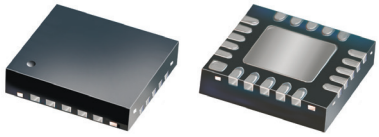
NON-CATALOG

Digital Step Attenuator 75Ω DC-2000 MHz

31 dB, 1dB Step
5 Bit, Parallel Control Interface, Dual Supply Voltage

Product Features
- Dual Supply Voltage: V_{DD}=+3V, V_{SS}=-3V
- Immune to latch up
- Excellent accuracy, 0.1 dB Typ
- Parallel control interface
- Fast switching control frequency, 1 MHz typ.
- Low Insertion Loss
- High IP3, +52 dBm
- Very low DC power consumption
- Excellent return loss, 20 dB Typ
- Small size 4.0 x 4.0 mm



DAT-3175-PN+
DAT-3175-PN

CASE STYLE: DG983-1

Typical Applications
- Base Station Infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- Wireless Local Loop
- UNII & Hiper LAN
- Power amplifier distortion canceling loops

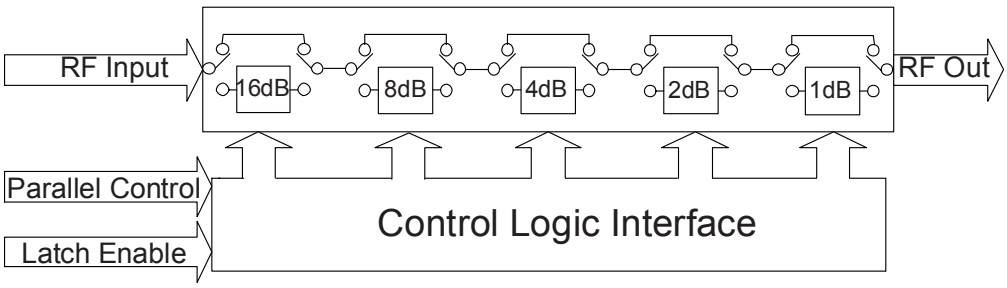
+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

This model will be replaced in the future with a improved design. The new model will be DAT-3175A-PN+. It will have similar performance, the same case style and footprint.

General Description

The DAT-3175-PN is a 75Ω RF digital step attenuator that offers an attenuation range up to 31 dB in 1.0 dB steps. The control is a 5-bit parallel interface, operating on dual supply voltage: V_{DD}=+3V, V_{SS}=-3V. The DAT-3175-PN is produced using a unique CMOS process on silicon, offering the performance of GaAs, with the advantages of conventional CMOS devices.

Simplified Schematic



RF Electrical Specifications, DC-2000 MHz, T_{AMB}=25°C, V_{DD}=+3V, V_{SS}=-3V

Parameter	Freq. Range (GHz)	Min.	Typ.	Max.	Units
Accuracy @ **1 dB** Attenuation Setting	DC-1.2	—	0.03	0.24	dB
	1.2-2.0	—	0.1	0.25	dB
Accuracy @ **2 dB** Attenuation Setting	DC-1.2	—	0.07	0.28	dB
	1.2-2.0	—	0.15	0.3	dB
Accuracy @ **4 dB** Attenuation Setting	DC-1.2	—	0.05	0.36	dB
	1.2-2.0	—	0.15	0.4	dB
Accuracy @ **8 dB** Attenuation Setting	DC-1.2	—	0.1	0.52	dB
	1.2-2.0	—	0.24	0.6	dB
Accuracy @ **16 dB** Attenuation Setting	DC-1.2		0.23	0.84	dB
	1.2-2.0		0.8	1.0	dB
Insertion Loss (note 1) @ all attenuator set to 0dB	DC-1.2	—	1.2	1.8	dB
	1.2-2.0	—	1.6	2.1	dB
Input IP3 (note 2) (At Min. and Max. Attenuation)	DC-2.0	—	+52	—	dBm
Input Power @ 0.2dB Compression (note 2) (At Min. and Max. Attenuation)	DC-2.0	—	+24	—	dBm
VSWR	DC-1.2	—	1.6	2.0	—
	1.2-2.0	—	1.7	2.0	—

DC Electrical Specifications

Parameter	Min.	Typ.	Max.	Units
V_{DD}, Supply Voltage	2.7	3	3.3	V
V_{SS}, Supply Voltage	-3.3	-3	-2.7	V
I_{DD} (I_{SS}), Supply Current, quiescent (note 3)	—	—	100	μA
Control Input Low	—	—	0.3xV_{DD}	V
Control Input High	0.7xV_{DD}	—	—	V
Control Current	—	—	1	μA

Notes:
1. I. Loss values are de-embedded from test board Loss (test board's Insertion Loss: 0.10dB @100MHz, 0.40dB @1200MHz, 0.55dB @2000MHz, 0.75dB @4000MHz).
2. Input IP3 and 1dB compression degrades below 1 MHz.
3. During turn-on and transition between attenuation states, device may draw up to 2mA.

Switching Specifications

Parameter	Min.	Typ.	Max.	Units
Switching Speed, 50% Control to 0.5dB of Attenuation Value	—	1.0	—	μSec
Switching Control Frequency	—	1.0	—	MHz

Absolute Maximum Ratings

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
V_{DD}	-0.3V Min., 4V Max.
V_{SS}	-4V Min., 0.3V Max.
Voltage on any input	-0.3V Min., V_{DD}+0.3V Max.
ESD, HBM	500V
ESD, MM	100V
Input Power	+24dBm

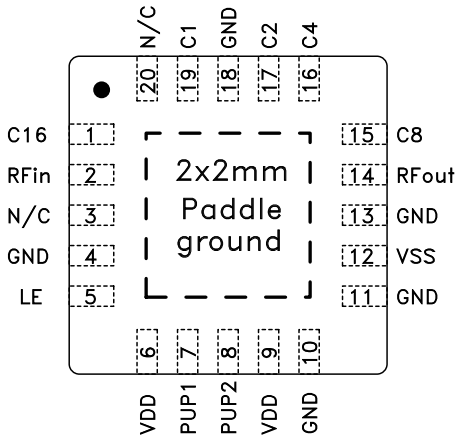
Permanent damage may occur if any of these limits are exceeded.

Pin Description

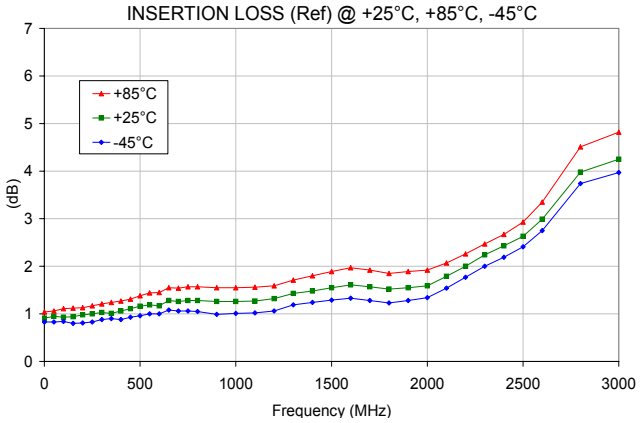
Function	Pin Number	Description
C16	1	Control for Attenuation bit, 16dB (Note 3)
RF in	2	RF in port (Note 1)
N/C	3	Not connected (Note 4)
GND	4	Ground connection
LE	5	Latch Enable Input (Note 2)
V_{DD}	6	Positive Supply Voltage
PUP1	7	Power-up selection
PUP2	8	Power-up selection
V_{DD}	9	Positive Supply Voltage
GND	10	Ground connection
GND	11	Ground connection
V_{SS}	12	Negative Supply Voltage
GND	13	Ground connection
RF out	14	RF out port (Note 1)
C8	15	Control for attenuation bit, 8 dB
C4	16	Control for attenuation bit, 4 dB
C2	17	Control for attenuation bit, 2 dB
GND	18	Ground Connection
C1	19	Control for attenuation bit, 1 dB
N/C	20	Not connected (Note 4)
GND	Paddle	Paddle ground (Note 5)

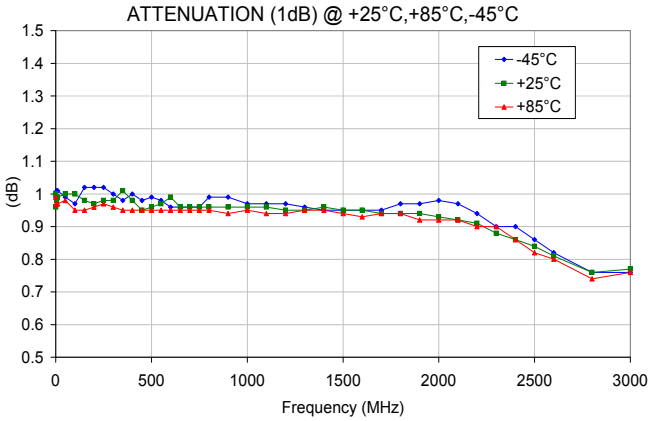
Notes:
1. Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.
2. Latch Enable (LE) has an internal 100KΩ resistor to V_{DD}.
3. Place a 10KΩ resistor in series, as close to pin as possible to avoid freq. resonance.
4. Place a shunt 10KΩ resistor to GND.
5. The exposed solder pad on the bottom of the package (See Pin configuration) must be grounded for proper device operation.

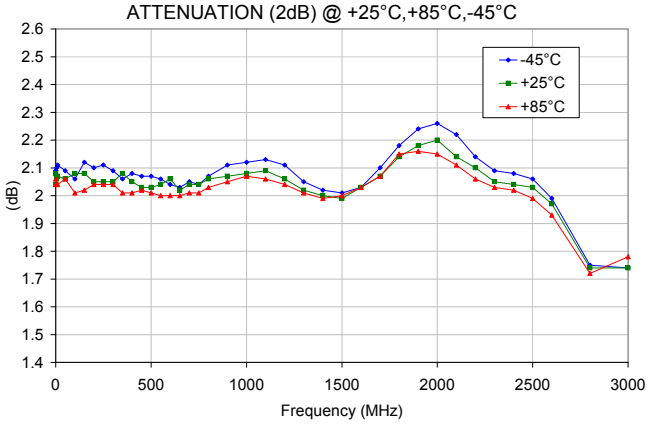
Pin Configuration (Top View)

