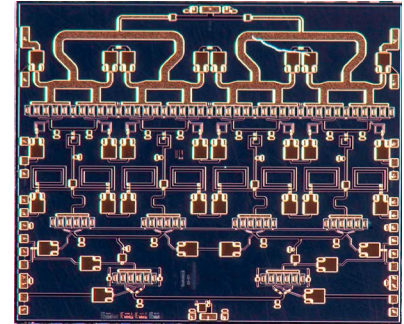


CMPA1D1E030D

30 W, 13.75 - 14.5 GHz, 40 V GaN MMIC,
Power Amplifier

Description

The CMPA1D1E030D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC) on a Silicon Carbide substrate, using a 0.25 μm gate length fabrication process. GaN-on-SiC has superior properties compared to silicon, gallium arsenide or GaN-on-Si, 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, GaAs, and GaN-on-Si transistors.



PN: CMPA1D1E030D

Typical Performance Over 13.75-14.5 GHz ($T_c = 25^\circ\text{C}$)

Parameter	13.75 GHz	14.0 GHz	14.5 GHz	Units
Small Signal Gain	27	26	25	dB
P_{SAT} @ $P_{\text{IN}} = 26 \text{ dBm}$	33	34	30	W
$P_{3\text{dB}}$ Backoff @ $P_{\text{IN}} = 20 \text{ dBm}$	20	20	16	W
PAE @ $P_{\text{IN}} = 26 \text{ dBm}$	24	23	22	%
PAE @ $P_{\text{IN}} = 20 \text{ dBm}$	22	21	20	%

Note: All data in this table is based on fixtured, CW performance

Features

- 27 dB Small Signal Gain
- 30 W Typical P_{SAT}
- Operation up to 40 V
- High Breakdown Voltage
- High Temperature Operation

Applications

- Satellite Communications Uplink



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		
Maximum Forward Gate Current	I _{GMAX}	10	mA	25°C
Maximum Drain Current Stage 1 ¹	I _{DMAX}	0.6	A	
Maximum Drain Current Stage 2 ¹		0.96		
Maximum Drain Current Stage 3 ¹		2.2		
Thermal Resistance, Junction to Case ²	R _{θJC}	1.5	°C/W	85°C, P _{DISS} = 94W
Mounting Temperature (30 seconds)	T _s	320	°C	30 seconds

Notes:

¹ Current limit for long term, reliable operation. Total current when biased from top and bottom drain pads

² Eutectic die attach using 80/20 AuSn solder mounted to a 20 mil thick CuMoCu carrier.

Electrical Characteristics (Frequency = 13.75 GHz to 14.5 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$)

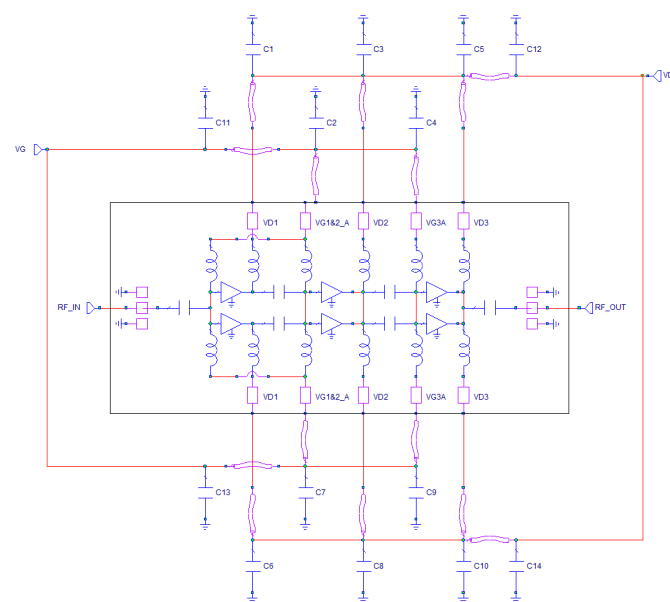
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold	V _{TH}	-3.7	-3.2	-2.8	V	V _{DS} = 10 V, I _D = 18.2 mA
Drain-Source Breakdown Voltage	V _{BD}	84	100	—		V _{GS} = -8 V, I _D = 18.2 mA
RF Characteristics ¹						
Small Signal Gain at 13.75 GHz	S21	20.75	26	—	dB	V _{DD} = 40 V, I _{DQ} = 300 mA, P _{IN} = 10 dBm
Small Signal Gain at 14.5 GHz		19.9	25	—		
Input Return Loss	S11	—	-16	—		V _{DD} = 40 V, I _{DQ} = 300 mA
Output Return Loss	S22	—	-9	—		
Power Output at 13.75 GHz	P _{OUT}	37	42	—	W	V _{DD} = 40 V, I _{DQ} = 300 mA , P _{IN} = 25 dBm
Power Output at 14.5 GHz		35	40	—		
Power Added Efficiency	PAE	—	30	—	%	V _{DD} = 40 V, I _{DQ} = 300 mA, CW, P _{IN} = 24 dBm
		23	25	—		V _{DD} = 40 V, I _{DQ} = 300 mA, P _{IN} = 18 dBm
Power Gain	G _P	—	22	—	dB	V _{DD} = 40 V, I _{DQ} = 300 mA
Output Mismatch Stress	VSWR	—	—	5:1	Ψ	No damage at all phase angles, V _{DS} = 40 V, I _{DQ} = 300 mA, P _{OUT} = 25 W CW

