

# ALM-1522

700 – 1100 MHz Low Noise, High Gain, High Linearity  
Balanced Amplifier Module



## Data Sheet

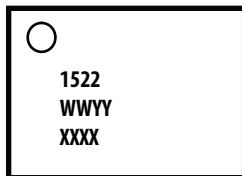
### Description

Avago Technologies' ALM-1522 is a low noise, high gain and high linearity balanced amplifier module operating in the 700MHz to 1100MHz frequency range. The exceptional noise and linearity performance are achieved through the use of Avago Technologies' proprietary 0.25um GaAs Enhancement-mode pHEMT process.

The ALM – 1522 is housed in a miniature 5.0 x 6.0 x 1.1 mm<sup>3</sup> 22-lead multiple-chips-on-board (MCOB) module package. The compact footprint and low profile makes the ALM-1522 an ideal choice for Wireless Infrastructure Basestation Tower-Mounted-Amplifiers (TMA), Radiocard Receivers, Multi-Carrier Driver Amplifiers for GSM, CDMA, W-CDMA, TD-SCDMA base stations operating in the 700MHz to 1100MHz band.

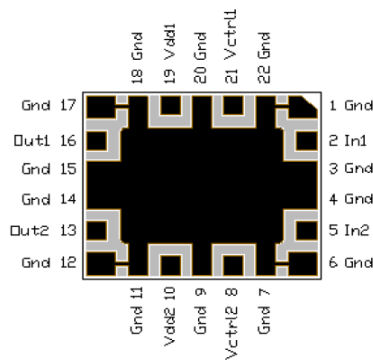
### Component Image

Surface Mount MCOB  
5.0 x 6.0 x 1.1mm<sup>3</sup> 22-lead



TOP VIEW

Note:  
Package marking provides orientation and identification.  
"1522" = Device Part Number  
"WWYY" = Work week and year of manufacture  
"XXXX" = Assembly lot number



BOTTOM VIEW

### Features

- Low noise figure
- High linearity and OP1dB
- 5V supply
- Adjustable current for optimum NF or OIP3
- High gain : 31dB
- Shutdown function
- GaAs E-pHEMT Technology
- Miniature package size : 5.0 x 6.0 x 1.1 mm<sup>3</sup>
- Tape-And-Reel packaging option available
- MSL-3 and Lead-free
- Meets ESD 100V Machine Model per EIA/JESD22-A115, and 500V Human Body Model per EIA/JESD22-A114
- Can be used in single-ended or balanced configuration
- Unconditionally stable
- Green/RoHS Compliant

### Specifications

900 MHz; 5V, Quiescent I<sub>dd</sub>=240 mA (typ) per channel  
V<sub>ctrl</sub> at 2.7V

- 31 dB Gain
- 0.6 dB Noise figure
- 27.7 dBm OP1dB
- 43 dBm OIP3
- 45 dB Reverse Isolation

### Applications

- TMA & Front End LNA for GSM, CDMA, W-CDMA, TD-SCDMA base stations.
- Driver amplifier for GSM, CDMA, W-CDMA, TD-SCDMA base stations.

### Absolute Maximum Rating<sup>[1]</sup> T<sub>A</sub>=25°C

Symbol	Parameter	Units	Absolute Max.
V <sub>dd</sub>	Supply voltages, bias supply voltage	V	5.5
V <sub>ctrl</sub>	Control Voltage	V	5.5
P <sub>in,max</sub>	CW RF Input Power	dBm	+20
P <sub>diss</sub>	Total Power Dissipation <sup>[2]</sup>	W	5.0
T <sub>j</sub>	Junction Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-65 to 150

### Thermal resistance

**Thermal Resistance<sup>[3]</sup>**  
 (V<sub>dd</sub> = 5V, V<sub>ctrl1</sub> = V<sub>ctrl2</sub> = 2.7V,  
 I<sub>dd</sub> = 480mA), θ<sub>jc</sub> = 16.5°C/W

Notes:

1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Board temperature T<sub>B</sub> is 25°C. Derate 61mW/°C for T<sub>B</sub>>97°C.
3. Thermal resistance measured using Infra-Red Microscopy Technique.

### Product Consistency Distribution Charts<sup>[4]</sup> [5]

T<sub>A</sub> = 25°C, V<sub>dd</sub> = 5V, V<sub>ctrl</sub> = 2.7V, RF performance at 900 MHz, unless otherwise specified.

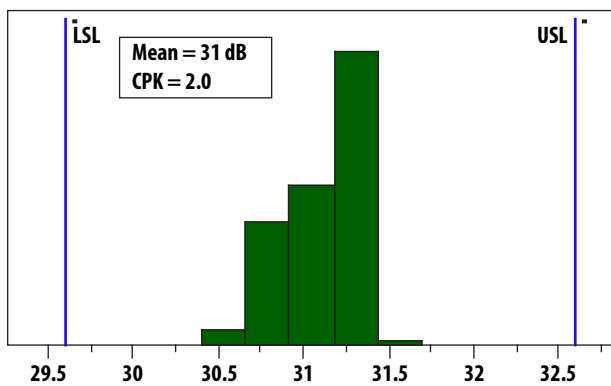


Figure 1. Gain (dB) Distribution

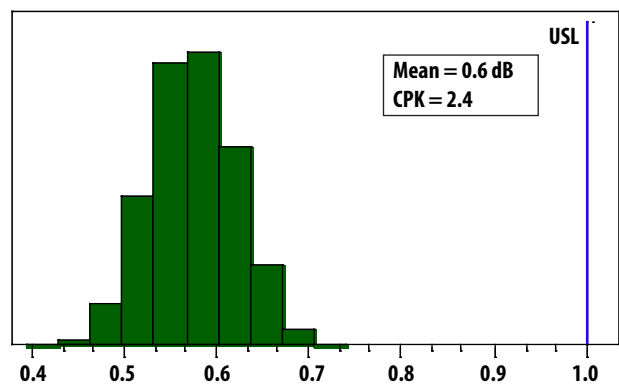


Figure 2. NF (dB) Distribution

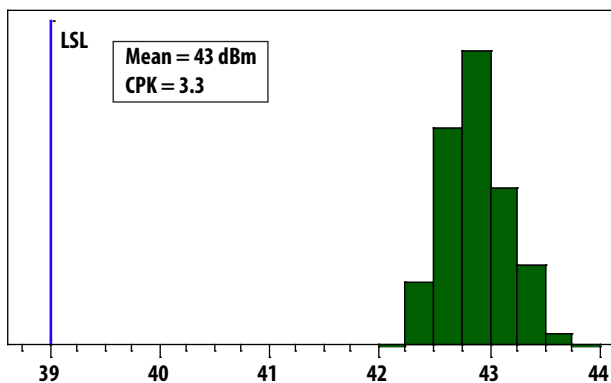


Figure 3. OIP3 (dBm) Distribution

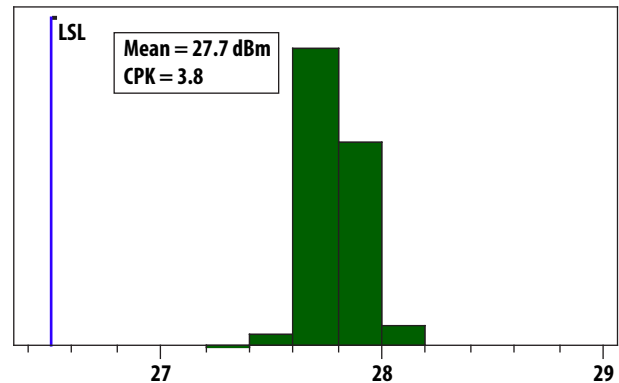


Figure 4. OP1dB (dBm) Distribution

Note:

