

## 5-4000 MHz Cascadeable InGaP HBT Gain Block

### Device Features

- 32dBm Output IP3 at 7dBm/tone at 900MHz
- 24.5dB Gain at 900 MHz
- 19dBm P1dB at 900MHz
- Highly Reliable InGaP/GaAs HBT Technology
- Temperature Compensation Circuit patent
- SOT-89 Surface Mount Package
- 50 ohm Cascadeable
- Lead-free/Green/RoHS compliant
- Application: commercial, space, military wireless system



### Electrical Specifications ( $T_a = 25^\circ\text{C}$ , $V_s = 5.0\text{V}$ )

Parameters	Test Conditions	Min	Typ	Max	Unit
<b>Frequency Range</b>		5		4000	MHz
<b>Gain</b>	900 MHz	23.5	24.5	25.5	dB
	1900 MHz	20.5	21.5	22.5	
	2450 MHz	19.0	20.0	21.5	
<b>S11</b>	900 MHz		-15.0		dB
	1900 MHz		-14.0		
	2450 MHz		-13.0		
<b>S22</b>	900 MHz		-11.0		dB
	1900 MHz		-11.0		
	2450 MHz		-11.0		
<b>OIP3</b>	900 MHz	30.0	32.0		dBm
	1900 MHz	30.0	32.0		
	2450 MHz	29.5	31.5		
<b>P1dB</b>	900 MHz	18.0	19.0		dBm
	1900 MHz	18.0	19.0		
	2450 MHz	18.0	19.0		
<b>Ic</b>	$V_c = 5.0\text{V}$	57	65	75	mA
<b>Vc</b>			5.0		V
<b>dG/dT</b>			-0.007		dB/°C
<b>Rth</b>	Thermal Resistance		85		°C/W

Test conditions unless otherwise noted.

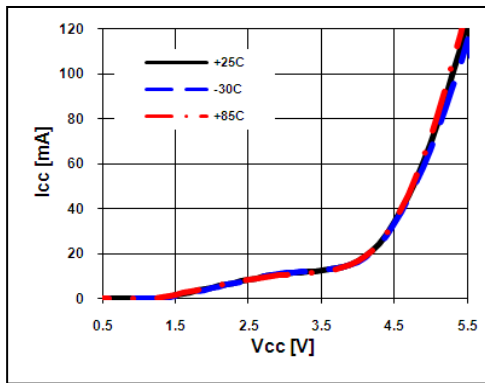
1. Device performance is measured on BeRex evaluation board at 25C, 50 ohm system
2. OIP3 measured with two tones at an output power of 7dBm/tone separated by 1MHz.

**Absolute Maximum Ratings**

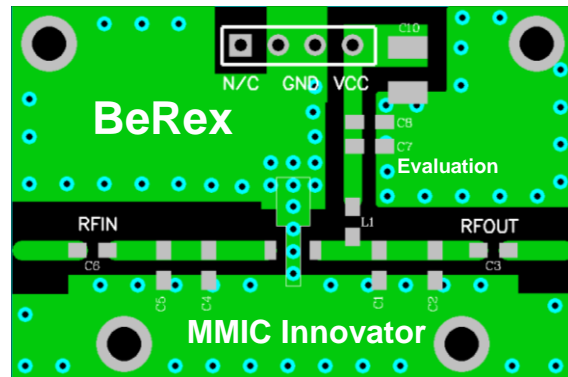
Parameters	Rating
Operating Case temperature	-40 to +85°C
Storage Temperature	-55 to +155°C
Junction Temperature	+220°C
Operating Voltage	+5.5V
Supply Current	150mA
Input RF Power	23dBm

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

[I-V Characteristics]



[Generic SOT89 Evaluation Board]



- \*Dielectric constant is 4.2
- \*RF pattern width 52mil
- \*31mil thick FR4 PCB

**Application Circuit: 5-4000 MHz**

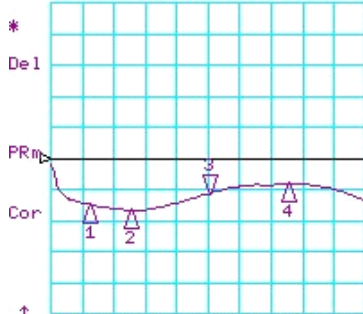
Schematic Diagram	BOM	Tolerance
	C1	100pF ±5%
	C2	100pF ±5%
	C3	100pF ±5%
	C4	1000pF ±5%
	C5	10uF ±20%
	L1*	39nH 5%

\*Note: Less than 20nH improves RF performance at frequencies over 1.9GHz.  
 40nH or higher value L1 improves RF performance at frequencies under 500MHz.  
 Optimum value of L1 may vary with board design.

