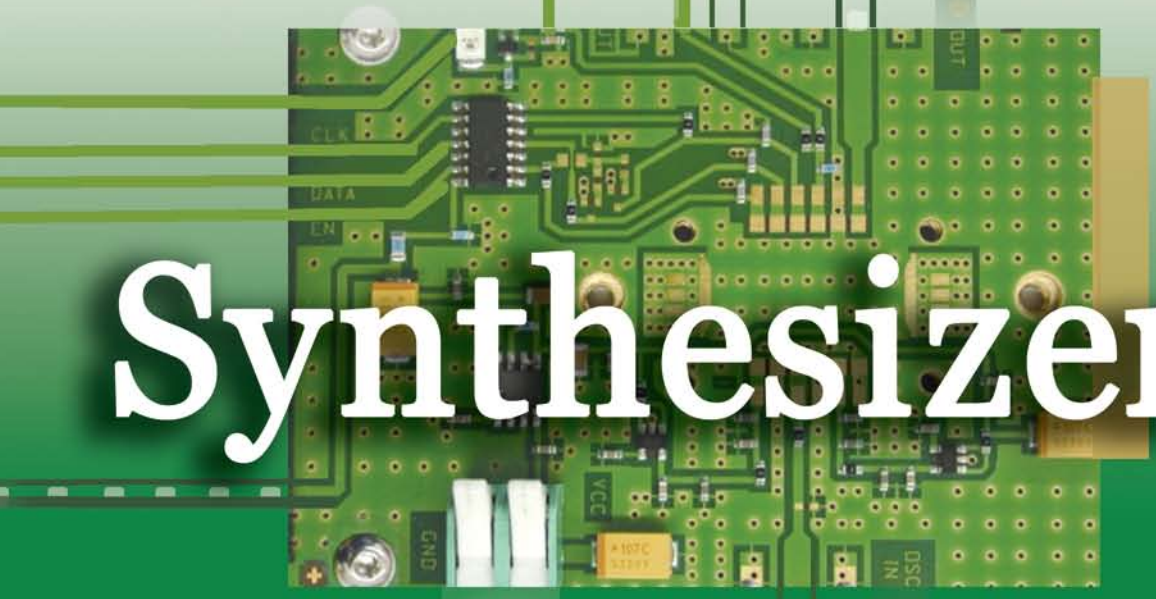

Synthesizers

56 MHz - 7800 MHz

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DIFFERENT TYPES OF SYNTHESIZERS

Let the Mini-Circuits design team create a custom frequency synthesizer tailored to your requirements. We will review your requirements and, following technical discussions between your engineers and Mini-Circuits designers, we will work closely with you to create final specifications that meet or exceed your requirements. To ensure high yields, we will factor in component tolerances and even variations in manufacturing processes. You will have full access to performance data from sample units, and can even evaluate sample units in your system to ensure that final production units fulfill your performance requirements.

To meet the needs of a wide range of systems and applications, Mini-Circuits offers seven different types of custom frequency synthesizers:

1 Fixed Frequency

For applications requiring a highly stable single frequency, Mini-Circuits engineering team can customize a low-noise synthesized source for any frequency from 56 MHz to 6010 MHz. Fixed-frequency synthesizers feature low phase noise with spurious performance of -90 dBc or better. They operate with low power consumption and are supplied in compact surface-mount or connectorized packages.

- *Settling times of typically 100 ms or better*
- *Harmonics of -20 dBc or better*

2 Tunable Narrow Bandwidth

For applications requiring tunable bandwidths of center frequency ± 10% (or less), Mini-Circuits custom narrowband frequency synthesizers can be specified to 6010 MHz with low phase noise, low harmonics, and spurious levels of -85 dBc or better. Available with customer-specified step sizes, these high-performance synthesizers are housed in compact surface-mount or connectorized packages.

- *Typical settling times of 30 ms or less*
- *Harmonics of -20 dBc or better*

3 Tunable Medium Bandwidth

Mini-Circuits medium-bandwidth frequency synthesizers can be specified for center frequency ±10% to ±30% over a frequency range of 56 MHz to 6010 MHz. They offer spurious performance of -90 dBc typical or better, with customer specified step sizes, low power consumption, and packaged in compact surface-mount or connectorized housings.

