NON-CATALOG

Digital Step Attenuator 75Ω DC-2000 MHz

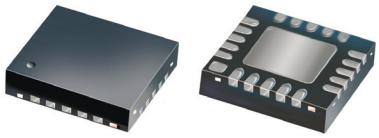
15.5 dB, 0.5 dB Step
5 Bit, Serial Control Interface, Dual Supply Voltage

Product Features

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

Typical Applications

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



DAT-15575-SN+

CASE STYLE: DG983-1

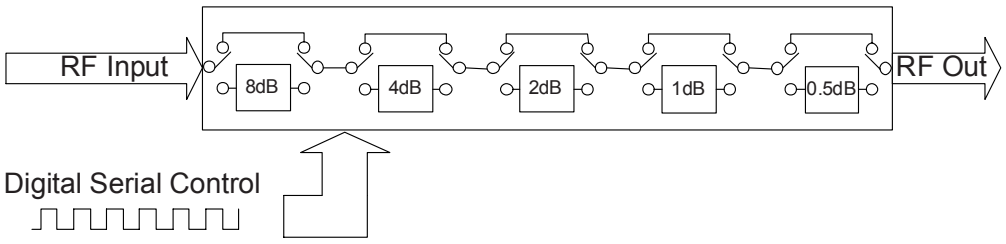
+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

This model will be replaced in the future with a improved design. The new model will be DAT-15575A-SN+. It will have similar performance, the same case style and footprint.

General Description

The DAT-15575-SN+ is a 75Ω RF digital step attenuator that offers an attenuation range up to 15.5 dB in 0.5 dB steps. The control is a 5-bit serial interface, operating on dual supply voltage: V_{DD}=+3V, V_{SS}=-3V. The DAT-15575-SN+ 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 @ **0.5 dB** Attenuation Setting	DC-1.2	—	0.03	0.17	dB
	1.2-2.0	—	0.05	0.18	dB
Accuracy @ **1 dB** Attenuation Setting	DC-1.2	—	0.03	0.19	dB
	1.2-2.0	—	0.1	0.2	dB
Accuracy @ **2 dB** Attenuation Setting	DC-1.2	—	0.07	0.23	dB
	1.2-2.0	—	0.15	0.25	dB
Accuracy @ **4 dB** Attenuation Setting	DC-1.2	—	0.05	0.25	dB
	1.2-2.0	—	0.15	0.35	dB
Accuracy @ **8 dB** Attenuation Setting	DC-1.2	—	0.1	0.25	dB
	1.2-2.0	—	0.24	0.55	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

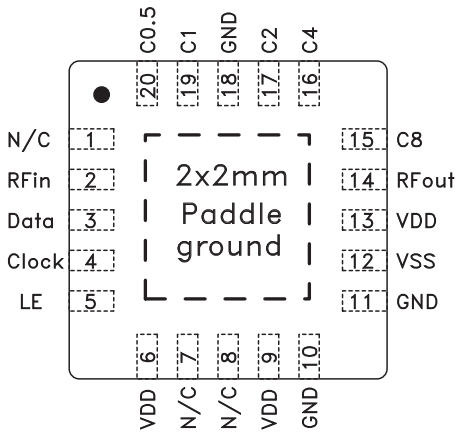
Permanent damage may occur if any of these limits are exceeded.

Pin Description

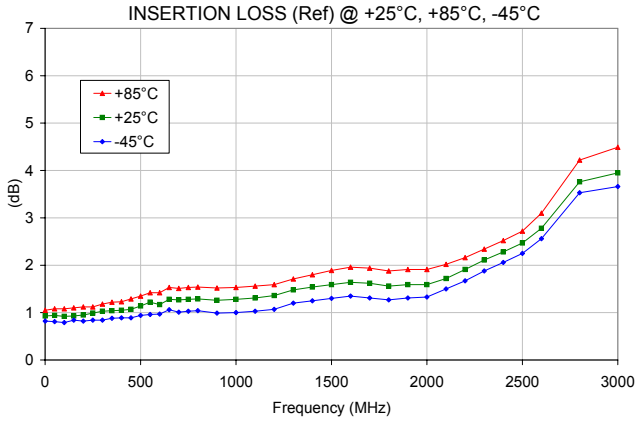
Function	Pin Number	Description
N/C	1	Not connected (Note 5)
RF in	2	RF in port (Note 1)
Data	3	Serial Interface data input (Note 3)
Clock	4	Serial Interface clock input
LE	5	Latch Enable Input (Note 2)
V_{DD}	6	Positive Supply Voltage
N/C	7	Not connected
N/C	8	Not connected
V_{DD}	9	Positive Supply Voltage
GND	10	Ground connection
GND	11	Ground connection
V_{SS}	12	Negative supply voltage
V_{DD}	13	Positive Supply Voltage
RF out	14	RF out port (Note 1)
C8	15	Control for attenuation bit, 8 dB (Note 4)
C4	16	Control for attenuation bit, 4 dB (Note 4)
C2	17	Control for attenuation bit, 2 dB (Note 4)
GND	18	Ground Connection
C1	19	Control for attenuation bit, 1 dB (Note 4)
C0.5	20	Control for attenuation bit, 0.5 dB (Note 4)
GND	Paddle	Paddle ground (Note 6)

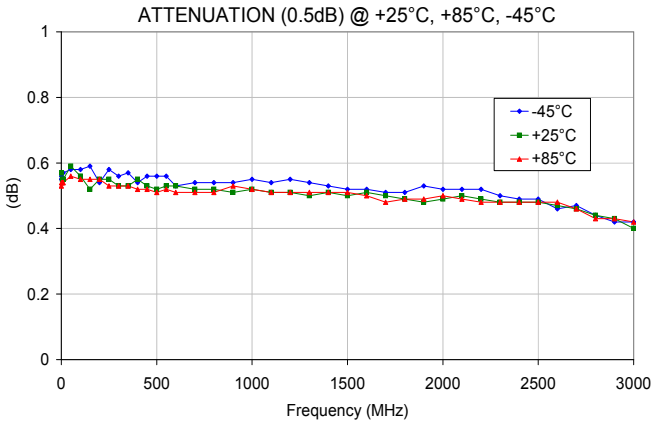
Notes:
1. Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.
2. Latch Enable (LE) has an internal 100KΩ resistor to V_{DD}.
3. Place a 10KΩ resistor in series, as close to pin as possible to avoid freq. resonance.
4. Refer to Power-up Control Settings.
5. Place a shunt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

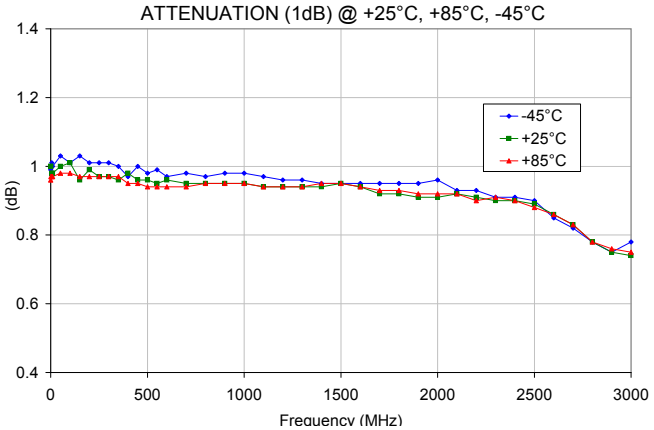
Pin Configuration (Top View)