### Typical Device Data

S-parameters (Vc=5V, Ic=65mA, T=25°C)

CH1 LOG 10 dB/ REF 0 dB  
S11 3:-11.342 dB 2 000.000 000 MHz

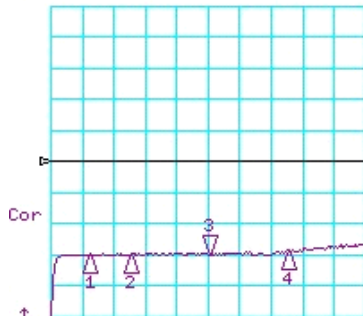


CH1 Markers

- 1:-14.757 dB  
500.000 MHz
- 2:-16.575 dB  
1.00000 GHz
- 4:-8.0746 dB  
3.00000 GHz

START 10.000 MHz STOP 4000.000 MHz

CH3 LOG 10 dB/ REF 0 dB  
S13 3:-29.905 dB 2 000.000 000 MHz

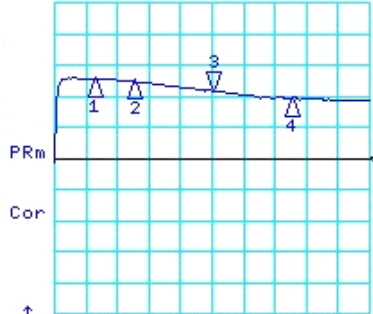


CH3 Markers

- 1:-30.036 dB  
500.000 MHz
- 2:-29.925 dB  
1.00000 GHz
- 4:-28.699 dB  
3.00000 GHz

START 10.000 MHz STOP 4000.000 MHz

CH2 LOG 10 dB/ REF 0 dB  
S31 3: 21.770 dB 2 000.000 000 MHz

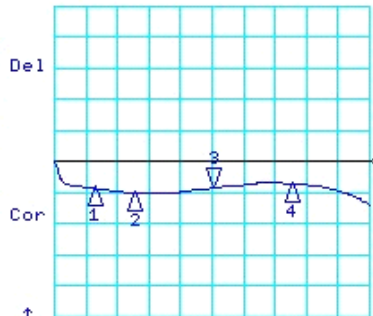


CH2 Markers

- 1: 25.679 dB  
500.000 MHz
- 2: 24.771 dB  
1.00000 GHz
- 4: 19.466 dB  
3.00000 GHz

START 10.000 MHz STOP 4000.000 MHz

CH4 LOG 10 dB/ REF 0 dB  
S33 3:-8.5810 dB 2 000.000 000 MHz



CH4 Markers

- 1:-8.6175 dB  
500.000 MHz
- 2:-10.088 dB  
1.00000 GHz
- 4:-7.1549 dB  
3.00000 GHz

START 10.000 MHz STOP 4000.000 MHz

### S-Parameter

(Vdevice = 5.0V, Icc = 65mA, 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	0.371	-46.71	17.980	-142.37	0.028	44.36	0.506	106.93
500	0.184	-47.05	19.135	144.06	0.031	-4.24	0.374	-26.08
1000	0.148	-79.53	17.280	96.74	0.032	-23.22	0.314	-90.77
1500	0.176	-125.09	14.637	56.43	0.033	-41.49	0.321	-140.62
2000	0.271	-163.96	12.220	18.73	0.032	-58.31	0.378	-171.51
2500	0.377	163.00	10.452	-13.09	0.034	-75.27	0.431	167.630
3000	0.392	135.99	9.372	-39.99	0.035	-82.89	0.440	145.411
3500	0.340	101.23	8.821	-74.62	0.040	-107.30	0.368	119.240
4000	0.208	39.13	8.471	-109.01	0.047	-131.75	0.203	78.293

Typical Performance ( $V_c = 5V$ ,  $I_c = 65mA$ ,  $T = 25^\circ C$ )

