## PROGETTAZIONE PCB

- Ciclo di Progettazione
  - Funzionalità del sistema
  - Schema Elettrico
  - Vincoli meccanici
  - Layout
  - Produzione
- Altium Designer
  - Schematic Project
  - Layout Project
  - Production Files



Ciclo di Progettazione

# Ciclo di Progettazione -Schematico





## Ciclo di Progettazione



Ingegnere di Processo



Ciclo di Progettazione



# Ciclo di Progettazione Produzione PCB



# Ciclo di Progettazione Produzione PCB

Vincoli Elettrici



#### Vincoli Meccanici



# Ciclo di Progettazione Assemblaggio



#### 



For Components with a termination height H < 1.2mm : The height of the meniscus must be at least 1/3 of the height H

For components with a termination height H  $\geq$  1.2mm : The height of the meniscus must be at least 0.4mm.



#### Occupied area

Solder land / Solder paste pattern



Tracks or Dummy tracks (for wave soldering only)

# Ciclo di Progettazione Meccanici - Designer



# Ciclo di Progettazione EMC



#### Ricevitore/Trasmettitore

# Ciclo di Progettazione EMC

Accoppiamento Magnetico



Generazione di corrente I per campo magnetico H (A/m)

Accoppiamento Elettrico

Tensione V generata per campo elettrico E (V/m)

# Ciclo di Progettazione EMC





Progettazione PCB 04/04/2018 Augusto Pieracci

### **Altium Designer - Schematics**



#### **Schematics - New Project**



#### Nota:

Un nuovo documento è utilizzabile solo dopo essere stato salvato.



# Schematics New Project Source

9	A 🔶 🖷					
<u>F</u> ile	<u>V</u> iew Proje <u>c</u> t <u>W</u> i	indow <u>H</u> el				
					1	PC <u>B</u> Project
-	<u>O</u> pen	Ctrl+O		<u>S</u> chematic	1	Multi-board Design Project
<u></u>	Open Project			<u>Р</u> СВ		Integrated Library
	Open Design Wor <u>k</u> sp	pace	-	Draftsman Document		
	Check Out		<b>#</b>	CAM Document		
			5	Outp <u>u</u> t Job File		
			6	<u>C</u> omponent		_
	Save Design Worksp	ace		<u>L</u> ibrary		_
	Save Design Worksp	ace As		Scri <u>p</u> t Files		
				Mixed-Signal Simulation		
ି ଆ			¢۳.	Design <u>W</u> orkspace		
	Import Wizard					
	Run Script					
	Recent Documents					
	Recent Projects					
	Recent Workspaces					
	E <u>x</u> it	Alt+F4				

	AT long bus (13.3 >	x 4.2 inches)	4.6		
	AT long bus (13.3 )	x 4.5 inches)	L		
	AT long bus (13.3 )	x 4.8 inches)	L		
	AT long bus with b	reak-away tab (13.3 x	L		
	AT long bus with b	reak-away tab (13.3 x	L		
	AT long bus with b	reak-away tab (13.3 x	L		
	AT short bus ( 7 x 4	4.2 inches)			
	AT short bus ( 7 x 4	4.5 inches)			
	AT short bus ( 7 x 4	4.8 inches)			
	AT short bus with b	oreak-away tab ( 7 x 4			
	AT short bus with b	oreak-away tab ( 7 x 4			
	AT short bus with b	oreak-away tab ( 7 x 4			
	Eurocard VME 3U	(3.937 x 6.299 inches)			
	Eurocard VME 3U	(3.937 x 8.660 inches)		۵	
	Eurocard VME 3U	with break-away tab (			*
	Eurocard VME 3U	with break-away tab (			e un contra c
	Eurocard VME 6U	(9.187 x 6.299 inches)			
	Eurocard VME 6U	(9.187 x 8.660 inches)			
	Eurocard VME 6U	with break-away tab (			
	Eurocard VME 6U	with break-away tab (			
	PC-104 16 bit bus				
		Create Project Folder			
Proje	etc	Drewer Leasting			
, roje	cus .	browse Location			

[17]

