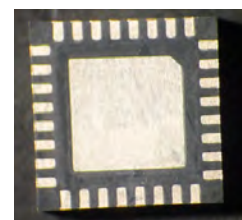


MMA-445933H-M5 4.4 - 5.9 GHz, 2 W High Efficiency Linear Power Amplifier

Features:

- 31 dB Gain
- 33 dBm P_{-1dB}
- OIP3 45 dBm
- 25.0 dBm Linear Pout @ 2.5 % EVM (802.11 64-QAM)
- Fully Matched Input and Output for Easy Cascade
- Internal Bias Tee
- Surface Mount, RoHS Compliant QFN 5x5mm Package



Description:

The MMA-445933H-M5 is a power amplifier with the State-of-the-Art linear power between 4.4 GHz and 5.9 GHz frequency band. Based on advanced robust HFET device technology, the linearity of this power amplifier is 25 dBm linear power at 2.5 % EVM and achieves an ACPR better than -36 dBc. The modulation test pattern is 802.16x 64-QAM. This linear power amplifier also has high gain. Ideal applications include the driver and the output power stage of WiMax and WLAN infrastructures and access points. It also can be used for PTP (Point-To-Point) radio applications for this band.

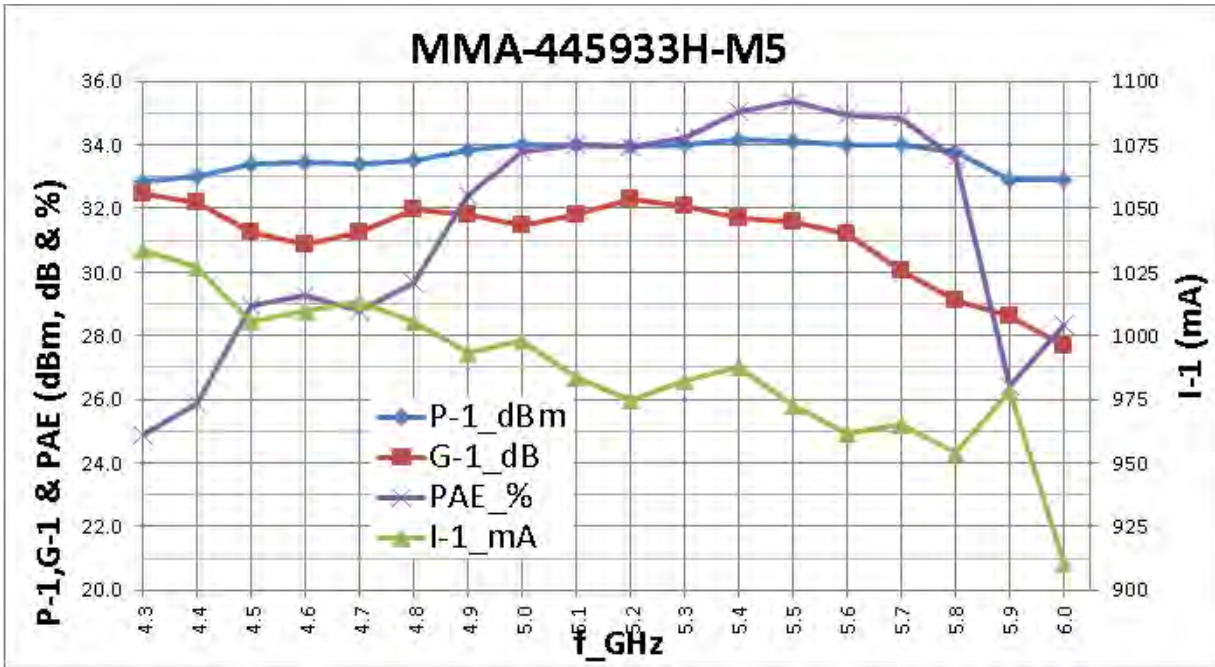
Typical RF Performance: $V_{d1} = 7.5 \text{ V}$, $V_{d2} = 7.5 \text{ V}$, $V_{g1} = -0.8 \text{ V}$, $V_{g2} = -0.8 \text{ V}$, $I_{dq1} = 410 \text{ mA}$, $I_{dq2} = 622 \text{ mA}$, $T_a = 25^\circ\text{C}$, $Z_0 = 50 \Omega$

