# AWT921

Integrated High Power Amp 900 MHz

**PRELIMINARY DATA SHEET - Rev 1.2**

## FEATURES

- High output power levels
- High Efficiency
- True Surface Mount Package with Integrated Heat Slug
- Internal Bias Circuit Requiring Nominal Input Voltages ±10%
- Low Cost
- Off Chip Output Matching Circuit Allows Application Optimization

**S11**
**SSOP-28**
**28 Pin Wide Body w/ Heat Slug**

## PRODUCT DESCRIPTION

The AWT921 is a monolithic amplifier for use in communication systems that require high gain and output intercept point. This device has been specifically designed for multi carrier and micro cell base station applications.

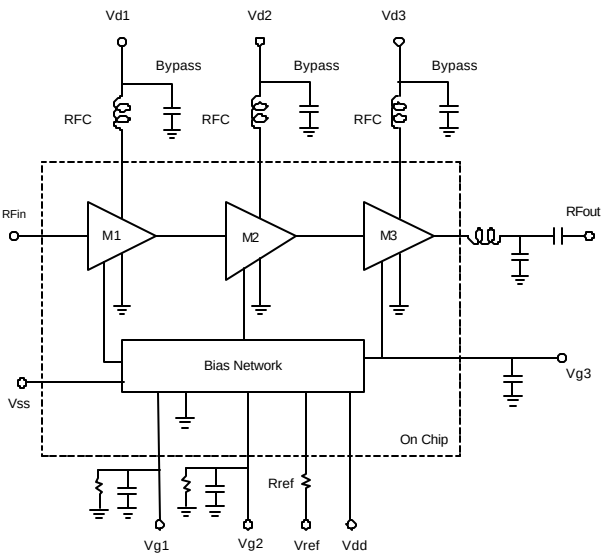



**Figure 1: Block Diagram**

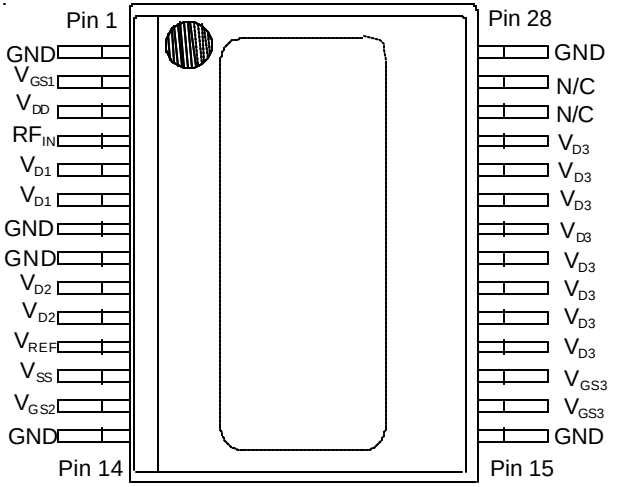



**Figure 1: Pin Layout**

**Table 1: Pin Description**

| PIN | NAME | DESCRIPTION |
|---|---|---|
| 1,14,15,28, slug | GND | AC and RF Ground |
| 2 | $V_{GS1}$ | First Stage Gate terminal |
| 3 | $V_{DD}$ | Positive Supply of Bias Circuit (+5V) |
| 4 | $RF_{IN}$ | RF Input |
| 5,6 | $V_{D1}$ | First Stage drain supply |
| 7,8 | GND | First Stage Source ground |
| 9,10 | $V_{D2}$ | Second Stage drain supply |
| 11 | $V_{REF}$ | Bias control Pin |
| 12 | $V_{SS}$ | Negative Supply for Bias Circuit (-3V) |
| 13 | $V_{GS2}$ | Second Stage Gate terminal |
| 16,17 | $V_{GS3}$ | Third Stage Gate terminal |
| 18-25 | $V_{D3}$ | Third Stage drain supply & RF out |
| 26,27 | N/C | Not Connected |

**Procedure for Amplifier Operation and Test**

1) Slug must be thermally and electrically connected to obtain rated performance.

2) The $V_{SS}$ Voltage should be applied first to the amplifier prior to $V_{D1}$, $V_{D2}$, or $V_{D3}$ voltages.

