AN9D, AN9E, AN9F Series

Analog master slice IC series

■ Overview

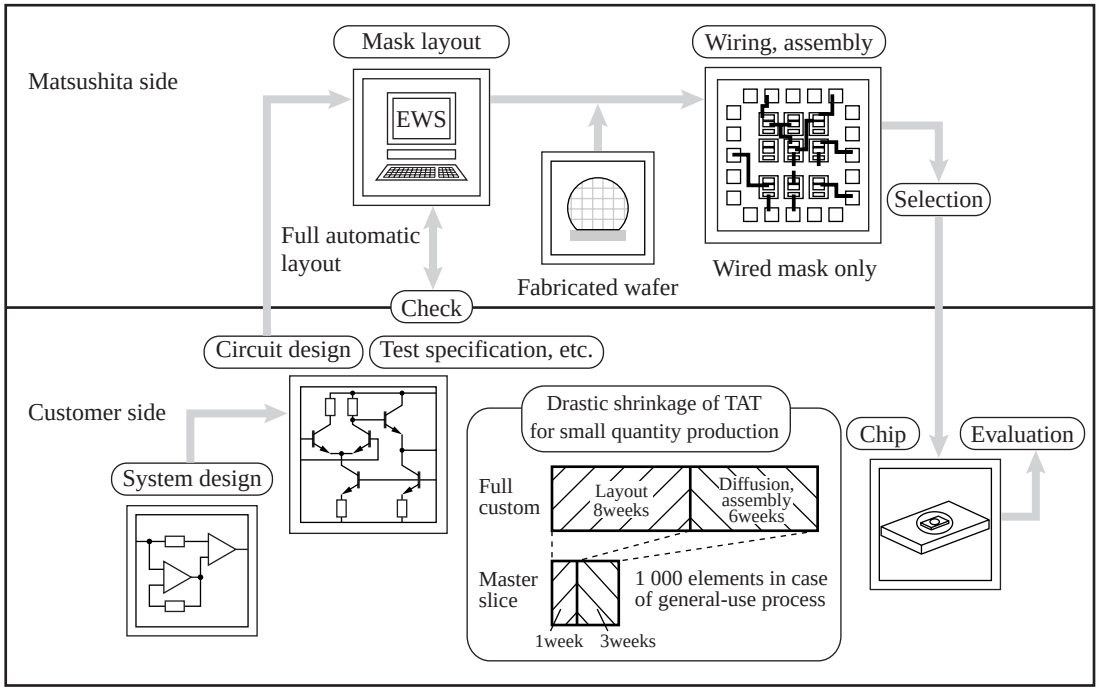
The AN9D, AN9E and AN9F series are master slice ICs of bipolar process, which enables you to integrate an analog circuit easily onto a single chip. A custom IC can be made by placing a wired pattern designed in line with the customer's analog circuit onto a master slice.

Starting from a wafer on which a most part of IC diffusion processes are already finished, you can shorten an IC pilot fabrication considerably. Further, placement of elements and inter-element wiring are done automatically by a computer, which results in short period of pattern designing and thereby developing a custom IC in a short period.

■ Features

- High design flexibility
  - Easy circuit constant design because of setting resistance or capacitance to an arbitrary value.
  - Free setting of contacts between a substrate and GND wiring prevents from operation error to be caused by floating of substrate potential.
  - Usable for multi power source because a resistor island potential can be set for each unit.
  - Builds in a lateral type PNP transistor of high reverse breakdown voltage between base and emitter, or a collector wall type NPN transistor of excellent saturation characteristics. (AN9DA00, AN9DB00, AN9DF00)
- Short development period
  - Due to a full automatic layout design, a sample is available in one month from a completion of a circuit diagram.
- Applicable to a small quantity production item
  - Possible to develop a custom IC for small quantity production due to a low development cost.

