GaN Amplifier 50 V, 70 W
4.4 - 5.9 GHz

MACOM PURE CARBIDE™

CGHV59070F/P
Rev. V1

Features

- 4.4 – 5.9 GHz Operation
- 70 W Minimum Output Power
- Large Signal Gain: 14 dB
- Drain Efficiency: 55 %
- Internally Matched

Applications

- Wireless Infrastructure
- Marine Radar
- Weather Monitoring
- Air Traffic Control
- Maritime Vessel Traffic Control
- Port Security
- Troposcatter Communications
- Beyond Line of Sight - BLOS

Description

The CGHV59070 is an internally matched gallium nitride (GaN) amplifier. The CGHV59070, operating from a 50 Volt rail, offers a general purpose, broadband solution to a variety of RF and microwave applications. The good efficiency, high gain and wide bandwidth capabilities make the CGHV59070 ideal for linear applications such as wireless infrastructure and for compressed amplifier circuits. The amplifier is available in a flange and pill package.

Typical RF Performance:

Measured in Evaluation Test Fixture[1] at P_{IN} = 35.5 dBm, 100 µsec pulse width and 10% Duty Cycle.

- V_{DS} = 50 V, I_{DQ} = 150 mA, T_C = 25°C

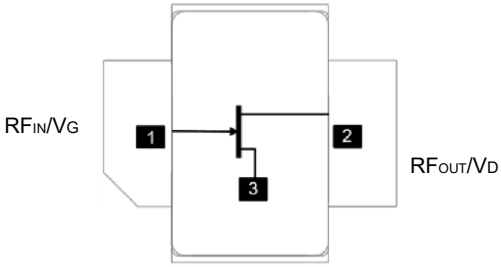
Frequency (GHz)	Output[1] Power (W)	Power[1] Gain (dB)	η_D[1] (%)
4.8	84	13.7	55
5.0	93	14.2	56
5.2	101	14.5	57
5.4	102	14.6	56
5.6	95	14.3	54
5.8	84	13.7	50
5.9	76	13.3	48

1. Performance values and curves in this data sheet were measured in this fixture.

440224

440170

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Flange[2]	Ground / Source

2. The flange on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	MOQ Increment
CGHV59070F	Bulk
CGHV59070P	Bulk
CGHV59070F-AMP	Sample Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU

RF Electrical Specifications: T_A = +25°C, V_{DS} = 50 V, I_{DQ} = 150 mA

Parameter	Units	Min.	Typ.	Max.	Conditions
Small Signal Gain at f = 5.2 GHz	dB	15.5	17	—	V_{dd} = 50 V, I_{dq}= 150 mA, P_{in} = 10 dBm
Output Power at f = 5.2 GHz	W	75.9	100	—	V_{dd} = 50 V, I_{dq}= 150 mA, P_{in} = 35.5 dBm Pulse Width = 100 µs, Duty Cycle = 10%
Output Power at f = 5.55 GHz	W	75.9	100	—	
Output Power at f = 5.9 GHz	W	62.4	77	—	
Power Gain at f = 5.2 GHz	dB	—	14.5	—	
Drain Efficiency at f = 5.2 GHz	%	50	54	—	
Drain Efficiency at f = 5.55 GHz	%	46	55	—	
Drain Efficiency at f = 5.9 GHz	%	40	48	—	
Ruggedness: Output Mismatch	Ψ	—	—	5:1	No damage at all phase angles, V_{dd} = 50 V, I_{dq}= 150 mA, P_{in} = 35.5 dBm Pulse width = 100 µs, Duty Cycle = 10%

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 150 V	I_{DLK}	-	-	4.16	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-1.45	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 10.4 mA	V_T	-3.8	-2.8	-2.3	V
Gate Quiescent Voltage	V_{DS} = 50 V, I_D = 150 mA	V_{GSQ}	-	-2.7	-	V

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Drain-Source Voltage	150 V
Gate Voltage	-10, +2 V
Storage Temperature	-65°C to +150°C
Junction Temperature[4,5,6]	+225°C
Gate Current	10.4 mA
DC Drain Current	6.3 A
Mounting Temperature[3]	+245°C
Operating Temperature	-40°C to +125°C

