

## 5-4000 MHz Cascadable InGaP HBT Gain Block

### Device Features

- 28.5dBm Output IP3 at 3dBm/tone at 900MHz
- 17.0dB Gain at 900MHz
- 16.0dBm P1dB at 900MHz
- Highly Reliable InGaP/GaAs HBT Technology
- Temperature Compensation Circuit patent
- SOT-89 Surface Mount Package
- 50 ohm Cascadable
- 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>	500 MHz	16.2	17.2	18.2	dB
	900 MHz	16.0	17.0	18.0	
	1900 MHz	15.0	16.0	17.0	
	2450 MHz	14.3	15.3	16.3	
<b>S11</b>	500 MHz		-15.0		dB
	900 MHz		-21.0		
	1900 MHz		-22.0		
	2450 MHz		-20.0		
<b>S22</b>	500 MHz		-32.0		dB
	900 MHz		-45.0		
	1900 MHz		-16.0		
	2450 MHz		-15.0		
<b>OIP3</b>	500 MHz	26.5	28.5		dBm
	900 MHz	26.5	28.5		
	1900 MHz	26.0	28.0		
	2450 MHz	25.5	27.5		
<b>P1dB</b>	500 MHz	14.6	15.6		dBm
	900 MHz	15.0	16.0		
	1900 MHz	14.5	15.5		
	2450 MHz	14.0	15.0		
<b>Icc</b>	$V_{cc} = 5.0\text{V}$	35	42	50	mA
<b>Vcc</b>			5.0		V
<b>dG/dT</b>			-0.004		dB/°C
<b>Rth</b>			50		°C/W

Test conditions unless otherwise noted.

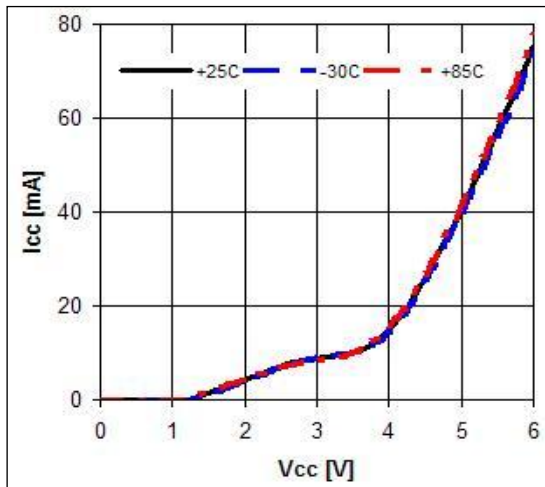
1. Device performance is measured on BeRex evaluation board at 25C, 50 ohm system.
2. OIP3 measured with two tones at an output power of 3dBm/tone separated by 1MHz.

**Absolute Maximum Ratings**

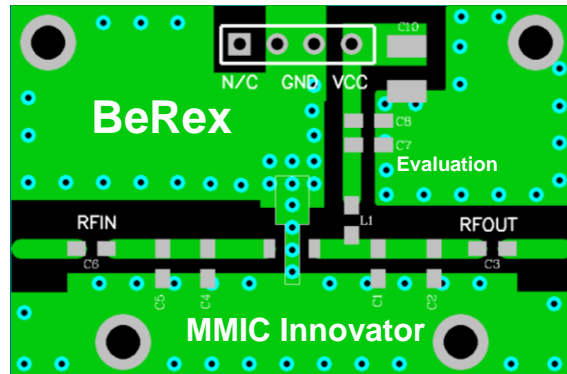
Parameters	Rating
Operating Case temperature	-40 to +85°C
Storage Temperature	-55 to +155°C
Junction Temperature	+220°C
Operating Voltage	6.5V
Supply Current	120mA
Input RF Power	23dBm

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**

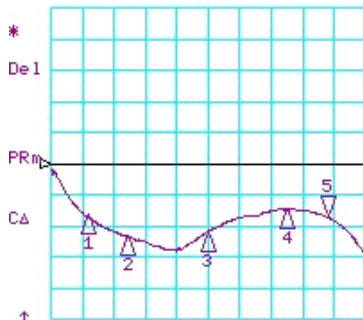
Schematic Diagram	BOM	Tolerance
	C1	100pF ±5%
	C2	100pF ±5%
	C3	100pF ±5%
	C4	1000pF ±5%
	C5	10uF ±20%
	*L1	33nH 5%