Notes:

¹ All data pulse tested on-wafer with Pulse Width = 3μs from DC pulse

² RF power and DC current measurements are made 6μs from start of RF pulse

Block Diagram Showing Additional Capacitors for Operation Over 13.75 to 14.5 GHz



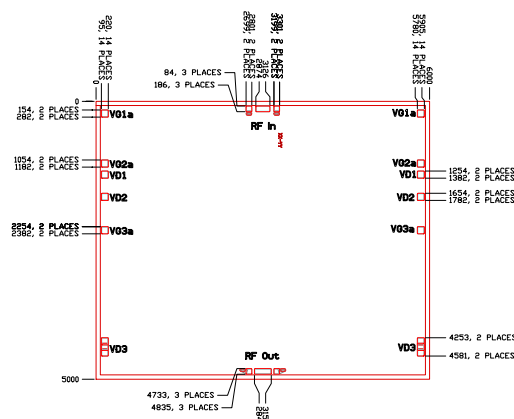
Designator	Description	Qty
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10	CAP, 51pF, +/-10%, SINGLE LAYER, 0.030", Er 3300, 100V, Ni/Au TERMINATION	10
C11, C12, C13, C14	CAP, 680pF, +/-10%, SINGLE LAYER, 0.070", Er 3300, 100V, Ni/Au TERMINATION	4

Note:
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

Die Dimensions (units in microns)



Overall die size 5000 x 6000 (+0/-50) microns, die thickness 100 (+/-10) microns.
All Gate and Drain pads must be wire bonded for electrical connection.

Pad Number	Function	Description	Pad Size (microns)	Note
1	RF_IN	RF-Input pad. Matched to 50 ohm	102x252	5
2	VG1A bottom	Gate control for stage 1. $V_G = -2.0$ to -3.5 V	128x125	1, 2
3	VG1A top			
4	VG2A bottom	Gate control for stage 2. $V_G = -2.0$ to -3.5 V		
5	VG2A top			
6	VD1 bottom	Drain control for stage 1. $V_D = 40$ V		1, 3
7	VD1 top			
8	VD2 bottom	Drain control for stage 2. $V_D = 40$ V		1, 4
9	VD2 top			
10	VG3A bottom	Gate control for stage 3. $V_G = -2.0$ to -3.5 V		1, 2
11	VG3A top			
12	VD3 bottom	Drain control for stage 3. $V_D = 40$ V	328x125	1, 4
13	VD3 top			
14	RF_OUT	RF-Output pad. Matched to 50 ohm	102x302	5

Note:

¹ Attach bypass capacitor to pads 2-13 per applications circuit

² VG1A&2A&3A top and bottom are connected internally, so it would be enough to connect either one for proper operation

³ VD1 top and bottom are not connected internally and have to be biased from both sides for proper operation

⁴ For current handling, it is recommended to bias VD2 and VD3 from both top and bottom sides

⁵ The RF Input and Output pads have a ground-signal-ground with a nominal pitch of 10 mil (250 μ m). The RF ground pads are 102 x 102 microns

Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to the website for the Eutectic Die Bond Procedure application note
- 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

Part Number System

CMPA1D1E030D

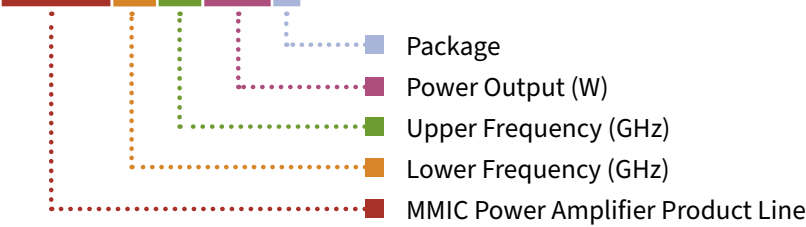


Table 1.

Parameter	Value	Units
Lower Frequency	13.75	GHz
Upper Frequency ¹	14.5	GHz
Power Output	30	W
Package	Bare Die	—

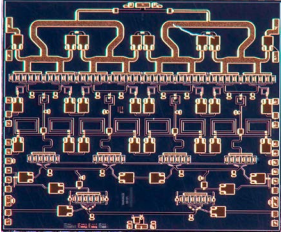
Note:
¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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	Image
CPMA1D1E030D	GaN MMIC, Bare Die	Each	

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