



ECG012

0.1 Watt, High Linearity InGaP HBT Amplifier

The Communications Edge™

Product Information

Product Features

- 60 – 2500 MHz
- +20 dBm P1dB
- +36 dBm Output IP3
- 14 dB Gain @ 900 MHz
- 12.5 dB Gain @ 1900 MHz
- Single Positive Supply (+3V)
- Available in a lead-free / green SOT-89 Package Style

Applications

- Final stage amplifiers for Repeaters
- Mobile Infrastructure
- CATV / DBS
- Defense / Homeland Security

Specifications ⁽¹⁾

Parameters	Units	Min	Typ	Max
Operational Bandwidth	MHz	60		2500
Test Frequency	MHz		1900	
Gain	dB	11	12.5	
Input Return Loss	dB		15	
Output Return Loss	dB		10	
Output P1dB	dBm		+20	
Output IP3 ⁽²⁾	dBm		+36	
IS-95A Channel Power @ -45 dBc ACPR	dBm		+13	
Noise Figure	dB		4.9	
Operating Current Range	mA	65	100	145
Device Voltage	V		+3	

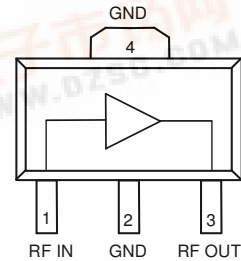
1. Test conditions unless otherwise noted: 25°C, Vsupply = +3 V, in a tuned application circuit.
 2. 3OIP measured with two tones at an output power of +6 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.

Product Description

The ECG012 is a high dynamic range driver amplifier in a low-cost surface mount package. The InGaP/GaAs HBT is able to achieve high performance across a broad range with +36 dBm OIP3 and +20 dBm of compressed 1dB power. It is housed in a lead-free/green/RoHS-compliant SOT-89 SMT package. All devices are 100% RF and DC tested.

The ECG012 is targeted for use as a driver amplifier in wireless infrastructure where high linearity and medium power is required. An internal active bias allows the ECG012 to maintain high linearity over temperature and operate directly off a single +3 V supply. This combination makes the device an excellent candidate for transceiver line cards in current and next generation multi-carrier 3G base stations.

Functional Diagram



Function	Pin No.
Input	1
Output/Bias	3
Ground	2, 4

Typical Performance ⁽³⁾

Parameters	Units	Typical		
Frequency	MHz	900	1900	2140
S21 - Gain	dB	14	12.5	11.5
S11 - Input R.L.	dB	-14	-15	-15
S22 - Output R.L.	dB	-10	-10	-10
Output P1dB	dBm	+20	+20	+20
Output IP3	dBm	+35	+36	+36
Noise Figure	dB	4.7	4.9	5.4
Supply Bias		+3 V @ 100 mA		

3. Typical parameters reflect performance in a tuned application circuit: Supply Voltage = +3 V, I = 100 mA, +25° C

Absolute Maximum Rating

Parameter	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-65 to +150 °C
RF Input Power (continuous)	+15 dBm
Device Voltage	+6 V
Device Current	220 mA
Junction Temperature	+250 °C

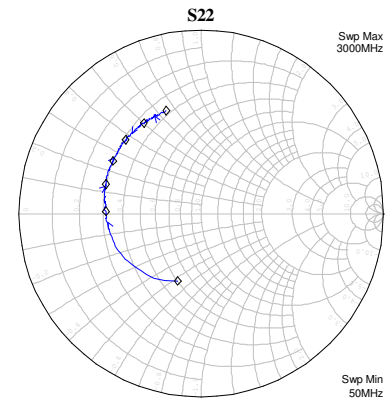
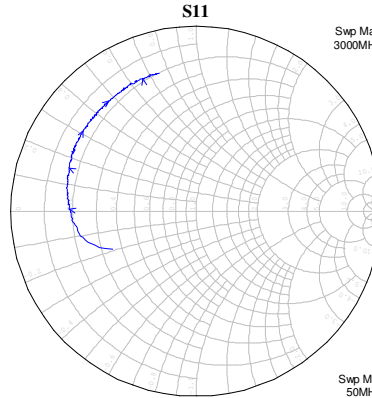
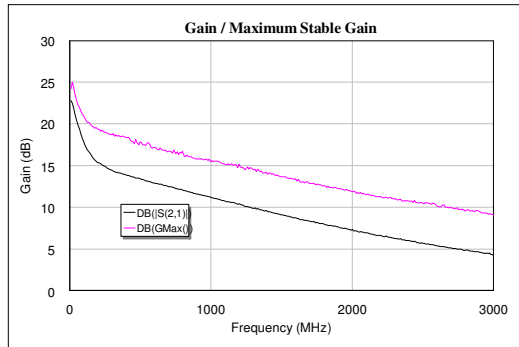
Operation of this device above any of these parameters may cause permanent damage.

