Thermally Enhanced GaN Amplifier
630 W, 48 V, 1930 - 2020 MHz

MACOM PURE CARBIDE™

WGC20630V1A
Rev. V1

Features

- GaN on SiC HEMT Technology
- Pulsed CW Performance: 1995 MHz, 48 V, 10 µs Pulse Width, 10% Duty Cycle, Combined Outputs
- Output Power @ P4dB = 630 W
- Efficiency @ P4dB = 74%
- RoHS* Compliant

Applications

- Cellular Power

Description

The WGC20630 is a 630 W (P4dB) GaN on Silicon Carbide HEMT amplifier designed for use in multi-standard cellular power amplifier applications. It features optimized operation from 1930 - 2020 MHz and a thermally-enhanced over-molded plastic package.

Typical RF Performance[1]

(Tested in Doherty application test circuit)

V_{DD} = 48 V, I_{DQ} = 360 mA, P_{OUT} = 49.3 dBm (85 W), T_A = +25°C, Channel Bandwidth = 3.84 MHz, Peak/Average = 10 dB @ 0.01% CCDF

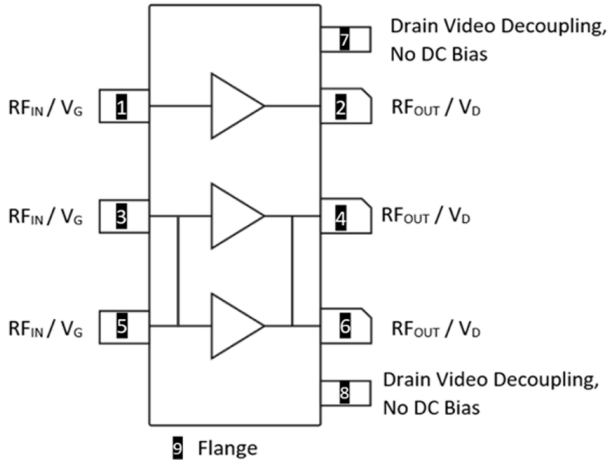
Frequency (MHz)	Gain (dB)	Efficiency (%)	OPAR (dB)	ACPR (dBc)
1930	16.1	56.9	8.5	-30.6
1975	15.9	55.9	8.7	-30.9
2020	15.7	54.7	8.9	-32.1

1. Measurements taken with the device soldered in an application test circuit.

Ordering Information

Part Number	Package
WGC20630V1A-R0	50 piece reel
WGC20630V1A-R2	250 piece reel
LTAWGC20630-E4	Sample Board

Functional Schematic



Pin Configuration[2]

Pin #	Function
1, 3, 5	RF_{IN} / V_G
2, 4, 6	RF_{OUT} / V_D
7, 8	Drain Video Decoupling. No DC Bias
9	Flange

2. Exposed metallization on the back side of the package.

1 * Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Single-Carrier WCDMA Specifications[3]: V_{DD} = 48 V, I_{DQ} = 360 mA, $V_{GS(PEAK)}$ = -5 V, T_C = 25°C, 2020 MHz, 3.84 MHz bandwidth, Peak/Average = 10 dB @ 0.01% CCDF

Parameter	Symbol	Units	Min.	Typ.	Max.
Gain	Gps	dB	13	14.8	—
Drain Efficiency	Eff	%	49	58.7	—
Adjacent Channel Power Ratio	ACPR	dBc	—	-26.5	-21
Output PAR @ 0.01% CCDF	OPAR	dB	6.9	7.8	—

3. Measurements taken in MACOM Production Test Fixture

DC Characteristics

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V Main Peak	mA	—	—	 6.3 12.5
Gate-Source Leakage Current, High Voltage	V_{GS} = -8 V, V_{DS} = 150 V Main Peak	mA	—	—	 -2.75 -8.25
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DD} = 50 V Main Peak	mA	—	—	 -9.4 -18.6
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 36 mA, Main V_{DS} = 10 V, I_D = 72 mA, Peak	V	-3.8	-3.0	-2.3

Recommended Operating Voltages

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain Operating Voltage	—	V	0	—	50
Gate Quiescent Voltage	V_{DS} = 48 V, I_D = 360 mA	V	-3.8	-2.9	-2.3

Absolute Maximum Ratings[4,5,6]

Parameter	Absolute Maximum
Drain Source Voltage	125 V
Gate Source Voltage	-10 V to +2 V
Operating Voltage	55 V
Gate Current Main Peak	 36 mA 72 mA
Drain Current Main Peak	 12.2 A 24.4 A
Junction Temperature	+225°C
Storage Temperature	-65°C to +150°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Product's qualification were performed @ +225°C. Operation @ T_J (+275°C) reduces median time to failure.