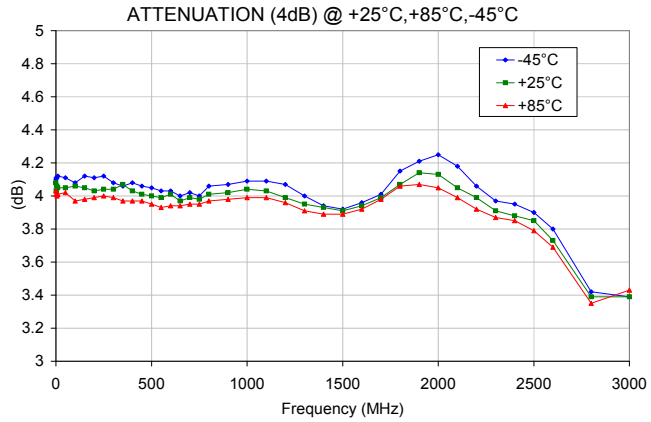


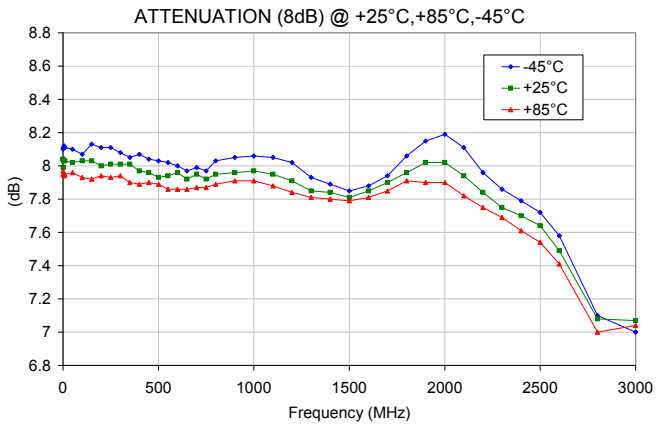
Typical Performance Curves

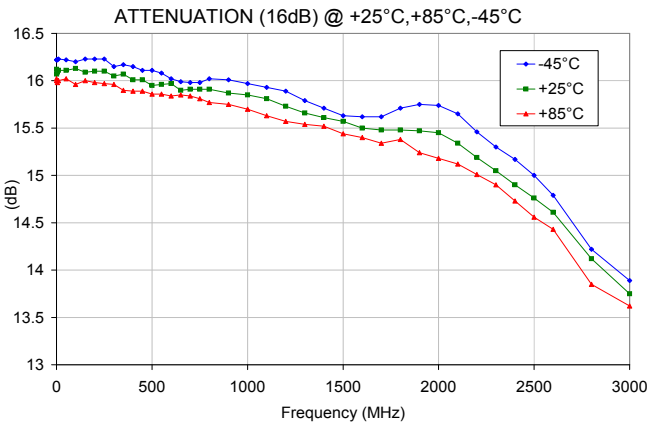




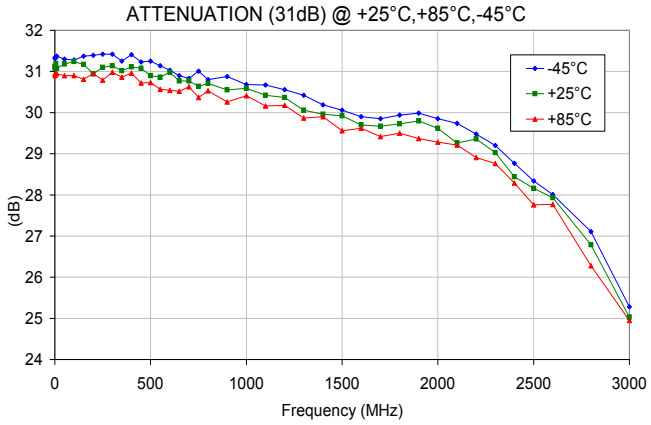


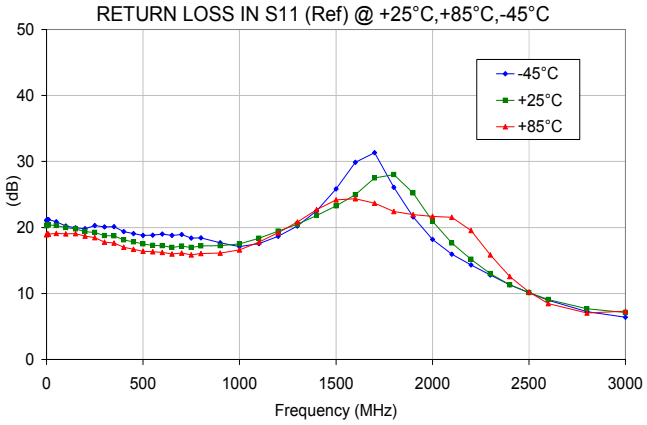


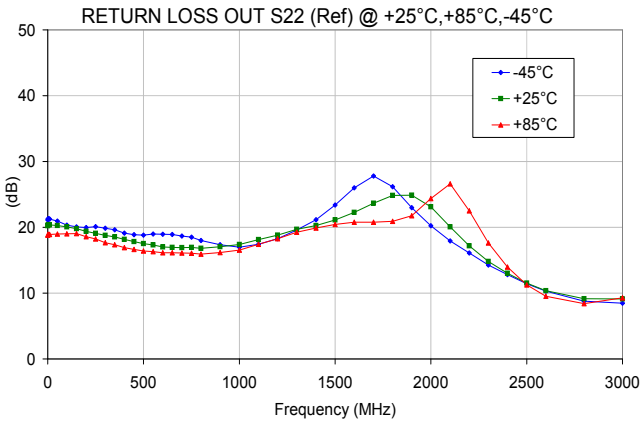


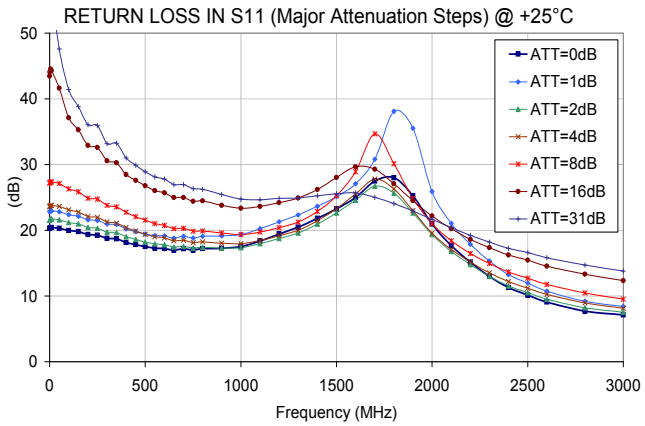


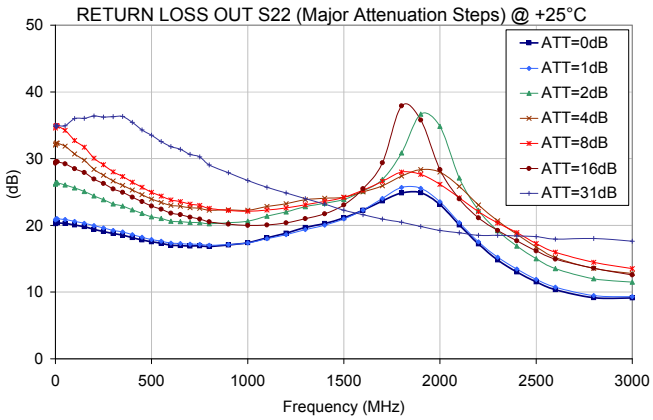
Typical Performance Curves











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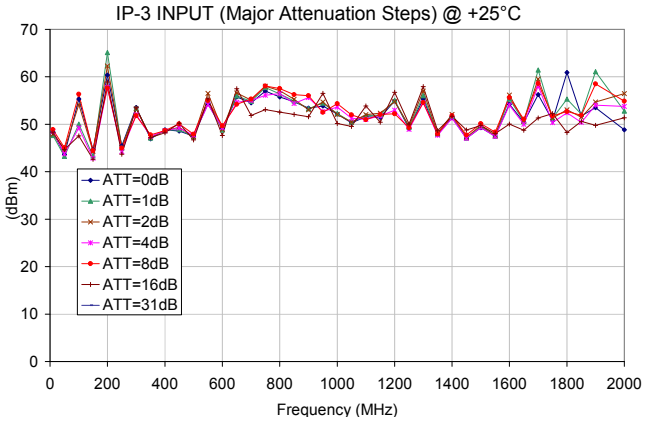
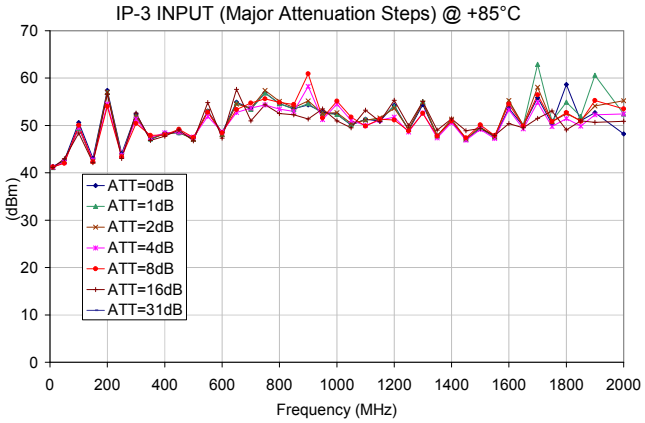
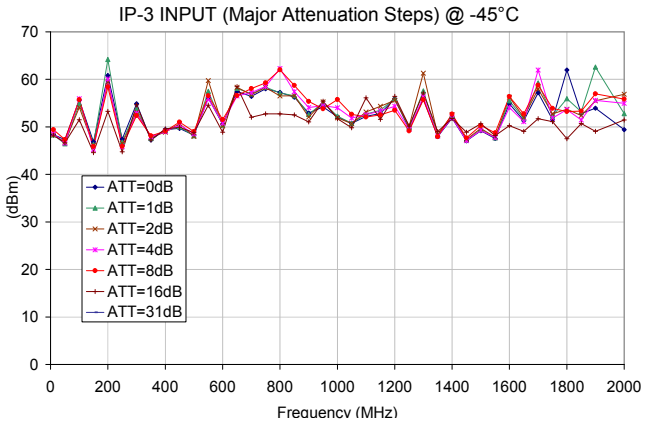
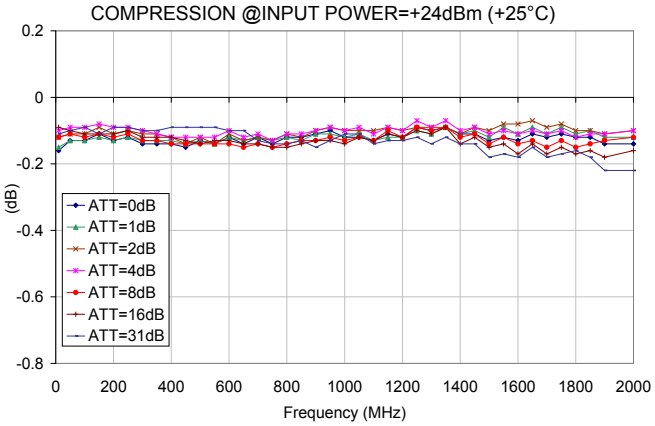
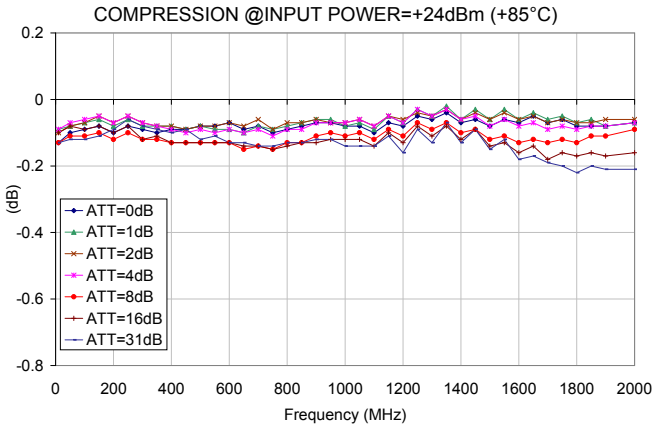
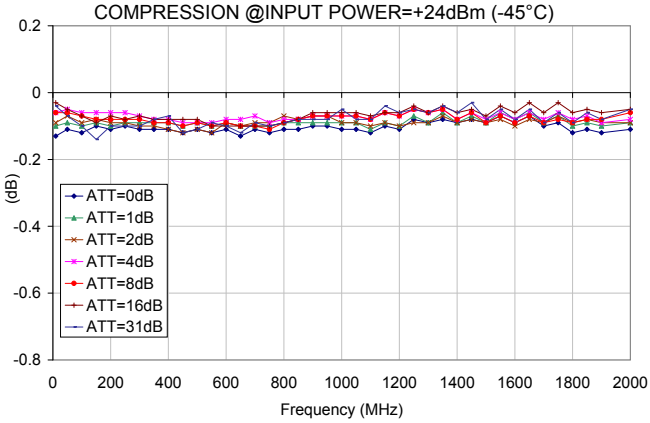




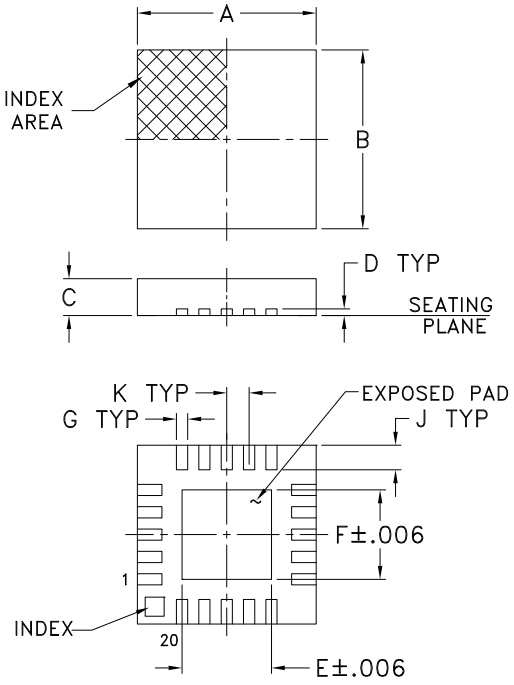




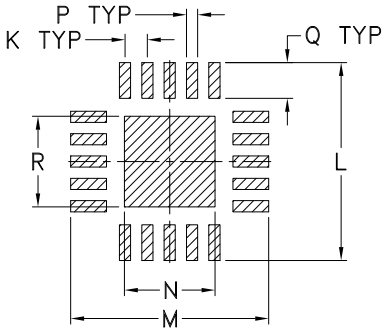




Outline Drawing (DG983-1)