\*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=40mA, T=25°C)

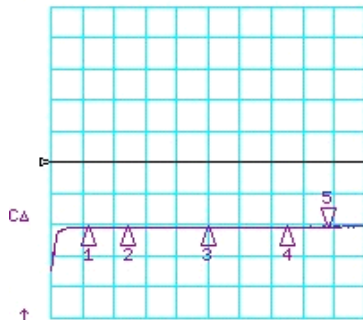
CH1 LOG 10 dB/ REF 0 dB  
S11 5: -16.974 dB 3 500.000 000 MHz



CH1 Markers  
1: -16.990 dB  
500.000 MHz  
2: -23.367 dB  
1.00000 GHz  
3: -22.163 dB  
2.00000 GHz  
4: -14.834 dB  
3.00000 GHz

START 50.000 MHz STOP 4000.000 MHz

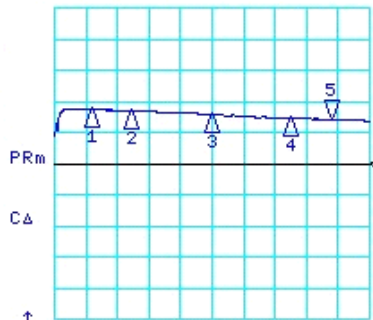
CH3 LOG 10 dB/ REF 0 dB  
S13 5: -20.734 dB 3 500.000 000 MHz



CH3 Markers  
1: -20.984 dB  
500.000 MHz  
2: -20.886 dB  
1.00000 GHz  
3: -21.005 dB  
2.00000 GHz  
4: -20.984 dB  
3.00000 GHz

START 50.000 MHz STOP 4000.000 MHz

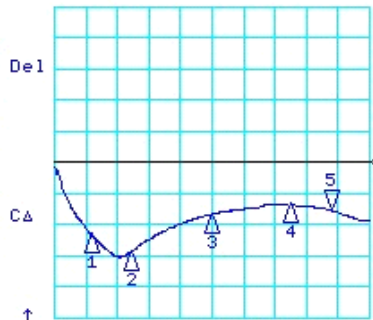
CH2 LOG 10 dB/ REF 0 dB  
S31 5: 14.185 dB 3 500.000 000 MHz



CH2 Markers  
1: 17.349 dB  
500.000 MHz  
2: 17.013 dB  
1.00000 GHz  
3: 15.794 dB  
2.00000 GHz  
4: 14.698 dB  
3.00000 GHz

START 50.000 MHz STOP 4000.000 MHz

CH4 LOG 10 dB/ REF 0 dB  
S33 5: -15.448 dB 3 500.000 000 MHz



CH4 Markers  
1: -23.037 dB  
500.000 MHz  
2: -28.965 dB  
1.00000 GHz  
3: -16.708 dB  
2.00000 GHz  
4: -13.704 dB  
3.00000 GHz

START 50.000 MHz STOP 4000.000 MHz

### S-Parameter

(Vdevice = 5.0V, Icc = 40mA, T = 25 °C, measured on a BeRex evaluation board)

Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100.00	0.718	-45.3	5.28	-144	0.0499	71.1	0.78	133
500.00	0.177	-148	7.42	122	0.0907	-31.8	0.119	72.7
1000.00	0.07	120	7.16	50.8	0.0913	-89.4	0.0247	-127
1500.00	0.0499	14.8	6.82	-16.6	0.0911	-143	0.104	-159
2000.00	0.0932	-82	6.34	-83.7	0.0885	164	0.166	-177
2500.00	0.103	-131	5.79	-147	0.0905	118	0.177	149
3500.00	0.128	159	5.2	86.9	0.0886	14.7	0.155	92.2
4000.00	0.0679	127	4.86	23.9	0.0941	-35.6	0.122	37.3

Typical Performance ( $V_c = 5V$ ,  $I_c = 40mA$ ,  $T_a = 25^\circ C$ )

Freq	MHz	500	900	1900	2140	2450	3000	3500
S21	dB	17.2	17.0	16.0	15.7	15.3	14.7	14.4
S11	dB	-17	-22	-24	-20	-16	-15	-19
S22	dB	-23	-29	-17	-16	-15	-14	-13.9
P1	dBm	15.6	16.0	15.5	15.5	15.0	14.4	12.7
OIP3	dBm	28.5	28.5	28.0	28.0	27.5	27.0	25
NF	dB	4.9	4.5	4.6	4.6	4.7	4.7	4.7

