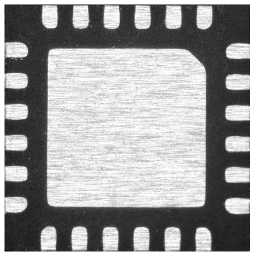
17.2 – 21.3GHz Power Amplifier

GaN Monolithic Microwave IC in SMD leadless package

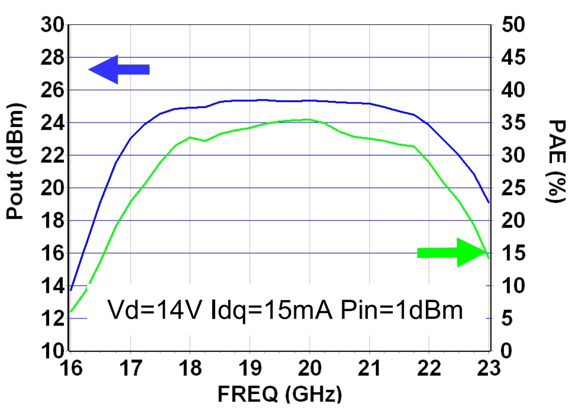
Description

The CHA4252-QKB is a three-stage Medium Power Amplifier in the 17.2 – 21.3GHz frequency band. This MPA typically provides 25dBm output power associated to 30% of Power Added Efficiency. The circuit exhibits a small signal gain of 30dB. The overall power supply is 0.21W (14V/15mA).
The circuit is a very versatile amplifier for high performance systems.
Designed for space applications, it is also well suited for a wide range of microwave applications and systems.
The product is developed on a robust GaN on SiC HEMT process and is provided on low cost SMD RoHS compliant QFN plastic package.



Main Features

- ■ 17.2 – 21.3 GHz frequency range
- ■ Linear Gain is 30dB
- ■ 25dBm Pout @Vd = 14V @Max_PAE
- ■ Associated PAE = 30%
- ■ DC bias: Vd = 14V @Idq = 0.015A
- ■ 24 Leads - QFN 4x4mm^2
- ■ MSL3



Main Electrical Characteristics

Tcase = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.2		21.3	GHz
Gain	Linear Gain		30		dB
Pout	Output Power @Max_PAE		25		dBm
PAE	Power Added Efficiency		30		%

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Specifications

T_{case} = +25°C, Vd = 14V, Idq = 15mA

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.2		21.3	GHz
Gain	Linear Gain		30		dB
Pout	Saturated output Power (Pin = 2dBm)		25		dBm
PAE	Power Added Efficiency (Pin = 2dBm)		30		%
Id	Drain current at saturation (Pin = 2dBm)		80		mA
S11	Input Return Loss		12		dB
S22	Output Return Loss		10		dB

These values are representative of on board measurements as defined on the drawing in paragraph " Definition of measurements reference planes ".

Recommended Operating Range (1), (2)

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage range	10 - 18	V
Idq	Quiescent current	15	mA
Pin	Maximum peak input power overdrive (3)	10	dBm
Tj	Maximum junction temperature(3)	200	°C

(1) Electrical performances are defined for specified test conditions.
(2) Electrical performances are not guaranteed over all recommended operating conditions.
(3) See Device thermal performances section.

Recommended Operating Range for Space Application (1), (2)

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage range	10 – 16	V
Idq	Quiescent current	15	mA
Pin	Maximum peak input power overdrive (3)	10	dBm
Tj	Maximum junction temperature(3)	160	°C

(1) Electrical performances are defined for specified test conditions.
(2) Electrical performances are not guaranteed over all recommended operating conditions.
(3) See Device thermal performances section.

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Absolute Maximum Ratings [1]

T_{case} = +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	27	V
Id	Maximum drain current	360	mA
Pin	Maximum peak input power overdrive	13	dBm
Vg	Gate bias voltage	-7 to -1.5	V

[1] Operation of this device above anyone of these parameters may cause permanent damage.

Temperature Range

T_{case}	Operating temperature range	-40 to +85	°C
T_{stg}	Storage temperature range	-55 to +150	°C

Typical Bias Conditions

T_{case} = +25°C

Symbol	Pad N°	Parameter	Values	Unit
Vg	7, 9, 10	Vg gate voltage	Set for Idq = 15mA @T_{case} = 25°C	V
Vd	20, 21, 23	Vd drain voltage	10 - 18	V

"Power ON" sequence

1. Bias MPA gate voltage at Vg close to Vpinch-off (Typically: Vg ≈ -5V)
2. Apply Vds bias voltage (Typically: Vd = 14V)
3. Increase Vgs up to quiescent bias drain current Idq (pulsed applied on the gate)
4. Apply RF signal

"Power OFF" sequence

1. Turn off RF signal
2. Bias MPA gate voltage at Vg close to Vpinch-off (Typically: Vg ≈ -5V)
3. Turn Vds bias voltage to 0V
4. Turn Vgs bias voltage to 0V

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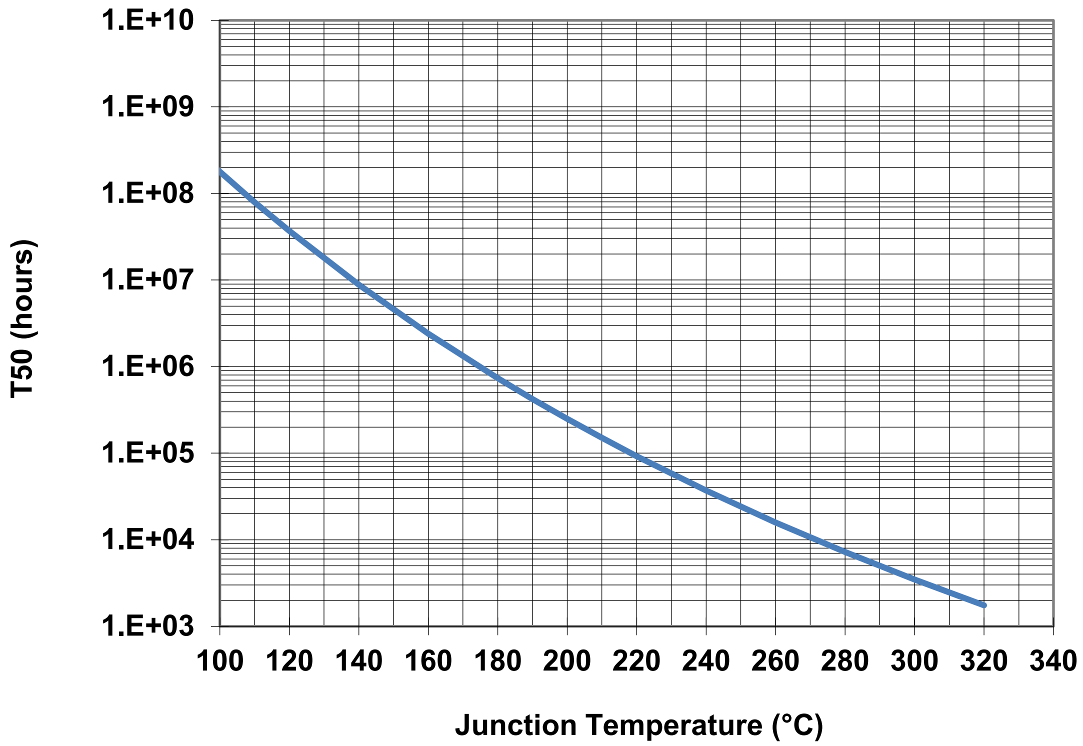
Device thermal performances

