

# BMT333

## 1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



### Device Features

- +5V/550mA at operating bias condition
- Gain = 25.5 dB @ 2.65 GHz
- P1dB = 33.5 dBm @ 2.65GHz
- LTE 10M ACLR = 22.7dBm Output Power at -50dBc @ 2.65GHz
- Intergrated interstage matching
- Lead-free/Green/RoHS-compliant QFN5x5 SMT package



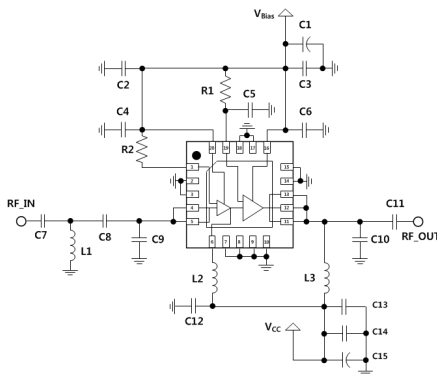
### Product Description

The BMT333 is a high dynamic range two-stage power amplifier housed in a lead-free/green/RoHS compliant 5x5mm QFN package. The BMT333 uses a high reliability InGaP/GaAs HBT process technology. The BMT333 is designed for use where high linearity and gain are required. The BMT333 is able to deliver over 22 dBm output power from 1.8 to 2.7GHz while maintaining superior ACLR performance with a few external matching components. All devices are 100% RF/DC screened.

### Applications

- Base station/Repeaters Infrastructure/Small Cell
- Commercial/Industrial/Military wireless system
- LTE / WCDMA /CDMA Wireless Infrastructure

### Application Circuits



### Typical Performance<sup>1</sup>

Parameter	Frequency				Unit
	1.8	2.35	2.55	2.65	
Gain	29.7	27.4	26.2	25.5	dB
S11	-23.4	-25.8	-23.1	-19.3	dB
S22	-12.4	-19.8	-17.0	-18.7	dB
OIP3 <sup>2</sup>	45.1	50	48.3	48.2	dBm
P1dB	32.9	34.1	33.3	33.5	dBm
LTE 10M ACLR	22.0	23.5	23.0	22.7	dBm
WCDMA ACLR	22.9	24.4	23.9	23.7	dBm
Noise Figure	5.9	5.3	5.0	5.1	dB

<sup>1</sup> Device performance \_ measured on a BeRex evaluation board at 25°C, 50 Ω

<sup>2</sup> OIP3 \_ measured on two tones with a output power 23dBm/ tone , F<sub>2</sub>—F<sub>1</sub> = 1 MHz..

\*ACLR Channel Power measured at -50dBc.

- LTE set-up: 3GPP LTE, FDD E-TM3.1, 10MHz BW, ±5MHz offset, PAR 9.75 @0.01% Prob.

- WCDMA set-up: 3GPP WCDMA, TM1+64DPCH, +5MHz offset, PAR 9.78 at 0.01% Prob.

	Min.	Typical	Max.	Unit
Bandwidth	1.8		2.7	GHz
I <sub>bias</sub> @ (I <sub>REF1&amp;2</sub> + I <sub>B1&amp;2</sub> )		27		mA
I <sub>c</sub> @ (I <sub>C1</sub> + I <sub>C2</sub> )		550		mA
V <sub>CC</sub> /V <sub>bias</sub>		5.0		V
R <sub>TH</sub>		8.7		°C/W

### Absolute Maximum Ratings

Parameter	Rating	Unit
Operating Case Temperature	-40 to +85	°C
Storage Temperature	-55 to +155	°C
Junction Temperature	+200	°C
Operating Voltage	+6	V
Supply Current	2	A
Input RF Power	20	dBm

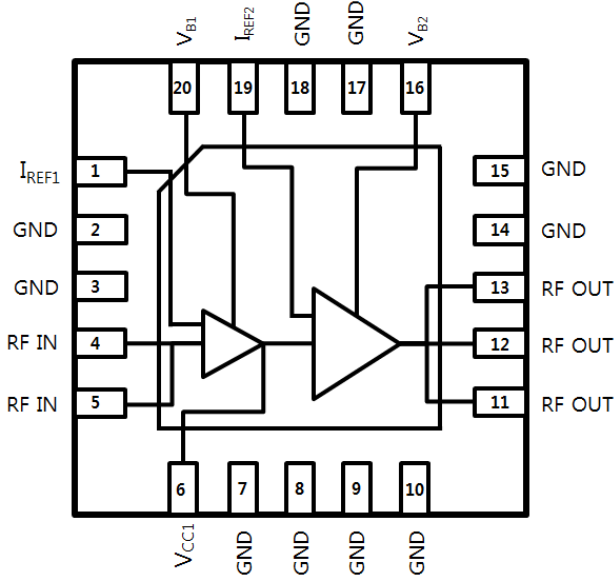
\*Operation of this device above any of these parameters may result in permanent damage.

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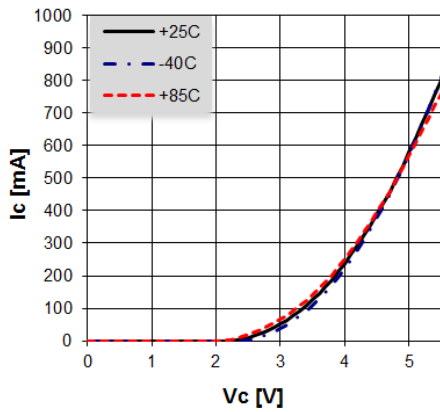


## Pin Configuration



Pin No.	Label
1	I <sub>REF1</sub>
4,5	RF IN
6	V <sub>CC1</sub>
11,12,13	RF OUT/V <sub>CC2</sub>
16	V <sub>B2</sub>
19	I <sub>REF2</sub>
20	V <sub>B1</sub>
2,3,7,8,9,10,14,15,17,18	GND
Backside Paddle	GND

## V-I Characteristics



## BeRex Evaluation Board

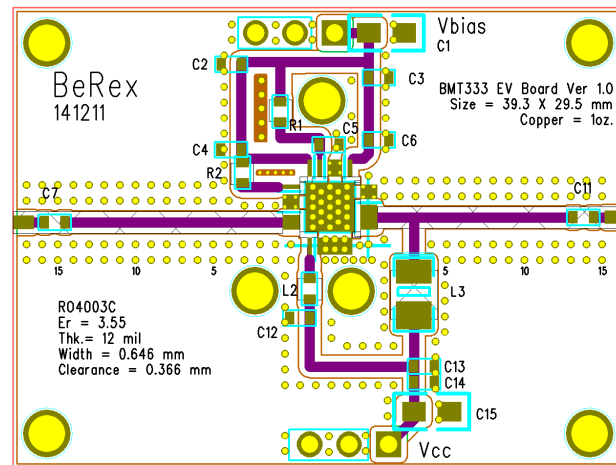
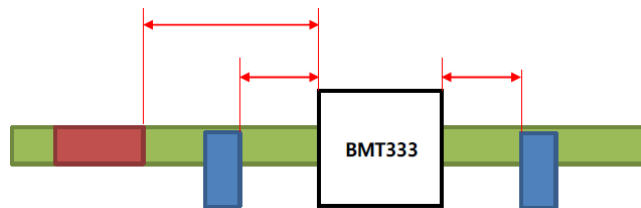


