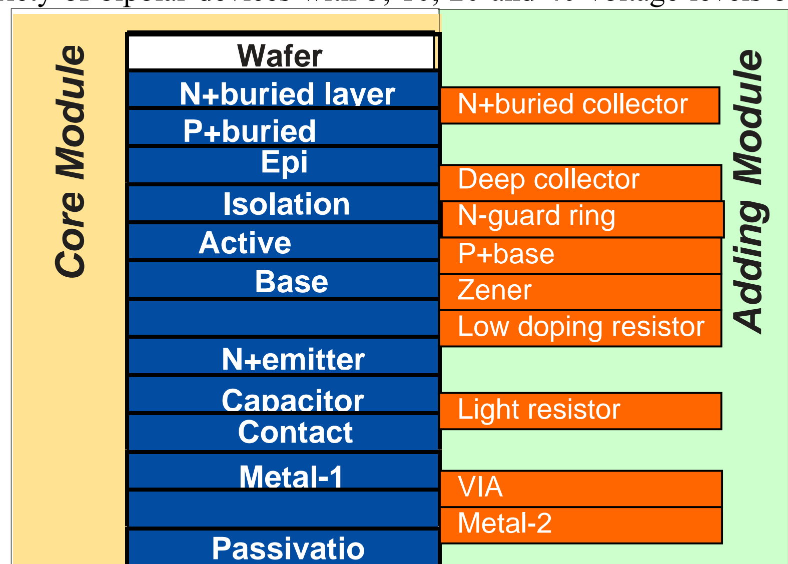
DMS LAB Limited

40V 1.5um Bipolar process specification

Description

- 40V 1.5um Bipolar process is DMS Lab Limited power technologies for scaling of bipolar chips. Main target applications are analog and digital-analog ICs for wide range application like DC-DC converters, Hi-Fi amplifiers, precision amplifiers and comparators, voltage regulators and etc for applications using 40V supply.
- The modular process combines bipolar elements for different supply application with core 40V bipolar processing steps to provide a wide variety of bipolar devices with 5, 10, 20 and 40 voltage levels on the same die.
- The 9 layers core process module is available for 40V and 20V breakdown voltage of elements.
- Other process modules can be added to integrate NPN transistors with small parasitic collector resistance (1 or 2 layer), elements for 5 and 10V application (1 layer), power lateral PNP transistors (1 layer), Zener diodes (1 layer), low doping p-resistors (1 layer), precision light p-resistors (1 layer), 2-nd metal level (2 layers).



Key Features

The small area of 5-20V elements is the main advantage of the DMS 40V bipolar technology. There is let greatly to decrease a chip size with consist a large number of low voltage elements.

A high number of different devices are available:

- 40V power NPN transistor;
- 40, 20, 10, 5V NPN transistors;
- 40V power lateral PNP transistor;
- 40, 20, 10, 5V lateral PNP transistors;
- 40, 20, 10, 5V vertical PNP transistors r;
- resistors in active layers;
- p/n junction and Me-nitride-Si capacitors;
- Zener diodes and Schottky diodes;

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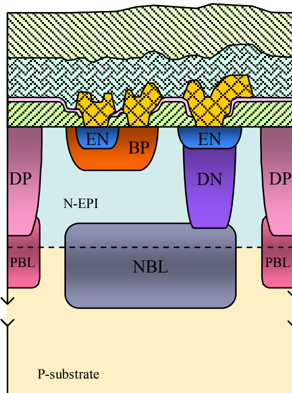
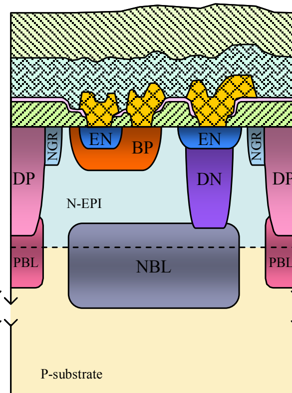
> Schematic cross section of main elements

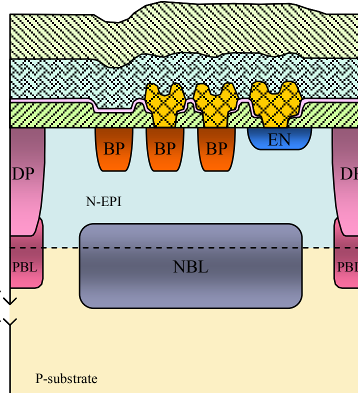
20-40V NPN transistors with Deep Collector (DN)



