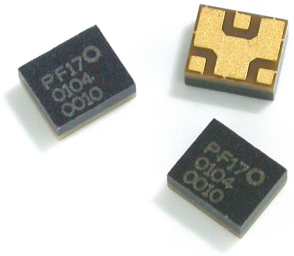
# THE DATASHEET OF

# ACMD-7612-BLKG

# ACMD-7612

## Miniature UMTS Band I Duplexer

## Data Sheet




### Description

The Avago ACMD-7612 is a miniature duplexer designed for use in UMTS Band I handsets.

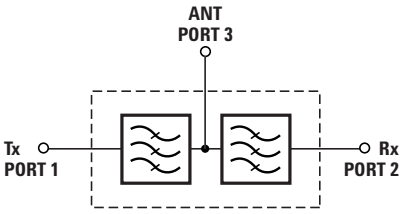
Maximum Insertion Loss in the Tx channel is only 1.5 dB, which minimizes current drain from the power amplifier. Insertion Loss in the Rx channel is a maximum of 2.0 dB, improving receiver sensitivity.

The ACMD-7612 enhances the sensitivity and dynamic range of WCDMA receivers by providing more than 53 dB attenuation of the transmitted signal at the receiver input and more than 43 dB rejection of transmit-generated noise in the receive band.

The ACMD-7612 is designed with Avago Technologies' Film Bulk Acoustic Resonator (FBAR) technology, which makes possible ultra-small, high-Q filters at a fraction of their usual size. The excellent power handling capability of the FBAR bulk-mode resonators supports the high output power levels needed in handsets while adding virtually no distortion.

The ACMD-7612 also utilizes Avago Technologies' innovative Microcap bonded-wafer, chip scale packaging technology. This process allows the filters to be assembled in a molded chip-on-board module that is less than 1.2 mm high with a maximum footprint of only 2.5 mm x 3.0 mm.

### Functional Block Diagram




### Features

- Miniature size
  - 2.5 x 3.0 mm max footprint
  - 1.2 mm max height
- High power rating
  - +33 dBm Abs Max Tx Power
- Lead-free construction

### Specifications

- Performance guaranteed –30 to +85°C
- Rx band performance (2110 – 2170 mHz)
  - Insertion loss: 2.0 dB max
  - Noise blocking: 43 dB min
- Tx band performance (1920 – 1980 mHz)
  - Insertion loss: 1.5 dB max
  - Interferer blocking: 53 dB min

### Applications

- Handsets or data terminals operating in the UMTS Band I frequency range

## ACMD-7612 Specifications, $Z_0 = 50\ \Omega$, $T_C$[1] as Indicated

| | | | –30 to +85°C[2] | | |
|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Units** | **Min** | **Typ[3]** | **Max** |
| | **Antenna Port to Receive Port** | | | | |
| S23 | Insertion Loss in Receive Band (2110 – 2170 MHz) | dB | | 1.1 | 2.0 |
| ΔS23 | Ripple (p-p) in Receive Band | dB | | 0.6 | 1.0 |
| ΔS23 | Ripple (p-p) in Any 5 MHz Channel within Receive Band | dB | | – | 0.5 |
| S22 | Return Loss of Receive Port in Receive Band | dB | 10 | 16 | |
| S23 | Attenuation 0 – 1900 mHz | dB | 30 | 50 | |
| S23 | Attenuation in Transmit Band (1920 – 1980 mHz) | dB | 53 | 61 | |
| S23 | Attenuation in Bluetooth Band (2400 – 2500 mHz) | dB | 40 | 54 | |
| | **Transmit Port to Antenna Port** | | | | |
| S31 | Insertion Loss in Transmit Band (1920 – 1980 mHz) -30° to +25°C | dB | | 1.1 | 1.5 |
| S31 | Insertion Loss in Transmit Band (1920 – 1980 mHz) +25° to +85°C | dB | | 1.1 | 1.6 |
| ΔS31 | Ripple (p-p) in Transmit Band | dB | | 0.4 | 1.0 |
| ΔS31 | Ripple (p-p) in Any 5 mHz Channel within Transmit Band | dB | | – | 0.5 |
| S11 | Return Loss of Transmit Port in Transmit Band | dB | 10 | 20 | |
| S31 | Attenuation 0 – 1800 mHz | dB | 30 | 44 | |
| S31 | Attenuation in Receive Band (2110 – 2170 mHz) | dB | 41 | 52 | |
| S31 | Attenuation in Bluetooth Band (2400 – 2500 mHz) | dB | 25 | 31 | |
| S31 | Attenuation in Transmit 2nd Harmonic Band (3840 – 3960 mHz) | dB | 25 | 36 | |
| S31 | Attenuation in Transmit 3rd Harmonic Band (5760 – 5940 mHz) | dB | 15 | 17 | |
| | **Antenna Port** | | | | |
| S33 | Return Loss of Antenna Port in Transmit and Receive Bands | dB | 10 | 17 | |
| | **Isolation Transmit Port to Receive Port** | | | | |
| S21 | Tx-Rx Isolation in Transmit Band (1920 – 1980 mHz) | dB | 53 | 62 | |
| S21 | Tx-Rx Isolation in Receive Band (2110 – 2170 mHz) | dB | 43 | 52 | |

**Notes:**

1. $T_C$ is the case temperature and is defined as the temperature of the underside of the duplexer where it makes contact with the circuit board.
2. Specifications guaranteed over the given temperature range (unless otherwise noted) with the input power to the Tx port equal to or less than +29 dBm over all Tx frequencies.
3. Typical data is the arithmetic mean value of the parameter over its indicated frequency range at the specified temperature. Typical values may vary from part to part and over time.

