Microstrip vs coplanar waveguide

Ignore the Coplanar wave guide the main content used to reduce the trace width of the transmission line. They are also used on one-layer tables that lack ground planes. (This image shows CPW with ground plane, but you can have CPW on a one-layer table) As a rule of thumb, for standard 50-Ohm microstrip, the trace width (w) is about twice the distance between the trace and the ground plane (h). If you have a table of 62 million, 2 layers, this makes a very thick microstrip (~120mil) ! For comparison, for the same board, you can get close to 50-Ohm using a 40-mil wide trace with a 5-mil distance to the coplanar ground plane. These numbers are just estimates. Make sure you do the calculations. CPW can be tricky to calculate. Many of the estimates out there require some assumptions, such as that the distance (w) is significantly smaller than the board thickness (h). To erm explain Kraig Mitzner, a CPW design tries often resulting in an accidental microstrip. I recommend using a field solveer to avoid these pitfalls. If you don't have access to one, there's a good free solution (GPL) called TNT. Coplanar wave guides are used to reduce the trace width of the transmission line. They are also used on one-layer tables that lack ground planes. (This image shows CPW with ground plane, but you can have CPW on a one-layer table) As a rule of thumb, for standard 50-Ohm microstrip, the trace width (w) is about twice the distance between the trace and the ground plane (h). If you have a table of 62 million, 2 layers, this makes a very thick microstrip (~120mil) ! For comparison, for the same board, you can get close to 50-Ohm using a 40-mil wide trace with a 5-mil distance to the coplanar ground plane. These numbers are just estimates. Make sure you do the calculations. CPW can be tricky to calculate. Many of the estimates out there require some assumptions, such as that the distance (w) is significantly smaller than the board thickness (h). To erm explain Kraig Mitzner, a CPW design tries often resulting in an accidental microstrip. I recommend using a field solveer to avoid these pitfalls. If you don't have access to one, there's a good free solution (GPL) called TNT. High-frequency circuit designers often have to consider the performance limits, physical dimensions, and even the power level of a particular design when deciding which in-circuit-board (PCB) material is optimal for that design. But the choice of transmission technology, such as microstrip or coplanar wave directional circuitry (GCPW), can also affect the expected final performance from a design. Many designers may be familiar with the stark difference between high-frequency microstrip and strip circuitry. But the GCPW circuit, when there are also its differences from traditional microstrip, also offers many benefits for high frequency circuit designers to consider. In making choices, it can help understand just what different types of PCB PCB may be available on microstrip and GCPW circuits. The differences between the two structures can be seen in the following simple illustration. For quick comparison, the microstrip circuit has a signal conductor built on top of an electrolyte layer, with a ground-based conductor metal plane at the bottom of the home electrolyte material. GCPW achieves an extra degree of grounding and isolation by making a signal conductor in between two ground conductors, all on top of a layer of home electrolympons, with an additional ground plane at the bottom of the home electrolympon layer. Metal-filled electrical holes connect the top and bottom layers for consistent ground performance. In addition, many GCPW circuits use ground straps to provide electrical connections to the top two layer ground conductors for consistency around circuit interruptions, such as intersections. Other than the two circuit approaches that may appear, the tight distance of the top layer bases and signal conductors for the GCPW approach allows it to achieve low resistance and adjust the resistance by adjusting the distance between the base and the signal line. Resistance increases as the distance between the highest level ground conductors and signal conductors increases. In fact, as the distance of a GCPW circuit of the top layer is based from the increase in signal conductors, these bases have little effect on the circuit and a GCPW circuit with sufficient distance between the top layer base and electrical signal conductors like a microstrip circuit. Why use one transmission line approach on the other? Obviously, microstrip has an elegant simplicity to it, which makes it easier to make and even easier to model through computers than GCPW circuits. With their strong ground structure, GCPW circuits are capable of lower loss performance at much higher frequencies than microstrip circuits, and provide great potential for well-worked designs into millimeter wave frequency ranges, even to 100 GHz frequencies and beyond. Microstrip, with strip lines, is one of the most common transmission formats at microwave frequencies, suffered increased circuit losses into the millimeter wave frequency range, making circuit technology less efficient to use at 30 GHz frequencies and beyond. What role does PCB material play in the choice of using microstrip or GCPW transmission approaches? Material parameters such as homeolyce constant (Dk) and consistency of Dk through materials will affect the electrical performance of either transmission line approach. The way in which the electrolytic field (EM) passes through each circuit structure will have a lot to do with Dk efficiency on display for a specific circuit material, since those EM fields can flow in the home and outer electrolytic materials of the home electrolytic material. For example, in microstrip circuits, with transmission lines at the top and ground surface, EM fields contained mainly in the electrolyel material between two metal surfaces, with a high concentration of field at the edges of the signal conductor. For microstrip circuits, the effective plyte constant is closely related to the specified Dk of PCB material, such as RO4350B™ PCB material from Rogers Corp. (www.rogerscorp.com), which has a process specification of 3.48 in the direction of z (thickness) at 10 GHz. Dk of the material is held to impressive ± 0.05 tolerances throughout the material. Dk the effectiveness of a PCB material will basically determine the size of the circuit structure required to achieve a specific characteristic resistance, such as 50?. So for microstrip transmission line on, for example, RO4350B circuit material, circuit width for 50 ? will be based on a Dk of 3.48. But for GCPW to use the same material, because the dk efficiency of the circuit is reduced because many EM fields are located in the air above the circuit rather than in