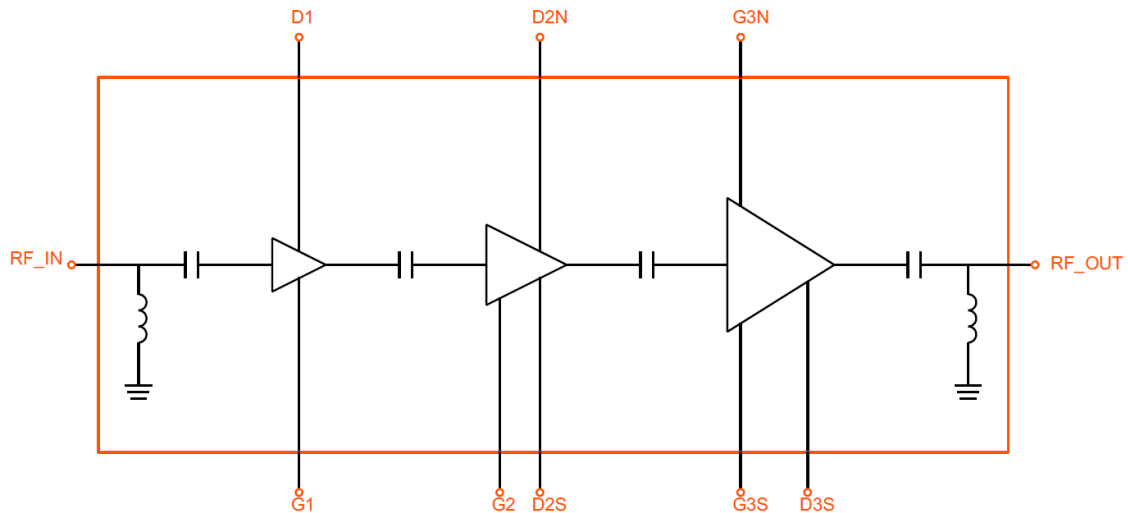


Advanced Information: AI2221

27.5 - 30 GHz 4W HPA

GaN Monolithic Microwave IC in QFN package



The CHA6357-QKB is a three stage monolithic GaN High Power Amplifier reaching 4W Output Power over 27.5-30GHz bandwidth.

The circuit is manufactured on a 0.15µm gate length GaN-on-SiC HEMT process and is available in Quad Flat no Lead Package.

It is well suited for VSAT, SatCom uplink and 5G communication applications.



Electrical Characteristics

Tcase= +25°C, Vd = +25V, Idq = +90mA

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	27.5		30	GHz
Gain	Linear Gain		26		dB
Psat	Saturated Output Power		35.5		dBm
PAE	Power Added Efficiency		20		%
Tcase	Operating temperature range at MMIC backside level	-40		85	°C

Absolute Maximum Ratings ⁽¹⁾

Tcase= +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	27V	V
Id	Drain current	1.2	A
Vg	Gate bias voltage	-1 to -6	V
Pin	Maximum peak input power overdrive	+20	dBm
Tcase	Operating temperature range	-40 to +95	°C

⁽¹⁾ Operation of this device above any one of these parameters may cause permanent damage.**Recommended Operating Range ^{(2), (3)}**

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	20 – 25	V
Idq	Quiescent Drain current	90	mA
Tj	Junction temperature	200	°C
Tcase	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

⁽²⁾ Electrical performances are defined for specified test conditions⁽³⁾ Electrical performances are not guaranteed over all recommended operating conditions

27.5 - 30 GHz 4W HPA

Device thermal performances

The device thermal performances below are based on UMS rules to evaluate the junction temperature.

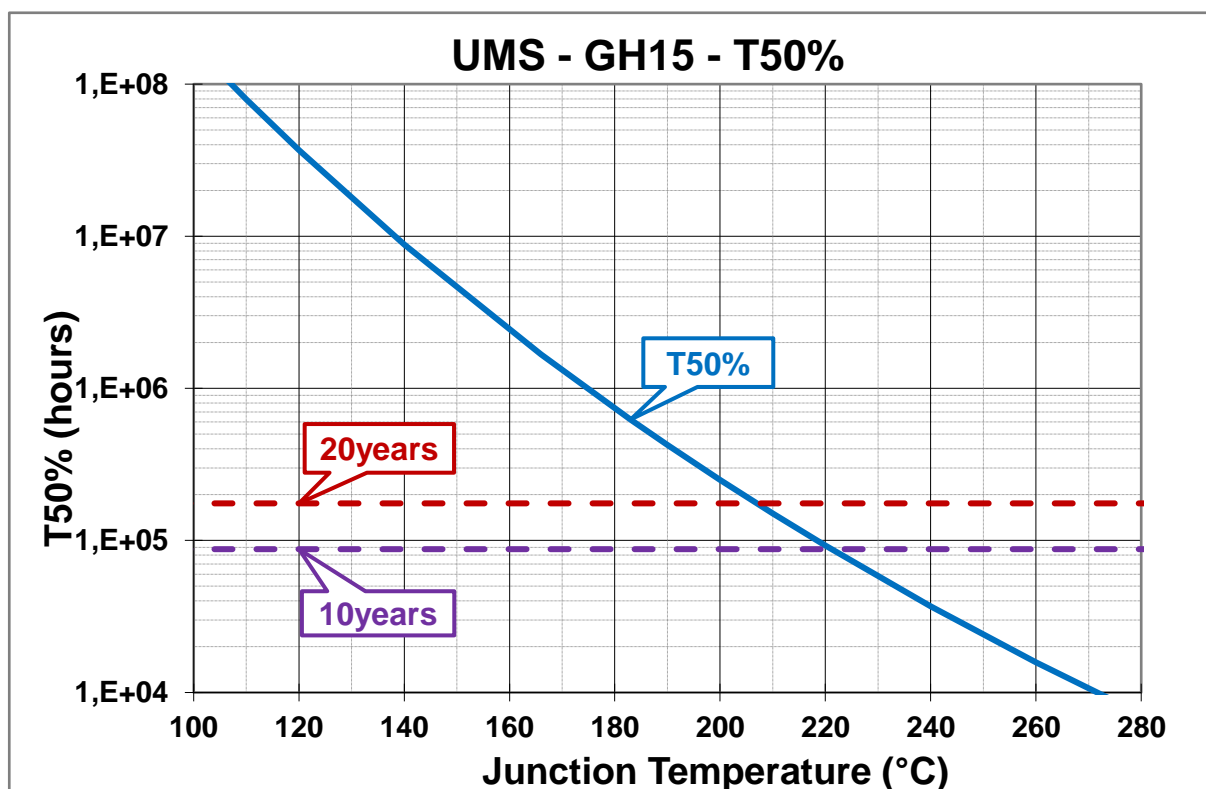
The temperature is monitored at the MMIC backside interface (Tcase).

