

Surface Mount Directional Coupler

50Ω 2300 to 2600 MHz

D17I+



CASE STYLE: CA531-1

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Permanent damage may occur if any of these limits are exceeded.	

Pin Connections

INPUT	4
OUTPUT	6
COUPLED	3
GROUND	1,2,5

Features

- low mainline loss, 0.3 dB typ.
- excellent VSWR, 1.2:1 typ.
- excellent repeatability
- miniature low profile package
- aqueous washable

Applications

- WLAN
- WiMAX
- Aeronautical

Not Recommended For New Designs
Recommended Replacement Part:
D17IA+

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

Available Tape and Reel at no extra cost	
Reel Size	Devices/Reel
7"	20, 50, 100, 200, 500, 1000

Directional Coupler Electrical Specifications

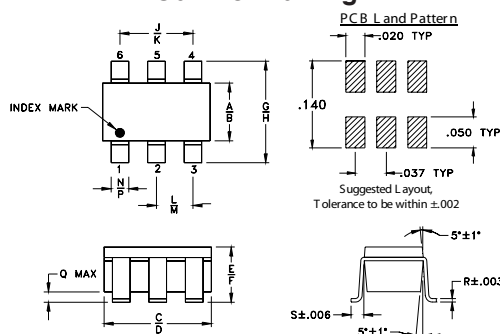
FREQ. RANGE (MHz)	COUPLING (dB)	MAINLINE LOSS ¹ (dB)		DIRECTIVITY (dB)		VSWR (:1)	POWER INPUT ² (W)
		Typ.	Max.	Typ.	Min.		
2300-2600	18.2±1.3	0.5	0.8	14	9	1.3	1.0

1. Mainline loss includes theoretical power loss at coupled port.
2. 4W CW when operating with a 2.0:1 maximum VSWR on all ports at 25°C.

Typical Performance Data

Frequency (MHz)	Mainline Loss (dB) In-Out	Coupling (dB) In-Cpl	Directivity (dB)	Return Loss (dB)		
				In	Out	Cpl
2300.00	0.30	18.72	17.37	37.17	37.46	22.94
2400.00	0.32	18.40	17.11	35.65	36.45	22.12
2440.00	0.33	18.28	17.05	36.10	36.80	21.93
2460.00	0.33	18.23	17.08	35.73	37.51	21.74
2480.00	0.33	18.16	17.05	34.79	37.40	21.55
2500.00	0.33	18.10	16.93	34.49	36.89	21.39
2540.00	0.35	17.99	16.76	35.20	36.35	21.20
2560.00	0.35	17.94	16.81	35.68	36.80	21.06
2580.00	0.35	17.88	16.80	35.01	37.11	20.87
2600.00	0.35	17.82	16.70	34.48	36.62	20.68

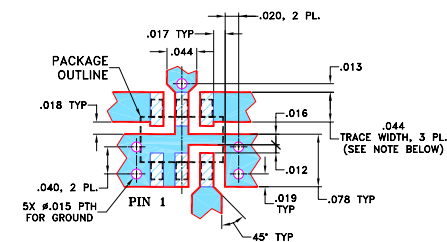
Outline Drawing



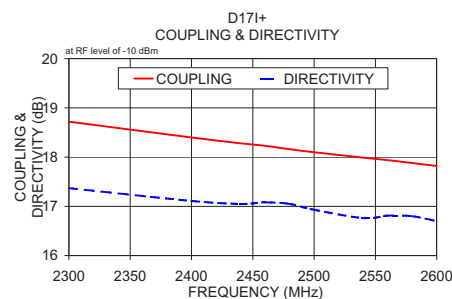
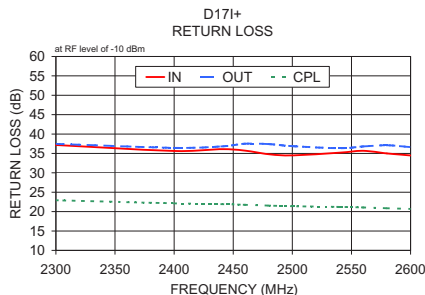
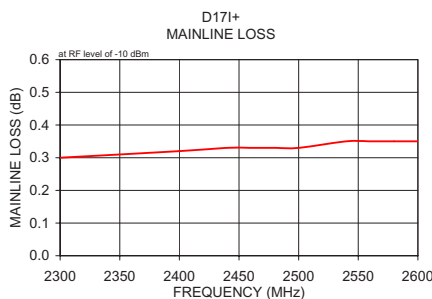
Outline Dimensions (inch mm)

A	B	C	D	E	F	G	H	J
.052	.067	.106	.122	.035	.064	.087	.118	.067
1.32	1.70	2.69	3.10	0.89	1.63	2.21	3.00	1.70
K	L	M	N	P	Q	R	S	wt
.083	.033	.042	.012	.020	.006	.018	.018	grams
2.11	0.84	1.07	0.30	0.51	0.30	0.15	0.46	0.020

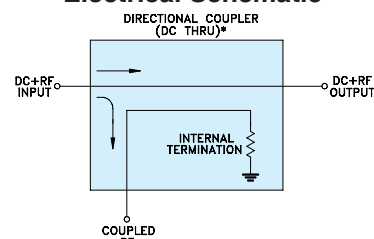
Demo Board MCL P/N: TB-396+ Suggested PCB Layout (PL-270)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. 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



Electrical Schematic



* ELECTRICAL SCHEMATIC FOR DIRECTIONAL COUPLER THAT IS DESIGNED WITHOUT INTERNAL TRANSFORMERS.

