UNDERSTANDING THE SEMICONDUCTOR INTELLECTUAL PROPERTY (SIP) BUSINESS PROCESS

Finding, Evaluating and Licensing Commercial SIP

TABLE OF CONTENTS

1. SIP INDUSTRY OVERVIEW

Semiconductor intellectual property (SIP or IP[1], also referred to as virtual components or VCs) has existed since the advent of the semiconductor industry. In the early years, IC Suppliers such as Fairchild, Intel, TI and Motorola developed proprietary SIP (including data and circuit design expertise, process knowledge, packaging test equipment and other items) for their internal use. They fiercely protected their SIP through patents, trade secrets and other legal protections. Occasionally SIP was licensed to third parties, but this tended to be the exception rather than the rule.

Over the last decade, IC design productivity has failed to keep pace with Moore's Law and a "design gap" has emerged. This is despite the development of a $3 billion per year commercial electronic design automation (EDA) industry. In response to this increasing capacity, IC suppliers began looking for ways to close the gap between what engineers could reasonably be expected to design within a given time frame while still meeting schedules, and the capacity of the silicon (this is sometimes referred to as the "design productivity gap"). They began to develop reusable SIP that contained increasingly complex functionality. As the foundry model emerged, fabless IC companies adopted a customer owned tooling (COT) design flow and a block-based design methodology partly to leverage the cost advantages of the Foundry model, but also to allow mobility of design. Many of them developed their own SIP but outsourced when possible.

Perhaps the best example of the emergence of SIP as a discrete entity licensed to third parties is the ARM core from ARM Holdings PLC. ARM developed a RISC processor architecture initially for PCs; however, it saw a broader opportunity and began to offer an embedded processor core that could be used in application-specific integrated circuit (ASIC) design. ARM's product is available in both a soft (synthesizable) and hard version. Since the ASIC design flow many companies use relied on the use of "libraries" of standard cell, memories and I/Os as building blocks, a number of "library" suppliers emerged, notably Artisan Components. The high content of embedded memory in ASICs was also addressed by companies like Virage Logic. These IP blocks are used today by several pure-play foundries, including TSMC, UMC and Chartered, and also by many IDMs. The net result has been the emergence of a commercial SIP industry that grew to $757M in 2002 and is projected to reach $1.5B by 2007[2].

SIP is critical for the design and implementation of complex system ICs. As designs become more complex, a greater number of SIP products are being embedded in IC designs. SIP has become a key part of the electronic design process because it can reduce IC development costs, accelerate time-to-market, reduce time-to-volume and increase end-product value; in short, it can provide a solution that enables companies to bridge the "design gap."

However, in some ways the SIP commercial business infrastructure is like the western United States in the mid to late nineteenth century: wild, unpredictable and untamed. Providers have introduced a variety of business models intended to capture value, maximize revenue and accommodate customer needs. A major portion of the industry still consists of smaller private companies many of whom also provide design services. With the increasing use of commercial SIP from multiple sources and the wide variety of SIP business models, the process of finding, evaluating and purchasing SIP has become time consuming and more complex than it should be.

The Industry Baseline Working Group (IBWG) was formed by FSA's IP Subcommittee to develop a best practices baseline for the SIP industry; to standardize on business terminology and simplify the business of locating, evaluating and purchasing SIP from multiple sources. Our focus has been to provide a common terminology and SIP classifications (or "taxonomy", a term we will use throughout this document), provide

[1] It should be noted that IP is used throughout this document in the industry sense; when referring to the legal concepts of intellectual property the term "intellectual property rights" ("IPR") is used.
[2] In-Stat/MDR Reports, April 2003.

examples and a discussion of commercial issues that should help SIP Buyers to navigate through a host of business models, licensing contracts and evolving technical standards.

This document is intended to serve as a guide to educate and inform buyers and sellers on SIP. It is also intended to stimulate discussion and promote consistency in understanding different business models and licensing agreements that will simplify commercial SIP transactions. The IP Subcommittee plans to provide training and documentation on this topic as well as other future topics related to SIP, including quality, silicon validation, design reuse and a host of technical issues not covered in this document.

1.1 SIP Business Environment

SIP business practices include elements similar to those found in the traditional semiconductor or ASIC, EDA and design services markets. However, unlike the well-established business models in the ASIC and EDA industries, SIP business models tend to be more complex because several parties in the supply chain are involved with the successful deployment of commercial SIP in an IC design. For example, an IC that incorporates multiple SIP products may involve several SIP suppliers and more than one source of manufacturing. As a result, buyers may need to manage multiple vendors in the supply chain, each with different business models and technical capabilities.

While some uniformity in business practices and SIP business models has emerged, the industry has not yet standardized due to the wide variety of SIP product types, customer needs and frequent changes in EDA tools and process technologies. SIP products are generally available in two forms - soft and hard. In addition, there are several classifications of SIP Products such as, foundation, processor, memory, library, analog/mixed-signal and connectivity SIP. Other classifications of SIP such as verification or software SIP may also be included in the above products, or marketed separately as stand-alone products. The form and type of SIP products can influence the price of a license to the SIP product, how readily available it is, how often it is updated, the type of support it may require, and how quickly it can be integrated in the end product. The value of an SIP product also varies based on customer utilization.

The following description should help the reader gain a basic understanding of the forms and types of SIP and at the same time appreciate the complexity of the industry. It is also hoped that the reader may appreciate why to date no consistent business models have emerged, as has been the case in the ASIC industry:

Soft SIP – This is usually offered in high-level language (usually RTL C++ Verilog or VHDL) or sometimes in netlist format. Soft SIP is generally portable (it can be moved from one foundry process to another without great difficulty), but it is not optimized for a specific process technology. Thus, the power, performance and area are not known until it is committed to a specific process technology and library. The value of the SIP is typically its functionality, reusability, availability and possible conformance to an industry standard specification such as Universal Serial Bus (USB) 1.0, ARM AMBA 1.0, PCI or IEEE 802.11. Some suppliers of soft SIP may also provide netlist or programming data that would allow implementing the SIP in a field programmable gate array (FPGA) for validation or in a finished product.

Hard SIP – Hard SIP is usually offered in GDSII format along with an accompanying set of EDA views or models, and is optimized for a specific foundry process. It may also be offered in “bit-stream” format if the originating soft SIP was ‘hardened’ for a particular FPGA device. Hard SIP often has a data sheet detailing items such as power, speed and area similar to that found with a finished discrete IC. Examples of hard SIP include processors, standard cells, memories, phase locked loops (PLLs), I/Os and analog blocks. Hard SIP is generally not portable to another foundry process and even though portable libraries exist (usually consisting of standard cells, I/Os and memory) they are generally not optimized for any specific foundry. Some suppliers of hard SIP conduct extensive silicon validation on test chips to ensure high quality and yield.

Foundation SIP – This often includes standard cell libraries, PLLs, I/Os and small macros. It is readily available mostly as hard SIP and is usually offered as a single package; that is, several items of foundation SIP are licensed to the end user as a single package and not as discrete SIP products. General-purpose foundation SIP may be offered at no cost by suppliers and foundries to attract customers. Specialty foundation SIP (i.e. low power or high performance) is typically priced based on specific customer needs, level of customization and process technology supported.

Memory SIP – Memory SIP is generally provided as hard SIP targeted at a specific process node, sometimes together with memory compilers. A wide variety of memory types and specifications are often needed on a single system IC. This can include SRAM, non-volatile (Flash, EEPROM), DRAM and 1T-SRAM. Higher density memories may be offered with redundancy to improve yield, error detection and correction, and even integrated test and repair. SRAM types may include single- and dual-port (1rw, 1r/1w, 2rw) register files and SRAMs; multi-ports; CAMs and custom designs that may be further optimized for area, power or speed. Memories can be generated with memory compiler tools created with foundry and process specific bitcells or on an individual basis as macros. Memory compilers enable users to customize specific features such as aspect ratio, power bussing, redundancy, etc. On the 130nm process node, as many as 25 different memory compilers may be needed to support designs. Since memory uses special design rules that allow for higher density, it is a “defect magnet”. It is often used to drive silicon processes so validation is a key requirement.

Connectivity SIP – This is also known as standards SIP; it implements a given specification or standard such as USB, PCI, IEEE1394 (commonly known as “Firewire”) IrDA, Bluetooth or 802.11. Connectivity SIP may be available in soft or hard form. Its availability is often closely related to a specific revision of the standard it supports, which may be continuously evolving. While “connectivity” generally refers to off-chip buses or interfaces, it could include on-chip buses such as AMBA or OCP.

Processor SIP – Processor SIP includes microprocessors, digital signal processors (DSPs), MPEG and others. It is typically available in soft form and may be hardened to support any process technology. Some foundries offer hardened processors for companies that do not already have a license or want to know what specifications will be at the time of selection. When referred to as “silicon proven” this means only for selected process technologies. Processor SIP tends to be of the highest value because of its rich architecture, software and hardware support infrastructure.

Analog SIP – This includes a variety of functions such as digital to analog converters (DACs) or analog to digital converters (ADCs), crystals, voltage detectors and other items. It is always provided in hard form and for a specific manufacturing process technology. It is highly sensitive to process changes and may require re-design if these changes occur during IC implementation.

Platform SIP – Platform SIP is an emerging segment of the industry focusing on products that enable development of a “structured ASIC”, application-specific standard product (ASSP) or platform. This may include system-level integration functions and some programmability (modular array ASIC, metal programmable logic, FPGA cores, and non-volatile memory) that allows the platform to be used by multiple companies. Platform SIP can include bus interconnect architectures, power, clock and other physical structures.

Further adding to the complexity of SIP business models is the variety of distribution channels, each of which may influence how the SIP is licensed, maintained and supported. For example, certain foundation SIP may be downloaded from the Web site of the provider or foundry, though most commercial processor and memory SIP products are licensed through a direct sales channel and require longer technical evaluations and more complex licensing agreements. Most specialty SIP (cell libraries, I/Os and analog SIP) may require

close interaction with foundries (some of which offer their own specialty SIP directly, through providers or through EDA vendors).

In addition, it is common in the industry to develop custom-built SIP through a service contract and subsequently offer it as stand-alone product when it matures. Once the SIP matures, it may be classified as a "commercial" product that is offered with technical support, including maintenance updates when the foundry design rules change or when re-characterization is required due to process changes.

