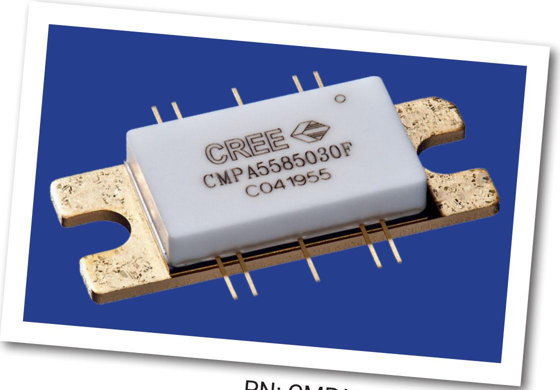
CMPA5585030F

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

Cree's CMPA5585030F 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 is available in a 10 lead metal/ceramic flanged package for optimal electrical and thermal performance.



PN: CMPA5585030F
Package Type: 440213

Typical Performance Over 5.8-8.4 GHz (T_c = 25˚C)

Parameter	5.8 GHz	6.4 GHz	7.2 GHz	7.9 GHz	8.4 GHz	Units
S21[1,2]	25.9	23.8	26.5	24.5	26.7	dB
Power Gain[2,5]	22.3	19.0	20.9	21.6	21.2	dB
PAE[1,2,4,5]	24.7	20.7	20.3	22.6	22.9	%
ACLR[1,2,3,5]	-37	-42	-33	-34	-40	dBC

Notes (unless otherwise specified):
1. At 25˚**C**
2. Measurements are performed using Cree test fixture AD-938516
3. Under OQPSK modulated signal, 1.6 Msps, PN23, Alpha Filter = 0.2
4. Power Added Efficiency = (P_{OUT} - P_{IN}) / PDC
5. Measured at P_{OUT} = 41 dBm

Features

- 25 dB Small Signal Gain
- 30 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation
- Size 1.00 x 0.385 inches

Applications

- Point to Point Radio
- Communications
- Satellite Communication Uplink

Rev 0.1 – August 2017

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	84	V_{DC}	25˚C
Gate-source Voltage	V_{GS}	-10, +2	V_{DC}	25˚C
Power Dissipation	P_{DISS}	55	W	
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	10	mA	25˚C
Soldering Temperature[1]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.38	˚C/W	CW, 85˚C, P_{DISS} = 43 W
Case Operating Temperature	T_C	-40, +150	˚C	

Note:
[1] Refer to the Application Note on soldering at www.cree.com/RF/Document-Library

Electrical Characteristics (Frequency = 5.5 GHz to 8.5 GHz unless otherwise stated; T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	V_{TH}	-3.8	-2.8	-2.3	V	V_{DS} = 10 V, I_{DS} = 20.6 mA
Saturated Drain Current	I_{DS}	16.4	18.6	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V	V_{GS} = -8 V, I_{DS} = 20.6 mA
RF Characteristics[3]						
Small Signal Gain	S21	–	26	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{IN} = -20 dBm
Input Return Loss	S11	–	-7	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{IN} = -20 dBm
Output Return Loss	S22	–	-7	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{IN} = -20 dBm
Output Mismatch Stress	VSWR	–	–	5:1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 43 dBm

Notes:
[1] Measured on-wafer prior to packaging.
[2] Scaled from PCM data.
[3] Measured in the CMPA5585030F-AMP

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Electrical Characteristics Continued... (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[1,2,3,4]						
Power Added Efficiency, 5.8 GHz	PAE1	–	24.8	–	%	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Added Efficiency, 6.4 GHz	PAE2	–	22.4	–	%	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Added Efficiency, 7.2 GHz	PAE3	–	22.0	–	%	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Added Efficiency, 7.9 GHz	PAE4	–	23.9	–	%	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Added Efficiency, 8.4 GHz	PAE5	–	21.8	–	%	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Gain, 5.8 GHz	G_{P1}	–	22.4	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Gain, 6.4 GHz	G_{P2}	–	20.2	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Gain, 7.2 GHz	G_{P3}	–	21.0	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Gain, 7.9 GHz	G_{P4}	–	22.2	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
Power Gain, 8.4 GHz	G_{P5}	–	21.8	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
OQPSK Linearity, 5.8 GHz	ACLR1	–	-42	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
OQPSK Linearity, 6.4 GHz	ACLR2	–	-44	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
OQPSK Linearity, 7.2 GHz	ACLR3	–	-34	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
OQPSK Linearity, 7.9 GHz	ACLR4	–	-37	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm
OQPSK Linearity, 8.4 GHz	ACLR5	–	-40	–	dB	V_{DD} = 28 V, I_{DQ} = 285 mA, P_{OUT} = 41 dBm

Notes:

[1] At 25°C

[2] Measurements are to be performed using Cree

[3] Measured using network analyzer

[4] Under OQPSK modulated signal, 1.6 Msps, PN23

[5] Power Added Efficiency = (P_{OUT} - P_{IN})/PDC

[4] Fixture loss de-embedded using the following offset:

a. 5.8 GHz
b. 7.2 GHz
c. 7.9 GHz
d. 8.4 GHz

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical Performance of the CMPA5585030F

Figure 1. - Gain vs. Frequency & Output Power OQPSK 1.6 Msps
V_{DD} = 28 V, I_{DQ} = 285 mA

