



Attenuator 50 to 2000 MHz

Technical Data

UTF-035

Features

- **Frequency Range: 50 to 2000 MHz**
- **Attenuation Range: 2 to 25 dB (Typ)**
- **Linearity: ±0.6 dB (Typ)**
- **5 μs Switching Speed**
- **Linearizer and Attenuator in One Package**

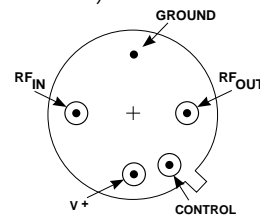
Applications

- **Open and Closed Loop Gain Control**
- **AGC Circuits**

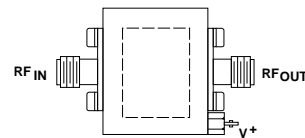
Description

The UTF-035 is a thin-film voltage-controlled RF attenuator that operates from 50 to 2000 MHz. The RF attenuation will change a fixed increment of nearly 3 dB per volt, over the full control voltage range. Utilizing PIN diodes, device attenuation vs. voltage linearity is typically ±0.6 dB flat over the complete control voltage range. The UTF-035 is only unique because the linearizer is housed in the same single TO-8 package weighing 2.1 grams.

Pin Configuration UTF-030, TO-8F



TC-1



Maximum Ratings

Parameter	Maximum
Continuous Voltage (V_{CC}/V_{cont})	+17/-15 Volts
Continuous RF Input Power (CW or Pulse)	+23 dBm
Operating Case Temperature	-55 to +125°C
Storage Temperature	-62 to +150°C
"R" Series Burn-In Temperature	+125°C

Thermal Characteristics

θ_{JC}	100°C/W
Active Transistor Power Dissipation	185/145/190 mW
Junction Temperature Above Case Temperature	18.5/14.5/19.0°C

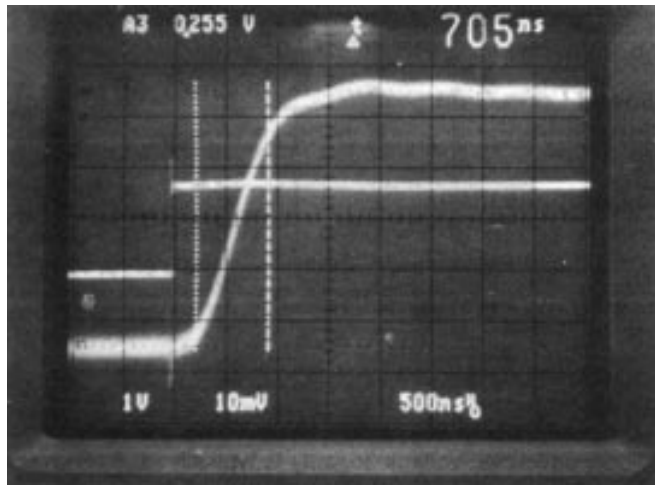
Weight: (typical) 2.1 grams

Electrical Specifications

(Measured in 50 Ω system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25^\circ\text{C}$	Guaranteed Specifications		Unit
			$T_C = 0 \text{ to } 50^\circ\text{C}$	$T_C = -55 \text{ to } +85^\circ\text{C}$	
BW	Frequency Range	50-2000	50-2000	50-2000	MHz
—	Attenuation				
	Min. Insert Loss, $V_C = -10 \text{ V}$				
	50 to 1000 MHz (Max.)	2.0	2.5	3.0	dB
	1000-2000 MHz (Max.)	2.5	3.0	3.5	dB
	Max. Attenuation Loss, $V_C = -2 \text{ V}$				
	50 to 2000 MHz (Max.)	25.5	23.5	20.0	dB
—	Gain Flatness (Max.)	± 0.7	± 1.5	± 2.0	dB
—	Attenuation vs. Voltage Linearity				
	$V_C = -2 \text{ to } -10 \text{ V}$	± 0.6	± 1.5	± 2.0	dB
—	Input VSWR (Max.)	1.6:1	2.0:1	2.0:1	—
—	Output VSWR (Max.)	1.6:1	2.0:1	2.0:1	—
IP ₃	Two Tone 3rd Order Intercept Point	+45.0	—	—	dBm
—	Switching Speed	5	—	—	μs
—	Phase Shift	.002/dB	—	—	Deg/MHz
—	Supply Voltage/Current	15/45	—	—	V/mA
—	Control Voltage/Current	-10/35	—	—	V/mA