The system maximum temperature must be adjusted in order to guarantee that Tjunction remains below the maximum value specified in the Absolute Maximum Ratings table.

So, the system PCB must be designed to comply with this requirement.

Parameter	Biasing conditions	Tjunction (°C)	R _{TH} (°C/W)	T50 (hours)
R _{TH} ⁽¹⁾ Thermal Resistance (Junction to Backside)	Vd=25V Pout=35dBm Pdiss=11.5W	198	9.8	2.8E+5
R _{TH} ⁽¹⁾ Thermal Resistance (Junction to Backside)	Vd=25V Pout=32dBm Pdiss=7.6W	157	9.5	2.9E+6
R _{TH} ⁽¹⁾ Thermal Resistance (Junction to Backside)	Vd=25V Pout=25dBm Pdiss=3.8W	118	8.7	4.3E+7

¹ Assuming 85°C Tcase

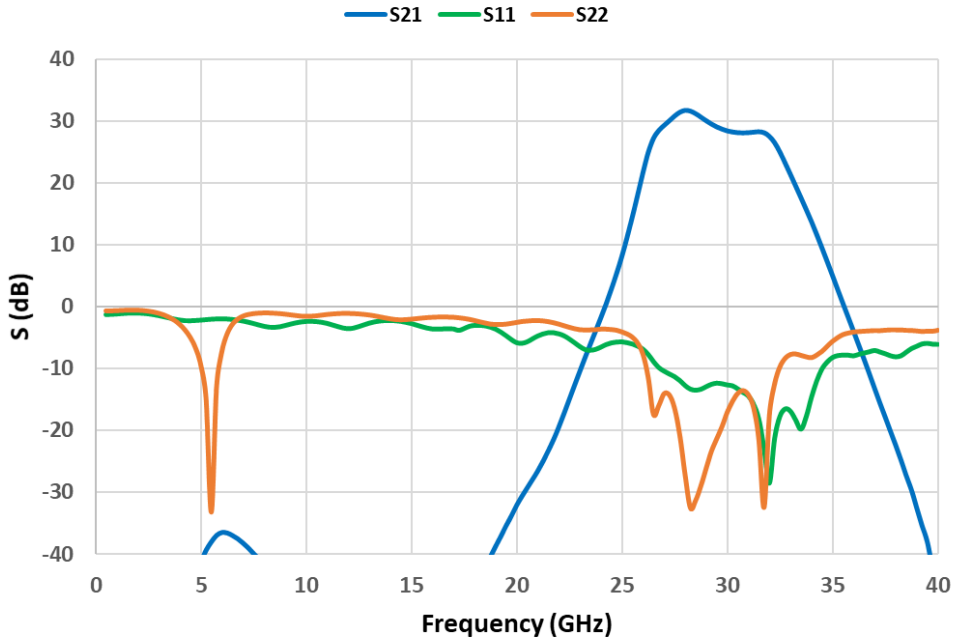


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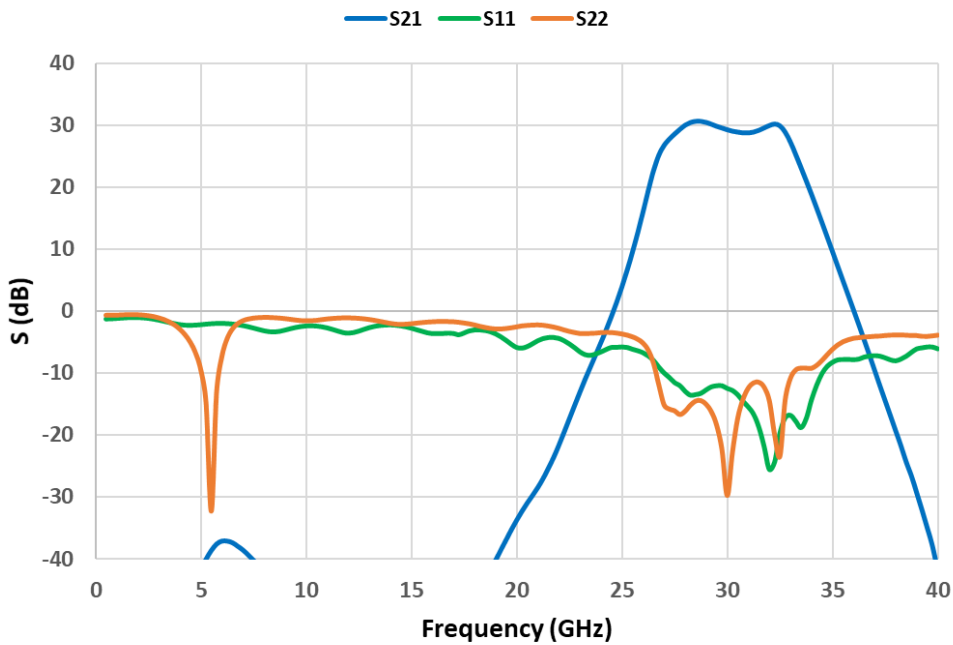
Typical Board Measurements

