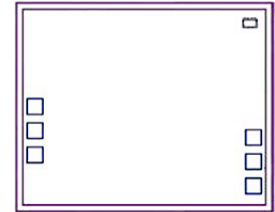


X2 MMIC Frequency Multiplier Die

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: <ul style="list-style-type: none">• 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 integrate the doubler directly into hybrids. |

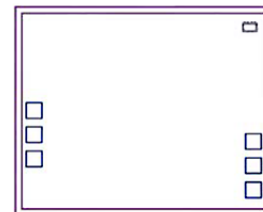
X2 MMIC Frequency Multiplier Die

CY2-143-D+

50Ω Output 4 to 14 GHz

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 Specifications¹ 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 Ratings³

| 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

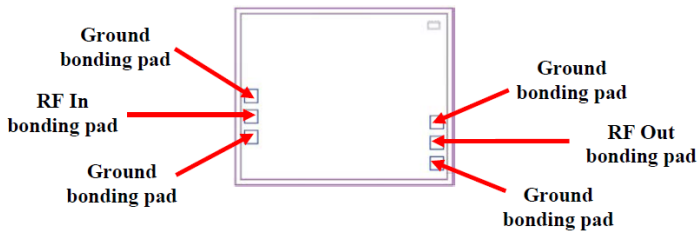


Fig 1. Die Layout

Bonding Pad Position
(Dimensions in μm , Typical)

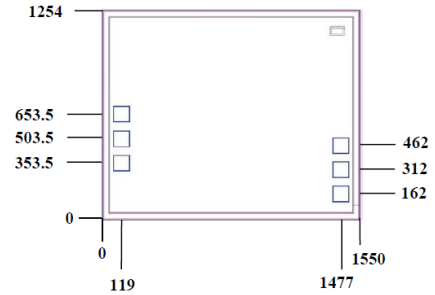


Fig 2. Bonding Pad Positions

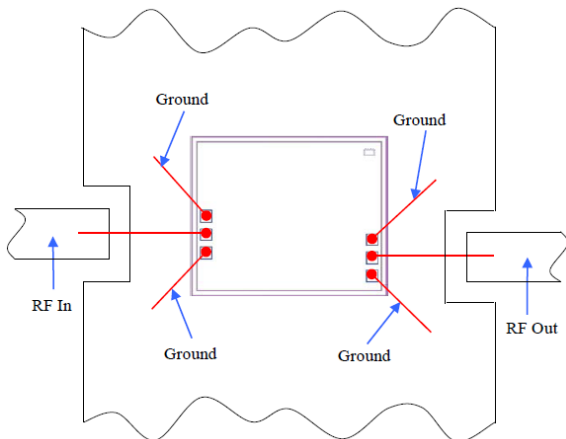
Critical Dimensions

| 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

- Storage**
Dice should be stored in a dry nitrogen purged desiccators or equivalent.
- 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.
- 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.
- 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 |

Frequency Multiplier Die (Doublers)

CY2-143-D+

Typical Performance Data

| Frequency (MHz) | | | | RF IN = 12dBm | | | |
|-----------------|-----------|-----------|-----------|--------------------------------------|----------------------------|-----------|-----------|
| | | | | Conversion Loss (dB) X2 Output | Harmonic Output* (-dBc) | | |
| X1 Output | X2 Output | X3 Output | X4 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) X2 Output | Harmonic Output* (-dBc) | | |
| X1 Output | X2 Output | X3 Output | X4 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 .

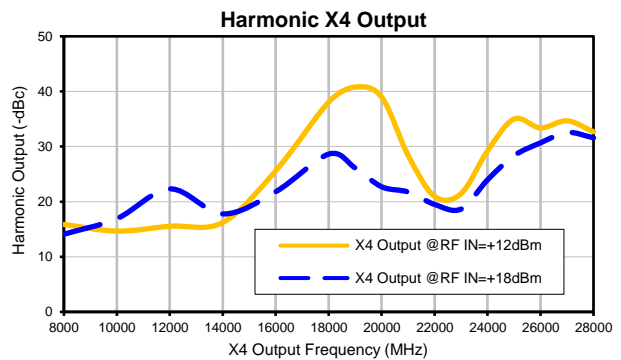
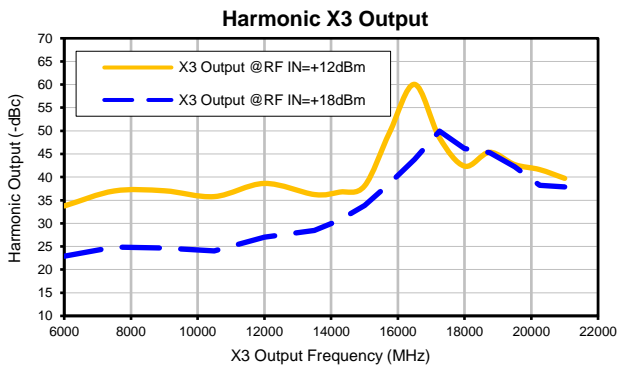
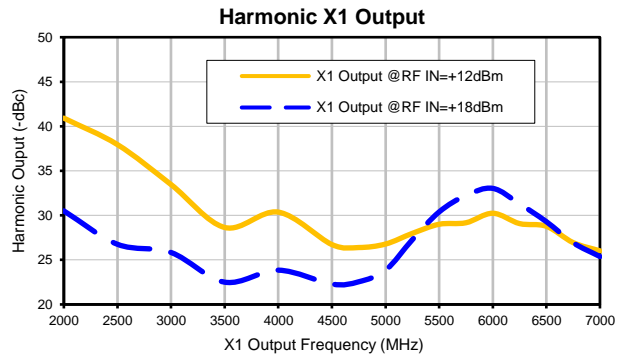
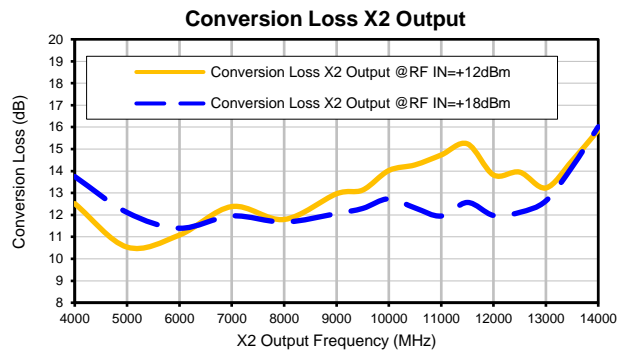
Note: "Test data of Die packaged in industry standard 4x4mm, 24-lead MCLP package"



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 The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

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 CY2-143-D+
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Typical Performance Curves



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

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) | |