IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

PCB Library Creation and Maintenance

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Library standards give Designer

- Organization
  - All parts made the same way
  - Same shape, appearance, attributes, etc
- Time effectiveness
  - Many people use ONE library
  - Reduces edit time and error rate
- Consistency
  - Reliability of part information
  - Consistent storage location

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Read and understand data sheets before building parts

What part is / what it does

Source / Load / Bi-directional Pins and Gates

Rise / Fall Time

Voltage

Component Height

Manufacturer Information

Part number / footprint needed

RoHS and Manufacturing information

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Footprint Standards

- Equal appearance
- Equal attributes
- Equal layers
- Equal naming convention
- Equal orientation
- Equal model attachment

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Footprint (Land Pattern) Websites

- http://www.pcblibraries.com/ (The IPC Standard)
- www.smtplus.com
- Other vendors of footprints
- Individual vendor's websites (data sheets) get mfr suggested footprints

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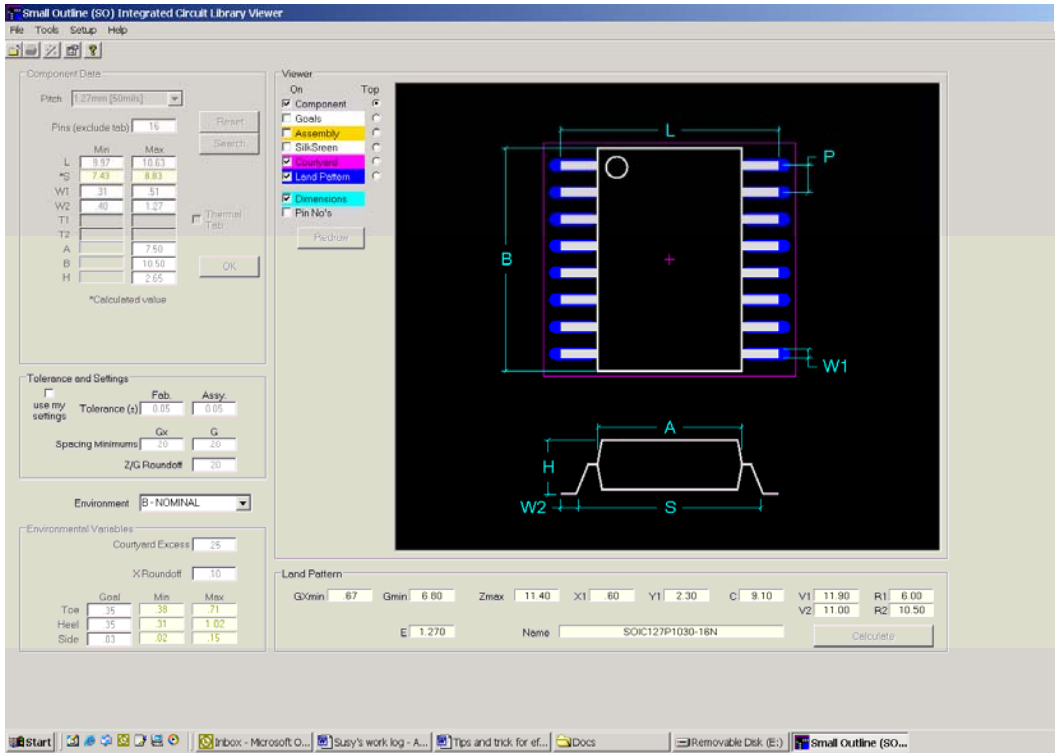
SMT Parts built per Calculator or Standard

PCB Libraries calculator **IPC-7351** automatically calculates pad and part size based on the pin and part size variables you enter.



Calculator shown from the PCB Libraries web site.