## Absolute Maximum Ratings[1]

| Parameter | Unit | Value |
|---|---|---|
| Storage Temperature | °C | -65 to +125 |
| Maximum RF Input Power to Tx Port | dBm | +33 |

## Maximum Recommended Operating Conditions[2]

| Parameter | Unit | Value |
|---|---|---|
| Operating Temperature, $T_C$[3] , Tx Power ≤ 29 dBm | °C | -40 to +100 |
| Operating Temperature, $T_C$[3] , Tx Power ≤ 30 dBm | °C | -40 to +85 |

**Notes:**
1. Operation in excess of any one of these conditions may result in permanent damage to the device.
2. The device will function over the recommended range without degradation in reliability or permanent change in performance, but is not guaranteed to meet electrical specifications.
3. $T_C$ is defined as case temperature, the temperature of the underside of the duplexer where it makes contact with the circuit board.

## ACMD-7612 Typical Performance at $T_C$ = 25°C

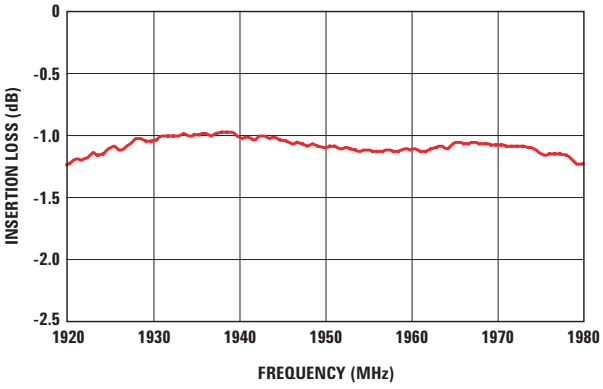



Figure 1. Tx band insertion loss

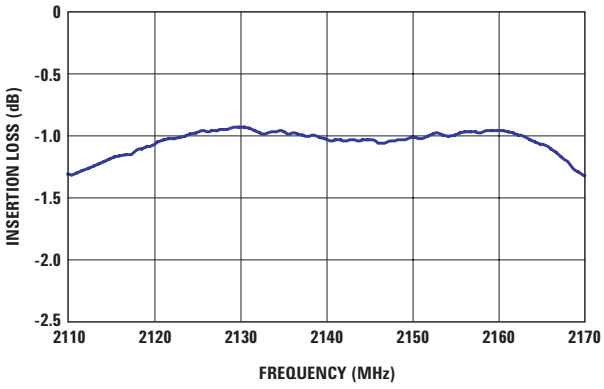



Figure 2. Rx band insertion loss

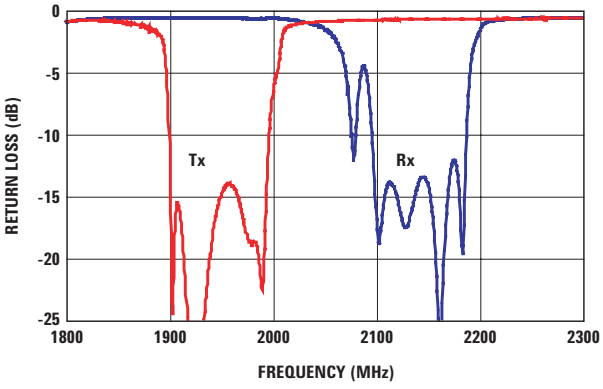



Figure 3. Tx and Rx port return loss

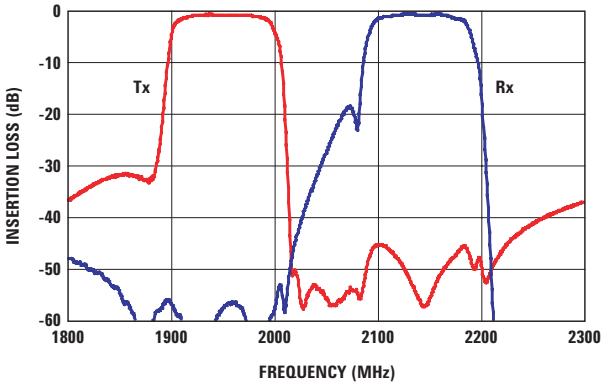



Figure 4. Tx rejection in Rx band and Rx rejection in Tx band

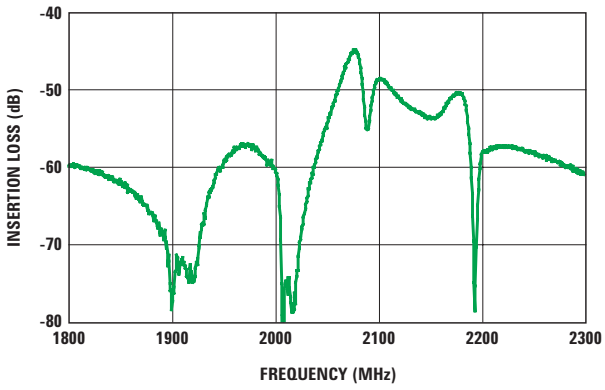



Figure 5. Tx to Rx isolation

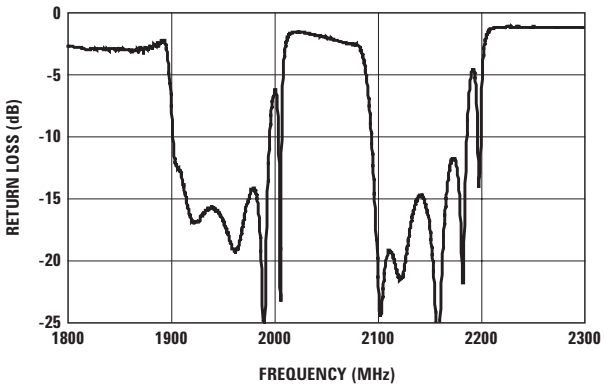



Figure 6. Antenna port return loss

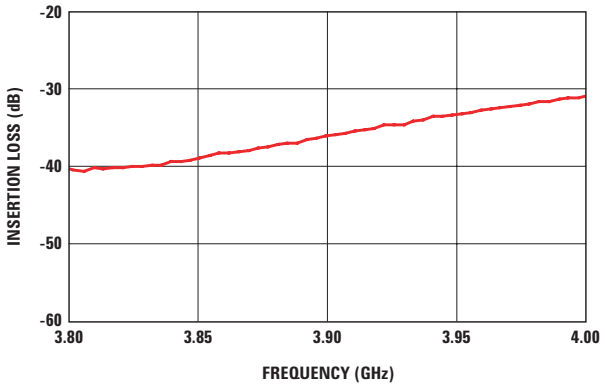



Figure 7. Tx second harmonic rejection

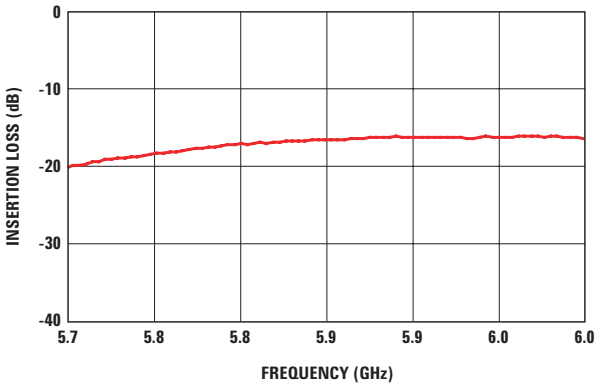



Figure 8. Tx third harmonic rejection

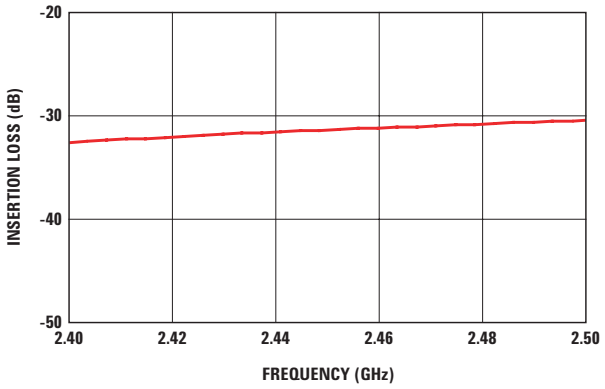



Figure 9. Tx rejection in bluetooth band (2400 – 2500 mHz)

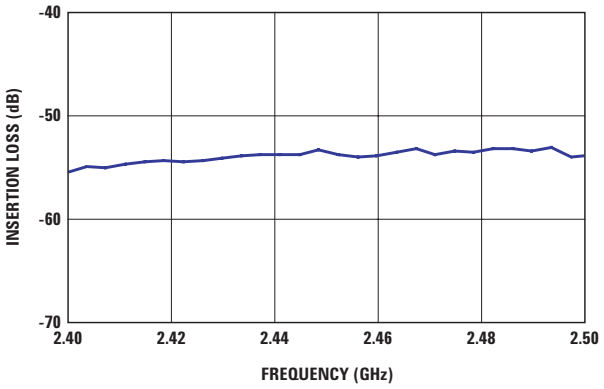



Figure 10. Rx rejection in bluetooth band (2400 – 2500 mHz)

