PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT5755086

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
AVAGO TECHNOLOGIES GENERAL IP (SINGAPORE) PTE. LTD.	12/08/2017
BROADCOM CORPORATION	12/08/2017

RECEIVING PARTY DATA

Name:	BELL SEMICONDUCTOR, LLC
Street Address:	401 N. MICHIGAN AVE.
Internal Address:	SUITE 1600
City:	CHICAGO
State/Country:	ILLINOIS
Postal Code:	60611

PROPERTY NUMBERS Total: 60

Property Type	Number
Patent Number:	5639696
Patent Number:	8552560
Patent Number:	6064113
Patent Number:	5885848
Patent Number:	5789813
Patent Number:	5673479
Patent Number:	7829424
Patent Number:	7508062
Patent Number:	8601683
Patent Number:	6830999
Patent Number:	5925827
Patent Number:	5939641
Patent Number:	5965903
Patent Number:	5745986
Patent Number:	6156676
Patent Number:	6130113
Patent Number:	6117352
Patent Number:	5973397

Property Type	Number
Patent Number:	5672911
Patent Number:	7180011
Patent Number:	7205673
Patent Number:	7531442
Patent Number:	8222719
Patent Number:	6838769
Patent Number:	6319450
Patent Number:	7817434
Patent Number:	6701270
Patent Number:	7982307
Patent Number:	6252289
Patent Number:	6326685
Application Number:	08595022
Application Number:	11283219
Application Number:	09006356
Application Number:	08901489
Application Number:	08724076
Application Number:	08323817
Application Number:	12174479
Application Number:	11078052
Application Number:	11379256
Application Number:	10173182
Application Number:	08938619
Application Number:	09127707
Application Number:	09022733
Application Number:	08506382
Application Number:	09122335
Application Number:	09114345
Application Number:	08975025
Application Number:	08955929
Application Number:	08655599
Application Number:	11276938
Application Number:	11283044
Application Number:	11290087
Application Number:	12526334
Application Number:	09465089
Application Number:	09351945
Application Number:	11403492

Property Type	Number
Application Number:	09957410
Application Number:	11562537
Application Number:	09480014
Application Number:	09072248

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 3123755138
Email: jgammon@hilcoglobal.com
Correspondent Name: JOSHUA GAMMON
Address Line 1: 401 N. MICHIGAN AVE.
Address Line 2: SUITE 1600
Address Line 4: CHICAGO, ILLINOIS 60611

NAME OF SUBMITTER:	JOSHUA GAMMON
SIGNATURE:	//Joshua Gammon//
DATE SIGNED:	10/04/2019
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 99
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Patent Assignment Agreement

This Patent Assignment Agreement ("Assignment Agreement") is made and entered into as of the date of the last signature below ("EFFECTIVE DATE") by and among Avago Technologies General IP (Singapore) Pte. Ltd. (Company Registration No. 200512430D) ("Avago"), a Singapore company having an office at No. 1 Yishun Avenue 7, Singapore 768923, for itself and its AFFILIATES, and Broadcom Corporation (and together with Avago and AFFILIATES, hereinafter collectively "BROADCOM"), and Bell Semiconductor, LLC, a Delaware limited liability company ("Bell Semi") and Bell Northern Research, LLC, a Delaware limited liability company ("Bell Northern" and together with Bell Semi, "ASSIGNEES")), each represented by Hilco Patent Acquisition 56, LLC, a Delaware limited liability company, having its principal place of business at 401 North Michigan Avenue, Chicago, Illinois 60611, (hereinafter "HILCO") acting as agent on behalf of each of Bell Semi and Bell Northern only for purposes of this Assignment Agreement (each a "Party" or together the "Parties").

1 BACKGROUND

1.1 BROADCOM is the owner of the PATENTS; and

1.2 ASSIGNEES wish to acquire the PATENTS as herein provided.

2 DEFINITIONS

For purposes of this Assignment Agreement the following terms have the following definitions:

2.1 "AFFILIATE(S)" of a Party means any entity that, directly or indirectly, CONTROLS, is CONTROLLED by, or is under common CONTROL with a Party.

2.2 "BROADCOM'S KNOWLEDGE" means the KNOWLEDGE of anyone in BROADCOM'S IP and Licensing Division.

2.3 "CONTROL(S) or CONTROLLED" means direct or indirect ownership of more than fifty percent (50%) of the outstanding voting stock of the subject entity having the right and power to elect the majority of the directors of the subject entity or, in the case of a non-corporate entity, an equivalent interest.

2.4 "DEED OF ASSIGNMENT" means a duly executed assignment deed in the English language substantially in the form set out in Exhibit B.

2.5 "ENCUMBRANCE(S)" means an express written license or covenant not to sue that may bind an assignee of any of the PATENTS. As used herein, ENCUMBRANCE does not include (i) obligations arising from membership or participation in standards setting organizations or (ii) licenses or covenants not to sue with respect to the PATENTS that may be included in commercial agreements

between BROADCOM and its customers, distributors, resellers, suppliers and other third parties which are providing or receiving products or services to, from or on behalf of BROADCOM, solely to the extent of the sale, distribution or use of the products or services pursuant to and in accordance with the license or covenant not to sue (the licenses and covenants not to sue collectively "COMMERCIAL LICENSES").

2.6 "KNOWLEDGE" means actually aware of a fact or matter or expected to discover or otherwise become aware of that fact or matter in the course of conducting a reasonable investigation.

2.7 "LITIGATION" means any litigation or administrative action or proceeding involving any of the PATENTS in any jurisdiction in the world.

2.8 "PATENTS" means (a) (i) the U.S. and foreign patents and patent applications listed in Exhibit A(1), Exhibit A(2), and/or Exhibit A(3), including, without limitation, all rights in the patents and patent applications pursuant to 35 U.S.C. Sec. 154, (ii) all patents, patent applications, divisionals, re-issues, re-examination certificates, continuations, continuations-in-part, conversions, extensions, provisionals (or foreign equivalents of any of the foregoing) that may issue thereon and claim priority thereto, including any and all foreign counterpart of the foregoing, whether or not listed on Exhibit A(1), Exhibit A(2), and/or Exhibit A(3), and (iii) all other patent applications, patents and other similar governmental grants or issuances that are terminally disclaimed over any items set forth in the foregoing subsections (a)(i) or (a)(ii), or over which any items set forth in the foregoing subsections (a)(i) or (a)(ii) are terminally disclaimed, all of the foregoing subsections (a)(i), (a)(ii) and (a)(iii) excluding any patent or patent application that is not listed in Exhibit A(1), Exhibit A(2), Exhibit A(3) or Exhibit A(4) and to which priority is claimed after the EFFECTIVE DATE, through an amendment to one of the PATENTS listed in Exhibit A(1), Exhibit A(2), or Exhibit A(3) (collectively, the "Bell Semi PATENTS") or Exhibit A(4) and (b) (i) the U.S. and foreign patents and patent applications listed in Exhibit A(4), including, without limitation, all rights in the patents and patent applications pursuant to 35 U.S.C. Sec. 154, (ii) all patents, patent applications, divisionals, re-issues, re-examination certificates, continuations, continuations-in-part, conversions, extensions, provisionals (or foreign equivalents of any of the foregoing) that may issue thereon and claim priority thereto, including any and all foreign counterpart of the foregoing, whether or not listed on Exhibit A(4), and (iii) all other patent applications, patents and other similar governmental grants or issuances that are terminally disclaimed over any items set forth in the foregoing subsections (b)(i) or (b)(ii), or over which any items set forth in the foregoing subsections (b)(i) or (b)(ii) are terminally disclaimed, all of the foregoing subsections (b)(i), (b)(ii) and (b)(iii) excluding any patent or patent application that is not listed in Exhibit A(1), Exhibit A(2), Exhibit A(3) or Exhibit A(4) and to which priority is claimed after the EFFECTIVE DATE, through an amendment to one of the PATENTS listed in

Exhibit A(4) (collectively, the "Bell Northern PATENTS") or Exhibit A(1), Exhibit A(2) or Exhibit A(3).

2.9 "SEMICONDUCTOR-RELATED PATENT ASSET" means any granted U.S. or foreign patent or pending patent application having claims primarily related to a semiconductor manufacturing process or structure, a semiconductor packaging process or structure, or a semiconductor design process.

3 ASSIGNMENT AND GRANT OF LICENSE

3.1 In consideration for the payment to BROADCOM set forth in Section 4.1 and subject to the BROADCOM LIEN, as set out herein, BROADCOM hereby sells, assigns, transfers, and sets over to Bell Semi, with effect from the EFFECTIVE DATE, all right, title, and interest in, to, and under the PATENTS listed in Exhibit A(1) and all of its right, title, and interest in, to, and under the PATENTS listed in Exhibit A(2) and/or Exhibit A(3), each of the foregoing in all jurisdictions, including without limitation, all rights to claim priority on the basis thereof, all rights to sue for past, present and future infringement thereof, including the right to collect and receive all damages, royalties, or settlements for the infringements, all rights to sue for injunctive and/or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof, subject, however, only to: (a) all existing express written licenses or covenants not to sue relating to the Bell Semi PATENTS (whether currently in effect or contingent), including releases, as of the EFFECTIVE DATE, (b) any restrictions or obligations regarding enforcement, transfer or licensing of the Bell Semi PATENTS arising from participation in standard-setting organizations, including those standard-setting organizations set forth in Exhibit E; and (c) the nonexclusive license granted to BROADCOM under Section 3.3 of this Assignment Agreement.

3.2 In consideration for the payment to BROADCOM set forth in Section 4.1 and subject to the BROADCOM LIEN, as set out herein, BROADCOM hereby sells, assigns, transfers, and sets over to Bell Northern, with effect from the EFFECTIVE DATE, all right, title, and interest in, to, and under the PATENTS listed in Exhibit A(4), each of the foregoing in all jurisdictions, including without limitation, all rights to claim priority on the basis thereof, all rights to sue for past, present and future infringement thereof, including the right to collect and receive all damages, royalties, or settlements for the infringements, all rights to sue for injunctive and/or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof, subject, however, only to: (a) all existing express written licenses or covenants not to sue relating to the Bell Northern PATENTS (whether currently in effect or contingent), including releases, as of the EFFECTIVE DATE, (b) any restrictions or obligations regarding enforcement, transfer or licensing of the Bell Northern PATENTS arising from participation in standard-setting organizations, including those standard-setting organizations set forth in Exhibit E; and (c) the nonexclusive license granted to BROADCOM under Section 3.4 of this Assignment Agreement.

3.3 Bell Semi hereby grants to BROADCOM a nonexclusive royalty-free, fully paid-up, fully exhaustive, non-sublicensable, non-transferable and non-assignable (except a transfer or assignment to another BROADCOM AFFILIATE as further provided by Section 12.6) license, under the Bell Semi PATENTS (the "Bell Semi License"): (a) to make, have made, lease, sell, offer for sale, import, distribute, both directly and indirectly, including through one or more tiers of distribution, and otherwise use and exploit any and all products that practice any invention, apparatus or method that would, absent this license, infringe any claim of any of the Bell Semi PATENTS, (b) with respect to any act which would constitute infringement, inducement of infringement or contributory infringement under U.S. patent law or its equivalent as a result of any of the activities by BROADCOM as set forth in the foregoing subsection 3.3 (a), or (c) with respect to any products or services provided to BROADCOM for the use of the products or services by BROADCOM within, in combination or in conjunction with a BROADCOM product or service, (subsections (a)-(c) collectively "Bell Semi Licensed Products"). The foregoing Bell Semi License granted to BROADCOM is intended to be a broad license covering all of BROADCOM'S products and services, and applies to the use of Bell Semi Licensed Products by all downstream purchasers of the Bell Semi Licensed Products in every jurisdiction throughout the world, regardless of the jurisdiction in which a first sale of the Bell Semi Licensed Products is deemed to have occurred. Licenses or rights not expressly granted to BROADCOM in this Section 3.3 cannot arise by implication, estoppel, or otherwise. All rights and licenses not expressly granted in this Section 3.3 are hereby expressly reserved by Bell Semi.

3.4 Bell Northern hereby grants to BROADCOM a nonexclusive royalty-free, fully paid-up, fully exhaustive, non-sublicensable, non-transferable and non-assignable (except a transfer or assignment to another BROADCOM AFFILIATE as further provided by Section 12.6) license, under the Bell Northern PATENTS (the "Bell Northern License"): (a) to make, have made, lease, sell, offer for sale, import, distribute, both directly and indirectly, including through one or more tiers of distribution, and otherwise use and exploit any and all products that practice any invention, apparatus or method that would, absent this license, infringe any claim of any of the Bell Northern PATENTS, (b) with respect to any act which would constitute infringement, inducement of infringement or contributory infringement under U.S. patent law or its equivalent as a result of any of the activities by BROADCOM as set forth in the foregoing subsection 3.4 (a), or (c) with respect to any products or services provided to BROADCOM for the use of the products or services by BROADCOM within, in combination or in conjunction with a BROADCOM product or service, (subsections (a)-(c) collectively "Bell Northern Licensed Products"). The foregoing Bell Northern License granted to BROADCOM is intended to be a broad license covering all of BROADCOM'S products and services, and applies to the use of Bell Northern Licensed Products by all downstream purchasers of the Bell Northern Licensed Products in every jurisdiction throughout the world, regardless of the jurisdiction in which a first sale of the Bell Northern Licensed Products is deemed to have occurred. Licenses or

rights not expressly granted to BROADCOM in this Section 3.4 cannot arise by implication, estoppel, or otherwise. All rights and licenses not expressly granted in this Section 3.4 are hereby expressly reserved by Bell Northern.

3.5 Within sixty (60) days of the EFFECTIVE DATE, except with respect to the BROADCOM LIEN, BROADCOM shall, at its own expense, release and cause the release of any and all liens, mortgages, security interests and/or similar financial interests in or on the PATENTS ("LIENS"). All LIENS are set forth in Exhibit F, annexed hereto.

3.6 Upon receipt by BROADCOM of the first payment of Ten Million United States Dollars (U.S. $10,000,000) set forth in Section 4.1, BROADCOM shall execute and deliver to (a) Bell Semi a legally binding copy of the DEED OF ASSIGNMENT of the Bell Semi PATENTS, as set forth in Exhibit B(1) for filing with governmental agencies and (b) Bell Northern a legally binding copy of the DEED OF ASSIGNMENT of the Bell Northern PATENTS, as set forth in Exhibit B(2) for filing with governmental agencies. If there is an inconsistency between either of Exhibit B(1) or Exhibit B(2) and the terms and conditions of this Assignment Agreement, then the terms and conditions of this Assignment Agreement prevail. BROADCOM further shall deliver, within five (5) business days of BROADCOM'S receipt of such payment, (a) to Bell Semi original cop(ies) of the DEED OF ASSIGNMENT for the Bell Semi PATENTS as set forth in Exhibit B(1), and (b) to Bell Northern original cop(ies) of the DEED OF ASSIGNMENT for the Bell Northern PATENTS as set forth in Exhibit B(2) .

3.7 BROADCOM agrees to use its best efforts, without additional charge to HILCO, Bell Semi or Bell Northern, to promptly execute and deliver any further assignment documents reasonably requested by HILCO, Bell Semi or Bell Northern to complete transfer of all right, title and interest in and to the PATENTS; provided, however, that Bell Semi and Bell Northern shall each bear all costs of filing or recording any of their respective assignment documents.

4 CONSIDERATION

4.1 In consideration for the assignment of PATENTS, as set out herein, HILCO shall pay to BROADCOM the sum of Thirty Five Million United States Dollars (U.S. $35,000,000) as the agent for and on behalf of each of Bell Semi and Bell Northern in accordance with the following payment schedule ("PAYMENT OBLIGATIONS"):

PAYMENT AMOUNT	PAYMENT DUE DATE
U.S. $10,000,000	Within ten (10) days of the EFFECTIVE DATE

U.S. $10,000,000	January 24, 2018
U.S. $5,000,000	April 24, 2018
U.S. $5,000,000	July 24, 2018
U.S. $5,000,000	October 24, 2018

Payment of Ten Million United States Dollars (U.S. $10,000,000) shall be payable to BROADCOM upon execution of this Assignment Agreement; provided that for the convenience of the Parties, payment to BROADCOM of such Ten Million United States Dollars (U.S. $10,000,000) shall be made within ten (10) days of the EFFECTIVE DATE. The remaining balance of Twenty Five Million United States Dollars (U.S. $25,000,000) shall be paid to BROADCOM according to the payment schedule set forth in the PAYMENT OBLIGATIONS in this Section 4.1. Subject to Section 5.3, in no event will the sum or any portion thereof be credited or refunded to HILCO, Bell Semi, or Bell Northern.

4.2 **SECURITY INTEREST IN PATENTS**

a) In consideration for the assignment of the PATENTS, as set out herein, HILCO, Bell Semi, and Bell Northern (collectively "GRANTORS") hereby grant to BROADCOM a security interest in and continuing lien on all of GRANTORS' right, title and interest in and to (i) the PATENTS, (ii) any and all claims for damages for past, present and future infringement, misappropriation or breach with respect to the PATENTS, with the right, but not the obligation, to sue for and collect, or otherwise recover, such damages, and (iii) any and all proceeds of the foregoing ((i)-(iii) collectively "COLLATERAL")("BROADCOM LIEN").

b) This Assignment Agreement secures, and the COLLATERAL is collateral security for, the prompt and complete payment when due, as set forth in the payment schedule for HILCO's PAYMENT OBLIGATIONS (including the payment of amounts that would become due but for the operation of the automatic stay under Section 362(a) of the Bankruptcy Code, 11 U.S.C. § 362(a) (and any successor provision thereof)) (collectively, the "SECURED OBLIGATIONS").

c) If GRANTORS have breached Section 4.1 hereof by failing to make a scheduled payment, then BROADCOM may exercise in respect of the COLLATERAL, in addition to all other rights and remedies provided for herein or otherwise available to them at law or in equity, all the rights and remedies of a secured party on default under the UCC (whether or not the UCC applies to the affected Collateral) to collect, enforce or satisfy any SECURED

OBLIGATIONS then owing, whether by acceleration or otherwise, and also may pursue any of the following separately, successively or simultaneously:

1) notify GRANTORS or other party obligated on the COLLATERAL to make payment to BROADCOM;

2) notify GRANTORS or other party obligated on the COLLATERAL to assign the PATENTS back to BROADCOM;

3) direct a Securities Intermediary to the disposition of funds in a Securities Account (Capitalized terms not defined in this Agreement shall have the meaning given to them in the Uniform Commercial Code (UCC) as in effect in the State of New York);

4) prior to the disposition of the Collateral, prepare the Collateral for disposition in any manner to the extent BROADCOM deems appropriate; and

5) without notice except as specified below or under the UCC, sell, assign, transfer or otherwise dispose of the Collateral or any part thereof in one or more parcels at public or private sale, for cash, on credit or for future delivery, at such time or times and at such price or prices and upon such other terms as BROADCOM may deem commercially reasonable.

d) Together with execution of this Assignment Agreement, GRANTORS agree to execute the INTELLECTUAL PROPERTY SECURITY AGREEMENT, as set forth in Exhibit G, covering the BROADCOM LIEN on the COLLATORAL for recording with the U.S. Patent and Trademark Office and other governmental authorities.

e) With respect to the payment due January 24, 2018 only, if GRANTORS fail to make such payment when due, GRANTORS shall have sixty (60) days to cure such non-payment prior to BROADCOM invoking the remedies set forth in Section 4.2(c). If payment is made on or prior to the 30th day in arrears, no penalty shall be payable by GRANTORS to BROADCOM. If payment is made in the period 31 to 60 days in arrears, GRANTORS shall pay to BROADCOM a penalty equal to the product of (a) $500,000 and (b) the number of days that lapse since the 30th day divided by 30. For the avoidance of doubt and by way of example, if GRANTORS cure 45 days in arrears (i.e., 45 days after January 24, 2018), GRANTORS shall pay to BROADCOM $250,000 (= $500,000) x (15/30).

f) Upon receipt by BROADCOM of the full payment of Thirty Five Million United States Dollars (U.S. $35,000,000) set forth in Section 4.1, the BROADCOM LIEN will be terminated and BROADCOM will no longer possess a security interest in and continuing lien on all of GRANTORS' right, title and interest in and to the COLLATORAL. Upon termination of the BROADCOM LIEN, BROADCOM agrees to execute and/or record any termination of interest agreements that may be reasonably requested by the GRANTORS.

4.3 BROADCOM shall pay or withhold and otherwise bear all taxes and other charges (including without limitation, sales and value added taxes) imposed by any national government, and any state, local or other political subdivision thereof, of any country in which BROADCOM is subject to taxation, as the result of HILCO'S payment of the consideration hereunder on behalf of each of Bell Semi and Bell Northern. Any overdue payment will be subject to a late payment charge calculated at an annual rate of three percentage points (3%) over the prime rate or successive prime rates (as posted in New York City) during delinquency. If the amount of the charge exceeds the maximum permitted by law, the charge will be reduced to the maximum.

5 REPRESENTATIONS AND WARRANTIES

5.1 As a material inducement for Bell Semi and Bell Northern to enter into this Assignment Agreement, and for HILCO to act as the agent for each of Bell Semi and Bell Northern, BROADCOM represents, warrants and covenants to each of HILCO, Bell Semi and Bell Northern that:

a) BROADCOM is free to enter into this Assignment Agreement and any other relevant documents referred to in this Assignment Agreement;

b) BROADCOM has full right and legal power and authority to enter into this Assignment Agreement and the other documents and has received all necessary authorizations to do so;

c) other than consents and authorizations already obtained prior to the execution of this Assignment Agreement, BROADCOM does not require any consents or authorizations of any third party to fulfill its obligations set forth in this Assignment Agreement or the other documents;

d) BROADCOM is the sole and exclusive owner, assignee and holder of all right, title and interest in and to (i) all of the PATENTS listed in Exhibit A(1) and (ii) all of the PATENTS listed in Exhibit A(4), including without limitation, the right to sue for past, present and future infringement of the PATENTS including the rights set forth in Section 3.1. BROADCOM is an owner, assignee and holder of right, title and interest in and to all of the PATENTS listed in Exhibit A(3), including the right to sue for past, present and future infringement of the PATENTS, subject to the rights held by any joint owners of such PATENTS, including the rights set forth in Section 3.1;

e) To BROADCOM'S KNOWLEDGE, except with respect to all of the PATENTS listed in Exhibit A(2), executed assignments, including from all inventors of the PATENTS, for the PATENTS have been recorded as necessary to fully perfect BROADCOM'S rights and title therein in accordance with governing law and regulations in each respective jurisdiction;

f) To BROADCOM'S KNOWLEDGE, those patents and patent applications of the PATENTS that are identified in any of Exhibit A(1), Exhibit A(2), Exhibit A(3) and Exhibit A(4) as having a "Granted" status have not been abandoned or lapsed on or before the EFFECTIVE DATE;

g) none of the PATENTS have been found invalid or unenforceable in any administrative, arbitration, judicial or other proceeding;

h) to BROADCOM'S KNOWLEDGE, BROADCOM has not received notice of any actions, suits, investigations, claims, or proceeding threatened, pending or in progress relating to infringement, invalidity or unenforceability of the PATENTS, including but not limited to any opposition, re-examination, reissue, interference proceeding, or any similar proceeding;

i) to BROADCOM'S KNOWLEDGE, with the exception of any agreements between BROADCOM and Apple Inc. and its AFFILIATES, all written licenses, obligations or agreements regarding any ENCUMBRANCES on the PATENTS that may exist with respect to the entities listed in Exhibit C (collectively "Encumbrance Agreements") have been placed in a reading room for review by HILCO'S, Bell Semi's and Bell Northern's outside counsel or otherwise shared with HILCO, Bell Semi or Bell Northern as part of the due diligence for this Assignment Agreement;

j) to BROADCOM'S KNOWLEDGE, other than the Encumbrance Agreements, no other licenses, obligations or agreements exist with respect to the PATENTS that grant any exclusive rights or exclusive licenses to any party;

k) to BROADCOM'S KNOWLEDGE, none of the COMMERCIAL LICENSES impose any additional restrictions on or licenses to the PATENTS beyond the sale, distribution, manufacturing or use of BROADCOM'S products and services;

l) to BROADCOM'S KNOWLEDGE, other than as set forth in Exhibit F, there are no LIENS in or on the PATENTS; and

m) BROADCOM makes no additional representations, warranties or covenants regarding the existence of any other licenses, obligations or ENCUMBRANCES on the PATENTS.

