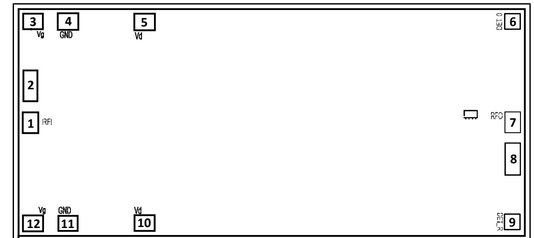
SUPER WIDEBAND, MEDIUM POWER

Monolithic Amplifier Die AVA-20453BL-D+

50Ω 20 to 45 GHz



THE BIG DEAL

- Super Wideband & Flat Gain, 23.5±2.2 dB @20 to 45 GHz
- Medium Power +23.4 dBm Typ. @20 to 40 GHz
- Potential Replacement for AMMC-6345[a,b]

+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

SEE ORDERING INFORMATION ON THE LAST PAGE

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Ka-band Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The AVA-20453BL-D+ is a GaAs PHEMT MMIC Medium Power Amplifier Die designed for use in microwave and millimeter wave transmitter systems operating from 20 to 45 GHz. The amplifier provides 23.5 dB of gain, +23 dBm P1dB and +30 dBm OIP3 while operating from a +5V supply with 480 mA current consumption. The amplifier is constructed using a balanced configuration thus providing excellent input and output impedance matches which makes for easy cascading with other devices in multi-chip modules.

KEY FEATURES

Feature	Advantages
Super-Wide Bandwidth with Flat Gain • 23.5±2.2 dB over 20 to 45 GHz	General purpose wideband amplifier is suitable for wide variety of applications.
Medium Power Over Wideband: • +23.4 dBm over 20 to 40 GHz	Excellent characteristics for use as a driver amplifier for mmW transmitter systems.
High Output IP3 • +30 dBm Typ. from 20 to 45 GHz	Excellent return loss and linearity enable easy integration while maintaining system performance requirements.
Good Wideband In/Out Return Loss • >12 dB from 20 to 45 GHz	
Unpackaged Die	Suitable for chip and wire hybrid assemblies

A. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application and compatibility with other components and environmental conditions and stresses.
B. The AMMC-6345 part number is used for identification and comparison purposes only

REV. OR
ECO-012492
AVA-20453BL-D+
MCLNY
220325

ELECTRICAL SPECIFICATIONS[1] AT 25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	VDD = 5V, IDD = 480mA			Units
		Min.	Typ.	Max.	
Frequency Range		20		45	GHz
Gain	20 30 35 40 45		21.8 21.3 22.1 24.0 25.7		dB
Input Return Loss	20 30 35 40 45		16.5 17.7 13.9 14.9 22.2		dB
Output Return Loss	20 30 35 40 45		24.1 18.6 19.2 15.2 15.0		dB
Directivity	20 - 45		45.0		dB
P1dB[2]	20 30 35 40 45		20.5 23.4 23.4 21.8 19.7		dBm
OIP3 Pout = +12 dBm/Tone	20 30 35 40 45		30.9 31.2 29.4 28.9 31.5		dBm
Noise Figure	20 30 35 40 45		10.1 8.4 8,7 9.0 12.5		dB
VDD		4.75	5.0	5.25	V
IG to get IDD = 480mA			17.0		uA
VG to get IDD = 480mA		-0.7	-0.53	-0.4	V
Thermal Resistance Øjc @Ground-Lead Temperature = 85°C			19.9		°C/W

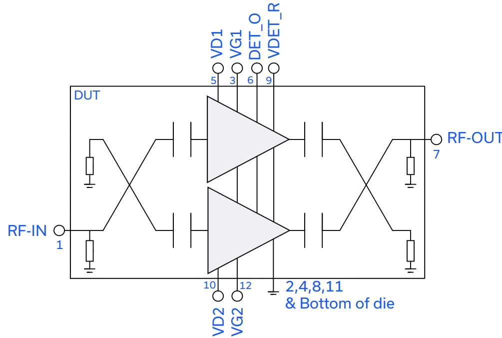
1. Measured on Mini-Circuits Characterization Test Board MB-083. See Recommended Application and Characterization Circuit (Fig. 1)
2. IDD can increase up to 600 mA at P1dB

MAXIMUM RATINGS[3]

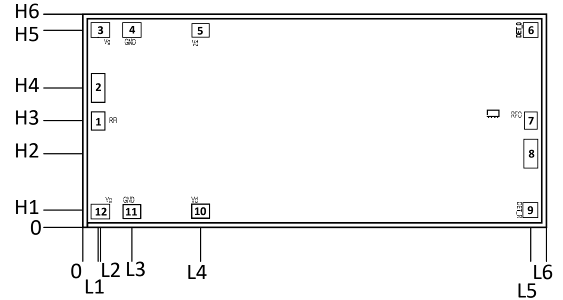
Parameter	Ratings
Operating temperature (ground lead)	-40°C to 85°C
Junction Temperature	150°C[4]
Total Power Dissipation	3.5 W
Input Power (CW)	23 dBm
DC Voltage at VDD	5.5V
DC voltage at VG	-2.5V to 0.5V
Pinch-Off Voltage (VG)	-1.2V

3. Permanent damage may occur if any of those limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.
4. Tj = 85˚C + (VDD)*(IDD)*Ø(JC) = 132˚C. Keeping Tj below 132°C will ensure MTTF >100 Years.

