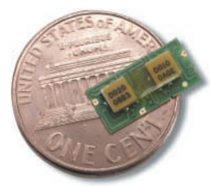
Agilent HPMD-7904 FBAR Duplexer for US PCS Band

Data Sheet



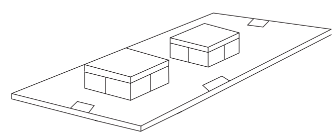
General Description

The HPMD-7904 is a miniaturized duplexer designed for US PCS handset, designed using Agilent Technologies' Film Bulk Acoustic Resonator (FBAR) Technology. The HPMD-7904 features a very small size: it is less than 2 mm thick and has a footprint of only 5.6 x 11.9 mm^2.

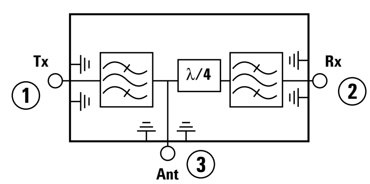
The HPMD-7904 enhances the sensitivity and dynamic range of CDMA receivers, providing more than 50 dB attenuation of transmitted signal at the receiver input, and more than 40 dB rejection of the transmit-generated noise in the receive band. Typical insertion loss in the Tx channel is only 1.8 dB, minimizing current drain from the power amplifier. Typical insertion loss in the Rx channel is 2.2 dB, improving receiver sensitivity.

Agilent's thin-Film Bulk Acoustic Resonator (FBAR) technology makes possible high-Q filters at a fraction their usual size. The excellent power handling of the bulk-mode resonators supports the high output powers needed in PCS handsets, with virtually no added distortion.

Board Diagram



Functional Block Diagram



port numbers are circled

Features

- Miniature size: less than 2 mm high;
  5.6 x 11.9 footprint
- Rx Band: 1930-1990 MHz
  Typical performance:
  Rx noise blocking: 42dB
  Insertion loss: 2.2 dB typical
  3.0 dB band edge
- Tx Band: 1850-1910 MHz
  Typical performance:
  Tx interferer blocking: 54dB
  Insertion Loss: 1.8 dB typical
  2.5 dB band edge
- 30 dBm Tx power handling

Applications

- Handsets or data terminals operating in the US PCS frequency band

HPMD-7904 Electrical Specifications, $Z_0 = 50\Omega$, T_C[1] as indicated

			+25°C[1,3]			+85°C[1,2,3]			–30°C[1,2,3]		
Symbol	**Parameters**	**Units**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**
f_{RX}	Receive Bandwidth	MHz	1930.6	—	1989.4	1930.6	—	1989.4	1930.6	—	1989.4
S23 Rx	Attenuation in Transmit Band (1850.6 – 1909.4 MHz)	dB	50	54	—	50	52	—	50	52	—
S23 Rx	Typical Insertion Loss in Receive Band (1935– 1985MHz)	dB	—	2.2	3.5	—	2.2	3.8	—	2.2	3.8
S23 Rx	Insertion Loss at Edges of Receive Band (1930.6-1935 MHz and 1985-1989.4 MHZ)	dB	—	3.0	3.5	—	3.0	3.8	—	3.0	4.5
Δ S23	Ripple in Receive Band	dB	—	1.5	—	—	1.5	—	—	2.0	—
S22 Rx	Return Loss in Receive Band	dB	8.0	10	—	8.0	10	—	8.0	10	—
f_{TX}	Transmit Bandwidth	MHz	1850.6	—	1909.4	1850.6	—	1909.4	1850.6	—	1909.4
S31 Tx	Attenuation in Receive Band (1930.6 – 1935 MHz)	dB	40	42	—	40	42	—	37	42	—
S31 Tx	Attenuation in Receive Band (1935– 1989.4 MHz)	dB	40	42	—	40	42	—	40	42	—
S31 Tx	Insertion Loss in Transmit Band (1855– 1905 MHz)	dB	—	1.8	3.0	—	1.8	3.5	—	1.8	3.5
S31 Tx	Insertion Loss at Edges of Transmit Band (1850.6-1855 MHz and 1905-1909.4 MHz)	dB	—	2.5	3.0	—	3.0	3.8	—	3.0	3.6
Δ S31	Ripple in Transmit Band	dB	—	2.0	—	—	3.0	—	—	2.0	—
S11 Tx	Return Loss in Transmit Band	dB	8.0	10	—	8.0	10	—	8.0	10	—
S33 Ant	Return Loss, Tx and Rx bands	dB	8.0	—	—	—	—	—	—	—	—
S21	Tx-Rx Isolation, 1850.6 – 1909.4 MHz (Transmit Band)	dB	50	54	—	50	54	—	50	54	—
S21	Tx-Rx Isolation, 1930.6 – 1935 MHz (Receive Band)	dB	40	42	—	40	42	—	38	42	—
S21	Tx-Rx Isolation, 1935– 1989.4 MHz (Receive Band)	dB	40	42	—	40	42	—	40	42	—

