

Integr8tor

AutoCam



Integr8tor - AutoCam

Manufacturers Goals

- Fast response to customers.
- Faster throughput in pre production departments (Sales, Engineering/CAM)
- Detecting design flaws in a very early stage.
- Detect production problems in an early stage.
- Collecting accurate parameters for quoting.
- Reducing errors by automating the CAM process

Integr8tor - AutoCam

Solution

Integr8tor:

- Application which will inputs PCB fabrication data fully automatically
- Generating a ready to use Job for CAM
- Generate an extended report with all required design parameters.
 - Report can be used in :
 - Sales as input for quoting.
 - Engineering as a guideline to process the job.
- Will do automatic cleanup of the Cam data.
- Reduces cycle time in preproduction 30-40% depending on the job.

Integr8tor - AutoCam

Process Flow

Input

- Email
- WebForm
- ERP
- HotFolder
- Pdf Form
- Manual

Job Database

- Job instances
- Status
- Reports
- Fabrication Specs

Workflow

- AutoInput
- AutoAnalysis
- AutoReference
- AutoRebuild
- AutoClean
- AutoDFM-Filter
- Solder Mask Optimizer
- Legend Optimizer
- Outputs (VHS)

Output - Reporting

- Original Job → CAM Report - Input
- AutoAnalysis → QED Report (PDF, XML)
- Netlist Reference → CAM Report - Reference
- Rebuilt Job → CAM Report - Rebuild
- Clean Job → CAM Report - Clean
- AutoDFM-Filter → CAM Report - DFM Filter

Integrations

- Cockpit User
- Cockpit Editor
- Ucam Genesis
- InCam
- Cam350
- CheckPoint
- Capabilities

Outputs

- Fabrication Spec
- Automation scripts
- Stackup

System Stack

- CAM
- Quotation
- ERP
- Engineering
- Stackup



- Automatic and guided-interactive data entry.
- Auto Conversion of image & drill files .
- Gerber 274X and 274D, DPF, ODB++, Excellon, S&M.
- Automatic Stackup recognition, including polarity, buried & blinds, plated & non-plated hole detection.
- Automatic Registration and Outline detection.
- Layer renaming to the company's naming convention.

- Automatic design analysis.
- Immediate DRC/capability check on the job.
- More accurate/comprehensive product engineering data.
- Integration with Quotation and/or Engineering systems.
- Return accurate quotes parameters within minutes.
- Less risk of error or missing critical parameters.

- The following Netlist formats can be handled (one license per format)
 - IPC-356-A
 - Mentor Neutral Format
 - DPF
 - ODB++
- The reference Netlist is added to the job, either the input or the one derived from the image
- The input Netlist is compared to the Netlist derived from the image
- An Input Warning is given when a Netlist difference is detected
- A summary of the Netlist compare result is added to the CAM Report

- Rebuilds information lost in translation from CAD to CAM
- AutoPadRebuilder:
Painted pads are replaced by flashed pads
- AutoAreaRebuilder:
Painted areas are replaced by contour areas
- AutoReverse:
Negative layers are reversed
- AutoMarkup:
Pads and drill tools are marked up by setting attributes
 - Pads: Component, NPTH, Via, SMD, BGA...
 - Drill Tools: Component, NPTH, Via,...

Every step can be switched on/off and parameterized in the Fabrication Spec.

- **Remove double drill hits:**

Remove identical drill holes.

- **Remove pre-drill hits:**

Remove smaller drill holes on the same position as larger ones.

- **Remove non-functional pads:**

Remove non-functional pads on inner layers.

- **Clean copper on NPTH:**

Remove isolated pads that are fully covered by an NPTH drill hole, after the drill hole is increased with a configurable margin (`cleanCopperOnNPTHMargin`). When the NPTH is a component hole no clean is performed and a warning is given. The complete clean copper on NPTH step is skipped on single sided jobs.

- **Align drill to copper pads:**

Snap drill holes to pads within a configurable margin (`alignDrillsToCopperMargin`).

