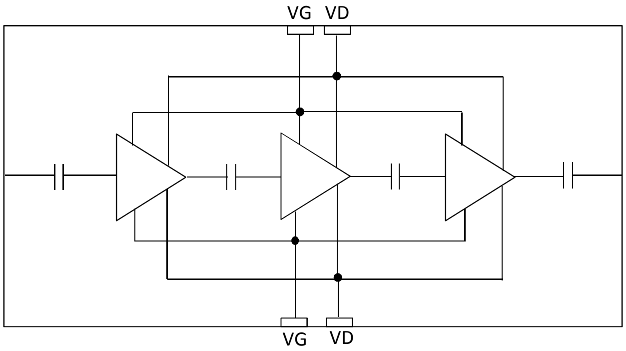
MECX10W-3

X-Band GaAs pHEMT High Power Amplifier



Product Description

MECX10W-3 is a 0.25µm GaAs pHEMT based High Power Amplifier designed by MEC for X-Band applications.

The MECX10W-3 provides more than 11W of saturated output power in the frequency range from 8.5 GHz to 11.1 GHz, with PAE up to 44% and 27 dB of small signal Gain.

The MECX10W-3 is fully matched to 50 Ω with DC decoupling capacitors on both Input and Output ports. Bond Pad are gold plated for compatibility with thermo-compression bonding process.

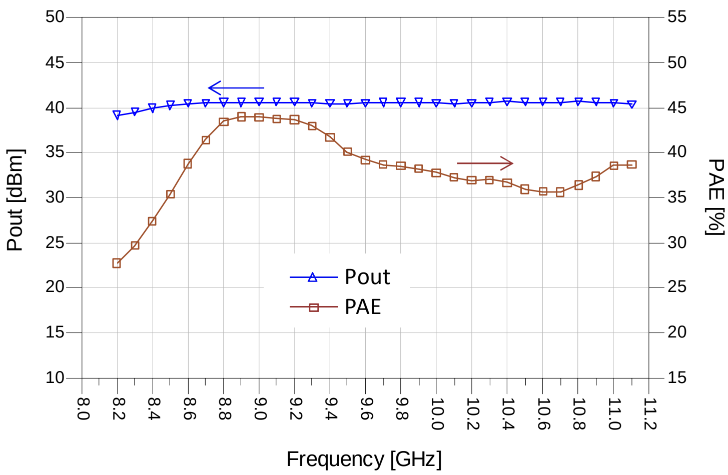
Main Features

- 0.25µm GaAs pHEMT Technology
- 8.5 – 11.1 GHz full performances Frequency Range
- Saturated Output Power ≥ 11W
- PAE = 35% - 44%
- Small Signal Gain > 27 dB
- Bias: Vd = 8V, Id = 2.5A, Vg = -0.45V (Typ.)
- Chip Size: 5 x 3.3 x 0.07 mm

Typical Applications

- Radar
- Telecom

Measured Data



Main Characteristics

Test Conditions: T_{base_plate} = 25°C , Vd = 8 V, Idq = 2.5 A, Pulse Width = 100 µs, Duty Cycle = 30%

Parameter	Min	Typ	Max	Unit
Operating frequency	8.5		11.1	GHz
Small Signal Gain		31		dB
Input Return Loss	-20		-10	dB
Output Return Loss		-10		dB
Saturated Output Power		40.5		dBm
Power Added Efficiency @ Pout=Psat	35		44	%
Gain @ Pout=Psat		27		dB
Drain Supply Voltage		8.0		V
Supply Quiescent Drain Current		2.5		A
Supply Drain Current	3.2		4.2	A
Psat Vs. Temperature		-0.007		dB/°C
PAE @Psat Vs. Temperature		-0.03		%/°C
Drain Current @Psat Vs. Temperature		-0.004		A/°C
Linear Gain Vs. Temperature		-0.042		dB/°C

Absolute Maximum Rating*		
Parameter	**Values**	**Unit**
Compression Level	6	dB
Drain Supply Voltage with RF input Power	9.0	V
Drain Supply Voltage without RF input Power	10	V
Supply Quiescent Drain Current	3.5	A
Max. forward gate current	14	mA
Max. negative gate source voltage	-2.5	V
Max. negative gate drain voltage	-10	V
Maximum junction temperature	175	°C

* Tamb = 25°C

Thermal and Reliability Information*			
Test Conditions	**Parameter**	**Values**	**Unit**
VD = 8.0 V, ID = 2.5 A PDC = 20W, **No RF Input** Tbaseplate = 80°C	**Equivalent Thermal Resistance (No RF Drive)**	**4**	**°C/W**
	Channel Temperature (No RF Drive)	**160**	**°C**
	Mean Time Failure (No RF Drive)	**3E+5**	**Hrs**
VD = 8.0 V, ID = 3.8 A PDC =30 W**, Pout= 41dBm** Tbaseplate = 80°C	**Thermal Resistance (Under RF Drive) ** **	**3.5**	**°C/W**
	Channel Temperature (Under RF Drive)	**142**	**°C**
	Mean Time Failure (Under RF Drive)	**2.8E+6**	**Hrs**

* Assumes eutectic attach using 1.5 mil thick 80/20 AuSn mounted to a 20 mil CuMo Carrier Plate.

