Frequency Synthesizer ZSN-7800A+

50Ω 7600 to 7800 MHz

CASE STYLE: KF1336

The Big Deal

- Low phase noise and spurious
- Fast settling time, 50µs Max
- Robust design and construction
- Frequency modulation capability
- Size 2.75" x 1.96" x 0.75"

Product Overview

The ZSN-7800A+ is a Frequency Synthesizer, designed to operate from 7600 to 7800 MHz suitable for a variety of military & commercial applications. The ZSN-7800A+ is packaged in a shielded metal case (size of 2.75" x 1.96" x 0.75") to shield against unwanted signals and noise.

Key Features

Feature	Advantages
Low phase noise and spurious: • Phase noise: -88 dBc/Hz typ. @ 10 kHz offset • Comparison spurious: -66 dBc typ. • Reference spurious: -86 dBc typ.	Low phase noise and spurious improve system EVM (Error Vector Magnitude).
Fast settling time	Less than 50µ sec Max, can be used for fast settling applications.
Frequency Modulation	Modulation frequency from100 Hz to 1kHz @ modulation voltage from 0.3V to 3.0V.
No reference required.	The Internal reference signal removes the need to provide a reference signal and simplifies the setup of the ZSN-7800A+

NON-CATALOG

Connectorized

Frequency Synthesizer

ZSN-7800A+

50Ω 7600 to 7800 MHz

Features

- Fast settling time, 50µs Max
- High reliability over temperature changes
- Robust design and construction
- Operating voltage (VCC =+12V)
- Case size 2.75" x 1.96" x 0.75"
- Frequency modulation capability

CASE STYLE: KF1336

Connectors	Model
SMA Female	ZSN-7800A+

+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

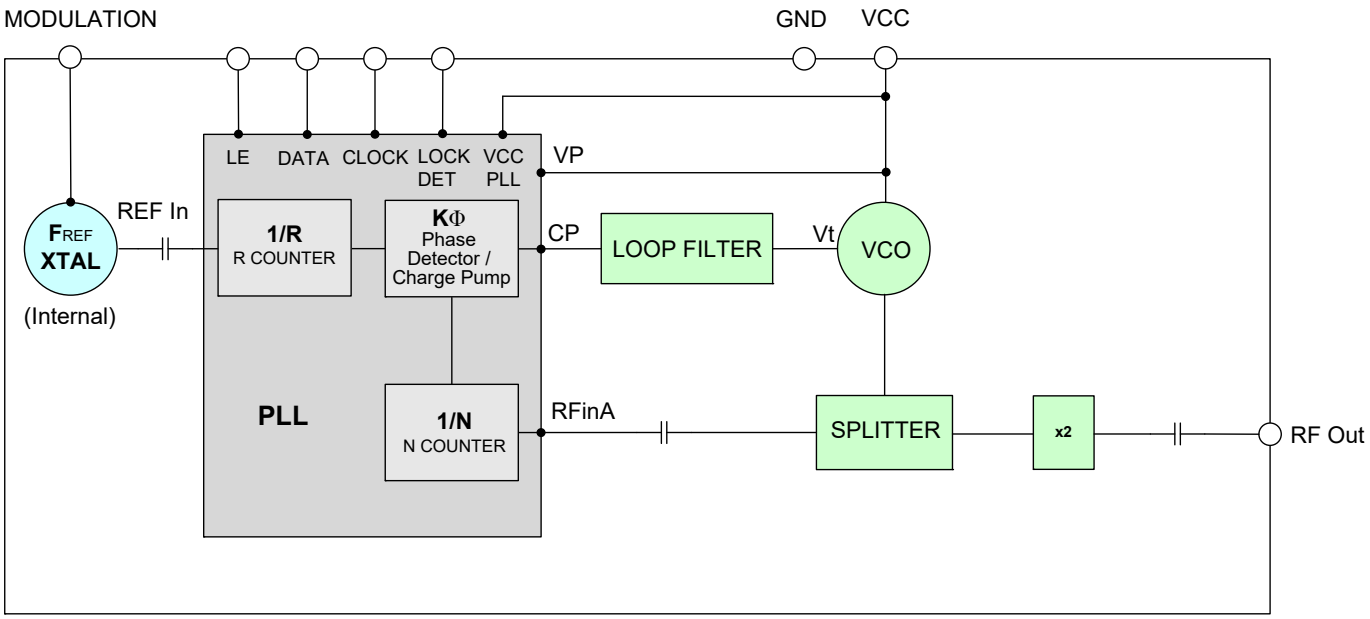
Applications

- Military

General Description

The ZSN-7800A+ is a Frequency Synthesizer, designed to operate from 7600 to 7800 MHz suitable for a variety of military & commercial applications. The ZSN-7800A+ is packaged in a shielded metal case (size of 2.75" x 1.96" x 0.75") to shield against unwanted signals and noise, with an SMA(F) RF output and all controls through a 15 pin D-Sub.