ESD Rating
Human Body Model (HBM): Class 1A (250 v to <500 v) in accordance with ANSI/ESD STM 5.1 - 2001
Machine Model (MM): Class M1 (< 100 v) in accordance with ANSI/ESD STM 5.2 - 1999 (pass 50V)

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



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Directional Coupler

D17I+

Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	(dB) OUT	CPL
10	0.07	64.60	16.50	42.14	42.24	33.62
25	0.08	57.47	15.94	41.07	41.22	33.50
50	0.09	51.27	15.58	39.92	39.80	33.33
100	0.10	45.16	15.19	37.85	37.99	33.02
250	0.13	37.30	15.24	35.86	35.78	32.65
500	0.17	31.36	15.23	34.22	34.28	33.59
750	0.19	27.89	15.32	33.56	33.76	35.52
1000	0.21	25.48	15.53	33.60	34.25	36.54
1250	0.24	23.64	15.93	34.56	35.42	34.19
1500	0.26	22.16	16.44	36.48	38.33	30.58
1600	0.27	21.63	16.69	37.27	40.12	29.21
1700	0.29	21.16	16.91	37.77	42.51	28.06
1800	0.30	20.71	17.16	37.98	45.70	26.79
1900	0.30	20.28	17.39	37.83	49.32	25.83
2000	0.31	19.89	17.66	37.49	55.18	24.85
2100	0.33	19.52	17.86	37.13	62.06	23.91
2150	0.33	19.34	17.96	36.78	67.90	23.47
2200	0.33	19.17	18.00	36.71	68.37	23.10
2225	0.34	19.09	18.05	36.55	65.25	22.91
2250	0.34	19.01	18.09	36.48	60.40	22.68
2275	0.34	18.92	18.13	36.37	61.54	22.48
2300	0.35	18.85	18.13	36.12	60.70	22.28
2325	0.35	18.77	18.16	36.01	57.08	22.08
2350	0.35	18.69	18.19	35.99	56.79	21.88
2375	0.35	18.61	18.24	35.82	55.62	21.69
2400	0.36	18.53	18.22	35.63	55.01	21.47
2450	0.36	18.39	18.23	35.55	53.14	21.10
2500	0.37	18.24	18.21	35.36	51.22	20.79
2525	0.37	18.17	18.16	35.20	50.55	20.64
2550	0.38	18.10	18.14	35.10	49.33	20.47
2575	0.37	18.03	18.12	35.07	48.95	20.29
2600	0.38	17.96	18.10	34.84	47.23	20.07
2625	0.38	17.89	18.04	34.87	46.76	19.86
2650	0.38	17.83	17.99	34.69	45.58	19.64
2675	0.39	17.76	17.98	34.60	45.06	19.49
2700	0.39	17.69	17.92	34.64	44.77	19.35
2750	0.39	17.57	17.73	34.13	43.51	19.09
2800	0.40	17.44	17.59	34.12	42.38	18.76
2900	0.41	17.21	17.18	33.43	41.05	18.06
3000	0.43	16.98	16.76	32.65	39.23	17.44
3100	0.44	16.77	16.25	32.08	37.95	16.88
3200	0.45	16.57	15.71	31.20	36.47	16.25
3300	0.46	16.38	15.14	30.34	35.09	15.66
3400	0.47	16.19	14.62	29.54	34.03	15.15
3500	0.49	16.03	14.04	28.79	33.06	14.54
3750	0.51	15.63	12.64	27.00	30.69	13.25
4000	0.54	15.29	11.34	25.77	28.58	12.05
4500	0.59	14.72	9.29	25.06	27.47	10.05
5000	0.64	14.21	7.82	28.27	31.62	8.56
5500	0.70	13.74	6.80	36.66	27.94	7.52
6000	0.81	13.27	6.28	21.98	19.09	6.78
6500	1.01	12.95	5.99	15.46	13.96	6.21
7000	1.41	13.03	6.16	10.94	10.12	5.70

