

**HI-201/883**

Quad SPST CMOS Analog Switch

FN7990  
Rev.0.00  
April 9, 2012

The HI-201/883 is a monolithic device comprised of four independently selectable SPST switchers which feature fast switching speeds (185ns typical) combined with low power dissipation (15mW typical at +25 °C).

Each switch provides low “ON” resistance operation for input signal voltages up to the supply rails and for signal currents up to 25mA continuous. Rugged DI construction eliminates latch-up and substrate SCR failure modes.

All devices provide break-before-make switching and are TTL and CMOS compatible for maximum application versatility. The HI-201/883 is an ideal component for use in high frequency analog switching. Typical applications include signal path switching, sample and hold circuits, digital filters, and op amp gain switching networks.

HI-201/883 is available in a 16 Ld CerDIP package.

**Features**

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Low “On” Release .....100Ω Max
- Wide Analog Signal Range ..... ±15V
- TTL/CMOS Compatible ..... 2.4V (Logic “1”)
- Turn-On Time..... 500ns
- Analog Current Range (Continuous) ..... 25mA
- No Latch-Up
- Replaces DG201

**Applications**

- High Frequency Analog Switching
- Sample and Hold Circuits
- Digital Filters
- Op Amp Gain Switching Networks

**Pin Configuration**

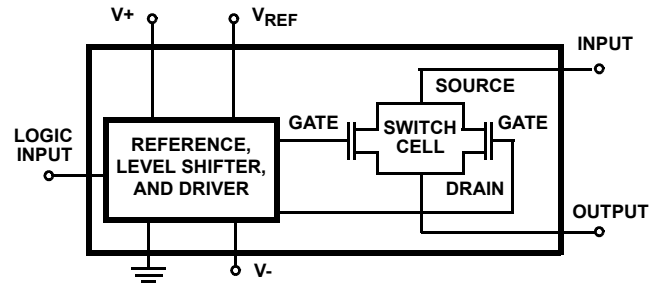
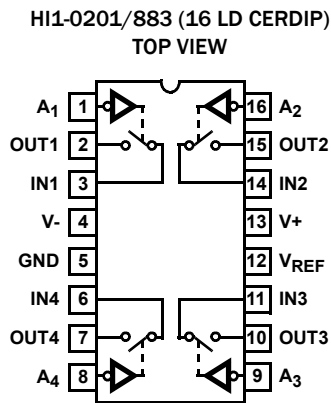


FIGURE 1. FUNCTIONAL DIAGRAM

**Ordering Information**

PART NUMBER	PART MARKING	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
HI1-0201/883	HI1-201/883	-55 to +125	16 Ld CerDIP	F16.3

### Absolute Maximum Ratings

Voltage Between V+ and V- Terminals	40V
$\pm V_{SUPPLY}$ to Ground (V+, V-)	$\pm 20V$
Analog Input Voltage, (+V <sub>S</sub> )	+V <sub>SUPPLY</sub> +2V
(-V <sub>S</sub> )	-V <sub>SUPPLY</sub> -2V
Digital Input Voltage, (+V <sub>A</sub> )	+V <sub>SUPPLY</sub> +4V
(-V <sub>A</sub> )	-V <sub>SUPPLY</sub> -4V
Peak Current (S or D)	
(Pulse at 1ms, 10% Duty Cycle Max)	40mA
Continuous Current Any Terminal (Except S or D)	25mA

### Thermal Information

Thermal Resistance	$\theta_{JA}$ (°C/W)	$\theta_{JC}$ (°C/W)
CerDIP Package	86	22
Package Power Dissipation at +75°C		
CerDIP Package	0.88W	
Package Power Dissipation Derating Factor above +75°C		
CerDIP Package	11.76mW/°C	
Junction Temperature	+175°C	
Storage Temperature Range	-65°C to +150°C	
Lead Temperature (Soldering 10s)	≤275°C	

### Recommended Operating Conditions

Operating Temperature Range	-55°C to +125°C
Operating Supply Voltage Range ( $\pm V_{SUPPLY}$ )	$\pm 15V$
Analog Input Voltage (V <sub>S</sub> )	$\pm V_{SUPPLY}$
Logic Low Level (V <sub>AL</sub> )	0V to 0.8V
Logic High Level (V <sub>AH</sub> )	2.4V to +V <sub>SUPPLY</sub>

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.

**TABLE 1. D.C. ELECTRICAL PERFORMANCE SPECIFICATIONS**

Device Tested at: +V<sub>SUPPLY</sub> = +15V, -V<sub>SUPPLY</sub> = -15V, V<sub>REF</sub> = OPEN, GND = 0V, Unless Otherwise Specified.

