

CMPA5585030D

30 W, 5.5 - 8.5 GHz, GaN MMIC, Power Amplifier

Description

WolfSpeed's CMPA5585030D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC contains a two-stage reactively matched amplifier design approach enabling very wide bandwidths to be achieved.

Typical Performance Over 5.5 - 8.5 GHz ($T_c = 25^\circ\text{C}$)

Parameter	5.5 GHz	6.5 GHz	7.5 GHz	8.5 GHz	Units
Small Signal Gain	32.5	29.7	30.1	29.5	dB
P_{OUT} @ $P_{IN} = 26$ dBm	61.2	55.1	57.3	53.8	W
Power Gain @ $P_{IN} = 26$ dBm	21.9	21.4	21.6	21.3	dB
PAE @ $P_{IN} = 26$ dBm	44	40	45	44	%

Features

- 30 dB Small Signal Gain
- 50 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation
- Size 0.142 x 0.188 x 0.004 inches

Applications

- Point to Point Radio
- Communications
- Test Instrumentation
- EMC Amplifier Drivers





Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain source Voltage	V_{DSS}	84	V_{DC}	25°C
Gate source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-55, +150	°C	
Operating Junction Temperature	T_J	225		
Thermal Resistance, Junction to Case (packaged) ¹	$R_{\theta JC}$	2.16	°C/W	CW, 85°C @ $P_{DISS} = 66W$
Mounting Temperature (30 seconds)	T_S	320	°C	

Note

¹ Eutectic die attach using 80/20 AuSn mounted to a 40 mil thick CPC carrier

Electrical Characteristics (Frequency = 5.5 GHz to 8.5 GHz unless otherwise stated; $T_C = 25^\circ C$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10 V, I_D = 12.7 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—	V_{DC}	$V_{DD} = 28 V, I_{DQ} = 800 mA$
Saturated Drain Current ¹	I_{DS}	9.2	12.7	—	A	$V_{DS} = 6.0 V, I_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	V_{BD}	84	—	—	V	$V_{GS} = -8 V, I_D = 12.7 mA$
RF Characteristics²						
Small Signal Gain at 5.5 GHz	S21	23.7	32.3	—	dB	$V_{DD} = 28 V, I_{DQ} = 800 mA$
Small Signal Gain at 6.5 GHz		23.1	29.6	—		
Small Signal Gain at 8.5 GHz			29.8	—		
Output Power at 5.5 GHz	P_{OUT}	46.8	58.9	—	W	$V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm$
Output Power at 6.5 GHz		40.7	53.7	—		
Output Power at 8.5 GHz			51.3	—		
Power Added Efficiency at 5.5 GHz	PAE	34	45	—	%	$V_{DD} = 28 V, I_{DQ} = 800 mA, P_{IN} = 26 dBm$
Power Added Efficiency at 6.5 GHz		30	41	—		
Power Added Efficiency at 8.5 GHz		36	39	—		
Power Gain	G_P	—	21.5	—	dB	$V_{DD} = 28 V, I_{DQ} = 800 mA$
Input Return Loss	S11	—	10	—		
Output Return Loss	S22	—	—	—		
Output Mismatch Stress	VSWR	—	—	5:1	Ψ	No damage at all phase angles, $V_{DD} = 28 V, I_{DQ} = 800 mA, P_{OUT} = 25W CW$

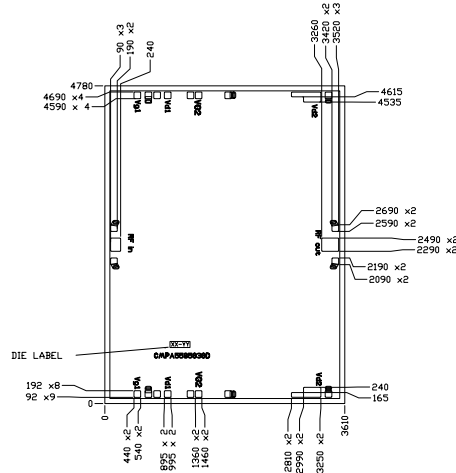
Notes:

¹ Scaled from PCM data

² All data pulse tested on-wafer with Pulse Width = 10μs, Duty Cycle = 0.1%



Die Dimensions (units in microns)



Overall die size 3610 x 4780 (+0/-50) microns, die thickness 100 (+/-10) micron.
 All Gate and Drain pads must be wire bonded for electrical connection.

