

BG13B

5-4000 MHz Cascadable InGaP HBT Gain Block



Device Features

- OIP3 = 35 dBm @ 1900 MHz
- Gain = 13.3 dB @ 1900 MHz
- Output P1 dB = 18.5 dBm @ 1900 MHz
- 50 Ω Cascadable
- Patented temperature compensation
- Lead-free/RoHS-compliant SOT-89 SMT package



Product Description

BeRex's BG13B is a high performance InGaP/ GaAs HBT MMIC amplifier, internally matched to 50 Ohms and uses a patented **temperature compensation** circuit to provide stable current over the operating temperature range without the need for external components. The BG13B is designed for high linearity gain block applications that require excellent gain flatness. It is packaged in a RoHS-compliant with SOT-89 surface mount package.

Typical Performance¹

	Frequency						Unit
	70	900	1900	2140	2450	3500	MHz
Gain	13.8	13.5	13.3	13	12.5	12.1	dB
S11	-10.8	-14.3	-16.3	-17.2	-16.6	-16.3	dB
S22	-10.1	-12.2	-11.1	-10.4	-11.8	-13.9	dB
OIP3 ²	38.0	37.0	35.0	35.0	35.0	30.0	dBm
P1dB	18.4	18.5	18.5	18.5	18.5	17.7	dBm
N. F	8.2	8.1	8.3	8.3	8.4	8.5	dB

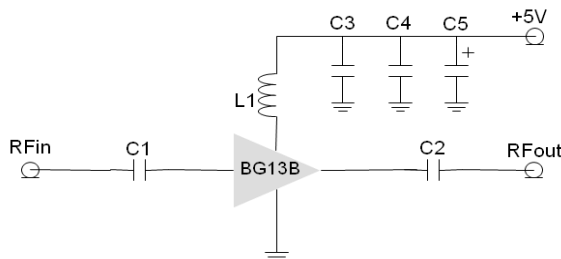
¹ Device performance _ measured on a BeRex evaluation board at 25°C, 50 Ω system.

² OIP3 _ measured with two tones at an output of 7 dBm per tone separated by 1 MHz.

Applications

- Base station Infrastructure/RFID
- Commercial/Industrial/Military wireless system

Applications Circuit



*C1, C2, C3 =100 pF ± 5%; C4 = 1000 pF ± 5%; C5 = 10uF; L1 = 22nH

*less than 20nH improves RF performance at over 1.9GHz.

*100nH or higher value L1 improves RF performance at under 500MHz.

*Optimum value of L1 may vary with board design.

*L1:1.2uH, C1&C2:6.8nF for 70MHz Application.

*L1:6.8nH, C1&C2:10pF for 3.5GHz Application.

	Min.	Typical	Max.	Unit
Bandwidth	5		4000	MHz
I _c @ (V _c = 5V)	65	70	80	mA
V _c		5.0		V
dG/dT		-0.004		dB/°C
R _{TH}		85		°C/W

Absolute Maximum Ratings

Parameter	Rating	Unit
Operating Case Temperature	-40 to +85	°C
Storage Temperature	-55 to +155	°C
Junction Temperature	+220	°C
Operating Voltage	+5.5	V
Supply Current	150	mA
Input RF Power	23	dBm

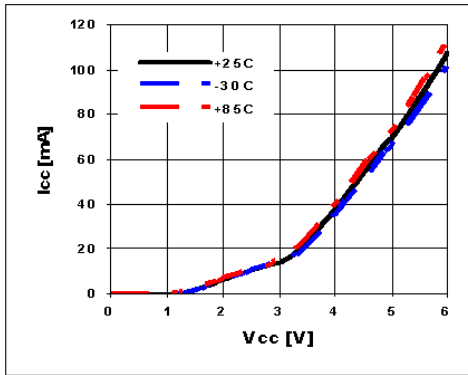
Operation of this device above any of these parameters may result in permanent damage.

