ACA2407E

750/870 MHz CATV
Power Doubler Line Amplifier
Data Sheet

FEATURES

- 21.3 dB Gain
- Very Low Distortion
- Excellent 75 Ω Input and Output Match
- Stable with High VSWR Load Conditions
- Monolithic Design for Consistent Performance Part-to-Part
- Low DC Power Consumption
- Surface Mount Package Compatible with Automatic Assembly
- Low Cost Alternative to Hybrids
- Meets Cenelec Standards
- Materials set consistent with RoHS Directives.

S7 Package
16 Pin Wide Body SOIC
with Heat Slug

APPLICATIONS

- CATV Line Amplifiers, System Amplifiers, Distribution Nodes

PRODUCT DESCRIPTION

The ACA2407E is a highly linear, monolithic GaAs RF amplifier that has been developed to replace, in new designs, standard CATV hybrid amplifiers. 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 ACA2407E is cascaded between two appropriate transmission line baluns.

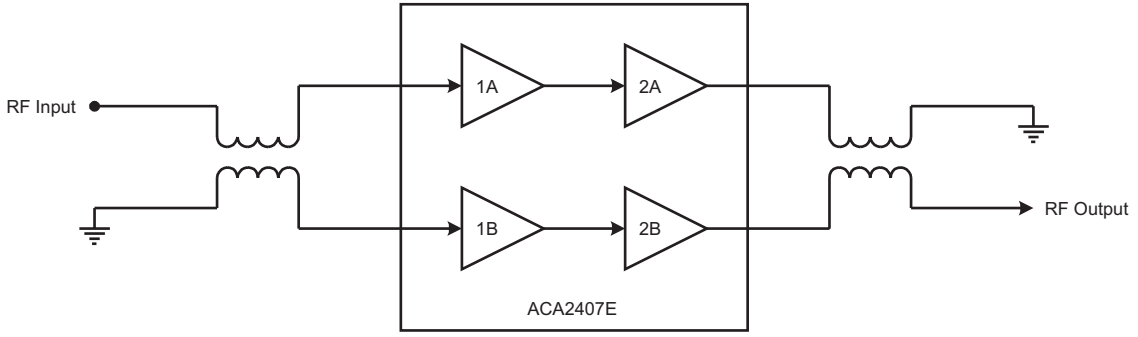


Figure 1: Hybrid Application Diagram

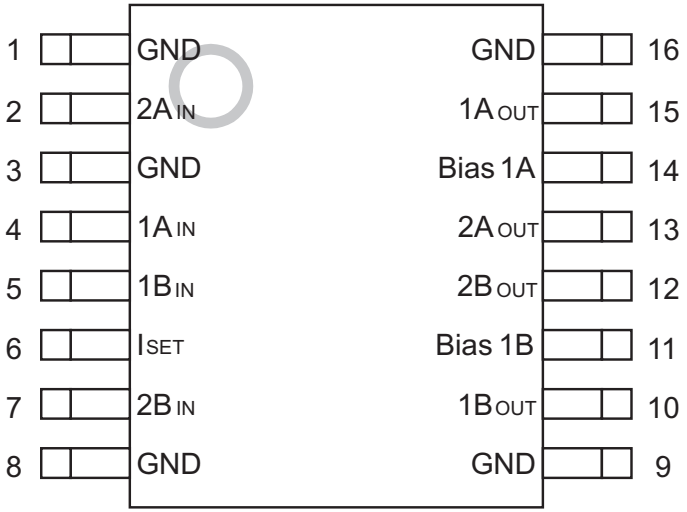


Figure 2: Pinout

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 Mimimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT
Supply (pins 12, 13)	0	+28	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:

(1) Pins 2, 4, 5 and 7 should be AC-coupled. No external DC bias should be applied.

(2) Pin 6 should be AC-grounded and/or pulled to ground through a resistor for current control.

(3) Pins 11 and 14 are bias feeds for input amplifiers 1A and 1B. No external DC bias should be applied.

(4) Pins 10 and 15 receive DC bias directly from pins 11 and 14.

