

**Digital Attenuator**  
**31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz**

**MAATCC0010**  
**V3**

**Features**

- Attenuation: 1.0 dB Steps to 31 dB
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free CSP-1 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT90-0263

**Description**

M/A-COM's MAATCC0010 is a GaAs FET 5-bit digital attenuator with integral TTL driver. Step size is 1.0 dB providing 31 dB total attenuation range. This device is in a PQFN plastic surface mount package. The MAATCC0010 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

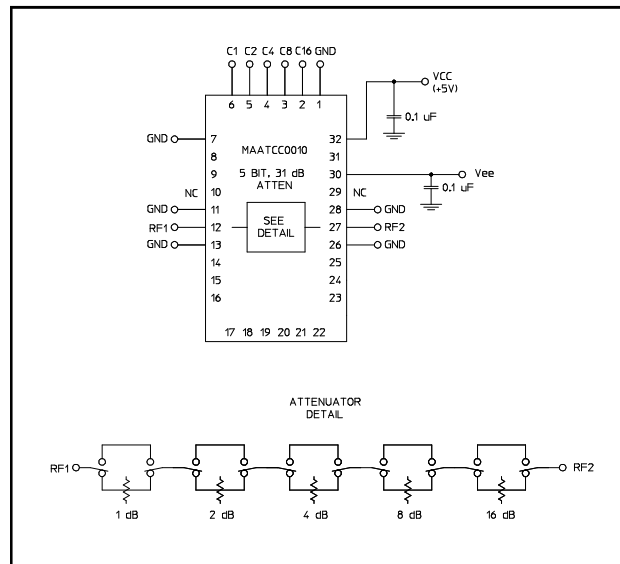
**Ordering Information**

| Part Number   | Package           |
|---------------|-------------------|
| MAATCC0010    | Bulk Packaging    |
| MAATCC0010TR  | 1000 piece reel   |
| MAATCC0010-TB | Sample Test Board |

Note: Reference Application Note M513 for reel size information.

Note: Die quantity varies.

**Block Diagram**



**Pin Configuration<sup>2</sup>**

| Pin No. | Function        | Pin No. | Function        |
|---------|-----------------|---------|-----------------|
| 1       | GND             | 17      | NC              |
| 2       | C16             | 18      | NC              |
| 3       | C8              | 19      | NC              |
| 4       | C4              | 20      | NC              |
| 5       | C2              | 21      | NC              |
| 6       | C1              | 22      | NC              |
| 7       | GND             | 23      | NC              |
| 8       | NC              | 24      | NC              |
| 9       | NC              | 25      | NC              |
| 10      | NC <sup>3</sup> | 26      | GND             |
| 11      | GND             | 27      | RF2             |
| 12      | RF1             | 28      | GND             |
| 13      | GND             | 29      | NC <sup>1</sup> |
| 14      | NC              | 30      | Vee             |
| 15      | NC              | 31      | NC              |
| 16      | NC              | 32      | +Vcc            |

1. Pins 10 & 29 must be isolated
2. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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**Electrical Specifications: T<sub>A</sub> = +25°C**