BG13B

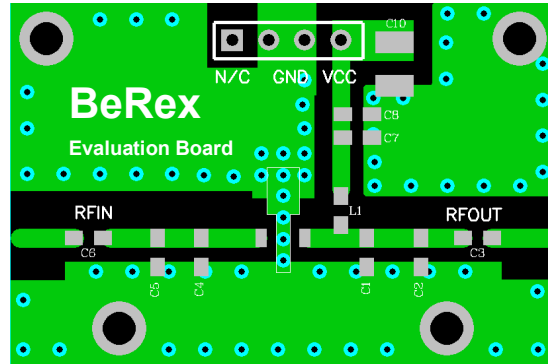
5-4000 MHz Cascadable InGaP HBT Gain Block



V-I Characteristics



BeRex SOT89 Evaluation Board

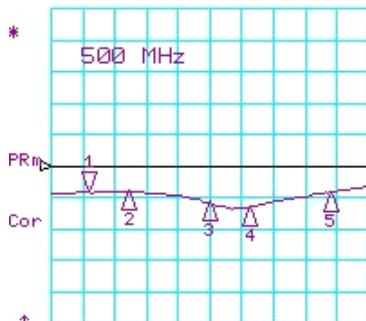


*Dielectric constant _ 4.2 *RF pattern width 52mil *31mil thick FR4 PCB

Typical Device Data

S-parameters (V_c=5V, I_c=70mA, T=25°C)

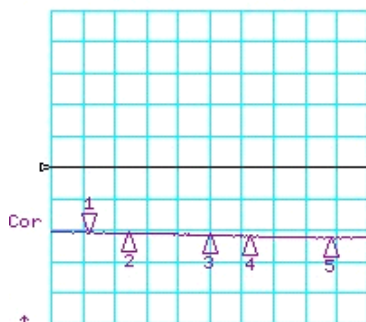
CH1 LOG 20 dB/ REF 0 dB
S11 1: -16.783 dB 500.000 000 MHz



CH1 Markers
2: -16.335 dB
1.00000 GHz
3: -23.120 dB
2.00000 GHz
4: -26.098 dB
2.50000 GHz
5: -16.687 dB
3.50000 GHz

START 50.000 MHz STOP 4000.000 MHz

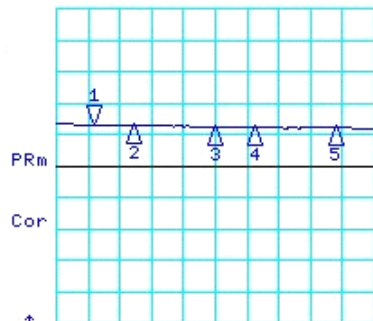
CH3 LOG 10 dB/ REF 0 dB
S13 1: -20.694 dB 500.000 000 MHz



CH3 Markers
2: -20.729 dB
1.00000 GHz
3: -21.484 dB
2.00000 GHz
4: -21.885 dB
2.50000 GHz
5: -22.361 dB
3.50000 GHz

START 50.000 MHz STOP 4000.000 MHz

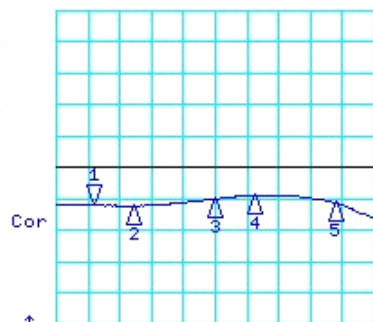
CH2 LOG 10 dB/ REF 0 dB
S31 1: 13.133 dB 500.000 000 MHz



CH2 Markers
2: 12.987 dB
1.00000 GHz
3: 12.616 dB
2.00000 GHz
4: 12.355 dB
2.50000 GHz
5: 12.286 dB
3.50000 GHz

START 50.000 MHz STOP 4000.000 MHz

CH4 LOG 10 dB/ REF 0 dB
S33 1: -11.938 dB 500.000 000 MHz



CH4 Markers
2: -12.243 dB
1.00000 GHz
3: -9.9775 dB
2.00000 GHz
4: -8.8718 dB
2.50000 GHz
5: -11.140 dB
3.50000 GHz

START 50.000 MHz STOP 4000.000 MHz

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5-4000 MHz Cascadable InGaP HBT Gain Block

S-Parameter

(Vdevice = 5.0V, Icc = 70mA, T = 25 °C, calibrated to device leads)

Freq [MHz]	S11 [Mag]	S11 [Ang]	S21 [Mag]	S21 [Ang]	S12 [Mag]	S12 [Ang]	S22 [Mag]	S22 [Ang]
100	0.14	171.81	4.61	173.88	0.09	-4.42	0.26	-7.83
500	0.14	142.15	4.54	150.66	0.09	-20.72	0.25	-37.69
1000	0.15	107.88	4.46	121.54	0.09	-41.87	0.24	-76.84
1500	0.12	75.55	4.34	92.58	0.09	-61.58	0.27	-114.21
2000	0.07	34.78	4.27	64.42	0.08	-80.82	0.32	-143.96
2500	0.05	-55.88	4.14	36.72	0.08	-99.78	0.36	-166.97
3000	0.09	-96.09	4.11	8.91	0.08	-119.26	0.35	170.79
3500	0.15	-100.53	4.12	-18.95	0.08	-139.12	0.28	144.53
4000	0.22	-103.52	3.90	-47.65	0.08	-162.43	0.16	95.73

