



(12) **United States Patent**
Minoo et al.

(10) **Patent No.:** **US 8,339,798 B2**
(45) **Date of Patent:** **Dec. 25, 2012**

(54) **PRINTED CIRCUIT BOARDS WITH EMBEDDED COMPONENTS**

(75) Inventors: **Jahan Minoo**, San Jose, CA (US);
Anthony P. N. Bidmead, Los Gatos, CA (US); **Michael Nikkhoo**, San Jose, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 194 days.

3,973,091	A *	8/1976	Kaminski	200/5 A
4,074,088	A *	2/1978	Keough et al.	200/5 A
4,127,752	A *	11/1978	Lowthorp	200/5 A
4,175,816	A *	11/1979	Burr et al.	
4,207,448	A *	6/1980	Furusawa et al.	200/516
4,263,485	A *	4/1981	Corwin	200/5 A
5,826,708	A *	10/1998	Finlay	
5,986,228	A *	11/1999	Kamoto et al.	200/516
6,388,218	B1 *	5/2002	Ando et al.	200/512
6,518,527	B2	2/2003	Watanabe et al.	
6,730,869	B2 *	5/2004	Teruyama et al.	200/516
6,928,726	B2	8/2005	Zollo et al.	
6,982,394	B2 *	1/2006	Ide et al.	200/516
7,094,985	B2	8/2006	Kobayashi et al.	

(Continued)

(21) Appl. No.: **12/832,885**

(22) Filed: **Jul. 8, 2010**

(65) **Prior Publication Data**

US 2012/0008294 A1 Jan. 12, 2012

(51) **Int. Cl.**

H05K 1/18	(2006.01)
H05K 1/03	(2006.01)
H05K 1/00	(2006.01)
H05K 1/16	(2006.01)

(52) **U.S. Cl.** **361/764**; 361/761; 361/777; 361/781; 200/5 A; 200/5 B; 200/516

(58) **Field of Classification Search** 361/679.02, 361/679.3, 679.15, 760-767, 784-788, 794-797; 174/254-267; 200/5 A, 6 A, 512-517, 306, 200/302.2, 292, 406, 341-345, 521; 345/156-184; 455/550.1, 575.1, 556, 556.2; 29/622
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,600,528	A *	8/1971	Leposavic	200/5 A
3,684,842	A *	8/1972	Boulangier	200/5 R
3,725,907	A *	4/1973	Boulangier	341/22
3,806,673	A *	4/1974	Boulangier	200/5 A

FOREIGN PATENT DOCUMENTS

DE **3002772 C2** 3/1984

(Continued)

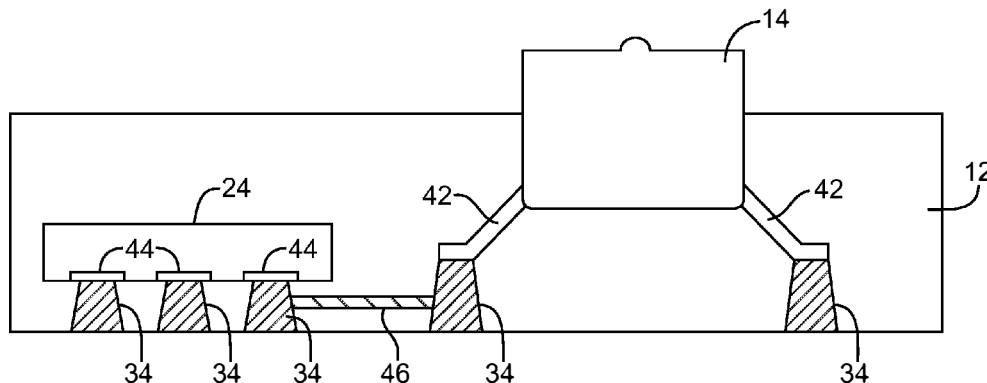
Primary Examiner — Michail V Datskovskiy

(74) *Attorney, Agent, or Firm* — Treyz Law Group; G. Victor Treyz; Nancy Y. Ru

(57) **ABSTRACT**

Printed circuit boards are provided with embedded components. The embedded components may be mounted within recesses in the surface of a printed circuit board substrate. The printed circuit board substrate may have grooves and buried channels in which wires may be mounted. Recesses may be provided with solderpads to which the wires may be soldered or attached with conductive adhesive. An integrated switch may be provided in an opening within a printed circuit board substrate. The integrated switch may have a dome switch member that is mounted within the opening. A cover member for the switch may be formed from a flexible layer that covers the dome switch member. Terminals for the integrated switch may be formed from conductive structures in an interior printed circuit board layer. Interconnects may be used to electrically connect embedded components such as switches, integrated circuits, solder pads for wires, and other devices.

