

CIRCUIT DESIGN PROCESS

2.1 Introduction:

In this chapter we are going to study how to get the schematic into stick diagrams or layouts.

MOS circuits are formed on four basic layers:

- > N-diffusion
- > P-diffusion
- > Polysilicon
- > Metal

These layers are isolated by one another by thick or thin silicon dioxide insulating layers.

Thin oxide mask region includes n-diffusion / p-diffusion and transistor channel.

2.2 Stick diagrams:

Stick diagrams may be used to convey layer information through the use of a color code. For example: n-diffusion--green poly--red blue-- metal yellow--implant black--contact areas.

Encodings for NMOS process:

COLOR	STICK ENCODING	LAYERS	MASK LAYOUT ENCODING	CIF LAYER
GREEN		n-diffusion (n ⁺ active) Thin _{ox} *		ND
RED		Polysilicon		NP
BLUE		Metal 1		NM
BLACK		Contact cut		NC
GRAY	NOT APPLICABLE	Overglass		NG
nMOS ONLY YELLOW		Implant		NI
nMOS ONLY BROWN		Buried contact		NB
FEATURE	FEATURE (STICK)	FEATURE (SYMBOL)	FEATURE (MASK)	
n-type enhancement mode transistor				
Transistor length to width ratio L:W should be shown.				
n-type depletion mode transistor nMOS only				
Source, drain and gate labelling will not normally be shown.				

Figure 1: NMOS encodings.

Figure shows the way of representing different layers in stick diagram notation and mask layout using nmos style.

Figure 1 shows when a n-transistor is formed: a transistor is formed when a green line (n+ diffusion) crosses a red line (poly) completely. Figure also shows how a depletion mode transistor is represented in the stick format.

2.2.1 Encodings for CMOS process:

COLOR	STICK ENCODING	LAYERS	MASK LAYOUT ENCODING	CIF LAYER
GREEN	Encoding as in Color plate 1 (a)	n-diffusion (n ⁺ active) Thinox [®]	Encoding as in Color plate 1 (a)	CAA or CNA
RED		Polysilicon		CPF
BLUE		Metal 1		CMF
BLACK		Contact out		CC
GRAY		Overglass		COG
YELLOW (STICK)	 green outline here for clarity	p-diffusion (p ⁺ active)		CAA or CPA
YELLOW	Not shown on diagram	p ⁺ mask		CPP
DARK BLUE OR PURPLE		Metal 2		CMS
BLACK		VIA		CVA
BROWN	 p-well edge is shown as a demarcation line in stick diagrams	p-well		CPW
BLACK		V _{DD} or V _{SS} contact		CC
FEATURE	FEATURE (STICK)	FEATURE (SYMBOL)	FEATURE (MASK)	
n-type enhancement mode transistor (as in Color plate 1 (a))	 Transistor length to width ratio L/W may be shown.			
p-type enhancement mode transistor	 Note: p-type transistors are placed above and n-type below the demarcation line.			

Figure 2: CMOS encodings.

Figure 2 shows when a n-transistor is formed: a transistor is formed when a green line (n+ diffusion) crosses a red line (poly) completely.

Figure 2 also shows when a p-transistor is formed: a transistor is formed when a yellow line (p+ diffusion) crosses a red line (poly) completely.