Typical Performance (Vd = 5V, Ic = 70mA, T = 25°C)

Freq	MHz	70	500	900	1900	2140	2450	3500
S21	dB	13.9	13.7	13.5	13.3	13.0	12.5	12.1
S11	dB	-17.0	-16.5	-16.2	-21.2	-25.0	-26.0	-16.3
S22	dB	-11.0	-12.0	-12.2	-10.0	-9.5	-9.0	-13.9
P1	dBm	18.4	18.5	18.5	18.5	18.5	18.5	17.7
OIP3	dBm	36.0	36.0	37.0	35.0	35.0	35.0	30.0
NF	dB	8.2	8.1	8.1	8.3	8.3	8.4	8.5

Typical Performance (Vd = 4.7 V, Ic = 65 mA, Ta = 25 °C)

Freq	MHz	70	500	900	1900	2140	2450
S21	dB	13.8	13.7	13.5	12.9	12.6	12.5
S11	dB	-10.6	-13.9	-14	-15.9	-16.8	-16.3
S22	dB	-10.1	-11.8	-12.3	-11.2	-10.4	-11.8
P1	dBm	17	17	17	17.2	16.8	17.2
OIP3	dBm	36	33.5	34	33.5	33	33
NF	dB	8.2	8.1	8.1	8.3	8.3	8.4

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5-4000 MHz Cascadable InGaP HBT Gain Block

Typical Performance (Vd = 4.5 V, Ic = 58 mA, Ta = 25 °C)

Freq	MHz	70	500	900	1900	2140	2450
S21	dB	13.7	13.7	13.4	13.2	12.9	12.5
S11	dB	-10.8	-14.2	-14.3	-16.3	-17.2	-16.6
S22	dB	-10.1	-11.7	-12.2	-11.1	-10.4	-11.8
P1	dBm	16.0	15.9	15.8	15.9	15.9	16.1
OIP3	dBm	35.0	34.0	32.0	31.5	31.0	32.5
NF	dB	8.2	8.1	8.1	8.3	8.3	8.4

Typical Performance (Vd = 4 V, Ic = 41 mA, Ta = 25 °C)

Freq	MHz	70	500	900	1900	2140	2450
S21	dB	13.3	13.1	13.2	12.6	12.3	12.3
S11	dB	-11.7	-11.3	-15.5	-17.8	-18.9	-18.1
S22	dB	-9.9	-11.2	-11.8	-10.8	-10.0	-11.1
P1	dBm	12	11.7	11.8	12.2	11.4	12.5
OIP3	dBm	27	25	25.5	26	25.0	26.0
NF	dB	8.2	8.1	8.1	8.3	8.3	8.4

Typical Performance (Vd = 3.5 V, Ic = 27 mA, Ta = 25 °C)

