

Rev. V6

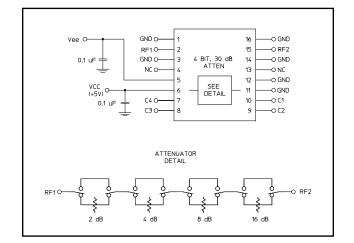
Features

- Attenuation: 2.0 dB steps to 30 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 Ohm Impedance
- Temperature Stability: ±0.18 dB from -55°C to +85°C Typ.
- SOIC-16 Package

Description

M/A-COM's AT65-0233 is a GaAs FET 4-bit digital attenuator with a 2.0 dB minimum step size and a 30 dB total attenuation range. This device is in a SOIC-16 plastic surface mount package. The AT65-0233 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required. Typical applications include dynamic range setting in precision receiver circuits and other gain/ leveling control circuits.

Schematic with Off-Chip Components or Functional Block Diagram



Pin Configuration

| Pin No. | Function | Pin No. | Function | |
|---------|-----------------|---------|-----------------|--|
| 1 | GND | 9 | C2 | |
| 2 | RF1 | 10 | C1 | |
| 3 | GND | 11 | GND | |
| 4 | NC ¹ | 12 | GND | |
| 5 | Vee | 13 | NC ¹ | |
| 6 | Vcc | 14 | GND | |
| 7 | C4 | 15 | RF2 | |
| 8 | C3 | 16 | GND | |

1. NC = No Connection

Ordering Information

| Part Number | Package | |
|--------------|-------------------|--|
| AT65-0233 | Bulk Packaging | |
| AT65-0233TR | 1000 piece reel | |
| AT65-0233-TB | Sample Test Board | |

Note: Reference Application Note M513 for reel size information.

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Electrical Specifications: T_A = 25°C

| Parameter | Test Conditions | Frequency | Units | Min | Тур | Max |
|--|---|--|--|-------------------|----------------------------|----------------------------|
| Insertion Loss | — DC - 0.5 GHz dB DC - 2.0 GHz dB DC - 3.0 GHz dB DC - 3.0 GHz dB | | | 1.7 2.3 2.6 | 2.0 2.7 3.1 | |
| Attenuation Accuracy | Any Bit or Combination of Bits | DC - 3.0 GHz | DC - 3.0 GHz dB ± (.4 + 8% attenuation | | ± (.4 + 8% of attenuation) | ± (.4 + 8% of attenuation) |
| VSWR | Full Range | DC - 3.0 GHz | Ratio | _ | — | 1.7:1 |
| Trise, Tfall Ton, Toff Transients | 10% to 90% 50% Cntl to 90%/10% RF In-Band | 0% Cntl to 90%/10% RF 50% Cntl to nS — | | | 10 30 35 | 50 150 — |
| 1 dB Compression | Input Power Input Power | 0.05 GHz 0.5 - 3.0 GHz | dBm dBm | _ | +20 +28 | _ |
| Input IP ₃ | Two-tone inputs up to +5 dBm | 0.05 GHz 0.5 - 3.0 GHz | dBm dBm | _ | +40 +50 | _ |
| Input IP ₂ | Two-tone inputs up to +5 dBm | 0.05 GHz 0.5 - 3.0 GHz | dBm dBm | _ | +45 +68 | _ |
| Vcc VEE | _ | _ | V V | 4.5 -8.0 | 5.0 -5.0 | 5.5 -4.75 |
| V _{IL} V _{IH} | LOW-level input voltage HIGH-level input voltage | _ | V V | 0.0 2.0 | _ | 0.8 5.0 |
| lin (Input Leakage Current) | Vin = V_{CC} or GND | — | uA | -1.0 | — | 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 | — |

Absolute Maximum Ratings ^{2,3}

| Parameter | Absolute Maximum | |
|---|--|--|
| Max. Input Power 0.05 GHz 0.5 - 3.0 GHz | +27 dBm +34 dBm | |
| V _{CC} | $-0.5 V \le V_{CC} \le +7.0 V$ | |
| V _{EE} | $-8.5 \text{V} \leq \text{V}_{\text{EE}} \leq +0.5 \text{V}$ | |
| V_{CC} - V_{EE} | $-0.5 V \leq V_{CC} - V_{EE} \leq 14.5 V$ | |
| 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 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.