Freq	MHz	500	900	1900	2140	2450	3500
S21	dB	25.4	24.5	21.5	20.7	20.0	19.0
S11	dB	-13.0	-15.0	-12.0	-12.0	-10.0	-8.5
S22	dB	-8.4	-10.1	-8.8	-8.5	-8.0	-7.4
P1	dBm	19.0	19.0	19.0	19.0	19.0	19.0
OIP3	dBm	32.0	32.0	32.0	31.5	31.0	30.0
NF	dB	4.0	4.0	4.2	4.3	4.5	4.8

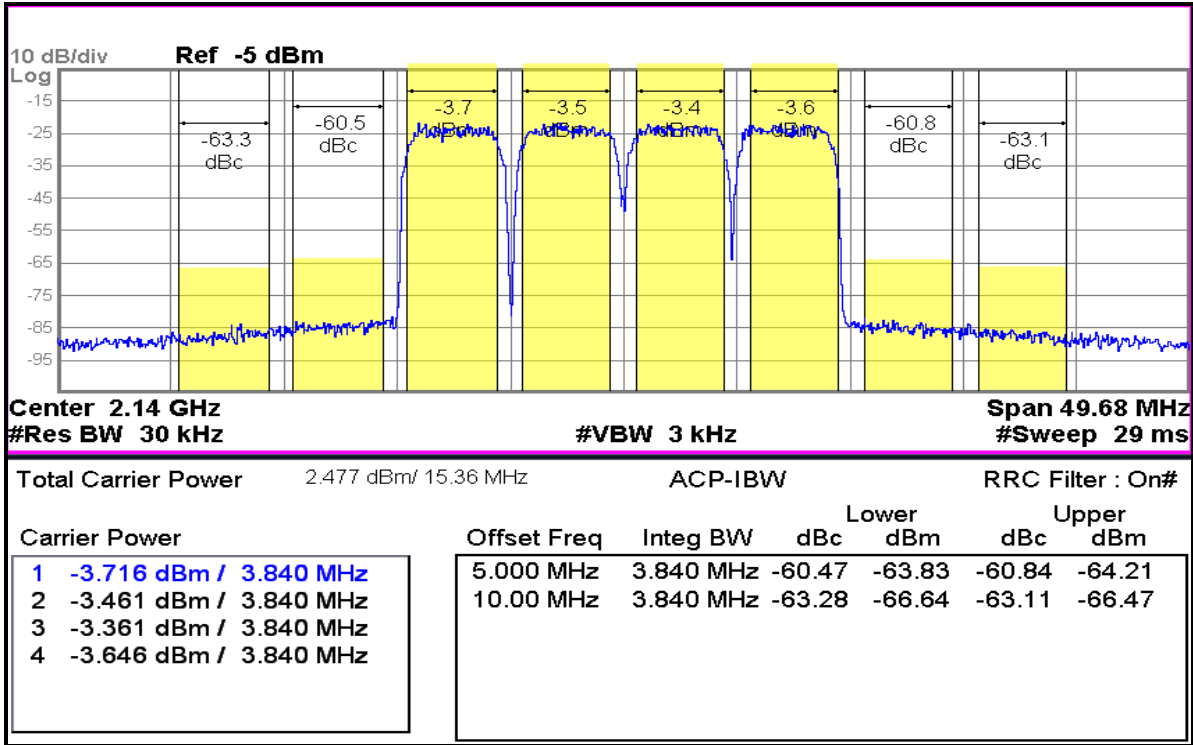
Typical Performance ( $V_c = 4.7V$ ,  $I_c = 44mA$ ,  $T = 25^\circ C$ )

Freq	MHz	70	500	900	1900	2140	2450	3500
S21	dB	25.1	24	23.6	21.2	20.5	19.8	17.9
S11	dB	-11.0	-9.5	-10.4	-10.3	-10.0	-10.1	-8.6
S22	dB	-4.8	-5.5	-6.2	-7.5	-7.4	-7.9	-9.2
P1	dBm	14.8	15.2	15.2	16.1	13.5	16.1	15.4
OIP3	dBm	28.0	26.0	26.5	27.5	26.5	27.5	26.5
NF	dB		4.0	4.0	4.2	4.3	4.5	4.8