Thermal Characteristics

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Thermal Resistance ($R_{\theta JC}$) Main Peak	T_C = +85°C 123 W DC 157 W DC	°C/W	—	 1.1 0.6	—

Bias Sequencing

Bias ON
1. Ensure RF is turned off
2. Apply pinch-off voltage of -5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias OFF
1. Turn RF off
2. Apply pinch-off voltage to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B and CDM Class C3 devices.

Load Pull Performance: Pulsed CW Signal: 10 µs, 10% Duty Cycle

Main Side:

Frequency (MHz)	Z_{SOURCE} (Ω)	Maximum Output Power				
		V_{DS} = 48 V, I_{DQ} = 360 mA, T_C = 25°C, P3dB, Class AB				
		Z_{LOAD} (Ω)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	η_D (%)
1930	6.8 - j13.5	3.3 - j7.0	17.87	55.16	328	69.8
1990	7.8 - j13.0	2.8 - j7.1	17.87	54.57	286	66.5
2020	8.9 - j10.1	3.0 - j7.6	17.55	55.01	317	70.7

Frequency (MHz)	Z_{SOURCE} (Ω)	Maximum Drain Efficiency				
		V_{DS} = 48 V, I_{DQ} = 360 mA, T_C = 25°C, P3dB, Class AB				
		Z_{LOAD} (Ω)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	η_D (%)
1930	6.8 - j13.5	4.6 - j5.4	19.0	54.30	266	77.3
1990	7.8 - j13.0	5.0 - j3.8	19.7	52.10	161	75.1
2020	8.9 - j10.1	3.9 - j3.6	19.2	52.90	193	82.5

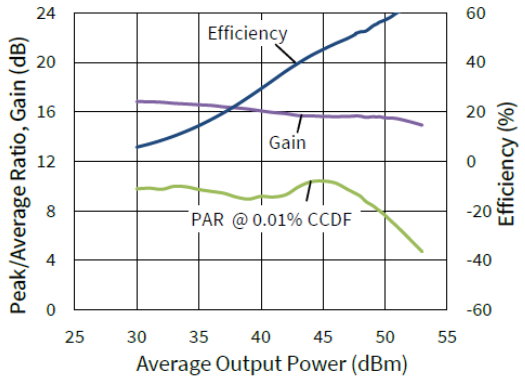
Peak Side:

Frequency (MHz)	Z_{SOURCE} (Ω)	Maximum Output Power				
		V_{DS} = 48 V, $V_{GS(PEAK)}$ = -5 V, T_C = 25°C, P3dB, Class C				
		Z_{LOAD} (Ω)	Gain (dB)	P_{3dB} (dBm)	P_{3dB} (W)	η_D (%)
1930	6.3 - j3.9	1.5 - j3.9	12.4	57.90	612	66.8
1990	7.6 - j1.8	1.8 - j4.4	13.0	58.20	656	67.3
2020	7.4 - j1.0	1.7 - j4.0	13.2	57.70	593	65.8

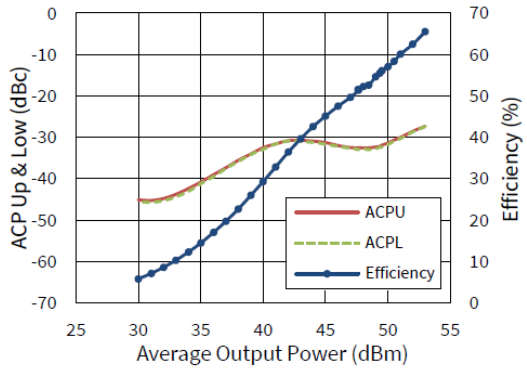
Frequency (MHz)	Z_{SOURCE} (Ω)	Maximum Drain Efficiency				
		V_{DS} = 48 V, $V_{GS(PEAK)}$ = -5 V, T_C = 25°C, P3dB, Class C				
		Z_{LOAD} (Ω)	Gain (dB)	P_{3dB} (dBm)	P_{3dB} (W)	η_D (%)
1930	6.3 - j3.9	2.5 + j1.3	13.1	54.90	311	80.7
1990	7.6 - j1.8	2.5 + j2.3	13.8	56.00	401	81.0
2020	7.4 - j1.0	2.5 + j2.2	14.1	56.10	406	82.7

