

TTL-Compatible, CMOS Analog Switches

The DG300A through DG303A family of monolithic CMOS switches are truly compatible second source of the original manufacturer. The switches are latch-proof and are designed to block signals up to 30V_{P-P} when OFF. Featuring low leakage and low power consumption, these switches are ideally suited for precision application in instrumentation, communication, data acquisition and battery powered applications. Other key features include Break-Before-Make switching, TTL and CMOS compatibility, and low ON resistance. Single supply operation (for positive switch voltages) is possible by connecting V- to 0V.

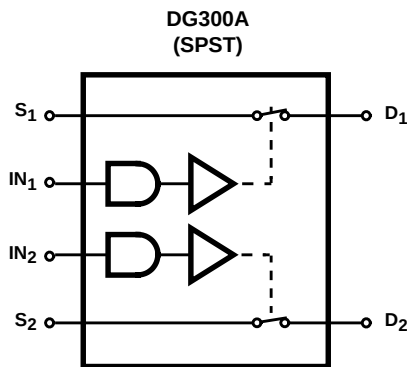
Features

- Low Power Consumption
- Break-Before-Make Switching
 - t_{ON}150ns
 - t_{OFF}130ns
- TTL, CMOS Compatible
- Low r_{DS(ON)} (Max)..... 50Ω
- Single Supply Operation
- True Second Source

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
DG300ABK	-25 to 85	14 Ld Cerdip	F14.3
DG301ACJ	0 to 70	14 Ld PDIP	E14.3
DG303AAK	-55 to 125	14 Ld Cerdip	F14.3
DG303ABK	-25 to 85	14 Ld Cerdip	F14.3
DG303ACJ	0 to 70	14 Ld PDIP	E14.3
DG303ACY	0 to 70	16 Ld SOIC	M16.3

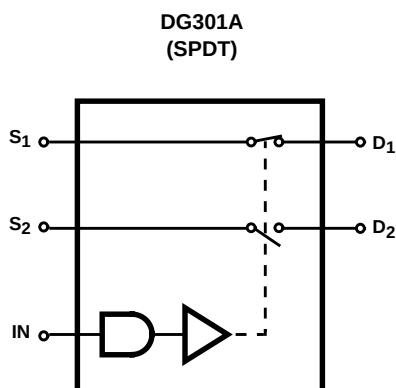
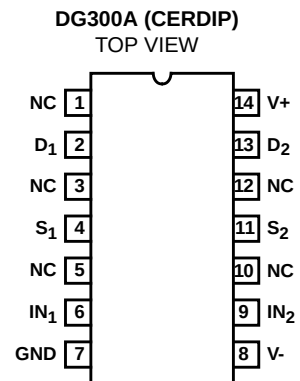
Functional Diagrams and Pinouts (Switches shown for a logic "1" input)



DG300A TRUTH TABLE

LOGIC	SWITCH
0	OFF
1	ON

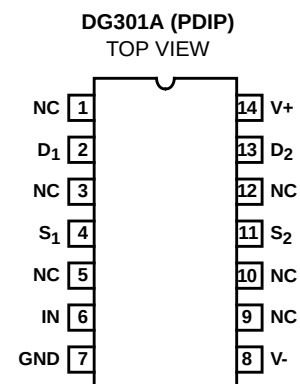
Logic "0" ≤ 0.8V, Logic "1" ≥ 4.0V.



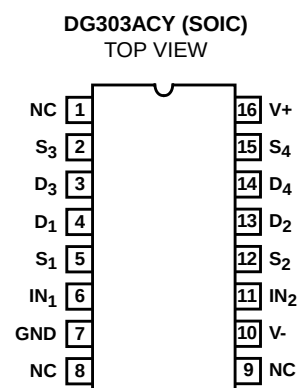
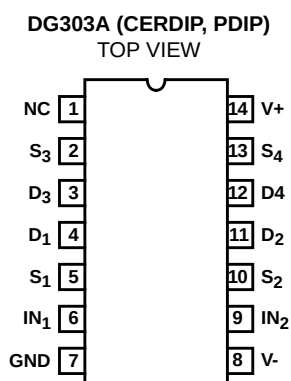
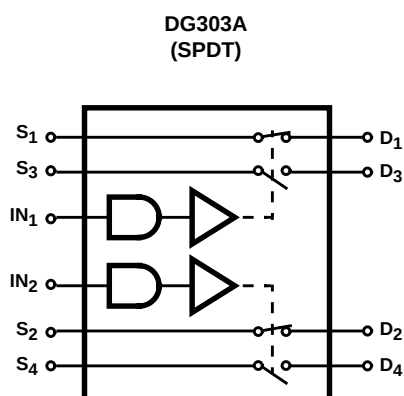
DG301A TRUTH TABLE