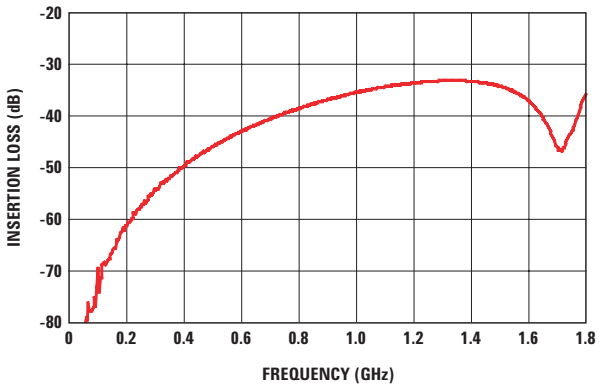



Figure 11. Tx low frequency rejection

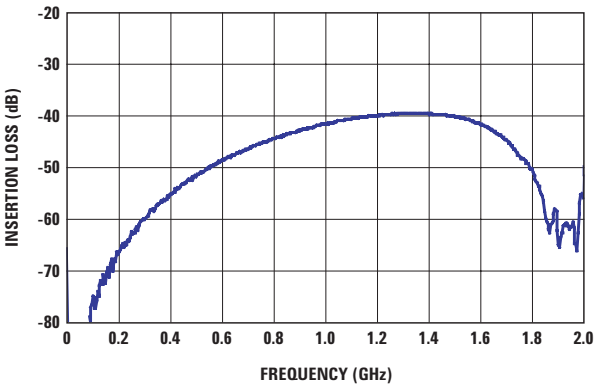



Figure 12. Rx low frequency rejection

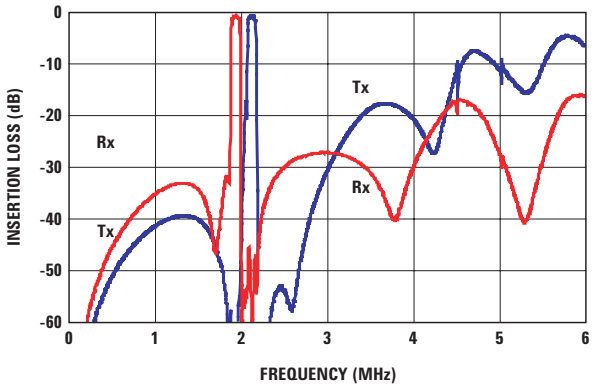



Figure 13. Tx and Rx wideband response

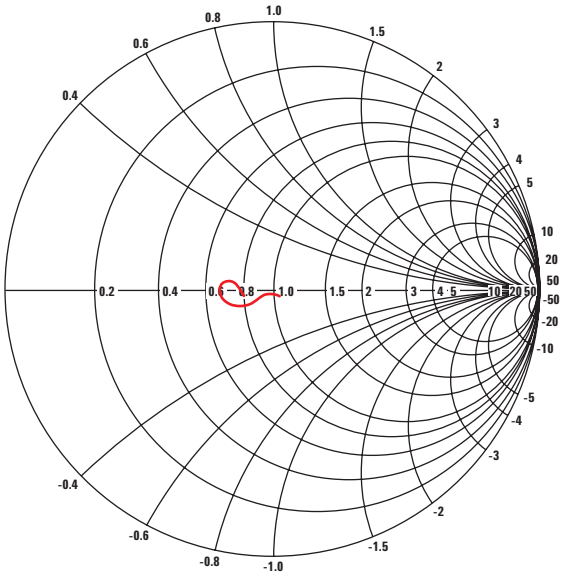