Pad	Function	Description	Pad Size (microns)	Note
1	RF-IN	RF-Input pad. Matched to 50 ohm.	150x200	3
2	VG1_A	Gate control for stage 1. $V_G \sim 2.0 - 3.5$ V.	100x100	1, 2
3	VG1_B			
4	VD1_A	Drain supply for stage 1. $V_D = 28$ V.		1
5	VD1_B			
6	VG2_A	Gate control for stage 2A. $V_G \sim 2.0 - 3.5$ V.	1, 3	
7	VG2_B			
8	VD2_A	Drain supply for stage 2A. $V_D = 28$ V.	—	1
9	VD2_B	Drain supply for stage 2B. $V_D = 28$ V.	—	
10	RF-Out	RF-Output pad. Matched to 50 ohm.	250x200	3

Notes:

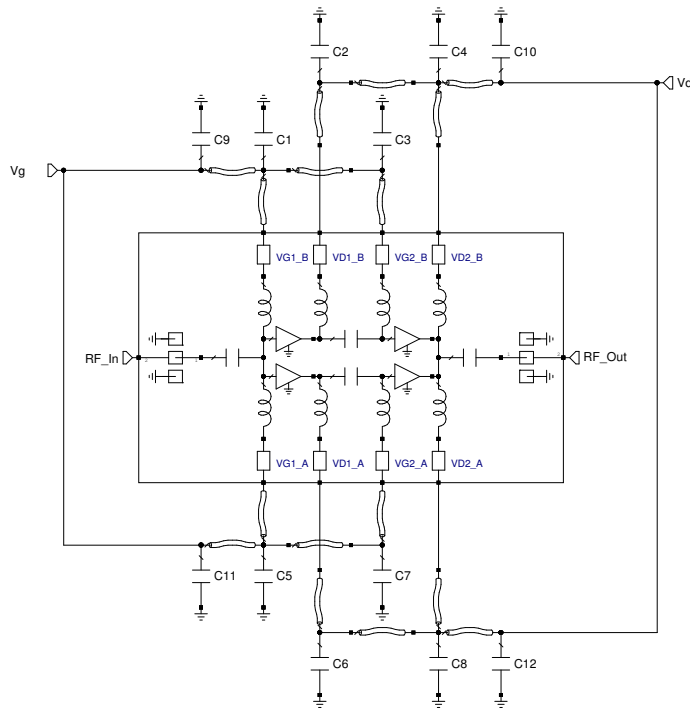
- ¹ Attach bypass capacitor to pads 2-9 per application circuit
- ² VG1_A and VG1_B are connected internally so it would be enough to connect either one for proper operation
- ³ VG2_A and VG2_B are connected internally so it would be enough to connect either one for proper operation
- ⁴ The RF Input and Output pad have a ground-signal-ground with a nominal pitch of 10 mil (250µm). The RF ground pads are 100 x 100 microns

Die Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Wolfspeed’s website for the Eutectic Die Bond Procedure application note at <https://www.wolfspeed.com/rf/document-library>
- Vacuum collet is the preferred method of pick-up
- The backside of the die is the Source (ground) contact
- Die back side gold plating is 5 microns thick minimum
- Thermosonic ball or wedge bonding are the preferred connection methods
- Gold wire must be used for connections
- Use the die label (XX-YY) for correct orientation



Block Diagram Showing Additional Capacitors for Operation Over 5.5 to 8.5 GHz



Designator	Description	Qty
C1,C2,C3,C4,C5,C6,C7,C8	CAP, 51pF, +/-10%, SINGLE LAYER, 0.035", Er 3300, 100V, Ni/Au TERMINATION	8
C9,C10,C11,C12	CAP, 680pF, +/-10%, SINGLE LAYER, 0.070", Er 3300, 100V, Ni/Au TERMINATION	4

Notes:
¹ The input, output and decoupling capacitors should be attached as close as possible to the die- typical distance is 5 to 10 mils with a maximum of 15 mils.
² The MMIC die and capacitors should be connected with 2 mil gold bond wires.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C



