

**MAPC-A1558-AB** 

Rev. V1

## MACOM PURE CARBIDE

#### Features

- Saturated Power: 1200 W
- Drain Efficiency: 68%
- Small Signal Gain: 16 dB
- Lead-Free Air Cavity Ceramic Package
- RoHS\* Compliant

#### Applications

- Avionics TACAN, DME, IFF
- L-band Radar
- General Amplification

#### Description

The MAPC-A1558-AB is an 1200W packaged, partially-matched amplifier. The MAPC-A1558-AB operates up to 1.4 GHz and supports both defense commercial-related avionics and and radar 65 operation. applications. Under V the MAPC-A1558-AB typically achieves 1200 W of saturated output power with 16 dB of large signal gain and 68% drain efficiency via a 1.2 - 1.4 GHz reference design.

Packaged in a thermally-enhanced, flange package, the MAPC-A1558-AB provides superior performance under long pulse operation allowing customers to improve SWaP-C benchmarks in their nextgeneration systems.

#### Typical RF Performance:

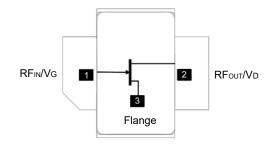
• Pulsed measurement,  $P_{IN} = 45 \text{ dBm}$ ,  $V_{DS} = 65 \text{ V}$ ,  $I_{DQ} = 800 \text{ mA}$ ,  $T_C = 25^{\circ}\text{C}$ 

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η₀ (%)
1.2	61.0	16.0	70.7
1.3	60.9	15.9	68.6
1.4	60.6	15.6	67.5



AC-780B-2

### **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 <sup>1</sup>	Ground / Source	

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

#### **Ordering Information**

Part Number	MOQ Increment		
MAPC-A1558-AB000	Bulk Quantity: Bolt-down		
MAPC-A1558-ABSB1	Sample Board: Bolt-down		

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

1



### MAPC-A1558-AB

Rev. V1

### RF Electrical Specifications<sup>2</sup>: Freq. = 1.2 and 1.4 GHz, Pulse Width 100 $\mu$ s, 10% Duty Cycle, P<sub>IN</sub> = 45 dBm, T<sub>A</sub> = +25°C, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA

Parameter	Conditions	Symbol	Min.	Тур.	Max.	Units
Output Power	1.2 GHz 1.4 GHz	P <sub>OUT</sub>	1000 1000	1230 1175	_	W
Drain Efficiency	1.2 GHz 1.4 GHz	η	69 65	75 71	—	%
Power Gain	1.2 GHz 1.4 GHz	G <sub>P</sub>	15.0 15.0	15.9 15.7	—	dB

2. Final testing and screening for all transistor sales is performed using the MAPC-A1558-AB production test fixture at 1.2 GHz and 1.4 GHz.

#### Absolute Maximum Ratings<sup>3,4</sup>

Parameter	Absolute Maximum
Drain-Source Voltage	150 V
Gate Voltage	-10 V, +2 V
Drain Current	24 A
Gate Current	133 mA
Input Power	47 dBm
Junction Temperature <sup>5,6</sup>	+225°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Mounting Temperature	+260°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.

 MACOM does not recommend sustained operation near these survivability limits.

- Operating at nominal conditions with T<sub>J</sub> ≤ +225 °C will ensure MTTF > 1 x 10<sup>6</sup> hours.
- 5. Junction Temperature (T<sub>J</sub>) = T<sub>C</sub> +  $\Theta$ jc \* (V \* I) Typical thermal resistance ( $\Theta$ jc) = 0.146 °C/W for pulse width = 100 µs, Duty Cycle = 10%. a) For T<sub>C</sub> = +85°C,

T<sub>J</sub> = 180 °C @ P<sub>DISS</sub> = 650 W

#### **Handling Procedures**

Please observe the following precautions to avoid damage:

#### Static Sensitivity

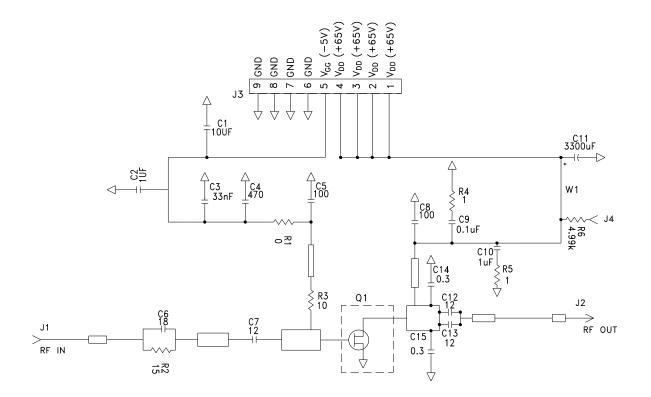
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.



