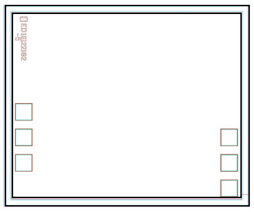
X2 MMIC

Frequency Multiplier Die

CY2-283-D+

50Ω Output 7 to 28 GHz



The Big Deal

- Ultra-wideband, output from 7 to 28 GHz
- Wide input power range, +12 to +18 dBm
- Low conversion loss, 13 dB
- Good fundamental and harmonic suppression:
  F1, 35 dBc; F3, 34 dBc; F4, 23 dBc

Product Overview

Mini-Circuits' CY2-283-D+ is an ultra-wideband MMIC frequency doubler die, converting input frequencies from 3.5 to 14 GHz into output frequencies from 7 to 28 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, 7 to 28 GHz output	With an output frequency range spanning 7 to 28 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, CY2-283-D+ produces higher output power, reducing the need for amplification.
Excellent fundamental and harmonic suppression: • F1, 35 dBc • F3, 34 dBc • F4, 23 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.

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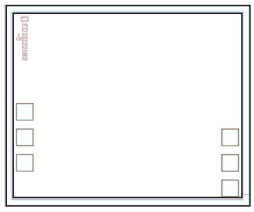
Features

- wideband, output 7 to 28 GHz
- low conversion loss, 13 dB typ.
- high fundamental & harmonic suppression, F1, 35 dBc; F3, 34 dBc; F4, 23 dBc



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)				3.5 - 1.4		GHz
Frequency Range, Output (F2)				7 - 28		GHz
Input Power			12	—	18	dBm
Conversion Loss		3.5 - 12		11.2 - 14.2		dB
		12 - 14		13.3 - 16.7		
Harmonic Output[2]	F1	3.5 - 12		23 - 73		dBc
		12 - 14		14 - 24		
	F3	3.5 - 12		25 - 48		
		12 - 14		33 - 43		
	F4	3.5 - 10.8		15 - 38		

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]

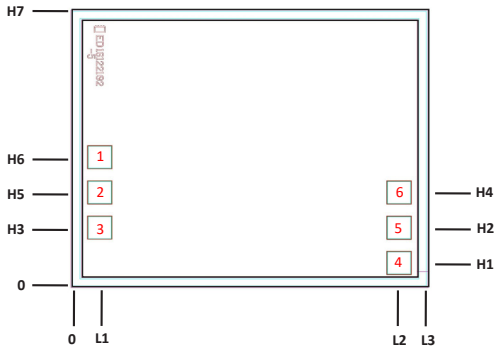
Parameter	Ratings
Operating Temperature	-40°C to 85°C
RF Input Power	21 dBm

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

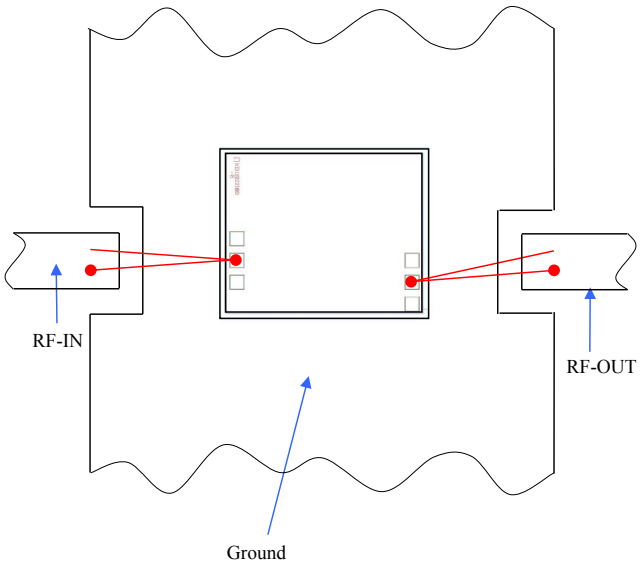
Bonding Pad Position



Dimensions in µm, Typical

L1	L2	L3	H1	H2	H3	H4	H5	H6	H7	Thickness	Bond pad size
95.5	1306.5	1402	83.5	233.5	233.8	383.5	383.8	533.8	1140	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 *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: 5,10,50,100 KGD* — CY2-283-DG+ Medium†, Partial Wafer: KGD*<5K — CY2-283-DP+ Large†, Full Wafer — CY2-283-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 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

