

# ACMD-7410

## UMTS/NCDMA/Co-band GSM Rx Band 2 Duplexer



### Data Sheet



### Description

The Avago ACMD-7410 is a highly miniaturized duplexer designed for use in UMTS Band 2 (1850.48 – 1909.52 MHz UL, 1930.48 – 1989.52 MHz DL) handsets and mobile data terminals.

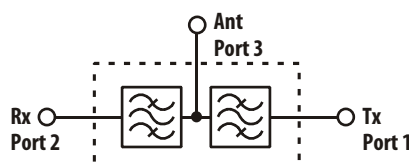
Low Insertion Loss in the Tx channel minimizes current drain from the power amplifier, while low Rx channel Insertion Loss improves receiver sensitivity.

The ACMD-7410 enhances the sensitivity and dynamic range of handset receivers by providing high isolation of the transmitted signal from the receiver input and high rejection of transmit-generated noise in the receive band.

The ACMD-7410 is designed with Avago Technologies' innovative 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 FBAR bulk-mode resonators supports the high output power levels used in mobile communications applications, while adding virtually no distortion.

The ACMD-7410 also utilizes Avago Technologies' advanced Microcap bonded-wafer, chip scale packaging technology. This process allows the filters to be assembled into a molded chip-on-board module with an overall size of only 2.0 x 2.5 mm and maximum height of 0.95 mm. The ACMD-7410 is compatible with standard 2.0 x 2.5 mm duplexer PCB footprints.

### Functional Block Diagram



### Features

- Miniature Size
  - 2.0 x 2.5 mm size
  - 0.95 mm Max height
  - Standard 2 x 2.5 mm PCB footprint
- High Isolation enables elimination of interstage filter
- Co-banding allows elimination of the GSM Rx filter
- High Power Rating
  - 33 dBm Abs Max Tx Power
- Environmental
  - RoHS 6 Compliant
  - Halogen free
  - TBBPA Free

### Specifications

- Rx Band Performance, –20 to +85°C
  - Insertion Loss: 3.2 dB Max
  - Rx Noise Blocking: 50 dB Min
- Tx Band Performance, –20 to +85°C
  - Insertion Loss: 2.8 dB Max
  - Tx Interferer Blocking: 55 dB Min

### Applications

UMTS and NCDMA Handsets or data terminals operating in the Band 2 frequency range.

**ACMD-7410 Electrical Specifications <sup>[2]</sup>,  $Z_0=50\ \Omega$ ,  $T_c$ <sup>[1]</sup> as indicated**

Symbol	Parameter	Units	- 20°C			+25°C			+85°C		
			Min	Typ <sup>[3]</sup>	Max	Min	Typ <sup>[3]</sup>	Max	Min	Typ <sup>[3]</sup>	Max
<b>Antenna Port to Receive Port</b>											
S23	Insertion Loss in Receive Band <sup>[4]</sup> (UMTS 1930.48 – 1989.52 MHz)	dB			3.2		1.4	3.0			2.9
S23	Insertion Loss in Receive Band <sup>[6]</sup> (NCDMA 1930.6 – 1989.4 MHz)	dB			4.0		1.4	3.0			3.2
S23	Insertion Loss in Receive Band (GSM Rx 1930 – 1990 MHz)	dB			4.3		1.4	3.5			3.9
S22	Return Loss (SWR) of Receive Port in Receive Band (1930.48 – 1989.52 MHz)	dB	8		(2.3)	8	14	(2.3)	8		(2.3)
S23	Attenuation in Transmit Band (1850.48 – 1909.52 MHz)	dB	52			52	64		52		
S23	Attenuation, 0 – 1600 MHz	dB	33			33	44		33		
S23	Attenuation, 1770 – 1830 MHz	dB	33			33	45		33		
S23	Attenuation in Bluetooth Band (2400 – 2483.5 MHz)	dB	35			35	44		35		
S23	Attenuation, 3780 – 3900 MHz	dB	35			35	59		35		
S23	Attenuation, 5630 – 5810 MHz	dB	30			30	50		30		
<b>Transmit Port to Antenna Port</b>											
S31	Insertion Loss in Transmit Band <sup>[4]</sup> (UMTS 1850.48 – 1909.52 MHz)	dB			2.9		1.4	2.5			2.8 <sup>[5]</sup>
S31	Insertion Loss in Transmit Band <sup>[6]</sup> NCDMA, 1850.6 – 1852.8 MHz NCDMA, 1852.8 – 1909.4 MHz	dB			3.4 3.0		2.4 1.4	3.0 2.5			2.5 <sup>[5]</sup> 3.5 <sup>[5]</sup>
S11	Return Loss (SWR) of Transmit Port in Transmit Band (1850.48 – 1909.52 MHz)	dB	9		(2.1)	9	18	(2.1)	9		(2.1)
S31	Attenuation in Receive Band (1930.48 – 1989.52 MHz)	dB	44			44	64		44		
S31	Attenuation, 0 – 1600 MHz	dB	30			30	51		30		
S31	Attenuation in GPS Band 1565.42 – 1573.374 MHz 1573.374 – 1577.466 MHz 1577.466 – 1585.42 MHz	dB	40 45 40			40 45 40	49 49 49		40 45 40		
S31	Attenuation in GLONASS Band (1597.5515 – 1605.886 MHz)	dB	45			45	49		45		
S31	Attenuation, 2110 – 2170 MHz	dB	30			30	61		30		
S31	Attenuation in Bluetooth Band (2400 – 2483.5 MHz)	dB	40			40	47		40		
S31	Attenuation in Transmit 2nd Harmonic Band (3700 – 3820 MHz)	dB	20			20	44		20		
S31	Attenuation in Transmit 3rd Harmonic Band (5550 – 5730 MHz)	dB	15			15	31		15		