Simplified Schematic



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Electrical Specifications *(over operating temperature -40°C to +85°C)*

Parameters		Test Conditions	Min.	Typ.	Max.	Units
Frequency Range		-	7600	-	7800	MHz
Step Size		-	-	10	-	MHz
Settling Time		Within ± 1 kHz	-	0.02	0.05	mSec
Frequency Stability		-	-	±55	-	kHz
Output Power		-	+7.0	+10.0	+13.0	dBm
SSB Phase Noise		@ 100 Hz offset	-	-60	-	dBc/Hz
		@ 1 kHz offset	-	-82	-75	
		@ 10 kHz offset	-	-87	-82	
		@ 100 kHz offset	-	-83	-78	
		@ 1 MHz offset	-	-116	-111	
Integrated SSB Phase Noise		@ 100Hz to 1MHz	-	-32	-	dBc
Reference Spurious Suppression		Ref. Freq. 20 MHz	-	-86	-75	dBc
Comparison Spurious Suppression		Step Size 5 MHz	-	-66	-55	
Non - Harmonic Spurious Suppression		-	-	-90	-	
F0.5 & F1.5 & F2 Harmonic Suppression		-	-	-50	-33	dBc
F2.5 & F3 Harmonic Suppression		-	-	-27	-15	dBc
VCC Power Supply		+12.00	+11.75	+12.00	+12.25	V
VCC Supply Current		-	-	226	250	mA
Frequency Modulation (see table below)		-	-	100-1000	-	Hz
Modulation Voltage (see table below)		-	+0.3±0.05	-	+3.0±0.05	V
Reference Input (Internal)	Frequency	20 (square wave)	-	20	-	MHz
	Amplitude	1	-	1	-	V_{P-P}
	Input impedance	-	-	100	-	KΩ
	Phase Noise @ 1 kHz offset	-	-	-135	-	dBc/Hz
RF Output port Impedance		-	-	50	-	Ω
Input Logic Level	Input high voltage	-	2.60	-	-	V
	Input low voltage	-	-	-	0.60	V
Digital Lock Detect	Locked	-	2.60	-	3.25	V
	Unlocked	-	-	-	0.40	V
Frequency Synthesizer PLL		-	ADF4106			
PLL Programming		-	3-wire serial 3.12V CMOS			

Register Map NOTE 1															
	F_Register NOTES 2,3	*Prescaler Value*	*Power-Down 2*	*Current Setting 2*	*Current Setting 1*	*Timer Counter Control*	*Fastlock Mode*	*Fastlock Enable*	*CP Three-State*	*PD Polarity*	*Muxout Control*	*Power-Down 1*	*Counter Reset*	*Control Bits*	
		01	0	111	111	0000	0	0	0	1	001	0	0	10	
	N_Register @ 7800 MHz	*Reserved*	*CP Gain*	*13-Bit B Counter*						*6-Bit A Counter*				*Control Bits*	
		00	1	0000000110000						001100				01	
	R_Register	*Don't Care*	*Reserved*	*Lock Detect Precision*	*Test Mode Bits*	*Anti-Backlash Width*	*14-BIT Reference Counter, R*							*Control Bits*	
		Ø	00	1	00	00	00000000000100							00	

Note 1: Registers Load Sequence on power up: Initialization Register, R Register, N Register.
Note 2: Once the Synthesizer has been initialized Register F or Initialization register can be used interchangeably.
Note 3: For the Initialization Register use Register F with Control Bits 11.

Frequency Deviation From Carrier Vs Modulation Voltage

TYPICAL FREQUENCY DEVIATION FROM CARRIER(@7600 MHz) (Hz)	MODULATION VOLTAGE (V)
0	0
100	0.3
200	0.6
300	0.9
400	1.2
500	1.5
600	1.8
700	2.1
800	2.4
900	2.7
1000	3.0

The frequency decreases as the modulation voltage increases.

Absolute Maximum Ratings

Parameters	Ratings
Supply Voltage	13V
Data, Clock, LE Levels	-0.3Vmin, +3.3Vmax
Modulation Levels	-0.5Vmin, +4Vmax
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C

Permanent damage may occur if any of these limits are exceeded

Typical Performance Data

FREQUENCY (MHz)	POWER OUTPUT (dBm)			VCO CURRENT (mA)		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
7600	9.09	9.99	9.39	224.49	225.83	227.04
7620	9.10	10.16	9.57	224.72	226.08	227.23
7660	9.10	10.08	9.48	225.02	226.38	227.47
7700	9.10	9.21	8.68	225.13	226.55	227.53
7740	9.11	9.62	9.23	225.33	226.76	227.69
7780	9.11	8.91	8.67	225.56	226.97	227.81
7800	9.11	8.63	8.42	225.66	227.09	227.87

