MMIC DIE

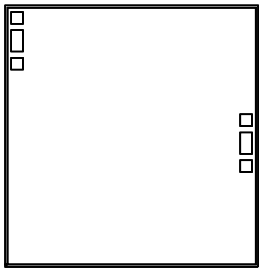
X3 Frequency Multiplier

CY3-64-D+

50Ω Output 30 to 60 GHz

THE BIG DEAL

- Wideband Output from: 30 to 60 GHz
- Outstanding Fundamental and Close-in Harmonic Suppression:
  - F1: +30 dBc Typ.
  - F2: +33 dBc Typ.
  - F4: +42 dBc Typ.
- Input Drive Level: +12 to +19 dBm
- Conversion Loss: 21 dB Typ.



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

SEE ORDERING INFORMATION ON THE LAST PAGE

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

Mini-Circuits' CY3-64-D+ is a wideband MMIC Frequency Tripler, converting input frequencies from 10 to 20 GHz into output frequencies from 30 to 60 GHz. Its wide output range makes this model suitable for broadband systems as well as a wide variety of narrow-band applications. The CY3-64-D+ die utilizes GaAs HBT technology and is suitable for chip and wire assemblies.

KEY FEATURES

Feature	Advantages
Broadband, 30 to 60 GHz output	With an output frequency range spanning 30 to 60 GHz, this multiplier supports broadband applications such as defense and instrumentation as well as a wide range of narrowband system requirements including 5G.
Excellent fundamental and harmonic suppression: • F1, +30 dBc Typ. • F2, +33 dBc Typ. • F4, +42 dBc Typ.	Harmonic and fundamental filtering requirements are dramatically simplified due to the high suppression resulting from internal cancellation within the diode configuration.
Wide input power range +12 to +19 dBm	Wide input power signal range accommodates different input signal levels while still maintain a low conversion loss
Unpackaged Die	Enable user to integrate it directly into hybrids chip and wire assemblies

REV. A
ECO-018288
CY3-64-D+
MCL NY
230711

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ELECTRICAL SPECIFICATIONS[1] AT +25°C AND Zo = 50Ω, UNLESS NOTED OTHERWISE

Parameter		Condition (GHz)	Min.	Typ.	Max.	Unit
Multiplication Factor				3		
Frequency Range, Input (F1)			10		20	GHz
Frequency Range, Output (F3)			30	-	60	GHz
Input Power[4]			+12	+18	+19	dBm
Conversion Loss (F3)[3]		10-12		20.0		dB
		12-14		19.3		
		14-16		20.7		
		16-18		22.2		
		18-20		23.8		
Harmonic Output[2,3]	F1	10-12		37		dBc
		12-14		34		
		14-16		30		
		16-18		26		
		18-20		22		
	F2	10-12		49		dBc
		12-14		35		
		14-16		33		
		16-18		28		
		18-20		22		
	F4	10-12		44		dBc
		12-14		47		
		14-16		42		
		16-18		35		
		18-20		43		

1. Electrical specifications are measured by attaching the die on Mini-Circuits Die Characterization Test Board. Trace and connector losses are de-embedded. Specifications Include the effect of bond wires.
2. Harmonics of input frequency below the power of F3.
3. F1=Input Frequency, F2=Second Harmonic, F3=Fundamental Output, F4=Fourth Harmonic
4. All specifications are measured with RF input power = +18 dBm.

MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	+20°C to +35°C
RF Input Power	+22 dBm

5. Permanent damage may occur if any of these limits are exceeded.

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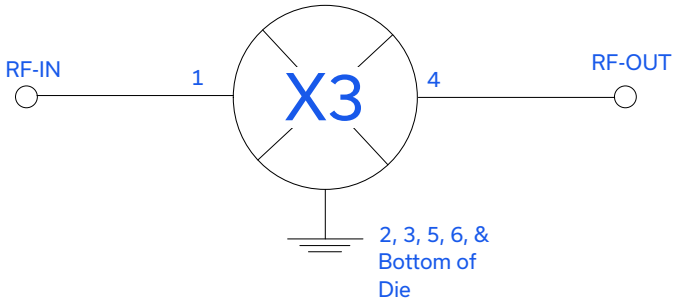
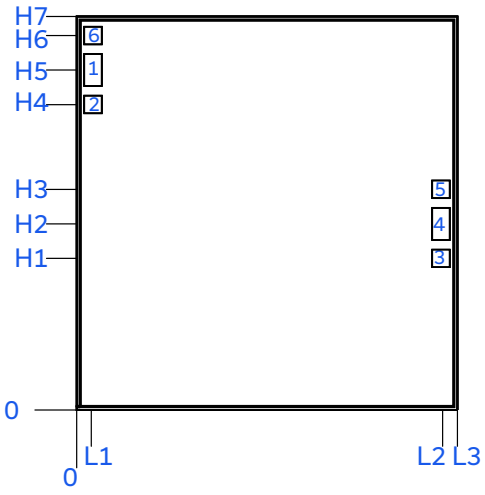
SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION

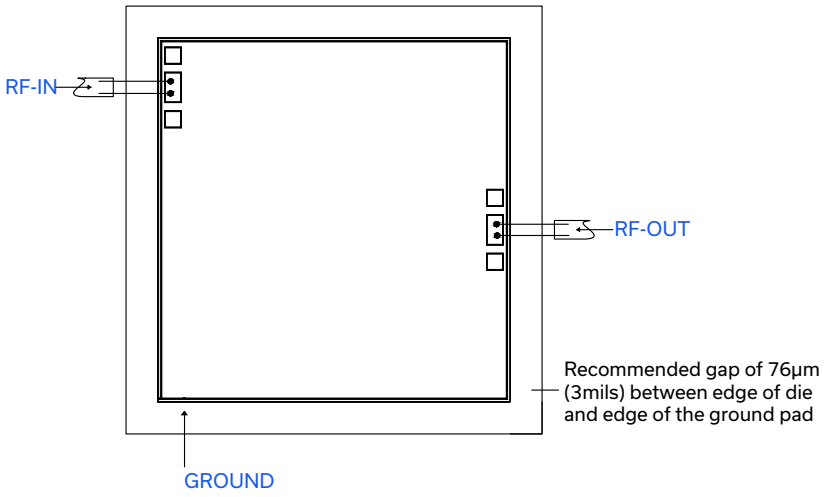


Function	Pad Number	Description
RF-IN	1	RF-Input pad
RF-OUT	4	RF-Output pad
Ground	2, 3, 5 & 6	The bond pads are connected to back-side through vias and do not require wire-bond connections to ground.