All the figures given in this section are obtained assuming that the die is only cooled down by conduction through the package case.
The temperature is monitored at the QFN back-side interface (T_{case}).
For nominal operating, the system maximum temperature must be adjusted in order to guarantee that $T_{junction}$ remains below the maximum value specified in the Recommended Operating Ratings table.
So, the system PCB must be designed to comply with this requirement.

Parameter	Biasing conditions	$T_{junction}$ (°C)	R_{TH} (°C/W)	T_{50} (hours)
R_{TH} (1) Thermal Resistance (Junction to Case)	Vd= 14V Pout= 25dBm Pdiss= 0.75W	134	108	1.37E+07
	Vd= 18V Pout= 27dBm Pdiss= 1.27W	187	80	5.14E+05

(1) Assuming 85°C T_{case}



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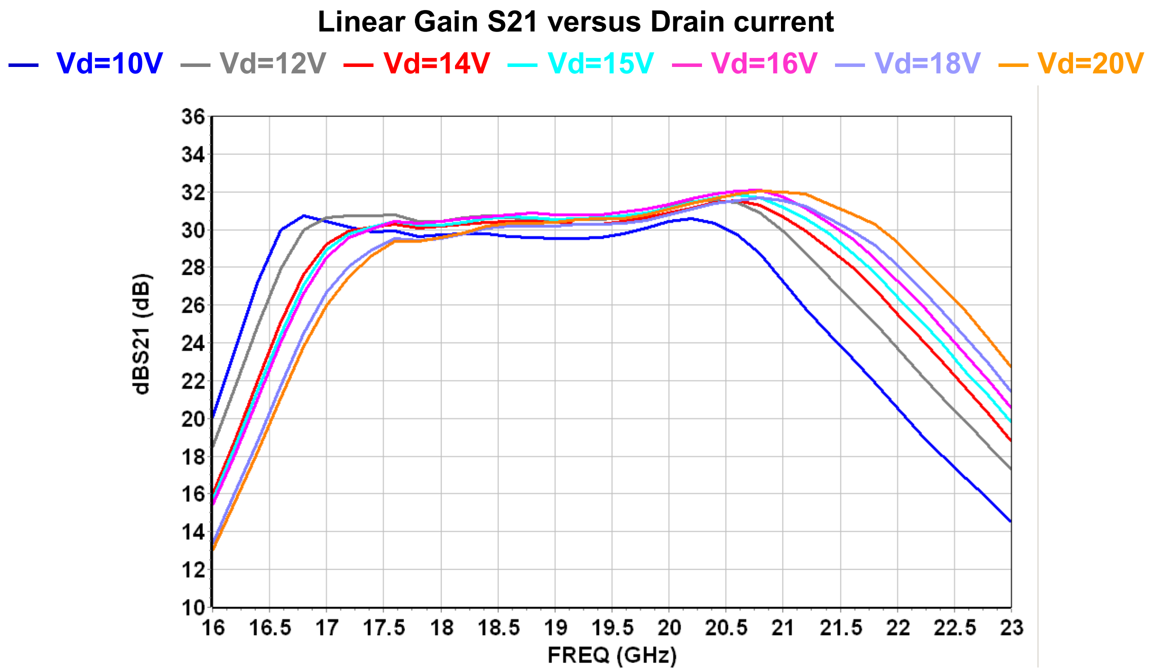
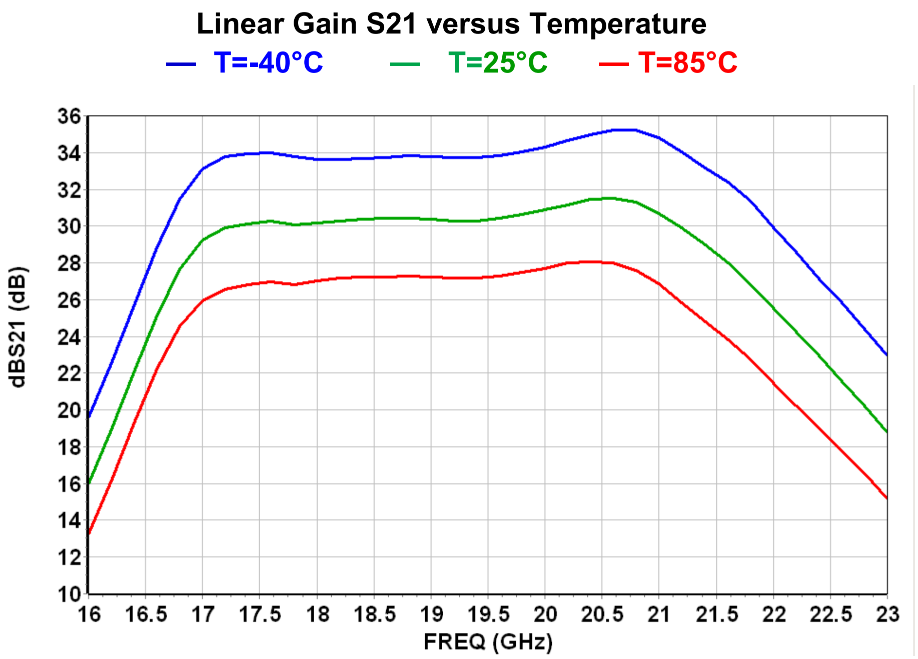
Typical Board Measurements

T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA
Board losses are de-embedded. Measurements are given in the package reference planes.