5.2 HILCO, Bell Semi and Bell Northern each represent, warrant and covenant to BROADCOM that each of HILCO, Bell Semi, and Bell Northern:

a) is free to enter into this Assignment Agreement and any other relevant documents referred to in this Assignment Agreement;

b) has full legal power and authority to enter into this Assignment Agreement and any the other documents and has received all necessary corporate authorizations to do so; and

c) other than consents and authorizations already obtained prior to the execution of this Assignment Agreement, does not require any consents or authorizations of any third party to fulfill its obligations set forth in this Assignment Agreement or any the other documents.

5.3 Upon notification by HILCO, Bell Semi, or Bell Northern of the occurrence of any breach of any representation, warranty, or covenant contained in Section 5.1, in case of a breach capable of remedy, BROADCOM shall cure the breach within thirty (30) days from the notification. In the event that BROADCOM fails to cure the breach within the 30-day period or in the event of a breach not capable of remedy, each of HILCO Bell Semi and Bell Northern will be entitled to pursue any remedy it may have in law or in equity.

5.4 All representations, warranties, and covenants of each Party will survive the closing of this transaction and remain in full force and effect until the expiration of any applicable statute of limitations. To the fullest extent not prohibited by law, the running of any applicable statute of limitations will commence as of the actual knowledge by the non-breaching Party of the breach of the relevant representation, warranty, or covenant.

6 DISCLAIMER OF WARRANTIES

6.1 **Except as otherwise expressly provided in this Assignment Agreement, the PATENTS are being sold and transferred "as is", without warranty of any kind whatsoever by BROADCOM and subject to all existing licenses, licensing obligations and ENCUMBRANCES as of the EFFECTIVE DATE.**

6.2 **BROADCOM expressly disclaims any warranty of merchantability or fitness for a particular purpose.**

7 LITIGATION

7.1 HILCO, Bell Semi and Bell Northern each has no obligation to initiate any LITIGATION, or to defend any LITIGATION brought by any third party at any time after the EFFECTIVE DATE.

7.2 HILCO, Bell Semi and Bell Northern each shall not join BROADCOM as a party to any LITIGATION involving the PATENTS, unless a court determines that BROADCOM is an indispensable or a necessary party to the LITIGATION (the "No-Joinder Covenant").

(a) Notwithstanding the foregoing, in the event a third party makes a filing in a LITIGATION in which Bell Semi is a named party, and despite Bell Semi's reasonable efforts to dispute the filing, a court determines that BROADCOM is an indispensable or necessary party to the LITIGATION, then BROADCOM will voluntarily join the proceedings, subject to the provisions of Section 7.2(b). Notwithstanding the foregoing, in the event a third party makes a filing

in a LITIGATION in which Bell Northern is a named party, and despite Bell Northern's reasonable efforts to dispute the filing, a court determines that BROADCOM is an indispensable or necessary party to the LITIGATION, then BROADCOM will voluntarily join the proceedings, subject to the provisions of Section 7.2

(b) In the event BROADCOM is joined as a party to a LITIGATION in which Bell Semi or Bell Northern is a party, BROADCOM shall relinquish and Bell Semi or Sell Northerns, as the case may be, shall assume all control over the LITIGATION as it relates to infringement, scope, ownership, validity or enforceability of any of the PATENTS, and Bell Semi or Bell Northern, as the case may be shall (i) provide separate counsel acceptable to BROADCOM to represent BROADCOM, which acceptance shall not be unreasonably denied; (ii) pay for the counsel's reasonable fees and costs in connection with the LITIGATION as it relates to the PATENTS; and (iii) reimburse BROADCOM for its direct and reasonable out-of-pocket costs and expenses (but not any damages, fines, or settlements) required to be paid by BROADCOM pursuant to the final, non-appealable judgment of a court of competent authority in the LITIGATION as it relates to the PATENTS, other than any fees, costs or expenses attributable solely to the conduct of BROADCOM or its representatives that is found by the court to be sanctionable. Without limiting the foregoing, BROADCOM shall not seek to join or intervene as a party in any LITIGATION unless required by the court order.

(c) The undertakings of Bell Semi and/or Bell Northern in this Section 7.2 are further subject to BROADCOM reasonably cooperating with Bell Semi and/or Bell Northern,as the case may be and executing any and all documents reasonably requested by Bell Semi and/or Bell Northern, as the case may be.

7.3 Without limiting Section 7.2 and in addition to that Section, in the event of a LITIGATION and at Bell Semi's or Bell Northern's request, BROADCOM shall provide reasonable assistance to (a) Bell Semi in enforcing the rights of the Bell Semi PATENTS, and (b) Bell Northern in enforcing the rights of the Bell Northern PATENTS. Bell Semi and/or Bell Northern, as the case may be shall pay all reasonable costs and expenses associated with the requested assistance, respectively.

8 CONFIDENTIALITY

8.1 Either Party may disclose the existence of this Assignment Agreement and the Assignments in Exhibit B, but shall otherwise keep the terms of this Assignment Agreement other than the Assignments in Exhibit B confidential and shall not now or thereafter divulge any part thereof to any third party except under any one of the following conditions:

a) with the prior written consent of the other Party;

b) to legal advisors, financial advisors and auditors, and other similar professionals representing either Party;

c) to any governmental body demanding the information which has jurisdiction to compel production;

d) as otherwise may be required by law, rule or regulation, including the rules of the Securities Exchange Commission or NASDAQ, or by order from a court of competent jurisdiction;

e) to the extent necessary to establish, perfect, or maintain BROADCOM'S licensed rights set out in Section 3.2;

f) to the extent necessary to establish, perfect, or maintain Bell Semi's and Bell Northern's rights set out in this Assignment Agreement or in the Assignments;

g) under a suitable confidentiality agreement or protective order, in response to a subpoena or other litigation discovery request;

h) under a suitable confidentiality agreement, in connection with due diligence activities relating to: (1) the licensing of a Party's or its AFFILIATES' patents, or (2) the sale or other transfer of the stock or a portion of the business of a Party or its AFFILIATES; or

i) for purposes of recording the Assignments in Exhibit B with the United States Patent and Trademark Office and corresponding patent offices in each jurisdiction in which one or more of the PATENTS is pending or issued.

8.2 Each Party acknowledges and agrees that the unauthorized reproduction, use, or disclosure of the Confidential Information or any part thereof or any of licensees' unlicensed use or other exploitation of any of the PATENTS is likely to cause irreparable injury to the other Party, who shall therefore be entitled to injunctive relief to enforce these confidentiality or other obligations under this Assignment Agreement, in addition to any other remedies available at law, in equity, or under this Assignment Agreement, and without the need to post a bond even if ordinarily required.

9 LIMITATION OF LIABILITIES

9.1 EXCEPT IN THE EVENT OF AN INTENTIONAL MISREPRESENTATION OR FRAUD BY ONE OF THE PARTIES, (i) EACH OF BROADCOM AND HILCO, BELL SEMI AND BELL NORTHERN, THEIR RESPECTIVE AFFILIATES, AND ITS OR THEIR RESPECTIVE EMPLOYEES, DIRECTORS, OFFICERS, AGENTS AND CONTRACTORS SHALL NOT HAVE ANY LIABILITY FOR ANY INCIDENTAL, INDIRECT, EXEMPLARY, PUNITIVE, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES OR LOSSES (INCLUDING LOST PROFITS OR REVENUES OR GOODWILL) ARISING OUT OF THIS ASSIGNMENT AGREEMENT EVEN IF A PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF THE DAMAGES OR THE FAILURE OF ESSENTIAL PURPOSE OF ANY REMEDY, WHETHER THE RESULTS FROM AN

ACTION FOR BREACH OF CONTRACT OR WARRANTY, TORT (INCLUDING NEGLIGENCE), INDEMNITY OR STRICT LIABILITY OR ANY OTHER THEORY OF RECOVERY, AND (ii) IN NO EVENT SHALL THE TOTAL AND CUMULATIVE LIABILITY OF ANY PARTY RESULTING FROM THIS ASSIGNMENT AGREEMENT EXCEED ONE-HALF (1/2) OF THE TOTAL CONSIDERATION PAID TO BROADCOM BY BELL SEMI AND BELL NORTHERN PURSUANT TO SECTION 4.1. THE PARTIES UNDERSTAND AND AGREE THAT THESE EXCLUSIONS OF DAMAGES AND LOSSES WERE AN ESSENTIAL ELEMENT IN ESTABLISHING THE CONSIDERATION SET OUT IN THIS ASSIGNMENT AGREEMENT (collectively "LIMITATION OF LIABILITIES").

10 PROSECUTION, MAINTENANCE AND CO-OPERATION

10.1 On the EFFECTIVE DATE, Bell Semi shall, at its expense, take over and assume responsibility for further prosecution, if any, and all maintenance fees of the Bell Semi PATENTS and Bell Northern shall, at its expense, take over and assume responsibility for further prosecution, if any, and all maintenance fees of the Bell Northern PATENTS. On or prior to the EFFECTIVE DATE, BROADCOM shall provide Bell Semi and Bell Northern with a table separate from any other disclosures made hereunder of any relevant due dates related to maintenance or prosecution of the PATENTS that will occur within ninety (90) days after the EFFECTIVE DATE.

10.2 After conducting a reasonable search, BROADCOM shall transfer to each of Bell Semi and Bell Northern, at Bell Semi and Bell Northern reasonable expense, copies of the documents listed in Exhibit D that are in its possession, custody, or control that relate to the PATENTS (collectively, the "DOCUMENTS") within sixty (60) days of the EFFECTIVE DATE. The Parties agree that no claim of protection under the attorney-client privilege, the work product doctrine or any other applicable privilege is waived or limited in any way by any disclosure of the Documents or any information relating to the Documents. Further, neither Party may waive, and each Party will be entitled to assert against third parties, the privileges or other protections available by law or under the terms of any agreement between the Parties with respect to the other Party's privileged information, without the prior written consent of the Party to whom the privilege pertains.

10.3 BROADCOM shall reasonably cooperate with each of Bell Semi and Bell Northern with respect to any ongoing prosecution at the United States Patent and Trademark Office and corresponding patent offices in all other jurisdictions in which any of the Bell Semi PATENTS or Bell Northern PATENTS, respectively, are issued or pending, including providing access to named inventors on the pending PATENTS that are employed by BROADCOM at the time of the request for access and/or assisting each of Bell Semi and Bell Northern, respectively, in locating and obtaining access to the named inventors on the PATENTS.

10.4 To the fullest extent not prohibited by applicable law, BROADCOM agrees not to challenge or assist any person or entity in challenging the scope or ownership or validity or enforceability of any of the PATENTS in any action or proceeding of any kind or to assist any third party in any action or proceeding involving the PATENTS, except (i) to the extent the assistance is required pursuant to a subpoena or otherwise compelled by an order issued by a court of law or the USPTO or any other tribunal or agency of competent jurisdiction, or (ii) in any infringement action pursuant to which one or more of the PATENTS is asserted against BROADCOM or any unaffiliated person or entity for whom BROADCOM owes a pre-existing contractual obligation to defend or assist in the defense.

11 OPTION

11.1 For a period of two (2) years from the EFFECTIVE DATE, if BROADCOM elects to abandon or allow to lapse any U.S. patent asset, BROADCOM shall undertake reasonable efforts to identify whether the asset is a SEMICONDUCTOR-RELATED PATENT ASSET ("LAPSING SEMICONDUCTOR-RELATED PATENT ASSET") and to notify Bell Semi and Bell Northern, in writing with no less than forty-five (45) days' notice prior to the lapse date of the LAPSING SEMICONDUCTOR-RELATED PATENT ASSET, of its intent to abandon or allow to lapse the LAPSING SEMICONDUCTOR-RELATED PATENT ASSET, and Bell Semi and, if it waives the option, Bell Northern thereupon shall have the option in its sole discretion to acquire the LAPSING SEMICONDUCTOR-RELATED PATENT ASSET and any active foreign counterpart thereof at no additional cost by delivery of written notice to BROADCOM. In the event of the election, BROADCOM shall promptly execute and deliver to Bell Semi or Bell Northern, as the case may be, a patent assignment document similar in form and scope to this Assignment Agreement and the Assignment in Exhibit B to effectuate the assignment and acquisition.

12 MISCELLANEOUS PROVISIONS

12.1 All notices, authorizations, and requests in connection with this Assignment Agreement must be given in writing and will be deemed given on the day they are delivered personally or sent by an nationally recognized overnight courier or US certified mail, and addressed as follows:

To BROADCOM:

Broadcom Ltd.
Suite F-200
Intellectual Property and Licensing Division, Room 10C-231D
Attention: Vice President and General Manager, Intellectual Property and Licensing
1110 American Parkway NE
Allentown, Pennsylvania 18109-9137, USA

To HILCO:

Hilco IP Merchant Capital, LLC
401 N. Michigan Ave.
Chicago, IL 60611, USA

or to the other address as the Party to receive the notice or request so designates by written notice to the other pursuant to this Section 12.1.

12.2 Payments to BROADCOM shall be made by bank wire transfers to the account:

Avago Technologies General IP (Singapore) Pte. Ltd.
Account Number: 821979064
Citibank NA, Singapore Branch
8 Marina View #16-01 Asia Square Tower 1
Singapore 018960
Swift Code: CITISGSG

12.3 This Assignment Agreement may be amended or modified only by an instrument in writing duly executed by the authorized representatives of the Party or Parties to be bound thereby. Neither the failure nor the delay of either Party to enforce any provision of this Assignment Agreement shall constitute a waiver of the provision or of the right of either Party to enforce each and every provision of this Assignment Agreement.

12.4 This Assignment Agreement and the Exhibits hereto set forth the entire agreement and understanding between the Parties as to the subject matters of the Parties' agreement and supersedes all prior discussions, agreements, and representations, whether oral or written and whether or not executed by BROADCOM, HILCO, Bell Semi and/or Bell Northern related to the subject matter of this Assignment Agreement and Exhibits, and none of the Parties are bound by any conditions, definitions, warranties, understandings, or representations with respect to the subject matters other than as expressly provided in the Assignment Agreement or Exhibits or as duly set forth on or subsequent to the EFFECTIVE DATE in a writing signed by proper and duly authorized representatives of the Parties.

12.5 This Assignment Agreement and any and all disputes or matters arising out of or relating to this Assignment Agreement will be governed by and interpreted under the laws of the State of New York, United States of America, and any federal laws of the United States of America applicable to the transactions contemplated hereunder without regard to its choice or conflicts of law provisions. Any claim or action brought by any of the Parties relating to or arising in any manner out of this Assignment Agreement must be brought in the United States District Court, Southern District of New York or, if subject matter jurisdiction cannot be obtained in that court, in any court of competent jurisdiction sitting in the City and County of New York, provided however that a party may seek emergency or injunctive relief

or the enforcement of any judgment or order in any court of competent jurisdiction. BROADCOM, HILCO, Bell Semi and Bell Northern hereby submit to the jurisdiction and venue of the courts for these purposes.

12.6 This Assignment Agreement or any rights or obligations hereunder are not assignable or transferable or delegable (collectively "assignment") by a Party to another party (whether by merger or consolidation or operation of law or otherwise) without the other Party's express written consent, which consent shall not be unreasonably withheld. Any purported assignment of this Assignment Agreement or any the rights or obligations without the required consent shall be void; provided however that notwithstanding the foregoing, (a) BROADCOM may freely assign or transfer this Assignment Agreement or any rights or obligations hereunder to another BROADCOM AFFILIATE without requiring any consent or other restriction, and (b) Bell Semi and Bell Northern may each freely assign or transfer any or all of their respective patents and patent applications comprising the PATENTS and any rights thereto without requiring any consent subject to the rights and obligations set forth in this Assignment Agreement. For these purposes "assignment" shall be deemed to include any change of control of a Party or its assets.

12.7 If any term, clause, or provision of this Assignment Agreement is judged to be invalid, the validity of any other term, clause, or provision will not be affected unless to do so materially alters a responsibility owed by the Party against whom enforcement is sought; and the invalid term, clause, or provision will be deemed deleted from this Assignment Agreement and the Assignment Agreement shall be enforced as if the deleted provision had never been part of this Assignment Agreement unless to do so materially alters a responsibility owed by the Party against whom enforcement is sought, and in such an event this Assignment Agreement is subject to reformation to achieve for the Parties the benefits and responsibilities most appropriate under those changed circumstances.

12.8 This Assignment Agreement does not create any partnership, joint venture, or agency agreement or arrangement between the Parties, or with any other legal entity, association, or organization of any kind, and does not give rise to any fiduciary obligation between them and does not create any obligations between them other than those defined in this Assignment Agreement. No Party has authority to bind the other Party.

12.9 Each of the Parties shall execute and deliver any and all additional papers, documents, and other assurances, and shall do any and all acts and things reasonably necessary in connection with the performance of their obligations under this Assignment Agreement and to carry out the intent of the Parties.

12.10 This Assignment Agreement may be executed on facsimile or electronically scanned copies in any number of counterparts, each of which will be deemed an original, but all of which together will constitute one and the same instrument.

Notwithstanding the foregoing, BROADCOM agrees to provide to each of Bell Semi and Bell Northern a reasonably requested number of Assignments (as set forth in Exhibit B) with original signatures.

[Signature page to follow]

WHEREOF, the Parties have caused this Assignment Agreement to be executed by their duly authorized representatives.

Avago Technologies General IP (Singapore) Pte. Ltd.

By: DocuSigned by: Thomas Krause Jr. 6E6EC25E056C47A...

Name: Thomas H. Krause

Title: Director

Date: Nov-30-2017

Hilco Patent Acquisition 56, LLC, in its capacity as Agent for Assignees

By: [signature]

Name: ERIC W. KAUP

Title: SECRETARY

Date: 28 Nov 2017

Broadcom Corporation

By: DocuSigned by: Thomas Krause Jr. 6E6EC25F056C47A...

Name: Thomas H. Krause

Title: Vice President, CFO & Secretary

Date: Nov-30-2017

Bell Northern Research, LLC

By: [signature]

Name: ERIC W. KAUP

Title: SECRETARY

Date: 28 Nov 2017

Bell Semiconductor, LLC

By: [signature]

Name: ERIC W. KAUP

Title: SECRETARY

Date: 28 Nov 2017

EXHIBIT A(1)

PATENTS

Exhibit A(1) comprises all of the patents and patent applications listed in Schedules B(1)(a) – B(1)(e) to Exhibit B(1) of this Assignment Agreement, excluding those patents and patent applications listed in Exhibit A(2) and Exhibit A(3).

EXHIBIT A(2)

PATENTS

Country	Patent No.	Issue Date	App. No.	Filing Date	Title	Status
USA	5750312	5/12/1998	08236706	5/2/1994	Process For Fabricating A Device	Expired
USA	6548854	4/15/2003	08995435	12/22/1997	Compound, high-k, gate and capacitator insulator layer	Granted
USA	6869873	3/22/2005	10609889	6/30/2003	Copper Silicide Passivation For Improved Reliability	Granted
USA	7022581	4/4/2006	10886763	7/8/2004	Interdigitaded Capacitors	Granted
USA	7132735	11/7/2006	11074358	3/7/2005	Integrated Circuit Package With Lead Fingers Extending Into A Slot Of A Die Paddle	Granted
USA	6266249	7/24/2001	09375835	8/16/1999	Semiconductor Flip Chip Ball Grid Array Package	Granted
USA	6316817	11/13/2001	09272732	12/14/1998	Mev Implantation To Form Vertically Modulated N+ Buried Layer In An Npn Bipolar Transistor	Expired
USA	6794694	9/21/2004	09/742314	12/21/2000	Inter-Wiring-Layer Capacitors	Granted
USA	5760834	6/2/1998	08/287128	8/8/1994	Electronic Camera With Binary Lens Element Array	Expired

EXHIBIT A(3)

PATENTS

USA	6134687	2000-10-17	08994430	1997-12-19	Peripheral partitioning and tree decomposition for partial scan	Granted
USA	6505316	2003-01-07	09497521	2000-02-04	Peripheral partitioning and tree decomposition for partial scan	Granted
USA	6732310	2004-05-04	09568049	2000-05-10	Peripheral partitioning and tree decomposition for partial scan	Granted

USA	5956350	1999-09-21	08958775	1997-10-27	Built in self repair for DRAMs using on-chip temperature sensing and heating	Expired
USA	6966020	2005-11-15	09994299	2001-11-26	Identifying Faulty Programmable Interconnect Resources Of Field Programmable Gate Arrays	Granted
USA	5822228	1998-10-13	08863798	1997-05-27	Method for using built in self test to characterize input-to-output delay time of embedded cores and other integrated circuits	Expired
USA	7412343	2008-08-12	10516583	2005-03-	Method For Delay-Fault Testing In	Granted

				24	Field Programmable Gate Arrays	
USA	6874108	2005-03-29	10228444	2002-08-27	Fault Tolerant Operation Of Reconfigurable Devices Utilizing An Adjustable System Clock	Granted
USA	6052808	2000-04-18	08962340	1997-10-31	Maintenance Registers With Boundary Scan Interface	Expired
USA	6706609	2004-03-16	09867202	2001-05-29	Method Of Forming An Alignment Feature In Or On A Multi-Layered Semiconductor Structure	Granted
USA	5701014	1997-12-23	08673705	1996-06-25	A Projection Lithography Apparatus	Expired
USA			10786481	2004-02-24	Buried Channel Devices And A Process For Their Fabrication Simultaneously With Surface Channel Devices To Produce Transistors And Capacitors With Multiple Electrical Gate Oxides	Abandoned
USA	6165859	2000-12-26	09255845	1999-02-23	Method Of Making InP Heterostructure Devices	Granted
USA	6333508	2001-12-25	09580530	2000-05-30	Illumination System For Electron Beam Lithography Tool	Granted
USA	6706609	2004-03-16	09867202	2001-05-29	Method Of Forming An Alignment Feature In Or On A Multi-Layered Semiconductor Structure	Granted

EXHIBIT A(4)

PATENTS

Exhibit A(4) comprises all of the patents and patent applications listed in Schedule B(2) to Exhibit B(2) of this Assignment Agreement.

EXHIBIT B(1)

ASSIGNMENT

THIS ASSIGNMENT ("Assignment") is made by and between Avago Technologies General IP (Singapore) Pte. Ltd. (Company Registration No. 200512430D), a Singapore company having an office at No. 1 Yishun Avenue 7, Singapore 768923 ("Avago") on behalf of itself and as representative and agent for its affiliates (collectively, "Affiliates") and Broadcom Corporation (and together with Avago and Affiliates, "Assignors" and each an "Assignor") and Bell Semiconductor, LLC, a Delaware limited liability company, having its principal place of business at 401 North Michigan Avenue, Chicago, Illinois 60611 ("Assignee").

WHEREAS, each of the Assignors owns, right, title and interest in, to and under one or more of the Patents listed in the Attachments hereto (the "PATENTS");

WHEREAS, each of the Assignors has agreed to assign all of its rights, title, and interest in, to and under all of Patents it owns from the PATENTS listed in Schedules B(1)(a)-(e) to Assignee.

