Surface Mount

Directional Coupler

50Ω 810 to 960 MHz

D20C+

Generic photo used for illustration purposes only

CASE STYLE: CA531

+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

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

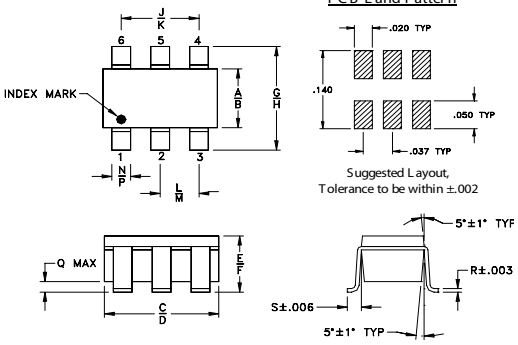
Features

- low mainline loss, 0.3 dB typ.
- excellent VSWR, 1.1:1 typ.
- excellent repeatability
- miniature low profile package
- aqueous washable

Applications

- cellular
- PCS

Outline Drawing

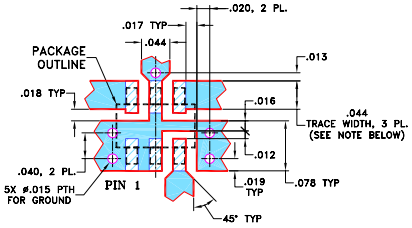


Outline Dimensions (inch / mm)

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	.012	.006	.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

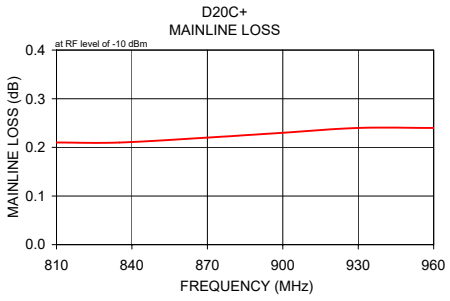
Directional Coupler Electrical Specifications

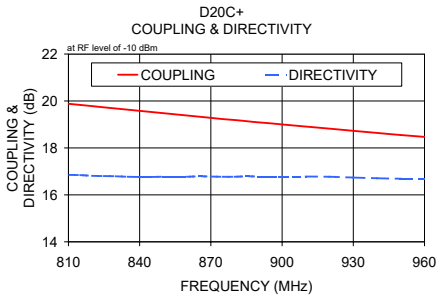
FREQ. RANGE (MHz)	COUPLING (dB)	MAINLINE LOSS[1] (dB)		DIRECTIVITY (dB)		VSWR (:1)	POWER INPUT[2] (W)
		Typ.	Max.	Typ.	Min.	Typ.	Max.
810-960	19.4±1.4	0.3	0.5	15	7	1.1	1.0

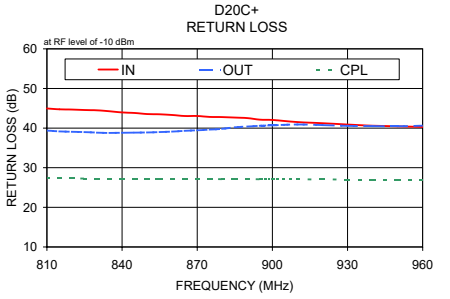
1. Mainline loss includes theoretical power loss at coupled port.
2. 4W CW when operating with a 2.0:1 maximum VSWR on all ports at 25°C.

Typical Performance Data

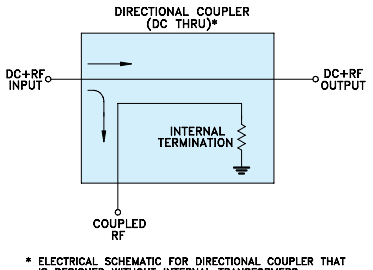
Frequency (MHz)	Mainline Loss (dB) In-Out	Coupling (dB) In-Cpl	Directivity (dB)	Return Loss (dB) In	Return Loss (dB) Out	Return Loss (dB) Cpl
810.00	0.21	19.88	16.85	44.95	39.39	27.31
820.00	0.21	19.78	16.81	44.68	39.07	27.28
835.00	0.21	19.63	16.77	44.25	38.78	27.23
850.00	0.21	19.48	16.77	43.54	38.90	27.18
860.00	0.22	19.38	16.77	43.31	39.11	27.16
875.00	0.22	19.23	16.77	42.82	39.62	27.12
885.00	0.22	19.14	16.79	42.66	40.18	27.11
900.00	0.23	19.00	16.78	42.05	40.70	27.08
930.00	0.24	18.73	16.74	40.89	40.57	27.02
960.00	0.24	18.47	16.69	40.28	40.62	26.90