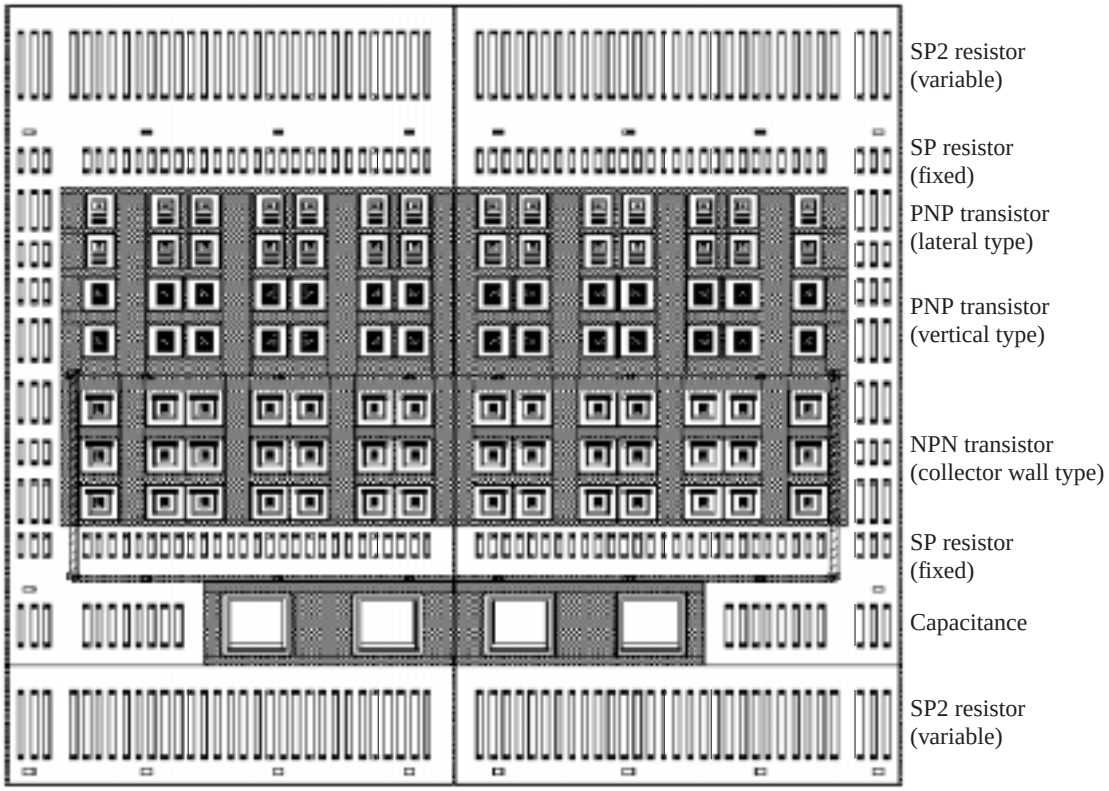
■ Development Flow



■ Product Mix

Series name	Supply voltage	Element characteristics						Remarks
		NPN transistor			PNP transistor			
		$f_{T(max)}$	BV_{CEO}	h_{FE}	$f_{T(max)}$	BV_{CEO}	h_{FE}	
AN9D series	to 12 V	2.6 GHz	14.4 V	100 to 250	1.0 GHz	14.4 V	66 to 200	For low power dissipation/ high speed operation IC
AN9E series	to 12 V	3.5 GHz	14.4 V	80 to 250	1.5 GHz	14.4 V	50 to 130	For Bi-CMOS IC
AN9F series	to 30 V	300 MHz	30 V	80 to 250	9 MHz	30 V	80 to 350	For high breakdown voltage IC

■ Basic Block Configuration (AN9DA00, AN9DB00, AN9DF00)



- AN9D series (V_{CC} = to 12 V, $f_{T(max)}$ = 2.6 GHz)
  - High speed low power dissipation process
  - Constant-variable resistor and capacitor elements built in
  - Large current transistor built in (AN9DA00, AN9DB00, AN9DF00)
  - Optimal for a control-system application due to built-in collector wall type NPN transistors and lateral PNP transistors (AN9DA00, AN9DB00, AN9DF00)
  - Optimal for signal processing application due to built-in high speed NPN transistors and vertical PNP transistors (AN9DC00, AN9DD00, AN9DE00)
  - IIL element built-in (AN9DF00)

Product name			AN9DA00	AN9DB00	AN9DC00	AN9DE00	AN9DD00*	AN9DF00	Remarks
Pad count			28	36	55	64	75	32	
Total element count			1 287	2 424	3 854	5 106	6 602	1 607	
Transistor count			306	600	920	1 288	1 610	306	
	NPN	A11			320	448	560		Basic size
		A21			160	224	280		Double size
		A62P	8	8				8	62 times size
		B11	126	252				126	Basic size (CW winding)
	PNP	LA1	84	168				84	Basic size (Lateral type)
		LA4S	4	4				4	8 times size (Lateral type)
		V11	84	168	320	448	560	84	Basic size (Vertical type)
		V21			120	168	210		Double size (Vertical type)
Gate countIIL					320				
Resistor count			969	1 800	2 854	3 706	4 852	969	
	SP	5 kΩ	474	888	1 408	1 728	2 440	474	
		10 kΩ	198	336	480	640	800	198	
	SP2	2.5 kΩ	297	576	966	1 338	1 612	297	Resistance variable
Capacitor count		5 pF	12	24	80	112	140	12	

Note) *: Under development

- AN9E series (V_{CC} = to 12 V, $f_{T(max)}$ = 3.5 GHz)
  - Bi-CMOS process adopted
  - Constant-variable resistor and capacitor elements built in
  - Gate array and standard cell built in
  - Zener zap elements built in

Product name			AN9EA00*	AN9EB00*	Remarks
Pad count			40	55	
Total element count			8 830	14 033	
Transistor count			900	1 402	
	NPN	N21	420	588	Double size
		N54	20	34	40 times size
		A42G	20	96	
	PNP	P21	420	588	Double size (Vertical type)
		V42G	20	96	
Resistor count			5 016	7 138	
	SP	40 kΩ	90	160	
		10 kΩ	1 440	2 016	
		5 kΩ	1 680	2 352	
	PS	5 kΩ	1 086	1 602	Resistance variable
		2 kΩ	720	1 008	Resistance variable
Capacitor count		5 pF	60	84	
Diode count			30	42	
	ZD1		30	42	Zener zap element
MOS count			12	32	
	N-MOS		6	16	60/2
	P-MOS		6	16	30/2
Gate array count			2 800	5 400	
	LOGIC		2 800	5 400	Use rate 35% or less
Standard cell count			12	19	
	Analog SW		6	12	
	Analog SW		4	4	
	8-bit DAC		1	1	
	Oscillation circuit		1	2	

Note) *: Under development

- AN9F series (V_{CC} = to 30 V, $f_{T(max)}$ = 300 MHz)
  - High voltage process adopted
  - Constant-variable resistor and capacitor elements built in
  - Built-in Zener diode for simplified reference voltage
  - Output-circuit-exclusive three blocks are built in
  - ZAP-adopted reference-voltage-exclusive one block is built in

Product name			AN9FA00	Remarks
Pad count				36
Total element count				1 655
Transistor count				308
	NPN	N11X	72	Basic size
		W11X	72	Basic size (surrounded with DN)
		N100X	8	100 times size
	PNP	YA1	144	Basic size (Lateral type)
		YX1DP	12	Emitter and collector are surrounded with DN
Resistor count			1 308	
	SP	2 kΩ	1 068	Resistance variable
		5 kΩ	48	Resistance variable
	PW	10 kΩ	136	
		50 kΩ	56	
Capacitor count		7.5 pF	24	Capacitance variable
Diode count	ZD	ZB2	15	Bulk Zener diode
Special block	Output circuit		3	250 times size transistor built-in
	Reference power supply circuit		1	2.5 V reference power supply circuit

■ Circuit Library

General-use basic circuits are available as libraries.

Circuit name	Contents	Features	Remarks
Op-amp.1	General-use Single power supply operational amp.	Wide output D-range: 0.2 V to V_{CC} − 0.5 V Low power consumption: I_{CC} = 0.5 mA	AN9D series
Op-amp.2	High speed Highly stable operational amp.	High speed: Cutoff frequency = 20 MHz : Slew rate = 100 V/μs	AN9D series
Op-amp.3	General-use Single power supply operational amp.	Low power consumption: I_{CC} = 0.15 mA	AN9D series
Op-amp.4	General-use Single power supply operational amp.	High gain: Voltage gain = 107 dB High stability: Phase margin = 43°	AN9D series
Comp1	Low power consumption Single power supply comparator	Low power consumption: I_{CC} = 0.1 mA High speed: t_r / t_f = 0.15 μs/0.3 μs	AN9D series
Comp2	Single power supply High speed comparator	High speed: t_d = 0.015 μs	AN9D series
Reg1	General-use Stabilized power supply	High temp. stability: 150 ppm/degree or less Wide output voltage range: 1.3 V to V_{CC} − 0.5 V	AN9D series

■ Package Table

Series name		AN9DX00 series						AN9EX00 series		AN9FX00
Master name		AN9DA00	AN9DB00	AN9DC00	AN9DD00	AN9DE00	AN9DF00	AN9EA00	AN9EB00	AN9FA00
Package	Pin count									
DIL	16	●								
	18									
	20									
	22	●	●				●			
	24	●								
	28		●	●						●
SDIL	20	●					●			
	22	●					●			
	24	●	●				●			
	28		●	●		●		●	●	●
	30		●	●						●
	42		●	●						●
	52			●		●			●	●
SO	18									
	20	●	●				●			
	22									
	24	●					●			
	28	●	●	●		●	●	●	●	●
	36	●	●				●			●
QPF	32							●		●
	44								●	
	48						●		●	●
	64			●	●	●	●		●	●
	80								●	●
QFN	24	●								
	44	●	●	●			●	●	●	●