#### **Schematics** Place



#### **Schematics Preferences**

		Preferences	×
	Q Search		
	• System	Schematic – Denvilts	
	A Management		
From	Schematic	Default Primitives	
	General		
	Graphical Editing	Primitives	✓ Properties
ICOLS	Compiler	Milis MMIs	
	AutoFocus	Primitives	
	Grids		Radius —
	Break Wire	Primitive List	Start Angle
	Defaults *	Arc	End Angle
	PCB Editor	Bezier	
	Text Editors	Blanket	Width Small
	<ul> <li>Scripting System</li> </ul>	Bus	
	CAM Editor	Bus Entry	Radius 100mil
	Simulation	Comment	Start Angle 30
	<ul> <li>Draftsman</li> </ul>	Designator	End Angle 330
	Multi-board Schematic	Granhin	
	<ul> <li>Multi-board Assembly</li> </ul>	Harness Connector	
		Harness Connector Type	
		Harness Entry	
		Net Label	
		No ERC	
		Note	
		Offsheet Connector	
		Parameter	
		Parameter Set	
		Part	
		Pin	
		Polygon	
		Save As Load Reset All	
	Set To Defaults 👻 Save 💌	Load 👻 Import From 👻	OK Cancel Apply
	Set To Defaults + Save +	Net Label No ERC Note Offsheet Connector Parameter Parameter Set Part Polygon Polygon Polygon Polygon Polygon Polygon Reset All Load_  Import From.	OK Cancel Apply

While attributes can be modified during placement (**Tab** to bring up associated properties dialog), bear in mind that these will become the default settings for further placement unless the **Permanent** option on the **Schematic** – **Default Primitives**page of the *Preferences* dialog is enabled. When this option is enabled, changes made will affect only the object being placed and subsequent objects placed during the same placement session.



Pane



#### Solo i componenti delle Librerie installate possono essere utilizzati

# **Schematics** Libraries **Components** Properties



NOTA: Per la simulazione è necessario inserire tutti i parametri richiesti. Es: per Resistenza serve il «Value»

R

## **Schematics Navigation**

- Spacebar  $\rightarrow$  ruota in senso orario il componente
- Shift + Spacebar  $\rightarrow$  ruota in senso antiorario il componente
- Mentre è Floating
  - $\begin{array}{l} Y \rightarrow \text{ mirror verticale} \\ X \rightarrow \text{ mirror orizzontale} \end{array}$
- PgUp e PgDown oppure CTRL e ruota mouse  $\rightarrow$  Zoom
- Mentre è Floating TAB  $\rightarrow$  Apre le proprietà del componente
- Andare sui lati provoca il PAN se sto facendo qualche azione particolare
- V F  $\rightarrow$  Fit della View