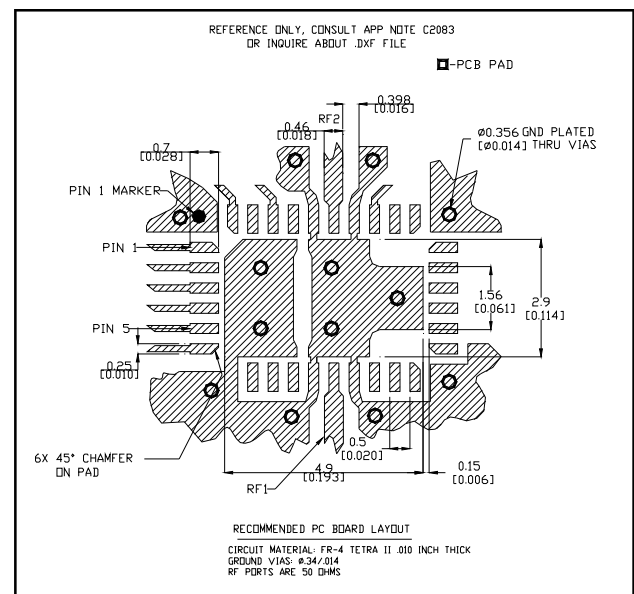
| Parameter  | Test Conditions  | Frequency                    | Units      | Min          | Typ         | Max  |
|--|--|------------------------------|------------|--------------|-------------|--|
| Insertion Loss   | —  | DC - 3.0 GHz                 | dB         | —            | 3.6         | 4.0  |
| Attenuation Accuracy   | Individual Bits 1-2-4-8-16 dB<br>Any Combination of Bits 1 to 31 dB              | DC - 3.0 GHz<br>DC - 3.0 GHz | dB<br>dB   | —<br>—       | —<br>—      | ±(.3 +5% of atten setting)<br>±(.5 +7% of atten setting) |
| VSWR   | Full Range   | DC - 3.0 GHz                 | Ratio      | —            | 2.0:1       | 2.2:1  |
| Switching Speed  | 50% Cntl to 90%/10% RF<br>10% to 90% or 90% to 10%                               | —<br>—                       | ns<br>ns   | —<br>—       | 75<br>20    | 150<br>50  |
| 1 dB Compression   | —<br>—   | 50 MHz<br>0.5 - 3.0 GHz      | dBm<br>dBm | —<br>—       | +21<br>+24  | —<br>—   |
| Input IP <sub>3</sub>  | Two-tone inputs up to +5 dBm   | 50 MHz<br>0.5 - 3.0 GHz      | dB<br>dB   | —<br>—       | +35<br>+48  | —<br>—   |
| V <sub>CC</sub><br>V <sub>EE</sub>                                   | —<br>—   | —<br>—                       | V<br>V     | 4.75<br>-8.0 | 5.0<br>-5.0 | 5.25<br>-4.75  |
| V <sub>IL</sub><br>V <sub>IH</sub>                                   | LOW-level input voltage<br>HIGH-level input voltage                              | —<br>—                       | V<br>V     | 0.0<br>2.0   | —<br>—      | 0.8<br>5.0   |
| I <sub>in</sub> (Input Leakage Current)                              | V <sub>in</sub> = V <sub>CC</sub> or GND   | —                            | uA         | -1.0         | —           | 1.0  |
| I <sub>CC</sub><br>(Quiescent Supply Current)                        | V <sub>cntrl</sub> = V <sub>CC</sub> or GND                                      | —                            | uA         | —            | 250         | 400  |
| ΔI <sub>CC</sub><br>(Additional Supply Current<br>Per TTL Input Pin) | V <sub>CC</sub> = Max, V <sub>cntrl</sub> = V <sub>CC</sub> - 2.1 V              | —                            | mA         | —            | —           | 1.0  |
| I <sub>EE</sub>  | V <sub>EE</sub> min to max, V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> | —                            | mA         | -1.0         | -0.2        | —  |
| Thermal Resistance θ <sub>Jc</sub>                                   | —  | —                            | °C/W       | —            | 35          | —  |

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

| Parameter                                     | Absolute Maximum                                  |
|---|---|
| Max. Input Power<br>0.05 GHz<br>0.5 - 3.0 GHz | +27 dBm<br>+34 dBm                                |
| V <sub>CC</sub>                               | -0.5V ≤ V <sub>CC</sub> ≤ +7.0V                   |
| V <sub>EE</sub>                               | -8.5V ≤ V <sub>EE</sub> ≤ +0.5V                   |
| V <sub>CC</sub> - V <sub>EE</sub>             | -0.5V ≤ V <sub>CC</sub> - V <sub>EE</sub> ≤ 14.5V |
| V <sub>in</sub> <sup>5</sup>                  | -0.5V ≤ V <sub>in</sub> ≤ V <sub>CC</sub> + 0.5V  |
| Operating Temperature                         | -40°C to +85°C                                    |
| Storage Temperature                           | -65°C to +125°C                                   |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.
- Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

**Recommended PCB Configuration<sup>6</sup>**



6. Application Note S2083 is available on line at [www.macom.com](http://www.macom.com)

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

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**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.