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Directional Coupler

D17I+

Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	(dB) OUT	CPL
10	0.05	65.46	17.36	45.43	44.89	34.42
25	0.06	57.55	15.22	45.98	42.71	33.81
50	0.06	51.41	16.11	46.37	39.79	32.72
100	0.08	45.26	15.74	38.93	38.60	32.64
250	0.09	37.32	15.74	35.05	35.64	32.62
500	0.11	31.37	15.58	33.34	33.64	33.36
750	0.12	27.89	15.65	32.36	32.58	35.04
1000	0.13	25.45	15.77	31.95	32.58	35.03
1250	0.14	23.60	16.11	32.68	33.14	32.44
1500	0.15	22.10	16.57	35.06	35.64	29.41
1600	0.15	21.57	16.82	36.14	37.43	28.42
1700	0.17	21.08	17.09	36.67	40.01	26.88
1800	0.17	20.62	17.34	36.82	42.29	26.14
1900	0.17	20.21	17.51	39.12	42.36	24.96
2000	0.18	19.80	17.72	37.38	44.87	24.12
2100	0.18	19.43	17.93	38.63	54.60	23.39
2150	0.19	19.24	18.04	37.75	49.23	22.87
2200	0.19	19.07	18.12	36.70	47.03	22.45
2225	0.19	18.98	18.16	36.63	46.53	22.27
2250	0.19	18.90	18.18	37.08	47.02	22.09
2275	0.19	18.82	18.21	37.65	49.55	21.93
2300	0.20	18.74	18.22	37.87	52.48	21.72
2325	0.20	18.66	18.25	37.74	51.02	21.51
2350	0.20	18.58	18.26	37.41	48.67	21.32
2375	0.20	18.50	18.33	36.76	46.13	21.16
2400	0.20	18.42	18.31	36.30	44.67	21.01
2450	0.21	18.27	18.32	37.11	44.96	20.66
2500	0.21	18.12	18.36	38.07	48.71	20.35
2525	0.21	18.05	18.37	37.42	48.29	20.24
2550	0.21	17.98	18.31	36.79	45.89	20.10
2575	0.21	17.90	18.30	36.37	44.31	19.89
2600	0.21	17.84	18.29	36.11	43.37	19.58
2625	0.22	17.77	18.14	36.08	42.89	19.27
2650	0.22	17.71	18.10	35.43	41.00	18.99
2675	0.22	17.64	18.07	34.80	39.29	18.82
2700	0.22	17.57	17.95	34.28	38.26	18.73
2750	0.22	17.44	17.83	33.99	38.24	18.64
2800	0.23	17.31	17.58	34.65	38.66	18.38
2900	0.24	17.07	17.13	34.28	38.05	17.43
3000	0.24	16.84	16.74	33.74	37.28	16.82
3100	0.25	16.62	16.23	35.46	41.27	16.20
3200	0.26	16.42	15.63	33.22	36.94	15.66
3300	0.27	16.24	15.01	30.34	32.69	14.95
3400	0.27	16.04	14.41	29.27	31.99	14.60
3500	0.28	15.88	13.82	27.80	30.02	13.93
3750	0.30	15.47	12.45	26.61	29.30	12.79
4000	0.31	15.11	11.17	25.61	28.25	11.77
4500	0.35	14.51	9.05	24.08	26.35	9.83
5000	0.38	13.94	7.70	27.03	30.89	8.43
5500	0.41	13.44	6.63	35.51	29.24	7.21
6000	0.50	12.98	6.21	21.45	18.56	6.16
6500	0.67	12.73	5.82	15.60	13.95	5.42
7000	1.02	12.70	6.03	10.84	9.69	4.95