3) The Bias Pins $V_{DD}$ and $V_{REF}$ may be applied with no $V_{SS}$ voltage present.

4) Always follow ESD precautions when handling these devices.

## ELECTRICAL CHARACTERISTICS

**Table 2: Electrical Specifications:[1]**

(Pin +12 dBm, fo = 925-960 MHz, $V_{DS1} = V_{DS2} = V_{DS3} = 8.5V$, $V_{SS} = -3V$, $V_{REF} = +5V$, $V_{DD} = +5V$, Tc=25C, 50Ω System[2]

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Frequency | fo | 925 | - | 960 | MHz |
| Power Output | $P_{OUT}$ | - | +39 | - | dBm |
| Power Added Efficiency | $\eta_{EFF}$ | - | 40 | - | % |
| Gain<br>@$P_{OUT}$=+37.5 dBm | PG | 26 | 28 | - | dB |
| Harmonics@37.5 dBm $P_{OUT}$<br>2nd<br>3rd | | | <br>30<br>35 | | dBc |
| Stability: -60 dBc all spurious outputs relative to desired signal | - | - | 3:1 | - | VSWR load, all phase angles, |
| Bias Supply Currents | $I_{SS}$<br>$I_{REF}$<br>$I_{DD}$ | - | 8<br>1.2<br>8 | - | mA<br>mA<br>mA |
| Quiescent Currents | $I_{DQ1}$<br>$I_{DQ2}$<br>$I_{DQ3}$ | | 100<br>250<br>200 | | |
| Input Return Loss | - | - | 12 | - | dB |
| Gain Flatness vs. Frequency<br>@ POUT=+37.5 dBm<br>@ POUT=+30 dBm | Δ PG | - | <br>±0.5<br>±0.5 | - | <br>dB<br>dB |
| Thermal Resistance[3] | | | 4.5 | | C/W |

*Notes:*

*1. As measured in ANADIGICS test fixture, see application section*

*2. 50W Measurement system after off chip matching circuit, input terminated in 50W*

*3. Thermal resistance for junction to bottom of slug. Qjc= (Tj-Tc)/(($I_{D1}$+$I_{D2}$+$I_{D3}$)*$V_{SUP}$ - $P_{OUT}$)*

**Table 3: Absolute Maximum Ratings**

| PIN | NAME | MAX RATING | PIN | NAME | MAX RATING |
|---|---|---|---|---|---|
| 2 | $V_{DD}$ | +7$V_{DC}$ | 11 | $V_{REF}$ | +7 $V_{DC}$ |
| 3 | $RF_{IN}$ | +20 dBm | 12 | $V_{SS}$ | -7 $V_{DC}$ |
| 4,5 | $V_{D1}$ | +10 $V_{DC}$ | 18,19,2-0,21,22,-23,24,25 | $V_{D3}$ | +10 $V_{DC}$ |
| 8,9 | $V_{D2}$ | +10 $V_{DC}$ | | | |

**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.**

*Operating Temperature: -30 to + 85° C*

*Storage Temperature: -55 to + 100° C*

## PERFORMANCE DATA

Conditions unless otherwise stated (Pin +12 dBm, fo = 925-960 MHz, $V_{DS1} = V_{DS2} = V_{DS3} = 8.5V$, $V_{SS} = -3V$, $V_{REF} = +5V$, $V_{DD} = +5$ V, Tc=25°C, 50 W system [2])

