University of Nottingham
UK | CHINA | MALAYSIA

Printed Circuit Board Design Workshop

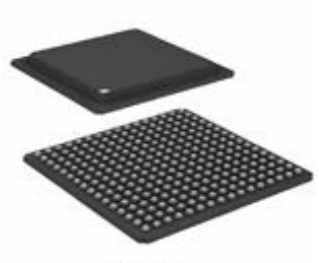
PCB Layout Design

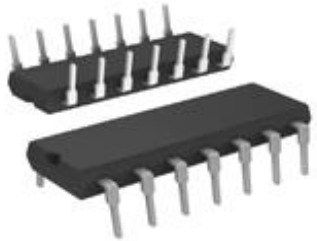
Naim Fuad , CID

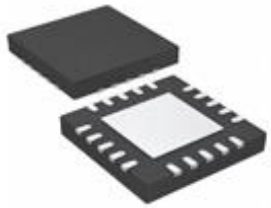
Department of Electrical and Electronic Engineering

PCB Layout Design

Component Package Type


BGA


DIP


QFN

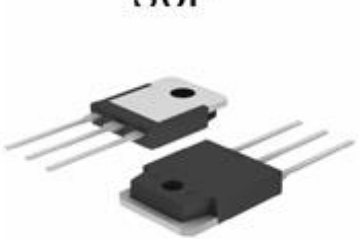

QFP


SOP


SOP


SOT23


SOT223


TO-3P


TO-92


TO-220


TO-220


TO-247

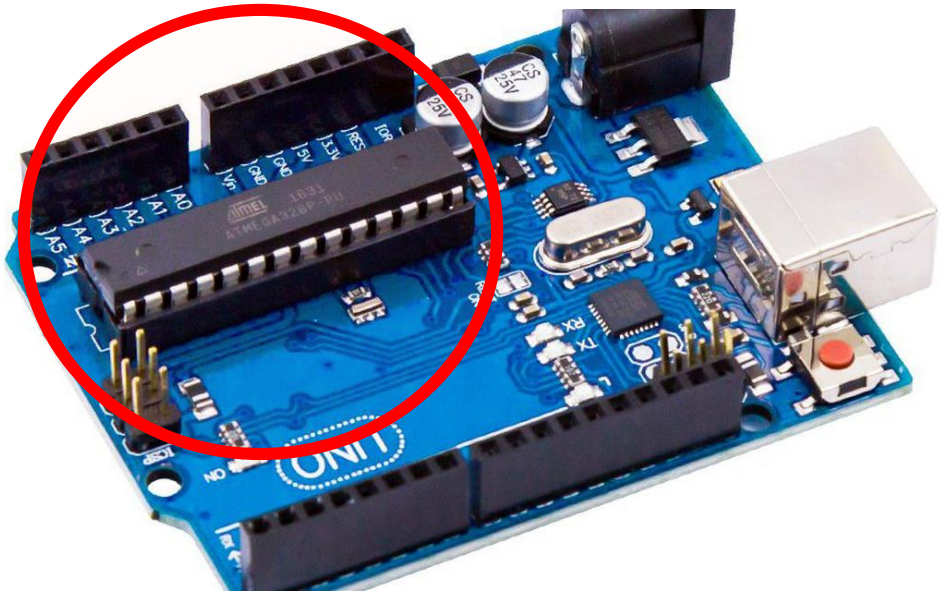

ZIP


DIP

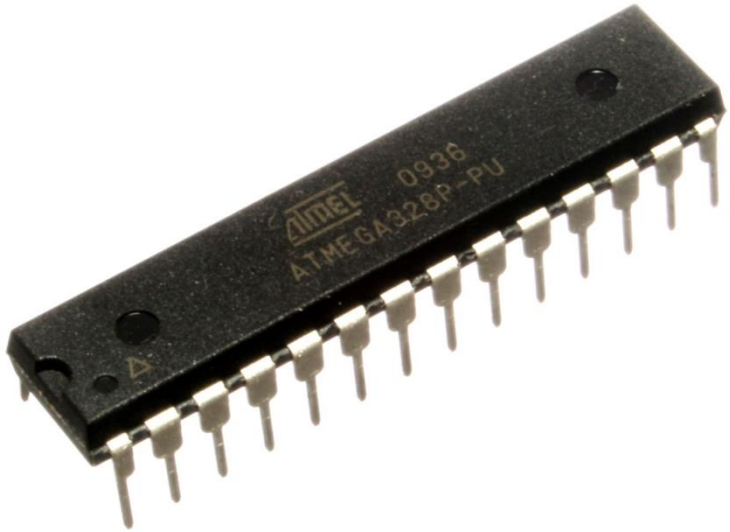

TO-252

PCB Layout Design

Component Package Type – Example



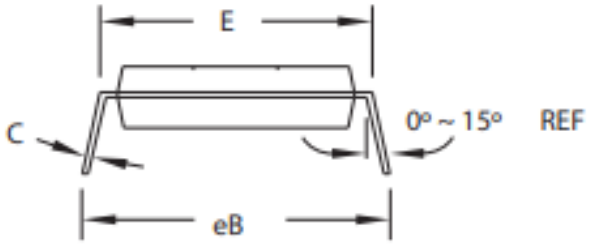
Arduino Uno



AVR ATmega328P

PCB Layout Design

Component Package Type – Example Datasheet



COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	4.5724	
A1	0.508	–	–	
D	34.544	–	34.798	Note 1
E	7.620	–	8.255	
E1	7.112	–	7.493	Note 1
B	0.381	–	0.533	
B1	1.143	–	1.397	
B2	0.762	–	1.143	
L	3.175	–	3.429	
C	0.203	–	0.356	
eB	–	–	10.160	
e	2.540 TYP			

Note: 1. Dimensions D and E1 do not include mold Flash or Protrusion. Mold Flash or Protrusion shall not exceed 0.25mm (0.010").

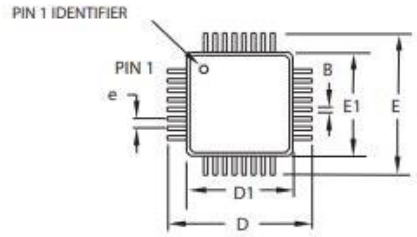
09/28/01

Atmel 2325 Orchard Parkway San Jose, CA 95131	TITLE	DRAWING NO.	REV.
	28P3, 28-lead (0.300"/7.62mm Wide) Plastic Dual Inline Package (PDIP)	28P3	B

ATmega328 Datasheet (Page28)

PCB Layout Design

Component Package Type – Example Datasheet TQFP



TQFP

COMMON DIMENSIONS
(Unit of measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.20	
A1	0.05	–	0.15	
A2	0.95	1.00	1.05	
D	8.75	9.00	9.25	
D1	6.90	7.00	7.10	Note 2
E	8.75	9.00	9.25	
E1	6.90	7.00	7.10	Note 2
B	0.30	–	0.45	
C	0.09	–	0.20	
L	0.45	–	0.75	
e	0.80 TYP			

Notes:
1. This package conforms to JEDEC reference MS-026, Variation ABA.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Lead coplanarity is 0.10mm maximum.

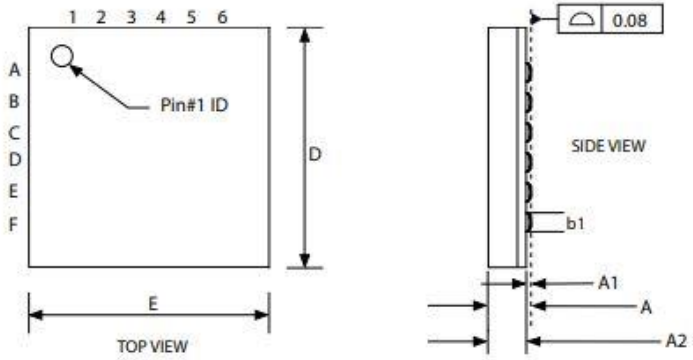
2010-10-20

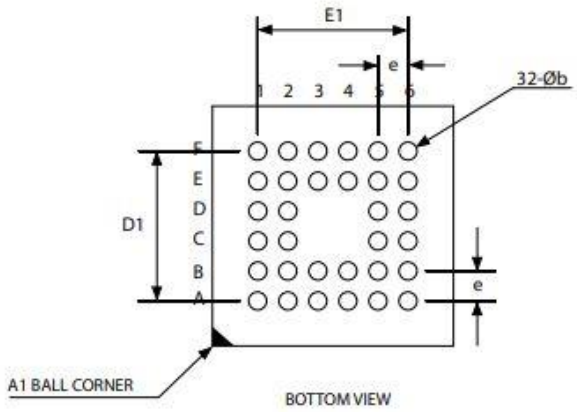
Atmel	TITLE	DRAWING NO.	REV.
	32A, 32-lead, 7 x 7mm body size, 1.0mm body thickness, 0.8mm lead pitch, thin profile plastic quad flat package (TQFP)	32A	C

ATmega328 Datasheet (Page24)

PCB Layout Design

Component Package Type – Example Datasheet UFBGA





COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	0.60	
A1	0.12	–	–	
A2	0.38 REF			
b	0.25	0.30	0.35	1
b1	0.25	–	–	2
D	3.90	4.00	4.10	
D1	2.50 BSC			
E3.90	4.00	4.10		
E1	2.50 BSC			
e	0.50 BSC			

Note1: Dimension "b" is measured at the maximum ball dia. in a plane parallel to the seating plane.
Note2: Dimension "b1" is the solderable surface defined by the opening of the solder resist layer.

07/06/10

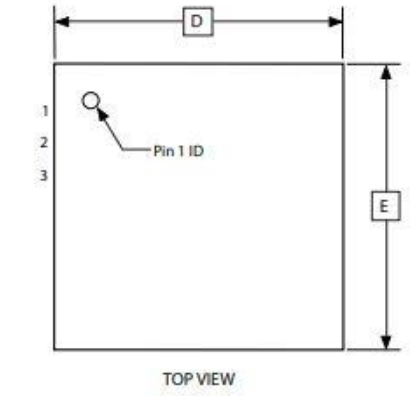
Atmel	TITLE	GPC	DRAWING NO.	REV.
Package Drawing Contact: packagedrawings@atmel.com	32CC1, 32-ball (6 x 6 Array), 4 x 4 x 0.6 mm package, ball pitch 0.50 mm, Ultra Thin, Fine-Pitch Ball Grid Array (UFBGA)	CAG	32CC1	B

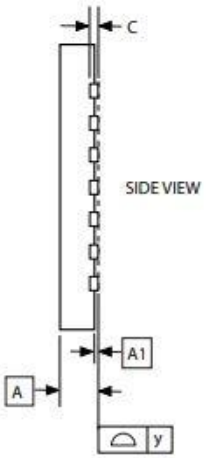
UFBGA

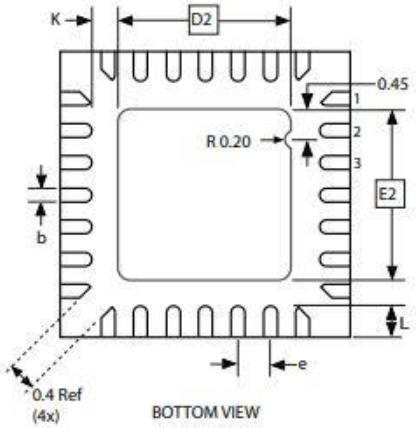
ATmega328 Datasheet (Page25)

PCB Layout Design

Component Package Type – Example Datasheet VQFN







Note: The terminal #1 ID is a Laser-marked Feature.

COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	0.80	0.90	1.00	
A1	0.00	0.02	0.05	
b	0.17	0.22	0.27	
C		0.20 REF		
D	3.95	4.00	4.05	
D2	2.35	2.40	2.45	
E	3.95	4.00	4.05	
E2	2.35	2.40	2.45	
e		0.45		
L	0.35	0.40	0.45	
y	0.00	–	0.08	
K	0.20	–	–	

10/24/08

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE	GPC	DRAWING NO.	REV.
	28M1, 28-pad, 4 x 4 x 1.0mm Body, Lead Pitch 0.45mm, 2.4 x 2.4mm Exposed Pad, Thermally Enhanced Plastic Very Thin Quad Flat No Lead Package (VQFN)	ZBV	28M1	B

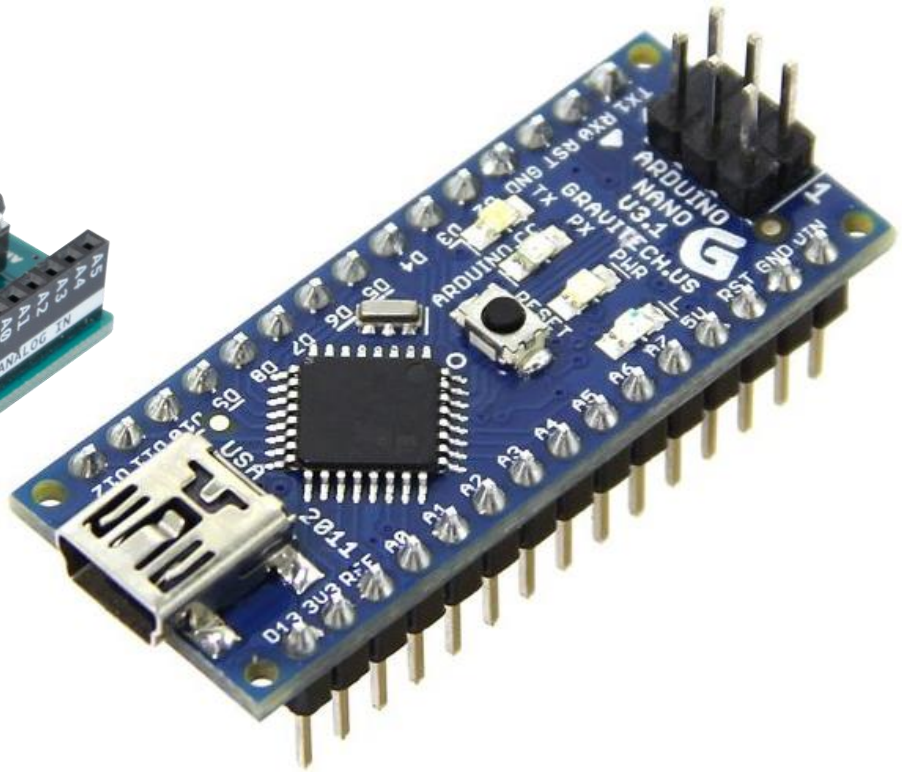
VQFN

ATmega328 Datasheet (Page26)

PCB Layout Design

Component Package Type – Example Arduino 328 Based

Arduino Uno



Arduino Nano

PCB Layout Design

THT – Supported Holes / Unsupported Holes

Figure 4.1.6 Through Solder Joints: Supported Holes

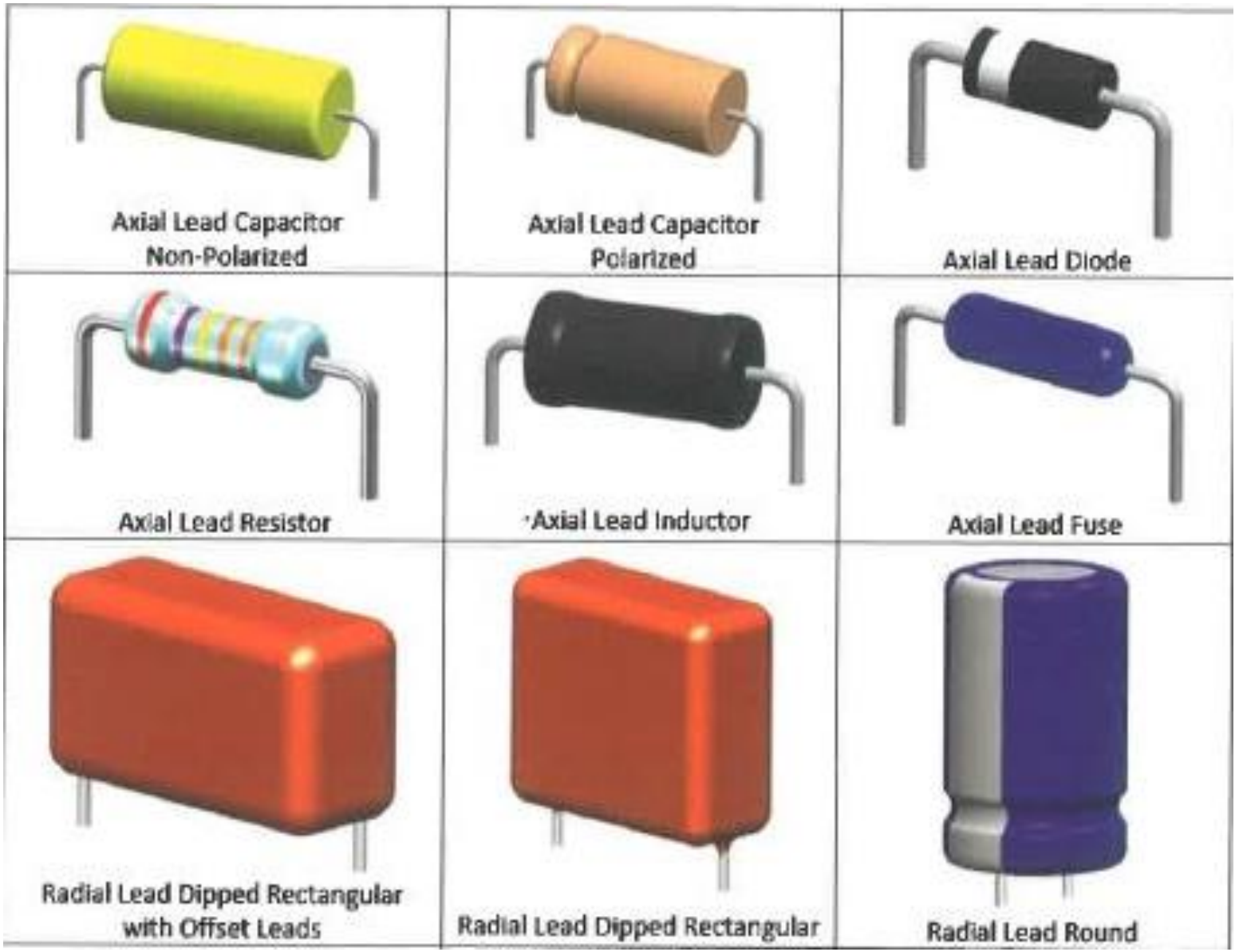
On single-sided printed boards, the component leads are placed in unsupported holes, the ends of the leads are clinched to one side, and the solder joint formed on the copper pads that surround the drilled hole (usually on the secondary side of the printed board). There is no plating or solder in the barrel of the drilled hole. See Figure 4.1.7. [IPC-AJ-820A – 3.5.1.2]

Figure 4.1.7 Through Solder Joints: Unsupported Holes

Examples of the most common through-hole components are shown in Figures 4.1.8 and 4.1.9

