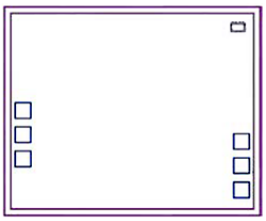
X2 MMIC

Frequency Multiplier Die

CY2-143-D+

50Ω Output 4 to 14 GHz



The Big Deal

- Ultra-wideband, output from 4 to 14 GHz
- Wide input power range, +12 to +18 dBm
- Low conversion loss, 12 dB
- Good fundamental and harmonic suppression: F1, 30 dBc; F3, 32 dBc

Product Overview

Mini-Circuits' CY2-143-D+ is an ultra-wideband MMIC frequency doubler, converting input frequencies from 2 to 7 GHz into output frequencies from 4 to 14 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, 4 to 14 GHz output	With an output frequency range spanning 4 to 14 GHz, this multiplier supports broadband applications such as defense and instrumentation as well as a wide range of narrowband system requirements.
Low conversion loss, 12 dB typ.	With a low conversion loss, CY2-143-D+ produces higher output power, reducing the need for amplification.
Excellent fundamental and harmonic suppression: • F1, 30 dBc • F3, 32 dBc • F4, 17 dBc	Reduces spurious 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 integrated the doubler directly into hybrids.

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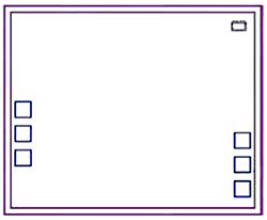


Features

- wideband, output 4 to 14 GHz
- low conversion loss, 12 dB typ.
- high fundamental & harmonic suppression, F1, 30 dBc typ.; F3, 32 dBc typ.; F4, 17 dBc typ.

Applications

- synthesizers
- local oscillators

+RoHS Compliant

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

Ordering Information: Refer to Last Page

Electrical Specifications[1] at 25°C

Parameter		Input Frequency (GHz)	Min.	Typ.	Max.	Unit
Multiplier Factor				2		
Frequency Range, Input (F1)				2-7		GHz
Frequency Range, Output (F2)				4-14		GHz
Input Power			12	—	18	dBm
Conversion Loss		2 - 4		12		dB
		4 - 7		13		
Harmonic Output[2]	F1	2 - 4		30		dBc
		4 - 7		27		
	F3	2 - 4		32		
		4 - 7		39		
	F4	2 - 4		17		
		4 - 7		27		

1. Measured on Mini-Circuits Characterization Test Board. Die packaged in industry standard 4x4 mm MCLP package.
2. Harmonics of input frequency below the power level of F2

Maximum Ratings[3]

Parameter	Ratings
Operating Temperature	-40°C to 85°C
RF Input Power[1]	21 dBm

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

Pad Connections

Pad	Description
RF IN	RF input pad
RF OUT	RF output pad
GROUND	Ground pad

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

Die Layout

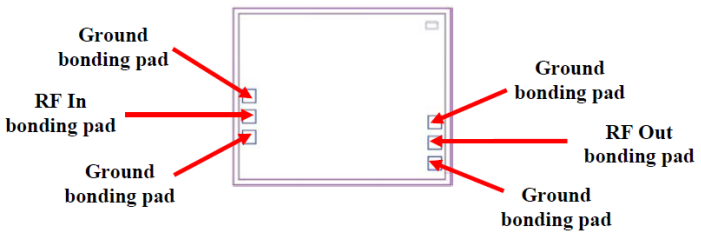


Fig 1. Die Layout

Bonding Pad Position

(Dimensions in µm, Typical)

