



SKYWORKS®

AWB7228

2.496 - 2.690 GHz

Small-Cell Power Amplifier Module

DATA SHEET

FEATURES

- InGaP HBT Technology
- -48 dBc ACPR @ ±10 MHz, +27 dBm
- 28 dB Gain
- High Efficiency
- Low Transistor Junction Temperature
- Matched for a 50 Ω System
- Low Profile Miniature Surface Mount Package; RoHS Compliant
- Multi-Carrier Capability

APPLICATIONS

- LTE, WCDMA and HSDPA Air Interfaces
- FDD and TDD Systems
- Picocell, Femtocell, Home Nodes
- Customer Premises Equipment (CPE)
- Data Cards and Terminals



PRODUCT DESCRIPTION

The AWB7228 is a fully matched, Multi-Chip-Module (MCM) designed for picocell, femtocell, and customer premises equipment (CPE) applications. Its high linearity and efficiency meet the extremely demanding needs of small cell infrastructure architectures. Designed for LTE, WCDMA and HSDPA air interfaces operating in the 2.496 GHz to 2.690 GHz band, the AWB7228 delivers up to +27 dBm of LTE (E-TM1.1) power with an ACPR of -47 dBc. It operates from

a convenient +4.5 V supply and provides 27 dB of gain. The device is manufactured using an advanced InGaP HBT MMIC technology offering state-of-the-art reliability, temperature stability, and ruggedness. The self-contained 7 mm x 7 mm x 1.3 mm surface mount package incorporates RF matching networks optimized for output power, efficiency, and linearity in a 50 Ω system.

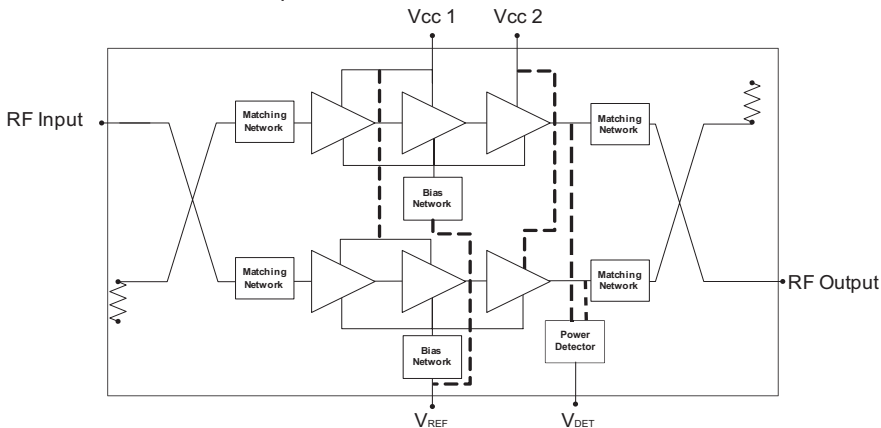


Figure 1: Block Diagram

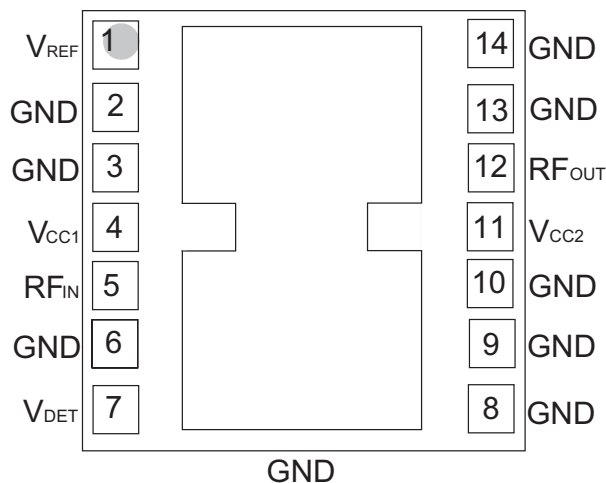


Figure 2: Pinout (X-ray Top View)

Table 1: Pin Description

| PIN | NAME | DESCRIPTION |
|-----|------------|-------------------|
| 1 | V_{REF} | Reference Voltage |
| 2 | GND | Ground |
| 3 | GND | Ground |
| 4 | V_{CC1} | Supply Voltage |
| 5 | RF_{IN} | RF Input |
| 6 | GND | Ground |
| 7 | V_{DET} | Detector Voltage |
| 8 | GND | Ground |
| 9 | GND | Ground |
| 10 | GND | Ground |
| 11 | V_{CC2} | Supply Voltage |
| 12 | RF_{OUT} | RF Output |
| 13 | GND | Ground |
| 14 | GND | Ground |