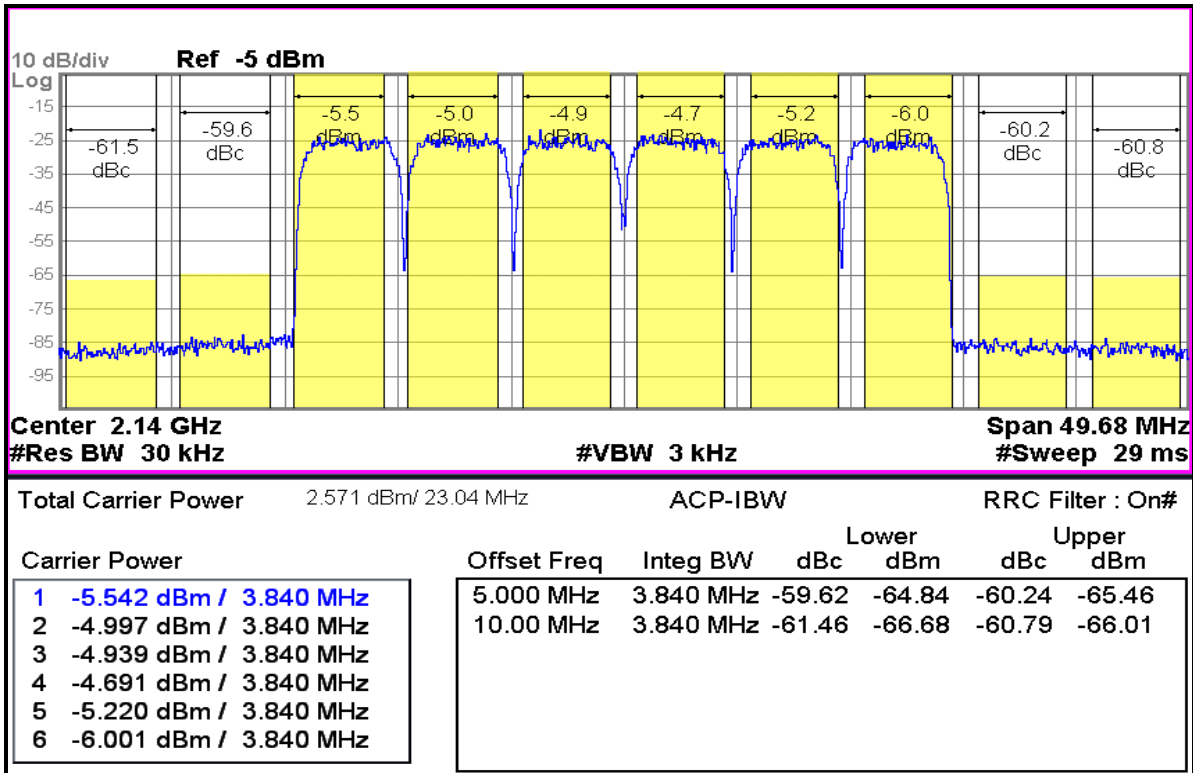
Typical Performance ( $V_c = 4.5V$ ,  $I_c = 34mA$ ,  $T = 25^\circ C$ )

Freq	MHz	70	500	900	1900	2140	2450	3500
S21	dB	24.8	23.1	23.1	20.6	20.5	19.3	17.7
S11	dB	-9.8	-8.6	-9.4	-9.5	-9.3	-9.4	-8.1
S22	dB	-4.3	-5.0	-5.5	-6.7	-6.6	-7.2	-8.5
P1	dBm	14.4	14.1	14.1	13.8	13.8	15.2	15.4
OIP3	dBm	26.0	23.0	23.0	23.5	23.0	23.5	22.5
NF	dB	4.0	4.0	4.0	4.2	4.3	4.5	4.8