Electrical Schematic



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

ESD Rating

Human Body Model (HBM): Class 1B (500 v to <1000 v) in accordance with ANSI/ESD STM 5.1 - 2001
Machine Model (MM): Class M3 (200 v to < 400 v) in accordance with ANSI/ESD STM 5.2 - 1999

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 D20C+

Typical Performance Data

TEST CONDITIONS: INPUT POWER = -10dBm @Temperature = +25°C

FREQ. (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	ISOLATION (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
					INPUT	OUTPUT	COUPLED
500	0.10	24.00	40.64	16.64	46.54	41.24	30.80
550	0.11	23.18	39.82	16.64	46.73	42.15	30.60
600	0.12	22.44	39.05	16.61	45.90	40.66	30.47
650	0.13	21.77	38.36	16.58	45.46	40.73	30.48
700	0.14	21.14	37.71	16.58	45.02	40.81	30.21
750	0.15	20.56	37.16	16.59	44.75	39.66	30.30
780	0.15	20.22	36.79	16.57	44.87	40.51	30.05
790	0.15	20.11	36.68	16.57	44.50	40.56	29.97
800	0.16	20.02	36.57	16.56	44.39	40.45	29.91
810	0.16	19.92	36.46	16.54	44.20	40.16	29.88
815	0.15	19.87	36.41	16.54	44.20	40.04	29.87
820	0.16	19.82	36.38	16.56	44.12	39.83	29.88
825	0.16	19.77	36.32	16.55	44.15	39.67	29.87
830	0.16	19.72	36.27	16.55	44.06	39.46	29.89
835	0.16	19.67	36.22	16.55	44.07	39.26	29.90
840	0.16	19.62	36.17	16.55	44.00	39.22	29.91
845	0.17	19.57	36.14	16.57	44.00	39.04	29.92
850	0.17	19.52	36.06	16.53	44.00	38.97	29.91
855	0.17	19.47	36.02	16.55	44.01	38.99	29.90
860	0.17	19.42	35.97	16.55	44.05	39.05	29.88
865	0.18	19.37	35.91	16.54	44.07	39.11	29.85
870	0.17	19.32	35.87	16.55	44.04	39.19	29.83
875	0.17	19.27	35.81	16.54	43.88	39.27	29.78
880	0.17	19.22	35.77	16.55	43.94	39.32	29.74
885	0.17	19.18	35.72	16.54	43.75	39.42	29.71
890	0.17	19.12	35.67	16.55	43.60	39.46	29.66
895	0.17	19.08	35.63	16.55	43.45	39.54	29.62
900	0.17	19.04	35.57	16.54	43.32	39.50	29.57
905	0.17	18.99	35.54	16.55	43.25	39.43	29.55
910	0.18	18.95	35.48	16.53	43.17	39.42	29.50
915	0.18	18.90	35.43	16.52	42.95	39.28	29.50
920	0.18	18.86	35.39	16.53	42.79	39.16	29.48
925	0.18	18.82	35.35	16.53	42.76	39.00	29.47
930	0.18	18.77	35.32	16.55	42.67	38.84	29.47
935	0.18	18.73	35.23	16.50	42.71	38.69	29.49
940	0.18	18.68	35.20	16.52	42.58	38.56	29.47
945	0.18	18.64	35.15	16.51	42.59	38.40	29.48
950	0.19	18.60	35.12	16.52	42.60	38.27	29.47
955	0.19	18.55	35.07	16.52	42.62	38.18	29.48
960	0.19	18.51	35.03	16.52	42.66	38.14	29.48
970	0.19	18.43	34.94	16.51	42.59	38.07	29.47
980	0.19	18.34	34.86	16.52	42.55	38.00	29.42
990	0.19	18.26	34.76	16.49	42.37	38.01	29.34
1000	0.20	18.17	34.66	16.49	42.00	37.91	29.24
1050	0.20	17.78	34.27	16.48	40.63	37.02	29.02
1100	0.21	17.39	33.84	16.45	40.26	36.60	28.90
1150	0.22	17.05	33.47	16.42	38.67	35.79	28.59
1200	0.24	16.69	33.10	16.41	37.57	34.93	28.49
1250	0.24	16.38	32.77	16.39	37.00	34.57	28.12
1300	0.26	16.05	32.41	16.36	35.56	33.57	27.97