Absolute Maximum Ratings[4]

Parameter	Unit	Value
Operating temperature[1]	°C	-30 to +85
Storage temperature[1]	°C	-30 to +100

Notes:

1. T_C is defined as case temperature, the temperature of the underside of the duplexer where it makes contact with the circuit board.
2. Specifications are given at operating temperature limits and room temperature. To estimate performance at some intermediate temperature, use linear interpolation.
3. Specifications are guaranteed over the given temperature range, with the input power to the Tx port equal to +30 dBm (or lower) over all Tx frequencies. The application of input power levels in excess of +30 dBm will not destroy the duplexer, but its performance may exceed the specification limits given above.
4. Operation in excess of any one of these conditions may result in permanent damage to the device.

The plots below provide typical performance obtained from samples of the HPMD-7904 duplexer.

In order to obtain the best performance from the HPMD-7904 duplexer, refer to Design Note D007, which is available from your Agilent Technologies technical support or sales departments.

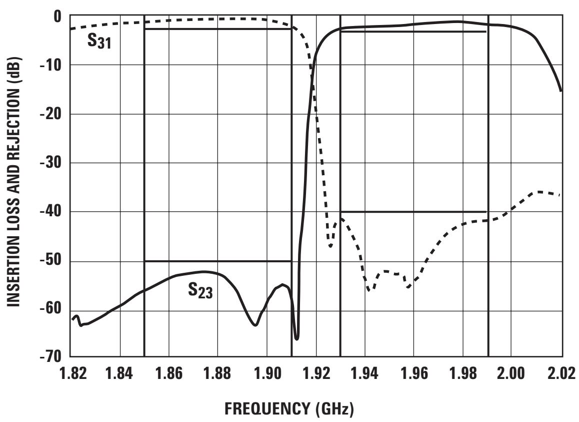


Figure 1. Tx and Rx Port Insertion Loss (typical).

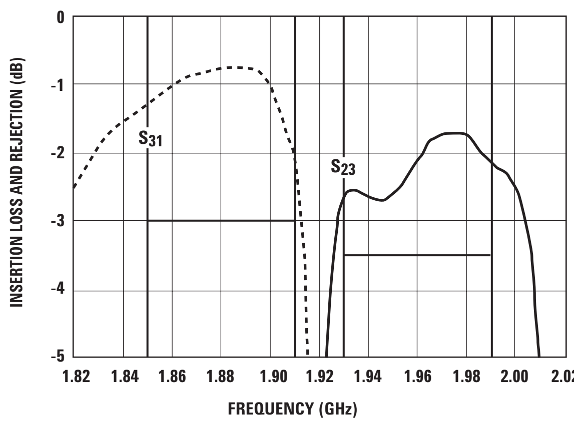


Figure 2. Insertion Loss Detail (typical).

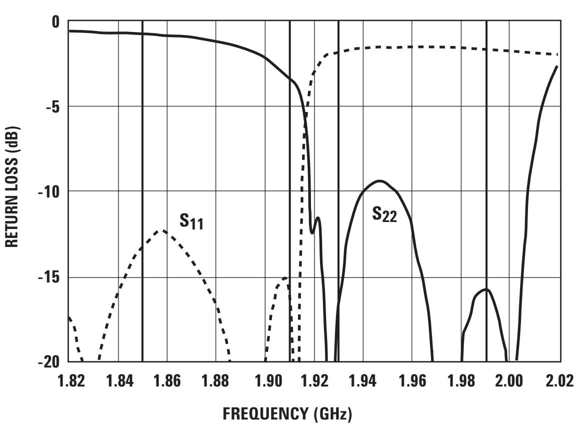


Figure 3. Tx and Rx Port Return Loss (typical).