## ACMD-7410 Electrical Specifications<sup>[2]</sup>, $Z_0=50\ \Omega$ , $T_C$ <sup>[1]</sup> as indicated

Symbol	Parameter	Units	-20°C			+25°C			+85°C		
			Min	Typ <sup>[3]</sup>	Max	Min	Typ <sup>[3]</sup>	Max	Min	Typ <sup>[3]</sup>	Max
<b>Antenna Port</b>											
S33	Return Loss (SWR) of Ant Port in Rx Band (1930.48 – 1989.52 MHz)	dB	8		(2.3)	8	19	(2.3)	8		(2.3)
S33	Return Loss (SWR) of Ant Port in Tx Band (1850.48 – 1909.52 MHz)	dB	9		(2.1)	9	14	(2.1)	9		(2.1)
<b>Isolation Transmit Port to Receive Port</b>											
S21	Tx-Rx Isolation in Receive Band <sup>[4]</sup> UMTS 1930.48 – 1931.60 MHz UMTS 1931.60 – 1989.52 MHz	dB		50		55	66		55		55
S21	Tx-Rx Isolation in Transmit Band <sup>[4]</sup> UMTS 1850.48 – 1909.52 MHz	dB		55		55	61		55		
S21	Tx-Rx Isolation in Receive Band <sup>[6]</sup> NCDMA 1930.6 – 1932.4 MHz NCDMA 1932.4 – 1989.4 MHz	dB		44		55	66		55		55
S21	Tx-Rx Isolation in Transmit Band <sup>[6]</sup> NCDMA 1850.6 – 1909.4 MHz	dB		54		55	61		54		

Notes:

- $T_C$  is the case temperature and is defined as the temperature of the underside of the Duplexer where it makes contact with the circuit board.
- Min/Max specifications are guaranteed at the indicated temperature with the input power to the Tx port equal to or less than +29 dBm over all Tx frequencies unless otherwise noted.
- Typical data is the average value of the parameter over the indicated band at the specified temperature. Typical values may vary over time.
- Integrated Insertion Loss over any 3.84 MHz channel within the band.
- The maximum Tx Insertion Loss specification at  $T_C = +85^\circ\text{C}$  is guaranteed for input power  $\leq +27$  dBm. For Tx input power between +27 dBm and +29 dBm, the Tx Insertion Loss is higher by 0.2 dB. Alternatively, the Tx Insertion Loss specification is compliant to +29 dBm input power for  $T_C \leq 79^\circ\text{C}$ .
- Integrated Insertion Loss over any 1.25 MHz channel within the band.

## Absolute Maximum Ratings<sup>[1]</sup>

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

## Maximum Recommended Operating Conditions<sup>[2]</sup>

Parameter	Unit	Value
Operating temperature, $T_C$ <sup>[3]</sup> , Tx Power $\leq 29$ dBm	°C	-40 to +100
Operating temperature, $T_C$ <sup>[3]</sup> , Tx Power $\leq 30$ dBm	°C	-40 to +85

Notes:

- Operation in excess of any one of these conditions may result in permanent damage to the device.
- 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.
- $T_C$  is defined as case temperature, the temperature of the underside of the duplexer where it makes contact with the circuit board.