Wideband S-Parameters

Tcase= +25°C, Vd = +20V, Idq = 90mA



Tcase= +25°C, Vd = +25V, Idq = 90mA



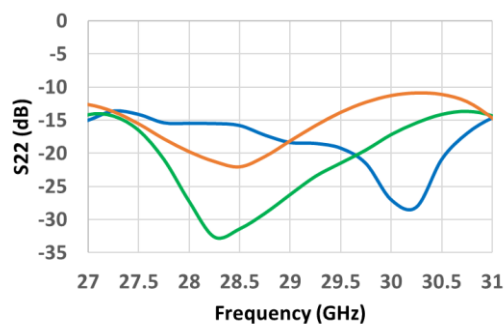
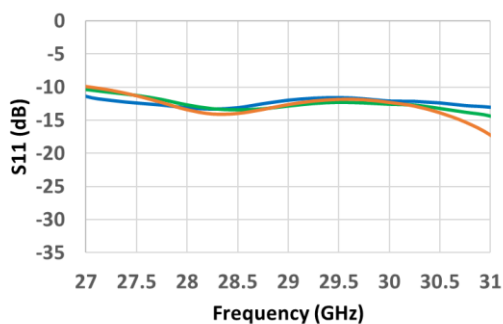
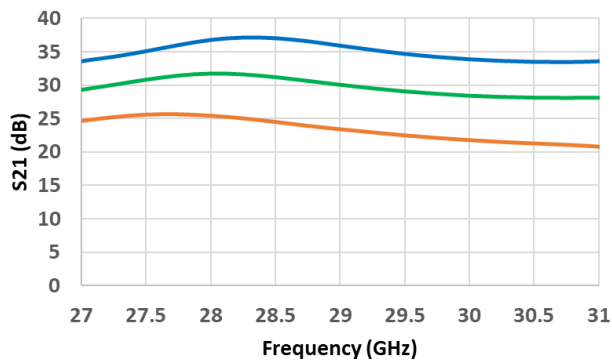
Advanced Information

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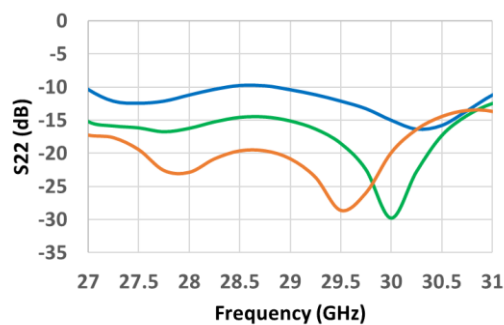
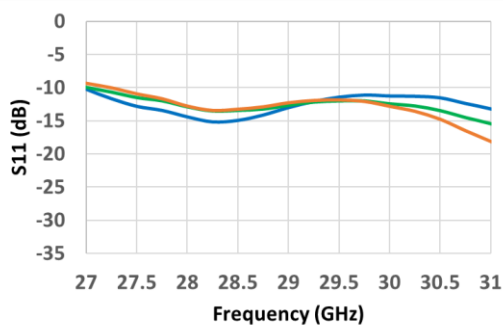
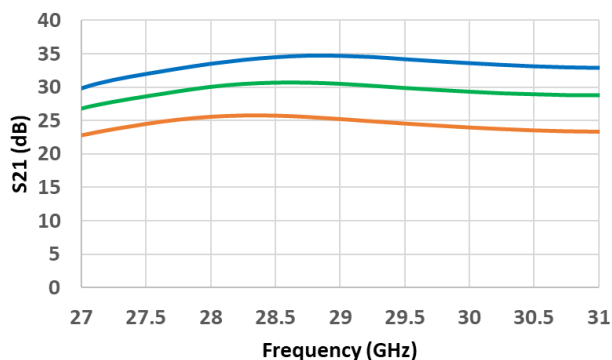
Typical Board Measurements