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) CY2-283-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
3.0	6.0	9.0	12.0	19.52	40.19	21.36	12.07
3.3	6.6	9.9	13.2	14.48	37.66	27.22	14.38
3.5	7.0	10.5	14.0	12.47	39.61	29.74	14.02
3.6	7.2	10.8	14.4	12.23	39.66	29.11	16.38
3.9	7.8	11.7	15.6	11.57	37.46	31.86	15.51
4.2	8.4	12.6	16.8	10.93	37.04	35.94	19.03
4.5	9.0	13.5	18.0	11.37	35.85	31.96	16.13
4.8	9.6	14.4	19.2	10.45	34.92	37.43	18.18
5.1	10.2	15.3	20.4	11.29	35.09	36.70	16.90
5.4	10.8	16.2	21.6	11.17	37.26	35.20	17.63
5.7	11.4	17.1	22.8	11.61	37.55	33.85	16.38
6.0	12.0	18.0	24.0	12.11	38.83	31.76	15.90
6.3	12.6	18.9	25.2	13.69	36.17	30.16	15.56
6.6	13.2	19.8	26.4	13.47	33.53	28.76	17.15
7.3	14.6	21.9	29.2	12.57	43.29	31.35	22.08
7.6	15.2	22.8	30.4	12.73	43.39	31.98	26.31
7.9	15.8	23.7	31.6	13.65	37.17	31.09	26.98
8.2	16.4	24.6	32.8	13.60	31.74	36.39	26.12
8.5	17.0	25.5	34.0	14.09	32.72	37.21	32.88
8.8	17.6	26.4	35.2	13.62	32.42	37.55	34.45
9.1	18.2	27.3	36.4	13.96	31.42	34.90	27.01
9.4	18.8	28.2	37.6	13.29	31.18	35.67	27.45
9.7	19.4	29.1	38.8	13.06	31.22	36.67	31.76
10.0	20.0	30.0	40.0	13.03	30.59	40.44	38.66
10.3	20.6	30.9	41.2	13.58	30.19	42.05	43.77
10.6	21.2	31.8	42.4	12.62	29.72	55.51	44.70
11.0	22.0	33.0	--	13.63	27.55	51.54	--
11.3	22.6	33.9	--	14.43	25.05	42.5	--
11.6	23.2	34.8	--	13.72	23.16	41.94	--
11.9	23.8	35.7	--	12.97	22.71	48.25	--
12.0	24.0	36.0	--	14.54	23.37	51.34	--
12.2	24.4	36.6	--	13.72	22.53	38.26	--
12.5	25.0	37.5	--	15.18	21.73	36.61	--
12.8	25.6	38.4	--	16.76	19.32	36.56	--
13.1	26.2	39.3	--	16.42	16.63	37.33	--
13.4	26.8	40.2	--	15.55	16.30	41.49	--
13.7	27.4	41.1	--	16.49	16.45	42.76	--
14.0	28.0	42.0	--	16.95	16.93	45.89	--
14.3	28.6	42.9	--	17.84	16.27	53.54	--
14.6	29.2	--	--	17.77	16.06	--	--
15.0	30.0	--	--	19.67	13.95	--	--

