# AFEM-S105
5 GHz WiFi FEM

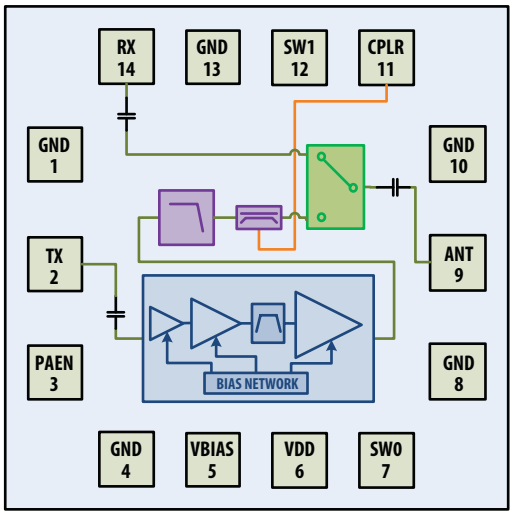
## Data Sheet

### Description

Avago Technologies AFEM-S105 WiFi FEM includes power amplifier, directional coupler, and SPDT antenna switch. It is designed for mobile and fixed wireless data applications in the 5.15 to 5.85 GHz frequency ranges. The PA is optimized for IEEE 802.11 a/n WiFi modulation. The PA exhibits flat gain and good match while providing linear power efficiency to meet stringent mask conditions. It utilizes Avago Technologies proprietary GaAs Enhancement-mode pHEMT technology for superior performance across voltage and temperature levels.

The AFEM-S105 is packaged in a 3.2 x 3.2 x 0.6 mm size for space-constrained applications.

### Functional Block Diagram (Top View)






**Attention: Observe precautions for handling electrostatic sensitive devices.**
ESD Machine Model = 50 V
ESD Human Body Model = 450 V
*Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.*

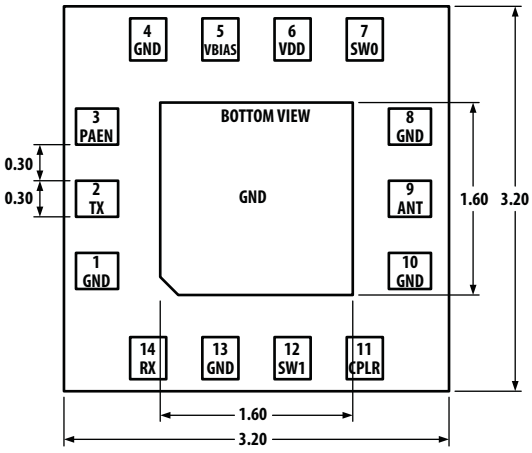
### Features

- 50 Ω all RF ports
- Integrated directional coupler, -17 dB coupling factor, > 14 dB directivity
- High Tx – Rx switch isolation
- 3 to 4.2 V supply
- Small size: 3.2 x 3.2 x 0.6 mm
- Stable under all loads or conditions
- Gain of 28 dB
- Meets 802.11a/n emission mask requirements @ 15 dBm
- Meets FCC 15.205 emission requirements @ 15 dBm
- EVM < -32.5 dB at 15dBm, < -35 dB at 12 dBm
- Idd < 105 mA @ 15 dBm Pout
- PAE(PA) > 21% @ Pout (ANT) = 15 dBm
- Only 1 external component required

### Applications

- Portable WiFi applications
- WiFi Access points

### Package Diagram (Bottom View)



## ELECTRICAL SPECIFICATIONS

### Absolute Minimum and Maximum Ratings

**Table 1. Minimum and Maximum Ratings**

| Parameter | | Specifications | | | |
|---|---|---|---|---|---|
| **Description** | **Pin** | **Min.** | **Max.** | **Unit** | **Comments** |
| Supply Voltage | VCC | | 5.5 | V | |
| Bias Supply | VBIAS | | 5.5 | V | |
| PA enable | PAEN | | 4.5 | V | |
| Switch Control | SW0, SW1 | | 4.5 | V | |
| RF Input Power | RFIN | | 15 | dBm | |
| Channel Temperature | | | 150 | °C | |
| Storage Temperature | | -65 | 150 | °C | |

**Table 2. Operating Range**

| Parameter | | Specifications | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Pin** | **Min.** | **Typical** | **Max.** | **Unit** | **Comments** |
| Supply Voltage | VCC | 3.0 | 3.3 | 4.2 | V | |
| Bias Supply | VBIAS | 3.0 | 3.3 | 4.2 | V | |
| | | | | 16 | mA | |
| PA enable | PAEN | 2.7 | 2.9 | 3.3 | V | |
| | | | | 2.0 | mA | |
| Switch Control | SW0 | 2.7 | 2.9 | 3.6 | V | RX Mode |
| | | | | 200 | µA | |
| | SW1 | 2.7 | 2.9 | 3.6 | V | TX Mode |
| | | | | 200 | µA | |
| RF Output Power | ANT | | 15 | | dBm | |
| Frequency Range | | 5.15 | | 5.85 | GHz | |
| Thermal Resistance, $\theta_{jc}$ | | | 29.8 | | °C/W | Channel to board |
| Case Temperature | | -30 | | +85 | °C | |

## Electrical Specifications

All data measured on an Avago demo board at Vdd = 3.3 V, Tc = 25° C, 50 Ω at all ports. Unless otherwise specified, all data is taken at 54 Mbps 64QAM modulated signal per IEEE 802.11a with 20 MHz BW at 5.15 – 5.85 GHz. For TX mode PAEN = SW1 = 2.9 V, SW0 = 0 V. For RX mode SW0 = 2.9 V, PAEN = SW1 = 0 V.