## MACOM PURE CARBIDE

### MAPC-A1558-AB Rev. V1

### Evaluation Test Fixture and Recommended Tuning Solution, 1.2 - 1.4 GHz



### Description

Parts measured on evaluation board (25-mil thick RO3010). 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

For further information and support please visit: <u>https://www.macom.com/support</u>

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.

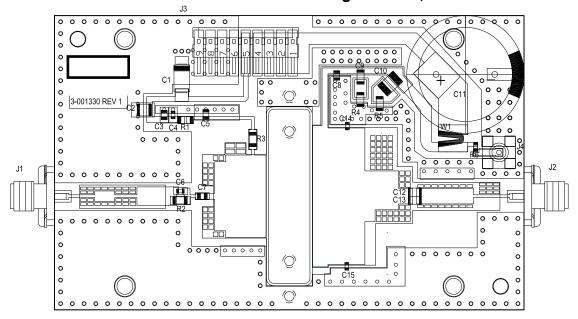


**MAPC-A1558-AB** 

Rev. V1

## MACOM PURE CARBIDE

### Evaluation Test Fixture and Recommended Tuning Solution, 1.2 - 1.4 GHz



#### **Assembly Parts List**

Reference Designator	Description	Manufacturer	Part Number	
R1	RES, 1/4W, 1206, 1%, 0 OHM	КОА	RK73Z2BTTD	
R2	RES, 15 Ohm, 5%, 1/4W, 1206	KOA	RK73B2BTTD150J	
R3	RES, 10 OHM, 5%, 1/4W 1206	Bourns	CR1206-JX100 E LF	
R4, R5	RES, 1 Ohm 5%, 1/4W, 1206	XICON	263-1.0-RC	
R6	RES,1/16W,0603,1%,4.99K OHMS	Vishay	CRCW06034K99FKTA	
C1	CAP 10UF 16V TANTALUM	Kemet	T496C106K016ATE2K0	
C2, C10	CAP, 1.0UF, 100V, 10%, X7R, 1210	Murata	GRM32ER72A105KA01L	
C3	CAP, 0.033UF, 100V, X7R, 0805	Murata	GRM21BR72A333KA01L	
C4	CAP, 470pF, 0603, 250V, C0G	Murata	GCM1885C1H471JA16J	
C5, C8	CAP, 100PF, +/-5%, 250V, 0805, ATC 600F	KAVX	600F101JT250XT	
C6	CAP, 18pF, +/-5%, 250V, 0603, ATC 600S	KAVX	600S180JT250XT	
C7	CAP, 12 PF, +/- 5%, 250V, 0805, ATC 600F	KAVX	600F120JT250XT	
C9	CAP, 0.1UF, 250V, X7R, 1206	KEMET	C1206C104KARAC7800	
C11	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC	NICHICON	UFW2A332MRD	
C12, C13	CAP, 12PF, +/- 2%,500V, ATC800B	KAVX	800B120GT500XT	
C14, C15	CAP, 0.3PF, +/- 0.05pF, 0603, ATC 600S	KAVX	600S0R3AT250XT	
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	Amphenol RF	132150	
J3	HEADER RT>PLZ .1CEN LK 9POS	AMP	640457-9	
J4	CONNECTOR; SMB, Straight, JACK, SMD	JOHNSON	131-3711-201	
Q1	MACOM GaN Power Amplifier		MAPC-A1558-AB	
PCB	Rogers 3010, 25mil, 2 oz Cu			

.