- *Typical settling times of 25 ms or less*
- *Harmonics of -20 dBc or better*

4 Tunable Wide Bandwidth

For tuning bandwidths of center frequency ±30% to ±50% Mini-Circuits wide-bandwidth frequency synthesizers can be specified from 56 MHz to 6010 MHz with custom step sizes.They feature outstanding spurious performance of -80 dBc or better with output levels to +9 dBm or more. Mini-Circuits wide-bandwidth frequency synthesizers are supplied in surface-mount or connectorized packages.

- *Bandwidths greater than 500 MHz*
- *Typical settling times of 25 ms or less*
- *Harmonics of -20 dBc or better*

5 Tunable Very Wide Bandwidth

For extremely wide tuning bandwidths up to 6 octave ex; 700 MHz to 4000 MHz, achieved in one model, Mini-Circuits very-wide-bandwidth frequency synthesizers can be specified with customer-specified step sizes. These broadband synthesizers boast output levels of +8 dBm typical spurious performance of -80 dBc or better, and low phase noise. Very-wide-bandwidth frequency synthesizers can be supplied in surface-mount or connectorized packages.

- *Typical settling times of 15µs or less*
- *Harmonics of -20 dBc or better*
- *Frequency 700 to 4000 MHz*

6 Tunable Fast Settling Time

Fast switching speed alone is not enough. Mini-Circuits custom fast-settling-time frequency synthesizers provide fast switching speed while also settling to a stable, new frequency quickly. Fast-settling-time frequency synthesizers settle within ±5.4 deg. of a new tuned frequency in microseconds even for large frequency steps.

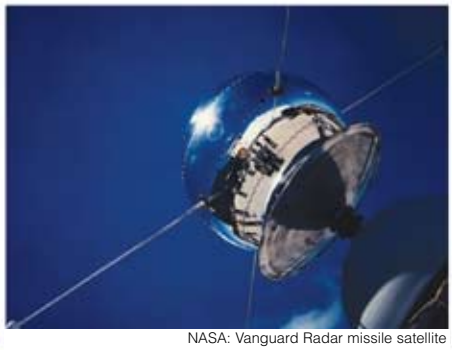
- *Settling time of 25 µs or less*
- *Typical spurious of -65 dBc or better*
- *Frequency 714 to 1618 MHz*

7 Dual Frequency

For savings in cost and system real estate, Mini-Circuits can customize a single package containing two discrete, single frequency synthesizers, with any two frequencies. Both synthesizers are characterized by low phase noise and spurious levels of -90 dBc or less. These dual-frequency synthesizers can be supplied in compact surface-mount or connectorized packages.

- *Harmonics of -20 dBc or better*
- *Typical phase noise of -92 dBc/Hz or better at 1 kHz offset*
- *Programmable*

FOR DIFFERENT APPLICATIONS



NASA: Vanguard Radar missile satellite

US Navy Photo: Ground to Satellite Communication center

US Navy Photo: WiMax Technology

US Navy Photo: X-45A / Unmanned combat aerial vehicle

NASA: Discovery Launch

Mini-Circuits is an industry leader in synthesizer designs, with models designed into major programs world wide. Mini-Circuits has designed over 250 synthesizer models, most of which were developed from face-to-face discussions with customers.

In addition to which, Mini-Circuits has designed these synthesizers in both SMT and connectorized packages for applications including:

- *TDSCDMA*
- *CDMA Repeaters*
- *WCDMA*
- *EDGE*
- *GSM*
- *TDMA*
- *PCS*
- *UMTS*
- *L-Band Satellite*
- *Wireless LAN*
- *Point-to Point Radio*
- *Test Equipment*
- *Microwave Radio High Data Transfer Rate Applications, up to 600 Mbytes/Sec*
- *CATV*
- *WiMAX*
- *Military Programs*
- *LTE*
- *Mobile TV*

Let Mini-Circuits Design Your Next Synthesizer Using Our Time-Proven Process:

1 ***Customer consultation***

Every new frequency synthesizer starts with a set of requirements; Mini-Circuits experienced and knowledgeable staff will review your performance requirements and reliability concerns, and develop a draft specification that precisely documents your needs and clearly details project milestones and final delivery dates.

2 ***Synthesizer simulation***

Once we've documented your synthesizer specifications, Mini-Circuits engineering staff will use the latest computer-aided-engineering (CAE) tools to create a computer model for your design along with simulations of expected performance. These simulations will help fine-tune your design to meet or exceed its target performance specifications.