DIE DIMENSIONS



ASSEMBLY DIAGRAM



Note: bond wires should be as short as possible

DIMENSIONS µm, TYPICAL

L1	L2	L3	H1	H2	H3	H4	H5	H6	H7
81.0	2019.0	2100.0	836.0	1026.0	1217.0	1684.0	1875.0	2066.0	2170.0

Thickness	Die Size	Pad Size 1 & 4	Pad Size 2, 3, 5 & 6
100	2100 x 2170	92 x 172	92 x 92

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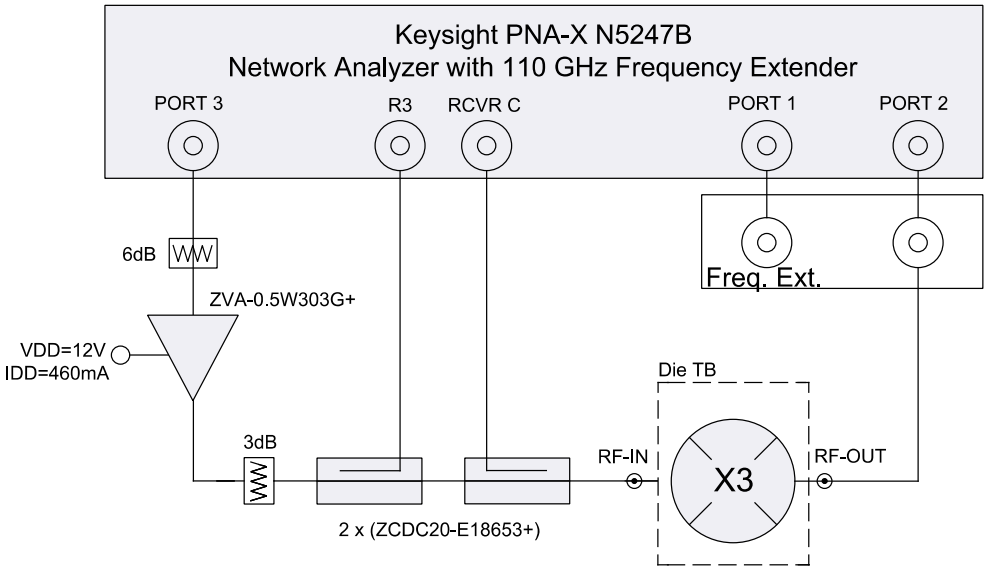
CHARACTERIZATION CIRCUIT



6 dB attenuator P/N BW-E6-1W653+
3 dB attenuator P/N BW-E3-1W653+

Note: DUT attached on a Mini-Circuits Die Characterization Test Board. Conversion Loss and Harmonic Output are measured using PNA-X Network Analyzer.

Test Condition: For CL and Harmonic Rejection: RF input power: +12 to +19dBm.

ASSEMBLY PROCEDURE

1. Storage
   Die should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC HBT Multiplier die are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
3. Die Handling and Attachment
   Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition.
4. Wire Bonding
   Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the die gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wire length and bond wire height should be kept as short as possible unless specified by the Assembly Drawing to minimize performance degradation due to undesirable series inductance

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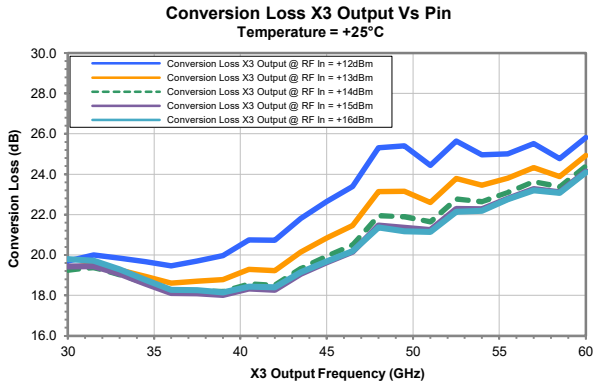
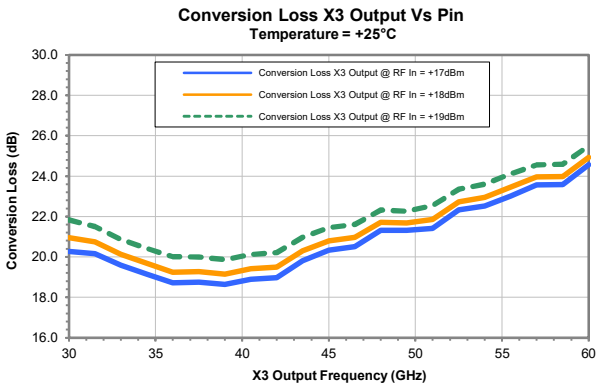
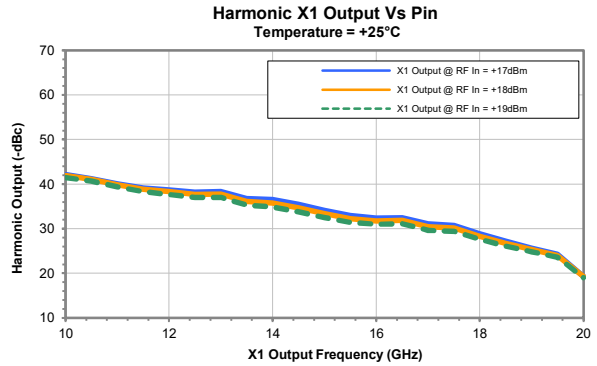
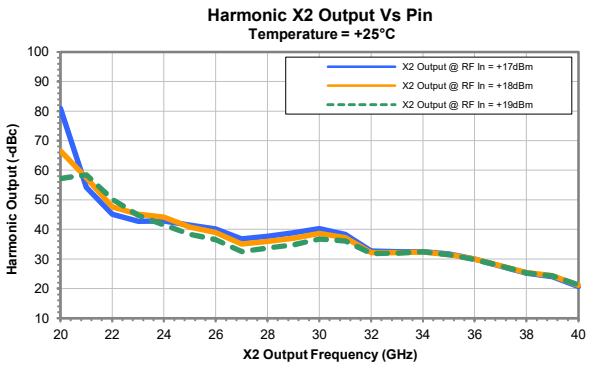
TYPICAL PERFORMANCE CURVES

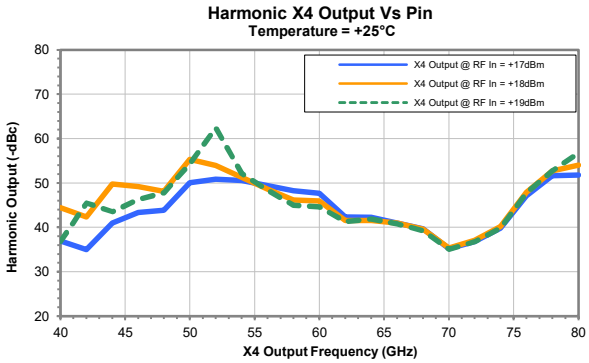
Note: Harmonics data is presented as the harmonic of input frequency below the power of F3











