



- (51) **International Patent Classification:**  
H01L 33/54 (2010.01) H01L 33/50 (2010.01)  
H01L 33/24 (2010.01)
- (21) **International Application Number:**  
PCT/US2013/062640
- (22) **International Filing Date:**  
30 September 2013 (30.09.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**

13/649,052	10 October 2012 (10.10.2012)	US
13/649,067	10 October 2012 (10.10.2012)	US
13/770,389	19 February 2013 (19.02.2013)	US
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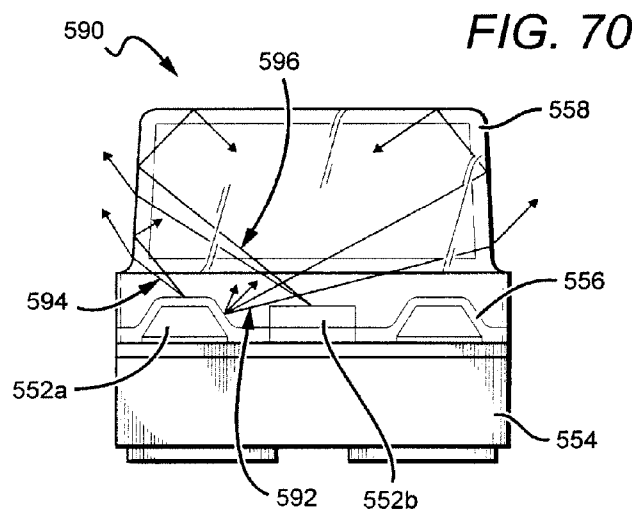
(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

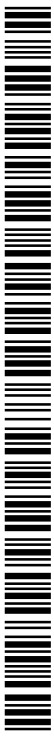
**Published:**  
— with international search report (Art. 21(3))

[Continued on next page]

(54) **Title:** LED PACKAGE WITH MULTIPLE ELEMENT LIGHT SOURCE AND ENCAPSULANT HAVING PLANAR SURFACES



(57) **Abstract:** LED packages are disclosed that are compact and efficiently emit light, and can comprise encapsulants with planar surfaces that refract and/or reflect light within the package encapsulant. The packages can comprise a submount with one or a plurality of LEDs. In packages with a plurality of LEDs, each LED can emit the same or different wavelengths of light. A blanket conversion material layer can be included on at least some of the LEDs and the submount. The encapsulant with planar surfaces can be on the submount, over at least some of the LEDs, with the planar surfaces causing total internal reflection of light within the package. TIR light within the encapsulant can reach the conversion material, where it can be absorbed and emitted omnidirectionally. TIR light can now escape from the encapsulant and allow for efficient emission and a broader emission profile when compared to conventional packages with hemispheric encapsulants.





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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**(88) Date of publication of the international search report:**  
10 July 2014

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2013/062640

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H01L33/54 H01L33/24 ADD. H01L33/50  According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) H01L F21V  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, INSPEC, WPI Data				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 2009/057699 A1 (BASIN GRIGORIY [US] ET AL) 5 March 2009 (2009-03-05)	1-12, 15, 19-34, 72		
Y	paragraphs [0001], [0008] - [0011], [0027] - [0032]; figure 2 paragraph [0044]	13-18, 35, 36		
Y	----- US 2011/156061 A1 (WANG BILY [TW] ET AL) 30 June 2011 (2011-06-30) paragraphs [0002] - [0004], [0031]; figure 9	13, 15		
A	----- EP 2 149 920 A1 (SHOWA DENKO KK [JP]) 3 February 2010 (2010-02-03) paragraph [0014]  ----- -/--	13		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <span style="margin-left: 100px;"><input checked="" type="checkbox"/> See patent family annex.</span>				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;">                     "A" document defining the general state of the art which is not considered to be of particular relevance                      "E" earlier application or patent but published on or after the international filing date                      "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)                      "O" document referring to an oral disclosure, use, exhibition or other means                      "P" document published prior to the international filing date but later than the priority date claimed                 </td> <td style="width: 50%; border: none; vertical-align: top;">                     "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                      "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone                      "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art                      "&amp;" document member of the same patent family                 </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search	Date of mailing of the international search report			
20 January 2014	22/05/2014			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Müller-Kirsch, Lutz			

**INTERNATIONAL SEARCH REPORT**

International application No PCT/US2013/062640
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2006/278886 A1 (TOMODA KATSUHIRO [JP] ET AL) 14 December 2006 (2006-12-14) paragraphs [0058] - [0065]; figures 1, 6, 7, 14-18  -----	14
Y	US 2011/221330 A1 (NEGLEY GERALD H [US] ET AL) 15 September 2011 (2011-09-15) paragraphs [0014] - [0020], [0126] - [0127], [0135]; figure 16E paragraph [0079]; figure 3E  -----	16-18, 35,36

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2013/062640

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-36, 72

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-36, 72

Emitter package comprising an encapsulation layer over a solid state light source whereby light conversion material is only distributed in parts of the encapsulation layer

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2. claims: 37-63

Emitter package comprising a light emitting diode having one or more surfaces that are at least partially obliged to at least one of the surfaces of the encapsulation layer which covers the light emitting diode

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3. claims: 64-71

Emitter package whereby the light emitting diode has a textured surface

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/062640

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009057699	A1	05-03-2009	NONE
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