TELEDYNE
MICROWAVE SOLUTIONS
Everywhereyoulook™

# Thin-Film Cascadable Amplifier 500 to 2000 MHz

## Technical Data

**UTO/UTC 2013 Series**

### Features

- **Frequency Range: 500 to 2000 MHz**
- **High Dynamic Range**
- **High Output Power: +21.0 dBm (Typ)**
- **GaAs FET Technology**
- **Temperature Compensated**
- **Surface Mount Option**

### Applications

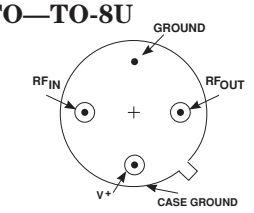
- **System Front End**
- **Output Stage**
- **Surface Mount Assembly**

### Description

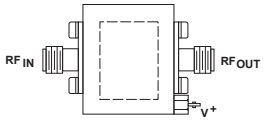
The 2013 Series is a thin-film high power GaAs FET RF amplifier using active bias and resistive feedback for stability over temperature and bias voltage variations. Input/output blocking capacitors couple RF through the amplifier, while a low VSWR is maintained through inductive tuning. The 2013 Series 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

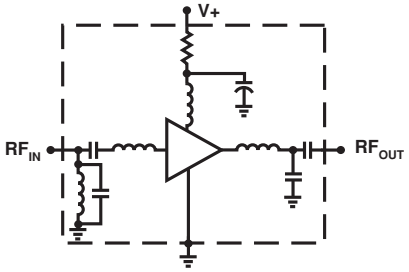
**UTO—TO-8U**




**UTC—TC-1A**




### Schematic




### Maximum Ratings

| Parameter | Maximum |
|---|---|
| DC Voltage | +17 Volts |
| Continuous RF Input Power | +17 dBm |
| Operating Case Temperature | –55 to +100°C |
| Storage Temperature | –62 to +150°C |
| "R" Series Burn-In Temperature | +100°C |

### Thermal Characteristics[1]

| | |
|---|---|
| $\theta_{JC}$ | 60°C/W |
| Active Transistor Power Dissipation | 900 mW |
| Junction Temperature Above Case Temperature | 54°C |
| MTBF (MIL-HDBK-217E, $A_{UF}$ @ 90°C) | 361,600 Hrs. |

