

10 W 2-Stage Hybrid GaN Module

225 - 2600 MHz



MAMG-100227-010C0L

Rev. V7

Features

- Compact Size (14 x 18 mm²)
- GaN-on-Si Technology
- Fully Matched at Input and Output
- 28 V Operation
- CW Output Power >10 W, 40% PAE and 22 dB Power Gain
- Lead-Free Package with Heat Sink
- RoHS* Compliant

Applications

- Tactical Military Communications
- LMR
- Wireless (public safety)

Description

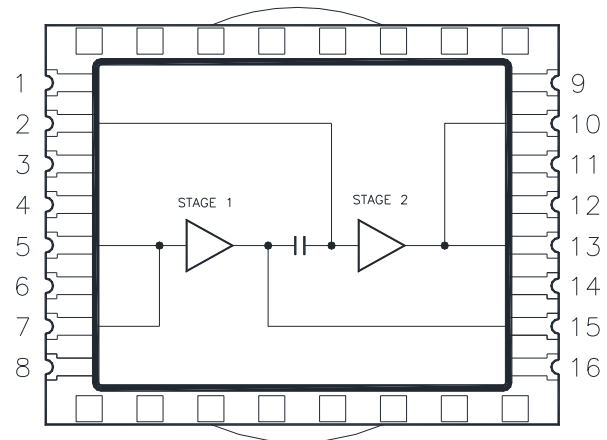
The MAMG-100227-010C0L is a broadband 2-stage GaN-on-Si hybrid power amplifier module in an air-cavity laminate package. A gold-plated copper heat sink is attached to the bottom side of the laminate substrate. The package can be accessed from the top or the bottom allowing for “live bug” or “dead bug” mounting.

Ordering Information¹

Part Number	Package
MAMG-100227-010C0L	JEDEC tray (84 per tray)
MAMG-1U0227-010C0L	Sample Board

1. All sample boards include a part soldered down to the board.

Functional Schematic



Pin Configuration^{2,3}

Pin #	Function	Pin #	Function
1	NC	9	GND
2	V _{G2}	10	V _{D2}
3	GND	11	GND
4	GND	12	GND
5	RF _{IN}	13	RF _{OUT}
6	GND	14	GND
7	V _{G1}	15	V _{D1}
8	GND	16	GND

2. MACOM recommends connecting unused package pins to ground.

3. The package heat sink must be connected to RF, DC, and thermal ground.

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

10 W 2-Stage Hybrid GaN Module

225 - 2600 MHz



MAMG-100227-010C0L

Rev. V7

Electrical Specifications⁴:

$T_A = 25^\circ\text{C}$, $Z_O = 50 \Omega$, CW RF Signal, $I_{DQ1} = 40 \text{ mA}$, $I_{DQ2} = 100 \text{ mA}$

Parameter	Test Conditions	Min.	Typ.	Max.	Units	
28 V Specifications						
Output Power (P_{OUT})	$P_{IN} = 16 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 16 \text{ dBm}$	225 MHz 450 MHz 1400 MHz 2600 MHz	39.5	41	—	dBm
Power Gain (G_P)	$P_{IN} = 16 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 16 \text{ dBm}$	225 MHz 450 MHz 1400 MHz 2600 MHz	—	25 23 23 25	—	dB
Drain Efficiency (η_D)	$P_{IN} = 16 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 16 \text{ dBm}$	225 MHz 450 MHz 1400 MHz 2600 MHz	46 39 30 33	50 43 37 38	—	%
Input Return Loss (I_{RL})	$P_{IN} = 16 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 18 \text{ dBm}$ $P_{IN} = 16 \text{ dBm}$	225 MHz 450 MHz 1400 MHz 2600 MHz	—	-14 -15 -15 -8	—	dB
3rd Order Intermodulation Distortion (IM3)	33.5 dBm/tone, $F_2 - F_1 = 1.25 \text{ MHz}$	225 MHz 450 MHz 1400 MHz 2600 MHz	—	-30	-26	dBc
	31.0 dBm/tone, $F_2 - F_1 = 1.25 \text{ MHz}$			-31	-26	
Load Mismatch Tolerance (V_{SWR_T})	No Damage or Oscillations, All Phases		—	5:1	—	—
36 V Specifications						
Output Power (P_{OUT})	$P_{IN} = 18 \text{ dBm}$	320 MHz	42.2	43	—	dBm
Power Gain (G_P)			—	25	—	dB
Drain Efficiency (η_D)			49	51	—	%