** Equivalent Thermal Resistance under RF Drive takes into account the amount of the power dissipated by a resistor on the DC Drain paths of the first stage of the HPA.

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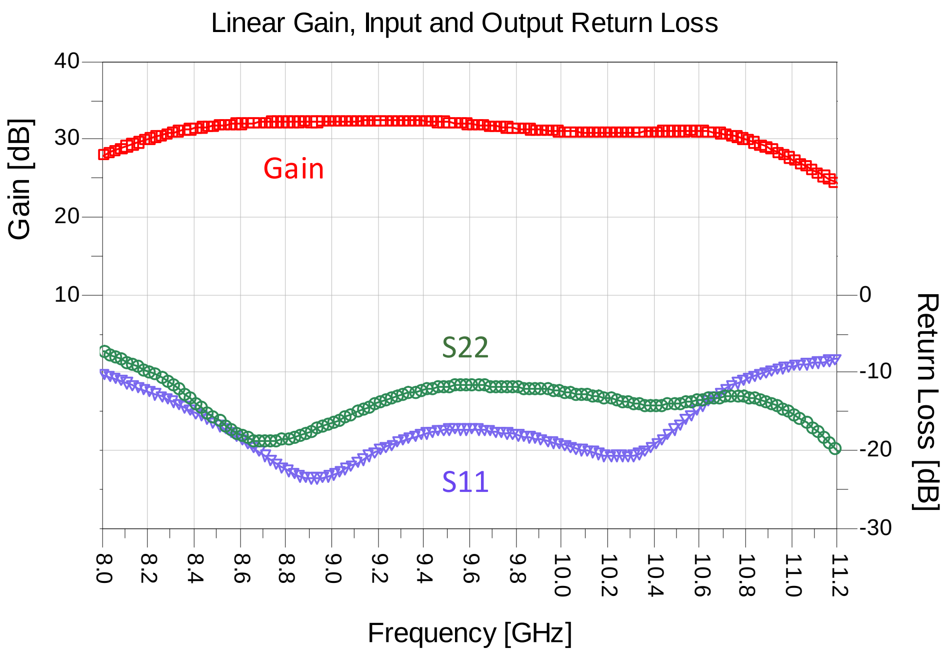
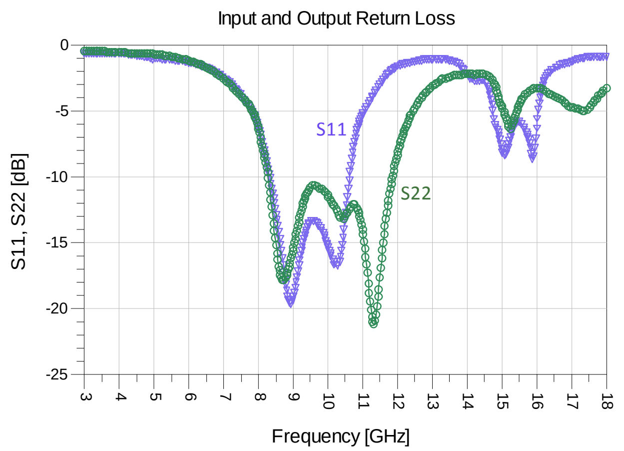
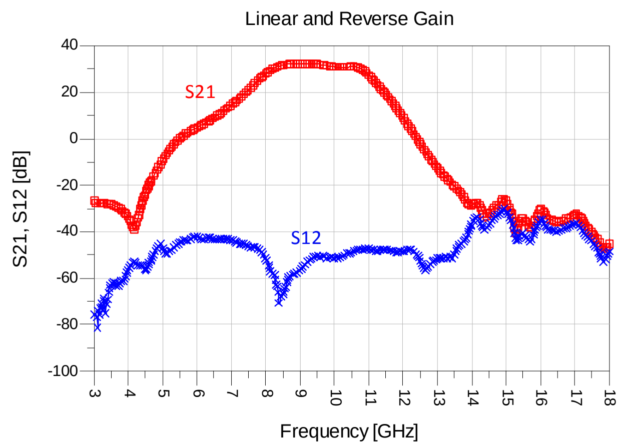
Small Signal Measurements

