MMIC SURFACE MOUNT

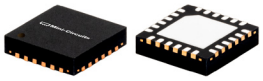
Directional Coupler

EDC10-273+

50Ω 10 dB 6 to 26.5 GHz

THE BIG DEAL

- Wideband, 6-26.5 GHz
- Excellent coupling flatness 10±1.5 dB typ.
- Highly repeatable performance (GaAs based design)
- Small Size, 4 x 4 mm
- No external termination required



Generic photo used for illustration purposes only

CASE STYLE: DG1847

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

APPLICATIONS

- Satellite communications
- Wireless infrastructure
- Test and measurements

PRODUCT OVERVIEW

Mini-Circuits' EDC10-273+ is a 10 dB directional coupler that operates from 6 to 26.5 GHz packaged in MCLP 4 x 4mm, 24-lead package. It provides excellent coupling flatness over a broad bandwidth and good return loss. This coupler also provides a quadrature phase shift between the signal at the through port and coupler port. Manufacturing using GaAs Technology, this model results in relatively high repeatablility in performance.

KEY FEATURES

Feature	Advantages
Wideband, 6-26.5 GHz	EDC10-273+ can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation.
Excellent coupling flatness	Excellent coupling flatness yields higher accuracy.
Small size, 4x4 MCLP package.	Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

REV. A
ECO-012570
EDC10-273+
MCL NY
220315

Directional Coupler

EDC10-273+

ELECTRICAL SPECIFICATIONS[1] AT 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		6000		26500	MHz
Mainline Loss	6000 - 10000	—	1.0	2.2	dB
	10000 - 18000	—	1.4	2.3	
	18000 - 23000	—	1.5	3.2	
	23000 - 26500	—	1.8	—	
Nominal Coupling	6000 - 10000	9.2	10.3	12.5	dB
	10000 - 18000	9.5	10.4	11.9	
	18000 - 23000	9.8	11.4	13.3	
	23000 - 26500	8.6	10.1	13.0	
Coupling Flatness(±)	6000 - 26500	—	1.5	—	dB
Directivity	6000 - 10000	10	16	—	dB
	10000 - 18000	8.9	15	—	
	18000 - 23000	8.5	14	—	
	23000 - 26500	—	11	—	
Return Loss (Input)	6000 - 10000		24		dB
	10000 - 18000		17		
	18000 - 23000		15		
	23000 - 26500		15		
Return Loss (Output)	6000 - 10000		22		dB
	10000 - 18000		16		
	18000 - 23000		16		
	23000 - 26500		19		
Return Loss (Coupled)	6000 - 10000		24		dB
	10000 - 18000		16		
	18000 - 23000		14		
	23000 - 26500		14		

1. Measured on Mini-Circuits Characterization test board TB-EDC10-273+ with testboard loss deducted.

Directional Coupler

EDC10-273+

MAXIMUM RATINGS

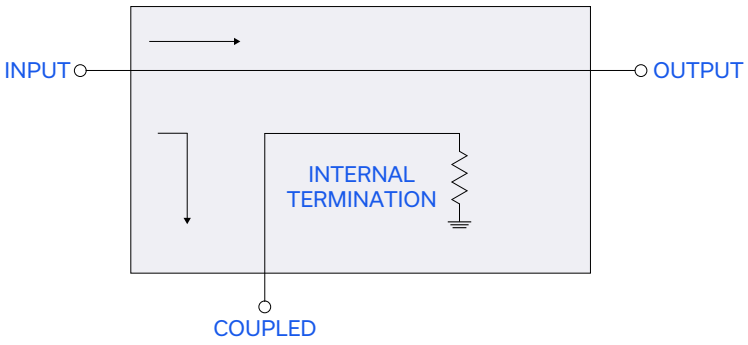
Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Input Power	28 dBm (5 minute max.) 25 dBm (continuous)
Power at internal termination	19 dBm (5 minute max.) 16 dBm (continuous)

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

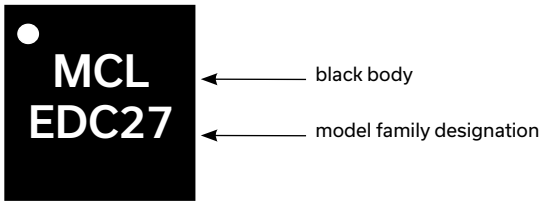
PAD CONNECTIONS

Function	Pad Number
INPUT	5
COUPLED	2
OUTPUT	14
GROUND	Paddle
NC (GROUND EXTERNALLY)	1,3,4,6-13,15-24