S-Parameters versus Temperature

Tcase= -40/+25/+85°C, Vd = +20V, Idq = 90mA



Tcase= -40/+25/+85°C, Vd = +25V, Idq = 90mA



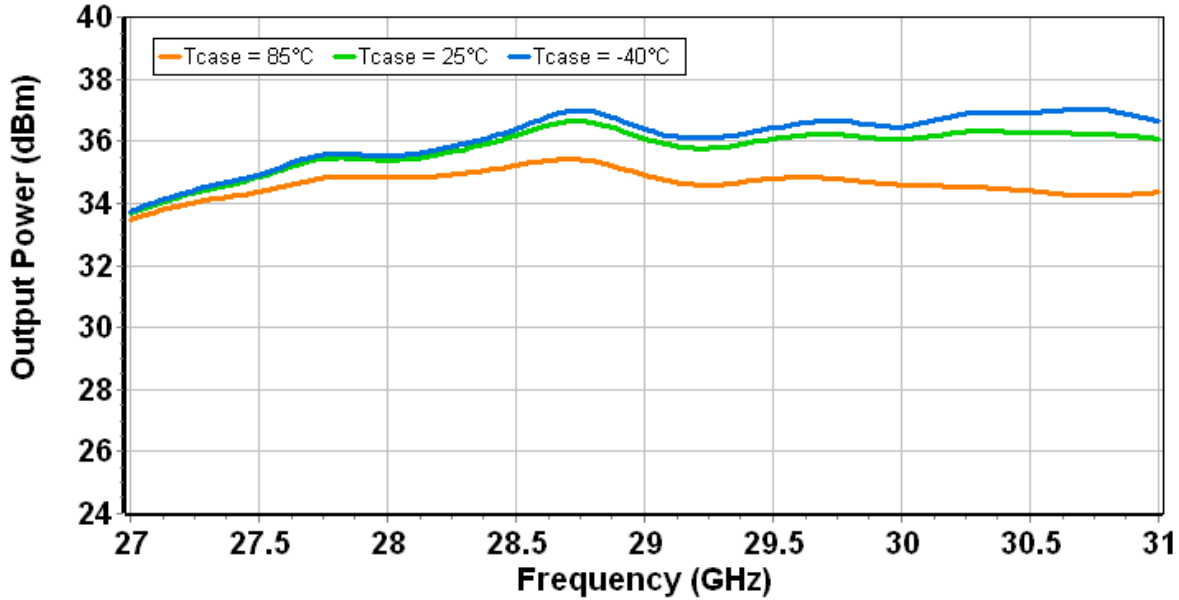
Advanced Information

Typical Board Measurements

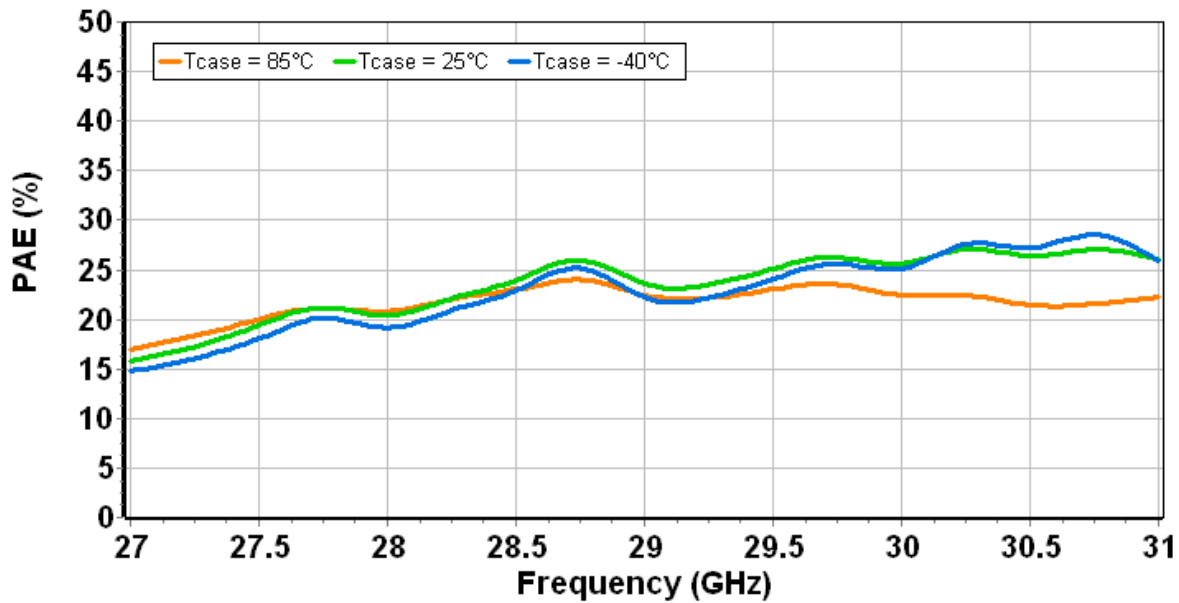
Power Performances versus Temperature

Tcase= -40/+25/+85°C, Vd = +25V, Idq = 90mA, Pin = 14dBm

