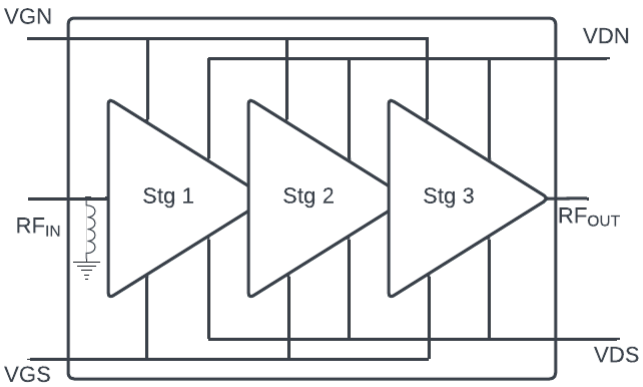
Advanced Information: AI2515

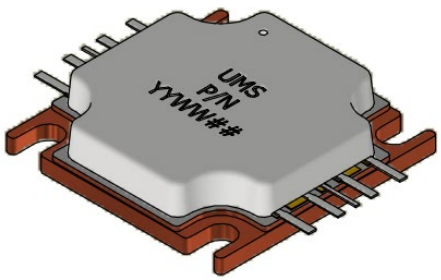
CHA8362-EBB

26.5-31GHz 20W GaN Monolithic High Power Amplifier in drop-in copper base package



Description

The CHA8362-EBB is a packaged three stage High Power Amplifier operating between 26.5 and 31GHz and providing typically 20W of saturated output power associated to 28% of Power Added Efficiency. It exhibits 10W of linear power with -20dBc IMD3 at 10MHz bandwidth. This HPA is dedicated to SatCom and 5G applications and well suited for a wide range of microwave applications and systems. The circuit is manufactured on a robust GaN-on-SiC HEMT process and is available in a drop-in package with a copper base. Input & output are 50Ω matched.



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Electrical Characteristics

T_{case}=+25°C, CW excitation (Tcase: Package backside temperature)

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	26.5		31	GHz
Gain	Linear Gain		24		dB
Pout	Output Power @ Pin=25dBm		43.5		dBm
PAE	Power Added Efficiency @ Pin = 25dBm		28		%
Id	Drain current @ Pin = 25dBm		3.5		A
S11	Input Return Loss		-9		dB
S22	Output return loss		-5		dB
Idq	Quiescent current		330		mA
Vd	Drain Voltage		25		V

These values are representative of on-board measurements. The reference plane is on the edge of the RF lines, between the PCB and the package.

Absolute Maximum Ratings (1)

T_{case}=+25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	27	V
Id	Quiescent Drain bias current	1000	mA
Vg	Gate bias voltage	-7 to -1	V
Pin	Maximum Input Power	32	dBm

(1) Operation of this device above anyone of these parameters may cause permanent damage.

Recommended Operating Range (2), (3)

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	20 to 25	V
Idq	Total Quiescent Drain Current	300 to 840	mA
Pin	Maximum Input Power	30	dBm
Tj	Maximum Junction temperature(5)	200	°C

(2) Electrical performances are defined for specified test conditions

(3) Electrical performances are not guaranteed over all recommended operating conditions

Temperature Range

Tcase	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

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Typical Bias Conditions

T_{case}=+25°C

Symbol	Pad N°	Parameter	Values	Unit
V_G	1,3	Gate voltage tuned for Idq	-3.1 to -2.5	V
V_D	4,6	Drain voltage	25	V

"Power ON" sequence

1. Bias HPA gate voltage at Vg close to Vpinch-off (Typically: $V_G \approx -5$)
2. Apply Vd bias voltage (Typically: Vd = 25V)
3. Increase gate voltage V_g up to quiescent bias drain current Idq
4. Apply RF signal

"Power OFF" sequence

1. Turn off RF signal
2. Bias HPA gate voltage at Vg close to Vpinch-off (Typically: $V_G \approx -5V$)
3. Check that quiescent bias drain current Idq is close to 0mA
4. Turn Vd bias voltage to 0V
5. Check that quiescent bias drain current Idq is close to 0mA
6. Turn V_G bias voltage to 0V

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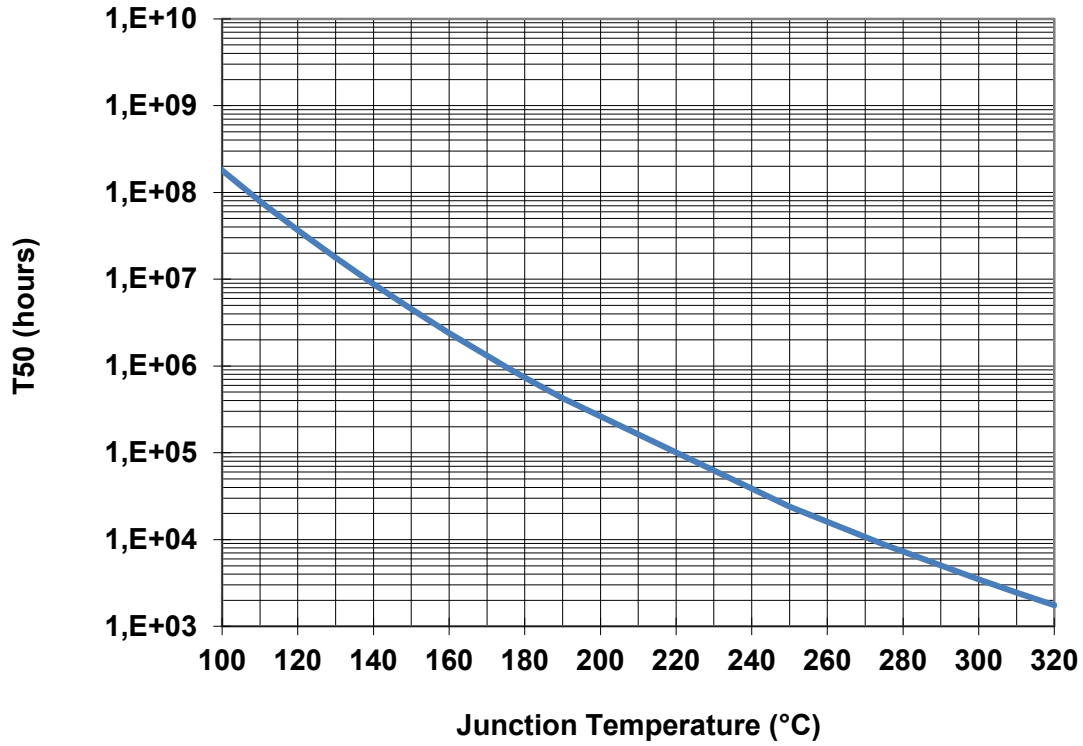
Device thermal performances

The device thermal performances below are based on UMS rules to evaluate the junction temperature.
This same procedure is the basis for junction temperature evaluation of the samples used to derive the Median lifetime and activation energy for the particular technology on which the CHA8362-99F is manufactured (GaN HEMT 0.15µm).
The temperature T_{case} is defined as the package baseplate backside temperature. The thermal resistance (Rth_eq), given in the following table, is for the full circuit in CW mode.

Thermal Resistance (1)	R_{th_eq}	T_{case} = +85°C, Vd = 25V, Idq = 440mA, Pin = 28dBm, Freq = 29GHz, Pdiss = 55W	2.07	°C/W
Junction Temperature	T_j		199	°C
Median Life	T50		>2E5	Hrs

(1) Thermal resistance measured at the package baseplate backside



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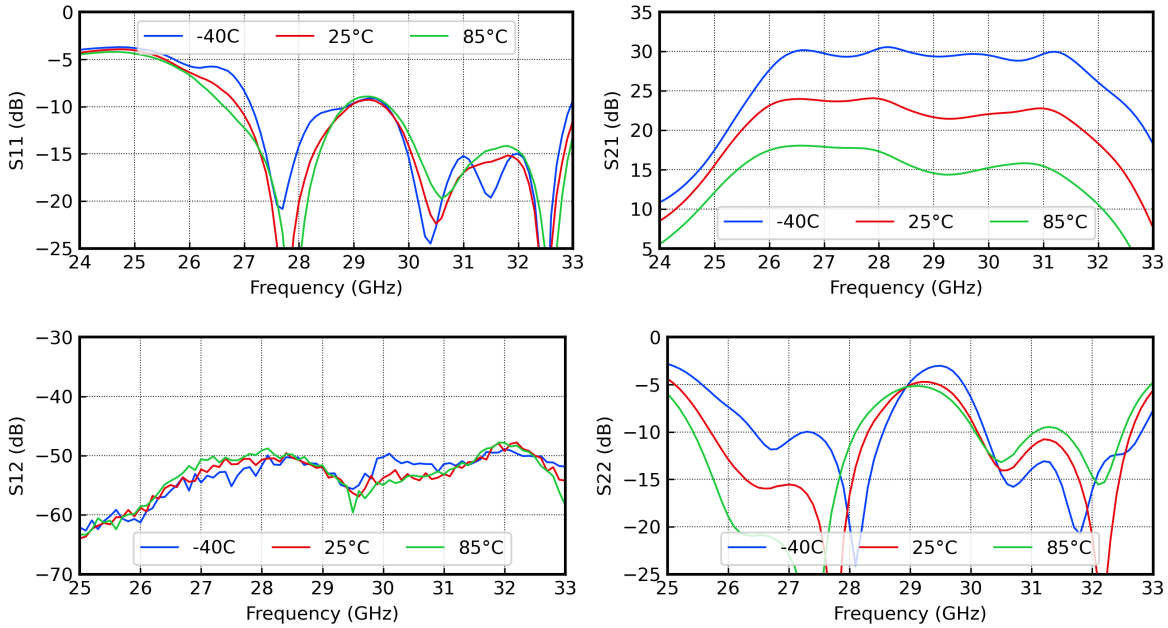
Typical Board Measurements: Small Signal Performance