## MACOM PURE CARBIDE

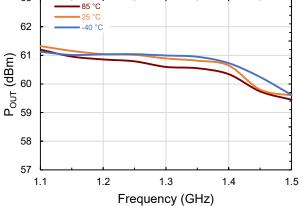
### MAPC-A1558-AB

Rev. V1

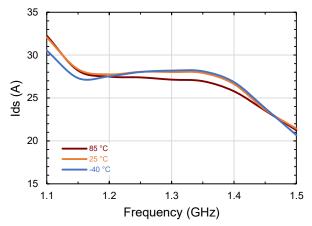
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

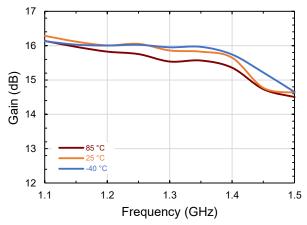




Drain Current vs. Temperature and Frequency

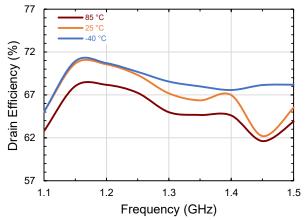


Large Signal Gain vs. Temperature and Frequency

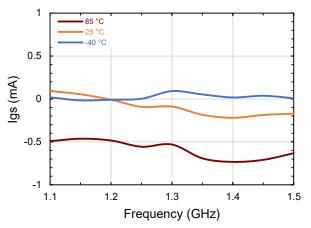


5

Drain Efficiency vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



## MACOM PURE CARBIDE

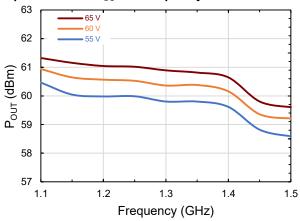
### MAPC-A1558-AB

Rev. V1

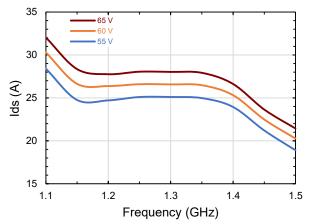
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

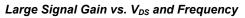
Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

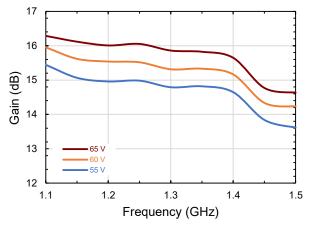
#### Output Power vs. $V_{DS}$ and Frequency



Drain Current vs. V<sub>DS</sub> and Frequency

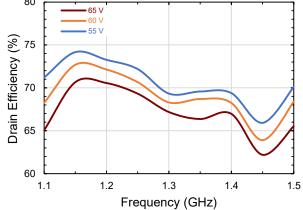




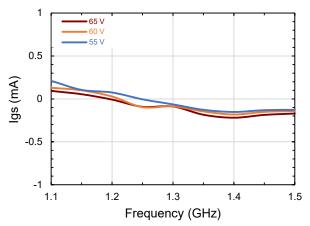


#### 6

Drain Efficiency vs. V<sub>DS</sub> and Frequency



Gate Current vs. V<sub>DS</sub> and Frequency





## MACOM PURE CARBIDE

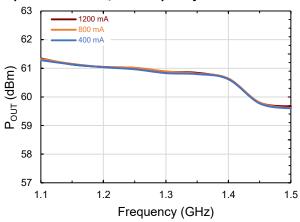
### MAPC-A1558-AB

Rev. V1

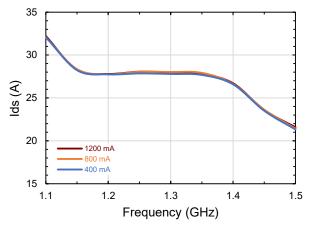
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

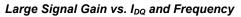
Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

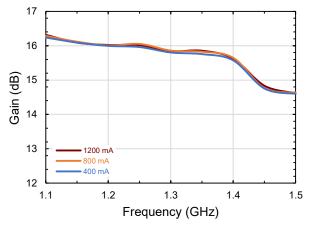
#### Output Power vs. I<sub>DQ</sub> and Frequency



Drain Current vs. I<sub>DQ</sub> and Frequency

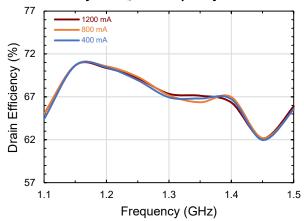




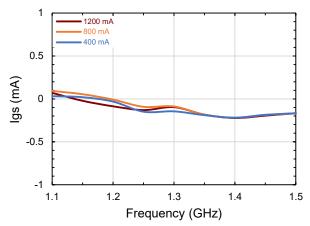


7

Drain Efficiency vs. I<sub>DQ</sub> and Frequency



Gate Current vs. IDQ and Frequency





## MACOM PURE CARBIDE

### MAPC-A1558-AB

Rev. V1

### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

80

70

60

50

40 30

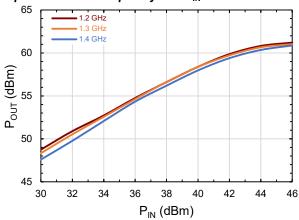
20

10

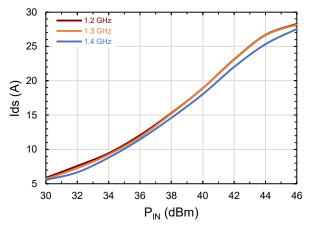
30

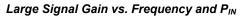
Drain Efficiency (%)