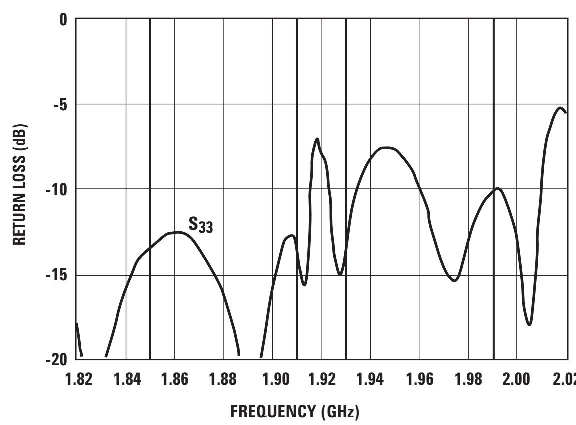


Figure 4. Ant Port Return Loss (typical).

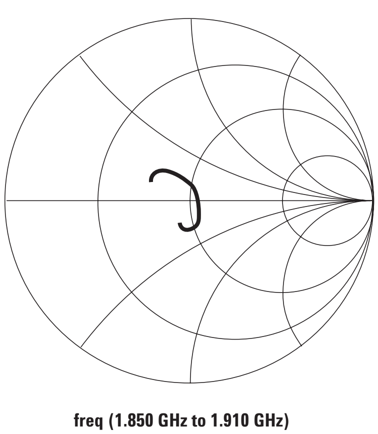


Figure 5. S11, Tx Port Impedance (typical).

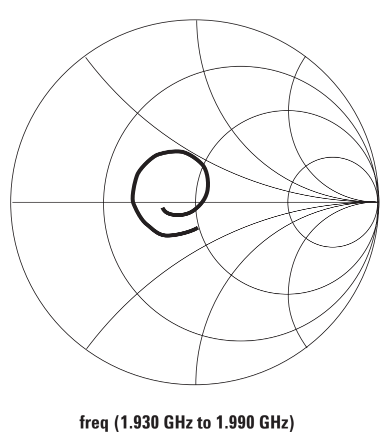


Figure 6. S22, Rx Port Impedance (typical).

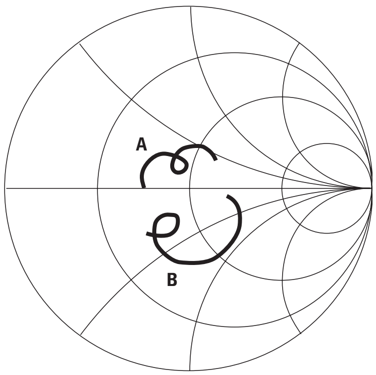


Figure 7. S33, Ant Port Impedance.

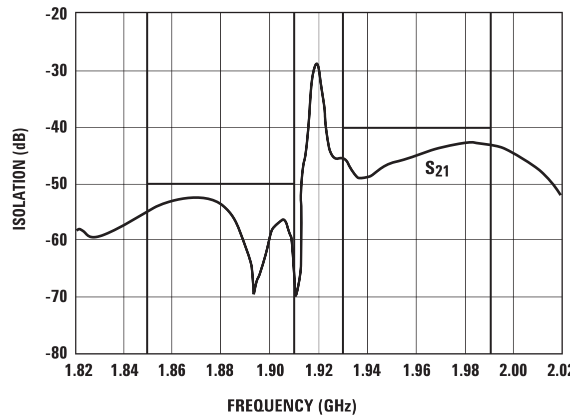


Figure 8. S21, Isolation (typical).