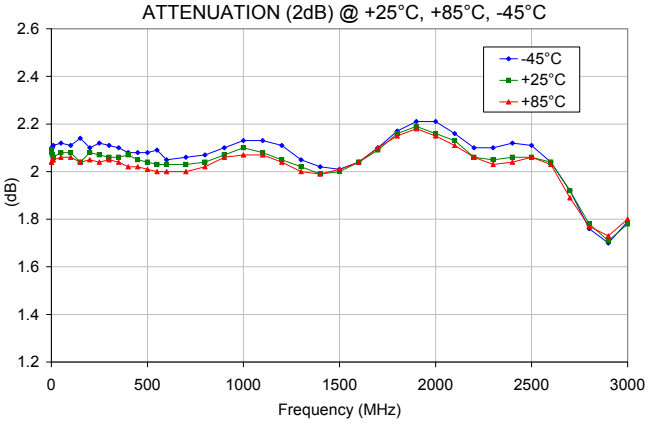


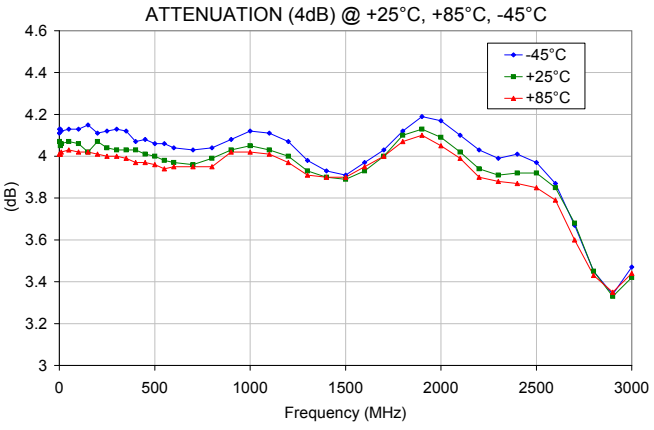
Typical Performance Curves

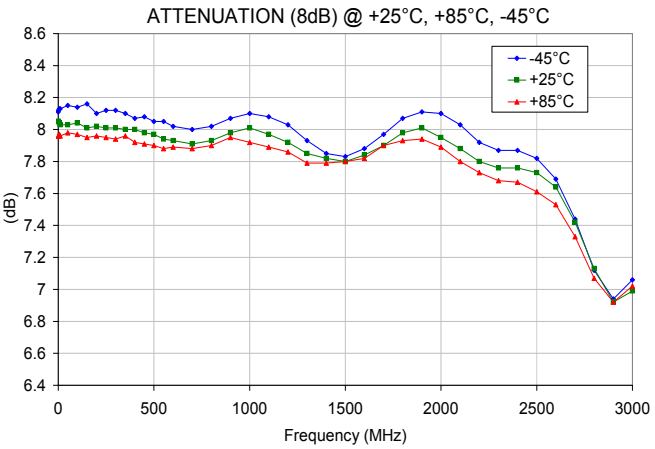












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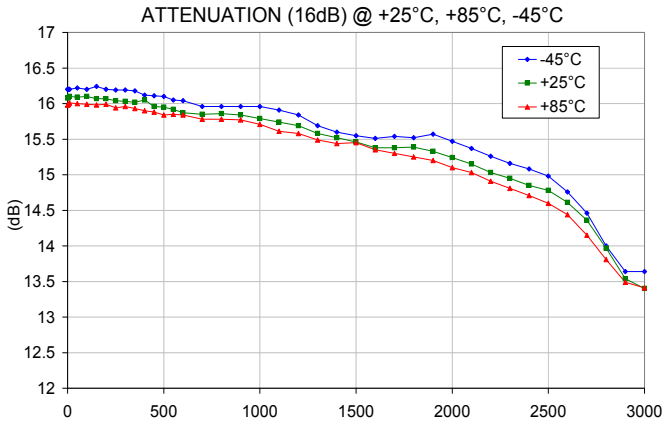
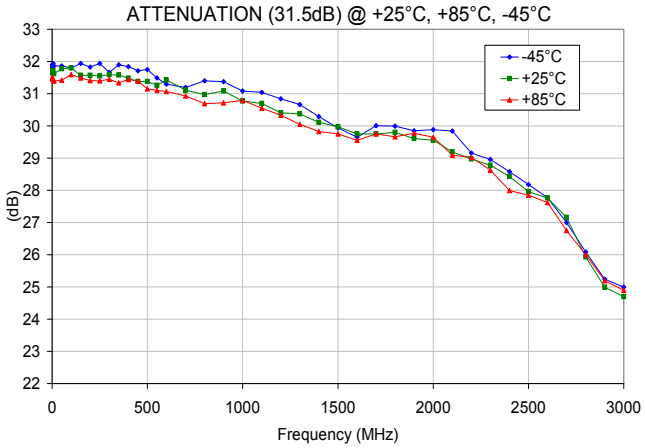
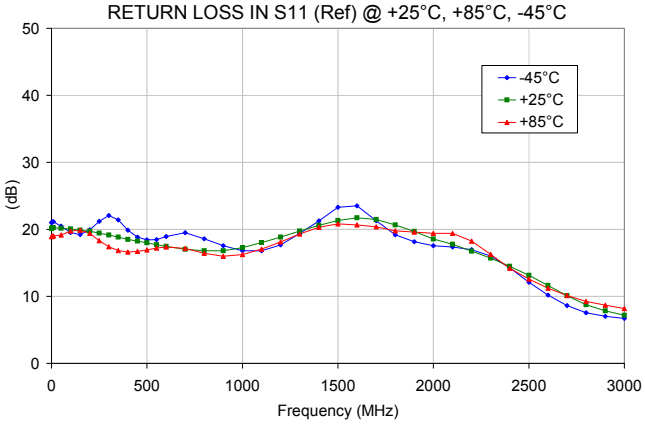
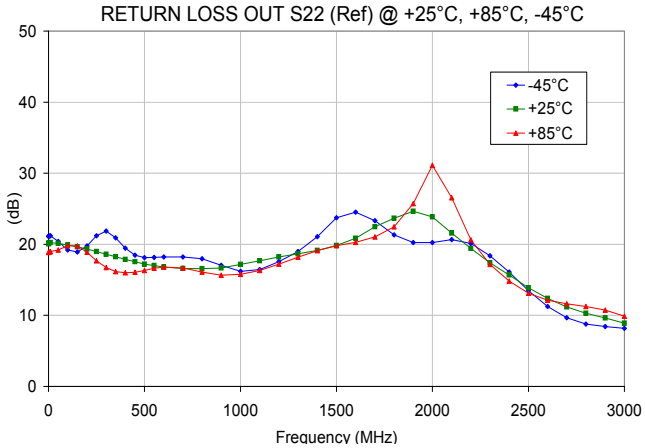
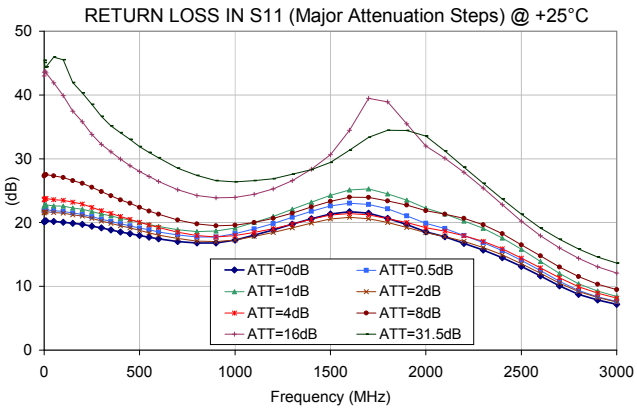


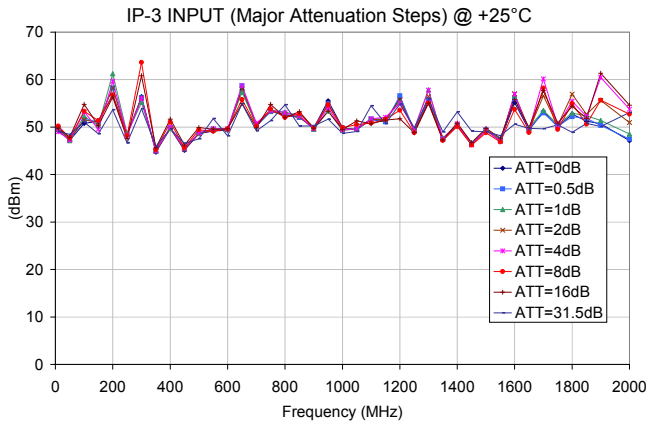


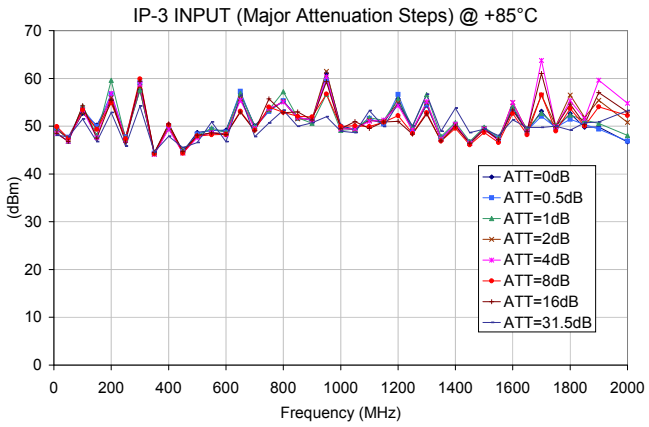


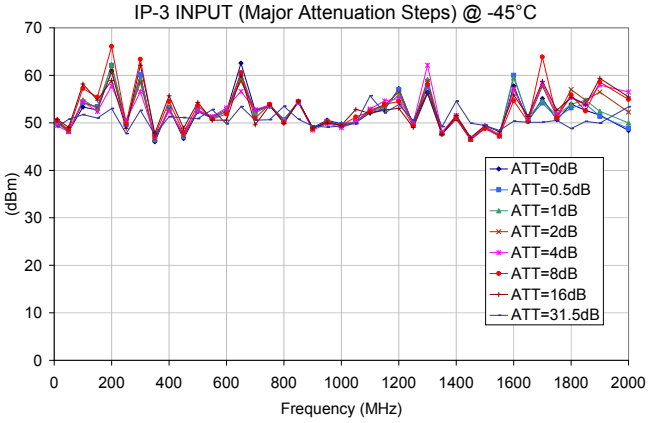


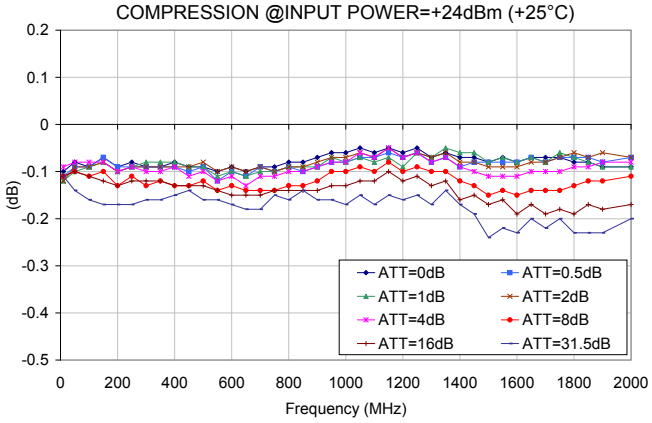


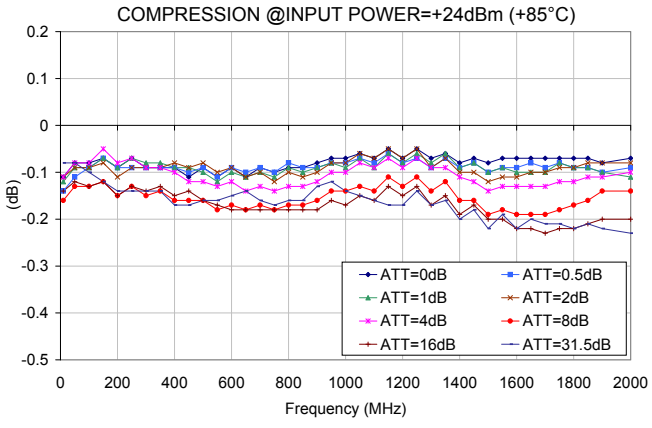
Typical Performance Curves

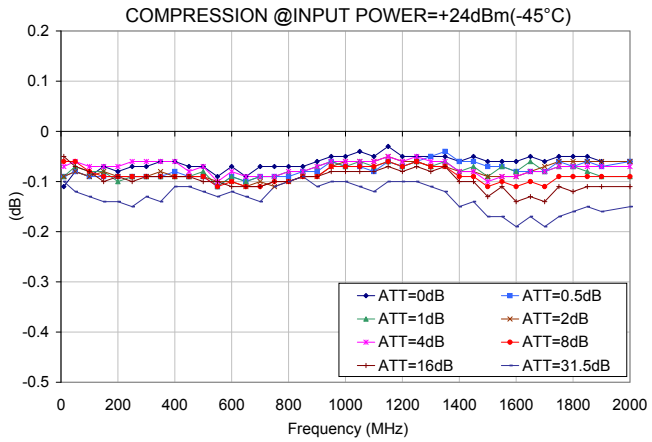




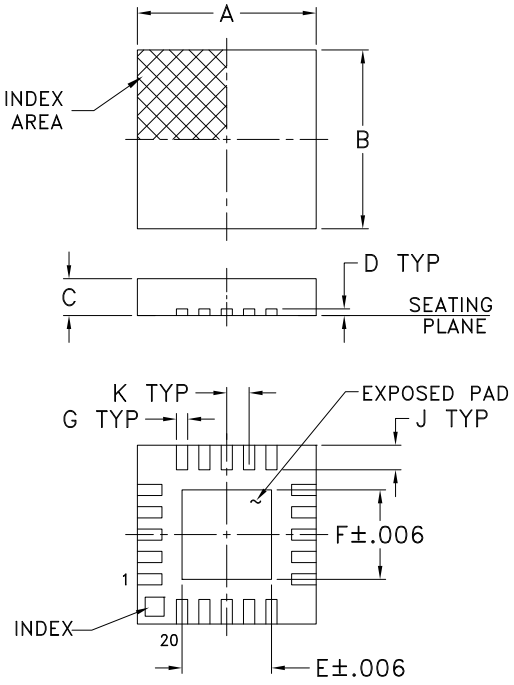




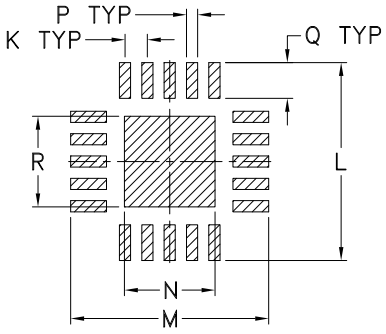




Outline Drawing (DG983-1)