NOW, THEREFORE, for other good and valuable consideration, the receipt of which is hereby acknowledged:

Effective on _____, 2017, each of the Assignors agrees to sell, assign, transfer and set over, and hereby sells, assigns, transfers, and sets over to Assignee, Assignor's entire right, title, and interest in, to, and under the PATENTS, and all patents, patent applications, foreign patents, foreign patent applications, continuations, continuations–in-part, divisionals, extensions, renewals, reissues and re-examination certificates that may issue thereon and claim priority to the PATENTS, including without limitation, all rights to claim priority on the basis thereof, all rights to sue for past, present and future infringement, including the right to collect and receive any damages, royalties, or settlements for the infringements, all rights to sue for injunctive or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof.

IN WITNESS WHEREOF, each of the Assignors has caused this Assignment to be executed by its duly authorized officer, representative, or agent as of this ___ day of __ _____, 2017.

Avago Technologies General IP (Singapore) Pte. Ltd.

Signature:_____
By:_____
Name:_____
Title:_____

Broadcom Corporation

Signature:_____
By:_____
Name:_____
Title:_____

ACCEPTED AND AGREED by:

Bell Semiconductor, LLC

Signature: _____
Name: _____
Title: _____
Date: _____

State of_____)
County of _____)

On this _____ day of _____, 2017, before me appeared _____, to me personally known who, being duly sworn, did depose and say that he is the _____of the Assignor and the agent of each of the Affiliates named in and which executed the foregoing instrument; and that said instrument was signed on behalf of said Assignor and each of the Affiliates; and said person acknowledged said instrument to be the free and authorized act and deed of said Assignor and each of the Affiliates.

_____
Notary Public
My Commission Expires:_____

SCHEDULE B(1)(a)

See attached listing of patents and patent applications for Schedule B(1)(a) on the pages that follow.

SCHEDULE B(1)(b)

See attached listing of patents and patent applications for Schedule B(1)(b) on the pages that follow.

SCHEDULE B(1)(c)

See attached listing of patents and patent applications for Schedule B(1)(c) on the pages that follow.

SCHEDULE B(1)(d)

See attached listing of patents and patent applications for Schedule B(1)(d) on the pages that follow.

SCHEDULE B(1)(e)

See attached listing of patents and patent applications for Schedule B(1)(e) on the pages that follow.

EXHIBIT B(2)

ASSIGNMENT

THIS ASSIGNMENT ("Assignment") is made by and between Avago Technologies General IP (Singapore) Pte. Ltd. (Company Registration No. 200512430D), a Singapore company having an office at No. 1 Yishun Avenue 7, Singapore 768923 ("Avago") on behalf of itself and as representative and agent for its affiliates (collectively, "Affiliates"), and Broadcom Corporation (and together with Avago and Affiliates, "Assignors" and each an Assignor) and Bell Northern Research, LLC, a Delaware limited liability company, having its principal place of business at 401 North Michigan Avenue, Chicago, Illinois 60611 ("Assignee").

WHEREAS, each of the Assignors owns, right, title and interest in, to and under one or more of the Patents listed in the Attachments hereto (the "PATENTS");

WHEREAS, each of the Assignors has agreed to assign all of its rights, title, and interest in, to and under each of the Patents it owns from the PATENTS listed in Schedule B(2) to Assignee.

NOW, THEREFORE, for other good and valuable consideration, the receipt of which is hereby acknowledged:

Effective on _____, 2017, each of the Assignors agrees to sell, assign, transfer and set over, and hereby sells, assigns, transfers, and sets over to Assignee, Assignor's entire right, title, and interest in, to, and under the PATENTS, and all patents, patent applications, foreign patents, foreign patent applications, continuations, continuations–in-part, divisionals, extensions, renewals, reissues and re-examination certificates that may issue thereon and claim priority to the PATENTS, including without limitation, all rights to claim priority on the basis thereof, all rights to sue for past, present and future infringement, including the right to collect and receive any damages, royalties, or settlements for the infringements, all rights to sue for injunctive or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof.

IN WITNESS WHEREOF, each of the Assignors has caused this Assignment to be executed by its duly authorized officer, representative or agent as of this ___ day of __ _____, 2017.

Avago Technologies General IP (Singapore) Pte. Ltd.

Signature:_____
By:_____
Name:_____
Title:_____

Broadcom Corporation

Signature:_____
By:_____
Name:_____
Title:_____

ACCEPTED AND AGREED by:

Bell Northern Research, LLC

Signature: _____
Name: _____
Title: _____
Date: _____

State of_____)
County of _____)

On this _____ day of _____, 2017, before me appeared _____, to me personally known who, being duly sworn, did depose and say that he is the _____of the Assignor and the agent of each of the Affiliates named in and which executed the foregoing instrument; and that said instrument was signed on behalf of said Assignor and each of the Affiliates; and said person acknowledged said instrument to be the free and authorized act and deed of said Assignor and each of the Affiliates.

_____
Notary Public
My Commission Expires:_____

SCHEDULE B(2)

See attached listing of patents and patent applications for Schedule B(2) on the pages that follow.

EXHIBIT C

ENCUMBRANCES that may exist on or to the PATENTS have been disclosed with respect to the following Third Party entities:

Acer Incorporated	Inprocomm	Radia
AKM	Intel	Radrix
Alantro	Karbonn Mobile	Ralink
Alcatel	Konka	RDA
Amazon	Kyocera	Realtek
AMD	Lantiq	Redpine
AMS	Lattice Semiconductor	Renesas
Analog Devices	Lenovo	RFMD
Apple	LG Electronics	Rockchip
Archos S.A.	Macronix	Rohm
ARM Holdings	Marvell	Roving Networks
ARRIS	Maxim	SaberTek
Asustek	Maxscend	Samsung
AT&T	MediaTek	Sequans
Atheros	Metalink	Sharp
Atmel	Microchip	SiBeam
Belkin	Micron	Sierra Wireless
Blackberry	Microsemi	Silicon Image
Blu Products, Inc.	Microsoft	Silicon Storage Technology
Blue Wireless	Mitsubishi	Silicon Works
Bosch	Motorola	Silterra
BridgeCo	MSI Data	SK Hynix
Casio	Mstar	Smartchip (SCI)
Celeno	Mundo Reader	SMSC
CEVA	Nanya Technology	SONIM
Cisco	Netgear	Sony
Coolpad Group Limited	New Japan Radio	Spreadtrum
CSR	Newlogic	Standard Microsystems
Cypress	Newport	STMicro
Dell	Newracom	Synad
D-Link	Nichia	Systemonic
Dongbu	Nitero	TCL Corporation
Ericsson	Nokia	Telechips
Espressif	Nufront	Tensorcom
G2 Microsystems	Nuvoton	Texas Instruments
GainSpan	Nvidia	Toshiba
GCT Semiconductor	NXP	TowerJazz
Gionee Communication	On Semiconductor	u-blox

GlobalFoundries	OnePlus	UMC
Google	OPPO Electronics	Western Digital (Sandisk)
Guangdong BBK Electronics	Osram	Winbond Electronics
HelloSoft	Ozmo	Winner Micro
HHNEC/Grace	Panasonic	Wipro
Hitachi	Pantech	X-Fab
HP	Peraso	Xiaomi
HTC Corporation	Philips	XRONet
Huawei	Polar Fab	Yezz
I&C Technology	Powerchip	ZeroG Wireless
IDT	Qorvo	ZTE
Imagination Technologies	Qualcomm	ZyDAS
Infineon	Quantenna	ZyXEL
SMIC	TSMC	
Vanguard	Seiko Instruments	

EXHIBIT D

Document Request Form

Documents Provided that Relate to the Patents Listed in Exhibit A of the Agreement

BROADCOM has provided the following documents that relate to the Patents listed in Exhibit A of the Agreement. These documents have been provided in electronic form. Paper copies, where available, have also been provided. As patent prosecution will vary from application to application, not all of the below documents will be generated during the preparation and prosecution of every Patent. The documents listed below are not intended to be descriptive of any one (or all) of the Patents, but rather are intended to describe the types of documents that, if available through reasonable efforts, have been provided.

Pre-Filing Documents:

- Assignments documents, including:
  - Inventor assignments;
  - Other documents demonstrating or relevant to Patent title;
- Documents relating to product development, where available;
- Invention Disclosure Documents;
  - Invention disclosure forms;
  - Emails evidencing invention disclosures;
  - Other documents evidencing disclosure of inventions;
  - To the extent not subsumed by the three items immediately above, documents concerning the conception and/or reduction to practice of inventions;
- An identification of a product or service to which the invention disclosure relates, where available;
- Documents relating to prior art or prior art searches on the subject matter of the invention
- Correspondence documents relating the Invention Disclosure Documents

Post-Filing Documents:

- Prosecution file history documents for the Patents, including copies of:
  - applications as filed,
  - related filing documentation (such as Oaths and Declarations and Filing Receipts),
  - Power of Attorney documents,
  - Inventions Disclosure Forms,
  - Corrective documents (if any),
  - Terminal Disclaimers,
  - Patent office search results,

    - Office actions (or other examination related documents) and responses thereto, Confidential Page 36
    - Claim amendments filed during prosecution (if made),
    - Appeal-related documents, including appeal briefs.
- Copies of US Provisional (or other priority) Applications,
- "Inventor Declaration to Establish Invention" documents;
- Copies of any prosecution references that are currently under BROADCOM'S control, including:
    - references cited during prosecution,
    - references submitted voluntarily,
    - references submitted in response to a requisition (or request) from the patent office;
    - identification of cited patent references (as found in patent office correspondence in the file history documents);
    - identification of cited foreign references (as found in patent office correspondence in the file history documents);
    - identification of cited non-patent references (as found in patent office correspondence in the file history documents);

Post-Allowance and Grant Documents:

- Electronic copies of issued patents;
    - Ribbon copies of issued patents where available;
- Report of renewal fees that have been paid for the Patents as well as a list of remaining outstanding renewals fees;
- Name change documents, including Certificates of Articles of amendment;
- Certificates of Correction; and
- Fee payment statements.

Assertion and Enforcement Related Documents

- All assertion and enforcement related documents (in hard and electronic form) previously shared by BROADCOM with Any Third Party Entity Listed in Exhibit C, including but not limited to:
    - Notice Letters
    - Claim Charts, Evidence of Use Documents, Etc.
    - Assertion and Business Presentations
    - Rebuttal Presentations
    - Prior Art Documents
    - Litigation Documents

EXHIBIT E

STANDARDS SETTING ORGANIZATIONS IN WHICH BROADCOM IS OR HAS BEEN A MEMBER

Organization	WorkGroup
100G Lambda MSA	100G Lambda MSA
1394 Trade Association	1394 Trade Association
25G/50G Ethernet Consortium	25G/50G Ethernet Consortium
3GPP	CT 1: MM/CC/SM (Iu)
3GPP	CT 3: Interworking with external networks
3GPP	CT 4: Diameter/GTP/DNS/BCH/SS/MAP
3GPP	CT 6: Smart Card Application Aspects
3GPP	CT: Core Network & Terminals
3GPP	GERAN 1: Radio Aspects
3GPP	GERAN 2: Protocol Aspects
3GPP	GERAN 3: Terminal Testing
3GPP	GERAN: GSM EDGE Radio Access Network
3GPP	RAN
3GPP	RAN 1: Radio Layer 1 Spec
3GPP	RAN 2: Radio Layer 2 and Radio Layer 3 RR Spec
3GPP	RAN 3: Iub spec, Iur spec, Iu spec, UTRAN O&M reqts
3GPP	RAN 4: Radio Performance, Protocol aspects
3GPP	RAN 5: Mobile Terminal Conformance Testing
3GPP	SA1: Services
3GPP	SA2: Architecture
3GPP	SA3: Security
3GPP	SA4: CODEC
3GPP	SA5: Telecom Management
3GPP	SA: Service and Systems Aspects
4C Entity	4C Entity
Accellera	UCIS (Unified Coverage Interoperability Standard)
Accellera	VIP TC (Verification Intellectual Property Technical Subcommittee)
AMBA4 (Advanced Microcontroller Bus Architecture) Group	AMBA4 (Advanced Microcontroller Bus Architecture) Group
AirFuel Alliance	AirFuel Alliance
ANSI	ANSI
ANT+ Alliance	ANT+ Alliance
Anywire Forum	Anywire Forum
ARIB	ARIB
ARM	AMBA (Advanced Microcontroller Bus Architecture)
ARM	HSSTP
ATIS	COAST-NAI
ATSC	TG1
ATSC	TG3

Organization	WorkGroup
AVnu Alliance	AVnu Alliance
AVS	AVS
BBF (Broadband Forum)	BBF (Broadband Forum)
Bluetooth SIG	Audio Video Working Group
Bluetooth SIG	Bluetooth Special Interest Group
Bluetooth SIG	Discovery of Things
Bluetooth SIG	Telephony Working Group
Blu-Ray Disc Association	Blu-ray Disc Association
BMCO	BMCO
CABA Research Program	CABA Research Program
CableLabs	AMP
CableLabs	Business Ethernet
CableLabs	CCAP (formerly NGAA)
CableLabs	CPE Reduced Energy Consumption DOCSIS
CableLabs	CPE Reduced Energy Consumption STB
CableLabs	DOCSIS
CableLabs	DOCSIS 2.0
CableLabs	DOCSIS 3.0
CableLabs	DOCSIS 3.1
CableLabs	DOCSIS 3.1 ATP
CableLabs	DOCSIS CCAP (fka CMAP)
CableLabs	DPoE
CableLabs	DPoG
CableLabs	EPoC
CableLabs	Full Duplex DOCSIS 3.1
CableLabs	Metadata
CableLabs	OpenCable
CableLabs	openRPD
CableLabs	PacketCable
CableLabs	Proactive Network Maintenance (InGeNeOs)
CableLabs	Remote PHY
CableLabs	WiFi RRM
CCIX Group	CCIX Group
CCSA	TC 1 (IP & Multimedia Communication); TC6 (Transport & Access)
CCTF (Taiwan)	Cloud Computing TV Forum
CEA	r4sc8wg7
Center for Research in Intelligent Storage Membership	Center for Research in Intelligent Storage Membership
China DRM	China DRM
CIPA	CIPA (Camera and Imaging Products Association)
COBO Consortium	COBO Consortium
CSEP 2.0	CSEP 2.0
Climate Savers Computing Initiative	Climate Savers Computing Initiative

Organization	WorkGroup
CSS CPRM CPPM (Content Scramble System; Content Protection for Recordable Media; Content Protection for Pre-Recorded Media)	CSS CPRM CPPM (Content Scramble System; Content Protection for Recordable Media; Content Protection for Pre-Recorded Media)
DECT Forum	DECT Forum
Dfi	DDR PHY-Interface (DFI) Technical
Die Products Consortium	Die Products Consortium
Display R2 SIG	Display R2 SIG
DLNA	DLNA
DMTF (Distributed Mgmt Task Force)	DMTF (Distributed Mgmt Task Force)
DMTF (Distributed Mgmt Task Force)	RMII - Reduced Media Independent Interface
DSS	DSS (Data Standards Subcommittee)
DTCP-DTLA	DTCP-DTLA
DTG - Digital Television Group	DTG - Digital Television Group
DTG - Digital Television Group	Ultra HD
DTVKit	DTVKit
DVB Project	CM-3DTV
DVB Project	CM-AVC
DVB Project	CM-UHDTV
DVB Project	DVB-C2
DVB Project	DVB-T2
DVB Project	TM-3DTV
DVB Project	TM-AVC
DVD Forum	DVD Forum
DVS (Digital Video Subcommittee)	WG4
Dynamic Spectrum Alliance (DSA)	Dynamic Spectrum Alliance (DSA)
ECMA International	ECMA International
EEMBC	EEMBC
Electronic Discharge Failure Analysis Society (EDFAS)	Electronic Discharge Failure Analysis Society (EDFAS)
Electrostatic Discharge Association	Electrostatic Discharge Association
Embedded Microprocessor Benchmark Consortium	Embedded Microprocessor Benchmark Consortium
Embedded Vision Alliance of Berkeley Design Technology Inc (BDTI)	Embedded Vision Alliance of Berkeley Design Technology Inc (BDTI)
Energy Star	Energy Star
Ethernet Alliance	Ethernet Alliance
ETSI	BRAN
ETSI	DEN/JTC-DVB-154 (EN 302 307)
ETSI	ERM
ETSI	ETSI ATTM TM4; ETSI ISG
ETSI	European version of VDSL
ETSI	ISG
ETSI	mWT ISG

Organization	WorkGroup
ETSI	Network Function Virtualization (NFV)
ETSI	ORI (Open Radio Interface)
ETSI	TC Cable
ETSI	TM4 - Fixed Radio Systems
Execution Memory Solution	Execution Memory Solution
Extend	Extend
Fibre Channel Industry Association (FCIA)	Fibre Channel Industry Association (FCIA)
FIDO Alliance	FIDO Alliance
FMCA (Fixed-Mobile Convergence Alliance) (disbanded in 2010)	FMCA (Fixed-Mobile Convergence Alliance)
FSAN (Full Service Access Network)	FSAN (Full Service Access Network)
GCF Certification Forum	GCF FTAG
Genivi	Genivi
Gen-Z Group	Gen-Z Group
Global Platform Inc.	Global Platform Inc.
Global Semiconductor Alliance	Global Semiconductor Alliance
Green Grid Association (inc. CSCI)	Green Grid Association
GreenTouch	GreenTouch (not listed as a member)
GSM Association	GSM Association
HbbTV (Hybrid Broadcast Broadband Consortium)	HbbTV (Hybrid Broadcast Broadband Consortium)
HDCP (High-Bandwidth Digital Content Protection)	HDCP (High-Bandwidth Digital Content Protection)
HDMI Forum	HDMI Forum
HEW (DensiFI) SIG	DensiFi SIG
HGI (Home Gateway Initiative)	HGI (Home Gateway Initiative)
Homeplug Powerline Alliance	Homeplug Powerline Alliance
HSAF (Heterogenous Systems Architecture Foundation)	HSAF (Heterogenous Systems Architecture Foundation)
Hybrid Memory Cube Consortium (HMCC)	Hybrid Memory Cube Consortium (HMCC)
HyperTransport	HyperTransport
I3A (International Imaging Industry Assocation)	I3A (International Imaging Industry Assocation)
IBIS	I/O Buffer Information Specification Open Forum
IDEMA Advanced Storage Technology Consortium (ASTC)	IDEMA Advanced Storage Technology Consortium (ASTC)
IEEE	1588
IEEE	1667
IEEE	1722
IEEE	1733
IEEE	1904.2
IEEE	1904.3 Radio Over Ethernet

Organization	WorkGroup
IEEE	1905.1
IEEE	1914
IEEE	802.1
IEEE	802.11
IEEE	802.11aa
IEEE	802.11ac
IEEE	802.11ad
IEEE	802.11ae
IEEE	802.11af
IEEE	802.11ah
IEEE	802.11ai
IEEE	802.11 AMP
IEEE	802.11ax
IEEE	802.11ay
IEEE	802.11az
IEEE	802.11 DLS Study Group
IEEE	802.11e
IEEE	802.11 EWC
IEEE	802.11g
IEEE	802.11 GLK SG (General Link)
IEEE	802.11h
IEEE	802.11i
IEEE	802.11 IMT Advanced Ad Hoc
IEEE	802.11j
IEEE	802.11k
IEEE	802.11n
IEEE	802.11p
IEEE	802.11 QSE Study Group
IEEE	802.11r
IEEE	802.11s
IEEE	802.11t
IEEE	802.11u
IEEE	802.11v
IEEE	802.11 VHT
IEEE	802.11 VTS
IEEE	802.11w
IEEE	802.11 WNG Standing Committee
IEEE	802.11y
IEEE	802.11z
IEEE	802.15
IEEE	802.15.3
IEEE	802.15.3a (withdrawn)
IEEE	802.15.3c
IEEE	802 15.3x

Organization	WorkGroup
IEEE	802.16
IEEE	802.17
IEEE	802.18
IEEE	802.19
IEEE	802.1AEbn
IEEE	802.1af
IEEE	802.1aq
IEEE	802.1AR
IEEE	802.1AS
IEEE	802.1at (802.1Qat)
IEEE	802.1au (802.1Qau)
IEEE	802.1AVB (including AS, Qat, Qav)
IEEE	802.1AX (link Agg from .3)
IEEE	802.1az (802.1Qaz)
IEEE	802.1BR
IEEE	802.1 CB
IEEE	802.1CM
IEEE	802.1DCB and Addressing Task Group
IEEE	802.1Qah
IEEE	802.1Qav
IEEE	802.1Qbb
IEEE	802.1Qbg
IEEE	802.1Qbh
IEEE	802.1Qbp
IEEE	802.1Qbu
IEEE	802.1Qbv
IEEE	802.1Qbz (802.11 Bridging)
IEEE	802.1 Qca
IEEE	802.1 Qcc
IEEE	802.1Q-REV
IEEE	802.1 TSN
IEEE	802.2
IEEE	802.2
IEEE	802.22
IEEE	802.3
IEEE	802.3.1
IEEE	802.3ab
IEEE	802.3af
IEEE	802.3an
IEEE	802.3ap
IEEE	802.3aq
IEEE	802.3ar
IEEE	802.3as
IEEE	802.3at

Organization	WorkGroup
IEEE	802.3av
IEEE	802.3az
IEEE	802.3ba
IEEE	802.3bc
IEEE	802.3bd
IEEE	802.3bf
IEEE	802.3bg
IEEE	802.3bj
IEEE	802.3bk
IEEE	802.3bm
IEEE	802.3bn
IEEE	802.3bp
IEEE	802.3bq
IEEE	802.3br
IEEE	802.3bu
IEEE	802.3bw
IEEE	802.3by
IEEE	802.3ca
IEEE	CM
IEEE	IEEE 1904.1 Service Interoperability in Ethernet Passive Optical Networks (SIEPON)
IEEE	IEEE802 ECSG on TV Whitespace
IEEE	IEEE-ISTO Interconnect Modeling Technical Advisory Board
IEEE	IEEE-ISTO Liberty Technical Advisory Board
IEEE	P1394c
IEEE	P1801
IEEE	P1901
IEEE	P2415
IEEE	P2416
IETF	6LO
IETF	6MAN
IETF	aqm
IETF	bfd
IETF	bvcodec
IETF	codecopus
IETF	CORE
IETF	DetNet
IETF	DHC
IETF	DICE
IETF	Dime
IETF	DMM
IETF	DNSSD
IETF	Homenet

Organization	WorkGroup
IETF	i2rs
IETF	ICCRG
IETF	Intarea
IETF	ipcdn
IETF	ips
IETF	IPSECME
IETF	l2vpn
IETF	LWIG
IETF	Mif
IETF	MPLS
IETF	NETEXT
IETF	Network Overlay
IETF	Nv03
IETF	OPSEC
IETF	PWE3
IETF	RADEXT
IETF	rddp
IETF	rmt
IETF	rtcweb
IETF	sfc
IETF	Softwire
IETF	Spring
IETF	STORM
IETF	tictoc
IETF	trill
IETF	tsvwg (transport)
IETF	V6OPS
INCITS	FibreChannel T10 SCSI Storage Interfaces
INCITS	FibreChannel T11
INCITS	FibreChannel T11: T11.2 - Physical Variants
INCITS	FibreChannel T11: T11.3 - Interconnection Schemes
INCITS	FibreChannel T13 ATA Storage Interface
INCITS	L3.1 (MPEG) (ISO WG11 of SC29)
INCITS	L3.2 (JPEG) (ISO WG1 of SC29)
Infiniband Trade Association (IBTA)	IBoXE
Infiniband Trade Association (IBTA)	Marketing Working Group
Infiniband Trade Association (IBTA)	Technical Working Group
In-Location Alliance (formerly Accurate Mobile Indoor Pos)	In-Location Alliance
Institute for Interconnecting & Packaging Electronic Circuits (IPC)	Institute for Interconnecting & Packaging Electronic Circuits (IPC)
Interlaken Alliance	Interlaken Alliance
International SEMATECH Manufacturing Initiative (ISMI)	Semiconductor Logistics Forum