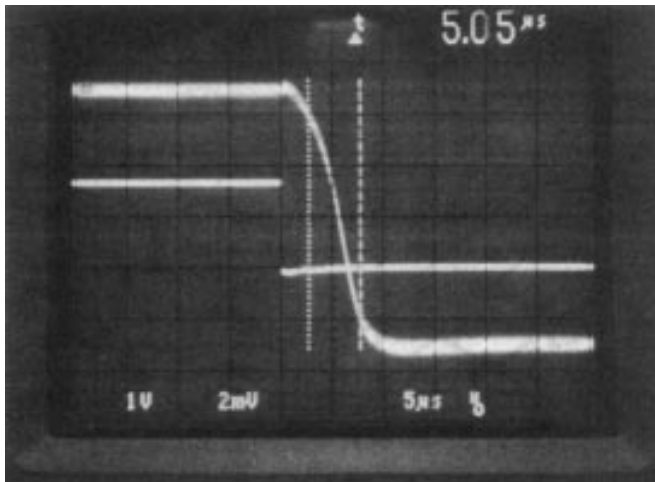
UTF Switching Speed



Control Voltage **Attenuation**

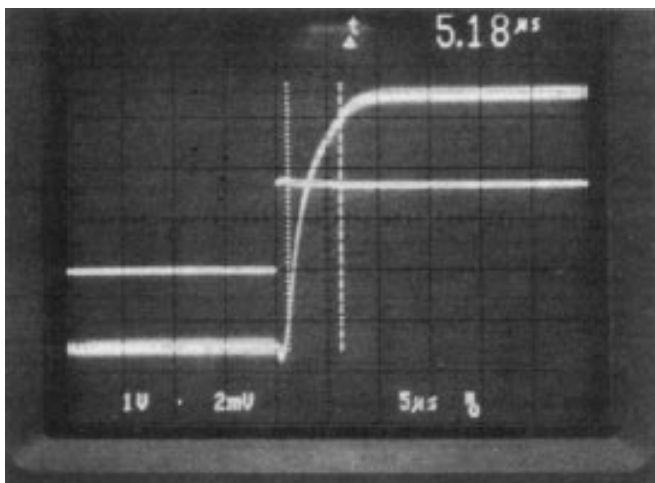
-4.1 to -2.4 Volts **-20 to -25 dB**

5 dB step at Maximum Attenuation



-8.3 to -10 Volts **-7 to -2 dB**

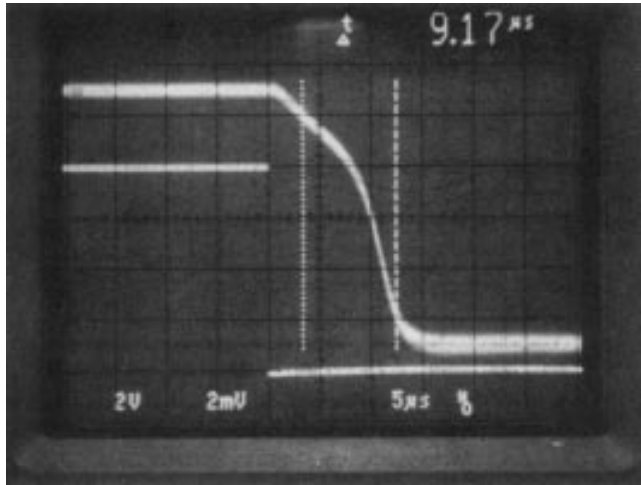
5 dB step at Minimum Attenuation



-10 to -8.3 Volts **-2 to -7 dB**

5 dB step at Minimum Attenuation

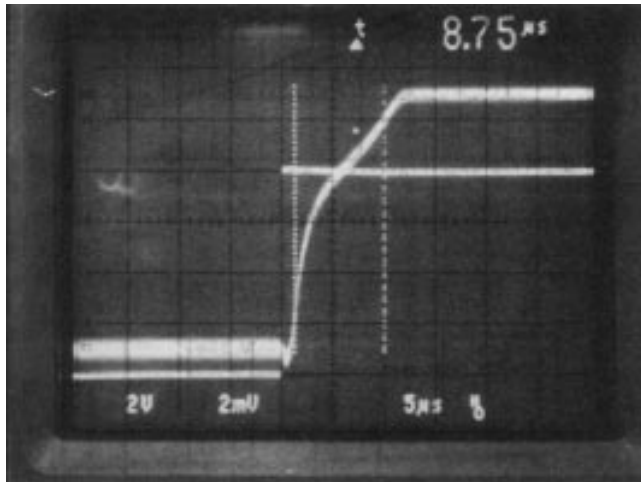
UTF Switching Speed (continued)



