

DATA SHEET

# ACA2417: 1218 MHz CATV Push-Pull Driver Amplifier

## Applications

- DOCSIS® and Euro DOCSIS® 3.1 (D3.1) compliant downstream
- RF Pre-amplifier for node + 0 HFC and FTTC/FTTB networks
- Final stage amplifier in FTTC applications

## Features

- 40 to 1218 MHz frequency range
- Output power:  $\geq +44$  dBmV/channel
- Gain: 25 dB at 1218 MHz
- Total composite power :  $\geq +64.4$  dBmV
- Single +24 V supply
- Operating current: 240 mA ( $P_{diss} < 6$  Wdc)
- Surface-mount package compatible with automatic assembly and excellent reliability
- Halogen-free/RoHS compliant



## Description

The ACA2417 is a highly linear low-noise, high-gain RF pre-amplifier module in the industry standard SOIC-16 wide body SMT package. Designed to drive D3.1 compliant power doublers in deep fiber node CATV infrastructure applications, the module consists of two parallel amplifiers in cascade forming a push-pull optimized for low noise, low distortion, high output power per channel, and high TCP. Advanced GaAs optimizes operating current, making the module an excellent choice for environmentally friendly “green” applications.

A block diagram of the ACA2417 is shown in Figure 1. The device package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

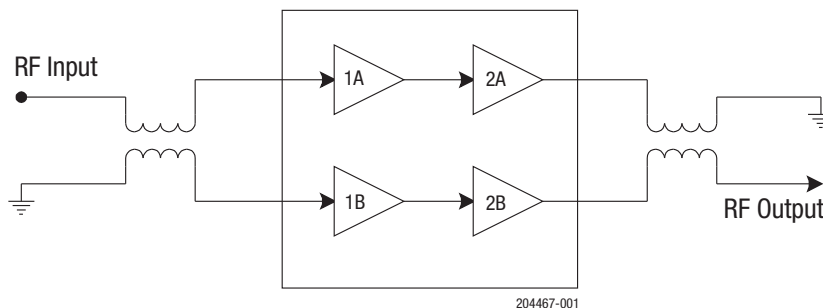
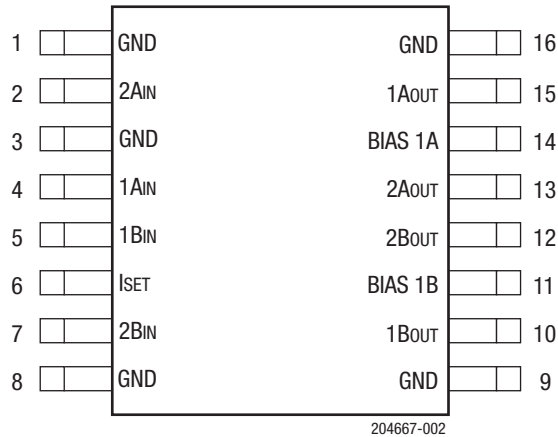


Figure 1. ACA2417 Block Diagram



**Figure 2. ACA2417 Pinout (Top View)**

**Table 1. ACA2417 Signal Pin Descriptions**

| Pin | Name | Description        | Pin | Name    | Description             |
|-----|------|--------------------|-----|---------|-------------------------|
| 1   | GND  | Ground             | 9   | GND     | Ground                  |
| 2   | 2Ain | Amplifier 2A input | 10  | 1Bout   | Amplifier 1B output     |
| 3   | GND  | Ground             | 11  | BIAS 1B | Bias for 1B amplifier   |
| 4   | 1Ain | Amplifier 1A input | 12  | 2Bout   | Amplifier 2B output     |
| 5   | 1Bin | Amplifier 1B input | 13  | 2Aout   | Output from Amplifier A |
| 6   | ISET | Current adjust     | 14  | BIAS 1A | Bias for 1A amplifier   |
| 7   | 2Bin | Amplifier 2B input | 15  | 1Aout   | Amplifier 1A output     |
| 8   | GND  | Ground             | 16  | GND     | Ground                  |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the ACA2417 are provided in Table 2. Recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