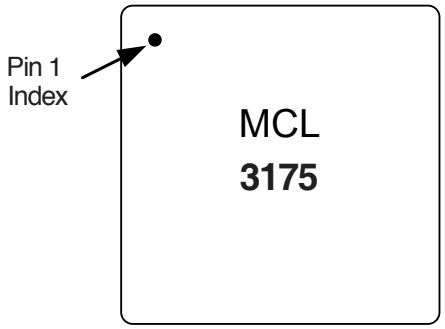


PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Device Marking

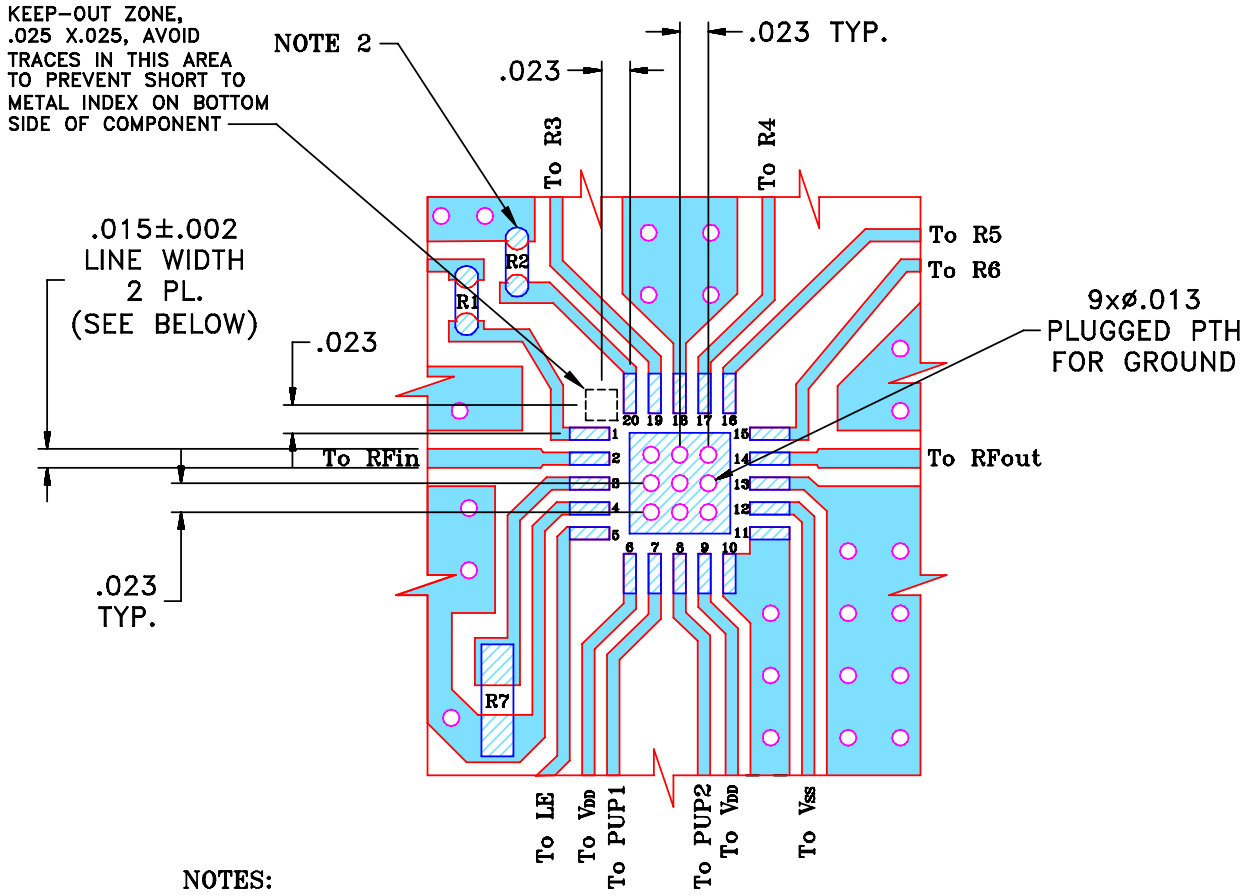


Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	WT. GRAMS
.157	**.157**	**.035**	**.008**	**.081**	**.081**	**.010**	**—**	**.022**	**.020**	**.177**	**.177**	**.081**	**.010**	**.032**	**.081**	.04
4.00	4.00	0.90	0.20	2.06	2.06	0.25	—	0.56	0.50	4.50	4.50	2.06	0.25	0.81	2.06	

Suggested Layout for PCB Design (PL-192)

The suggested Layout shows only the footprint area of the DAT, and the components located near this area (i.e.: R1, R2, R7). For the complete Layout, see photo and schematic diagram on page 11 of 12.



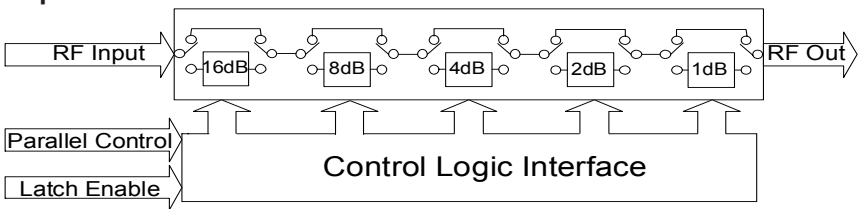
NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. 0603, 0402 SIZES CHIP FOOT PRINTS SHOWN FOR REFERENCE, VALUES OF RESISTORS WILL VARY BASED ON APPLICATION.
3. 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

Simplified Schematic



The DAT-3175-PN parallel interface consists of 5 control bits that select the desired attenuation state, as shown in Table 1: Truth Table

Table 1. Truth Table

Attenuation State	C16	C8	C4	C2	C1
Reference	0	0	0	0	0
1 (dB)	0	0	0	0	1
2 (dB)	0	0	0	1	0
4 (dB)	0	0	1	0	0
8 (dB)	1	0	0	0	0
16 (dB)	1	0	0	0	0
31 (dB)	1	1	1	1	1
Note: Not all 32 possible combinations of C1 - C16 are shown in table					

The parallel interface timing requirements are defined by **Figure 1** (Parallel Interface Timing Diagram) and **Table 2** (Parallel Interface AC Characteristics), and switching speed.

For latched parallel programming the Latch Enable (LE) should be held LOW while changing attenuation state control values, then pulse LE HIGH to LOW (per Figure 1) to latch new attenuation state into device.

For direct parallel programming, the Latch Enable (LE) line should be pulled HIGH. Changing attenuation state control values will change device state to new attenuation. Direct mode is ideal for manual control of the device (using hardwire, switches, or jumpers).

Figure 1: Parallel Interface Timing Diagram

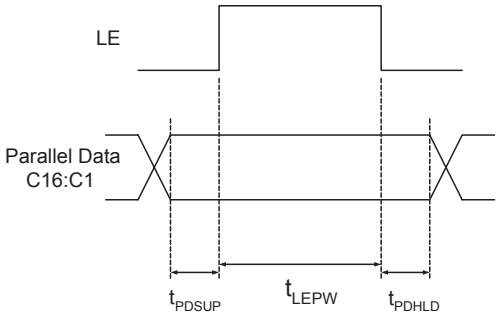


Table 2. Parallel Interface AC Characteristics

Symbol	Parameter	Min.	Max.	Units
t_{LEPW}	LE minimum pulse width	10		ns
t_{PDSUP}	Data set-up time before clock rising edge of LE	10		ns
t_{PDHLD}	Data hold time after clock falling edge of LE	10		ns

Pin 20 must always be low to prevent the attenuator from entering an unknown state.

Power-up Control Settings

The DAT-3175-PN always assumes a specifiable attenuation setting on power-up, allowing a known attenuation state to be established before an initial parallel control word is provided.

When the attenuator powers up with LE=0, the control bits are automatically set to one of four possible values. These four values are selected by the two power-up control bits, PUP1 and PUP2, as shown in Table 3: (Power-Up Truth Table, Parallel Mode)

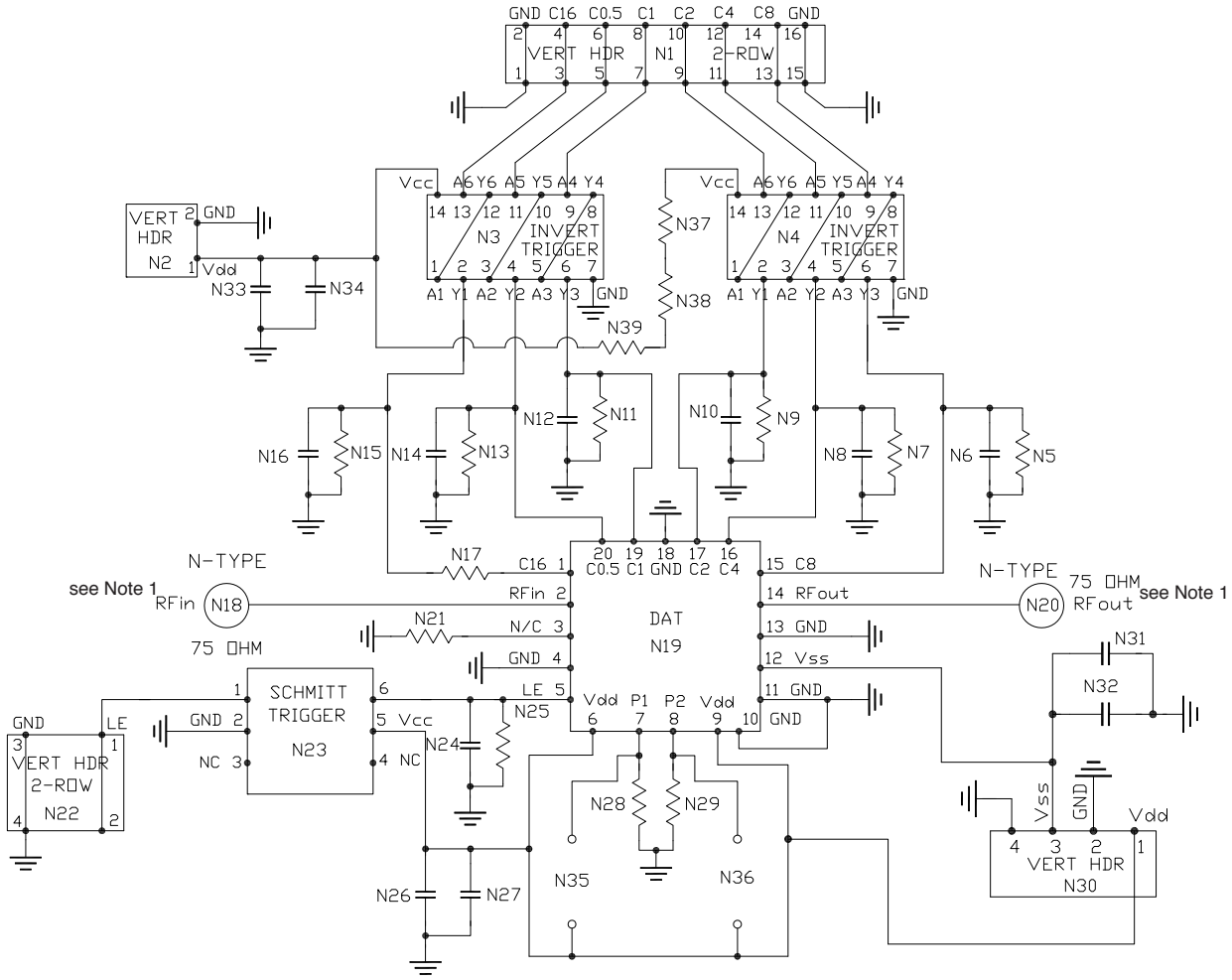
Table 3. Power-Up Truth Table, Parallel Mode

Attenuation State	PUP1	PUP2	LE
Reference	0	0	0
8 (dB)	0	1	0
16 (dB)	1	0	0
31 (dB)	1	1	0
Defined by C1-C16 (See Table 1-Truth Table)	X (Note 1)	X (Note 1)	1

Note: PUP1 and PUP2 Connection may be 0, 1, GROUND, or not connect, without effect on attenuation state.

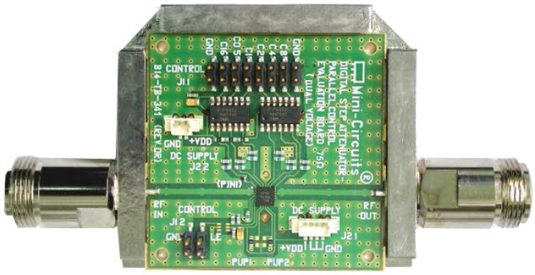
Power-Up with LE=1 provides normal parallel operation with C1-C16, and PUP1 and PUP2 are not active.