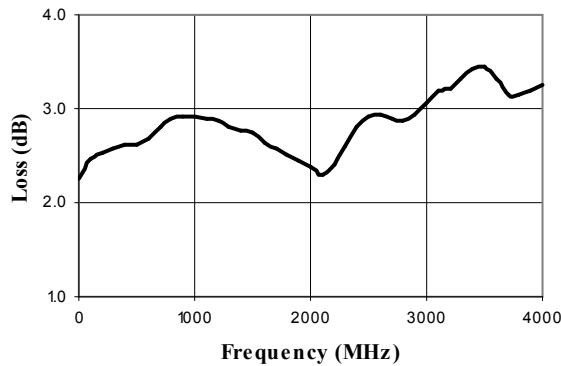
**Truth Table (Digital Attenuator)**

| C16 | C8 | C4 | C2 | C1 | Attenuation     |
|-----|----|----|----|----|-----------------|
| 0   | 0  | 0  | 0  | 0  | Loss, Reference |
| 0   | 0  | 0  | 0  | 1  | 1.0 dB          |
| 0   | 0  | 0  | 1  | 0  | 2.0 dB          |
| 0   | 0  | 1  | 0  | 0  | 4.0 dB          |
| 0   | 1  | 0  | 0  | 0  | 8.0 dB          |
| 1   | 0  | 0  | 0  | 0  | 16.0 dB         |
| 1   | 1  | 1  | 1  | 1  | 31.0 dB         |