Parameter	Units	Typical Data
Frequency Range	MHz	4400 - 5900
Gain (Typ)	dB	31
Gain Flatness (Typ)	±dB	2.5
Input Return Loss (Typ)	dB	10
Output Return Loss (Typ)	dB	10
Output P1dB (Typ)	dBm	33
OIP3 (Typ)	dBm	45
Pout @ 2.5 % EVM (Typ)	dBm	25.0
Operating Current Range	mA	1050
Thermal Resistance (Driver Stage)	°C /W	20
Thermal Resistance (Output Stage)	°C /W	16

MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

Typical RF Performance: $V_{d1} = 7.5\text{ V}$, $V_{d2} = 7.5\text{ V}$, $V_{g1} = -0.8\text{ V}$, $V_{g2} = -0.8\text{ V}$, $I_{dq1} = 410\text{ mA}$, $I_{dq2} = 620\text{ mA}$
 $Z_0 = 50\ \Omega$, $T_a = 25\ ^\circ\text{C}$



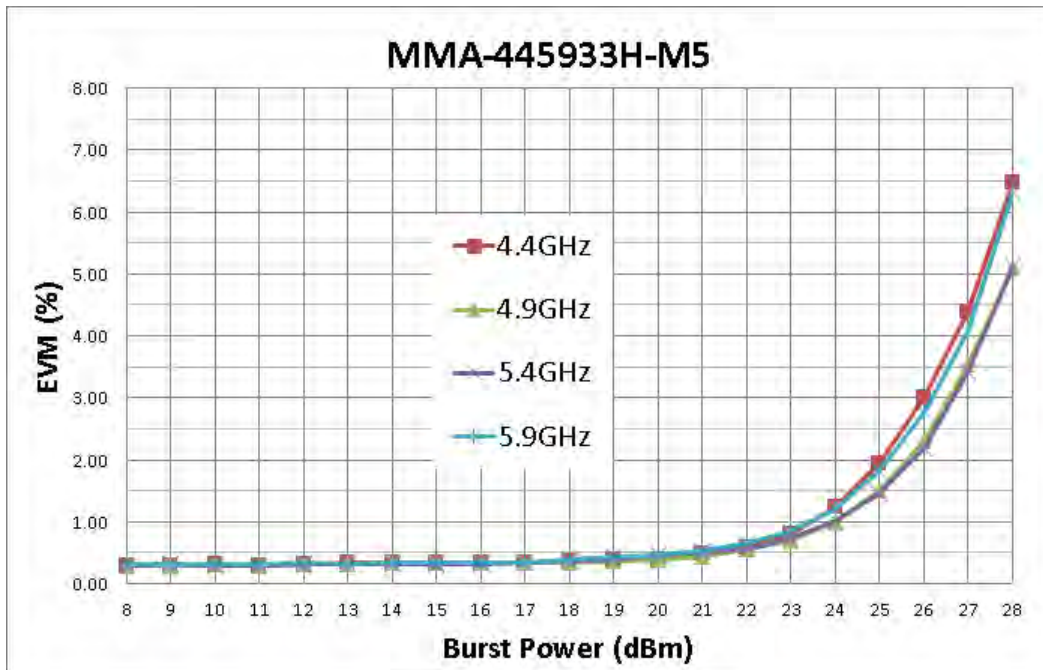
ESD Caution



High-performance RF integrated circuits are highly sensitive to electrostatic discharge (ESD) and may contain unprotected inputs and outputs. Handling and assembly should be conducted in an ESD-controlled environment. It is recommended that ESD precautions and protocols are adopted to minimise the risk of electrostatic discharge and protect product integrity.

MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

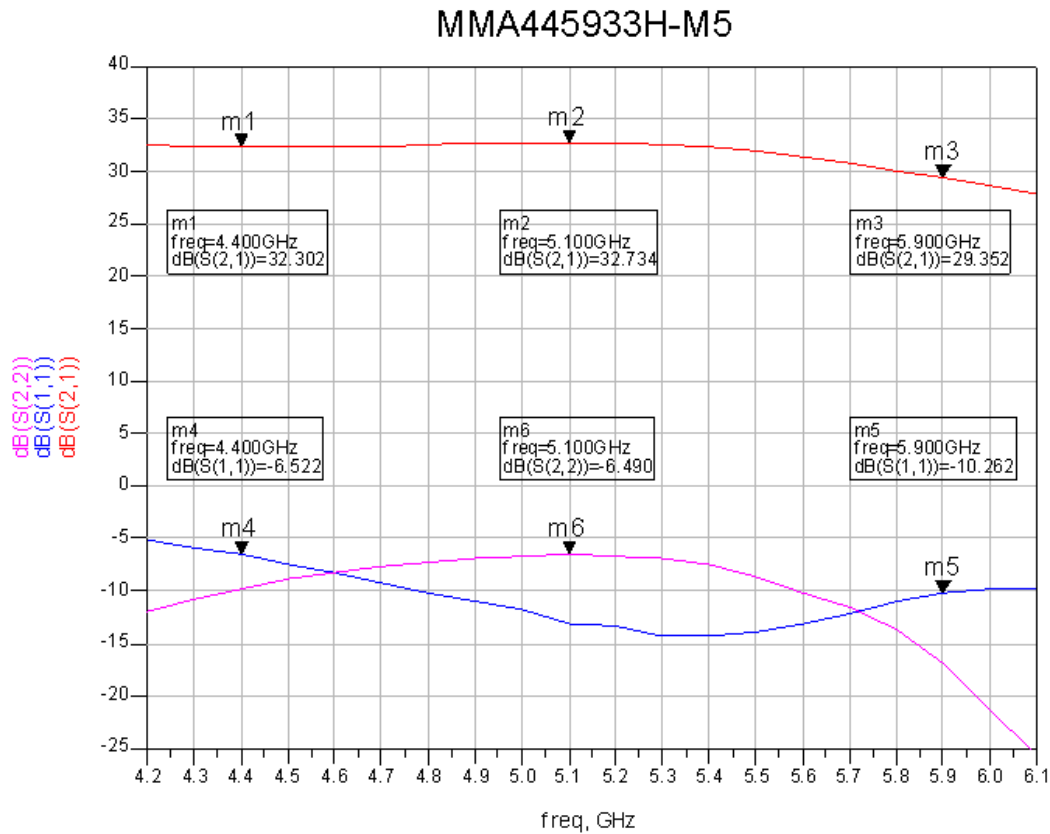


Absolute Maximum Ratings: ($T_a = 25^\circ\text{C}$)*

SYMBOL	PARAMETERS	UNITS	ABSOLUTE MAXIMUM
Vdd1	Drain-Source Voltage Driver Stage	V	10
Vdd2	Drain-Source Voltage Output Stage	V	10
Vgg1	Gate-Source Voltage Driver Stage	V	-5
Vgg2	Gate-Source Voltage Output Stage	V	-5
Idq1	Drain Current Driver Stage	mA	500
Idq2	Drain Current Output Stage	mA	750
Ig1 and Ig2	Gate Current	mA	10
I _p	Pinch-Off Current	mA	10
P _{diss}	DC Power Dissipation	W	9.0
P _{in max}	RF Input Power	dBm	+10
T _{oper}	Operating Temperature	°C	-40 to +85
T _{ch}	Channel Temperature	°C	175
T _{stg}	Storage Temperature	°C	-55 to 150

*Operation of this device above any one of these parameters may cause permanent damage.