Control Voltage Attenuation

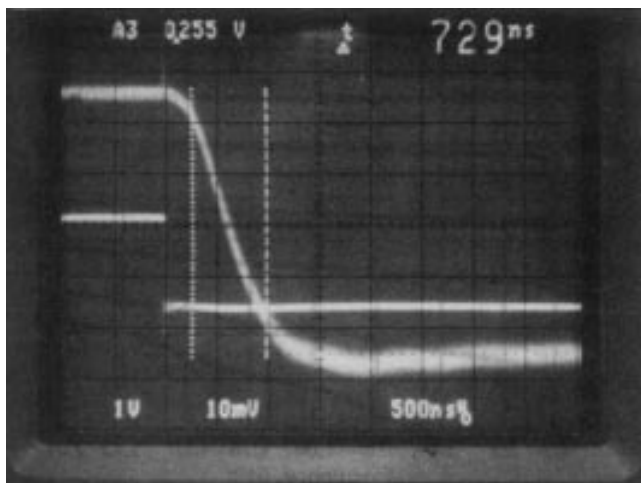
-2 to -10 Volts -26 to -2 dB

**Step through full Attenuation
range. Maximum to Minimum**



-10 to -2 Volts -2 to -26 dB

**Step through full Attenuation
range. Minimum to Maximum**

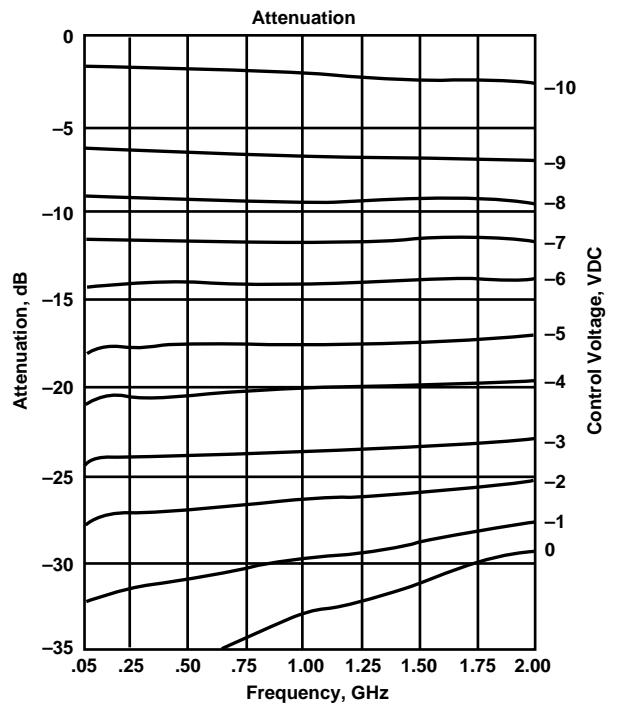
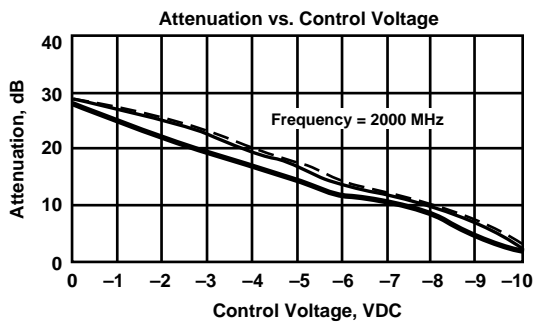
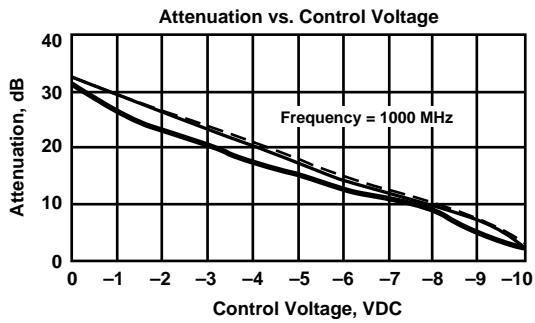
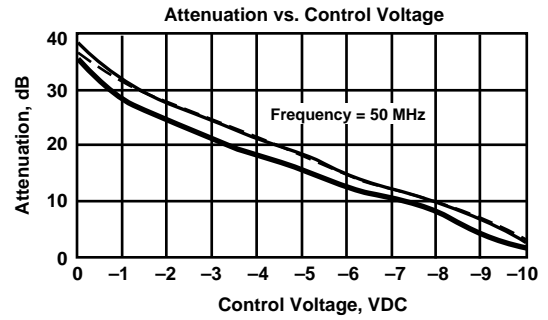
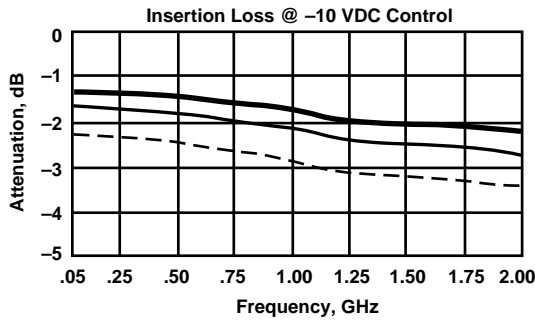
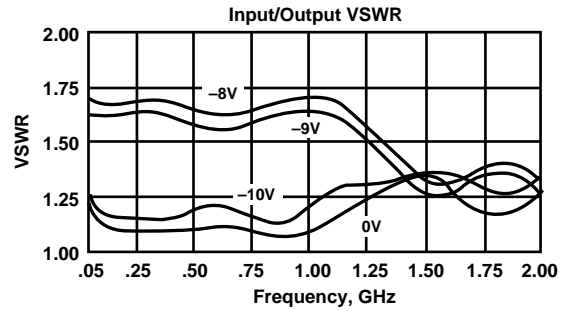
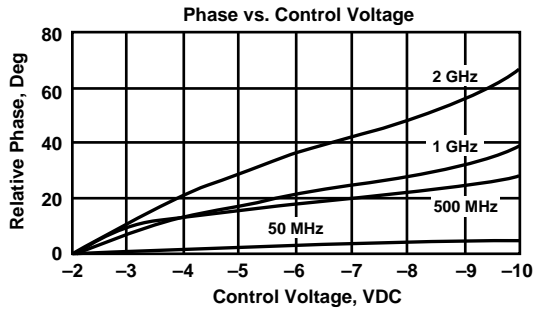