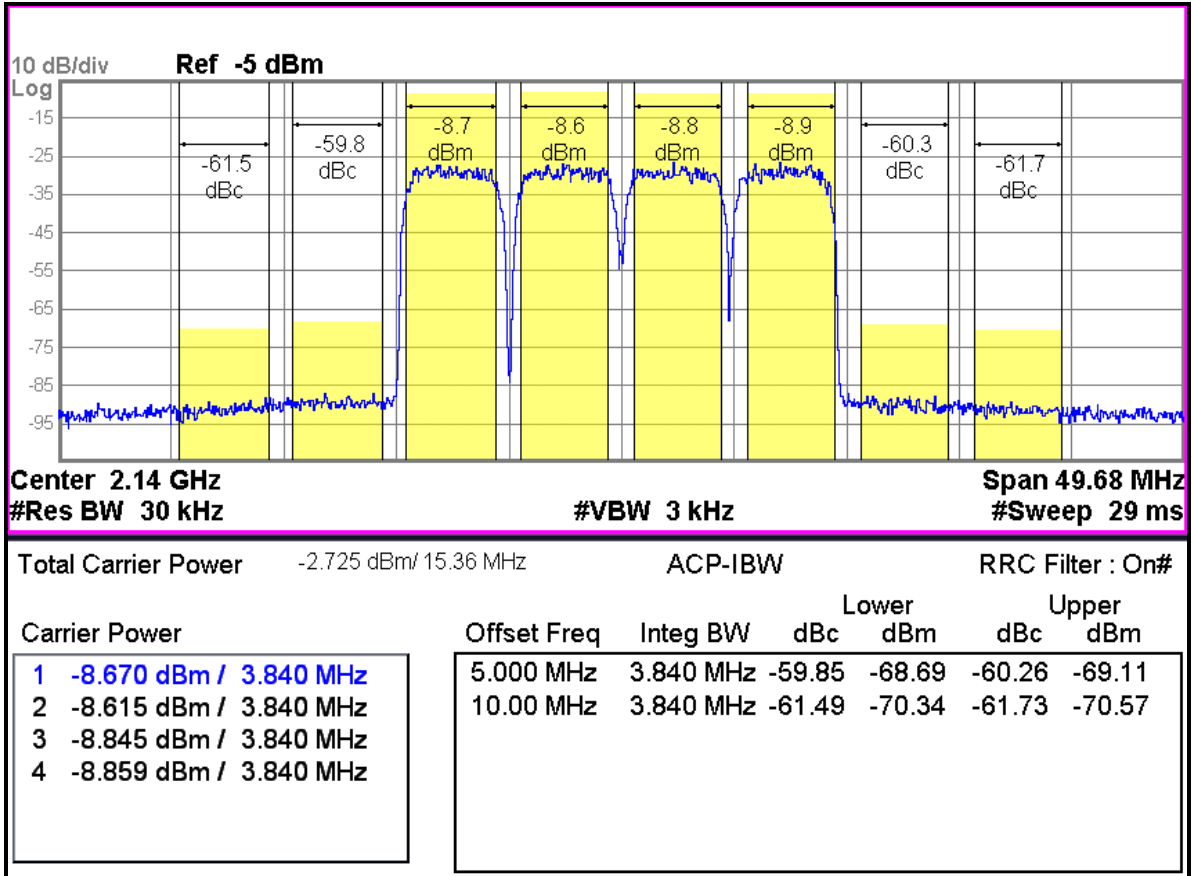
Typical Performance ( $V_{device} = 4.7 V$ ,  $I_c = 34 mA$ ,  $T_a = 25^\circ C$ )

Freq	MHz	70	500	900	1900	2140	2450	3500
S21	dB	19.6	17.0	16.8	15.7	15.4	15.1	14.2
S11	dB	-11.8	-29.8	-24.6	-18.8	-16.9	-18.9	-18.1
S22	dB	-5.9	-13.9	-15.8	-13.5	-12.3	-13.1	-13.4
P1	dBm	13.8	13.3	12.9	13.6	13.1	13.5	11.9
OIP3	dBm	25.5	23.5	24.5	25	24	24.5	23.5
NF	dB	4.9	4.9	4.5	4.6	4.6	4.7	4.7