PCB die die electrolyte material, Dk is less efficient when compared to microstrip. The difference in dk efficiency for GCPW and microstrip depends on the thickness of the substrate used by the GCPW circuit and the distance between the ground signal conductors on the top layer. PCB manufacturing issues have less impact on microstrip circuits than GCPW circuits. For example, copper-plated PCB thickness variations have little effect on the performance of microstrip circuits but they can affect the performance of GCPW circuits. Thicker copper plating on PCBs for microstrip circuits can alleviate insertion losses and reduce the Dk efficiency of circuits. For GCPW circuits, PCBs with thicker copper plating lead to an increase in EM schools between top-class roads, signals, and roads, with many EM fields in the air above the GCPW circuit. With many fields in the air above the circuit, signal loss decreased and the PCB's DK efficiency decreased for a GCPW circuit, all because of thicker copper-plated PCB thickness. For quick comparison, microstrip supports moderate bandwidth circuits through microwave frequencies, although with high radiation loss at higher wave frequencies, millimeters and difficulty in achieving inhibition mode at millimeter wave frequencies. Microstrip circuits suffer from minimal sensitivity to PCB manufacturing techniques and material characteristics, such as copper plating thicknesses and copper thickness variations. In contrast, GPCW only loses moderate radiation at millimeter wave frequencies, and is capable of inhibiting moderate or better mode at millimeter wave frequencies, making this circuit technology a strong contender for designs at speeds of 30 GHz or more. In addition, GCPW circuits are only moderately sensitive to PCB manufacturing techniques and variations, making them well suited for higher frequency production volume applications. To learn more about the differences of microstrip and GCPW circuits and PCB materials them for different applications, attendees of the IEEE International Microwave Conference 2015 (IMS) on May 17-22, 2015 in Phoenix, AZ (www.ims2015.org) can attend the Microwave Application Workshop (MicroApps) presented by John Coonrod of Rogers Corp., Microwave PCB Structure Choice: Microstrip vs. Grounded Coplanar Waveguide. , scheduled for Tuesday, May You have a design or manufacturing question? Rogers Corporation experts are here to help. Sign in to Rogers Technology Support Center and Ask an Engineer today. Smaller Page 2 is usually wiser in the era of electronic mobility and mobility, and the choice of circuit material at the start of a design has more to do with efforts to create smaller RF and microwave circuits. Circuit materials with higher homeolytic constants (Dk) often bring circuits with smaller features and sizes for a certain frequency range. But higher Dk values can also lead to increased insertion loss and other performance balances. The Dk value of the circuit material will also affect circuit parameters such as radiation loss, dispersion and coupling. Read more about circuit material characteristics and factors in circuitry manufacturing and operating environment all play a role in determining the design of dk circuit materials. By being aware of the effects, their effects can be minimized. Read this blog post to learn about the different effects. Read more 10 years of the ROG Blog and It May Just Be the Start Ten years ago, when we started the ROG Blog with the help of microwave magazine's dedicated editorial staff, it may seem impossible to keep a regular blog scheduled on the circuit material going for even a few years , let alone 10, without unsymed repetition. But the continued interest in the ROG Blog from our readers–thank you, folks–and the ever-improving quality of the circuit materials that we're writing about has fueled the fire and given us much to write about. Read more The successful application of GCPW technology involves understanding how performance levels from manufacturing PCBs may differ from the near-ideal performance levels predicted for GCPW circuit designs using commercial computer-aided technical software tools (CAE). A few factors can lead to the difference between what the software predicts and what is achieved by GCPW circuitry, especially for high volume mmWave circuit design. Read more Design and build a printed circuit board (PCB) at millimeter wave frequencies starting with circuit material, although the choice of transmission line technology can play a s quite large part in how much performance can be distributed at these high frequencies. Learn about expanding range PCBs to mmWave frequencies Read more Mobile wireless communication systems are moving to the fifth generation (5G) and with them, the world is shifting to millimeter wave frequencies (mmWave). For many circuit designers, this means a close look at of printed circuit board material (PCB) to understand how well it will work in 5G circuits and systems at mmWave frequencies. It means counting on circuit material that gives a value of pers permission or constant homeolycry (Dk) will be the foundation of many new designs, counting on the DK measurements of circuit material suppliers. But how reliable are these Dk measurements? Read more TCDk is an asset that all circuit materials possess and that is how much Dk's material will change, with temperature changes. The default test method for determining TCDk is usually performed as a raw material test and this video outlines how to perform TCDk testing in circuit form. Circuit testing for TCDk is considered a real-world test as opposed to a raw material testing method, usually intended for material characteristics. Watch this video from John Coonrod covering this topic. Read more This is the 2nd video on the SIW topic and this video focuses on real-world issues that may affect SIW's RF performance. Read more Modern computer-aided software design tools (CAE) based on electrolytic simulation (EM) are pretty good at predicting circuit performance using different models. But even the best simulation software can fall short of predicting the effects of some normal circuit making process variations, in particular, the deviation in copper plating thickness and how it can affect how conductors are shaped and the resulting performance of the combined edge circuits. Read some variations that may affect your design. Read more This video gives an overview of many studies in which various final plating finishes are evaluated for RF performance at millimeter wave frequencies. Read More Page 3 Please select a publication below. Volume: 63 Edition: 11 NXP's 150 mm GaN Wafer Fab — Most Advanced RF GaN Fab in the USRead More Page 4 Please choose a publication below. Volume: 63 Edition: 11 NXP's 150 mm GaN Wafer Fab — Most Advanced RF GaN Fab in the USRead More More