- **Split plated/non-plated:**

Split through-hole drill tools into plated and non-plated layers.

- **Delete outside outline:**

- For drill layers objects completely outside the outline are removed.
- For signal/extra layers objects outside the outline are clipped. Non-functional copper used to draw an outline is also removed. Objects touching the outline edge are removed if within a narrow configurable band (clipOutsideOutlineRemoveEdgesMargin) around the edge. If the outline cuts functional copper or if the outline cuts the legend a warning is given.
- For signal layers a configurable clipping margin (clipOutsideOutlineMargin) is available to allow to clip a bit more than on the basis of the outline.

- **Calculate drill tool diameter:**

Adjust the drill tool diameter using a drill tool table (ttb).

For security, a Netlist compare with original situation before AutoClean is performed at the end of this process. The results are reported on the CAM Report.

Checkpoint visualizes the Board Design Characteristics (BDC) values and locations.

Furthermore CheckPoint:

- Shows the BDC parameters in different graphs. Zoom in from an overall graph to a detailed graph.
- Shows all BDC parameters available in your Integr8tor installation.
- Is a client/server application running on every Windows client without setup.
- Features a highly Intuitive and Customizable User Interface.
- Checkpoint is launched from the Integr8tor Cockpit in a separate window.

Benefits

- General or drill-down view of the BDC info in an easy-to-use Interface
- Graphical feedback about a board's technology class
- Uncomplicated visualization of locations with Design/Manufacturing issues
- Easy assessment of design issue repair ability.
- Quantify number of locations where minimum Design parameters exist

Capabilities

- Application

View: **Default Layout** FileList Layout

JOB QUEUE [926] JOB EDITOR: [Click to load]

REFRESH SUBMIT JOB MODIFY JOB RESUBMIT JOB MOVE JOB ABORT JOB DELETE JOB

LOCK	ID	HANDLER	DUPLICATES	ORIGINAL DATA	BOARD ID	LOCATION	PROGRESS	DURATION	FULL DURATION	PRIO	ARTICLE ID	QUOT
	748		748, 750	GRB27828263C(40X112).zip		BM Job is OK	Output Generated	17:45	01:01:20	3		
	747		747, 749	GRB27828263C(32X112).zip		QED With Image Data	Review	08:06	36:58	3		
	746			anp7814-3.i8.zip		BM Job is OK	Output Generated	16:31	51:19	3		
	745			12.rar		QED With Image Data	Review	06:31	14:09	3		
	744			8.rar		QED With Image Data	Review	05:00	10:09	3		
	741		726, 737, 741	EXJ750.rar		QED With Image Data	Review	11:22	35:21	3		
	740		735, 740	R50_Main_A1_Gerber-131029.zip		QED With Image Data	Review	05:20	25:07	3		
	739		727, 739, 1065	FL42EA111.rar		QED With Image Data	Review	01:53	13:11	3		
	738		725, 738	CL87CS3A0 Gerber.rar		QED With Image Data	Review	01:50	11:44	3		
	737		726, 737, 741	EXJ750.rar		Edit in Cockpit	Checked-In	09:37	51:41	3		
	736			balluff.zip		QED Check Todo's	Review	01:54	04:02	3		
	735		735, 740	R50_Main_A1_Gerber-131029.zip		QED With Image Data	Review	04:29	19:16	3		
	734		734, 769	R50_Main_A1_Gerber-131029.zip		QED With Image Data	Output Generated	05:42	14:37	3		
	733		712, 733	2224750a01_rev2.zip		Edit in Cockpit	Review	02:02	02:02	3		
	732		711, 732	2224750a01_rev1.zip		Edit in Cockpit	Review	02:03	02:03	3		

