



ACA2404

750/870 MHz CATV

High Output Power Doubler Line Amplifier

ADVANCED PRODUCT INFORMATION - Rev 0.0

FEATURES

- 21.5 dB Gain
- Characterized at +58 dBmV Output
- Very Low Distortion
- Excellent 75 Ω Input and Output Match
- Stable with High VSWR Load Conditions
- Monolithic Design for Consistent Performance Part-to-Part
- Surface Mount Package Compatible with Automatic Assembly
- Low Cost Alternative to Hybrids
- Meets Cenelec Standards

APPLICATIONS

- CATV Line Amplifiers, System Amplifiers, Distribution Nodes



PRODUCT DESCRIPTION

The ACA2404 is a highly linear, high output power, monolithic GaAs RF amplifier that has been developed to replace standard CATV hybrid amplifiers, in new designs. Offered in a convenient surface mount package, the MMIC consists of two pairs of parallel amplifiers that are optimized for

exceptionally low distortion and noise figure. A hybrid equivalent that provides flat gain response and excellent input and output return loss over the 40 to 870 MHz CATV downstream band is formed when one ACA2404 is cascaded between two appropriate transmission line baluns.

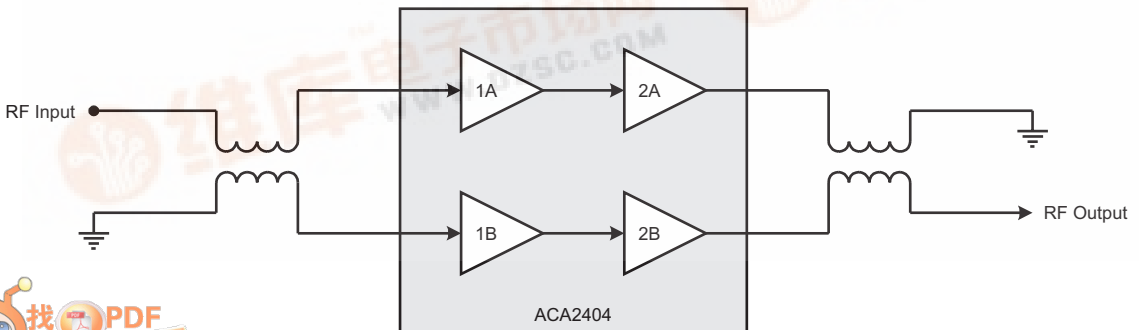


Figure 1: Hybrid Application Diagram



ACA2404

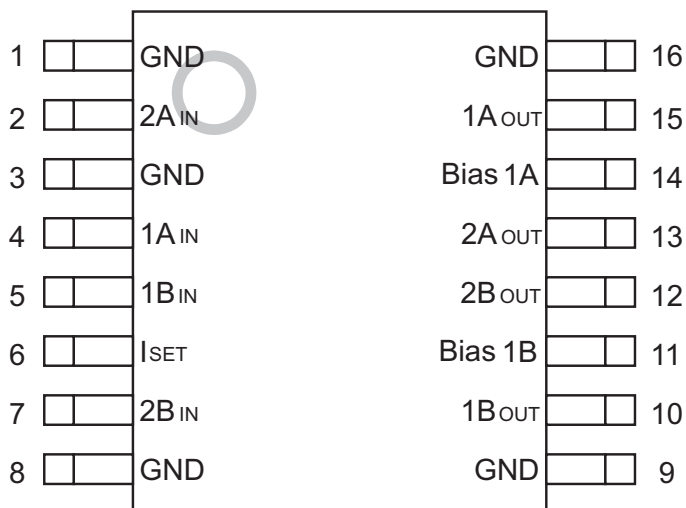


Figure 2: Pin Out

Table 1: Pin Description

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------------------|--------------------|-----|-------------------|--------------------------------|
| 1 | GND | Ground | 9 | GND | Ground |
| 2 | 2A _{IN} | Amplifier 2A Input | 10 | 1B _{OUT} | Amplifier 1B Output |
| 3 | GND | Ground | 11 | Bias 1B | Bias for 1B Amplifier |
| 4 | 1A _{IN} | Amplifier 1A Input | 12 | 2B _{OUT} | Amplifier 2B Output and Supply |
| 5 | 1B _{IN} | Amplifier 1B Input | 13 | 2A _{OUT} | Amplifier 2A Output and Supply |
| 6 | I _{SET} | Current Adjust | 14 | Bias 1A | Bias for 1A Amplifier |
| 7 | 2B _{IN} | Amplifier 2B Input | 15 | 1A _{OUT} | Amplifier 1A Output |
| 8 | GND | Ground | 16 | GND | Ground |

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

| PARAMETER | MIN | MAX | UNIT |