D.C. PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE (°C)	MIN	MAX	UNITS
Switch "ON" Resistance	$r_{DS}$	V <sub>A</sub> = 0.8V, V <sub>S</sub> = 10V, I <sub>D</sub> = -1mA, All Unused Channels V <sub>A</sub> = 2.4V	1	+25	-	70	Ω
			2, 3	-55 to +125	-	100	Ω
		V <sub>A</sub> = 0.8V, V <sub>S</sub> = -10V, I <sub>D</sub> = 1mA, All Unused Channels V <sub>A</sub> = 2.4V	1	+25	-	70	Ω
			2, 3	-55 to +125	-	100	Ω
Source "OFF" Leakage Current	$I_{S(OFF)}$	V <sub>S</sub> = +14V, V <sub>D</sub> = -14V, V <sub>A</sub> = 2.4V, All Unused Channels V <sub>A</sub> = 2.4V, V <sub>D</sub> = +14V, V <sub>S</sub> = -14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-100	100	nA
		V <sub>S</sub> = -14V, V <sub>D</sub> = +14V, V <sub>A</sub> = 2.4V, All Unused Channels V <sub>A</sub> = 2.4V, V <sub>D</sub> = -14V, V <sub>S</sub> = +14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-100	100	nA
Drain "OFF" Leakage Current	$I_{D(OFF)}$	V <sub>D</sub> = -14V, V <sub>S</sub> = +14V, V <sub>A</sub> = 2.4V, All Unused Channels V <sub>A</sub> = 2.4V, V <sub>D</sub> = +14V, V <sub>S</sub> = -14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-100	100	nA
		V <sub>D</sub> = +14V, V <sub>S</sub> = -14V, V <sub>A</sub> = 2.4V, All Unused Channels V <sub>A</sub> = 2.4V, V <sub>D</sub> = -14V, V <sub>S</sub> = +14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-100	100	nA
Channel "ON" Leakage Current	$I_{D(ON)}$	V <sub>D</sub> = V <sub>S</sub> = +14V, V <sub>A</sub> = 0.8V, All Unused Channels V <sub>A</sub> = 0.8V, V <sub>D</sub> = V <sub>S</sub> = -14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-100	100	nA
		V <sub>D</sub> = V <sub>S</sub> = -14V, V <sub>A</sub> = 0.8V, All Unused Channels V <sub>A</sub> = 0.8V, V <sub>D</sub> = V <sub>S</sub> = +14V	1	+25	-2	2	nA
			2, 3	-55 to +125	-200	200	nA
Low Level Input Current	$I_{AL}$	V <sub>AL</sub> = 0.8V, All Unused Channels V <sub>A</sub> = 2.4V	1	+25	-0.5	0.5	μA
			2, 3	-55 to +125	-1.0	1.0	μA
High Level Input Current	$I_{AH}$	V <sub>AH</sub> = 2.4V, All Unused Channels V <sub>AH</sub> = 4.0V	1	+25	-0.5	0.5	μA
			2, 3	-55 to +125	-1.0	1.0	μA
Supply Current	$+I_{CC}$	All Channels V <sub>A</sub> = 0.8V	1, 2	+25, +125	-	1.5	mA
			3	-55	-	2.0	mA
		All Channels V <sub>A</sub> = 2.4V	1, 2	+25, +125	-	1.5	mA
			3	-55	-	2.0	mA

**TABLE 1. D.C. ELECTRICAL PERFORMANCE SPECIFICATIONS (Continued)**

Device Tested at: +V<sub>SUPPLY</sub> = +15V, -V<sub>SUPPLY</sub> = -15V, V<sub>REF</sub> = OPEN, GND = 0V, Unless Otherwise Specified.

D.C. PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE (°C)	MIN	MAX	UNITS
Supply Current	-I <sub>CC</sub>	All Channels V <sub>A</sub> = 0.8V	1, 2	+25, +125	-1.5	-	mA
			3	-55	-2.0	-	mA
		All Channels V <sub>A</sub> = 2.4V	1, 2	+25, +125	-1.5	-	mA
			3	-55	-2.0	-	mA

**TABLE 2. A.C. ELECTRICAL PERFORMANCE SPECIFICATIONS**

Device Tested at: +V<sub>SUPPLY</sub> = +15V, -V<sub>SUPPLY</sub> = -15V, V<sub>REF</sub> = OPEN, GND = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE (°C)	MIN	MAX	UNITS
Turn "ON" Time	t <sub>ON</sub>	C <sub>L</sub> = 100pF, R <sub>L</sub> = 1kΩ	9	+25	-	600	ns
			10, 11	-55, +125	-	800	ns
Turn "OFF" Time	t <sub>OFF</sub>	C <sub>L</sub> = 100pF, R <sub>L</sub> = 1kΩ	9	+25	-	500	ns
			10, 11	-55, +125	-	650	ns

**TABLE 3. ELECTRICAL PERFORMANCE SPECIFICATIONS (NOTE 1)**

Device Tested at: +V<sub>SUPPLY</sub> = +15V, -V<sub>SUPPLY</sub> = -15V, V<sub>REF</sub> = OPEN, GND = 0V

PARAMETERS	SYMBOL	CONDITIONS	NOTE	TEMPERATURE (°C)	MIN	MAX	UNITS
Address Capacitance	C <sub>A</sub>	f = 1MHz, V <sub>AL</sub> = 0V	1	+25	-	15	pF
Switches Input Capacitance	C <sub>S</sub> (OFF)	f = 1MHz, V <sub>AH</sub> = 5V, Measured Source to GND	1	+25	-	15	pF
Switch Output Capacitance	C <sub>D</sub> (OFF)	f = 1MHz, V <sub>AH</sub> = 5V, Measured Output to Ground	1	+25	-	20	pF
	C <sub>D</sub> (ON)	f = 1MHz, V <sub>AL</sub> = 0V, Measured Output to Ground	1	+25	-	30	pF
Drain to Source Capacitance	C <sub>DS</sub>	f = 1MHz, V <sub>AH</sub> = 5V	1	+25	-	2.0	pF
Off Isolation	V <sub>ISO</sub>	f = 200kHz, V <sub>A</sub> = 2.4, R <sub>L</sub> = 1k, V <sub>GEN</sub> = 1V <sub>P-P</sub> , C <sub>L</sub> = 10pF	1	+25	55	-	dB
Cross Talk	V <sub>CT</sub>	f = 200kHz, V <sub>A</sub> = 2.4, R <sub>L</sub> = 1k, V <sub>GEN</sub> = 1V <sub>P-P</sub> , C <sub>L</sub> = 10pF	1	+25	60	-	dB
Charge Transfer Error	V <sub>CTE</sub>	f = 200kHz, V <sub>A</sub> = 0 to 4V, C <sub>L</sub> = 0.01μF	1	+25	-10	10	mV

NOTE:

- Parameters listed in Table 3 are controlled via design or process parameters and are not directly tested at final production. These parameters are lab characterized upon initial design release, or upon design changes. These parameters are guaranteed by characterization based upon data from multiple production runs which reflect lot to lot and within lot variation.

