

FTTx RF Amplifier 50 - 1000 MHz

Rev. V5

Features

- -8 dBm to +2 dBm Optical Input Range
- Low Equivalent Input Noise (EIN): 4.8 pA/rtHz
- 5 V Bias
- 37 dB Gain; Flat from 55 MHz to 1000 MHz
- 25 dB Gain Control Range
- 20 dBmV/ch Flat Output
- Lead-Free 4 mm PQFN-24LD Plastic Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant

Description

The MAAM-008863 provides high gain, low noise and low distortion amplification of the downstream CATV signal in fiber-to-the-home (FTTH) applications. This device is ideally suited for interfacing with the RF video output of optical triplexers used within optical network terminals (ONTs).

The MAAM-008863 is fabricated using MACOM's low noise GaAs pHEMT technology in a lead-free 4 mm 24-lead package. The amplifier requires a minimal number of off-chip components resulting in a highly integrated low cost solution.

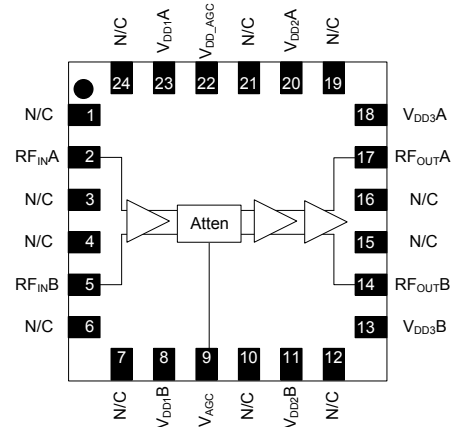
Ordering Information ^{1,2}

Part Number	Package
MAAM-008863-TR1000	1000 Piece Reel
MAAM-008863-TR3000	3000 Piece Reel
MAAM-008863-002SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.
2. All sample kits include photodiode and 5 loose parts.

* Restrictions on Hazardous Substances,
European Union Directive 2011/65/EU.

Functional Schematic



Pin Configuration ³

Pin No.	Pin Name	Description
1	N/C	No Connection
2	RF _{IN} A	RF Input A
3	N/C	No Connection
4	N/C	No Connection
5	RF _{IN} B	RF Input B
6	N/C	No Connection
7	N/C	No Connection
8	V _{DD} 1B	5 V Bias Voltage
9	V _{AGC}	AGC Control Voltage: 0 V to 3 V
10	N/C	No Connection
11	V _{DD} 2B	5 V Bias Voltage
12	N/C	No Connection
13	V _{DD} 3B	5 V Bias Voltage
14	RF _{OUT} B	RF Output B
15	N/C	No Connection
16	N/C	No Connection
17	RF _{OUT} A	RF Output A
18	V _{DD} 3A	5 V Bias Voltage
19	N/C	No Connection
20	V _{DD} 2A	5 V Bias Voltage
21	N/C	No Connection
22	V _{DD} _AGC	5 V AGC Bias Voltage
23	V _{DD} 1A	5 V Bias Voltage
24	N/C	No Connection
25	Paddle	RF and DC Ground

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

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Electrical Specifications⁴: $T_A = 25^\circ\text{C}$, $V_{DD} = 5\text{ Volts}$, $Z_0 = 75\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain @ AGC = 3 V	50 MHz	dB	36.2	38.2	40.2
	870 MHz		36.9	38.9	40.9
	1000 MHz		36.8	38.8	40.8
Gain @ AGC = 1.3 V	50 MHz	dB	36.3	38.3	40.3
	870 MHz		37.4	39.4	41.4
	1000 MHz		34.9	36.9	38.9
Gain @ AGC = 1 V	50 MHz	dB	35.5	37.5	39.5
	870 MHz		35.0	37.0	39.0
	1000 MHz		34.8	36.8	38.8
Gain @ AGC = 0.5 V	50 MHz	dB	23.5	26.0	28.5
	870 MHz		23.9	26.4	28.9
	1000 MHz		23.3	25.8	28.3
Gain @ AGC = 0 V	50 MHz	dB	10.3	12.3	14.3
	870 MHz		11.5	13.5	15.5
	1000 MHz		11.8	13.8	15.8
Gain Tilt	Within AGC control voltage range	dB	-	0	-
AGC Control Voltage Range	—	V	0	-	3
EIN	—	pA/rtHz	-	4.8	-
Output Return Loss	—	dB	-	16	-
CTB ⁵	79 channels	dBc	-	-61	-
CSO ⁵	79 channels	dBc	-	-62	-
Current Consumption	5 V V_{DD}	mA	-	220	250