LOGIC	SWITCH 1	SWITCH 2
0	OFF	ON
1	ON	OFF

Logic "0" ≤ 0.8V, Logic "1" ≥ 4.0V.



Functional Diagrams and Pinouts (Switches shown for a logic "1" input) (Continued)



DG303A TRUTH TABLE

LOGIC	SWITCH 1 AND 2	SWITCH 3 AND 4
0	OFF	ON
1	ON	OFF

Logic "0" $\leq 0.8V$, Logic "1" $\geq 4.0V$.

Pin Descriptions

PIN	SYMBOL	DESCRIPTION
DG300A		
1	NC	No Connection
2	D ₁	Drain (Output) Terminal for Switch 1
3	NC	No Connection
4	S ₁	Source (Input) Terminal for Switch 1
5	NC	No Connection
6	IN ₁	Logic Control for Switch 1
7	GND	Ground Terminal (Logic Common)
8	V-	Negative Power Supply Terminal
9	IN ₂	Logic Control for Switch 2
10	NC	No Connection
11	NC	No Connection
12	S ₂	Source (Input) Terminal for Switch 2
13	D ₂	Drain (Output) Terminal for Switch 2
14	V+	Positive Power Supply Terminal
DG301A		
1	NC	No Connection
2	D ₁	Drain (Output) Terminal for Switch 1
3	NC	No Connection
4	S ₁	Source (Input) Terminal for Switch 1
5	IN	Logic Control for Switches
6	GND	Ground Terminal (Logic Common)
7	V-	Negative Power Supply Terminal

PIN	SYMBOL	DESCRIPTION
8	NC	No Connection
9	NC	No Connection
10	S ₂	Source (Input) Terminal for Switch 2
11	NC	No Connection
12	D ₂	Drain (Output) Terminal for Switch 2
13	NC	No Connection
14	V+	Positive Power Supply Terminal
DG303A		
1	NC	No Connection
2	S ₃	Source (Input) Terminal for Switch 3
3	D ₃	Drain (Output) Terminal for Switch 3
4	D ₁	Drain (Output) Terminal for Switch 1
5	S ₁	Source (Input) Terminal for Switch 1
6	IN ₁	Logic Control for Switch 1
7	GND	Ground Terminal (Logic Common)
8	V-	Negative Power Supply Terminal
9	IN ₂	Logic Control for Switch 2
10	S ₂	Source (Input) Terminal for Switch 2
11	D ₂	Drain (Output) Terminal for Switch 2
12	D ₄	Drain (Output) Terminal for Switch 4
13	S ₄	Source (Input) Terminal for Switch 4
14	V+	Positive Power Supply Terminal

Absolute Maximum Ratings

V+ to V-	44.0V
V- to GND	25V
Digital Inputs, V _S , V _D (Note 1)	(V-) - 2V to (V+) + 2V or 30mA, Whichever Occurs First
Continuous Current, (Any Terminal)	30mA
Peak Current, S or D (Pulsed 1ms, 10% Duty Cycle Max)	100mA

Operating Conditions

Voltage Range	±15V
Temperature Range	
“A” Suffix	-55°C to 125°C
“B” Suffix	-25°C to 85°C
“C” Suffix	0°C to 70°C
Input Low Voltage	0.8V (Max)
Input High Voltage	4.0V (Min)
Input Rise and Fall Time	≤20ns

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
SOIC Package	100	N/A
PDIP Package	100	N/A
CERDIP Package	75	20
Maximum Junction Temperature		
Hermetic Packages		175°C
Plastic Packages		150°C
Maximum Storage Temperature Range		-65°C to 150°C
Maximum Lead Temperature (Soldering, 10s)		300°C (SOIC - Lead Tips Only)