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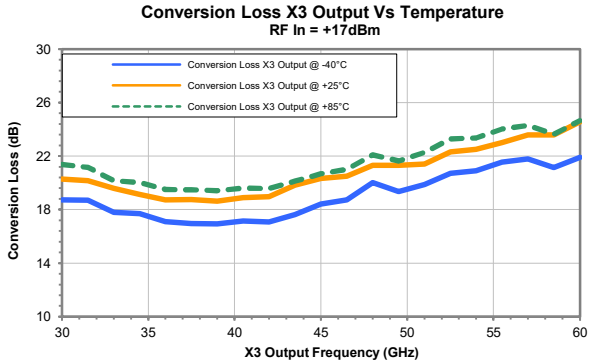
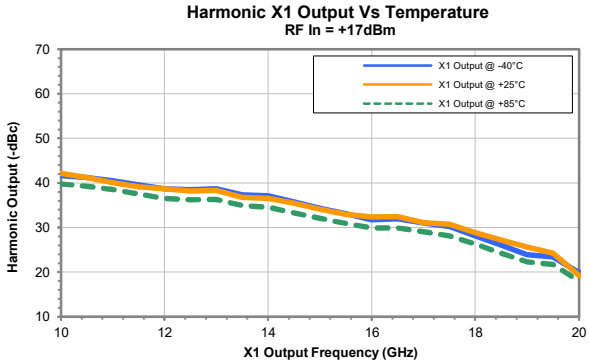
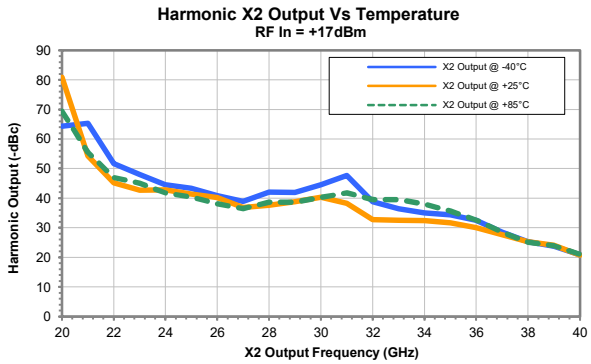
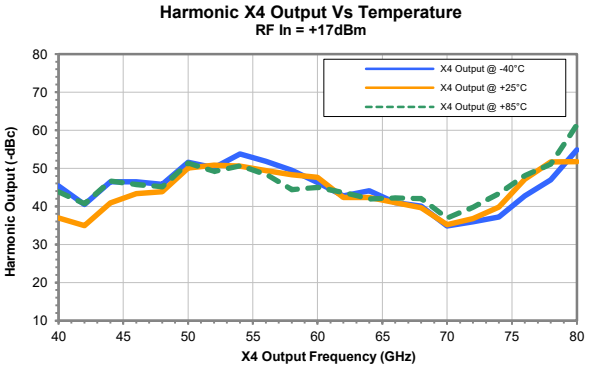
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3









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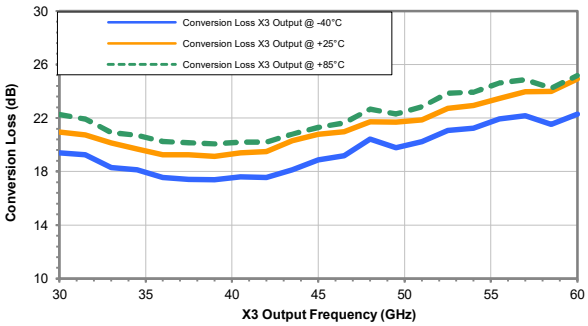
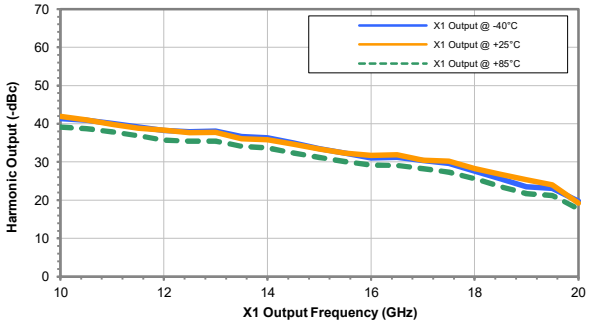
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

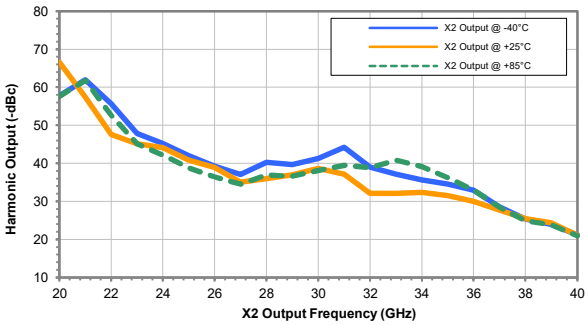
Conversion Loss X3 Output Vs Temperature
RF In = +18dBm



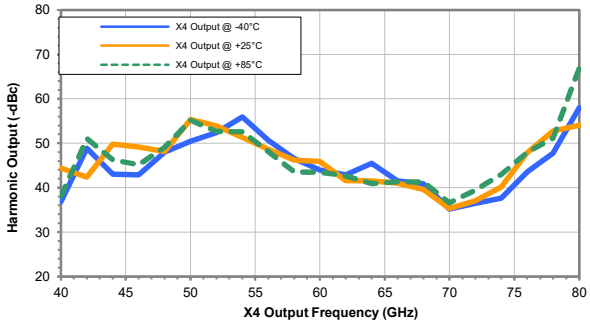
Harmonic X1 Output Vs Temperature
RF In = +18dBm



