

TDPA5115QFN

X-Band (8 GHz – 12 GHz) Medium Power Amplifier

Product Overview

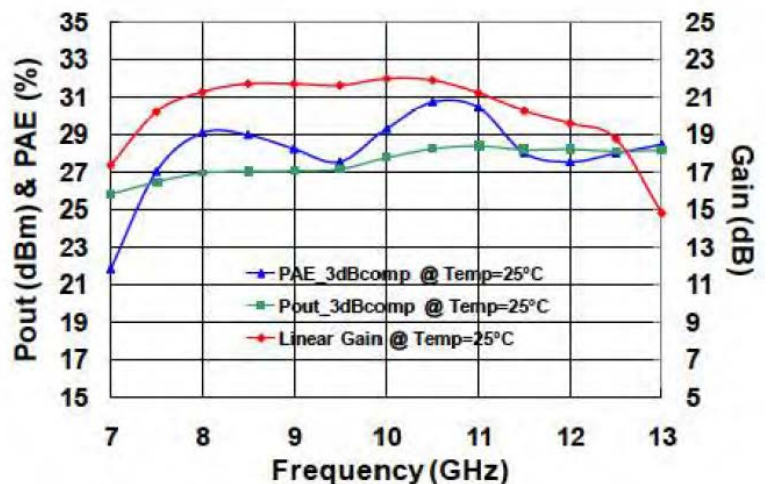
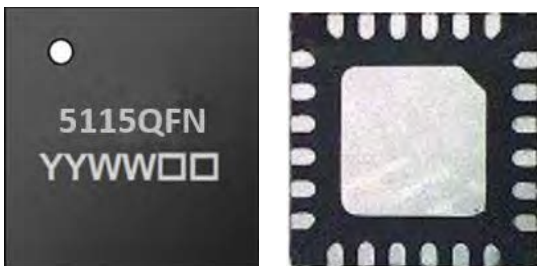
The TDPA5115QFN is a monolithic, two-stage GaAs, medium power amplifier designed for X-band applications.

The MPA provides typically 28 dBm output power associated to 30% power added efficiency at 3 dB gain compression.

It is supplied in a leadless surface mount, 24-pin, 4 x 4 mm² QFN package. The circuit is dedicated to space applications and also well suited for a wide range of microwave and millimeter wave applications and systems.

Features

- Frequency band: 8-12 GHz
- Output power: 28 dBm @3dBcomp
- Linear gain: 21.5 dB
- High PAE: 30% @ 3 dBcomp
- Quiescent bias point: Vd = 8 V, Id = 190 mA
- 24-pin QFN 4 x 4 mm²
- MSL Level:3



Absolute Maximum Ratings¹

T_{amb.} = +25 °C

Symbol	Parameter	Values	Unit
Cmp	Compression level ²	6	dB
Vd	Supply voltage ³	9.5	V
I _d	Supply quiescent current	240	mA
I _{d sat}	Supply current in saturation	300	mA
Vg	Supply voltage	-0.6	V
T _j	Maximum junction temperature	175	°C
T _{stg}	Storage temperature range	-55 to +150	°C
T _{op}	Operating temperature range	-40 to +85	°C

- (1) Operation of this device above any one of these parameters may cause permanent damage.
- (2) For higher compression the level limit can be increased by decreasing the voltage V_d using the rate 0.5 V/dBcomp.
- (3) Without RF input power.

Recommended Operating Conditions

T_a = 20 °C, V_d = 8 V, I_d (Quiescent) = 190 mA, Drain Pulse width = 100 μs, Duty cycle = 20%

Symbol	Parameter	Min	Typ	Max	Unit
F _{op}	Operating frequency range	8		12	GHz
PAE P-3dB	Power added efficiency @3 dBcomp & 20 °C		30		%
P-3dB	Output power @ 3 dBcomp @ 20 °C		28		dBm

ESD Protection: Electrostatic discharge sensitive device, please observe handling precautions!

Electrical Specifications

T_{amb} = +25 °C, V_d = +4.5 V, pads: B, D, E = GND (Low Current Configuration)

Symbol	Parameter	Min	Typ	Max	Unit
F _{op}	Operating frequency	8		12	GHz
G	Small signal gain		21.5		dB
R _{lin}	Input Return Loss		11	9	dB
R _{Lout}	Output Return Loss		10	7	dB
P-1dB	Output power @ 1 dBcomp		27		dBm
PAE P-1dB	Power Added Efficiency @ 1 dBcomp		26		%
I _d P-1dB	Supply drain current @ 1 dBcomp		240		mA
p-3dB	Output power @ 3 dBcomp		28		dBm
PAE P-3dB	Power Added Efficiency @ 3 dBcomp		30		%
I _d p-3dB	Supply drain current @ 3 dBcomp		250		mA
V _{d1} , V _{d2}	Drain supply voltage		8		V
I _d	Supply quiescent current ¹		190		mA
Vg	Gate supply voltage		-1		V

- 1) Parameter can be adjusted by tuning of V_g.

Device Thermal Performance

All the figures given in this section are obtained assuming that the QFN device is cooled down only by conduction through the package thermal pad (no convection mode considered).

The temperature is monitored at the package back-side interface (Tcase) as shown below. The system maximum temperature must be adjusted in order to guarantee that Tcase remains below than the maximum value specified in the next table. So, the system PCB must be designed to comply with this requirement.