Typical Performance Curves: Data taken in evaluation board

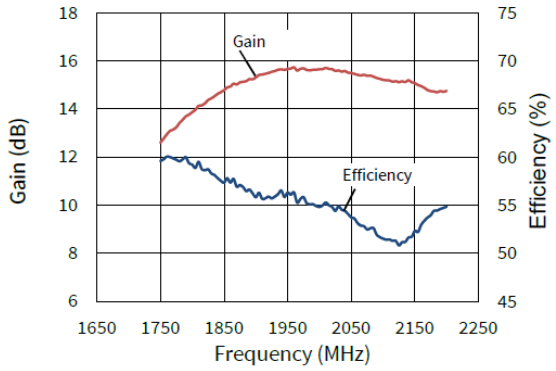
Single-Carrier WCDMA Drive-up @ 2020 MHz



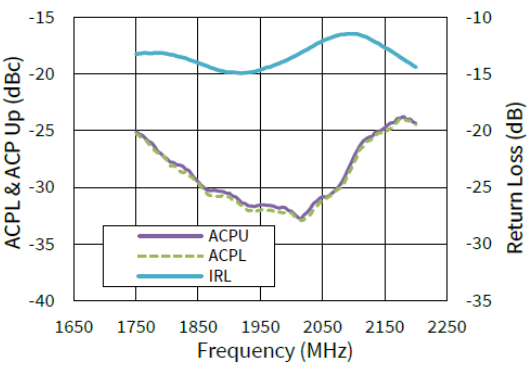
Single-Carrier WCDMA Drive-up @ 2020 MHz