-2.4 to -4.1 Volts -25 to -20 dB

5 dB step at Maximum Attenuation

Typical Performance Over Temperature (@ +15 VDC unless otherwise noted)

Key: +25°C ———
 +85°C - - - -
 -55°C ———

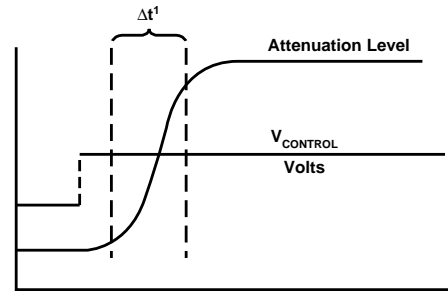


ATTENUATION VS. CONTROL VOLTAGE

V _{CONTROL} Volts	Attenuation dB
-2.0	27.5
-4.0	20.8
-6.0	14.7
-8.0	8.6
-10.0	2.5

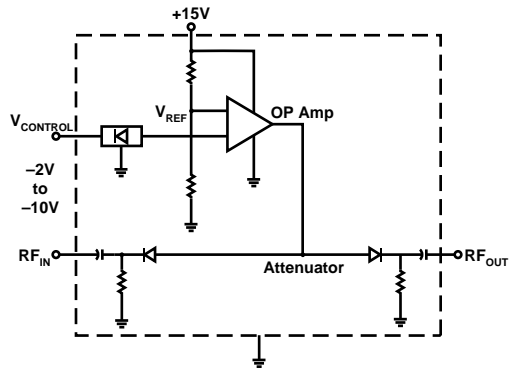
@ +25°C (Approx. 3 dB/Volt)

SWITCHING SPEED

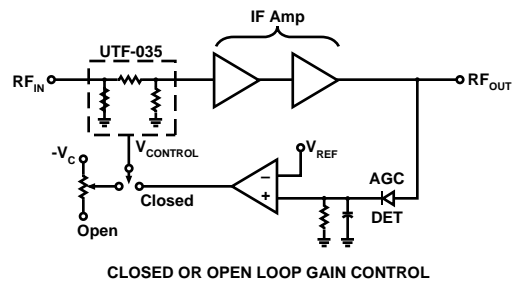


NOTE 1: 5 dB Step at Max Attenuation
 $\Delta t = 0.7 \mu s$
 Step Through Full Attenuation
 $\Delta t = 10 \mu s$

UTF-035 SIMPLIFIED SCHEMATIC



APPLICATIONS



CLOSED OR OPEN LOOP GAIN CONTROL

Automatic Network Analyzer Measurements (Typical production unit @ +25°C ambient)

S-Parameters
Bias = 15 Volts
Control Voltage = -10V
Bias Current = 45.9 mA Control Current = -36.3 mA