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

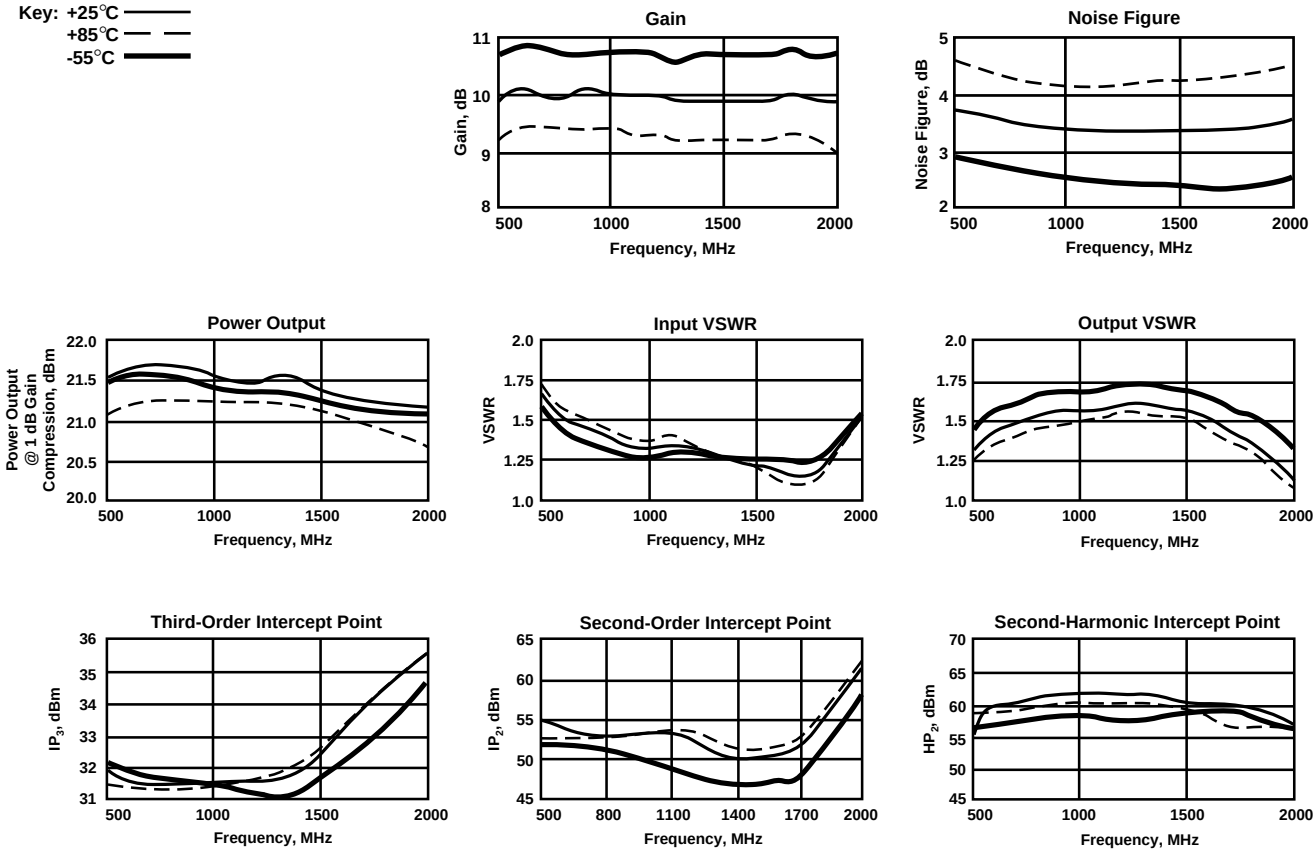
## Electrical Specifications[1]

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

| Symbol | Characteristic | Typical | Guaranteed Specifications | | Unit |
|---|---|---|---|---|---|
| | | $T_C$ = 25°C | $T_C$ = 0 to 50°C | $T_C$ = –55 to +85°C | |
| BW | Frequency Range | 500-2000 | 500-2000 | 500-2000 | MHz |
| GP | Small Signal Gain (Min.) | 10.0 | 9.0 | 8.5 | dB |
| — | Gain Flatness (Max.) | ±0.5 | ±1.0 | ±1.0 | dB |
| NF | Noise Figure (Max.) | 4.5 | 5.5 | 6.0 | dB |
| $P_{1dB}$ | Power Output @ +1 dB Comp. (Min.) | +21.0 | +19.0 | +18.0 | dBm |
| — | Input VSWR (Max.) | <1.7:1 | 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 | +30.0 | — | — | dBm |
| $IP_2$ | Two Tone 2nd Order Intercept Point | +40.0 | — | — | dBm |
| $HP_2$ | One Tone 2nd Order Intercept Point | +45.0 | — | — | dBm |
| $I_D$ | DC Current | 100 | — | — | mA |

Note 1: RF input pin at DC ground—no input blocking capacitor.