|--------------------------------|-----|------|------|
| Supply (pins 12, 13) | 0 | +28 | VDC |
| Current Adjust (pin 6) | 0 | +4 | VDC |
| RF Power at Inputs (pins 4, 5) | - | +75 | dBmV |
| Storage Temperature | -65 | +150 | °C |
| Soldering Temperature | - | +260 | °C |
| Soldering Time | - | 5.0 | Sec |

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Notes:

- Pins 2, 4, 5 and 7 should be AC-coupled. No external DC bias should be applied.*
- Pins 11 and 14 are bias feeds for input amplifiers 1A and 1B. No external DC bias should be applied.*
- Pins 10 and 15 receive DC bias directly from pins 11 and 14. No other external bias should be applied.*

Table 3: Operating Ranges

| PARAMETER | MIN | TYP | MAX | UNIT |
|--------------------------------|-----|-----|------|------|
| Supply: V_{DD} (pins 12, 13) | - | +24 | - | VDC |
| Current Adjust (pin 6) | - | +3 | - | VDC |
| RF Frequency | 40 | - | 870 | MHz |
| Case Temperature | -40 | - | +110 | °C |

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Table 4: AC and DC Electrical Specifications
(T_A = +25 °C, V_{DD} = +24 VDC)

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|--|-------------|------------|----------|------|-------------|
| Gain at 870 MHz ⁽¹⁾ | 20.8 | 21.5 | 22.1 | dB | |
| Cable Equivalent Slope ⁽¹⁾ | - | 0 | - | dB | |
| Gain Flatness ⁽¹⁾ to 870 MHz | - | ± 0.2 | - | dB | |
| Noise Figure ⁽¹⁾ | - | 4.0 | 5.0 | dB | |
| CTB ⁽¹⁾ 77 Channels ⁽²⁾ 110 Channels ⁽³⁾ | - - - | -75 -67 | -70 - | dBc | |
| CSO ⁽¹⁾ 77 Channels ⁽²⁾ 110 Channels ⁽³⁾ | - - - | -69 -64 | -67 - | dBc | |
| XMOD ⁽¹⁾ 77 Channels ⁽²⁾ 110 Channels ⁽³⁾ | - - - | -62 -60 | -60 - | dBc | |
| Return Loss (Input/Output) ⁽¹⁾ | 18 | 22 | - | dB | 75 Ω system |
| Supply Current | 485 | 500 | 515 | mA | |
| Thermal Resistance | - | 2.7 | 3.3 | °C/W | |

Notes:

(1) Measured with baluns on the input and output of the device.

(2) Parts measured with 77 channels, +58 dBmV power, 13.5 dB tilt at 870 MHz.

(3) Parts measured with 110 channels, +54 dBmV power, 13.5 dB tilt at 870 MHz.