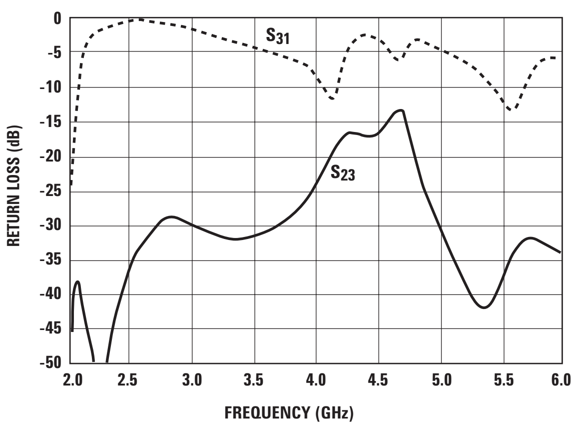


Figure 9. Wideband Insertion Loss (typical).

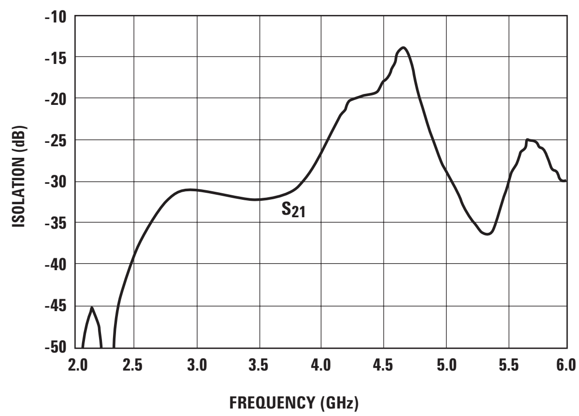


Figure 10. Wideband Isolation (typical).

Note that the specifications given on page 2 are guaranteed when the duplexer is mounted on a ground surface with a hole pattern like that one shown in Figure 11. See Design Note D007, which is available from your Agilent Technologies technical support or sales departments.

Note that it is important that proper heat sinking be provided in order to remove the heat generated in the Tx filter by the handset's power amplifier. Failure to do so may result in excessive losses, especially at the top end of the Tx band.

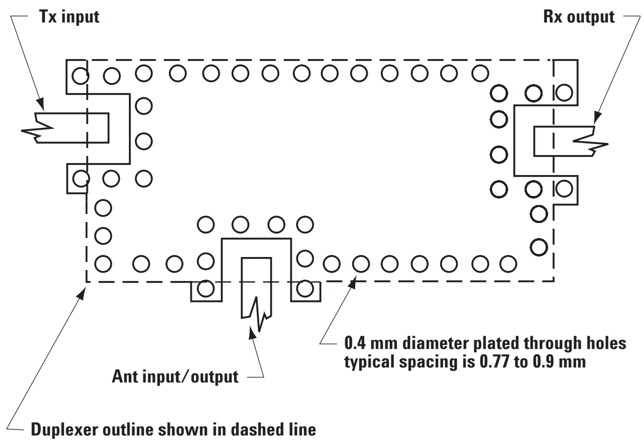
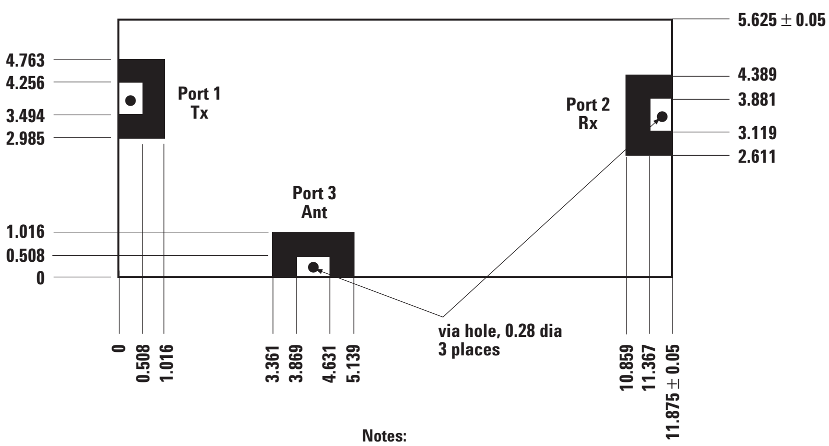
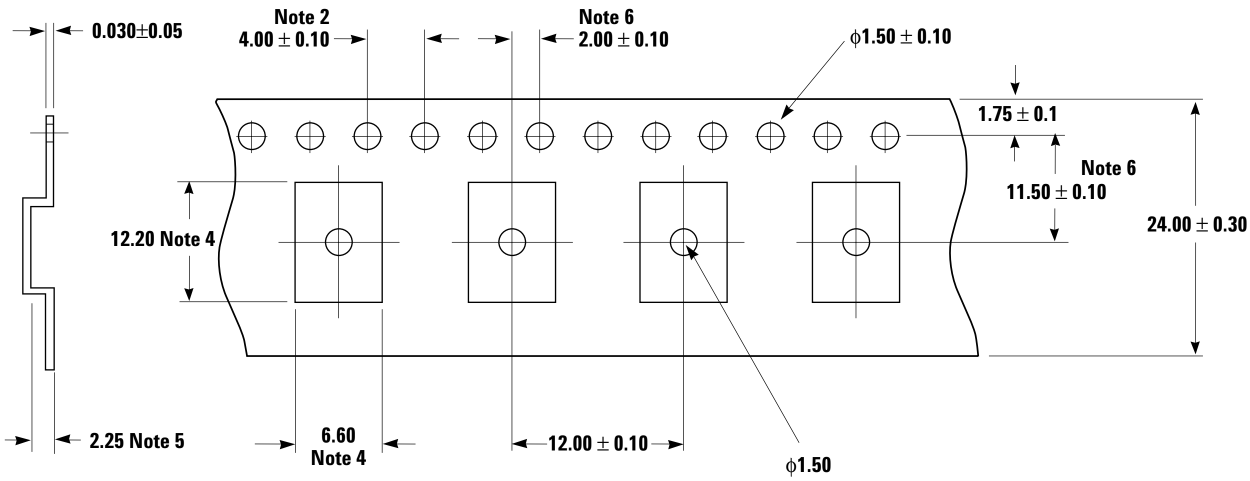


