**Features**
- Substrate - Alumina
- Power Rating - 0.1 to 2 Watts
- Frequency Range DC to 18 GHz
- Tape and Reel Packaging Available
- VSWR under 1.50:1
- Variety of Chip Sizes
- Attenuation Values from 1 to 20 dB in 1 dB increments; consult the factory for fractional and higher attenuation values.
- S-Parameter Files Available
- Surface Mount and Lead Attachment Versions Available

**Applications**
- Circulators
- Coaxial Attenuator Components
- Filters
- High Power Amplifiers
- Instrumentation
- Isolators
- Military
- Signal Sampling
- Interstage Isolation
- Impedance Matching

**Quick Selector Chart**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency Range (GHz)</th>
<th>Dimensions (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS03</td>
<td>DC-12.4</td>
<td>.145 x .122</td>
</tr>
<tr>
<td>TS04</td>
<td>DC-2.5</td>
<td>.100 x .125</td>
</tr>
<tr>
<td>TS05</td>
<td>DC-18</td>
<td>.075 x .060</td>
</tr>
</tbody>
</table>

EMC Technology’s attenuators are available in a low power chip package. The power ratings range from 0.1 to 2 watts. The attenuation values range from 1 dB to 20 dB. The terminals of EMC chip attenuators are made with thick film base material that is nickel plated and solder coated. The resistive element is thin film offering superior electrical performance. The TS04 series uses thick film resistor elements. The devices are available for shipping in tray or tape and reel packaging.

**Table of Contents**
- General Specifications .............................................20
- TS03 Chip ..............................................................22
- TS04 Chip ..............................................................24
- TS05 Chip ..............................................................26
General Specifications

**Attenuators**

### Attenuation Accuracy

<table>
<thead>
<tr>
<th>Increment (dB)</th>
<th>DC - 2.5 GHz TS04XX</th>
<th>DC - 4 GHz TS03XX, W1, W3 TS05XX, G, W1, WB1, W3 Series</th>
<th>4 - 8 GHz TS03XX, W1, W3 TS05XX, G, W1, WB1, W3 Series</th>
<th>8 - 12.4 GHz TS03XX TS05XX, G, W1, WB1, W3 Series</th>
<th>12.4 - 18 GHz TS05 &amp; G Series Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>± 0.3 dB</td>
<td>± 0.3 dB</td>
<td>± 0.5 dB</td>
<td>± 0.5 dB</td>
<td>± 0.5 dB</td>
</tr>
<tr>
<td>4 - 6</td>
<td>± 0.4 dB</td>
<td>± 0.4 dB</td>
<td>± 0.5 dB</td>
<td>± 0.5 dB</td>
<td>± 0.75 dB</td>
</tr>
<tr>
<td>7 - 10</td>
<td>± 0.5 dB</td>
<td>± 0.5 dB</td>
<td>± 0.5 dB</td>
<td>± 0.75 dB</td>
<td>± 1.0 dB</td>
</tr>
<tr>
<td>11 - 15</td>
<td>± 0.75 dB</td>
<td>± 0.75 dB</td>
<td>+ 0.5/- 3.0 dB</td>
<td>+ 0.5/- 3.5 dB</td>
<td>-</td>
</tr>
<tr>
<td>16 - 20</td>
<td>± 1.0 dB</td>
<td>± 1.0 dB</td>
<td>+ 0.5/- 4.0 dB</td>
<td>+ 1.0/- 6.0 dB</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Contact the factory for specifications for fractional and higher attenuation values.
- Performance is based on a device mounted in a matched 50Ω line and is highly dependent upon device mounting. See Application Note 003 on page 61 and Application Note 004 on page 66 for mounting instructions.
- Rated input power is 2.0 watts on TS03 Series, 100 mw on TS05 Series, and 1 watt on the TS04 Series.
- Maximum peak input power is 50 watts on TS03 Series chips and 1 watt on TS05 Series chips. Duty cycle is 1% with a pulse width of 10 microseconds.
- Full rated power to 125°C, derate linearly to 0 watts at 150°C.
- Tight tolerance chip attenuators and 0.5 dB increments available upon request. Please contact factory.

### Chip Attenuator Kits

**TS03 and TS05 Series Kits**

Our chip attenuator kits are perfect for designers who need fast, convenient and accurate fine tuning of attenuation values for microwave circuits. Each kit is comprised of 50 attenuator chips, with five chips each of ten different attenuation values ranging from 1 to 10 dB. The following kits are available: TS03XX, TS03XXW3, TS05XX, TS05XXWB1 and TS05XXW3.

See page 58 for attenuator kit selection guide.
**General Specifications**

**Attenuators**

**Planar Configuration**

- **Planar (no code)**: Planar device for flip chip mounting offers the best RF performance and lowest cost.

**W1/WB1 Configuration**

- **Labeled (T3)**: Leads/tabs (gold plated copper); requires top plate.