Harmonic X2 Output Vs Temperature
RF In = +18dBm



Harmonic X4 Output Vs Temperature
RF In = +18dBm



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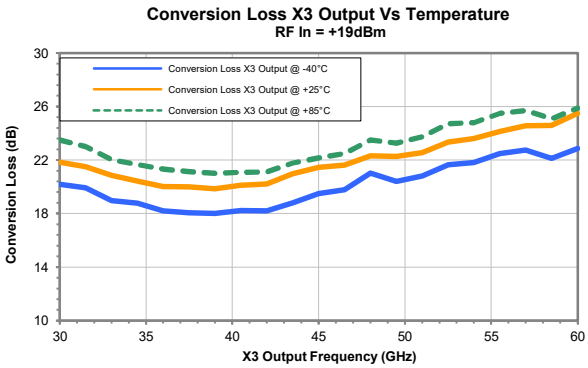
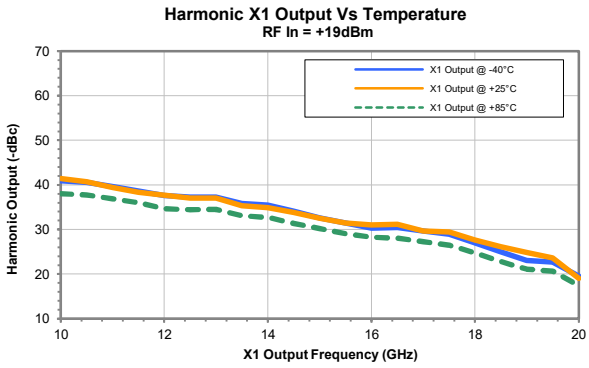
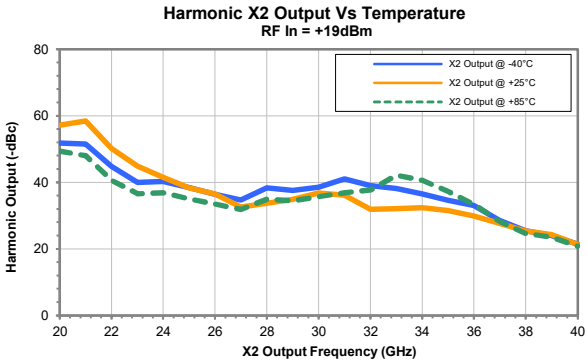
50Ω Output 30 to 60 GHz

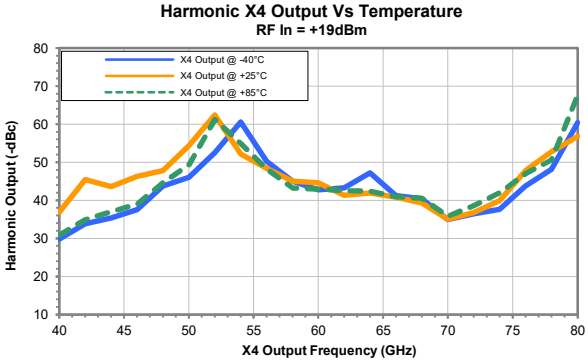
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3









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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table Swept Graphs	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package Gel – Pak: 5, 10, 50, 100 Medium†, Partial wafer: <506 Full Wafer† †Available upon request contact sales representative Refer to AN-60-067	Model No. CY3-64-DG+ CY3-64-DP+ CY3-64-DF+
Die Marking	EL-MUL-7	
Environmental Ratings	ENV80	

NOTES

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Frequency Multiplier CY3-64-D+

Typical Performance Data

TEST CONDITION: RF In = +17dBm

Frequency (GHz)				Temperature = -40°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	18.7	41.7	64.4	45.4
10.5	21.0	31.5	42.0	18.7	41.2	65.4	40.4
11.0	22.0	33.0	44.0	17.8	40.5	51.7	46.4
11.5	23.0	34.5	46.0	17.7	39.5	48.0	46.5
12.0	24.0	36.0	48.0	17.1	38.7	44.5	45.8
12.5	25.0	37.5	50.0	16.9	38.5	43.4	51.5
13.0	26.0	39.0	52.0	16.9	38.7	40.8	50.1
13.5	27.0	40.5	54.0	17.2	37.3	38.9	53.7
14.0	28.0	42.0	56.0	17.1	37.1	42.1	51.8
14.5	29.0	43.5	58.0	17.6	35.8	41.9	49.4
15.0	30.0	45.0	60.0	18.4	34.3	44.5	46.2
15.5	31.0	46.5	62.0	18.7	33.1	47.7	42.7
16.0	32.0	48.0	64.0	20.0	31.7	38.8	44.1
16.5	33.0	49.5	66.0	19.3	31.9	36.5	41.0
17.0	34.0	51.0	68.0	19.9	31.0	35.0	40.1
17.5	35.0	52.5	70.0	20.7	30.2	34.4	34.9
18.0	36.0	54.0	72.0	20.9	28.1	32.6	36.0
18.5	37.0	55.5	74.0	21.5	26.1	28.5	37.2
19.0	38.0	57.0	76.0	21.8	23.9	25.3	42.7
19.5	39.0	58.5	78.0	21.1	23.4	23.8	46.9
20.0	40.0	60.0	80.0	21.9	19.9	20.9	54.9

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +25°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	20.3	42.2	80.9	37.0
10.5	21.0	31.5	42.0	20.2	41.2	54.3	35.0
11.0	22.0	33.0	44.0	19.6	40.0	45.2	40.9
11.5	23.0	34.5	46.0	19.1	39.2	42.7	43.3
12.0	24.0	36.0	48.0	18.7	38.7	42.8	43.9
12.5	25.0	37.5	50.0	18.7	38.2	41.4	50.1
13.0	26.0	39.0	52.0	18.6	38.3	40.2	50.8
13.5	27.0	40.5	54.0	18.9	36.8	36.8	50.5
14.0	28.0	42.0	56.0	19.0	36.5	37.6	49.4
14.5	29.0	43.5	58.0	19.8	35.4	38.8	48.3
15.0	30.0	45.0	60.0	20.3	34.1	40.3	47.7
15.5	31.0	46.5	62.0	20.5	33.0	38.3	42.3
16.0	32.0	48.0	64.0	21.3	32.4	32.7	42.3
16.5	33.0	49.5	66.0	21.3	32.4	32.5	41.0
17.0	34.0	51.0	68.0	21.4	31.1	32.4	39.6
17.5	35.0	52.5	70.0	22.3	30.7	31.7	35.2
18.0	36.0	54.0	72.0	22.5	28.8	30.0	36.8
18.5	37.0	55.5	74.0	23.0	27.2	27.7	39.8
19.0	38.0	57.0	76.0	23.6	25.7	25.2	47.1
19.5	39.0	58.5	78.0	23.6	24.2	24.1	51.7
20.0	40.0	60.0	80.0	24.6	19.3	20.8	51.8