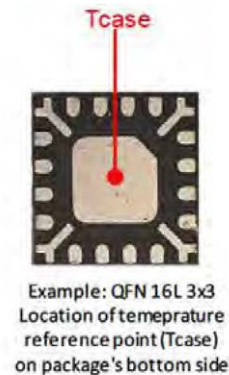
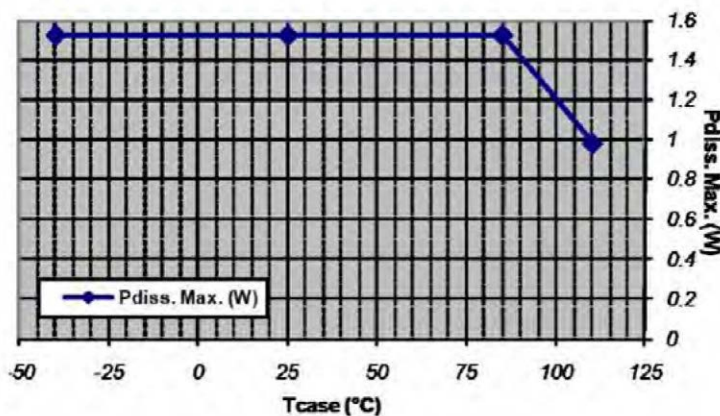
A derating must be applied on the dissipated power if the Tcase temperature can not be maintained below than the maximum temperature specified (see the curve Pdiss. Max) in order to guarantee the nominal device life time (MTTF).

DEVICE THERMAL SPECIFICATION: CHA5115-QDG		
Recommended max. junction temperature (Tj max)		155 °C
Junction temperature absolute maximum rating		175 °C
Max. continuous dissipated power@Tcase= 85 °C		1.52 W
=> Pdiss derating above Tcase ¹ >= 85 °C		22 mW/°C
Junction-Case thermal resistance (Rth J-C) ²		<46 °C/W
Min. package back side operating temperature ³		-40 °C
Max. package back side operating temperature ³		85 °C
Min. storage temperature		-55 °C
Max. storage temperature		150 °C

(1) Derating at junction temp constant= Tj max

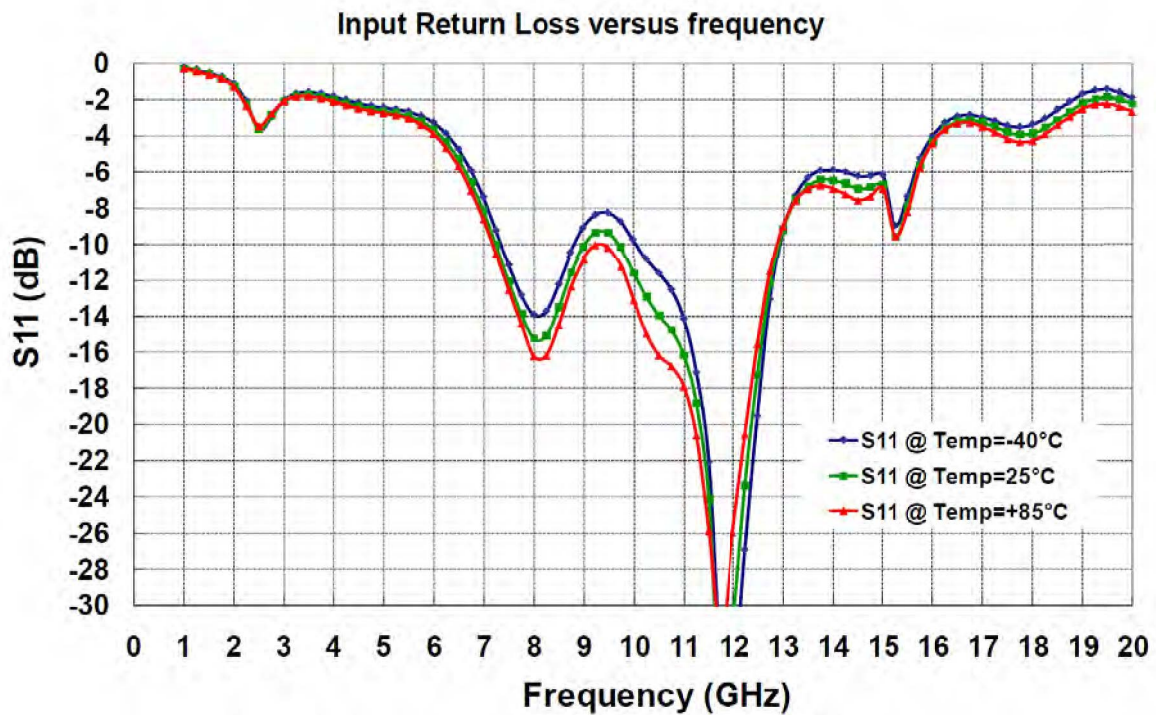
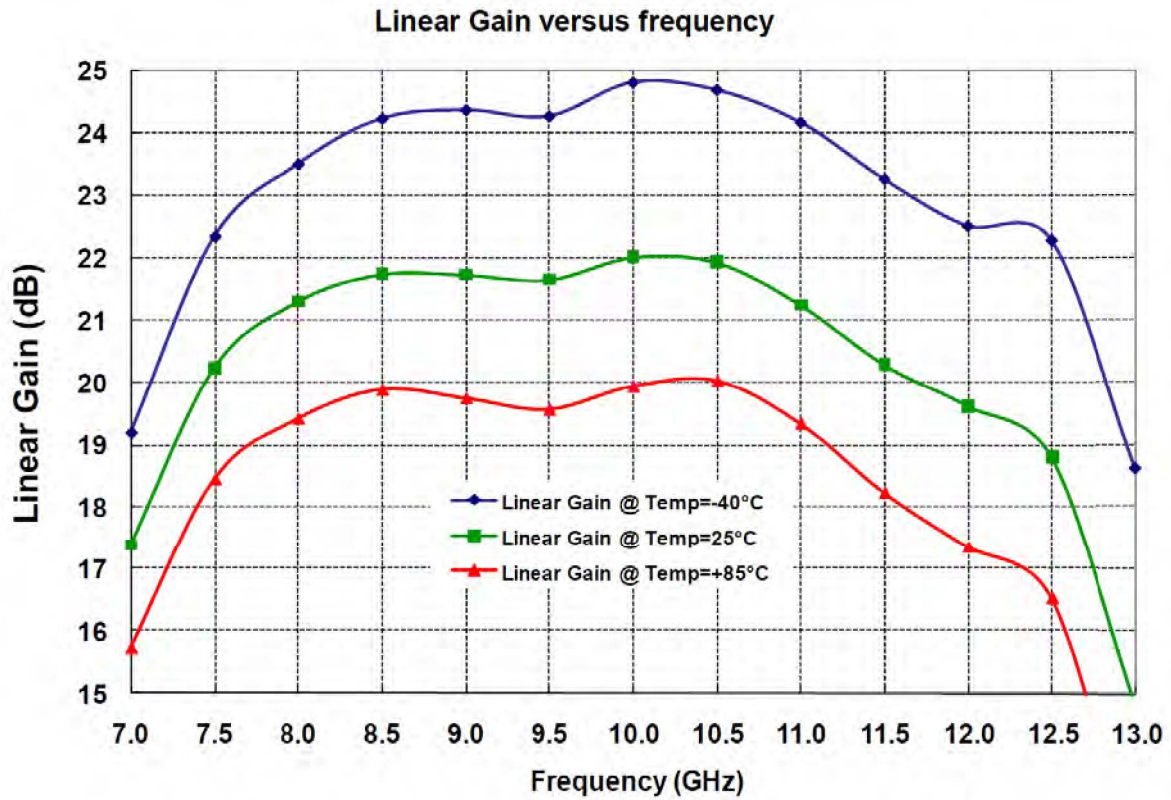
(2) Rth J-C is calculated for a worse case where the hottest junction of the MMIC is considered.