**Table 3. RF Electrical Characteristics**

| | Performance | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Min.** | **Typical** | **Max.** | **Unit** | **Comments** |
| Input Return Loss | | -15 | | dB | TX and RX ports |
| Antenna Switch Switching Time | | 100 | | nS | |
| **WiFi TX Path** | | | | | |
| Gain | 25 | 28 | | dB | |
| Gain Variation over any 20 MHz | | ±0.25 | | dB | |
| Mask compliant OFDM output power | 15 | | | dBm | .11a 64QAM |
| EVM | | -32.5 | -31.0 | dB | Pout = 15 dBm |
| | | -35 | | | Pout = 12 dBm |
| Total DC Current | | 105 | 120 | mA | Pout = 15 dBm |
| | | 85 | | | Pout = 12 dBm |
| PAE @ PA output | | 21 | | % | Pout = 15 dBm |
| | | 14 | | | Pout = 12 dBm |
| Harmonics | | -43 | | dBm/MHz | Pout = 15 dBm |
| Coupler coupling factor | | -17 | | dB | @ 5850 MHz |
| Coupler directivity | | 14 | | dB | |
| PA Turn-On Time | | 125 | | nS | |
| | | | | | |
| **WiFi Rx Path** | | | | | |
| Insertion Loss (In-Band) | | 1.3 | | dB | |
| Isolation ANT/RX in WiFi TX mode | | 28 | | dB | |

