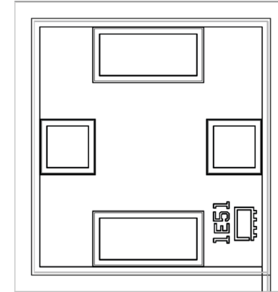
MMIC, High Linearity

Monolithic Amplifier Die

ERA-51SM-D+

50Ω DC to 4 GHz



The Big Deal

- Single Voltage Supply
- High Linearity
- Transient protected, US patent 6,943,629

Product Overview

ERA-51SM-D+ (RoHS compliant) is a wideband amplifier die offering high dynamic range. It has repeatable performance from lot to lot. ERA-51SM-D+ uses Darlington configuration and is fabricated using InGaP HBT technology. Expected MTTF is 450 years at 85°C case temperature.

Key Features

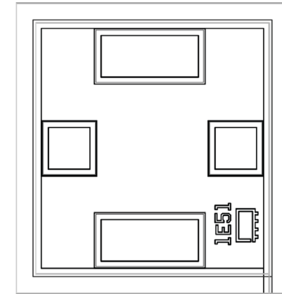
Feature	Advantages
Broadband, DC to 4 GHz	Covers the primary wireless communications bands: cellular, PCS & 3G.
High IP3 versus DC power consumption • +35.1 dBm typical at 0.1 GHz • +31 dBm typical at 3 GHz	The ERA-51SM-D+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and InGaP HBT structure provides enhanced linearity over a broad frequency range, evident in IP3 values typically 15 dB above the P1dB point to 3 GHz. This feature makes this amplifier ideal for use in: •Driver amplifiers for complex waveform up converter paths •Drivers in linearized transmit systems
Unpackaged die	Enables user to integrate it directly into hybrids

5 Volt, High Gain

Monolithic Amplifier Die

ERA-51SM-D+

50Ω DC to 4 GHz



Product Features

- DC-4 GHz
- Single Voltage Supply
- Internally Matched to 50 Ohms
- Low Performance Variation Over Temperature
- Protected By US Patent 6,943,629

Typical Applications

- Cellular/ PCS/ 3G Base Station
- CATV, Cable Modem & DBS
- Fixed Wireless & WLAN
- Microwave Radio & Test Equipment

+RoHS Compliant

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

Ordering Information: Refer to Last Page

General Description

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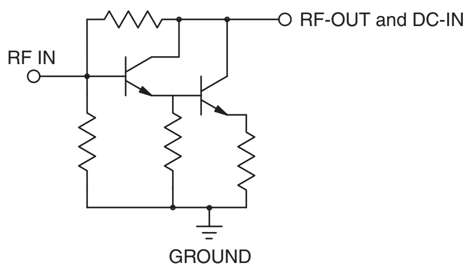
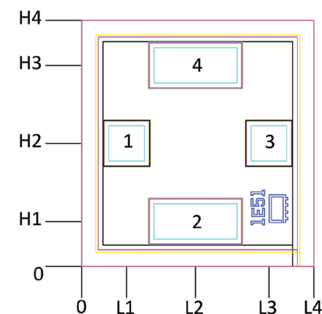
Simplified Schematic and Pad description



Pad#	Function
1	RF-IN
3	RF-OUT & DC-IN
2,4 and bottom of die	GROUND

Bonding Pad Position



Dimensions in µm, Typical

L1	L2	L3	L4	H1	H2	H3	H4
95.0	240.0	395.0	490.0	95.0	260.0	425.0	520.0

Thickness	Die size	Pad size 1 & 3	Pad size 2 & 4
100	490 x 520	75 x 75	175 x 75

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Electrical Specifications[1] at 25°C and 4.5V, unless noted