4. Performance is specified using JDSU Photodiode EPM-745 or equivalent (EPM705) and output balun # MABA-009210-CT1760.

5. OMI = 3.5%; $P_{OUT} = 20\text{ dBmV/ch}$; Optical input power range: -8 dBm to +2 dBm.

Absolute Maximum Ratings^{6,7}

Parameter	Absolute Maximum
Input Power	3 dBm Optical
Operating Voltage	15 volts
AGC Voltage	5 volts
Operating Temperature	-40°C to +85°C
Junction Temperature ^{8,9}	+150°C
Storage Temperature	-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 $T_J \leq +150^\circ\text{C}$ will ensure $MTTF > 1 \times 10^6$ hours.
9. Junction Temperature (T_J) = $T_C + \Theta_{jc} * ((V * I) - (P_{OUT} - P_{IN}))$
Typical thermal resistance (Θ_{jc}) = 19°C/W.
 - a) For $T_C = 25^\circ\text{C}$,
 $T_J = 46^\circ\text{C}$ @ 5 V, 220 mA
 - b) For $T_C = 85^\circ\text{C}$,
 $T_J = 106^\circ\text{C}$ @ 5 V, 220 mA

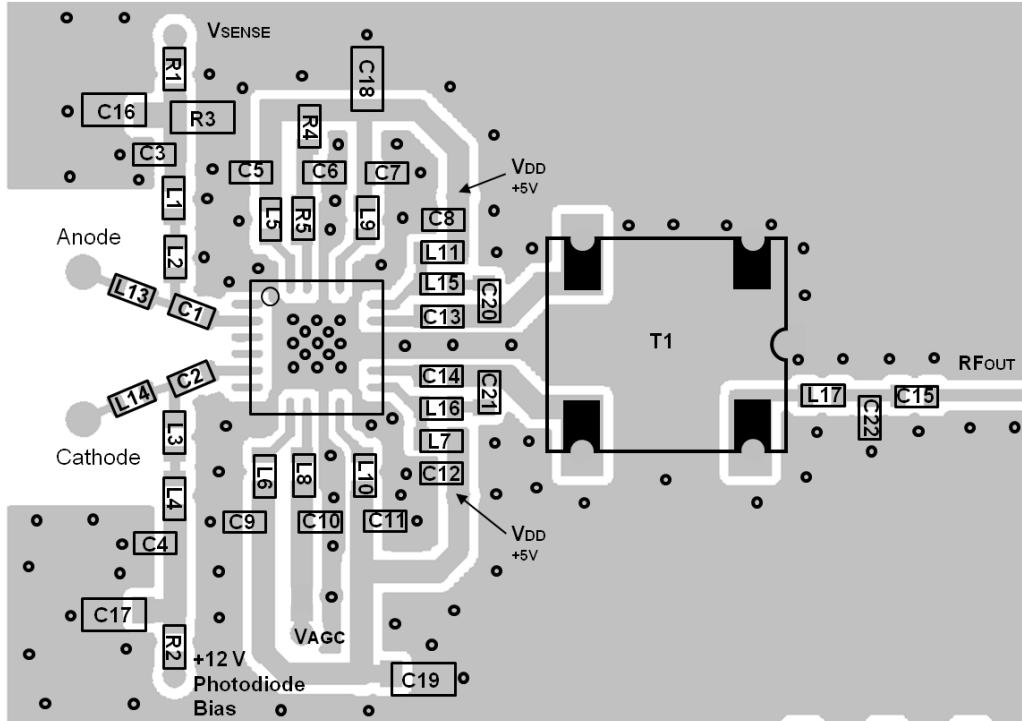
Handling Procedures

Please observe the following precautions to avoid damage:

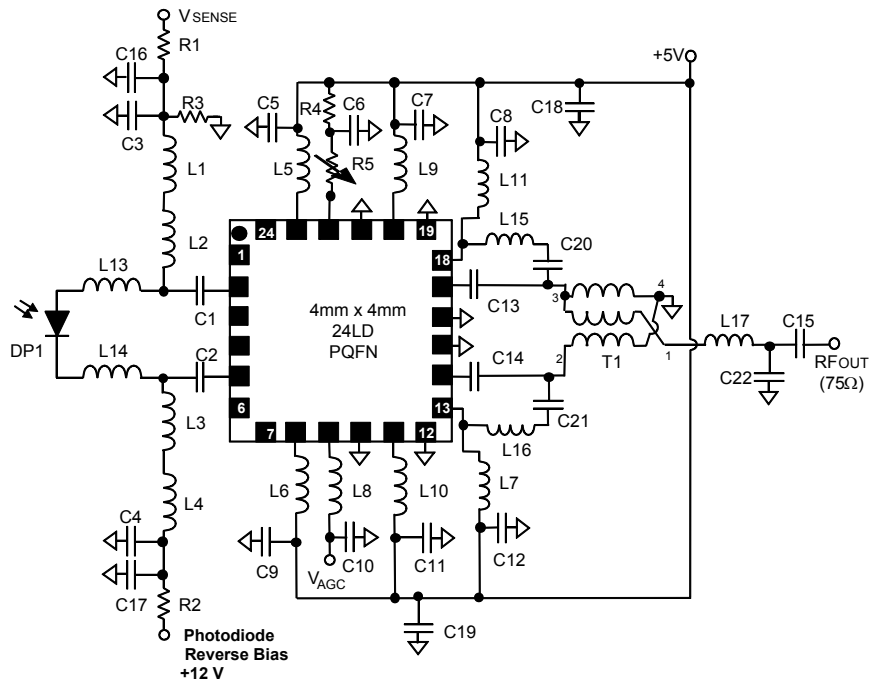
Static Sensitivity

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

Recommended PCB



Schematic Including Off-Chip Components



Parts List

Component	Value	Case Style
L1 - L11 ¹⁰	Ferrite Bead	0402
L13 - L14	18 nH wire wound	0402
L15 - L16	15 nH	0402
L17	4.7 nH	0402
C1 - C15	0.01 μ F	0402
C16 - C19	1 μ F	0603
C20,C21	1.2 pF	0402
C22	0.6 pF	0402
R1	1 k Ω	0402
R2	200 Ω	0402
R3	1 k Ω	0603
R4	270 Ω	0402
R5 ¹¹	120 Ω , 3300 ppm/ $^{\circ}$ C	0402
T1 ¹²	1:1 Balun	SM-118A
DP1	Photodiode	T08

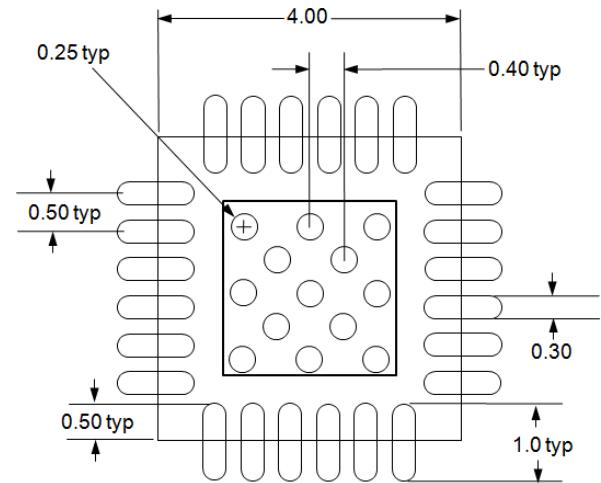
10. Ferrite Bead from Murata, part number BLM15HD182SN