Small Signal Gain and S-Parameters

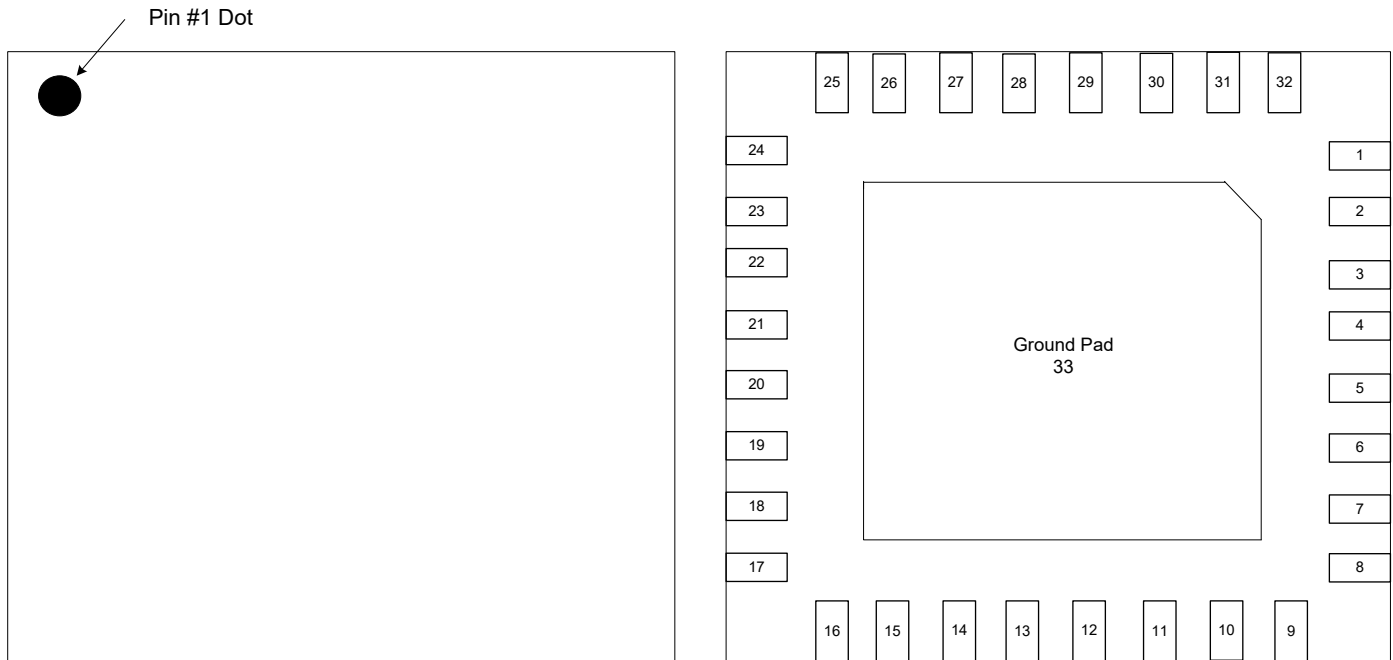


S11, S22, S21

MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

Mechanical Information:

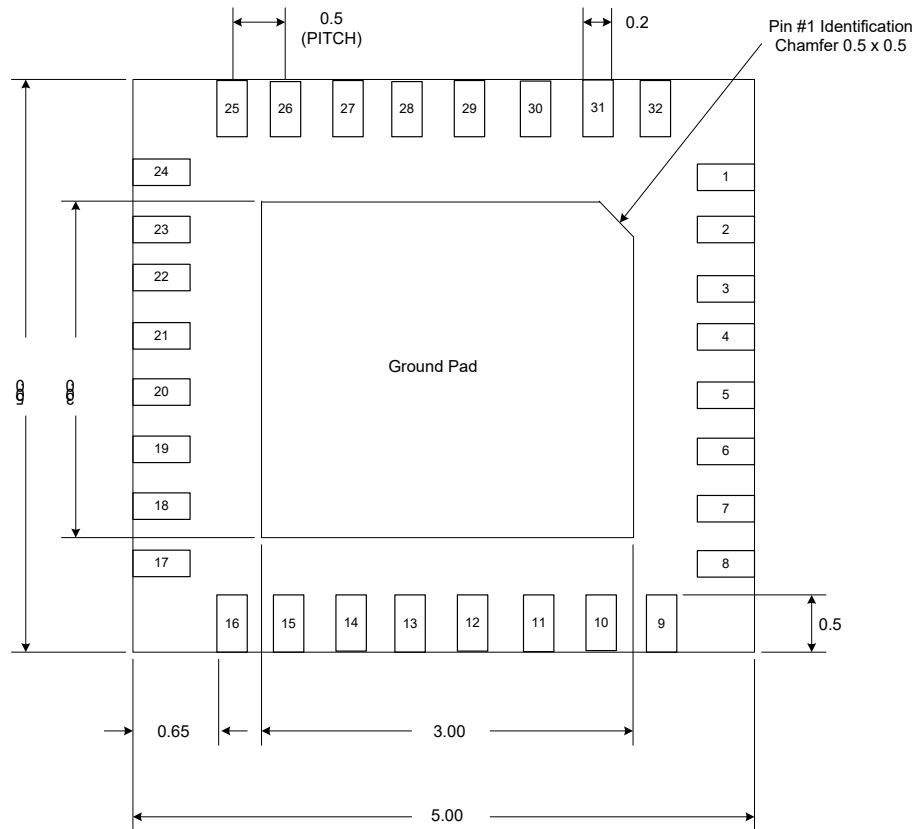


Pin	Description
4, 5	RFin
20, 21	RFout
30, 29	Vgs1a, Vgs1b
27	Vgs2
11, 12	Vds1a, Vds1b
14	Vds2
1, 2, 7, 8, 9, 16, 17, 18, 23, 24, 25, 32	Ground
3, 6, 10, 13, 15, 19, 22, 26, 28, 31	N/C