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

| PARAMETER | MIN | MAX | UNIT |
|--|----------------------|--------|----------------|
| Supply Voltage (V_{CC}) | 0 | +5 | V |
| Reference Voltage (V_{REF}) | 0 | +3.5 | V |
| RF Output Power (P_{OUT}) | - | +30 | dBm, modulated |
| RF Input Power (P_{IN}) | - | +10 | dBm, CW |
| ESD Rating Human Body Model ⁽¹⁾ Charged Device Model ⁽²⁾ | Class 1C Class IV | - - | |
| MSL Rating ⁽³⁾ | 4 | - | |
| Junction Temperature (T_J) | - | +150 | °C |
| Storage Temperature (T_{STG}) | -40 | +150 | °C |

Functional operation is not implied under these conditions. Exceeding any one or a combination of the Absolute Maximum Rating Conditions may cause permanent damage to the device. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Notes:

(1) JEDEC JS-001-2010.

(2) JEDEC JESD22-C101D.

(3) 260 °C peak reflow.

Table 3: Operating Ranges

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|--|------------|------------|---------------|------|---------------------------|
| Operating Frequency (f) | 2496 | - | 2690 | MHz | |
| Supply Voltage (V_{CC}) | +3.6 | +4.5 | +4.65 | V | |
| Reference Voltage (V_{REF}) | +2.75 0 | +2.85 - | +2.95 +0.5 | V | PA "on" PA "shut down" |
| RF Output Power (P_{OUT}) ⁽¹⁾ | - | +27 | - | dBm | |
| Case Temperature (T_C) ⁽²⁾ | -40 | - | +85 | °C | |

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

Notes:

(1) Typ RF Output Power is used during production test.

(2) Case Temperature references the board temperature at the ground paddle on the backside of the package.

Table 4: Electrical Specifications
 (T_C = +25 °C, V_{CC} = +4.5 V, V_{REF} = +2.85 V, 50 Ω system)

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|--|--------|------------|------------|------|--|
| Gain ⁽²⁾ | 25 | 28 | 32 | dB | |
| ACPR ^{(1), (2), (3)} @ 10 MHz @ 20 MHz | - - | -48 -60 | -45 -53 | dBc | |
| Power-Added Efficiency ^{(1), (2), (3)} | 12 | 14.3 | - | % | |
| Thermal Resistance (R _{JC}) ⁽⁴⁾ | - | 12.5 | - | °C/W | Junction to Case |
| Supply Current ^{(1), (2), (3)} | - | 775 | 930 | mA | total through V _{CC} pins |
| Quiescent Current (I _q) | 180 | 250 | 320 | mA | |
| Reference Current | 10 | 14 | 18 | mA | through V _{REF} pin |
| Leakage Current | - | 3 | 10 | μA | V _{CC} = +4.65 V, V _{REF} = 0 V |
| Harmonics 2f _o 3f _o , 4f _o | - - | -40 -55 | -30 -50 | dBc | |
| Input Return Loss | 12 | 18 | - | dB | |
| Output Return Loss | 12 | 18 | - | dB | |
| P1dB | - | +34 | - | dBm | CW tone |
| RF Switching Time ⁽⁵⁾ Rise Time (PA “off” to “on”) Fall Time (PA “on” to “off”) | - - | - - | 12 4 | μs | V _{CC} = +4.5 V, V _{REF} switched between 0 V and +2.85 V |
| Spurious Output Level (all spurious outputs) | - | - | -60 | dBc | P _{OUT} ≤ +27 dBm In-band load VSWR < 5:1 Out-of-band load VSWR < 10:1 Applies over all voltage and temperature operating ranges |
| Load mismatch stress with no permanent degradation or failure | 8:1 | - | - | VSWR | V _{CC} = +4.5 V, P _{OUT} = +27 dBm Applies over full operating temperature range |

Notes:

(1) Measured at 2620 MHz.

(2) P_{OUT} = +27 dBm.

(3) E-TM1.1 LTE 10 MHz BW.