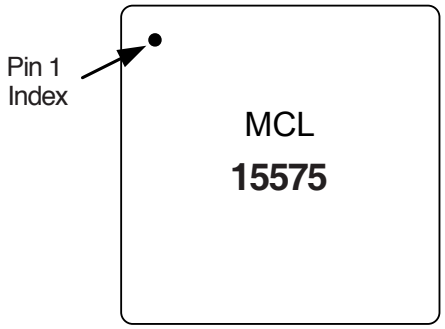


PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Device Marking

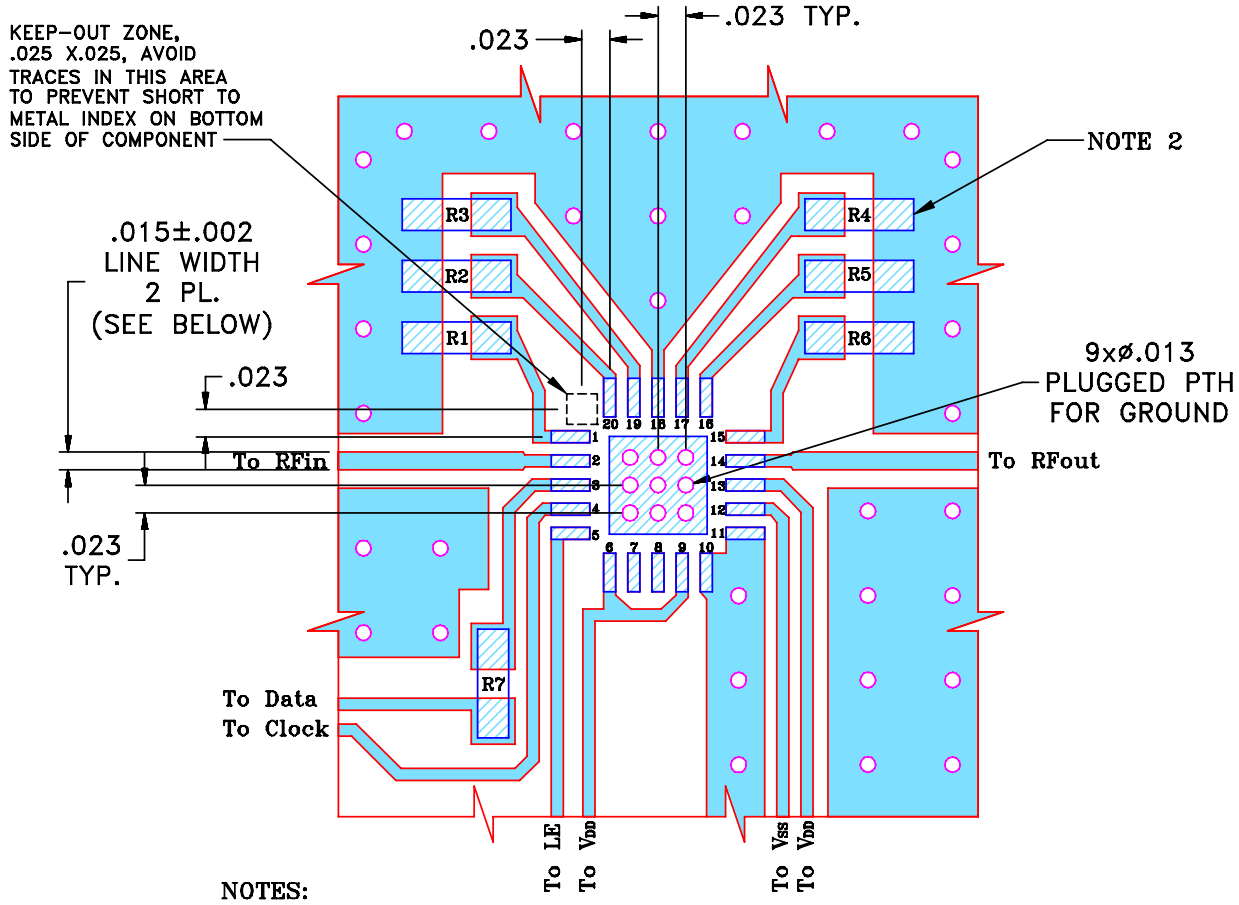


Outline Dimensions (inch/mm)

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-202)

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



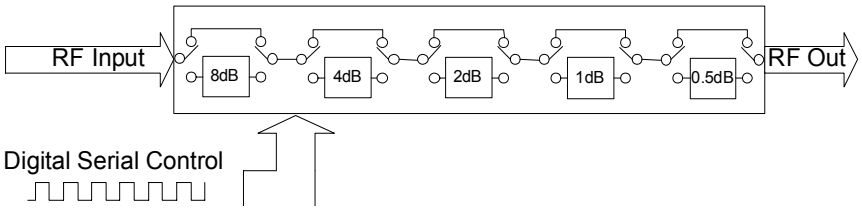
NOTES:

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 SIZE 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 SOLDERMASK

Simplified Schematic



The DAT-15575-SP serial 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	C8	C4	C2	C1	C0.5
Reference	0	0	0	0	0
0.5 (dB)	0	0	0	0	1
1 (dB)	0	0	0	1	0
2 (dB)	0	0	1	0	0
4 (dB)	0	1	0	0	0
8 (dB)	1	0	0	0	0
15.5 (dB)	1	1	1	1	1

Note: Not all 32 possible combinations of C0.5 - C8 are shown in table

The serial interface is a 5-bit serial in, parallel-out shift register buffered by a transparent latch.

It is controlled by three CMOS-compatible signals: Data, Clock, and Latch Enable (LE). The Data and Clock inputs allow data to be serially entered into the shift register, a process that is independent of the state of the LE input.

The LE input controls the latch. When LE is HIGH, the latch is transparent and the contents of the serial shift register control the attenuator. When LE is brought LOW, data in the shift register is latched.

The shift register should be loaded while LE is held LOW to prevent the attenuator value from changing as data is entered. The LE input should then be toggled HIGH and brought LOW again, latching the new data. The timing for this operation is defined by **Figure 1** (Serial Interface Timing Diagram) and **Table 2** (Serial Interface AC Characteristics).

Figure 1: Serial Interface Timing Diagram

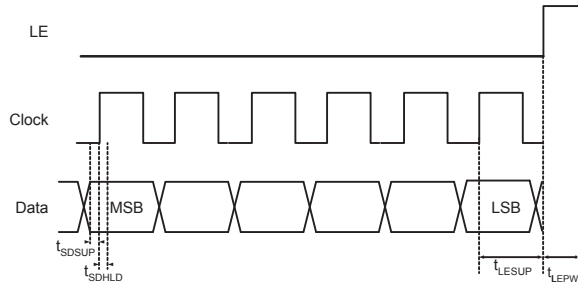


Table 2. Serial Interface AC Characteristics

Symbol	Parameter	Min.	Max.	Units
f_{clk}	Serial data clock frequency (Note 1)		10	MHz
t_{clkH}	Serial clock HIGH time	30		ns
t_{clkL}	Serial clock LOW time	30		ns
t_{LESUP}	LE set-up time after last clock falling edge	10		ns
t_{LEPW}	LE minimum pulse width	30		ns
t_{SDSUP}	Serial data set-up time before clock rising edge	10		ns
t_{SDHLD}	Serial data hold time after clock falling edge	10		ns

Note 1. fclk verified during the functional pattern test. Serial programming sections of the functional pattern are clocked at 10MHz to verify fclk specification.

The DAT-15575-SN+, uses a common 5-bit serial word format, as shown in Table 3: 5-Bit attenuator Serial Programming Register Map.

Bit B4 corresponds to the 8 dB Step and Bit B0 corresponds to the 0.5 dB step.

Table 3. 5-Bit attenuator Serial Programming Register Map

B5	B4	B3	B2	B1	B0
0	C8	C4	C2	C1	C0.5

MSB (first in)

LSB (last in)

Note: The start bit (B5) must always be low to prevent the attenuator from entering an unknown state.

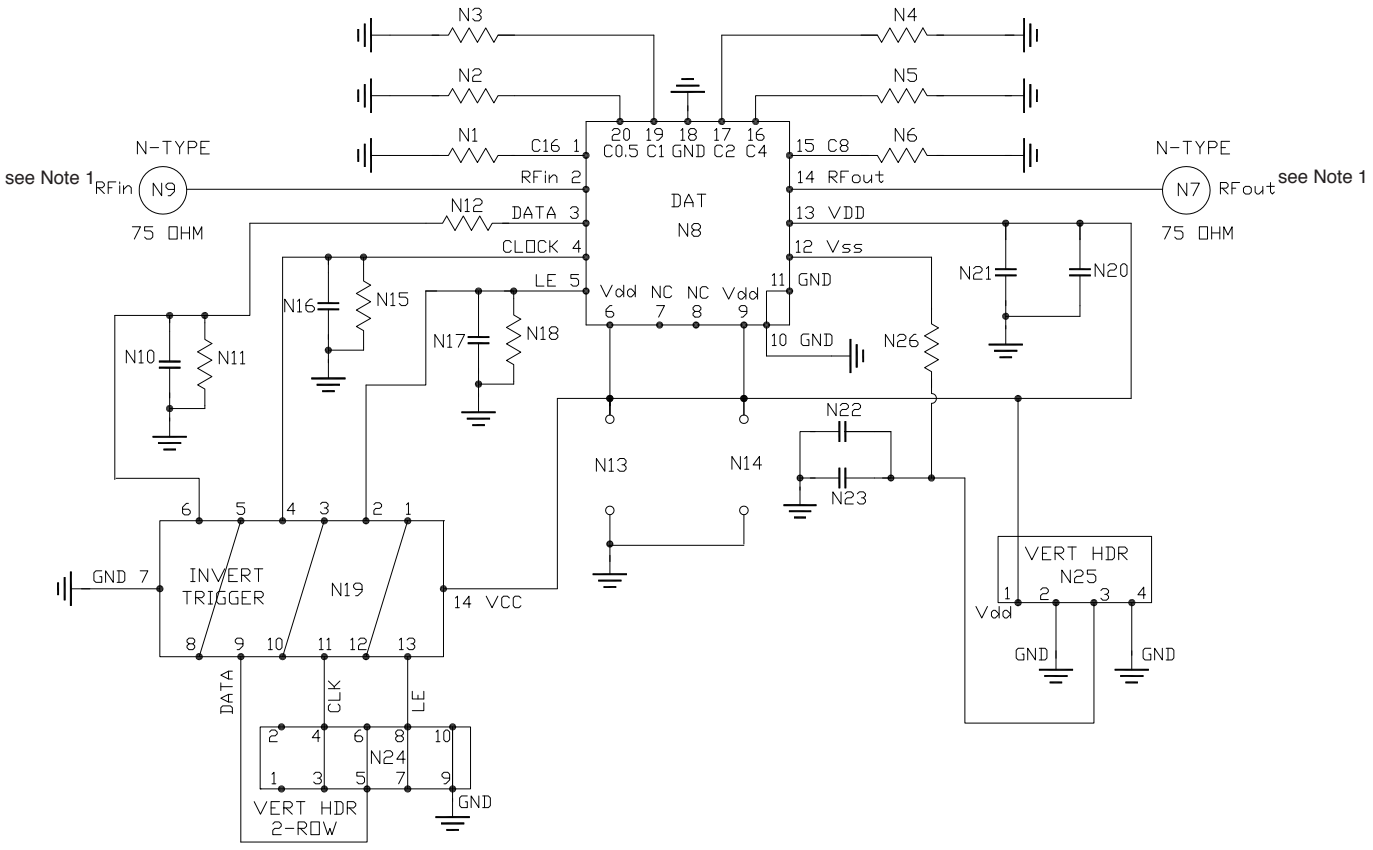
Power-up Control Settings

The DAT-15575-SN+ always assumes a specifiable attenuation setting on power-up, allowing a known attenuation state to be established before an initial serial control word is provided.