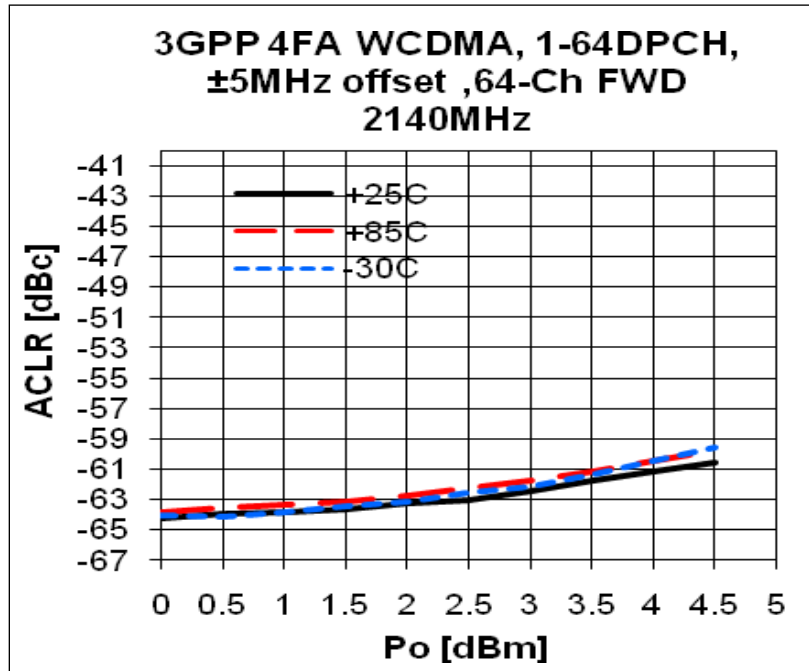
WCDMA 4FA 2140 -60dBc



WCDMA 6FA 2140 -60dBc

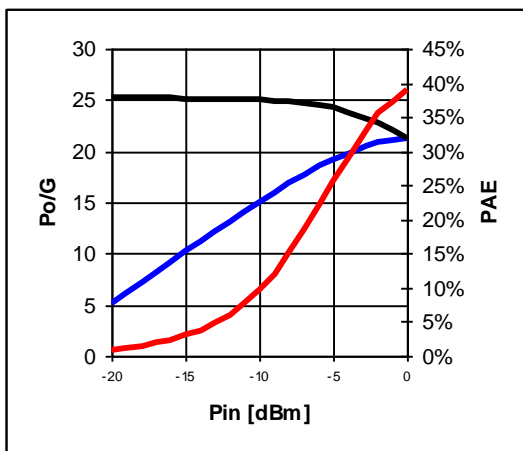


ACLR

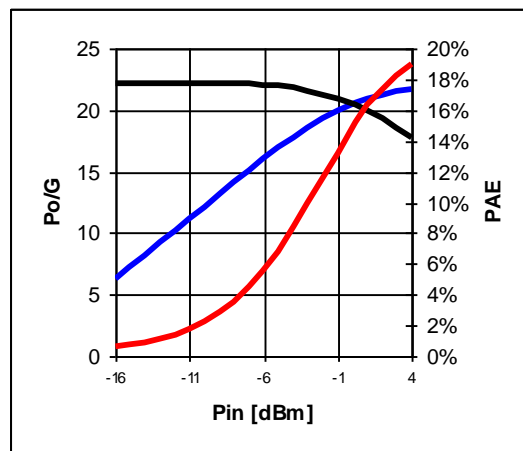


Device Performance

Pin-Pout-Gain

