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(54) **USE OF HYBRID PCB MATERIALS IN PRINTED CIRCUIT BOARDS**

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**H05K 3/46** (2006.01)

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CPC ..... **H05K 1/024** (2013.01); **H05K 3/4688**  
(2013.01); **H05K 3/4626** (2013.01)

(58) **Field of Classification Search**

USPC ..... 361/748, 360, 361; 174/250  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,925,024 A	5/1990	Ellenberger et al.	
5,652,055 A	7/1997	King et al.	
6,890,635 B2	5/2005	Lin et al.	
7,265,181 B2	9/2007	Lin et al.	
7,378,598 B2	5/2008	Bois et al.	
7,416,972 B2	8/2008	Japp et al.	
7,470,990 B2	12/2008	Japp et al.	
7,730,613 B2 *	6/2010	Vasoya	29/852
7,989,895 B2 *	8/2011	White et al.	257/379
8,242,380 B2	8/2012	Bois et al.	
2003/0098177 A1 *	5/2003	Cheng	174/261
2005/0183883 A1	8/2005	Bois et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

CN	1658734 A	8/2005
CN	1838855 A	9/2006
EP	1705974	9/2006

OTHER PUBLICATIONS

Rick Hartley, "Designing PCBs with Mixed Materials," Printed Circuit Design and Manufacture Magazine, Mar. 30, 2006, 4 pages  
<http://pcdandf.com/cms/index2php?option=com>.

(Continued)

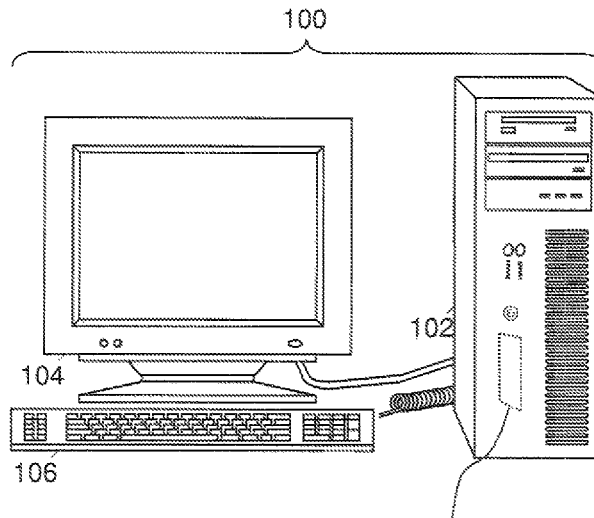
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(57) **ABSTRACT**

A apparatus comprising a printed circuit board ("PCB"). The PCB comprises a first insulating layer and a second insulating layer. The first insulating layer is made of a first material and the second insulating layer is made of a second material. The first material has a lower dissipation factor than the second material. The first material and second material have substantially similar dielectric constants.

**17 Claims, 4 Drawing Sheets**



(56)

**References Cited**

U.S. PATENT DOCUMENTS

2005/0218524	A1	10/2005	Japp et al.	
2007/0040626	A1*	2/2007	Blair et al. ....	333/1
2007/0040689	A1*	2/2007	Reynolds .....	340/572.7
2007/0090894	A1*	4/2007	Phan et al. ....	333/33
2007/0182016	A1	8/2007	Japp et al.	
2008/0196933	A1	8/2008	Bois et al.	
2010/0323477	A1*	12/2010	Arnal et al. ....	438/121

OTHER PUBLICATIONS

International Search Report and Written Opinion, dated Mar. 13, 2009, 11 pages.