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. Signals on S_X, D_X or IN_X exceeding V+ or V- will be clamped by internal diodes. Limit diode forward current to maximum current ratings.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications V+ = +15V, V- = -15V, GND = 0V, T_A = 25°C

PARAMETER	TEST CONDITIONS		“A” SUFFIX			“B” AND “C” SUFFIX			UNITS
			MIN	(NOTE 3) TYP	MAX	MIN	(NOTE 3) TYP	MAX	
DYNAMIC CHARACTERISTICS									
Turn-ON Time, t _{ON}	See Figure 3		-	150	300	-	150	-	ns
Turn-OFF Time, t _{OFF}	See Figure 3		-	130	250	-	130	-	ns
Break-Before-Make Interval, t _D	See Figure 2, DG301A/DG303A		-	50	-	-	50	-	ns
Charge Injection, Q	C _L = 10nF, R _S = 0, V _S = 0		-	3	-	-	3	-	mV
OFF Isolation (Note 4)	V _{IN} = 0, R _L = 1kΩ, V _S = 1V _{RMS} , f = 500kHz		-	62	-	-	62	-	dB
Crosstalk (Channel-to-Channel)			-	-74	-	-	-74	-	dB
Source OFF Capacitance, C _{S(OFF)}	f = 1MHz, V _{IN} = 0.8V or V _{IN} = 4.0V	V _S = 0	-	14	-	-	14	-	pF
Drain OFF Capacitance, C _{D(OFF)}		V _D = 0	-	14	-	-	14	-	pF
Channel ON Capacitance, C _{D(ON)} + C _{S(ON)}		V _S = V _D = 0	-	40	-	-	40	-	pF
Input Capacitance, C _{IN}	f = 1MHz	V _{IN} = 0	-	6	-	-	6	-	pF
		V _{IN} = 15V	-	7	-	-	7	-	pF
DIGITAL INPUT CHARACTERISTICS									
Input Current with Voltage High, I _{IH}	V _{IN} = 5.0V		-1	-0.001	-	-1	-0.001	-	μA
	V _{IN} = 15.0V		-	0.001	1	-	0.001	1	μA
Input Current with Voltage Low, I _{IL}	V _{IN} = 0V		-1	-0.001	-	-1	-0.001	-	μA

DG300A, DG301A, DG303A

Electrical Specifications $V_+ = +15V$, $V_- = -15V$, GND = 0V, $T_A = 25^{\circ}C$ (Continued)

PARAMETER	TEST CONDITIONS		“A” SUFFIX			“B” AND “C” SUFFIX			UNITS
			MIN	(NOTE 3) TYP	MAX	MIN	(NOTE 3) TYP	MAX	
ANALOG SWITCH CHARACTERISTICS									
Analog Signal Range, V_{ANALOG}	$I_S = 10mA$, $V_{IN} = 0.8V$ or $4V$		-15	-	15	-15	-	15	V
Drain-Source ON Resistance, $r_{DS(ON)}$	$V_{IN} = 0.8V$ or $V_{IN} = 4.0V$	$I_S = -10mA$, $V_D = 10V$	-	30	50	-	30	50	Ω
		$I_S = 10mA$, $V_D = -10V$	-	30	50	-	30	50	Ω
Source OFF Leakage Current, $I_{S(OFF)}$	$V_{IN} = 0.8V$ or $V_{IN} = 4.0V$	$V_S = 14V$, $V_D = -14V$	-	0.1	1	-	0.1	5	nA
		$V_S = -14V$, $V_D = 14V$	-1	-0.1	-	-5	-0.1	-	nA
Drain OFF Leakage Current, $I_{D(OFF)}$	$V_{IN} = 0.8V$ or $V_{IN} = 4.0V$	$V_S = -14V$, $V_D = 14V$	-	0.1	1	-	0.1	5	nA
		$V_S = 14V$, $V_D = -14V$	-1	-0.1	-	-5	-0.1	-	nA
Channel ON Leakage Current, $I_{D(ON)}$	$V_{IN} = 0.8V$ or $V_{IN} = 4.0V$	$V_D = V_S = 14V$	-	0.1	1	-	0.1	5	nA
		$V_D = V_S = -14V$	-2	-0.1	-	-5	-0.1	-	nA
POWER SUPPLY CHARACTERISTICS									
Positive Supply Current, I_+	$V_{IN} = 4V$ (One Input) (All Others = 0)		-	0.23	0.5	-	0.23	0.5	mA
Negative Supply Current, I_-			-10	-0.001	-	-10	-0.001	-	μA
Positive Supply Current, I_+	$V_{IN} = 0.8V$ (All Inputs)		-	0.001	10	-	0.001	10	μA
Negative Supply Current, I_-			-10	-0.001	-	-10	-0.001	-	μA