4. Distribution data sample size is 1700 samples taken from 3 different wafers. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
5. Measurements are made on a production test boards, which can show a variance of up to 1dB in Gain and OIP3 compared to a soldered-down demo board. Circuit trace losses have not been de-embedded from actual measurements.

## Electrical Specifications<sup>[6][9]</sup>

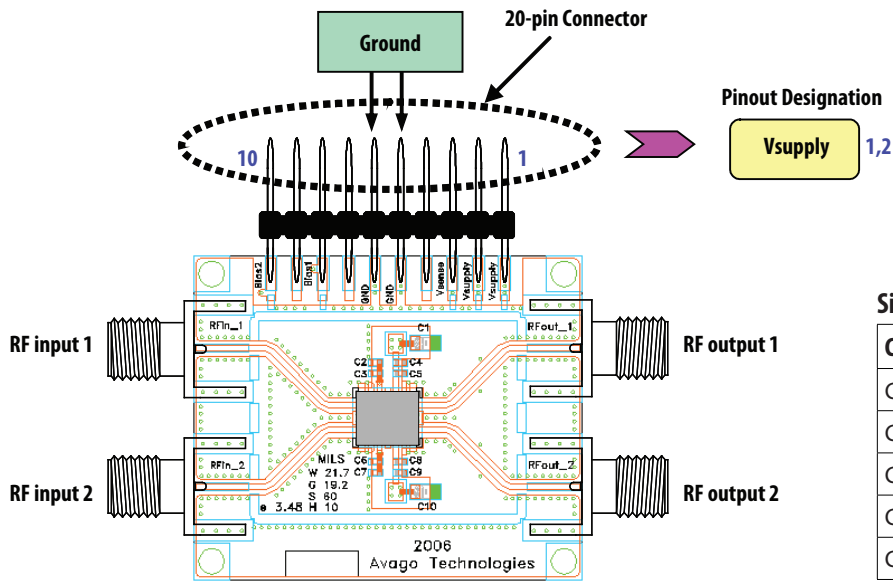
$T_A = 25^\circ\text{C}$ ,  $V_{dd} = 5\text{V}$ ,  $V_{ctrl} = 2.7\text{V}$ , RF performance at 900 MHz, given for each of the 2 RF paths, measured on evaluation board (see Fig. 5) unless otherwise specified.

Symbol	Parameter and Test Condition	Units	Min.	Typ.	Max.
Vdd	Supply Voltage	V	-	5.0	-
Vctrl	Control Voltage	V	-	2.7	-
Idd	Quiescent Supply Current	mA	180	240	280
Gain	Gain	dB	29.6	31	32.6
OIP3 <sup>[7]</sup>	Output Third Order Intercept Point	dBm	39	43	-
NF <sup>[8]</sup>	Noise Figure	dB	-	0.6	1.0
OP1dB	Output Power at 1dB Gain Compression	dBm	26.5	27.7	-
S11	Input Return Loss, 50Ω source	dB	-	-10	-
S22	Output Return Loss, 50Ω load	dB	-	-14	-
S12	Reverse Isolation	dB	-	45	-
ISO <sub>1-2</sub>	Isolation between RF Input 1 and RF Input 2	dB	-	27	-

Notes:

6. Measurement at 900MHz obtained using demo board described in Figure 5.
7. 900MHz OIP3 test condition:  $F_{RF1} = 900\text{ MHz}$ ,  $F_{RF2} = 901\text{ MHz}$  with input power of -20 dBm per tone.
8. Circuit trace losses have not been de-embedded from actual measurements.
9. Use proper bias, board, heatsink and derating designs to ensure maximum junction temperature is not exceeded. See absolute maximum ratings and application note for more details.

## ALM-1522 Demo Board Layout



### Single-Ended Demo Board Layout

Circuit Symbol	Size	Description
C1, C10	0805	2.2uF ceramic
C2, C7	0402	Not used
C3, C6	0402	0.1 uF ceramic
C4, C9	0402	Not used
C5, C8	0402	0.1 uF ceramic

Figure 5. Evaluation Board Layout Diagram

Recommended PCB material is 10 mils Rogers RO4350.

Suggested component values may vary according to layout and PCB material.

## Demo Board Schematic

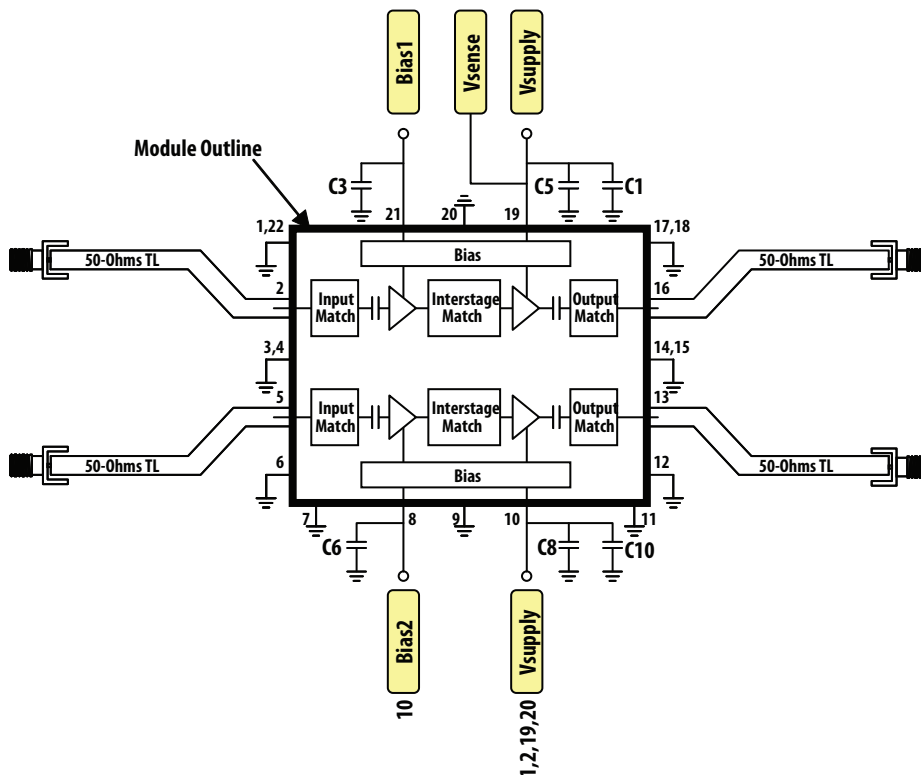


Figure 6. Evaluation Board Schematic Diagram

## ALM-1522 Single-Ended Typical Performance Curves

Vdd = 5V, Vctrl = 2.7V, Frequency = 900 MHz, measured on evaluation board (see Figure 5) unless otherwise specified.

