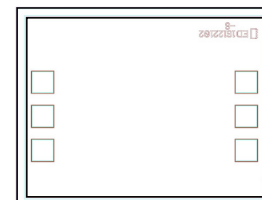


X2 MMIC Frequency Multiplier Die

CY2-44-D+

50Ω

Output 14 to 40 GHz



The Big Deal

- Ultra-wideband, output from 14 to 40 GHz
- Wide input power range, +12 to +18 dBm
- Low conversion loss, 13 dB
- Good fundamental and harmonic suppression:
F1, 30 dBc; F3, 30 dBc

Product Overview

Mini-Circuits' CY2-44-D+ is an ultra-wideband MMIC frequency doubler, converting input frequencies from 7 to 20 GHz into output frequencies from 14 to 40 GHz. Its wide output range makes this model suitable for broadband systems as well as a wide variety of narrowband applications. Utilizing GaAs HBT technology, the multiplier offers excellent repeatability.

Key Features

Feature	Advantages
Broadband, 14 to 40 GHz output	With an output frequency range spanning 14 to 40 GHz, this multiplier supports broadband applications such as defense and instrumentation as well as a wide range of narrowband system requirements.
Low conversion loss, 13 dB typ.	With a low conversion loss, CY2-44-D+ produces higher output power, reducing the need for amplification.
Excellent fundamental and harmonic suppression: <ul style="list-style-type: none">• F1, 30 dBc• F3, 30 dBc	Reduces unwanted harmonic signals and the need for additional filtering.
Wide input power range, +12 to +18 dBm	Wide input power signal range accommodates different input signal levels while still maintaining a low conversion loss.
Unpackaged die	Enables the user to integrate the doubler directly into hybrids.

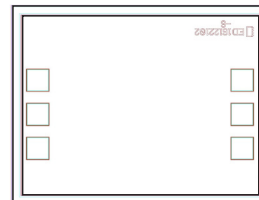
X2 MMIC Frequency Multiplier Die

CY2-44-D+

50Ω Output 14 to 40 GHz

Features

- wideband, output 14 to 40 GHz
- low conversion loss, 13 dB typ.
- high fundamental & harmonic suppression, F1, 30 dBc typ.; F3, 30 dBc typ.



Applications

- synthesizers
- local oscillators
- 5G

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

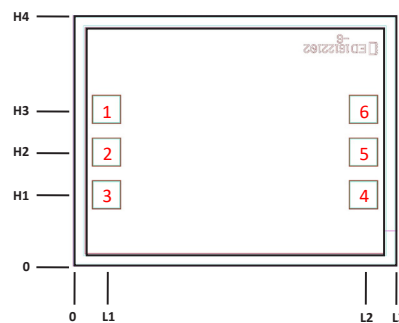
Ordering Information: Refer to Last Page

Electrical Specifications¹ at 25°C

Parameter	Input Frequency (GHz)	Min.	Typ.	Max.	Unit
Multiplier Factor			2		
Frequency Range, Input (F1)			7 - 20		GHz
Frequency Range, Output (F2)			14 - 40		GHz
Input Power		12	—	18	dBm
Conversion Loss	7 - 16		10.7-16.3		dB
	16 - 20		14.7-19.0		
Harmonic Output ²	F1	7 - 16	26-48		dBc
		16 - 20	19-28		
	F3	7 - 14.5	24-38		
	F4	7 - 10.8	7-20		

1. Electrical specification are typical measured characteristics on Die using MPI Tiran series 150 μm pitch GSG probe with Pin=+15dBm
2. Harmonics of input frequency below the power level of F2

Bonding Pad Position



Dimensions in μm, Typical

L1	L2	L3	H1	H2	H3	H4	Thickness	Bond pad size
90.7	986	1085	233.8	383.8	533.8	838	100	100x100