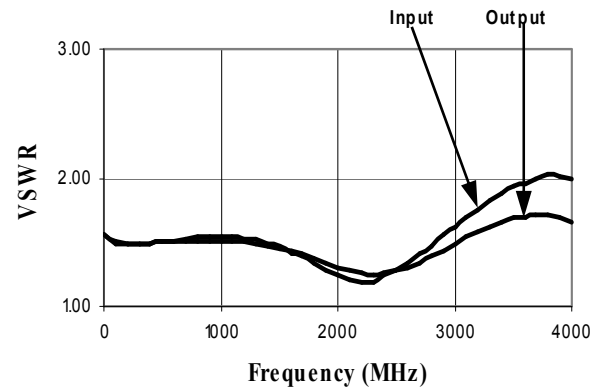
0 = TTL Low; 1 = TTL High

**Typical Performance Curves**

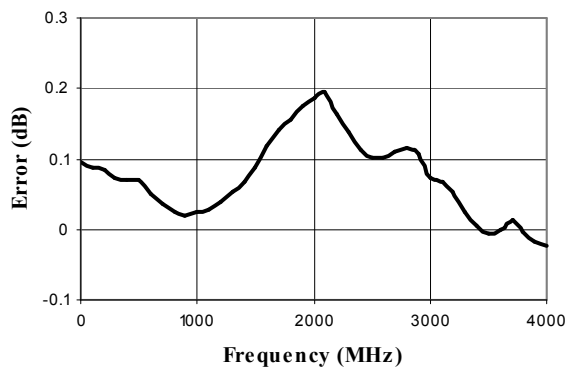
**Insertion Loss**



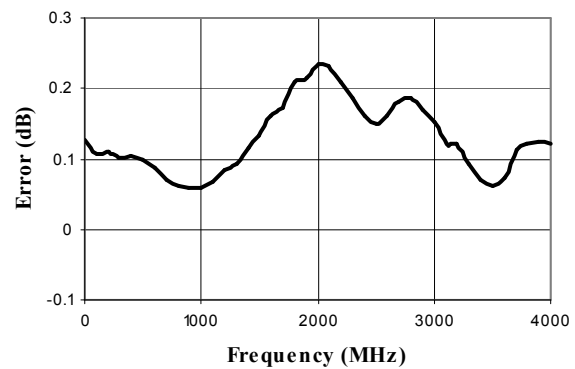
**VSWR @ Insertion Loss**



**Attenuation Error, 1 dB Bit**



**Attenuation Error, 2 dB Bit**

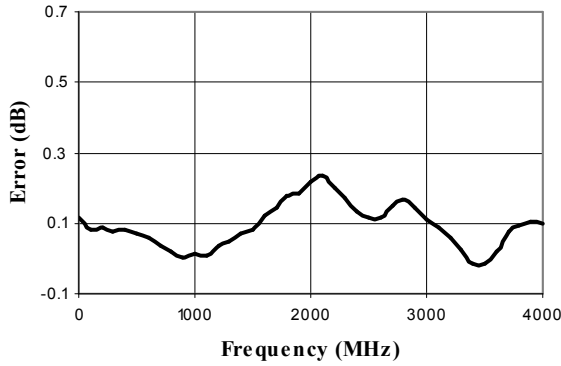


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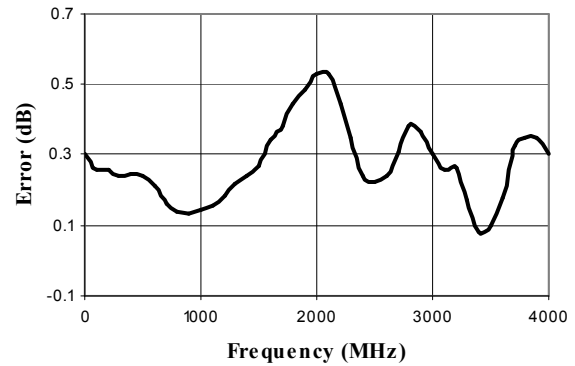
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**Typical Performance Curves**