(3) Tcase=Package back side temperature measured under the die-attach-pad (see the drawing below)



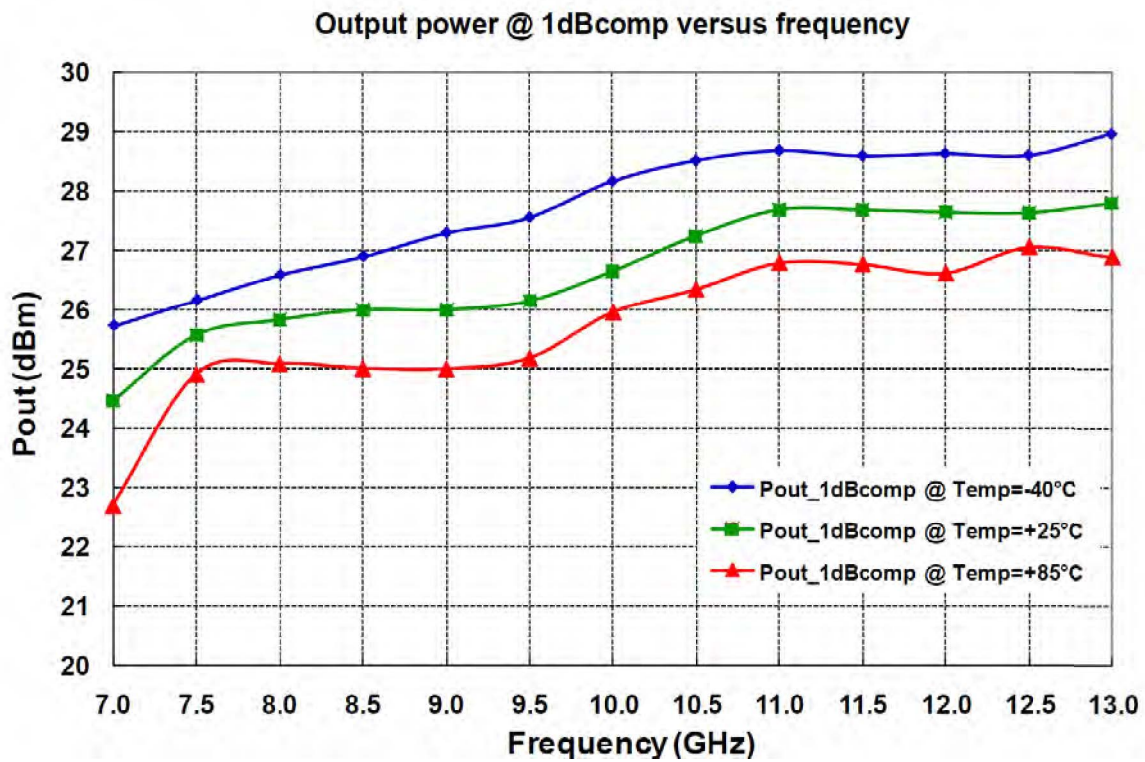
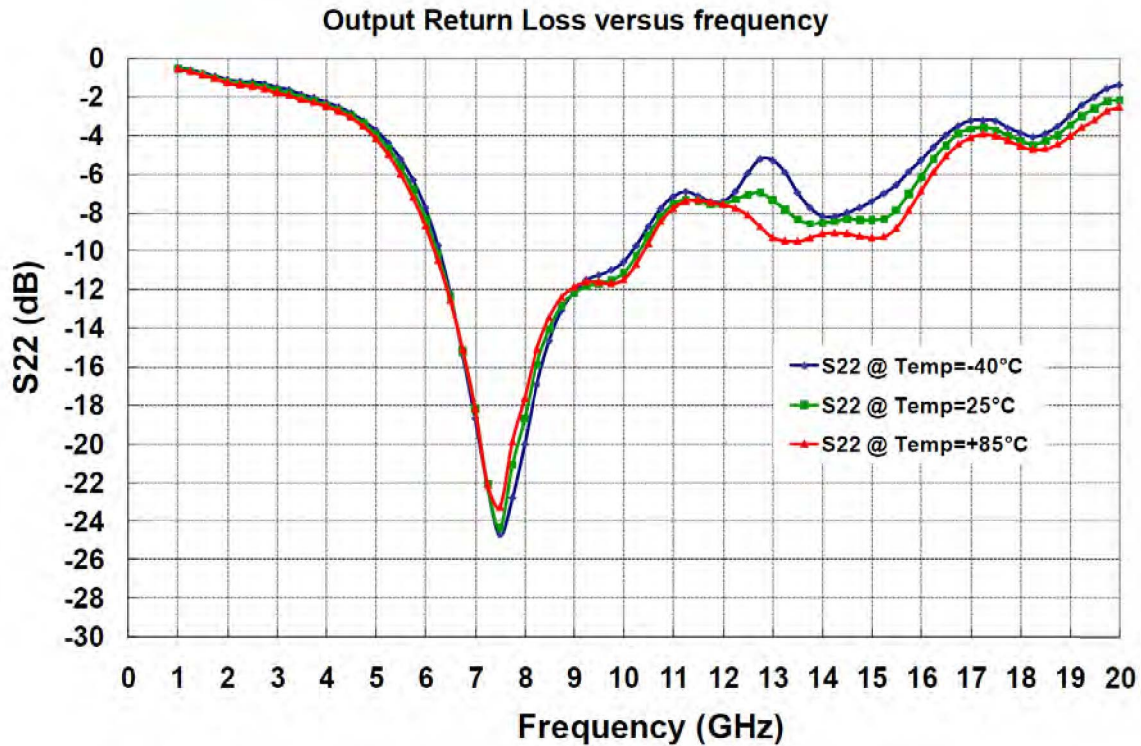
Typical Board Measurements