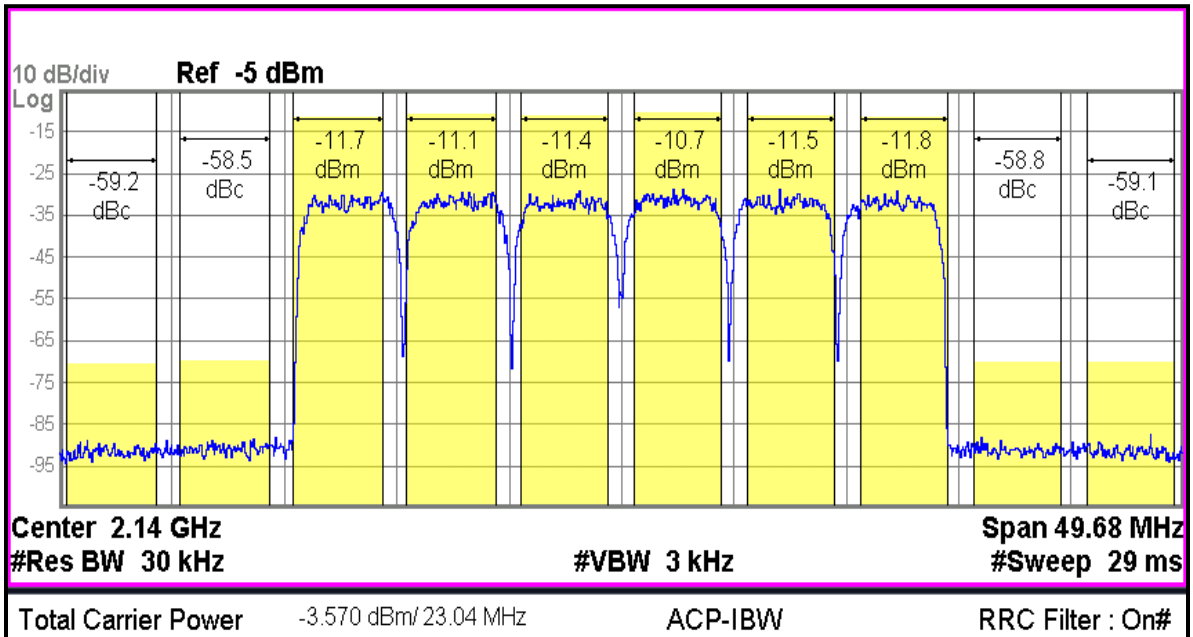
Typical Performance ( $V_{device} = 4.5 V$ ,  $I_c = 29 mA$ ,  $T_a = 25^\circ C$ )

Freq	MHz	70	500	900	1900	2140	2450	3500
S21	dB	19.4	16.8	16.3	15.4	15.2	14.8	14
S11	dB	-13.1	-25.2	-24.3	-18.2	-16.3	-18.1	-17.1
S22	dB	-5.7	-13.1	-14.7	-12.7	-11.6	-12.5	-12.9
P1	dBm	13.3	12.8	11.8	12.0	12.2	13.0	11.4
OIP3	dBm	23.5	23.5	22.0	20.0	22.0	22.0	22.0
NF	dB	4.9	4.9	4.5	4.6	4.6	4.7	4.7