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Typical Performance Data

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

FREQUENCY (MHz)	INSERTION LOSS (dB)	COUPLING LOSS (dB)	DIRECTIVITY (dB)	RETURN LOSS		
				IN	(dB) OUT	CPL
10	0.08	65.42	15.25	40.26	40.62	33.04
25	0.09	57.54	15.23	38.60	40.00	33.25
50	0.10	51.11	15.41	37.25	39.66	33.82
100	0.12	45.13	14.93	37.38	38.19	33.44
250	0.16	37.28	14.90	36.20	35.70	32.73
500	0.20	31.32	14.95	34.61	34.64	33.68
750	0.23	27.88	15.08	34.35	34.64	35.95
1000	0.27	25.48	15.32	35.14	35.30	38.05
1250	0.30	23.65	15.73	36.07	36.71	35.76
1500	0.33	22.18	16.28	37.25	38.58	31.77
1600	0.34	21.67	16.54	37.81	39.81	30.31
1700	0.36	21.19	16.76	38.17	41.57	29.03
1800	0.37	20.74	17.03	38.46	42.00	27.63
1900	0.39	20.33	17.24	37.24	44.08	26.59
2000	0.40	19.94	17.47	36.92	45.64	25.52
2100	0.42	19.57	17.68	35.96	47.02	24.41
2150	0.42	19.40	17.74	35.75	48.15	24.04
2200	0.43	19.23	17.79	35.84	46.53	23.63
2225	0.43	19.15	17.84	35.64	46.73	23.40
2250	0.44	19.07	17.87	35.35	47.19	23.16
2275	0.44	18.99	17.89	35.05	47.21	22.95
2300	0.45	18.90	17.94	34.76	47.82	22.75
2325	0.45	18.83	17.94	34.71	48.23	22.51
2350	0.45	18.75	17.94	34.76	47.14	22.31
2375	0.45	18.68	17.96	34.62	47.21	22.07
2400	0.46	18.60	17.95	34.42	46.42	21.85
2450	0.46	18.45	17.93	34.24	44.90	21.49
2500	0.48	18.31	17.94	33.85	44.90	21.19
2525	0.48	18.24	17.92	33.59	44.37	21.01
2550	0.48	18.17	17.87	33.47	43.50	20.81
2575	0.48	18.11	17.85	33.38	43.55	20.61
2600	0.49	18.04	17.87	33.13	43.08	20.38
2625	0.49	17.97	17.78	33.15	43.16	20.17
2650	0.50	17.91	17.75	33.04	42.49	19.96
2675	0.50	17.84	17.73	32.94	42.62	19.79
2700	0.50	17.78	17.64	33.04	42.70	19.66
2750	0.51	17.65	17.53	32.37	40.83	19.38
2800	0.52	17.53	17.40	32.26	40.68	19.02
2900	0.53	17.30	17.03	31.59	38.61	18.31
3000	0.55	17.07	16.67	30.77	37.34	17.68
3100	0.56	16.86	16.15	30.29	35.96	17.15
3200	0.58	16.67	15.65	29.57	35.17	16.47
3300	0.59	16.47	15.17	29.59	35.83	15.92
3400	0.60	16.29	14.69	29.42	35.73	15.33
3500	0.62	16.12	14.17	29.00	35.65	14.75
3750	0.65	15.74	12.85	27.79	33.07	13.43
4000	0.69	15.40	11.52	27.17	31.08	12.23
4500	0.76	14.83	9.55	27.78	31.04	10.22
5000	0.83	14.37	7.99	31.70	35.50	8.74
5500	0.91	13.93	6.92	37.63	27.31	7.76
6000	1.03	13.50	6.30	22.68	19.72	7.19
6500	1.25	13.19	6.00	15.72	14.29	6.77
7000	1.66	13.25	6.29	10.88	10.28	6.34

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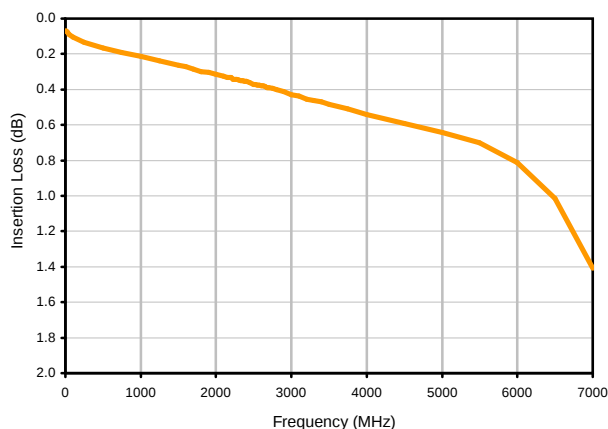


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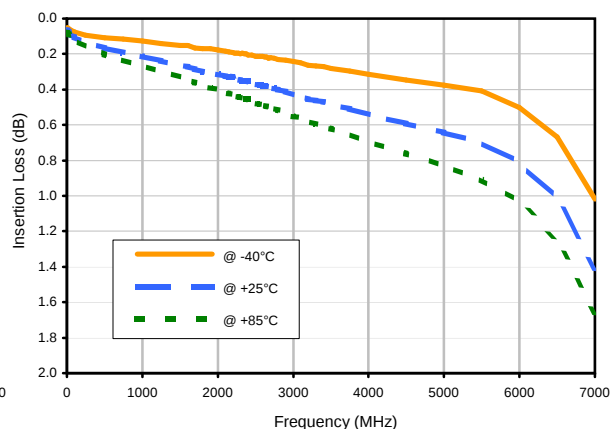
Typical Performance Curves

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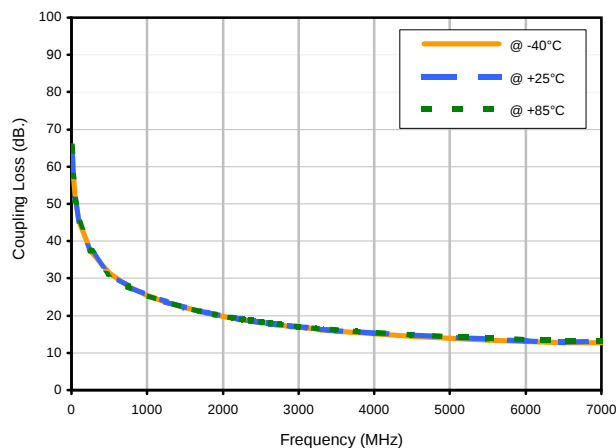
Insertion Loss



