

X2 MMIC Surface Mount Frequency Multiplier

CY2-44+

50Ω Output 12.4 to 40 GHz



CASE STYLE: DQ1225

The Big Deal

- Ultra-wideband, output from 12.4 to 40 GHz
- Wide input power range, +12 to +18 dBm
- Low conversion loss, 14 dB
- Good fundamental and harmonic suppression:
F1, 26 dBc; F3, 34 dBc
- Tiny size, 3 x 3 x 0.89mm

Product Overview

Mini-Circuits' CY2-44+ is an ultra-wideband MMIC frequency doubler, converting input frequencies from 6.2 to 20 GHz into output frequencies from 12.4 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 comes housed in a tiny 3 x 3 x 0.89mm MCLP package and offers excellent repeatability, low inductance, and good thermal efficiency.

Key Features

Feature	Advantages
Broadband, 12.4 to 40 GHz output	With an output frequency range spanning 12.4 to 40 GHz, this multiplier supports broadband applications such as defense and instrumentation as well as a wide range of narrowband system requirements including 5G.
Low conversion loss, 14 dB typ.	With a low conversion loss, CY2-44+ produces higher output power, reducing the need for post amplification.
Excellent fundamental and harmonic suppression: <ul style="list-style-type: none">• F1, 26 dBc• F3, 34 dBc• F4, 18 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.
3 x 3 mm, 12 lead MCLP package	Low inductance, repeatable transitions, and excellent thermal contact to the PCB

X2 MMIC Surface Mount Frequency Multiplier

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50Ω Output 12.4 to 40 GHz

Features

- Wideband, output 12.4 to 40 GHz
- Low conversion loss, 14 dB typ.
- High fundamental & harmonic suppression, F1, 26 dBc typ.; F3, 34 dBc typ.; F4, 18 dBc typ.
- Miniature size 3 x 3 x 0.89mm
- Aqueous washable



CASE STYLE: DQ1225

Applications

- Synthesizers
- Local Oscillators
- 5G

+RoHS Compliant

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

Electrical Specifications¹ at 25°C

Parameter	Input Frequency (GHz)	Min.	Typ.	Max.	Unit
Multiplier Factor			2		
Frequency Range, Input (F1)		6.2 16	—	16 20	GHz
Frequency Range, Output (F2)		12.4 32	—	32 40	GHz
Input Power		12	—	18	dBm
Conversion Loss	6.2 - 16 16 - 20	—	14 17	20 23	dB
Harmonic Output ²	F1	6.2 - 16 16 - 20	— —	26 27	—
	F3	6.2 - 16 16 - 16.5	— —	34 36	—
	F4	6.2 - 12.4	—	18	—

1. At +15 dBm input power measured on Mini-Circuits test board TB-973-CY244C+

2. Harmonics of input frequency below the power of F2. Harmonics are measured to 50 GHz.

Maximum Ratings

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Input RF Power	21dBm

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

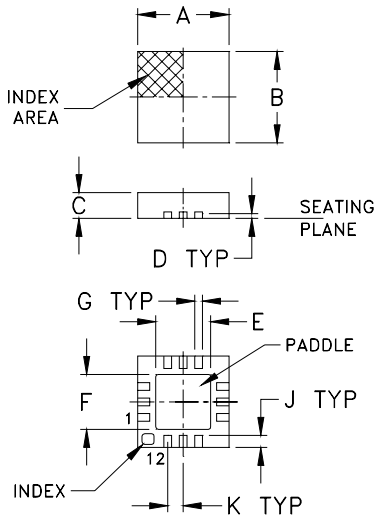
Pad Connections

Function	Pad Number
Input	5
Output	11
Ground	4,6,10,12 & paddle
No Connections	all others

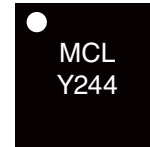
ESD rating

Human body model (HBM): Class 1C (1000 to <2000V) in accordance with ANSI/ESD 5.1-2007

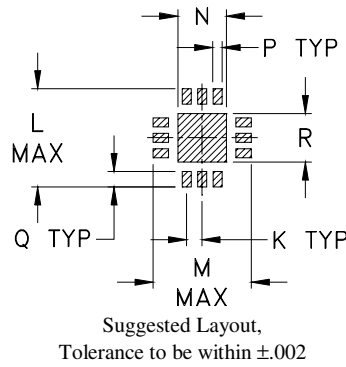
Outline Drawing



Product Marking



PCB Land Pattern

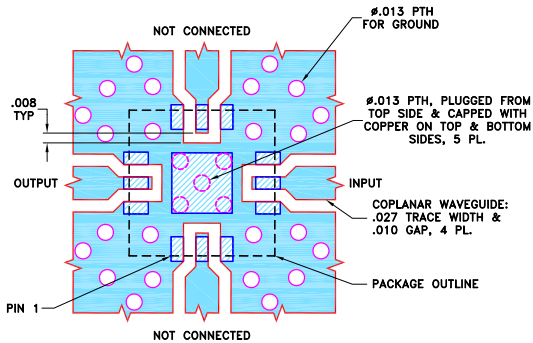


Lead Finish: Matte-Tin.

Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J
.118	.118	.035	.008	.057	.057	.009	---	.016
3.00	3.00	0.89	0.20	1.45	1.45	0.23	---	0.41
K	L	M	N	P	Q	R	wt	
.020	.127	.127	.049	.010	.020	.049	grams	
0.51	3.23	3.23	1.24	0.25	0.51	1.24	0.02	

Demo Board MCL P/N: TB-973-CY244C+
Suggested PCB Layout (PL-541)

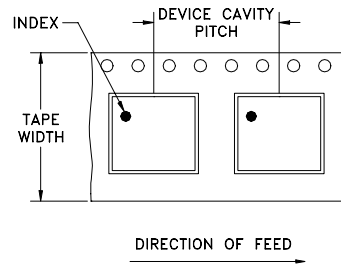


NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR TACONIC TLY-5 WITH DIELECTRIC THICKNESS $.010 \pm .001$ ". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
 - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Tape and Reel (F66)

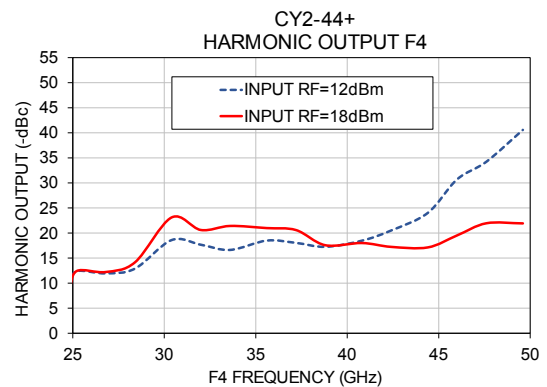
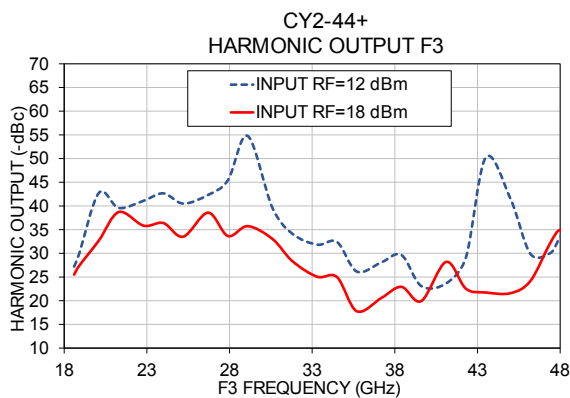
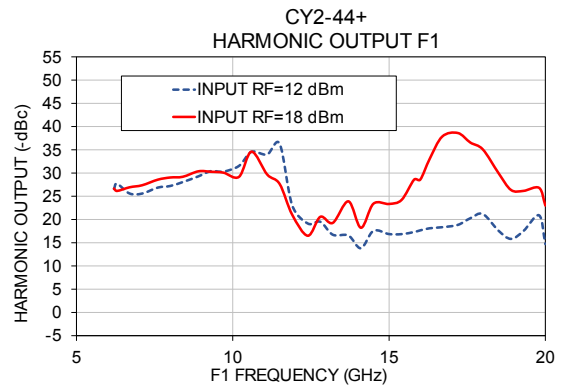
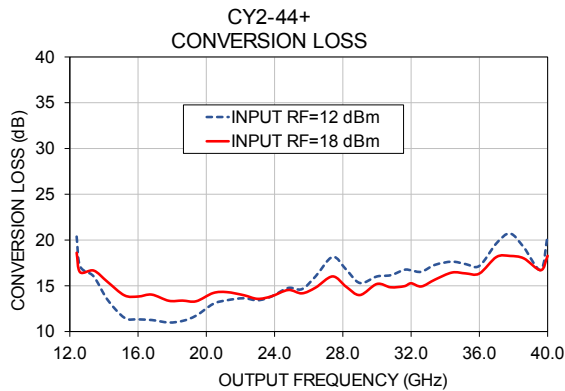
DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
8	4	7	Standard	100
				200
8	4	7	Standard	500
				1000, 2000