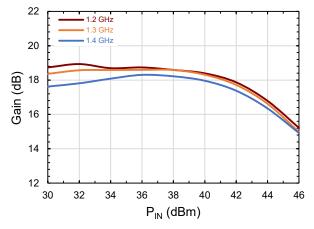
#### Output Power vs. Frequency and PIN



Drain Current vs. Frequency and P<sub>IN</sub>







8

P<sub>IN</sub> (dBm)

34

36

38

40

42

44

46

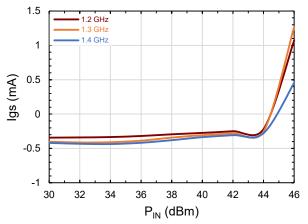
32

Drain Efficiency vs. Frequency and PIN

1 2 GHz

4 GHz

Gate Current vs. Frequency and PIN



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



### MAPC-A1558-AB

Rev. V1

### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

80

70

60 50

40 30

20

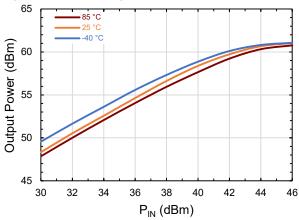
10

30

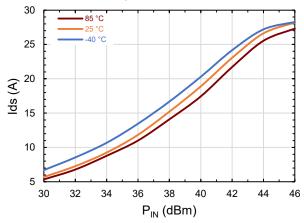
32

Drain Efficiency (%)

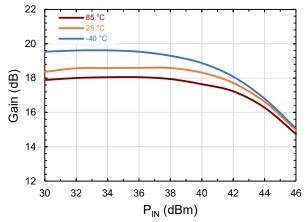
#### Output Power vs. Temperature and P<sub>IN</sub>



Drain Current vs. Temperature and PIN



Large Signal Gain vs. Temperature and PIN



9

Gate Current vs. Temperature and P<sub>IN</sub>

34

36

38

P<sub>IN</sub> (dBm)

40

42

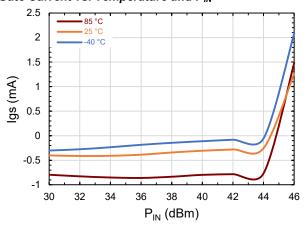
44

46

Drain Efficiency vs. Temperature and P<sub>IN</sub>

85 °C

-40 °C



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



## MACOM PURE CARBIDE

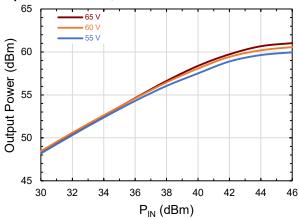
### MAPC-A1558-AB

Rev. V1

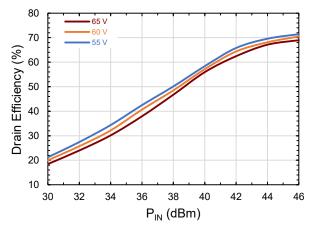
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

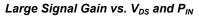
Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

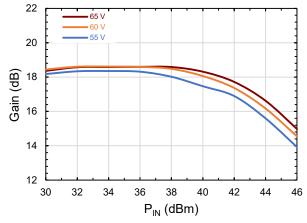
#### Output Power vs. V<sub>DS</sub> and P<sub>IN</sub>



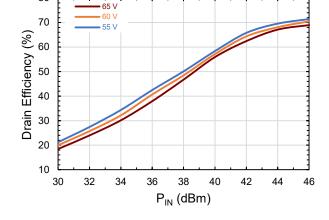
Drain Current vs. V<sub>DS</sub> and P<sub>IN</sub>