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. Mounting temperature for 30 seconds.
4. Operating at nominal conditions with $T_J \leq +225$ C will ensure MTTF > 1 x 10^6 hours.
5. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 2.99 °C/W for CW.
   a) For T_C = +55°C,
   T_J = 225 °C @ P_{diss}= 57 W
6. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 0.85 °C/W for 100µs, 10%.
   a) For T_C = +85°C,
   T_J = 145 °C @ P_{diss}= 70 W

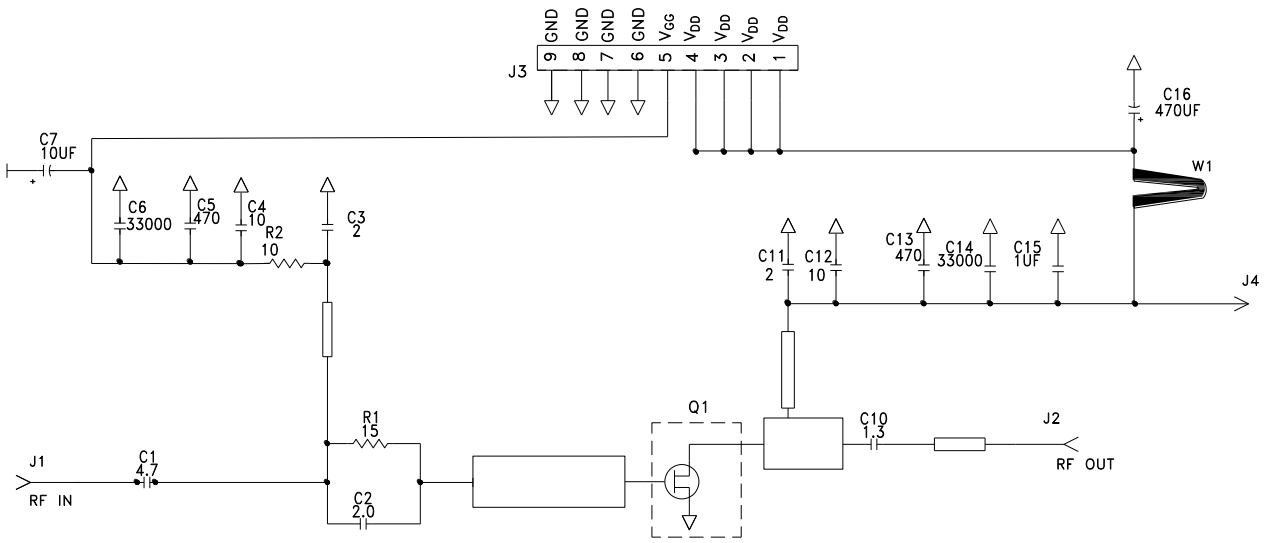
Handling Procedures

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 devices.

Evaluation Test Fixture and Recommended Tuning Solution, 5.2—5.9 GHz



Description

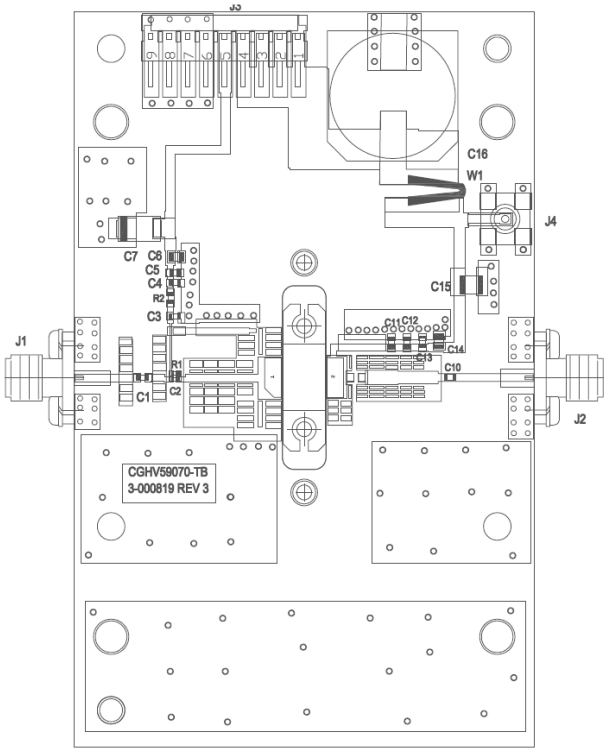
Parts measured on evaluation board (20-mil thick RF-35). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Biasing Sequence