Typical Performance Data

Input Frequency (MHz)	INPUT RF= 12 dBm				INPUT RF= 18 dBm			
	Conversion Loss (dB)	Harmonic Output Below F2 (dBc)			Conversion Loss (dB)	Harmonic Output Below F2 (dBc)		
	F2	F1	F3	F4	F2	F1	F3	F4
6.2	20.37	26.58	27.20	9.39	18.61	26.66	25.51	8.08
7.1	13.50	25.58	39.57	12.90	15.44	27.37	38.72	14.16
8.0	11.33	27.21	42.66	17.66	13.82	29.04	36.39	20.60
9.3	11.16	30.41	45.42	18.03	13.38	30.27	33.66	20.59
10.2	13.02	31.54	39.54	18.47	14.21	29.19	33.03	18.01
11.1	13.64	33.98	31.83	24.01	13.97	29.69	25.06	17.13
12.4	14.76	19.14	28.12	40.58	14.54	16.51	20.62	21.92
13.2	16.03	16.73	23.09	--	14.80	19.28	19.93	--
14.1	16.76	13.82	29.15	--	14.89	18.22	22.54	--
15.0	16.02	16.86	41.46	--	15.20	23.34	21.59	--
16.0	16.69	17.67	33.38	--	15.27	28.60	34.91	--
17.2	17.64	18.84	--	--	16.45	38.61	--	--
18.0	17.17	21.18	--	--	16.34	35.08	--	--
20.0	20.53	14.71	--	--	18.27	23.01	--	--



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-Circuits' 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

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
5.0	10.0	15.0	20.0	41.77	2.59	13.68	1.79
5.4	10.8	16.2	21.6	30.49	18.61	18.04	5.21
5.8	11.6	17.4	23.2	24.82	30.10	19.15	7.83
6.2	12.4	18.6	24.8	20.37	26.58	27.20	9.39
6.3	12.6	18.9	25.2	17.14	27.70	29.84	12.36
6.7	13.4	20.1	26.8	16.02	25.59	42.76	11.95
7.1	14.2	21.3	28.4	13.50	25.58	39.57	12.90
7.6	15.2	22.8	30.4	11.50	26.86	41.09	18.59
8.0	16.0	24.0	32.0	11.33	27.21	42.66	17.66
8.4	16.8	25.2	33.6	11.26	28.05	40.50	16.63
8.9	17.8	26.7	35.6	10.99	29.29	42.32	18.49
9.3	18.6	27.9	37.2	11.16	30.41	45.42	18.03
9.7	19.4	29.1	38.8	11.74	30.31	54.78	17.25
10.2	20.4	30.6	40.8	13.02	31.54	39.54	18.47
10.6	21.2	31.8	42.4	13.42	34.55	34.13	20.51
11.1	22.2	33.3	44.4	13.64	33.98	31.83	24.01
11.5	23.0	34.5	46.0	13.41	36.30	32.41	30.69
11.9	23.8	35.7	47.6	13.82	23.07	26.15	34.21
12.4	24.8	37.2	49.6	14.76	19.14	28.12	40.58
12.8	25.6	38.4	--	14.63	19.51	29.64	--
13.2	26.4	39.6	--	16.03	16.73	23.09	--
13.7	27.4	41.1	--	18.16	16.55	23.65	--
14.1	28.2	42.3	--	16.76	13.82	29.15	--
14.5	29.0	43.5	--	15.30	17.56	50.24	--
15.0	30.0	45.0	--	16.02	16.86	41.46	--
15.4	30.8	46.2	--	16.15	16.85	29.88	--
15.8	31.6	47.4	--	16.74	17.31	30.05	--
16.0	32.0	48.0	--	16.69	17.67	33.38	--
16.3	32.6	48.9	--	16.53	18.11	36.51	--
16.7	33.4	--	--	17.29	18.34	--	--
17.2	34.4	--	--	17.64	18.84	--	--
17.6	35.2	--	--	17.37	20.27	--	--
18.0	36.0	--	--	17.17	21.18	--	--
18.5	37.0	--	--	19.64	17.60	--	--
18.9	37.8	--	--	20.71	15.83	--	--
19.3	38.6	--	--	19.21	17.53	--	--
19.8	39.6	--	--	16.73	20.90	--	--
20.0	40.0	--	--	20.53	14.71	--	--
20.2	40.4	--	--	17.83	18.27	--	--
20.6	41.2	--	--	22.80	11.05	--	--
21.1	42.2	--	--	24.30	9.20	--	--
21.5	43.0	--	--	20.75	10.54	--	--
22.0	44.0	--	--	21.53	9.24	--	--

*Harmonic Output below power level of X2 Output .