Typical Performance Data

TEST CONDITIONS: INPUT POWER = -10dBm @Temperature = -40°C

FREQ. (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	ISOLATION (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
					INPUT	OUTPUT	COUPLED
500	0.07	24.01	41.23	17.22	49.76	44.84	28.51
550	0.08	23.20	40.36	17.16	47.84	45.33	28.44
600	0.08	22.44	39.58	17.13	47.30	42.41	28.35
650	0.09	21.78	38.94	17.16	46.32	42.43	28.21
700	0.10	21.13	38.27	17.13	44.58	42.25	27.92
750	0.11	20.56	37.69	17.12	42.48	40.43	28.11
780	0.11	20.22	37.31	17.09	41.22	40.63	28.05
790	0.11	20.11	37.20	17.09	40.68	40.39	28.03
800	0.11	20.01	37.10	17.09	40.30	40.01	28.04
810	0.11	19.92	36.98	17.06	40.01	39.60	28.09
815	0.11	19.86	36.93	17.07	39.90	39.43	28.13
820	0.11	19.82	36.89	17.07	39.78	39.21	28.19
825	0.12	19.77	36.81	17.04	39.75	39.02	28.23
830	0.12	19.72	36.78	17.06	39.65	38.77	28.28
835	0.12	19.67	36.73	17.06	39.65	38.64	28.32
840	0.12	19.62	36.66	17.04	39.58	38.65	28.37
845	0.12	19.57	36.60	17.03	39.47	38.40	28.41
850	0.12	19.52	36.56	17.04	39.50	38.39	28.44
855	0.13	19.46	36.52	17.06	39.52	38.40	28.47
860	0.13	19.41	36.46	17.05	39.59	38.46	28.49
865	0.13	19.37	36.40	17.04	39.63	38.52	28.49
870	0.13	19.31	36.34	17.03	39.62	38.59	28.48
875	0.13	19.26	36.29	17.03	39.54	38.64	28.46
880	0.13	19.21	36.23	17.02	39.57	38.68	28.45
885	0.13	19.17	36.18	17.02	39.51	38.80	28.45
890	0.12	19.12	36.13	17.01	39.47	38.84	28.42
895	0.13	19.08	36.09	17.02	39.39	38.88	28.41
900	0.13	19.03	36.04	17.01	39.43	38.85	28.40
905	0.12	18.99	36.02	17.04	39.45	38.87	28.39
910	0.13	18.94	35.94	17.00	39.48	38.84	28.37
915	0.13	18.90	35.91	17.01	39.50	38.79	28.38
920	0.13	18.86	35.85	16.99	39.54	38.76	28.40
925	0.14	18.82	35.81	16.99	39.66	38.67	28.40
930	0.13	18.77	35.76	16.99	39.75	38.67	28.41
935	0.14	18.72	35.73	17.01	39.95	38.66	28.46
940	0.14	18.68	35.65	16.98	40.10	38.61	28.46
945	0.14	18.63	35.62	16.99	40.34	38.58	28.48
950	0.14	18.59	35.59	17.01	40.54	38.53	28.50
955	0.14	18.55	35.55	17.00	40.83	38.62	28.52
960	0.14	18.50	35.49	16.99	41.15	38.70	28.51
970	0.14	18.42	35.40	16.98	41.52	38.83	28.50
980	0.15	18.33	35.32	16.98	41.88	38.97	28.43
990	0.15	18.24	35.22	16.97	42.09	39.15	28.34
1000	0.15	18.16	35.15	16.99	42.05	39.21	28.25
1050	0.15	17.77	34.69	16.92	42.25	38.70	28.05
1100	0.16	17.37	34.28	16.91	42.69	38.47	27.96
1150	0.16	17.03	33.90	16.86	40.54	37.25	27.78
1200	0.18	16.67	33.52	16.85	39.13	36.11	27.85
1250	0.18	16.36	33.17	16.80	38.40	35.54	27.54
1300	0.20	16.02	32.79	16.77	37.03	34.48	27.46

Directional Coupler D20C+

Typical Performance Data

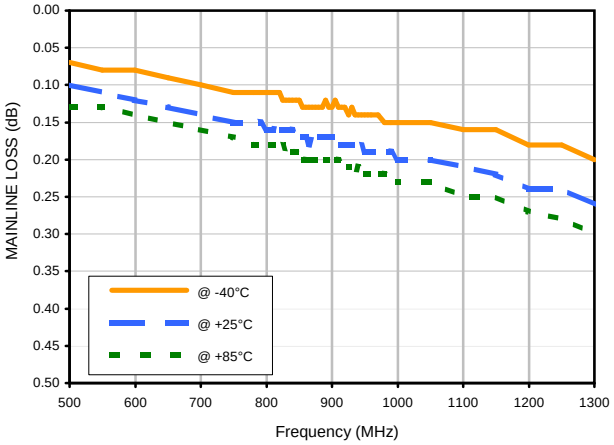
TEST CONDITIONS: INPUT POWER = -10dBm @Temperature = +85°C

