

### FEATURES

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

### APPLICATIONS

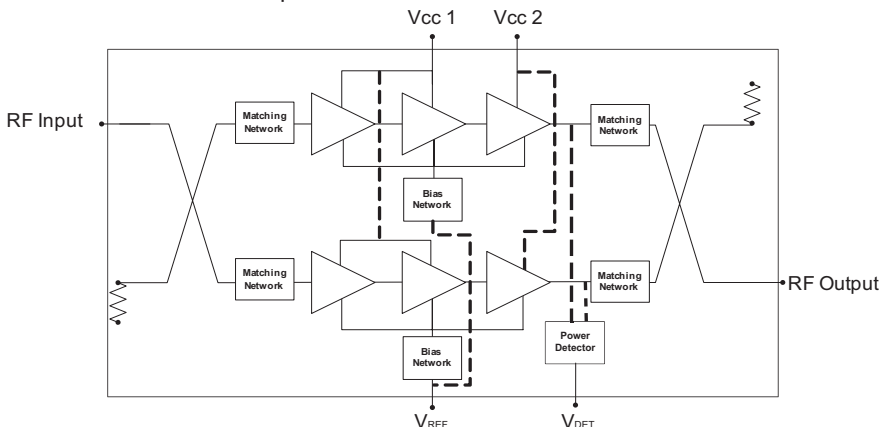
- LTE, WCDMA and HSDPA Air Interfaces
- FDD and TDD Systems
- Picocell, Femtocell, Home Nodes
- Customer Premises Equipment (CPE)
- Data Cards and Terminals



### 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  $50\ \Omega$  system.



**Figure 1: Block Diagram**



Figure 2: Pinout (X-ray Top View)

Table 1: Pin Description

PIN	NAME	DESCRIPTION
1	V <sub>REF</sub>	Reference Voltage
2	GND	Ground
3	GND	Ground
4	V <sub>CC1</sub>	Supply Voltage
5	RF <sub>IN</sub>	RF Input
6	GND	Ground
7	V <sub>DET</sub>	Detector Voltage
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	V <sub>CC2</sub>	Supply Voltage
12	RF <sub>OUT</sub>	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 <sup>(1)</sup>	Class 1C	-	
Charged Device Model <sup>(2)</sup>	Class IV	-	
MSL Rating <sup>(3)</sup>	3	-	
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 ( $P_{OUT}$ ) <sup>(1)</sup>	-	+27	-	dBm	
Case Temperature ( $T_C$ ) <sup>(2)</sup>	-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<sub>C</sub> = +25 °C, V<sub>CC</sub> = +4.5 V, V<sub>REF</sub> = +2.85 V, 50 Ω system)**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain <sup>(2)</sup>	25	28	32	dB	
ACPR <sup>(1), (2), (3)</sup> @ 10 MHz @ 20 MHz	- -	-48 -60	-45 -53	dBc	
Power-Added Efficiency <sup>(1), (2), (3)</sup>	12	14.3	-	%	
Thermal Resistance (R <sub>JC</sub> ) <sup>(4)</sup>	-	12.5	-	°C/W	Junction to Case
Supply Current <sup>(1), (2), (3)</sup>	-	775	930	mA	total through V <sub>CC</sub> pins
Quiescent Current (I <sub>q</sub> )	180	250	320	mA	
Reference Current	10	14	18	mA	through V <sub>REF</sub> pin
Leakage Current	-	3	10	μA	V <sub>CC</sub> = +4.65 V, V <sub>REF</sub> = 0 V
Harmonics 2f <sub>0</sub> 3f <sub>0</sub> , 4f <sub>0</sub>	- -	-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 <sup>(5)</sup> Rise Time (PA “off” to “on”) Fall Time (PA “on” to “off”)	- -	- -	12 4	μs	V <sub>CC</sub> = +4.5 V, V <sub>REF</sub> switched between 0 V and +2.85 V
Spurious Output Level (all spurious outputs)	-	-	-60	dBc	P <sub>OUT</sub> ≤ +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 <sub>CC</sub> = +4.5 V, P <sub>OUT</sub> = +27 dBm Applies over full operating temperature range

Notes:

(1) Measured at 2620 MHz.

(2) P<sub>OUT</sub> = +27 dBm.

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

(4) Use only V<sub>CC2</sub> (pin 11) current when calculating device junction temperature.