**Table 2. ACA2417 Absolute Maximum Ratings<sup>1</sup>**

| Parameter                         | Minimum | Maximum | Units |
|-----------------------------------|---------|---------|-------|
| Supply (pins 12 and 13)           | 0       | +28     | VDC   |
| Current adjust (pin 6)            |         | +4      | VDC   |
| RF power at inputs (pins 4 and 5) |         | +75     | dBmV  |
| Storage temperature               | -65     | +150    | °C    |
| Soldering temperature             |         | +260    | °C    |
| Soldering time                    |         | 5.0     | sec   |

<sup>1</sup> Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

<sup>2</sup> Pins 2, 4, 5, and 7 should be AC coupled. No external DC bias should be applied.

<sup>3</sup> Pin 6 should be AC-grounded and/or pulled to ground through a resistor for current control.

<sup>4</sup> Pins 10, 11, 14, and 15 should have no other external bias applied.

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**ESD HANDLING:** *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

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**Table 3. ACA2417 Recommended Operating Conditions<sup>1</sup>**

| Parameter        | Symbol | Min | Typ | Max  | Units |
|------------------|--------|-----|-----|------|-------|
| RF frequency     | f      | 40  |     | 1218 | MHz   |
| Supply voltage   | VDD    |     | +24 |      | VDC   |
| Case temperature | TCASE  | -40 |     | +110 | °C    |

<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.

**Table 4. ACA2417 Electrical Specifications<sup>1</sup>****T<sub>A</sub> = +25 °C, V<sub>DD</sub> = +24 VDC, 75 Ω System, Unless Otherwise Noted)**

| Parameter                                | Symbol          | Test Condition        | Min  | Typ   | Max  | Units |
|--|-----------------|-----------------------|------|-------|------|-------|
| Gain <sup>3</sup>                        | G               | 1218 MHz              | 24.2 | 25.2  | 26.2 | dB    |
| Gain flatness to 1218 MHz <sup>2,3</sup> |                 |                       |      | ± 0.2 |      | dB    |
| Cable equivalent slope <sup>3</sup>      |                 |                       | 0.5  | 1.0   | 1.5  | dB    |
| Noise figure                             | NF              |                       |      | 5     |      | dB    |
| CTB <sup>1</sup>                         | CTB             |                       |      | -68   | -65  | dBc   |
| CSO <sup>1</sup>                         | CSO             |                       |      | -67   | -65  | dBc   |
| XMOD <sup>1</sup>                        | ACLR            |                       |      | -60   |      | dBc   |
| CIN <sup>1</sup>                         |                 |                       |      | -65   | -62  | dB    |
| Return loss 50 to 600 MHz                | RL              |                       |      | -20   | -18  | dB    |
| Return loss 600 to 1218 MHz              | RL              |                       |      | -20   | -16  | °C/W  |
| Thermal resistance                       | θ <sub>Jc</sub> | Junction to case slug |      | 2.7   | 3.3  | °C/W  |
| Supply current                           |                 |                       |      | 240   | 270  | mA    |

<sup>1</sup> Parts measured with 79 NTSC analog channels plus digital QAM channels to 1000 MHz, +44 dBmV output power and 0.0 dB tilt.

<sup>2</sup> Peak deviation from a straight line between gain value at 50 MHz and 1218 MHz.

<sup>3</sup> Measured in application circuit in Figure 3.

<sup>4</sup> All specifications as measured on the Evaluation Board.

### Evaluation Board Description

The ACA2417 Evaluation Board is used to test the performance of the ACA2417 device. An Evaluation Board schematic is provided

in Figure 3. Table 6 provides the Bill of Materials (BOM) list for Evaluation Board components.