TB-341 Evaluation Board Schematic Diagram



Note 1: Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.

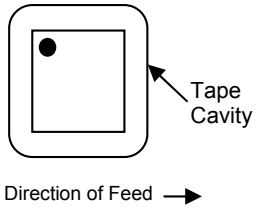
Bill of Materials	
N5, N7, N9, N11, N13, N15, N21 & N25	Resistor 0603 10 KOhm +/- 1%
N28 & N29	Resistor 0603 475 Ohm +/- 1%
N37-N39	Resistor 0603 0 Ohm
N17	Resistor 0402 10 KOhm +/- 1%
N6, N8, N10, N12, N14, N16, N24, N26, N31 & N33	NPO Capacitor 0603 100pF +/- 5%
N27, N32 & N34	Tantalum Capacitor 0805 100nF +/- 10%
N3 & N4	Hex Invert Schmitt Trigger MSL1
N23	Dual Schmitt Trigger Buffer SC-70 MSL1



TB-341

Tape and Reel Packaging Information

Table T&R

TR No.	No. of Devices	Reel Size	Tape Width	Pitch	Unit Orientation
F87	Small quantity standards 20, 50, 100, 200	7 inch	12 mm	8 mm	
	3000 (Standard)	13 inch			

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-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

Digital Step Attenuator DAT-3175-PN+

Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=-45degC

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE (dB)						
	00000 THRU LOSS	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	0.83	0.99	2.09	4.10	8.10	16.22	31.34
1	0.83	1.00	2.09	4.11	8.11	16.22	31.31
5	0.82	1.01	2.10	4.11	8.12	16.22	31.34
10	0.84	1.01	2.11	4.12	8.11	16.23	31.37
50	0.88	0.99	2.09	4.11	8.10	16.22	31.30
100	0.92	0.97	2.06	4.08	8.07	16.20	31.28
150	0.90	1.02	2.12	4.12	8.13	16.23	31.37
200	0.93	1.02	2.10	4.11	8.11	16.23	31.39
250	0.96	1.02	2.11	4.12	8.11	16.23	31.42
300	1.03	1.00	2.09	4.08	8.08	16.15	31.42
350	1.07	0.98	2.06	4.06	8.05	16.17	31.25
400	1.07	1.00	2.08	4.08	8.07	16.15	31.41
450	1.13	0.98	2.07	4.06	8.04	16.11	31.23
500	1.18	0.99	2.07	4.05	8.03	16.11	31.25
550	1.23	0.98	2.06	4.03	8.02	16.08	31.14
600	1.25	0.96	2.04	4.03	8.00	16.02	31.03
650	1.33	0.96	2.03	4.00	7.97	15.99	30.90
700	1.32	0.96	2.05	4.02	7.99	15.98	30.83
750	1.34	0.96	2.04	4.00	7.97	15.98	31.01
800	1.34	0.99	2.07	4.06	8.03	16.02	30.80
900	1.30	0.99	2.11	4.07	8.05	16.01	30.88
1000	1.34	0.97	2.12	4.09	8.06	15.97	30.68
1100	1.37	0.97	2.13	4.09	8.05	15.93	30.67
1200	1.44	0.97	2.11	4.07	8.02	15.89	30.56
1300	1.59	0.96	2.05	4.00	7.93	15.79	30.42
1400	1.67	0.95	2.02	3.94	7.89	15.71	30.19
1500	1.75	0.95	2.01	3.92	7.85	15.63	30.06
1600	1.81	0.95	2.03	3.96	7.88	15.62	29.90
1700	1.80	0.95	2.10	4.01	7.94	15.62	29.85
1800	1.76	0.97	2.18	4.15	8.06	15.71	29.94
1900	1.83	0.97	2.24	4.21	8.15	15.75	29.99
2000	1.91	0.98	2.26	4.25	8.19	15.74	29.85
2100	2.12	0.97	2.22	4.18	8.11	15.65	29.74
2200	2.36	0.94	2.14	4.06	7.96	15.46	29.48
2300	2.60	0.90	2.09	3.97	7.86	15.30	29.20
2400	2.81	0.90	2.08	3.95	7.79	15.17	28.77
2500	3.04	0.86	2.06	3.90	7.72	15.00	28.34
2600	3.40	0.82	1.99	3.80	7.58	14.79	28.01
2800	4.44	0.76	1.75	3.42	7.10	14.22	27.11
3000	4.71	0.76	1.74	3.39	7.00	13.89	25.28

* Step Attenuation above Thru Loss (TTL Logic 00000).

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=-45degC

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	21.05	24.80	24.19	28.51	41.31	28.50	27.03
1	21.15	24.94	24.32	28.72	42.29	28.43	27.00
5	21.22	25.04	24.44	28.85	42.78	28.34	26.94
10	21.19	25.01	24.39	28.84	42.56	28.35	26.93
50	20.88	24.50	23.97	27.96	37.65	28.78	27.37
100	20.21	23.52	22.97	26.42	33.25	30.37	28.77
150	19.96	23.19	22.56	25.81	32.22	31.08	29.45
200	19.83	22.92	22.33	25.35	31.45	32.16	30.29
250	20.29	23.50	22.79	25.98	32.64	30.93	29.34
300	20.10	23.13	22.36	25.29	30.68	30.09	28.86
350	20.12	23.24	22.28	24.93	29.82	29.61	28.64
400	19.36	22.20	21.27	23.55	27.43	29.09	28.66
450	19.06	21.79	20.85	22.98	26.76	30.22	29.91
500	18.81	21.59	20.53	22.53	26.10	30.12	30.19
550	18.85	21.66	20.47	22.43	26.10	31.26	31.52
600	19.00	21.80	20.50	22.34	25.75	30.42	30.71
650	18.79	21.40	20.12	21.85	25.11	30.16	30.89
700	18.94	21.57	20.07	21.77	24.99	29.89	30.62
750	18.41	21.02	19.47	21.00	24.00	29.01	30.21
800	18.44	21.01	19.40	20.84	23.70	29.15	30.66
900	17.69	20.04	18.45	19.72	22.23	28.02	30.28
1000	17.12	19.36	17.75	18.87	21.18	27.45	30.70
1100	17.54	19.82	18.03	19.10	21.40	28.89	32.87
1200	18.68	21.12	19.04	20.14	22.60	31.61	34.22
1300	20.24	22.90	20.57	21.76	24.48	33.84	31.47
1400	22.53	25.63	23.13	24.74	28.76	31.26	27.31
1500	25.85	29.63	27.06	29.58	40.27	27.11	24.32
1600	29.88	35.92	29.98	31.65	34.61	24.05	22.19
1700	31.34	38.46	27.19	26.51	26.26	21.65	20.48
1800	26.08	30.64	22.90	22.31	22.23	19.94	19.27
1900	21.62	25.17	19.76	19.41	19.75	18.82	18.47
2000	18.18	21.21	17.25	17.34	18.06	18.08	18.08
2100	15.96	18.67	15.63	15.94	16.91	17.58	17.76
2200	14.34	16.83	14.41	14.89	16.00	17.12	17.34
2300	12.79	15.05	13.10	13.76	15.00	16.42	16.74
2400	11.33	13.35	11.83	12.54	13.88	15.51	15.96
2500	10.14	11.93	10.70	11.47	12.86	14.62	15.22
2600	8.99	10.58	9.59	10.34	11.74	13.71	14.36
2800	7.26	8.62	7.86	8.62	10.08	12.33	13.18
3000	6.41	7.60	6.95	7.60	8.99	11.45	12.51

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=-45degC

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	21.12	22.59	31.16	51.59	35.48	38.39	24.88
1	21.28	22.70	31.40	49.20	35.13	37.88	24.77
5	21.32	22.78	31.50	49.02	35.21	37.89	24.81
10	21.27	22.74	31.34	49.23	35.16	37.94	24.84
50	20.96	22.35	30.22	42.51	35.85	38.26	25.17
100	20.35	21.65	28.40	37.50	37.18	38.59	26.20
150	20.08	21.32	27.69	36.11	37.86	38.98	26.79
200	19.96	21.17	27.29	35.49	38.48	38.67	27.18
250	20.10	21.29	27.48	34.78	36.82	36.95	26.71
300	19.86	20.96	26.71	32.54	34.67	34.88	26.91
350	19.63	20.68	26.08	31.19	33.46	33.09	27.29
400	19.11	20.10	25.01	29.71	32.47	31.62	28.14
450	18.89	19.88	24.66	29.39	32.28	31.11	28.95
500	18.81	19.78	24.61	29.33	32.65	31.28	29.64
550	18.98	19.90	24.84	29.60	32.82	31.22	29.54
600	18.95	19.83	24.68	29.29	32.39	30.86	29.42
650	18.93	19.75	24.49	28.91	31.58	30.08	29.09
700	18.69	19.43	23.97	27.96	30.23	28.89	29.14
750	18.50	19.18	23.55	27.07	29.05	27.69	29.17
800	17.99	18.62	22.73	26.11	28.04	26.57	30.16
900	17.36	17.85	21.72	24.88	26.37	24.86	32.20
1000	16.99	17.38	21.17	24.10	25.52	23.69	37.78
1100	17.41	17.74	21.75	24.70	25.78	23.77	37.31
1200	18.28	18.55	22.85	25.80	26.50	24.59	30.34
1300	19.59	19.90	24.51	26.98	27.28	25.97	26.22
1400	21.16	21.63	26.32	27.31	27.47	27.96	23.43
1500	23.40	24.21	28.11	26.88	26.69	29.96	21.32
1600	26.01	27.29	30.41	26.35	25.76	30.05	19.99
1700	27.80	29.42	32.19	25.77	24.66	27.64	19.12
1800	26.18	27.19	31.83	25.25	23.59	24.93	18.48
1900	22.98	23.57	28.92	24.66	22.77	22.95	18.10
2000	20.24	20.73	25.69	23.79	21.83	21.47	17.73
2100	17.93	18.51	22.77	22.55	20.97	20.25	17.44
2200	16.10	16.68	20.48	21.07	19.92	19.09	17.06
2300	14.28	14.93	18.28	19.40	18.88	17.96	16.76
2400	12.82	13.39	16.46	17.92	17.91	17.02	16.55
2500	11.42	12.00	14.77	16.39	16.78	16.01	16.34
2600	10.29	10.79	13.29	14.88	15.53	14.91	15.94
2800	8.78	9.20	11.42	12.97	13.96	13.49	15.67
3000	8.46	8.77	10.71	12.07	12.97	12.48	15.82

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+25degC

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE (dB)						
	00000 THRU LOSS	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	0.91	1.00	2.08	4.08	8.04	16.12	31.12
1	0.95	0.96	2.04	4.03	7.99	16.07	31.08
5	0.94	0.98	2.06	4.06	8.03	16.09	31.19
10	0.96	0.99	2.07	4.05	8.03	16.11	31.07
50	1.00	1.00	2.06	4.05	8.02	16.11	31.18
100	1.01	1.00	2.08	4.06	8.03	16.13	31.24
150	1.04	0.98	2.08	4.05	8.03	16.09	31.17
200	1.10	0.97	2.05	4.03	8.00	16.10	30.94
250	1.13	0.98	2.05	4.04	8.01	16.10	31.10
300	1.18	0.98	2.05	4.04	8.01	16.05	31.14
350	1.18	1.01	2.08	4.07	8.01	16.07	31.02
400	1.25	0.98	2.05	4.03	7.97	16.01	31.11
450	1.31	0.95	2.03	4.01	7.96	16.01	31.08
500	1.38	0.96	2.03	4.00	7.93	15.95	30.90
550	1.42	0.97	2.04	3.99	7.94	15.96	30.86
600	1.42	0.99	2.06	4.01	7.96	15.97	30.98
650	1.53	0.96	2.02	3.97	7.92	15.90	30.77
700	1.52	0.96	2.04	3.99	7.95	15.91	30.77
750	1.56	0.96	2.04	3.98	7.92	15.91	30.64
800	1.57	0.96	2.06	4.01	7.95	15.91	30.71
900	1.57	0.96	2.07	4.02	7.96	15.87	30.55
1000	1.59	0.96	2.08	4.04	7.97	15.85	30.59
1100	1.62	0.96	2.09	4.03	7.95	15.81	30.42
1200	1.70	0.95	2.06	3.99	7.91	15.73	30.37
1300	1.83	0.95	2.02	3.95	7.85	15.66	30.06
1400	1.91	0.96	2.00	3.93	7.84	15.61	29.96
1500	2.01	0.95	1.99	3.91	7.81	15.57	29.92
1600	2.09	0.95	2.03	3.94	7.85	15.50	29.70
1700	2.09	0.94	2.07	3.99	7.90	15.48	29.67
1800	2.05	0.94	2.14	4.07	7.96	15.48	29.73
1900	2.10	0.94	2.18	4.14	8.02	15.47	29.80
2000	2.16	0.93	2.20	4.13	8.02	15.45	29.62
2100	2.37	0.92	2.14	4.05	7.94	15.34	29.26
2200	2.59	0.91	2.10	3.99	7.84	15.19	29.36
2300	2.84	0.88	2.05	3.91	7.75	15.05	29.03
2400	3.05	0.86	2.04	3.88	7.70	14.90	28.44
2500	3.26	0.84	2.03	3.85	7.64	14.76	28.16
2600	3.64	0.81	1.97	3.73	7.49	14.61	27.93
2800	4.68	0.76	1.74	3.39	7.08	14.12	26.79
3000	4.99	0.77	1.74	3.39	7.07	13.75	25.03

* Step Attenuation above Thru Loss (TTL Logic 00000).