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT
Supply: V_{DD} (pins 12, 13)	-	+24	-	VDC
Voltage at I_{SET} (pin 6)	-	+3	-	VDC
RF Frequency	40	-	1000	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: Electrical Specifications
(T_A = +25 °C, V_{DD} = +24 VDC)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain (1)	20.4 -	21.3 21.1	22.4 -	dB dB	870 MHz 1000 MHz
Cable Equivalent Slope (1)	-	0	-	dB	
Gain Flatness (1) to 870 MHz	-	±0.2	-	dB	
Noise Figure (1)	-	4.0	4.5	dB	
CTB (1) 77 Channels (2) 110 Channels (3) 112 Channels plus QAM to 1 GHZ (5), (6)	 - - -	 -70 -65 -65	 -66 - -	 dBc	
CSO (1) 77 Channels (2) 110 Channels (3) 112 Channels plus QAM to 1 GHZ (5), (6)	 - - -	 -66 -60 -60	 -64 - -	 dBc	
XMOD (1) 77 Channels (2) 110 Channels (3) 112 Channels plus QAM to 1 GHZ (5), (6)	 - - -	 -62 -60 -60	 -60 - -	 dBc	
Return Loss (Input/Output) (1)	18	22	-	dB	75 Ω system
Supply Current (I_{DD})	410	425	440	mA	R1 = 75 kΩ, R3 open Refer to Figure 8
Thermal Resistance	-	3.1	3.8	°C/W	
I_{DD} Adjust	-	<1	-	mA	Refer to Figure 8

Notes:
(1) Measured with baluns on the input and output of the device.
(2) Parts measured with 77 channels, +56 dBm V power, 13.5 dB tilt at 870 MHz.
(3) Parts measured with 110 channels, +52 dBm V power, 13.5 dB tilt at 870 MHz.
(4) All specifications as measured on Evaluation Board (see Figures 7 & 8).
(5) 112 analog channels plus QAM, +51 dBmV, 15.6 dB tilt at 1 GHz.
(6) QAM is set 6 dB below analog carrier.

Table 5: Electrical Specifications at Reduced I_{DD}
(T_A = +25 °C, V_{DD} = +24 VDC)

PARAMETER	TYP	TYP	UNIT	COMMENTS
Gain	21.0	21.2	dB	
CTB (1) 77 Channels (2)	-58	-64	dBc	
CSO (1) 77 Channels (2)	-60	-62	dBc	
XMOD (1) 77 Channels (2)	-50	-55	dBc	
Supply Current (I_{DD})	360	390	mA	
R1 (Figure 8)	Open	Open	☐	
R3 (Figure 8)	10 k	Open	☐	

Notes:
(1) Measured with baluns on the input and output of the device.
(2) Parts measured with 77 channels, +56 dBm V power, 13.5 dB tilt at 870 MHz.