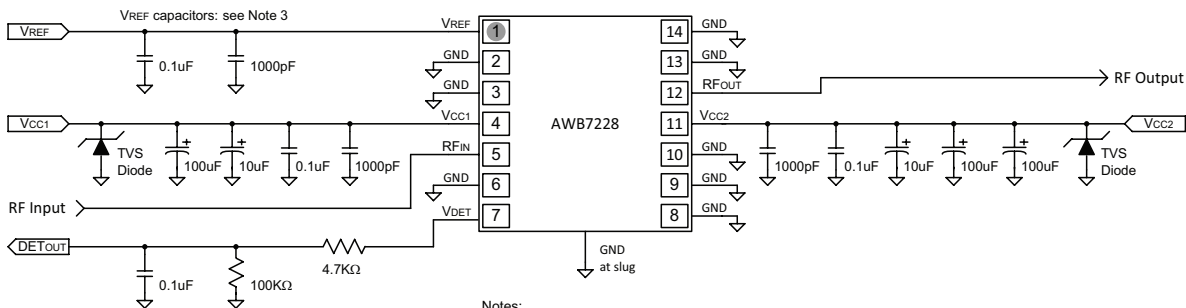
(4) Use only V_{CC2} (pin 11) current when calculating device junction temperature.(5) Rise Time defined from time at which V_{REF} is switched from 0 V to +2.85 V, to time at which the RF output power achieves 90% of the average steady-state “on” level; Fall Time defined from time at which V_{REF} is switched from +2.85 V to 0 V, to time at which the RF output power decreases to 10% of the average steady-state “on” level.

APPLICATION INFORMATION

To ensure proper performance, refer to all related Application Notes.

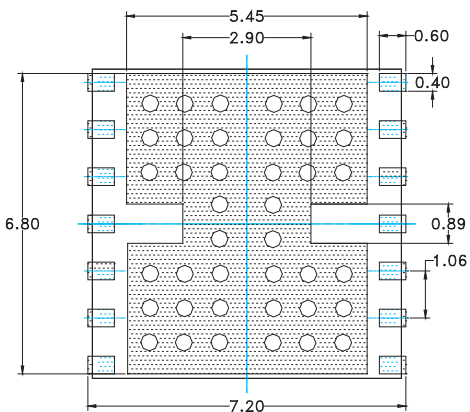
Shutdown Mode

The power amplifier may be placed in a shutdown mode by applying logic low levels (see Operating Ranges table) to the V_{REF} voltage.



- Notes:
1. 10µF and 100µF capacitors are optional.
 2. Applications that have large supply voltage transients may benefit from the use of TVS diodes. For such applications, recommended TVS diodes are SM05T1G or SMJ5.0A.
 3. To achieve the RF Switching Time specifications listed in Table 4, the maximum recommended capacitance on the V_{REF} line is 0.01µF. The noise on the V_{REF} line should be kept as low as possible to minimize required capacitance.

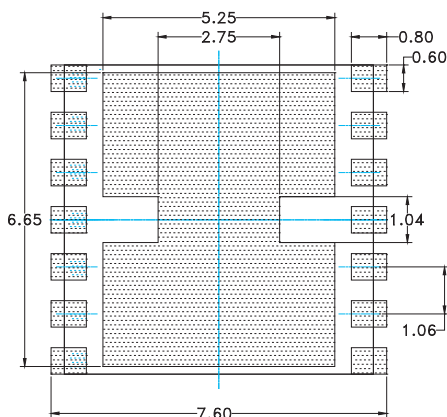
Figure 3: Application Circuit Schematic



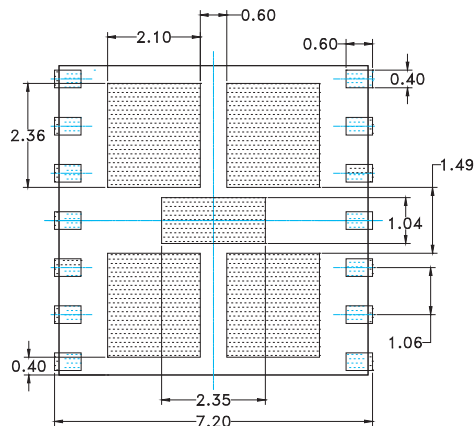
PCB METAL
TOP (X-RAY) VIEW
ONLY PACKAGE I/O's AND
GROUND REQUIREMENTS
SHOWN.

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 HEAT DISSIPATION REQUIREMENT AND THE PCB PROCESS CAPABILITY.