SIMPLIFIED SCHEMATIC



BONDING PAD POSITION



PAD DESCRIPTION

Function	Pad#	Description
RF-IN	1	RF Input Pad
VG1	3	Gate voltage, VGG can be supplied at either VG1 and VG2
VD1	5	Drain Voltage, connects to VDD
VDET_O	6	Voltage Detector Output
RF-OUT	7	RF Output Pad
VDET_R	9	Reference Voltage for Output Detector
VD2	10	Drain Voltage, Connects to VDD
VG2	12	Gate Voltage, VGG can be supplied at either VG1 and VG2
GND	2,4,8,11 & Bottom of Die	The bond pads are connected to backside through vias and do not required wire-bond connections to ground

DIMENSION IN µm, TYP.

H1	H2	H3	H4	H5	H6
93	398	575	752	1062	1150

L1	L2	L3	L4	L5	L6
83	95	265	635	2415	2500

Thickness	Die size	Pad size 1 & 7	Pad size 2 & 8	Pad size 3-5,10-12	Pad size 6 & 9
100	1150 x 2500	68 x 93	68 x 150	93 x 73	73 x 73

RECOMMENDED APPLICATION AND CHARACTERIZATION TEST CIRCUIT

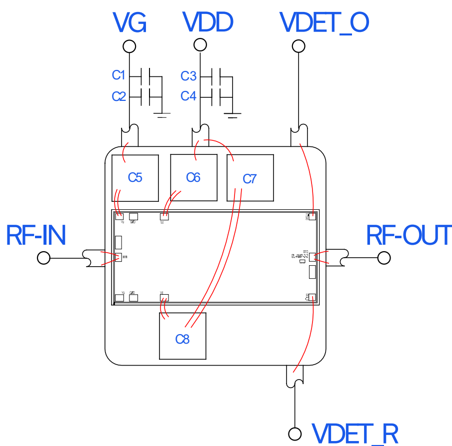


Figure 1. Characterization, Application Circuit & Assembly Drawing
Note: This block diagram is used for characterization. (DUT is soldered on test board of Mini-Circuits Characterization Test Board MB-083). Gain, Return Loss, Output Power at 1dB Compression (P1dB), Ouptut IP3 (OIP3) and Noise Figure are measured using Agilent's N5242A PNA-X Microwave Network Analyzer.

Condition:
1. VDD = 5V, IDD = 480mA
2. Gain & Return Loss: Pin = -30dBm
3. Output IP3 (OIP3): Two Tones, Spaced 1MHz apart, 12 dBm/Tone at Output
(Use ZVA-02443HP+ as Pre-Amp)

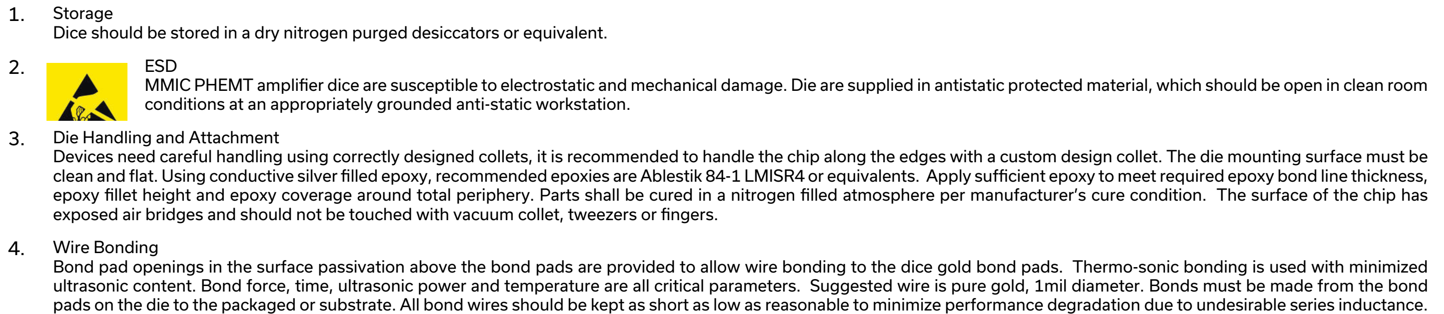
ON Sequence:
1. Turn ON VG = -1.5V
2. Turn ON VDD = 5V,
3. Increase VG until IDD =480mA, Typical VG = -0.53V

OFF Sequence:
1. Decrease VG back to -1.5V
2. Turn OFF VDD
3. Turn OFF VG.

Component #	Size	Value	Manufacturer	P/N
C1, C3	1206	10uF	SAMSUNG	CL31B106KBHNNNE
C2, C4	0402	0.1uF	MURATA	GRM115R71C04KA88D
C5, C6, C7, C8	22mil x 22mil	100pF	MACOM	MA4M3100

ASSEMBLY PROCEDURE

1. Storage
Dice should be stored in a dry nitrogen purged desiccators or equivalent.

2. 
ESD
MMIC PHEMT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.

3. Die Handling and Attachment
Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. The surface of the chip has exposed air bridges and should not be touched with vacuum collet, tweezers or fingers.

4. Wire Bonding
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
Case Style	Die
Die Ordering and packaging information	Quantity, Package — Model No. Small, Gel - Pak: 5,10,50,100 KGD* — AVA-20453BL-DG+ Medium†, Partial wafer: KGD*<700 — AVA-20453BL-DP+ Full Wafer — AVA-20453BL-DF+ †Available upon request contact sales representative Refer to AN-60-067
Die Marking	EL-AMP-2-1
Environmental Ratings	ENV80

*Known Good Die ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does provide a higher degree of confidence that die are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

NOTES

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

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