FREQUENCY (MHz)	HARMONICS (dBc)								
	F0.5			F1.5			F2		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
7600	-47.57	-48.84	-48.98	-41.29	-45.43	-48.63	-58.61	-70.69	-70.39
7620	-48.05	-49.11	-49.09	-42.29	-46.42	-49.31	-59.07	-70.52	-70.52
7660	-48.40	-49.87	-49.89	-41.52	-46.44	-49.77	-58.97	-70.94	-70.87
7700	-47.69	-49.09	-49.43	-41.41	-46.16	-49.21	-59.99	-70.50	-68.18
7740	-48.06	-49.47	-49.57	-40.22	-45.10	-48.24	-60.36	-71.26	-70.65
7780	-47.29	-48.91	-49.57	-40.02	-44.76	-48.02	-59.66	-69.28	-67.50
7800	-46.61	-48.45	-49.13	-39.76	-44.76	-48.20	-57.61	-69.54	-66.02

FREQUENCY (MHz)	HARMONICS (dBc)					
	F2.5			F3		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
7600	-39.16	-42.88	-46.33	-39.04	-45.87	-49.16
7620	-38.96	-42.73	-46.26	-38.02	-44.58	-48.33
7660	-39.60	-42.89	-46.03	-37.45	-44.61	-49.35
7700	-37.86	-41.64	-44.64	-35.67	-42.54	-47.98
7740	-37.46	-41.53	-44.93	-36.93	-43.86	-48.28
7780	-35.78	-39.85	-43.95	-36.79	-43.63	-49.13
7800	-36.14	-39.75	-43.52	-36.33	-43.47	-48.58

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @OFFSETS +25°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
7600	-64.55	-81.23	-86.97	-83.32	-116.79
7620	-65.14	-82.66	-86.89	-83.84	-116.77
7660	-64.58	-83.09	-87.73	-84.17	-116.62
7700	-65.83	-81.96	-87.23	-84.67	-116.30
7740	-62.76	-83.62	-88.29	-85.02	-116.11
7780	-63.47	-82.11	-88.38	-85.48	-116.36
7800	-61.23	-81.76	-89.22	-86.05	-116.57

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @OFFSETS -45°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
7600	-61.69	-83.77	-87.40	-82.58	-117.20
7620	-64.23	-81.61	-87.35	-82.80	-117.34
7660	-61.18	-83.11	-88.99	-84.03	-117.25
7700	-63.27	-83.06	-89.15	-84.60	-117.62
7740	-61.39	-82.64	-89.09	-84.94	-118.06
7780	-62.36	-81.11	-90.39	-86.71	-116.79
7800	-60.14	-82.80	-91.55	-87.96	-115.65

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @OFFSETS +85°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
7600	-56.71	-79.16	-85.95	-82.12	-116.06
7620	-57.91	-80.27	-85.89	-82.46	-115.80
7660	-58.11	-78.87	-86.16	-83.29	-114.67
7700	-58.63	-78.07	-86.79	-83.64	-114.52
7740	-57.14	-77.99	-87.40	-83.70	-115.27
7780	-58.32	-78.20	-87.08	-83.39	-116.53
7800	-57.21	-78.83	-87.47	-84.02	-116.69

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Modulation Voltage [V]	+25°C Carrier Frequency [MHz]	+25°C Frequency deviation from carrier [Hz]
0	7600.027866	0 (REF)
0.3	7600.027747	119
0.6	7600.027646	220
0.9	7600.027539	327
1.2	7600.027424	442
1.5	7600.027316	550
1.8	7600.027209	657
2.1	7600.027097	769
2.4	7600.026998	868
2.7	7600.026880	986
3.0	7600.026773	1093

Modulation Voltage [V]	-45°C Carrier Frequency [MHz]	-45°C Frequency deviation from carrier [Hz]
0	7600.035090	0 (REF)
0.3	7600.034979	111
0.6	7600.034882	208
0.9	7600.034834	256
1.2	7600.034756	334
1.5	7600.034646	444
1.8	7600.034546	544
2.1	7600.034380	710
2.4	7600.034333	757
2.7	7600.034247	843
3.0	7600.034150	940

Modulation Voltage [V]	+85°C Carrier Frequency [MHz]	+85°C Frequency deviation from carrier [Hz]
0	7600.047657	0 (REF)
0.3	7600.047462	195
0.6	7600.047376	281
0.9	7600.047290	367
1.2	7600.047210	447
1.5	7600.047139	518
1.8	7600.047051	606
2.1	7600.046964	693
2.4	7600.046879	778
2.7	7600.046797	860
3.0	7600.046666	991