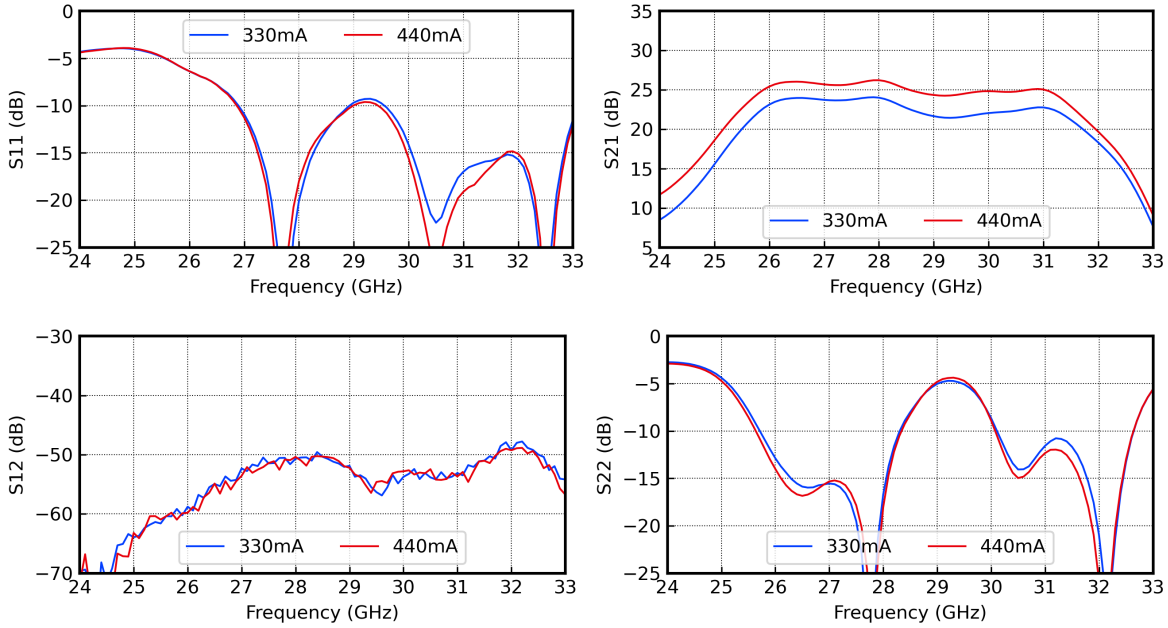
Test conditions : CW, Vd = 25V, Idq = 330mA, Tcase = -40°C / 25°C / 85 °C
Measurements reference planes are de-embedded at the end of the RF line on the board.

S Parameters versus Frequency versus temperature



S Parameters versus Frequency versus drain current

Test conditions : CW, Vd = 25V, T_{case}=+25°C
Measurements reference planes are de-embedded at the end of the RF line on the board.



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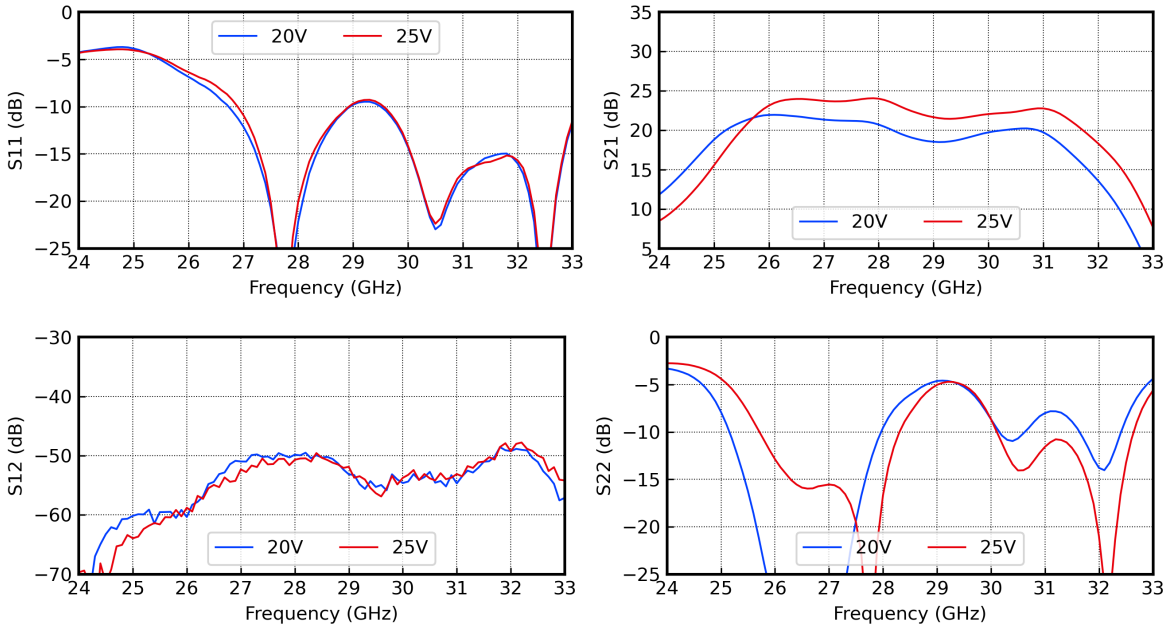
Typical Board Measurements: Small Signal Performance

Test conditions : CW, Vd = 20V / 25V, Idq = 330mA, T_{case} = 25°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

S Parameters versus Frequency versus drain voltage



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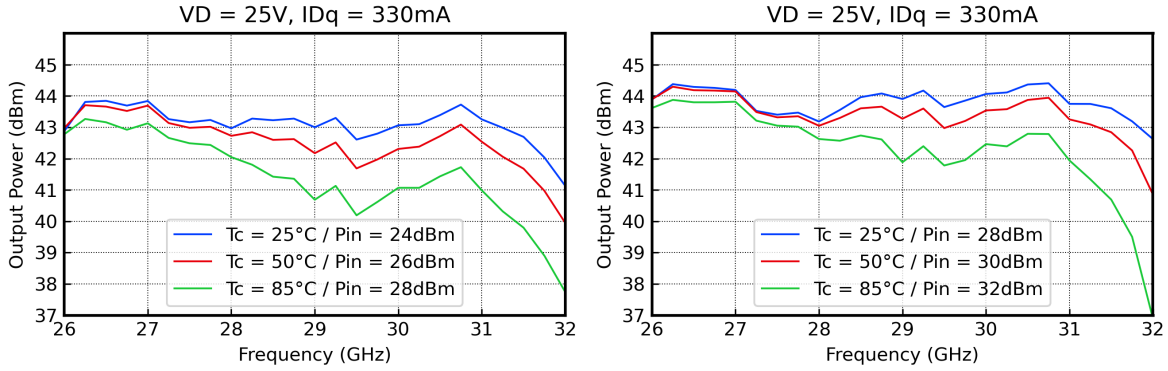
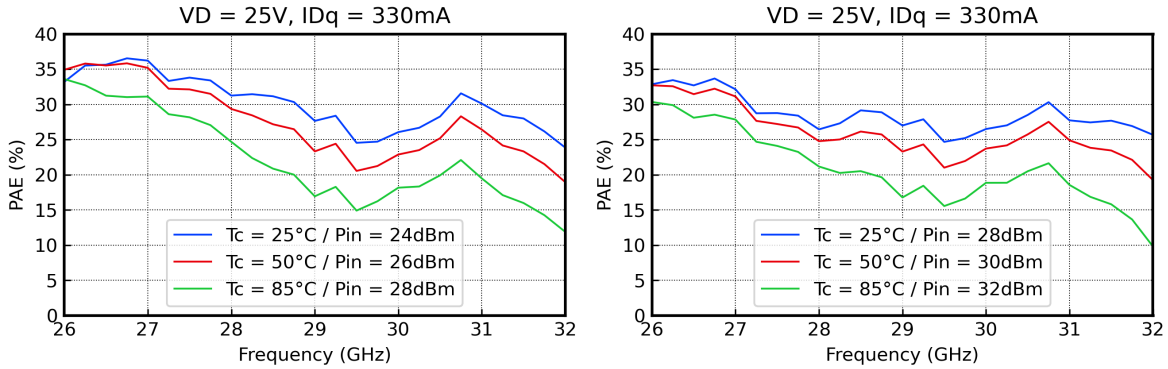
Typical Board Measurements: Large Signal Performance