19 Claims, 21 Drawing Sheets



US 8,339,798 B2

Page 2

U.S. PATENT DOCUMENTS

7,676,242 B2 3/2010 Siddiqui et al.
2003/0229795 A1* 12/2003 Kunigkeit et al. 713/189
2007/0111380 A1 5/2007 Cho et al.
2010/0265184 A1 10/2010 Jung

FOREIGN PATENT DOCUMENTS

JP 2006040803 A * 2/2006
JP 2009193467 A 8/2009
* cited by examiner

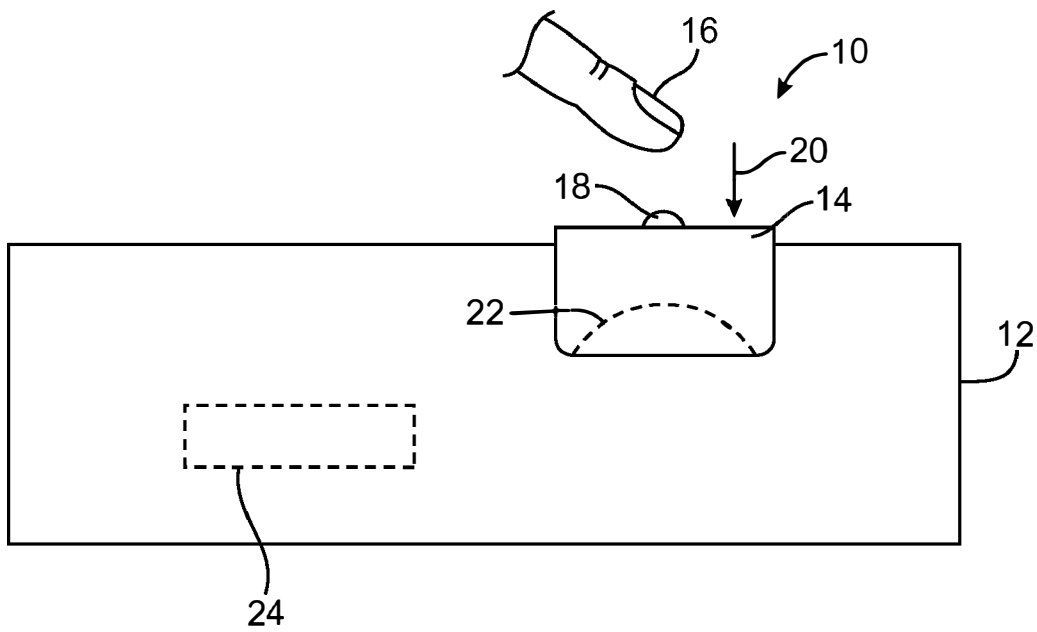


FIG. 1

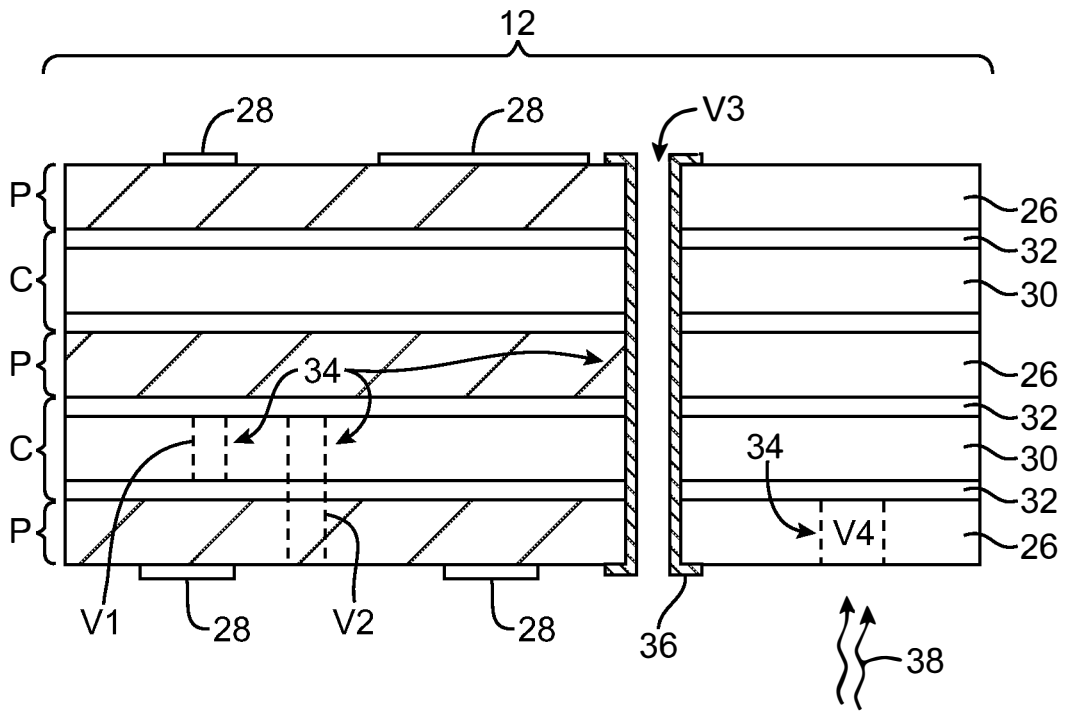


FIG. 2

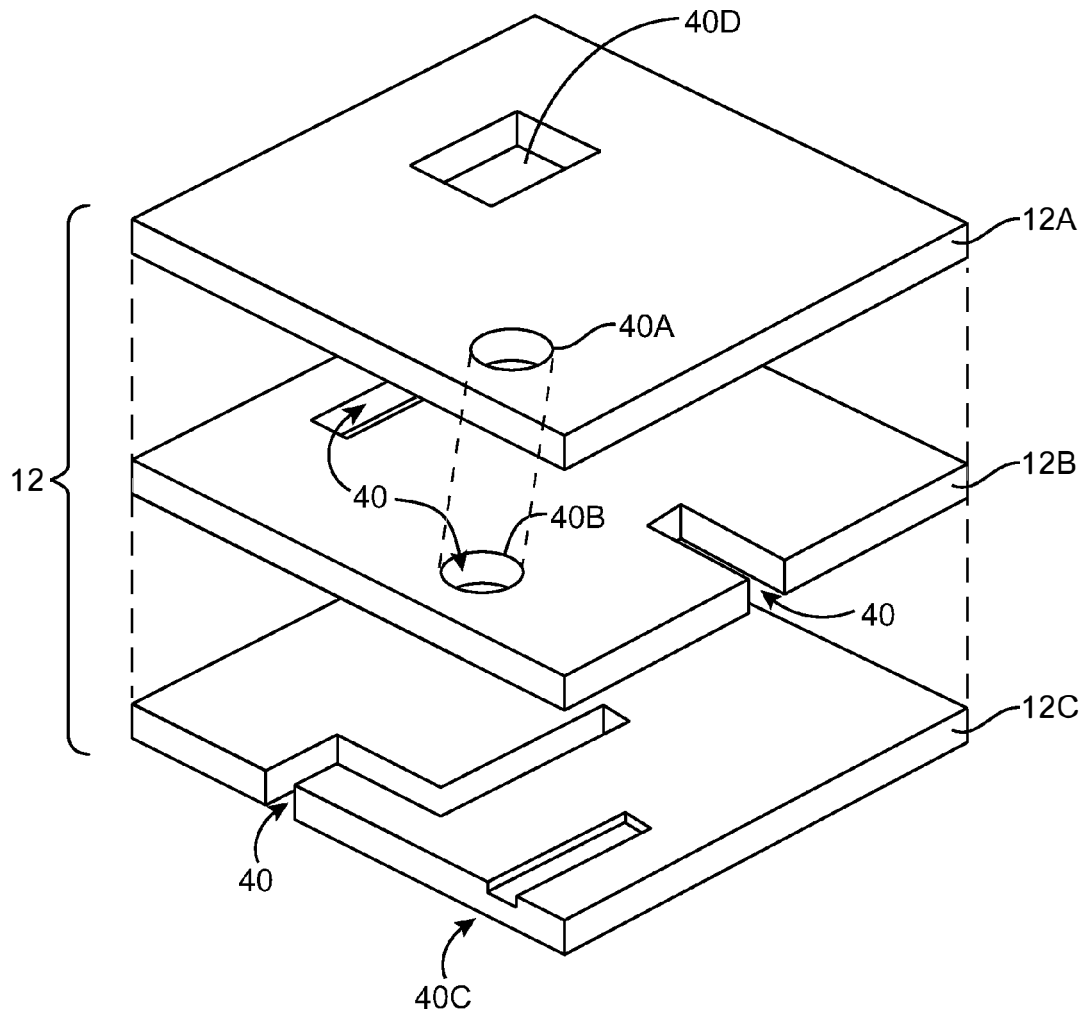


FIG. 3

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.