

Dual Matched High Dynamic Range

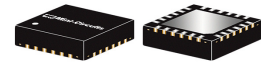
# Monolithic Amplifier

MPGA-122-75+

75Ω 40 to 1250 MHz

## The Big Deal

- High IP3
- Positive Gain Slope
- 1W Output Power



4x4mm 24-lead, MCLP package

## Product Overview

MPGA-122-75+ (RoHS compliant) is an advanced wideband dual amplifier fabricated using E-PHEMT\* technology and offers extremely high dynamic range over a broad frequency range and with low noise figure and flat gain. In addition, the MPGA-122-75+ has excellent input and output return loss when used per suggested application circuit over a broad frequency range. It is enclosed in a 4x4mm, 24 lead MCLP package for very good thermal performance.

## Key Features

Feature	Advantages
Broad Band: 0.04 to 1.25 GHz Usable to 1.5 GHz	Covers primary CATV applications such as DOCSIS 3.1
Positive Gain Slope, 0.3 dB	Compensates for increasing loss versus frequency of cables
High IP3 Versus DC power Consumption: 51 dBm typical at 0.5 GHz	The MPGA-122-75+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMPT structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 14-19 dB above the P 1dB point. This feature makes this amplifier ideal for use in CATV applications.
High IP2, 68 dBm at 0.5 GHz	Suppresses second order product on wideband applications such as CATV
Low Noise Figure, 2.8 dB at 0.5 GHz	Low noise figure performance in combination with the high output IP3 results in high dynamic range.
Excellent CSO/CTB* CSO, -80 dBc CTB, -83 dBc Measured at channel 17	Competitive performance at lower current and supply voltage.

\*108 channels flat, 40 dBm/channel at output, 6 MHz channel spacing.

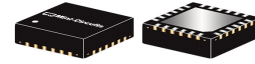


# Dual Matched High Dynamic Range Monolithic Amplifier

## 40-1250 MHz

### Product Features

- High IP3, 50 dBm typ. at 0.5 GHz
- Gain, 15.1 dB typ. at 0.5 GHz
- High Pout, P1dB 80 dBmV typ. at 0.5 GHz
- Low Noise Figure, 2.9 dB at 0.5 GHz
- Usable over 40-1800 MHz



## MPGA-122-75+

CASE STYLE: DG1847

### Typical Applications

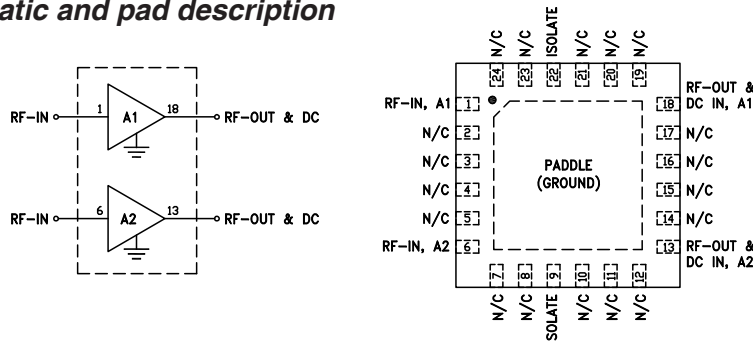
- CATV, DOCSIS 3.1
- GPON
- MOCA
- DBS

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

### General Description

MPGA-122-75+ (RoHS compliant) is an advanced wideband dual amplifier fabricated using E-PHEMT\* technology and offers extremely high dynamic range over a broad frequency range and with low noise figure and flat gain. In addition, the MPGA-122-75+ has excellent input and output return loss when used per suggested application circuit over a broad frequency range. It is enclosed in a 4x4mm, 24 lead MCLP package for very good thermal performance.

### simplified schematic and pad description



Function	Pad Number	Description (Refer to Figure 1)
RF IN, A1	1	RF input pad. This pad requires the use of an external DC blocking capacitor
RF IN, A2	6	RF input pad. This pad requires the use of an external DC blocking capacitor
RF-OUT and DC-IN, A1	18	RF output and bias pad. DC voltage is present on this pad; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 1
RF-OUT and DC-IN, A2	13	RF output and bias pad. DC voltage is present on this pad; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 1
GND	Paddle	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.
N/C	2-5, 7,8 10-12,14-17, 19-21 23-24	No connection. Ground externally
Do not use	9,22	Isolate on PCB trace

\*Enhanced mode pseudomorphic High Electron Mobility Transistor.

