



SIEMENS DIGITAL INDUSTRIES SOFTWARE

PCB sourcing and quoting

Overcoming complex challenges with intelligent software solutions

Executive summary

Electronic manufacturing services companies contend with multiple challenges in the quoting and pricing process, including lack of data standardization, difficulty comparing data sources to identify discrepancies, inefficient process pricing and lack of integration with ERP systems. Intelligent, manufacturing-aware applications can help overcome these challenges, empowering manufacturers to quote rapidly and accurately.

I Background

Electronic Manufacturing Services (EMS) companies face major challenges when attempting to provide accurate quotes to their customers in a timely manner. All EMS companies must quote many more products than they will actually build, often three or four times as many, which ties up significant resources. This is sometimes referred to in the context of the “75-75” rule of thumb. The first 75 refers to the 75 percent of quoted projects that do not result in orders. The second 75 refers to the costs of components, which typically comprise 75 percent of the total costs of building a printed circuit board (PCB).

The manufacturing processes themselves account for the remaining 25 percent of the overall costs. In some cases, pricing is complicated by commodity parts that need to be priced in bulk or by a lack of tools to accurately price process costs or address supply chain issues. This paper reviews the challenges and demonstrates how they can be overcome with intelligent software solutions, such as Siemens’ Valor BOM Connector.

Production quantity	Base quantity	Loss	Additional Orderquantity	Surcharge	Needed order quantity	Real order quantity	Surplus quantity	Purchase costs	Average price per unit	Calculation sum	Surplus type	Surplus sum	surplus proportion
10	4,490			0.00 €	4,490	5,000	510	22.50 €	0.00450 €	20.21 €	Using by us	2.30 €	10%

Source	Order Quantity	Actions	SKU	Distributor	MPN	Manufacturer	LTD	Stock	Packaging	Multi	Qty 1	Price 1	Qty 2	Price 2	Qty 3	Price 3	Valid until	Original currency	Description	Commen
ERP					GRM155R71C104KA88J	MURATA		629,285	PC		1	0.00110 €		€		€				
DistiDirect	5,000		8819742	Farnell	GRM155R71C104KA88D	MURATA			1		10	0.00840 €	400	0.00730 €	5,000	0.00450 €			MURATA - GRM155R71...	

Source	SKU	Distributor	MPN	Manufacturer	Description	Stock	Packaging	Qty 1	Price 1	Qty 2	Price 2	Qty 3	Price 3	
Priority: Preferred														
DistiDirect	490-6328-1-ND	Digi-Key	GRM155R71C104KA88J	Murata Electronics North America	CAP CER 0.1UF 16V X7R 0402	2080989	CT	1	0.10000 €	10	0.01200 €	10,000	0.00230 €	
Priority: Normal														
DistiDirect	8819742	Farnell	GRM155R71C104KA88D	MURATA	MURATA - GRM155R71C104KA88D - K...			1	10	0.00840 €	400	0.00730 €	5,000	0.00450 €
DistiDirect	2408523	Farnell	GRM155R71C104KA88D	MURATA	MURATA - GRM155R71C104KA88D - K...			1	10,000	0.00340 €	50,000	0.00300 €	100,000	0.00270 €

Data is not standardized

It is often difficult for an OEM to receive quick feedback regarding the pricing of a design before the product is finalized. Data problems, such as inaccuracies in a single file, inconsistencies across files and incomplete data are common. There is no standardization of data—different formats used for the bill of materials (BOM) and PCB layout. Although there are many applications that can handle the types of files that are easily imported to Excel in a delimited or columnized format, BOM files present more of a challenge. There can be multiple formats seen in the same file, including different handling of unplaced parts and approved vendor information. Physical layout data is often delivered in ODB++ or Gerber files. In the case of Gerber files, the format is not intelligent and so it must be processed into an intelligent format before being used in a quoting environment. Therefore, quoting typically relies on the BOM files supplied by the OEM.

Nearly every BOM file format is unique. Some BOM formats are focused on human readability rather than machine readability. Lines at the borders of a table show how the parts are arranged; but other than that, there is no repeatable way to extract the important pieces of data and their associations with one another. The minimal required information generally includes customer part number (CPN), description, quantity, reference designator, approved vendor list (AVL) of manufacturer, and manufacturer part number (MPN). BOM files regularly have inaccurate manufacturer part numbers that make it difficult to know exactly which part is needed. Therefore, a significant amount of time is wasted figuring out the correct part and supplied MPNs must be validated to prevent mistakes in quoting.

Siemens Valor BOM Connector software focuses on getting data imported without manual intervention. Multiple aspects of the BOM import capability can be deployed with different BOM files to automate the import process. Once a specific format has been configured, BOM Connector stores the settings so they can be automatically applied to additional BOM files with the same format and from the same customer.

#	QTY	REFDES	DEVICE	PACKAGE	VALUE	TOL	MANUFACTURER	MPN
1	52	C1324	CP	803	100F 50V	10%	AVX	096039C103AT2A
1		C2932						
1		C2156						
1		C118103						
1		C120123						
1		C126126						
1		C1202146						
1		C191196						
1		C189204						
1		C206206						
1		C191209						
1		C244247						
2	93	C8276	CAP0812	612	1000F 50V X7R	10%	TDK	C16207RH10600
2		C1416						
2		C3338						
2		C3749						
2		C99115						
2		C130181						
2		C146152						
2		C154162						
2		C154171						
2		C170181						
2		C211217						
2		C170201						
2		C227225						
2		C227226						
2		C211233						
2		C206240						
3	11	C3946	CAP081M	TAB	150F 20V	10%	AVX	TAB150K020R01

Comparing data sources to identify discrepancies

PCB quoting is based primarily on the BOM itself, with little additional corroborating information to verify the data it contains. Therefore, performing various cross-checks within the BOM can be a good first step in identifying potential problems during the quoting process. Comparing quantity mismatches to the number of component reference designator counts is worth checking, as are duplicate component names and part numbers. Although it is currently unusual to have CAD layout data, as we move more into process quoting, the presence of this additional source of quoting information becomes increasingly important. It also offers an additional opportunity for cross-checking and identifying discrepancies, because there are two data sources: one based on the BOM, and one based on the layout.

Imagine this common scenario. An EMS company receives a final version of the BOM during the quoting phase. They then receive an update saying that one or two components have been changed, and maybe even receive the new component names. Without the ability to perform a true BOM-to-BOM comparison, the EMS must start from scratch to adjust the quote. Simple text line comparisons do not work for BOM files with varying parts on the AVL list—only different comparison modes, based on component names, CPNs or MPNs as the index, provide the needed comparison capability.

Valor BOM Connector uses multiple methods to compare two BOM files: customer part number as a key, reference designator as a key and manufacturer part number as a key. Employing all these methods provides detailed insight for efficient and accurate BOM-to-BOM comparisons.

As we have seen so far, there are numerous challenges that can affect a PCB quote, and so communication between the OEM and EMS is critical to this process. Being able to quickly highlight and feed information back to the OEM can reduce the overall time needed to create a quote as well as improve the accuracy of the overall process.

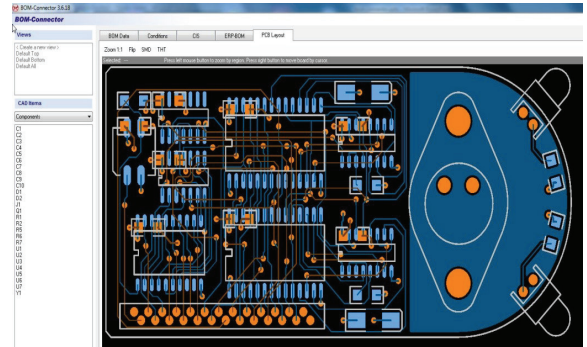
BOM	RefDes	Description	CPN	tol	value	type
Comparison status: The same key with different values						
Key: C200						
a	C200		70232001834	1%	.01uF	CAP
b	C200		7023201834	1%	.01uF	CAP
Key: C201						
a	C201		70232001834	1%	.01uF	CAP
b	C201		70232001834	1%	1uF	CAP
Key: C202						
a	C202		70232001834	1%	.01uF	CAP
b	C202		70232001834	1%	1uF	CAP
Key: C203						
a	C203		70232001834	1%	.01uF	CAP
b	C203		70232001834	1%	1uF	CAP
Key: C204						
a	C204		70232001834	1%	.01uF	CAP
b	C204		70232001834	1%	1uF	CAP
Key: C205						
a	C205		70232001834	1%	.01uF	CAP
b	C205		70232001834	1%	1uF	CAP
Key: C206						
a	C206		70232001834	1%	.01uF	CAP
b	C206		70232001834	1%	1uF	CAP

ERP integration

Efficient ERP system utilization can be critical to improving the cash flow of EMS companies. Although it can seem easier to simply acquire all parts for a BOM, components need to be stored if they are not being used. Therefore, reviewing your ERP system seems like an obvious first step. However, the challenge is being able to connect what a customer wants on the board with the parts that are available in the ERP. If the MPNs are the same, it can be straightforward. However, if alternate parts are involved, the challenges begin to mount.

When multiple methods to create connections between an OEM CPN and the EMS IPN are available, the existing parts that are on hand can be used. In addition to searching for the exact MPN information, fault-tolerance matching may show alternative parts that are available in the ERP that may have been overlooked. Breaking down a description field into specific fields in the same manner as the ERP description can also provide meaningful possible matches between a customer BOM and the ERP system. Once completed, a complete “golden” BOM can be exported for use in other business systems or exported to the ERP system.

These connections are so important to Valor BOM Connector that they are part of the product name. The power of Valor BOM Connector is driven by its ability to connect all the sources—the imported BOMs, the ERP system and the component portals.



Component manufacturers have recently been making portals available that provide web-based access to pricing, lead time and alternative parts. These portals allow many parts to be searched in batches to speed up the manual process of looking up each one individually and enable user-specific access so that corresponding customer pricing is available.

In addition, the past two years have presented many challenges, one of which is sourcing goods. Items from toilet paper to semiconductors have been in short supply. In the PCB assembly supply chain, single-sourcing of any component increases the likelihood of delay, and thus the ability to quickly identify alternative sources has become critical to keeping production moving.

Internal Parts		Data MPN	
IPN	Description	MPN	Manufacturer
100k 0805		ERA6AEB104V	PANASONIC
ERP 40519	RES-GEN-100k-125mW-0.1%-0805-SMT		
ERP 4525	RES-GEN-100k-125mW-1%-0805-SMT		
ERP 3068	RES-GEN-100k-125mW-5%-0805-SMT		

I Demand forecasts

Volume discounts can be significant—as purchase volume increases, the price per part will decrease. Therefore, it may be worthwhile to purchase more parts than you initially need to secure a lower price per part. This brings us to demand forecasts. Although quoting is typically performed on a per-BOM basis, purchasing can be driven by a demand forecast for a certain period. Commodity parts can be totaled up across multiple products or timeframes, along with total quantities. The quoting and purchase of bulk parts is then directed by the full picture rather than the quantity of parts needed to build a specific number of boards.

Valor BOM Connector does not need a BOM to show its value. Demand forecasts can be imported with a list of internal part numbers, AVL data and quantities, and BOM Connector will use the component portals to obtain the optimum price.

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Process pricing

As noted earlier, components normally make up around 75 percent of the overall cost of a PCB board. Simple markup rates or elaborate spreadsheet macros are generally used to estimate the remaining 25 percent of margin and process-related costs. The problem with the former is lack of accuracy, making it easy to over- or under-bid. The problem with the latter is that the ongoing management of spreadsheet macros is usually difficult because of their complexity and the specific knowledge needed to maintain them.

Typical industry solutions rely on manual entering of specific values that can then be compiled in a spreadsheet. Like the simple approach to process costing estimates, these approaches do not create accurate estimates. The Valor Division of Siemens

DISW provides cutting-edge solutions that address the fundamental needs of process costing. Not only can CAD design data be used to provide the necessary details regarding the complexity of the design, but complex models can be easily created to cover specific needs in process costing. These models include options for different scenarios to be included or excluded in the overall price, and information about batch size, number of shipping pallets, and type of shipping (air, sea and land) can be used along with overall margin to derive an accurate process price.

Going a step further, Valor BOM Connector integrates seamlessly with Valor Process Preparation to move those products into production once the quote becomes an order.

Production Steps		Demo (100)					
Step	ERP-ID	Cost	Cost	Cost	Cost	Cost	Cost
A Pre Production Preparations							
		Office				Office	Office
A1	BOM Scrubbing	1.05 USD				1.05 USD	1.05 USD
A2	BOM Material Calculation	1.51 USD				1.51 USD	1.51 USD
A3	Production Calculation	0.04 USD				0.41 USD	0.41 USD
		Total 2.62 USD				Total 2.99 USD	Total 2.99 USD
B SMD							
		Line A	Line B			Line A	Line A
B1	Assembly Line	0.00 USD	0.00 USD			0.00 USD	0.00 USD
B2	Programming NRE	2.92 USD	2.92 USD			2.92 USD	2.92 USD
		Total 2.92 USD	Total 2.92 USD			Total 2.92 USD	Total 2.92 USD
C THT							
		Machine	Manual			Machine	Machine
C1	THT Assembly	1.33 USD	0.73 USD			1.33 USD	1.33 USD
		Total 1.33 USD	Total 0.73 USD			Total 1.33 USD	Total 1.33 USD
D Electrical Test							
		ICT	Flying Probe			ICT	ICT
D1	Test	0.03 USD	0.73 USD			0.03 USD	0.03 USD
D2	Test Fixture NRE	4.19 USD	0.41 USD			4.19 USD	4.19 USD
		Total 4.22 USD	Total 1.15 USD			Total 4.22 USD	Total 4.22 USD
E Optical Test							
		AOI	Manual Optical Inspection			AOI	AOI
E1	Test	0.12 USD	0.73 USD			0.12 USD	0.12 USD
		Total 0.12 USD	Total 0.73 USD			Total 0.12 USD	Total 0.12 USD
F Mechanical Assembly							
		Line A				Line A	Line A
F1	Assembly	3.00 USD				3.00 USD	3.00 USD
		Total 3.00 USD				Total 3.00 USD	Total 3.00 USD
G Quality Control							
		Storage Area				Storage Area	Storage Area
G1	Switch On Test	0.05 USD				0.05 USD	0.05 USD
G2	Final Inspection	0.33 USD				0.33 USD	0.33 USD
		Total 0.38 USD				Total 0.38 USD	Total 0.38 USD
H Packaging							
		Line A				Line A	Line A
H1	Packaging	1.00 USD				1.00 USD	1.00 USD
		Total 1.00 USD				Total 1.00 USD	Total 1.00 USD
I Shipping							
		Land	Air	Ship		Land	Land
I1	Shipping	150.00 USD	765.00 USD	277.50 USD		150.00 USD	150.00 USD
		Total 150.00 USD	Total 765.00 USD	Total 277.50 USD		Total 150.00 USD	Total 150.00 USD
J Final Price							
		Office				Office	Office
J1	Material Cost	105.41 USD				105.41 USD	105.41 USD
J2	Material Surcharge	3.16 USD				3.16 USD	3.16 USD
J3	Production Cost	158.48 USD				158.86 USD	158.86 USD
J4	Project Cost	267.06 USD				267.44 USD	267.44 USD
J5	Profit Mark Up	13.35 USD				13.37 USD	13.37 USD
J6	Final Price	280.41 USD				280.81 USD	280.81 USD
						Demo (China) Total: 280.42 USD	Demo (USA) Total: 280.81 USD
							Demo (Germany) Total: 280.81 USD

Conclusion

Accurately quoting PCB assembly products is a complex process with many things to consider. Given the myriad of data that needs to be processed, spreadsheets can only go so far, and an intelligent, manufacturing-aware application has become a necessity.

Valor BOM Connector is an essential solution for today's electronic manufacturing services companies. We would be happy to discuss your specific challenges and match you with the appropriate solution.



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