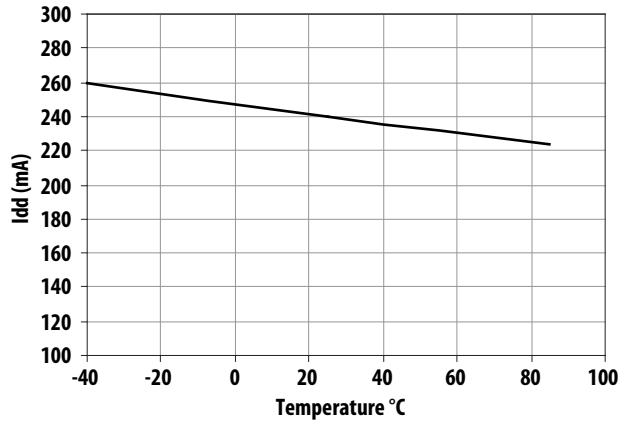


Figure 7. Idd vs. Temperature

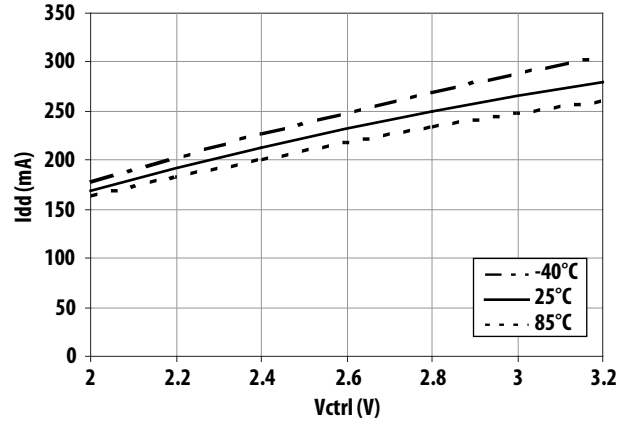


Figure 8. Idd vs. Vctrl and Temperature

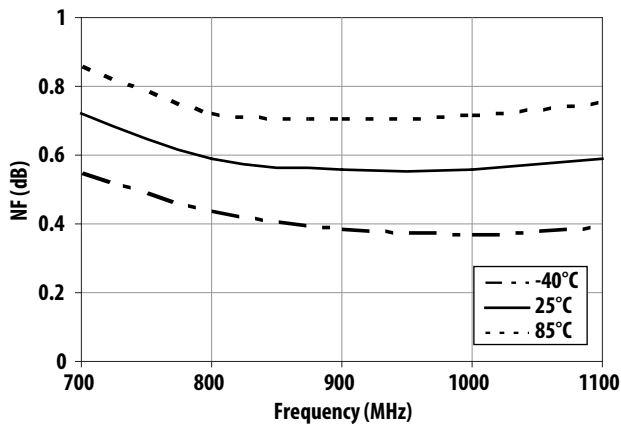


Figure 9. NF vs. Frequency and Temperature

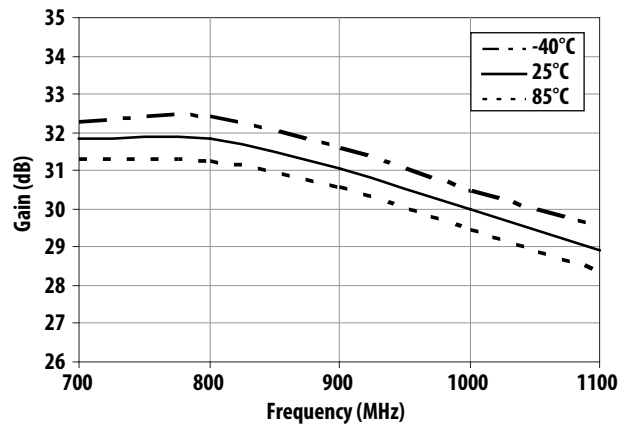


Figure 10. Gain vs. Frequency and Temperature

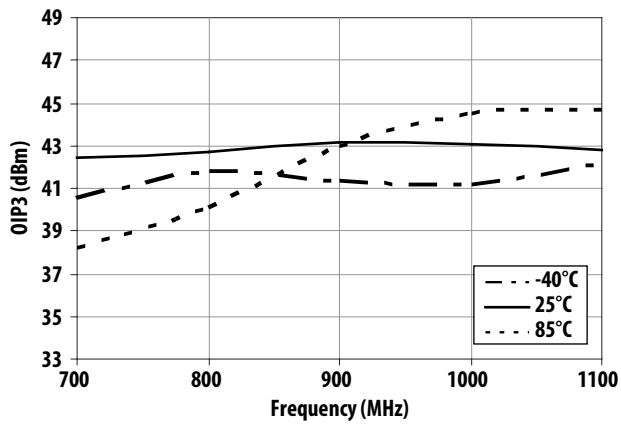


Figure 11. OIP3 vs. Frequency and Temperature

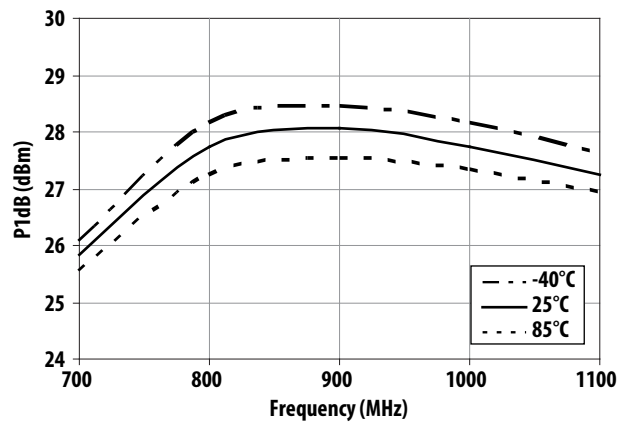


Figure 12. OP1dB vs. Frequency and Temperature

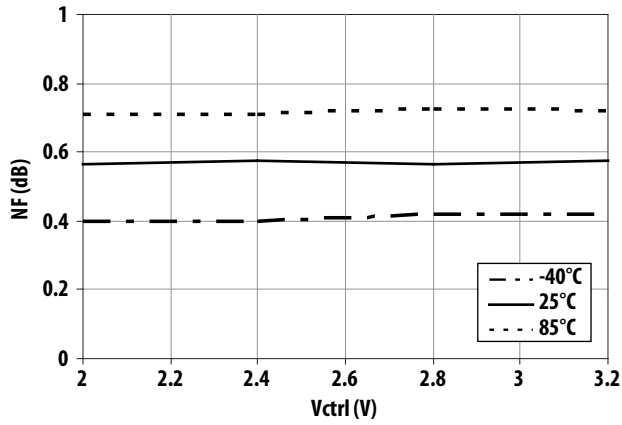