Vd = 8 V, Id (Quiescent) = 190 mA, Drain Pulse width = 100 μ s, Duty cycle = 20%



Typical Board Measurements

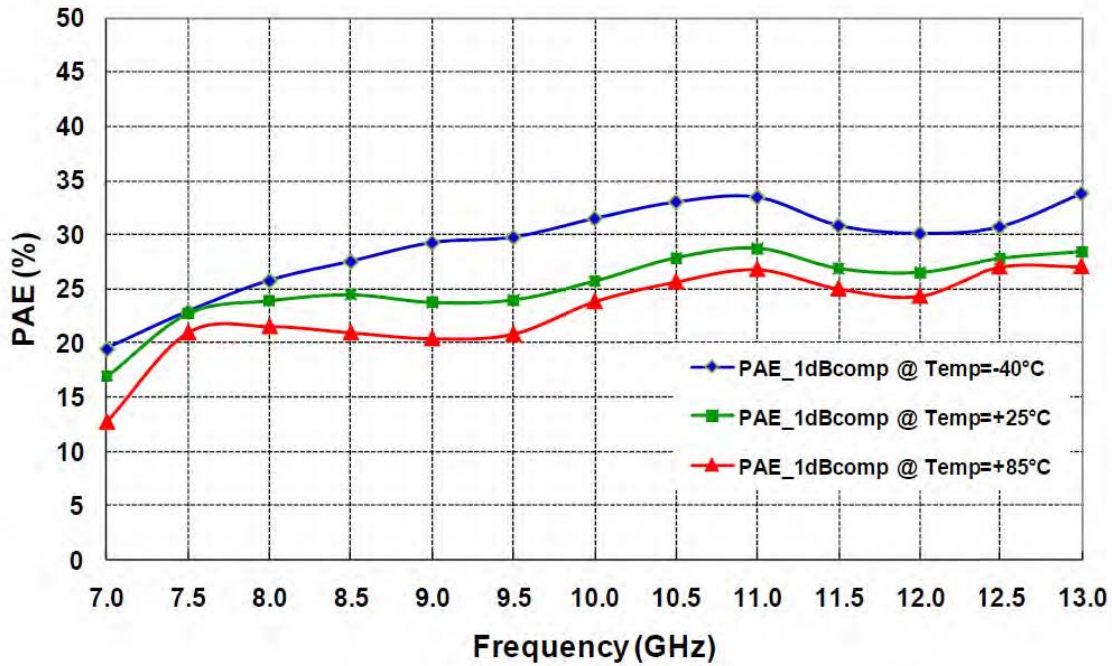
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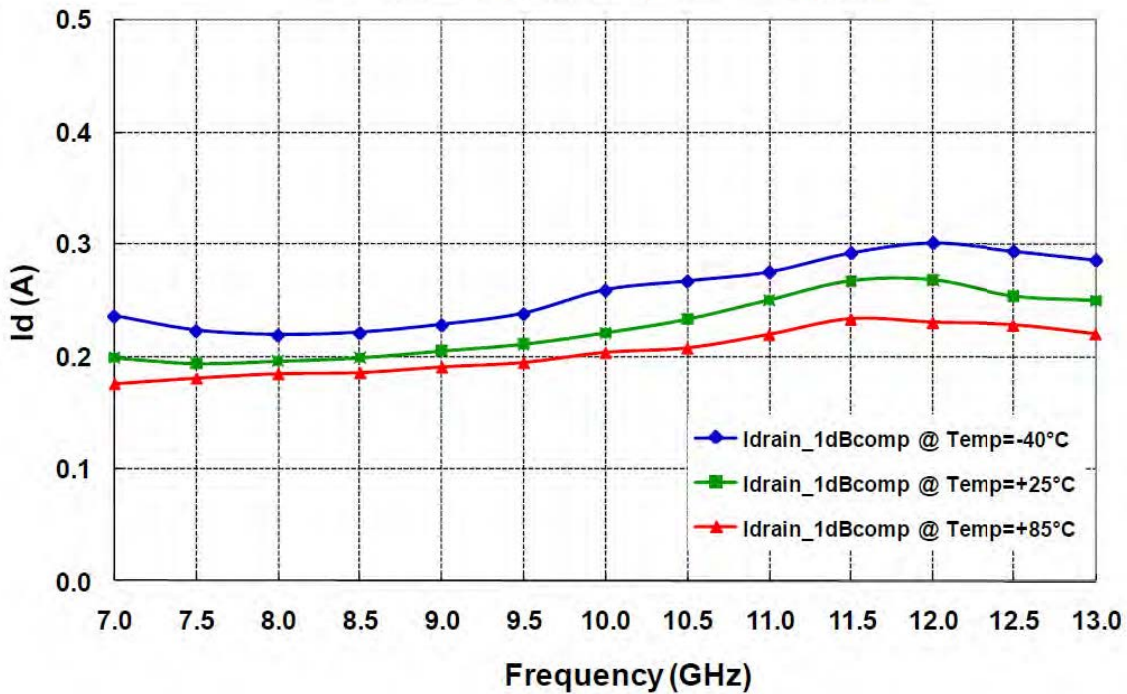
Typical Board Measurements