Typical Performance of the CPA5585030D

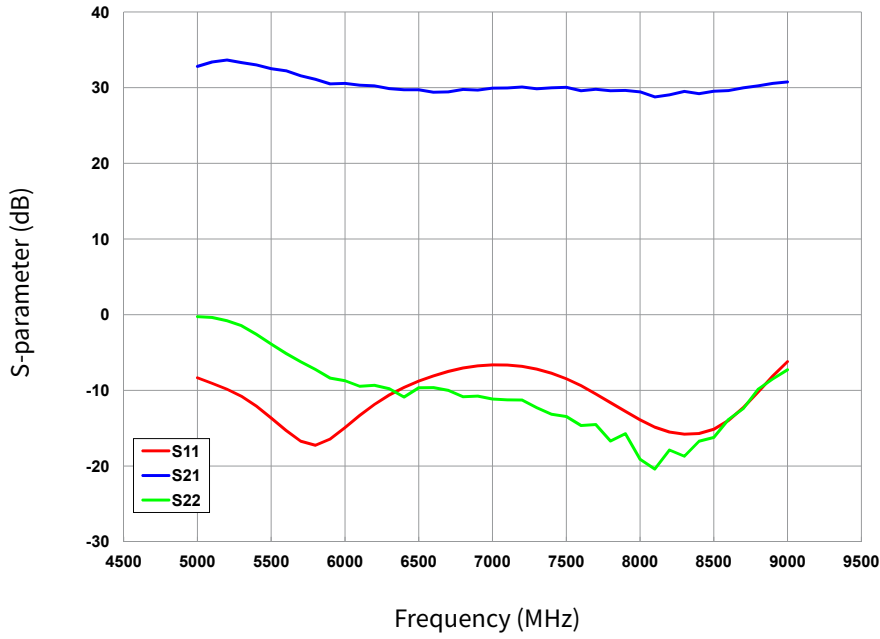


Figure 1. Typical S-Parameters
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.8\text{ A}$

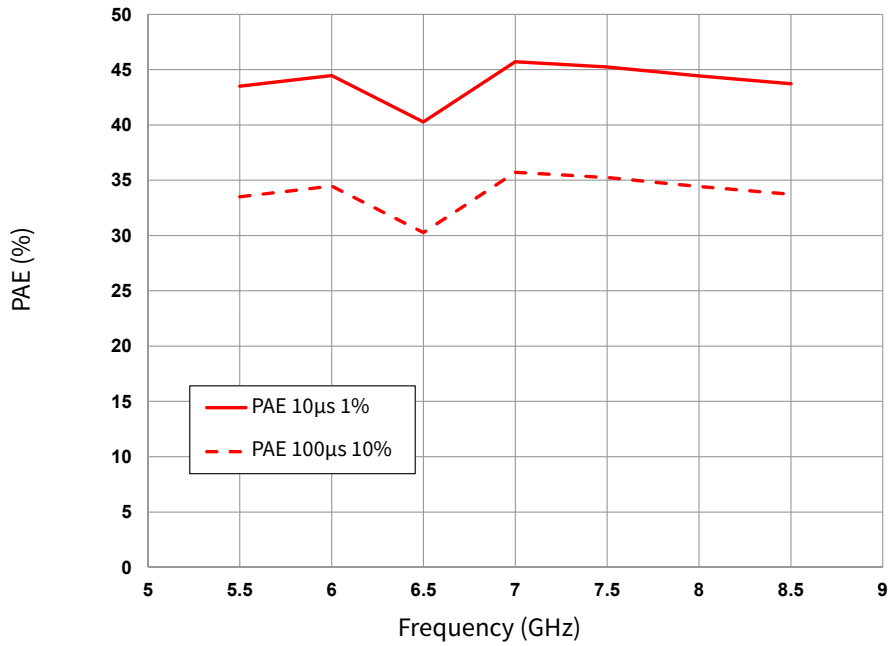


Figure 2. Frequency & PAE
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.8\text{ A}$