Figure 13. NF vs. Vctrl and Temperature

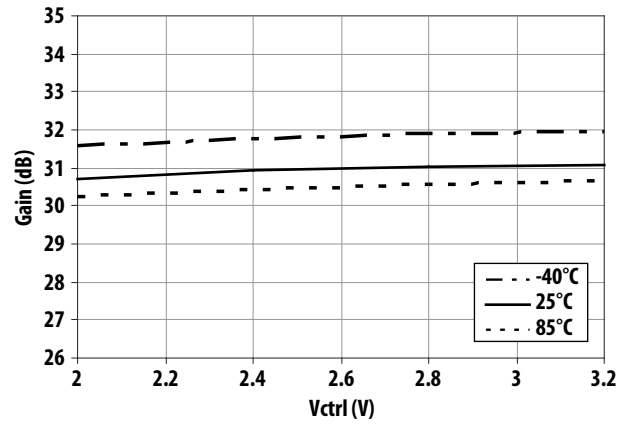


Figure 14. Gain vs. Vctrl and Temperature

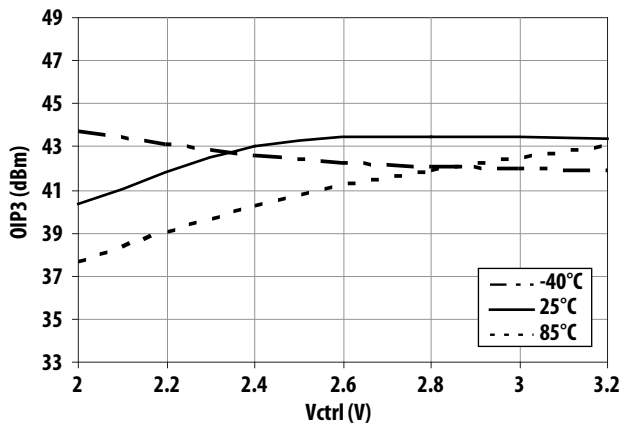


Figure 15. OIP3 vs. Vctrl and Temperature

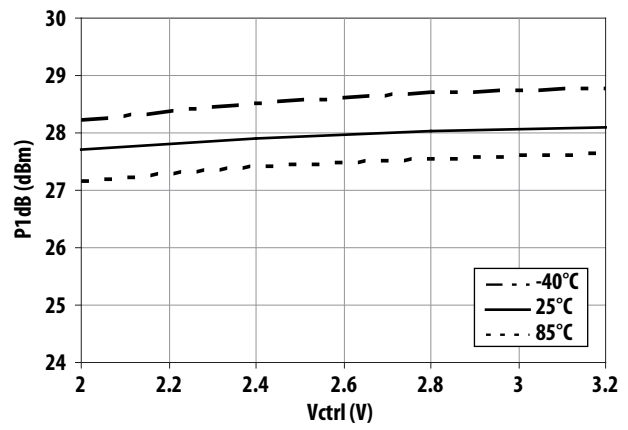


Figure 16. OP1dB vs. Vctrl and Temperature

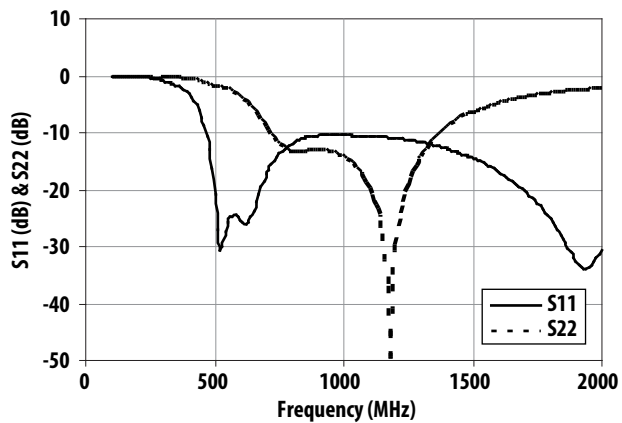


Figure 17. S11 & S22 vs. Frequency (0.1 to 2GHz)

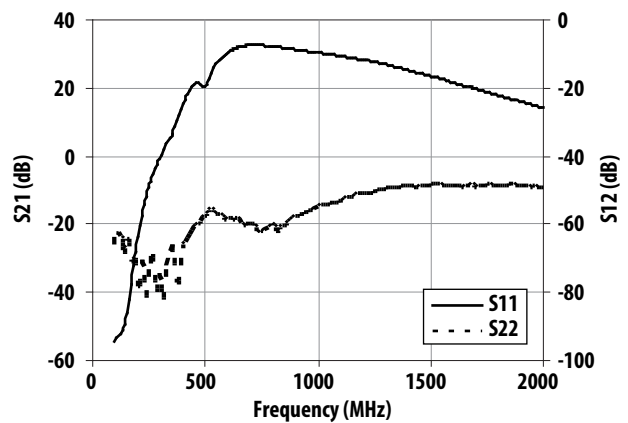


Figure 18. S21 & S12 vs. Frequency (0.1 to 2GHz)

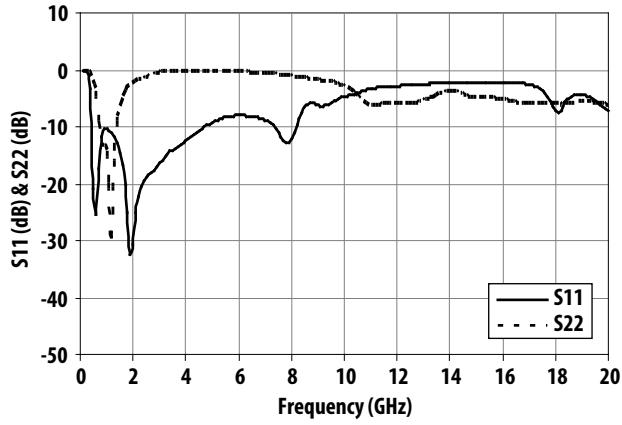


Figure 19. S11 & S22 vs. Frequency (0.1 to 20GHz)