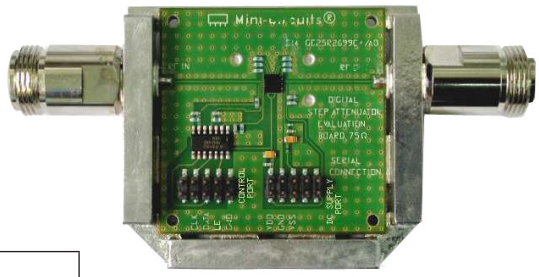
When the attenuator powers up, the five control bits are set to whatever data is present on the five data inputs (C0.5 to C8).

This allows any one of the 32 attenuation settings to be specified as the power-up state.

TB-343 Evaluation Board Schematic Diagram



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

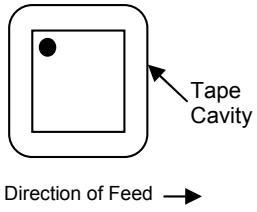


TB-343

Bill of Materials	
N1-N6, N11, N12, N15 & N18	Resistor 0603 10 KOhm +/- 1%
N26	Resistor 0603 0 Ohm
N10, N16, N17, N20 & N23	NPO Capacitor 0603 100pF +/- 5%
N21 & N22	Tantalum Capacitor 0805 100nF +/- 10%
N19	Hex Invert Schmitt Trigger MSL1

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-15575-SN+

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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	0.82	0.57	1.02	2.10	4.12	8.13	15.85
1	0.83	0.55	1.00	2.09	4.11	8.12	15.83
5	0.82	0.58	1.03	2.11	4.11	8.13	15.85
10	0.84	0.57	1.02	2.10	4.12	8.13	15.86
50	0.86	0.58	1.03	2.10	4.12	8.13	15.85
100	0.87	0.58	1.03	2.12	4.12	8.14	15.86
150	0.94	0.56	0.98	2.07	4.08	8.11	15.82
200	0.94	0.57	1.00	2.09	4.11	8.11	15.83
250	0.97	0.59	1.02	2.10	4.11	8.13	15.82
300	0.99	0.56	1.03	2.11	4.13	8.12	15.85
350	1.05	0.57	0.99	2.08	4.08	8.07	15.76
400	1.08	0.54	0.99	2.08	4.09	8.08	15.75
450	1.09	0.57	1.02	2.11	4.11	8.09	15.78
500	1.16	0.56	1.00	2.08	4.07	8.06	15.71
550	1.19	0.58	1.01	2.09	4.08	8.06	15.70
600	1.22	0.56	1.00	2.06	4.06	8.04	15.68
650	1.31	0.53	0.98	2.04	4.02	8.00	15.64
700	1.27	0.57	1.01	2.08	4.07	8.05	15.71
750	1.31	0.55	0.99	2.05	4.03	8.01	15.64
800	1.33	0.55	1.00	2.08	4.06	8.03	15.69
900	1.30	0.56	1.01	2.11	4.10	8.08	15.72
1000	1.33	0.55	0.99	2.12	4.13	8.09	15.71
1100	1.38	0.54	0.99	2.11	4.11	8.07	15.68
1200	1.45	0.54	0.98	2.11	4.08	8.04	15.63
1300	1.60	0.53	0.98	2.05	4.02	7.94	15.51
1400	1.68	0.53	0.98	2.03	3.97	7.90	15.41
1500	1.76	0.53	0.97	2.01	3.94	7.88	15.31
1600	1.83	0.51	0.96	2.03	3.97	7.90	15.38
1700	1.83	0.52	0.97	2.08	4.01	7.94	15.43
1800	1.80	0.52	0.97	2.15	4.11	8.02	15.52
1900	1.86	0.54	0.96	2.20	4.17	8.10	15.62
2000	1.90	0.53	0.98	2.23	4.21	8.13	15.66
2100	2.08	0.52	0.96	2.19	4.14	8.07	15.52
2200	2.26	0.51	0.95	2.13	4.05	7.97	15.37
2300	2.48	0.50	0.92	2.09	3.97	7.86	15.23
2400	2.68	0.49	0.87	2.07	3.95	7.81	15.07
2500	2.88	0.48	0.86	2.04	3.90	7.73	14.97
2600	3.21	0.46	0.83	2.00	3.83	7.64	14.74
2800	4.23	0.45	0.78	1.77	3.48	7.19	14.04
3000	4.40	0.43	0.78	1.74	3.41	7.03	13.55

* 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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	21.12	23.44	24.70	23.97	27.66	37.70	35.70
1	21.18	23.51	24.78	24.07	27.77	38.26	35.39
5	21.25	23.62	24.89	24.14	27.89	38.57	35.20
10	21.24	23.60	24.86	24.14	27.93	38.53	35.07
50	21.05	23.28	24.52	23.81	27.28	35.88	35.19
100	20.34	22.38	23.46	22.78	25.77	32.06	37.84
150	20.12	22.09	23.15	22.52	25.42	31.53	38.92
200	19.99	21.89	22.96	22.23	25.03	30.85	41.04
250	20.44	22.48	23.63	22.84	25.80	32.23	39.93
300	20.22	22.15	23.32	22.50	25.14	30.71	36.15
350	20.33	22.16	23.41	22.40	24.98	30.17	34.95
400	19.54	21.24	22.35	21.38	23.56	27.72	32.18
450	19.20	20.79	21.87	20.89	22.94	26.89	32.75
500	19.08	20.57	21.72	20.66	22.59	26.39	32.36
550	19.12	20.68	21.79	20.70	22.63	26.54	33.51
600	19.43	20.97	22.25	20.92	22.84	26.90	33.70
650	19.27	20.74	22.01	20.62	22.56	26.37	32.87
700	19.49	21.02	22.30	20.74	22.58	26.33	32.45
750	18.92	20.27	21.55	20.07	21.66	25.02	30.27
800	18.80	20.17	21.44	19.87	21.40	24.70	29.95
900	17.83	19.04	20.23	18.68	20.01	22.85	27.31
1000	17.02	18.10	19.17	17.72	18.88	21.39	25.41
1100	17.13	18.16	19.24	17.68	18.70	21.14	24.98
1200	18.08	19.21	20.25	18.61	19.61	22.09	25.78
1300	19.76	20.99	22.06	20.24	21.35	23.97	27.02
1400	22.12	23.70	24.72	22.88	24.25	27.58	28.65
1500	25.36	27.50	28.08	26.54	28.84	33.85	29.03
1600	29.53	33.38	32.90	30.75	34.59	41.55	27.62
1700	33.67	41.48	38.96	29.91	30.30	29.94	25.12
1800	28.95	31.42	36.55	25.55	25.16	25.43	23.42
1900	24.52	25.98	29.88	22.30	22.08	22.67	22.02
2000	20.82	22.04	25.06	19.69	19.89	20.88	21.01
2100	18.39	19.48	22.02	17.97	18.42	19.58	20.20
2200	16.55	17.56	19.70	16.52	17.14	18.37	19.20
2300	14.64	15.51	17.30	14.85	15.56	16.92	17.90
2400	12.75	13.54	15.01	13.16	13.92	15.37	16.53
2500	11.27	11.94	13.17	11.74	12.54	14.06	15.28
2600	9.75	10.37	11.45	10.32	11.14	12.66	14.09
2800	7.73	8.23	9.12	8.38	9.16	10.76	12.49
3000	7.16	7.60	8.41	7.68	8.40	9.95	11.78

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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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	21.21	22.50	22.50	30.52	54.57	38.23	26.44
1	21.28	22.58	22.60	30.61	57.06	37.74	26.36
5	21.37	22.68	22.69	30.76	56.98	37.79	26.45
10	21.33	22.63	22.63	30.66	52.86	37.74	26.40
50	21.00	22.31	22.32	29.78	41.48	38.33	26.89
100	20.48	21.62	21.63	28.10	36.78	39.66	28.16
150	20.28	21.41	21.43	27.65	36.11	40.81	28.61
200	20.21	21.38	21.37	27.49	35.29	40.76	28.90
250	20.41	21.56	21.52	27.85	35.55	38.18	28.07
300	20.17	21.19	21.19	26.90	32.89	35.06	28.41
350	19.92	20.86	20.85	26.18	31.18	33.73	29.05
400	19.32	20.27	20.26	25.23	29.92	32.75	30.23
450	19.14	20.02	20.05	24.87	29.60	32.74	31.83
500	19.27	20.07	20.12	25.04	30.08	33.76	32.74
550	19.61	20.44	20.48	25.77	31.14	35.25	31.73
600	19.75	20.57	20.61	25.86	31.26	34.68	31.05
650	19.82	20.56	20.64	25.82	30.86	33.77	30.51
700	19.62	20.36	20.41	25.37	29.93	32.21	30.31
750	19.47	20.13	20.17	24.94	28.94	30.74	29.63
800	18.90	19.54	19.57	23.93	27.42	29.09	30.02
900	17.82	18.38	18.39	22.21	25.15	26.43	30.91
1000	17.17	17.59	17.59	21.19	23.88	24.98	33.80
1100	17.36	17.75	17.70	21.42	24.06	25.04	34.97
1200	18.26	18.65	18.54	22.61	25.31	26.01	31.51
1300	19.50	19.95	19.76	24.21	26.35	26.96	27.59
1400	21.51	21.97	21.74	26.22	27.27	27.73	24.44
1500	24.19	24.86	24.64	28.80	27.60	28.12	22.49
1600	27.27	28.52	28.23	30.82	27.19	27.16	21.12
1700	29.40	30.84	30.95	32.53	26.95	26.29	20.45
1800	27.61	28.68	28.55	33.22	26.80	25.36	20.03
1900	24.54	25.06	25.12	31.74	26.66	24.53	19.83
2000	22.19	22.71	22.88	29.78	26.54	24.07	19.66
2100	20.16	20.55	20.83	26.58	25.42	22.98	19.12
2200	18.37	18.84	19.17	24.12	24.15	21.98	18.72
2300	16.49	16.87	17.17	21.06	21.73	20.36	17.87
2400	14.45	14.81	15.11	18.38	19.58	18.94	17.45
2500	12.65	12.95	13.22	15.93	17.35	17.23	16.83
2600	11.07	11.34	11.63	14.08	15.57	15.83	16.39
2800	9.39	9.63	9.85	12.01	13.46	14.23	16.10
3000	9.04	9.21	9.36	11.31	12.61	13.33	16.27

