GaN Amplifier 50 V, 350 W
5.2 - 5.9 GHz

MACOM

MACOM PURE CARBIDE™

CGHV59350F/P
Rev. V2

Features

- Output Power: 350 W Minimum
- Large Signal Gain: 10.5 dB
- Drain Efficiency: 55 %
- Internally Matched: 50 Ω
- High Temperature Operation
- RoHS* Compliant

Applications

- C-Band RADAR

Description

The CGHV59350 is a gallium nitride (GaN) amplifier designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV59350 ideal for 5.2 - 5.9 GHz C-Band radar amplifier applications. The amplifier is supplied in a ceramic/metal flange or pill package.

440217

440218

Typical RF Performance:

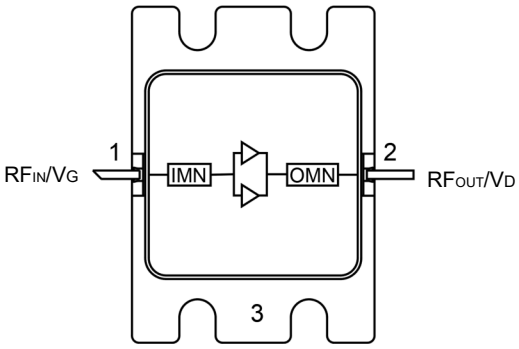
Measured in Evaluation Test Fixture[1], P_{IN} = 46 dBm, 100 µs Pulse Width & 10% Duty Cycle.

- V_{DS} = 50 V, I_{DQ} = 1 A, T_C = 25°C

Frequency (GHz)	Output[1] Power (W)	Power[1] Gain (dB)	η_D[1] (%)
5.2	440	10.5	59
5.4	415	10.2	55
5.8	475	10.8	53
5.9	490	11.0	55

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

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
CGHV59350F	Bulk
CGHV59350P	Bulk
CGHV59350F-AMP2	Sample Board

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

RF Electrical Specifications: T_A = +25°C, V_{DS} = 50 V, I_{DQ} = 1 A

Parameter	Conditions	Units	Min.	Typ.	Max.
Output Power	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm Pulse Width = 100 µs, Duty Cycle = 10% 5.2 GHz 5.4 GHz 5.8 GHz 5.9 GHz	W	 389 335 302 302	 440 415 475 490	—
Gain	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm Pulse Width = 100 µs, Duty Cycle = 10% 5.2 GHz 5.4 GHz 5.8 GHz 5.9 GHz	dB	 — 	 10.5 10.2 10.8 11.0	—
Drain Efficiency	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm Pulse Width = 100 µs, Duty Cycle = 10% 5.2 GHz 5.4 GHz 5.8 GHz 5.9 GHz	%	 53 46 40 40	 59 55 53 55	—
Small Signal Gain	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 10 dBm	dB	11.5	15	—
Input Return Loss	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 10 dBm	dB	—	-7	-3
Output Return Loss	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 10 dBm	dB	—	-11	-3
Ruggedness: Output Mismatch	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm Pulse width = 100 µs, Duty Cycle = 10%	Ψ	—	—	5:1

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Drain-Source Leakage Current (I_{DLK})	V_{GS} = -8 V, V_{DS} = 150 V	mA	—	—	25.6
Gate-Source Leakage Current (I_{GLK})	V_{GS} = -8 V, V_{DS} = 10 V	mA	-8.9	—	—
Gate Threshold Voltage (V_T)	V_{DS} = 10 V, I_D = 64 mA	V	-3.8	-3.0	-2.3
Gate Quiescent Voltage (V_{GSQ})	V_{DS} = 50 V, I_D = 1 A	V	—	-2.7	—

Absolute Maximum Ratings[3,4]

Parameter	Absolute Maximum
Pulse Width	500 µs
Duty Cycle	10 %
Drain-Source Voltage	150 V
Gate Voltage	-10, +2 V
DC Drain Current	9 A
Gate Current	64 mA
Mounting Temperature[5]	+245°C
Junction Temperature[6,7]	+225°C
Operating Temperature	-40°C to +125°C
Storage Temperature	-65°C to +150°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. Mounting temperature for 30 seconds.
6. Operating at nominal conditions with $T_J \leq +225$ °C will ensure MTTF > 1 x 10^6 hours.
7. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 0.31 °C/W for
   Pulse Width = 100 µs, Duty Cycle = 10%.
   a) For T_C = +85 °C, T_J = 184 °C @ P_{DISS} = 320 W