11. R5 is a 120 Ω , 0402 thermistor, 3300 ppm/ $^{\circ}$ C.

Part number is ERA-W33J121X from Panasonic.

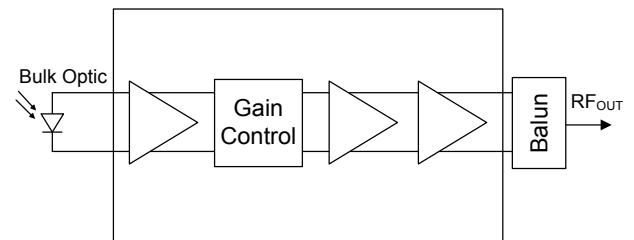
12. MACOM MABA-009210-CT1760 1:1 T_x Line Balun

PCB Land Pattern



All dimensions in mm.

Application Schematic



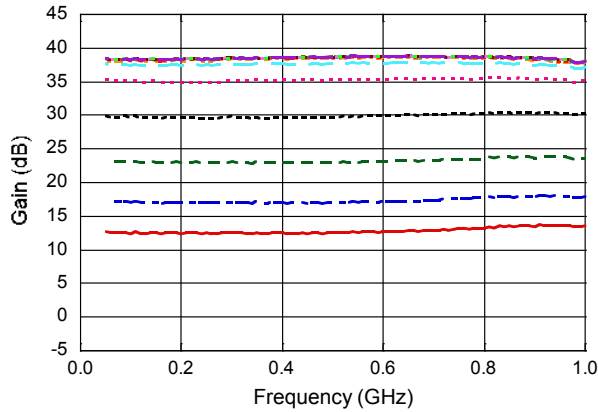
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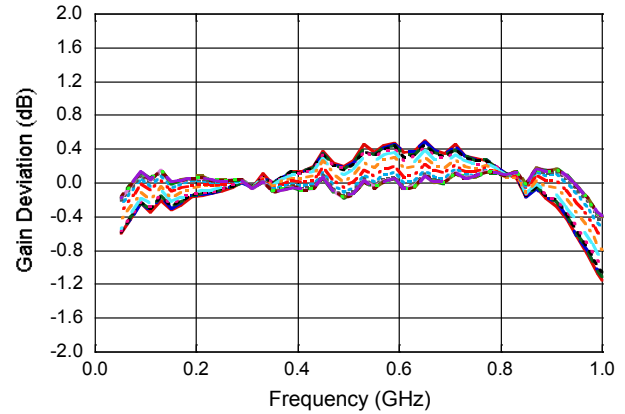
Typical Performance Curves: V_{AGC} : 0 V to 3 V in 0.2 V Steps