FREQ. (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	ISOLATION (dB)	DIRECTIVITY (dB)	RETURN LOSS (dB)		
					INPUT	OUTPUT	COUPLED
500	0.13	23.97	40.13	16.16	35.21	34.16	32.71
550	0.13	23.16	39.34	16.18	36.12	35.15	32.48
600	0.14	22.41	38.61	16.20	36.26	34.77	32.18
650	0.15	21.75	37.96	16.21	36.44	34.96	32.21
700	0.16	21.11	37.34	16.23	36.35	34.83	31.88
750	0.17	20.54	36.79	16.25	36.03	34.14	32.27
780	0.18	20.20	36.44	16.24	36.01	34.40	32.15
790	0.18	20.10	36.33	16.23	35.88	34.32	32.09
800	0.18	19.99	36.25	16.25	35.80	34.22	32.06
810	0.18	19.90	36.16	16.26	35.69	34.05	32.06
815	0.18	19.85	36.08	16.24	35.65	33.98	32.08
820	0.18	19.80	36.03	16.23	35.61	33.85	32.11
825	0.18	19.75	35.99	16.24	35.60	33.78	32.15
830	0.19	19.70	35.96	16.26	35.54	33.68	32.18
835	0.19	19.65	35.89	16.25	35.51	33.57	32.24
840	0.19	19.60	35.84	16.24	35.40	33.50	32.29
845	0.19	19.55	35.80	16.25	35.36	33.43	32.33
850	0.20	19.50	35.74	16.24	35.36	33.42	32.36
855	0.20	19.45	35.70	16.25	35.35	33.40	32.37
860	0.20	19.40	35.65	16.25	35.38	33.44	32.40
865	0.21	19.35	35.58	16.23	35.43	33.48	32.39
870	0.20	19.30	35.53	16.23	35.40	33.51	32.40
875	0.20	19.26	35.48	16.22	35.35	33.56	32.34
880	0.20	19.21	35.43	16.22	35.38	33.58	32.30
885	0.20	19.16	35.39	16.23	35.37	33.64	32.26
890	0.20	19.11	35.34	16.23	35.33	33.64	32.21
895	0.20	19.06	35.31	16.24	35.30	33.67	32.19
900	0.20	19.02	35.27	16.24	35.27	33.65	32.13
905	0.20	18.97	35.23	16.26	35.29	33.63	32.09
910	0.20	18.93	35.19	16.25	35.27	33.63	32.04
915	0.21	18.89	35.12	16.23	35.25	33.56	32.03
920	0.21	18.84	35.07	16.23	35.22	33.54	32.02
925	0.21	18.80	35.03	16.23	35.22	33.45	32.01
930	0.21	18.76	34.98	16.22	35.22	33.42	32.03
935	0.22	18.71	34.94	16.23	35.26	33.38	32.07
940	0.21	18.67	34.89	16.23	35.22	33.34	32.07
945	0.22	18.62	34.84	16.22	35.25	33.26	32.08
950	0.22	18.58	34.80	16.22	35.29	33.22	32.08
955	0.22	18.54	34.75	16.21	35.34	33.25	32.13
960	0.22	18.50	34.71	16.22	35.41	33.26	32.14
970	0.22	18.41	34.63	16.21	35.46	33.31	32.14
980	0.22	18.33	34.54	16.21	35.56	33.36	32.07
990	0.23	18.24	34.45	16.21	35.62	33.45	31.99
1000	0.23	18.16	34.36	16.20	35.61	33.51	31.86
1050	0.23	17.77	33.93	16.16	35.68	33.40	31.51
1100	0.25	17.38	33.54	16.15	36.35	33.71	31.41
1150	0.25	17.04	33.14	16.10	36.18	33.66	30.96
1200	0.27	16.69	32.75	16.06	36.22	33.54	30.92
1250	0.28	16.38	32.42	16.04	36.52	33.83	30.36
1300	0.30	16.05	32.04	15.99	35.94	33.48	30.19