Test conditions : CW, Vd = 25V, Idq = 330mA, T_{case} = 25°C/50°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

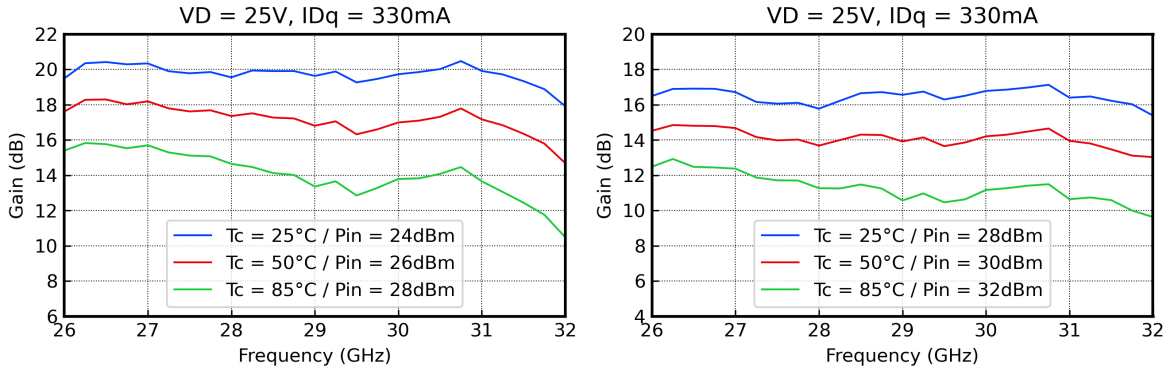
Output power versus Frequency versus Temperature and Input Power



PAE versus Frequency versus Temperature and Input Power



Gain versus Frequency versus Temperature and Input Power



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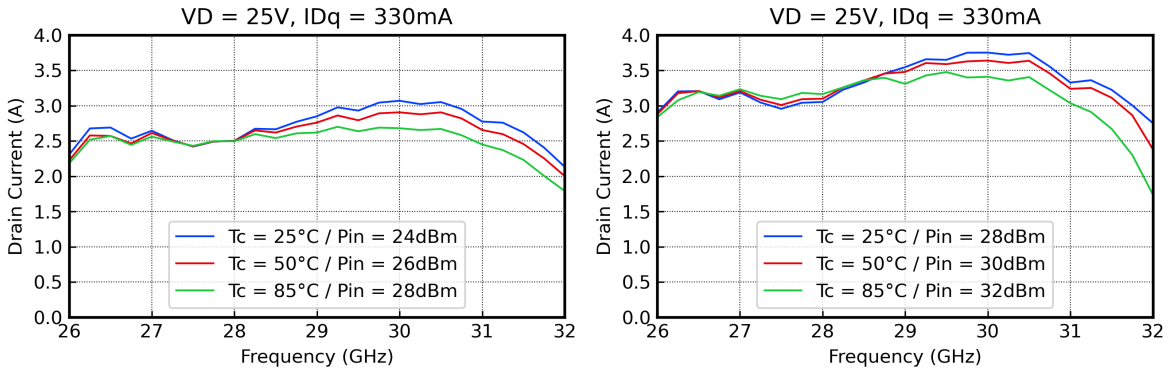
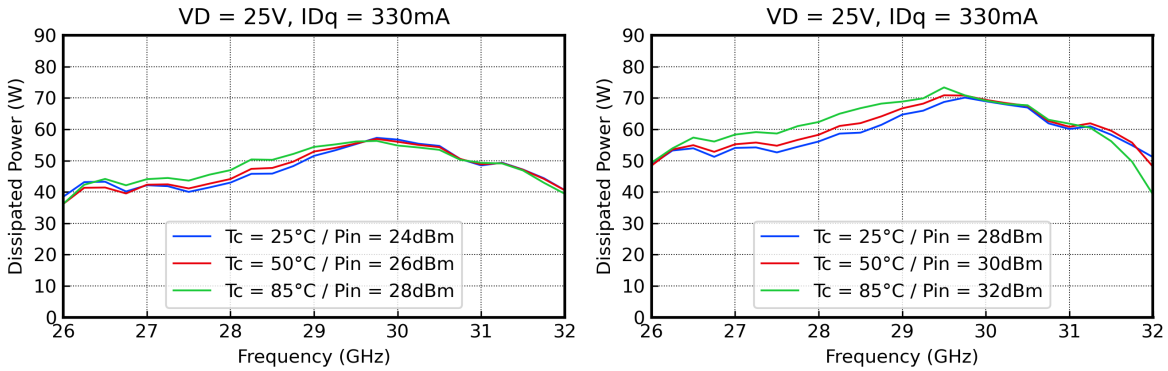
Typical Board Measurements: Large Signal Performance

Test conditions : CW, Vd = 25V, Idq = 330mA, T_{case} = 25°C/50°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

Drain current versus Frequency versus Temperature and Input Power



Dissipated power versus Frequency versus Temperature and Input Power



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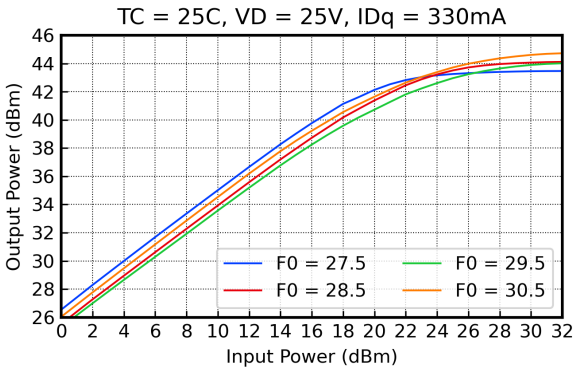
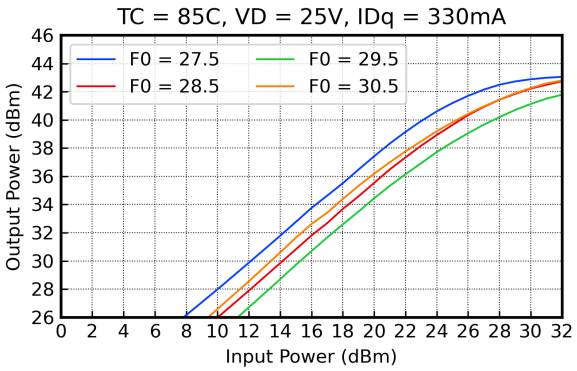
Typical Board Measurements: Large Signal Performance

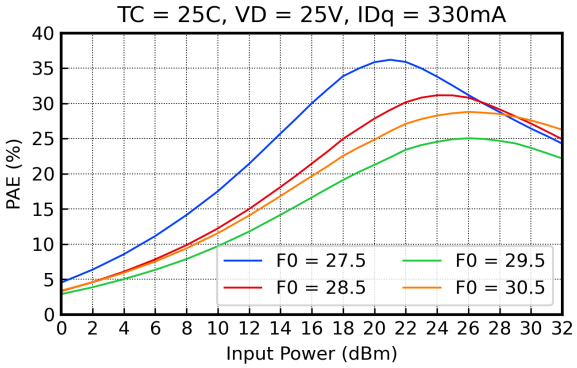
Test conditions : CW, Vd = 25V, I_{Dq} = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

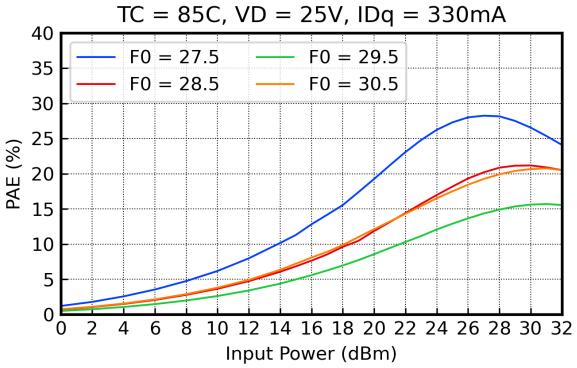
Output power versus Input Power versus Frequency