Frequency Multiplier (Doublers)

CY2-44+

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
5.0	10.0	15.0	20.0	30.80	14.92	21.70	9.94
5.4	10.8	16.2	21.6	26.46	28.59	20.94	11.87
5.8	11.6	17.4	23.2	21.93	30.24	23.43	8.36
6.2	11.6	18.6	23.2	18.96	27.56	29.24	9.41
6.3	12.6	18.9	25.2	16.30	27.71	31.60	12.66
6.7	13.4	20.1	26.8	15.70	26.56	39.66	11.58
7.1	14.2	21.3	28.4	14.14	26.59	44.03	12.59
7.6	15.2	22.8	30.4	12.59	27.95	45.16	24.09
8.0	16.0	24.0	32.0	12.45	28.43	44.19	21.18
8.4	16.8	25.2	33.6	12.57	28.88	39.14	17.81
8.9	17.8	26.7	35.6	12.04	30.23	46.25	18.92
9.3	18.6	27.9	37.2	12.10	30.91	40.59	18.22
9.7	19.4	29.1	38.8	12.26	30.80	44.16	16.00
10.2	20.4	30.6	40.8	13.33	30.84	38.43	16.55
10.6	21.2	31.8	42.4	13.52	35.66	33.20	17.14
11.1	22.2	33.3	44.4	13.30	33.34	29.80	18.14
11.5	23.0	34.5	46.0	12.89	33.55	29.97	21.15
11.9	23.8	35.7	47.6	13.20	22.83	21.96	23.33
12.4	24.8	37.2	49.6	13.96	18.51	25.77	23.83
12.8	25.6	38.4	--	13.62	22.02	32.66	--
13.2	26.4	39.6	--	14.51	20.06	26.87	--
13.7	27.4	41.1	--	15.95	23.03	34.22	--
14.1	28.2	42.3	--	14.90	17.09	30.68	--
14.5	29.0	43.5	--	14.08	22.06	25.49	--
15.0	30.0	45.0	--	15.00	21.58	25.39	--
15.4	30.8	46.2	--	14.85	21.74	27.08	--
15.8	31.6	47.4	--	15.20	23.95	32.81	--
16.0	31.6	48.0	--	15.37	24.22	35.57	--
16.3	32.6	48.9	--	15.04	26.11	34.37	--
16.7	33.4	--	--	15.72	27.48	--	--
17.2	34.4	--	--	16.40	27.28	--	--
17.6	35.2	--	--	16.21	30.02	--	--
18.0	36.0	--	--	16.00	31.84	--	--
18.5	37.0	--	--	17.95	29.49	--	--
18.9	37.8	--	--	18.51	29.16	--	--
19.3	38.6	--	--	17.92	25.76	--	--
19.8	39.6	--	--	16.22	29.79	--	--
20.0	40.0	--	--	18.41	25.42	--	--
20.2	40.4	--	--	16.75	23.67	--	--
20.6	41.2	--	--	20.45	19.56	--	--
21.1	42.2	--	--	22.20	16.20	--	--
21.5	43.0	--	--	20.03	14.08	--	--
22.0	44.0	--	--	20.96	12.59	--	--

*Harmonic Output below power level of X2 Output .