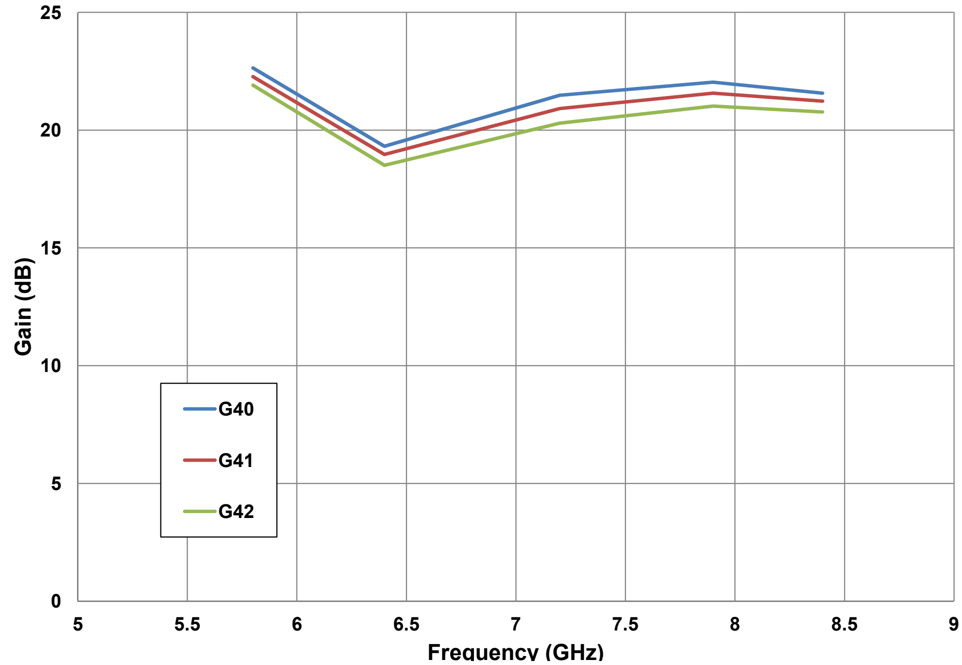
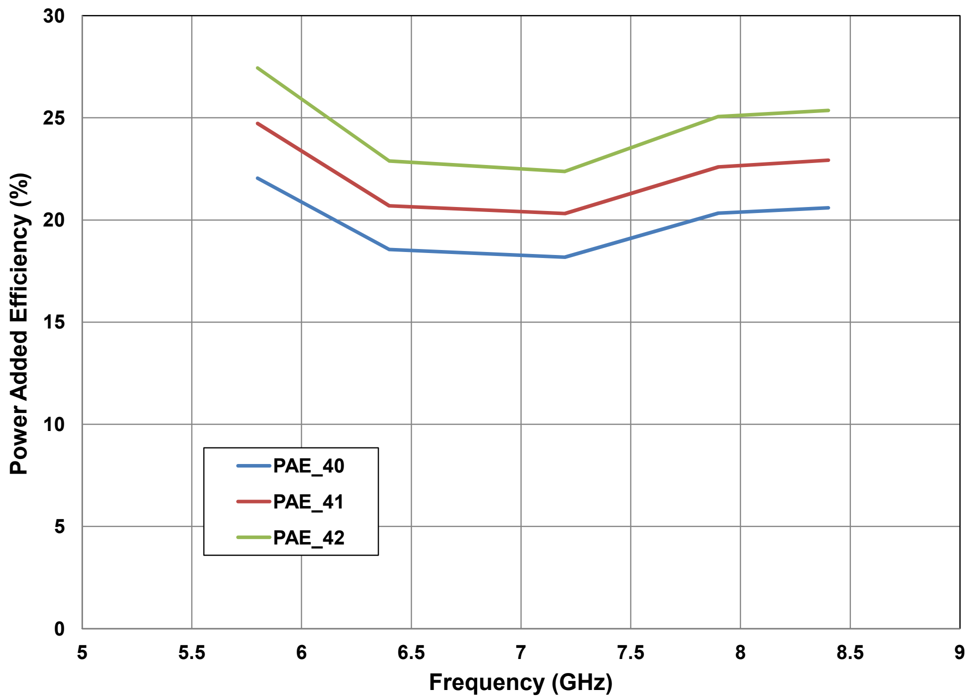


Figure 2. - Power Added Efficiency vs. Frequency & Output Power OQPSK 1.6 Msps
V_{DD} = 28 V, I_{DQ} = 285 mA



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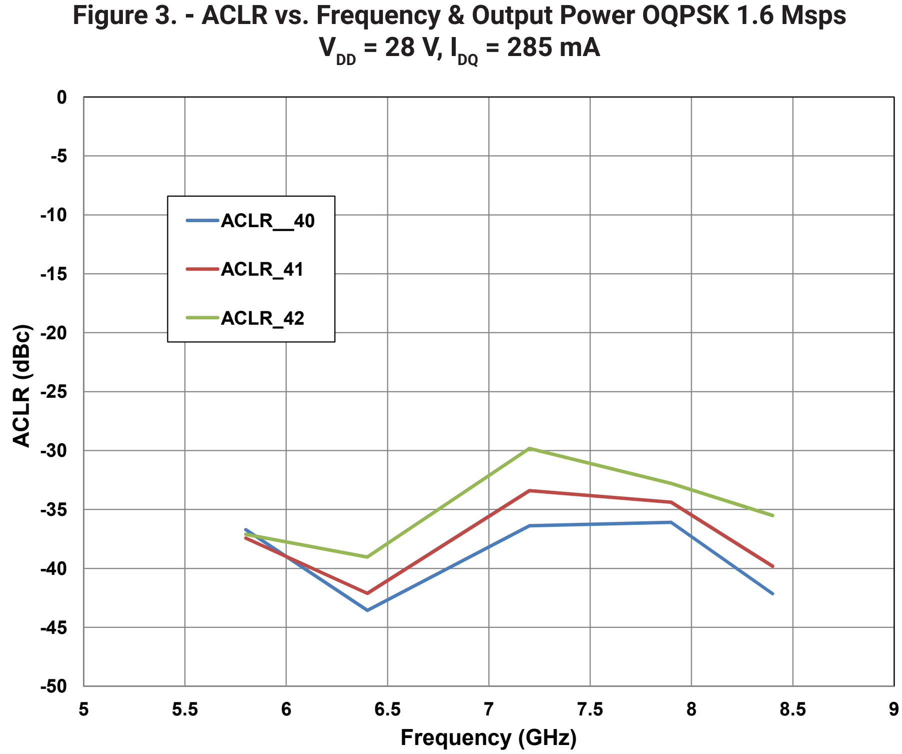
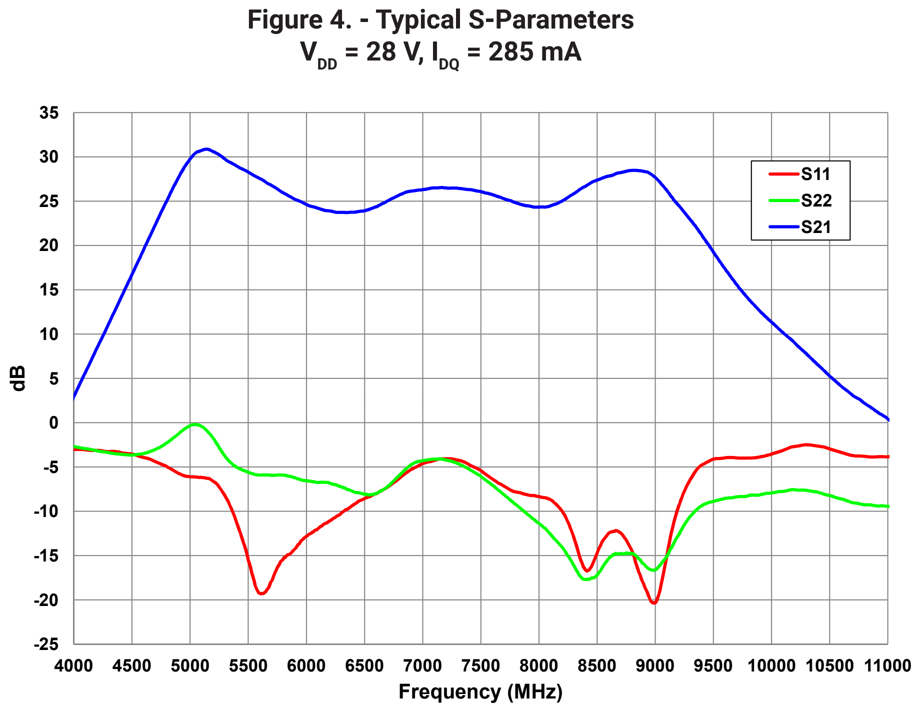
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf





Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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Typical Performance of the CMPA5585030F

Figure 5. - Gain vs. Output Power and Frequency OQPSK 1.6 Msps
V_{DD} = 28 V, I_{DQ} = 285 mA

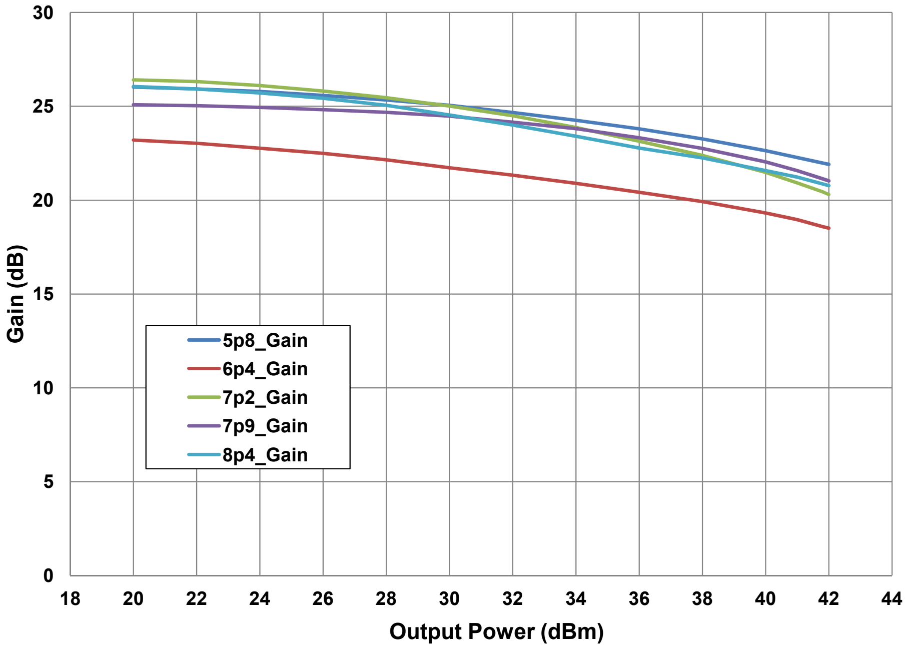
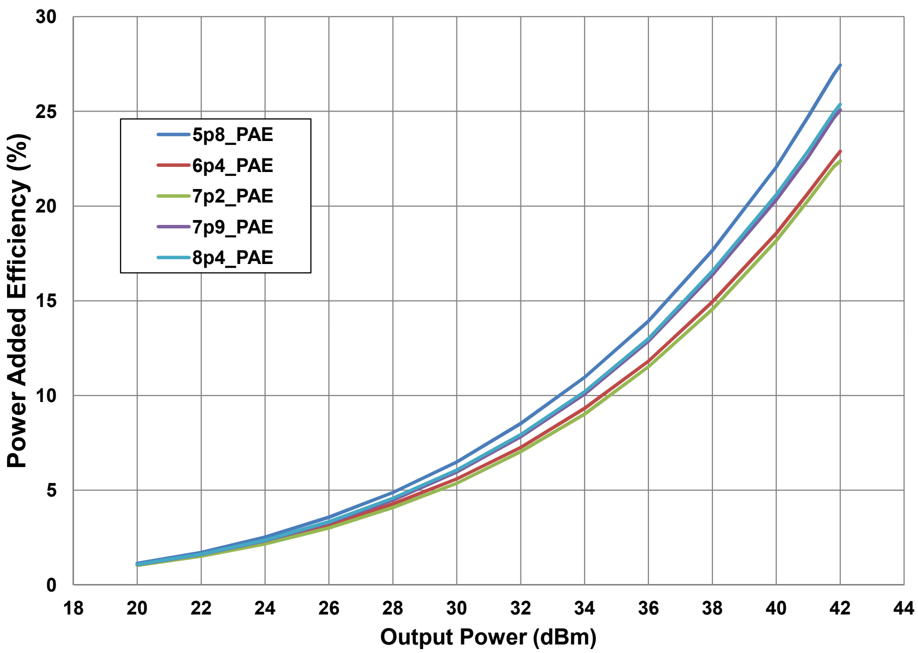


Figure 6. - Power Added Efficiency vs. Output Power and Frequency OQPSK 1.6 Msps
V_{DD} = 28 V, I_{DQ} = 285 mA



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4600 Silicon Drive
Durham, North Carolina, USA 27703
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Figure 7. -ACLR vs. Output Power and Frequency OQPSK 1.6 Msps
V_{DD} = 28 V, I_{DQ} = 285 mA