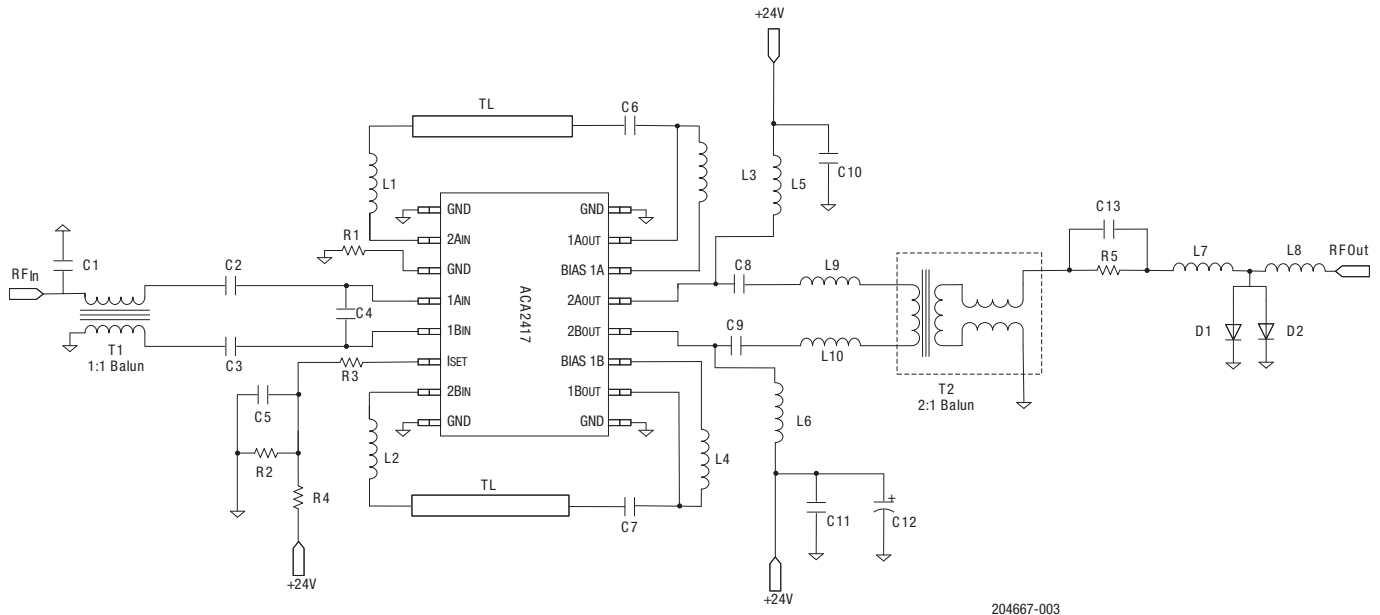


Figure 3. ACA2417 Evaluation Board Schematic

Table 5. ACA2417 Evaluation Board Bill of Materials (BOM)

| Component            | Description    | Value   | Component | Description            | Value     |
|----------------------|----------------|---------|-----------|------------------------|-----------|
| C1                   | 0402 capacitor | 0.2 pF  | L9, L10   | 0402 inductor          | 5.1 nH    |
| C2, C3, C5, C10, C11 | 0402 capacitor | 0.01 uF | T1        | Minntronix 1:1 BALUN   | MRF-25001 |
| C4                   | 0402 capacitor | 1.0 pF  | T2        | Minntronix 2:1 BALUN   | MRF-27001 |
| C6, C7               | 0402 capacitor | 270 pF  | R1        | 0402 resistor          | 0 Ω       |
| C8, C9               | 0402 capacitor | 150 pF  | R2        | 0402 resistor          | 4.64 kΩ   |
| C12                  | ELECTR CAP     | 47 uF   | R3        | 0402 resistor          | 510 Ω     |
| C13                  | 0402 capacitor | 330 pF  | R4        | 0402 resistor          | 26.7 kΩ   |
| L1, L2               | 0402 inductor  | 2.7 nH  | R5        | 0402 resistor          | 3 Ω       |
| L3, L4               | 0805 inductor  | 470 nH  | D1, D2    | 0402 DIO               |           |
| L5, L6               | 0603 inductor  | 680 nH  | TL        | 75 Ω transmission line |           |
| L7                   | 0402 inductor  | 3.3 nH  | U1        | ACA2417                |           |
| L8                   | 0402 inductor  | 1.8 nH  |           |                        |           |

## Package Dimensions

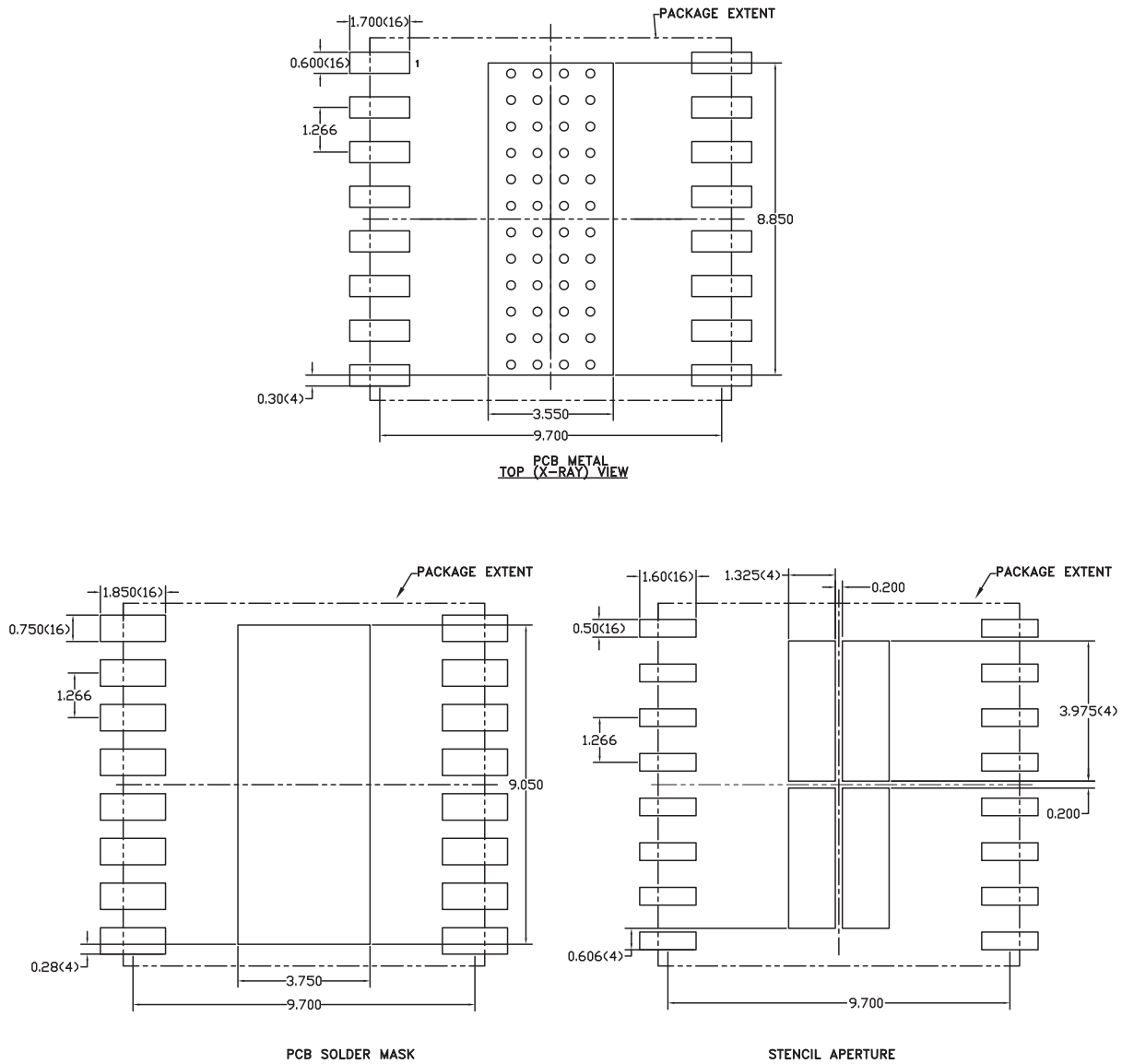
The PCB layout footprint drawing for the ACA2417 is shown in Figure 4. The package dimensions for the ACA2417 are shown in Figure 5. The tape and reel dimensions are provided in Figure 6.

## Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The ACA2417 is rated to Moisture Sensitivity Level 2 (MSL2) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

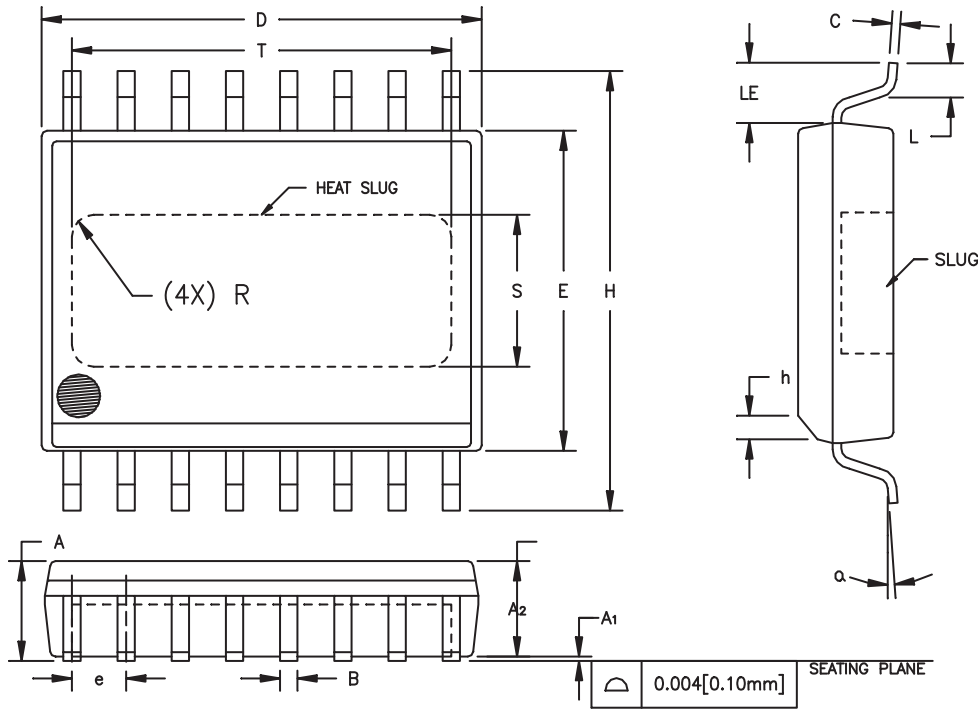


**NOTES:**

- (1) UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES SHOWN.
- (2) DIMENSIONS IN MILLIMETERS.
- (3) VIAS SHOWN IN PCB METAL VIEW ARE FOR REFERENCE ONLY. NUMBER & SIZE OF THERMAL VIAS REQUIRED DEPENDENT ON HEA DISSIPATION REQUIREMENT AND THE PC PROC SS CAPABILITY.
- (4) RECOMMENDED STENCIL THICKNESS: APPROX. 0.125mm (5 Mils)

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**Figure 4. ACA2417 PCB Layout Footprint Dimensions**



| SYMBOL         | INCHES |       | MILLIMETERS |       | NOTE |
|----------------|--------|-------|-------------|-------|------|
|                | MIN.   | MAX.  | MIN.        | MAX.  |      |
| A              | 0.087  | 0.098 | 2.21        | 2.49  |      |
| A <sub>1</sub> | 0.000  | 0.004 | 0.00        | 0.10  | 6    |
| A <sub>2</sub> | 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    |

