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DATA SHEET

# AWB7138: 791 to 821 MHz Small-Cell Power Amplifier Module

## Applications

- LTE, WCDMA and HSDPA air interfaces
- Picocell, femtocell, home nodes
- Customer premises equipment
- Data cards and terminals

## Features

- InGaP HBT technology
- -48 dBc ACPR @  $\pm 10$  MHz, +24.5 dBm
- 31 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
- Surface-mount (14-pin, 7  $\times$  7  $\times$  1.3 mm) package (MSL rating 4, 260  $^{\circ}$ C per JEDEC J-STD-020)



## Description

The AWB7138 is a highly linear, fully matched, power amplifier module designed for picocell, femtocell, and customer premises equipment (CPE) applications. Its high-power efficiency and low adjacent channel power levels meet the extremely demanding needs of small-cell infrastructure architectures.

Designed for LTE, WCDMA, HSDPA air interfaces operating in the 791 MHz to 821 MHz band, the AWB7138 delivers up to +24.5 dBm of LTE (E-TM1.1) power with an ACPR of -48 dBc. The device operates from a convenient +4.2 V supply and provides 31 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.

A block diagram of the AWB7138 is shown in Figure 1. The device package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.



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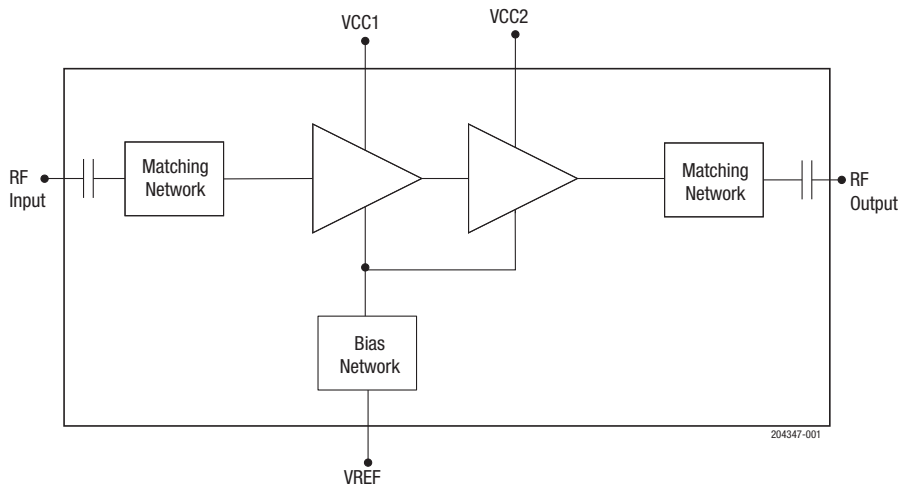


Figure 1. AWB7138 Block Diagram

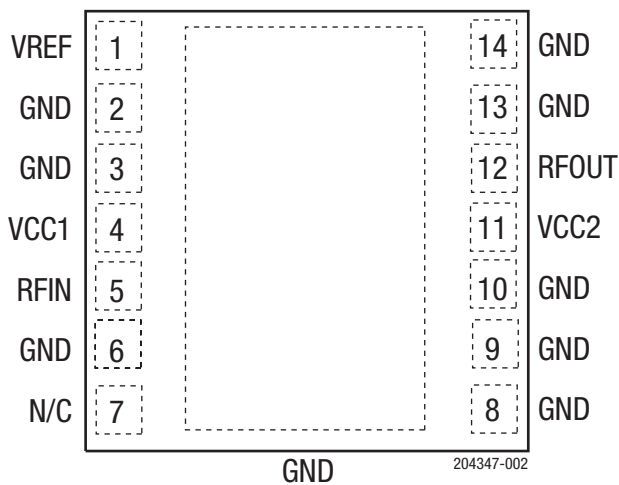


Figure 2. AWB7138 Pinout (Top View)