4. All specifications as measured on Evaluation Board (see Figures 13 & 14).

PERFORMANCE DATA

Figure 3: Noise Figure vs. Frequency
($T_A = +25\text{ }^\circ\text{C}$, $V_{DD} = +24\text{ V}$)

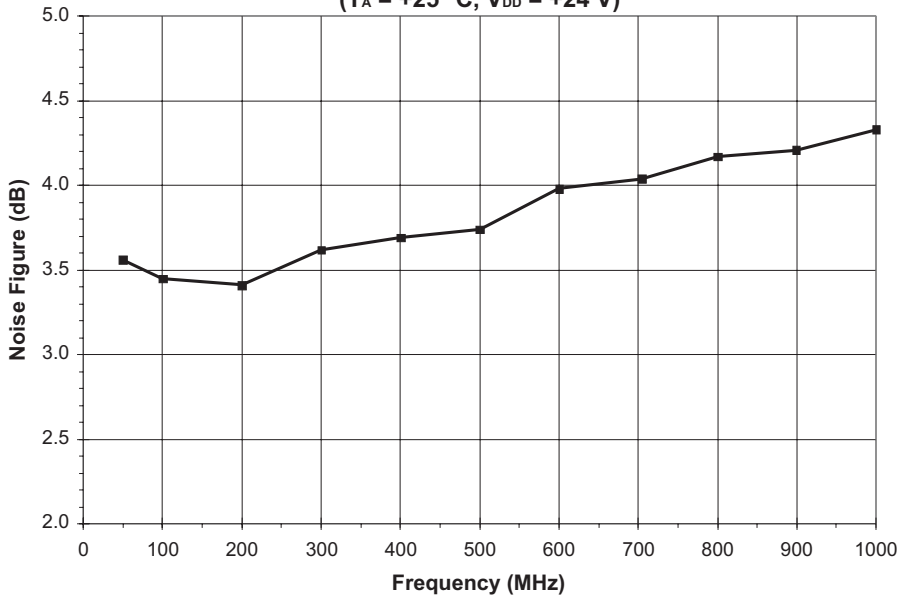


Figure 4: Gain (S21) vs. Frequency
($T_A = +25\text{ }^\circ\text{C}$, $V_{DD} = +24\text{ V}$, $75\text{ }\Omega$ system)

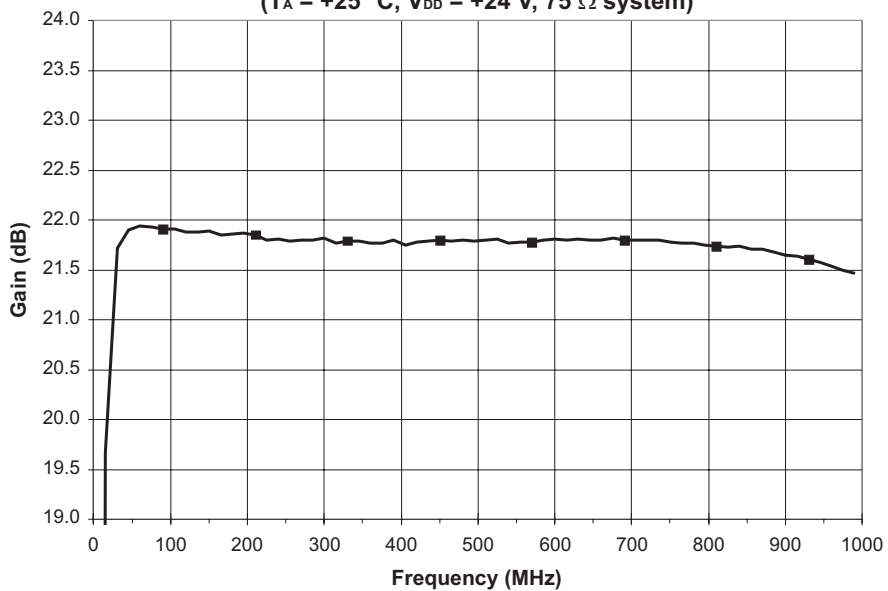


Figure 5: Input and Output Return Loss (S11 and S22) vs. Frequency
($T_A = +25\text{ }^\circ\text{C}$, $V_{DD} = +24\text{ V}$, $75\text{ }\Omega$ system)