ELECTRICAL SCHEMATIC



PRODUCT MARKING



Marking may contain other features or characters for internal lot control

Directional Coupler

EDC10-273+

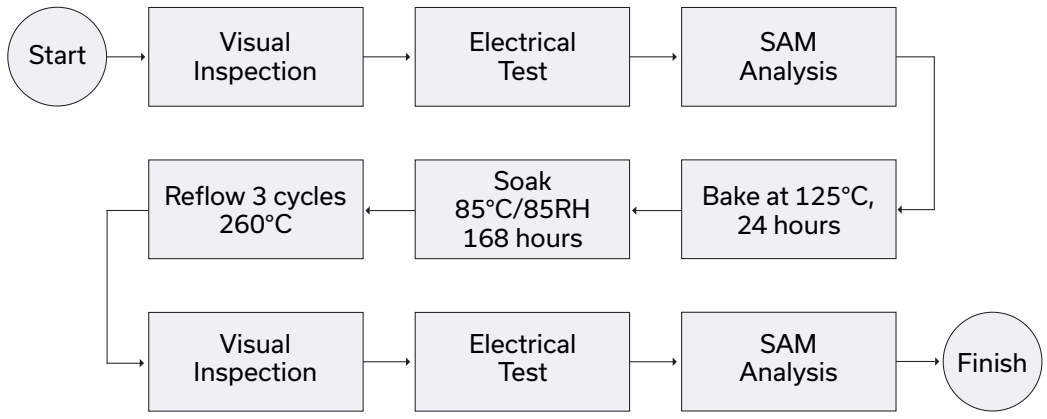
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS CLICK HERE

Performance Data	Data Table Swept Graphs S-Parameter (S3P Files) Data Set (.zip file)
Case Style	DG1847 Plastic package, exposed paddle lead finish: matte-tin
Tape & Reel **Standard quantities available on reel**	F68 7" reels with 20, 50, 100, 200, 500 or 1K devices
Suggested Layout for PCB Design	PL-614
Evaluation Board	TB-EDC10-273+
Environmental Ratings	ENV08T2

ESD RATING

Human Body Model (HBM): Class 1B (Pass 500V) in accordance with ANSI/ESD STM 5.1 - 2001

MSL TEST FLOW CHART



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.
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

Directional Coupler EDC10-273+

Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +25°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
1000	0.25	24.50	33.54	31.29	24.30	33.87
3000	0.61	15.80	19.55	14.03	18.73	13.82
6000	0.77	11.30	18.77	22.56	23.44	22.04
6500	0.81	10.94	20.42	25.32	27.54	24.57
7000	0.84	10.63	20.71	38.48	28.82	33.30
7500	0.89	10.38	19.18	31.27	24.24	31.46
8000	0.94	10.17	17.16	29.87	20.65	37.01
8500	1.03	10.03	15.51	24.67	18.49	25.62
9000	1.15	9.99	14.50	17.34	17.31	16.71
9500	1.33	10.07	13.91	13.19	16.68	12.45
10000	1.47	10.17	13.76	11.26	16.10	10.46
10500	1.50	10.19	14.10	10.94	15.37	10.11
11000	1.42	10.13	14.77	12.16	14.86	11.41
11500	1.28	9.98	15.97	15.41	15.10	15.01
12000	1.16	9.85	17.98	22.28	16.68	24.01
12500	1.14	9.81	20.01	28.84	20.26	31.98
13000	1.16	9.87	19.59	30.57	23.03	22.86
13500	1.22	10.06	16.86	19.28	18.26	16.57
14000	1.38	10.40	14.25	13.32	14.62	12.14
14500	1.47	10.63	12.59	11.74	12.37	10.91
15000	1.37	10.56	12.04	14.68	11.41	13.89
15500	1.30	10.40	12.42	22.21	11.71	19.55
16000	1.48	10.50	13.95	13.27	13.90	11.90
16500	1.66	10.72	16.69	10.45	18.02	9.23
17000	1.52	10.88	21.84	11.72	19.78	10.52
17500	1.25	10.95	22.48	19.25	17.52	17.24
18000	1.19	11.11	16.56	21.51	17.14	19.95
18500	1.28	11.14	13.04	15.91	19.26	14.68
19000	1.29	10.95	11.27	19.97	26.00	16.50
19500	1.36	10.90	10.67	21.57	28.21	15.77
20000	1.63	11.27	10.87	11.95	18.70	10.20
21000	1.59	11.92	14.31	10.31	10.44	9.57
22000	1.31	11.63	17.57	17.42	9.32	17.18
23000	1.58	10.62	10.42	12.76	18.59	11.34
24000	1.76	10.35	8.05	12.19	16.37	11.73
25000	1.85	10.54	9.33	10.10	11.54	9.75
26000	1.64	9.34	13.31	29.10	24.55	21.47
26500	1.78	9.08	12.21	18.07	17.59	19.32