Electrical Specifications $V_+ = +15V$, $V_- = -15V$, GND = 0V, T_A = Full Temperature Range

PARAMETER	TEST CONDITION		“A” SUFFIX			“B” AND “C” SUFFIX			UNITS
			MIN	(NOTE 3) TYP	MAX	MIN	(NOTE 3) TYP	MAX	
DIGITAL INPUT CHARACTERISTICS									
Input Current with Voltage High, I _{IH}	V _{IN} = 5.0V		-1	-	-	-	-	-	μA
	V _{IN} = 15.0V		-	-	1	-	-	-	μA
Input Current with Voltage Low, I _{IL}	V _{IN} = 0V		-1	-	-	-	-	-	μA
ANALOG SWITCH CHARACTERISTICS									
Analog Signal Range, V _{ANALOG}	I _S = 10mA, V _{IN} = 0.8V or 4V		-15	-	15	-	-	-	V
Drain-Source ON Resistance, r _{DS(ON)}	V _{IN} = 0.8V or V _{IN} = 4.0V	I _S = -10mA, V _D = 10V	-	-	75	-	-	-	Ω
		I _S = 10mA, V _D = -10V	-	-	75	-	-	-	Ω
Source OFF Leakage Current, I _{S(OFF)}	V _{IN} = 0.8V or V _{IN} = 4.0V	V _S = 14V, V _D = -14V	-	-	100	-	-	-	nA
		V _S = -14V, V _D = 14V	-100	-	-	-	-	-	nA

Electrical Specifications $V_+ = +15V$, $V_- = -15V$, $GND = 0V$, $T_A = \text{Full Temperature Range}$ (Continued)

PARAMETER	TEST CONDITION		“A” SUFFIX			“B” AND “C” SUFFIX			UNITS
			MIN	(NOTE 3) TYP	MAX	MIN	(NOTE 3) TYP	MAX	
Drain OFF Leakage Current, I _{D(OFF)}	V _{IN} = 0.8V or V _{IN} = 4.0V	V _S = -14V, V _D = 14V	-	-	100	-	-	-	nA
		V _S = 14V, V _D = -14V	-100	-	-	-	-	-	nA
Channel ON Leakage Current, I _{D(ON)}	V _{IN} = 0.8V or V _{IN} = 4.0V	V _D = V _S = 14V	-	-	100	-	-	-	nA
		V _D = V _S = -14V	-200	-	-	-	-	-	nA
POWER SUPPLY CHARACTERISTICS									
Positive Supply Current, I ₊	V _{IN} = 4V (One Input) (All Others = 0)		-	-	1	-	-	-	mA
Negative Supply Current, I ₋			-100	-	-	-	-	-	μA
Positive Supply Current, I ₊	V _{IN} = 0.8V (All Inputs)		-	-	100	-	-	-	μA
Negative Supply Current, I ₋			-100	-	-	-	-	-	μA

NOTES:

- For design only, not 100% tested.
- OFF isolation = $20 \log V_S/V_D$, where V_S = input to OFF switch, and V_D = output.

