



# Thin-Film Cascadable Amplifier 5 to 500 MHz

## Technical Data

### UTO/UTC 509 Series

#### Features

- **Frequency Range: 5 to 500 MHz**
- **High Dynamic Range**
- **Output Power: +22.3 dBm (Typ)**
- **Noise Figure: 4.5 dB (Typ)**
- **Temperature Compensated**
- **Surface Mount Option**
- **Low Phase Noise**

#### Applications

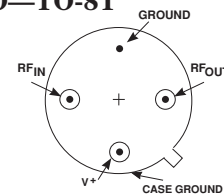
- **IF/RF Amplification**
- **Output Stage**
- **Surface Mount Assembly**

#### Description

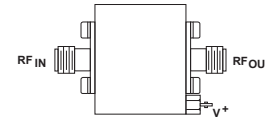
The 509 Series is a wideband single stage high power bipolar RF amplifier using thin-film construction with two transistors in parallel for better RF and thermal performance. Resistive feedback and active bias provide for temperature compensation and increased immunity to bias voltage variations. Blocking capacitors couple the RF through the amplifier. The 509 Series amplifiers are available in three packages: the surface mount PlanarPak PP-38 (.375 in. x .375 in.) case, the TO-8 hermetic case and the connectorized TC-1A case.

#### Pin Configuration

##### UTO—TO-8T



##### UTC—TC-1A



#### Maximum Ratings

Parameter	Maximum
DC Voltage	+17 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	-55 to +115°C
Storage Temperature	-62 to +150°C
"R" Series Burn-In Temperature	+115°C

#### Thermal Characteristics<sup>1</sup>

$\theta_{JC}$	75°C/W
Active Transistor Power Dissipation	413 mW
Junction Temperature Above Case Temperature	31°C
MTBF (MIL-HDBK-217E, $A_{UF}$ @ 90°C)	486,500 Hrs.

**Weight:** (typical) PPA—0.5 grams; UTO—2.1 grams; UTC—21.5 grams

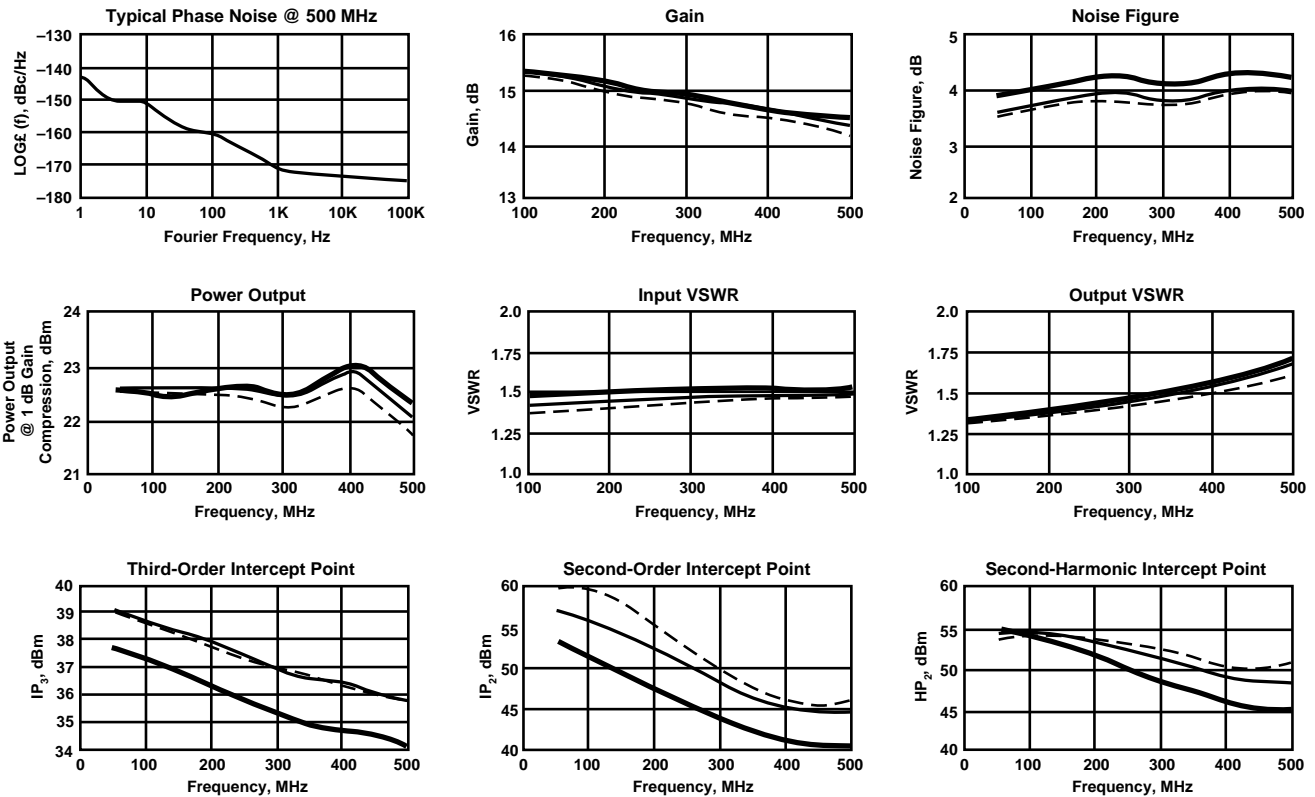
## Electrical Specifications

(Measured in 50  $\Omega$  system @ +15 VDC nominal unless otherwise noted)

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	5-500	5-500	5-500	MHz
GP	Small Signal Gain (Min.)	14.3	13.0	12.0	dB
—	Gain Flatness (Max.)	$\pm 0.5$	$\pm 0.7$	$\pm 1.0$	dB
NF	Noise Figure (Max.)	4.5	5.5	6.0	dB
P <sub>1dB</sub>	Power Output @ +1 dB Comp. (Min.)	+22.3	+20.0	+20.0	dBm
—	Input VSWR (Max.)	<1.4:1	2.0:1	2.0:1	—
—	Output VSWR (Max.)	<1.6:1	2.0:1	2.0:1	—
IP <sub>3</sub>	Two Tone 3rd Order Intercept Point	+35.0	+30.0	+29.0	dBm
IP <sub>2</sub>	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
HP <sub>2</sub>	One Tone 2nd Harmonic Intercept Point	+47.0	—	—	dBm
I <sub>D</sub>	DC Current	90	—	—	mA
—	Phase Noise @ 500 MHz; 1KHz Offset	-170	—	—	dBc/Hz

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

Key: +25°C —  
+85°C - -  
-55°C —



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

**Numerical Readings**
**Bias = 15.00 Volts**

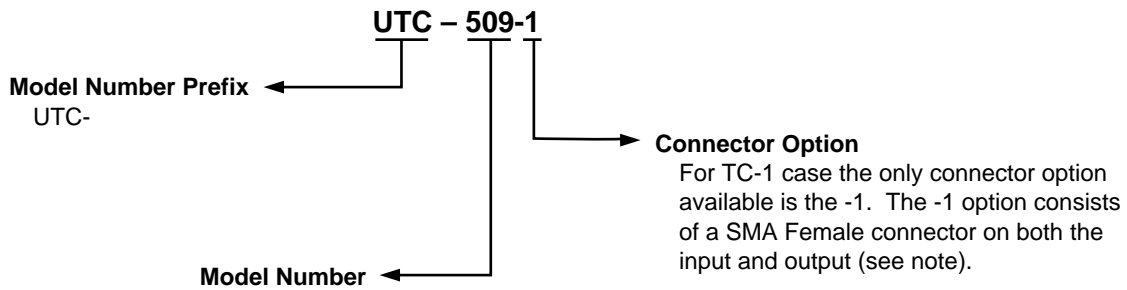
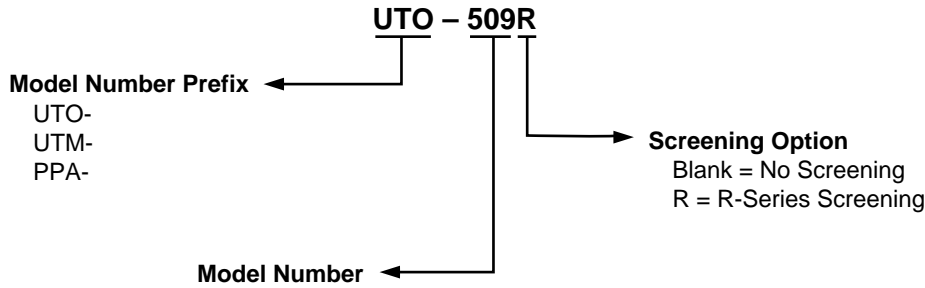
FREQUENCY MHz	VSWR IN	GAIN dB	PHASE DEGREES	PHASE DEV	GROUP DELAY ns	VSWR OUT	ISOLATION dB
100.0	1.11	14.69	167.83	-.21	.00	1.09	18.73
150.0	1.12	14.70	161.60	-.32	.32	1.11	18.68
200.0	1.14	14.61	156.20	.32	.32	1.16	18.59
250.0	1.16	14.54	149.99	.19	.34	1.14	18.67
300.0	1.17	14.49	143.81	.09	.34	1.20	18.64
350.0	1.19	14.38	137.89	.25	.33	1.24	18.61
400.0	1.19	14.32	131.76	.20	.35	1.29	18.61
450.0	1.20	14.24	125.23	-.24	.35	1.34	18.58
500.0	1.21	14.22	119.13	-.25	.34	1.40	18.54
550.0	1.23	14.27	112.91	—	.35	1.46	18.40
600.0	1.24	14.23	106.42	—	.36	1.53	18.34
650.0	1.29	14.21	100.01	—	.38	1.59	18.31
700.0	1.37	14.17	92.65	—	.43	1.66	16.25
750.0	1.49	14.12	84.40	—	.48	1.74	18.27
800.0	1.64	14.04	75.54	—	.52	1.80	18.32
850.0	1.86	14.12	65.84	—	.55	1.84	18.38
900.0	2.27	14.02	55.59	—	.60	1.83	18.75
950.0	2.96	13.73	44.41	—	.68	1.75	19.15
1000.0	4.04	13.12	31.03	—	.70	1.63	20.02
1050.0	5.65	12.10	19.02	—	.64	1.49	21.02
1100.0	7.83	10.69	7.85	—	.56	1.35	22.26
1150.0	10.64	8.92	-1.24	—	.44	1.25	23.57
1200.0	12.36	7.07	-8.08	—	.31	1.21	24.30
1250.0	12.36	5.29	-12.57	—	.21	1.21	25.47
1300.0	12.31	3.62	-15.74	—	.13	1.23	26.15
1350.0	13.42	2.10	-17.32	—	.08	1.26	26.85
1400.0	13.75	.67	-18.71	—	.08	1.30	27.78
1450.0	13.02	-.78	-20.10	—	.04	1.33	28.30
1500.0	12.66	-2.03	-20.17	—	.00	1.35	28.52