Typical Performance Data

TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = -40°C

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
1000	0.19	24.49	34.44	32.29	24.28	34.63
3000	0.50	15.74	19.49	13.86	18.85	13.72
6000	0.60	11.16	18.86	22.22	22.65	21.80
6500	0.62	10.79	20.95	25.25	26.36	24.41
7000	0.64	10.47	21.18	37.39	27.60	35.14
7500	0.68	10.20	19.35	32.13	23.88	35.57
8000	0.72	9.99	17.53	29.95	20.74	48.73
8500	0.80	9.84	16.13	24.20	18.62	25.38
9000	0.90	9.77	15.08	18.11	17.30	17.75
9500	1.06	9.81	14.22	13.64	16.53	12.98
10000	1.24	9.93	13.73	11.00	15.91	10.18
10500	1.31	9.99	13.88	10.17	15.12	9.34
11000	1.21	9.91	14.54	11.21	14.46	10.47
11500	1.03	9.73	15.84	14.36	14.55	13.95
12000	0.90	9.59	17.82	20.51	15.88	21.92
12500	0.85	9.53	19.92	26.40	19.31	32.42
13000	0.86	9.56	20.16	29.31	23.23	23.13
13500	0.90	9.73	17.58	19.98	18.45	17.03
14000	1.06	10.07	14.53	13.08	14.44	11.99
14500	1.20	10.36	12.44	10.79	12.03	10.11
15000	1.09	10.30	11.70	13.05	10.71	12.49
15500	0.96	10.09	12.03	21.30	11.06	20.21
16000	1.11	10.14	13.48	13.48	13.21	12.33
16500	1.26	10.33	16.19	10.49	17.66	9.40
17000	1.11	10.47	20.68	11.62	21.35	10.63
17500	0.87	10.54	22.96	17.65	18.70	16.70
18000	0.78	10.68	17.56	23.18	17.27	24.80
18500	0.85	10.75	13.40	15.94	18.14	15.47
19000	0.88	10.61	10.99	17.16	22.02	16.10
19500	0.93	10.46	10.07	22.57	27.37	17.60
20000	1.21	10.79	10.36	11.76	19.46	10.24
21000	1.18	11.49	14.24	9.85	10.52	8.91
22000	0.80	11.21	17.34	19.43	8.96	19.50
23000	1.07	10.31	10.81	11.84	15.13	11.16
24000	1.22	9.82	7.44	12.48	16.97	13.91
25000	1.42	10.25	8.80	8.93	10.41	8.59
26000	1.09	8.94	13.23	26.38	23.57	21.61
26500	1.21	8.67	11.40	18.01	17.80	21.36

Directional Coupler EDC10-273+

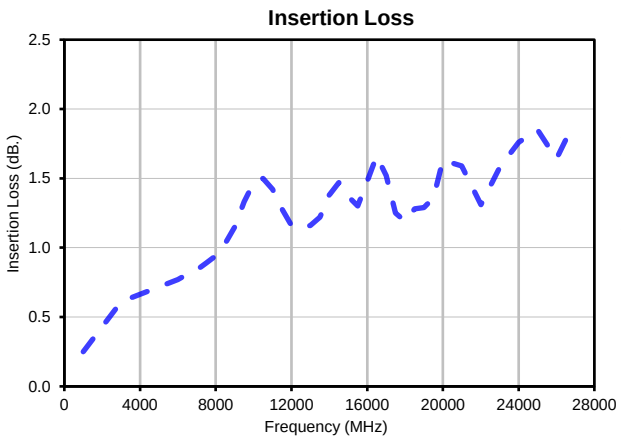
Typical Performance Data

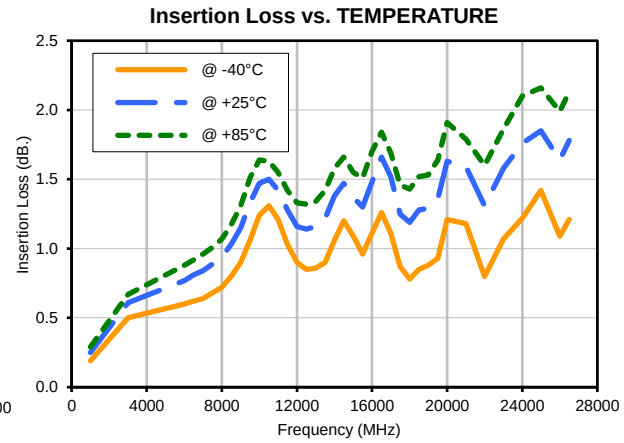
TEST CONDITIONS: INPUT POWER =0 dBm @Temperature = +85°C