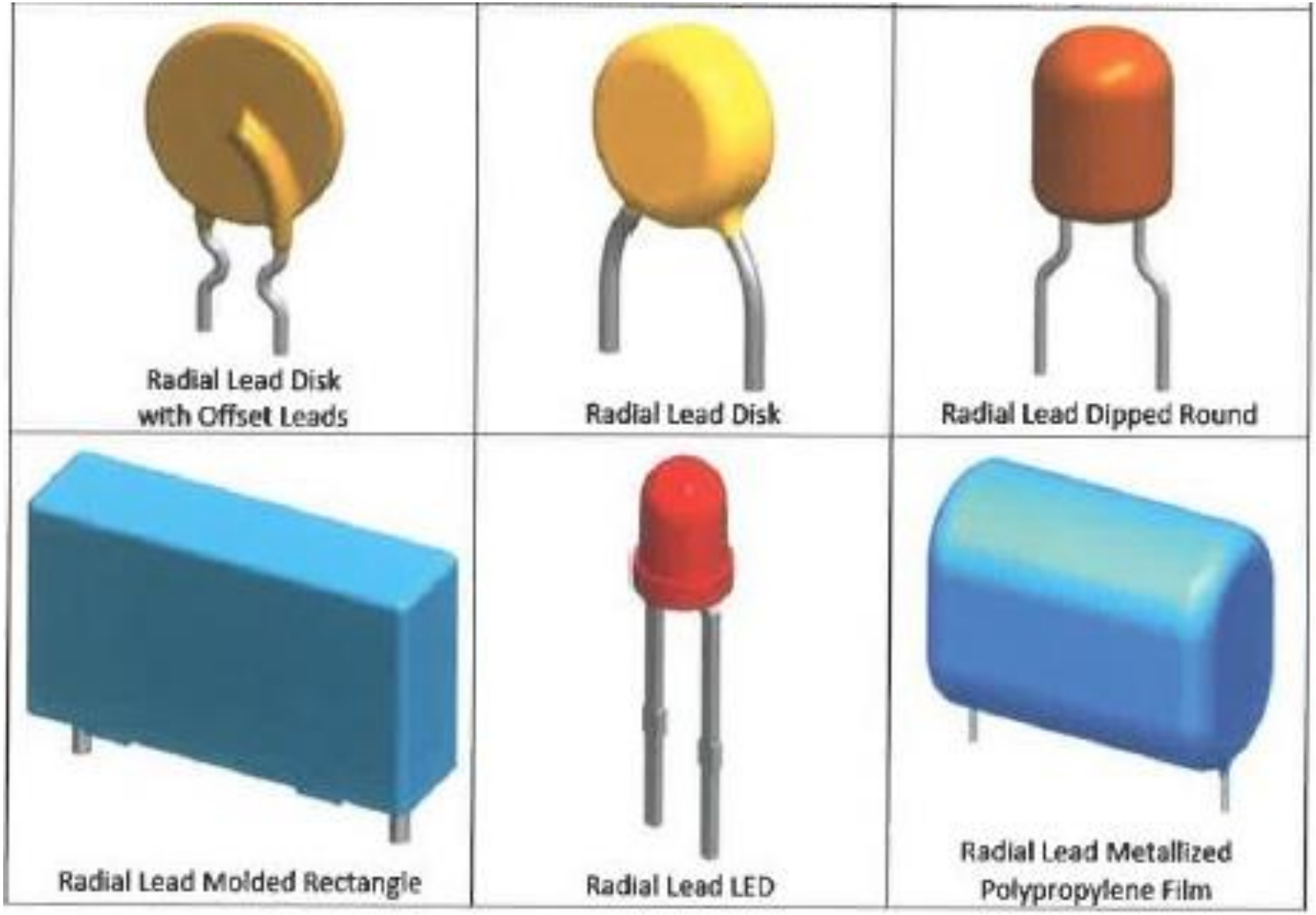
PCB Layout Design

Axial & Radial Lead Through-Hole Component



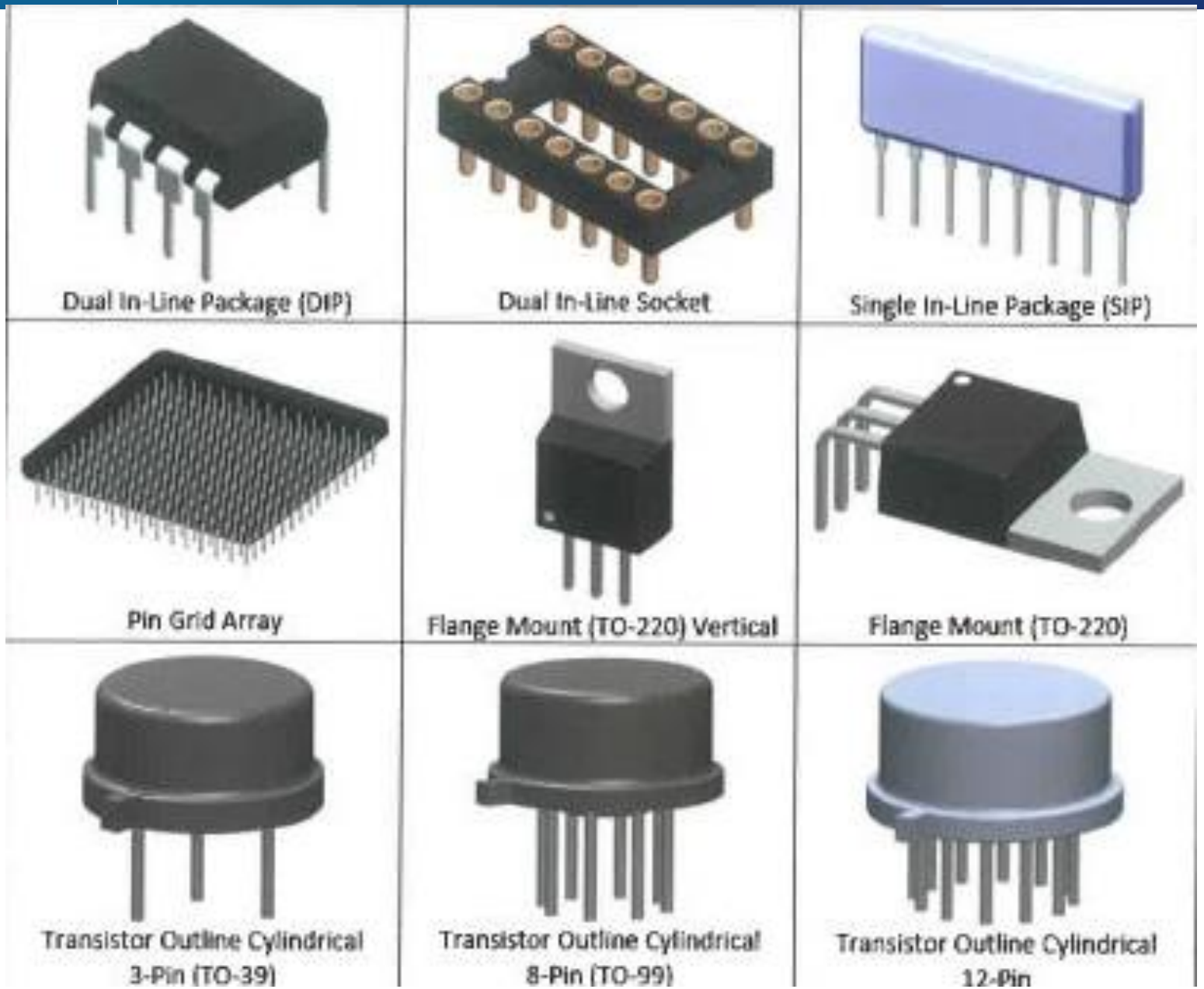
PCB Layout Design

Axial & Radial Lead Through-Hole Component



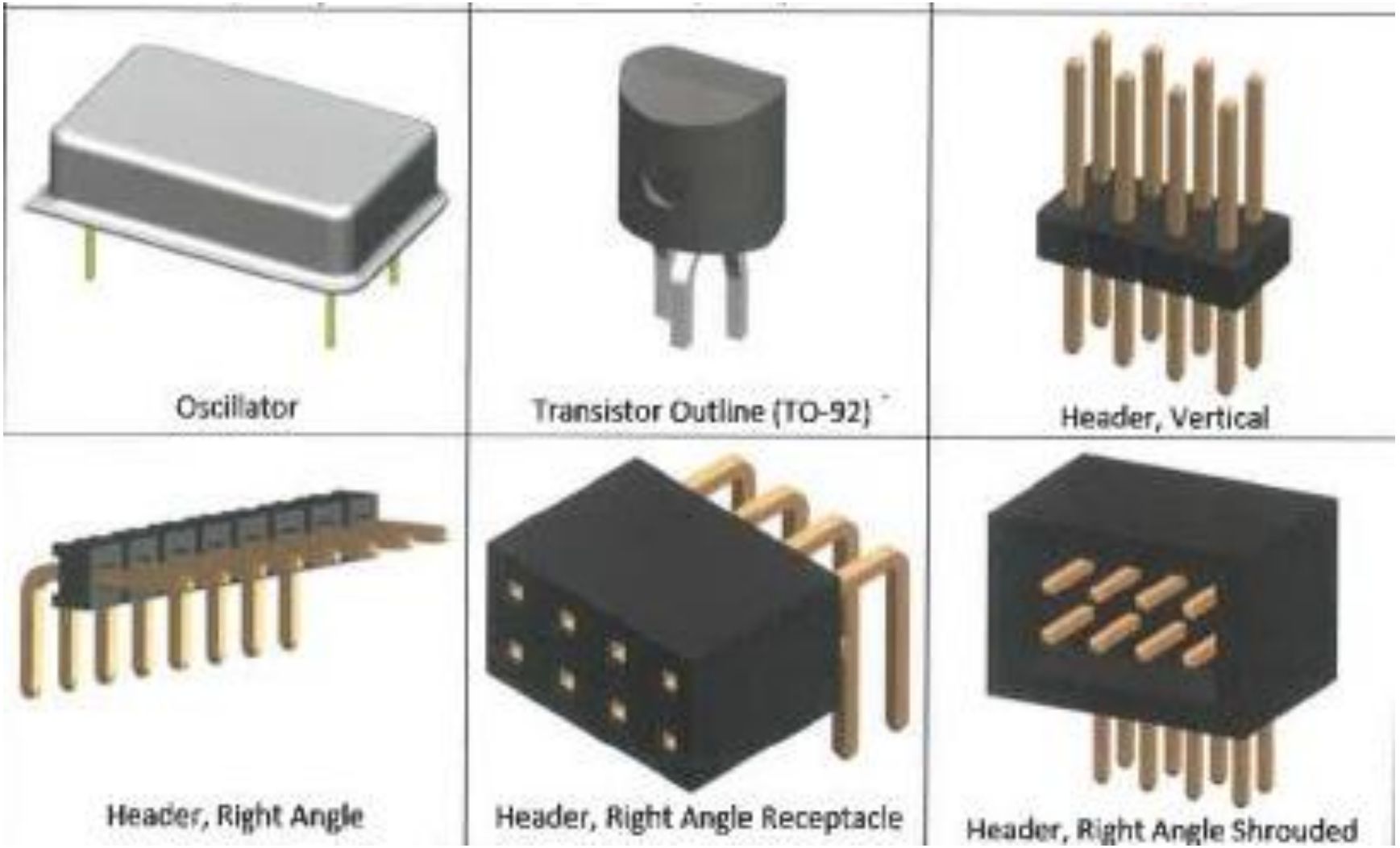
PCB Layout Design

Miscellaneous Through-Hole Package



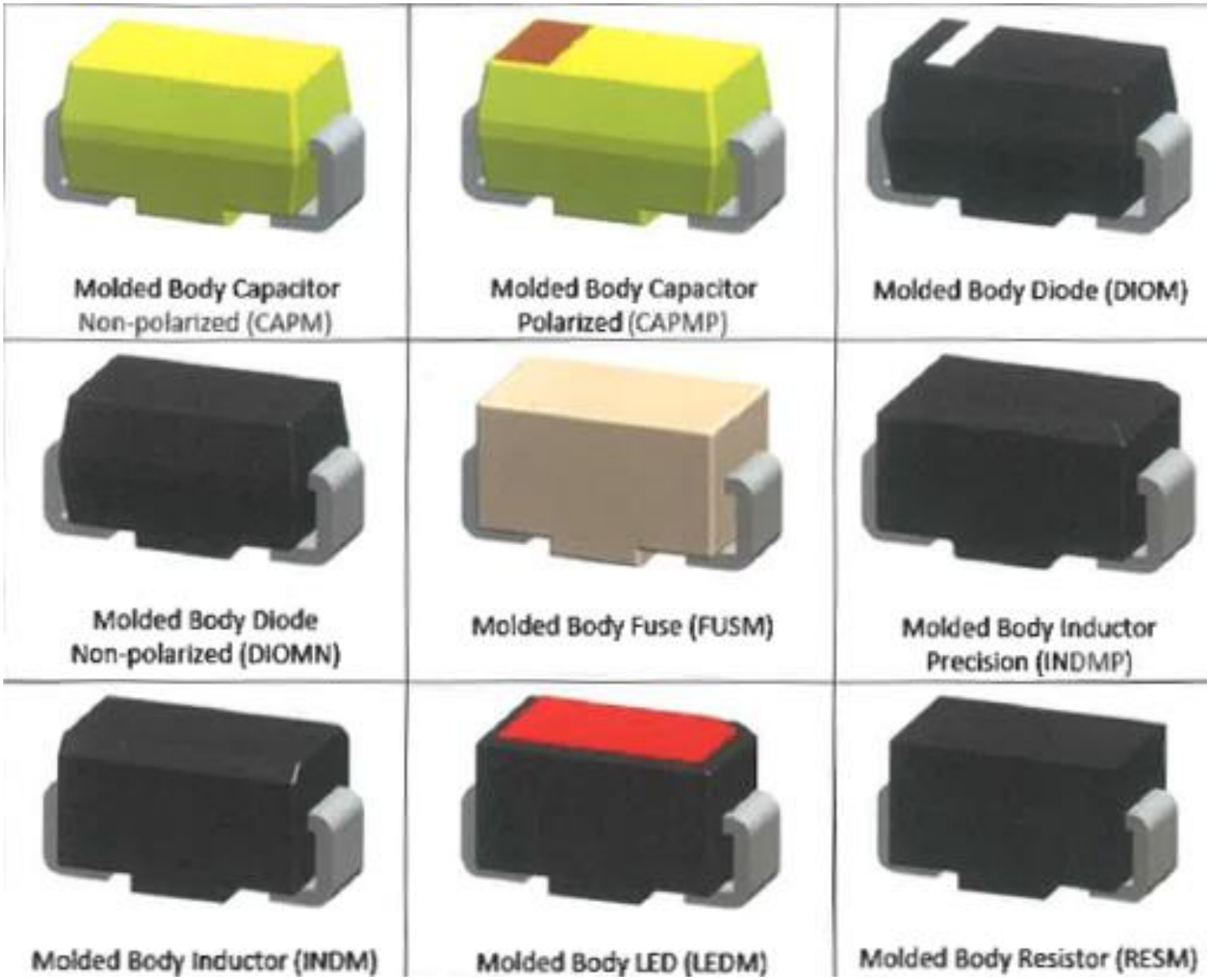
PCB Layout Design

Miscellaneous Through-Hole Package



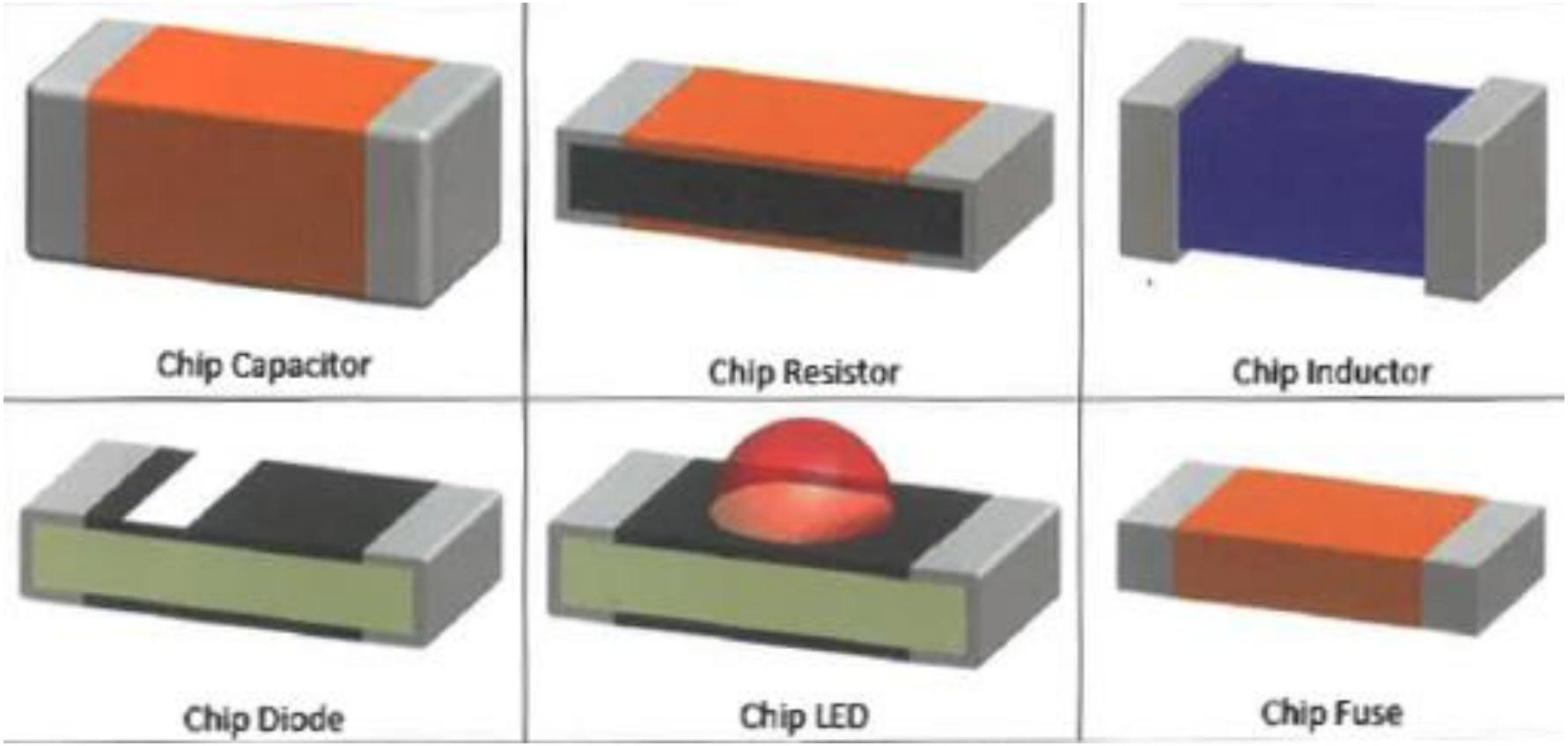
PCB Layout Design

Molded Body & Chip Surface Mount Package



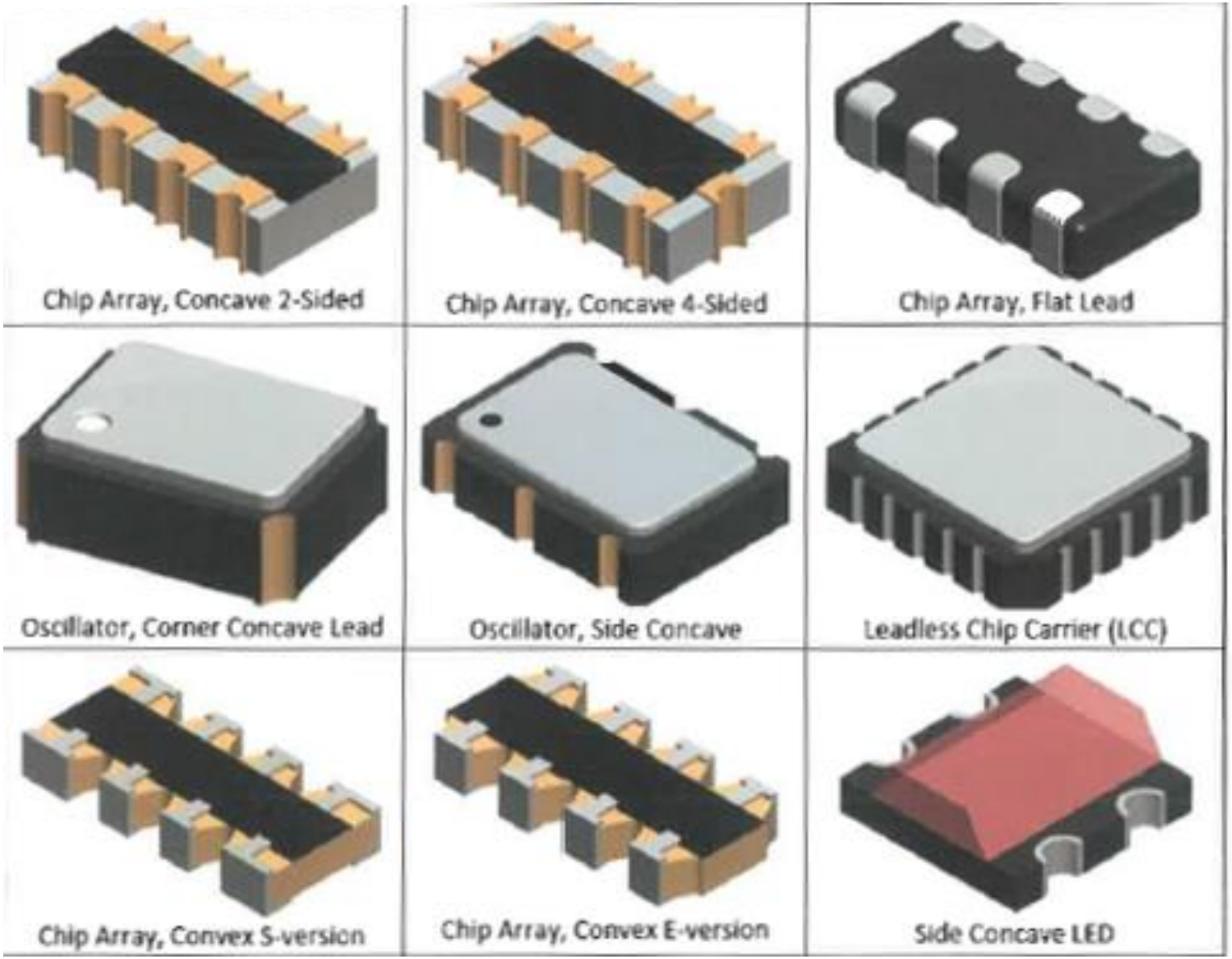
PCB Layout Design

Molded Body & Chip Mount Package