3 ***Customer approval of specs and simulation***

After your design has been computer simulated, Mini-Circuits synthesizer design team will share the simulation results with you. At that time, we will also offer any comments or recommendations, such as tradeoffs that could result in lower power consumption or lower phase noise. Your approval of the preliminary specification will be based on simulation and expected performance levels.

4 ***Prototyping your synthesizer***

Armed with your approval of the specifications and the simulation, Mini-Circuits synthesizer design team will create a hardware prototype of your design, using the highest performance components available and the latest RoHS-compliant assembly practices. Assembled prototypes are 100% tested for electrical performance, over the full operating temperature range to evaluate key parameters such as frequency margin stability, output power, phase noise, harmonics, spurious, power consumption, etc.

5 ***Customer approval of prototype performance***

After your prototype synthesizer has been 100% tested, over the full operating temperature range, Mini-Circuits staff shares the results of those tests with you, providing clear descriptions of each performance parameter, such as frequency, output power, and phase noise, and thorough details on how each test was performed, right down to the type of test equipment used in the measurements. Only when you are fully satisfied with the results will we proceed to the next step in our synthesizer design process.

6 ***Engineering run***

Following your approval, Mini-Circuits will transfer your prototype frequency synthesizer design to engineering production, with the same component bill of materials (BOM) and RoHS-compliant assembly procedures used to produce the prototype. In addition, the same rigorous 100% testing over the full operating temperature range procedures will be applied to each production synthesizer, to ensure that each unit in your production run is of the highest quality and highest reliability.

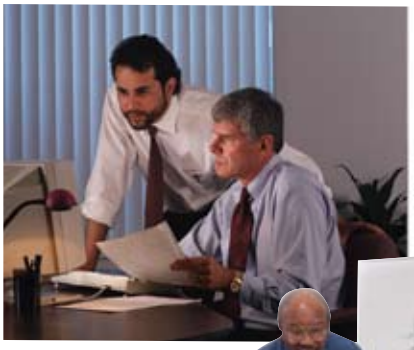
7 ***Customer acceptance and sign off***

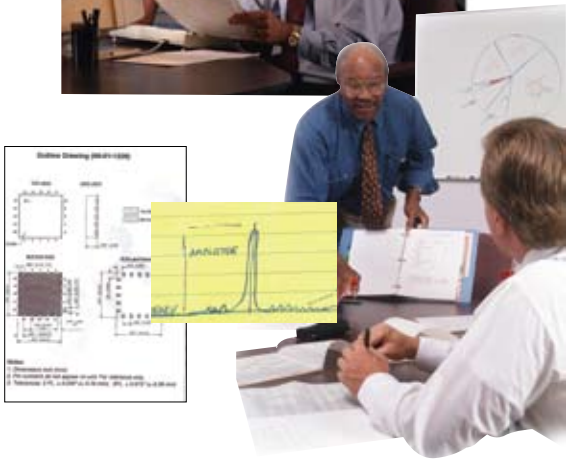
After engineering run has been completed, units will be sent to you for qualification in your system. In parallel, a final specification will be created and sent for your approval. The final specification will be created based on the engineering run data that was taken over the full operating temperature range and reflects the specification we can guarantee for mass production.

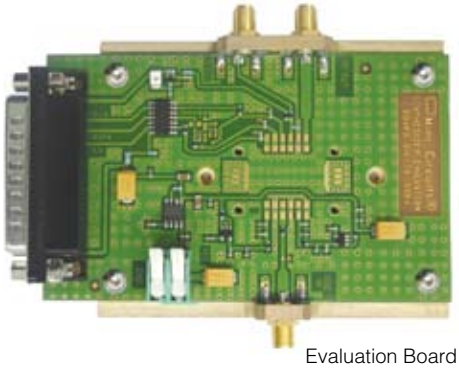
8 ***Model finalized***

Every Mini-Circuits synthesizer is 100% tested during production, where we perform over 44 electrical tests (see page 7) in automated setups to ensure and guarantee quality and performance repeatability.

Working "Face-to-Face" with customers in a close cooperative relationship, ensures that Mini-Circuits provides optimal State-of-the-Art solutions to our customers needs.