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +85°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	21.4	39.8	69.4	43.9
10.5	21.0	31.5	42.0	21.2	39.3	55.5	40.7
11.0	22.0	33.0	44.0	20.2	38.6	47.1	46.7
11.5	23.0	34.5	46.0	20.0	37.6	45.0	45.8
12.0	24.0	36.0	48.0	19.5	36.5	41.8	45.1
12.5	25.0	37.5	50.0	19.5	36.2	40.4	51.4
13.0	26.0	39.0	52.0	19.4	36.3	38.2	49.2
13.5	27.0	40.5	54.0	19.6	34.9	36.5	50.6
14.0	28.0	42.0	56.0	19.6	34.6	38.7	48.5
14.5	29.0	43.5	58.0	20.1	33.3	38.7	44.4
15.0	30.0	45.0	60.0	20.7	32.1	40.3	45.0
15.5	31.0	46.5	62.0	21.0	30.9	41.8	43.7
16.0	32.0	48.0	64.0	22.1	30.0	39.5	42.0
16.5	33.0	49.5	66.0	21.6	29.9	39.6	42.2
17.0	34.0	51.0	68.0	22.3	29.0	38.1	42.1
17.5	35.0	52.5	70.0	23.3	28.1	35.7	37.0
18.0	36.0	54.0	72.0	23.4	26.3	32.6	39.8
18.5	37.0	55.5	74.0	24.0	24.2	28.5	43.4
19.0	38.0	57.0	76.0	24.3	22.4	25.2	48.1
19.5	39.0	58.5	78.0	23.7	21.8	24.0	51.1
20.0	40.0	60.0	80.0	24.7	18.0	21.1	61.4

* Harmonic Output below power level of X3 Output

Typical Performance Data

TEST CONDITION: RF In = +18dBm

Frequency (GHz)				Temperature = -40°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	19.4	41.4	57.7	36.8
10.5	21.0	31.5	42.0	19.2	41.0	62.0	48.8
11.0	22.0	33.0	44.0	18.3	40.1	55.6	43.0
11.5	23.0	34.5	46.0	18.1	39.2	47.8	42.9
12.0	24.0	36.0	48.0	17.6	38.2	45.3	48.0
12.5	25.0	37.5	50.0	17.4	37.9	42.0	50.5
13.0	26.0	39.0	52.0	17.4	38.0	39.2	52.4
13.5	27.0	40.5	54.0	17.6	36.6	37.0	56.0
14.0	28.0	42.0	56.0	17.6	36.3	40.3	50.6
14.5	29.0	43.5	58.0	18.1	34.9	39.7	46.6
15.0	30.0	45.0	60.0	18.9	33.5	41.3	43.9
15.5	31.0	46.5	62.0	19.2	32.3	44.2	42.9
16.0	32.0	48.0	64.0	20.4	31.0	39.0	45.5
16.5	33.0	49.5	66.0	19.8	31.2	37.1	41.5
17.0	34.0	51.0	68.0	20.2	30.4	35.6	40.9
17.5	35.0	52.5	70.0	21.1	29.6	34.5	35.2
18.0	36.0	54.0	72.0	21.2	27.6	32.9	36.4
18.5	37.0	55.5	74.0	21.9	25.6	28.6	37.6
19.0	38.0	57.0	76.0	22.2	23.5	25.4	43.5
19.5	39.0	58.5	78.0	21.5	23.1	23.9	47.8
20.0	40.0	60.0	80.0	22.3	19.8	21.2	58.1

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +25°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	21.0	41.9	66.6	44.4
10.5	21.0	31.5	42.0	20.7	41.0	57.4	42.4
11.0	22.0	33.0	44.0	20.1	39.8	47.6	49.8
11.5	23.0	34.5	46.0	19.7	38.8	45.2	49.2
12.0	24.0	36.0	48.0	19.2	38.3	44.1	48.1
12.5	25.0	37.5	50.0	19.3	37.7	40.8	55.4
13.0	26.0	39.0	52.0	19.1	37.8	38.9	53.9
13.5	27.0	40.5	54.0	19.4	36.1	35.0	51.3
14.0	28.0	42.0	56.0	19.5	35.8	36.0	48.6
14.5	29.0	43.5	58.0	20.3	34.7	37.0	46.2
15.0	30.0	45.0	60.0	20.8	33.4	38.6	45.9
15.5	31.0	46.5	62.0	21.0	32.3	37.2	41.6
16.0	32.0	48.0	64.0	21.7	31.7	32.1	41.5
16.5	33.0	49.5	66.0	21.7	31.8	32.1	41.0
17.0	34.0	51.0	68.0	21.9	30.5	32.3	39.6
17.5	35.0	52.5	70.0	22.7	30.2	31.5	35.4
18.0	36.0	54.0	72.0	22.9	28.3	30.0	37.1
18.5	37.0	55.5	74.0	23.5	26.7	27.8	40.1
19.0	38.0	57.0	76.0	24.0	25.3	25.4	47.9
19.5	39.0	58.5	78.0	24.0	24.0	24.3	52.7
20.0	40.0	60.0	80.0	24.9	19.2	21.2	54.0

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +85°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	22.3	39.1	57.7	38.1
10.5	21.0	31.5	42.0	21.9	38.7	61.8	51.1
11.0	22.0	33.0	44.0	20.9	37.9	52.6	46.2
11.5	23.0	34.5	46.0	20.7	36.9	45.1	45.2
12.0	24.0	36.0	48.0	20.3	35.7	42.2	49.1
12.5	25.0	37.5	50.0	20.2	35.5	38.9	55.2
13.0	26.0	39.0	52.0	20.1	35.5	36.5	52.7
13.5	27.0	40.5	54.0	20.2	34.1	34.5	52.6
14.0	28.0	42.0	56.0	20.2	33.7	37.0	48.2
14.5	29.0	43.5	58.0	20.8	32.4	36.7	43.5
15.0	30.0	45.0	60.0	21.3	31.2	38.2	43.5
15.5	31.0	46.5	62.0	21.6	30.1	39.5	42.6
16.0	32.0	48.0	64.0	22.7	29.2	38.9	40.9
16.5	33.0	49.5	66.0	22.3	29.1	40.9	41.4
17.0	34.0	51.0	68.0	22.9	28.3	39.2	41.3
17.5	35.0	52.5	70.0	23.9	27.4	36.3	36.6
18.0	36.0	54.0	72.0	23.9	25.6	33.0	39.5
18.5	37.0	55.5	74.0	24.6	23.6	28.4	43.0
19.0	38.0	57.0	76.0	24.9	21.8	24.9	48.0
19.5	39.0	58.5	78.0	24.3	21.3	23.9	51.3
20.0	40.0	60.0	80.0	25.2	17.8	21.0	67.0