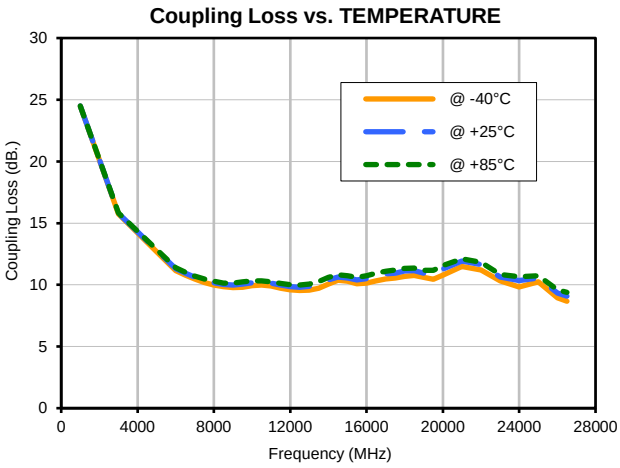
FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
				IN	OUT	CPL
1000	0.29	24.49	32.27	30.91	24.46	33.27
3000	0.67	15.81	19.77	14.36	18.91	14.15
6000	0.88	11.38	18.64	22.21	23.92	21.73
6500	0.92	11.02	20.23	24.89	28.60	24.12
7000	0.96	10.72	20.61	36.63	30.02	32.22
7500	1.01	10.48	19.24	31.95	24.79	32.01
8000	1.07	10.28	17.16	29.90	20.91	35.47
8500	1.17	10.14	15.36	24.86	18.51	25.74
9000	1.31	10.13	14.23	17.00	17.19	16.43
9500	1.51	10.23	13.65	12.81	16.54	12.17
10000	1.64	10.33	13.60	11.18	16.02	10.45
10500	1.63	10.32	14.12	11.27	15.42	10.48
11000	1.55	10.24	14.92	12.81	15.12	12.11
11500	1.42	10.12	16.14	16.19	15.58	15.86
12000	1.33	10.01	18.01	23.05	17.17	25.14
12500	1.32	9.99	19.87	29.51	20.55	31.10
13000	1.34	10.05	19.21	31.82	22.97	22.70
13500	1.42	10.26	16.46	18.94	18.22	16.37
14000	1.58	10.61	13.91	13.15	14.62	12.07
14500	1.66	10.82	12.37	11.96	12.44	11.22
15000	1.55	10.73	12.02	15.74	11.57	15.04
15500	1.51	10.60	12.66	20.98	12.17	19.26
16000	1.70	10.73	14.41	13.06	14.73	11.84
16500	1.84	10.93	17.36	10.98	19.01	9.76
17000	1.69	11.09	22.16	12.77	19.80	11.50
17500	1.46	11.19	21.38	20.92	17.63	18.75
18000	1.43	11.34	16.16	21.16	17.49	19.98
18500	1.52	11.36	12.89	16.36	19.88	15.17
19000	1.53	11.18	11.21	20.94	27.50	17.32
19500	1.64	11.17	10.71	20.18	27.25	15.60
20000	1.91	11.57	11.14	11.84	18.09	10.24
21000	1.79	12.12	15.04	11.44	10.53	10.56
22000	1.60	11.81	16.83	17.24	9.96	16.51
23000	1.86	10.83	10.53	13.69	19.78	12.08
24000	2.10	10.66	8.17	11.95	16.07	11.65
25000	2.16	10.74	9.64	10.75	11.78	10.26
26000	1.99	9.59	13.21	27.41	30.65	22.34
26500	2.13	9.39	11.88	17.82	15.80	22.06

