

DG300A, DG301A, DG302A, DG303A

TTL-Compatible,
CMOS Analog Switches

August 1997

Features

- Low Power Consumption
- Break-Before-Make Switching (Typ)
 - t_{OFF} 130ns
 - t_{ON} 150ns
- TTL, CMOS Compatible
- Low $r_{DS(ON)}$ $\leq 50\Omega$
- Single Supply Operation
- True Second Source

Description

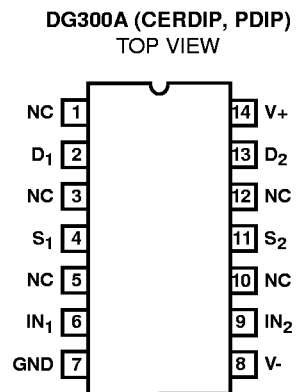
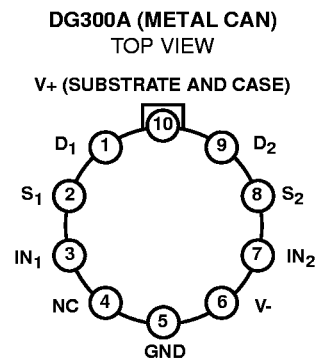
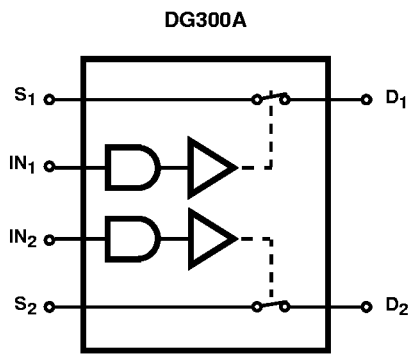
The DG300A through DG303A family of monolithic CMOS switches are truly compatible second source of the original manufacturer. The switches are latch-proof and are designed to block signals up to $30V_{P-P}$ when OFF. Featuring low leakage and low power consumption, these switches are ideally suited for 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.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
DG300AAK	-55 to 125	14 Ld Cerdip	F14.3
DG301AAK	-55 to 125	14 Ld Cerdip	F14.3
DG302AAK	-55 to 125	14 Ld Cerdip	F14.3
DG303AAK	-55 to 125	14 Ld Cerdip	F14.3
DG300ABK	-25 to 85	14 Ld Cerdip	F14.3
DG301ABK	-25 to 85	14 Ld Cerdip	F14.3
DG302ABK	-25 to 85	14 Ld Cerdip	F14.3
DG303ABK	-25 to 85	14 Ld Cerdip	F14.3
DG300ACK	0 to 70	14 Ld Cerdip	F14.3
DG301ACK	0 to 70	14 Ld Cerdip	F14.3
DG302ACK	0 to 70	14 Ld Cerdip	F14.3
DG303ACK	0 to 70	14 Ld Cerdip	F14.3
DG300ACJ	0 to 70	14 Ld PDIP	E14.3

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
DG301ACJ	0 to 70	14 Ld PDIP	E14.3
DG302ACJ	0 to 70	14 Ld PDIP	E14.3
DG303ACJ	0 to 70	14 Ld PDIP	E14.3
DG300AAA	-55 to 125	10 Pin Metal Can	T10.B
DG301AAA	-55 to 125	10 Pin Metal Can	T10.B
DG303ACY	0 to 70	16 Ld SOIC	M16.3
DG300AAA/883B	-55 to 125	10 Pin Metal Can	T10.B
DG300AAK/883B	-55 to 125	14 Ld Cerdip	F14.3
DG301AAA/883B	-55 to 125	10 Pin Metal Can	T10.B
DG301AAK/883B	-55 to 125	14 Ld Cerdip	F14.3
DG302AAK/883B	-55 to 125	14 Ld Cerdip	F14.3
DG303AAK/883B	-55 to 125	14 Ld Cerdip	F14.3

Functional Diagrams and Pinouts



TRUTH TABLE

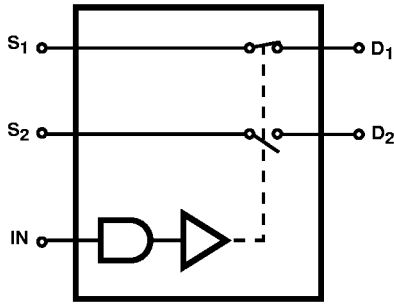
LOGIC	SWITCH
0	OFF
1	ON

Logic "0" $\leq 0.8V$, Logic "1" $\geq 4.0V$; Two SPST switches per package (switches shown for Logic "1" input)