1.2 Sourcing SIP Products

Deciding whether to develop internally or source commercial SIP products depends on several factors such as whether or not the SIP product meets the specific project requirements, availability, specification, cost, number of sources, the reputation of suppliers and number of foundries supported. Outsourcing is unlikely if the SIP product is seen by the potential buyer as a core competency or a key differentiator in his product, or if its use requires third-party access to the buyer's patents or trade secrets. To simplify the process of finding, evaluating and purchasing SIP products, the above factors should be considered as a starting point in the planning stages of a design project.

Finding – Finding the SIP product can be as simple as browsing Internet based SIP product catalogs or Web sites from providers and foundries. The difficulty is usually in determining the suitability of an SIP product for a given application. In the early stages of the design and during the system-level architecture phase, the primary focus tends to be on high-level requirements, what types of functions are needed, where to get the SIP Product, how available it is and what it costs. The manufacturing source is often overlooked or seen as a secondary concern, unless the buyer has already chosen the foundry. However, the manufacturing source should be considered up front and together with the choice of the SIP product, as it can affect availability, cost and specifications, particularly for hard SIP products.

Evaluating – Evaluating the SIP Product to determine whether it is technically and commercially feasible to instantiate an SIP product in a given design is a more complex process. It requires knowing the variety of SIP product types and forms, maturity, process mobility and business models involved. It may be very hard to perform a "like for like" comparison of the economic value for two similar different SIP products. Some key factors that potential buyers of SIP products should consider are:

- **SIP Form –** If the SIP product is in soft form, then buyers should consider what it would take to prove the SIP product in silicon, and factor in the cost of physical design on top of the SIP product's price. If the SIP product is in hard form, then buyers should consider how mobile it is and factor in the cost and risk of changing foundries, if need arises.

- **SIP Type –** If buyers are looking to source a connectivity SIP product, then they should consider how frequently the standard is changing, whether the SIP product complies with the standard, and what updates the provider will offer if the standard changes. If buyers are looking to source a processor SIP product, or any other complex functional SIP product, then they should evaluate whether its architecture and software tools meet their specific needs, and factor in the cost of any modifications needed. If buyers are looking to source specialty or analog SIP products, then they should consider its silicon performance and how it may be affected by process variations.

- **SIP Mobility –** If buyers are looking to source a hard SIP product, then they should consider how mobile or how portable it is. This is a key factor that should be evaluated upfront with the manufacturing source. Foundry-provided SIP products are usually not technically portable, or their use in another foundry process may be restricted by license. This presents a potential time-to-market risk during shortages in foundry production capacity. Buyers should carefully weigh the pros

and cons of sourcing SIP products that cannot be moved. Alternatively, buyers can look for multiple sources of SIP products they might substitute if replacement becomes necessary.

Licensing – Licensing the SIP is the final step in the sourcing process. This step can be very time consuming, considering the variety of business models and licensing agreements that can vary based on the buyer's needs, SIP product form, type and process technology. In addition, if more than two parties are involved, licensing transactions may be more complex as there may be additional considerations relating to cost, mobility and sublicensing.

1.3 Scope of This Document

It should be clear that the process of sourcing SIP products is complex and depends on a number of variable factors, some of which can be controlled by the buyer, and some, which cannot.

Because of this complexity and the relative immaturity of the SIP products industry, the IBWG concluded that any attempt to standardize on business models would be counter-productive. It was the consensus of the IBWG that it would be more appropriate at this stage of the industry to develop a taxonomy of typical SIP business models and licensing provisions to better aid common understanding and reduce friction in business negotiations.

Through a better understanding of the most typical business models and licensing practices, and promoting this understanding to the SIP buyer and provider community at large, the IBWG hopes to remove some of the uncertainty inherent in SIP product sourcing and facilitate the development of a more robust industry for SIP products.

1.4 Baseline Terminology

Even though some of the SIP products business models originated in EDA, SIP products can be very different from EDA products in how they are licensed, maintained and supported. In general, soft SIP products tend to bear more resemblance to EDA – and indeed to the software industry in general – than do hard SIP products. Hard SIP Products tend to bear more resemblance to discrete ICs and are treated very differently. In order to avoid any confusion it is necessary to define some key terms that are used through the remainder of this document:

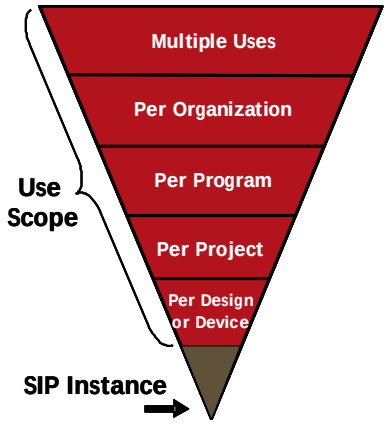
SIP Product – In this paper, the term "SIP product" means the design files, models characterization data, test benches and other items that make up the product offered by providers to buyers. An SIP product is a "virtual good" that is licensed to one or more buyers while ownership of the underlying IP rights remains with the provider. SIP products have detailed functional specifications and - if hardened – well defined operating characteristics, all of which are essential for integration into the end device, as well as achieving its intended functional specifications.

SIP Purchase – The term "SIP purchase" means the non-exclusive transfer of a limited subset of the provider's IP Rights (IPR) in an SIP product to a buyer. With an SIP purchase there is normally no wholesale transfer of ownership of the IPR in the SIP, rather there is the granting of a license to some limited IPR from the provider to the buyer. An SIP purchase is usually accomplished through an SIP License Agreement.

SIP License Agreement – In this paper, the term "SIP License Agreement" means the contract that defines the terms of the SIP purchase; more simply it defines how, where and when the buyer may use the SIP. This typically includes the right to manufacture ICs containing instantiation(s) of the SIP and may limit the use of SIP to a pre-defined field.

SIP Rights – The term "SIP rights," means the scope of permissible uses for the SIP defined in the SIP License Agreement. The SIP rights may vary depending upon the SIP form, type, maturity, provider's

business objectives and buyer's needs. SIP rights are broken down into five basic categories, *use, copying, modification, distribution and sublicensing.*



SIP Instance – In this paper, the term "SIP instance" means a specific configuration of the SIP that can be used one or multiple times as defined in the SIP rights "use" category.

SIP Use Scope – The term "SIP use scope" means a set of restrictions that are determined by the business model and the license agreement. SIP use scope is generally broken down into the categories described in Table 1.1.

SIP use scope can range from narrow to broad, which suggests that - unlike EDA licenses that are tracked by the number of CPUs or number of users - SIP is tracked by its usage and restrictions that are intimately related to the SIP value.

SIP Tracking – In this paper, the term "SIP tracking" refers to the technical measures implemented by providers to identify, track and monitor usage of their products. A typical mechanism for tracking a hard SIP product is to assign special layers in the SIP Product used for identification purposes and to restrict buyers by license from modifying these layers. The VSIA has published a spec for the identification and tagging of hard SIP, which can be found at http://www.vsi.org/resources/VSIAStandards.htm.

Table 1.1: SIP Use Scope

Per Design	An IC intended to be manufactured and distributed commercially
Per Project	One or multiple chip designs for a single application segment
Per Program	One or multiple projects for a variety of application segments
Per Organization	One or more geographies (incl. corporate-wide) and/or programs
Multiple Uses	Many uses over a period of time for given process technologies

2. FINDING SIP AND RELATED PRODUCTS

Direct Sources – Buyers can locate SIP products, related tools and design services directly through the web sites of providers, foundries, EDA vendors and broad line IC suppliers. Appendix A provides a list of vendors who are currently members of FSA, some of whom are members of the IP Subcommittee. Some companies provide products in more than one area. FSA has developed a Suppliers' directory that lists all FSA members and the services that each provides. It is available for FSA members only at: https://www.fsa.org/directories/suppliers/index.htm

Internet Catalog Listings – A popular method for locating SIP products is though on line Internet catalog listings, such as the Virtual Component Exchange (VCX) and Design & Reuse (D&R). Both sites include a comprehensive listing of SIP organized by provider, type, application segment, etc. as well as search engines to find the SIP.

- **The Virtual Component Exchange (VCX) –** The VCX develops and licenses Internet tools for trading SIP, and delivered the first regulated IP exchange server technology for trading SIP: the VCX TradeFloor. TradeFloor tools link the engineering, procurement and legal functions of both buyers and sellers with a common toolset and language. Alignment of data evaluation, access and contracting protocols between buyers and sellers, using industry standards, dramatically accelerates the speed of SIP transactions, helping move more products to market in shorter time

cycles. Distributed Internet access to the VCX TradeFloor is provided through the VCX Gateway — distributing VC data and transaction agents to the Web-based market, extending the reach and value for buyers and sellers alike. (www.thevcx.com)

- **Design & Reuse (D&R) –** D&R is focused on providing a global collaboration network for sharing design resources in the IC industry, including IP, design centers, EDA tools, process technologies and supply-chain exchange software. D&R offers a wide variety of listings on silicon IP, software IP and verification IP. (www.design-reuse.com)

- **Open Cores –** This group is focusing on providing an open source forum for designers to publish reusable core designs. Open Cores' objectives are to develop standards, create tools and methods and provide documentation for open cores and platforms. Core designers are encouraged to use free tools and share designs. (www.opencores.org)

SIP Industry Consortia – Additional information on SIP can be obtained by monitoring the progress of industry consortia, standard bodies, initiatives and working groups active with SIP issues:

- **FSA IP Subcommittee –** The IP Subcommittee is an FSA sponsored group focused on industry initiatives on SIP related subjects such as, hard SIP quality, SIP portability, business models, licensing and other topics driven by FSA members and current or future needs. These include working groups on the above subjects coupled with educational initiatives for the design community. http://www.fsa.org/committeess/ip

- **The Virtual Socket Interface Alliance (VSIA) –** The VSIA is an industry body focused on the definition and adoption of SIP technical standards and interfaces, to enable SIP products to be used as plug-and-play components. The VSIA's vision is to improve dramatically the productivity of system-on-chip (SOC) development by specifying open standards and specifications that facilitate the integration of SIP (as a component) from multiple sources. (www.vsi.org)

- **The Silicon Integration Initiative (Si2) –** Si2 is a user-driven organization of industry-leading silicon systems and tool companies focused on advanced silicon system integration issues and associated design environments to improve design productivity and reduce cost in creating and producing integrated silicon systems. (www.si2.org)

- **The RosettaNet Consortium** – This is a consortium of major information technology, electronic components, semiconductor manufacturing and telecommunications companies working to create and implement industry-wide, open e-business process standards. These standards form a common e-business language, aligning business processes in the supply chain. (www.rosettanet.org)

Infrastructure Tools – Finding, evaluating and managing SIP products across the SIP supply chain (or internal SIP repositories) can be simplified with e-commerce and/or infrastructure tools for SIP trade and management.