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COMPARISON SPURIOUS ORDER	COMPARISON SPURIOUS @Fcarrier 7600MHz+(n*Freference) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 7700MHz+(n*Freference) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 7800MHz+(n*Freference) (dBc) note 1		
n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-102.93	-104.06	-104.07	-98.78	-114.43	-105.60	-96.64	-97.94	-99.01
-4	-86.81	-92.56	-96.73	-83.42	-86.62	-87.40	-81.02	-80.90	-80.16
-3	-90.73	-90.52	-90.43	-114.49	-102.93	-113.29	-94.93	-90.63	-89.00
-2	-81.11	-81.79	-82.39	-92.51	-93.52	-107.97	-90.45	-83.35	-80.40
-1	-66.46	-67.71	-68.67	-74.32	-79.00	-87.75	-80.10	-70.66	-66.67
0 note 2	-	-	-	-	-	-	-	-	-
+1	-66.59	-67.75	-68.50	-74.39	-78.74	-87.61	-80.19	-70.84	-66.87
+2	-81.31	-81.72	-82.51	-91.58	-93.96	-109.41	-90.37	-84.06	-80.58
+3	-91.37	-90.79	-90.62	-106.55	-105.75	-113.60	-95.52	-91.29	-89.51
+4	-85.09	-91.43	-103.77	-84.69	-89.84	-90.54	-86.83	-84.29	-82.26
+5	-100.27	-101.81	-105.90	-97.12	-108.88	-104.96	-97.67	-98.78	-100.29

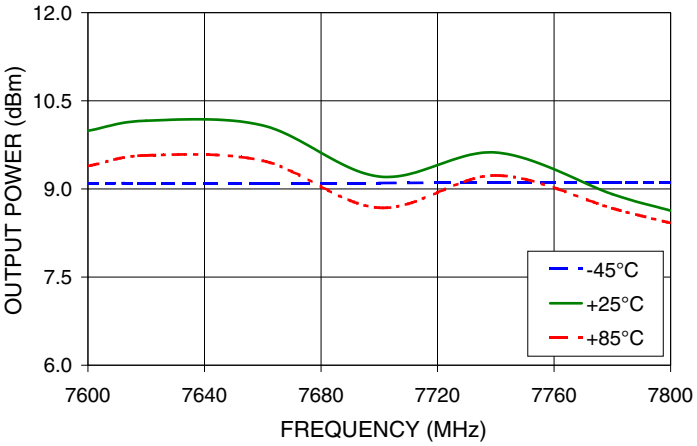
Note 1: Comparison frequency 5 MHz
Note 2: All spurs are referenced to carrier signal (n=0).

REFERENCE SPURIOUS ORDER	REFERENCE SPURIOUS @Fcarrier 7600MHz+(n*Fcomparison) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 7700MHz+(n*Fcomparison) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 7800MHz+(n*Fcomparison) (dBc) note 3		
n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-95.19	-100.81	-106.25	-100.00	-104.02	-119.60	-98.54	-104.17	-106.51
-4	-93.59	-97.75	-104.76	-97.69	-101.64	-104.47	-96.57	-98.41	-100.04
-3	-96.48	-102.75	-103.27	-92.11	-100.83	-96.16	-91.42	-91.48	-92.78
-2	-93.61	-94.80	-95.41	-88.83	-92.80	-90.04	-87.11	-87.89	-88.07
-1	-86.08	-92.03	-97.73	-82.79	-86.52	-86.22	-80.94	-81.02	-80.22
0 note 4	-	-	-	-	-	-	-	-	-
+1	-84.63	-91.13	-104.00	-83.77	-89.56	-88.61	-86.64	-84.27	-82.34
+2	-92.75	-94.96	-96.18	-89.25	-93.43	-90.52	-88.44	-88.58	-88.76
+3	-95.19	-101.92	-102.67	-95.16	-102.24	-97.00	-93.55	-91.76	-93.19
+4	-93.19	-97.12	-100.33	-93.14	-98.53	-99.15	-89.82	-93.27	-96.78
+5	-95.80	-101.26	-112.82	-96.41	-104.28	-109.13	-93.62	-100.43	-108.30

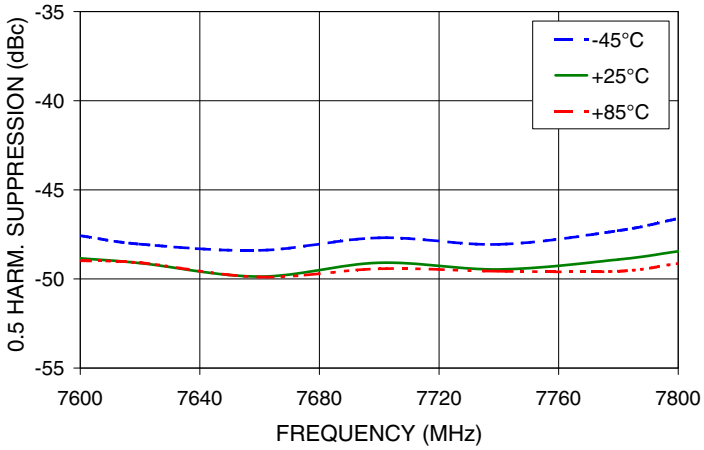
Note 3: Reference frequency 20 MHz
Note 4: All spurs are referenced to carrier signal (n=0).