Maximum Ratings³

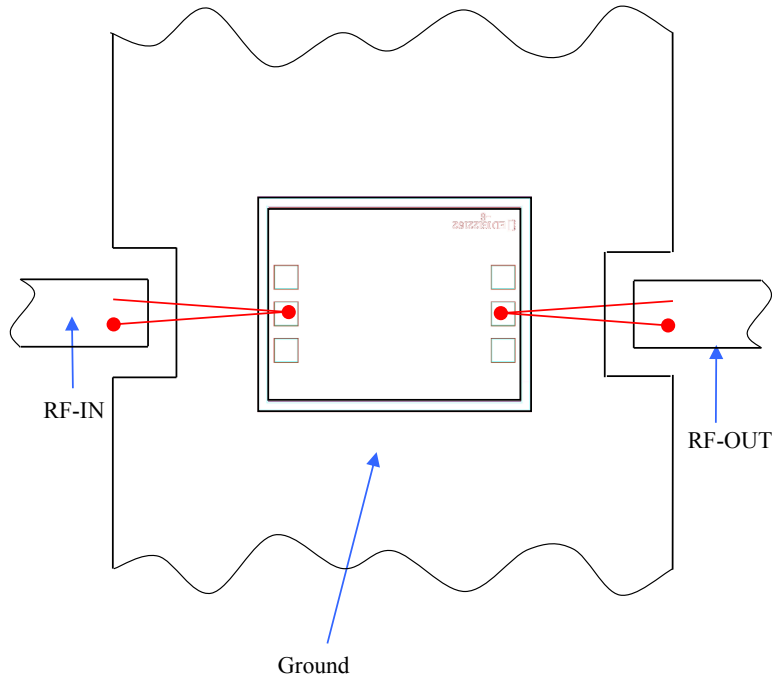
Parameter	Ratings
Operating Temperature	-40°C to 85°C
RF Input Power	21 dBm

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

Pad#	Function
2	RF-IN
5	RF-OUT
1,3,4,6	Ground
Die Bottom	Ground

- Note: 1. Bond Pad material - Gold
2. Bottom of Die - Gold plated

Assembly Diagram



Note: Ground bond wires are optional

Assembly and Handling Procedure

1. Storage
Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
MMIC doubler dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.
3. Die Attach
The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic die pick up tools only.
4. Wire Bonding
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

Additional Detailed Technical Information <i>additional information is available on our dash board.</i>	
Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
Case Style	Die
Die Ordering and packaging information (Note 3)	Quantity, Package Model No. Small, Gel - Pak: 5,10,50,100 KGD* CY2-44-DG+ Medium†, Partial Wafer: KGD* <5K CY2-44-DP+ Large†, Full Wafer CY2-44-DF+
	†Available upon request contact sales representative Refer to AN-60-067
Environmental Ratings	ENV-80

*Known Good Dice ("KGD") means that the dice are taken from PCM good wafer and visually inspected in question have been subjected to Mini-Circuits. It does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD Rating**

Human Body Model (HBM): Class 1C (1000 to <2000V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard 3x3 mm, 12-lead MCLP package.

Additional 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
- D. Mini-Circuits does not warrant the accuracy or completeness of the information, text, graphics and other items contained within this document and same are provided as an accommodation and on an "As is" basis, with all faults.
- E. Purchasers of this part are solely responsible for proper storing, handling, assembly and processing of Known Good Dice (including, without limitation, proper ESD preventative measures, die preparation, die attach, wire bonding and related assembly and test activities), and Mini-Circuits assumes no responsibility therefor or for environmental effects on Known Good Dice.
- F. Mini-Circuits and the Mini-Circuits logo are registered trademarks of Scientific Components Corporation d/b/a Mini-Circuits. All other third-party trademarks are the property of their respective owners. A reference to any third-party trademark does not constitute or imply any endorsement, affiliation, sponsorship, or recommendation by any such third-party of Mini-Circuits or its products.