Vd = 8 V, Id (Quiescent) = 190 mA, Drain Pulse width = 100 μs, Duty cycle = 20%

Power added efficiency @ 1dBcomp versus frequency



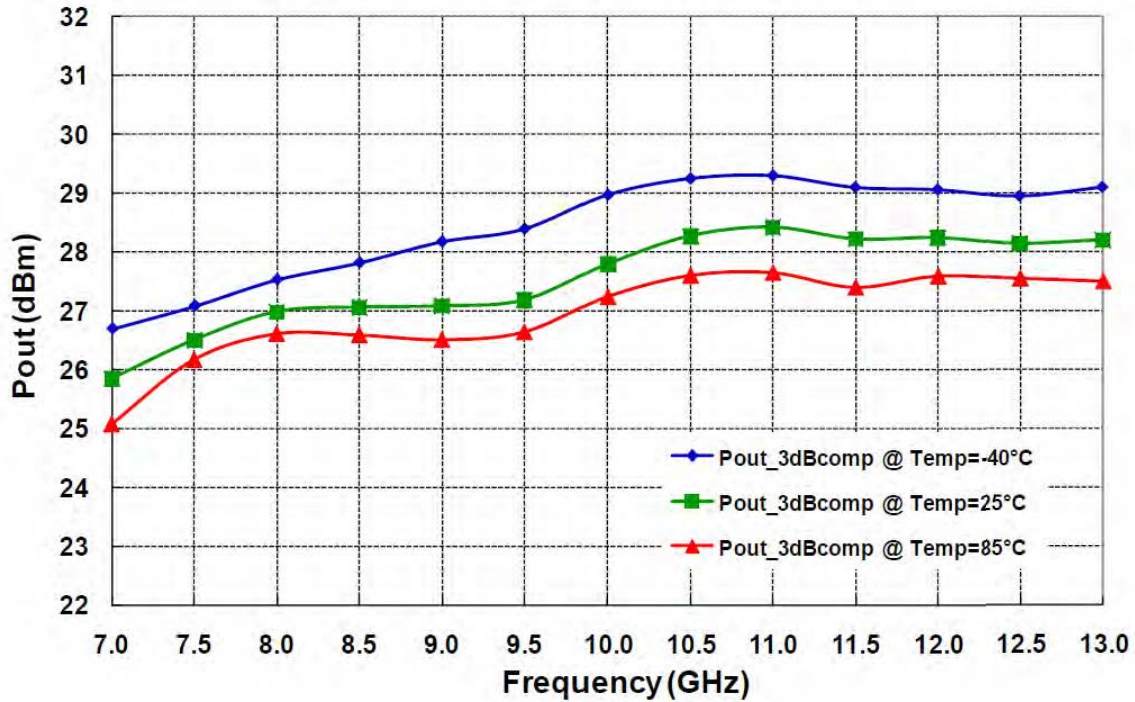
Drain Current @ 1dBcomp versus frequency



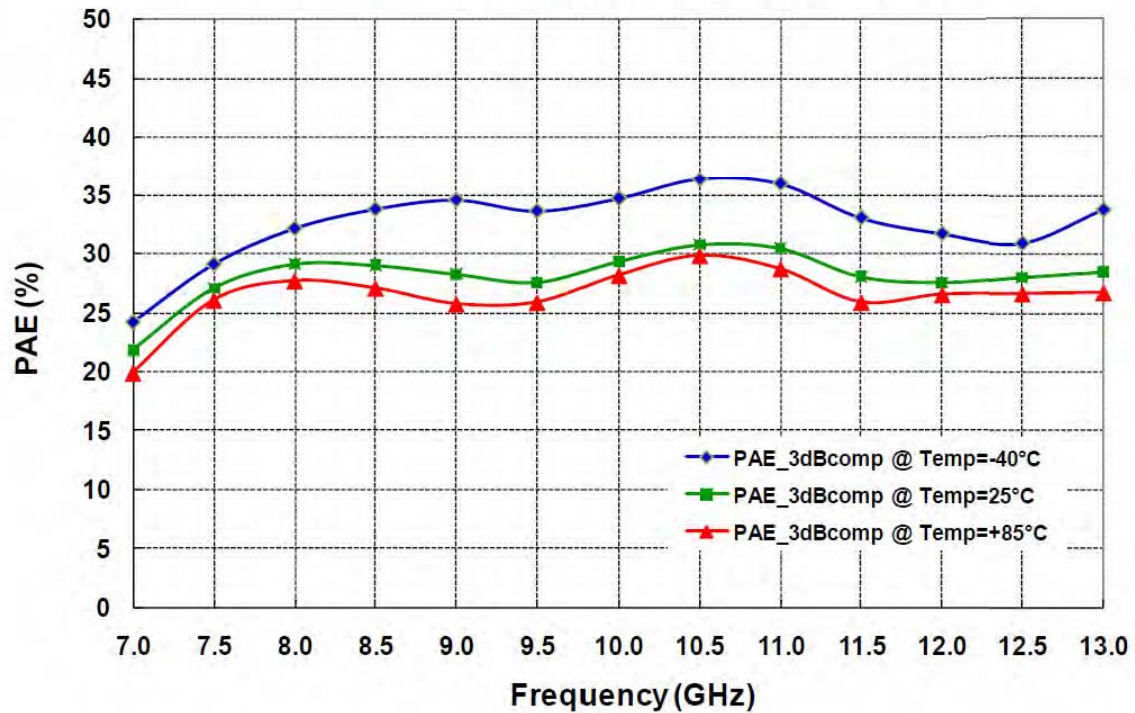
Typical Board Measurements

Vd = 8 V, Id (Quiescent) = 190 mA, Drain Pulse width = 100 μ s, Duty cycle = 20%

Output power @ 3dBcomp versus frequency

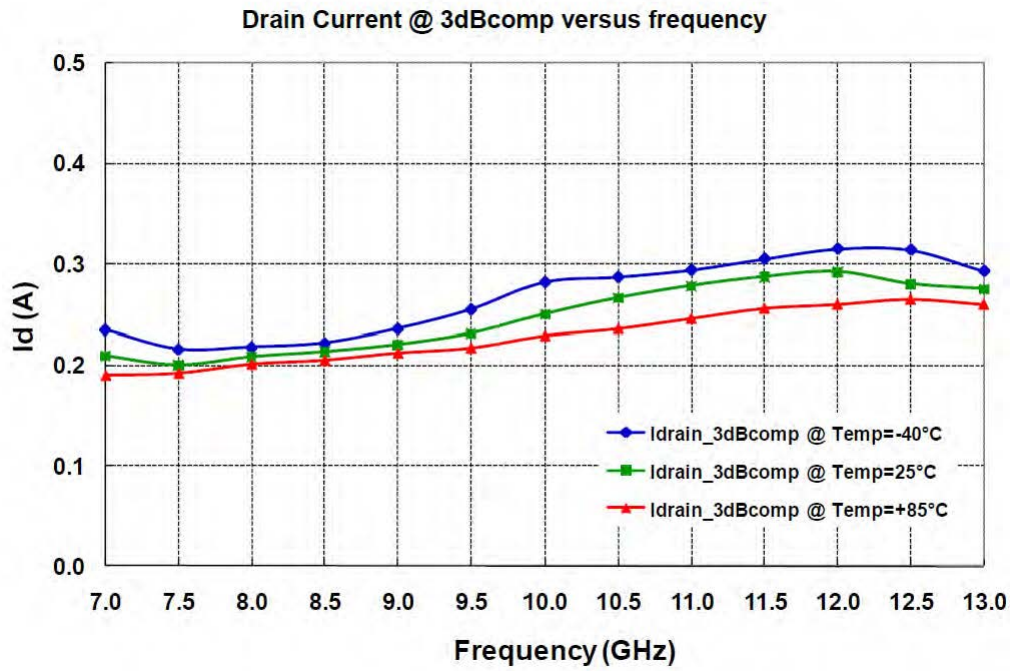


Power added efficiency @ 3dBcomp versus frequency

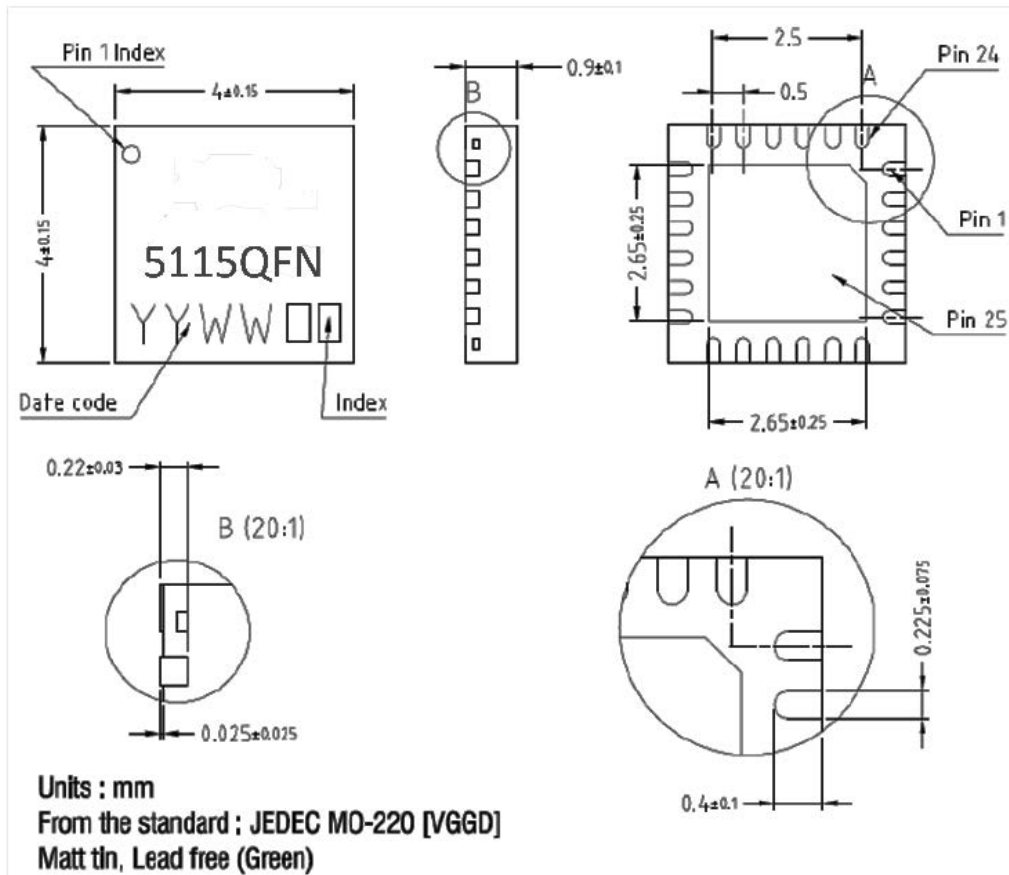


Typical Board Measurements

Vd = 8 V, Id (Quiescent) = 190 mA, Drain Pulse width = 100 μ s, Duty cycle = 20%



Package Outline 1



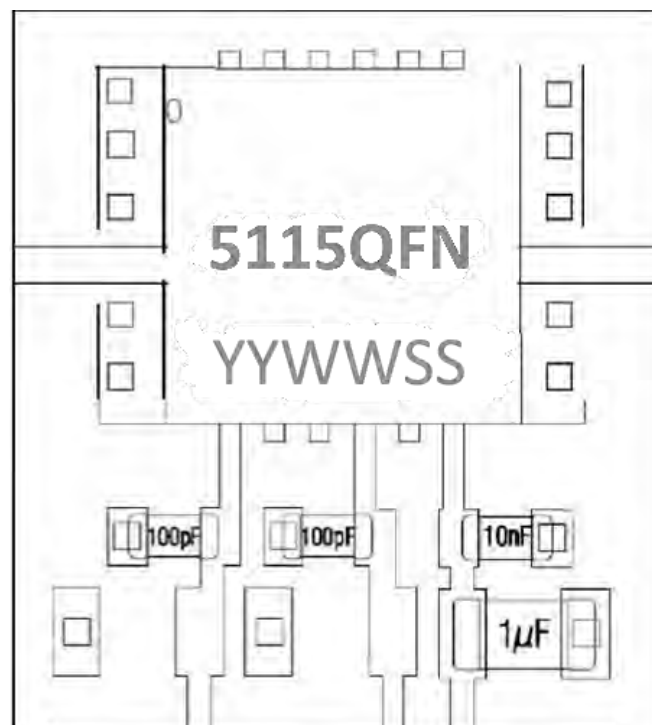
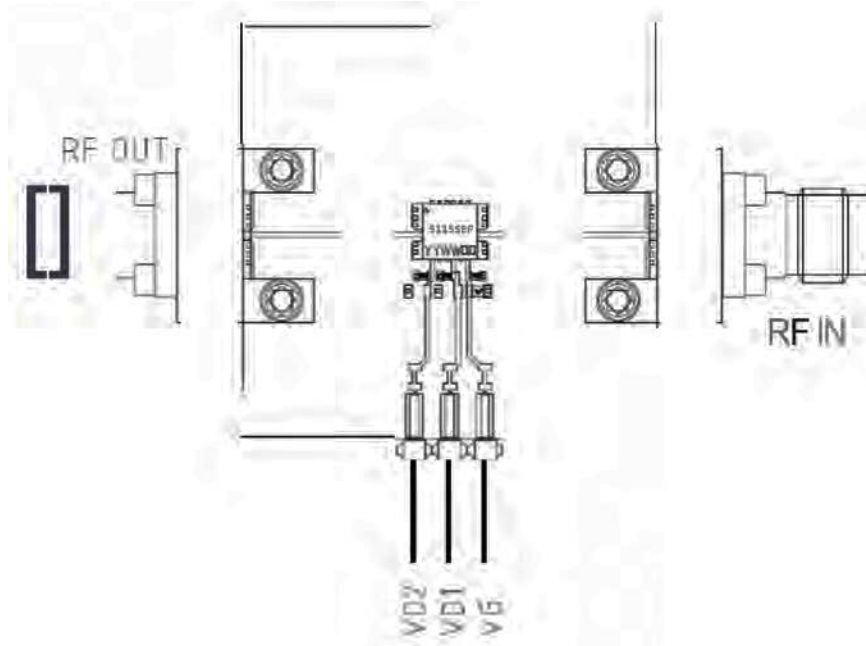
Matt tin, Lead Free	(Green)	1-	Ne	11-	Gnd	21-	Ne
Units:	mm	2-	Gnd ²	12-	Vg	22-	Ne
From the standard :	JEDEC M0-220 (VGGD)	3-	Gnd	13-	Gnd	23-	Ne
		4-	RF OUT	14-	Gnd	24-	Ne
	25-	GND	5-	Gnd	15-	RFIN	
		6-	Gnd	16-	Gnd		
		7-	Vd2	17-	Gnd		
		8-	Gnd	18-	Ne		
		9-	Gnd	19-	Ne		
		10-	Vd1	20-	Ne		