**TABLE 4. ELECTRICAL TEST REQUIREMENTS**

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (Tables 1 and 2)
Interim Electrical Parameters (Pre Burn-in)	1
Final Electrical Test Parameters	1 (Note 2), 2, 3, 9, 10, 11
Group A Test Requirements	1, 2, 3, 9, 10, 11
Groups C & D Endpoints	1

NOTE:

- PDA applies to Subgroup 1 only.

# Test Circuits

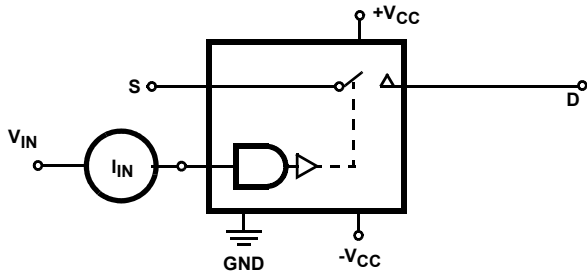


FIGURE 2. INPUT LEAKAGE CURRENT

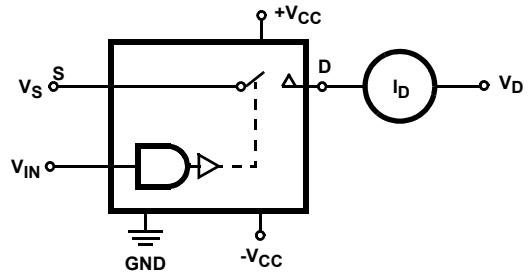


FIGURE 3.  $I_D$  (OFF)

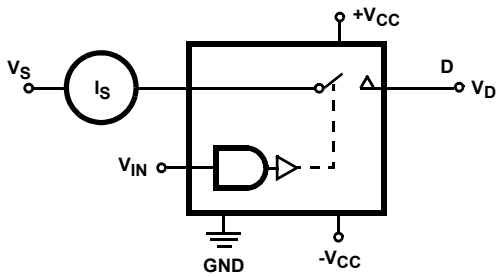


FIGURE 4.  $I_S$  (OFF)

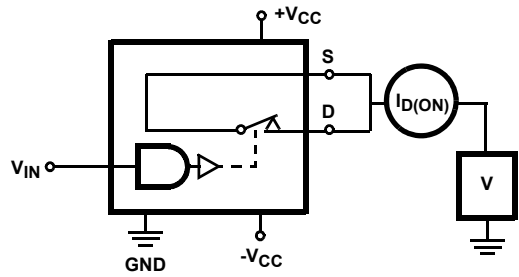


FIGURE 5.  $I_D$  (ON)