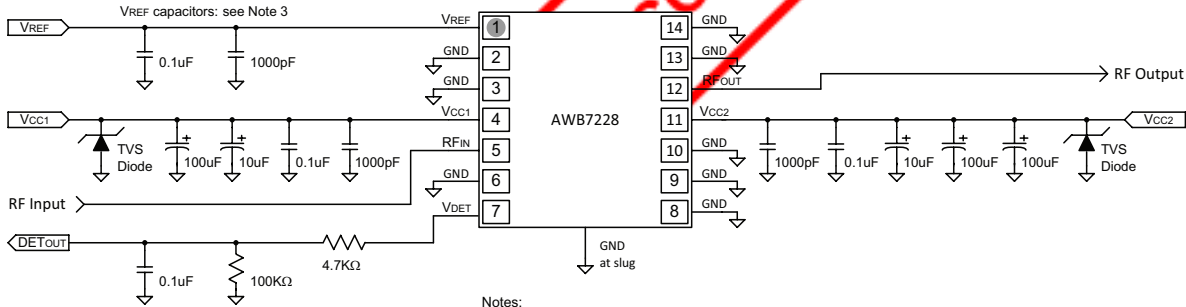
(5) Rise Time defined from time at which V<sub>REF</sub> is switched from 0 V to +2.85 V, to time at which the RF output power achieves 90% of the average steady-state “on” level; Fall Time defined from time at which V<sub>REF</sub> is switched from +2.85 V to 0 V, to time at which the RF output power decreases to 10% of the average steady-state “on” level.

# APPLICATION INFORMATION

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

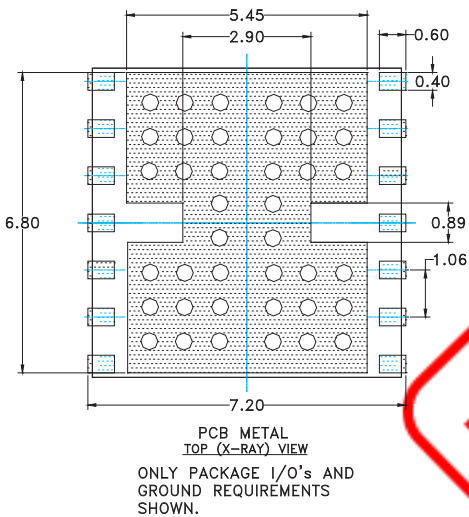
## Shutdown Mode

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. 10uF and 100uF 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**



## 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.

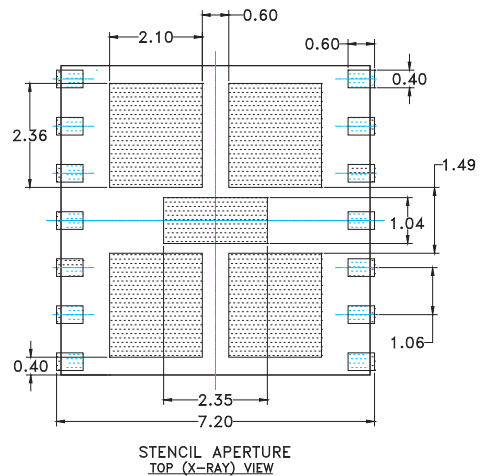
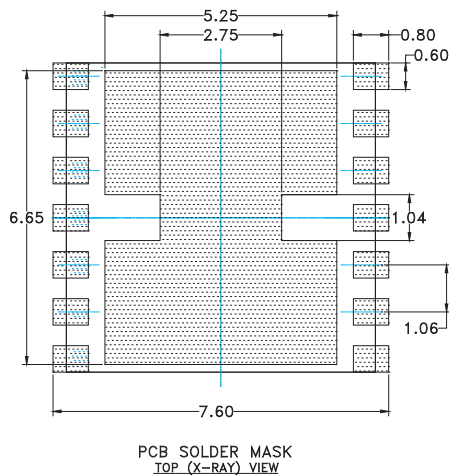
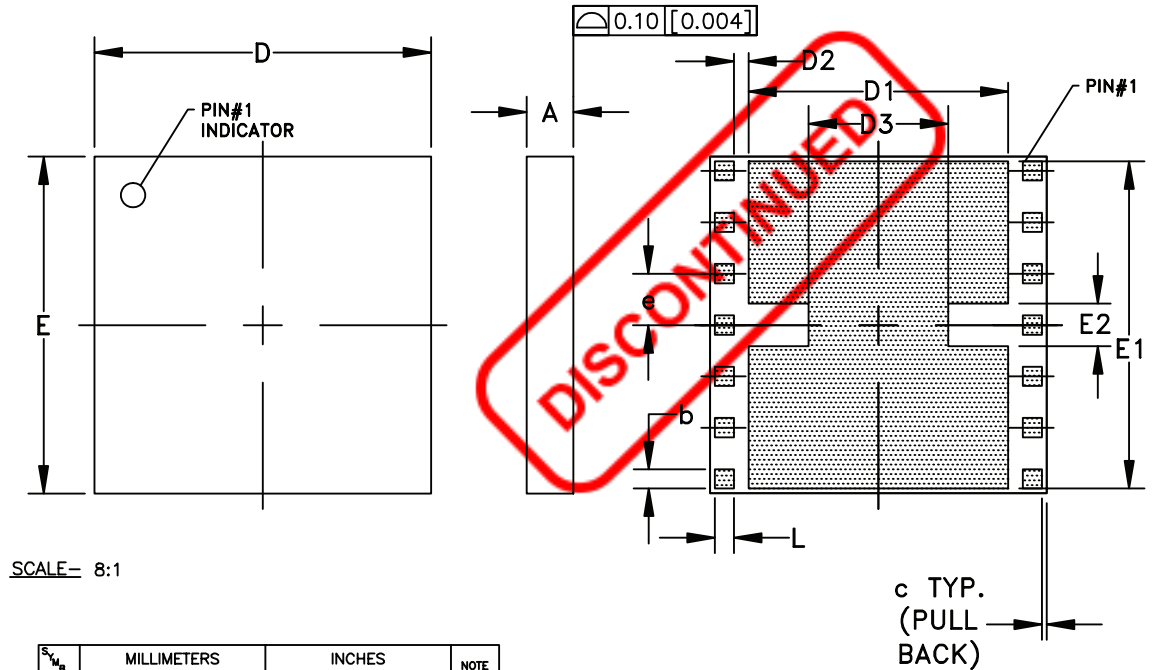