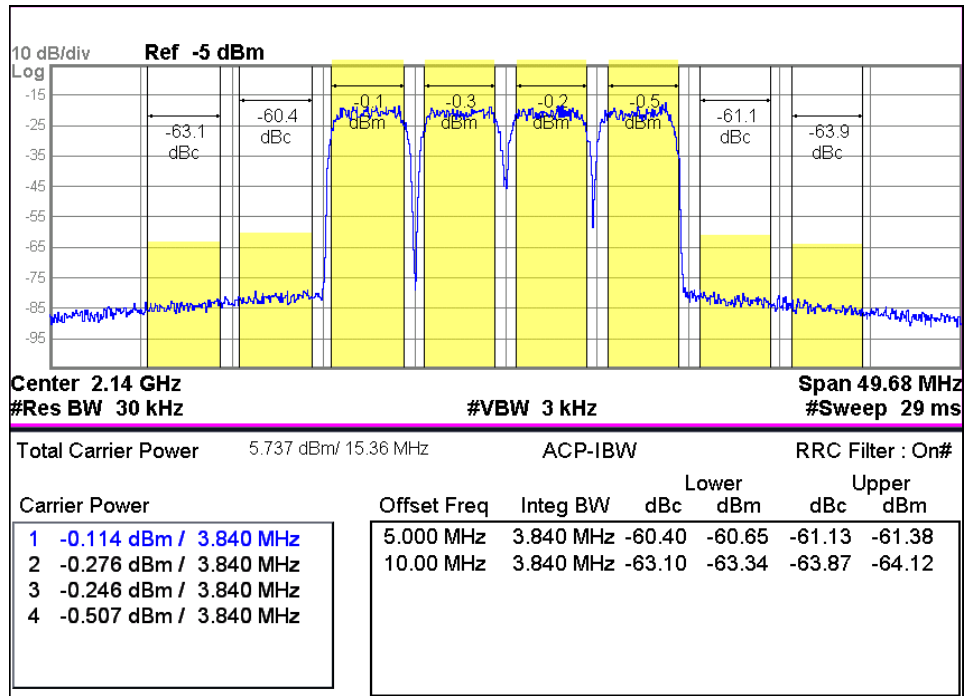
Freq	MHz	70	500	900	1900	2140	2450
S21	dB	12.4	12.2	12.3	11.8	11.5	11.4
S11	dB	-14.2	-19.9	-19.5	-23.3	-25.4	-22.9
S22	dB	-9.2	-9.9	-10.2	-9.5	-9.0	-10.0
P1	dBm	5.0	6.2	6.2	6.4	5.7	6.7
OIP3	dBm	17.5	16	16.5	17.0	16.0	17.0
NF	dB	8.2	8.1	8.1	8.3	8.3	8.4

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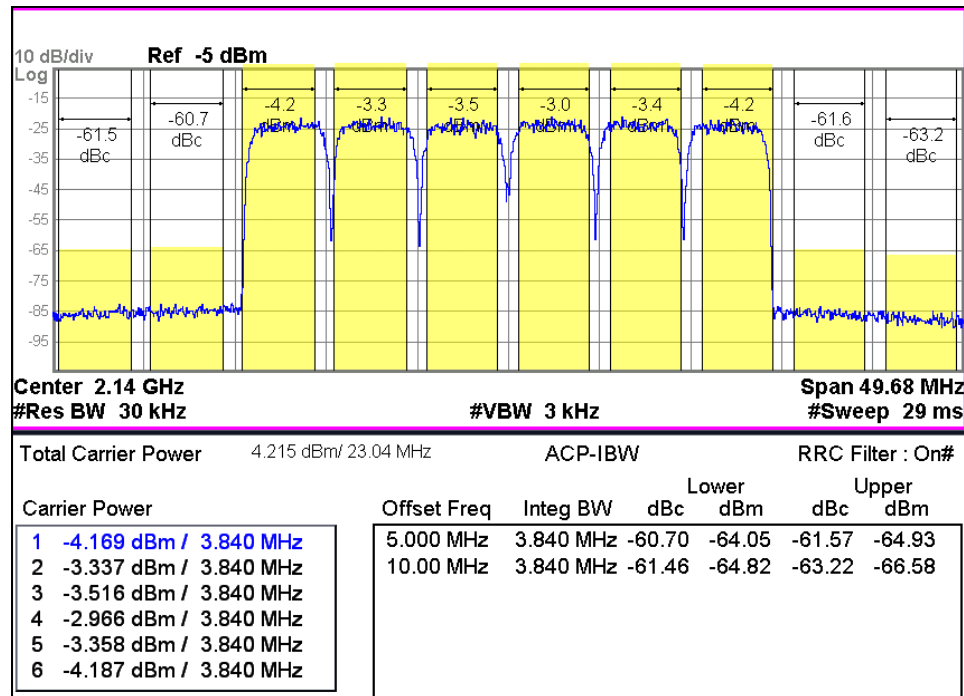