PCB Layout Design

Concave & Flat Lead Surface Mount

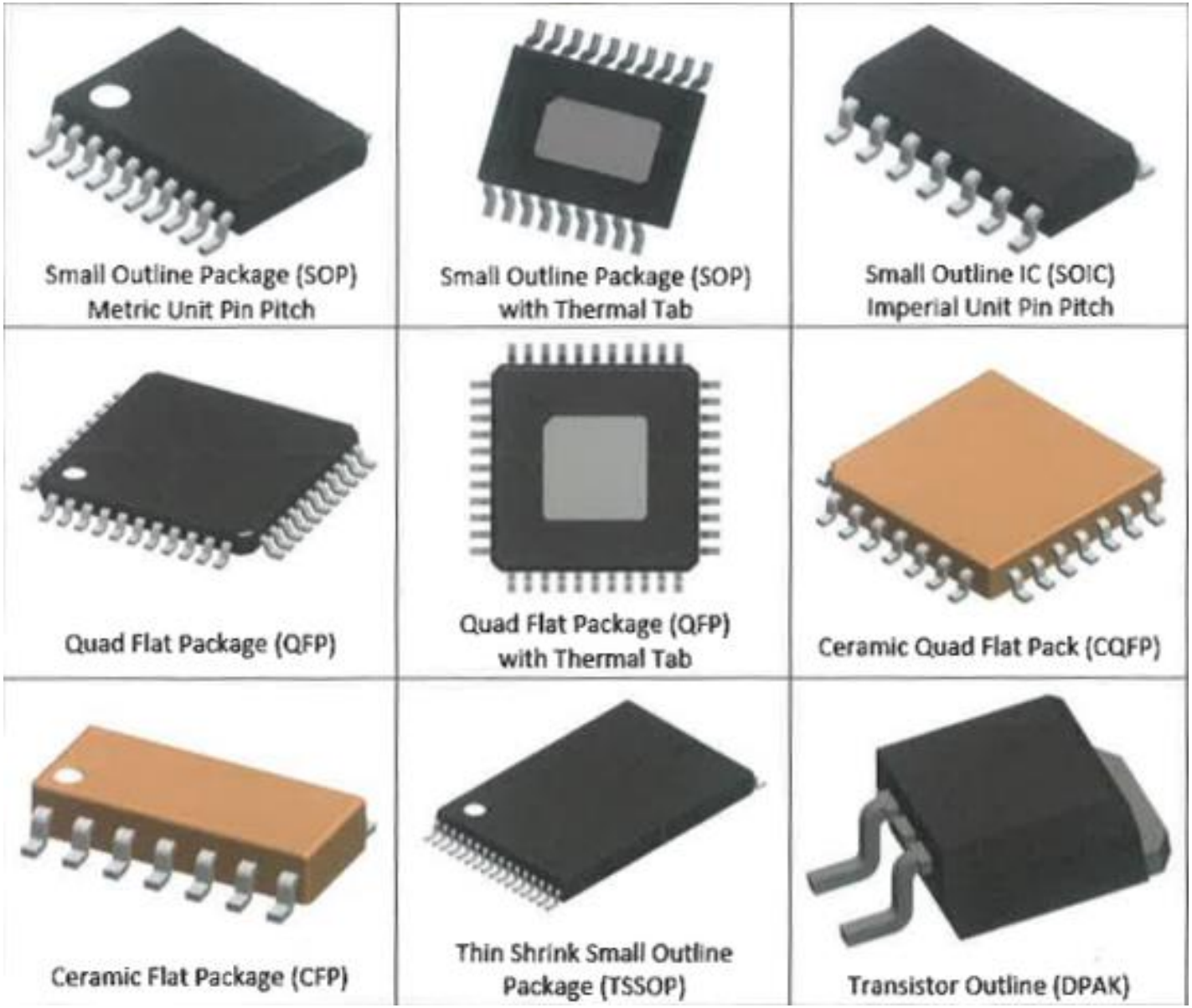


PCB Layout Design

Concave & Flat Lead Surface Mount

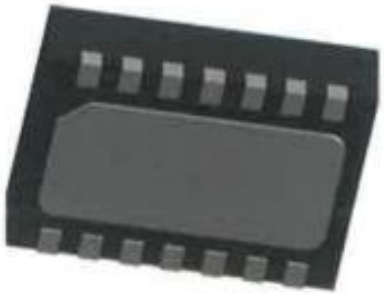
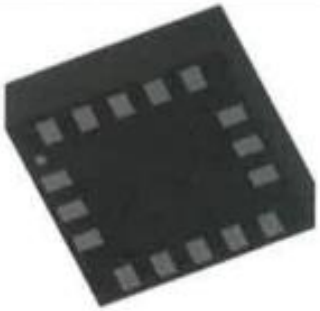
PCB Layout Design

Gull Wing Lead Component Package



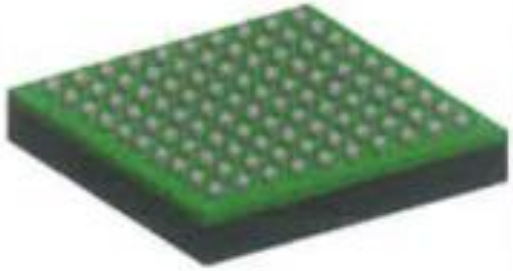
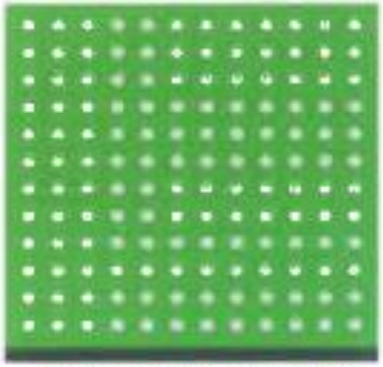
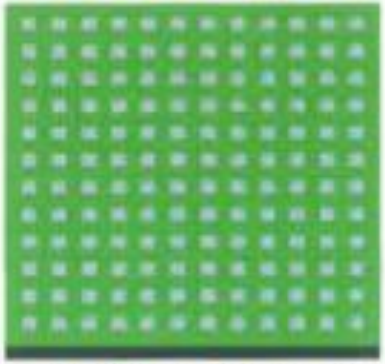
PCB Layout Design

Bottom Terminal Surface Mount Leaded Package

 Quad Flat No-lead (QFN) with Rectangular Lead Shape	 Quad Flat No-lead (QFN) with D-shape Lead	 Small Outline No-lead (SON) with Rectangular Lead Shape