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+25degC

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	20.26	22.80	21.54	23.61	27.14	43.45	55.57
1	20.32	22.88	21.63	23.71	27.24	44.06	58.47
5	20.41	22.97	21.74	23.80	27.35	44.55	56.71
10	20.39	22.94	21.72	23.81	27.37	44.32	56.67
50	20.29	22.82	21.60	23.64	27.12	41.63	47.59
100	19.97	22.37	21.19	23.12	26.29	37.11	41.41
150	19.79	22.13	20.98	22.78	25.87	35.29	38.80
200	19.37	21.59	20.43	22.09	24.87	32.92	36.07
250	19.25	21.48	20.32	21.95	24.74	32.61	35.92
300	18.78	20.96	19.73	21.29	23.79	30.56	33.17
350	18.72	20.87	19.66	21.09	23.57	30.28	33.25
400	18.13	20.22	19.01	20.39	22.73	28.48	31.01
450	17.83	19.81	18.61	19.89	22.07	27.60	29.91
500	17.52	19.44	18.21	19.40	21.56	26.77	28.90
550	17.29	19.20	17.94	19.01	21.01	26.03	28.13
600	17.23	19.14	17.80	18.84	20.76	25.69	27.81
650	16.98	18.80	17.45	18.41	20.24	25.00	26.94
700	17.18	19.08	17.55	18.48	20.29	25.00	26.95
750	16.98	18.80	17.29	18.15	19.87	24.42	26.33
800	17.22	19.07	17.41	18.24	19.91	24.46	26.23
900	17.25	19.15	17.29	18.03	19.58	23.81	25.45
1000	17.53	19.35	17.34	17.96	19.37	23.36	24.76
1100	18.37	20.25	17.95	18.45	19.72	23.64	24.65
1200	19.43	21.28	18.73	19.18	20.42	24.22	24.86
1300	20.48	22.34	19.60	19.99	21.27	24.92	24.91
1400	21.82	23.65	20.95	21.47	22.87	26.22	25.24
1500	23.26	25.13	22.63	23.29	25.26	28.04	25.56
1600	24.98	27.09	24.58	25.53	28.90	29.65	25.68
1700	27.50	30.81	26.70	27.79	34.68	29.28	25.02
1800	28.01	38.11	25.65	26.29	30.12	27.10	24.07
1900	25.25	35.53	22.66	22.98	24.84	24.51	22.96
2000	20.95	25.91	19.35	19.57	21.02	22.18	21.67
2100	17.65	21.04	16.79	17.09	18.42	20.24	20.41
2200	15.16	17.85	14.79	15.19	16.49	18.62	19.21
2300	13.00	15.31	13.00	13.52	14.95	17.34	18.20
2400	11.30	13.27	11.52	12.19	13.65	16.25	17.25
2500	10.13	11.95	10.51	11.20	12.72	15.46	16.62
2600	9.08	10.76	9.54	10.25	11.77	14.53	15.84
2800	7.70	9.17	8.22	8.95	10.46	13.32	14.71
3000	7.11	8.39	7.52	8.15	9.54	12.34	13.79

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+25degC

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	20.25	20.81	26.18	32.03	34.59	29.32	35.02
1	20.35	20.91	26.35	32.19	34.87	29.46	34.83
5	20.42	21.01	26.43	32.35	34.97	29.55	34.77
10	20.38	20.96	26.36	32.32	34.86	29.52	34.96
50	20.28	20.87	26.07	31.86	34.25	29.23	34.92
100	20.06	20.59	25.62	30.70	32.71	28.49	36.01
150	19.79	20.32	25.09	29.75	31.72	27.91	36.03
200	19.40	19.95	24.43	28.41	30.08	26.93	36.38
250	19.08	19.61	23.85	27.51	29.10	26.27	36.24
300	18.79	19.24	23.22	26.67	28.02	25.45	36.28
350	18.54	19.02	22.90	25.99	27.33	24.95	36.32
400	18.17	18.60	22.33	25.29	26.46	24.23	35.43
450	17.83	18.24	21.78	24.62	25.70	23.57	34.31
500	17.52	17.88	21.29	23.94	24.96	22.90	33.51
550	17.32	17.64	21.03	23.45	24.38	22.41	32.58
600	17.03	17.35	20.64	23.01	23.82	21.84	31.81
650	16.96	17.28	20.57	22.88	23.56	21.60	31.39
700	16.91	17.17	20.43	22.65	23.19	21.21	30.65
750	16.94	17.16	20.41	22.56	22.98	20.93	30.26
800	16.83	17.01	20.24	22.26	22.54	20.54	29.06
900	17.06	17.13	20.40	22.32	22.25	20.17	27.90
1000	17.40	17.36	20.64	22.28	22.12	19.99	26.71
1100	18.14	17.99	21.39	22.83	22.29	20.06	25.71
1200	18.83	18.59	22.03	23.25	22.60	20.36	24.86
1300	19.69	19.35	22.80	23.85	23.09	21.01	24.00
1400	20.27	20.02	23.30	24.06	23.59	21.72	23.18
1500	21.12	20.97	23.89	24.23	24.18	23.07	22.26
1600	22.28	22.31	25.14	25.01	25.27	25.50	21.59
1700	23.65	24.05	26.89	25.94	26.58	29.36	20.93
1800	24.85	25.68	30.86	27.38	28.00	37.89	20.47
1900	24.89	25.55	36.66	28.36	27.65	35.80	19.83
2000	23.11	23.54	34.85	27.99	26.15	28.35	19.25
2100	20.07	20.39	27.10	25.85	24.14	23.98	18.89
2200	17.20	17.54	22.27	23.05	22.05	21.13	18.51
2300	14.80	15.23	19.20	20.70	20.36	19.23	18.52
2400	13.01	13.46	16.90	18.66	18.91	17.69	18.42
2500	11.52	11.91	15.00	16.76	17.28	16.18	18.31
2600	10.37	10.75	13.51	15.18	15.98	14.95	17.94
2800	9.16	9.49	12.01	13.54	14.46	13.57	18.04
3000	9.12	9.31	11.51	12.78	13.51	12.57	17.61

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+85degC

FREQUENCY (MHz)	STEP ATTENUATION* AT TTL CONTROL STATE (dB)						
	00000 THRU LOSS	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	1.04	0.99	2.06	4.03	7.97	16.02	30.94
1	1.06	0.97	2.04	4.01	7.95	16.00	30.90
5	1.07	0.97	2.04	4.00	7.94	15.98	30.96
10	1.09	0.97	2.04	4.01	7.95	16.00	30.94
50	1.11	0.98	2.06	4.02	7.96	16.02	30.90
100	1.19	0.95	2.01	3.97	7.93	15.96	30.90
150	1.22	0.95	2.02	3.98	7.92	16.00	30.81
200	1.25	0.96	2.04	3.99	7.94	15.98	30.95
250	1.30	0.97	2.04	4.00	7.93	15.97	30.79
300	1.36	0.96	2.04	3.99	7.94	15.96	30.98
350	1.41	0.95	2.01	3.97	7.90	15.90	30.86
400	1.46	0.95	2.01	3.97	7.89	15.89	30.96
450	1.51	0.95	2.02	3.97	7.90	15.89	30.72
500	1.60	0.95	2.01	3.95	7.89	15.86	30.73
550	1.67	0.95	2.00	3.93	7.86	15.86	30.57
600	1.70	0.95	2.00	3.94	7.86	15.84	30.54
650	1.80	0.95	2.00	3.94	7.86	15.85	30.52
700	1.80	0.95	2.01	3.95	7.87	15.84	30.63
750	1.85	0.95	2.01	3.95	7.87	15.81	30.37
800	1.86	0.95	2.03	3.97	7.89	15.77	30.53
900	1.86	0.94	2.05	3.98	7.91	15.75	30.26
1000	1.88	0.95	2.07	3.99	7.91	15.70	30.41
1100	1.91	0.94	2.06	3.99	7.88	15.63	30.16
1200	1.97	0.94	2.04	3.96	7.84	15.57	30.18
1300	2.11	0.95	2.01	3.91	7.81	15.54	29.87
1400	2.23	0.95	1.99	3.89	7.80	15.52	29.90
1500	2.35	0.94	2.00	3.89	7.79	15.44	29.56
1600	2.45	0.93	2.03	3.92	7.81	15.40	29.62
1700	2.44	0.94	2.07	3.98	7.85	15.34	29.42
1800	2.38	0.94	2.15	4.06	7.91	15.38	29.50
1900	2.44	0.92	2.16	4.07	7.90	15.24	29.37
2000	2.49	0.92	2.15	4.05	7.90	15.18	29.28
2100	2.65	0.92	2.11	3.99	7.82	15.12	29.21
2200	2.85	0.90	2.06	3.92	7.75	15.01	28.91
2300	3.07	0.90	2.03	3.87	7.69	14.90	28.76
2400	3.29	0.86	2.02	3.85	7.61	14.73	28.29
2500	3.56	0.82	1.99	3.79	7.54	14.56	27.76
2600	4.00	0.80	1.93	3.69	7.41	14.43	27.77
2800	5.21	0.74	1.72	3.35	7.00	13.85	26.28
3000	5.56	0.76	1.78	3.43	7.04	13.62	24.95

* Step Attenuation above Thru Loss (TTL Logic 00000).

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+85degC

FREQUENCY (MHz)	INPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	18.89	20.43	18.90	19.79	21.10	24.73	26.00
1	18.97	20.52	19.00	19.87	21.18	24.81	26.06
5	19.03	20.62	19.06	19.94	21.25	24.87	26.19
10	19.01	20.57	19.06	19.95	21.26	24.86	26.19
50	19.09	20.65	19.13	20.03	21.33	25.01	26.34
100	19.04	20.58	19.11	19.96	21.28	24.96	26.21
150	19.06	20.74	19.15	20.04	21.41	25.16	26.57
200	18.69	20.22	18.73	19.55	20.86	24.31	25.69
250	18.46	20.06	18.54	19.37	20.68	24.18	25.53
300	17.80	19.26	17.86	18.64	19.87	23.06	24.34
350	17.64	19.09	17.64	18.36	19.61	22.66	23.92
400	16.99	18.40	17.05	17.72	18.93	21.80	22.98
450	16.70	18.09	16.72	17.34	18.45	21.18	22.26
500	16.41	17.76	16.39	16.98	18.06	20.70	21.79
550	16.32	17.61	16.16	16.73	17.67	20.24	21.24
600	16.24	17.56	16.05	16.56	17.51	20.03	21.03
650	15.99	17.30	15.78	16.23	17.11	19.53	20.40
700	16.12	17.44	15.79	16.20	17.04	19.31	20.22
750	15.87	17.18	15.52	15.88	16.67	18.85	19.73
800	16.04	17.27	15.59	15.85	16.54	18.62	19.40
900	16.12	17.25	15.44	15.60	16.18	18.01	18.63
1000	16.60	17.63	15.72	15.75	16.18	17.77	18.20
1100	17.77	18.67	16.61	16.51	16.77	18.11	18.36
1200	19.21	19.97	17.81	17.63	17.76	18.89	18.98
1300	20.85	21.40	19.20	18.94	19.05	20.05	19.78
1400	22.71	23.33	20.90	20.72	20.94	21.94	21.34
1500	24.18	25.55	22.09	22.02	22.80	24.56	23.45
1600	24.34	26.59	22.01	21.99	23.38	27.01	25.66
1700	23.69	26.61	21.49	21.63	23.28	28.70	27.19
1800	22.43	25.38	20.83	21.03	22.95	29.18	27.91
1900	21.94	25.13	20.71	21.20	23.51	31.11	28.18
2000	21.68	25.78	20.85	21.56	24.61	36.26	28.88
2100	21.54	27.47	20.60	21.39	25.00	35.73	27.82
2200	19.54	24.84	18.63	19.25	21.74	25.93	24.35
2300	15.87	19.17	15.39	15.90	17.63	20.73	21.06
2400	12.56	14.82	12.45	12.97	14.46	17.36	18.23
2500	10.24	12.06	10.32	10.90	12.29	15.06	16.26
2600	8.48	10.05	8.77	9.35	10.69	13.36	14.66
2800	7.05	8.36	7.41	7.98	9.29	11.92	13.31
3000	7.33	8.57	7.64	8.16	9.39	11.96	13.42