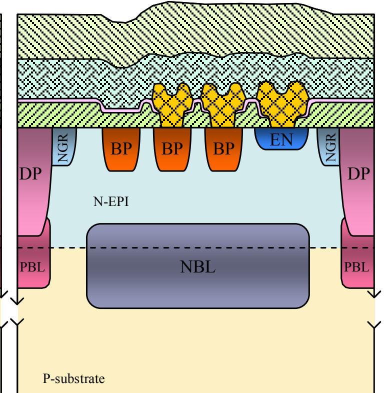
5-10V NPN with DN and N-guard Ring



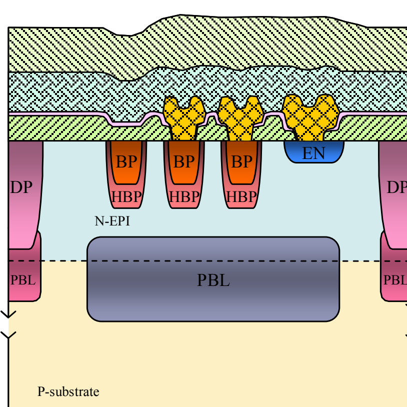
20-40V PNP lateral transistors



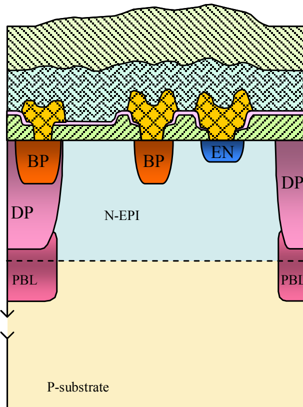
5-10V PNP lateral with N-guard ring



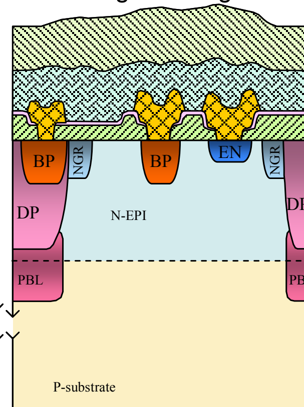
20-40V PNP lateral transistors in P+Base



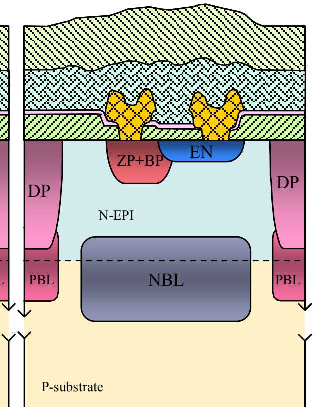
20-40V PNP vertical transistors



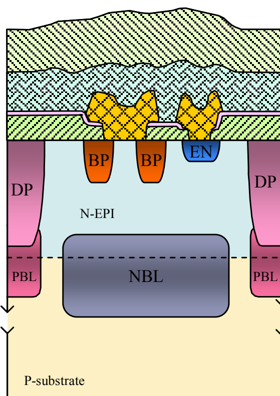
5-10V PNP vertical with N-guard ring



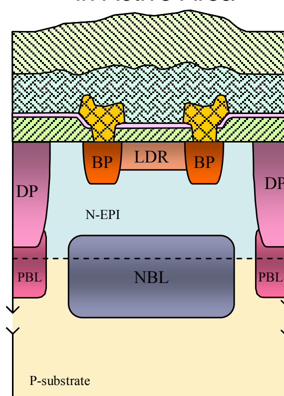
Zener Diode



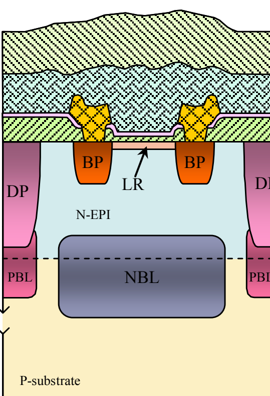
Schottky Diode



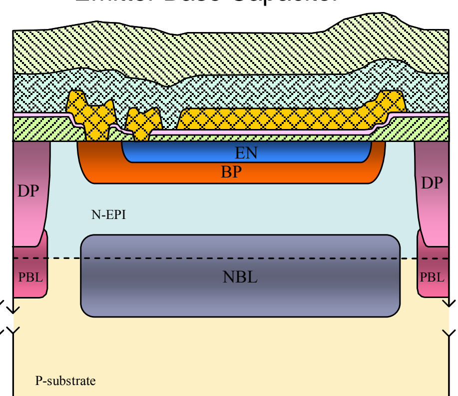
Low Doping Resistor in Active Area



Light Resistor



Metal – Si3N4 – n+Si and – Emitter Base Capacitor



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> Basic design rules

Layer	Min width (um)	Min spacing (um)
NPN Emitter size	4.5x4.5	---
Vertical PNP Emitter size	4.5x4.5	---
Lateral PNP emitter diameter	9.0	---
Isolation	4.0	6.0
Active Area	3.5	8.0
Base, Low doping resistors	3.5	8.0
Light resistor	2.5	4.5
Contact	1.5x1.5	2.0
Metal-1	6.5	1.5
VIA	2.0x2.0	3.0
Metal-2	6.0	2.0

〉 Device Parameters of main elements

NPN405 (Se=7.0x7.0 um² with Deep Collector)