Figure about the reference position of components



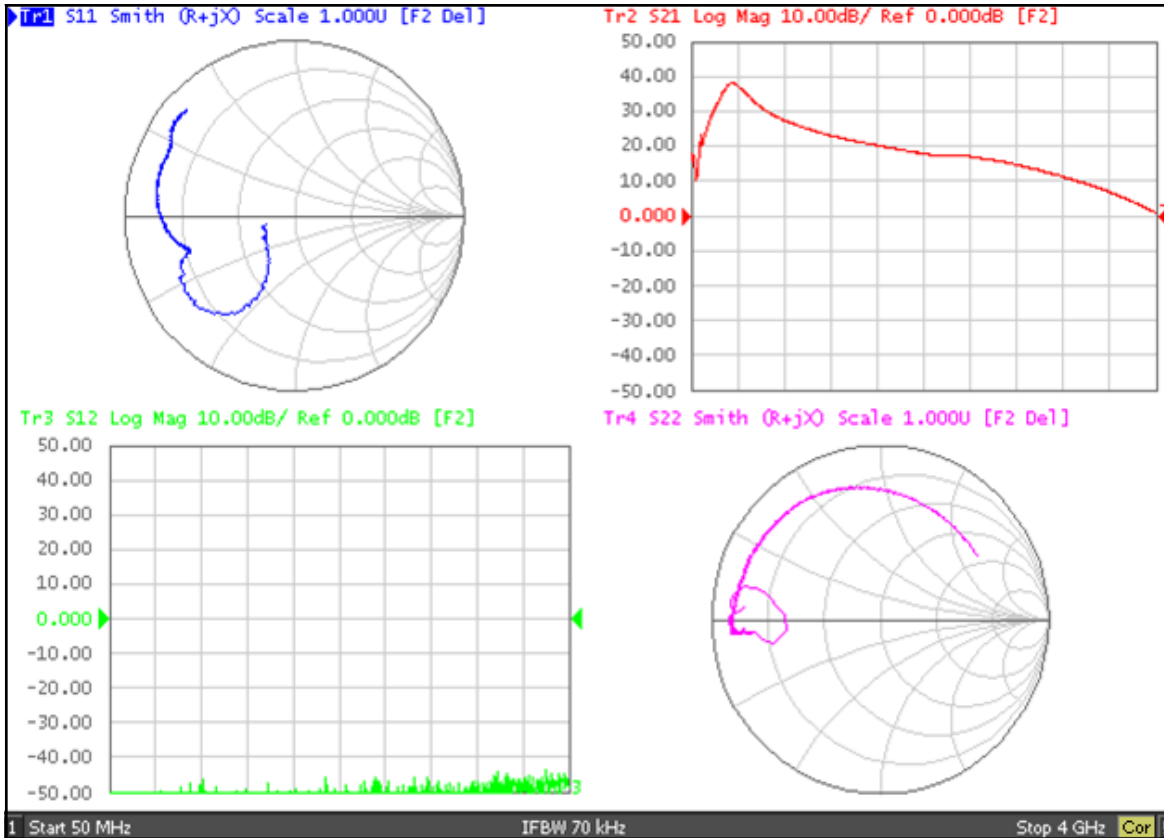
# BMT333

## 1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



### Typical Device Data

S-parameters ( $V_{cc}$  &  $V_{Bias}$  = +5V,  $I_{cq}$ =550mA,  $T_a$ =25°C)



### S-Parameter

( $V_{cc}$  &  $V_{Bias}$  = +5V,  $I_{cq}$  = 550mA,  $T_a$  = 25 °C, calibrated to device leads)

Freq [GHz]	S11 [Mag]	S11 [Ang]	S21 [Mag]	S21 [Ang]	S12 [Mag]	S12 [Ang]	S22 [Mag]	S22 [Ang]
1.8	0.823	48.909	8.999	-14.544	0.002	-47.886	0.851	56.153
1.9	0.829	39.208	8.410	-31.779	0.003	-54.191	0.851	47.807
2.0	0.829	29.005	7.873	-48.880	0.002	-46.186	0.855	39.252
2.1	0.837	19.120	7.499	-65.053	0.001	-44.098	0.846	30.329
2.2	0.840	9.645	7.353	-81.298	0.002	-103.445	0.846	21.294
2.3	0.839	0.350	7.422	-101.020	0.004	-80.766	0.843	12.643
2.4	0.834	-8.866	7.175	-122.701	0.003	-106.587	0.839	3.550
2.5	0.834	-17.528	6.794	-143.783	0.003	-39.239	0.838	-5.571
2.6	0.834	-26.175	6.401	-164.426	0.002	-150.204	0.833	-15.217
2.7	0.833	-34.246	5.948	174.823	0.002	-71.305	0.832	-25.071

# BMT333

1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Application Circuit: 1.8 GHz

Preliminary Datasheet

Schematic Diagram		BOM		Marks
	C1	1206	10uF	Tantalum
	C2	0603	N/A	
	C3	0603	680pF	COG/NPO
	C4	0603	1nF	
	C5	0603	1nF	
	C6	0603	N/A	
	C7	0603	0 Ω	Jumper
	C8	0603	2.5pF	
	C9	0603	N/A	
	C10	0603	4.3pF	High Q Cap
	C11	0603	3.9pF	
	C12	0603	1uF	
	C13	0603	100pF	
	C14	0603	1nF	
	C15	1206	10uF	Tantalum
L1	0603	2.2nH		
L2	0603	39nH		
L3	1008	39nH	High Q Coil	
R1	0603	150 Ω	±5%	
R2	0603	270 Ω	±5%	

PCB Diagram	Notice																					
<p>BeRex 141211 1.8GHz</p> <p>BMT333 EV Board Ver 1.0 Size = 39.3 X 29.5 mm Copper = 1oz.</p> <p>R04003C Er = 3.55 Thk. = 12 mil Width = 0.646 mm Clearance = 0.366 mm</p>	<p>Below information is subject to change as conditions of the substrate.</p> <table border="1"> <thead> <tr> <th>Reference</th> <th>Object</th> <th>Distance</th> </tr> </thead> <tbody> <tr> <td>Input pin</td> <td>L1</td> <td>1.4mm</td> </tr> <tr> <td>Input pin</td> <td>C8</td> <td>3.4mm</td> </tr> <tr> <td>Output pin</td> <td>C10</td> <td>2.6mm</td> </tr> <tr> <td>Pin 16</td> <td>C3</td> <td>6.0mm</td> </tr> <tr> <td>Pin 19</td> <td>C5</td> <td>1.0mm</td> </tr> <tr> <td>Pin 20</td> <td>C4</td> <td>5.0mm</td> </tr> </tbody> </table>	Reference	Object	Distance	Input pin	L1	1.4mm	Input pin	C8	3.4mm	Output pin	C10	2.6mm	Pin 16	C3	6.0mm	Pin 19	C5	1.0mm	Pin 20	C4	5.0mm
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	<p>2. C10 : We recommend High-Q capacitor for better output power performance. In this document we used 4.3pF(251R14S4R3BV4, EIA 0603) of Johanson Technology.</p>																					
	<p>3. C7 are just jumpers as 0Ω</p>																					

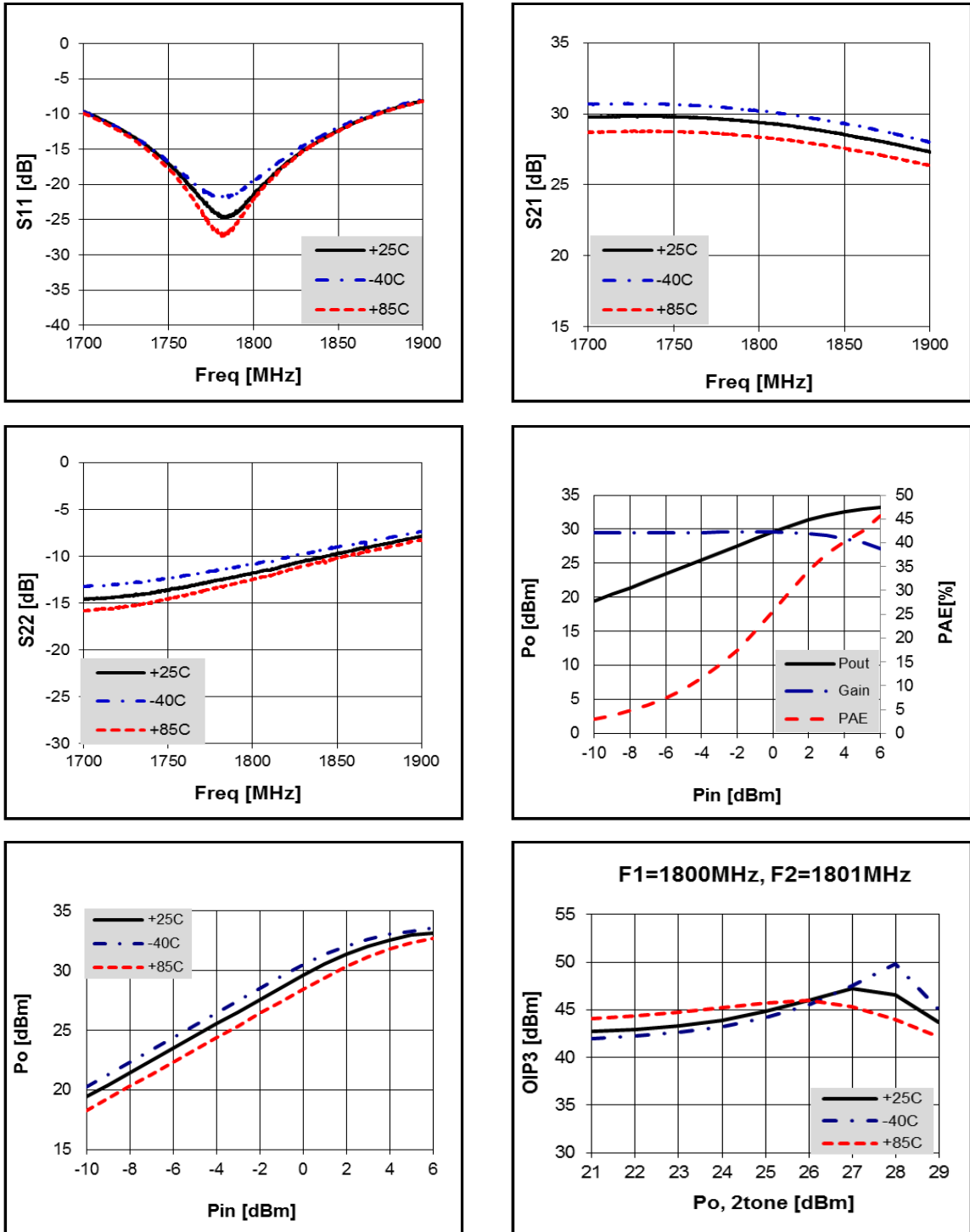
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Preliminary Datasheet