\* cited by examiner

Figure 1

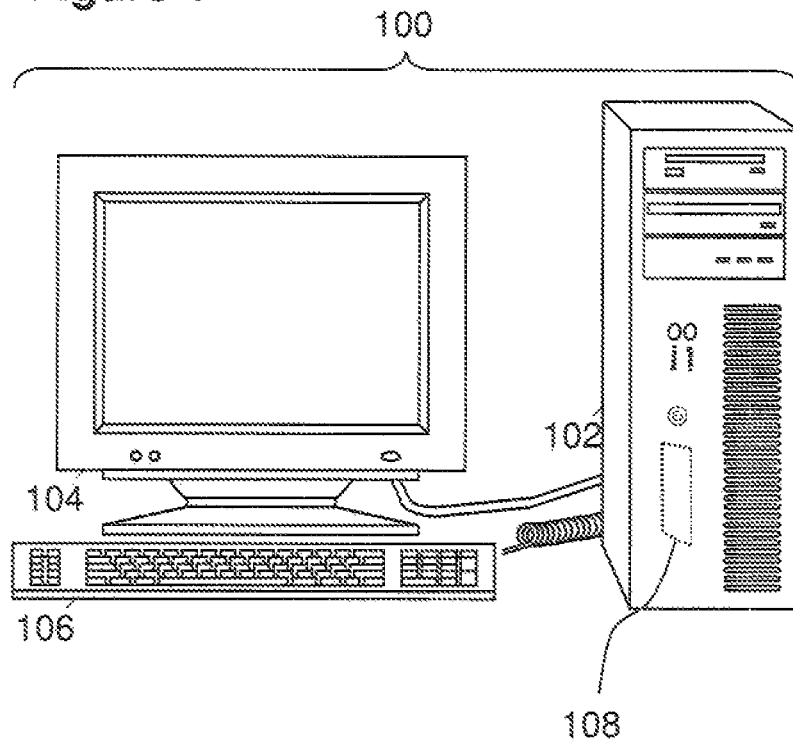


Figure 2

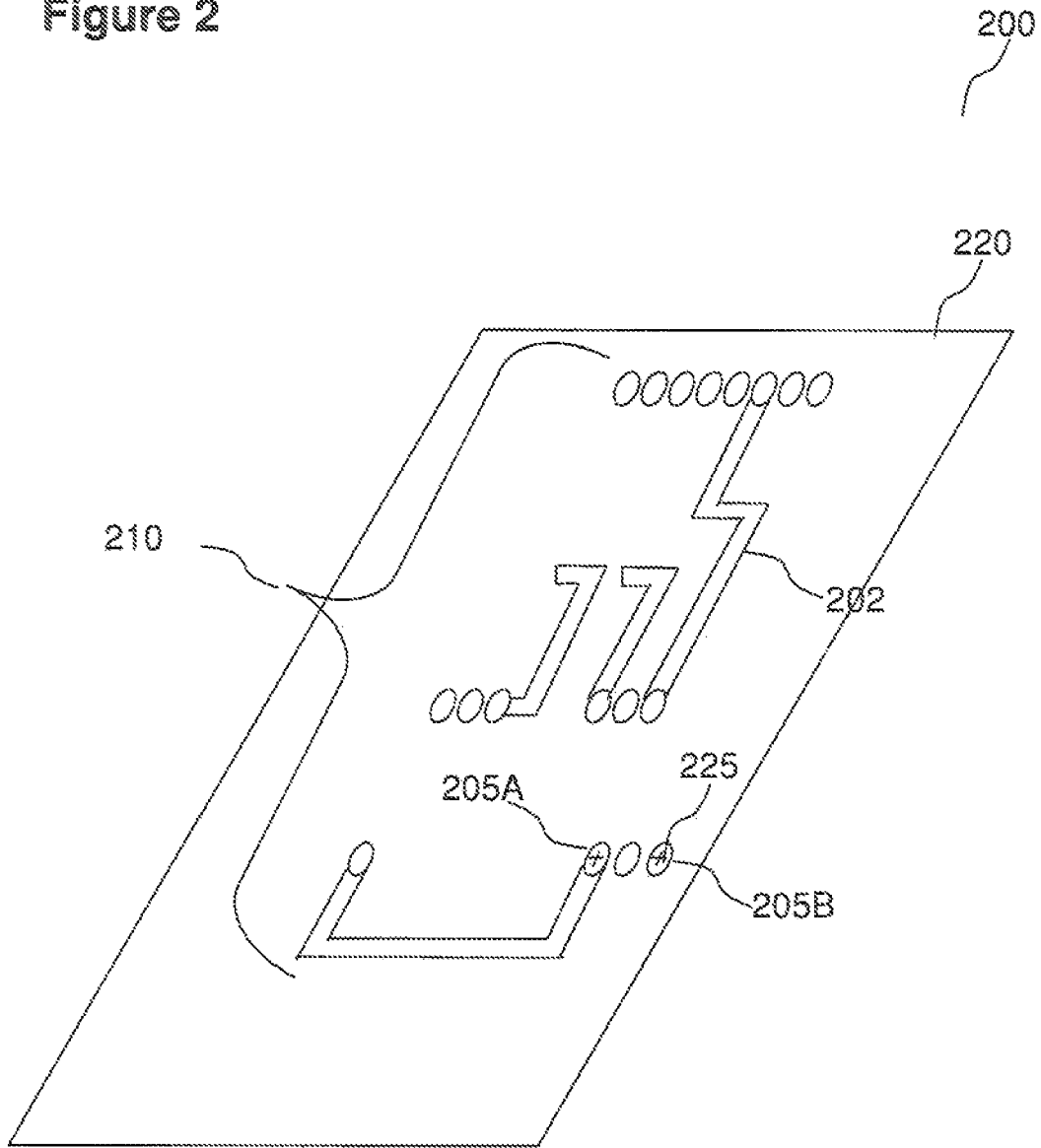