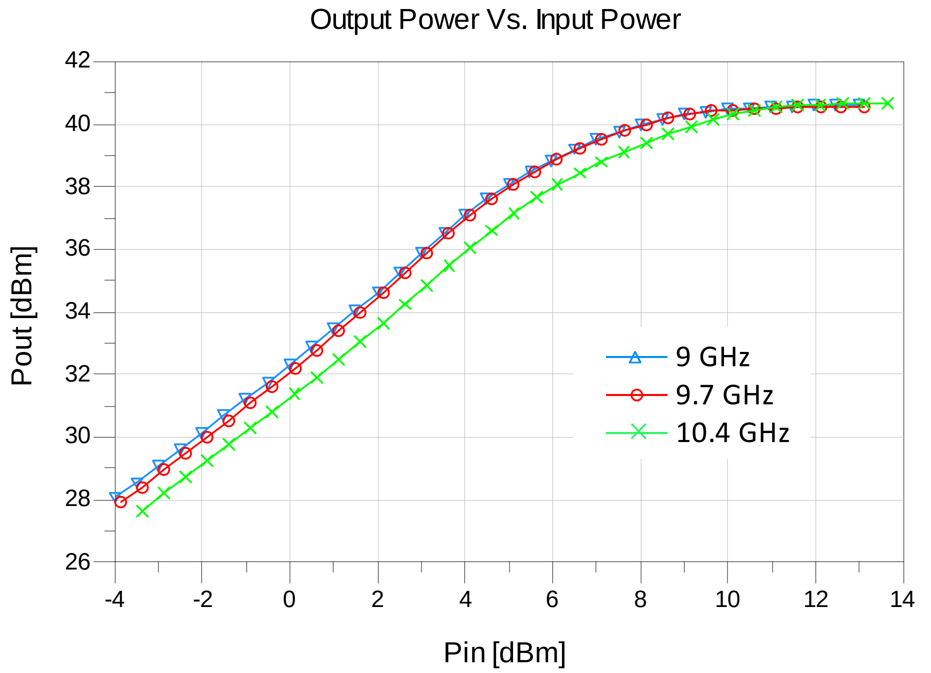


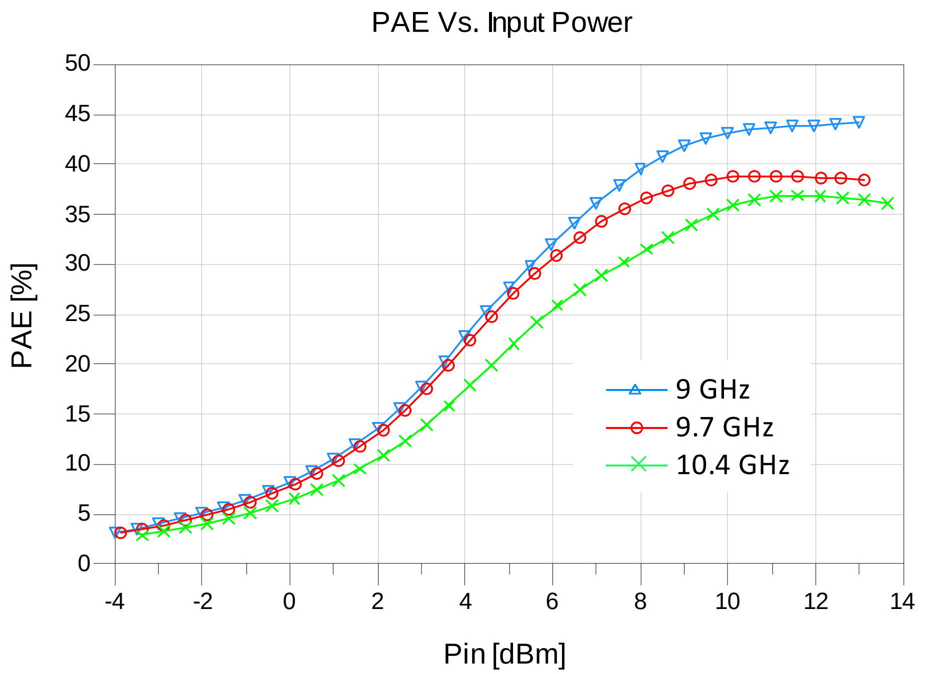
Broadband Small Signal Measurements

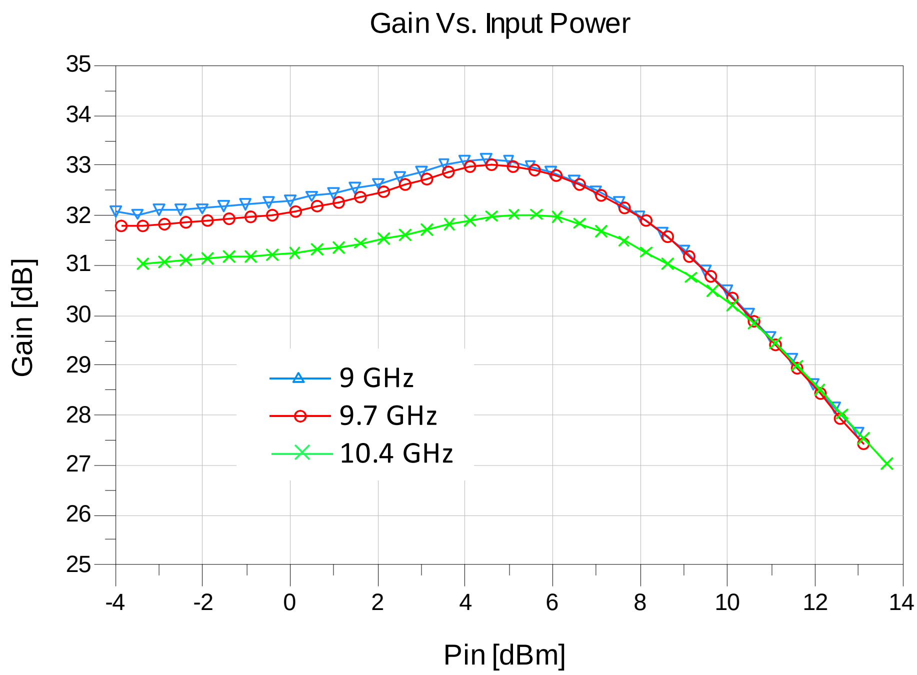


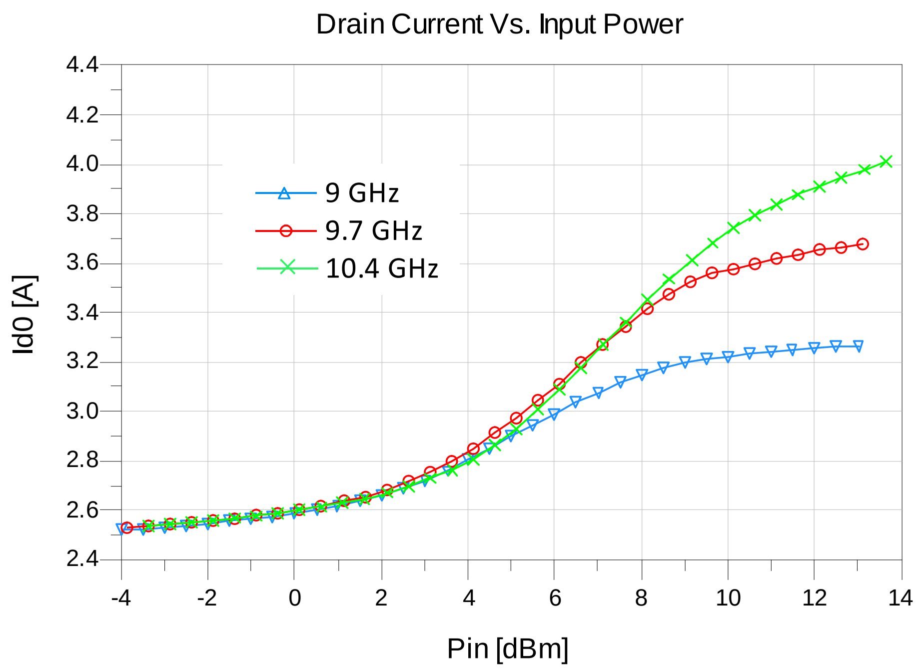