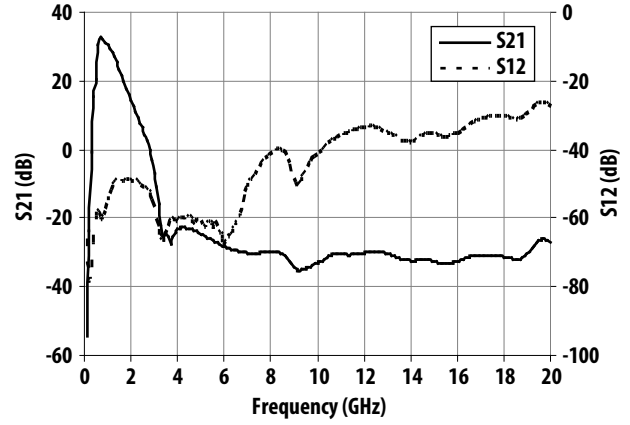


Figure 20. S21 & S12 vs. Frequency (0.1 to 20GHz)

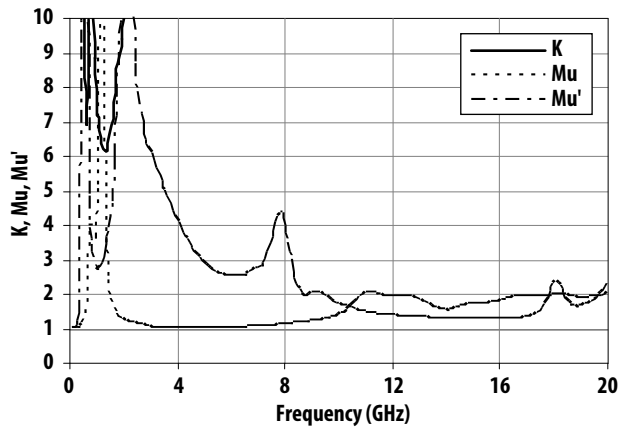


Figure 21. Stability vs. Frequency (0.1 to 20GHz)

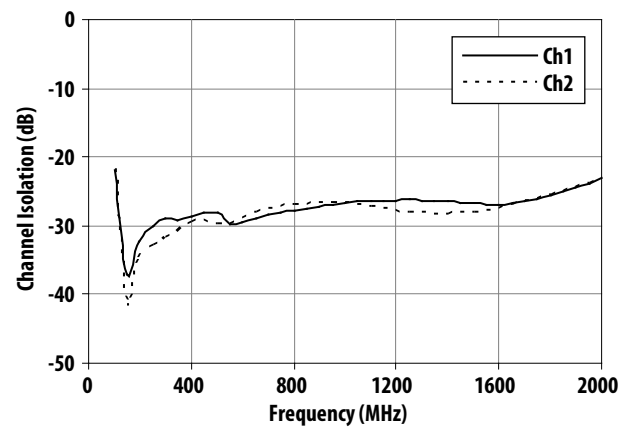
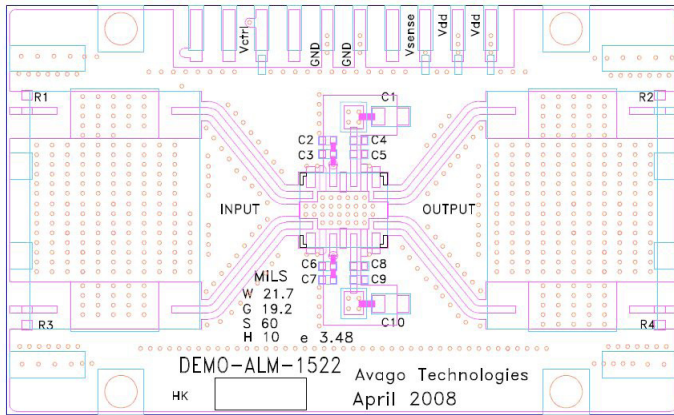


Figure 22. Channel Isolation vs. Frequency (0.1 to 2GHz)

## Balanced Amplifier Demo Board Layout



Circuit Symbol	Size	Description	Value
C1, C10	0805	Ceramic capacitor	2.2uF
C3, C5, C6, C8	0402	Ceramic capacitor	0.1 uF
C2, C4, C7, C8	0402	Not used	
R1, R4	0402	Not used	
R2, R3	0402	Resistor	50Ω
Coupler	16.51mmx12.19mm	Anaren Xinger II XC0900L-03S	

Figure 23. Suggested Balanced Amplifier Evaluation Board Layout Diagram

Recommended PCB material is 10 mils Rogers RO4350.

Suggested component values may vary according to layout and PCB material.

Coupler operating frequency specified from 800MHz to 1000MHz

## Balanced Demo Board Schematic

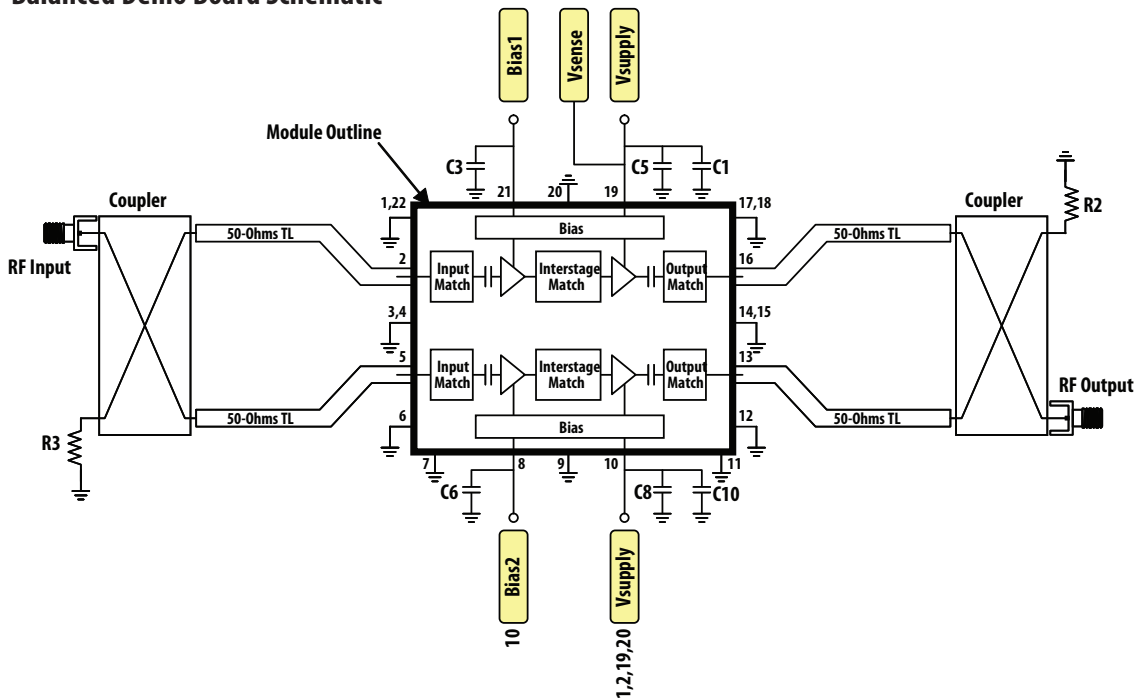


Figure 24. Evaluation Board Schematic for Balanced Amplifier



## Balanced Amplifier Typical Performance Curves

Vdd = 5V, Vctrl = 2.7V, Frequency = 900 MHz, measured on evaluation board (see Figure 23) unless otherwise specified.