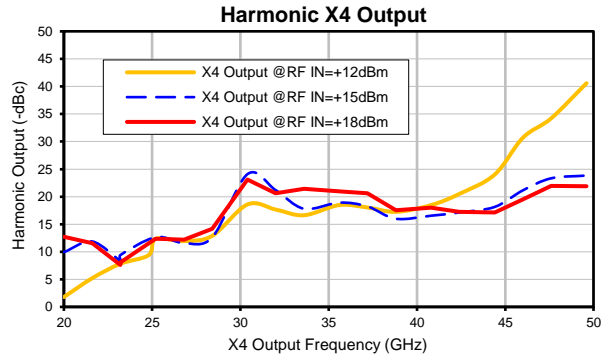
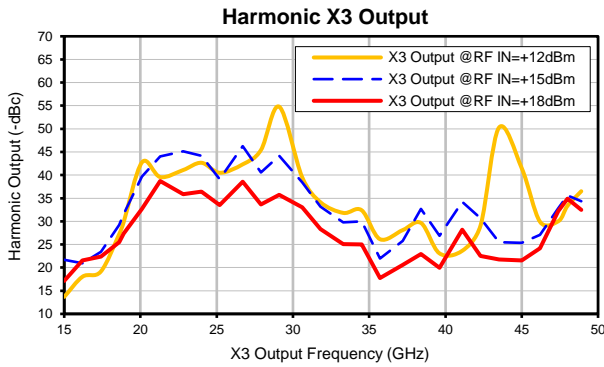
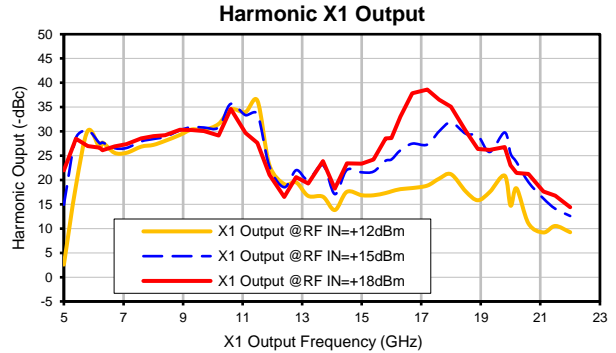
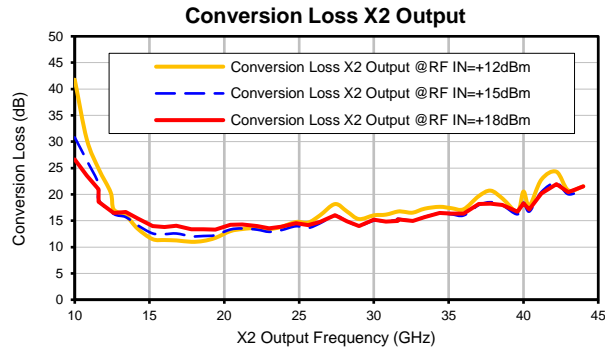
Typical Performance Data

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
5.0	10.0	15.0	20.0	26.62	21.95	17.13	12.73
5.4	10.8	16.2	21.6	23.59	28.51	21.57	11.54
5.8	11.6	17.4	23.2	20.94	26.98	22.40	7.62
6.2	11.6	18.6	23.2	18.61	26.66	25.51	8.08
6.3	12.6	18.9	25.2	16.48	26.15	27.34	12.39
6.7	13.4	20.1	26.8	16.66	26.93	32.72	12.22
7.1	14.2	21.3	28.4	15.44	27.37	38.72	14.16
7.6	15.2	22.8	30.4	13.95	28.57	35.84	23.11
8.0	16.0	24.0	32.0	13.82	29.04	36.39	20.60
8.4	16.8	25.2	33.6	14.04	29.19	33.51	21.41
8.9	17.8	26.7	35.6	13.36	30.37	38.59	20.99
9.3	18.6	27.9	37.2	13.38	30.27	33.66	20.59
9.7	19.4	29.1	38.8	13.31	30.08	35.74	17.57
10.2	20.4	30.6	40.8	14.21	29.19	33.03	18.01
10.6	21.2	31.8	42.4	14.31	34.59	28.35	17.24
11.1	22.2	33.3	44.4	13.97	29.69	25.06	17.13
11.5	23.0	34.5	46.0	13.57	27.64	24.99	19.52
11.9	23.8	35.7	47.6	13.84	21.04	17.78	21.95
12.4	24.8	37.2	49.6	14.54	16.51	20.62	21.92
12.8	25.6	38.4	--	14.17	20.58	22.93	--
13.2	26.4	39.6	--	14.80	19.28	19.93	--
13.7	27.4	41.1	--	16.02	23.91	28.19	--
14.1	28.2	42.3	--	14.89	18.22	22.54	--
14.5	29.0	43.5	--	13.99	23.40	21.74	--
15.0	30.0	45.0	--	15.20	23.34	21.59	--
15.4	30.8	46.2	--	14.84	24.21	24.18	--
15.8	31.6	47.4	--	14.95	28.57	32.19	--
16.0	31.6	48.0	--	15.27	28.60	34.91	--
16.3	32.6	48.9	--	14.93	33.05	32.46	--
16.7	33.4	--	--	15.68	37.84	--	--
17.2	34.4	--	--	16.45	38.61	--	--
17.6	35.2	--	--	16.35	36.56	--	--
18.0	36.0	--	--	16.34	35.08	--	--
18.5	37.0	--	--	18.15	30.00	--	--
18.9	37.8	--	--	18.26	26.36	--	--
19.3	38.6	--	--	18.00	26.16	--	--
19.8	39.6	--	--	16.70	26.80	--	--
20.0	40.0	--	--	18.27	23.01	--	--
20.2	40.4	--	--	17.14	21.46	--	--
20.6	41.2	--	--	20.17	21.24	--	--
21.1	42.2	--	--	21.95	17.60	--	--
21.5	43.0	--	--	20.42	16.78	--	--
22.0	44.0	--	--	21.50	14.40	--	--