Single-Carrier WCDMA Broadband

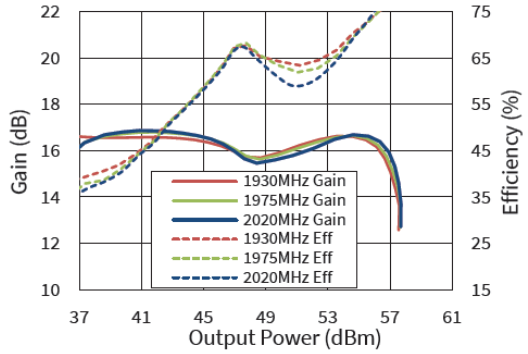


Single-Carrier WCDMA Broadband

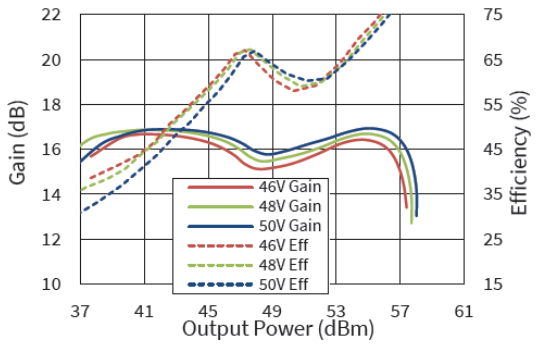


Typical Performance Curves: Data taken in evaluation board

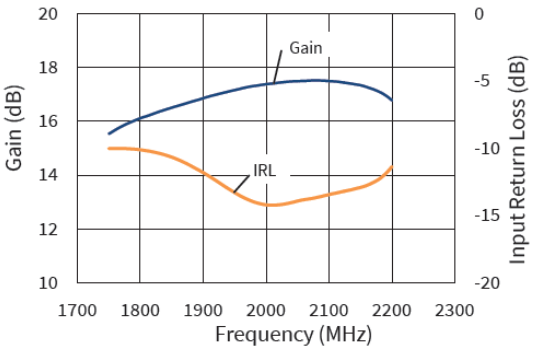
Pulsed CW Performance



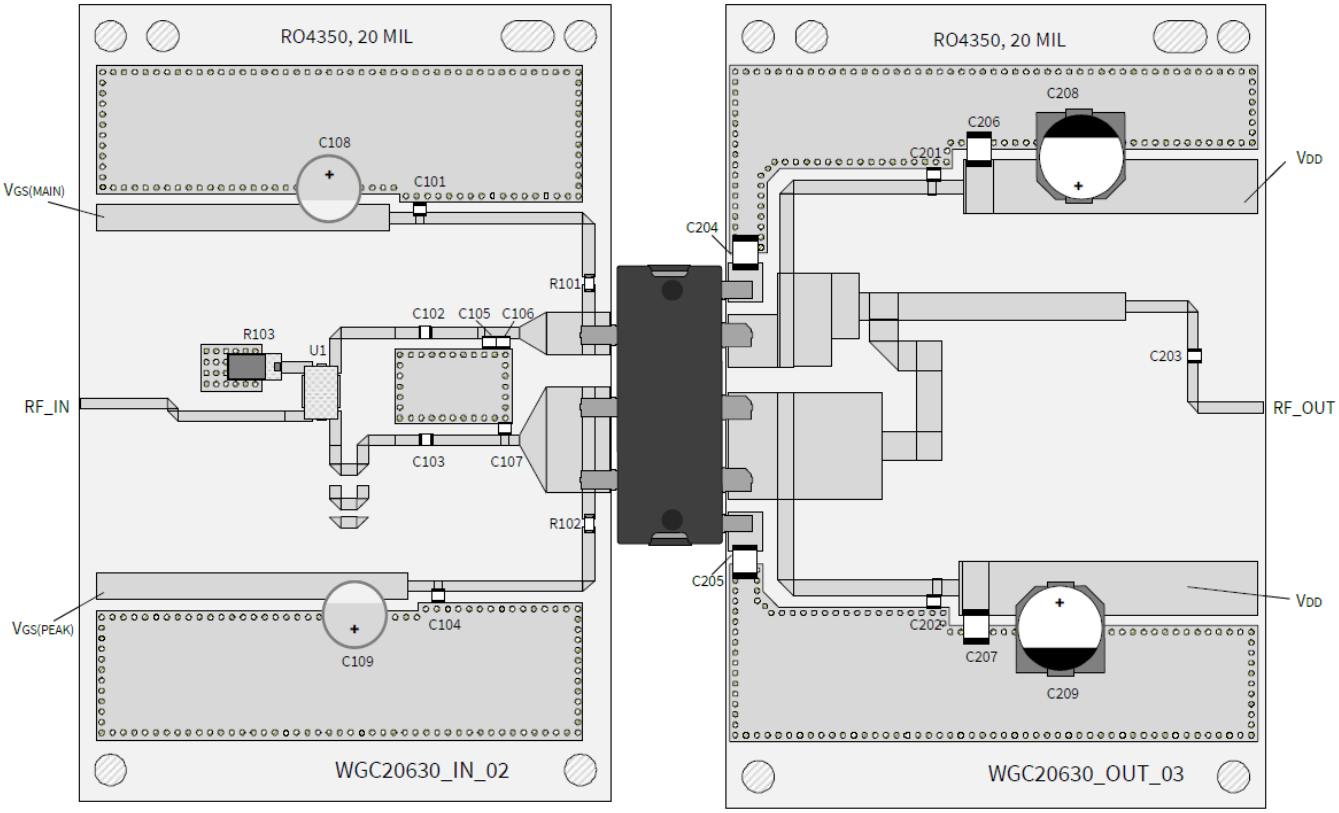
Pulsed CW Performance at various V_{DD} @ 2020 MHz