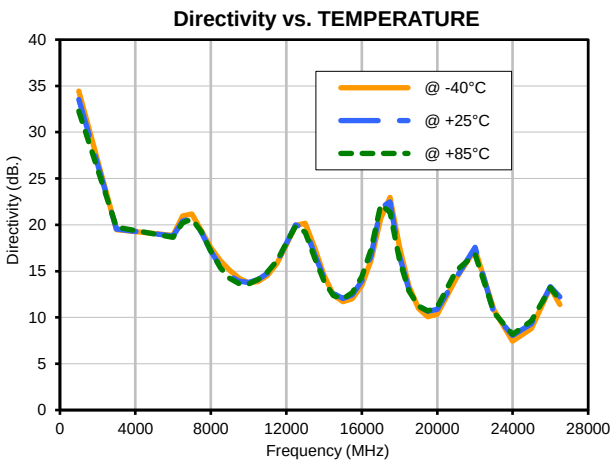
Directional Coupler EDC10-273+

Typical Performance Curves

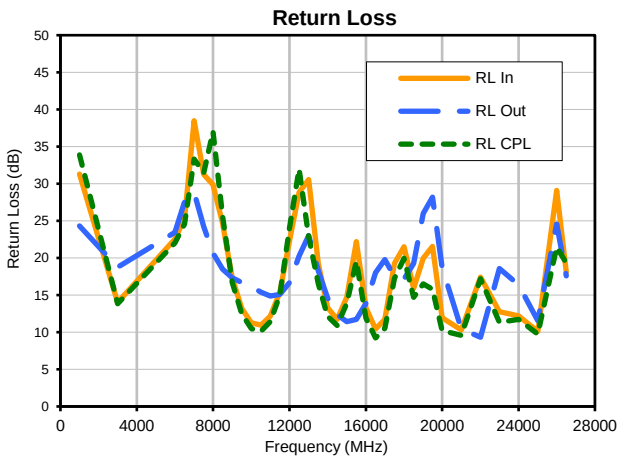


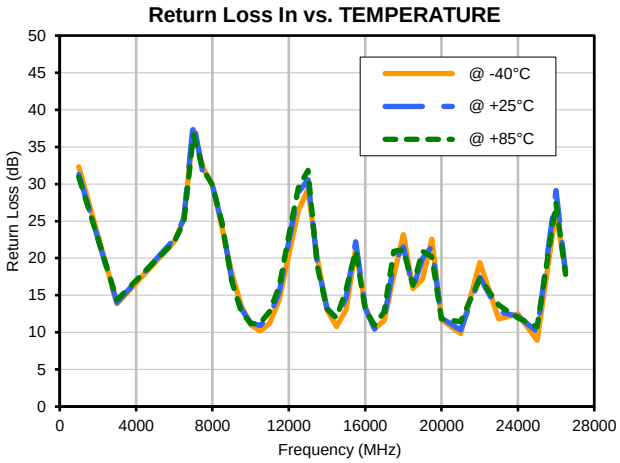


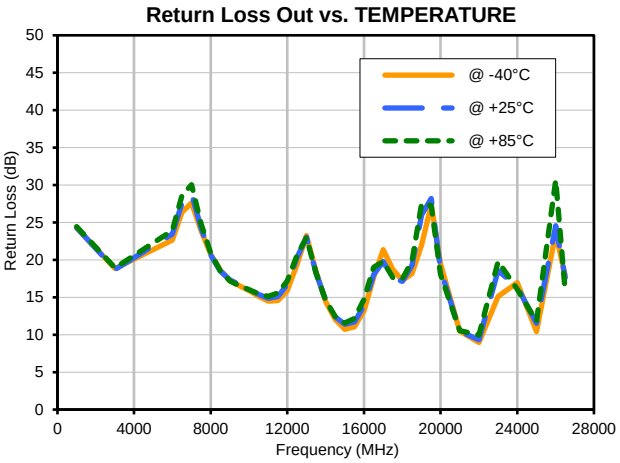


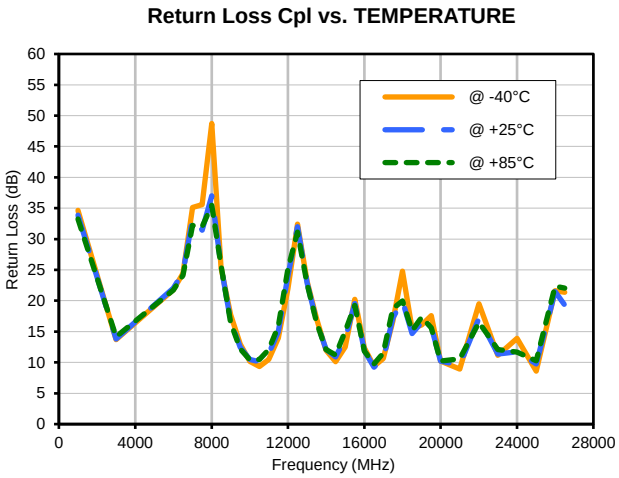


Typical Performance Curves