*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
3.0	6.0	9.0	12.0	19.02	32.99	20.65	10.59
3.3	6.6	9.9	13.2	15.11	36.44	21.98	14.59
3.5	7.0	10.5	14.0	13.64	37.32	24.80	15.54
3.6	7.2	10.8	14.4	13.42	37.07	25.03	19.97
3.9	7.8	11.7	15.6	12.87	34.62	27.31	17.81
4.2	8.4	12.6	16.8	12.21	34.24	30.44	25.08
4.5	9.0	13.5	18.0	12.55	32.67	27.86	19.82
4.8	9.6	14.4	19.2	11.21	32.71	32.18	22.99
5.1	10.2	15.3	20.4	12.18	32.08	31.50	20.89
5.4	10.8	16.2	21.6	11.75	33.93	31.92	22.57
5.7	11.4	17.1	22.8	12.18	33.05	30.35	19.54
6.0	12.0	18.0	24.0	12.54	34.37	28.96	17.10
6.3	12.6	18.9	25.2	13.99	31.98	26.99	15.66
6.6	13.2	19.8	26.4	13.67	29.35	25.39	16.08
7.3	14.6	21.9	29.2	12.84	32.40	28.81	18.65
7.6	15.2	22.8	30.4	12.74	35.61	30.67	20.66
7.9	15.8	23.7	31.6	13.38	37.69	30.49	22.12
8.2	16.4	24.6	32.8	13.27	46.75	34.28	22.62
8.5	17.0	25.5	34.0	13.70	48.00	34.27	28.08
8.8	17.6	26.4	35.2	13.17	42.66	36.33	30.60
9.1	18.2	27.3	36.4	13.53	39.78	37.57	23.31
9.4	18.8	28.2	37.6	12.90	36.74	36.00	24.52
9.7	19.4	29.1	38.8	12.48	36.46	36.96	28.45
10.0	20.0	30.0	40.0	12.12	34.89	40.76	32.64
10.3	20.6	30.9	41.2	12.65	33.84	40.90	35.73
10.6	21.2	31.8	42.4	12.38	31.64	47.05	37.69
11.0	22.0	33.0	--	12.81	29.68	44.66	--
11.3	22.6	33.9	--	13.59	26.61	40.33	--
11.6	23.2	34.8	--	13.46	23.72	42.63	--
11.9	23.8	35.7	--	13.23	23.10	42.67	--
12.0	24.0	36.0	--	13.76	23.71	42.12	--
12.2	24.4	36.6	--	13.83	21.53	34.36	--
12.5	25.0	37.5	--	14.74	20.32	33.74	--
12.8	25.6	38.4	--	16.18	17.16	33.89	--
13.1	26.2	39.3	--	16.42	13.73	35.65	--
13.4	26.8	40.2	--	15.61	14.77	39.39	--
13.7	27.4	41.1	--	15.96	16.60	38.93	--
14.0	28.0	42.0	--	15.58	18.47	42.43	--
14.3	28.6	42.9	--	16.87	18.11	46.11	--
14.6	29.2	--	--	17.44	17.88	--	--
15.0	30.0	--	--	19.39	15.84	--	--

*Harmonic Output below power level of X2 Output .

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

Typical Performance Data

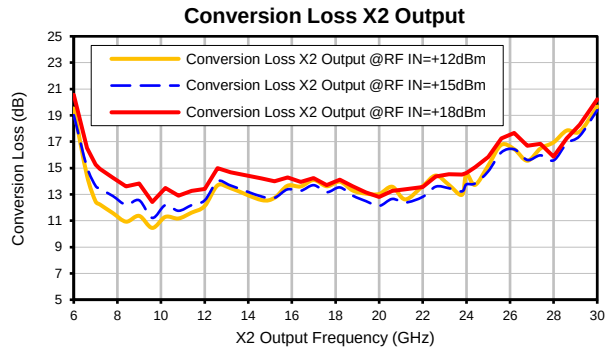
Frequency (GHz)				RF IN = 18dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
3.0	6.0	9.0	12.0	20.56	28.23	10.89	8.82
3.3	6.6	9.9	13.2	16.52	29.99	16.21	20.00
3.5	7.0	10.5	14.0	15.27	30.60	18.51	22.31
3.6	7.2	10.8	14.4	14.93	31.29	20.81	40.92
3.9	7.8	11.7	15.6	14.26	31.20	23.00	21.12
4.2	8.4	12.6	16.8	13.62	30.47	24.65	22.35
4.5	9.0	13.5	18.0	13.83	28.23	22.84	23.26
4.8	9.6	14.4	19.2	12.42	28.86	25.35	23.81
5.1	10.2	15.3	20.4	13.48	28.75	25.28	26.77
5.4	10.8	16.2	21.6	12.90	30.76	27.31	29.14
5.7	11.4	17.1	22.8	13.27	28.83	25.50	27.51
6.0	12.0	18.0	24.0	13.42	29.94	24.63	21.13
6.3	12.6	18.9	25.2	15.00	27.48	22.49	17.83
6.6	13.2	19.8	26.4	14.67	25.33	21.44	16.86
7.3	14.6	21.9	29.2	14.21	26.46	23.05	17.84
7.6	15.2	22.8	30.4	14.00	28.25	25.18	19.38
7.9	15.8	23.7	31.6	14.27	30.14	25.90	21.32
8.2	16.4	24.6	32.8	13.94	35.51	28.89	21.40
8.5	17.0	25.5	34.0	14.23	32.54	28.63	26.11
8.8	17.6	26.4	35.2	13.70	38.84	31.72	29.20
9.1	18.2	27.3	36.4	14.12	47.56	39.16	22.24
9.4	18.8	28.2	37.6	13.60	42.86	36.33	24.47
9.7	19.4	29.1	38.8	13.13	40.54	36.85	28.14
10.0	20.0	30.0	40.0	12.79	36.50	40.89	31.54
10.3	20.6	30.9	41.2	13.27	34.26	38.47	33.67
10.6	21.2	31.8	42.4	13.39	29.86	39.66	35.60
11.0	22.0	33.0	--	13.56	27.56	37.98	--
11.3	22.6	33.9	--	14.36	24.82	35.88	--
11.6	23.2	34.8	--	14.53	22.63	40.44	--
11.9	23.8	35.7	--	14.51	22.41	39.80	--
12.0	24.0	36.0	--	14.62	22.30	37.88	--
12.2	24.4	36.6	--	15.07	19.45	31.84	--
12.5	25.0	37.5	--	15.83	18.09	30.86	--
12.8	25.6	38.4	--	17.25	15.07	31.31	--
13.1	26.2	39.3	--	17.67	11.37	33.69	--
13.4	26.8	40.2	--	16.69	13.22	36.82	--
13.7	27.4	41.1	--	16.83	15.50	34.89	--
14.0	28.0	42.0	--	15.88	18.07	38.19	--
14.3	28.6	42.9	--	17.25	18.02	39.35	--
14.6	29.2	--	--	18.29	18.13	--	--
15.0	30.0	--	--	20.21	16.36	--	--