Ordering Information

Part No.	Description
ECG012B	0.1 Watt, High Linearity InGaP HBT Amplifier (lead-tin SOT-89 Pkg)
ECG012B-G	0.1 Watt, High Linearity InGaP HBT Amplifier (lead-free/green/RoHS-compliant SOT-89 Pkg)
ECG012B-PCB900	900 MHz Evaluation Board
ECG012B-PCB1900	1900 MHz Evaluation Board
ECG012B-PCB2140	2140 MHz Evaluation Board

Typical Device Data

S-Parameters (Vcc = +3 V, Icc = 100 mA, T = 25°C, unmatched 50 ohm system)



Notes:

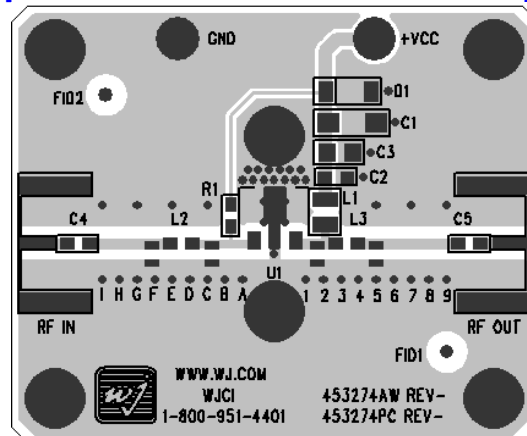
The gain for the unmatched device in 50 ohm system is shown as the trace in black color. For a tuned circuit for a particular frequency, it is expected that actual gain will be higher, up to the maximum stable gain. The maximum stable gain is shown in the dashed red line. The impedance plots are shown from 50 – 3000 MHz, with markers placed at 0.5 – 3.0 GHz in 0.5 GHz increments.

S-Parameters (Vcc = +3 V, Icc = 100 mA, T = 25°C, unmatched 50 ohm system, calibrated to device leads)

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	-6.10	-155.37	20.62	150.95	-25.48	18.56	-8.19	-109.32
250	-3.49	-176.62	14.94	140.53	-23.11	6.69	-5.84	-166.90
500	-3.10	174.48	13.45	129.49	-22.77	5.89	-5.64	178.74
750	-2.96	167.11	12.26	115.68	-22.45	3.33	-5.43	170.66
1000	-2.79	160.22	11.17	102.37	-22.24	1.71	-5.27	162.86
1250	-2.64	153.20	10.12	89.48	-21.89	-0.69	-5.06	156.23
1500	-2.55	146.05	9.07	78.22	-21.32	-2.91	-5.01	149.29
1750	-2.44	138.76	8.18	67.48	-21.09	-5.27	-4.84	142.22
2000	-2.49	132.13	7.30	57.62	-20.45	-7.61	-4.77	135.81
2250	-2.39	125.66	6.45	48.01	-20.33	-11.25	-4.69	128.87
2500	-2.35	119.11	5.69	39.53	-19.88	-16.63	-4.68	122.52
2750	-2.28	111.83	4.98	30.50	-19.58	-18.56	-4.70	115.41
3000	-2.29	104.87	4.30	21.43	-18.98	-24.51	-4.54	108.72

Device S-parameters are available for download off of the website at: <http://www.wj.com>

Application Circuit PC Board Layout



Circuit Board Material: .014" Getek, 4 layers (other layers added for rigidity), .062" total thickness, 1 oz copper
Microstrip line details: width = .026", spacing = .026"