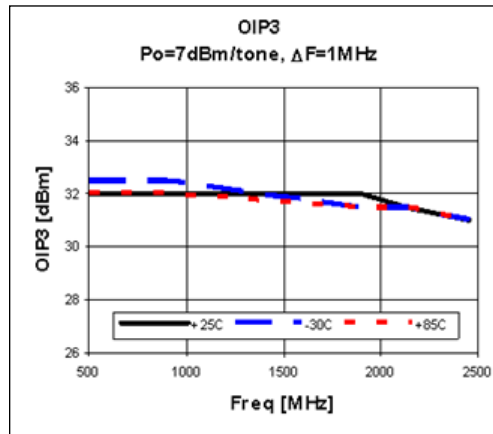
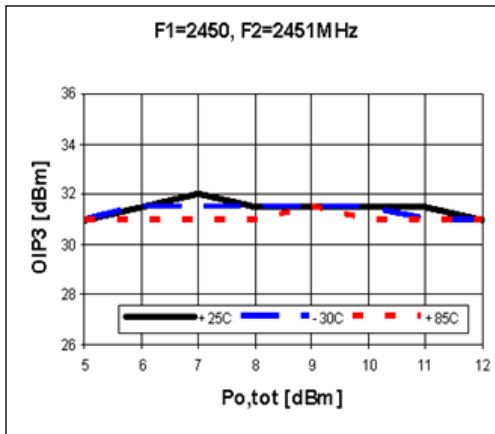
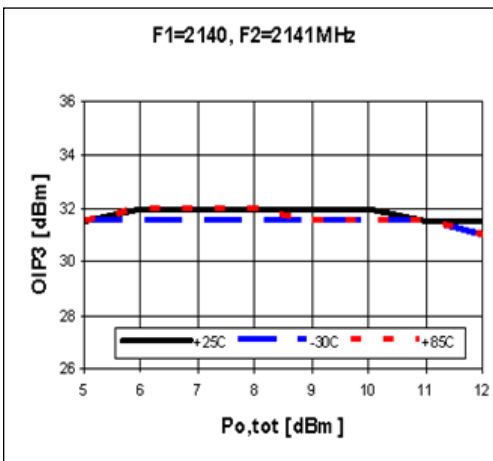
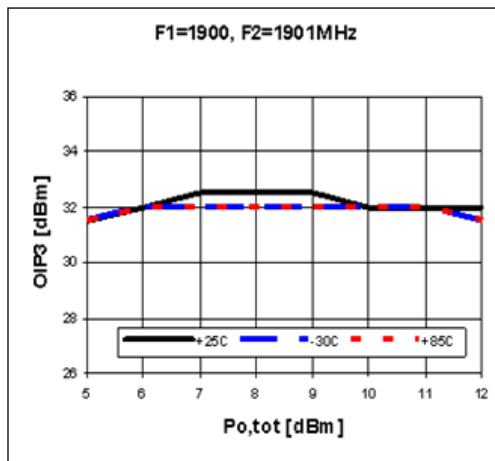
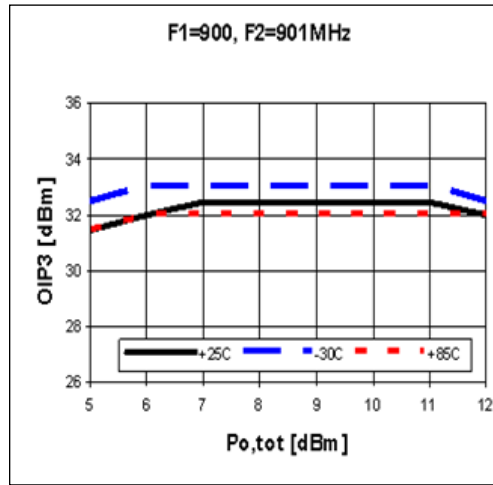
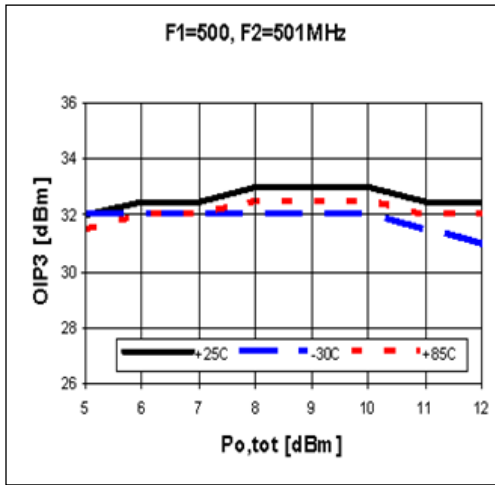


