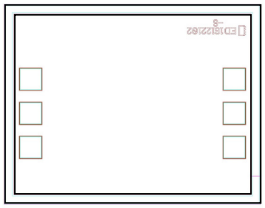
*X2 MMIC*

# 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:<br>• F1, 30 dBc<br>• F3, 30 dBc | Reduces unwanted harmonic signals and the need for additional filtering. |
| Wide input power range,<br>+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. |

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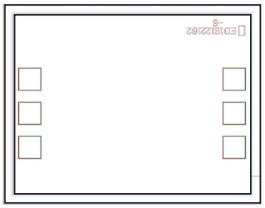
## 50Ω Output 14 to 40 GHz



## 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 Specifications[1] 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 proble with Pin=+15dBm
2. Harmonics of input frequency below the power level of F2

## Maximum Ratings[3]

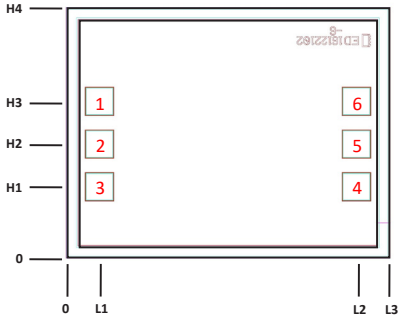
| Parameter | Ratings |
|---|---|
| Operating Temperature | -40°C to 85°C |
| RF Input Power | 21 dBm |

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

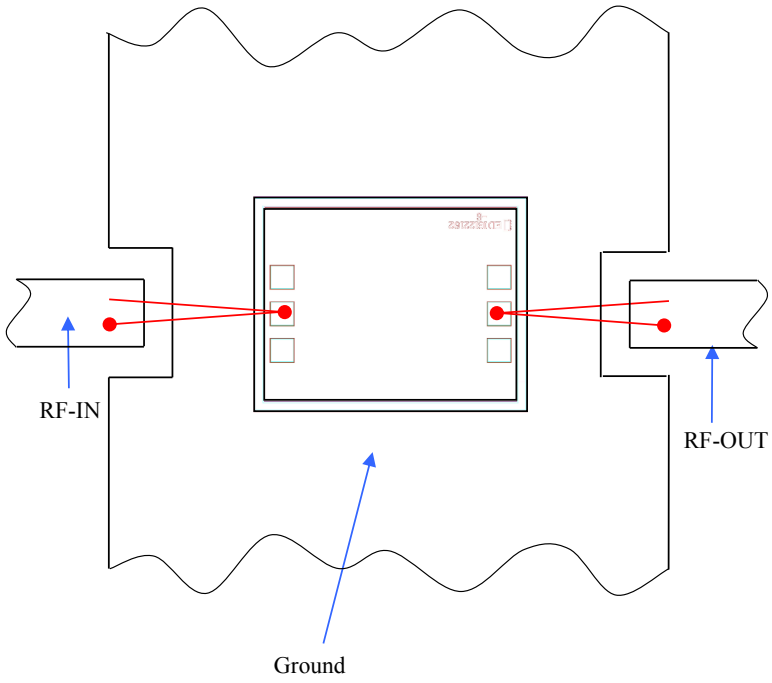
## Bonding Pad Position




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 |

## 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<br>*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.<br>Small, Gel - Pak: 5,10,50,100 KGD* — CY2-44-DG+<br>Medium†, Partial Wafer: KGD*<5K — CY2-44-DP+<br>Large†, Full Wafer — CY2-44-DF+<br>†*Available upon request contact sales representative*<br>Refer to AN-60-067 |
| **Environmental Ratings** | ENV-80 |

*Known Good Dice ("KGD") means that the dice are taken from PCM good wafer and vissually 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.