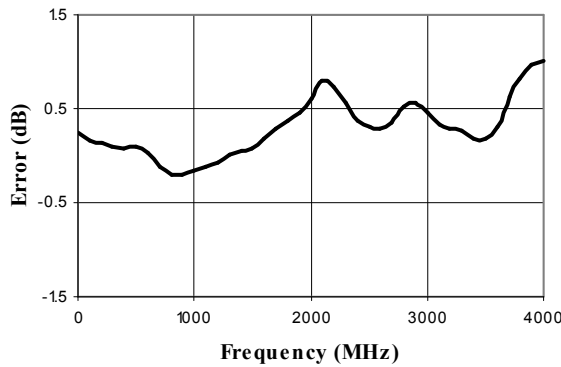
*Attenuation Error, 4 dB Bit*



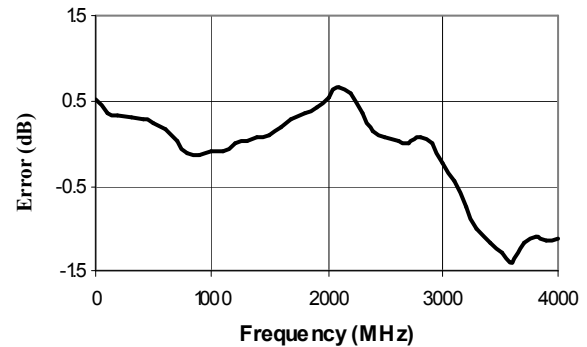
*Attenuation Error, 8 dB Bit*



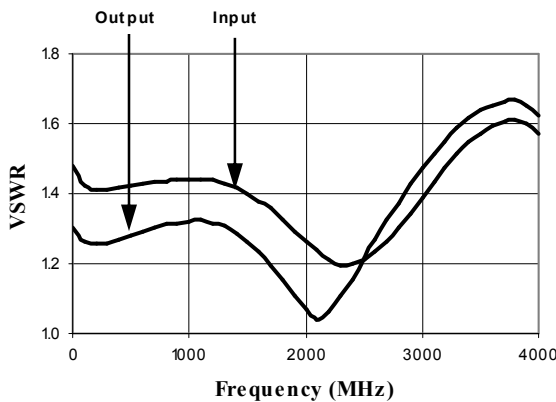
*Attenuation Error, 16 dB Bit*



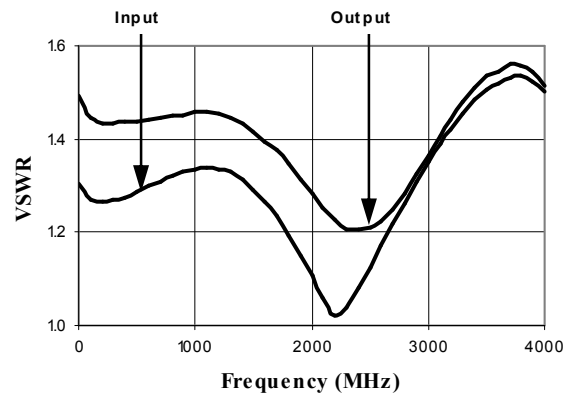
*Attenuation Error, Max. Attenuation*



*VSWR, 1 dB Bit*

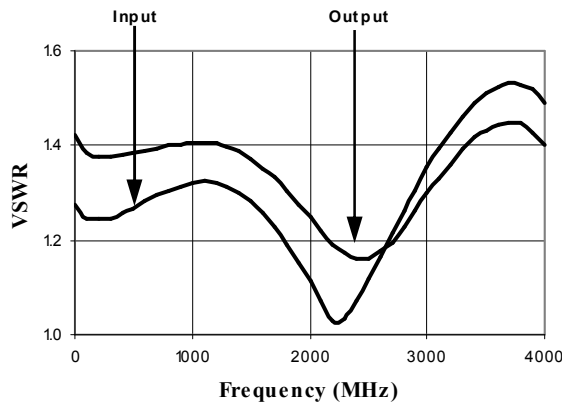


*VSWR, 2 dB Bit*

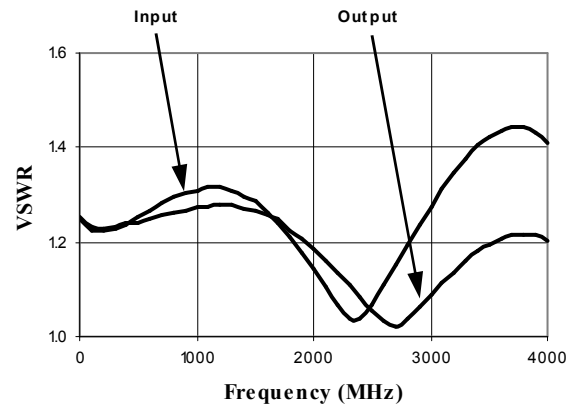