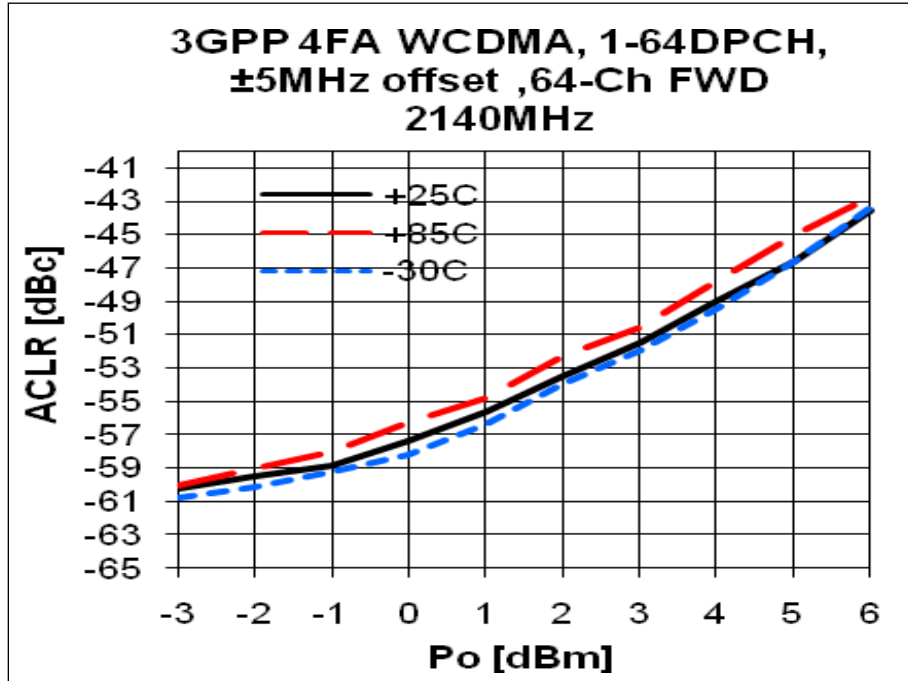
WCDMA 4FA 2140 -60dBc



WCDMA 6FA 2140 -60dBc

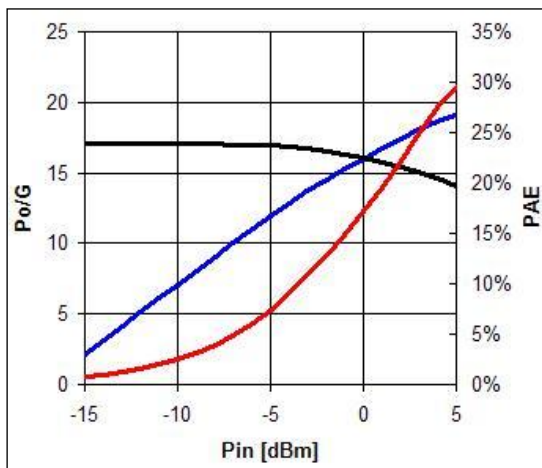


ACLR

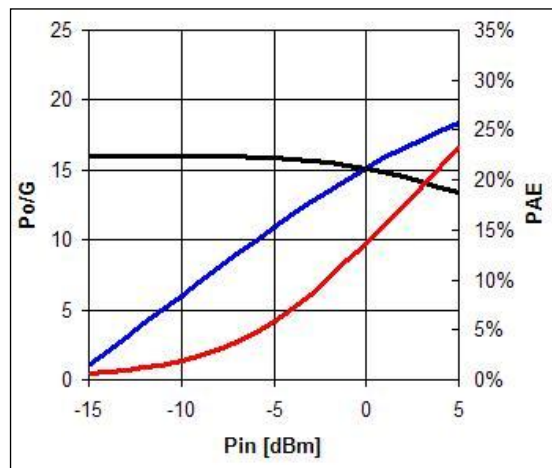


Device Performance

Pin-Pout-Gain