The VCX, Si2 and Synchronicity, have developed tools that can greatly optimize the process of finding, organizing and sharing SIP data and deliverables. More can be found at http://www.si2.org/si2_publications/ecix/pdf/datepaperquickvc.pdf

Similarly, Design & Reuse offers tools for cataloging, managing and exchanging SIP over the Internet, and tools for SIP repository management and version control. More can be found at http://www.us.design-reuse.com/eda/?id=2

Emerging Initiatives – A number of new initiatives were recently launched in the areas of SIP integration and process design kits (PDKs) that may be worthwhile to monitor:

- **The SPIRIT Consortium** (Structure for Packaging, Integrating and Re-using IP within Tool Flows) aims to ensure SIP metadata can be easily transferred between SIP providers, EDA vendors and semiconductor and systems companies. More can be found at http://www.spiritconsortium.com

- **The OK (Open Kit) Initiative** is a recently formed working group focusing on establishing some fundamentals, such as naming conventions and delivery mechanisms around PDKs with an initial focus on digital custom design.

3. EVALUATING SIP BUSINESS MODELS

3.1 Introduction

Buyers who deal with multiple sources for SIP products may have difficulty coping with the variety of business models, and the different fees involved. Often, it is very difficult for buyers to compare the value of similar – or even functionally identical – commercial SIP products. Unlike the ASIC and EDA marketplaces that have mature and relatively consistent business models, the SIP business infrastructure can be confusing. Buyers often feel that it takes a significant effort to decide whether to design or source SIP products from third parties because it is tedious to determine the economic value of different SIP products.

Without any objective means to compare differing business models, some of the value of design reuse may be lost. Two identical SIP products purchased on different business terms may have different value when analyzed in light of the buyer's specific needs. As a result, what is needed first is an objective taxonomy of the prevalent business models in the current SIP product marketplace. By using this taxonomy, Buyers can sort out the economic elements among different business models and make informed decisions on whether to design or source SIP products.

The following section contains a description of the prevalent business models in the current SIP product marketplace, what is typical to expect from different providers, and considerations for determining the economic value of different SIP product types. The discussion of each business model includes:

- The purpose of the particular business model
- A definition of the payment options
- Typical structure of the fees paid
- Most common SIP use scope for the SIP products

Table 2.1 provides a summary of the principal attributes of business models for established providers and SIP products. While this may appear to be a simplification, in reality a typical SIP purchase may involve elements of more than one business model.

Table 2.1: Typical Business Models for SIP Products

	Per Use	Time Based	Royalty Based	Access
Purpose	Fee for each SIP on defined use scope	Multiple uses of SIP over a period of time	Amortize cost of SIP Share Risk-Reward	Fee for SIP portfolio over a period of time
Payments	Event Based	Time Based	Value Based	Subscription Based
Structure	One time fee for a design (first or subsequent)	Fee for all designs within a given time	Some or all fees spread across units	Up Front Fee plus discounted use fee
Scope	Per Design Per Device	Multiple Uses Per Device	% of Unit Value Per Device	Multiple SIPs Per Organization

Sources: SIP Business Overview - Dan Caldwell - Virage Logic; SIP Market – Gartner Inc.; Selected SIP vendors

Another aspect of determining the economic value of an SIP product is related to the different fees for enabling the successful use of the SIP product.

Table 2.2: Typical Enabling Components for SIP Products

	Maintenance	Support	NRE	Contract Service
Purpose	SIP updates, bug fixes, and revisions	Address specific customer needs	Enable SIP use	Enable IC design
Payments	% List Price License Fee	Scope Based	Milestone Based	Hourly Based
Structure	Part of Initial License Agreement (May be included)	Basic Package or, Separate Contract	Initial Fee % Milestones	Initial Fee (SOW) % Milestones
Scope	Changes in spec, process tech, etc.	Web, Email, Tel, On-Site, Geography	Modifications, re-spins, porting, etc.	Tool runs, IC Integ, EDA Views, etc.

Sources: SIP Business Overview - Dan Caldwell - Virage Logic; SIP Market – Gartner Inc.; Selected SIP vendors

Table 2.2 provides the typical enabling components that usually represent a secondary revenue stream for providers. These are often structured as separate fees within the SIP License Agreement itself, or sometimes as a separate Statement of Work (SOW) or contract if there are specific needs that are non-standard. These components enable:

- The use of the SIP product itself
- The IC design in which the SIP product is instantiated
- Specific needs relating to SIP product use and deployment

Use of consistent terminology when discussing SIP product business models and their enabling components is essential in the industry, particularly where SIP purchases from multiple suppliers are involved. Consistent terminology can simplify negotiation, provide a consistency in the structure of payments, and align expectations between two parties in the SIP purchase.

3.2 SIP Business Models

3.2.1 Per Use Model

In the per use model, the SIP purchase gives the buyer the right to use each SIP product within a defined SIP use scope. The per use model is common where the SIP product requirements and usage are well understood early in the design phase. The fee paid may apply to a specific SIP product instance (such as a single use of a DSP core) or an SIP configuration containing several instantiations of the SIP product that may be treated as a single use (such as instantiating multiple SRAMs in a single IC design). Since what constitutes a “use” is often the subject of disagreement, it is important for providers and buyers to agree early which “uses” trigger payment obligations and which do not.

The payments in a per use model typically include an initial fee for the first use normally paid upon execution of the SIP License Agreement. If the SIP product requires some development work to meet the needs of the buyer’s application, then the initial fee may be a percentage of the license fee with subsequent portions being paid upon a milestone or an acceptance event (such as the delivery of EDA views or GDSII files to the buyer).

The per use model often includes a subsequent discounted reuse fee that is paid for a new SIP use scope. If there is a reuse fee, it is typically paid when the end product goes to production and not for prototype runs or bug fixes.

Other fees may be paid for derivative uses of the SIP product; these may include modifications, re-spins or new configurations of the SIP product. Derivative uses are generally treated as an NRE and often subject to a new contract, but some providers may treat such derivative uses as an entirely new product with a new SIP use scope.

The SIP use scope in a per use model is usually per device, or per project (which may include one or multiple chips), and the right to manufacture is normally restricted to a specific process technology.

3.2.2 Time Based Model

In the time-based model, the SIP purchase gives the buyer the right to use the SIP multiple times over a defined time period. The time period may be explicit, such as a fixed date, or implicit in that the use of SIP may be restricted to a specific process technology that will become obsolete over time.

The time-based model for SIP products is different from the time based license (TBL) model used in the EDA industry. In a TBL, the user licenses the right to use a tool and the IP in the work product of that tool belongs to the user. By contrast, the time based model for SIP products usually provides the buyer with the right to design and manufacture with the SIP. In most SIP time-based models, there is no transfer of the underlying IP rights in the SIP product. In addition, maintenance and support for SIP products is different from EDA tools; this will be discussed later.

The payments in a time-based model include an initial fee paid on signing of the SIP License Agreement. This fee normally covers multiple uses during a specified period of time or limited to a specific process technology node. The SIP License Agreement may expire at the end of the time period and/or end of life of

the specified process technology, although it may be renewed on expiration or sometimes if the buyer adopts a new foundry or process technology.

Some SIP products may be offered in both per use and time based models. In such a case, the buyer should expect the pricing of the time based model fee to be some multiple of the per use fee. For example, the fee for a perpetual license of a foundation SIP product may be between three to five times the amounts for a per use model.

In some SIP products that include companion software there may be a TBL of the software that is separate from the license for the SIP product. There are two types of companion software: generators and embedded software. Examples of generators include memory compilers, programmable processors (parameterized SIP), and PLL compilers. Examples of embedded software – which may also be offered as stand alone software IP- include application layers, device drivers, protocol stacks and real-time operating systems (RTOS).

The SIP use scope in the time-based model is generally unlimited. Buyers can use the SIP product as many times and in as many projects as they wish within the time limits of the SIP License Agreement.

3.2.3 Royalty Based Model

An increasingly common model in the SIP products industry is the royalty based model. Here, the provider and the buyer agree to amortize a portion of the license fee over the life cycle of the end product and thereby share the risks and rewards of the SIP product's use. The royalty-based model may be appropriate for buyers who wish to minimize their up-front costs and SIP providers who are willing to accept a lesser amount upfront in return for potentially greater long-term rewards if the buyer's end product is successful.

In the royalty-based model, there is an ongoing payment of consideration tied to some objectively quantifiable measure, such as the number of units sold or the number of wafers manufactured. The royalty-based model is most common in the licensing of highly differentiated SIP products and may include other parties to the agreement such as the foundry who manufactures the device instantiating the SIP. In some cases, royalties are paid by foundries, such as in the case of foundation SIP products; in other cases, royalties are paid by the end user such as in the case of processor SIP products and specialty memory SIP products.

Payments in the royalty-based model typically include an initial fee paid upon execution of the SIP License Agreement, followed by subsequent per unit fees based on some measurable criteria agreed up front between the provider and the buyer. In certain cases the initial fee may be discounted, waived or treated as an advance recoupable against ongoing royalties. Per unit fees usually apply to the total number of production units manufactured. Royalties are normally due and payable within 30 days of the end of the calendar quarter in which the units are shipped, or in which the defined criteria have been met. Providers normally include audit provisions in the agreements to ensure timely and accurate royalty payments.