4. Measured in MACOM's evaluation circuit (see page 4).

Thermal Characteristics

Parameter	Symbol	Test Conditions	Units	Min.	Typ.	Max.
Channel-to-Case Thermal Resistance ⁵	Θ_{CH-C}	$T_{CASE} = 85^\circ\text{C}$, RF applied, $P_{DISS} = 22.5 \text{ W}$	$^\circ\text{C/W}$	—	4.35	—

5. The channel temperature (T_{CH}) is determined using Raman and simulation techniques. For more details about this measurement contact the local application team.

Absolute Maximum Ratings^{6,7}

Parameter	Symbol	Absolute Maximum
Input Power	P_{IN}	27 dBm
Drain Supply Voltage	V_D	40 V
Gate Supply Voltage	V_G	-4 V to 0 V
Supply Current	I_{DS}	1.6 A
Power Dissipation	P_{DISS}	32 W
Channel Temperature ⁸	T_{CH}	250°C
Operating Temperature	T_{OP}	-40°C to 85°C
Storage Temperature	TSTG	-65°C to 150°C

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

7. MACOM does not recommend sustained operation near these survivability limits.

8. Operating at nominal conditions with $T_{CH} \leq 210^\circ\text{C}$ will ensure MTTF > 1×10^6 hours.

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.

Biasing Sequence

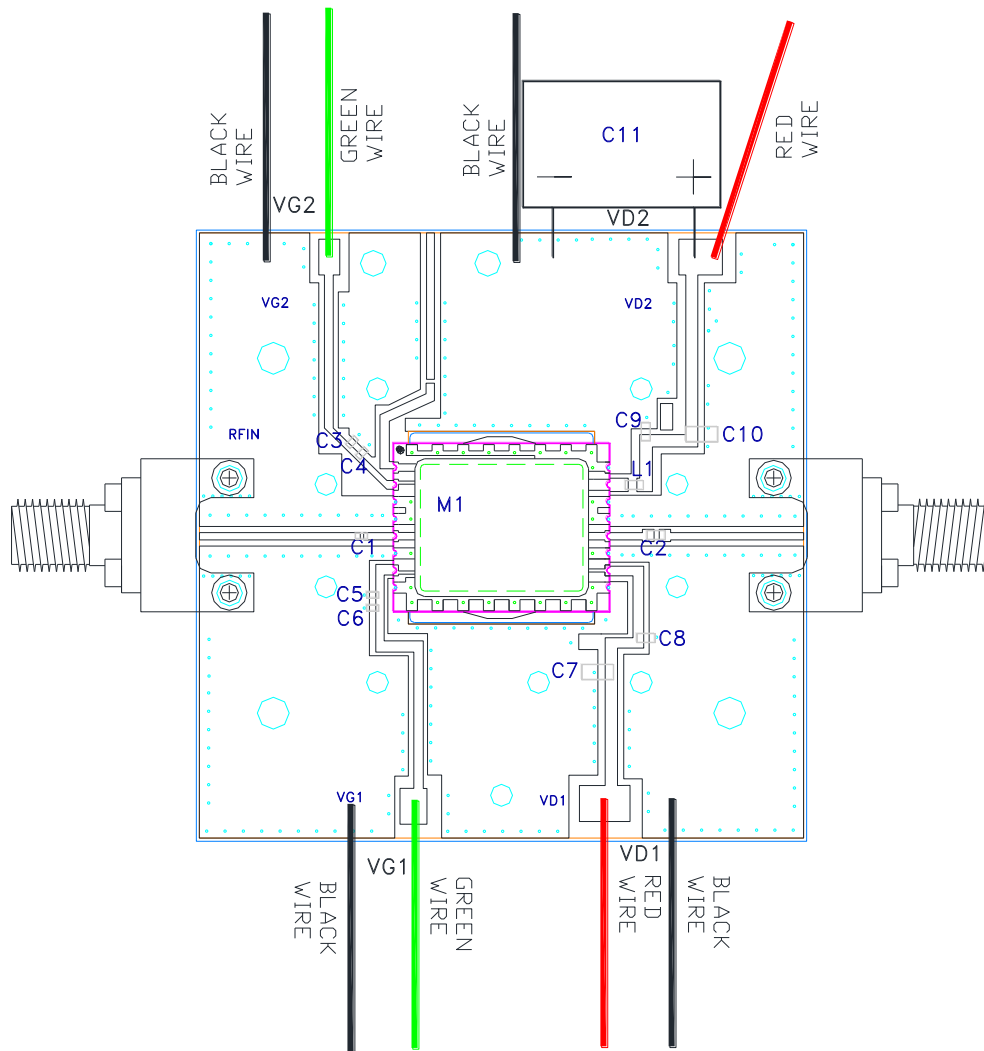
Turning the device ON:

1. Set V_G to pinch-off (V_P), typically -5 V.
2. Turn on V_D to nominal voltage (+28 V).
3. Increase V_G until the desired quiescent current I_{DQ} is reached.
4. Apply RF power to desired level.

Turning the device OFF:

1. Turn the RF power off.
2. Decrease V_{GS} down to V_P .
3. Decrease V_{DS} down to 0 V.
4. Turn off V_{GS} .

Evaluation Board and Component Layout



Parts List

Reference	Value	Case Style	Tolerance	Manufacturer	Part Number
L1	110 nH	0805	5%	Coilcraft	0805LS-111XJE
C1	1000 pF	0402	10%	Murata	GRM155R72A102KA01D
C2	1000 pF	0603	10%	Murata	GRM188R72A102KA37D
C3,C6	1 μ F	0402	20%	TDK	C1005X5R1E105M050BC
C4,C5	10 nF	0402	10%	Murata	GRM155R71H103KA88D
C8,C9	10 nF	0603	10%	Murata	GCM188R72A103KA37D
C7,C10	1 μ F	1210	10%	KEMET	C1210C105K1RACTU
C11	100 μ F	Axial	20%	Multicomp	MCAX63V107M10X21

10 W 2-Stage Hybrid GaN Module

225 - 2600 MHz



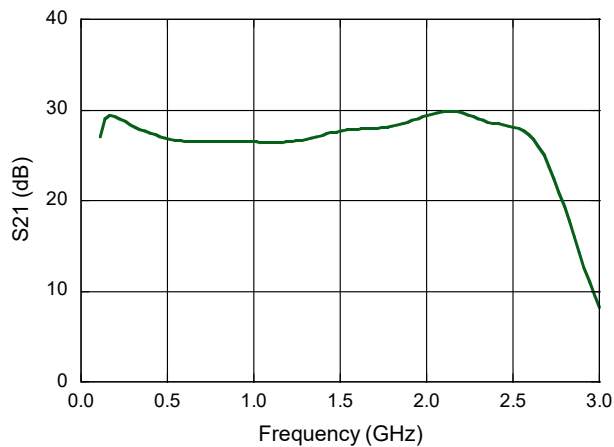
MAMG-100227-010C0L

Rev. V7

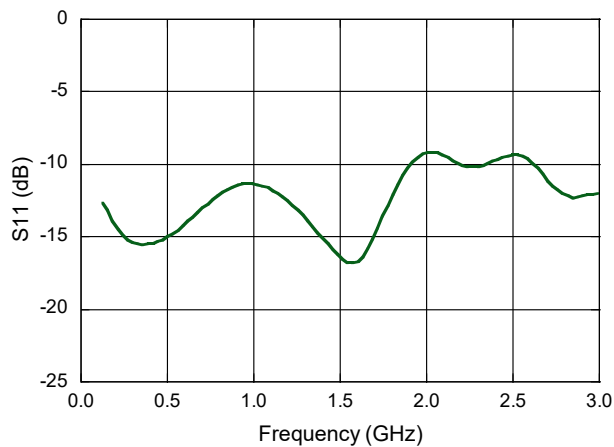
Typical Small Signal Performance:

$V_{DD} = 28 \text{ V}$, $I_{DQ1} = 40 \text{ mA}$, $I_{DQ2} = 100 \text{ mA}$, $T_A = 25^\circ\text{C}$

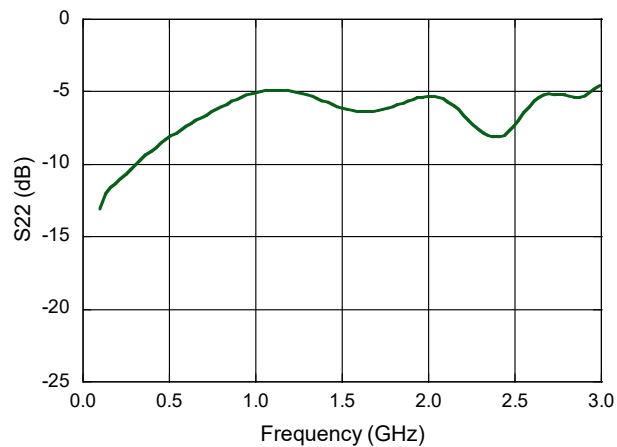
Gain



Input Return Loss



Output Return Loss



10 W 2-Stage Hybrid GaN Module

225 - 2600 MHz



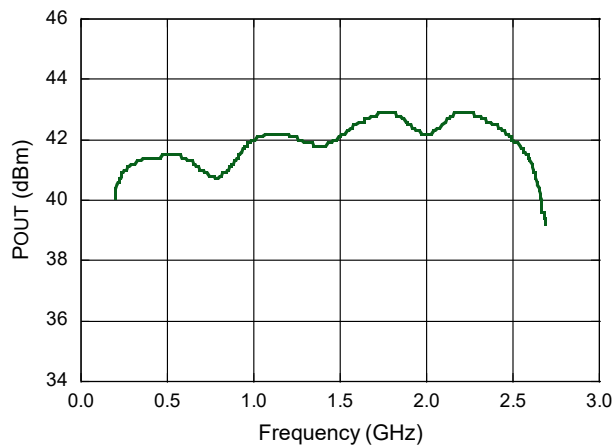
MAMG-100227-010C0L

Rev. V7

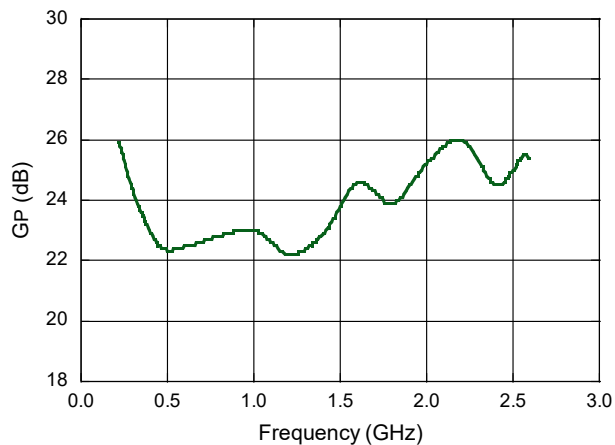
Typical Large Signal Performance:

$T_A = 25^\circ\text{C}$, $V_{DD} = 28\text{ V}$, $I_{DQ1} = 40\text{ mA}$, $I_{DQ2} = 100\text{ mA}$, P_{SAT} , CW