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	60	90	150	-	Vce=5V, Ib=10μA
Early Voltage	Va	>300			V	Ib=10μA, Vce=2~35V
Saturation Voltage	Vces	175	250	325	mV	Ib=10μA, Ic=0.6mA
Collector to Emitter Breakdown Voltage	BVceo	43	47	-	V	Ic=10μA
Collector to Base Breakdown Voltage	BVcbo	50	60	-	V	Ic=10μA
Emitter to Base Breakdown Voltage	BVebo	6.9	7.2	7.5	V	Ie=10μA

LPNP403 (Wb=9um, De=9um)

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	80	120	160	-	Vce=-5V, Ib=-1μA
Forward Current Gain	BF	30	45	60	-	Vce=-5V, Ib=-10μA
Early Voltage	Va	>90			V	Ib=-10μA,Vce=-2~35V
Saturation Voltage	Vces	200	250	300	mV	Ib=-100μA, Ic=-0.93mA
Collector to Emitter Breakdown Voltage	BVceo	43	45	-	V	Ic=-10μA
Collector to Base Breakdown Voltage	BVcbo	50	60	-	V	Ic=-10μA
Emitter to Base Breakdown Voltage	BVebo	50	90	-	V	Ie=-10μA

HLPNP400 (Wb=13um, De=9um)

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	20	25	35	-	Vce=-5V, Ib=-100μA
Early Voltage	Va	>60			V	Ib=-10μA, Vce=-2~35V
Saturation Voltage	Vces	200	250	300	mV	Ib=-100μA, Ic=-1.3mA
Collector to Emitter Breakdown Voltage	BVceo	43	48	-	V	Ic=-10μA
Collector to Base Breakdown Voltage	BVcbo	50	60	-	V	Ic=-10μA
Emitter to Base Breakdown Voltage	BVebo	50	90	-	V	Ie=-10μA

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VPNP401 (Se=4.5x4.5um²)

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	100	160	220	-	Vce=-5V, Ib=-1µA
Forward Current Gain	BF	30	45	65	-	Vce=-5V, Ib=-100µA
Early Voltage	Va	>190			V	Ib=-10µA, Vce=-2~35V
Saturation Voltage	Vces	250	350	450	mV	Ib=-100µA, Ic=-0.97mA
Collector to Emitter Breakdown Voltage	BVceo	43	50	-	V	Ic=-10µA
Collector to Base Breakdown Voltage	BVcbo	50	60	-	V	Ic=-10µA
Emitter to Base Breakdown Voltage	BVebo	50	90	-	V	Ie=-10µA

RESISTORS

Parameter	Size	SPEC			Unit
		min	type	max	
Base layer resistor	Wr ≥ 6um	180	200	220	Ohm/sq
	Wr=3.5um	150	180	250	Ohm/sq
Light resistor	Wr ≥ 6um	2.55	3.0	3.45	K/sq
	Wr=2.5um	2.4	3.0	3.6	K/sq

CAPACITORS

Parameter	Device name	SPEC			Unit	Measurement condition
		min	type	max		
M1 – nitride – n+Si capacitance	cme (all)	3.4E-1	3.9E-1	4.4E-1	fF/um2	F=1MHz
M1 – nitride – p+Si capacitance	cmb (all)	3.9E-1	4.4E-1	4.9E-1	fF/um2	F=1MHz
M1 – M2 capacitance	cmm	2.5E-2	2.95E-2	3.4E-2	fF/um2	F=1MHz
Emitter – Base side capacitance	cebs	2.32	2.9	3.48	fF/um	F=1MHz
Emitter – Base bottom capacitance	cebb	6.96E-1	8.7E-1	1.04	fF/um2	F=1MHz

DIODES

Parameter	Size, um	SPEC			Unit	Measurement condition
		min	type	max		
Emitter – Base diode breakdown voltage	3x21, 6x21	6.9	7.2	7.5	V	I=10uA
6.5V Zener diode breakdown voltage	6x26, 12x26	6.2	6.5	6.8	V	I=10uA

CONTACT RESISTANCE

Parameter	Symbol	SPEC			Unit
		min	type	max	
ME1– n+Si, 250 contacts 3x3, 2x4um	Rc_n+	1.5	2.5	4.0	KOhm
ME1– n+Si, 250 contacts 2x2um	Rc_n+	1.9	3.4	5.4	KOhm
ME1– n+Si, 250 contacts 1.5x1.5um	Rc_n+	2.5	4.7	7.0	KOhm
ME1– p+Si, 250 contacts 3x3,2x4um	Rc_p+	25	40	55	KOhm
ME1– p+Si, 250 contacts 2x2 um	Rc_p+	35	55	80	KOhm
ME1– p+Si, 250 contacts 1.5x1.5 um	Rc_p+	45	75	95	KOhm
M1 – ME2, 1000 contacts 4x4um	Rc_me	15	47.5	70	Ohm
M1 – ME2, 1000 contacts 3x3um	Rc_me	16.5	52	80	Ohm
M1 – ME2, 1000 contacts 2.5x2.5um	Rc_me	18	56	90	Ohm
M1 – ME2, 1000 contacts 2x2um	Rc_me	20	60	100	Ohm