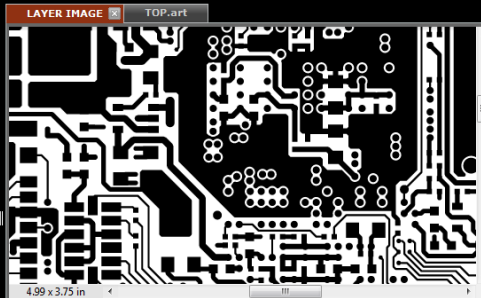
FILE LIST

ACCEPT ALL CONTINUE TO UCAM CHECKPOINT CAPABILITIES ODB OUT ODB IN EDIT QED UPLOAD EXP

R50_Main_A1_Gerber-131029.zip [740]

INITIAL	RENAMED	FORMAT	FUNCTION	POSITION	POLARITY
PASTTOP.art	Paste-T	gerber	paste	top	
SILKTOP.art	Legend-T	gerber	legend	top	
MASKTOP.art	Mask-T	gerber	soldermask	top	positive
TOP.art	Top	gerber	outer	1	positive
GND1.art	Inner2	gerber	inner	2	positive
IN1.art	Inner3	gerber	inner	3	positive
VCC.art	Inner4	gerber	inner	4	positive
GND2.art	Inner5	gerber	inner	5	positive

INPUT REMARKS [18] TODO'S [0] CRITICAL REMARKS [0]



CAM INPUT REPORT

CAM Report Integr8tor

Name	R50_Main_A1_Gerber-131029.zip	ID	T42 - Auto Analysis Processing
Report Generated on	May 6, 2014 10:41:15 AM	Customer	Artjob
Board ID		Article ID	
Quote ID		Year	2013

QED: [Q...]

QED Report Integr8tor

Name	R50_Main_A1_Gerber-131029.zip	ID	T42 - Auto Analysis Processing
Report Generated on	May 6, 2014 10:40:48 AM	Customer	Artjob
Board ID		Article ID	
Quote ID		Year	2013
User Name	ron		

Single PCB View

Top View Bottom View

Thumbnail

Thickness

Sublay Type	Copper Fall	Inner Thickness	untouched
Outer Fall Thickness	untouched	Coin Thickness	untouched

QED: [QED ...]

QED Report Integr8tor

Name	R50_Main_A1_Gerber-131029.zip	ID	T42 - Auto Analysis Processing
Report Generated on	May 6, 2014 10:41:15 AM	Customer	Artjob
Board ID		Article ID	
Quote ID		Year	2013
User Name	ron		