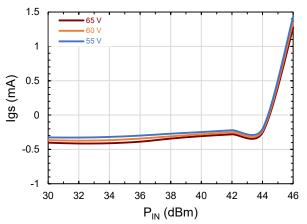


10



Gate Current vs. V<sub>DS</sub> and P<sub>IN</sub>

Drain Efficiency vs. V<sub>DS</sub> and P<sub>IN</sub>



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



## MACOM PURE CARBIDE

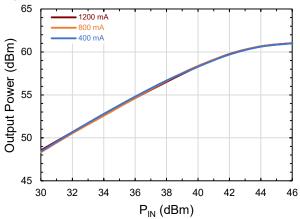
### MAPC-A1558-AB

Rev. V1

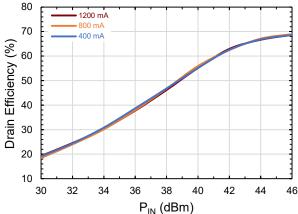
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

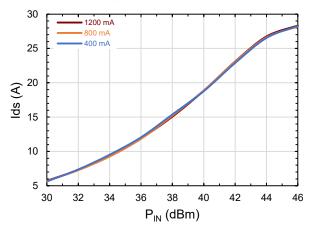
#### Output Power vs. I<sub>DQ</sub> and P<sub>IN</sub>



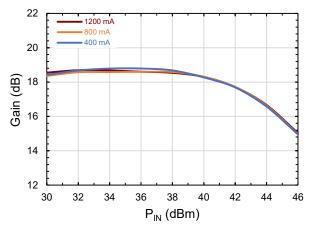
Drain Efficiency vs.  $I_{DQ}$  and  $P_{IN}$ 



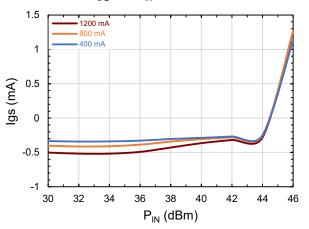
Drain Current vs. I<sub>DQ</sub> and P<sub>IN</sub>



Large Signal Gain vs. IDQ and PIN



Gate Current vs. IDQ and PIN



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



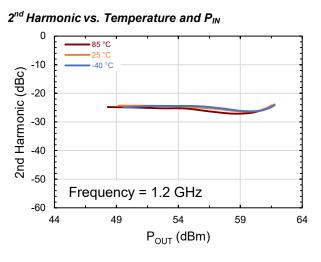
## MACOM PURE CARBIDE

### MAPC-A1558-AB

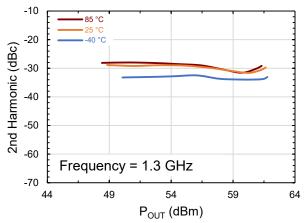
Rev. V1

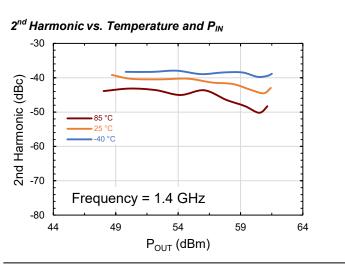
### Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

Pulsed 100  $\mu$ s 10%, P<sub>IN</sub> = 45 dBm, V<sub>DS</sub> = 65 V, I<sub>DQ</sub> = 800 mA, Frequency = 1.3 GHz (unless otherwise noted) For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

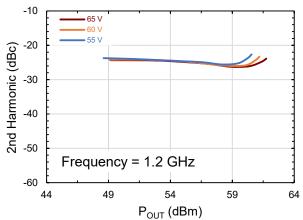


#### 2<sup>nd</sup> Harmonic vs. Temperature and P<sub>IN</sub>

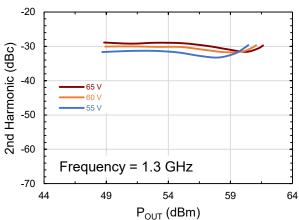


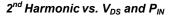


#### 2<sup>nd</sup> Harmonic vs. V<sub>DS</sub> and P<sub>IN</sub>



2<sup>nd</sup> Harmonic vs. V<sub>DS</sub> and P<sub>IN</sub>





-20 65 V 60 \ -30 55 V 2nd Harmonic (dBc) -40 -50 -60 -70 -80 Frequency = 1.4 GHz -90 49 54 59 64 44 P<sub>OUT</sub> (dBm)

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



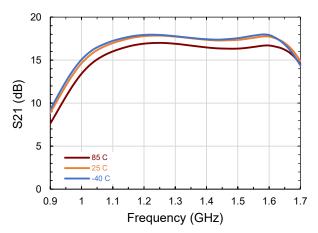
### MAPC-A1558-AB

Rev. V1

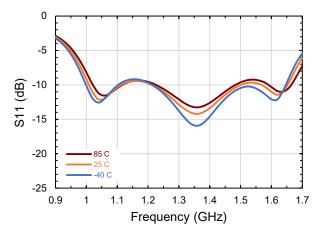
# Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture: CW, $V_{DS}$ = 65 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = -20 dBm (unless Otherwise Noted)