**Figure 14. Tx impedance (S11) in Tx band**

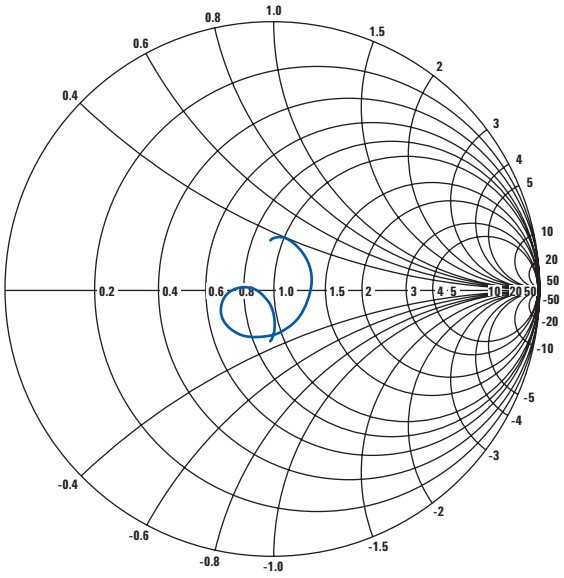



**Figure 15. Rx impedance (S22) in Rx band**

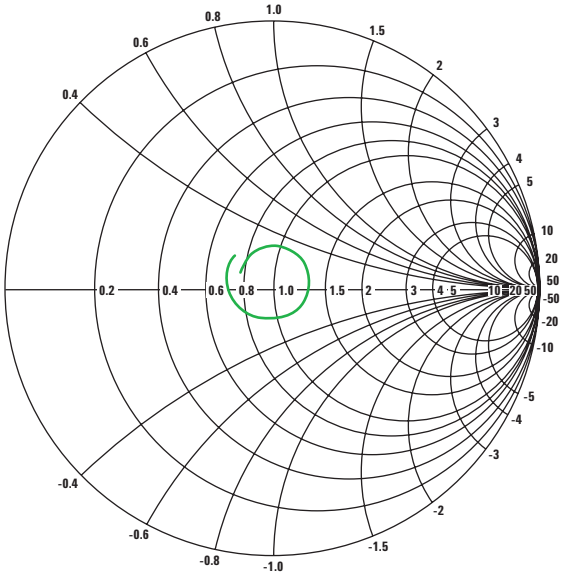



**Figure 16. Ant impedance (S33) in Tx band**

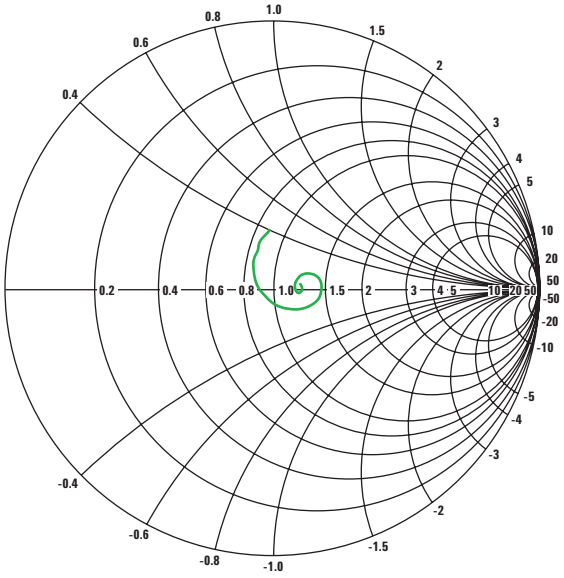
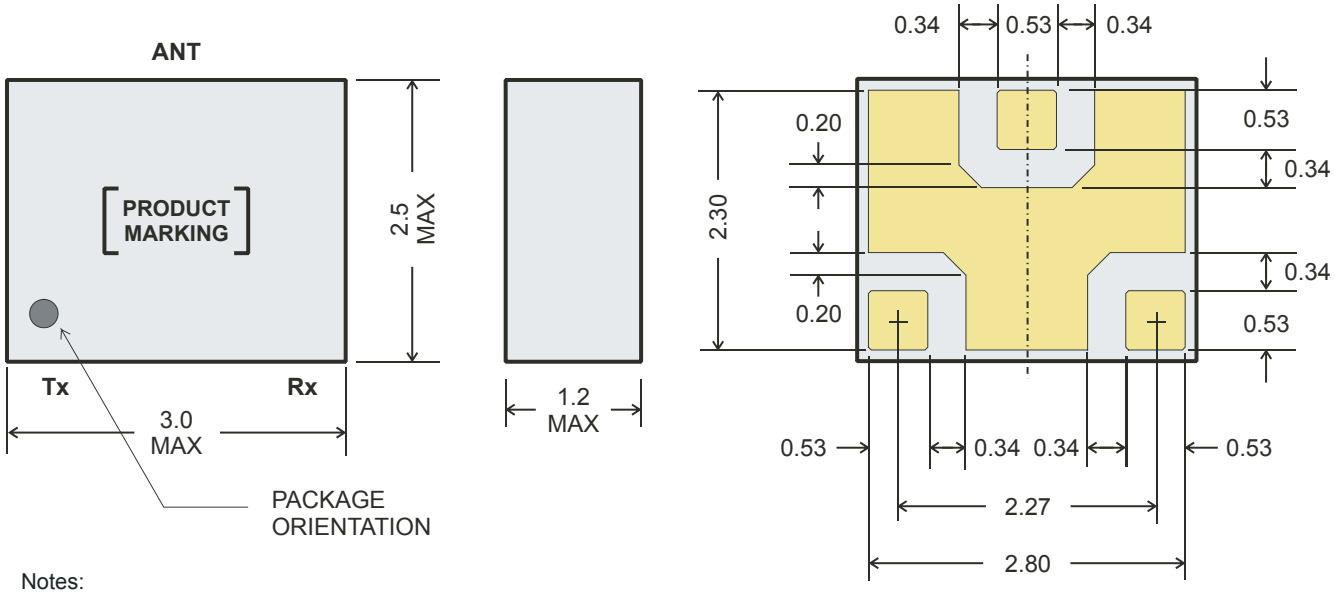
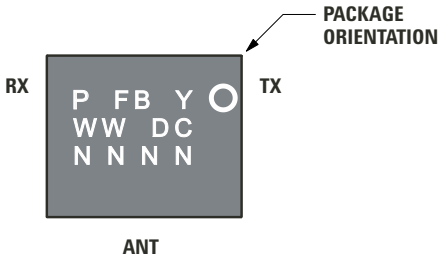