Evaluation Board

Some Examples Of Custom Synthesizers Provided To Customers

KSN
0.800" x 0.584"x 0.154
(20.32 x 14.83 x 3.91mm)

DSN
1.25" x 1.00" x 0.20"
(31.75 x 25.40 x 5.08 mm)

RSN
0.91" x 0.91" x 0.252"
(23.11 x 23.11 x 6.40 mm)

SSN/SSND
0.60" x 0.60" x 0.138"
(15.24 x 15.24 x 3.50 mm)

WSN
1.75" x 1.25" x 0.22"
(44.45 x 31.75 x 5.99 mm)

ZSN
2.75" x 1.96" x 0.62"
(69.85 x 49.78 x 15.75 mm)

Model Package Style	Freq. Min. (MHz)	Freq. Max (MHz)	Ref. Freq. (MHz)	Step Size (kHz)	VCC PLL (V)	VCC VCO (V)	Output Power (dBm) Typ.	Harmonics (-dBc) Typ.	Reference Spurious (-dBc) Typ.	Comparison Spurious (-dBc) Typ.	Phase Noise 100 Hz (-dBc/Hz) Typ.	Phase Noise 1 K (-dBc/Hz) Typ.	Phase Noise 10 K (-dBc/Hz) Typ.	Phase Noise 100 K (-dBc/Hz) Typ.	Settling Time (mSec) Typ.	Case Style	Application
Fixed Frequency Synthesizers (with internal microcontroller)																	
KSN	144	144	52	N/A	3	5	3	25	95	90	95	105	106	134	100	99-01-1251	WIMAX 2.5 GHz
KSN	675	675	27	N/A	3	5	3	20	85	85	97	92	110	134	30	DK1042	BROADBAND ACCESS
KSN	768	768	52	N/A	3	5	6	25	85	90	75	96	103	129	35	99-01-1251	WIMAX 3.5 GHz
KSN	1024	1024	10.24	N/A	5	5	0	27	95	78.5	74	78	104	131	10	DK1042	CATV
ZSN *	4950	4950	26	N/A	15	15	-3	35	102	86	60	80	84	112	27	99-01-1336	MILITARY
Tunable Narrow Band Synthesizers (center frequency ±10% or less)																	
KSN	620	660	30	20	3.3	5	-0.5	40	90	75	70	74	106	129	15	DK801	CDMA
KSN	900	960	8	100	5	5	3	20	85	85	82	75	100	125	5	DK1042	RFID READER
KSN	1150	1160	20	250	5	5	2	30	100	80	86	81	104	130	5	DK801	CATV
KSN	1850	1970	76.8	1280	5	5	5	50	95	95	88	86	95	125	10	DK1042	TD-SCDMA
KSN	2110	2170	10	200	5	5	2	35	100	90	67	81	108	129	10	DK801	W-CDMA
KSN	2110	2170	4.8	200	5	5	5	45	100	90	62	75	106	126	30	DK801	UMTS 2.5
KSN	2090	2190	12.8	100	5	5	1	40	105	95	68	73	104	124	5	DK801	UMTS
KSN	2027	2222	52	125	3	5	4	25	90	95	77	87	104	129	20	99-01-1251	WIMAX 2.5 GHz
KSN	2045	2310	14.4	50	5	5	6	25	100	80	50	69	94	115	15	DK801	REPEATER
SSN	2495	2690	52	250	3	5	3	30	80	95	77	88	95	123	25	99-01-1367	WIMAX 2.5 GHz
DSN	2300	2700	10	250	12.5	5	5	25	95	90	56	67	97	119	25	99-01-942	POINT TO MULTIPOINT
ZSN *	2536	2736	26	200	12	12	9.5	27	87	80	70	89	94	123	27	99-01-1336	MILITARY
SSN	2932	3132	52	250	3	5	3	20	80	80	82	88	95	118	10	99-01-1367	WIMAX 3.5 GHz
Tunable Medium Band Synthesizers (center frequency ±10% to ±30%)																	
DSN	1100	1500	10	500	12	5	5	20	115	100	61	72	98	122	5	99-01-942	POINT TO MULTIPOINT
DSN	1200	2200	20	10000	22	10	9	20	75	75	84	97	99	106	0.5	99-01-1294	CABLE TV
DSN	1690	2310	10	250	12	5	5	25	100	95	58	68	97	121	10	99-01-942	POINT TO MULTIPOINT
DSN	1788	3019	10	100	15	5	2	11	85	75	51	60	81	106	20	99-01-942	RECEIVER
DSN	2700	3500	10	1000	16	5	3.5	25	92	85	83	84	85	105	0.22	99-01-1294	VSAT
Tunable Wide Band Synthesizer (center frequency ±30% to ±50%)																	
DSN	900	2000	10	250	19	10	-2	20	100	80	80	84	80	107	3	99-01-1294	SATELLITE
Tunable Very Wide Band Synthesizer (up to 6 octave)																	
WSN	700	4000	20	10000	22	10	8	30	97	82	89	101	101	100	0.015	99-01-1368	MILITARY
Tunable Fast Settling Time Synthesizers (less than 30 micro Sec)																	
RSN	714	749	52	200	3.3	5.5	4	25	100	90	95	100	104	106	0.025	99-01-1228	GSM 850
RSN	760.6	795.4	52	200	3.3	5.5	5	25	90	65	92	102	104	105	0.025	99-01-1228	GSM 900
RSN	1543	1618	52	200	3.3	5.5	4.5	25	85	61	88	94	98	106	0.025	99-01-1228	GSM 1800
Dual Band Frequency Synthesizers																	
SSND	600 1390	600 1390	10 10	2000 2000	2.5 2.5	3 3	-10 3	24 29	85 76	91 91	89 84	96 91	95 90	122 122	- -	99-01-1373	GPS
SSND	1000 1440	1000 1440	10 10	2000 2000	2.5 2.5	3 3	-9.7 3	31 31	77 102	96 97	85 82	92 89	90 89	119 119	- -	99-01-1373	GPS