Table 1. AWB7138 Signal Pin Descriptions

| Pin | Name | Description       | Pin | Name  | Description    |
|-----|------|-------------------|-----|-------|----------------|
| 1   | VREF | Reference voltage | 8   | GND   | Ground         |
| 2   | GND  | Ground            | 9   | GND   | Ground         |
| 3   | GND  | Ground            | 10  | GND   | Ground         |
| 4   | VCC1 | Supply voltage    | 11  | VCC2  | Supply voltage |
| 5   | RFIN | RF input          | 12  | RFOUT | RF output      |
| 6   | GND  | Ground            | 13  | GND   | Ground         |
| 7   | N/C  | No connection     | 14  | GND   | Ground         |



## Electrical and Mechanical Specifications

The absolute maximum ratings of the AWB7138 are provided in Table 2. Recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

**Table 2. AWB7138 Absolute Maximum Ratings<sup>1</sup>**

| Parameter                                  | Minimum | Maximum | Units          |
|--|---------|---------|----------------|
| Supply voltage (V <sub>CC</sub> )          | 0       | +5      | V              |
| Reference voltage (V <sub>REF</sub> )      | 0       | +3.5    | V              |
| RF output power (P <sub>OUT</sub> )        |         | +28     | dBm, modulated |
| RF input power (P <sub>IN</sub> )          |         | +10     | dBm, CW        |
| Junction temperature (T <sub>J</sub> )     |         | +150    | °C             |
| Storage temperature (T <sub>STG</sub> )    | -40     | +150    | °C             |
| MSL rating <sup>3</sup>                    | 4       |         |                |
| Electrostatic discharge:                   |         |         |                |
| Human Body Model, Class 1C <sup>2</sup>    |         | 2000    | V              |
| Charged Device Model, Class 4 <sup>3</sup> |         | 1000    | V              |

<sup>1</sup> Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

<sup>2</sup> JEDEC JS-001-2010.

<sup>3</sup> JEDEC JESD22-C101D.

**ESD HANDLING:** *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

**Table 3. AWB7138 Recommended Operating Conditions<sup>1</sup>**

| Parameter                     | Symbol           | Min   | Typ   | Max   | Units |
|-------------------------------|------------------|-------|-------|-------|-------|
| Operating frequency           | f                | 791   |       | 821   | MHz   |
| Supply voltage                | V <sub>CC</sub>  | +3.2  | +4.2  | +4.5  | V     |
| Reference voltage:            |                  |       |       |       |       |
| PA on                         | V <sub>REF</sub> | +2.80 | +2.85 | +2.90 | V     |
| PA off                        |                  | 0     |       | +0.5  | V     |
| RF output power <sup>2</sup>  | P <sub>OUT</sub> |       | +24.5 |       | dBm   |
| Case temperature <sup>3</sup> | T <sub>C</sub>   | -40   |       | +85   | °C    |

<sup>1</sup> The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

<sup>2</sup> Typ RF output power is used during production test.

<sup>3</sup> Case temperature references the board temperature at the ground paddle on the backside of the package.

**Table 4. AWB7138 Electrical Specifications<sup>1</sup>**  
 (T<sub>C</sub> = +25 °C, V<sub>CC</sub> = +4.2 V, V<sub>REF</sub> = +2.85 V, 50 Ω System)