FREQ GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	GPDEL ns	PHASE DEG
	Mag	Ang	dB	Ang	dB	Ang	Mag	Ang			
.050	.11	-73.5	-1.7	-38.8	-1.7	-38.8	.11	-91.11	1.06	.33	4.58
.100	.08	-86.4	-1.7	-69.6	-1.7	-69.6	.08	-121.87	1.06	.33	1.81
.150	.07	-108.5	-1.7	-106.6	-1.7	-106.6	.07	-162.60	1.06	.23	.78
.200	.07	-134.9	-1.7	-143.1	-1.7	-143.1	.07	151.79	1.07	.20	.24
.250	.07	-163.4	-1.7	-179.4	-1.7	-179.4	.07	105.12	1.07	.19	-.09
.300	.06	168.0	-1.7	144.4	-1.7	144.4	.07	59.52	1.07	.18	-.28
.350	.06	141.1	-1.8	108.3	-1.8	108.3	.07	15.11	1.08	.18	-.45
.400	.07	115.6	-1.8	72.3	-1.8	72.2	.07	-29.78	1.08	.18	-.57
.450	.07	90.4	-1.8	36.2	-1.8	36.2	.06	-77.29	1.08	.18	-.65
.500	.08	64.1	-1.8	.2	-1.8	.2	.05	-129.47	1.08	.18	-.70
.550	.09	36.3	-1.9	-35.8	-1.9	-35.8	.05	174.28	1.09	.17	-.71
.600	.09	7.3	-1.9	-71.8	-1.9	-71.8	.05	121.67	1.09	.18	-.75
.650	.09	-22.1	-1.9	-107.7	-1.9	-107.8	.06	76.57	1.09	.17	-.75
.700	.08	-51.8	-2.0	-143.6	-2.0	-143.7	.07	36.24	1.09	.17	-.76
.750	.07	-81.3	-2.0	-179.6	-2.0	-179.7	.08	-2.62	1.10	.17	-.76
.800	.06	-111.4	-2.0	144.5	-2.0	144.4	.08	-42.16	1.10	.17	-.69
.850	.06	-142.3	-2.0	108.5	-2.1	108.5	.08	-84.88	1.10	.17	-.68
.900	.06	-175.5	-2.1	72.5	-2.1	72.5	.08	-132.96	1.11	.17	-.63
.950	.07	151.5	-2.1	36.5	-2.1	36.5	.08	174.43	1.11	.17	-.59
1.000	.09	119.1	-2.1	.5	-2.2	.4	.09	120.12	1.12	.17	-.56
1.050	.10	67.7	-2.2	-35.5	-2.2	-35.6	.11	69.38	1.12	.17	-.48
1.100	.12	58.3	-2.3	-71.3	-2.3	-71.5	.13	22.57	1.13	.17	-.44
1.150	.13	31.0	-2.3	-107.1	-2.4	-107.2	.14	-21.44	1.13	.17	-.42
1.200	.13	6.6	-2.4	-142.8	-2.4	-142.8	.14	-64.19	1.14	.17	-.33
1.250	.13	-14.4	-2.4	-178.5	-2.4	-178.4	.14	-107.50	1.14	.17	-.29
1.300	.13	-32.4	-2.4	145.8	-2.5	145.9	.12	-152.51	1.14	.17	-.14
1.350	.13	-49.5	-2.5	110.1	-2.5	110.1	.10	159.26	1.15	.17	-.13
1.400	.14	-67.6	-2.5	74.3	-2.5	74.2	.08	106.46	1.15	.17	-.13
1.450	.14	-87.5	-2.5	38.5	-2.5	38.3	.07	52.31	1.15	.17	-.10
1.500	.14	-108.7	-2.5	2.6	-2.5	2.6	.07	2.40	1.16	.17	.04
1.550	.14	-130.8	-2.5	-33.2	-2.5	-33.2	.06	-38.62	1.16	.17	.07
1.600	.12	-152.7	-2.6	-69.0	-2.6	-69.1	.06	-70.96	1.16	.17	.12
1.650	.11	-173.8	-2.6	-104.9	-2.6	-105.0	.06	-97.68	1.16	.17	.20
1.700	.09	165.3	-2.6	-140.9	-2.6	-140.9	.07	-123.54	1.17	.17	.23
1.750	.08	143.5	-2.6	-176.8	-2.6	-176.8	.07	-152.22	1.17	.17	.37
1.800	.08	118.6	-2.6	147.3	-2.6	147.2	.06	174.67	1.17	.17	.42
1.850	.08	89.6	-2.6	111.3	-2.7	111.2	.05	136.84	1.18	.17	.54
1.900	.09	57.6	-2.7	75.2	-2.7	75.2	.03	89.11	1.19	.16	.73
1.950	.10	26.0	-2.7	39.2	-2.7	39.2	.02	3.74	1.19	.16	.88
2.000	.12	-3.5	-2.8	3.2	-2.8	3.2	.03	-86.96	1.20	.16	1.07
2.050	.13	-30.4	-2.8	-32.8	-2.8	-32.8	.03	-137.43	1.20	.17	
2.100	.14	-54.0	-2.9	-68.7	-2.9	-68.8	.03	-174.94	1.20	.17	
2.150	.16	-74.6	-2.9	-104.5	-2.9	-104.6	.02	159.49	1.21	.17	
2.200	.17	-92.6	-3.0	-140.5	-3.0	-140.5	.01	-113.44	1.21	.17	
2.250	.18	-110.1	-3.0	-176.3	-3.0	-176.4	.04	-129.68	1.22	.18	
2.300	.20	-128.5	-3.1	147.9	-3.1	147.9	.07	-163.34	1.22	.17	
2.350	.22	-148.5	-3.1	112.2	-3.1	112.2	.09	158.89	1.23	.17	
2.400	.23	-169.9	-3.1	76.5	-3.1	76.4	.09	118.20	1.23	.17	
2.450	.22	168.5	-3.1	40.9	-3.2	40.7	.09	72.27	1.23	.17	
2.500	.21	147.2	-3.1	5.0	-3.2	4.9	.07	15.55	1.24	.17	