 Small Outline No-lead (SON) With D-shape Lead	 Pullback Quad Flat No-lead (PQFN) Rectangular Lead	 Pullback Quad Flat No-lead (PQFN) with D-shape Lead
 Pullback Small Outline No-lead (PSON) Rectangular Lead Shape	 Pullback Small Outline No-lead (PSON) with D-shape Lead	 Column Grid Array (CGA)

PCB Layout Design

Bottom Terminal Surface Mount Leaded Package

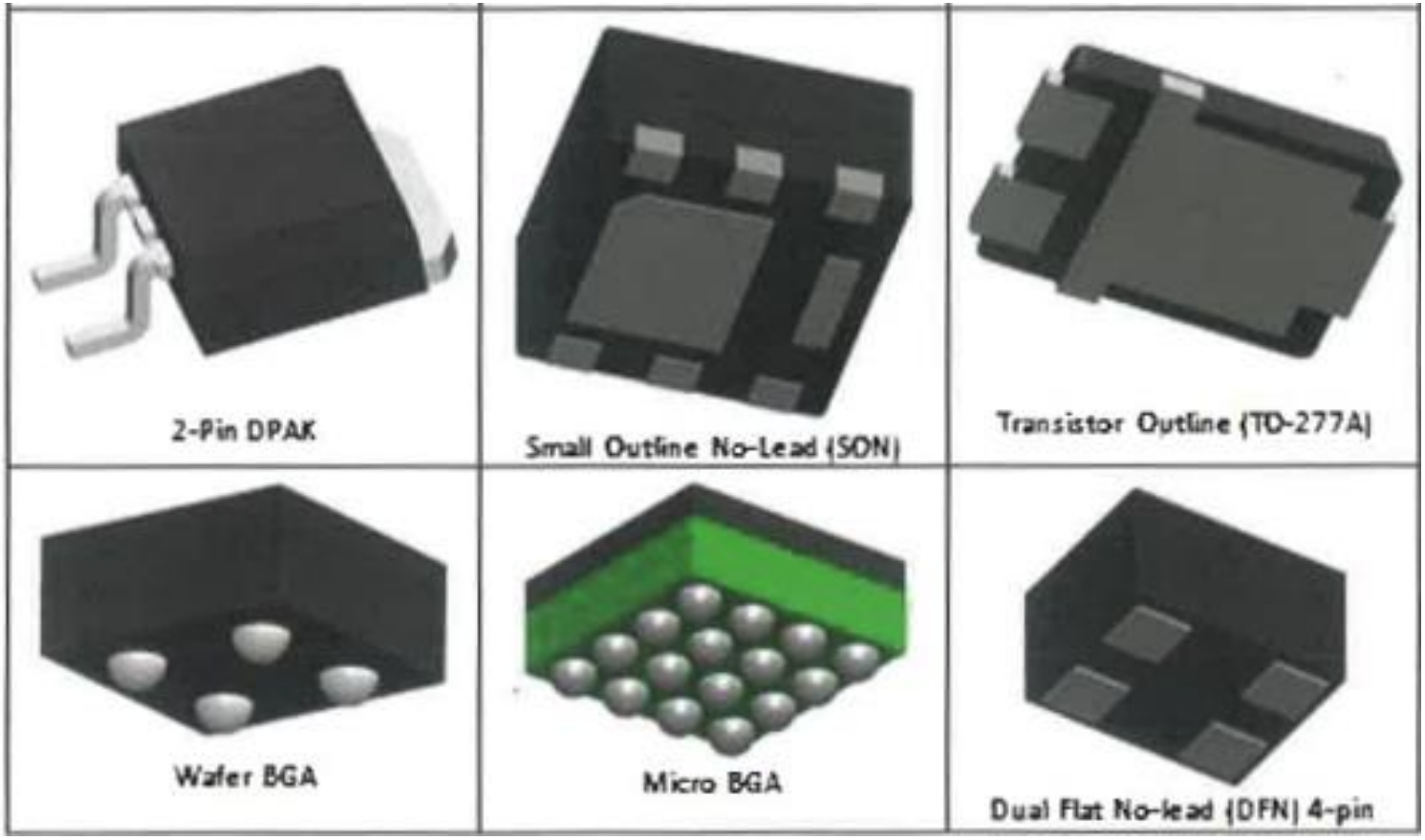
 Dual Flat No-lead (DFN) 2-Pins	 Dual Flat No-lead (DFN) 3-Pins	 Dual Flat No-lead (DFN) 4-Pins
 Ball Grid Array (BGA)	 Land Grid Array (LGA) Round Lead	 Land Grid Array (LGA) Square Lead