| Parameter   | Symbol          | Test Condition   | Min  | Typ        | Max        | Units      |
|---|-----------------|--|------|------------|------------|------------|
| Gain <sup>2</sup>   | G               |  | 28.5 | 31         | 36         | dB         |
| ACPR: <sup>1,2,3</sup><br>@ 10 MHz offset<br>@ 20 MHz offset  |                 | 10 MHz LTE BW  |      | -48<br>-57 | -45<br>-54 | dBc<br>dBc |
| Power-added efficiency <sup>1,2,3</sup>                       |                 |  | 12   | 16.5       |            | %          |
| Thermal resistance  | R <sub>JC</sub> | Junction to case   |      | 23         |            | °C/W       |
| Supply current <sup>1,2,3</sup>                               | V <sub>CC</sub> | Total through VCC pins   |      | 405        | 545        | mA         |
| Quiescent current   | I <sub>cq</sub> |  |      | 140        | 190        | mA         |
| Reference current   |                 | Through VREF pin   |      | 5          | 10         | mA         |
| Leakage current   |                 | V <sub>CC</sub> = +5 V, V <sub>REF</sub> = 0 V   |      | 1.5        | 5          | μA         |
| Harmonics:<br>2fo<br>3fo, 4fo                                 |                 |  |      | -50<br>-62 | -37<br>-40 | dBc<br>dBc |
| Input return loss   |                 |  | 9    | 18         |            | dB         |
| Spurious output level (all spurious outputs)                  |                 | P <sub>OUT</sub> ≤ +24.5 dBm, in-band load VSWR < 5:1, Out-of-band load VSWR < 10:1, applies over all voltage and temperature operating ranges |      |            | -60        | dBc        |
| Load mismatch stress with no permanent degradation or failure |                 | V <sub>CC</sub> = +4.2 V, P <sub>IN</sub> = +0 dBm<br>Applies over full operating temperature range  | 8:1  |            |            | VSWR       |

<sup>1</sup> Measured at 806 MHz.

<sup>2</sup> P<sub>OUT</sub> = +24.5 dBm.

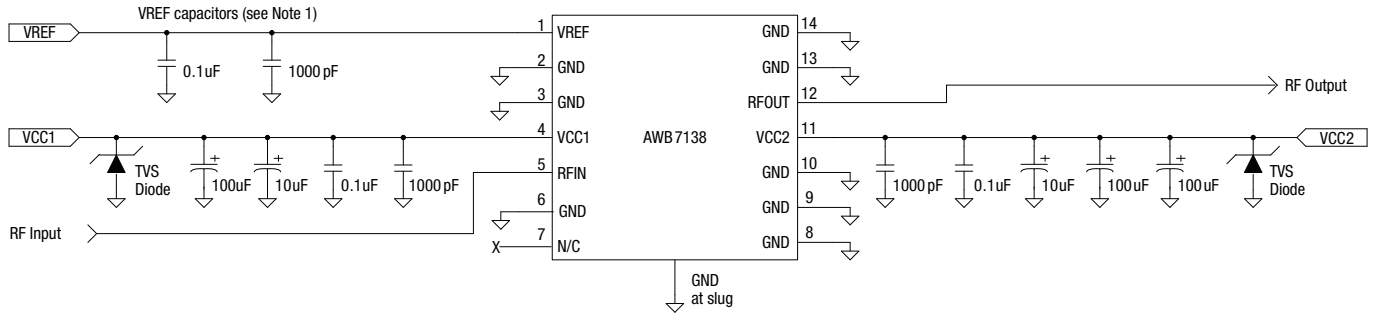
<sup>3</sup> E-TM1.1 10 MHz.

### Evaluation Board Description

The AWB7138 Evaluation Board is used to test the performance of the AWB7138 device. A schematic of a typical application circuit is shown in Figure 3.

### Shutdown Mode

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



- Notes:
1. 10 uF and 100 uF 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.

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Figure 3. AWB7138 Evaluation Board Schematic