Output Power versus Frequency and Temperature



PAE versus Frequency and Temperature



Advanced Information



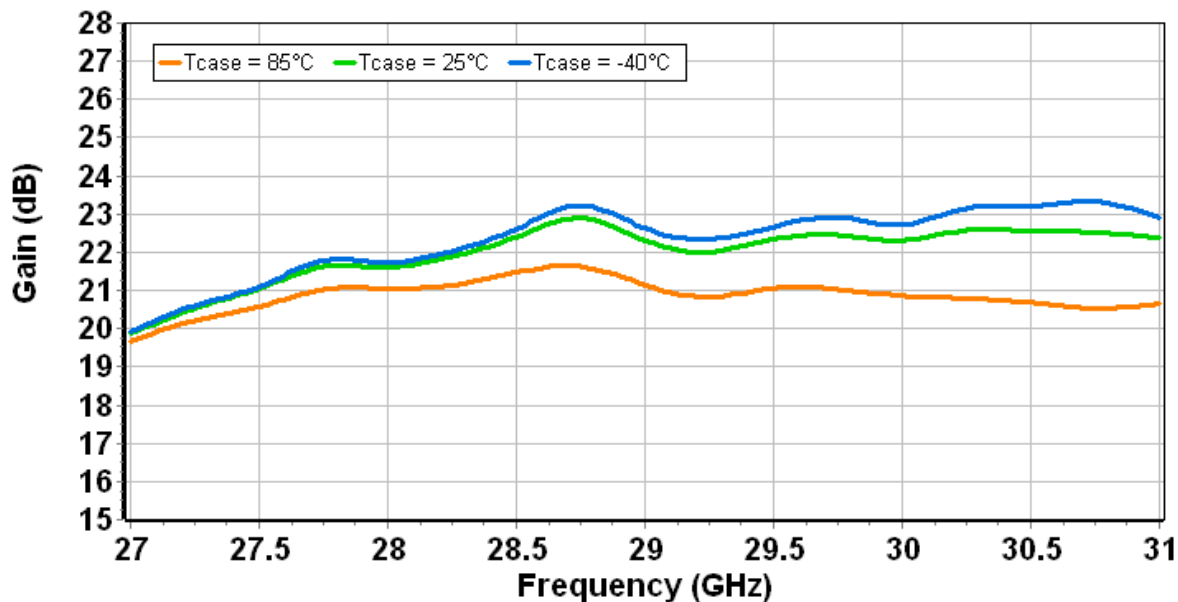
27.5 - 30 GHz 4W HPA

Typical Board Measurements

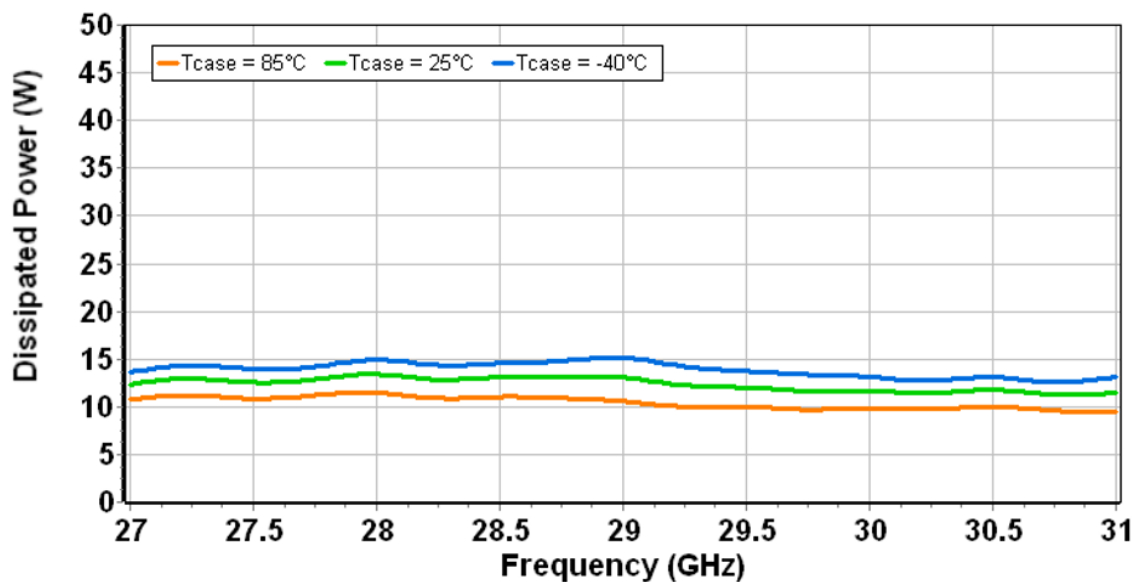
Power Performances versus Temperature

Tcase= -40/+25/+85°C, Vd = +25V, Idq = 90mA, Pin = 14dBm

Gain versus Frequency and Temperature