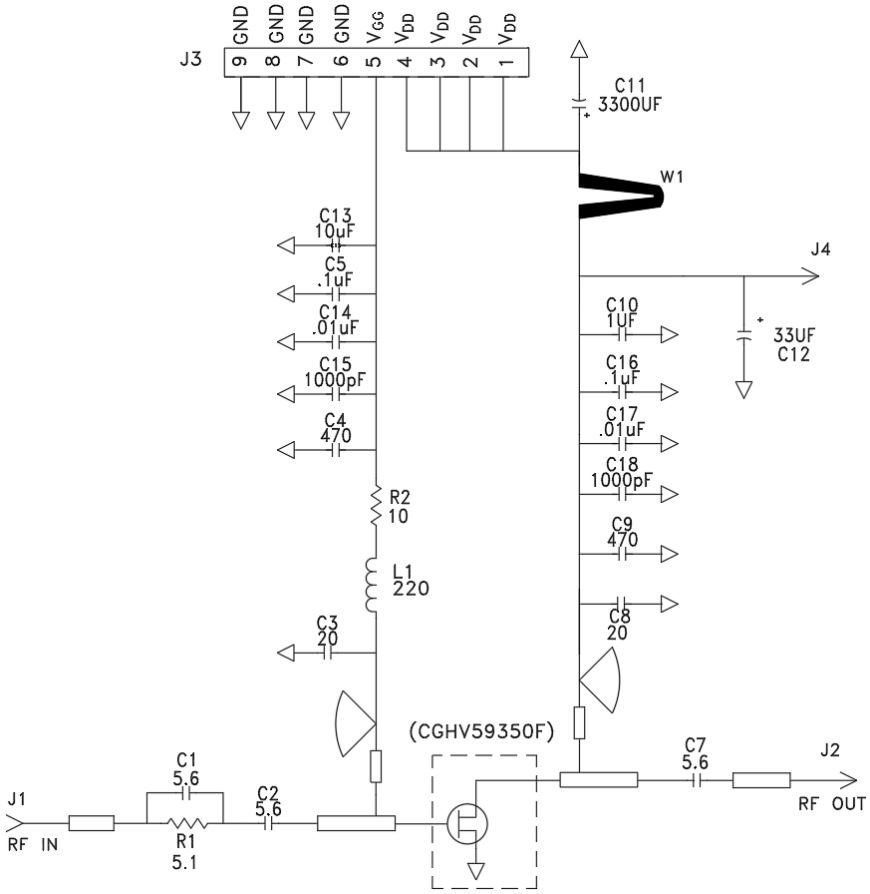
Handling Procedures

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

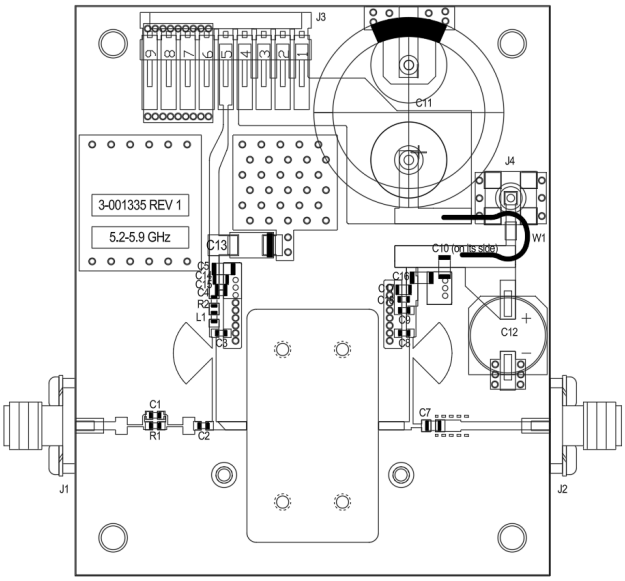
Parts measured on evaluation board (20-mil thick RF35P). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