**Typical Performance Curves**

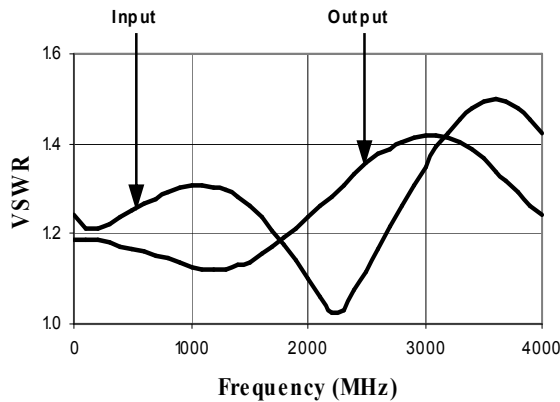
**VSWR, 4 dB Bit**



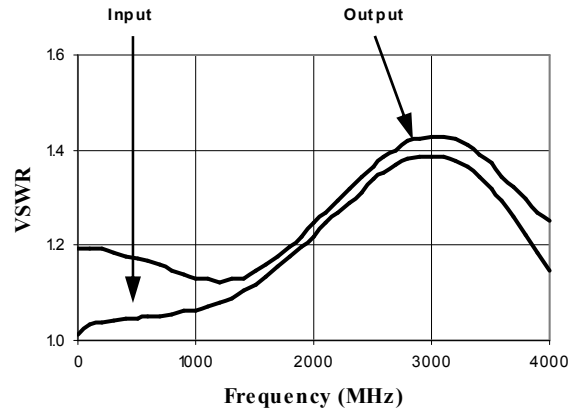
**VSWR, 8 dB Bit**



**VSWR, 16 dB Bit**



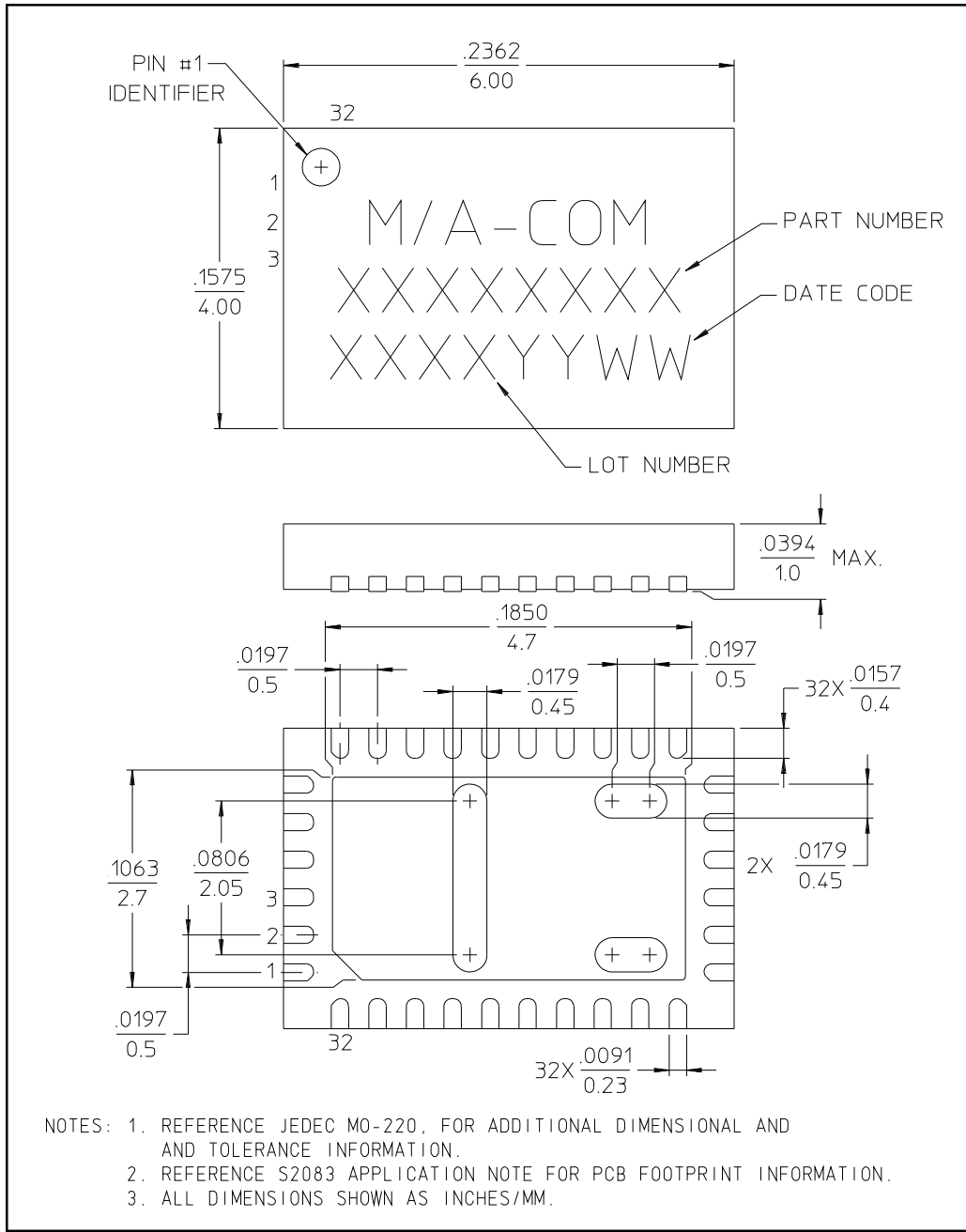
**VSWR, Maximum Attenuation**



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**CSP-1, Lead-Free 4 x 6 mm, 32-lead  
PQFN†**



† Reference Application Note M538 for lead-free solder reflow recommendations.