**Figure 17. Ant impedance (S33) in Rx band**



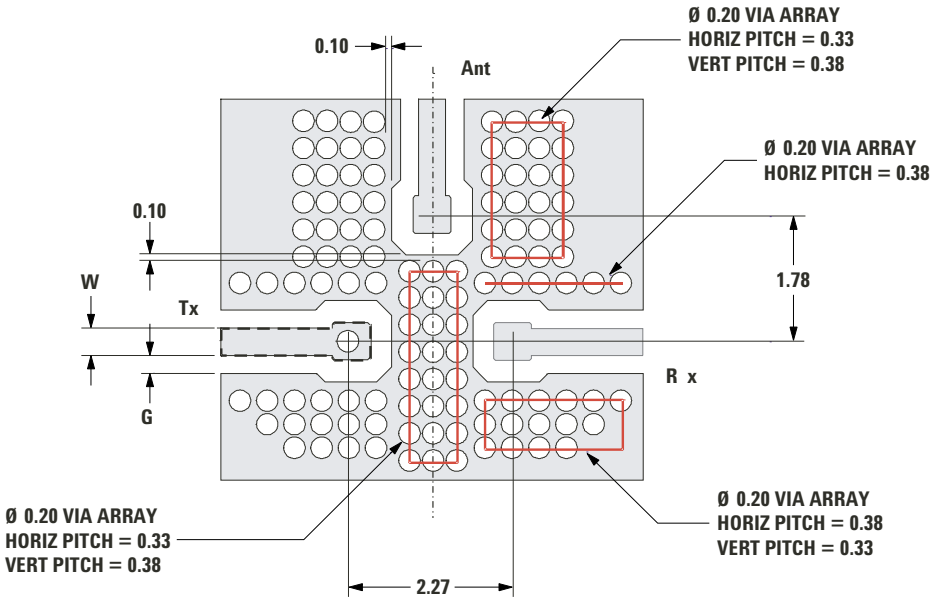

Notes:
1. Dimensions in millimeters
2. Dimensions nominal unless otherwise noted
3. All chamfers 45°
4. I/O pads (3 ea)
   Size: 0.53 x 0.53, corner chamfers: 0.03 x 0.03
   Spacing to ground plane: 0.34
   Inside ground plane chamfer: 0.20 x 0.20
5. Tolerance:
   X.X = ± 0.1
   X.XX = ±0.05
6. Contact areas are gold plated

**Figure 18. Package drawing**




**P = ACMD-7612**
**FB = Avago ID**
**Y = Year**
**WW = Work Week**
**DC = Date Code**
**NNNN = Lot Number**

**Figure 19. Package marking**




**Notes:**
1. Dimensions in mm.
2. Transmission line Gap (G) and Width (W) adjusted for Zo = 50 ohms.
3. I/O Pads (3 ea) 0.53 x 0.53, corner chamfer 0.30.
4. I/O Pad to Ground plane gap = 0.34, corner chamfer 0.30.
5. Ground vias positioned to maximize port-to-port isolation.

**Figure 20. PCB layout**

A PCB layout implementing design principles similar to those illustrated in Figure 16 is recommended to optimize performance of the ACMD-7612.

It is particularly important to maximize isolation between the Tx connection to the duplexer and the Rx port. High isolation is achieved by (1) maintaining a continuous ground plane around the duplexer mounting area, (2) surrounding the I/O ports with sufficient ground vias to enclose the connections in a "Faraday cage", and (3) preferably routing the Tx trace in a different metal layer than the Rx.

The latter is especially useful, not only to maintain Tx-Rx isolation of the duplexer, but also to prevent leakage of the Tx signal into other components that could result in the creation of intermodulation products and degradation of overall system performance.

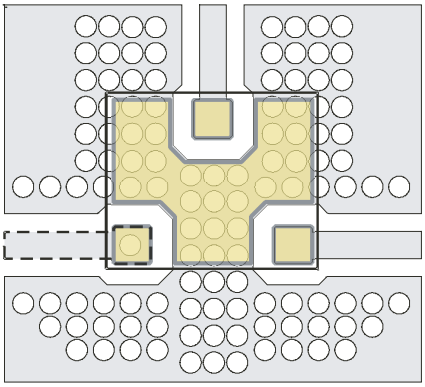
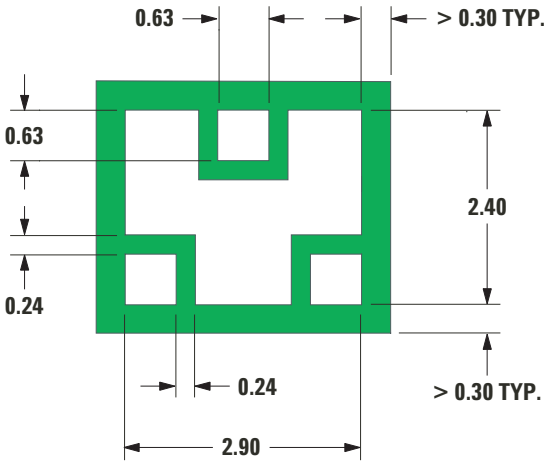


**Figure 21. ACMD-7612 superposed on PCB layout**




**Note:**
**Dimensions in mm.**

**Figure 22. Recommended solder mask**

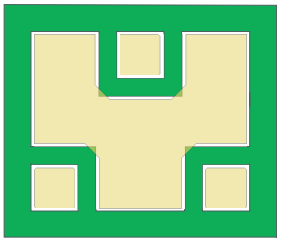
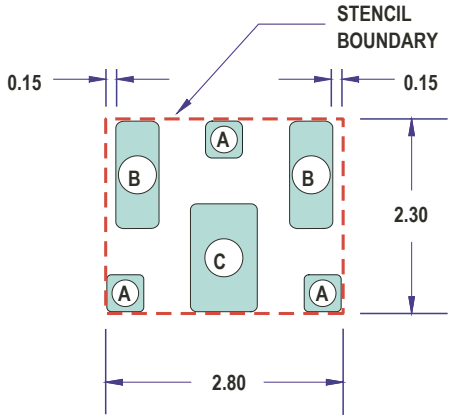