Dissipated Power versus Frequency and Temperature



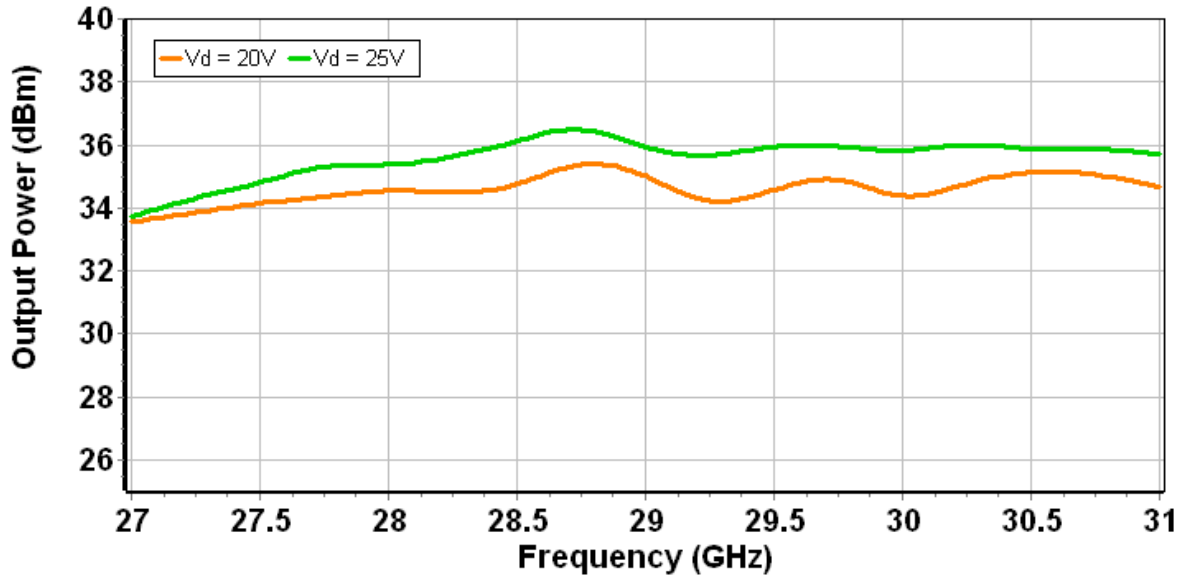
Advanced Information

Typical Board Measurements

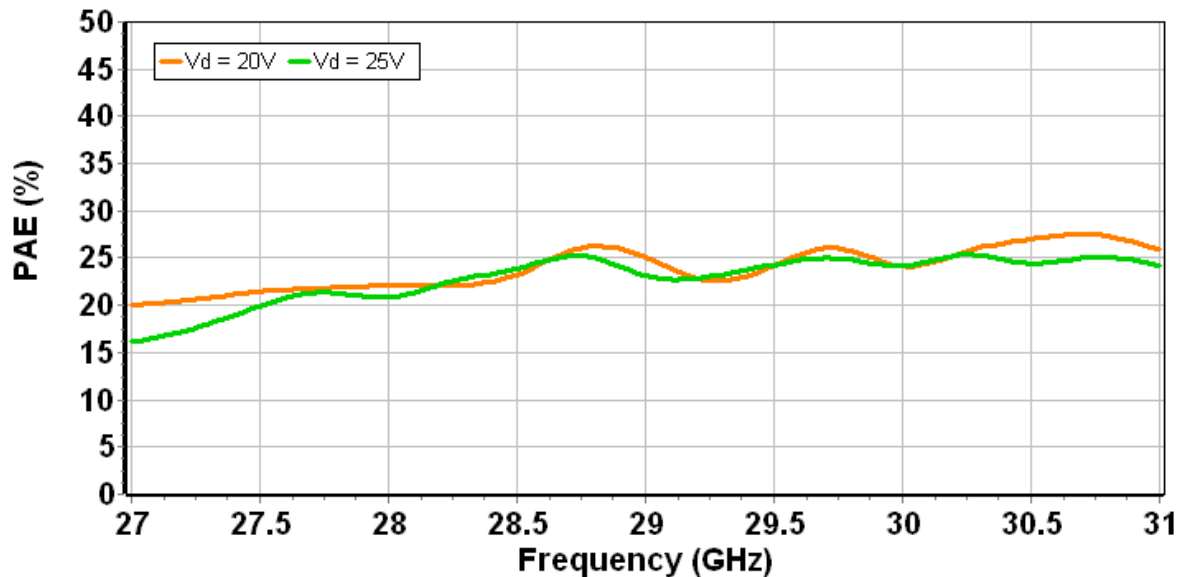
Power Performances versus Drain Voltage

T_{case} = +25°C, V_d = +20/+25V, I_{dq} = 90mA, P_{in} = 14dBm

Output Power versus Frequency and Drain Voltage



PAE versus Frequency and Drain Voltage



Advanced Information