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq = 15mA@25°C



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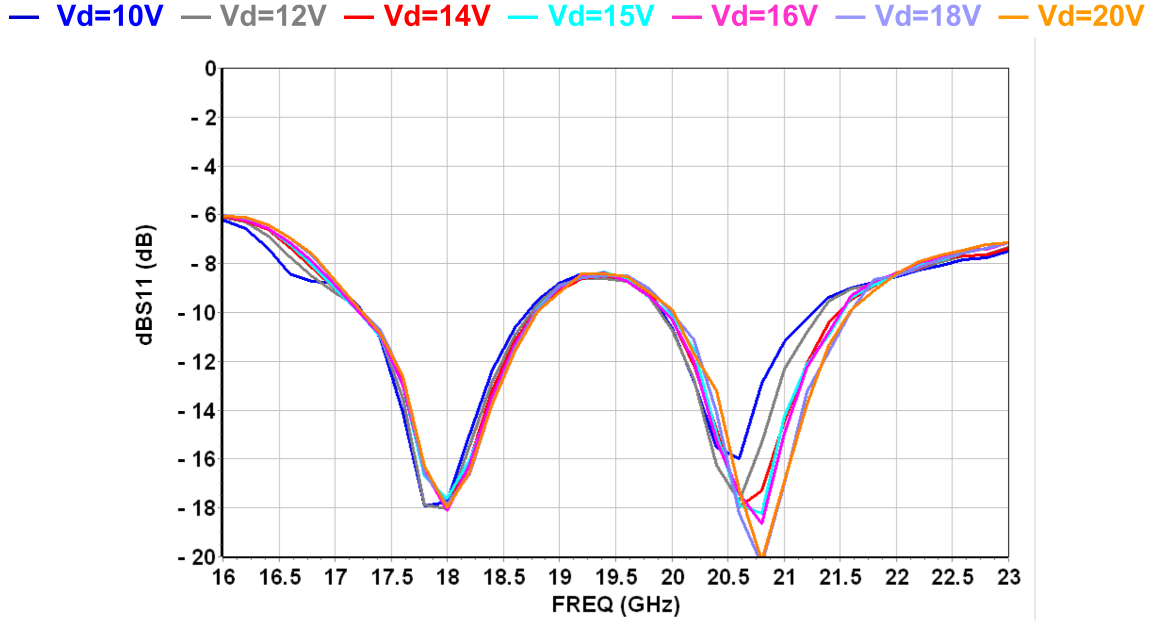
Typical Board Measurements

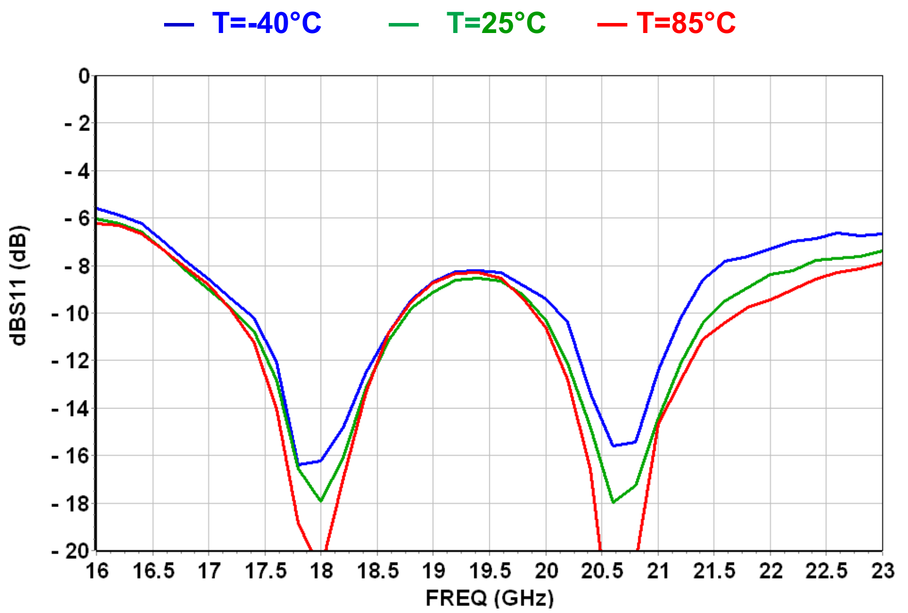
T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA
Board losses are de-embedded. Measurements are given in the package reference planes.

Input Return Loss S11 versus Drain current



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq= 15mA@25°C

Input Return Loss S11 versus Temperature



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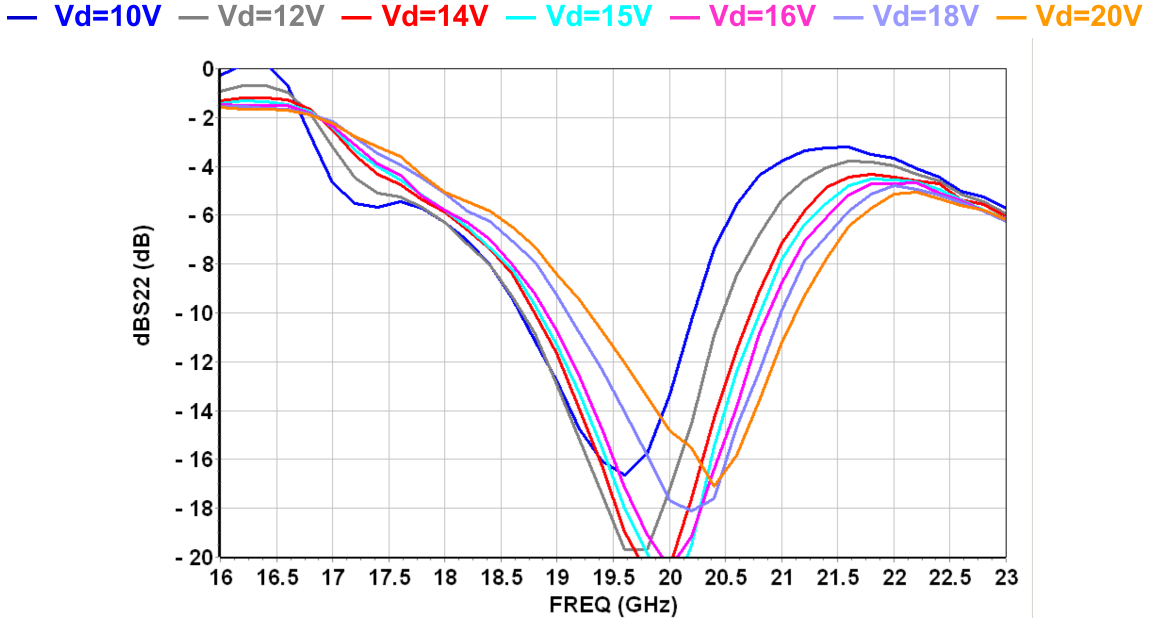
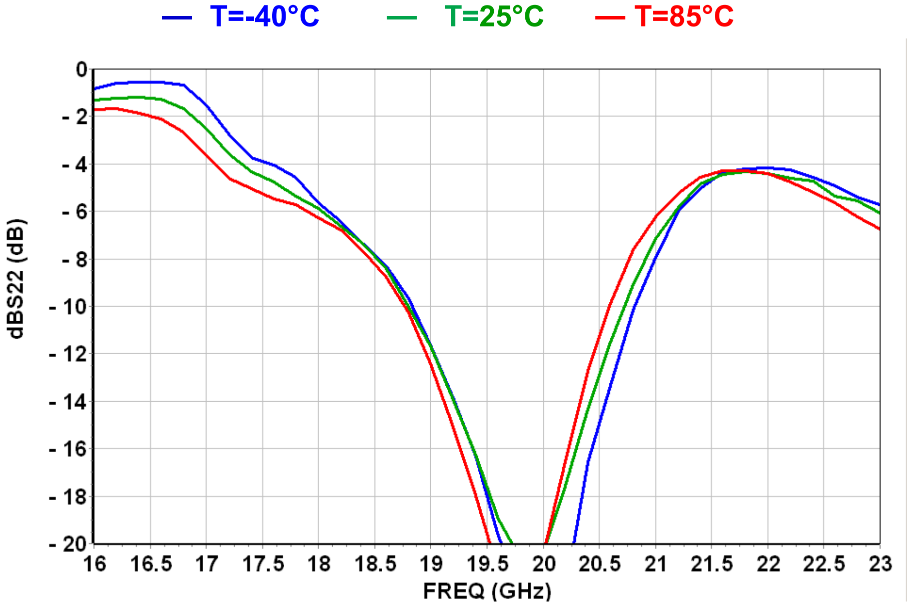
Typical Board Measurements