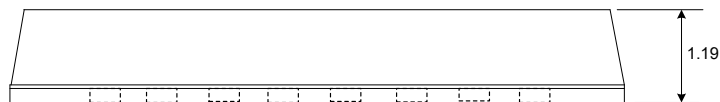
MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

Mechanical Information:



BOTTOM VIEW



SIDE VIEW

The units are in [mm].

MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

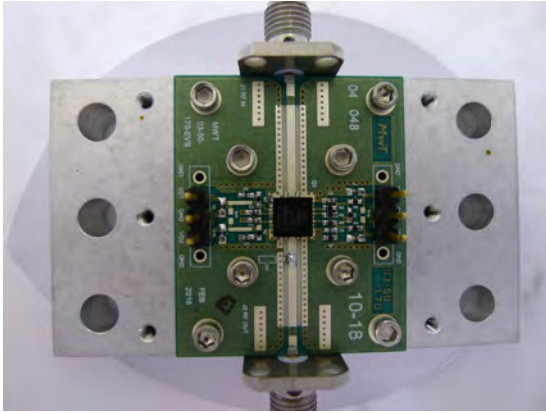


Figure 1 Evaluation Board

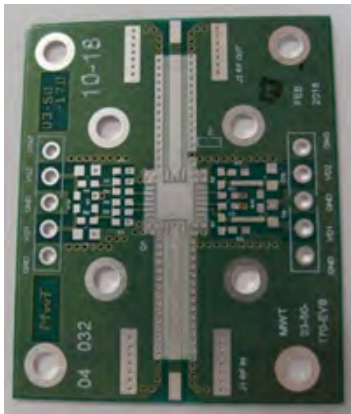


Figure 2 Hole Layout

Application Note:

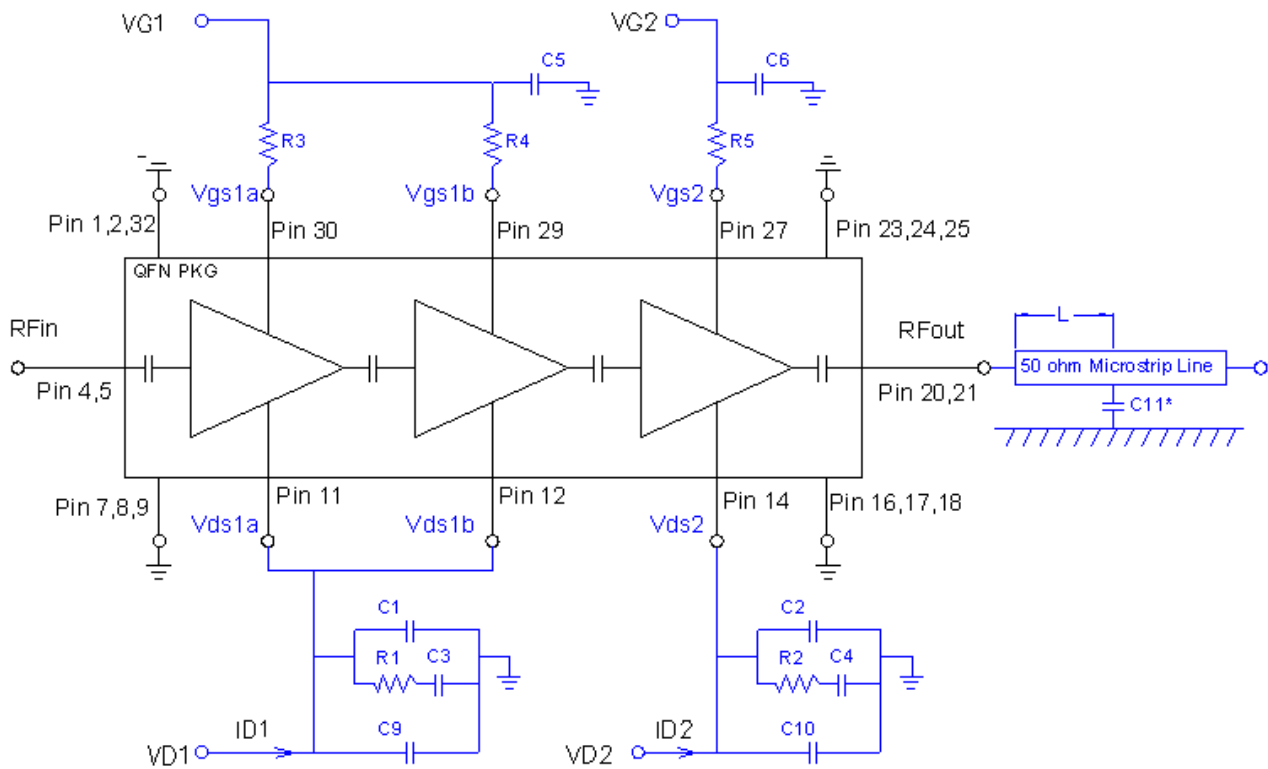
The evaluation board, shown in Figure 1, is fabricated with Rogers's 4003 material, 20 mil thick, 2 oz copper weight and includes four DC input connections and two RF lines. The MMA-445933H-M5 shown in the center of board is a 2 watt high gain and high linearity amplifier. The MMA-445933H-M5 is a 3-stage amplifier assembly die attach to the modified '02' package which includes four bias entries and two RF connections. The bias tees are built-in to the package. Small value bypassing capacitors are included with assembly. Proper bypassing is still required on the DCC lines. The amplifier operates over a temperature range of approximately 85°C.