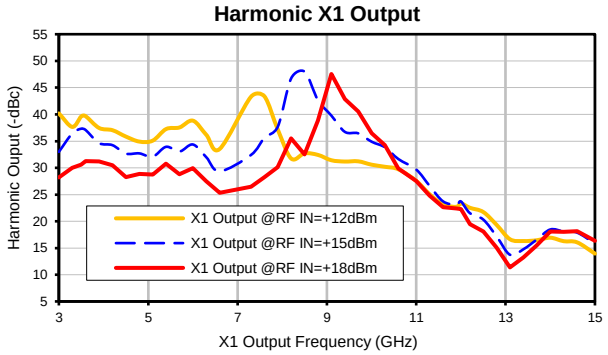
*Harmonic Output below power level of X2 Output .

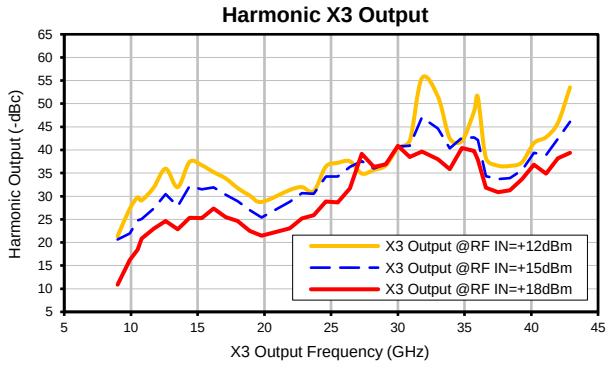
Note: Die using MPI Tiran series 150 µm pitch GSG proble

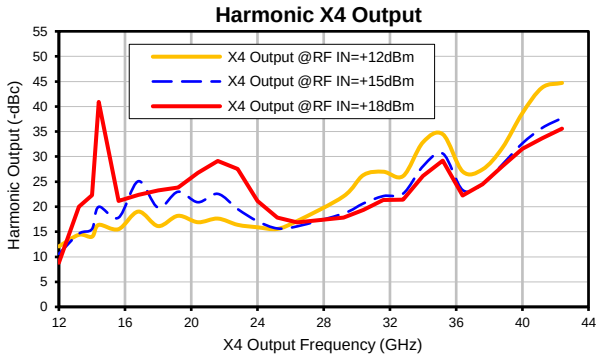
Frequency Multiplier Die (Doubler) CY2-283-D+

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 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)	