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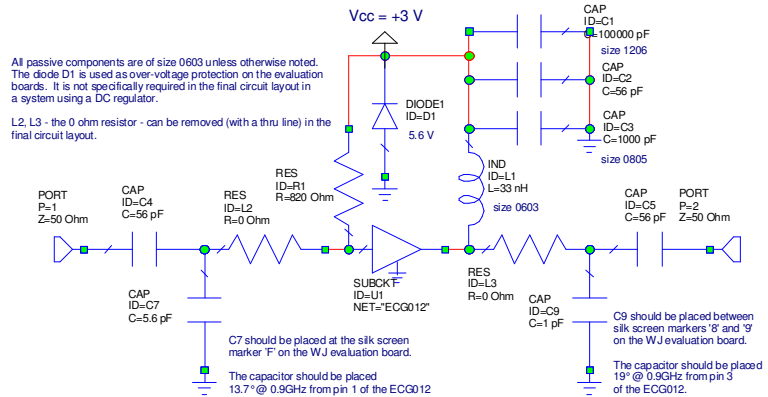
Product Information

900 MHz Application Circuit (ECG012B-PCB900)

Typical RF Performance

Frequency	900 MHz
S21 – Gain	14 dB
S11 – Input Return Loss	-14 dB
S22 – Output Return Loss	-10 dB
Output IP3 (+6 dBm / tone, 1 MHz spacing)	+35 dBm
Output P1dB	+20 dBm
Noise Figure	4.7 dB
Supply Voltage	+3 V
Supply Current	100 mA

Measured parameters were taken at 25 °C.

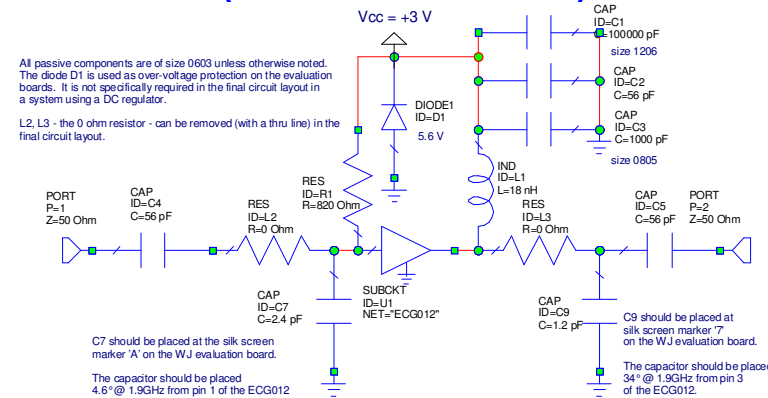


1900 MHz Application Circuit (ECG012B-PCB1900)

Typical RF Performance

Frequency	1900 MHz
S21 – Gain	12.5 dB
S11 – Input Return Loss	-15 dB
S22 – Output Return Loss	-10 dB
Output IP3 (+6 dBm / tone, 1 MHz spacing)	+36 dBm
Output P1dB	+20 dBm
Noise Figure	4.9 dB
Supply Voltage	+3 V
Supply Current	100 mA

Measured parameters were taken at 25 °C.

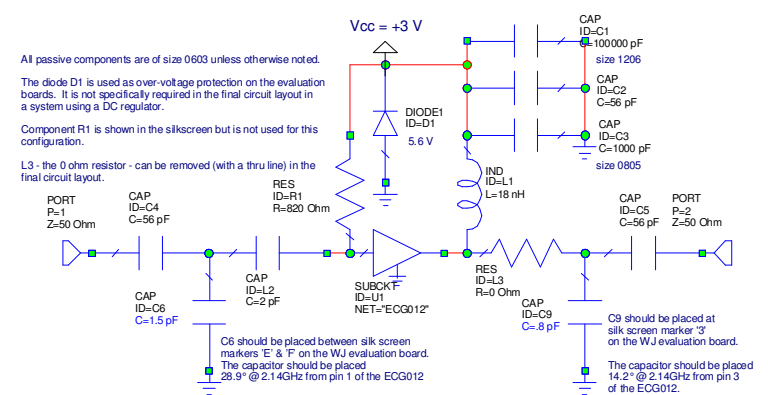


2140 MHz Application Circuit (ECG012B-PCB2140)

Typical RF Performance

Frequency	2140 MHz
S21 – Gain	11.5 dB
S11 – Input Return Loss	-15 dB
S22 – Output Return Loss	-10 dB
Output IP3 (+6 dBm / tone, 1 MHz spacing)	+34 dBm
Output P1dB	+20 dBm
Noise Figure	5.4 dB
Supply Voltage	+3 V
Supply Current	100 mA

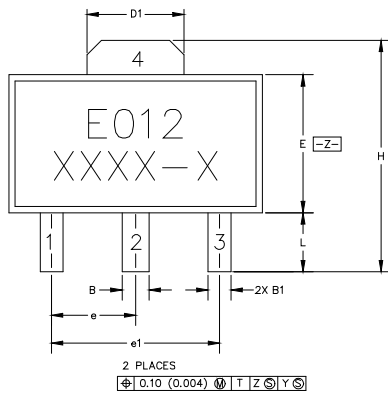
Measured parameters were taken at 25 °C.