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 of -5 V to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Evaluation Test Fixture and Recommended Tuning Solution, 5.2 - 5.9 GHz



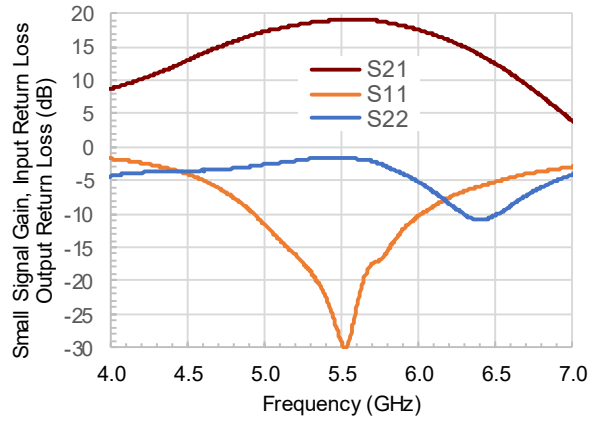
Assembly Parts List

Reference Designator	Description	Qty
R1	RES, 15,OHM, +/- 1%, 1/16W, 0402	1
R2	RES,1/16W,0603,1%,10.0 OHMS	1
C1	CAP, 4.7 pF,+/-0.1pF, 0603, ATC600S	2
C10	CAP, 1.3 pF,+/-0.1pF, 0603, ATC600S	1
C3,C11	CAP, 2.0 pF,+/-0.1pF, 0603, ATC600S	2
C2	CAP, 2.0 pF, +/- 0.05 pF, 0402, ATC	1
C4,C12	CAP, 10pF,+/-5%, 0603, ATC	2
C5,C13	CAP, 470PF, 5%, 100V, 0603, X	2
C6,C14	CAP,33000PF, 0805,100V, X7R	2
C15	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C7	CAP 10UF 16V TANTALUM	1
C16	CAP, 470uF, 20%, 80V, ELECT, SMD Size K	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MI	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK,SMD	1
W1	CABLE, 18 AWG, 4.2"	1
-	PCB, TEST FIXTURE, TACONIC RF35, 20 MIL	1
Q1	CGHV59070F/P	1

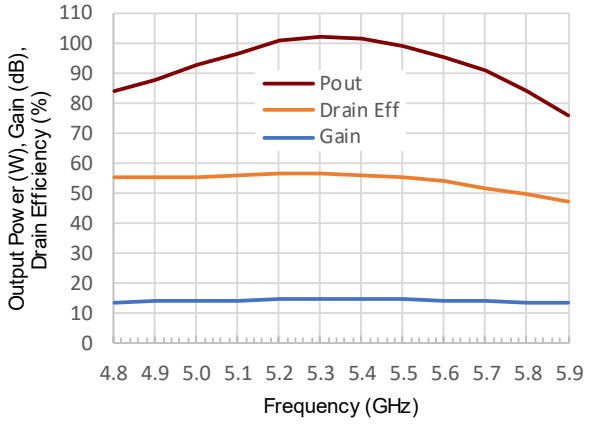
Typical Performance Curves as Measured in the 5.2 – 5.9 GHz Evaluation Test Fixture

Pulse width = 100 µs, Duty Cycle = 10%, P_{IN} = 35.5 dBm, V_{DS} = 50 V, I_{DQ} = 150 mA **(Unless otherwise noted)**
For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