* Harmonic Output below power level of X3 Output

Typical Performance Data

TEST CONDITION: RF In = +19dBm

Frequency (GHz)				Temperature = -40°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	20.2	40.9	51.9	29.9
10.5	21.0	31.5	42.0	19.9	40.6	51.5	33.8
11.0	22.0	33.0	44.0	19.0	39.6	44.8	35.3
11.5	23.0	34.5	46.0	18.8	38.7	40.0	37.5
12.0	24.0	36.0	48.0	18.2	37.6	40.3	43.8
12.5	25.0	37.5	50.0	18.1	37.2	38.4	46.0
13.0	26.0	39.0	52.0	18.0	37.3	36.4	52.5
13.5	27.0	40.5	54.0	18.2	35.8	34.7	60.6
14.0	28.0	42.0	56.0	18.2	35.5	38.3	50.2
14.5	29.0	43.5	58.0	18.8	34.1	37.6	45.0
15.0	30.0	45.0	60.0	19.5	32.6	38.5	42.8
15.5	31.0	46.5	62.0	19.8	31.4	41.0	43.2
16.0	32.0	48.0	64.0	21.0	30.3	39.0	47.2
16.5	33.0	49.5	66.0	20.4	30.4	38.2	41.3
17.0	34.0	51.0	68.0	20.8	29.6	36.5	40.4
17.5	35.0	52.5	70.0	21.6	29.0	34.5	34.9
18.0	36.0	54.0	72.0	21.8	27.0	33.1	36.4
18.5	37.0	55.5	74.0	22.5	25.0	28.5	37.6
19.0	38.0	57.0	76.0	22.7	23.0	25.5	43.7
19.5	39.0	58.5	78.0	22.1	22.7	24.0	48.1
20.0	40.0	60.0	80.0	22.9	19.6	21.4	60.4

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +25°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	21.8	41.5	57.2	36.8
10.5	21.0	31.5	42.0	21.5	40.7	58.5	45.5
11.0	22.0	33.0	44.0	20.9	39.4	50.2	43.6
11.5	23.0	34.5	46.0	20.4	38.3	44.8	46.3
12.0	24.0	36.0	48.0	20.0	37.7	41.5	47.8
12.5	25.0	37.5	50.0	20.0	37.0	38.4	54.4
13.0	26.0	39.0	52.0	19.9	37.0	36.5	62.4
13.5	27.0	40.5	54.0	20.1	35.3	32.6	52.2
14.0	28.0	42.0	56.0	20.2	34.9	33.7	48.4
14.5	29.0	43.5	58.0	21.0	33.8	34.9	45.0
15.0	30.0	45.0	60.0	21.5	32.5	36.8	44.6
15.5	31.0	46.5	62.0	21.6	31.4	36.1	41.3
16.0	32.0	48.0	64.0	22.3	31.0	31.9	41.9
16.5	33.0	49.5	66.0	22.3	31.1	32.0	40.8
17.0	34.0	51.0	68.0	22.6	29.7	32.4	39.3
17.5	35.0	52.5	70.0	23.4	29.5	31.5	35.1
18.0	36.0	54.0	72.0	23.6	27.6	29.9	36.8
18.5	37.0	55.5	74.0	24.1	26.1	27.7	39.9
19.0	38.0	57.0	76.0	24.6	24.8	25.4	47.8
19.5	39.0	58.5	78.0	24.6	23.6	24.3	52.8
20.0	40.0	60.0	80.0	25.5	19.1	21.3	56.8

* Harmonic Output below power level of X3 Output

Frequency (GHz)				Temperature = +85°C			
				Conversion Loss	Harmonic Output*		
X1 Output	X2 Output	X3 Output	X4 Output	X3 Output	X1 Output	X2 Output	X4 Output
10.0	20.0	30.0	40.0	23.5	38.1	49.4	30.9
10.5	21.0	31.5	42.0	23.0	37.8	48.1	34.9
11.0	22.0	33.0	44.0	22.0	36.9	40.7	37.0
11.5	23.0	34.5	46.0	21.7	36.0	36.6	39.0
12.0	24.0	36.0	48.0	21.3	34.7	36.8	44.6
12.5	25.0	37.5	50.0	21.2	34.4	35.0	49.4
13.0	26.0	39.0	52.0	21.0	34.5	33.5	61.2
13.5	27.0	40.5	54.0	21.1	33.1	31.9	55.0
14.0	28.0	42.0	56.0	21.1	32.7	35.0	48.2
14.5	29.0	43.5	58.0	21.8	31.3	34.5	43.2
15.0	30.0	45.0	60.0	22.2	30.2	35.7	43.0
15.5	31.0	46.5	62.0	22.5	29.1	36.9	42.6
16.0	32.0	48.0	64.0	23.5	28.3	37.7	42.4
16.5	33.0	49.5	66.0	23.3	28.1	42.2	41.0
17.0	34.0	51.0	68.0	23.8	27.3	40.7	40.6
17.5	35.0	52.5	70.0	24.7	26.5	37.3	35.8
18.0	36.0	54.0	72.0	24.8	24.8	33.4	38.6
18.5	37.0	55.5	74.0	25.5	22.8	28.3	42.0
19.0	38.0	57.0	76.0	25.7	21.1	24.6	47.0
19.5	39.0	58.5	78.0	25.1	20.7	23.5	50.6
20.0	40.0	60.0	80.0	25.9	17.4	20.8	67.6

* Harmonic Output below power level of X3 Output

Typical Performance Data

TEST CONDITION: RF In = +12dBm to 16dBm

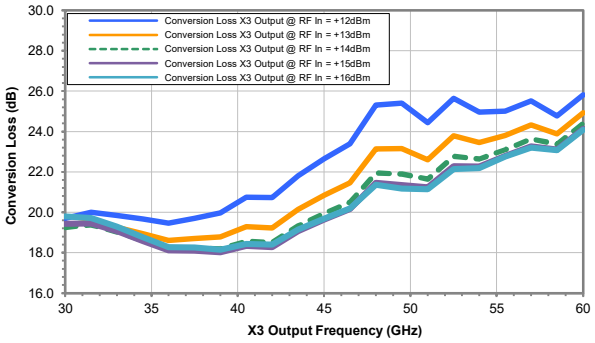
Frequency (GHz)				Temperature = +25°C				
				Conversion Loss				
X1 Output	X2 Output	X3 Output	X4 Output	12dBm	13dBm	14dBm	15dBm	16dBm
10.0	20.0	30.0	40.0	19.7	19.3	19.3	19.4	19.8
10.5	21.0	31.5	42.0	20.0	19.5	19.4	19.4	19.7
11.0	22.0	33.0	44.0	19.8	19.3	19.0	19.1	19.3
11.5	23.0	34.5	46.0	19.7	18.9	18.6	18.6	18.8
12.0	24.0	36.0	48.0	19.5	18.6	18.2	18.1	18.3
12.5	25.0	37.5	50.0	19.7	18.7	18.2	18.1	18.3
13.0	26.0	39.0	52.0	20.0	18.8	18.2	18.0	18.2
13.5	27.0	40.5	54.0	20.7	19.3	18.6	18.3	18.4
14.0	28.0	42.0	56.0	20.7	19.2	18.5	18.3	18.4
14.5	29.0	43.5	58.0	21.8	20.1	19.3	19.1	19.1
15.0	30.0	45.0	60.0	22.6	20.8	20.0	19.6	19.7
15.5	31.0	46.5	62.0	23.4	21.5	20.5	20.2	20.2
16.0	32.0	48.0	64.0	25.3	23.1	22.0	21.5	21.4
16.5	33.0	49.5	66.0	25.4	23.1	21.9	21.3	21.2
17.0	34.0	51.0	68.0	24.4	22.6	21.6	21.2	21.1
17.5	35.0	52.5	70.0	25.6	23.8	22.8	22.3	22.1
18.0	36.0	54.0	72.0	25.0	23.4	22.6	22.3	22.2
18.5	37.0	55.5	74.0	25.0	23.8	23.1	22.8	22.8
19.0	38.0	57.0	76.0	25.5	24.3	23.6	23.3	23.2
19.5	39.0	58.5	78.0	24.8	23.9	23.4	23.1	23.1
20.0	40.0	60.0	80.0	25.8	24.9	24.4	24.1	24.1