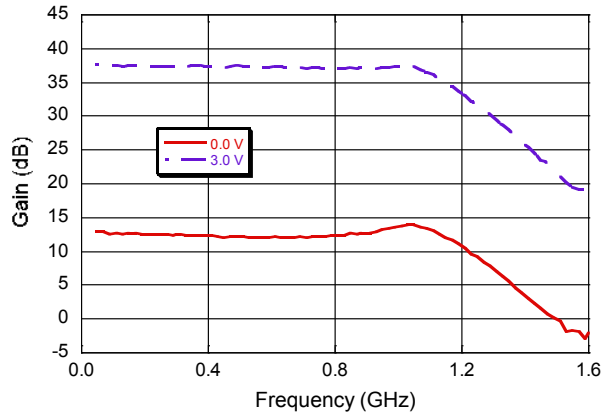
Gain @ +25°C



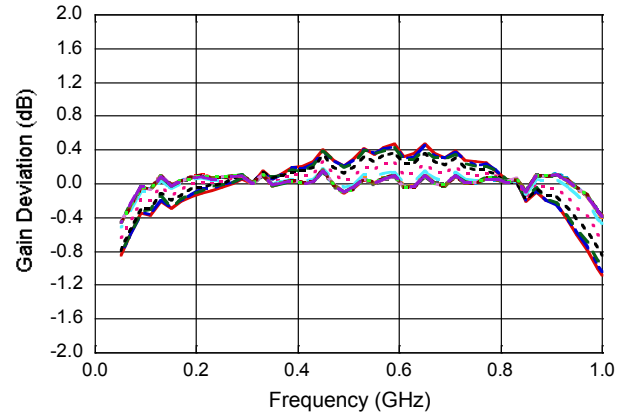
Gain Flatness Deviation From Best Fit Line @ +25°C



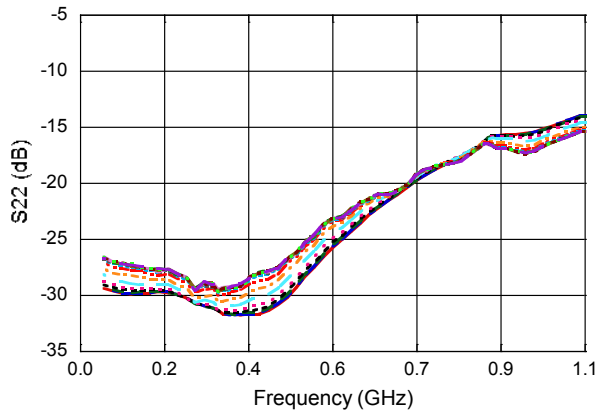
Gain vs. Frequency to 1.6 GHz @ +25°C



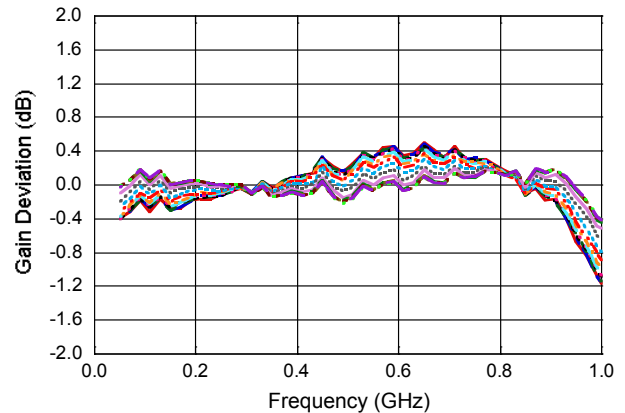
Gain Flatness Deviation From Best Fit Line @ -40°C