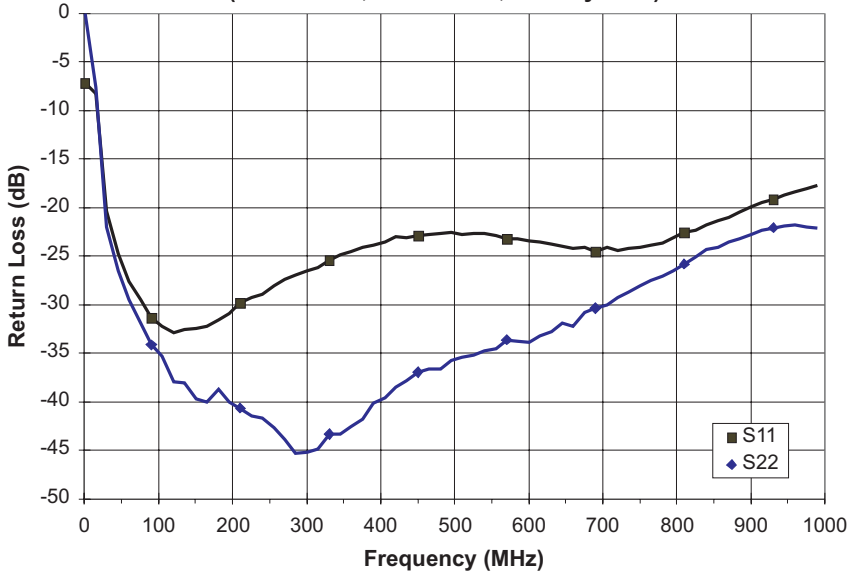


Figure 6: Isolation (S12) vs. Frequency
($T_A = +25\text{ }^\circ\text{C}$, $V_{DD} = +24\text{ V}$, $75\text{ }\Omega$ system)

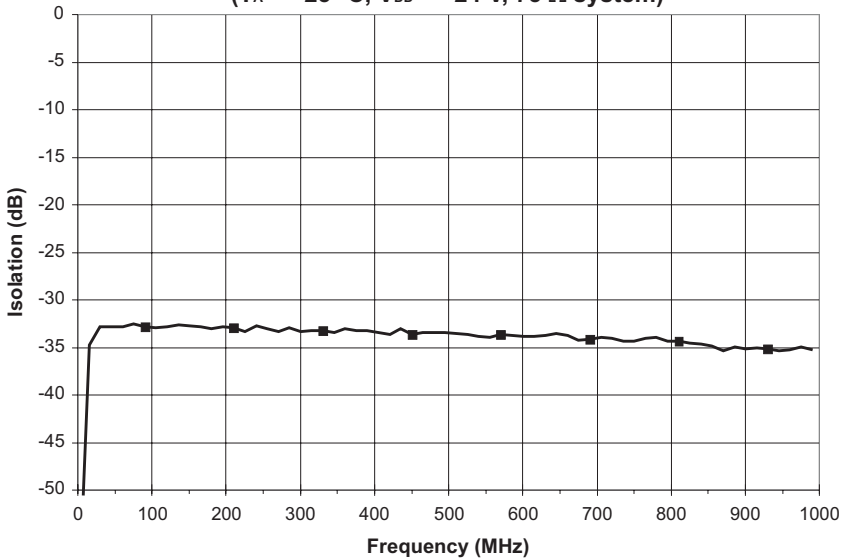


Figure 7: CTB vs. Frequency
 (110 channels, +54 dBmV power, 13.5 dB tilt at 870 MHz)