Organization	WorkGroup
International Wireless Industry Consortium (IWPC)	International Wireless Industry Consortium (IWPC)
IOVisor Project	IOVisor Project
IrDA (Infrared Data Association)	obex (object exchange protocol)
ISO/IEC/ITU	AVC - Advanced Video Coding
ISO/IEC/ITU	HEVC - High Efficiency Video Coding
ISO/IEC/ITU	JCT - Joint Collaborative Team
ISO/IEC/ITU	JPEG - Joint Photographic Expert Group
ISO/IEC/ITU	JVT - Joint Video Team
ISO/IEC/ITU	MPEG
ISO/IEC/ITU	SC 25 WG3
ISO/IEC/ITU	VCEG
ISOC	Internet Society
ITU-T	AVC
ITU-T	G.722 Appendix III; G.722 (1988) App. IV
ITU-T	HEVC
ITU-T	ITU SG15/Q4
ITU-T	ITU-T G.9701
ITU-T	ITU-T G.989.3
ITU-T	ITU-T G.992.3
ITU-T	ITU-T G.992.5
ITU-T	ITU-T G.993.1
ITU-T	ITU-T G.993.2
ITU-T	ITU-T G.993.5
ITU-T	ITU-T G.994.1
ITU-T	ITU-T G.997.1
ITU-T	ITU-T G.998.1
ITU-T	ITU-T G.998.2
ITU-T	ITU-T G.998.3
ITU-T	ITU-T G.998.4 (G.inp)
ITU-T	ITU-T SG15/Q2
ITU-T	ITU-T SG16
ITU-T	ITU-T SG9
ITU-T	J.161
ITU-T	J.361
ITU-T	VCEG
ITU-T	VCEG SG16/Q6
JEDEC	33JC42-JC-42 Solid State Memories
JEDEC	33JC45-JC-45 DRAM Modules
JEDEC	33JC64-JC-64 Embedded/Removable Memory: Storage/Cards
JEDEC	GENERAL
JEDEC	JC-42-3
JEDEC	JC-42.6

Organization	WorkGroup
JEDEC	JC45
JEDEC	JC-63 / TG63.3
JEDEC	JC-64
JEDEC	JESD204B
Joint Development Foundation	Alliance for Open Media
Joint Electron Devices Engineering Council (JEDEC)	Joint Electron Devices Engineering Council (JEDEC)
Khronos	OpenCL-SPIR
Khronos	OpenGL-ES Graphics
Khronos	OpenMAX IL
Khronos	OpenVG
Khronos	OpenVX
Khronos	Parallel Computing
Khronos	Vulkan 1.0
Linaro	Linaro
Linux Foundation	Linux Foundation
Marlin Developers Community	Digital Rights Management (DRM)
MEF (Metro Ethernet Forum)	Technical Committee (general)
MGBASE-T	MGBASE-T
MHL	MHL
Microelectronics Packaging & Test Engineering Council (MEPTEC)	Microelectronics Packaging & Test Engineering Council (MEPTEC)
Micro-QSFP	Micro-QSFP
MIPI Alliance	Interfaces in Mobile Platforms
MIPI Alliance	MIPI Alliance
MIPI Alliance	MIPI Debug
Mobile DTV Alliance	Mobile Digital TV Alliance
MoCA (Multimedia over Coax Alliance)	MoCA (Multimedia over Coax Alliance)
Mopria	Technical Working Group
MP3	MPEG-3
Multi-AP SIG	Multi-AP SIG
NBASE-T	NBASE-T
Nexus 5001 Forum (IEEE_ISTO)	Nexus 5001 Forum (IEEE_ISTO)
NFC Forum	Active Communication Mode Task Force
NFC Forum	Analog Working Group
NFC Forum	Compliance Committee
NFC Forum	Compliance Program Working Group
NFC Forum	Devices
NFC Forum	Digital Working Group
NFC Forum	Interfaces
NFC Forum	NFC Devices Working Group
NFC Forum	Reference Application Framework
NFC Forum	Security Working Group
NFC Forum	Tags and Formats Task Force

Organization	WorkGroup
NFC Forum	Technical Committee
NFC Forum	Testing Work Group
NG60	NG60
NGMN	NGMN
NGNA (Next Generation Network Architecture)	NGNA (Next Generation Network Architecture)
NIST	SGIP 1.0
NVM Express (NVMe)	NVM Express (NVMe)
NVMHCI	NVMHCI
OASIS (Organization for the Advancement of Structured Information Standards)	OASIS Darwin Information Typing Architecture Committee
OCP-IP Association	OCP-IP Association
ODVA	ODVA
OFA (Open Fabrics Alliance)	Open Fabrics Alliance
OIF (Optical Internetworking Forum)	OIF (Optical Internetworking Forum)
OPEN Alliance	Steering Committee
OPEN Alliance	TC1
OPEN Alliance	TC2
OPEN Alliance	TC3 (for 1000BASE-T1)
OPEN Alliance	TC3 (for magnetics)
OPEN Alliance	TC9
Open Compute Project (OCP)	Cloud HDD Fast Fail Read Retry
Open Compute Project (OCP)	Hardware Management
Open Core Protocol International Partnership (OCP-IP)	Open Core Protocol International Partnership (OCP-IP)
OpenFabrics Inc.	OpenFabrics Inc.
OpenFlow Networking Foundation	OpenFlow Networking Foundation
Open Handset Alliance	Mobile Platforms
Open Mobile Alliance	Open Mobile Alliance
Open NAND Flash Interface (ONFI)	Open NAND Flash Interface (ONFI)
Open Networking Foundation (ONF)	Open Networking Foundation (ONF)
Open Platform for NFV Project (OPNFV)	Open Platform for NFV Project (OPNFV)
OpenPOWER Foundation	OpenPOWER Foundation
Open Scalable File Systems, Inc.	Open Scalable File Systems, Inc.
OpenSwitch Project	OpenSwitch Project
Open System C Initiative (OSCI)	Open System C Initiative (OSCI)
Optical Internetworking Forum (OIF)	Optical Internetworking Forum (OIF)
P4 Language Consortium	P4 Language Consortium
PC/SC Workgroup	PC Smartcards
PCI SIG	PCI-SIG
PCI SSC	PCI DSS Agreement
PCI SSC	PCI SSC

Organization	WorkGroup
PICMG	Open Modular Computing Specifications
PMA (Power Matters Alliance)	PMA (Power Matters Alliance)
Power.org	Power.org
Power Forward Initiative	Power Forward Initiative
prpl Foundation	prpl Foundation
QSFP-DD	QSFP-DD MSA
RapidIO	RapidIO
RDMA Consortium	RDMA Consortium
RNG	RNG
RVU Alliance	RVU Alliance
SARFT	ABS-S
SARFT	AVS
SARFT	C-DOCSIS
SARFT	DCAS
SARFT	Satellite DTH (DirectHome)
SCSI Trade Association	SCSI Trade Association
SCTE	DSS
SCTE	DVS (adv-codecs)
SCTE	IPS
SD Card Association	SD Card Association
Secure Content Storage Association (SCSA)	SCSA
Server System Infrastructure (SSI)	Server System Infrastructure (SSI)
Serial ATA International Organization SATA-IO	Serial ATA International Organization SATA-IO
Serial ATA-IO	Serial ATA-IO
SES (Secure Easy Setup) Working Group	SES WG (no longer exists)
SIP (Session Initiation Protocol) Forum	SIP (Session Initiation Protocol) Forum
SFF Committee	SFF Committee
Si2 Compact Model Coalition	
Si2, Inc. (Silicon Integration Initiative, Si2 Low Power Coalition	Si2, Inc. (Silicon Integration Initiative, Si2 Low Power Coalition
Si2 Design-To-Manufacturing Coalition (DTMC)	Si2 Design-To-Manufacturing Coalition (DTMC)
SLI SIG	SLI SIG
Small Cell Forum (previously Femto Forum)	Small Cell Forum (previously Femto Forum)
Small Form Factor Committee	
SMPTE	SMPTE
SNIA	SNIA NVM Programming Technical Working Group
SNIA	SNIA Solid State Storage Initiative (SNIA SSSI)
SNIA (Storage Networking Industry Assocation)	SNIA (Storage Networking Industry Assocation)

Organization	WorkGroup
Social WiFi SIG	Social WiFi SIG
Social Wi-Fi SIG 2.0	Social Wi-Fi SIG 2.0
SOG-IS	JHAS (JIL Hardware-related Attacks Subgroup)
Sourcing Interests Group (SIG)	Sourcing Interests Group (SIG)
SSD Form Factor Working Group	SSD Form Factor Working Group
Storage Performance Council (SPC)	Storage Performance Council (SPC)
Storage Research Consortium (SRC)	Storage Research Consortium (SRC)
SVP Alliance (Secure Video Processor)	SVP Alliance (Secure Video Processor)
Symbian Foundation	Symbian Foundation
TCB Council (Regulatory)	TCB Council (Regulatory)
TCG - Trusted Computing Group	TCG - Trusted Computing Group
Telecom Infra Project (TIP)	Open Optical Packet Transport
The Multicore Association	Communications API (MCAPI)
The Multicore Association	Task Management (MTAPI)
TIA	TIA TR-41.4
TIA	TIA TR-41.9
TIA	TIA TR-42 (including TR42.7)
Trusted Computing Group (TCG)	Trusted Computing Group (TCG)
TTC	TTC
UCIF (Unified Communication Interoperability Forum)	UCIF (Unified Communication Interoperability Forum)
UEFI	ARM Binding Sub-Team (ABST)
UEFI	Unified Extensible Firmware Interface
ULPI (UTMI+ low pin interface)	ULPI (UTMI+ low pin interface)
Unified Extensible Firmware Interface Forum	Unified Extensible Firmware Interface Forum
UPnP	UPnP
USB	USB-IF 2.0
USB	USB-IF 2.0 Power Delivery Group
USB	USB-IF 3.0
USB	USB-IF Audio Headset
USB	USB-IF Battery Charging
USB	USB-IF CabCon
USB	USB-IF Communication Device Class
USB	USB-IF Content Security
USB	USB-IF Mass Storage
USB	USB-IF Media Agnostics WG
USB	USB-IF Media Transfer Protocol
USB	USB-IF Network Control Model
USB	USB-IF Serial Link-Phy Interface (SLPI)
USB	USB-IF Video Display
U-Snap Alliance	U-Snap Alliance
VESA	DisplayPort
VESA	DSC (Display Stream Compression)

Organization	WorkGroup
VITA	VMEBus (VersaBus) International Trade Association
WiFi Forward	WiFi Forward
WiFi Location SIG	WiFi Location SIG
Wi-Fi Peer-to-Peer	Wi-Fi Peer-to-Peer
Wi-Fi-Alliance (incl WiGig)	Wi-Fi-Alliance (incl WiGig)
WiMedia Alliance	WiMedia Alliance
WIND	WIND
Wireless Broadband Alliance (WBA)	Wireless Broadband Alliance (WBA)
Wireless Display	Wireless Display
Wireless HD	Wireless HD
Wireless Power Consortium (WPC)	Wireless Power Consortium (WPC)
X40	X40
Zigbee Alliance	Zigbee Alliance

EXHIBIT F

None.

EXHIBIT G

INTELLECTUAL PROPERTY SECURITY AGREEMENT

THIS INTELLECTUAL PROPERTY SECURITY AGREEMENT (the "*IP Security Agreement*") is made and entered into as of the date of the last signature below ("EFFECTIVE DATE") by and among Avago Technologies General IP (Singapore) Pte. Ltd. (Company Registration No. 200512430D) ("Avago"), a Singapore company having an office at No. 1 Yishun Avenue 7, Singapore 768923, for itself and its AFFILIATES, and Broadcom Corporation (and together with Avago and AFFILIATES, hereinafter collectively "BROADCOM"), and Bell Semiconductor, LLC, a Delaware limited liability company ("Bell Semi") and Bell Northern Research, LLC, a Delaware limited liability company ("Bell Northern" and together with Bell Semi, "ASSIGNEES")), each represented by Hilco Patent Acquisition 56, LLC, a Delaware limited liability company, having its principal place of business at 401 North Michigan Avenue, Chicago, Illinois 60611 (and together with Bell Semi and Bell Northern, hereinafter collectively "GRANTORS"), as Parties under that certain Assignment Agreement executed on even date herewith. Terms defined in the Assignment Agreement and not otherwise defined herein are used herein as defined in the Assignment Agreement.

WHEREAS, under the terms of the Assignment Agreement, GRANTORS have granted a security interest in, among other property, certain intellectual property of GRANTORS to BROADCOM, and have agreed as a condition thereof to execute this IP Security Agreement covering such intellectual property for recording with the U.S. Patent and Trademark Office and other governmental authorities.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, GRANTORS agree as follows:

SECTION 1. Grant of Security. GRANTORS hereby grant to BROADCOM a security interest in and to all of GRANTORS' right, title and interest in and to the following (the *"Collateral"*):

(i) the United States, international and foreign patents, patent applications and patent licenses set forth in **Schedule A** hereto (as such Schedule A may be supplemented from time to time by supplements to this IP Security Agreement, each such supplement, an *"IP Security Agreement Supplement,"* executed and delivered by GRANTORS to BROADCOM from time to time), together with all divisionals, reissues, continuations, continuations-in-part, conversions, extensions and reexaminations thereof (or foreign equivalents of any of the foregoing) that may issue thereon and claim priority thereto, including any and all foreign counterpart of the foregoing, whether or not listed in Schedule A and all rights therein provided by international treaties or conventions (the *"IP Security Patents"*);

(ii) any and all claims for damages for past, present and future infringement, misappropriation or breach with respect to the IP Security Patents,

with the right, but not the obligation, to sue for and collect, or otherwise recover, such damages; and

(iii) any and all proceeds of the foregoing.

SECTION 2. Security for Obligations. The grant of a security interest in the Collateral by GRANTORS under this IP Security Agreement secures the payment of the Payment Obligations (as defined in the Assignment Agreement) of GRANTORS now or hereafter existing, whether direct or indirect, absolute or contingent, and whether for principal, reimbursement obligations, interest (including any interest that accrues after the commencement of bankruptcy), premiums, penalties, fees, indemnifications, contract causes of action, costs, expenses or otherwise.

SECTION 3. Recordation. GRANTORS authorize and request that the Commissioner of Patents and Trademarks and any other applicable government office record this IP Security Agreement.

SECTION 4. Execution in Counterparts. This IP Security Agreement may be executed in any number of counterparts, each of which when so executed shall be deemed to be an original and all of which taken together shall constitute one and the same agreement.

SECTION 5. Grants, Rights and Remedies. This IP Security Agreement has been entered into in conjunction with the provisions of the Assignment Agreement. GRANTORS do hereby acknowledge and confirm that the grant of the security interest hereunder to, and the rights and remedies of, BROADCOM with respect to the Collateral are more fully set forth in the Assignment Agreement, the terms and provisions of which are incorporated herein by reference as if fully set forth herein.

SECTION 6. Governing Law. This IP Security Agreement shall be governed by, and construed in accordance with, the law of the State of New York.

[SIGNATURE PAGE FOLLOWS]

WHEREOF, the Parties have caused this IP Security Agreement to be executed by their duly authorized representatives.

Avago Technologies General IP (Singapore) Pte. Ltd.

By: DocuSigned by: Thomas Krause Jr. 6E6EC25F056C47A...

Name: Thomas H. Krause

Title: Director

Date: Nov-30-2017

Hilco Patent Acquisition 56, LLC, in its capacity as Agent for Assignees

By:

Name Eric W. Kamp

Title: Secretary

Date: 28 Nov 2017

Broadcom Corporation

By: DocuSigned by: Thomas Krause Jr. 6E6EC25F056C47A...

Name: Thomas H. Krause

Title: Vice President, CFO & Secretary

Date: Nov-30-2017

Bell Northern Research, LLC

By:

Name Eric W. Kamp

Title: Secretary

Date: 28 Nov 2017

Bell Semiconductor, LLC

By:

Name Eric W. Kamp

Title: Secretary

Date: 28 Nov 2017

Schedule A to the IP Security Agreement

All of the patents and patent applications listed in Exhibits A(1), A(2), A(3), and A(4) of the Assignment Agreement,

Schedule B(1)(c) – Semic Packaging

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
09045062	6103615	1998-03-19	2000-08-15	Granted	United States of America	Corrosion sensitivity structures for vias and contact holes in integrated circuits
09464225	6278129	1999-12-15	2001-08-21	Granted	United States of America	Corrosion sensitivity structures for vias and contact holes in integrated circuits
08771955	5776551	1996-12-23	1998-07-07	Expired	United States of America	Use of plasma activated NF3 to clean solder bumps on a device
08922141	5786073	1997-08-29	1998-07-28	Expired	United States of America	Integrated circuit comprising solder bumps
08904530	5911112	1997-08-01	1999-06-08	Expired	United States of America	Method for forming electrical connections between a semiconductor die and a semiconductor package
08608679	5793104	1996-02-29	1998-08-11	Expired	United States of America	Apparatus for forming electrical connections between a semiconductor die and a semiconductor package
08936829	5970321	1997-09-25	1999-10-19	Expired	United States of America	Method of fabricating a microelectronic package having polymer ESD protection
08595021	5869869	1996-01-31	1999-02-09	Expired	United States of America	Microelectronic device with thin film electrostatic discharge protection structure
08723140	5955762	1996-10-01	1999-09-21	Expired	United States of America	Microelectronic package with polymer ESD protection
08909312	5885855	1997-08-14	1999-03-23	Expired	United States of America	Method for distributing connection pads on a semiconductor die
08747325	5952726	1996-11-12	1999-09-14	Expired	United States of America	Flip chip bump distribution on die
08989098		1997-12-11		Abandoned	United States of America	Integrated Circuit Package.
08648350	5700723	1996-05-15	1997-12-23	Expired	United States of America	Method of packaging an integrated circuit
08810304		1997-02-28		Abandoned	United States of America	Microelectronioc Integrated Circuit Mounted On Circuit Board With Solder Column Grid Array Interconnection (As Amended)
08595022	5639696	1996-01-31	1997-06-17	Expired	United States of America	Microelectronic integrated circuit mounted on circuit board with solder column grid array interconnection, and method of fabricating the solder column grid array
08778909	5784780	1997-01-03	1998-07-28	Expired	United States of America	Method of mounting a flip-chip
08538631	5637920	1995-10-04	1997-06-10	Expired	United States of America	High contact density ball grid array package for flip-chips
08653591		1996-05-24		Abandoned	United States of America	Powdered Metal Heat Sink With Increased Surface Area

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
08578966	5814536	1995-12-27	1998-09-29	Expired	United States of America	Method of manufacturing powdered metal heat sinks having increased surface area
08854780	5869891	1997-05-12	1999-02-09	Expired	United States of America	Powdered Metal Heat Sink With Increased Surface Area
08718852	5827777	1996-09-24	1998-10-27	Expired	United States of America	Method of making a barrier metal technology for tungsten plug interconnection
08378027	5600182	1995-01-24	1997-02-04	Expired	United States of America	Barrier metal technology for tungsten plug interconnection
08916025	5872026	1997-08-21	1999-02-16	Expired	United States of America	Process of Fabricating An Integrated Circuit Die Package Having a Plurality of Pins
08485060	5739584	1995-06-07	1998-04-14	Expired	United States of America	Multiple pin die package
10306064	6597189	2002-11-27	2003-07-22	Granted	United States of America	Socketless/boardless test interposer card
11324119	RE41516	2005-12-30	2010-08-17	Lapsed	United States of America	Socketless/Boardless Test Interposer Card
10428200	6771085	2003-04-30	2004-08-03	Lapsed	United States of America	Socketless/boardless test interposer card
07856905		1992-05-14		Abandoned	United States of America	Encapsulation Of Electronic Components
08331251	5537342	1994-10-28	1996-07-16	Expired	United States of America	Encapsulation of electronic components
08484177	5663872	1995-06-07	1997-09-02	Expired	United States of America	Encapsulation of electronic components
11277188	8049340	2006-03-22	2011-11-01	Granted	United States of America	Device For Avoiding Parasitic Capacitance in an Integrated Circuit Package
13252632	8288269	2011-10-04	2012-10-16	Granted	United States of America	Methods for Avoiding Parasitic Capacitance in an Integrated Circuit Package
14045081		2013-10-03		Abandoned	United States of America	Alternate Pad Structures/Passivation Integration Schemes to Reduce or Eliminate IMC Cracking in Post Wire Bonded Dies During Cu/Low-K BEOL Processing
11283219	8552560	2005-11-18	2013-10-08	Granted	United States of America	Alternate Pad Structures/Passivation Integration Schemes to Reduce or Eliminate IMC Cracking in Post Wire Bonded Dies During Cu/Low-K BEOL Processing
11964920	7565592	2007-12-27	2009-07-21	Lapsed	United States of America	Failure Analysis and Testing of Semi-Conductor Devices Using Intelligent Software on Automated Test Equipment (ATE)

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
11670031	7430700	2007-02-01	2008-09-30	Granted	United States of America	Failure analysis and testing of semi-conductor devices using intelligent software on automated test equipment (ATE)
11028695	7203877	2005-01-04	2007-04-10	Granted	United States of America	Failure analysis and testing of semi-conductor devices using intelligent software on automated test equipment (ATE)
12253403	7960812	2008-10-17	2011-06-14	Granted	United States of America	Electrical Devices Having Adjustable Capacitance
10746824	7456716	2003-12-24	2008-11-25	Granted	United States of America	Electrical Devices Having Adjustable Electrical Characteristics
10926631	7109589	2004-08-26	2006-09-19	Granted	United States of America	Integrated Circuit With Substantially Perpendicular Wire Bonds
11494221	7465655	2006-07-27	2008-12-16	Granted	United States of America	Integrated Circuit With Substantially Perpendicular Wire Bonds
09162247	6087732	1998-09-28	2000-07-11	Granted	United States of America	Bond Pad For A Flip Chip Package, And Method Of Forming The Same
09503814	6187658	2000-02-15	2001-02-13	Granted	United States of America	Bond Pad For A Flip Chip Package, And Method Of Forming The Same
10921497		2004-08-18		Abandoned	United States of America	Multi-Level Redistribution Layer Traces for Reducing Current Crowding in FlipChip Solder Bumps
10327333	6818996	2002-12-20	2004-11-16	Granted	United States of America	Multi-level redistribution layer traces for reducing current crowding in flipchip solder bumps
09489302	6369448	2000-01-21	2002-04-09	Granted	United States of America	Vertically integrated flip chip semiconductor package
09993466	6558978	2001-11-05	2003-05-06	Granted	United States of America	Chip-over-chip integrated circuit package
11015534	7224047	2004-12-18	2007-05-29	Granted	United States of America	Semiconductor Device Package With Reduced Leakage
11788346	7541669	2007-04-19	2009-06-02	Granted	United States of America	Semiconductor Device Package With Base Features to Reduce Leakage
09642216	6319617	2000-08-18	2001-11-20	Granted	United States of America	Oxide-Bondable Solder
09466449	6306516	1999-12-17	2001-10-23	Granted	United States of America	Article Comprising Oxide-Bondable Solder
09006356	6064113	1998-01-13	2000-05-16	Granted	United States of America	Semiconductor device package including a substrate having bonding fingers within an electrically conductive ring surrounding a die area and a combined power and ground plane to stabilize signal path impedances
09428164	6137168	1999-10-27	2000-10-24	Granted	United States of America	Semiconductor package with traces routed underneath a die