Typical Performance Curves

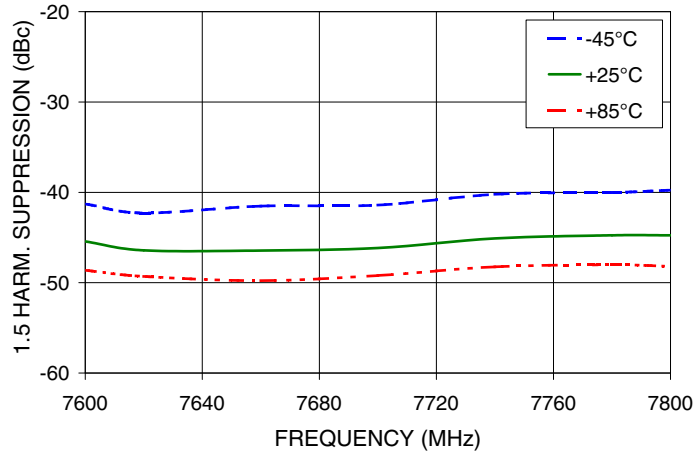
OUTPUT POWER Vs FREQUENCY



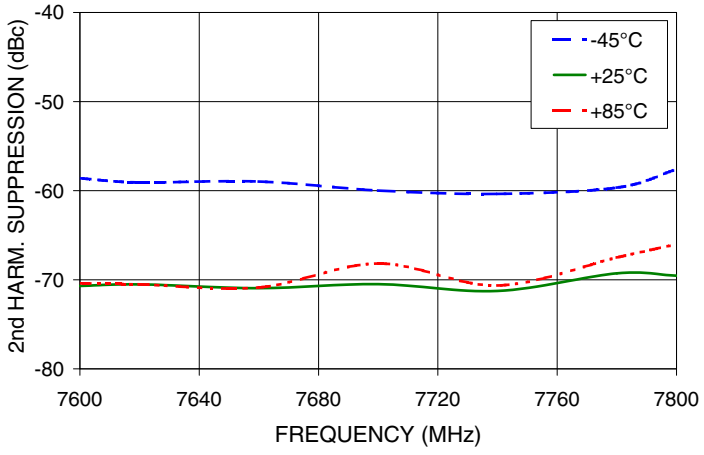
0.5 HARMONIC Vs FREQUENCY



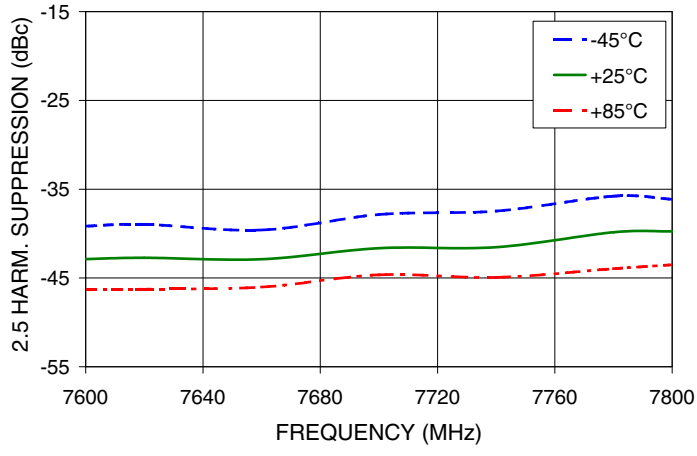
1.5 HARMONIC Vs FREQUENCY



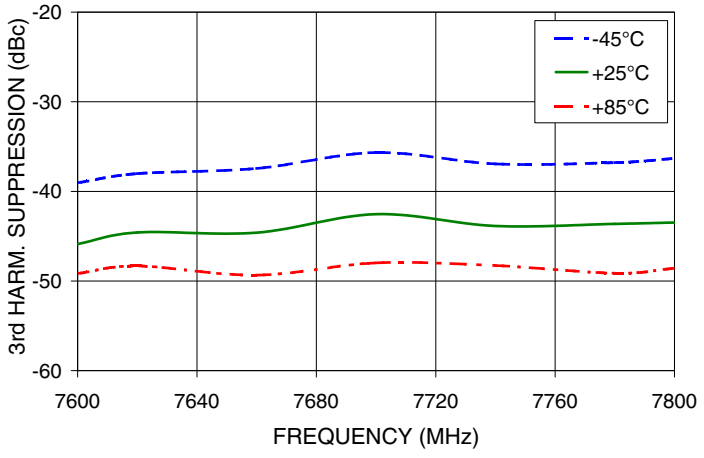