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# Frequency Multiplier Die (Doubler) CY2-44-D+

*Typical Performance Data*

| Frequency (GHz) | | | | 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 |
| 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 proble

*Typical Performance Data*

| Frequency (GHz) | | | | RF IN = 15dBm | | | |
|---|---|---|---|---|---|---|---|
| | | | | Conversion Loss (dB) | Harmonic Output* (-dBc) | | |
| X1 Output | X2 Output | X3 Output | X4 Output | 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 proble

*Typical Performance Data*

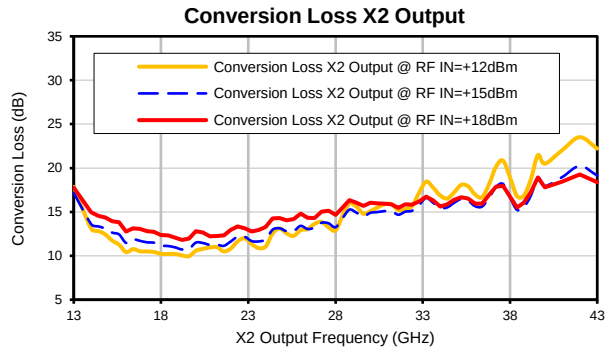
| Frequency (GHz) | | | | RF IN = 18dBm | | | |
|---|---|---|---|---|---|---|---|
| | | | | Conversion Loss (dB) | Harmonic Output* (-dBc) | | |
| X1 Output | X2 Output | X3 Output | X4 Output | X2 Output | X1 Output | X3 Output | X4 Output |
| 6.5 | 13.0 | 19.5 | 26.0 | 17.76 | 27.07 | 18.61 | 6.41 |
| 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 | -- | -- |

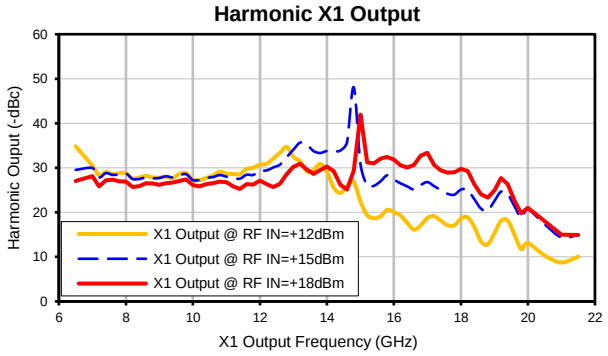
*Harmonic Output below power level of X2 Output .

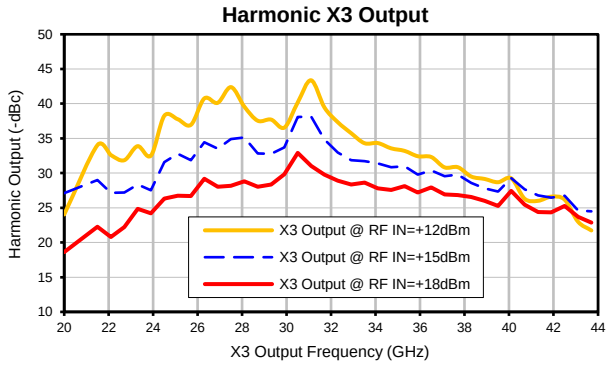
Note: Die using MPI Tiran series 150 µm pitch GSG proble

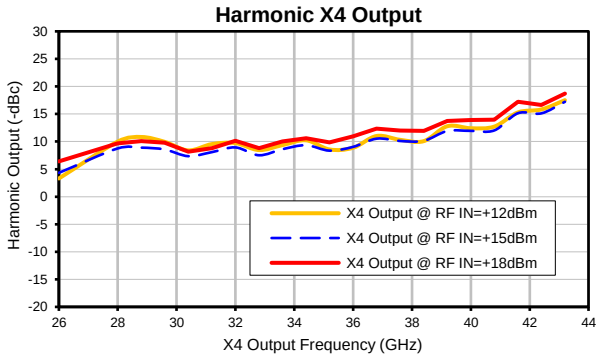
# Frequency Multiplier Die (Doubler) CY2-44-D+

*Typical Performance Curves*




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

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<br>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) | |