### ACMD-7410 Typical Performance at $T_c = 25^\circ\text{C}$

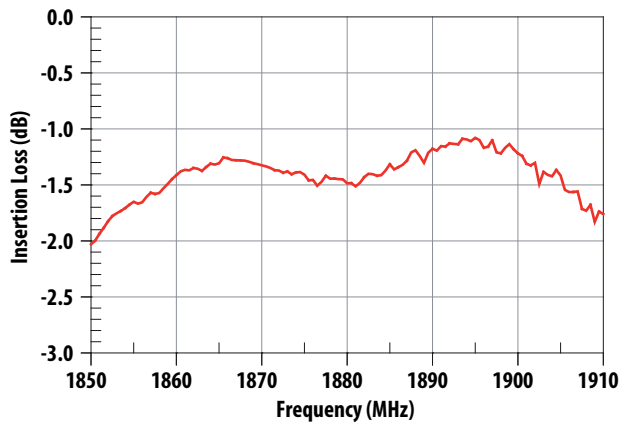


Figure 1. Tx-Ant Insertion Loss

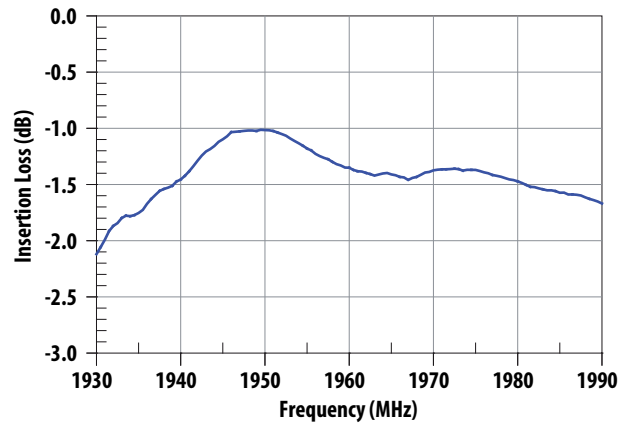


Figure 2. Ant-Rx Insertion Loss

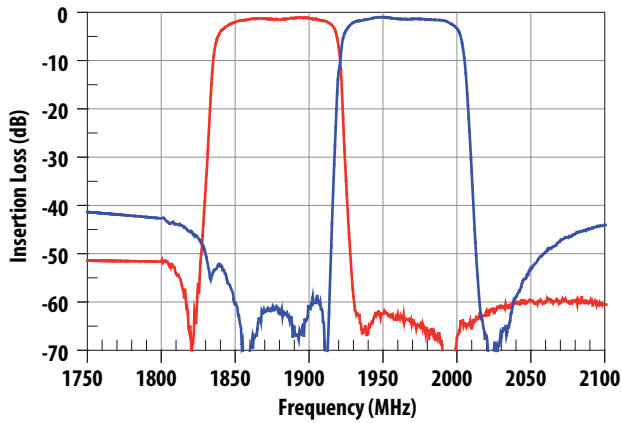


Figure 3. Tx Rejection in Rx Band and Rx Rejection in Tx Band

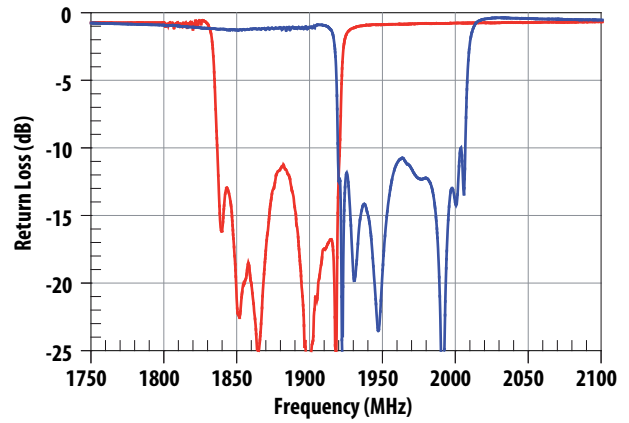


Figure 4. Tx and Rx Port Return Loss

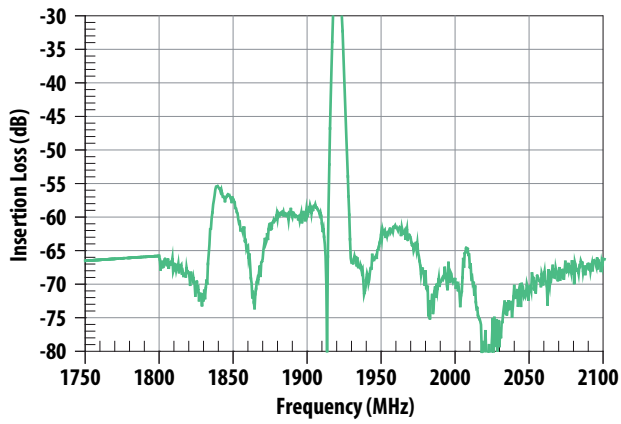


Figure 5. Tx-Rx Isolation

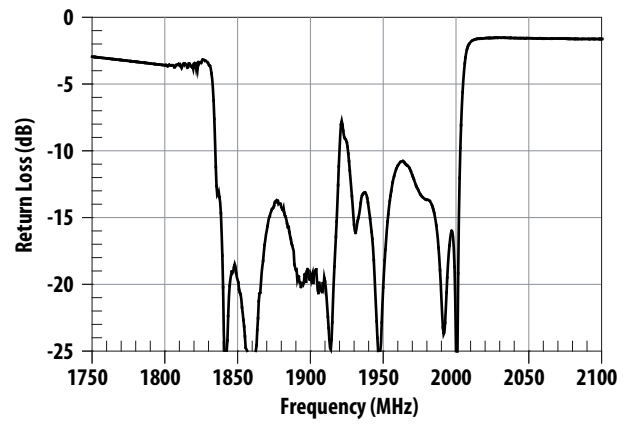


Figure 6. Antenna Port Return Loss

### ACMD-7410 Typical Performance at $T_c = 25^\circ\text{C}$

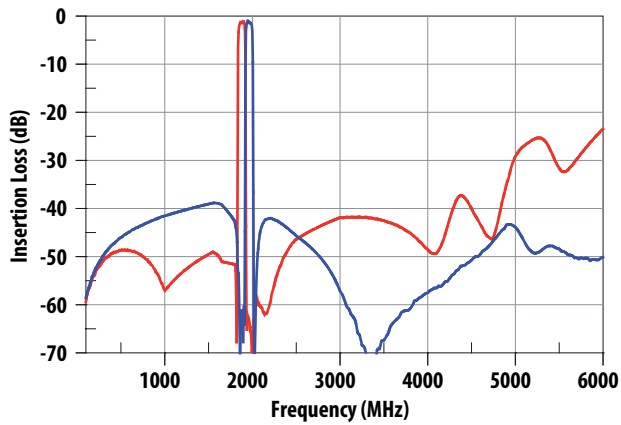


Figure 7. Tx-Ant and Ant-Rx Wideband Insertion Loss

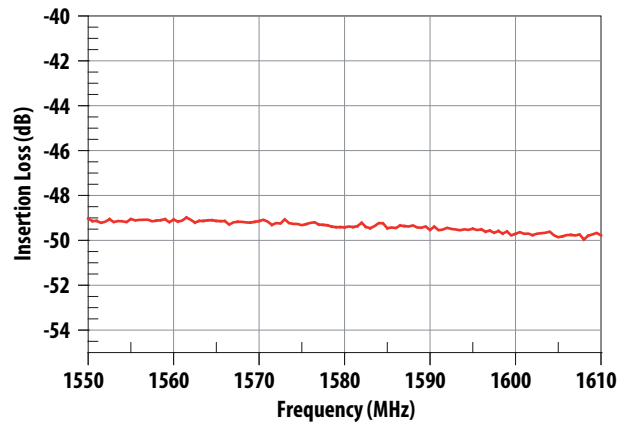


Figure 8. Tx-Ant Rejection in GPS/GLONASS Bands

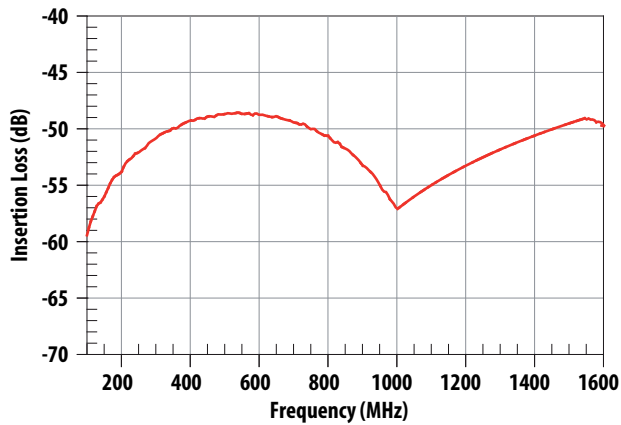