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
09618143		2000-07-17		Abandoned	United States of America	Semiconductor Package With Traces Routed Underneath A Die
08901489	5885848	1997-07-28	1999-03-23	Expired	United States of America	Ball Grid Array Package With Inexpensive Threaded Secure Locking Mechanism To Allow Removal Of A Threaded Heat Sink Therefrom
08724076	5789813	1996-09-30	1998-08-04	Expired	United States of America	Ball grid array package with inexpensive threaded secure locking mechanism to allow removal of a threaded heat sink therefrom
08427674		1995-04-24		Abandoned	United States of America	Electronic System Including Packaged Integrated Circuits With Heat Spreading Stand-Off Support Members
08323817	5673479	1994-10-17	1997-10-07	Expired	United States of America	Method For Mounting A Microelectronic Circuit Peripherally-Leaded Package Including Integral Support Member With Spacer
08646014		1996-05-07		Abandoned	United States of America	Microelectronic Circuit Structure
08427306		1995-04-24		Abandoned	United States of America	Location And Standoff Pins For Chip On Tape
08170102	5410451	1993-12-20	1995-04-25	Expired	United States of America	Location And Standoff Pins For Chip On Tape
08710573	5898575	1996-09-19	1999-04-27	Expired	United States of America	Support Assembly For Mounting An Integrated Circuit Package On A Surface
08713174	5896651	1996-09-12	1999-04-27	Expired	United States of America	Method For Mounting A Microelectronic Circuit Package
08646037	5923538	1996-05-07	1999-07-13	Expired	United States of America	Support member for mounting a microelectronic circuit package
08903241	6008991	1997-07-24	1999-12-28	Expired	United States of America	Electronic system including packaged integrated circuits with heat spreading standoff support members
12139185	7919354	2008-06-13	2011-04-05	Granted	United States of America	Asymmetric Alignment of Substrate Interconnect to Semiconductor Die
11260334	7405476	2005-10-27	2008-07-29	Granted	United States of America	Asymmetric alignment of substrate interconnect to semiconductor die
09802424	6518193	2001-03-09	2003-02-11	Granted	United States of America	Substrate processing system
10322974		2002-12-18		Abandoned	United States of America	Substrate Processing System
08424828	6313519	1995-04-19	2001-11-06	Granted	United States of America	Support for semiconductor bond wires

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
07914621		1992-07-15		Abandoned	United States of America	Support For Semiconductor Bond Wires
08506164	5744084	1995-07-24	1998-04-28	Expired	United States of America	Method of improving molding of an overmolded package body on a substrate
08920430	5927505	1997-08-29	1999-07-27	Expired	United States of America	Overmolded package body on a substrate
10007247	6678950	2001-11-01	2004-01-20	Granted	United States of America	Method for forming a bonding pad on a substrate
10694486		2003-10-27		Abandoned	United States of America	Bonding Pad Design
08908404	5990543	1997-08-07	1999-11-23	Expired	United States of America	Reframed chip-on-tape die
08635288	6043100	1996-04-19	2000-03-28	Expired	United States of America	Chip on tape die reframe process
09477306	6492253	2000-01-04	2002-12-10	Granted	United States of America	Method for programming a substrate for array-type packages
09006584	6054767	1998-01-13	2000-04-25	Granted	United States of America	Programmable substrate for array-type packages
12174479	7829424	2008-07-16	2010-11-09	Lapsed	United States of America	Package Configuration And Manufacturing Method Enabling The Addition Of Decoupling Capacitors To Standard Package Designs
11078052	7508062	2005-03-11	2009-03-24	Lapsed	United States of America	Package Configuration And Manufacturing Method Enabling The Addition Of Decoupling Capacitors To Standard Package Designs
07935449	5300815	1992-08-25	1994-04-05	Expired	United States of America	Technique of increasing bond pad density on a semiconductor die
08430399	5635424	1995-04-28	1997-06-03	Expired	United States of America	High-density bond pad layout arrangements for semiconductor dies, and connecting to the bond pads
08688148		1996-07-29		Abandoned	United States of America	Overmolded Semiconductor Package
07975185	5399898	1992-11-12	1995-03-21	Expired	United States of America	Multi-chip semiconductor arrangements using flip chip dies
08270123		1994-07-01		Abandoned	United States of America	Semiconductor Packaging Technique Yielding Increased Inner Lead Count For A Given Die-Receiving Area
08015947		1993-02-10		Abandoned	United States of America	Floorplanning Techniques Using Multi-Partitioning Based On A Partitions Cost Factor For Non-Square Shaped Partitions
07938690		1992-09-01		Abandoned	United States of America	Ball Bump Array Semiconductor Packages

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
07400572		1989-08-28		Abandoned	United States of America	Method And Apparatus For Isolation Of Flux Materials In Flip-Chip Manufacturing
08105547	5504035	1993-08-12	1996-04-02	Expired	United States of America	Process for solder ball interconnecting a semiconductor device to a substrate using a noble metal foil embedded interposer substrate
08105269		1993-08-12		Abandoned	United States of America	Optically Transmissive Preformed Planar Structures
08679949	5834799	1996-07-15	1998-11-10	Expired	United States of America	Optically transmissive preformed planar structures
07917894		1992-07-21		Abandoned	United States of America	Ball Bump Array Semiconductor Packages
08382147		1995-02-01		Abandoned	United States of America	Ball Bump Array Semiconductor Packages
07947854	5248903	1992-09-18	1993-09-28	Expired	United States of America	Composite bond pads for semiconductor devices
07984206	5284797	1992-11-30	1994-02-08	Expired	United States of America	Semiconductor bond pads
08387154	5565385	1995-02-10	1996-10-15	Expired	United States of America	Semiconductor bond pad structure and increased bond pad count per die
08470945	5821624	1995-06-05	1998-10-13	Expired	United States of America	Semiconductor device assembly techniques using preformed planar structures
07993188		1992-12-18		Abandoned	United States of America	Mounting And Connecting Non-Square Semiconductor Dies
08476431	5744856	1900-01-01	1998-04-28	Expired	United States of America	Non-Square Die For Integrated Circuit And Systems Containing The Same
08194241	5410805	1994-02-10	1995-05-02	Expired	United States of America	Method And Apparatus For Isolation Of Flux Materials In Flip-Chip Manufacturing
08079499	5434750	1993-06-18	1995-07-18	Expired	United States of America	Partially-Molded, Pcb Chip Carrier Package For Certain Non-Square Die Shapes
08720219	5744858	1996-09-26	1998-04-28	Expired	United States of America	Semiconductor packaging technique yielding increased inner lead count for a given die-receiving area
07969862		1992-10-28		Abandoned	United States of America	Overmolded Semiconductor Package
08331263		1994-10-28		Abandoned	United States of America	Overmolded Semiconductor Package
08429605	5557150	1995-04-27	1996-09-17	Expired	United States of America	Overmolded semiconductor package

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
07981096	5299730	1992-11-24	1994-04-05	Expired	United States of America	Method and apparatus for isolation of flux materials in flip-chip manufacturing
07775009	5168346	1991-10-11	1992-12-01	Expired	United States of America	Method and apparatus for isolation of flux materials in flip-chip manufacturing
08428323	5569963	1995-04-25	1996-10-29	Expired	United States of America	Preformed planar structures for semiconductor device assemblies
08105838	5347162	1993-08-12	1994-09-13	Expired	United States of America	Preformed planar structures employing embedded conductors
08432535	5594626	1995-05-02	1997-01-14	Expired	United States of America	Partially-molded, PCB chip carrier package for certain non-square die shapes
07916328	5340772	1992-07-17	1994-08-23	Expired	United States of America	Method of increasing the layout efficiency of dies on a wafer and increasing the ratio of I/O area to active area per die
07978483	5341024	1992-11-18	1994-08-23	Expired	United States of America	Method of increasing the layout efficiency of dies on a wafer, and increasing the ratio of I/O area to active area per die
08664146	5729894	1996-06-14	1998-03-24	Expired	United States of America	Method of assembling ball bump grid array semiconductor packages
07933430	5329157	1992-08-21	1994-07-12	Expired	United States of America	Semiconductor packaging technique yielding increased inner lead count for a given die-receiving area
08251058	5441917	1994-05-31	1995-08-15	Expired	United States of America	Method of laying out bond pads on a semiconductor die
08416457	5532934	1995-04-03	1996-07-02	Expired	United States of America	Floorplanning technique using multi-partitioning based on a partition cost factor for non-square shaped partitions
07576182	5111279	1990-08-30	1992-05-05	Expired	United States of America	Apparatus for isolation of flux materials in flip-chip manufacturing
08106157	5489804	1993-08-12	1996-02-06	Expired	United States of America	Flexible preformed planar structures for interposing between a chip and a substrate
07995644	5404047	1992-12-18	1995-04-04	Expired	United States of America	Semiconductor die having a high density array of composite bond pads
07834182	5262927	1992-02-07	1993-11-16	Expired	United States of America	Partially-molded, PCB chip carrier package
08260078	5468681	1994-06-15	1995-11-21	Expired	United States of America	Process for interconnecting conductive substrates using an interposer having conductive plastic filled vias
13934110		2013-07-02		Abandoned	United States of America	Contact Support Pillar Structure for Flip Chip Semiconductor Devices and Method Of Manufacture Therefore
13093032	8507317	2011-04-25	2013-08-13	Granted	United States of America	Solder Bump Structure For Flip Chip Semiconductor Devices And Method Of Manufacturing Therefore

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
11459249	7952206	2006-07-21	2011-05-31	Granted	United States of America	Solder Bump Structure For Flip Chip Semiconductor Devices And Method Of Manufacture Therefore
08259439		1994-06-14		Abandoned	United States of America	Techniques For Isolating Superconducting Substrates From Heat Generated By Semiconductor Devices
08434276	5700715	1995-05-03	1997-12-23	Expired	United States of America	Process for mounting a semiconductor device to a circuit substrate
11131885	7053639	2005-05-18	2006-05-30	Granted	United States of America	Probing fixture for semiconductor wafer
09731596	6927079	2000-12-06	2005-08-09	Granted	United States of America	Method for probing a semiconductor wafer
11506680	7456498	2006-08-18	2008-11-25	Granted	United States of America	Integrated circuit package and system interface
12283820	7550839	2008-09-15	2009-06-23	Granted	United States of America	Integrated Circuit Package and System Interface
61055505		2008-05-23		Expired	United States of America	Solution For Package Cross Talk Minimization
12469985	8324019	2009-05-21	2012-12-04	Granted	United States of America	Solution For Package Cross Talk Minimization
10930590	8404960	2004-08-31	2013-03-26	Granted	United States of America	Method for Heat Dissipation on Semiconductor Device
13775922	8653357	2013-02-25	2014-02-18	Lapsed	United States of America	Method for Heat Dissipation on Semiconductor Device
12337519	8258016	2008-12-17	2012-09-04	Granted	United States of America	Semiconductor Package Having Increased Resistance to Electrostatic Discharge
11304862	7498664	2005-12-14	2009-03-03	Granted	United States of America	Semiconductor Package Having Increased Resistance to Electrostatic Discharge
11399723	7646091	2006-04-06	2010-01-12	Granted	United States of America	Semiconductor Package and Method Using Isolated VSS Plane to Accomodate High Speed Circuitry Ground Isolation
12625457	8129759	2009-11-24	2012-03-06	Granted	United States of America	Semiconductor Package and Method Using Isolated VSS Plane to Accomodate High Speed Circuitry Ground Isolation
10951430		2004-09-28		Abandoned	United States of America	Whisker-Free Lead Frames
12462069	8013428	2009-07-28	2011-09-06	Granted	United States of America	Whisker-Free Lead Frames
10979491	7352062	2004-11-02	2008-04-01	Granted	United States of America	Integrated circuit package design
10271003	6825556	2002-10-15	2004-11-30	Granted	United States of America	Integrated circuit package design with non-orthogonal die cut out

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
12160553	8242378	2008-07-10	2012-08-14	Granted	United States of America	Soldering Method and Related Device for Improved Resistance to Brittle Fracture With An Intermetallic Compound Region Coupling A solder Mass to an NI Layer Which has a low Concentration of P, wherein the amount of P in the underlying NI layer is controlled as a function of the expected volume of the solder mass
13552266		2012-07-18		Abandoned	United States of America	Soldering Method and Related Device for Improved Resistance to Brittle Fracture
11469960	8319343	2006-09-05	2012-11-27	Granted	United States of America	Routing Under Bond Pad For The Replacement Of An Interconnect Layer
13656092		2012-10-19		Abandoned	United States of America	Routing Under Bond Pad For The Replacement Of An Interconnect Layer
10642706	6991147	2003-08-18	2006-01-31	Lapsed	United States of America	Insulated bonding wire tool for microelectronic packaging
09687263	6670214	2000-10-12	2003-12-30	Lapsed	United States of America	Insulated bonding wire for microelectronic packaging
10638772	6858930	2003-08-11	2005-02-22	Granted	United States of America	Multi chip module
10265751	6680532	2002-10-07	2004-01-20	Lapsed	United States of America	Multi chip module
12692209	8084857	2010-01-22	2011-12-27	Granted	United States of America	Method and Article of Manufacture for Wire Bonding with Staggered Differential Wire Bond Pairs
11065838	7675168	2005-02-25	2010-03-09	Granted	United States of America	Integrated Circuit With Staggered Differential Wire Bond Pairs
09639288	6972494	2000-08-15	2005-12-06	Granted	United States of America	Integrated Circuit Die For Wire Bonding And Flip-Chip Mounting
11158435	7541674	2005-06-22	2009-06-02	Granted	United States of America	Integrated Circuit Die For Wire Bonding And Flip-Chip Mounting
11395779	8025201	2006-03-31	2011-09-27	Granted	United States of America	Methods And Apparatus For Integrated Circuit Ball Bonding With Substantially Perpendicular Wire Bond Profiles
10786182	7074705	2004-02-25	2006-07-11	Granted	United States of America	Methods And Apparatus For Integrated Circuit Ball Bonding With Substantially Perpendicular Wire Bond Profiles
09680759	6639321	2000-10-06	2003-10-28	Granted	United States of America	Balanced coefficient of thermal expansion for flip chip ball grid array
10631328	6806119	2003-07-30	2004-10-19	Granted	United States of America	Method of balanced coefficient of thermal expansion for flip chip ball grid array
11258253	7582938	2005-10-25	2009-09-01	Lapsed	United States of America	I/O and Power ESD Protection Circuits by Enhancing Substrate-Bias In Deep-Submicron CMOS Process

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12506746	7948036	2009-07-21	2011-05-24	Granted	United States of America	I/O and Power ESD Protection Circuits by Enhancing Substrate-Bias In Deep-Submicron CMOS Process
13110581	8269280	2011-05-18	2012-09-18	Granted	United States of America	I/O and Power ESD Protection Circuits by Enhancing Substrate-Bias In Deep-Submicron CMOS Process
10676602	6979869	2003-10-01	2005-12-27	Granted	United States of America	Substrate-biased I/O and power ESD protection circuits in deep-submicron twin-well process
10939292		2004-09-10		Abandoned	United States of America	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
09467253	6790757	1999-12-20	2004-09-14	Granted	United States of America	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
09072369	5986343	1998-05-04	1999-11-16	Granted	United States of America	Bond Pad Design For Integrated Circuits
09305766	6207547	1999-05-05	2001-03-27	Granted	United States of America	Bond Pad Design For Integrated Circuits
12228720	7632717	2008-08-15	2009-12-15	Granted	United States of America	Plastic Overmolded Packages With Mechanically Decoupled Lid Attach Attachment
11505152	7423341	2006-08-16	2008-09-09	Granted	United States of America	Plastic Overmolded Packages With Mechanically Decoupled Lid Attach Attachment
10061518	6617181	2002-02-01	2003-09-09	Granted	United States of America	Flip chip testing
10462524	6710453	2003-06-16	2004-03-23	Granted	United States of America	Integrated circuit containing redundant core and peripheral contacts
09193832	6118177	1998-11-17	2000-09-12	Granted	United States of America	Heatspreader For A Flip Chip Device, And Method For Connecting The Heatspreader
09496989	6681482	2000-02-02	2004-01-27	Granted	United States of America	Heatspreader For A Flip\(miChip Device And Method For Connecting The Heatspreader
09244857	6068130	1999-02-05	2000-05-30	Granted	United States of America	Device And Method For Protecting Electronic Component
09580522	6554137	2000-05-30	2003-04-29	Granted	United States of America	Device And Method For Protecting Electronic Component
07940157	6077725	1992-09-03	2000-06-20	Expired	United States of America	Method and Apparatus for Assembling Multichip Modules
08479587	5564617	1995-06-07	1996-10-15	Expired	United States of America	Method And Apparatus For Assembling Multichip Modules
09461609	6409829	1999-12-15	2002-06-25	Granted	United States of America	Manufacture Of Dielectrically Isolated Integrated Circuits
10091291	6727567	2002-03-05	2004-04-27	Granted	United States of America	Integrated Circuit Device Substrates With Selective Epitaxial Growth Thickness Compensation

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09698175	6675450	2000-10-30	2004-01-13	Granted	United States of America	Method Of Manufacturing And Mounting Electronic Devices To Limit The Effects Of Parasitics
10742916		2003-12-23		Abandoned	United States of America	Method Of Manufacturing And Mounting Electronic Devices To Limit The Effects Of Parasitics
09578082	6465884	2000-05-24	2002-10-15	Granted	United States of America	Semiconductor Device With Variable Pin Locations
10218783	6833286	2002-08-14	2004-12-21	Granted	United States of America	Semiconductor Device With Variable Pin Locations
10254473	6849936	2002-09-25	2005-02-01	Granted	United States of America	System and method for using film deposition techniques to provide an antenna within an integrated circuit package
11012838		2004-12-15		Abandoned	United States of America	System and Method For Using Film Deposition Techniques to Provide an Antenna Within an Integrated Circuit Package
10229601	6781150	2002-08-28	2004-08-24	Granted	United States of America	Test structure for detecting bonding-induced cracks
10856213	6998638	2004-05-28	2006-02-14	Granted	United States of America	Test structure for detecting bonding-induced cracks
09920144		1900-01-01		Abandoned	United States of America	Adhesive Pad Having EMC Shielding Characteristics
09932307	6563198	2001-08-17	2003-05-13	Granted	United States of America	Adhesive pad having EMC shielding characteristics
08838536	6281590	1997-04-09	2001-08-28	Expired	United States of America	Circuit And Method For Providing Interconnections Among Individual Integrated Circuit Chips In A Multi-Chip Module
09873551	6465336	2001-06-04	2002-10-15	Expired	United States of America	Circuit And Method For Providing Interconnections Among Individual Integrated Circuit Chips In A Multi-Chip Module
11868624	7429502	2007-10-08	2008-09-30	Granted	United States of America	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
11235920	7327029	2005-09-27	2008-02-05	Granted	United States of America	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
11448560	7301231	2006-06-07	2007-11-27	Granted	United States of America	Reinforced Bond Pad For A Semiconductor Device
10955913	7115985	2004-09-30	2006-10-03	Granted	United States of America	Reinforced Bond Pad For A Semiconductor Device
11379256	8601683	2006-04-19	2013-12-10	Granted	United States of America	Method for Electrical Interconnection Between Printed Wiring Board Layers Using Through Holes with Solid Core Conductive Material
10755616		2004-01-12		Abandoned	United States of America	A Printed Wiring Board Including A Solid Core Conductive Material Located Therein

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11385245	7443042	2006-03-21	2008-10-28	Granted	United States of America	Methods And Apparatus For Wire Bonding With Wire Length Adjustment In An Integrated Circuit
10787010	7086148	2004-02-25	2006-08-08	Granted	United States of America	Methods And Apparatus For Wire Bonding With Wire Length Adjustment In An Integrated Circuit
12171903	7637414	2008-07-11	2009-12-29	Granted	United States of America	Methods And Apparatus For Wire Bonding With Wire Length Adjustment In An Integrated Circuit
09197074	6342442	1998-11-20	2002-01-29	Granted	United States of America	Kinetically Controlled Solder Bonding
10021174	7009299	2001-10-29	2006-03-07	Granted	United States of America	Kinetically Controlled Solder Bonding
10266267	6881613	2002-10-08	2005-04-19	Lapsed	United States of America	Electronic Component Package
11080859	7224076	2005-03-15	2007-05-29	Granted	United States of America	Electronic Component Package
10173182	6830999	2002-06-17	2004-12-14	Expired	United States of America	Method Of Fabricating Flip Chip Semiconductor Device Utilizing Polymer Layer For Reducing Thermal Expansion Coefficient Differential
09609582	6441473	2000-06-30	2002-08-27	Expired	United States of America	Flip Chip Semiconductor Device
08938619	5925827	1997-09-25	1999-07-20	Expired	United States of America	System And Method For Empirically Determining Shrinkage Stresses In A Molded Package And Power Module Employing The Same
09127707	5939641	1998-07-31	1999-08-17	Expired	United States of America	System And Method For Empirically Determining Shrinkage Stresses In A Molded Package And Power Module Employing The Same
11385086	7705473	2006-03-21	2010-04-27	Granted	United States of America	Methods And Apparatus For Determining Pad Height For A Wire-Bonding Operation In An Integrated Circuit
10673703	7056819	2003-09-29	2006-06-06	Granted	United States of America	Methods And Apparatus For Determining Pad Height For A Wire\(miBonding Operation In An Integrated Circuit
11530550	7271485	2006-09-11	2007-09-18	Granted	United States of America	Systems And Methods For Distributing I\(slO In A Semiconductor Device
11684674	7709861	2007-03-12	2010-05-04	Granted	United States of America	Systems And Methods For Supporting a Subset of Multiple Interface Types In A Semiconductor Device
09022733	5965903	1998-02-12	1999-10-12	Expired	United States of America	A Device And Method Of Manufacture For An Integrated Circuit Having A BIST Circuit And Bond Pads Incorporated Therein
09288746	6136620	1999-04-08	2000-10-24	Expired	United States of America	A Device And Method Of Manufacture For An Integrated Circuit Having A BIST And Bond Pads Incorporated Therein

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08549990	5751065	1995-10-30	1998-05-12	Expired	United States of America	Integrated Circuit With Active Devices Under Bond Pads
09499801	6335491	2000-02-08	2002-01-01	Granted	United States of America	Interposer for semiconductor package assembly
09974157	6618938	2001-10-09	2003-09-16	Granted	United States of America	Interposer for semiconductor package assembly
08506382	5745986	1995-07-24	1998-05-05	Expired	United States of America	Method of planarizing an array of plastically deformable contacts on an integrated circuit package to compensate for surface warpage
08192081	5435482	1994-02-04	1995-07-25	Expired	United States of America	Integrated circuit having a coplanar solder ball contact array
08960831	6088914	1997-10-30	2000-07-18	Expired	United States of America	Method for planarizing an array of solder balls
08918451	5989937	1997-08-26	1999-11-23	Expired	United States of America	Method for compensating for bottom warpage of a BGA integrated circuit
08936259		1997-09-24		Abandoned	United States of America	Integrated Circuit Having A Coplanar Solder Ball Contact Array
08578049		1995-12-26		Abandoned	United States of America	Integrated Circuit Having A Coplanar Solder Ball Contact Array
61377171		2010-08-28		Expired	United States of America	Low Cost 3D-Face to Face Fan Out, F2FFO, Assembly
13217857	8502372	2011-08-25	2013-08-06	Granted	United States of America	Low-Cost 3D Face-to-Face Out Assembly
13344207		2012-01-05		Abandoned	United States of America	Aluminum Bond Pads With Enhanced Wire Bond Stability
12471982	8101871	2009-05-26	2012-01-24	Granted	United States of America	Aluminum Bond Pads With Enhanced Wire Bond Stability
09946033	6573113	2001-09-04	2003-06-03	Granted	United States of America	Integrated circuit having dedicated probe pads for use in testing densely patterned bonding pads
09100665	6061889	1998-06-19	2000-05-16	Granted	United States of America	Device and method for removing heatspreader from an integrated circuit package
09375835	6266249	1999-08-16	2001-07-24	Granted	United States of America	Semiconductor flip chip ball grid array package
08842379	6057594	1997-04-23	2000-05-02	Expired	United States of America	High power dissipating tape ball grid array package
09097883	6002169	1998-06-15	1999-12-14	Granted	United States of America	Thermally enhanced tape ball grid array package