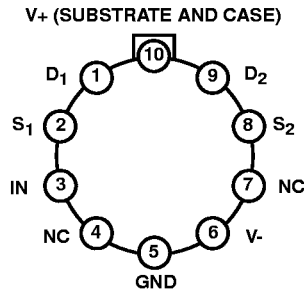
DG300A, DG301A, DG302A, DG303A

Functional Diagrams and Pinouts (Continued)

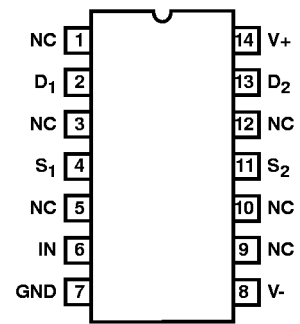
DG301A



DG301A (METAL CAN)
TOP VIEW



DG301A (CERDIP, PDIP)
TOP VIEW

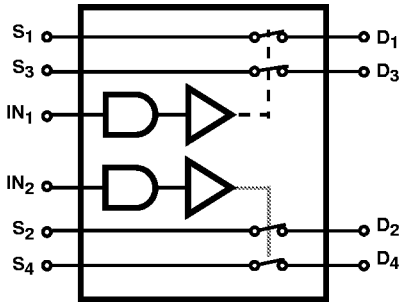


TRUTH TABLE

LOGIC	SWITCH 1	SWITCH 2
0	OFF	ON
1	ON	OFF

Logic "0" $\leq 0.8V$, Logic "1" $\geq 4.0V$; One SPDT switch per package (switches shown for Logic "1" input).

DG302A

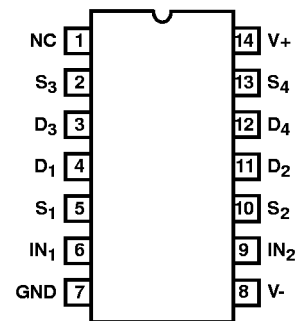


TRUTH TABLE

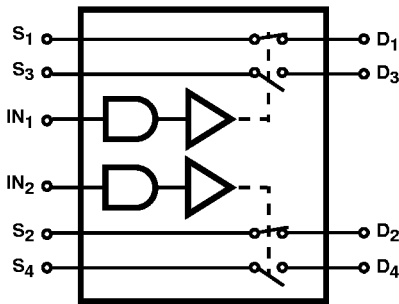
LOGIC	SWITCH
0	OFF
1	ON

Logic "0" $\leq 0.8V$, Logic "1" $\geq 4.0V$; Two DPST switch per package (switches shown for Logic "1" input)

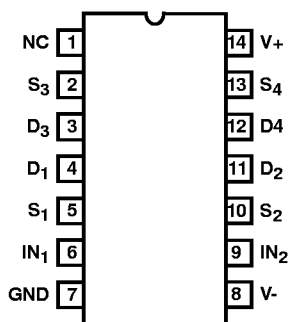
DG302A (CERDIP, PDIP)
TOP VIEW



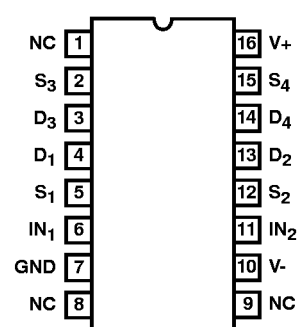
DG303A



DG303A (CERDIP, PDIP)
TOP VIEW



DG303ACY (SOIC)
TOP VIEW



TRUTH TABLE

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

Logic "0" $\leq 0.8V$, Logic "1" $\geq 4.0V$; Two SPDT switch per package (switches shown for Logic "1" input)

DG300A, DG301A, DG302A, DG303A

Absolute Maximum Ratings

V+ to V-	+44.0V
V- to GND	-25V
V _{IN} to Ground (Note 1)	(V- - 2V), (V+ + 2V)
V _S or V _D to V+ (Note 1)	+2, (V- - 2V)
V _S or V _D to V- (Note 1)	-2, (V+ + 2V)
Current, Any Terminal Except S or D	30mA
Continuous Current, S or D	30mA
Peak Current, S or D (Pulsed at 1ms, 10% Duty Cycle Max)	100mA