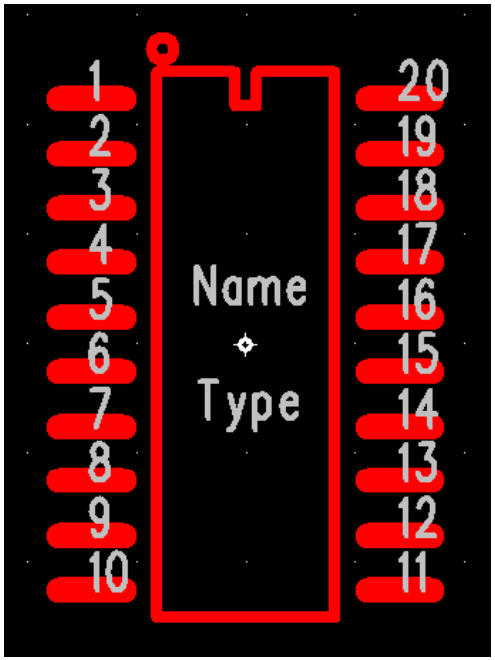
Understand how parts (Libraries) affect PCB designer and others

- Schematic entry
- Other Designers
- Fabricators
- Assembly
- Test
- Technicians
- Repair

Footprint Information:

- Attribute Standards for footprint information

In ADDITION to info already discussed:



- Description
- Company Part number
- Ref Des size and location
- Voltage
- Checked
- Mfr Part Number
- MFR ref Info
- Lead Free
- Alternate parts

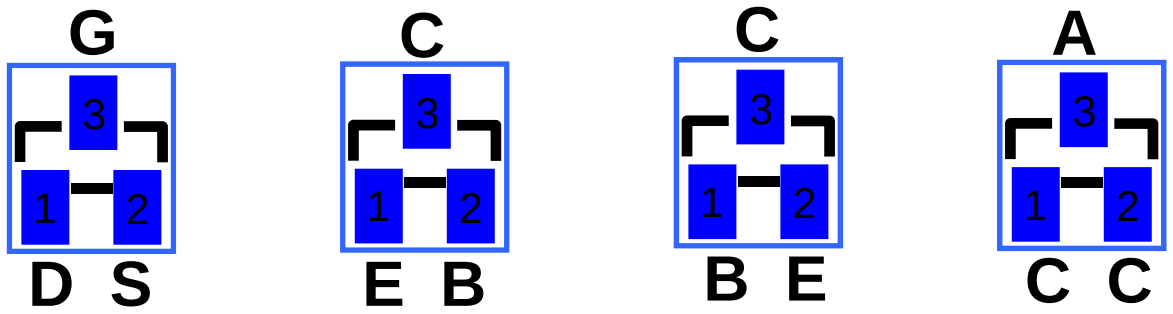
Metric vs. Imperial

When making PCB Footprint:

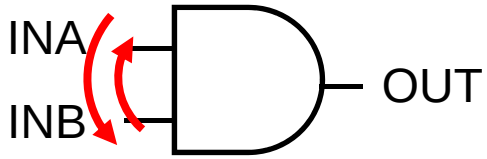
- Build Metric parts on Metric grid
- Build Imperial parts on Imperial grid
- Using the ‘Native Grid’ prevents tolerance buildup when translating from one grid system to the other
- Origin and part centroid on proper grid for placement

Pin Names vs Pin Numbers

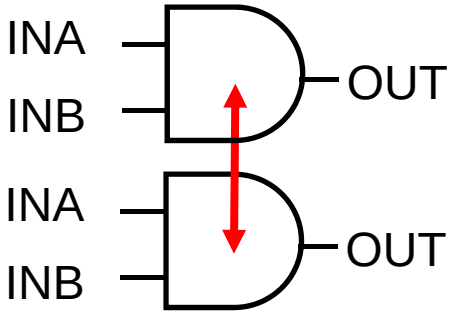
- Numbers are easy for all to remember and duplicate in most parts
- Names describe function as well as position
  - Some parts leave information ambiguous when using only numbers – SOT23 -1E2B3C