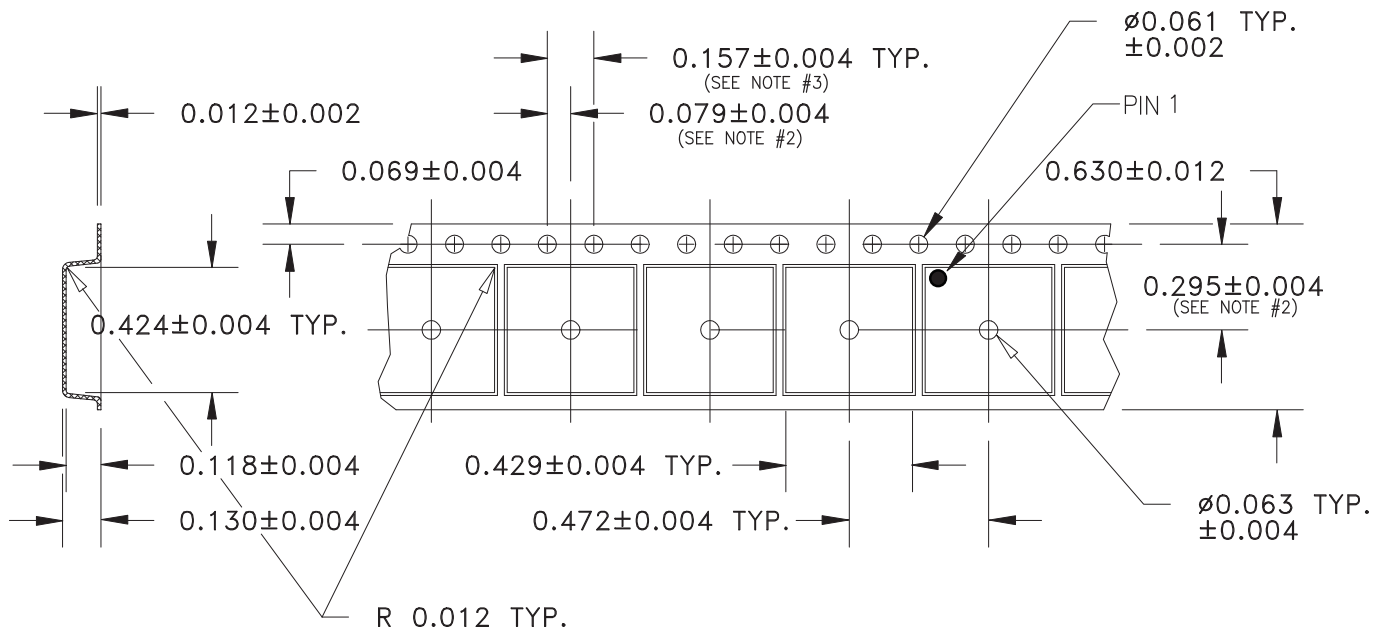
**NOTES:**

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 (A<sub>1</sub>) MEASURED FROM BOTTOM OF SLUG.

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**Figure 5. ACA2417 Package Dimensions**





- NOTES: 1. MATERIAL – CONDUCTIVE POLYSTYRENE.  
 2. MEASURED FROM CENTERLINE OF SPROCKET HOLE TO CENTERLINE OF POCKET.  
 3. CUMULATIVE TOLERANCE OF 10 SPROCKET HOLES IS ± 0.008.

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Figure 6. ACA2417 Tape and Reel Dimensions

## Ordering Information

| Product Description | Package Description                  | Component Packaging          |
|---------------------|--------------------------------------|------------------------------|
| ACA2417P2           | 16-pin wide body SOIC with heat slug | 1500-piece tape and reel     |
| EVB2417             |                                      | Evaluation Board part number |

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