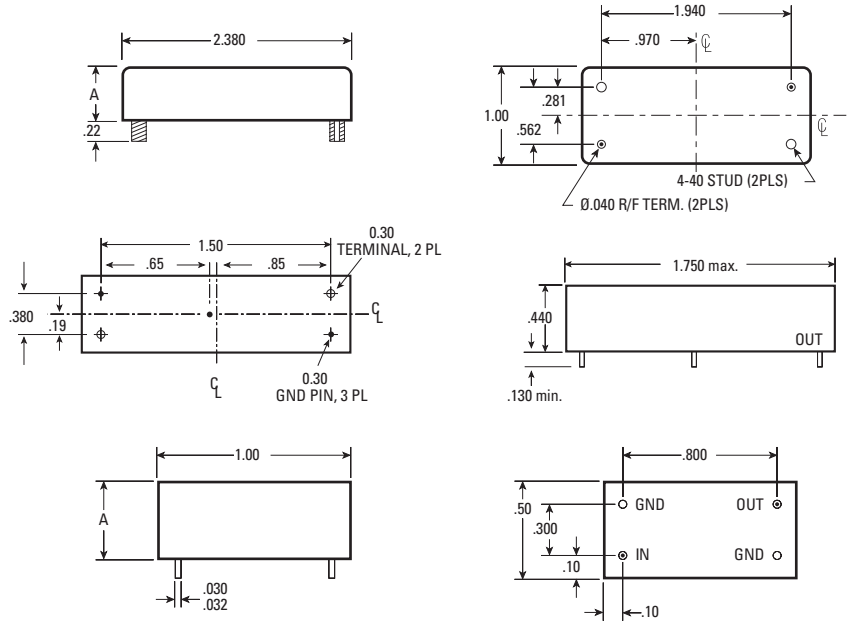
A	B
2.050	1.750
2.450	2.150
3.125	2.825



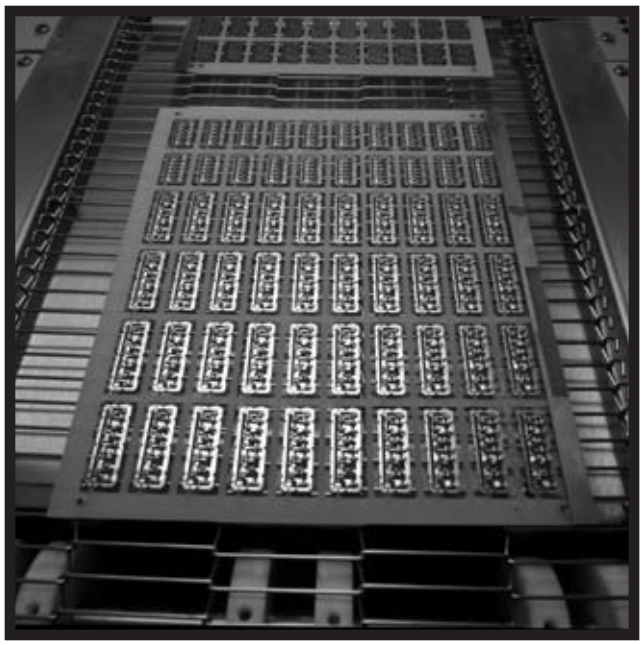
RF Pin: Thru-Hole
Hermetic



A = Available Height
.400
.500
.600
.750



Recommended SMT Installation



The following is NIC's suggested guidelines for Surface Mount (SMT) installation. A typical reflow profile is provided below. Mass of all components and Circuit Card Assembly should be considered when establishing a reflow procedure. Higher density board populations may take longer to achieve reflow temperatures. The temperatures shown below are the temperatures at the NIC component.

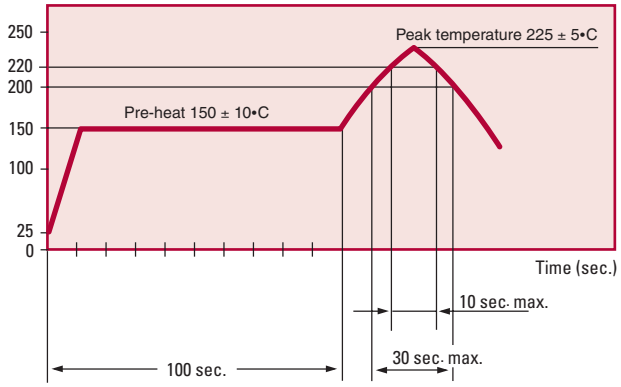
NIC builds its surface mount components using high temperature solders. Standard alloys (Sn63) should be used for installation.

NIC products can be cleaned with aqueous and semi-aqueous systems. Parts should be thoroughly baked after cleaning to prevent entrapment of moisture.

The rate of heating and cooling must be controlled to avoid thermal cracking of internal components. Processes, heating or cooling should not exceed a rate of 200°C per minute. Spikes must not exceed 100°C maximum for any solder operation. Avoid forced cooling or contact with heat sinks, such as conveyor belts, metal tables or cleaning solutions, before the units reach ambient temperatures.

Please contact NIC for specific requirements or questions.

Typical Reflow Profile



NIC

NETWORKS INTERNATIONAL CORPORATION

RF + MICROWAVE FILTERS AND ASSEMBLIES

NIC Warranty

Products manufactured by NIC are warranted against defective materials and workmanship for a period of one year from the date of shipment. NIC's obligation for any defect shall be limited to the repair of the defective part. NIC assumes no liability if defects result from improper use, operation above rated capacities, repairs not made by us, or misapplication of equipment. No other warranty is expressed or implied. NIC neither makes nor authorizes any other person to make any other warranty concerning its products. NIC is not liable for consequential damages. Warranty returns must first be authorized by NIC prior to return and must be returned pre-paid.