**Figure 23. ACMD-7612 superposed on solder mask**




| STENCIL OPENING ID | QTY | WIDTH (mm) | LENGTH (mm) |
|---|---|---|---|
| A (I/O pad areas) | 3 | 0.43 | 0.43 |
| B | 2 | 0.50 | 1.24 |
| C | 1 | 0.77 | 1.24 |

Notes:
1. Chamfer or radius all corners 0.05 mm min.
2. Stencil openings aligned to Boundary rectangle or center lines.

**Figure 24. Recommended solder stencil**

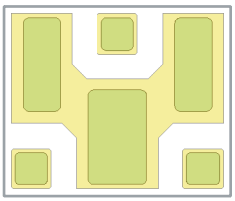
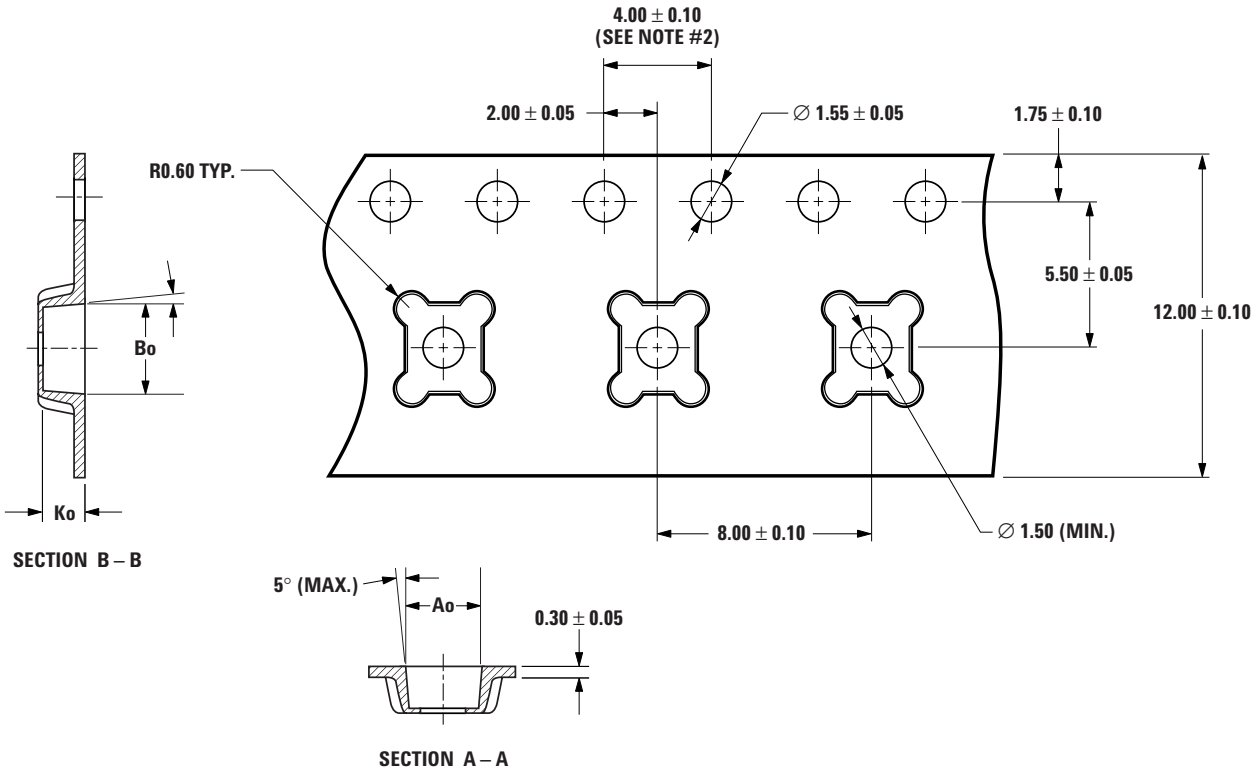


**Figure 25. Solder stencil overlaid on ACMD-7612 bottom metal pattern**




**NOTES:**
1. Ao and Bo measured at 0.3 mm above base of pocket.
2. 10 pitches cumulative tolerance ± 0.2 mm.
3. ( ) Reference dimensions only.

| | | |
|---|---|---|
| Ao | = | 2.80 |
| Bo | = | 3.30 |
| Ko | = | 1.50 |
| Pitch | = | 8.00 |
| Width | = | 12.00 |

**Figure 26. SMD tape packing**

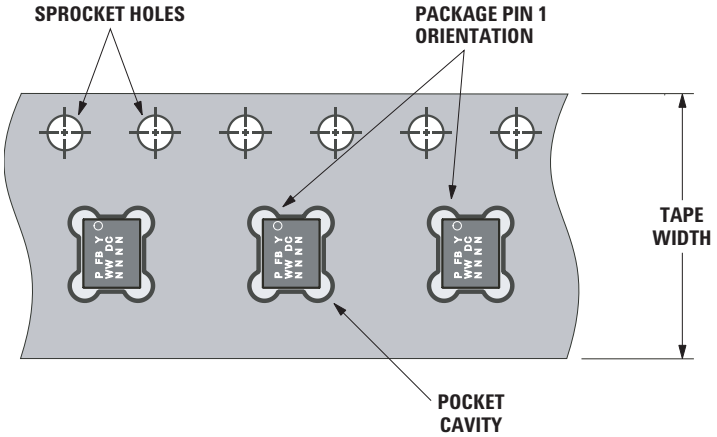



**Figure 27. Unit orientation in tape**

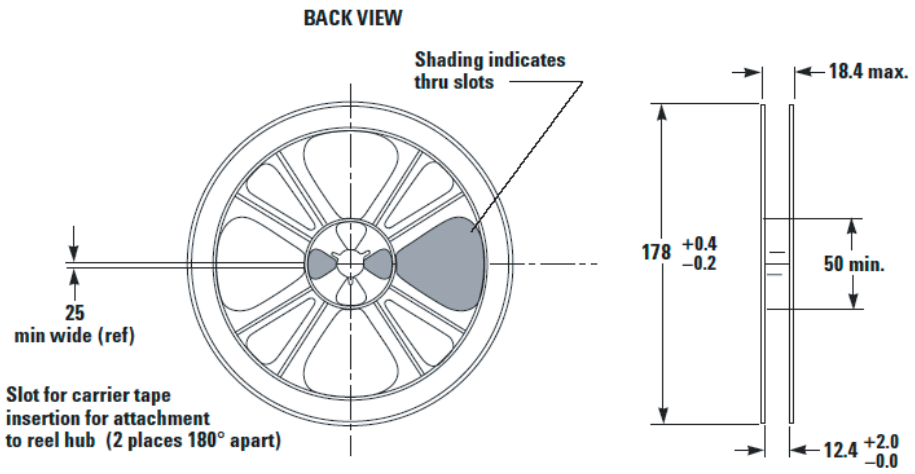
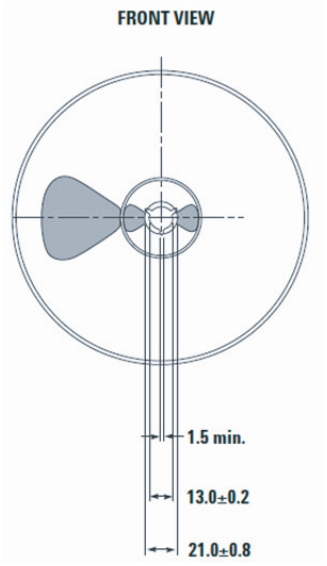



**Figure 28. Reel drawing, back view**

| Reel Component | Resistivity |
|---|---|
| Reel (coated with proprietary antistatic agent) | 10^9 to 10^11 Ohm/Sq |
| Carrier Tape (carbon polystyrene) | 10^9 Ohm/Sq |
| Cover Tape<br>Top Layer – transparent PET film<br>Bonding Layer – adhesive Polyolefin<br>Sealing Layer – peelable, special film | 10^9 to 10^11 Ohm/Sq |




Notes:
1. Reel shall be labeled with the following information (as a minimum):
   a. Manufactures name or symbol
   b. Avago Technologies part number
   c. Purchase order number
   d. Date code
   e. Quantity of units
2. A certificate of compliance © of C) shall be issued and accompany each shipment of product.
3. Reel must not be made with or contain ozone depleting materials.
4. All dimensions in millimeters (mm).

**Figure 29. Reel drawing, front view**

## Package Moisture Sensitivity

| Feature | Test Method | Performance |
|---|---|---|
| Moisture Sensitivity Level (MSL) at 260°C | J-STD-020C | Level 3 |

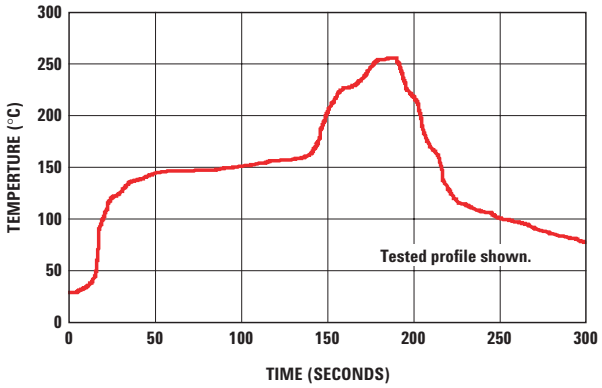



**Figure 30. Verified SMT solder profile**

## ACMD-7612 Ordering Information

| Part Number | No. of Devices | Container |
|---|---|---|
| ACMD-7612-BLK | 25 | Anti-static Bag |
| ACMD-7612-TR1 | 1000 | 178 mm (7-inch) Reel |

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


AV02-0473EN - September 25, 2007

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