5-4000 MHz Cascadable InGaP HBT Gain Block

WCDMA 4FA 2140 -60dBc



WCDMA 6FA 2140 -60dBc

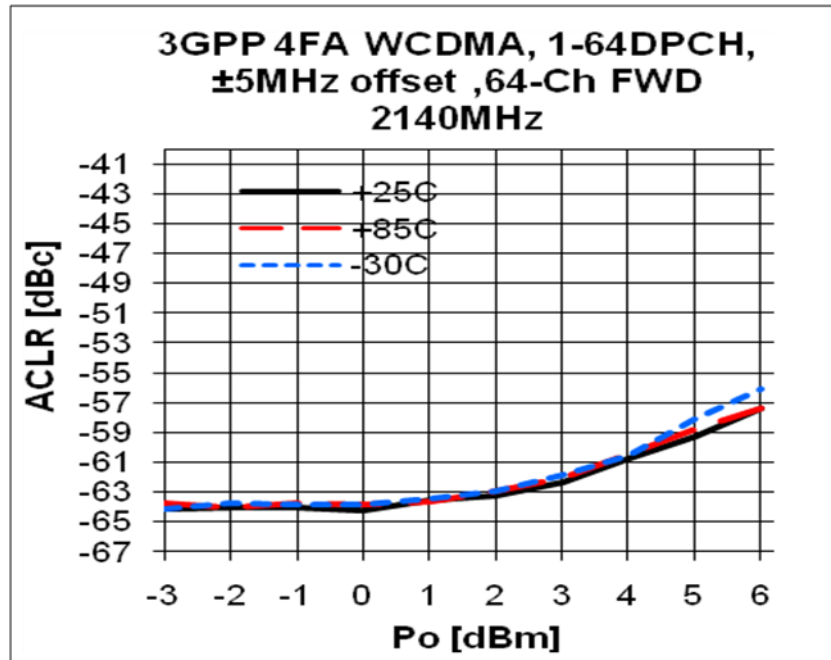


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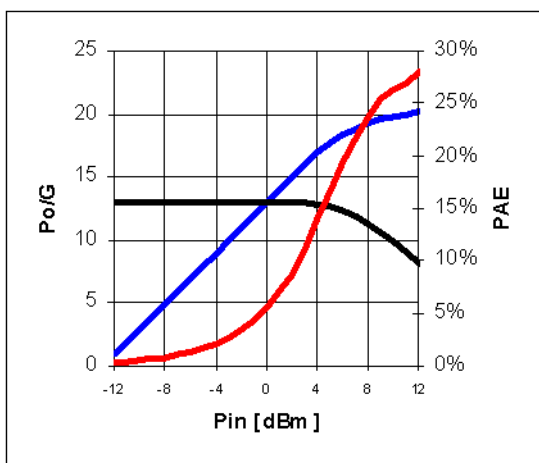
5-4000 MHz Cascadable InGaP HBT Gain Block