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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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	0.93	0.56	1.00	2.07	4.07	8.05	15.69
1	0.95	0.55	0.99	2.06	4.06	8.04	15.69
5	0.95	0.55	1.00	2.07	4.06	8.04	15.69
10	0.96	0.56	1.00	2.07	4.06	8.04	15.70
50	0.99	0.57	0.99	2.07	4.07	8.04	15.70
100	1.00	0.56	1.01	2.09	4.07	8.07	15.70
150	1.03	0.57	1.02	2.09	4.08	8.06	15.71
200	1.07	0.58	1.00	2.08	4.07	8.04	15.69
250	1.12	0.56	0.99	2.08	4.07	8.04	15.68
300	1.18	0.58	0.98	2.06	4.04	8.02	15.64
350	1.21	0.54	0.98	2.05	4.03	8.01	15.63
400	1.24	0.55	0.98	2.06	4.03	8.00	15.61
450	1.27	0.57	1.00	2.08	4.04	8.02	15.63
500	1.36	0.56	0.99	2.06	4.03	7.99	15.58
550	1.45	0.51	0.95	2.02	3.98	7.95	15.53
600	1.42	0.56	0.99	2.07	4.02	7.98	15.52
650	1.53	0.53	0.97	2.03	4.00	7.94	15.51
700	1.53	0.53	0.96	2.04	4.00	7.95	15.51
750	1.56	0.53	0.97	2.04	4.00	7.96	15.51
800	1.58	0.52	0.97	2.05	4.03	7.96	15.53
900	1.57	0.53	0.97	2.08	4.04	7.98	15.50
1000	1.61	0.51	0.97	2.09	4.05	7.98	15.54
1100	1.66	0.51	0.96	2.08	4.03	7.96	15.53
1200	1.74	0.51	0.95	2.05	4.00	7.92	15.43
1300	1.88	0.51	0.96	2.01	3.94	7.86	15.31
1400	1.97	0.50	0.96	2.00	3.92	7.83	15.25
1500	2.05	0.51	0.97	2.01	3.92	7.82	15.24
1600	2.12	0.50	0.97	2.04	3.95	7.85	15.24
1700	2.14	0.50	0.93	2.07	4.00	7.87	15.29
1800	2.09	0.51	0.93	2.13	4.05	7.93	15.42
1900	2.14	0.50	0.94	2.16	4.10	7.97	15.41
2000	2.16	0.52	0.95	2.19	4.13	7.98	15.43
2100	2.30	0.52	0.94	2.15	4.07	7.94	15.33
2200	2.50	0.49	0.92	2.09	3.98	7.86	15.15
2300	2.71	0.49	0.90	2.06	3.91	7.77	15.02
2400	2.90	0.49	0.88	2.06	3.90	7.72	14.91
2500	3.10	0.48	0.86	2.04	3.86	7.66	14.77
2600	3.43	0.46	0.84	1.99	3.78	7.56	14.59
2800	4.46	0.44	0.77	1.77	3.46	7.14	13.89
3000	4.69	0.44	0.79	1.78	3.43	7.07	13.47

* 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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	20.24	21.85	22.55	21.21	22.84	25.81	31.70
1	20.28	21.87	22.62	21.25	22.87	25.81	31.66
5	20.32	21.95	22.68	21.33	22.92	25.87	31.75
10	20.35	21.97	22.73	21.35	22.98	25.94	31.99
50	20.35	21.98	22.63	21.32	22.91	25.86	31.76
100	20.12	21.66	22.39	21.08	22.59	25.39	30.67
150	19.95	21.42	22.17	20.88	22.36	25.11	30.32
200	19.59	21.03	21.74	20.47	21.83	24.40	28.97
250	19.43	20.82	21.50	20.24	21.60	24.13	28.64
300	18.94	20.19	20.95	19.72	20.98	23.32	27.37
350	18.77	20.00	20.76	19.47	20.72	22.99	26.85
400	18.23	19.34	20.10	18.88	20.03	22.16	25.84
450	17.84	18.93	19.67	18.41	19.47	21.48	24.82
500	17.61	18.63	19.41	18.15	19.13	21.08	24.29
550	17.36	18.39	19.10	17.80	18.74	20.63	23.58
600	17.39	18.38	19.15	17.76	18.70	20.52	23.51
650	17.12	18.07	18.83	17.45	18.32	20.06	22.83
700	17.39	18.36	19.17	17.63	18.46	20.19	22.97
750	17.18	18.10	18.92	17.33	18.17	19.80	22.50
800	17.40	18.36	19.19	17.53	18.28	19.88	22.54
900	17.38	18.26	19.11	17.34	17.96	19.50	21.88
1000	17.52	18.39	19.21	17.34	17.87	19.27	21.43
1100	18.28	19.11	19.92	17.86	18.31	19.52	21.46
1200	19.23	20.05	20.86	18.59	18.94	20.11	21.84
1300	20.16	20.99	21.74	19.38	19.72	20.80	22.30
1400	21.31	22.20	22.71	20.55	20.89	22.05	23.24
1500	22.49	23.47	23.90	21.90	22.28	23.52	24.64
1600	23.77	24.88	25.10	23.33	23.96	25.68	26.27
1700	25.84	27.02	26.99	25.44	26.37	29.40	28.37
1800	27.15	29.47	29.33	26.80	28.56	35.96	30.65
1900	28.63	32.17	34.77	26.74	28.00	36.16	30.67
2000	25.64	28.15	37.84	23.61	24.18	27.73	27.90
2100	21.67	23.21	27.48	20.31	20.83	22.98	24.23
2200	18.22	19.24	21.87	17.39	17.90	19.61	21.19
2300	15.07	15.94	17.78	14.82	15.40	17.02	18.80
2400	12.67	13.38	14.83	12.72	13.40	15.01	16.96
2500	11.03	11.66	12.91	11.30	11.99	13.69	15.67
2600	9.65	10.23	11.34	10.04	10.79	12.47	14.58
2800	8.16	8.69	9.68	8.68	9.46	11.16	13.39
3000	8.04	8.52	9.41	8.47	9.14	10.79	13.00

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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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	19.93	20.58	20.32	24.91	28.87	30.37	56.49
1	19.91	20.60	20.33	24.88	28.77	30.26	65.28
5	20.01	20.69	20.42	25.01	28.93	30.36	61.85
10	20.02	20.70	20.42	25.02	28.98	30.43	60.31
50	19.98	20.68	20.43	25.00	28.88	30.33	60.94
100	20.05	20.75	20.47	25.05	28.96	30.41	54.35
150	20.02	20.67	20.44	25.04	28.86	30.42	48.75
200	19.89	20.56	20.33	24.73	28.52	29.85	44.44
250	19.68	20.29	20.06	24.33	27.84	29.13	41.17
300	19.41	19.99	19.83	23.93	27.03	28.32	38.02
350	19.07	19.67	19.48	23.27	26.22	27.29	36.29
400	18.69	19.19	19.05	22.73	25.45	26.40	34.15
450	18.12	18.62	18.49	21.86	24.30	25.15	32.14
500	17.79	18.25	18.12	21.43	23.69	24.42	31.10
550	17.50	17.92	17.79	20.98	23.05	23.70	30.00
600	17.32	17.67	17.54	20.65	22.62	23.17	29.11
650	17.12	17.51	17.35	20.39	22.30	22.71	28.45
700	17.12	17.46	17.29	20.35	22.18	22.46	27.85
750	17.12	17.41	17.23	20.32	22.03	22.20	27.39
800	17.09	17.33	17.18	20.21	21.87	21.97	26.75
900	17.30	17.55	17.31	20.40	21.83	21.71	25.89
1000	17.85	18.03	17.75	20.97	22.23	21.90	25.27
1100	18.72	18.82	18.51	21.80	22.94	22.22	24.92
1200	19.71	19.76	19.33	22.82	23.77	22.96	24.85
1300	20.47	20.49	20.03	23.66	24.46	23.60	24.86
1400	21.08	21.05	20.55	24.27	24.76	24.08	24.37
1500	21.57	21.58	21.05	24.40	24.81	24.56	23.80
1600	22.16	22.32	21.92	24.88	25.09	25.34	23.14
1700	22.88	23.13	22.76	25.64	25.57	26.49	22.67
1800	23.91	24.34	24.01	26.75	26.04	27.62	21.88
1900	25.52	26.05	25.99	29.04	26.91	28.51	21.09
2000	26.76	27.70	27.65	32.80	27.45	27.85	20.28
2100	24.39	24.87	24.90	32.89	27.23	25.88	19.63
2200	20.30	20.50	20.66	26.22	25.31	23.68	19.40
2300	16.87	17.11	17.24	21.50	22.41	21.39	19.31
2400	14.37	14.58	14.79	18.36	19.88	19.55	19.43
2500	12.44	12.67	12.85	15.97	17.56	17.69	19.13
2600	11.02	11.26	11.46	14.26	15.90	16.29	18.82
2800	10.02	10.22	10.38	12.93	14.44	15.15	19.16
3000	10.01	10.15	10.27	12.54	13.80	14.36	18.71

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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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	1.05	0.54	0.98	2.04	4.02	7.97	15.54
1	1.06	0.54	0.98	2.04	4.02	7.97	15.55
5	1.06	0.54	0.97	2.04	4.01	7.96	15.55
10	1.08	0.54	0.98	2.04	4.01	7.97	15.55
50	1.13	0.53	0.97	2.02	4.00	7.96	15.53
100	1.16	0.53	0.97	2.03	4.01	7.97	15.51
150	1.20	0.54	0.97	2.04	4.01	7.96	15.56
200	1.24	0.52	0.96	2.04	4.00	7.95	15.49
250	1.25	0.57	1.00	2.08	4.03	7.99	15.56
300	1.33	0.56	0.98	2.05	4.00	7.95	15.51
350	1.39	0.52	0.95	2.02	3.98	7.91	15.43
400	1.42	0.54	0.98	2.04	4.00	7.94	15.52
450	1.49	0.52	0.97	2.03	3.98	7.91	15.47
500	1.57	0.52	0.97	2.03	3.97	7.91	15.44
550	1.65	0.52	0.95	2.01	3.96	7.88	15.40
600	1.67	0.52	0.95	2.01	3.97	7.90	15.39
650	1.78	0.51	0.95	2.00	3.95	7.88	15.35
700	1.77	0.52	0.94	2.02	3.97	7.90	15.40
750	1.81	0.52	0.95	2.03	3.97	7.90	15.37
800	1.83	0.52	0.96	2.05	3.99	7.92	15.40
900	1.83	0.52	0.96	2.06	4.01	7.92	15.41
1000	1.86	0.52	0.96	2.08	4.02	7.93	15.41
1100	1.91	0.51	0.95	2.06	3.99	7.89	15.37
1200	1.97	0.51	0.94	2.05	3.97	7.86	15.29
1300	2.11	0.52	0.95	2.02	3.92	7.84	15.22
1400	2.23	0.51	0.96	2.00	3.92	7.80	15.15
1500	2.35	0.51	0.97	2.01	3.91	7.80	15.12
1600	2.44	0.50	0.95	2.04	3.93	7.82	15.17
1700	2.46	0.48	0.93	2.07	3.97	7.83	15.22
1800	2.41	0.49	0.92	2.12	4.03	7.88	15.25
1900	2.46	0.48	0.92	2.13	4.03	7.87	15.25
2000	2.48	0.49	0.91	2.14	4.02	7.84	15.20
2100	2.60	0.49	0.93	2.12	3.96	7.80	15.10
2200	2.75	0.48	0.91	2.06	3.92	7.74	14.95
2300	2.94	0.49	0.90	2.03	3.88	7.69	14.86
2400	3.14	0.46	0.87	2.03	3.85	7.64	14.74
2500	3.35	0.48	0.85	2.03	3.84	7.57	14.63
2600	3.75	0.44	0.82	1.96	3.72	7.46	14.36
2800	4.92	0.43	0.76	1.73	3.38	7.07	13.64
3000	5.23	0.44	0.78	1.79	3.46	7.06	13.34