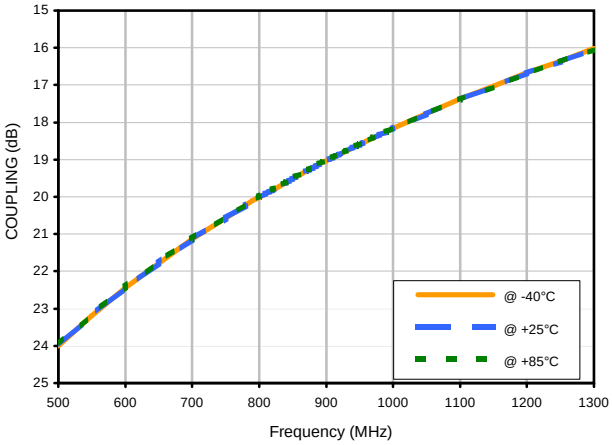
Directional Coupler D20C+

Typical Performance Curves

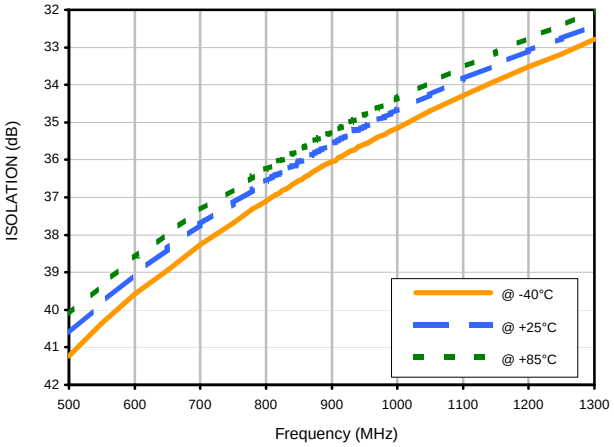
MAINLINE LOSS vs. TEMPERATURE



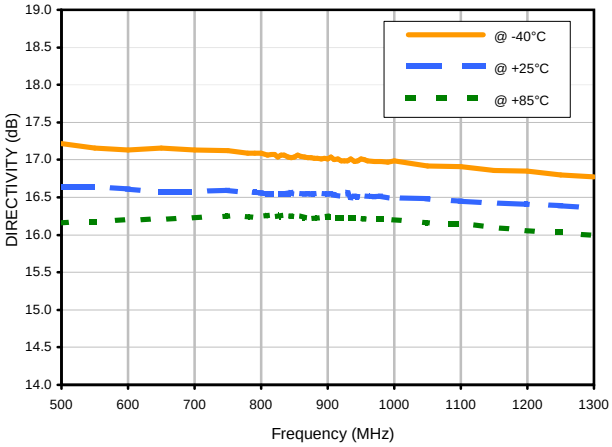
COUPLING vs. TEMPERATURE



ISOLATION vs. TEMPERATURE

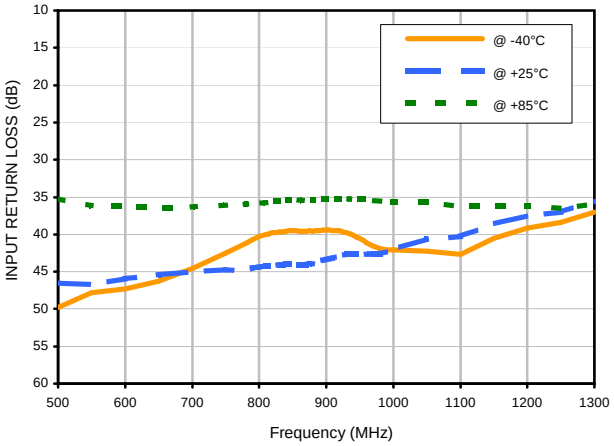


DIRECTIVITY vs. TEMPERATURE

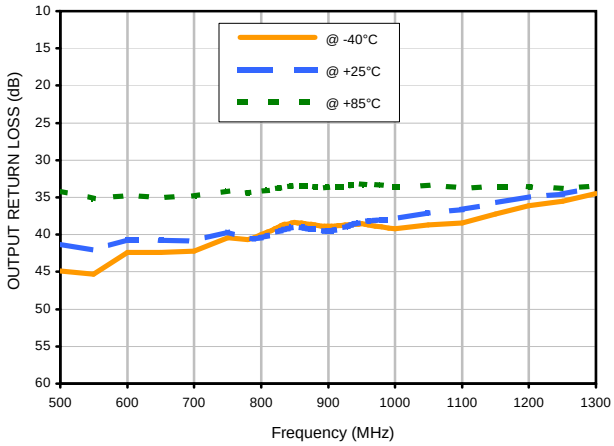


Typical Performance Curves

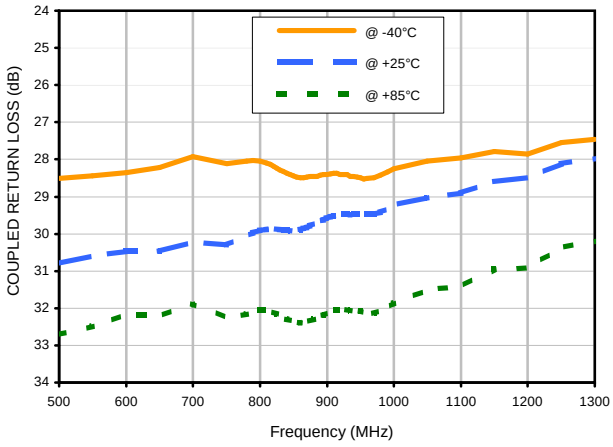
INPUT RETURN LOSS vs. TEMPERATURE



OUTPUT RETURN LOSS vs. TEMPERATURE



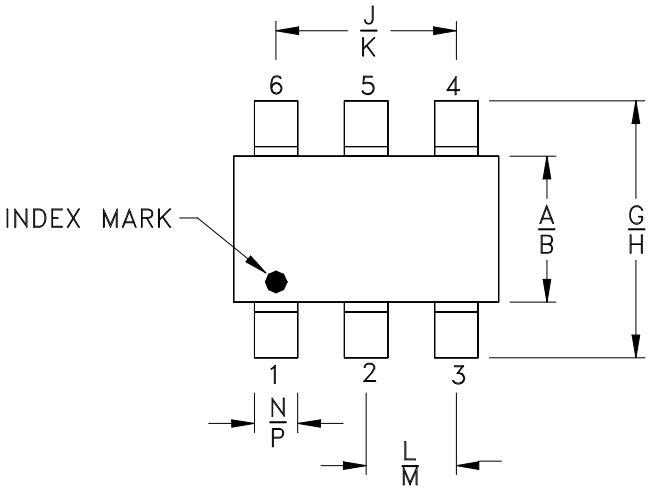
CPL. RETURN LOSS vs. TEMPERATURE