Typical Performance Data

Frequency (GHz)				RF IN = 12dBm			
X1 Output	X2 Output	X3 Output	X4 Output	Conversion Loss	Harmonic Output*		
				(dB)	(-dBc)		
				X2 Output	X1 Output	X3 Output	X4 Output
6.5	13.0	19.5	26.0	17.85	34.84	24.04	3.30
7.0	14.0	21.0	28.0	13.09	30.45	34.05	10.00
7.2	14.4	21.6	28.8	12.83	28.34	32.60	10.83
7.4	14.8	22.2	29.6	12.44	29.06	31.85	9.94
7.6	15.2	22.8	30.4	11.75	28.57	33.88	8.40
7.8	15.6	23.4	31.2	11.26	28.78	32.53	9.54
8.0	16.0	24.0	32.0	10.42	28.84	38.25	9.72
8.2	16.4	24.6	32.8	10.76	27.61	37.77	8.46
8.4	16.8	25.2	33.6	10.52	27.83	36.96	9.36
8.6	17.2	25.8	34.4	10.49	28.18	40.76	10.23
8.8	17.6	26.4	35.2	10.44	27.86	40.13	8.56
9.0	18.0	27.0	36.0	10.22	27.78	42.39	8.88
9.2	18.4	27.6	36.8	10.20	28.01	39.57	11.02
9.4	18.8	28.2	37.6	10.21	27.71	37.54	10.31
9.6	19.2	28.8	38.4	10.05	28.66	37.71	10.08
9.8	19.6	29.4	39.2	9.95	28.83	36.56	12.79
10.0	20.0	30.0	40.0	10.58	27.36	40.18	12.42
10.2	20.4	30.6	40.8	10.79	27.22	43.37	12.72
10.4	20.8	31.2	41.6	10.96	27.76	39.45	15.29
10.6	21.2	31.8	42.4	11.00	28.29	37.33	15.83
10.8	21.6	32.4	43.2	10.50	29.11	35.75	17.51
11.0	22.0	33.0	--	10.83	28.72	34.31	--
11.2	22.4	33.6	--	11.66	28.61	34.33	--
11.4	22.8	34.2	--	12.00	28.58	33.57	--
11.6	23.2	34.8	--	11.33	29.74	33.20	--
11.8	23.6	35.4	--	10.87	30.02	32.43	--
12.0	24.0	36.0	--	11.06	30.70	32.32	--
12.2	24.4	36.6	--	12.56	30.90	30.82	--
12.4	24.8	37.2	--	13.12	32.07	30.84	--
12.6	25.2	37.8	--	12.55	33.39	29.50	--
12.8	25.6	38.4	--	12.27	34.70	29.16	--
13.0	26.0	39.0	--	12.92	32.45	28.69	--
13.2	26.4	39.6	--	13.05	31.45	29.24	--
13.4	26.8	40.2	--	13.64	29.20	26.30	--
13.6	27.2	40.8	--	13.86	29.44	26.00	--
13.8	27.6	41.4	--	13.25	30.87	26.61	--
14.0	28.0	42.0	--	12.89	29.16	26.17	--
14.2	28.4	42.6	--	14.54	25.58	23.00	--
14.4	28.8	43.2	--	15.98	24.36	21.73	--
14.6	29.2	--	--	15.60	25.89	--	--
14.8	29.6	--	--	14.80	26.92	--	--
15.0	30.0	--	--	15.08	22.47	--	--
15.2	30.4	--	--	15.51	19.41	--	--
15.4	30.8	--	--	15.85	18.70	--	--
15.6	31.2	--	--	15.90	19.08	--	--
15.8	31.6	--	--	15.21	20.56	--	--
16.0	32.0	--	--	15.31	20.04	--	--
16.2	32.4	--	--	15.70	19.28	--	--
16.4	32.8	--	--	17.22	17.62	--	--
16.6	33.2	--	--	18.46	16.11	--	--
16.8	33.6	--	--	17.76	17.08	--	--
17.0	34.0	--	--	16.87	18.76	--	--
17.2	34.4	--	--	16.53	19.15	--	--
17.4	34.8	--	--	17.23	18.13	--	--
17.6	35.2	--	--	18.07	17.12	--	--
17.8	35.6	--	--	17.92	17.07	--	--
18.0	36.0	--	--	16.99	18.56	--	--
18.2	36.4	--	--	16.67	18.91	--	--
18.4	36.8	--	--	18.15	16.74	--	--
18.6	37.2	--	--	20.16	13.47	--	--
18.8	37.6	--	--	20.85	12.79	--	--
19.0	38.0	--	--	18.95	15.31	--	--
19.2	38.4	--	--	16.81	18.15	--	--
19.4	38.8	--	--	16.87	18.12	--	--
19.6	39.2	--	--	18.73	14.96	--	--
19.8	39.6	--	--	21.46	11.71	--	--
20.0	40.0	--	--	20.49	13.09	--	--
20.5	41.0	--	--	22.05	10.30	--	--
21.0	42.0	--	--	23.51	8.75	--	--
21.5	43.0	--	--	22.21	10.06	--	--

*Harmonic Output below power level of X2 Output .