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Typical Performance Data

TEST CONDITIONS: INPUT POWER=-10dBm, Vdd=+3V, TEMPERATURE=+85degC

FREQUENCY (MHz)	OUTPUT RETURN LOSS AT TTL CONTROL STATE (dB)						
	00000 0 dB	00001 1 dB	00010 2.0 dB	00100 4.0 dB	01000 8.0 dB	10000 16.0 dB	11111 31 dB
0.5	18.81	18.74	22.14	24.32	24.07	21.06	30.35
1	18.90	18.84	22.27	24.50	24.23	21.16	30.59
5	18.96	18.90	22.31	24.51	24.25	21.19	30.59
10	18.93	18.89	22.29	24.50	24.22	21.18	30.58
50	18.99	18.94	22.40	24.60	24.38	21.30	30.88
100	19.02	18.99	22.48	24.72	24.53	21.37	31.00
150	19.05	19.02	22.47	24.79	24.62	21.49	31.46
200	18.59	18.60	21.90	23.99	23.87	21.10	29.95
250	18.24	18.24	21.41	23.38	23.35	20.69	29.00
300	17.65	17.69	20.62	22.43	22.42	20.01	27.36
350	17.35	17.38	20.19	21.94	21.90	19.58	26.58
400	16.93	16.98	19.66	21.30	21.25	19.06	25.60
450	16.65	16.70	19.36	20.88	20.84	18.68	24.97
500	16.40	16.46	19.00	20.50	20.44	18.35	24.33
550	16.30	16.31	18.88	20.22	20.11	18.04	23.92
600	16.13	16.10	18.65	19.98	19.76	17.73	23.28
650	16.13	16.07	18.62	19.84	19.53	17.48	22.95
700	16.09	15.97	18.49	19.62	19.22	17.16	22.41
750	16.08	15.93	18.42	19.45	18.94	16.94	22.01
800	15.93	15.75	18.17	19.02	18.47	16.52	21.18
900	16.16	15.78	18.14	18.80	17.99	16.04	20.22
1000	16.53	16.05	18.22	18.65	17.72	15.77	19.40
1100	17.44	16.73	18.79	18.96	17.85	15.98	19.09
1200	18.26	17.54	19.44	19.40	18.36	16.53	19.10
1300	19.24	18.47	20.23	20.21	19.23	17.46	19.50
1400	19.91	19.20	21.05	21.01	20.25	18.52	20.08
1500	20.45	19.89	21.92	21.90	21.37	19.65	20.66
1600	20.78	20.20	22.93	22.98	22.66	20.73	21.29
1700	20.79	20.47	23.52	23.74	23.35	21.39	21.54
1800	20.90	20.71	24.14	24.29	24.08	22.46	21.35
1900	21.75	21.60	25.00	24.47	24.54	23.94	20.44
2000	24.37	24.18	27.66	25.40	25.74	28.07	19.44
2100	26.62	26.42	32.49	26.45	26.60	39.98	18.75
2200	22.51	22.59	28.13	25.11	24.75	27.74	18.18
2300	17.63	17.79	21.96	22.20	21.78	21.42	17.98
2400	13.97	14.18	17.55	18.77	18.64	17.54	17.75
2500	11.27	11.51	14.42	15.76	16.06	14.84	17.39
2600	9.53	9.81	12.41	13.81	14.31	13.15	17.08
2800	8.40	8.62	11.06	12.34	13.00	11.95	17.47
3000	9.29	9.43	11.68	12.70	13.13	12.04	17.38

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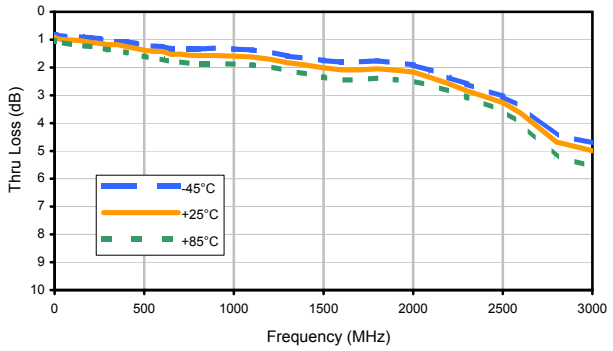
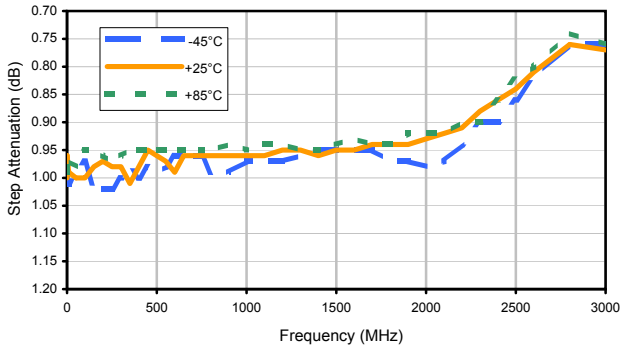
Typical Performance Curves

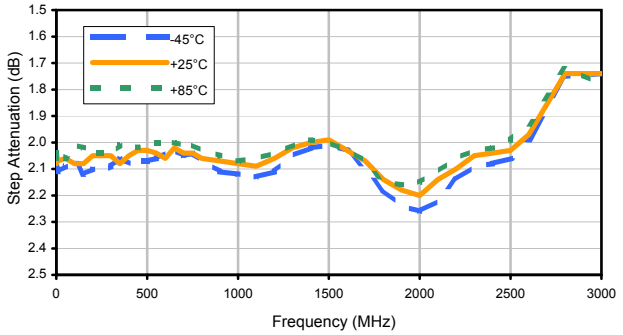
Thru Loss



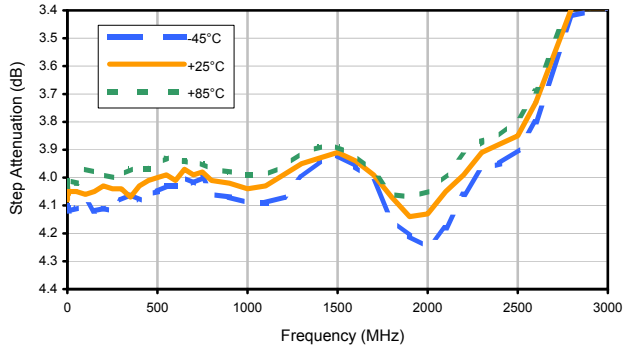
Step Attenuation (1dB)



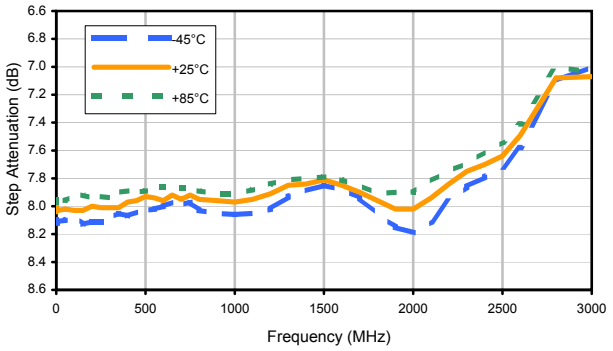
Step Attenuation (2dB)



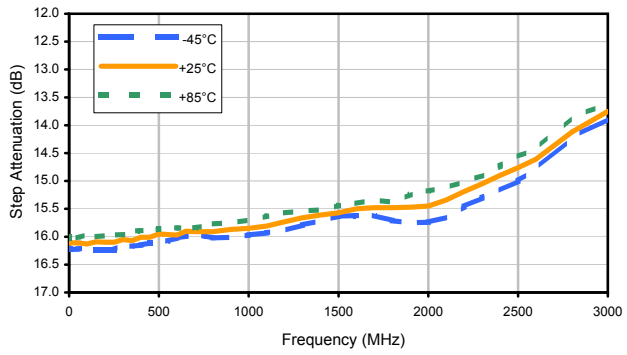
Step Attenuation (4dB)



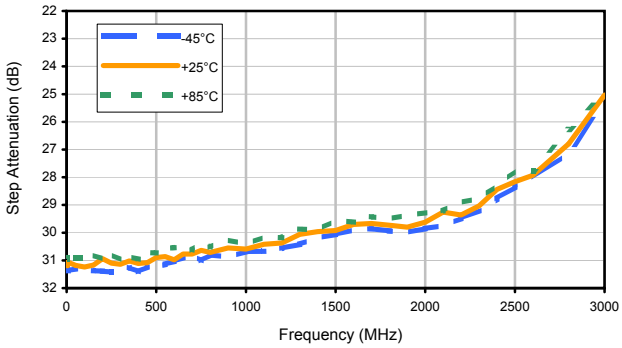
Step Attenuation (8dB)



Step Attenuation (16dB)



Step Attenuation (31dB)



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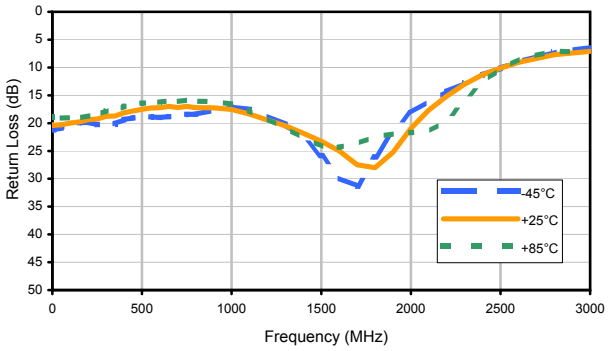
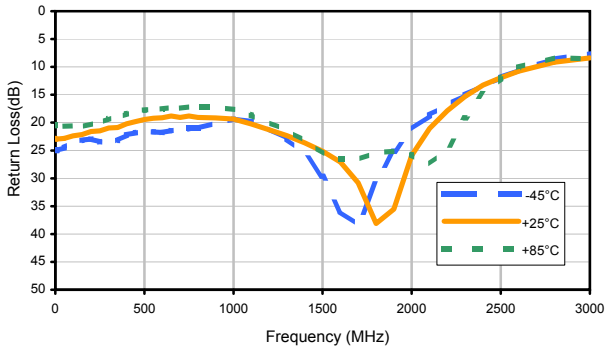
Typical Performance Curves

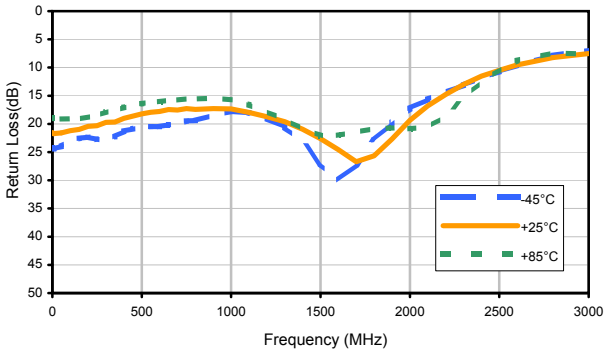
Input Return Loss (0dB)



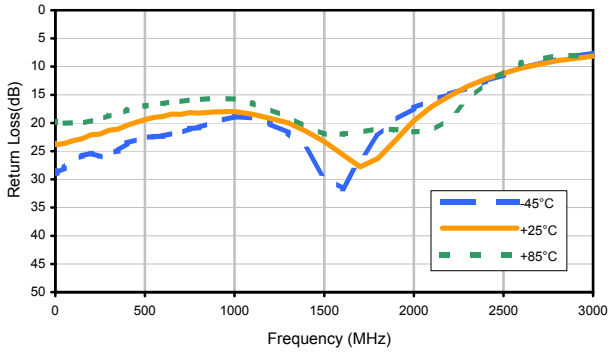
Input Return Loss (1dB)