### Package Dimensions

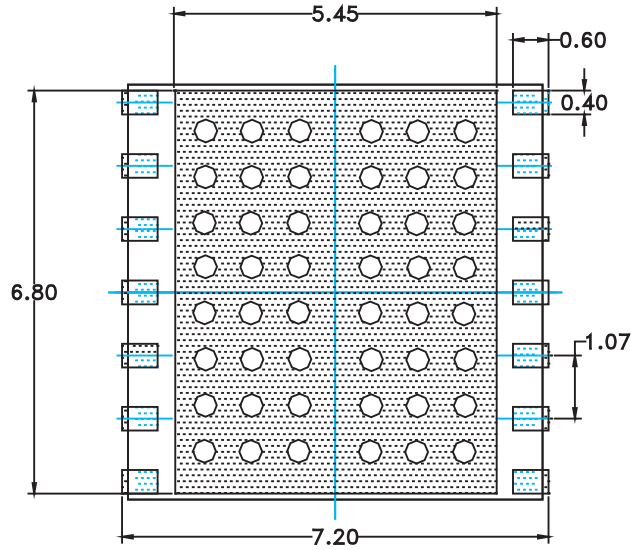
The PCB layout footprint drawing for the AWB7138 is shown in Figure 4. Typical part markings are shown in Figure 5. The package dimensions for the AWB7138 are shown in Figure 6. The tape and reel dimensions are provided in Figure 7.

### Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

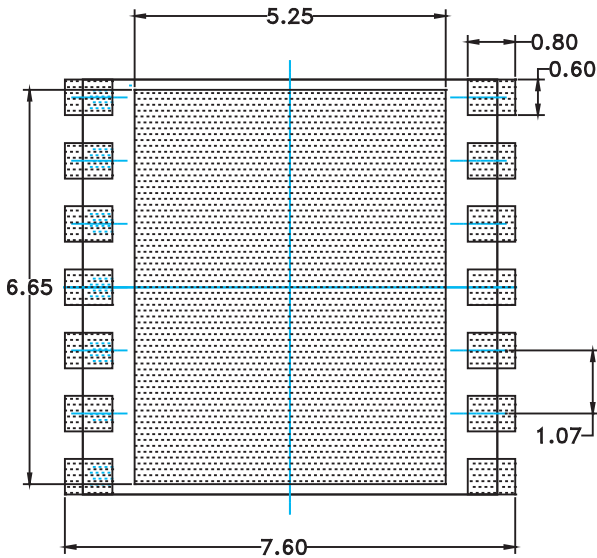
The AWB7138 can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

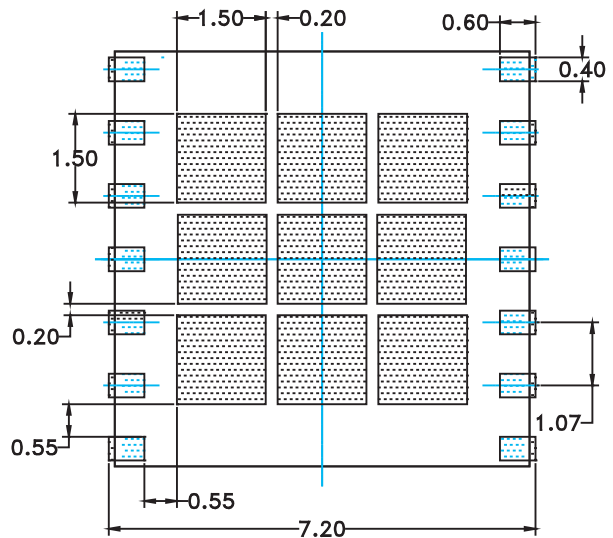


PCB METAL  
TOP (X-RAY) VIEW

ONLY PACKAGE I/O's AND  
GROUND REQUIREMENTS  
SHOWN.



PCB SOLDER MASK  
TOP (X-RAY) VIEW



STENCIL APERTURE  
TOP (X-RAY) VIEW

Notes:

1. Unless specified, dimensions are symmetrical about center lines shown.
2. Dimensions are in millimeters.
3. Vias shown in PCB Metal View are for reference only. Number and size of thermal vias required are dependent on heat dissipation requirements and the PCB process capability.