* Available with & without external reference.

See our web site for RoHS Compliance methodologies and qualifications.

RoHS compliant in accordance with EU Directive (2002/95/EC)

ACHIEVING THE HIGHEST SYNTHESIZER QUALITY

Frequency Synthesizers from Mini-Circuits *are manufactured to the industry's most demanding quality standards, with a relentless commitment to providing our customers with the highest-quality products in the industry. Achieving quality for any electronic product requires adhering to proven standards, and Mini-Circuits has qualified its manufacturing practices to three of the most recognized quality standards in the industry: ISO 9001:2000, ISO 14001:2004, and aerospace standard AS 9100B.*

But at Mini-Circuits, quality manufacturing practices alone are not enough-quality must start at the design stage. To create your custom frequency synthesizer, Mini-Circuits synthesizer design team draws upon years of engineering experience, reinforced by skillful use of the latest computer-aided-engineering (CAE) software design tools, such as the Advanced Design System (ADS) suite of simulation and analysis software from Agilent Technologies. Such software tools allow Mini-Circuits engineering team to evaluate different design approaches to find the right strategy for your requirements.

To maintain tight quality control in manufacturing, process controls meet the requirements of the above-mentioned quality standards. Components are purchased from a short list of suppliers with parts known for proven, long-term reliability and lot-to-lot performance repeatability. Once a model design is fixed, components from the specified manufacturer cannot be substituted with a different vendor. In addition, semiconductor devices must be supplied from the same wafer foundry. The goal of such attention to detail is to ensure that the performance and quality of the first synthesizer delivered to you precisely matches that of the last synthesizer you receive, with every synthesizer in your order meeting or exceeding your expectations.

Mini-Circuits takes exceptional measures to ensure the highest quality and performance levels in its frequency synthesizers. For example, components are epoxied in place on each circuit board to restrict movement during vibration, virtually eliminating microphonics and phase hits during synthesizer operation. Components are assembled to circuit boards by means of computer-controlled automated assembly systems, in order to ensure minimal manufacturing variations and consequently high unit-to-unit repeatability.

To verify quality, each production unit must pass 100% visual inspection, including x-ray analysis of solder joints of leadless chips. Electrically, each unit must also pass a rigorous series of RF tests, with 44 performance parameters typically evaluated during production testing. Mechanically, frequency synthesizers in surface-mount packages are checked for coplanarity within 4 mils (0.1 mm) to ensure our customers will have trouble-free mounting and soldering of these synthesizers in their applications. In addition, they must pass mechanical solder joint testing, shear testing, and visual inspection per IPC-A-610 criteria. Finally, they are subjected to electrostatic-discharge (ESD) sensitivity testing according to the ANSI ESD S5.1 and ANSI ESD S5.2 standards.