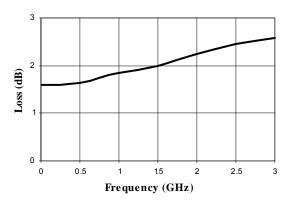
Truth Table (Digital Attenuator)

| C1 | C2 | C3 | C4 | Attenuation |
|----|----|----|----|-----------------|
| 0 | 0 | 0 | 0 | Loss, Reference |
| 1 | 0 | 0 | 0 | 2.0 dB |
| 0 | 1 | 0 | 0 | 4.0 dB |
| 0 | 0 | 1 | 0 | 8.0 dB |
| 0 | 0 | 0 | 1 | 16.0 dB |
| 1 | 1 | 1 | 1 | 30.0 dB |

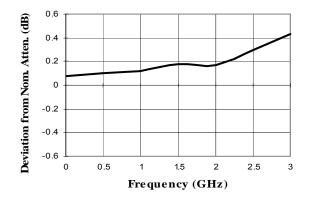
0 = TTL Low; 1 = TTL High

Typical Performance Curves

Typical Insertion Loss (dB)



Attenuation Accuracy, 4 dB

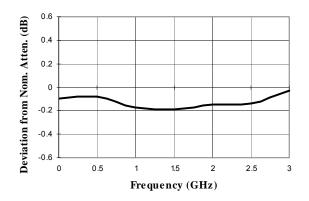


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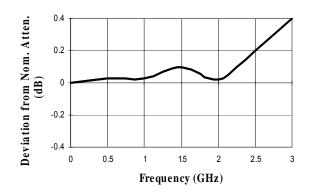
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Attenuation Accuracy, 2 dB



Attenuation Accuracy, 8 dB



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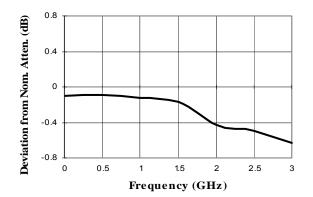
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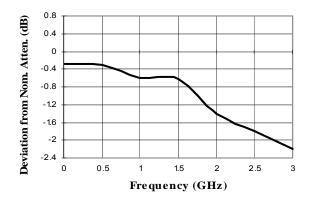
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Typical Performance Curves

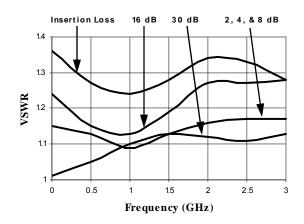
Attenuation Accuracy, 16 dB



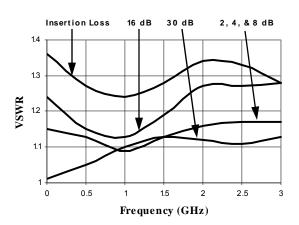
Attenuation Accuracy, 30 dB



Typical RF1 VSWR



Typical RF2 VSWR



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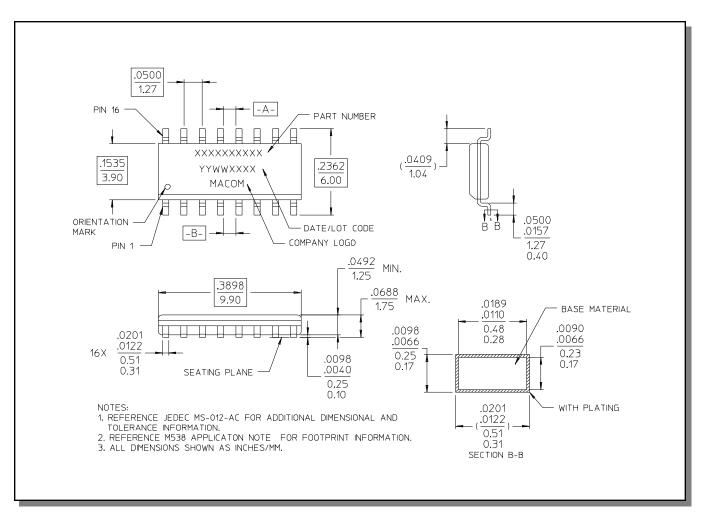
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AT65-0233

Digital Attenuator 30.0 dB, 4-Bit, TTL Driver, DC-3.0 GHz

SOIC-16[†]



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

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