**Figure 2: $P_{OUT}$ & Eff vs. Pin**

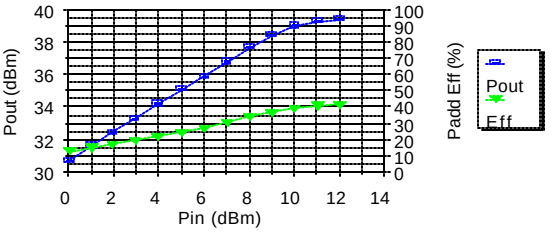



**Figure 3: $P_{OUT}$ & Eff vs. Frequency**

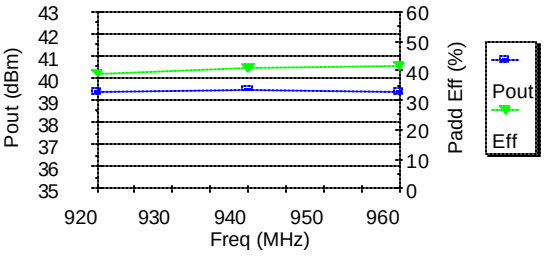



**Figure 4: $P_{OUT}$ vs. Supply Voltage**

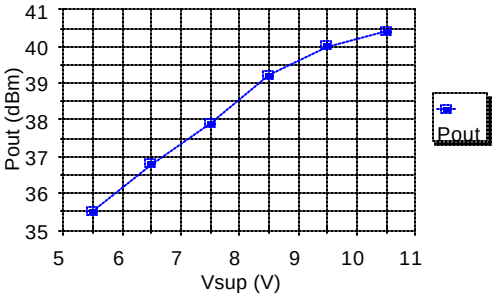
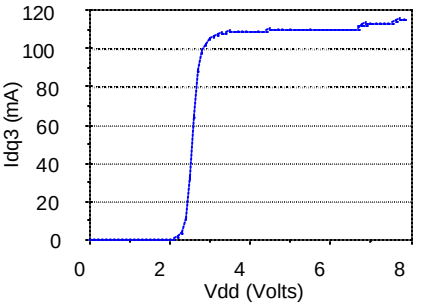



**Figure 5: Idq3 vs. $V_{dd}$**




*Notes:*

*1: As measured in ANADIGICS test fixture, see application section*

*2: 50 W Measurement system after off chip matching circuit, input terminated in 50 W*