PCB Layout Design

Miscellaneous Surface Mount ICs and Discrete

PCB Layout Design

Miscellaneous Surface Mount ICs and Discrete



Electrical Functionality

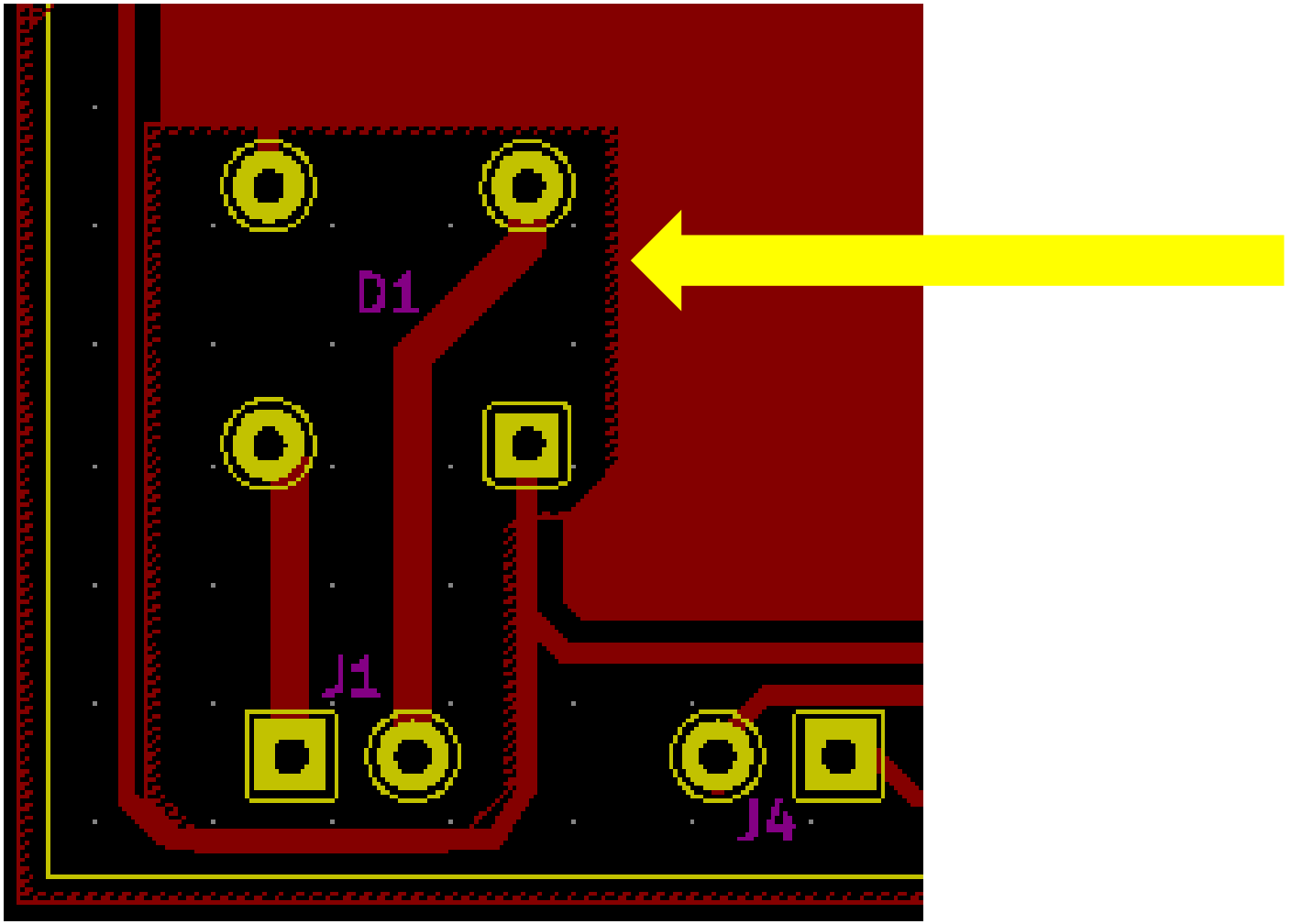
-Pull-up or pull-down resistor for unused logic pins

-Special Keep out areas, specific voltage, capacitive or inductive plane

-Separation of circuit by frequency

PCB Layout Design

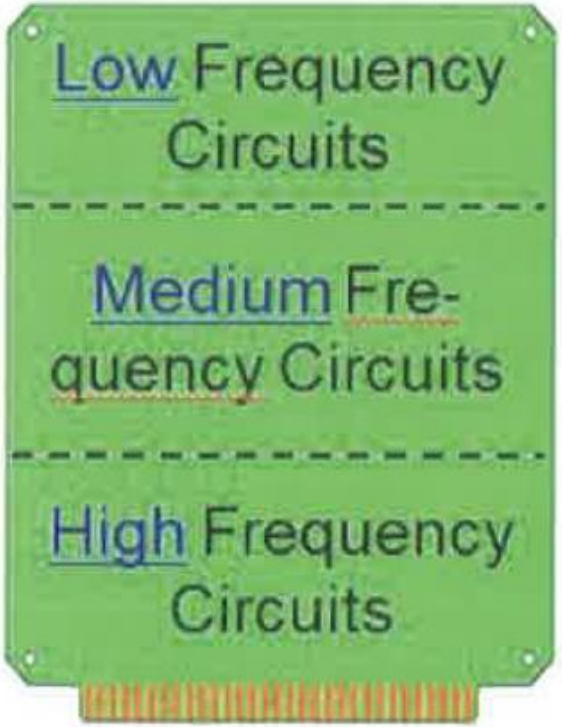
Component Placement – Keepout Areas



PCB Layout Design

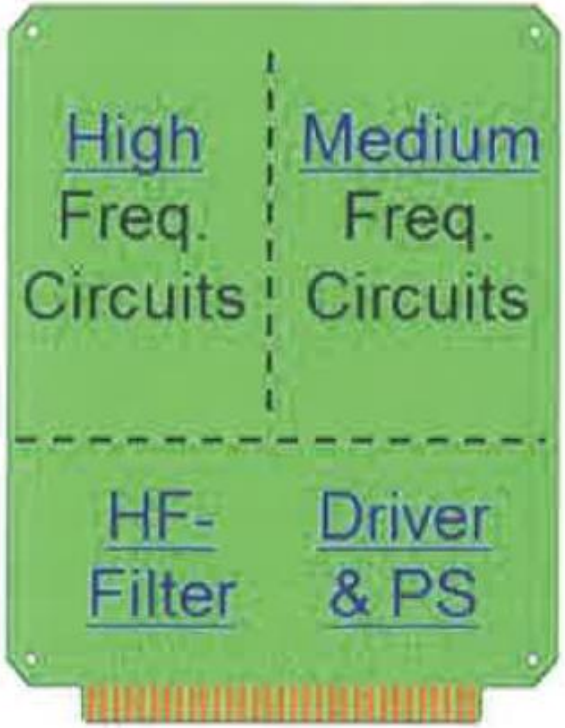
Component Placement – Circuit Distribution By Frequency