* 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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	18.92	19.98	20.36	18.79	19.46	20.68	23.09
1	19.02	20.09	20.47	18.88	19.54	20.78	23.15
5	19.10	20.18	20.58	18.97	19.61	20.85	23.29
10	19.09	20.16	20.55	18.96	19.62	20.85	23.30
50	19.23	20.35	20.73	19.11	19.73	21.02	23.53
100	19.19	20.25	20.64	19.08	19.73	20.97	23.44
150	19.36	20.43	20.86	19.22	19.88	21.22	23.72
200	18.86	19.89	20.37	18.78	19.40	20.63	23.07
250	18.71	19.75	20.22	18.66	19.31	20.57	23.01
300	17.96	18.93	19.42	17.96	18.56	19.78	22.05
350	17.85	18.76	19.27	17.77	18.35	19.50	21.73
400	17.18	18.01	18.54	17.12	17.67	18.83	20.88
450	16.90	17.73	18.24	16.82	17.34	18.40	20.37
500	16.61	17.38	17.92	16.50	16.98	18.04	19.90
550	16.52	17.24	17.79	16.31	16.76	17.74	19.45
600	16.49	17.18	17.77	16.25	16.65	17.61	19.31
650	16.29	16.98	17.54	16.02	16.37	17.25	18.93
700	16.41	17.10	17.68	16.04	16.40	17.20	18.80
750	16.19	16.87	17.42	15.78	16.10	16.90	18.39
800	16.29	16.91	17.47	15.76	16.00	16.74	18.14
900	16.16	16.73	17.20	15.53	15.63	16.21	17.46
1000	16.44	16.94	17.32	15.60	15.57	16.03	17.01
1100	17.38	17.81	18.10	16.29	16.15	16.42	17.15
1200	18.73	19.10	19.30	17.42	17.13	17.24	17.78
1300	20.30	20.63	20.60	18.78	18.46	18.47	18.74
1400	22.28	22.65	22.46	20.50	20.17	20.24	20.37
1500	23.89	24.39	24.34	21.79	21.52	21.94	22.33
1600	24.17	24.90	25.41	21.96	21.85	22.83	23.82
1700	23.83	24.75	25.51	21.89	21.77	23.14	24.60
1800	22.89	23.87	24.59	21.53	21.57	23.11	24.84
1900	22.70	23.57	24.18	21.81	22.22	24.07	25.55
2000	23.21	24.33	25.05	22.73	23.61	26.61	27.86
2100	24.59	26.70	28.89	23.98	25.37	32.31	32.65
2200	23.61	25.88	33.59	22.17	23.02	27.50	28.93
2300	18.51	19.68	22.69	17.65	18.27	20.53	22.63
2400	14.23	15.01	16.76	13.92	14.58	16.38	18.47
2500	11.42	12.07	13.39	11.46	12.11	13.73	15.88
2600	9.39	9.96	11.05	9.63	10.28	11.87	13.93
2800	7.73	8.21	9.09	8.09	8.71	10.21	12.26
3000	8.07	8.51	9.35	8.37	8.89	10.31	12.27

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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 0.5 dB	00010 1.0 dB	00100 2.0 dB	01000 4.0 dB	10000 8.0 dB	11111 15.5 dB
0.5	18.80	19.13	18.70	21.85	23.61	23.40	28.23
1	18.94	19.24	18.80	22.00	23.80	23.56	28.47
5	18.98	19.29	18.87	22.04	23.76	23.55	28.48
10	18.96	19.28	18.85	22.04	23.78	23.55	28.48
50	19.08	19.41	18.96	22.19	23.94	23.75	28.71
100	19.17	19.51	19.07	22.34	24.20	23.97	29.18
150	19.28	19.64	19.19	22.56	24.46	24.30	29.80
200	18.88	19.17	18.82	21.93	23.73	23.59	28.65
250	18.48	18.79	18.45	21.45	23.12	23.07	27.81
300	17.90	18.18	17.89	20.69	22.14	22.15	26.29
350	17.62	17.92	17.62	20.37	21.76	21.65	25.65
400	17.18	17.42	17.16	19.76	21.12	21.09	24.74
450	16.94	17.16	16.91	19.46	20.74	20.64	24.14
500	16.72	16.92	16.67	19.22	20.45	20.28	23.63
550	16.75	16.91	16.66	19.21	20.40	20.16	23.42
600	16.61	16.75	16.51	19.03	20.11	19.80	22.95
650	16.67	16.82	16.55	19.06	20.09	19.69	22.78
700	16.61	16.76	16.45	18.99	19.91	19.43	22.36
750	16.68	16.79	16.44	18.94	19.79	19.24	22.08
800	16.45	16.55	16.20	18.63	19.40	18.74	21.37
900	16.48	16.47	16.12	18.38	18.88	18.11	20.27
1000	16.84	16.76	16.32	18.48	18.70	17.76	19.52
1100	17.58	17.40	16.87	18.79	18.85	17.80	19.06
1200	18.49	18.23	17.72	19.51	19.31	18.27	19.05
1300	19.41	19.11	18.57	20.27	20.03	19.10	19.51
1400	20.29	20.02	19.50	21.13	20.88	20.10	20.10
1500	21.00	20.74	20.26	22.12	21.89	21.27	20.86
1600	21.50	21.30	20.76	23.09	22.82	22.43	21.48
1700	21.46	21.36	20.84	23.65	23.49	23.21	21.99
1800	21.32	21.29	20.75	23.55	23.45	23.41	21.70
1900	21.98	22.01	21.61	23.76	23.37	23.89	20.80
2000	24.24	24.29	23.95	24.69	23.62	24.53	19.78
2100	29.64	29.66	29.47	27.53	24.77	26.26	19.20
2200	28.19	28.16	27.93	29.25	25.35	25.79	18.85
2300	20.67	20.71	20.67	24.58	23.67	22.91	18.71
2400	15.85	15.89	16.04	19.51	20.35	19.67	18.72
2500	12.53	12.66	12.78	15.72	16.96	16.81	18.28
2600	10.35	10.51	10.64	13.28	14.60	14.79	17.77
2800	9.08	9.23	9.33	11.72	12.96	13.40	17.67
3000	9.88	10.01	10.06	12.31	13.27	13.62	17.56

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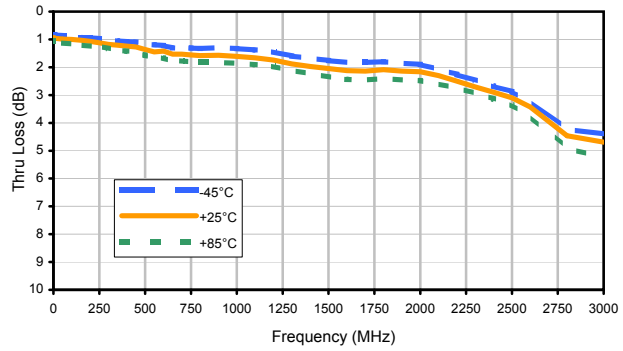
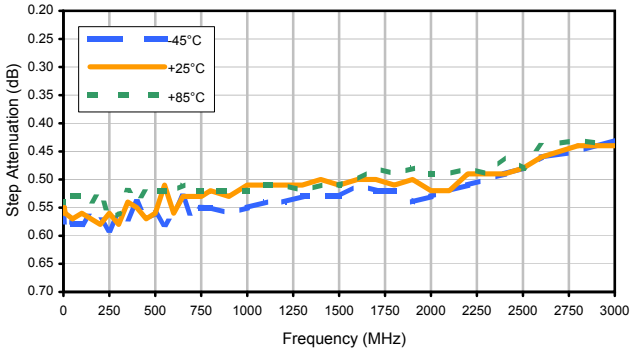
Typical Performance Curves

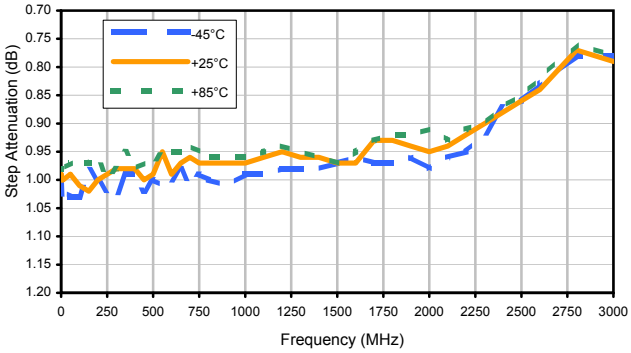
Thru Loss



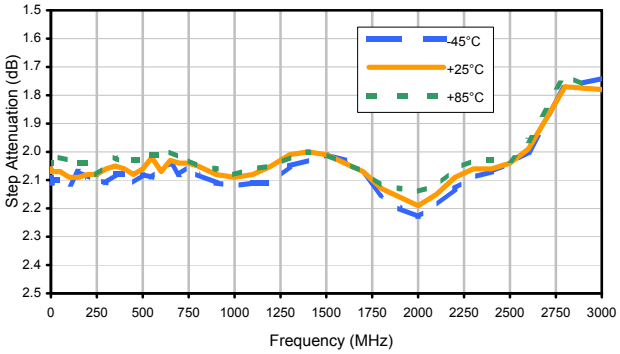
Step Attenuation (0.5dB)



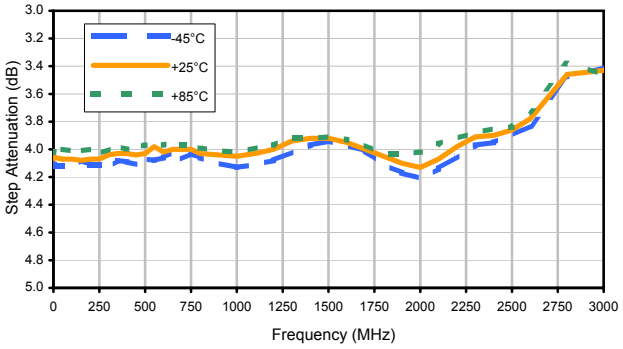
Step Attenuation (1dB)



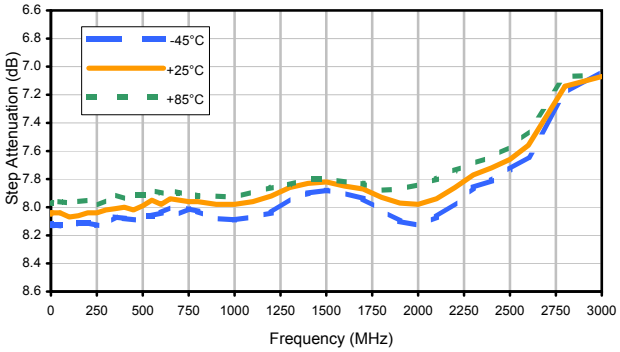
Step Attenuation (2dB)



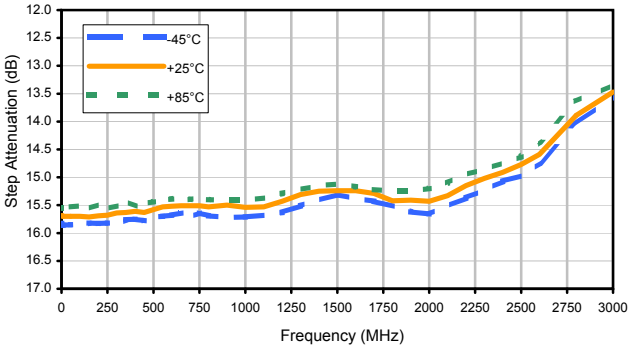
Step Attenuation (4dB)



Step Attenuation (8dB)



Step Attenuation (15.5dB)