The SIP use scope in the royalty-based model is normally on a per unit basis, the "unit" being the device in which the SIP product is instantiated, typically the finished end product or the wafer. For most SIP types, payments are structured as a percentage of the manufactured cost or the average sales price (ASP) of the end product. When the SIP product is replacing a discrete device such as analog or memory, payments may be structured as a flat ASP per unit calculated as a percent of the price of the equivalent discrete IC minus packaging, manufacturing and testing costs. For other SIP products, payments may be structured as a percentage of the measurable value the SIP product provides to the end product. For example, a royalty may be structured as a percentage of the cost savings due to die size or yield improvement; or a percentage of the end product price premium gained due to performance improvement.

It may often be the case that additional royalties have to be paid to a third party. It is important for buyers considering a royalty model to be aware whether such royalties apply. Failure to do this may result in unexpected cost and delay in the use of the SIP product. Some of these payments may be part of a well-defined royalty or patent pool, such as the MPEG or IEEE1394 that normally requires payment of a royalty by the end equipment manufacturer; others may be less well defined and might require additional payments of different amounts to one or more participants in the pooling arrangement. These third party royalty scenarios all differ in some respects, so it is important for buyers to look into whether they are facing such payments for use of a particular SIP product before committing to the use of an SIP product.

3.2.4 Access Model

In the Access model, the buyer generally is granted access to an SIP product portfolio for a defined period. This model may be useful when the buyer does not know his design needs up front. It may also be attractive for design service groups that are seeking to widen the range of market application segments they support and thereby attract more design projects. The advantage of the access model is that it allows the buyer lower cost access to a wide range of SIP products that may be used as and when needed.

The payment structure for the access model generally includes some sort of up-front fee paid upon execution of the SIP License Agreement. This fee enables the buyer to design with any of the SIP products and in some cases may include the right to manufacture products using the SIP products. There may also be a subsequent annual fee that is sometimes discounted based on usage. In some cases, there may be an additional per use fee paid upon production, if the SIP product is used in a manufactured device.

The actual amount of the access fee varies based on a number of factors such as the breadth of the SIP product portfolio accessed, the target application segments, and the buyer's specific support requirements. In some cases, providers may provide a design service company with access to an SIP product portfolio at no charge in exchange for a license fee paid by the end customer. In other cases, providers may discount the access fee for design aggregators such as IDMs or Fabless ASIC vendors, in exchange for alternative revenue streams, such as tape-out fees or royalties.

The SIP use scope for the access model can be broad and may include multiple uses-per-project, site or location, or be unlimited across the buyer corporation and its subsidiaries. The right to manufacture may include the right to use multiple foundries and process technologies.

3.3 SIP Product Enablers

As mentioned previously, the above license fees represent a primary revenue stream for established providers. Another aspect of the SIP products business is the customer's ability to successfully deploy and deliver end products instantiating the SIP product. As a result, it is common for providers to offer additional services. Because these services and associated fees enable either the SIP or the end product, the IBWG has termed them SIP enablers.

3.3.1 Maintenance

Before discussing the particulars of maintenance, it is important to draw a distinction between warranty, maintenance and the support of an SIP product. Warranty repair is discussed in Section 4.9. Maintenance is related to the SIP product's specifications and applies only to the SIP product as a discrete entity. Support on the other hand is primarily related to the specific customer needs, which may be intimately linked to the SIP use scope.

Maintenance for soft SIP products is similar to the concept in the EDA business. It covers the provision of minor updates, bug fixes and any other revisions to the SIP product because of a change in functionality or

specifications. Maintenance for hard SIP products is much more resource intensive, since it must include the costs of manufacturing and testing enough devices to ensure conformance to specifications and achieve silicon performance. Since the quality and performance of SIP products depends on numerous external factors such as changes in standards, process technologies and EDA tools, maintenance is a major cost component of the SIP products business. This may be amplified by the fact that maintenance costs may need to be amortized among a smaller number of users.

Maintenance fees are calculated based on the list price of the initial SIP product and they usually range from 12% to 18% per annum. Unlike the SIP license fee that is sometimes discounted, maintenance is usually not discounted.

Maintenance may be provided under a separate agreement whose term might extend beyond the term of the SIP License Agreement. Some providers may occasionally bundle the cost of maintenance into the license fee or require that the buyer take a maintenance contract that runs with the term of the SIP License Agreement. In addition, they may also include basic support such as email, telephone and on-site support as part of the maintenance offering. However, this does not reflect the norm of the industry and it is likely to phase out as the SIP Products industry matures.

It is essential for buyers to understand what services are provided under maintenance, and what services are not. To ensure that there are no future surprises, buyers should consider the following factors for each SIP product they seek to license:

- **Changes in Functionality and/or Specifications –** Which updates are covered and which are not. What are the functional corner cases and the test bench coverage? What changes are needed to adhere to changes in the specification and what is covered under warranty?

- **Process Technology –** Which and how many updates are covered for the licensed process node. How will process changes affect the SIP product's silicon performance? How portable is the SIP product and what mobility alternatives does the provider offer?

- **Connectivity Standards –** Which revision of the standard is supported? How is compliance with the standard ensured? How does the provider handle future standard changes?

- **EDA Tools and Formats –** Which EDA tools, models and what interface formats are supported? Which tool version is supported? How often are the EDA tools views and models updated? What is provided as part of maintenance?

- **End Product Integration –** How does the SIP product perform in the context of the IC? What are the corner cases? What services are offered to enable the IC using the SIP Product?

Most providers will typically specify what nonconformities are covered and how many updates are included to cover changes in process rules, EDA tools and future revisions of standards. For example, certain process corners may be not covered, or there may be limit on process changes may be covered; or for some types of SIP products and leading-edge process nodes, any new characterizations may be treated as NRE and not covered under the maintenance agreement.

Buyers should insist on clear, unambiguous statements of how often updates are made available, response times for bug reports and the provider's stated time commitments for fixes to critical, serious and minor bugs.

3.3.2 Support

Because the SIP use scope varies by business model, SIP product type and customer needs, the support requirements for different customers may vary significantly. As a result, it is difficult to generalize as to what constitutes "standard" support for SIP products. Even though most providers offer a pre-defined basic support package, support is often negotiated separately and is in a separate contract.

The pre-defined basic support package usually includes email support, some kind of Web-based "helpdesk" and possibly phone access to application engineering staff. Others may provide some basic level of on-site application engineering support and/or some measure of R&D support.

Often providers may also offer tiered or custom support packages that extend the level of support based on the buyer's needs and the demands such support places on the provider's engineering resources. These packages are priced based on the level of support needed by the buyer and the resource commitment required by the provider; the number of users, simultaneous projects and multiple geographies that must be served may complicate this pricing. These support packages may specify a pre-defined level of support by the number of engineers, simultaneous projects or geographies served. They may also include training, expert support for SIP product modification and expert support on the end application.

Buyers should make sure that the support contract clearly identifies which services are covered and which are not as part of a standard support package. In addition, they should anticipate the future levels of SIP product usage and expertise requirements and work with the provider to determine an appropriate level of custom support, if needed.

3.3.3 NRE Charges

NRE fees are typically paid to a provider to adapt, modify or optimize an existing SIP product, or sometimes to develop new custom SIP products designed for the buyer's specific needs. As such, NRE fees are paid to enable the use of the SIP product: the engineering work is central to the functionality of the SIP product and not necessarily the end application.

With an NRE contract there is typically an initial fee paid upon execution of the agreement followed by subsequent fees paid on a per milestone or event basis. Fees tend to vary based on the agreed scope of ownership of the IP rights (IPR) in the resulting SIP product(s). Providers may charge a lower fee and grant buyers a limited license, but if the buyer wishes to own all of the IP rights in the SIP product then the fee will be significantly higher. In some rare cases, the newly developed SIP may result in some form of joint ownership where multiple SIP products are merged into a new one; this may complicate business transactions if both parties plan to offer the SIP product commercially.

Some providers believe that any SIP product that comes from modifications is an entirely new product that must be treated as such, with a new SIP License Agreement and a new SIP use scope. This classification of the modified SIP product as a new SIP product is largely due to revenue recognition principles that may favor new products over ongoing NRE. If the SIP is treated as a new product, the provider can recognize most of the revenue upon delivery to the buyer. If on the other hand modifications are treated as NRE, then the payments to the provider are normally event based and could involve special acceptance criteria that can delay recognition of revenue.[3]

The scope of NRE work may vary with the SIP form, type and maturity. Examples of minor NRE work are simple SIP product modifications, custom configurations and ports to a new foundry process. Examples of

[3] While we have mentioned revenue recognition issues in brief, any detailed discussion is well beyond the scope of this document.

major NRE work include, analog SIP product development, porting of specialty SIP products into a leading-edge process technology and integration of multiple SIP products into a single platform. The exact nature of the work, the deliverables and the cost and timing are normally outlined in a written statement of work (SOW).

3.3.4 Contract Services

For purposes of this paper, "contract services" are defined as outsourced engineering work such as design services, custom EDA views, and EDA tool expertise or simply design resources. As such, contract services enable the design using the SIP product; the engineering work is peripheral to the SIP product itself.

Contract services usually require an initial fee paid upon execution of as SOW that describes the scope and nature of the services to be provided, followed by subsequent fees paid on a milestone or hourly basis. The SOW is usually attached to the SIP License Agreement.

There is no clear distinction between NRE and contract services in the SIP products industry. Occasionally some NRE development may include work peripheral to the SIP product and some contract services may include work that is central to the SIP product. Buyers should expect that contract services are essentially paying for access to resources and expertise to ensure successful use of the SIP products in the context of the EDA design flow, or in the context of the end product.

Design services are usually offered by EDA vendors, or design service houses often referred by foundries. Examples of contract services include EDA flow services such as, synthesis, analysis or place-and-route; custom design views such as timing and physical models; and IC integration services such as chip assembly, system verification and design for test or manufacturing.

3.4 Examples by SIP Product Type

An SIP product transaction usually combines several of the above business models and enabling components. Furthermore, the choice of business model may vary based on the type of SIP. Tables 3.3, 3.4, 3.5 and 3.6 provide examples by category, digital, memory, library and analog SIP respectively.

Digital SIP – Digital SIP Products may be offered in several forms, soft, firm and hard. Table 3.3 provides examples on per design, time based and royalty models for the three forms.