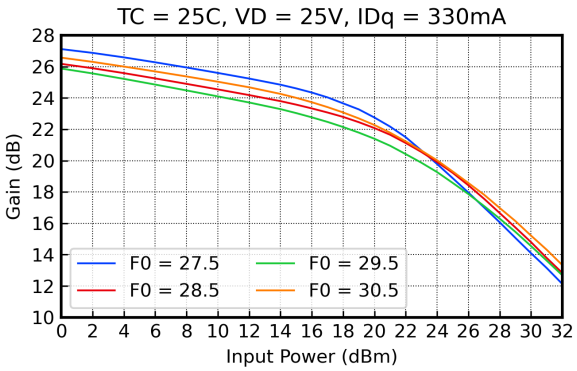


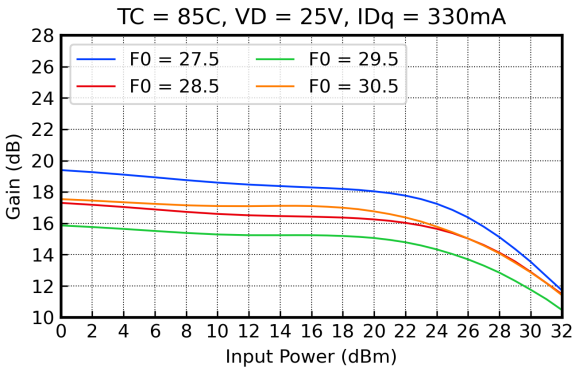
PAE versus Input Power versus Frequency





Gain versus Input Power versus Frequency





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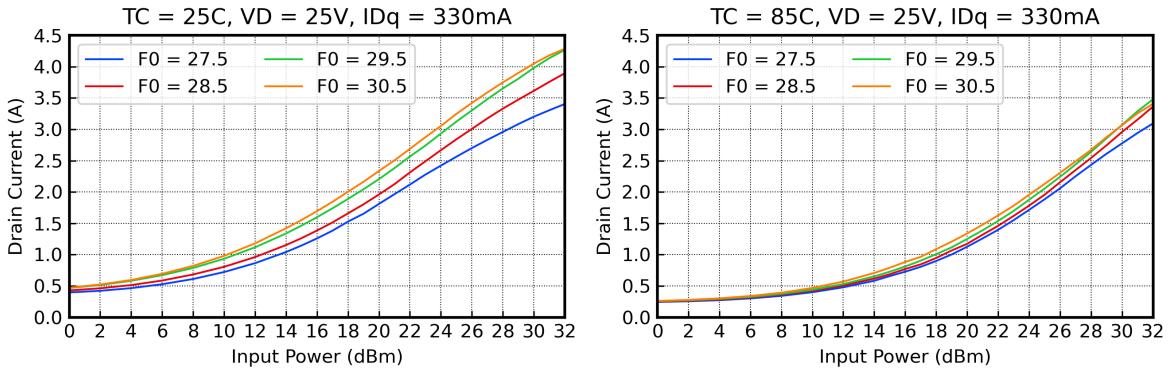
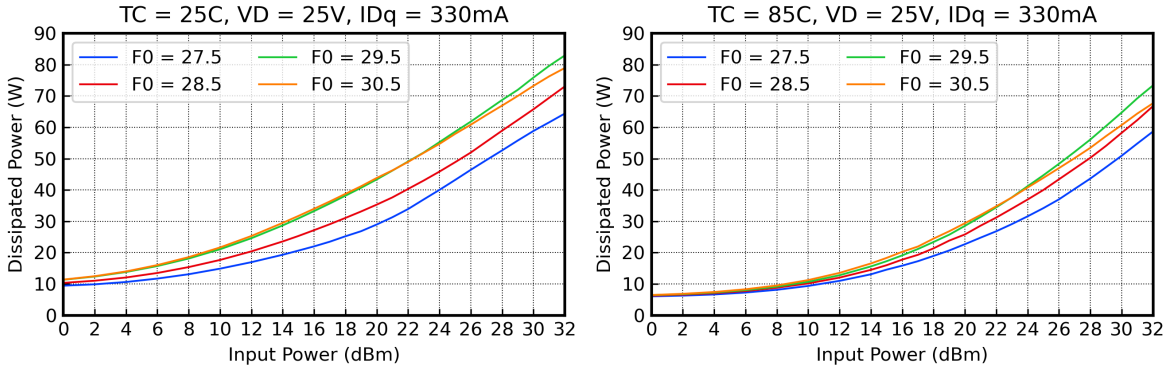
Typical Board Measurements: Large Signal Performance

Test conditions : CW, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

Drain current versus Input Power versus Frequency



Dissipated power versus Input Power versus Frequency



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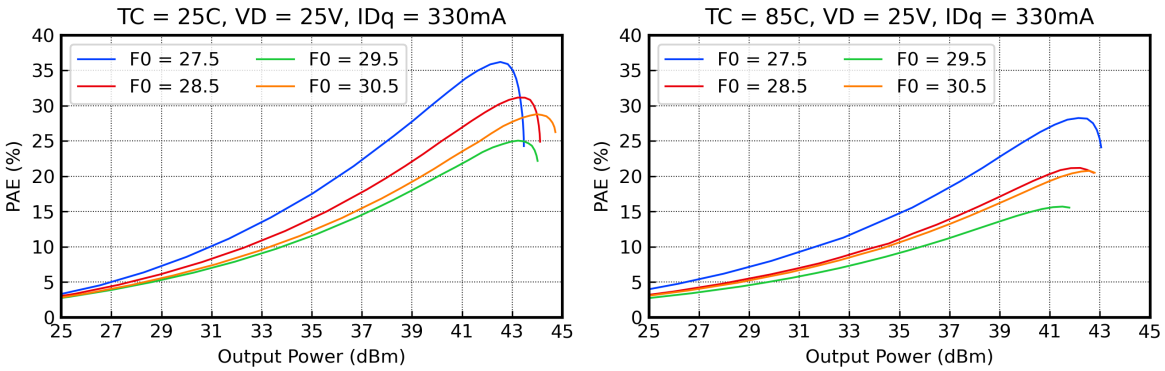
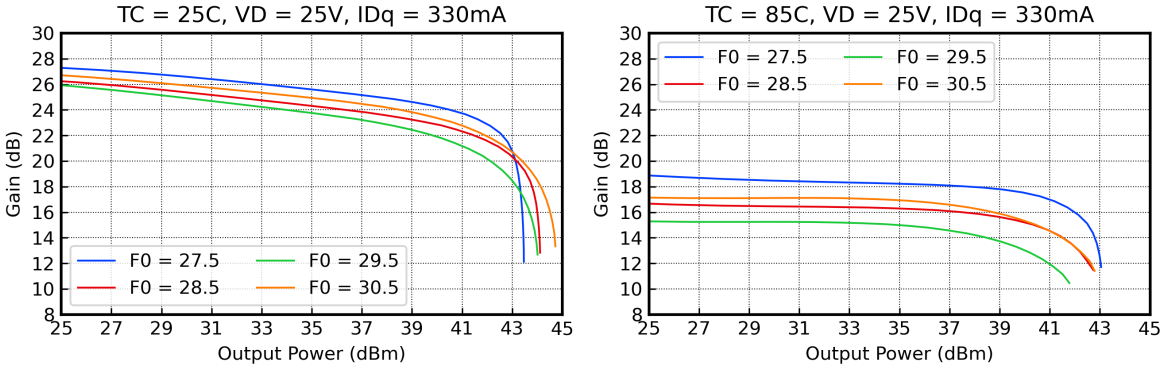
Typical Board Measurements: Large Signal Performance

Test conditions : CW, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

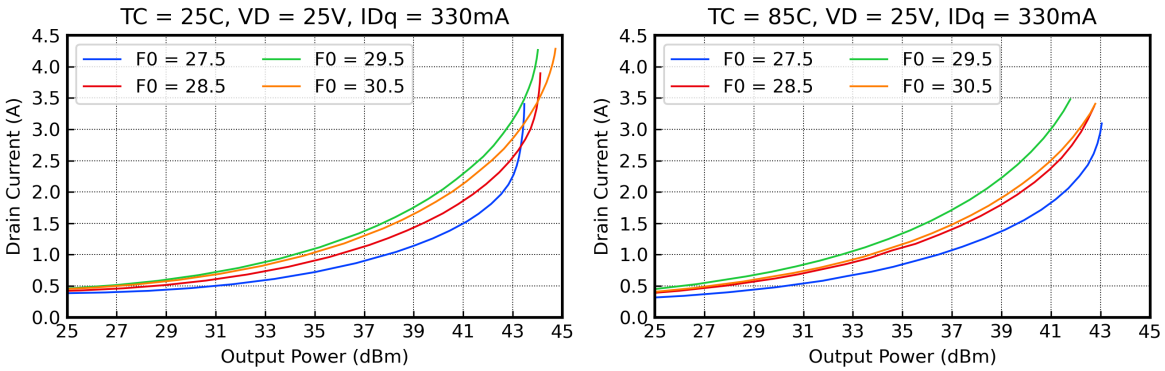
PAE versus Output Power versus Frequency



Gain versus Output Power versus Frequency



Drain current versus Output Power versus Frequency



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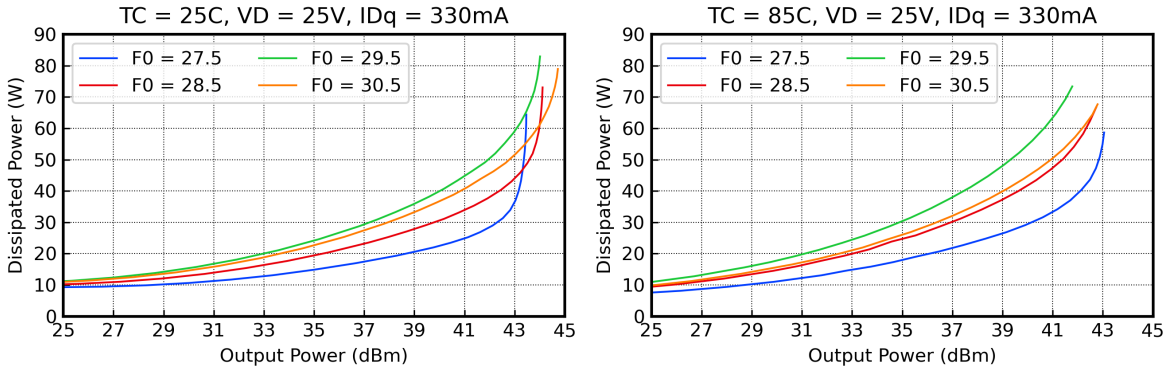
Typical Board Measurements: Large Signal Performance