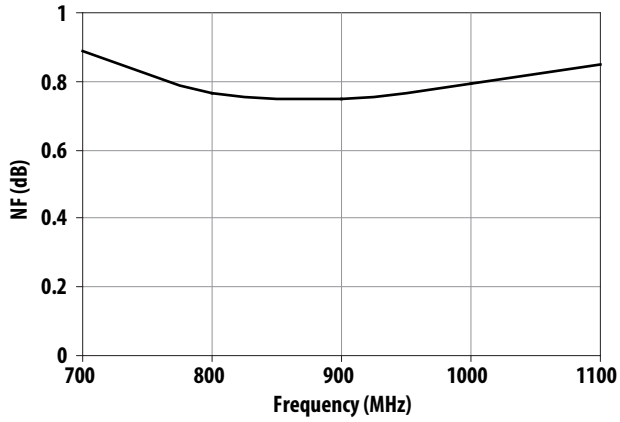


Figure 25. Balanced mode NF vs. Frequency

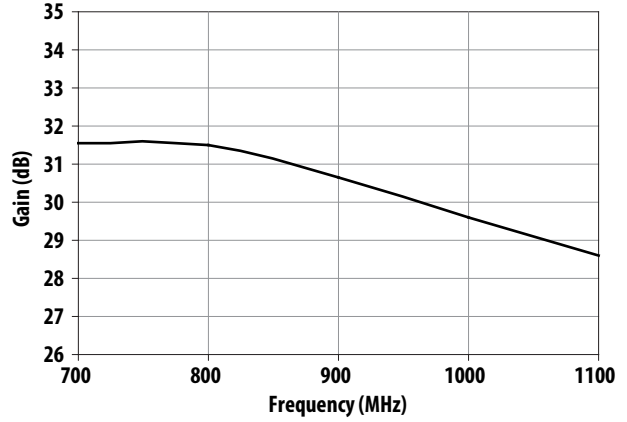


Figure 26. Balanced mode Gain vs. Frequency

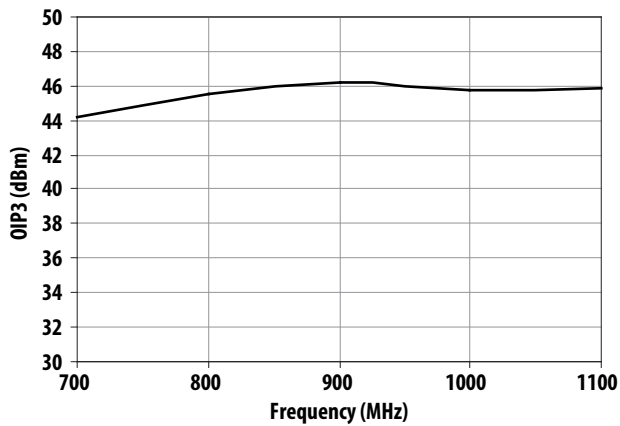


Figure 27. Balanced mode OIP3 vs. Frequency

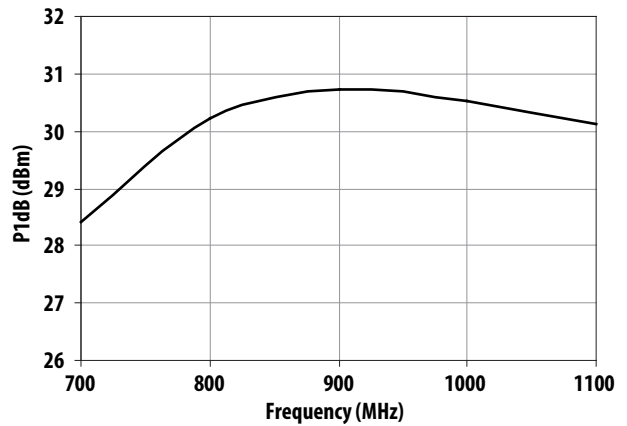


Figure 28. Balanced mode OP1dB vs. Frequency

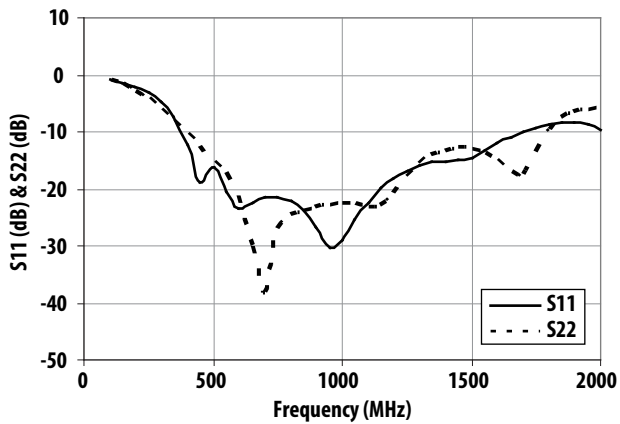


Figure 29. Balanced mode S11 & S22 vs. Frequency (0.1 to 2GHz)

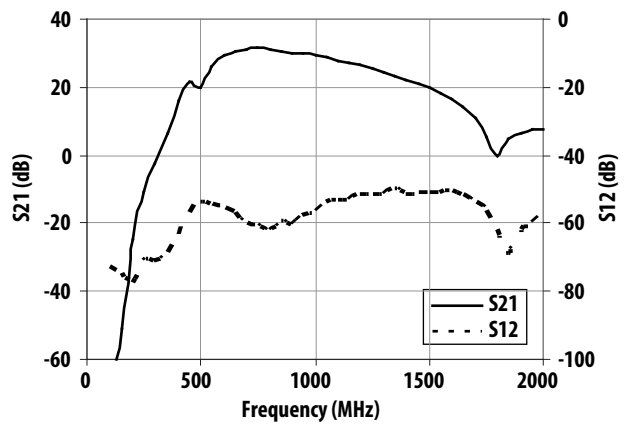


Figure 30. Balanced mode S21 and S12 vs. Frequency (0.1 to 2GHz)