ACLR

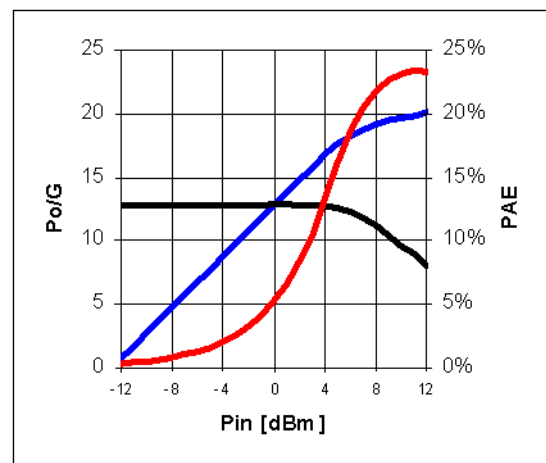


Device Performance

Pin-Pout-Gain



900MHz, 5V/70mA



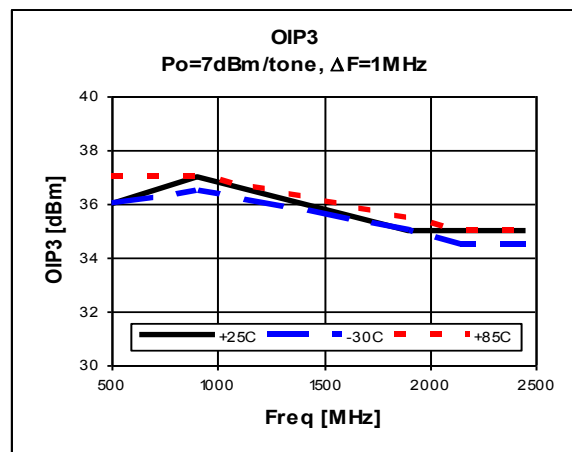
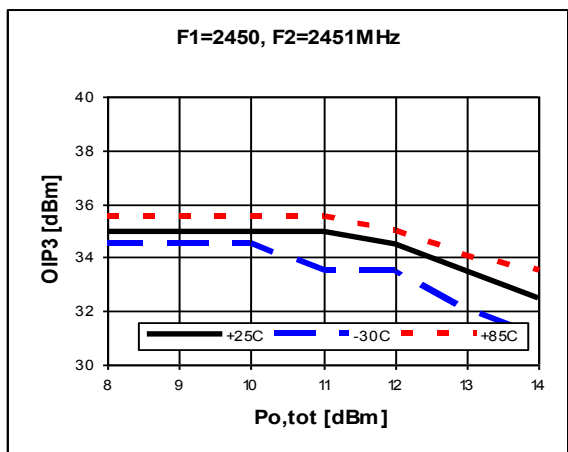
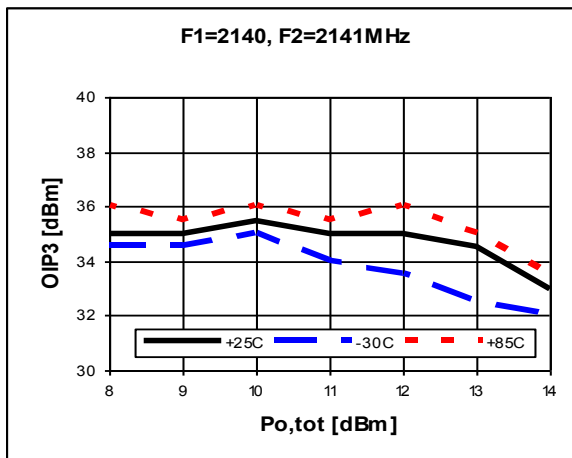
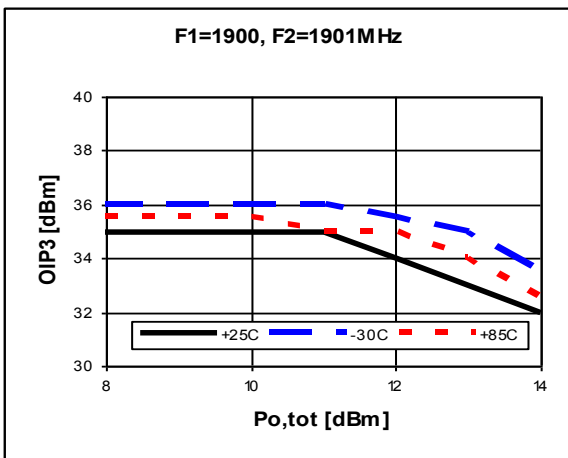
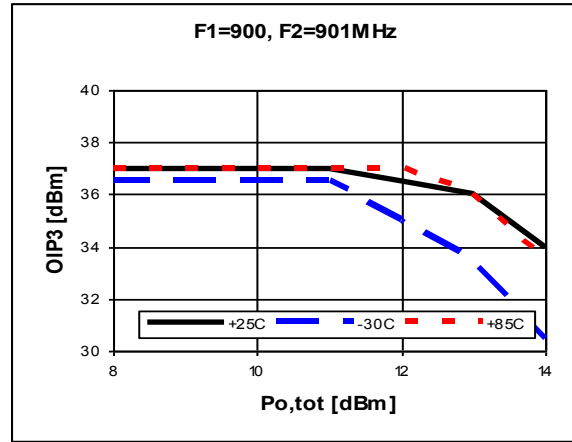
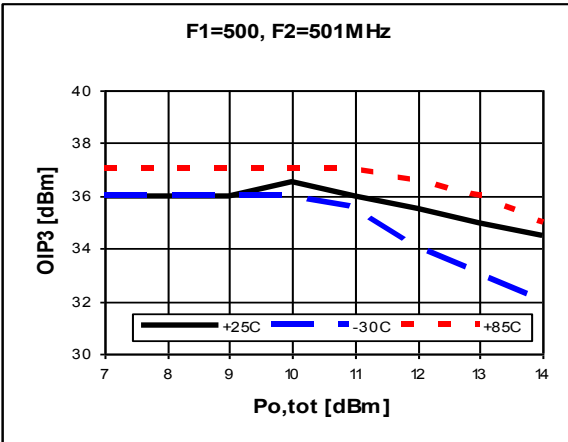
1900 MHz, 5V/70mA