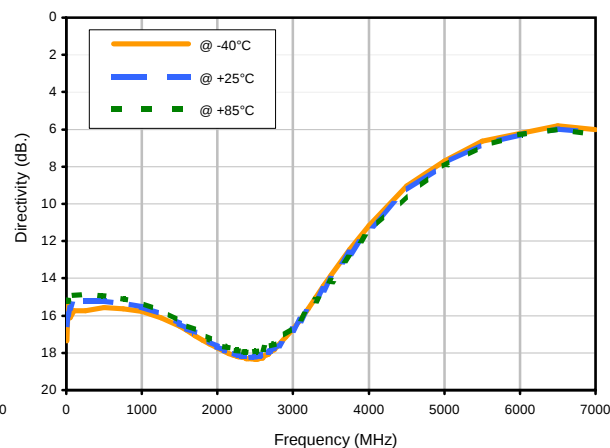
Insertion Loss vs. TEMPERATURE



Coupling Loss vs. TEMPERATURE



Directivity vs. TEMPERATURE



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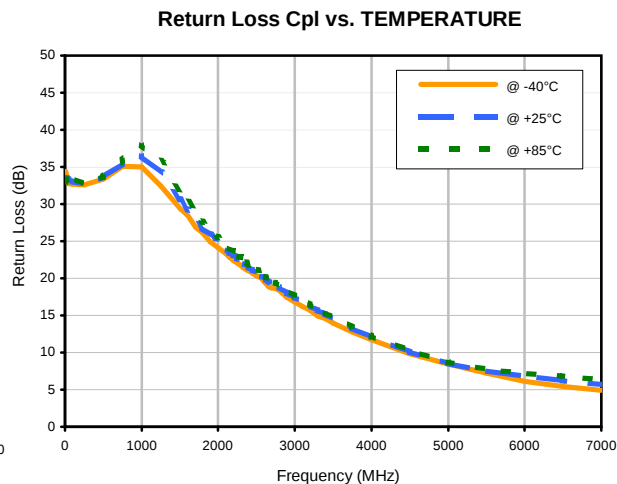
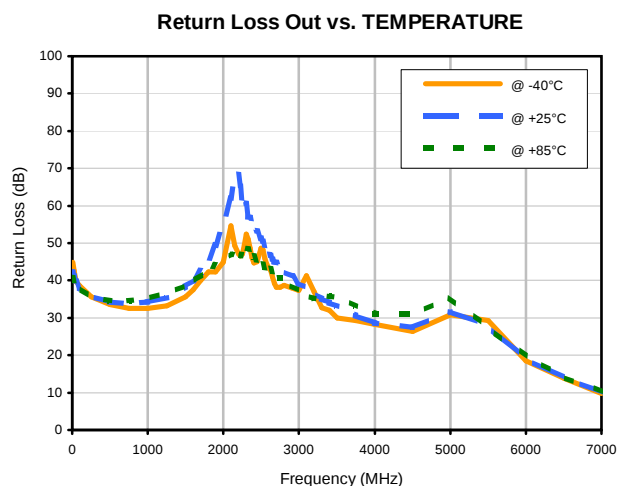
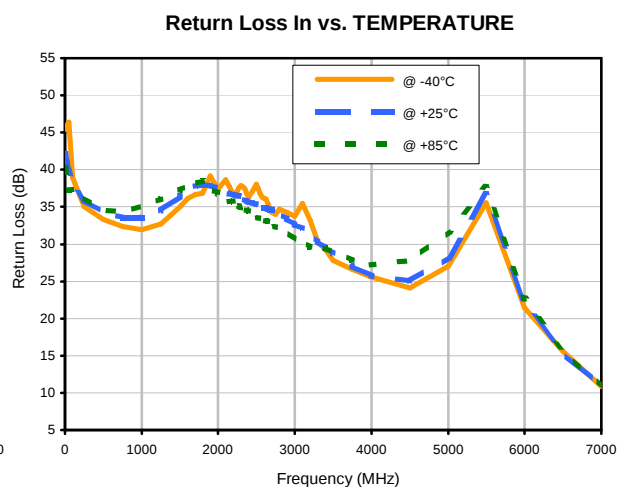
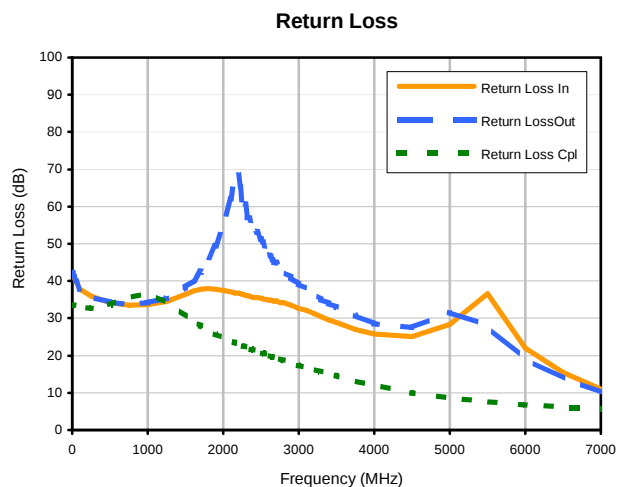
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Typical Performance Curves