## Typical Performance



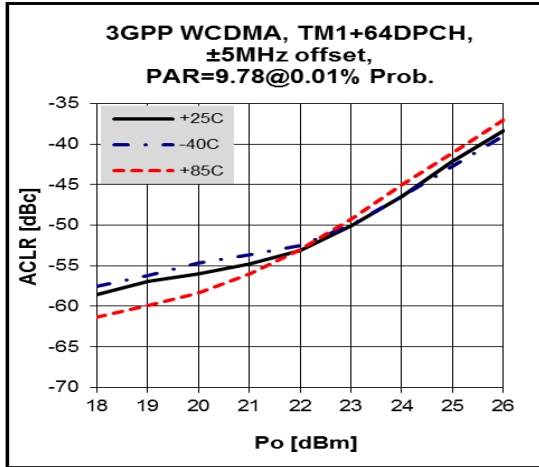
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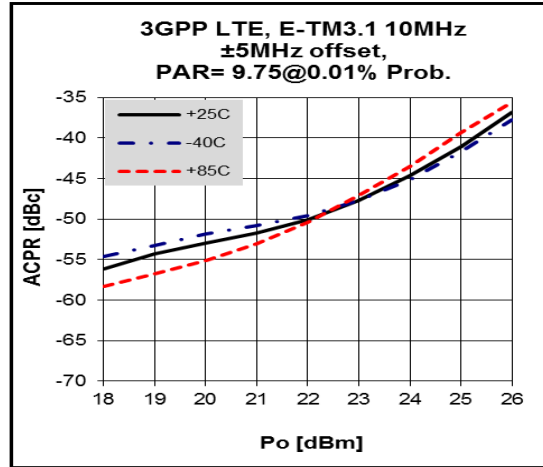


Preliminary Datasheet

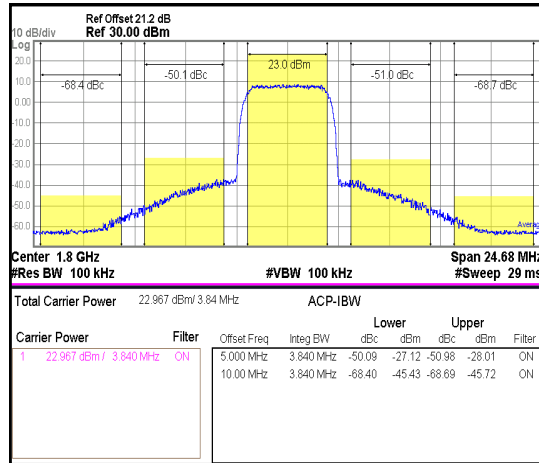
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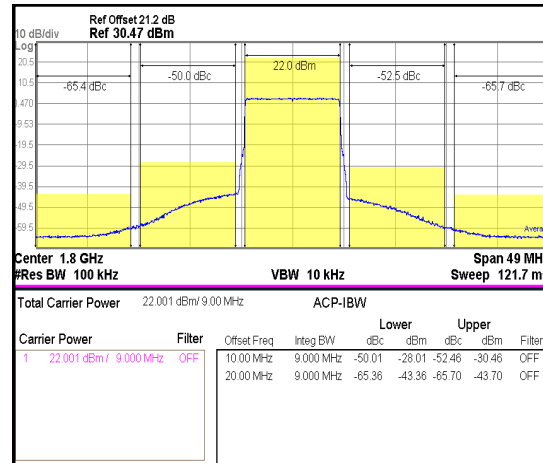
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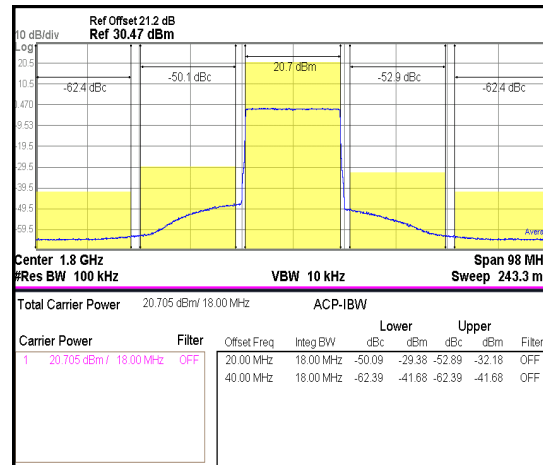
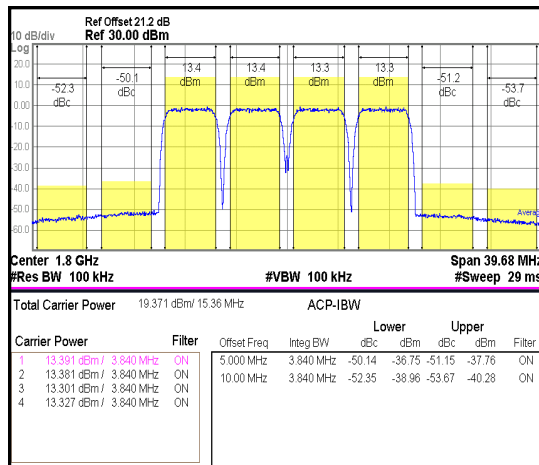
3GPP LTE E-TM3.1 10MHz



3GPP WCDMA TM1 +64DPCH 4FA



3GPP LTE E-TM3.1 20MHz



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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Application Circuit: 2.35 GHz