PERFORMANCE DATA

Figure 3: Noise Figure vs. Frequency

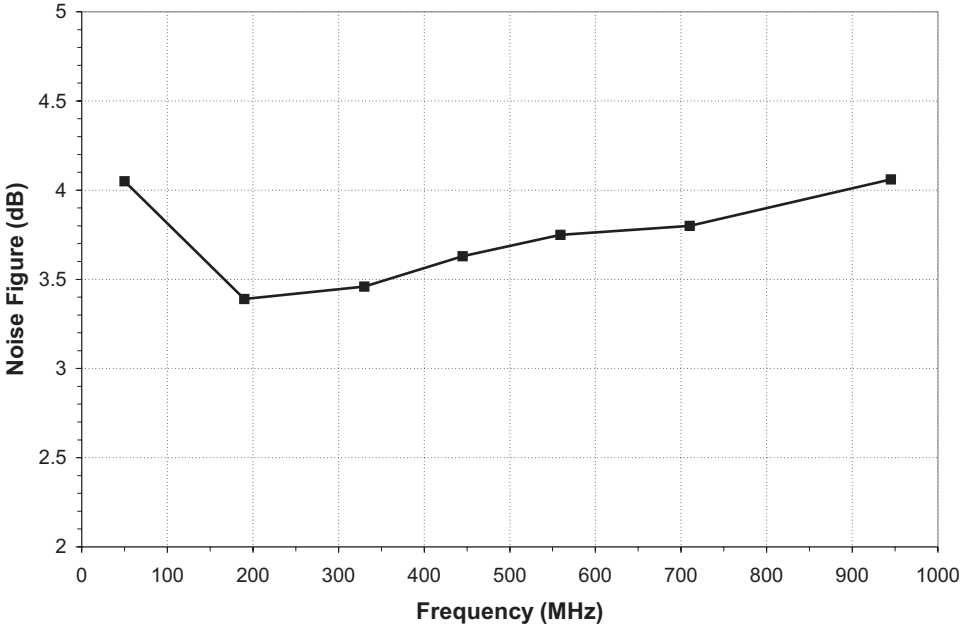


Figure 4: Gain (S21) vs. Frequency

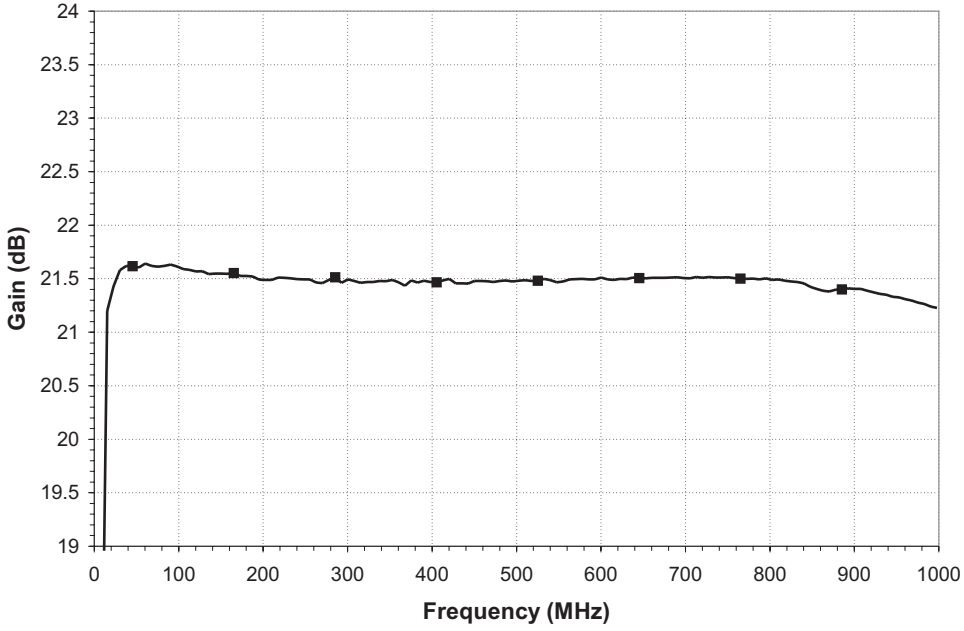


