**LEAD-FREE / RoHS-COMPLIANT**

**HIGH POWER SURFACE-MOUNT BALUN**

**Features**
- 10 MHz to 12 GHz 1:1 Balun (Balanced to Unbalanced Transformer)
- High 37 dBm 1-dB compression enables high power applications
- Tuned for Optimal Phase/Amplitude Balance
- Applications: Analog to Digital Converters, Balanced Receivers, Baseband Digital Modulation, Signal Integrity
- [BAL-0012SSG.s3p](#)

**Electrical Specifications** - Specifications guaranteed from -55 to +100°C, measured in a 50Ω system.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency Range</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>Insertion Loss as a mode converter (dB)</td>
<td>10 MHz to 12 GHz</td>
<td>2</td>
<td>3.5</td>
<td></td>
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<tr>
<td>Nominal Phase Shift (Degrees)</td>
<td></td>
<td>180</td>
<td></td>
<td></td>
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<tr>
<td>Amplitude Balance (dB)</td>
<td></td>
<td>0.6</td>
<td>1.8</td>
<td></td>
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<tr>
<td>Phase Balance (Degrees)</td>
<td></td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Common Mode Rejection (dB)</td>
<td></td>
<td>16</td>
<td>25</td>
<td></td>
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<tr>
<td>Isolation (dB)</td>
<td></td>
<td>5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSWR (Common)</td>
<td></td>
<td>1.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSWR (Output)</td>
<td></td>
<td>1.35</td>
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<td></td>
</tr>
<tr>
<td>Input 1dB Compression (dBm)</td>
<td></td>
<td>37</td>
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<td></td>
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</table>

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>BALH-0012SSG</td>
<td>10 MHz to 12 GHz Balun, Surface Mount, LEAD-FREE/RoHS COMPLIANT</td>
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<tr>
<td>EVAL-BALH-0012</td>
<td>Connectorized Evaluation Fixture, LEAD-FREE/RoHS COMPLIANT</td>
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</table>
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Block Diagram

Single ended to differential

Differential to single ended

Outline Drawing

Shaded Areas are Metal

Substrate material is 8-mil thick Rogers 4003, 1 Oz Rolled Cu. I/O Pads & Ground Plane Finish is Gold, 2 to 8 μ-inches, over solderable Electroplated Nickel, 100-200 μ-inches per QQ-N-290A. Or ENIG

215 Vineyard Court, Morgan Hill, CA 95037 | Ph: 408.778.4200 | Fax 408.778.4300 | info@markimicrowave.com

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PCB Footprint Drawing

The landing pattern is to be used on Rogers4003 0.008" thick. Grounded coplanar waveguide with 0.005" slot

SMA female connector, 3PL

All measurements are typical.

Ground Pad/ Apply solder paste in hatch pattern with 40-60% fill ratio to prevent signal shorts

Click here for a DXF of the above layout.

Eval Package Outline Drawing
Mixed mode scattering parameters are used to characterize differential circuits. For baluns, this means that the 0° and 180° ports become a single differential port and the common port remains common port. The two-port s-parameters of the balun are then characterized based on differential (d), common mode (c), or single-ended (s) signals. For example: Sds12 is the differential output response given a single ended input.

Fig. 1. Insertion loss as a mode converter

Fig. 2. Insertion loss as a mode converter, 50 units spread

Fig. 3. Differential port return loss

Fig. 4. Insertion loss of a common mode signal

Fig. 5. Reflection converted between differential and common modes

Fig. 6. Return loss of a common mode signal
Typical Performance Scattering Parameter

Three port scattering parameters measured as three single-ended 50Ω ports showing relationship between any two ports.

Fig. 7. Unbalanced port return loss

Fig. 8. Common to output port insertion loss

Fig. 9. Return loss for common port and output ports.

Fig. 10. Common mode rejection.

Fig. 11. Common mode rejection, 50 unit spread.
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Fig. 12. Amplitude balance between output ports.

Fig. 13. Amplitude balance between output ports, 50 unit spread.

Fig. 14. Phase balance between output ports.

Fig. 15. Phase balance between output ports, 50 unit spread.

Fig. 16. Isolation between output ports

Fig. 17. Low Frequency Insertion Loss
DC Interface

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>DC Interface Schematic</th>
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</thead>
<tbody>
<tr>
<td>Common Port / In (Unbalanced)</td>
<td>The common port is DC short to ground.</td>
<td>![Common Port (Unbalanced)]</td>
</tr>
<tr>
<td>Out 1 / 0° Port (Balanced)</td>
<td>The 0° port is DC short to ground.</td>
<td>![0° Port (Balanced)]</td>
</tr>
<tr>
<td>Out 2 / 180° Port (Balanced)</td>
<td>The 180° port is DC short to ground.</td>
<td>![180° Port (Balanced)]</td>
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Absolute Maximum Ratings

<table>
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<tr>
<th>Parameter</th>
<th>Maximum Rating</th>
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<tbody>
<tr>
<td>DC Current</td>
<td>TBD</td>
</tr>
<tr>
<td>RF Power Handling</td>
<td>33 dBm</td>
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<tr>
<td>Operating Temperature</td>
<td>-55°C to +100°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +125°C</td>
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</table>
DATASHEET NOTES:
1. $S_{dd11}$: differential return loss of the differential port driven with a differential signal
   $S_{dc11}$: differential return loss of the differential port driven with a common signal
   $S_{ds12}$: insertion loss from a single ended input to a differential output
   $S_{cc11}$: common mode return loss of the differential port driven with a common signal
   $S_{cd11}$: common mode return loss of the differential port driven with a differential signal
   $S_{cs12}$: insertion loss from a single ended input to a common output
   $S_{ss22}$: single ended return loss
   $S_{sd21}$: insertion loss from a differential signal to single ended output
   $S_{sc12}$: insertion loss from a common signal to single ended output

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Revision History

<table>
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<tr>
<th>Revision code</th>
<th>Revision Date</th>
<th>Comment</th>
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<tbody>
<tr>
<td>-</td>
<td>August 2020</td>
<td>Draft</td>
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