T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA
Board losses are de-embedded. Measurements are given in the package reference planes.



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq = 15mA@25°C



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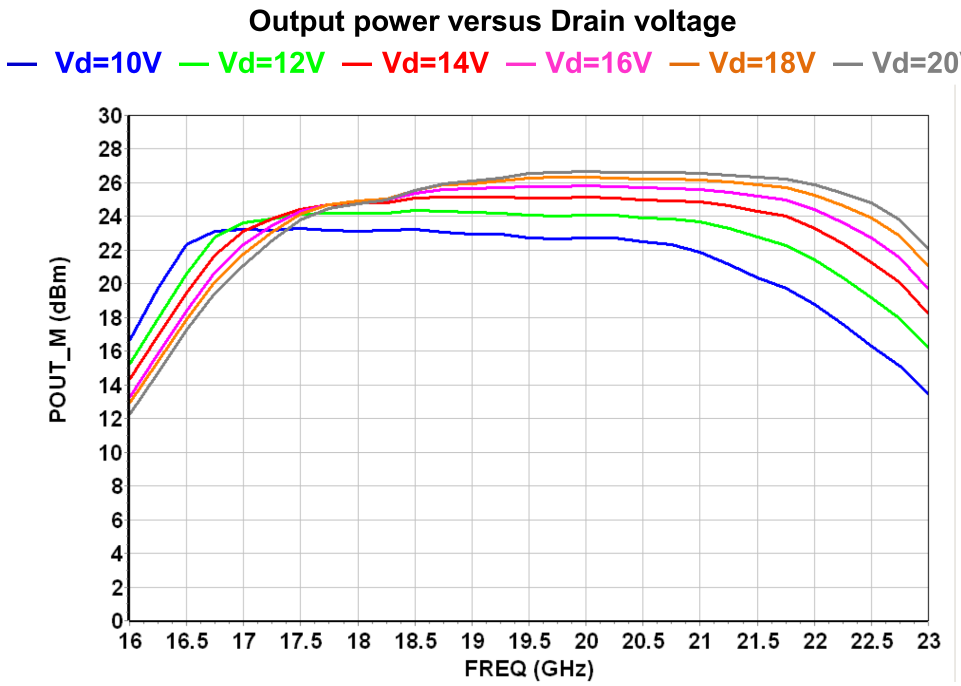
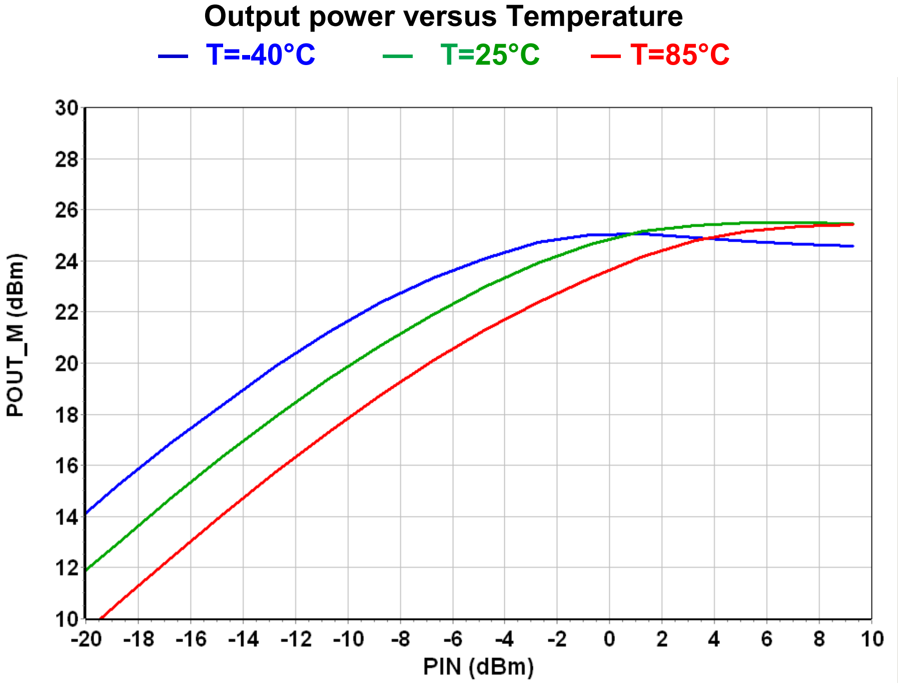
Typical Board Measurements

T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA, Pin = 2dBm
Board losses are de-embedded. Measurements are given in the package reference planes.