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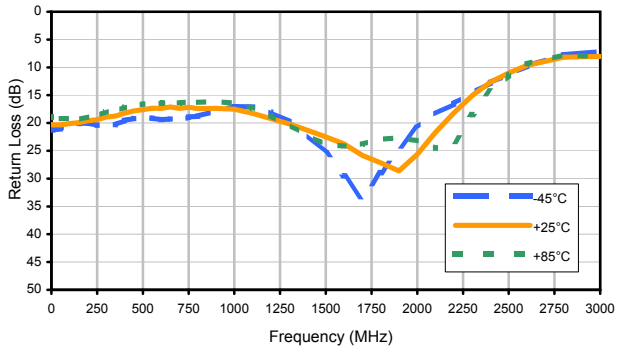
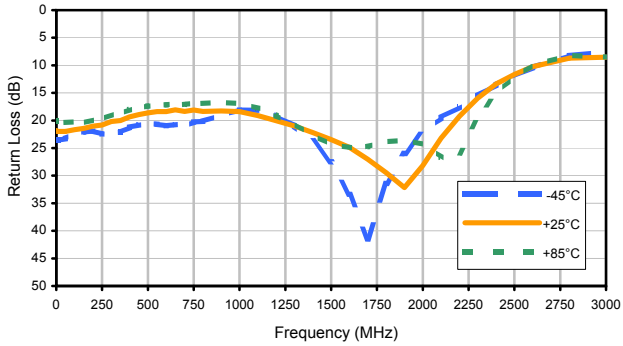
Typical Performance Curves

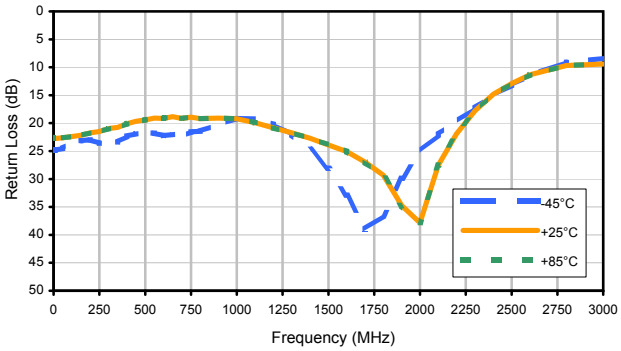
Input Return Loss (0dB)



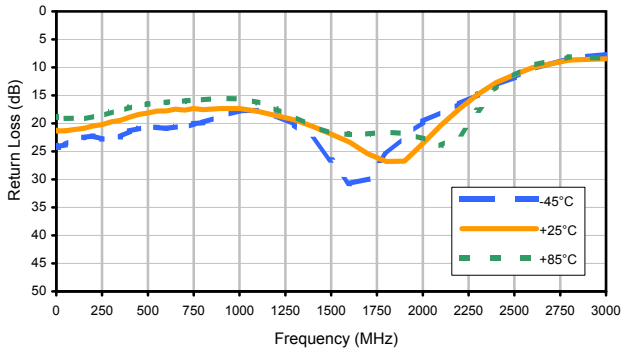
Input Return Loss (0.5dB)



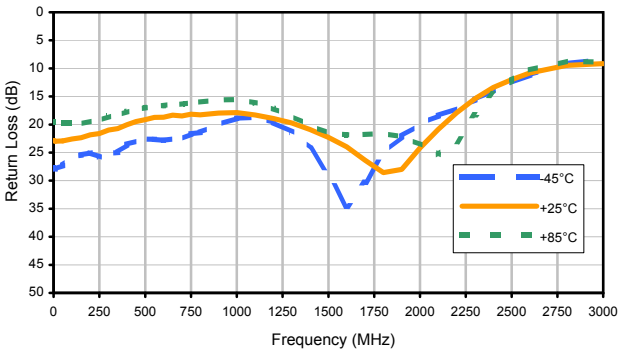
Input Return Loss (1dB)



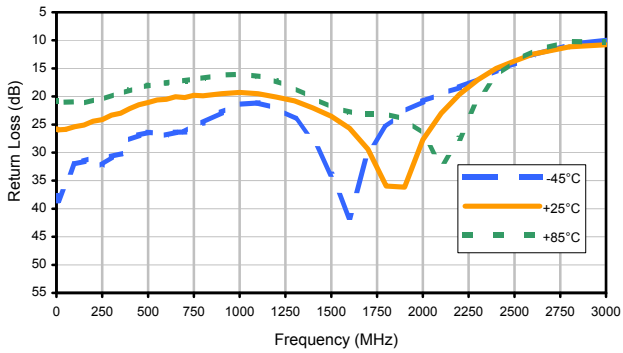
Input Return Loss (2dB)



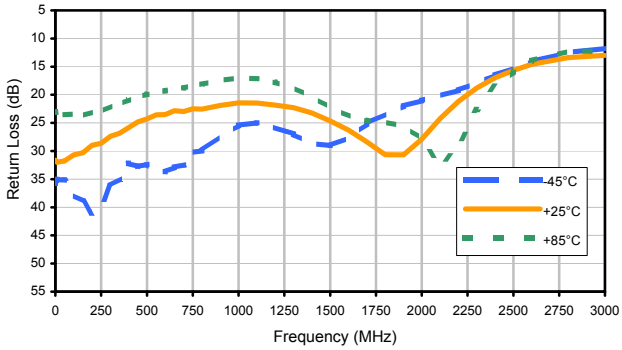
Input Return Loss (4dB)



Input Return Lossn (8dB)



Input Return Loss (15.5dB)



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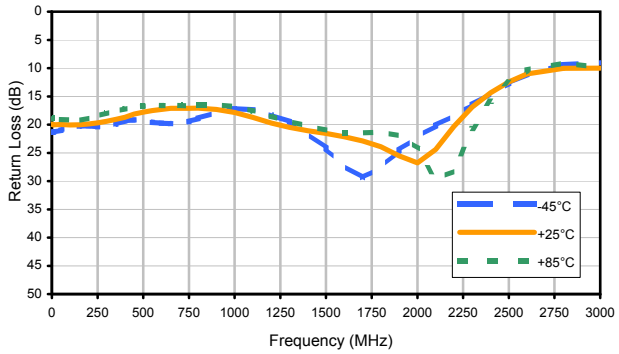
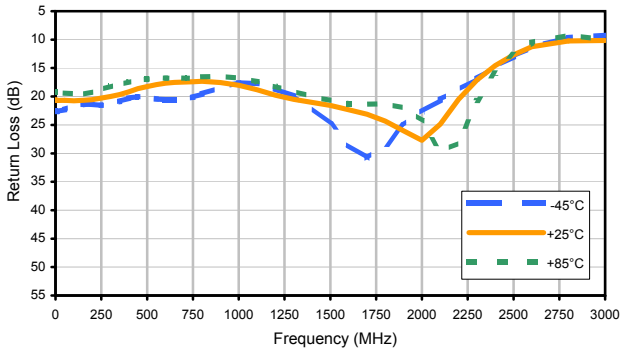
Typical Performance Curves

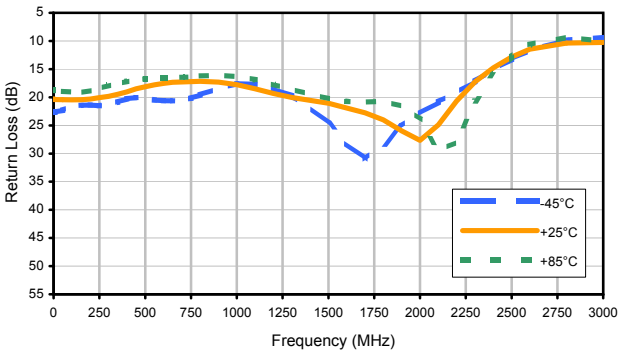
Output Return Loss (0dB)



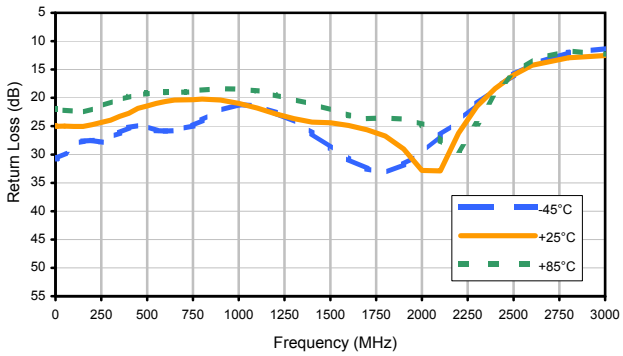
Output Return Loss (0.5dB)



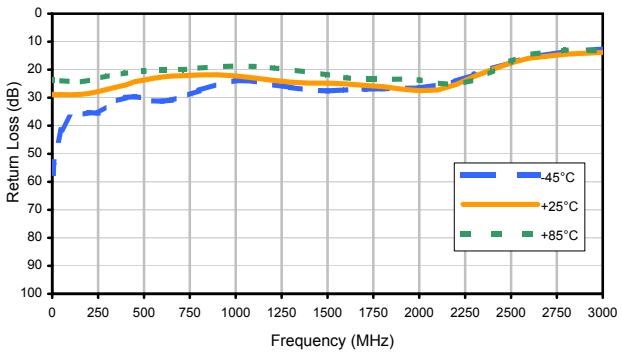
Output Return Losss (1dB)



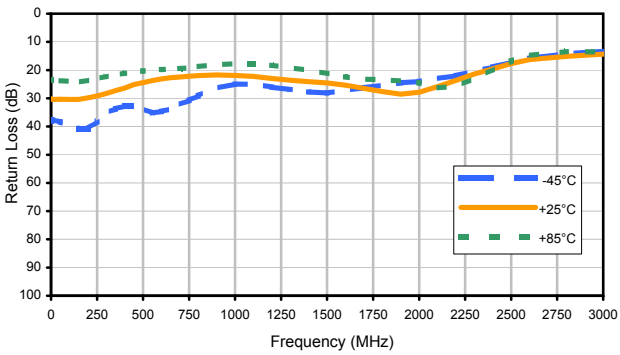
Output Return Loss (2dB)



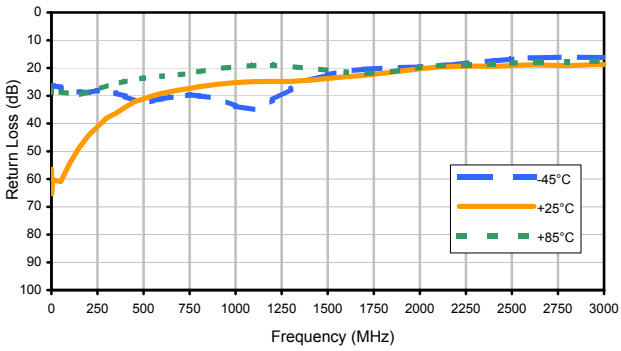
Output Return Loss (4dB)



Output Return Loss (8dB)



Output Return Loss (15.5dB)