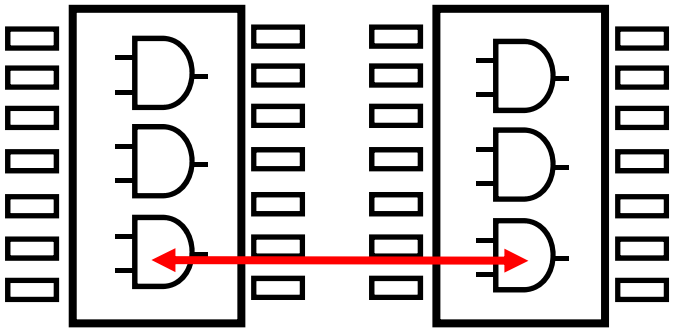
Pin and Gate Swapping



Pin Swap

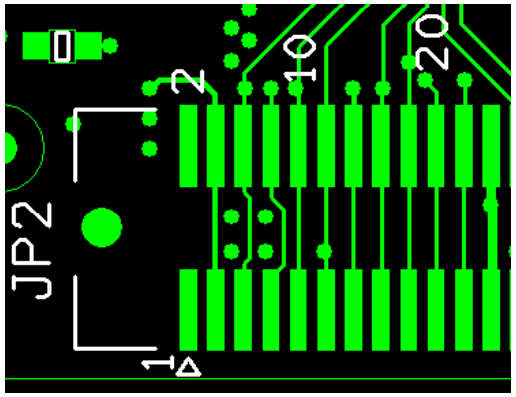


Gate Swap within Part



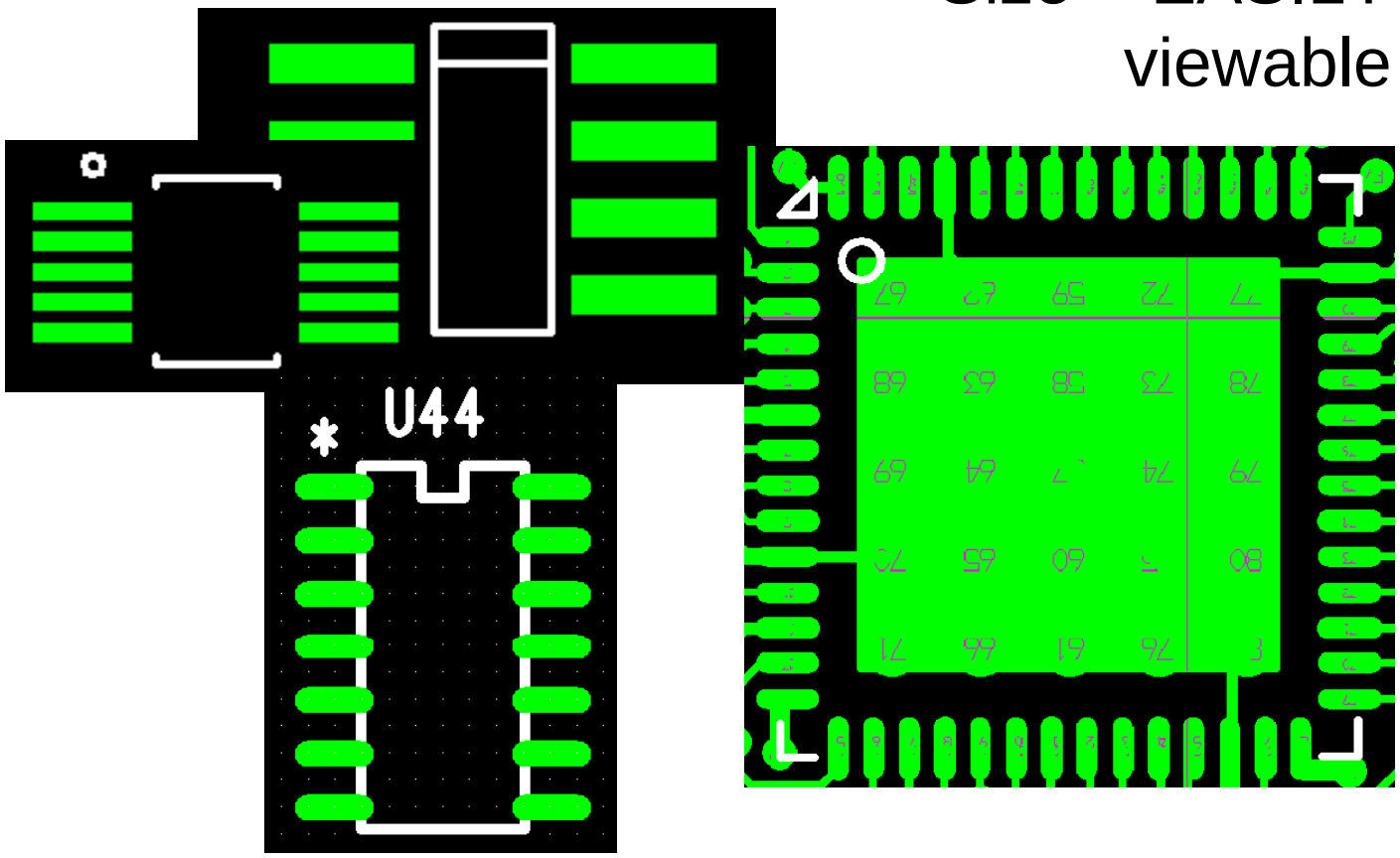
Gate Swap Part to Part

Footprint **Silkscreen** Markings