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09097882	6143586	1998-06-15	2000-11-07	Granted	United States of America	Electrostatic protected substrate
10298971	6861748	2002-11-18	2005-03-01	Lapsed	United States of America	Test structure
09122335	6156676	1998-07-24	2000-12-05	Granted	United States of America	Laser marking of semiconductor wafer substrate while inhibiting adherence to substrate surface of particles generated during laser marking
09009580	6114761	1998-01-20	2000-09-05	Granted	United States of America	Thermally-enhanced flip chip IC package with extruded heatspreader
09114345	6130113	1998-07-13	2000-10-10	Granted	United States of America	Enhanced lamination process between heatspreader to pressure sensitive adhesive (PSA) interface as a step in the semiconductor assembly process
09885491	6445066	2001-06-20	2002-09-03	Granted	United States of America	Splitting and assigning power planes
09006784	6040632	1998-01-14	2000-03-21	Granted	United States of America	Multiple sized die
09053357	6297550	1998-04-01	2001-10-02	Granted	United States of America	Bondable anodized aluminum heatspreader for semiconductor packages
09052884	6083848	1998-03-31	2000-07-04	Granted	United States of America	Removing solder from integrated circuits for failure analysis
08975025	6117352	1997-11-20	2000-09-12	Granted	United States of America	Removal of a heat spreader from an integrated circuit package to permit testing of the integrated circuit and other elements of the package
08911515	6126063	1997-08-14	2000-10-03	Expired	United States of America	Integrated circuit packaging apparatus and method
08934529	5835355	1997-09-22	1998-11-10	Expired	United States of America	Tape ball grid array package with perforated metal stiffener
08911418	6081997	1997-08-14	2000-07-04	Expired	United States of America	System and method for packaging an integrated circuit using encapsulant injection
1580331997	4550173	1997-05-30	2010-07-16	Expired	Japan	Wire Bondable Package Design With Maximum Electrical Performance And Minimum Number Of Layers
08868316	5909056	1997-06-03	1999-06-01	Expired	United States of America	High performance heat spreader for flip chip packages
08864994	5907189	1997-05-29	1999-05-25	Expired	United States of America	Conformal diamond coating for thermal improvement of electronic packages
08971769	5992012	1997-11-17	1999-11-30	Granted	United States of America	Method for making electrical interconnections between layers of an IC package

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08958776	5998242	1997-10-27	1999-12-07	Expired	United States of America	Vacuum assisted underfill process and apparatus for semiconductor package fabrication
08927704	6114189	1997-09-10	2000-09-05	Expired	United States of America	Molded array integrated circuit package
08861884	5834839	1997-05-22	1998-11-10	Expired	United States of America	Preserving clearance between encapsulant and PCB for cavity-down single-tier package assembly
08850292	6011304	1997-05-05	2000-01-04	Expired	United States of America	Stiffener ring attachment with holes and removable snap-in heat sink or heat spreader/lid
08859751	6069027	1997-05-21	2000-05-30	Expired	United States of America	Fixture for lid-attachment for encapsulated packages
08852597	5972738	1997-05-07	1999-10-26	Expired	United States of America	PBGA stiffener package
08837530	5841191	1997-04-21	1998-11-24	Expired	United States of America	Ball grid array package employing raised metal contact rings
08770872	5814881	1996-12-20	1998-09-29	Expired	United States of America	Stacked integrated chip package and method of making same
08845696	5977622	1997-04-25	1999-11-02	Expired	United States of America	Stiffener with slots for clip-on heat sink attachment
08850076	5940271	1997-05-02	1999-08-17	Expired	United States of America	Stiffener with integrated heat sink attachment
08771636	5973393	1996-12-20	1999-10-26	Expired	United States of America	Apparatus and method for stackable molded lead frame ball grid array packaging of integrated circuits
08717601	5899737	1996-09-20	1999-05-04	Expired	United States of America	Fluxless solder ball attachment process
08819299	5959320	1997-03-18	1999-09-28	Expired	United States of America	Semiconductor die having on-die de-coupling capacitance
08615865	5723369	1996-03-14	1998-03-03	Expired	United States of America	Method of flip chip assembly
08764039	6020221	1996-12-12	2000-02-01	Expired	United States of America	Process for manufacturing a semiconductor device having a stiffener member
08719266	5731223	1996-09-24	1998-03-24	Expired	United States of America	Array of solder pads on an integrated circuit
08615388	5801072	1996-03-14	1998-09-01	Expired	United States of America	Method of packaging integrated circuits
08644000	5780924	1996-05-07	1998-07-14	Expired	United States of America	Integrated circuit underfill reservoir
08538629	5695593	1995-10-04	1997-12-09	Expired	United States of America	Method of centering a high pressure lid seal

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08556599	5719733	1995-11-13	1998-02-17	Expired	United States of America	ESD protection for deep submicron CMOS devices with minimum tradeoff for latchup behavior
08536002	5621616	1995-09-29	1997-04-15	Expired	United States of America	High density CMOS integrated circuit with heat transfer structure for improved cooling
12432763	8115321	2009-04-30	2012-02-14	Granted	United States of America	Separate Probe And Bond Regions Of An Integrated Circuit
11772267	7479703	2007-07-02	2009-01-20	Granted	United States of America	INTEGRATED CIRCUIT PACKAGE WITH SPUTTERED HEAT SINK FOR IMPROVED THERMAL PERFORMANCE
2013027597	5350550	2013-02-15	2013-08-30	Granted	Japan	Package with Power and Ground Through Silicon Via
068480516		2006-12-21		Application	European Patent	High Thermal Performance PBGA/FSBGA
11283340	7298036	2005-11-18	2007-11-20	Granted	United States of America	Scaling of functional assignments in packages
20117005408	10-1333387	2009-01-07	2013-11-20	Granted	Korea, Republic of (KR)	Package with Power and Ground Through Silicon Via
078524717		2007-09-27		Application	European Patent	Wire Bond Integrated Circuit Package For High Speed I/O
11300789	7379836	2005-12-14	2008-05-27	Lapsed	United States of America	Method of using automated test equipment to screen for leakage inducing defects after calibration to intrinsic leakage
10394445	6777971	2003-03-20	2004-08-17	Granted	United States of America	High speed wafer sort and final test
60147106		1999-08-04		Expired	United States of America	Vacuum-Assisted Integrated Circuit Test Socket
60095397		1998-08-05		Expired	United States of America	An Integrated Circuit Carrier And Method Of Manufacturing And Integrated Circuit
60714214		2005-09-02		Expired	United States of America	Heat Dissipation In Integrated Circuits
12160233	7776648	2008-07-08	2010-08-17	Granted	United States of America	High Thermal Performance Packaging For Circuit Dies
1020107007877	10-1360815	2007-10-31	2014-02-04	Lapsed	Korea, Republic of (KR)	Bond Pad Support Structure For Semiconductor Device
11360200	7394028	2006-02-23	2008-07-01	Granted	United States of America	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
10675260	6960836	2003-09-30	2005-11-01	Granted	United States of America	Reinforced Bond Pad
10878157	7157361	2004-06-28	2007-01-02	Granted	United States of America	Methods For Processing Integrated Circuit Packages Formed Using Electroplating And Apparatus Made Therefrom
09346100	6282100	1999-07-01	2001-08-28	Granted	United States of America	Low Cost Ball Grid Array Package

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10647863	7148535	2003-08-25	2006-12-12	Granted	United States of America	Zero capacitance bondpad utilizing active negative capacitance
10635276	6828682	2003-08-06	2004-12-07	Granted	United States of America	Substrate voltage connection
10718829	7082585	2003-11-21	2006-07-25	Granted	United States of America	Analysis of integrated circuits for high frequency performance
08946980	5898223	1997-10-08	1999-04-27	Expired	United States of America	Chip-On-Chip IC Packages
09149803	6175158	1998-09-08	2001-01-16	Granted	United States of America	Interposer For Recessed Flip-Chip Package
10456281	6911736	2003-06-06	2005-06-28	Granted	United States of America	Electrostatic discharge protection
08581299	5918794	1995-12-28	1999-07-06	Expired	United States of America	Solder Bonding Of Dense Arrays Of Microminiature Contact Pads
08346454	5583285	1994-11-29	1996-12-10	Expired	United States of America	Method for Detecting A Coating Material on A Substrate
08359973	5607882	1994-12-20	1997-03-04	Expired	United States of America	Multi-Component Electronic Devices and Methods for Making Them
10420219	6768386	2003-04-22	2004-07-27	Granted	United States of America	Dual clock package option
10458130	6867480	2003-06-10	2005-03-15	Granted	United States of America	Electromagnetic interference package protection
10819684	7173328	2004-04-06	2007-02-06	Granted	United States of America	Integrated circuit package and method having wire-bonded intra-die electrical connections
89122966	NI-182345	2000-11-01	2003-08-01	Granted	Taiwan	Testing Integrated Circuits
89100891	NI-138749	2000-04-11	2001-08-21	Granted	Taiwan	Flip Chip Assembly of Semiconductor IC Chips
87115697	NI-124614	1998-09-21	2000-12-11	Lapsed	Taiwan	Chip-On-Chip IC Packages
87103290	NI-125782	1998-03-06	2001-01-11	Lapsed	Taiwan	Circuit And Method For Providing Interconnections Among Individual Integrated Circuit Chips In A Multi-Chip Module
097127688	I452657	2008-07-21	2014-09-11	Granted	Taiwan	Soldering Method and Related Device for Improved Resistance to Brittle Fracture
1019990038064	754752	1999-09-08	2007-08-28	Granted	Korea, Republic of (KR)	Translator For Recessed Flip-chip Package
1019990015968	324832	1999-05-04	2002-02-04	Lapsed	Korea, Republic of (KR)	Bond Pad Design For Integrated Circuits
11289840	3554685	1999-10-12	2004-05-14	Granted	Japan	Flip Chip Metallization
2000012153	3554695	2000-01-20	2004-05-14	Granted	Japan	Flip Chip Assembly of Semiconductor IC Chips
11253017	3803213	1999-09-07	2006-05-12	Granted	Japan	Translator For Recessed Flip-chip Package

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11053116	3503739	1999-03-01	2003-12-19	Granted	Japan	Manufacture Of Flip-Chip Devices
10280566	6654248	2002-10-25	2003-11-25	Granted	United States of America	Top gated heat dissipation
2000284630	3590340	2000-09-20	2004-08-27	Granted	Japan	Integrated Circuit Packages With Improved EMI Characteristics
10268361	7041516	2002-10-10	2006-05-09	Granted	United States of America	Multi chip module assembly
2006261623	5250193	2006-09-27	2013-04-19	Lapsed	Japan	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
09846435	6433565	2001-05-01	2002-08-13	Granted	United States of America	Test fixture for flip chip ball grid array circuits
2007101120369	ZL 200710112936.9	2007-06-21	2011-11-16	Granted	China	Plastic Overmolded Packages with Mechanically Decoupled Lid Attach Attachment
10267410	6861343	2002-10-09	2005-03-01	Lapsed	United States of America	Buffer metal layer
10289074	6734697	2002-11-06	2004-05-11	Granted	United States of America	Die location on ungrounded wafer for back-side emission microscopy
993011295	69944012.2	1999-02-16	2012-02-01	Lapsed	Germany (Federal Republic of)	Manufacture Of Flip-Chip Devices
993078310	69918631.5	1999-10-05	2004-07-14	Granted	Germany (Federal Republic of)	Flip Chip Metallization
003011756	60046100.9	2000-02-18	2011-06-22	Lapsed	Germany (Federal Republic of)	Flip Chip Bump Bonding
09441543	6559670	1999-11-16	2003-05-06	Granted	United States of America	Backside liquid crystal analysis technique for flip-chip packages
09596039	6431432	2000-06-15	2002-08-13	Granted	United States of America	Method for attaching solderballs by selectively oxidizing traces
09975871	6555914	2001-10-12	2003-04-29	Granted	United States of America	Integrated circuit package via
12079124	7566953	2008-03-25	2009-07-28	Granted	United States of America	Leadframe Designs For Plastic Overmolded Packages
09465425	6320127	1999-12-20	2001-11-20	Granted	United States of America	Method and structure for reducing the incidence of voiding in an underfill layer of an electronic component package
09478164	6347291	2000-01-05	2002-02-12	Granted	United States of America	Substrate position location system
09322064	6133064	1999-05-27	2000-10-17	Granted	United States of America	Flip chip ball grid array package with laminated substrate

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09494070	6397944	2000-01-28	2002-06-04	Granted	United States of America	Heat dissipating apparatus and method for electronic components
09940130	6519844	2001-08-27	2003-02-18	Granted	United States of America	Overmold integrated circuit package
09884711	6411114	2001-06-18	2002-06-25	Granted	United States of America	Universal test coupon for performing prequalification tests on substrates
09103291	6110815	1998-06-23	2000-08-29	Granted	United States of America	Electroplating fixture for high density substrates
09104838	5981311	1998-06-25	1999-11-09	Granted	United States of America	Process for using a removeable plating bus layer for high density substrates
10287668	6828643	2002-11-04	2004-12-07	Granted	United States of America	Bonding pads over input circuits
1997355620	4709336	1997-12-24	2011-03-25	Granted	Japan	Use Of Plasma Activated Nf3 To Clean Solder Bumps On A Device
09070671	5903050	1998-04-30	1999-05-11	Granted	United States of America	Semiconductor package having capacitive extension spokes and method for making the same
09075300	6117695	1998-05-08	2000-09-12	Granted	United States of America	Apparatus and method for testing a flip chip integrated circuit package adhesive layer
09885299	6459049	2001-06-20	2002-10-01	Granted	United States of America	High density signal routing
09078093	6068727	1998-05-13	2000-05-30	Granted	United States of America	Apparatus and method for separating a stiffener member from a flip chip integrated circuit package substrate
08963553	6118180	1997-11-03	2000-09-12	Granted	United States of America	Semiconductor die metal layout for flip chip packaging
08955929	5973397	1997-10-22	1999-10-26	Expired	United States of America	Semiconductor device and fabrication method which advantageously combine wire bonding and tab techniques to increase integrated circuit I/O pad density
08938100	5949137	1997-09-26	1999-09-07	Expired	United States of America	Stiffener ring and heat spreader for use with flip chip packaging assemblies
08935424	5909057	1997-09-23	1999-06-01	Expired	United States of America	Integrated heat spreader/stiffener with apertures for semiconductor package
08935834	6002171	1997-09-22	1999-12-14	Expired	United States of America	Integrated heat spreader/stiffener assembly and method of assembly for semiconductor package
1580321997	4572011	1997-05-30	2010-08-20	Expired	Japan	Apparatus To Decouple Core Circuits Power Supply From Input-Output Circuits Power Supply In A Semiconductor Device Package
09005491	6111313	1998-01-12	2000-08-29	Granted	United States of America	Integrated circuit package having a stiffener dimensioned to receive heat transferred laterally from the integrated circuit

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
08837685	5841198	1997-04-21	1998-11-24	Expired	United States of America	Ball grid array package employing solid core solder balls
09839925	6479319	2001-04-20	2002-11-12	Granted	United States of America	Contact escape pattern
09894210	6531932	2001-06-27	2003-03-11	Granted	United States of America	Microstrip package having optimized signal line impedance control
08412087	5610442	1995-03-27	1997-03-11	Expired	United States of America	Semiconductor device package fabrication method and apparatus
08203919	5644102	1994-03-01	1997-07-01	Expired	United States of America	Integrated circuit packages with distinctive coloration
97143311	I379364	2008-11-10	2012-12-11	Lapsed	Taiwan	Process of grounding heat spreader/stiffener to a flip chip package using solder and film adhesive
09068171	4592122	1997-03-21	2010-09-24	Expired	Japan	Flip Chip Package With Reduced Number Of Package Layers
08619909	5686764	1996-03-20	1997-11-11	Expired	United States of America	Flip chip package with reduced number of package layers
08632952	5761048	1996-04-16	1998-06-02	Expired	United States of America	Conductive polymer ball attachment for grid array semiconductor packages
08538630	5716493	1995-10-04	1998-02-10	Expired	United States of America	High pressure lid seal clip apparatus
08539188	5786631	1995-10-04	1998-07-28	Expired	United States of America	Configurable ball grid array package
08656033	5691568	1996-05-31	1997-11-25	Expired	United States of America	Wire bondable package design with maxium electrical performance and minimum number of layers
08647344	5777383	1996-05-09	1998-07-07	Expired	United States of America	Semiconductor chip package with interconnect layers and routing and testing methods
08299209	5465470	1994-08-31	1995-11-14	Expired	United States of America	Fixture for attaching multiple lids to multi-chip module (MCM) integrated circuit
95108042	I386663	2006-03-10	2013-02-21	Lapsed	Taiwan	Test Vehicle Data Analysis
2006100595493	ZL200610059549.3	2006-03-06	2010-04-14	Lapsed	China	Test Vehicle Data Analysis
09801007	6518161	2001-03-07	2003-02-11	Granted	United States of America	Method for manufacturing a dual chip in package with a flip chip die mounted on a wire bonded die
08538907	5632437	1995-10-04	1997-05-27	Expired	United States of America	Method of centering a lid seal clip
08539189	5598775	1995-10-04	1997-02-04	Expired	United States of America	Centering lid seal clip apparatus
08580800	5818102	1995-12-29	1998-10-06	Expired	United States of America	System having integrated circuit package with lead frame having internal power and ground busses

AppNo	PatentNo	FiledDate	GrantDate	Status	Country	Title
08627411	6078502	1996-04-01	2000-06-20	Expired	United States of America	System having heat dissipating leadframes
08573892	5767580	1995-12-18	1998-06-16	Expired	United States of America	Systems having shaped, self-aligning micro-bump structures
08655599	5672911	1996-05-30	1997-09-30	Expired	United States of America	Apparatus to decouple core circuits power supply from input-output circuits power supply in a semiconductor device package
12034745	7750460	2008-02-21	2010-07-06	Granted	United States of America	Ball Grid Array Package Layout Supporting Many Voltage Splits and Flexible Split Locations
07828468	5831836	1992-01-30	1998-11-03	Expired	United States of America	Power plane for semiconductor device
098102349	I453875	2009-01-21	2014-09-21	Granted	Taiwan	Package with Power and Ground Through Via
12121363	8350375	2008-05-15	2013-01-08	Granted	United States of America	Flipchip Bump Patterns for Efficient I-Mesh Power Distribution Schemes
201495711	5922702	2008-08-21	2016-04-22	Granted	Japan	Mitigation of Whiskers in SN-Films
2011197816	5562308	2011-09-12	2014-06-20	Granted	Japan	Reinforced Bond Pad
003086758		2000-10-03		Application	European Patent	Multifunction Lead Frame And Integrated Circuit Package Incorporating The Same
062556691	1827067	2006-11-03	2016-09-21	Completed	European Patent	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
062556691	60 2006 050 331.8-08	2006-11-03	2016-09-21	Granted	Germany (Federal Republic of)	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
201489934	5882390	2007-02-23	2016-02-12	Granted	Japan	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
09843443	6586825	2001-04-26	2003-07-01	Granted	United States of America	Dual chip in package with a wire bonded die mounted to a substrate
2000248741	5069387	2000-08-18	2012-08-24	Granted	Japan	Multiple Layers Tape Ball Grid Array Package
11276938	7180011	2006-03-17	2007-02-20	Granted	United States of America	Device for minimizing differential pair length mismatch and impedance discontinuities in an integrated circuit package design
2009801224755	ZL2009801224755	2009-01-07	2015-04-08	Granted	China	Package with Power and Ground Through Silicon Via
088727722	2248165	2008-11-20	2017-01-18	Granted	Germany (Federal Republic of)	Process of grounding heat spreader stiffener to a FPBGA using solder and film adhesive
088727722	2248165	2008-11-20	2017-01-18	Completed	European Patent	Process of grounding heat spreader stiffener to a FPBGA using solder and film adhesive
11334870	7737564	2006-01-19	2010-06-15	Granted	United States of America	POWER CONFIGURATION METHOD FOR STRUCTURED ASICS
2008801275042	ZL200880127504.2	2008-11-20	2012-07-18	Granted	China	Process of grounding heat spreader stiffener to a FPBGA using solder and film adhesive

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20107018929	1177039	2008-11-20	2012-08-20	Granted	Korea, Republic of (KR)	Process of grounding heat spreader stiffener to a FPBGA using solder and film adhesive
096144051	I402958	2007-11-21	2013-07-21	Granted	Taiwan	Wire Bond Integrated Circuit Package For High Speed I/O
11102156	7370257	2005-04-08	2008-05-06	Granted	United States of America	Test vehicle data analysis
09766104	6396699	2001-01-19	2002-05-28	Granted	United States of America	Heat sink with chip die EMC ground interconnect
11641989	7557303	2006-12-18	2009-07-07	Granted	United States of America	ELECTRONIC COMPONENT CONNECTION SUPPORT STRUCTURES INCLUDING AIR AS A DIELECTRIC
12038911	7968999	2008-02-28	2011-06-28	Granted	United States of America	Process of grounding heat spreader/stiffener to a flip chip package using solder and film adhesive
09695540	6496374	2000-10-24	2002-12-17	Granted	United States of America	Apparatus suitable for mounting an integrated circuit
11565701	7804167	2006-12-01	2010-09-28	Granted	United States of America	Wire Bond Integrated Circuit Package For High Speed I/O
2011526065	5525530	2009-01-07	2014-04-18	Lapsed	Japan	Package with Power and Ground Through Silicon Via
098133820		2009-01-07		Application	European Patent	Package with Power and Ground Through Silicon Via
10918933	7117467	2004-08-16	2006-10-03	Granted	United States of America	Methods for optimizing package and silicon co-design of integrated circuit
11283044	7205673	2005-11-18	2007-04-17	Granted	United States of America	Reduce or eliminate IMC cracking in post wire bonded dies by doping Aluminum used in bond pads during Cu/low-k BEOL processing
098108322	I336512	2006-09-25	2011-01-21	Granted	Taiwan	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
11073802	7081672	2005-03-07	2006-07-25	Granted	United States of America	Substrate via layout to improve bias humidity testing reliability
003002094		2000-01-13		Abandoned	European Patent	Flip Chip Assembly Of Semiconductor IC Chips
60655816		2005-02-24		Expired	United States of America	Structure And Method For Fabricating Flip Chip Devices
60535839		2004-01-12		Expired	United States of America	Post Sn Plate Reflow To Prevent Sn Whisker Formation On Matte Sn\(slNi Plated Cu Lead Frames
10939082	7235889	2004-09-10	2007-06-26	Granted	United States of America	Integrated heatspreader for use in wire bonded ball grid array semiconductor packages
2010548652	5226087	2008-11-20	2013-03-22	Lapsed	Japan	Process of grounding heat spreader stiffener to a FPBGA using solder and film adhesive
11290087	7531442	2005-11-30	2009-05-12	Lapsed	United States of America	Eliminate IMC Cracking in post wirebonded dies: Macro level stress reduction by modifying dielectric/metal film stack in BE layers during Cu/low-k processing