Preliminary Datasheet

Schematic Diagram	BOM		Marks	
	C1	1206	10uF	Tantalum
	C2	0603	N/A	
	C3	0603	680pF	COG/NPO
	C4	0603	1nF	
	C5	0603	1nF	
	C6	0603	27pF	COG/NPO
	C7	0603	0 Ω	Jumper
	C8	0603	1.2pF	
	C9	0603	1.2pF	
	C10	0603	3.3pF	High Q Cap
	C11	0603	10pF	
	C12	0603	1nF	
	C13	0603	100pF	
	C14	0603	1nF	
	C15	1206	10uF	Tantalum
L1	0603	N/A		
L2	0603	0 Ω	Jumper	
L3	1008	18nH	High Q Coil	
R1	0603	150 Ω	±5%	
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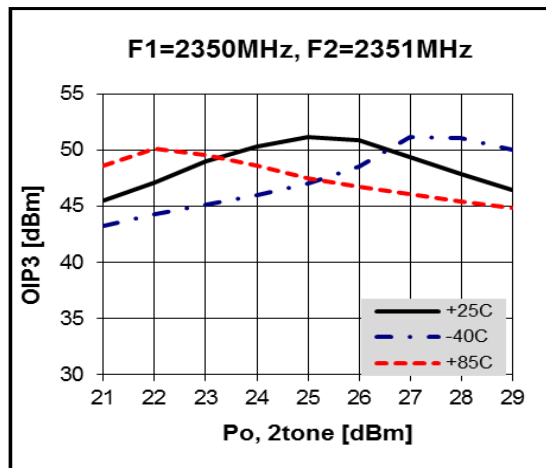
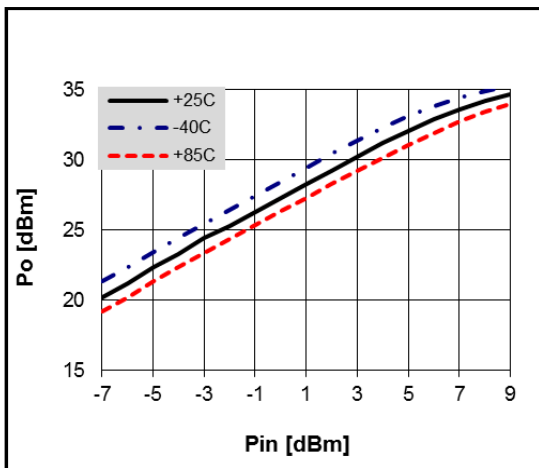
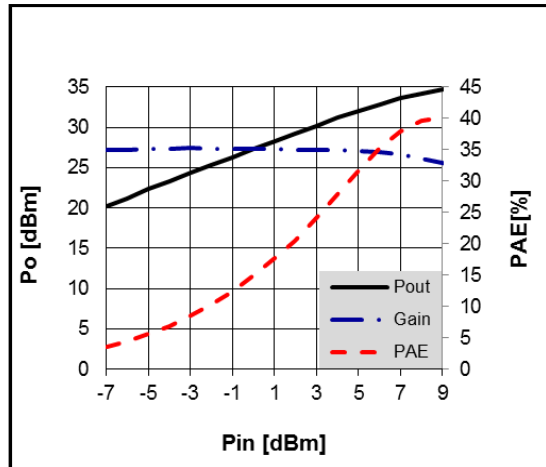
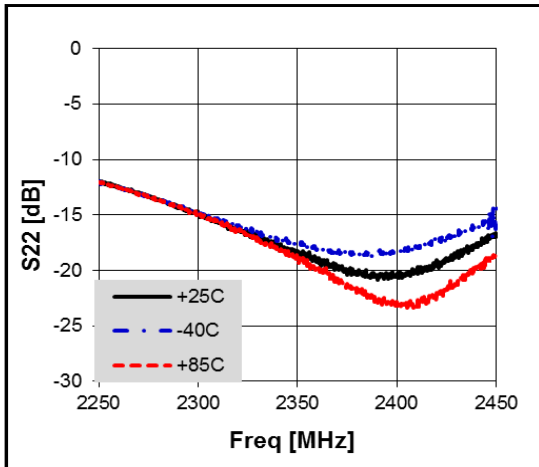
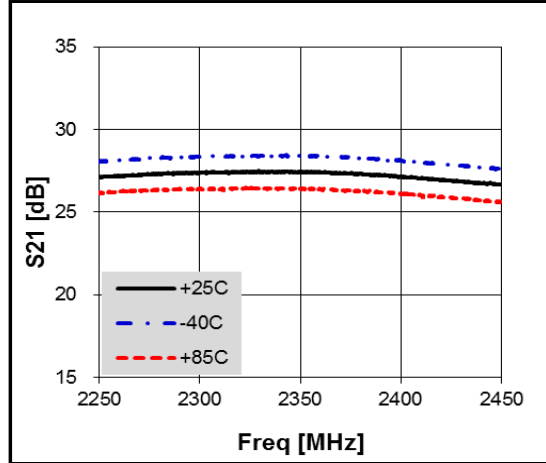
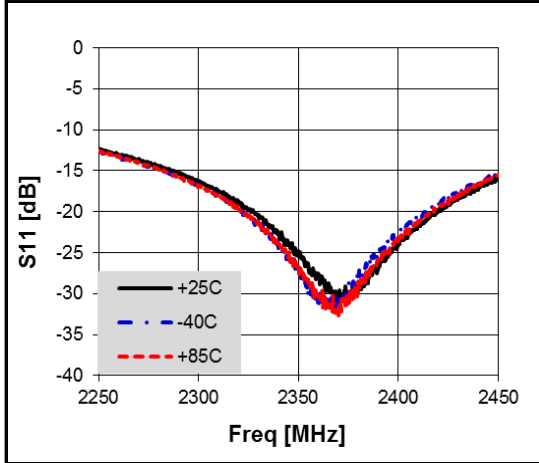
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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



Preliminary Datasheet

## Typical Performance



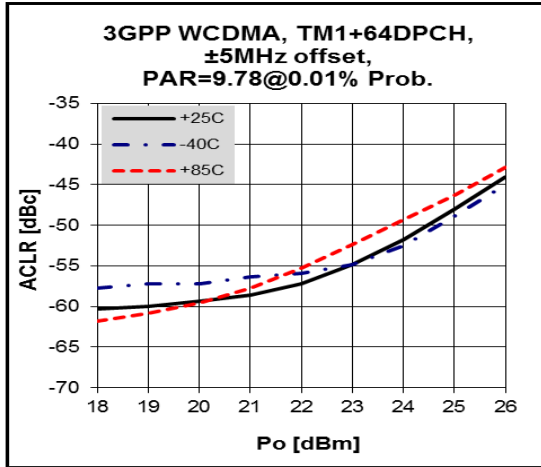
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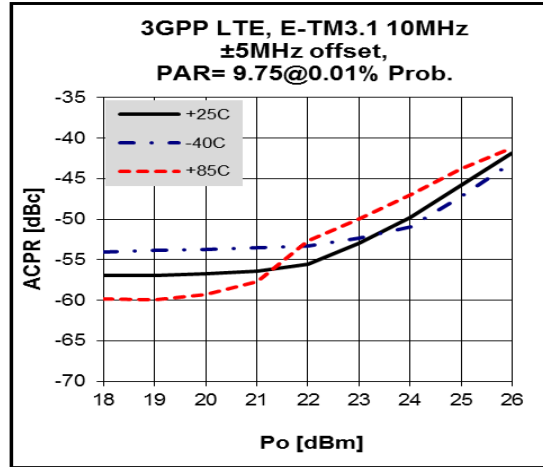


Preliminary Datasheet

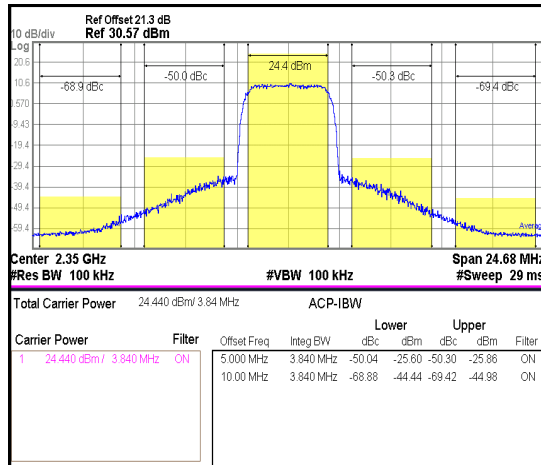
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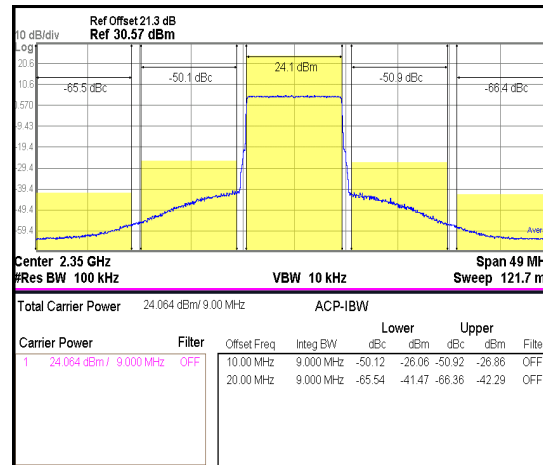
3GPP WCDMA TM1 +64DPCH 1FA