**Table 4. Control Logic Truth Table**

| Mode | SW0 | SW1 | PAEN |
|---|---|---|---|
| RX | 1 | 0 | 0 |
| TX | 0 | 1 | 1 |
| FEM OFF | 0 | 0 | 0 |

## Selected Performance Plots

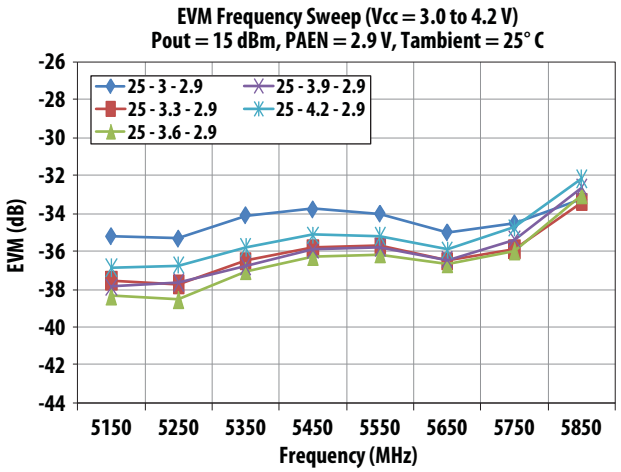



Figure 1. EVM Frequency Sweep at 25° C and Pout = 15 dBm over Vcc

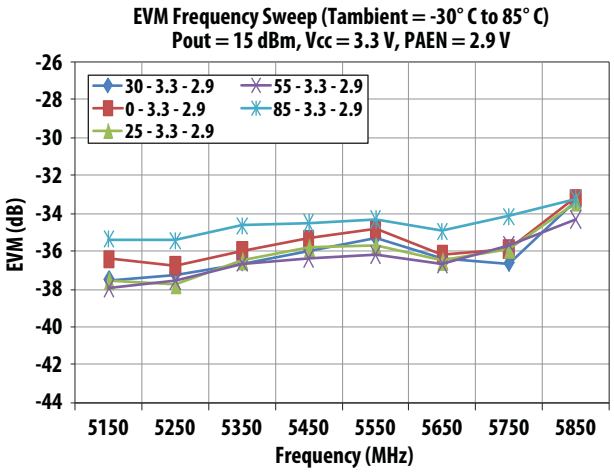



Figure 2. EVM Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over Tambien

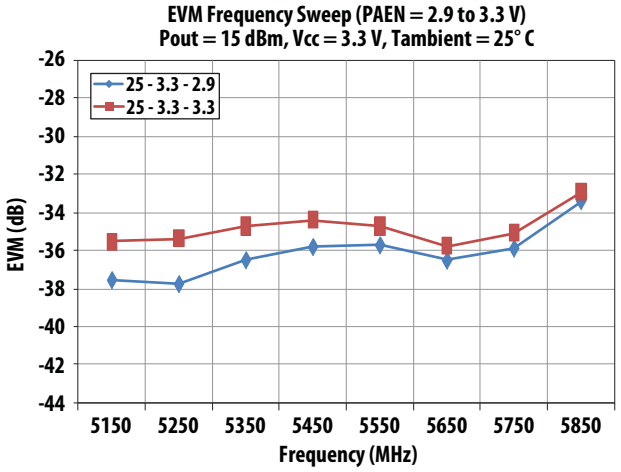



Figure 3. EVM Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over PAEN

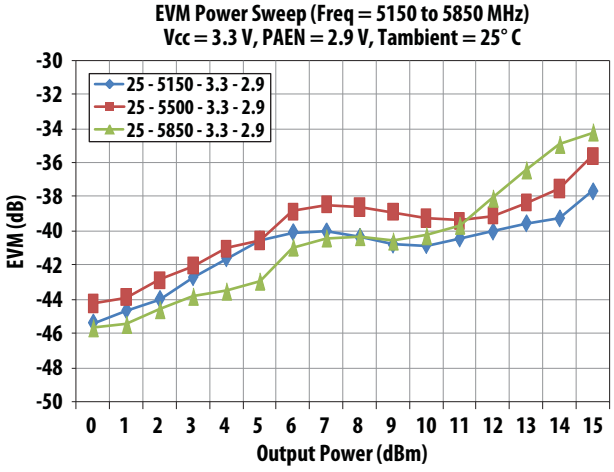



Figure 4. EVM Power Sweep at Vcc = 3.3 V and 25° C over Frequency

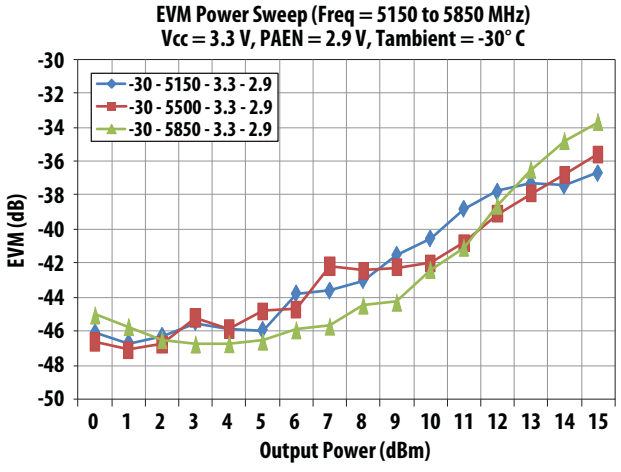



Figure 5. EVM Power Sweep at Vcc = 3.3 V and -30° C over Frequency

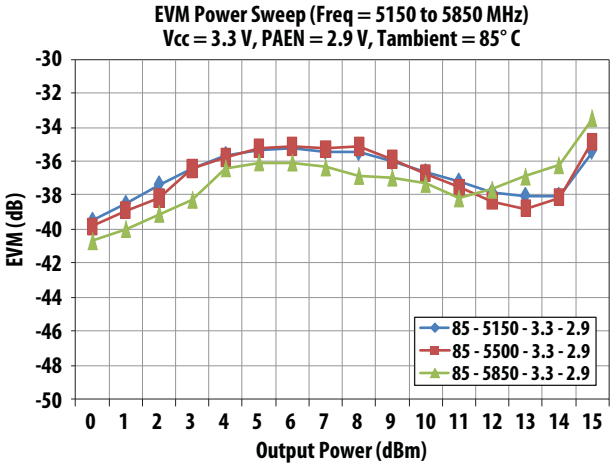



Figure 6. EVM Power Sweep at Vcc = 3.3 V and 85° C over Frequency

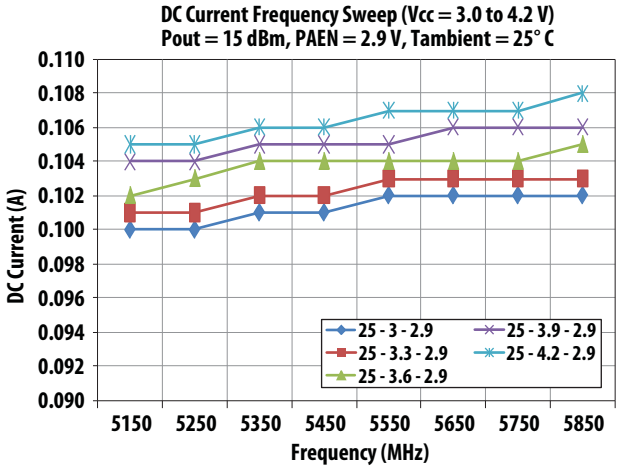



Figure 7. DC Current Frequency Sweep at 25° C and Pout = 15 dBm over Vcc

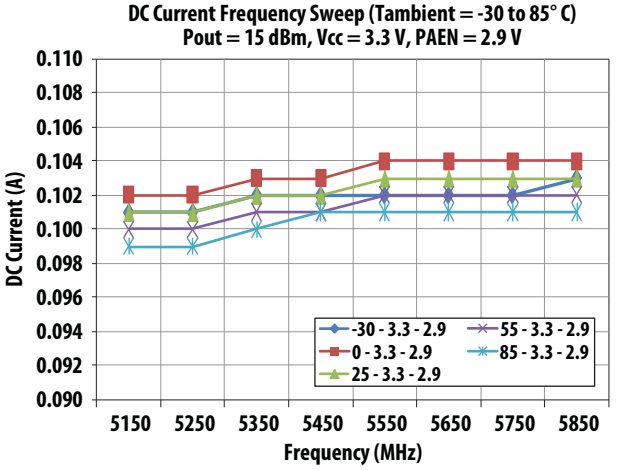



Figure 8. DC Current Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over Tambient