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units	CPK
Frequency Range[2]		DC		4	GHz	
Gain	0.1 1 2 3 4	— — — — —	18.0 17.4 16.1 14.8 12.5	— — — — —	dB	≥1.5
Magnitude of Gain Variation versus Temperature (values are negative)	0.1 1 2 3 4	— — — — —	0.0012 0.0020 0.0027 0.0033 0.0043	— — — — —	dB/°C	
Input Return Loss	0.1 1 2 3 4	— — — — —	26 29 32 28 25	— — — — —	dB	
Output Return Loss	0.1 1 2 3 4	— — — — —	28 24 21 24 21	— — — — —	dB	
Reverse Isolation	1		22		dB	
Output Power @1 dB compression	0.1 1 2 3 4	— — — — —	18.3 18.1 17.8 16.9 14.8	— — — — —	dBm	≥1.33
Saturated Output Power (at 3dB compression)	0.1 1 2 3 4	— — — — —	18 18 18 17 16	— — — — —	dBm	
Output IP3	0.1 1 2 3 4	— — — — —	35.1 35.4 33.9 31 27.8	— — — — —	dBm	≥1.33
Noise Figure	0.1 1 2 3 4	— — — — —	3.6 3.7 3.7 3.9 4	— — — — —	dB	≥1.33
Group Delay	1		100		psec	
Recommended Device Operating Current			65		mA	
Device Operating Voltage		4.2	4.5	4.8	V	≥1.5
Device Voltage Variation vs. Temperature at 65mA			-3.2		mV/°C	
Device Voltage Variation vs. Current at 25°C			5.8		mV/mA	
Thermal Resistance, Junction to case[3]			154		°C/W	

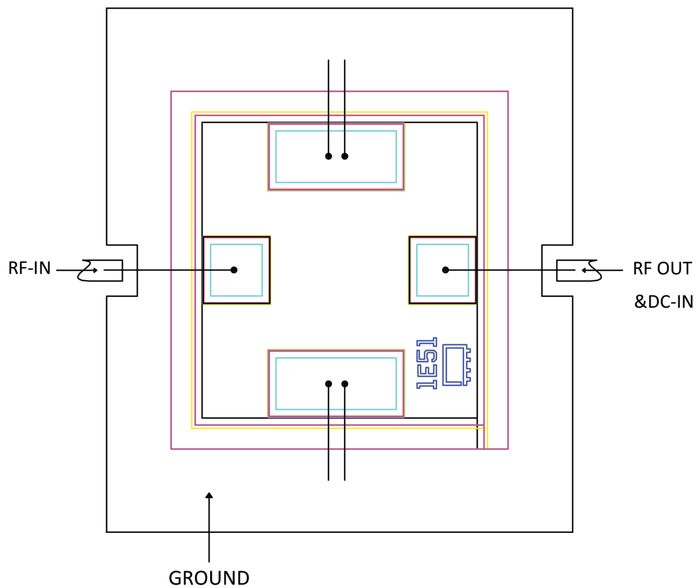
[1] Die was packaged in a Micro-X Package and tested on test board TB-408-51+
[2] Guaranteed specification DC-4 GHz. Low frequency cut off determined by external coupling capacitors.
[3] Case is defined as ground leads

Absolute Maximum Ratings[5]

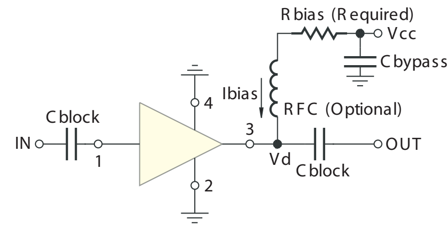
Parameter	Ratings
Operating Temperature [4]	-45°C to 85°C
Operating Current	85mA
Power Dissipation	451mW
Input Power	13dBm

[4] Based on typical case temperature rise 5°C above ambient.
[5] Permanent damage may occur if any of these limits are exceeded.
These ratings are not intended for continuous normal operation.

Assembly Diagram



Recommended Application Circuit



Test Board includes case, connectors, and components (in bold) soldered to PCB

R BIAS	
Vcc	**"1%" Res. Values (ohms) for Optimum Biasing**
7	40.2
8	53.6
9	68.1
10	82.5
11	97.6
12	113
13	127
14	143
15	158
16	174
17	191
18	205
19	221
20	237

Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC HBT amplifer 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 sufficent 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.
5. 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
additional 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* — ERA-51SM-DG+ Medium†, Partial wafer: KGD*<3024 — ERA-51SM-DP+ Large†, Full Wafer — ERA-51SM-DF+ †*Available upon request contact sales representative* Refer to AN-60-067
Environmental Ratings	ENV80

*Known Good Dice ("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 help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD Rating**
Human Body Model (HBM): Class 1B (500V to <1000V) accordance with ANSI/ESD STM 5.1 - 2001

** Tested in a Micro-X package.

Additional 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.

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