* Harmonic Output below power level of X3 Output

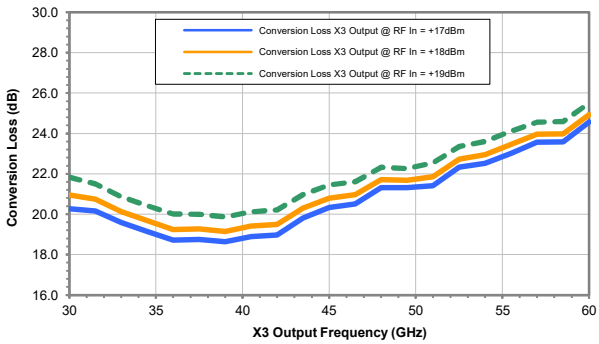
Typical Performance Curves

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

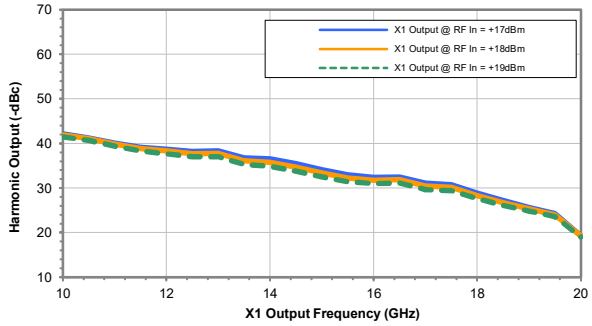
Conversion Loss X3 Output Vs Pin
Temperature = +25°C



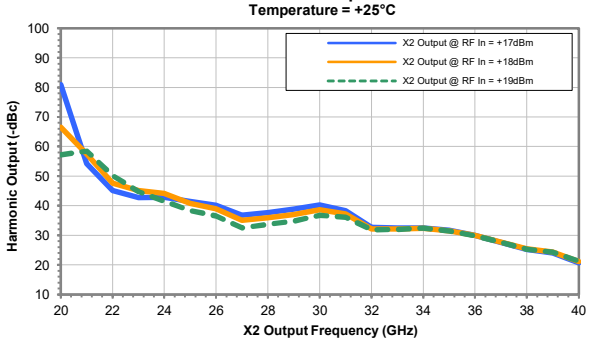
Conversion Loss X3 Output Vs Pin
Temperature = +25°C



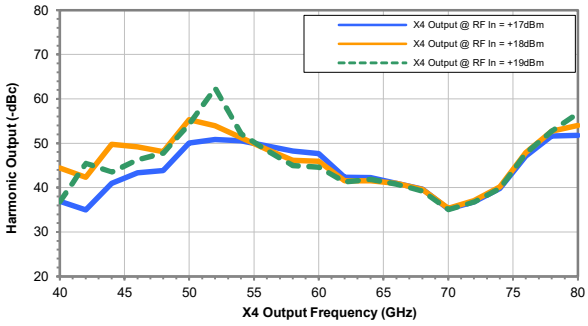
Harmonic X1 Output Vs Pin
Temperature = +25°C



Harmonic X2 Output Vs Pin
Temperature = +25°C



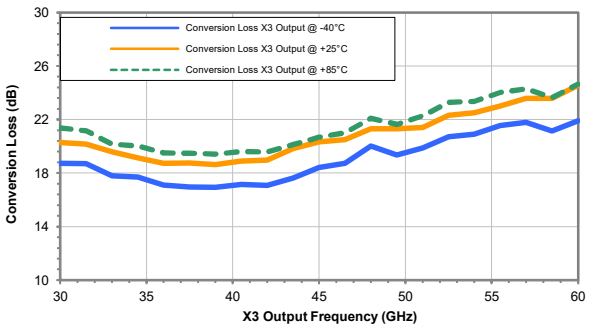
Harmonic X4 Output Vs Pin
Temperature = +25°C



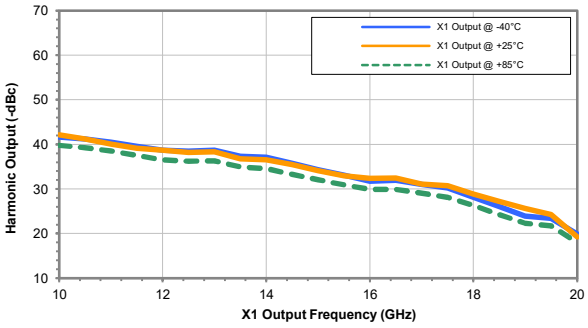
Typical Performance Curves

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

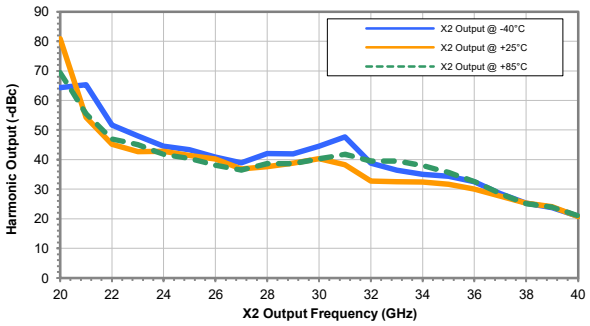
Conversion Loss X3 Output Vs Temperature
RF In = +17dBm



