Digital Attenuator 31.5 dB, 6-Bit, TTL Driver, DC-2.0 GHz



Rev. V4

Features

- Attenuation: 0.5 dB Steps to 31.5 dB
- Low DC Power Consumption
- Plastic SOIC, Wide Body, SMT Package
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-24 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT65-0107

Description

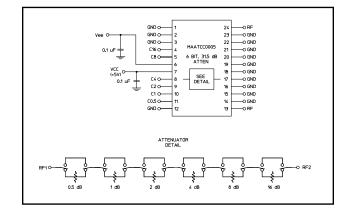
M/A-COM's MAATCC0005 is a GaAs FET 6-bit digital attenuator with a 0.5 dB minimum step size and a 31.5 dB total attenuation range. This device is in a SOIC-24 wide body, plastic surface mount package. The MAATCC0005 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

Ordering Information

| Part Number | Package |
|---------------|-------------------|
| MAATCC0005 | Bulk Packaging |
| MAATCC0005TR | 1000 piece reel |
| MAATCC0005-TB | Sample Test Board |

Note: Reference Application Note M513 for reel size information.

Schematic with Off-Chip Components

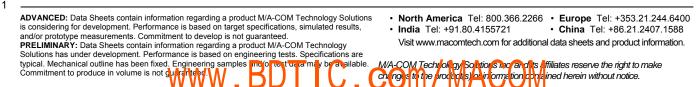


Pin Configuration

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1 | GND | 13 | RF |
| 2 | GND | 14 | GND |
| 3 | GND | 15 | GND |
| 4 | C16 | 16 | GND |
| 5 | C8 | 17 | GND |
| 6 | Vee | 18 | GND |
| 7 | Vcc | 19 | GND |
| 8 | C4 | 20 | GND |
| 9 | C2 | 21 | GND |
| 10 | C1 | 22 | GND |
| 11 | C0.5 | 23 | GND |
| 12 | GND | 24 | RF |

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

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Electrical Specifications: T_A = 25°C

| Parameter | Test Conditions | Frequency | Units | Min | Тур | Max |
|--|---|---------------------------------------|-------------------|--------------|-------------|---------------------|
| Insertion Loss | | DC - 1.0 GHz DC - 2.0 GHz | dB dB | _ | 3.1 3.6 | 3.6 4.2 |
| Attenuation Accuracy | Any Bit or Combination of Bits | DC - 2.0 GHz | DC - 2.0 GHz dB — | | _ | ±(.3 +4% of atten.) |
| VSWR | Full Range | DC - 2.0 GHz | Ratio | _ | 1.8:1 | 2:1 |
| Switching Speed | 50% Cntl to 90%/10% RF 10% to 90% or 90% to 10% | _ | nS — nS — | | 75 20 | 150 50 |
| 1 dB Compression | | 50 MHz 0.5 - 2.0 GHz | | | +21 +29 | _ |
| Input IP ₃ | Two-tone inputs up to +5 dBm | i dBm 50 MHz dB — 0.5-2.0 GHz dB — | | _ | +35 +48 | _ |
| Vcc ¹ Vee ¹ | _ | | | 4.75 -8.0 | 5.0 -5.0 | 5.25 -4.75 |
| V _{IL} V _{IH} | LOW-level input voltage HIGH-level input voltage | _ | — V — V | | _ | 0.8 5.0 |
| lin (Input Leakage Current) | Vin = V _{CC} or GND | _ | — uA | | — | 1.0 |
| Icc (Quiescent Supply Current) | Vcntrl = V_{CC} or GND | _ | uA | _ | 250 | 400 |
| ∆lcc (Additional Supply Current Per TTL Input Pin) | V_{CC} = Max, Vcntrl = V_{CC} - 2.1 V | — | mA | _ | - | 1.0 |
| IEE | VEE min to max, Vin = V_{IL} or V_{IH} | _ | mA | -1.0 | -0.2 | — |

1. Decoupling capacitors (.1 µF) are required on Power Supply lines.

Absolute Maximum Ratings^{2,3}

| Parameter | Absolute Maximum | | |
|---|---|--|--|
| Max. Input Power 0.05 GHz 0.5 - 2.0 GHz | +27 dBm +34 dBm | | |
| V _{cc} | $-0.5 V \le V_{CC} \le +7.0 V$ | | |
| V _{EE} | $-8.5V \le V_{EE} \le +0.5V$ | | |
| V _{CC} - V _{EE} | $-0.5 \text{V} \leq \text{V}_{\text{CC}} - \text{V}_{\text{EE}} \leq 14.5 \text{V}$ | | |
| Vin ⁴ | $-0.5V \le Vin \le V_{CC} + 0.5V$ | | |
| Operating Temperature | -40°C to +85°C | | |
| Storage Temperature | -65°C to +125°C | | |

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

3. M/A-COM does not recommend sustained operation near these survivability limits.

4. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

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Handling Procedures

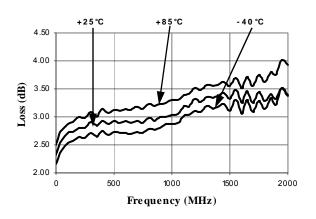
Please observe the following precautions to avoid damage:

Static Sensitivity

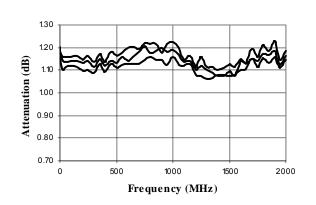
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves

Loss vs. Temperature



1 dB Bit vs. Temperature



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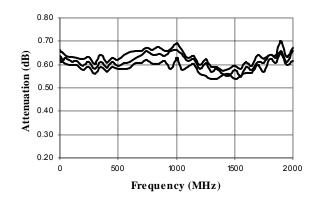
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Truth Table (Digital Attenuator)

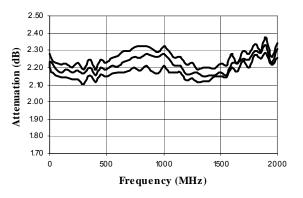
| C16 | C8 | C4 | C2 | C1 | C0.5 | Attenuation |
|-----|----|----|----|----|------|-----------------|
| 0 | 0 | 0 | 0 | 0 | 0 | Loss. Reference |
| 0 | 0 | 0 | 0 | 0 | 1 | 0.5 dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 1.0 dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 2.0 dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 4.0 dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 8.0 dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 16.0 dB |
| 1 | 1 | 1 | 1 | 1 | 1 | 31.5 dB |

0 = TTL Low; 1 = TTL High

0.5 dB Bit vs. Temperature



2 dB Bit vs. Temperature



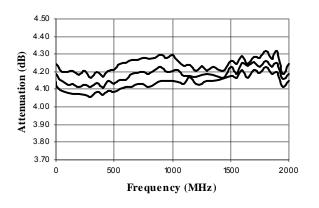
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Typical Performance Curves

4 dB Bit vs. Temperature



16 dB Bit vs. Temperature

16.50

16.30

16.10

15.90

15.70

15.50

1.6

1.4

1.2

0

500

VSWR

0

VSWR @ Insertion Loss

500

1000

Frequency (MHz)

Output

1500

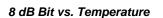
Input

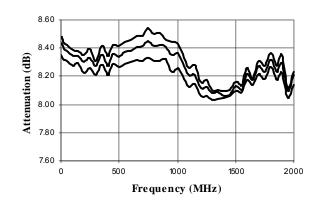
1500

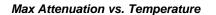
2000

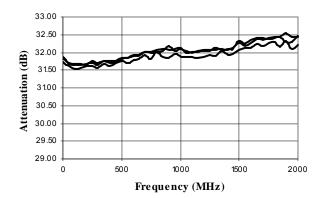
2000

Attenuation (dB)





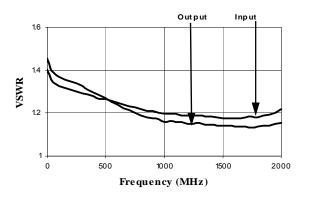




VSWR, 0.5 dB Bit

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1000

Frequency (MHz)

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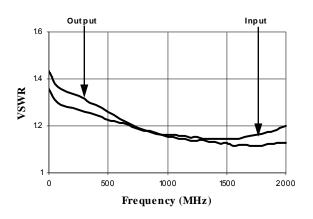
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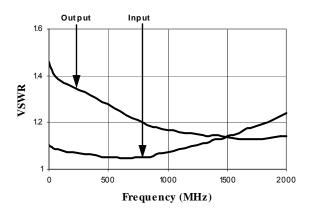
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Typical Performance Curves

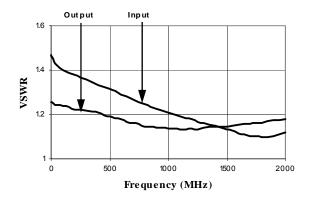
VSWR, 1 dB Bit



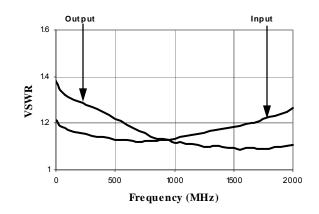
VSWR, 4 dB Bit



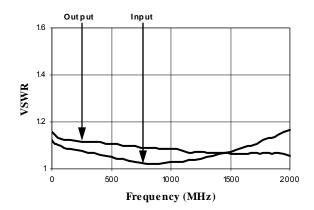
VSWR, 16 dB Bit



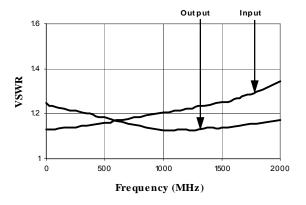
VSWR, 2 dB Bit



VSWR, 8 dB Bit



VSWR, Maximum Attenuation



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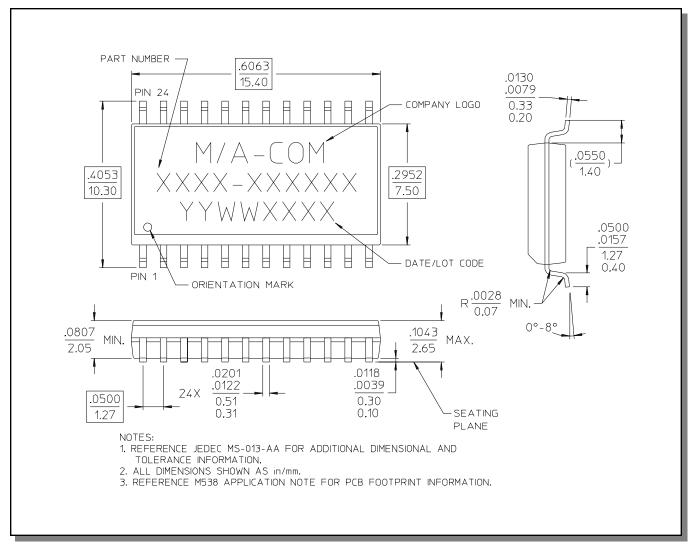
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Lead-Free, SOW-24[†]



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

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