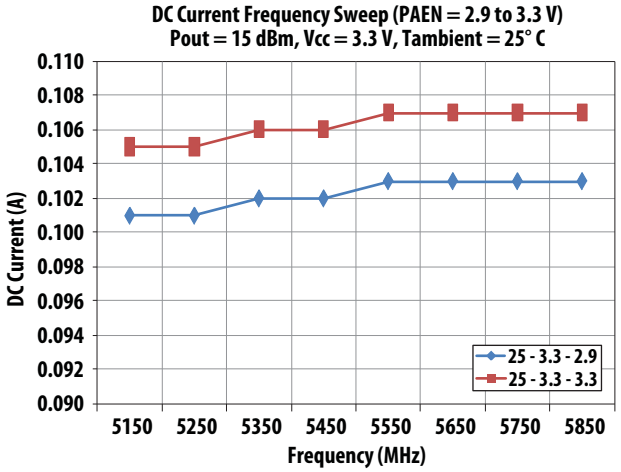



Figure 9. DC Current Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over PAEN

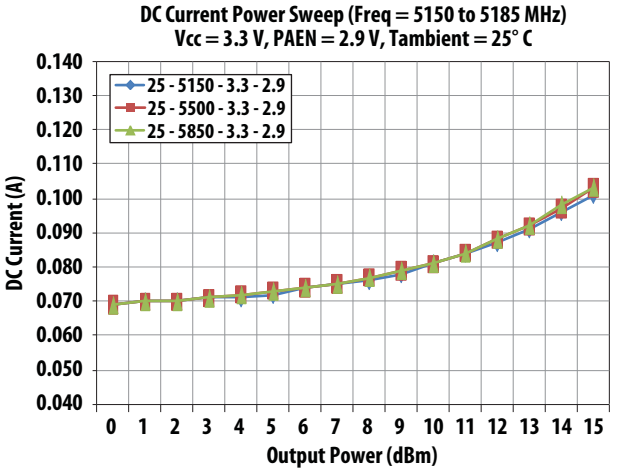



Figure 10. DC Current Power Sweep at Vcc = 3.3 V and 25° C over Frequency

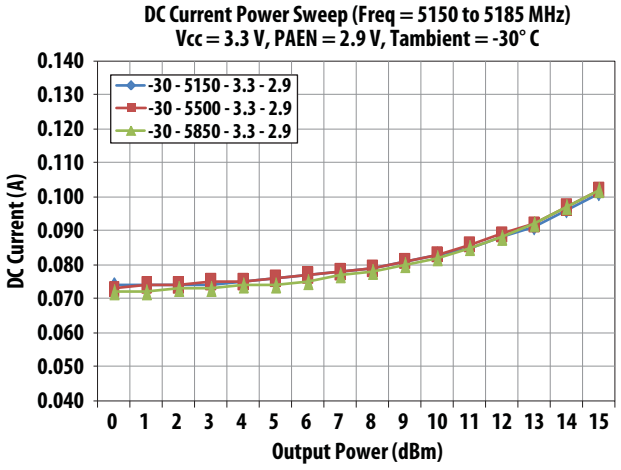



Figure 11. DC Current Power Sweep at Vcc = 3.3 V and -30° C over Frequency

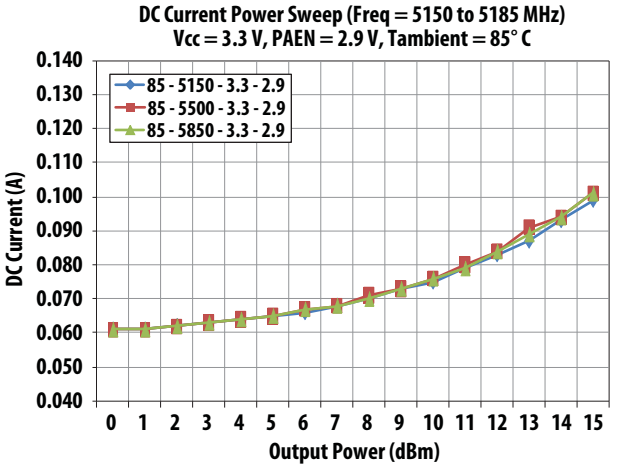



Figure 12. DC Current Power Sweep at Vcc = 3.3 V and 85° C over Frequency

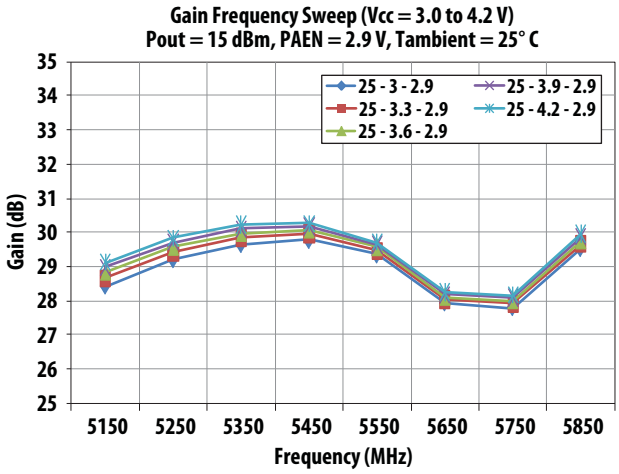



Figure 13. Gain Frequency Sweep at 25° C and Pout = 15 dBm over Vcc

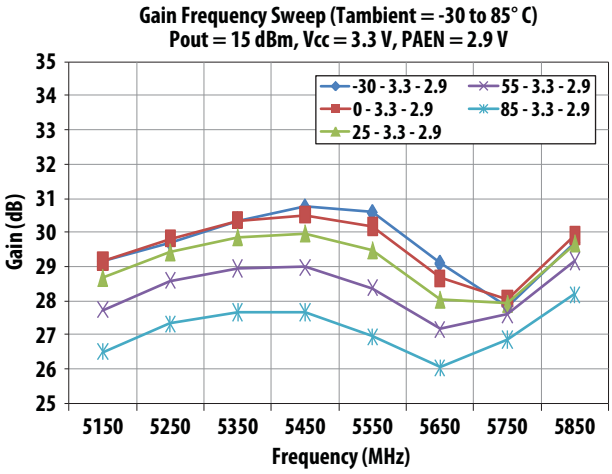



Figure 14. Gain Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over Tambient

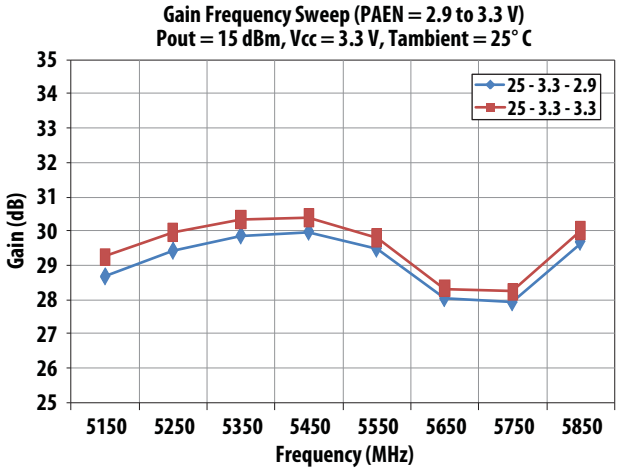



Figure 15. Gain Frequency Sweep at Vcc = 3.3 V and Pout = 15 dBm over PAEN

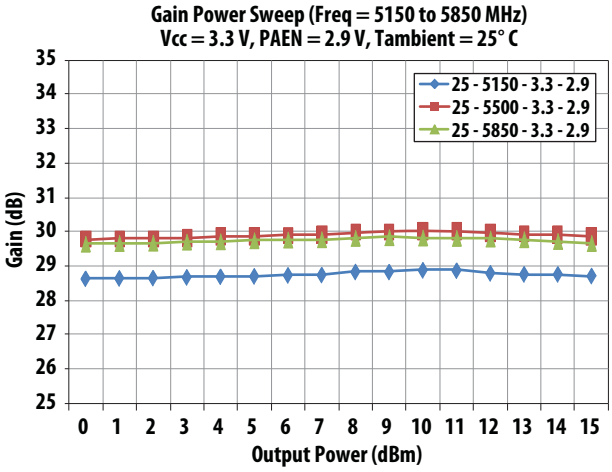



Figure 16. Gain Power Sweep at Vcc = 3.3 V and 25° C over Frequency

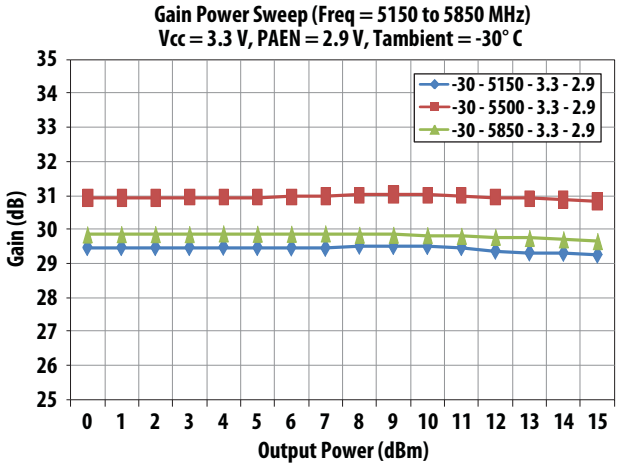



Figure 17.Gain Power Sweep at Vcc = 3.3 V and -30° C over Frequency

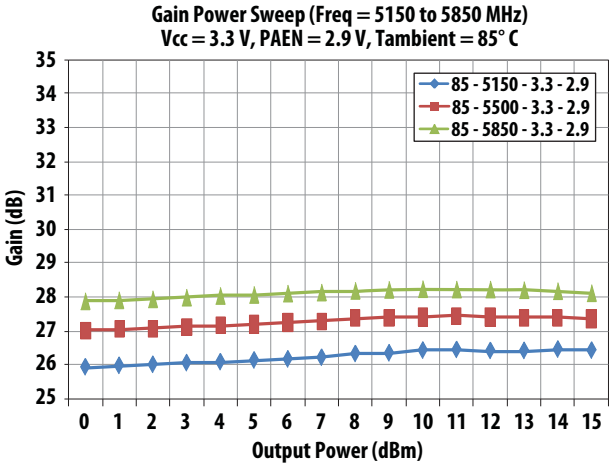



Figure 18. Gain Power Sweep at Vcc = 3.3 V and 85° C over Frequency

## Evaluation Board Descpition

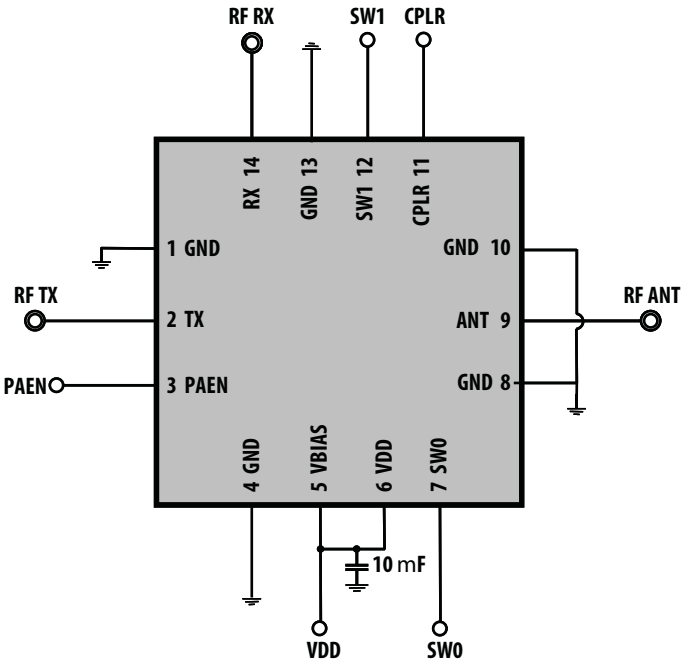
### Table 5. Pin Description:

| Top Pin No. | Function | Bottom Pin No. | Function |
|---|---|---|---|
| 1 | VDD | 2 | GND |
| 3 | VBIAS | 4 | GND |
| 5 | VREF | 6 | GND |
| 7 | PAEN | 8 | GND |
| 9 | SW0 | 10 | GND |
| 11 | SW2 | 12 | GND |
| 13 | SW1 | 14 | GND |

### Table 6. Typical Test Conditions:

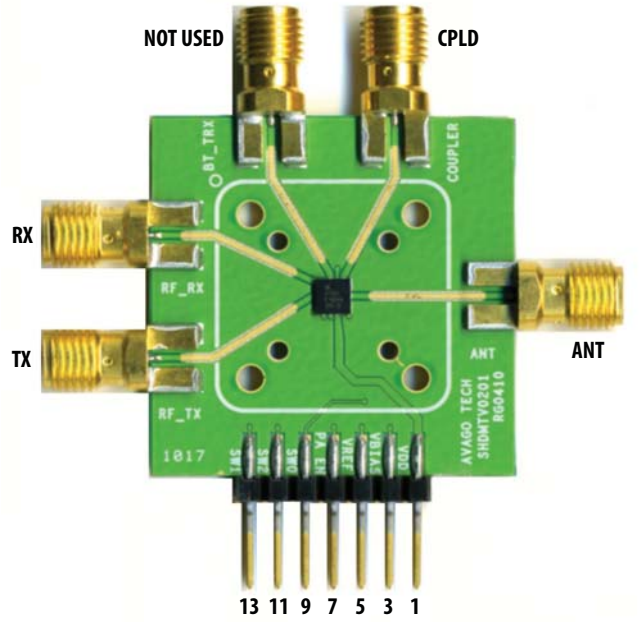
| PIN | TX | RX | Description |
|---|---|---|---|
| VDD | 3.3 V | 3.3 V | Supply Voltage |
| VBIAS | 3.3 V | 3.3 V | Bias Supply |
| VREF | NA | NA | NOT USED |
| PAEN | 2.9 V | 0 V | PA Enable |
| SW0 | 0 V | 2.9 V | Switch Control |
| SW2 | 2.9 V | 0 V | Switch Control |
| SW1 | NA | NA | NOT USED |

## Application Circuit

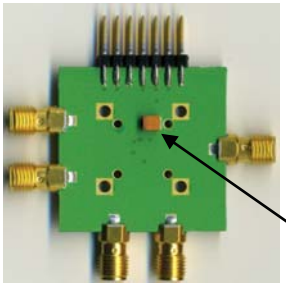



**Note: Only one bypass cap on VDD is required**

## Demoboard Top Pins




## Demoboard Bottom Pins




**Note: Bottom pins 2, 4, 6, 8, 10, 12, and 14 are all grounded.**

## Ordering Information

| Part Number | No. of Devices | Container |
|---|---|---|
| AFEM-S105-TR1G | 3000 | 13″ Reel |
| AFEM-S105-BLKG | 100 | Antistatic Bag |

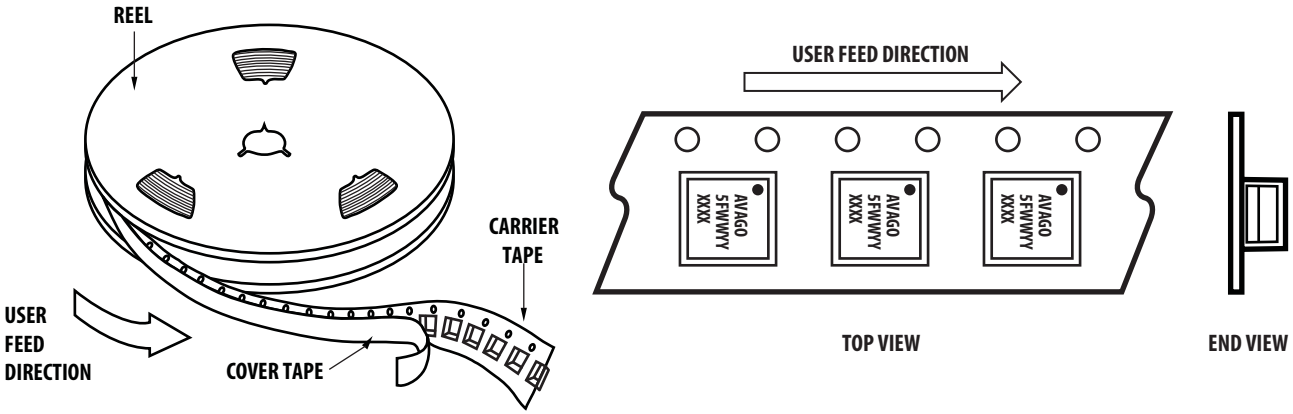
## Marking Specification



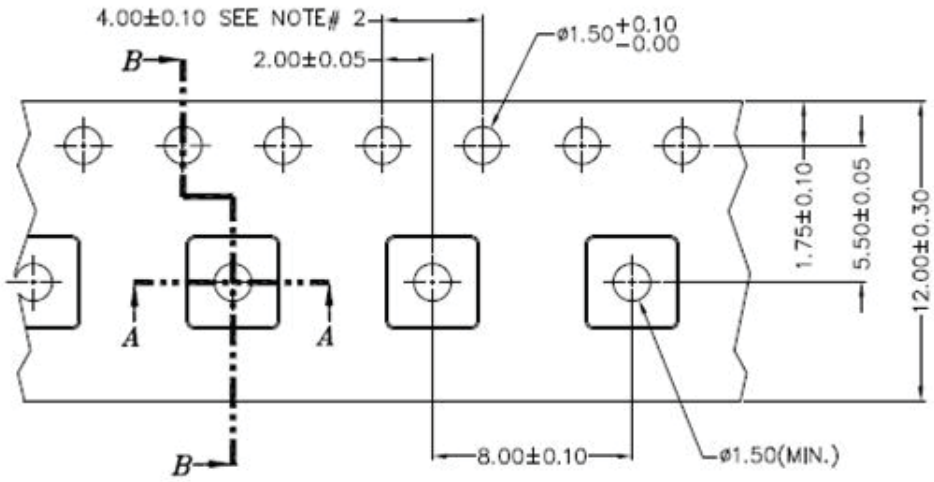

Note: Package marking provides Orientation and Identification

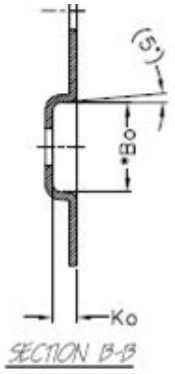
"5" = Device Code
"F" = Manufacturing code
"WW" = Build of Work Week
"YY" = Build of Year
"XXXX" = Last 4 Digits of Assembly Lot Number

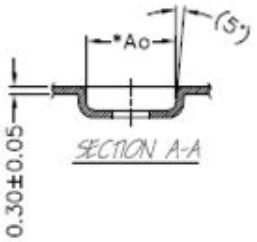
## Device Orientation & Pin 1 Location In Tape



## Tape Dimensions



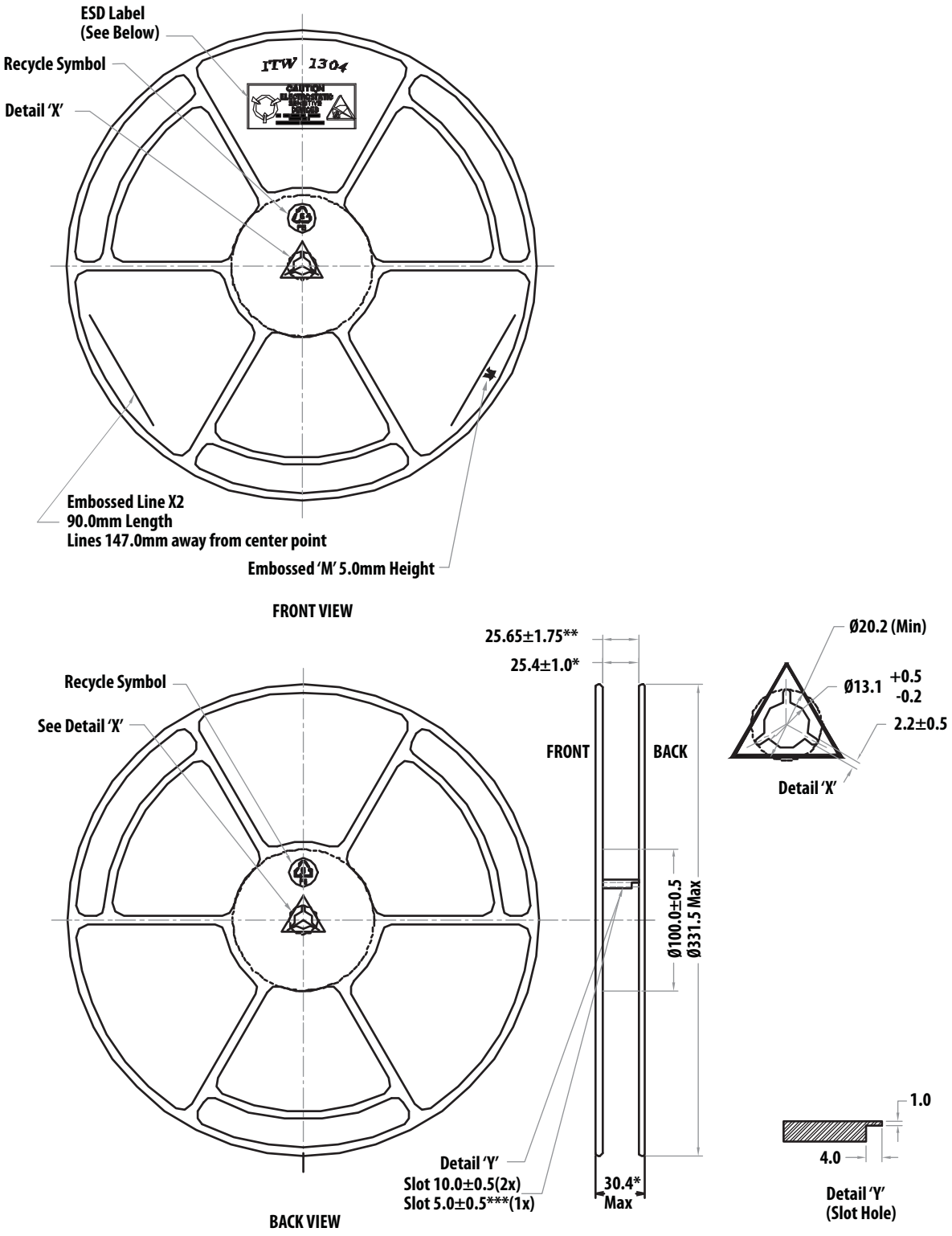



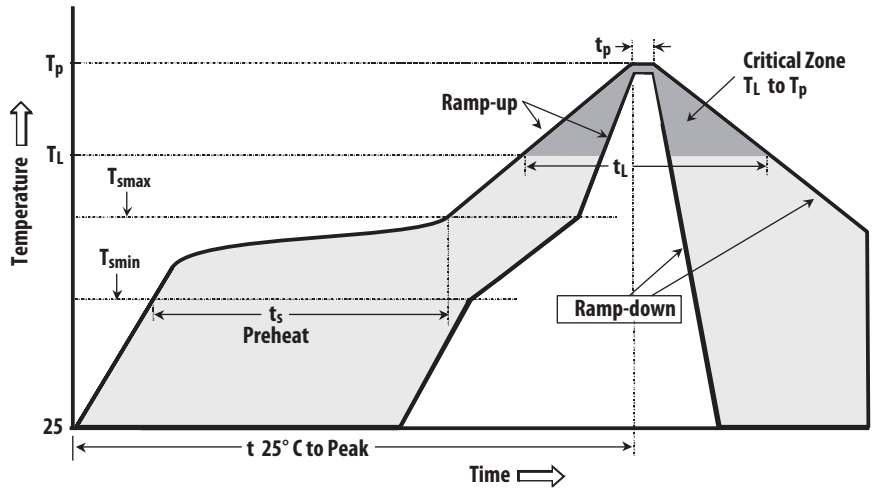

| | |
|---|---|
| **Ao:** | **3.60** |
| **Bo:** | **3.60** |
| **Ko:** | **0.95** |
| **Pitch:** | **8.00** |
| **Width:** | **12.00** |

Notes:
1. Ao & Bo measured at 0.3 mm above base of pocket.
2. 10 pitches cumulative tol. ±0.2 mm.
3. ( ) Reference dimensions only.

## Reel Dimensions (13 inch)



## Reflow Profile Recommendations




### Typical SMT Reflow Profile for Maximum Temperature = 260 +0/-5° C

| Profile Feature | Sn-Pb Solder | Pb-Free Solder |
|---|---|---|
| Average ramp-up rate (TL to TP) | 3°C/sec max | 3°C/sec max |
| Preheat<br>– Temperature Min (Tsmin)<br>– Temperature Max (Tsmax)<br>– Time (min to max) (ts) | <br>100° C<br>150° C<br>60-120 sec | <br>150° C<br>200° C<br>60-120 sec |
| Tsmax to TL<br>– Ramp-up Rate | | 3°C/sec max |
| Time maintained above:<br>– Temperature (TL)<br>– Time (TL) | <br>183° C<br>60-150 sec | <br>217° C<br>60-150 sec |
| Peak temperature (Tp) | 240 +0/-5° C | 260 +0/-5° C |
| Time within 5° C of actual Peak Temperature (tp) | 10-30 sec | 20-40 sec |
| Ramp-down Rate | 6°C/sec max | 6°C/sec max |
| Time 25° C to Peak Temperature | 6 min max. | 8 min max. |

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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AV02-3311EN - May 31, 2012

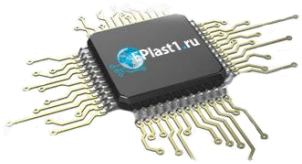
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

**Телефон:** 8 (812) 309 58 32 (многоканальный)
**Факс:** 8 (812) 320-02-42
**Электронная почта:** org@eplast1.ru
**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.