Figure 9. Tx-Ant Low Frequency Rejection

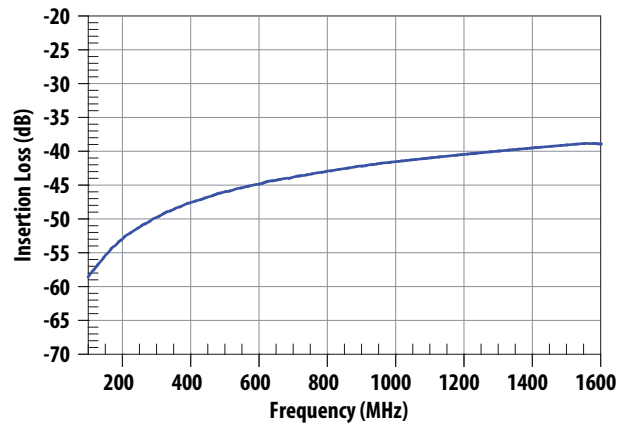


Figure 10. Ant-Rx Low Frequency Rejection

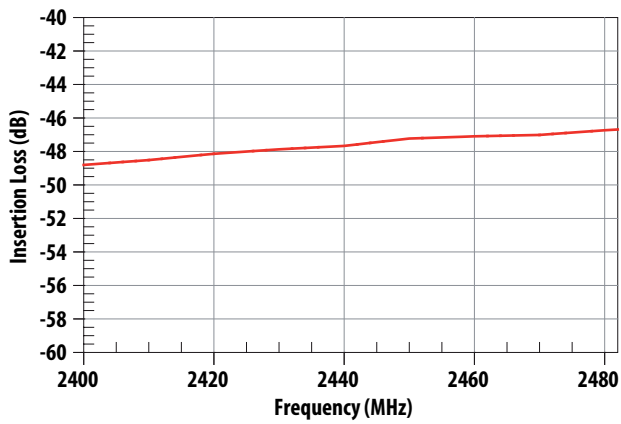


Figure 11. Tx-Ant Rejection in Bluetooth Band

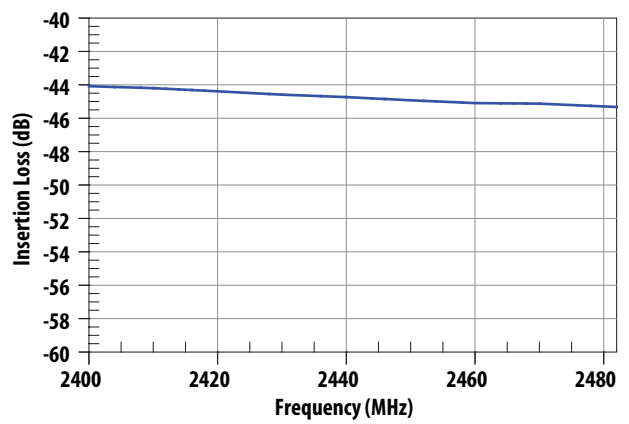


Figure 12. Ant-Rx Rejection in Bluetooth Band

### ACMD-7410 Typical Performance at $T_c = 25^\circ\text{C}$

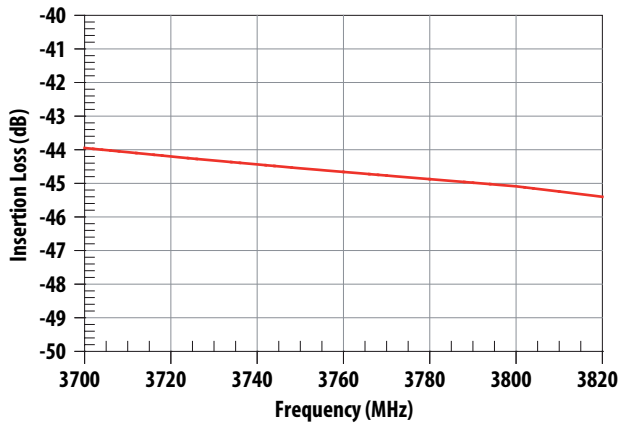


Figure 13. Tx-Ant Rejection at Tx Second Harmonic

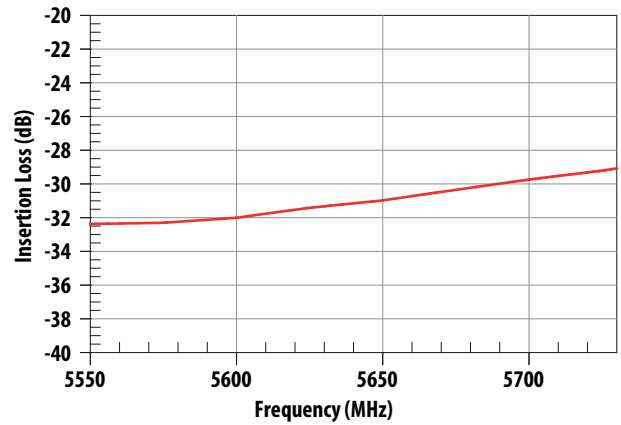


Figure 14. Tx-Ant Rejection at Tx Third Harmonic

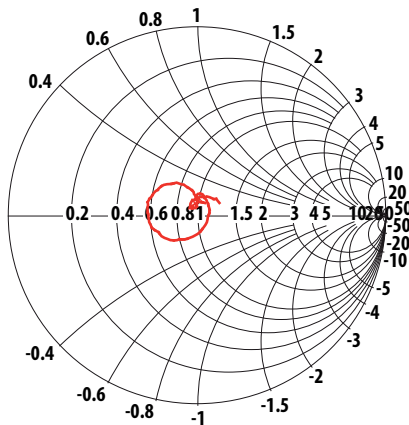


Figure 15. Tx Port Impedance in Tx Band

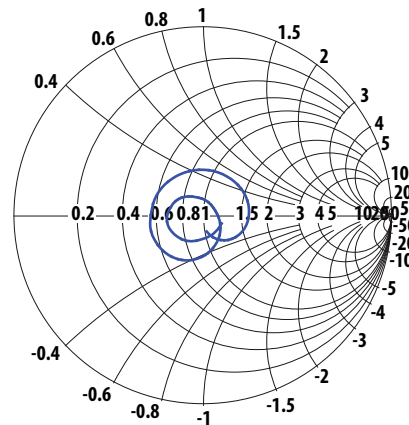


Figure 16. Rx Port Impedance in Rx Band

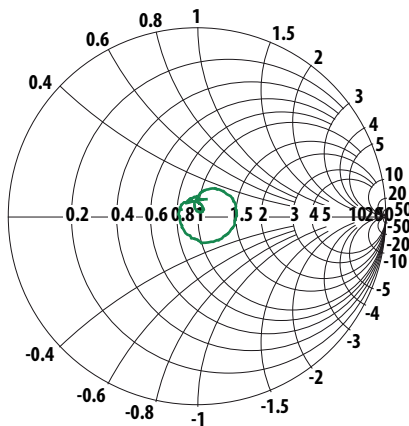


Figure 17. Ant Port Impedance in Tx Band

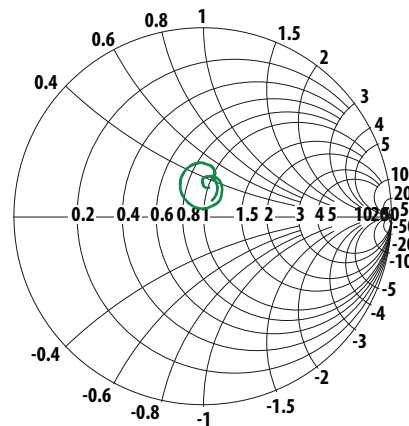