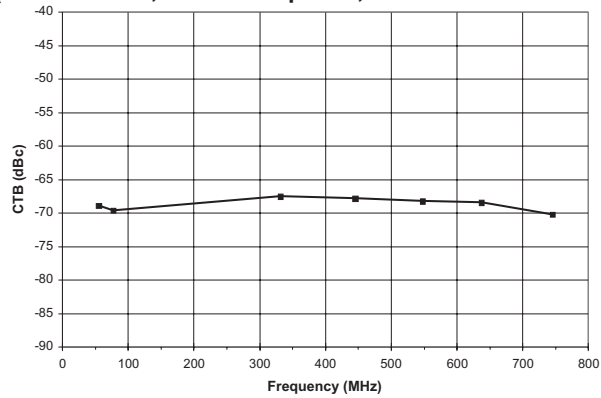


Figure 8: CSO vs. Frequency
 (110 channels, +54 dBmV power, 13.5 dB tilt at 870 MHz)

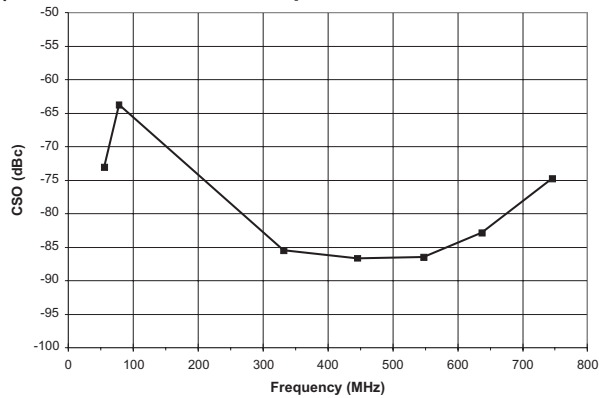


Figure 9: XMOD vs. Frequency
 (110 channels, +54 dBmV power, 13.5 dB tilt at 870 MHz)

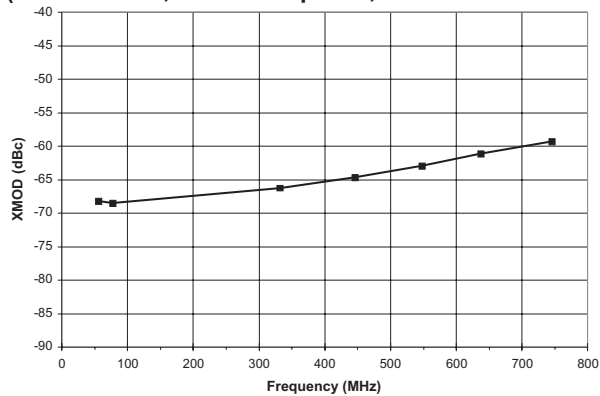


Figure 10: CTB vs. Frequency
(77 channels, +58 dBmV power, 13.5 dB tilt at 870 MHz)

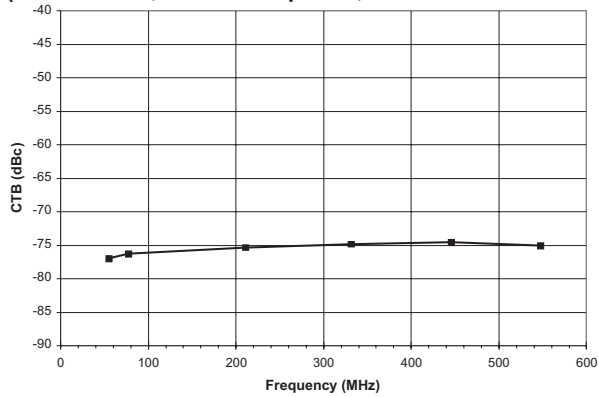


Figure 11: CSO vs. Frequency
(77 channels, +58 dBmV power, 13.5 dB tilt at 870 MHz)