Typical Performance of the CPMA5585030D

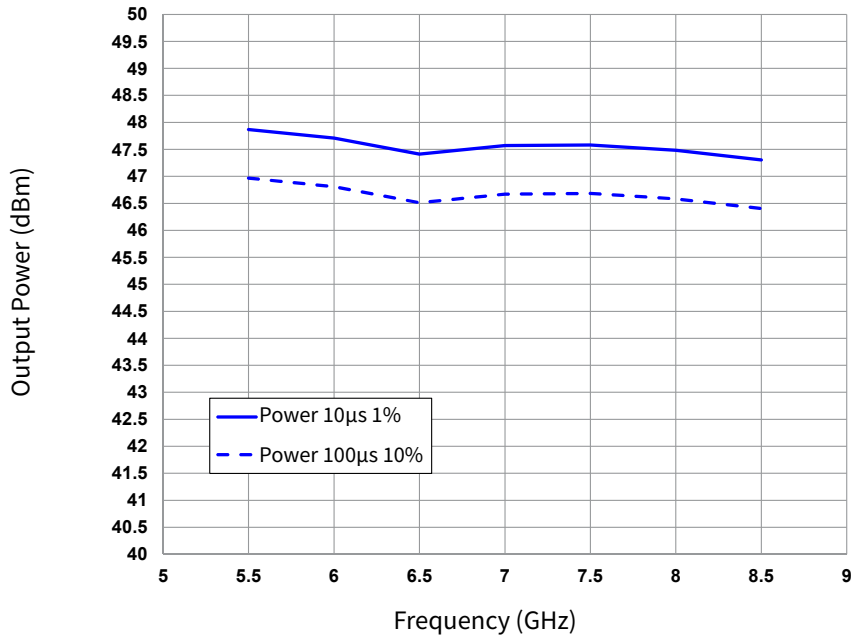


Figure 3. Output Power @ $P_{IN} = 26$ dBm vs Frequency
 $V_{DD} = 28$ V, $I_{DQ} = 0.8$ A

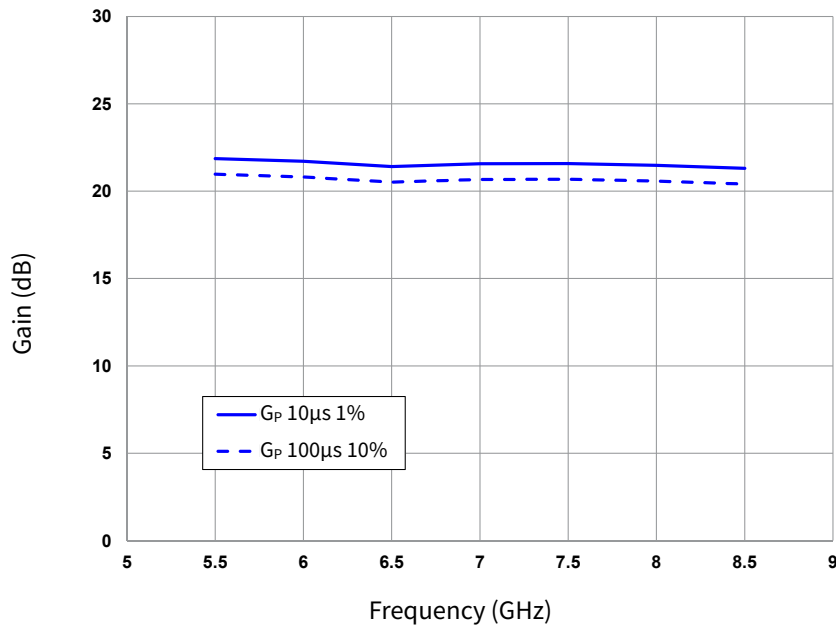


Figure 4. Power Gain @ $P_{IN} = 26$ dBm vs Frequency
 $V_{DD} = 28$ V, $I_{DQ} = 0.8$ A



Part Number System

CPMA5585030D

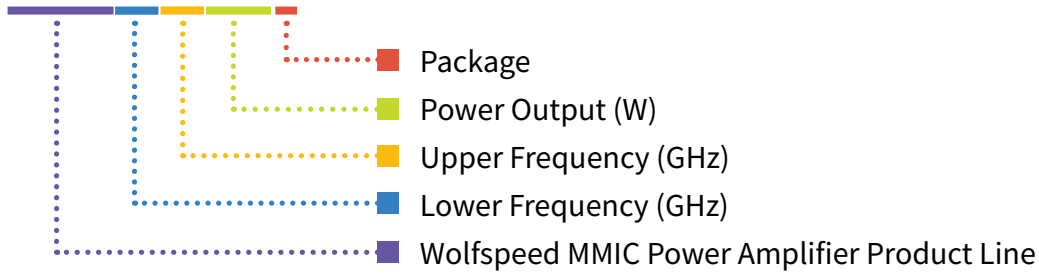


Table 1.

Parameter	Value	Units
Lower Frequency	5.5	GHz
Upper Frequency ¹	8.5	
Power Output	30	W
Package	Bare Die	—

Note:
¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

**Product Ordering Information**

Order Number	Description	Unit of Measure
CMPA5585030D	GaN HEMT	Each

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