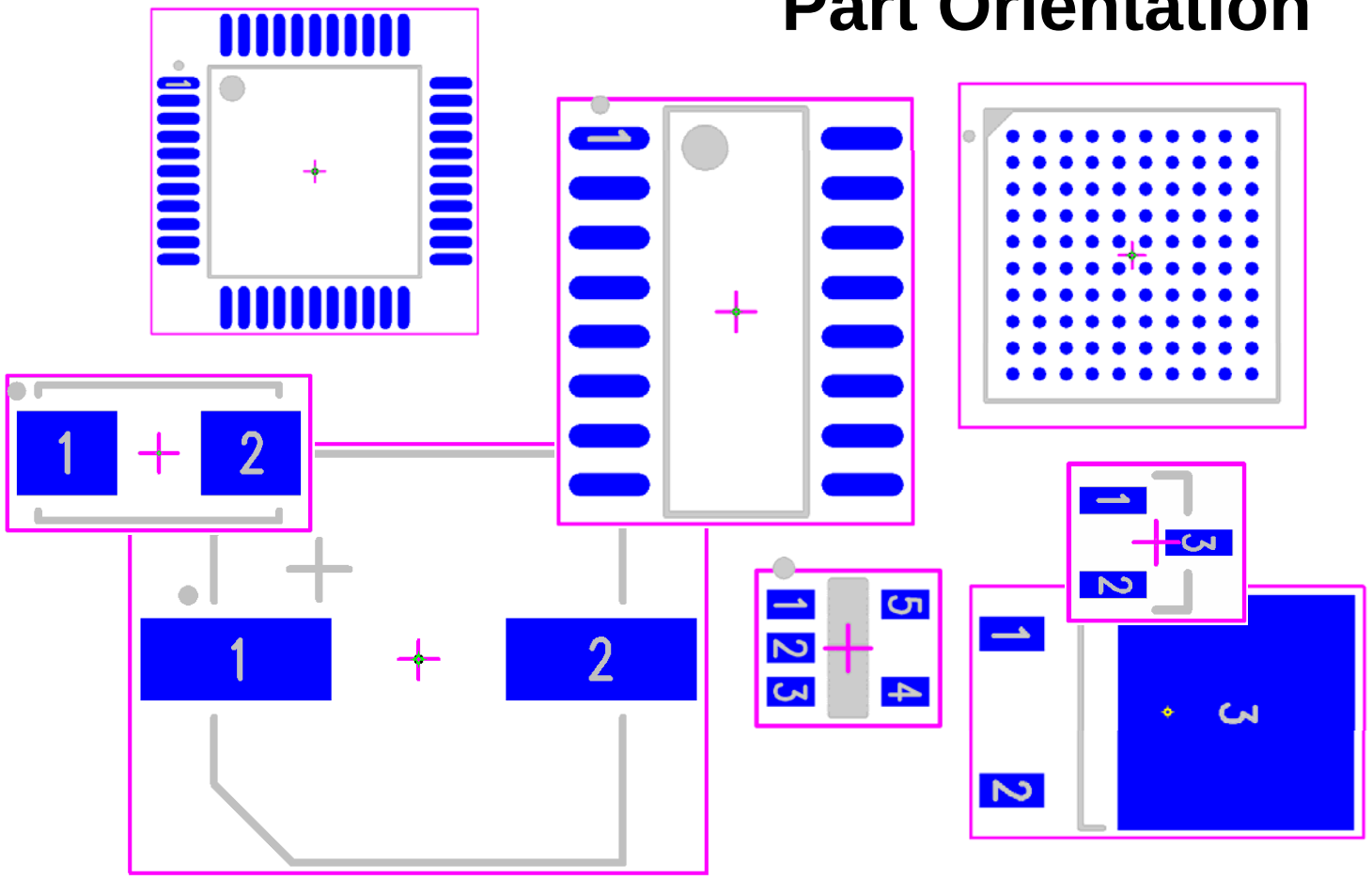


- Pin 1 and 2 indication, 10s 1A, 1B, etc.
- 
- + and/or –
- Complete body shape size including shape irregularities
- **Consistency** on indicators helps those who assemble and use the board

- Pin one indicator **outside** part silkscreen
  Size = EASILY viewable

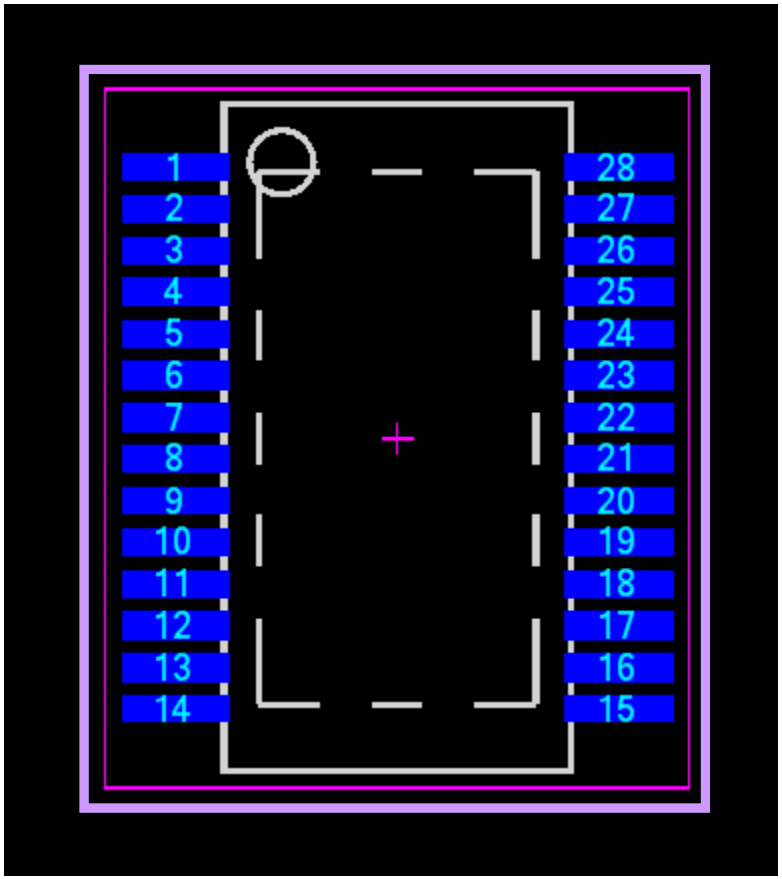


Part Orientation



Standard Component Orientations by PCB Libraries

Part Courtyard

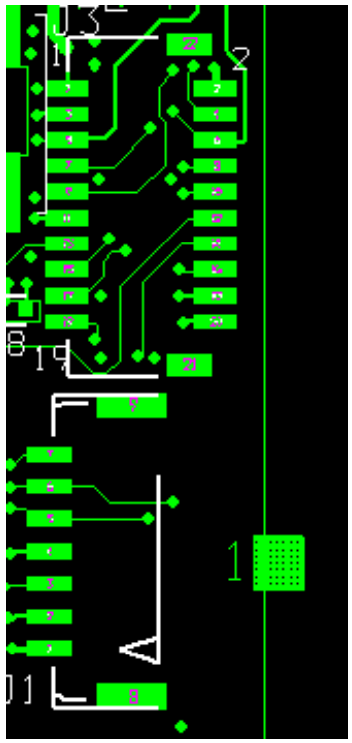


- Sets spacing around part with tolerances
- Allows room for placement head
- Allows for rework room

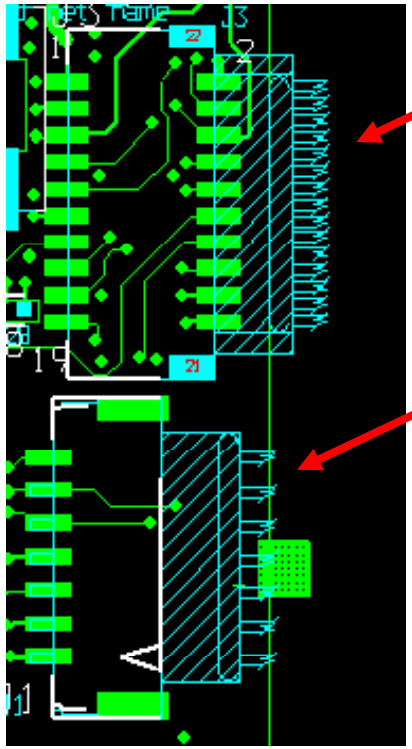
Assembly Drawing info built into Part

- Maximum part outline
  - Pads shown
- Reference Designators
  - Pin one indicators
  - Polarity Indicators
- Build information into parts to help you

Build information into parts to help you



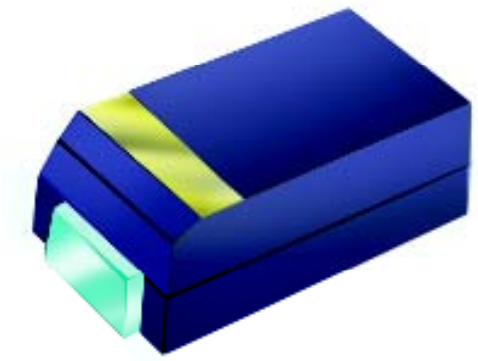
Top layer and Silkscreen

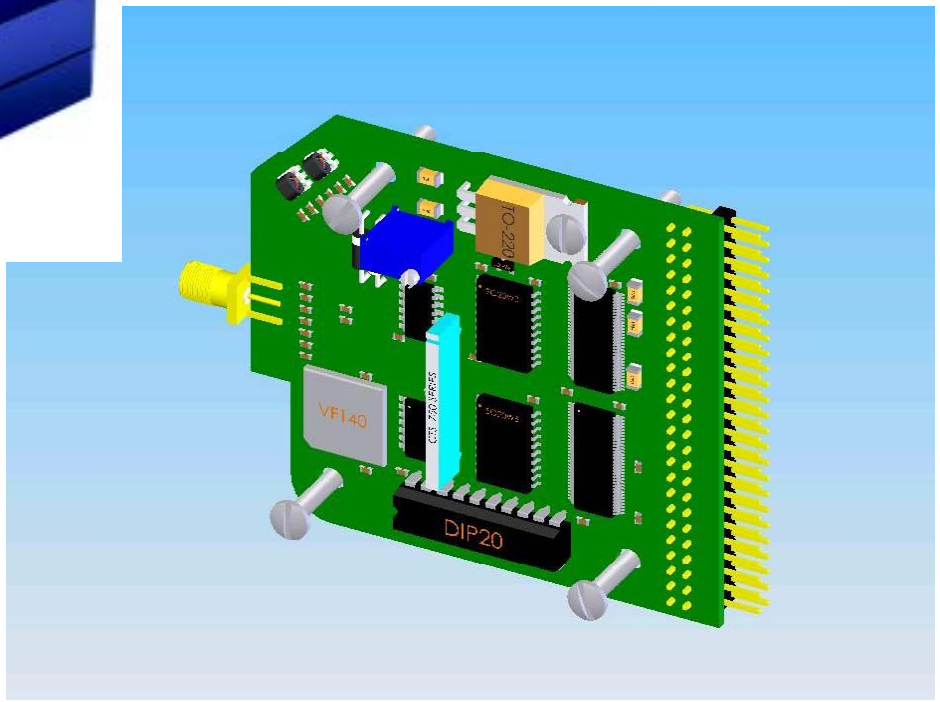


Add Assembly Layer

3D Modeling of parts

Pro-E, SolidWorks, etc.

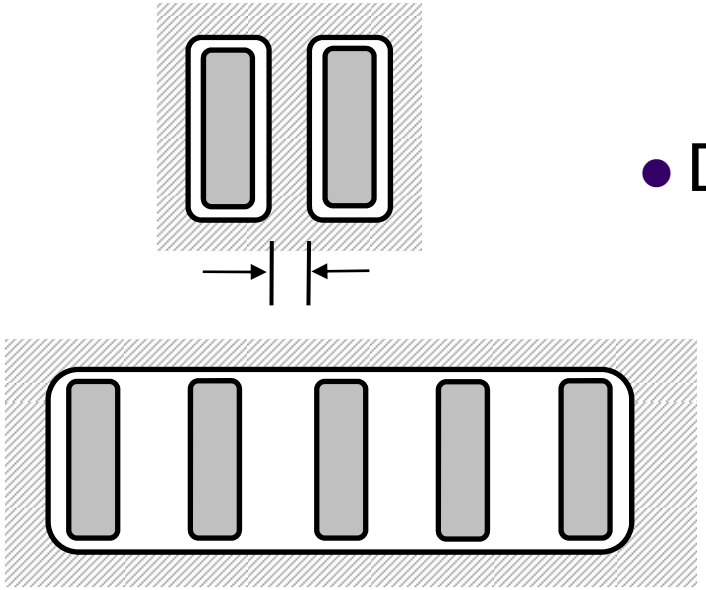




Pictures courtesy of PCB Libraries

Solder Mask Opening

- Minimum solder mask ‘web’ size between pads depends on type of mask used

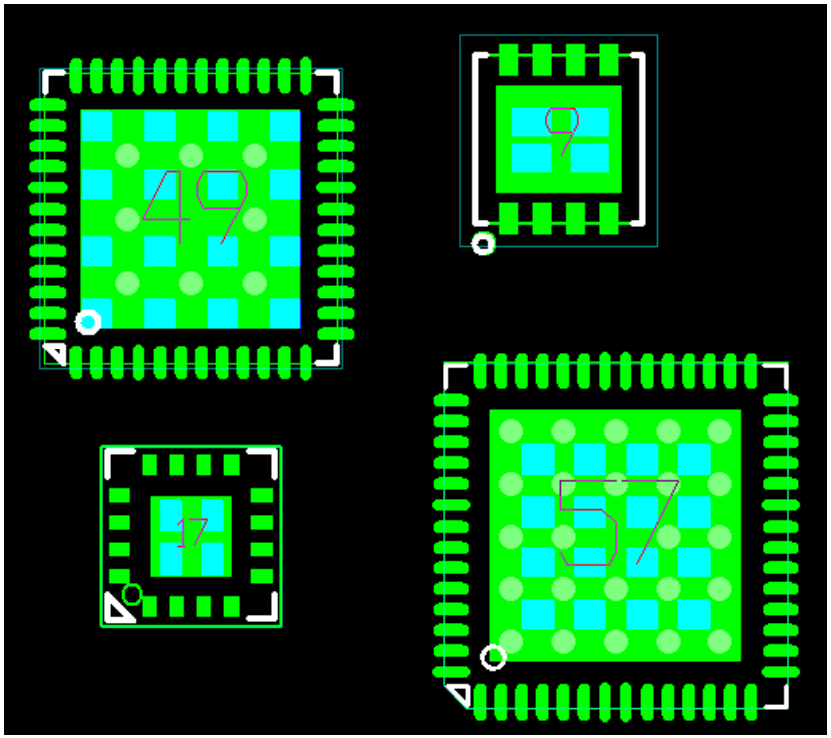


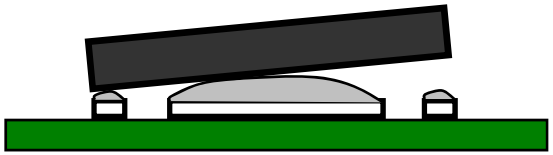
- LPI = 0 - 0.0035”
- Dry film = .004 - .006”

- Avoid Gang SM openings

Solder Paste

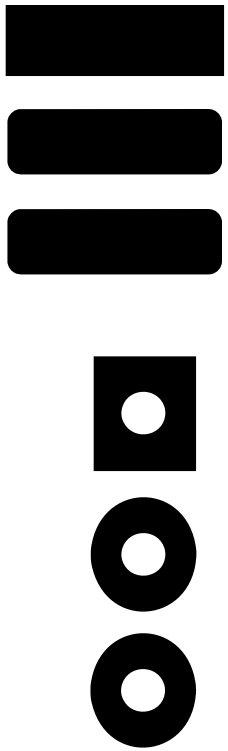
- Several round, square, or rect openings are better than one large one





Maintenance Naming Conventions

Padstacks



70c40d
TH_70s40d
SM12x84
SM_12rec84
SM.5obl1.27mm
(SM-5X1-27mm)

- Pad sizes mil or mm

Maintenance
Naming Conventions
Generic Footprints

- Make symbols and footprints as generic as possible for re-use
  - Nand_2-Input
    - Invertor
  - Res_0805
  - C_T491A(3216)
    - SOIC14

Maintenance Part Naming Conventions

- Organize by name in the software library with a code or naming convention like:

TYPE NUMBER
74HC257N; 74HCT257N
74HC257D; 74HCT257D
74HC257DB; 74HCT257DB
74HC257PW; 74HCT257PW

- IC-74HC257D
- Ics-74HCT257D (soic)
- Ics(soic)-74LS240D-i (ipc)
- Ict(tssop)-74HCT257PW-d (data sht)
- R_0805-s (software)
- C_T491D(7343)-i

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Library Part Naming Conventions
Land Pattern

SO14	SOIC127P600-14N	SOIC,1.27mm pitch,14 pin,4.00mm W X 8.75mm L X 1.75mm H Body
SO14M	SOIC127P760-14N	SOIC,1.27mm pitch,14 pin,5.70mm W X 10.10mm L X 2.03mm H Body
SO14W	SOIC127P1030-14N	SOIC,1.27mm pitch,14 pin,7.50mm W X 9.20mm L X 2.65mm H Body
SO16	SOIC127P600-16N	SOIC,1.27mm pitch,16 pin,4.00mm W X 10.00mm L X 1.75mm H Body
SO16M	SOIC127P760-16N	SOIC,1.27mm pitch,16 pin,5.70mm W X 10.40mm L X 2.03mm H Body
SO16W	SOIC127P1030-16N	SOIC,1.27mm pitch,16 pin,7.50mm W X 10.50mm L X 2.65mm H Body
SO18	SOIC127P760-18N	SOIC,1.27mm pitch,18 pin,5.70mm W X 12.60mm L X 2.03mm H Body
SO18W	SOIC127P1030-18N	SOIC,1.27mm pitch,18 pin,7.60mm W X 13.90mm L X 2.65mm H Body
	SOIC127P1420-21N	SOIC,1.27mm [50mils] pitch,20 pin,11.10mm W X 16.00mm L X 3.60mm
	SOIC127P1420-21AN	SOIC,1.27mm [50mils] pitch,20 pin,11.10mm W X 16.00mm L X 3.60mm
SO20	SOIC127P760-20N	SOIC,1.27mm pitch,20 pin,5.70mm W X 12.90mm L X 2.03mm H Body
SO20W	SOIC127P1030-20N	SOIC,1.27mm pitch,20 pin,7.50mm W X 13.00mm L X 2.65mm H Body
SO24W	SOIC127P1047-24N	SOIC,1.27mm pitch,24 pin,7.60mm W X 15.85mm L X 2.64mm H Body

Land Pattern, pitch, lead span, total pin count

Dimensions

Naming Convention used by PCB Libraries

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Maintenance Checking

- For new parts, make a 1:1 Xerox print of footprint and place part on it for ‘general’ size comparison
- If you have a lot of new parts, consider sending out a ‘padmaster’ board for checking the parts against
- Check gerber layer with it’s associated layers – top with solder mask top

Maintenance Saving

- Standard where parts are saved
- Multiple libraries or one within software – ICs, Caps, Res, Inductors, Mech, etc
- DO NOT keep parts locally… store all in library directory
- Keep Cross Reference of packaged part to company part number

Maintenance Saving

- Make a ‘known good parts’ library

Parts produced on a board, and there were no fab or assembly problems

- Permanent Network “Home” Library where Golden parts live – Read only

- Check out/check in system

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References

Gary Ferrari, Ferrari Technical Services, *"Basic Printed Circuit Board Design"* Presentation

Tom Hausherr, PCB Libraries, *"The Future of Cad Libraries",* Printed Circuit Design and Manufacture Magazine

and

"Electronic Component Zero Orientation For CAD Library Construction"

IPC-2221, 2222, A-610, CM-770 and 7351

Lee Ritchey, Speeding Edge, "*Padstack Design & Printed Circuit Board Stackup Generation for High Yields*" Presentation

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