2nd HARMONIC Vs FREQUENCY



2.5 HARMONIC Vs FREQUENCY



3rd HARMONIC Vs FREQUENCY



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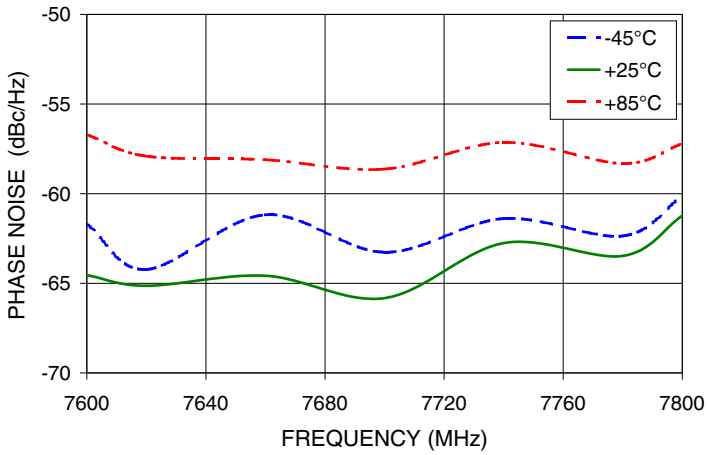
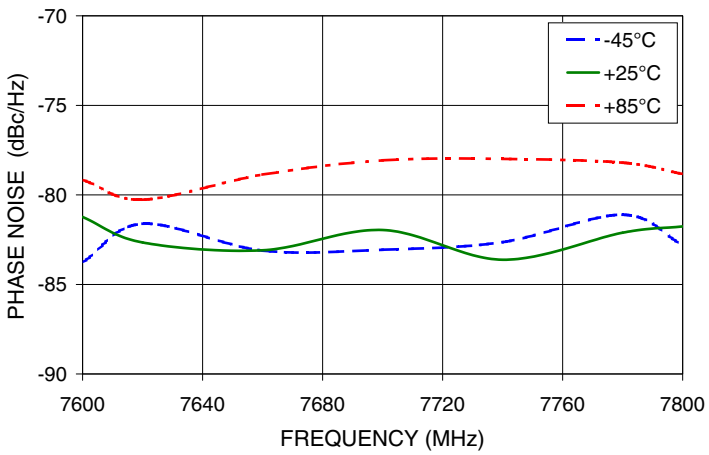
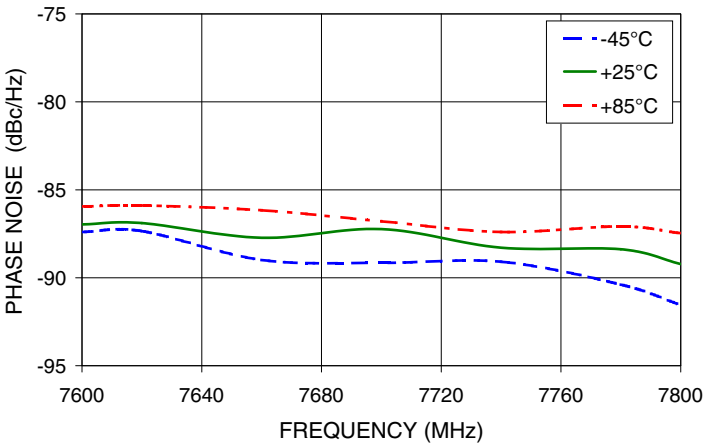
PHASE NOISE @100Hz offset