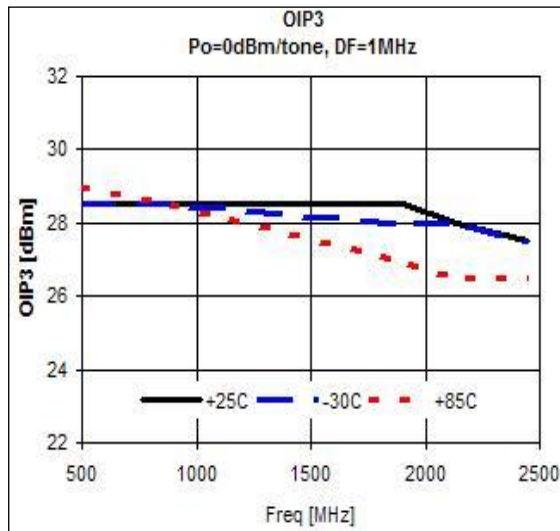
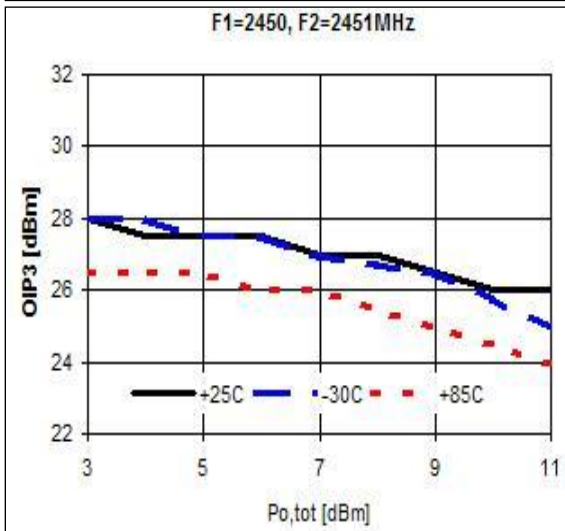
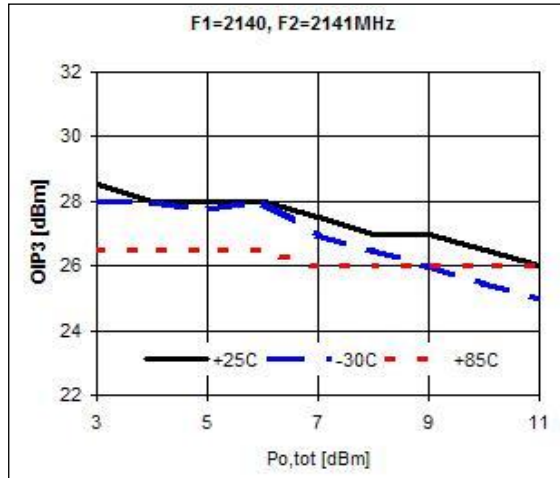
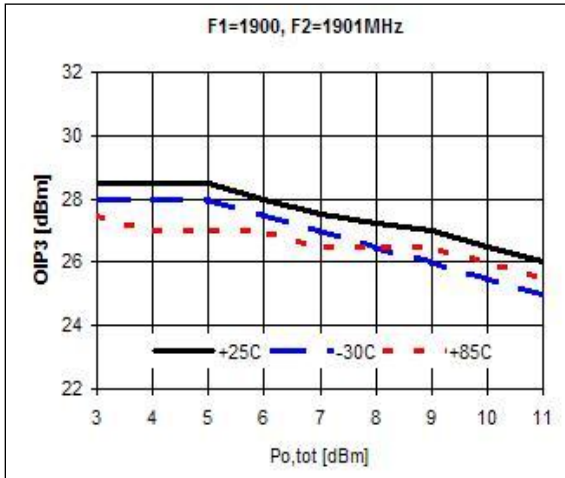
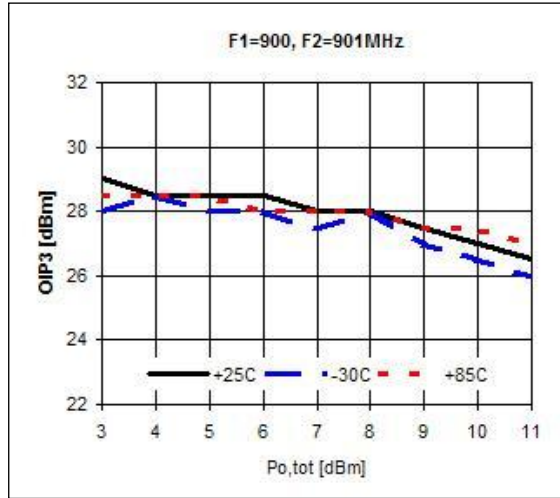
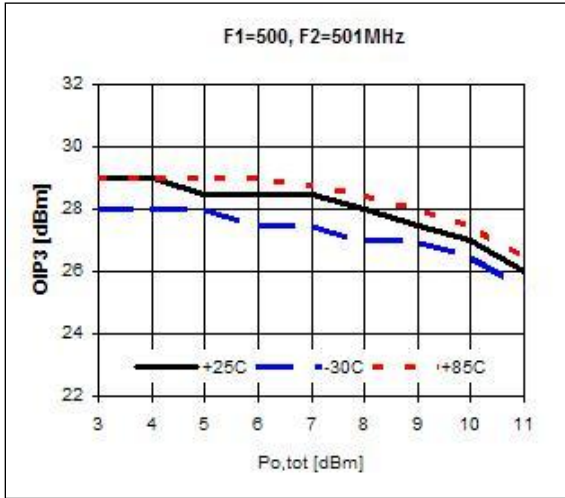