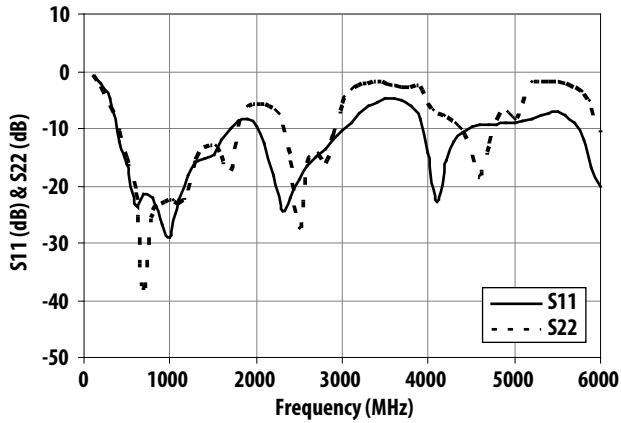


Figure 31. Balanced mode S11 & S22 vs. Frequency (0.1 to 6GHz)

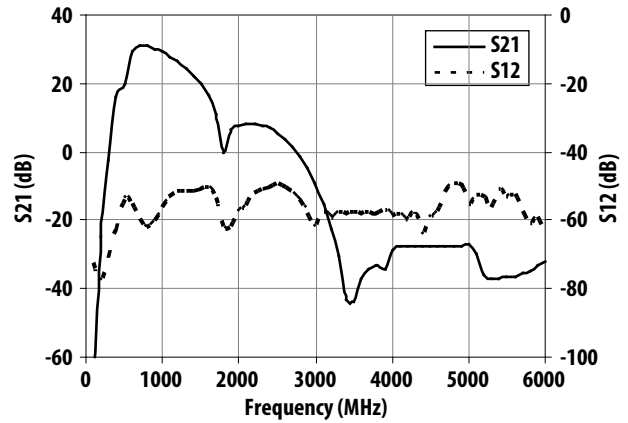


Figure 32. Balanced mode S21 and S12 vs. Frequency (0.1 to 6GHz)

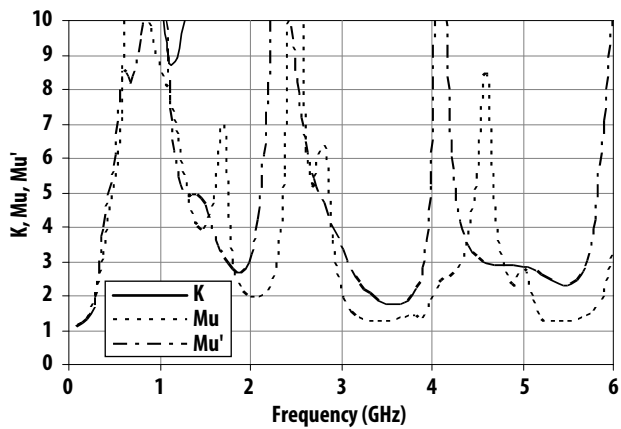
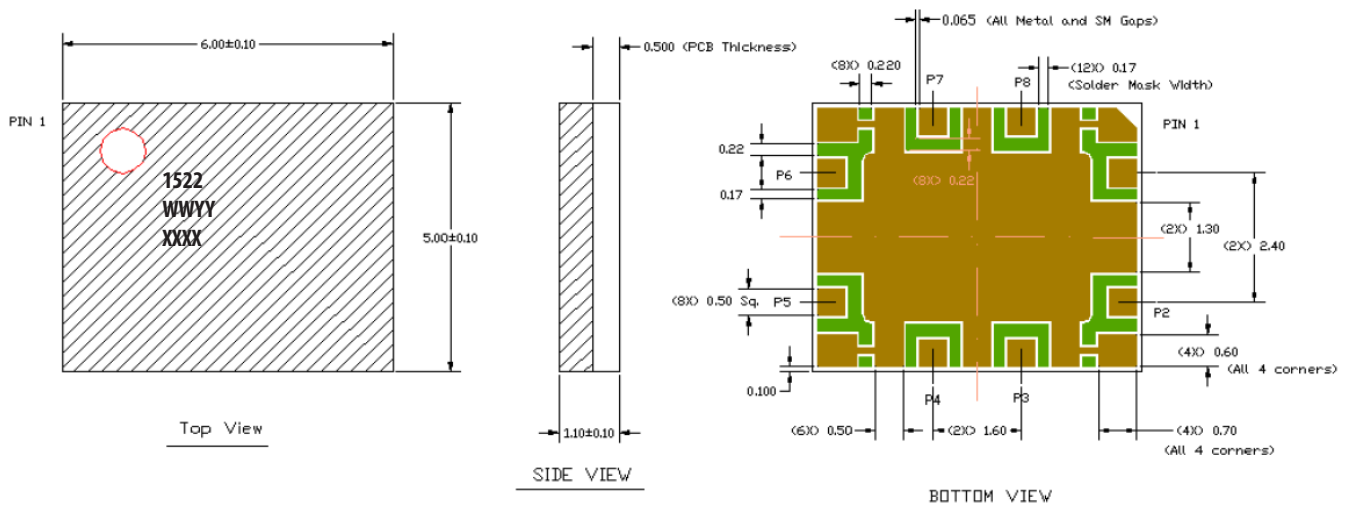


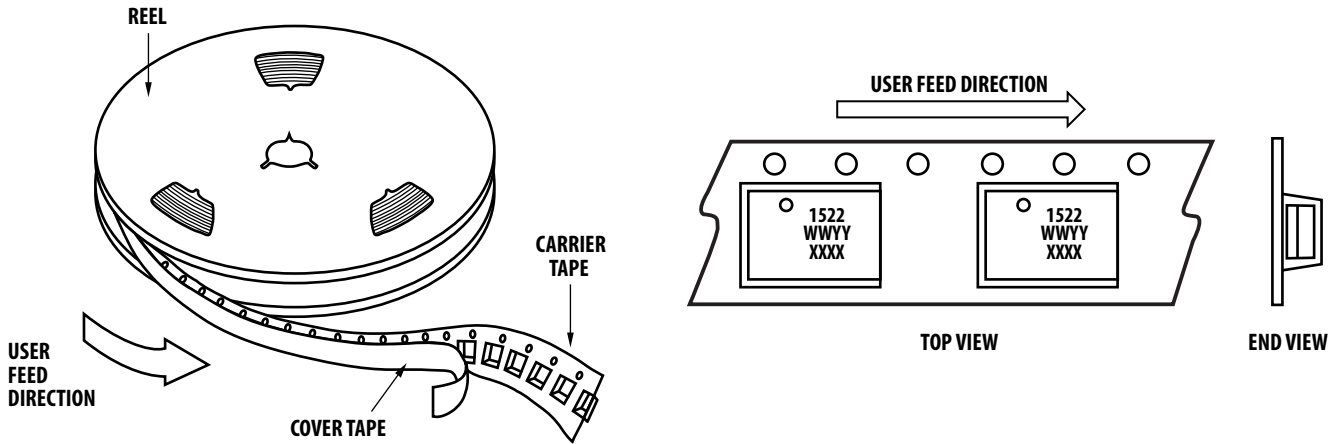
Figure 33. Balanced mode Stability vs. Frequency (0.1 to 6GHz)