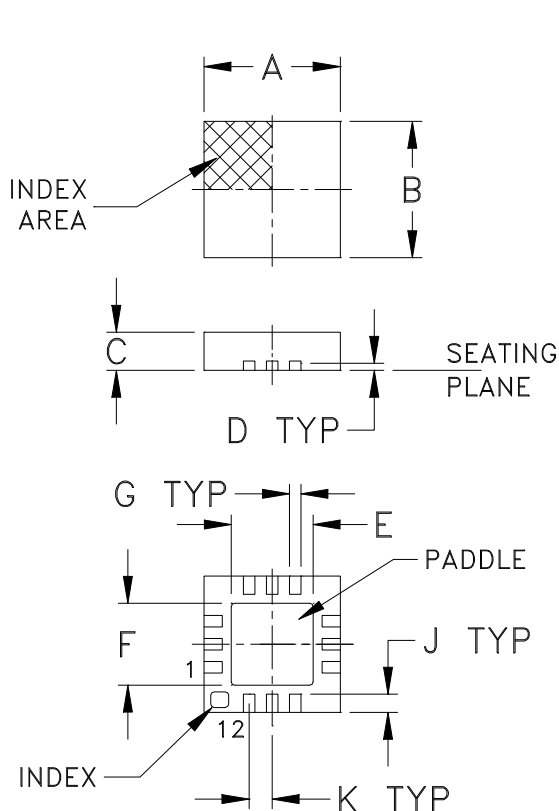
*Harmonic Output below power level of X2 Output .



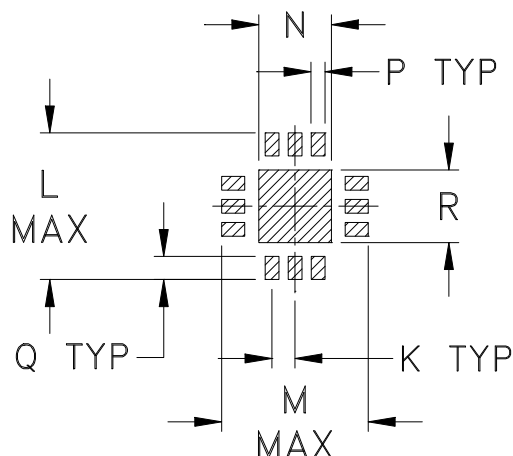
Typical Performance Curves



Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
DQ1225	.118 (3.00)	.118 (3.00)	.035 (0.89)	.008 (0.20)	.057 (1.45)	.057 (1.45)	.009 (0.23)	-- --	.016 (0.41)	.020 (0.51)	.127 (3.22)	.127 (3.22)	.049 (1.25)

CASE #	P	Q	R	S	T	WT. GRAM
DQ1225	.010 (0.25)	.020 (0.51)	.049 (1.25)	-- --	-- --	.02

Dimensions are in inches (mm). Tolerances: 2Pl. $\pm .01$; 3 Pl. $\pm .004$

Notes:

- Case material: Plastic.
- Termination finish:
 - For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin. All models, (+) suffix. See Data sheet.
 - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



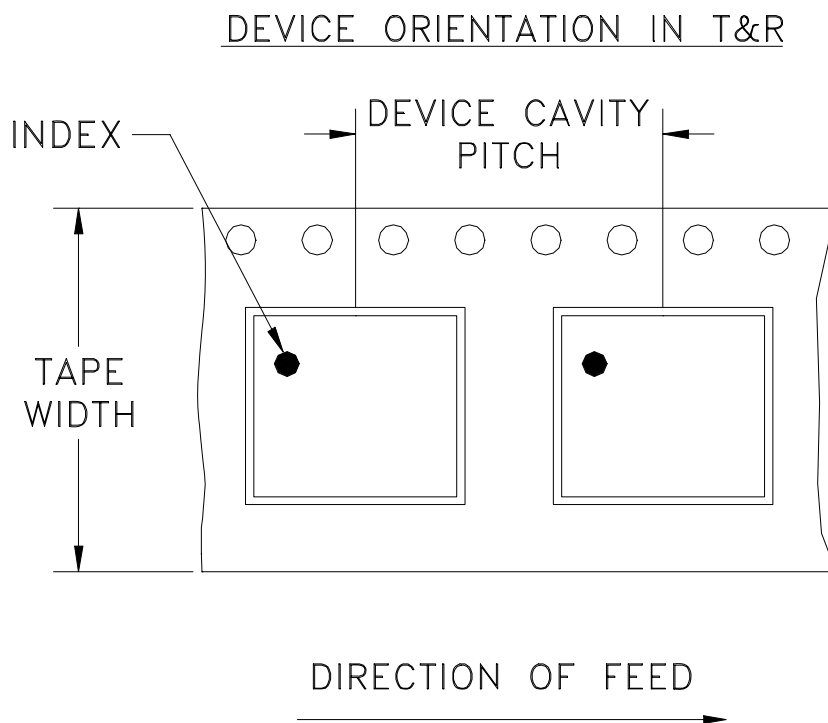
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INTERNET <http://www.minicircuits.com>