Operating Conditions

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

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 V_S, V_D or V_{IN} exceeding V+ or V- will be clamped by internal diodes. Limit diode toward current to maximum current ratings.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

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
Metal Can Package	160	75
Maximum Junction Temperature		
Hermetic Packages		175°C
Plastic Packages		150°C
Maximum Storage Temperature Range		
(C Suffix)		-65°C to 125°C
(A and B Suffix)		-65°C to 150°C
Maximum Lead Temperature (Soldering, 10s)		300°C
(SOIC - Lead Tips Only)		

Electrical Specifications $V_+ = +15V, V_- = -15V, GND = 0V, T_A = 25^\circ C$

PARAMETER	TEST CONDITIONS	DG300A - DG303AA			DG300A - DG303AB/C			UNITS
		MIN	(NOTE 7) TYP	MAX	MIN	(NOTE 7) 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, $t_{ON} - t_{OFF}$	See Figure 2, DG301A/DG303A	-	50	-	-	50	-	ns
Charge Injection, Q	$C_L = 10nF, R_S = 0, V_S = 0$	-	3	-	-	3	-	mV
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
OFF Isolation (Note 9)	$V_{IN} = 0, R_L = 1K, V_S = 1V_{RMS}, f = 500kHz$	-	62	-	-	62	-	dB
Crosstalk (Channel-to-Channel)		-	74	-	-	74	-	dB
INPUT								
Input Current with Voltage High, I_{INH}	$V_{IN} = 5.0V$	-1	-0.001	-	-1	-0.001	-	μA
	$V_{IN} = 15.0V$	-	0.001	1	-	0.001	1	μA
Input Current with Voltage Low, I_{INL}	$V_{IN} = 0V$	-1	-0.001	-	-1	-0.001	-	μA
ANALOG SWITCH								
Analog Signal Range, V_{ANALOG}	$I_S = 10mA, V_{IN} = 0.8V$ or $4V$	-15	-	15	-15	-	15	V

DG300A, DG301A, DG302A, DG303A

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

PARAMETER	TEST CONDITIONS	DG300A - DG303AA			DG300A - DG303AB/C			UNITS	
		MIN	(NOTE 7) TYP	MAX	MIN	(NOTE 7) TYP	MAX		
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
Drain 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 SUPPLIES									
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 $V_+ = +15V, V_- = -15V, GND = 0V, T_A =$ Over Temperature Range

PARAMETER	TEST CONDITION	DG300A - DG303AA			DG300A - DG303AB/C			UNITS	
		MIN	(NOTE 7) TYP	MAX	MIN	(NOTE 7) TYP	MAX		
INPUT									
Input Current with Voltage High, I_{INH}	$V_{IN} = 5.0V$	-1	-	-	-	-	-	μA	
	$V_{IN} = 15.0V$	-	-	1	-	-	-	μA	
Input Current with Voltage Low, I_{INL}	$V_{IN} = 0V$	-1	-	-	-	-	-	μA	
ANALOG SWITCH									
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
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
Drain 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

DG300A, DG301A, DG302A, DG303A

Electrical Specifications $V_+ = +15V$, $V_- = -15V$, $GND = 0V$, $T_A =$ Over Temperature Range (Continued)

PARAMETER	TEST CONDITION	DG300A - DG303AA			DG300A - DG303AB/C			UNITS
		MIN	(NOTE 7) TYP	MAX	MIN	(NOTE 7) TYP	MAX	
POWER SUPPLIES								
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:

3. Device mounted with all leads soldered or welded to PC board.
4. Derate $11mW/^\circ C$ above $75^\circ C$
5. Derate $6.5mW/^\circ C$ above $25^\circ C$.
6. Derate $6mW/^\circ C$ above $75^\circ C$.
7. For design only, not 100% tested.
8. The algebraic convention whereby the most negative value is a minimum, and the most positive value is a maximum, is used in this data sheet.
9. OFF isolation = $20 \text{ Log } V_S/V_D$, where V_S = input to OFF switch, and V_D = output.