LINEARIZATION RANGE: 100.0 to 400.0 MHz

**S-Parameters**
**Bias = 15.00 Volts**

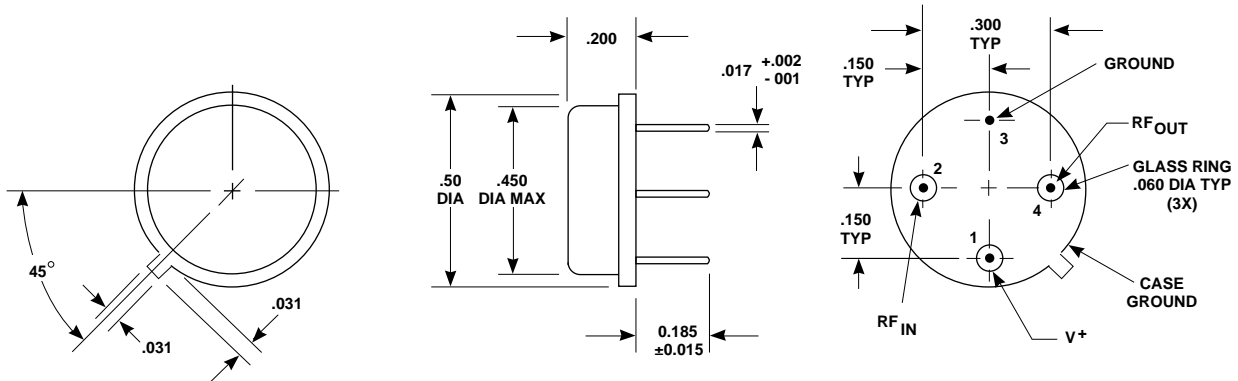
FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	Mag	Ang	dB	Ang	dB	Ang	Mag	Ang
100.00	.053	-152.1	14.644	166.7	-18.644	-2.1	.044	-160.3
200.00	.065	-162.4	14.574	153.6	-18.711	-6.8	.064	-133.6
300.00	.078	-179.6	14.473	140.2	-18.704	-11.8	.091	-128.1
400.00	.087	159.4	14.295	126.8	-18.637	-17.4	.126	-128.4
500.00	.097	130.4	14.181	113.1	-18.580	-24.2	.163	-132.0
600.00	.111	98.6	14.192	99.4	-18.428	-31.7	.205	-138.9
700.00	.161	72.4	14.129	84.4	-18.270	-40.1	.246	-148.6
800.00	.242	48.4	14.047	66.0	-18.330	-50.3	.282	-162.5
900.00	.389	26.2	14.033	44.4	-18.731	-63.0	.293	179.5
1000.00	.608	-1.0	13.111	19.0	-19.939	-78.4	.239	157.2
1100.00	.776	-29.1	10.641	5.7	-22.229	-88.3	.151	143.9
1200.00	.855	-51.6	7.060	-22.9	-24.374	-88.9	.098	158.7
1300.00	.857	-68.2	3.547	-31.6	-26.234	-88.4	.104	176.0
1400.00	.867	-79.3	.613	-35.6	-27.653	-90.8	.131	173.3
1500.00	.868	-87.1	-2.105	-38.2	-28.563	-90.7	.153	164.1
1600.00	.865	-92.8	-4.330	-40.6	-29.732	-93.3	.179	152.4
1700.00	.875	-97.4	-6.341	-41.4	-30.476	-94.3	.199	142.8
1800.00	.864	-101.4	-8.131	-43.6	-31.627	-92.6	.231	133.9
1900.00	.900	-105.7	-9.563	-43.8	-32.251	-93.6	.257	127.6
2000.00	.884	-108.7	-11.263	-43.7	-32.793	-94.3	.284	124.2

### Product Options



Note: R-Series screening is not available in the TC-1 case as the case is non-hermetic.

### Case Drawings TO-8T



APPROXIMATE WEIGHT 2.1 GRAMS

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

# TC-1A