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq = 15mA, Freq = 19.25GHz



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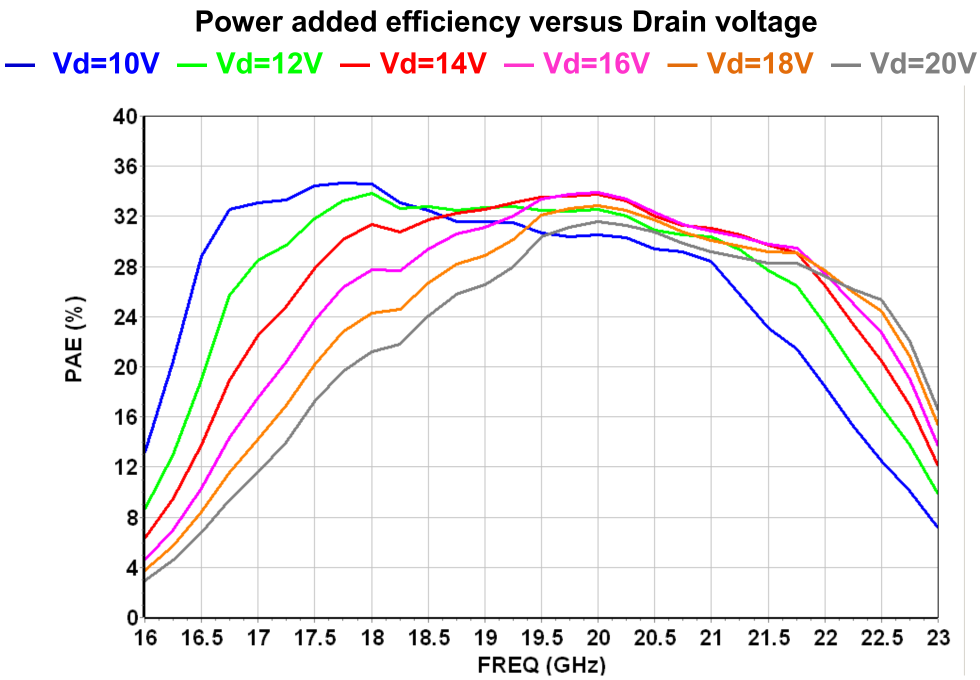
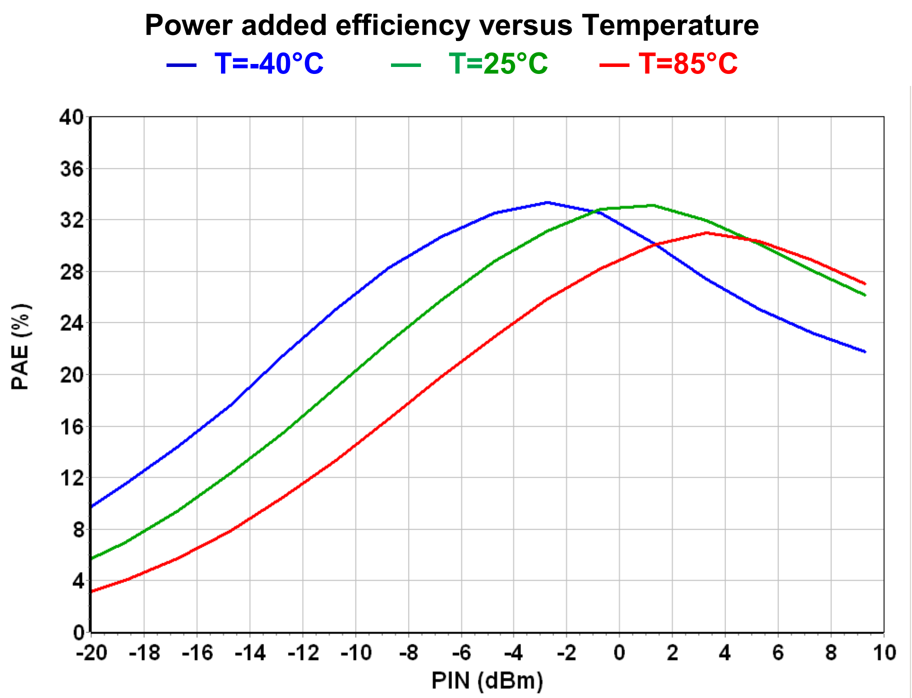
Typical Board Measurements

T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA, Pin = 2dBm
Board losses are de-embedded. Measurements are given in the package reference planes.



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq = 15mA, Freq = 19.25GHz



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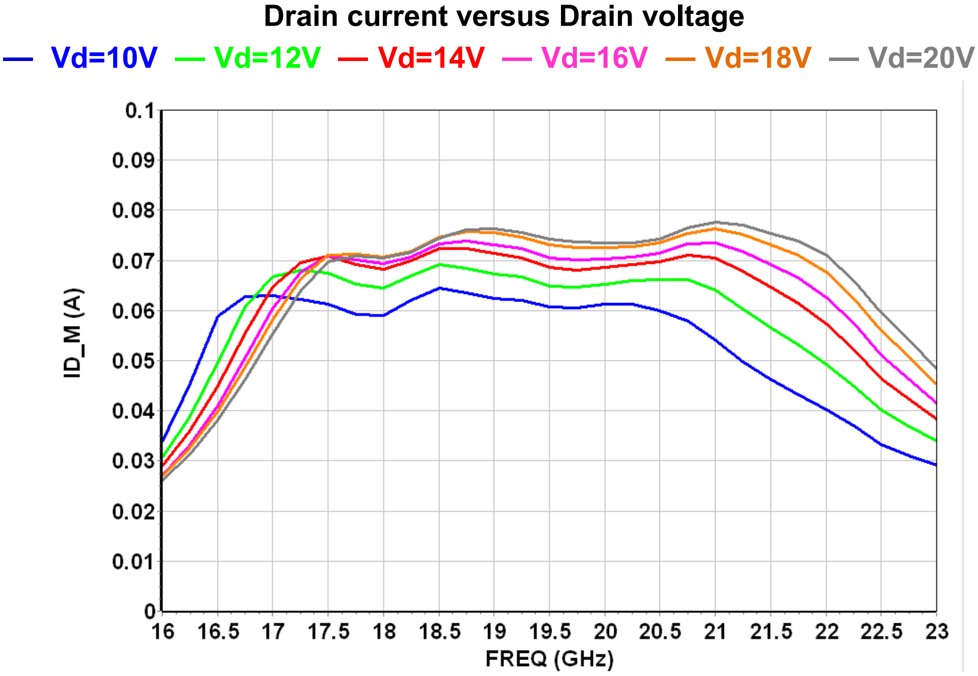
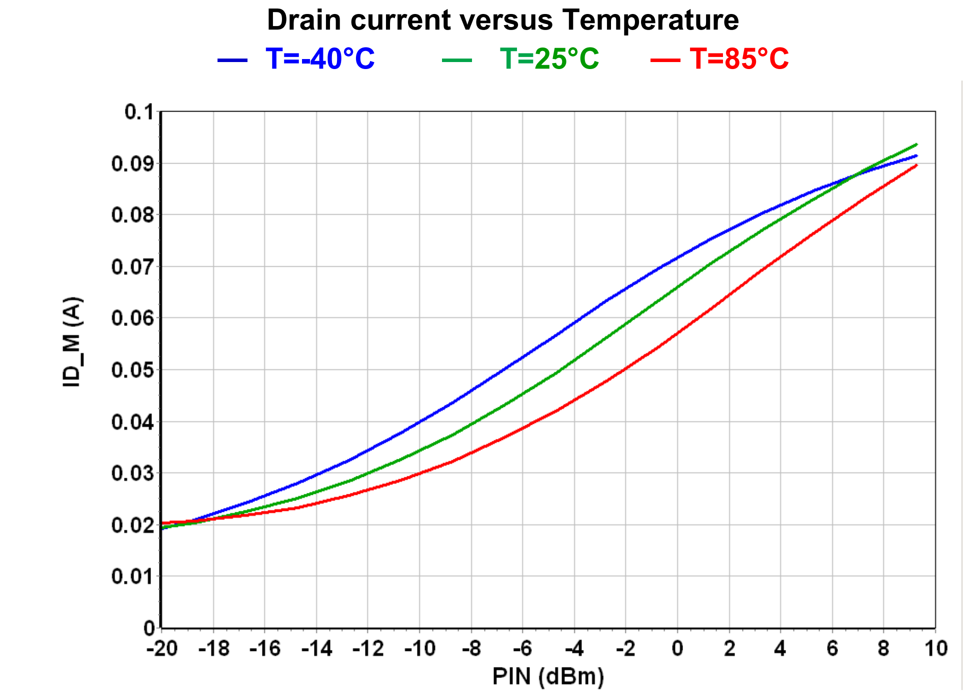
Typical Board Measurements