Test conditions : CW, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

Dissipated power versus Output power versus Frequency



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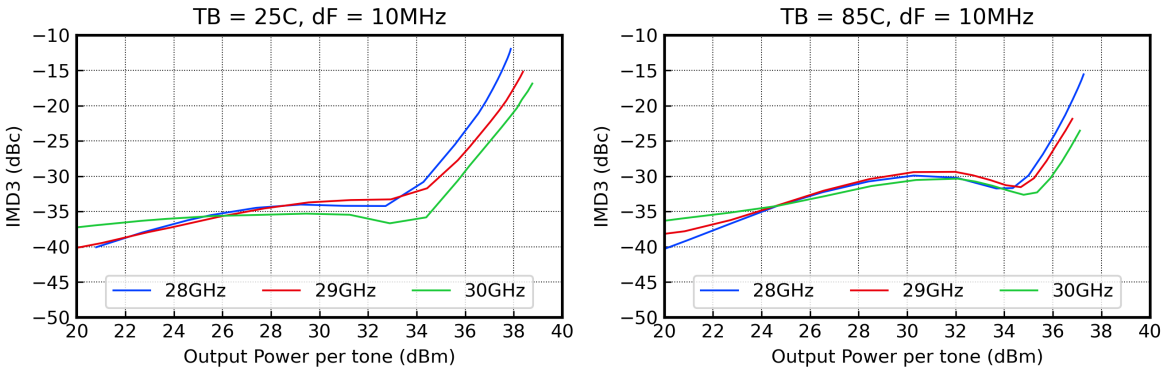
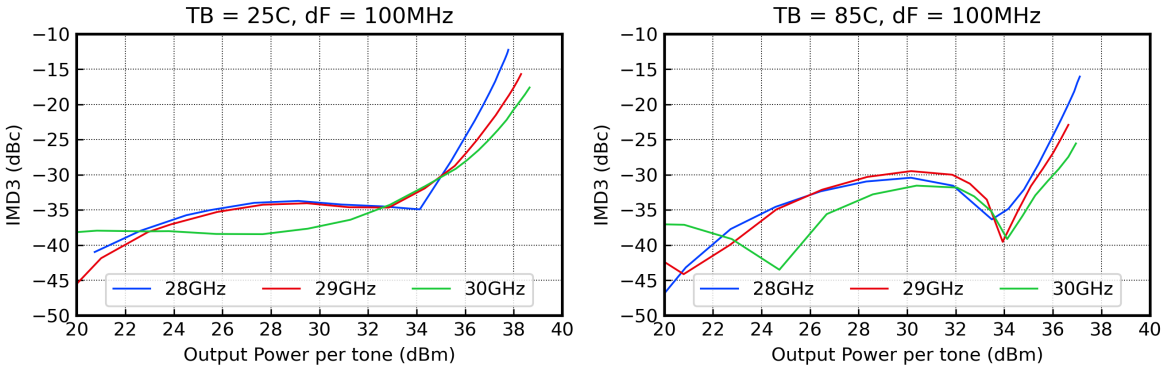
Typical Board Measurements: Intermodulation Distortion

Test conditions : 2 tones CW measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

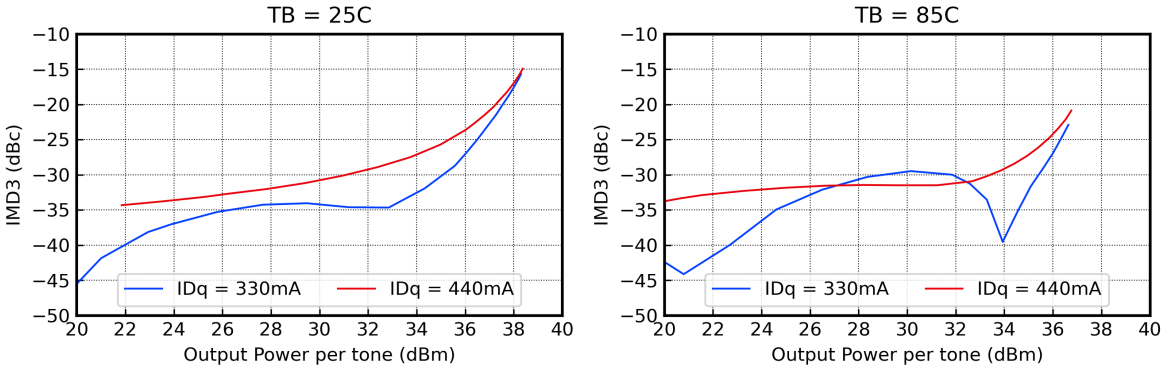
IMD3 versus Total Output Power versus Frequency, 10MHz tone spacing



IMD3 versus Total Output Power versus Frequency, 100MHz tone spacing



IMD3 versus Total Output Power versus Quiescent Current, 100MHz tone spacing



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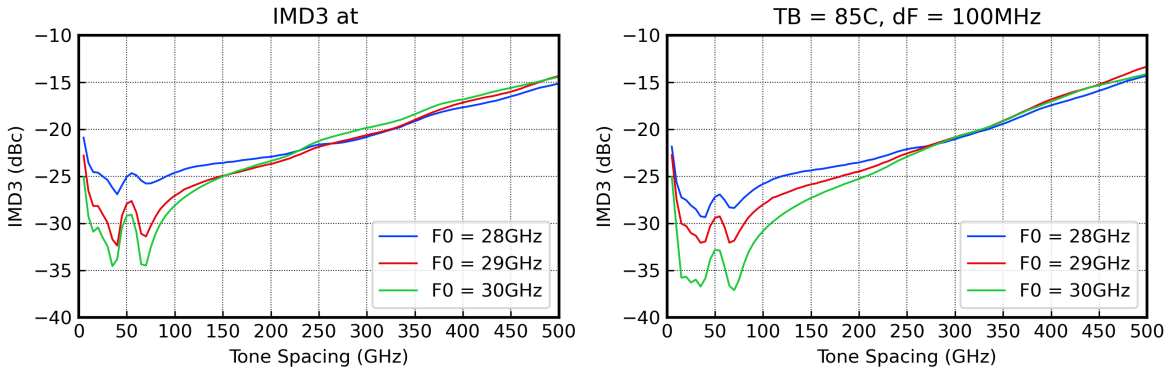
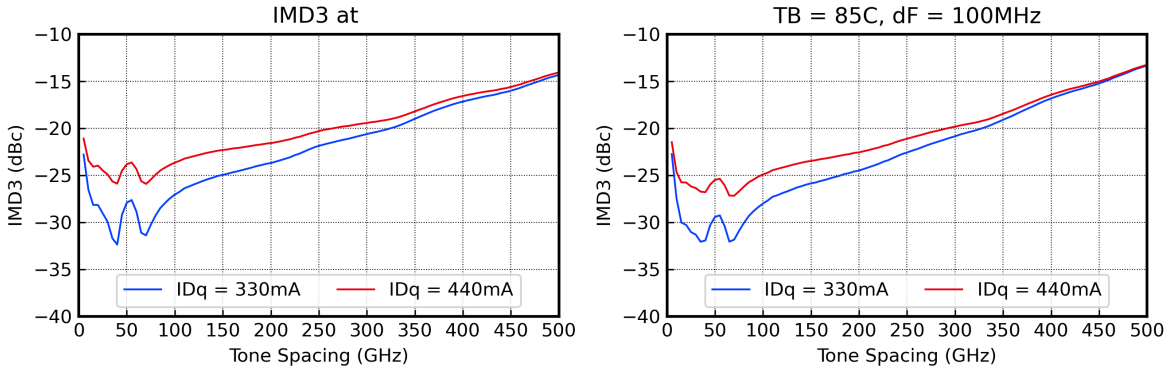
Typical Board Measurements: Intermodulation Distortion

Test conditions : 2 tones CW measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/ 85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