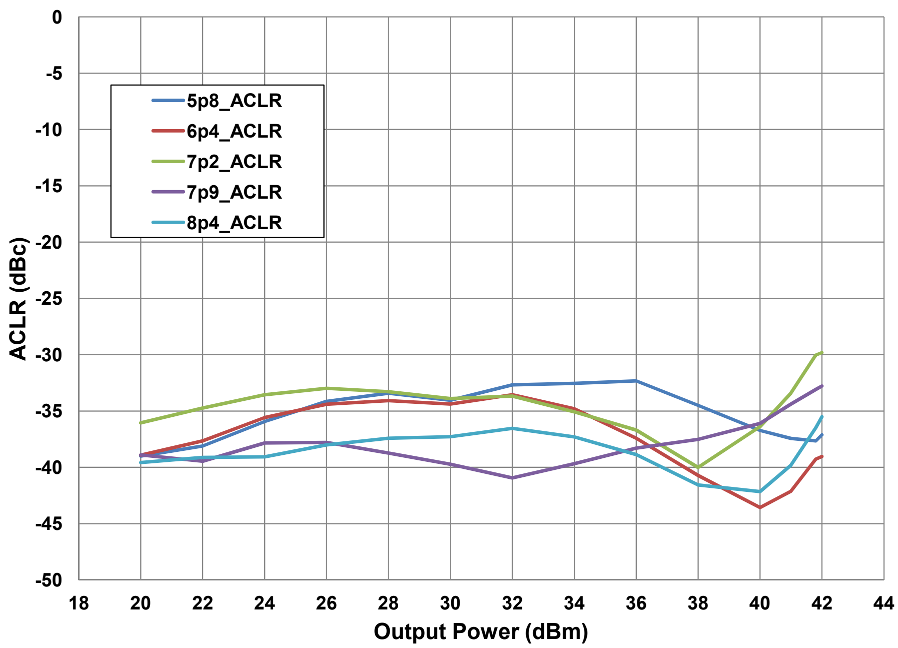
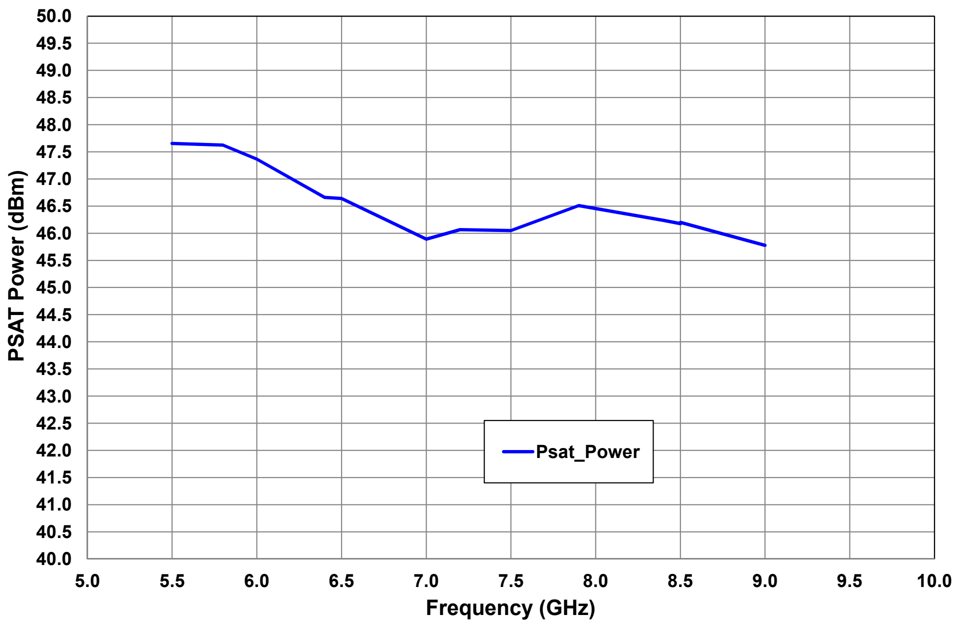


Figure 8. - PSAT Power vs. Frequency
V_{DD} = 28 V, I_{DQ} = 800 mA Pulsed 100 µs/10%



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4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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Figure 9. - PAE @PSAT vs. Frequency
V_{DD} = 28 V, I_{DQ} = 800 mA Pulsed 100 µs/10%

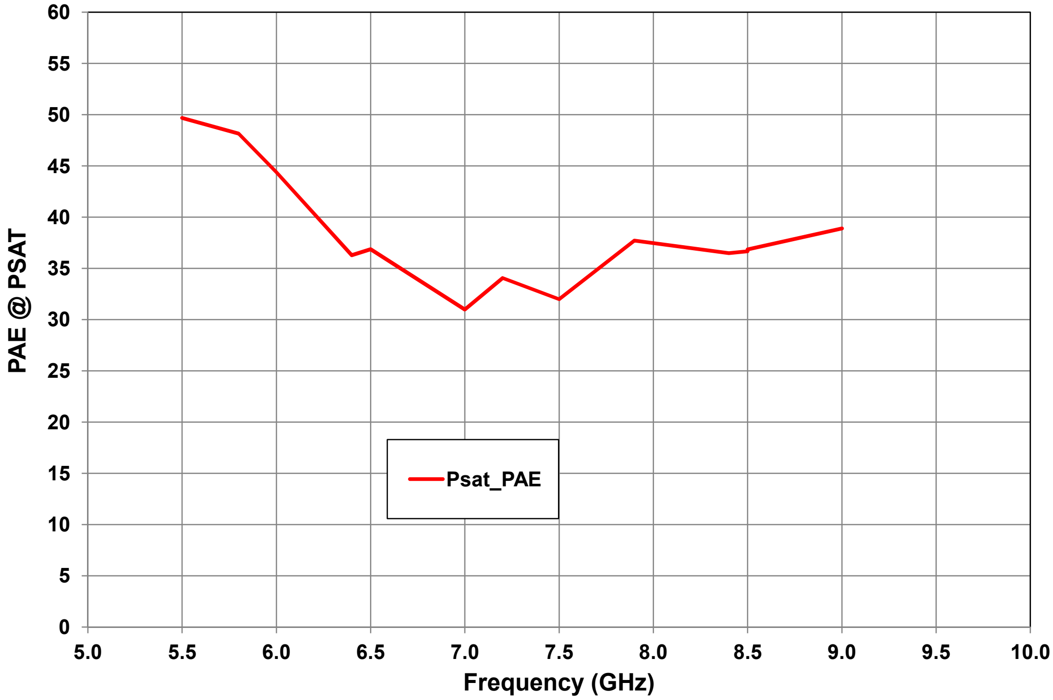
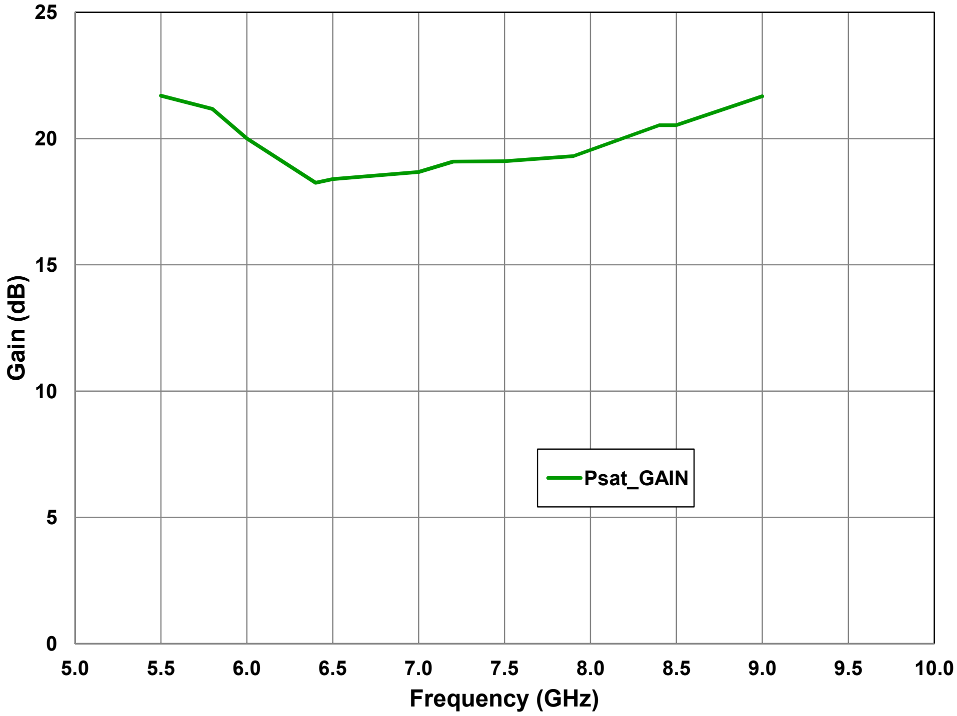