900MHz, 5V/65mA

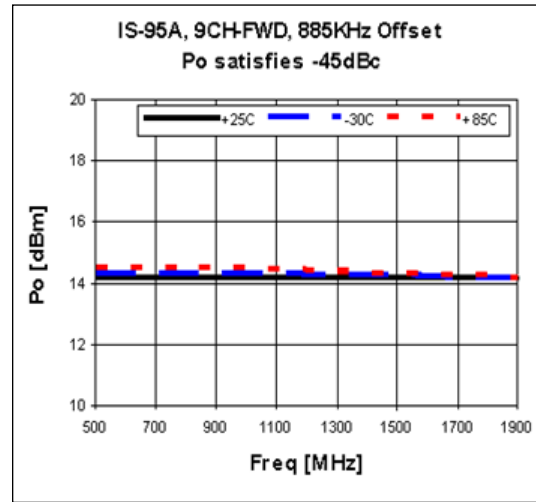
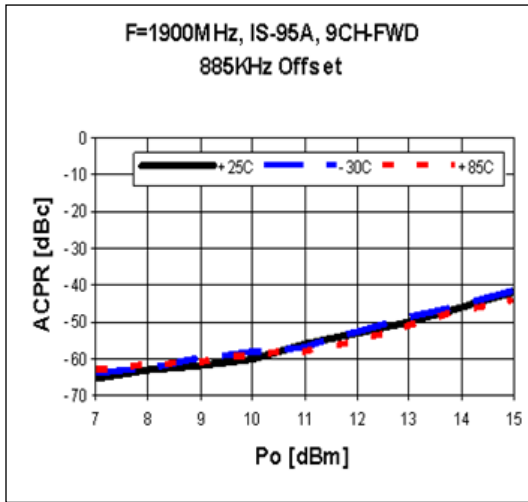
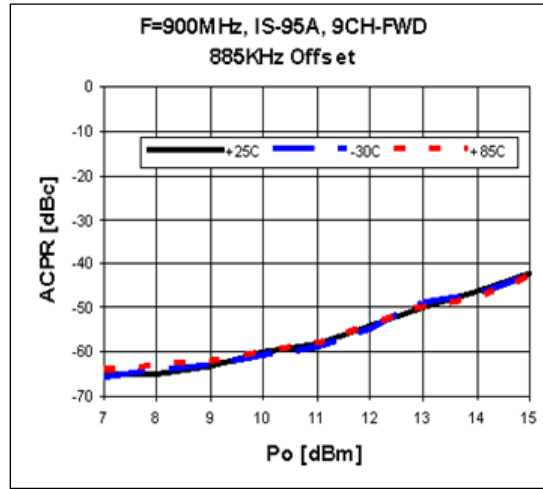
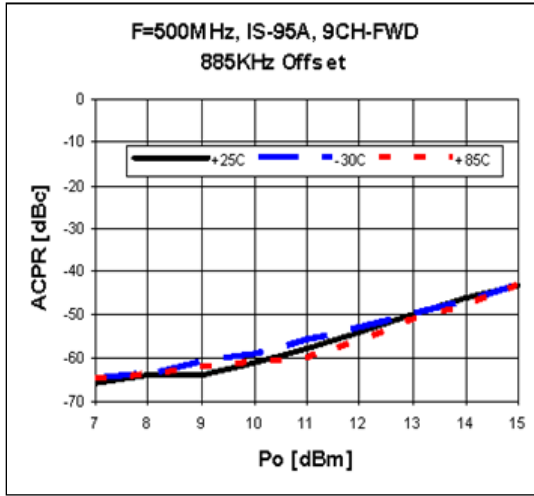