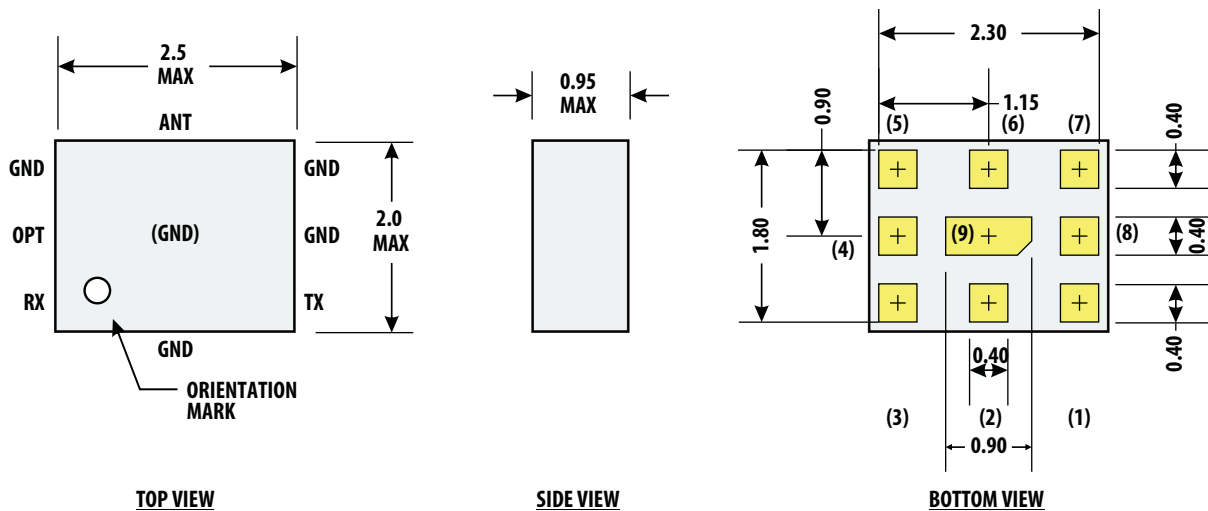


Figure 18. Ant Port Impedance in Rx Band



Notes:

1. Dimensions in millimeters  
Tolerance:  $X.X \pm 0.1$  mm  
 $X.XX \pm 0.05$  mm
2. Dimensions nominal unless otherwise noted
3. Angles  $45^\circ$  nominal
4. I/O Pads (3 ea)  
Size:  $0.40 \times 0.40$  mm  
Spacing to ground metal: 0.30 mm
5. Contact areas are gold plated

Pin Connections:

- |               |                            |
|---------------|----------------------------|
| 1             | Rx (or RX(+))              |
| 2, 4, 5, 7, 9 | Gnd                        |
| 3             | Tx                         |
| 6             | Ant                        |
| 8             | Optional: Gnd, NC or Rx(-) |

Figure 19. Package Outline Drawing

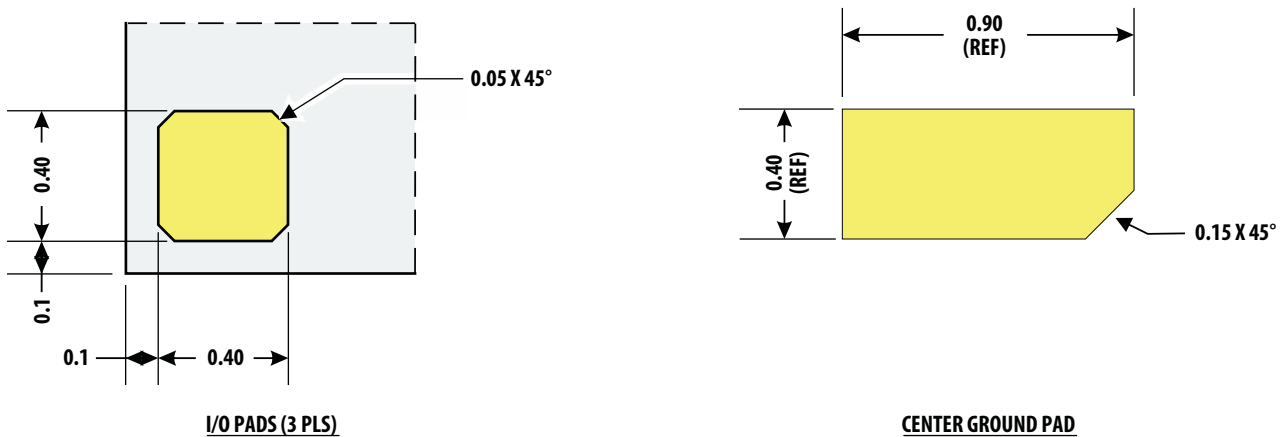
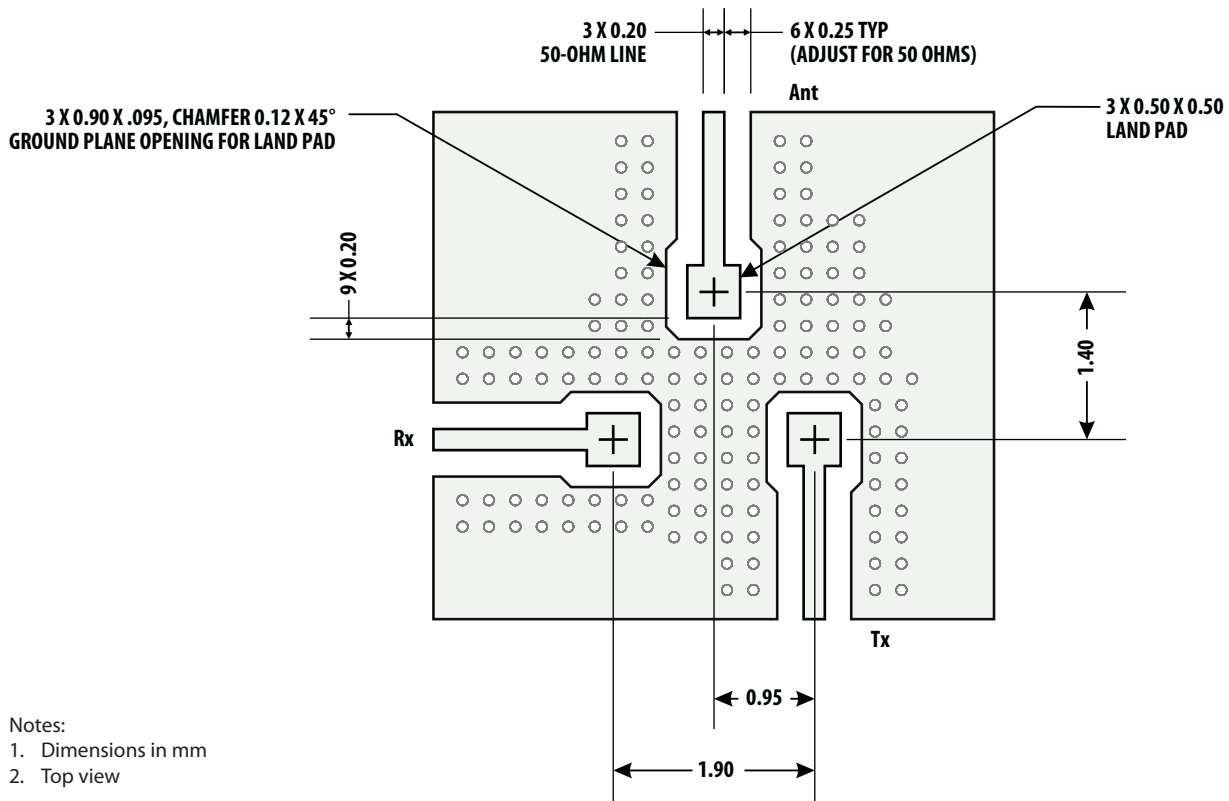