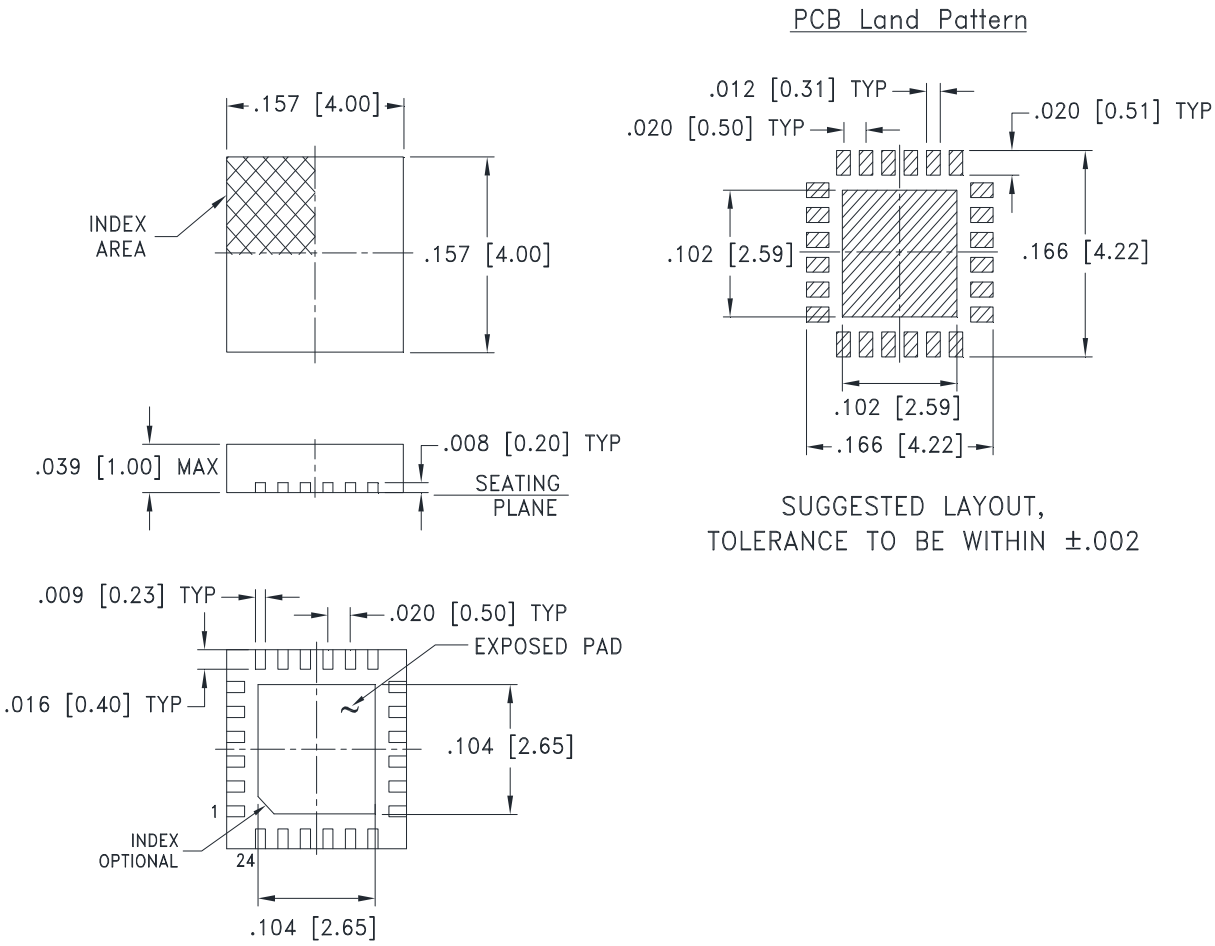




Case Style DG

DG1847

Outline Dimensions



Weight: .04 Grams

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

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

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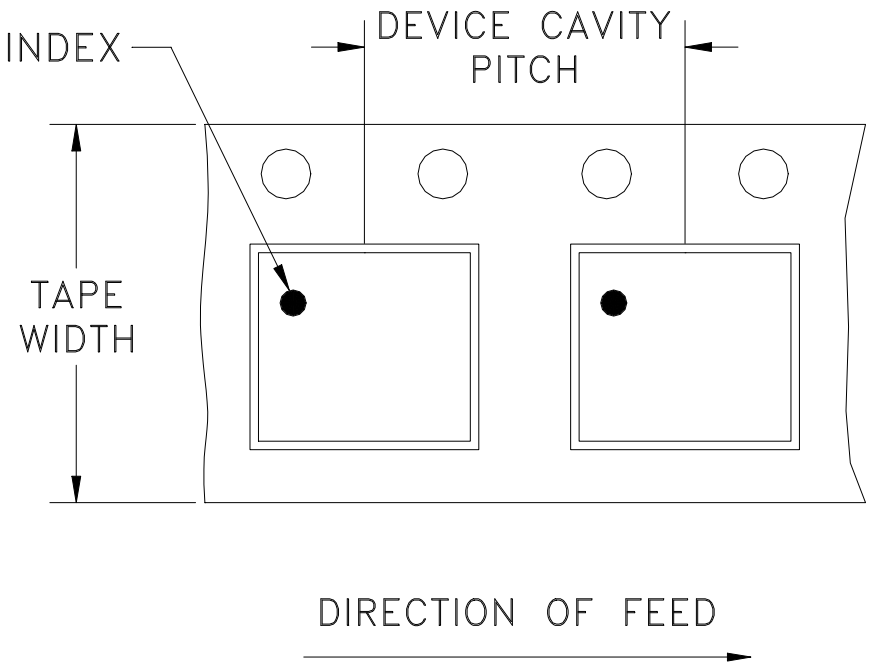
Tape & Reel Packaging TR-F68