T_{case} = +25°C, Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA, Pin = 2dBm
Board losses are de-embedded. Measurements are given in the package reference planes.



T_{case} = -40°C, +25°C & +85°C, Vd = 14V, Idq = 15mA, Freq = 19.25GHz



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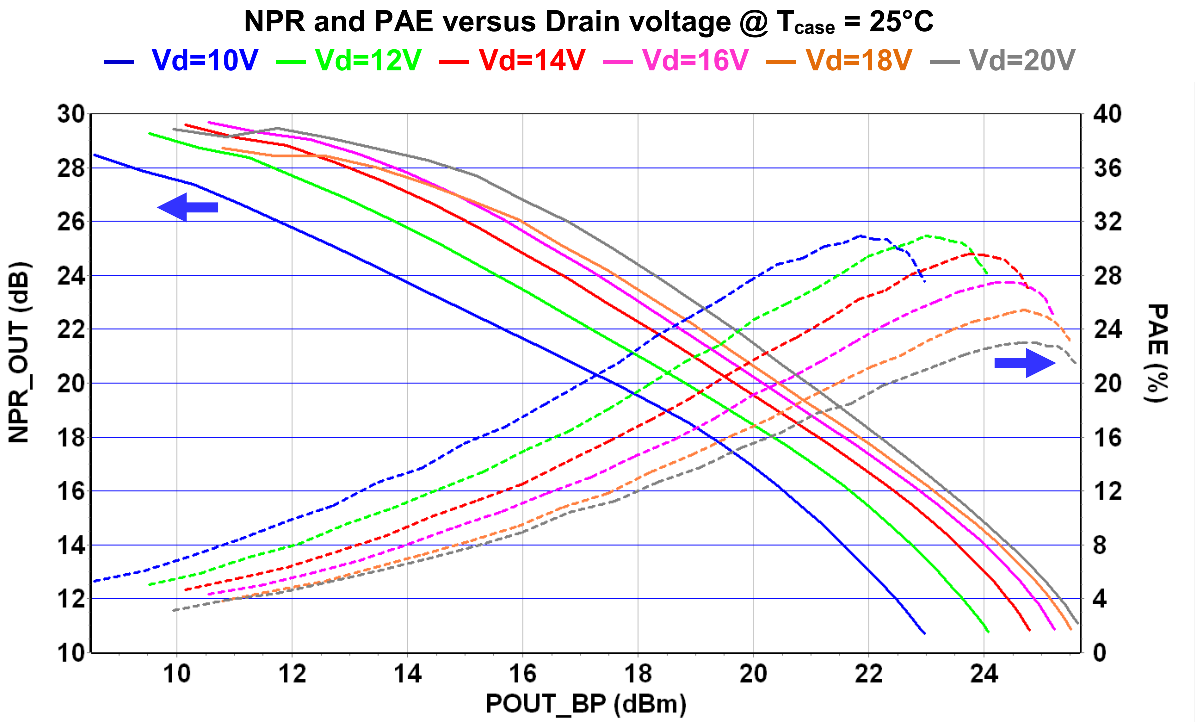
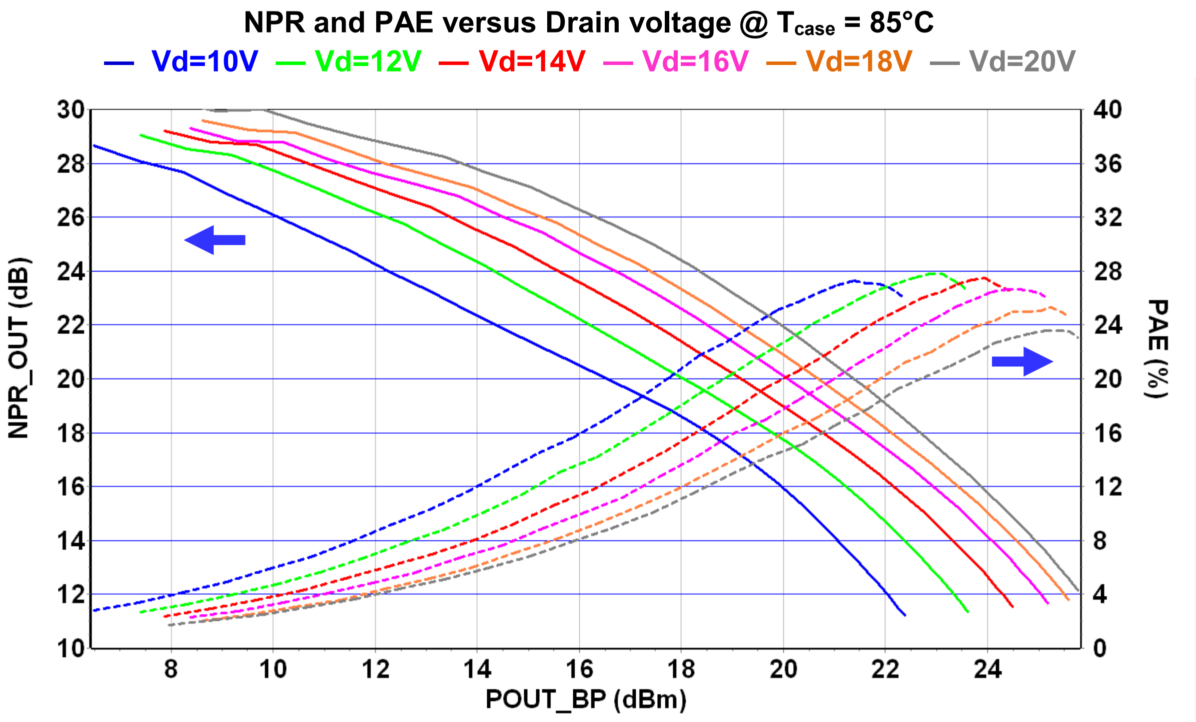
Typical Board Measurements

Vd = 10, 12, 14, 15, 16, 18 & 20V, Idq = 15mA, Bandwidth = 1GHz, Notch = 10%
Board losses are de-embedded. Measurements are given in the package reference planes.