The PCB requires via holes with a diameter of 20 mils placed uniformly over the center pad for thermal relief and RF ground as shown in Figure 2. The via holes can be back filled with conductive epoxy for best thermal performance.

MMA-445933H-M5

4.4 – 5.9 GHz, 2 W High Efficiency
Linear Power Amplifier

Circuit Diagram:



Components	Value	
R1,R2	50 ohm	
R3,R4	39 ohm	
R5	22 ohm	
C1,C2	100~1000 pF	
C3,C4,C5,C6	0.1 μ F	
C9,C10	>0.1 μ F	
C11* (Option for better VSWR)	0.15 - 0.2 pF, Distance = L	
	$L = \frac{0.203}{\sqrt{\epsilon_e}}$ (inch)	

ϵ_e is the effective dielectric constant of the 50 ohm micro-strip transmission line of the PCB circuit. For example, this length will be 0.1215 inch from the package edge to the capacitor center for 50 ohm line with Rogers RO 4003C substrate (Line width will be 0.042 inch for

RoHS Compliance



CML Micro certifies, to the best of our knowledge, that its products comply with RoHS directive (2011/65/EU), as amended by Directive (EU) 2015/863.

REACH Compliance



CML Micro certifies, to the best of our knowledge, that its products do not contain any of the banned substances specified in the SVHC list at <https://echa.europa.eu/candidate-list-table>. CML Micro are committed to ensuring the safety of products and the compliance with regulations. Publications will be updated in the event that REACH control is compromised.

Contact Information

For further information please contact your local CML sales representative.
Contact details can be found at www.cmlmicro.com.

Important notice: The information provided in this document is believed to be accurate and reliable however, CML assumes no responsibility for any errors or omissions in this document. CML reserves the right to make changes to this document at any time without notice.

The product(s) referenced within this document are not designed, authorized, or warranted for use in life support, life-critical, surgical or nuclear applications, nor in any application where the failure of the product could create a situation where personal injury or death may occur. Customers using or selling the product for such applications do so entirely at their own risk and without any recourse to CML, financial or otherwise.

CML assumes no liability for applications assistance or the design of customers' products. Customers are solely responsible for the design, validation, and testing of customer products as well as compliance with all legal, regulatory, and safety-related requirements concerning their applications.

ALL SPECIFICATIONS AND DATA ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. PRODUCTS ARE PROVIDED UNDER THE TERMS OF CML'S CONDITIONS OF SALE.

Nothing in this document or any purchase of CML products shall be construed as granting any license, whether express or implied, under any patent, copyright, trade secret, or other intellectual property right owned or controlled by CML.