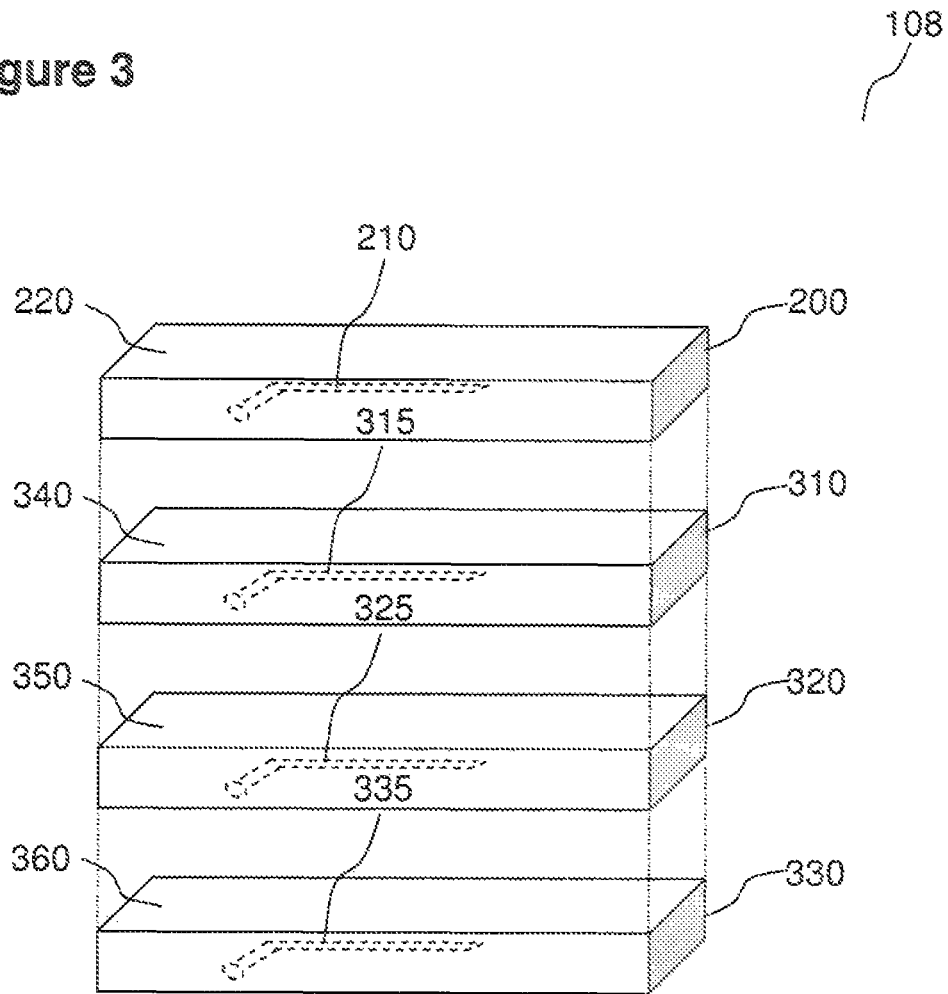


Figure 3



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