The DSP core is a silicon proven soft SIP product (netlist level). It is licensed per design with the right to manufacture on TSMC, UMC and CSM 0.18µm processes. The initial fee is due upon delivery of the EDA views (netlist, test bench, etc.) for the first chip. A discounted reuse fee applies for subsequent use for up to three chips. Maintenance is set at 15% of the license price and is not discounted; (it covers bug fixes, minor changes in specifications and basic support. Any functional modifications beyond the spec are treated as NRE. Verification expertise is offered on a contract service basis.

Table 3.3: Examples of Digital SIP

Digital SIP	Per Use	Time Based	Royalty Based
IP & Deliverables	Soft Silicon Proven DSP Netlist, Test Bench, etc.	Firm Silicon Proven PCI EDA Views + Test Bench	Protocol Processor EDA, GDSII, Firmware
Initial Fee - Scope	Fee for first IC in 0.18u TSMC, UMC, or CSM	Up-front fee for 3-years Multiple use in UMC L130	Fee due on GDSII delivery Any IC in TSMC 0.13u
Event Fees	Fee due on execution of SIP License Agreement	Fee due on execution of SIP License Agreement	Quarterly payments made after first shipment
(Re) Use Fees	% Reuse Fee up to 3 ICs	Renewal upon expiration	Royalty per chip (% ASP) based on performance
Maintenance	15% covers bug fixesand minor spec updates	15% covers bug fixes and updates for Rev 2.1 only	15% covers firmware and up to 2 process updates
Support	Incl: Email, Tel, on site AE	Incl: Email, Tel, on site AE, Separate On-site R&D	Separate custom package
NRE	Functional Modifications	Revisions beyond 2.1	Port to a New Foundry
Contract Services	System Level Verification	Back-end implementation	Full Chip Verification

The Protocol Processor is a high-performance hard SIP product licensed on a per chip basis with the right to manufacture in TSMC's 0.13µm process technology. Customers may gain access to the front-end EDA views on a trial basis at no charge. The initial fee is due upon delivery of GDSII followed by a subsequent (optional) tape-out fee per design. Per chip royalties are agreed up-front as a percent of ASP provided that certain performance criteria are met. Maintenance covers firmware updates but only two process changes, and support is priced separately. Any ports to a new foundry are treated as NRE and contract services include full chip verification.

The PCI core is a silicon proven SIP product licensed for multiple uses with the right to manufacture in UMC L130 process. The initial fee is due upon delivery of EDA views and can be renewed in three years. Optional discounted fees may be structured on an annual basis. Maintenance covers only revision 2.1 and basic support. Any new revisions of the standard during the license term are treated as NRE. Back-end implementation is also offered as a contract service.

Memory SIP – Memory SIP is offered in many different ways, a single memory instance or memory configuration, a set of configurations to be used on a project or multiple uses from a memory compiler coupled with bit cells from a foundry or a Provider. When memories use a foundry bit cell they are often restricted to use on that foundry.

Table 3.4a provides examples on per use (Instance), time based and royalty models for different memory configurations.

Table 3.4a: Examples of Memory SIP

Memory SIP	Per Use (Instance)	Time Based	Royalty Based
IP & Deliverables	Dual-port SRAM 2Kx16 Col Mux 4 EDA Views, BitCell*	SRAM Compiler, EDA Views, and BitCell GDSII*	Custom High Speed SRAM EDA Views, BitCell GDSII
Intial Fee - Scope	Fee upon delivery Multi-uses in TSMC* 0.18u	Up-front fee for multiple uses in CSM* 0.18u	% Fee upon SOW Per Design UMC L130
Event Fees		Annual TBL for Compiler	% Fee upon tape-out
(Re) Use Fees	% of License Fee to reuse on another foundry	Renewal upon expiration or for a new foundry port	% of chip Cost based on acceptance criteria
Maintenance	Optional - 15% per annum	15% covers compiler, EDA, bitcell, process updates	12% covers bug fixes and up to 3 process updates
Support	Incl: Email, Phone AE	Incl: up to three chips	Custom Package
NRE	Characterizations and Modifications if needed	Re-Characterization	Custom Development
Contract Services		Custom EDA Views	IC integration + Testing

* Foundry provided bitcell in GDSII

The dual port SRAM is a silicon-proven hard SIP product, which is offered on a per use model for unlimited usage of a unique configuration, in this case a 2Kx16 dual port (2rw), Column Mux 4 (determines aspect ratio). This can be duplicated multiple times on a single chip or across multiple chips. The SIP uses a foundry specific bitcell, so it is not portable. The license fee is paid upon delivery and a discounted reuse fee is charged for changing foundries. Maintenance is optional and costs 15% of the license fee per annum paid and accounted separately. Support covers email, or applications support by phone. The SIP is delivered from a memory compiler, so there are no NRE charges unless there is a speed or power requirement that cannot be met with the standard part. Contract services are generally not required since the memory I/Os can be modified by the compiler.

The SRAM compiler and related bitcell is offered with a time based model for multiple uses, and the right to manufacture in Chartered's 0.18µm process. Since the buyer may not know its future needs in advance, the memory compiler allows reconfiguring the SIP for each design. The SIP is not portable since it uses a foundry specific bitcell (which may require a separate license from the foundry). The initial fee is due upon delivery of the SIP package (EDA views, GDSII, and compiler). There is also an EDA time based license component for the compiler that is paid annually. Maintenance covers compiler updates, EDA views and process changes.

The non-volatile RAM (NVRAM) is a custom developed component (NRE), which is licensed on a royalty basis based on agreed acceptance criteria in UMC's L130 process technology. The initial fee is due upon execution

of the statement of work, followed by a tape-out fee. Royalty is agreed to be a percentage of the cost per unit. Maintenance covers up to three process updates and support is separate. Any new configurations are treated as NRE, and any re-configuration for yield improvement as a contract service.

Table 3.4b provides examples on per use (project), royalty based and access models for different memory configurations.

The pre-determined number of unique SRAM configurations is licensed on a per use basis with the scope of use to be a particular project. The project is defined as a mask set for a particular foundry, process node and variant (TSMC 0.18G). Since the number of configurations may vary, the project may be priced as a small, medium or large project based on the number of configurations needed. Configurations can be used multiple times on the mask set. The initial license fee is paid upon delivery, followed by a discounted reuse fee for another mask set (subsequent to initial use). Maintenance is optional, and if selected is 15% per annum and includes standard support. NRE charges apply for modifications and/or characterizations.

The self-testable and repairable memory system is a high-density, high-yield platform offered in pre-determined unique SRAM configurations. The different configurations include redundancy, a self-test, and a repair processor in soft SIP form and a fuse box in hard SIP form. The memory system is intended for use on a particular project which is defined as a mask set for a particular foundry, process node and variant (TSMC 0.18µm), with multiple instantiations on the mask set. The initial license fee is paid upon SIP delivery. Royalties are structured per unit sold, or as a percentage of the savings due to yield improvement upon repair. Customers may want assistance integrating the memory system into the rest of the chip, or with the actual test and repair operation. A yield enhancement service including failure analysis may be provided to improve yield.

Table 3.4b: Examples of Memory SIP

Memory SIP	Per Use - (Project)	Royalty Based	Access
IP & Deliverables	All SRAMs needed for a particular mask set	Self Testable, Repairable, SRAM Platform System	All Memory Compilers and complete Bitcell portfolio
Initial Fee - Scope	License fee upon delivery for a specific mask set	Up front License Fee plus Royalties Per Unit	Up-front fee for 3 years in TSMC and CSM 0.18u
Event Fees			% Fee Per Design due upon tape-out
(Re) Use Fees	% of License Fee to reuse on another mask set	% per unit sold, or per die based on savings (repair)	Renewal upon expiration
Maintenance	Optional 15% per annum	15% covers bug fixes and process updates	Included
Support	Incl: Email, Tel, on site AE	Incl: Email, Tel, on site AE	Incl: Email, Tel, on site AE
NRE	Characterizations and Modifications if needed	Characterizations and Modifications if needed	Re-characterization
Contract Services		Test + Repair Integration Yield Enhancement	Custom Fit Sizes

* Foundry provided bit cell (implicit time base)

The complete memory compiler and bitcell portfolio package is licensed for multiple uses with any 0.18µm process in TSMC and CSM for a period of three years. The up-front access fee provides flexibility to create any SIP configuration. Subsequent discounted fees are paid for each SIP configuration on per design basis upon tape-out.

Library SIP – Foundation library or specialty library SIP is usually offered as a package including standard cells, I/O pads and memory bit cells from the provider, the foundry or both. Table 3.5 provides examples on per use time based, third party royalty based and access (including per use) models for the different forms.

The high-performance library package is licensed on a per use basis for UMC L130 process technology. An initial fee is paid by the end-user upon SIP delivery followed by a discounted fee upon tape-out. Additional reuse fees apply for up to three more chips. Maintenance covers only two process updates and support is priced separate based on customer needs. Any customization for I/O cells is structured as NRE.

The full standard cell, I/O and bitcell package for TSMC 0.18µm process is offered on the provider's Web site through a click-wrap license (i.e. download) at no charge to the customer. The SIP is not portable (contains foundry specific bitcell and I/O) and the license includes provisions for the right to audit, and a separate license required from TSMC. Royalties are paid to the provider by TSMC on a per wafer basis. The provider has a separate agreement with TSMC for distribution and support of their SIP and offers separately priced application support packages.

Table 3.5: Examples of Library SIP

Library SIP	Per Use	Royalty (3rd Party)	Access (+Per Use)
IP & Deliverables	High speed Std Cell Lib and I/O package	Std Cell Lib, I/O*, Bitcell*, & RAM compiler package	Complete Cell, I/O, SRAM Compiler, and bitcell* pack
Initial Fee - Scope	First chip in L130	Free for TSMC 0.18u (Paid by Foundry)	Annual Access Fee for use in UMC L180, L130
Event Fees	Tape-out Fee (Paid by End-User)		Per Design Tape-out Fee (Paid by Fabless ASIC Co)
(Re) Use Fees	% of Initial fee for each new chip up to 3 uses	Royalty per Wafer (Paid by foundry; Audit Right)	
Maintenance	12% covers up to 2 process updates	Free; Covers up to 4 process updates	Included; Covers process updates beyond time
Support	Paid Separately	Applications support package paid separately	Custom Premium Package
NRE Charges	Custom I/O Cells	New Custom Cells	I/O Modifications
Contract Services		Special Characterization	

* Foundry specific Foundation SIP

The full library package for UMC L130 and L180 processes is licensed in a combination of access and per use models to a fabless ASIC company. The access fee is paid annually, with subsequent per design fees paid upon tape-out by the fabless ASIC company who has rights to sub-license the SIP to its customers. Maintenance is included in the price, custom support is paid separately and I/O modifications are treated as NRE.