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OIP3

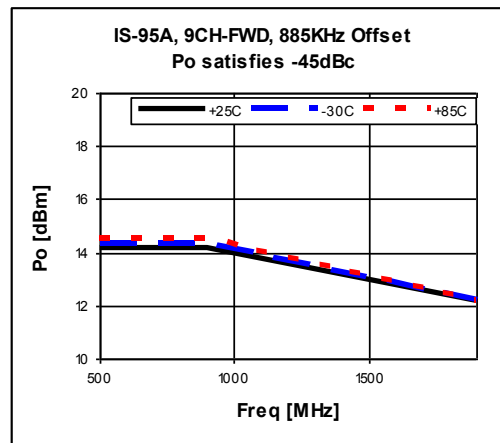
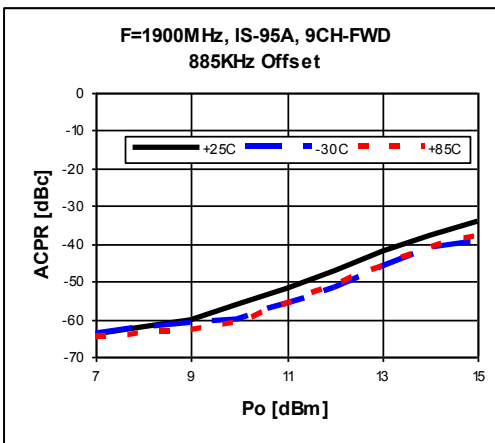
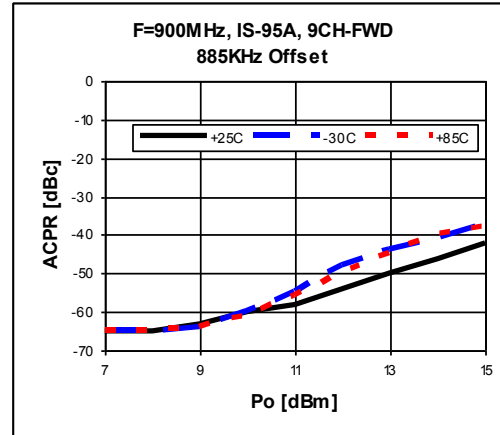
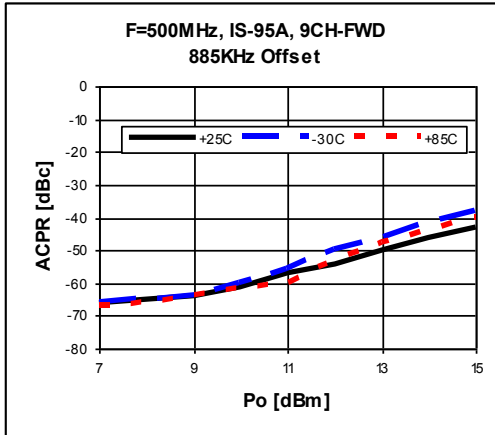


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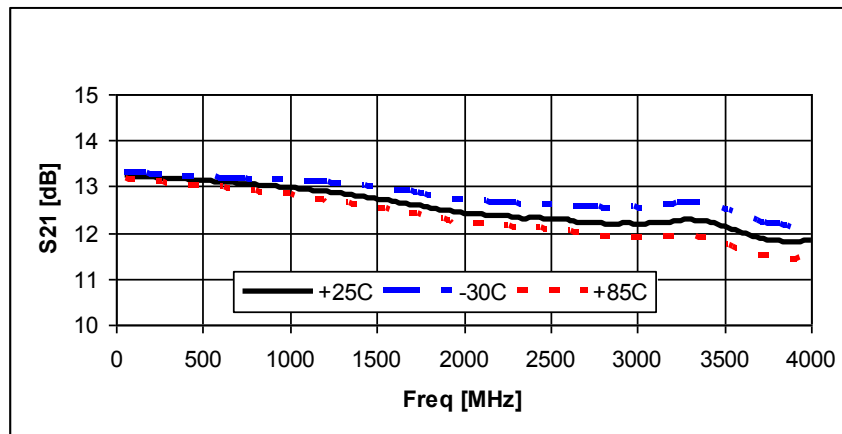
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ACPR



Gain Flatness

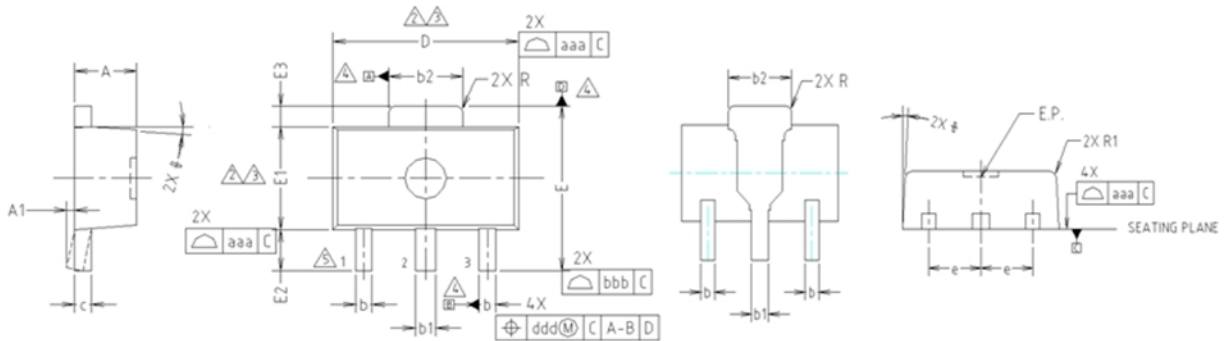


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5-4000 MHz Cascadable InGaP HBT Gain Block



Package Outline Dimension

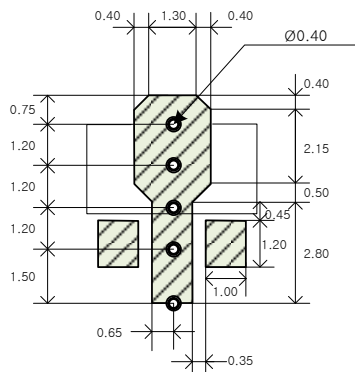


- NOTE:**
1. DIMENSIONS IN MILLIMETERS.
- ⚠ DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.5mm PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.5mm PER SIDE.
 - ⚠ DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
 - ⚠ DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.
 - ⚠ TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.40	1.50	1.60	
A1	0.00	—	0.10	
b	0.38	0.42	0.48	
b1	0.48	0.52	0.58	
b2	1.79	1.82	1.87	
c	0.40	0.42	0.46	
D	4.40	4.50	4.70	2,3
E	3.70	4.00	4.30	
E1	2.40	2.50	2.70	2,3
E2	0.80	1.00	1.20	
E3	0.40	0.50	0.60	
e	1.50 TYP.			
φ	4° TYP.			
R	0.15 TYP.			
R1	—	—	0.20	
SYMBOL	TOLERANCES OF FORM AND POSITION		NOTE	
aaa	0.15			
bbb	0.20			
ccc	0.10			
ddd	0.10			

Suggested PCB Land Pattern and PAD Layout

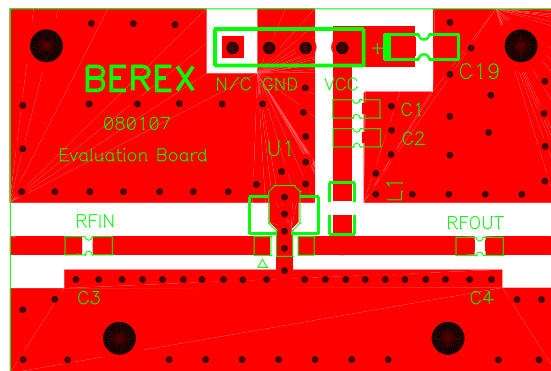
PCB Land Pattern



Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting

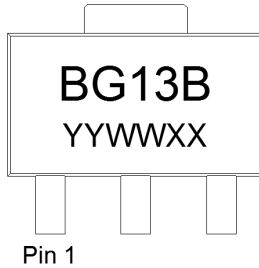


BG13B



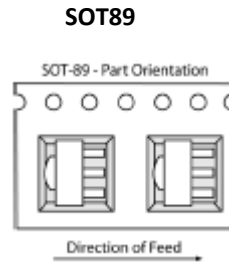
5-4000 MHz Cascadable InGaP HBT Gain Block

Package Marking



YY = Year, WW = Working Week,
XX = Wafer No.

Tape & Reel



Packaging information:

- Tape Width (mm): 12
- Reel Size (inches): 7
- Device Cavity Pitch (mm): 8
- Devices Per Reel: 1000

Lead plating finish

100% Tin Matte finish

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

MSL / ESD Rating

ESD Rating:	Class 1C
Value:	Passes <2000V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114B
MSL Rating:	Level 1 at +265°C convection reflow
Standard:	JEDEC Standard J-STD-020

NATO CAGE code:

2	N	9	6	F
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