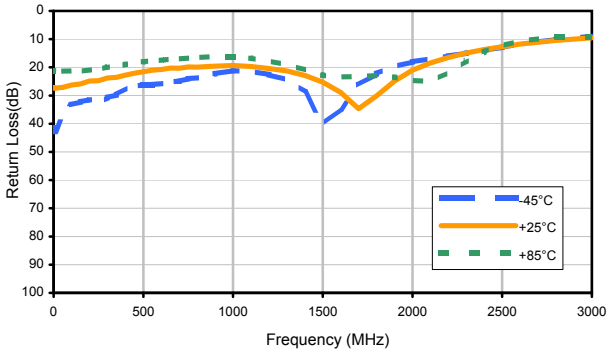
Input Return Loss (2dB)



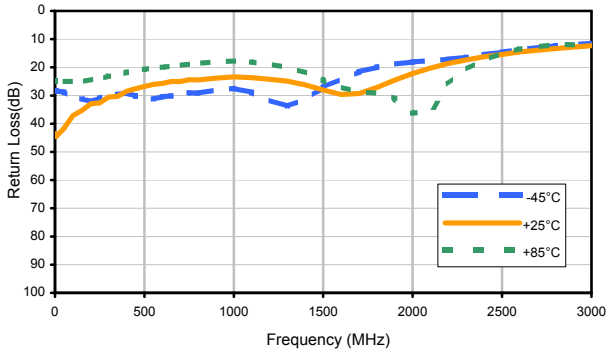
Input Return Loss (4dB)



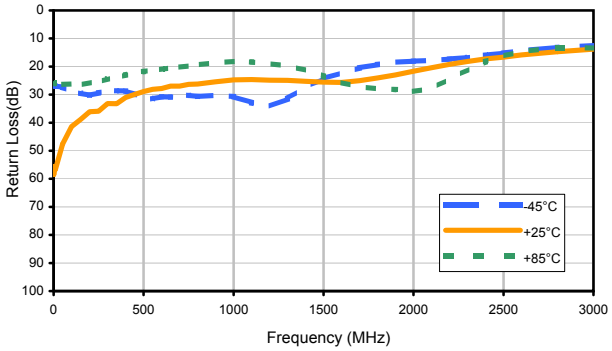
Input Return Loss (8dB)



Input Return Loss (16dB)



Input Return Loss (31dB)



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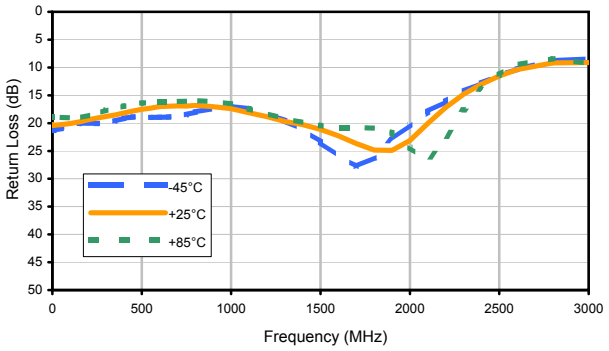
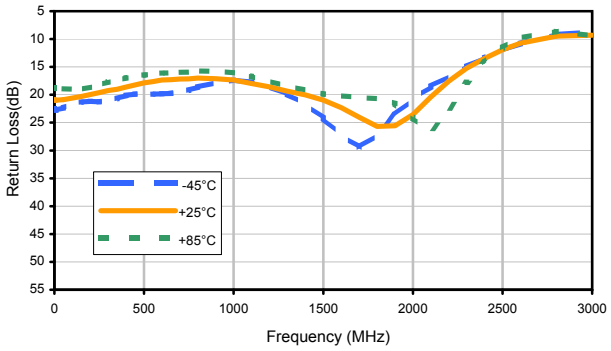
Typical Performance Curves

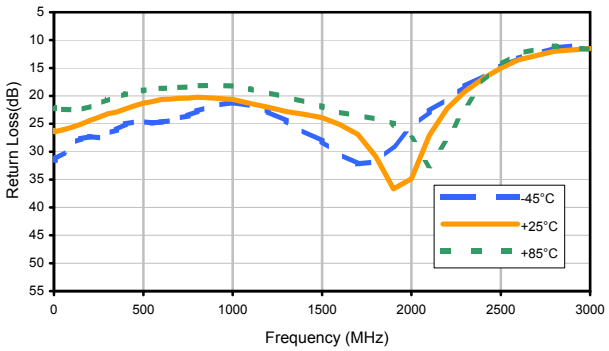
Output Return Loss (0dB)



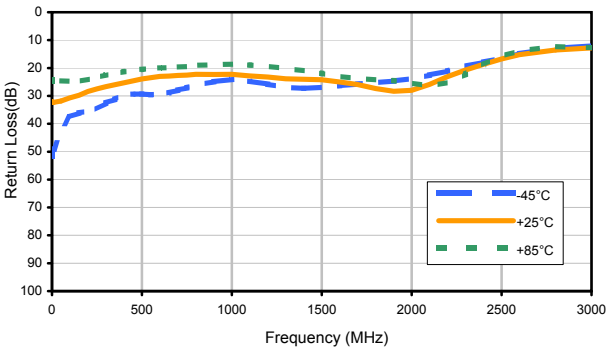
Output Return Loss (1dB)



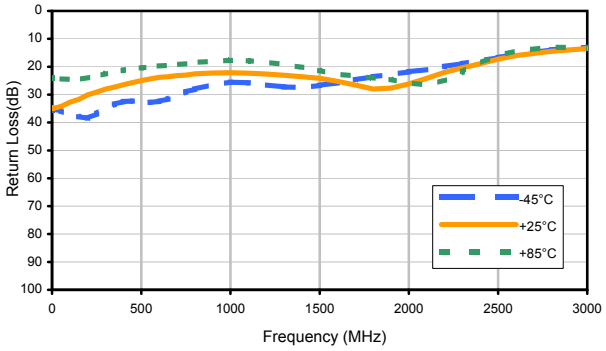
Output Return Loss (2dB)



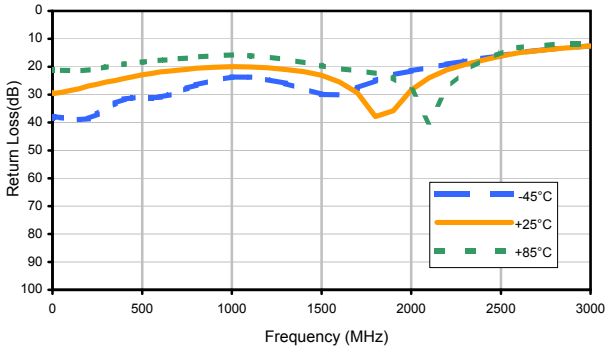
Output Return Loss (4dB)



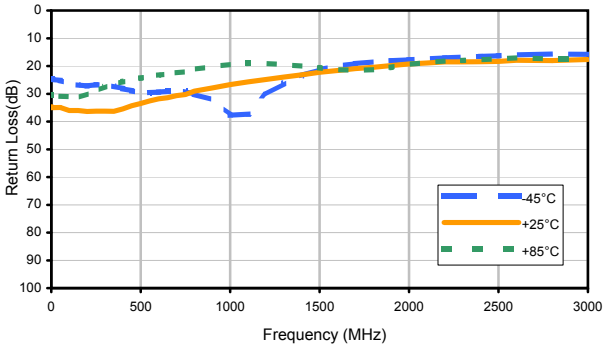
Output Return Loss(8dB)



Output Return Loss (16dB)



Output Return Loss (31dB)



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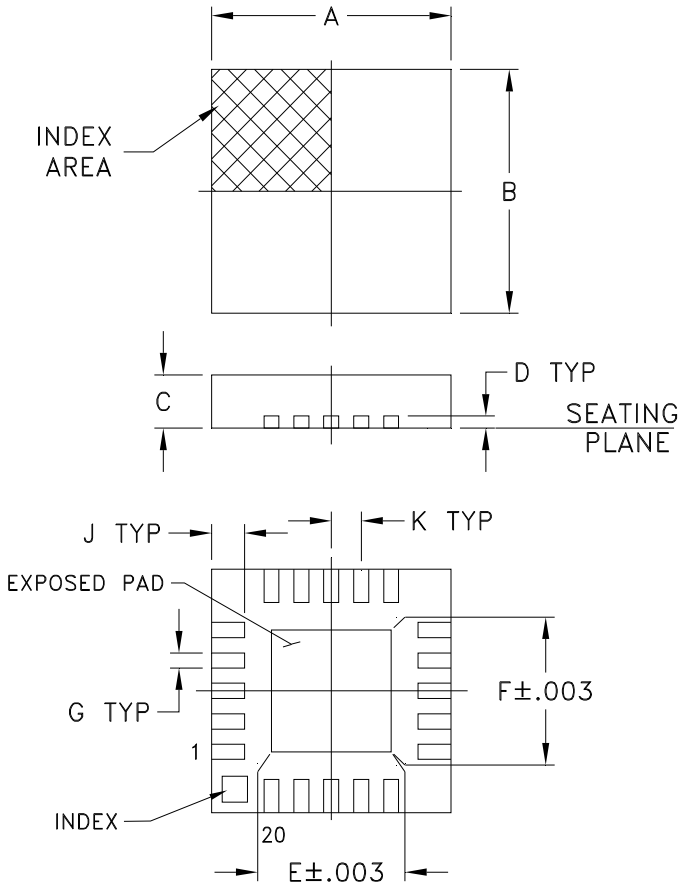
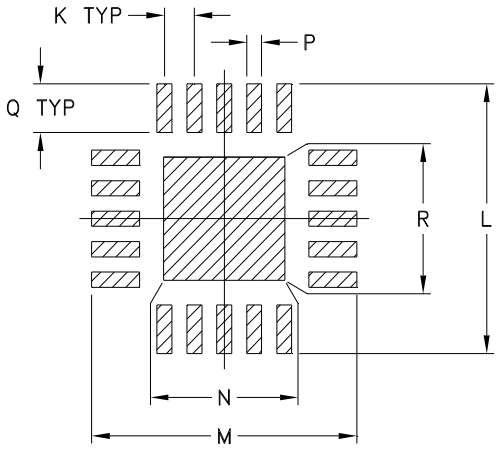
Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K
DG983-1	.157 (4.00)	.157 (4.00)	.035 (0.90)	.008 (0.20)	.081 (2.06)	.081 (2.06)	.010 (0.25)	-- --	.022 (0.56)	.020 (0.50)

CASE #	L	M	N	P	Q	R	WT. GRAM
DG983-1	.177 (4.50)	.177 (4.50)	.081 (2.06)	.010 (0.25)	.032 (0.81)	.081 (2.06)	.04

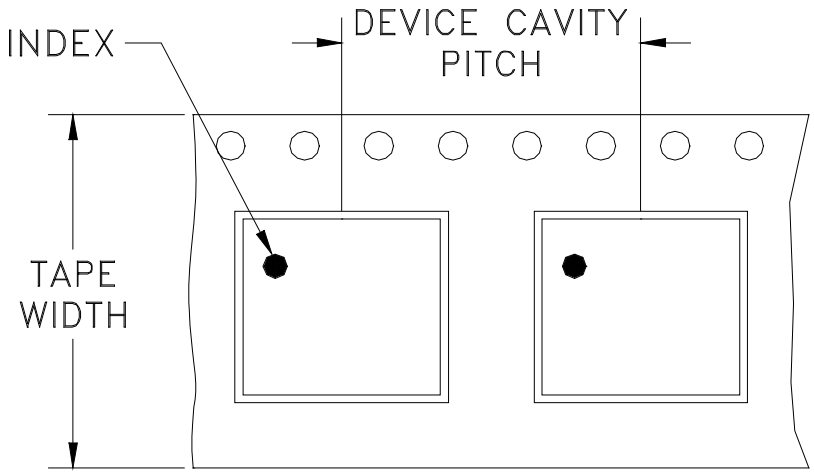
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

