CAPACITANCE PARASITIC

\[ C = \varepsilon \frac{A}{d} \]

\[ 1.6\text{mm} = d \]

dielectric
Adjacent tracks

Coupling factor $\Rightarrow \frac{pF}{cm}$
Capacitance between conductors on opposite sides of the PWB.

line width = 2 mm
Total common length = 250 mm
line width of bottom track = 4 mm

\[ C = 8.86 \times 5.4 \times \frac{2 \times 10^{-3} \times 250 \times 10^{-3}}{1.6 \times 10^{-8}} \approx 15 \text{pF} \]
High Freq Amplifier
INDUCTANCE  Parasitic

SELF INDUCTANCE

CONTINUOUS VARIABLE

Mutual Inductance Effect
$L_{\text{per unit length}}$

Inductance factor $\mu H/cm$
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = \]
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \]
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \text{ pF} \]
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \] pF

Dielectric thickness, m
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \text{ pF} \]

Overlap area, m²

Dielectric thickness, m
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \quad \text{pF} \]

- Relative dielectric constant
- Overlap area, m²
- Dielectric thickness, m
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \text{ pF} \]

- Relative dielectric constant
- Overlap area, m²
- Dielectric thickness, m

\[ \varepsilon_r = 5.4 \text{ for G-10, G11, FR-4, FR-5} \]
CAPACITANCE BETWEEN CONDUCTORS ON OPPOSITE SIDES OF PCB

\[ C = 8.86 \cdot \varepsilon_r \cdot \frac{A}{b} \text{ pF} \]

1. \( \varepsilon_r = 5.4 \) for G-10, G11, FR-4, FR-5
2. \( \varepsilon_r = 4.8 \) for FR-2, FR-3

- \( \varepsilon_r \): Relative dielectric constant
- Overlap area, \( m^2 \)
- Dielectric thickness, \( m \)
CAPACITANCE BETWEEN ADJACENT CONDUCTORS
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

\( \text{pF/cm} = \)
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

$pF/cm =$
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

\[ \text{pF/cm} = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \epsilon_r\right) \cdot a \]
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

\[
pF/cm = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \varepsilon_r \right) \cdot a
\]

Where
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

\[
pF/cm = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \epsilon_r\right) \cdot a
\]

Where \( a = \log \left(1 + \frac{2w}{s} + 2\sqrt{\frac{w}{s}} + \frac{w^2}{200}\right) \)
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

\[
pF/cm = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \epsilon_r \right) \cdot a
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Where \( a = \log \left( 1 + \frac{2w}{s} + 2\sqrt{\frac{w}{s}} + \frac{w^2}{200} \right) \)

1. \( s = \text{dist. between two adjacent conductors, mm} \)
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

\[ \frac{pF}{cm} = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \epsilon_r\right) \cdot a \]

Where \( a = \log \left(1 + \frac{2w}{s} + 2\sqrt{\frac{w}{s}} + \frac{w^2}{200}\right) \)

1. \( s = \text{dist. between two adjacent conductors, mm} \)
2. \( t = \text{laminate thickness, mm} \)
CAPACITANCE BETWEEN ADJACENT CONDUCTORS

Coupling Capacity

\[ \frac{pF}{cm} = 0.122 \cdot \frac{t}{s} + 0.0905 \left(1 + \varepsilon_r \right) \cdot a \]

Where \( a = \log \left(1 + \frac{2w}{s} + 2\sqrt{\frac{w}{s}} + \frac{w^2}{200} \right) \)

1. \( s = \text{dist. between two adjacent conductors, mm} \)
2. \( t = \text{laminate thickness, mm} \)
3. \( w = \text{conductor width, mm} \)
INDUCTANCE BETWEEN ADJACENT CONDUCTORS
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

\[ nH/cm = \]
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

per unit Inductance

\( \frac{nH}{cm} = \)
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

\[ \frac{nH}{cm} = 9.21 \cdot \log \left( \frac{s+w}{t+w} \right) + 6 - a \]
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

Where

\[ \frac{nH}{cm} = 9.21 \cdot \log \left( \frac{s+w}{t+w} \right) + 6 - a \]
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

Where per unit Inductance

\[
\frac{nH}{cm} = 9.21 \cdot \log \left( \frac{s+w}{t+w} \right) + 6 - a
\]

Where \( a = 4 \cdot \left( \frac{s+w}{10l} + 0.0967 \cdot \left( \frac{w}{w+s} \right)^{2.082} \right) \)
INDUCTANCE BETWEEN ADJACENT CONDUCTORS

\[ \frac{nH}{cm} = 9.21 \cdot \log \left( \frac{s+w}{t+w} \right) + 6 - a \]

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1. \( s = \text{dist. between two adjacent conductors, mm} \)
2. \( t = \text{laminate thickness, mm} \)
3. \( w = \text{conductor width, mm} \)
4. \( l = \text{parallel run length, cm} \)