Small Signal CW Gain & Input Return Loss



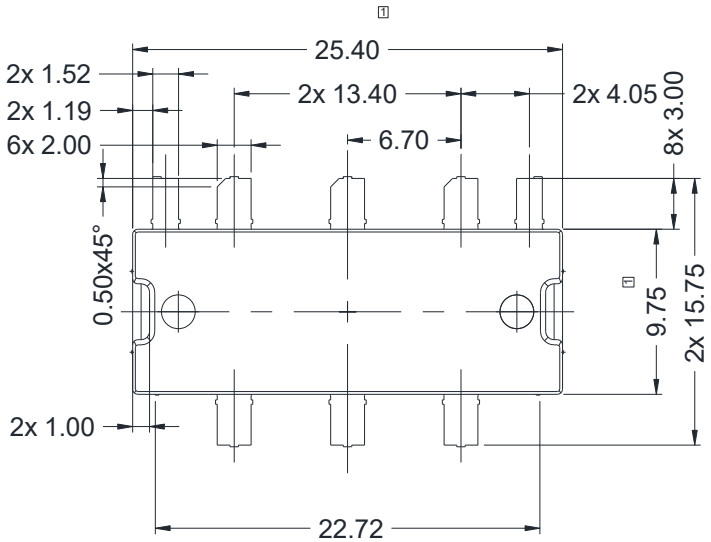
Evaluation Board: 1930 - 2020 MHz



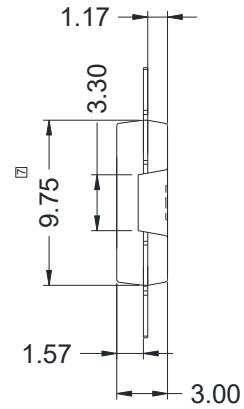
Parts List for Evaluation Board: 1930 - 2020 MHz

Component	Description	Manufacturer	Manufacturer P/N
Input			
C101, C102, C103, C104	Capacitor, 22 pF	ATC	ATC800A220JT250X
C105	Capacitor, 0.7 pF	ATC	ATC800A0R7CT250X
C106	Capacitor, 1.0 pF	ATC	ATC800A1R0CT250X
C107	Capacitor, 2.7 pF	ATC	ATC800A2R7CT250X
C108, C109	Capacitor, 10 µF, 35 V	Panasonic	EEE-1VA100WR
R101, R102	Resistor, 10 Ω	Panasonic	ERJ-8GEYJ100V
R103	Resistor, 50 Ω	TTM Technologies	C16A50Z4
U1	Hybrid Coupler	Anaren	X3C20F1-02S
Output			
C201 - C203	Capacitor, 22 pF	ATC	ATC800A220JT250X
C204 - C207	Capacitor, 4.7 µF, 80 V	Murata	GRM32ER71K475KE14L
C208 - C209	Capacitor, 100 µF, 63 V	Panasonic	EEE-FK1J101P

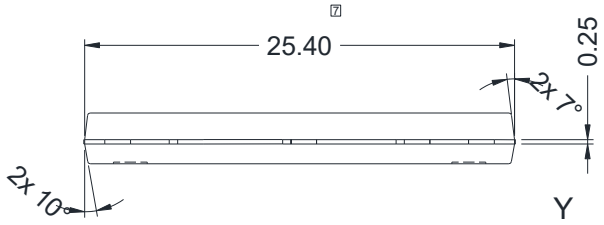
Lead-Free Outline Drawing PG-HBSOF-8-1



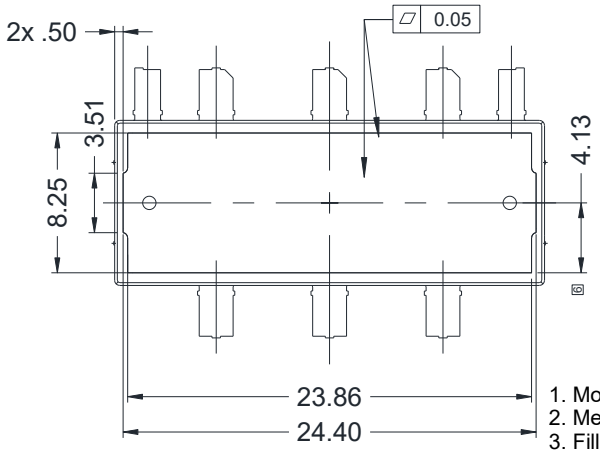
TOP VIEW



END VIEW



SIDE VIEW



BOTTOM VIEW

1. Mold/dam bar/metal protrusion of 0.30 mm max per side not included.
2. Metal protrusions connected to source and shall not exceed 0.10 mm max.
3. Fillets and radii: Unless otherwise noted all radii are 0.3 mm max.
4. Molded package Ra 1.2-1.6 µm.
5. All metal surfaces tin pre-plated, except area of cut.
6. Exposed metal surface tin plated, may not be covered by mold compound.
7. Does not include mold/dam bar/metal protrusion.
8. Interpret dimensions and tolerances per ISO 8015.
9. Dimensions are in mm.
10. All tolerances are ± 0.1 mm unless specified otherwise.