Note: Die using MPI Tiran series 150 μm pitch GSG probe



Typical Performance Data

Frequency (GHz)				RF IN = 15dBm			
X1 Output	X2 Output	X3 Output	X4 Output	Conversion Loss	Harmonic Output*		
				(dB)	(-dBc)		
				X2 Output	X1 Output	X3 Output	X4 Output
6.5	13.0	19.5	26.0	17.15	29.54	27.10	4.33
7.0	14.0	21.0	28.0	13.60	29.95	29.01	8.76
7.2	14.4	21.6	28.8	13.35	27.86	27.15	8.90
7.4	14.8	22.2	29.6	13.11	28.81	27.19	8.56
7.6	15.2	22.8	30.4	12.65	28.44	28.35	7.35
7.8	15.6	23.4	31.2	12.43	28.50	27.51	8.09
8.0	16.0	24.0	32.0	11.47	28.75	31.60	8.94
8.2	16.4	24.6	32.8	11.87	27.51	32.80	7.52
8.4	16.8	25.2	33.6	11.70	27.49	31.87	8.62
8.6	17.2	25.8	34.4	11.54	27.83	34.46	9.34
8.8	17.6	26.4	35.2	11.49	27.66	33.54	8.35
9.0	18.0	27.0	36.0	11.16	27.72	34.92	9.04
9.2	18.4	27.6	36.8	11.12	28.12	35.13	10.53
9.4	18.8	28.2	37.6	10.97	27.83	32.83	10.11
9.6	19.2	28.8	38.4	10.72	28.34	32.80	10.14
9.8	19.6	29.4	39.2	10.78	28.57	33.72	11.92
10.0	20.0	30.0	40.0	11.51	27.25	38.09	11.95
10.2	20.4	30.6	40.8	11.46	27.28	38.14	12.03
10.4	20.8	31.2	41.6	11.25	27.75	34.86	15.14
10.6	21.2	31.8	42.4	11.28	27.93	32.96	15.12
10.8	21.6	32.4	43.2	11.14	28.37	31.86	17.22
11.0	22.0	33.0	--	11.64	28.02	31.71	--
11.2	22.4	33.6	--	12.19	27.72	31.41	--
11.4	22.8	34.2	--	12.17	27.56	30.83	--
11.6	23.2	34.8	--	11.68	28.45	30.97	--
11.8	23.6	35.4	--	11.64	28.40	29.80	--
12.0	24.0	36.0	--	11.88	29.34	30.39	--
12.2	24.4	36.6	--	12.98	29.42	29.56	--
12.4	24.8	37.2	--	13.13	30.10	29.78	--
12.6	25.2	37.8	--	12.80	30.73	28.57	--
12.8	25.6	38.4	--	12.81	32.40	27.82	--
13.0	26.0	39.0	--	13.41	34.09	27.32	--
13.2	26.4	39.6	--	13.06	35.66	29.26	--
13.4	26.8	40.2	--	13.21	35.21	27.66	--
13.6	27.2	40.8	--	13.76	33.77	26.79	--
13.8	27.6	41.4	--	13.71	33.34	26.48	--
14.0	28.0	42.0	--	13.25	33.79	26.76	--
14.2	28.4	42.6	--	14.28	33.74	24.63	--
14.4	28.8	43.2	--	15.26	33.88	24.49	--
14.6	29.2	--	--	14.92	35.75	--	--
14.8	29.6	--	--	14.50	48.10	--	--
15.0	30.0	--	--	14.90	30.93	--	--
15.2	30.4	--	--	14.98	26.11	--	--
15.4	30.8	--	--	15.09	25.96	--	--
15.6	31.2	--	--	15.09	26.97	--	--
15.8	31.6	--	--	14.68	28.32	--	--
16.0	32.0	--	--	15.03	27.38	--	--
16.2	32.4	--	--	15.14	26.51	--	--
16.4	32.8	--	--	15.81	25.83	--	--
16.6	33.2	--	--	16.59	25.12	--	--
16.8	33.6	--	--	16.04	26.14	--	--
17.0	34.0	--	--	15.47	26.81	--	--
17.2	34.4	--	--	15.51	25.89	--	--
17.4	34.8	--	--	16.04	25.02	--	--
17.6	35.2	--	--	16.47	24.18	--	--
17.8	35.6	--	--	16.27	23.96	--	--
18.0	36.0	--	--	15.66	25.12	--	--
18.2	36.4	--	--	15.61	25.02	--	--
18.4	36.8	--	--	16.62	22.95	--	--
18.6	37.2	--	--	17.84	20.84	--	--
18.8	37.6	--	--	18.18	20.39	--	--
19.0	38.0	--	--	16.67	22.57	--	--
19.2	38.4	--	--	15.24	24.67	--	--
19.4	38.8	--	--	15.58	24.01	--	--
19.6	39.2	--	--	16.86	21.37	--	--
19.8	39.6	--	--	18.90	18.79	--	--
20.0	40.0	--	--	17.95	20.63	--	--
20.5	41.0	--	--	18.98	17.33	--	--
21.0	42.0	--	--	20.23	14.38	--	--
21.5	43.0	--	--	19.14	14.92	--	--

*Harmonic Output below power level of X2 Output .

Note: Die using MPI Tiran series 150 μm pitch GSG probe



Typical Performance Data

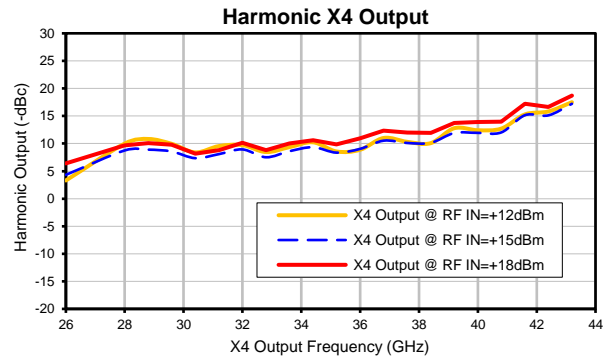
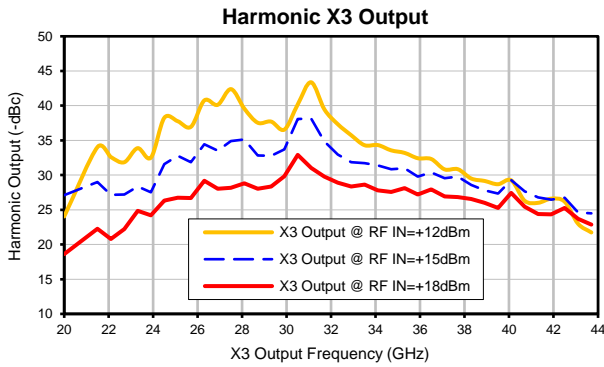
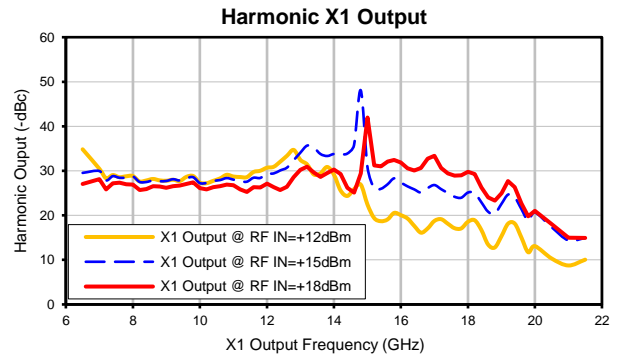
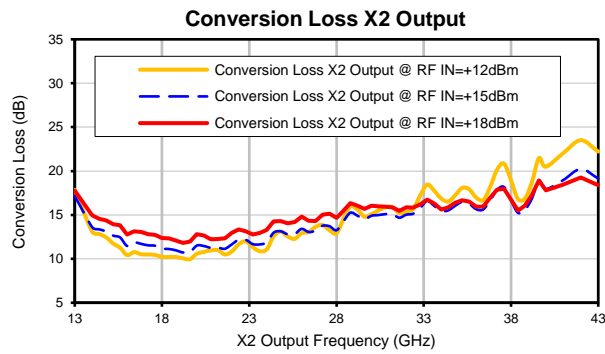
Frequency (GHz)				RF IN = 18dBm			
X1 Output	X2 Output	X3 Output	X4 Output	Conversion Loss	Harmonic Output*		
				(dB)	(-dBc)		
				X2 Output	X1 Output	X3 Output	X4 Output
6.5	13.0	19.5	26.0	17.76	27.07	18.61	6.41
7.0	14.0	21.0	28.0	14.95	28.14	22.26	9.69
7.2	14.4	21.6	28.8	14.56	25.85	20.77	10.10
7.4	14.8	22.2	29.6	14.37	27.20	22.22	9.80
7.6	15.2	22.8	30.4	13.93	27.31	24.84	8.16
7.8	15.6	23.4	31.2	13.81	26.99	24.19	8.78
8.0	16.0	24.0	32.0	12.76	26.94	26.30	10.14
8.2	16.4	24.6	32.8	13.14	25.68	26.73	8.79
8.4	16.8	25.2	33.6	13.05	25.89	26.69	10.04
8.6	17.2	25.8	34.4	12.80	26.59	29.21	10.62
8.8	17.6	26.4	35.2	12.73	26.48	28.04	9.85
9.0	18.0	27.0	36.0	12.37	26.19	28.16	10.93
9.2	18.4	27.6	36.8	12.33	26.56	28.82	12.37
9.4	18.8	28.2	37.6	12.07	26.73	28.04	12.00
9.6	19.2	28.8	38.4	11.81	27.05	28.36	11.93
9.8	19.6	29.4	39.2	11.98	27.39	29.84	13.73
10.0	20.0	30.0	40.0	12.79	26.09	32.91	13.92
10.2	20.4	30.6	40.8	12.67	25.85	31.01	13.99
10.4	20.8	31.2	41.6	12.23	26.35	29.77	17.24
10.6	21.2	31.8	42.4	12.26	26.53	28.89	16.66
10.8	21.6	32.4	43.2	12.33	26.92	28.37	18.70
11.0	22.0	33.0	--	12.94	26.74	28.65	--
11.2	22.4	33.6	--	13.33	25.81	27.78	--
11.4	22.8	34.2	--	13.14	25.26	27.59	--
11.6	23.2	34.8	--	12.75	26.37	28.14	--
11.8	23.6	35.4	--	12.95	26.26	27.20	--
12.0	24.0	36.0	--	13.28	27.14	27.93	--
12.2	24.4	36.6	--	14.25	26.36	26.95	--
12.4	24.8	37.2	--	14.29	25.70	26.81	--
12.6	25.2	37.8	--	14.04	26.41	26.56	--
12.8	25.6	38.4	--	14.18	28.57	25.98	--
13.0	26.0	39.0	--	14.82	30.22	25.25	--
13.2	26.4	39.6	--	14.34	30.92	27.45	--
13.4	26.8	40.2	--	14.31	29.65	25.46	--
13.6	27.2	40.8	--	15.03	28.65	24.39	--
13.8	27.6	41.4	--	15.15	29.52	24.36	--
14.0	28.0	42.0	--	14.68	30.31	25.26	--
14.2	28.4	42.6	--	15.47	29.25	23.69	--
14.4	28.8	43.2	--	16.34	26.16	22.88	--
14.6	29.2	--	--	16.04	25.13	--	--
14.8	29.6	--	--	15.67	29.46	--	--
15.0	30.0	--	--	16.06	41.97	--	--
15.2	30.4	--	--	15.96	31.24	--	--
15.4	30.8	--	--	15.93	31.02	--	--
15.6	31.2	--	--	15.88	32.09	--	--
15.8	31.6	--	--	15.46	32.48	--	--
16.0	32.0	--	--	15.86	31.87	--	--
16.2	32.4	--	--	15.84	30.60	--	--
16.4	32.8	--	--	16.18	30.05	--	--
16.6	33.2	--	--	16.75	30.64	--	--
16.8	33.6	--	--	16.30	32.74	--	--
17.0	34.0	--	--	15.63	33.36	--	--
17.2	34.4	--	--	15.86	30.66	--	--
17.4	34.8	--	--	16.39	29.41	--	--
17.6	35.2	--	--	16.66	28.91	--	--
17.8	35.6	--	--	16.50	28.98	--	--
18.0	36.0	--	--	15.93	29.79	--	--
18.2	36.4	--	--	15.94	29.29	--	--
18.4	36.8	--	--	16.91	26.29	--	--
18.6	37.2	--	--	17.87	24.01	--	--
18.8	37.6	--	--	17.98	23.28	--	--
19.0	38.0	--	--	16.75	24.97	--	--
19.2	38.4	--	--	15.51	27.69	--	--
19.4	38.8	--	--	16.04	26.37	--	--
19.6	39.2	--	--	17.26	22.69	--	--
19.8	39.6	--	--	18.94	19.82	--	--
20.0	40.0	--	--	17.81	21.04	--	--
20.5	41.0	--	--	18.44	18.01	--	--
21.0	42.0	--	--	19.27	14.98	--	--
21.5	43.0	--	--	18.39	14.94	--	--

*Harmonic Output below power level of X2 Output .

Note: Die using MPI Tiran series 150 μm pitch GSG probe



Typical Performance Curves



Note: Die using MPI Tiran series 150 μ m pitch GSG probe



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)	