900MHz, 5V/40mA

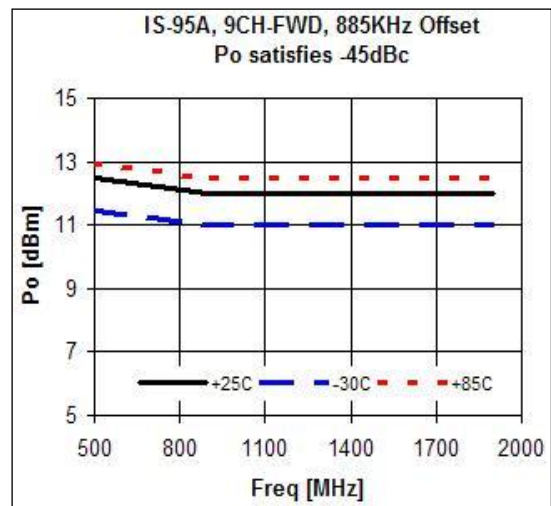
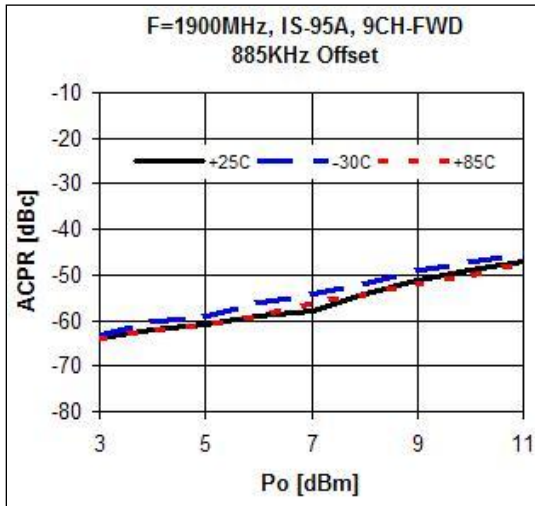
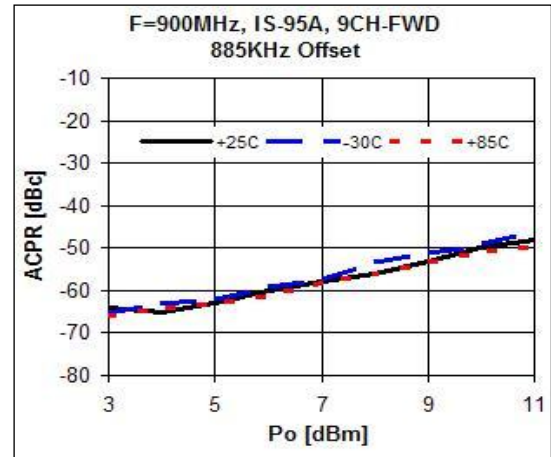
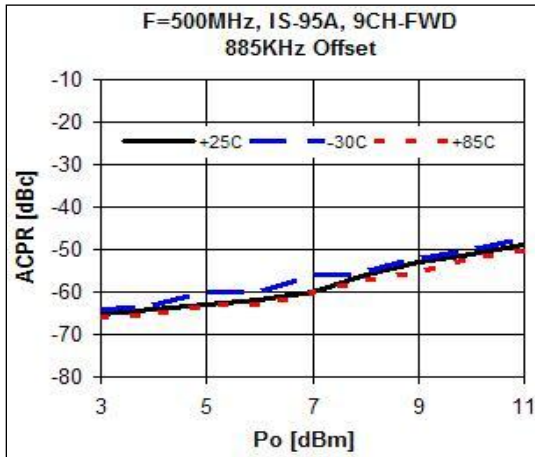