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



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

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

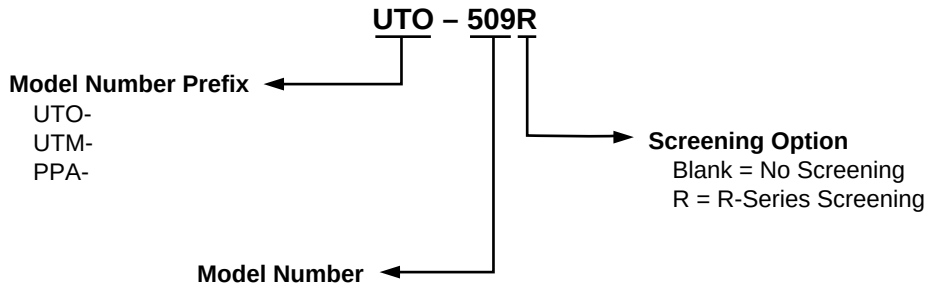
| FREQUENCY MHz | VSWR IN | GAIN dB | PHASE DEGREES | PHASE DEV | GROUP DELAY ns | VSWR OUT | ISOLATION dB |
|---|---|---|---|---|---|---|---|
| 400.0 | 1.58 | 9.54 | –160.92 | — | .92 | 1.39 | 15.90 |
| 500.0 | 1.28 | 9.91 | 170.88 | 10.08 | .69 | 1.36 | 16.01 |
| 600.0 | 1.15 | 10.02 | 148.57 | 3.28 | .57 | 1.38 | 16.14 |
| 700.0 | 1.08 | 10.03 | 128.97 | –.80 | .52 | 1.42 | 16.35 |
| 800.0 | 1.09 | 10.04 | 111.27 | –2.97 | .47 | 1.44 | 16.53 |
| 900.0 | 1.11 | 10.13 | 94.80 | –3.92 | .43 | 1.46 | 16.68 |
| 1000.0 | 1.11 | 10.20 | 80.09 | –3.11 | .40 | 1.44 | 16.90 |
| 1100.0 | 1.07 | 10.20 | 65.49 | –2.18 | .42 | 1.39 | 17.03 |
| 1200.0 | 1.06 | 10.18 | 50.46 | –1.70 | .41 | 1.34 | 17.07 |
| 1300.0 | 1.07 | 10.15 | 35.55 | –1.08 | .42 | 1.32 | 17.01 |
| 1400.0 | 1.07 | 10.19 | 20.43 | –.68 | .41 | 1.32 | 17.02 |
| 1500.0 | 1.04 | 10.19 | 5.46 | –.13 | .43 | 1.38 | 17.00 |
| 1800.0 | 1.06 | 10.30 | –9.46 | .45 | .39 | 1.51 | 17.05 |
| 1700.0 | 1.14 | 10.23 | –23.97 | 1.46 | .42 | 1.65 | 17.16 |
| 1800.0 | 1.24 | 10.16 | –38.70 | 2.24 | .43 | 1.74 | 17.32 |
| 1900.0 | 1.32 | 10.12 | –55.02 | 1.45 | .45 | 1.72 | 17.35 |
| 2000.0 | 1.40 | 10.21 | –71.49 | .51 | .46 | 1.68 | 17.43 |
| 2100.0 | 1.44 | 10.29 | –88.92 | — | .52 | 1.66 | 17.28 |

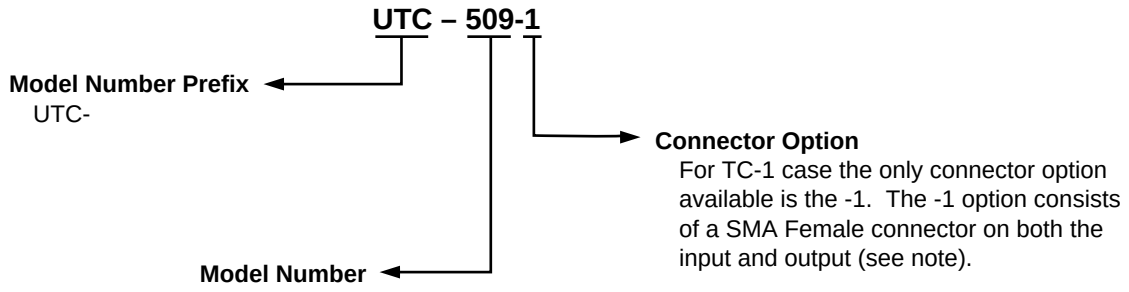
Linearization Range: 500.0 to 2000.0 MHz