#### New Components

Bits       Die Work Roget       Die Works Ro	) 🖩 🗐 📔 h 🔿			PCB_Project1.F	rjPCB - Altium Desi	gner (18.0.9)		Q Search	- 0
Project • • • • • • • • • • • • • • • • • • •	<u>File E</u> dit <u>V</u> iew Proje <u>c</u> t <u>P</u> lace <u>T</u> oo	ls <u>R</u> eports <u>W</u> indow <u>H</u> elp							٠
Suppler Suppler   Suppler Suppler   Waringsel Suppler   Waringsel Suppler   Waringsel Suppler   Bener Suppler <t< th=""><th>Projects • # ×</th><th>🗔 Sheet1.SchDoc 💶 PCB1.Pc</th><th>:bDoc 📑 Job1.OutJob</th><th>Schlib1.SchLib</th><th></th><th></th><th>Add Supplier Links</th><th></th><th>×</th></t<>	Projects • # ×	🗔 Sheet1.SchDoc 💶 PCB1.Pc	:bDoc 📑 Job1.OutJob	Schlib1.SchLib			Add Supplier Links		×
Q. Sarch       Suppler       Description       Unit Price         * ORCE Priced State Documents       Suppler       Description       Unit Price         * Montation Documents       Price Priced State Documents       Ander       IC Many Print CTRI.R QUAD 32-QFN         * Montation Documents       Price Priced State Documents       Description       Unit Price         * Montation Documents       Price Priced State Documents       Display Bale Code-CR       IC Many Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. MAIN Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. Main Print CTRI.R QUAD 32-QFN       Meter       IC MAIN Print CTRI.R QUAD 32-QFN         * Meter       K. Main Print CTRI.R QUAD 32-QFN       Meter       IC Main Print Tri R QUAD 32-QFN <th>a 🗴 🍺 👼 o</th> <th></th> <th>Supplier Links</th> <th></th> <th>×</th> <th>Keywords: USL6236AIRZ-T-ND</th> <th></th> <th>👻 … Search</th> <th>0</th>	a 🗴 🍺 👼 o		Supplier Links		×	Keywords: USL6236AIRZ-T-ND		👻 … Search	0
• Montgace 10 Munit. • Montgate 10 Munit. <p< td=""><td>Q, Search</td><td>Supplier</td><td>Desc</td><td></td><td>Price</td><td>Supplier</td><td>Description</td><td>Unit Price</td><td></td></p<>	Q, Search	Supplier	Desc		Price	Supplier	Description	Unit Price	
Burg Bourness     Burg Bourness     Borg Bourness     Borg Bourness     Borg Bourness     Borg Bourness     Borg Bourness     Borg Bourness     Bourg Bourness     Bourge	Workspace1.DsnWrk					Intersil ISL6236AIRZ-T			
Projets Nave for Konge version   Projets Nave for Konge version Projets Nave version Nave	Source Documents					Avnet	IC MAIN PWR CTRLR QUAD 32-QFN		
<ul> <li>Add</li></ul>	Sheet1.SchDoc					Mouser	IC MAIN PWR CTRLR QUAD 32-QFN		
<ul> <li>Coluptar Lab Files</li> <li>Lotarries</li> <li>Lotarries</li> <li>Location</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Projects</li> <li>Narge for Schult Labary</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Components</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Components</li> <li>Components</li> <li>Medi</li> <li>Type</li> <li>Location</li> <li>Description</li> <li>Case/Package</li> <li>CAM</li> <li>Case/Package</li> <li>CAM</li> <li>Manne Walk</li> <li>Case/Package</li> <li>CAM</li> <li>Components</li> <li>Components</li></ul>	Esttings     Ennotation Documents								
Projects Nave or Schellbarry Deam <ul> <li>Bernove</li> <li>Renove</li> <li< td=""><td><ul> <li>         Output Job Files     </li> <li>         Job1.OutJob     </li> </ul></td><td></td><td></td><td></td><td></td><td>Digi-Key</td><td>IC MAIN PWR CTRLR QUAD 32-QFN</td><td></td><td></td></li<></ul>	<ul> <li>         Output Job Files     </li> <li>         Job1.OutJob     </li> </ul>					Digi-Key	IC MAIN PWR CTRLR QUAD 32-QFN		
Concernation     C	<ul> <li>Libraries</li> <li>Schematic Library Docum</li> </ul>	Add		<none></none>	y: 1 0				
CAMtastic Documents Documents Documents Documents Documents Documents Cocomponents	Schlib1.SchLib				*				
<ul> <li>Design Rule Check - PC</li> <li>Design Rule Check - PC</li> <li>Text Documents</li> <li>T</li></ul>	CAMtasticl Documents								
• Fred Voider As   • Total results 1     • Model     • Type     • Model     • Type     • Contion     • Description     • Order Quantity:     • Order Quantity:     • Order Quantity:     • Order Quantity:     • Projects Navig for SCH Library     • Order Schuldrage     • Order Quantity:	<ul> <li>Documents</li> <li>Design Rule Check - PC</li> </ul>			ок	Cancel				
Components      Model      Type      Location      Description	<ul> <li>PCB_Project1.xis</li> <li>Text Documents</li> </ul>								
Editor     Model     Type     Location     Description     Image: Comparing the series of the	<ul> <li>Components</li> <li>Nets</li> </ul>								
Model Type Location Description   Version Version Version   Version Version		Editor							
Projects Navig for SCH Library & d Signal Integrity * Bernove Edit		Model -	Туре	Location	Description				
Projects       Navig for       SCH Library       Bemove       Edit						< > Total results 1		<none>  • Order Quantity:</none>	
Navig for     SCH Library     & d Signal Integrity     Remove     Edit						$\sim$	P	arameters	
Projects Navig for SCH Library & dd Signal Integrity      Remove Edit      Projects Navig for SCH Library Add Signal Integrity      Remove Edit      Case/Package OFN      Case/Package     OFN      Description     IC MAIN PWR CTRLR QUAD 32-QFN      Height     0.95mm						Samuel and Samuel	Name	Value	
Projects Navig for SCH Library & d Signal Integrity      Remove Edit						Same a	Case/Package	QFN	
Projects Navig tor SCH Library 4 d Signal Integrity      Bemove Edit							Description Height	IC MAIN PWR CTRLR QUAD 32-QFI 0.95mm	
	Projects Navig tor SCH Library	A d Signal Integrity 👻	<u>R</u> emove	<u>E</u> dit					