Test Circuits and Waveforms

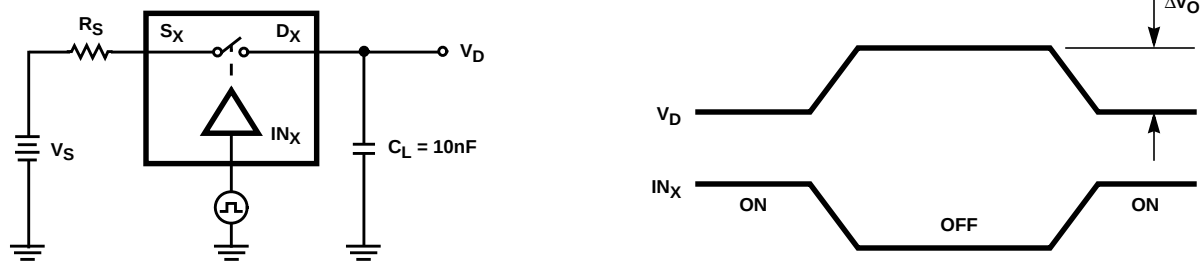


FIGURE 1. CHARGE INJECTION TEST CIRCUIT AND MEASUREMENT POINTS

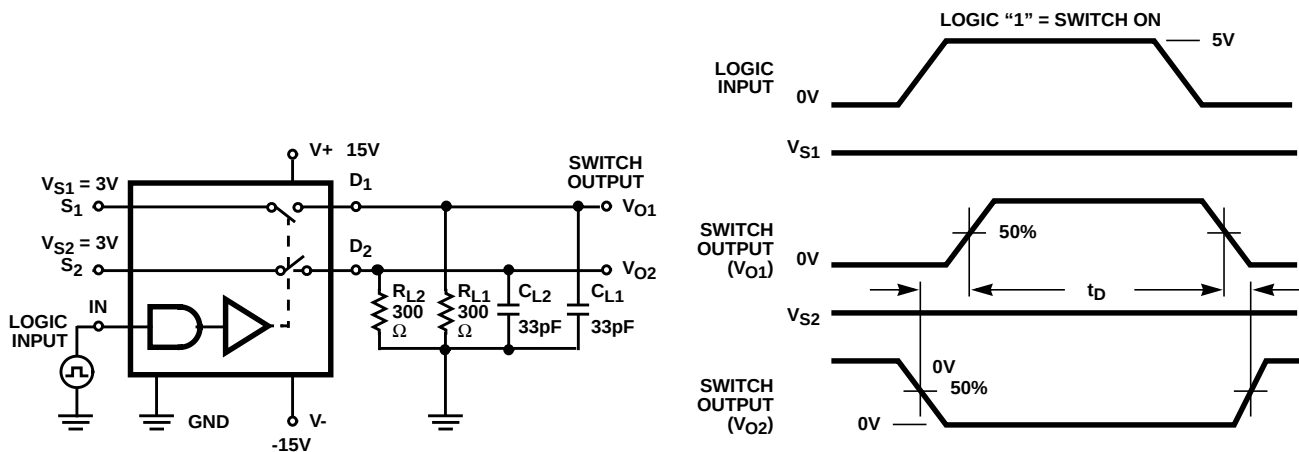


FIGURE 2. BREAK-BEFORE MAKE TEST CIRCUIT AND MEASUREMENT POINTS (DG301A, DG303A)

Test Circuits and Waveforms (Continued)

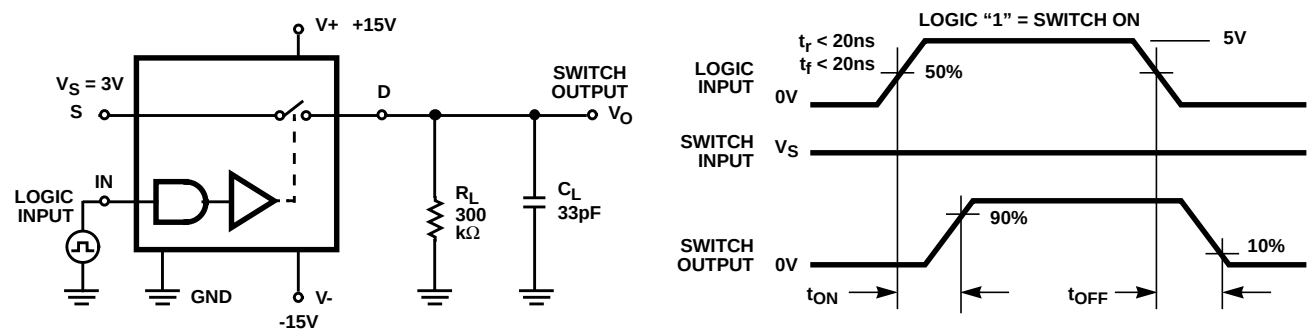


FIGURE 3. t_{ON} and t_{OFF} TEST CIRCUIT AND MEASUREMENT POINTS

Die Characteristics

DIE DIMENSIONS:

89 mils x 99 mils x 12 mils

METALLIZATION:

Type: Al

Thickness: $10\text{k}\text{\AA} \pm 1\text{k}\text{\AA}$

PASSIVATION:

Type: PSG Over Nitride

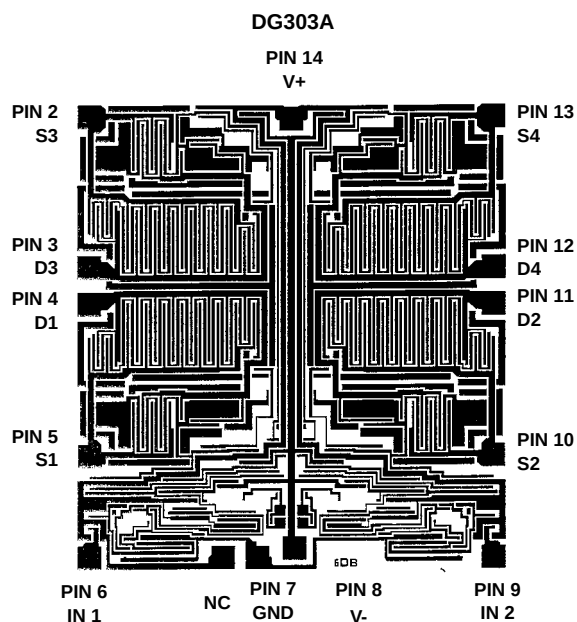
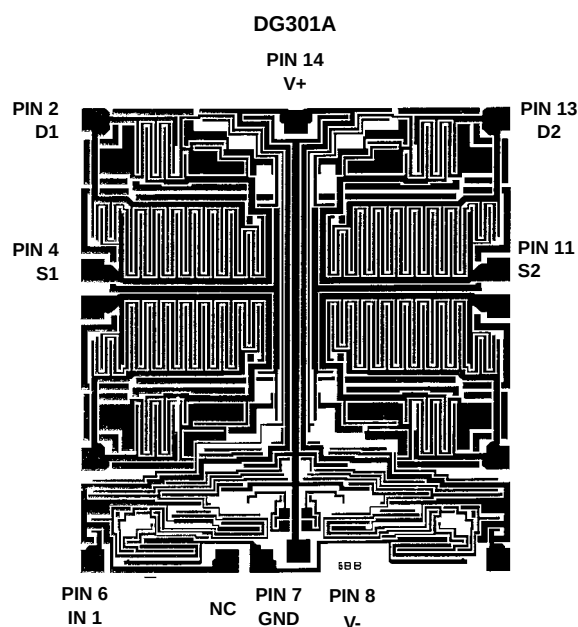
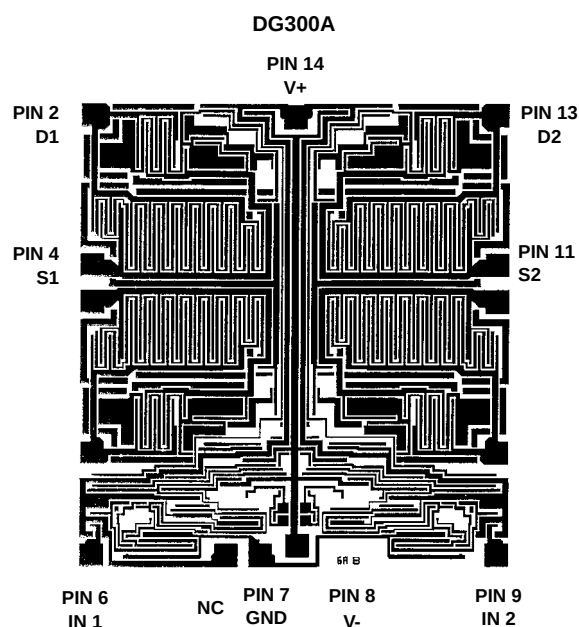
PSG Thickness: $7\text{k}\text{\AA} \pm 1.4\text{k}\text{\AA}$

Nitride Thickness: $8\text{k}\text{\AA} \pm 1.2\text{k}\text{\AA}$

WORST CASE CURRENT DENSITY:

$1 \times 10^5 \text{ A/cm}^2$

Metallization Mask Layouts



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