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

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | Mag | Ang | dB | Ang | dB | Ang | Mag | Ang |
| 500.00 | .199 | 32.7 | 10.097 | 178.2 | –17.058 | –14.6 | .130 | –72.6 |
| 600.00 | .125 | 19.7 | 10.257 | 154.3 | –16.560 | –29.8 | .111 | –108.7 |
| 700.00 | .069 | –14.2 | 10.299 | 135.3 | –16.848 | –48.7 | .094 | –154.8 |
| 800.00 | .053 | –69.5 | 10.268 | 117.2 | –17.316 | –61.4 | .093 | 166.5 |
| 900.00 | .078 | –111.6 | 10.385 | 100.5 | –17.040 | –77.9 | .120 | 145.9 |
| 1000.00 | .069 | –111.9 | 10.375 | 86.4 | –17.402 | –91.4 | .114 | 139.3 |
| 1100.00 | .103 | –109.0 | 10.296 | 71.4 | –18.034 | –105.3 | .094 | 146.7 |
| 1200.00 | .115 | –116.0 | 10.205 | 56.0 | –17.977 | –119.2 | .071 | 146.7 |
| 1300.00 | .116 | –120.1 | 10.078 | 40.9 | –17.625 | –131.8 | .048 | 172.7 |
| 1400.00 | .111 | –135.0 | 10.045 | 26.8 | –17.854 | –143.2 | .040 | –171.3 |
| 1500.00 | .098 | –144.1 | 10.015 | 12.8 | –18.129 | –156.0 | .025 | –170.5 |
| 1600.00 | .071 | 179.8 | 10.159 | –.1 | –17.931 | –170.3 | .018 | 115.7 |
| 1700.00 | .068 | 134.5 | 10.142 | –14.9 | –17.947 | 177.3 | .019 | 64.0 |
| 1800.00 | .072 | 93.3 | 10.156 | –30.8 | –18.386 | 158.1 | .013 | –38.3 |
| 1900.00 | .095 | 66.8 | 10.091 | –47.6 | –18.220 | 145.4 | .032 | –54.2 |
| 2000.00 | .110 | 46.5 | 9.907 | –63.4 | –18.194 | 132.1 | .068 | –88.7 |