## Package Dimensions

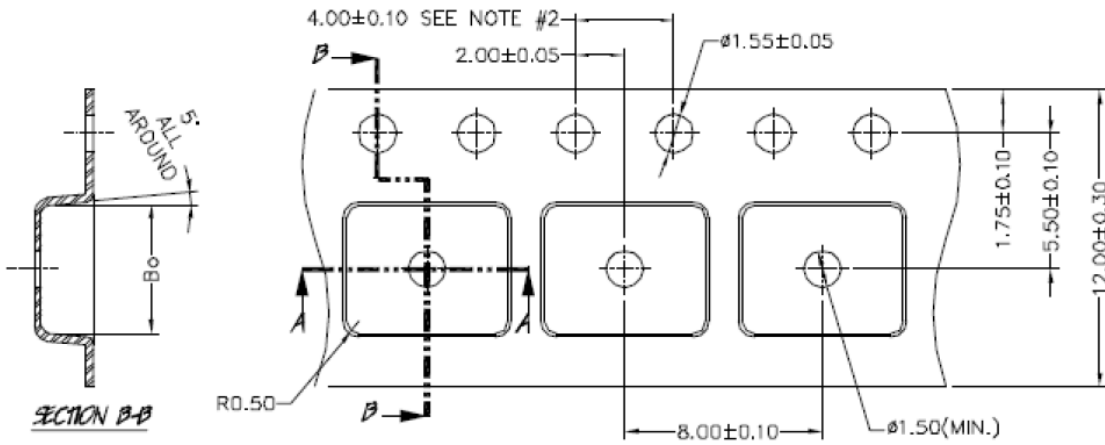
Laser Marking, POD, Stencil



## Device Orientation



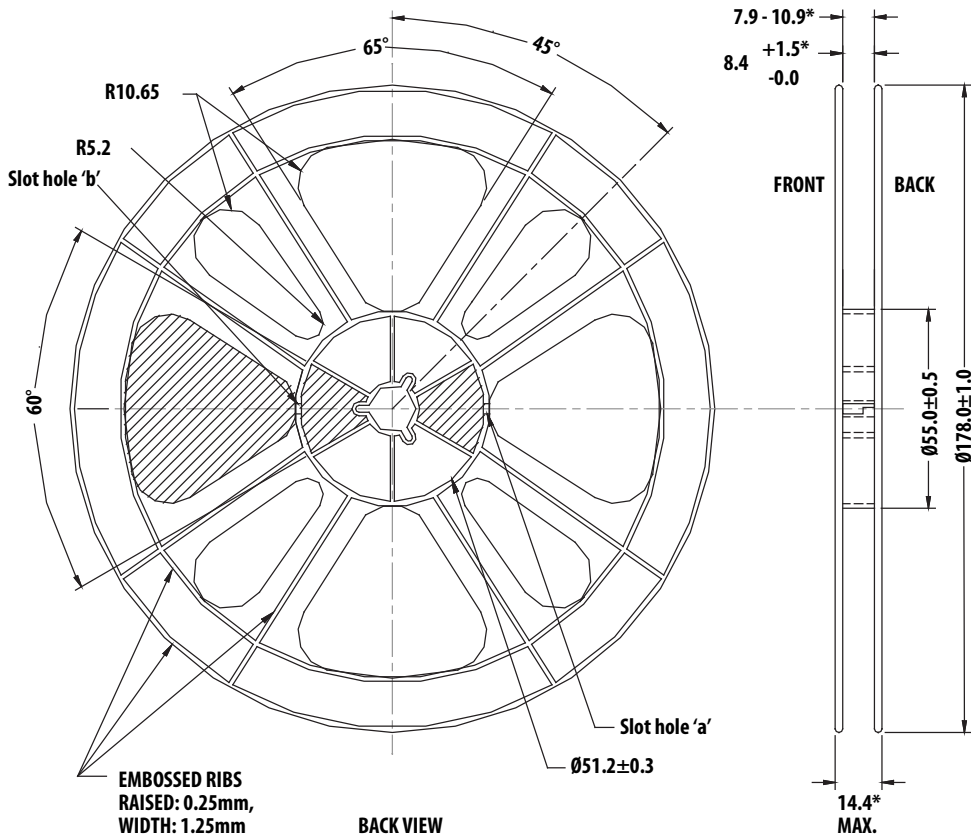
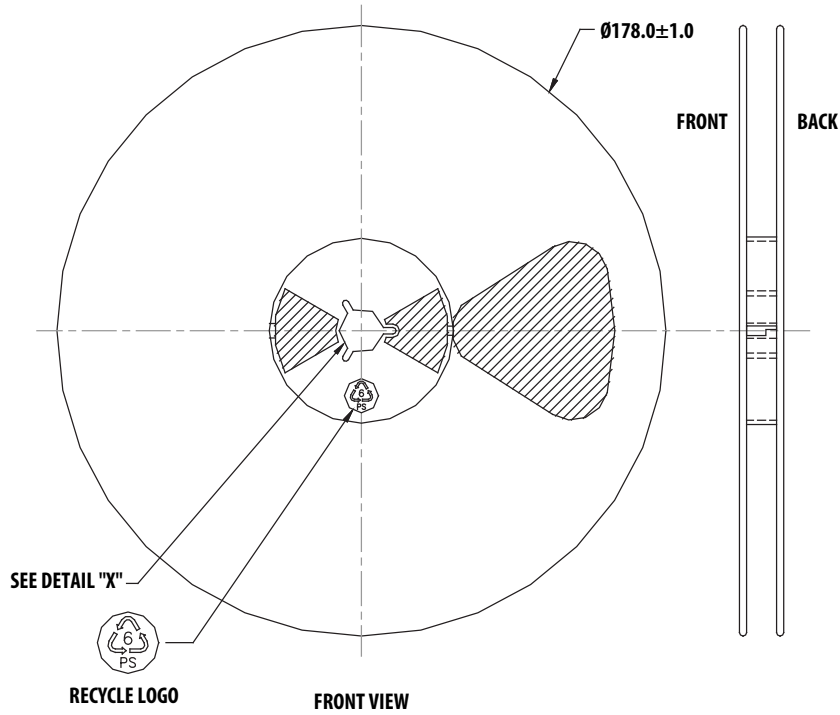
## Tape Dimensions



## Part Number Ordering Information

Part Number	No. of Devices	Container
ALM-1522-BLKG	100	Antistatic bag
ALM-1522-TR1G	1000	7" Reel
ALM-1522-TR2G	3000	13" Reel

# Reel Dimensions



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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