IMD3 versus Tone Spacing versus Central Frequency at 39dBm Total Output Power



IMD3 versus Tone Spacing versus Quiescent Current at 39dBm Total Output Power



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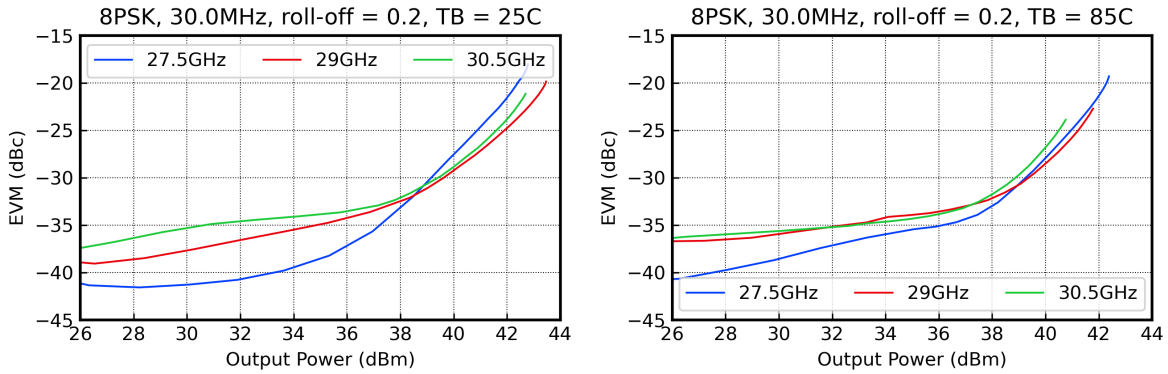
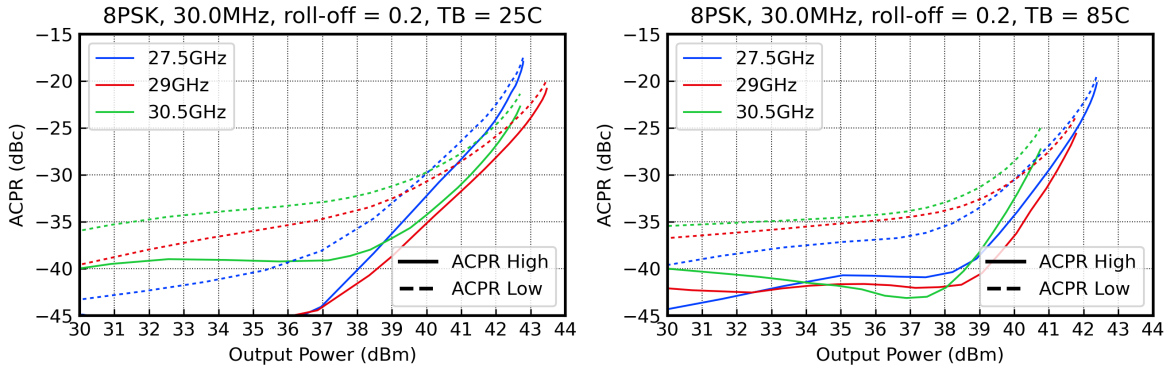
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

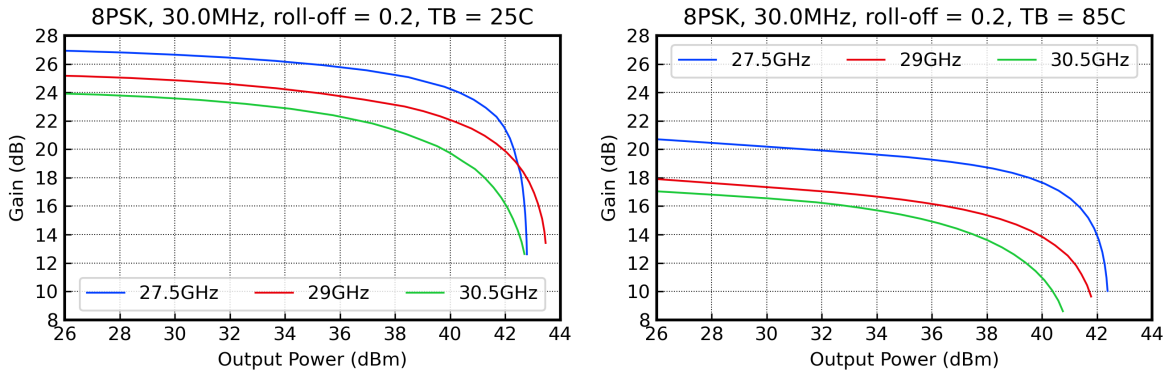
EVM versus Output Power versus Frequency, 8PSK, 30MHz Bandwidth



ACPR versus Output Power versus Frequency, 8PSK, 30MHz Bandwidth



Gain versus Output Power versus Frequency, 8PSK, 30MHz Bandwidth



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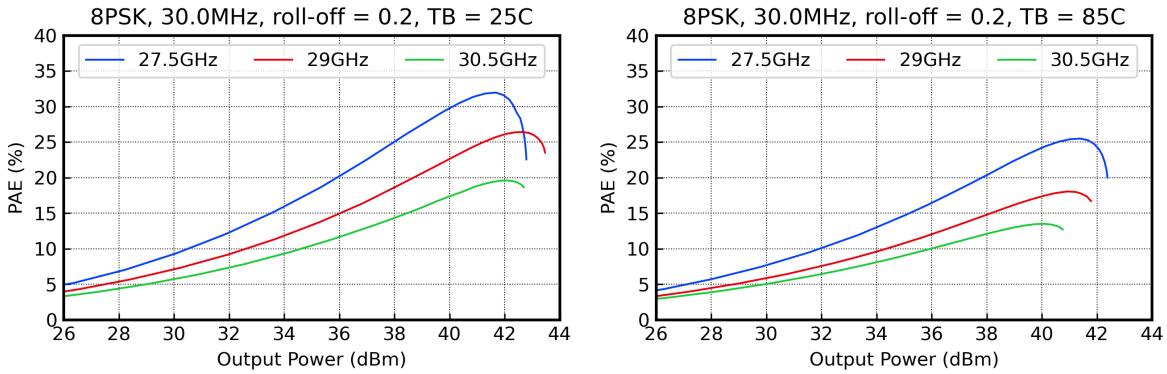
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

PAE versus Output Power versus Frequency, 8PSK, 30MHz Bandwidth



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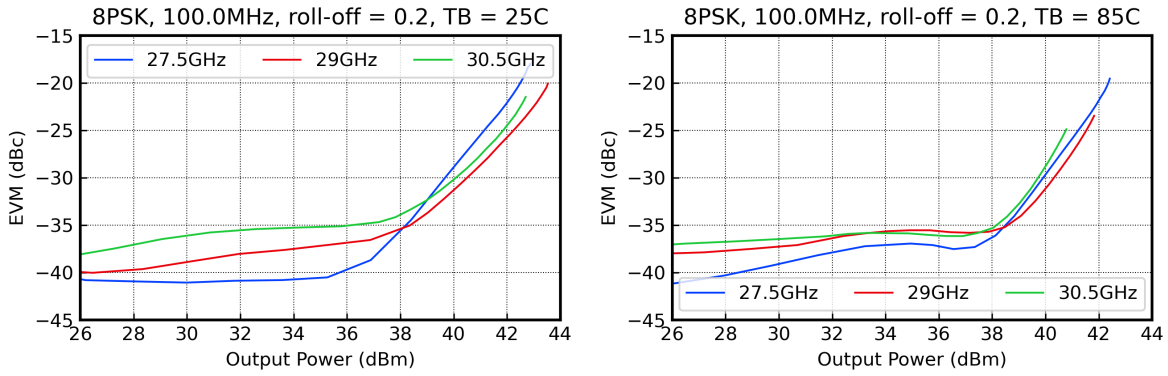
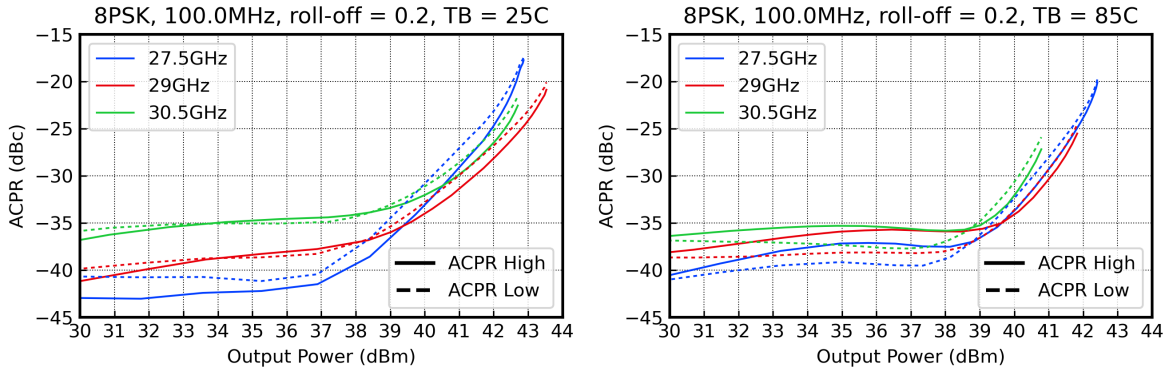
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