ECG012B (SOT-89 Package) Mechanical Information

This package may contain lead-bearing materials. The plating material on the leads is SnPb.

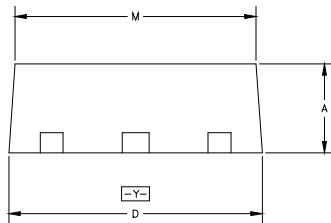
Outline Drawing



SYMBOL	MIN	MAX
A	1.40 (.055)	1.60 (.063)
B	.44 (.017)	.56 (.022)
B1	.36 (.014)	.48 (.019)
C	.35 (.014)	.44 (.017)
D	4.40 (.173)	4.60 (.181)
D1	1.62 (.064)	1.83 (.072)
E	2.29 (.079)	2.60 (.102)
E1	2.13 (.084)	2.29 (.090)
e	1.50 BSC (.059)	
e1	3.00 BSC (.118)	
H	3.94 (.155)	4.25 (.167)
L	.89 (.035)	1.20 (.047)
M	4.04 (.159)	4.19 (.165)

NOTES:

1. DIMENSIONS CONFORM WITH JEDEC TO-243C EXCEPT WHERE INDICATED.
2. DIMENSIONS ARE EXPRESSED IN MILLIMETERS(INCHES).
3. DIMENSIONING AND TOLERANCING IAW ANSI Y14.5M



Product Marking

The component will be marked with an "E012" designator with an alphanumeric lot code on the top surface of the package.

Tape and reel specification for this part is located on the website in the "Application Notes" section.

ESD / MSL Information

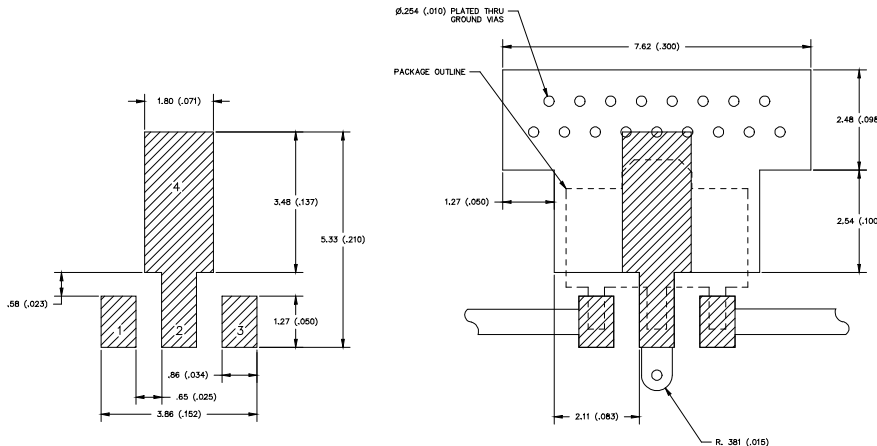


Caution! ESD sensitive device.

ESD Rating: Class 1B
 Value: Passes between 500 and 1000V
 Test: Human Body Model (HBM)
 Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 3 at +235° C convection reflow
 Standard: JEDEC Standard J-STD-020

Land Pattern



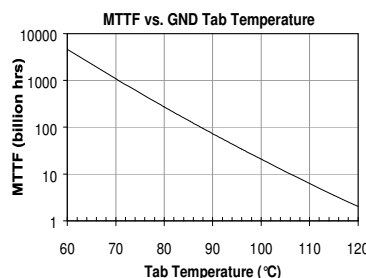
1. Ground / thermal vias are critical for the performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
4. Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
5. RF trace width depends upon the PC board material and construction.
6. Use 1 oz. Copper minimum.
7. All dimensions are in millimeters (inches). Angles are in degrees.