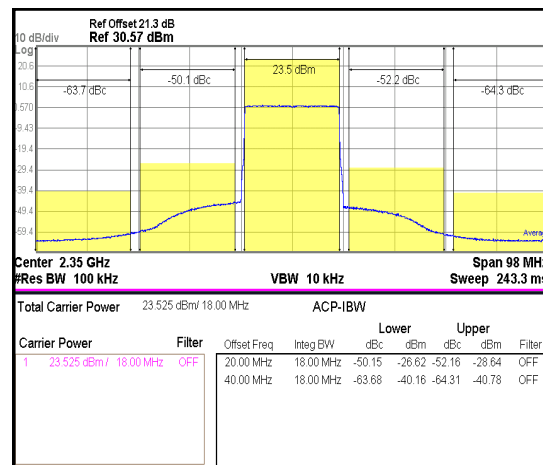
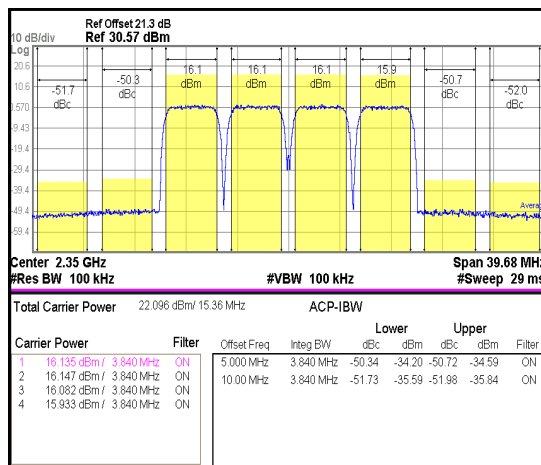
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3GPP LTE E-TM3.1 20MHz



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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Application Circuit: 2.55 GHz

Preliminary Datasheet

Schematic Diagram	BOM		Marks
	C1	1206 10uF	Tantalum
	C2	0603 1nF	
	C3	0603 680pF	COG/NPO
	C4	0603 N/A	
	C5	0603 1nF	
	C6	0603 27pF	COG/NPO
	C7	0603 0 Ω	Jumper
	C8	0603 1.0pF	
	C9	0603 1.5pF	
	C10	0603 3.0pF	High Q Cap
	C11	0603 10pF	
	C12	0603 1nF	
	C13	0603 100pF	
	C14	0603 1nF	
	C15	1206 10uF	Tantalum
L1	0603 N/A		
L2	0603 0 Ω	Jumper	
L3	1008 18nH	High Q Coil	
R1	0603 150 Ω	±5%	
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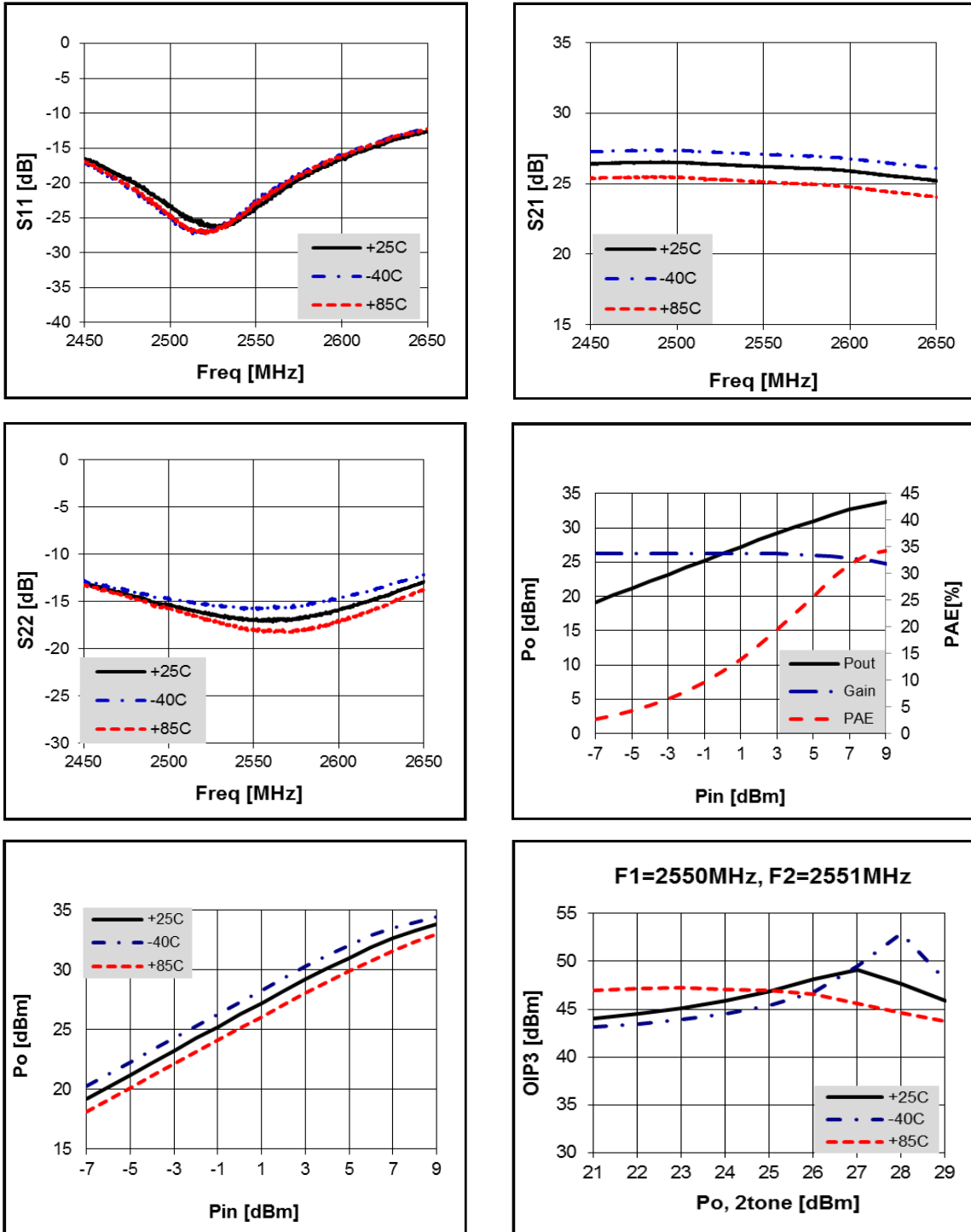
# BMT333

1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



Preliminary Datasheet

## Typical Performance



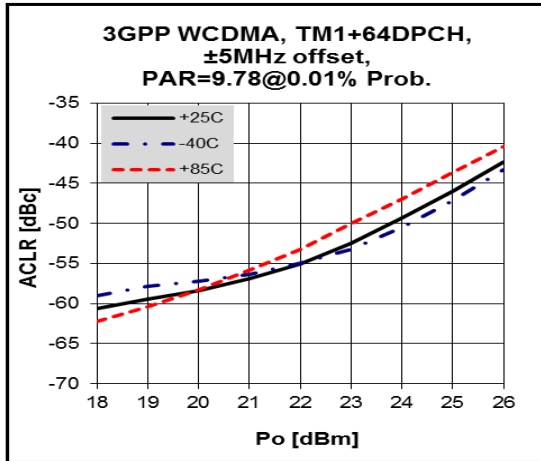
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## 1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier

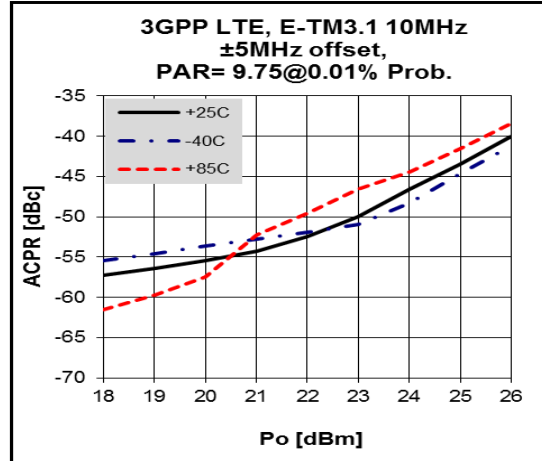


Preliminary Datasheet

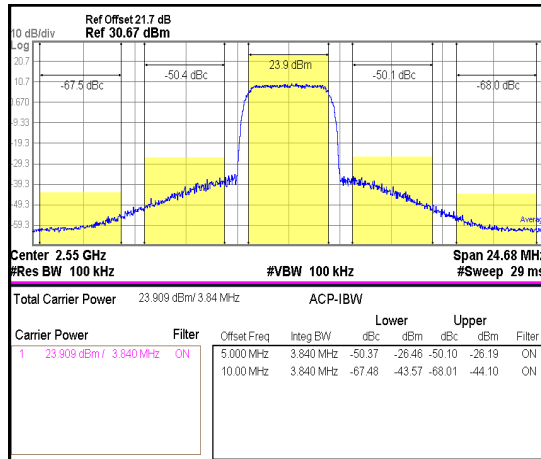
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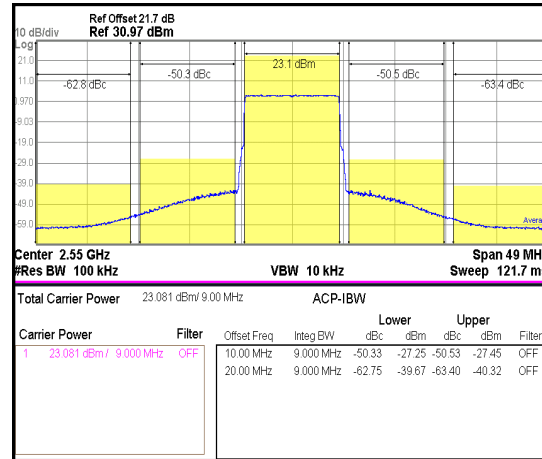
3GPP WCDMA TM1 +64DPCH 1FA