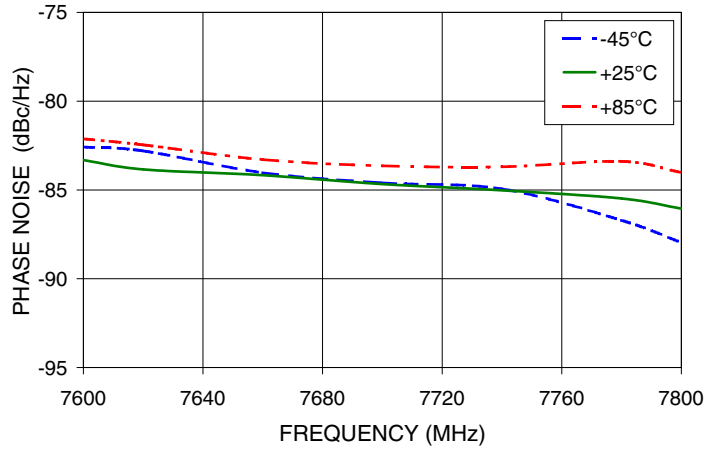
PHASE NOISE @1kHz offset



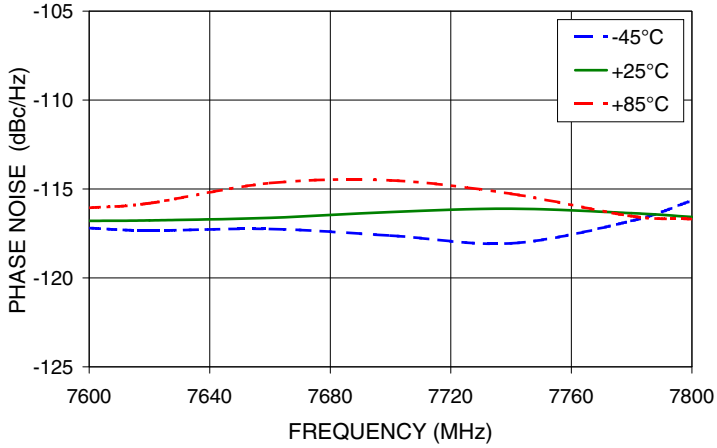
PHASE NOISE @10 kHz offset



PHASE NOISE @100 kHz offset



PHASE NOISE @1MHz offset



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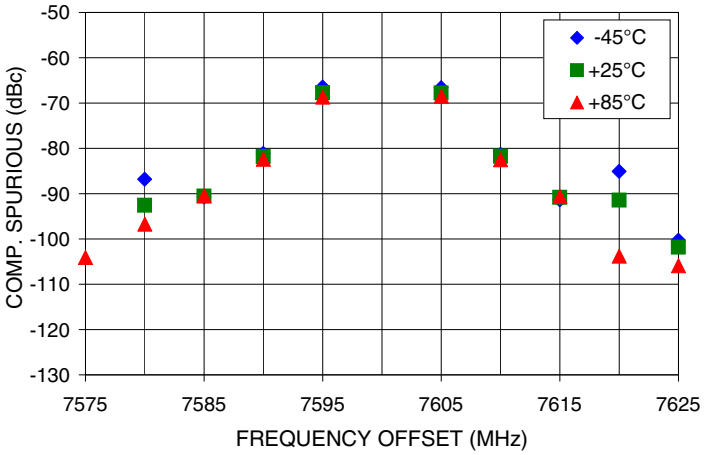
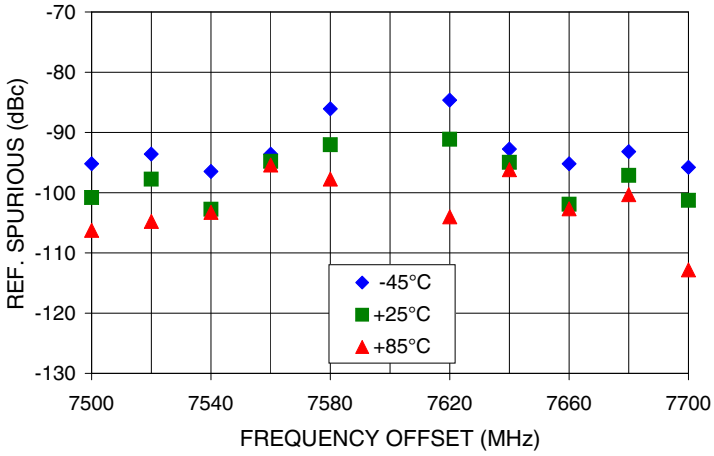
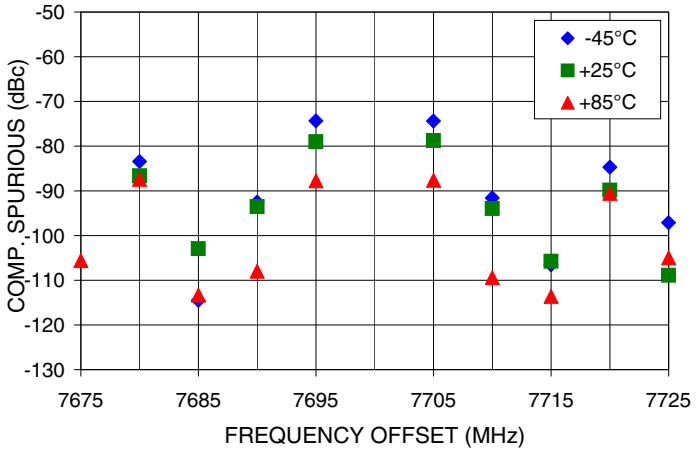
COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7600MHz