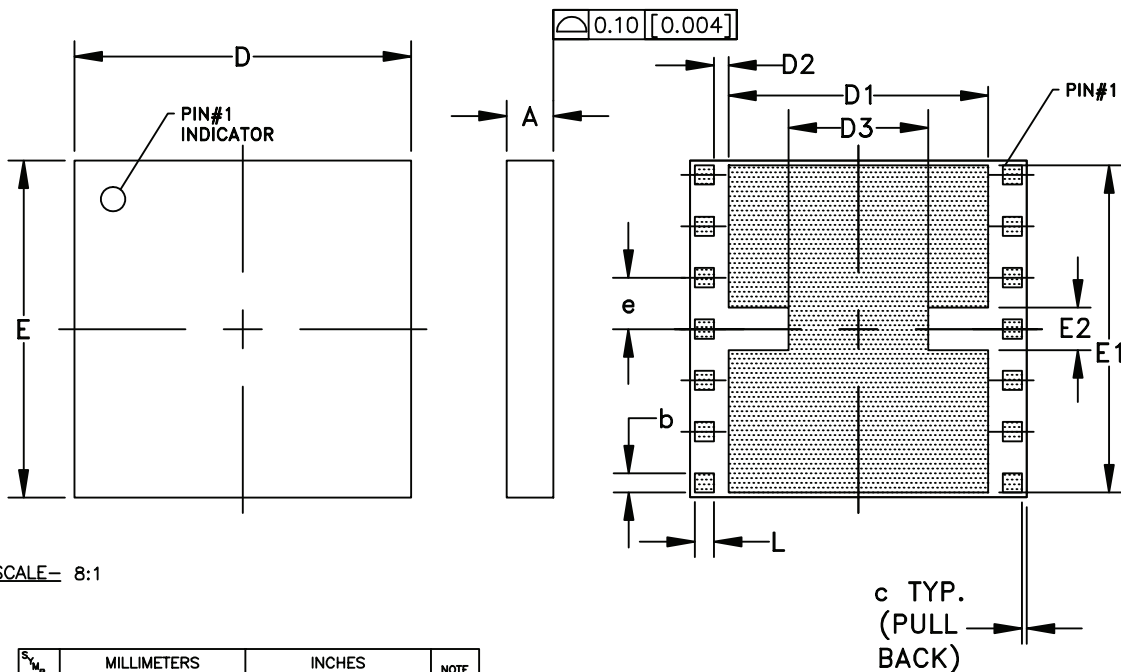
PCB SOLDER MASK
TOP (X-RAY) VIEW



STENCIL APERTURE
TOP (X-RAY) VIEW

Figure 4: PCB Footprint

PACKAGE OUTLINE



SCALE- 8:1

| Symbol | MILLIMETERS | | | INCHES | | | NOTE |
|--------|-------------|-------|-------|--------|--------|--------|------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | |
| A | 1.17 | 1.27 | 1.37 | 0.046 | 0.05 | 0.054 | - |
| b | 0.375 | 0.400 | 0.425 | 0.0148 | 0.0157 | 0.0167 | 14X |
| c | - | 0.10 | - | - | 0.004 | - | - |
| D | 6.90 | 7.00 | 7.10 | 0.272 | 0.276 | 0.280 | - |
| D1 | - | 5.40 | - | - | 0.213 | - | - |
| D2 | - | 0.30 | - | - | 0.0118 | - | - |
| D3 | - | 2.90 | - | - | 0.114 | - | - |
| E | 6.90 | 7.00 | 7.10 | 0.272 | 0.276 | 0.280 | - |
| E1 | - | 6.80 | - | - | 0.268 | - | - |
| E2 | - | 0.89 | - | - | 0.035 | - | - |
| e | - | 1.067 | - | - | 0.0420 | - | 6X |
| L | 0.375 | 0.400 | 0.425 | 0.0148 | 0.0157 | 0.0167 | 14X |

NOTES:

1. CONTROLLING DIMENSIONS: MILLIMETERS
2. UNLESS SPECIFIED TOLERANCE=±0.076[0.003].
3. PADS (INCLUDING CENTER) SHOWN UNIFORM SIZE FOR REFERENCE ONLY. ACTUAL PAD SIZE AND LOCATION WILL VARY WITHIN MIN. AND MAX. DIMENSIONS ACCORDING TO SPECIFIC LAMINATE DESIGN.