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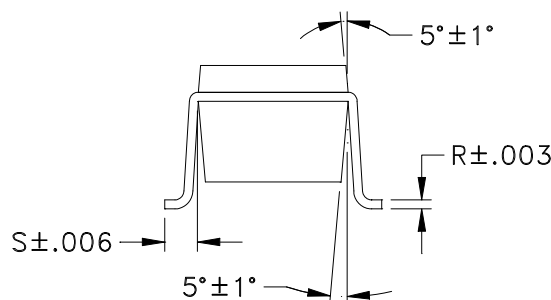
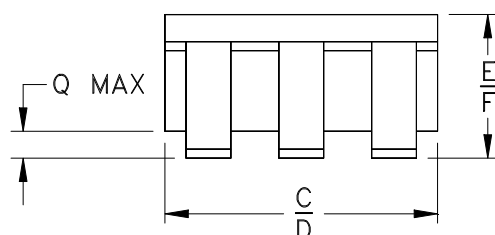
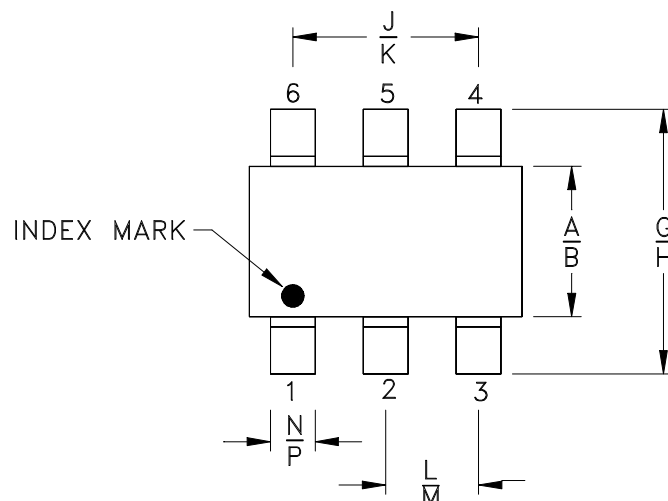
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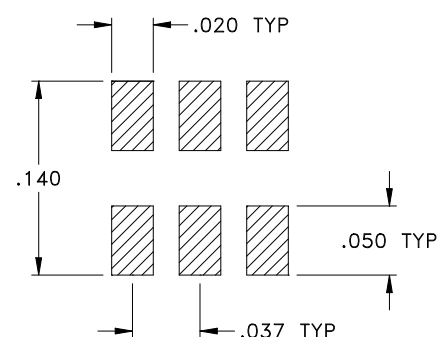
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Outline Dimensions



PCB Land Pattern



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

CASE #	A	B	C	D	E	F	G	H	J	K
CA531-1	.052 (1.32)	.067 (1.70)	.106 (2.69)	.122 (3.10)	.035 (0.89)	.064 (1.63)	.087 (2.21)	.118 (3.00)	.067 (1.70)	.083 (2.11)

CASE #	L	M	N	P	Q	R	S	WT. GRAM
CA531-1	.033 (0.84)	.042 (1.07)	.012 (0.30)	.020 (0.51)	.012 (0.30)	.006 (0.15)	.018 (0.46)	.020

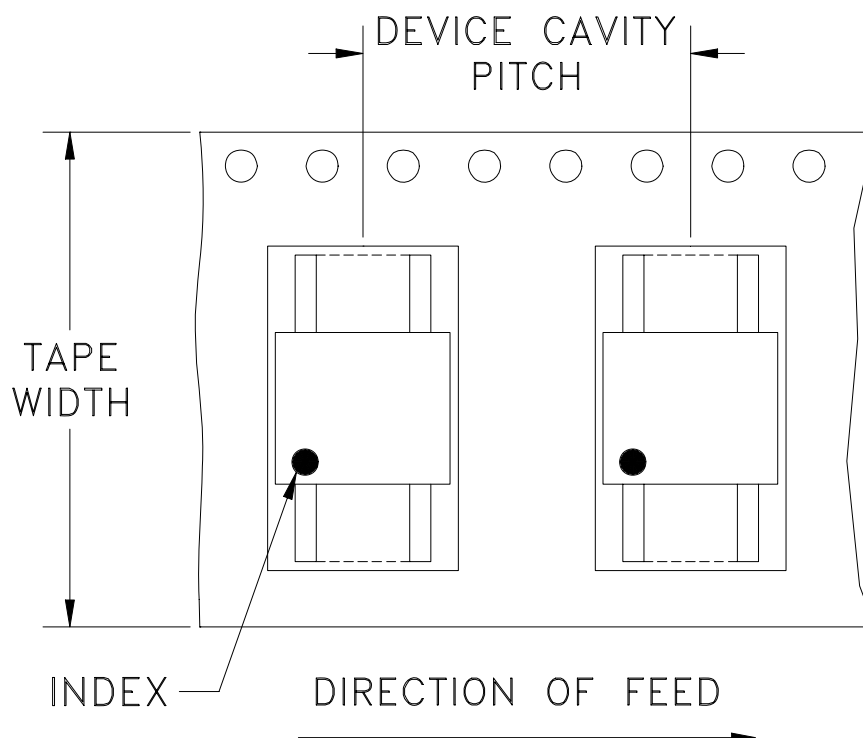
Dimensions are in inches (mm). Tolerances: 2Pl. $\pm .01$; 3Pl. $\pm .005$