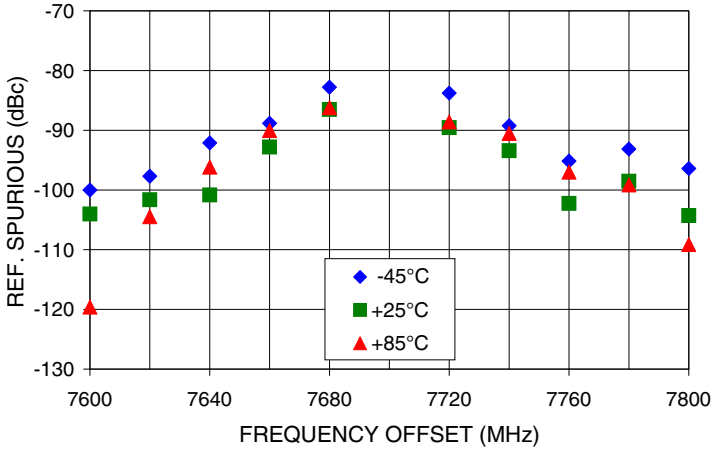
REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7600MHz



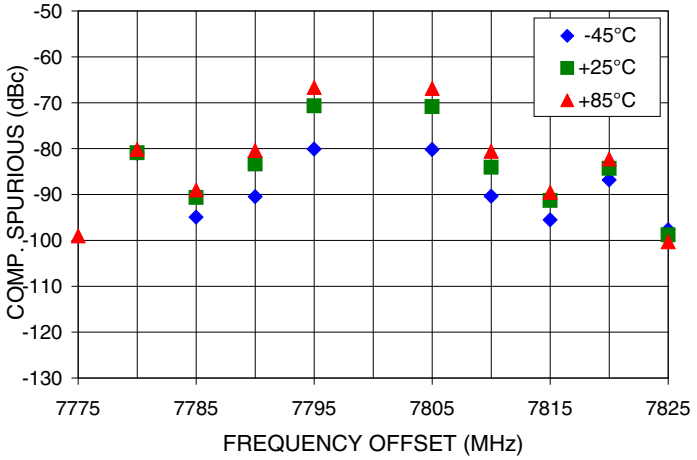
COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7700MHz



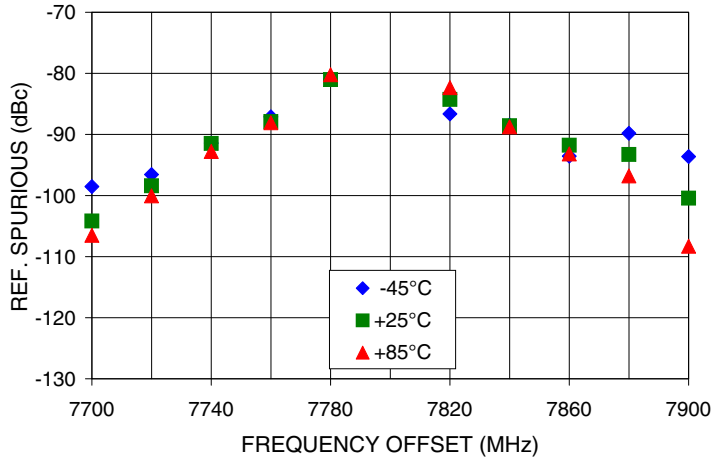
REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7700MHz



COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7800MHz

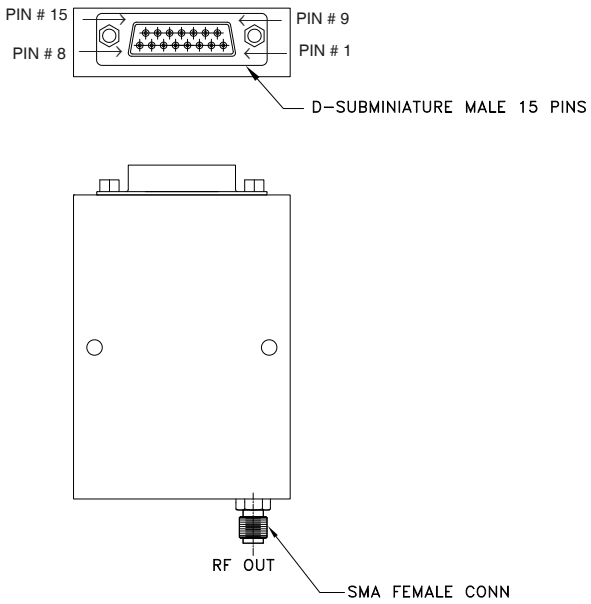


REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 7800MHz



Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

Connectors Configuration



D-SUBMINIATURE MALE 15 PINS Connection

Pin Number	Function
1	GND
2	MODULATION
3	GND
4	LOCK DET
5	LE
6	DATA
7	CLOCK
8	VCC
9	GND
10	GND
11	GND
12	GND
13	GND
14	GND
15	GND

Additional Detailed Technical Information

Additional information is available on our web site. To access this information enter the model number on our web site home page.

Case Style: KF1336

Tape & Reel: N.A.

Suggested Layout for PCB Design: N.A.

Evaluation Board: N.A.

Environment Ratings: ENV48T3

Synthesizer evaluation software to set PLL registers manually is available at http://www.minicircuits.com/support/software_download.html