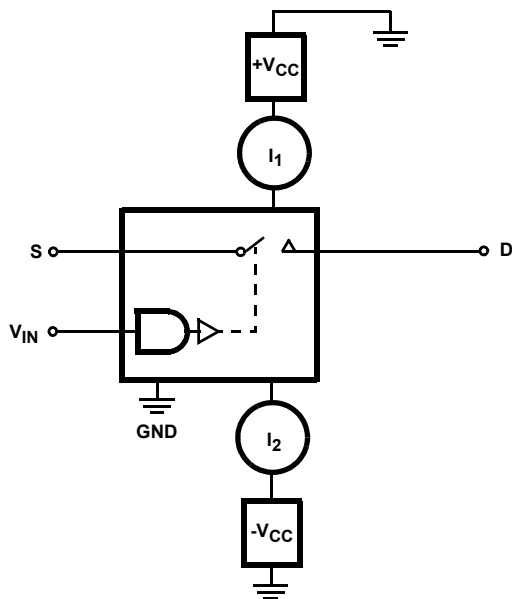


FIGURE 6. SUPPLY CURRENTS

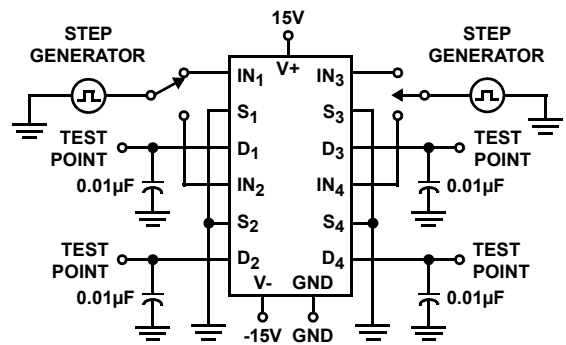


FIGURE 7. CHARGE TRANSFER ERROR

**Test Circuits** (Continued)

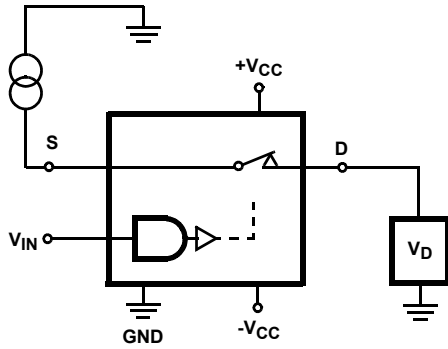


FIGURE 8.  $R_{DS}$

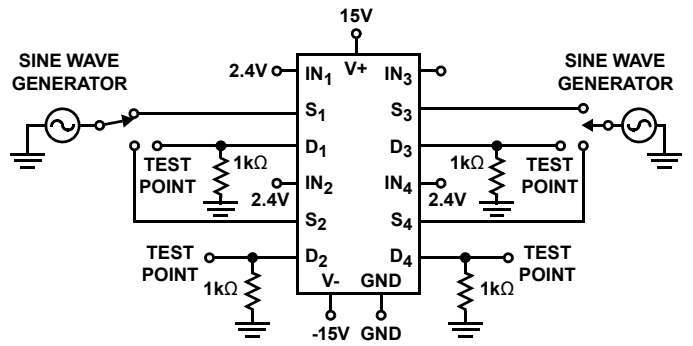


FIGURE 9. OFF CHANNEL ISOLATION

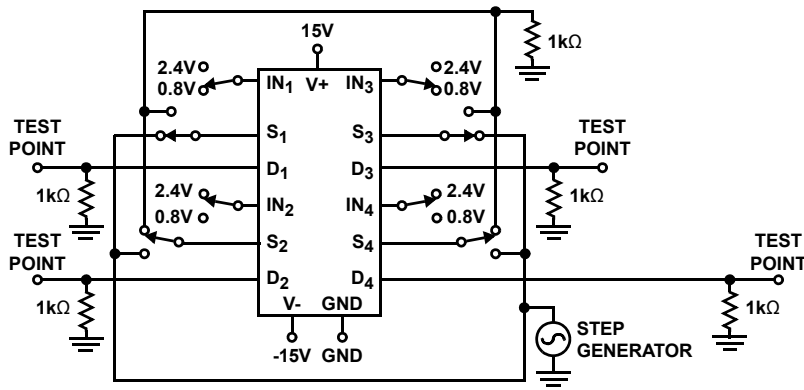


FIGURE 10. CROSSTALK BETWEEN CHANNELS

# Switching Waveforms

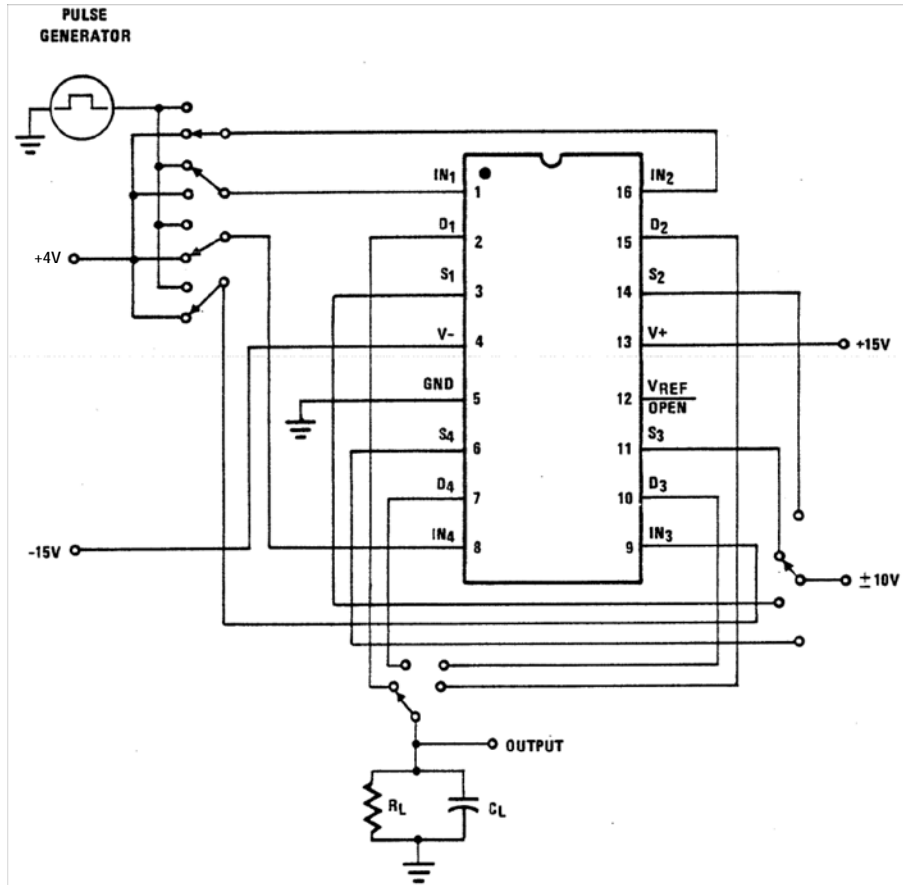


FIGURE 11.