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

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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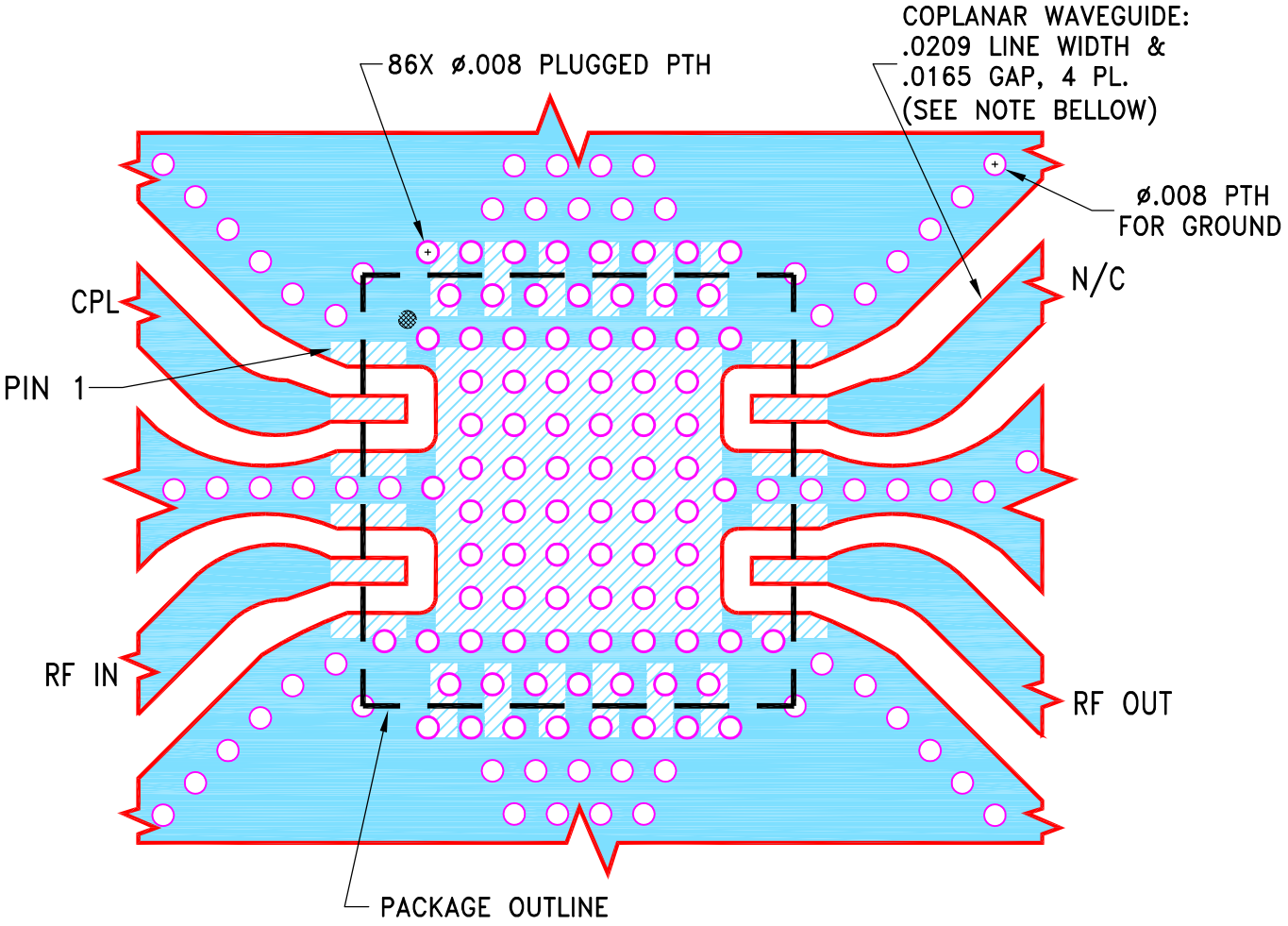
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
0R	M171265	NEW RELEASE	12/05/18	ITG	JG

SUGGESTED MOUNTING CONFIGURATION
FOR DG1847 CASE STYLE, "24DC04" PIN CODE



NOTES:

1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"±.001". COPPER: 1 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. UNIT LAND PATTERN WAS OPTIMIZED FOR BETTER PERFORMANCE.