Output Return Loss @ +25°C

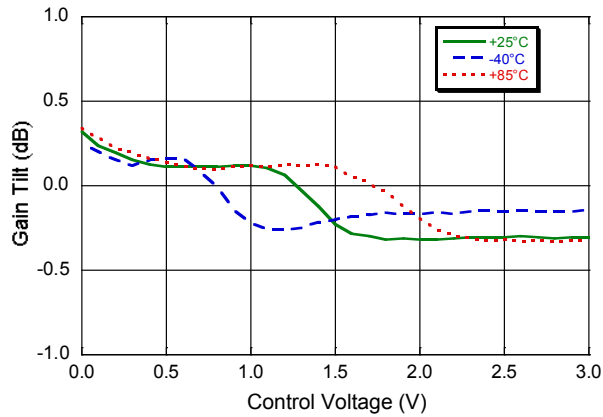


Gain Flatness Deviation From Best Fit Line @ +85°C

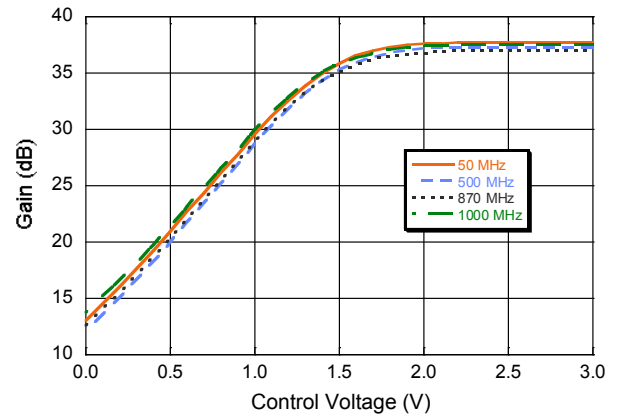


Typical Performance Curves

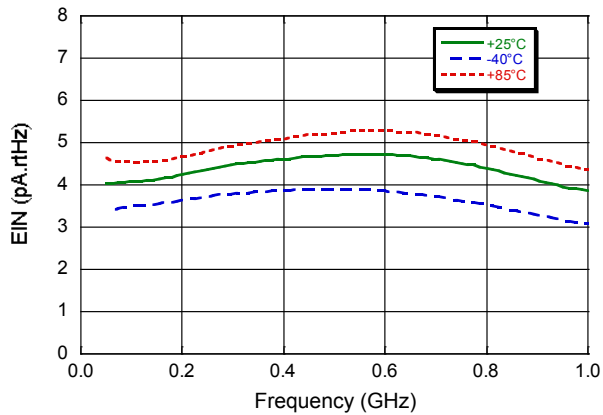
Gain Tilt Deviation From Average Tilt; Over Temp
 V_{AGC} : 0 V to 3 V in 0.2 V Steps



Gain vs. V_{AGC} ; At 4 Frequencies
 V_{AGC} : 0 V to 3 V in 0.2 V Steps

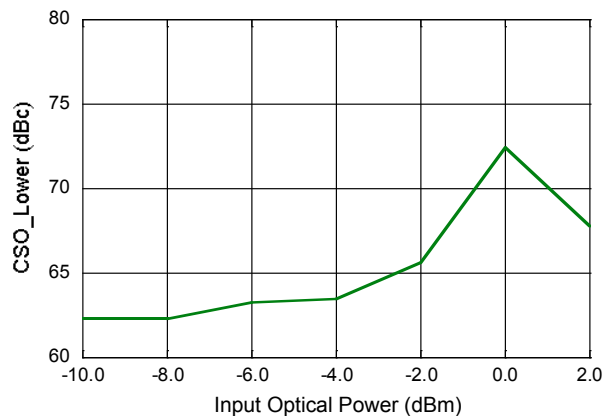


Equivalent Input Noise; Over Temp;
At Max Gain; $V_{AGC} = 3$ V

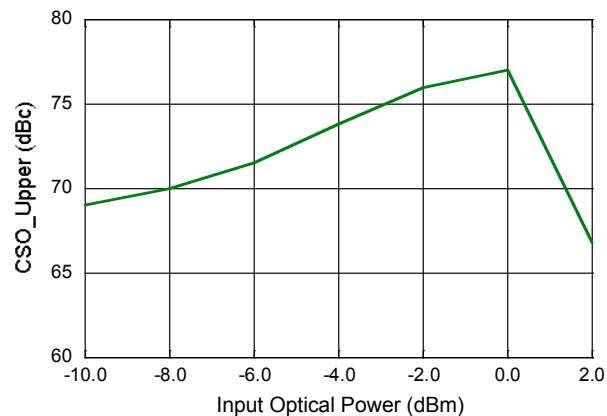


Typical Performance Curves: 79 Channels; NTSC Frequency Plan, $P_{OUT} = 20 \text{ dBmV/ch}$