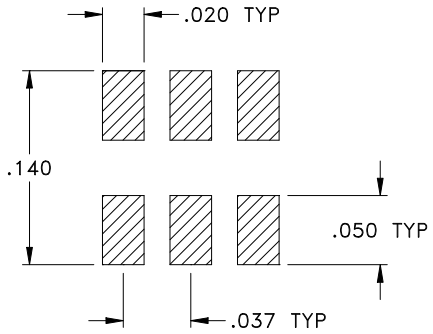
Case Style CA

CA531

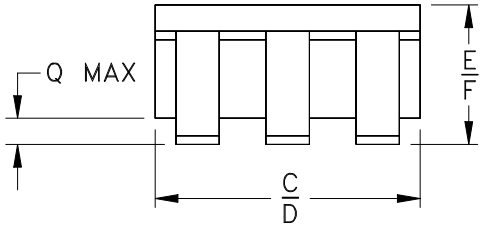
Outline Dimensions

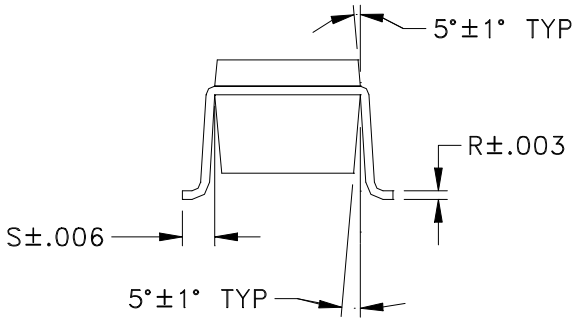


PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002





CASE #	A	B	C	D	E	F	G	H	J	K
CA531	.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	.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. ± .01; 3Pl. ± .005

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier.
   (Unless stated otherwise on Data sheet).

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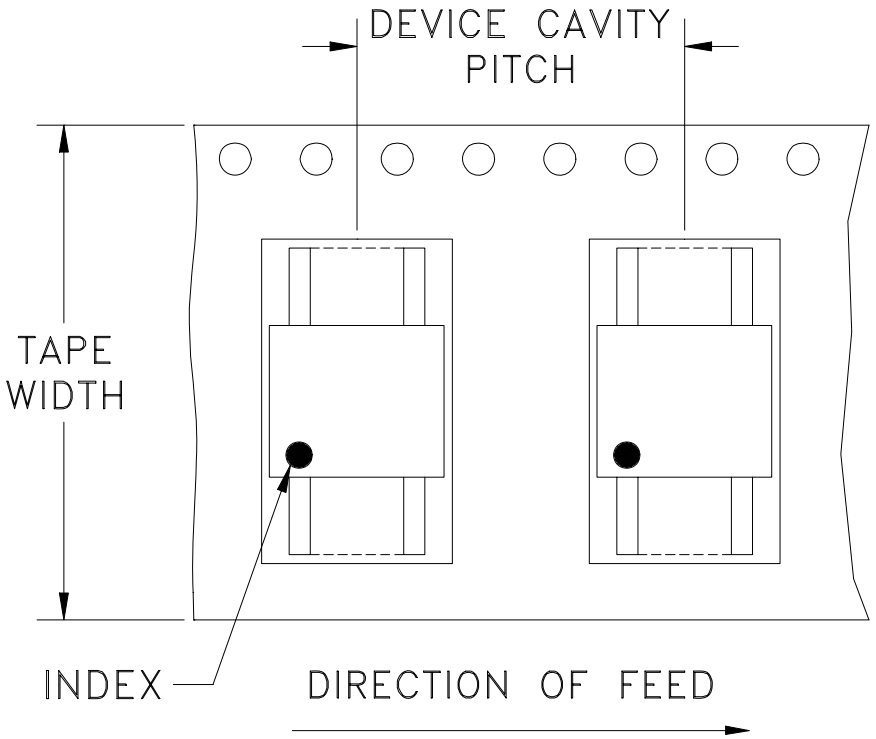
Tape & Reel Packaging TR-F31