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	11/30/18
TOLERANCES ON:	CHECKED	GF	12/05/18
2 PL DECIMALS ±	APPROVED	JG	12/05/18
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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ASHEETA1.DWG REV:A DATE:01/12/95

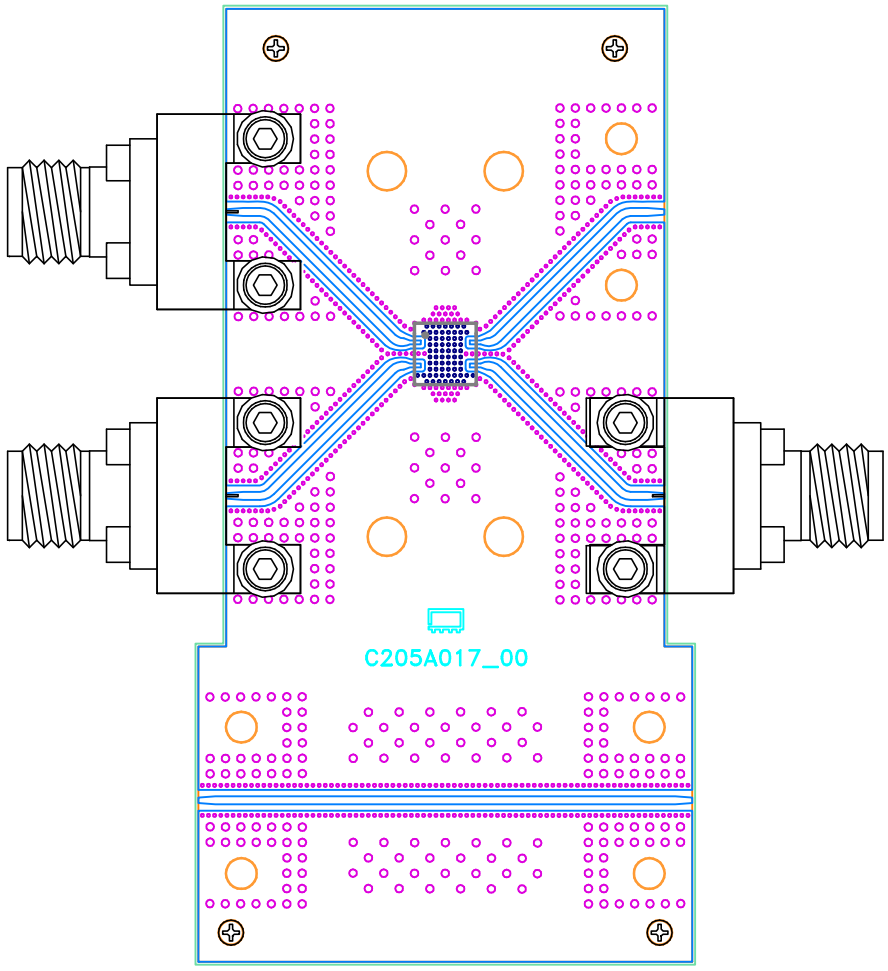
Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

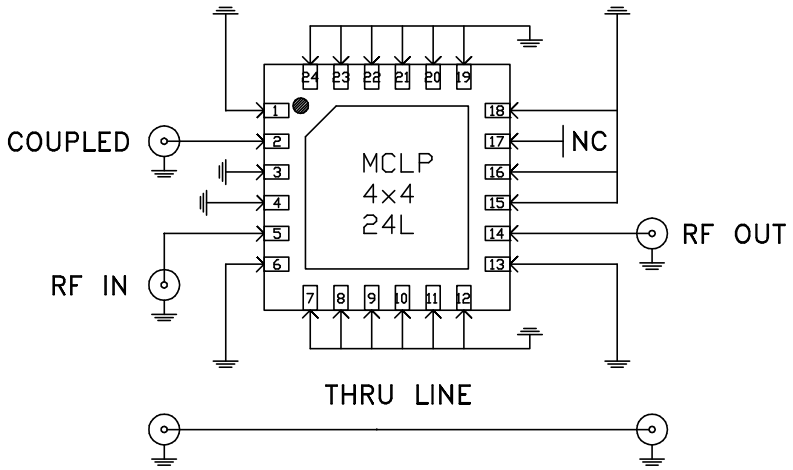
PL, 24DC04, DG1847, TB-EDC10-183+/273+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-614	0R

FILE:	SCALE:	SHEET:
98PL614	15:1	1 OF 1

Evaluation Board and Circuit





Schematic Diagram

Function	Pad
COUPLED	2
RF IN	5
RF OUT	14
GND	1,3,4,6,7,8,9,10,11, 12,13,15,16,18,19, 20,21,22,23,24
NC	17

NOTES:

1. 2.92 mm Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

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Environmental Specifications **ENV08T2**

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	-45° to 85°C or -40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C 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
	monoethanolamine at 63°C to 70°C	

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