

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

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(54) **LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY**

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(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,302,849 A 4/1994 Cavin  
5,428,248 A 6/1995 Cha  
(Continued)

FOREIGN PATENT DOCUMENTS

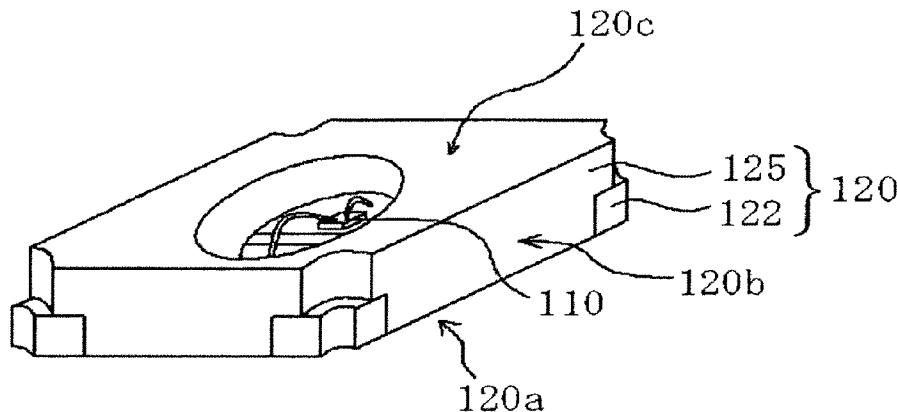
EP 0 936 683 A1 8/1999  
EP 2 100 908 A1 9/2009  
(Continued)

OTHER PUBLICATIONS

Translation of JP 2007-235085A (Urashaki) Sep. 13, 2007, 16 pages.\*  
(Continued)

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(57) **ABSTRACT**  
A method of manufacturing a light emitting device having a resin package which provides an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, and in which a resin part and a lead are formed in a substantially same plane in an outer side surface, includes a step of sandwiching a lead frame pro-  
(Continued)



vided with a notch part, by means of an upper mold and a lower mold, a step of transfer-molding a thermosetting resin containing a light reflecting material in a mold sandwiched by the upper mold and the lower mold to form a resin-molded body in the lead frame and a step of cutting the resin-molded body and the lead frame along the notch part.

**26 Claims, 13 Drawing Sheets**

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**B29C 45/14** (2006.01)  
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**H01L 33/64** (2010.01)

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 See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,763,829	A	6/1998	Tomita et al.
5,818,105	A	10/1998	Kouda
6,107,646	A	8/2000	Kim
6,107,676	A	8/2000	Suzuki
6,184,544	B1	2/2001	Toda et al.
6,252,254	B1*	6/2001	Soules ..... C09K 11/7731 257/100
6,335,545	B1	1/2002	Toda et al.
6,424,024	B1	7/2002	Shih et al.
6,433,277	B1	8/2002	Glenn
6,498,099	B1	12/2002	McLellan et al.
6,531,370	B2	3/2003	Sakamoto et al.
6,624,007	B2	9/2003	Kobayakawa et al.
6,627,482	B2	9/2003	Wang et al.
6,638,780	B2	10/2003	Fukasawa et al.
6,770,498	B2	8/2004	Hsu
6,853,057	B2	2/2005	Yasuda et al.
6,914,267	B2	7/2005	Fukasawa et al.
6,978,079	B2	12/2005	Uwada et al.
7,161,190	B2	1/2007	Chikugawa
7,301,176	B2	11/2007	Abe et al.
7,364,947	B2	4/2008	Kobayakawa
7,407,834	B2	8/2008	Shimanuki et al.
7,687,292	B2	3/2010	Park et al.
7,799,611	B2	9/2010	Ramos et al.
8,093,619	B2	1/2012	Hayashi
8,530,250	B2	9/2013	Ichikawa et al.
8,637,892	B2	1/2014	Egoshi et al.

2002/0028525	A1	3/2002	Sakamoto et al.
2002/0140092	A1	10/2002	Nakanishi et al.
2003/0006492	A1*	1/2003	Ogasawara ..... H01L 21/561 257/684
2004/0051171	A1	3/2004	Ng et al.
2004/0066933	A1	4/2004	Jeffery et al.
2004/0106234	A1*	6/2004	Sorg ..... H01L 21/4846 438/123
2004/0159850	A1	8/2004	Takenaka
2005/0151149	A1	7/2005	Chia et al.
2005/0280017	A1	12/2005	Oshio et al.
2006/0170083	A1	8/2006	Kim et al.
2006/0284207	A1	12/2006	Park et al.
2007/0138697	A1*	6/2007	Takeda ..... B29C 45/14221 264/278
2007/0241362	A1	10/2007	Han et al.
2008/0044934	A1*	2/2008	Loh ..... B29C 45/14655 438/21
2008/0224161	A1*	9/2008	Takada ..... H01L 33/486 257/98
2009/0050925	A1	2/2009	Kuramoto et al.
2009/0315049	A1	12/2009	Urasaki et al.
2010/0038662	A1	2/2010	Fushimi et al.
2010/0140638	A1	6/2010	Kotani et al.
2010/0150638	A1	6/2010	Namiki et al.
2010/0155739	A1	6/2010	Kuramoto et al.
2010/0187546	A1	7/2010	Fushimi et al.
2010/0314654	A1	12/2010	Hayashi

**FOREIGN PATENT DOCUMENTS**

JP	S54-069068	A	6/1979
JP	H08-037252		2/1996
JP	H11-045958		2/1999
JP	H11-087780		3/1999
JP	H11-1630007	A	6/1999
JP	H11-191562	A	7/1999
JP	H11-214754		8/1999
JP	2000-174347	A	6/2000
JP	2001-036154	A	2/2001
JP	2001-077160	A	3/2001
JP	2001-077235	A	3/2001
JP	2001-267482	A	9/2001
JP	2003-037236	A	2/2003
JP	2003-110145	A	4/2003
JP	2003-218398	A	7/2003
JP	2003-304000	A	10/2003
JP	2004-111964	A	4/2004
JP	2005-243857	A	9/2005
JP	2005-311137	A	11/2005
JP	2005535135	W*	11/2005 ..... H01L 21/4846
JP	2006-060034	A	3/2006
JP	2006-093697	A	4/2006
JP	2006-140207	A	6/2006
JP	2006-156704	A	6/2006
JP	2006-278427	A	10/2006
JP	2006-313943	A	11/2006
JP	2007-035794	A	2/2007
JP	2007-123302	A	5/2007
JP	2007-235085	A	9/2007
JP	2007235085	A*	9/2007 ..... H01L 24/97
JP	2007-294506	A	11/2007
JP	2007-297601	A	11/2007
JP	2007-329502	A	12/2007
JP	2008-103460	A	5/2008
JP	2008-106226	A	5/2008
JP	2008-130735	A	6/2008
JP	2008-186891	A	8/2008
JP	2008-192880	A	8/2008
JP	2013-145908	A	7/2013
JP	2013-153182	A	8/2013
WO	WO2004015769	A1*	2/2004 ..... H01L 21/4868
WO	WO-2006/126438	A1	11/2006
WO	WO-2007/015426	A1	2/2007

(56)

**References Cited**

FOREIGN PATENT DOCUMENTS

WO WO-2008/059856 A1 5/2008  
WO WO-2008/081794 A1 7/2008

OTHER PUBLICATIONS

EP Communication for application No. 09877246.9 dated Nov. 25, 2013 with attached Supplementary European Search Report for EP 09 81 1246 dated Oct. 31, 2013.  
European Patent Office, Third Party Observation Concerning EP09811246.9 dated Aug. 1, 2013.  
Extended European Search Report for EP Application No. 09 811 246.9-1226 dated Nov. 25, 2013 submitted by Eisenfuhr Speiser in a letter dated Dec. 10, 2013.  
International Search Report in PCT/JP2009/004170 dated Nov. 24, 2009.

Non-Final Office Action U.S. Appl. No. 12/737,940 dated Sep. 28, 2012.  
Notice of Allowance issued in U.S. Appl. No. 13/969,182 dated Jul. 9, 2015.  
Notice of Allowance issued in U.S. Appl. No. 12/737,940 dated May 13, 2013.  
Office Action issued in U.S. Appl. No. 13/969,182 dated Dec. 4, 2014.  
Office Action issued in U.S. Appl. No. 13/969,182 dated Mar. 5, 2014.  
Translation of JP2007-297601A (Yuasa et al, Hitachi Chemical Co. Ltd.), Mar. 2007, 17 pages.  
Written Opinion of the International Searching Authority in PCT/JP2009/004170 dated Nov. 24, 2009.  
Notice of Allowance issued in U.S. Appl. No. 13/969,182 dated Oct. 30, 2015.  
Office Action issued in Japanese Patent Application No. 2015-200794 mailed Sep. 13, 2016.

\* cited by examiner

Fig. 1

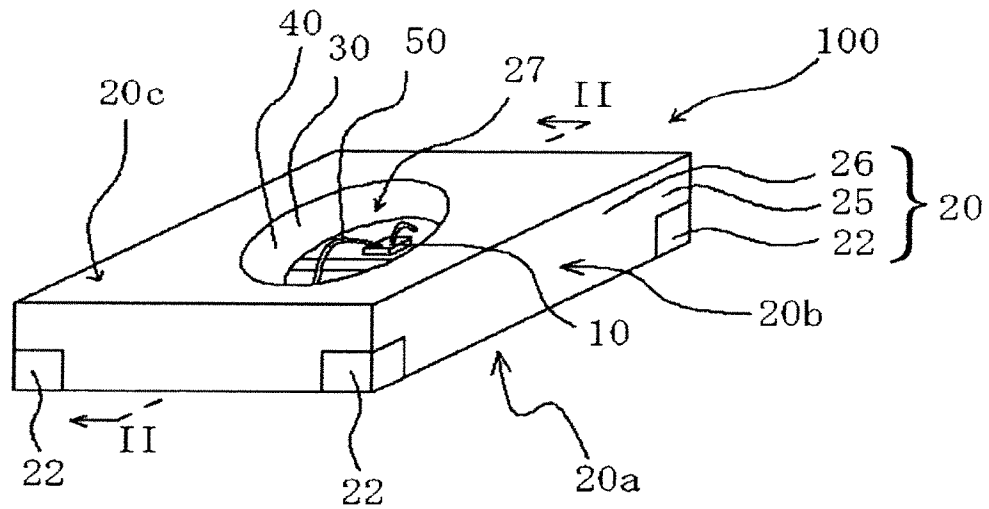
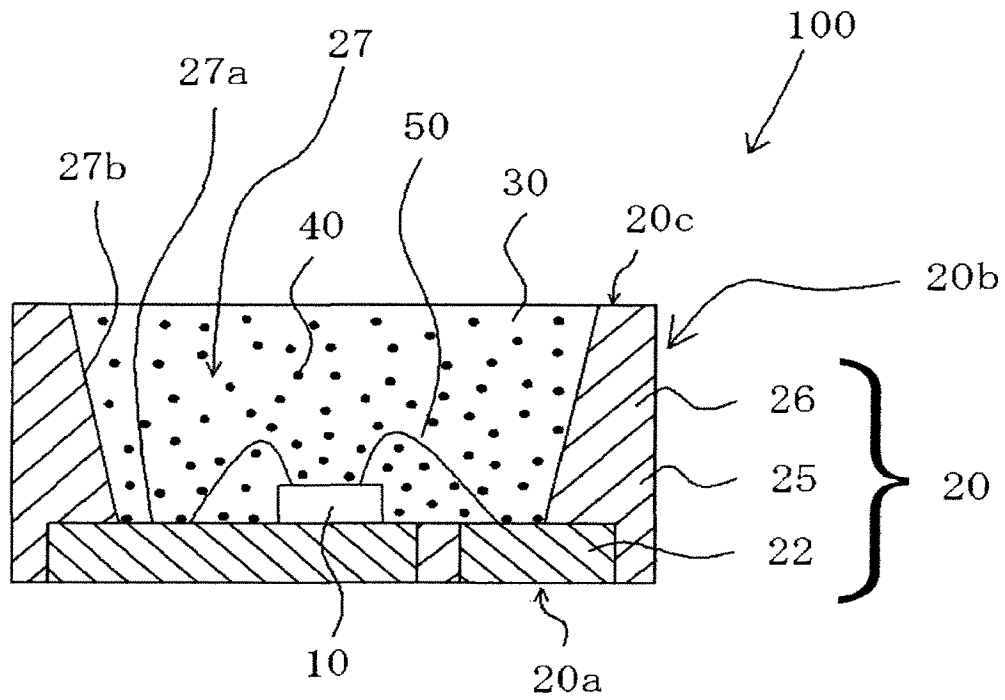


Fig. 2



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