Thermal Specifications

Parameter	Rating
Operating Case Temperature	-40 to +85° C
Thermal Resistance, Rth ⁽¹⁾	149° C / W
Junction Temperature, Tjc ⁽²⁾	130° C

Notes:

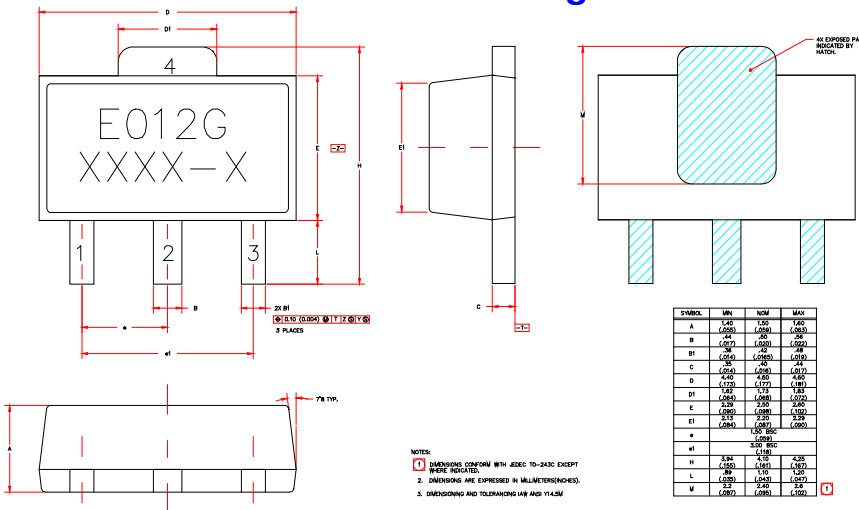
1. The thermal resistance is referenced from the junction-to-case at a case temperature of 85° C.
2. This corresponds to the typical biasing condition of +3V, 100 mA at an 85° C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 247° C.



ECG012B (Green / Lead-free SOT-89 Package) Mechanical Information

This package is lead-free/Green/RoHS-compliant. It is compatible with both lead-free (maximum 260°C reflow temperature) and leaded (maximum 245°C reflow temperature) soldering processes. The plating material on the leads is NiPdAu.

Outline Drawing



Product Marking

The component will be marked with an "E012G" designator with an alphanumeric lot code on the top surface of the package.

Tape and reel specification for this part is located on the website in the "Application Notes" section.

ESD / MSL Information

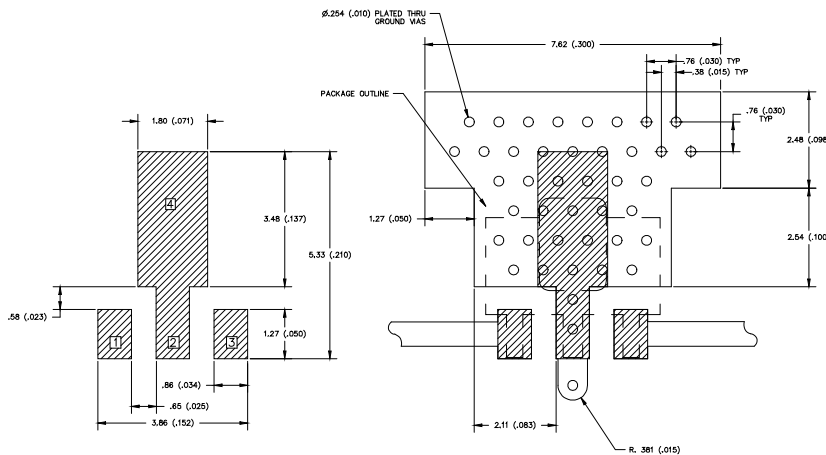


Caution! ESD sensitive device.

ESD Rating: Class 1B
 Value: Passes between 500 and 1000V
 Test: Human Body Model (HBM)
 Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 3 at +260° C convection reflow
 Standard: JEDEC Standard J-STD-020

Land Pattern



Mounting Config. Notes

- Ground / thermal vias are critical for the performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
- Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
- Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
- Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
- RF trace width depends upon the PC board material and construction.
- Use 1 oz. Copper minimum.
- All dimensions are in millimeters (inches). Angles are in degrees.

Thermal Specifications

Parameter	Rating
Operating Case Temperature	-40 to +85° C
Thermal Resistance, Rth ⁽¹⁾	149° C / W
Junction Temperature, Tjc ⁽²⁾	130° C

Notes:

- The thermal resistance is referenced from the junction-to-case at a case temperature of 85° C.
- This corresponds to the typical biasing condition of +3V, 100 mA at an 85° C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 247° C.