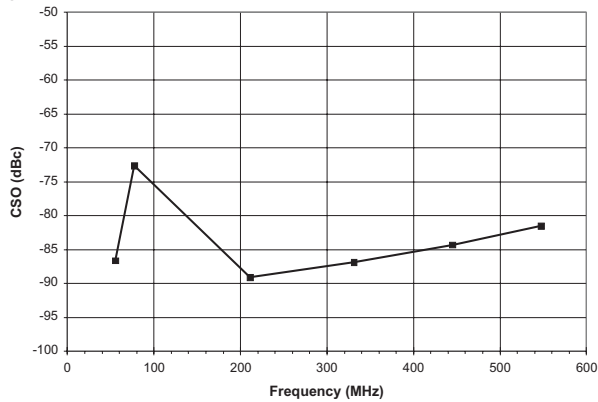
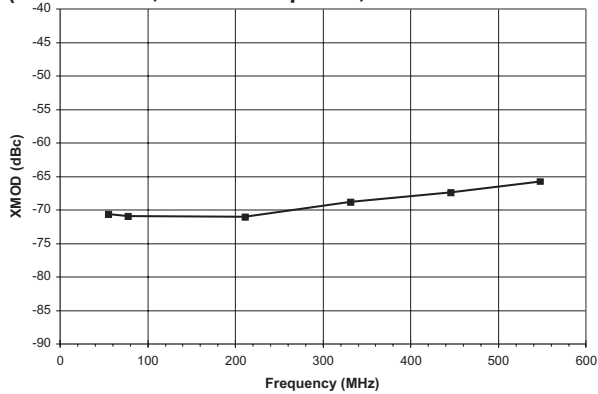


Figure 12: XMOD vs. Frequency
(77 channels, +58 dBmV power, 13.5 dB tilt at 870 MHz)