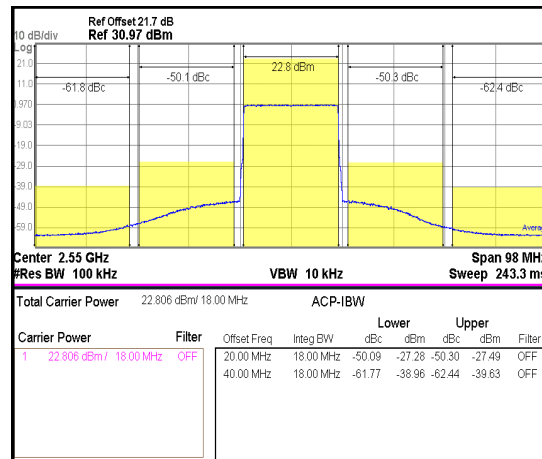
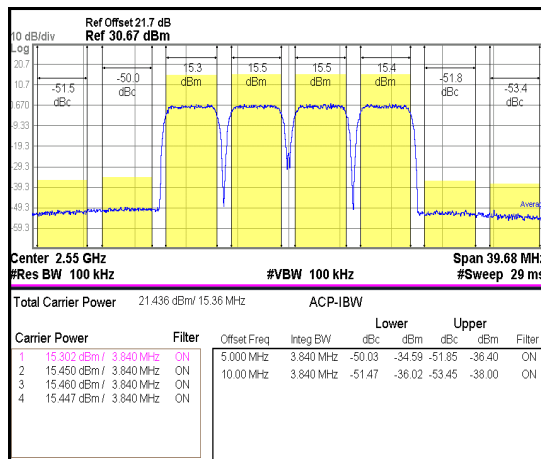
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3GPP LTE E-TM3.1 20MHz



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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Application Circuit: 2.65 GHz

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	C5	0603	1nF	
	C6	0603	27pF	COG/NPO
	C7	0603	0 Ω	Jumper
	C8	0603	1.0pF	
	C9	0603	1.2pF	
	C10	0603	3.0pF	High Q Cap
	C11	0603	10pF	
	C12	0603	1nF	
	C13	0603	100pF	
	C14	0603	1nF	
	C15	1206	10uF	Tantalum
L1	0603	N/A		
L2	0603	0 Ω	Jumper	
L3	1008	18nH	High Q Coil	
R1	0603	150 Ω	±5%	
R2	0603	270 Ω	±5%	

PCB Diagram	Notice																								
	<p>Below information is subject to change as conditions of the substrate.</p> <table border="1"> <thead> <tr> <th>Reference</th> <th>Object</th> <th>Distance</th> </tr> </thead> <tbody> <tr> <td>Input pin</td> <td>C8</td> <td>3.6mm</td> </tr> <tr> <td>Input pin</td> <td>C9</td> <td>2.8mm</td> </tr> <tr> <td>Output pin</td> <td>C10</td> <td>0.8mm</td> </tr> <tr> <td>Pin 16</td> <td>C3</td> <td>6.2mm</td> </tr> <tr> <td>Pin 16</td> <td>C6</td> <td>2.2mm</td> </tr> <tr> <td>Pin 19</td> <td>C5</td> <td>1.0mm</td> </tr> <tr> <td>Pin 20</td> <td>C4</td> <td>5.0mm</td> </tr> </tbody> </table> <p>1. Pin 16 &amp; 20 is used for Vce of the inner bias circuit. To eliminate bias line resonance you need above 10mm transmission line and adjust the position of C2, C3, C4, C5 and C6. Also you can adjust spectrum regrowth about bandwidth of signals which you want.</p> <p>2. C10 : We recommend High-Q capacitor for better output power performance. In this document we used 3.0pF(251R14S3R0BV4, EIA 0603) of Johanson Technology.</p> <p>3. C7 &amp; L2 are just jumpers as 0Ω</p>	Reference	Object	Distance	Input pin	C8	3.6mm	Input pin	C9	2.8mm	Output pin	C10	0.8mm	Pin 16	C3	6.2mm	Pin 16	C6	2.2mm	Pin 19	C5	1.0mm	Pin 20	C4	5.0mm
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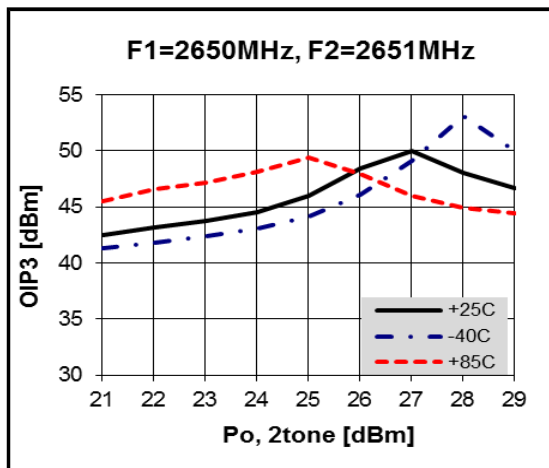
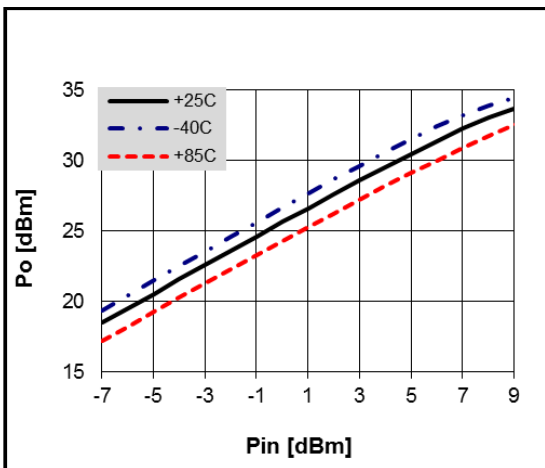
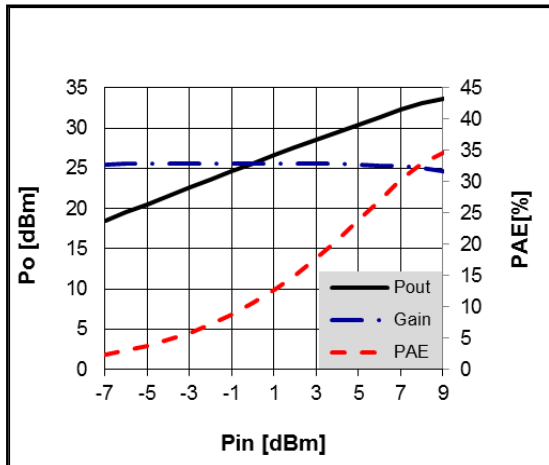
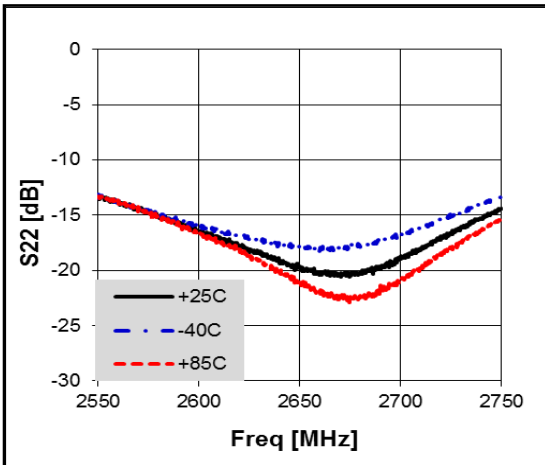
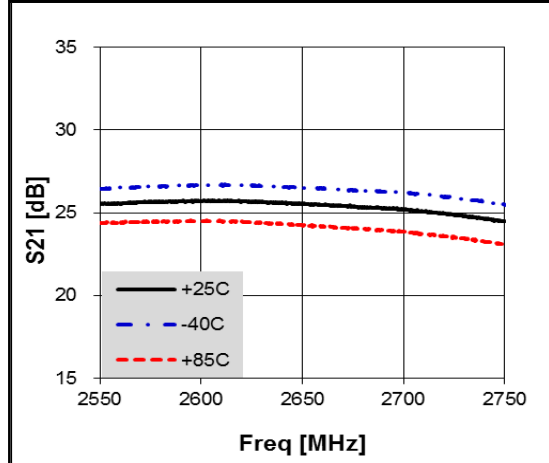
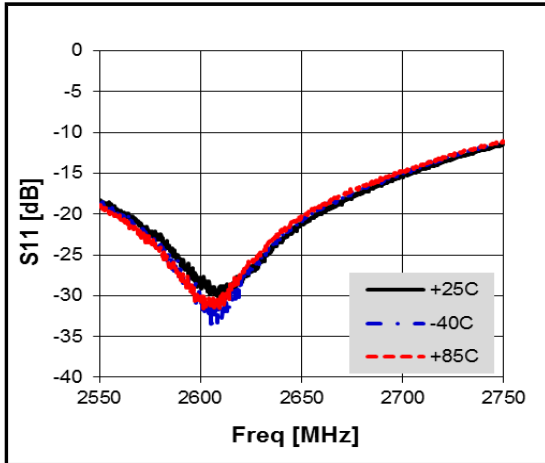
# BMT333