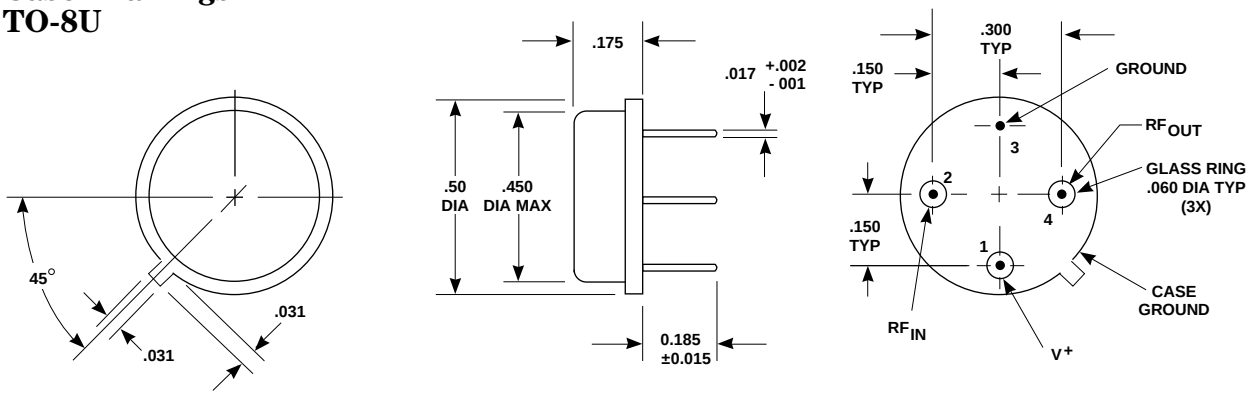
## Product Options




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

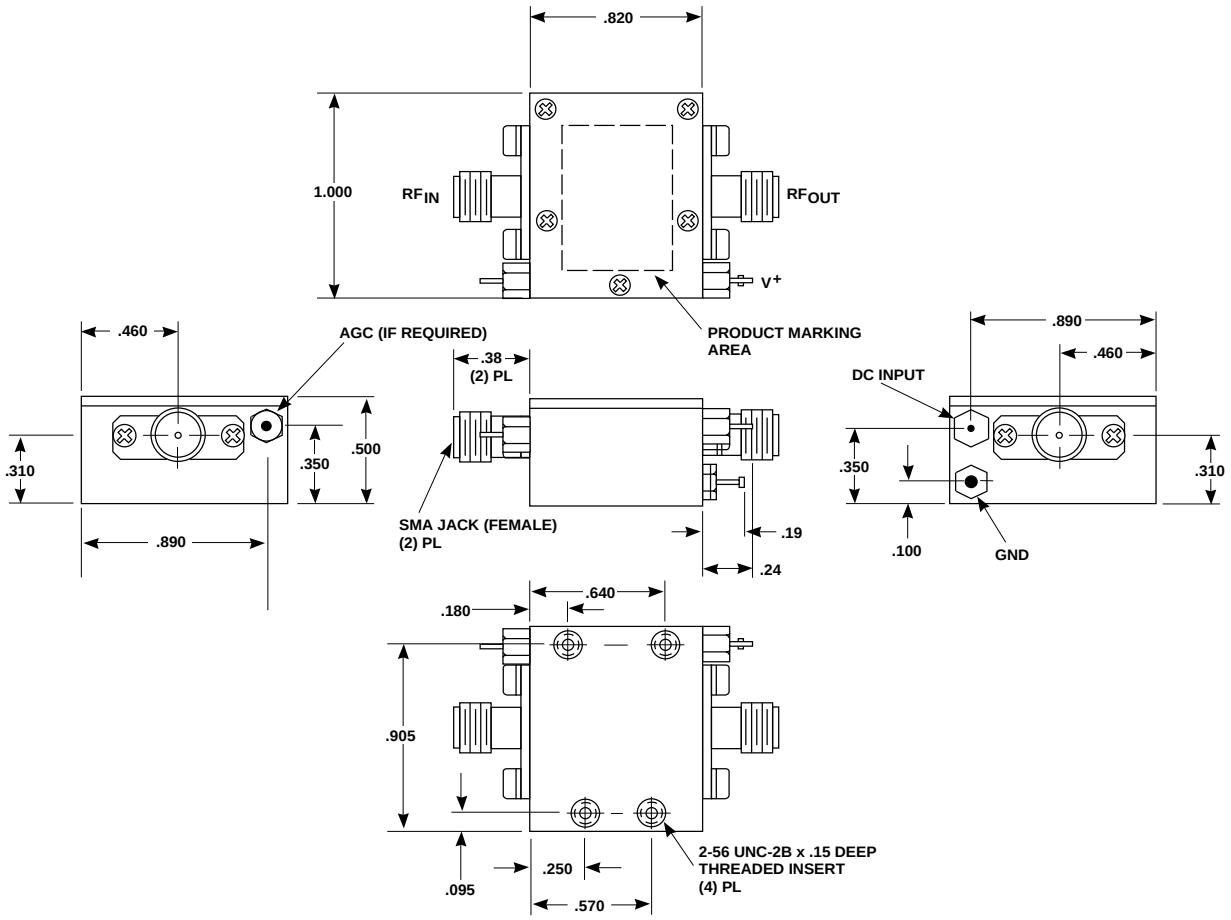
## Case Drawings
### TO-8U




APPROXIMATE WEIGHT 2.1 GRAMS

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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