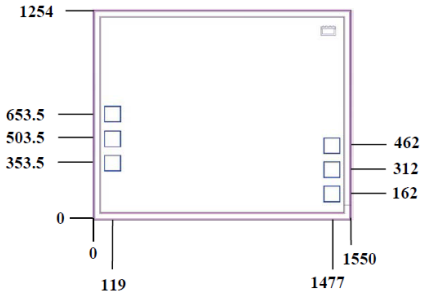


Fig 2. Bonding Pad Positions

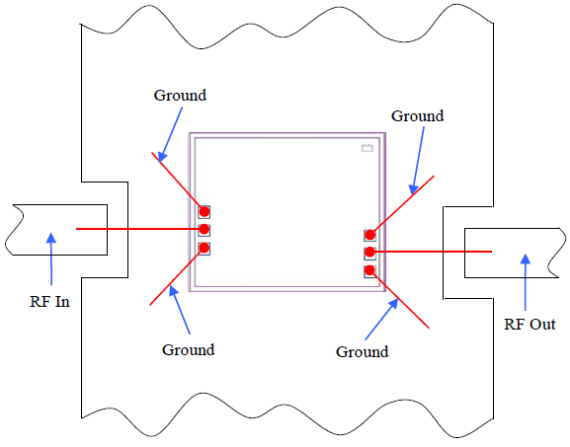
Critical Dimensions

Parameter	Values
Die Thickness, µm	100
Die Width, µm	1550
Die Length, µm	1254
Bond Pad Size (RF In), µm	100 X 100
Bond Pad Size (RF Out), µm	100 X 100
Bond Pad Size (Ground pad), µm	100 X 100

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.

Assembly Diagram



Note: Ground bond wires are optional.

Recommended Wire Length, Typical

Wire	Wire Length (mm)	Wire Loop Height (mm)
RF In, RF Out, Ground	1.00	0.15

Additional Detailed Technical Information *additional information is available on our dash board.*	
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: 10,50,100 KGD* — CY2-143-DG+ Medium†, Partial wafer: KGD*<955 — CY2-143-DP+ Large†, Full Wafer — CY2-143-DF+ †*Available upon request contact sales representative* Refer to AN-60-067
Environmental Ratings	ENV-80

*Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, 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 4x4 mm 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.

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Frequency Multiplier Die (Doubler) CY2-143-D+

Typical Performance Data

Frequency (MHz)				RF IN = 12dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
2000	4000	6000	8000	12.51	40.92	33.76	15.87
2500	5000	7500	10000	10.53	37.94	37.00	14.66
3000	6000	9000	12000	11.08	33.46	37.04	15.55
3500	7000	10500	14000	12.38	28.64	35.79	16.22
4000	8000	12000	16000	11.79	30.37	38.63	25.62
4500	9000	13500	18000	12.96	26.72	36.23	38.06
4750	9500	14250	19000	13.13	26.39	36.75	40.80
5000	10000	15000	20000	14.02	26.78	38.07	38.98
5250	10500	15750	21000	14.28	27.98	49.62	28.39
5500	11000	16500	22000	14.73	29.00	60.05	20.95
5750	11500	17250	23000	15.24	29.17	48.47	21.47
6000	12000	18000	24000	13.82	30.24	42.36	29.24
6250	12500	18750	25000	13.95	29.08	45.37	35.00
6500	13000	19500	26000	13.23	28.77	42.70	33.39
6750	13500	20250	27000	14.46	26.94	41.63	34.68
7000	14000	21000	28000	15.86	26.02	39.73	32.68

*Harmonic Output below power level of X2 Output .