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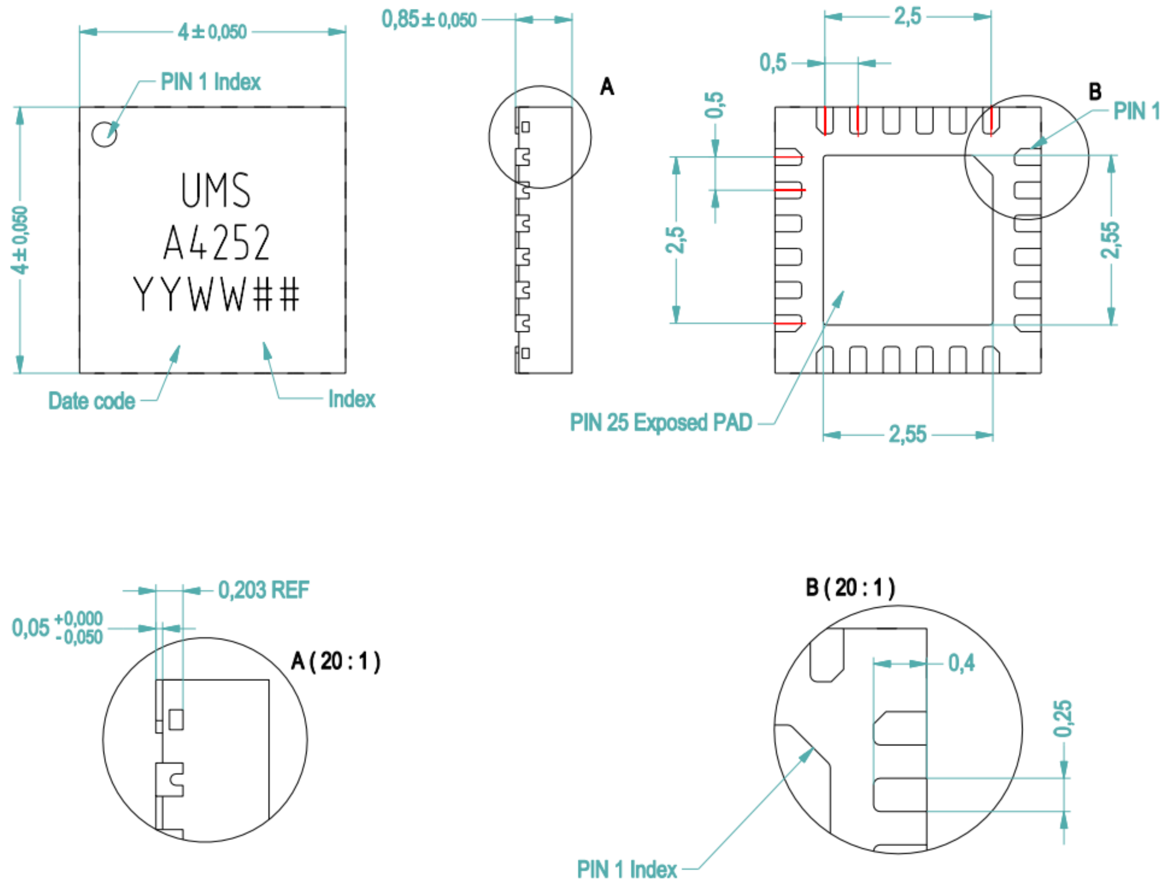
Package outline [1]



Units :	mm	1- Nc	11- GND[2]	21- VD2
Finish :	NiPdAuAg	2- Nc	12- Nc	22- GND[2]
MSL Rating :	MSL3	3- GND[2]	13- Nc	23- VD1
Lead Free (Green)		4- RF in	14- GND[2]	24- Nc
From the standard :	JEDEC MO-220	5- GND[2]	15- RF out	25- GND[2]
	VGGD	6- Nc	16- GND[2]	
NC :	Not Connected	7- VG1	17- Nc	
		8- GND[2]	18- Nc	
		9- VG2	19- GND[2]	
		10- VG3	20- VD3	

[1] Refer to the application note AN0017 (https://www.ums-rf.com) for general consideration and recommendations for Molded Plastic QFN/DFN packages.

[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.

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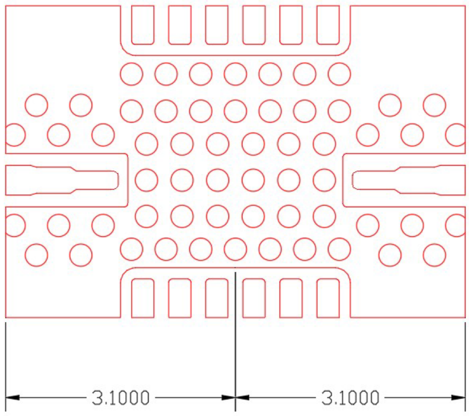
Definition of measurements reference planes

The reference planes used measurements given above are symmetrical from the symmetrical axis of the package (see drawing beside). The input and output reference planes are located at 3.1mm offset (input wise and output wise respectively) from this axis.



ESD sensitivity

Parameter	Classification	Standard
Human Body Model (HBM)	1A	ANSI/ESDA/JEDEC - JS-001

Package Information

Parameter	Value
Package body material	RoHS-compliant
	Low stress Injection Molded Plastic
Lead finish	NiPdAuAg
MSL Rating	MSL3