Figure 11. Mounting (grounding) Pattern.



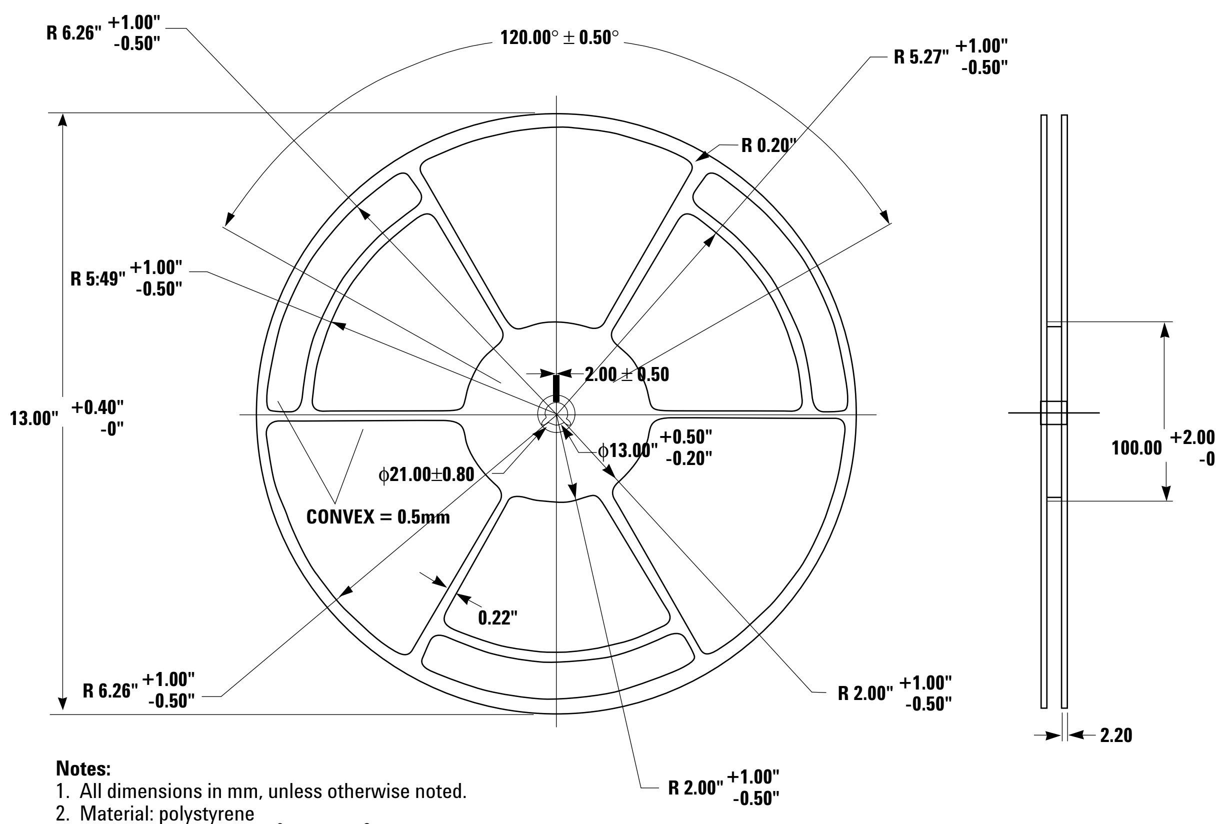
Notes:
View of the duplexer underside, seen from the top.
All dimensions in millimeters.
Pin assignments are as shown above.
Maximum duplexer height is 1.9 mm.