Linearization Range: .050 to 2.000 GHz

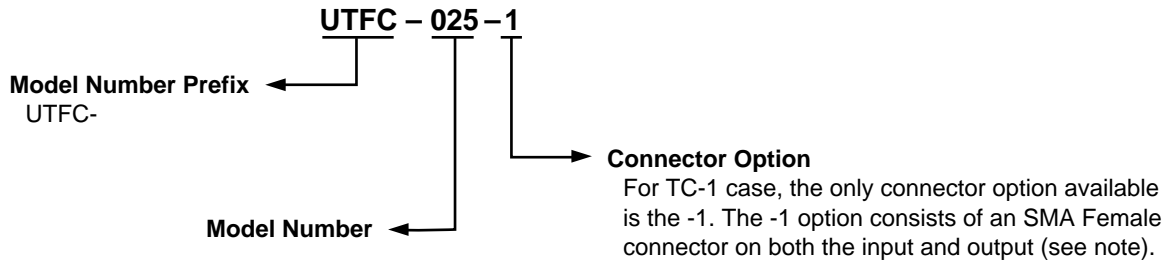
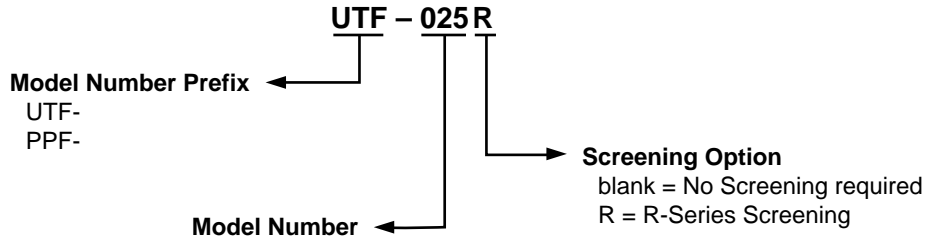
Automatic Network Analyzer Measurements (Typical production unit @ +25°C ambient)

S-Parameters
Bias=15 Volts
Control Voltage = -2V
Bias Current = 24.1 mA Control Current = -17.4 mA