Notes:

- Case material: Plastic.
- Termination finish:
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

Tape & Reel Packaging TR-F31

DEVICE ORIENTATION IN T&R



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

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

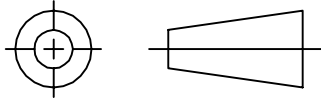
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

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



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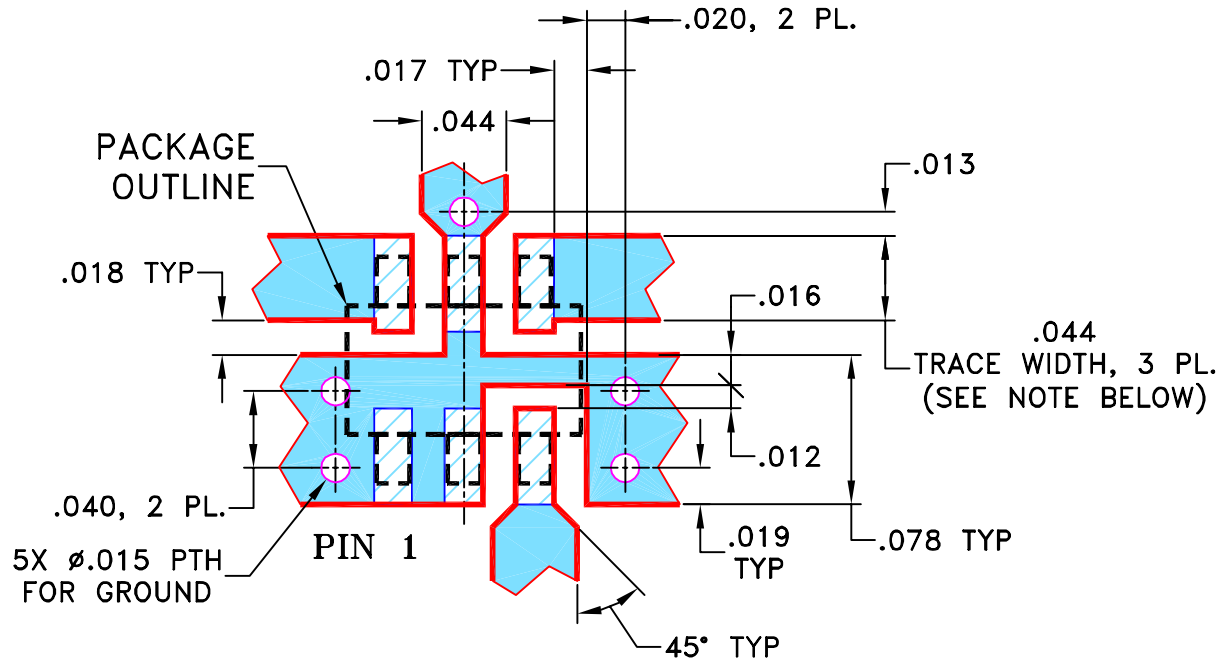
THIRD ANGLE PROJECTION



REVISIONS

REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M110291	NEW RELEASE	03/20/07	AV	WP

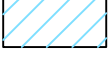
SUGGESTED MOUNTING CONFIGURATION FOR CA531 CASE STYLE, "jn" PIN CONNECTION



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS 0.020" $\pm$ 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

2. 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

TOLERANCES ON:

2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$

DRAWN

AV

03/07/07

CHECKED

IL

03/20/07

APPROVED

WP

03/20/07



Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, jn, CA531, D20C+, TB-396+

SIZE
ACODE IDENT
15542DRAWING NO:
98-PL-270REV:
OR

FILE: 98PL270

SCALE: 10:1

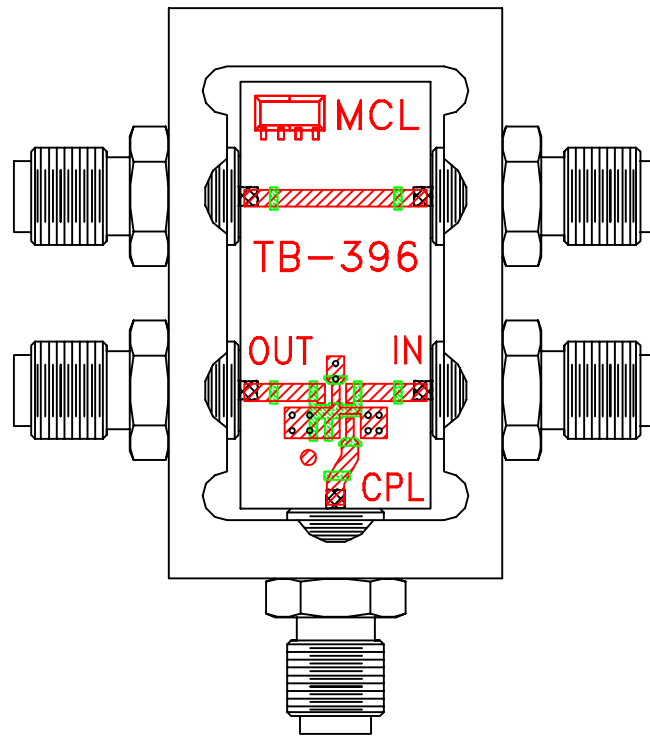
SHEET: 1 OF 1

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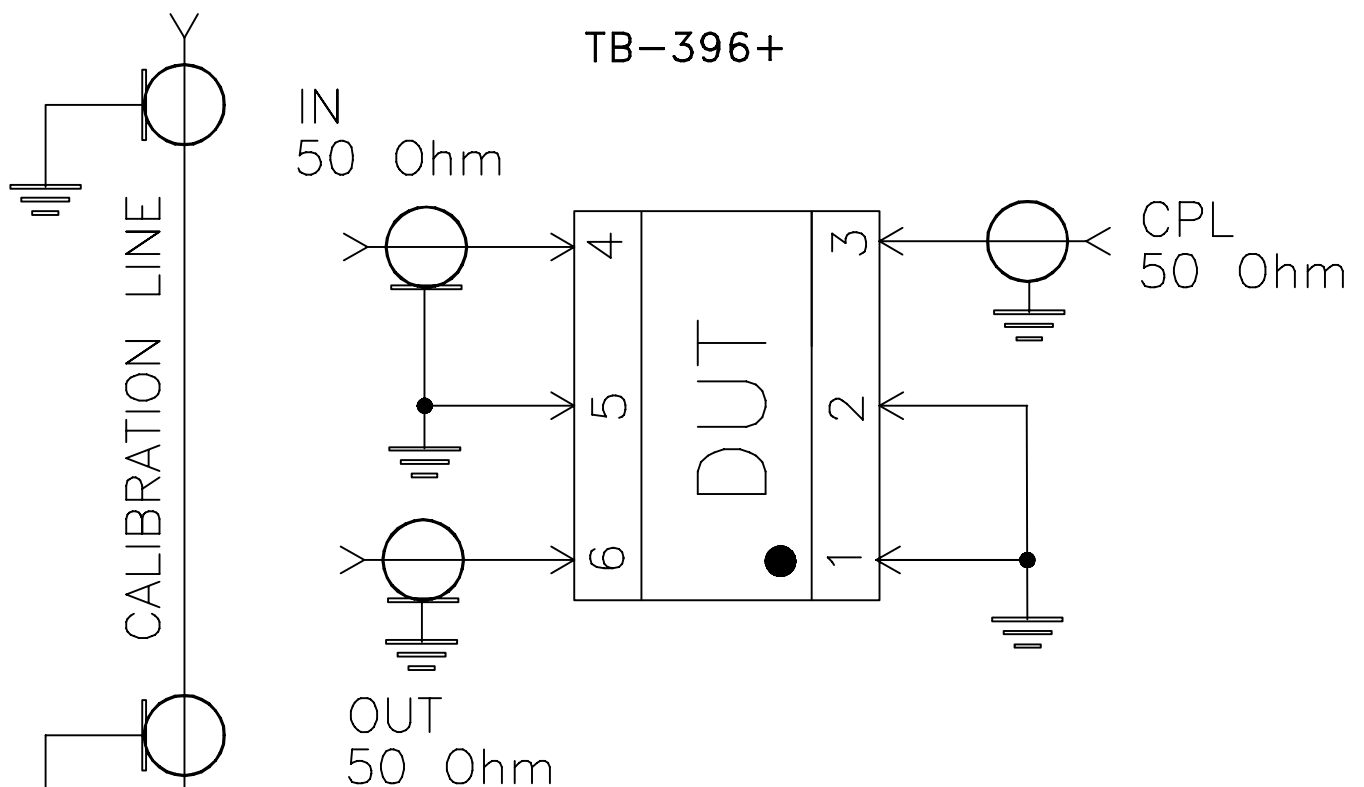
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ASHEETA1.DWG REV:A DATE:01/12/95

Evaluation Board and Circuit



TB-396+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers R04350B or its equivalent, Dielectric Constant=3.5, Thickness=.020"

 **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	-65° to 150° C Ambient Environment	Individual Model Data Sheet
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
Temperature Cycling	-65° to 150°C, 100 cycles	JESD22-A104
Temperature Humidity	85°C/ 85% RH, 168 hours	JESD22-113
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 240°C peak (Non-RoHS) or 260°C (RoHS)	J-STD-020
Solderability	10X magnification, 95% coverage	JESD22-B102, Method 1: Dip and Look Test
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
Vibration (High Frequency)	20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)	MIL-STD-202, Method 204, Condition D