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

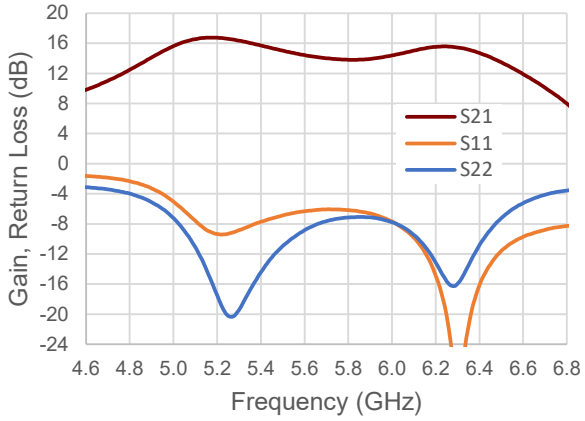
Reference Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 5.1 Ohms	1
R2	RES, 1/16W, 0603, 1%, 10.0 Ohms	1
C1, C2	CAP, 5.6pF +/- 0.1pF, 0603	2
C3, C8	CAP, 20.0pF, +/-5%, 0603	2
C4, C9	CAP, 470PF, 5%, 100V, 0603, X7R	2
C5, C16	CAP, 0.1uF, +/-10%, 250V, 1206, X7R	2
L1	IND, FERRITE, 220 OHM, 0603	1
C10	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C7	CAP, 5.6 PF +/- 0.1 pF, 0805, ATC 600F	1
C11	CAP, 3300µF, +/-20%, 100V, ELECTROLYTIC	1
C12	CAP, 33µF, 20%, G CASE	1
C13	CAP TANT 10UF 10% 16V 2312	1
C14, C17	CAP, 0.01 uF, +/-10%, 250V, 0805, X7R DIELECTRIC	2
C15, C18	CAP, 1000pF, +/-5%, 0603	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE	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 RF35P, 20 MIL	1
-	2-56 SOC HD SCREW 1/4 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV59350F/P	1

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

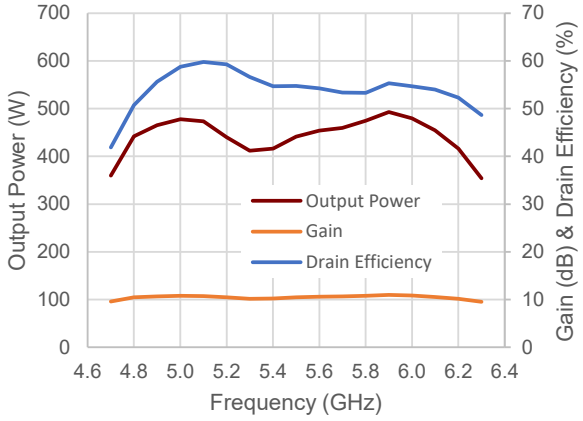
Pulse width = 100 µs, Duty Cycle = 10%, P_{IN} = 46 dBm, V_{DS} = 50 V, I_{DQ} = 1 A **(Unless otherwise noted)**

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

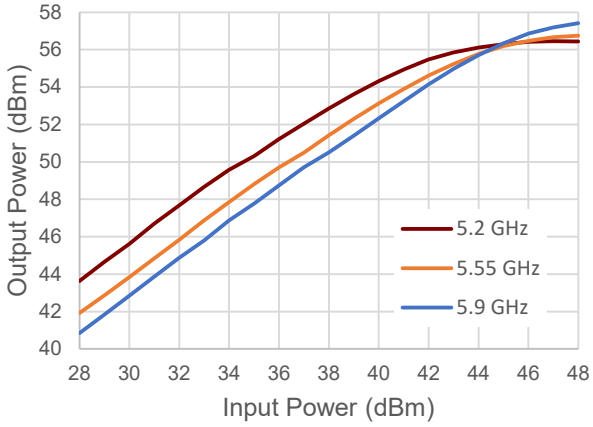
S11, S21, & S22 vs. Frequency



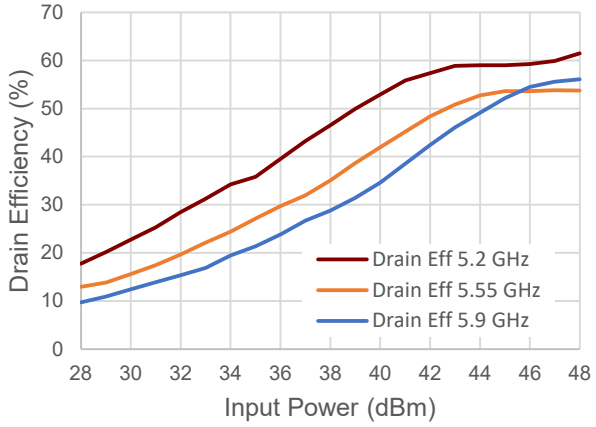
Output Power, Gain and PAE vs. Frequency