FREQ GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	GPDEL ns	PHASE DEG
	Mag	Ang	dB	Ang	dB	Ang	Mag	Ang			
.050	.10	-103.6	-27.6	-27.4	-27.6	-27.4	.09	-137.22	280.55	.19	1.40
.100	.05	-133.2	-27.4	-64.1	-27.4	-64.1	.05	158.81	273.56	.19	-.04
.150	.04	-163.1	-27.3	-98.9	-27.4	-99.0	.04	97.27	269.88	.14	-.54
.200	.03	165.9	-27.3	-133.3	-27.3	-133.3	.04	42.95	266.59	.12	-.73
.250	.03	134.9	-27.2	-167.5	-27.2	-167.5	.04	-5.44	263.10	.11	-.74
.300	.03	105.7	-27.2	158.4	-27.2	158.3	.03	-53.39	259.97	.11	-.66
.350	.03	79.8	-27.1	124.3	-27.1	124.2	.03	-106.40	256.88	.11	-.61
.400	.03	56.8	-27.0	90.1	-27.1	90.1	.03	-165.29	253.08	.11	-.48
.450	.03	36.5	-27.0	55.9	-27.0	55.9	.03	138.49	249.99	.11	-.39
.500	.03	17.7	-26.9	21.8	-27.0	21.7	.04	92.42	246.55	.11	-.31
.550	.03	-.8	-26.9	-12.4	-26.9	-12.5	.04	53.27	243.14	.10	-.17
.600	.02	-19.7	-26.8	-46.7	-26.8	-46.7	.05	17.68	239.78	.11	-.04
.650	.02	-39.9	-26.7	-80.9	-26.8	-81.0	.05	-16.19	236.67	.10	.03
.700	.02	-64.4	-26.7	-115.2	-26.7	-115.2	.04	-51.06	233.18	.11	.13
.750	.01	-97.9	-26.6	-149.6	-26.7	-149.6	.03	-88.79	230.35	.11	.17
.800	.01	-146.7	-26.6	176.1	-26.6	176.1	.03	-133.27	227.47	.10	.32
.850	.01	161.8	-26.5	141.6	-26.5	141.6	.02	168.38	224.69	.10	.38
.900	.02	126.6	-26.5	107.2	-26.5	107.1	.02	109.59	222.29	.11	.44
.950	.03	101.6	-26.4	72.7	-26.5	72.6	.03	64.00	219.90	.11	.40
1.000	.04	80.7	-26.4	38.2	-26.4	38.1	.04	29.18	217.82	.11	.38
1.050	.05	61.6	-26.4	3.7	-26.4	3.6	.04	.74	215.89	.10	.53
1.100	.06	43.3	-26.3	-30.8	-26.4	-30.9	.04	-24.97	214.83	.11	.58
1.150	.07	25.6	-26.3	-65.3	-26.4	-65.3	.04	-48.99	214.07	.11	.52
1.200	.08	7.9	-26.3	-99.6	-26.4	-99.7	.04	-72.61	213.63	.11	.46
1.250	.09	-9.6	-26.3	-133.9	-26.4	-133.9	.04	-97.22	213.01	.11	.40
1.300	.10	-27.0	-26.3	-168.0	-26.3	-168.0	.03	-121.11	211.38	.10	.50
1.350	.11	-44.5	-26.2	157.9	-26.3	157.8	.02	-141.99	208.16	.12	.45
1.400	.11	-62.1	-26.2	123.6	-26.2	123.6	.01	-161.15	204.43	.12	.28
1.450	.12	-79.9	-26.1	89.2	-26.1	89.2	.01	174.82	200.80	.12	.15
1.500	.12	-98.0	-26.0	54.7	-26.0	54.7	0.00	66.48	196.98	.11	.14
1.550	.12	-116.8	-25.9	20.2	-26.0	20.1	.01	-2.51	193.65	.12	.11
1.600	.11	-136.5	-25.8	-14.4	-25.9	-14.4	.02	-29.03	190.37	.12	-.09
1.650	.11	-157.5	-25.8	-49.0	-25.8	-49.0	.03	-54.74	187.30	.12	-.17
1.700	.10	179.8	-25.7	3.7	-25.7	-83.8	.04	-80.93	184.37	.12	-.24
1.750	.09	154.1	-25.6	-118.4	-25.7	-118.5	.05	-107.71	181.52	.11	-.31
1.800	.08	125.3	-25.6	-153.2	-25.6	-153.2	.06	-135.61	179.04	.12	-.45
1.850	.08	93.3	-25.5	172.1	-25.5	172.1	.06	-164.50	176.52	.11	-.45
1.900	.09	60.3	-25.5	137.2	-25.5	137.3	.06	165.01	173.95	.12	-.49
1.950	.09	28.7	-25.4	102.4	-25.4	102.4	.05	130.91	171.67	.11	-.52
2.000	.11	.2	-25.4	67.6	-25.4	67.6	.04	89.57	169.44	.11	-.35
2.050	.13	-25.5	-25.3	32.8	-25.3	32.7	.03	31.70	166.96	.11	
2.100	.14	-49.0	-25.3	-2.0	-25.3	-2.2	.04	-35.81	164.42	.12	
2.150	.16	-70.9	-25.2	-36.8	-25.2	-36.8	.05	-86.31	161.77	.12	
2.200	.18	-91.6	-25.2	-71.5	-25.2	-71.6	.07	-124.97	159.02	.13	
2.250	.19	-111.8	-25.1	-106.2	-25.1	-106.3	.08	-158.56	156.10	.13	
2.300	.20	-131.3	-25.1	-140.9	-25.1	-140.8	.09	169.47	153.27	.13	
2.350	.21	-150.5	-25.0	-175.5	-25.0	-175.5	.09	137.37	150.26	.13	
2.400	.21	-169.8	-24.9	149.9	-24.9	149.8	.08	103.88	147.25	.13	
2.450	.21	170.9	-24.8	115.3	-24.8	115.2	.07	66.17	144.15	.13	
2.500	.20	151.4	-24.7	80.5	-24.7	80.4	.05	19.22	141.04	.13	