Measured Performances Vs. Pin @ Frequency [9, 9.7, 10.4] GHz

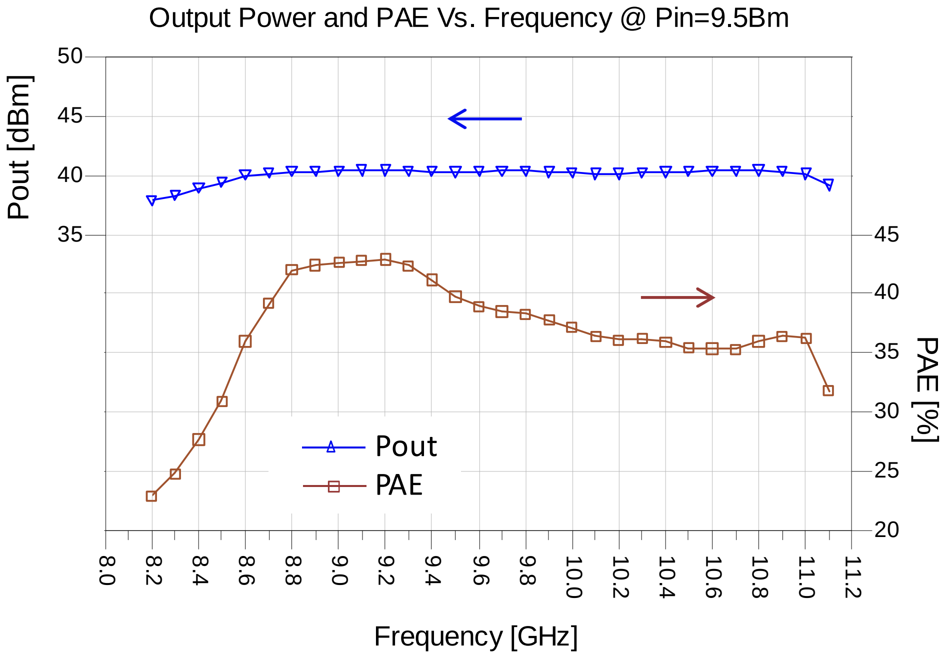


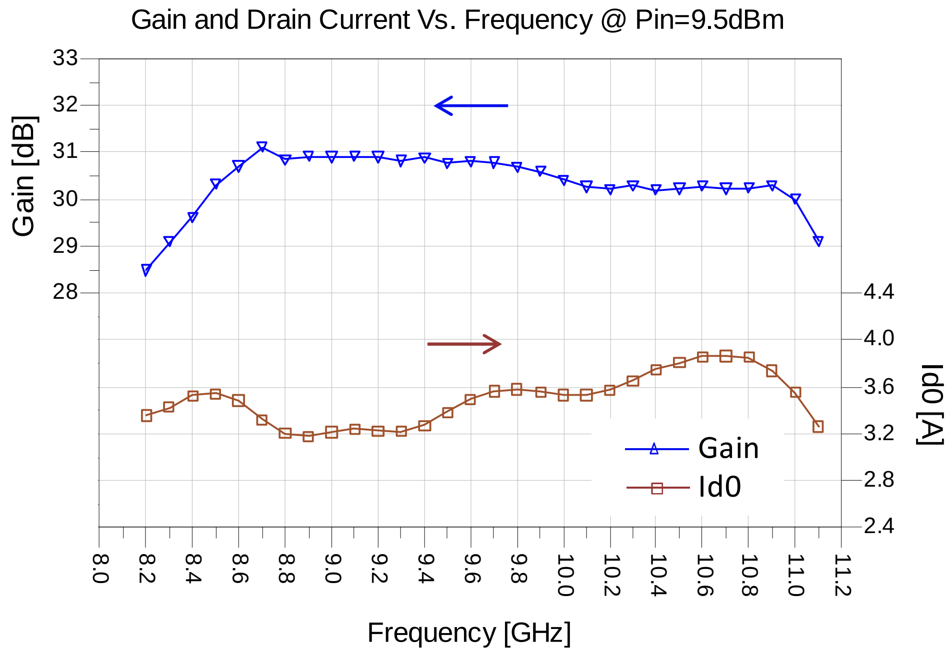



Gain Vs. Input Power
Gain [dB]
Pin [dBm]
9 GHz
9.7 GHz
10.4 GHz
35
34
33
32
31
30
29
28
27