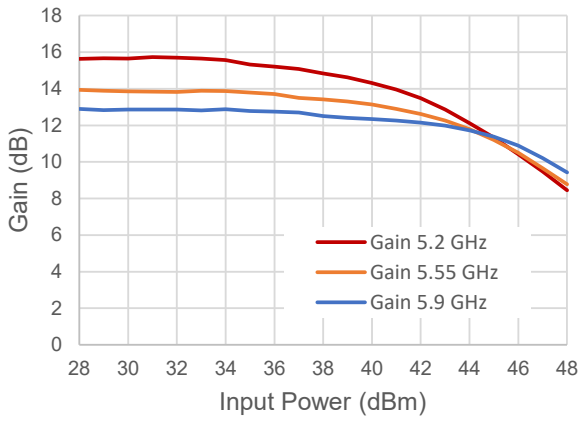
Output Power vs. Input Power and Frequency



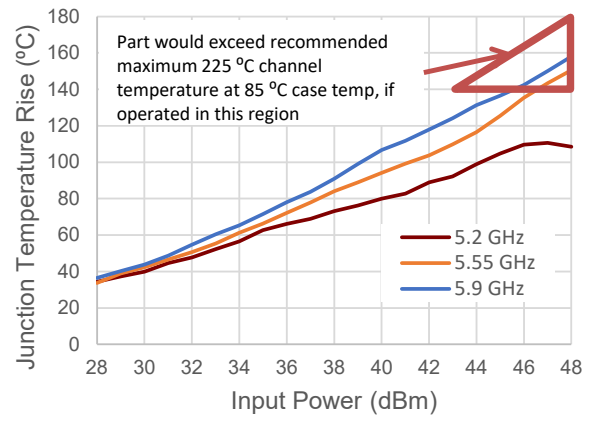
Drain Efficiency vs. Input Power and Frequency



Gain vs. Input Power and Frequency



Gain vs. Input Power and Frequency



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

Pulse width = 500 µs, Duty Cycle = 10%, P_{IN} = 46 dBm, V_{DS} = 50 V, I_{DQ} = 1 A **(Unless otherwise noted)**

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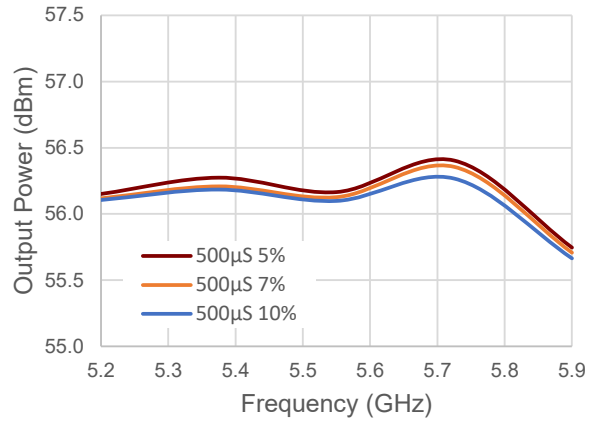
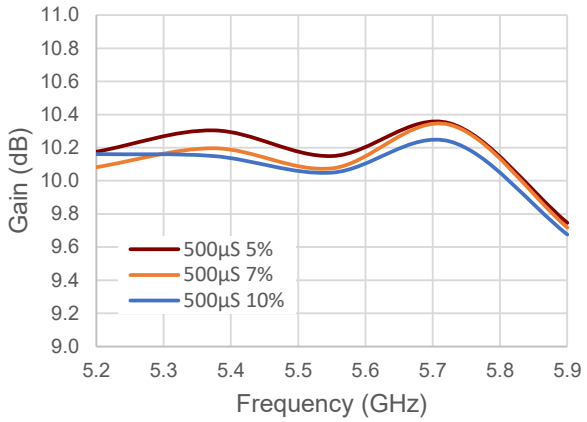
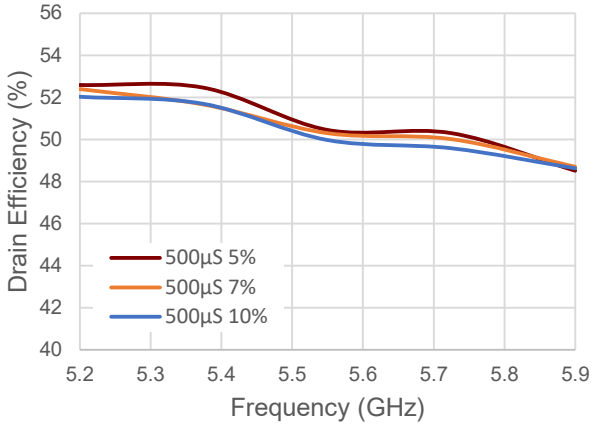
Output Power vs. Frequency