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2010843	5731121	2010-01-06	2015-04-17	Lapsed	Japan	A Gate Stack Structure For Integrated Circuit Fabrication
11140455	7528616	2005-05-27	2009-05-05	Lapsed	United States of America	Zero ATE Insertion Force Interposer Daughter Card
60435033		2002-12-20		Expired	United States of America	Method Of Bonding TO Copper
11097895	7319272	2005-04-01	2008-01-15	Granted	United States of America	Ball assignment system
11132751	7354790	2005-05-18	2008-04-08	Granted	United States of America	Method and apparatus for avoiding dicing chip-outs in integrated circuit die
60719234		2005-09-21		Expired	United States of America	Aluminum Bond Pad And Interconnect Structure For The Replacing An Upper Level Of Copper Interconnect In An Integrated Circuit Product
11079028	7491579	2005-03-14	2009-02-17	Lapsed	United States of America	Composable System-in-Package Integrated Circuits and Process of Composing the Same
10954940	7145232	2004-09-30	2006-12-05	Granted	United States of America	Construction to improve thermal performance and reduce die backside warpage
10114144	6847123	2002-04-02	2005-01-25	Granted	United States of America	Vertically staggered bondpad array
10900869	7096748	2004-07-28	2006-08-29	Granted	United States of America	Embedded strain gauge in printed circuit boards
10865179	7436060	2004-06-09	2008-10-14	Granted	United States of America	Semiconductor package and process utilizing pre-formed mold cap and heatspreader assembly
10741155	7328830	2003-12-19	2008-02-12	Granted	United States of America	Structure And Method For Bonding To Copper Interconnect Structures
09631150	6369596	2000-08-02	2002-04-09	Granted	United States of America	Vacuum-Assisted Integrated Circuit Test Socket
10744363	7098528	2003-12-22	2006-08-29	Granted	United States of America	Embedded redistribution interposer for footprint compatible chip package conversion
10855148	7368326	2004-05-27	2008-05-06	Granted	United States of America	Methods And Apparatus To Reduce Growth Formations On Plated Conductive Leads
2006800530073	ZL200680053007.3	2006-12-21	2013-07-10	Granted	China	High Thermal Performance Packaging For Circuit Dies
09138146	7023087	1998-08-21	2006-04-04	Granted	United States of America	Integrated Circuit Carrier And Method Of Manufacturing And Integrated Circuit
60014182		2007-12-17		Expired	United States of America	Integrated Circuit Package For High\(miSpeed Signals
11468901	7633152	2006-08-31	2009-12-15	Granted	United States of America	Heat Dissipation In Integrated Circuits

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12526334	8222719	2009-08-07	2012-07-17	Granted	United States of America	A Quad Flat No Lead (QFN) Integrated Circuit (IC) Package Having a Modified Paddle and Method for Designing the Package
12678405	8183698	2010-03-16	2012-05-22	Granted	United States of America	Bond Pad Support Structure For Semiconductor Device
1020097018981	10-1356591	2007-02-12	2014-01-22	Lapsed	Korea, Republic of (KR)	Enhanced QFN Exposed Pad Geometry To enable PCB Under Package
1020077019305	10-1266335	2006-02-24	2013-05-15	Granted	Korea, Republic of (KR)	Structure And Method For Fabricating Flip Chip Devices
1020087024806	10-1212473	2006-04-14	2012-12-10	Granted	Korea, Republic of (KR)	Method And Apparatus For Improving Thermal Energy Dissipation In A Direct-Chip-Attach Coupling Configuration Of An Integrated Circuit And A Circuit Board
2009542743	5073756	2006-12-21	2012-08-31	Granted	Japan	High Thermal Performance Packaging For Circuit Dies
2006800060148	200680006014.8	2006-02-24	2010-03-03	Lapsed	China	Structure And Method For Fabricating Flip Chip Devices
077504819		2007-02-12		Lapsed	European Patent	Enhanced QFN Exposed Pad Geometry To enable PCB Under Package
09885687	6759860	2001-06-19	2004-07-06	Granted	United States of America	Semiconductor device package substrate probe fixture
11055712	7433192	2005-02-10	2008-10-07	Granted	United States of America	Packaging For Electronic Modules
10816060	7030472	2004-04-01	2006-04-18	Granted	United States of America	Integrated Circuit Device Having Flexible Leadframe
11298030	7504728	2005-12-09	2009-03-17	Lapsed	United States of America	Integrated Circuit Having Bond Pad With Improved Thermal And Mechanical Properties
10727474	6954082	2003-12-04	2005-10-11	Granted	United States of America	Method and apparatus for testing of integrated circuit package
11884328	7777333	2008-05-30	2010-08-17	Granted	United States of America	Structure And Method For Fabricating Flip Chip Devices
09465089	6838769	1999-12-16	2005-01-04	Granted	United States of America	Dual Damascene Bond Pad Structure For Lowering Stress And Allowing Circuitry Under Pads
20097024392	10-1317019	2007-09-21	2013-10-02	Granted	Korea, Republic of (KR)	Soldering Method and Related Device for Improved Resistance to Brittle Fracture
20097012892	10-1323978	2006-12-21	2013-10-24	Granted	Korea, Republic of (KR)	High Thermal Performance Packaging For Circuit Dies
09081448	6369444	1998-05-19	2002-04-09	Expired	United States of America	Packaging Silicon On Silicon Multichip Modules

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09149804	6160715	1998-09-08	2000-12-12	Granted	United States of America	Translator For Recessed Flip-chip Package
2007800522300		2007-02-12		Abandoned	China	Enhanced QFN Exposed Pad Geometry To enable PCB Under Package
2015100536899		2007-02-07		Application	China	A Quad Flat No Lead Integrated Circuit Package and Method
10620074	6933602	2003-07-14	2005-08-23	Granted	United States of America	Semiconductor package having a thermally and electrically connected heatspreader
10702996	7791210	2003-11-05	2010-09-07	Granted	United States of America	Semiconductor Package Having Discrete Non-Active Electrical Components Incorporated Into The Package
09344656	6371665	1999-06-25	2002-04-16	Granted	United States of America	Plastic Packaged Optoelectronic Device
10681554	7345245	2003-10-08	2008-03-18	Granted	United States of America	Robust high density substrate design for thermal cycling reliability
10464178	6963129	2003-06-18	2005-11-08	Granted	United States of America	Multi-chip package having a contiguous heat spreader assembly
09235795	6178088	1999-01-22	2001-01-23	Granted	United States of America	Electronic Apparatus
09172467	6130141	1998-10-14	2000-10-10	Granted	United States of America	Flip Chip Metallization
09032338	6015652	1998-02-27	2000-01-18	Granted	United States of America	Manufacture Of Flip-Chip Devices
10953291	7221173	2004-09-29	2007-05-22	Granted	United States of America	Method And Structures For Testing A Semiconductor Wafer Prior To Performing A Flip Chip Bumping Process
08542995	5696405	1995-10-13	1997-12-09	Expired	United States of America	Microelectronic Package With Device Cooling
09620939	6465882	2000-07-21	2002-10-15	Granted	United States of America	Integrated Circuit Package Having Partially Exposed Conductive Layer
08393628	5608262	1995-02-24	1997-03-04	Expired	United States of America	Packaging Multi-Chip Modules Without Wire-Bond Interconnection
08946693	6683384	1997-10-08	2004-01-27	Expired	United States of America	Air Isolated Crossovers
08991867	6043670	1997-12-16	2000-03-28	Granted	United States of America	Method For Testing Integrated Circuits
09583126	6480657	2000-05-30	2002-11-12	Granted	United States of America	Methods Of Packaging Polarization Maintaining Fibers
10672495	7009282	2003-09-26	2006-03-07	Granted	United States of America	Packaged Integrated Circuit Providing Trace Access To High-Speed Leads

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09256443	6232212	1999-02-23	2001-05-15	Granted	United States of America	Flip Chip Bump Bonding
11074358	7132735	2005-03-07	2006-11-07	Granted	United States of America	Integrated Circuit Package With Lead Fingers Extending Into A Slot Of A Die Paddle
09235011	6190940	1999-01-21	2001-02-20	Granted	United States of America	Flip Chip Assembly Of Semiconductor IC Chips
08430664	5627407	1995-04-28	1997-05-06	Expired	United States of America	Electronic Package With Reduced Bending Stress
08638003	5741430	1996-04-25	1998-04-21	Expired	United States of America	Conductive Adhesive Bonding Means
09012304	6075427	1998-01-23	2000-06-13	Granted	United States of America	MCM With High Q Overlapping Resonator
10652453	6743979	2003-08-29	2004-06-01	Granted	United States of America	Bonding pad isolation
09385735	6372600	1999-08-30	2002-04-16	Granted	United States of America	Etch Stops And Alignment Marks For Bonded Wafers
09413605	6351033	1999-10-06	2002-02-26	Granted	United States of America	Multifunction Lead Frame And Integrated Circuit Package Incorporating The Same
08578816	5837380	1995-12-26	1998-11-17	Expired	United States of America	Multilayer Structures And Process For Fabricating The Same
08633992	5667132	1996-04-19	1997-09-16	Expired	United States of America	Method For Solder-Bonding Contact Pad Arrays
09351546	6199464	1999-07-12	2001-03-13	Granted	United States of America	Method And Apparatus For Cutting A Substrate
09351945	6319450	1999-07-12	2001-11-20	Granted	United States of America	Vented Mold, Method Of Making The Mold, Method Of Encapsulating A Circuit Using The Mold, And Circuit Encapsulated By The Method
09120148	6154370	1998-07-21	2000-11-28	Granted	United States of America	Recessed Flip-Chip Package
09261093	6232047	1999-03-02	2001-05-15	Granted	United States of America	Fabricating High-Q RF Component
10417049	7023225	2003-04-16	2006-04-04	Granted	United States of America	Wafer-mounted micro-probing platform
08333168	5505367	1994-11-02	1996-04-09	Expired	United States of America	Method For Bumping Silicon Devices
10600255	6798035	2003-06-20	2004-09-28	Granted	United States of America	Bonding pad for low k dielectric

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10615063	6744130	2003-07-08	2004-06-01	Granted	United States of America	Isolated stripline structure
09425706	6251705	1999-10-22	2001-06-26	Granted	United States of America	Low Profile Integrated Circuit Packages
09628067	6509642	2000-07-28	2003-01-21	Granted	United States of America	Integrated Circuit Package
09498005	6678167	2000-02-04	2004-01-13	Granted	United States of America	High Performance Multi-Chip IC Package
09401690	6297551	1999-09-22	2001-10-02	Granted	United States of America	Integrated Circuit Packages With Improved EMI Characteristics
09621110	6790760	2000-07-21	2004-09-14	Granted	United States of America	A Method Of Manufacturing An Integrated Circuit Package
10683101	6825563	2003-10-09	2004-11-30	Granted	United States of America	Slotted bonding pad
09435971	6342399	1999-11-08	2002-01-29	Granted	United States of America	Testing Integrated Circuits
09528882	6437990	2000-03-20	2002-08-20	Granted	United States of America	Multi-Chip Ball Grid Array IC Packages
89103182	NI-137162	2000-04-08	2001-11-14	Granted	Taiwan	Flip Chip Bump Bonding
88114052	NI-142196	1999-08-17	2002-02-01	Granted	Taiwan	Flip Chip Metallization
89121960	NI-172446	2000-10-19	2003-02-21	Lapsed	Taiwan	Low Profile Integrated Circuit Packages
90102134	NI-170172	2001-02-02	2003-05-19	Granted	Taiwan	High Performance Multi-Chip IC Package
90117908	NI-160876	2001-07-23	2002-08-11	Granted	Taiwan	Integrated Circuit Package
10614402	6836026	2003-07-03	2004-12-28	Granted	United States of America	Integrated circuit design for both input output limited and core limited integrated circuits
90117328	NI-167645	2001-07-16	2002-12-01	Granted	Taiwan	Integrated Circuit Package Having Partially Exposed Conductive Layer
89124902	NI-147525	2000-11-23	2002-01-01	Granted	Taiwan	Semiconductor Device Having Self-Aligned Contact And Landing PAD Structure And Method Of Forming Same
89126790	NI-147894	2000-12-14	2002-04-24	Granted	Taiwan	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
89126837	NI-150760	2001-01-03	2002-02-21	Lapsed	Taiwan	Dual Damascene Bond Pad Structure for Lowering Stress and Allowing Circuitry Under Pads
89120479	NI-155555	2000-10-02	2002-09-05	Lapsed	Taiwan	Multifunction Lead Frame And Integrated Circuit Package Incorporating The Same
88113740	NI-127340	1999-08-11	2001-02-21	Lapsed	Taiwan	Interposer For Recessed Flip-Chip Package
09752626	6591410	2000-12-28	2003-07-08	Granted	United States of America	Six-to-one signal/power ratio bump and trace pattern for flip chip design

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09416069	6245993	1999-10-12	2001-06-12	Granted	United States of America	Electronic Assembly Having Shielding And Strain-Relief Member
90117314	NI-183318	2001-07-16	2003-08-11	Granted	Taiwan	A Method Of Manufacturing An Integrated Circuit Package
10371386	6891392	2003-02-21	2005-05-10	Granted	United States of America	Substrate impedance measurement
94132327	I364082	2005-09-19	2012-05-11	Granted	Taiwan	Method and Structure for Testing a Semiconductor Wafer Prior to Performing a Flip Chip Bumping Process
095142149	I411052	2006-11-14	2013-10-01	Granted	Taiwan	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
095135361	I310597	2006-09-25	2009-06-01	Granted	Taiwan	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
1020010043826	678878	2001-07-20	2007-01-30	Granted	Korea, Republic of (KR)	Integrated Circuit Package Having Partially Exposed Conductive Layer
20000008193	712772	2000-02-21	2007-04-23	Lapsed	Korea, Republic of (KR)	Flip Chip Bump Bonding
19990028642	0310572	1999-07-15	2001-09-18	Granted	Korea, Republic of (KR)	Recessed Flip-Chip Package
1019990038065	637008	1999-09-08	2006-10-16	Granted	Korea, Republic of (KR)	Interposer For Recessed Flip-Chip Package
20000078613	687994	2000-12-19	2007-02-21	Lapsed	Korea, Republic of (KR)	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
1020000046915	390229	2000-08-14	2003-06-24	Granted	Korea, Republic of (KR)	Integrated Circuit Die For Wire Bonding And Flip-Chip Mounting
1020010043981	675030	2001-07-21	2007-01-22	Granted	Korea, Republic of (KR)	Integrated Circuit Package
20000076794	691051	2000-12-15	2007-02-27	Lapsed	Korea, Republic of (KR)	Dual Damascene Bond Pad Structure for Lowering Stress and Allowing Circuitry Under Pads
1019990049683	662218	1999-11-10	2006-12-21	Granted	Korea, Republic of (KR)	Heatspreader For A Flip Chip Device, And Method For Connecting The Heatspreader
10396955	7190082	2003-03-24	2007-03-13	Granted	United States of America	Low stress flip-chip package for low-K silicon technology
1019990006458	682284	1999-02-26	2007-02-07	Lapsed	Korea, Republic of (KR)	Manufacture Of Flip-Chip Devices
10347759	6801437	2003-01-21	2004-10-05	Lapsed	United States of America	Electronic organic substrate
09735085	6605951	2000-12-11	2003-08-12	Granted	United States of America	Interconnector and method of connecting probes to a die for functional analysis
1020010005358	742107	2001-02-05	2007-07-18	Granted	Korea, Republic of (KR)	High Performance Multi-Chip IC Package

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10339844	6781228	2003-01-10	2004-08-24	Granted	United States of America	Donut power mesh scheme for flip chip package
1020040078075	1150312	2004-09-30	2012-05-21	Granted	Korea, Republic of (KR)	Reinforced Bond Pad
10290953	6943446	2002-11-08	2005-09-13	Granted	United States of America	Via construction for structural support
1020060094257	10-1245114	2006-09-27	2013-03-13	Lapsed	Korea, Republic of (KR)	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
10283965	6744081	2002-10-30	2004-06-01	Granted	United States of America	Interleaved termination ring
2000386402	3796116	2000-12-20	2006-04-21	Lapsed	Japan	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
2000306945	4008195	2000-10-06	2007-09-07	Granted	Japan	Multifunction Lead Frame And Integrated Circuit Package Incorporating The Same
90106482	I222205	2001-03-20	2004-10-11	Granted	Taiwan	Multi-Chip Ball Grid Array IC Packages
20070018179	10-1297915	2007-02-23	2013-08-12	Granted	Korea, Republic of (KR)	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
20050055694	10-1421714	2005-06-27	2014-07-15	Granted	Korea, Republic of (KR)	Methods For Processing Integrated Circuit Packages Formed Using Electroplating And Apparatus Made Therefrom
20050002443	10-1120288	2005-01-11	2012-02-17	Lapsed	Korea, Republic of (KR)	Methods And Apparatus To Reduce Growth Formations On Plated Conductive Leads
11123342	3821984	1999-04-30	2006-06-30	Granted	Japan	Bond Pad Design For Integrated Circuits
88120078	NI-131285	1999-11-26	2001-04-11	Lapsed	Taiwan	Heatspreader For A Flip Chip Device, And Method For Connecting The Heatspreader
88104689	NI-121715	1999-03-25	2000-10-21	Granted	Taiwan	Bond Pad Design For Integrated Circuits
089111993	NI-156707	2000-06-19	2002-06-11	Granted	Taiwan	Integrated Circuit Die For Wire Bonding And Flip-Chip Mounting
11011396	3578931	1999-01-20	2004-07-23	Granted	Japan	MCM With High Q Overlapping Resonator
11205181	3742252	1999-07-19	2005-11-18	Granted	Japan	Recessed Flip-Chip Package
10402054	6798069	2003-03-28	2004-09-28	Granted	United States of America	Integrated circuit having adaptable core and input/output regions with multi-layer pad trace conductors
93127180	I364833	2004-09-08	2012-05-21	Granted	Taiwan	Reinforced Bond Pad
2000189021	3785026	2000-06-23	2006-03-24	Lapsed	Japan	Plastic Packaged Optoelectronic Device
10267814	6717423	2002-10-09	2004-04-06	Granted	United States of America	Substrate impedance measurement
1020000058790	742104	2000-10-06	2007-07-18	Granted	Korea, Republic of (KR)	Multifunction Lead Frame And Integrated Circuit Package Incorporating The Same

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1019990031985	623895	1999-08-04	2006-09-07	Granted	Korea, Republic of (KR)	Integrated Circuit Carrier And Method Of Manufacturing And Integrated Circuit
1019990002078	617887	1999-01-23	2006-08-23	Granted	Korea, Republic of (KR)	MCM With High Q Overlapping Resonator
9842014	0311356	1998-10-08	2001-09-25	Granted	Korea, Republic of (KR)	Chip-On-Chip IC Packages
10357142	6963138	2003-02-03	2005-11-08	Granted	United States of America	Dielectric stack
20040076318	10-1060430	2004-09-23	2011-08-23	Granted	Korea, Republic of (KR)	Packaged Integrated Circuit Providing Trace Access To High-Speed Leads
1020060021401	10-1184201	2006-03-07	2012-09-13	Granted	Korea, Republic of (KR)	Integrated Circuit Package With Lead Fingers Extending Into A Slot Of A Die Paddle
1020060094340	10-1288790	2006-09-27	2013-07-17	Granted	Korea, Republic of (KR)	Solder Bump Structure For Flip Chip Semiconductor Devices And Method Of Manufacture Therefore
1020070079027	10-1398404	2007-08-07	2014-05-16	Granted	Korea, Republic of (KR)	Plastic Overmolded Packages with Mechanically Decoupled Lid Attach Attachment
2005188120	5676833	2005-06-28	2015-01-09	Granted	Japan	Methods For Processing Integrated Circuit Packages Formed Using Electroplating And Apparatus Made Therefrom
10298338	6648064	2002-11-14	2003-11-18	Granted	United States of America	Active heat sink
2000044330	3588027	2000-02-22	2004-08-20	Granted	Japan	Flip Chip Bump Bonding
11221875	3929651	1999-08-05	2007-03-16	Lapsed	Japan	Integrated Circuit Carrier And Method Of Manufacturing And Integrated Circuit
10354961	3258285	1998-12-14	2001-12-07	Lapsed	Japan	Method For Testing Integrated Circuits
11139175	3476708	1999-05-19	2003-09-26	Granted	Japan	Packaging Silicon On Silicon Multichip Modules
09086440	3168256	1997-04-04	2001-03-09	Expired	Japan	Method For Solder-Bonding Contact Pad Arrays
2007043174	5905181	2007-02-23	2016-03-25	Granted	Japan	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
2006060406	5550204	2006-03-07	2014-05-30	Granted	Japan	Integrated Circuit Package With Lead Fingers Extending Into A Slot Of A Die Paddle
10278373	6603201	2002-10-23	2003-08-05	Granted	United States of America	Electronic substrate
2001120442	4193019	2001-04-19	2008-10-03	Lapsed	Japan	Micromagnetic Components
2000242828	4130295	2000-08-10	2008-05-30	Granted	Japan	Integrated Circuit Die For Wire Bonding And Flip-Chip Mounting
98106356X	98106356.X	1998-04-08	2004-01-07	Granted	China	Circuit And Method For Providing Interconnections Among Individual Integrated Circuit Chips In A Multi-Chip Module
09636498	6403399	2000-08-11	2002-06-11	Granted	United States of America	Method of rapid wafer bumping

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10349770	6951000	2003-01-22	2005-09-27	Granted	United States of America	Simulated voltage contrasted image generator and comparator
2006101395386	200610139538.6	2006-09-25	2010-05-12	Granted	China	Integrated Circuit Device Incorporating Metallurgical Bond To Enhance Thermal Conduction To A Heat Sink
2006101630672	ZL 200610163067.2	2006-11-30	2009-10-07	Granted	China	Flexible Circuit Substrate For Flip-Chip-On-Flex Applications
2006101519001	ZL 200610151900.1	2006-09-13	2009-07-22	Granted	China	Solder Bump Structure For Flip Chip Semiconductor Devices And Method Of Manufacture Therefore
2004281010	4959929	2004-09-28	2012-03-30	Lapsed	Japan	Reinforced Bond Pad
2007212015	5121353	2007-08-16	2012-11-02	Granted	Japan	Plastic Overmolded Packages with Mechanically Decoupled Lid Attach Attachment
10211914	6777314	2002-08-02	2004-08-17	Granted	United States of America	Method of forming electrolytic contact pads including layers of copper, nickel, and gold
10229659	6777803	2002-08-28	2004-08-17	Granted	United States of America	Solder mask on bonding ring
993003284	69941168.8	1999-01-19	2009-07-29	Granted	Germany (Federal Republic of)	MCM With High Q Overlapping Resonator
003003696	60014461.5	2000-01-19	2004-10-06	Granted	Germany (Federal Republic of)	Article Comprising Aligned, Truncated Carbon Nanotubes And Process For Fabricating Article
983025164	69839861.0	1998-03-31	2008-08-13	Granted	Germany (Federal Republic of)	Circuit And Method For Providing Interconnections Among Individual Integrated Circuit Chips In A Multi-Chip Module
10141252	6815812	2002-05-08	2004-11-09	Granted	United States of America	Direct alignment of contacts
003050135	600 45 904.7	2000-06-13	2011-07-04	Granted	Germany (Federal Republic of)	Plastic Packaged Optoelectronic Device
983079195		1998-09-29		Abandoned	Germany (Federal Republic of)	Chip-On-Chip IC Packages
983079161	69836944.0	1998-09-29	2007-01-24	Granted	Germany (Federal Republic of)	Air Isolated Crossovers
003078318	60037990.6	2000-09-11	2008-02-13	Granted	Germany (Federal Republic of)	Integrated Circuit Packages With Improved EMI Characteristics
10055812	6605954	2002-01-23	2003-08-12	Granted	United States of America	Reducing probe card substrate warpage
10293458	6861183	2002-11-13	2005-03-01	Granted	United States of America	Scatter dots
10212448	6700207	2002-08-05	2004-03-02	Granted	United States of America	Flip-chip ball grid array package for electromigration testing
10082027	6674176	2002-02-20	2004-01-06	Lapsed	United States of America	Wire bond package with core ring formed over I/O cells