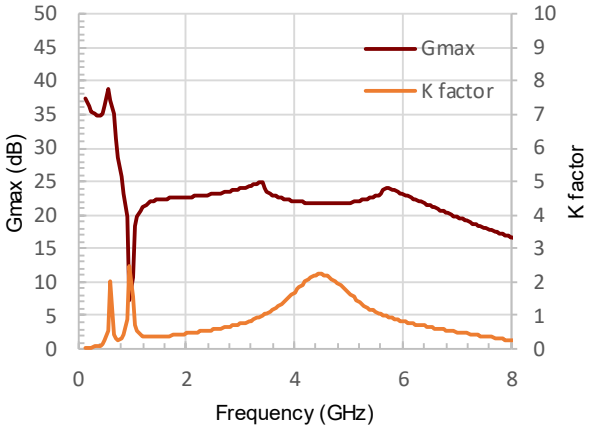
S11, S21, & S22 vs. Frequency



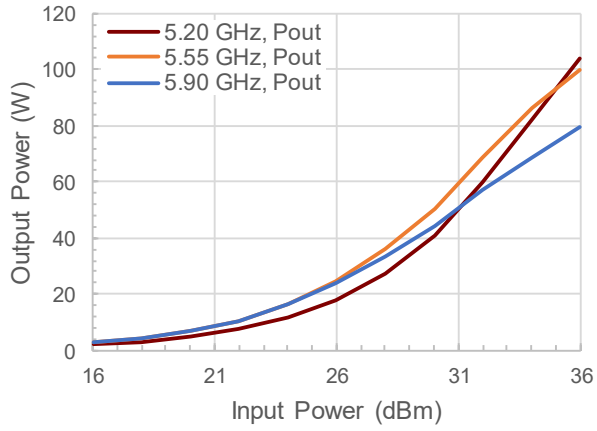
Output Power, Gain and PAE vs. Frequency



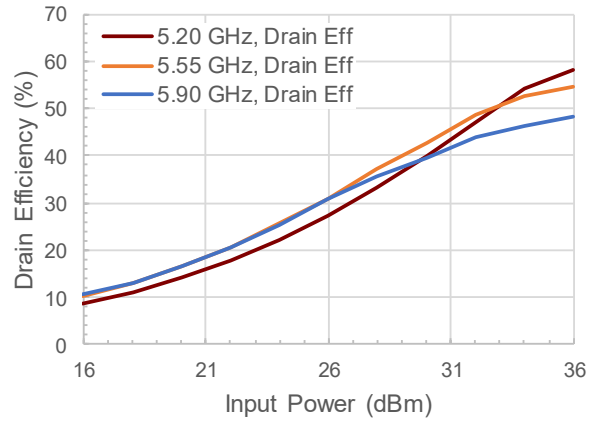
Maximum Available Gain and K Factor vs. Frequency



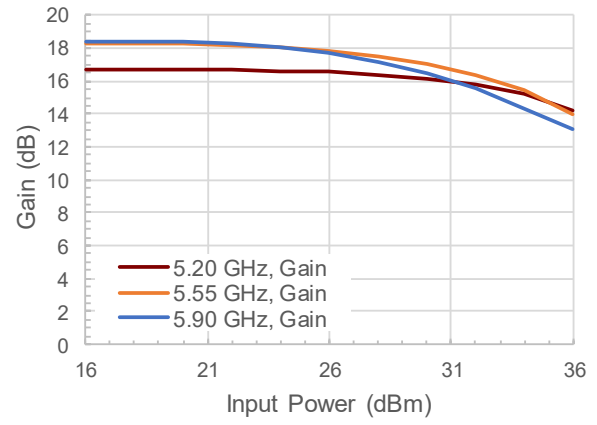
Output Power vs. Input Power and Frequency



Drain Efficiency vs. Input Power and Frequency



Gain vs. Input Power and Frequency

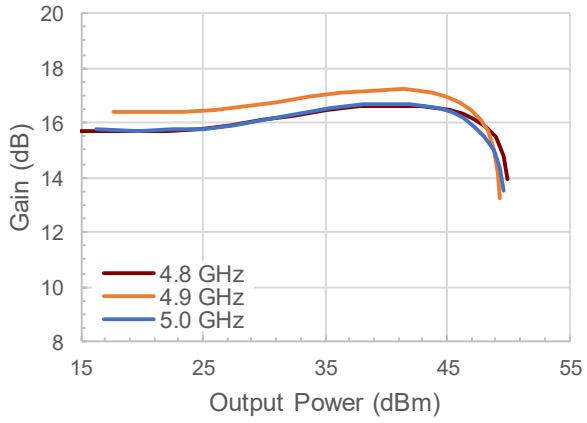


Typical Performance Curves as Measured in the 4.8 – 5.0 GHz Evaluation Test Fixture