1900 MHz, 5V/65mA

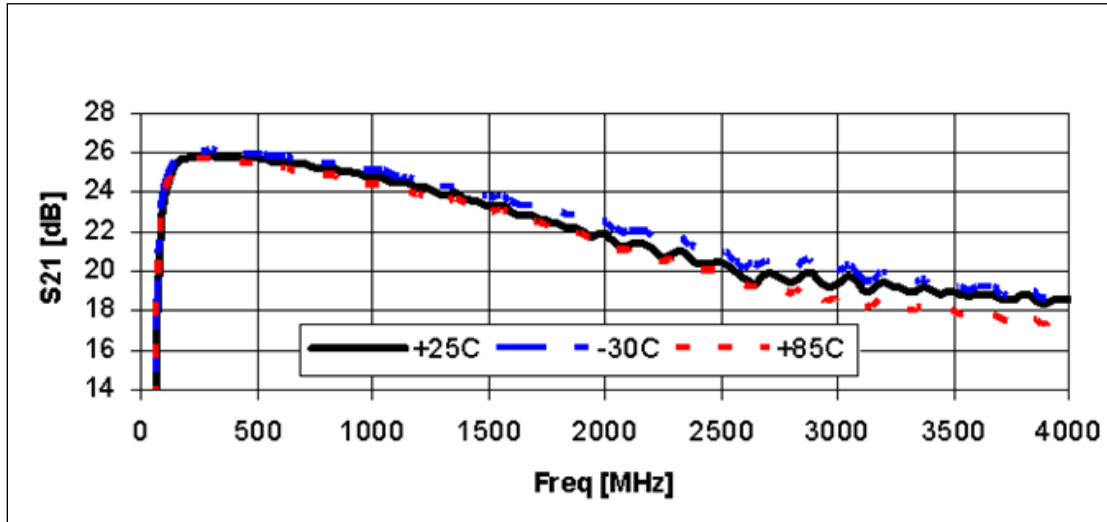
OIP3



ACPR

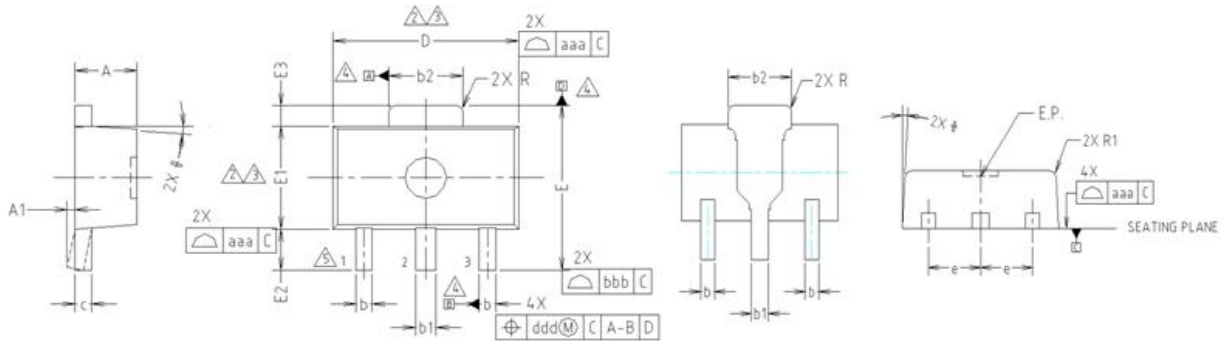


Gain Flatness





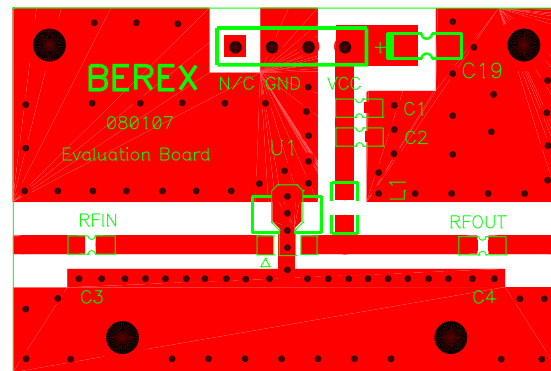
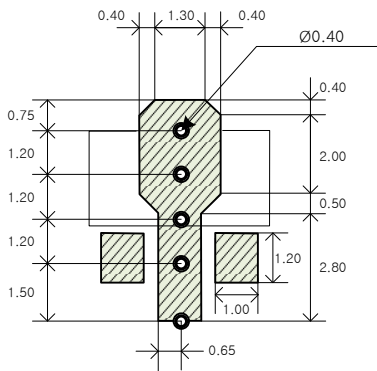
### Package Outline Dimension



- 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 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.

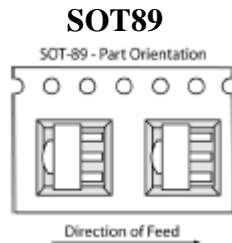
SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.40	1.50	1.60	
A1	0.00	—	0.10	
b	0.38	0.42	0.48	
b1	0.48	0.52	0.58	
b2	1.79	1.82	1.87	
c	0.40	0.42	0.46	
D	4.40	4.50	4.70	2,3
E	3.70	4.00	4.30	
E1	2.40	2.50	2.70	2,3
E2	0.80	1.00	1.20	
E3	0.40	0.50	0.60	
e	1.50 TYP.			
φ	4° TYP.			
R	0.15 TYP.		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



**Note :** All dimension are in millimeters  
 Visit <http://www.berex.com> for PCB layout

## 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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## NOTICE

BeRex Corporation reserves the right to make changes of product specification or to discontinue product at any time without notice.