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003050168	60043373.0	2000-06-13	2009-11-25	Lapsed	Germany (Federal Republic of)	Bonded Article Having Improved Crystalline Structure And Work Function Uniformity And Method For Making The Same
09465131	6962437	1999-12-16	2005-11-08	Granted	United States of America	Method and apparatus for thermal profiling of flip-chip packages
10024054	6769923	2001-12-17	2004-08-03	Granted	United States of America	Fluted signal pin, cap, membrane, and stanchion for a ball grid array
09994567	6671865	2001-11-27	2003-12-30	Lapsed	United States of America	High density input output
09478972	6429534	2000-01-06	2002-08-06	Granted	United States of America	Interposer tape for semiconductor package
10021829	6573523	2001-12-12	2003-06-03	Granted	United States of America	Substrate surface scanning
10094549	6623992	2002-03-08	2003-09-23	Granted	United States of America	System and method for determining a subthreshold leakage test limit of an integrated circuit
09949207	6706622	2001-09-07	2004-03-16	Granted	United States of America	Bonding pad interface
10023311	6590409	2001-12-13	2003-07-08	Granted	United States of America	Systems and methods for package defect detection
08697121	5646828	1996-08-20	1997-07-08	Expired	United States of America	Thin Packaging of multi-chip modules with enhanced thermal power management
09187885	5965197	1998-11-06	1999-10-12	Expired	United States of America	Article Comprising Fine-Grained Solder Compositions With Dispersoid Particles
09238706	6074897	1999-01-28	2000-06-13	Expired	United States of America	Integrated Circuit Bonding Method and Apparatus
11302690	7541220	2005-12-14	2009-06-02	Lapsed	United States of America	Integrated Circuit Device Having Flexible Leadframe
2008290462		2008-11-13		Abandoned	Japan	Semiconductor Device Having Self-Aligned Contact And Landing PAD Structure And Method Of Forming Same
2005367979	4279835	2000-12-20	2009-03-19	Granted	Japan	Wire Bonding Method For Copper Interconnects In Semiconductor Devices
2004175054		2004-06-14		Lapsed	Japan	Heatspreader For A Flip Chip Device, And Method For Connecting The Heatspreader
2008045768	5135493	2008-02-27	2012-11-22	Granted	Japan	Integrated Circuit Package Having Partially Exposed Conductive Layer
2007138865	4685834	1998-10-06	2011-02-18	Lapsed	Japan	Air Isolated Crossovers
08111765	5834792	1993-08-25	1998-11-10	Expired	United States of America	Articles Comprising Doped Semiconductor Material

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09864577	6472304	2001-05-24	2002-10-29	Granted	United States of America	Wire Bonding To Copper
11403492	7817434	2006-04-13	2010-10-19	Granted	United States of America	Method And Apparatus For Improving Thermal Energy Dissipation In A Direct-Chip-Attach Coupling Configuration Of An Integrated Circuit And A Circuit Board
09968286	6657870	2001-10-01	2003-12-02	Granted	United States of America	Die power distribution system
09437559	6475828	1999-11-10	2002-11-05	Granted	United States of America	Method of using both a non-filled flux underfill and a filled flux underfill to manufacture a flip-chip
09488438	6279889	2000-01-20	2001-08-28	Granted	United States of America	Loose die fixture
09440492	6373142	1999-11-15	2002-04-16	Granted	United States of America	Method of adding filler into a non-filled underfill system by using a highly filled fillet
09651308	6441499	2000-08-30	2002-08-27	Granted	United States of America	Thin form factor flip chip ball grid array
09928071	6534968	2001-08-10	2003-03-18	Lapsed	United States of America	Integrated circuit test vehicle
09406308	6306751	1999-09-27	2001-10-23	Granted	United States of America	Apparatus and method for improving ball joints in semiconductor packages
09417255	6425179	1999-10-12	2002-07-30	Granted	United States of America	Method for assembling tape ball grid arrays
09753000	6407462	2000-12-30	2002-06-18	Granted	United States of America	Irregular grid bond pad layout arrangement for a flip chip package
09612867	6465338	2000-07-10	2002-10-15	Granted	United States of America	Method of planarizing die solder balls by employing a die's weight
08853154	6115910	1997-05-08	2000-09-12	Expired	United States of America	Misregistration fidutial
09370856	6449748	1999-08-09	2002-09-10	Granted	United States of America	Non-destructive method of detecting die crack problems
09465132	6395097	1999-12-16	2002-05-28	Granted	United States of America	Method and apparatus for cleaning and removing flux from an electronic component package
08928826	6603200	1997-09-12	2003-08-05	Expired	United States of America	Integrated circuit package
09443036	6294840	1999-11-18	2001-09-25	Granted	United States of America	Dual-thickness solder mask in integrated circuit package
08935583	6166434	1997-09-23	2000-12-26	Expired	United States of America	Die clip assembly for semiconductor package

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09921028	6617866	2001-08-02	2003-09-09	Granted	United States of America	Apparatus and method of protecting a probe card during a sort sequence
09377887	6285077	1999-08-19	2001-09-04	Granted	United States of America	Multiple layer tape ball grid array package
09967195	6496081	2001-09-28	2002-12-17	Granted	United States of America	Transmission equalization system and an integrated circuit package employing the same
09467081	6225690	1999-12-10	2001-05-01	Granted	United States of America	Plastic ball grid array package with strip line configuration
09400767	6328347	1999-09-22	2001-12-11	Granted	United States of America	Uniform axial loading ground glass joint clamp
09345432	6150729	1999-07-01	2000-11-21	Granted	United States of America	Routing density enhancement for semiconductor BGA packages and printed wiring boards
09321298	6127726	1999-05-27	2000-10-03	Granted	United States of America	Cavity down plastic ball grid array multi-chip module
08869796	6225695	1997-06-05	2001-05-01	Expired	United States of America	Grooved semiconductor die for flip-chip heat sink attachment
09212366	6150175	1998-12-15	2000-11-21	Granted	United States of America	Copper contamination control of in-line probe instruments
09127486	6242814	1998-07-31	2001-06-05	Granted	United States of America	Universal I/O pad structure for in-line or staggered wire bonding or arrayed flip-chip assembly
09143083	6261870	1998-08-28	2001-07-17	Granted	United States of America	Backside failure analysis capable integrated circuit packaging
09932716	6759921	2001-08-17	2004-07-06	Granted	United States of America	Characteristic impedance equalizer and an integrated circuit package employing the same
09957410	6701270	2001-09-20	2004-03-02	Granted	United States of America	Method for reliability testing leakage characteristics in an electronic circuit and a testing device for accomplishing the source
12206786	8350379	2008-09-09	2013-01-08	Granted	United States of America	Package with Power and Ground Through Via
962020897	59609905.3	1996-07-24	2002-11-27	Expired	Germany (Federal Republic of)	Semiconductor device having a carrier and a multilayer metallization
08692852	5731635	1996-07-24	1998-03-24	Expired	United States of America	Semiconductor device having a carrier and a multilayer metallization
962020897	0756325	1996-07-24	2002-11-27	Expired	European Patent	Semiconductor device having a carrier and a multilayer metallization
962020897	0756325	1996-07-24	2002-11-27	Lapsed	France	Semiconductor device having a carrier and a multilayer metallization

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962020897	0756325	1996-07-24	2002-11-27	Lapsed	United Kingdom	Semiconductor device having a carrier and a multilayer metallization
962020897	0756325	1996-07-24	2002-11-27	Lapsed	Netherlands	Semiconductor device having a carrier and a multilayer metallization
101657385		2010-06-11		Application	European Patent	Electronic Device Package And Method Of Manufacture
099118956	I413210	2010-06-10	2013-10-21	Lapsed	Taiwan	Electronic Device Package And Method Of Manufacture
12483139	7993981	2009-06-11	2011-08-09	Lapsed	United States of America	Electronic Device Package And Method Of Manufacture
2010102027867	ZL2010102027867	2010-06-10	2016-01-06	Lapsed	China	Electronic Device Package And Method Of Manufacture
2010132552	5784280	2010-06-10	2015-07-31	Lapsed	Japan	Electronic Device Package And Method Of Manufacture
1020100054807		2010-06-10		Abandoned	Korea, Republic of (KR)	Electronic Device Package And Method Of Manufacture
2010040590	167757	2010-06-10	2013-07-31	Lapsed	Singapore	An Electronic Device Package And Method Of Manufacture
13174970	8384205	2011-07-01	2013-02-26	Lapsed	United States of America	An Electronic Device Package and Method of Manufacture
11717227	7667321	2007-03-12	2010-02-23	Granted	United States of America	Wire Bonding Method And Related Device For High-Frequency Applications
10853395	6894400	2004-05-25	2005-05-17	Granted	United States of America	Robust Electronic Device Packages
10879909	7745927	2004-06-29	2010-06-29	Granted	United States of America	Heat Sink Formed Of Multiple Metal Layers On Backside Of Integrated Circuit Die
10814062	7041561	2004-03-31	2006-05-09	Granted	United States of America	Enhanced Substrate Contact For A Semiconductor Device
10788162	7075174	2004-02-26	2006-07-11	Granted	United States of America	Semiconductor Packaging Techniques For Use With Non-Ceramic Packages
10697757	6987052	2003-10-30	2006-01-17	Granted	United States of America	Method For Making Enhanced Substrate Contact For A Semiconductor Device
09876522	6740222	2001-06-07	2004-05-25	Granted	United States of America	Method Of Manufacturing A Printed Wiring Board Having A Discontinuous Plating Layer
09329420	6313999	1999-06-10	2001-11-06	Granted	United States of America	Self-Alignment Device For Ball Grid Array Devices
09388242	6239382	1999-09-01	2001-05-29	Granted	United States of America	Device And Method Of Controlling The Bowing Of A Soldered Or Adhesively Bonded Assembly
09263075	6153506	1999-03-08	2000-11-28	Granted	United States of America	Integrated Circuit Having Reduced Probability Of Wire-Bond Failure
09123370	5936849	1998-07-27	1999-08-10	Granted	United States of America	Test Fixture Retainer For An Integrated Circuit Package

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09073279	6057700	1998-05-06	2000-05-02	Granted	United States of America	Pressure Controlled Alignment Fixture
08956527	5975408	1997-10-23	1999-11-02	Granted	United States of America	Solder Bonding Of Electrical Components
08824574	5975836	1997-03-26	1999-11-02	Expired	United States of America	Apparatus For Visually Reading Semiconductor Wafer Identification Indicia
08724129	5719449	1996-09-30	1998-02-17	Expired	United States of America	Flip-Chip Integrated Circuit With Improved Testability
08663336	5672913	1996-06-13	1997-09-30	Expired	United States of America	Semiconductor Device Having A Layer Of Gallium Amalgam On Bump Leads
08366539	5501777	1994-12-30	1996-03-26	Expired	United States of America	Method For Testing Solder Mask Material
12119575	7554133	2008-05-13	2009-06-30	Granted	United States of America	PAD CURRENT SPLITTING
13032429	8547681	2011-02-22	2013-10-01	Granted	United States of America	Decoupling Capacitor
12061728	8134232	2008-04-03	2012-03-13	Granted	United States of America	HEAT DISSIPATION FOR INTEGRATED CIRCUIT
098124922	I401440	2009-07-23	2013-07-11	Granted	Taiwan	Circuit Apparatus Including Removable Bond Pad Extension
12463718	7724023	2009-05-11	2010-05-25	Granted	United States of America	Circuit Apparatus Including Removable Bond Pad Extension
2009234710	5676868	2009-10-09	2015-01-09	Granted	Japan	Circuit Apparatus Including Removable Bond Pad Extension
2009056979	166712	2009-08-26	2012-07-13	Lapsed	Singapore	Circuit Apparatus Including Removable Bond Pad Extension
101564813	2251703	2010-03-15	2012-01-25	Completed	European Patent	Circuit Apparatus Including Removable Bond Pad Extension
101564813	602010000720.0	2010-03-15	2012-01-25	Lapsed	Germany (Federal Republic of)	Circuit Apparatus Including Removable Bond Pad Extension
1020090085791	10-1420174	2009-09-11	2014-07-10	Granted	Korea, Republic of (KR)	Circuit Apparatus Including Removable Bond Pad Extension
101564813	2251703	2010-03-15	2012-01-25	Lapsed	United Kingdom	Circuit Apparatus Including Removable Bond Pad Extension
12501686	8378485	2009-07-13	2013-02-19	Granted	United States of America	Improvement Of Solder Interconnect By Addition Of Copper
1020100066127	10-1704030	2010-07-09	2017-02-01	Granted	Korea, Republic of (KR)	Improvement Of Solder Interconnect By Addition Of Copper
099122029	I394632	2010-07-05	2013-05-01	Lapsed	Taiwan	Improvement Of Solder Interconnect By Addition Of Copper
101690105		2010-07-09		Abandoned	European Patent	Improvement Of Solder Interconnect By Addition Of Copper
2010158372	5604665	2010-07-13	2014-09-05	Granted	Japan	Improvement Of Solder Interconnect By Addition Of Copper
2010102269692	ZL201010226969.2	2010-07-12	2014-09-03	Granted	China	Improvement Of Solder Interconnect By Addition Of Copper

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13752524	8580621	2013-01-29	2013-11-12	Granted	United States of America	Solder Interconnect By Addition Of Copper
12327987	7787252	2008-12-04	2010-08-31	Granted	United States of America	Preferentially Cooled Electronic Device
2010102027994	10 1930935	2010-06-10	2014-07-23	Granted	China	Lead Frame Design To Improve Reliability
099118954	I411082	2010-06-10	2013-10-01	Granted	Taiwan	Lead Frame Design To Improve Reliability
12486592	8334467	2009-06-17	2012-12-18	Granted	United States of America	Lead Frame Design To Improve Reliability
101659696		2010-06-15		Application	European Patent	Lead Frame Design To Improve Reliability
1020100055837	10-1676038	2010-06-14	2016-11-08	Granted	Korea, Republic of (KR)	Lead Frame Design To Improve Reliability
13677547	8869389	2012-11-15	2014-10-28	Granted	United States of America	Method of Manufacturing an Electronic Device Package
12485238	8370777	2009-06-16	2013-02-05	Lapsed	United States of America	A Method Of Generating A Leadframe IC Package Model, A Leadframe Modeler And An IC Design System
12331561	8125091	2008-12-10	2012-02-28	Granted	United States of America	Wire bonding over active circuits
200880130797X	ZL200880130797.X	2008-08-21	2014-01-29	Lapsed	China	Mitigation of Whiskers in SN-Films
2011523783		2008-08-21		Abandoned	Japan	Mitigation of Whiskers in SN-Films
088199641		2008-08-21		Abandoned	European Patent	Mitigation of Whiskers in SN-Films
13059502	8653375	2011-02-17	2014-02-18	Granted	United States of America	Mitigation of Whiskers in SN-Films
098127625	I399461	2009-08-17	2013-06-21	Granted	Taiwan	Mitigation of Whiskers in SN-Films
12060387	7671450	2008-04-01	2010-03-02	Granted	United States of America	Integrated Circuit Package For High-Speed Signals
12220182	7727781	2008-07-22	2010-06-01	Granted	United States of America	Manufacture Of Devices Including Solder Bumps
12154794	7724359	2008-05-27	2010-05-25	Granted	United States of America	A Method Of Making Electronic Entities
12969852	8742535	2010-12-16	2014-06-03	Granted	United States of America	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
2011273948	5670306	2011-12-15	2014-12-26	Granted	Japan	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
2011104217470	ZL2011104217470	2011-12-16	2015-01-21	Granted	China	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
111930921		2011-12-12		Application	European Patent	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs

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1020110134104	10-1475108	2011-12-14	2014-12-15	Granted	Korea, Republic of (KR)	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
100142971	I463584	2011-11-23	2014-12-01	Granted	Taiwan	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
14251258	9613847	2014-04-11	2017-04-04	Granted	United States of America	Integration of Shallow Trench Isolation and Through-Substrate Vias into Integrated Circuit Designs
12151108	7671436	2008-05-02	2010-03-02	Granted	United States of America	Electronic Packages
12969836	8987137	2010-12-16	2015-03-24	Granted	United States of America	Method of Fabrication of Through-Substrate Vias
11973859	7888257	2007-10-10	2011-02-15	Granted	United States of America	Integrated Circuit Package Including Wire Bonds
13921707	9054064	2013-06-19	2015-06-09	Granted	United States of America	Stacked Interconnect Heat Sink
111747341		2011-07-20		Application	European Patent	Stacked Interconnect Heat Sink
2011158573	5885952	2011-07-20	2016-02-19	Granted	Japan	Stacked Interconnect Heat Sink
100121685	I413222	2011-06-21	2013-10-21	Granted	Taiwan	Stacked Interconnect Heat Sink
14678223		2015-04-03		Abandoned	United States of America	Stacked Interconnect Heat Sink
12840016	8492911	2010-07-20	2013-07-23	Granted	United States of America	Stacked Interconnect Heat Sink
1020110071262		2011-07-19		Application	Korea, Republic of (KR)	Stacked Interconnect Heat Sink
2011101997470		2011-07-18		Abandoned	China	Stacked Interconnect Heat Sink
11562537	7982307	2006-11-22	2011-07-19	Granted	United States of America	Integrated Circuit Chip Assembly Having Array Of Thermally Conductive Features Arranged In Aperture Of Circuit Substrate
11460459	7800879	2006-07-27	2010-09-21	Granted	United States of America	On-Chip Sensor Array For Temperature Management In Integrated Circuits
12194706	7973544	2008-08-20	2011-07-05	Granted	United States of America	Thermal Monitoring And Management Of Integrated Circuits
11375302	7479695	2006-03-14	2009-01-20	Lapsed	United States of America	Low Thermal Resistance Assembly for Flip Chip Applications
11158370	8664759	2005-06-22	2014-03-04	Granted	United States of America	Integrated Circuit With Heat Conducting Structures For Localized Thermal Control
11097796	7005880	2005-04-02	2006-02-28	Granted	United States of America	Method Of Testing Electronic Wafers Having Lead-Free Solder Contacts

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10997630	7221042	2004-11-24	2007-05-22	Granted	United States of America	Leadframe Designs For Integrated Circuit Plastic Packages
11015535	7956451	2004-12-18	2011-06-07	Granted	United States of America	Packages For Encapsulated Semiconductor Devices And Method Of Making Same
11095929	7408246	2005-03-31	2008-08-05	Granted	United States of America	Controlling Warping In Integrated Circuit Devices
13041674	8133799	2011-03-07	2012-03-13	Granted	United States of America	Controlling Warping In Integrated Circuit Devices
12163453	7598602	2008-06-27	2009-10-06	Granted	United States of America	Controlling Warping In Integrated Circuit Devices
200696225	5657188	2006-03-31	2014-12-05	Granted	Japan	Controlling Warping In Integrated Circuit Devices
12546083	7923347	2009-08-24	2011-04-12	Granted	United States of America	Controlling Warping In Integrated Circuit Devices
11049407	7242090	2005-02-02	2007-07-10	Granted	United States of America	Device Package
11049246	7235422	2005-02-02	2007-06-26	Granted	United States of America	Device Packages
10788678	7164200	2004-02-27	2007-01-16	Granted	United States of America	Techniques For Reducing Bowing In Power Transistor Devices
10722652	7429703	2003-11-26	2008-09-30	Granted	United States of America	Methods And Apparatus For Integrated Circuit Device Power Distribution Via Internal Wire Bonds
10955912	7367486	2004-09-30	2008-05-06	Granted	United States of America	System And Method For Forming Solder Joints
10702875	7314781	2003-11-05	2008-01-01	Granted	United States of America	Device Packages Having Stable Wirebonds
10960680	7122892	2004-10-07	2006-10-17	Granted	United States of America	Multi-Chip Integrated Circuit Module For High-Frequency Operation
10881191	7009305	2004-06-30	2006-03-07	Granted	United States of America	Methods And Apparatus For Integrated Circuit Ball Bonding Using Stacked Ball Bumps
10150790	6628001	2002-05-17	2003-09-30	Granted	United States of America	Integrated Circuit Die Having Alignment Marks In The Bond Pad Region And Method Of Manufacturing Same
09641899	6476472	2000-08-18	2002-11-05	Granted	United States of America	Integrated Circuit Package With Improved ESD Protection For No-Connect Pins
09614854	6358779	2000-07-12	2002-03-19	Granted	United States of America	A Technique For Reducing Dambar Burrs
09669278	6412680	2000-09-26	2002-07-02	Granted	United States of America	Dual In-Line BGA Ball Mounter

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09781423	6559535	2001-02-13	2003-05-06	Granted	United States of America	Lead Structure For Sealing Package
09465075	6417087	1999-12-16	2002-07-09	Granted	United States of America	Process For Forming A Dual Damascene Bond Pad Structure Over Active Circuitry
09492600	6309097	2000-01-27	2001-10-30	Granted	United States of America	Die Coating Material Stirring Machine
09351220	6276593	1999-07-12	2001-08-21	Granted	United States of America	Apparatus And Method For Solder Attachment Of High Powered Transistors To Base Heatsink
09480014	6252289	2000-01-10	2001-06-26	Granted	United States of America	Electrical Contact And Housing For Use As An Interface Between A Texting Fixture And A Device Under Test
09168638	6043876	1998-10-08	2000-03-28	Granted	United States of America	METHOD AND APPARATUS FOR DETECTING A SOLDER BRIDGE IN A BALL GRID ARRAY
09305732	6140710	1999-05-05	2000-10-31	Granted	United States of America	Power And Ground And Signal Layout For Higher Density Integrated Circuit Connections With Flip-Chip Bonding
09135969	6180241	1998-08-18	2001-01-30	Granted	United States of America	Arrangement For Reducing Bending Stress In An Electronics Package
09221726	6145385	1998-12-29	2000-11-14	Granted	United States of America	Measurement Of Mechanical Fastener Clamping Force
09133606	6028772	1998-08-13	2000-02-22	Granted	United States of America	Electronic Assembly Having Improved Resistance to Delamination
09173502	6110576	1998-10-16	2000-08-29	Granted	United States of America	Article Comprising Molded Circuit
09169117	5955683	1998-10-08	1999-09-21	Granted	United States of America	Method and Appartus for Detecting a Solder Bridge in a Ball Grid Array
09072248	6326685	1998-05-04	2001-12-04	Granted	United States of America	Low Thermal Expansion Composite Comprising Bodies Of Negative CTE Material Disposed Within A Positive CTE Matrix
08825923	5904859	1997-04-02	1999-05-18	Expired	United States of America	Flip Chips Metalization
08979063	6034441	1997-11-26	2000-03-07	Granted	United States of America	Overcast Semiconductor Package
08818813	5897333	1997-03-14	1999-04-27	Expired	United States of America	Method For Forming Integrated Composite Semiconductor Devices
08826606	5783465	1997-04-03	1998-07-21	Granted	United States of America	Compliant Bump Technology

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08803474	5778913	1997-02-20	1998-07-14	Expired	United States of America	Cleaning Solder-Bonded Flip-Chip Assemblies
08761047	5747982	1996-12-05	1998-05-05	Expired	United States of America	Multi-Chip Modules With Isolated Coupling Between Modules
09058505	6125042	1998-04-10	2000-09-26	Granted	United States of America	Ball Grid Array Semiconductor Package Having Improved EMI Characteristics
08498738	5735698	1995-07-06	1998-04-07	Expired	United States of America	Connector for Mounting An Electrical Component
08438296	5622305	1995-05-10	1997-04-22	Expired	United States of America	Bonding Scheme Using Group VB Metallic Layer
08884095	5773322	1997-06-27	1998-06-30	Expired	United States of America	Molded Encapsulated Electronic Component
08486844	5646451	1995-06-07	1997-07-08	Expired	United States of America	Multifunctional Chip Wire Bonds
12689806	8222745	2010-01-19	2012-07-17	Granted	United States of America	INTEGRATED HEAT SINK
08430665	5619068	1995-04-28	1997-04-08	Expired	United States of America	Externally Bondable Overmolded Package Arrangements