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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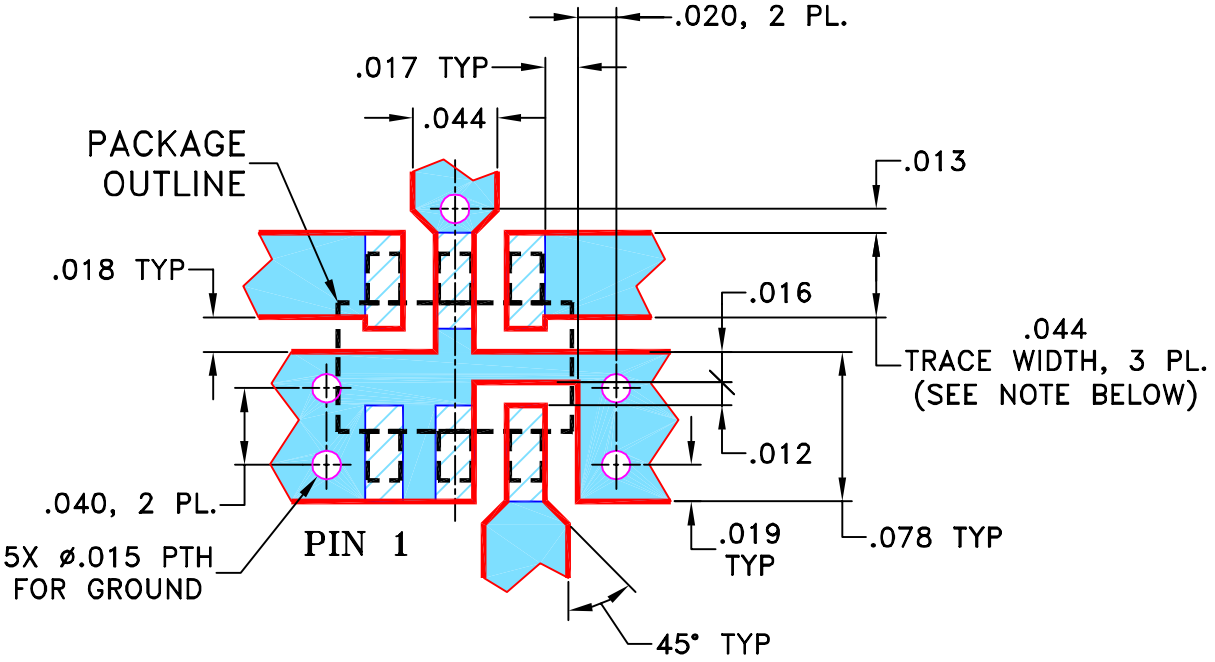
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	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 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

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	AV	03/07/07
TOLERANCES ON:	CHECKED	IL	03/20/07
2 PL DECIMALS ±	APPROVED	WP	03/20/07
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

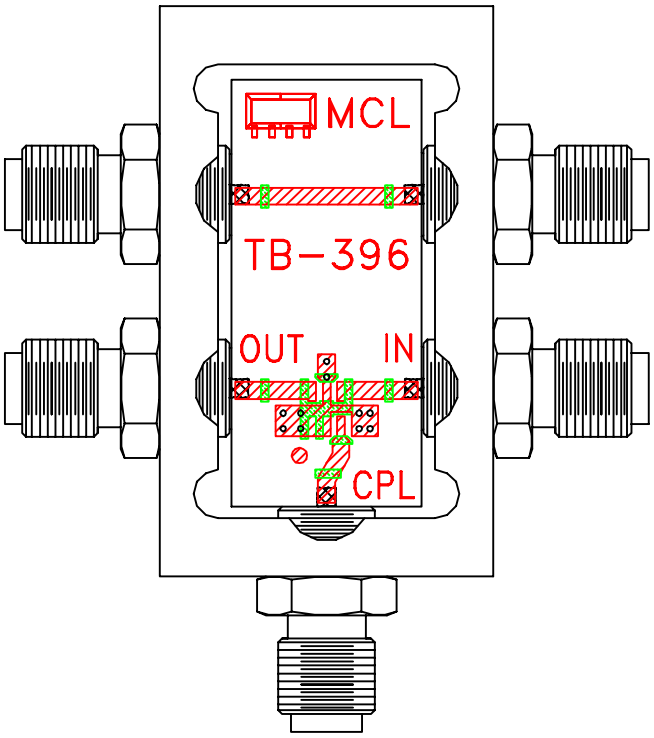
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