The warranty period shall commence on the date of shipment from Seller's plant and extend one (1) year following the date of shipment. Upon beginning of said warranty period, all customers' remedies shall be governed by the terms stated or referenced in this warranty. Replacement or repair under warranty does not extend the original warranty. In-warranty repaired or replacement parts or Products are warranted only for the remaining unexplored portion of the original warranty period applicable to the repaired or replaced parts or Products. After expiration of the warranty period, the Customer shall be charged at the then current prices for parts, labor, and transportation.

Repairs and recalibration of NIC products are made at the factory. Before returning any component, please contact NIC directly for the assignment of an RMA number, shipping address, and instructions. All non-warranty returns are subject to a minimum evaluation charge. An additional estimate of the cost to repair is based upon the cost of labor and materials, plus a service charge. Returns must be shipped prepaid to the attention of the Repair Department. All conditions, limitations, actions, and liabilities express or implied in the forgoing NIC "Standard Warranty" apply to all returns regardless of conflicting Customer declarations unless otherwise agreed to in writing by Seller.

Catalog specifications subject to change without notice.

P: 913.685.3400 | **F:** 913.685.3732

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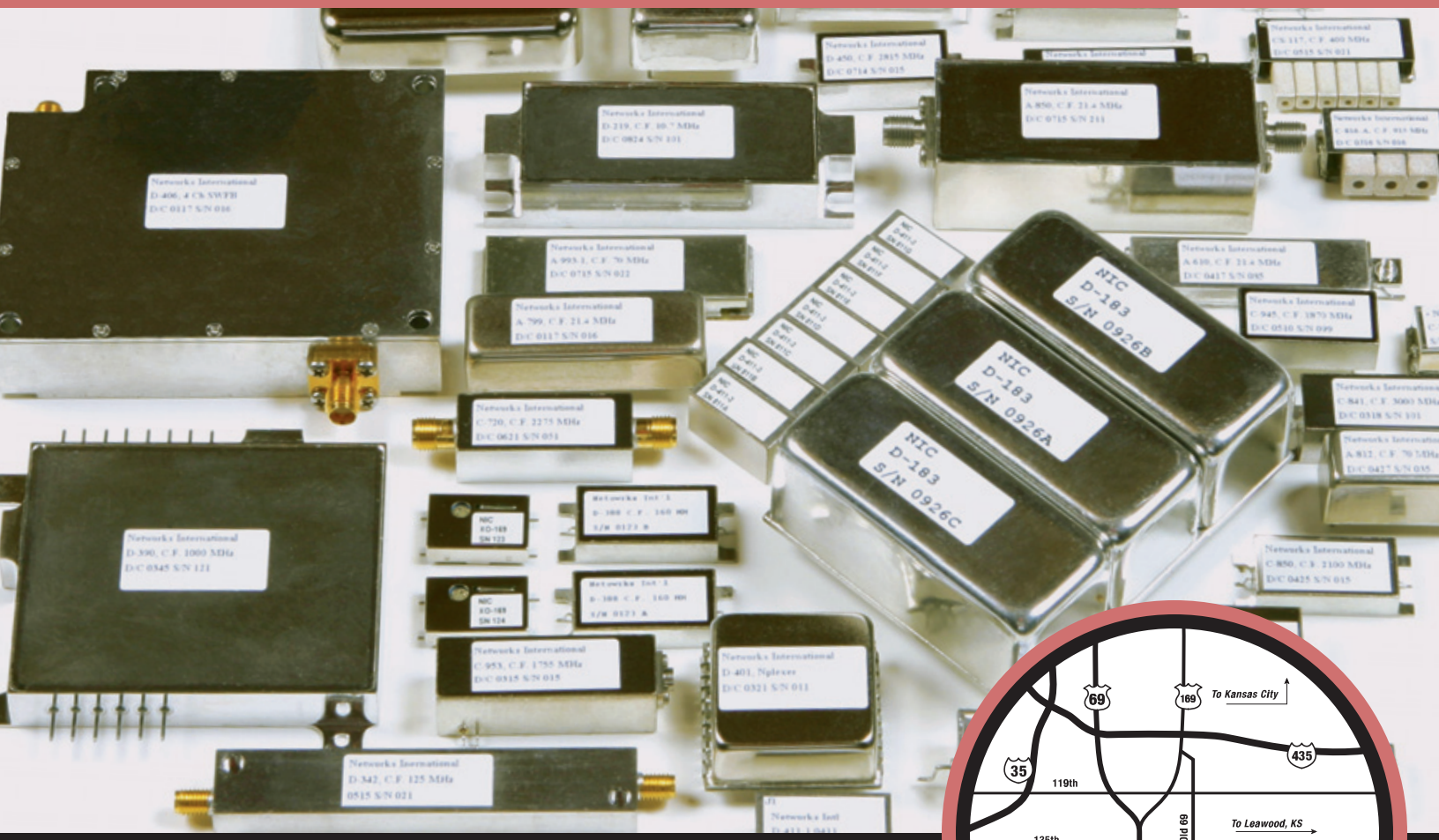
QSR-624

NIC

NETWORKS INTERNATIONAL CORPORATION

RF + MICROWAVE FILTERS AND ASSEMBLIES



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