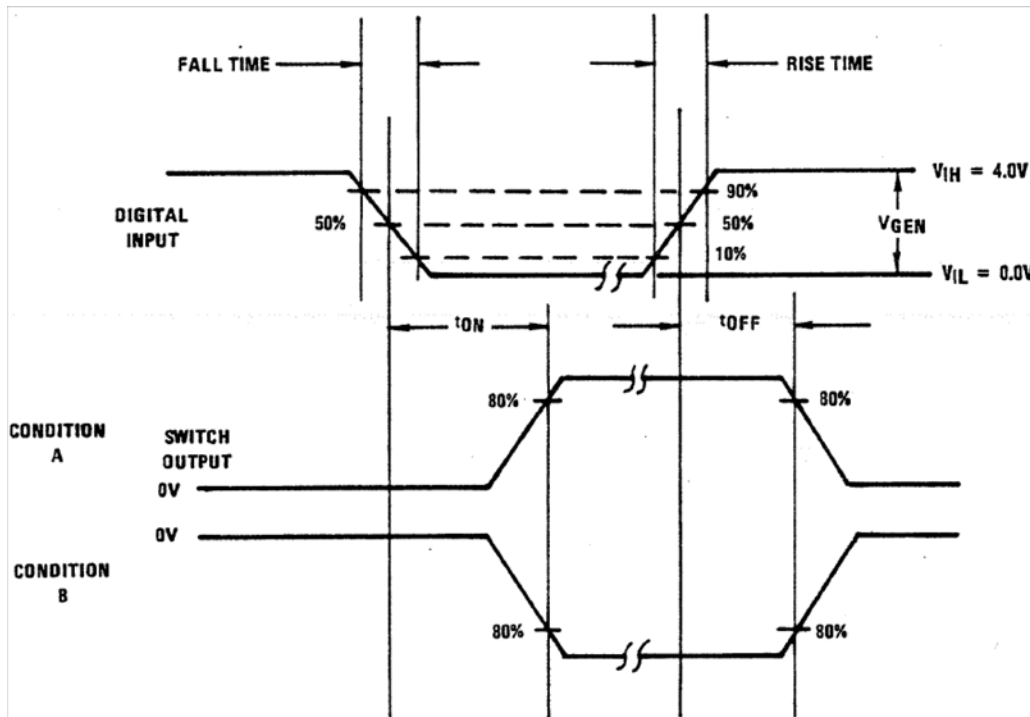


FIGURE 12.