Figure 10. - Gain @PSAT vs. Frequency
V_{DD} = 28 V, I_{DQ} = 800 mA Pulsed 100 µs/10%



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4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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Figure 11. PAE vs. Output Power and Frequency
V_{DD} = 28 V, I_{DQ} = 800 mA Pulsed 100 µs/10%

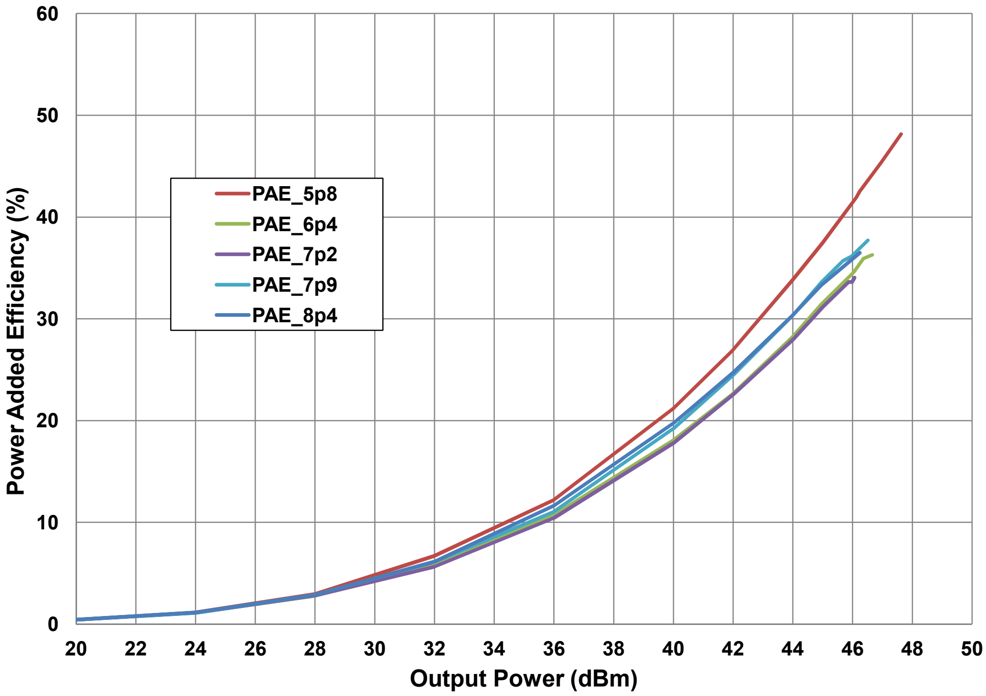
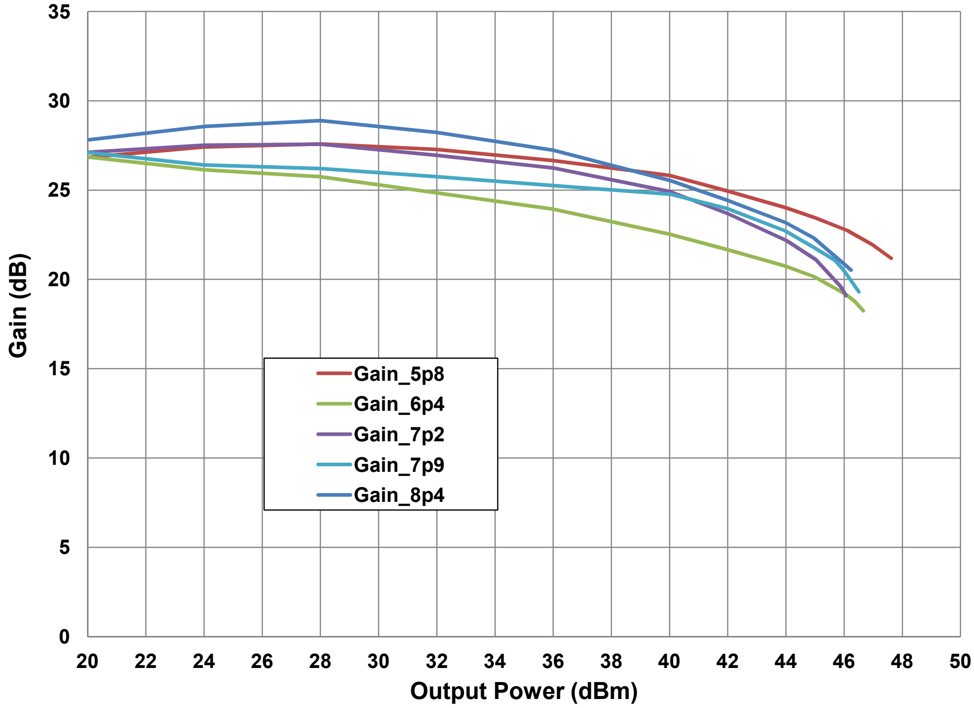


Figure 12. Gain vs. Output Power and Frequency
V_{DD} = 28 V, I_{DQ} = 800 mA Pulsed 100 µs/10%