Progettazione PCB 04/04/2018 Augusto Pieracci

#### New Components





24 )

### PIN and Body

PCB_Project1.PrjPCI	B - Altium Designer (18.0.9)						
Sheet1 SchDoc 📧 PCB1 PcbDoc 🞥 Joh1 OutJob 🍡 1	fest Schl ih *						
I\$L62364	AIRZ-T-ND	」⊫J¥ � ∕,A					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	8 7 6 5 5 ₽lacc Refe	Similar Objects r Filter Shift+C e rences	Pin				
	Tools	s · C	Arc				
	× Cut	Ctrl+X	Full Circle		🖻 🏫 🔿		
	🖬 <u>С</u> ору			e <u>E</u> dit	<u>V</u> iew Proje <u>c</u> t <u>[</u>	lace <u>T</u> ools	Reports
	Prefe	erences	<u>R</u> ectangle Round Rectangle	₩ ~	Nothing to Redo	Ctrl+Z Ctrl+Y	
iditor	Supp	olier Links 💧	Polygon		Cu <u>t</u>	Ctrl+X	
ноле туре сосилот		J, A B	Bezier Text String Text <u>F</u> rame <u>G</u> raphic		⊆opy Copy As Text Paste	Ctrl+C Ctrl+V	R CTRLR
				89 A	Paste Arra <u>y</u> Eind Text Repl <u>a</u> ce Text	Ctrl+F Ctrl+H	
					Find Ne <u>x</u> t Select	F3	
					<u>D</u> elete		
				*	Duplicate	Ctrl+R	
					Move Alian	h	- + Mc
					lump	,	. L. Mo
				٩	Fi <u>n</u> d Similar Object	s Shift+F	Mo Ro
				Plac	e Add	Del	et Ro
				ipplier	Manufactu	rer Descri	ip Bri Sei
			1	Dig	<b>ji-Key In</b> tersil	IC MA CTRLF 32-QF	All 强 🛛 Bri R ( FN 🍡 Sei

Ē	i 🖻 🔨 🤭										PCE	3_Proje	ct1.Prji	PCB - Alt	ium Desig
dit	<u>V</u> iew Proje	<u>ct</u> <u>P</u> la	ce I	ools j	Reports	<u>W</u> indow <u>H</u> elp									
5	<u>U</u> ndo		Ctrl	+Z			She	et1.SchDoc	E 🛄 PCB	1.PcbDo	c 📴 Jo	bb1.Out	Job	Test.Sch	
	Cu <u>t</u>		Ctrl												
b	<u>C</u> opy		Ctrl		RCTR	LR						TOT	(22)		7 7 1
	Copy As Text						1					IPLO	5230	OAIR	<b>Z-1-</b>
4	<u>P</u> aste		Ctrl	+V											
•	Paste Array						1		1	1				8	
	Find Text		Ctrl						2					7	_
	Replace Text		Ctrl	+H					3	-				6	_
	Find Next								4	-				5	_
	Select								<u> </u>	-			F		-
	D <u>e</u> Select									<b>b</b>	-	,			
	Delete														
	Duplicate		Ctrl	+R											
	Move			Þ		<u>M</u> ove						mand			
	Align			×		Move <u>S</u> election									
	Jump					Move Selection by X									
	Find Similar O	biects	Shift	t+F		Mo <u>v</u> e To Front									
						Rotat <u>e</u> Selection		Sp	ace						
Pla		Add		Dele	t	Rotate Selection Clo	ckwise	Shift+Sp	ace	me		- 10	cation		
	Manı	ifacturei		Descrit		Bring To Front				pic					
					C	Send To <u>B</u> ack									
P	ini-Key Inter				٩.	Bring 10 Front Of									
ľ	igi-key filter:			32-QF	*	Send <u>T</u> o Back Of									

#### **Designator and Comment**



Se voglio poter fare la simulazione devo mettere il valore se è un parametro Scrivendo '=Value'

#### New Components



Progettazione PCB 04/04/2018 Augusto Pieracci

### **Examples : CAP and Inductor**



#### ATTENZIONE ALLA GRIGLIA I PIN DEVONO SEMPRE ESSERE NELLA GLIGLIA DELLO SCHEMATICO!





#### 



# PIN UNCONNECTED



## **Schematics Compile**

La verifica della correttezza dello schematico avviene attraverso la Compilazione del progetto