26
25
-4
-2
0
2
4
6
8
10
12
14

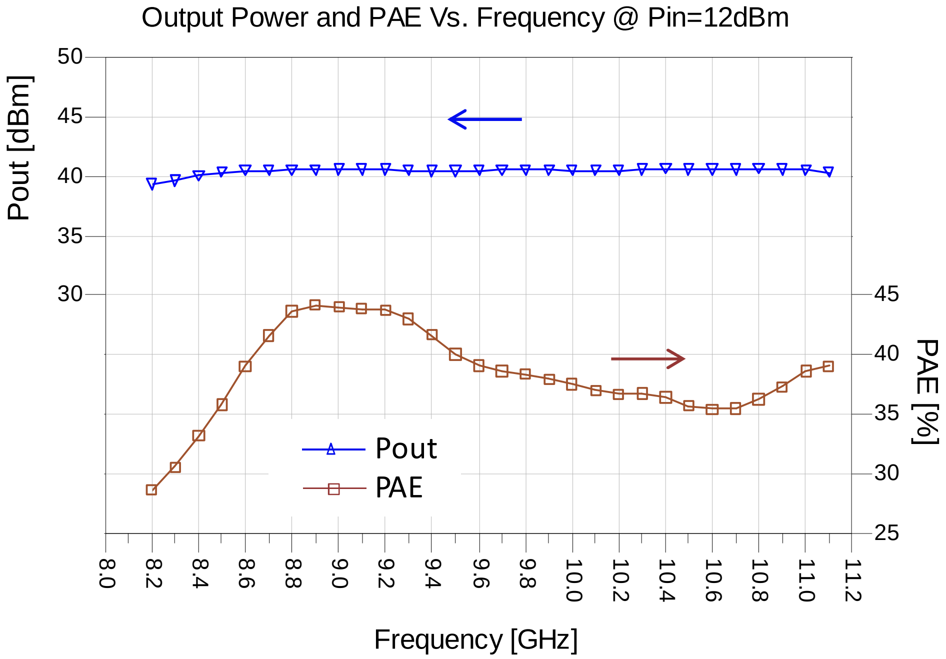

Drain Current Vs. Input Power
Id0 [A]
Pin [dBm]
9 GHz
9.7 GHz
10.4 GHz
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
-4
-2
0
2
4
6
8
10
12
14