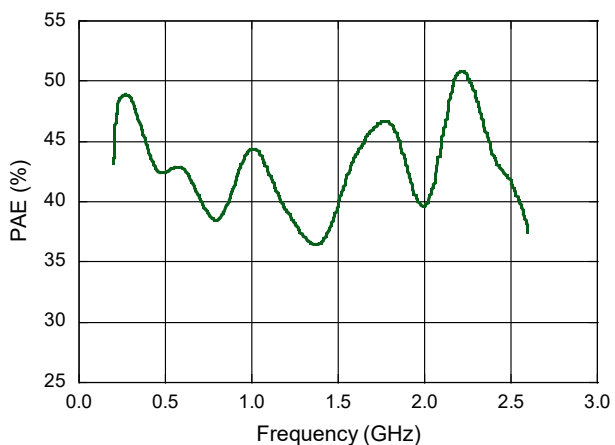
Output Power



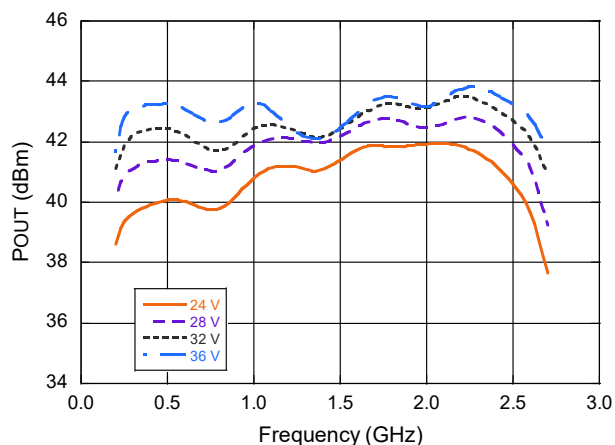
Power Gain



Power Added Efficiency



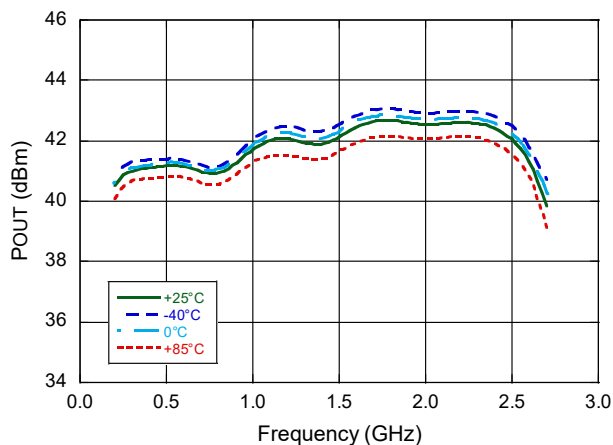
Output Power vs. Voltage



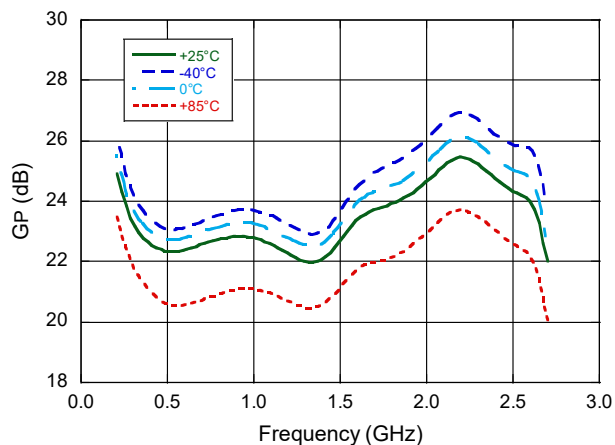
Typical Large Signal Performance vs. Temperature:

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 40\text{ mA}$, $I_{DQ2} = 100\text{ mA}$