1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



Preliminary Datasheet

## Typical Performance



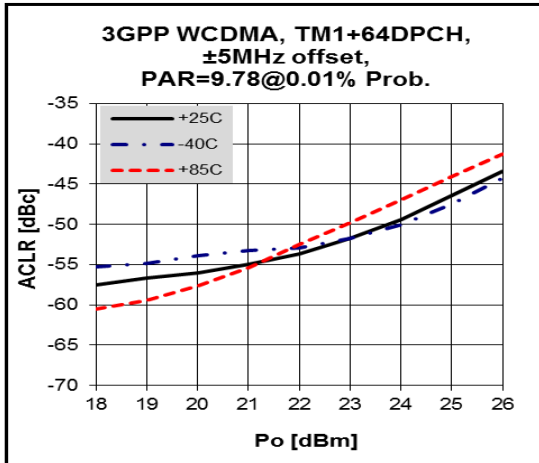
# BMT333



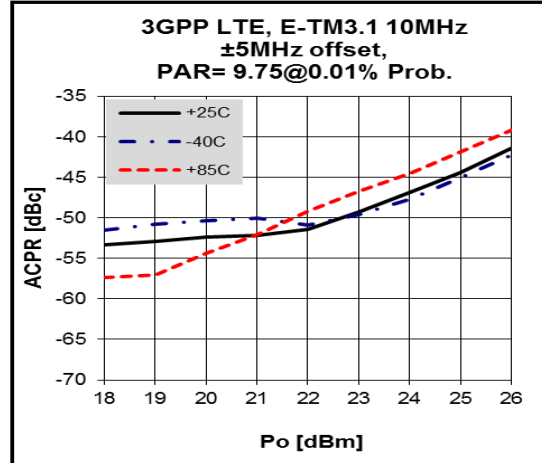
## 1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier

Preliminary Datasheet

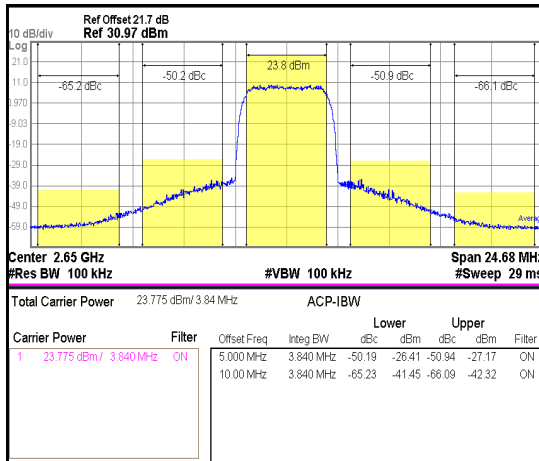
### Typical Performance



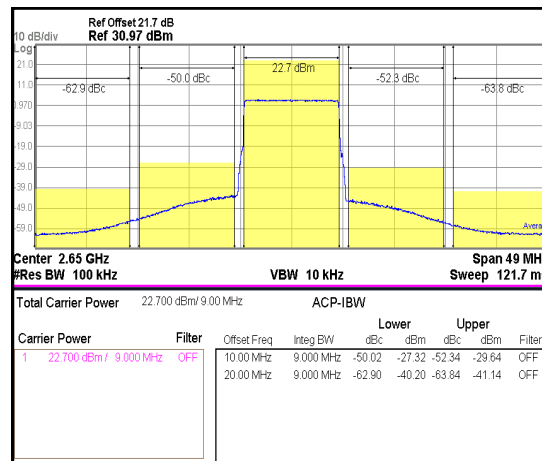
3GPP WCDMA TM1 +64DPCH 1FA



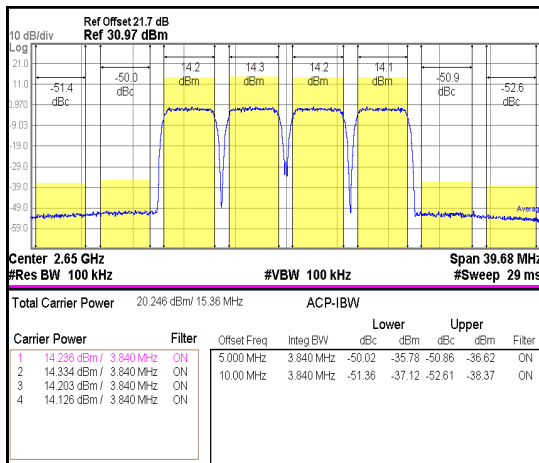
3GPP LTE E-TM3.1 10MHz



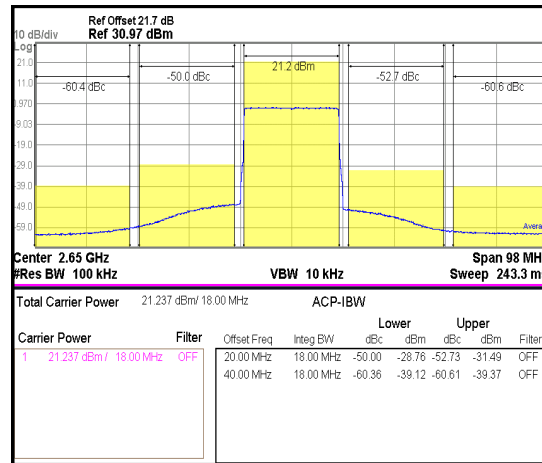
3GPP WCDMA TM1 +64DPCH 4FA



3GPP LTE E-TM3.1 20MHz



3GPP WCDMA TM1 +64DPCH 4FA



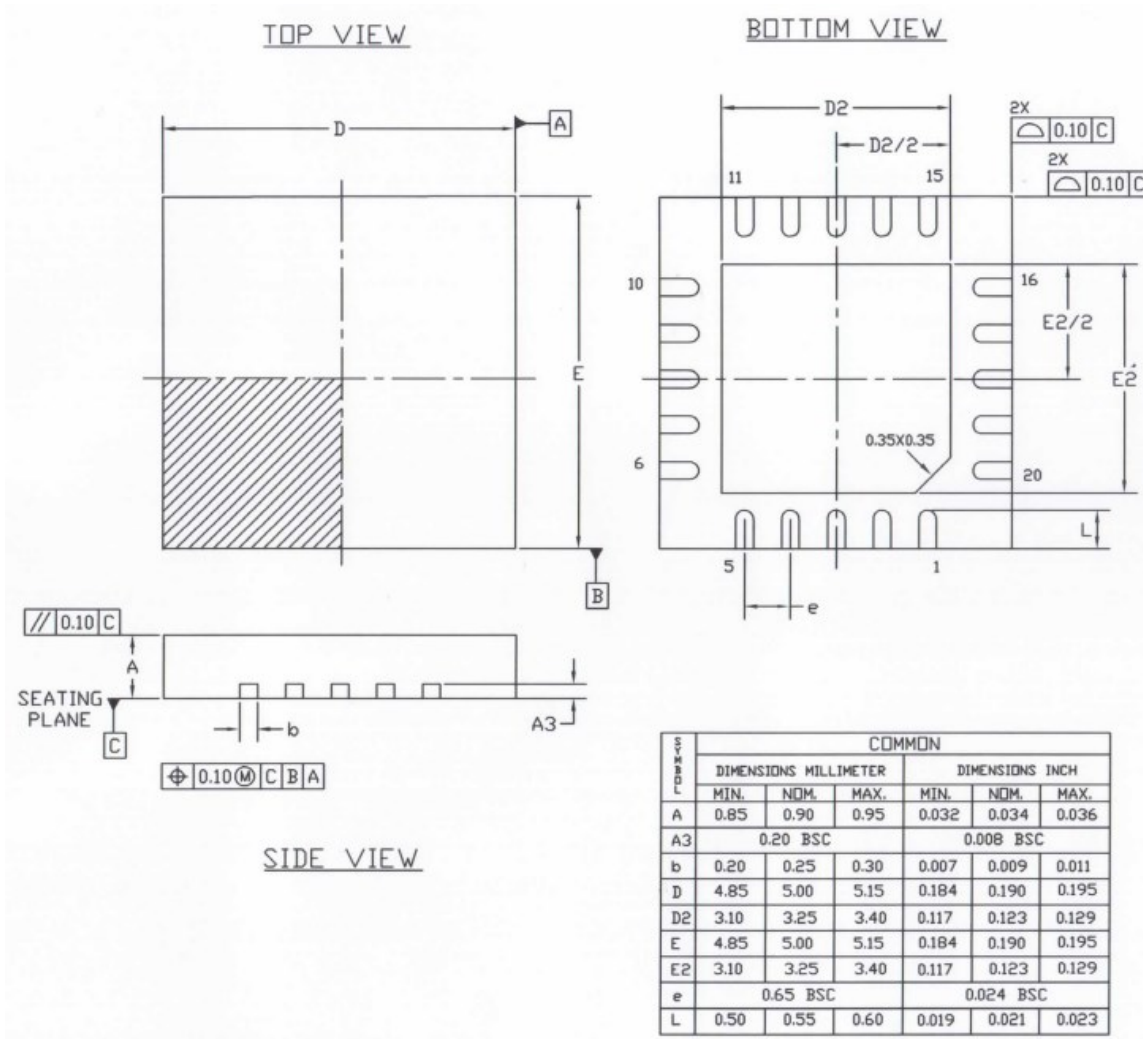
3GPP LTE E-TM3.1 20MHz

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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Package Outline Dimension



**NOTES :**

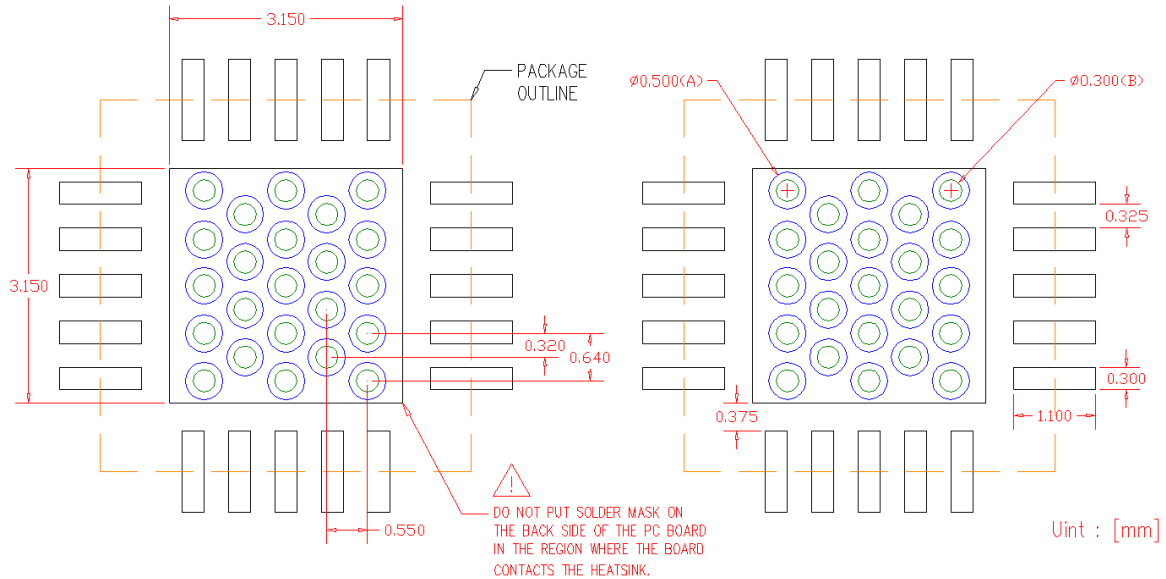
1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. CONTROLLING DIMENSIONS : MILLIMETER. CONVERTED INCH DIMENSION ARE NOT NECESSARILY EXACT.
3. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM. FROM TERMINAL TIP.
4. INSULATION THICKNESS, CLEARANCE OF OVERLAP ARE USER DEFINED.
5. INSULATION NOT COMPLETELY SHOWN FOR REASONS OF CLARITY.

# BMT333

1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Suggested PCB Land Pattern and PAD Layout

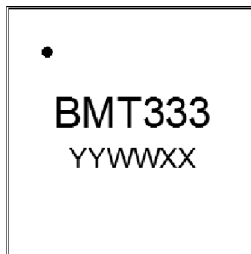


### Notes

1. Use 1 oz. copper minimum for top and bottom layer metal.
2. A heatsink underneath the area of the PCB for the mounted device is required for proper thermal operation.
3. Ground / thermal vias are critical for the proper performance of this device.

Vias should use a 0.5 mm(A) diameter drill and have a final plated thru diameter of 0.3 mm(B).

### Package Marking



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

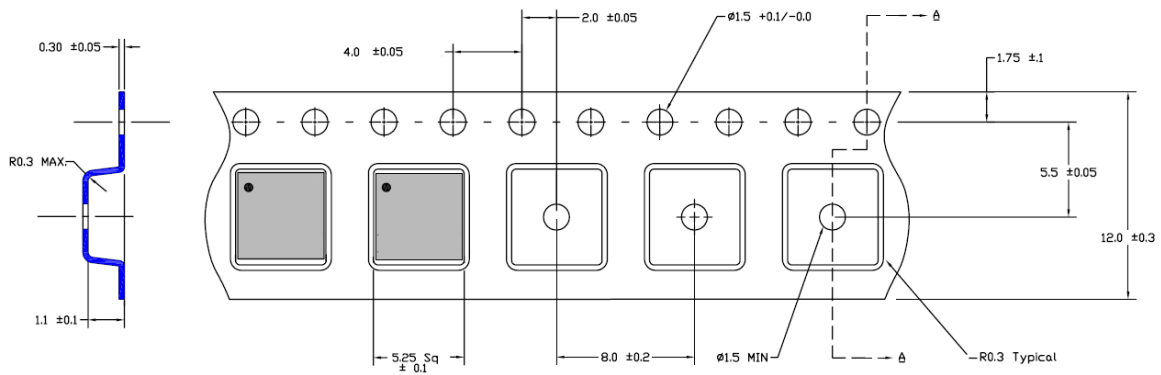
# BMT333

1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier



## Tape & Reel

QFN 5x5



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.)

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1.8-2.7 GHz 2W High Linearity 5V 2-Stage Power Amplifier

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## MSL / ESD Rating

<b>ESD Rating:</b>	Class 1C
<b>Value:</b>	Passes $\geq 1000V$ to $< 2000 V$
<b>Test:</b>	Human Body Model (HBM)
<b>Standard:</b>	JEDEC Standard JESD22-A114B
<b>ESD Rating:</b>	Class C3
<b>Value:</b>	Passes $>1000V$
<b>Test:</b>	Charged Device Model (CDM)
<b>Standard:</b>	JEDEC Standard JESD22-C101F
<b>MSL Rating:</b>	Level 1 at $+260^{\circ}C$ convection reflow
<b>Standard:</b>	JEDEC Standard J-STD-020

## NATO CAGE code:

2	N	9	6	F
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