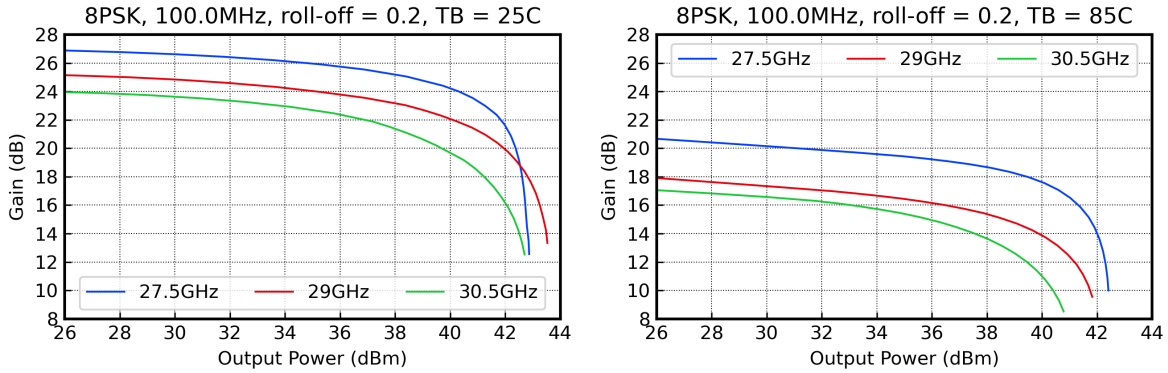
EVM versus Output Power versus Frequency, 8PSK, 100MHz Bandwidth



ACPR versus Output Power versus Frequency, 8PSK, 100MHz Bandwidth



Gain versus Output Power versus Frequency, 8PSK, 100MHz Bandwidth



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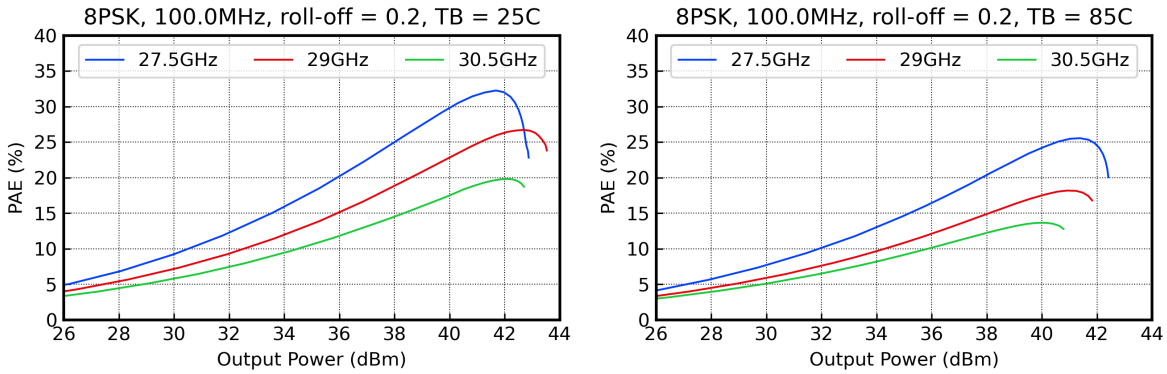
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

PAE versus Output Power versus Frequency, 8PSK, 100MHz Bandwidth



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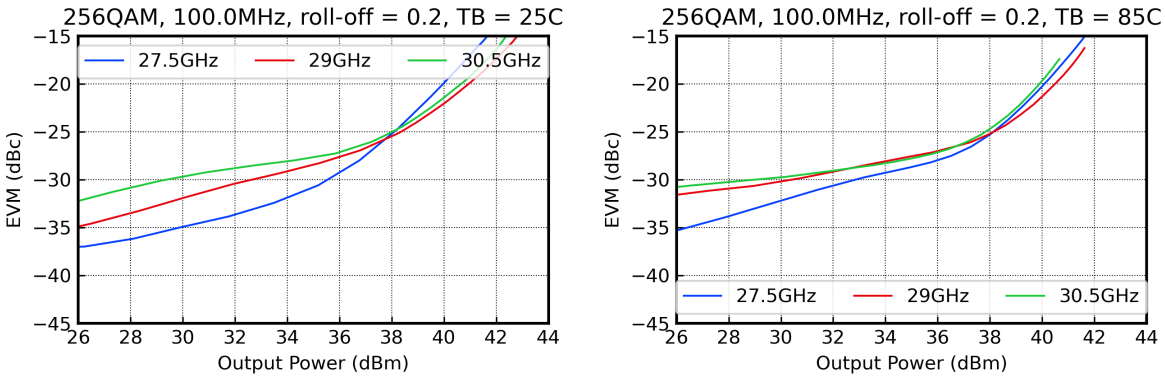
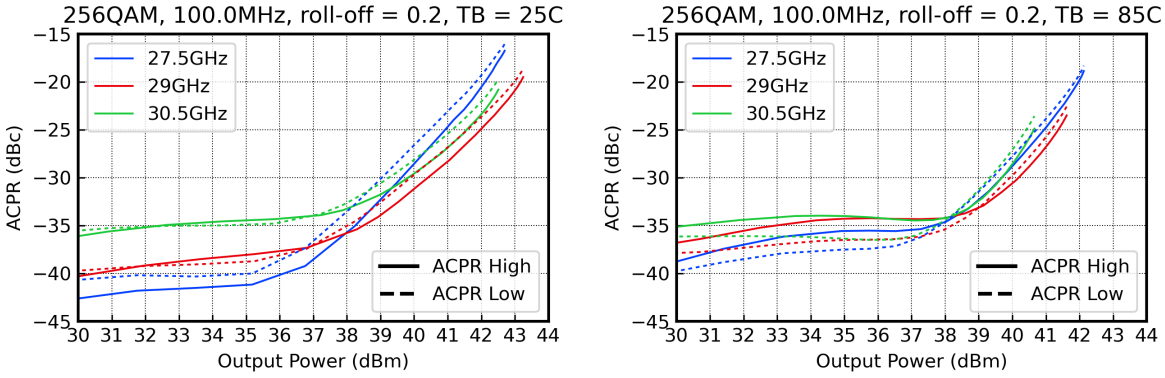
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

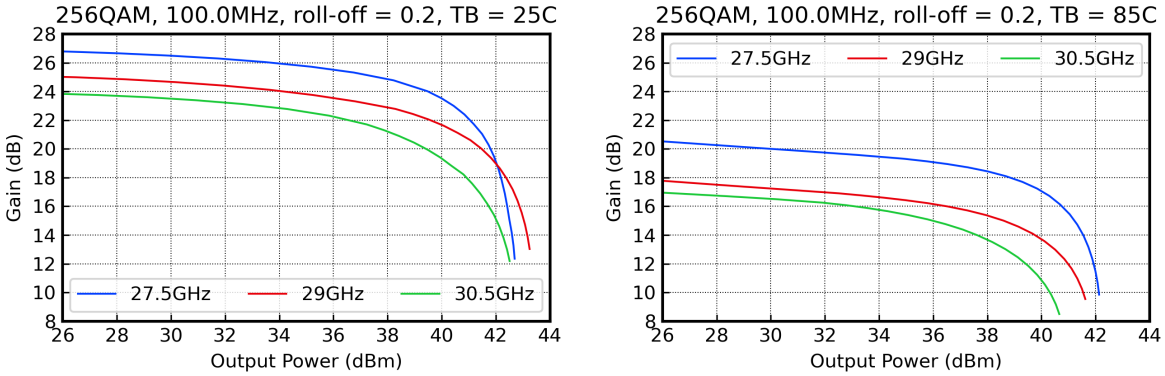
EVM versus Output Power versus Frequency, 256QAM, 100MHz Bandwidth



ACPR versus Output Power versus Frequency256QAM, 100MHz Bandwidth



Gain versus Output Power versus Frequency, 256QAM, 100MHz Bandwidth



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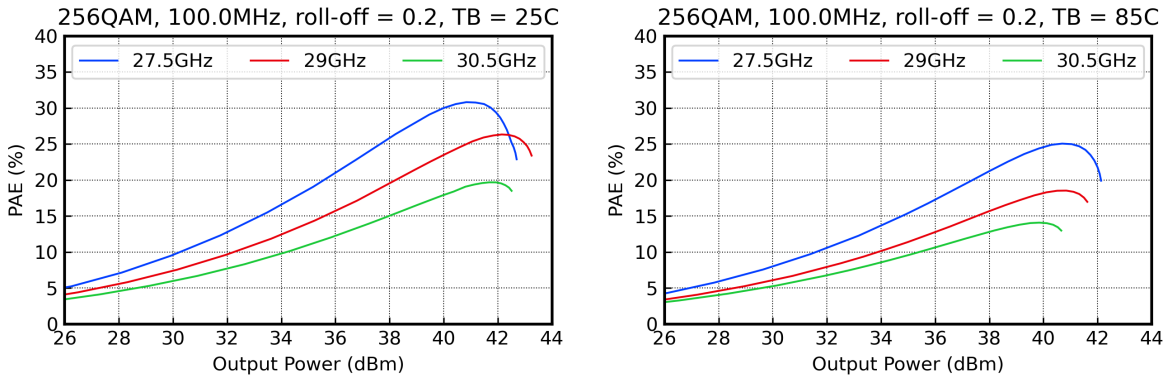
Typical Board Measurements: Modulated Measurements

Test conditions : Modulated measurements, Vd = 25V, Idq = 330mA, T_{case} = 25°C/85°C
Measurements reference planes are de-embedded at the end of the RF line on the board.

