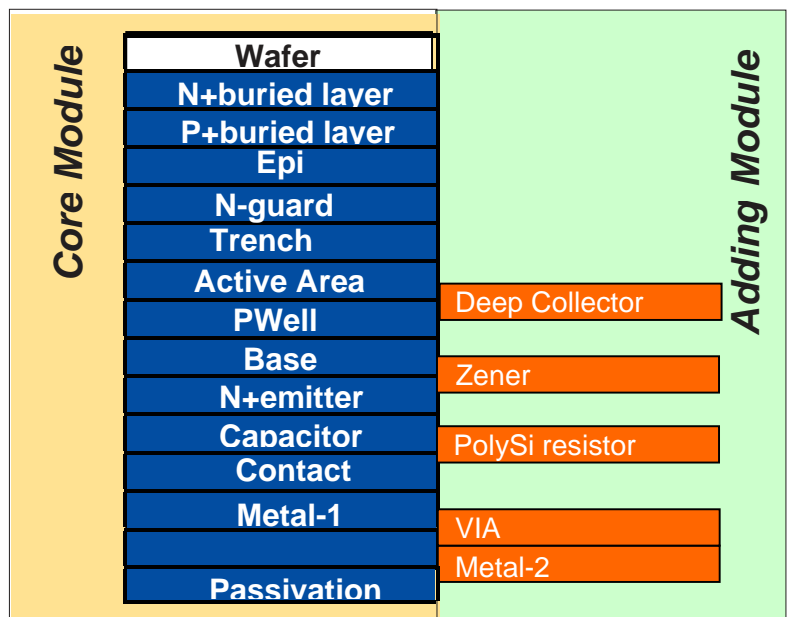




40V 0.8um trench Bipolar process specification

> Description

- 40V 0.8um trench Bipolar process is DMS Lab Limited smart 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 trench isolation process allows greatly decrease size of 40V bipolar elements.
- The 12 layers core process module is available for design of simple chips with single level of metallization.
- Other process modules can be added to integrate bipolar transistors with low parasitic resistance of collector (1 layer), Zener diodes (1 layer), polySi-resistors (1 layer), 2-nd metal level (2 layers).



> Key Features

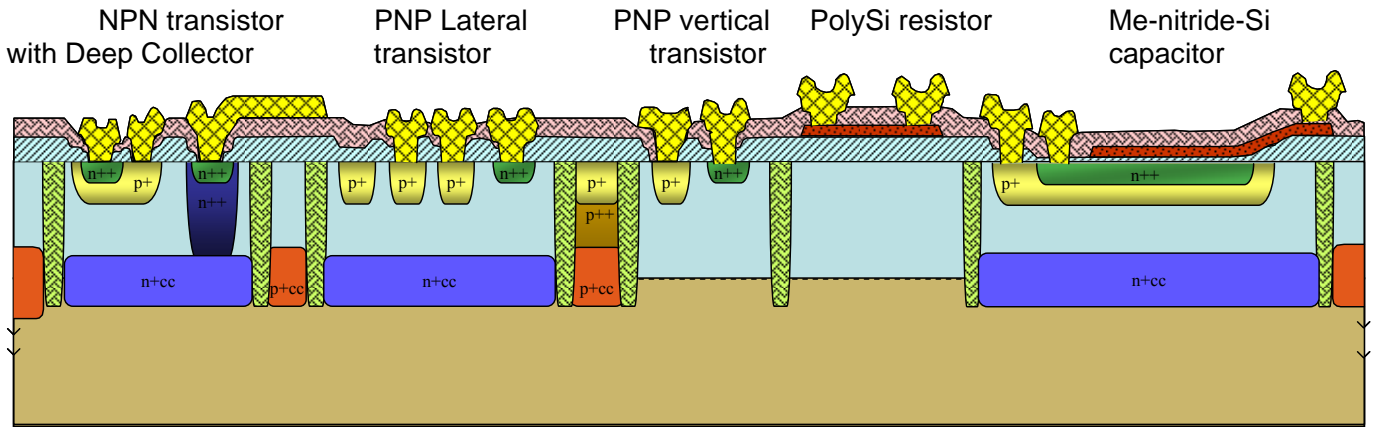
The small area of 40V bipolar elements is the main advantage of the DMS 40V bipolar technology.

A high number of different devices are available:

- NPN transistors;
- lateral PNP transistors;
- vertical PNP transistors;
- resistors in active layers;
- polysilicon resistors with $R_s=1500 \text{ Ohm/sq}$;
- p/n junction and Me-nitride-Si capacitors;
- Zener diodes;



> Schematic cross section of main elements



> Basic design rules

Layer	Min width (um)	Min spacing (um)
Trench	0.8	2.5
NPN Emitter size	3.5x3.5	---
Vertical PNP Emitter size	3.5x3.5	---
Lateral PNP emitter diameter	4.5	---
Active Area	3.0	3.0
polySi resistors	3.0	2.0
Contact	1.0x1.0	1.5
Metal-1	4.5	1.0
VIA	2.0x2.0	2.5
Metal-2	4.5	1.5



Device Parameters of main elements

NPN Se=3.5x3.5 um² without Deep Collector

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	45	70	100	-	V _{ce} =5V, I _b =10μA
Early Voltage	V _a	>150			V	I _b =10μA, V _{ce} =2~15V
Collector to Emitter Breakdown Voltage	BV _{ceo}	26	30	-	V	I _c =10μA
Collector to Base Breakdown Voltage	BV _{cb0}	26	30	-	V	I _c =10μA
Emitter to Base Breakdown Voltage	BV _{eb0}	6.3	6.5	6.7	V	I _e =10μA

NPN Se=7.5x7.5 um² with Deep Collector

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	70	105	140	-	V _{ce} =5V, I _b =10μA
Early Voltage	V _a	>120			V	I _b =10μA, V _{ce} =2~15V
Collector to Emitter Breakdown Voltage	BV _{ceo}	25	29	-	V	I _c =10μA
Collector to Base Breakdown Voltage	BV _{cb0}	25	30	-	V	I _c =10μA
Emitter to Base Breakdown Voltage	BV _{eb0}	6.3	6.5	6.7	V	I _e =10μA

LPNP Wb=6um, De=4.5um

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	130	180	250	-	V _{ce} =-5V, I _b =-1μA
Forward Current Gain	BF	40	60	100	-	V _{ce} =-5V, I _b =-10μA
Early Voltage	V _a	>80			V	I _b =-10μA, V _{ce} =-2~35V
Collector to Emitter Breakdown Voltage	BV _{ceo}	22	25	-	V	I _c =-10μA
Collector to Base Breakdown Voltage	BV _{cb0}	35	50	-	V	I _c =-10μA
Emitter to Base Breakdown Voltage	BV _{eb0}	35	50	-	V	I _e =-10μA

VPNP Se=5x5um²

Parameter	Symbol	SPEC			Unit	Measurement condition
		min	type	max		
Forward Current Gain	BF	90	180	280	-	V _{ce} =-5V, I _b =-1μA
Forward Current Gain	BF	40	60	135	-	V _{ce} =-5V, I _b =-100μA
Early Voltage	V _a	>70			V	I _b =-10μA, V _{ce} =-2~35V
Collector to Emitter Breakdown Voltage	BV _{ceo}	22	50	-	V	I _c =-10μA
Collector to Base Breakdown Voltage	BV _{cb0}	60	90	-	V	I _c =-10μA
Emitter to Base Breakdown Voltage	BV _{eb0}	25	35	-	V	I _e =-10μA



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/um ²	F=1MHz
M1 – nitride – p+Si capacitance	cmb (all)	4.2E-1	4.7E-1	5.2E-1	fF/um ²	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