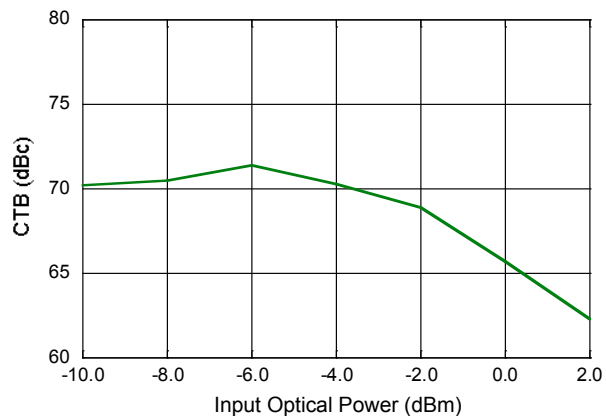
CSO_Lower



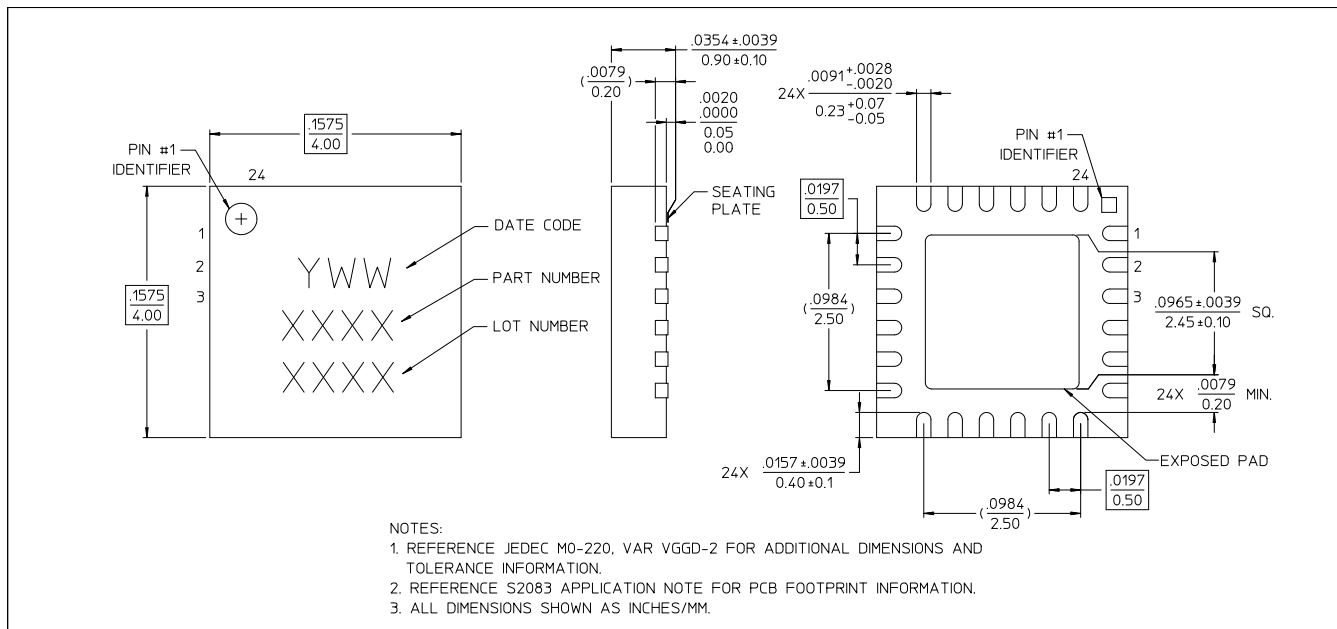
CSO_Upper



CTB



Lead Free 4 mm 24-lead PQFN[†]



[†] Reference Application Note S2082 for lead-free solder reflow recommendations.
 Meets JEDEC moisture sensitivity level 1 requirements.
 Plating is 100% matte tin over copper.

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