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Figure 4. AWB7138 PCB Layout Footprint Dimensions

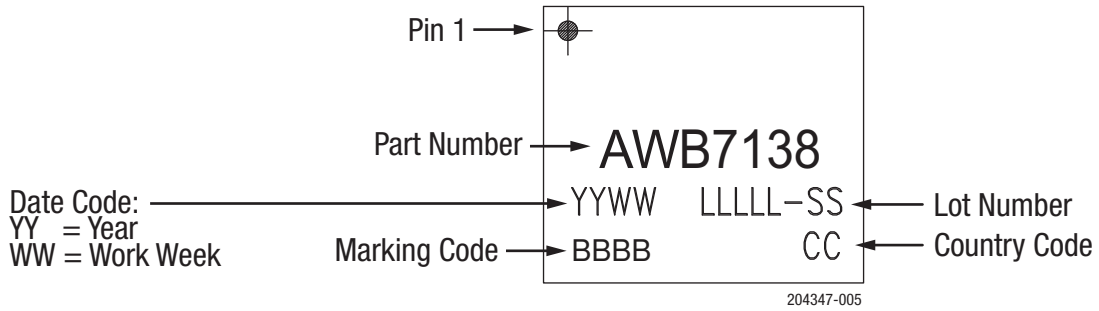
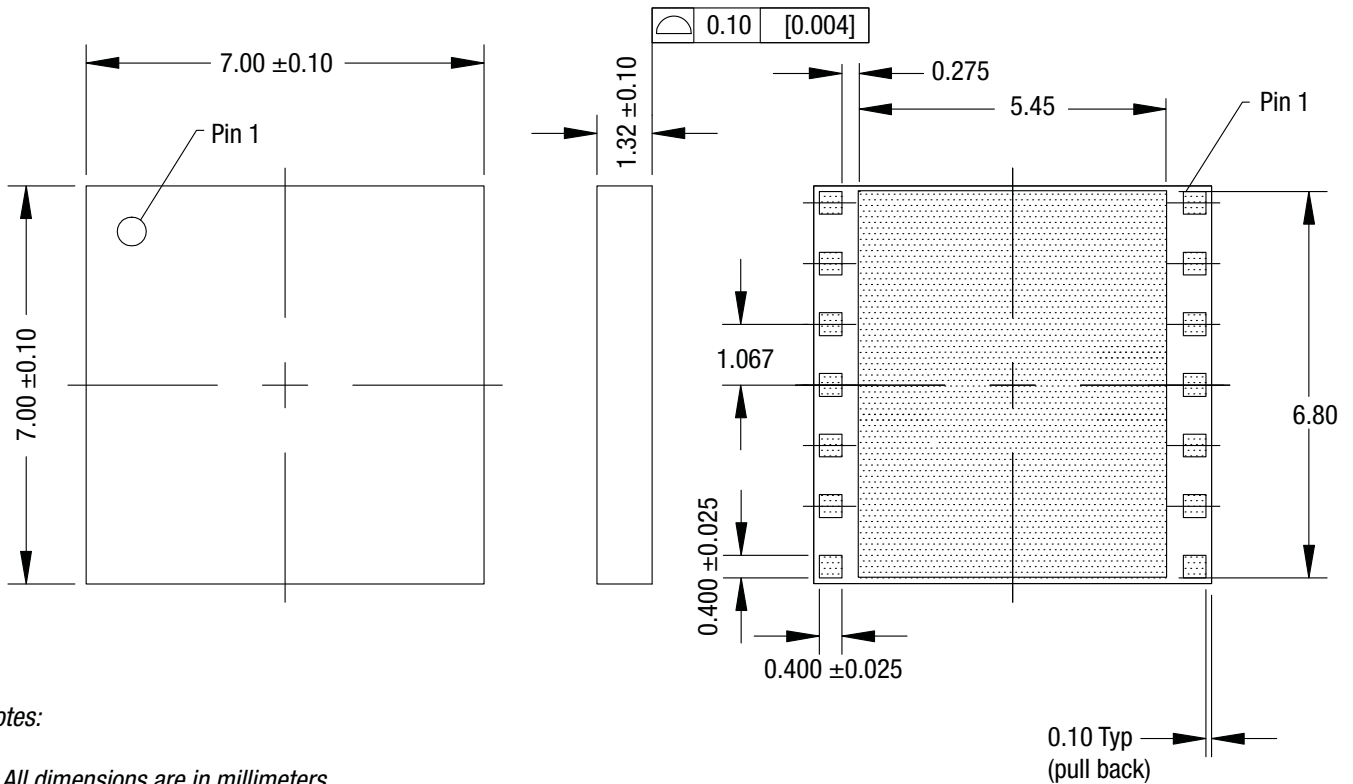