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

Tape & Reel Packaging TR-F87

DEVICE ORIENTATION IN T&R



DIRECTION OF FEED

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

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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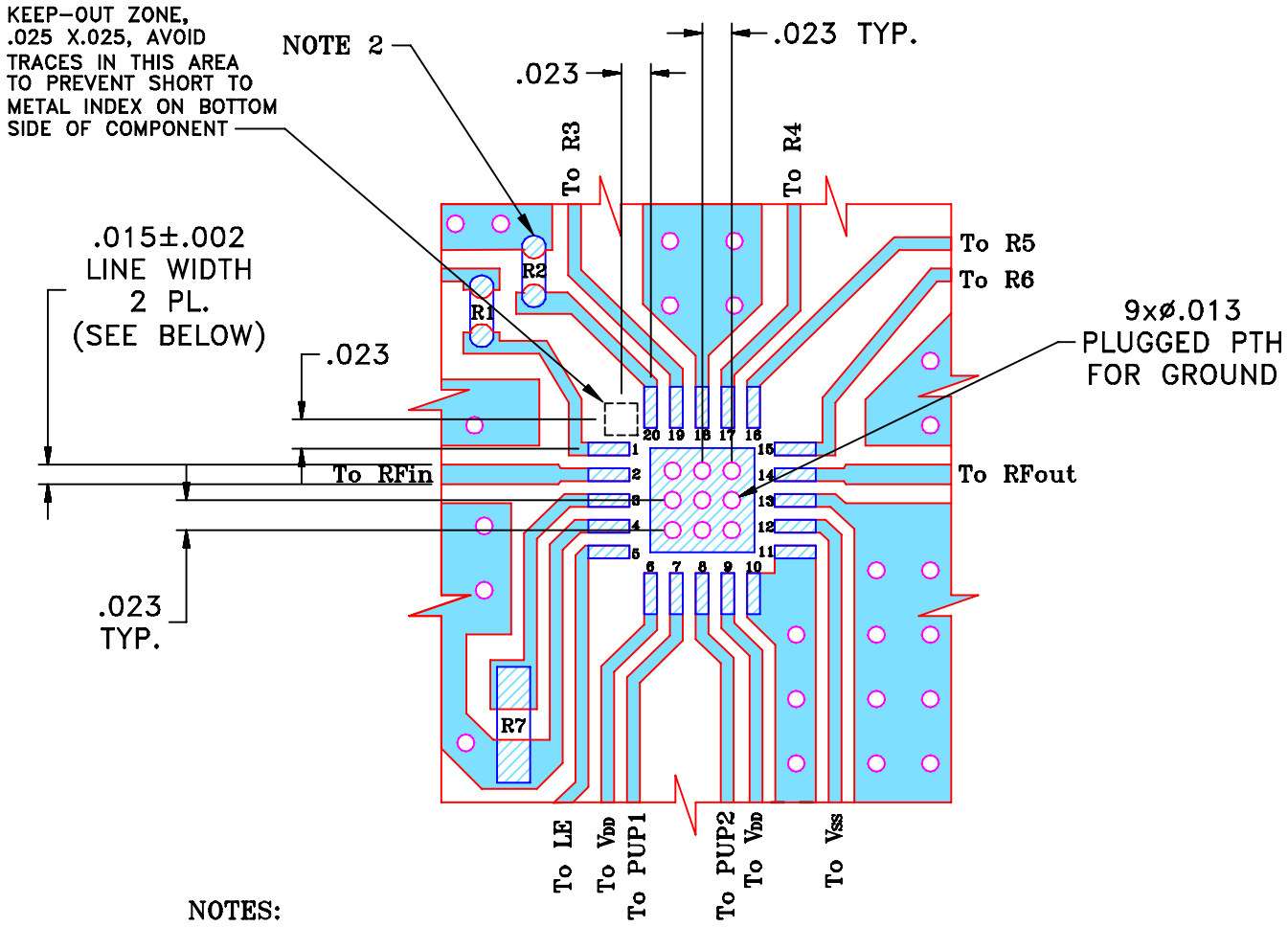
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M97254	NEW RELEASE (FROM RAVON)	03/05	DK	HH
A	M102713	MODIFIED HATCH, NOTES & ADDED "...WITH SMOBC"	01/06	GT	IL
B	M103510	ADD R7 & CHANGE LOCATION DESIGNATORS	07/09	EM	KN
B	R63339	ADD R7 & CHANGE LOCATION DESIGNATORS	07/09	EM	KN

SUGGESTED MOUNTING CONFIGURATION

FOR DG983-1 CASE STYLE, qr PIN CONNECTIONS, 75 Ω.



NOTES:

1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. 0603, 0402 SIZES CHIP FOOT PRINTS SHOWN FOR REFERENCE, VALUES OF RESISTORS WILL VARY BASED ON APPLICATION.
3. 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	DK (RAVON)	08 MAR 05
TOLERANCES ON:	CHECKED	RZ (RAVON)	08 MAR 05
2 PL DECIMALS ±	APPROVED	HH (RAVON)	08 MAR 05
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

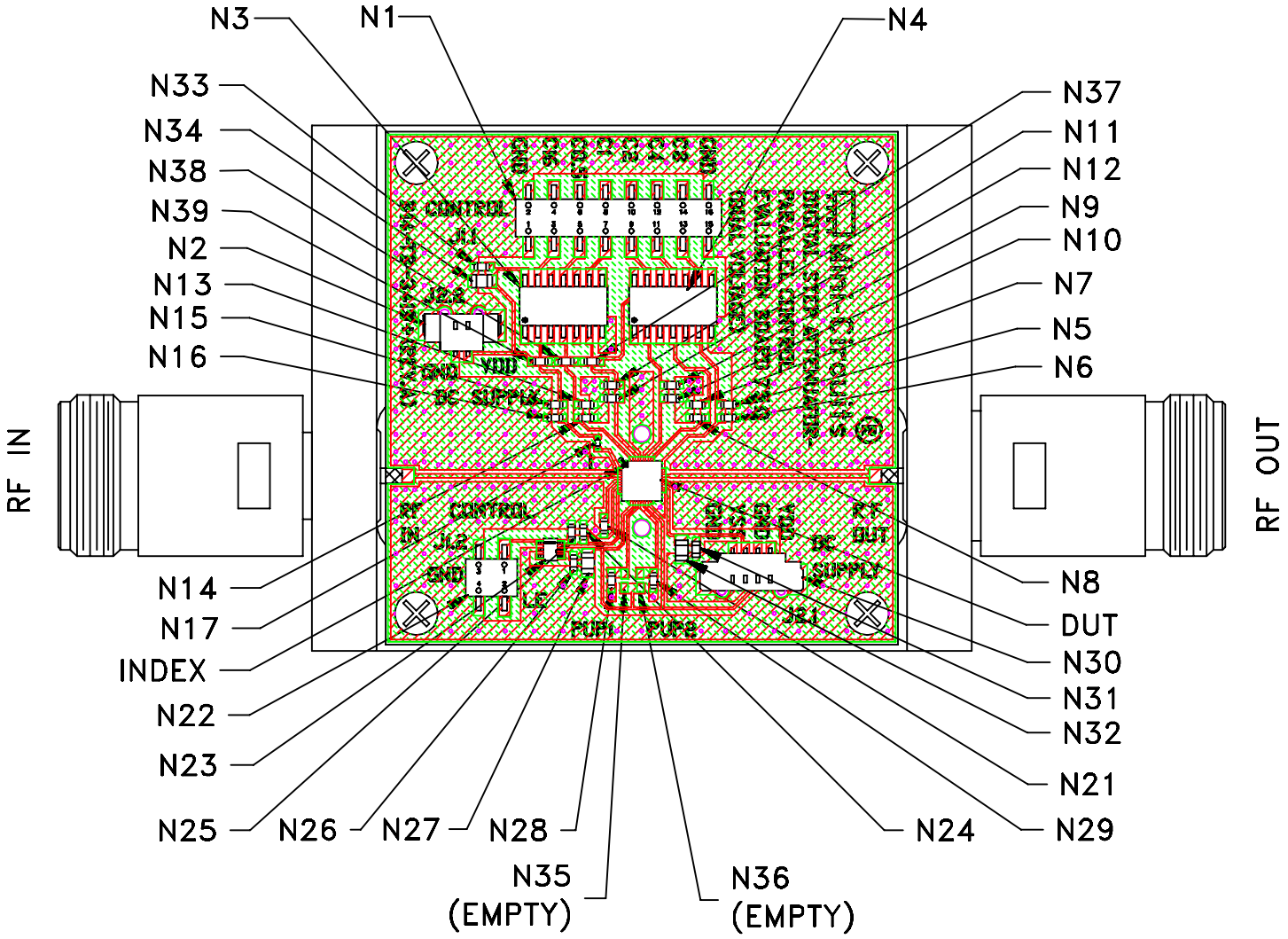
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, qr, DG983-1
TB-341 (75 Ω)

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-192	B

FILE:	SCALE:	SHEET:
98PL192	7:1	1 OF 1

Evaluation Board and Circuit



TB-341

Notes:
1. N-Type Female connectors.
2. PCB Material: FR4 Grade IT 180TC (ITEQ Corporation) or equivalent, Dielectric Constant=4.7, Thickness=.025 inch.

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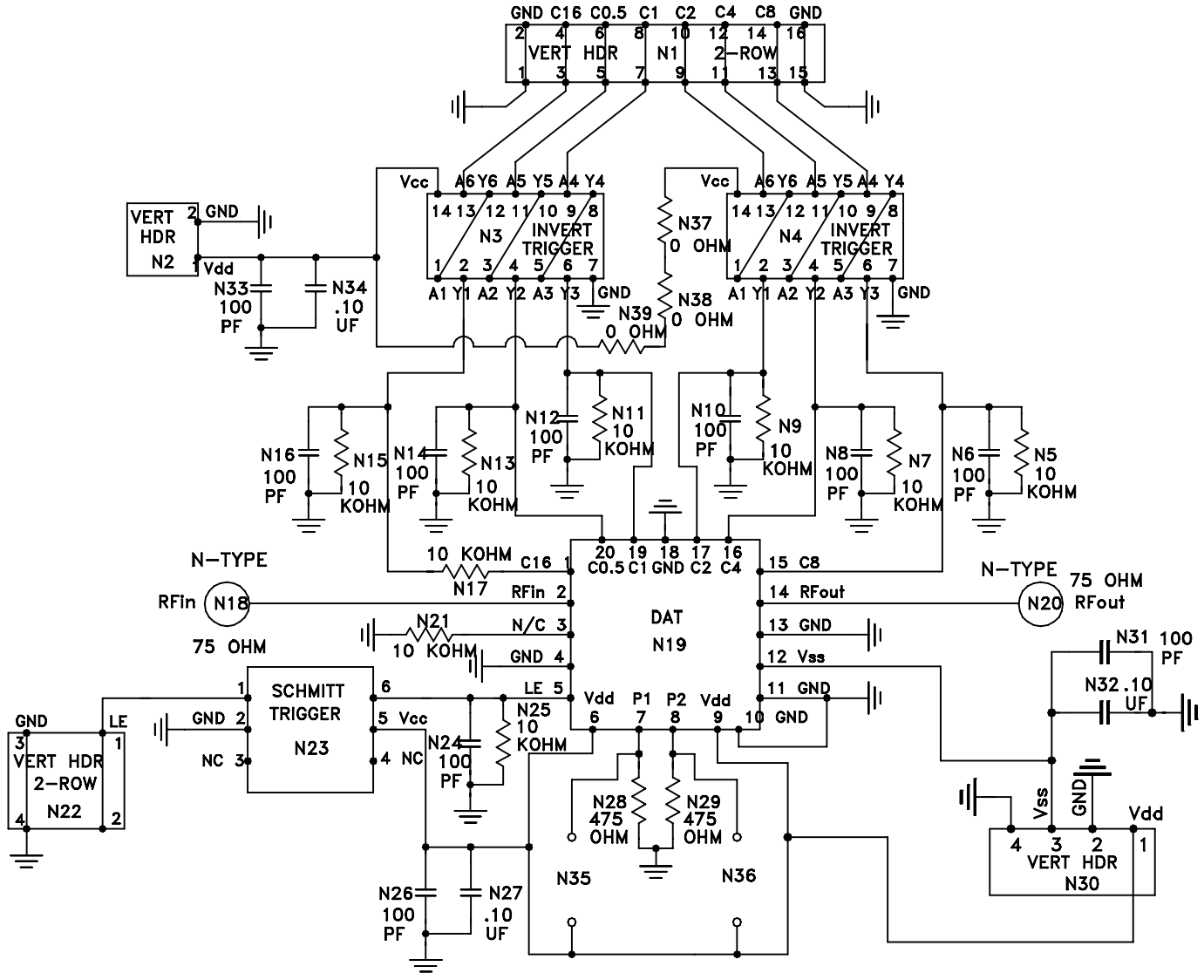

Schematic Diagram

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Environmental Specifications ENV33T1

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 Ambient Environment	Refer to Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° C Ambient Environment	Refer to Individual Model Data Sheet
Temperature Humidity Bias	85°C, 85% RH, 96 hours	JESD22-A101B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Solderability	10X magnification, 95% coverage	JESD22-B102, Method 1: Dip and Look Test
Marking Resistance to Solvents	Laser marked, visual observation	Mini-Circuits D4-Q4T0-04

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