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
DG302A, 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

Test Circuits and Waveforms

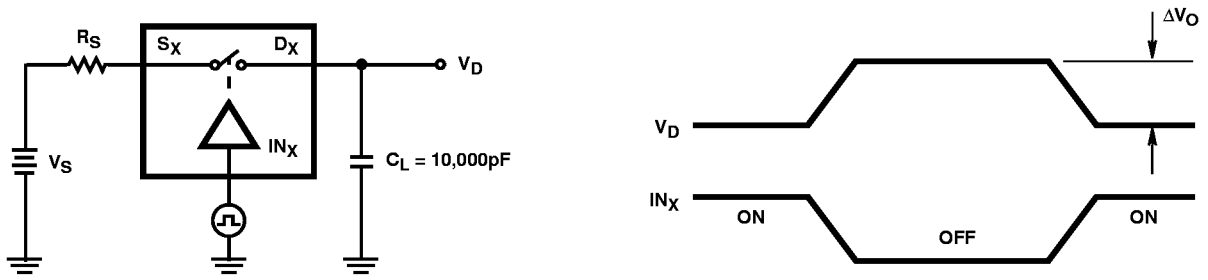


FIGURE 1. CHARGE INJECTION TEST CIRCUIT

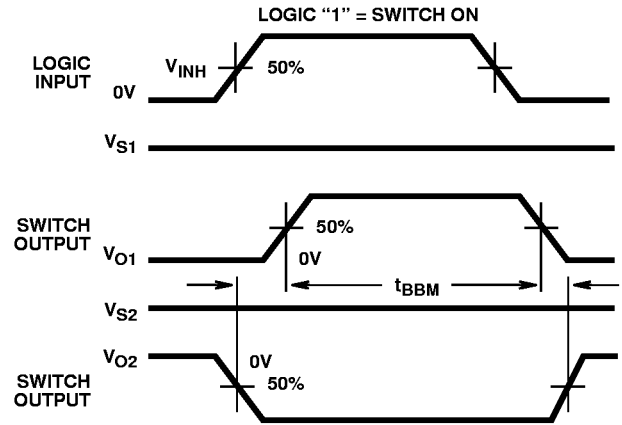
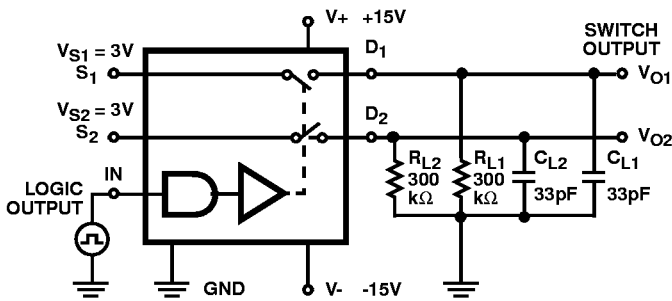


FIGURE 2. BREAK-BEFORE MAKE TEST CIRCUIT (DG301A, DG303A)

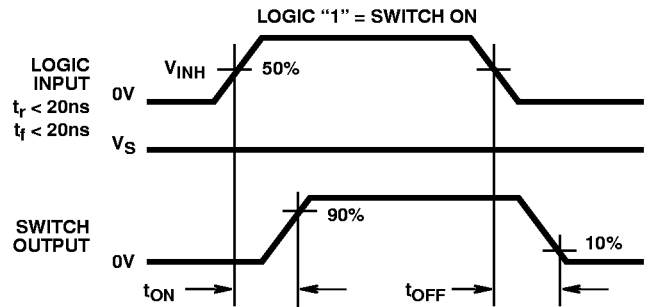
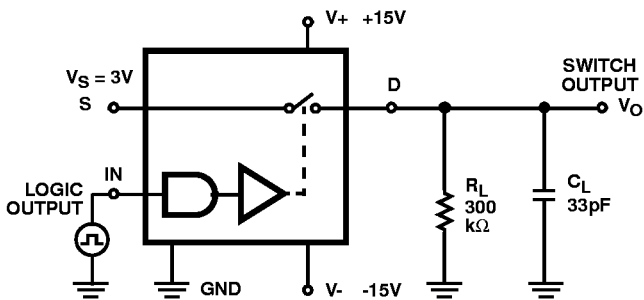


FIGURE 3. t_{ON} and t_{OFF} TEST CIRCUIT

DG300A, DG301A, DG302A, DG303A

Die Characteristics

DIE DIMENSIONS:

89 mils x 99 mils x 12 mils ± 2 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