I vincoli che vengono verificati sono specificati in Project Option ( da Project)

# Progettazione PCB 04/04/2018 Augusto Pieracci

#### **Schematics Compile**



Con RIGHT CLICK posso cambiarli tutti in un a volta

#### **Schematics Compile**



# Progettazione PCB 04/04/2018 Augusto Pieracci

34

#### Zoom su Errori

	Preferences
Q Search <ul> <li>System</li> </ul>	System – Navigation
General View Account Management Transparency Navigation Design Insight Projects Panel	Highlight Methods         Choose here the methods used to highlight graphical objects during navigation. These options are used during navigation, cross probing, and when exploring differences between documents or compiler messages.         Selecting       Zooming         Far       Close         Connective Graph       Dimming         None       Invisible
Default Locations File Types New Document Defaults Printer Settings Mouse Wheel Configuration Installation Product Improvement Network Activity Data Management	Connective Graph       Indude Power Parts         Objects To Display       Choose here the objects to display in the Navigator Panel.         Pins       Net Labels         Ports       Sheet Entries         Sheet Connectors       Sheet Symbols         Graphical Lines       Graphical Lines
<ul> <li>Schematic</li> <li>PCB Editor</li> <li>Text Editors</li> <li>Scripting System</li> <li>CAM Editor</li> </ul>	Cross Select Mode This mode gives the ability to select objects between the Schematic and PCB editors. When this mode is on each selected object in one editor will be selected in the open documents of the other editor. For finding objects from a PCB in a closed schematic document it is necessary to use the cross probe tool.
<ul> <li>Simulation</li> <li>Draftsman</li> <li>Multi-board Schematic</li> <li>Multi-board Assembly</li> </ul>	Cross Selection       Objects for cross selection         Dimming       Zooming       Components         Reposition selected component in PCB (Hotkey: Ctrl+Shift+Y)       Nets         Focus document containing selection if visible       Pins

#### **Schematics Reports**



#### **Schematics Reports**

Appunti	5	Carattere	5	Allineamento	r <sub>a</sub>	Numeri 🖓	S	ili
13	<b>▼</b> (n	fx						
A	В	С		D		E	F	
Bill o	f Mate	rials	Bill o	of Materials For Project [PC	B_Proj	ject1.PrjPCB] (No PCB Do	cument Selecte	i)
Source Data	From:	PCB_Project1	.PrjPCB					
Project:		PCB_Project1	.PrjPCB					
Variant:		None						
Creation Date:	02/04/2018	10:34:52						
Print Date:	02-Apr-18	10:35:37 AM						
			_					
Footprint	Comment	LibDef	Desir	astor	Dece	rintion	Quantity	
HDR1X2	Header 2	Header 2	P1 P	2 P4	Hear	der 2-Pin	Quantity	
HDR1X3H	Header 3H	Header 3H	P3		Head	der, 3-Pin, Right Angle	1	
E3	MOSFET-P	MOSFET-P	Q1		P-Ct	nannel MOSFET	1	
E3	MOSFET-N	MOSFET-N	Q2		N-Cł	nannel MOSFET	1	
AXIAL-0.3	Res1	Res1	R1, R	2	Resi	stor	2	
Approved		Notes					8	
				LT0 .	jx			2
▶ ► BOM F	Report / Project	Information 🖉 💭		A Project Full Path		C:\Llsors\Public\Documents\/		
			1	Project Filename		PCB Project1 PriPCB	Autumrcb_rtojet	SU.FIJFOD
			2	Variant Name		None		
			3	Data-Source Filename		PCB Project1 PriPCB		
			4	Data-Source Full Path		C:\Users\Public\Documents\/	Altium\PCB Project	t1 PriPCB
			C C	Title		Bill of Materials For Project II	PCB Project1 Pril	CB1 (No PCB Document Selected)
			0	Total Quantity		8		obj () ob bootimont belocited)
			1	Report Time		10:34:52		
			8	Report Date		02/04/2018		
			9	Report Date & Tine		02/04/2018 10:34:52		
			14	Output Name		Bill of Materials		
			10	Output Type		BOM PartType		
			12	Output Generator Name		BOM		
			13	Output Generator Descript	tion	Bill of Materials		
			14	output Generator Descript		Din of Wateriais		

#### Esempio / esercizio