APPLICATION INFORMATION

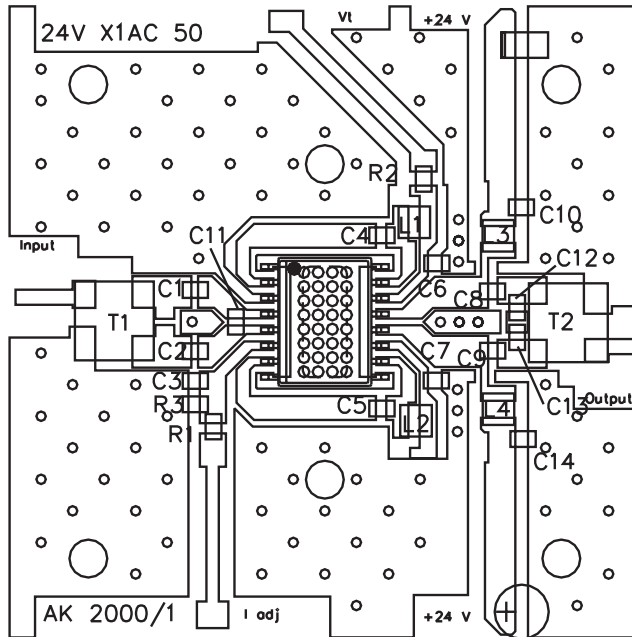


Figure 13: Evaluation Board Layout

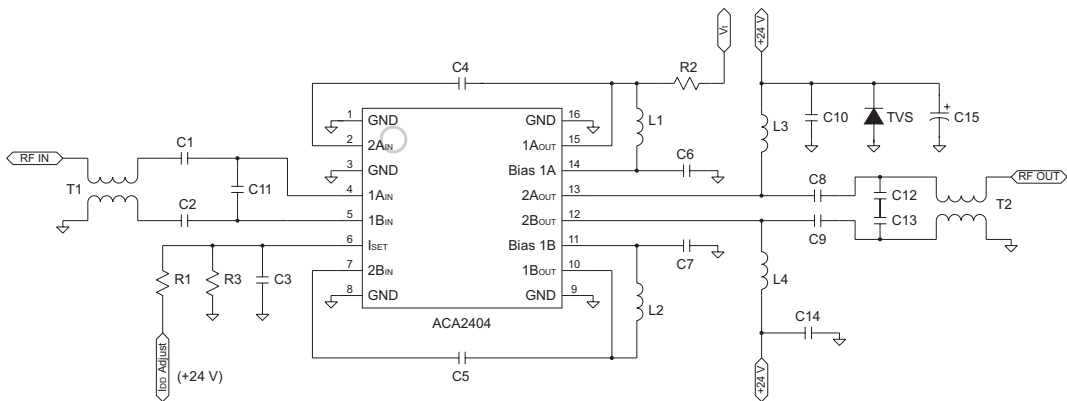


Figure 14: Evaluation Board Schematic

Table 5: Evaluation Board Parts List

| REF | DESCRIPTION | QTY | VENDOR | VENDOR P/N |
|----------------------------------|--------------------------------------|-----|----------------------------|-----------------|
| C1, C2, C3, C6, C7, C10, C14 | 0.01 μ F CHIP CAP | 7 | MURATA | GRM39X7R103K50V |
| C4, C5, C8, C9 | 470 pF CHIP CAP | 4 | MURATA | GRM39X7R471K50V |
| C11 | 0.5 pF CHIP CAP | 1 | MURATA | GRM36COG0R5C50 |
| C15 | 47 μ F ELECT. CAP | 1 | DIGI-KEY CORP | P5275-ND |
| C12, C13, R1, R2, R3 | NOT USED | | | |
| TVS | TVS 24 VOLT 600 WATT | 1 | DIGI-KEY CORP | SMBJ24ACCCT-ND |
| L1, L2, L3, L4 ⁽⁴⁾ | 680 nH INDUCTOR | 4 | COILCRAFT | 1008CS-681XKBC |
| R1 | 75 K Ω Resistor | 1 | DIGI-KEY CORP | P75KGCT-ND |
| CONNECTOR ⁽¹⁾ | 75 Ω N MALE PANEL MOUNT | 2 | PASTERNAK ENTERPRISES | PE4504 |
| T1, T2 ⁽²⁾ (BALUN) | Ferrite Core | 2 | FAIR-RITE | 2843002702 |
| | Wire | | MWS WIRE IND. | T-2361429-20 |
| | Printed Circuit Board ⁽³⁾ | 1 | STANDARD PRINTED CIRC. INC | 24VX1AC50 |
| INDIUM | 300 X 160 MILS | 1 | INDIUM CORP OF AMERICA | 14996Y |

Notes:

(1) N connector center pin should be approximately 80 mils in length.

(2) T1, T2 balun: 6.5 turns thru, as shown in Figure 15.

(3) Due to the power dissipation of this device, the printed circuit board should be mounted / attached to a heat sink.

(4) 400 mA minimum current rating.