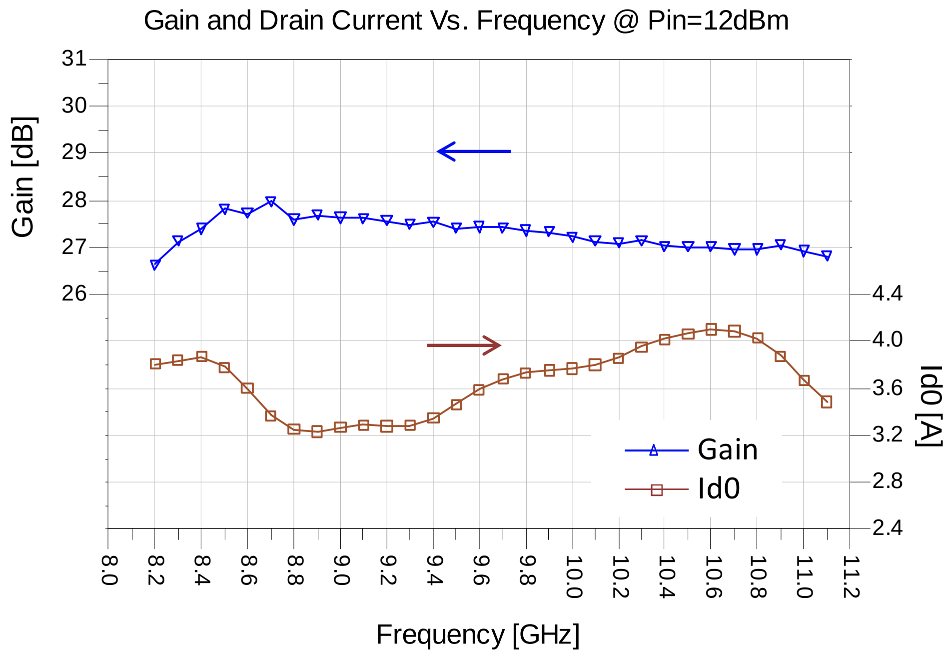
Measured Performances Vs. Frequency @ 1dB of Gain Compression



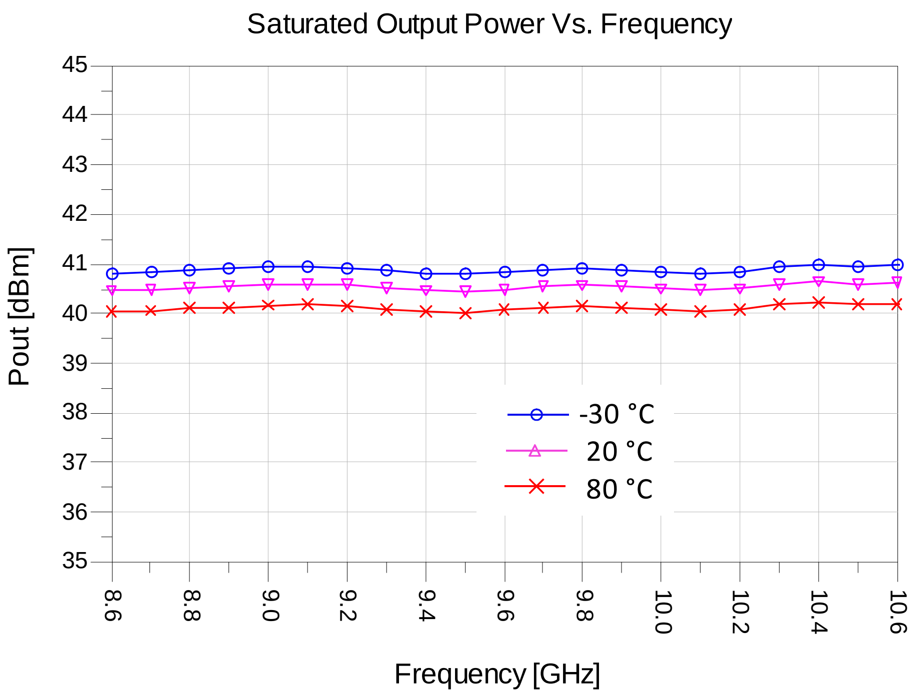


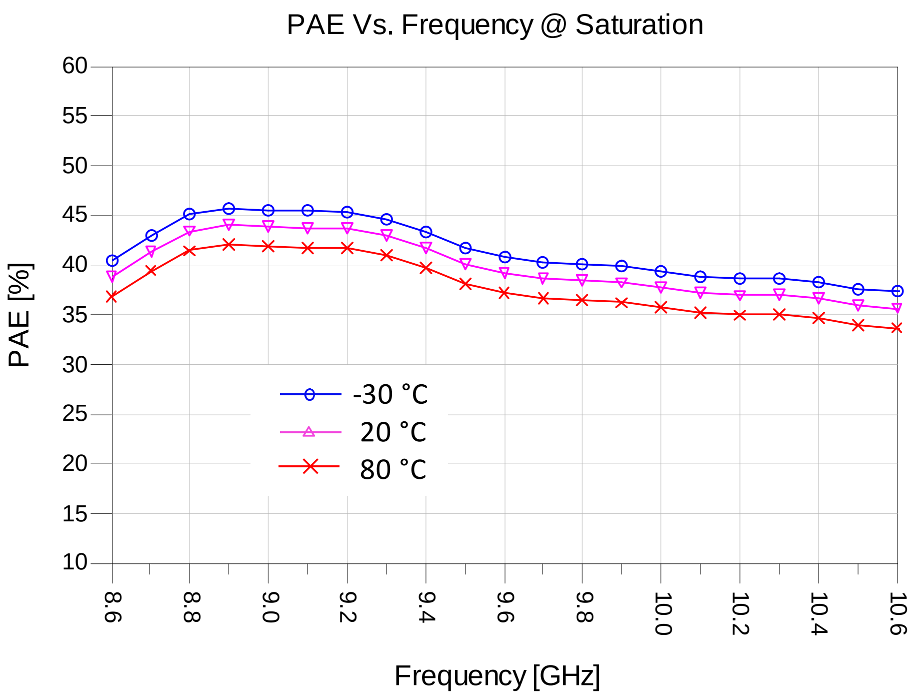
Measured Performances Vs. Frequency @ Saturation

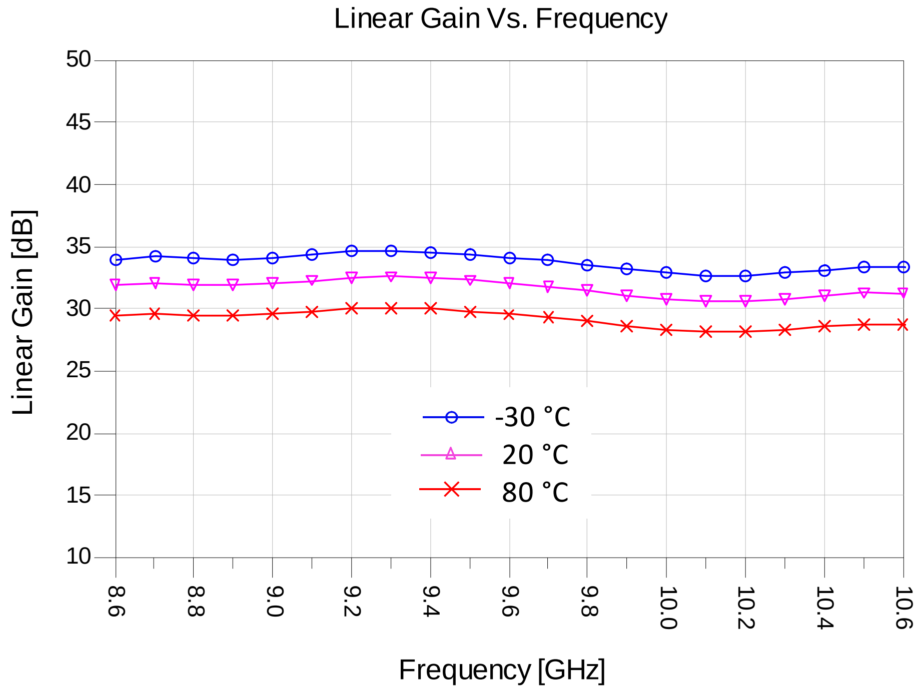




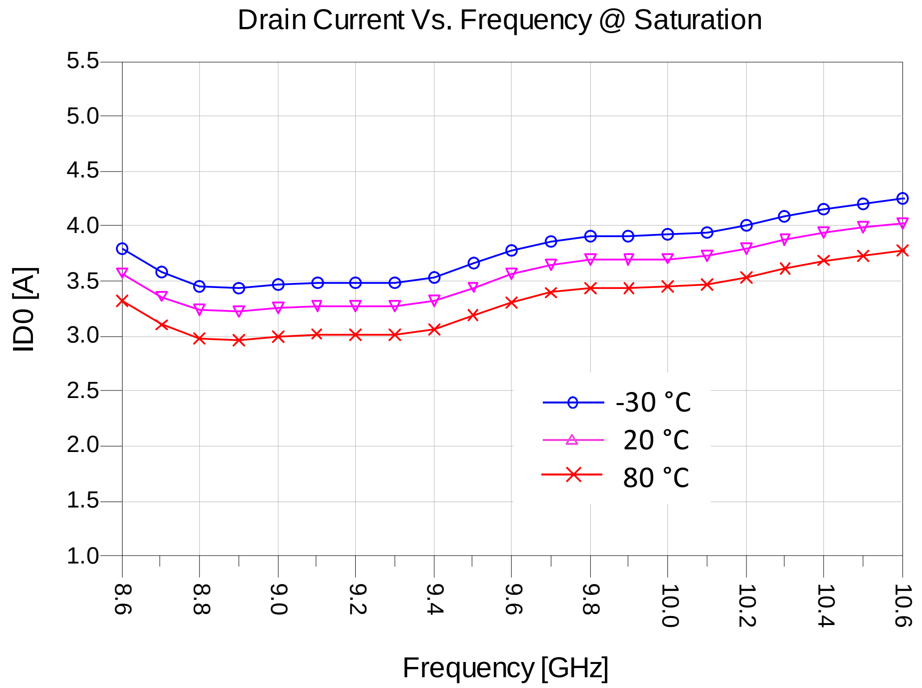
Measured Performances Vs. Frequency @ Temperature [-30, 20, 80]°C





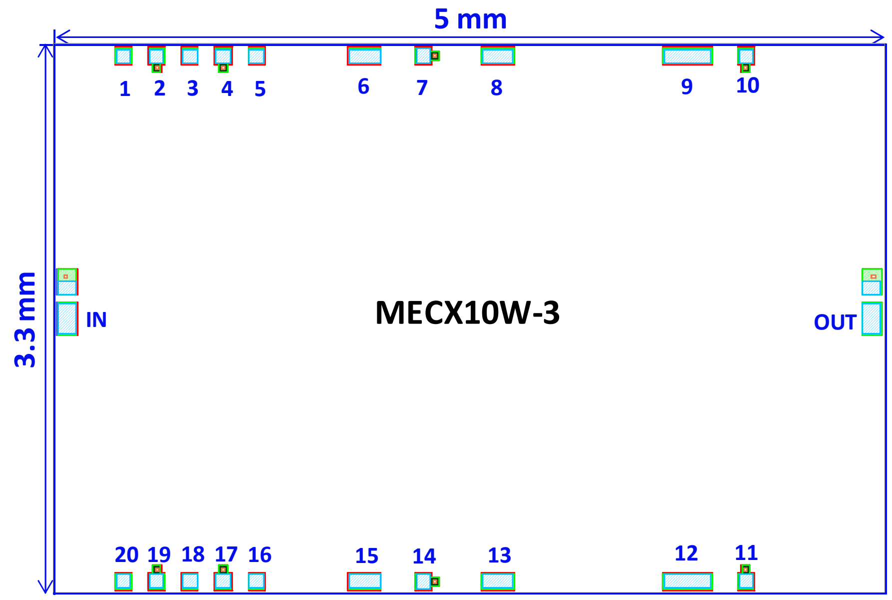


Linear Gain Vs. Frequency
Linear Gain [dB]
Frequency [GHz]
-30 °C
20 °C
80 °C
50
45
40
35
30
25
20
15
10
8.6
8.8
9.0
9.2
9.4
9.6
9.8
10.0
10.2
10.4
10.6



Drain Current Vs. Frequency @ Saturation
ID0 [A]
Frequency [GHz]
-30 °C
20 °C
80 °C
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
8.6
8.8
9.0
9.2
9.4
9.6
9.8
10.0
10.2
10.4
10.6

Bond Pad Configuration



- A tolerance of ± 35µm has to be considered for chip dimensions
- Chip Thickness is 70 µm ± 10 µm
- RF Pads [IN, OUT] = 118µm x 196µm
- DC Pads [1, 2, 3, 4, 5, 7, 10, 11, 14, 16, 17, 18, 19, 20] = 100µm x 100µm
- DC Pads [6, 8, 13, 15] = 200µm x 100µm
- DC Pads [9, 12] = 300µm x 100µm

Bond Pad #	Symbol	Description
IN	RFin	Input RF Port
OUT	RFout	Output RF Port
1, 3, 5, 16, 18, 20	Vg	Gate Negative Supply Voltage
6, 8, 9, 12, 13, 15	Vd	Drain Positive Supply Voltage
2, 4, 7, 10, 11, 14, 17, 19	GND	Ground Pads – Not Connected

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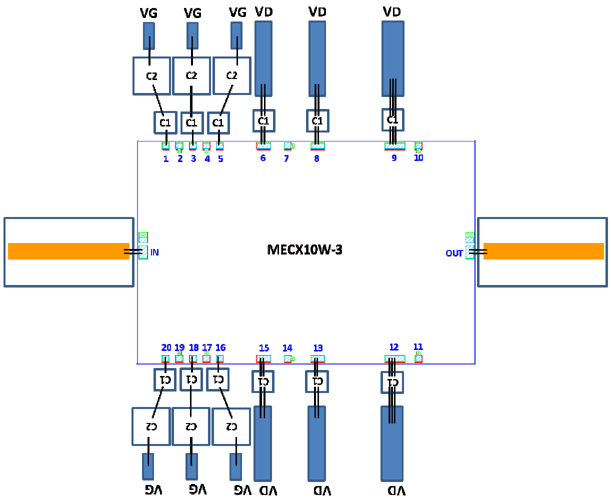
Assembly Recommendations



Bond Pad #	Connection	External Components
IN and OUT	**2** Bonding Wires L_bond = 0.3nH	
1, 3, 5, 16, 18, 20 **Vg**	L_bond ≤ 1 nH	C1 = 100pF/10V C2 = 10nF/10V
6, 8, 13, 15 **Vd**	**2** Bonding Wires L_bond ≤ 1nH	**Pulsed mode** C1 = 100pF/50V
9, 12 **Vd**	**3** Bonding Wires L_bond ≤ 1nH	**CW mode:** C1 = 100pF/50V C2 = 10nF/50V

- Eutectic Die bond using AuSn (80/20) solder is recommended.
- Great care must be used for thermal dimensioning.
- The backside of the die is the Source (ground) contact.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.

Bias Procedure

Bias-Up

1. Vg set to -1.5 V.
2. Vd set to +8 V.
3. Adjust Vg until quiescent Id is 2.5 A (Vg = -0.45 V Typical).
4. Apply RF signal.

Bias-Down

1. Turn off RF signal.
2. Reduce Vg to -1.5 V (Id0 ≈ 0 mA).
3. Set Vd to 0 V.
4. Turn off Vd.
5. Turn off Vg.

Contact Information

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Notice

The furbished information is believed to be reliable. However, performances and specifications contained herein are based on preliminary characterizations and then susceptible to possible variations. On the basis of customer requirements the product can be tested and characterized in specific operating conditions and, if needed, tuned to meet custom specifications.