Electrical Specifications<sup>1</sup> at 25°C, 75Ω unless noted

Parameter	Condition (GHz)	V <sub>DD</sub> =9V (Note 1)			V <sub>DD</sub> =8V (Note 1)			V <sub>DD</sub> =9V (Note 1A)	Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	
Frequency range		0.04		1.25	0.04		1.25	0.04-1.25	GHz
Gain	0.04		15			14.9		15.0	dB
	0.5		15.1			15.1		15.1	
	0.86	13.8	15.3	16.9		15.3		15.3	
	1.25		15.3			15.3		15.0	
	1.5		15.1			15.0		14.5	
Input return loss	0.04		13.6			13.7		13.4	dB
	0.5		16.4			16.3		15.3	
	0.86		20.5			20.1		20.6	
	1.25		19.1			18.7		20.3	
	1.5		15.1			14.6		15.7	
Output return loss	0.04		16.8			16.7		16.7	dB
	0.5		13.7			13.6		13.4	
	0.86		16.4			16.3		17.1	
	1.25		17.5			17.0		15.3	
	1.5		12.6			12.2		9.7	
Reverse isolation	1.0		21.5			21.5		21.7	dB
Output power @ 1dB compression	0.04		30.1 (78.8)			29.1 (77.8)		30.2 (78.9)	dBm (dBmV)
	0.5		30.9 (79.6)			29.9 (78.7)		30.9 (79.7)	
	0.86		30.6 (79.4)			29.6 (78.3)		30.5 (79.2)	
	1.25		28.6 (77.4)			27.4 (76.2)		28.0 (76.7)	
	1.5		28.2 (76.4)			27.1 (75.9)		27.3 (76.0)	
Output IP3	0.04		45.9			45.4		44.4	dBm
	0.5		49.7			48.9		50.6	
	0.86		48.8			46.5		47.0	
	1.25		48.4			48.6		46.3	
	1.5		42.8			43.0		40.7	
Output IP2 <sup>2</sup>	0.04		75.7			73.7		76.2	dBm
	0.5		68.9			69.4		69.2	
	0.86		68.8			66.8		67.1	
	1.25		72.5			70.6		66.2	
	1.5		55.3			53.1		50.1	
Noise figure	0.04		2.9			2.8		2.8	dB
	0.5		2.9			2.8		2.9	
	0.86		3.2			3.2		3.2	
	1.25		3.6			3.5		3.6	
	1.5		3.9			3.9		4.1	
Supply operating voltage			9.0			8.0		9.0	V
Supply operating current (Total)		—	391	487		343		392	mA
Device current variation vs temperature <sup>3</sup>			9.4			29.4		—	μA/°C
Device current variation vs voltage			0.0506			0.0507		—	mA/mV
Thermal resistance, junction-to-ground lead			8.6			8.6		8.6	°C/W

1. Measured on Mini-Circuits Characterization Test board MB012. PCB material Rogers 4350B. See Characterization Test Circuit (Fig. 1).

1A. Measured on Mini-Circuit Evaluation Board TB-937+ (PCB Material FR4) VDD=12V is applied to get 9V at DUT (Fig. 2)

2. Output IP2 measured at sum frequency of the two tones (f means= f1+f2).

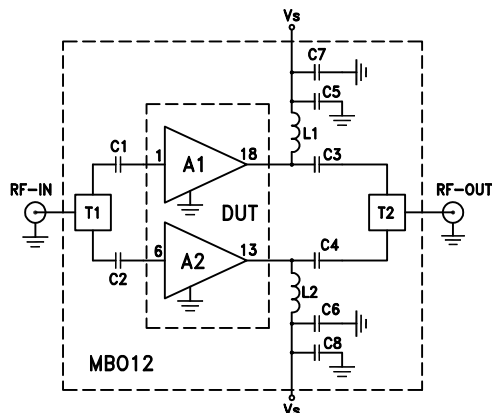
3. (Current at 85°C - Current at -45°C)/130

Absolute Maximum Ratings<sup>6</sup>

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current at 9.0V	464 mA
Power Dissipation	8.5 W
Input Power (CW) at 9V	+28 dBm (5 minutes) +25 dBm (continuous)
DC Voltage on Pad 13 & 18	12V

6. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

**Characterization and Application Test Circuit**



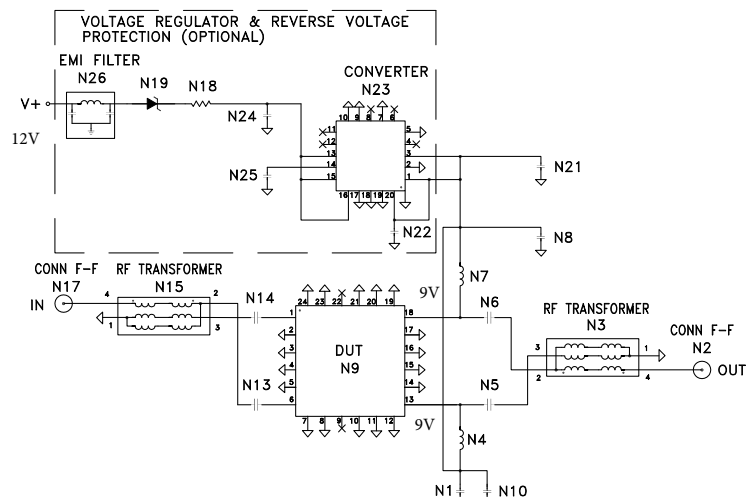
Component	Size	Value	Manufacturers P/N	Manufacturer
DUT	--	---	MPGA-122-75+	Mini-Circuits
C1 & C2	0402	220 pF	GRM1555C1H221JA01D	Murata
C3 & C4	0402	220 pF	GRM1555C1H221JA01D	Murata
C5 & C6	0402	0.01 $\mu$ F	GRM155R71E103KA01D	Murata
C7 & C8	1210	10 $\mu$ F	GRM32ER71H106MA2L	Murata
L1, L2	0805	390 nH	0805CS-391XGLC	Coilcraft
T1 & T2	--	--	TRS1-182-75+	Mini-Circuits

**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT tested on Mini-Circuits Characterization test board MB012) Gain, Return loss, Output power at 1 dB compression (P1 dB) , output IP3 (OIP3), output IP2 (OIP2) and noise figure measured using Agilent’s N5242A PNA-X microwave network analyzer.

**Conditions:**

1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.
3. Output IP2 (OIP2): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.

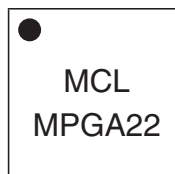
**Application Circuit**



COMPONENT	VALUE	SIZE
N9 (DUT)	Mini-Circuits MPGA-122-75+	4X4 mm
N1,N21,N24	Capacitor 10 uF	1206
N3,N15	Mini-Circuits TRS1-182-75+	7.11X6.35 mm
N4,N7	Inductor 390 nH	0805
N5,N6,N13,N14	Capacitor 220 pF	0402
N8,N10	Capacitor .01 uF	
N18	Resistor 4.32 Ohms,1W	2512
N19	Diode Schottky SMA 40V MSL1	5.21X2.60 mm
N22	Capacitor 22 uF	1210
N23	Voltage Regulator QFN20 ADJ MSL2	5X5 mm
N25	Capacitor 1 uF	0603
N26	EMI Filter	-

**Fig 2.** Block Diagram of Application Circuit (DUT soldered on TB-937+) due to 3V drop at the voltage regulator and reversed voltage protection circuit,  $V_{DD}=12V$  is needed to get 9V at DUT.

**Product Marking**



Marking may contain other features or characters for internal lot control

<b>Additional Detailed Technical Information</b> <i>additional information is available on our dash board. To access this information <a href="#">click here</a></i>	
<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	DG1847 <i>Plastic package, exposed paddle lead finish: matt-tin</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-500
<b>Evaluation Board</b>	TB-937+
<b>Environmental Ratings</b>	ENV08T1

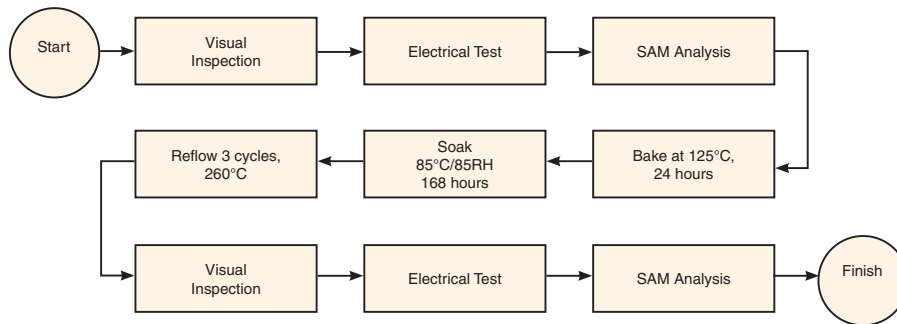
### ESD Rating

Human Body Model (HBM): Class 1A (Pass 250V) in accordance with ANSI/ESD STM 5.1 - 2001

### MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

### MSL Test Flow Chart



### Additional Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)