Single PCB View

TOP BOTTOM

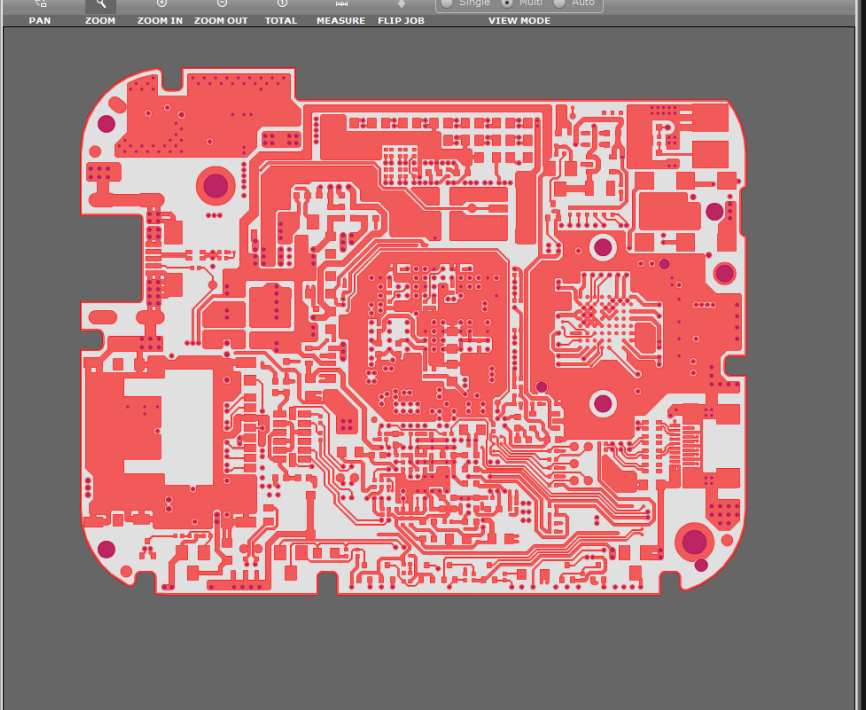
Thumbnail

LAYER STRUCTURE EDITOR

Top Bottom Both None Pos Neg Add Duplicate Cu Renumber Flip Job

INITIAL	RENAMED	FUNCTION	POSITION	POLARITY	COLOR
PASTTOP.art	Paste-T	paste	top		
SILKTOP.art	Legend-T	legend	top		White
MASKTOP.art	Mask-T	soldermask	top	positive	Green
TOP.art	Top	outer	1	positive	
GND1.art	Inner2	inner	2	positive	
IN1.art	Inner3	inner	3	positive	
VCC.art	Inner4	inner	4	positive	
GND2.art	Inner5	inner	5	positive	
IN2.art	Inner6	inner	6	positive	
GND3.art	Inner7	inner	7	positive	
BOTTOM.art	Bot	outer	8	positive	
MASKBOT.art	Mask-B	soldermask	bottom	positive	Green
SILKBOT.art	Legend-B	legend	bottom		White
PASTBOT.art	Paste-B	paste	bottom		
R50_Main_A1-1029f-1-2.drl	Blind_1-2	plated	1-2		
R50_Main_A1-1029f-1-8.drl	drill	mixed	1-8		
R50_Main_A1-1029f-2-7.drl	Buried_2-7	plated	2-7		
R50_Main_A1-1029f-7-8.drl	Blind_7-8	plated	7-8		
DRILL1-2.art	Drillmap	drillmap	none		
DRILL1-8.art	Drillmap_1	drillmap	none		
DRILL2-7.art	Drillmap_2	drillmap	none		
DRILL7-8.art	Drillmap_3	drillmap	none		
art_aper.txt		document			
art_param.txt		document			
nc_param.txt		document			
ncdrill.log		document			
photoplot.log		document			

STACKUP LAYER IMAGE MASKTOP.art



18 checkpoint v10.1.8-140428 - [D:\Integr8tor\Out] Work14031903] - [Licensed to Ron Geelen]

Check	Count
Linewidth	1,590
Ring	753
Clr. to Cop...	787
Clr. to PTH	1,966
Clr. to NPPTH	0
Clr. to Outfl...	124
Clr. Same ...	42
Clr Drill	95
Drillspan C...	16
Clr. Drill to ...	45
Clr. Mask	123
Mask Ring	1,000
Clr. Mask L...	1,000
Solderweb	821

Clr. to PTH - By Range (mm)

Clr. to PTH [0.2 - 0.22 mm] - By Layer

Layer: Top
1 / 520
Clear: 0.2024 mm Tool: 0 = CIR,0.2 in mm Pad: NA

Legend

- solder mask
- 1
- 2
- 3
- 4
- 5
- 6
- solder mask
- legend

Legend-T

- Mask-T
- Top
- Inner2
- Inner3
- Inner4
- Inner5
- Bot
- Mask-B
- Legend-B
- drill
- drill_1
- drill_2
- drill_3

18 checkpoint v10.1.8-140505 - [D:\Integrator\Out\Wurth\200103P0401_03_000_A_LPD_1_FR_743\work\200103P0401_03_000_A_LPD_1_FR] - [Licensed to Ron Geelen]