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Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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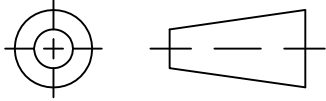
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

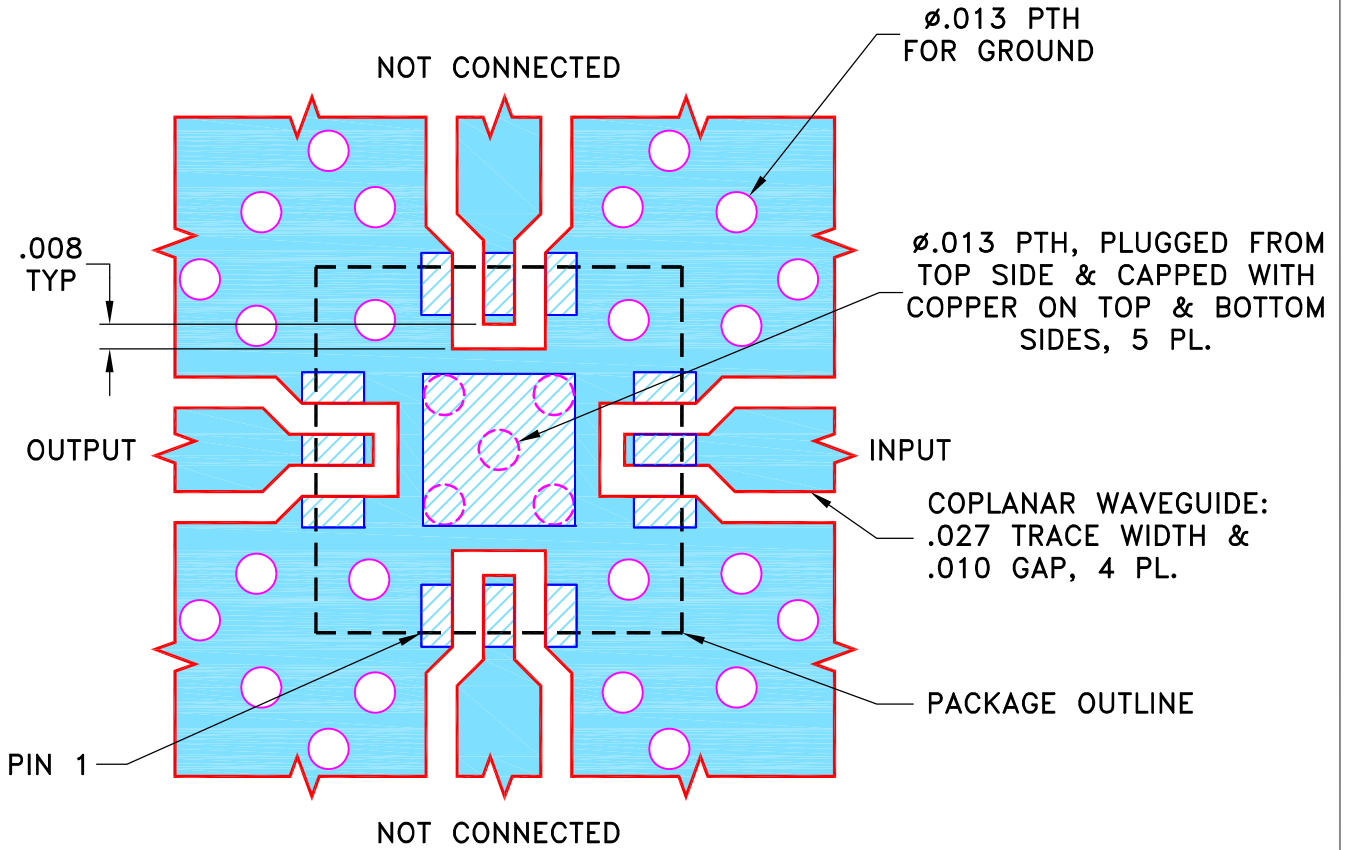
THIRD ANGLE PROJECTION



REVISIONS

REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M165191	NEW RELEASE	12/13/17	ITG	JX