**W3 Configuration**

- **Triple Wrap (W3)**: Metallization wraps around input, output, and ground terminals. Permits inspectable solder fillets when flip chip mounting. See Application Note 004 on page 66.

**Metallization Options**

- **Single Wrap (W1)**: Metallization wraps around ground terminal only. Full backside metallization.

- **Pretinned (S)**: Pretinned (with Sn 62) terminals improve solderability (available on all of the above options).

- **Lead Free (F)**: Lead free, pure tin plating options are available (excludes WB1 and G metallization options).

- **Single Wrap (WB1)**: (TS05 series only) Metallization wraps around ground terminal only. Full backside metallization. Input and output terminals have gold metallization.

- **Gold (G)**: (TS05 series only) Planar device with gold metallization. Typically used for wirebonding.
EMC Technology’s TS03 chip attenuators offer power dissipation up to 2 watts and are designed to work from DC to 12.4 GHz. High reliability and tight tolerance options are available.

**General Specifications**

- Impedance: 50 Ohms Nominal
- Attenuation Stability: 0.0001 dB/dB/C˚
- VSWR (Max): 1.25 @ DC-4 GHz, 1.35 @ 4-8 GHz, 1.50 @ 8-12.4 GHz
- Power Rating: 2.0 Watts
- Power Derating: 100% @ 125° C, Derates to 0% @ 150° C
- Operating Temperature: -55° C to 150° C

**Material Specifications**

- Substrate: Alumina
- Resistive Element: Thin Film
- Termination Material: Thick Film, Nickel Barrier with Solder Plated Finish

**Ordering Information**

<table>
<thead>
<tr>
<th>TS</th>
<th>0</th>
<th>3</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOP PLATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 = No Top Plate</td>
<td>9 = Top Plate with Leads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATTENUATION VALUE</td>
<td>in whole dB steps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = .122 x .145</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dimensions (TS03XX Series)**

- Chip Size: 0.122 x 0.145

Note: Contact factory for details regarding precision tight tolerance (TT) attenuators.
TS03 Chip

TS03 Style

**TS03XX Series**

- 0.040 [1.02] TYP
- 0.020 ±0.003 [0.91]
- 0.030 [0.76]
- 0.062 [1.57]
- 0.122 [3.10]

**TS03XXW1 Series**

- 0.040 [1.02] TYP
- 0.062 [1.57]
- 0.030 [0.76]
- WRAP AROUND GROUND
- 0.021 ±0.003 [0.53]
- 0.123 [3.12]

**TS03XXW3 Series**

- 0.041 [1.04] TYP
- 0.123 [3.12]
- 0.020 [0.51]
- WRAP AROUND GROUND
- 0.021 ±0.003 [0.53]
- 0.016 [0.38]
- WRAP AROUND TERMINAL, TYP
- 0.015 [0.38] TYP

**TS93XXT3 Series**

- 0.060 [1.55] TYP
- 0.062 [1.57]
- 0.023 [0.58] [TYP]
- 0.003 ±0.001 [0.08] TYP
- 0.023 [0.58] MAX
- 0.149 [3.88]
- 0.122 [3.10]
- 0.350 [8.85] MIN TYP
- 0.005 [0.13] MAX
EMC Technology’s TS04 chip attenuators offer power dissipation up to 1 Watt and are designed to work in frequencies from DC to 2.5 GHz. The TS04 series chip attenuators are designed for telecom commercial frequency bands and perform optimally in low power, narrow band applications.

**General Specifications**

- **Impedance**: 50 Ohms Nominal
- **Attenuation Stability**: 0.0001 dB /dB/C˚
- **VSWR (Max)**: 1.25 @ DC to 2.5 GHz
- **Power Rating**: 1.0 Watts
- **Power Derating**: 100% @ 85° C
  - Derates to 0% @ 150° C
- **Operating Temperature**: -55° C to 150° C

**Material Specifications**

- **Substrate**: Alumina
- **Resistive Element**: Thick Film
- **Termination Material**: Thick Film, Nickel Barrier with Solder Plated Finish

**Ordering Information**

- **TS0403**
  - **TOP PLATE**: 0 = No Top Plate
  - **ATTENUATION VALUE**: 01 = 1 dB, 02 = 2 dB, 03 = 3 dB, 06 = 6 dB, 10 = 10 dB, 20 = 20 dB
  - **CHIP SIZE**: 4 = .100 x .125

**Dimensions (TS04XX Series)**

- **INPUT PADS**: 0.025 [0.63] SQ TYP
- **GROUND PADS**: [PCB MUST CONNECT GROUND PADS]
- **PROTECTIVE COATING**: 0.100 [2.54]
- **0.125 [3.18] dB**
**TS04 Style**

**TS04XX Series**

- **INPUT PADS**
- **PROTECTIVE COATING**
  - 0.100 [2.54]
- **GROUND PADS**
  - [PCB MUST CONNECT GROUND PADS]
  - 0.021 [0.53]
  - 0.125 [3.18] dB
EMC Technology’s TS05 chip attenuators offer power dissipation up to 100 mW and are designed to work in frequencies from DC to 18 GHz. High reliability and tight tolerance options are available.

**General Specifications**

Impedance ................. 50 Ohms Nominal
Attenuation Stability .......... 0.0001 dB/dB/C°
VSWR (Max) ................. .125 @ DC-4 GHz
1.35 @ 4-8 GHz
1.50 @ 8-18 GHz
Power Rating .................. 100 mW
Power Derating ................. 100% @ 125° C
Derates to 0% @ 150° C
Operating Temperature .......... -55° C to 150° C

**Material Specifications**

Substrate .................. Alumina
Resistive Element ............ Thin Film
Termination Material ......... Thick Film, Nickel Barrier with Solder Plated Finish
Gold and Wire Bondable options available

**Ordering Information**

<table>
<thead>
<tr>
<th>TS</th>
<th>0</th>
<th>5</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOP PLATE</td>
<td>0 = No Top Plate</td>
<td>9 = Top Plate with Leads</td>
<td></td>
</tr>
<tr>
<td>ATTENUATION VALUE</td>
<td>in whole dB steps</td>
<td>(00 through 20)</td>
<td></td>
</tr>
<tr>
<td>CHIP SIZE</td>
<td>5 = .060 x .075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPTIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(blank) = Planar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G = Gold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W1 = Wrap-around Ground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W3 = Wrap-around, All Terms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WB1 = Gold Input/Output, Wrap-around Ground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 = Leaded, Top Plate Required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Contact factory for details regarding precision tight tolerance (TT) attenuators.

**Dimensions (TS05XX/TS05XXG Series)**
TS05 Chip

Attenuators

TS05 Style

TS05XX/TS05XXG Series

TS05XXW1/WB1 Series

TS05XXW3 Series

TS95XXT3 Series
## TS05 Marking Code

<table>
<thead>
<tr>
<th>Part #</th>
<th>dB Value</th>
<th>1st Dot</th>
<th>2nd Dot</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS0500</td>
<td>0 dB</td>
<td>Black</td>
<td>-</td>
</tr>
<tr>
<td>TS0501</td>
<td>1 dB</td>
<td>Brown</td>
<td>-</td>
</tr>
<tr>
<td>TS0502</td>
<td>2 dB</td>
<td>Red</td>
<td>-</td>
</tr>
<tr>
<td>TS0503</td>
<td>3 dB</td>
<td>Orange</td>
<td>-</td>
</tr>
<tr>
<td>TS0504</td>
<td>4 dB</td>
<td>Yellow</td>
<td>-</td>
</tr>
<tr>
<td>TS0505</td>
<td>5 dB</td>
<td>Green</td>
<td>-</td>
</tr>
<tr>
<td>TS0506</td>
<td>6 dB</td>
<td>Blue</td>
<td>-</td>
</tr>
<tr>
<td>TS0507</td>
<td>7 dB</td>
<td>Violet</td>
<td>-</td>
</tr>
<tr>
<td>TS0508</td>
<td>8 dB</td>
<td>Gray</td>
<td>-</td>
</tr>
<tr>
<td>TS0509</td>
<td>9 dB</td>
<td>White</td>
<td>-</td>
</tr>
<tr>
<td>TS0510</td>
<td>10 dB</td>
<td>Brown</td>
<td>Black</td>
</tr>
<tr>
<td>TS0511</td>
<td>11 dB</td>
<td>Brown</td>
<td>Brown</td>
</tr>
<tr>
<td>TS0512</td>
<td>12 dB</td>
<td>Brown</td>
<td>Red</td>
</tr>
<tr>
<td>TS0513</td>
<td>13 dB</td>
<td>Brown</td>
<td>Orange</td>
</tr>
<tr>
<td>TS0514</td>
<td>14 dB</td>
<td>Brown</td>
<td>Yellow</td>
</tr>
<tr>
<td>TS0515</td>
<td>15 dB</td>
<td>Brown</td>
<td>Green</td>
</tr>
<tr>
<td>TS0516</td>
<td>16 dB</td>
<td>Brown</td>
<td>Blue</td>
</tr>
<tr>
<td>TS0517</td>
<td>17 dB</td>
<td>Brown</td>
<td>Violet</td>
</tr>
<tr>
<td>TS0518</td>
<td>18 dB</td>
<td>Brown</td>
<td>Gray</td>
</tr>
<tr>
<td>TS0519</td>
<td>19 dB</td>
<td>Brown</td>
<td>White</td>
</tr>
<tr>
<td>TS0520</td>
<td>20 dB</td>
<td>Red</td>
<td>Black</td>
</tr>
</tbody>
</table>

### TS05 Marking

Marking Appears on Opposite Side of Resistive Element (Planar only)

*W1, W3, WB1, G options mark on resist area.