Figure 4: PCB Footprint

PACKAGE OUTLINE



SCALE- 8:1

	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

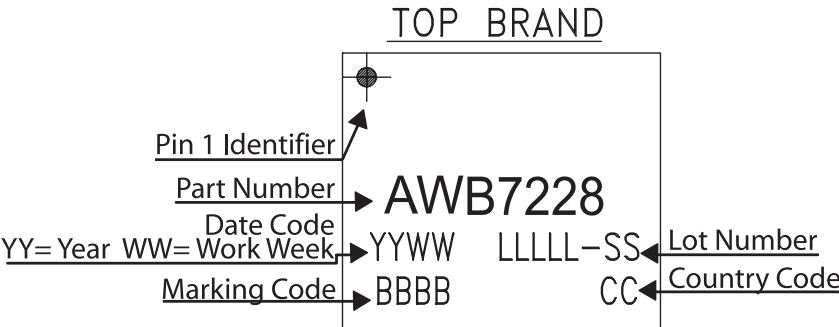


Figure 6: Branding Specification

## COMPONENT PACKAGING

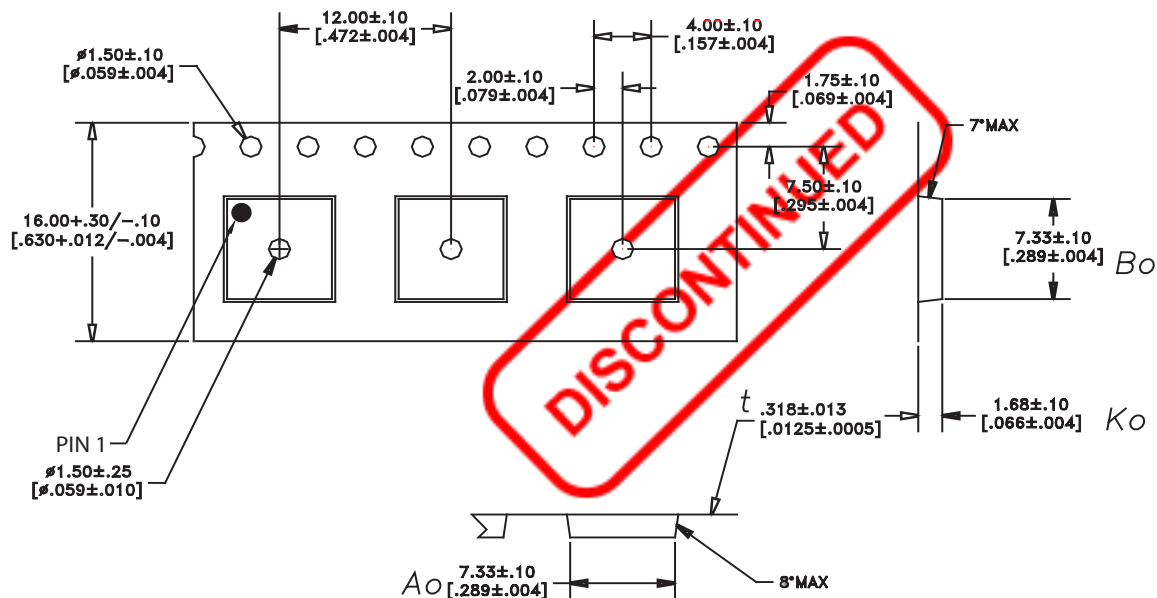


Figure 7: Tape &amp; Reel Packaging

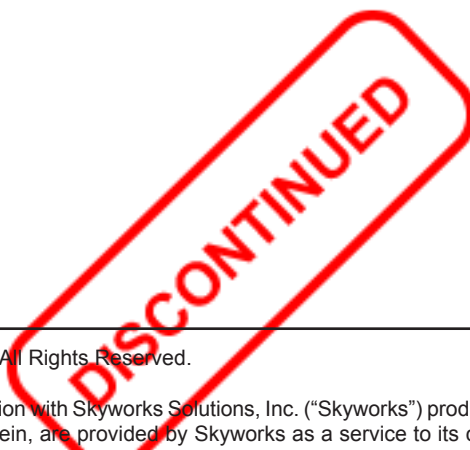
Table 5: Tape &amp; Reel Dimensions

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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