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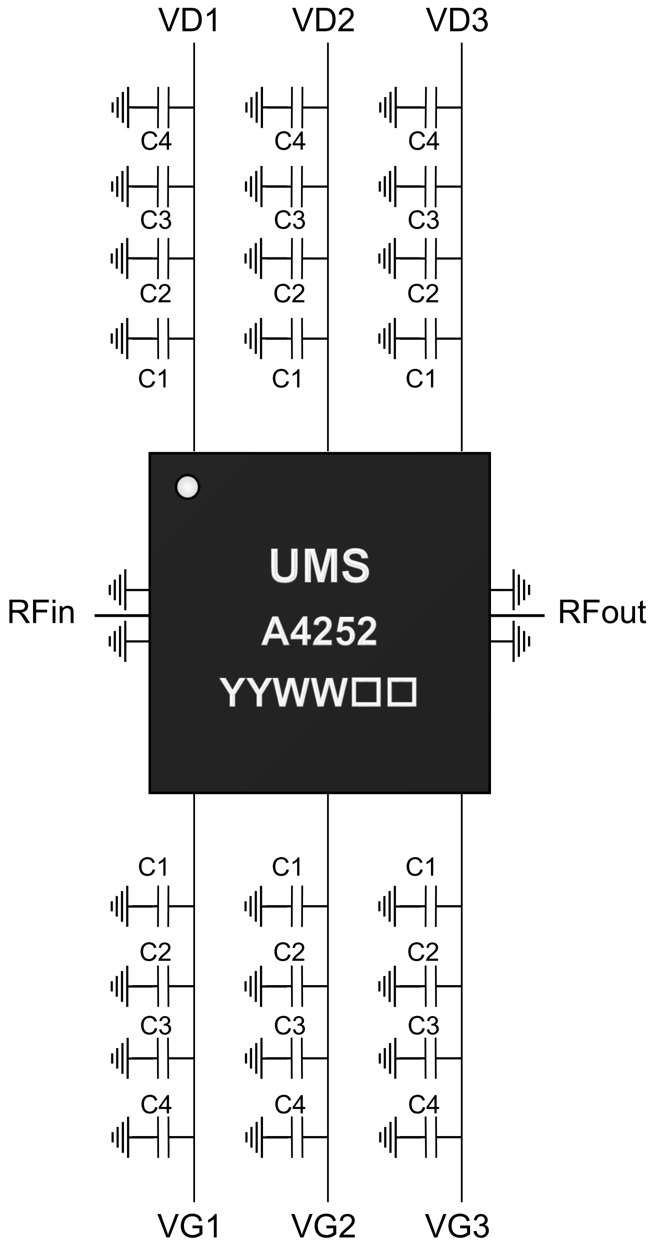
Recommended assembly plan



Bill of Materials

Label	Value	Description
C1	RF	Capa 120pF ±15% 50V
C2	RF	Capa 10nF ±10% 50V
C3	RF	Capa 1µF ±10% 50V
C4	RF	Capa 10µF ±10% 50V

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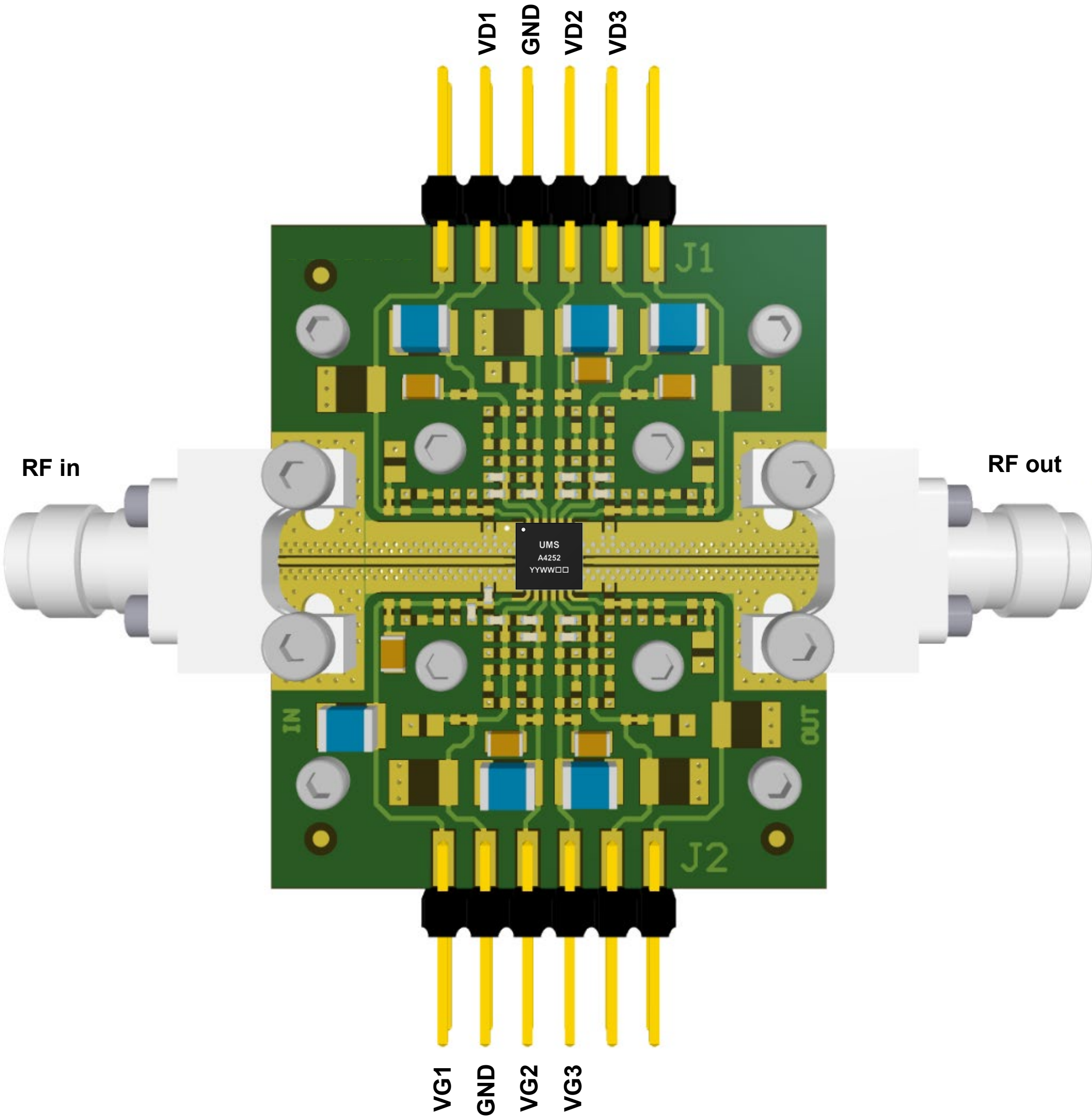
Evaluation board

- ■ Compatible with the proposed footprint.
- ■ Based on typically Ro4350 / 8mils 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 120pF, 10nF, 1µF, 10µF ±10% are recommended for all DC accesses.
- ■ See application note AN0017 for details.



Note: All board measurements are performed using shielded cables, even for DC bias, to ensure safe operation.

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Recommended Package Footprint

Refer to the application note AN0017 available at https://www.ums-rf.com for package foot print recommendations.

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 at https://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 https://www.ums-rf.com.

Recommended ESD Management

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

Description of Evaluation Board

Refer to the application note AN0031 available at https://www.ums-rf.com for the description of Evaluation Board for Packaged Die and recommendations for this UMS package product.

Ordering Information

QFN 4x4 package:	CHA4252-QKB/XY	
	Stick: XY = 20	Tape & reel: XY = 21
Evaluation Board:	EVB-CHA4252-QKB	

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