Analog SIP – Analog SIP is always offered in hard form (GDSII) for a specific process technology and is highly dependent on process technology updates and/or change in SPICE models. Table 3.6 provides examples on per use, time based and royalty models.

The PLL SIP package is licensed per design as an SIP configuration (one or multiple PLL instances may be used in a chip) for CSM 0.18µm process. The initial fee for the first chip is paid upon delivering GDSII, followed by a subsequent discounted fee upon tape out. Each new chip for the same foundry and process technology follows the same model. Maintenance covers only up to two process updates for minor layout modifications and characterizations, and a basic support package is included. Any port to a new foundry or process is treated as NRE and results in a new SIP license.

The low voltage DACs are offered in a perpetual time based model and multiple uses for any chip in UMC L130 process technology (implicit time base). However, the license expires if the customer wants to use the SIP on another foundry or process node. Maintenance covers only bug fixes and basic support. Any characterizations needed due to process changes are treated as NRE (enable the SIP itself), and any custom size modifications (enable the IC design) are treated as a contact service.

Table 3.6: Examples of Analog SIP

Analog SIP	Per Use	Time Based	Royalty Based
IP & Deliverables*	50-250 MHz PLLs (Multiple SIPs Per Config)	Dual 6-bit and 10-bit Low voltage DACs	Custom 10-bit 400Mhz DAC Optimized for Video
Initial Fee - Scope	First chip for CSM 0.18u	Perpetual for multiple uses in UMC L180	% upon execution Any chip in UMC L130
Event Fees	% upon Tape-out		% upon SIP acceptance % upon tape-out
(Re) Use Fees	New chip in CSM 0.18u (Alternate SIP Config)	Renewal upon expiration	Fixed Fee per chip within 30 days of quarter sold
Maintenance	Included for first year 2 process changes max	15% paid annually covers only bug fixes	18% covers process changes beyond term
Support	Incl: Email, Tel, On-site AE	Incl: Email, Tel, On-site AE	Separate for on-site Eng
NRE Charges	Port to new foundry (New SIP License)	Re-characterization	% upon GDSII delivery
Contract Services		Custom size modifications	Platform Integration

*All deliverables are in GDSII

The 10-bit video DAC is a specialty SIP that is enabled through an NRE arrangement, and licensed on a combination of per use and royalty models. A portion of the NRE fee is paid upon execution of the agreement with subsequent portions due on milestones (i.e. GDSII delivery, or acceptance criteria met). Upon acceptance, the SIP is licensed on a per design tape-out and per IC unit combination. Royalty is structured as flat fee per unit (priced as a percentage of the cost of an equivalent pure analog IC minus the packaging costs). Maintenance is paid separately at 18% of the license fee and covers basic support and process changes beyond the term of the license. A contract service may be a platform integration of multiple SIPs into one in order to reduce die size. This model may be used for custom SIP that may be expensive to develop and maintain, and may require special acceptance criteria due to sensitivity in process changes.

Summary

The above examples should provide sufficient insight on how the business models, enabling components and combinations of the above operate in the current SIP products industry. The SIP products business is unique and depends on a variety of factors making it difficult or impossible to standardize on a single business model.

Furthermore, the wide variety of uses coupled with the different forms and types of SIP makes it difficult to understand how to extract SIP value and negotiate an appropriate licensing agreement. By establishing a common terminology on business models, objective comparisons become easier and thus the negotiation and licensing process are simplified.

4. LICENSING SIP PRODUCTS

SIP License Agreements may require a significant effort depending upon the business objectives of the parties, the intended use of the SIP Product, the nature of the SIP
product and the risks associated with using the SIP product in the end application.
Buyers sourcing SIP products from multiple providers must cope with a variety of business and licensing models among providers. Each SIP License Agreement is unique and therefore the process can be very time-consuming, often taking as much, or more time than the technical evaluation and integration. It is very clear to the IBWG that the process can be simplified by establishing a common taxonomy for SIP licensing and some understanding on what to expect based on different transaction scenarios.

The key to a successful licensing negotiation is to know the issues and the likely positions of the other parties involved in the transaction. It is essential that these positions be fully discussed early in the transaction so that no surprises emerge late in the negotiations.

4.1 SIP Licensing Provisions

Table 4.1 provides a high-level description of the common provisions found in an SIP License Agreement, a short description and the consensus of the IBWG on the level of effort likely to be involved in negotiating these provisions.

An SIP License Agreement contains provisions that are generally included in most agreements (marked as “R” for required) and others that may be included (marked as “O” for optional). Some of the optional provisions may be required if the scope of the SIP License Agreement extends to additional deliverables or services. For example, if some NRE work were involved, then the buyer would probably require an acceptance provision and both parties would probably negotiate some special conditions.

Provisions that tend not to vary much are generally placed in the main body of the SIP License Agreement (marked as MLA). Others that tend to be more idiosyncratic such as payment structure and special conditions tend to be found in the appendix (marked as App). The MLA is negotiated and signed once upon initial purchase. The appendices are typically negotiated and signed with each purchase. Many of the

provisions of a typical SIP License Agreement are straightforward and do not tend to require a great deal of negotiation. There are some provisions that take more effort than others do; the longer bars in the effort column indicate these.

Table 4.1: Typical SIP License Provisions

Contract Provision	Description	Where	Req/Opt - Effort
Definitions	Type of agreement; Parties involved; SIP specifics; License grant rights	MLA	R
Scope of License	Where and how the SIP can be used *Use, Copy, Modify, Distribute, Sub-license*	MLA App	R
Restrictions-Rights	"Forbidden uses" of the SIP Product; Disclaimer on third party Licenses	MLA	O
Deliverables	Items are delivered; Media of delivery; Terms an conditions	MLA App	R
Acceptance	Conditions under which a non Silicon Proven SIP Product is accepted	App	O
Payments	Fee structure; Payment terms; Method; Currency & taxes;Rights/Terms of audit	App	R
Special Conditions	Requests related to SOW, SIP Mobility, SIP Performance, Sales & Marketing	App	O
Warranty	How long is the coverage; What to do if SIP does not work; What voids warranty	MLA	R
Indemnification	IPR covered; Remedies and obligations if a third party alleges SIP infringement	MLA	O
Limitation of Liability	What happens if use of an SIP causes harm to the Buyer; Formula for limitation	MLA	O
Maintenance	What is covered or not; Which process-tool updates; What if the spec changes	MLA	R
Support	What is included or not; Other contract for support based on Buyer's needs	Other	O
Term and Termination	How long the agreement lasts; What are the conditions for early termination	MLA	R
Confidentiality	What is confidential; How it's being treated; How to keep it that way	MLA	O
General Provisions	Governing law, assignment, export requirements, integration/modification	MLA	R

Sources: VCX Model agreement; Keith Witek - AMD; Carl Hoxeng - Virage; SIP provider agreements

Legend: R: Required; O:Optional; MLA: Usually in Master License Agreement; App: Usually in Appendix

4.2 Definitions

A typical SIP License Agreement starts by identifying what type of agreement is being formed, the date when the agreement begins – sometimes called the effective date, the names of the parties and their location. This section may also include definitions of certain specifics related to the SIP product, such as SIP form, EDA views and target technology. It may also define any third parties who may be involved in the SIP License Agreement such as foundries, design houses and others.

4.3 Scope of License

The Scope of License provision states what the buyer can do with the SIP. Normally the Scope of License provision will specify how, if at all, the buyer can, use, copy, modify, distribute and sublicense the SIP.

Use – This provision specifies how the buyer may use the SIP product and how this is related to the provider's business model. Table 1.1 provides a range of SIP use scope, from the narrowest to the broadest. This provision may also specify whether the buyer can use third parties such as design houses in furtherance of the rights granted to the buyer; in other words it may specify whether or not the buyer may engage a third party to design using the SIP product. Normally if such third parties are to have access to the SIP product, this provision will spell out the restrictions that the buyer must impose on such third parties before they have access to the SIP product. In some cases, there may be an Addendum that lists the third parties, which may have access to the SIP.

Copy – This provision specifies how many copies of the SIP product the buyer can make and the security restrictions on these copies. This provision is used to limit the provider's risk of unauthorized use or "leakage" of the SIP product. Normally these are copies other than those made as part of the manufacturing process; it may be helpful to think of the copies restricted under this clause as copies of the SIP product's design files and documentation.

Modify – This provision specifies what (if any) modifications the buyer is allowed to make to the SIP product. For example, if the SIP product is licensed in soft form, then the modification provision might prohibit all modifications except buffer changes and cell resizing. If the SIP product is licensed in hard form, then the provision might prohibit all modifications except changes in certain layers of the GDSII file, such as I/O pins)

Distribute – This provision specifies how the buyer may distribute the SIP product. In most cases, this is a simple right to distribute a device or devices containing an instantiation of the SIP product, but it may be more complex. For example, a provider may license a library package to a fabless ASIC vendor and grant certain distribution rights that enable the fabless ASIC vendor to provide the EDA views and SIP product support to their customers.

Sublicense – This provision specifies whether and how the buyer might be allowed to pass on to a third party all or a portion of the rights granted to them. This type of provision is common in original equipment manufacturer (OEM), reseller or distribution agreements, but is generally not that common in agreements where the buyer is simply given the right to design a device using the SIP product.

4.4 Modification Rights and Ownership

Most SIP License Agreements will state whether the buyer has the right to modify the SIP product. If so, then there is usually a provision in the agreement that specifies who owns the modifications. Normally this takes one of three forms: the buyer owns the modifications outright with some form of license back to the provider, the provider owns the modifications or there is some sort of shared ownership.

As noted previously, there may be some cases where the modifications – normally as part of an NRE contract – result in the creation of a new SIP product. There are many ways to allocate ownership in such situations. Some agreements approach ownership of the IPR in the new SIP product from an equitable or "sweat of the brow" theory; that is, the party who has done most of the modification is entitled to the lion's share of the IP rights in the resulting SIP product. Others may allocate SIP product ownership based on the individual core competencies of the two parties. In any of the above cases, there may be sublicense rights, particularly if newly formed SIP product contained SIP products from both parties.

4.5 Restrictions on Scope

Normally right after the scope of license provision in an SIP License Agreement there is a provision defining the "forbidden" uses of the SIP product. For example, the restrictions on scope provision may contain a clause stating that certain layers of an SIP product in hard form used for device tracking purposes may not be changed. Other restrictions may include a prohibition on reverse engineering, decompiling of computer code, black box probing of the SIP product or disassembly.

In addition, common in this provision is a disclaimer of any implied licenses. Normally, this provision will state that the rights given to the buyer in the SIP License Agreement are all the rights the buyer receives and that any implied licenses[4] are excluded to the extent possible under law[5].

Another issue that may also be dealt with in this clause is any requirement for licenses from third parties. Sometimes the use of an SIP product may require a separate license from a third party that providers may or may not be aware of. For example, the I^2C serial interface: a buyer who needs an I^2C SIP product may license the SIP product from a number of sources. However, to use the SIP product the buyer must also obtain a separate license. Some providers will state in the License Agreement that use of their SIP product requires the buyer to take a license from a named third party. Other providers may state that they are aware of the need to take a license from a third party but also caution that the buyer should find out if any other licenses are needed. Still other providers disclaim all responsibility and put the obligation on the buyer to find out if any third-party license is needed to use the SIP product.

4.6 Deliverables and Acceptance

This provision generally defines the items to be delivered that constitute the SIP product such as design files, EDA views and models. It may also state what acceptance testing criteria exist, if any. This provision normally specifies not only the items to be delivered but also at what point the buyer assumes the risk of loss for any such items and whether the items are to be delivered on a CD, other magnetic media or via electronic download. With respect to acceptance criteria, this provision tends not to be very common where the SIP product is silicon proven. In such cases, acceptance normally occurs as soon as the items to be delivered are actually delivered. Providers generally favor this approach since it allows them to recognize most of the revenue when the SIP product has been delivered to the buyer.

If the SIP product is not silicon proven, then there may be some acceptance criteria and procedure for the parties to determine whether the SIP product delivered functions according to the specification. For acceptance, there is normally a defined time period within which the buyer must indicate his acceptance or rejection of the SIP product; the criteria and time period may vary by SIP product type and by individual customer needs. For example, buyers might request special acceptance criteria to reduce their risk in using an unknown SIP product. However, as previously mentioned, providers tend not to favor special acceptance criteria as they may affect revenue recognition.

[4] In the US and Europe, the law may imply certain statutory warranties dealing with, for example, title, non-infringement or merchantability.
[5] In some cases, the law of a particular jurisdiction may not allow certain implied warranties to be disclaimed.

4.7 Payments

In all SIP License Agreements there is a provision stating how and when payments are to be made to the provider. Some elements of this provision may be put in the appendix to the agreement. Normally payment provisions define the structure of the fees paid and the currency in which payment is to be made. Most agreements will specify when payment is to be made and whether it is to be made by check, wire transfer or other means. For agreements that involve parties in different countries and payments taking place over an extended period of time, there may be some provision for any risk associated with fluctuations in exchange rates. Finally, if the buyer is in a country that strictly controls foreign exchange, the agreement should also state who is responsible for obtaining the necessary permissions or permits.

Payment provisions will also usually specify who is responsible for taxes associated with the transaction. While this may not be much of an issue in the U.S. and Europe there are certain countries where it is important to be aware of certain peculiarities in the local tax code[6].

If the SIP product is offered on a royalty basis, then the payment provision will also normally contain specific clauses relating to how royalties are to be calculated, how and when payments are to be made and how often the provider may audit the buyer to determine the correct payment of royalties.

It is worth noting that audit provisions are becoming increasingly common since providers need to track shipments of products using the licensed SIP products, particularly in per use and/or royalty-based business models. Recent changes in accounting practices require public companies to keep records on royalties that may require audits.

4.8 Special Conditions

Special conditions usually appear in the appendix since they are specific to the needs of the parties. It is hard to generalize about what these special conditions may consist of, so the following list of examples should provide an idea:

Statement of Work (SOW) – There may be an SOW for additional work that is to be performed as part of the SIP License Agreement; this may include milestones, an approval process for intermediate/iterative deliverables, state and regular progress updates.

Special SIP Requirements – These provisions may impose special performance criteria for the SIP product as integrated into the end device, such as its support of certain corner cases or minimum yields.

Sales and Marketing – These provisions may be common where the provider wants the buyer to become a reference customer, or where the provider may want the buyer's assistance in marketing or public relations.

SIP Product Mobility Requirements – To ensure an alternate source of silicon, the buyer may require the provider's assistance in moving the SIP product to another foundry process if there is limited foundry capacity when the device goes to production.

SIP product mobility provisions are becoming more common in SIP License Agreements. As buyers become more aware of the limitations inherent in using non-portable SIP products, they are increasingly requesting assurances from the provider on alternative sources of supply.

[6] Readers may be familiar with the Withholding Tax issue that applies to buyers located in Japan and providers located elsewhere.

4.9 Warranty

Warranty provisions vary widely among Providers, principally because there are as of yet no objective standards for SIP Product performance in the SIP Products industry. Typically, the warranty section of an SIP License Agreement will deal with the following issues:

Basis of the Warranty – What forms the basis of the warranty? This is typically the provider's policy on the functional and operating performance for the SIP product and is normally contained in some objectively referenced document such as a data sheet.

Duration of the Warranty – It is difficult to generalize what is an appropriate duration for an SIP product's warranty. Providers tend to keep warranty obligations as simple as possible to simplify the revenue recognition process. At the same time, buyers tend to seek longer warranty periods to ensure efficient deployment of the SIP product.

Notice of Non-Compliance – Normally the warranty provision will describe how the buyer must notify the provider of any defects and the time period within which the buyer must notify the provider of any non-compliance.

Provider's Obligations on Non-Compliance – If the SIP product does not meet the warranty criteria, the warranty provision describes how the provider will remedy such non-compliance. Usually this means the provider fixing or replacing the SIP product within a specified time period. While some SIP License Agreements may also mandate that the provider refund the license fees paid if these remedies fail, this provision is not common.

Situations That May Void Warranty – The warranty provision of an SIP License Agreement will normally contain a provision that states that if the buyer will void the warranty if he engages in certain conduct, such as unauthorized modification. Normally this is justified on cost grounds: providers simply cannot support buyer modifications where the provider does not necessarily know what modifications were made.

International Implications – Depending on the jurisdiction in which the buyer is located there may be mandatory warranty requirements that cannot be avoided by contract. Providers should be well aware of such requirements before licensing SIP products in such jurisdictions as they can have a significant effect on pricing.

4.10 Indemnification

In the context of an SIP License Agreement, indemnification refers to the obligation of the provider to make the buyer whole if the buyer is not able to use the SIP product because the SIP product infringes (or is alleged to infringe) some third party's IP rights. Typically, the indemnity section of a License Agreement deals with the following issues:

IPR Covered – The provision normally specifies which IP rights are included within the indemnity. In many SIP License Agreements, the coverage is typically for copyrights, trade secrets and patents, but there are some agreements that specifically exclude patents.

Applicable Geography – The provision normally specifies which country's patents, copyrights, trade secrets and the like come within the indemnity. The question is usually one for negotiation and normally relates to the location of the parties and the likely market for devices containing the SIP product.
Provider's Obligations in the Event of Infringement – This provision normally specifies what the provider is obligated to do if there is actual or alleged infringement. It will typically state that the provider must defend or settle the action and provide some form of remedy to allow the buyer uninterrupted use of the SIP. In general, this will involve the provider taking a license from the third party alleging the

infringement, or the provider redesigning the SIP product or providing the buyer with a functionally equivalent but non-infringing SIP product.

Buyer's Obligations in the Event of Infringement – This provision normally specifies what the buyer is obligated to do if there is actual or alleged infringement. Normally the buyer must cooperate with the provider in any defense or settlement of the action and not do anything to prejudice the provider's defense or settlement of the claims.

Conduct That Renders the Indemnity Null and Void – This provision normally specifies what conduct by the buyer - such as unauthorized modifications or uses - may void the indemnity.

4.11 Limitation of Liability

Another critical issue that is sometimes intimately linked to the indemnity provision is the limitation of liability. This provision typically states the maximum liability of the provider if the business transaction causes specified harm to the buyer. Typically, the limitation of liability section of an SIP License Agreement deals with the following issues:

Formula for Calculating the Limitation – A typical formula is license fees paid over the life of the license. However, this formula may be negotiated between the parties to contain one or more of the following variations:

- A multiple of license fees
- License fees paid over a specific period of time, such as the 12 months preceding the event, this is especially common in licenses of long duration
- A "floor" below which liability will not go. This is common in multi-year licenses where payments taper off and using a formula of the preceding 12 months would produce a limitation of liability figure of zero

Exclusions from the Limitation – The parties may wish to exclude certain conduct or certain provisions of the agreement from the limitation of liability. In many SIP License Agreements, buyers will seek to exclude the indemnity provision from the limitation of liability; in other words, the buyers want the provider's liability for third-party infringement to be unlimited.

"Reverse Indemnities" – Certain conduct by the buyer might result in liability to a third party for the provider; in some cases, the provider will want the buyer to indemnify them from any damages resulting from such conduct.

In limitation of liability discussions, there is often a significant gap between the limitation providers are willing to provide and the limitation buyers wish to have. Providers typically want to limit their liability to the amounts received under the license, while buyers want to have a limitation of liability that bears a greater relation to the risk they are taking by using the SIP product. The result is often a prolonged and contentious negotiation. Often the limitation of liability question is the last issue to close in a negotiation and leaves both parties feeling dissatisfied.

Even the most established providers are not able to bear the potential financial burden of millions of dollars in damages for an SIP product license from which they have only received tens of thousands of dollars. This gap between the limitation providers will offer and the limitation buyers expect is called the indemnity gap. While this is certainly not a new problem, there are solutions that are beginning to bridge this gap.

4.12 Maintenance and Support

Maintenance, which may also include basic support, is usually in an appendix. The parties should ensure that this section clearly spells out what is covered and what is not covered. In addition, providers may include some special provisions for accounting purposes because maintenance is not discounted and the term of maintenance that may be different from the term of the SIP license.

Support, apart from predefined packages, is usually structured in a separate contract that may be referenced in the SIP License Agreement. No matter where it may be located, buyers should ensure that it clearly spells out what is covered and what is not covered.

4.13 Term and Termination

This provision generally states how long the agreement lasts, when it ends and what conditions can bring it to a premature end. Another term that may be found in the termination provision deals with the buyer's rights after the agreement has terminated. For example, what may the buyer do with devices that have been manufactured using the SIP product but have not been sold. Termination provisions will typically also include any requirements for ongoing support and the like.

4.14 Confidentiality

A confidentiality provision is usually found in most SIP License Agreements. It is generally designed to protect trade secrets[7] and will typically define what information the parties deem confidential, what standard of conduct must be used for to maintain the confidentiality of the information and how long the obligations of confidentiality will endure. Typically, these obligations can be expected to last for between three and 10 years following the expiration or termination of the license.

4.15 General Provisions

General provisions in SIP License Agreements usually include governing law and jurisdiction, assignment, export requirements and the rules and conditions under which the agreement can be modified.

A choice of governing law can sometimes be overlooked in SIP License Agreements. It is advisable to make sure that the governing law is always stated clearly to avoid unexpected issues and difficulties that may arise, particularly in foreign countries where the environment is unfamiliar.

Assignment provisions are generally designed to ensure that the provider is aware of the buyer's desire to assign its rights and obligations under the SIP License Agreement and has the right to veto any such assignment if the assignment would be prejudicial to the provider's business. Normally these provisions do not receive much scrutiny but they can be important especially where the provider wishes to avoid the license being assigned to a competitor.
Export requirements typically state that some or all of the technology in the SIP product may be subject to requirements placed on sensitive technology by the U.S. Department of Commerce's Export Administration Regulations (EAR) and the U.S. Department of State/Department of Defense's International Traffic in Armaments Regulations (ITAR). They generally place a requirement on the buyer to comply with the requirements of these regulations when using, licensing or otherwise transacting in the SIP product.

[7] Unlike patents and copyrights, trade secrets (also known as know-how in certain jurisdictions) are of theoretically infinite duration. However, trade secret protection is lost if the information is revealed to a party without an obligation on that party to keep such information confidential.

Finally, there is usually a so-called "Merger" or "Entire Agreement" clause. This provision states that the SIP License Agreement is the entire agreement between the buyer and the provider. It will typically also state that all oral understandings - promises, sales commitments, marketing "puffery" and the like – not documented in the SIP License Agreement are null and void and that any other written documents such as purchase orders and the like shall have no effect on the License Agreement. It will also typically contain a provision that specifies how if at all the License Agreement may be amended.

5. PROVIDER AND BUYER PERSPECTIVES

The scope of license, warranty, indemnity and limitation of liability provisions usually consume the majority of the effort in negotiating an SIP License Agreement. As noted above, buyers and providers tend to have divergent views on how these provisions should be approached. Buyers may seek a more consistent policy on the above areas as they cope with multiple providers and SIP products instantiated in a single design. Tables 5.1 and 5.2 outline some of the key areas where the buyer and provider perspectives often diverge. While it might be easy to see how an SIP user might ask for or require some generous licensing, deliverable, support or warranty provisions from an SIP provider, it is important to understand that some of the terms may have severe implications on revenue for the provider.

License Grant – Providers usually seek a narrow scope of license to maximize revenues, while buyers try to broaden the provision to maximize flexibility. Providers may view a new scope of use as a new product or license fee, while buyers may feel that the additional cost may not be justified. For example, some providers view that a new port for an SIP product is a new use and thereby treated as new SIP product that justifies an additional fee if not a new SIP License Agreement.

Restrictions – Providers usually seek to impose as many restrictions as possible on the scope of use to minimize cost and risk, whereas buyers seek as few restrictions as possible to maximize use, reuse and distribution of the SIP product. As part of their broad restrictions, providers may seek to limit the countries in which the buyer may use or distribute the SIP product, or may seek to limit the number of copies of the SIP product the buyer may make, and place restrictions on modifications and assignment, distribution and sub-licensing of the SIP product. Buyers usually seek broader rights to modify, reproduce and distribute the SIP product.

Table 5.1: Perspectives on License Grant and Warranty

	Provider Perspective	Buyer Perspective
License Grant	Narrow Scope of Use	Broad + Flexible Scope
Restrictions	Limit Geographies, Copies, etc.	Few or No Restrictions
Deliverables	Set of Items; Accept on Delivery Narrow Maintenance Coverage	More Items; Accept On Criteria; Broad Maintenance Coverage
Warranty	As Is; Applies to SIP only Above and beyond is NRE	No Limitation; Applies to SIP and IC
Remedy - Cure	Fix, Replace - Weeks	Fix, Replace, Refund - Days
Period - Parties	30-90 days Licensee Only	3-5 years Licensee + Related Parties

SIP Deliverables – Providers may tend to view the deliverables as limited to the set of items for the SIP product (current process technology, version and/or specific EDA tools). As previously mentioned, they tend to seek acceptance of SIP product upon delivery to the buyer. Buyers on the other hand may seek a broader set of deliverables and special acceptance conditions beyond delivery of the items. It must be noted that any acceptance criteria imposed by the SIP user will delay the ability of the provider to recognize the revenue from the licensing transaction.

Maintenance and Support – Providers usually offer a small number of updates and separate support from maintenance because the scope of use varies from customer to customer. Buyers on the other hand seek much broader maintenance coverage (full conformance to spec, collateral, future versions, updates, upgrades and the like) in order to reduce cost and risk. As noted earlier, the maintenance and support agreement are generally separate from the licensing agreement. Again, this is because the maintenance obligations of the SIP provider are treated differently from an accounting standpoint. Simply including the maintenance or support obligations in the license agreement will require the provider to 'back out' some portion of the contract value and delay it for the period of the support obligation.

Warranty – Providers seek to limit warranty to the performance of SIP product itself. They usually ask for longer lead times to cure any problems and may try to limit the warranty period to a few months. They may also seek to narrow the warranty coverage to the buyer only. At the same time, buyers seek a longer warranty. They normally seek to minimize the risk that the end product will be delayed if the provider's cure period is long. Buyers may also try to reduce risks associated with end product performance (if there are issues with the SIP product used in the context of the IC); and they try to increase coverage with respect to end product life cycle (if the warranty period is short). Both parties need to carefully weight the pros and cons on these complex issues and appreciate the fact that the SIP product industry has not yet matured enough to support ISO compliance standards. As with maintenance and support, if a warranty provision extends beyond a typical 90-day period, the revenue from a licensing agreement will be reduced to account for possible problems in the future. Thus, the tendency of the SIP providers to focus on a maintenance agreement to address problems that arise after the initial license agreement is signed.

Indemnity – From the provider's perspective, a broad indemnity provision can be problematic. Although a provider can be fairly confident that his SIP product does not infringe known patents, it is virtually impossible to be certain because much of the captive SIP in the semiconductor industry has not been commercialized. Furthermore, it is very difficult to be certain if a third party contractor who contributed to the SIP product does not infringe the IP rights of another party. As a result, providers seek to narrow the scope of indemnification, geographies and remedies, while buyers try to broaden the scope in order to minimize risk. Again, there is not an immediate solution in the SIP products industry. Good faith collaboration between the parties in the event of an infringement combined with some creative insurance solutions may be the most productive remedy at the moment.

Table 5.2 Perspectives on Indemnity and Limitation of Liability

	Provider Perspective	Buyer Perspective
Indemnity	Copyrights + Trade Secrets Indemnify Only	No Limitation on Any SIP Defend, Indemnify, Hold Harmless
Geography	Limited the US, EC, and Asia	Worldwide Without Restriction
Remedies	License to Use, Design Around, Refund, Termination	No Restrictions, Some Remedies
Liability	Based on Transaction Value	Based on Business Risk
Damages	Limited to license price, or Multiple With a Cap	No Caps or Restrictions
Exclusions	Improper Use; Modifications	Flexibility Trade-offs

Limitation of Liability – Providers and buyers often face a major negotiation gap with respect to potential financial losses resulting from the use of the SIP product, which may be functional failures and/or third-party IP infringement. Providers view that their liability should not exceed the value of the transaction whereas buyers view that the value should be based on the business risk. The formula for damages is difficult to calculate and varies based on SIP product type, its level of maturity, and provider's risk management profile. Typically, providers will limit damages to license fees received - or at most, two to three times the license fees received - and tend to spell out any exclusion that void this provision, which in turn may limit flexibility for buyers. In some cases, providers may be willing to take more risk if their SIP product is silicon proven across several customers, but this is not the industry norm.

Summary

The time and cost benefits of using SIP products is real and can be substantial. However, technical standards, product quality, consistency in business practices and licensing agreements still need to improve for the industry to enjoy a true plug-and-play commercial SIP product trade throughout the supply chain.

From a supply chain perspective, there are several business and technical dimensions, which influence the SIP product industry's ability to standardize on business models and licensing provisions. In order to reduce these barriers providers, EDA vendors, foundries, IC vendors and their customers must work closer with one another and provide valuable input to industry consortia and standards committees. Only then, will the SIP products industry grow and the entire supply chain will benefit.

6. ACKNOWLEDGEMENTS

We would like to thank all the providers, foundries, EDA vendors and IC customers who participated in the IBWG initiative, and we look forward to continue the efforts toward common baselines and further standardization on technical and business issues for the SIP industry.

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7. FEEDBACK

This document is intended to encourage discussion and a baseline consistency in the adoption of business models and licensing agreements that simplify commercial SIP transactions. The IBWG intends to continue this effort with participation of the FSA community.

Please take a moment to send comments regarding this document, suggestions on how to improve, and input on what topics related to the SIP business infrastructure that you would like the IBWG to focus on in the future.