**SUGGESTED MOUNTING CONFIGURATION
FOR DQ1225 CASE STYLE, "12FM01" PIN CODE**

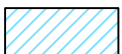


NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR TACONIC TLY-5 WITH DIELECTRIC THICKNESS .010" ± .001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN ITG	12/11/17
TOLERANCES ON:	CHECKED GF	12/13/17
2 PL DECIMALS ±	APPROVED JX	12/13/17
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		



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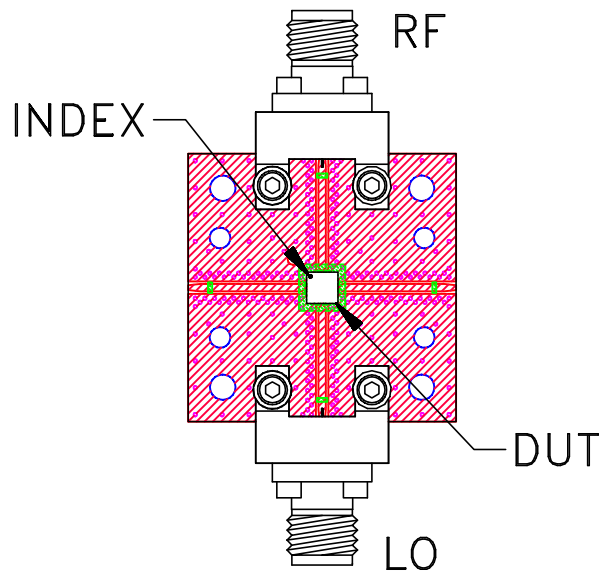
13 Neptune Avenue
Brooklyn NY 11235

PL, 12FM01, DQ1225, TB-973+

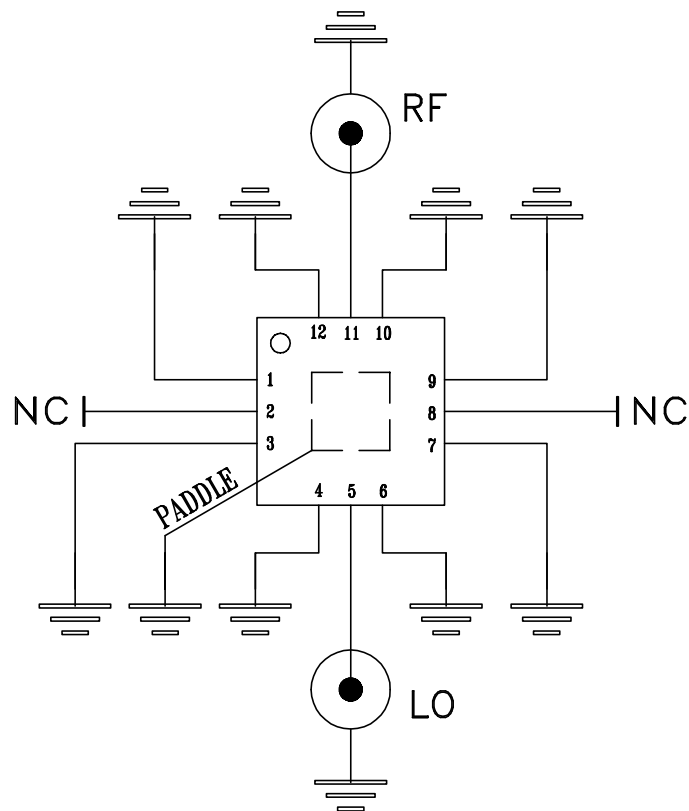
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-541	OR
FILE:	98PL541	SCALE:	SHEET:
		16:1	1 OF 1

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Evaluation Board and Circuit




TB-973-CY244C+



Schematic Diagram

Notes:

1. 50 Ohm 2.92mm Female end launch connectors.
2. PCB Material: TLY-5 or equivalent,
Dielectric Constant=2.2, Thickness=.010 inch.

 **Mini-Circuits®**

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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether +	MIL-STD-202, Method 215



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Specification	Test/Inspection Condition	Reference/Spec
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monoethanolamine at 63°C to 70°C