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

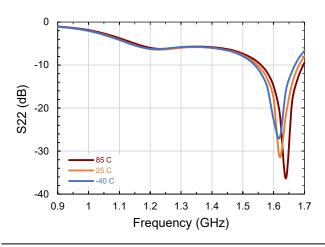
#### S21 vs Frequency and Temperature



S11 vs Frequency and Temperature

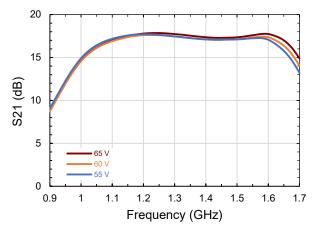


S22 vs Frequency and Temperature

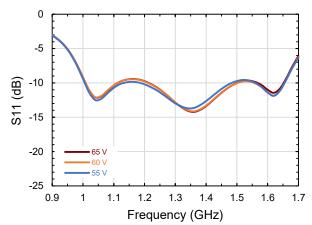


13

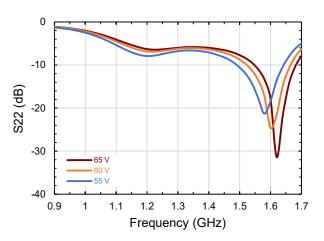
#### S21 vs Frequency and $V_{DS}$



#### S11 vs Frequency and V<sub>DS</sub>



S22 vs Frequency and V<sub>DS</sub>



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.

For further information and support please visit: <u>https://www.macom.com/support</u>



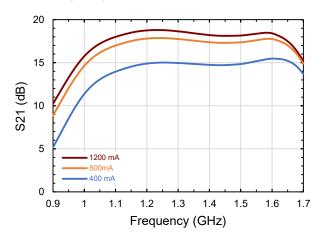
## MACOM PURE CARBIDE

### MAPC-A1558-AB

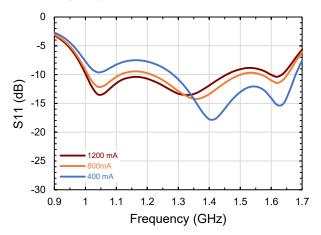
Rev. V1

#### **Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture:** CW, $V_{DS} = 65 \text{ V}$ , $I_{DQ} = 800 \text{ mA}$ , $P_{IN} = -20 \text{ dBm}$ (unless Otherwise Noted) For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

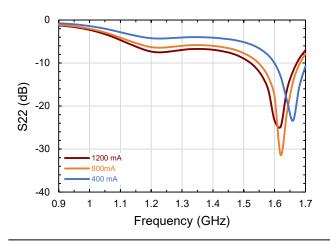
#### S21 vs Frequency and IDQ



S11 vs Frequency and IDQ



S22 vs Frequency and IDQ



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.

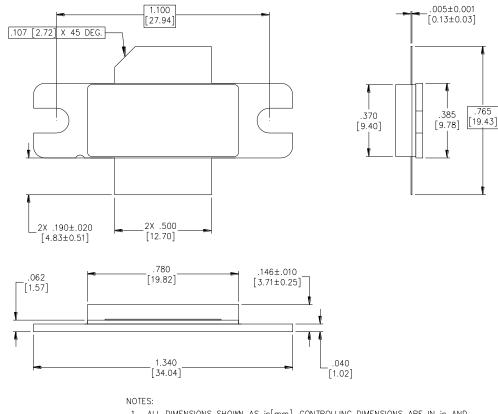


MACOM PURE CARBIDE

MAPC-A1558-AB

Rev. V1

### AC-780B-2 Package Dimensions



- ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in AND CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
- 2. ALL TOLERANCES ARE ±.005 [0.13] UNLESS OTHERWISE NOTED
- 3. LEAD FINISH: AU
- FLANGE FINISH: AU
- 4. LID SEAL EPOXY MAY FLOW OUT A MAXIMUM OF .020 [0.51] FROM EDGE OF LID
- 5. LID MAY BE MIS-ALIGNED UP TO .010 [0.25] FROM PACKAGE IN ANY DIRECTION



MAPC-A1558-AB Rev. V1

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.

<sup>16</sup> 

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.