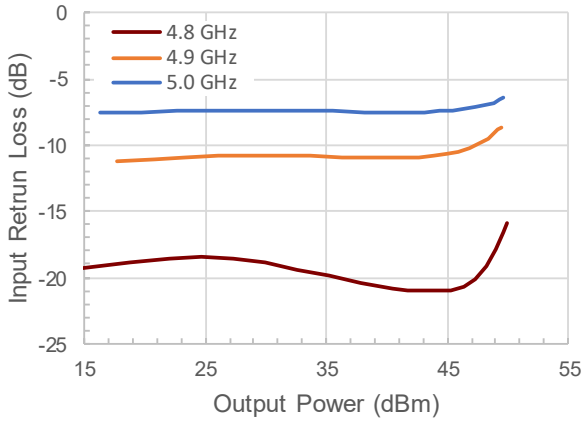
WCDMA, 7.5 dB PAR Signal, P_{IN} = 42 dBm, V_{DS} = 50 V, I_{DQ} = 75 mA **(Unless otherwise noted)**

For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

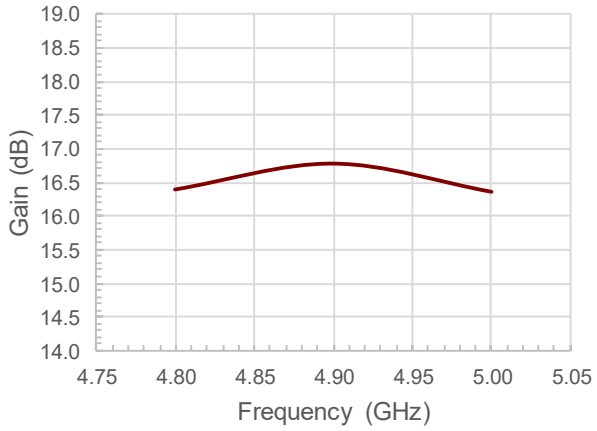
Power Gain vs. Output Power



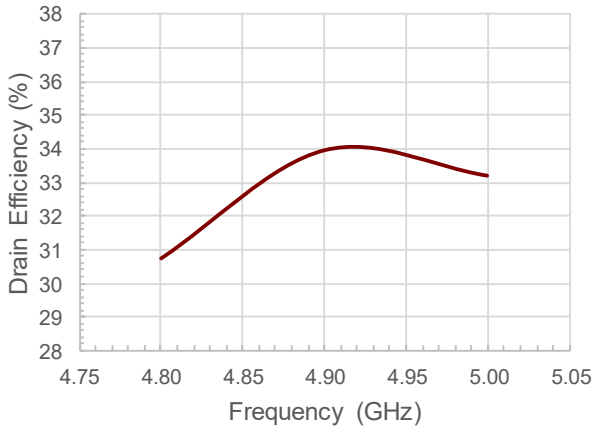
Input Power vs. Output Power



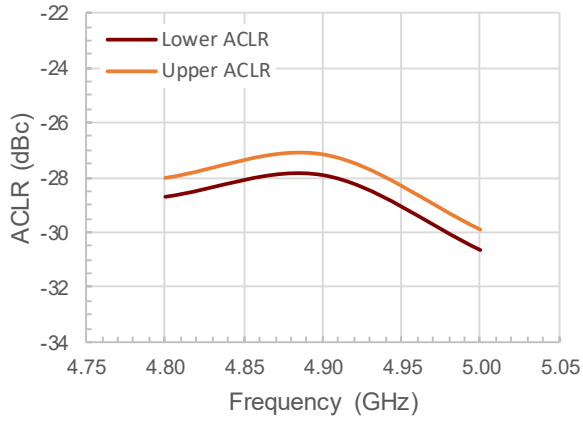
Power Gain vs. Frequency



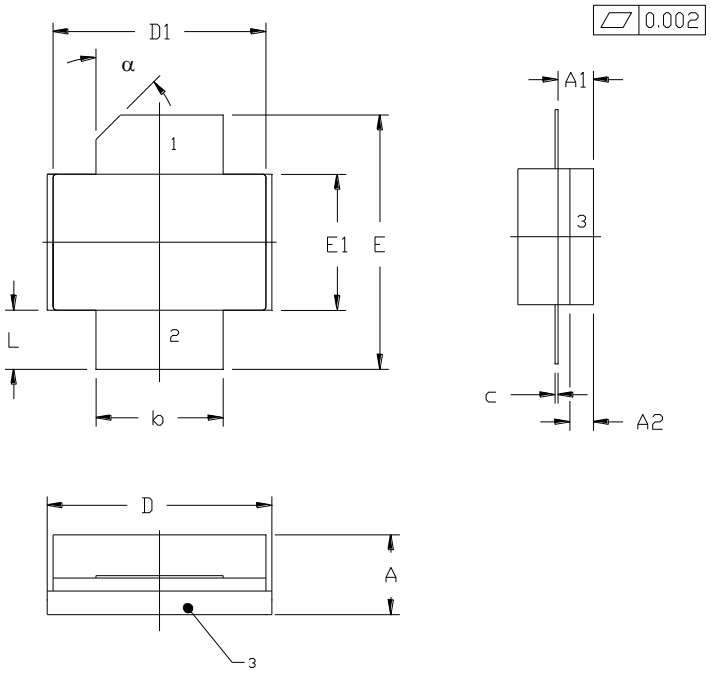
Drain Efficiency vs. Frequency



ACLR vs. Frequency



Lead-free 440170 Package Dimensions



NOTES:

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

2. CONTROLLING DIMENSION: INCH.

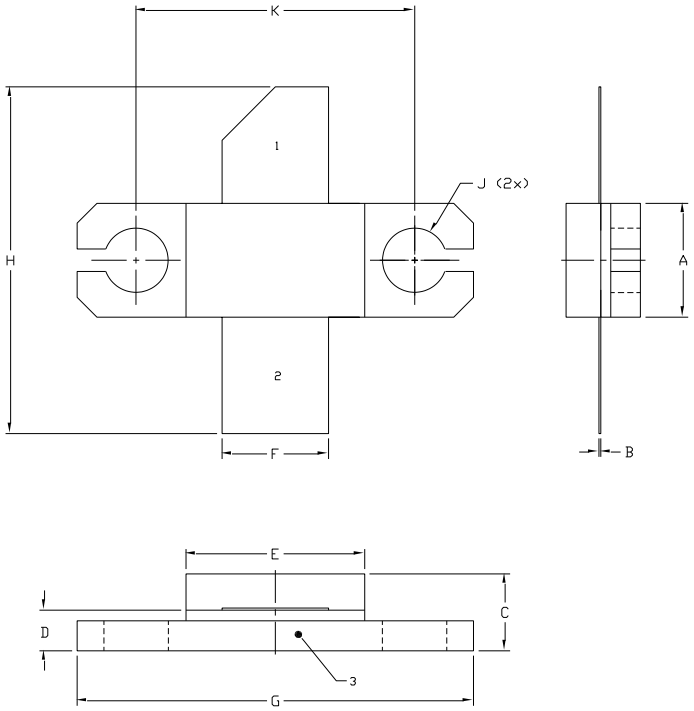
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

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	0.125	0.145	3.18	3.68	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.210	0.220	5.33	5.59	2x
c	0.004	0.006	0.10	0.15	2x
D	0.375	0.385	9.53	9.78	
D1	0.355	0.365	9.02	9.27	
E	0.400	0.460	10.16	11.68	
E1	0.225	0.235	5.72	5.97	
L	0.085	0.115	2.16	2.92	2x
α	45° REF		45° REF		

PIN 1. GATE
2. DRAIN
3. SOURCE

Lead-free 440224 Package Dimensions



NOTES:

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5. ALL PLATED SURFACES ARE NI/AU

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.225	0.235	5.72	5.97
B	0.004	0.006	0.10	0.15
C	0.145	0.165	3.18	4.19
D	0.077	0.087	1.96	2.21
E	0.355	0.365	9.02	9.27
F	0.210	0.220	5.33	5.59
G	0.795	0.805	20.19	20.45
H	0.670	0.730	17.02	18.54
J	ø .130		3.30	
k	0.562		14.28	

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE