DMS LAB Limited

20V 1.0um Bipolar process specification

Description

- 20V 1.0um 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 20V supply.
- The modular process combines bipolar elements for different supply application with core 20V bipolar processing steps to provide a wide variety of bipolar devices with 5, 10, 20 voltage levels on the same die.
- The 11 layers core process module is available for 5-20V breakdown voltage of elements.
- Other process modules can be added to integrate bipolar transistors for low voltage application with small area (1 layer), Zener diodes (1 layer), polySi-resistors (1 layer), 2-nd metal level (2 layers).

Key Features

The small area of 5-10V elements is the main advantage of the DMS 20V 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:

- 20, 10, 5V NPN transistors;
- 20, 10, 5V lateral PNP transistors;
- 20, 10, 5V vertical PNP transistors r;
- resistors in active layers;
- polysilicon resistors with Rs=1500 Ohm/sq;
- p/n junction and Me-nitride-Si capacitors;
- Zener diodes;

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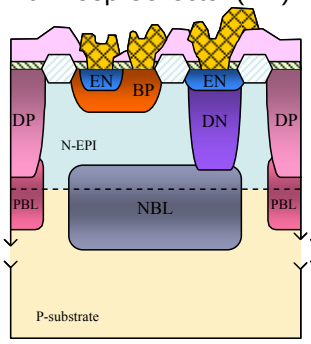
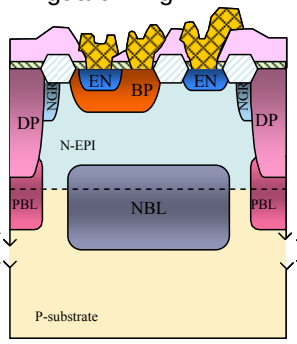
> Schematic cross section of main elements

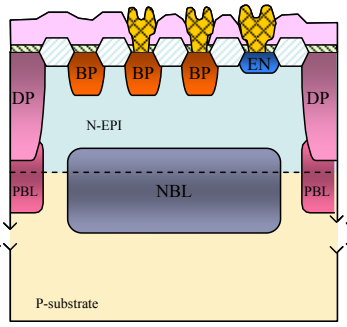
5-20V NPN transistors with Deep Collector (DN)



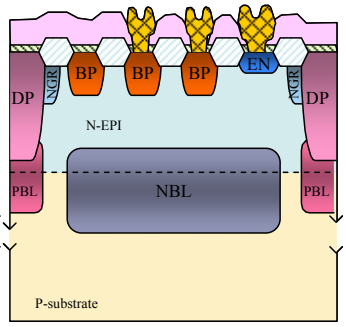
5-20V NPN with N-guard Ring



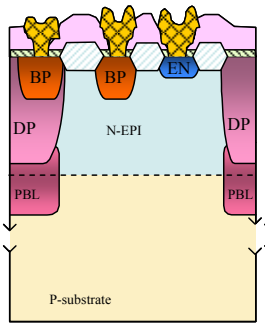
5-20V PNP lateral transistors



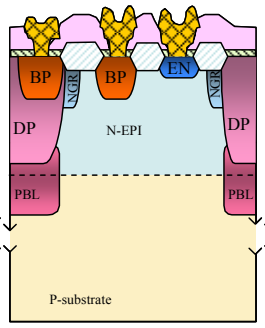
5-20V PNP lateral with N-guard ring



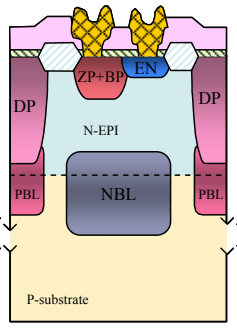
5-20V PNP vertical transistors



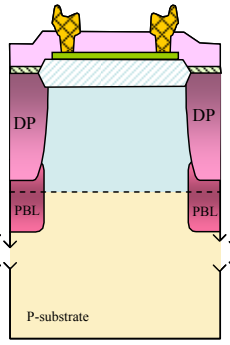
5-10V PNP vertical with N-guard ring



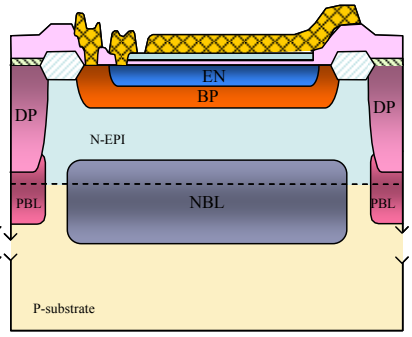
Zener Diode



PolySi-resistor



Metal – Si3N4 – n+Si and Emitter Base Capacitor



> Basic design rules

Layer	Min width (um)	Min spacing (um)
NPN Emitter size	3.5x3.5	---
Vertical PNP Emitter size	3.5x3.5	---
Lateral PNP emitter diameter	4.5	---
Isolation	3.0	3.0
Active Area	3.0	3.0
polySi resistors	3.0	2.0
Contact	1.0x1.0	2.0
Metal-1	4.5	1.0
VIA	2.0x2.0	2.5
Metal-2	4.5	1.5

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〉 Device Parameters of main elements

NPN Se=3.5x3.5 um^2 without Deep Collector

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	45	70	100	-	Vce=5V, Ib=10μA
Early Voltage	Va		>150		V	Ib=10μA, Vce=2~15V
Collector to Emitter Breakdown Voltage	BVceo	26	30	-	V	Ic=10μA
Collector to Base Breakdown Voltage	BVcbo	26	30	-	V	Ic=10μA
Emitter to Base Breakdown Voltage	BVebo	6.3	6.5	6.7	V	Ie=10μA

NPN Se=7.5x7.5 um^2 with Deep Collector

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	70	105	140	-	Vce=5V, Ib=10μA
Early Voltage	Va		>120		V	Ib=10μA, Vce=2~15V
Collector to Emitter Breakdown Voltage	BVceo	25	29	-	V	Ic=10μA
Collector to Base Breakdown Voltage	BVcbo	25	30	-	V	Ic=10μA
Emitter to Base Breakdown Voltage	BVebo	6.3	6.5	6.7	V	Ie=10μA

LPNP Wb=6um, De=4.5um

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	130	180	250	-	Vce=-5V, Ib=-1μA
Forward Current Gain	BF	40	60	100	-	Vce=-5V, Ib=-10μA
Early Voltage	Va		>80		V	Ib=-10μA,Vce=-2~35V
Collector to Emitter Breakdown Voltage	BVceo	22	25	-	V	Ic=-10μA
Collector to Base Breakdown Voltage	BVcbo	35	50	-	V	Ic=-10μA
Emitter to Base Breakdown Voltage	BVebo	35	50	-	V	Ie=-10μA

VPNP Se=5x5um^2

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	90	180	280	-	Vce=-5V, Ib=-1μA
Forward Current Gain	BF	40	60	135	-	Vce=-5V, Ib=-100μA
Early Voltage	Va		>70		V	Ib=-10μA, Vce=-2~35V
Collector to Emitter Breakdown Voltage	BVceo	22	50	-	V	Ic=-10μA
Collector to Base Breakdown Voltage	BVcbo	60	90	-	V	Ic=-10μA
Emitter to Base Breakdown Voltage	BVebo	25	35	-	V	Ie=-10μA

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RESISTORS

Parameter	Size	SPEC			Unit
		min	type	max	
Base layer resistor	Wr ≥ 6um	180	200	220	Ohm/sq
	Wr=3.5um	170	180	230	Ohm/sq
PolySi resistor	Wr ≥ 3um	1.2	1.5	1.8	K/sq

CAPACITORS

Parameter	Device name	SPEC			Unit	Measurement condition
		min	type	max		
M1 – nitride – n+Si capacitance	cme (all)	3.6E-1	4.0E-1	4.4E-1	fF/um2	F=1MHz
M1 – nitride – p+Si capacitance	cmb (all)	4.2E-1	4.7E-1	5.2E-1	fF/um2	F=1MHz

DIODE

Parameter	Size, um	SPEC			Unit	Measurement condition
		min	type	max		
5.8V Zener diode breakdown voltage	6x26, 12x26	5.5	5.8	6.1	V	I=10uA

CONTACT RESISTANCE

Parameter	Symbol	SPEC			Unit
		min	type	max	
ME– n+Si, 250 contacts 1.0x1.0um	Rc_n+	1.5	5.5	9.0	KOhm
ME– n+Si, 250 contacts 1.5x1.5um	Rc_n+	2.5	4.0	7.0	KOhm
ME– n+Si, 250 contacts 2.0x2.0um	Rc_n+	2.0	3.5	6.5	KOhm
ME– n+Si, 250 contacts 2.5x2.5um		1.5	3.1	5.5	KOhm
ME– p+Si, 250 contacts 1.0x1.0um	Rc_p+	40.0	65.0	135	KOhm
ME– p+Si, 250 contacts 1.5x1.5um	Rc_p+	30.0	50.0	95.0	KOhm
ME– p+Si, 250 contacts 2.0x2.0 um	Rc_p+	25.0	40.0	70.0	KOhm
ME– p+Si, 250 contacts 2.5x2.5 um	Rc_p+	20.0	35.0	60.0	KOhm
ME– polySi, 250 contacts 1.0x1.0um	Rc_poly	150	240	320	KOhm
ME– polySi, 250 contacts 1.5x1.5um	Rc_ poly	120	200	280	KOhm
ME– polySi, 250 contacts 2.0x2.0um	Rc_ poly	100	175	250	KOhm
ME– polySi, 250 contacts 2.5x2.5um	Rc_ poly	75	150	220	KOhm
M1 – ME2, 1000 contacts 2x2um	Rc_me	43	65	230	Ohm
M1 – ME2, 1000 contacts 2.5x2.5um	Rc_me	40	60	190	Ohm
M1 – ME2, 1000 contacts 3x3um	Rc_me	37	55	165	Ohm