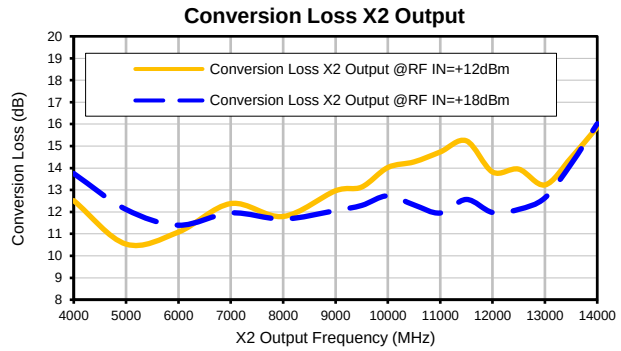
Frequency (MHz)				RF IN = 18dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
2000	4000	6000	8000	13.75	30.50	22.90	14.10
2500	5000	7500	10000	12.11	26.75	24.89	16.92
3000	6000	9000	12000	11.39	25.83	24.69	22.32
3500	7000	10500	14000	11.95	22.50	24.04	17.78
4000	8000	12000	16000	11.68	23.85	27.03	21.81
4500	9000	13500	18000	12.06	22.28	28.45	28.64
4750	9500	14250	19000	12.30	22.55	30.69	26.12
5000	10000	15000	20000	12.74	23.84	33.88	22.71
5250	10500	15750	21000	12.32	27.27	38.61	21.76
5500	11000	16500	22000	11.95	30.39	43.81	19.50
5750	11500	17250	23000	12.57	32.24	49.94	18.66
6000	12000	18000	24000	11.98	33.03	46.20	23.98
6250	12500	18750	25000	12.12	31.30	45.25	28.35
6500	13000	19500	26000	12.64	29.29	42.22	30.69
6750	13500	20250	27000	14.18	26.93	38.24	32.55
7000	14000	21000	28000	16.02	25.38	37.86	31.60

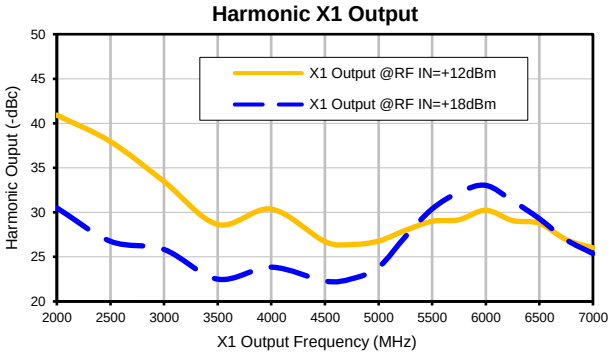
*Harmonic Output below power level of X2 Output .

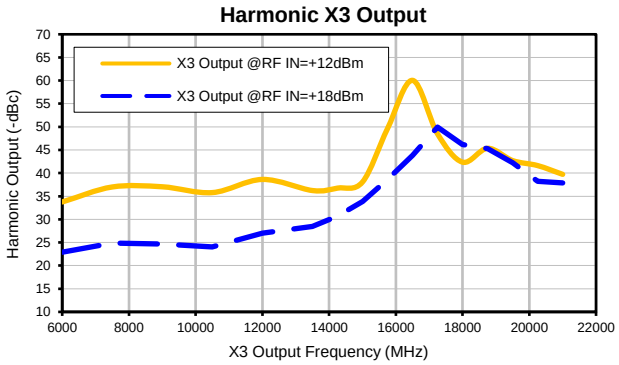
Note: ”Test data of Die packaged in industry standard 4x4mm, 24-lead MCLP package”

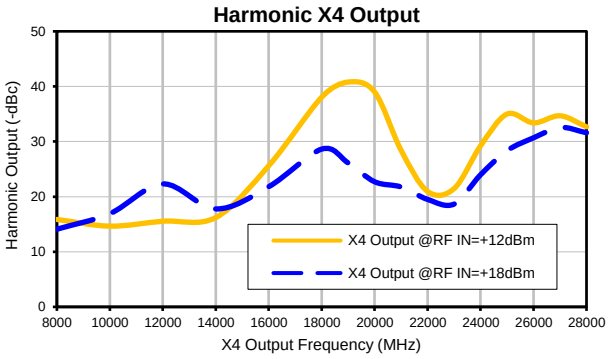
Frequency Multiplier Die (Doubler) CY2-143-D+

Typical Performance Curves









Note: ”Test data of Die packaged in industry standard 4x4mm, 24-lead MCLP package”

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)	