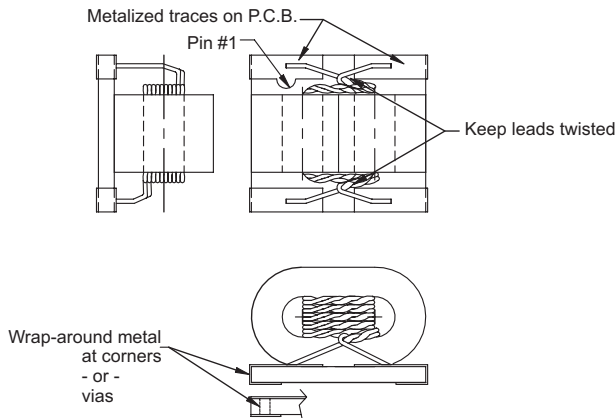
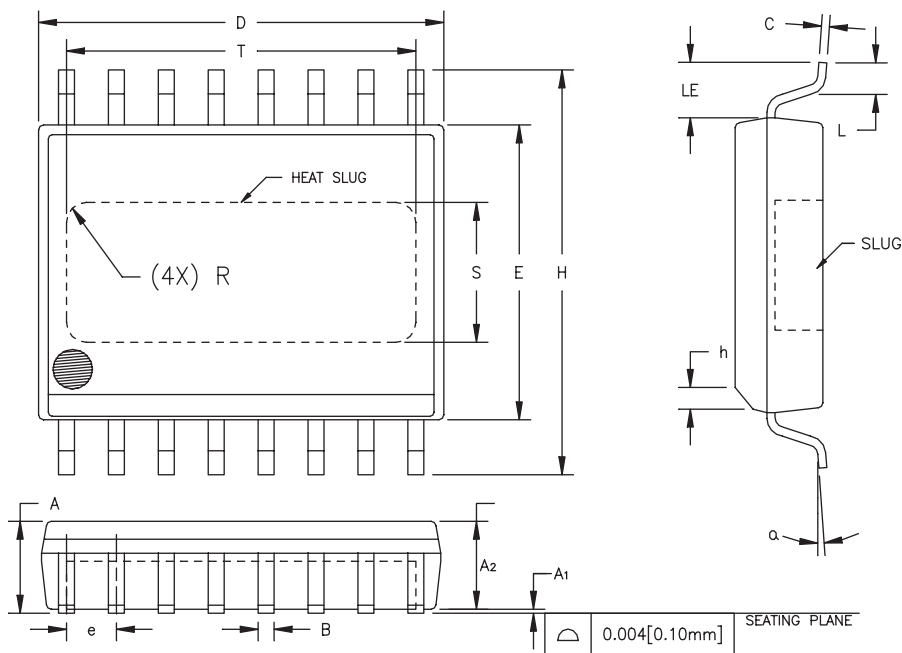


Figure 15: Balun Drawing

PACKAGE OUTLINE



| S _W B _{OL} | INCHES | | MILLIMETERS | | NOTE |
|--------------------------------|--------|-------|-------------|-------|------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 0.087 | 0.098 | 2.21 | 2.49 | |
| A ₁ | 0.000 | 0.004 | 0.00 | 0.10 | 6 |
| A ₂ | 0.087 | 0.094 | 2.21 | 2.39 | |
| B | 0.013 | 0.019 | 0.33 | 0.48 | |
| C | 0.007 | 0.009 | 0.18 | 0.23 | |
| D | 0.398 | 0.412 | 10.11 | 10.46 | 2 |
| E | 0.290 | 0.300 | 7.37 | 7.62 | 3 |
| e | 0.050 | BSC | 1.27 | BSC | 4 |
| H | 0.394 | 0.418 | 10.01 | 10.62 | |
| h | 0.010 | 0.028 | 0.25 | 0.71 | |
| L | 0.024 | 0.040 | 0.61 | 1.02 | |
| LE | 0.052 | — | 1.32 | — | |
| α | 0° | 8° | 0° | 8° | |
| S | 0.120 | 0.140 | 3.05 | 3.56 | 5 |
| T | 0.330 | 0.350 | 8.38 | 8.89 | 5 |
| R | REF. | 0.015 | REF. | 0.38 | 5 |

NOTES:

1. CONTROLLING DIMENSION: INCHES
2. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.006 [0.15mm] PER SIDE.
3. DIMENSION "E" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.010 [0.25mm] PER SIDE.
4. MAXIMUM LEAD TWIST/SKEW TO BE ±0.005 [0.13mm].
5. DIMENSIONS "S", "T" AND "R" INDICATE EXPOSED SLUG AREA.
6. STANDOFF HEIGHT (A₁) MEASURED FROM BOTTOM OF SLUG.

Figure 16: S7 Package Outline - 16 Pin Wide Body SOIC with Heat Slug

ACA2404

ORDERING INFORMATION

| ORDER NUMBER | TEMPERATURE RANGE | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|--------------|-------------------|--------------------------------------|------------------------------------|
| ACA2404S7P2 | -40 to 110 °C | 16 Pin Wide Body SOIC with Heat Slug | 1,500 piece tape and reel |
| ACA2404S7P0 | -40 to 110 °C | 16 Pin Wide Body SOIC with Heat Slug | Plastic tubes (25 pieces per tube) |



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