**Figure 6: Idq vs. $V_{ref}$**

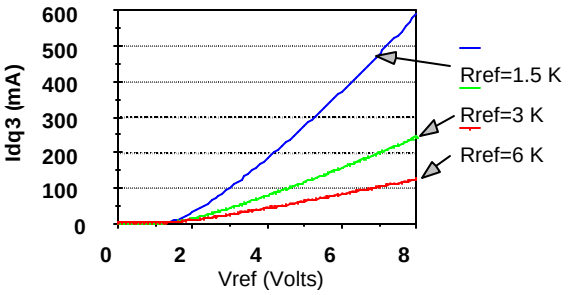



**Figure 7: Idq vs. $V_{ss}$**

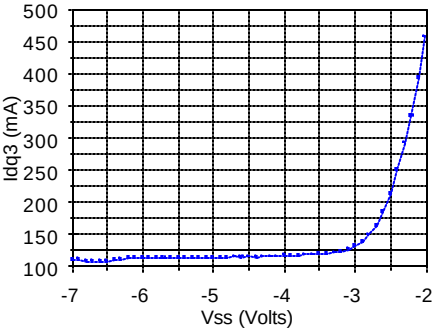



**Figure 8: Bias Ckt Gain vs. $V_{ref}$**

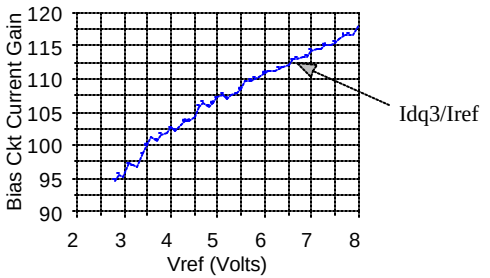



**Figure 9: $I_{q3}$ & $I_{ref}$ vs. Temperature**

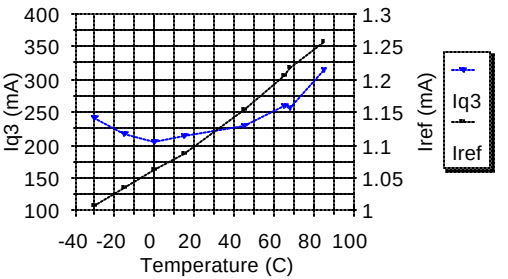



**Figure 10: $P_{OUT}$ & Eff vs. Temperature**

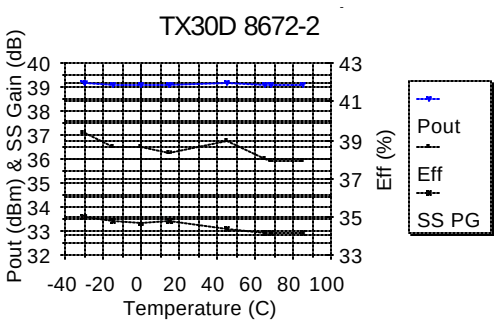



**Figure 11: S22 Reverse Reflection Impedance**

Output Impedance as seen by $V_{DS3}$

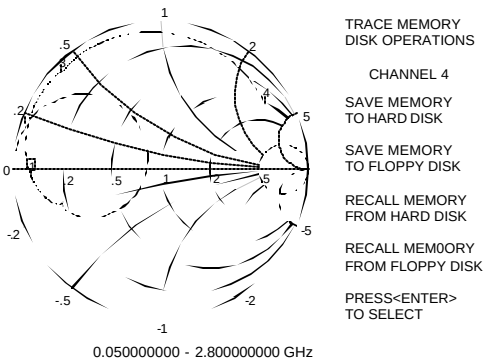


**Figure 12: S11 Reverse Reflection Impedance**

Impedance as seen by $V_{DS1}$