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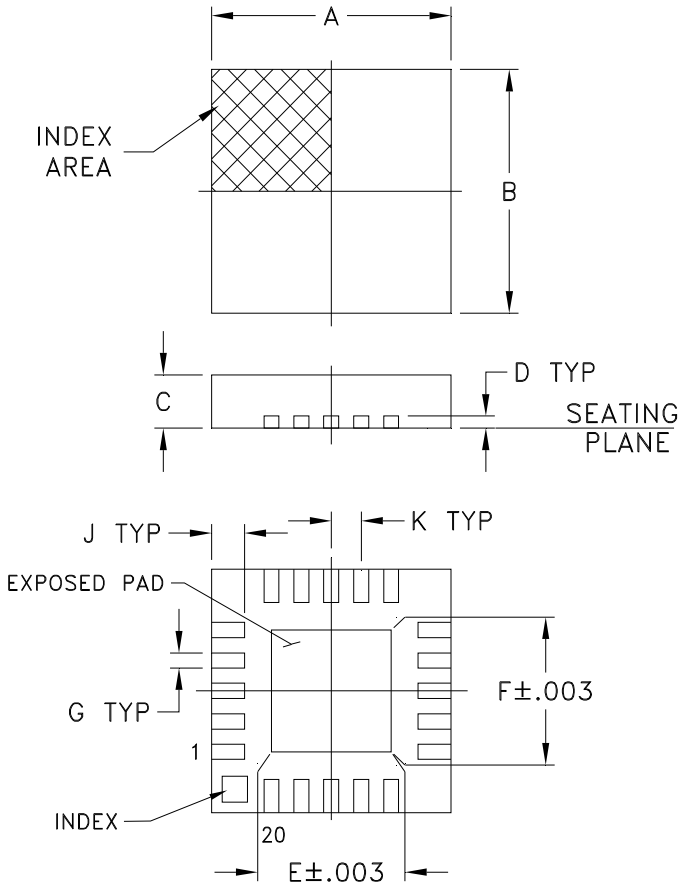
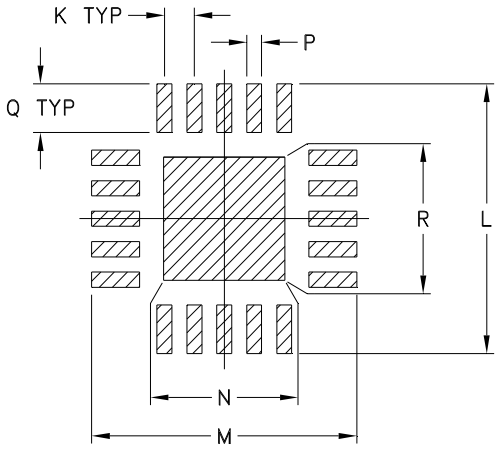
Outline Dimensions



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

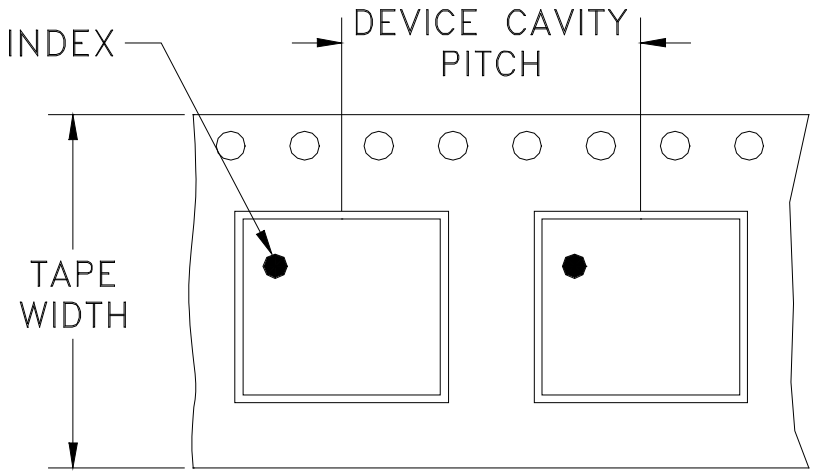
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

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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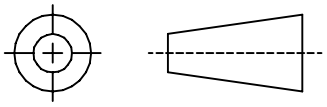
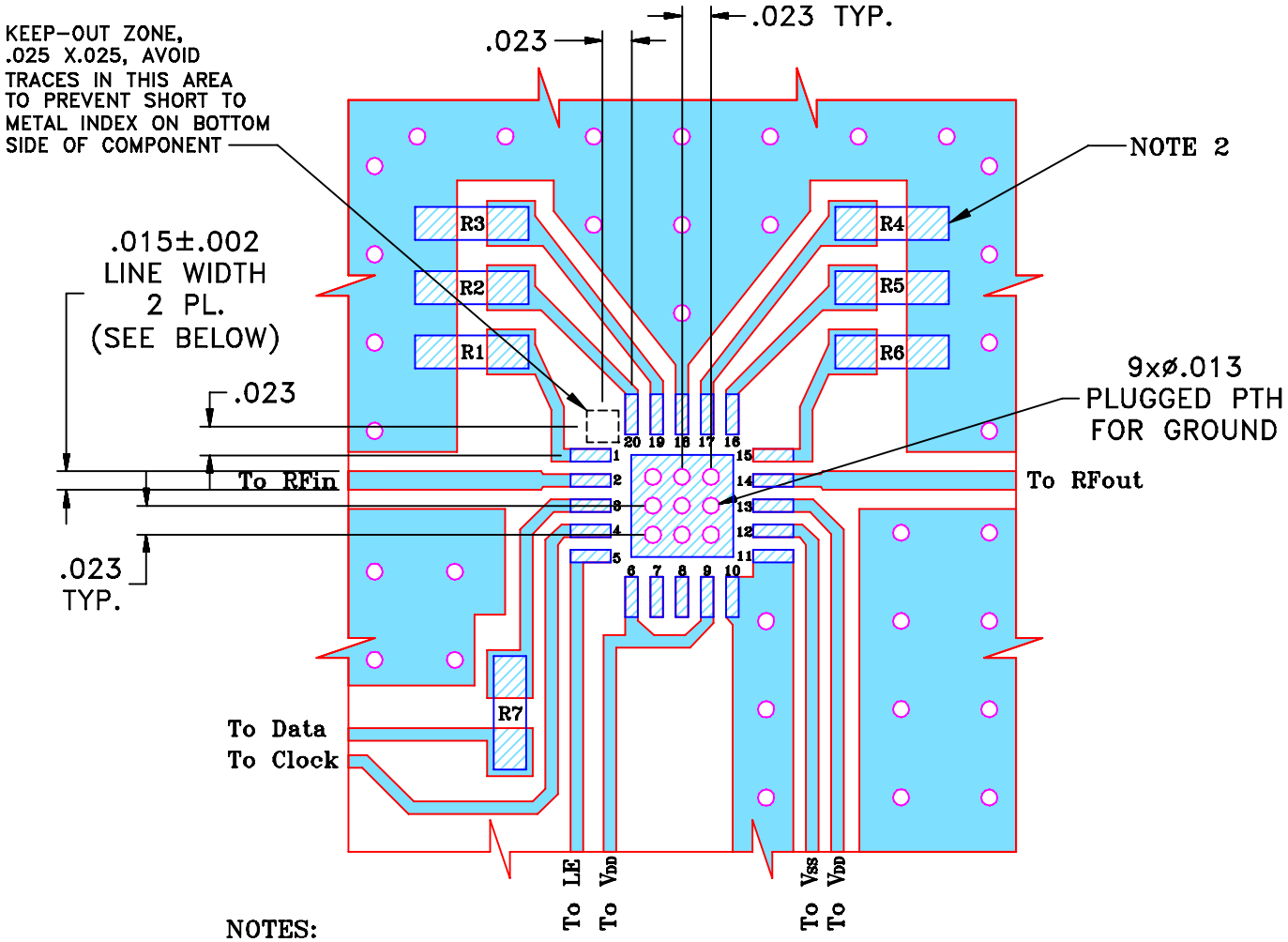
THIRD ANGLE PROJECTION



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, ql 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 SIZE 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 SOLDERMASK

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

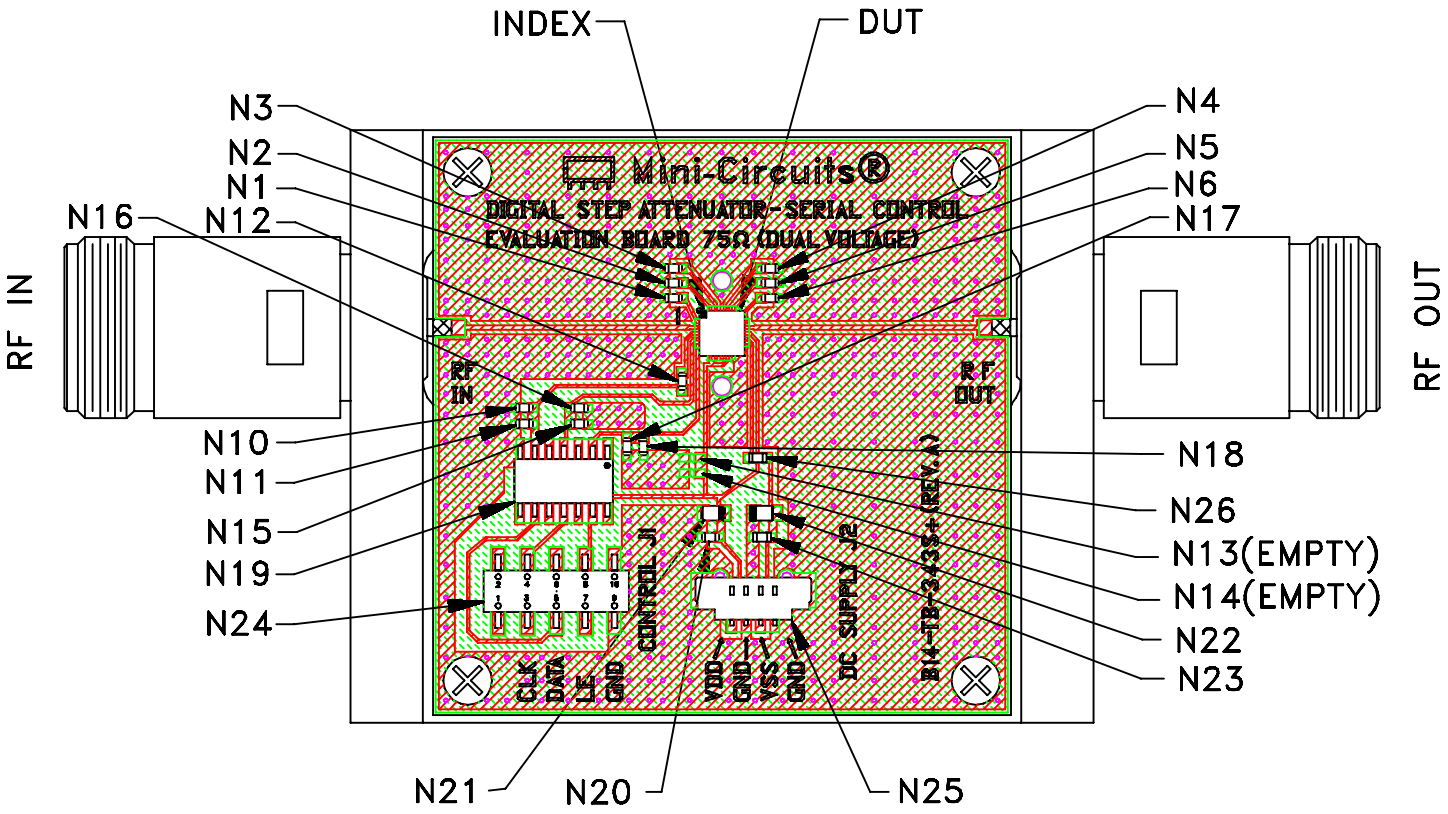
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, ql, DG983-1
TB-343 (75 Ω)

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-202	B

FILE:	SCALE:	SHEET:
98PL202	7:1	1 OF 1

Evaluation Board and Circuit



TB-343

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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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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