Figure 12. Outline Drawing.



Notes:
1. All dimensions in mm.
2. 10 sprocket hole pitch accumulative tolerance ± 0.10 mm
3. Camber not exceed 1 mm in 250 mm
4. Pocket dimensions measured on a plane 0.3 mm above the bottom of the pocket.
5. Pocket depth measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position on relative to sprocket hole measure as true position of pocket, not the pocket hole.

Figure 13. Tape Drawing.



Notes:
1. All dimensions in mm, unless otherwise noted.
2. Material: polystyrene
3. Surface resistivity: 1x10^9 ohm-mm^2

Figure 14. Reel Drawing.

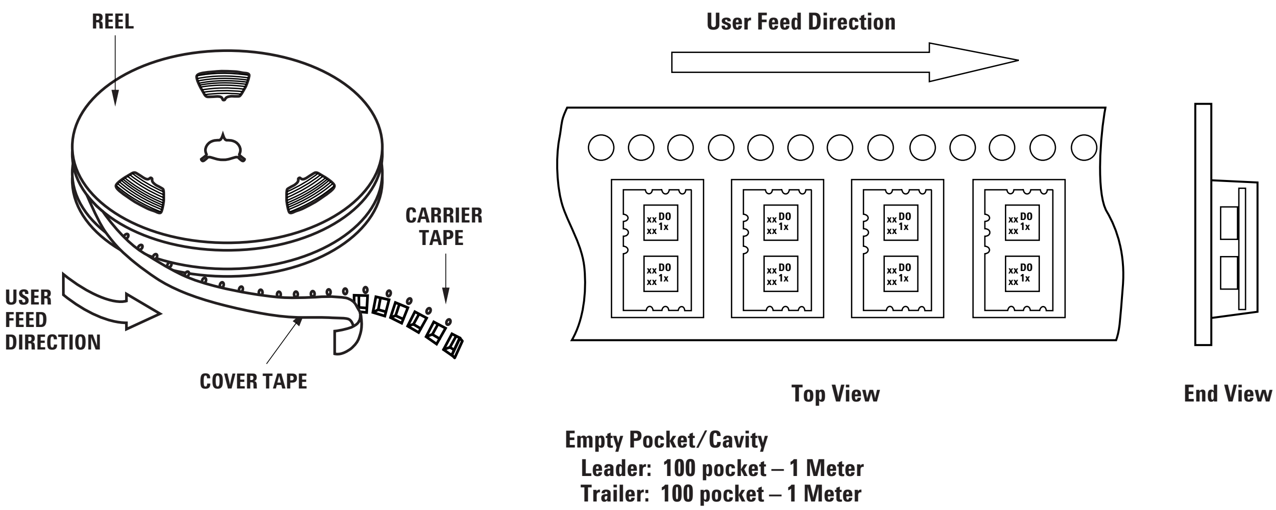


Figure 15. Device Orientation.