Figure 5: Input and Output Return Loss (S11 and S22) vs. Frequency

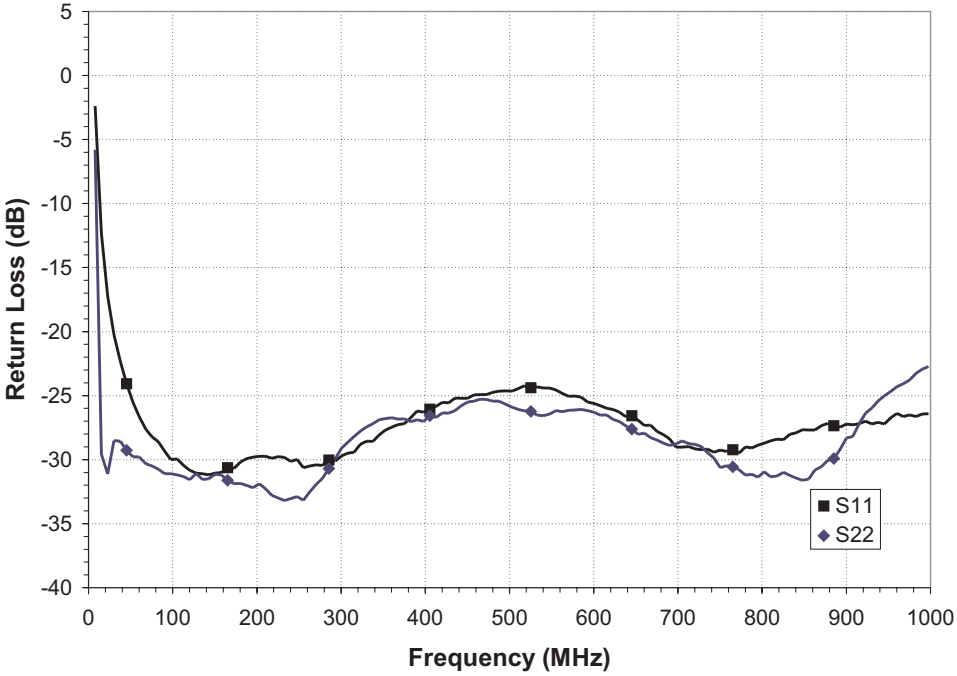
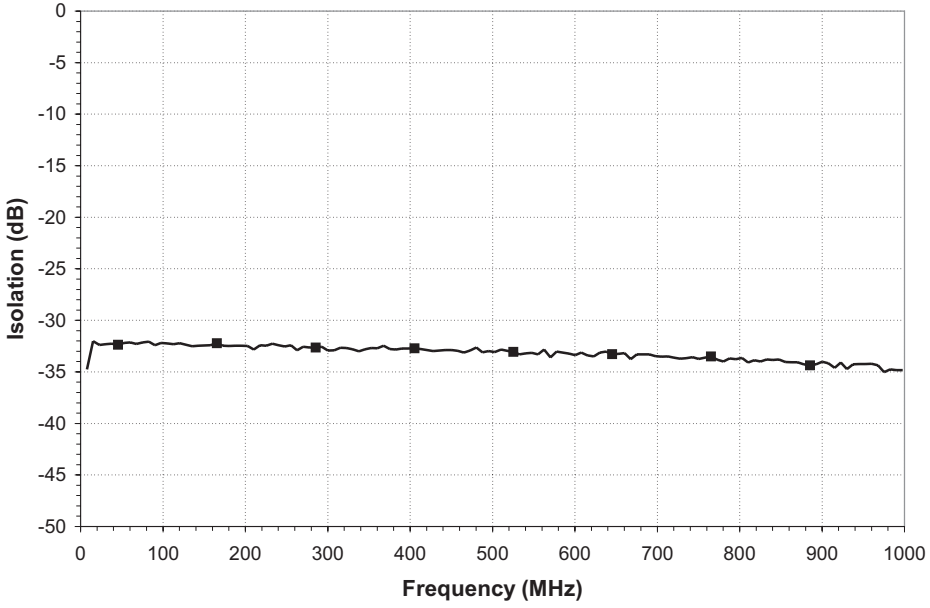