## Burn-In Circuit

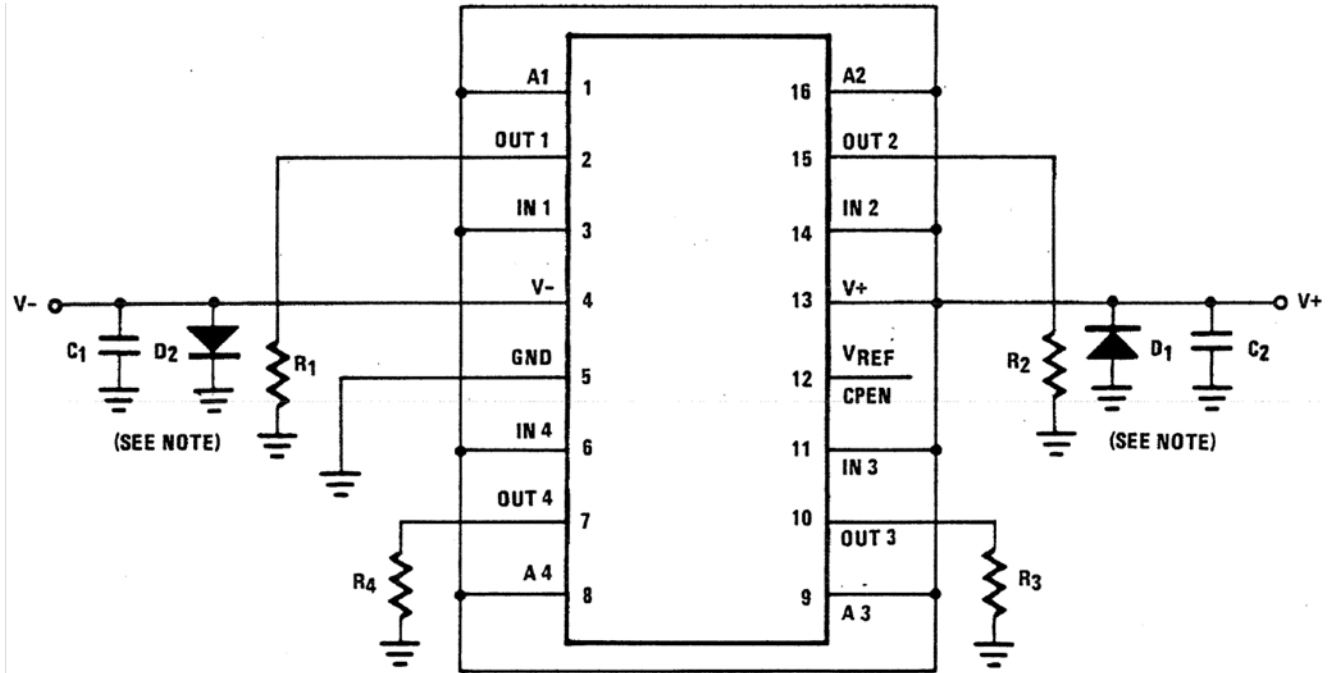


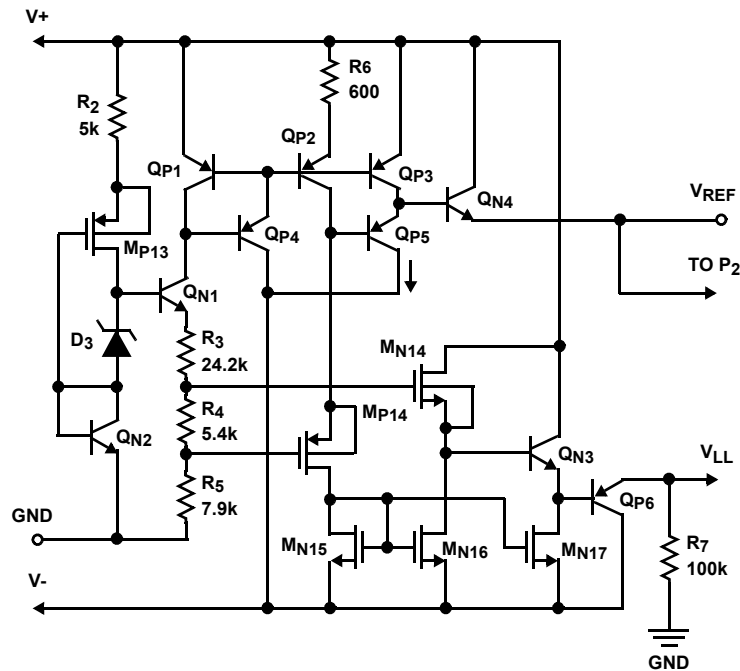
FIGURE 13. HI-201/883 CERDIP

**NOTE:**

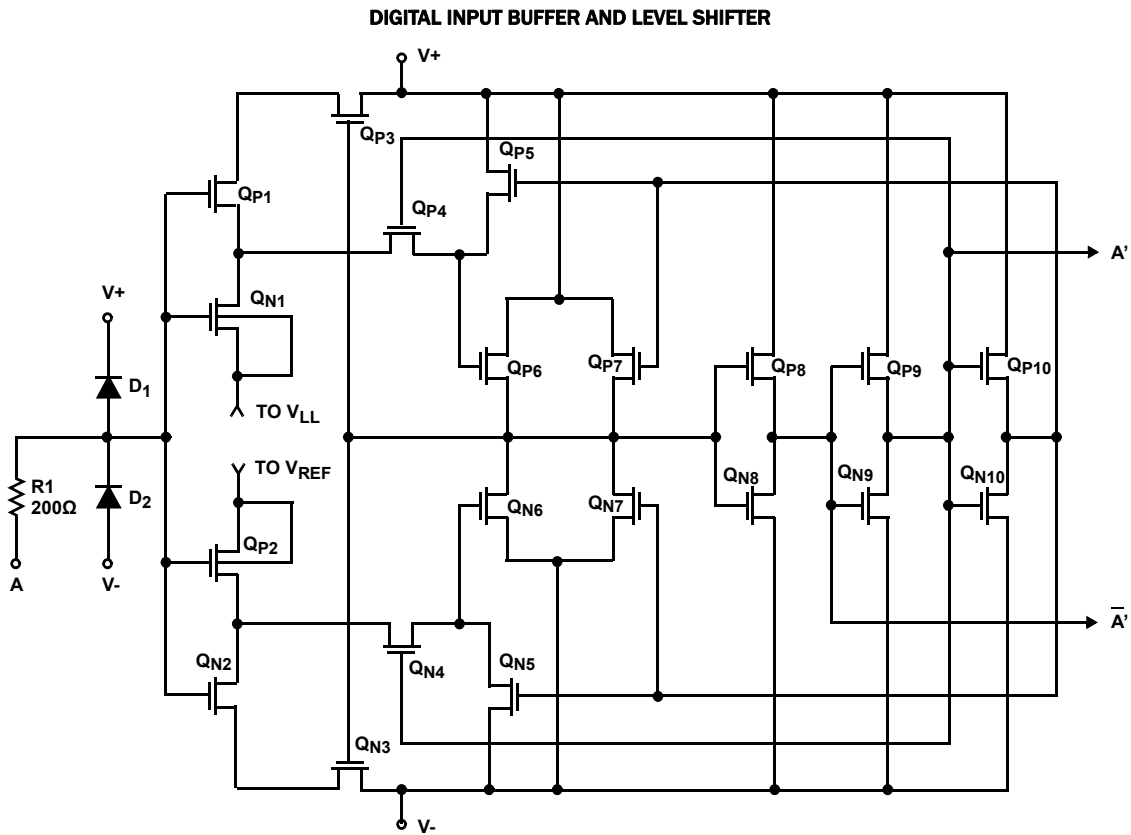
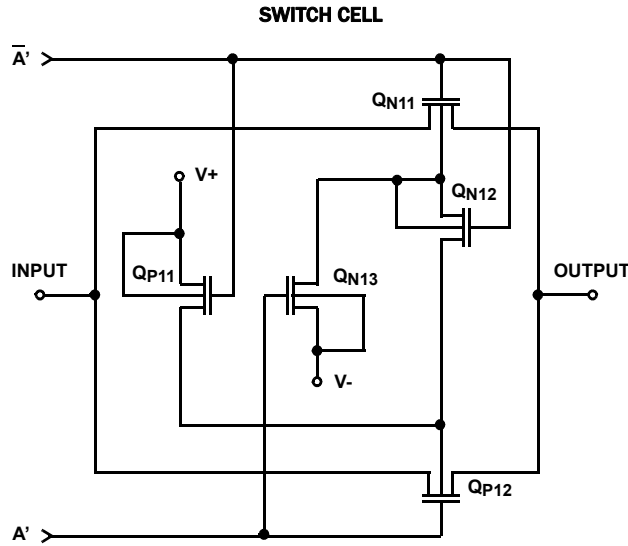
$R_1 = R_2 = R_3 = R_4 = 10k\Omega$ .  
 $C_1 = C_2 = 0.01\mu F$  (per socket) or  $0.1\mu F$  (per row).  
 $D_1 = D_2 = IN4002$  or equivalent/board.  
 $|(V+) - (V-)| = 30V$ .