Figure 5. AWB7138 Typical Part Marking



Notes:

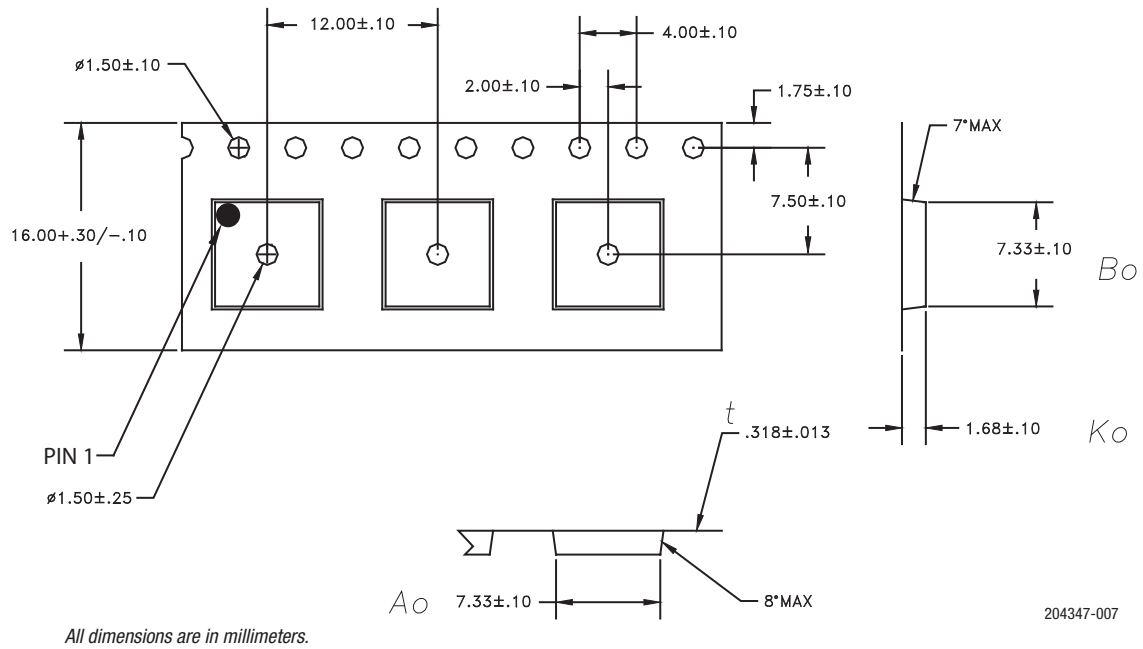
1. All dimensions are in millimeters.
2. Unless specified otherwise, tolerance =  $\pm 0.076$  [0.003].
3. Pads (including center) are shown as uniform size for reference only.  
Actual pad size and location will vary within the minimum and maximum dimensions according to the specific laminate design.

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Figure 6. AWB7138 Package Dimensions



**DATA SHEET • AWB7138: 791 TO 821 MHz SMALL-CELL POWER AMPLIFIER MODULE**



**Figure 7. AWB7138 Tape and Reel Dimensions**

## Ordering Information

| Part Number | Product Description                                       | Component Packaging          |
|-------------|---|------------------------------|
| AWB7138P8   | RoHS-compliant 14-pin 7 x 7 x 1.3 mm surface-mount module | 2500-piece tape and reel     |
| EVB7138     |   | Evaluation Board part number |

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