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4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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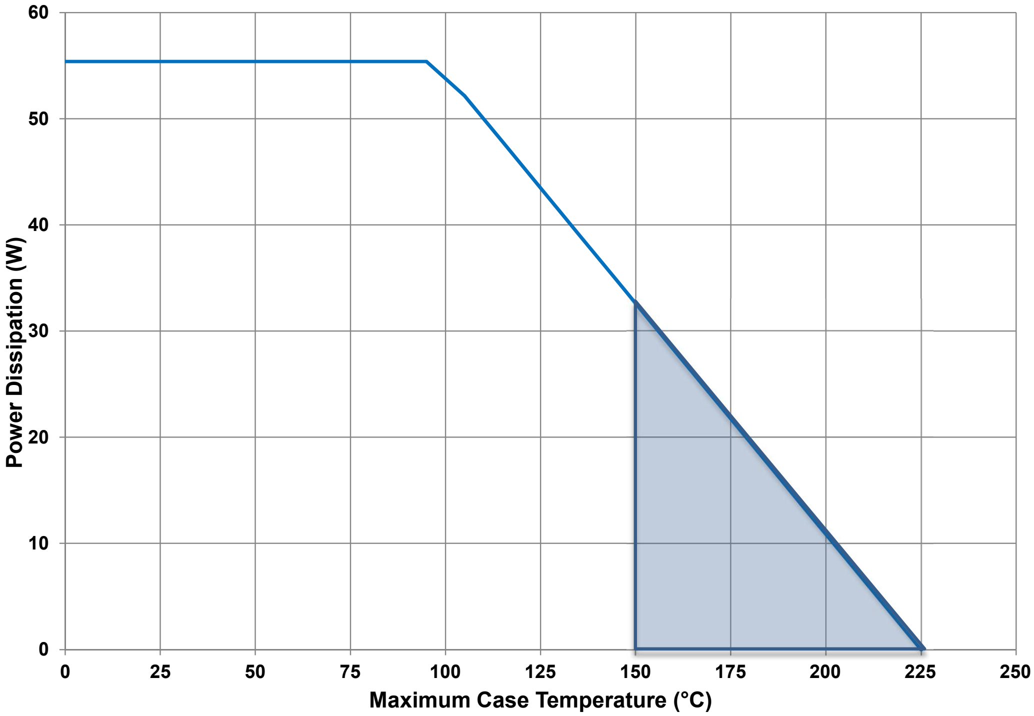
CMPA5585030F Power Dissipation De-rating Curve



Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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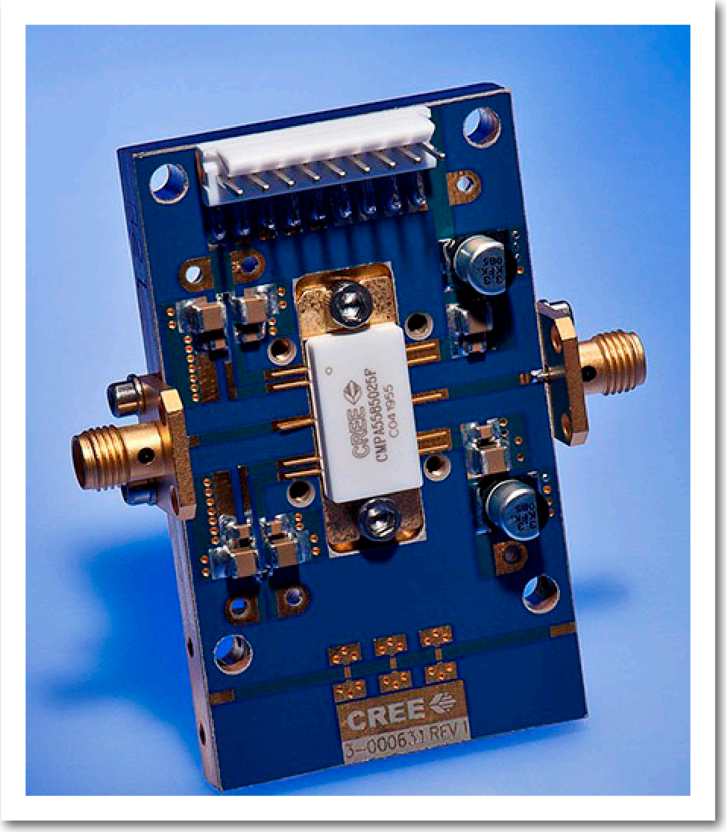
CMPA5585030F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C1, C3, C7, C8, C10, C13	CAP, 1.0 uF, +/-10%, 1210, 100V, X7R	6
C2, C4, C5, C6, C9, C12	CAP, 33000 pF, 0805, 100V, X7R	6
C11, C14	CAP ELECT 3.3UF 80V FK SMD	2
R1, R2	RES 0.0 OHM 1/16W 0402 SMD	2
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	CONNECTOR, HEADER, RT>PLZ .1CEN LK 9POS	1
-	PCB, TACONIC, RF-35P-0200-CL1/CL1	1
Q1	CMPA5585030F	1