All dimensions are in mm

² 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.

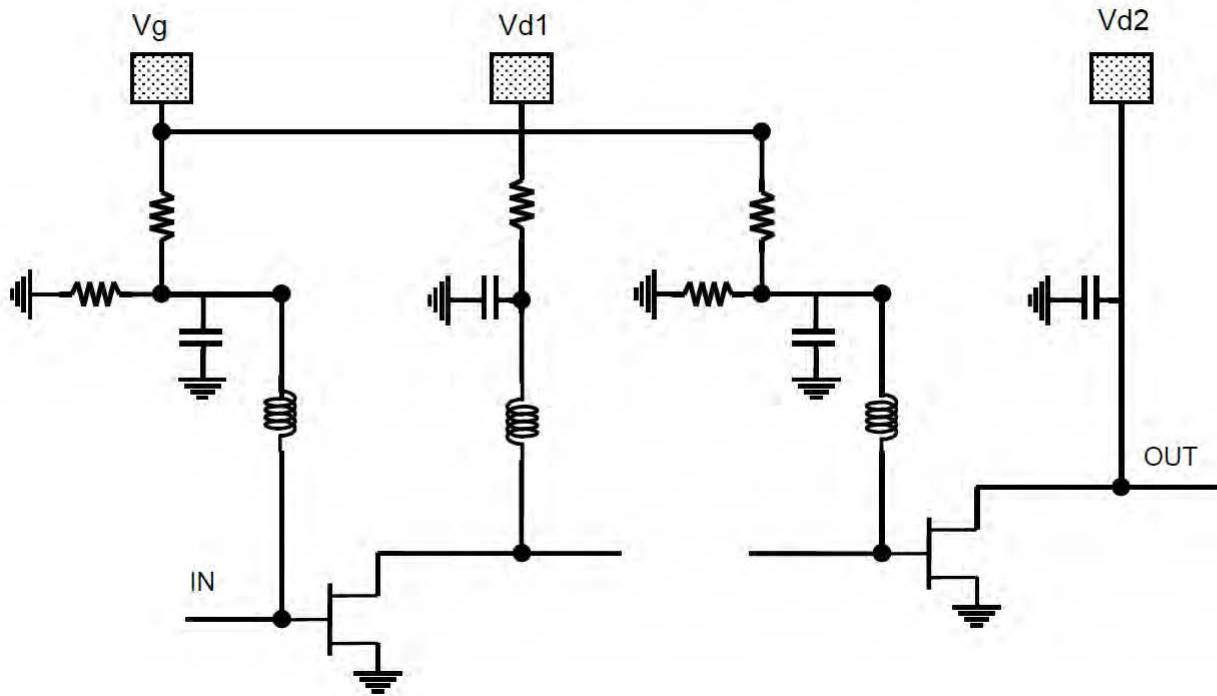
Evaluation Board

- Based on typically Ro4003 / 8 mils or equivalent.
- Using a micro-strip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.
- Decoupling capacitors of 100 pF $\pm 5\%$ on drains; and 10 nF $\pm 10\%$ and 1 μ F $\pm 10\%$ on gate are recommended for all DC accesses.
- When using CW mode, decoupling capacitors of 10 nF $\pm 10\%$ on drains are recommended.



DC Schematic

Medium Power Amplifier: 8V, 190mA



Ordering Information

Order Code	Description	Package	Shipping Method
TDPA5115QFN	X-Band Medium Power Amplifier	4 x 4 24-Pin QFN	Tape and Reel
TDPA5115QFN-EVK	X-Band Medium Power Amplifier Evaluation Kit	Boxed	Boxed

Revision Information

Document	Description / Date	Change/Revision Details
TDPA5115QFN-4-2024 Rev 0.4	TDPA5115QFN / April 2024	Initial Release

Document Categories and Definitions:

Advance Information

The product is in a formative or design stage. The data sheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The data sheet contains preliminary data. Additional data may be added at a later date. Teledyne e2v HiRel Electronics reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

The data sheet contains final data. In the event Teledyne e2v HiRel Electronics decides to change the specifications, Teledyne e2v HiRel Electronics will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Sales Contact

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