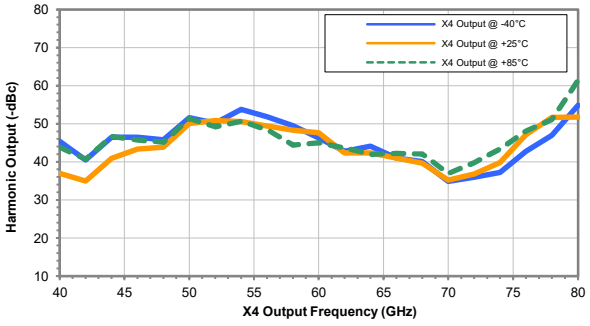
Harmonic X1 Output Vs Temperature
RF In = +17dBm



Harmonic X2 Output Vs Temperature
RF In = +17dBm



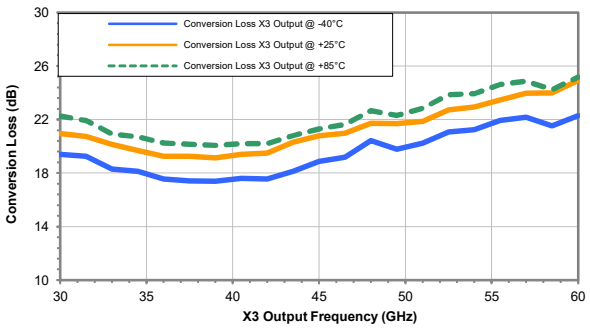
Harmonic X4 Output Vs Temperature
RF In = +17dBm



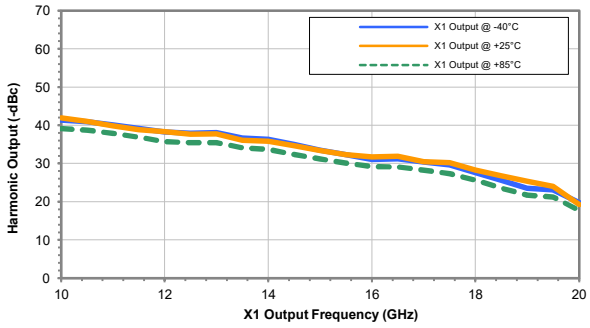
Typical Performance Curves

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

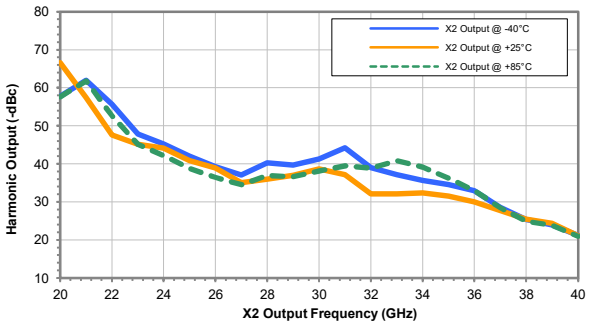
Conversion Loss X3 Output Vs Temperature
RF In = +18dBm



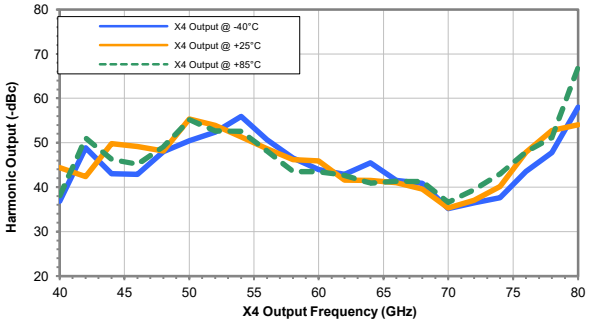
Harmonic X1 Output Vs Temperature
RF In = +18dBm



Harmonic X2 Output Vs Temperature
RF In = +18dBm



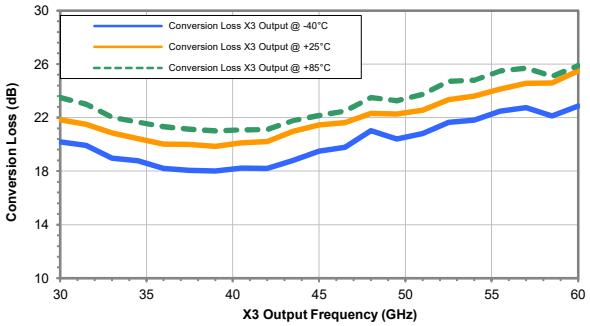
Harmonic X4 Output Vs Temperature
RF In = +18dBm



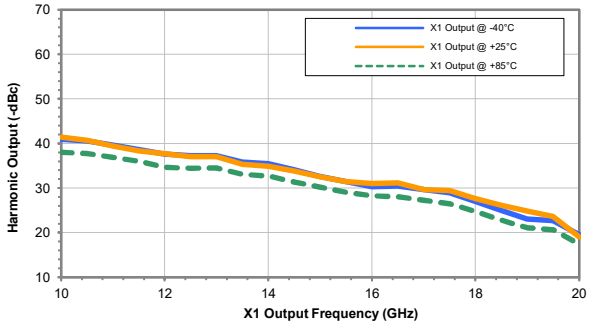
Typical Performance Curves

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

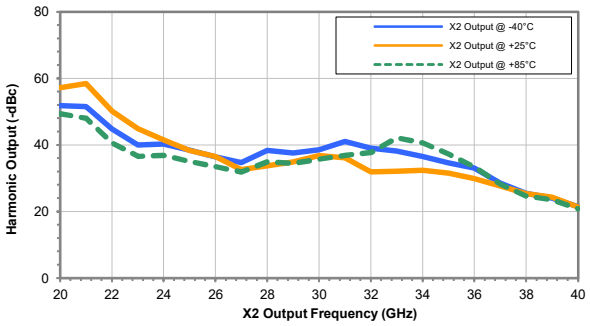
Conversion Loss X3 Output Vs Temperature
RF In = +19dBm



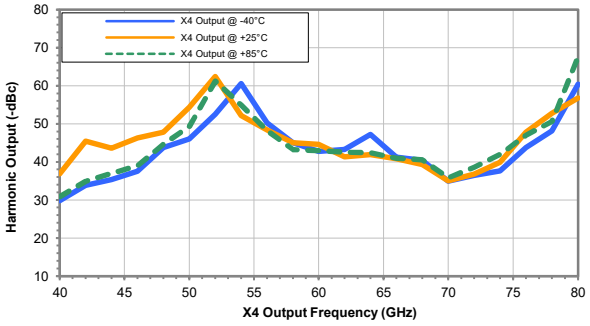
Harmonic X1 Output Vs Temperature
RF In = +19dBm



Harmonic X2 Output Vs Temperature
RF In = +19dBm



Harmonic X4 Output Vs Temperature
RF In = +19dBm



Mini-Circuits

Environmental Specifications ENV80

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85° C or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	