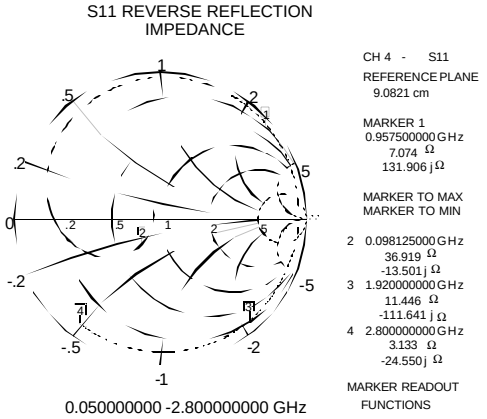



**Figure 13: S11 Reverse Reflection Impedance**

Impedance as seen by $V_{DS2}$

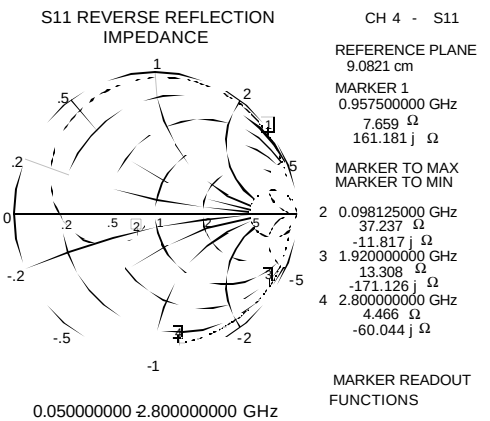


**Figure 14: 925 - 960 MHz Test Circuit Schematic**

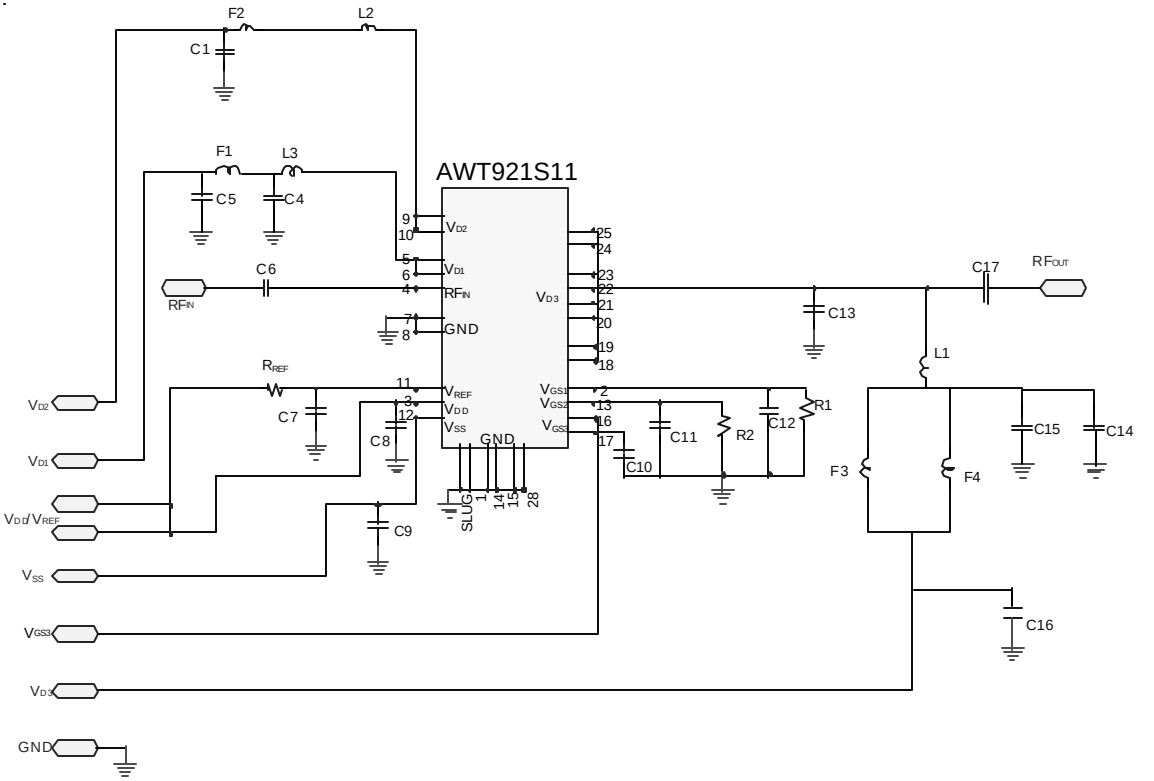



**Table 4: Pin Designations**

| DESIGNATION | VALUE |
|---|---|
| R1 | 7500Ω |
| R2 | 2.2 KΩ |
| $R_{REF}$ | 1.8 KΩ |
| C1, C5, C16 | 2.2 µF |
| C4, C15, C19 | 33 pF |
| C6, C17 | 47 pF |
| C7, C8, C9, C12 | 0.01µF |
| C10, C11 | 2700 pF |
| C13 | 11 pF |
| C14 | 4700 pF |
| L1 | 8 nH Colicraft, A03T |
| L2 | 12 nH |
| L3 | 6 nH |
| F1, F2, F3, F4, | Ferrite 47Ω@100 MHz, 1A Rating Taiyo Yuden, BK2125HS470 |