Figure 6: Isolation (S12) vs. Frequency



APPLICATION INFORMATION

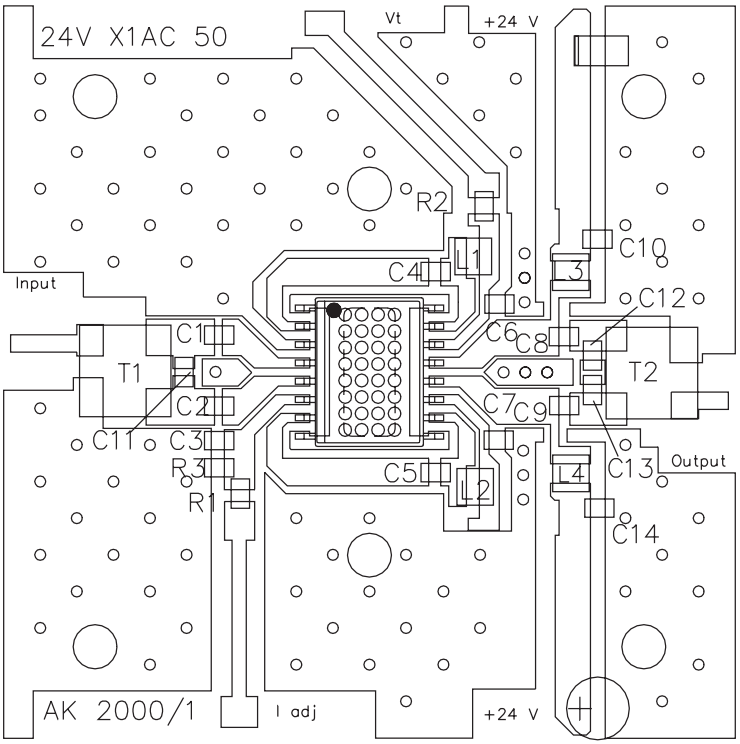


Figure 7: Evaluation Board Layout

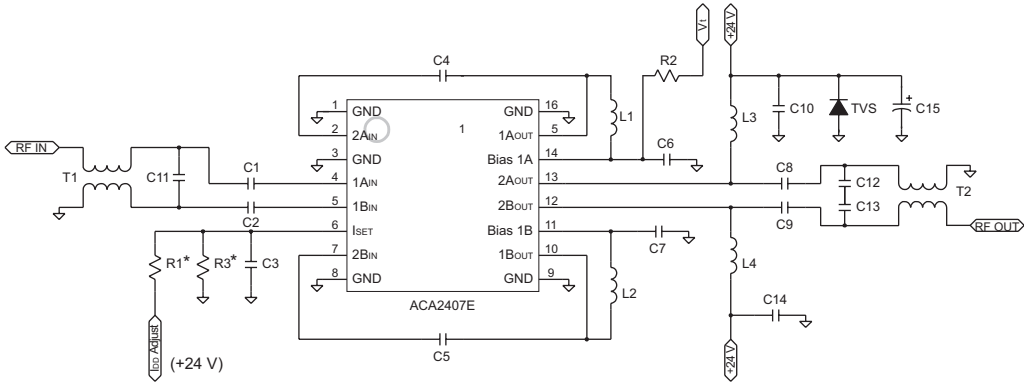


Figure 8: Evaluation Board Schematic

** Refer to Table 5 for R1, R3 use at lower I_{DD} operation.*

Table 6: Evaluation Board Parts List

REF	DESCRIPTION	QTY	VENDOR	VENDOR PART NO.
C1, C2, C3, C6, C7, C10, C14	0.01 □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 □F Elect. Cap	1	DIGI-KEY CORP	P5275-ND
C12, C13, R2	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 (5)	75 k□Resistor	1	DIGI-KEY CORP	P75KGCT-ND
R3 (5)	10 k□Resistor	1	DIGI-KEY CORP	P10KGCT-ND
CONNECTOR (1)	75 □N Male Panel Mount	2	PASTERNACK 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 9.
(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.
(5) Refer to Table 5 for R1, R3 use at lower I_{DD} operation.

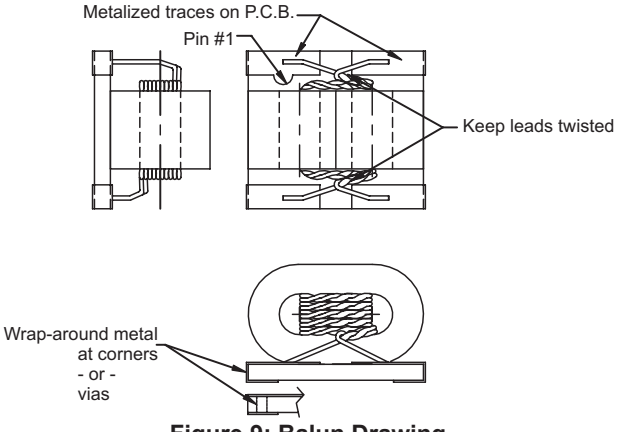
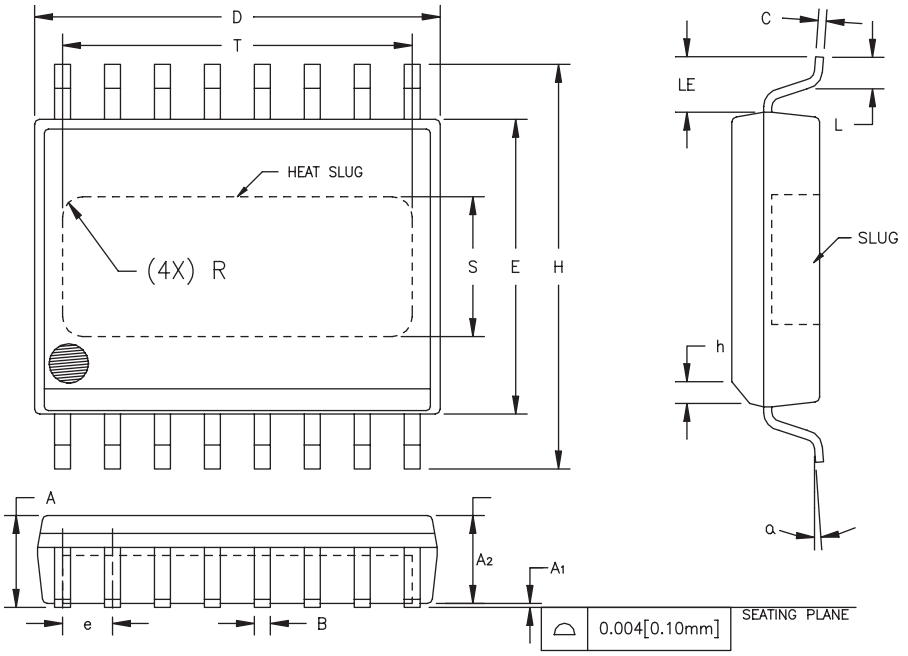


Figure 9: Balun Drawing

PACKAGE OUTLINE



SYMBOL	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 (A_1) MEASURED FROM BOTTOM OF SLUG.

Figure 10: S7 Package Outline - 16 Pin Wide Body SOIC with Heat Slug

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
ACA2407ERS7P2	-40 °C to +110 °C	RoHS Compliant 16 Pin Wide Body SOIC with Heat Slug	3,500 piece tape and reel
ACA2407ERS7P0	-40 °C to +110 °C	RoHS Compliant 16 Pin Wide Body SOIC with Heat Slug	Ship in Tubes

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