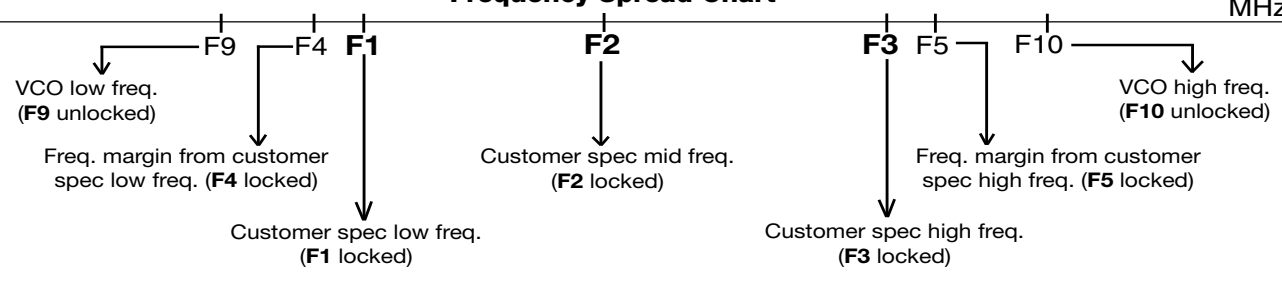
Mini-Circuits…
the industry's trusted name
for quality and reliability.

44 Synthesizer Parameters Tested In Production

Test Descriptions

1	Power Out (locked at Freq F4)
2	Power Out (locked at Freq F1)
3	VCO Current (at Freq F1)
4	PLL Current (at Freq F1)
5	Phase Noise (at Freq F1, @ 1 kHz offset)
6	Phase Noise (at Freq F1, @ 10 kHz offset)
7	Phase Noise (at Freq F1, @ 100 kHz offset)
8	F2 Harmonic Suppression (at Freq F1)
9	Comparison Spurious (at Freq F1 ± Comp Freq)
10	Comparison Spurious (at Freq F1 ± 2Comp Freq)
11	Comparison Spurious (at Freq F1 ± 5Comp Freq)
12	Reference Spurious (at Freq F1 ± Ref Freq)
13	Power Out (locked at Freq F2)
14	Comparison Spurious (at Freq F2 ± Comp Freq)
15	Comparison Spurious (at Freq F2 ± 2Comp Freq)
16	Comparison Spurious (at Freq F2 ± 5Comp Freq)
17	Reference Spurious (at Freq F2 ± Ref Freq)
18	Power Out (locked at Freq F3)
19	VCO Current (locked at Freq F3)
20	PLL Current (at Freq F3)
21	Phase Noise (at Freq F3, @ 1 kHz offset)
22	Phase Noise (at Freq F3, @ 10 kHz offset)
23	Phase Noise (at Freq F3, @ 100 kHz offset)
24	F2 Harmonic Suppression (at Freq F3)
25	Comparison Spurious (at Freq F3 ± Comp Freq)
26	Comparison Spurious (at Freq F3 ± 2Comp Freq)
27	Comparison Spurious (at Freq F3 ± 5Comp Freq)
28	Reference Spurious (at Freq F3 ± Ref Freq)
29	Power Out (locked at Freq F5)
30	LOCK Detect (PLL Lock at Freq F4)
31	LOCK Detect (PLL Lock at Freq F1)
32	LOCK Detect (PLL Lock at Freq F2)
33	LOCK Detect (PLL Lock at Freq F3)
34	LOCK Detect (PLL Lock at Freq F5)
35	LOCK Detect (PLL Unlock at Freq F9)
36	PLL Current (PLL Unlock at Freq F9)
37	LOCK Detect (PLL Unlock at Freq F10)
38	PLL Current (PLL Unlock at Freq F10)
39	Frequency Margin Minimum (PLL Lock relative to Freq F1)
40	Frequency Margin Maximum (PLL Lock relative to Freq F3)
41	Power at Minimum Frequency (Unlock at Freq F9)
42	Power at Maximum Frequency (Unlock at Freq F10)
43	Minimum Frequency (Unlock at Freq F9)
44	Maximum Frequency (Unlock at Freq F10)

Frequency Spread Chart



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To make your purchase, simply enter a Mini-Circuits model number and click on the item. Enter the quantity you want to buy. The unit price, total price, and shipping availability is shown in real time. To finalize your purchase, click on checkout and follow the instructions to have your purchase transaction completed. Most products are shipped the same or next day.

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