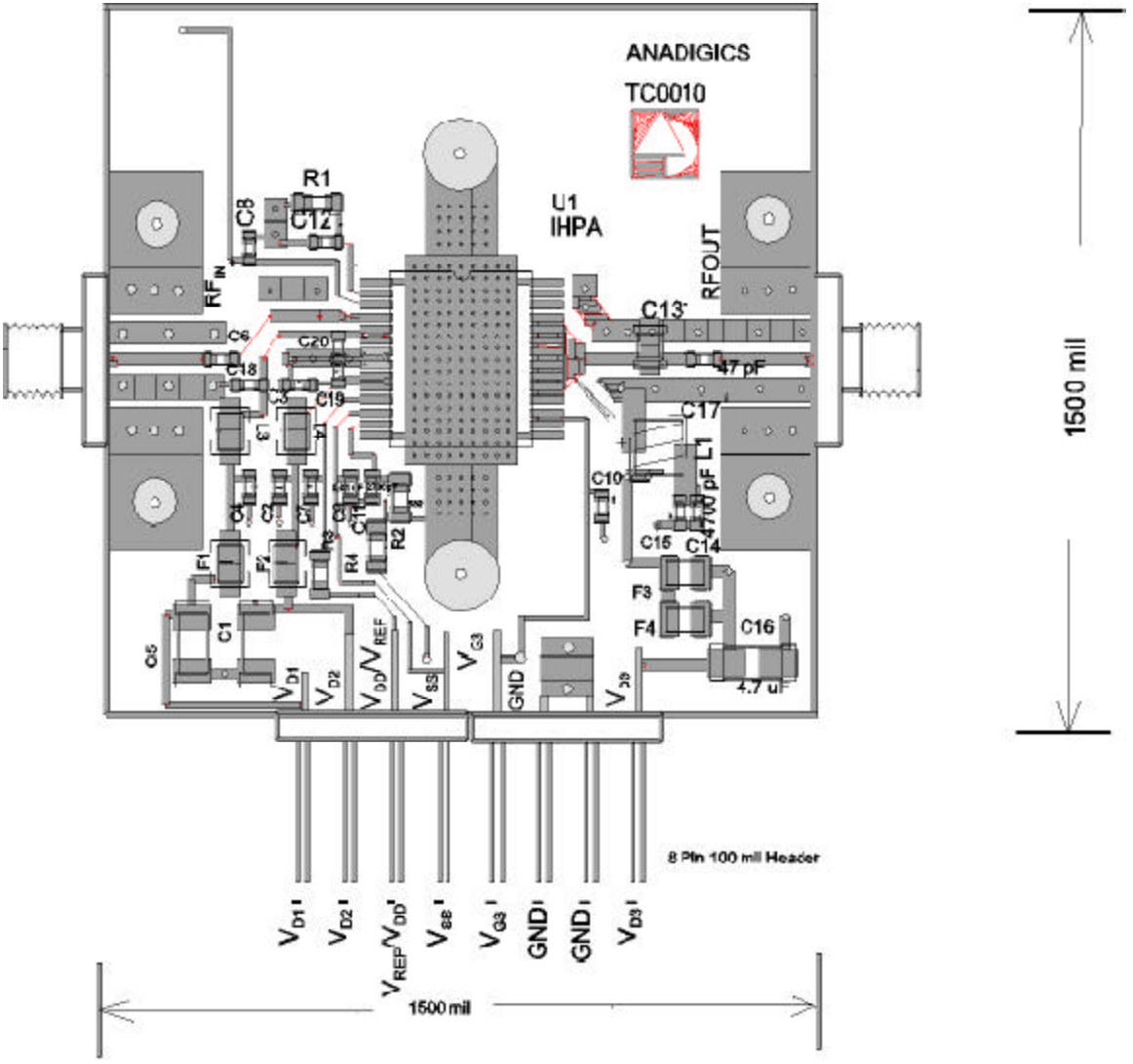



**Figure 15: Test Circuit Top Layer Pattern**

*Notes: Board material -6 layer FR4*

1) *1 oz. Copper*
2) *14 mil core layers*
3) *Gerber Files available*

**Table 5: 925 - 960 MHz GSM Test Circuit Component Listing**

| DESIGNATION | VALUE | MANUFACTURE | MANUFACTURE PART # | WEB ADDRESS | PHONE CONTACT # |
|---|---|---|---|---|---|
| R1 | 7500 | Panasonic | ERJ-36SYJ752V | www.panasonic.com | 201-348-5232 |
| R2 | 2.2 K | Panasonic | ERJ-36SYJ222V | www.panasonic.com | 201-348-5232 |
| RREF | 1.8 K | Panasonic | ERJ-36SYJ182V | www.panasonic.com | 201-348-5232 |
| C1,C5,C16 | 2.2 uF | Panasonic | ECS-H1AY225R | www.panasonic.com | 201-348-5232 |
| C4,C15,C19 | 33 pF | Murata | GRM36COG330J50 | www.murata.com | 1-800-237-1431 |
| C6,C17 | 47 pF | Murata | GRM36COG470J50 | www.murata.com | 1-800-237-1431 |
| C7,C8,C9,C12 | 0.01 uF | Murata | GRM36X7R103K16 | www.murata.com | 1-800-237-1431 |
| C10,C11 | 2700 pF | Murata | GRM36X7R272K50 | www.murata.com | 1-800-237-1431 |
| C13 | 11 pF | American Technical Ceramics | ATC100A110JW150X | www.atc-cap. com | (516) 547-5700 |
| C14 | 4700 pF | Murata | GRM36X7R472K25 | www.murata.com | 1-800-237-1431 |
| L1 | 8 nH | Coilcraft | A03T | www.coilcraft.com | 1-800-322-2645 |
| L2 | 12 nH | Coilcraft | 0805CS060XMBC | www.coilcraft.com | 1-800-322-2645 |
| L3 | 6.8 nH | Coilcraft | 0805CS120XMBC | www.coilcraft.com | 1-800-322-2645 |
| F1,F2,F3,F4 | Ferrite 47 @ 100 MHz, 1A Rating | Taiyo Yuden | BK2125HS470 | www.t-yuden.com | 800-348-2496 |