a) HF Interaction via Motherboard



PWB should be separated into areas for different frequency circuits

b) General HF-Board



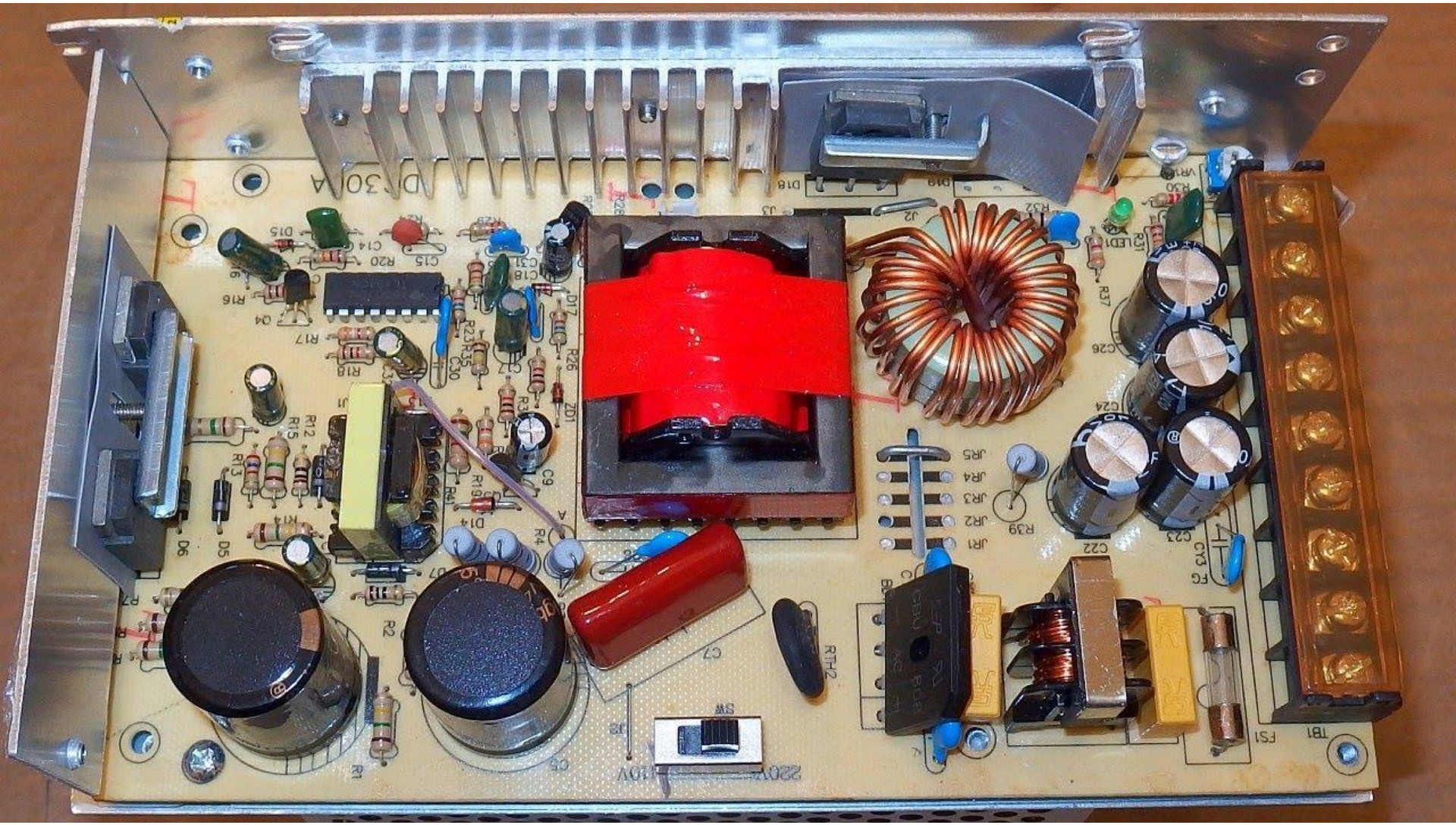
Mechanical Functionality

-Height restriction

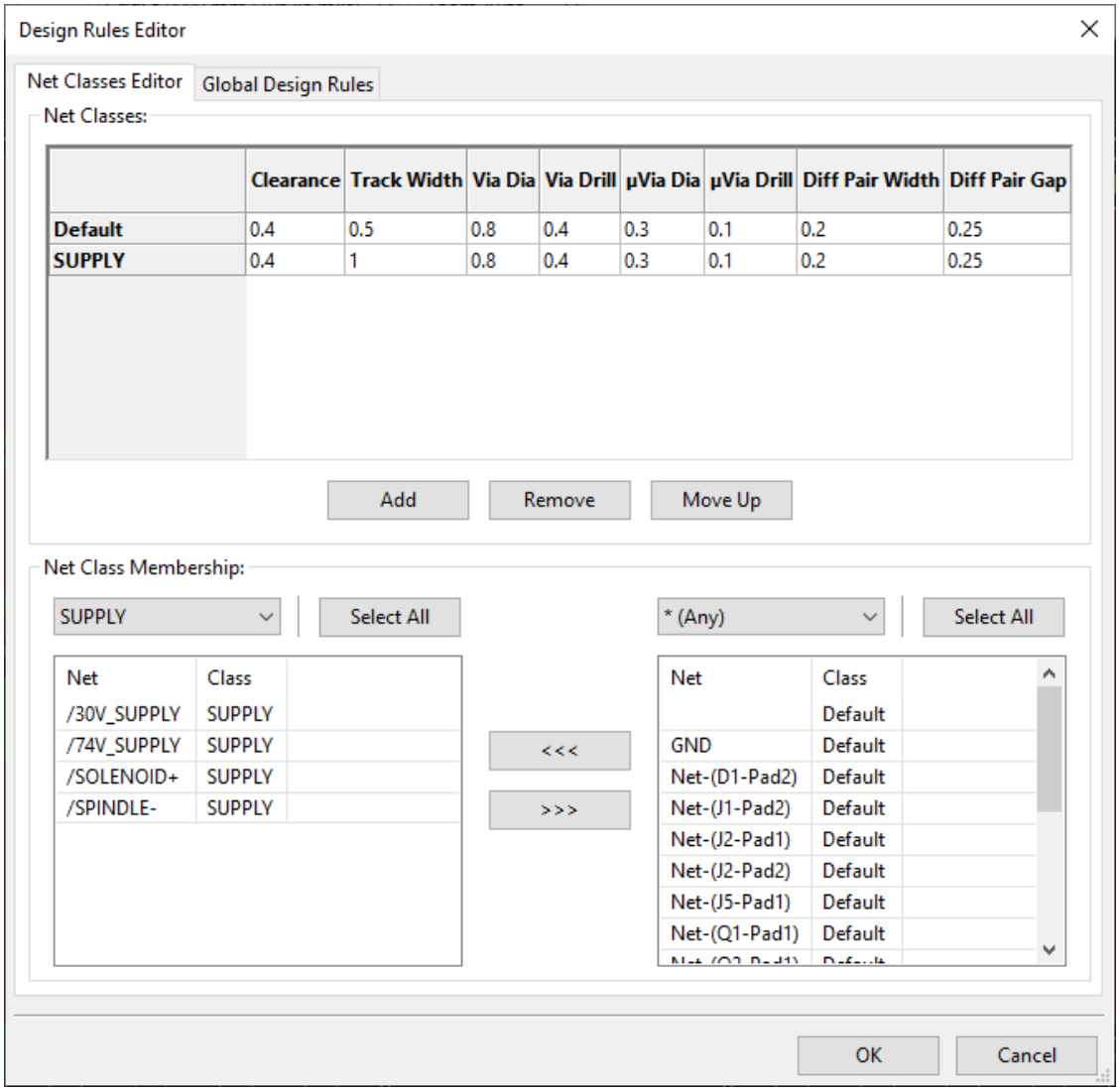
-Predefined location i.e adjustment, heat dissipation

Schematic Editing

Component Placement - Example

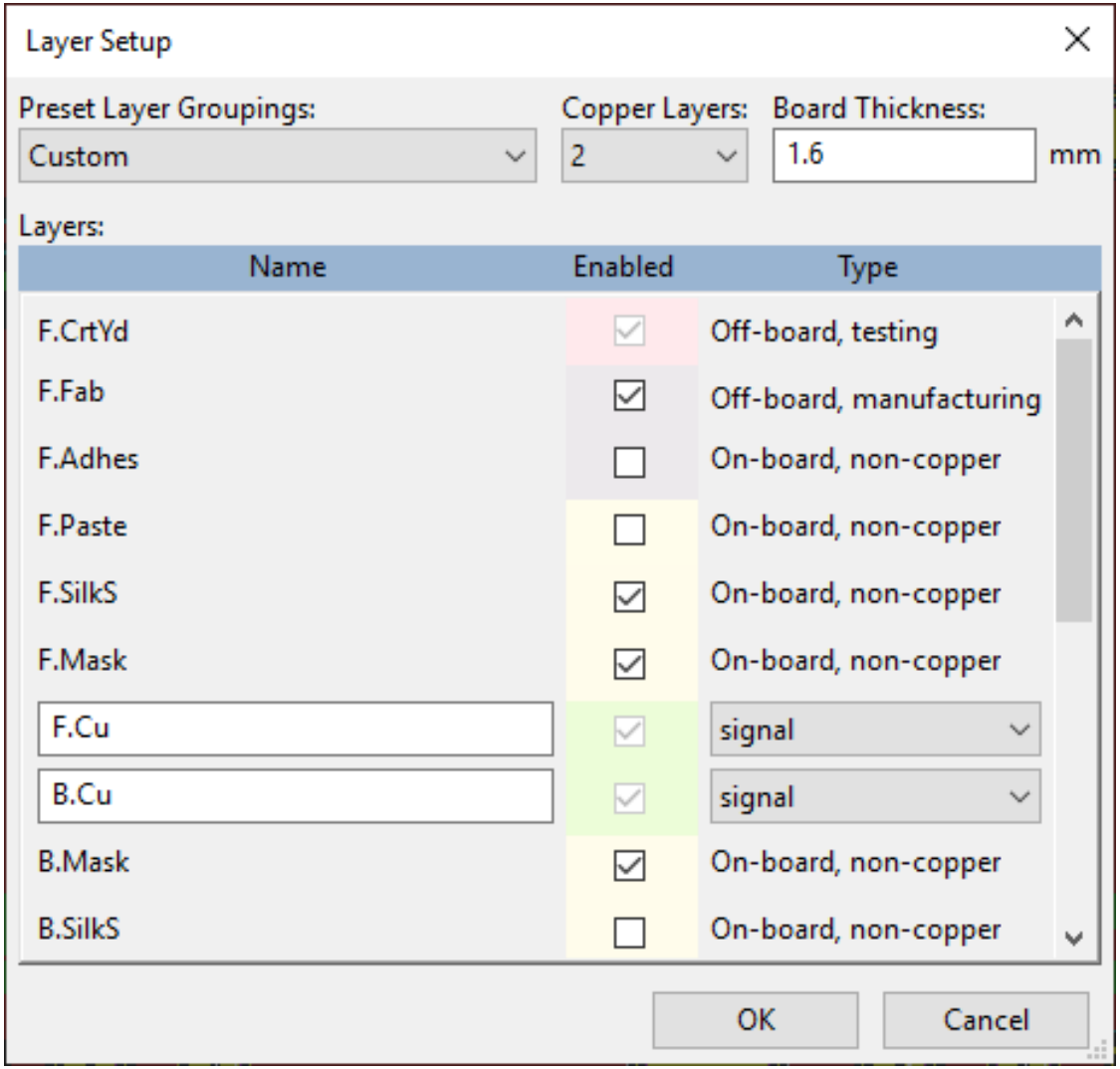


Schematic Editing
Design Rule



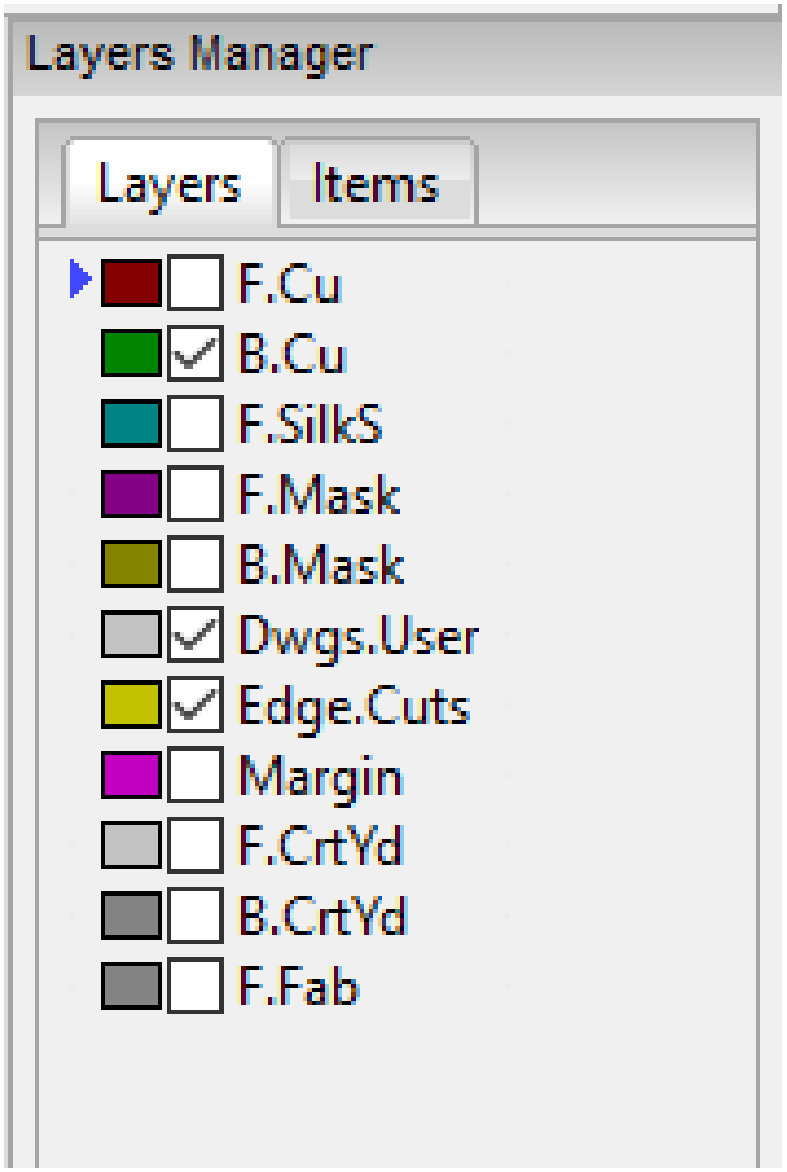
Refer Manufacturer's Rules and Limitation