Rule	Value	Standard						Advanced			
		3	4	5	6	7	8	9	10	11	12
min Track to Track (TT) / Track to Pad (TP) / Pad to Pad (PP)	0.152	0.3 (84)	0.2 (141)	0.15 (0)	0.12 (0)	0.1 (0)	0.1 (0)	0.085 (0)	0.075 (0)	0.06 (0)	0.0 (0)
min Track Width (MTW) / min Thermal Gap (GAP)	0.152	0.3 (91)	0.2 (5659)	0.15 (0)	0.12 (0)	0.1 (0)	0.1 (0)	0.085 (0)	0.075 (0)	0.06 (0)	0.0 (0)
min Plated Layer Annular Ring (OAR) on Production Hole Diameter (PHD)	0.176	0.2 (0)	0.175 (0)	0.15 (0)	0.12 (0)	0.1 (0)	0.1 (0)	0.075 (0)	0.075 (0)	0.06 (0)	0.0 (0)
min Inner Layer Annular Ring (IAR) / Thermal Annular Ring on PHD	0.177	0.225 (0)	0.2 (0)	0.175 (0)	0.145 (0)	0.125 (0)	0.125 (0)	0.1 (0)	0.1 (0)	0.085 (0)	0.0 (0)
min Plated Layer Annular Ring (OAR) on Production Hole Diameter (PHD)	0.176	0.25 (1920)	0.225 (0)	0.2 (192)	0.17 (0)	0.15 (0)	0.15 (0)	0.125 (0)	0.125 (0)	0.11 (0)	0.0 (0)
min Inner Layer Annular Ring (IAR) / Thermal Annular Ring on PHD	0.177	0.17 (0)	0.17 (0)	0.15 (0)	0.15 (0)	0.125 (0)	0.125 (0)	0.11 (0)	0.125 (0)	0.11 (0)	0.0 (0)
max aspect ratio PTH (Thickness / PHD)	5.6	3.3 (16)	3.6 (0)	4.0 (0)	5.0 (210)	5.7 (0)	6.7 (0)	8.0 (0)	- (0)	- (0)	- (0)
distance PTH to Cu on inner layers (= TT/TP/PP + IAR class2)	0.472	0.525 (159)	0.4 (13)	0.325 (0)	0.265 (0)	0.225 (0)	0.225 (0)	0.185 (0)	0.175 (0)	0.145 (0)	0.0 (0)
distance PTH to PTH (= TT + 2 x IAR class 2 for standard)	0.914	0.75 (445)	0.6 (100)	0.5 (11)	0.41 (0)	0.35 (0)	0.35 (0)	0.285 (0)	0.275 (0)	0.23 (0)	0.0 (0)
distance NPTH drill to Cu on inner layers (NPTH routing always > 250 um)	0.406	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.202 (0)	0.0 (0)
distance NPTH to Cu on outer layers (NPTH routing always > 200 um)	-	0.35 (0)	0.3 (0)	0.25 (0)	0.2 (0)	0.2 (0)	0.2 (0)	0.15 (0)	0.1 (0)	0.075 (0)	0.0 (0)
maximum total Cu thickness that can be etched (no minimum)	0.048	0.105 (-)	0.07 (-)	0.08 (-)	0.05 (-)	0.035 (-)	0.035 (-)	0.02 (-)	0.015 (-)	0.015 (-)	0.0 (-)
solder mask annular ring (MAR) & conductor overlap (MOC): typical	0.051	0.15 (4)	0.1 (0)	0.075 (0)	0.06 (14)	0.05 (0)	0.05 (0)	0.043 (0)	0.038 (0)	0.03 (0)	0.0 (0)
solder mask annular ring (MAR) & conductor overlap (MOC): exceptional	0.051	0.1 (0)	0.07 (14)	0.05 (0)	0.044 (0)	0.038 (0)	0.03 (0)	0.025 (0)	0.025 (0)	0.025 (0)	0.0 (0)
solder mask min segment (MSM)	0.025	0.2 (327)	0.15 (53)	0.125 (20)	0.1 (0)	0.1 (0)	0.1 (0)	0.087 (0)	0.087 (0)	0.075 (14)	0.0 (0)

Layer: Inner4
Clear: 0.197 mm

1 / 141

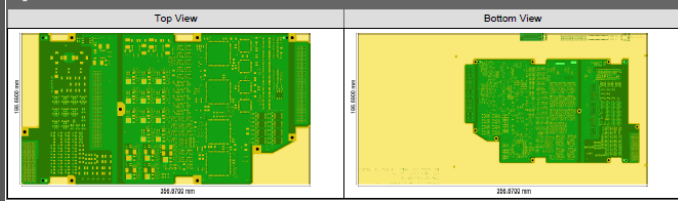
solder mask Mask-T

- 1 Top
- 2 Inner2
- 3 Inner3
- 4 Inner4
- 5 Inner5
- 6 Inner6
- 7 Inner7
- 8 Inner8
- 9 Inner9
- 10 Inner10
- 11 Inner1
- 12 Inner12
- 13 Inner13

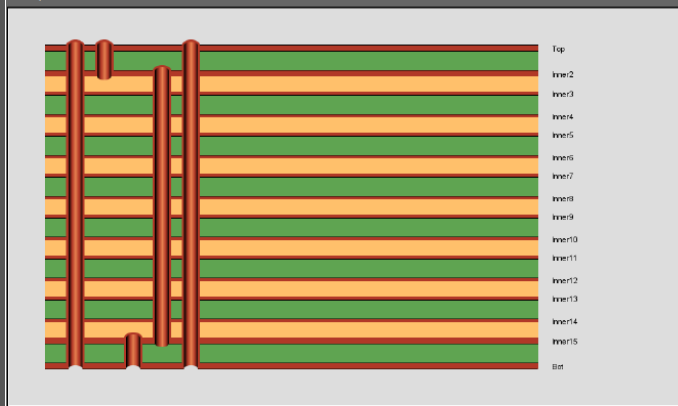
QED Report

Name	200103P0401_03_000_A_LPD_1_FR.ZIP	Id.	713 - Auto Analysis Processing
Report Generated on	May 6, 2014 1:04:27 PM	Customer	Integr8tor
Board Id		Article Id	
Quote Id		Year	2013
User Name	Ron		

Single PCB View



Stackup



QED Report

Copper Layers

File	Pos.	Min. Line Width	Min. Ring	Min. Cir. to Copper	Min. Cir. Pad to Pad	Min. Cir. Track to Track	Min. Cir. Track to Track	Min. Self-spacing	Min. Cir. to PTH	Min. Cir. to NPTH	Min. Cir. to Outline	Copper Area
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	dm ² %
Top	1	0.1524	0.1763	0.1524	0.1524	0.2078	0.2159	0.0033	0.3912	0.4064	0.0000	2.2846 38
Inner2	2	0.1524	0.1770	0.4411	0.4411	> 0.5000	> 0.5000	0.0254	0.6187	0.4064	0.0000	0.9424 16
Inner3	3	0.1524	0.2279	0.4451	> 0.5000	0.4451	> 0.5000	> 0.0500	0.7372	0.4064	0.0000	1.9608 34
Inner4	4	0.1524	0.2279	0.1790	> 0.5000	0.1790	> 0.5000	> 0.0500	0.4717	0.4064	0.0000	0.8100 14
Inner5	5	0.1524	0.2279	0.1905	> 0.5000	0.1905	> 0.5000	> 0.0500	0.4830	0.4064	0.0000	0.7308 12
Inner6	6	0.1524	0.2280	0.2416	> 0.5000	0.2416	> 0.5000	0.0171	0.5334	0.4064	0.0000	3.6862 62
Inner7	7	0.3048	0.2282	0.2509	> 0.5000	0.2509	> 0.5000	> 0.0500	0.5432	0.4064	0.0000	4.2418 71
Inner8	8	0.1524	0.2280	0.2149	> 0.5000	0.2149	> 0.5000	0.0207	0.5070	0.4064	0.0000	2.7772 47
Inner9	9	0.1524	0.2278	> 0.8000	> 0.5000	> 0.5000	> 0.5000	> 0.0500	> 0.8000	0.4064	0.0000	0.7728 13
Inner10	10	0.1524	0.2279	0.2799	> 0.5000	0.2799	> 0.5000	> 0.0500	0.5716	0.4064	0.0000	3.5139 59
Inner11	11	0.1524	0.2279	0.2329	> 0.5000	0.2329	> 0.5000	0.0212	0.5254	0.4064	0.0000	0.9574 16
Inner12	12	0.1524	0.2279	0.2509	> 0.5000	0.2509	> 0.5000	0.0192	0.5431	0.4064	0.0000	1.3757 23
Inner13	13	0.1524	0.2279	0.1905	> 0.5000	0.1905	> 0.5000	0.0309	0.4826	0.4064	0.0000	1.5785 27
Inner14	14	0.1524	0.2279	0.4451	> 0.5000	0.4451	> 0.5000	0.0167	0.7372	0.4064	0.0000	1.7304 29
Inner15	15	0.1524	0.1766	0.1524	0.3068	0.1778	0.1524	0.0220	0.3552	0.4064	0.0000	1.1905 20
Bot	16	0.1524	0.2280	0.1524	0.1956	0.1524	0.2032	0.0020	0.3810	0.4064	0.0000	1.9859 33

Copper Areas

Side	Total	Free Of Solder Mask	Free Of Gold Mask	Free Of Silver Mask	Edge Connectors
	dm ²	dm ²	dm ²	dm ²	dm ²
Top (including barrels)	2.4516	0.9591			
Bottom (including barrels)	2.1639	0.9825			
Total (including barrels)	4.6154	1.9416			

SMD

Side	Total SMD Pads	Non BGA Pads	BGA Pads	All Tracks in BGA Centered
Top	4702	4702	0	
Bottom	6143	6143	0	
All	10845	10845	0	

Solder Mask

Side	Min. Ring	Min. Cir. Mask to Mask	Min. Web	Min. Cir. Mask to Copper
	mm	mm	mm	mm
Top	0.0508	0.0254	0.0254	0.1524
Bottom	0.0508	0.0254	0.0254	0.1407

Carbon Masks

File	Position	Min. Line Width	Min. Cir. Carbon to Carbon	Min. Cir. to PTH	Min. Cir. to Outline	Layer Area
		mm	mm	mm	mm	dm ² %

Import and Conversion

Initial	Renamed	Filetype	Mirror	Unit	Format	Zeros
vp134500_LT.art	Mask-T	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_T.art	Top	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I1.art	Inner2	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I2.art	Inner3	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I3.art	Inner4	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I4.art	Inner5	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I5.art	Inner6	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I6.art	Inner7	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I7.art	Inner8	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I8.art	Inner9	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I9.art	Inner10	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I10.art	Inner11	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I11.art	Inner12	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I12.art	Inner13	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I13.art	Inner14	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_I14.art	Inner15	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_B.art	Bot	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_LB.art	Mask-B	ger274x	none	inch	5.5	Leading zeros omitted
vnc134500-1-16-np.tap	Npth	exocellon2	none	mm	3.3	Leading zeros omitted
vnc134500-1-16.tap	Pth	exocellon2	none	mm	3.3	Leading zeros omitted
vnc134500-1-2.tap	Blind_1-2	exocellon2	none	mm	3.3	Leading zeros omitted
vnc134500-15-16.tap	Blind_15-16	exocellon2	none	mm	3.3	Leading zeros omitted
vnc134500-2-15.tap	Buried_2-15	exocellon2	none	mm	3.3	Leading zeros omitted
vp134500_BO.art	Outline	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_BO_L1-2.art	Drillmap	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_BO_L16-15.art	Drillmap_1	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_BO_L2-15.art	Drillmap_2	ger274x	none	inch	5.5	Leading zeros omitted
vp134500_L.art	Mechanical	ger274x	none	inch	5.5	Leading zeros omitted
_1.txt		text				
vnc134500.log		text				