## PACKAGE OUTLINE

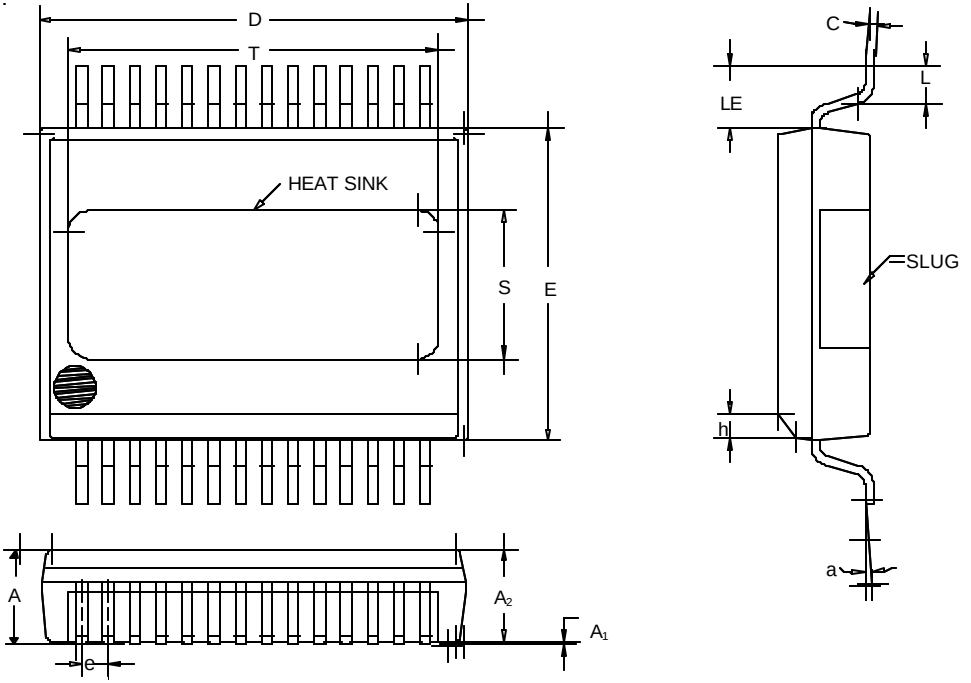



**Figure 16: Package Outline Drawing**

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| **SYMBOL** | **MIN** | **MAX** | **MIN** | **MAX** |
| A | 0.087 | 0.093 | 2.21 | 2.36 |
| A1 | 0.000 | 0.004 | 0.00 | 0.10 |
| A2 | 0.087 | 0.089 | 2.21 | 2.25 |
| B | 0.008 | 0.012 | 0.36 | 0.46 |
| C | 0.007 | 0.009 | 0.18 | 0.25 |
| D | 0.400 | 0.408 | 10.16 | 10.36 |
| E | 0.292 | 0.296 | 7.42 | 7.52 |
| e | 0.025 | BSC | 0.64 | BSC |
| H | 0.410 | 0.418 | 10.41 | 40.62 |
| h | 0.018 | 0.024 | 0.48 | 0.61 |
| L | 0.034 | 0.038 | 0.86 | 0.97 |
| LE | 0.84 | | 1.37 | |
| a | 0 | 8 | 0 | 8 |
| S | 0.139 | 0.141 | 3.54 | 3.55 |
| T | 0.349 | 0.351 | 8.86 | 8.92 |

*Notes:*

1. *Controlling dimensions : inches.*
2. *Dimension "d" does not include mold flash, protrusions or gate burrs. Mold flash, protrusions and gate burrs shall not exceed 0.006 (0.16mm).*
3. *Dimension "e" does not include inter-lead or protrusions. Inter-lead flash and protrusions shall not exceed 0.010 (0.25mm) per side.*
4. *Maximum lead twist/skew to be 0.002 (0.05mm).*
5. *Mold flash shall not extend more than 0.010 (0.25mm) on any edge of heat slug.*

**NOTES**

## ORDERING INFORMATION

| ORDER NUMBER | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|---|---|---|
| AWT921S11 | S11 | 28 Pin Body with Heat Slug |

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