1900 MHz, 5V/40mA

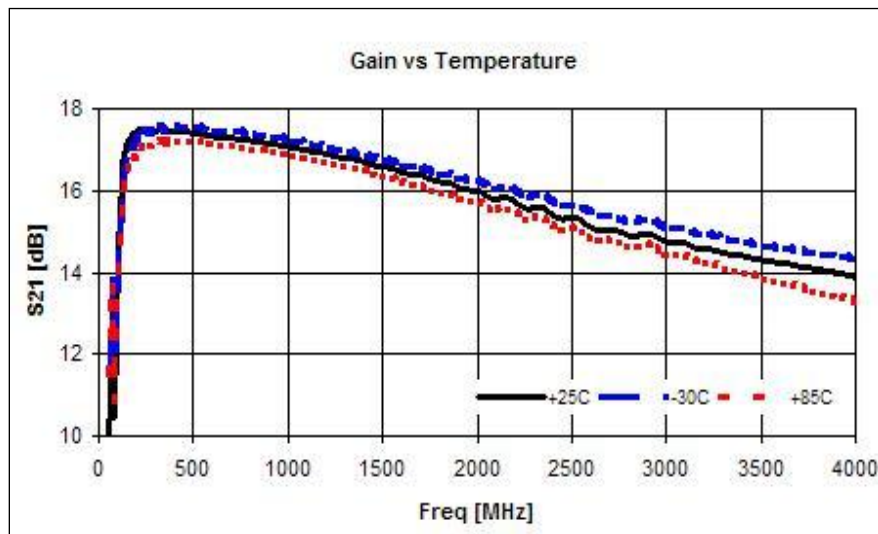
OIP3



ACPR

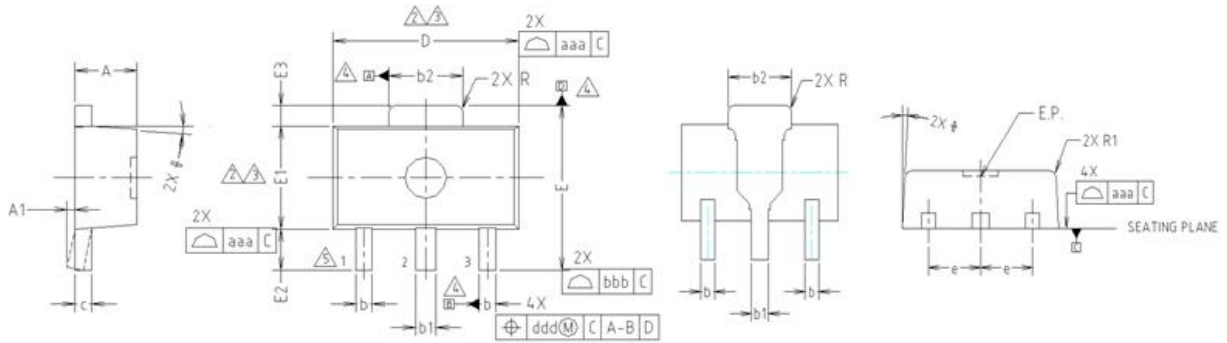


Gain Flatness





### 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.

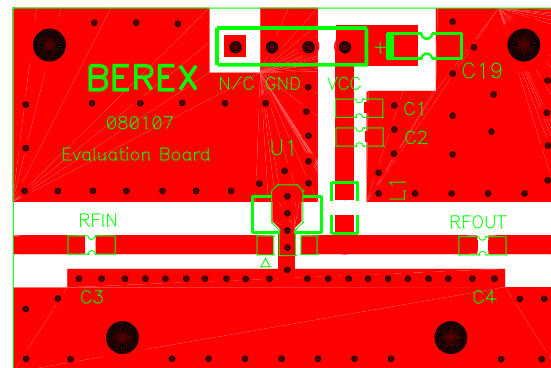
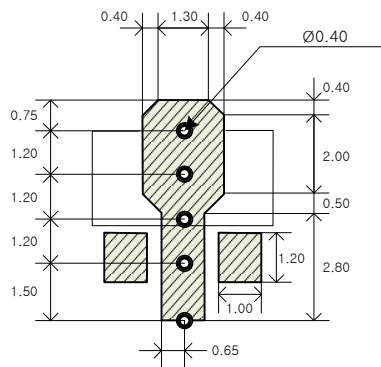
**△** DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.

**△** DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.

**△** TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

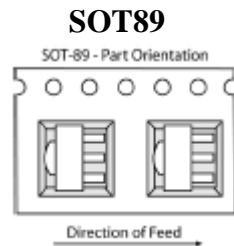
SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.40	1.50	1.60	
A1	0.00	—	0.10	
b	0.38	0.42	0.48	
b1	0.48	0.52	0.58	
b2	1.79	1.82	1.87	
c	0.40	0.42	0.46	
D	4.40	4.50	4.70	2,3
E	3.70	4.00	4.30	
E1	2.40	2.50	2.70	2,3
E2	0.80	1.00	1.20	
E3	0.40	0.50	0.60	
e	1.50 TYP.			
φ	4° TYP.			
R	0.15 TYP.		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

<b>ESD Rating:</b>	Class 2
<b>Value:</b>	<b>Passes &lt;4000V</b>
<b>Test:</b>	Human Body Model (HBM)
<b>Standard:</b>	JEDEC Standard JESD22-A114B
<b>MSL Rating:</b>	<b>Level 1 at +265°C convection reflow</b>
<b>Standard:</b>	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.