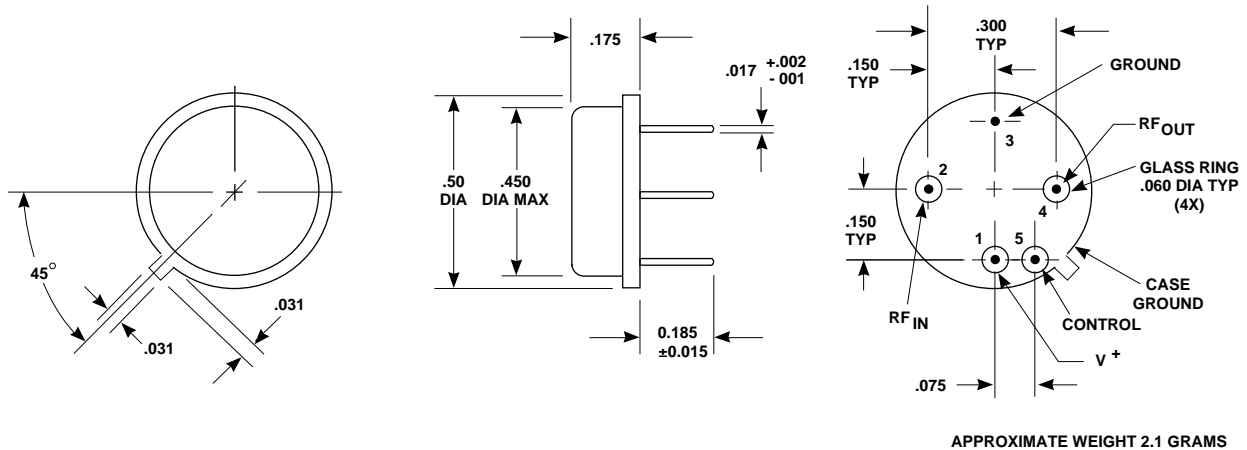
Linearization Range: .050 to 2.000 GHz

Product Options



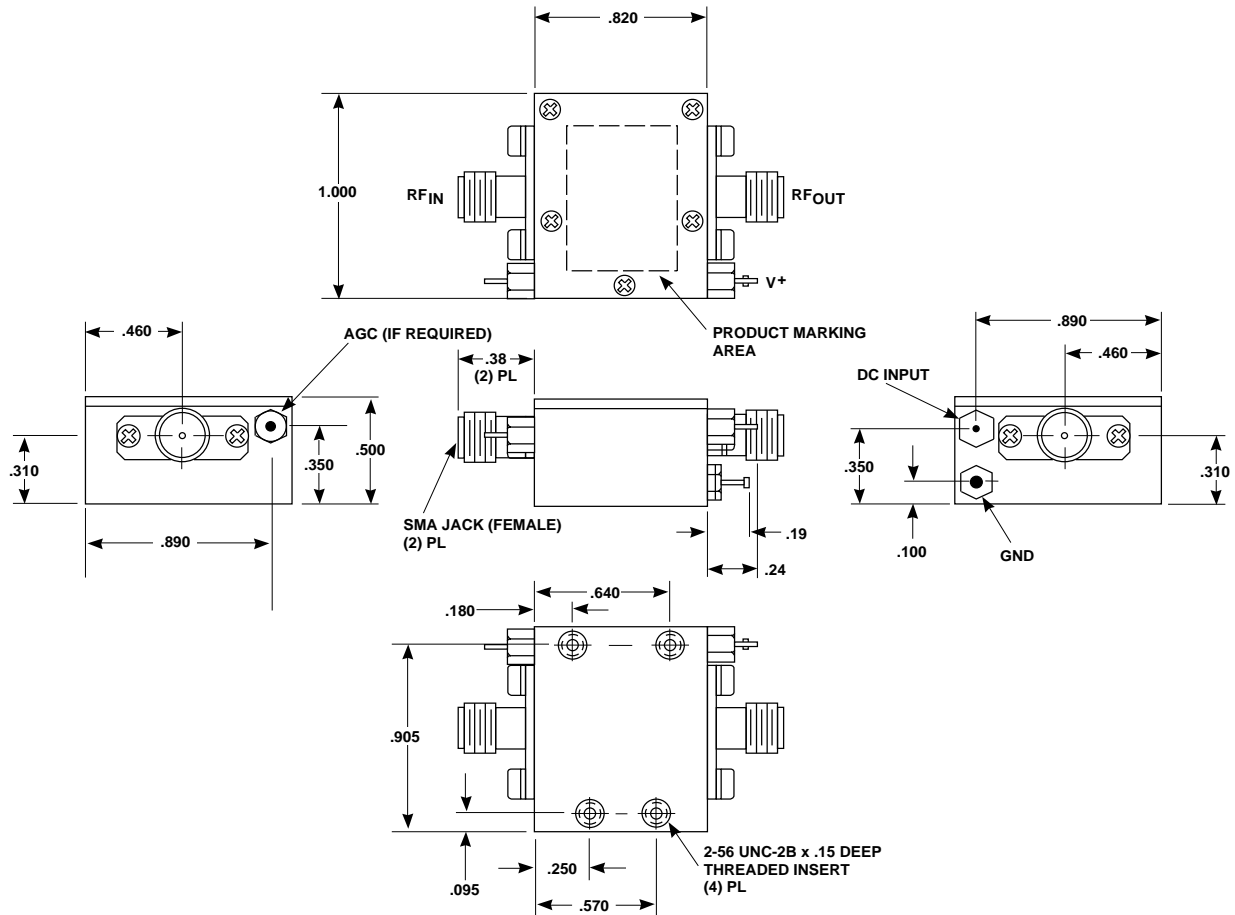
Note: No R-Series screening is available in the TC-1 case as the case is non-hermetic.

Case Drawings TO-8F



NOTES (UNLESS OTHERWISE SPECIFIED):
 1. DIMENSIONS ARE SPECIFIED IN INCHES
 2. TOLERANCES: xx ±.02
 xxx ±.010

Case Drawings TC-1



TYPICAL WEIGHT WITH CONNECTORS = 21.5 GRAMS

- NOTES: 1. THE TC-1 CASE IS A NON-HERMETIC CASE.
 2. THE ONLY CONNECTOR OPTION AVAILABLE FOR THE TC-1 CASE IS THE -1, SMA FEMALE CONNECTORS AT BOTH INPUT AND OUTPUT PORTS.

- NOTES (UNLESS OTHERWISE SPECIFIED):
 1. DIMENSIONS ARE SPECIFIED IN INCHES
 2. TOLERANCES: xx ± .02
 xxx ± .010

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