Schematic Editing
Layer Setup



Refer Manufacturer’s Rules and Limitation

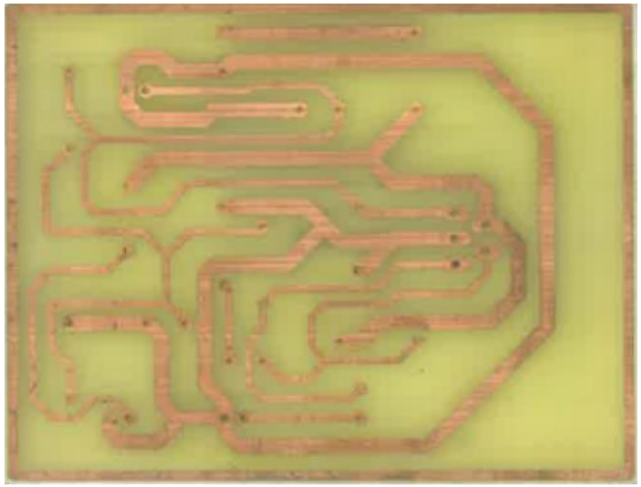
Schematic Editing
Layers



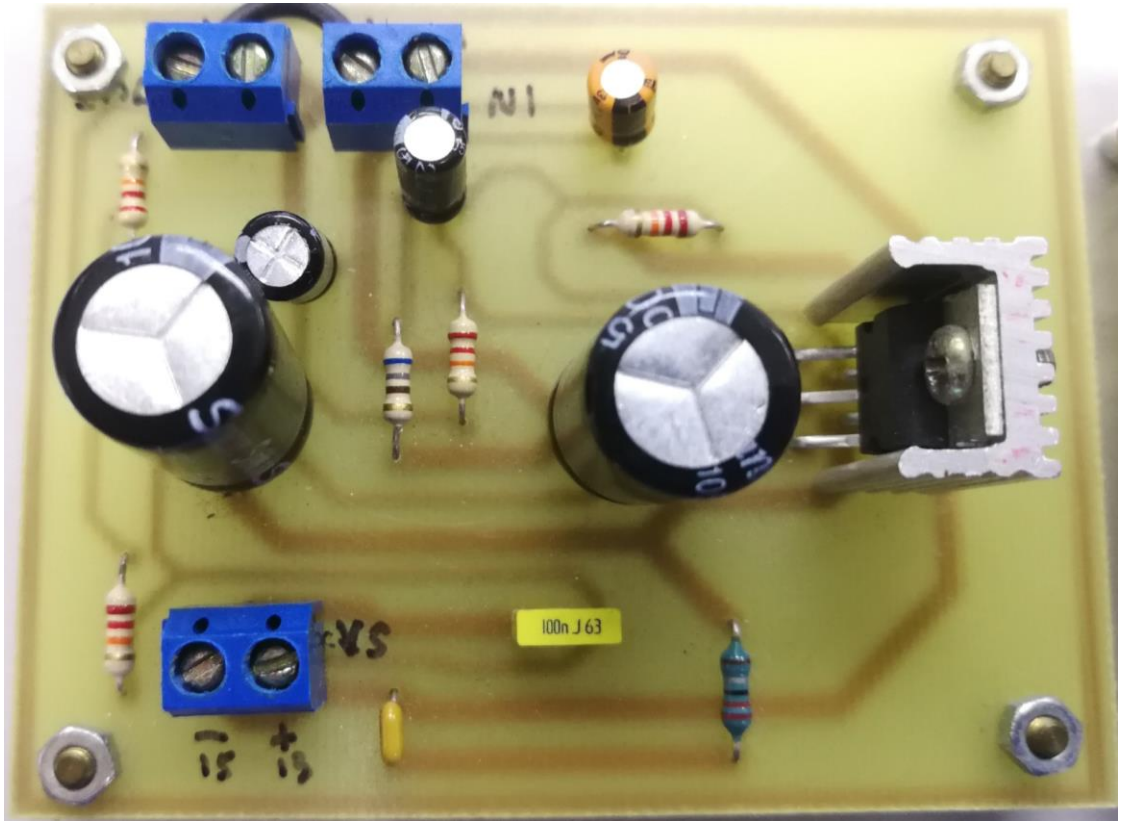
Schematic Editing

Single Sided PCB Layout Example

FRONT

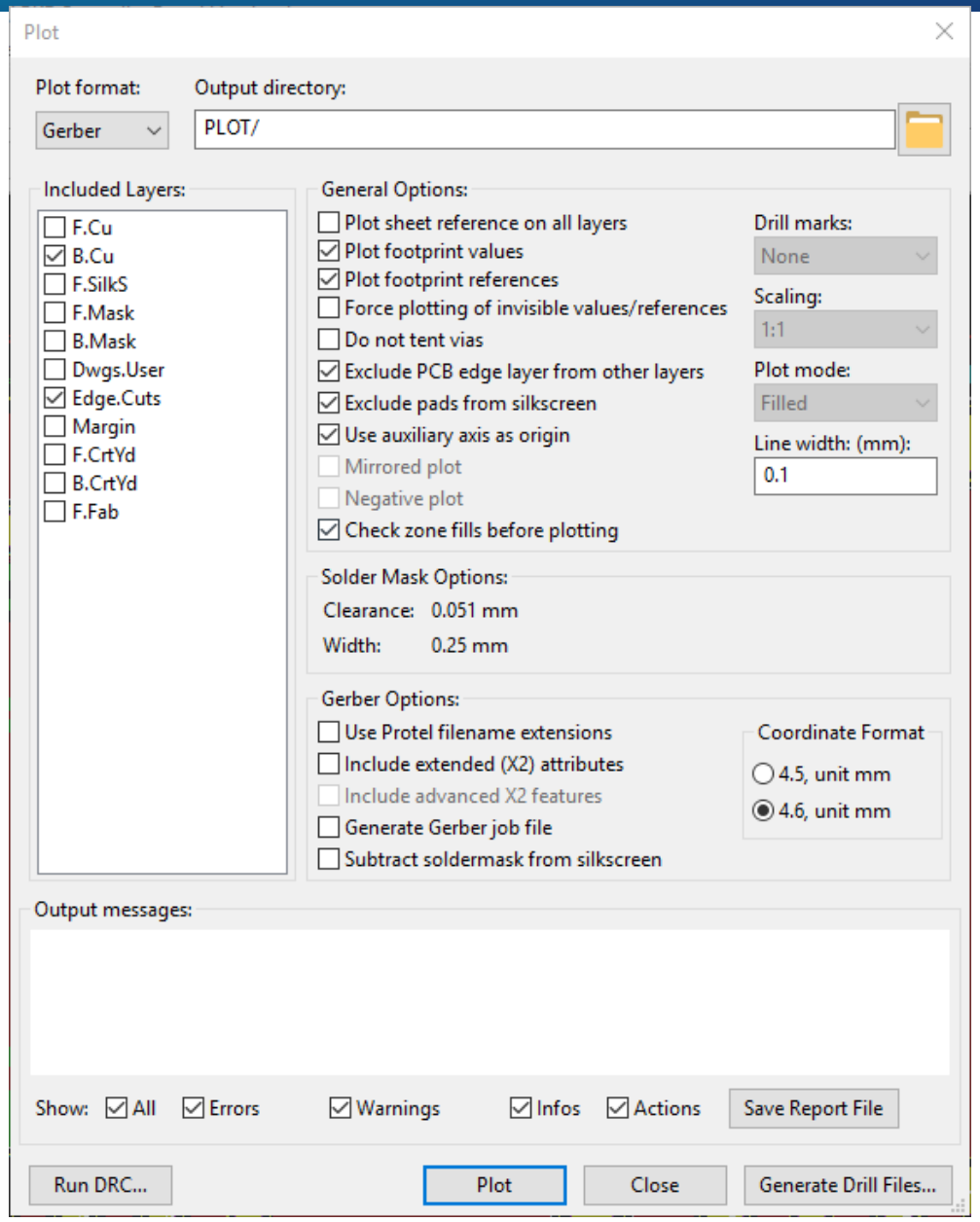


BACK



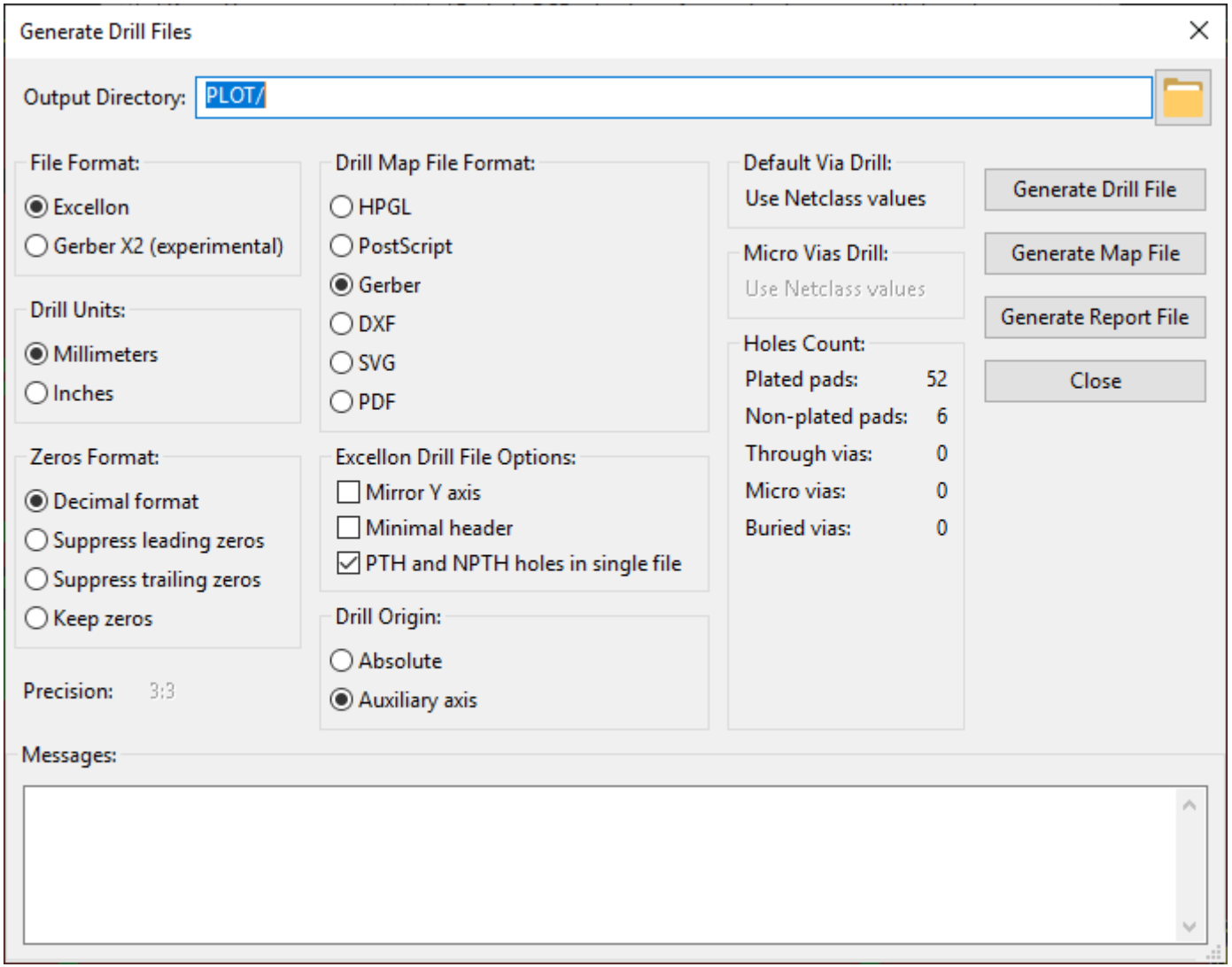
COMPONENT LAYOUT
(FRONT LAYER VIEW)

Schematic Editing
File Export – Gerber Export



Schematic Editing

File Export – Drill Export



Schematic Editing

Schematic Symbols