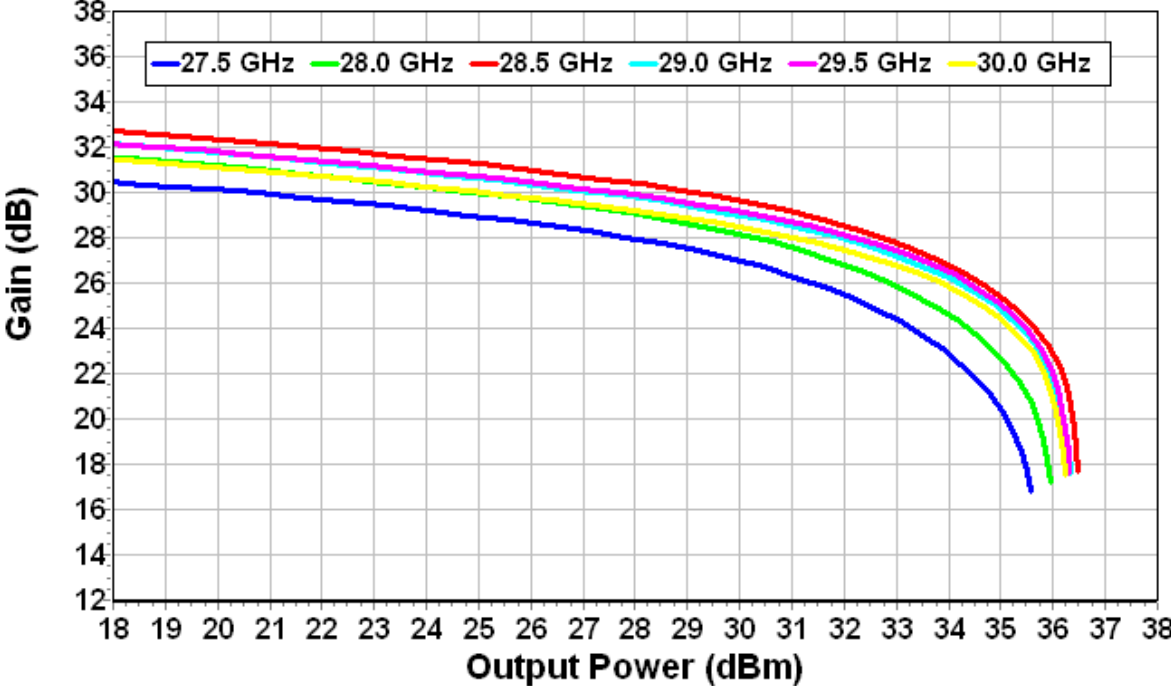
27.5 - 30 GHz 4W HPA

Typical Board Measurements

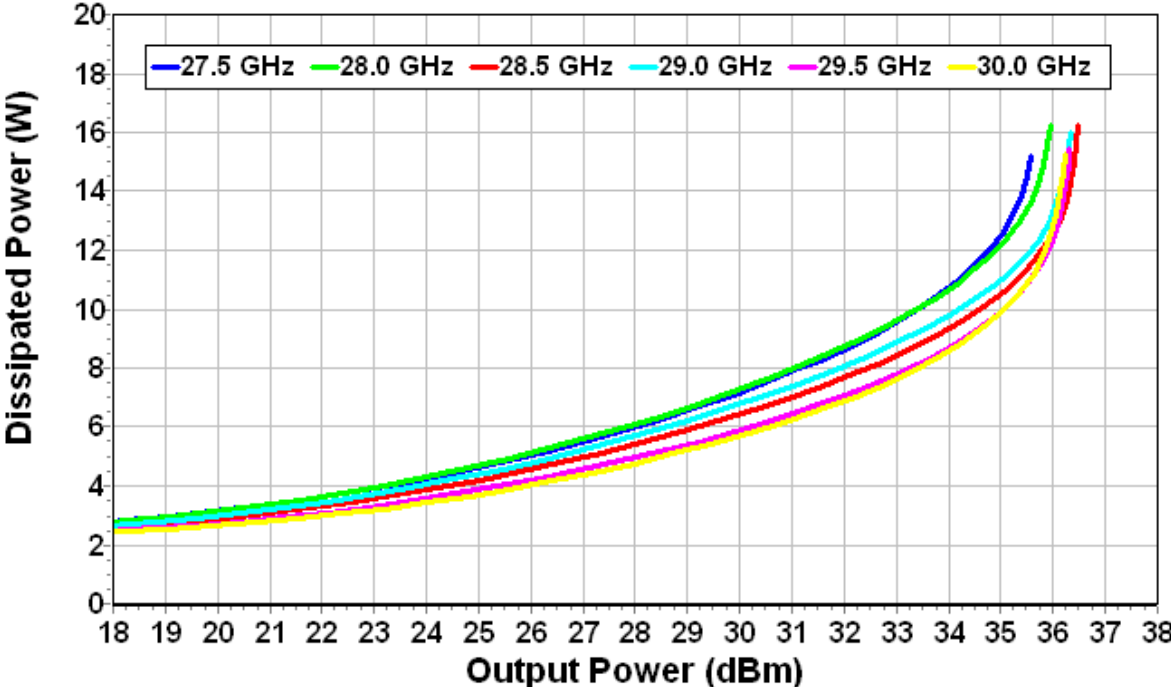
Power Performances versus Output Power

Tcase= +25°C, Vd = +25V, Idq = 90mA

Gain versus Output Power



Dissipated Power versus Output Power



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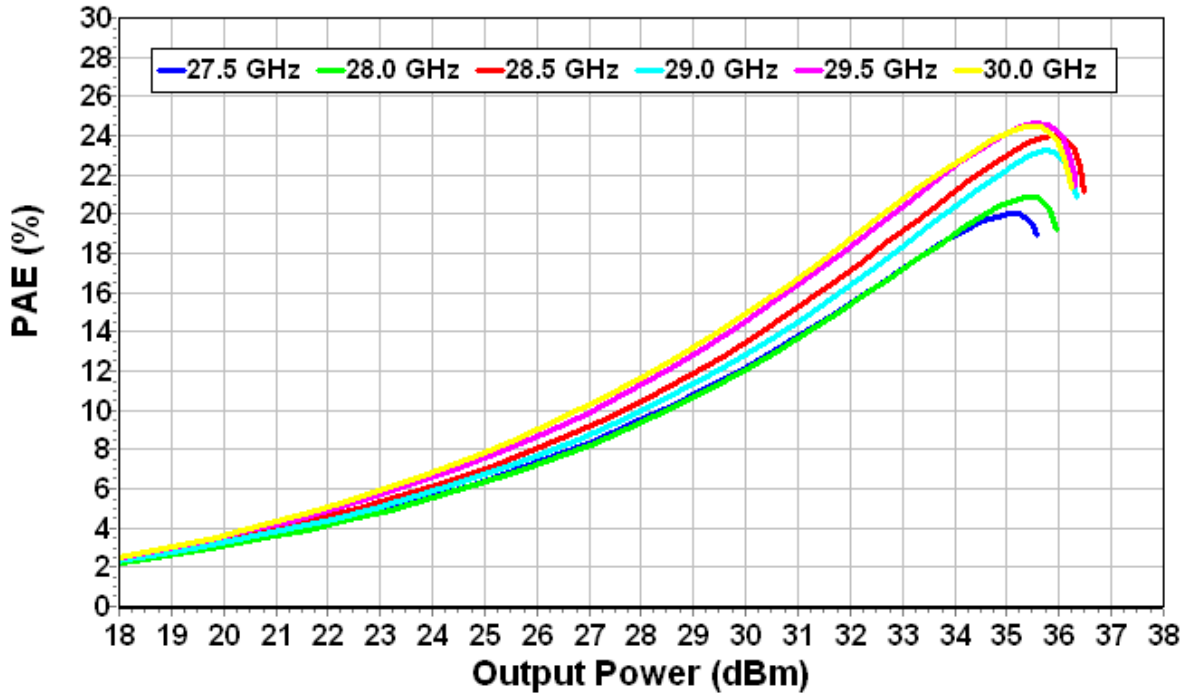