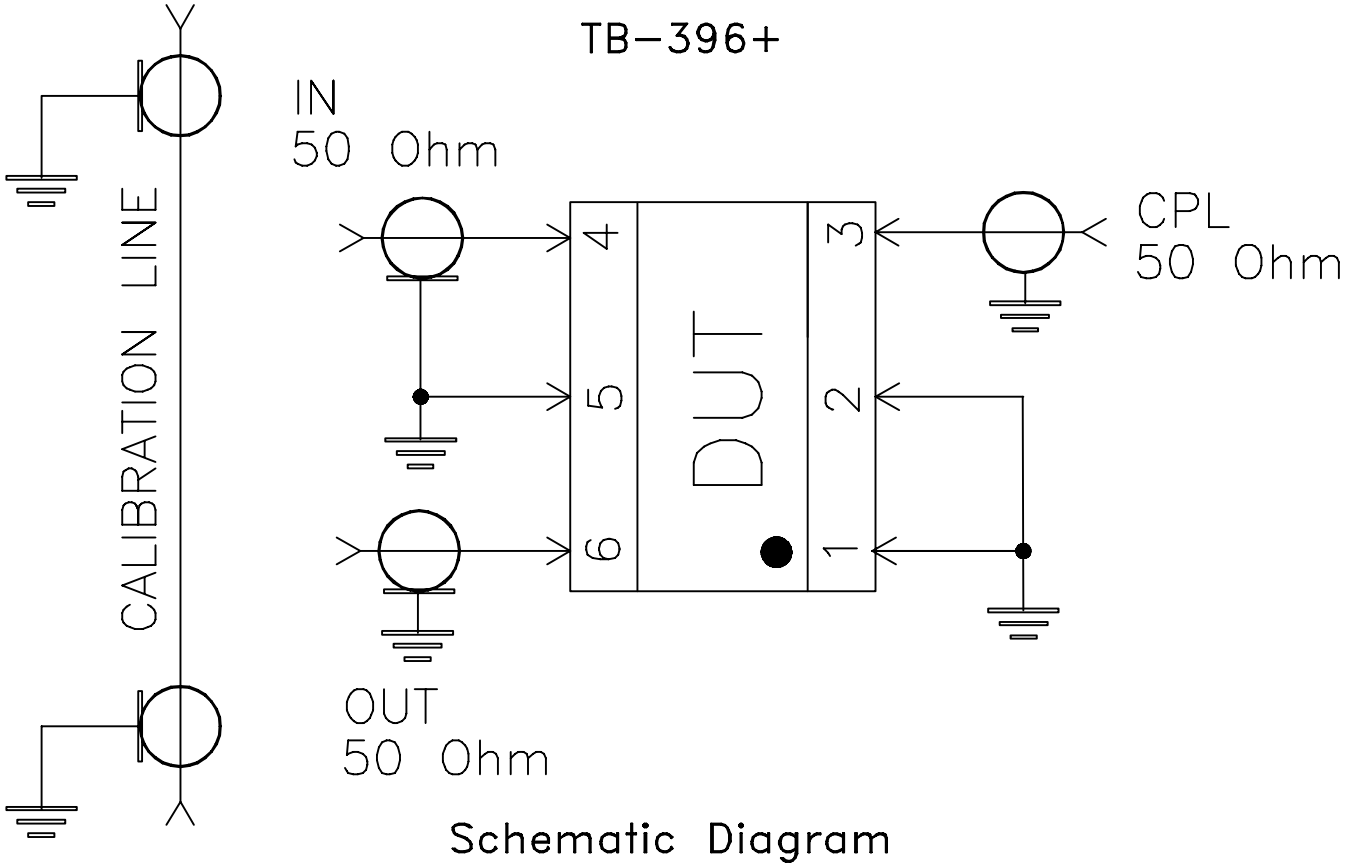
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-270	OR

FILE:	SCALE:	SHEET:
98PL270	10:1	1 OF 1

Evaluation Board and Circuit



TB-396+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: Rogers RO4350B or its equivalent, Dielectric Constant=3.5, Thickness=.020"

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Environmental Specifications ENV12

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