## Schematic Diagrams

TTL/CMOS REFERENCE CIRCUIT V<sub>REF</sub> CELL



# Schematic Diagrams (Continued)





**Typical Performance Curves**  $T_A = +25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ ,  $V_{\text{AH}} = 2.4\text{V}$ ,  $V_{\text{AL}} = 0.8\text{V}$  and  $V_{\text{REF}} = \text{Open}$

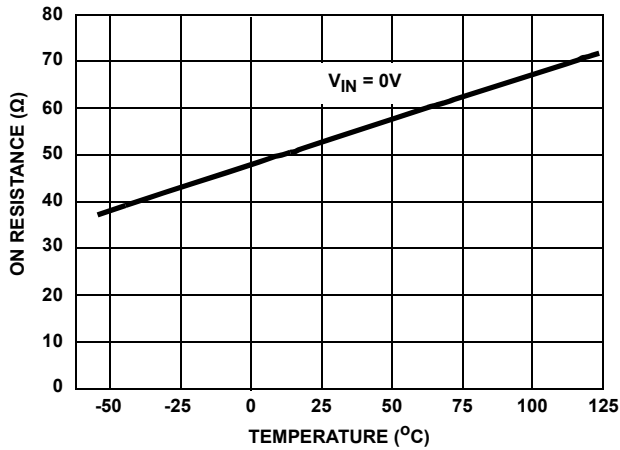


FIGURE 14. ON RESISTANCE vs TEMPERATURE

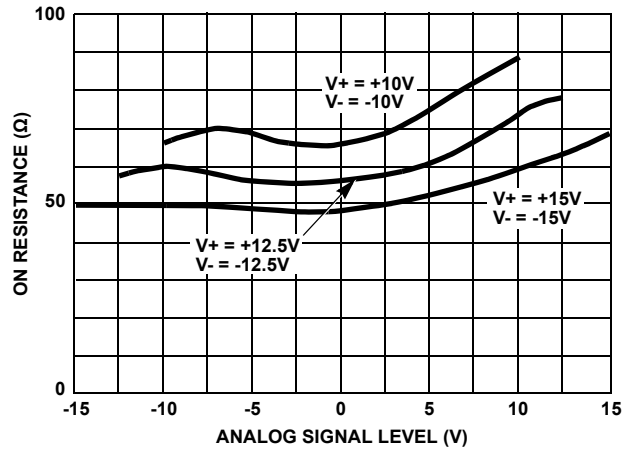


FIGURE 15. ON RESISTANCE vs ANALOG SIGNAL LEVEL AND POWER SUPPLY VOLTAGE

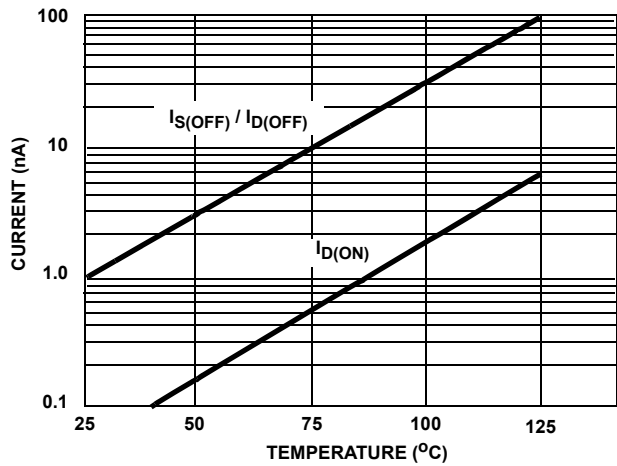


FIGURE 16. LEAKAGE CURRENT vs TEMPERATURE

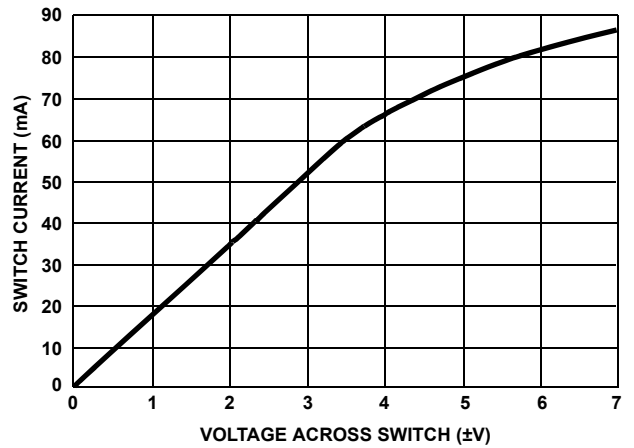


FIGURE 17A. SWITCH CURRENT vs VOLTAGE

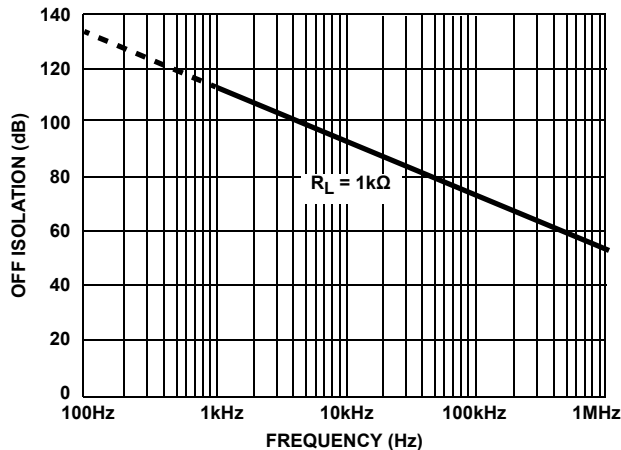


FIGURE 18. OFF ISOLATION vs FREQUENCY

## Die Characteristics

### DIE DIMENSIONS:

81 X 85 X 19 mils

### METALLIZATION:

Type: Aluminum  
 Thickness:  $16\text{k}\text{\AA} \pm 2\text{k}\text{\AA}$

### GLASSIVATION:

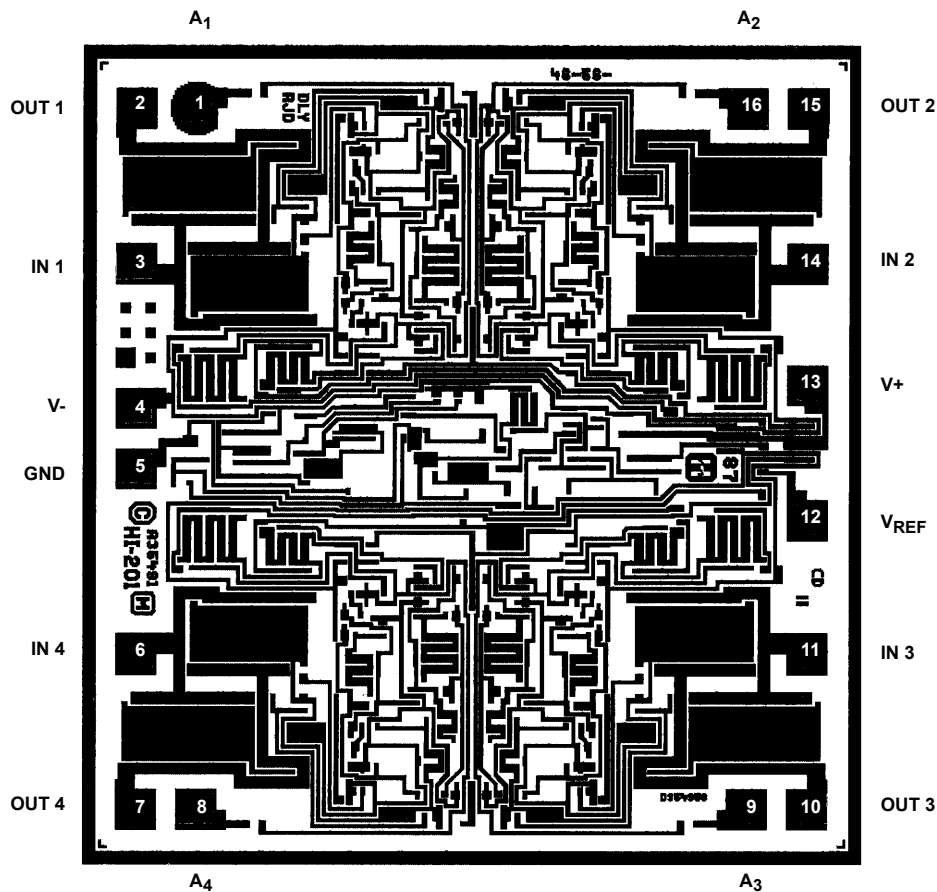
Type: Nitride over Silox  
 Silox Thickness:  $12\text{k}\text{\AA} \pm 2\text{k}\text{\AA}$   
 Nitride Thickness:  $3.5\text{k}\text{\AA} \pm 1\text{k}\text{\AA}$

### WORST CASE CURRENT DENSITY:

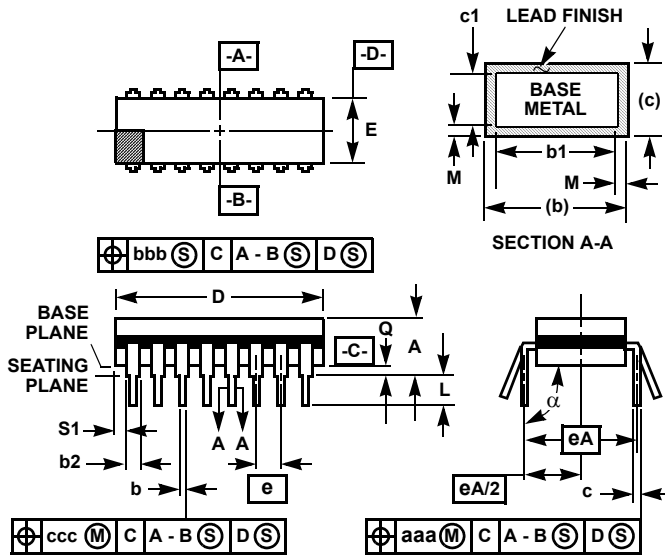
$2 \times 10^5 \text{A/cm}^2$  at 25mA

## Metallization Mask Layout

HI-201/883



**Ceramic Dual-In-Line Frit Seal Packages (CERDIP)**



**F16.3 MIL-STD-1835 GDIP1-T16 (D-2, CONFIGURATION A)  
16 LEAD CERAMIC DUAL-IN-LINE FRIT SEAL PACKAGE**