Typical Board Measurements

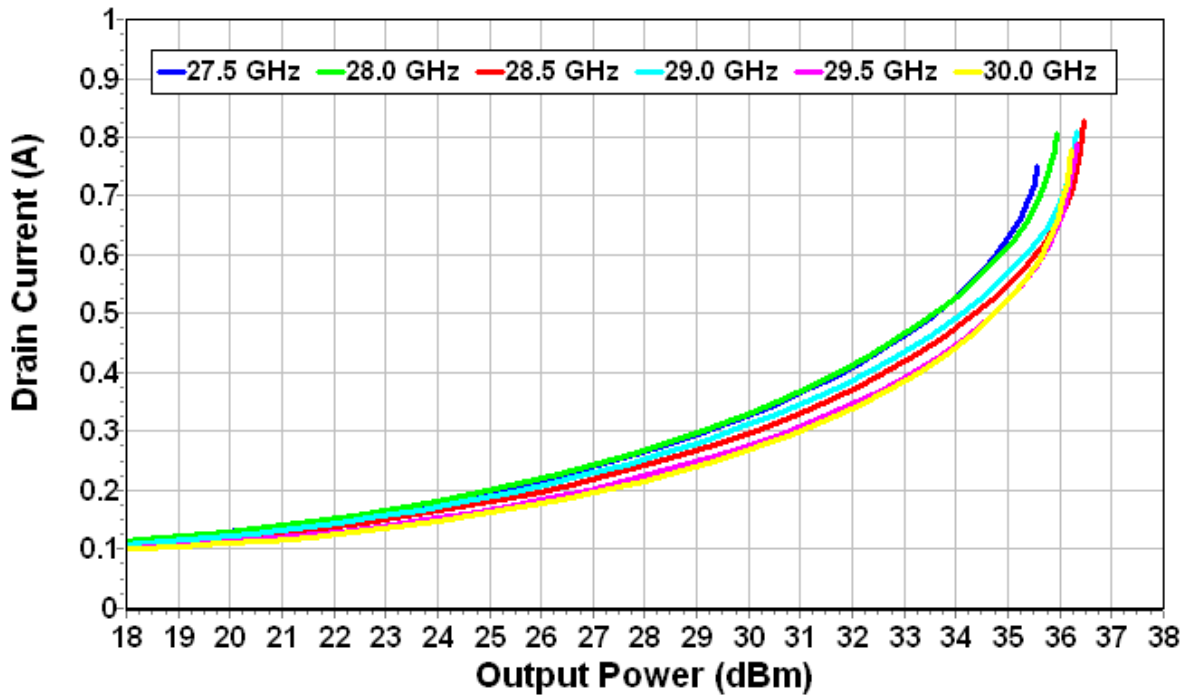
Power Performances versus Output Power

Tcase= +25°C, Vd = +25V, Idq = 90mA

PAE versus Output Power



Drain Current versus Output Power

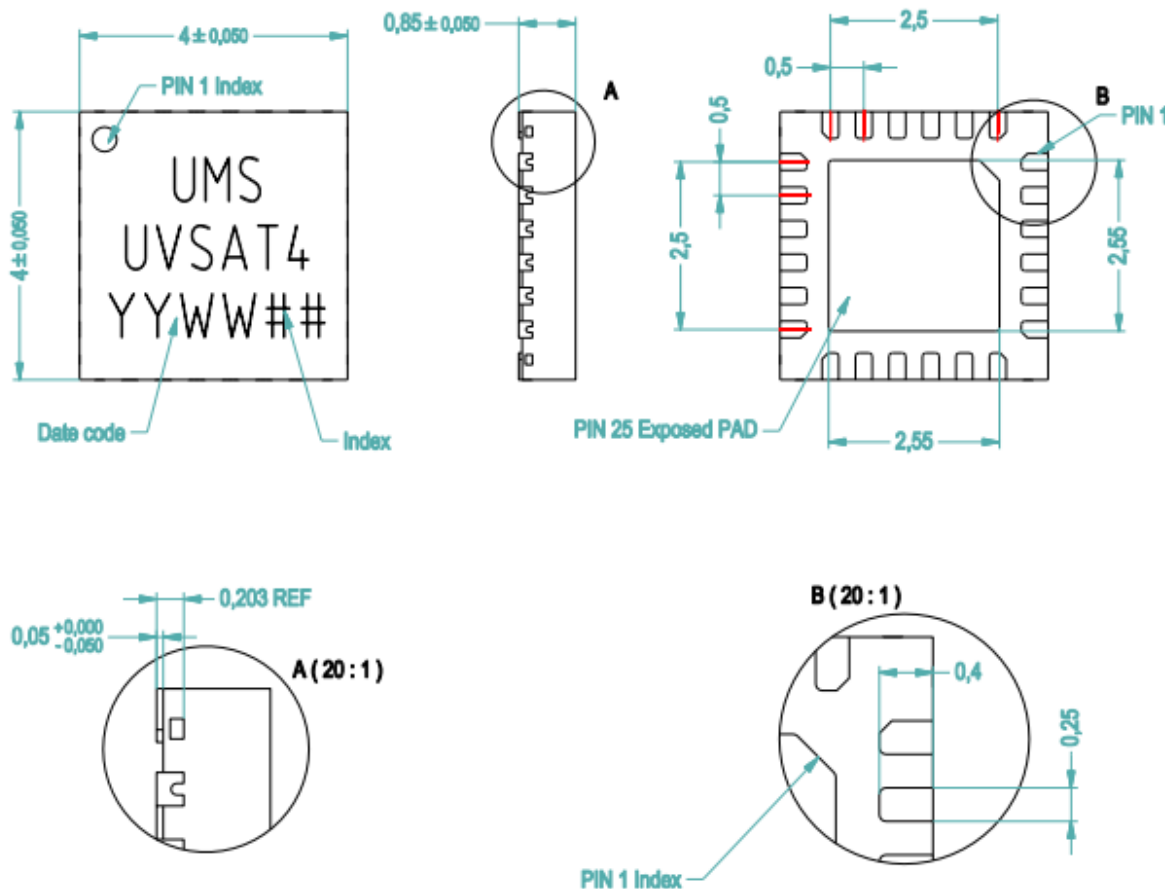


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27.5 - 30 GHz 4W HPA

Package outline ⁽¹⁾



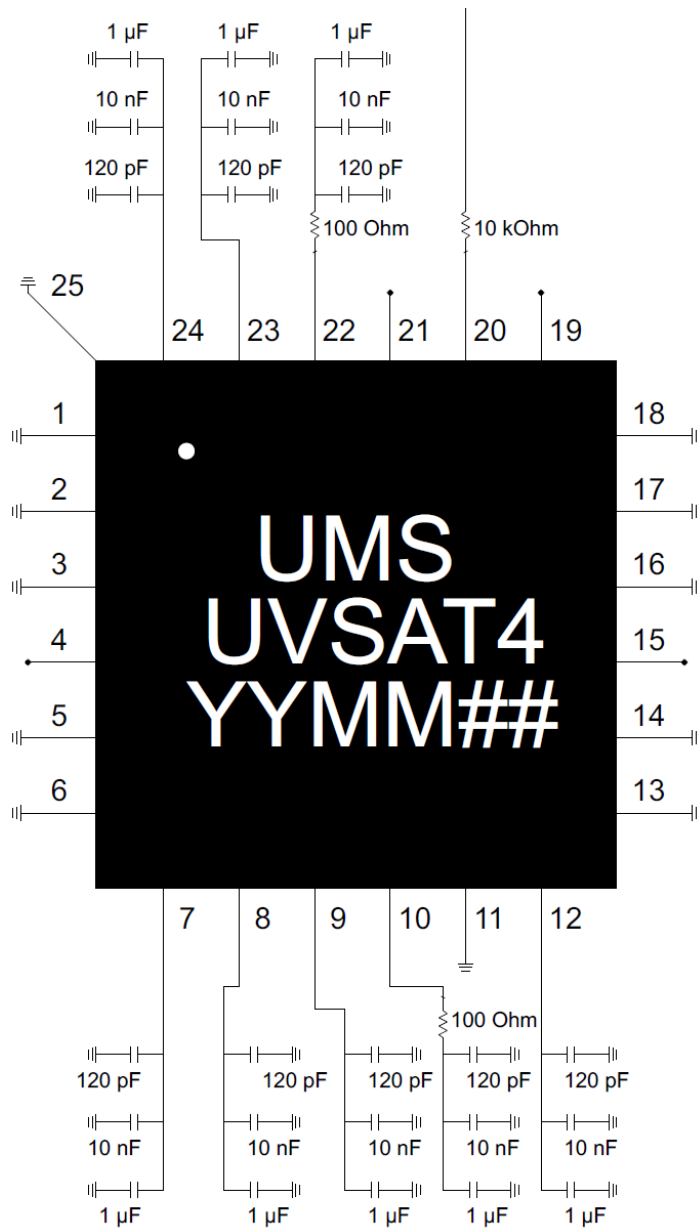
Matte tin, Lead Free (Green)	1- Nc	11- GND	21- DET
Units : mm	2- Nc	12- D3	22- G3N
From the standard : JEDEC MO-220 (VGGD)	3- GND	13- Nc	23- D2N
25- GND	4- IN	14- GND	24- D1
	5- GND	15- OUT	25- GND
	6- Nc	16- GND	
	7- G1	17- Nc	
	8- G2S	18- Nc	
	9- D2S	19- REF	
	10- G3S	20- VC	

⁽¹⁾ The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0017 (<http://www.ums-rf.com>) for exact package dimensions.

⁽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.

Advanced Information

Recommended assembly plan



The decoupling network used is composed of 3 levels of parallel capacitors. The first level is 120pF capacitor, the second level is 10nF chip capacitor and the third level is 1μF capacitor. The two firsts levels should be as close as possible of the die. A 100 Ω serie resistor was added on 3rd stage gate supply.

Advanced Information

Recommended package footprint

Refer to the application note AN0017 available at <http://www.ums-rf.com> for package foot print recommendations and exact package dimensions.

SMD mounting procedure

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0017 available at <http://www.ums-rf.com>.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACH N°1907/2006. More environmental data are available in the application note AN0019 also available at <http://www.ums-rf.com>.

Recommended ESD management

Refer to the application note AN0020 available at <http://www.ums-rf.com> for ESD sensitivity and handling recommendations for the UMS package products.

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 a similar one	Production

Advanced Information