PAE versus Output Power versus Frequency, 256QAM, 100MHz Bandwidth



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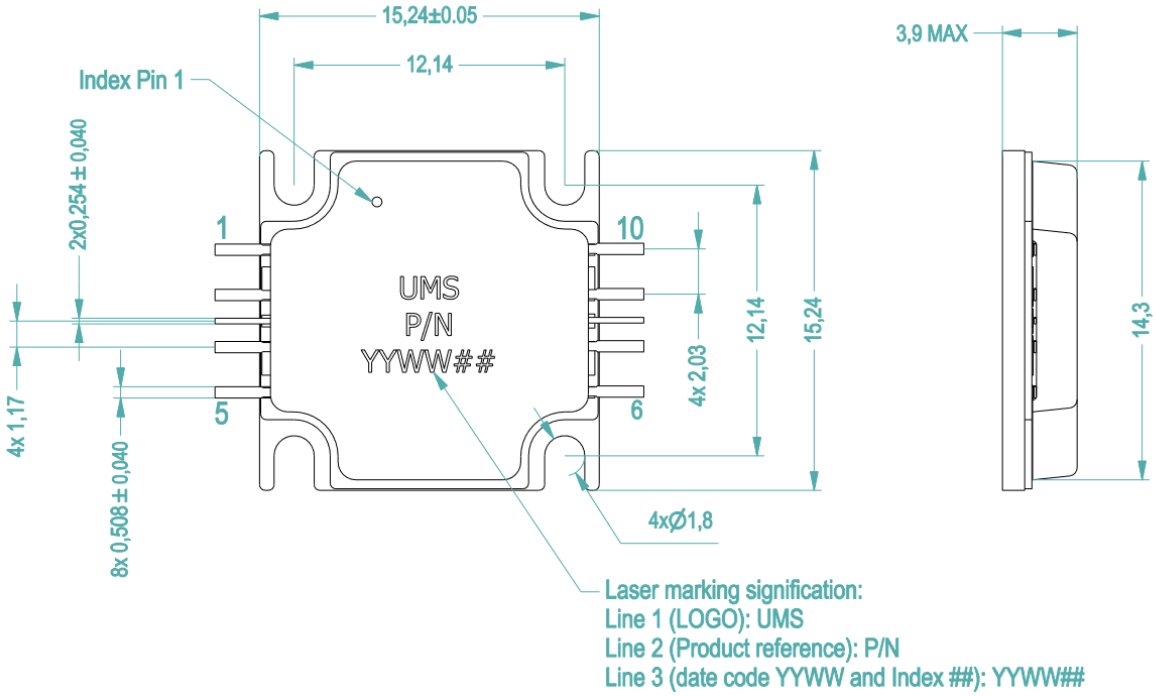
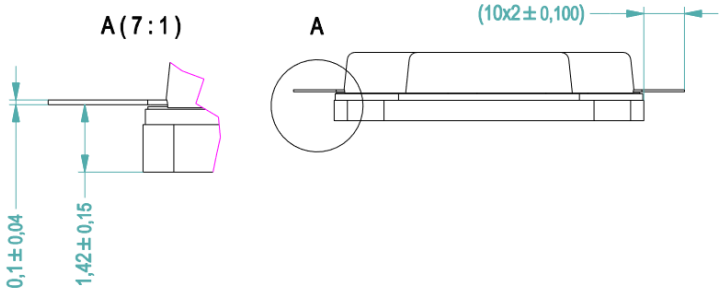
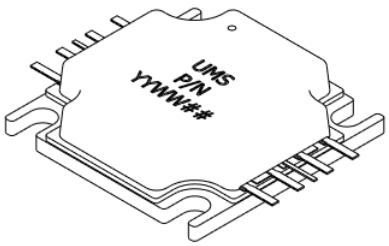
Package outline (1)







1- VG1	6- VD2
2- GND	7- GND
3- RF IN	8- RF OUT
4- GND	9- GND
5- VG2	10- VD1

Finish Base : Cu., EPIG finish
Lead Frame : Cu., Gold Type III grade finish

Units mm

(1) It is strongly recommended to ground all pins marked “GND” through the PCB board. Ensure that the PCB board is designed to provide the best possible ground to the package.

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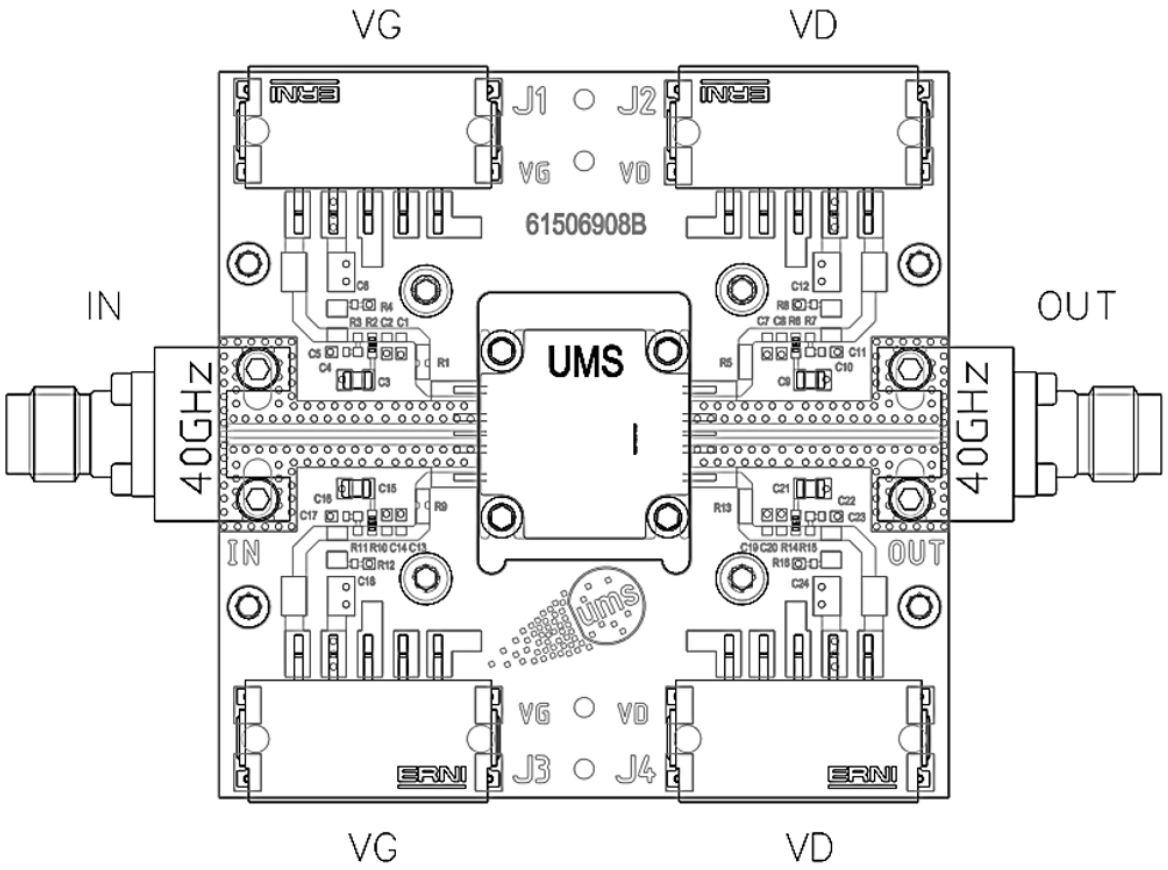
Recommendation for assembly

UMS recommends using a Thermal Interface Material between the package and the base of the assembly (example reference 70µm thick EYGS121807). Place the package in the cavity, be careful not to twist the leads. Align the leads with the corresponding copper tracks. Use 4 CHC M1.6X6 A2 screws with 0.09Nm torque to fix the package with the assembly. Use only R0 type flux to prepare the soldering of the leads. Use RoHS soldering (example SAC305 or 405) and apply the soldering iron no more than 10 cumulated seconds per lead. Carefully clean the assembly with isopropyl alcohol and a cloth.

Evaluation board



To ensure safe operation, measurements are performed using shielded cables, even for bias. The on-board decoupling network is composed of 0402 1uF SMD capacitor is series with a 10Ohms resistor.

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Notes

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Recommended assembly procedure

Maturity Level

Maturity Level	Product status	Documentation	Reliability	Usage in a system
Lab Sample (LS)	Decision to develop the product is not confirmed	Technical Information	No commitment	Lab demonstrator
Engineering Sample (ES)	**Design may change**	**Advanced Information**	**The design is within the recommended temperature, current and voltage ranges as regards the technology used.**	**Engineering demonstrator**
Product Representative Unit (PRU)	Design is frozen	Data-sheet	Tests results are available on the foreseen product or on an similar one	Production

Sampling request reference

Die: ES-CHA8362-99F
Package: ES-CHA8362-EBB
Demo board: EVB-CHA8362-EBB

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