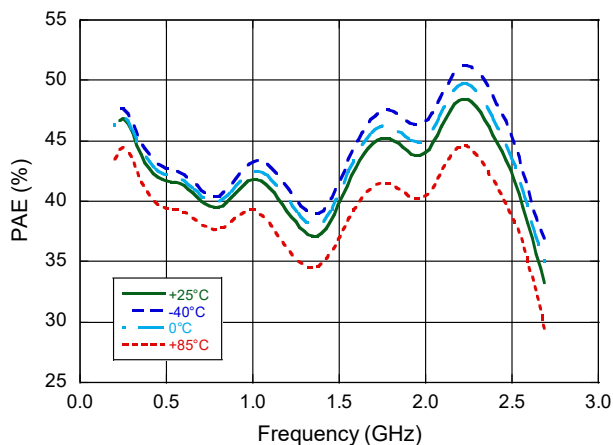
Saturated Output Power vs. Temperature



Saturated Power Gain vs. Temperature



Saturated Power Added Efficiency vs. Temperature



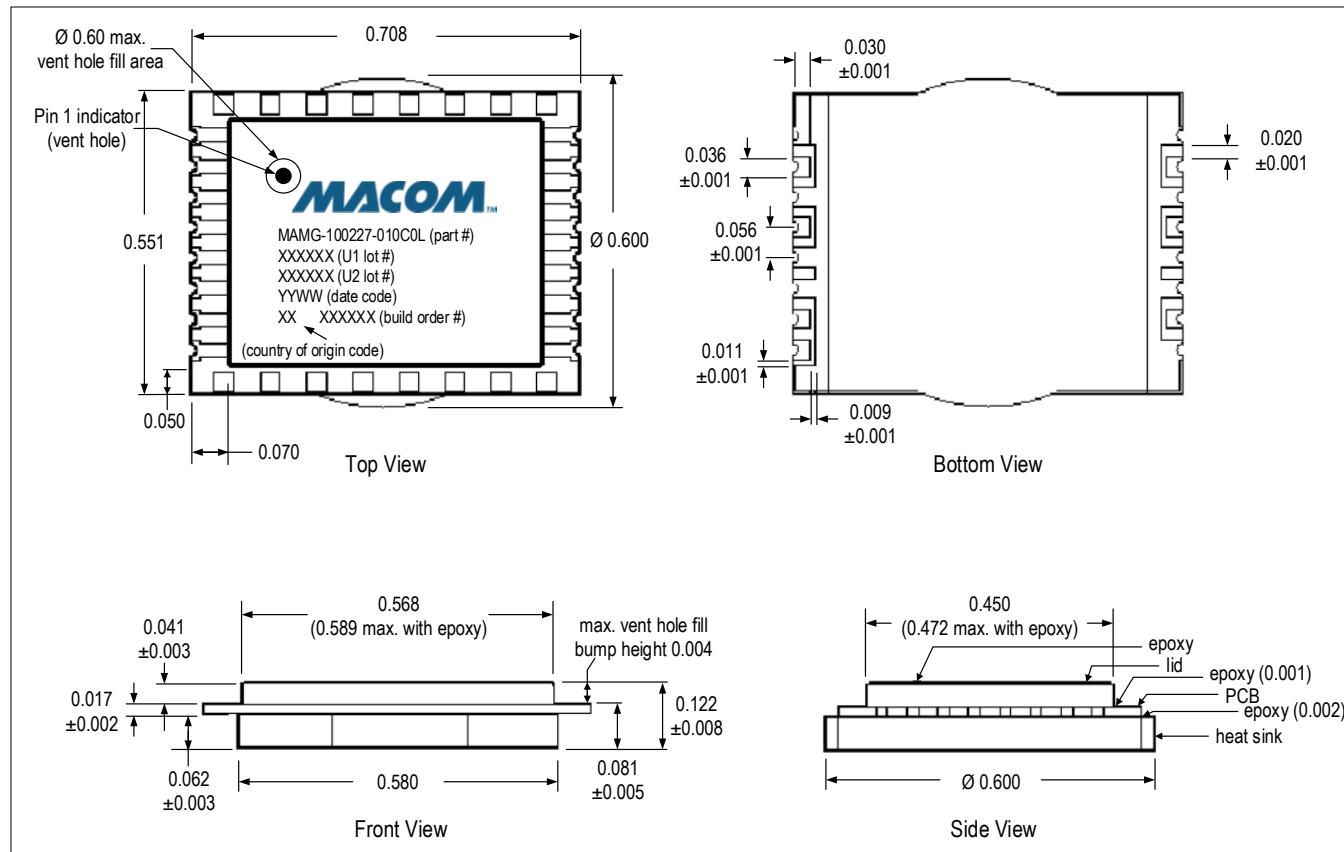
10 W 2-Stage Hybrid GaN Module 225 - 2600 MHz



MAMG-100227-010C0L

Rev. V7

Package Outline[†]



[†] All dimensions shown as inches.
Reference Application Note AN-0004016 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is Gold.

10 W 2-Stage Hybrid GaN Module

225 - 2600 MHz



MAMG-100227-010C0L

Rev. V7

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.