Figure 5: Package Outline - 14 Pin 7 mm x 7 mm x 1.3 mm Surface Mount Module

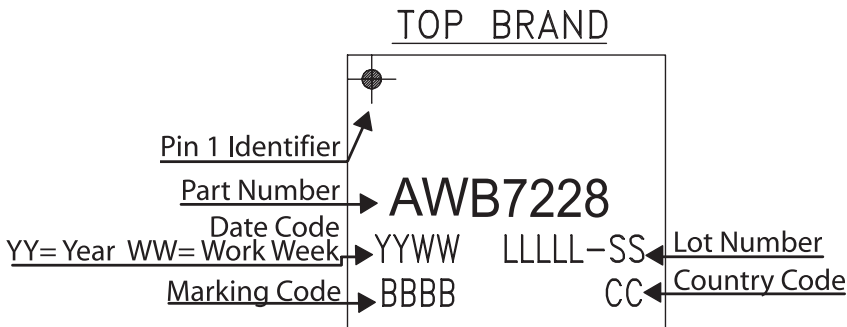


Figure 6: Branding Specification

COMPONENT PACKAGING

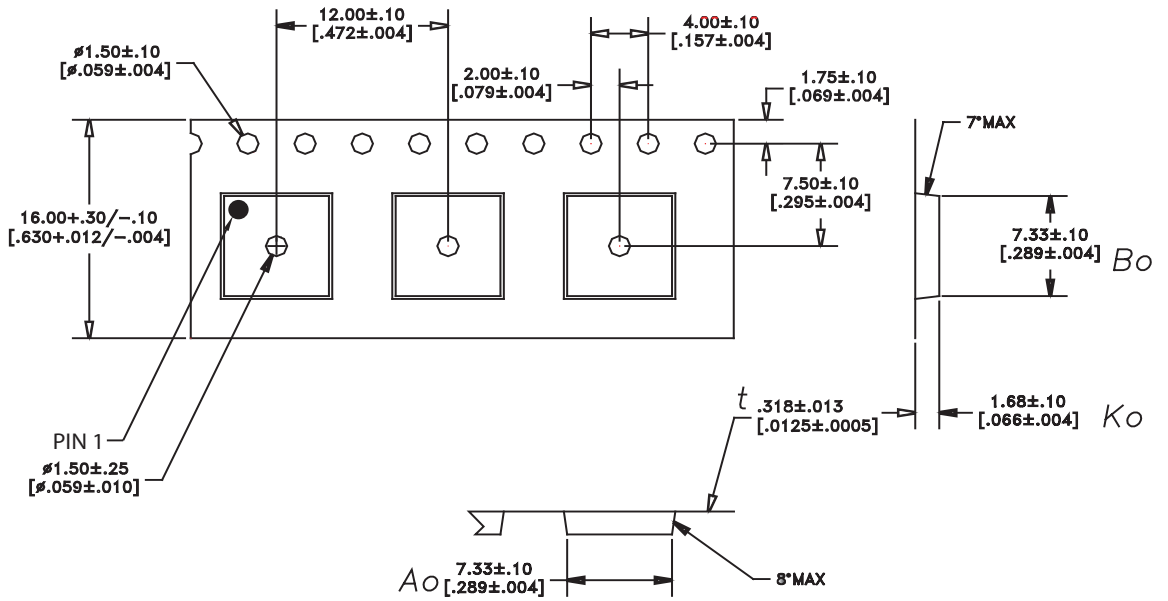


Figure 7: Tape & Reel Packaging

Table 5: Tape & Reel Dimensions

| PACKAGE TYPE | TAPE WIDTH | POCKET PITCH | REEL CAPACITY | MAX REEL DIA |
|----------------------|------------|--------------|---------------|--------------|
| 7 mm x 7 mm x 1.3 mm | 16 mm | 12 mm | 2500 | 13" |

ORDERING INFORMATION

| ORDER NUMBER | TEMPERATURE RANGE | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|---------------------|--------------------------|---|-------------------------------------|
| AWB7228P7 | -40 °C to +85 °C | RoHS-compliant 14 Pin 7 mm x 7 mm x 1.3 mm Surface Mount Module | Loose in Bag |
| AWB7228P8 | -40 °C to +85 °C | RoHS-compliant 14 Pin 7 mm x 7 mm x 1.3 mm Surface Mount Module | Tape and Reel, 2500 pieces per Reel |
| AWB7228P9 | -40 °C to +85 °C | RoHS-compliant 14 Pin 7 mm x 7 mm x 1.3 mm Surface Mount Module | Partial Reel |

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