Solder Recommendations

The HPMD-7904 FBAR duplexer (and its variants) is an assembly consisting of two LCC ceramic packages, containing the Tx and Rx filters, mounted to a small circuit board. Both packages on the circuit board are mounted in place using Sn96.5/Ag3.5 solder (shaded in Table 1).

The recommended solder profile for the FBAR duplexer is shown in Figure 16. Guidelines and a typical profile are both shown. This typical profile was tested on ten samples of the duplexer, each of which was subjected to the profile six times without effect upon the mechanical or electrical characteristics of the device.

Solder temperatures and times in excess of those given in the guidelines of Table 1 may result in damage to the duplexer or changes in its characteristics.

Table 1. Solder Compositions

Alloy type	Melting temp. (°C)	Recommended working temperature (°C)	Comments
Sn42Bi58	138	160 – 180	Lead free
Sn43Pb43Bi14	144 – 163	165 – 185	Contains lead – some customers prohibit it.
Sn63Pb37	183	200 – 240	Contains lead – some customers prohibit it.
Sn60Pb40	186	200 – 240	Contains lead – some customers prohibit it.
Sn91/Zn9	199	200 – 240	May have oxidation problems
Sn96.2Ag2.5Cu0.8Sb0.5	216	235 – 255	Popular lead free composition
Sn95.8Ag3.5Cu0.7	217	235 – 255	Other alloy ratios are available
Sn96.5Ag3.5	**221**	**240 – 260**	**Used in the assembly of duplexers**
Sn100	232	260 – 280	Too hot – will melt the duplexer
Sn95Sb5	235	260 – 280	Too hot – will melt the duplexer
Sn97Cu3	240	260 – 300	Too hot – will melt the duplexer

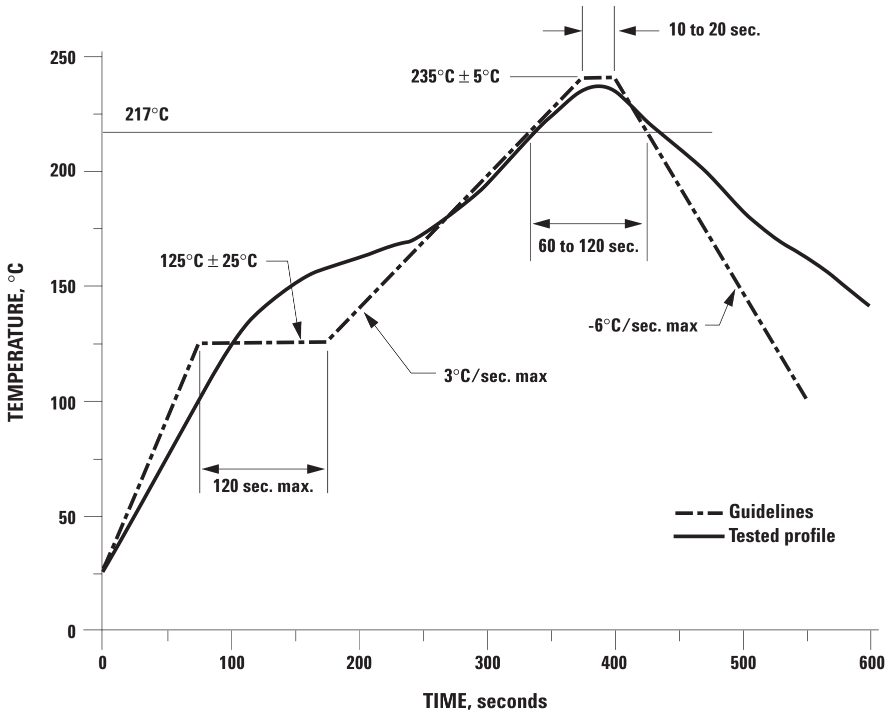


Figure 16. Recommended Solder Profile.

www.agilent.com/semiconductors

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Data subject to change.

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