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.200	-	5.08	-
b	0.014	0.026	0.36	0.66	2
b1	0.014	0.023	0.36	0.58	3
b2	0.045	0.065	1.14	1.65	-
b3	0.023	0.045	0.58	1.14	4
c	0.008	0.018	0.20	0.46	2
c1	0.008	0.015	0.20	0.38	3
D	-	0.840	-	21.34	5
E	0.220	0.310	5.59	7.87	5
e	0.100 BSC		2.54 BSC		-
eA	0.300 BSC		7.62 BSC		-
eA/2	0.150 BSC		3.81 BSC		-
L	0.125	0.200	3.18	5.08	-
Q	0.015	0.060	0.38	1.52	6
S1	0.005	-	0.13	-	7
$\alpha$	90°	105°	90°	105°	-
aaa	-	0.015	-	0.38	-
bbb	-	0.030	-	0.76	-
ccc	-	0.010	-	0.25	-
M	-	0.0015	-	0.038	2, 3
N	16		16		8

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**NOTES:**

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark.
2. The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
3. Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness.
4. Corner leads (1, N, N/2, and N/2+1) may be configured with a partial lead paddle. For this configuration dimension b3 replaces dimension b2.
5. This dimension allows for off-center lid, meniscus, and glass overrun.
6. Dimension Q shall be measured from the seating plane to the base plane.
7. Measure dimension S1 at all four corners.
8. N is the maximum number of terminal positions.
9. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
10. Controlling dimension: INCH.

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