Figure 20. Pad Detail



**Figure 21. Suggested PCB Layout**

A PCB layout using the principles illustrated in the figure above is recommended to optimize performance of the ACMD-7410.

Note: Pin 8 (Rx-) is grounded in this example.

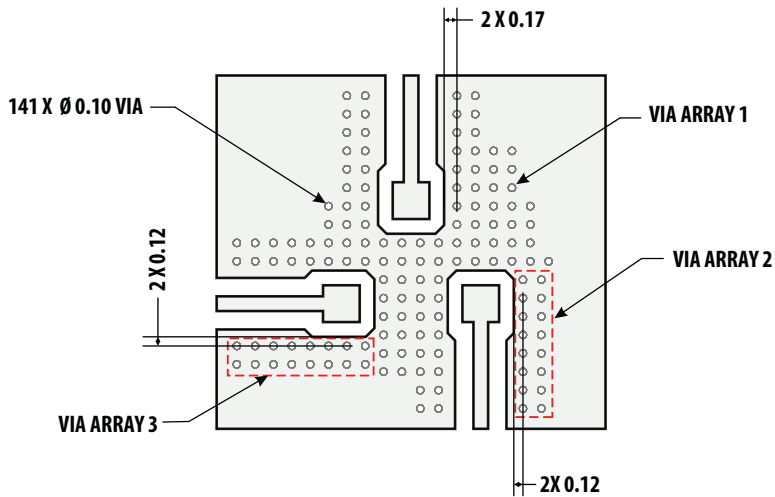
The transmission line dimensions shown are designed to achieve an impedance of 50 ohms for an 80 $\mu$ m thick PCB layer with a dielectric constant of 3.4. If other PCB materials or thicknesses are used, the 0.25 mm gap spacing may need to be adjusted to retain a  $Z_0$  of 50 ohms.

It is important to maximize isolation between the Tx and Rx ports.

High isolation is achieved by: (1) maintaining a continuous ground plane around the I/O connections and duplexer mounting area, and (2) surrounding the I/O ports with sufficient ground vias to enclose the connections in a "Faraday cage."

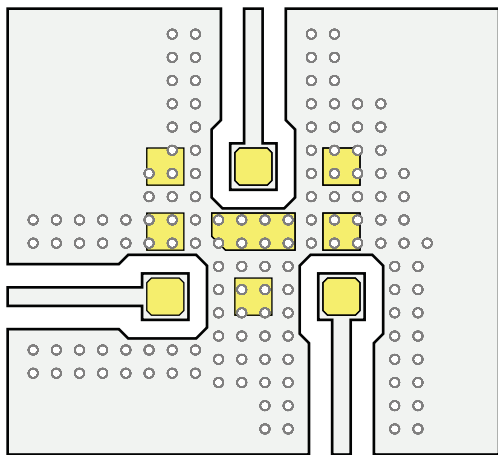
The ground vias under the ACMD-7410 mounting area are also needed to provide adequate heat sinking for the device.





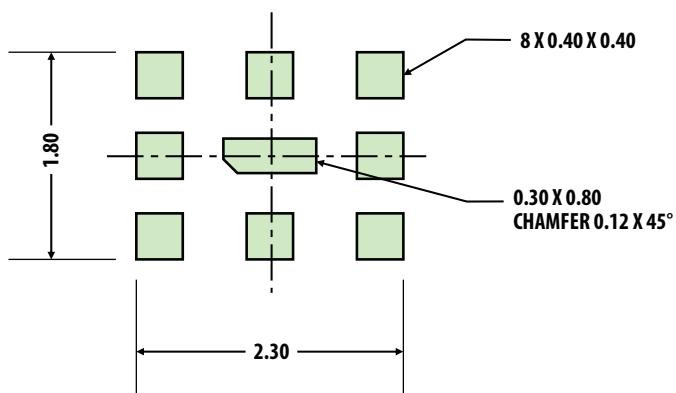
- Notes:
1. Dimensions in mm
  2. Top view
  3. Via arrays: horiz pitch = 0.25, vert pitch = 0.25

Figure 22. PCB Layout, Via Detail



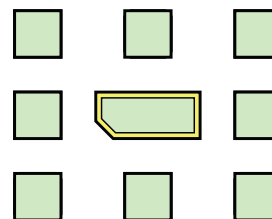
- Note:
1. Top view

Figure 23. ACMD-7410 Superposed on PCB Layout



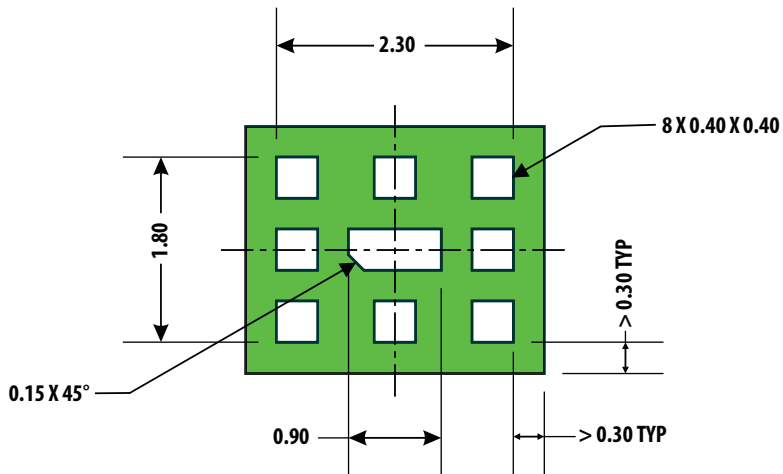
- Notes:
1. Dimensions in mm
  2. Top view
  3. Chamfer or radius all corners 0.05 mm min

Figure 24. Recommended Solder Stencil



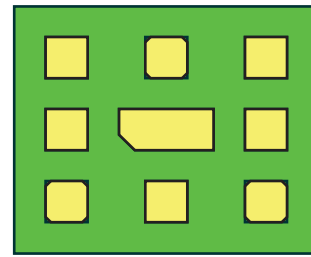
- Notes:
1. Top view
  2. Peripheral clearance of stencil aperture for center device pad is 0.05 mm. All other apertures match device pad 1:1

Figure 25. Solder Stencil Superposed on ACMD-7410



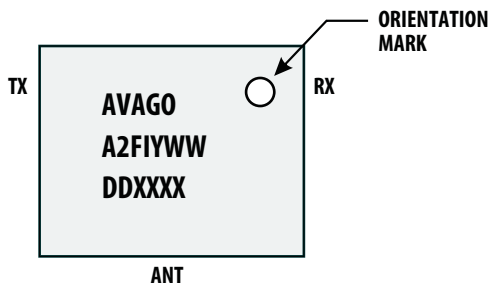
- Notes:
1. Dimensions in mm
  2. Top view

Figure 26. Recommended Solder Mask



- Notes:
1. Top view
  2. Mask apertures match device pads 1:1

Figure 27. Solder Mask Superposed on ACMD-7410



- A2 = ACMD-7410
- FI = Mfg Information
- Y = Year
- WW = Work Week
- DD = Date Code
- XXXX = Assembly Lot

Figure 28. Product Marking and Pin Orientation

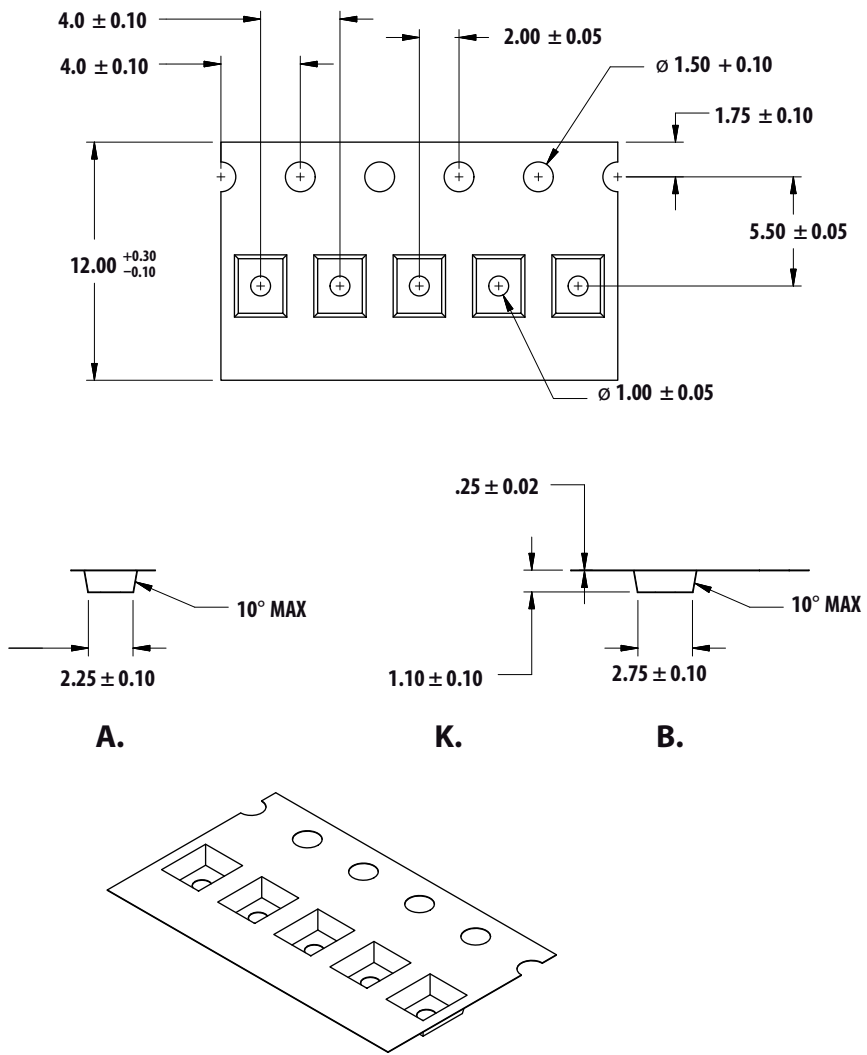


Figure 29. SMD Tape Packing (Dimensions for actual tape carrier may vary slightly)

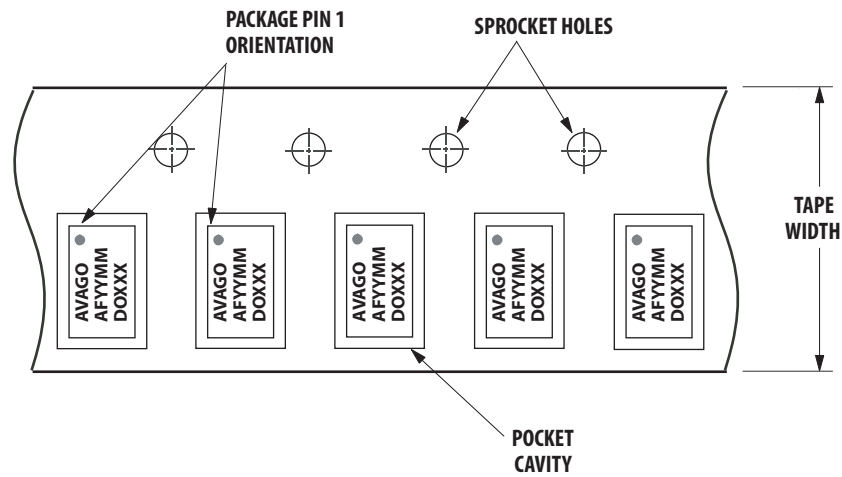
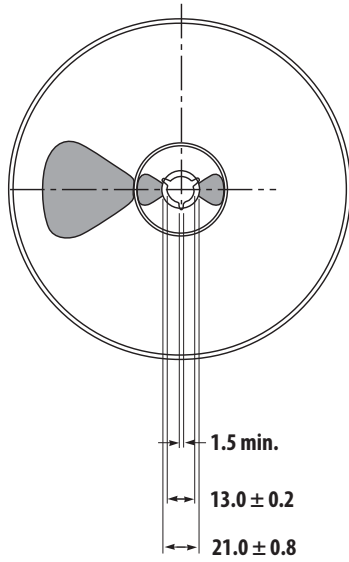


Figure 30. Unit Orientation in SMT Tape

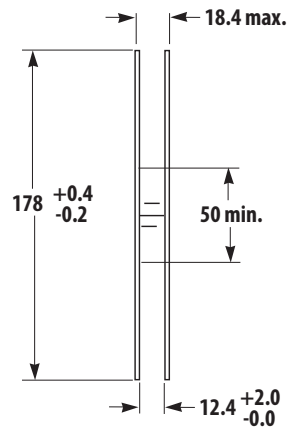
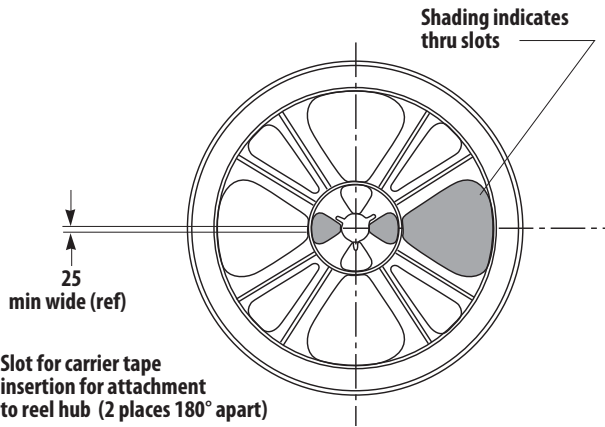
**FRONT VIEW**



**NOTES:**

1. Reel shall be labeled with the following information (as a minimum).
  - a. manufacturers name or symbol
  - b. Avago Technologies part number
  - c. purchase order number
  - d. date code
  - e. quantity of units
2. A certificate of compliance (c 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)

**BACK VIEW**



**Figure 31. SMT Reel Drawing**

## Package Moisture Sensitivity

Feature	Test Method	Performance
Moisture Sensitivity Level (MSL) at 260°C	JESD22-A113D	Level 3

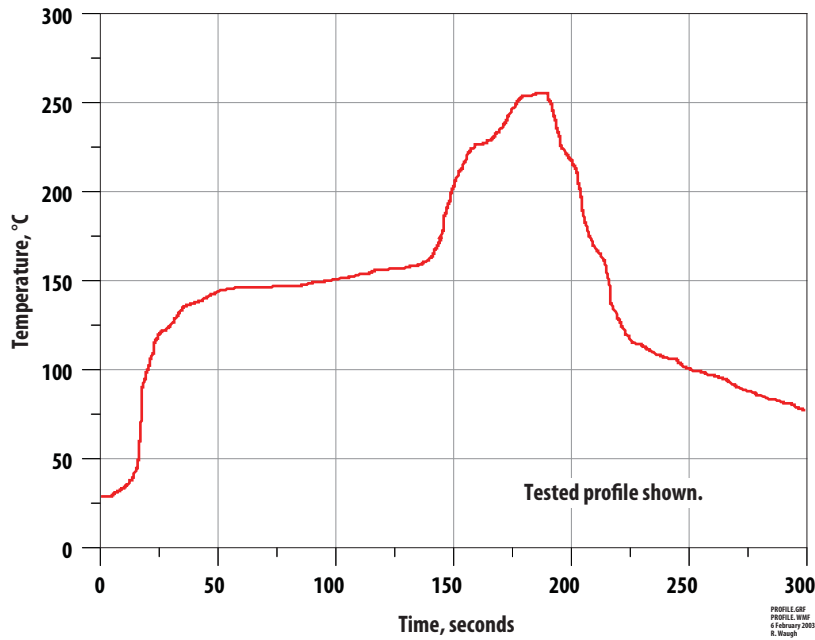


Figure 32. Verified SMT Solder Profile

## Ordering Information

Part Number	No. of Devices	Container
ACMD-7410-BLK	100	Tape strip or Anit-static Bag
ACMD-7410-TR1	3000	7-inch Reel

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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AV02-2360EN - July 15, 2010

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