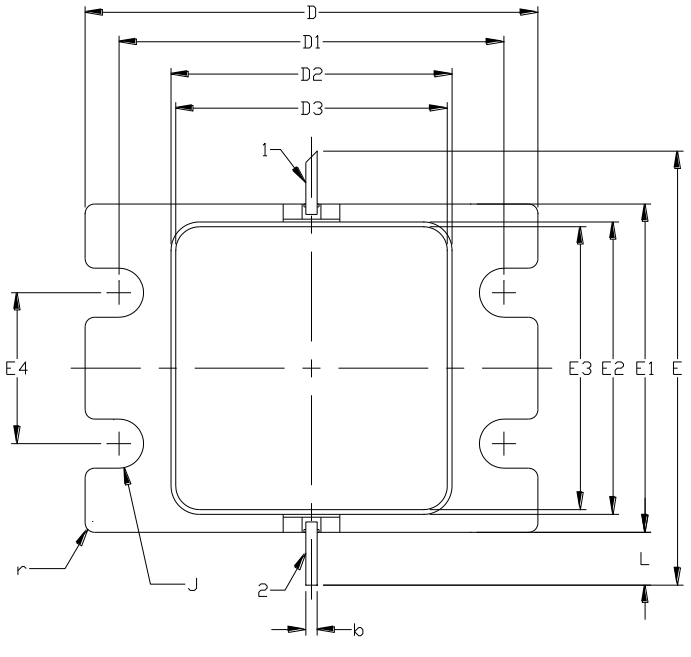
Gain vs. Frequency

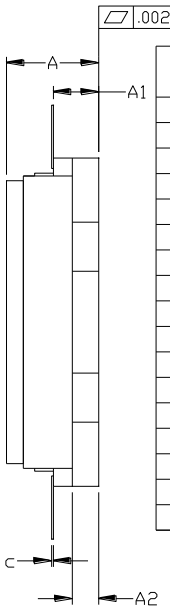


Drain Efficiency vs. Frequency



Lead-free 440217 Package Dimensions

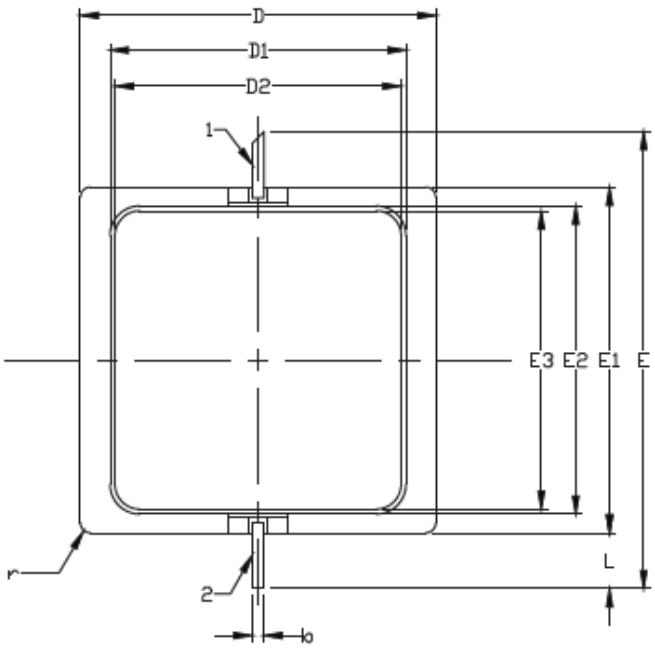


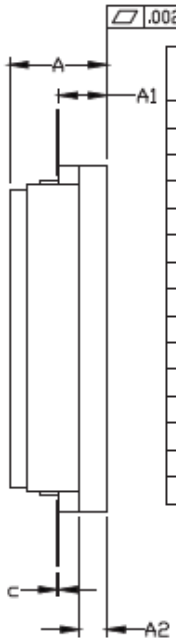


1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.185	0.201	4.70	5.11	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

Lead-free 440218 Package Dimensions





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b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.699	0.711	17.75	18.06	
D1	0.581	0.593	14.76	15.06	
D2	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

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