CMPA5585030F-AMP Demonstration Amplifier Circuit



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
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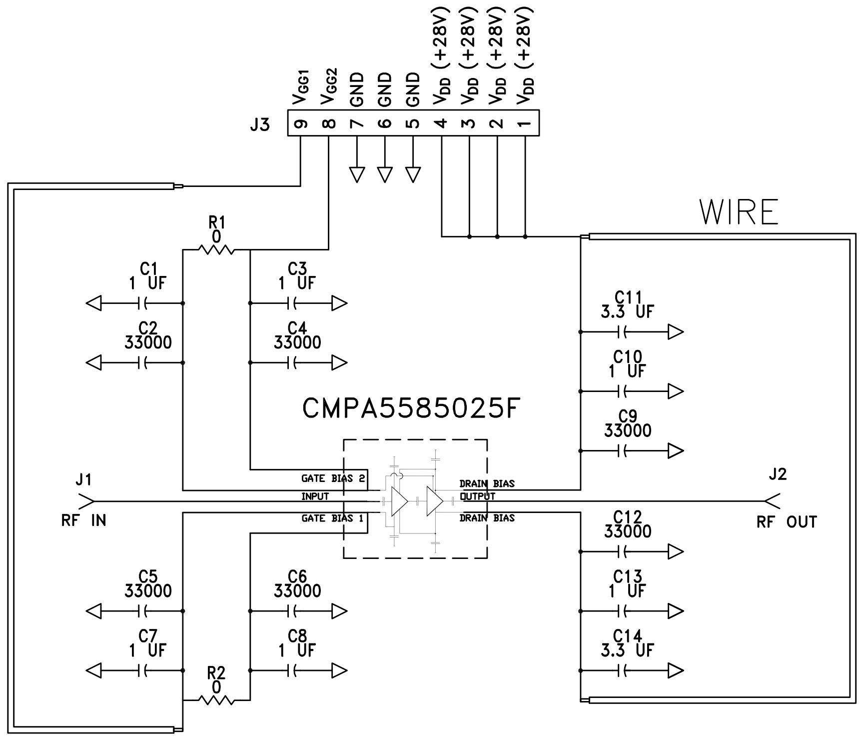
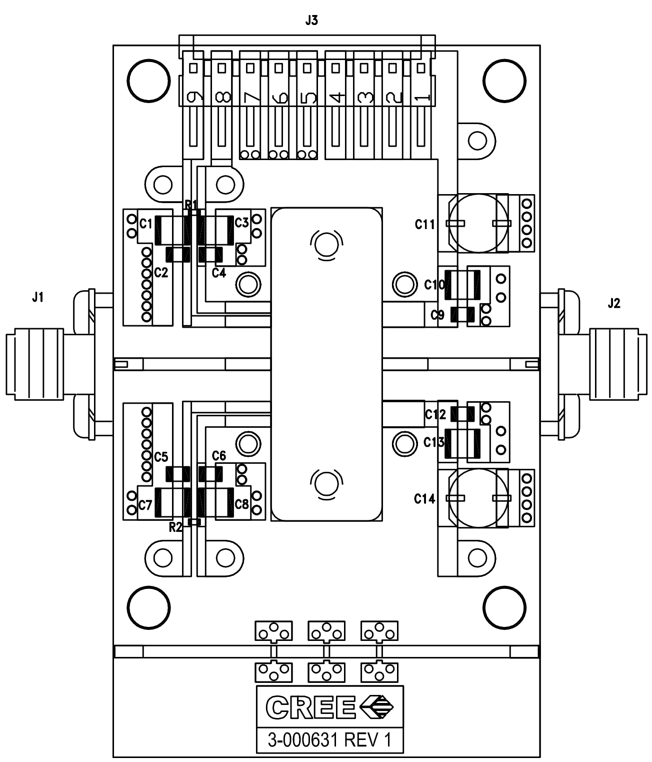


CMPA5585030F-AMP Demonstration Amplifier Circuit Outline



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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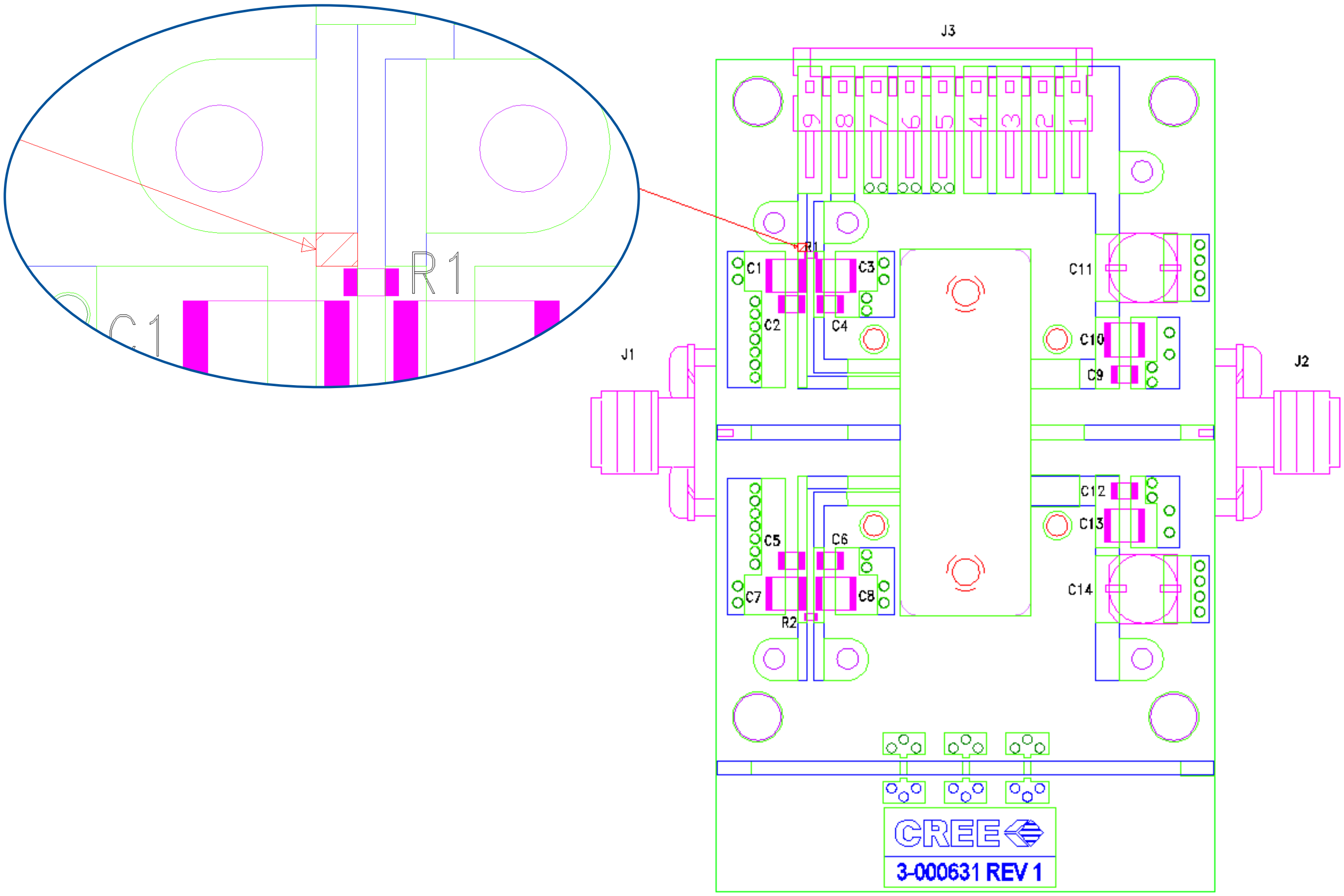
To configure the CMPA5585030F test fixture to enable independent V_{G1} / V_{G2} control of the device, a cut must be made to the microstrip line just above the R1 resistor as shown. Pin 9 will then supply V_{G1} and Pin 8 will supply V_{G2}.



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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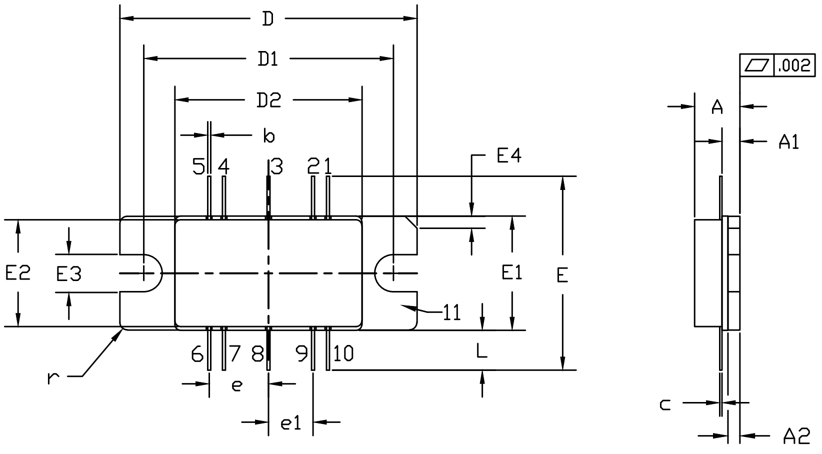
Product Dimensions CMPA5585030F (Package Type — 440213)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.

2. CONTROLLING DIMENSION: INCH.

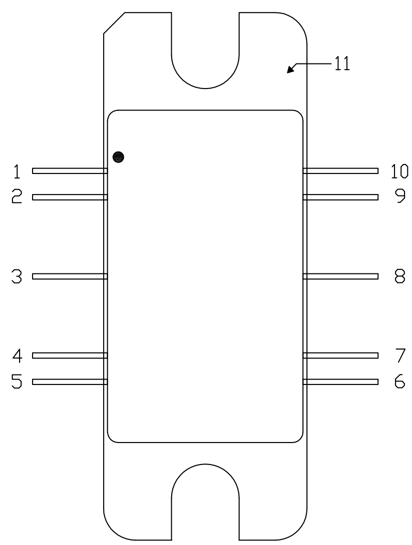
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

	INCHES		MILLIMETERS		NOTES
DIM	MIN	MAX	MIN	MAX	
A	0.148	0.168	3.76	4.27	
A1	0.055	0.065	1.40	1.65	
A2	0.035	0.045	0.89	1.14	
b	0.01 TYP		0.254 TYP		10x
c	0.007	0.009	0.18	0.23	
D	0.995	1.005	25.27	25.53	
D1	0.835	0.845	21.21	21.46	
D2	0.623	0.637	15.82	16.18	
E	0.653 TYP		16.59 TYP		
E1	0.380	0.390	9.65	9.91	
E2	0.355	0.365	9.02	9.27	
E3	0.120	0.130	3.05	3.30	
E4	0.035	0.045	0.89	1.14	45° CHAMFER
e	0.200 TYP		5.08 TYP		4x
e1	0.150 TYP		3.81 TYP		4x
L	0.115	0.155	2.92	3.94	10x
r	0.025 TYP		.635 TYP		3x

PIN 1: GATE BIAS
2: GATE BIAS
3: RF IN
4: GATE BIAS
5: GATE BIAS
6: DRAIN BIAS
7: DRAIN BIAS
8: RF OUT
9: DRAIN BIAS
10: DRAIN BIAS
11: SOURCE

Pin Number	Qty
1	Gate Bias for Stage 2
2	Gate Bias for Stage 2
3	RF In
4	Gate Bias for Stage 1
5	Gate Bias for Stage 1
6	Drain Bias
7	Drain Bias
8	RF Out
9	Drain Bias
10	Drain Bias
11	Source



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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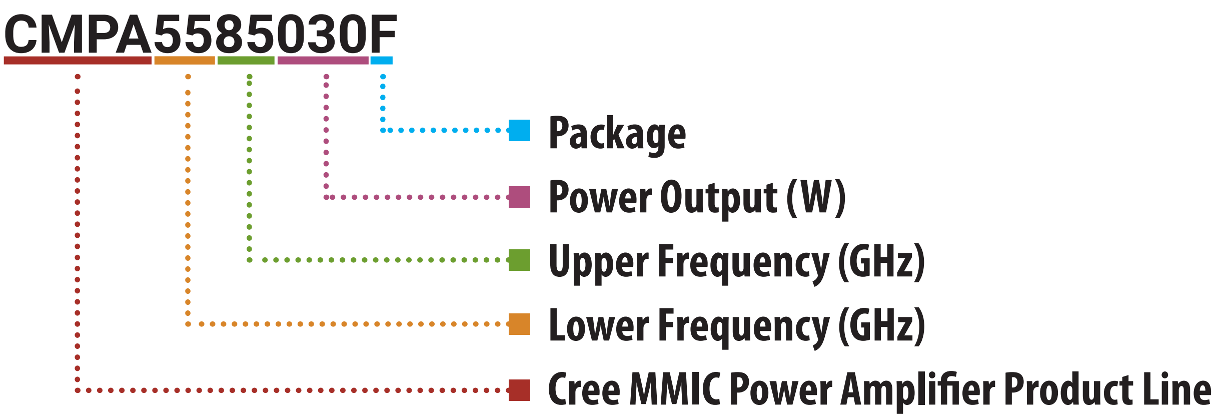
Part Number System



Parameter	Value	Units
Lower Frequency	5.5	GHz
Upper Frequency[1]	8.5	GHz
Power Output	30	W
Package	Flange	-

Table 1.

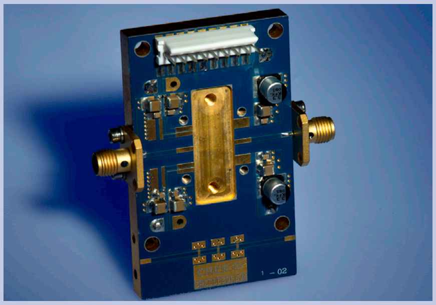
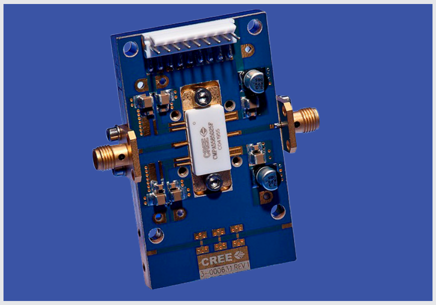
Note[1]: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

Table 2.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA5585030F	GaN MMIC	Each	
CMPA5585030F-TB	Test board without GaN MMIC	Each	
CMPA5585030F-AMP	Test board with GaN MMIC installed	Each	

Cree, Inc.
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USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/RF

Sarah Miller
Marketing
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf