IPC
ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

IPC-2141A Errata Information
(These corrections should be made in user's hard copies in accordance with the company's documented control program)

Sections are in red, instructional text in green, and corrections in black.

4.2.2 Surface Microstrip

Replace equation [4-4] with:

$$Z_{0,surf} = \frac{\eta_0}{2\pi\sqrt{2}\sqrt{\varepsilon_{r,eff}+1}} \ln\left\{1+4\frac{h}{w'}\left[4\frac{h}{w'}\left(\frac{14\varepsilon_{r,eff}+8}{11\varepsilon_{r,eff}}\right)+\sqrt{16\left(\frac{h}{w'}\right)^2\left(\frac{14\varepsilon_{r,eff}+8}{11\varepsilon_{r,eff}}\right)^2+\frac{\varepsilon_{r,eff}+1}{2\varepsilon_{r,eff}}\pi^2}\right]\right\}$$

Remove text:

"The accuracy of these equations is better than +/- 2% (1,2)"

4.2.3 Embedded Microstrip

Replace equation [4-7] with:

$$Z_{0,embedded} = Z_{0.surf}\frac{1}{\sqrt{e^{-\frac{2b}{h_1}}+\frac{\varepsilon_r}{\varepsilon_{r,eff}}\left(1-e^{-\frac{2b}{h_1}}\right)}}$$

4.2.4.1 Symmetric Stripline Formula Set 1

Remove text:

"According to (2), the errors for this set of formulas is less than 1.5%"

4.2.4.2 Symmetric Stripline Formula Set 2

Remove text:

"The stated error in equations [4-12] and [4-16] is less than 1.3% and worst case error is w/b = 0.35 (5)."

4.2.5 Asymmetric Stripline

Replace equation [4-17] and its "where" list with:

$$Z_{0,AS} = \frac{1}{\sqrt{\varepsilon_r}}\left\{ Z_{0,SS}\left[\varepsilon_r = 1, w', h = \frac{1}{2}\left(h_1 + h_2\right)\right] - \Delta Z_{0,air} \right\}$$

where $Z_{0,SS}\left(\varepsilon_r = 1, w', h = \frac{1}{2}\left[h_1 + h_2\right]\right)$ is given by $Z_{0,SS}$, see equation [4-9], evaluated at $\varepsilon_r = 1$, w' , and $h = ½(h_1 + h_2)$; and $\Delta Z_{0,air}$ is:

Do not change equation [4-18] and its "where" list.

Replace equation [4-19] and its "where" list with:

$$Z_{0,air} = 2\left\{ \frac{Z_{0,SS}\left[\varepsilon_r = 1, w', h = h_1\right] Z_{0,SS}\left[\varepsilon_r = 1, w', h = h_2\right]}{Z_{0,SS}\left[\varepsilon_r = 1, w', h = h_1\right] + Z_{0,SS}\left[\varepsilon_r = 1, w', h = h_2\right]} \right\}$$

where $Z_{0,SS}\left(\varepsilon_r = 1, w', h = h_i\right)$ is given by $Z_{0,SS}$, see equation [4-9], evaluated at $\varepsilon_r = 1$, w' , and $h = h_i$, for $i = 1$ or 2.

4.2.7 Wire Microstrip

Replace equation [4-20] with the following:

$$Z_0 = \frac{\eta}{2\pi\sqrt{\varepsilon_{r,eff}}} \cosh^{-1}\left(\frac{2h + d}{d}\right)$$

Remove text:

"The equation is accurate to within 1% for d<= h/2 (4)"

4.4.1 Edge-Coupled Surface Microstrip

Replace equation [4-24] and the first two lines of its "where" list with:

$$Z_{0,o} = \frac{Z_{0,surf}\sqrt{\dfrac{\varepsilon_{r,eff}}{\varepsilon_{r,eff,0}(0)}}}{1-\dfrac{Z_{0,surf}}{\eta_0}Q_{10}\sqrt{\varepsilon_{r,eff}}}$$

where
$Z_{0,surf}$ is given by equation [4-4],
$\varepsilon_{r,eff}$ is given by equation [4-6],

4.4.2 Edge-Coupled Symmetric Stripline

Replace equation [4-42] with the following:

$$Z_{0,o}\left(\frac{w}{b},\frac{t}{b},\frac{s}{b}\right) = \left\{\frac{1}{Z_{0,surf}\left(\varepsilon_r = 1, w', h = \dfrac{b-t}{2}\right)} - \frac{C'_f\left(\dfrac{t}{b}\right)}{C'_f(0)}\left[\frac{1}{Z_{0,o}\left(\dfrac{w}{b},0,\dfrac{s}{b}\right)} - \frac{1}{Z_{0,ideal}}\right]\right\}^{-1}$$

Replace equation [4-43] and the first four items of its "where"list, which includes equation [4-44], with the following:

$$Z_{0,o}\left(\frac{w}{b},\frac{t}{b},\frac{s}{b}\right) = \left\{\frac{2}{Z_{0,o}\left(\dfrac{w}{b},0,\dfrac{s}{b}\right)} - \frac{1}{Z_{0,ideal}} - \frac{2}{377\varepsilon}\left(C'_f\left(\frac{t}{b}\right) - C'_f(0) - \frac{\varepsilon}{s}\right)\right\}^{-1}$$

where
$Z_{0,ideal}$ is the characteristic impedance for symmetric stripline having zero-thickness conductors (see (2,7)),

$Z_{0,o}\left(\frac{w}{b},0,\frac{s}{b}\right)$ is the characteristic impedance for the odd mode coupled stripline having zero-thickness conductors (see (2,7)),

$Z_{0,SS}\left(\varepsilon_r=1,w',h=\left[\frac{b-t}{2}\right]\right)$ is given by $Z_{0,SS}$, see equation [4-9], evaluated at $\varepsilon_r = 1$, w', and $h = ½(b - t)$,

Replace equation [4-44] with the following:

$$C'_f\left(\frac{t}{b}\right)=\frac{0.0885\eta_r}{\pi}\left\{\frac{2b}{b-t}\ln\left(\frac{2b-t}{b-t}\right)-\left(\frac{t}{b-t}\right)\ln\left[\frac{b^2}{(b-t)^2}-1\right]\right\}$$

4.4.3 Broadside-coupled Symmetric Stripline

Remove Text

"According to (2), this equation is nearly exact for w/s>= 0.35, and is more accurate for substrates with large valued of Er."

4.7.4 Test Interconnect Routing

Append the following text to item "C"

"Caution should be taken regarding the design of serpentine and spiral conductors for characteristic impedance and propagation delay test coupons."